MAUI META Application Note

Version: 6.1208.0
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Document Revision History

Revision	Date (mm/dd/yyyy)	Author	Description
0.01	04/14/2003	Andy Ueng	First release for META LAB and META factory
0.02	04/28/2003	Andy Ueng	Add description about • Trim I, trim Q, offset I, offset Q (section 3.2.4) • APC DC offset, high weight, low weight (section 3.2.5.1.b) • Slope of AFC (section 3.2.6.2) • Recursive time, APC delta, APC DC offset (section 4.1.1)
0.03	12/25/2003	Andy Ueng	Update for META 3.3
0.04	03/22/2004	Andy Ueng	Update for META 3.5.01
0.05	04/05/2004	Andy Ueng	Update for META 3.5.02
0.06	05/05/2004	Andy Ueng	Update for META 3.5.03
0.07	06/24/2004	Andy Ueng	Update for META 3.5.04
0.08	08/13/2004	Andy Ueng	Update for META 3.5.05
0.09	10/29/2004	Andy Ueng	Update for META 3.5.0501
0.10	12/24/2004	Andy Ueng	Update for META 3.5.0502
0.11	12/31/2004	Andy Ueng	Update for META 3.5.06
0.12	02/01/2005	Andy Ueng	Update for META 3.5.0601
0.13	03/07/2005	Andy Ueng	Update for META 3.5.0602 (fix set TSC fail when user selects APC calibration only)
0.14	04/06/2005	Andy Ueng	Update for META 3.6 • Crystal AFC calibration cap_id fine tune • RAC preference setting • Continuous sine wave AFC detection
0.15	06/13/2005	Andy Ueng	Update for META 3.7 • Skyworks 77328 APC calibration • Crystal AFC sweep add temperature sweep • ADC calibration support Agilent E3631A, Keithley 2306 power supply • IP2 calibration support MT6139C, MT6140A, Skyworks74045 • Acoustic FIR tuning support Acqua file format
0.16	10/20/2005	Andy Ueng	Update for META 3.7.01 • IP2 calibration support Skyworks74117, 74400
0.17	12/09/2005	Andy Ueng	Update for META 3.7.02 • Crystal AFC control support AeroII (CAP ID range:0~127) • Crystal AFC sweep support AeroII • Crystal AFC calibration support AeroII • Support new software architecture for DSP's Speech Enhancement functions • Auxilary ADC: apply slope and offset according battery channel and charger channel selected
0.18	03/15/2006	Andy Ueng	Update for META 3.7.03 • Crystal AFC control support Stepmind transceiver AliceG2s (CAP ID range:0~127)

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			• Crystal AFC sweep support AliceG2s • Crystal AFC calibration support AliceG2s • APC calibration support bypassing APC check procedure
0.19	03/29/2006	Andy Ueng	Update for META 3.7.04 • Fixed PCS1900 APC profile mid level NVRAM write error
0.20	07/17/2006	Andy Ueng	Update for META 3.7.05 • Automatic power supply control add power off period setting • CSR headset BD address, BCHS BD address, ANA trim and power table read/write • Crystal AFC calibration support TRX offset calibration
0.21	07/27/2006	Andy Ueng	Update for META 3.7.06 • Fixed can't read BB TX parameter from RF tool UI
0.22	08/14/2006	Andy Ueng	Update for META 3.7.07 • Fixed APC calibration fail when crystal AFC calibration is selected
0.23	09/04/2006	Andy Ueng	Update for META 3.7.08 Fixed battery compensation value read from INI file incorrect issue.
0.24	10/12/2006	Andy Ueng	Update for META ver 5.3.01 Bug fixes: N/A New features: 1. [META_APP][META_DLL][Audio] Support echo loop on/off setting. 2. [META_APP][BT] Support RF test, packet test, and connect test. 3. [META_APP][EDGE] Multislot TX, continuous TX, TX level and profile support EDGE. 4. [META_APP][WiFi] Support TX, continuos packet RX, power save, BB register access, MAC register access, and EEPROM access. 5. [META_APP][Factory] Support Skyworks 77316 GMSK and EPSK APC calibration. 6. [META_APP][Factory] Support WiFi TX power and WiFi TX DC offset calibration. Enhancements: N/A
0.25	11/07/2006	Andy Ueng	Update for META ver 5.3.03 Bug fixes: N/A New features: 1. [META_APP][META_DLL][BB] Support PMIC register read/write Enhancements: N/A
0.26	11/23/2006	Andy Ueng	Update for META ver 5.3.04 Bug fixes: N/A

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			New features: 1. [META_APP][BASEBAND] Support LED backlight level setting, query RTC time and vibrator on/off. 2. [META_APP][RF] EPSK ramp profile add Vbias for each PCL. Enhancements: N/A
0.27	12/15/2006	Andy Ueng	Update for META ver 5.3.4.1 Bug fixes: Fixed write TX IQ calibration data will modified value of 850/900 and 1800/1900 swap fields accidentally New features: N/A Enhancements: N/A
0.28	1/2/2007	Andy Ueng	Update for META ver 5.3.4.2 Bug fixes: N/A New features: 1. [META_APP][Factory calibration] Automatic select “crystal” and “TX AFC offset cal” checked box with MT6139 or MT6140 RF chip. 2. [META_APP][Update parameter] Automatic select “crystal” checked box with MT6139 or MT6140 RF chip. Enhancements: N/A
0.29	2/5/2007	Andy Ueng	Update for META ver 5.3.6.0 Bug fixes: N/A New features: 2. [META_APP][Factory calibration] support Skyworks 77317/18/28, 77517/18/06 precharge calibration 3. [META_APP] Factory calibration] APC calibration support RFMD3159 PA for MT6140D transceiver 4. [META_APP] Factory calibration] WiFi TX power calibration enhancement ● TX rate, calibration channels and check channels can be configured by user ● Interpolate TX power DAC value if channel not calibrated 5. [META_APP] [Factory calibration] TX IQ calibration support 2-stage original offset calibration for MT6140D 6. [META_APP] [Factory calibration] New calibration data NVRAM write mechanism

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			● Direct write calibration data to NVRAM if LID version support ● Popup warning message if LID version is not support Enhancements: N/A
0.30	3/13/2007	Andy Ueng	Update for META ver 5.3.6.1 Bug fixes: 7. [META_APP] Fix reading AFC slope value from INI file incorrectly when decimal point setting is set to "," in control panel New features: N/A Enhancements: N/A
0.31	3/20/2007	Andy Ueng	Update for META ver 5.3.6.2 Bug fixes: 8. [META_APP] Fix write `APC bat low voltage` value to INI file incorrectly when decimal point setting is set to "," in control panel New features: N/A Enhancements: N/A
0.32	5/14/2007	Andy Ueng	Update for META ver 5.3.8 Bug fixes: N/A New features: 1. [META_APP][Factory calibration] WiFi TX power automatic calibration support ALC. 2. [META_APP][Factory calibration] BT crystal CAP ID automatic calibration. 3. [META_APP][WiFi] Support WiFi ALC. 4. [META_APP][Audio] Support new data structure format of FIR coefficient (speech FIR: 45→44 taps, melody FIR: 45→25 taps) 5. [META_APP][Audio] Acoustic Echo Cancellation (AEC) calibration. 6. [META_APP][Aduio] Speech FIR graphic interface tunning support audio tester Vita Aqua file format. Enhancements:

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			1. [META_APP][FAT] Check if FAT disk space is enough before writing file to FAT. 2. [META_APP][NVRAM] NVRAM editor can be used without installing META.
0.33	6/15/2007	Andy Ueng	Update for META ver 5.3.9 Bug fixes: N/A New features: 1.[META_DLL][NVRAM] modify the structure: mt6140tx_pa_vbias, so remove Compose/Decompose methods META_NVRAM_Compose_MT6140tx_RFSpecialCoef META_NVRAM_Decompose_MT6140tx_RFSpecialCoef increase Compose/Decompose methods META_NVRAM_Compose_MT6140tx_PaVbias META_NVRAM_Decompose_MT6140tx_PaVbias 2.[META_APP][Audio] Loud speaker mode tone frequency and volume testing 3.[META_DLL][Audio] API for setting frequency and volume to play tone META_Audio_Play_Freq_Vol_Tone META_Audio_Stop_Freq_Vol_Tone Enhancements: N/A
0.34	7/13/2007	Andy Ueng	Update for META ver 5.5.0 Bug fixes: N/A New features: 1.[META_APP][FM] FM radio tool provide following function A. Reset FM radio module B. Set frequency C. Audio setting D. Register data read/write E. Status report (RSSI, IF counter, H/L side and stereo/mono) 2. [META_APP][TDMB] TDMB tool provide following function A. Support Korea, L and VHF band B. Set frequency C. Auto scan TDMB service on certain band D. Select service to decode E. Record audio or video stream F. Signal report (SNR, BER and RSSI) 3.[META_DLL][FM] provide the following APIs for FM Radio test

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			META_FM_GetChipId META_FM_PowerOn META_FM_PowerOff META_FM_SetFreq META_FM_GetRSSI META_FM_GetIfCnt META_FM_SearchNextFreq META_FM_SearchPrevFreq META_FM_SetMonoOrStereo_Blend META_FM_SetRssiThreold META_FM_SetIfCntDelta META_FM_ReadByte META_FM_WriteByte META_FM_SetSoftMute META_FM_SelectSoftMuteStage META_FM_SelectSBlendStage META_FM_GetHighOrLowSide META_FM_GetStereoOrMono 4.[META_DLL][TDMB] provide the following APIs for TDMB test META_TDMB_TurnOn META_TDMB_SetBand META_TDMB_AutoScan_GetFreq META_TDMB_SetFreq META_TDMB_AutoScan_GetEnsemble META_TDMB_GetSignal META_TDMB_SelService META_TDMB_SetIdle META_TDMB_TurnOff META_TDMB_GetEnsm META_TDMB_SelServiceOnly 5.[META_DLL][3GRF] increase the following APIs META_3Grf_Set_Tx_PaApc META_3Grf_AFC 6.[META_DLL][NVRAM] for the new structure: sBBTXParameters, we provide the following APIs for compose/decompose META_NVRAM_BBTXParameters_Len META_NVRAM_Compose_BBTXParameters META_NVRAM_Decompose_BBTXParameters 7.[META_DLL][RF]increase the structure: RfBBTXCfg4, and provide the following APIs META_Rf_SetBBTxCfg4 META_Rf_GetBBTxCfg4 Enhancements: N/A
0.35	9/7/2007	Andy Ueng	Update for META ver 5.6.0 Bug fixes:

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			1.[META_DLL] An general error might occur when we delete all files in some disks. New features: 1.[META_APP][EDGE] Support Oxford COM port detection 2.[META_APP][FAT] FAT editor support multiple FAT file select to read/write/delete 3.[META_APP][RF] Support BBTXCfg ver 5 data structure format 4.[META_APP][EDGE] GMSK and EPSK APC calibration support RFMD3159 and Skyworks 77340 5.[META_DLL][RF] provide the following APIs for setting/getting BBTXCfg5 and 32k clock calibration. Note: BBTXCfg5 is the same as BBTXCfg4 except for range check. META_Rf_SetBBTxCfg5 META_Rf_GetBBTxCfg5 META_Rf_32kCalibration 6.[META_DLL][3GRF] provide the following APIs META_3Grf_GetRFID META_3Grf_ConfigHWTPC Enhancements: N/A
0.36	11/30/2007	Andy Ueng	Bug fixes: N/A New features: 1.[META_APP][Audio] Acoustic Echo Cancellation (AEC) calibration support normal mode. 2.[META_APP][Audio] Audio FIR coefficients data structure add audio compensation parameters. 3.[META_APP][BT] BT tool support BT 2.0. 3.1 RF test 3.2 Packet test 3.3 Throughput test 3.4 Connection test 4.[META_APP][EDGE] EPSK TX IQ auto calibration add phasesel calibration to improve IQ imbalance performance. 5.[META_APP][RTC] RTC 32k clock tracking. 6.[META_DLL][Audio] Acoustic Echo Cancellation API (record 2k bytes). 6.1 META_Audio_Tone_Loop_Back_Rec_2K 6.2 META_Audio_Tone_Loop_Back_Rec_2K_Normal 7.[META_DLL][BT] support BT2.0 TX/RX throughput test 7.1 META_BT_TxPureTest_V2 7.2 META_BT_RxTestStart_V2 8.[META_DLL][NVRAM] provide compose/decompose methods for new audio parameter structure.

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			8.1 META_NVRAM_Compose_AudioParam_W0740 8.2 META_NVRAM_Decompose_AudioParam_W0740 9.[META_DLL][USB] provide APIs to support USB cable for communication 9.1 META_GetDynamicUSBComPort 9.2 META_ConnectWithTargetByUSB 10.[META_DLL][3GRF] provide the following APIs for power detector 10.1 META_3Grf_GetPwrDtStep 10.2 META_3Grf_GetPwrDtDac 10.3 META_3Grf_GetPwrDtDefaultThr Enhancements: N/A
0.37	12/30/2007	Andy Ueng	Bug fixes: N/A New features: 1.[META_APP][Audio] Acoustic FIR tuning support R&S UPV file format. 2.[META_APP][RF] Support ADI AD6548 transceiver. 3.[META_DLL][NVRAM] provide compose/decompose methods for new audio parameter structure. META_NVRAM_Compose_AudioParam_W0748 META_NVRAM_Decompose_AudioParam_W0748 4.[META_DLL][BT] provide enable/disable online update BT-related parameters from nvram to BT task. META_BT_EnableNvramOnlineUpdate META_BT_DisableNvramOnlineUpdate Enhancements: N/A
0.38	2/22/2008	Andy Ueng	Bug fixes: 1. [META_DLL] move some parameter checking codes to suitable places for the API: META_ConnectInMetaMode New features: 1.[META_APP][Audio] Acoustic FIR coefficient runtime setting. 2.[META_APP][Audio] Custom volume runtime setting. 3.[META_APP][Audio] Support new acoustic FIR coefficient data structure for 08A. 4.[META_APP][Factory calibration] APC auto calibration support EDGE CMOS A60111A transceiver. 5.[META_APP][EDGE] Support EDGE CMOS A60111A transceiver register read/write. 6.[META_APP] Support connect with target in META mode for TK6516. 7.[META_DLL][Audio] provide APIs for online get/set profile and param settings.

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			META_Audio_Get_Audio_Profile_Settings META_Audio_Set_Audio_Profile_Settings META_Audio_Get_Audio_Param_Settings_0809 META_Audio_Set_Audio_Param_Settings_0809 8.[META_DLL][NVRAM] provide compose/decompose methods for the struct nvram_ef_btradio_mt6611_struct. And the struct ad6546tx META_NVRAM_BT_Compose_MT6611Radio META_NVRAM_BT_Decompose_MT6611Radio META_NVRAM_Compose_ad6546tx META_NVRAM_Decompose_ad6546tx 9.[META_DLL][BT] provide APIs to enable/disable PCM clock sync signal for BT calibration and let user remove their BT-related callbacks. META_BT_EnablePcmClockSyncSignal META_BT_DisablePcmClockSyncSignal META_BT_RemoveAutoCallback META_BT_RemoveReceiveHCIDataCallback 10. [META_DLL][NVRAM]Rename META_NVRAM_Compose_AudioParam_W0748 META_NVRAM_Decompose_AudioParam_W748 to META_NVRAM_Compose_AudioParam_W0809 META_NVRAM_Decompose_AudioParam_W809 Enhancements: N/A
0.39	4/24/2008	Andy Ueng	Bug fixes: N/A New features: 1.[META_APP][Factory calibration] Support slope skew and FB DAC auto calibration for OthelloE transceiver. 2.[META_APP][Factory calibration] APC auto calibration support TriQuint TQM7M5008 PA for OthelloE transceiver. 3.[META_APP][Update parameter] Support slope skew and FB DAC calibration data update for OthelloE transceiver. 4.[META_APP][TDMB] Support Frontier Silicon. 5.[META_APP][TDMB] Support China band. 6.[META_APP][IMEI] Support second IMEI NVRAM and INI file read/write for Gemini project. 7.[META_DLL][RF] provide an API for RF special coefficients run-time settings of chip AD6546 META_Rf_AD6546_SetSpecialCoef 8.[META_DLL][TDMB] provide an API to stop auto scan and modify the interface for new 3rd chip.(Note: for W0816~later load) META_TDMB_StopAutoScan 9.[META_DLL][FAT] provice an API to query target's drive type.(4

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			types: NOR, NAND, CARD, EXTERNAL) META_FAT_GetDriveType 10.[META_DLL][WCDMA] provide APIs for read/write registers. META_3Grf_SetImmediateBSI META_3Grf_GetImmediateBSI 11.[META_DLL][Basic] provide 3 APIs for upper applications to evaluate target performance META_StartTimer META_StopTimer META_GetProcessTime Enhancements: N/A
0.40	5/16/2008	Andy Ueng	Bug fixes: N/A New features: Supports MT6239 Enhancements: N/A
0.41	7/16/2008	Andy Ueng	Bug fixes: N/A New features: 1. [META_DLL][WCDMA] provides an API for continuous RX test META_3Grf_ContinuousRX META_3Grf_ContinuousRX_r 2. [META_DLL][RF] provides an API for fast device tuning META_Rf_StartFdtDL META_Rf_StartFdtDL_r META_Rf_StartFdtUL META_Rf_StartFdtUL_r META_Rf_QueryMSCapabilityEx2 META_Rf_QueryMSCapabilityEx2_r 3. [META_DLL][NVRAM] provides composing/ decomposing methods to the new structure: ul1cal_txdacData_T_B META_NVRAM_3G_Compose_txdacData_B META_NVRAM_3G_Decompose_txdacData_B 4. [META_APP][Factory calibration] APC auto-calibration supports Skyworks 77344 PA. 5. [META_APP][Update parameter] supports EPSK inter-slot ramp profile, INI file and NVRAM read/write. Enhancement: N/A
0.42	7/23/2008	Andy Ueng	Bug fixes:

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			[BROM_DLL] fixed the issue of the failed switch to different modes on MT6229E4 platform. New features: N/A Enhancement: N/A
5.0836.0	09/09/2008	Andy Ueng ShuMin Chen	Bug fixes: 1.[META_DLL][USB] Fix the problem of GetDynamicUSBComPort() might fail in dual-core computers. New features: 1.[META_APP][Factory calibration] BT auto calibration reduce BT module power on time 2~3 secs. 2.[META_APP][Factory calibration] BT CAP ID auto calibration without BT tester for MT6611. 3.[META_APP][Factory calibration] 33 step AFC slope auto calibration. 4.[META_DLL][RF] Add RF ID definition: RF_ID_MTKSOC1, and change the RF_ID_A60111A to RF_ID_CMOSEDGE 5.[META_DLL][BT] Provide the APIs to support BT power on/off with wait operation settings. META_BT_POWERON_EX META_BT_POWEROFF_EX Note: The API: META_BTPowerOn will not work in 08A W0836 later loads (including W0836), Please use META_QueryIfFunctionSupportedByTarget_r to query if target support META_BT_POWERON_EX_r. If yes, please use new APIs to do BT power on/off. 6.[META_DLL][BASIC] Provide APIs to support upload files to target with INI settings mechanism. META_UploadFilesToTarget 7.[META_DLL][BASIC] Change the L1 RF NVRAM LID checking rules based on target's compile options (__GSM850__,__EGSM900__,_DCS1800__,__PCS1900__) when we try to backup and restore calibration Enhancement: 1.[META_APP][Audio] Display last time FIR tuning settings to support engineers continuously fine tune in case they did not finish it last time. 2.[META_APP][BASIC] Enhance COM port enumerate procedure when computers have no COM port by default. Sections updated: 4.1.1 Configuration file 4.2.2 2-step AFC slope calibration 4.2.3 33-step AFC slope calibration 4.2.10 TX FB DAC calibration

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			4.2.12 TX slope skew calibration 4.2.13 Fast Handset Calibration (FHC) 4.2.15 CV calibration 4.2.18 BT crystal CAP ID calibration
5.0836.1	09/18/2008	ShuMin Chen	Bug fixes: 1.[META_APP][Update Parameter] Fixed the problem of saving ADC parameters into ini file. New features: N/A Enhancement: N/A
5.0844.0	11/04/2008	ShuMin Chen	Bug fixes: 1.[META_APP][Baseband] Change ADC channel number of MT6239 from 9 to 7 2.[META_APP][RF Tool] Fix the problem of downloading EPSK APC Profile to target's flash. New features: 1.[META_APP][Update Parameter] Support BT chip MT6611 CAP ID read/write operation. 2.[META_APP][Factory calibration] Add new cfg/ini files for OthelloE transceiver. 3.[META_APP][Factory calibration] Remove PA: Skyworks77340 support. 4.[META_DLL][RF] Change the API interface: META_Rf_StartFdtDL to get DTSParam info of target 5.[META_DLL][RF] The API: META_Rf_QueryMSCapabilityEx2 is used to replace the following two APIs: META_Rf_QueryMSCapability and META_Rf_QueryMSCapabilityEx. Please query if target support the API: META_Rf_QueryMSCapabilityEx2 before invoking these two APIs. 6.[META_DLL][CMMB] Provide the following APIs for controlling target's CMMB module. META_CMMB_TurnOn META_CMMB_TurnOff META_CMMB_SetBand META_CMMB_AutoScanGetFreq META_CMMB_AutoScan META_CMMB_StopAutoScan META_CMMB_SetFreq META_CMMB_SelServOnly META_CMMB_PauseServ META_CMMB_GetSignalStrength Enhancement: N/A
5.0848.0	12/02/2008	ShuMin Chen	Bug fixes:

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			N/A New features: 1.[META_APP][RF] Support BBTXCfg ver. 6 data structure format 2.[META_APP][Factory calibration] Provide FHC (fast handset calibration) with Agilent8960 for "AFC, RX Path loss and TX PCL" 3.[META_APP][RF] Provide FHC (fast handset calibration) UTS Pre-Scan mechanism to calculate the log-space offset required for log-space DAC samples with Agilent8960 4.[META_APP][WiFi] Support MT5921 EEPROM's format 5.[META_DLL][RF] Provide the following APIs for setting/getting BBTXCfg6: – META_Rf_SetBBTxCfg6 – META_Rf_GetBBTxCfg5 6.[META_DLL][FAT][ULC] The APIs below are no longer supported in ULC(Ultra low cost) projects and will return error code FT_FAT_ERR_ACTION_NOT_SUPPORT -503). – META_FAT_RemoveDir – META_FAT_GetDriveType – META_FAT_Move The API below can query if the phone is the ULC project: – META_Check_ULC_FAT_support 7.[META_DLL][CMMB] Expand the API of META_CMMB_GetSignalStrength for new CMMB chips. 8.[META_DLL][WiFi] Add new WiFi chip support: MT5921 Enhancement: N/A
5.0848.1	12/15/2008	ShuMin Chen	Bug fixes: N/A New features: N/A Enhancement: 1. [METAAPP] Provide an adaptive AFC DAC pre-search mechanism for RF chip, AD6548, and the corresponding CFG file (AD6548_AFC_Enhancement.cfg)
5.0852.0	12/30/2008	ShuMin Chen TH_Huang	Bug fixes: N/A New features: 1.[META_APP][CMMB] Modify the UI of signal strength information display 2.[META_DLL][CMMB] Modify the API, META_CMMB_GetSignalStrength, to provide more detailed signal information 3.[META_DLL][WCDMA] Provide the following APIs for runtime

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			setting TX DAC data by band and getting the TX power measured by target's power detector. – META_3Grf_SetTxDacData_B – META_3Grf_GetPwrDtMeasureResult Enhancement: N/A
5.0904.0	01/21/2009	ShuMin Chen TH Huang	Bug fixes: 1. [META_APP][Factory calibration] Fixed the problem of 2G AFC calibration failure when users use Agilent8960 to do RF auto-calibration. New features: 1. [META_DLL][RF] Provides the following APIs for FHC DTS to get FHC DTS result in an asynchronous way. ▪ META_Rf_StartFdtDLNotWaitResult ▪ META_Rf_GetFdtDL 2. [SmartPhone] Provides the following APIs for runtime detection to see if the target supports smart phone features and decide what functionality to provide. [Note]: This function is supported after W09.06 target code base: META_Check_SmartPhoneModem_support 3. [META_APP][CMMB] Provides CMMB module reset function 4. [META_APP][Factory calibration] Supports FHC (Fast Handset Calibration) on CMU200. Enhancement: N/A
5.0908.0	02/25/2009	TH Huang ShuMin Chen	Bug fix: N/A New features: 1.[META_APP][RF] Added the check mechanism on EPSK interslot_lowest_dac value. It should not exceed the APC dac of the power level in both GMSK and EPSK modulation. 2.[META_APP][Common] Removed unnecessary UI display on BT, WIFI, CMMB, TDMB, FM, Audio, ADC calibration function in META Tool for smart phone projects 3.[META_APP][Factory calibration] Supports MT5921: Wi-Fi Crystal CAP ID and Internal Sensor calibration with AgilentN4010A. 4.[META_APP][Update Parameter] Added one new item "Wi-Fi Crystal CAP ID/Internal Sensor" for MT59221. 5.[META_DLL][NVRAM] Provides the following APIs to compose/decompose the NVRAM structure of LID: NVRAM_EF_WNDRV_EXT_SETTING_TRIMVAL_THERMOVAL_LID for MT5921. META_NVRAM_TRIM_THERMO_Len META_NVRAM_WiFi_Compose_TrimThermo

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Revision	Date (mm/dd/yyyy)	Author	Description
			META_NVRAM_WiFi_Decompose_TrimThermo 6.[META_DLL][WCDMA] Provides the following API for AD6551 to turn on/off the internal power detector. META_3Grf_SetPowerControlMode Enhancement: 1.[META_APP][Factory calibration] Improved FHC performance on CMU200 by using one-shot GPIB command to set the DTS frequency, burst power level, and burt type. 2.[META_DLL][NVRAM] Provides the following APIs to reduce the NVRAM read/write coding efforts. META_NVRAM_Read_Ex META_NVRAM_Write_Ex
5.0912.0	03/25/2009	ShuMin Chen	Bug fixes: N/A New features: 1.[META_APP][CMMB] Provides channel settings for auto-scan operation. 2.[META_APP][Factory Calibration] Supports MT5921: Wi-Fi Crystal CAP ID and Internal Sensor calibration with LitePoint IQView. 3.[META_APP][Factory Calibration] 33-step AFC slope auto calibration on CMU200. 4.[META_DLL][MISC] Provides the API to get the IMEI record number on the target META_MISC_GetIMEIRecNum 5.[META_DLL][CMMB] Provides the API to set frequency range in auto scan operation META_CMMB_AutoScanWithFreqRange Enhancement: 1.[META_DLL][FAT] Extend the default timeout of basic FAT operations to 10 seconds.
5.0916.0	04/22/2009	Shumin Chen TH Huang YH Sung	Bug fixes: 1.[META_APP][Factory Calibration] Stopped RF function after TX IQ check to avoid abnormal multi-slot burst pattern in FHC UTs 2.[META_APP][RF Tool][FHC] Fixed arfcn_C0 configuration handling to align with factory calibration in the FHC UTS Pre-scan form New features: 1.[META_APP][SmartPhone] Integrated EBoot dll to boot up the smart phone into META mode and connected with the smart phone 2.[META_APP][RF Tool][FDT] Renamed the FDT related UI caption as FHC 3.[META_APP][Factory Calibration] Modified the UI to hide GMSK TX PCL and EPSK TX PCL when FHC option is checked Enhancement:

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			1.[META_APP][TX IQ][TX PCL] Exchanged the TX PCL and TX IQ calibration item to align ATE calibration flow (Now: TX PCL -> TX IQ; Before: TX IQ -> TX PCL)
5.0920.0	05/22/2009	YH Sung ShuMin Chen	Bug fixes: 1.[META_APP][Factory Calibration] Fixed the FHC 33-step AFC calibration failure issue when the user uses traditional 33-step AFC calibration first New features: 1.[META_APP][Factory Calibration] Integrated Skyworks PA pedestal calibration before FHC UTS 2.[META_APP][Factory Calibration] Integrated AD6548 initial AFC DAC pre-calibration before FHC DTS 3.[META_DLL][BASIC] In APIs related to "backup and restore calibration data", add two INI sections: [Backup/Restore File Prefix-MORE] and [Backup/Restore File Prefix-DELETE] The sections will be processed in the following APIs: META_BackupCalibrationData META_RestoreCalibrationData META_BasicBackupCalibrationData META_BasicRestoreCalibrationData Enhancement: N/A
5.0924.0	06/19/2009	YH Sung ShuMin Chen	Bug fixes: N/A New features: 1.[META_DLL][RF] Provides API for NSFT (Non-Signaling Final Test) META_Rf_NSFT_Start META_Rf_NSFT_ChangeSettings 2.[META_APP] Supports BT chip MT6612 Enhancement: 1.[META_APP][Update Parameter] Auto select download parameters for users when loading calibration data from file
5.0928.0	07/17/2009	YH Sung ShuMin Chen	Bug fixes: 1.[MEAT_DLL][FAT] Fixed the problem of FAT-related APIs failure after querying file list from an empty folder of target. New features: 1.[META_DLL][NVRAM] Provide API for UART port setting META_NVRAM_PortSetting_Len META_NVRAM_Compose_PortSetting META_NVRAM_Decompose_PortSetting Enhancement:

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Revision	Date (mm/dd/yyyy)	Author	Description
			N/A
6.0932.0	08/14/2009	YH Sung ShuMin Chen	Bug fixes: N/A New features: 1. [META_APP][Factory calibration] Supports NSFT, including GMSK TX performance test, BER, EPSK TX performance test. 2. [META_APP][Audio Tool] Provides the function “Quick speech tuning” for customers to fine-tune speech parameters easily. Note: The INI file format of “custom volume settings” is changed. 3. [META_DLL][MISC] Provides API for NVRAM folder amount query. META_MISC_QueryNVRAMFolderAmount 4. [META_DLL][Audio] Provides APIs for wave file playing. META_Audio_Set_Output_Dev META_Audio_Set_Output_Vol META_Audio_Play_Wave_File META_Audio_PlayCurMemContent META_Audio_StopPlaying META_Audio_FreeMemory Enhancement: 1. [META_DLL][MISC] The NVRAM initial flow changes NVRAM folder structure. The following API will return all the NVRAM folders on target instead of a single folder. META_QueryNVRAMFolder 2. [META_DLL][Init] Provides API for specifying the META DLL log file path META_DebugOn_With_FilePath
6.0940.0	10/09/2009	YH Sung ShuMin Chen	Bug fixes: N/A New features: 1. [META_APP][RF Tool] Provides AD6546 Polar APC CAP Sweep/Calibration function. 2. [META_DLL][MISC] Provides API for SIM card module insertion detection META_MISC_CheckSIM1Inserted META_MISC_CheckSIM2Inserted Enhancement: N/A
6.0944.0	11/06/2009	YH Sung	Bug fixes: N/A New features: 1. [META_DLL][MISC] Provides target MUIC charger mode setting META_MISC_SetMuicChargerMode

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			2. [META_DLL][MISC] Provides Calibration data integrity checking META_MISC_CalDataIntegrity_StartRec META_MISC_CalDataIntegrity_StopRec META_MISC_CalDataIntegrity_AddOne META_MISC_CalDataIntegrity_DelOne META_MISC_CalDataIntegrity_DelAll META_MISC_CalDataIntegrity_CheckOne META_MISC_CalDataIntegrity_CheckAll 3. [META_DLL][MISC] Provides ADC Calibration information retreiving from EFUSE META_MISC_GetADCFromEFuse 4. [META_DLL][Util] Provides target NVRAM security checking META_Util_CheckIfTargetNVSecOn 5. [META_DLL][Audio] Provides Auio ACF filter operations META_Audio_GetACFilterType META_Audio_SetACFilterCoef 6. [META_DLL][FM] Provides APIs for MT6616 support META_FM_SetVolume META_FM_AutoScan META_FM_SetRDS META_FM_GetRXFilterBW META_FM_GetPAMDLevel META_FM_GetMR META_FM_SetDecodeMode META_FM_SetHCC META_FM_SetPAMDThreshold META_FM_SetSoftmute META_FM_SetDeemphasisLevel META_FM_SetHLSide META_FM_SetDemodBW META_FM_SetDynamicLimiter META_FM_SetSoftmuteRate META_FM_GetPI META_FM_GetPTY META_FM_GetPS META_FM_GetAF META_FM_GetRT META_FM_GetTP META_FM_GetTA META_FM_GetMS META_FM_GetGoodBlockCounter META_FM_GetBadBlockCounter META_FM_ResetBlockCounter META_FM_GetGroupCounter

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			META_FM_ResetGroupCounter
			META_FM_RegisterRDSInfoUpdateCallback META_FM_RemoveRDSInfoUpdateCallback META_FM_RegisterRDSStatusUpdateCallback META_FM_RemoveRDSStatusUpdateCallback META_FM_HWSeek META_FM_HWSearch_Stop META_FM_SetStereoBlend Enhancement: 1. [META_APP][RF Tool] Polar APC CAP calibration target value auto selection after sweep
6.0952.0	12/30/2009	YH Sung ShuMin Chen	Bug fixes: 1. [Factory Calibration] Fixed APC DC offset calibration fail to trigger power issue while using CMU200 2. [META_DLL] Fixed backup and restore calibration data possible infinite loop condition while the size of the section is larger than 2K bytes 3. [META_DLL] Fixed the problem of NVRAM Database initialization procedure failure when the user application is disconnected with target. New features: 1. [Audio] Provides the runtime tuning functionality of audio compensation parameters. 2. [META_DLL][Util] Reboots META mode into normal mode META_Util_RebootToNormalMode 3. [META_DLL][Util] Provides BT/Wi-Fi single antenna SW capability query and antenna path switching. META_Util_QueryBTWiFiSingleAntennaCap META_Util_SetAntennaPathToBT META_Util_SetAntennaPathToWiFi Enhancement: 1. [Factory Calibration] NSFT modulation spectrum absolute limit checking
6.1004.0	01/28/2010	YH Sung ShuMin Chen	Bug fixes: N/A New features: N/A Enhancement: 1. [Audio] Supports Audio Compensation Coefficients generation for load before W09.52 2. [Audio] Enabled Melody FIR Page for the following chips only: MT6219, MT6223, MT6225, MT6226, MT6227, MT6228, MT6229, MT6230, MT6253

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Revision	Date (mm/dd/yyyy)	Author	Description
6.1012.0	2010/3/22	YH Sung ShuMin Chen	Bug fixes: N/A New features: 1. [META_DLL][Audio] Target audio DL Gain capability query function. META_Audio_EX_GetDLGainCapability 2. [META_DLL][FM] FM RDS API for RDS log information and BLER META_FM_GetRDSLogData META_FM_GetRDSBLERRatio 3. [META_APP][BT Tool] Supports MT6616. Enhancement: 1. [META_APP][RF Tool] Multislot-Tx supports TX power rollback settings. 2. [META_APP][RF Tool] GMSK and EPSK level and ramp settings support battery/temp. compensation threshold settings. 3. [META_APP][Factory Calibration] Factory calibration UI enhancement, user selectable DC offset calibration (for SKY 77517/77518/77506/77531 and SKY 77317/77318/77328 series). 4. [META_APP][Audio] Adds DL PGA with an adjustable step size in Quick Speech Tuning.
6.1020.0	2010/05/17	YH Sung ShuMin Chen	Bug fixes: 1. [META_APP][Audio] Fixed the incomplete loading issue of the function "Load from file" in the "Quick Speech Tuning" section. New features: 1. [META_DLL][MATV] Adds the following APIs for controlling Mobile Analog TV module META_MATV_PowerOn META_MATV_PowerOff META_MATV_SetRegion META_MATV_StartScan META_MATV_StartFullScan META_MATV_StopScan META_MATV_GetChannelList META_MATV_ChangeChannel META_MATV_SetChannelProperty META_MATV_GetChannelQuality META_MATV_GetChannelQualityAll 2. [META_APP][MATV] Adds "MATV Tool" GUI for Mobile Analog TV module evaluation 3. [META_APP][Factory Calibration] Supports Renasas PA RPF88130B, RPF88143B, RPF88144B, RPF88150B, RPF89007B GMSK TX PCL calibration. 4. [META_APP][Factory Calibration] Supports Renasas PA RPF89007B EPSK 4 PCL TX PCL calibration.

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			Enhancement: 1. [META_DLL][NVRAM] Removed META_NVRAM_Reset categories except NVRAM_RESET_FACTORY. 2. [META_APP][General] GUI enhancement for connection indication.
6.1020.5	2010/06/15	YH Sung	Updated Section 4. Factory calibration Configuration file/Calibration data intial file descriptions
6.1024.0	2010/06/18	YH Sung ShuMin Chen	Bug fixes: 1. [META_APP_DLL] Fixed memory leakage issue during NVRAM read/write. 2. [META_APP][Factory Calibration] Fixed NSFT start failure due to rounding error of CW mode related GPIB commands for traditional 33-step AFC calibration on Agilent 8960. New features: 1. [META_APP][Audio] Adds MATLAB-like coefficients generation by Audio Compensation filter. Enhancement: 1. [Factory Calibration] TX sub-band calibration algorithm revision, extending sub-band calibration samples from 1 to 4 or more (up to 50) to provide the flexibility to adjust the sub-band sample range.
6.1032.1.2	2010/10/11	YH Sung	Update 1. Multi-slot TX section (3.2.9): Add descriptions about TX power rollback in multi-slot TX (avaialbe since 09BW1008) 2. Factory calibration configuration file sample (4.1.1): [NSFT BER] supports single-end BER
6.1044.0	2010/11/05	YH Sung	**Bug fixes:** 1. [General] Fix the connect smart phone timeout issue caused by the timeout value too short 2. [NVRAM Editor] Fix the access violation in NVRAM editor after loading an invalid database 3. [Audio Tool] Fix the change database false alarm when the user selects the valid database. **New features:** 1. [Factory Calibration] NSFT BER test supports single-end BER 2. [Audio Tool] Add "Custom Spec" functionality in Speech FIR Tuning to support customer load a self-defined spec file. (updated in section: 3.8.9.2) **Enhancement:** 1. [Audio Tool] Display frequency response based on the FIR coefficients uploaded from flash in “Audio Compensation” pag
6.1112.0	2011/03/27	YH Sung Builn Huang	**New features:** 1. [Security] Support certificate selection in main form. 2. [Audio Tool] Support wide-band FIR tuning in Quick Speech Tuning window. 3. [Audio Tool] Support wide-band input speech FIR and wide-band

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			output speech FIR in wide-band FIR tuning window. 4. [Audio Tool] Support wide-band speech enhancement in Quick Speech Tuning window. 5. [Audio Tool] Support audio compensation loud-speaker besloudness. 6. [Audio Tool] Support udio compensation filter software FIR. 7. [FM Radio Tool] Support quiried status “Cap Array”. **Changes** 1. [RF tool] GMSK/EPSK APC profile setting for closed-loop control (Section **Error! Reference source not found.**) 2. [Factory Calibration] ADC calibration does not check slope and offset anymore (refer to Section 4.5.1) 3. [Factory Calibration] MT6251 IRR W coefficient calibration (Section 4.2.9) 4. [Factory Calibration] MT6162 LNA RX path loss calibration (Section 4.2.8) 5. [Factory Calibration] MT6276 + MT6162 2G EPSK FHC TX calibration (Section 4.2.18.3) 6. [Factory Calibration] MT6276 + MT6162 Closed-loop power control calibration (Section 4.2.17)
6.1204.0	02/01/2012	Eason Lai	**Enhancement:** 1. [Factory Calibration] Create 4.4 Others Calibration section. The contaion is moved from section 4.3. 2. [Factory Calibration] Aux. ADC is calibrated before shipment in MT6255. (Section 4.4.1.1)
6.1206.0	02/06/2012	Eason Lai	**Enhancement:** Add following configures illustration: 1. FHC_UTS_GSM850_GMSK_MATH_MODE 2. FHC_UTS_GMSK_APC_DAC_MODE 3. FHC_UTS_GSM850_GMSK_APC_LOG_SPACE_OFFSE 4. TEST_GSM850_CHANNEL_NUM 5. GMSK_TX_PVT_Enabled
6.1208.0	02/29/2012	YH Sung	Add descriptions of TDSCDMA configuration file in section 4.4 Add descriptions of 2G AFC calibration configuration file in section 4.2.3.1
6.1208.0	03/22/2012	YH Sung	Update FAT Editor descriptions in section 3.15
6.1212.0	04/02/2012	Eason Lai	Update Rx pathloss configure parameters

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1 Introduction

1.1 Overview

The document is META (Mobile Engineering Testing Architecture) application note. META application is composed of META LAB and META factory. Both META LAB and META factory are window application tools at PC side, but their main applications are different. META LAB offers versatile testing features in RF TX/RX/AFC control, NVRAM access testing and editing, audio related functions, baseband related functions, MMI data download, IMEI download, getting hardware and software version, barcode download, updating parameter, FAT editor and database change list but all testing procedure should be operated manually due to no specific equipment control. Contrarily, META-Factory provides the RF calibration and ADC calibration function required in factory mass production line and Agilent 8960, R&S CMU 200 and power supply control will be supported.

1.2 Environment requirement

OS:

1. MS Windows 2000 or XP

The following driver and library are needed for META factory:

2. NI (National Instruments) GPIB-USB driver (The driver is bundled with NI GPIB-USB device) or Agilent GPIB-USB driver.

Hardware:

3. Generic Pentium III or above PC

The following hardware is needed for META factory

4. NI or Agilent GPIB-USB device
5. Agilent 661x or Agilent 663x2 series power supply for ADC calibration
6. Agilent 8960 or R&S CMU 200 for RF calibration
7. Litepoint IQView or Agilent N4401A for WiFi calibration

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2 Installation

Please execute “setup.exe” to start installing META. The install shield will help user to install META step by step. It will register “controls.dll” automatically. (Figure 1~Figure 4 use 5.0828.01 for example)

1. Double click setup.exe.
2. Please click [Next>] button.
3. Please select a directory to install and click [Next>] button.
4. After confirm your installation settings, please click [Install] button to start installation.
5. After the installation complete, please click [Finish] button.

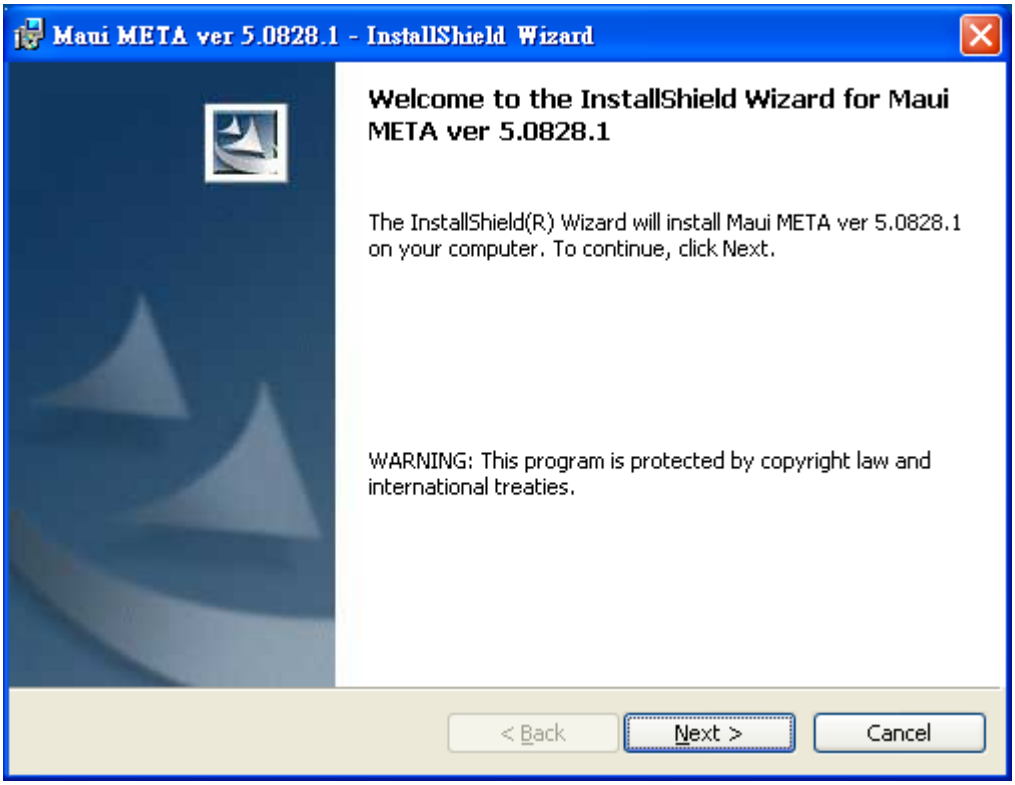

Figure 1 ***Please click [next >] button.***

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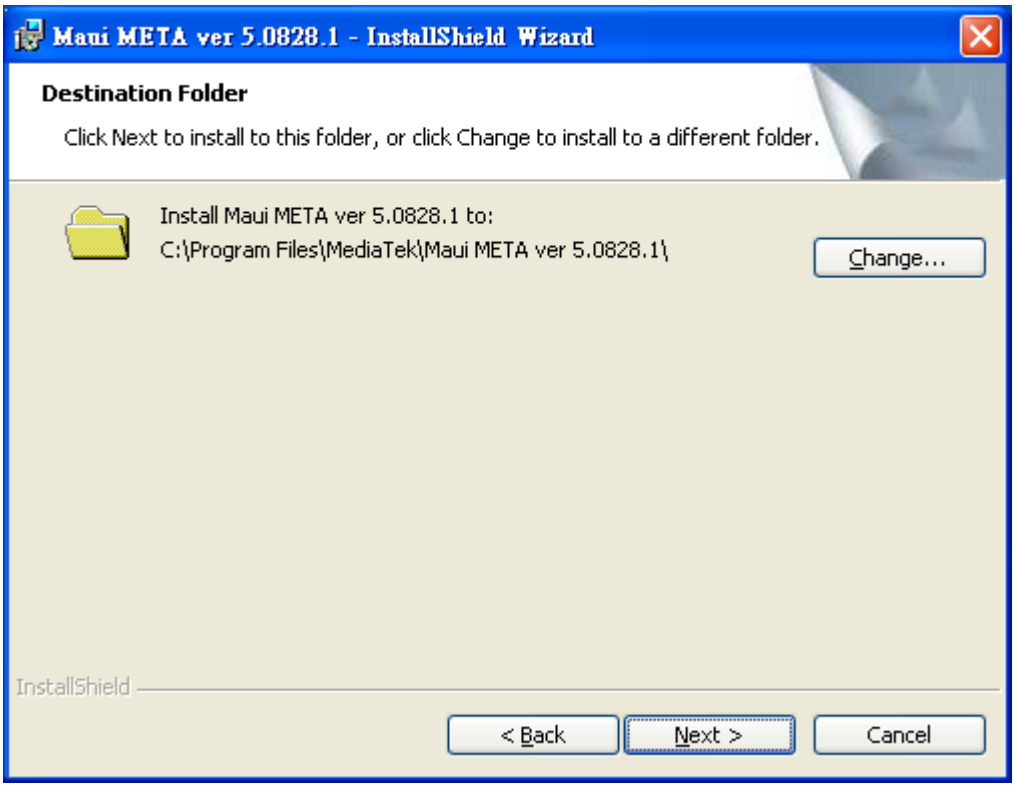

Figure 2 ***Please select a directory to install and then click [next >] button.***

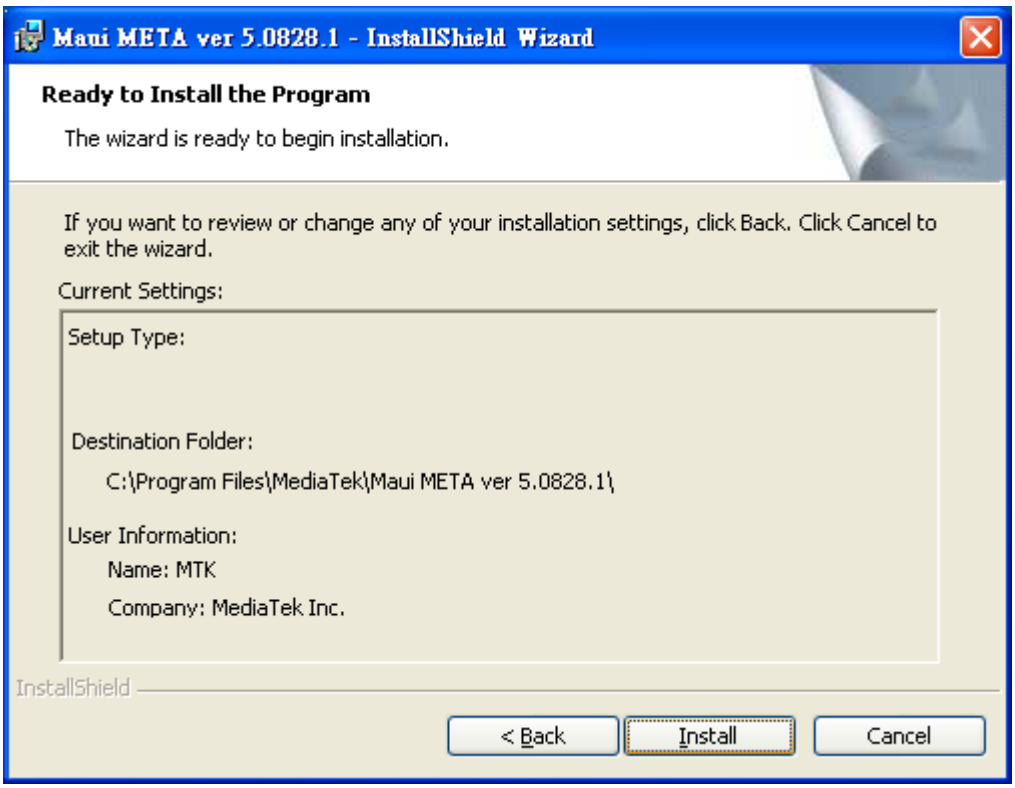

Figure 3 ***Please confirm installation setting and then click [Install] button.***

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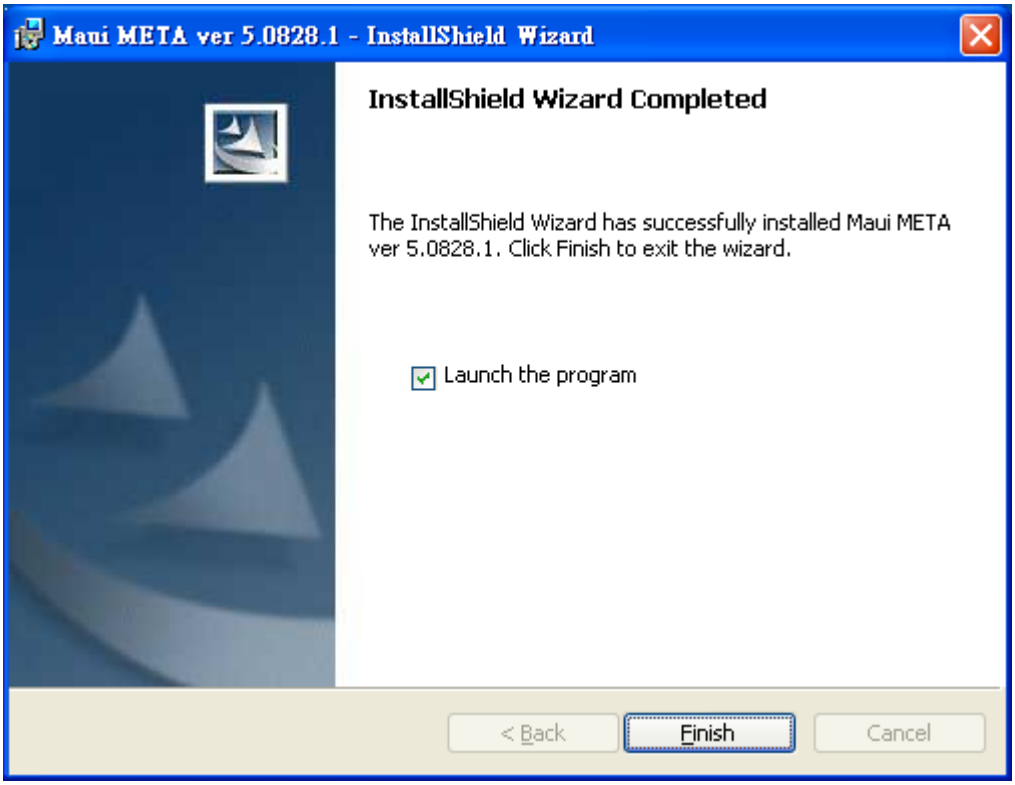

Figure 4 ***The Installation is complete, please click [Finish] button.***

Note: After installation, there will be a META shortcut icon on windows desktop and programs menu. User can click the META icon to start it.

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3 META LAB

3.1 Basic configuration

3.1.1 Connect with the target by UART

The user can connect with the target by UART COM port following the steps

1. Select the UART COM port
2. Click “Reconnect” button
3. Connect the UART cable to the target and then power on the target while the “Connection state indicator” starts to blink

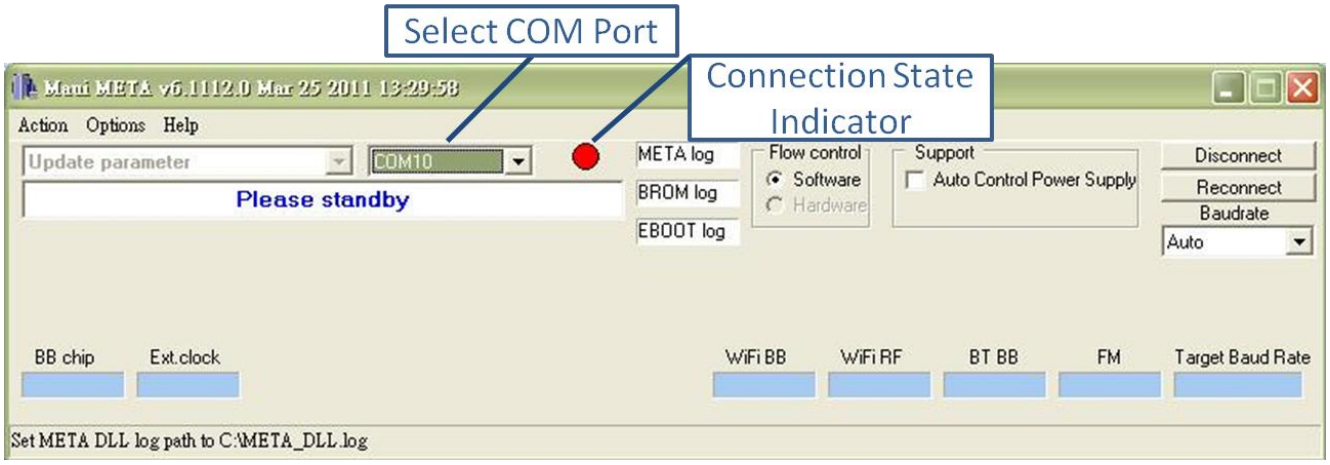

Figure 5 ***Select UART COM port***

The “Connection state indicator” has three states

1. Disconnected (Red): The META tool does not send any data to the target
2. Connecting (Yellow/Green blinking): The META tool sends data to the target through the COM port and try to sync with the target.
3. Connected (Yellow): The META tool is in connected state and wait for user’s input.

3.1.2 Connect with the target by USB

All of the operating procedures are the same with the UART case, except that the user has to choose the “USB COM” while selecting COM port.

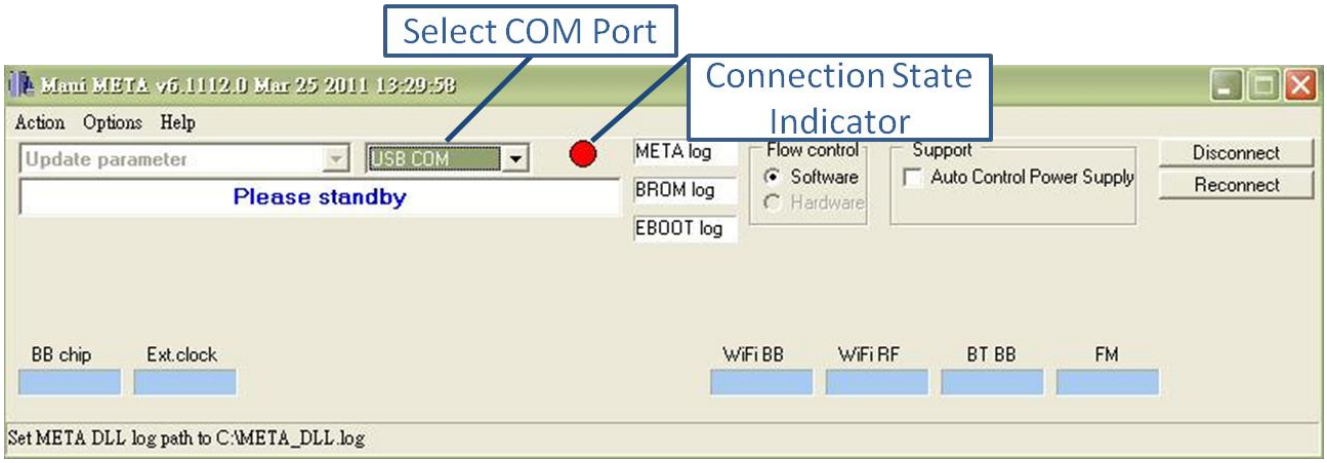

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Figure 6 ***Select USB COM port***

3.1.3 Open authentication file

META uses authentication file to pass target if target is with a secure-on baseband chip. Different secure-on baseband chip may require a different authentication file. User has to open corresponding authentication file for each secure-on baseband chip. Currently, only the few baseband chips can have secure-on version. They are MT6223, MT6225, MT6226C, MT6229E4, MT6235, MT6238, and MT6268A.User has to open authentication file if he wants to connect META with a secure-on baseband chip.

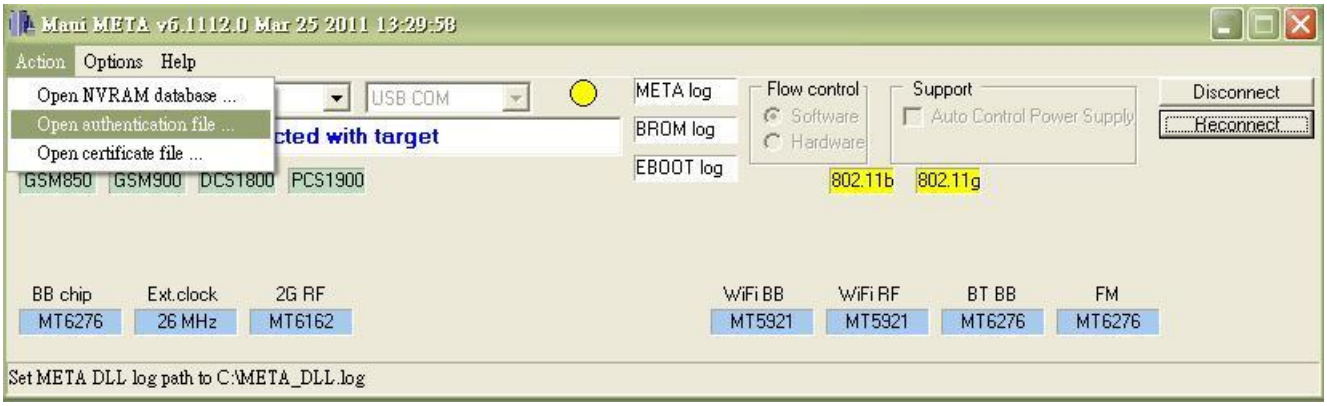

Figure 7 ***Open authentication file***

3.1.4 Open certificate file

META tool supports loading certificate file from file system for secure-on SV5 baseband chips. The user has to select certificate file from the UI and then click “Reconnect” button to connect with secure-on SV5 target

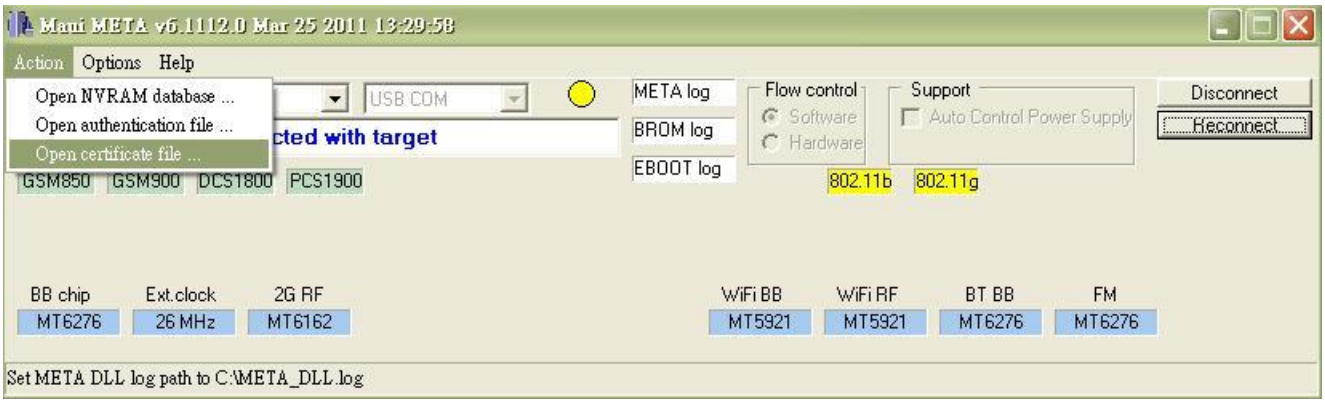

Figure 8 ***Open certificate file***

3.1.5 Open NVRAM database

META will initializes with “BPLGInfo” file that is generated at compile time of MS source code. The default directory of “BPLGInfo” is tst\database of target source code structure.

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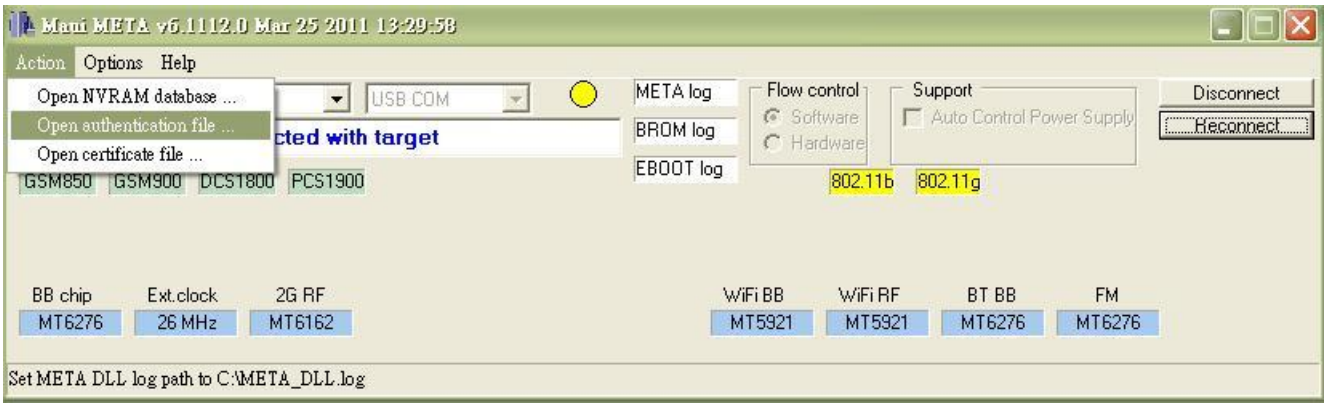

Figure 9 ***Click [Open NVRAM database] menu item***

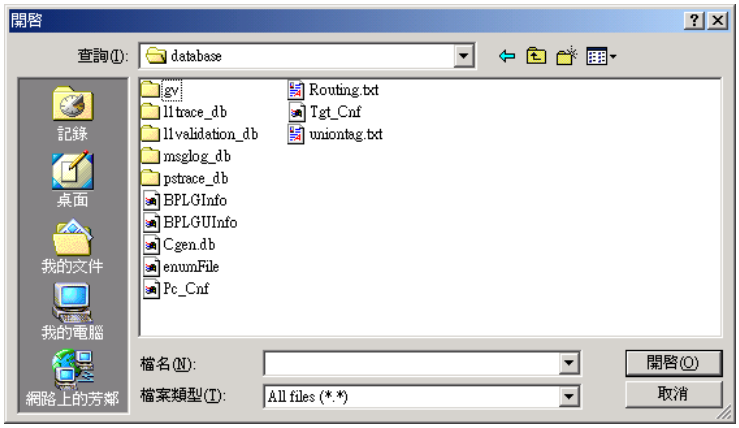

Figure 10 ***Please open NVRAM database***

3.1.6 META_DLL

META_DLL is responsible to communicate with MS via RS232or USB interface. You can get META_DLL version by clicking the [Help→About] menu item.

The META DLL log records the META API command sent to the target and the response from the target. The META DLL log is defaultly turned on for trouble shooting. The META DLL log also shows the OS version and UART cable driver information for further analysis.

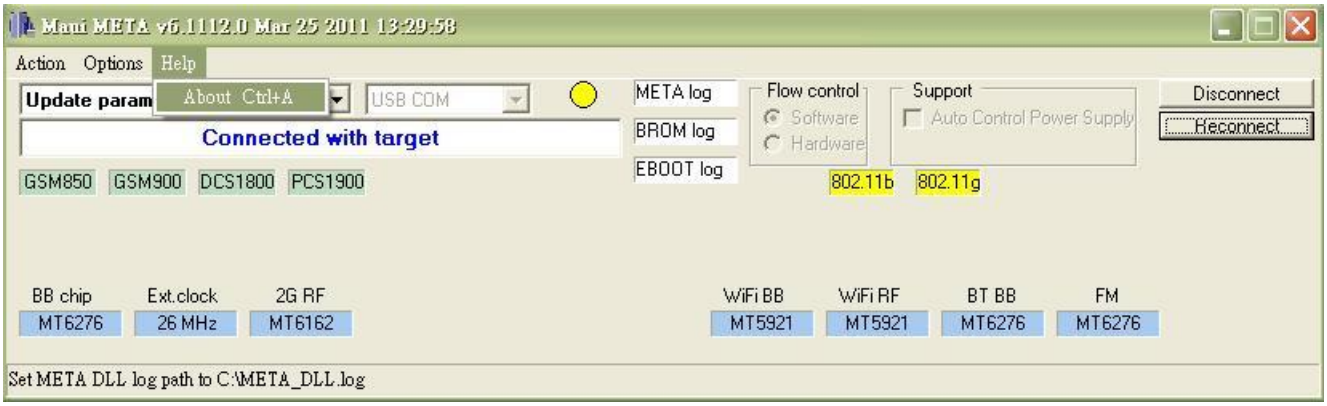

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Figure 11 ***Click [About] menu item***

```
05/17/10 22:21:00.155 META_DLL[2408][3704]:
==========================================================================================================================
= (Init.cpp:1329)
05/17/10 22:21:00.155 META_DLL[2408][3704]: META_GetDLLInfo(): META_DLL_v6.1016.05 [Official-Build](Release Version)
(Init.cpp:1330)
05/17/10 22:21:00.155 META_DLL[2408][3704]: META_GetDLLInfo(): Build-Date: 2010/05/17 21:06:18                    (Init.cpp:1331)
05/17/10 22:21:00.155 META_DLL[2408][3704]: META_GetDLLInfo(): LoadPath=C:\Program Files\MediaTek\Maui META ver 6.1016.5\META_DLL.DLL
(Init.cpp:1332)
05/17/10 22:21:00.155 META_DLL[2408][3704]: OS Version: 5.1 (Init.cpp:1301)
05/17/10 22:21:00.249 META_DLL[2408][3704]: ECP Printer Port (LPT1) (Driver File Path): C:\WINDOWS\system32\DRIVERS\parport.sys (Init.cpp:1178)
05/17/10 22:21:00.249 META_DLL[2408][3704]: ECP Printer Port (LPT1) (Driver FileVersion): 5.1.2600.5512 (Init.cpp:1204)
05/17/10 22:21:00.249 META_DLL[2408][3704]: ECP Printer Port (LPT1) (Driver File Manufacturer): Microsoft Corporation (Init.cpp:1224)
05/17/10 22:21:00.342 META_DLL[2408][3704]: ECP Printer Port (LPT1) (Driver Date): 2001/7/1 (Init.cpp:1257)
05/17/10 22:21:00.342 META_DLL[2408][3704]: ECP Printer Port (LPT1) (Driver Version): 5.1.2600.0 (Init.cpp:1259)
05/17/10 22:21:00.342 META_DLL[2408][3704]: ECP Printer Port (LPT1) (Driver Manufacturer): (Standard port types) (Init.cpp:1262)
05/17/10 22:21:00.342 META_DLL[2408][3704]: Communications Port (COM1) (Driver File Path): C:\WINDOWS\system32\DRIVERS\serial.sys (Init.cpp:1178)
05/17/10 22:21:00.342 META_DLL[2408][3704]: Communications Port (COM1) (Driver FileVersion): 5.1.2600.5512 (Init.cpp:1204)
05/17/10 22:21:00.342 META_DLL[2408][3704]: Communications Port (COM1) (Driver File Manufacturer): Microsoft Corporation (Init.cpp:1224)
05/17/10 22:21:00.561 META_DLL[2408][3704]: Communications Port (COM1) (Driver Date): 2001/7/1 (Init.cpp:1257)
05/17/10 22:21:00.561 META_DLL[2408][3704]: Communications Port (COM1) (Driver Version): 5.1.2600.0 (Init.cpp:1259)
05/17/10 22:21:00.561 META_DLL[2408][3704]: Communications Port (COM1) (Driver Manufacturer): (Standard port types) (Init.cpp:1262)
05/17/10 22:21:00.561 META_DLL[2408][3704]: Communications Port (COM1) (Driver Date): 2001/7/1 (Init.cpp:1257)
05/17/10 22:21:00.561 META_DLL[2408][3704]: Communications Port (COM1) (Driver Version): 5.1.2600.0 (Init.cpp:1259)
05/17/10 22:21:00.561 META_DLL[2408][3704]: Communications Port (COM1) (Driver Manufacturer): (Standard port types) (Init.cpp:1262)
05/17/10 22:21:00.561 META_DLL[2408][3704]: USB Serial Port (COM16) (Driver File Path): C:\WINDOWS\system32\drivers\ftser2k.sys (Init.cpp:1178)
05/17/10 22:21:00.561 META_DLL[2408][3704]: USB Serial Port (COM16) (Driver FileVersion): 2.2.4.1 (Init.cpp:1204)
05/17/10 22:21:00.561 META_DLL[2408][3704]: USB Serial Port (COM16) (Driver File Manufacturer): FTDI Ltd. (Init.cpp:1224)
05/17/10 22:21:00.624 META_DLL[2408][3704]: USB Serial Port (COM16) (Driver Date): 2007/6/27 (Init.cpp:1257)
05/17/10 22:21:00.624 META_DLL[2408][3704]: USB Serial Port (COM16) (Driver Version): 2.2.4.0 (Init.cpp:1259)
05/17/10 22:21:00.624 META_DLL[2408][3704]: USB Serial Port (COM16) (Driver Manufacturer): FTDI (Init.cpp:1262)
```

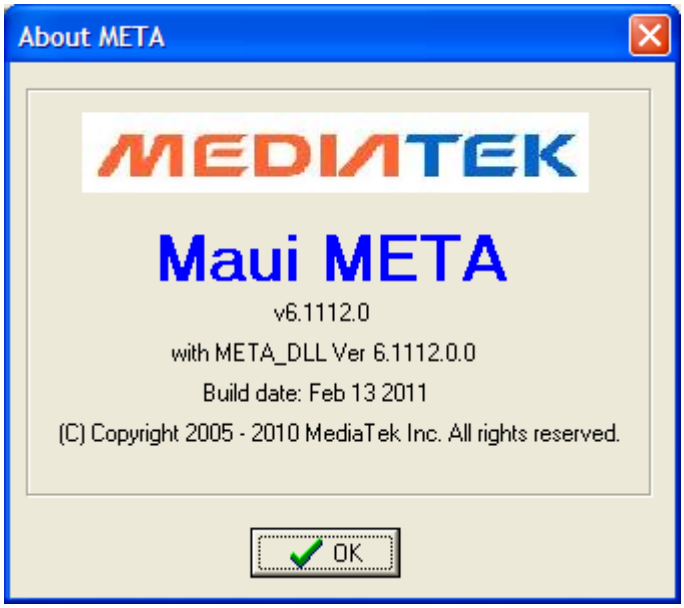

Figure 12 ***META dll version***

3.2 RF tool

After META opens COM port, reads NVRAM database and reset target to test mode, user can start to do all calibration and testing. User can switch to RF tool by selecting [RF tool] from main selection menu.

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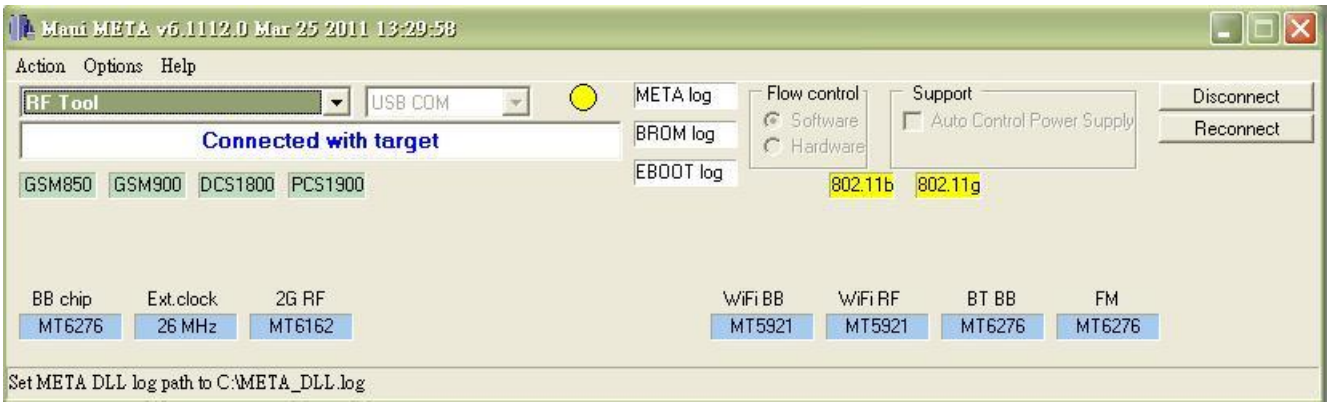

Figure 13 ***Select [RF Tool] from main selection menu***

3.2.1 PM (power measurement)

PM function is used for measuring the power of the indicated channel. User can key in ARFCN, PM/Frame, PM Count and Gain (dB) and then click [Start] button. We can get the deviation from the formula below.

$$Variation\ (PM) = \frac{\sum_{n=1}^{N}(PM_i - \overline{PM})^2}{N} = \overline{PM^2} - (\overline{PM})^2 = \left(\frac{\sum_{n=1}^{N} PM_i^2}{N}\right) - \left(\frac{\sum_{n=1}^{N} PM_i}{N}\right)^2,$$

$Deviation\ (PM) = \sqrt{Variation\ (PM)}$, where N = total measured samples = Testing FN * (Samples per frame)

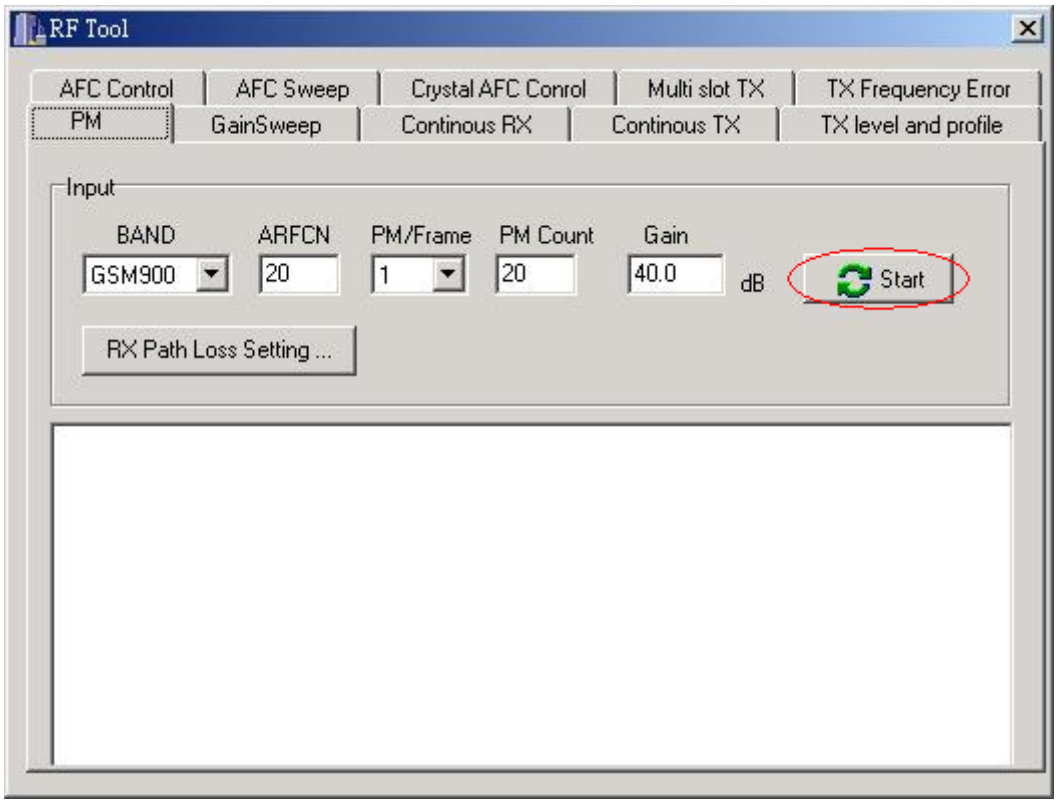

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Figure 14 ***Click [Start] button to start power measurement***

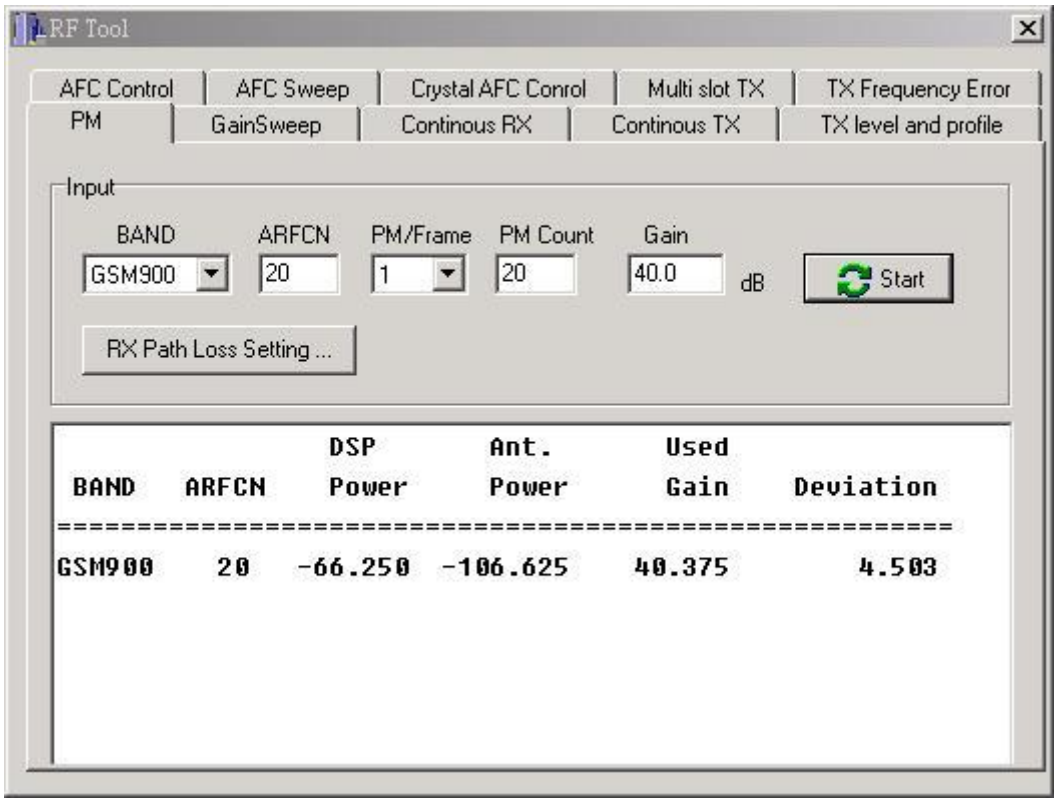

Figure 15 ***PM result***

8. DSP power (dBm): It is the average of power measurement samples at DSP.
9. Antenna power (dBm): It is the average of the power measurement samples at antenna.
10. Deviation: It is the deviation value of power measurement samples.
    - Note the value returned from target is square of deviation. PC side program will get deviation from root square of the value returned from target.
11. Used Gain (dB): It is gain of the entire RF module to measure input power.
    - Note the used gain returned may not equal the gain requested since the 2 dB quantization error from PGA of transceiver.

The difference of the downlink cell power and the average power of power measurement done by MS is the RX loss. User can save to flash or file by clicking [RX Path Loss Setting] button. Please refer to section 3.2.1.1.

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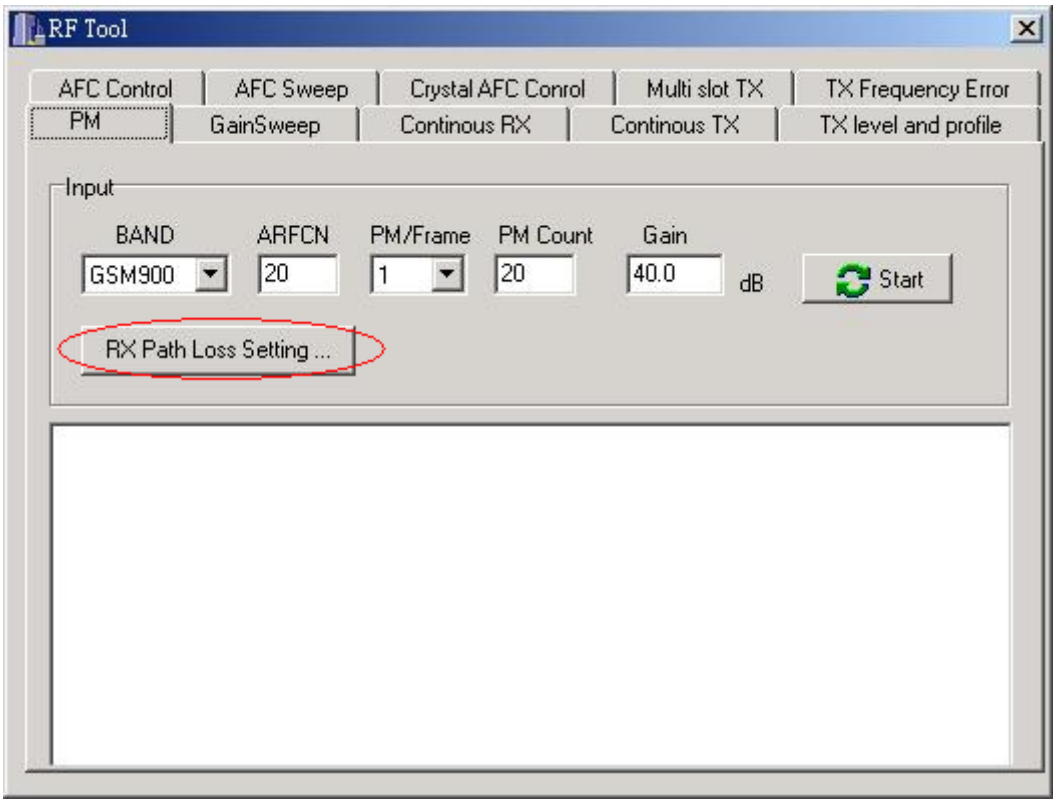

Figure 16 ***Click [RX Path Loss Setting] button***

3.2.1.1 Sub band and path loss window

User can upload or download sub band and path loss values from or to flash. User can load and save these values to files in PC, too. The RX path loss stored in flash of MS will compensate the difference of the downlink cell power and the average power of measurement by RF module.

User can set RX path loss for each band. If the max ARFCN of the (N-1)th and Nth are A, B and the Nth RX loss is C dB, that means MS will set the RX path loss to C for the ARFCN from A+1 to B. The 1st RX loss is set for ARFCNs that are equal and less than 1st ARFCN. The order of max ARFCN and RX loss are from left to right, from up to down. Please refer to Figure 18 .

Example: GSM900 (E-GSM900)

Max ARFCN	15	30	45	60	75	80	100	124	975	1000	1023	-1
RX loss (dB)	-0.25	-0.375	-0.125	0	0	-0.125	-0.5	-0.25	0.75	0.5	0	0

Note that the value –1 in Max ARFCN represents the end of setting.

ARFCN 0 ~ 15: -0.25 dB
ARFCN 16 ~ 30: -0.375 dB
ARFCN 31 ~ 45: -0.125 dB
ARFCN 46 ~ 60: 0 dB
ARFCN 61 ~ 75: 0 dB
ARFCN 76 ~ 80: -0.125 dB
ARFCN 81 ~ 100: -0.5 dB

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ARFCN 101 ~ 124: -0.25 dB
ARFCN 125 ~ 975: 0.75 dB
ARFCN 976 ~ 1000: 0.5 dB
ARFCN 1001 ~ 1023: 0 dB

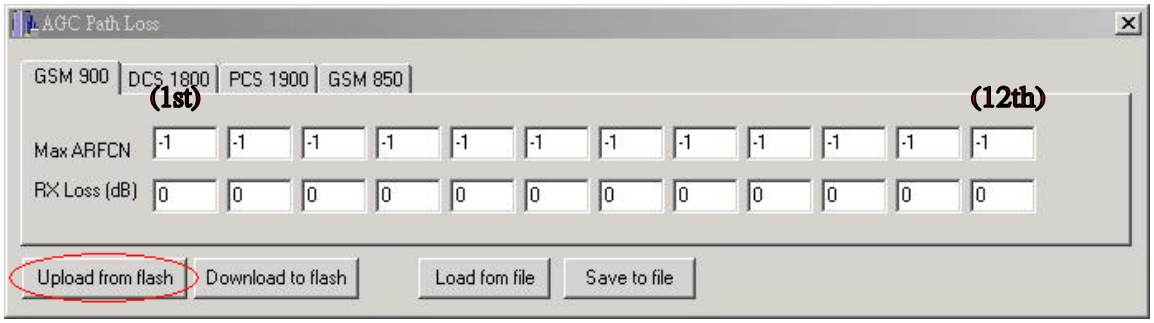

Figure 17 ***Click [Upload from flash] button to read value from flash***

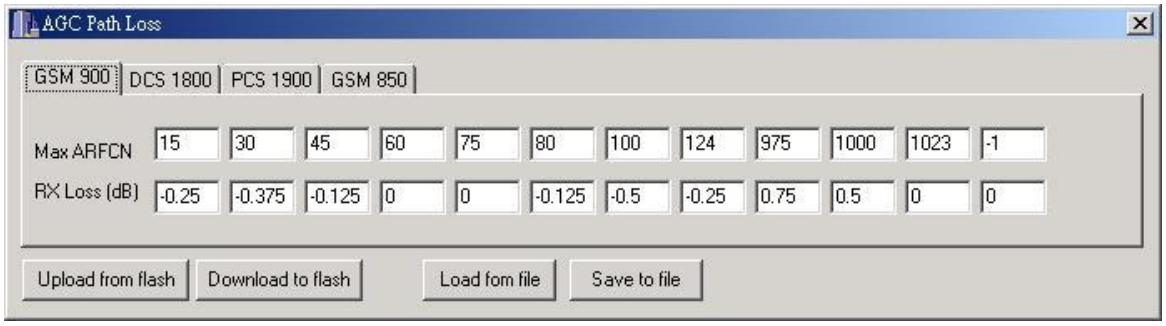

Figure 18 ***Result of sub band and RX path loss value read from flash***

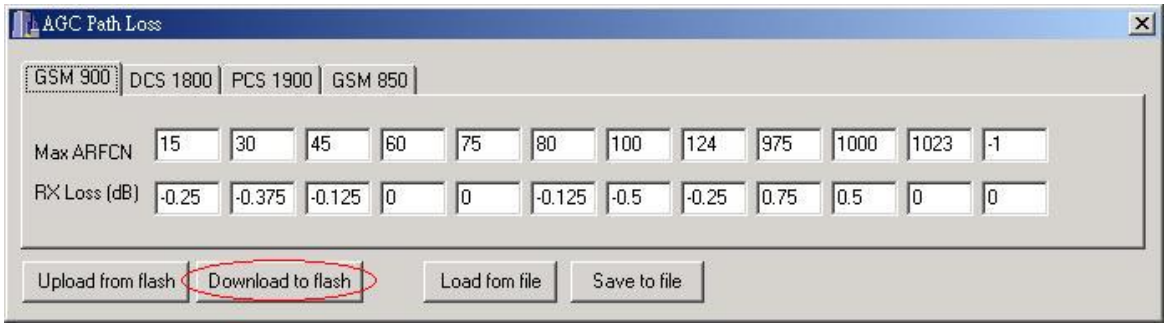

Figure 19 ***Click [Download to flash] button to write value to flash***

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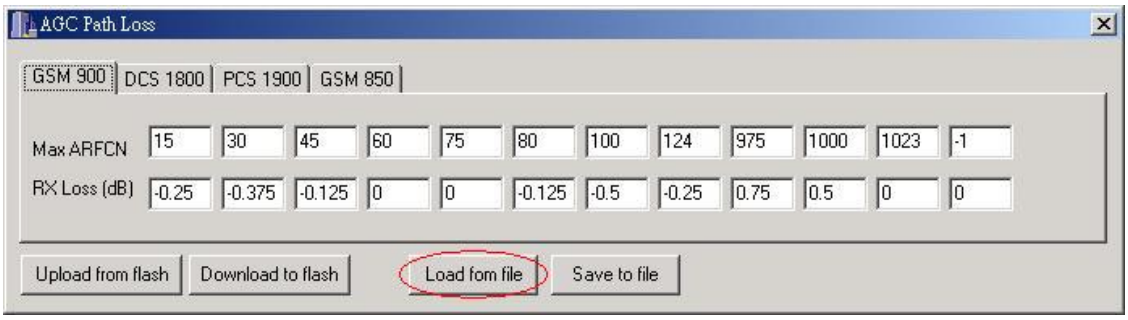

Figure 20 ***Click [Load from file] button to read value from file***

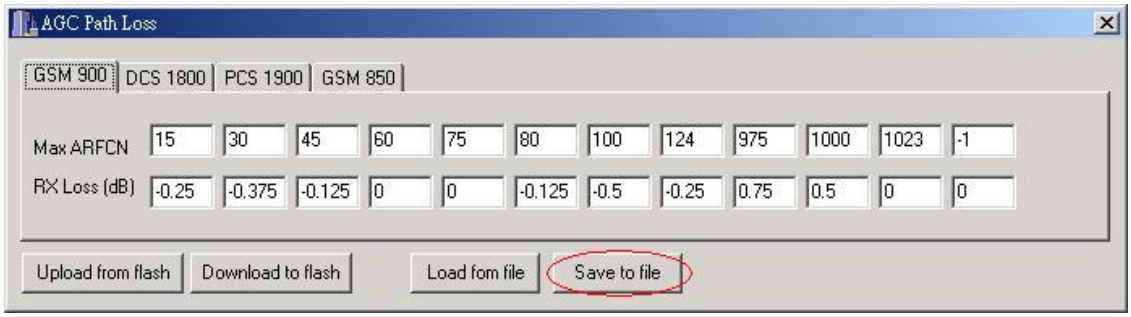

Figure 21 ***Click [Save to file] button to save value to file***

3.2.1.2 Sub band and path loss file format

There is a special text file format when you save the sub band and path loss values. Please follow the file format if you want to change the value in file. Each number must be followed with a comma. The tool can save the path loss value with level ramp table and AFC initial value in single or multiple files.

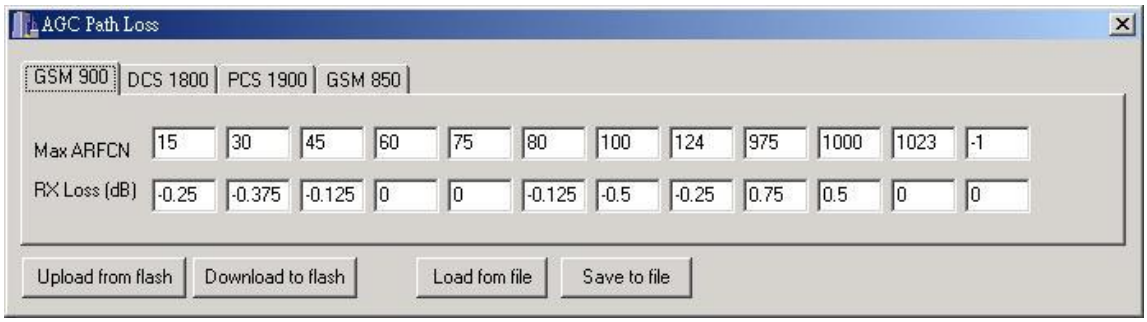

Figure 22 ***Path loss values***

User will get a text file after saving them. The following is a template file that contains RX loss. User will get the text file after saving maximum ARFCN and RX loss to file. Each value must be followed with a comma. Please follow the file format if you want to change the value in file. The Max ARFCN field is corresponding to the Max ARFCN field in path loss window (Figure 22) and RX loss field is corresponding to the RX loss field, too.

[GSM900 Sub band, RX loss]
Max ARFCN=15,30,45,60,75,80,100,124,975,1000,1023,-1
RX loss=-0.250,-0.375,-0.125,0.000,0.000,-0.125,-0.500,-0.250,0.750,0.500,0.000,0.0000

[DCS1800 Sub band, RX loss]
Max ARFCN=550,590,620,650,680,710,740,770,810,850,885,-1

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RX loss=6.625,6.500,5.875,4.750,3.625,3.500,3.875,4.750,5.750,7.000,8.500,0.0000

[PCS1900 Sub band, RX loss]
Max ARFCN=550,810,-1,0,0,0,0,0,0,0,0,0
RX loss=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000

Note: -1 indicates the end of the column Max_ARFCN

3.2.2 Gain sweep

Gain Sweep is used for measuring the power of the indicated channel by the different gains.

User can execute Gain Sweep function by following steps:
1) Input Band, ARFCN, PM/Frame, PM Count, Min Gain, Max Gain, and Step Gain.
2) Click [Start] button.
3) META shows the PM result: Band, ARFCN, DSP Power, Antenna Power, Used Gain, and Deviation.
4) User can stop this operation by clicking [Stop] button.

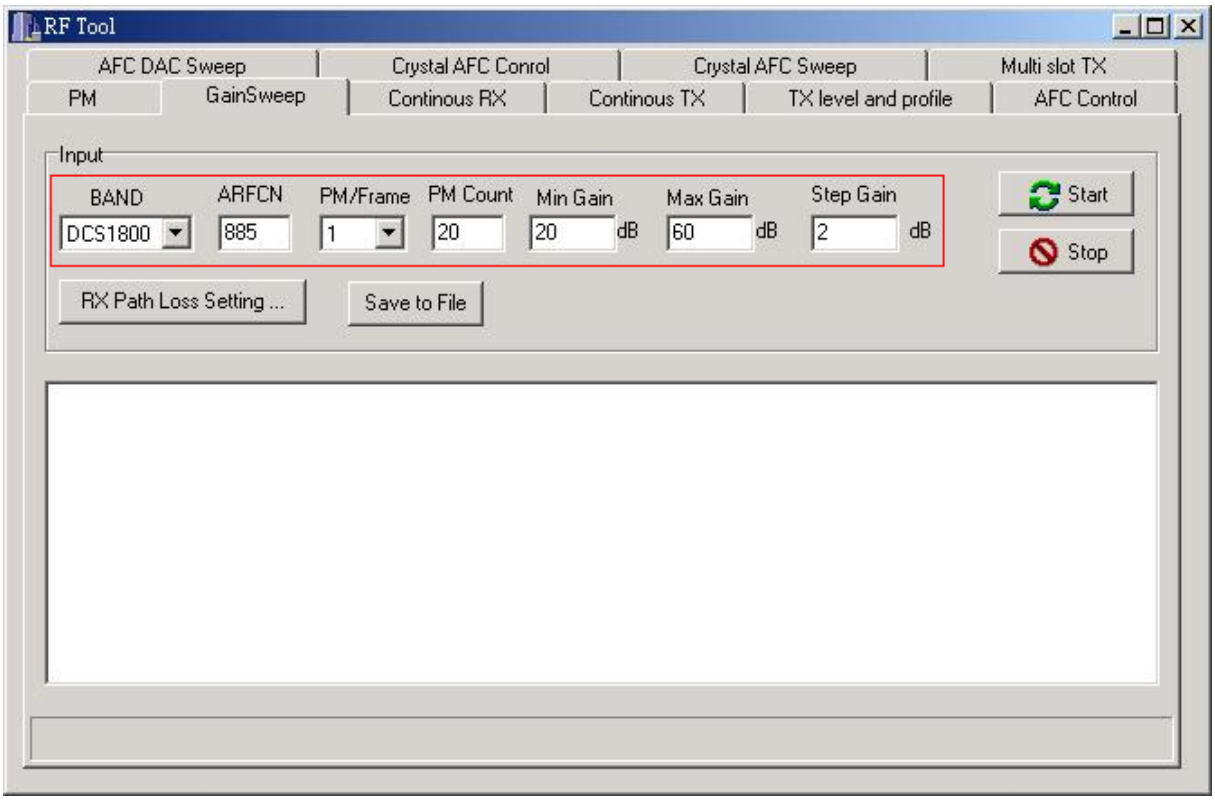

Figure 23 ***Input Band, ARFCN, PM/Frame, PM Count, Min Gain, Max Gain, and Step Gain.***

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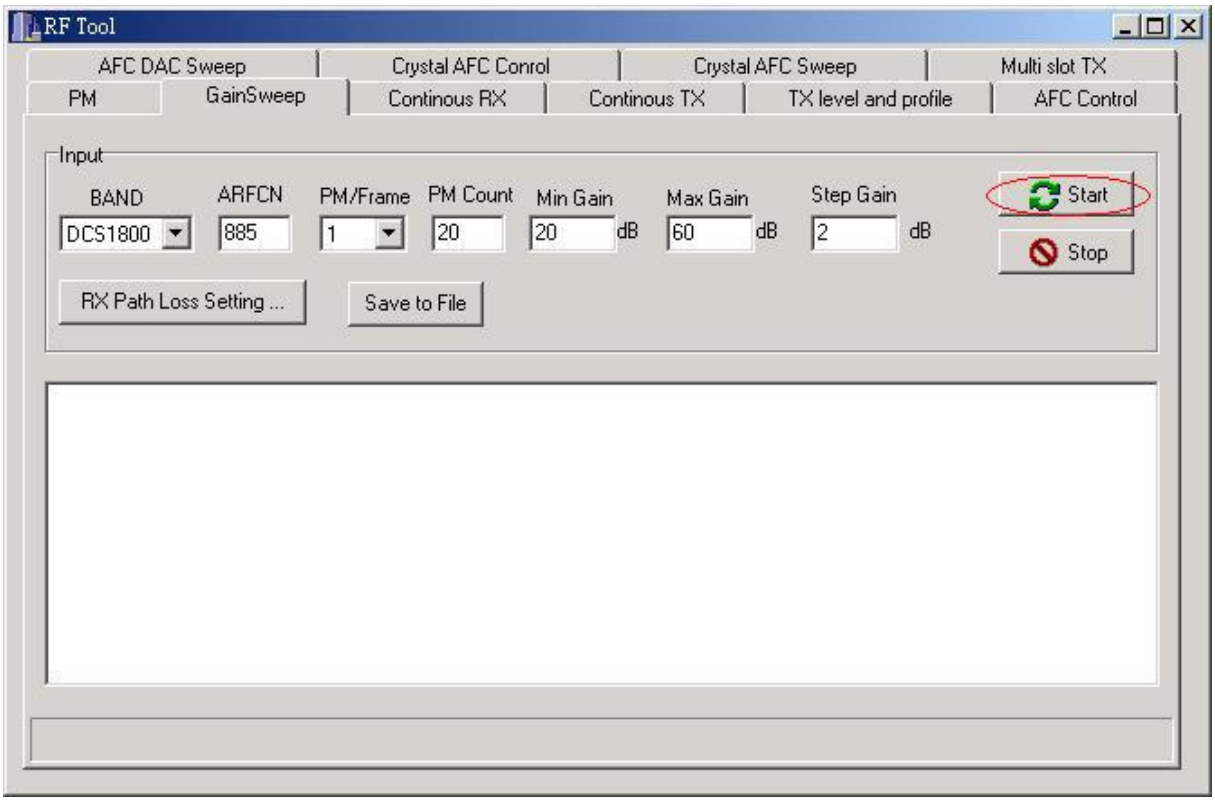

Figure 24 ***Click [Start] button***

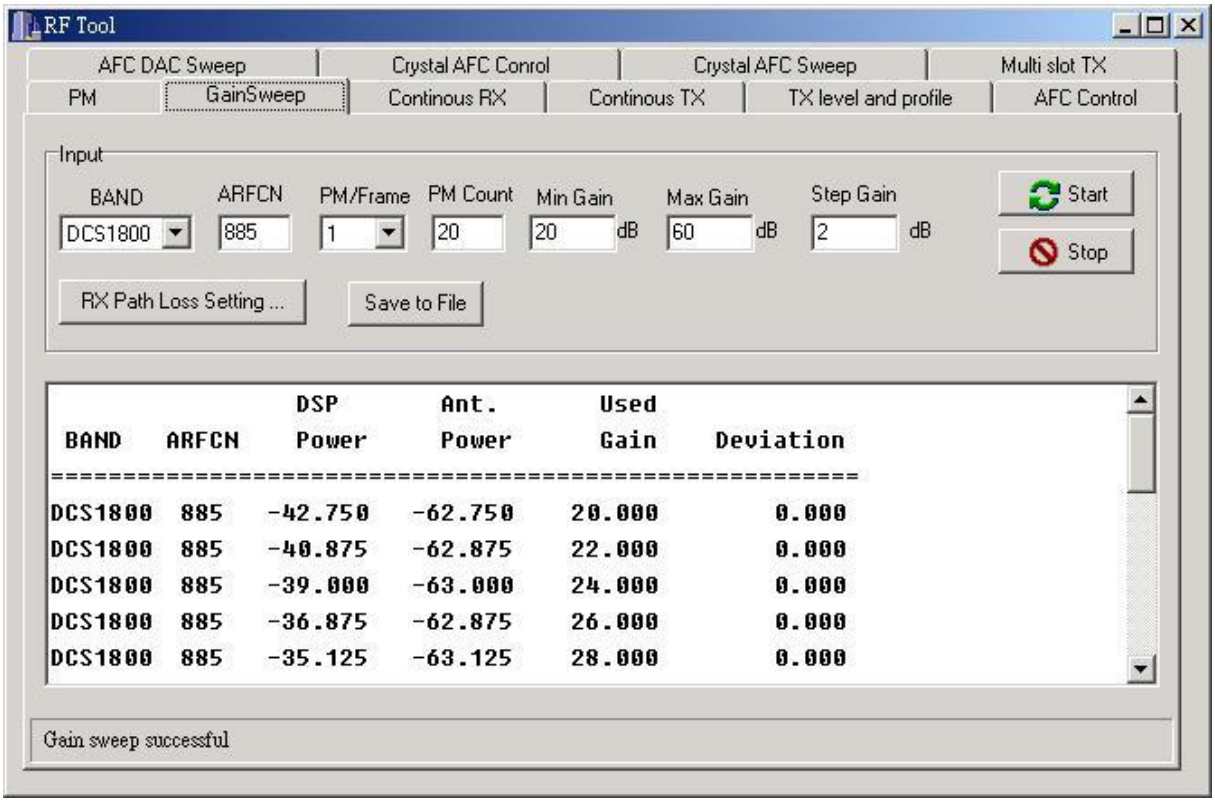

Figure 25 ***Meta shows gain sweep results***

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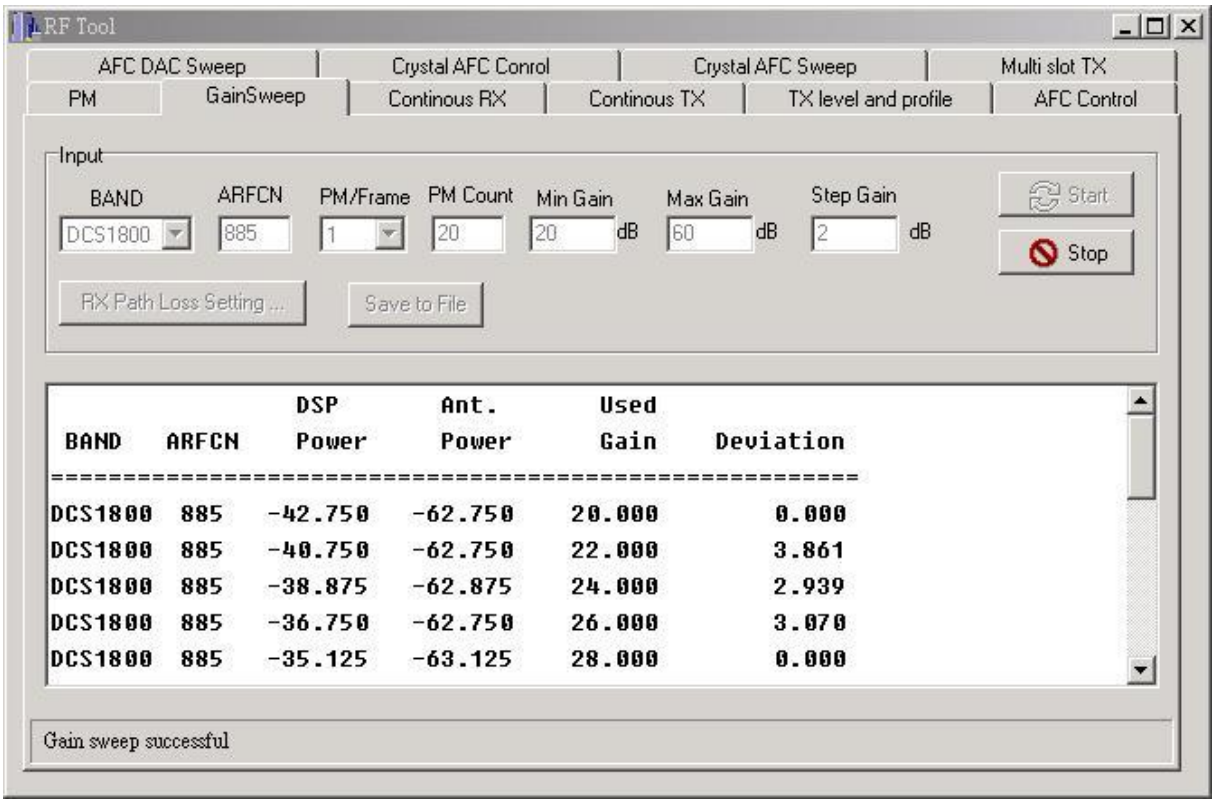

Figure 26 ***Click [Stop] button to stop gain sweep operation***

User can click [*RX Path Loss Setting]* button to show the AGC Path Loss window. Please refer to section 3.2.1.1.

3.2.3 Continuous RX

Continue RX is used for observing RX IQ. User can input ARFCN and Gain (dB) and then click [Start] button to do continuous RX testing. When user wants to stop RX, he can click [Stop] button.

MS will start to do continuous RX of the ARFCN with the gain set by user after getting the continuous RX command from META. It will test RX function of RF module.

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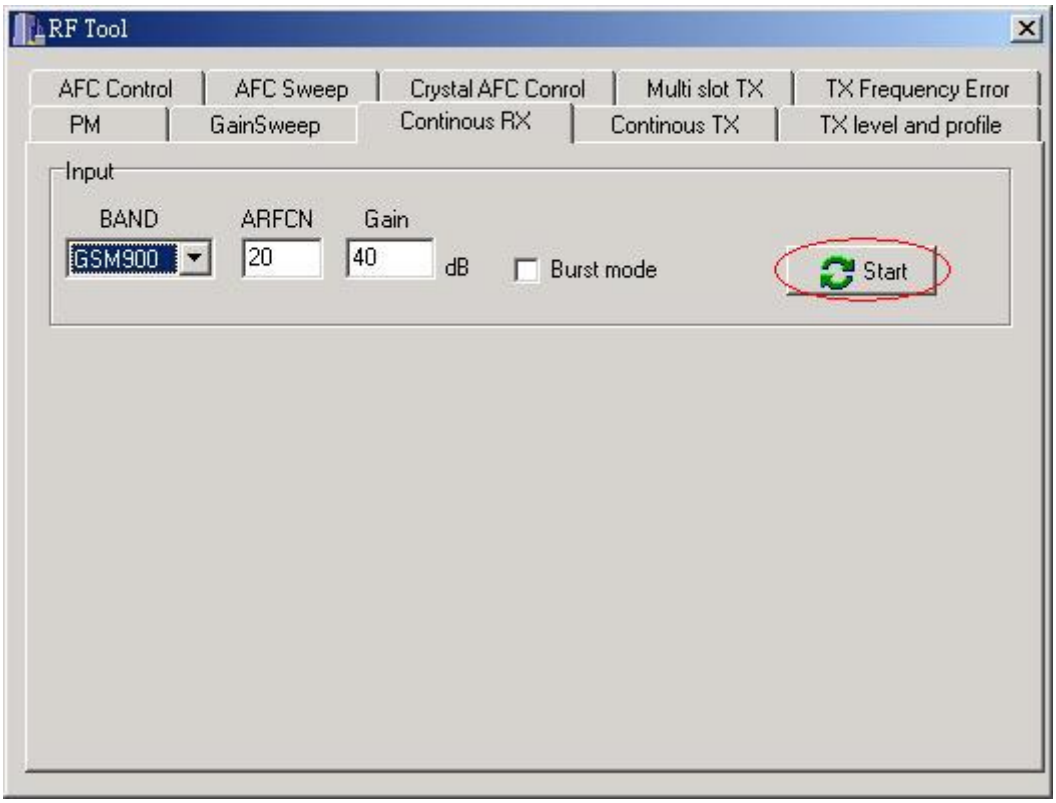

Figure 27 ***Click [Start] button to start continuous RX testing***

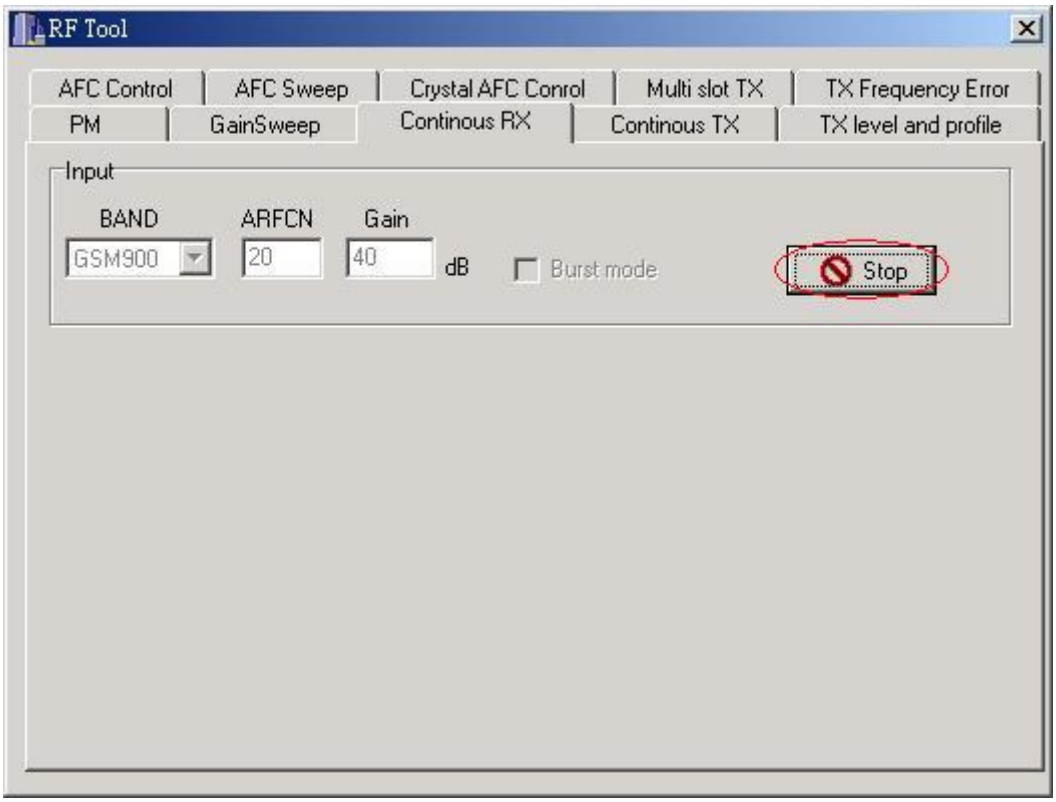

Figure 28 ***Click [Stop] button to stop continuous RX testing***

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After clicking [Stop] button, the caption of button will be changed to [Start].

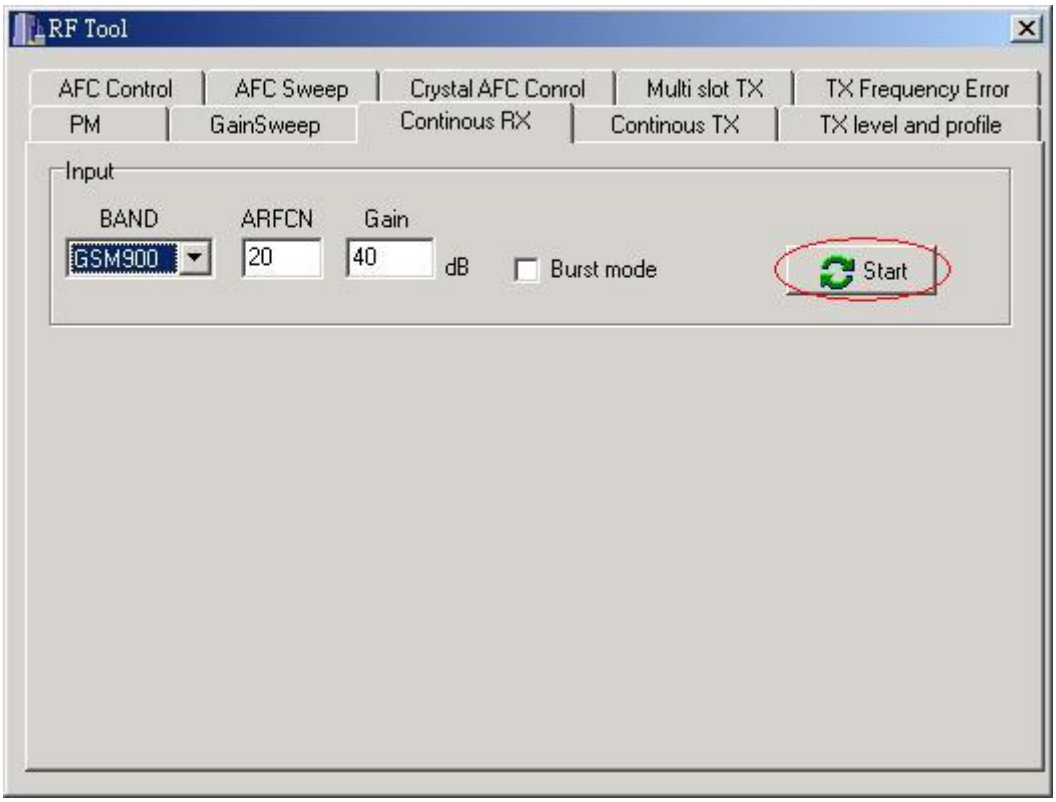

Figure 29 ***The caption of button will change to [Start]***

3.2.4 Continuous TX

Continue TX is used for observing TX IQ. Power amplifier is turned off in this operation. User can input ARFCN value, chose pattern and then click [Start] button to start continuous TX test. After starting continuous TX, user can click [Stop] button to stop it.

MS will start to do TX except for PA circuit on the ARFCN assigned by user continuously after getting the continuous TX command from META. It will test TX function of RF module in MS.

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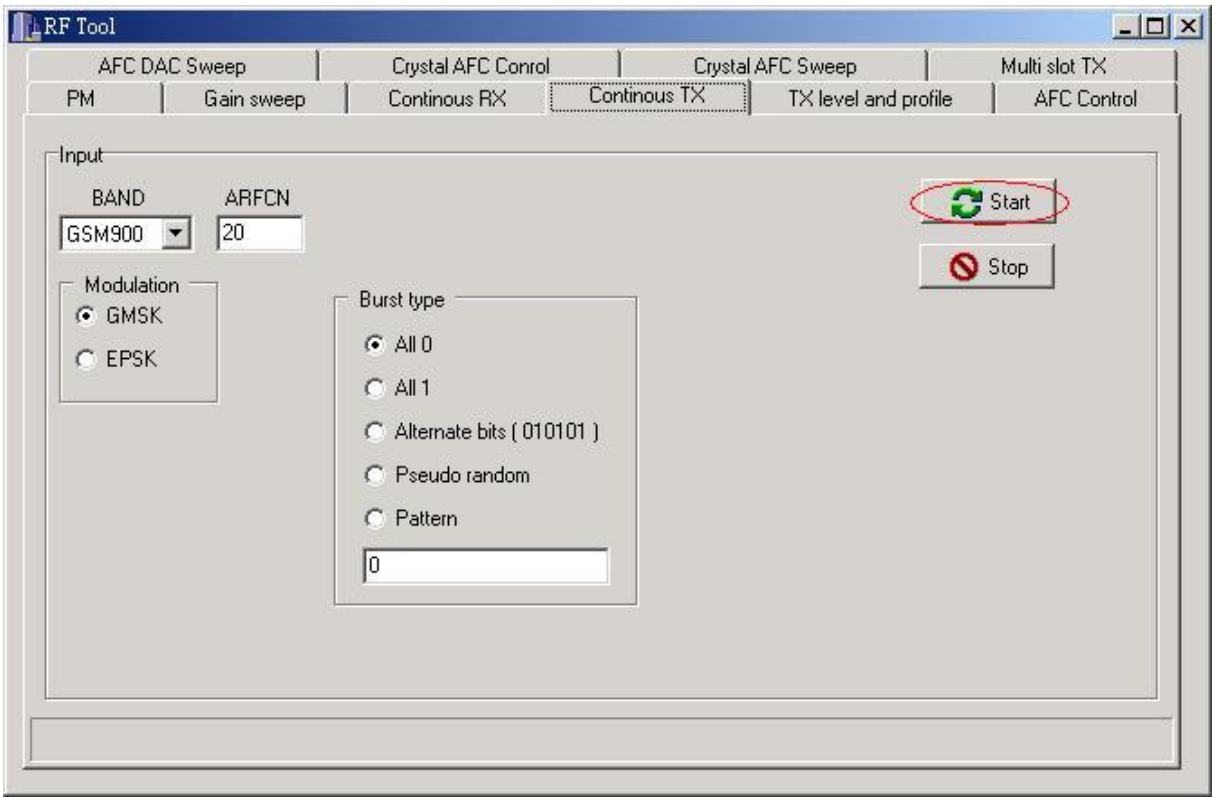

Figure 30 ***Click [Start] button to start testing***

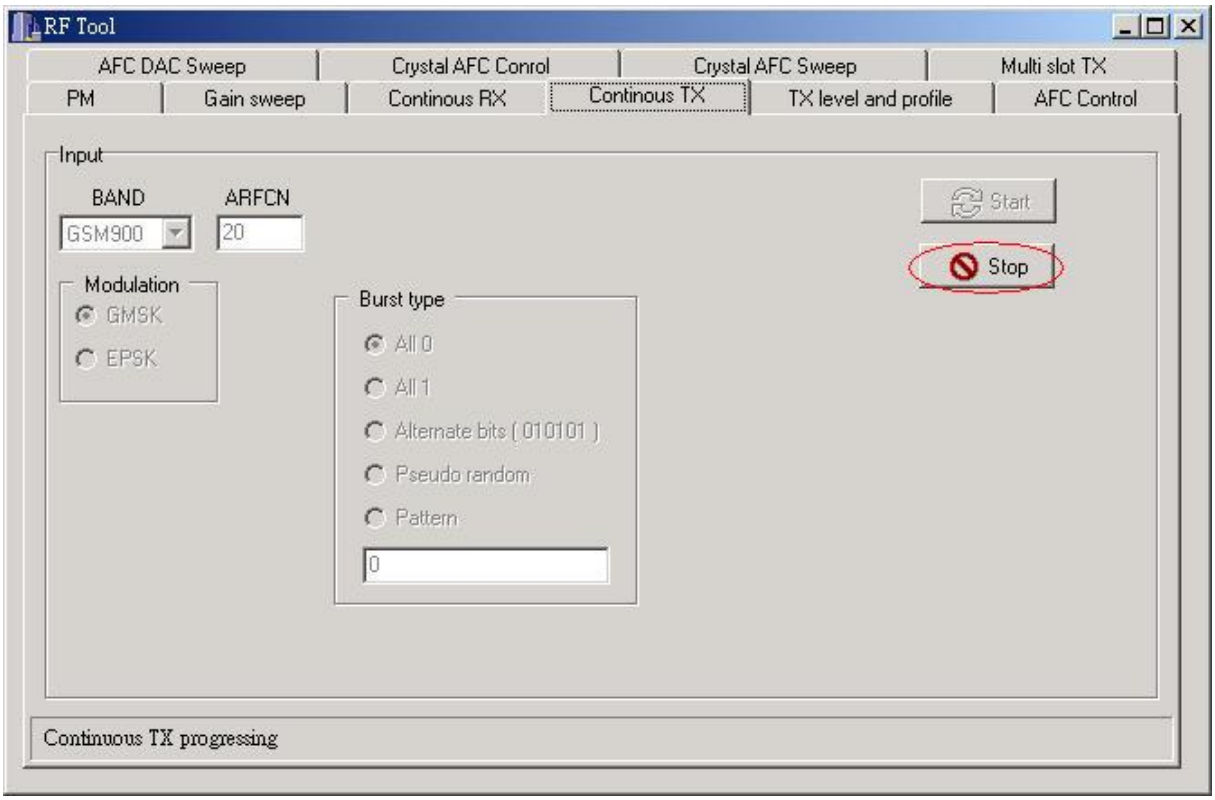

Figure 31 ***Click [Stop] button to stop testing***

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After clicking [Stop] button, the caption of button will change to [Start].

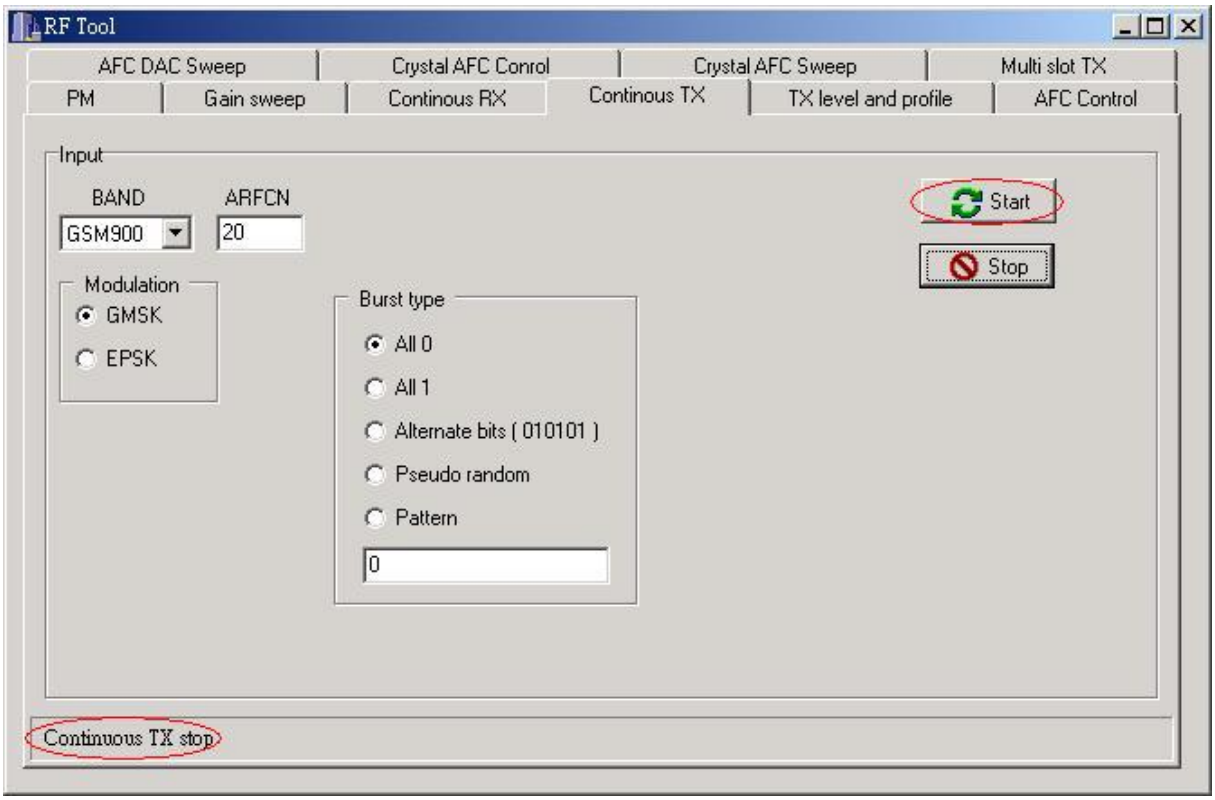

Figure 32 ***The caption of button will change to [Start]***

3.2.5 TX level and profile

This operation is used for fine tune TX configuration and profiles. Power Amplifier is turned on in this operation and indicated bursts are transmitted. User can input Band, ARFCN, TSC, PCL (Power control level), AFC DAC value, coding scheme and chose burst type and then click [Start] button to test TX power level. MS will start to transmit RF signal with the parameters set by user after MS get the command from META. RF engineer can measure the transmitted power of MS by Agilent 8960 or other measurement instrument.

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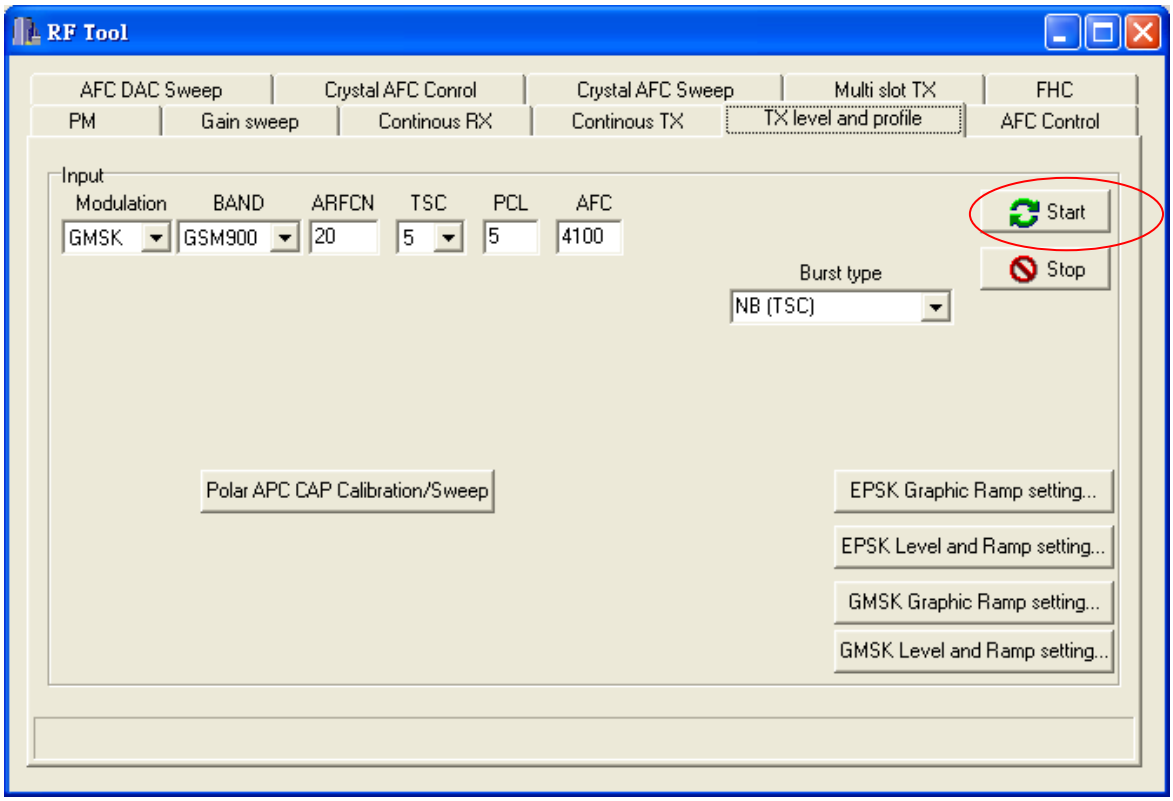

Figure 33 ***Click [Start] button to start TX level testing.***

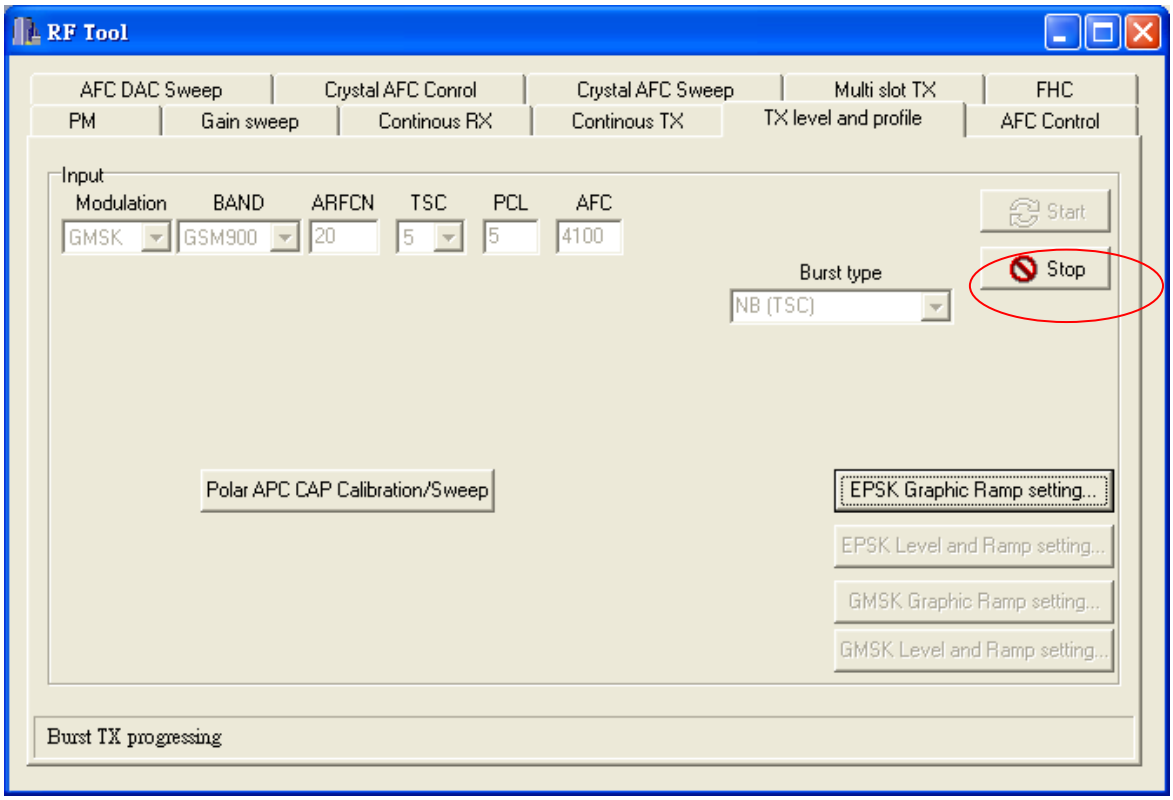

Figure 34 ***Click [Stop] button to stop TX level testing.***

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After clicking [Stop] button, the caption of button will change to [Start].

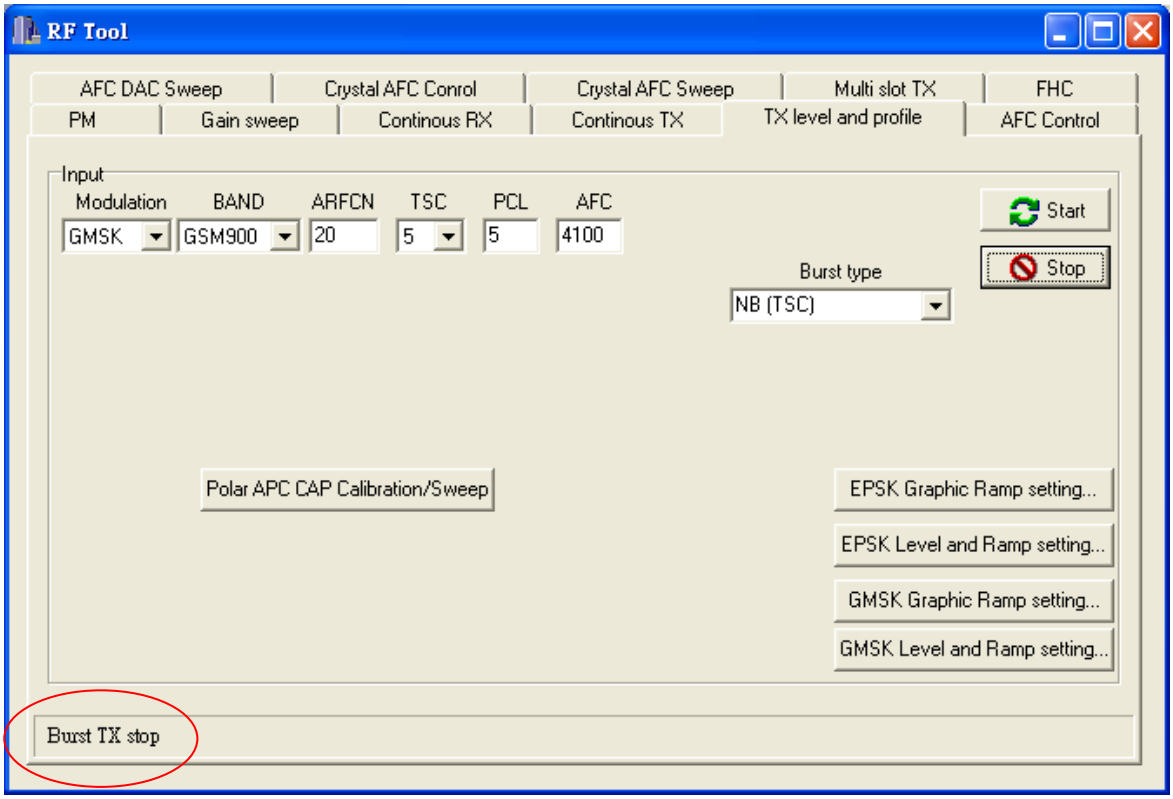

Figure 35 ***The [Start] button is enabled***

3.2.5.1 GMSK Level and ramp setting

User can click [GMSK level and ramp setting…] button to show the level and ramp window.

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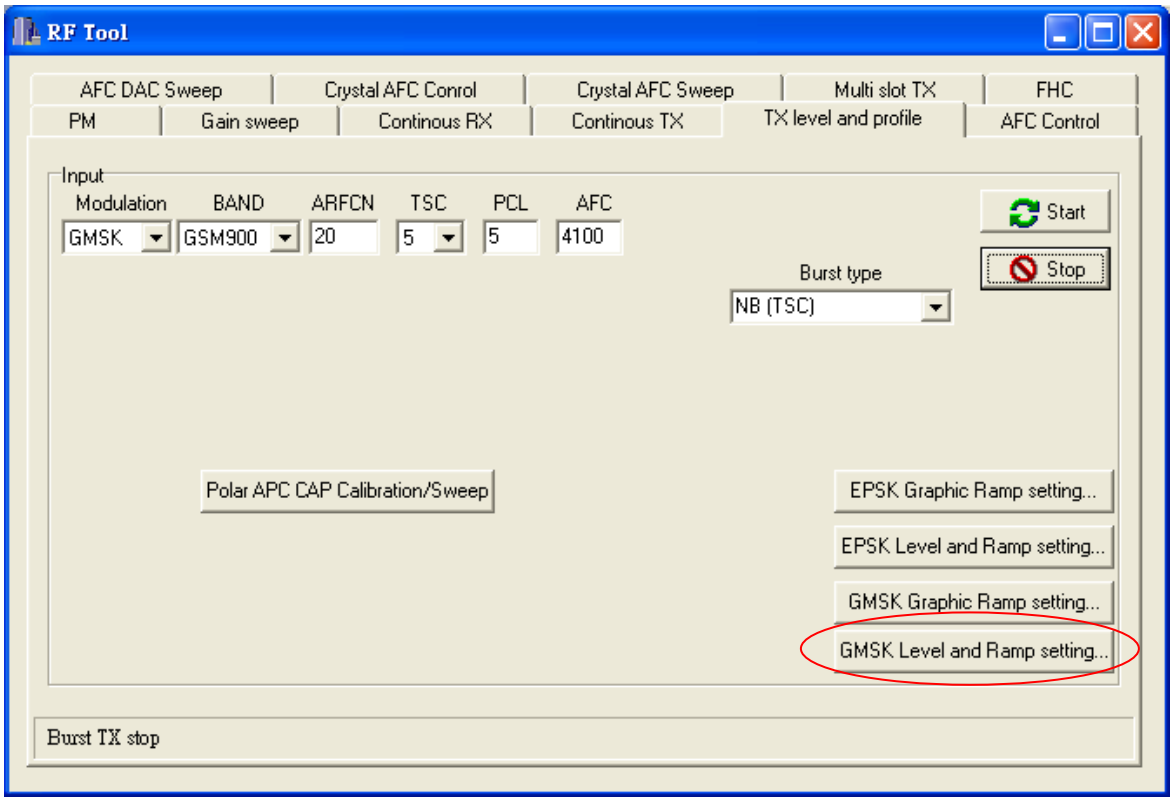

Figure 36 ***Click [GMSK Level and Ramp setting…] button***

User can set the TX level (scale factor) for each PCL (power control level). MS will adopt the scale factor for corresponding PCL while transmitting RF. Regarding ramp profile, each PCL could have its own ramp profile.

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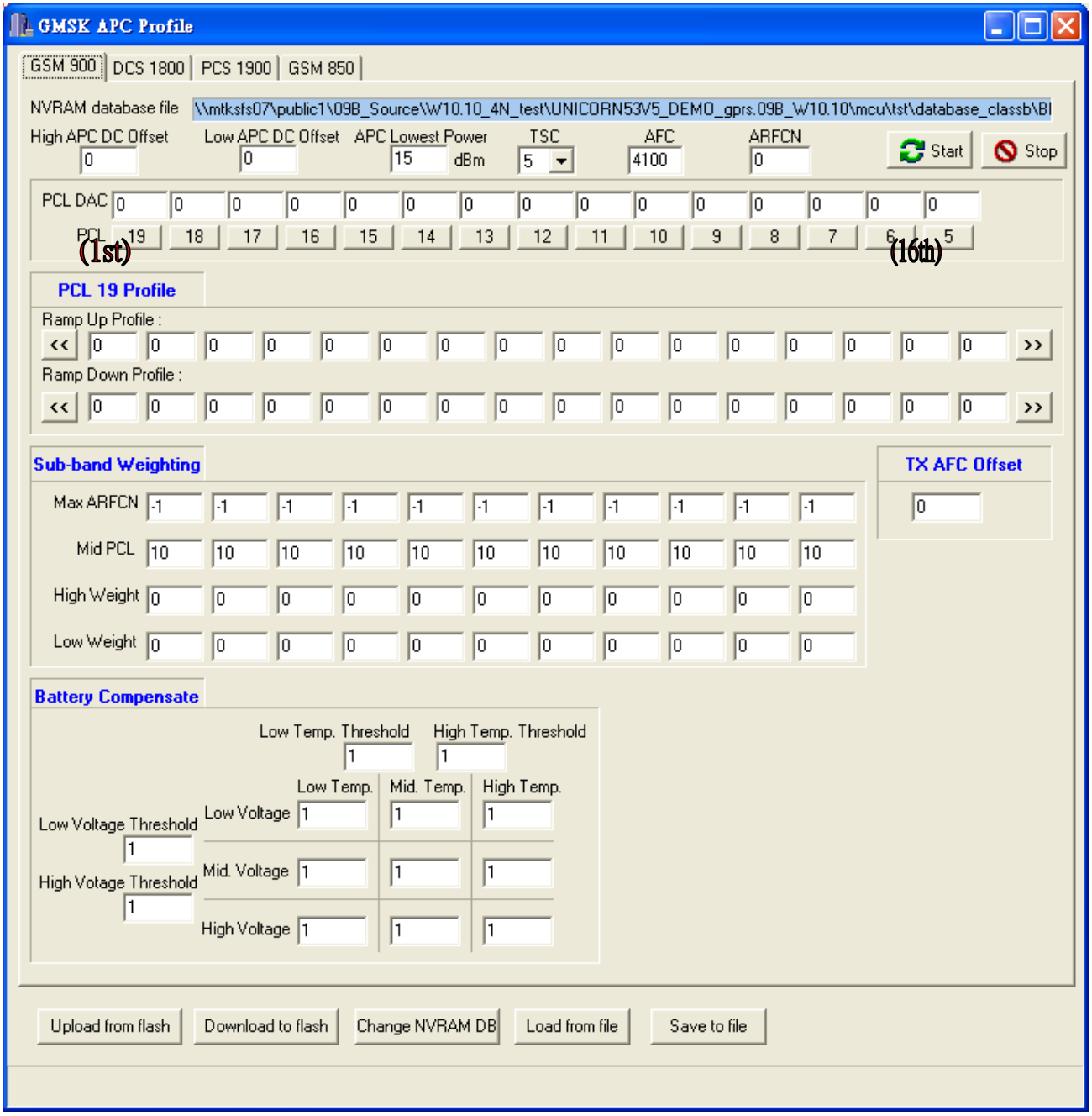

Figure 37 ***Level and Ramp setting window***

Note:

- High APC DC offset: the field specifies the pedestal value of the APC unit. The APC D/A converter is powered up biased on the offset value specified by the field. The nominal power of PCL large or equal APC lowest power, then High APC DC offset should be used.
- Low APC DC offset: the field specifies the pedestal value of the APC unit. The APC D/A converter is powered up biased on the offset value specified by the field. The nominal power of PCL small than APC lowest power, then low APC DC offset should be used.

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APC lowest power: threshold to determine weather high APC DC offset or low APC DC offset should be used. If the nominal power of PCL large or equal APC lowest power, high APC DC offset should be used. Otherwise, low APC DC offset should be used.

- Mid PCL: the level above or equal the [Mid PCL] will be multiplied by [low weight], and the level below [Mid PCL] will be multiplied by [high weight].
- high weight: each entry of the ramp profile of level below [Mid PCL] will be multiplied by [high weight].
- low weight: each entry of the ramp profile of level above or equal [Mid PCL] will be multiplied by [low weight].
- Battery compensate: These 3x3 array compensate the APC scaling factor under low/mid/high voltage/temperature.
- TX AFC Offset: the field specifies the crystal TX AFC Offset. Crystal TX AFC DAC = Crystal RX AFC DAC + TX AFC Offset.

User can input APC DAC offset, ARFCN, PCL (power control level) DAC, ramp up/down profile, sub-band weighting and battery compensation value and then press [Start] button to start TX level testing.

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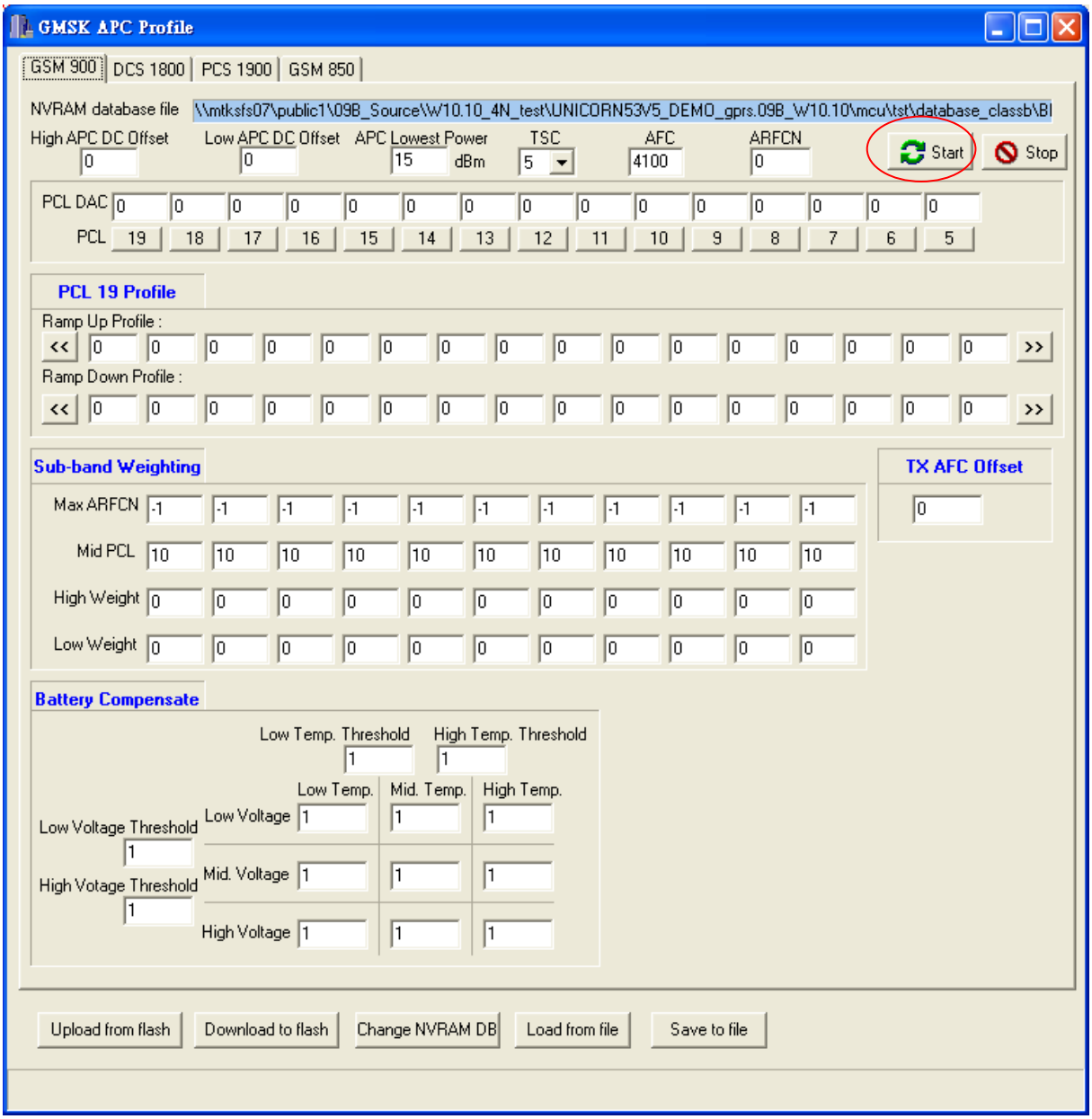

Figure 38 ***Click [Start] button to start TX level testing***

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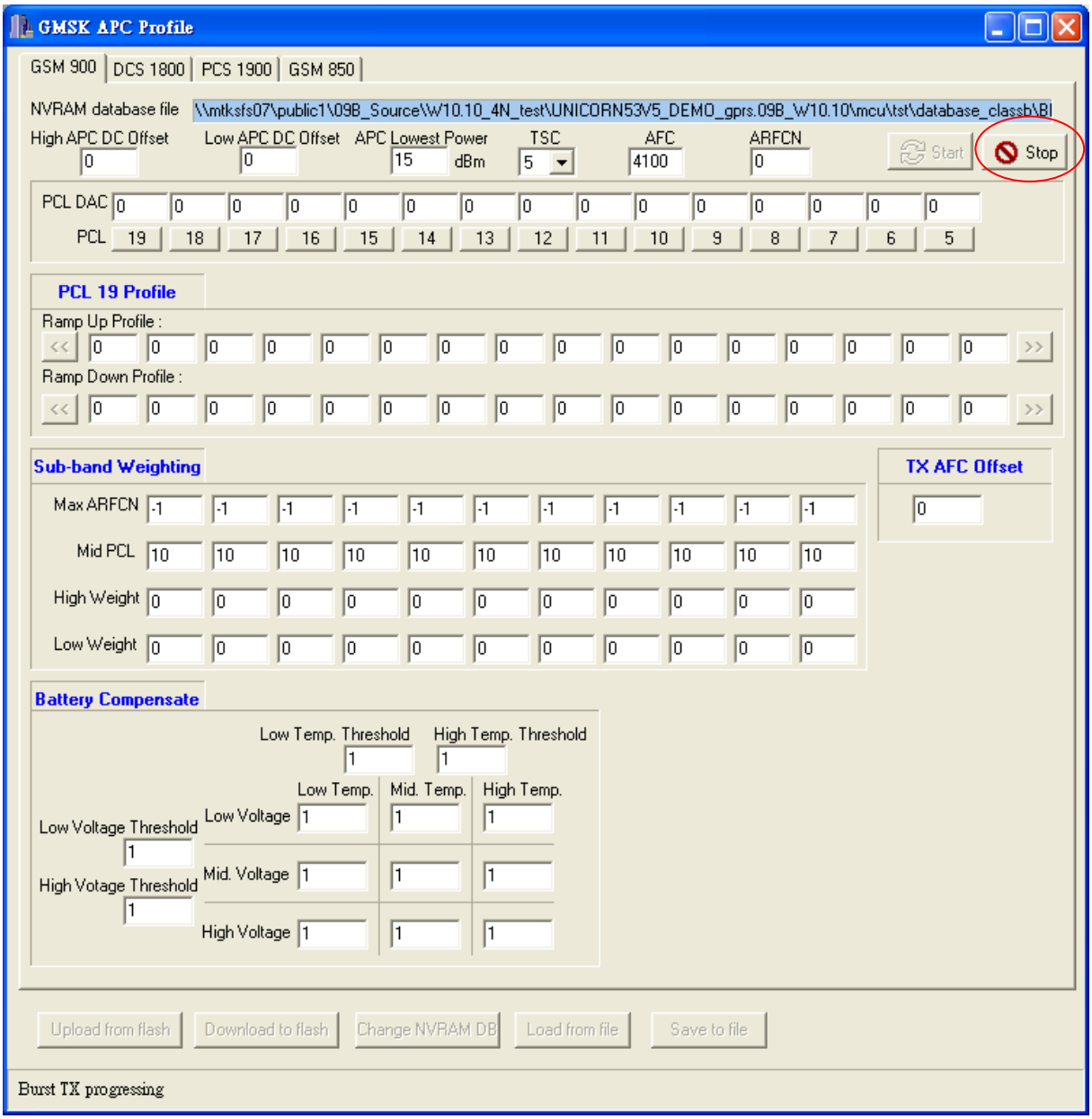

Figure 39 ***Click [Stop] button to stop testing***

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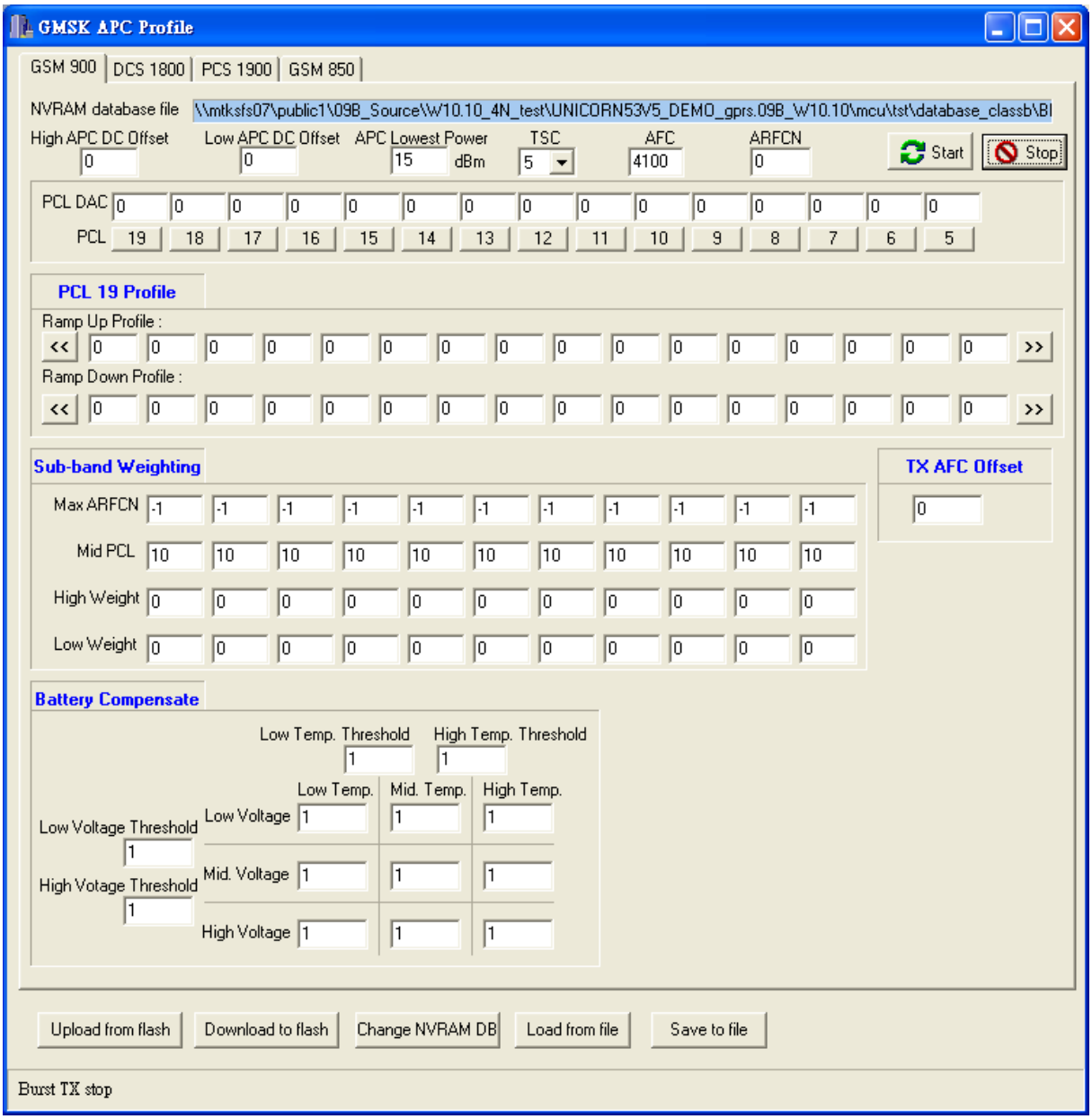

Figure 40 ***The caption of button will change to [Start]***

3.2.5.1.a Read and write the level ramp table in flash

User can click [Upload from flash] button to read level ramp table from flash and click [Download to flash] button to write level ramp table to flash.

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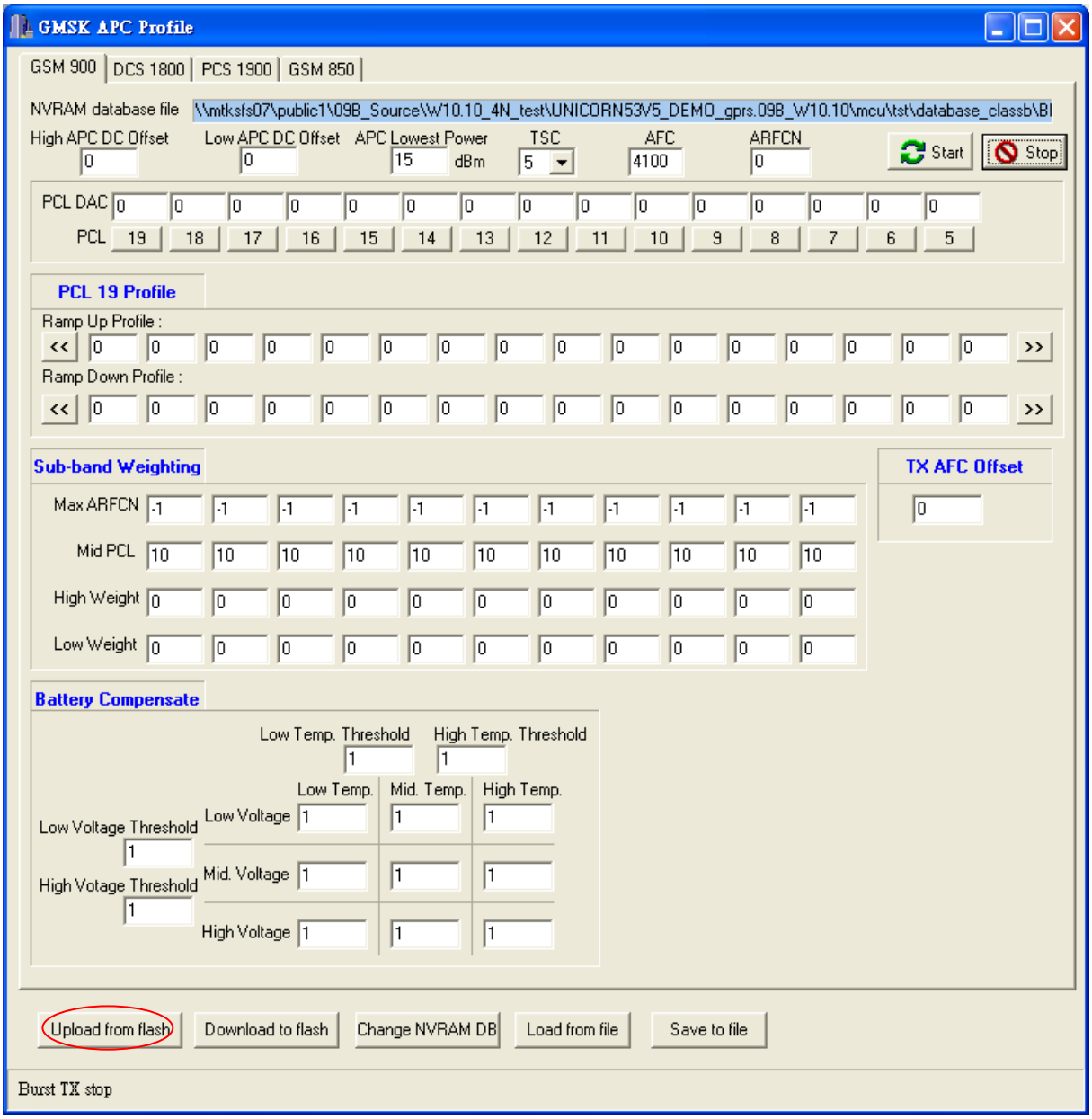

Figure 41 ***Click [upload from flash] button to read ramp table from flash.***

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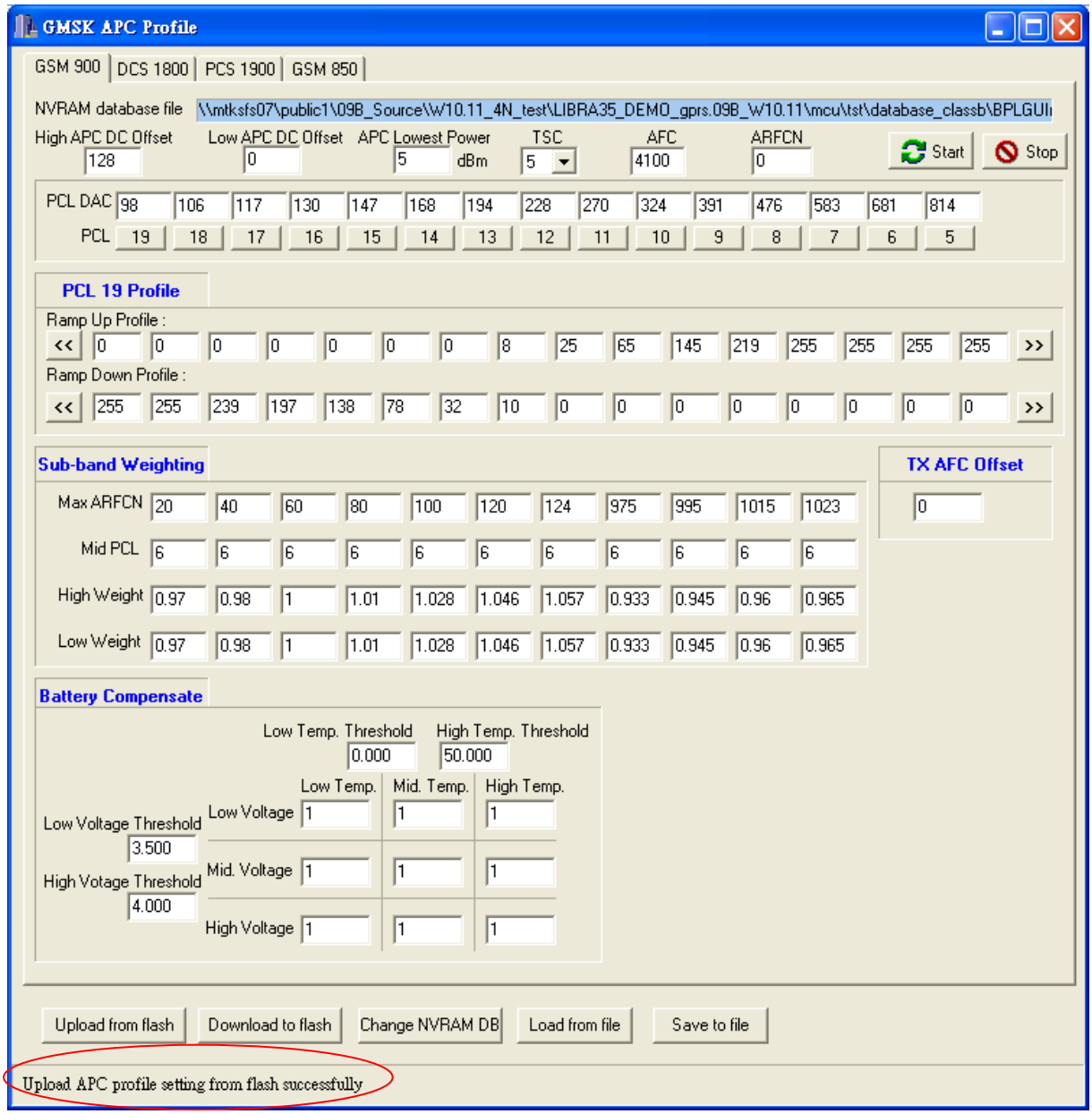

Figure 42 ***Ramp table result***

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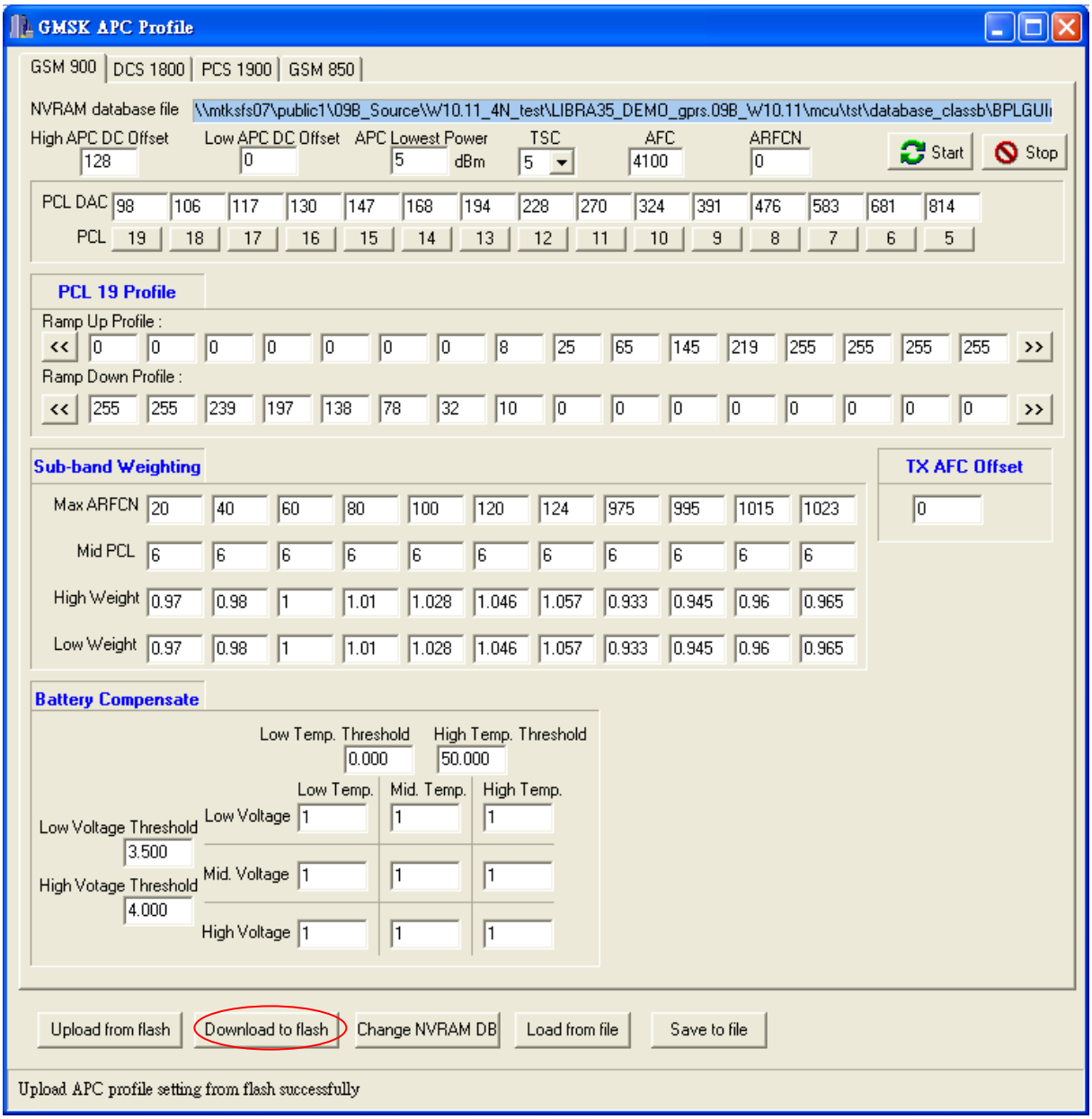

Figure 43 ***Click [Download to flash] button to save ramp table to flash.***

User can click [Change NVRAM DB] to change NVRAM database file.

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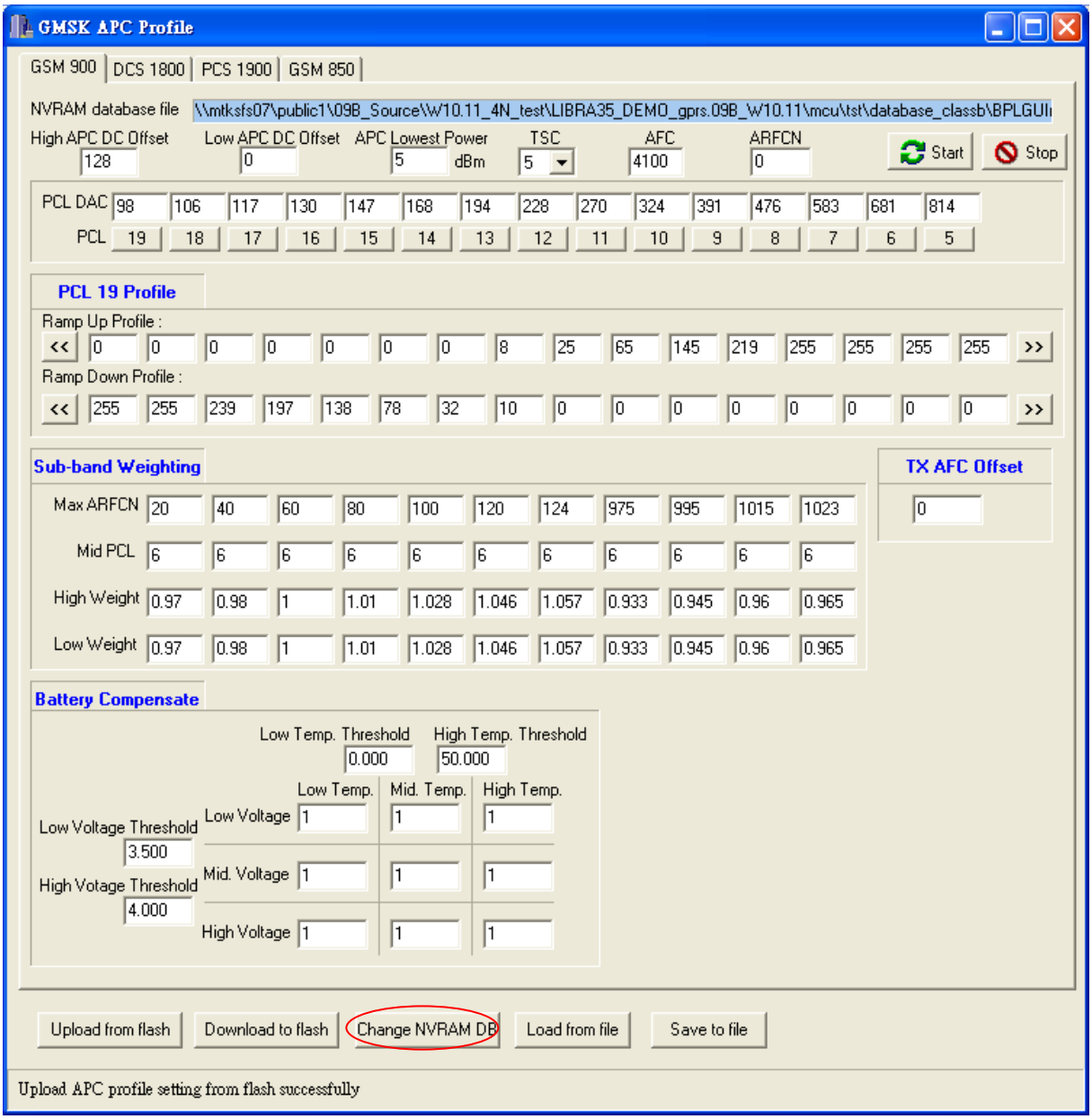

Figure 44 ***Click [Change NVRAM DB] button to change NVRAM database file***

3.2.5.1.b Read and write the GMSK level ramp table in file

User can click [Load from file] button to read GMSK level ramp table from INI file and click [Save to file] button to write GMSK level ramp table to INI file. The tool can save it with path loss and AFC initial value in single or multiple files. Each value must be followed with a comma in the TX level, ramp up, ramp down field.

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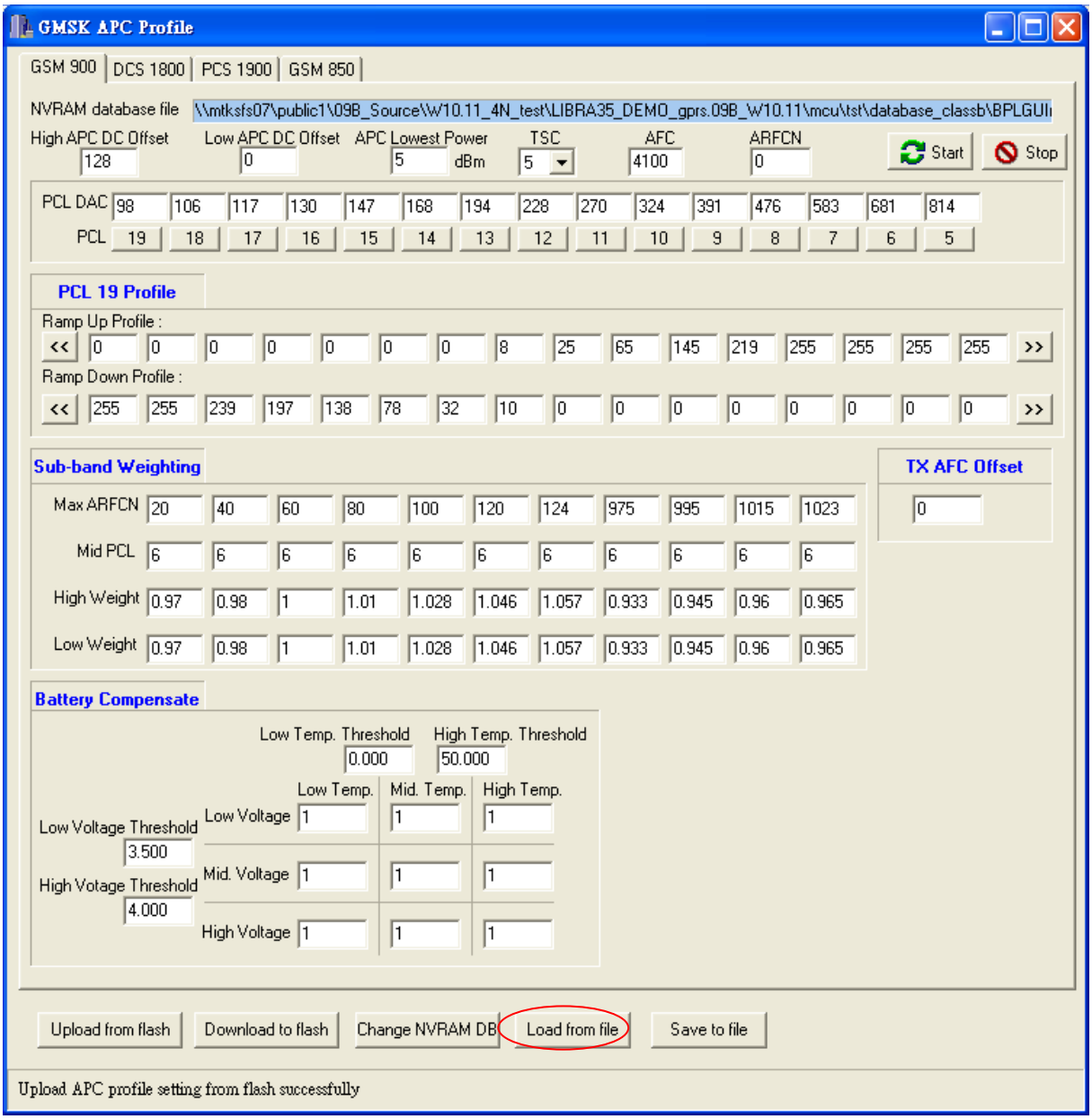

Figure 45 ***Click [Load from file] button to read ramp table from file***

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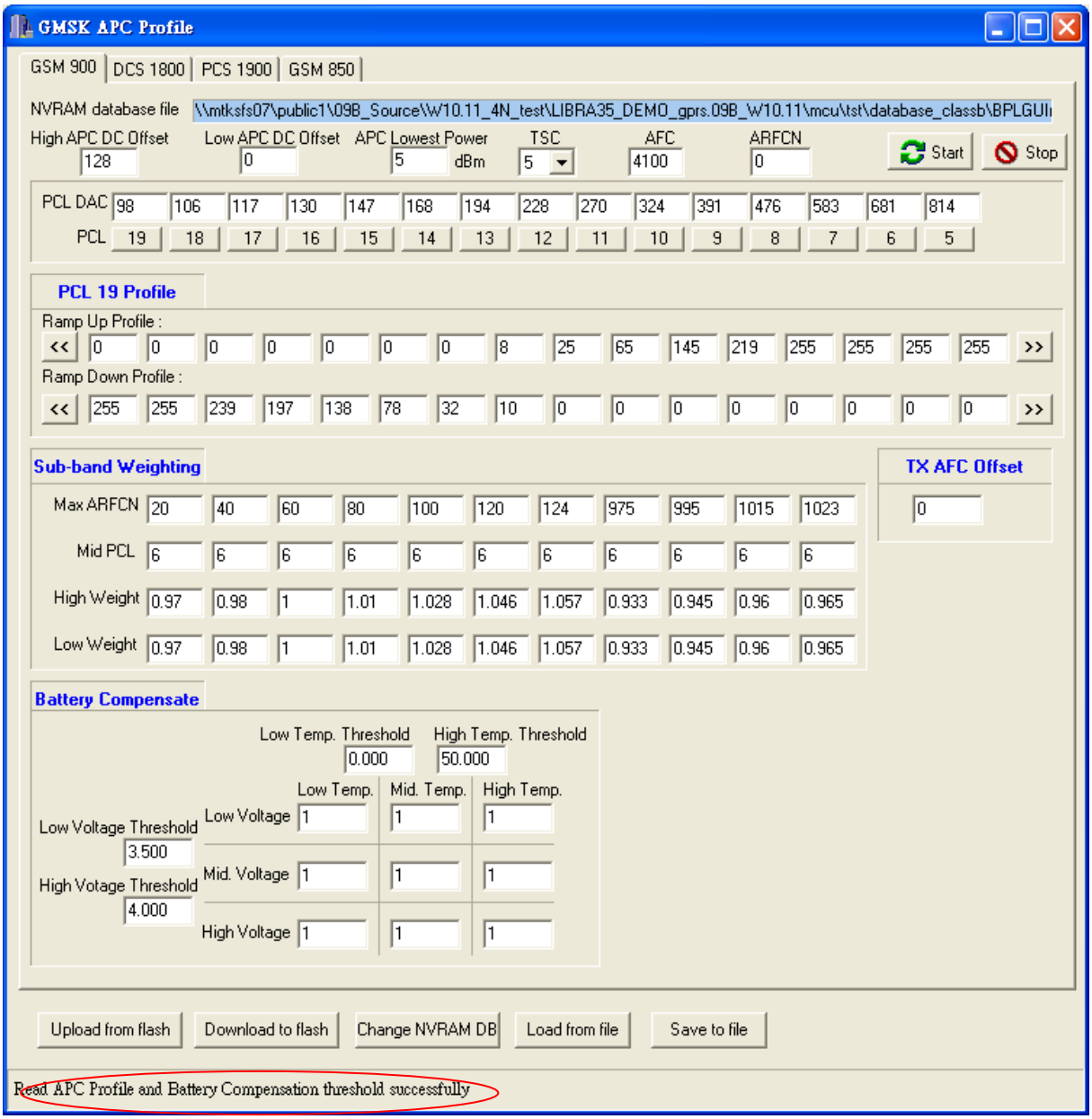

Figure 46 ***Ramp profile result***

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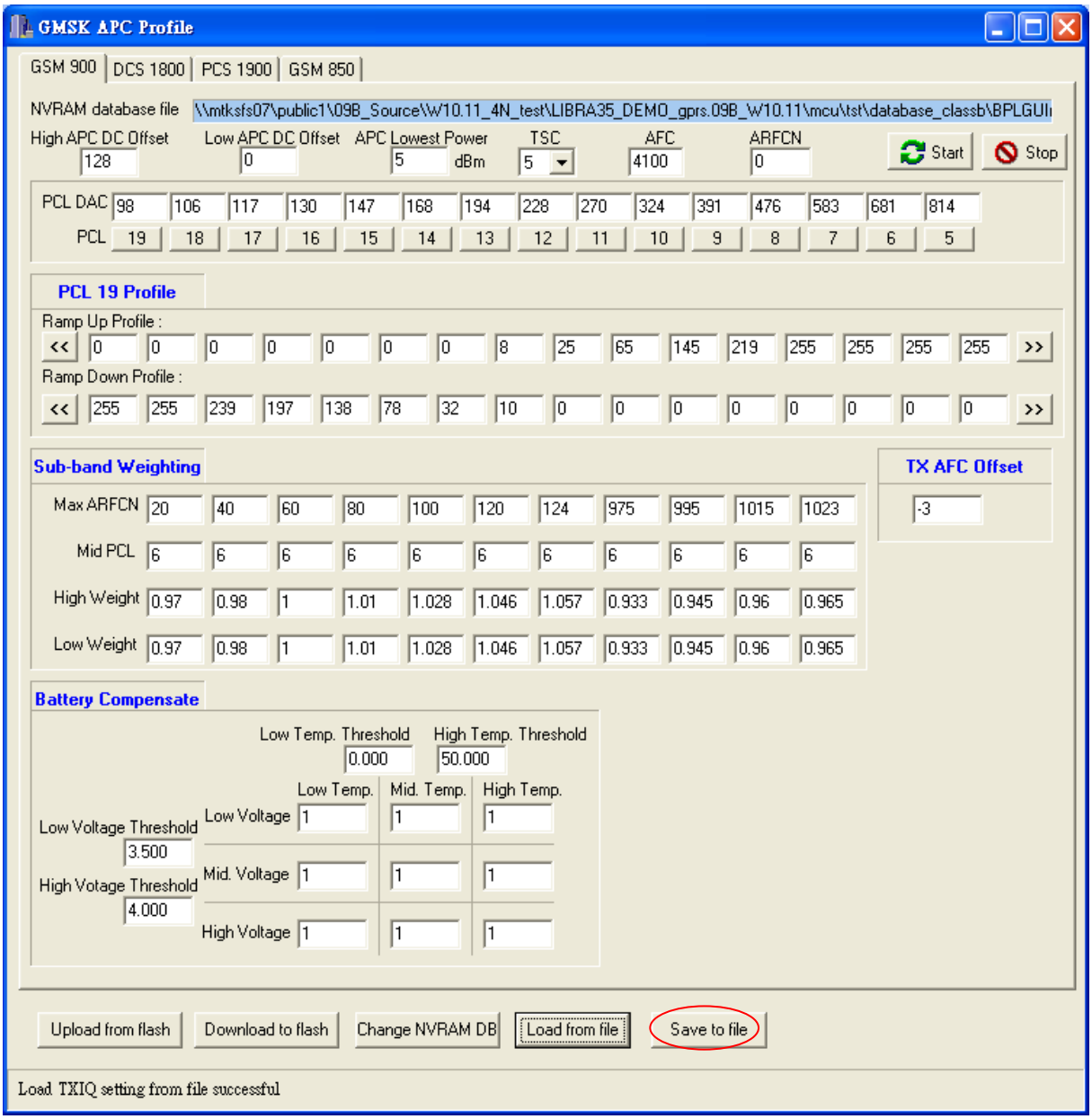

Figure 47 ***Click [Save to file] button to save ramp table to file***

If user click [Save to file] button, the tool will save to a INI file and following is the “GSM900 level, ramp” section in it. Each field is corresponding with same field name in the level and ramp window.

[GSM900 level, ramp]
APC dc offset=80
Low APC dc offset=0
APC lowest power=0
TX power level=92,105,123,142,165,190,219,251,289,335,383,438,498,548,610,610
profile 0 ramp up=0,0,0,0,0,8,25,65,145,219,255,255,255,255,255,255
profile 0 ramp down=255,255,255,255,255,239,197,138,78,32,10,0,0,0,0,0
profile 1 ramp up=0,0,0,0,0,8,25,65,145,219,255,255,255,255,255,255
profile 1 ramp down=255,255,255,255,255,239,197,138,78,32,10,0,0,0,0,0
profile 2 ramp up=0,0,0,0,0,8,25,65,145,219,255,255,255,255,255,255

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profile 2 ramp down=255,255,255,255,255,239,197,138,78,32,10,0,0,0,0,0
profile 3 ramp up=0,0,0,0,0,8,25,65,145,219,255,255,255,255,255,255
profile 3 ramp down=255,255,255,255,255,239,197,138,78,32,10,0,0,0,0,0
profile 4 ramp up=0,0,0,0,0,0,8,25,65,145,219,255,255,255,255,255
profile 4 ramp down=255,255,255,255,255,239,197,138,78,32,10,0,0,0,0,0
profile 5 ramp up=0,0,0,0,0,8,32,80,145,215,255,255,255,255,255,255
profile 5 ramp down=255,255,255,255,255,239,197,138,78,32,10,0,0,0,0,0
profile 6 ramp up=0,0,0,0,0,8,25,65,145,219,255,255,255,255,255,255
profile 6 ramp down=255,255,255,255,255,239,197,138,78,32,10,0,0,0,0,0
profile 7 ramp up=0,0,0,0,0,8,25,65,145,219,255,255,255,255,255,255
profile 7 ramp down=255,255,255,255,255,239,197,138,78,32,10,0,0,0,0,0
profile 8 ramp up=0,0,0,0,0,8,25,65,145,219,255,255,255,255,255,255
profile 8 ramp down=255,255,255,255,255,239,197,138,78,32,10,0,0,0,0,0
profile 9 ramp up=0,0,0,0,0,8,25,65,145,219,255,255,255,255,255,255
profile 9 ramp down=255,255,255,255,255,239,197,138,78,32,10,0,0,0,0,0
profile 10 ramp up=0,0,0,0,0,8,25,65,145,219,255,255,255,255,255,255
profile 10 ramp down=255,255,255,255,255,239,197,138,78,32,10,0,0,0,0,0
profile 11 ramp up=0,0,0,0,0,8,25,65,145,219,255,255,255,255,255,255
profile 11 ramp down=255,255,255,255,255,255,239,197,138,78,32,10,0,0,0,0
profile 12 ramp up=0,0,0,0,0,8,25,65,145,219,255,255,255,255,255,255
profile 12 ramp down=255,255,255,255,255,239,197,138,78,32,10,0,0,0,0,0
profile 13 ramp up=0,0,0,0,0,8,25,65,145,219,255,255,255,255,255,255
profile 13 ramp down=255,255,255,255,255,239,197,138,78,32,10,0,0,0,0,0
profile 14 ramp up=0,0,0,0,4,8,25,40,70,170,245,255,255,255,255,255
profile 14 ramp down=255,255,255,255,255,239,197,138,78,32,10,0,0,0,0,0
profile 15 ramp up=0,0,0,0,0,0,0,0,0,8,25,65,145,219,255,255
profile 15 ramp down=255,239,197,138,78,32,10,0,0,0,0,0,0,0,0,0
Subband max arfcn=37,82,124,975,1000,1023,-1,0,0,0,0
Subband mid level=11,11,11,11,11,11,19,19,19,19,19
Subband high weight=1.000,0.990,0.970,1.030,1.010,1.000,0.000,0.000,0.000,0.000,0.0000
Subband low weight=1.000,1.000,1.000,1.000,1.000,1.000,0.000,0.000,0.000,0.000,0.0000
Battery compensate, low voltage, low temperature=1
Battery compensate, low voltage, mid temperature=1
Battery compensate, low voltage, high temperature=1
Battery compensate, mid voltage, low temperature=1
Battery compensate, mid voltage, mid temperature=1
Battery compensate, mid voltage, high temperature=1
Battery compensate, high voltage, low temperature=1
Battery compensate, high voltage, mid temperature=1
Battery compensate, high voltage, high temperature=1
TX AFC DAC offset=0

[BB TX Parameters]
BB TX common mode voltage=-1
BB TX gain=0
BB TX calrcsel=0
APC bat low voltage=3.50000
APC bat high voltage=4.00000
APC bat low temperature=0.00000
APC bat high temperature=50.00000
Trim I=-1

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Trim Q=1
Offset I=8
Offset Q=16
Calibrated flag=1
BB TX phasesel=0
High band BB TX common mode voltage=-1
High band BB TX gain=0
High band BB TX calrcsel=0
High band Trim I=-1
High band Trim Q=1
High band Offset I=9
High band Offset Q=13
High band BB TX phasesel=1

Note:

- Profile 0 refer to PCL 19, profile 1 refer to PCL 18, ….., profile 14 refer to PCL 5
- High APC DC offset: the field specifies the pedestal value of the APC unit. The APC D/A converter is powered up biased on the offset value specified by the field. The nominal power of PCL large or equal APC lowest power, then High APC DC offset should be used.
- Low APC DC offset: the field specifies the pedestal value of the APC unit. The APC D/A converter is powered up biased on the offset value specified by the field. The nominal power of PCL small than APC lowest power, then low APC DC offset should be used.
  APC lowest power: threshold to determine weather high APC DC offset or low APC DC offset should be used. If the nominal power of PCL large or equal APC lowest power, high APC DC offset should be used. Otherwise, low APC DC offset should be used.
- Subband mid level: the level above or equal the [suband mid level] will be multiplied by [Subband low weight], and the level below [Subband mid level] will be multiplied by [Subband high weight].
- Subband high weight: each entry of the ramp profile of level below [Subband mid level] will be multiplied by [Subband high weight].
- Subband low weight: each entry of the ramp profile of level above or equal [Subband mid level] will be multiplied by [Subband low weight].
- Battery compensate: These 3x3 array compensate the APC scaling factor under low/mid/high voltage/temperature.
- TX AFC Offset: the field specifies the crystal TX AFC Offset. Crystal TX AFC DAC = Crystal RX AFC DAC + TX AFC Offset.
- Battery compensate: The threshold is defined in the [BB TX Parameters] INI section.

3.2.5.1.c EPSK level and ramp setting

User can click [EPSK Level and Ramp setting…] button to show the EPSK level and ramp window.

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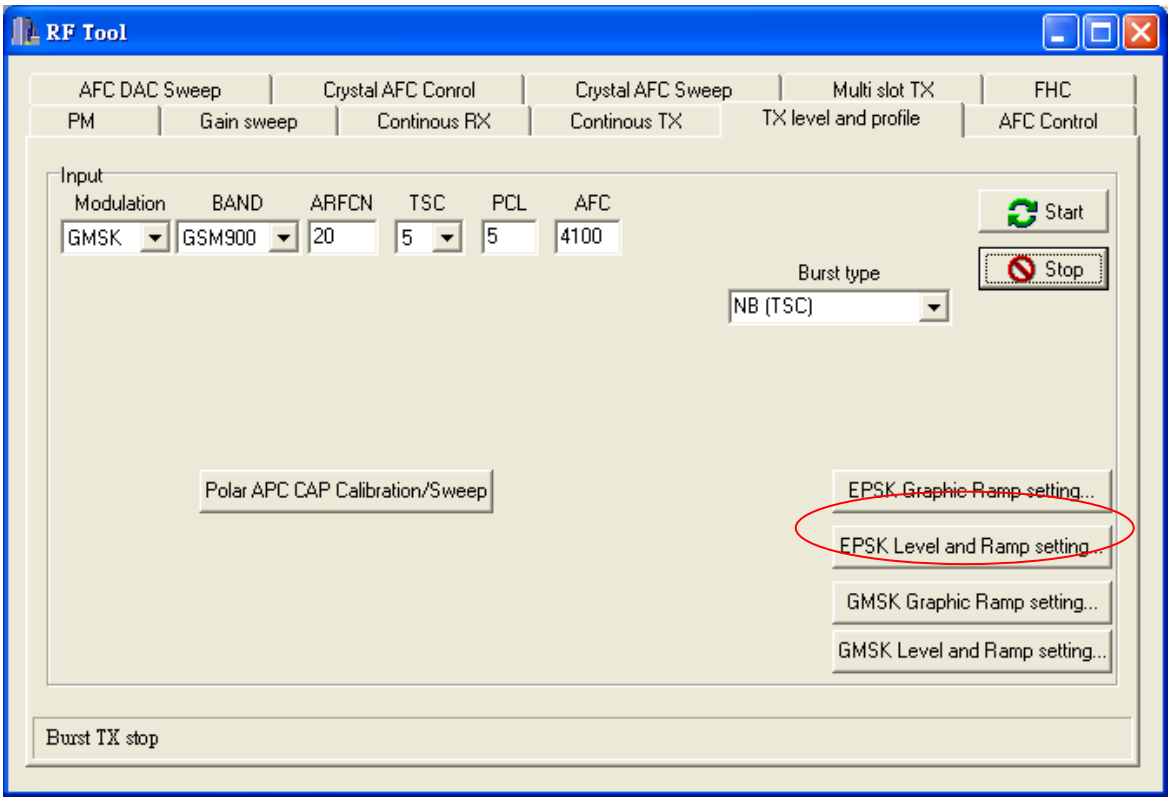

Figure 48 ***Click [EPSK Level and Ramp setting…] button***

User can set the TX level (scale factor) for each PCL (power control level). MS will adopt the scale factor for corresponding PCL while transmitting RF. Regarding ramp profile, each PCL could have its own ramp profile.

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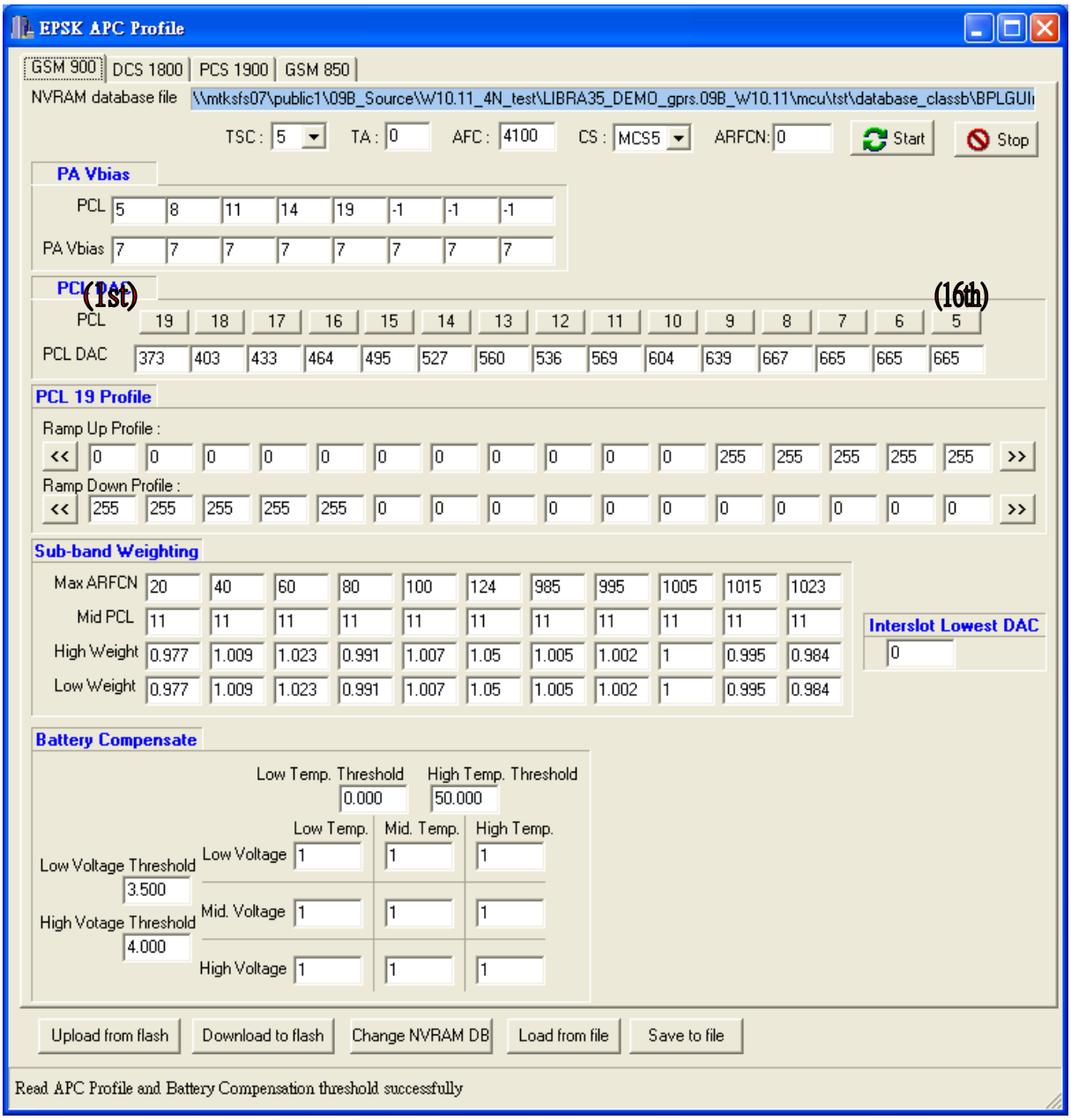

Figure 49 ***EPSK Level and Ramp setting window***

Note:

- Mid PCL: the level above or equal the [Mid PCL] will be multiplied by [low weight], and the level below [Mid PCL] will be multiplied by [high weight].
- high weight: each entry of the ramp profile of level below [Mid PCL] will be multiplied by [high weight].
- low weight: each entry of the ramp profile of level above or equal [Mid PCL] will be multiplied by [low weight].
- Battery compensate: These 3x3 array compensate the APC scaling factor under low/mid/high voltage/temperature.
- TX AFC Offset: the field specifies the crystal TX AFC Offset. Crystal TX AFC DAC = Crystal RX AFC DAC + TX AFC Offset.

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User can input ARFCN, PCL (power control level) DAC, ramp up/down profile, sub-band weighting and battery compensation value and then press [Start] button to start EPSK TX level testing.

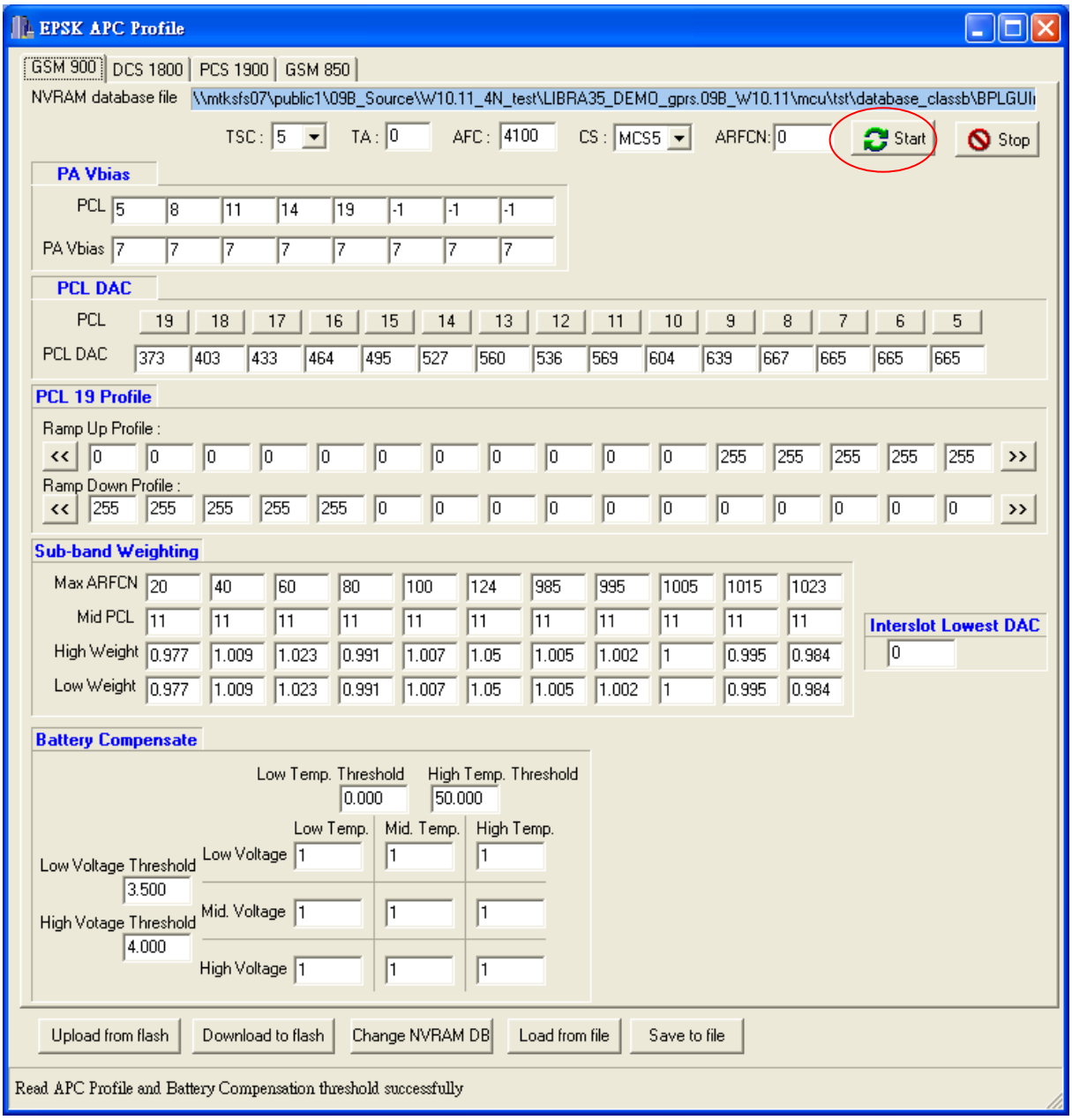

Figure 50 ***Click [Start] button to start EPSK TX level testing***

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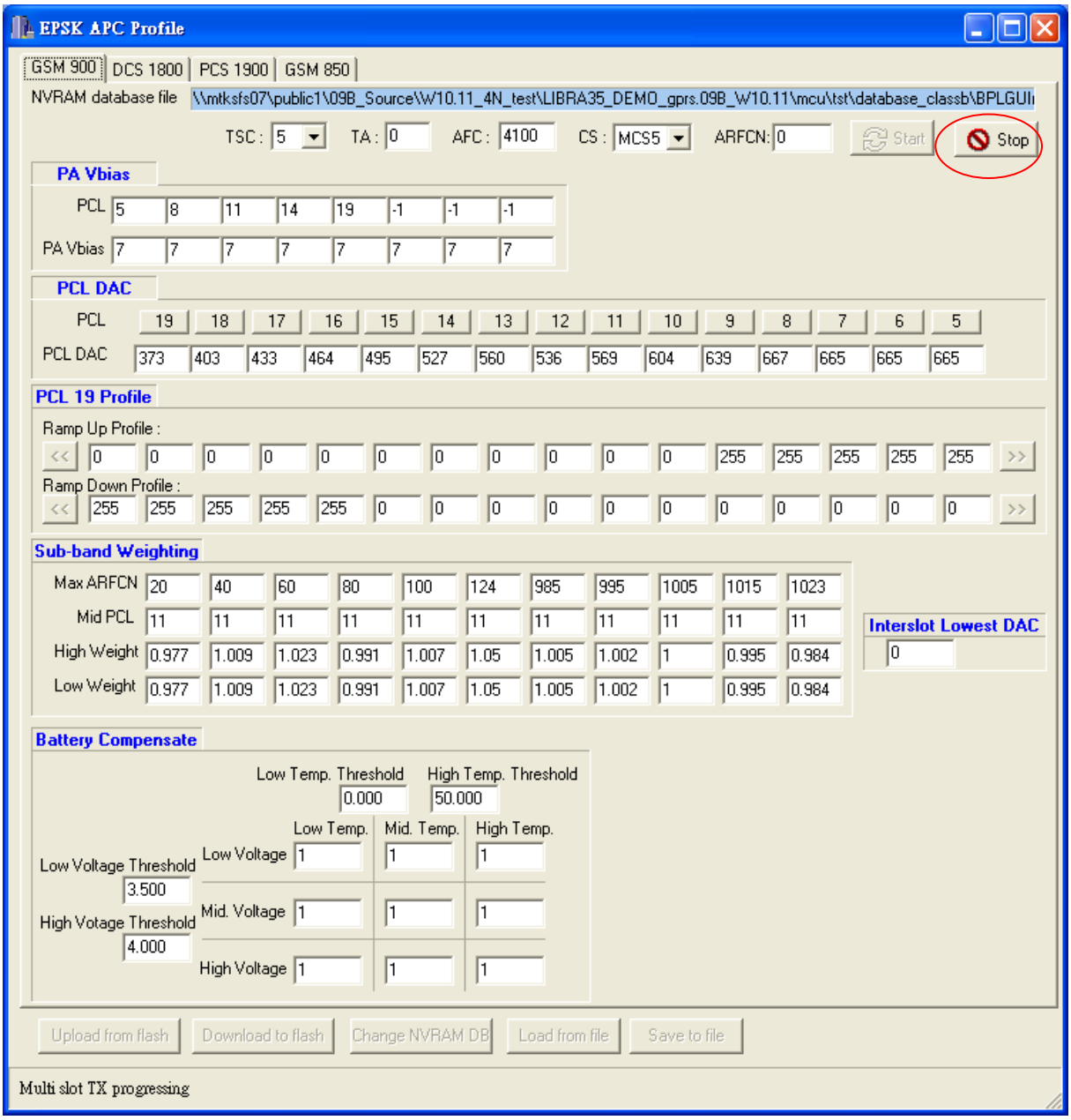

Figure 51 ***Click [Stop] button to stop testing***

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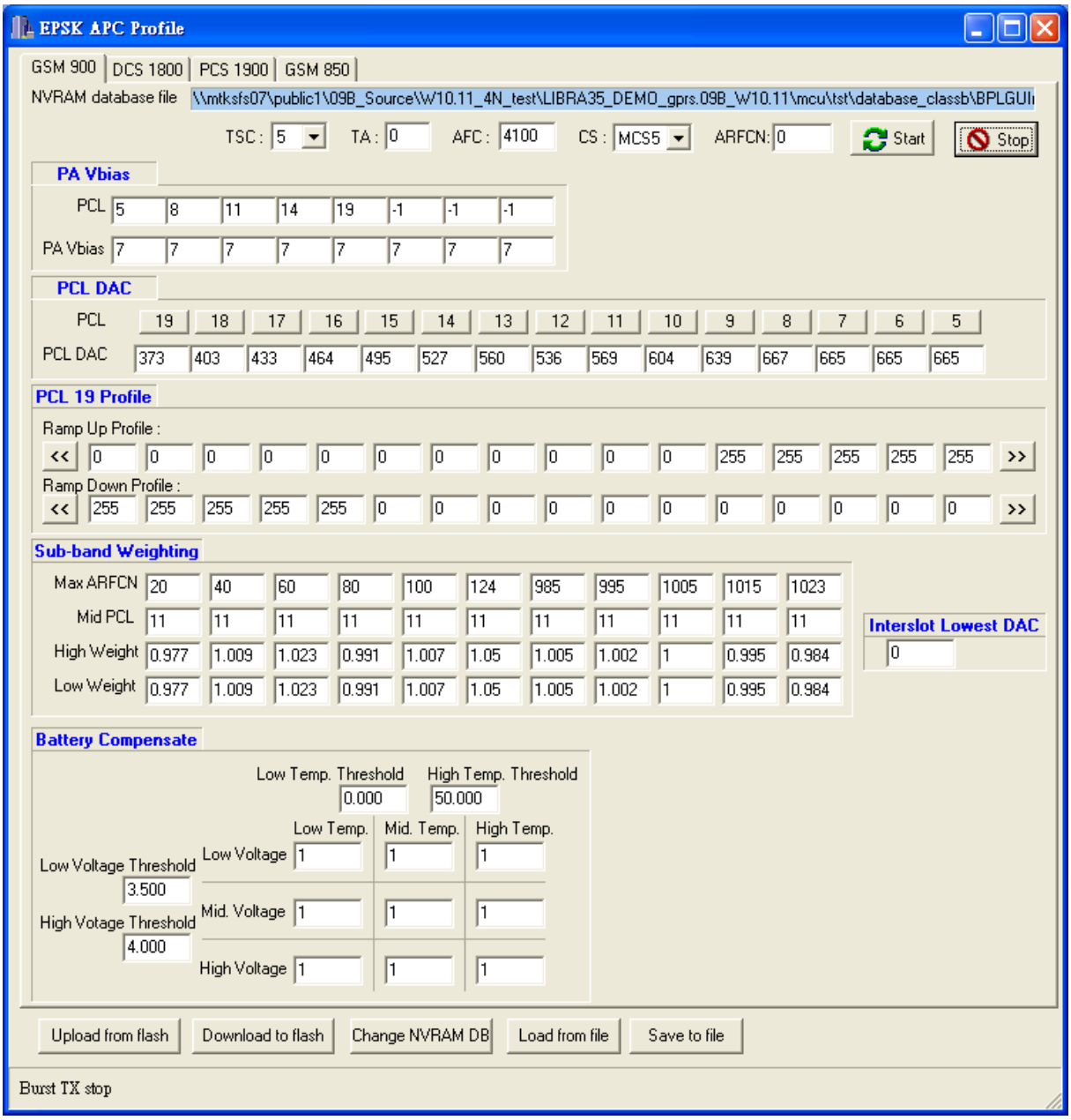

Figure 52 ***The [Start] button will be enabled***

3.2.5.1.d Read and write the EPSK level ramp table in flash

User can click [Upload from flash] button to read EPSK level ramp table from flash and click [Download to flash] button to write EPSK level ramp table to flash.

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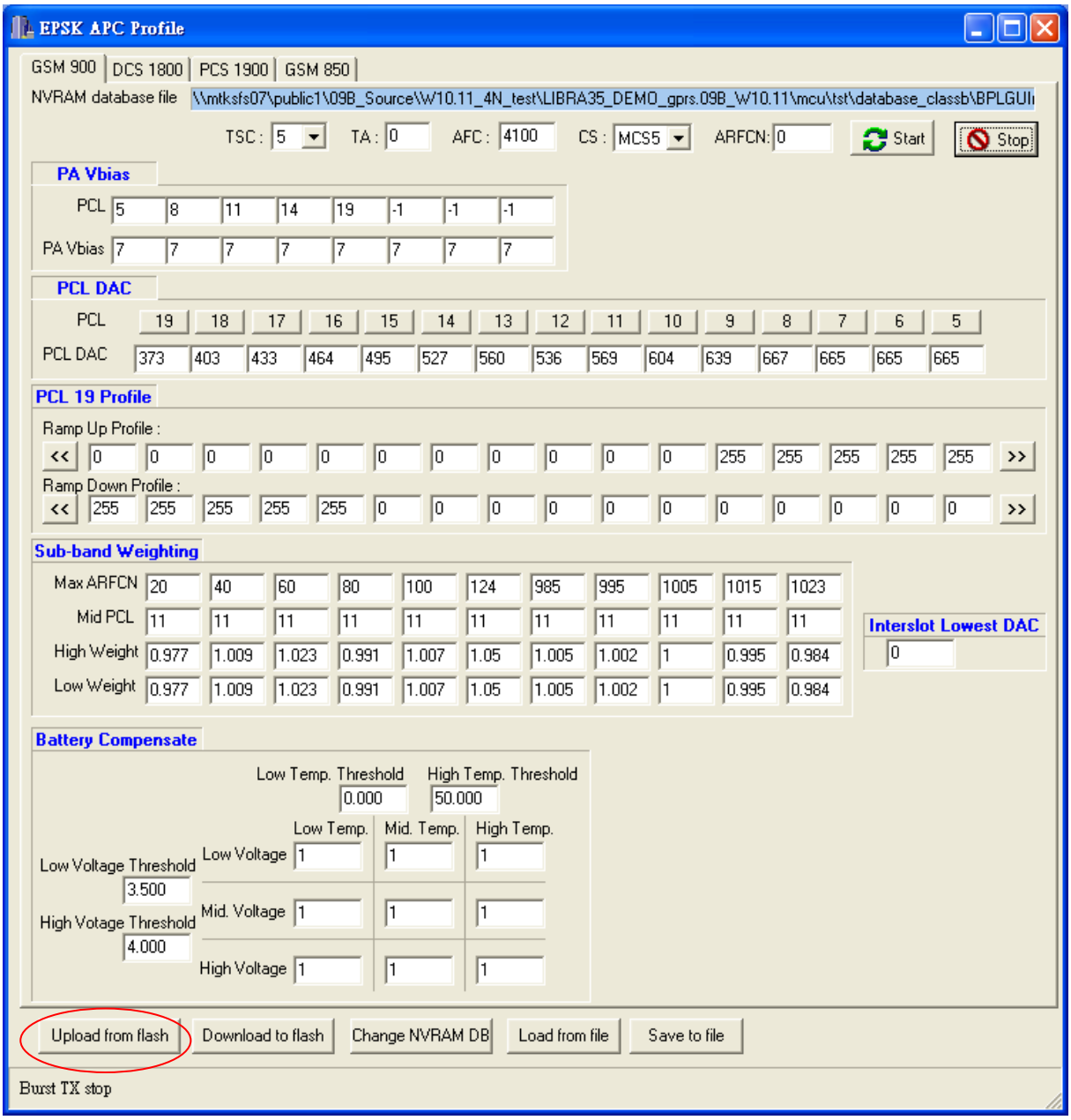

Figure 53 ***Click [upload from flash] button to read ramp table from flash.***

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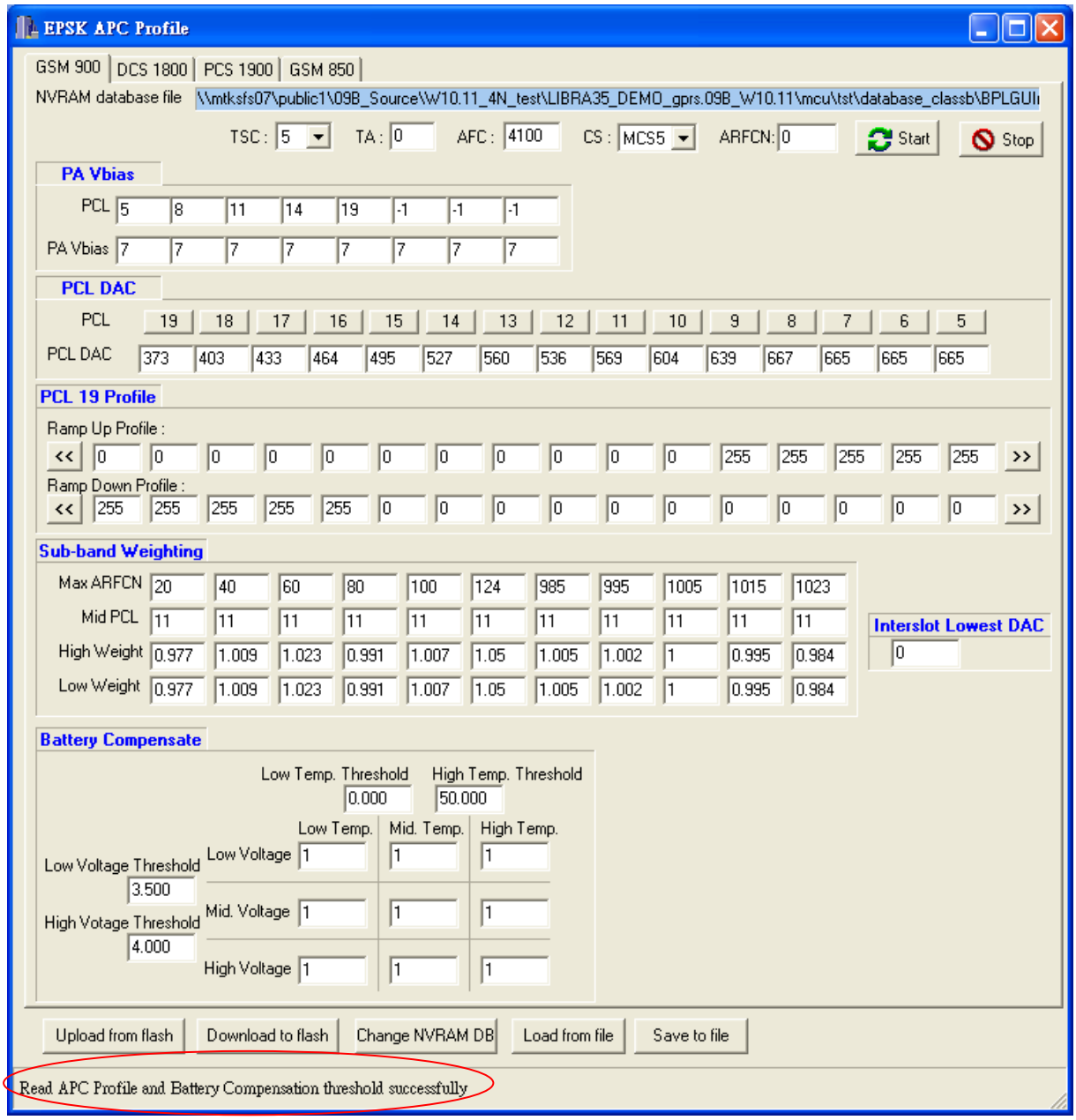

Figure 54 ***Ramp table result***

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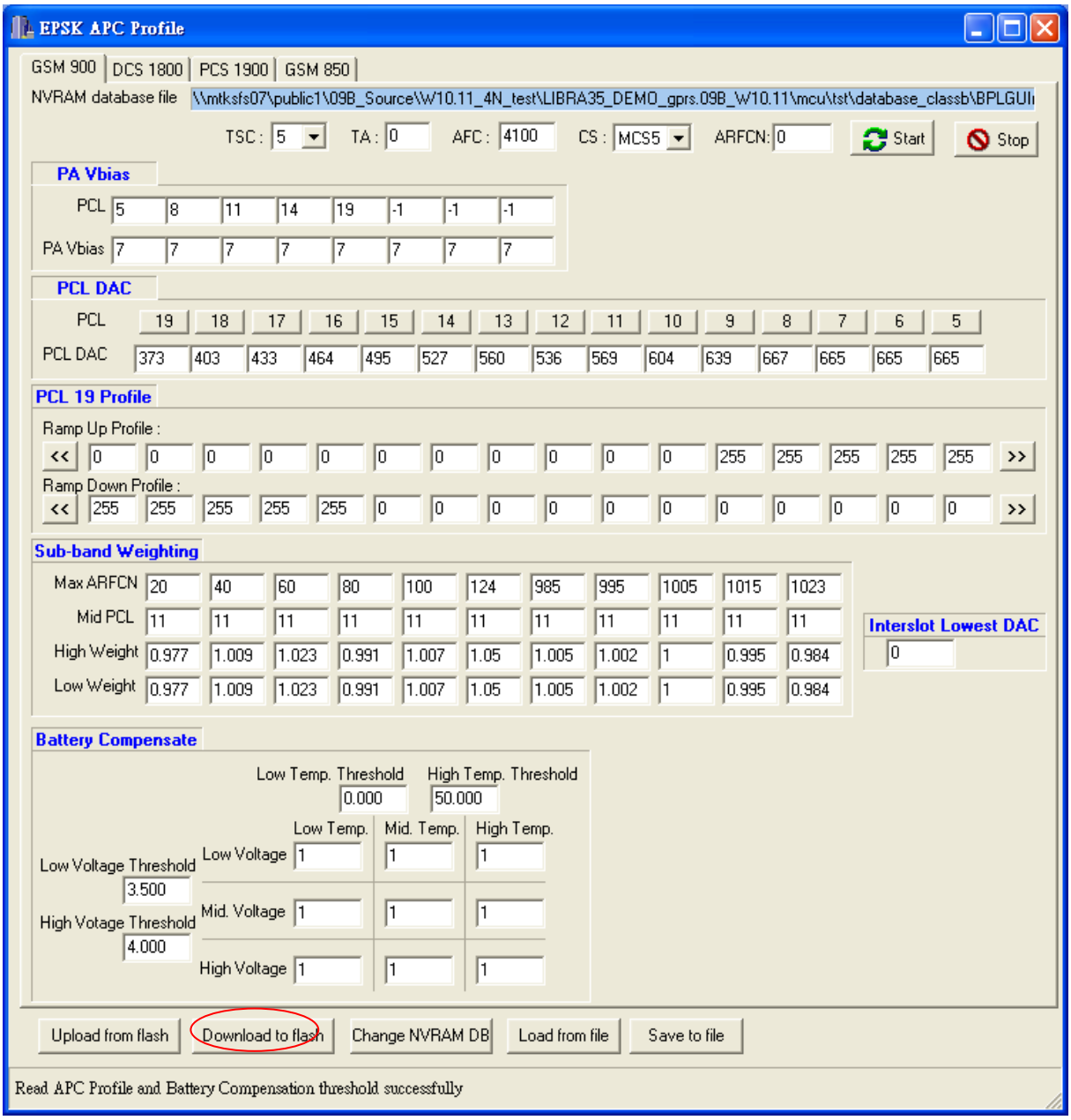

Figure 55 ***Click [Download to flash] button to save ramp table to flash.***

User can click [Change NVRAM DB] to change NVRAM database file.

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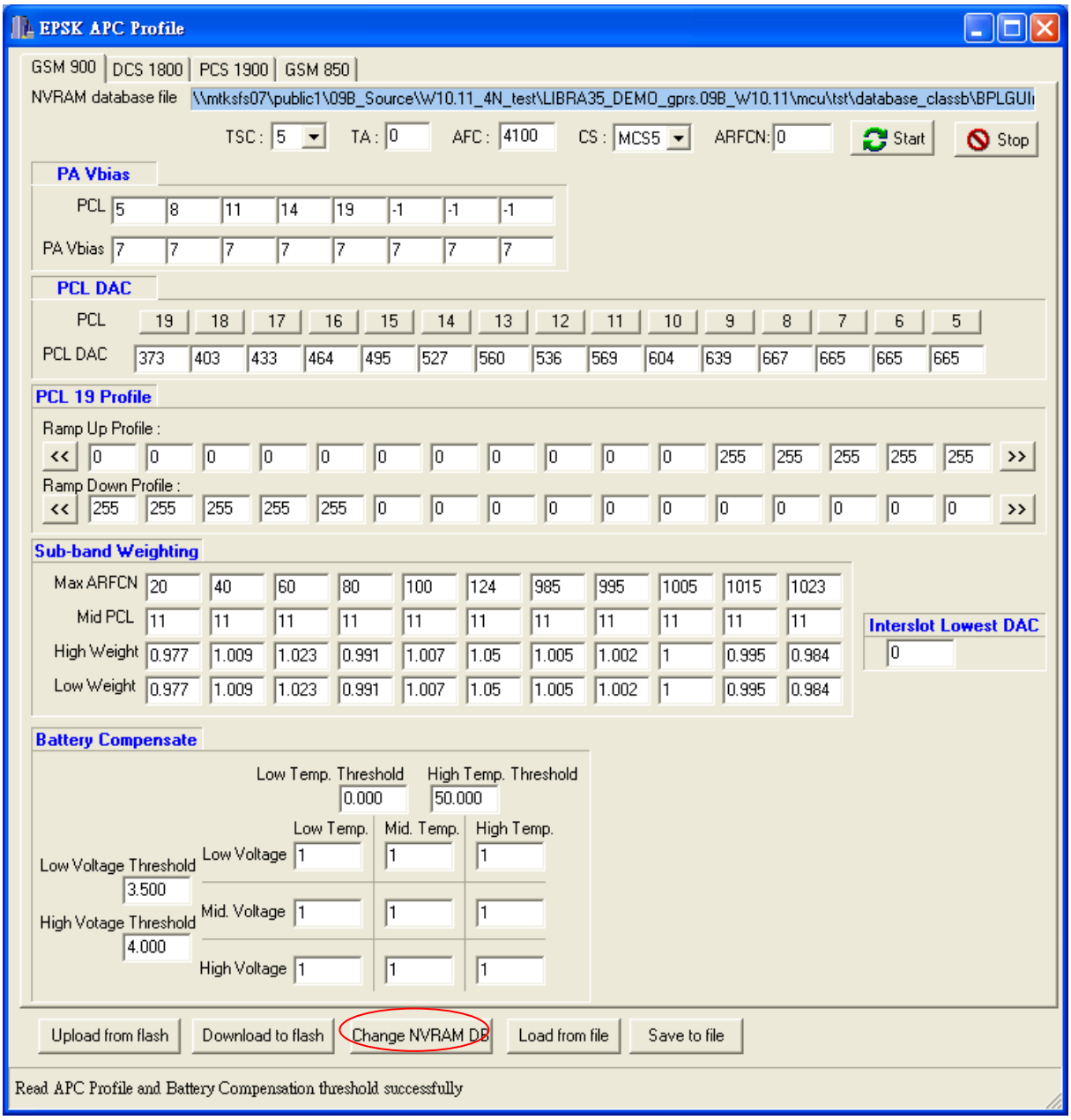

Figure 56 ***Click [Change NVRAM DB] button to change NVRAM database file***

3.2.5.1.e Read and write the EPSK level ramp table in file

User can click [Load from file] button to read EPSK level ramp table from INI file and click [Save to file] button to write EPSK level ramp table to INI file. The tool can save it with other calibration data such as path loss and AFC initial value in single or multiple files. Each value must be followed with a comma in the TX level, ramp up, ramp down field.

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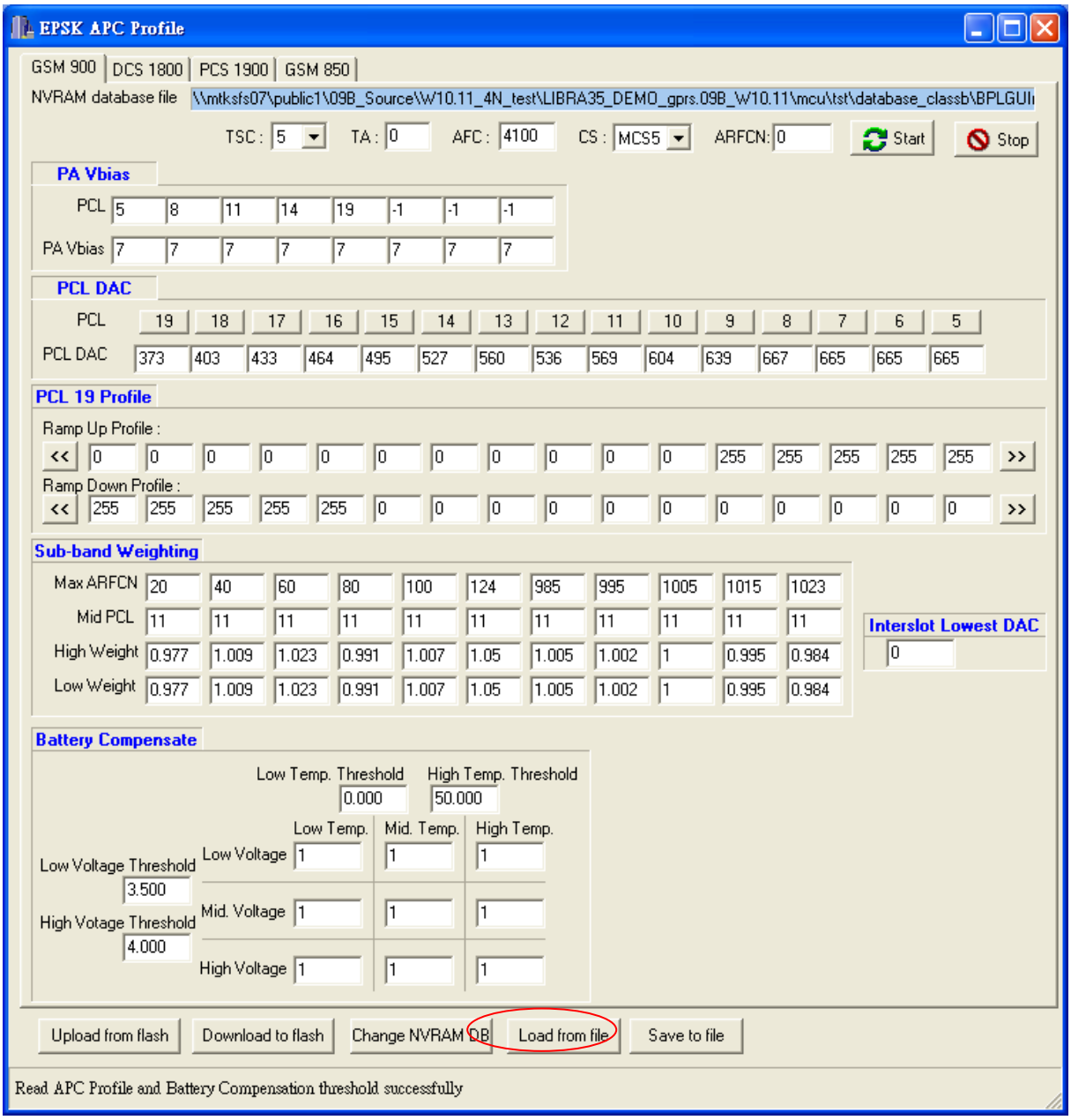

Figure 57 ***Click [Load from file] button to read ramp table from file***

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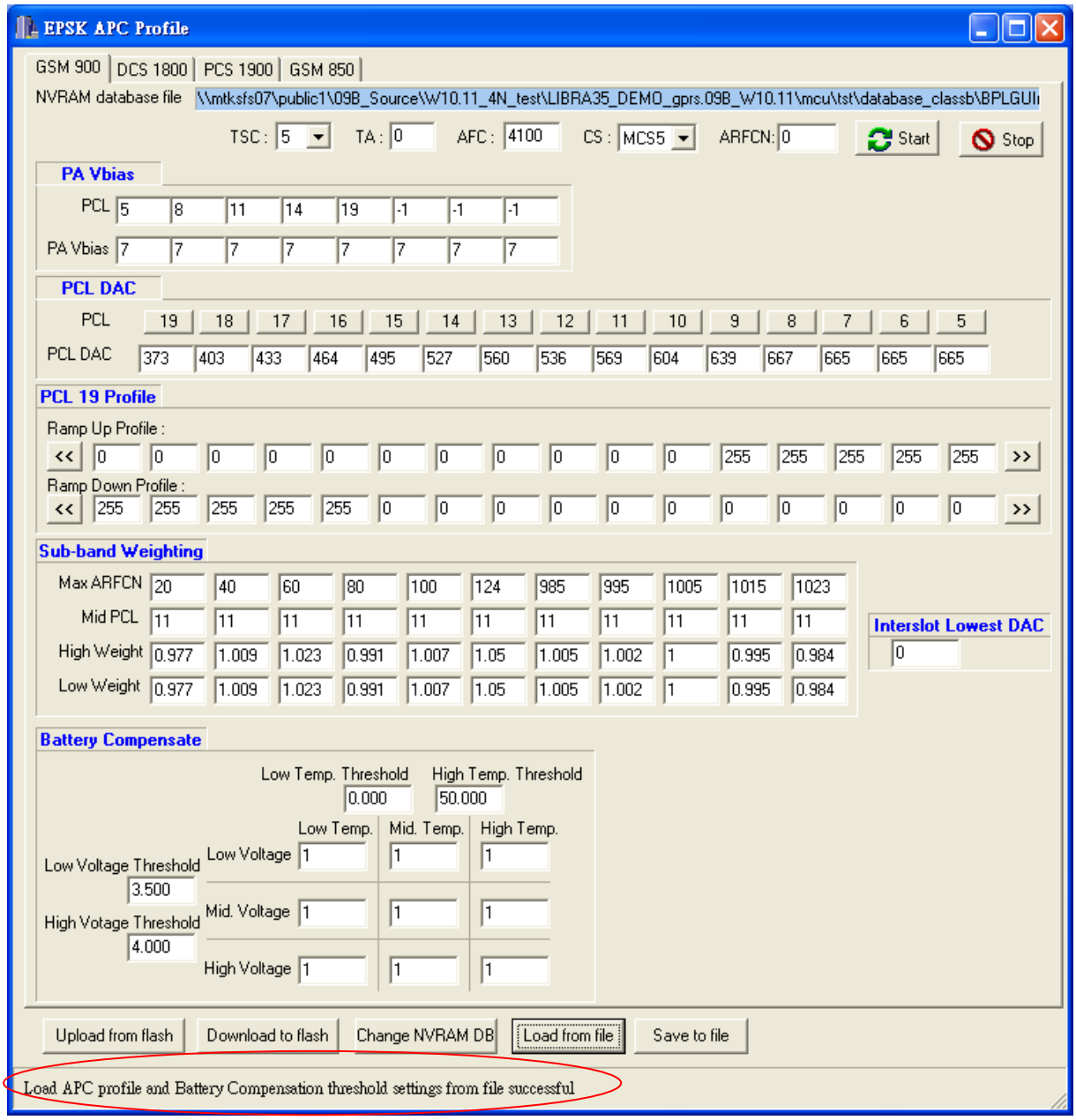

Figure 58 ***Ramp profile result***

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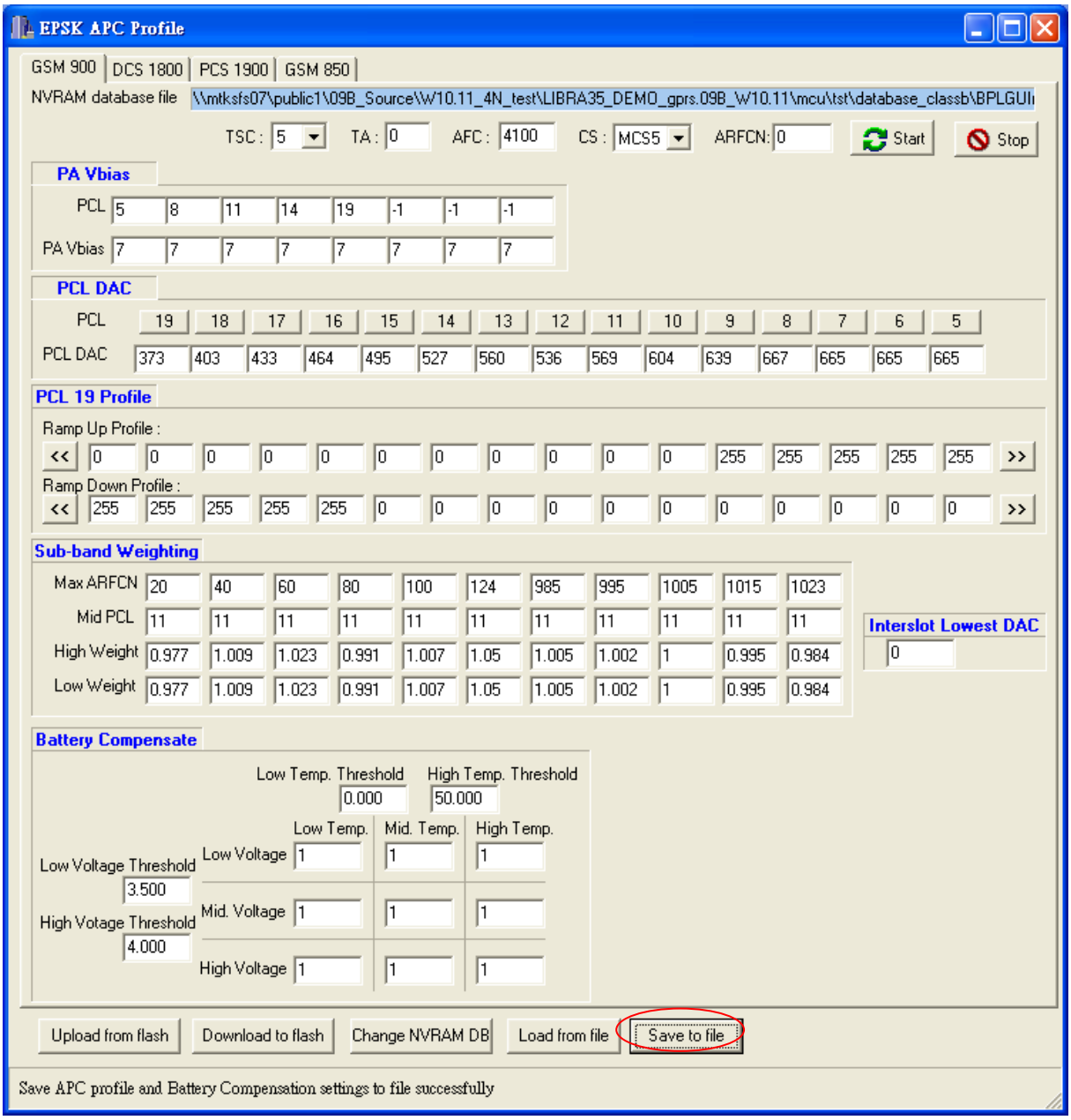

Figure 59 ***Click [Save to file] button to save ramp table to file***

If user click [save to file] button in window above, the tool will save a INI file and following is the "EPSK GSM900 level, ramp" section in it. Each field is corresponding with same field name in the level and ramp window.

[EPSK GSM900 level, ramp]
TX power level=358,375,395,415,435,453,472,490,508,526,543,558,558,558,558,558
profile 0 ramp up=0,0,0,100,100,100,100,100,100,100,114,178,211,232,245,255
profile 0 ramp down=255,255,248,238,223,200,166,101,0,0,0,0,0,0,0,0
profile 1 ramp up=0,0,0,100,100,100,100,100,100,100,114,178,211,232,245,255
profile 1 ramp down=255,255,248,238,223,200,166,101,0,0,0,0,0,0,0,0
profile 2 ramp up=0,0,0,100,100,100,100,100,100,100,114,178,211,232,245,255
profile 2 ramp down=255,255,248,238,223,200,166,101,0,0,0,0,0,0,0,0

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profile 3 ramp up=0,0,0,100,100,100,100,100,100,100,114,178,211,232,245,255
profile 3 ramp down=255,255,248,238,223,200,166,101,0,0,0,0,0,0,0,0
profile 4 ramp up=0,0,0,100,100,100,100,100,100,100,114,178,211,232,245,255
profile 4 ramp down=255,255,248,238,223,200,166,101,0,0,0,0,0,0,0,0
profile 5 ramp up=0,0,0,100,100,100,100,100,100,101,166,200,223,238,248,255
profile 5 ramp down=255,255,248,238,223,200,166,101,0,0,0,0,0,0,0,0
profile 6 ramp up=0,0,0,100,100,100,100,100,100,101,166,200,223,238,248,255
profile 6 ramp down=255,255,248,238,223,200,166,101,0,0,0,0,0,0,0,0
profile 7 ramp up=0,0,0,100,100,100,100,100,100,101,166,200,223,238,248,255
profile 7 ramp down=255,255,248,238,223,200,166,101,0,0,0,0,0,0,0,0
profile 8 ramp up=0,0,0,100,100,100,100,100,100,101,166,200,223,238,248,255
profile 8 ramp down=255,255,248,238,223,200,166,101,0,0,0,0,0,0,0,0
profile 9 ramp up=0,0,0,100,100,100,100,100,100,101,166,200,223,238,248,255
profile 9 ramp down=255,255,248,238,223,200,166,101,0,0,0,0,0,0,0,0
profile 10 ramp up=0,0,0,100,100,100,100,100,100,101,166,200,223,238,248,255
profile 10 ramp down=255,255,248,238,223,200,166,101,0,0,0,0,0,0,0,0
profile 11 ramp up=0,0,88,88,88,88,88,88,88,101,166,200,223,238,248,255
profile 11 ramp down=255,255,248,238,220,200,166,101,0,0,0,0,0,0,0,0
profile 12 ramp up=0,0,88,88,88,88,88,88,88,101,166,200,223,238,248,255
profile 12 ramp down=255,255,253,248,238,220,200,166,101,0,0,0,0,0,0,0
profile 13 ramp up=0,0,88,88,88,88,88,88,88,101,166,200,223,238,248,255
profile 13 ramp down=255,255,253,248,238,223,200,166,101,0,0,0,0,0,0,0
profile 14 ramp up=0,0,88,88,88,88,88,88,88,101,166,200,223,238,248,255
profile 14 ramp down=255,255,253,248,238,223,200,166,101,0,0,0,0,0,0,0
profile 15 ramp up=0,0,0,0,0,0,0,2,4,8,26,65,143,219,250,255
profile 15 ramp down=255,239,197,138,78,32,10,0,0,0,0,0,0,0,0,0
Subband max arfcn=40,82,124,1023,-1,0,0,0,0,0,0
Subband mid level=11,11,11,11,19,19,19,19,19,19,19
Subband high weight=1.000,1.000,1.000,1.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Subband low weight=1.000,1.000,1.000,1.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Battery compensate, low voltage, low temperature=1
Battery compensate, low voltage, mid temperature=1
Battery compensate, low voltage, high temperature=1
Battery compensate, mid voltage, low temperature=1
Battery compensate, mid voltage, mid temperature=1
Battery compensate, mid voltage, high temperature=1
Battery compensate, high voltage, low temperature=1
Battery compensate, high voltage, mid temperature=1
Battery compensate, high voltage, high temperature=1
TX AFC DAC offset=0
[BB TX Parameters]
BB TX common mode voltage=-1
BB TX gain=0
BB TX calrcsel=0
APC bat low voltage=3.50000
APC bat high voltage=4.00000
APC bat low temperature=0.00000
APC bat high temperature=50.00000
Trim I=-1
Trim Q=1
Offset I=8

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Offset Q=16
Calibrated flag=1
BB TX phasesel=0
High band BB TX common mode voltage=-1
High band BB TX gain=0
High band BB TX calrcsel=0
High band Trim I=-1
High band Trim Q=1
High band Offset I=9
High band Offset Q=13
High band BB TX phasesel=1

Note:

- Profile 0 refer to PCL 19, profile 1 refer to PCL 18, ….., profile 14 refer to PCL 5.
- Subband mid level: the level above or equal the [suband mid level] will be multiplied by [Subband low weight], and the level below [Subband mid level] will be multiplied by [Subband high weight].
- Subband high weight: each entry of the ramp profile of level below [Subband mid level] will be multiplied by [Subband high weight].
- Subband low weight: each entry of the ramp profile of level above or equal [Subband mid level] will be multiplied by [Subband low weight].
- Battery compensate: These 3x3 array compensate the APC scaling factor under low/mid/high voltage/temperature.
- TX AFC Offset: the field specifies the crystal TX AFC Offset. Crystal TX AFC DAC = Crystal RX AFC DAC + TX AFC Offset.
- Battery compensate: The threshold is defined in the [BB TX Parameters] INI section

3.2.5.1.f AD6546 transceiver related calibration data

If AD6546 transceiver is used, OthelloE related calibration data can be edited from EPSK APC profile window.

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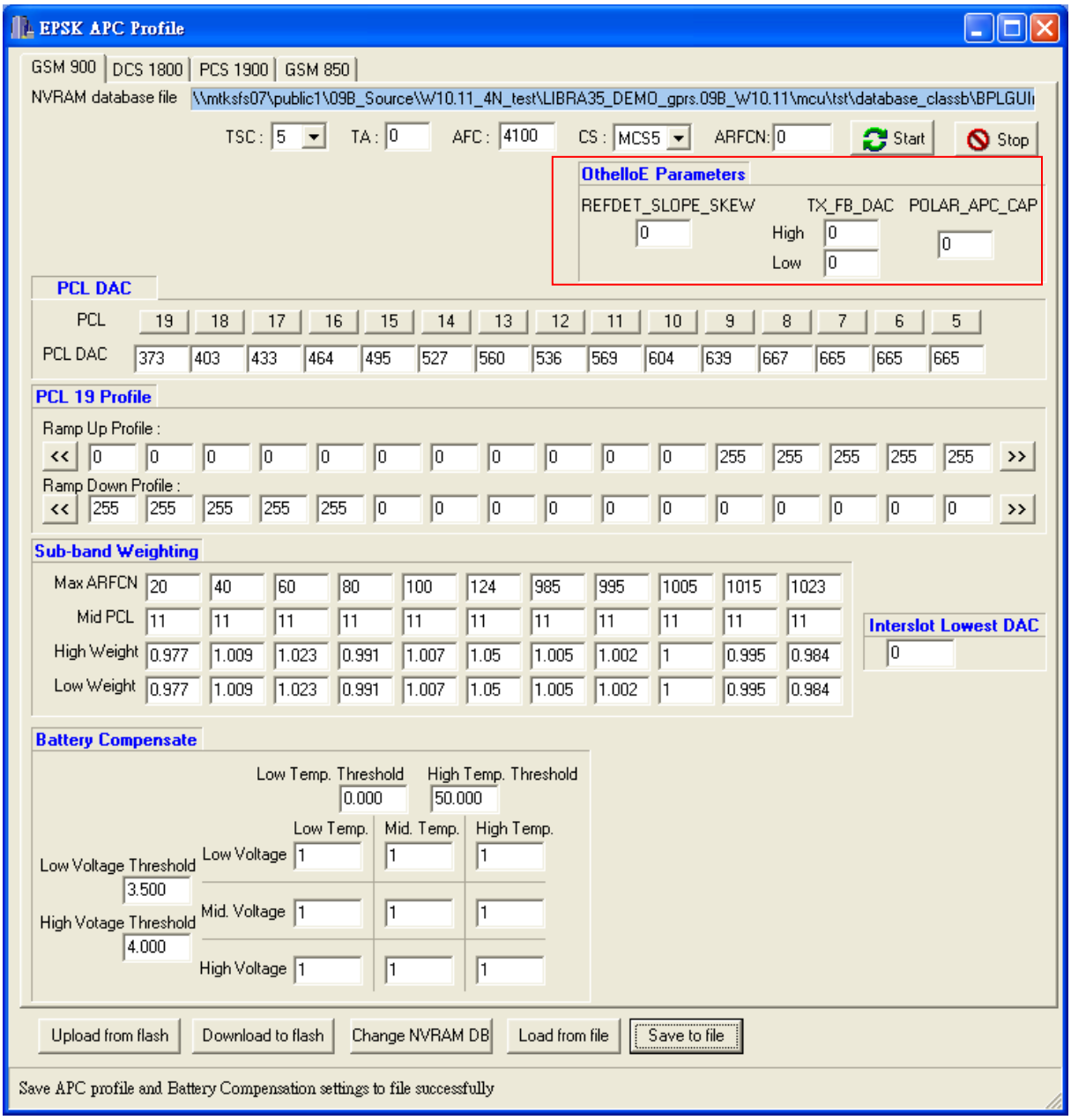

Figure 60 ***OthelloE related calibration data***

The following is a template file of OthelloE related calibration data. Please follow the format if you want to change it.

[Othello Parameters]
GSM900 band Refdet slope skew=0
DCS1800 band Refdet slope skew=0
PCS1900 band Refdet slope skew=0
GSM850 band Refdet slope skew=0
Low band TX FB DAC=0
High band TX FB DAC=-1
GSM850 band APC CAP=16
GSM900 band APC CAP=16
DCS1800 band APC CAP=12

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PCS1900 band APC CAP=12

3.2.5.2 Ramp setting for closed-loop control

The closed-loop control reuse the original ramp table setting in hi_weighting. There are 3 fields added in this form.

1. Closed-loop by-PCL compensation
2. Closed-loop Detector temperature compensation
3. Closed-loop Detector Subband Compensation

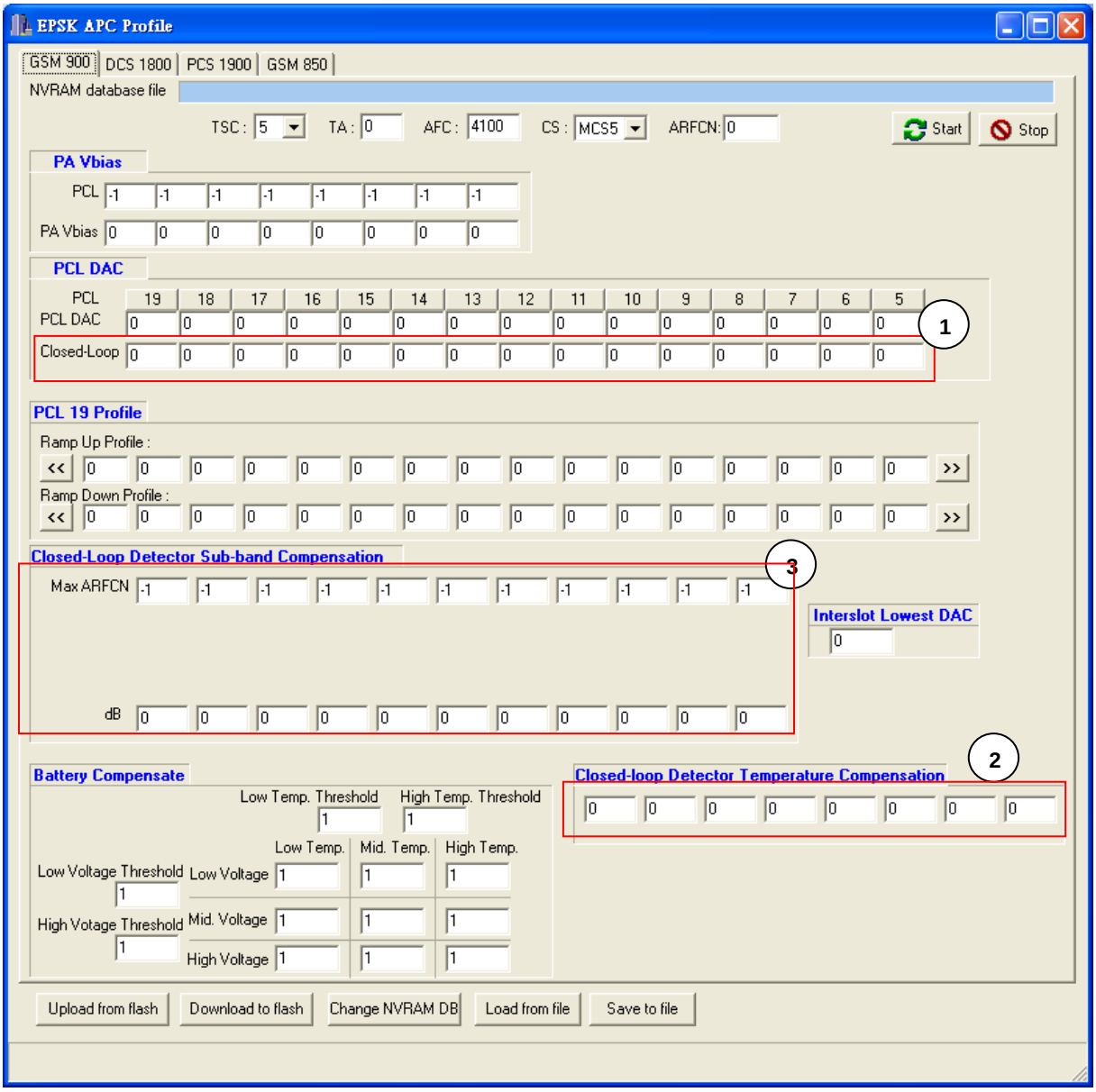

Figure 61 ***Overview of ramp setting that has closed-loop control support capability***

3.2.5.3 Graphic ramp setting

User can click [GMSK Graphic ramp setting] or [EPSK Graphic ramp setting] button to show graphic ramp setting window.

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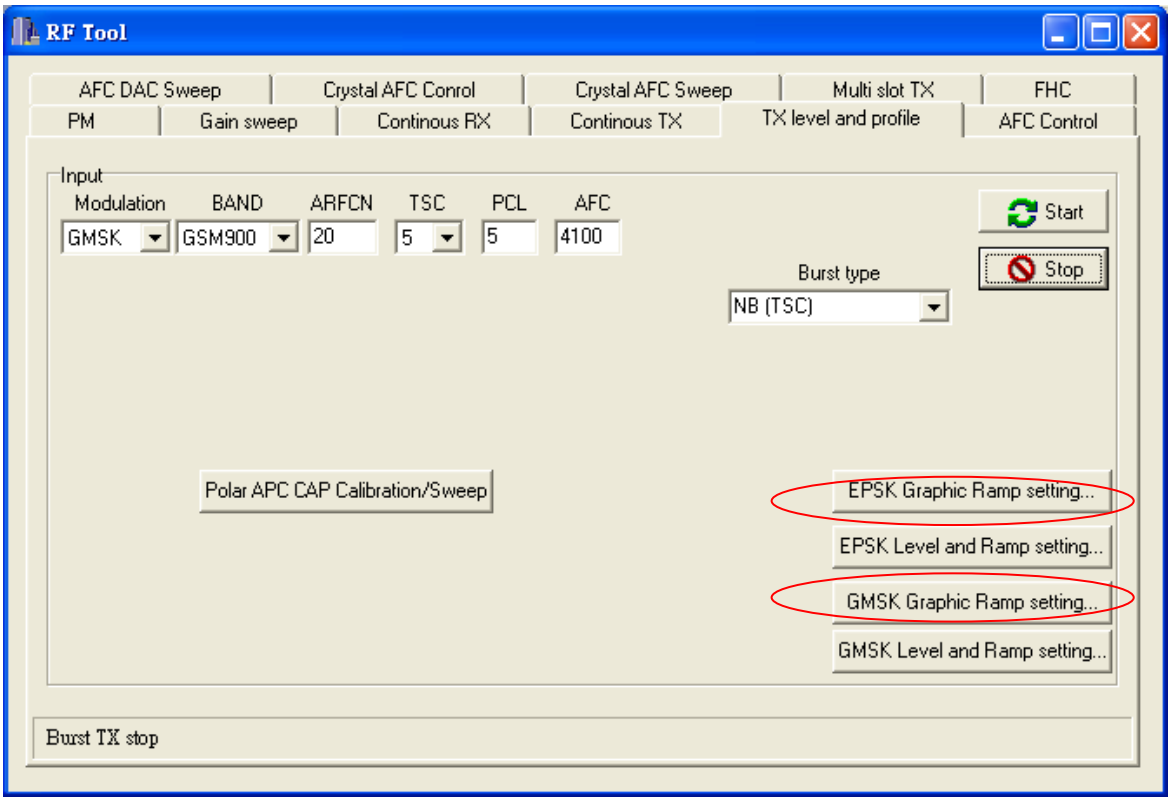

Figure 62 ***Click [GMSK Graphic Ramp setting] or [EPSK Graphic Ramp setting] button***

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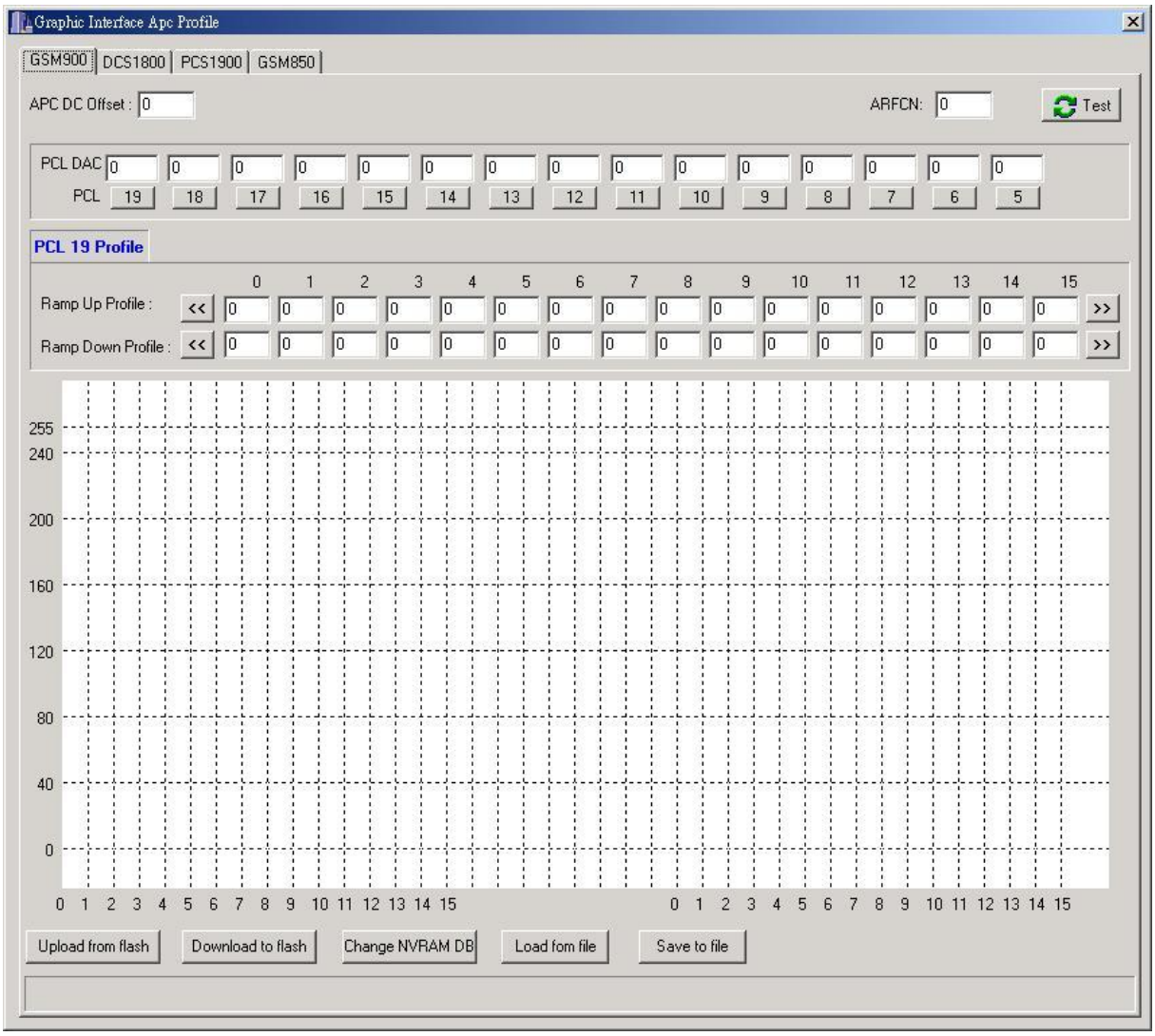

Figure 63 ***Graphic interface ramp profile window***

3.2.5.3.a Graphic ramp profile tuning

Graphic ramp profile window is used for user to fine tune ramp profile. Power amplifier is turned on in this operation. User can input APC DC offset, ARFCN, and then click left button of mouse to drag ramp level (i.e. green point). After user end drag ramp level, TX level testing is started automatically and the caption of the button will change to [Stop]. User can click [Stop] button to stop it.

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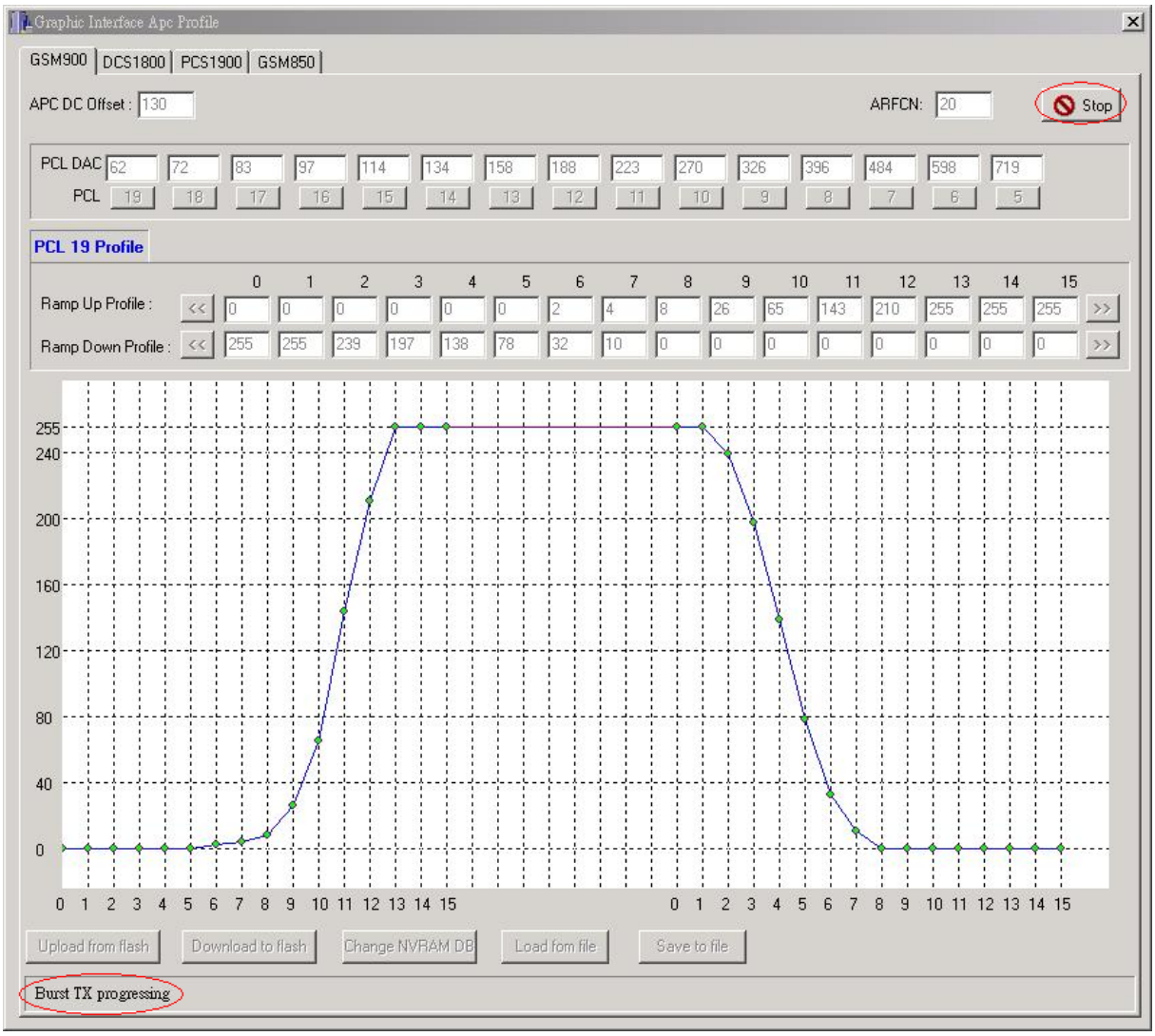

Figure 64 ***TX level testing is started automatically***

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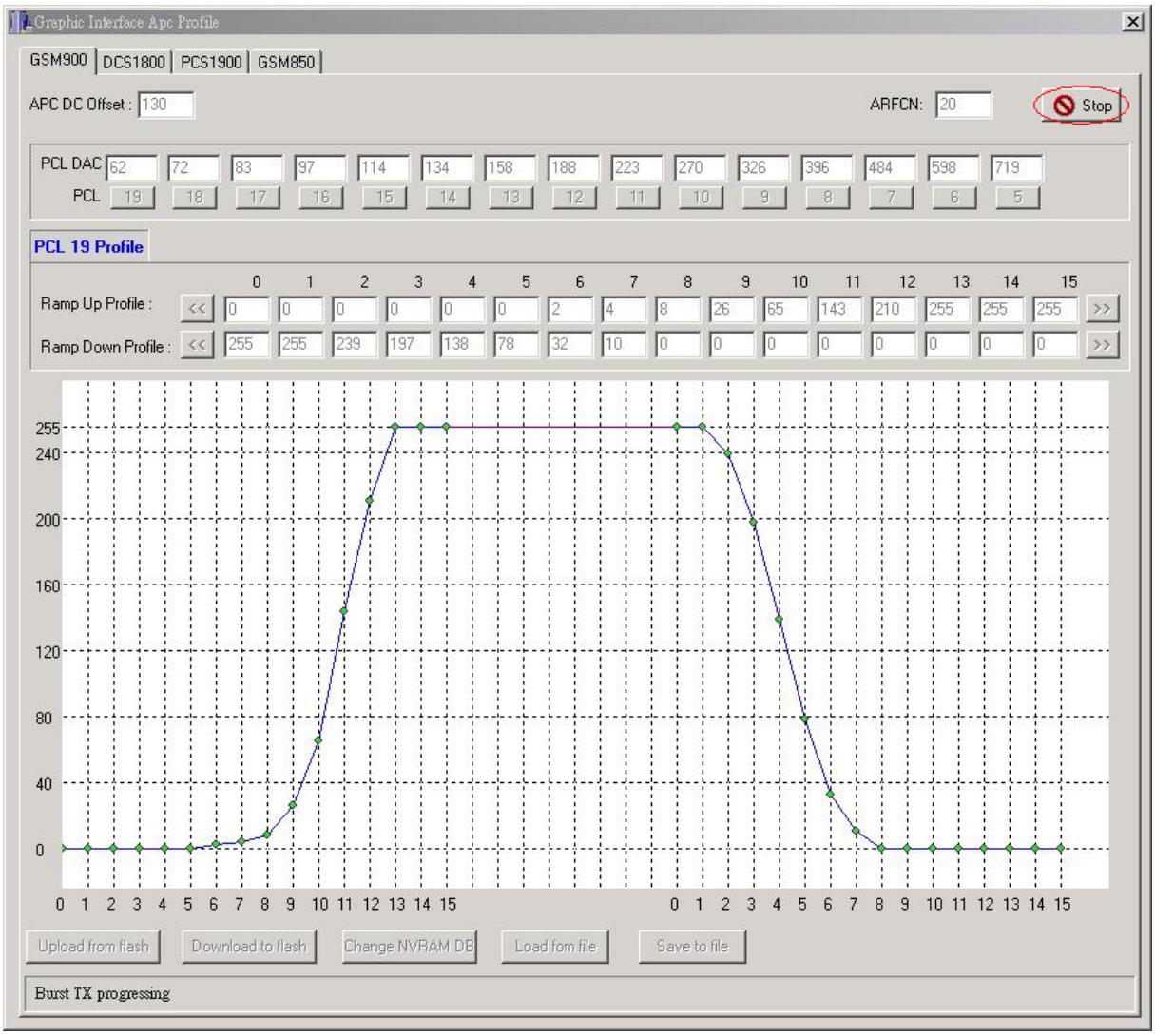

Figure 65 ***Click [Stop] button to stop testing***

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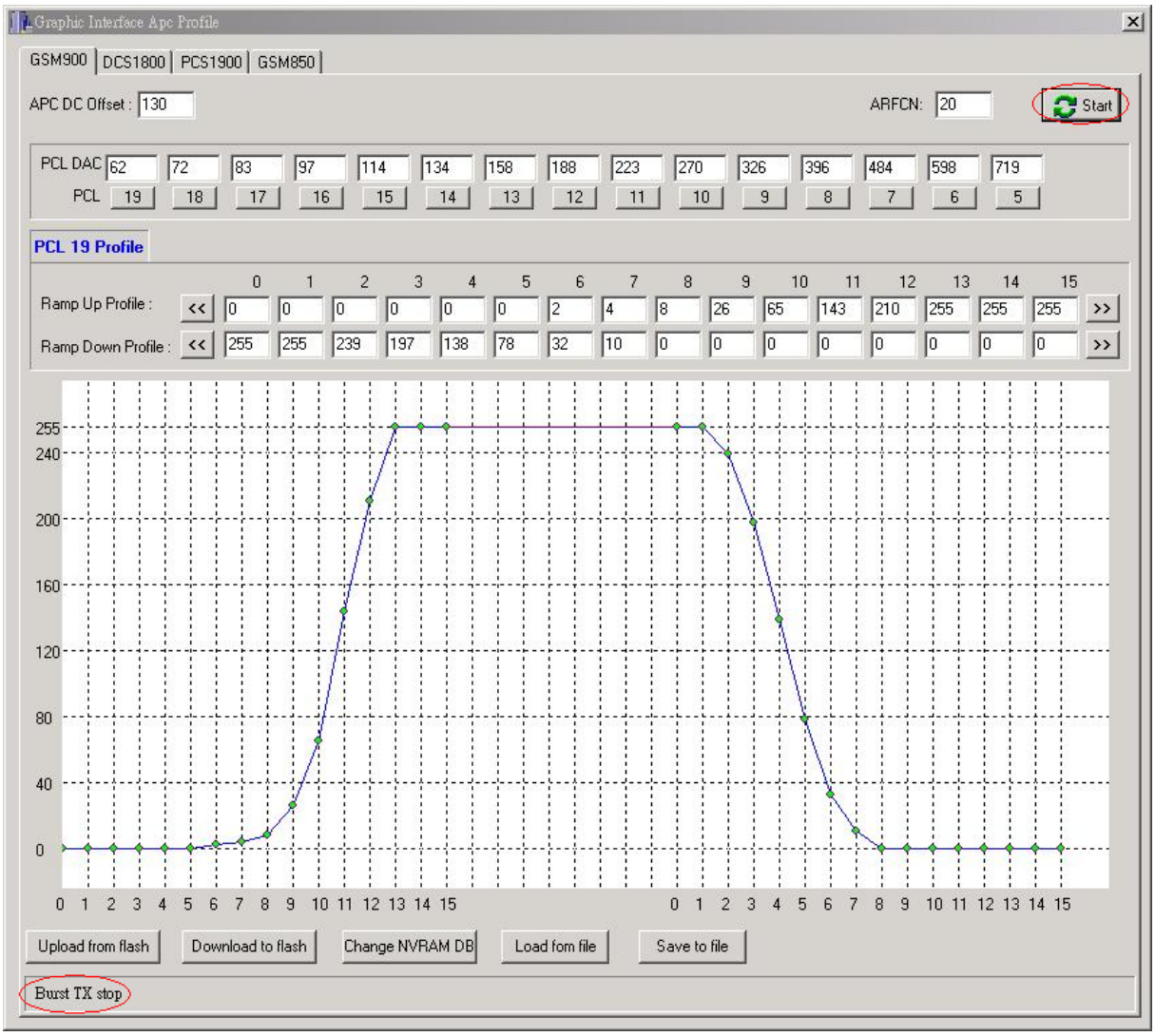

Figure 66 ***The caption of button will change to [Start]***

3.2.5.3.b Read and write the level ramp table in flash

User can click [Upload from flash] button to read graphic ramp profile from flash and click [Download to flash] button to write graphic ramp profile to flash.

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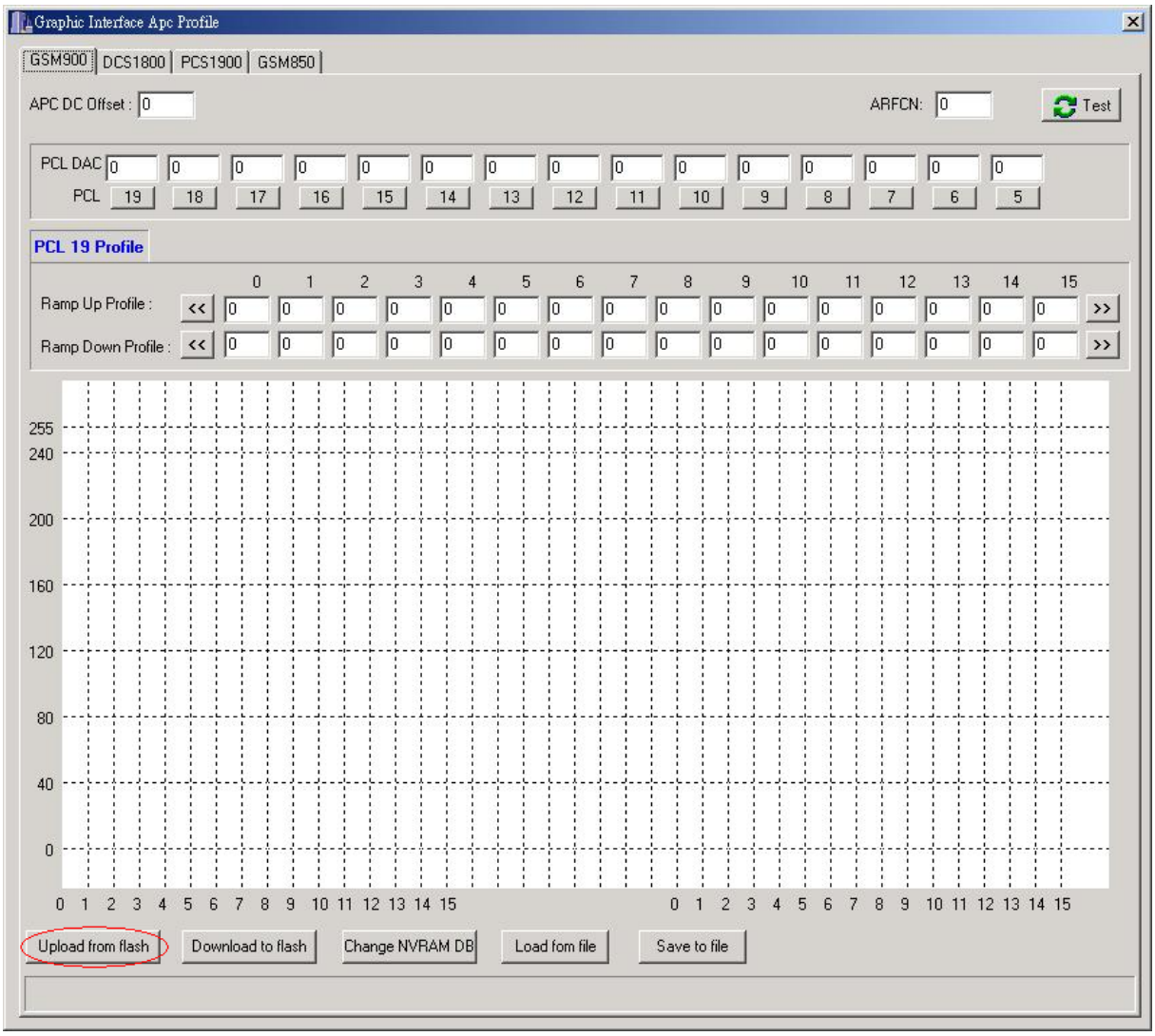

Figure 67 ***Click [Upload from flash] button to read graphic ramp profile from flash***

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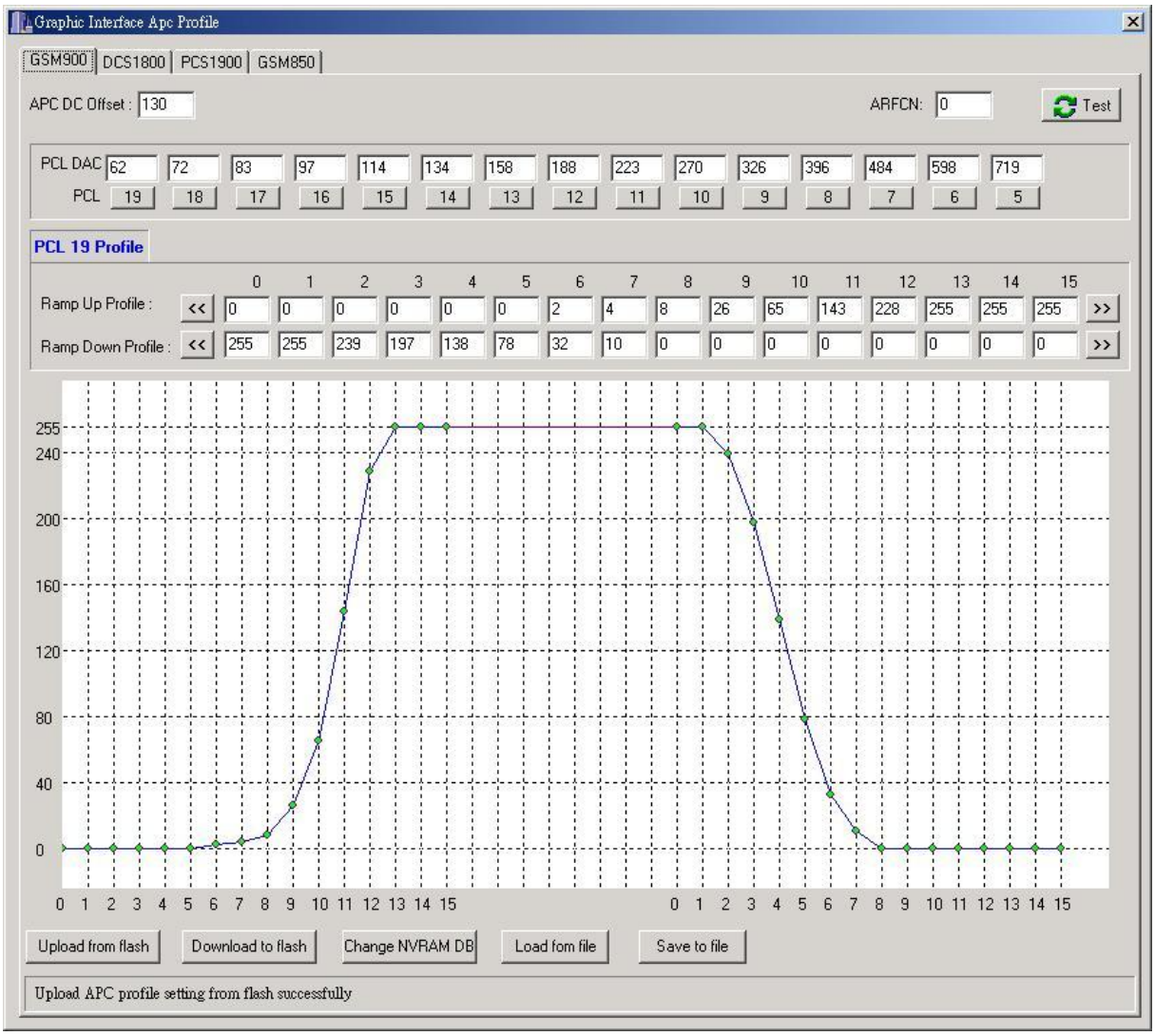

Figure 68 ***Graphic ramp profile result***

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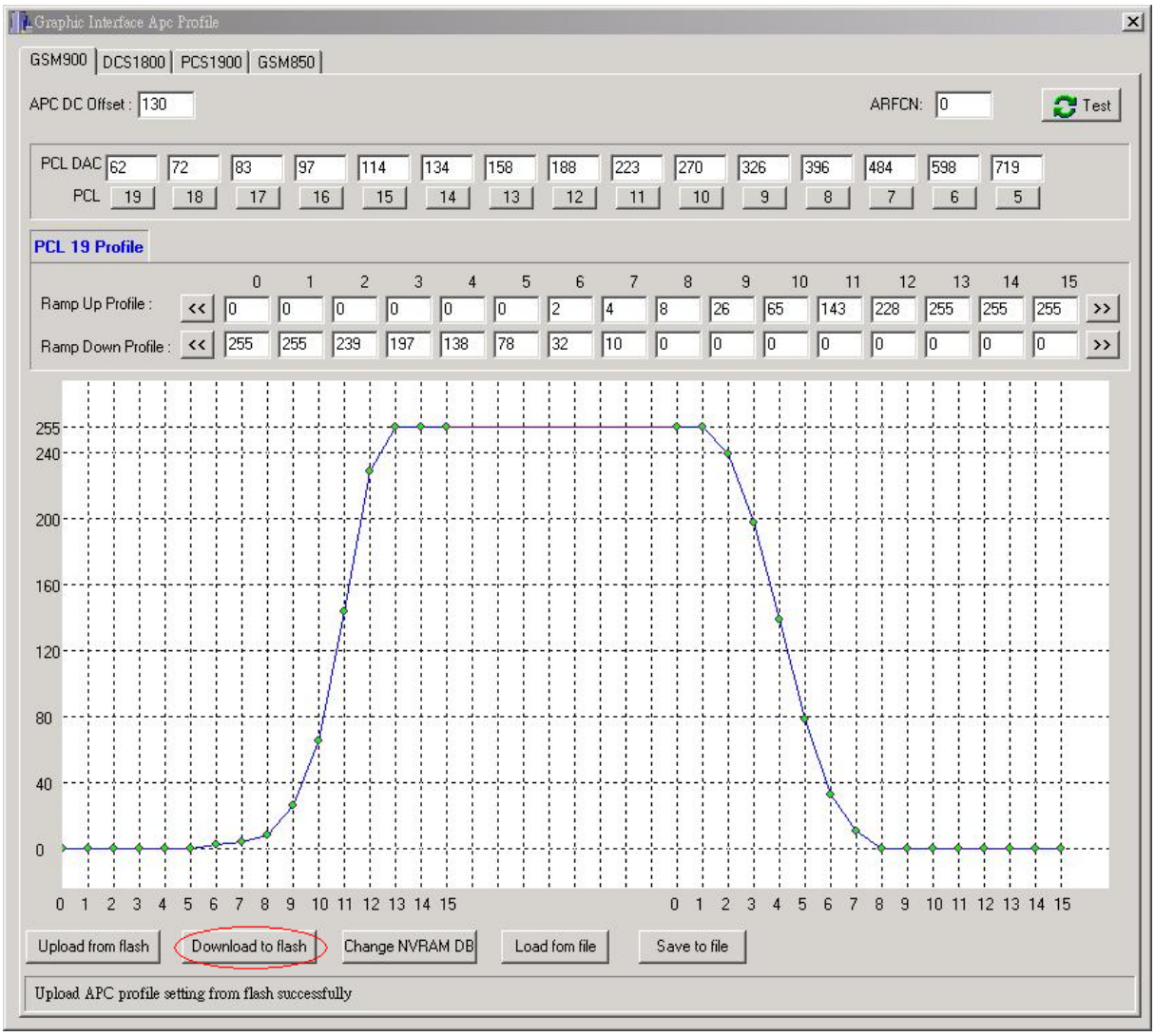

Figure 69 ***Click [Download to flash] to write graphic ramp profile to flash***

User can click [Change NVRAM DB] button to change NVRAM database file.

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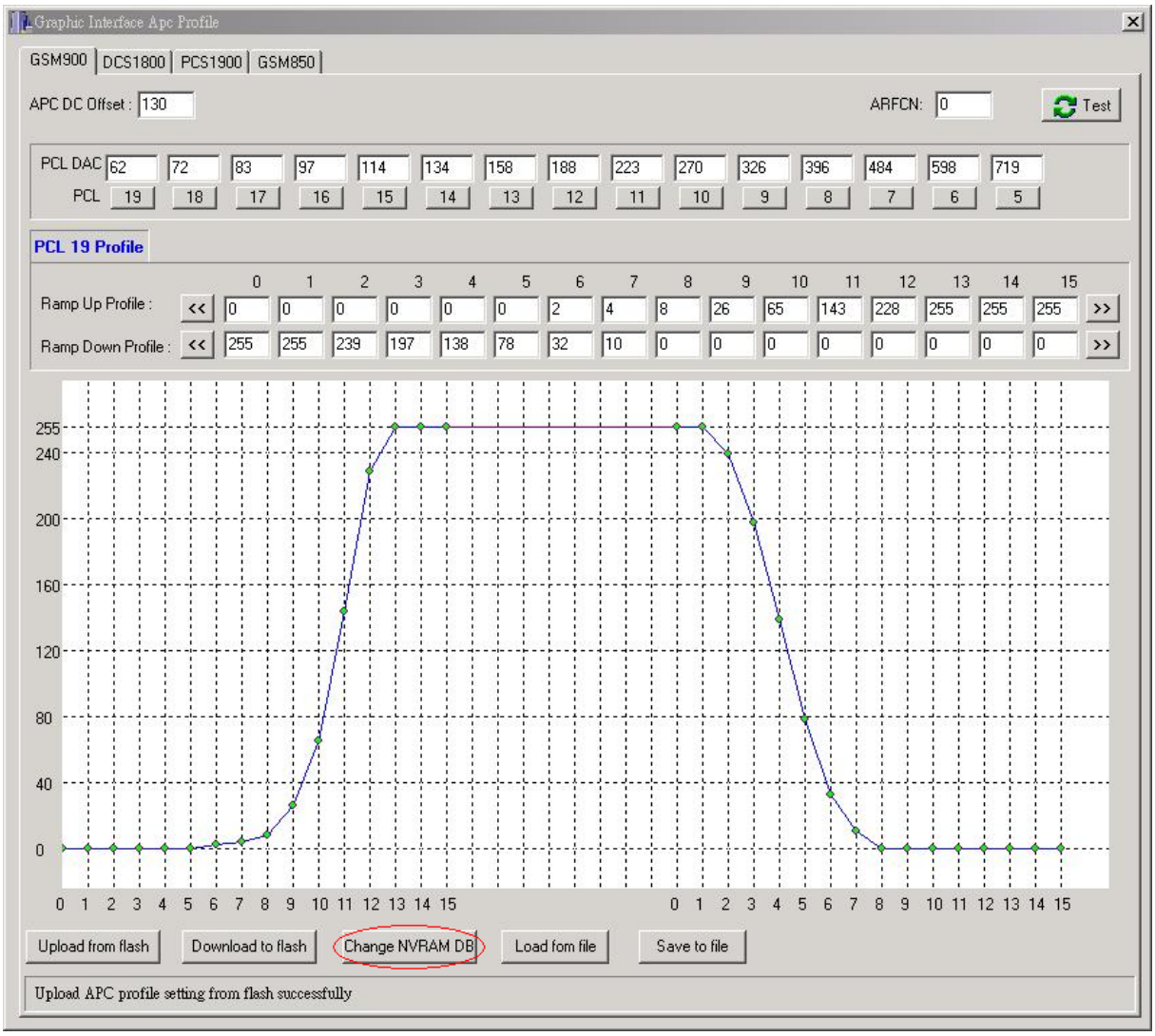

Figure 70 ***Click [Change NVRAM DB] button to change NVRAM database file***

3.2.5.3.c Read and write the graphic ramp profile in file

Users can click [Load from file] button to read graphic ramp profile from the text file and click [Save to file] button to write graphic ramp profile to the text file. The tool can save it with path loss and AFC initial value in single or multiple files. Each value must be followed with a comma in the TX level, ramp up, ramp down fields.

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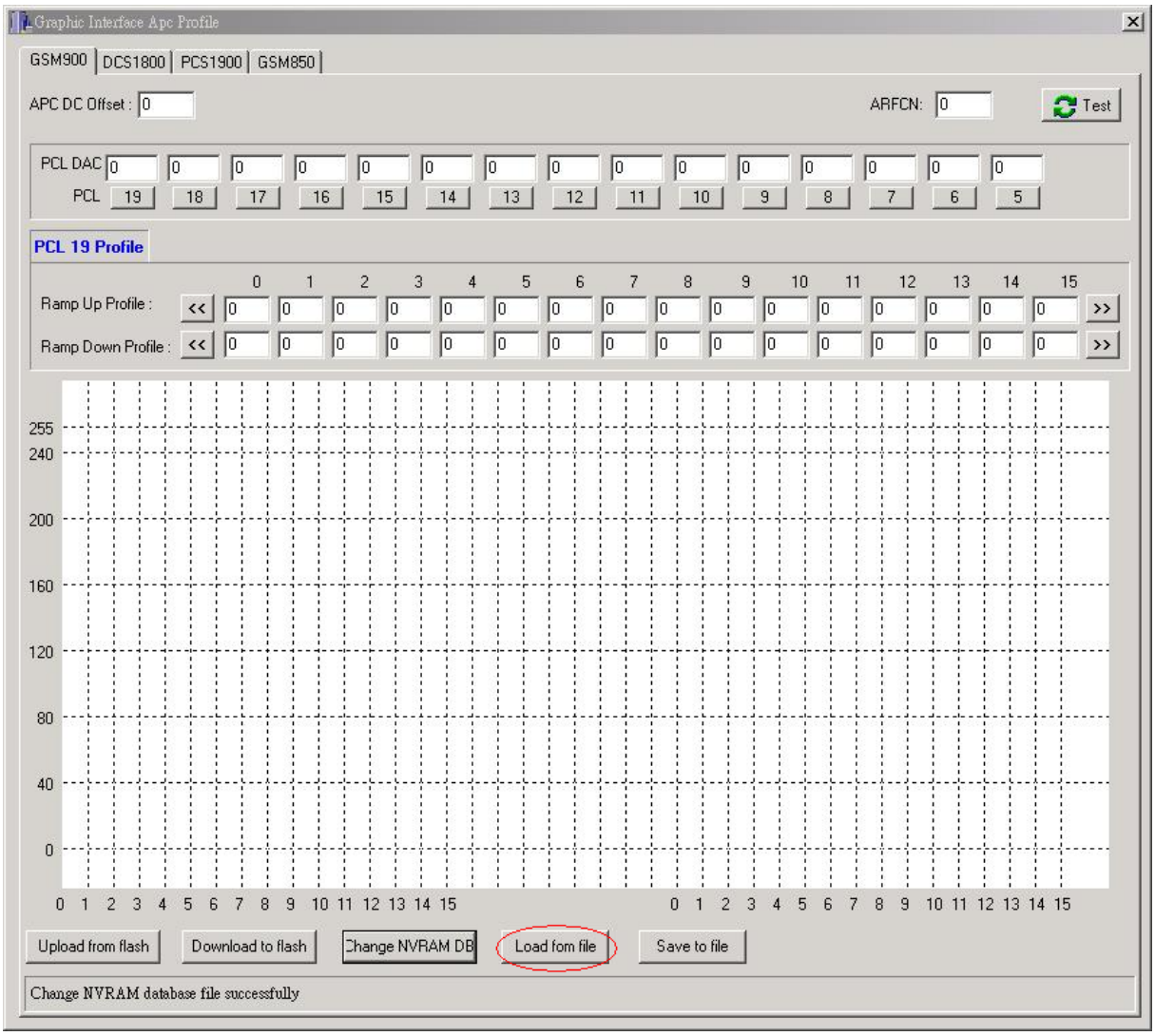

Figure 71 ***Click [Load from file] button to read graphic ramp profile from file***

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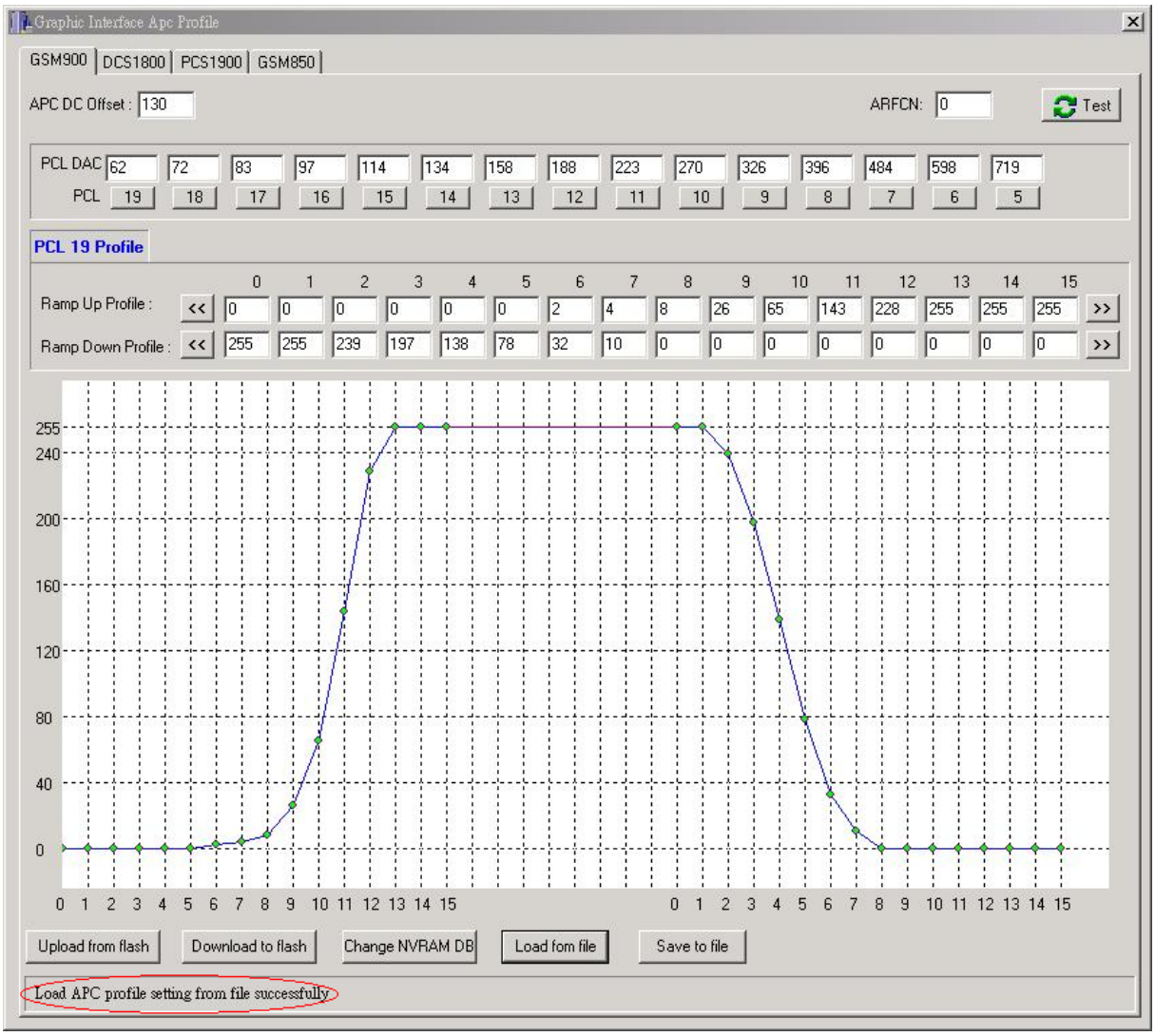

Figure 72 ***Graphic ramp profile result***

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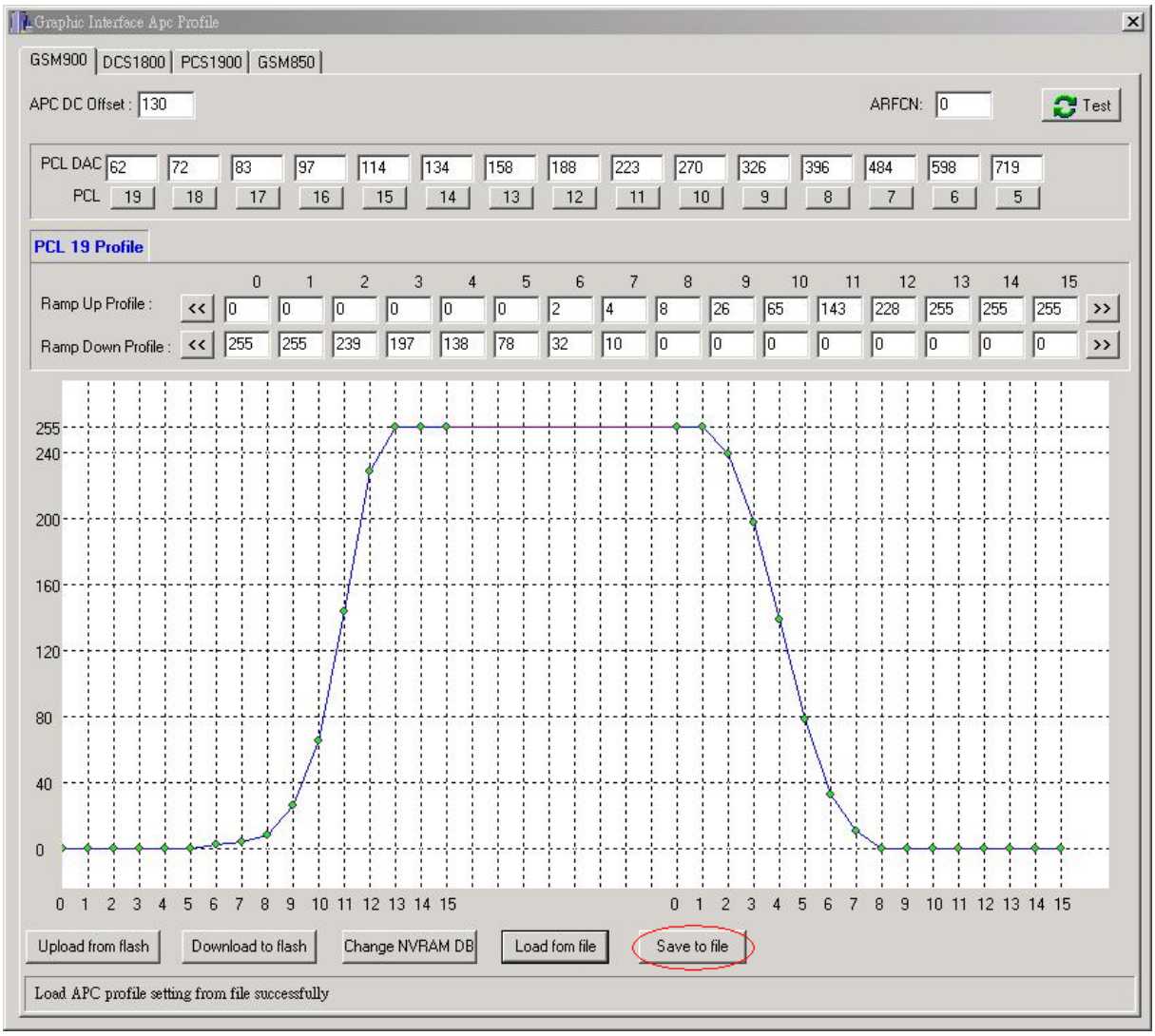

Figure 73 ***Click [Save to file] button to save graphic ramp profile to file***

The following is a template file of graphic ramp profile. User will get this file after saving graphic ramp profile to file.

[GSM900 level, ramp]
APC dc offset=130
; APC dc offset: the field specify the pedestal value of the APC unit. The APC D/A converter
; is powered up biased on the offset value specified by the field.
TX power level=62,72,83,97,114,134,158,188,223,270,326,396,484,598,719,719
; profile 0 refer to PCL 19, profile 1 refer to PCL 18, ….., profile 14 refer to PCL 5
profile 0 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,228,255,255,255
profile 0 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 1 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,225,255,255,255
profile 1 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 2 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 2 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 3 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 3 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0

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profile 4 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 4 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 5 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 5 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 6 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 6 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 7 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 7 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 8 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 8 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 9 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 9 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 10 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 10 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 11 ramp up=0,0,0,0,0,0,0,2,4,8,26,65,143,219,255,255
profile 11 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 12 ramp up=0,0,0,0,0,0,0,2,4,8,26,65,143,219,250,255
profile 12 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 13 ramp up=0,0,0,0,0,0,0,2,4,8,26,65,143,219,250,255
profile 13 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 14 ramp up=0,0,0,0,0,0,0,2,4,8,26,65,143,219,250,255
profile 14 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 15 ramp up=0,0,0,0,0,0,0,2,4,8,26,65,143,219,250,255
profile 15 ramp down=255,239,197,138,78,32,10,0,0,0,0,0,0,0,0,0
Subband max arfcn=40,82,124,1023,-1,0,0,0,0,0,0
Subband mid level=11,11,11,11,19,19,19,19,19,19,19
Subband high weight=1.000,1.000,1.000,1.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Subband low weight=1.000,1.000,1.000,1.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Battery compensate, low voltage, low temperature=1
Battery compensate, low voltage, mid temperature=1
Battery compensate, low voltage, high temperature=1
Battery compensate, mid voltage, low temperature=1
Battery compensate, mid voltage, mid temperature=1
Battery compensate, mid voltage, high temperature=1
Battery compensate, high voltage, low temperature=1
Battery compensate, high voltage, mid temperature=1
Battery compensate, high voltage, high temperature=1
CAP ID compensate=0

Note:

- APC dc offset: the field specify the pedestal value of the APC unit. The APC D/A converter is powered up biased on the offset value specified by the field.
- Subband mid level: the level above or equal the [suband mid level] will be multiplied by [Subband low weight], and the level below [Subband mid level] will be multiplied by [Subband high weight].
- Subband high weight: each entry of the ramp profile of level below [Subband mid level] will be multiplied by [Subband high weight].
- Subband low weight: each entry of the ramp profile of level above or equal [Subband mid level] will be multiplied by [Subband low weight].
- Battery compensate: These 3x3 array compensate the APC scaling factor under low/mid/high voltage/temperature.

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- TX AFC Offset: the field specifies the crystal TX AFC Offset. Crystal TX AFC DAC = Crystal RX AFC DAC + TX AFC Offset.

3.2.5.4 Polar APC CAP Calibration / SWeep

User can click [Polar APC CAP Calibration / Sweep] button to sweep or calibrate the AD6546 APC CAP to tune the AD6546 TX performance.

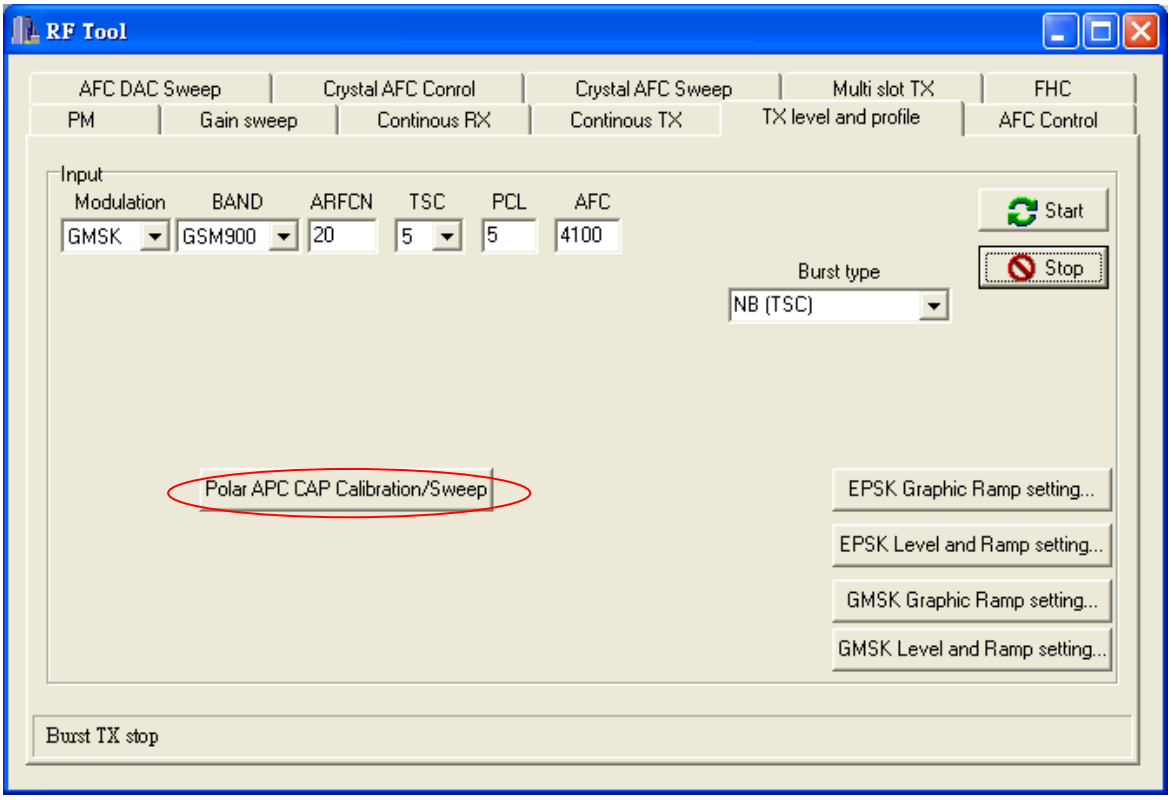

Figure 74 ***Click [Polar APC CAP Calibration/Sweep] button (for AD6546)***

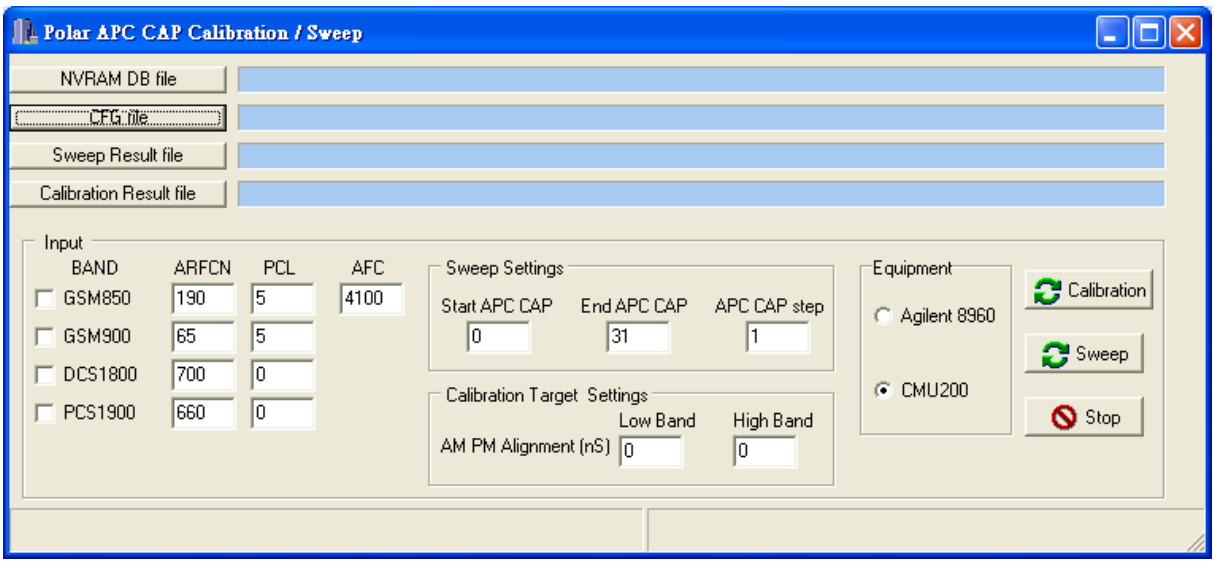

Figure 75 ***Polar APC CAP Calibration/Sweep UI***

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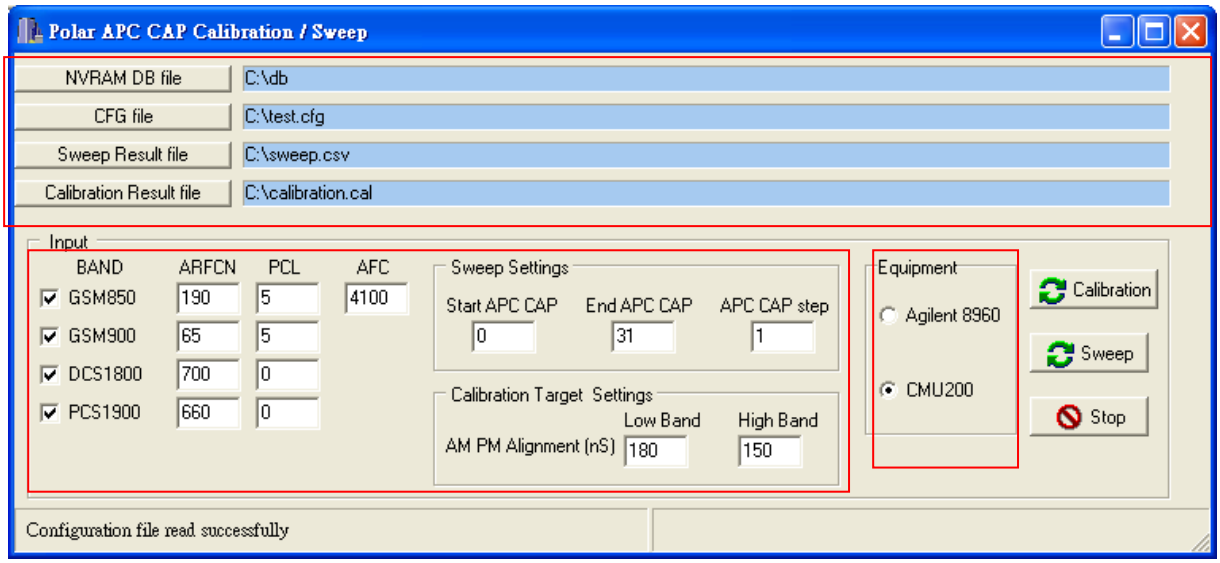

Figure 76 ***Select NVRAM DB, CFG, Sweep Result, Calibration Result file and set input and then select Equipment***

The following is a template file of Polar APC CAP Calibration /Sweep. User will get this file after calibration. Currently the calibration only supports CMU200. The sweep supports both Agilent 8960 and CMU200. After the sweep using CMU200, the calibration target settings will be automatically filled in for further evaluations.

[Othello Parameters]
GSM900 band Refdet slope skew=1
Low band TX FB DAC=-1
DCS1800 band Refdet slope skew=1
High band TX FB DAC=-1
PCS1900 band Refdet slope skew=1
GSM850 band Refdet slope skew=2
GSM850 band APC CAP=24
GSM900 band APC CAP=24
DCS1800 band APC CAP=16
PCS1900 band APC CAP=16

3.2.6 AFC control

User can input ARFCN, AFC DAC value, Gain (dB) and Test Count and then click [Start] button to test AFC control. MS will detect the FB with the parameters set by user after the command from META is received. If MS detection more than one FB, META_LAB will show the FB detection count, otherwise it shows “Fail”.

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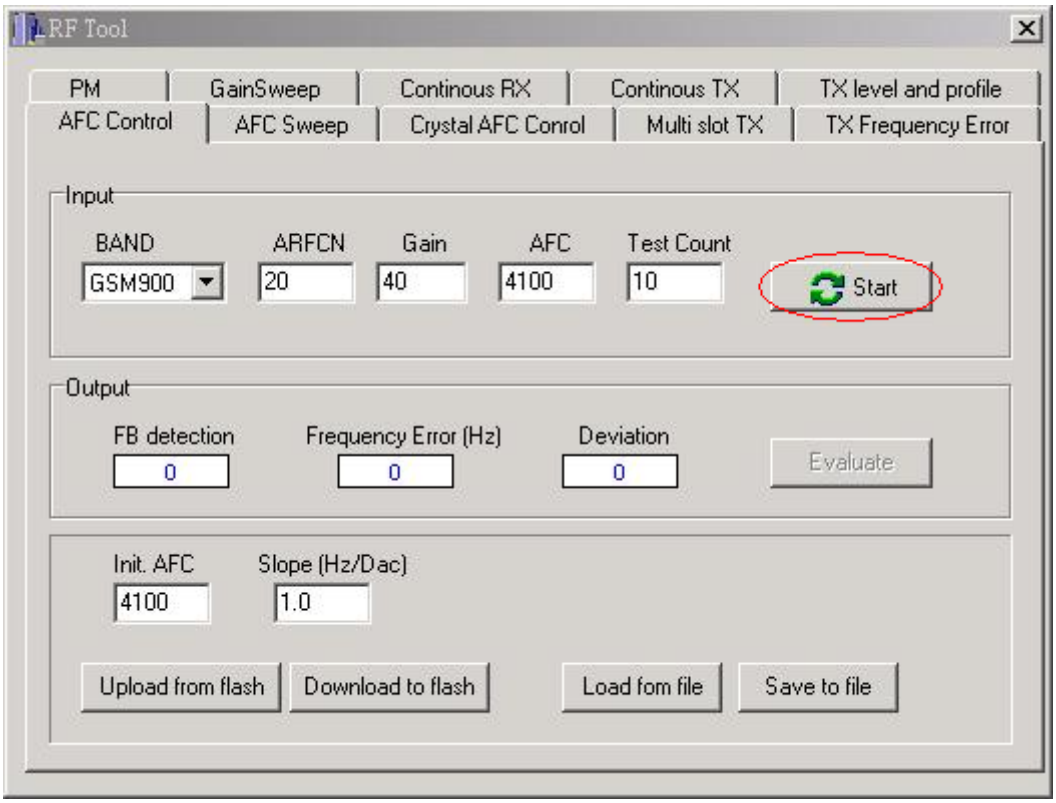

Figure 77 ***Click [Start] button to start testing***

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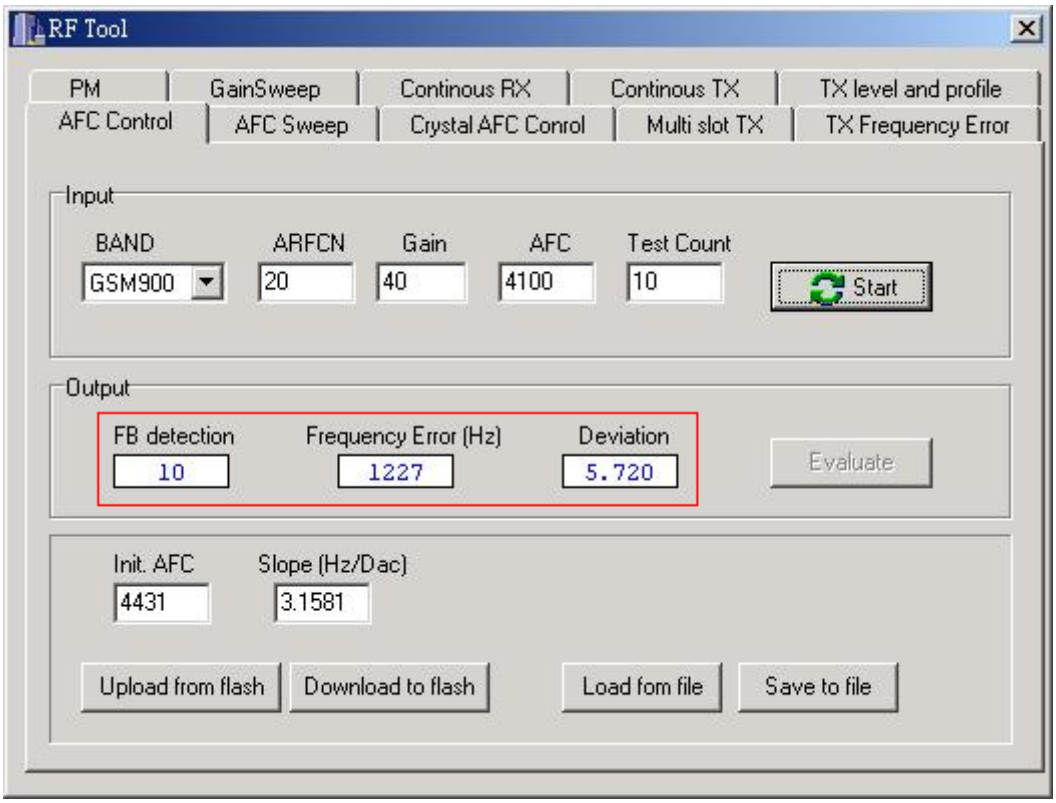

Figure 78 ***Measurement result of AFC control***

1. FB detection: It is the total FB detection count of MS among testing numbers.
2. Frequency Error: It is the average frequency error of the total FB detection.
3. Deviation: It is the deviation of the total FB detection.
   - Same as section 3.2.1 the value returned from target is the square of deviation. PC side program will get deviation from square root of the value returned from target. The user shall limit the test number to prevent deviation overflow if frequency error is large.

3.2.6.1 Upload and download the AFC value in flash

Following describes how to upload and download AFC value from and to flash. User can click [Upload from flash] button to read initial AFC and slope value from flash and click [Download to flash] button to write initial AFC and slope value to flash.

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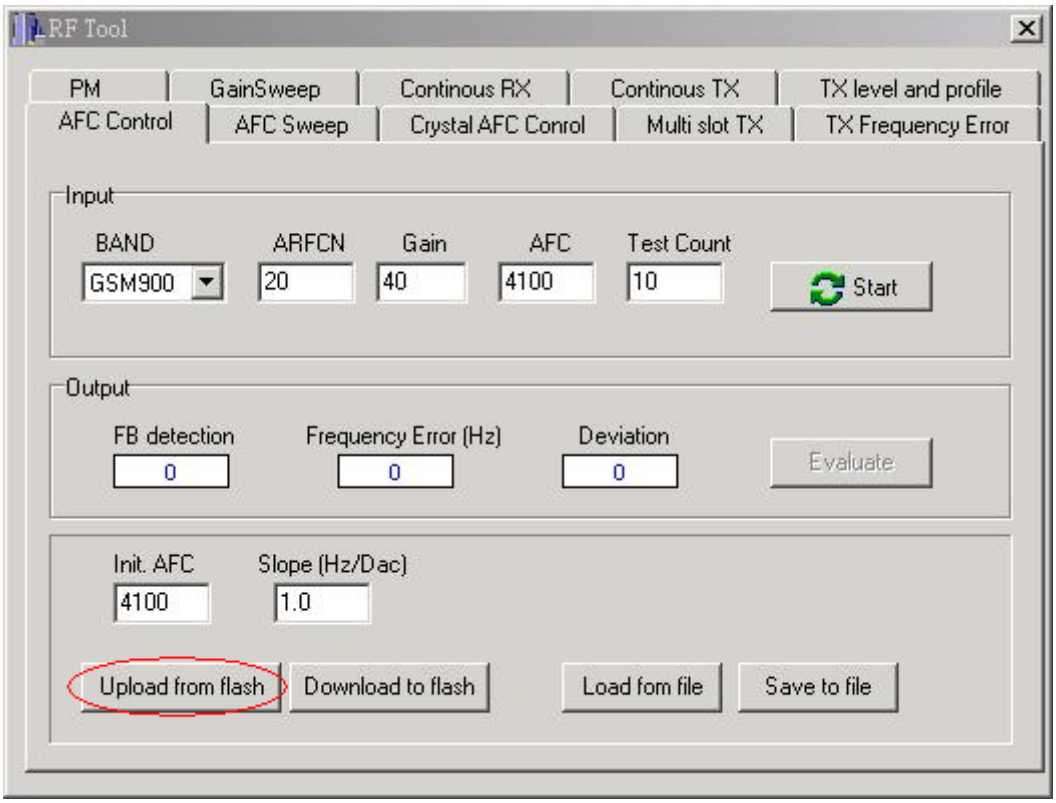

Figure 79 ***Click [Upload from flash] button to read value from flash***

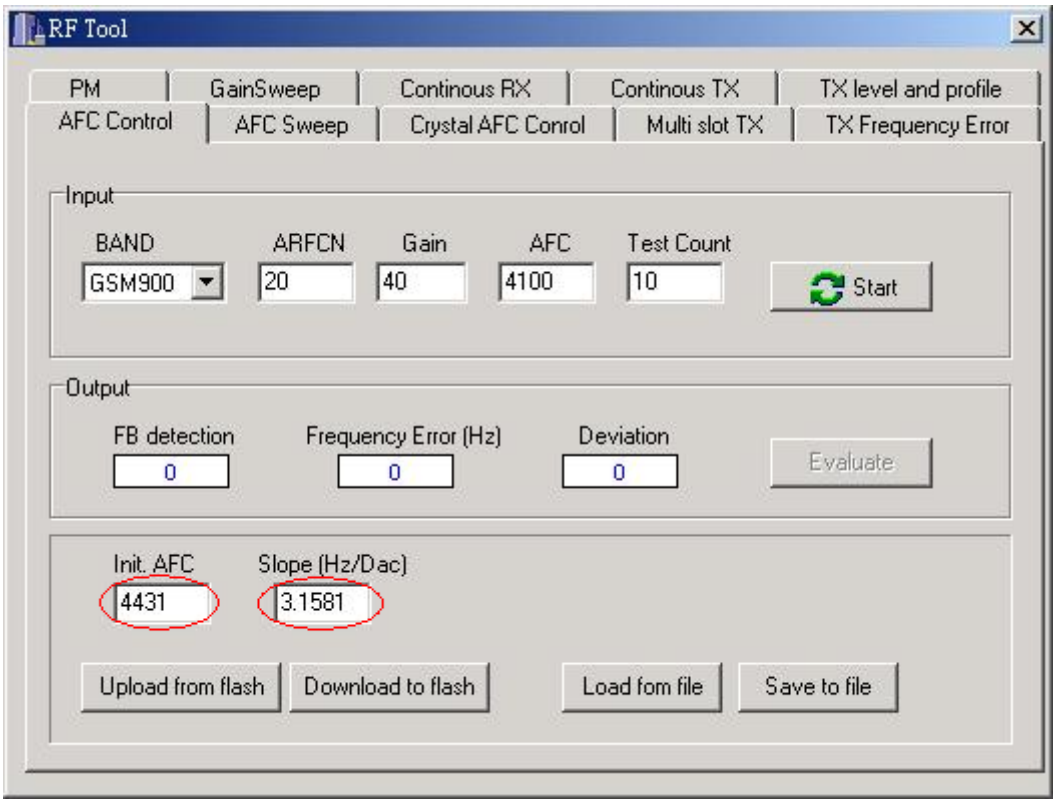

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Figure 80 ***Result of AFC value***

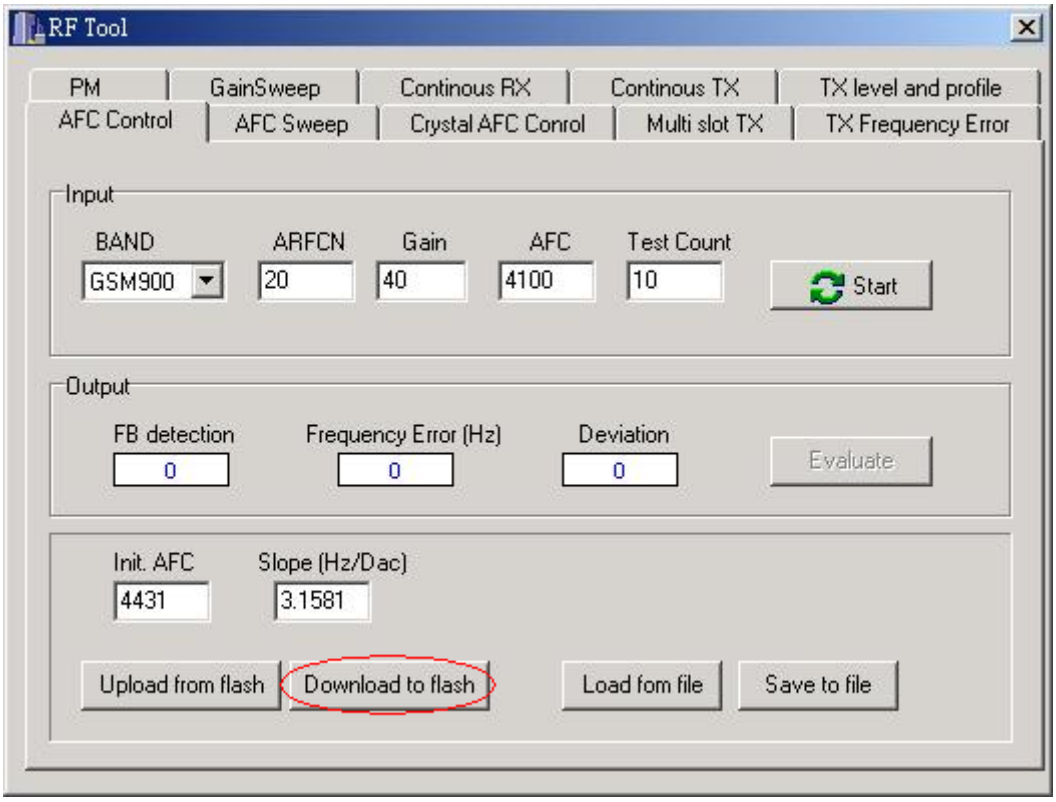

Figure 81 ***Click [Download to flash] button to write value to flash***

3.2.6.2 Read and write the AFC value in file

User can click [Load from file] button to load initial AFC and slope value from file and click [Save to file] button to save initial AFC and slope value to file.

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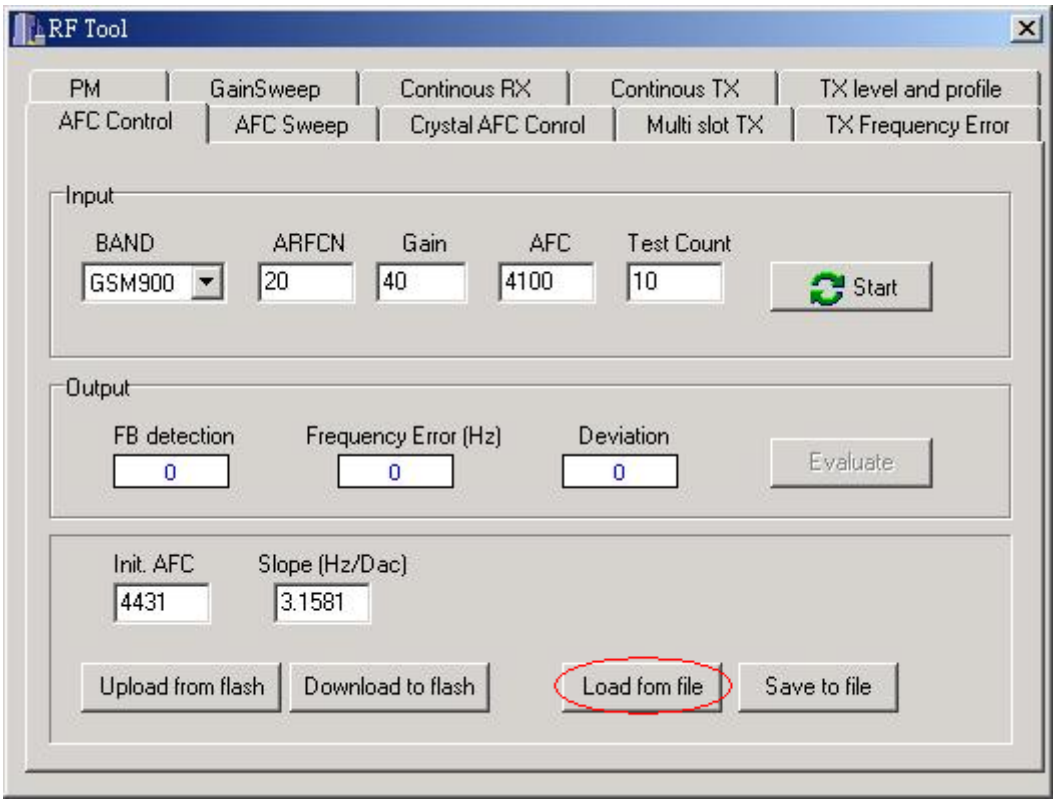

Figure 82 ***Click [Load from file] button to read value from file***

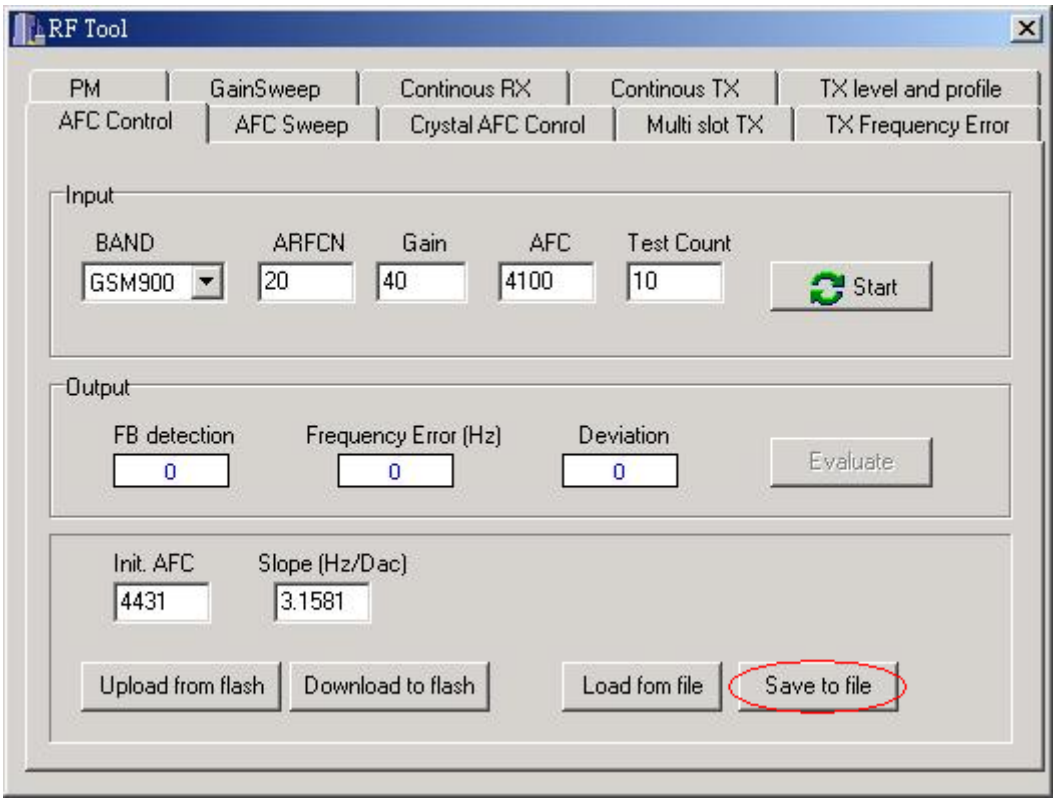

Figure 83 ***Click [Save to file] button to save value to file.***

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The following is a template file of AFC control. User will get the text file after saving initial value and slope. Please follow the file format if you want to change the value in file.

[AFC control]
Initial value = 4100
Slope = 2.8016

Note: Slope = $\overline{\Delta f_1} - \overline{\Delta f_2} \big/ DAC_2 - DAC_1$, where DAC1 and DAC2 are AFC DAC value, and $\overline{\Delta f_1}$ and $\overline{\Delta f_2}$ are averaged frequency error measured at target side.

3.2.6.3 RTC 32K clock tracking

RTC 32K clock tracking function is for customer to evaluate if RTC related H/W works well. When RTC clock is outside range, META will popup warning message. User can click [RTC 32K clock tracking …] button to show RTC 32K clock tracking window.

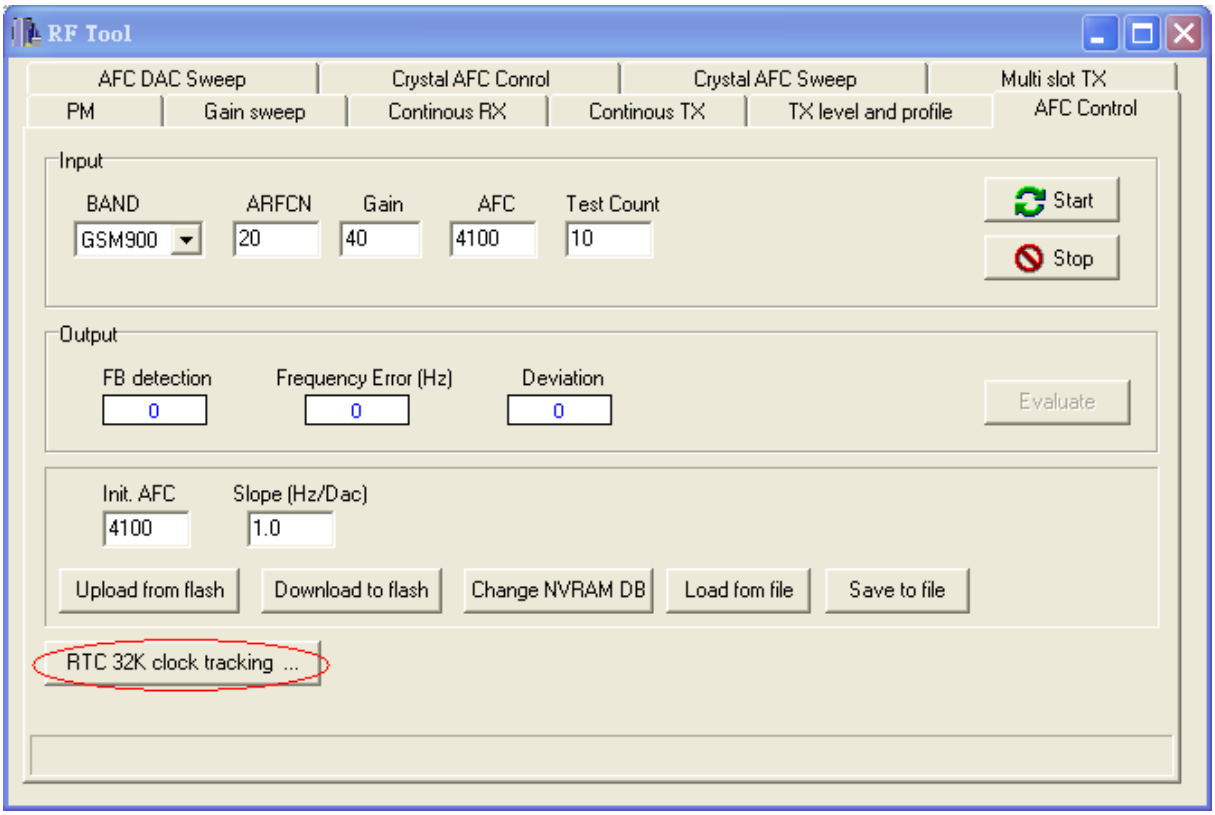

Figure 84 ***Click [RTC 32K clock tracking …] button to show RTC 32K clock tracking window***

User can follow below procedure to start RTC 32K clock tracking function.
1.Setup configuration file, configuration file contains equipment control related information such as GPIB address.
2.Setup log file, RTC 32K clock tracking log information is written to this file.
3. Select band, enter ARFCN, gain, AFC DAC and test count.
4. Press [Start] button to start RTC 32K clock tracking function.

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5. META will display RTC clock and RTC clock/32768 periodically. These information also be saved to log file.

When user wants to stop RTC 32K clock tracking function, he can press [Stop] button.

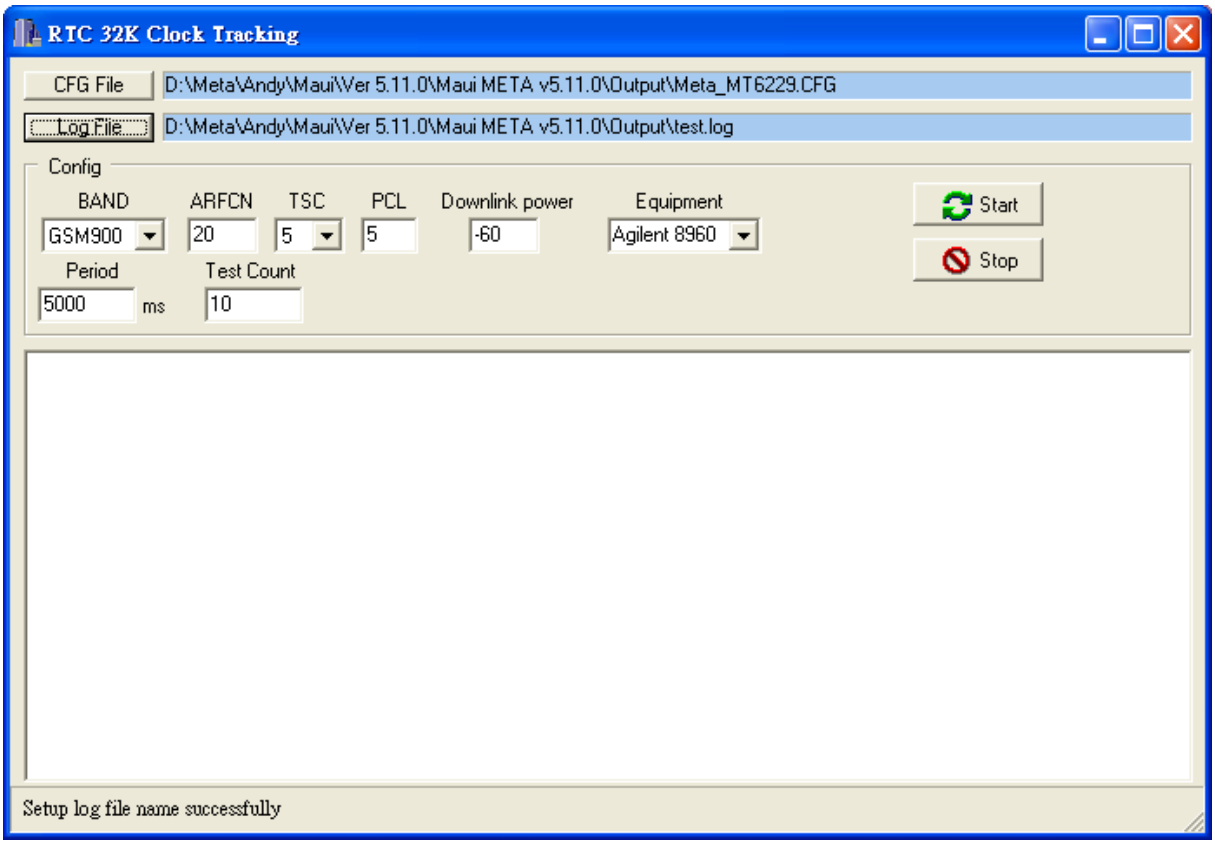

Figure 85 ***RTC 32k clock tracking window***

3.2.7 AFC DAC sweep

AFC sweep is used for detection of FB of the indicated channel by the different AFC DAC value.

User can execute AFC sweep function by following steps:
1) Input Band, ARFCN, Gain (dB), Test Count, Min AFC DAC, Max AFC DAC and step AFC DAC.
2) Click Start button.
3) Meta will show the FB detection result: AFC DAC, frequency offset, deviation and FB detection ok number.
4) User can stop this operation by clicking [Stop] button.

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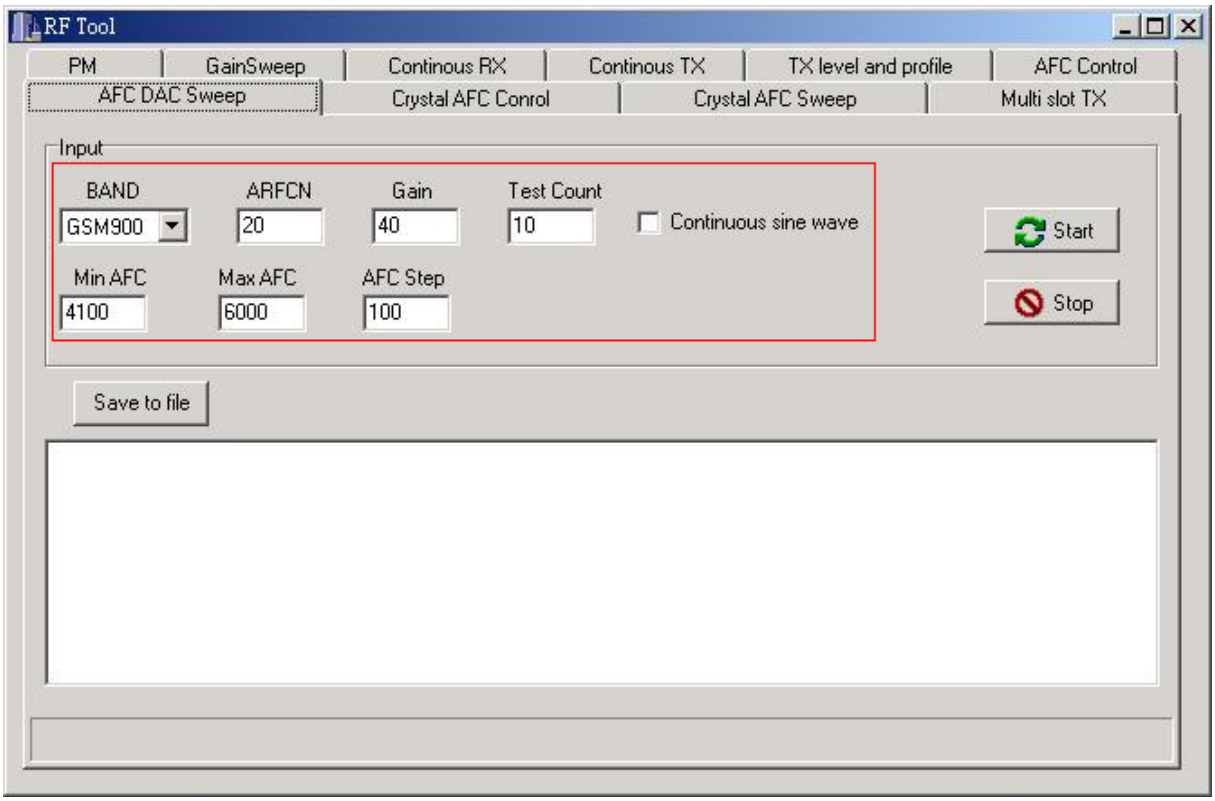

Figure 86 ***Input Band, ARFCN, Gain (dB), Test Count, Min AFC DAC, Max AFC DAC and step AFC DAC***

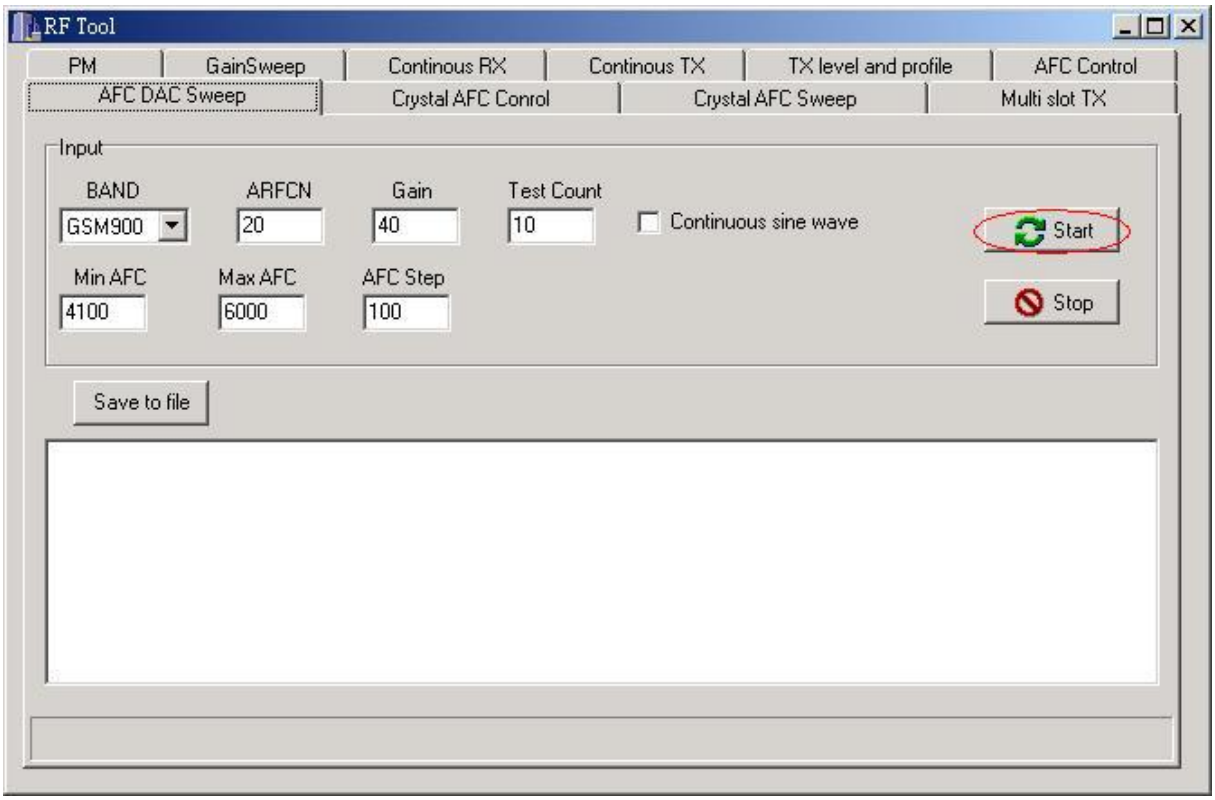

Figure 87 ***Click [Start] button***

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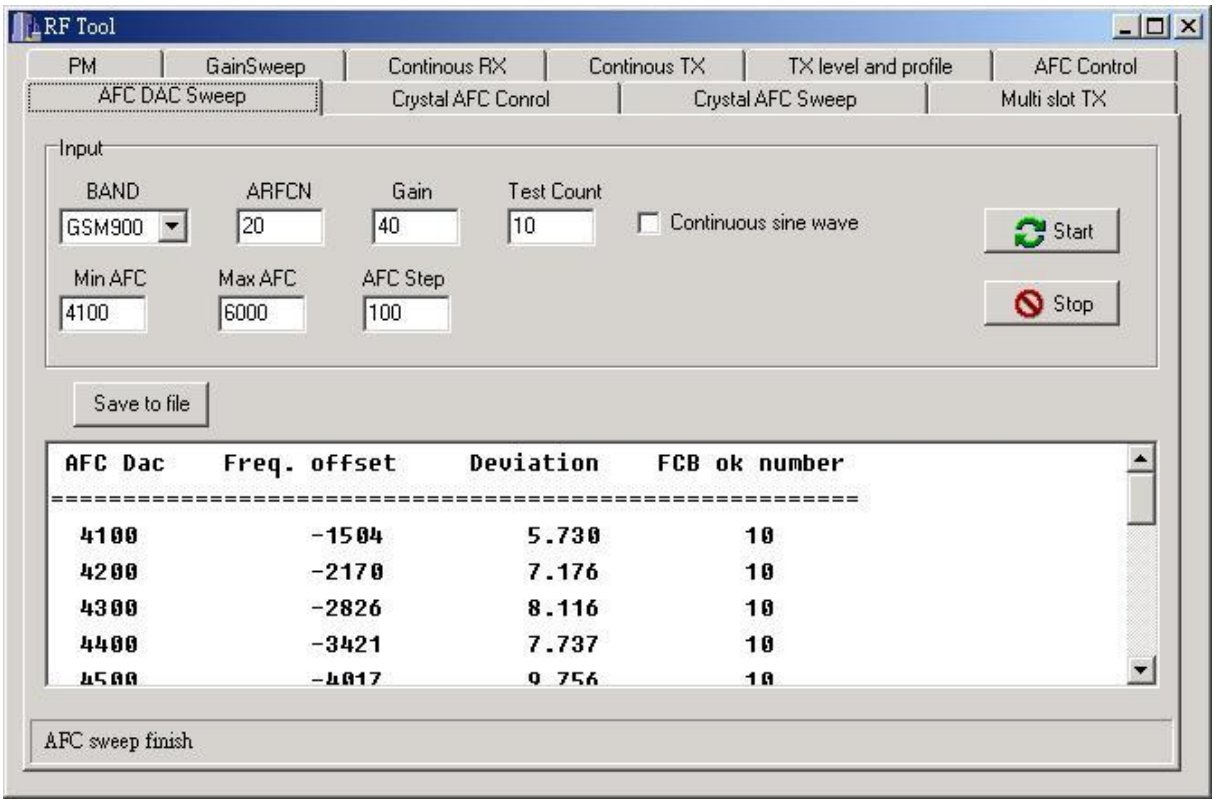

Figure 88 ***META shows AFC sweep result***

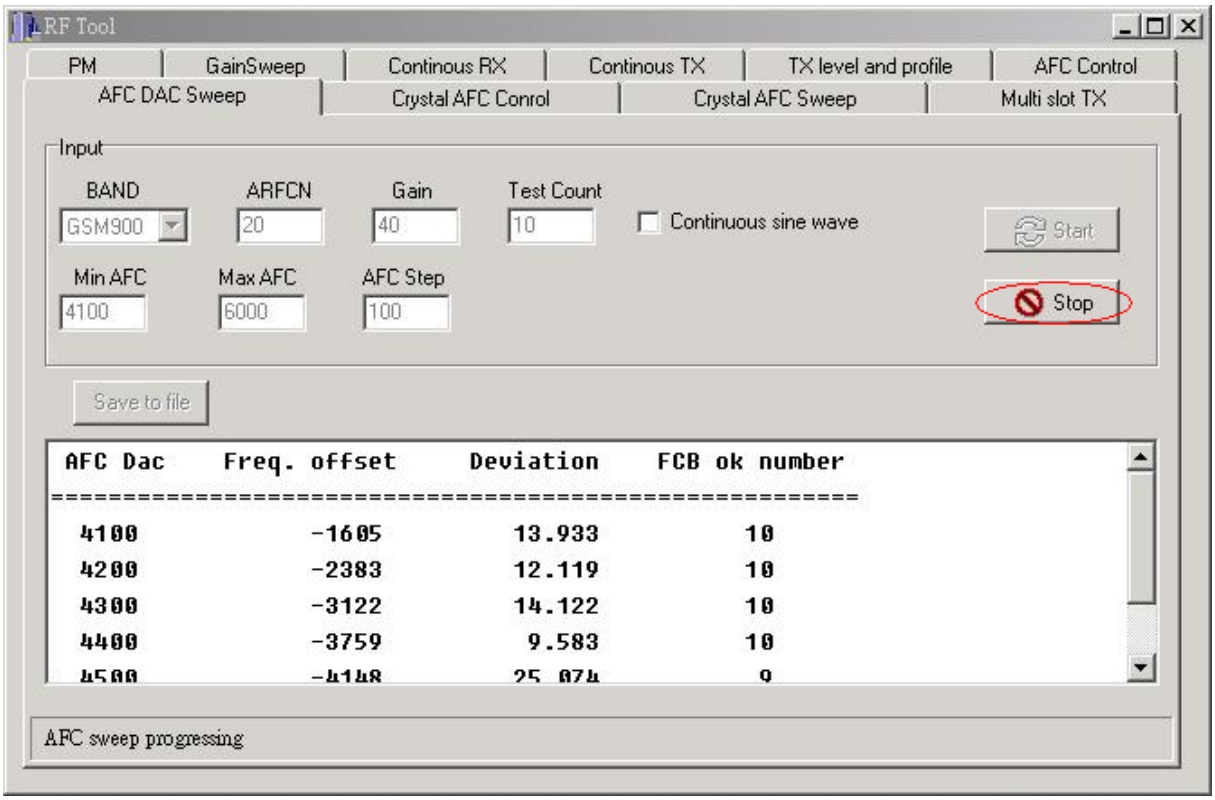

Figure 89 ***Click [Stop] button to stop AFC sweep operation***

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User can save AFC sweep result to text file by clicking [Save to file] button.

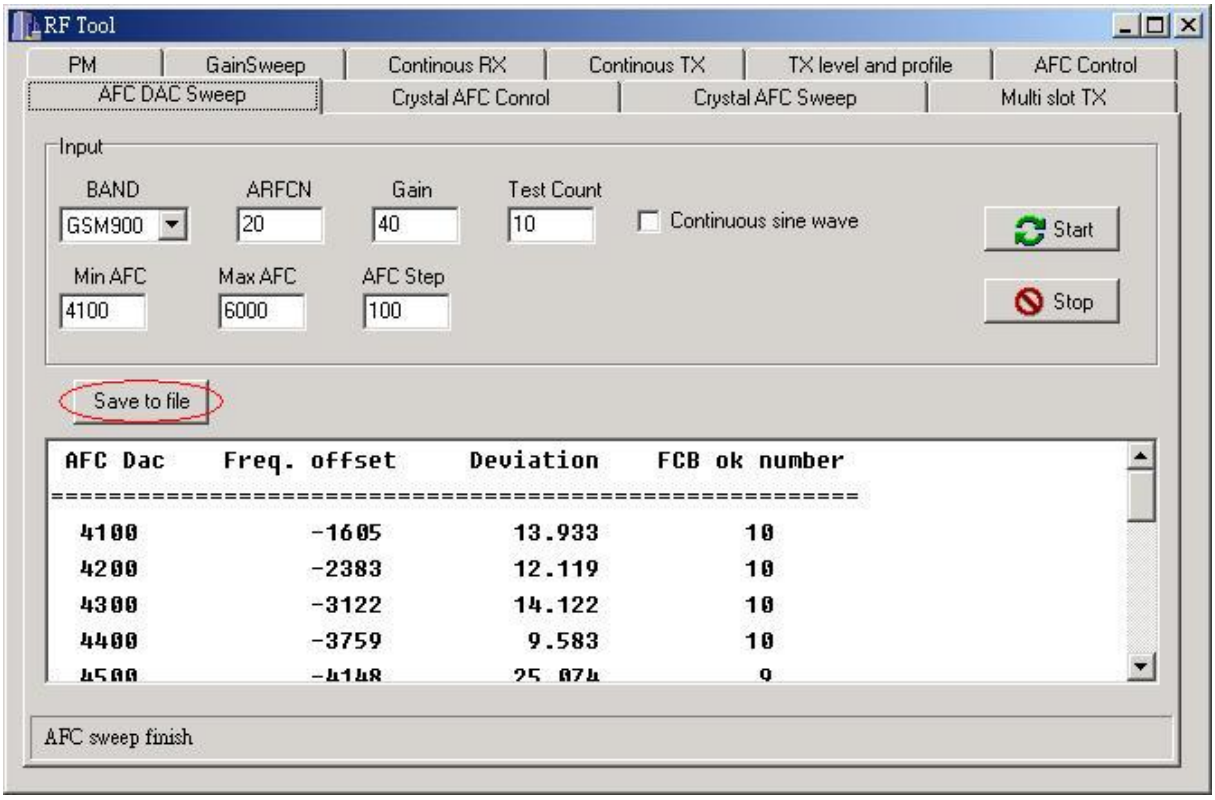

Figure 90 ***Click [Save to file] button to save AFC sweep result to text file***

3.2.8 Crystal AFC control

Crystal AFC control window provides transmitting normal burst to test equipment for user to get TX frequency error, upload or download crystal AFC control value from or to flash and load or save crystal AFC control value in text file.

User can input Band, ARFCN, TSC (training sequence code), PCL(power control level), CAP ID and AFC chosen and then click [Start] button to start crystal AFC control. MS will transmit normal burst with the parameters set by user after the command from META is received. User can get TX frequency error from Agilent 8960 or other test equipment.

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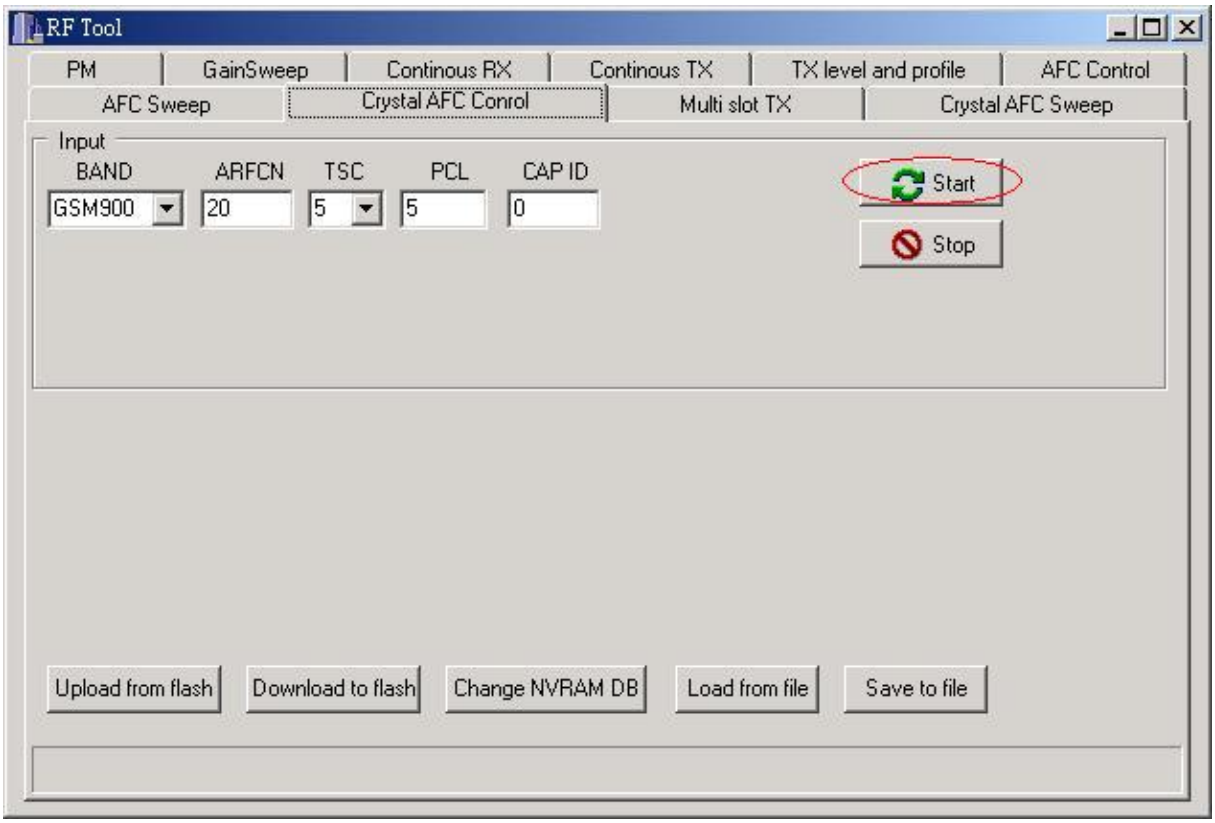

Figure 91 ***Click [Start] button to start crystal AFC control testing***

3.2.8.1 Upload and download the crystal CAP ID in flash

Following describes how to upload and download crystal CAP ID from and to flash. User can click [Upload from flash] button to read crystal CAP ID from flash and click [Download to flash] button to write crystal CAP ID to flash.

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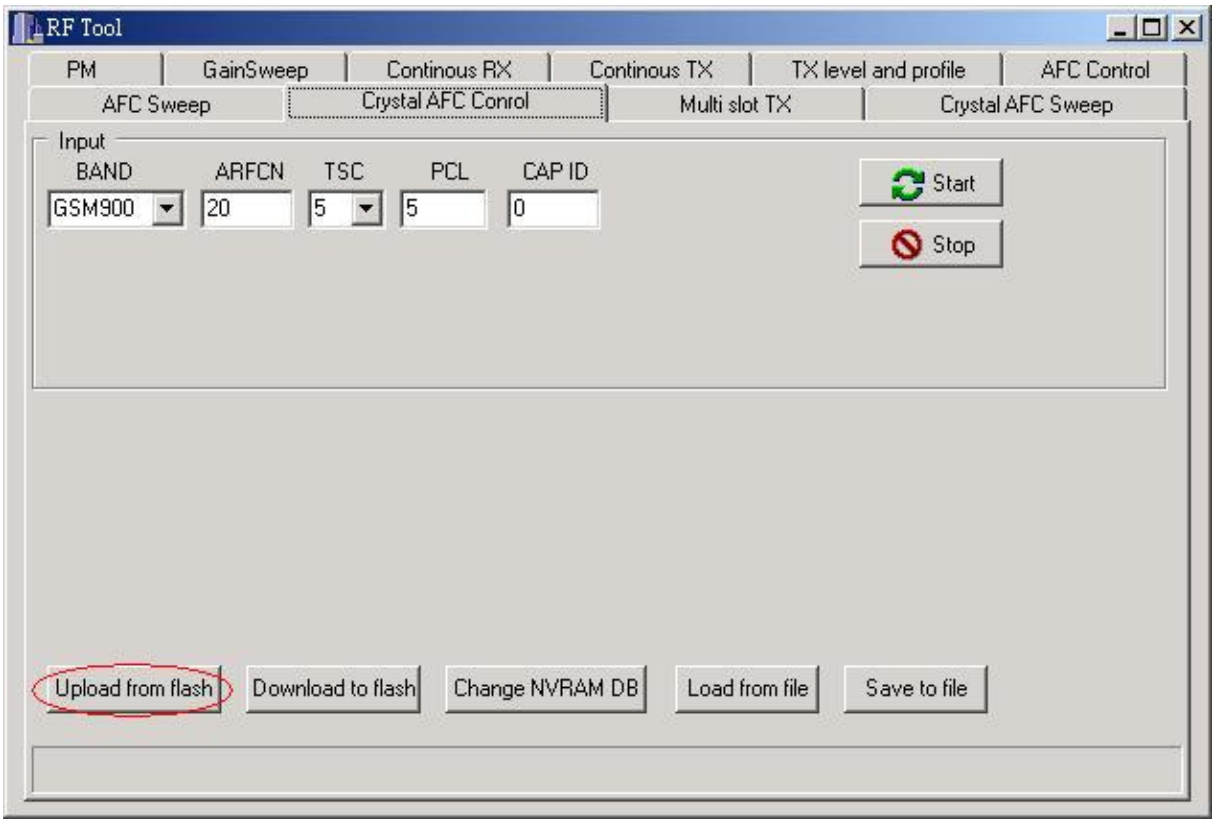

Figure 92 ***Click [Upload from flash] button to read crystal AFC control value from flash***

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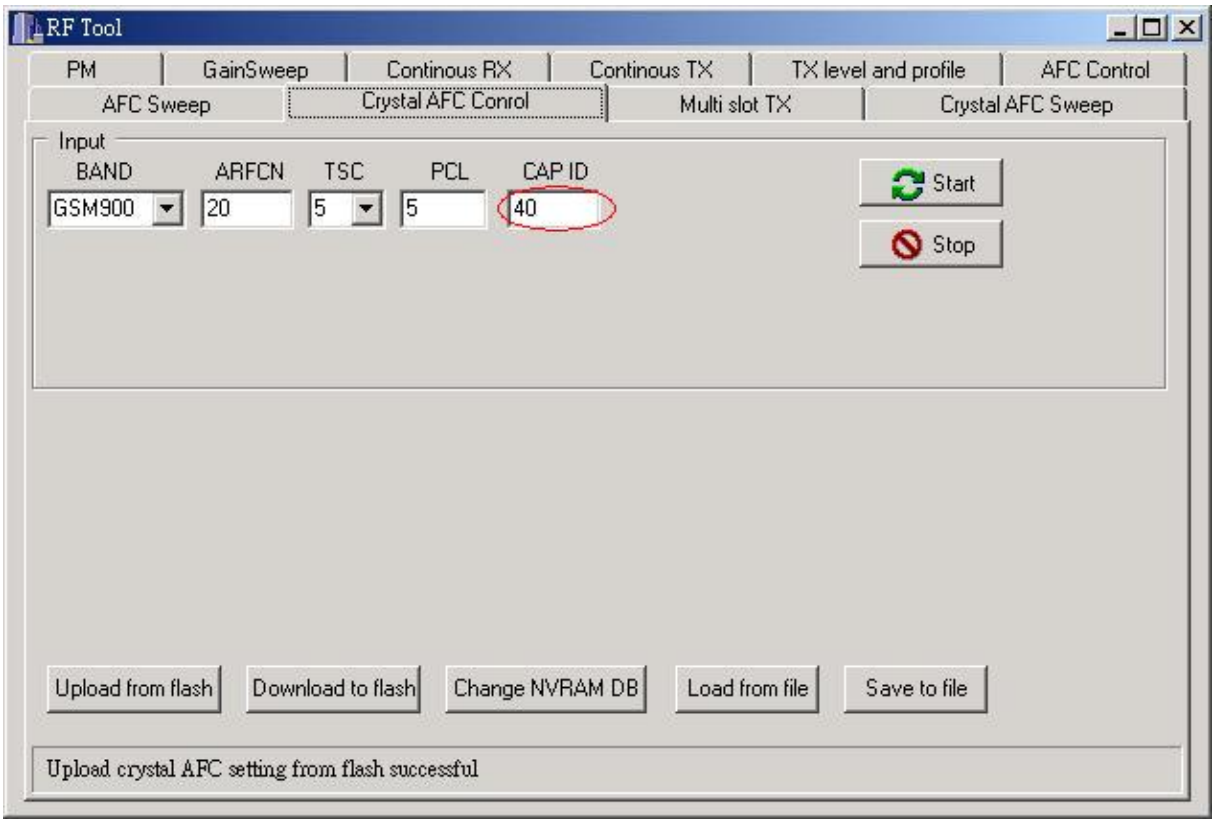

Figure 93 ***Result of uploading crystal CAP ID value from flash***

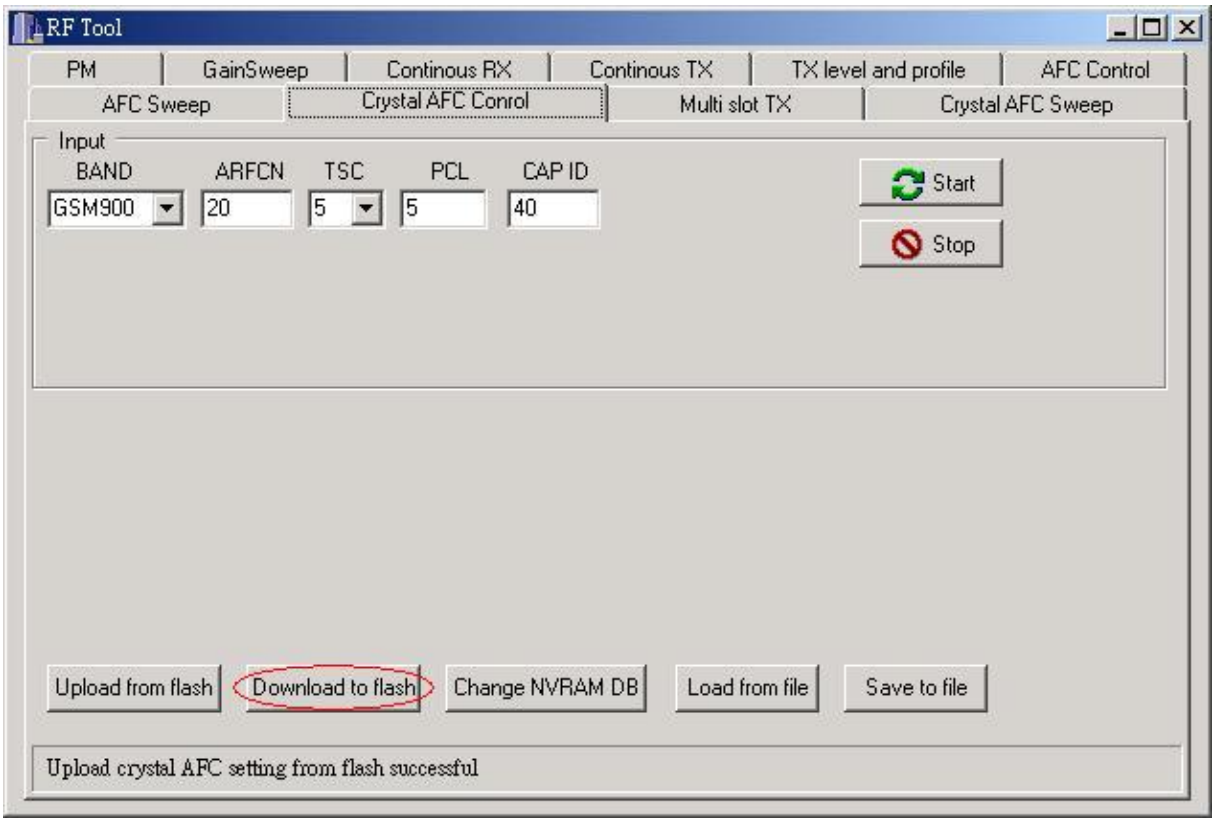

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Figure 94 ***Click [Download to flash] button***

User can click [Change NVRAM DB] button to change NVRAM database file.

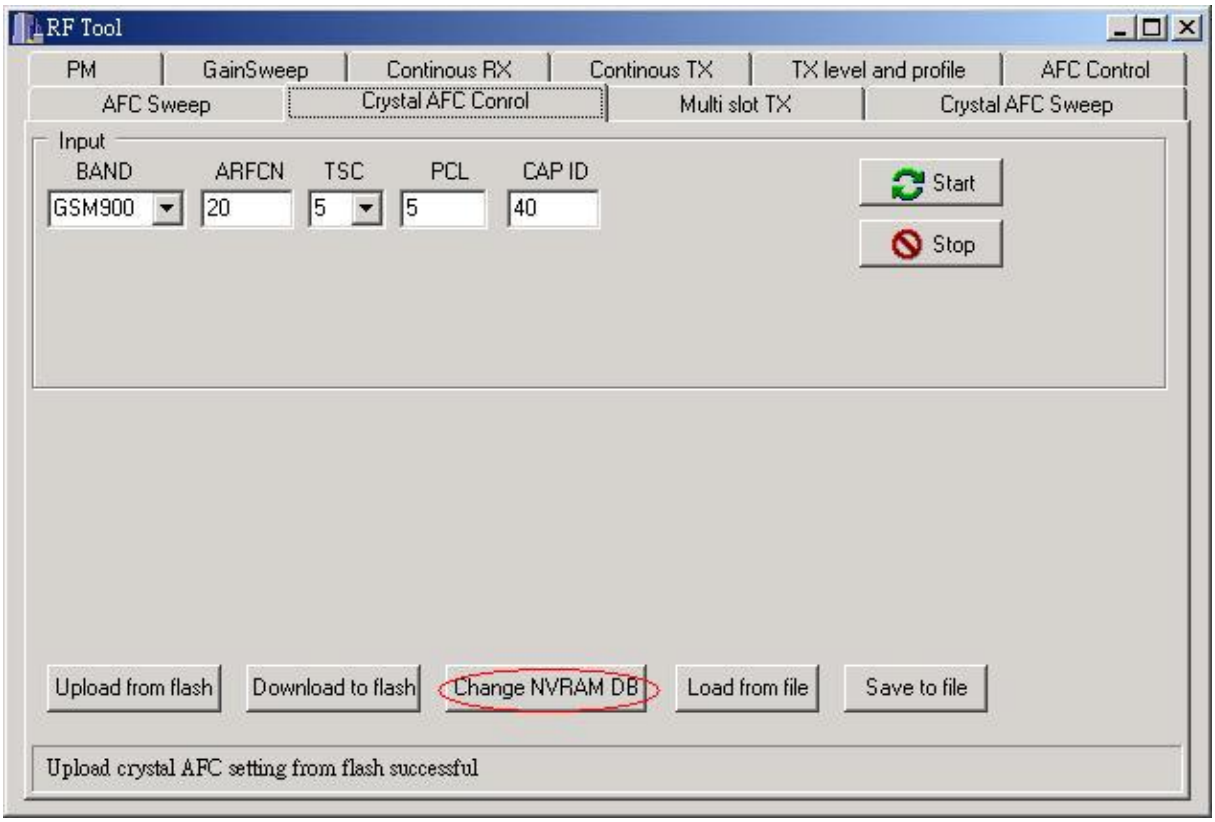

Figure 95 ***Click [Change NVRAM DB] button to change NVRAM database file***

3.2.8.2 Read and write crystal CAP ID value in file

Following describes how to load and save crystal CAP ID value from and to text file. User can click the [Load from file] button to read crystal CAP ID from INI file and click the [Save to file] button to write crystal CAP ID to INI file.

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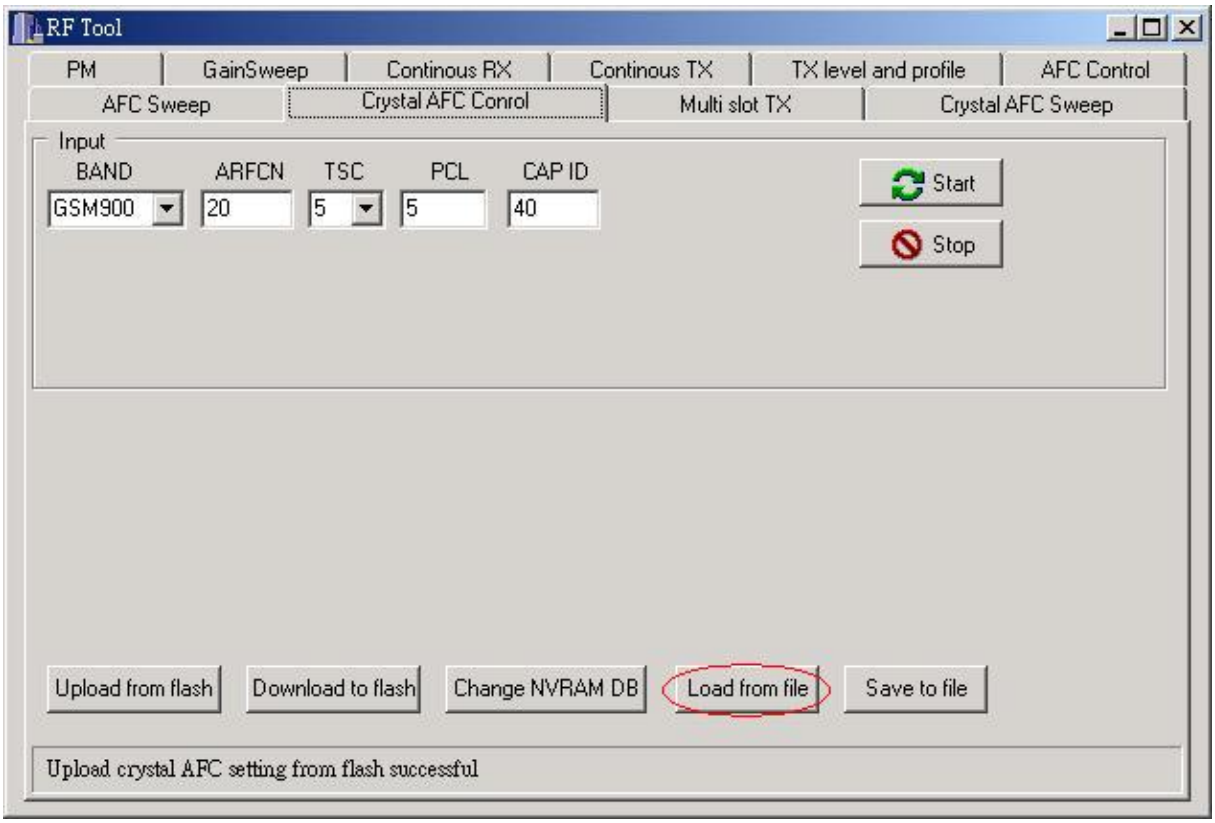

Figure 96 ***Click [Load from file] to read crystal AFC control value from file***

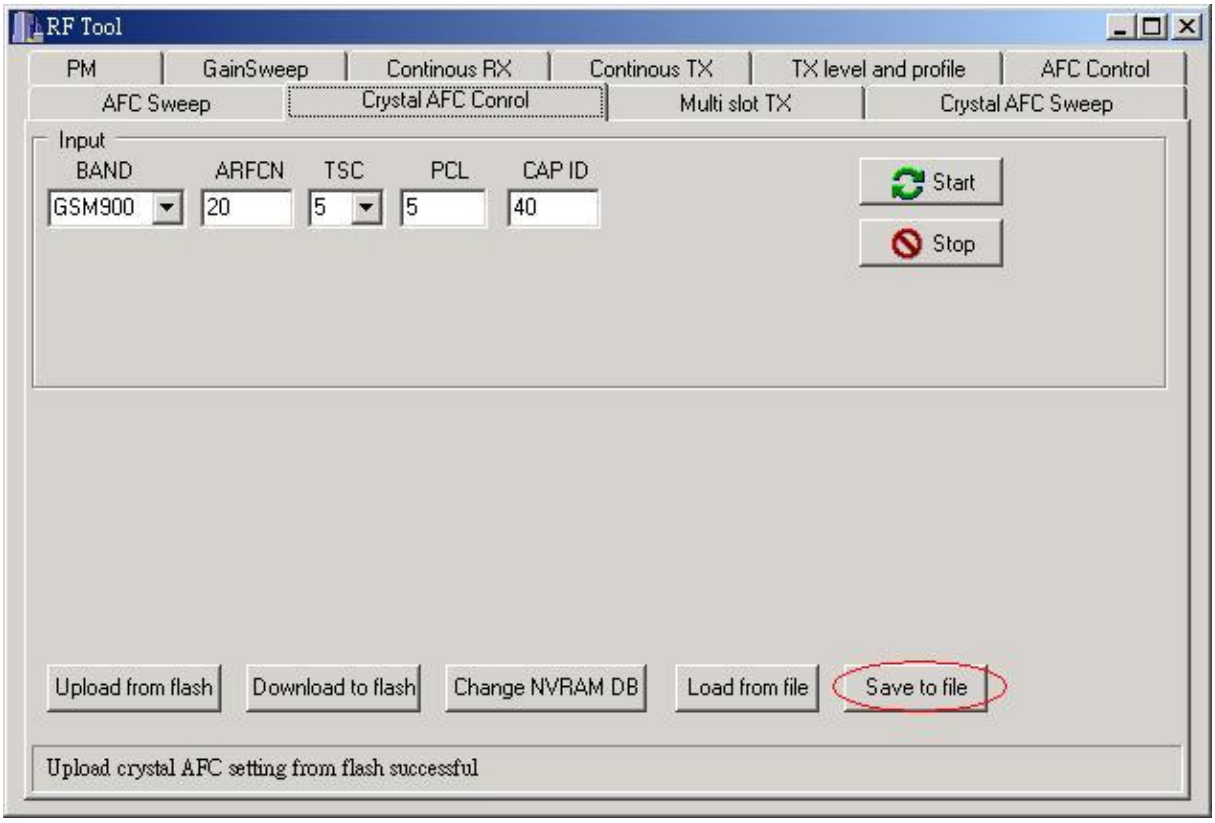

Figure 97 ***Click [Save to file] button to save crystal AFC control value to file***

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The following is a template file content that contains crystal AFC CAP ID. User will get the text file after clicking [Save to file] button. Please follow the file format if you want to change the value in file.

[Crystal AFC control]
cap_id=40

3.2.8.3 Crystal AFC calibration data setting

Crystal AFC calibration data setting is user to edit 33 step crystal AFC calibration data. User can click the [Crysstal AFC setting …] button to show crystal AFC data setting window. The [Crysstal AFC setting …] button is visible when 33 step AFC slope calibration flag of MS capability is true.

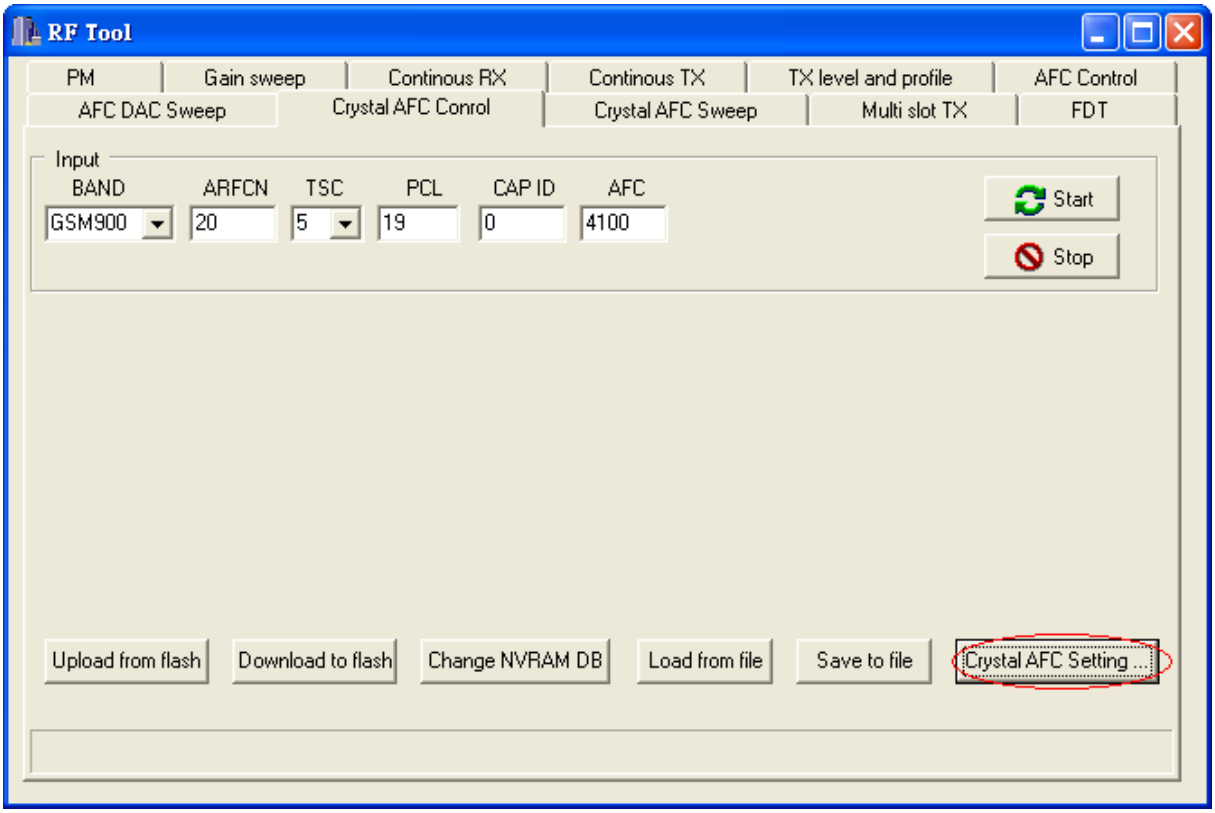

Figure 98 ***Click the [Crystal AFC Setting …] button***

3.2.8.3.a Upload and download the crystal AFC calibration data in flash

Following describes how to upload and download 33 step crystal AFC calibration data from and to flash. User can click the [Upload from flash] button to read 33 step crystal AFC calibration data from flash and click the [Download to flash] button to write 33 step crystal AFC calibration data to flash. User can click [Change NVRAM DB] button to change NVRAM database file. User can use -1 to specify the end of AFC DAC.

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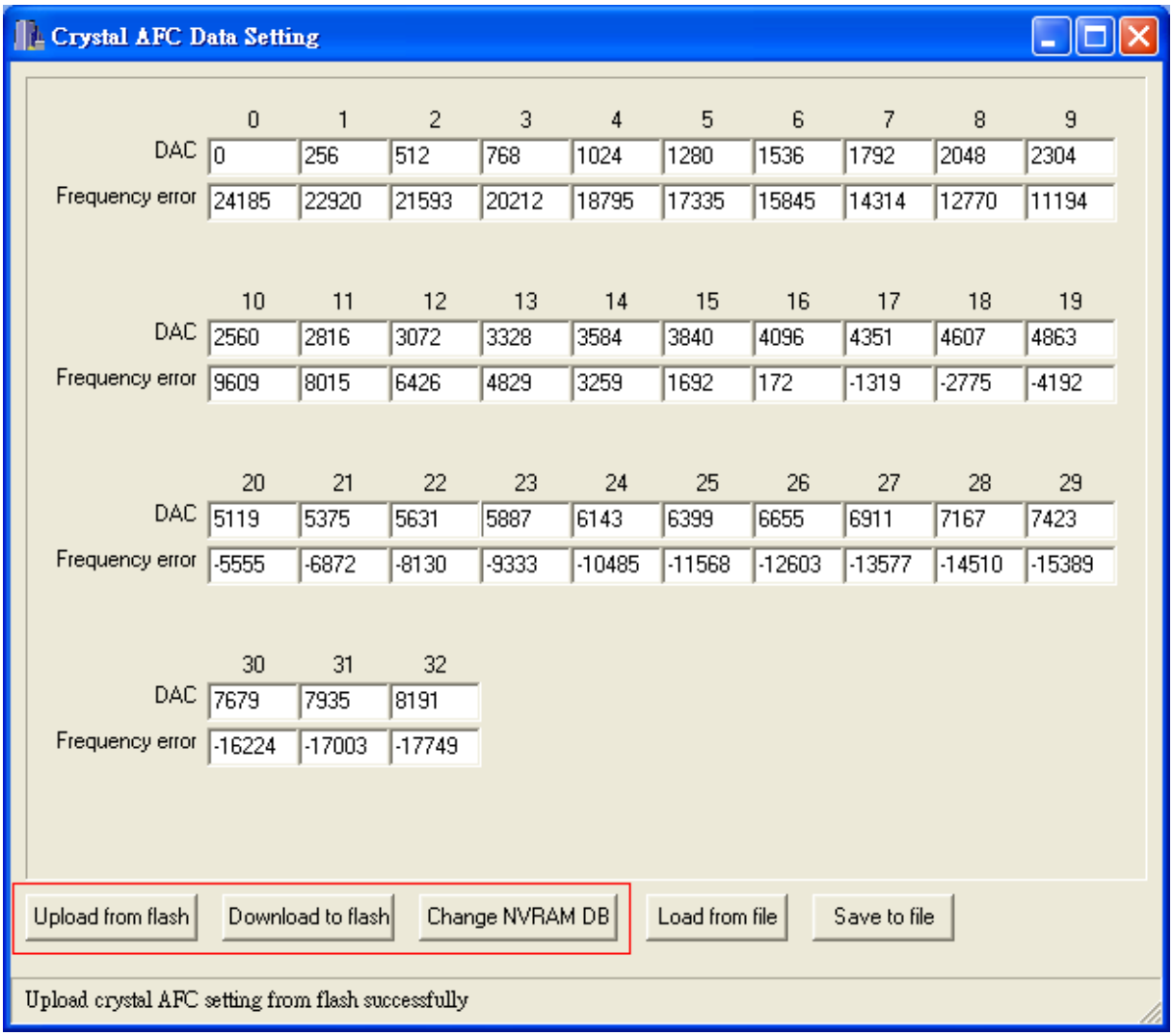

Figure 99 ***Button related to NVRAM access***

3.2.8.3.b Read and write crystal AFC calibration data value in file

The following describes how to load and save 33-step crystal AFC calibration data value from and to the text file. Users can click the [Load from file] button to read these calibration data from the INI file and click the [Save to file] button to write these calibration data to INI file.

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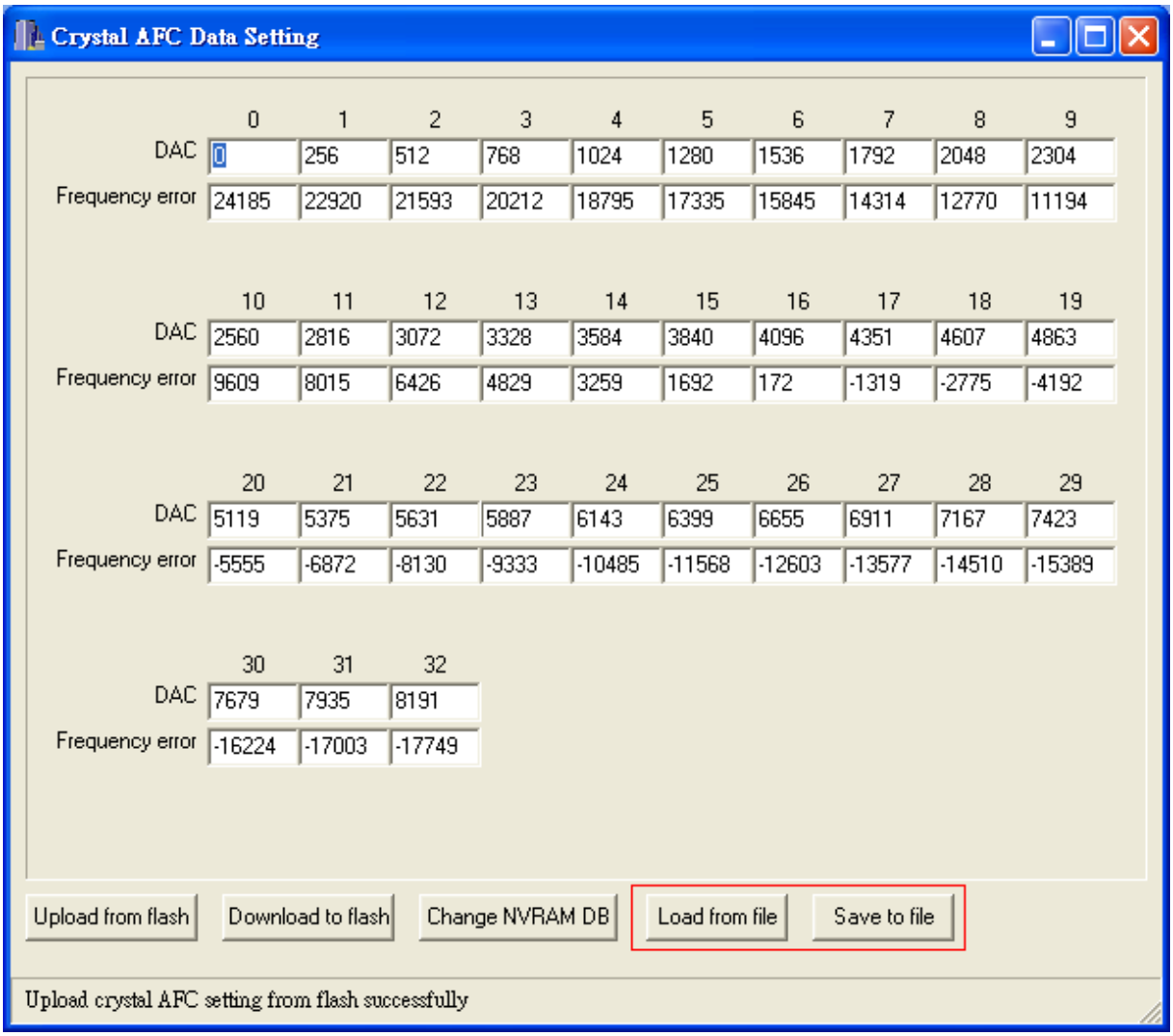

Figure 100 ***Buttons related to INI file access***

The following is a template file of 33 step crystal AFC calibration data. User will get the text file after clicking the [Save to file] button. Please follow the file format if you want to change the value in file. User can use -1 to specify the end of AFC DAC value if the step is less than 33.

[Crystal AFC control]
AFC DAC 0=0
Freq ERR 0=24185
AFC DAC 1=256
Freq ERR 1=22920
AFC DAC 2=512
Freq ERR 2=21593
AFC DAC 3=768
Freq ERR 3=20212
AFC DAC 4=1024
Freq ERR 4=18795
AFC DAC 5=1280
Freq ERR 5=17335
AFC DAC 6=1536

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Freq ERR 6=15845
AFC DAC 7=1792
Freq ERR 7=14314
AFC DAC 8=2048
Freq ERR 8=12770
AFC DAC 9=2304
Freq ERR 9=11194
AFC DAC 10=2560
Freq ERR 10=9609
AFC DAC 11=2816
Freq ERR 11=8015
AFC DAC 12=3072
Freq ERR 12=6426
AFC DAC 13=3328
Freq ERR 13=4829
AFC DAC 14=3584
Freq ERR 14=3259
AFC DAC 15=3840
Freq ERR 15=1692
AFC DAC 16=4096
Freq ERR 16=172
AFC DAC 17=4351
Freq ERR 17=-1319
AFC DAC 18=4607
Freq ERR 18=-2775
AFC DAC 19=4863
Freq ERR 19=-4192
AFC DAC 20=5119
Freq ERR 20=-5555
AFC DAC 21=5375
Freq ERR 21=-6872
AFC DAC 22=5631
Freq ERR 22=-8130
AFC DAC 23=5887
Freq ERR 23=-9333
AFC DAC 24=6143
Freq ERR 24=-10485
AFC DAC 25=6399
Freq ERR 25=-11568
AFC DAC 26=6655
Freq ERR 26=-12603
AFC DAC 27=6911
Freq ERR 27=-13577
AFC DAC 28=7167
Freq ERR 28=-14510
AFC DAC 29=7423
Freq ERR 29=-15389
AFC DAC 30=7679
Freq ERR 30=-16224
AFC DAC 31=7935
Freq ERR 31=-17003

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AFC DAC 32=8191
Freq ERR 32=-17749

3.2.9 Multislot TX

This operation is used to fine-tune multislot TX configuration and interslot ramp profile for GPRS and EDGE. Power Amplifier is turned on in this operation and indicated bursts are transmitted. MS will start to transmit the RF signal with parameters set by the user after MS gets the command from META. RF engineer can measure the transmitted power of MS by Agilent 8960 or other measurement instrument.

The user can execute multislot TX function by performing the following steps:

1) Input Band, ARFCN, TSC (training sequence code), TA (timing advance) and AFC DAC value.
2) Check time slot mask (at most 4 time slots are supported) and select coding scheme and PCL of the corresponding time slot.
3) Click burst type.
4) Input TX power rollback value for GMSK/EPSK.
5) Click [Start] button.
6) The user can stop this operation by clicking the [Stop] button.
7) Since 09BW1012, the MAUI software supports TX power rollback evaluation in META mode in every multi-slot TX function. If the TX setting is multi-slot TX, the rollback value in NVRAM will applied to the multi-slot TX. For example timeslot 0 and timeslot 3 is checked, the 2T rollback setting will be applied to this multi-slot TX. In the following example (Figure 101), the rollback value is 1dB. The maximum output power will limited to the calibrated power of PCL 5 (in this case) – approximately 1dB (eg. output power is limited to 31 (32-1))

The input fields of the Multi-slot TX is dissected as below

```
Set by META DLL API META_Rf_MultiSlot_TX_Ex_r
typedef struct {
 ARFCN                    arfcn;            // ARFCN of the TX request
 BSIC                     bsic;             // training sequence
 char                     timeSlotmask;// time slot mask setting for slot 0 ~ slot 3(1: ON, 0: OFF)  (slot 3: 0x08, slot2:
0x4, slot1: 0x02, slot1: 0x01)
 Power                    powerLev[4];  // PCL for each time slot
 CodingScheme         cs[4];            // coding scheme time slot, MCS1~9 is only valid for EPSK
 TimingAdvance        ta;  // time advance
 int                      frames;           // the number of frames should transmit
 short                    dacValue;         // AFC DAC value
 APCTxPattern     pattern;          // Tx pattern is only valid for EPSK function
 unsigned short   pattern_data;  // if NB_TX_PATTERN_WITHOUT_TSC==pattern, user can input any 16bits value as pattern.
} Rf_MultiSlotTXEx_Req;
```

```
Set by META DLL API META_Rf_SetTXPowerRollbackGMSK_r or
META_Rf_SetTXPowerRollbackEPSK_r
typedef struct
{
  int band;
  sTX_POWERROLLBACK PowerRollbackTable;
}Rf_TX_ROLLBACK_REQ_T;
typedef struct
{
  char rollback_2t; // power reduction for 2 slot TX (1/8dB)
  char rollback_3t; // power reduction for 3 slot TX (1/8dB)
  char rollback_4t; // power reduction for 4 slot TX (1/8dB)
  char rollback_5t; // reserved for 5 slot TX ((1/8dB)
}sTX_POWERROLLBACK;
```

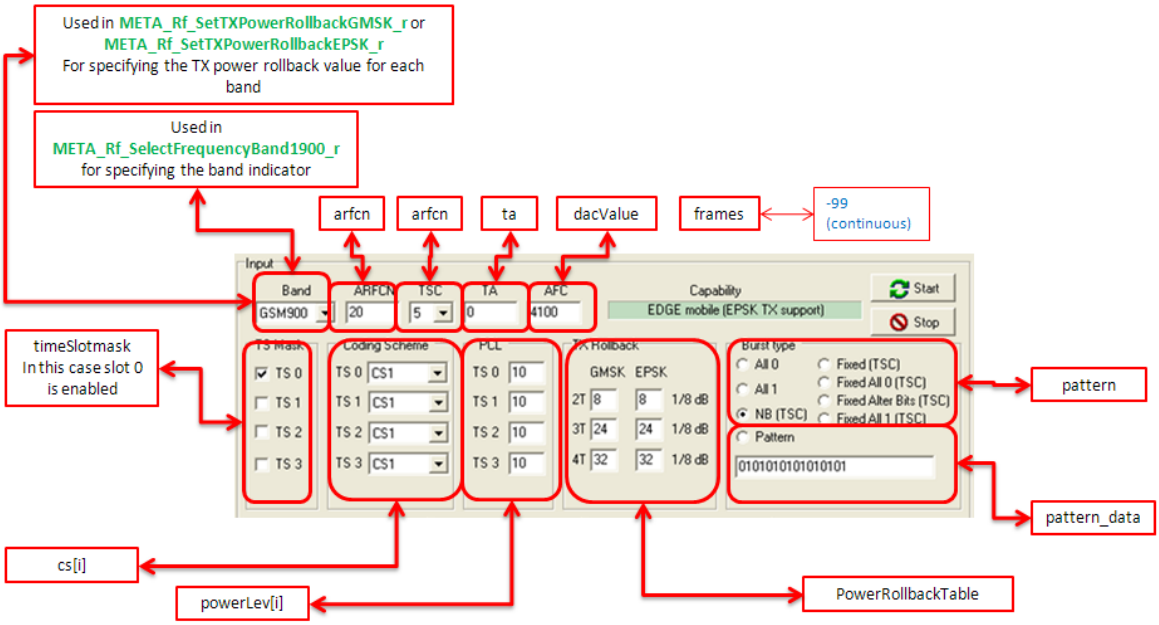

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Figure 101 ***Multi-slot TX input fields***

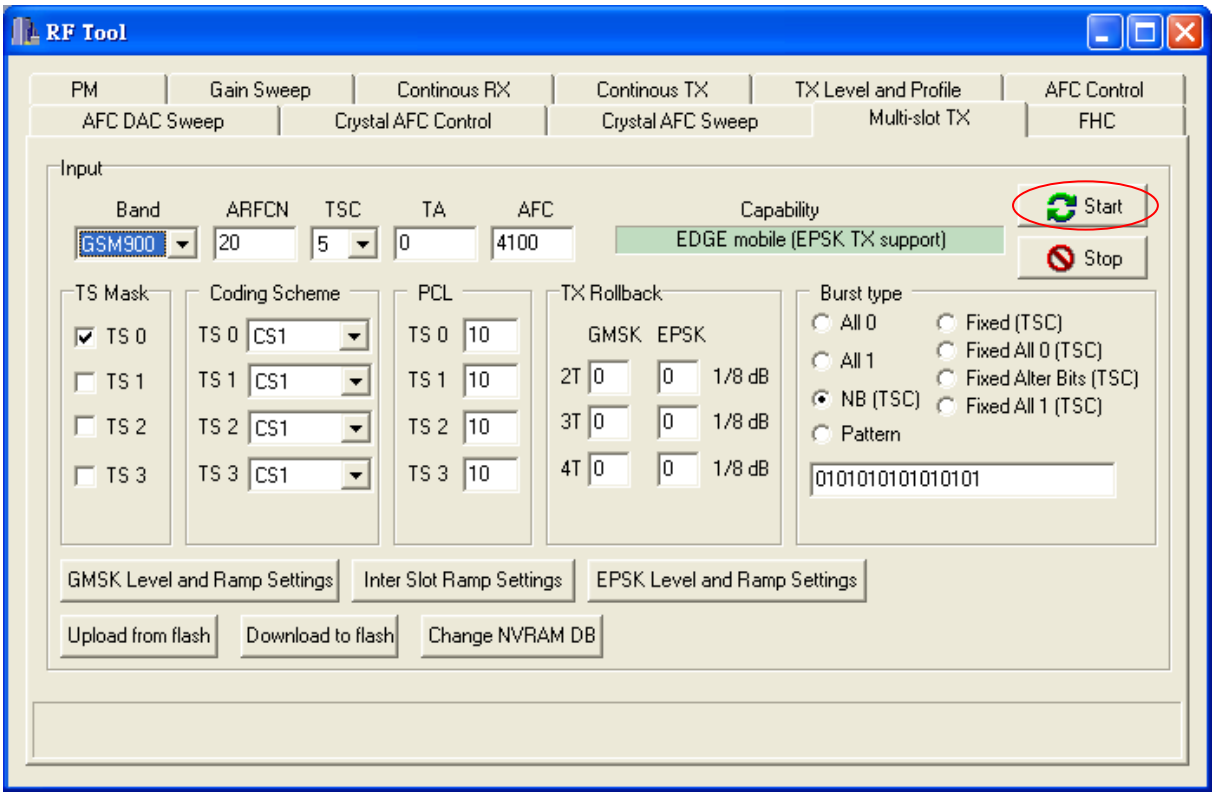

Figure 102 ***Click [Start] button to start multi-slot TX testing***

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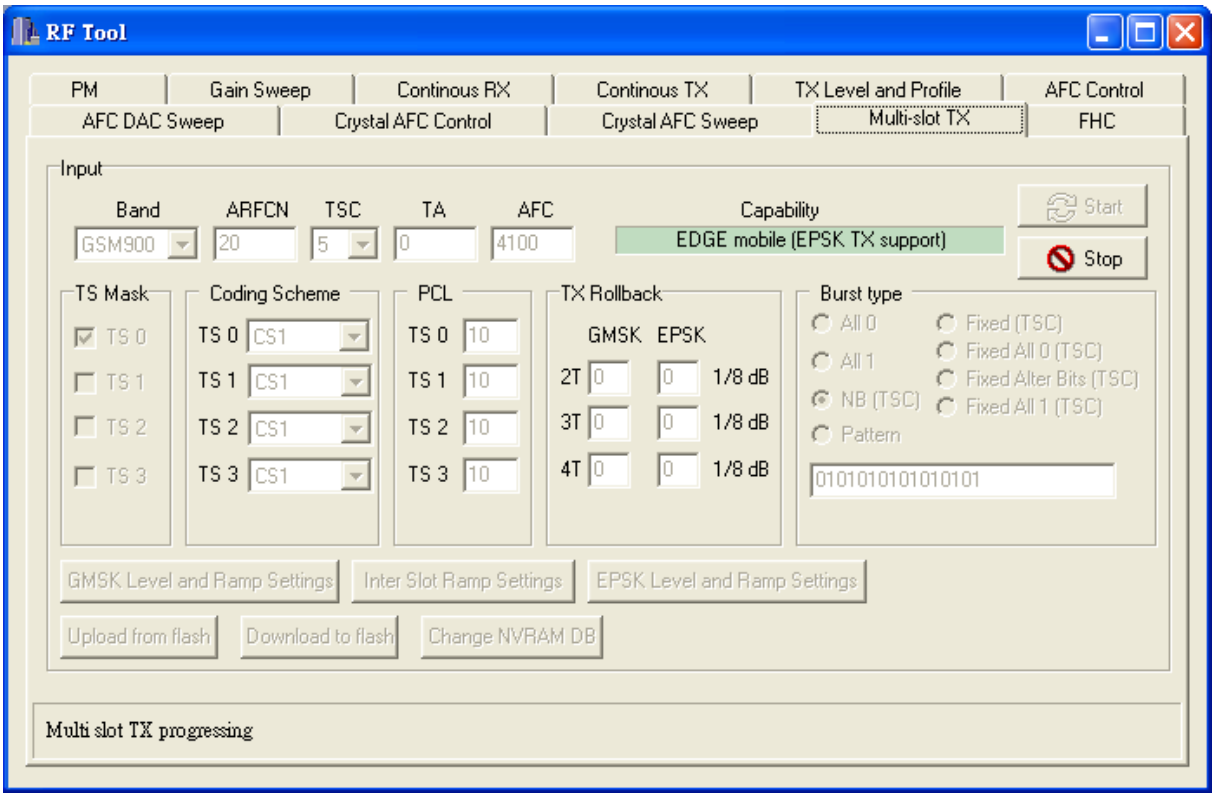

Figure 103 ***Click [stop] button to stop multislot TX testing***

The user can also read/write TX power rollback settings defined in NVRAM or change the settings in the NVRAM or multislot TX evaluations.

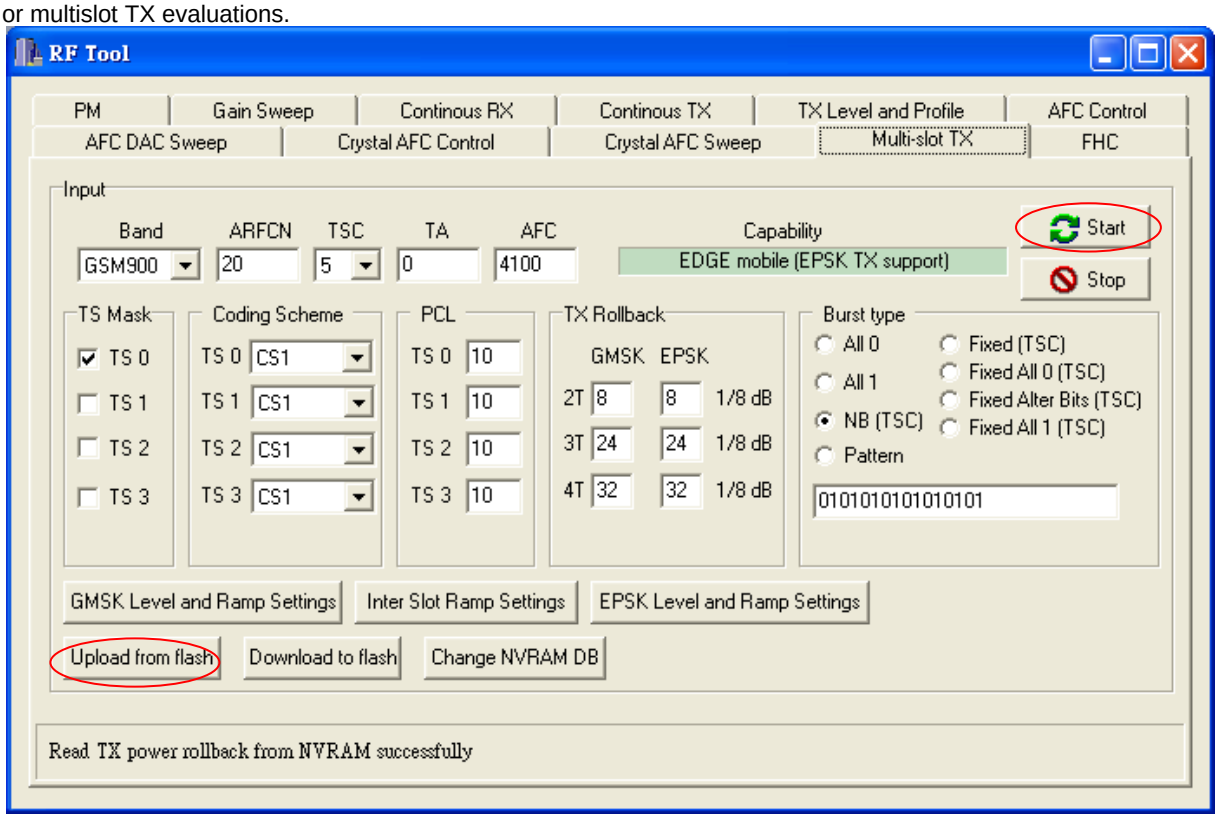

Figure 104 ***Click [Upload from flash] button to read TX power rollback settings***

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3.2.9.1 Interslot ramp setting

User can edit interslot ramp using inter slot ramp window. User can click [Inter Slot Ramp Setting] button to show inter slot ramp window.

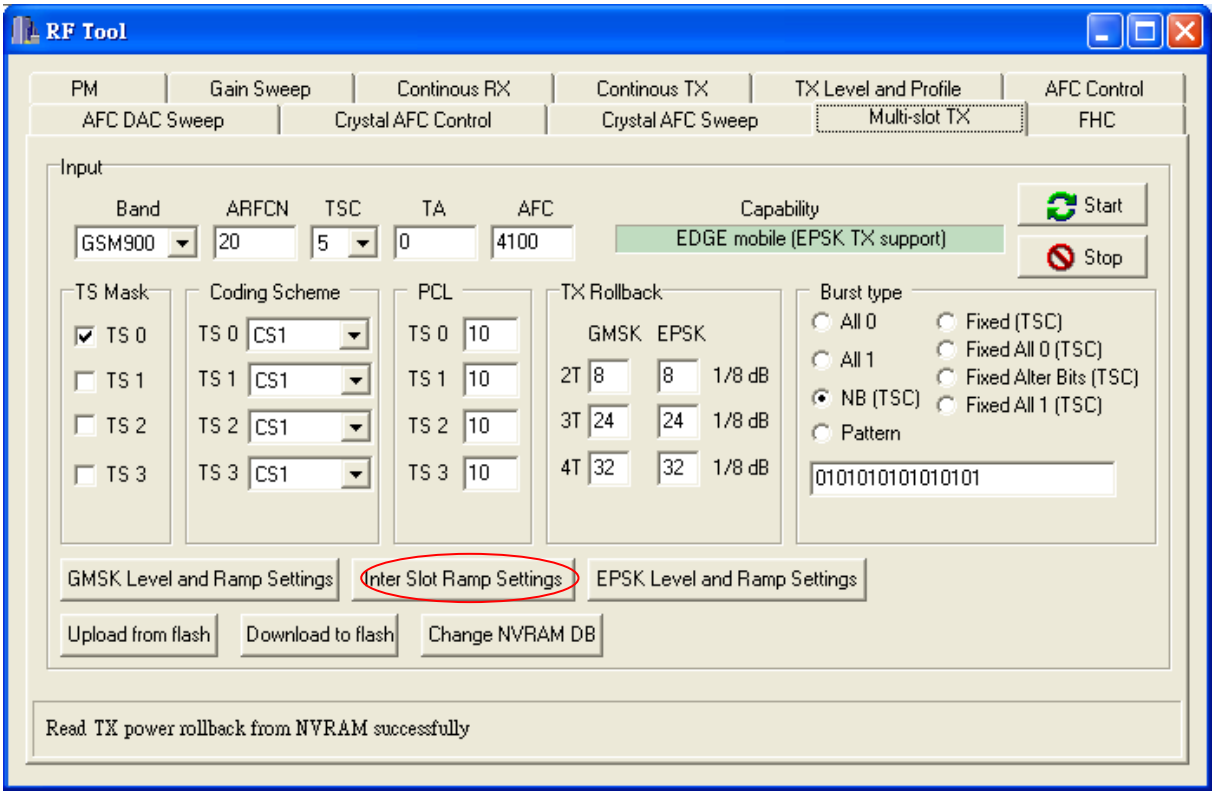

Figure 105 ***Click [Inter Slot Ramp Setting] button***

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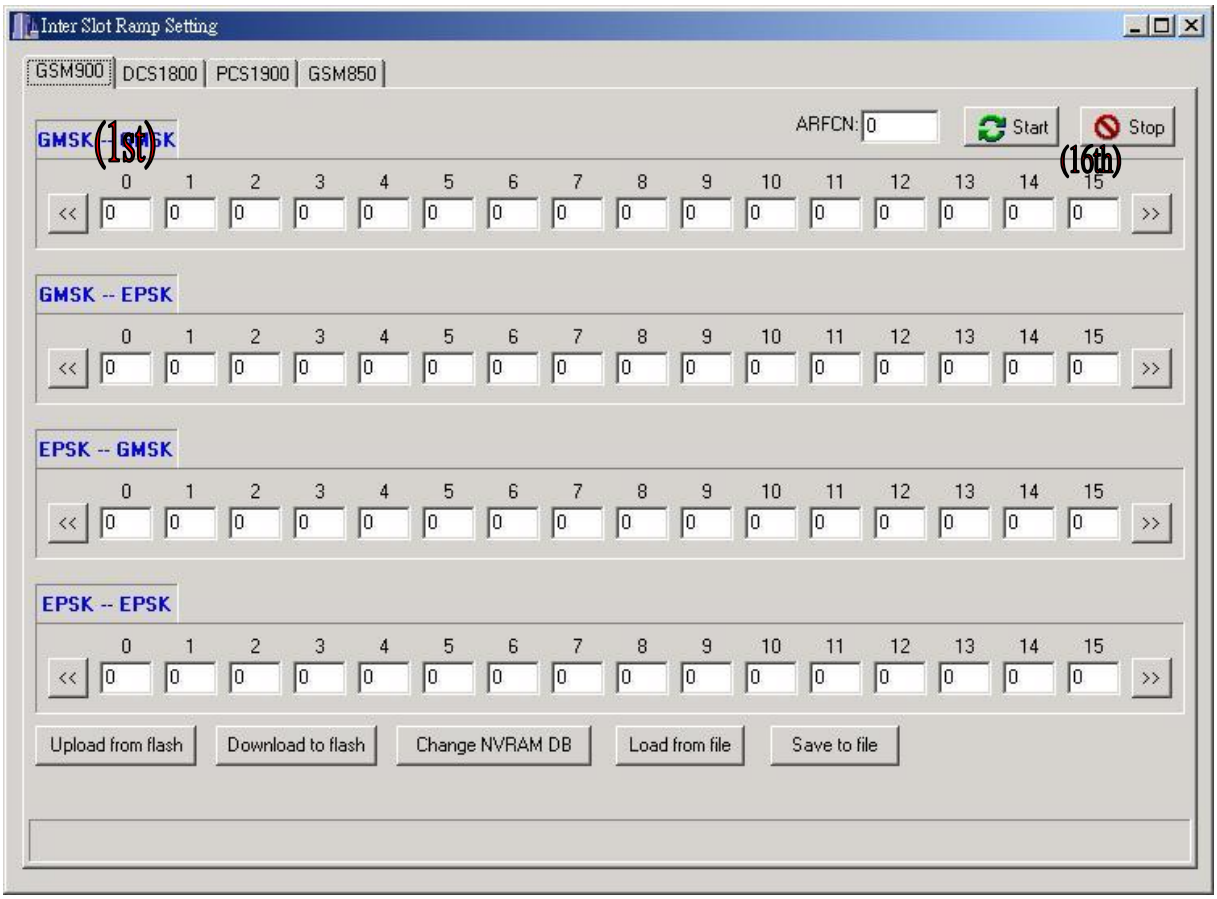

Figure 106 ***Inter slot ramp setting window***

3.2.9.2 Upload and download interslot ramp profile in flash

User can read interslot ramp profile from flash by clicking [Upload from flash] button and write interslot ramp profile to flash by clicking [Download to flash] button.

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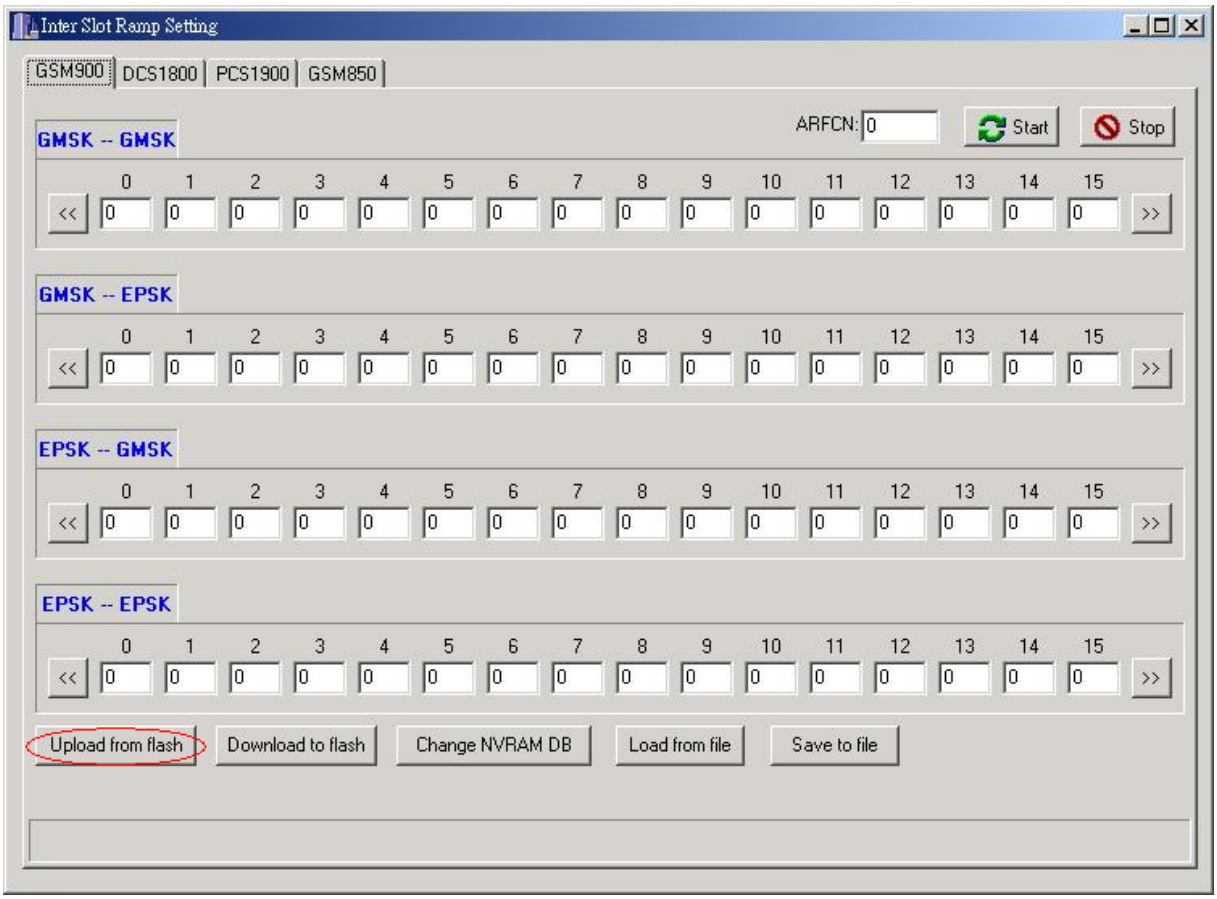

Figure 107 ***Click [Upload from flash] button to read interslot ramp profile from flash***

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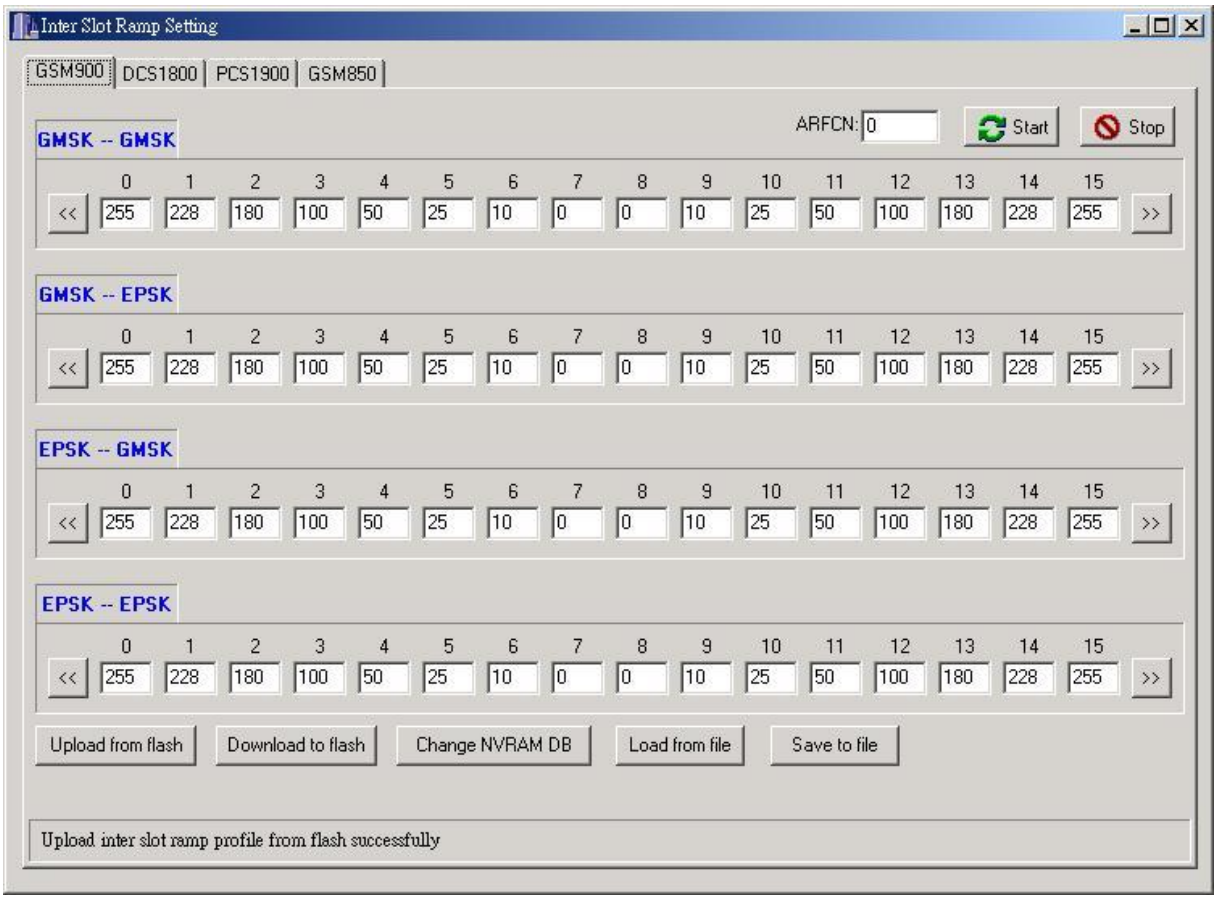

Figure 108 ***Result of uploading interslot ramp profile from flash***

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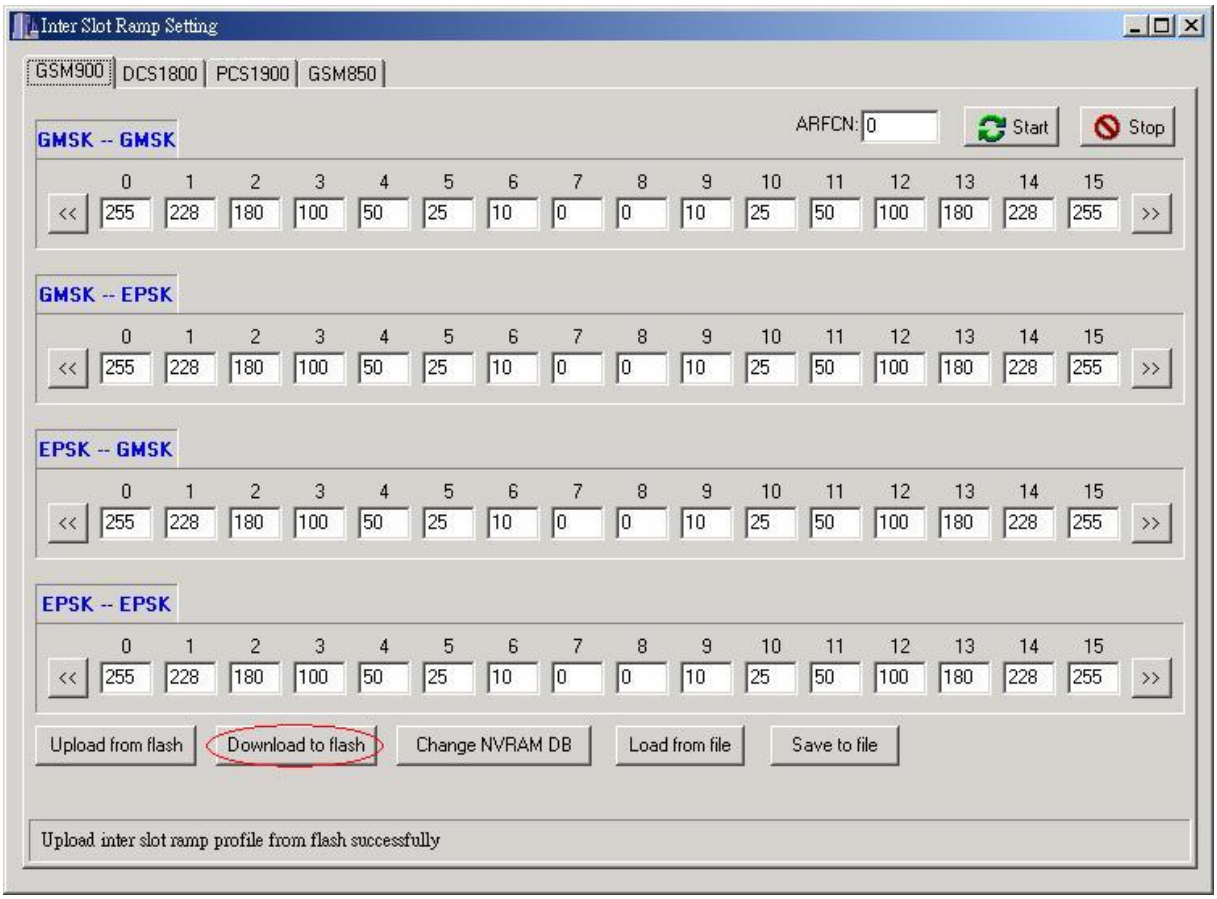

Figure 109 ***Click [Download to flash] button to download interslot ramp profile to flash***

3.2.9.3 Read and write interslot ramp profile in file

User can read interslot ramp profile by clicking [Load from file] button and write interslot ramp profile in file by clicking [Save to file] button.

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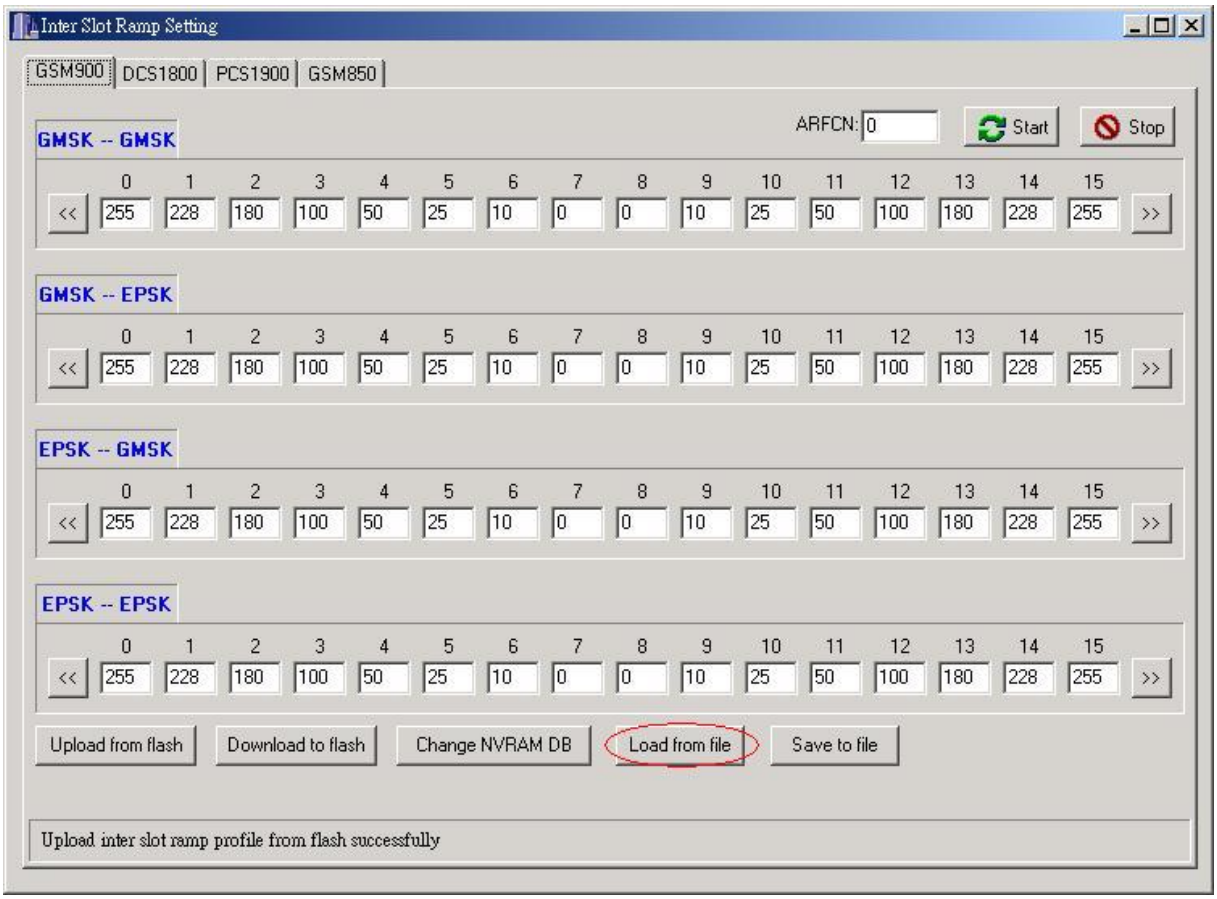

Figure 110 ***Click [Load from file] to read interslot ramp profile from file***

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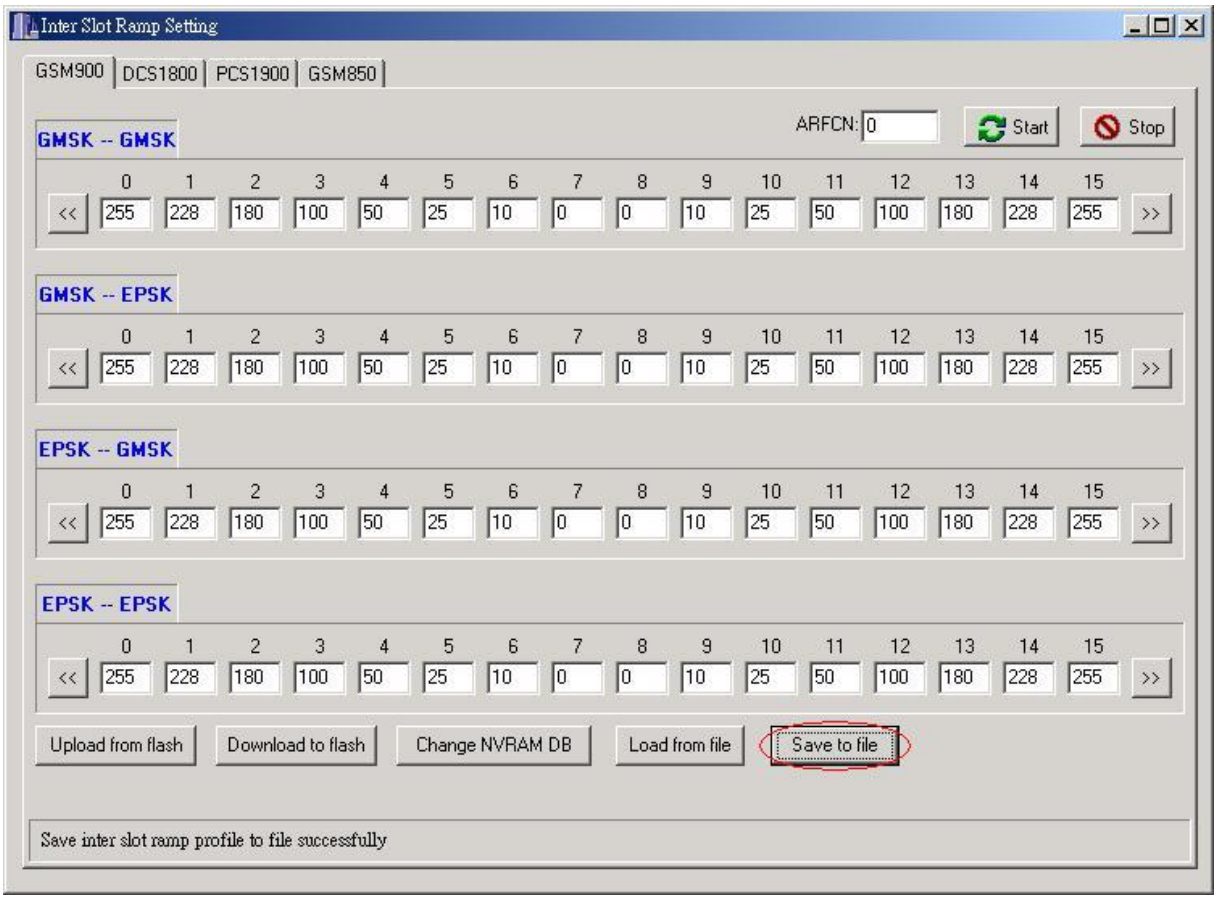

Figure 111 ***Click [Save to file] button to save interslot ramp profile to file***

The following is a template of interslot ramp profile file. User will get the text file after clicking [Save to file] button. Each value must be followed with a comma. Please follow the file format if you want to change the value in file.

[GSM900 EPSK inter slot ramp]
GMSK GMSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255
GMSK EPSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255
EPSK GMSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255
EPSK EPSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255
[DCS1800 EPSK inter slot ramp]
GMSK GMSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255
GMSK EPSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255
EPSK GMSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255
EPSK EPSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255
[PCS1900 EPSK inter slot ramp]
GMSK GMSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255
GMSK EPSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255
EPSK GMSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255
EPSK EPSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255
[GSM850 EPSK inter slot ramp]
GMSK GMSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255
GMSK EPSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255
EPSK GMSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255
EPSK EPSK inter slot ramp=255,228,180,100,50,25,10,0,0,10,25,50,100,180,228,255

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3.2.10 Crystal AFC sweep

Crystal AFC sweep could let user to get RX frequency error from mobile DSP or TX frequency error from Agilent 8960 or R&S CMU 200.

3.2.10.1 RX crystal AFC sweep

The following operation is used for user to get RX frequency error periodically from mobile DSP. User can execute RX crystal AFC sweep function by following steps:

1) Setup NVRAM database file, CFG file and log file.
2) Select RX sweep method.
3) Select equipment type.
4) Input Band, ARFCN, minimum CAP ID, maximum CAP ID, CAP ID step, test count, minimum AFC DAC, maximum AFC DAC and AFC DAC step.
5) Click [Start] button. The sweep result is record in log file.
6) User can stop this operation by clicking [Stop] button.

Note: CAP ID field is used to select index of CAP array (range: 0~63) in RF chip.

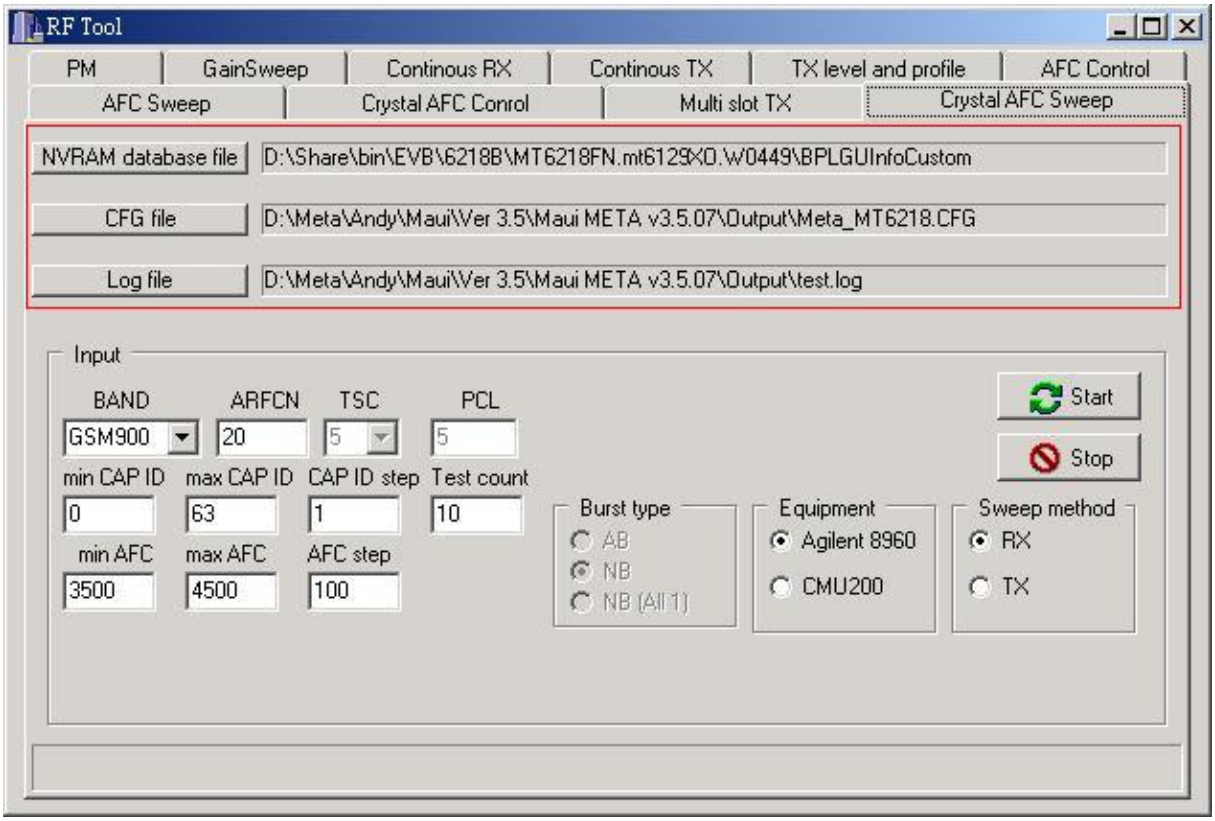

Figure 112 ***Setup NVRAM database file, CFG file and log file***

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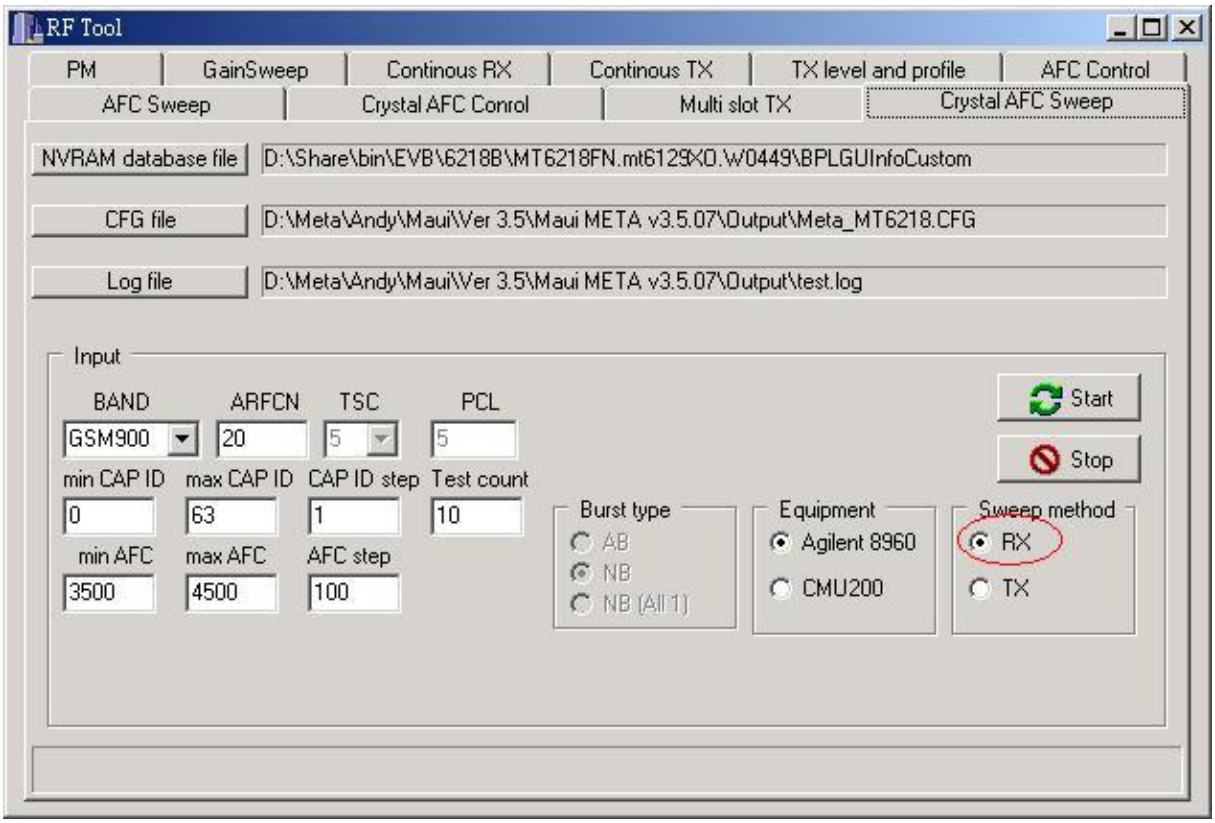

Figure 113 ***Select RX sweep method***

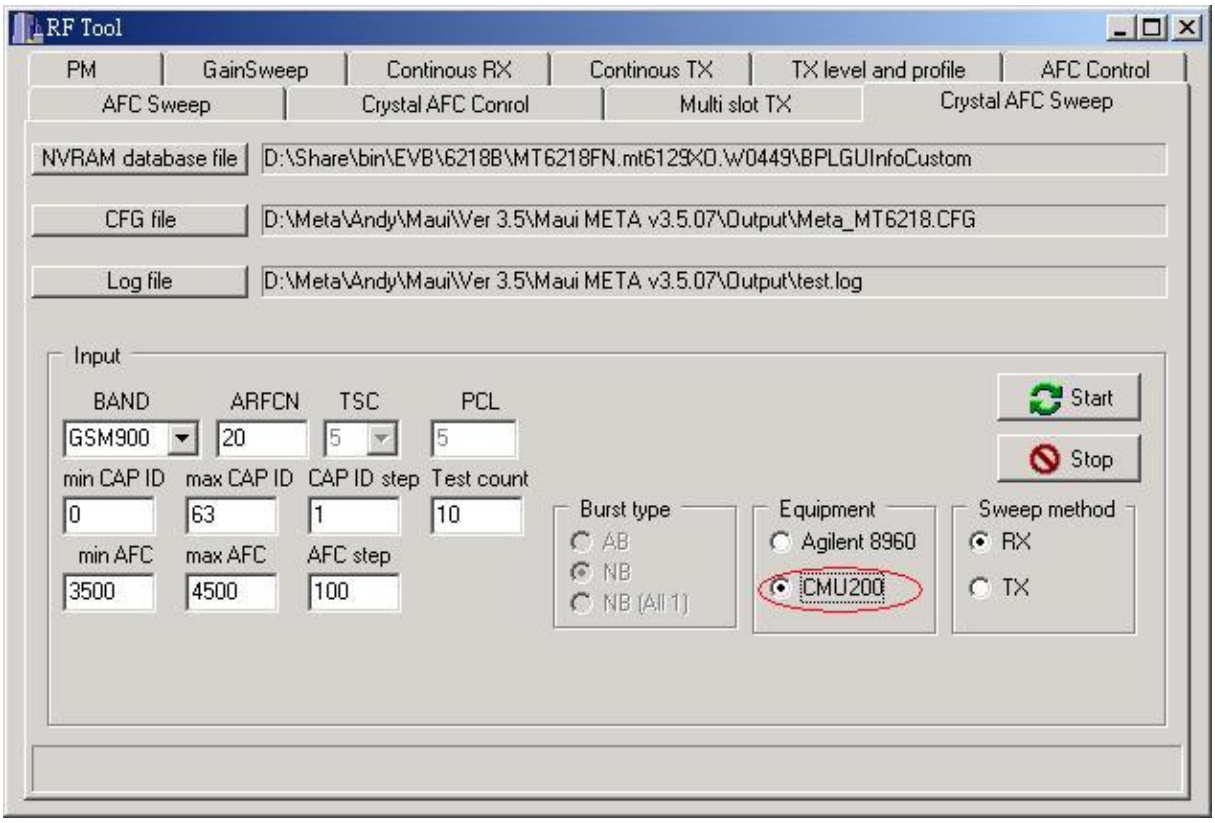

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Figure 114 ***Select equipment type***

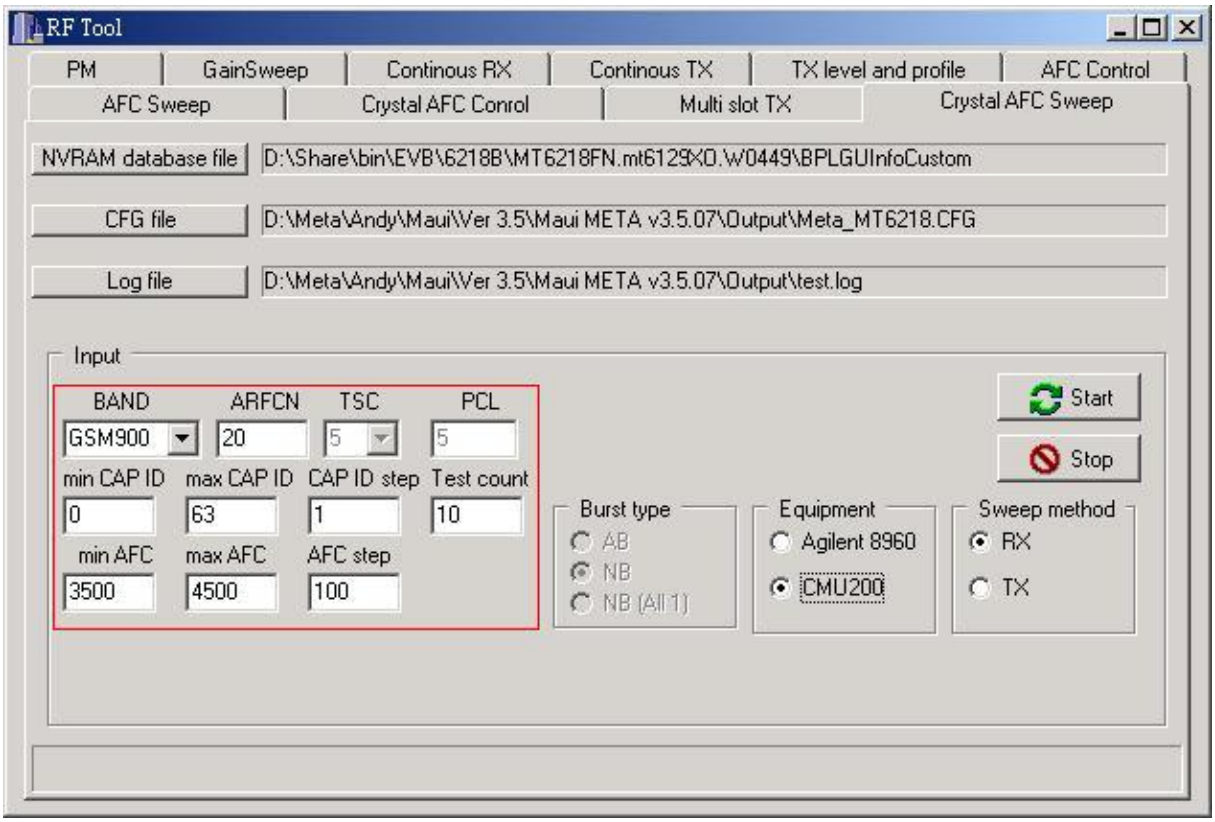

Figure 115 ***Input sweep parameter***

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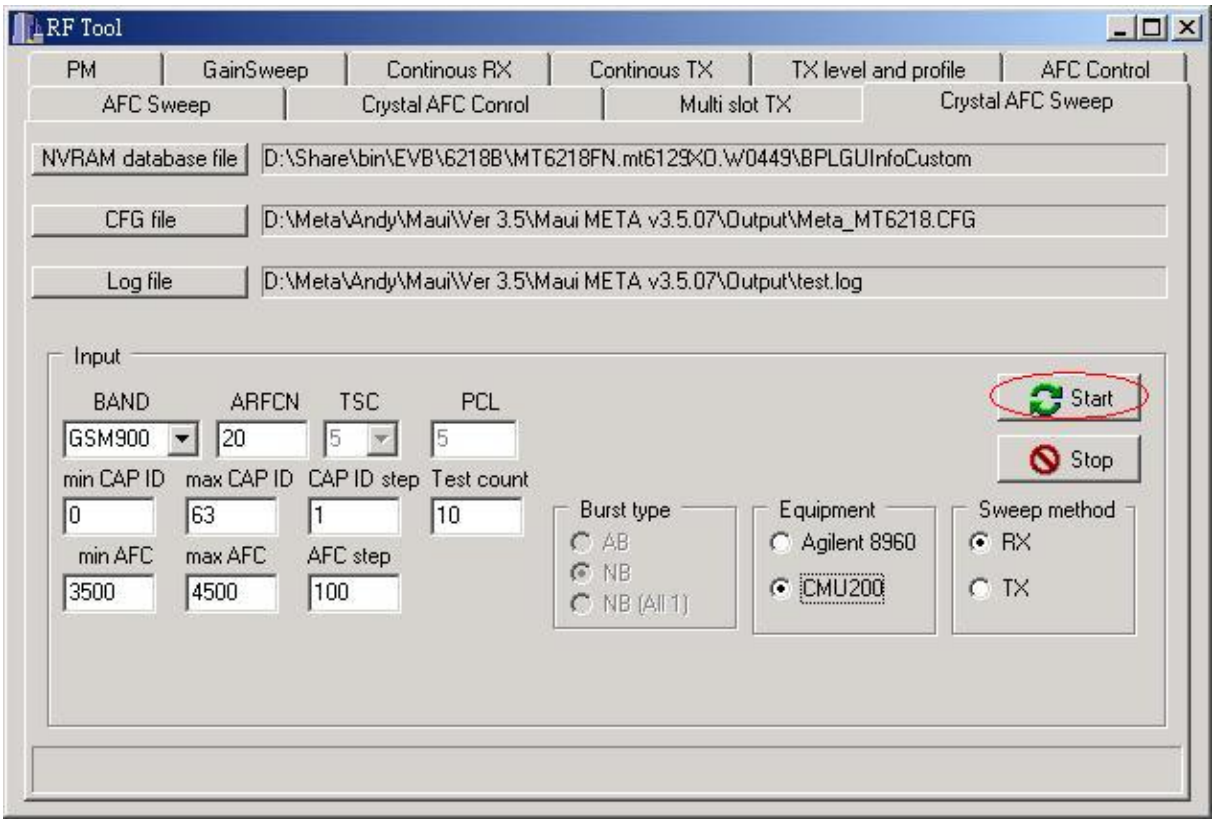

Figure 116 ***Click [Start] button to start RX crystal AFC sweep***

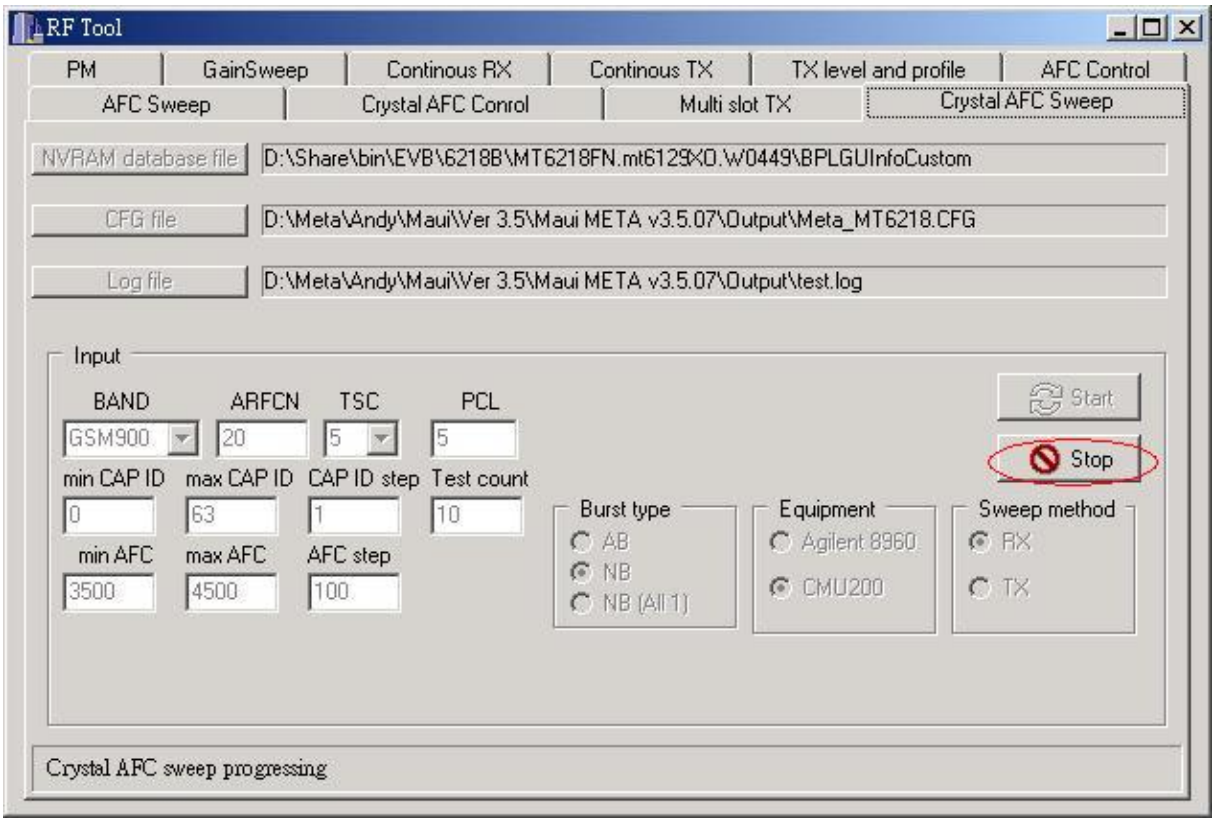

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Figure 117 ***Click [Stop] button to stop RX crystal AFC sweep***

3.2.10.2 TX crystal AFC sweep

The following operation is used for user to get TX frequency error periodically from Agilent 8960 or R&S CMU 200. User can execute TX crystal AFC sweep function by following steps:

1) Setup NVRAM database file, CFG file and log file.
2) Select TX sweep method.
3) Select equipment type.
4) Input Band, ARFCN, TSC (training sequence code), PCL (power control level), minimum CAP ID, maximum CAP ID, CAP ID step, minimum AFC DAC, maximum AFC DAC, AFC DAC step and burst type.
5) Click [Start] button.
6) User can stop this operation by clicking [Stop] button.

Note: CAP ID field is used to select index of CAP array (range: 0~63) in RF chip.

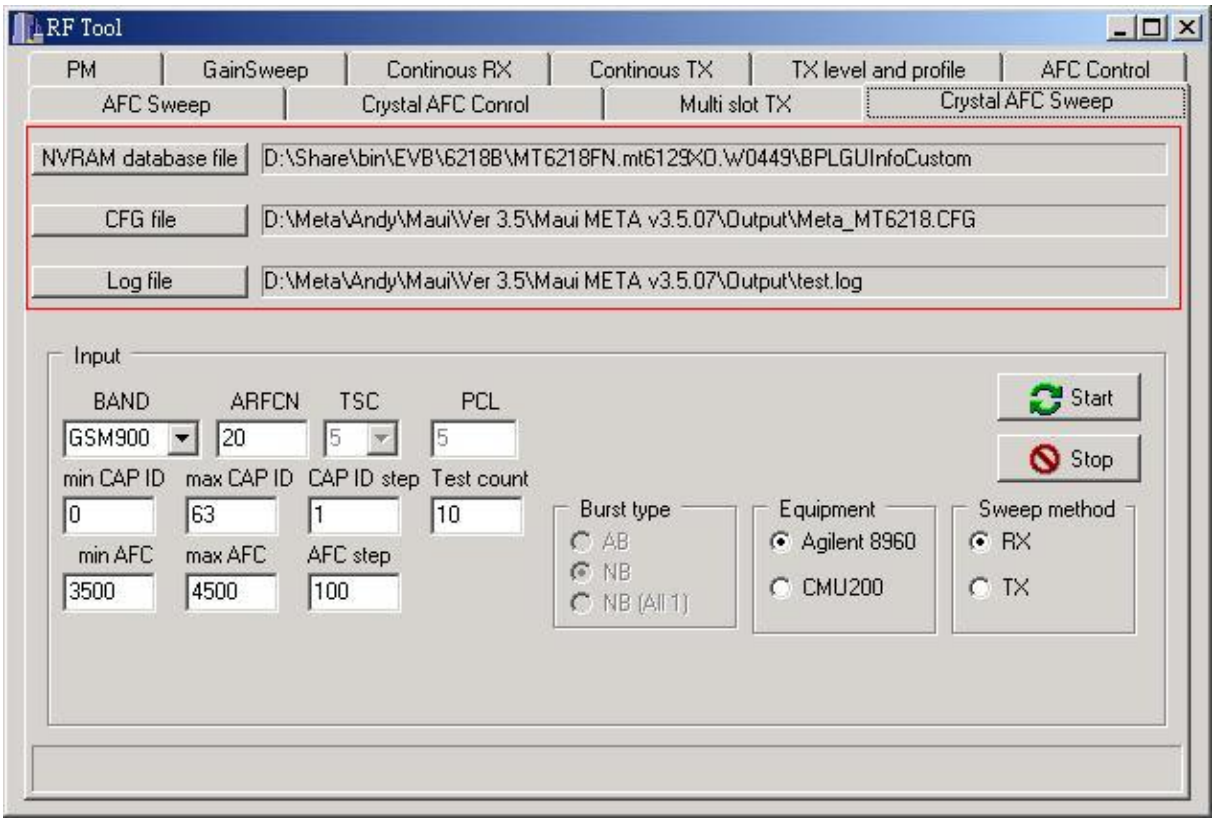

Figure 118 ***Setup NVRAM database file, CFG file and log file***

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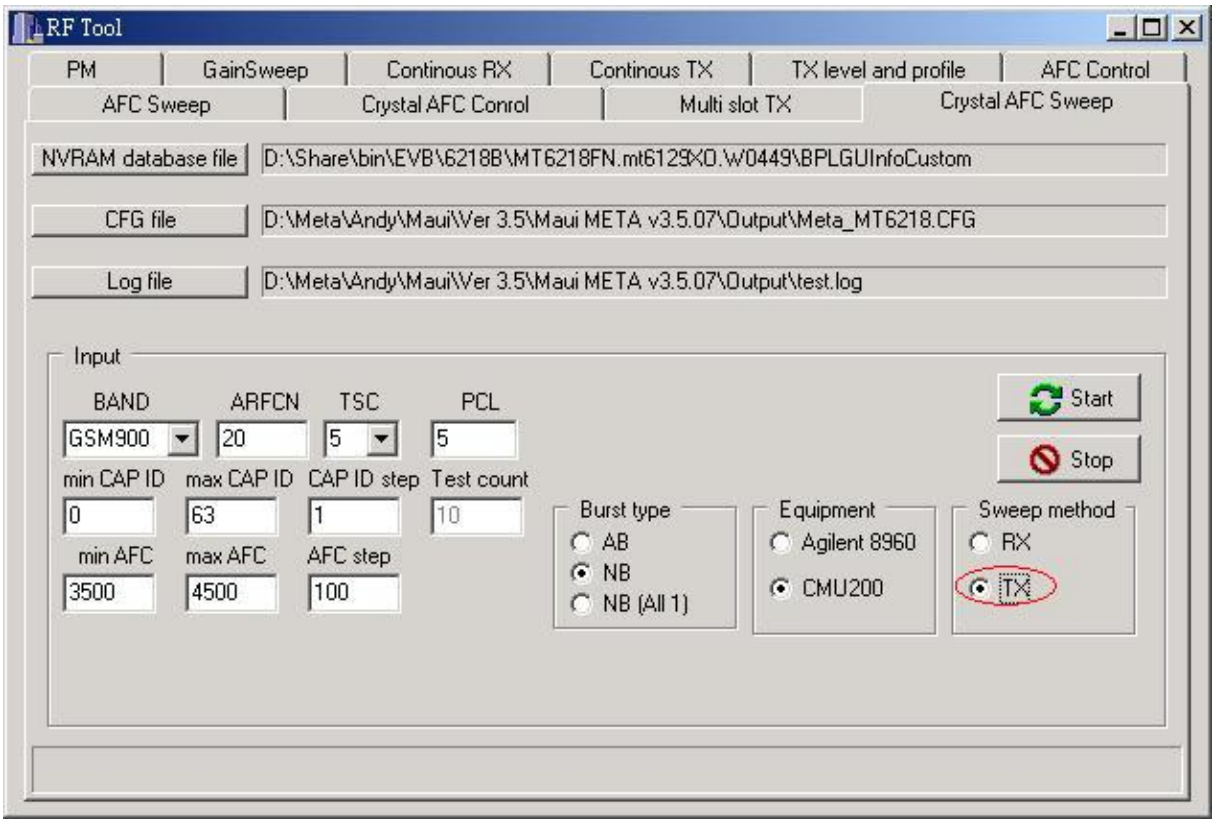

Figure 119 ***Select TX sweep method***

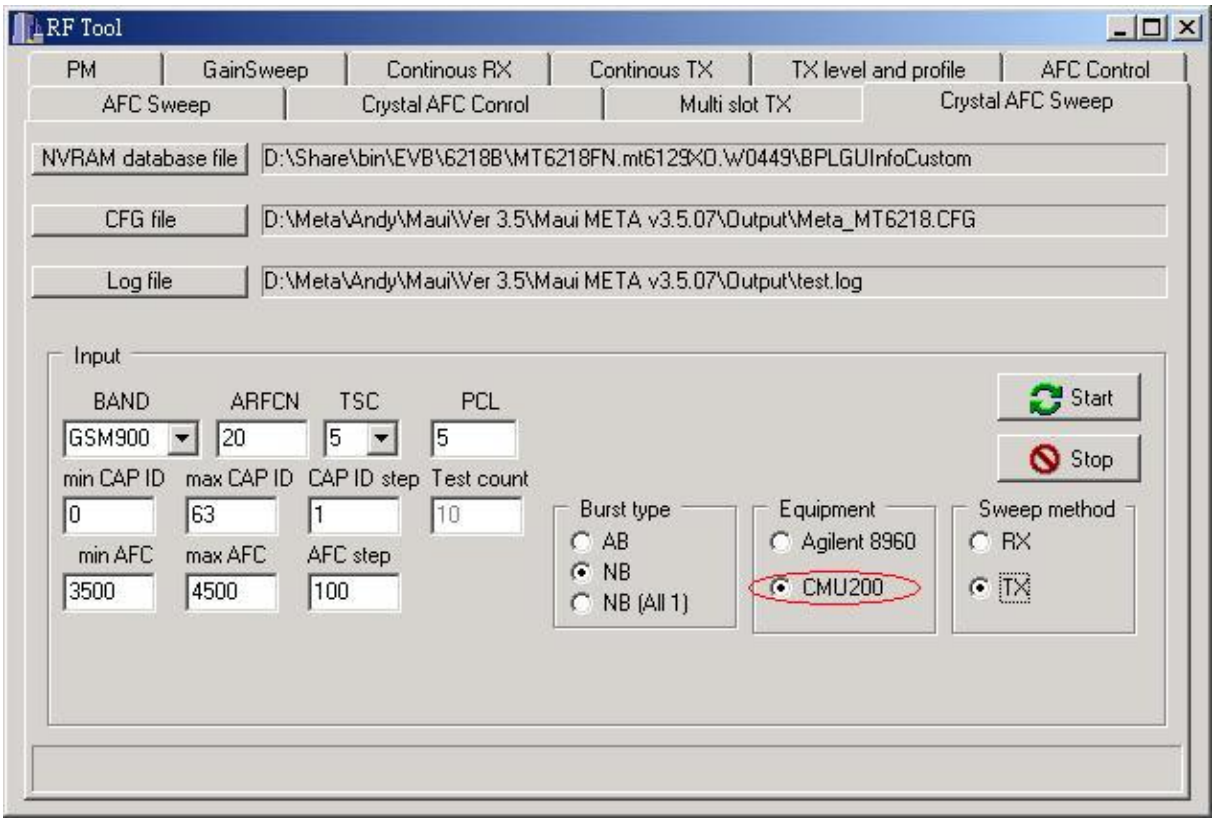

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Figure 120 ***Select equipment type***

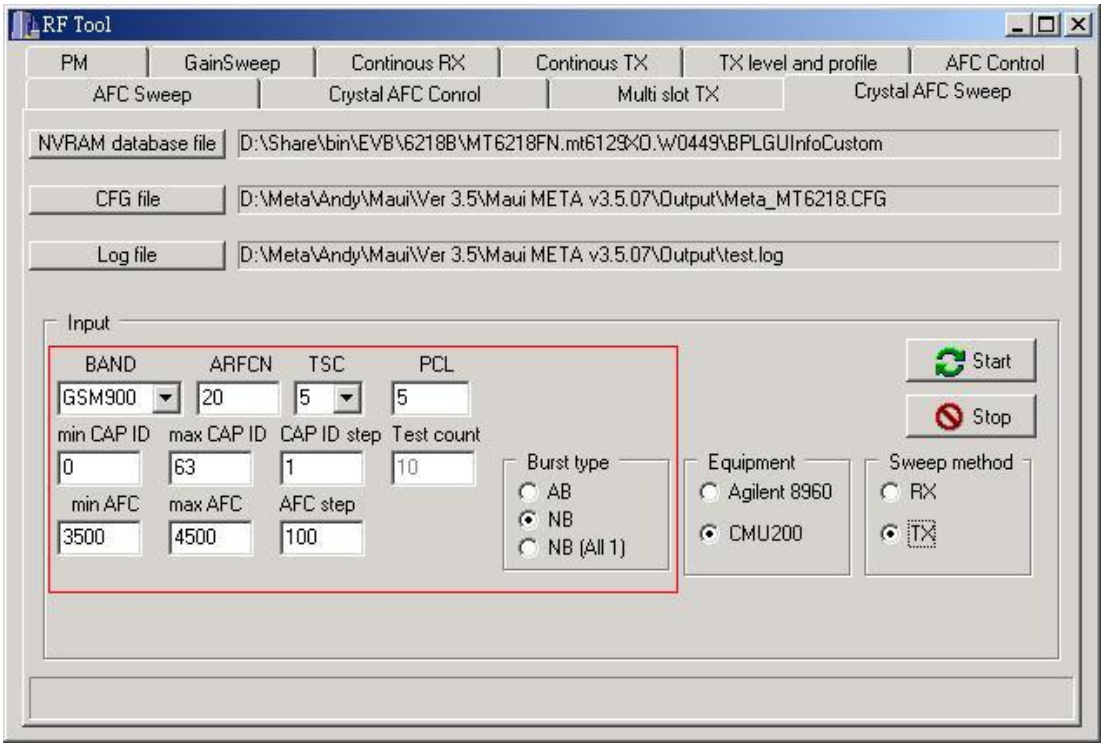

Figure 121 ***Input sweep parameter***

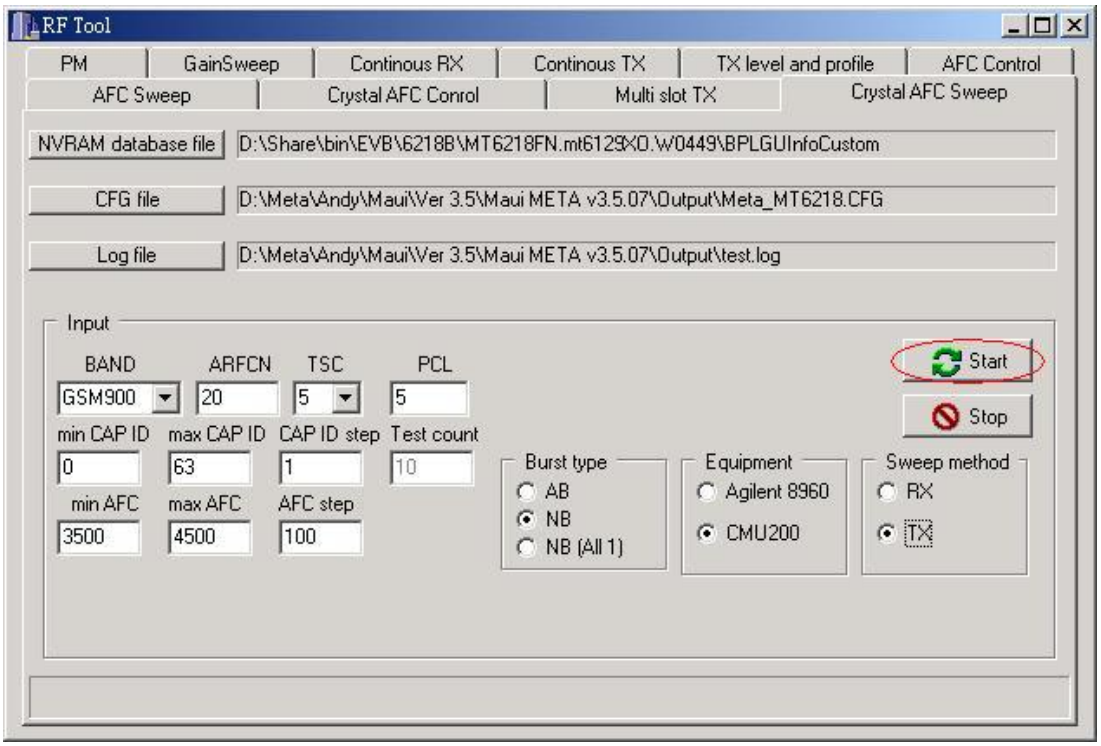

Figure 122 ***Click [Start] button to start TX crystal AFC sweep***

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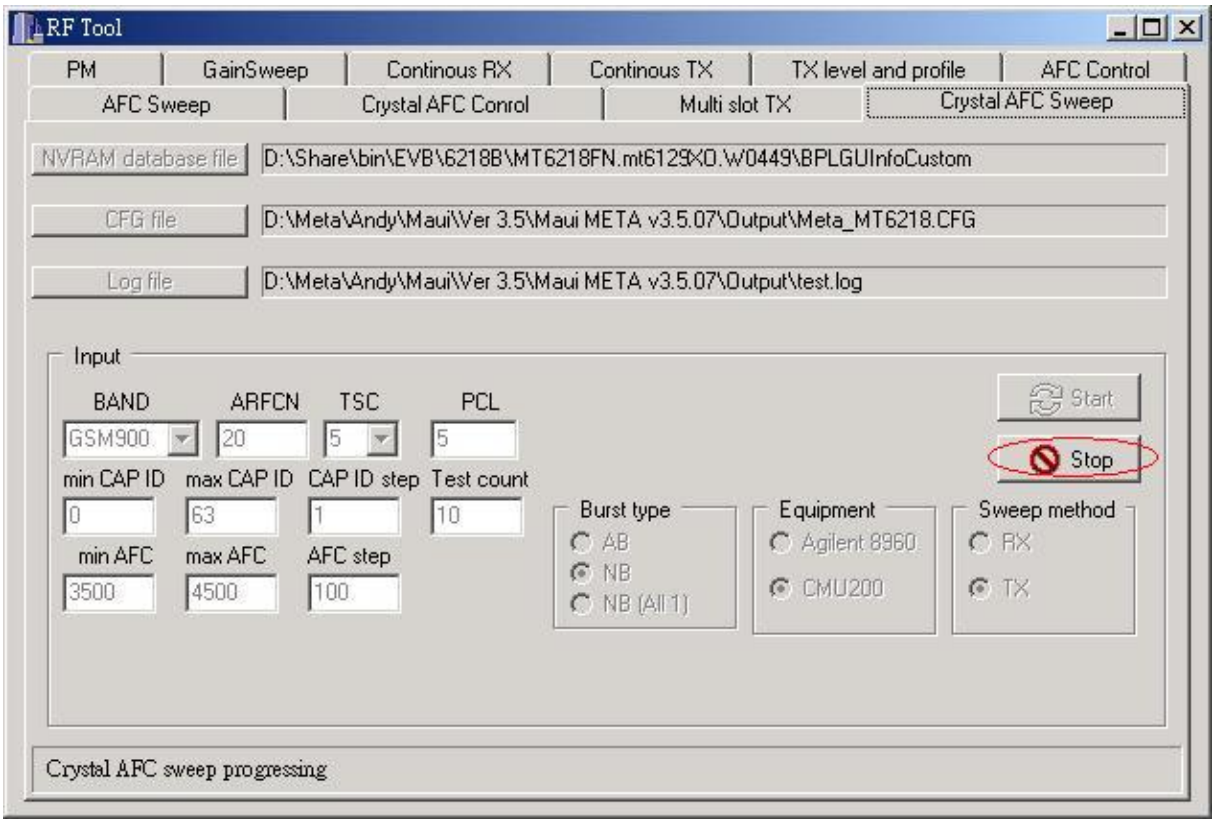

Figure 123 ***Click [Stop] button to stop TX crystal AFC sweep***

3.2.11 FHC

FHC provides UTS, DTS, and UTS Pre-scan functions for customers to verify target's FHC (fast handset calibration) capability using test equipments such as Agilent8960 and CMU200.

3.2.11.1 FHC UTS Pre-scan

FHC UTS PreScan can let user get log-space offset which is required for log-space DAC samples to perform auto calibration of TX PCL in Factory Tool.

If the Misc option: Pedestal is checked, the high_apc_dc_offset of the FHC UTS will be set to 0. This option is for DC offset calibration preparation.

Steps:

1) Set up CFG file, INI file and log file.

   The Min/Max DAC and Measure Samples settings will be configured based on the cfg settings in section [TX PCL table] and section [Frequency Bank] as follows:

   [Frequency Bank]
   bank = 0x1C
   [TX PCL table]
   MIN_GMSK_GSM850_APC_DAC_PRESCAN = 60
   MIN_GMSK_GSM900_APC_DAC_PRESCAN = 60
   MIN_GMSK_DCS1800_APC_DAC_PRESCAN = 70
   MIN_GMSK_PCS1900_APC_DAC_PRESCAN = 70
   MAX_GMSK_GSM850_APC_DAC_PRESCAN = 1000
   MAX_GMSK_GSM900_APC_DAC_PRESCAN = 1000

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MAX_GMSK_DCS1800_APC_DAC_PRESCAN = 900
MAX_GMSK_PCS1900_APC_DAC_PRESCAN = 900
MIN_EPSK_GSM850_APC_DAC_PRESCAN = 150
MIN_EPSK_GSM900_APC_DAC_PRESCAN = 150
MIN_EPSK_DCS1800_APC_DAC_PRESCAN = 150
MIN_EPSK_PCS1900_APC_DAC_PRESCAN = 150
MAX_EPSK_GSM850_APC_DAC_PRESCAN = 750
MAX_EPSK_GSM900_APC_DAC_PRESCAN = 750
MAX_EPSK_DCS1800_APC_DAC_PRESCAN = 750
MAX_EPSK_PCS1900_APC_DAC_PRESCAN = 750

FHC_UTS_GMSK_GSM850_MEASURE_SAMPLES_PRESCAN = 28
FHC_UTS_GMSK_GSM900_MEASURE_SAMPLES_PRESCAN = 28
FHC_UTS_GMSK_DCS1800_MEASURE_SAMPLES_PRESCAN = 32
FHC_UTS_GMSK_PCS1900_MEASURE_SAMPLES_PRESCAN = 32
FHC_UTS_EPSK_GSM850_MEASURE_SAMPLES_PRESCAN = 20
FHC_UTS_EPSK_GSM900_MEASURE_SAMPLES_PRESCAN = 20
FHC_UTS_EPSK_DCS1800_MEASURE_SAMPLES_PRESCAN = 20
FHC_UTS_EPSK_PCS1900_MEASURE_SAMPLES_PRESCAN = 20

2) Select at least one modulation type (GMSK/EPSK).
3) Select equipment type (so far, only Agilent8960 is supported here).
4) Press “Start” button.
5) Store the results by pressing the button “Save to cfg file.” The results will be stored in Section of [TX PCL table] as follows:
   FHC_UTS_GSM850_GMSK_APC_LOG_SPACE_OFFSET = 0
   FHC_UTS_GSM850_EPSK_APC_LOG_SPACE_OFFSET = 0
   FHC_UTS_GSM850_EPSK_APC_LOG_SPACE_OFFSET_HIGH = 0
   FHC_UTS_GSM900_GMSK_APC_LOG_SPACE_OFFSET=-62.19
   FHC_UTS_GSM900_EPSK_APC_LOG_SPACE_OFFSET_HIGH=358.30
   FHC_UTS_GSM900_EPSK_APC_LOG_SPACE_OFFSET=404.09
   FHC_UTS_DCS1800_GMSK_APC_LOG_SPACE_OFFSET=-64.90
   FHC_UTS_DCS1800_EPSK_APC_LOG_SPACE_OFFSET_HIGH=441.76
   FHC_UTS_DCS1800_EPSK_APC_LOG_SPACE_OFFSET=233.24
   FHC_UTS_PCS1900_GMSK_APC_LOG_SPACE_OFFSET=-64.16
   FHC_UTS_PCS1900_EPSK_APC_LOG_SPACE_OFFSET_HIGH=551.35
   FHC_UTS_PCS1900_EPSK_APC_LOG_SPACE_OFFSET=355.70

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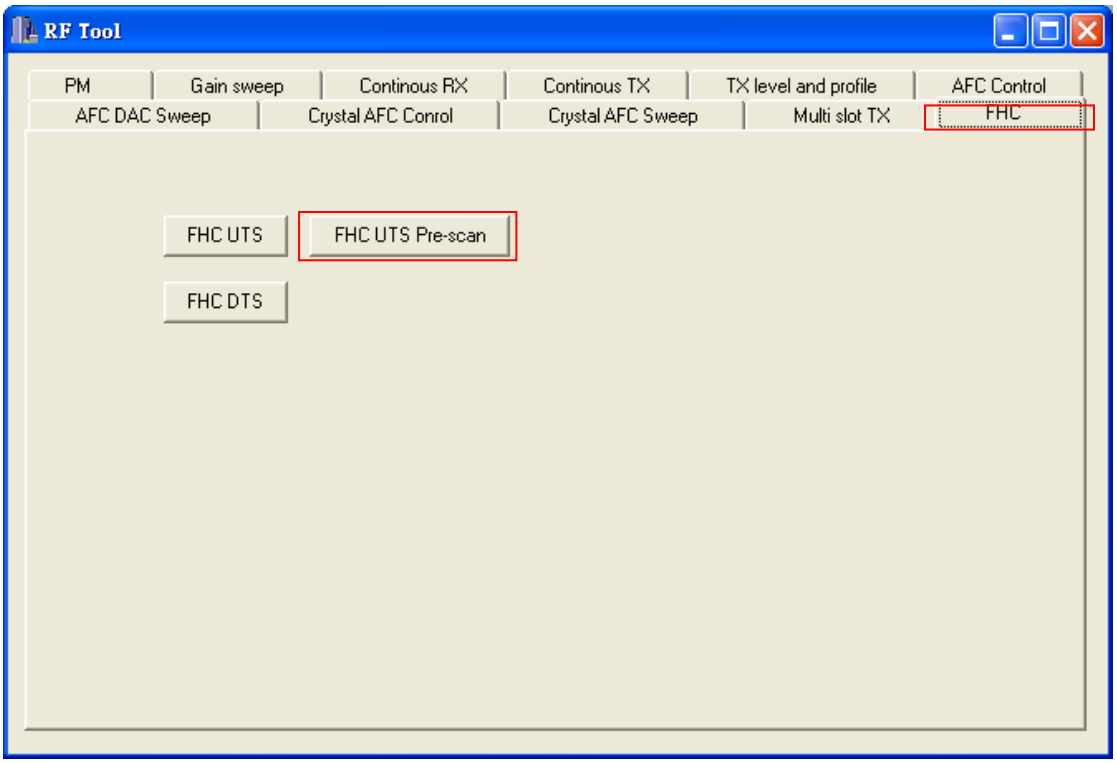

Figure 124 ***Click [FHC UTS Pre-scan] button to use the function.***

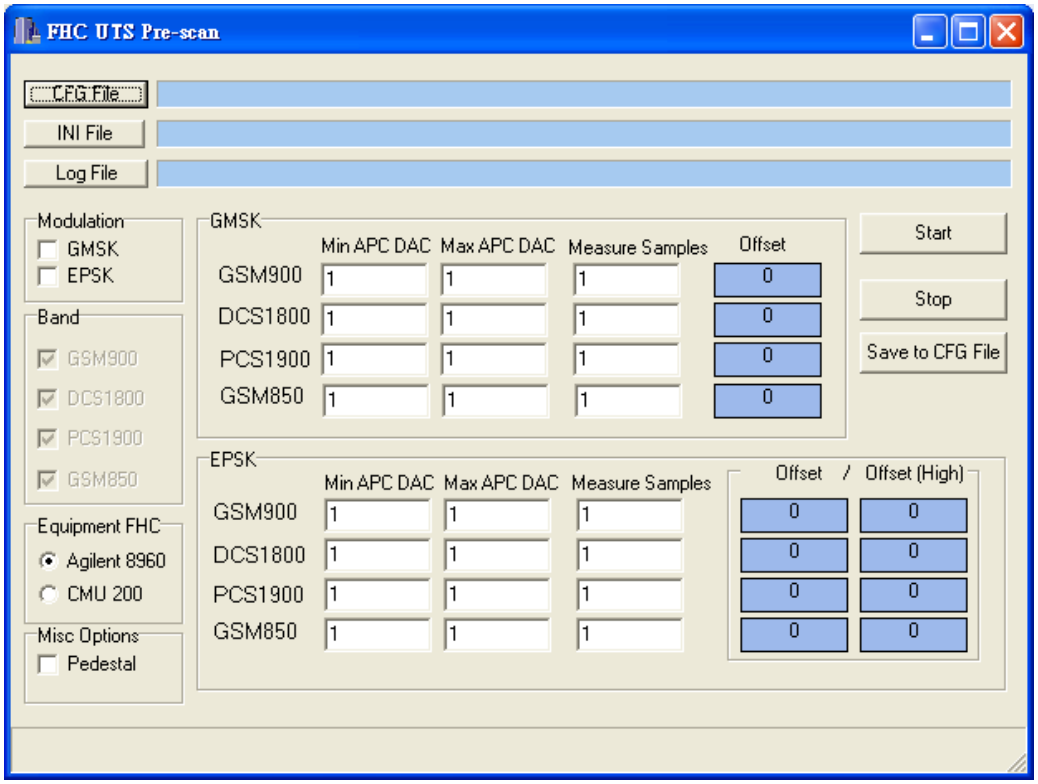

Figure 125 ***FHC UTS Pre-scan UI.***

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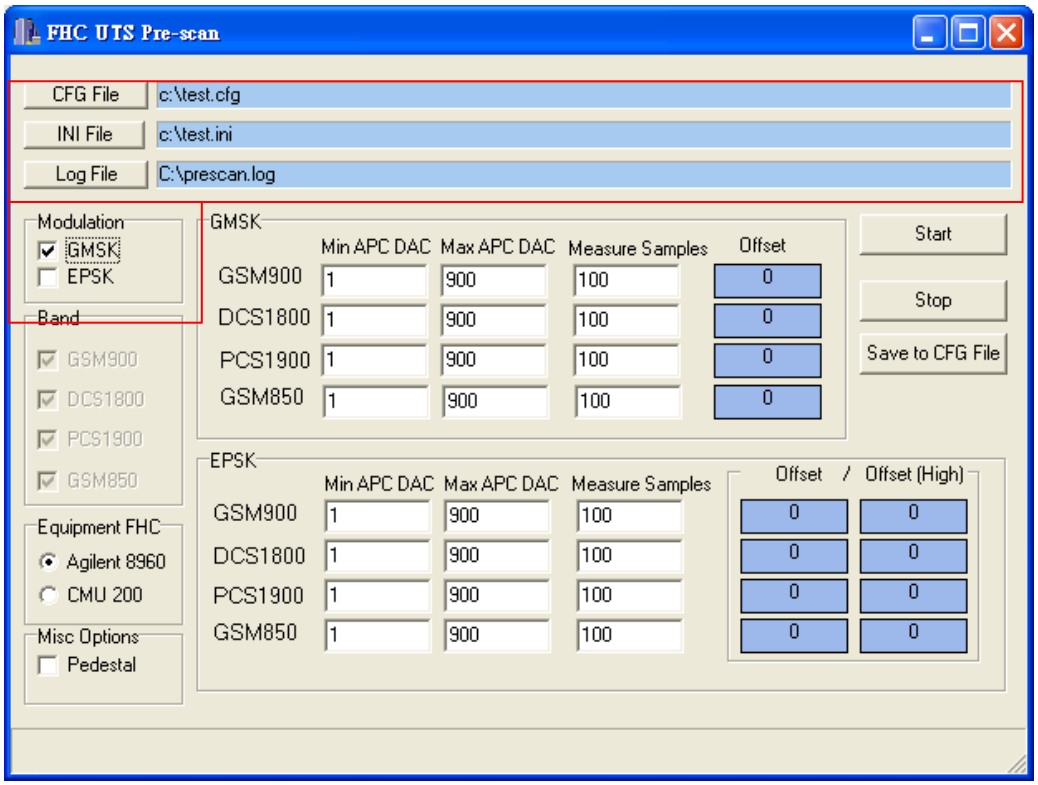

Figure 126 ***Set the "CFG file, INI File, and Log File" and select the modulation type.***

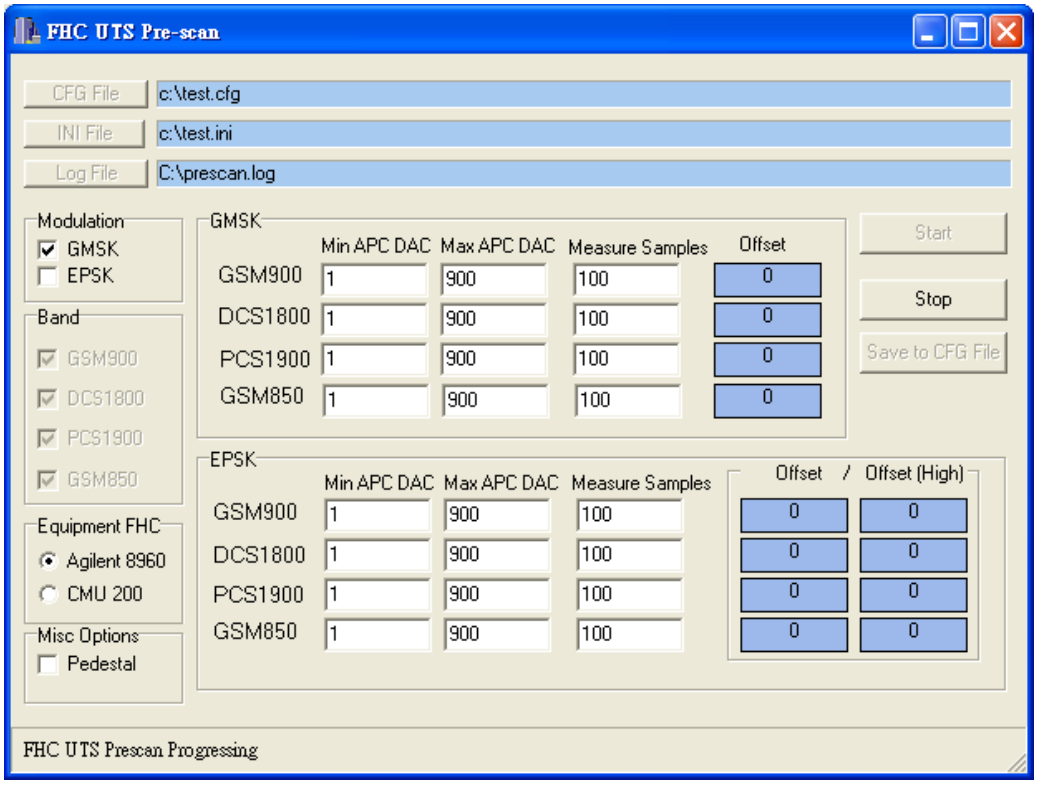

Figure 127 ***Press the "Start" button.***

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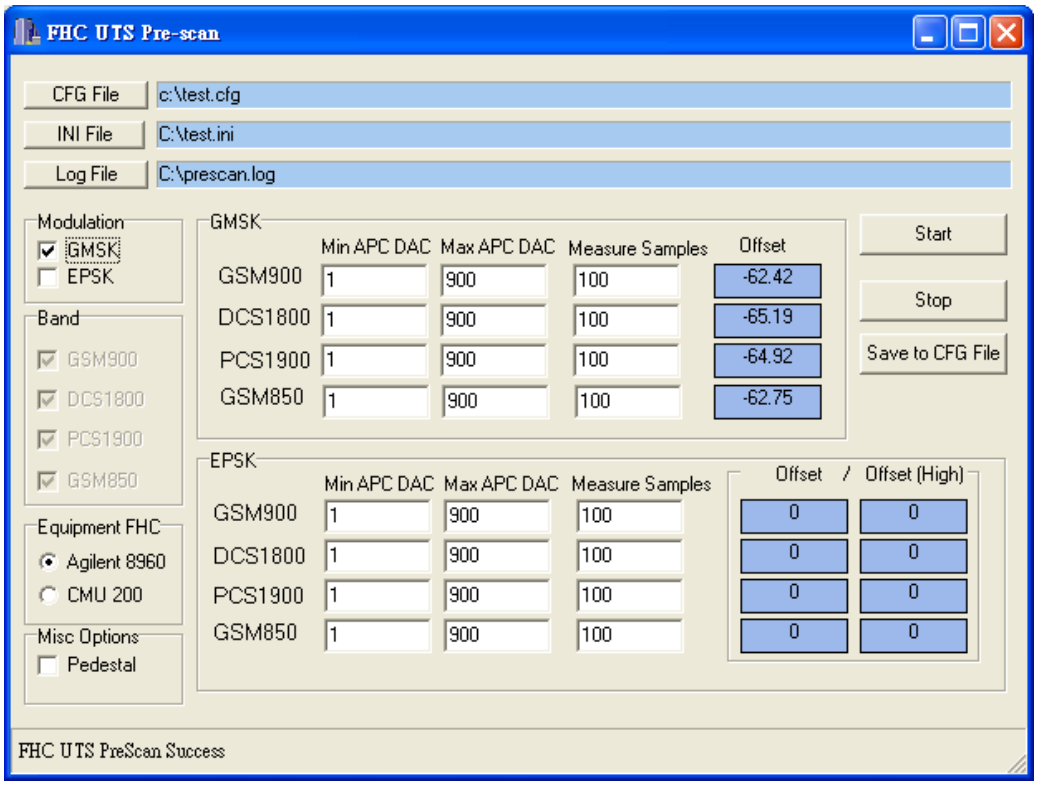

Figure 128 ***Calibration results are displayed when scan operation is successfully completed.***

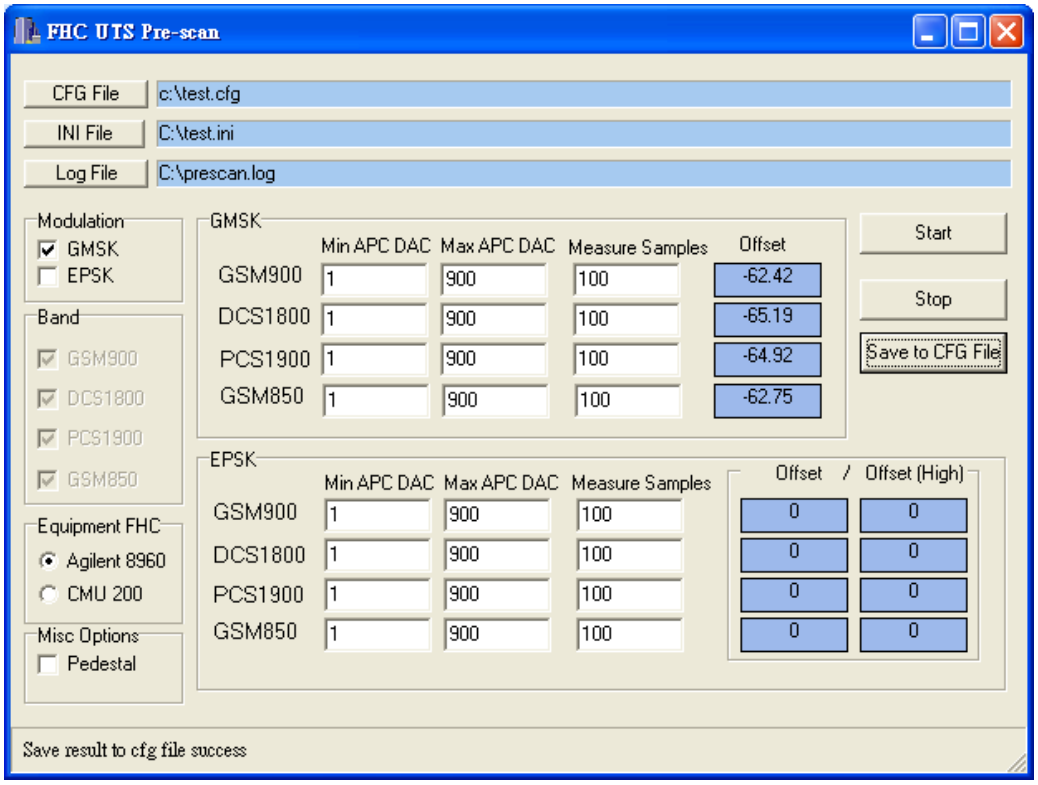

Figure 129 ***Press the "Save to Cfg File" button to save the results into CFG file.***

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After the pre-scan, the Max APC DAC and Min APC DAC can be found in the prescanlog. In the APC DAC vs. Pout data are saved in the last 2 line of each band in the log file. Selet the proper Min APC DAC/ Max APC DAC as the following figure demonstrated.

2009/4/7 21:38: 6.979 [Debug] burst power(sort):-30.955,-30.975,-30.974,-31.812,-35.590,-29.361,-20.601,-12.111,-5.785,-1.048,2.443,4.989,7.038,8.684,10.082,11.263,12.260,13.144,13.912,14.709,15.351,15.964,16.545,17.074,17.579,18.020,18.480,18.920,19.343,19.745,20.124,20.546,20.896,21.251,21.579,21.904,22.208,22.504,22.796,23.076,23.351,23.616,23.878,24.128,24.404,24.644,24.870,25.100,25.312,25.530,25.679,25.881,26.083,26.269,26.457,26.641,26.848,27.021,27.197,27.373,27.542,27.702,27.864,28.025,28.180,28.336,28.488,28.635,28.783,28.942,29.086,29.225,29.372,29.509,29.646,29.635,29.764,29.892,30.015,30.138,30.258,30.394,30.509,30.627,30.743,30.843,30.959,31.069,31.181,31.288,31.398,31.502,31.609,31.725,31.827,31.930,32.028,32.130,32.223,32.3250

2009/4/7 21:38: 6.979 [Debug] APC DAC used (sort):1,10,19,28,37,46,55,65,74,83,92,101,110,119,128,137,146,155,164,174,183,192,201,210,219,228,237,246,255,264,273,283,292,301,310,319,328,337,346,355,364,373,382,391,401,410,419,428,437,446,455,464,473,482,491,500,510,519,528,537,546,555,564,573,582,591,600,609,618,628,637,646,655,664,673,682,691,700,709,718,727,737,746,755,764,773,782,791,800,809,818,827,836,846,855,864,873,882,891,900

Figure 130 ***Choose Min/Max APC DAC from pre-scan log file.***

3.3 WiFi tool

After META opens COM port, reads NVRAM database and reset target to test mode, user can start to do all calibration and testing. User can switch to WiFi tool by selecting [WiFi] from main selection menu.

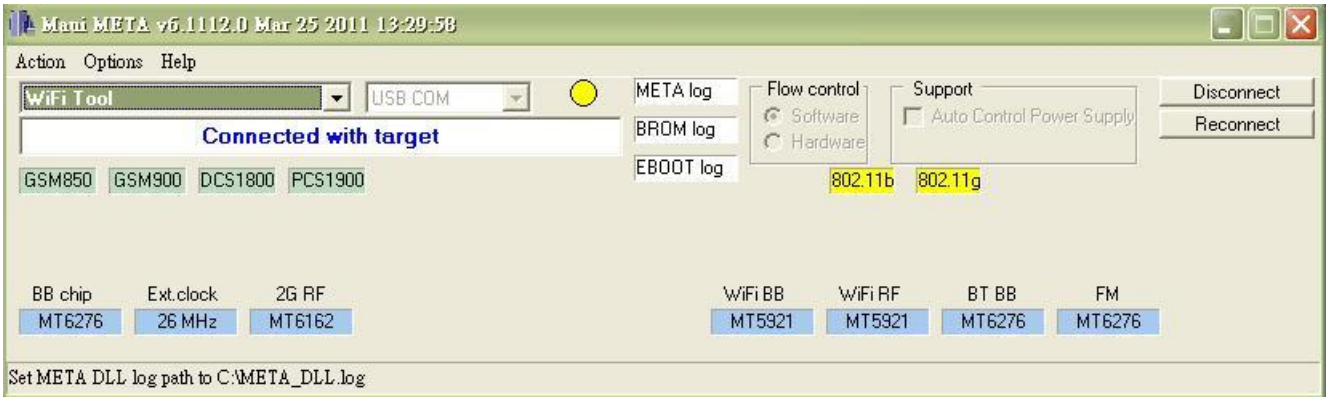

Figure 131 ***Select [WiFi] from main selection menu***

3.3.1 Continuous Packet TX

This operation is used for continuous transmitting WiFi packet. Power Amplifier is turned on in this operation and indicated bursts are transmitted. User can input channel, TX filter, TX rate, packet length, packet count, packet interval, TX power DAC, preamble and chose bit pattern and then click [Start] button to do continuous packet TX test. WiFi module will start to transmit RF signal with the parameters set by user after MS get the command from META. RF engineer can measure the transmitted signal characteristic of continuous packet TX by Litepoint IQView or other WiFi measurement instrument.

Packet sent StaticText indicates how many packets have been sent by WiFi module. Ack count StaticText indicates how many ACK received from remote side if unicast test is used. If broadcast test is used, Ack count is not used.

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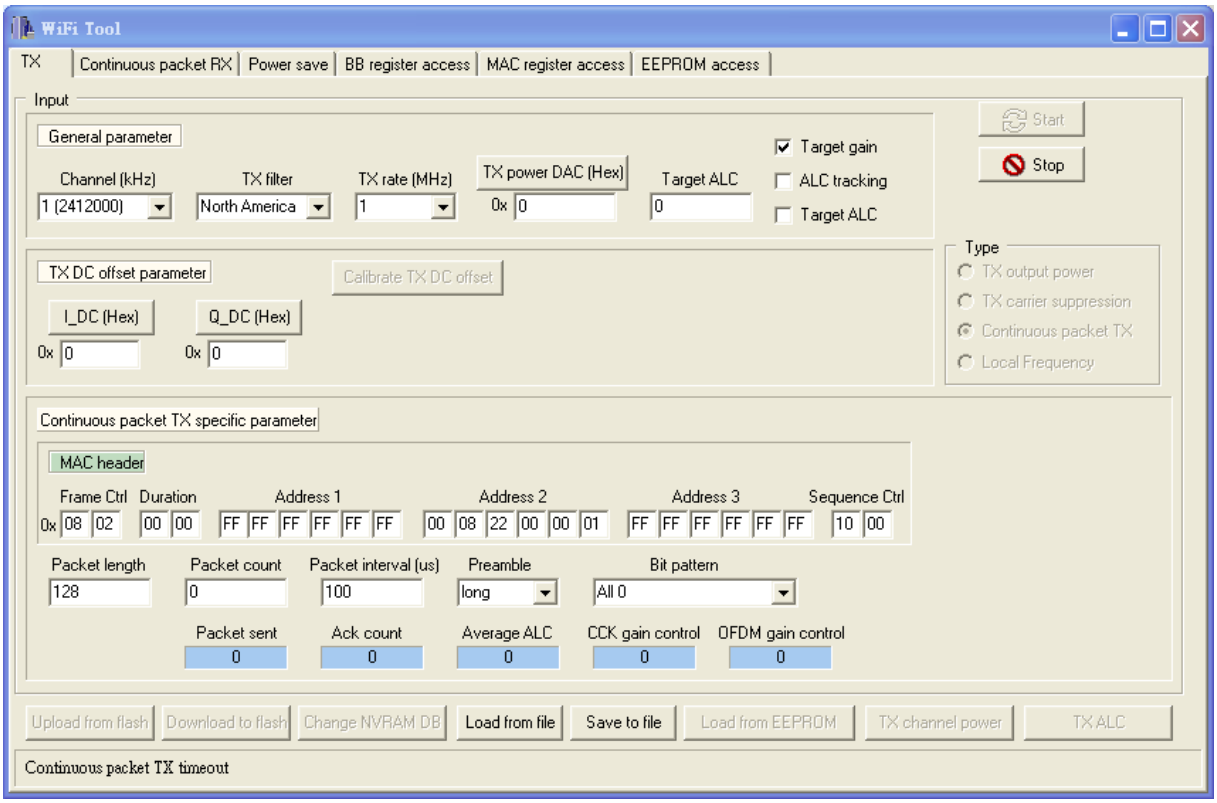

Figure 132 ***Click [Start] button to start continuous packet TX testing.***

After clicking [Stop] button, continuous packet TX test is stop and the [Start] button will be enabled.

3.3.1.1 Upload and download the TX power DAC value in flash

Following describes how to upload and download TX power DAC and TX DC offset parameters from and to flash. User can click [Upload from flash] button to read these parameters from flash and click [Download to flash] button to write these parameters to flash.

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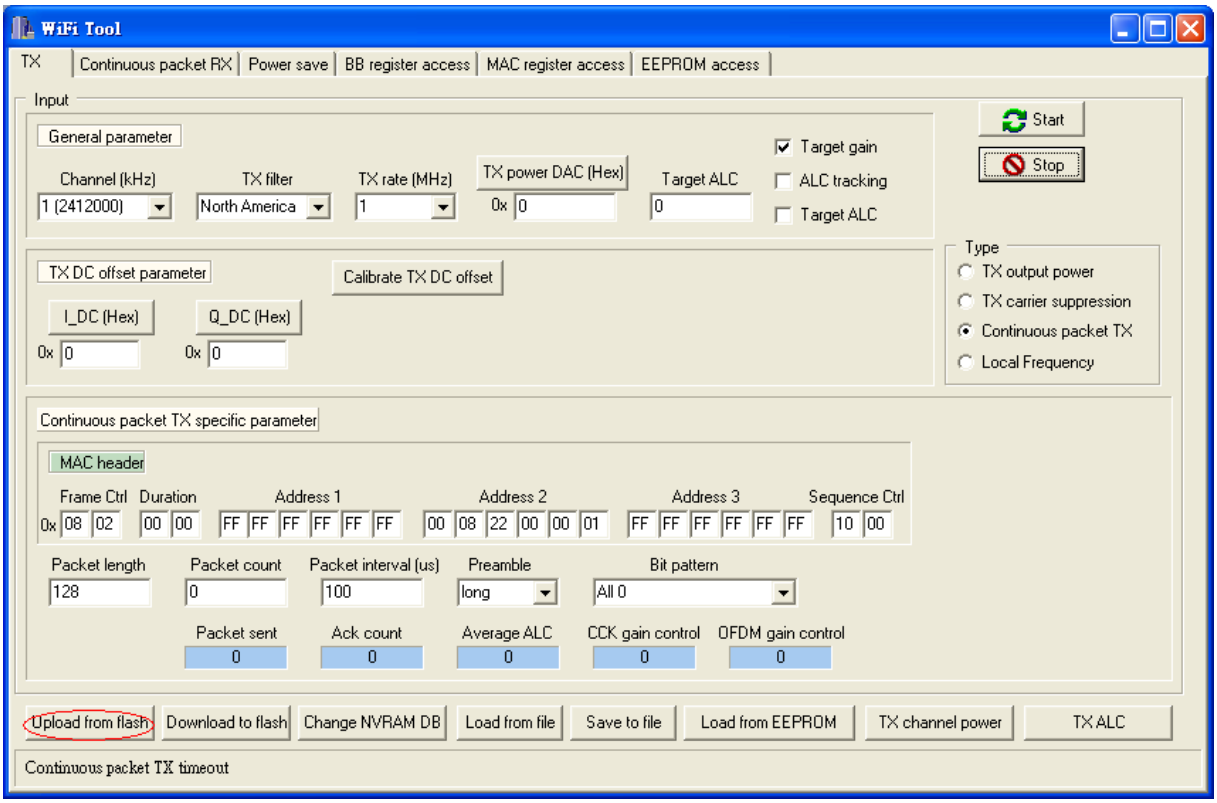

Figure 133 ***Click [Upload from flash] button to read value from flash***

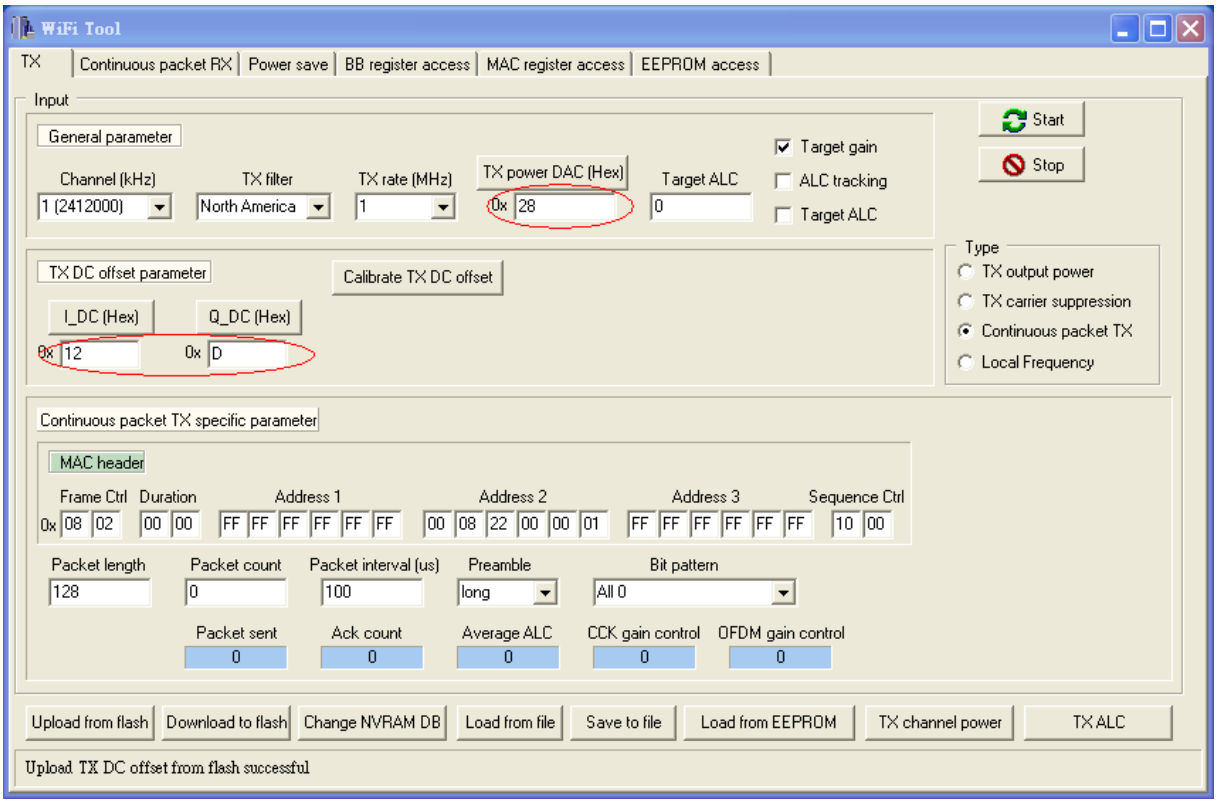

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Figure 134 ***Result of TX power DAC and TX DC offset value***

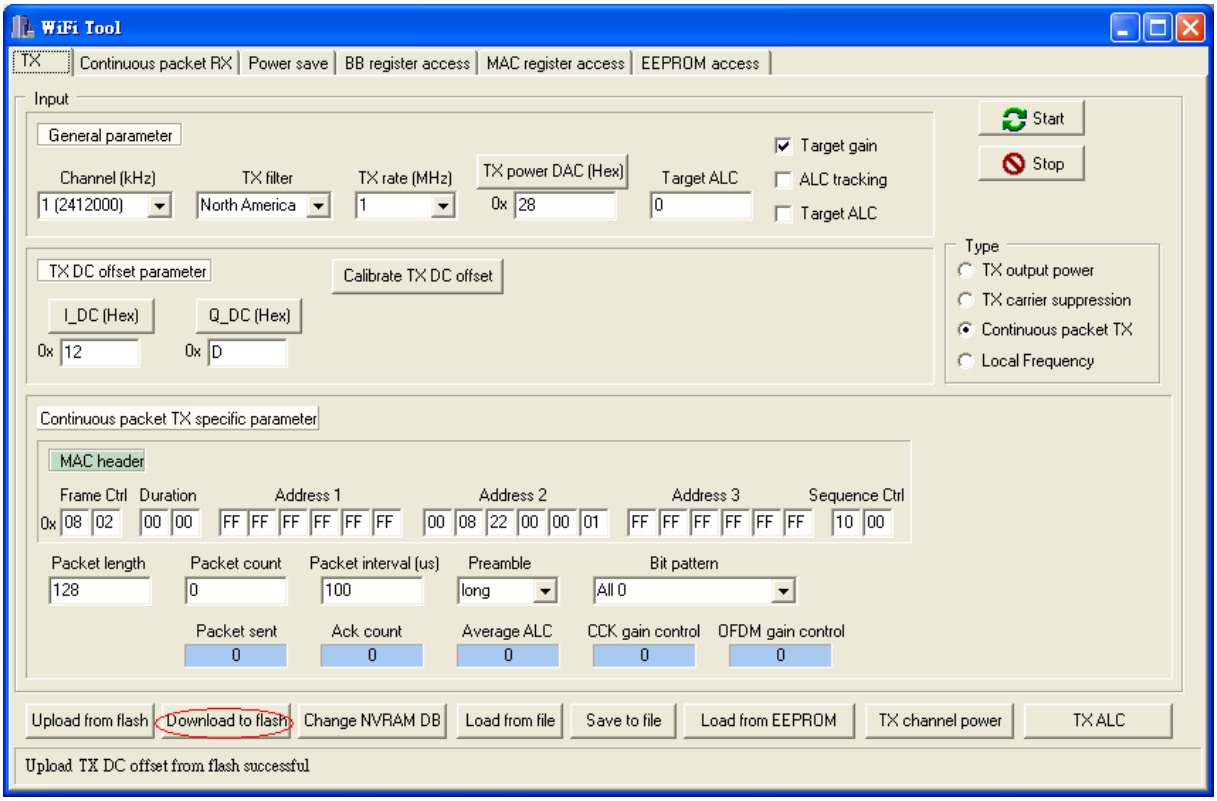

Figure 135 ***Click [Download to flash] button to write value to flash***

User can click [Change NVRAM DB] to change NVRAM database file.

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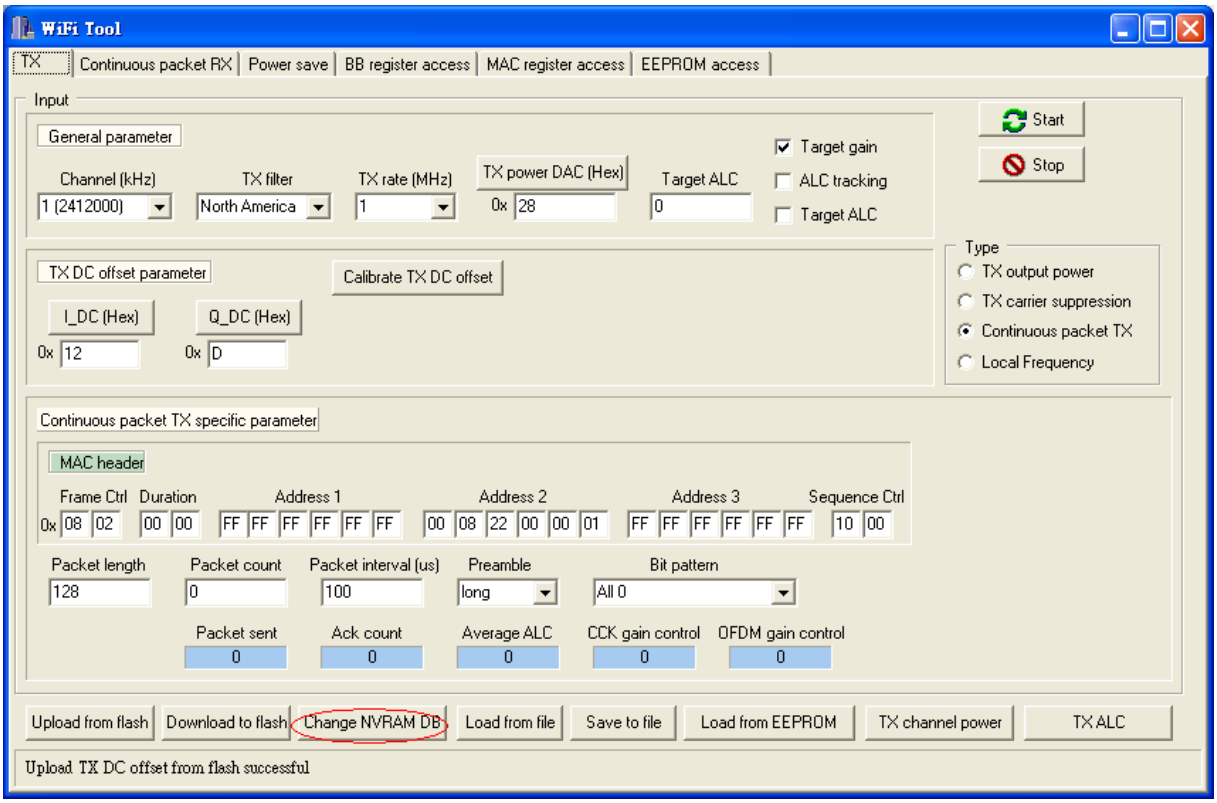

Figure 136 ***Click [Change NVRAM DB] button to change NVRAM database file***

3.3.1.2 Read and write the TX power DAC and TX DC offset vale in file

Users can click [Load from file] button to read TX power DAC value from INI file and click [Save to file] button to write TX power DAC value to INI file. Each value must be followed with a comma.

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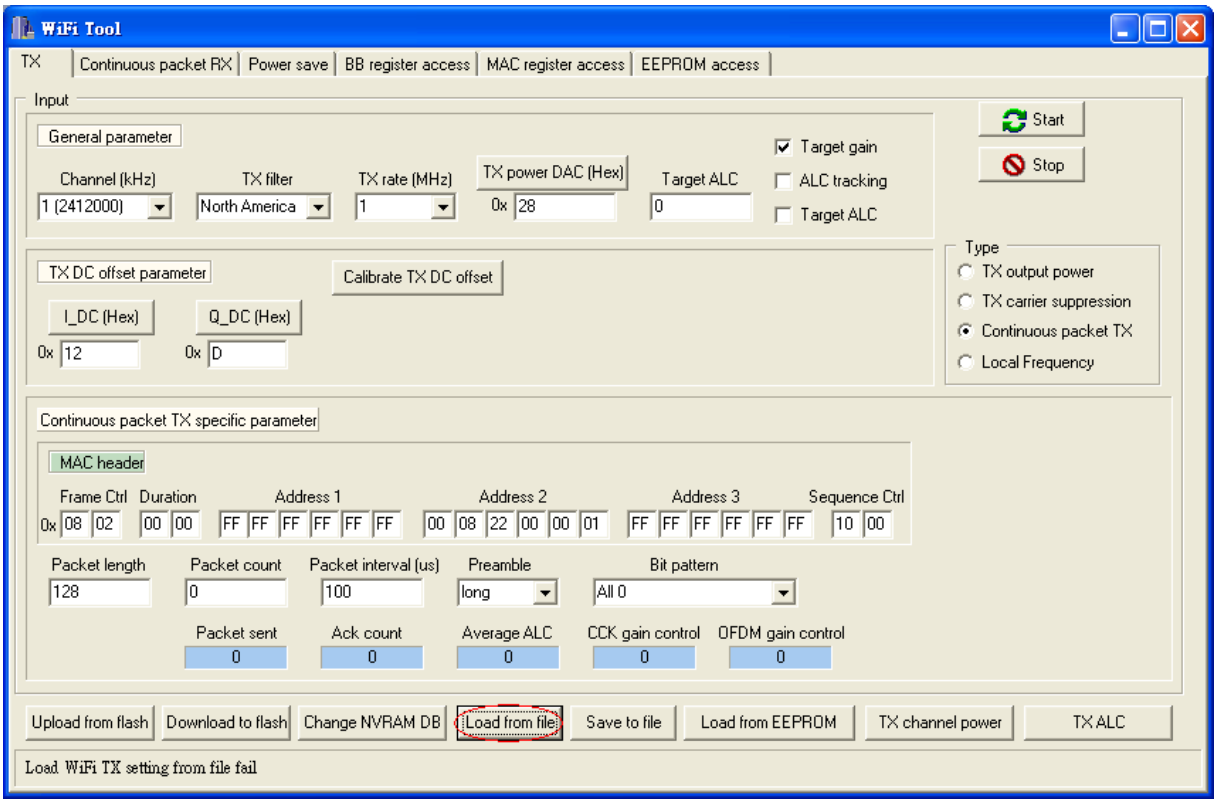

Figure 137 ***Click [Load from file] button to read value from file***

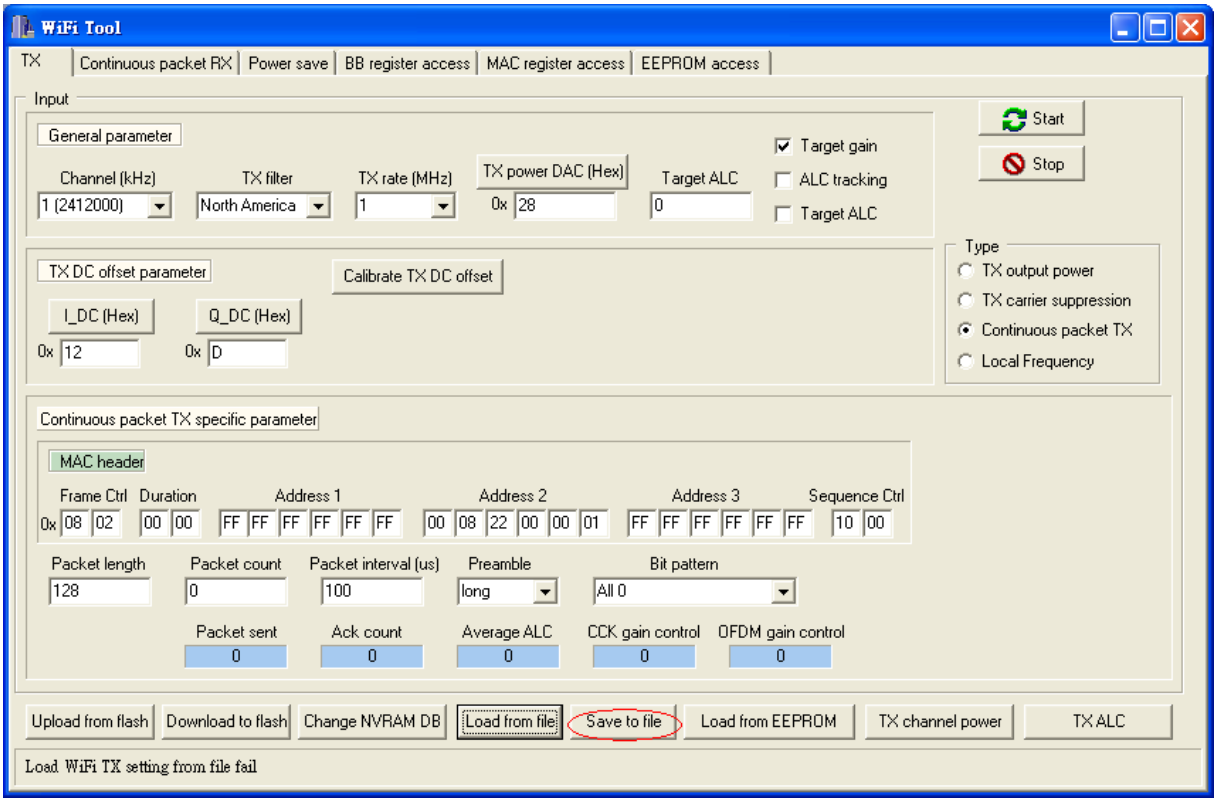

Figure 138 ***Click [Save to file] button to save value to file.***

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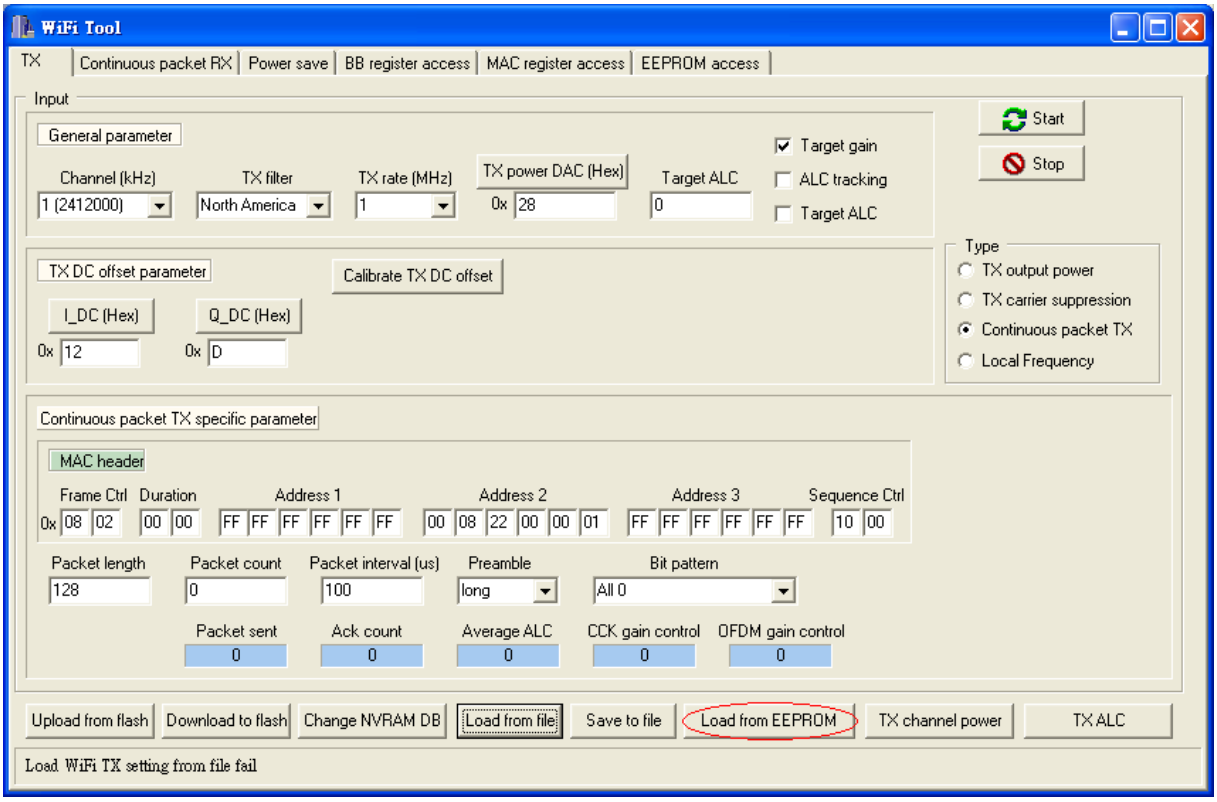
The following is a template file of TX power DAC and TX DC offset value. User will get the INI file after saving TX power DAC. Please follow the file format if you want to change the value in file.

[WiFi TX power 2.4G]
TX power CCK=40,40,40,40,40,40,40,40,40,40,40,40,40,40
TX power OFDM=53,53,53,53,53,53,53,53,53,53,53,53,53,53
[WiFi TX DC Offset]
I_DC=18
Q_DC=13

3.3.1.3 Read TX power DAC and TX DC offset vale from EEPROM

User can click [Load from EEPROM] button to read TX power DAC and TX DC offset value from EEPROM.



Click [Load from EEPROM] button to load TX power DAC and TX DC offset value from EEPROM

3.3.1.4 WiFi TX power profile window

User can click [TX channel power] button display WiFi TX power profile window. User can use WiFi TX power profile window to edit DAC of each channel. 802.11B uses CCK modulation and 802.11G use OFDM modulation.

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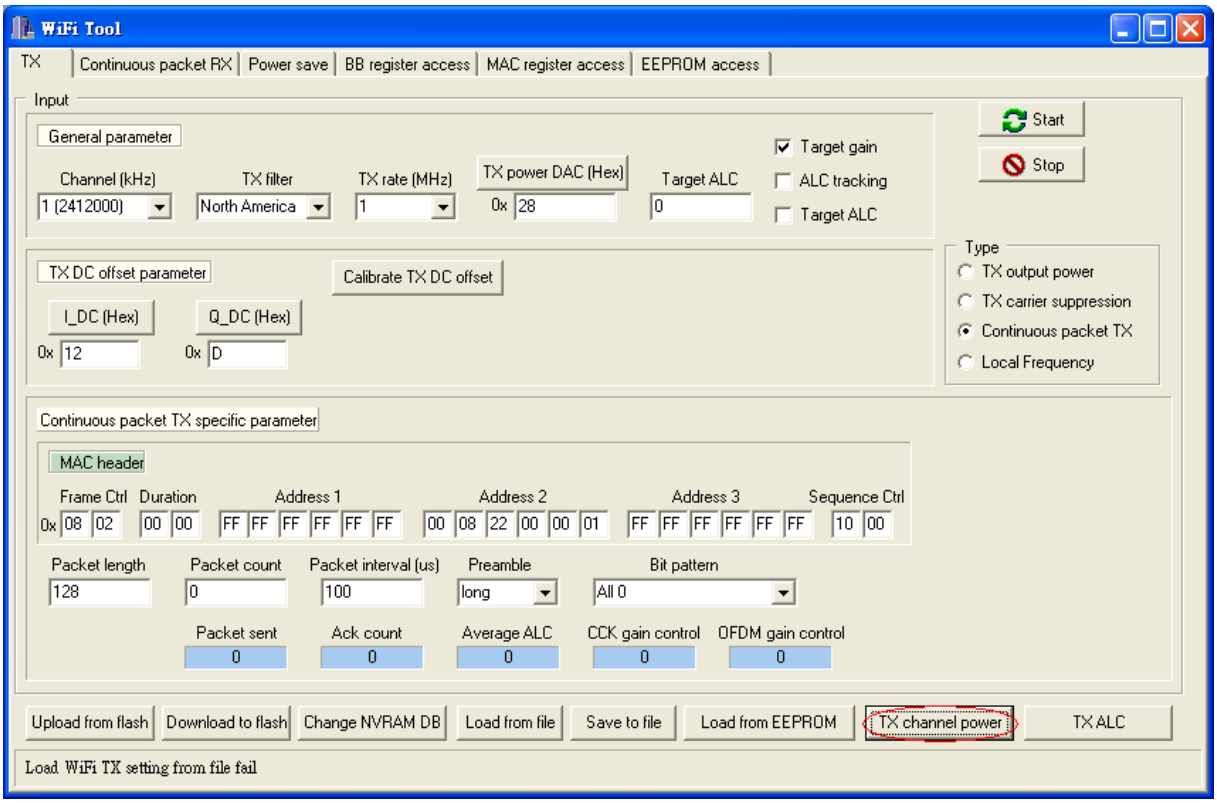

Figure 139 ***Click [TX channel power] button to display WiFi TX power profile window***

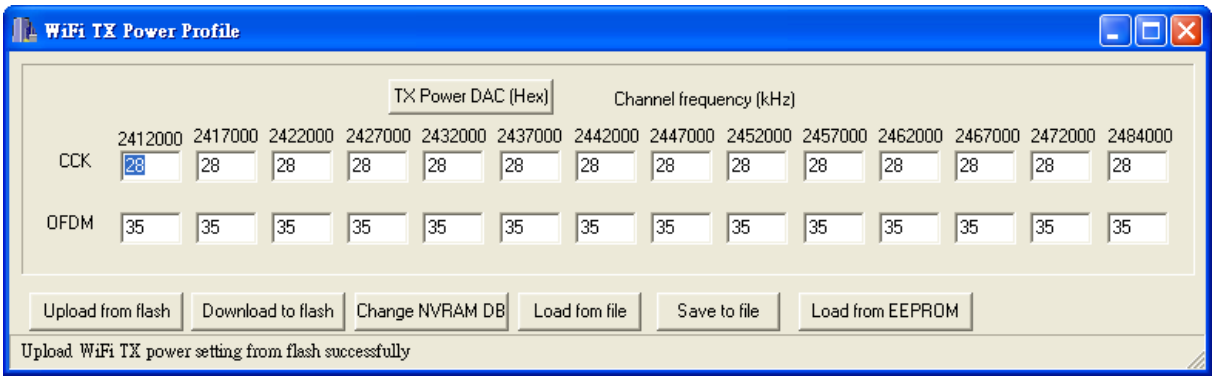

Figure 140 ***WiFi TX power profile window***

3.3.1.5 ALC (Automatic Level Control)

If target load support ALC, user can use META to do continuous packet TX test with ALC and read/write ALC calibration data. Otherwise, META doesn't show ALC related UI.

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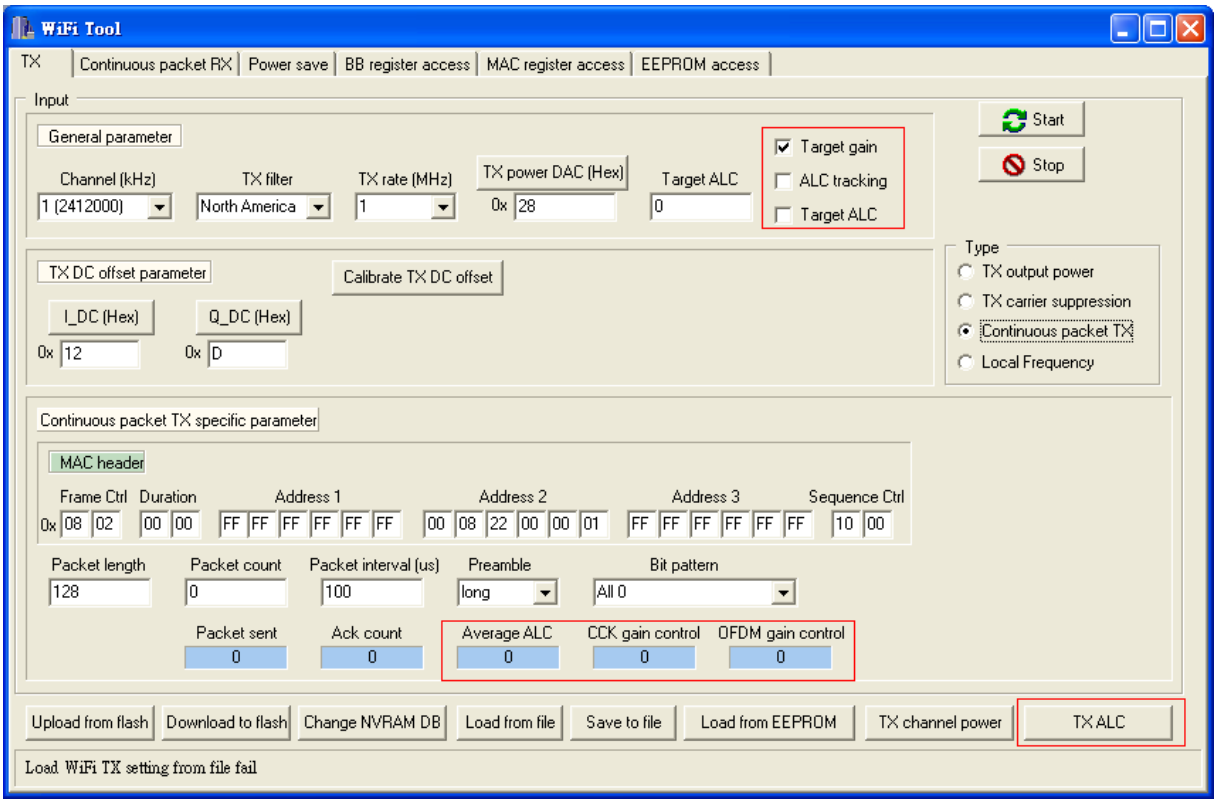

Figure 141 ***ALC releated UI***

3.3.1.5.a Continuous packet TX with ALC

There are three ALC related flags can be configured by user. They are target gain, ALC tracking and target ALC. If target gain flag is checked, target gain is provide by META TX power DAC field. Otherwise ALC calibration data saved in NVRAM is used. If ALC tracking is checked, ALC tracking is turned on. Otherwise, ALC tracking is turned off. If target ALC flag is checked, target ALC is provided by META UI target ALC editor. Otherwise, ALC calibration data saved in NVRAM is used. Average ALC StaticText indicates current ALC value reported by WiFi module. CCK gain control StaticText indicates current CCK gain used by WiFi module. And OFDM gain control indicates current OFDM gain used by WiFi module

3.3.1.5.b ALC calibration data access

User can enter ALC calibration data access window by click [TX ALC] button on TX page. User can read/write ALC calibration data from/to NVRAM by click [Upload from flash] and [Download to flash] button.

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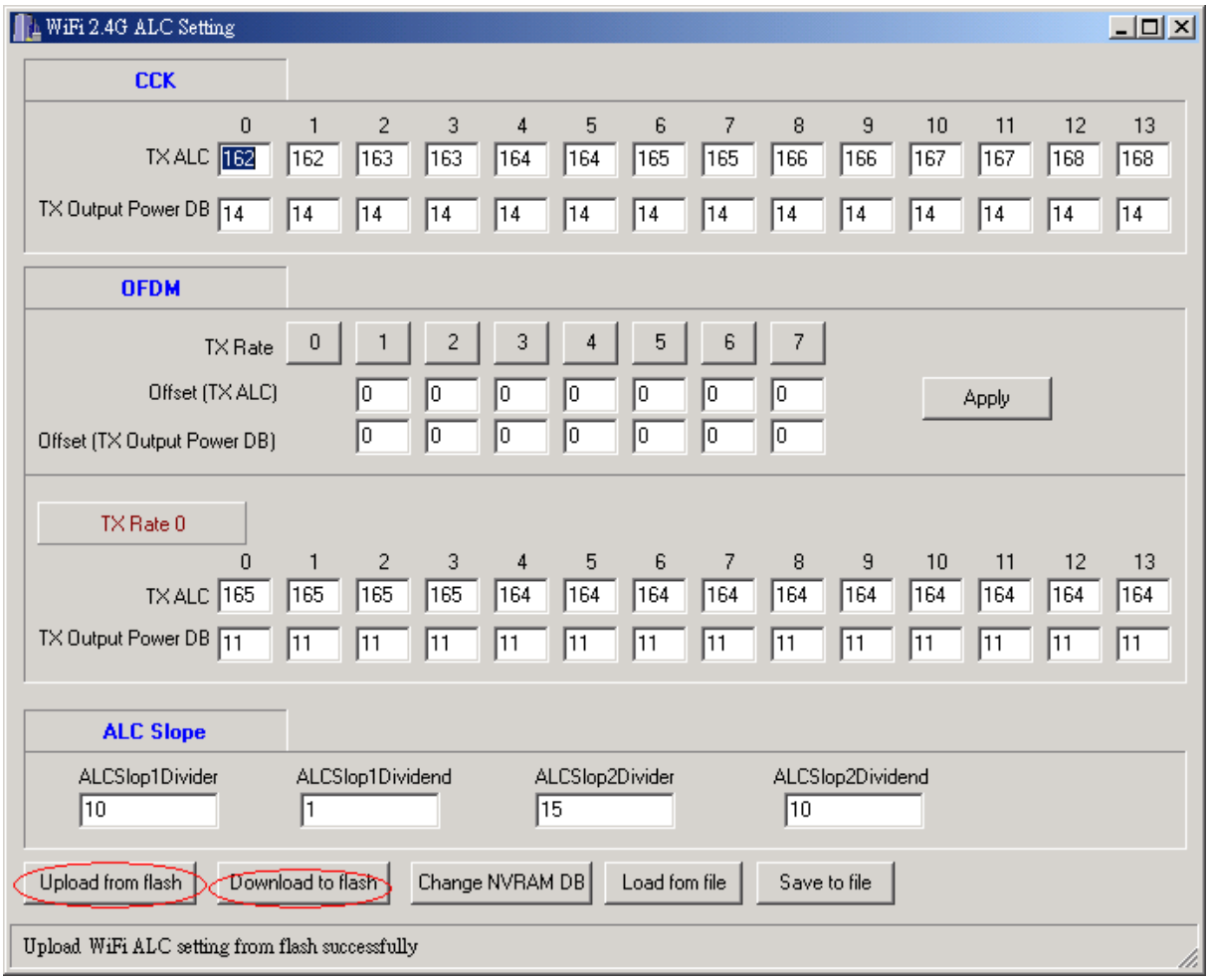

Figure 142 ***Click [Upload from flash] and [Download to flash] button to read/write ALC calibration data from/to NVRAM***

Users can read/write ALC calibration data from/to INI file by clicking [Load from file] and [Save to file] button.

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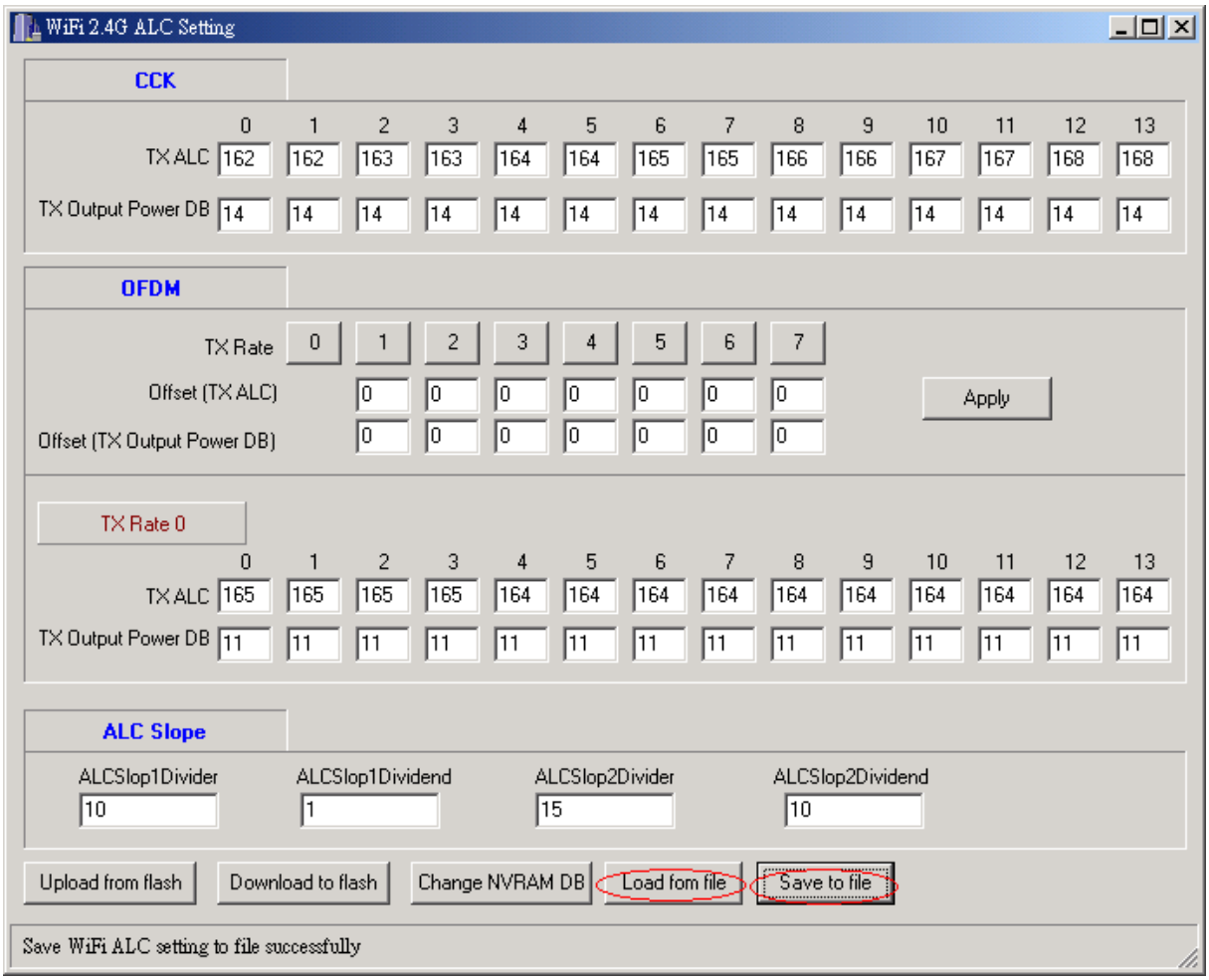

Figure 143 ***Click [Load from file] and [Save to file] button to read/write ALC calibration data from/to INI file***

The following is a template file of ALC calibration data. Users will get the INI file after saving ALC calibration data. Please follow the file format if you want to change the value in file.

[WiFi ALC 2.4G]
TX ALC CCK=162,162,163,163,164,164,165,165,166,166,167,167,168,168
TX output power DB CCK=14,14,14,14,14,14,14,14,14,14,14,14,14,14
TX ALC OFDM0=165,165,165,165,164,164,164,164,164,164,164,164,164,164
TX ALC OFDM1=165,165,165,165,164,164,164,164,164,164,164,164,164,164
TX ALC OFDM2=165,165,165,165,164,164,164,164,164,164,164,164,164,164
TX ALC OFDM3=165,165,165,165,164,164,164,164,164,164,164,164,164,164
TX ALC OFDM4=165,165,165,165,164,164,164,164,164,164,164,164,164,164
TX ALC OFDM5=165,165,165,165,164,164,164,164,164,164,164,164,164,164
TX ALC OFDM6=165,165,165,165,164,164,164,164,164,164,164,164,164,164
TX ALC OFDM7=165,165,165,165,164,164,164,164,164,164,164,164,164,164
TX output power DB OFDM0=11,11,11,11,11,11,11,11,11,11,11,11,11,11
TX output power DB OFDM1=11,11,11,11,11,11,11,11,11,11,11,11,11,11
TX output power DB OFDM2=11,11,11,11,11,11,11,11,11,11,11,11,11,11
TX output power DB OFDM3=11,11,11,11,11,11,11,11,11,11,11,11,11,11
TX output power DB OFDM4=11,11,11,11,11,11,11,11,11,11,11,11,11,11

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TX output power DB OFDM5=11,11,11,11,11,11,11,11,11,11,11,11,11,11
TX output power DB OFDM6=11,11,11,11,11,11,11,11,11,11,11,11,11,11
TX output power DB OFDM7=11,11,11,11,11,11,11,11,11,11,11,11,11,11
ALC Slop1 Divider=10
ALC Slop1 Dividend=1
ALC Slop2 Divider=15
ALC Slop2 Dividend=10

3.3.2 TX Output Power

This operation is used for spectral mask and power measurement test. Continuous data is transmitted. Power Amplifier is turned on in this operation. User can input channel, TX filter, TX rate, TX power DAC and then click [Start] button to do TX output power test. WiFi module will start to transmit RF signal with the parameters set by user after MS get the command from META. RF engineer can measure the transmitted signal characteristic of TX output power by Litepoint IQView or other WiFi measurement instrument.

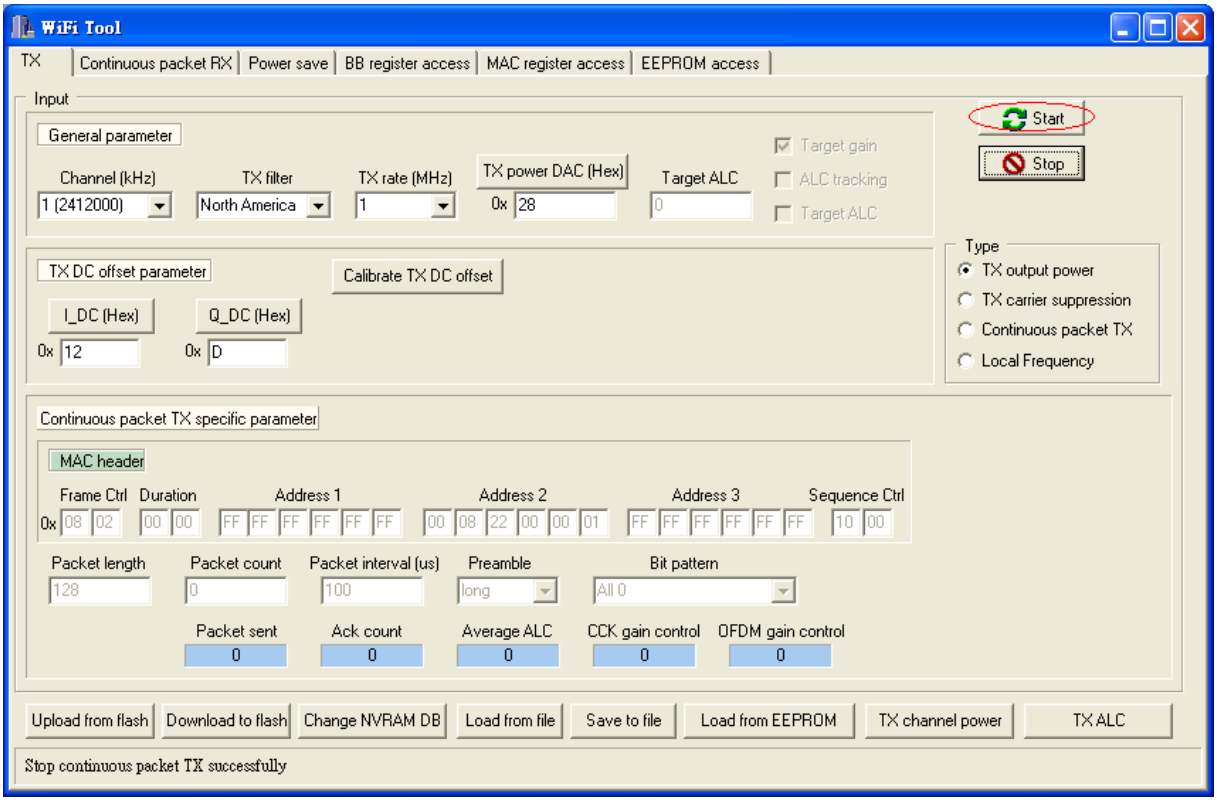

Figure 144 ***Click [Start] button to start TX output power testing***

After clicking [Stop] button, TX output power is stop and the [Start] button will be enabled.

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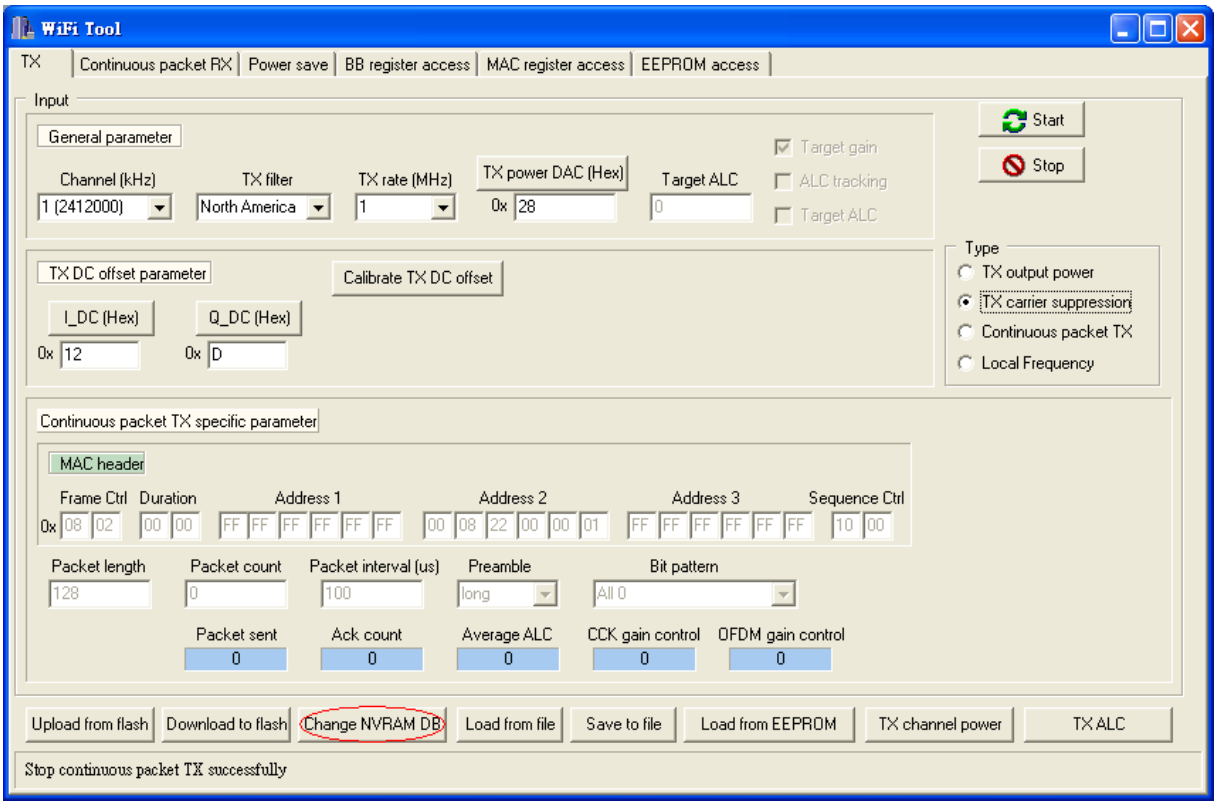

Figure 145 ***Select NVRAM database file***

3.3.3 TX Carrier Suppression

This operation is used for TX carrier suppression test. Only C/W wave is transmitted. No data is carried. Power Amplifier is turned on in this operation. User can input channel, TX filter, TX rate, TX power DAC and then click [Start] button to do TX carrier suppression test. WiFi module will start to transmit RF signal with the parameters set by user after MS get the command from META. RF engineer can measure the transmitted signal characteristic of TX carrier suppression by Litepoint IQView or other WiFi measurement instrument.

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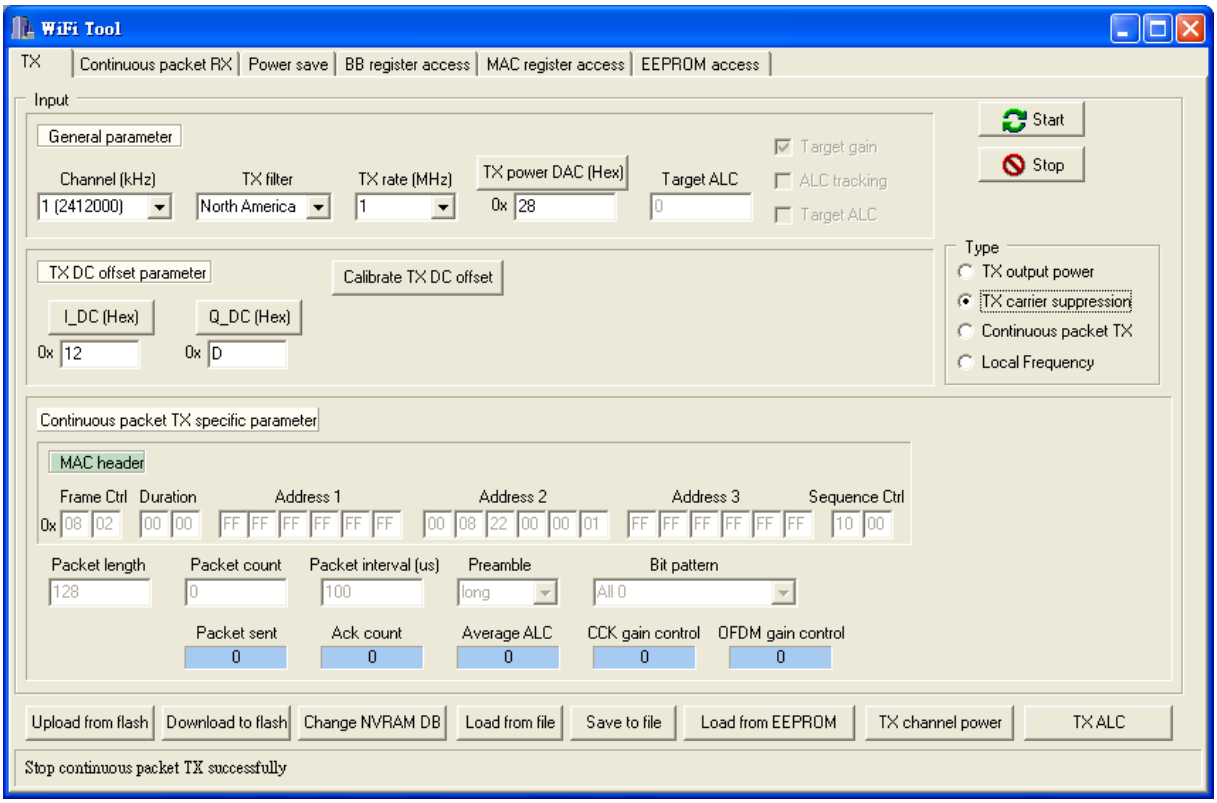

Figure 146 ***Click [Start] button to start TX carrier suppression testing***

After clicking [Stop] button, TX carrier suppression test is stop and the [Start] button will be enabled.

3.3.4 Local Frequency

This operation is used for local frequency test. User can use spectrum analyzer to measure frequency error. Power Amplifier is turned on in this operation. User can input channel, TX filter, TX rate, TX power DAC and then click [Start] button to do local frequency test. WiFi module will start to transmit RF signal with the parameters set by user after MS get the command from META. RF engineer can measure the transmitted signal characteristic of local frequency by Litepoint IQView or other WiFi measurement instrument.

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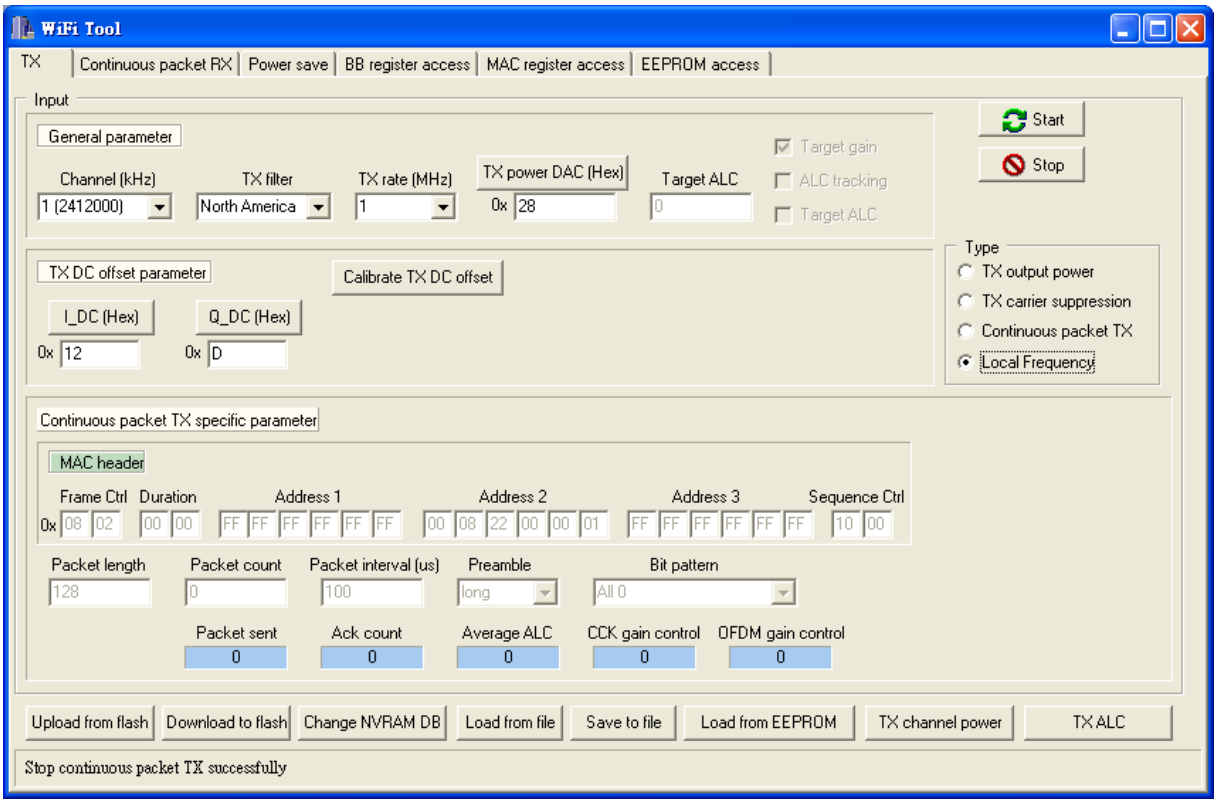

Figure 147 ***Click [Start] button to start local frequency testing***

After clicking [Stop] button, local frequency test is stop and the [Start] button will be enabled.

3.3.5 Continuous Packet RX

Continue packet RX is used for observing RX success, hardware CRC error, packet count from PAU MCR_PPCR, and software CRC error. User can channel ID and RX antenna type and then click [Start] button to do continuous packet RX testing. When user wants to stop continuous packet RX testing, he can click [Stop] button.

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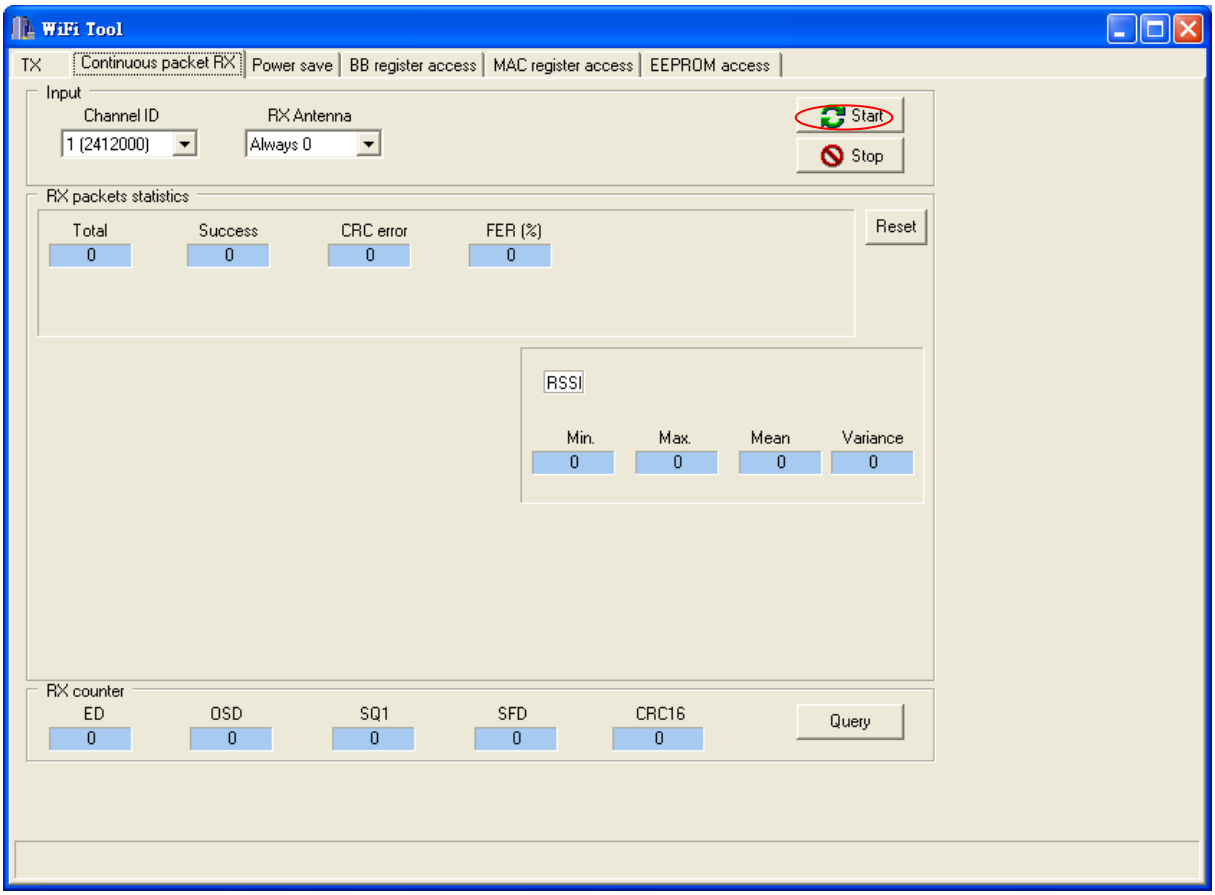

Figure 148 ***Click [Start] button to start continuous packet RX testing***

After clicking [Stop] button, continuous RX test is stop and the [Start] button will be enabled.

The meaning of RX packets statistics is as follows:

- Total StaticText indicates total received packet number.
- Success StaticText indicates total success received packet number.
- CRC error StaticText indicates CRC error packet number.
- FER StaticText indicates percentage of frame error rate.

User can click [Reset] button to reset all RX packets statistics to 0.

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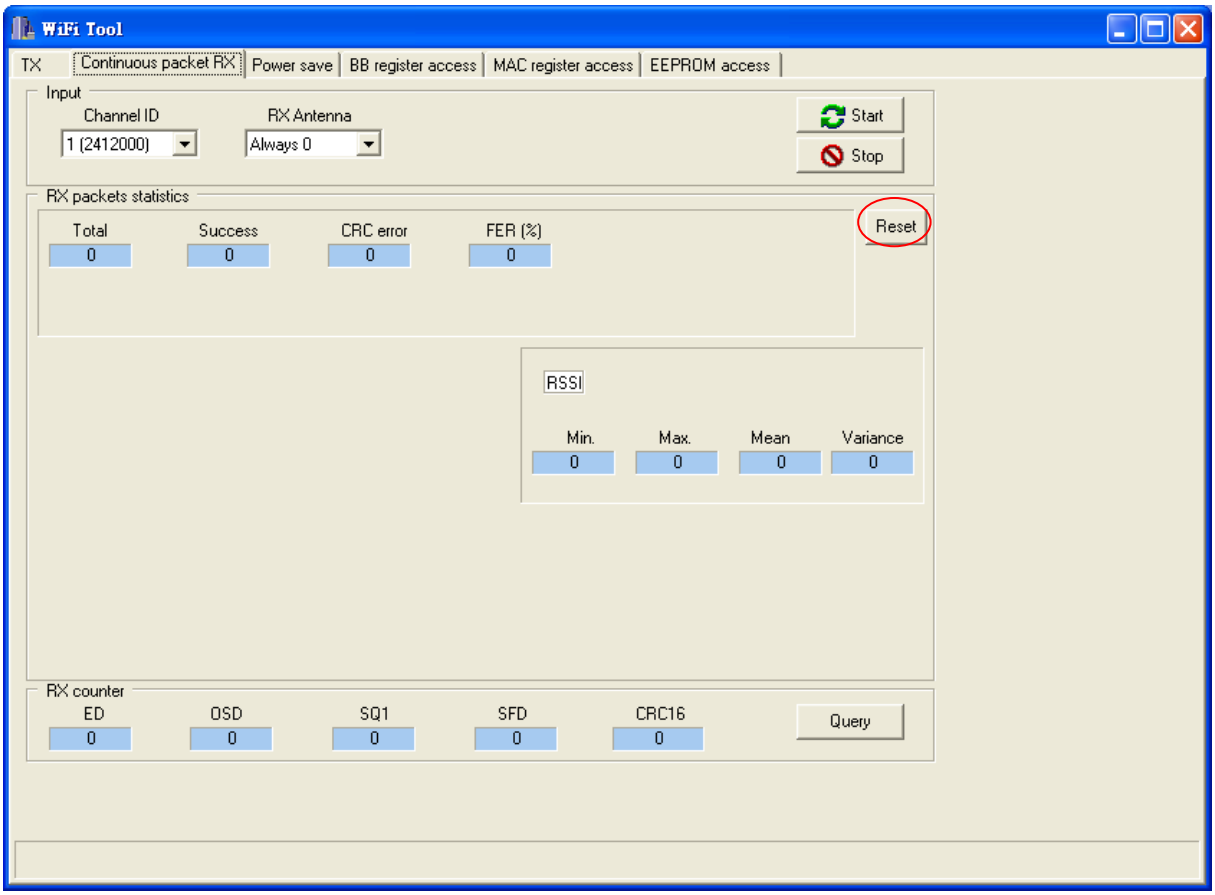

Figure 149 ***Click [Reset] button to reset all RX packets statistics to 0***

User can click [Query] button to query RX counter status. Please refer to WiFi baseband chip datasheet for meaning of these counters.

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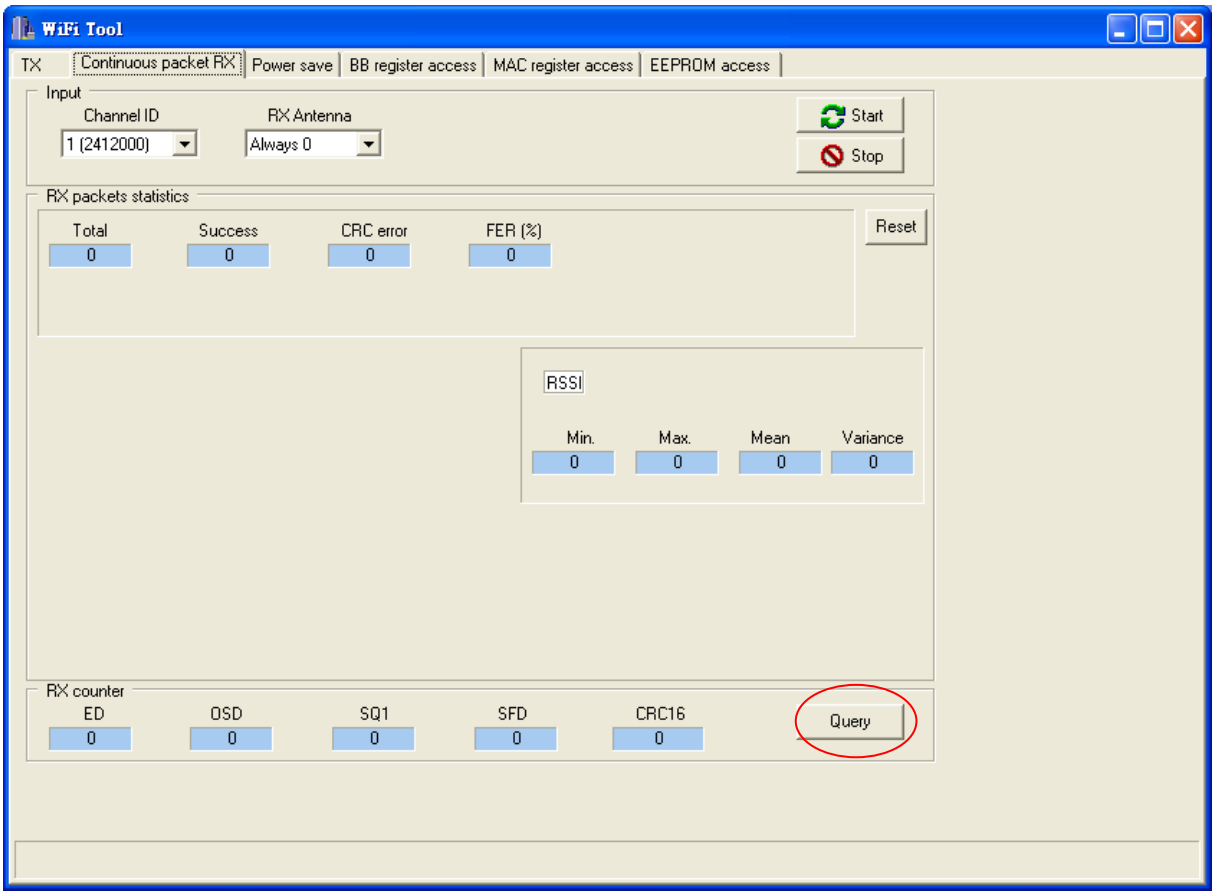

Figure 150 ***Click [Query] button to query RX counter status***

3.3.6 Power Save

This operation is used for power management operation test. User can select power save mode and then click [Start] button to do power saving test. WiFi module support two power saving mode, they are idle mode and sleep mode.

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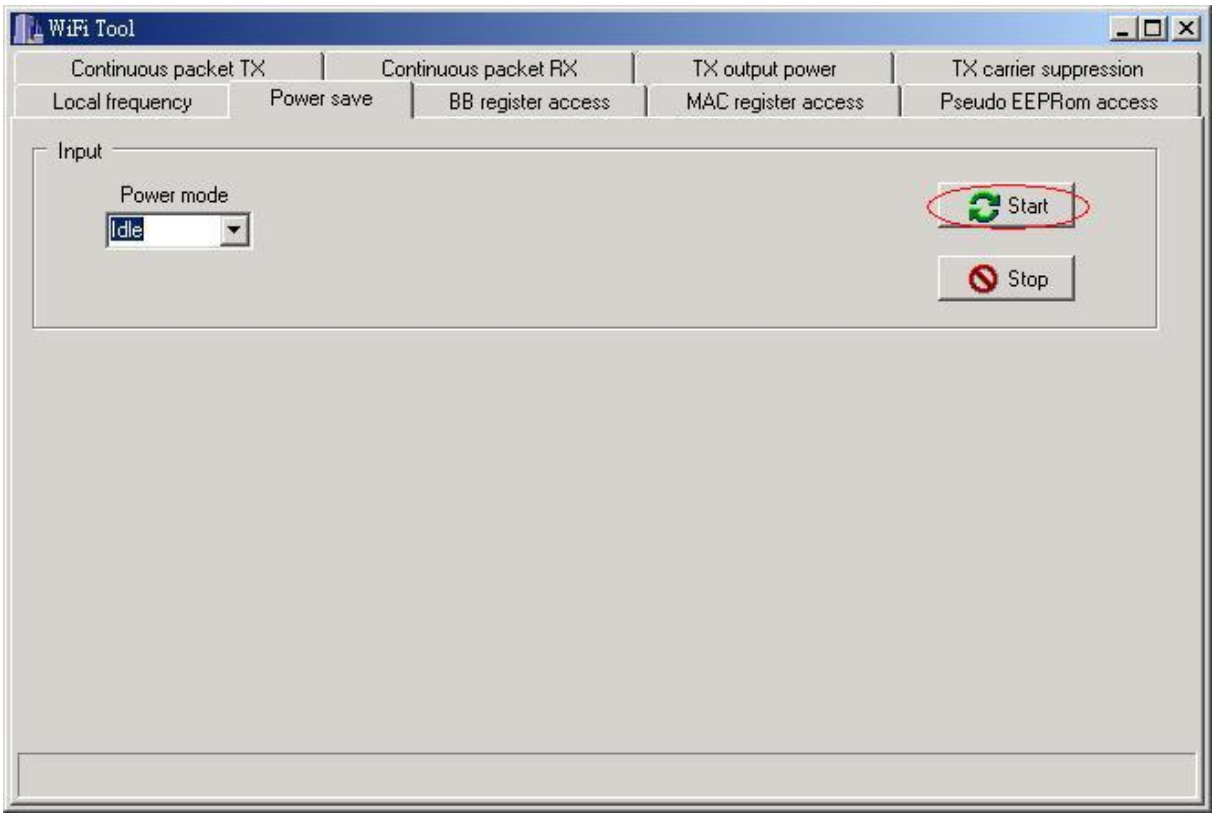

Figure 151 ***Click [Start] button to start power saving testing***

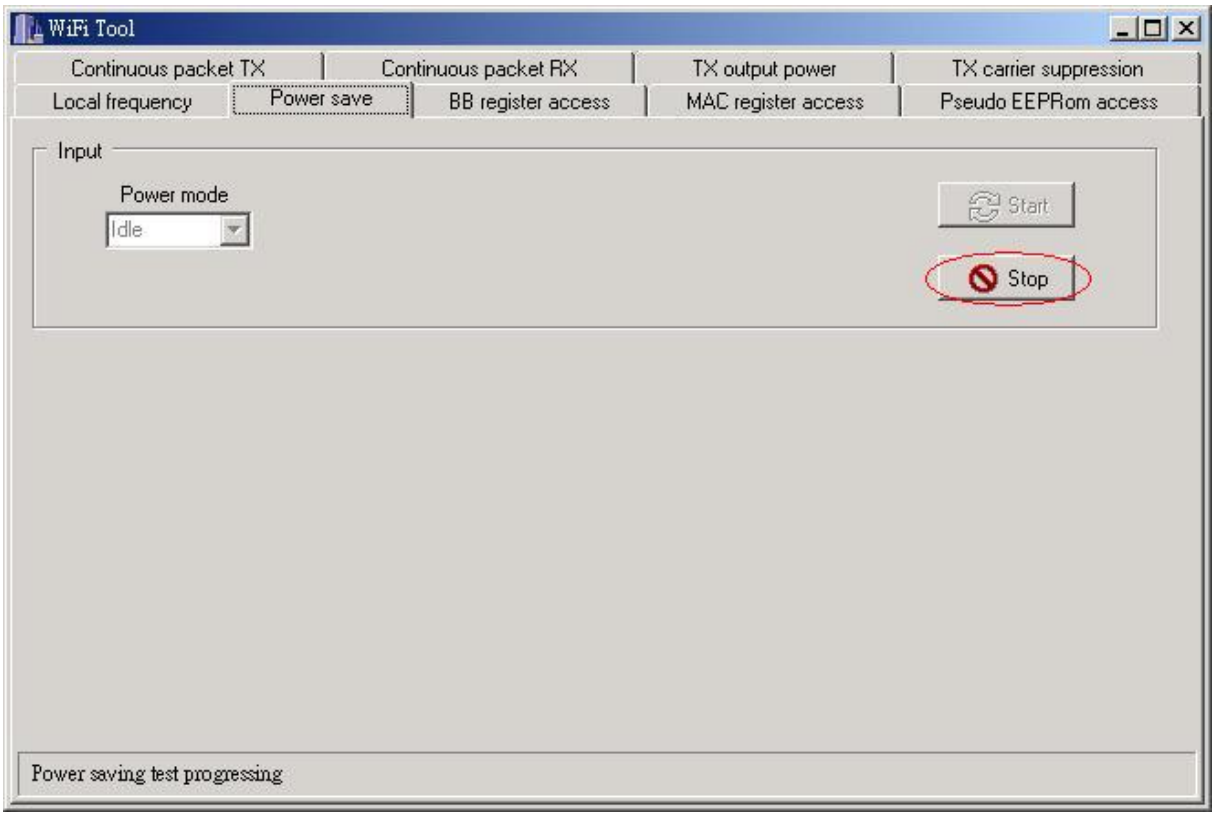

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Figure 152 ***Click [Stop] button to stop power saving testing***

After clicking [Stop] button, the [Start] button will be enabled.

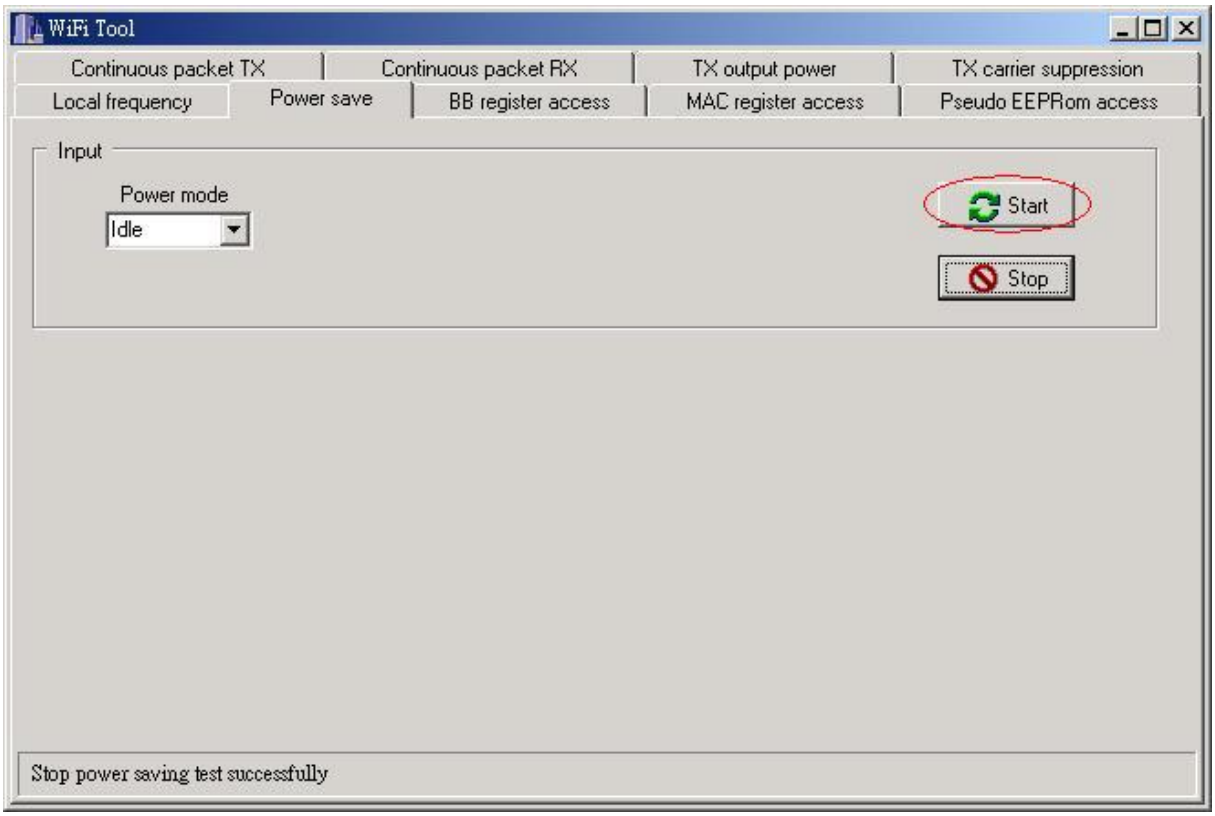

Figure 153 ***The [Start] button will be enabledThis operation is used to read or write the register of WiFi baseband chip.***

3.3.7 BB Register Access

User can read register by following steps:

1) Input address of register by Dec base.
2) Click [Read] button.
3) Register value is shown on CR Data filed.
4) User can click [CR Data (Hex)] button to toggle the value base (Hex or Dec).

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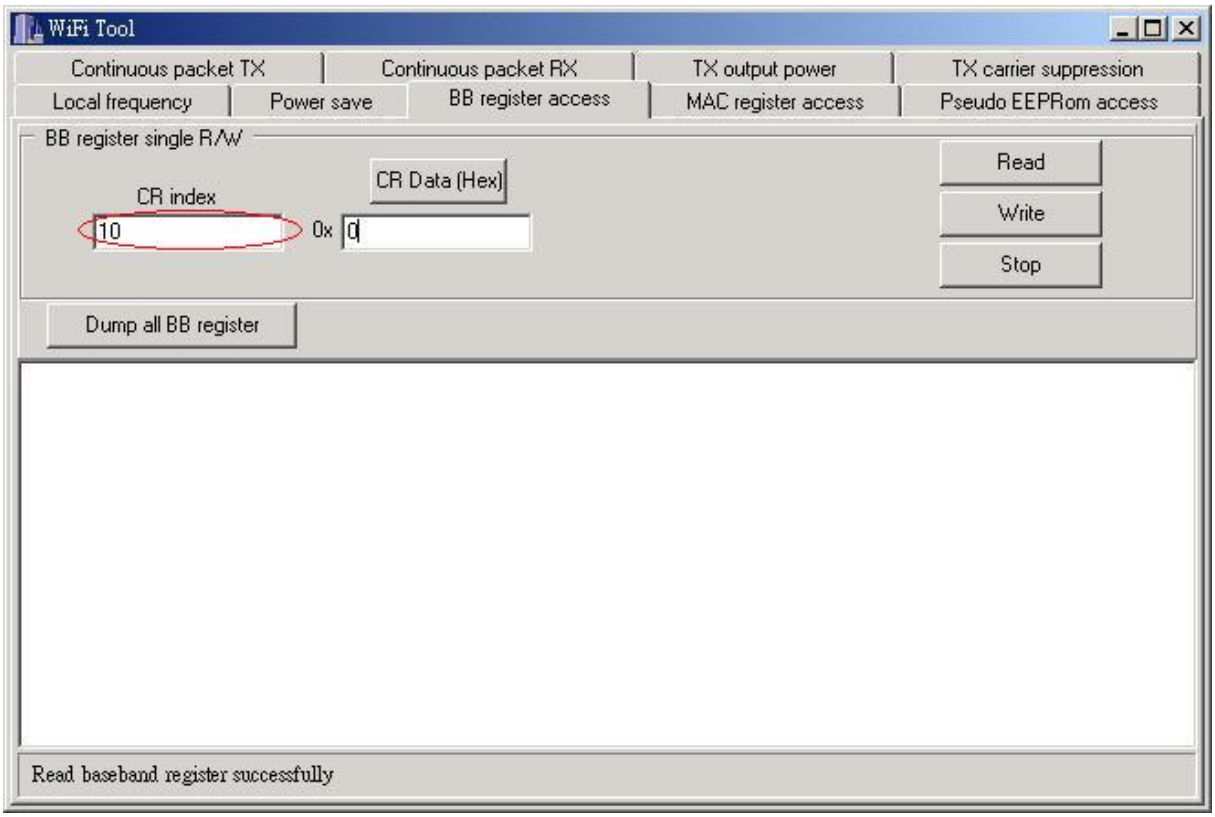

Figure 154 ***Input address of register by Dec base***

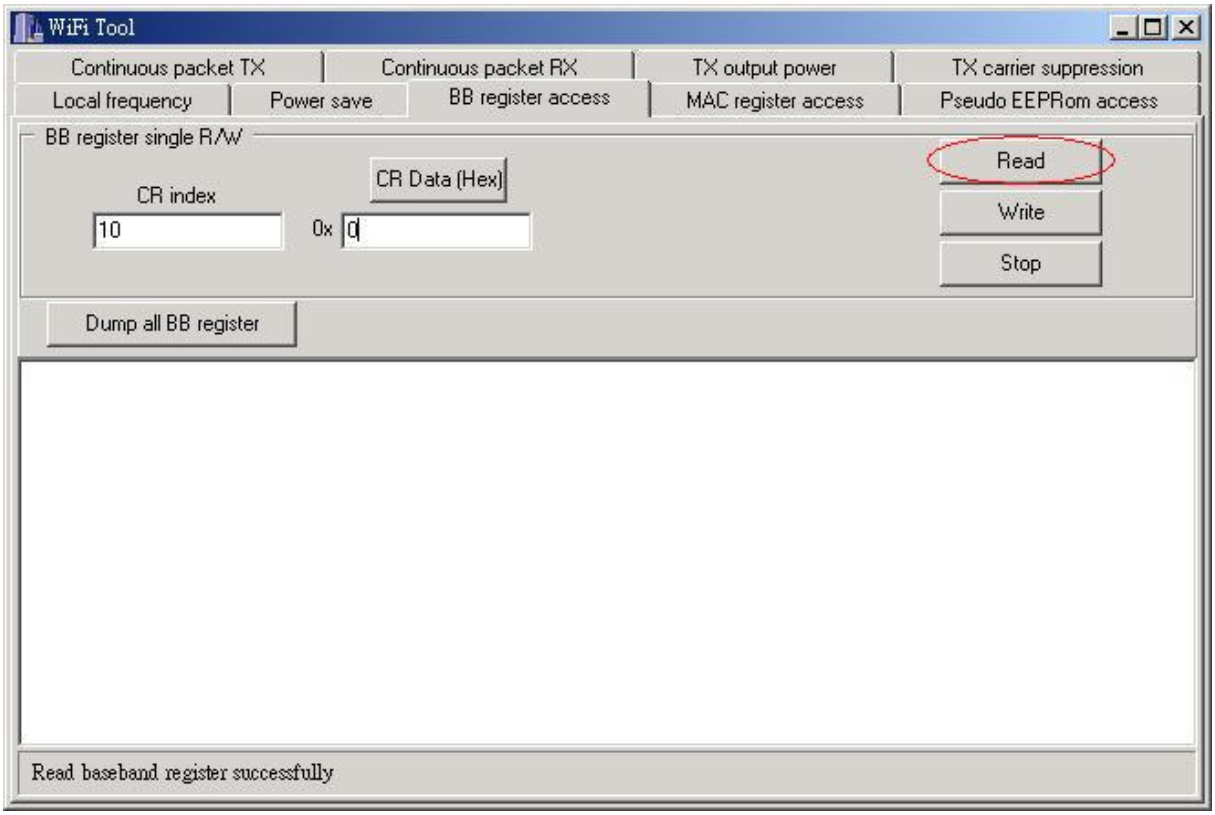

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Figure 155 ***Click [Read] button***

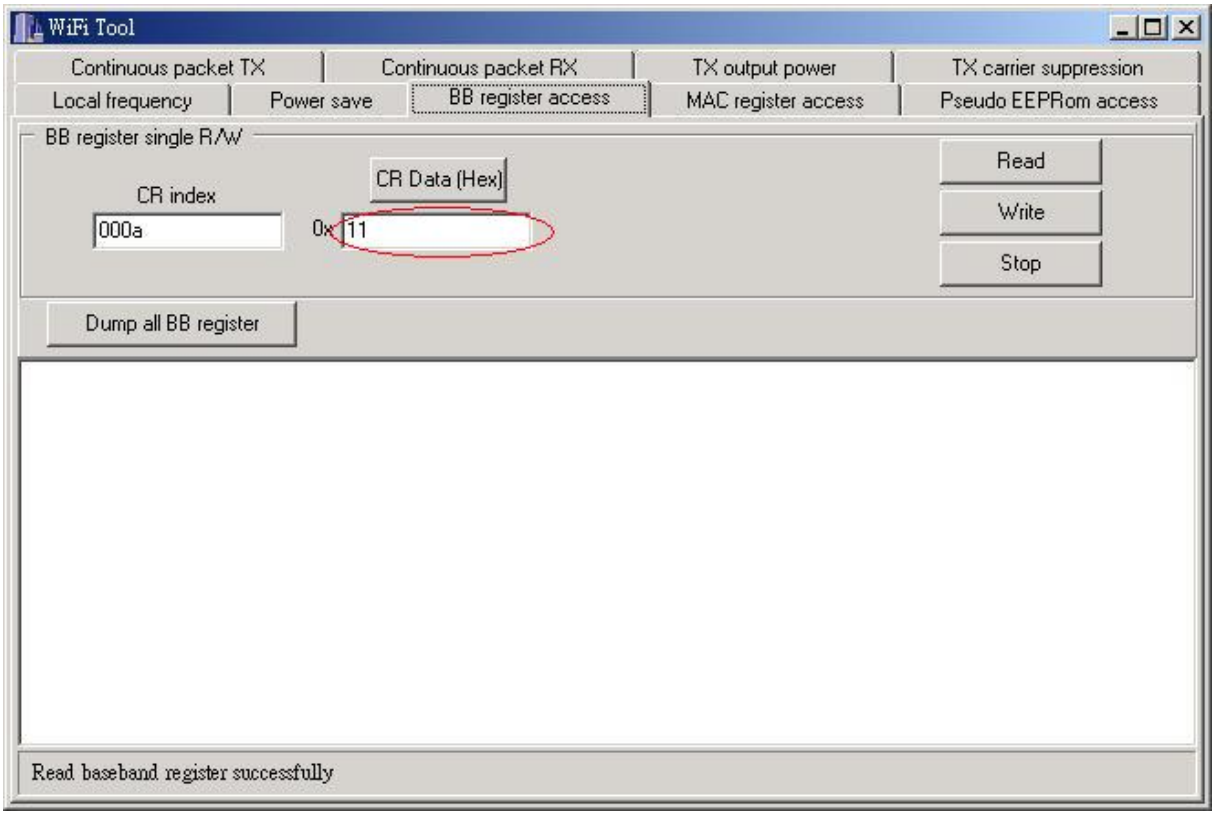

Figure 156 ***BB register result***

User can write register by following steps:

1) Input address of register by Dec base.

2) Input value in the CR data field (User can click [CR Data (Hex)] button to toggle the value base (Hex or Dec)).

3) Click [write] button.

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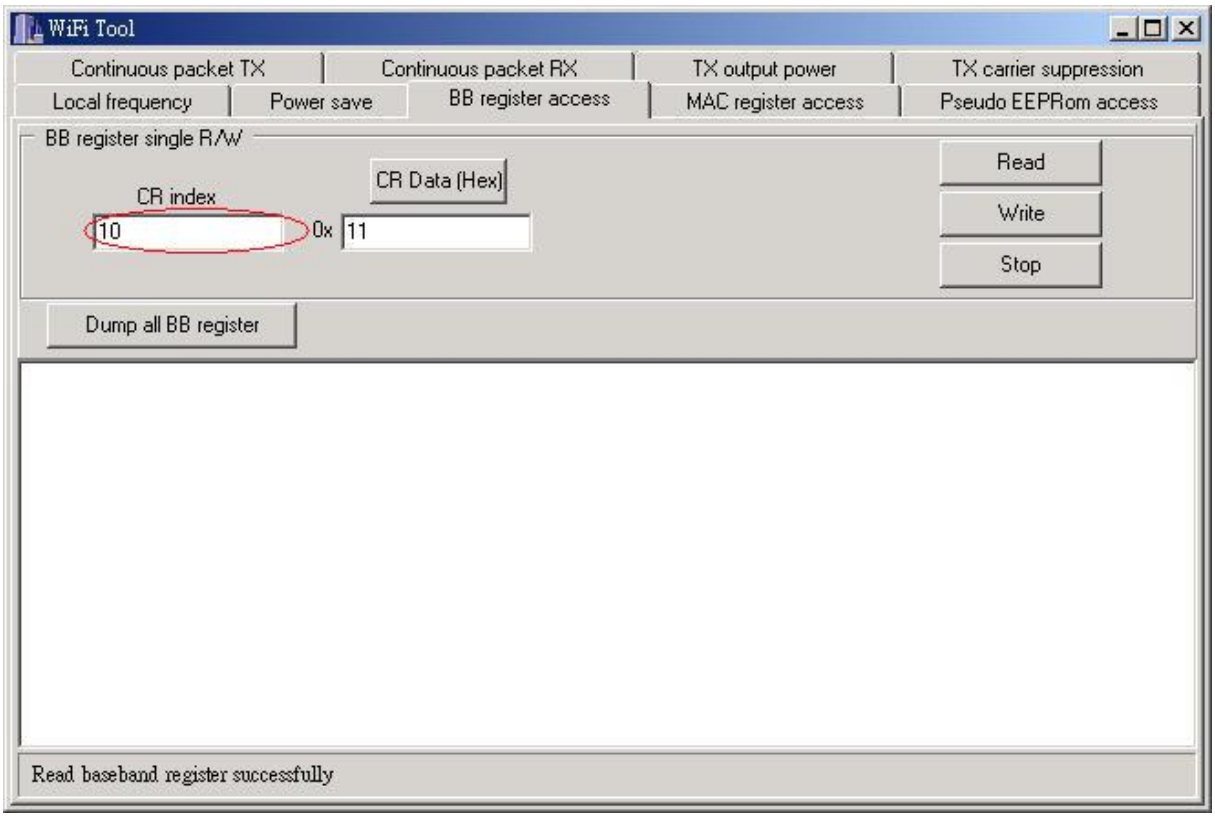

Figure 157 ***Input address of register by Dec base***

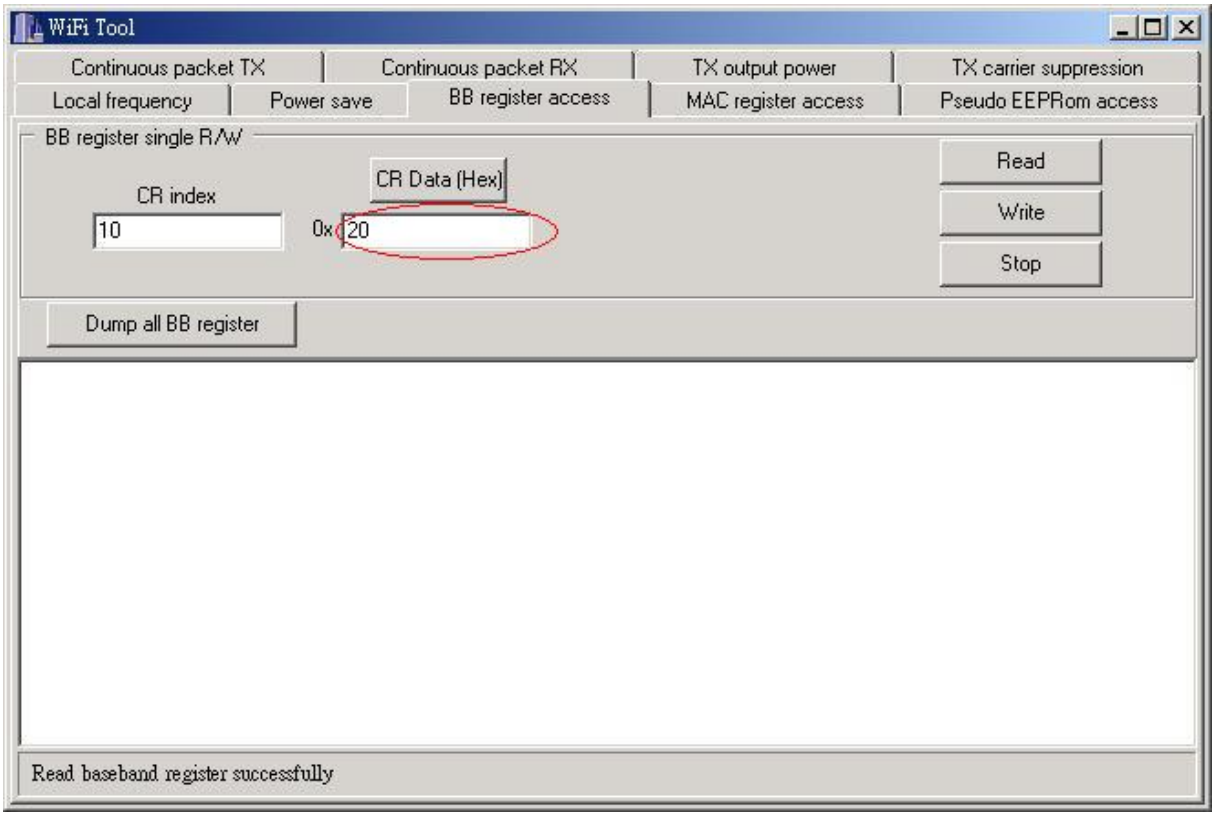

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Figure 158 ***Input value***

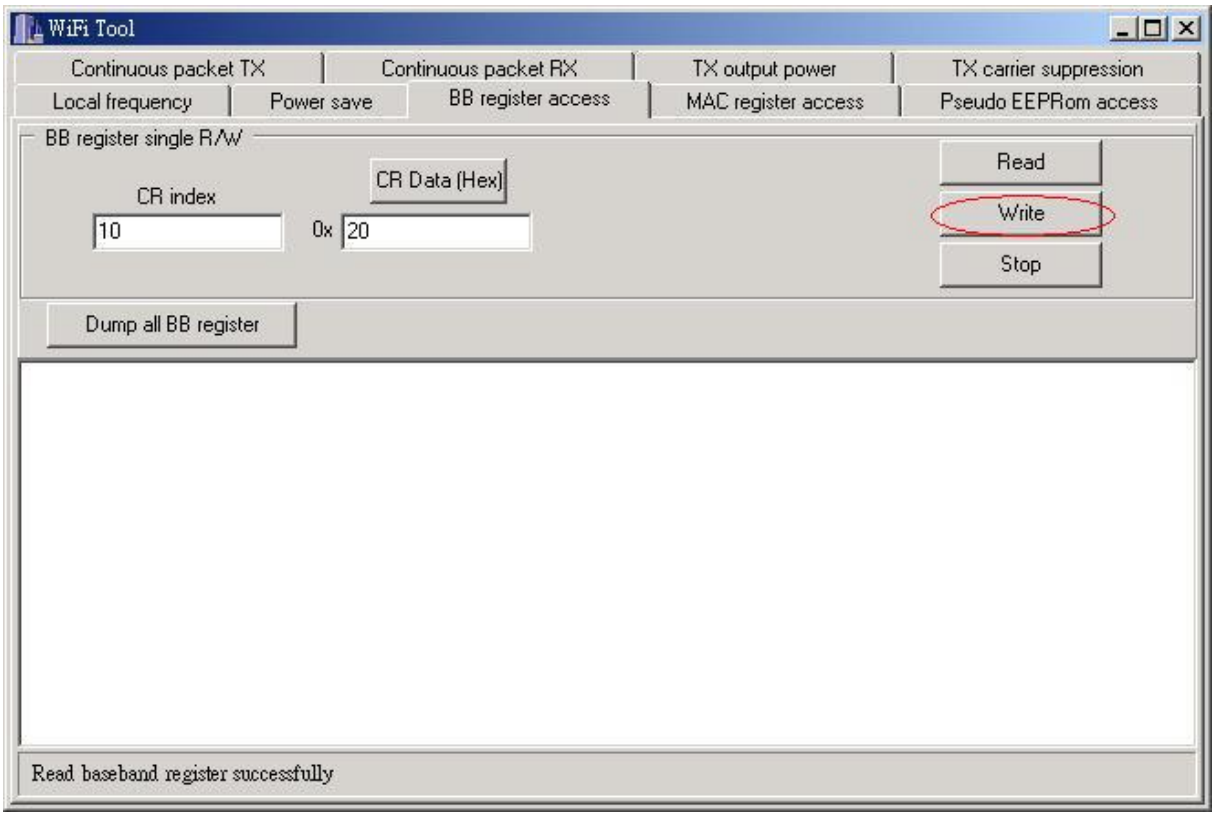

Figure 159 ***Click [Write] button***

User can click [Dump all BB register] button to list all BB register value.

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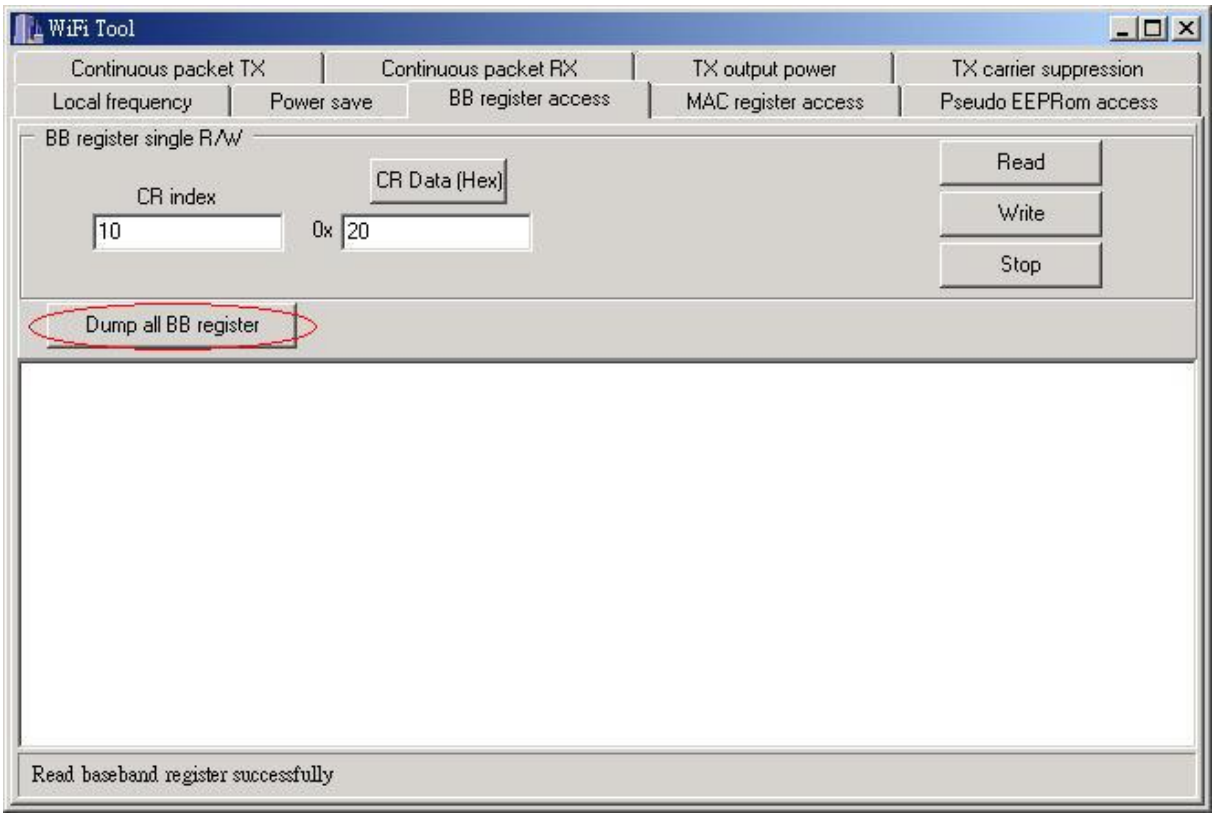

Figure 160 ***Click [Dump all BB register] button***

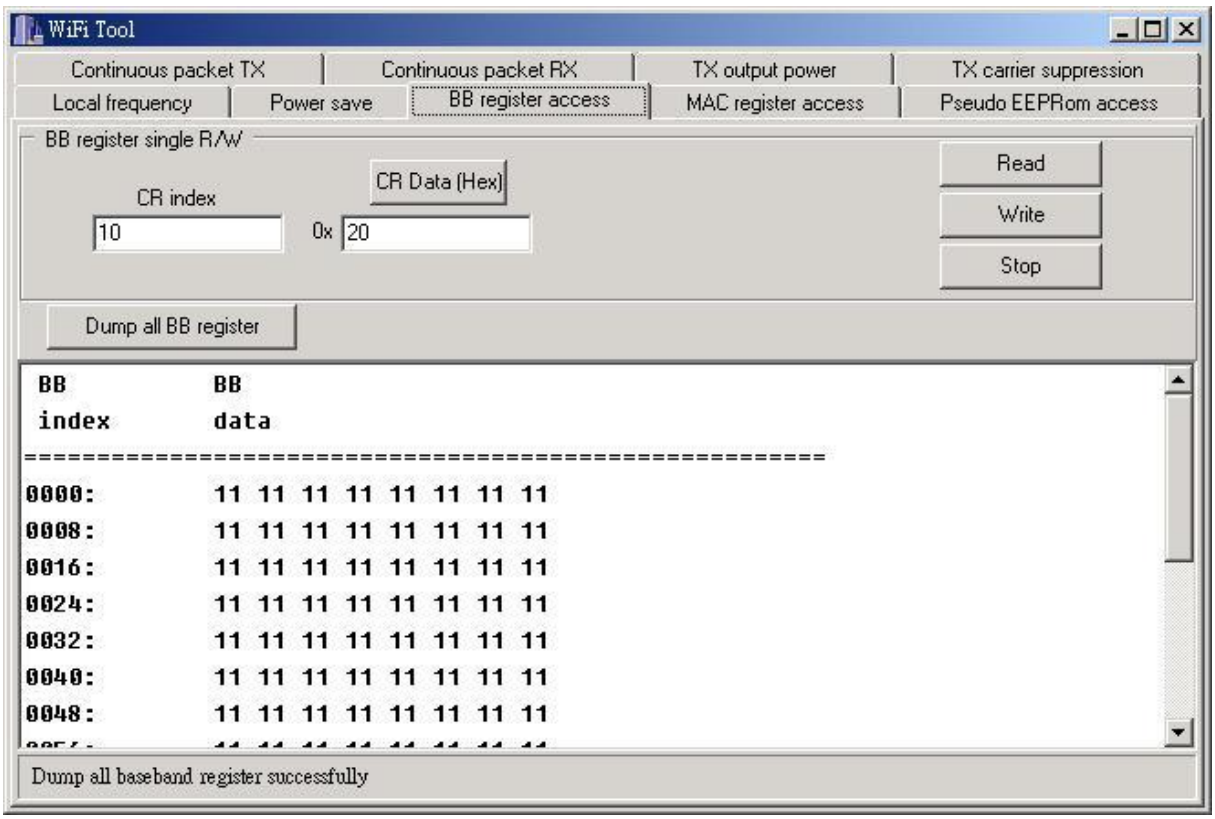

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Figure 161 ***Dumping all BB register result***

3.3.8 MAC Register Access

User can read register by following steps:

1) Input address of register by Hex base.
2) Click [Read] button.
3) Register value is shown on MCR Data filed.
4) User can click [MCR Data (Hex)] button to toggle the value base (Hex or Dec).

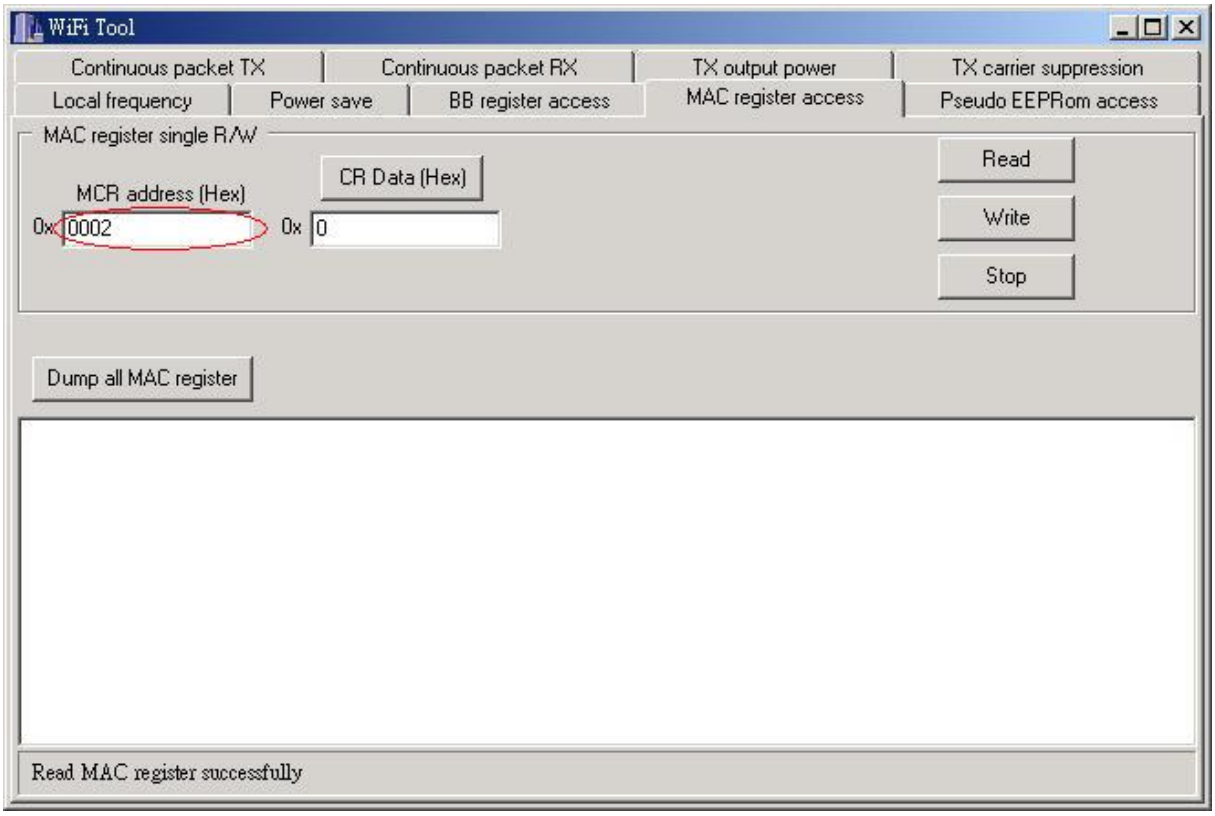

Figure 162 ***Input address of register by Hex base***

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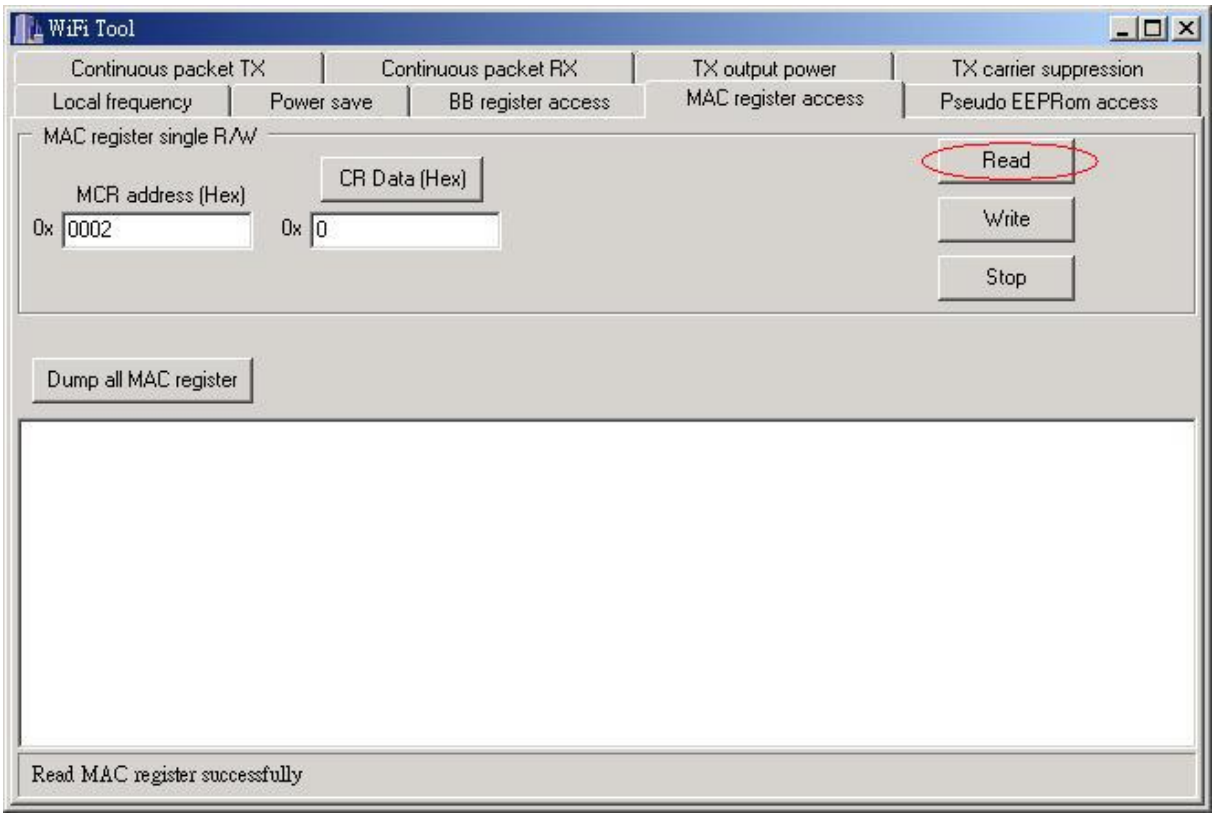

Figure 163 ***Click [Read] button***

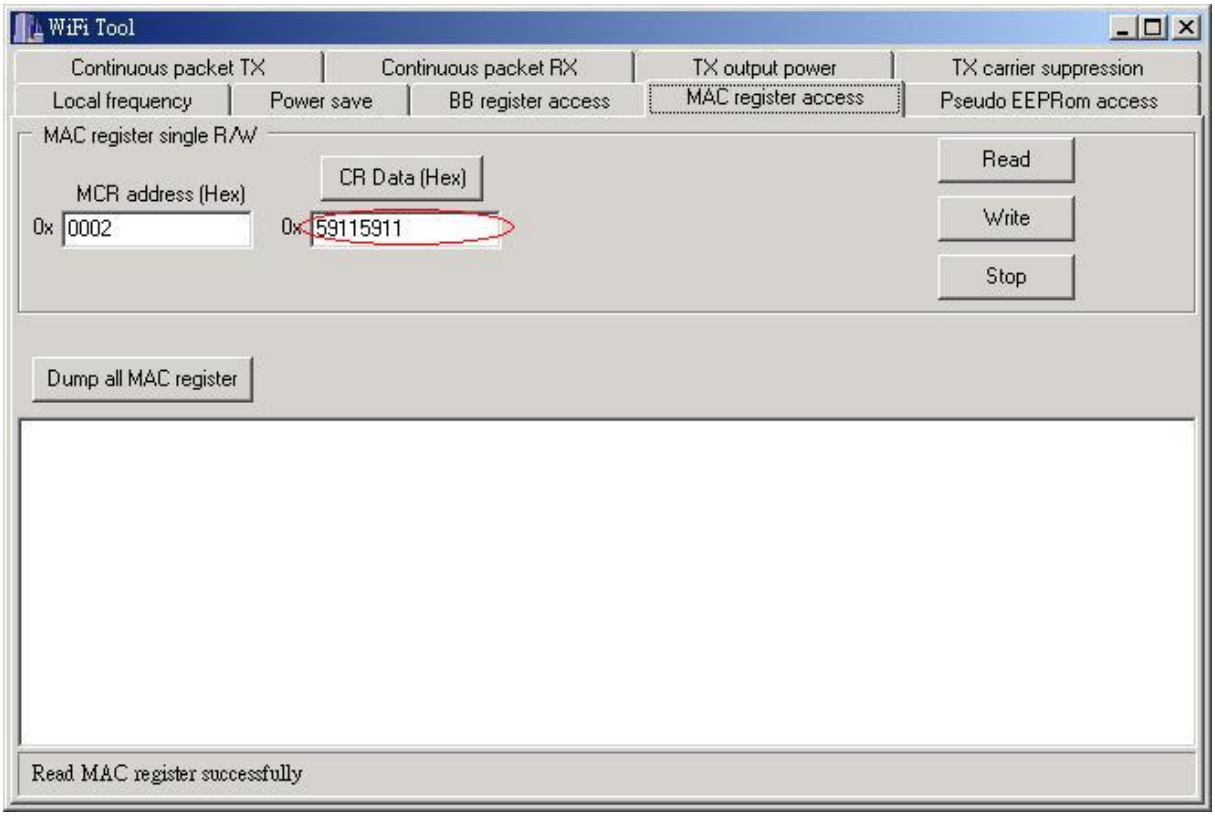

Figure 164 ***MAC register result***

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User can write register by following steps:
1) Input address of register by Hex base.
2) Input value in the CR data field (User can click [CR Data (Hex)] button to toggle the value base (Hex or Dec)).
3)Click [write] button.

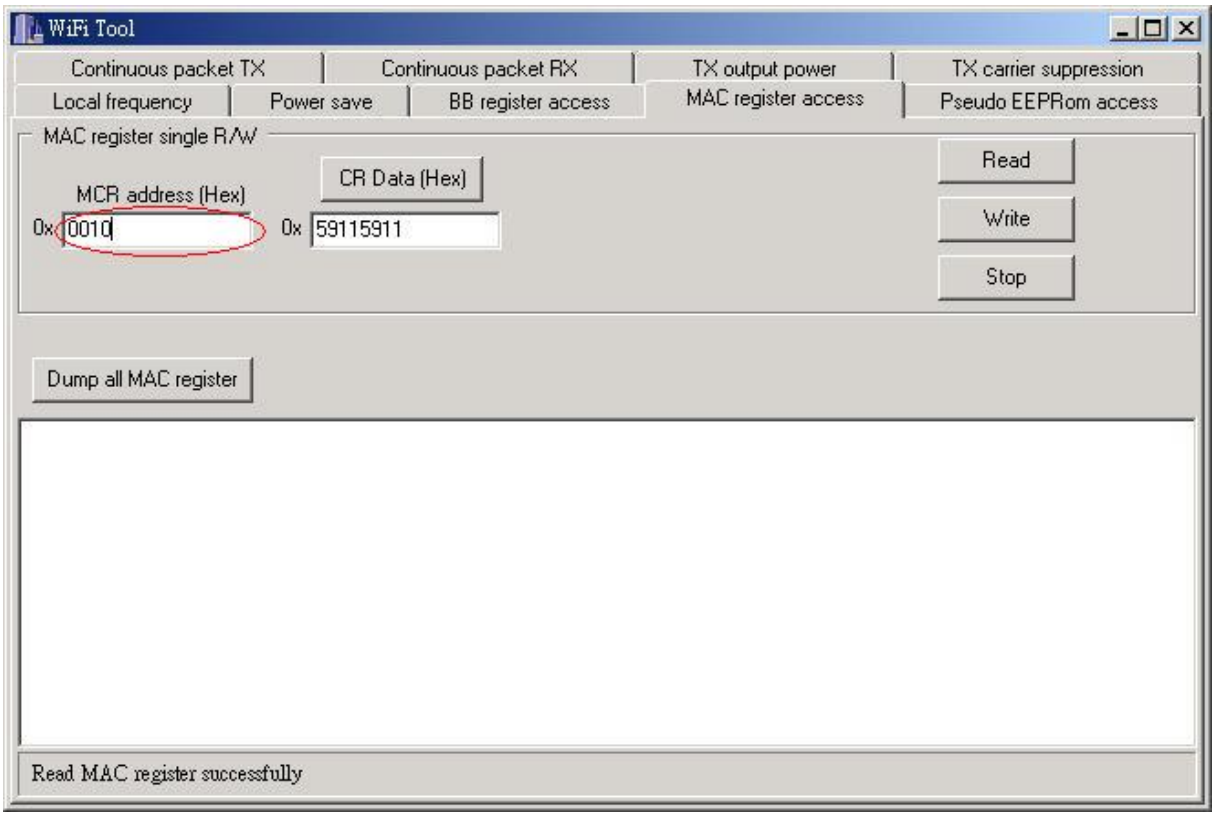

Figure 165 ***Input address of register by Hex base***

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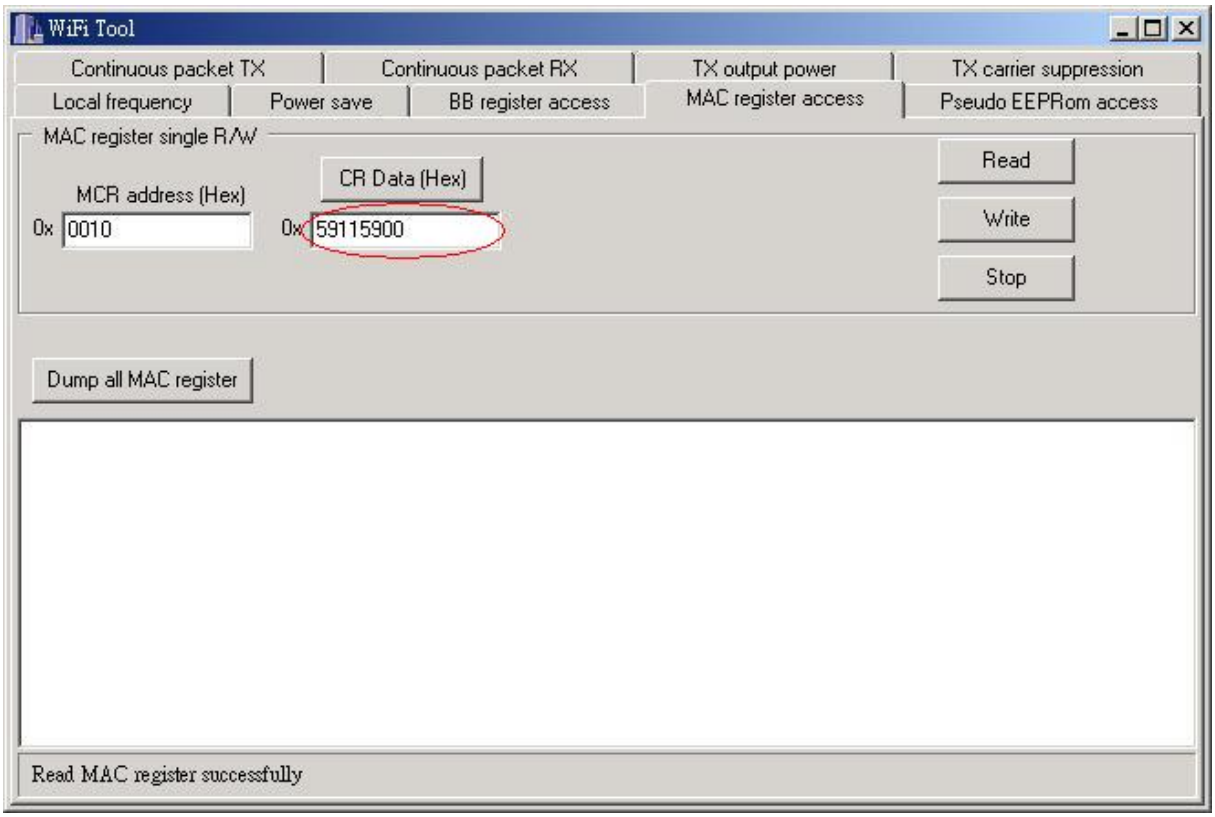

Figure 166 ***Input value in the CR data field***

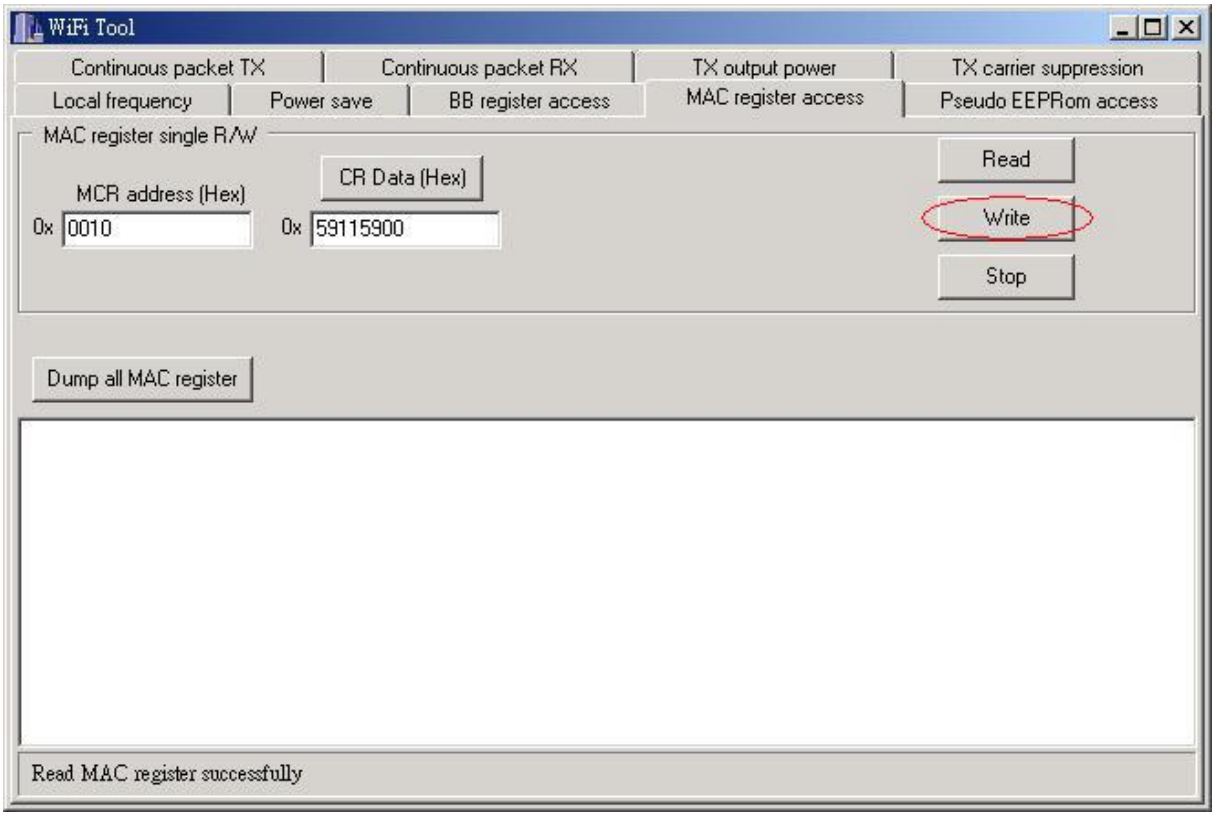

Figure 167 ***Click [Write] button***

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User can click [Dump all MAC register] button to dump all MAC register value.

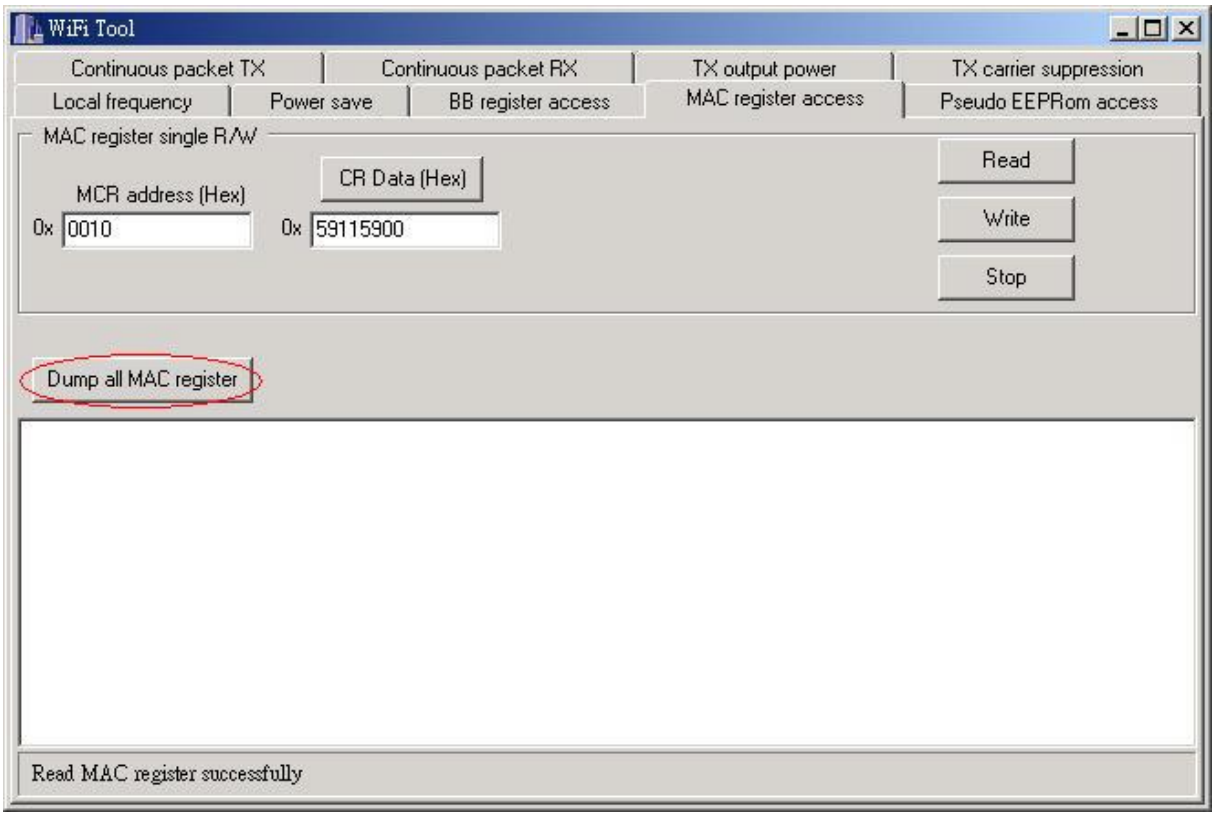

Figure 168 ***Click [Dump all MAC register] button***

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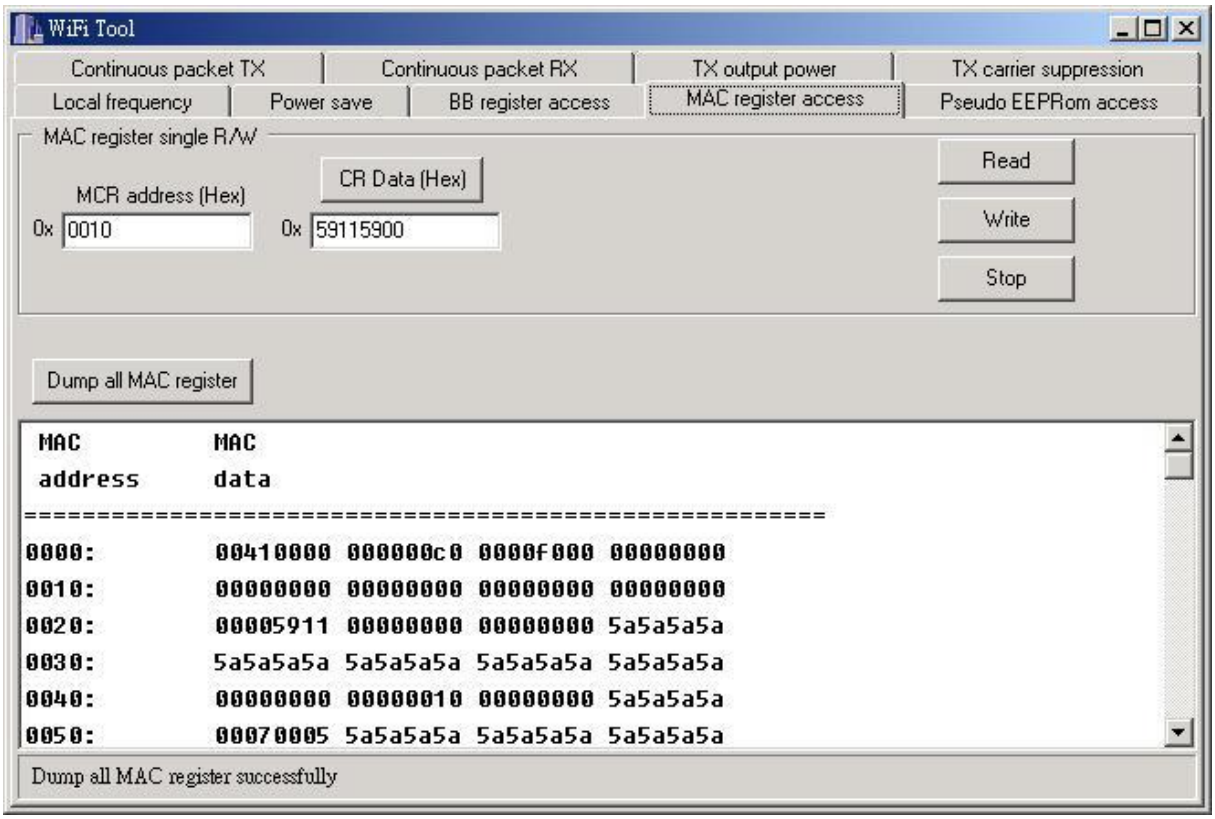

Figure 169 ***Dump all MAC register result***

3.3.9 Pseudo EEPROM Access

User can read pseudo EEPROM by following steps:

1) Input address of pseudo EEPROM by Hex base.

2) Click [Read] button.

3) Pseudo EEPROM value is shown on EEPROM data filed.

4)User can click [EEPROM data (Hex)] button to toggle the value base (Hex or Dec).

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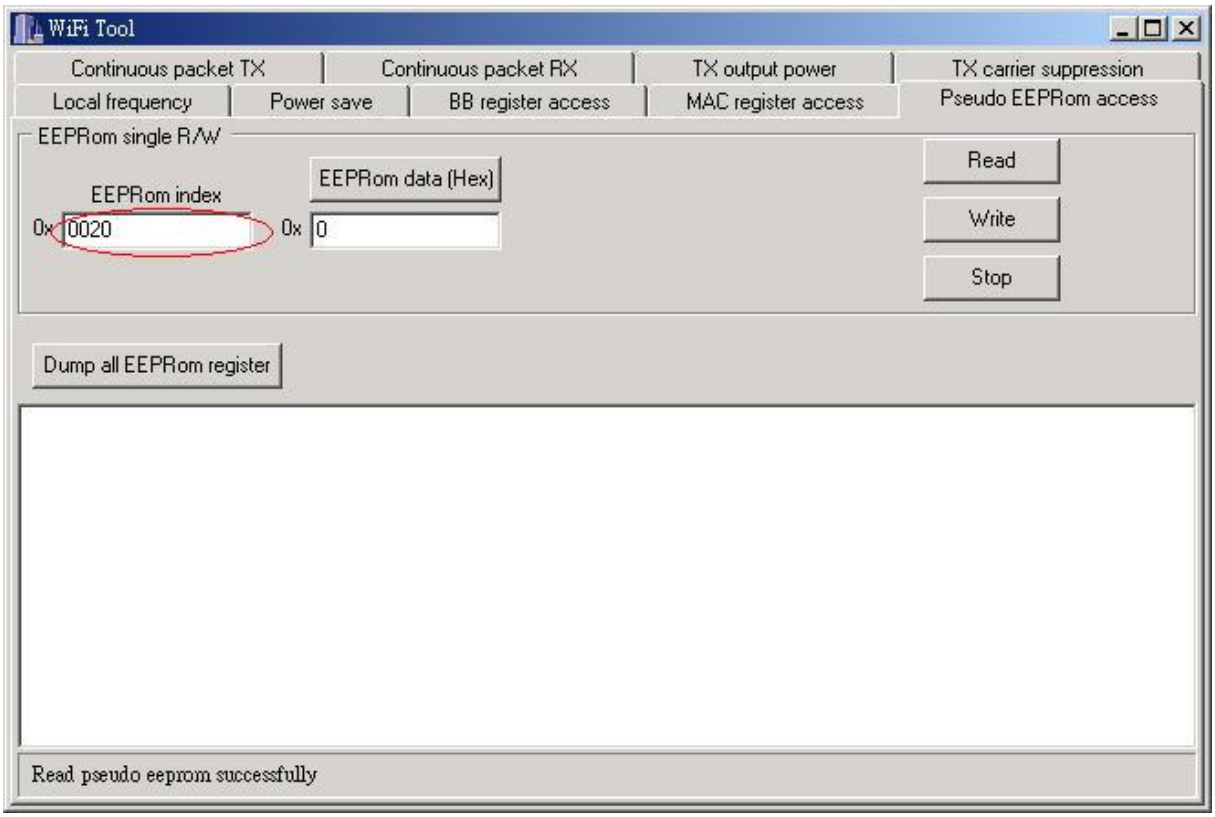

Figure 170 ***Input address of pseudo EEPROM by Hex base***

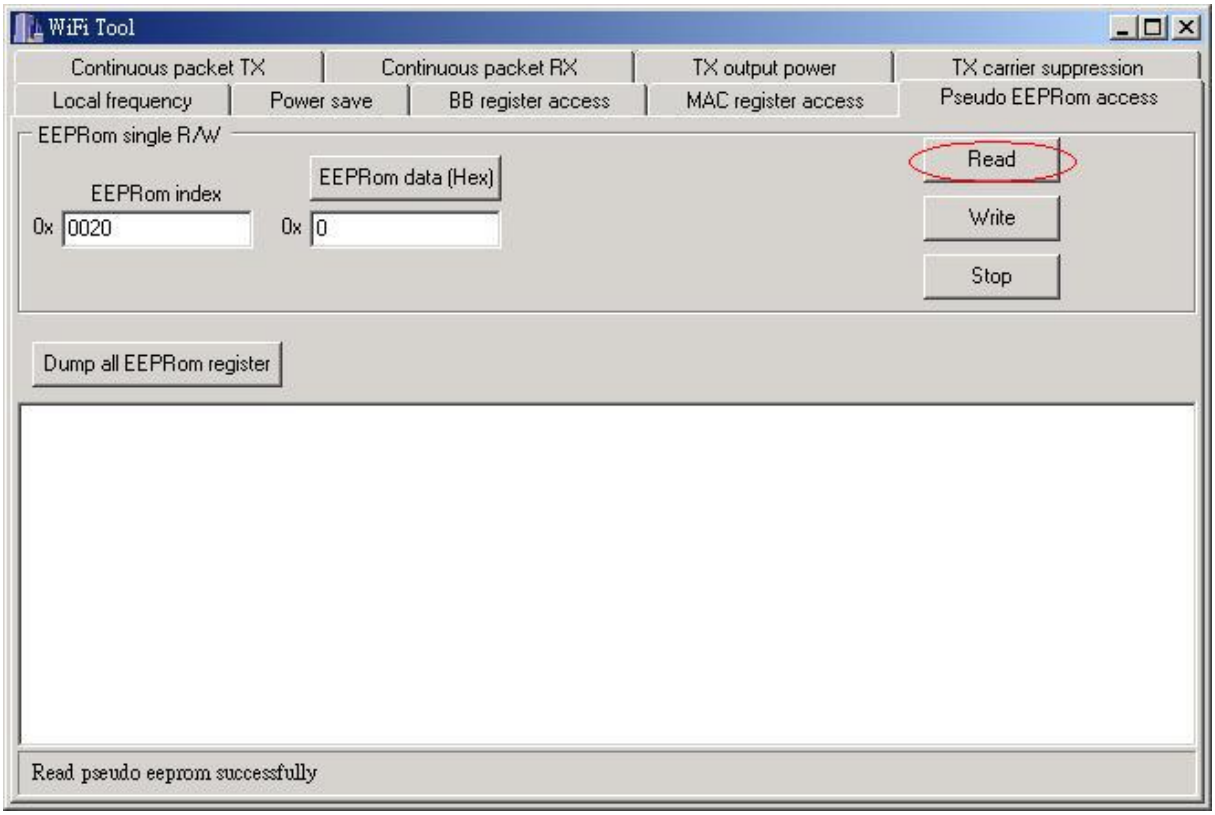

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Figure 171 ***Click [Read] button***

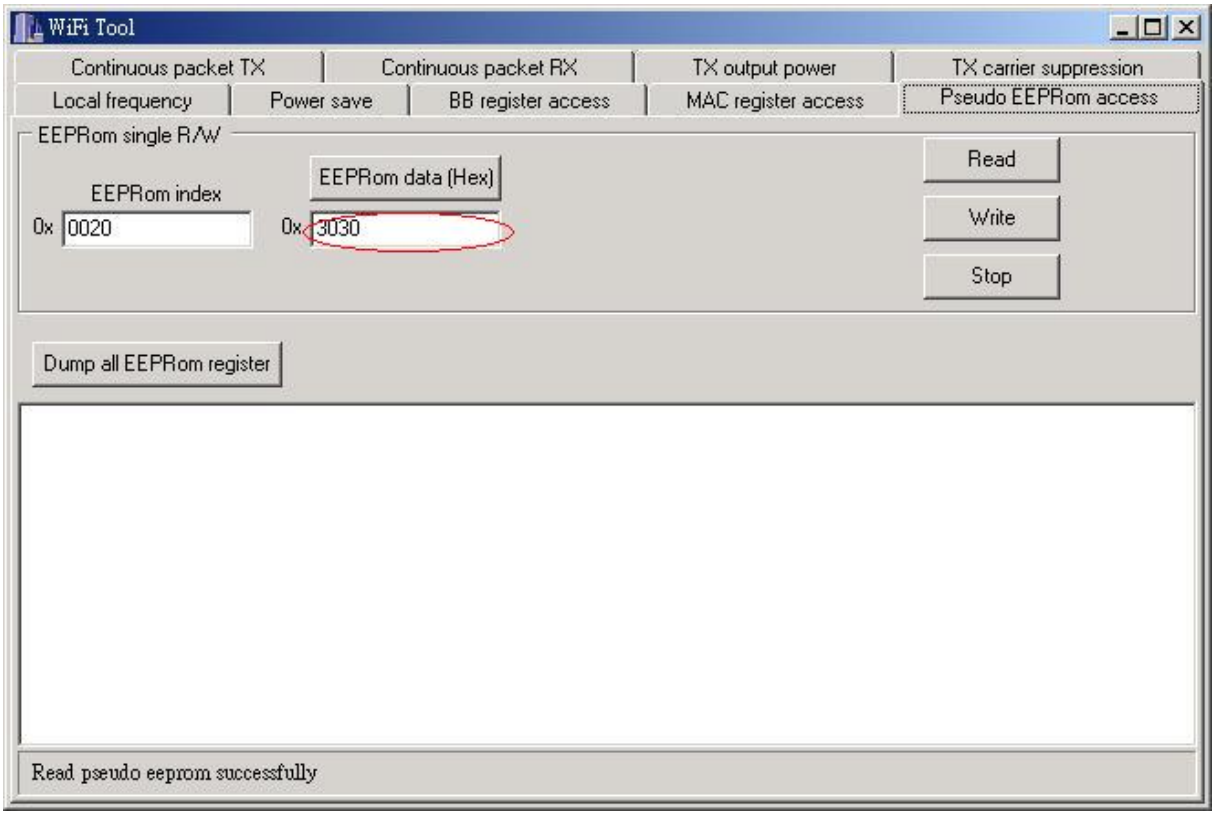

Figure 172 ***Pseudo EEPROM result***

User can write register by following steps:

1) Input address of pseudo EEPROM by Hex base.

2) Input value in the EEPROM data field (User can click [EEPROM data (Hex)] button to toggle the value base (Hex or Dec)).

3)Click [write] button.

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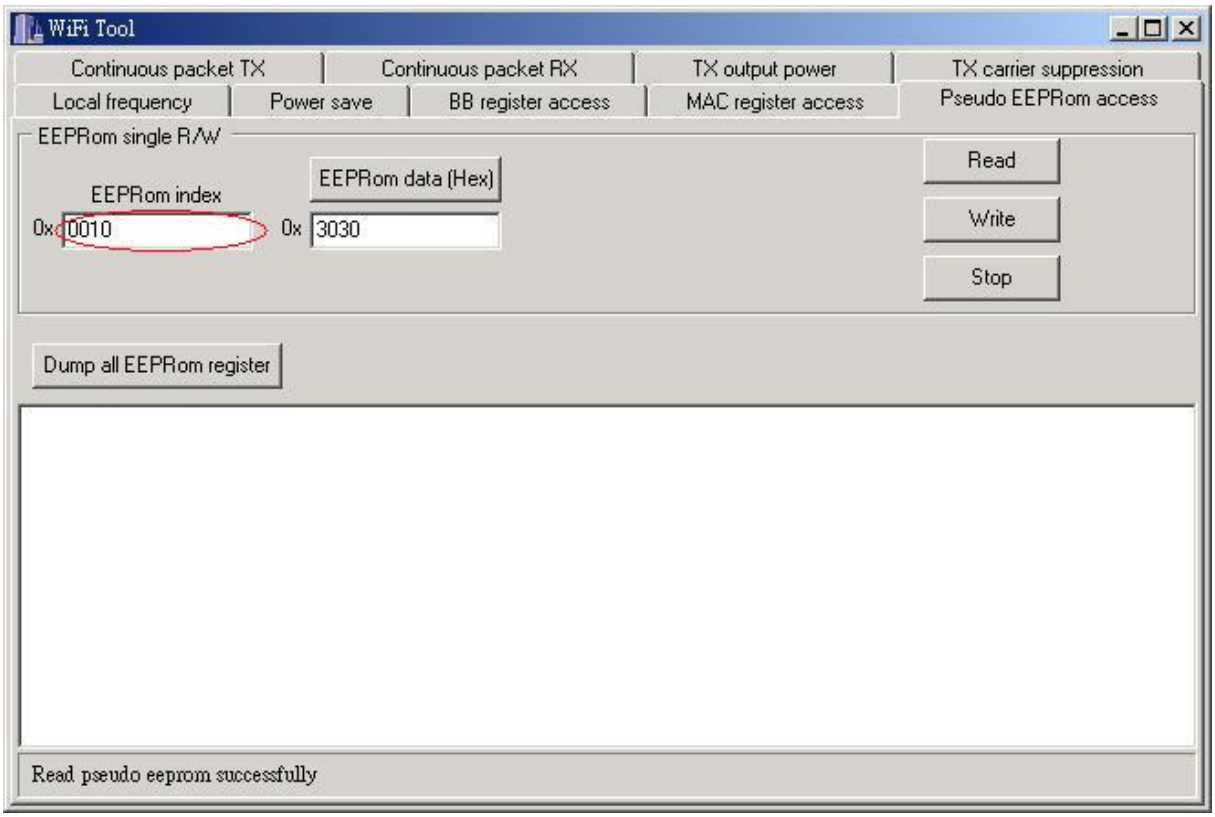

Figure 173 ***Input address of pseudo EEPROM by Hex base***

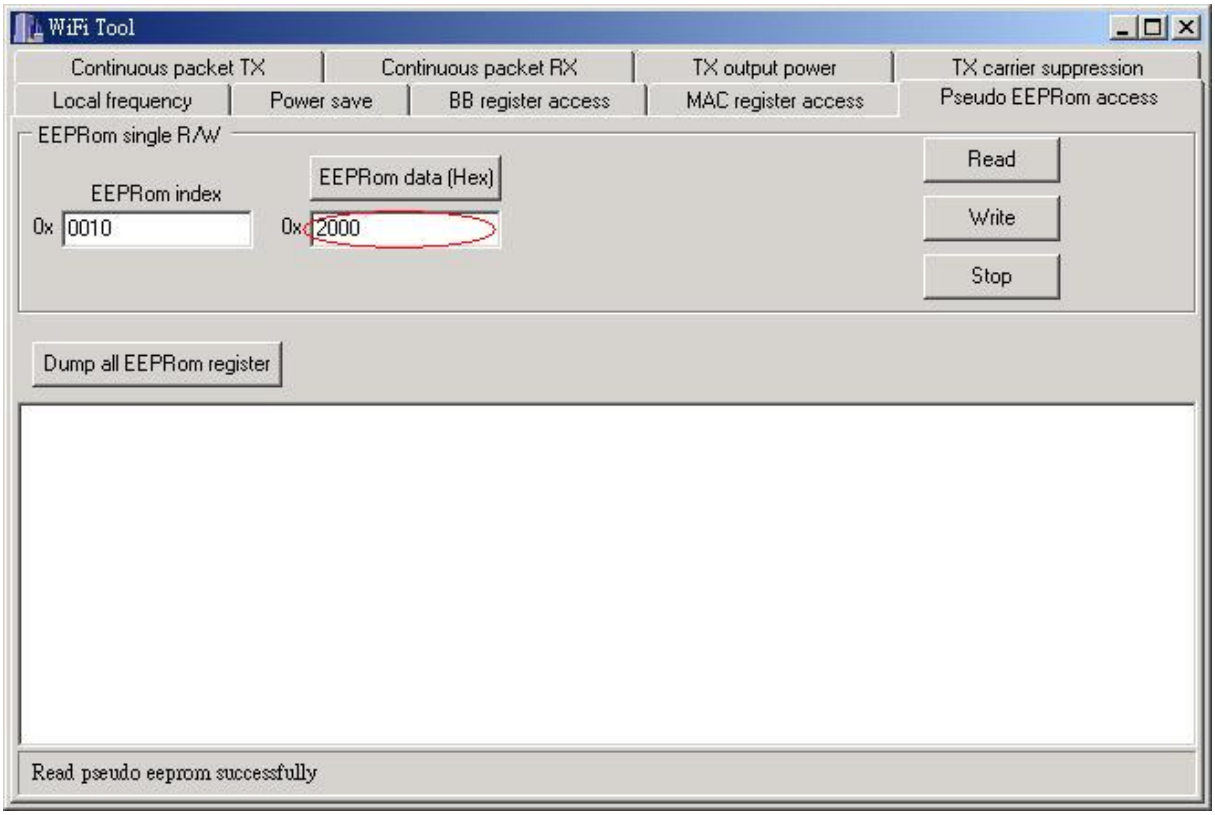

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Figure 174 ***Input value in the EEPROM data field***

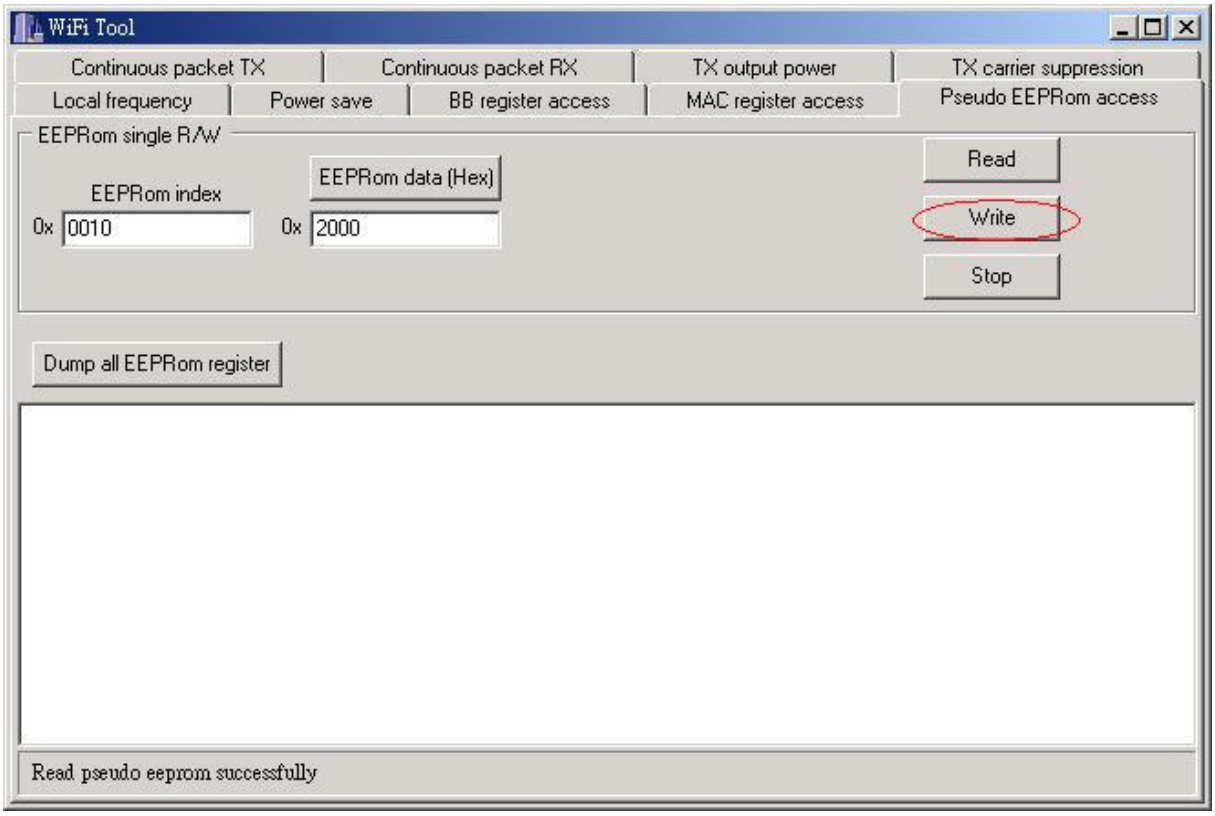

Figure 175 ***Click [Write] button***

User can click [Dump all pseudo EEPROM] button to dump all pseudo EEPROM value.

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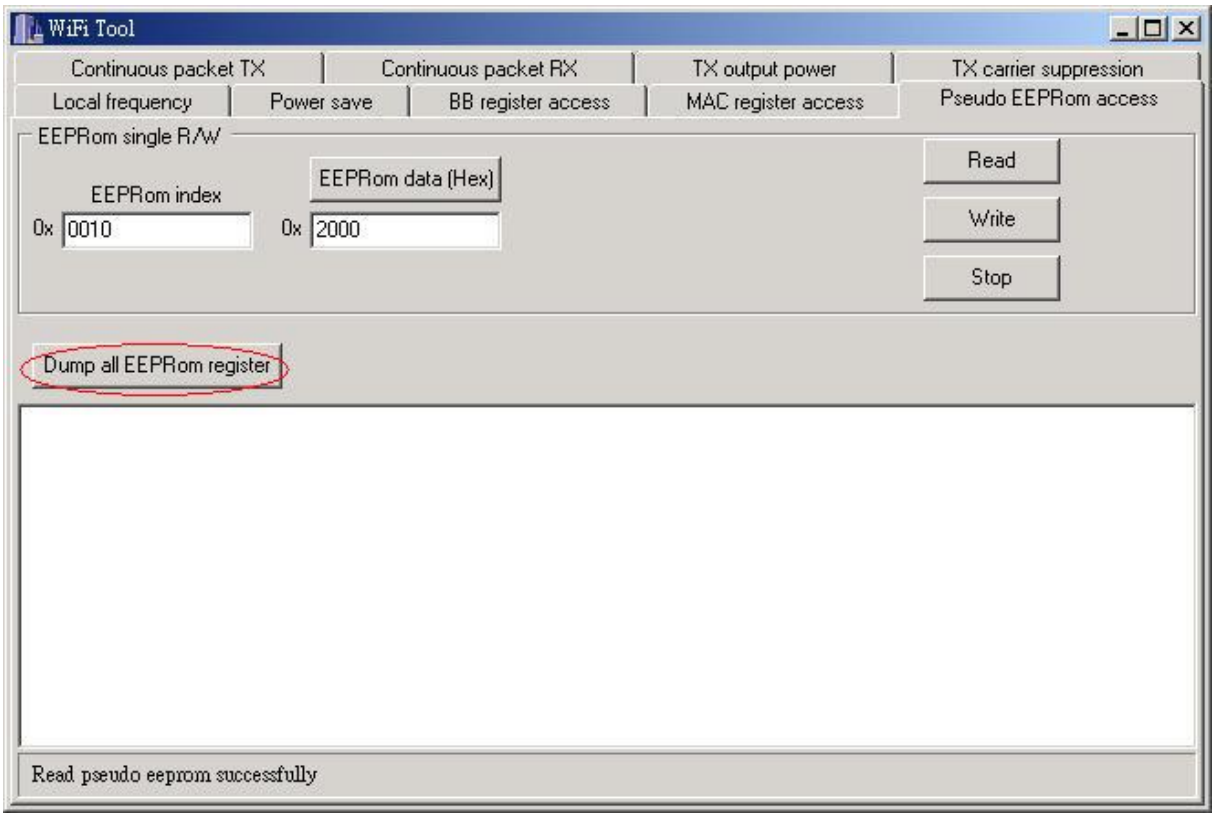

Figure 176 ***Click [Dump all EEPROM register] button***

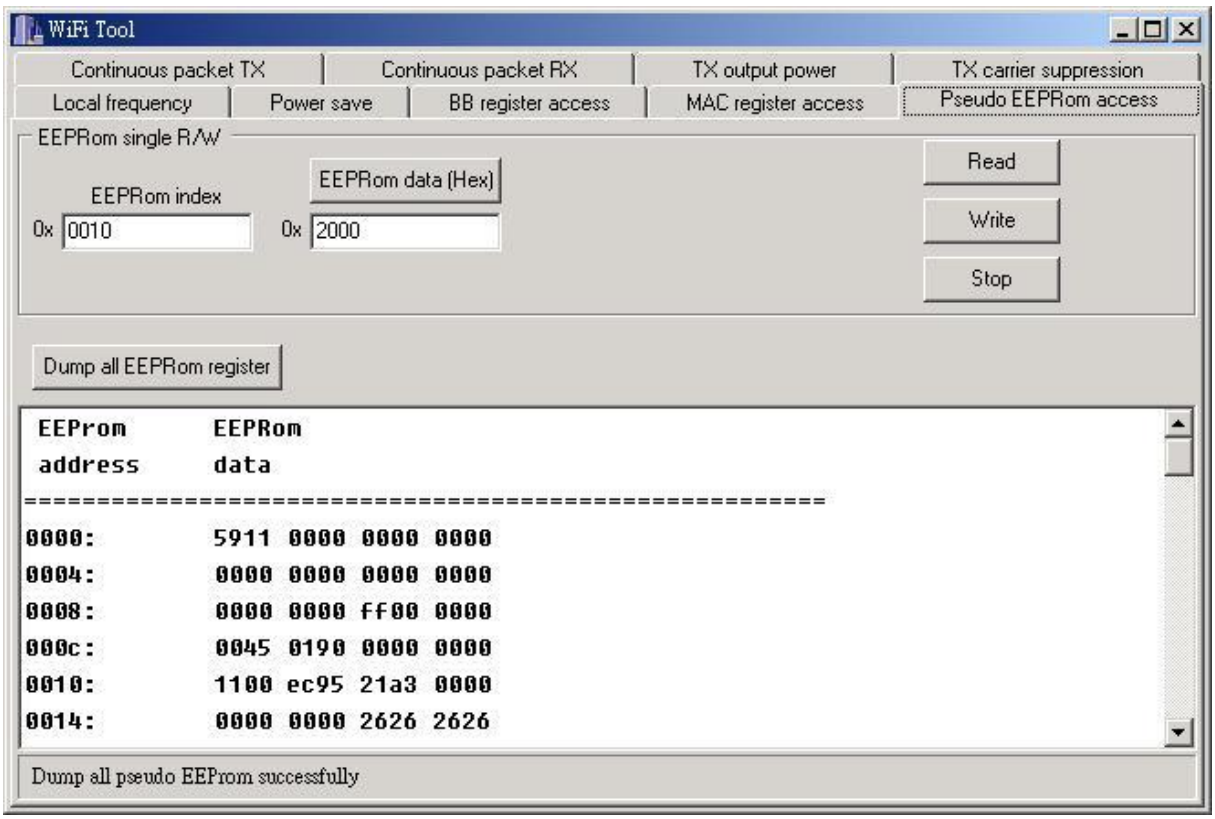

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Figure 177 ***Dump all pseudo EEPROM result***

3.4 MediaTek BT Tool

User can use MediaTek BT Tool to do RF test, packet test, throughput test, and connection test. MediaTek BT Tool communicates with target BT module using HCI (Host Control Interface) interface. This interface provides a standardized way to control BT operations such as inquiry, connection establishment, etc. User can switch to MediaTek BT Tool by selecting [MediaTek BT Tool] from main selection menu.

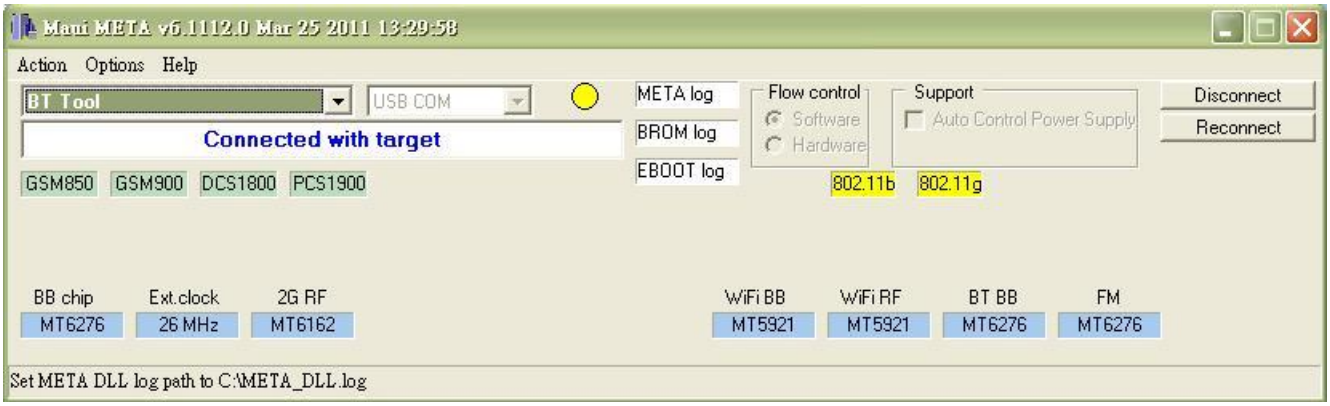

Figure 178 ***Select [MediaTek BT Tool] from main selection menu***

3.4.1 RF test

RF test supports transmission test and receiving test. User can use RF test feature to observe RX and TX performance of BT module with BT radio tester. RF test is urn if BT module is not in a connection, page or inquiry scanning state.

3.4.1.1 RF transmission test

User can configure transmission test parameters, such as transmission pattern, frequency, packet type, and power control type etc and then click [Start] button to continuous transmission. The transmitted packets have an access code, header and CRC all these fields are in accordance with BT specification. The packet content is depended packet type user selected.

User can use following procedure to do RF transmission test.
(1) Select transmission pattern.
(2) Select single frequency or frequency hopping.
(3) Select packet type and enter data length and poll period.
(4) Check power control (range 0~7, 7 is level of maximum power), whiten and modulation.
(5) Enter LAP value, then access code is generated automatically.
(6) Click [Start] button to do transmission test.

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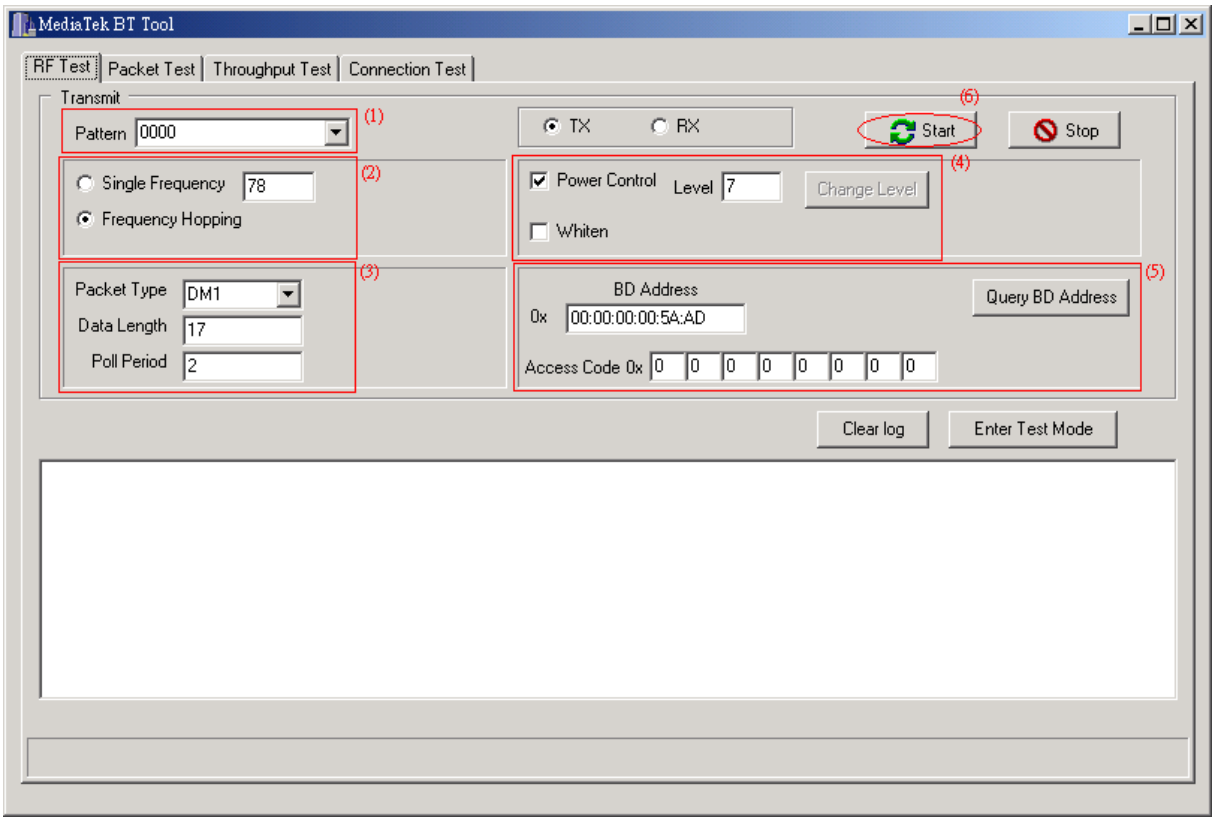

Figure 179 ***RF transmission test***

3.4.1.2 RF receiving test

User can configure receiving test frequency parameter and then click [Start] button to receive data.

User can use following procedure to do RF receiving test.

(1) Select single frequency or frequency hopping. If single frequency is selected, frequency should be also specified.

(2) Click [Start] button to do receiving test.

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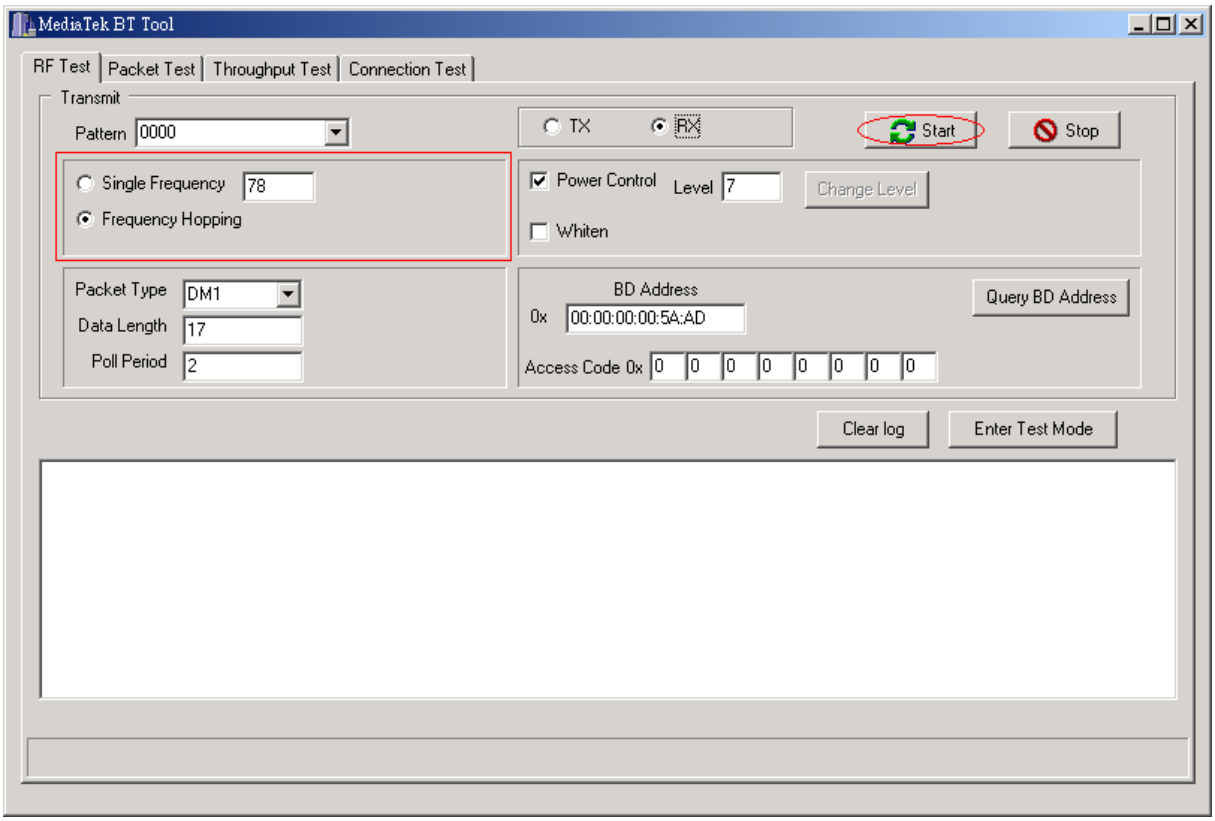

Figure 180 ***RF receiving test***

3.4.2 Packet test

Packet test supports transmission and receiving all BT packet type between Tester BT device and DUT BT device. The tester BT device and DUT BT device read BD Address, and then create connection between two BT devices. After connection is established, each type of packets are sent concurrently between two BT devices.

User can select packet type, input data length, poll period and packet count and then click [Start] button to do packet test. META UI will then display BD address and TX/RX packet count of Tester BT device and DUT BT device.

User can use following procedure to do packet test.
(1) Select COM port, baud rate and then press [Connect] button to connect DUT BT device.
(2) Check packet types, enter packet data length, poll period (unit: 625us), and packet count.
(3) Click [Start] button to do packet test.

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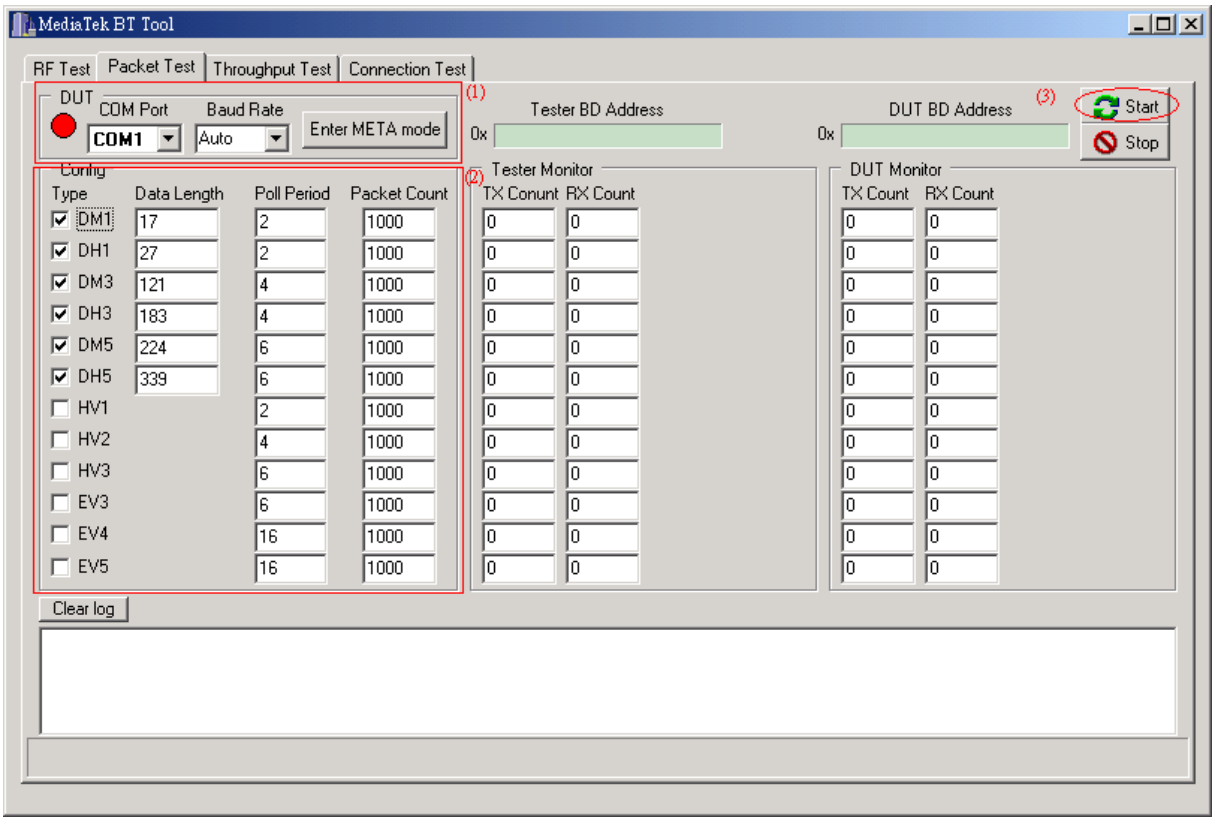

Figure 181 ***BT packet test***

3.4.3 Throughput Test

User can use throughput test to do TX and RX throughput test. User has to run two META on one PC or two PC. One META is for TX throughput test. One META is for RX throughput test.

User can use following procedure to do TX throughput test.

(1) Enter BD address of remote BT device.
(2) Select packet types.
(3) Click [Connect] button to connect remote BT device.
(4) Enter data length and packet count.
(5) Click [Start] button to start TX throughput test.

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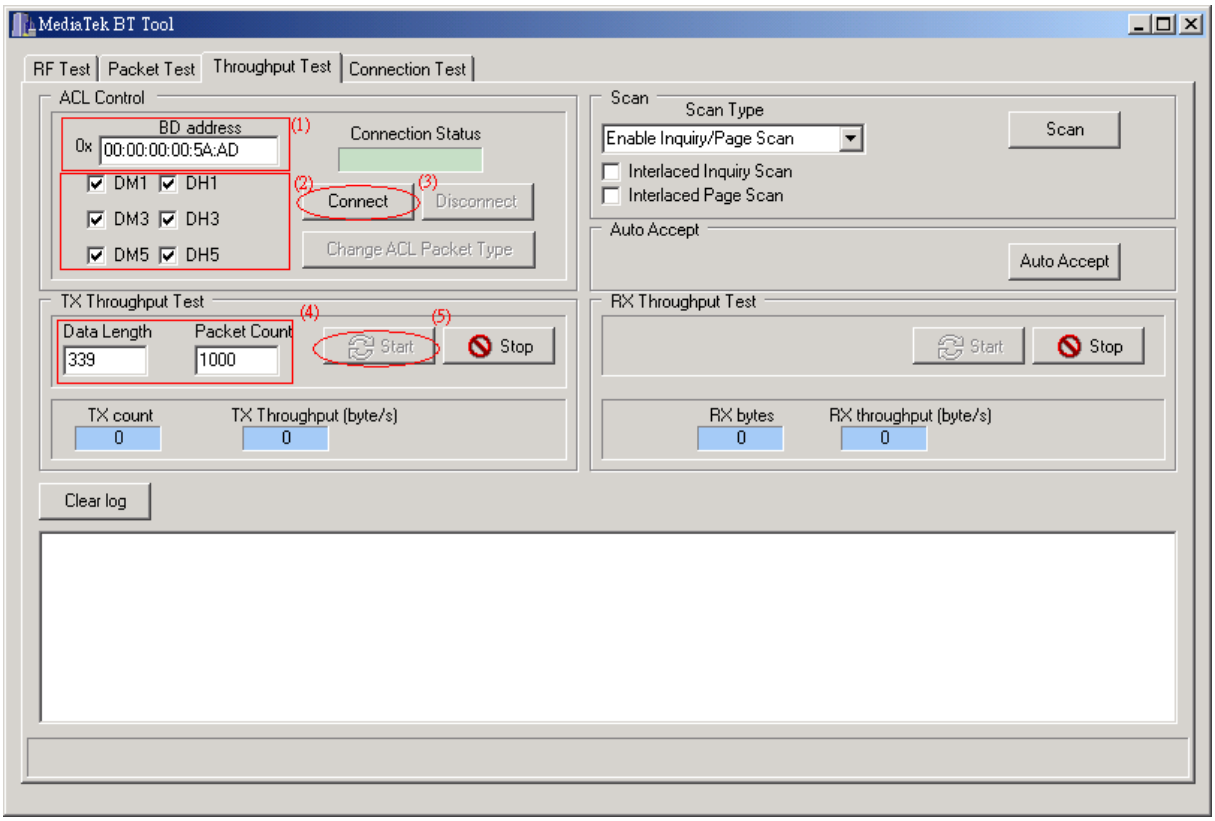

Figure 182 ***TX throughput test***

User can use following procedure to do RX throughput test.
(1)Select scan type.
(2)Click [Scan] button to set scan type to target BT module.
(3)Click [Auto accept] button to trigger target BT module to auto accept all incoming BT connection.
(4)Click [Start] button to start RX throughput test.

3.4.4 Connection Test

Connection test provide user frequently used functions. User can use connect test to read/write local BD address, set scan type, auto accept all incoming BT connection, inquiry nearby BT device, make ACL or SCO connection, disconnect ACL or SCO connection and change ACL or SCO packet types.

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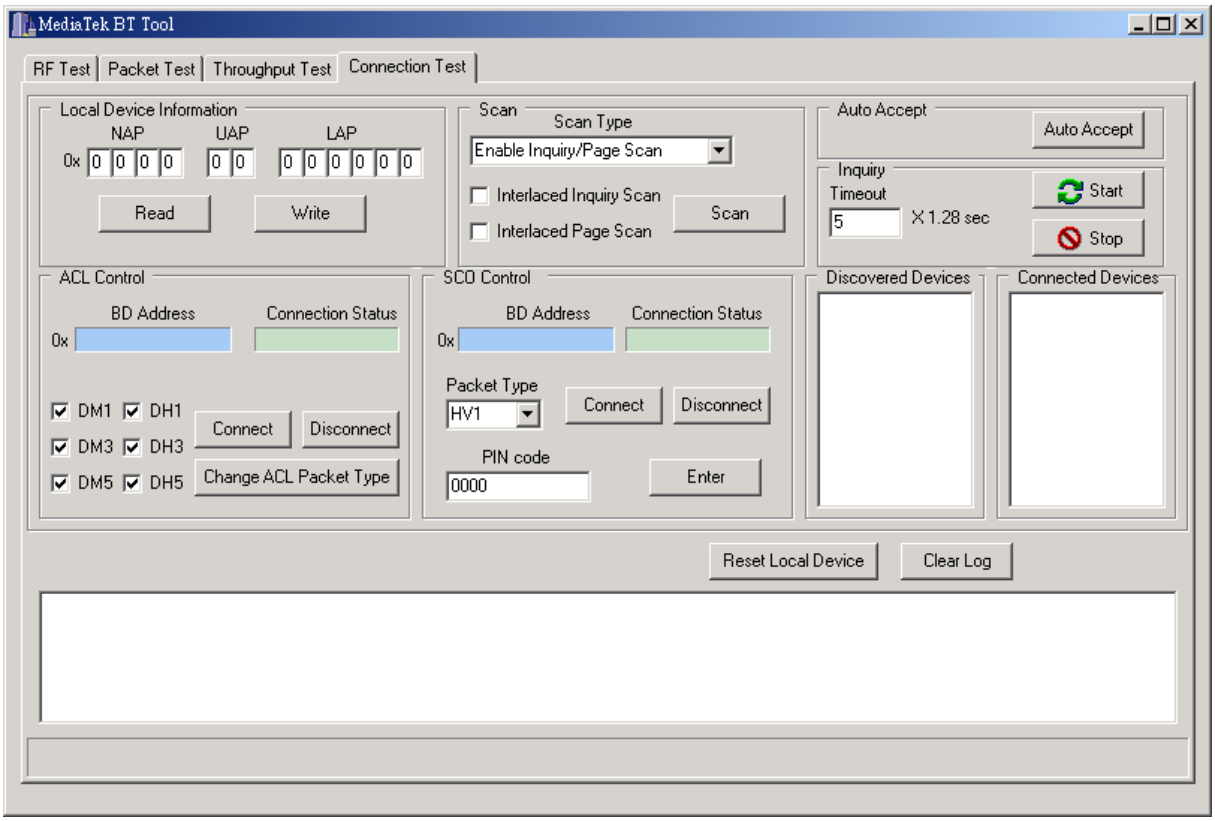

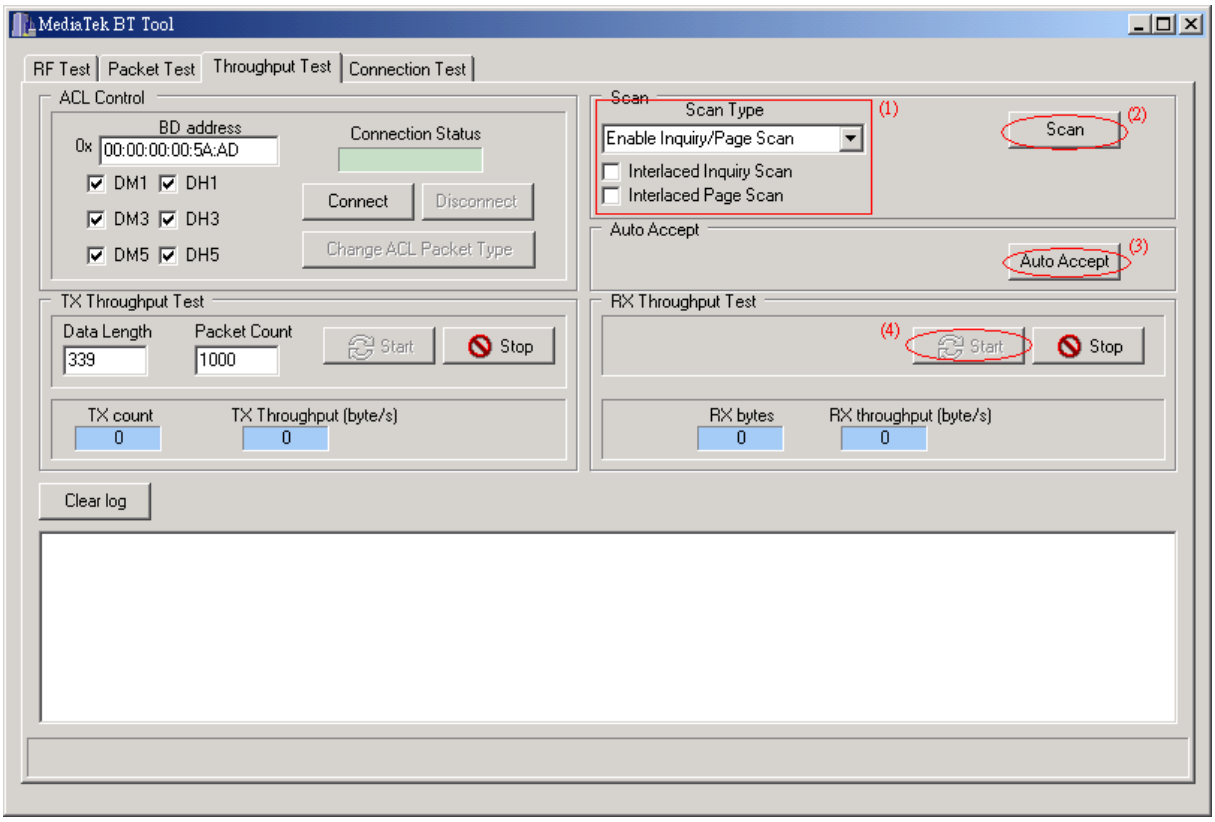

Figure 183 ***RX throughput test***

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3.5 FM Radio Tool

From 6.1012.0, the FM Radio Tool supports MT6616. For the MT6188/MT6189 series, the FM radio tool functions are still the same and are described in section 3.5.1. Section 3.5.2 depicts the FM radio tool functions for MT6616 and later chips.

3.5.1 Legacy FM Radio Tool

Legacy FM Radio tool provides following feature for user to verify FM radio test

- Reset FM radio module
- Set frequency
- Audio setting
- Register data read/write
- Status query (RSSI, IF counter, H/L side and audio stereo/mono mode)

User can switch to FM radio tool by selecting [FM Radio Tool] from main selection menu.

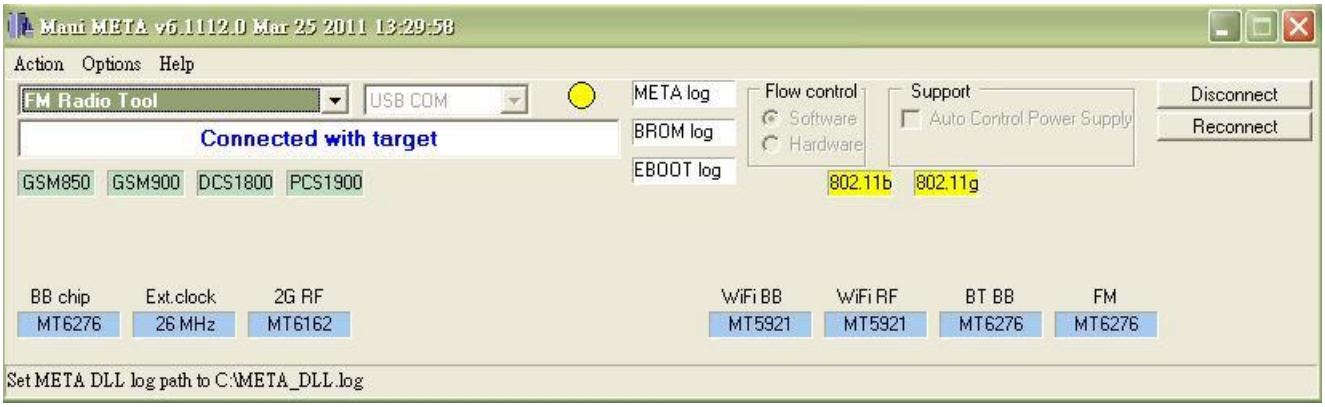

Figure 184 ***Select [FM Radio Tool] from main selection menu***

3.5.1.1 Reset FM radio module

User can click [Reset] button to reset FM radio module.

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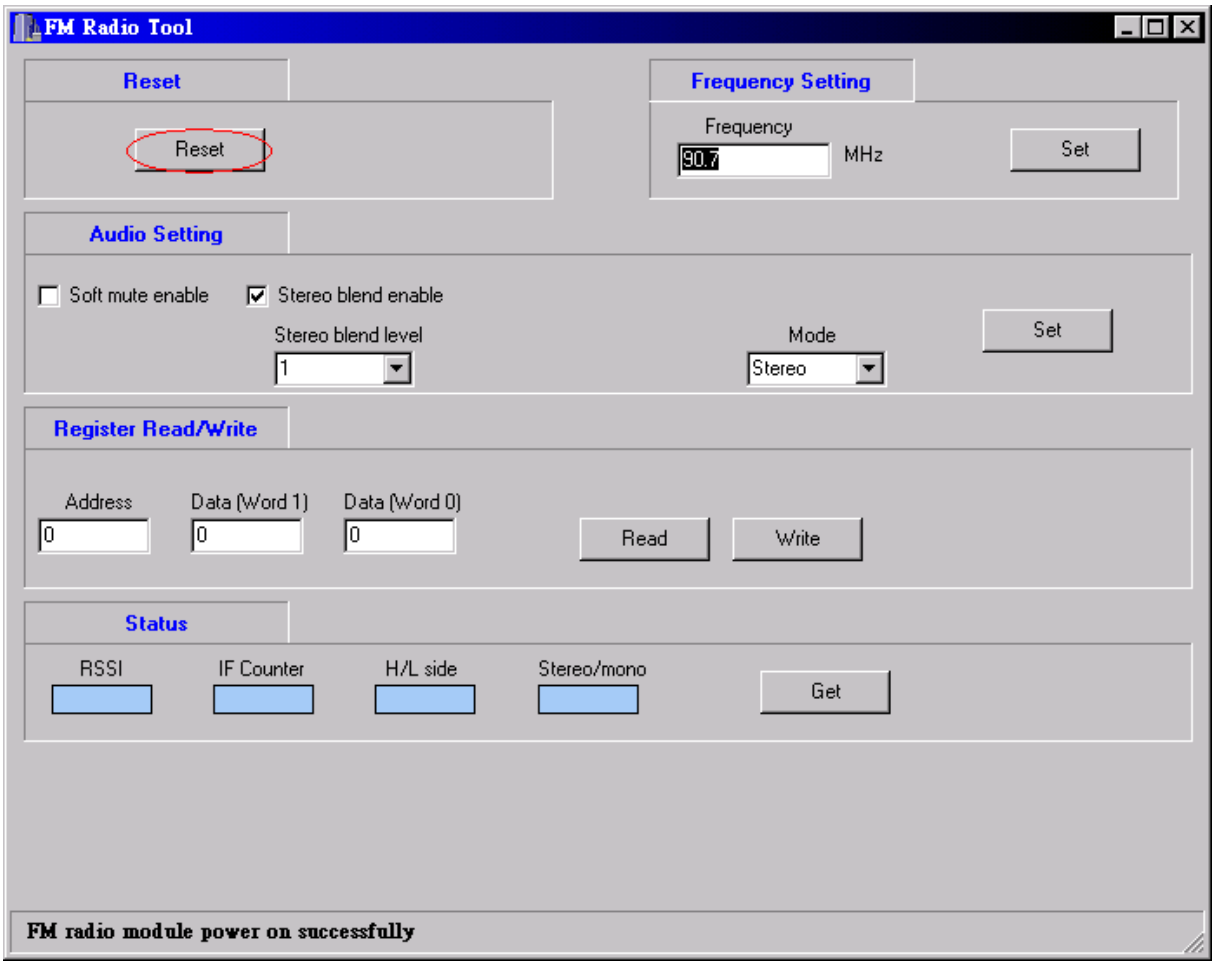

Figure 185 ***Reset FM radio module***

3.5.1.2 Set frequency

User can input frequency and then click [Set] button to set frequency.

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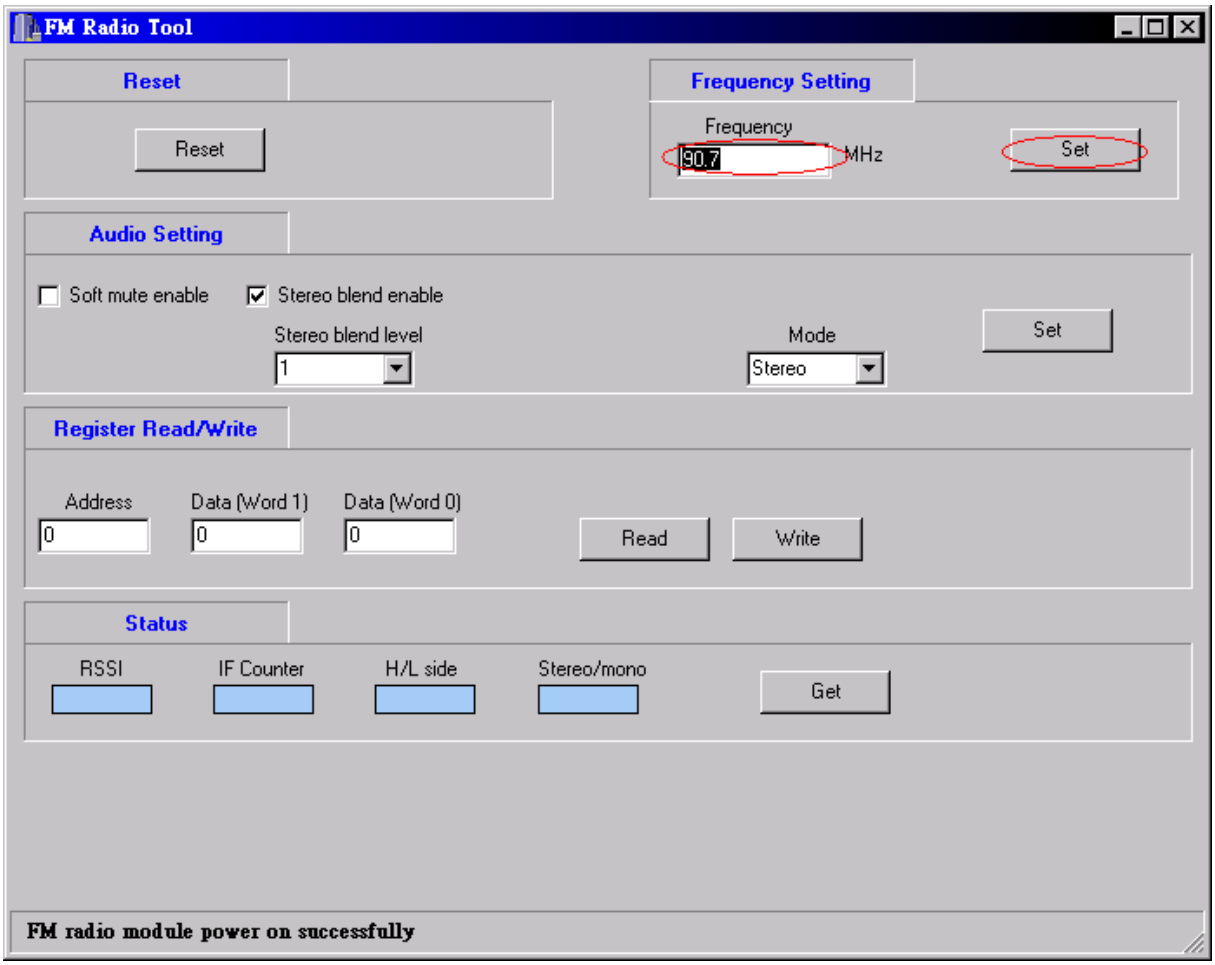

Figure 186 ***Set frequency***

3.5.1.3 Audio setting

FM radio provides following audio setting functions.

- Soft mute enable/disable
- Stereo blend enable/disable
- Stereo blend level setting
- Stereo/mono mode setting

User can configure audio setting and then click [Set] button to set audio setting to FM radio module.

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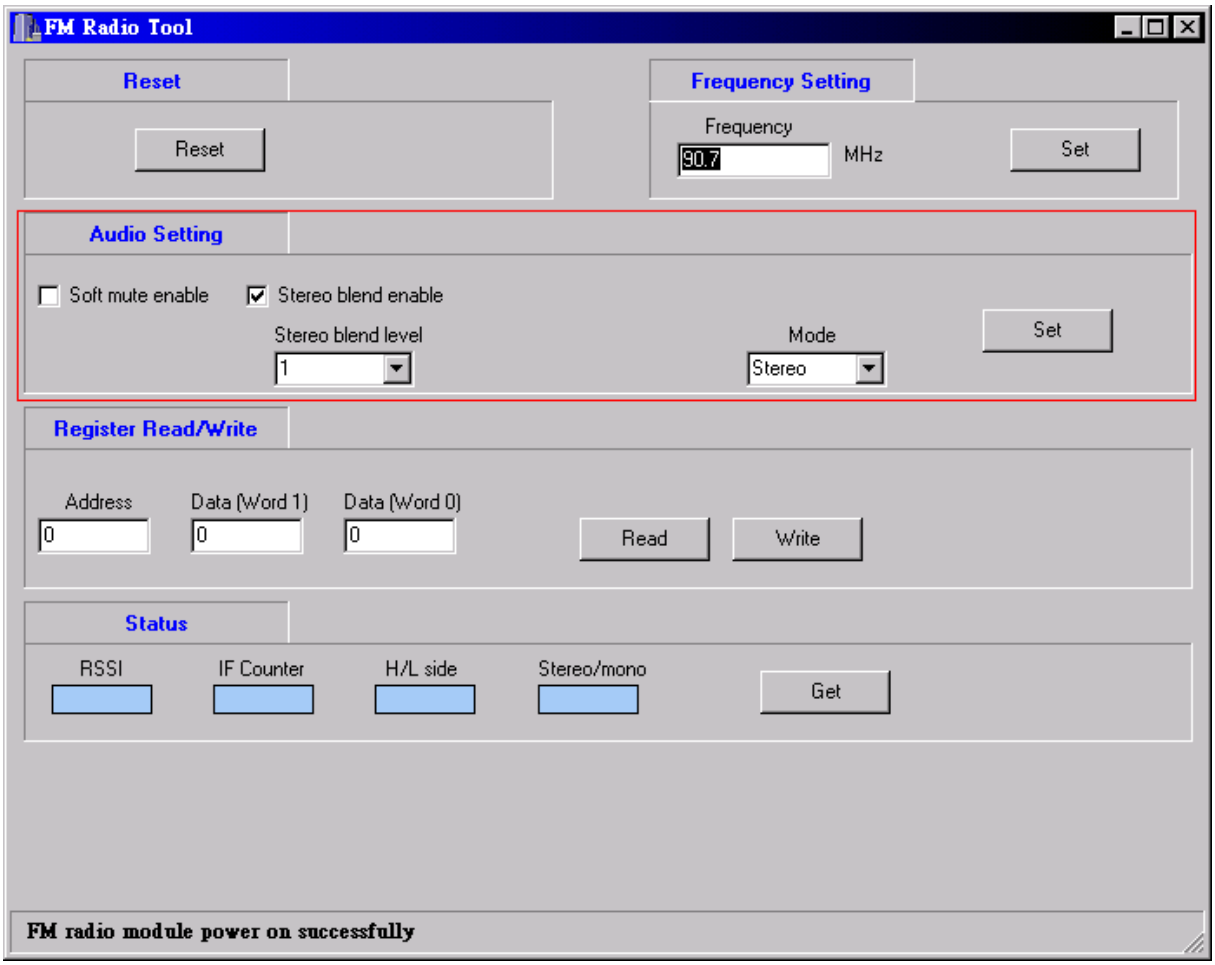

Figure 187 ***Audio setting***

3.5.1.4 Register data read/write

User can input register address and then click [Read] button to read data from register.

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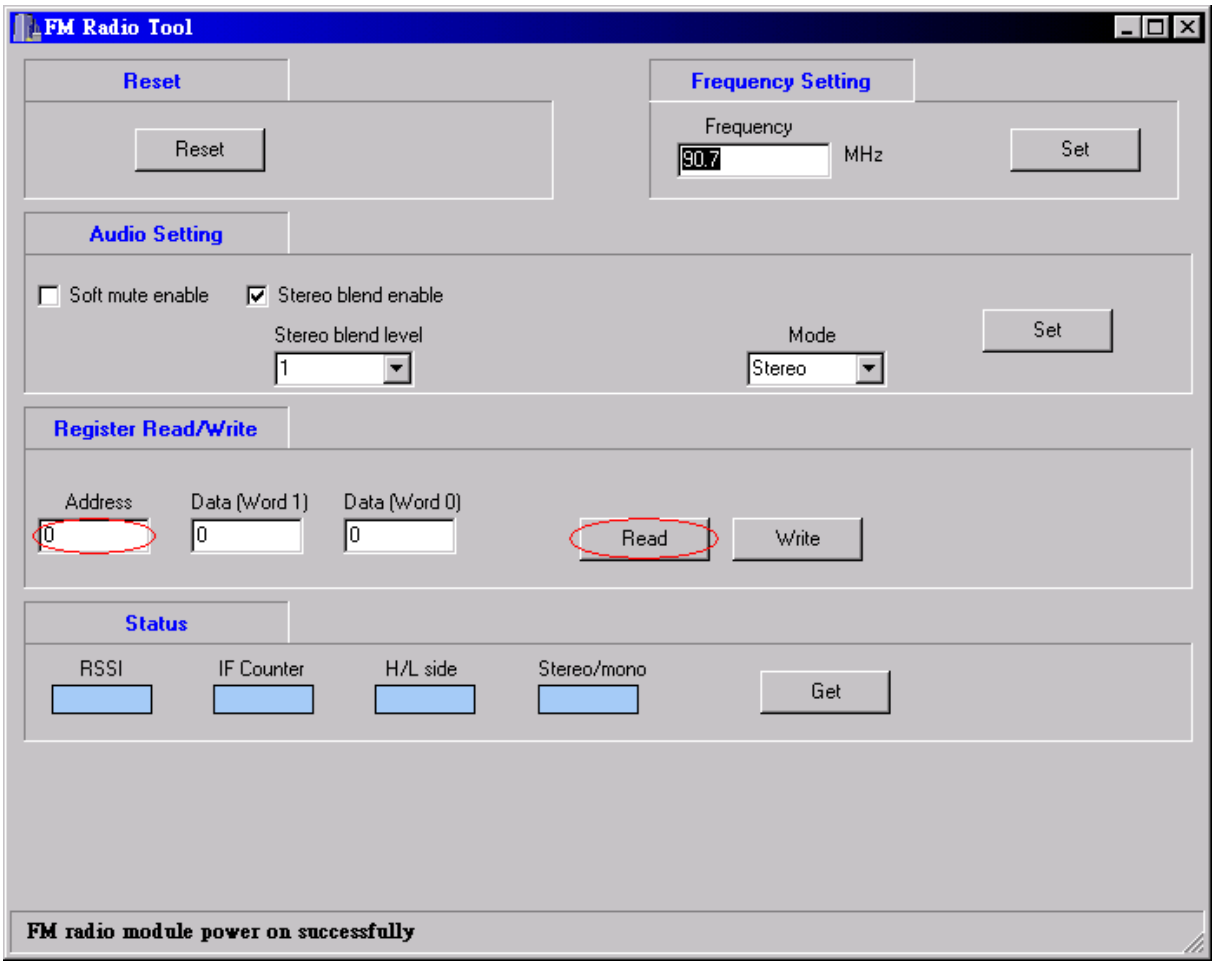

Figure 188 ***Read data from register***

User can input register address and data and then click [Write] button to write data to register.

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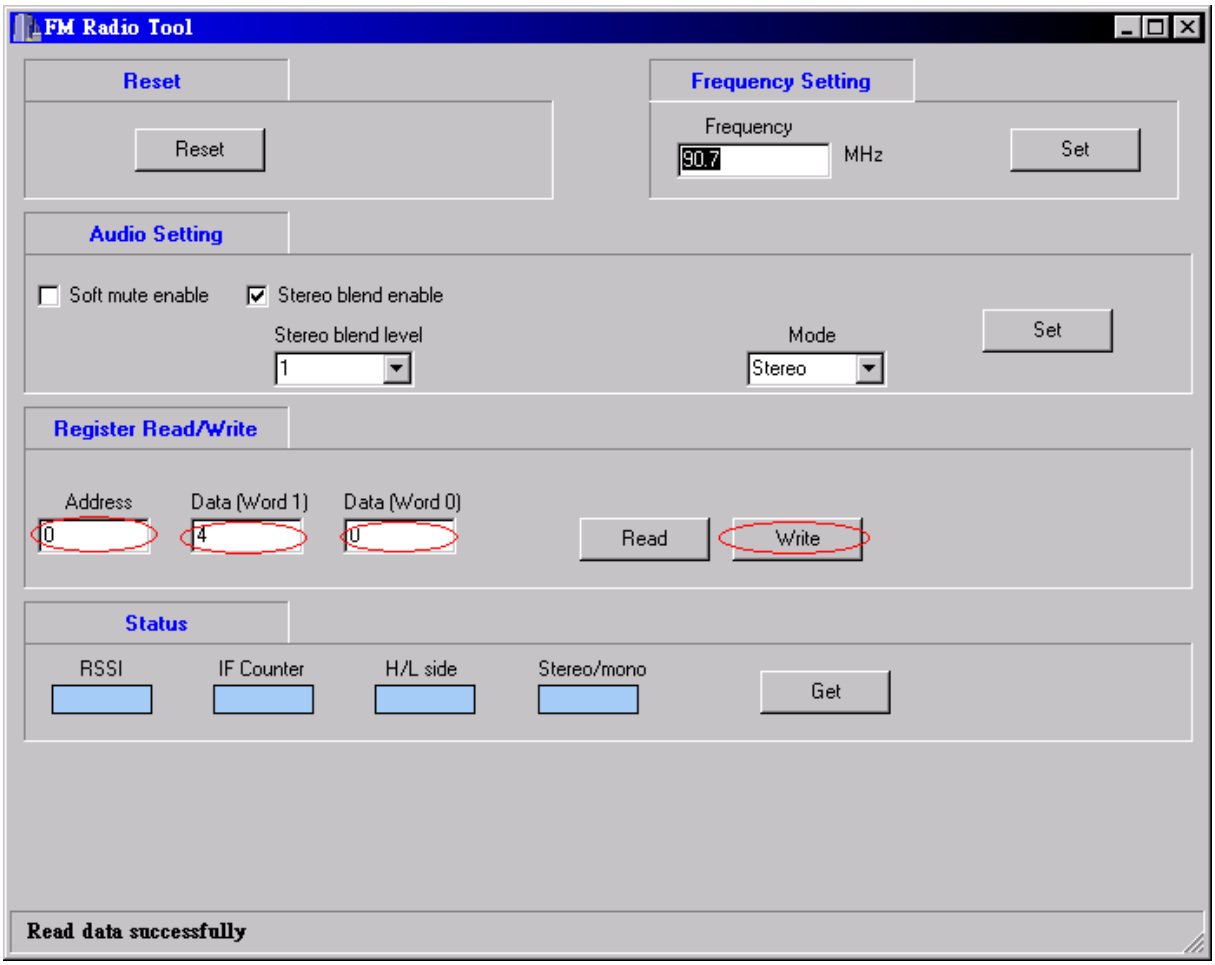

Figure 189 ***Write data to register***

3.5.1.5 Query status of FM radio module

User can click [Get] button to get RSSI, IF counter, H/L side and audio stereo/mono state from FM radio module.

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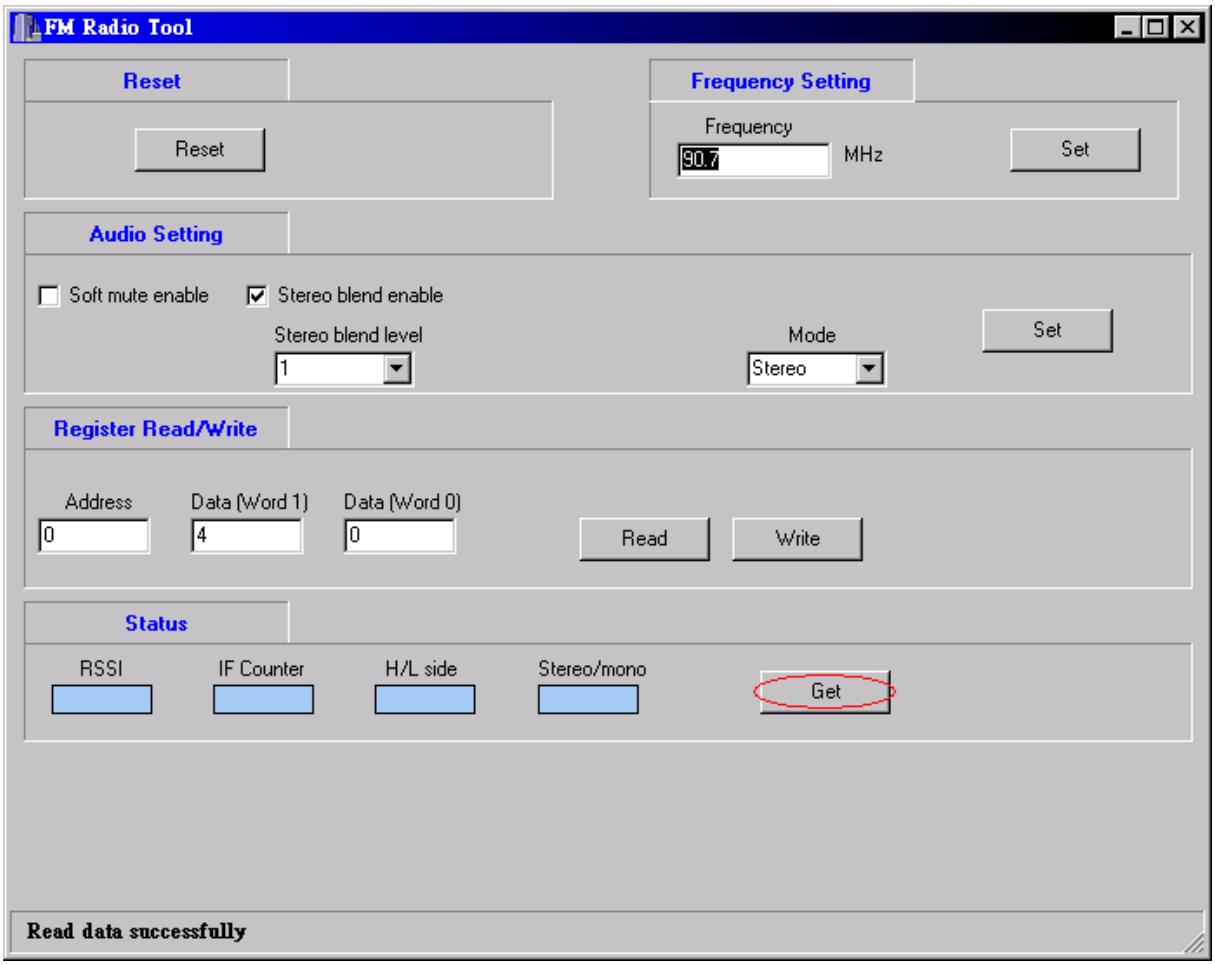

Figure 190 ***Get status of FM radio module***

3.5.2 FM Radio Tool for MT6616, MT6626, and MT6276

FM Radio tool for MT6616, MT6626, and MT6276 provide following feature for user to verify FM radio in FM Reciver Main Window. User can switch to FM radio tool by selecting [FM Radio Tool] from main selection menu.

- Set frequency
- Volume setting
- Status query (RSSI, Stero/Mono, Cap Array)
  - Note: Only MT6626 and MT6276 support Cap Array
- Hardware Seek/Scan
- RDS PS and RT information

User can switch to RDS Receive Data to check the RDS data received by FM chip, the RDS Receive Data window provides the following features

- General RDS Information (PS, PTY, PI, RT, TA, CT, AF List)
- Block counter (Accepted, Errors, Total, BLER)
- Group counters

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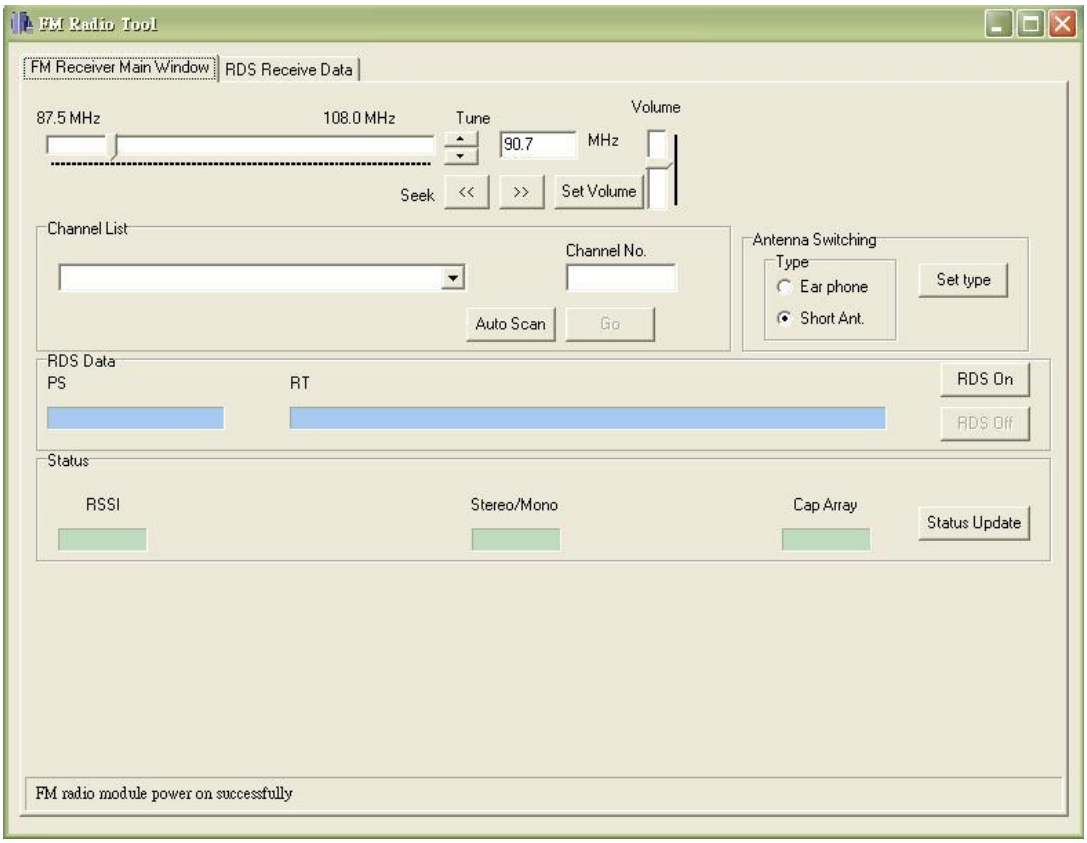

Figure 191 ***FM Receiver Main Window GUI Overview***

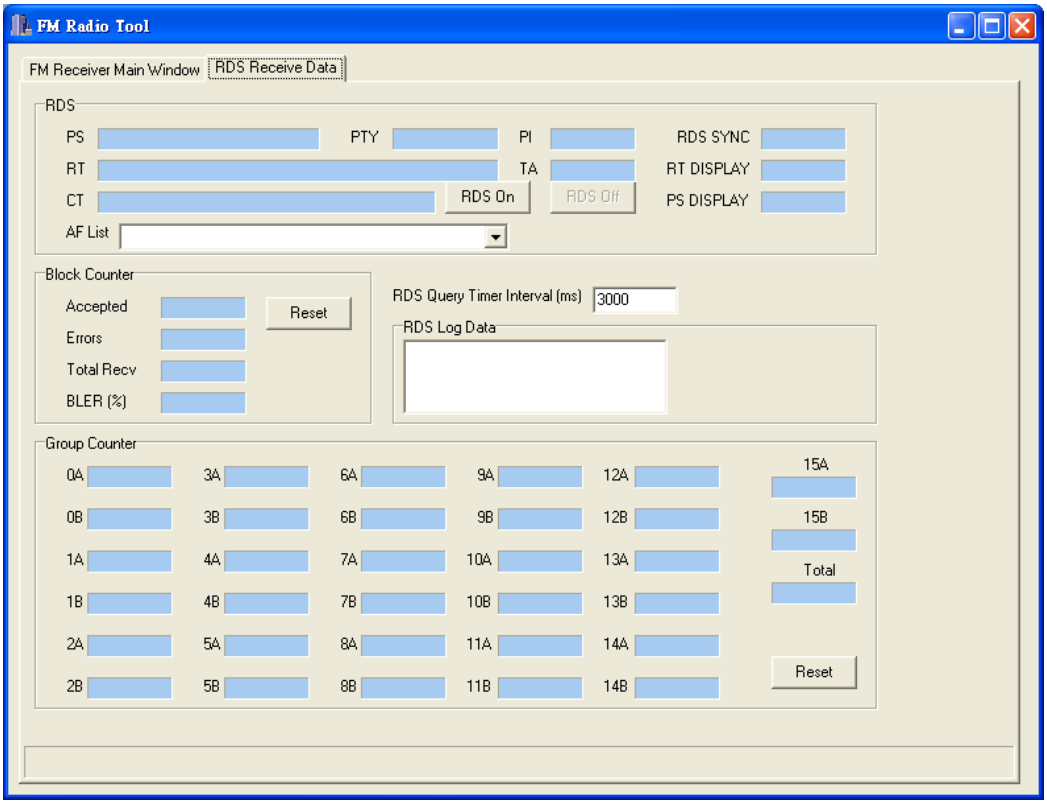

Figure 192 ***RDS Receive Data GUI Overview***

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3.5.2.1 Set frequency

By scrolling the frequency srollbar , clicking tune button or directly input frequency value in frequency input field. The user can set the FM radio frequency to evaluate the FM radio function. The user input the frequency value or scroll the scrollbar to certain frequency, and then press enter to set the frequency.

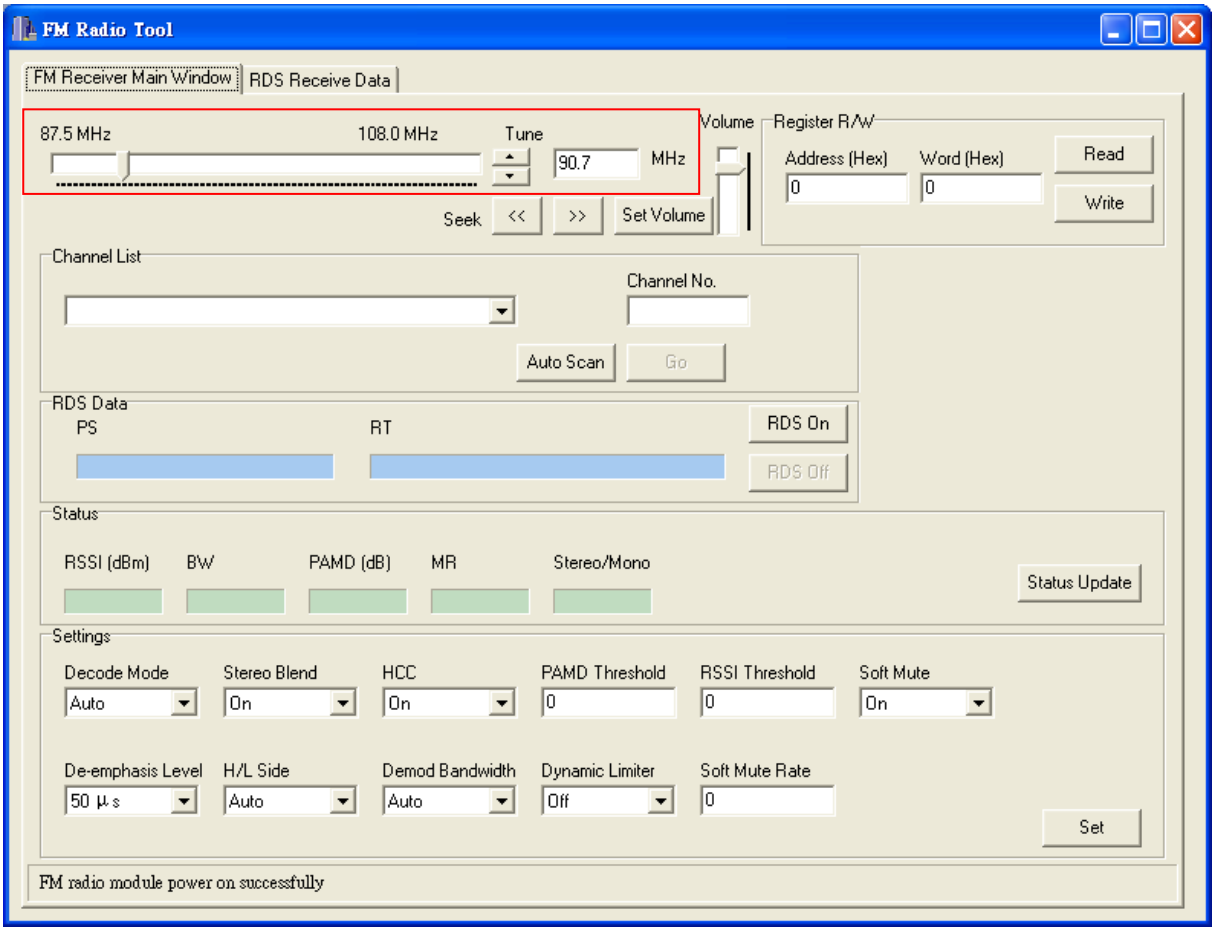

Figure 193 ***FM Receiver Main Window – Set Frequency***

3.5.2.2 Volume setting

The user can set the FM radio volume by scrolling the Volume scrollbar. After the volume is set, the user can click the “Set Volume” button to set the volume.

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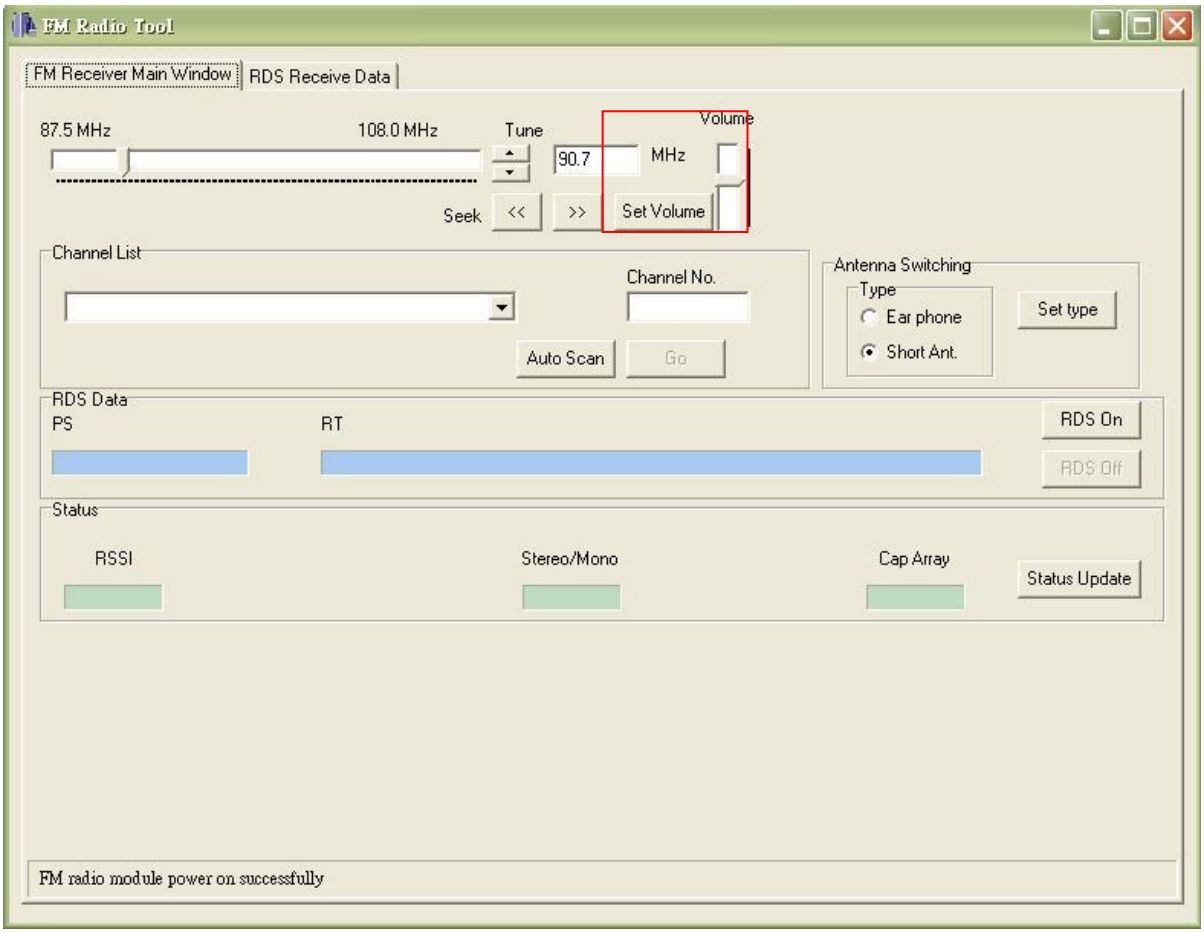

Figure 194 ***FM Receiver Main Window – Volume setting***

3.5.2.3 Status query

The user can query some FM chip status by clicking the “Status Update” button in “Status” group.

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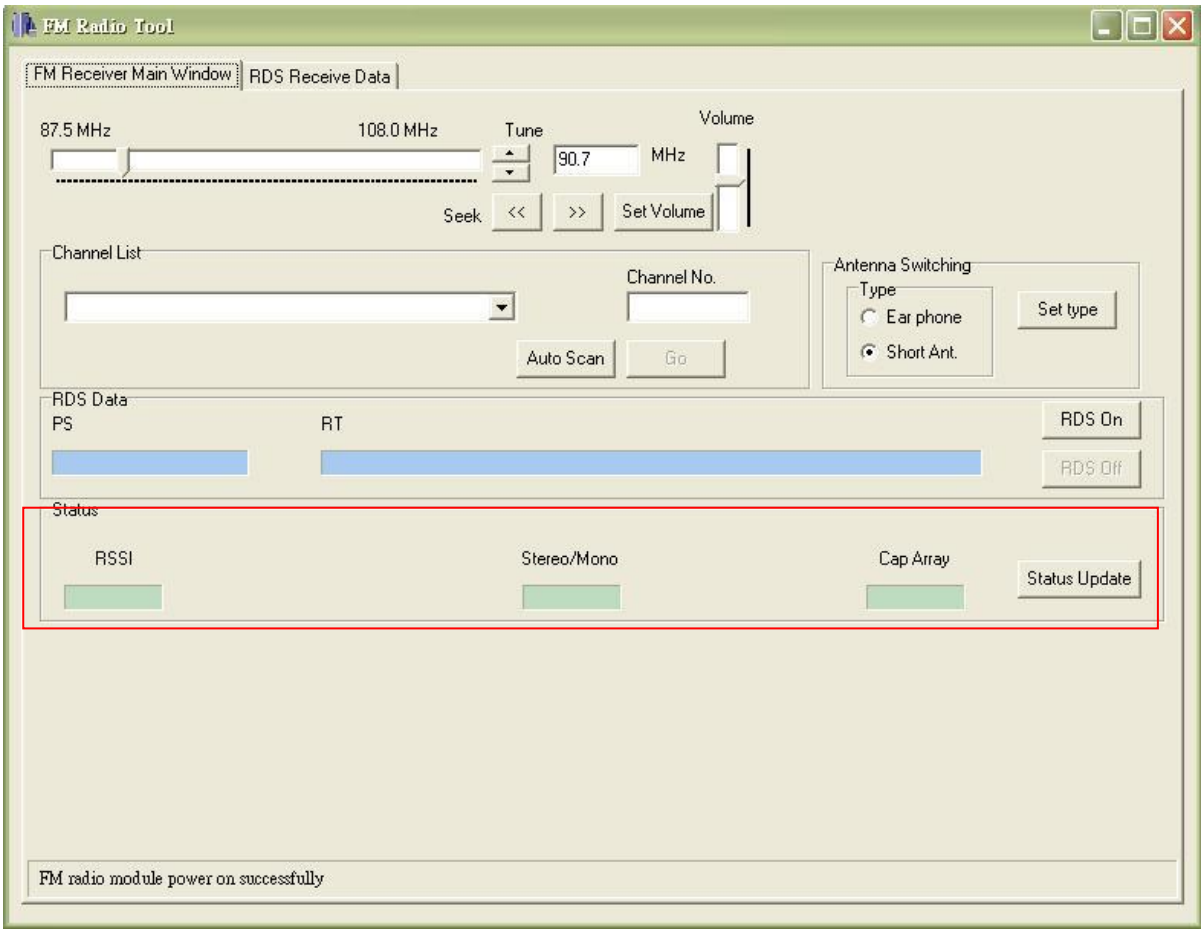

Figure 195 ***FM Receiver Main Window – Status query***

3.5.2.4 Hardware Seek/Scan

MT6616 suports hardware seek/scan. The user can click the “Seek” button to seek to previous or next FM radio station. By clicking the “Auto Scan” button, the user can do a automatically full scan from 87.5 MHz to 108.0 MHz. The full scan result will be stored in the “Channel List”, the user can choose from the channel list and then click “Go” button to set the FM radio frequency to specified FM radio station.

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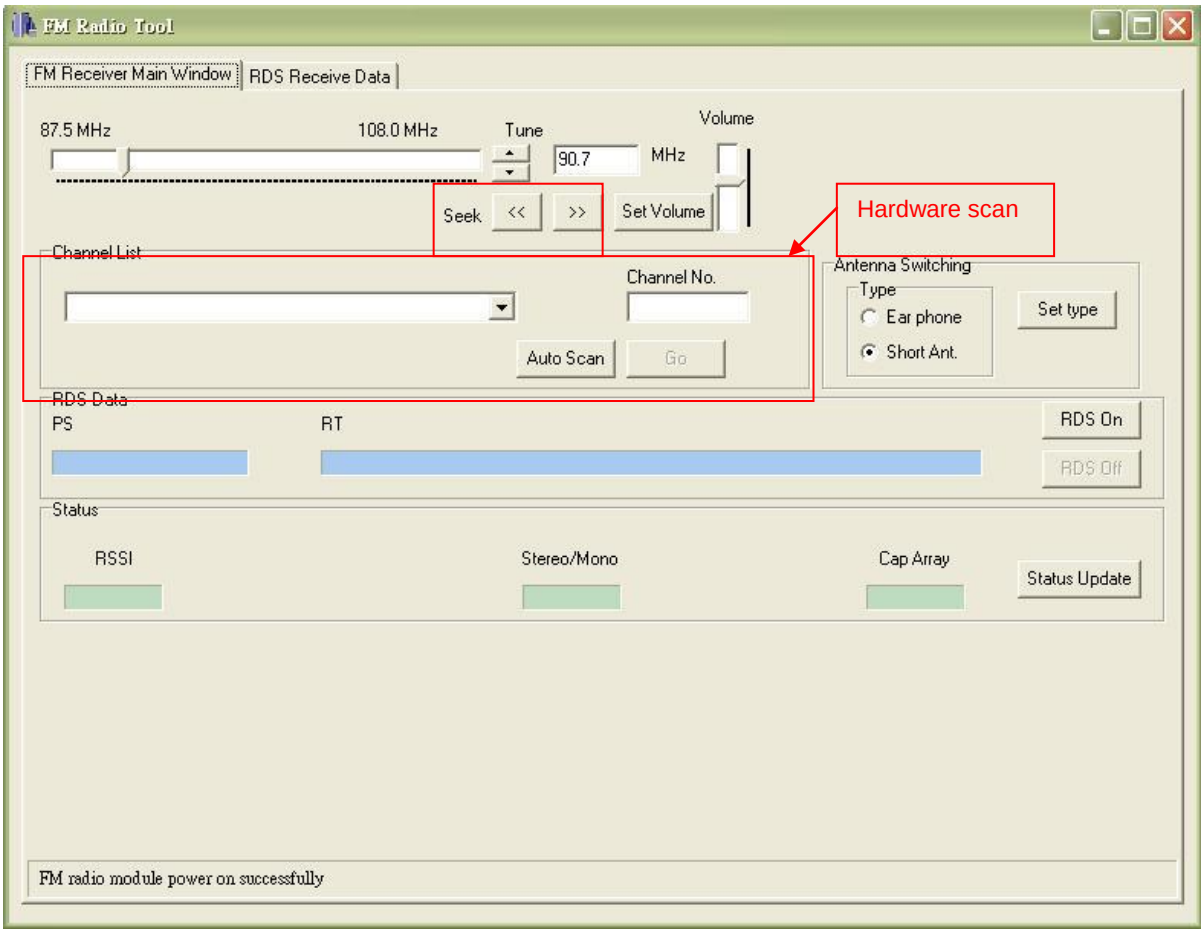

Figure 196 ***FM Receiver Main Window – Hardware seek/scan***

3.5.2.5 RDS PS and RT information

The user can evaluate the RDS function in the receiver main window. After click “RDS On”, the user can activate the RDS function of the target. The PS and RT information will be displayed on the “RDS Data” group.

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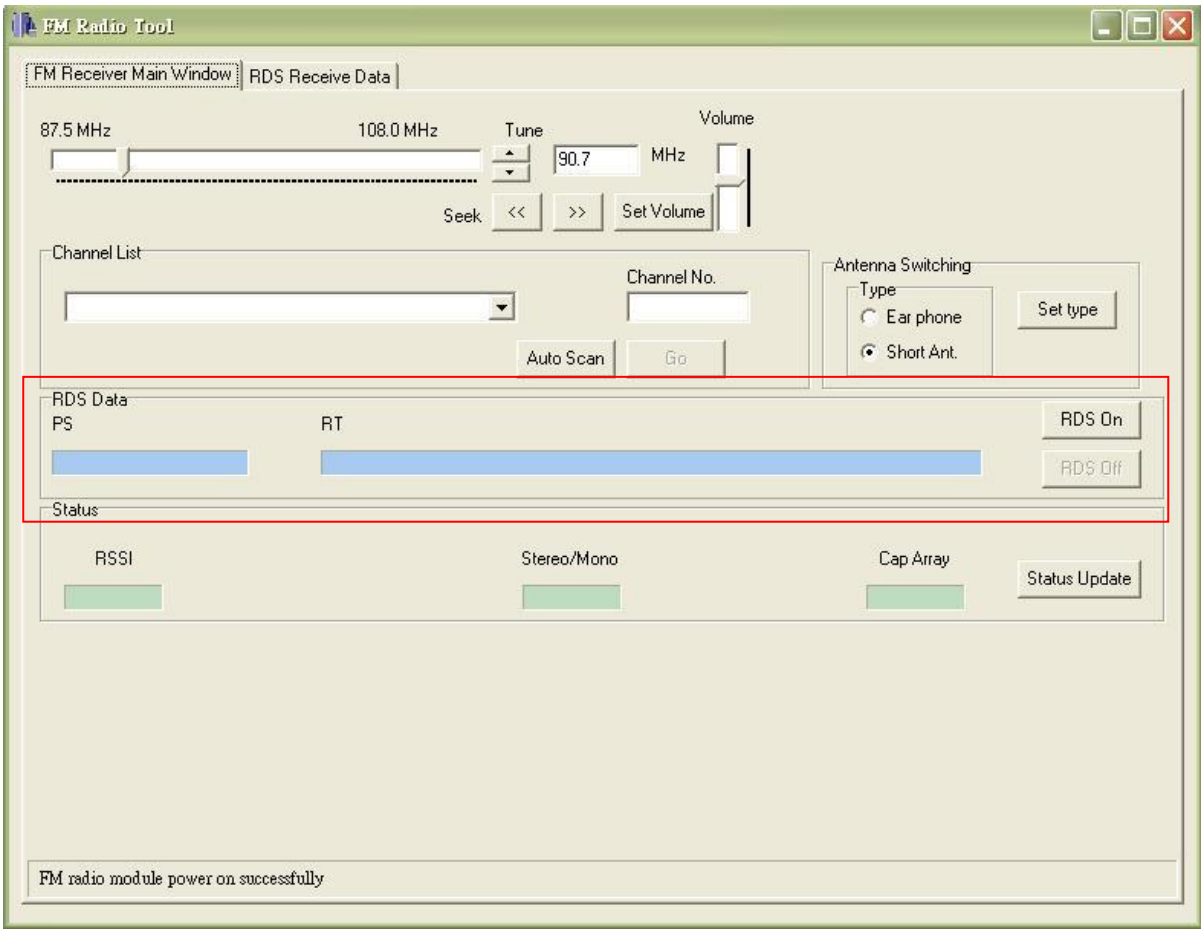

Figure 197 ***FM Receiver Main Window –RDS PS and RT information***

3.5.2.6 General RDS Information

After the user clicked the “RDS On” button, the RDS information will be displayed on the “RDS” group once the target has successfully decode the RDS data transmitted on the FM radio frequency.

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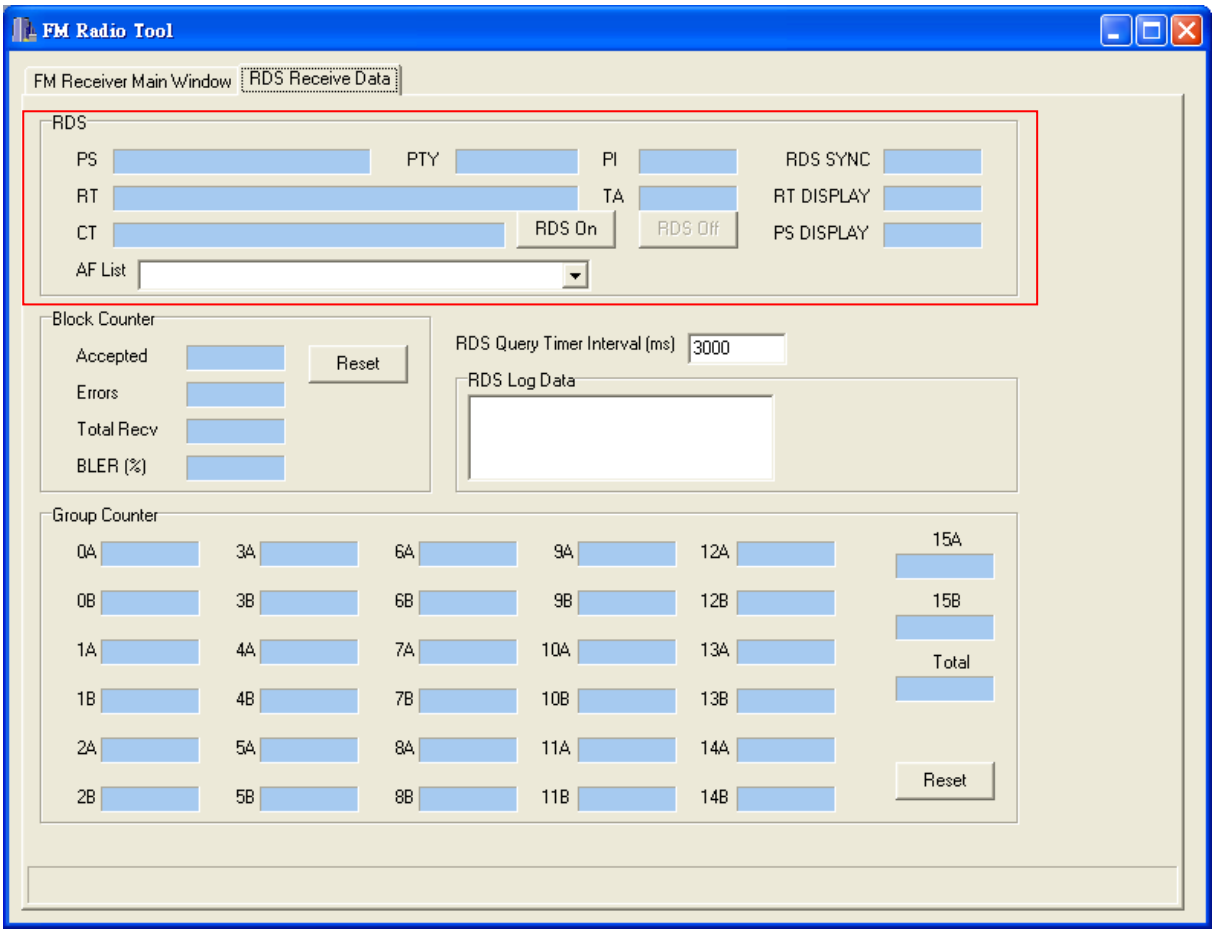

Figure 198 ***RDS Receive Data – General RDS Information***

3.5.2.7 Block counter

META tool will periodically update the “Block Counter” which contains the Accepted, Error, total and BLER of the received RDS data on the target. The query interval is adjustable in the “RDS Query Timer Interval” input field.

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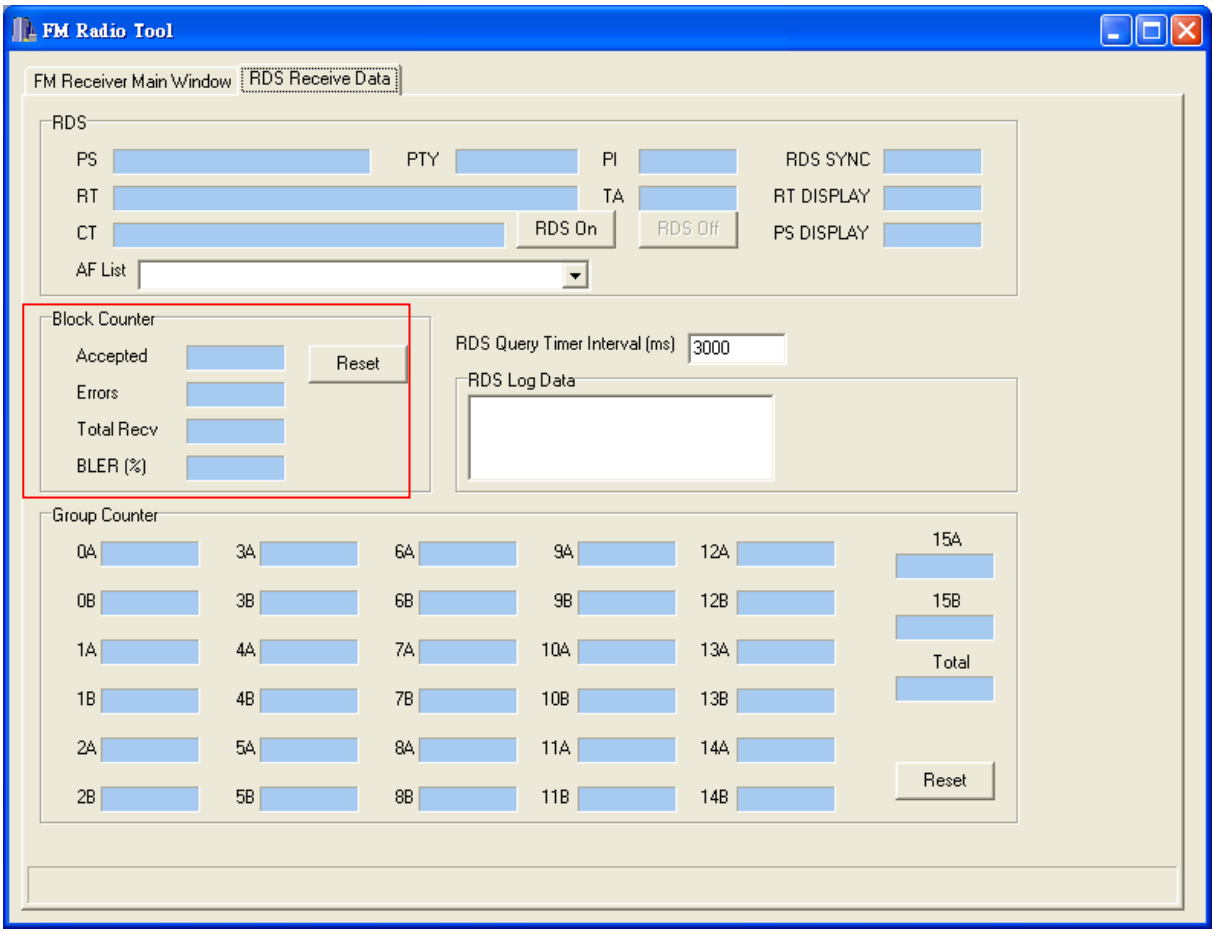

Figure 199 ***RDS Receive Data – Block Counter***

3.5.2.8 Group counters

META tool will periodically update the “Group Counter” which contains the RDS group information on the target. The query interval is adjustable in the “RDS Query Timer Interval” input field.

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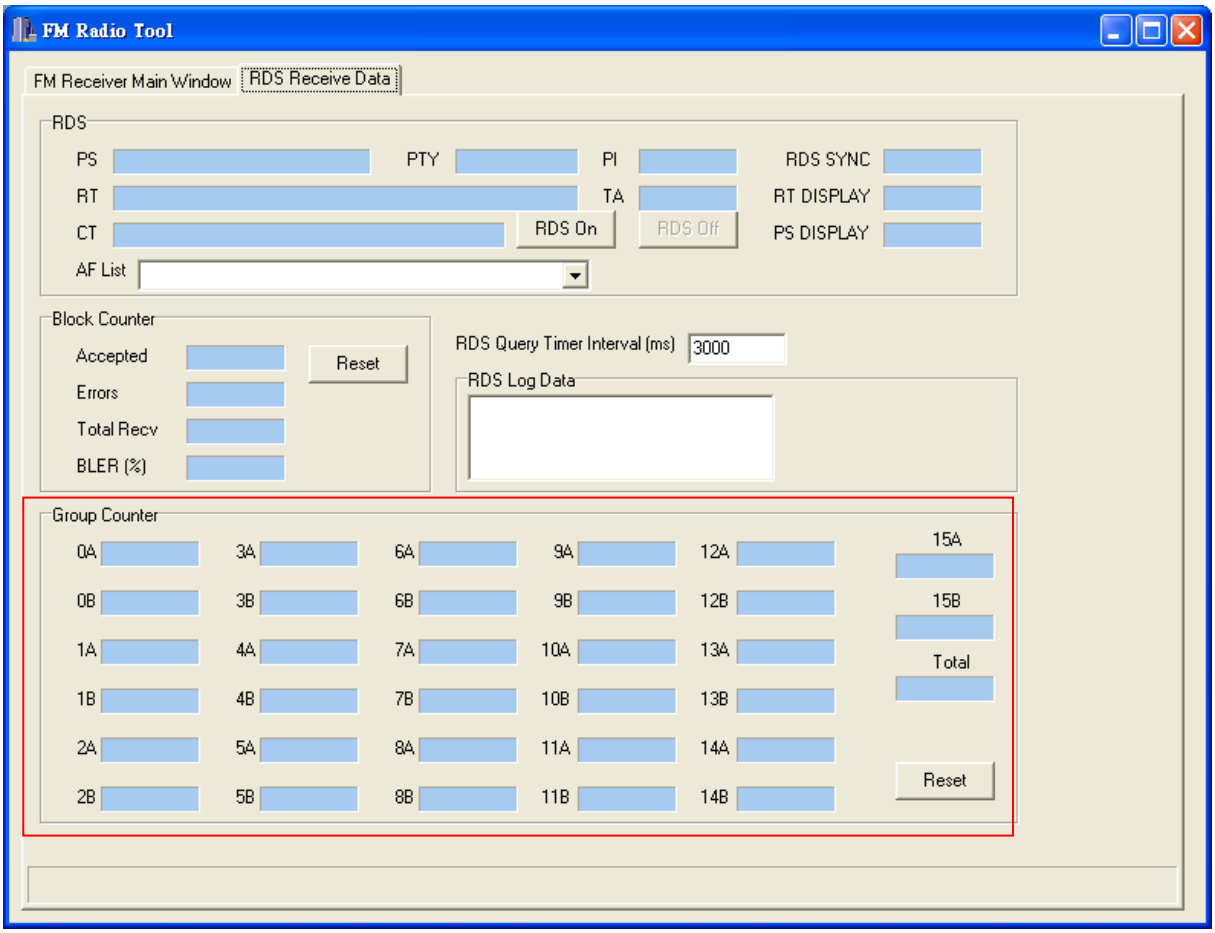

Figure 200 ***RDS Receive Data – Group Counters***

3.6 TDMB Tool

TDBM tool provides following feature for user to verify TDMB RF performance

- Set channel
- Automatic scan TDMB service
- Select service to decode
- Record audio or video stream
- Display signal strength and quality (RSSI, SNR and BER)

User can switch to TDMB tool by selecting [TDMB Tool] from main selection menu.

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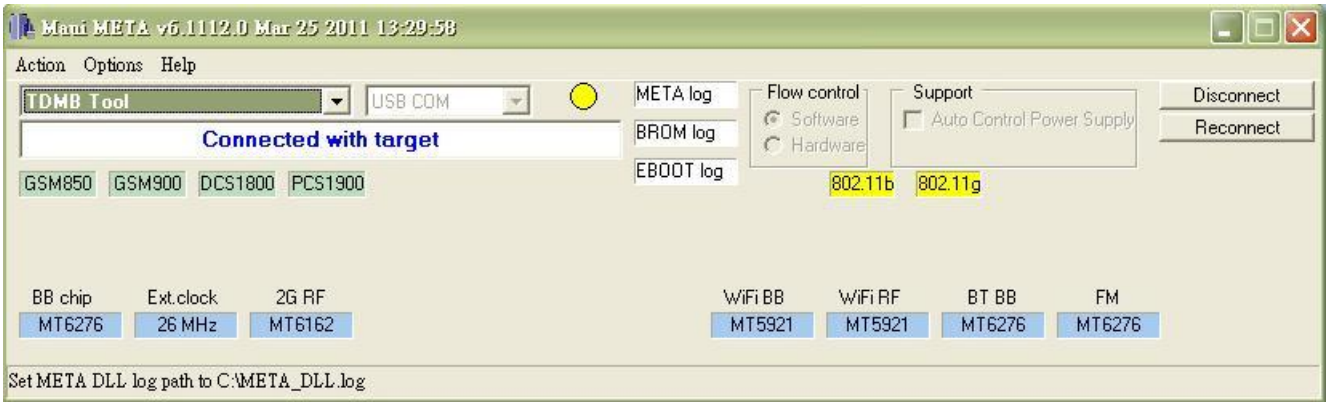

Figure 201 ***Select [TDMB Tool] from main selection menu***

3.6.1 Set channel

User can follow below procedure to set frequency

1. Select band (Korea, band III or L band)
2. Select channel
3. Click [Set channel] button to set TDMB channel

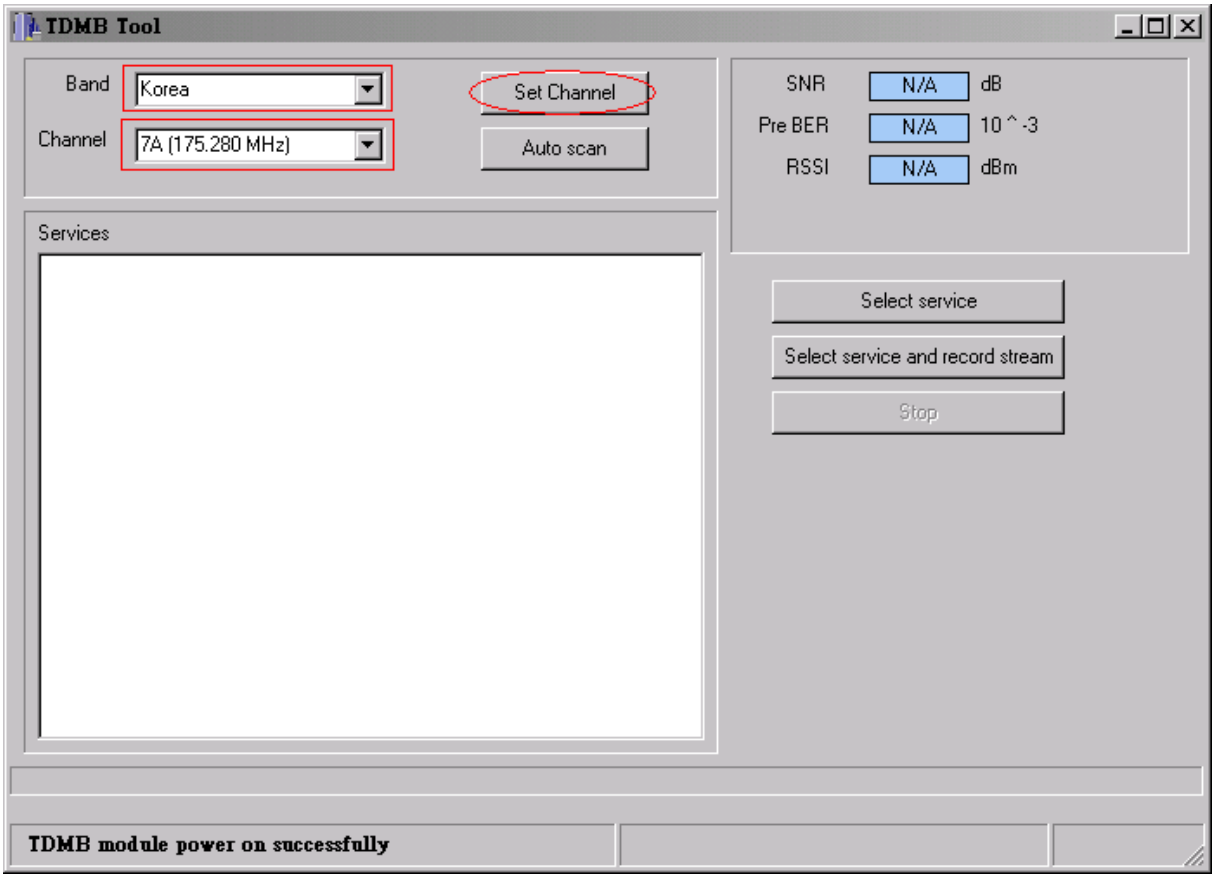

Figure 202 ***Set TDMB channel***

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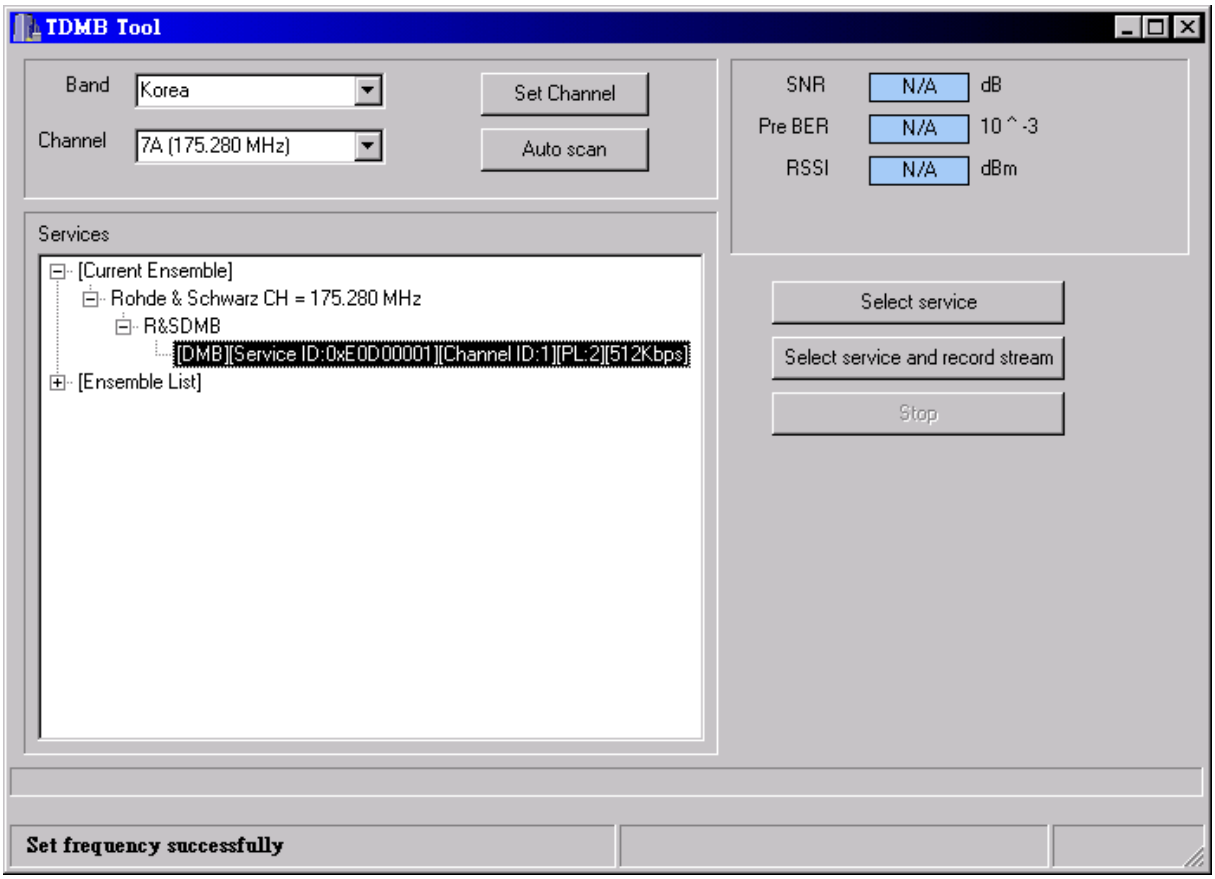

Figure 203 ***Result of set TDMB channel***

3.6.2 Automatic scan TDMB service

User can follow below procedure to scan TDMB service automatically

1. Select band (Korea, band III or L band)
2. Click [Auto scan] button scan TDMB service automatically

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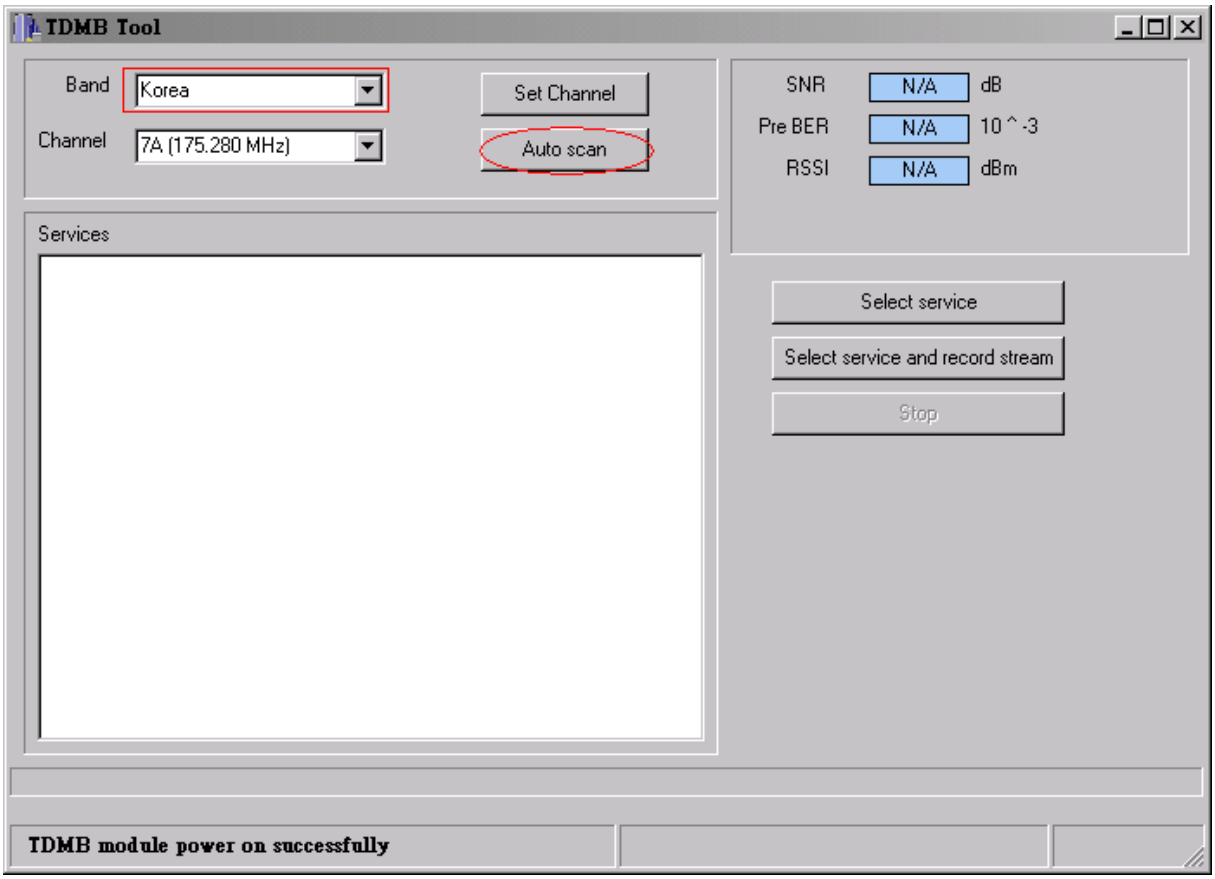

Figure 204 ***Scan TDMB service automatically***

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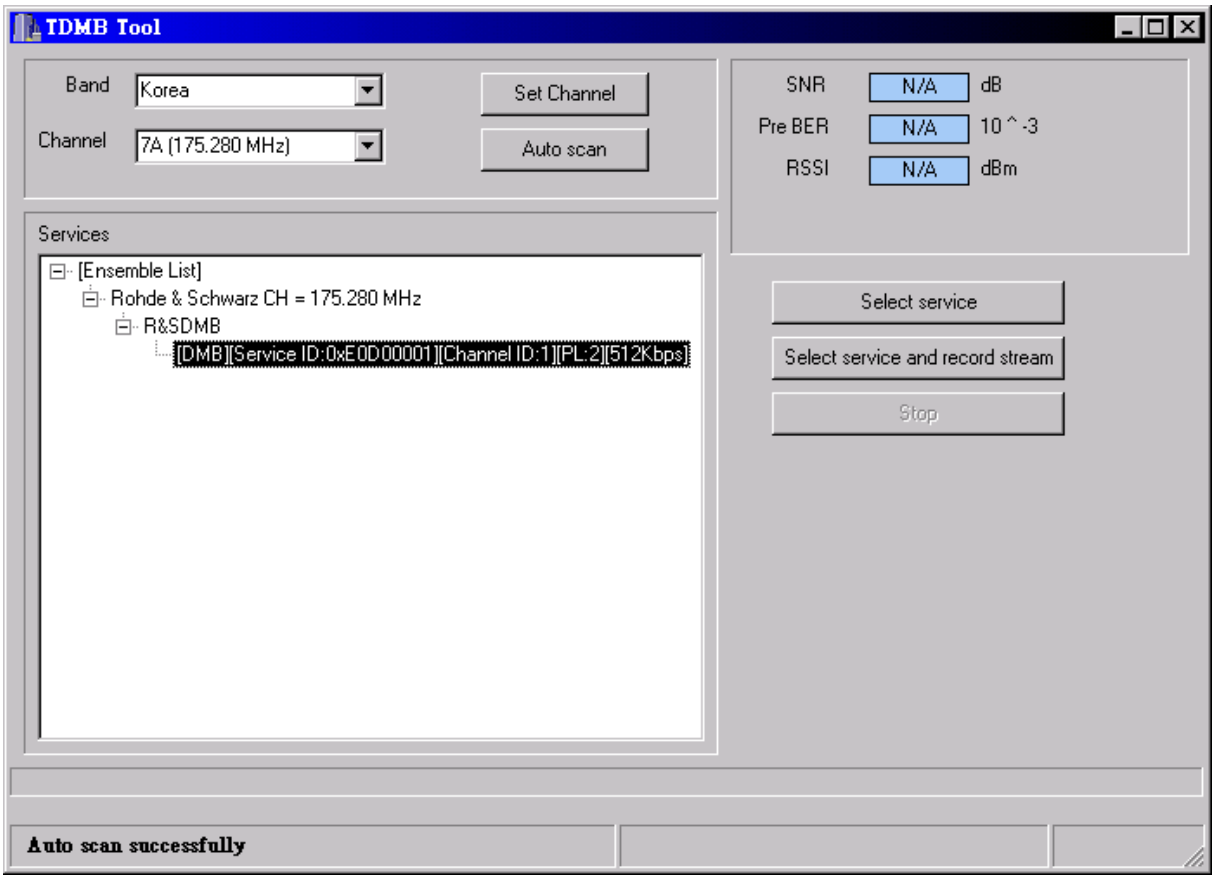

Figure 205 ***Result of scanning TDMB service automatically***

3.6.3 Select TDMB service to decode

User can follow below procedure to select TDMB service to decode

1. Select service from service tree view.
2. Click [Select service] button to decode TDMB service.
3. Single strength and quality (RSSI, SNR and BER) will automatic refresh.

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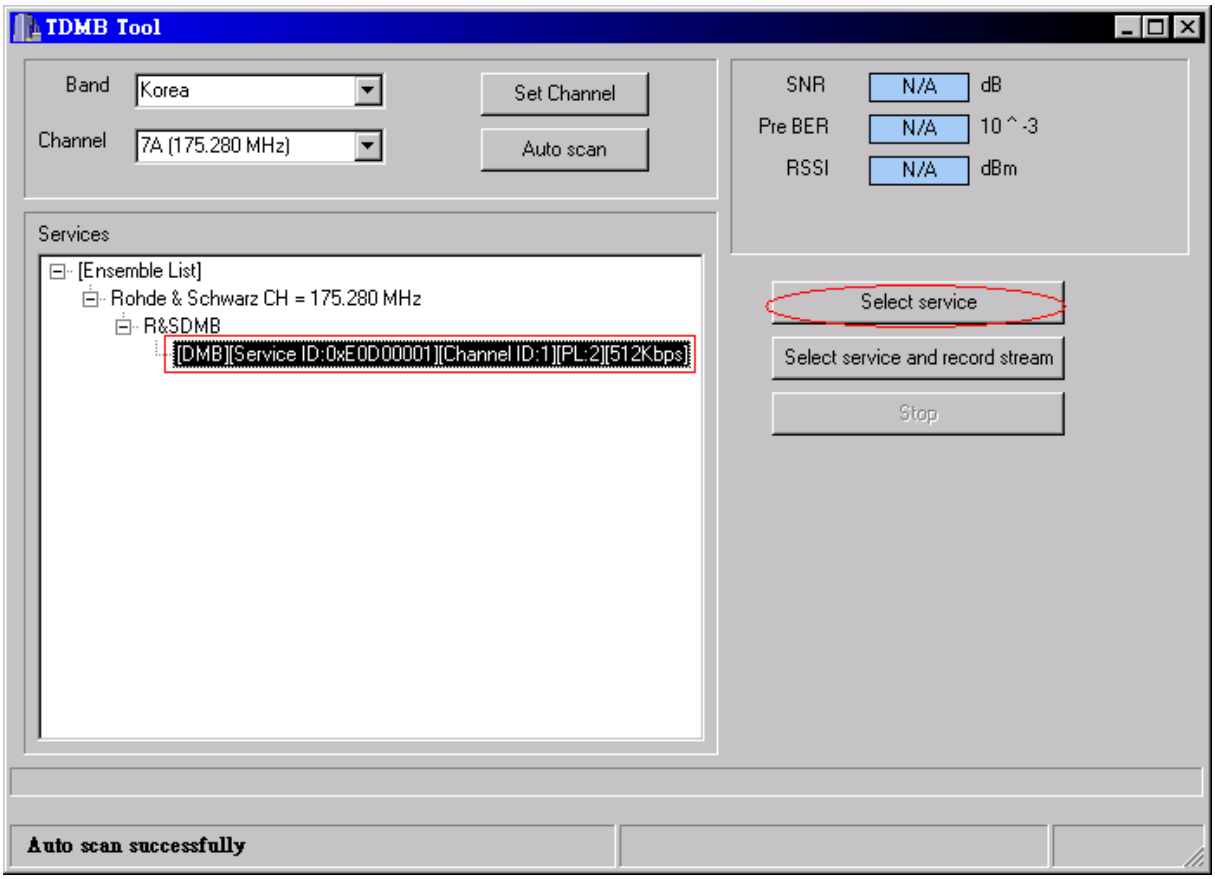

Figure 206 ***Select TDMB service to decode***

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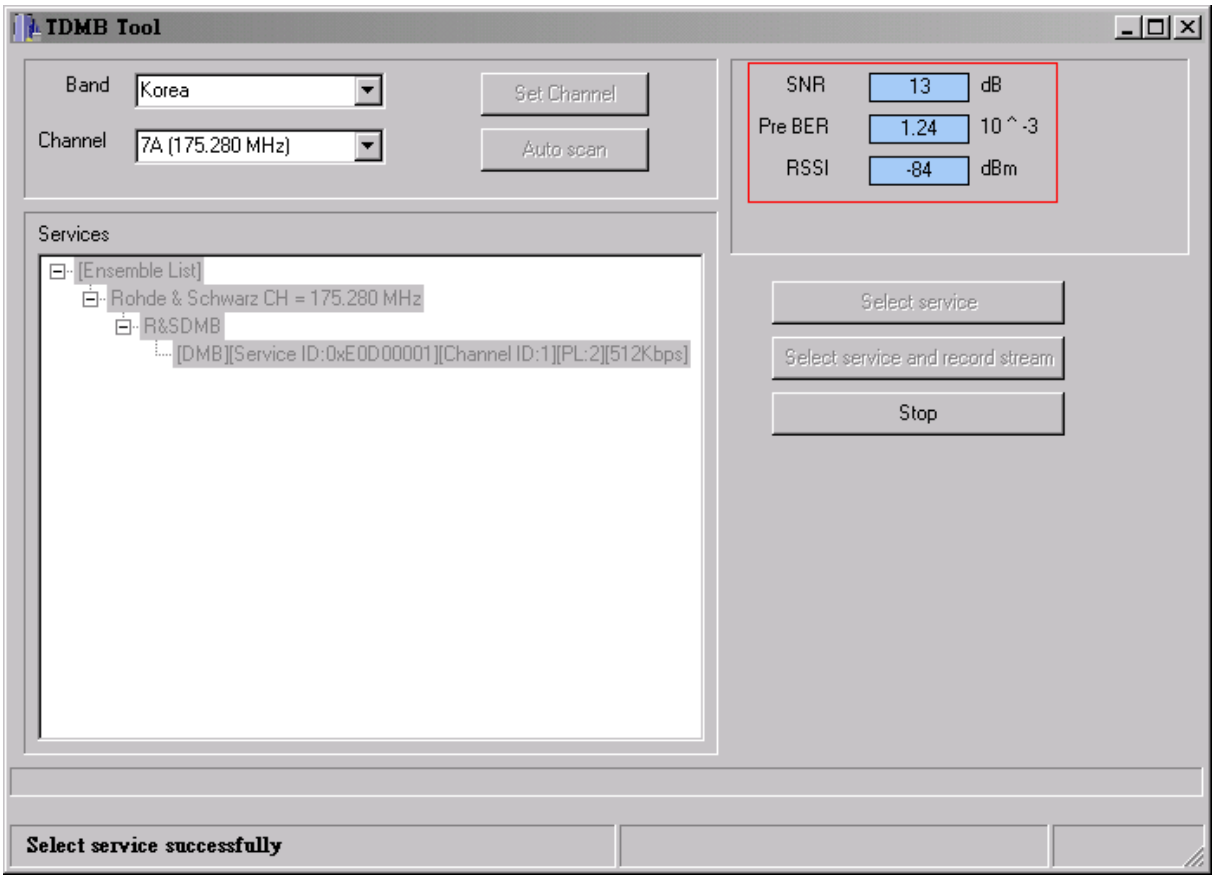

Figure 207 ***Signal strength and quality is refresh periodically***

3.6.4 Record audio or video stream

User can follow below procedure to record audio or video stream

1. Select service from service tree view.
2. Click [Select service and record stream] button to record audio or video stream.
3. Type file name of audio or video stream.
4. Click [Stop] button to stop recording audio or video stream.
5. Audio or video stream transfers from target FAT and saves to file.

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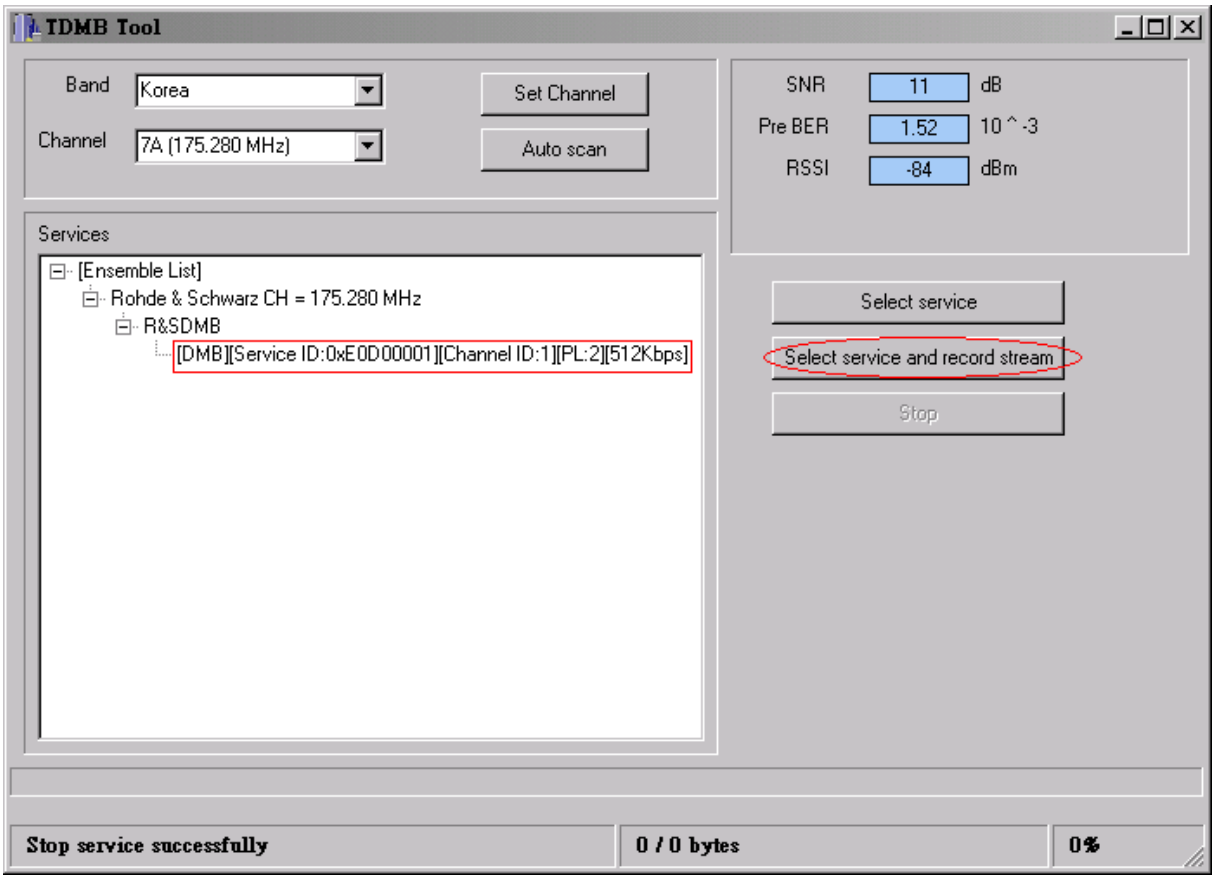

Figure 208 ***Record audio or video stream***

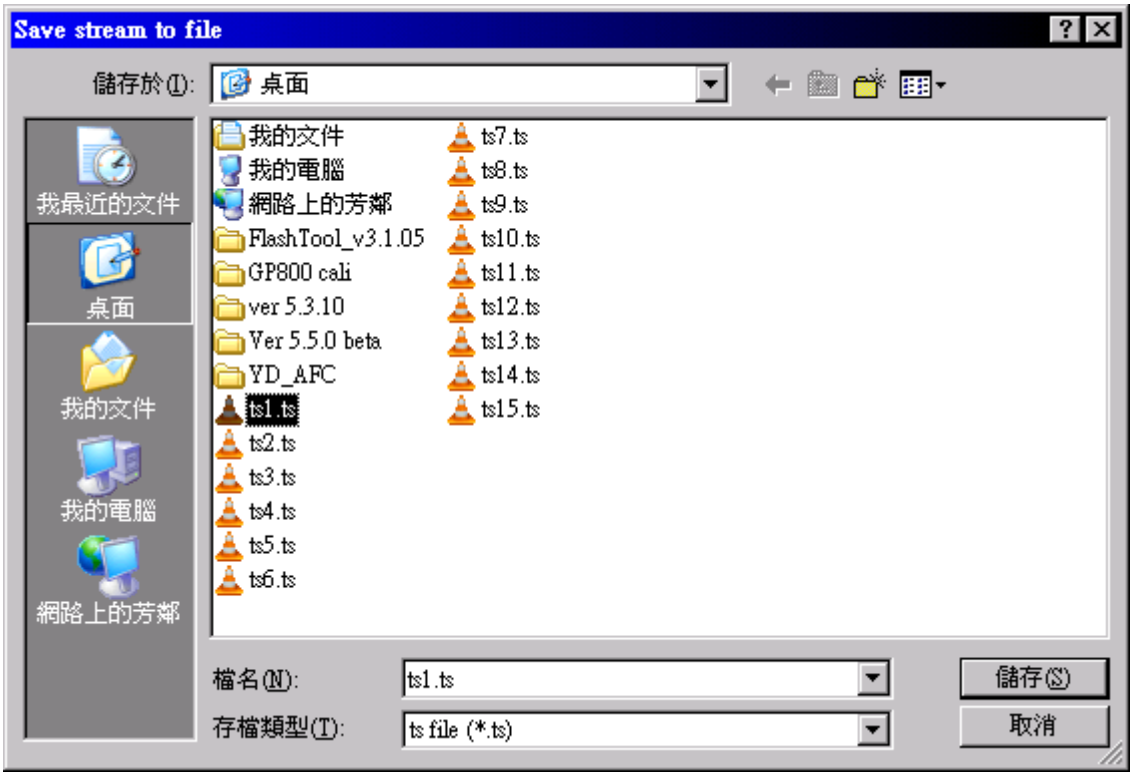

Figure 209 ***Set filename of audio or video stream***

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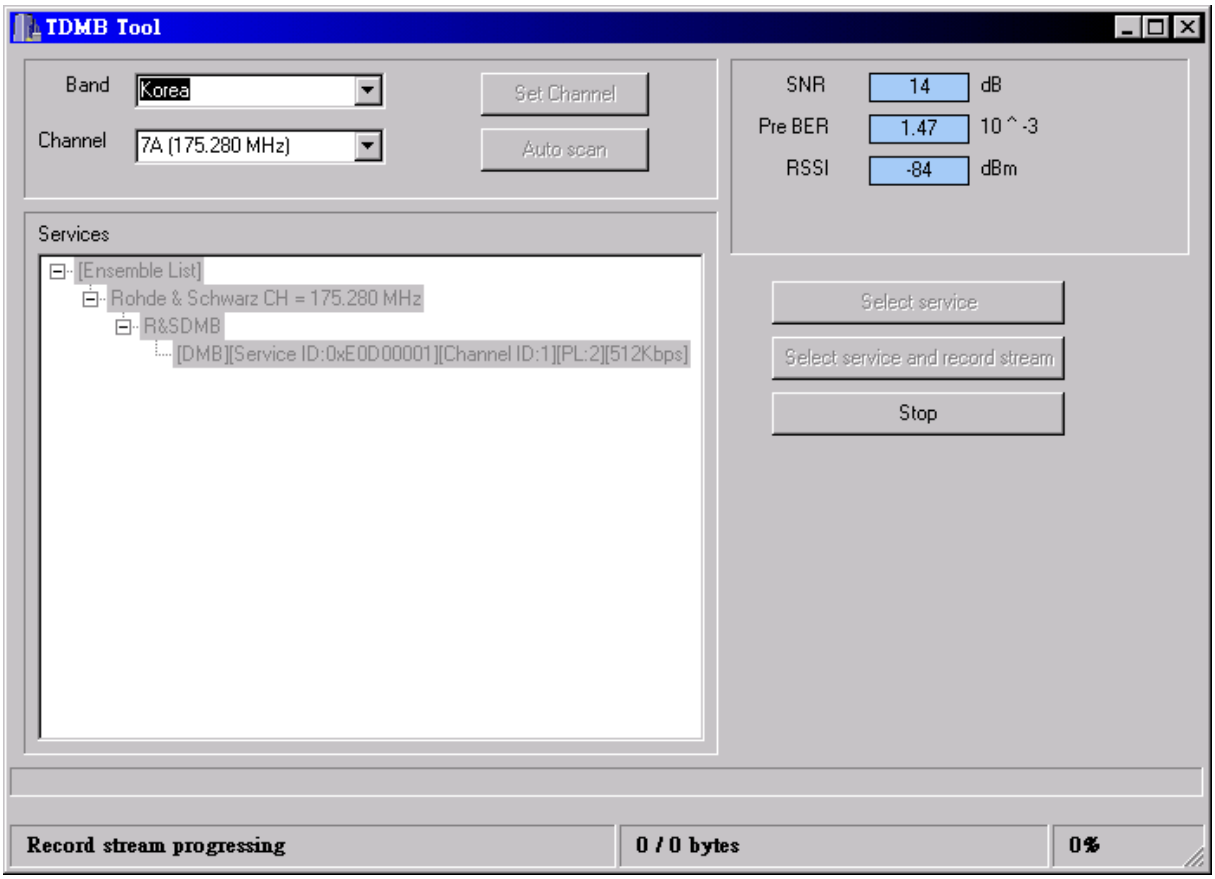

Figure 210 ***Click [Stop] button to stop record audio or video stream***

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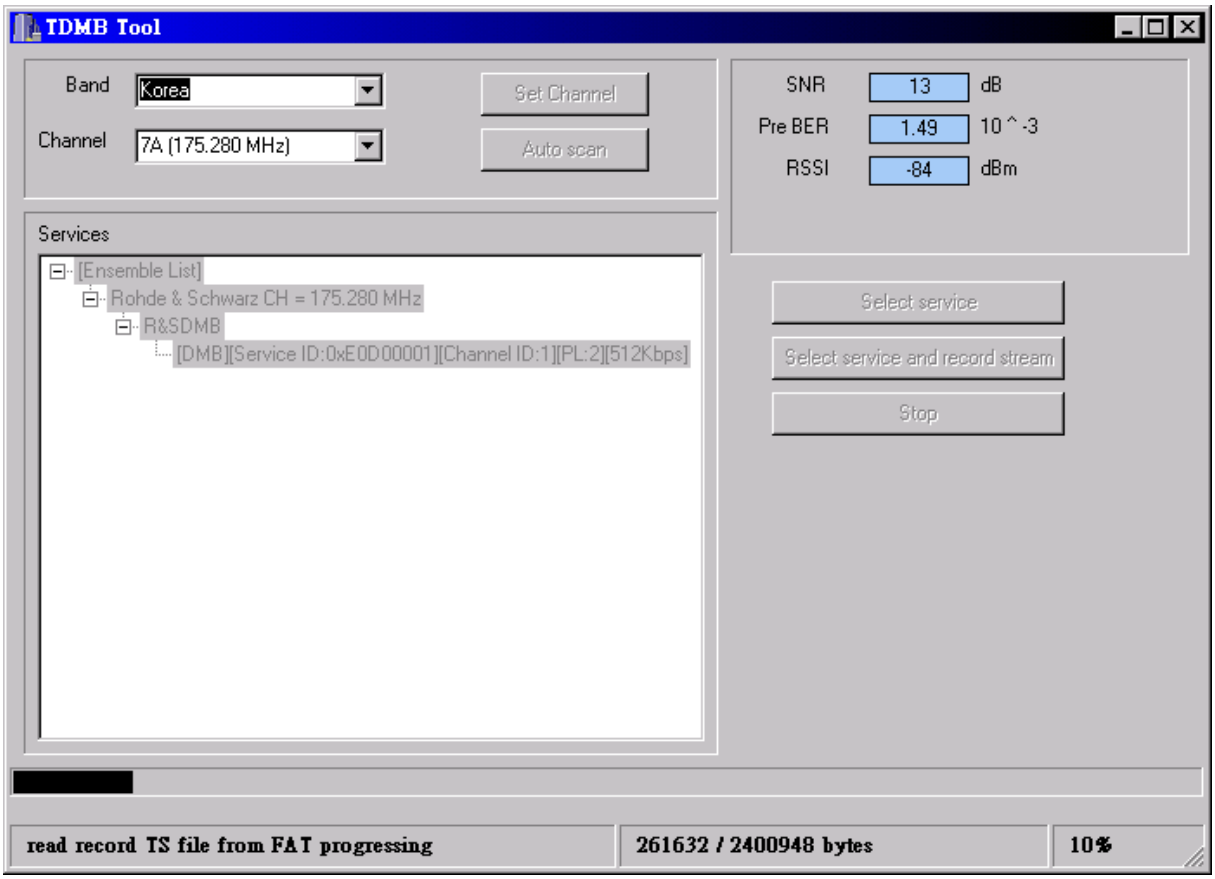

Figure 211 ***TS file transfers from target FAT and save to file***

3.7 NVRAM editor

The data saved in flash is constructed by many records. NVRAM editor can edit each value in each record in the flash. The tree at left side window will be automatic generated after opening the NVRAM database file. The window at the right side will display the data structure of the selected record read from NVRAM. User can switch to NVRAM editor by selecting [NVRAM editor] from main selection menu.

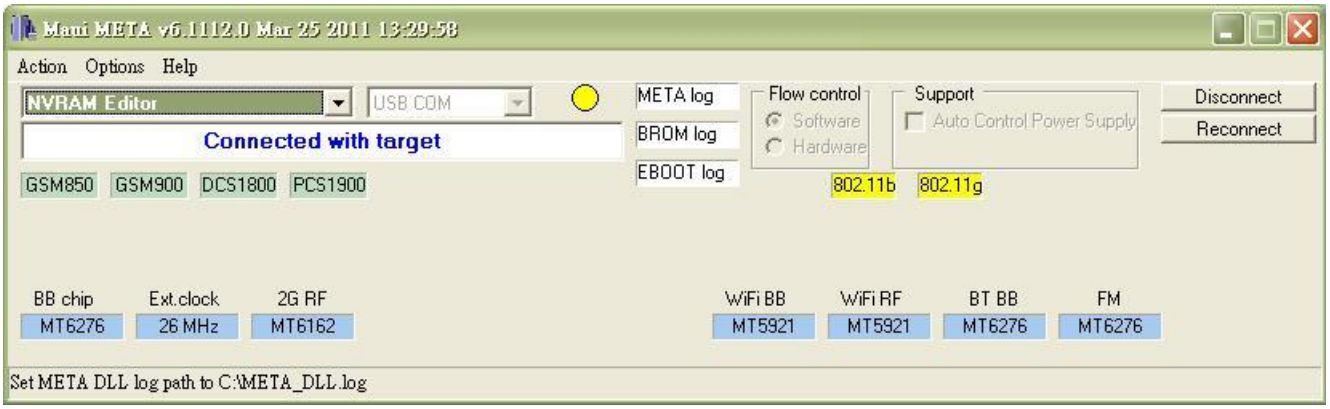

Figure 212 ***Select [NVRAM Editor] from main selection menu***

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3.7.1 Read from NVRAM

User can click [read from NVRAM] button to read one record from flash in MS.

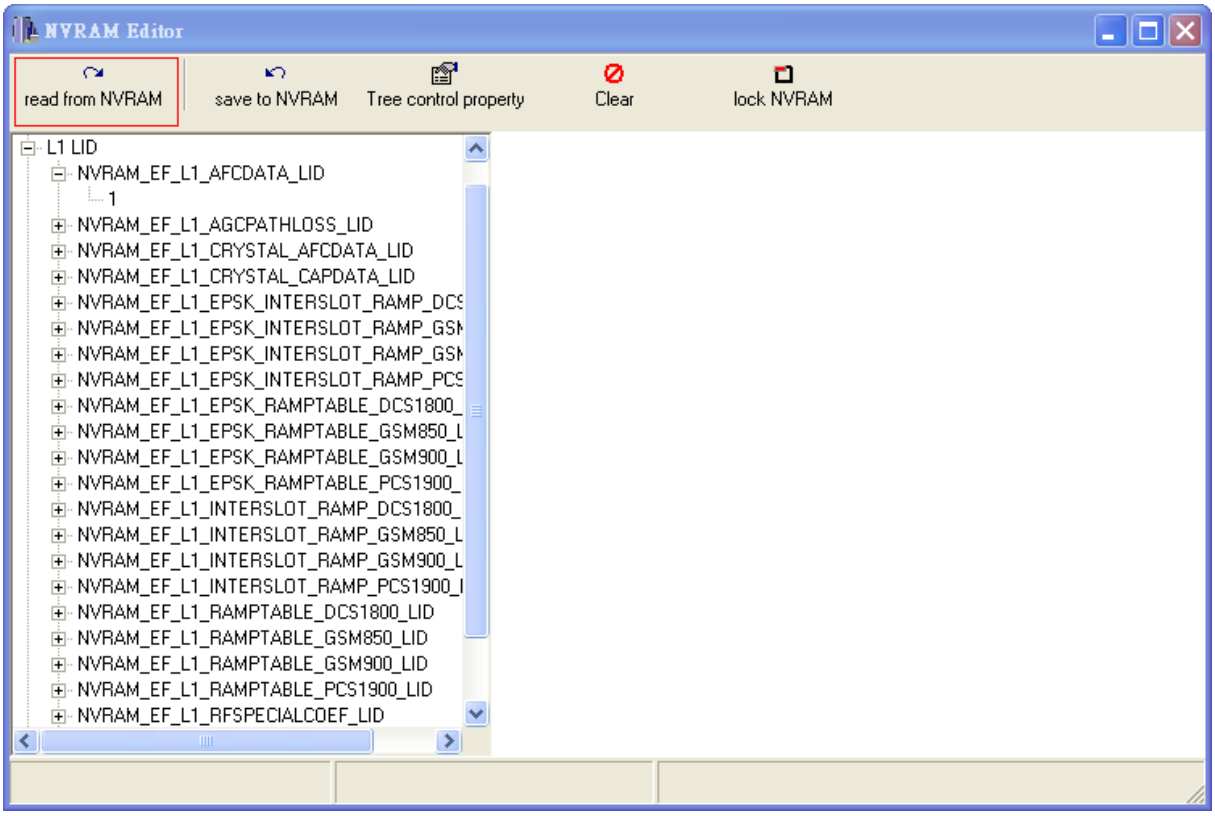

Figure 213 ***Click [read from NVRAM] button to read one record from flash***

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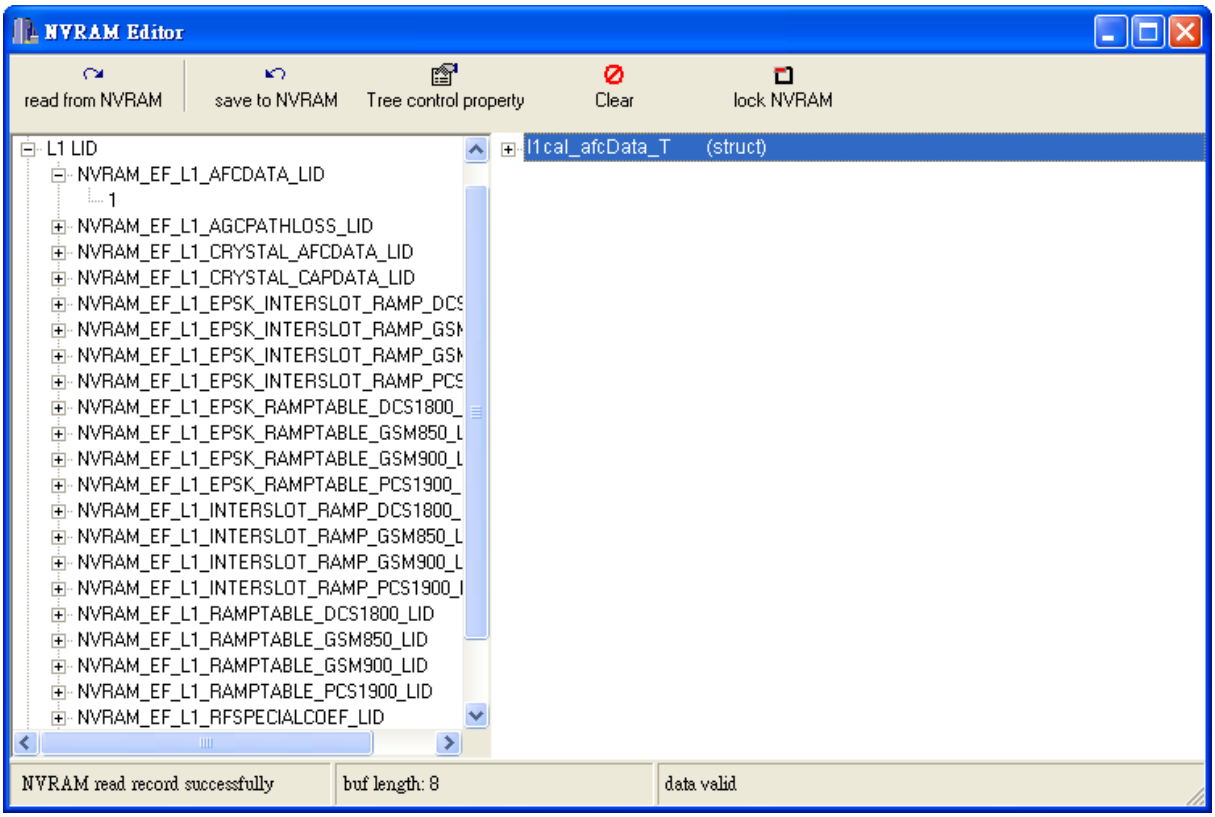

Figure 214 ***The record read from NVRAM is shown on the right side window***

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User can click the structure in the right side window to expend the data structure of the record.

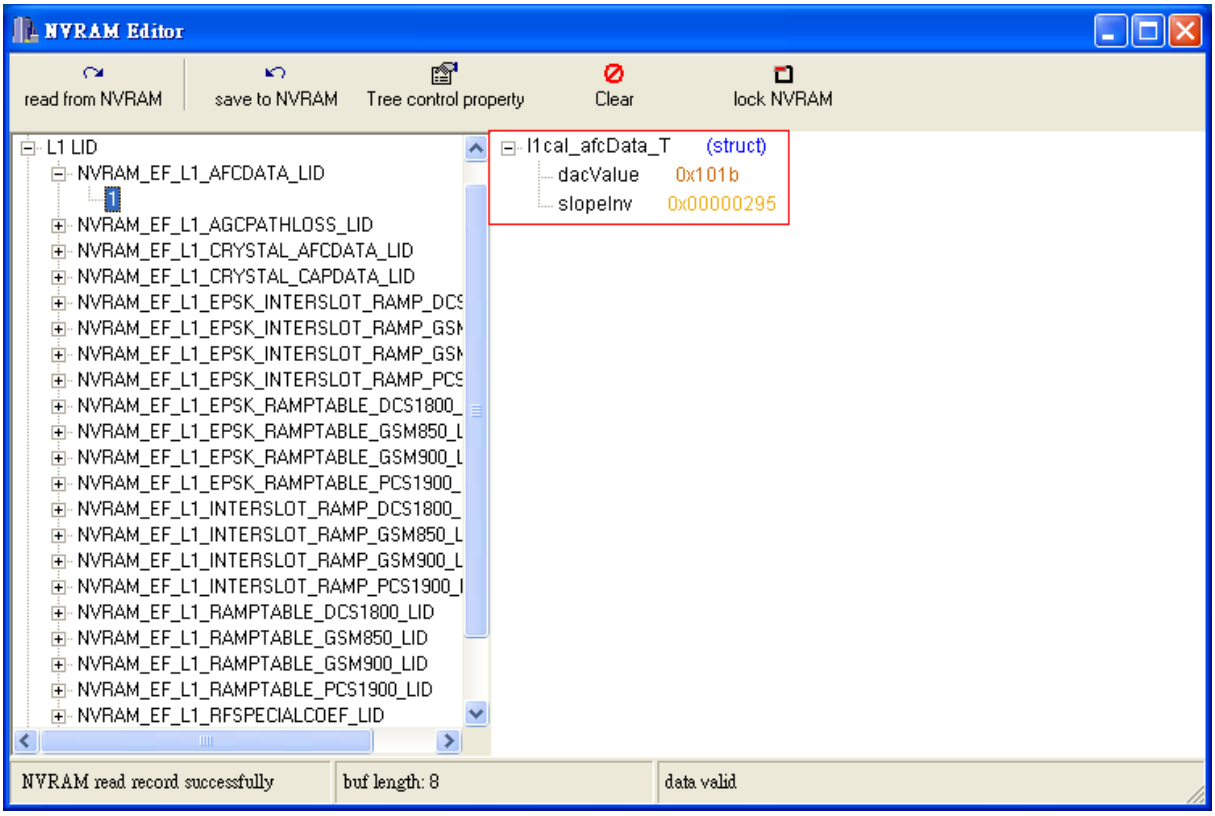

Figure 215 ***Data structure of the selected record***

User can read another record from NVRAM using following steps:
Step 1. Select one record in the tree of the left side window.
Step 2. Click [read from NVRAM] button.

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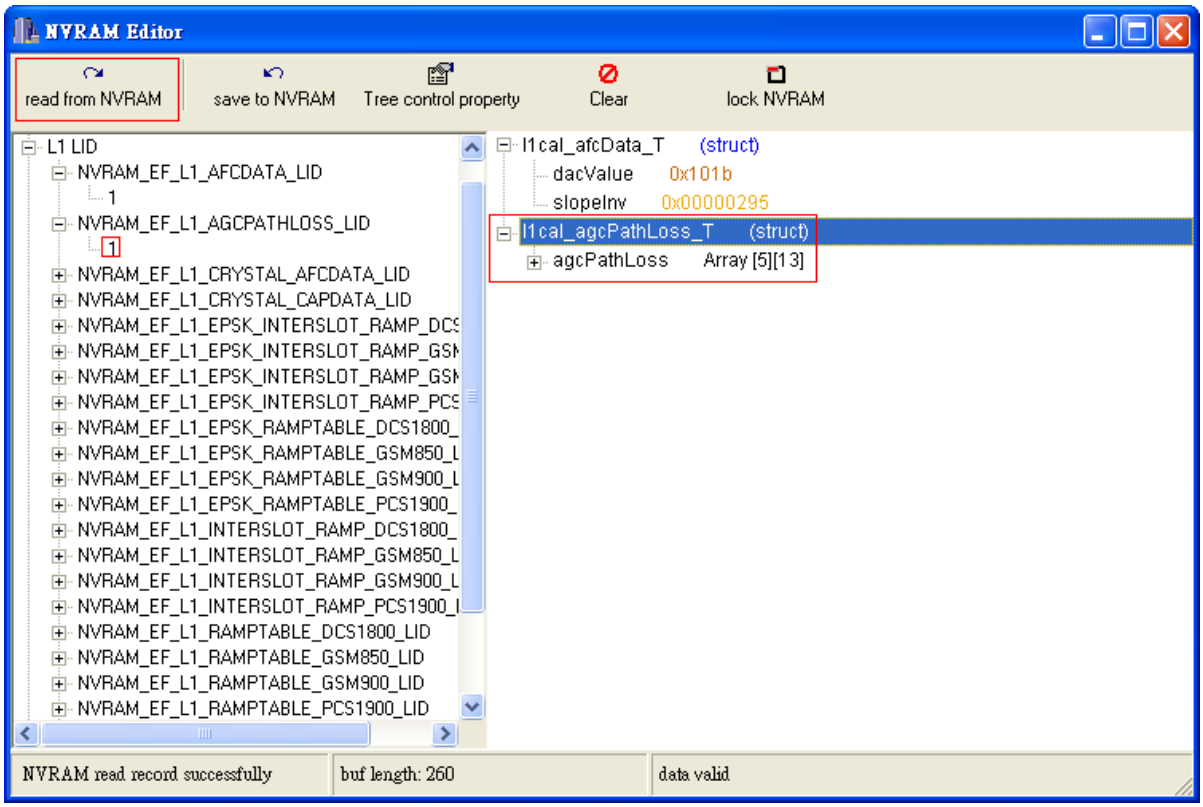

Figure 216 ***Read another record.***

Click the structure you read at the right side window to expand the structure.

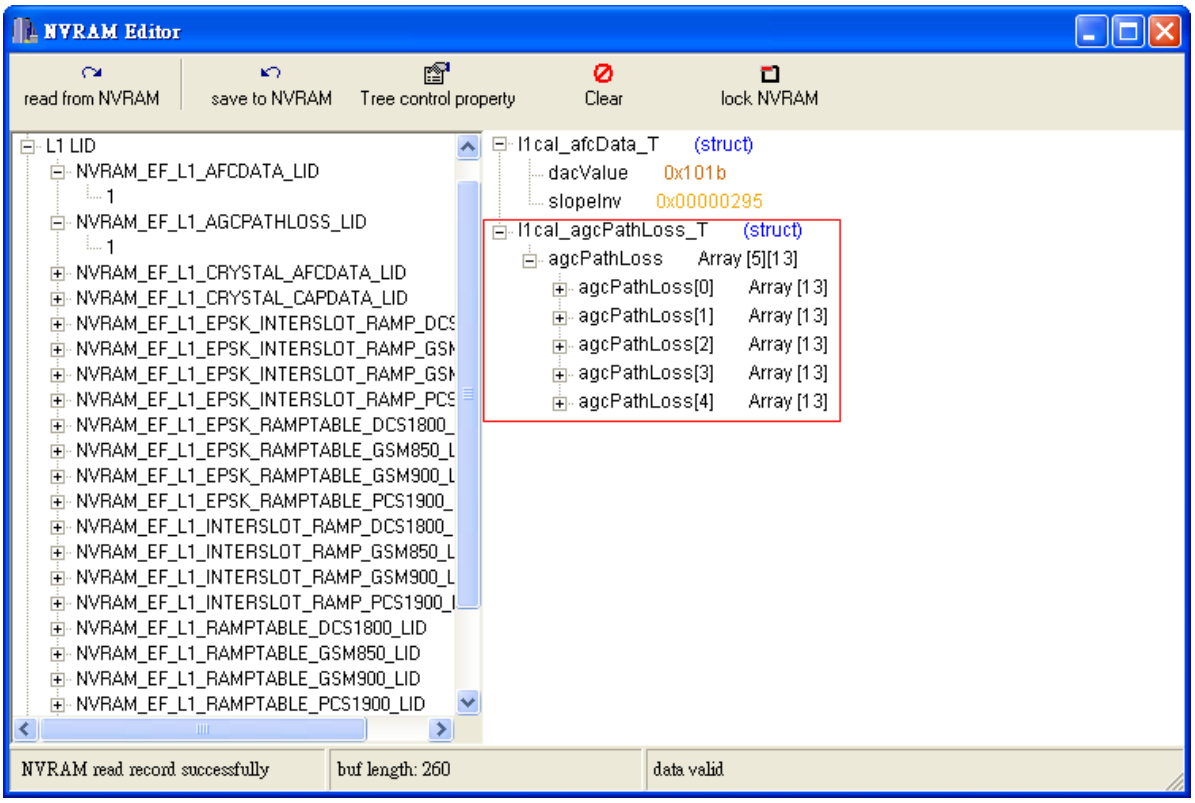

Figure 217 ***Show the data structure of the selected record***

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3.7.2 Editing the field in structure

User can select a field of the structure by clicking it. Then input value to the selected field.

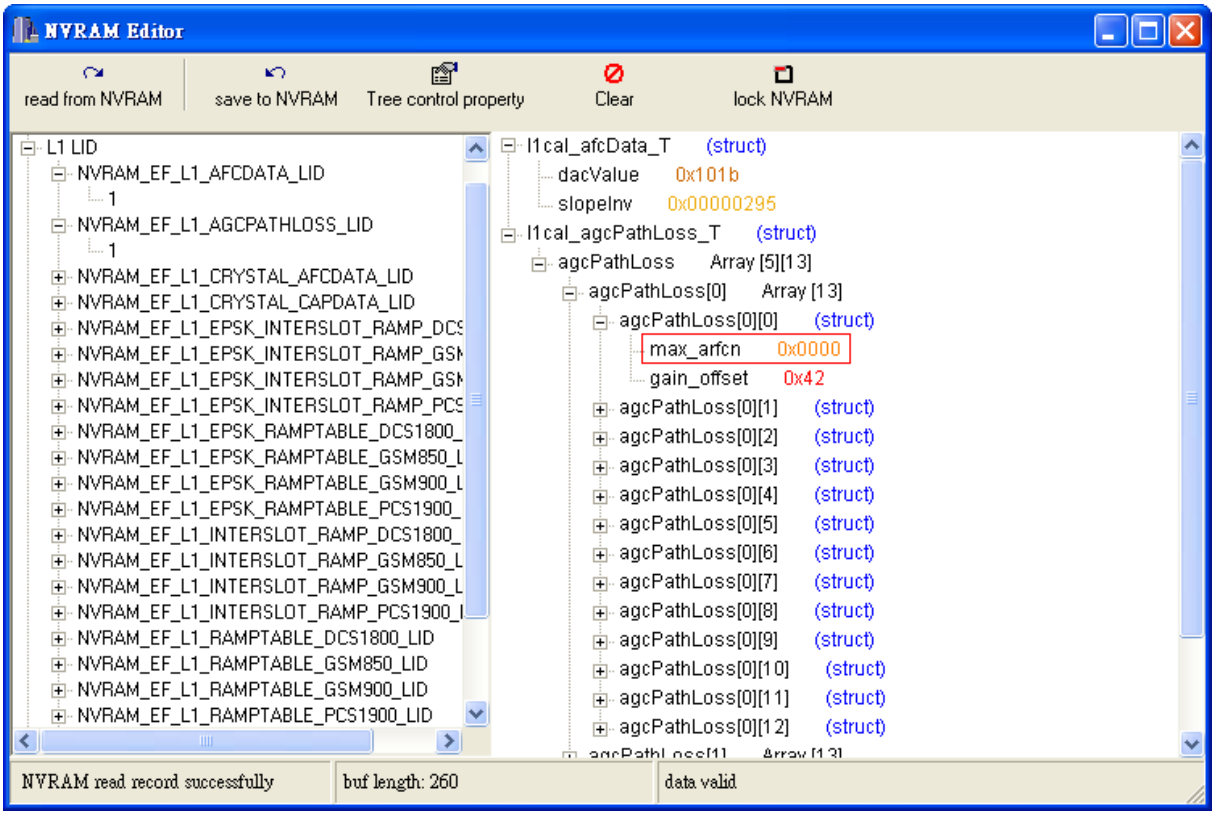

Figure 218 ***Select a field***

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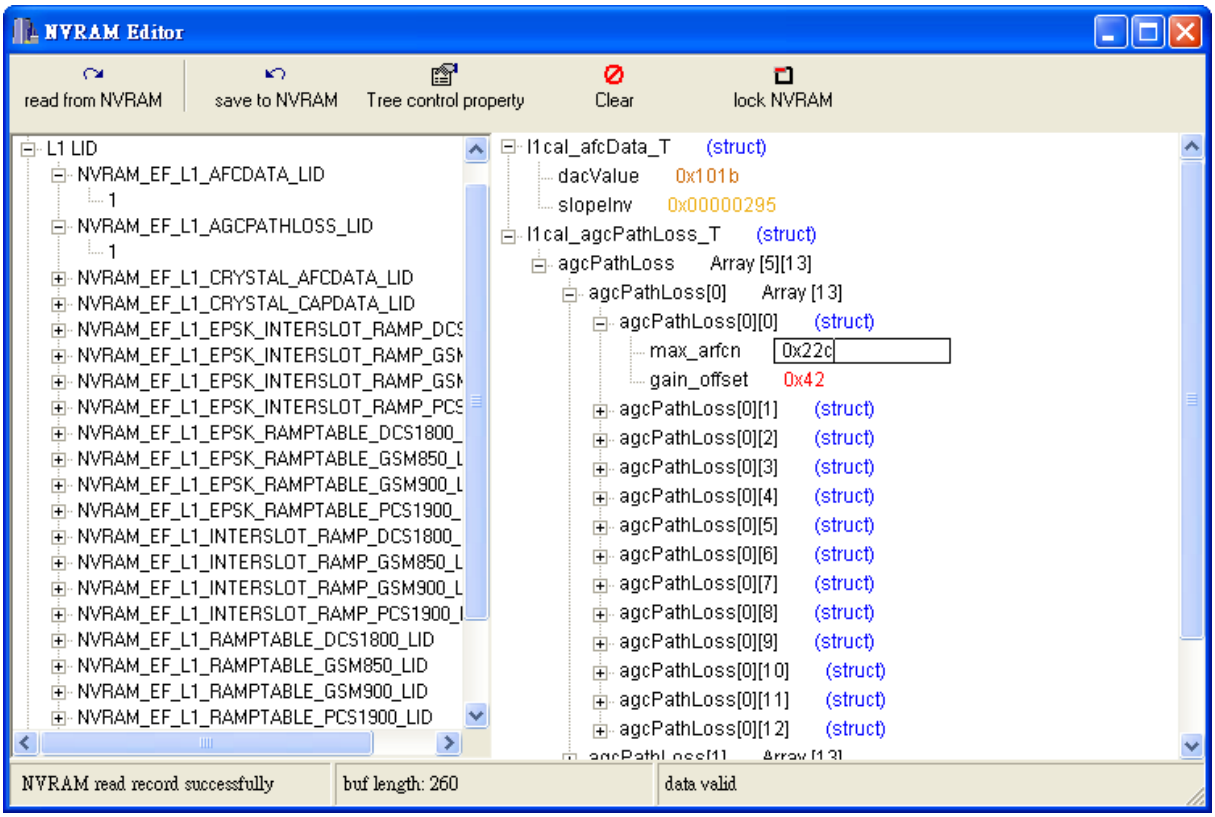

Figure 219 ***Change value of the field***

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The modified field and structure will change its color.

3.7.3 Save the record to NVRAM

User must select the record that he wants to save firstly and then click [Save to NVRAM] button to save the record.

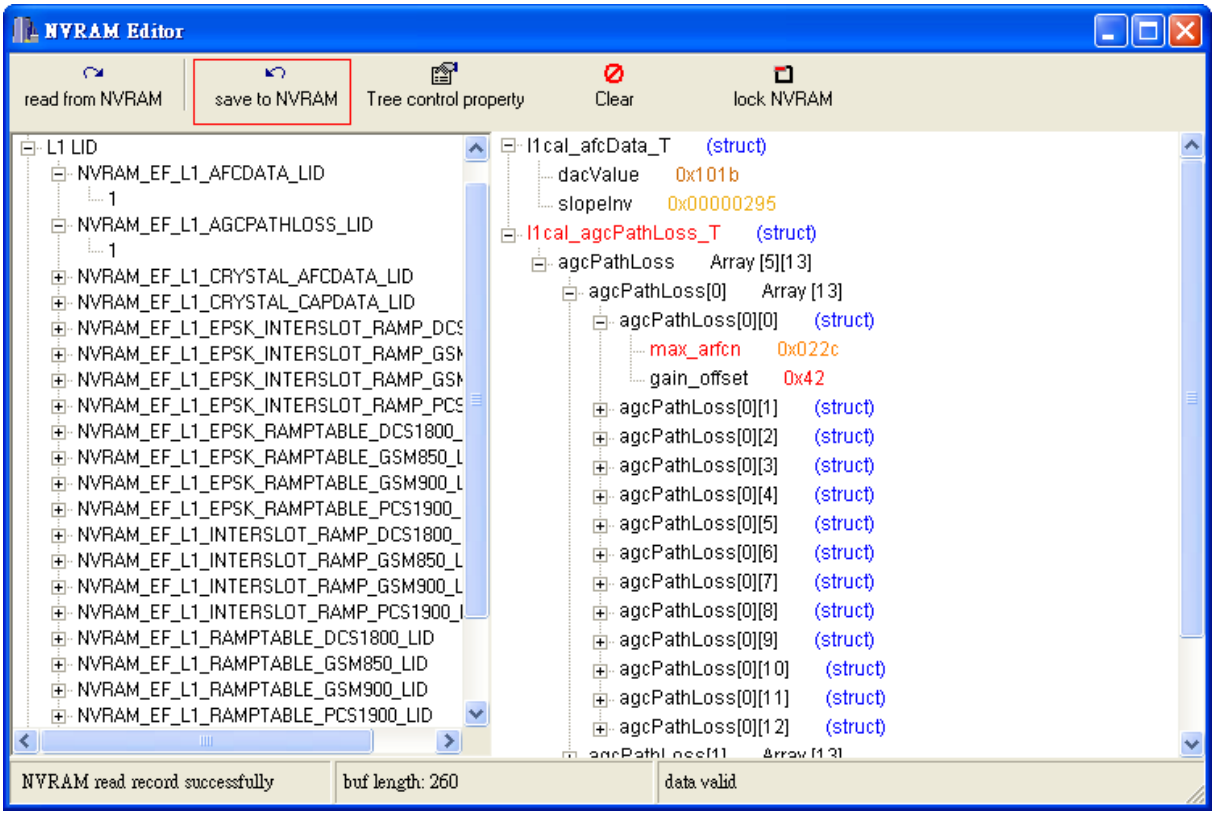

Figure 220 ***Save the selected record to flash***

3.7.4 Clear or remove a structure in NVRAM editor

User can click [Clear] button to remove a structure in NVRAM editor.

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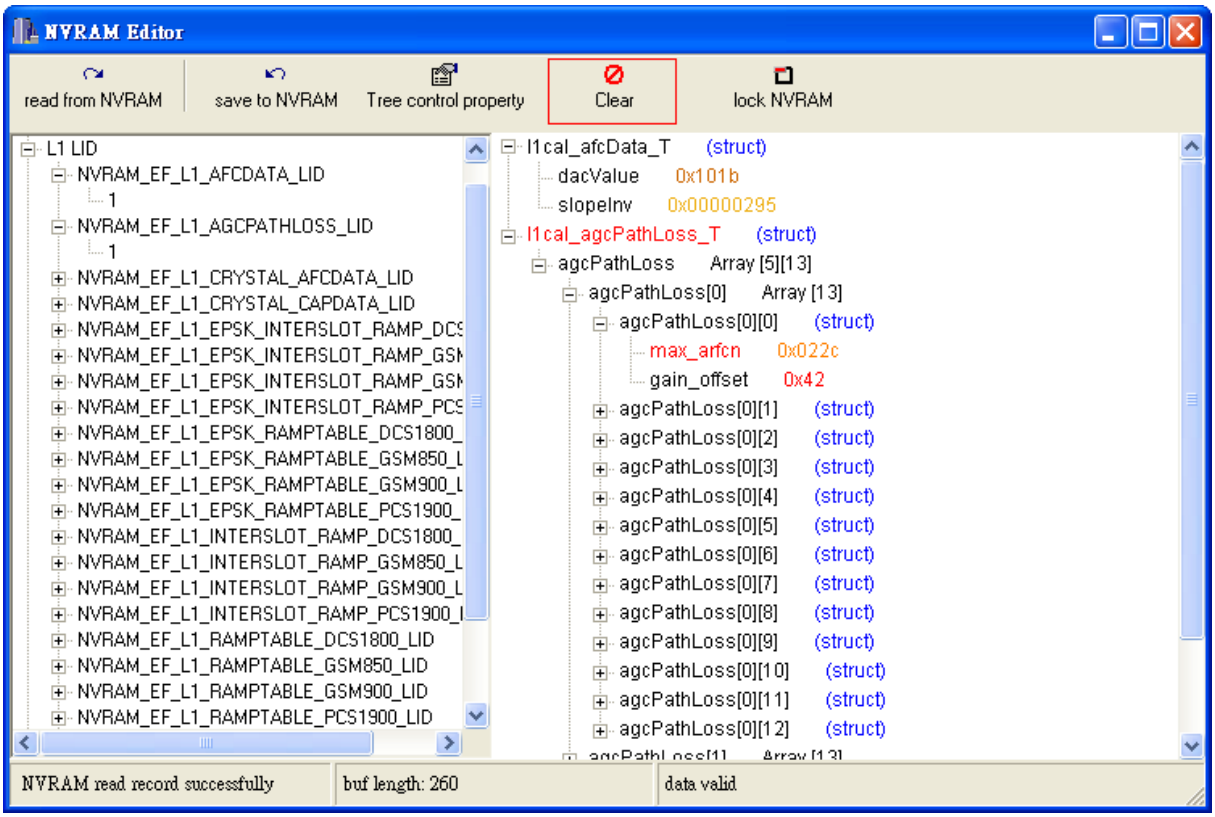

Figure 221 ***Clear one record in flash***

If user wants to clear a modified record, NVRAM editor will pop-up a dialog to ask user to save it or not.

Figure 222 ***Save or not or cancel***

3.7.5 NVRAM editor property setting

User can click [Tree control property] button to set colors of tree at the right side window.

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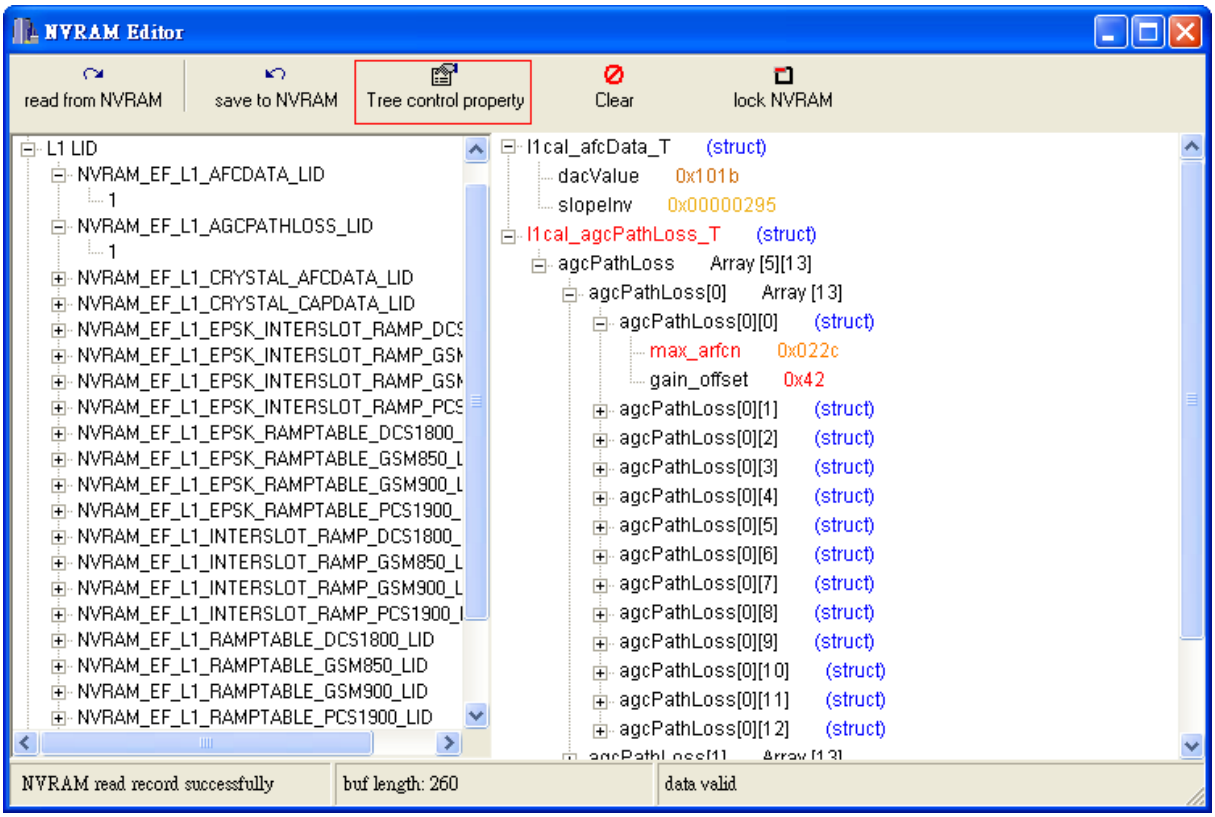

Figure 223 ***Click [Tree control property] button***

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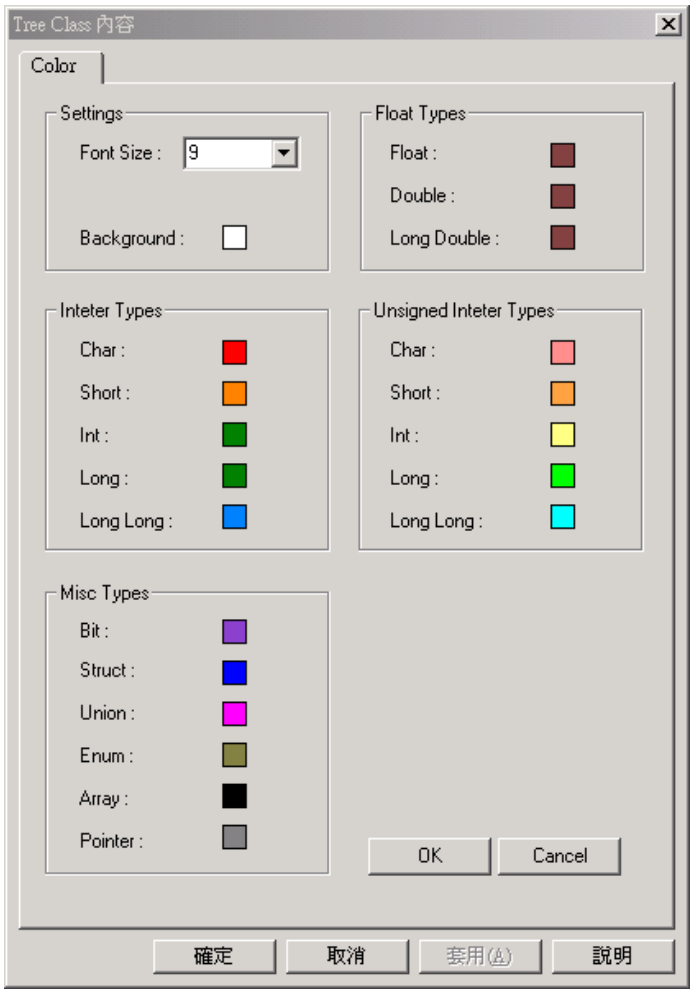

Figure 224 ***Tree control property window***

User can click each little square to change the color of each type in NVRAM editor.

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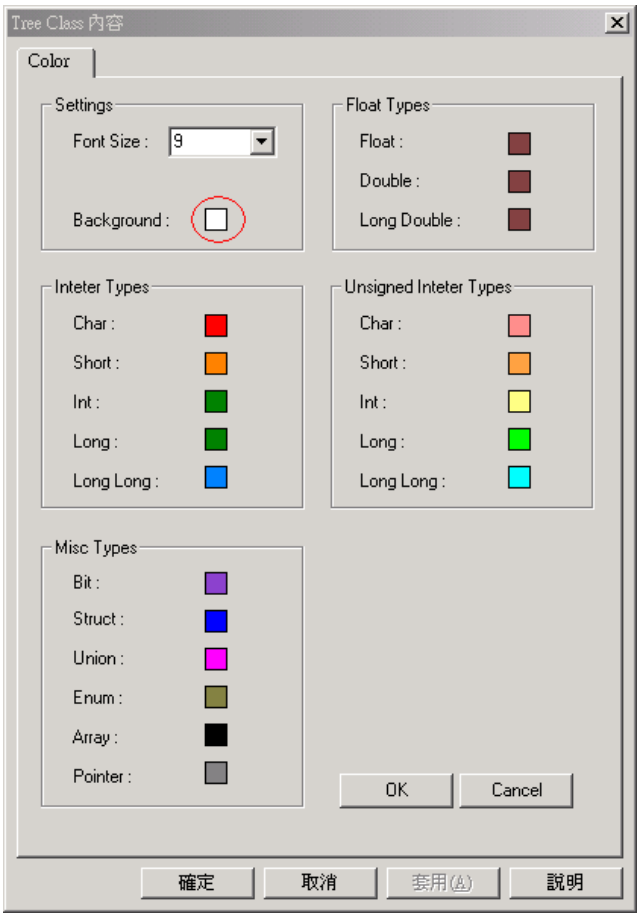

Figure 225 ***Set color of data type window***

After user clicks the square, NVRAM editor will pop-up a little window to show all colors that user can select.

Figure 226 ***Select color window***

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3.7.6 NVRAM lock

User can click the [NVRAM lock] button to lock those LIDs with NVRAM_ATTR_WRITEPROTECT attribute. User can not modify those LIDs if they have been locked.

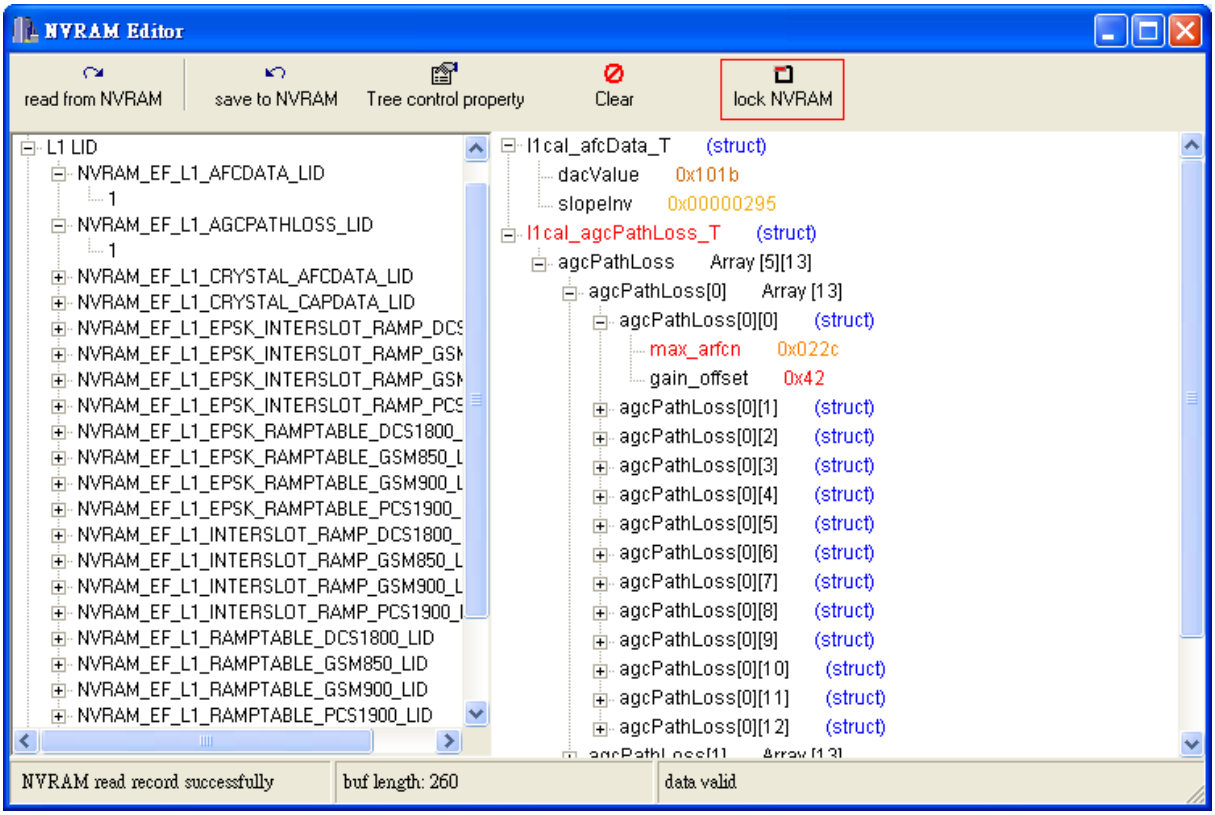

Figure 227 ***Click the [lock NVRAM] button***

3.8 Audio function

There are many audio functions supported by META. They are acoustic FIR-coefficient, additional output FIR-coefficient, AMR FIR-coefficient, melody FIR-coefficient, audio testing, ring composer, play song in FAT, play song using ID, customer volume setting, acoustic FIR tuning and melody FIR tuning. User can switch to audio function by selecting [Audio] from main selection menu.

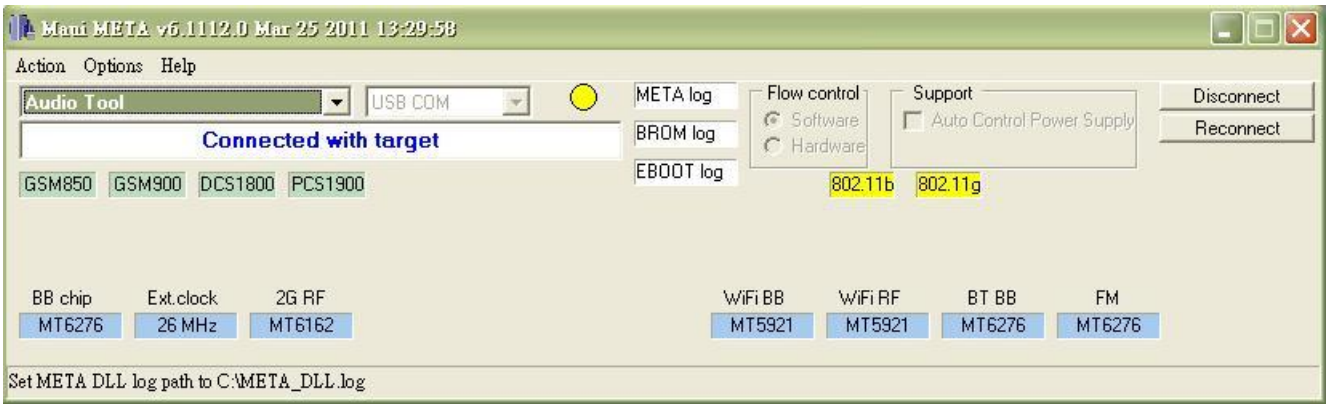

Figure 228 ***Select [Audio] from main selection menu***

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3.8.1 Acoustic FIR-coefficient

Acoustic FIR-coefficient window provides interface for user to read or write coefficient in flash, ini file or Matlab file and generating C file. User can click these 12 buttons shown on window to read coefficient from flash, write coefficient to flash, load coefficient from file and save coefficient to file. All values are in decimal format. The range of acoustic FIR coefficient is -32768 ~ 32767. There are four group of coefficient, they are handset input coefficient, handset output coefficient, earphone input coefficient and earphone output coefficient. There are 30 words in each group of coefficient. There are 5 parameters in echo suppression function. They are
Time energy gap: time-and-energy-gap constant for speakerphone application in loud-speaker mode.
Volume constant: gain constant for speakerphone application in loud-speaker mode.
Time energy gap 2: time-and-energy-gap constant for echo loss at maximum speaker volume in normal mode.
Volume constant 2: gain constant for echo loss at maximum speaker volume in normal mode.
Media playback max swing: the maximum output swing to ADC DAC.

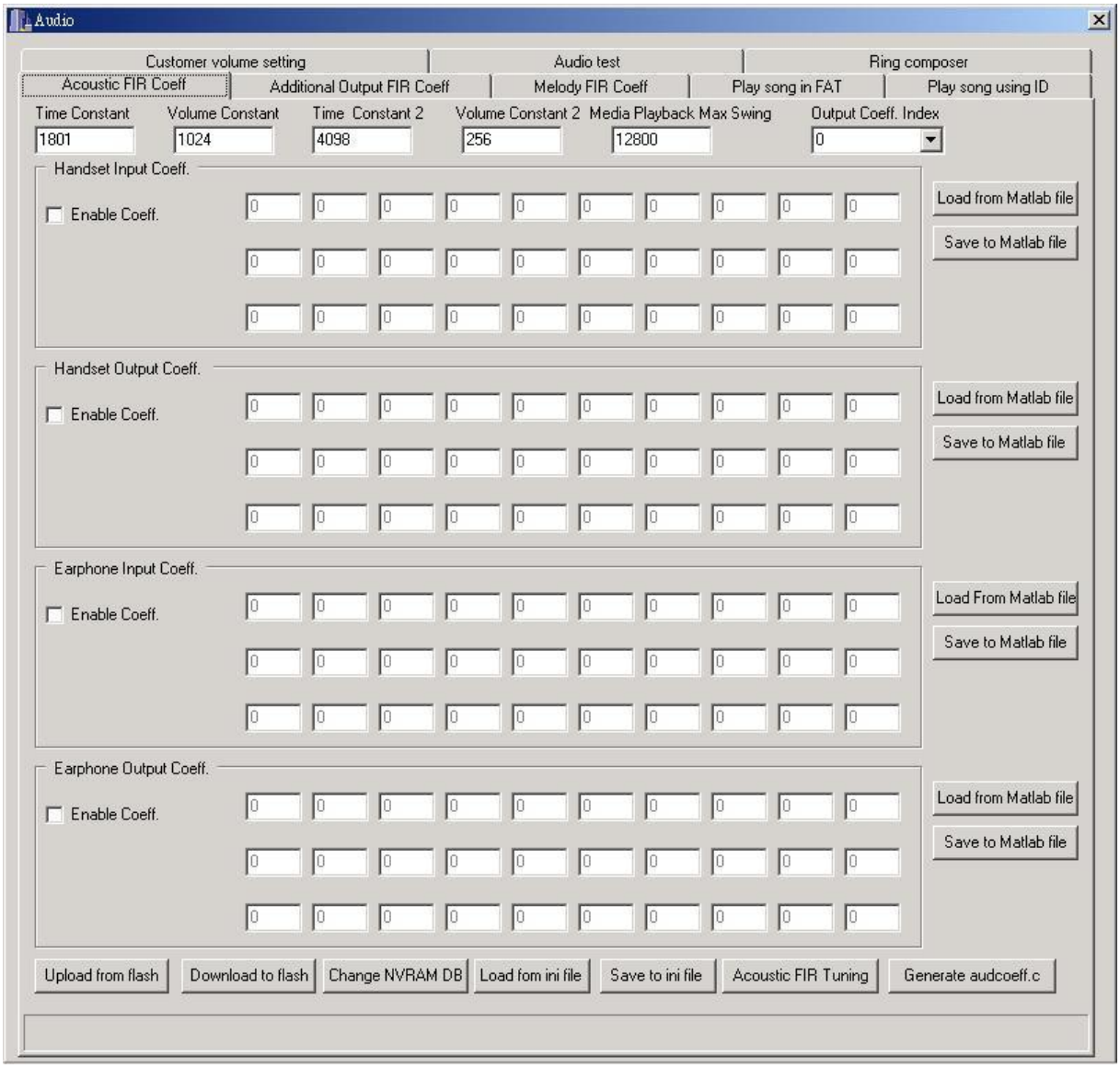

Figure 229 ***Acoustic FIR-Coefficient window***

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3.8.1.1 Upload and download acoustic FIR coefficient in flash

User can click [Upload from flash] button to read acoustic FIR coefficient from flash and click [Download to flash] button to write acoustic FIR coefficient to flash.

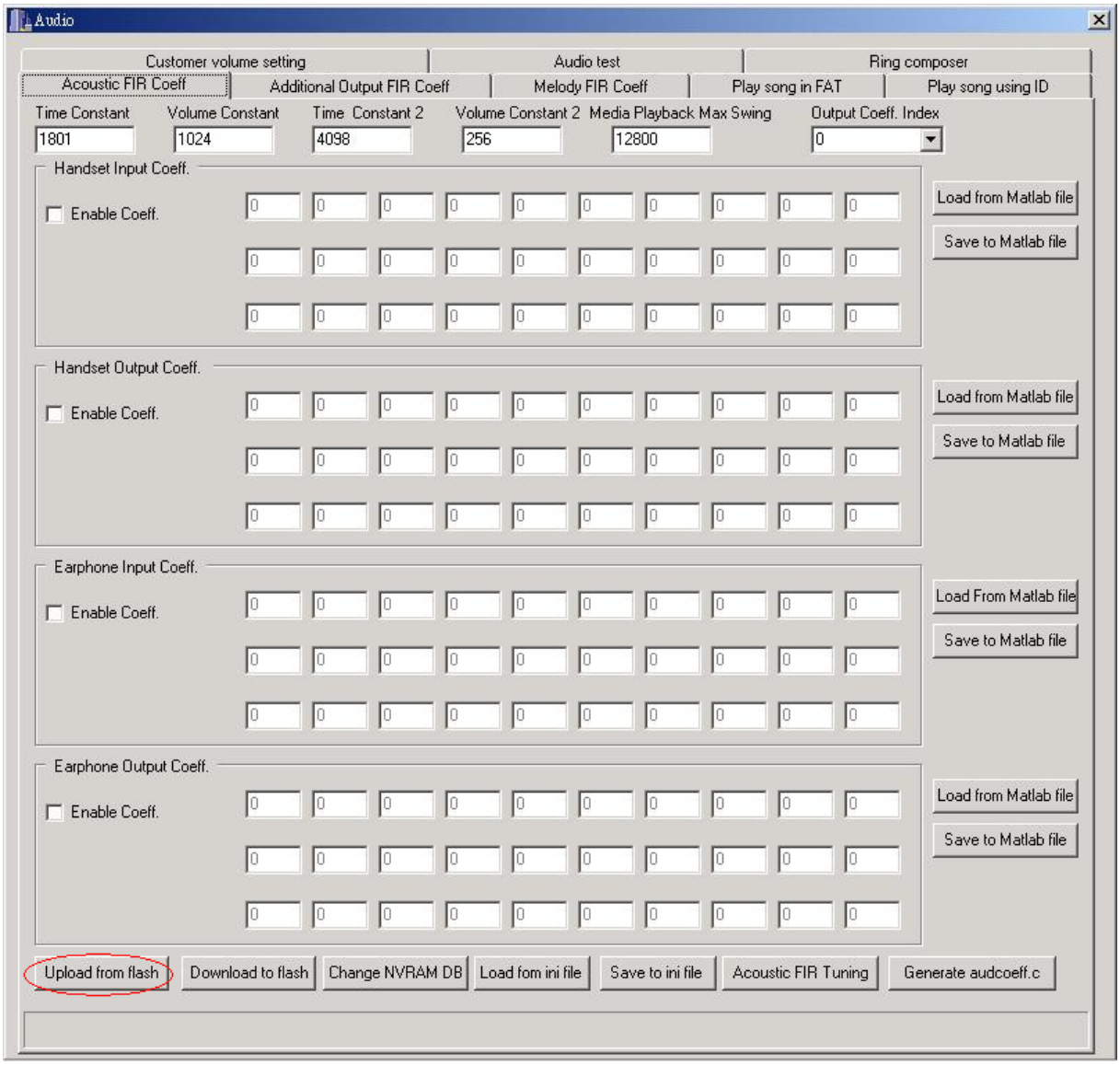

Figure 230 ***Click [Upload from flash] button to read coefficient from flash***

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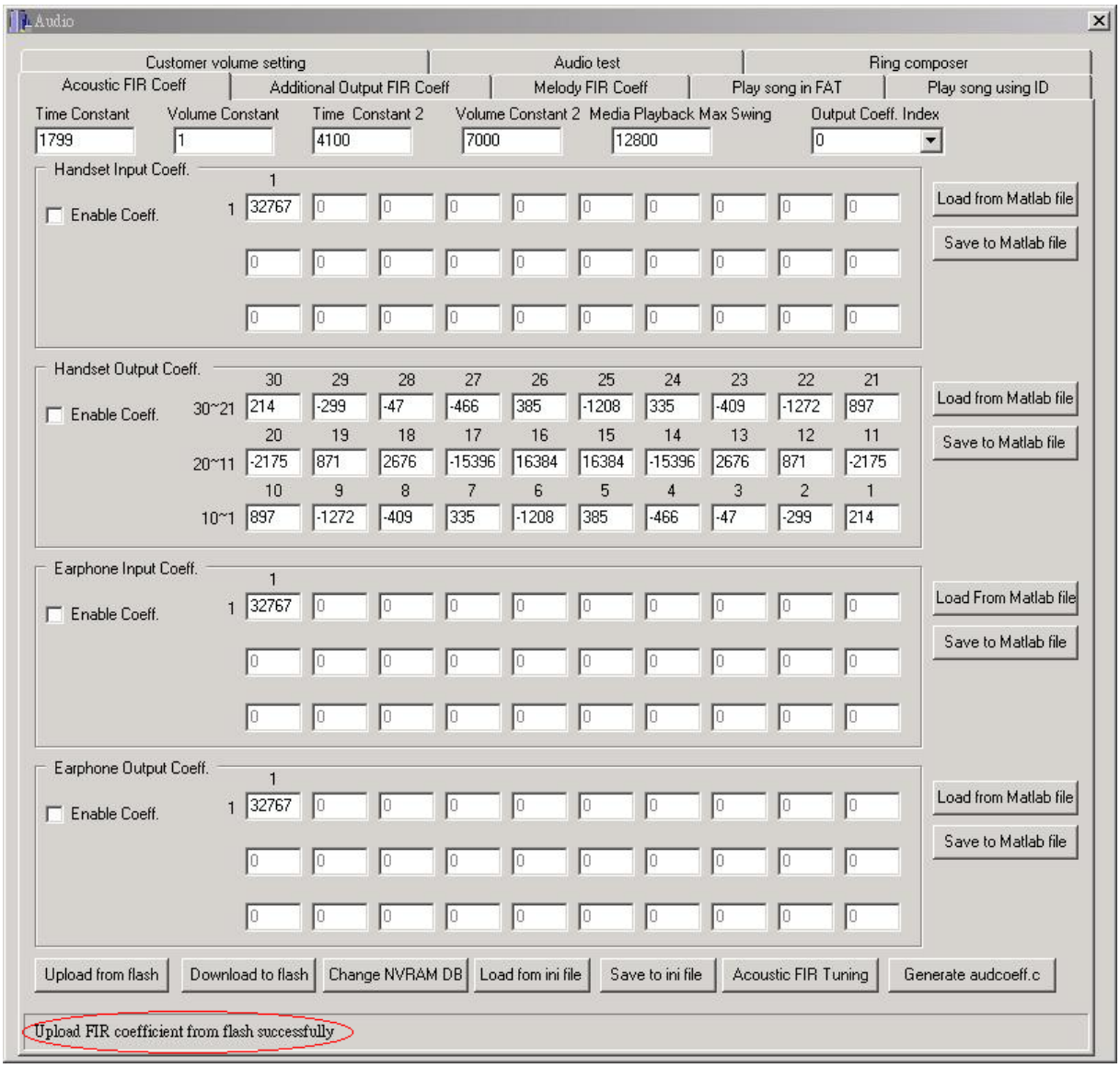

Figure 231 ***Result of upload acoustic FIR coefficient from flash***

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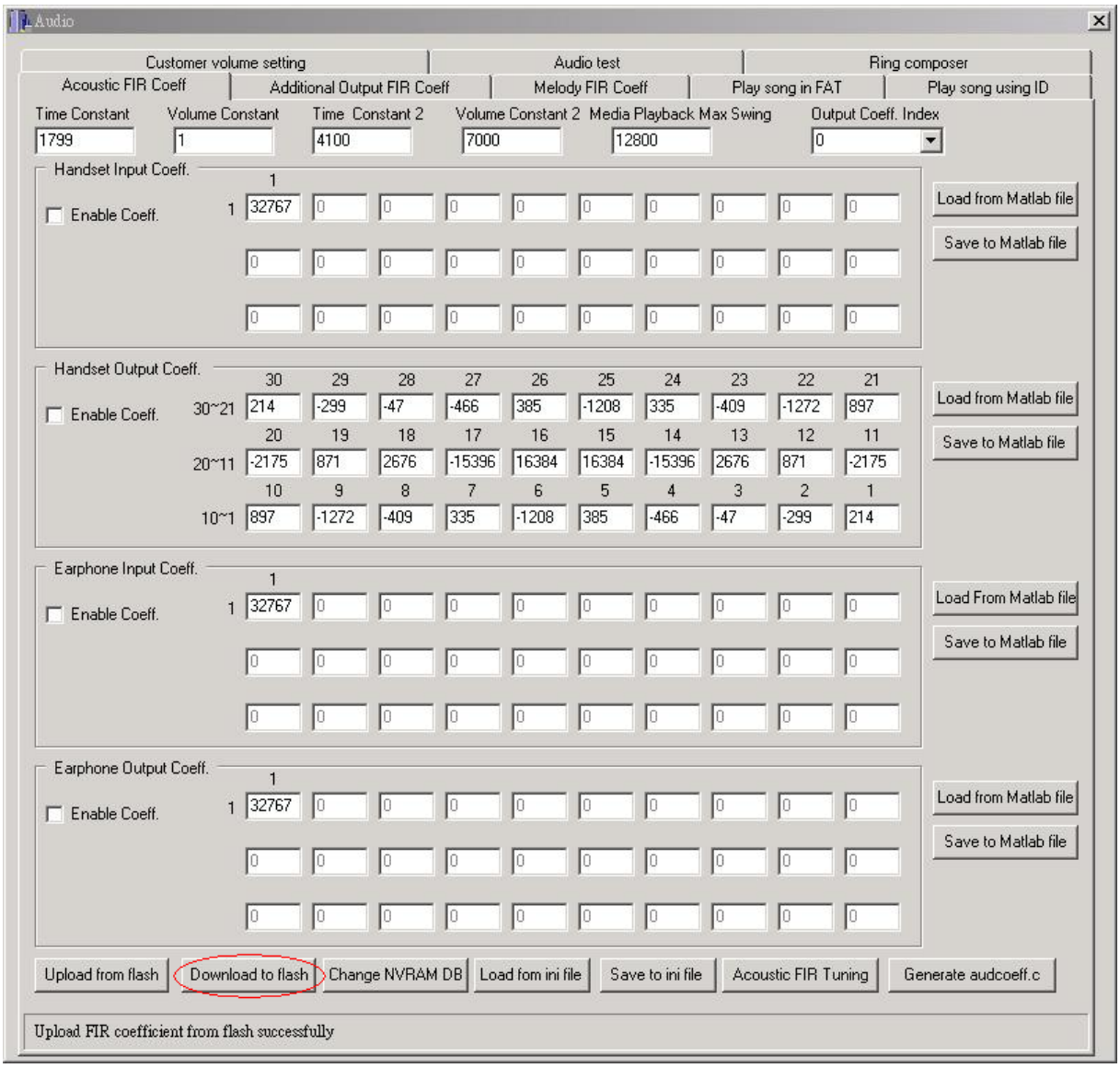

Figure 232 ***Click [Download to flash] button to save coefficient to flash***

User can click [Change NVRAM DB] button to change NVRAM database file.

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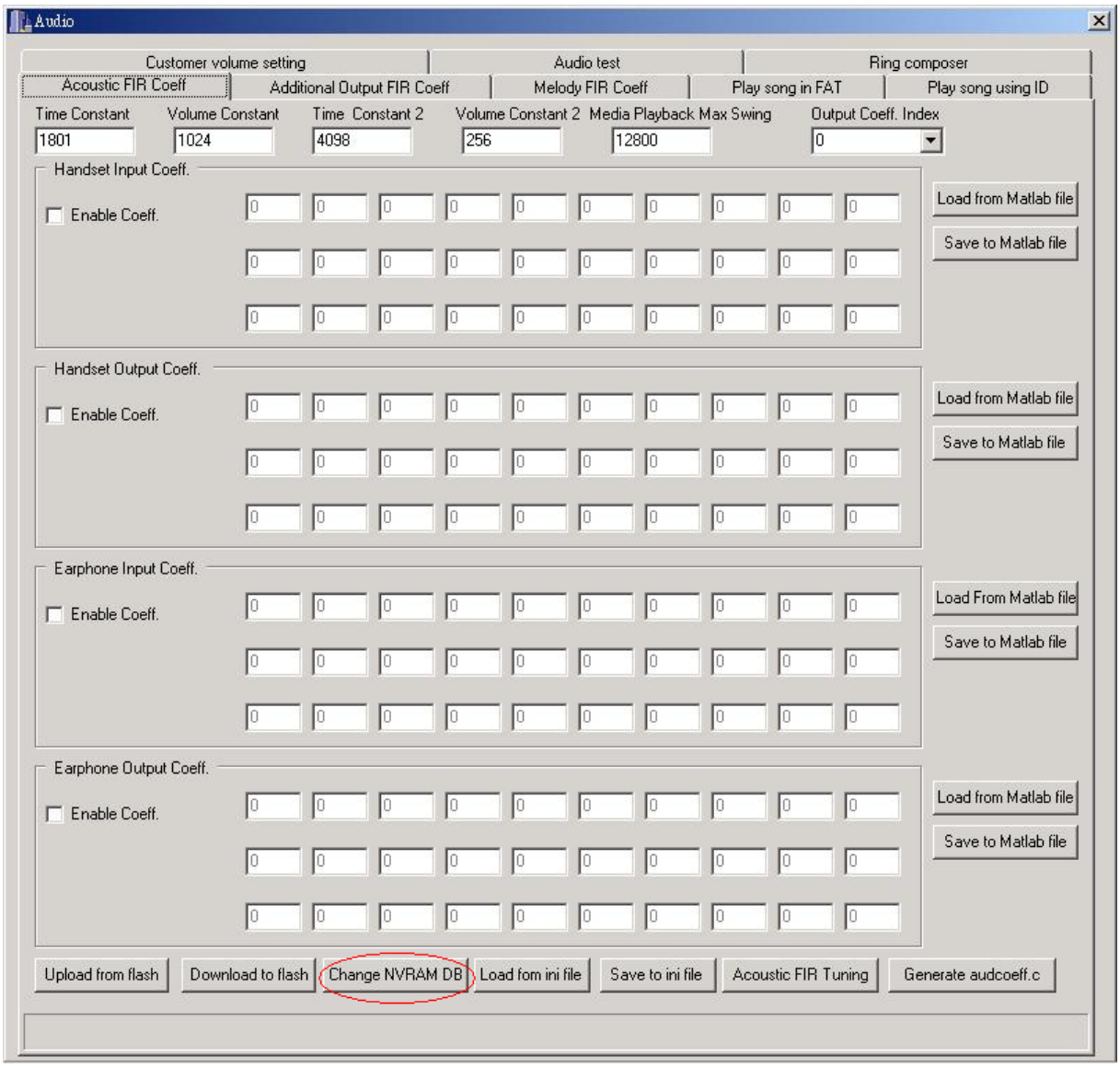

Figure 233 ***Click [Change NVRAM DB] to change NVRAM database file***

3.8.1.2 Read and write acoustic FIR coefficient in file

User can click [Load from file] button to read acoustic FIR coefficient from file and click [Save to file] button to save acoustic FIR coefficient to file.

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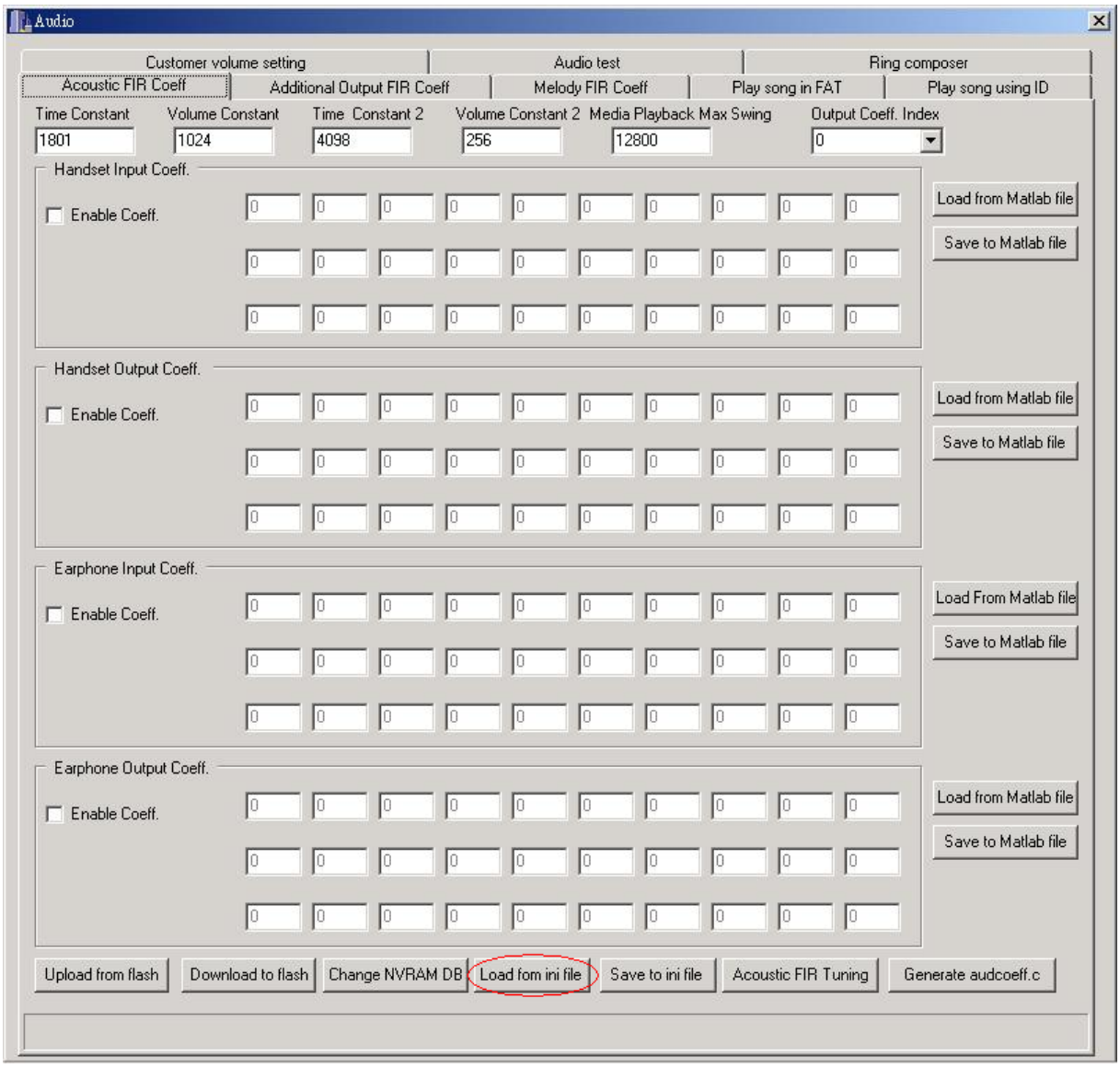

Figure 234 ***Click [Load from ini file] to read coefficient from file***

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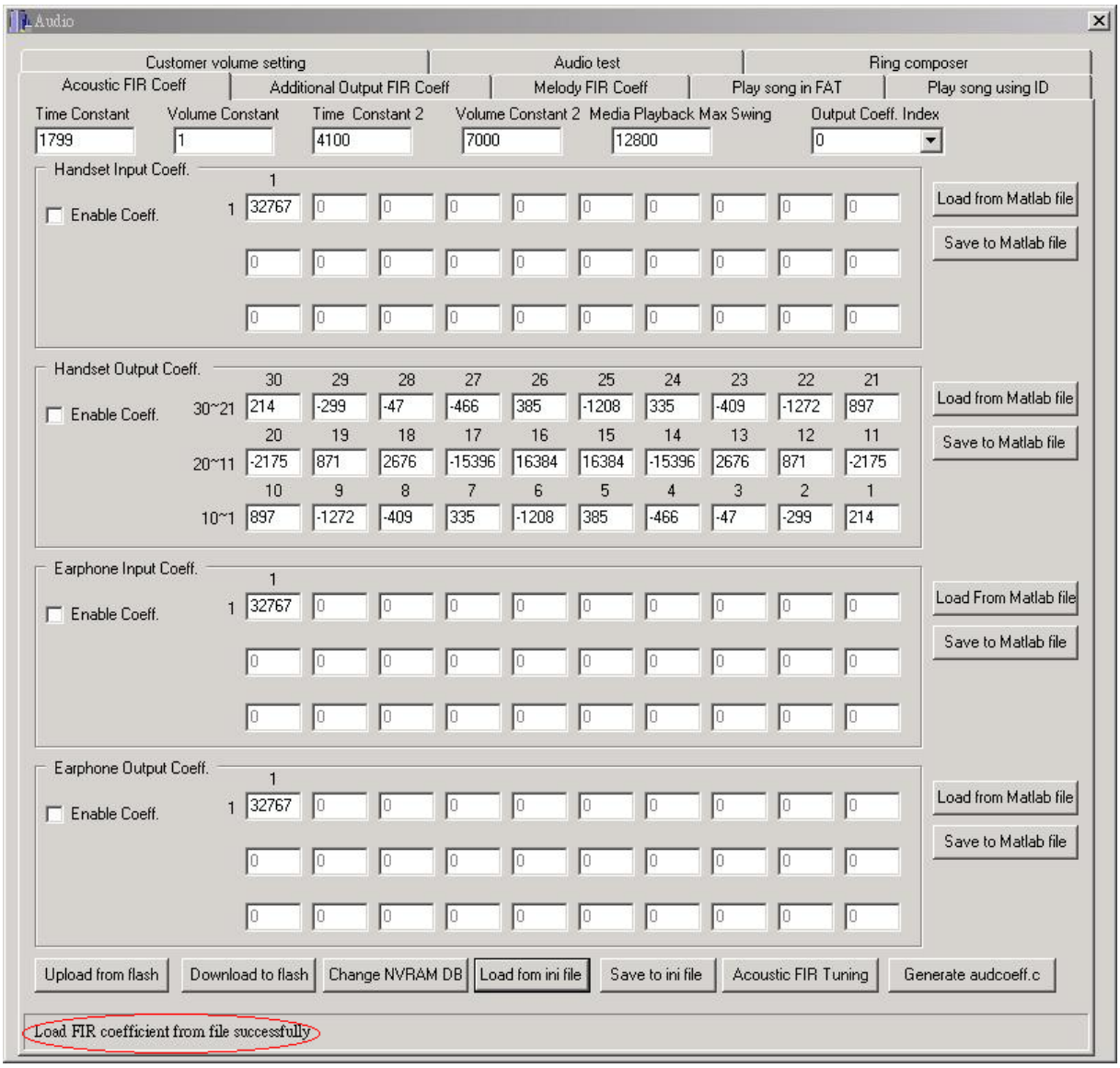

Figure 235 ***Acoustic FIR coefficient result***

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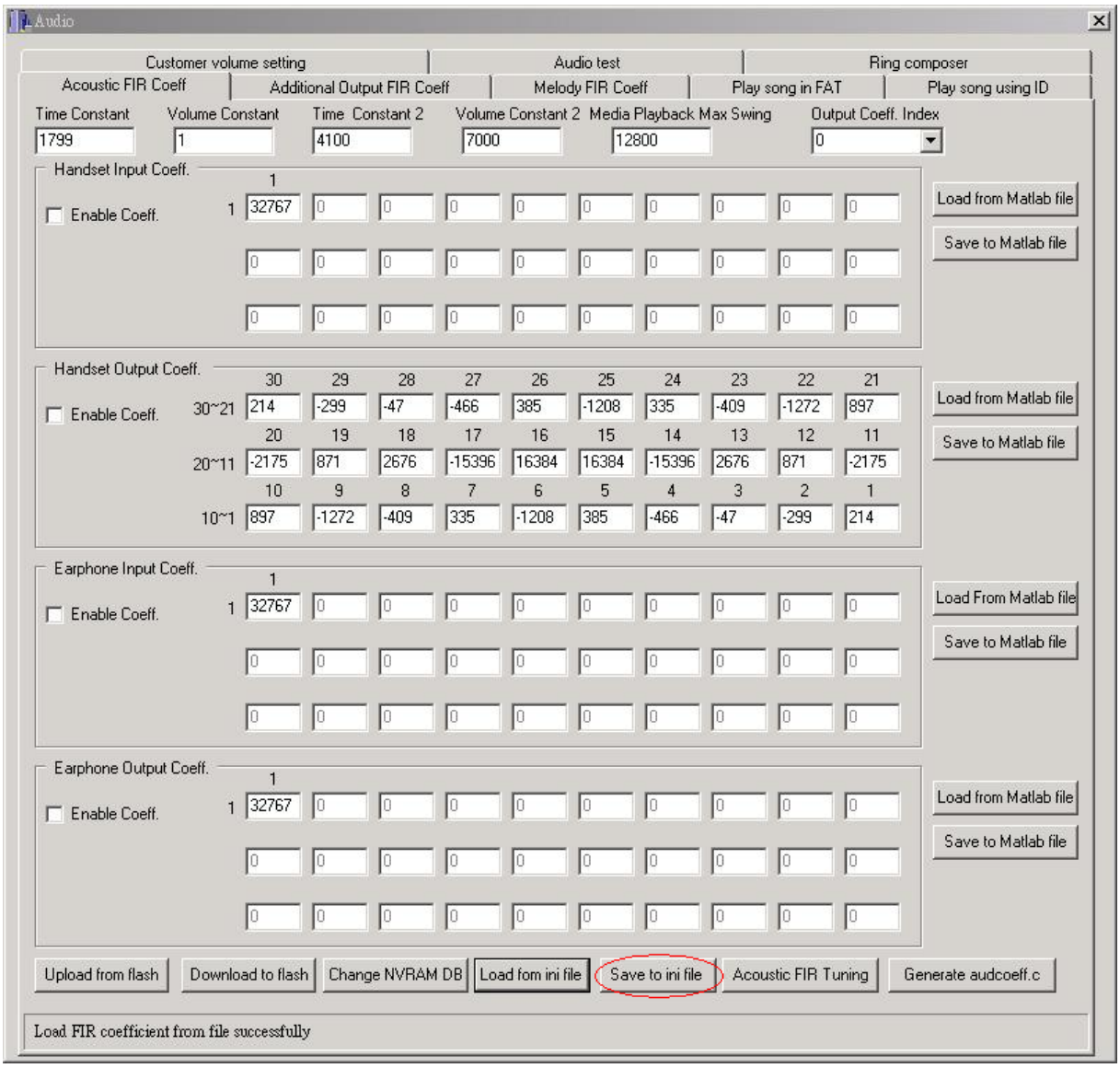

Figure 236 ***Click [Save to ini file] to save coefficient to file***

The following is a template of acoustic FIR coefficient file. User will get the text file after saving acoustic FIR coefficient to file. Each value must be followed with a comma. Please follow the file format if you want to change the value in file.

[Acoustic FIR-Coefficient]
Time Constant=1799
Volume Constant=1
Time Constant 2=4100
Volume Constant 2=7000
Media Playback Max Swing=12800
active output FIR index=0
8k Input (mic)=32767,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
8k Output (speaker)=214,-299,-47,-466,385,-1208,335,-409,-1272,897,-2175,871,2676,-15396,16384,16384,-15396,2676,871,-2175,897,-1272,-409,335,-1208,385,-466,-47,-299,214

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8k Input (earphone)=32767,0,0,0

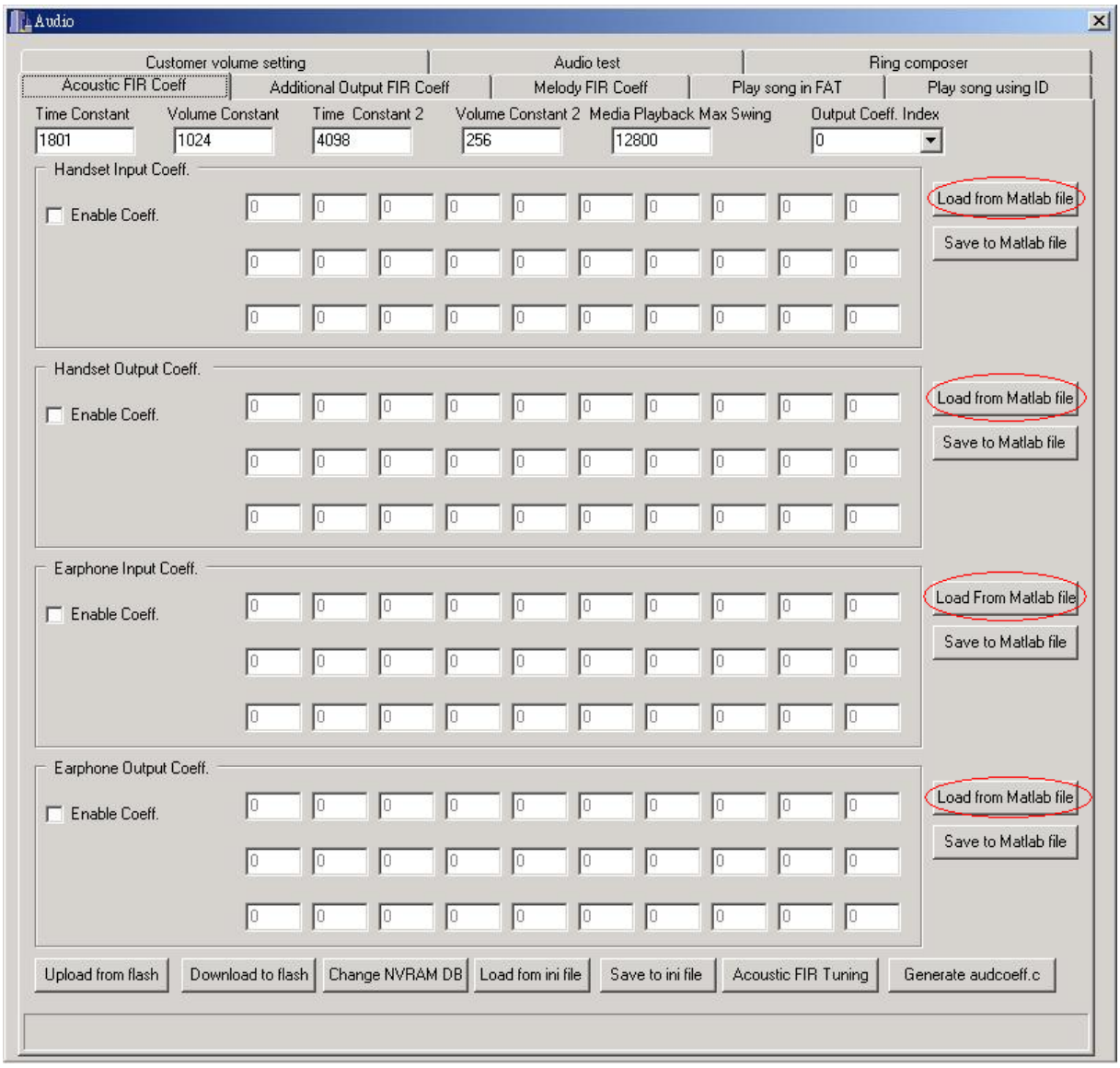

Figure 237 ***Click [Load from Matlab file] button to read file generated by Matlab***

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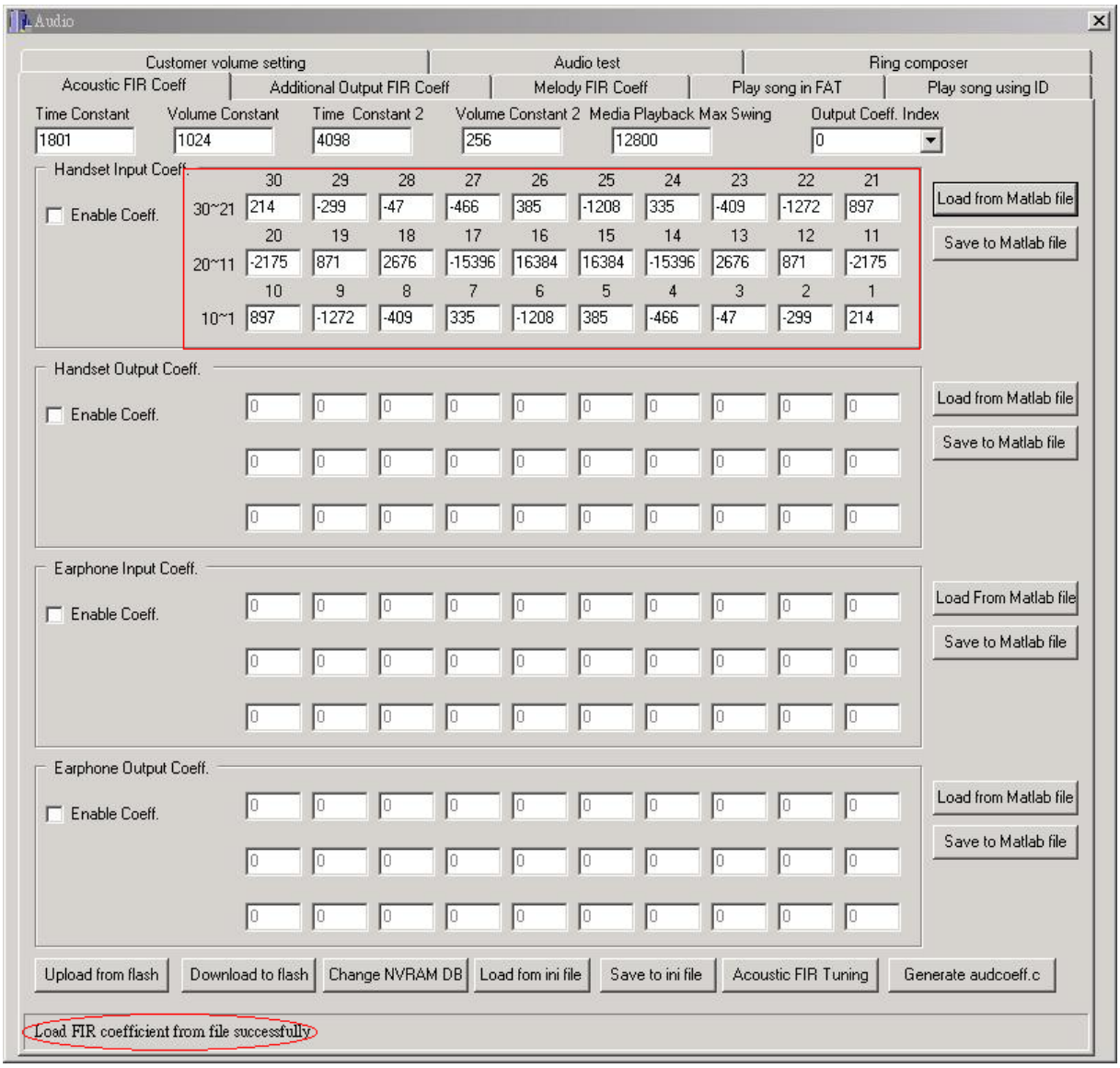

Figure 238 ***Acoustic FIR coefficient result***

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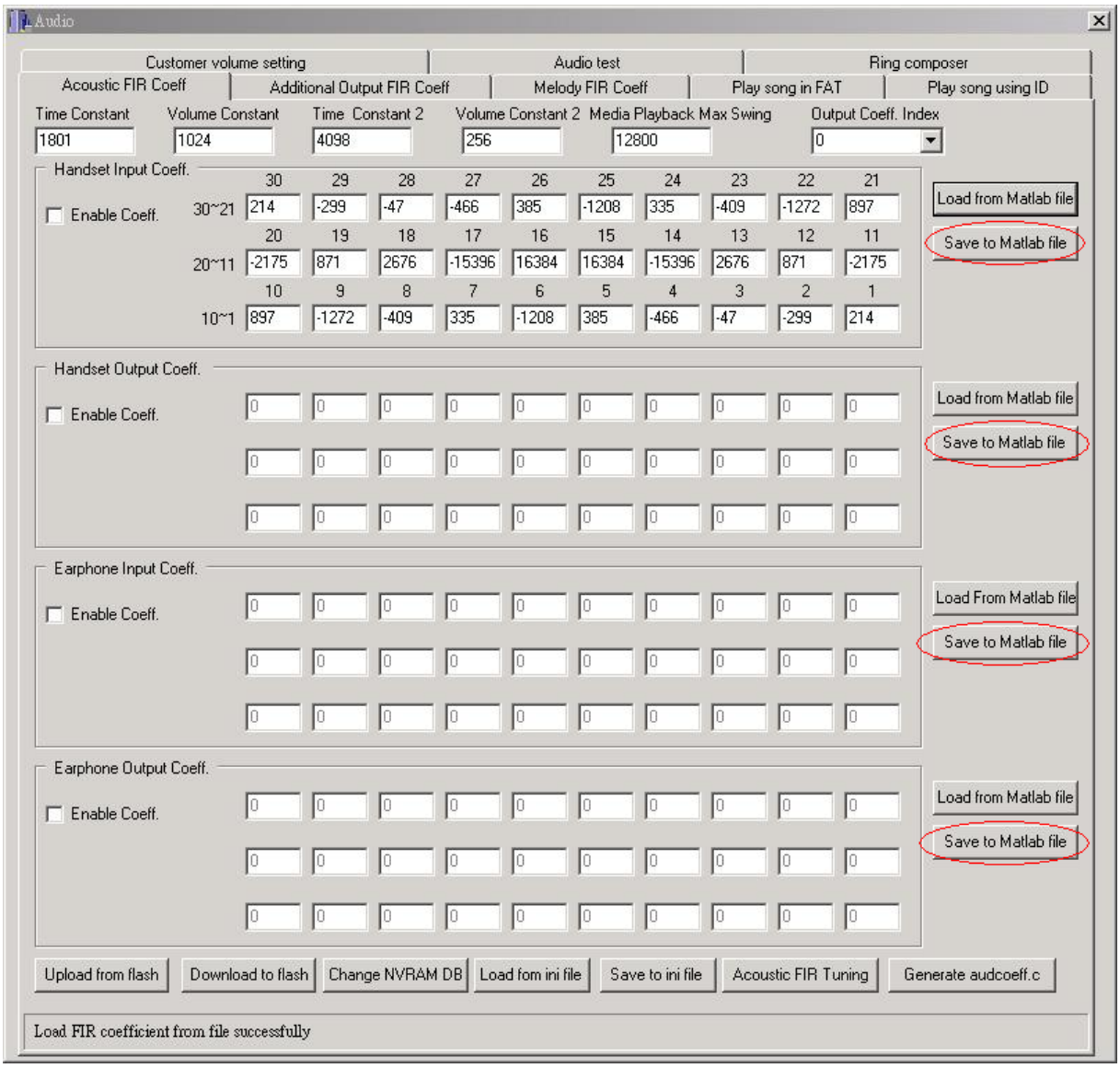

Figure 239 ***Click [Save to Matlab file] button to save to file that can be accepted by Matlab***

The following is a template of acoustic FIR coefficient file that generated by clicking [Save to Malab file] button. The first line indicates the number of acoustic FIR coefficient.

30
214
-299
-47
-466
385
-1208
335
-409
-1272
897
-2175

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871
2676
-15396
16384
16384
-15396
2676
871
-2175
897
-1272
-409
335
-1208
385
-466
-47
-299
214

3.8.1.4 Generating FIR-coefficient C file

User can click [Generate audcoeff.c] button to generate FIR-coefficient C file.

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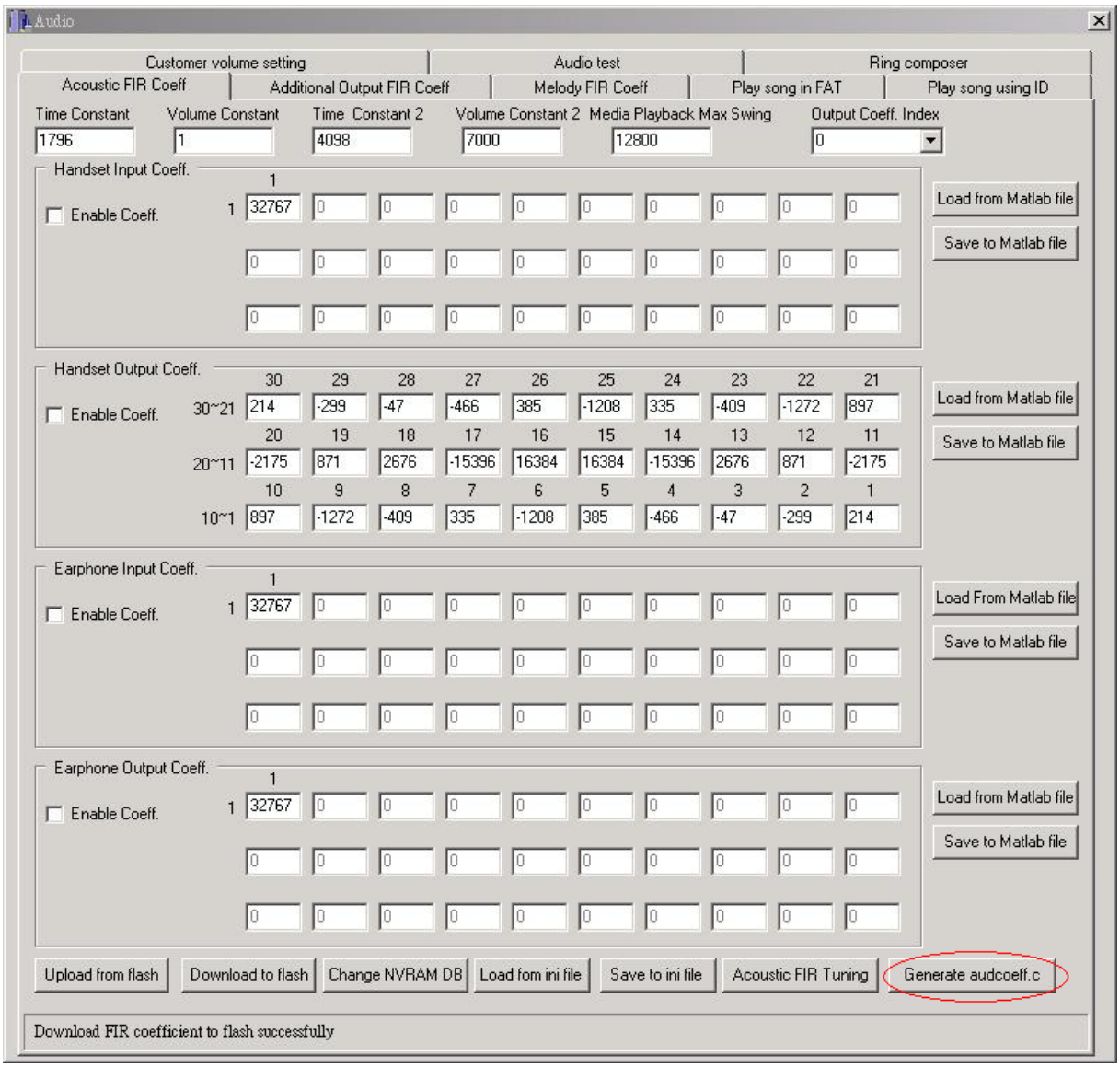

Figure 240 ***Click [Generate audcoeff.c] button to generate FIR-coefficient C file***

The following is a template of FIR-coefficient C file.

```
#include "l1audio.h"

const unsigned char  L1SP_MICROPHONE1  = L1SP_LNA_0;
const unsigned char  L1SP_MICROPHONE2  = L1SP_LNA_1;

const unsigned char  L1SP_SPEAKER1     = L1SP_BUFFER_0;
const unsigned char  L1SP_SPEAKER2     = L1SP_BUFFER_1;
const unsigned char  L1SP_LOUD_SPEAKER = L1SP_BUFFER_0;

const signed short Audio_FIR_Input_Coeff[30] = {
 32767,     0,     0,     0,     0,
     0,     0,     0,     0,     0,
```


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```
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0
};

const signed short Audio_FIR_Output_Coeff[30] = {
   214,  -299,   -47,  -466,   385,
 -1208,   335,  -409, -1272,   897,
 -2175,   871,  2676,-15396, 16384,
 16384,-15396,  2676,   871, -2175,
   897, -1272,  -409,   335, -1208,
   385,  -466,   -47,  -299,   214
};

const signed short Audio_FIR_Output_Coeff_a[30] = {
 32767,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0
};

const signed short Audio_FIR_Output_Coeff_b[30] = {
 32767,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0
};

const signed short Audio_FIR_Output_Coeff_c[30] = {
 32767,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0
};

const signed short Audio_FIR_Output_Coeff_d[30] = {
 32767,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0,
    0,    0,    0,    0,    0
};
```


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```
const signed short Audio_FIR_Output_Coeff_e[30] = {
 32767,     0,     0,     0,     0,
     0,     0,     0,     0,     0,
     0,     0,     0,     0,     0,
     0,     0,     0,     0,     0,
     0,     0,     0,     0,     0,
     0,     0,     0,     0,     0
};

const signed short Audio_FIR_Input_Coeff2[30] = {
 32767,     0,     0,     0,     0,
     0,     0,     0,     0,     0,
     0,     0,     0,     0,     0,
     0,     0,     0,     0,     0,
     0,     0,     0,     0,     0,
     0,     0,     0,     0,     0
};

const signed short Audio_FIR_Output_Coeff2[30] = {
 32767,     0,     0,     0,     0,
     0,     0,     0,     0,     0,
     0,     0,     0,     0,     0,
     0,     0,     0,     0,     0,
     0,     0,     0,     0,     0,
     0,     0,     0,     0,     0
};

const unsigned short ES_TimeConst   = 0x0704;
const unsigned short ES_VolConst    = 0x01;
const unsigned short ES_TimeConst2  = 0x1002;
const unsigned short ES_VolConst2   = 0x1b58;
const unsigned short Media_Playback_Maximum_Swing   = 12800;

const signed short Media_FIR_Melody_Output1_32K_Default[45] = {
   233,   -93,  -151,   473,  -648,   231,   809, -1739,   632,
  2600, -4195,  -888, 10539,  -888, -4195,  2600,   632, -1739,
   809,   231,  -648,   473,  -151,   -93,   233,     0,     0,
     0,     0,     0,     0,     0,     0,     0,     0,     0,
     0,     0,     0,     0,     0,     0,     0,     0,     0

};

const signed short Media_FIR_Melody_Output2_32K_Default[45] = {
   233,   -93,  -151,   473,  -648,   231,   809, -1739,   632,
  2600, -4195,  -888, 10539,  -888, -4195,  2600,   632, -1739,
   809,   231,  -648,   473,  -151,   -93,   233,     0,     0,
     0,     0,     0,     0,     0,     0,     0,     0,     0,
     0,     0,     0,     0,     0,     0,     0,     0,     0

};
```


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3.8.2 Additional output FIR–coefficient

Additional output FIR-coefficient window provides interface for user to read or write coefficient in flash, ini file or Matlab file. User can click these 11 buttons shown on window to read coefficient from flash, write coefficient to flash, load coefficient from file and save coefficient to file. All values are in decimal format. The range of acoustic FIR coefficient is -32768 ~ 32767. There are five group of additional output FIR-coefficient. There are 30 words in each group of coefficient. There are 5 parameters in echo suppression function. They are

Time energy gap: time-and-energy-gap constant for speakerphone application in loud-speaker mode.

Volume constant: gain constant for speakerphone application in loud-speaker mode.

Time energy gap 2: time-and-energy-gap constant for echo loss at maximum speaker volume in normal mode.

Volume constant 2: gain constant for echo loss at maximum speaker volume in normal mode.

Media playback max swing: the maximum output swing to ADC DAC.

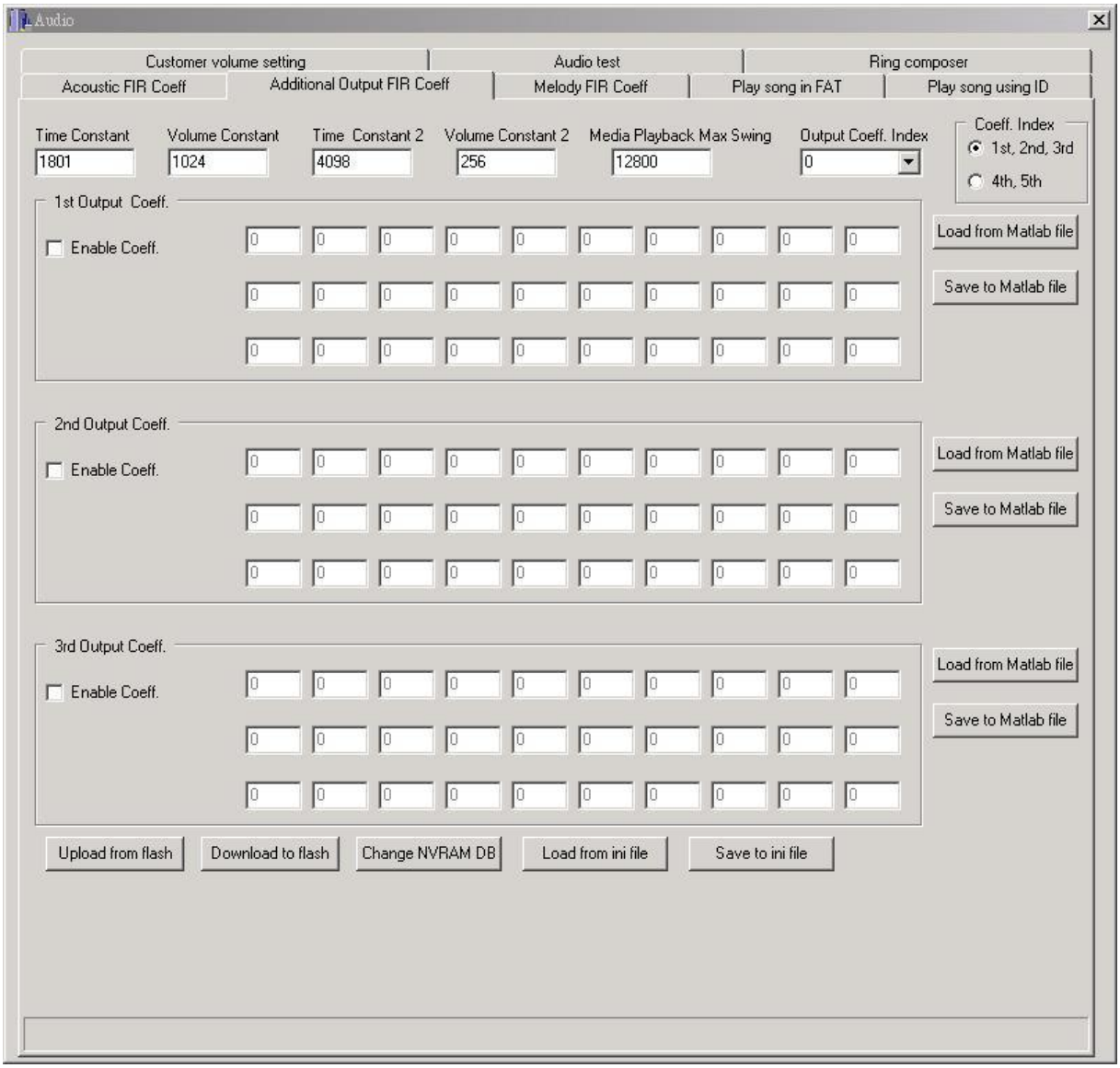

Figure 241 ***Additional output FIR-coefficient***

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3.8.2.1 Upload and download acoustic FIR coefficient in flash

User can click [Upload from flash] button to read acoustic FIR coefficient from flash and click [Download to flash] button to write acoustic FIR coefficient to flash.

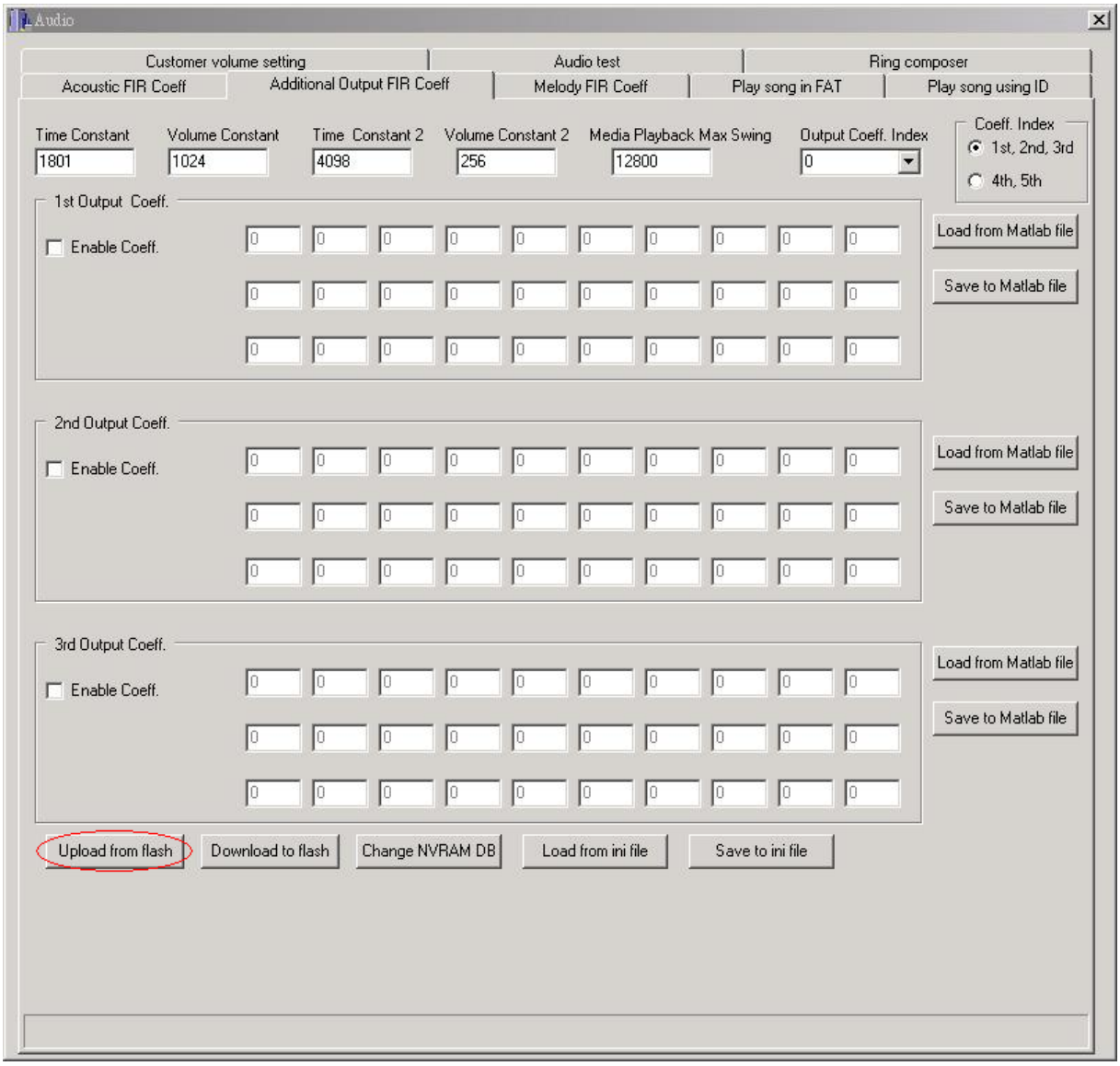

Figure 242 ***Click [Upload from flash] button to read additional output FIR-coefficient***

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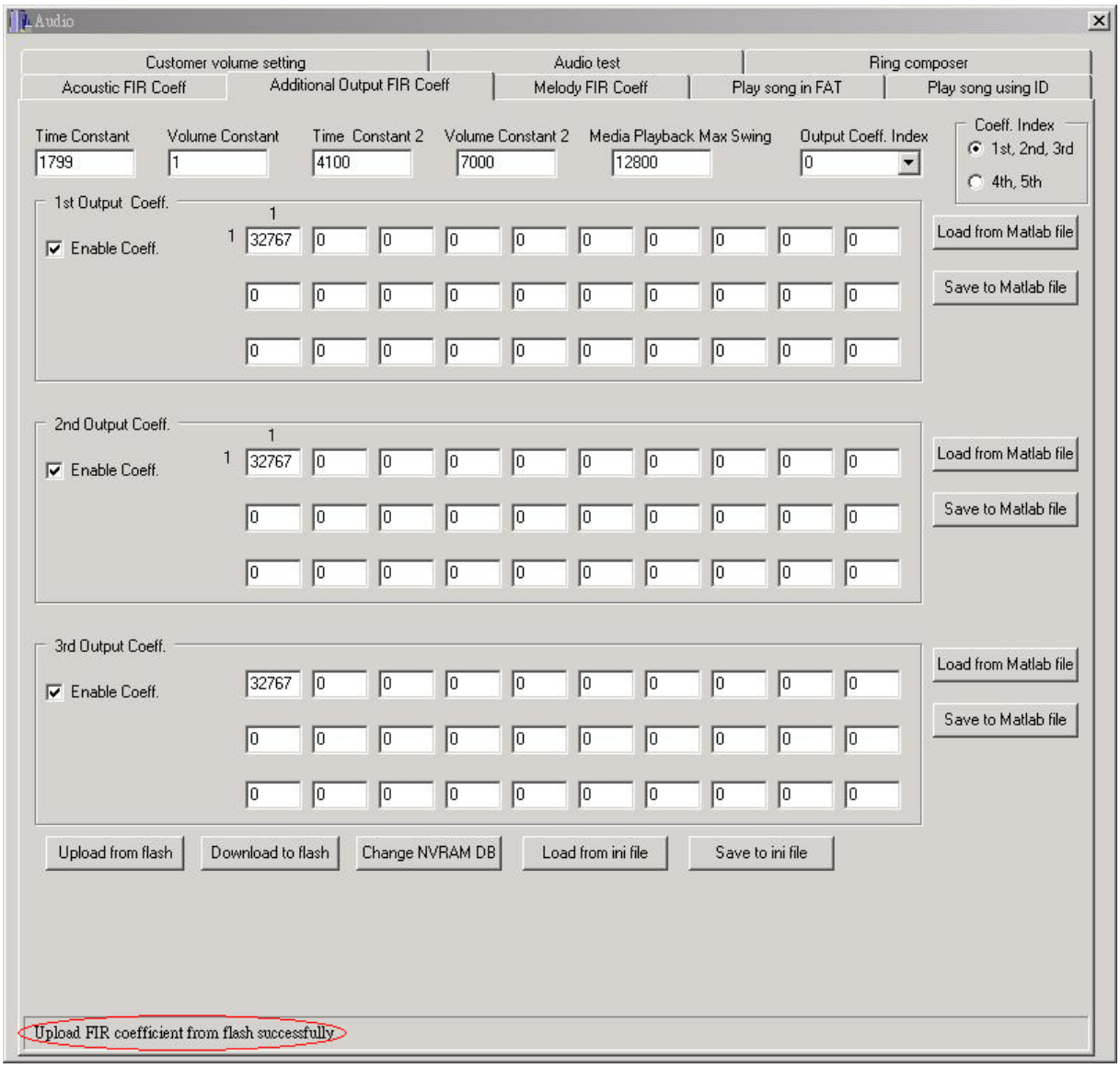

Figure 243 ***Additional output FIR-coefficient result***

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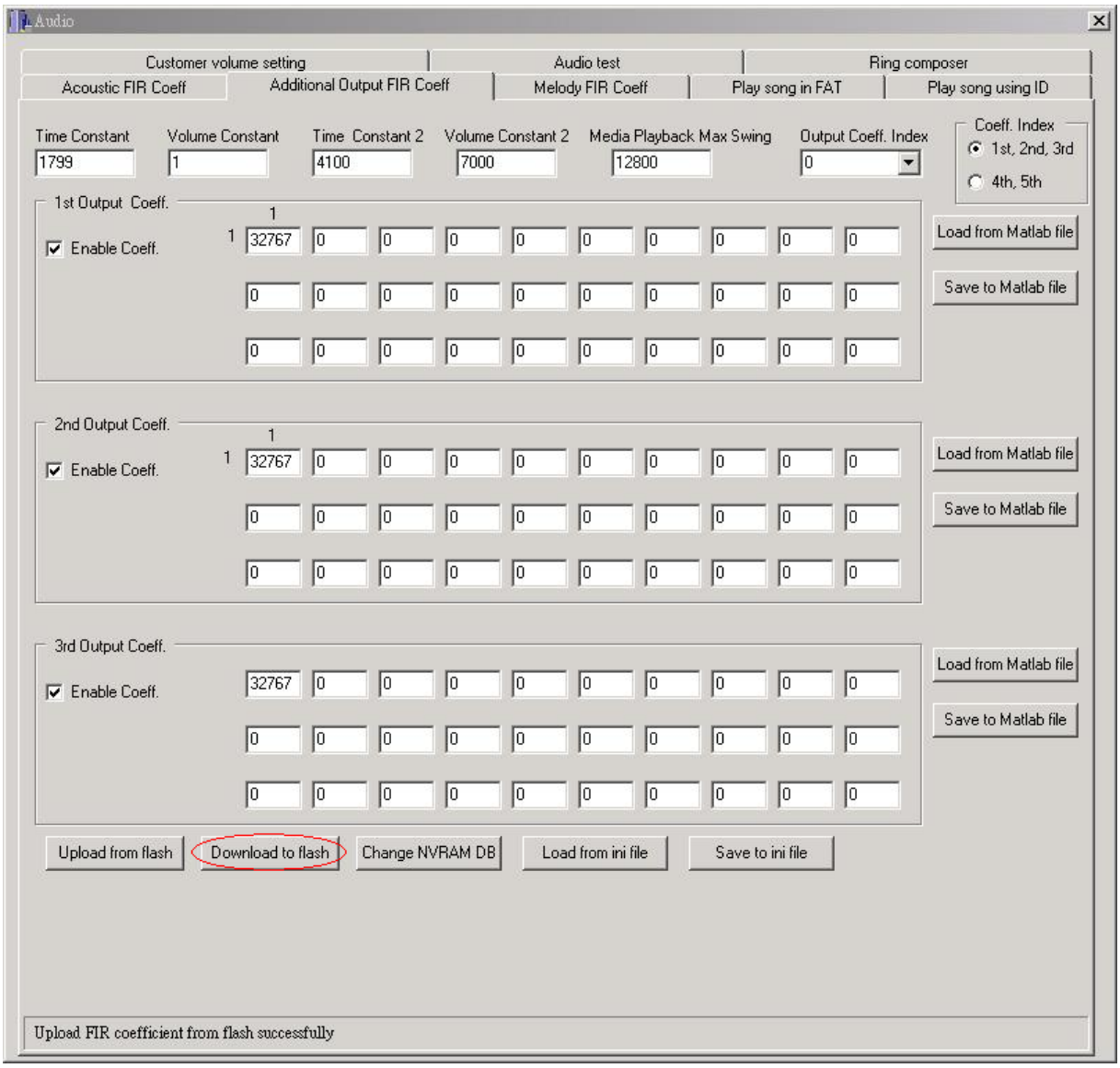

Figure 244 ***Click [Download to flash] button to write additional output FIR-coefficient to flash***

User can click [Change NVRAM DB] button to change NVRAM database file.

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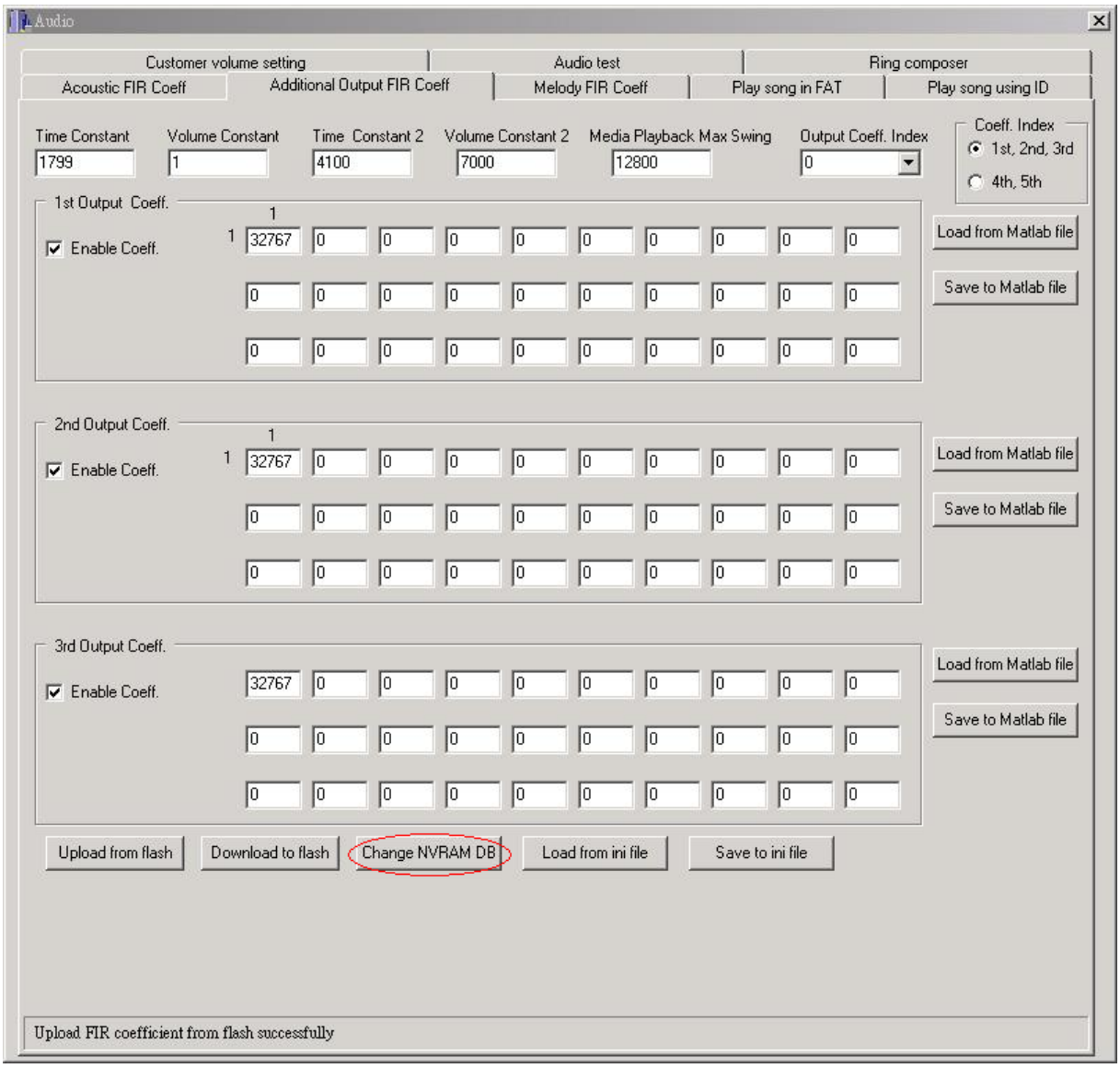

Figure 245 ***Click [Change NVRAM DB] to change NVRAM database file***

3.8.2.2 Read and write acoustic FIR coefficient in file

User can click [Load from file] button to read additional output FIR-coefficient from file and click [Save to file] button to save additional output FIR-coefficient to file.

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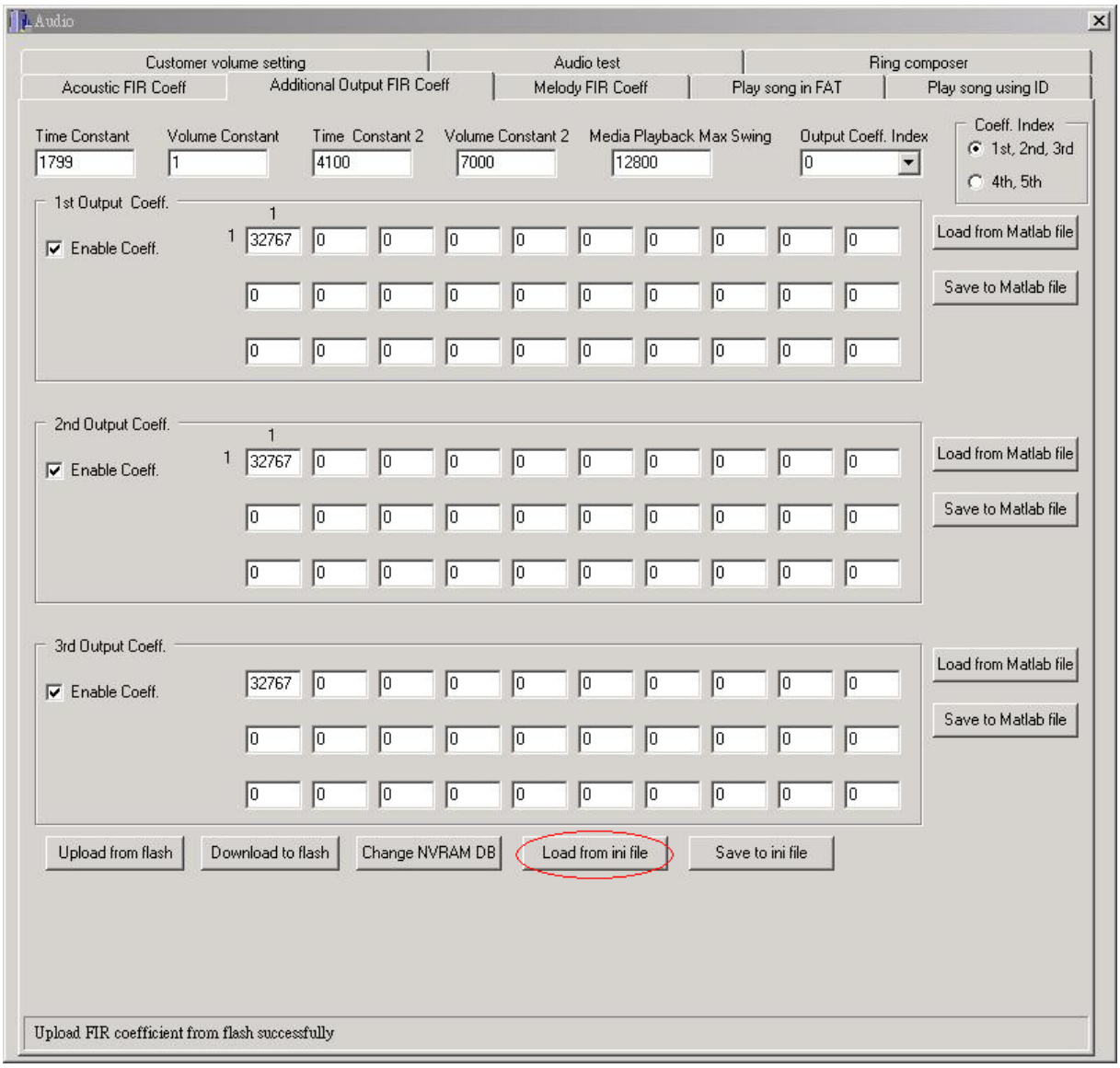

Figure 246 ***Click [Load from ini file] button to read additional output FIR-coefficient***

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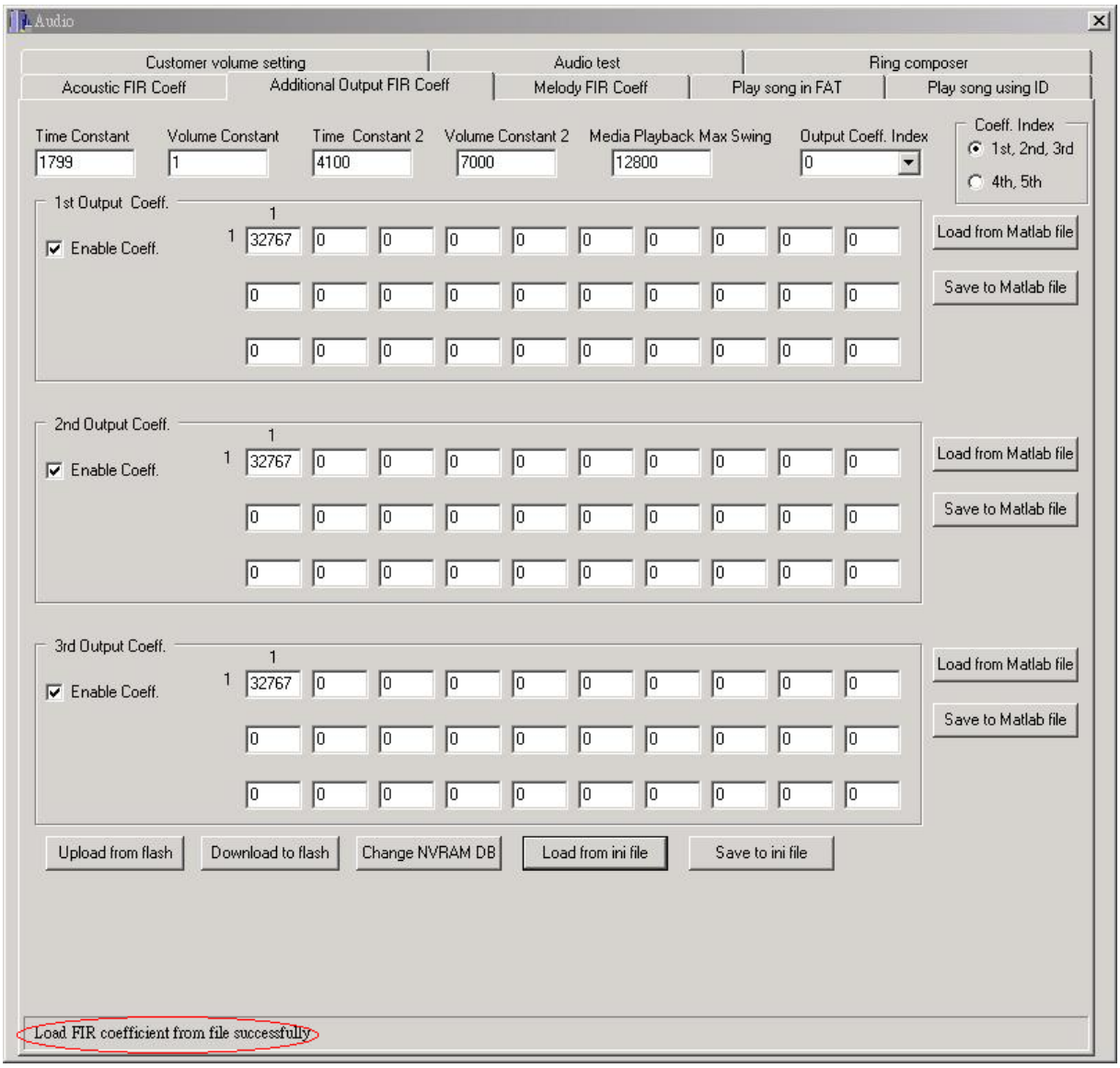

Figure 247 ***Additional output FIR-coefficient result***

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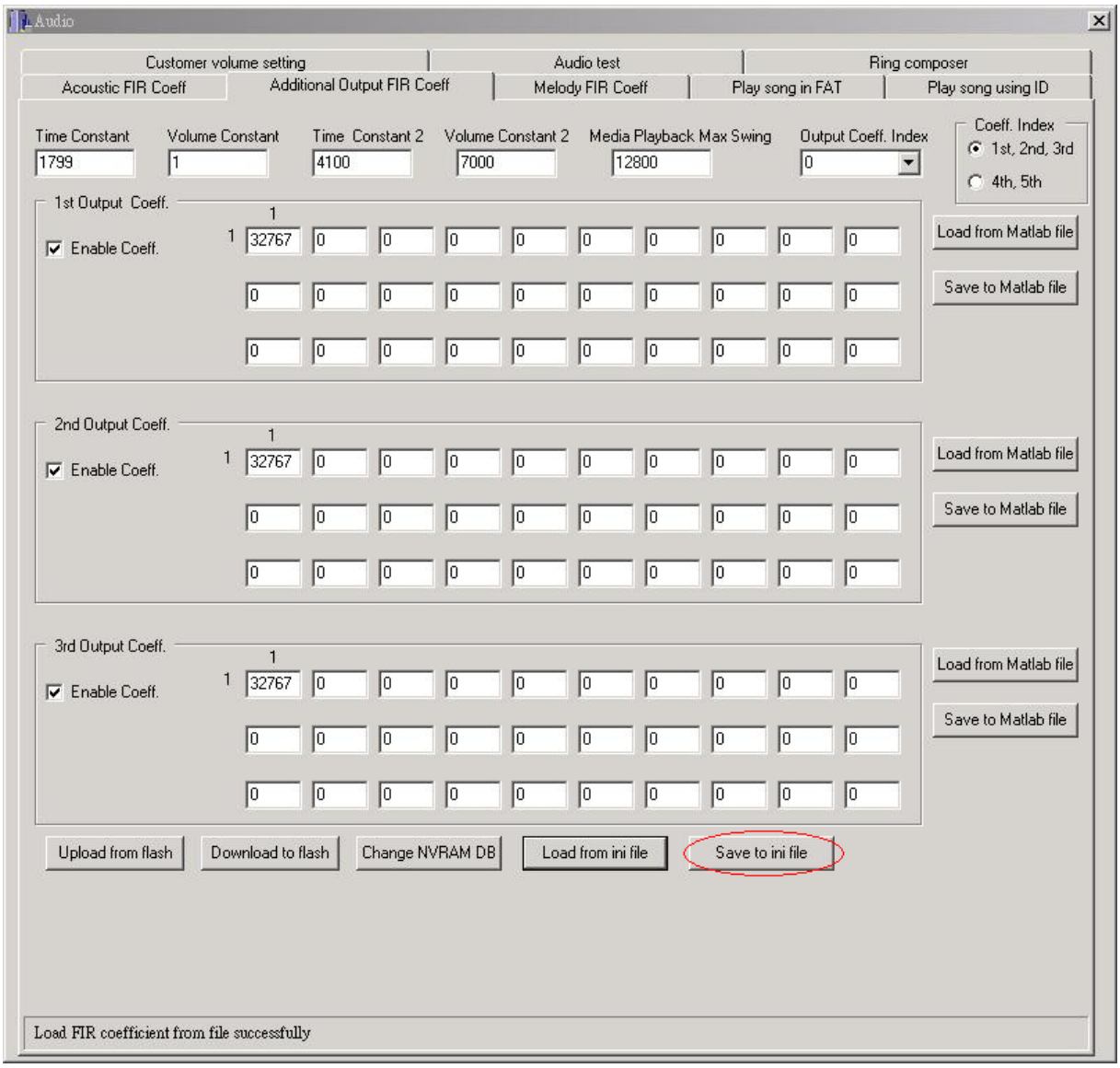

Figure 248 ***Click [Save to file] button to save additional output FIR-coefficient***

The following is a template of acoustic FIR coefficient file. User will get the text file after saving acoustic FIR coefficient to file. Each value must be followed with a comma. Please follow the file format if you want to change the value in file.

[Acoustic FIR-Coefficient]
Time Constant=1799
Volume Constant=1
Time Constant 2=4100
Volume Constant 2=7000
Media Playback Max Swing=12800
active output FIR index=0
8k Input (mic)=32767,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
8k Output (speaker)=214,-299,-47,-466,385,-1208,335,-409,-1272,897,-2175,871,2676,-15396,16384,16384,-15396,2676,871,-2175,897,-1272,-409,335,-1208,385,-466,-47,-299,214

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8k Input (earphone)=32767,0,0,0

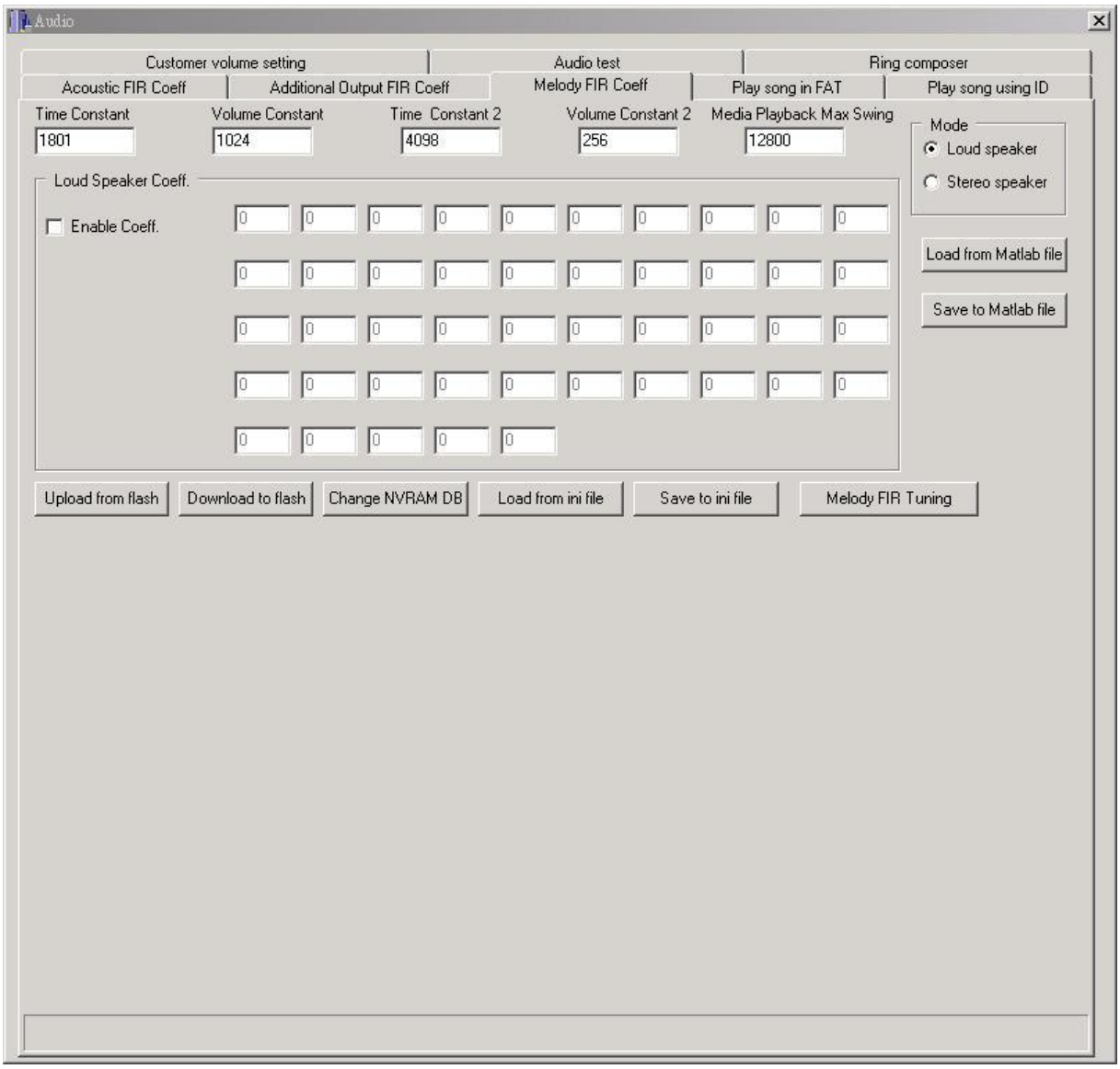

Figure 249 ***Melody FIR-Coefficient window***

3.8.3.1 Upload and download melody FIR coefficient in flash

User can click [Upload from flash] button to read melody FIR coefficient from flash and click [Download to flash] button to write melody FIR coefficient to flash.

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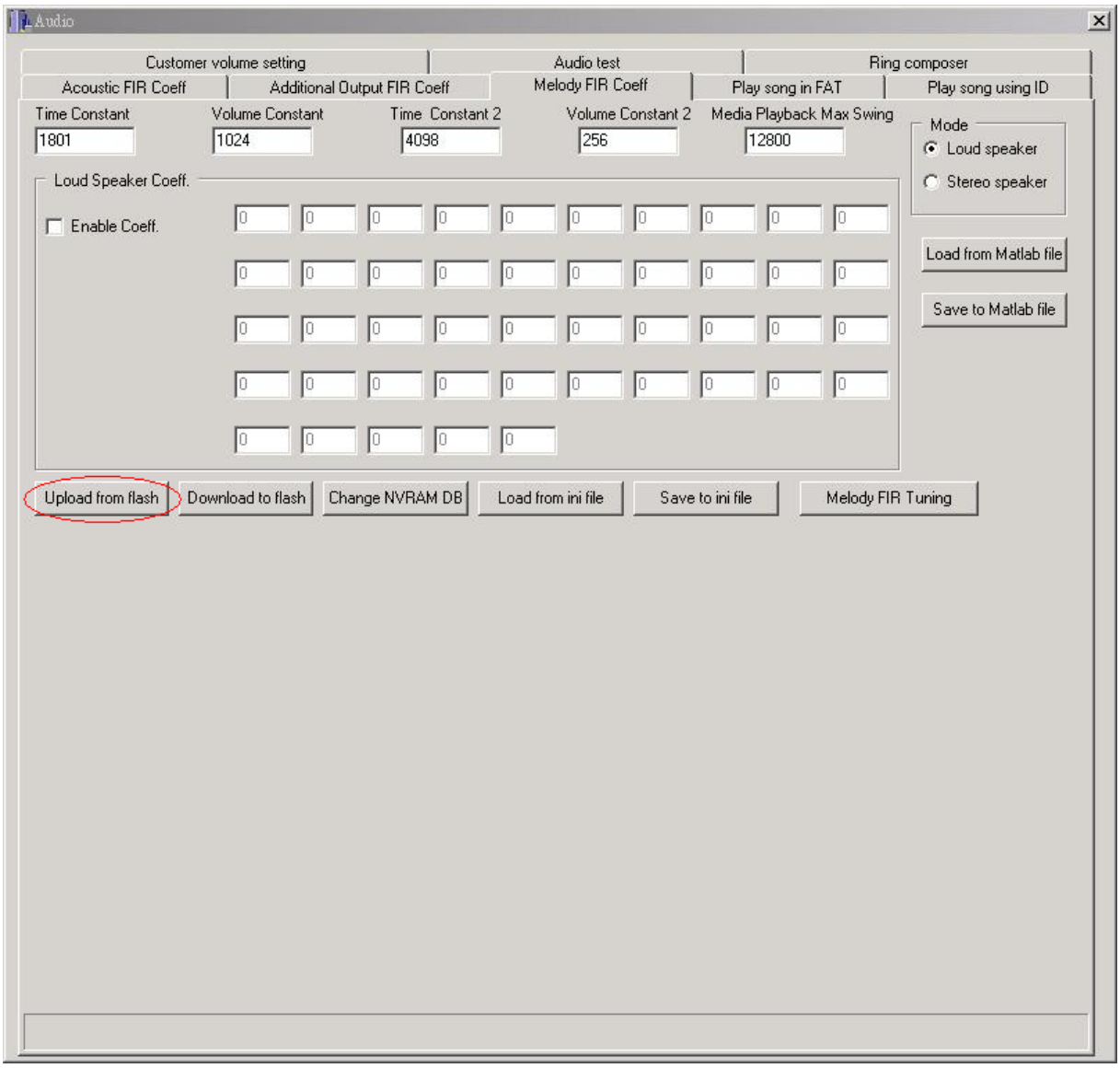

Figure 250 ***Click [Upload from flash] button to read coefficient from flash***

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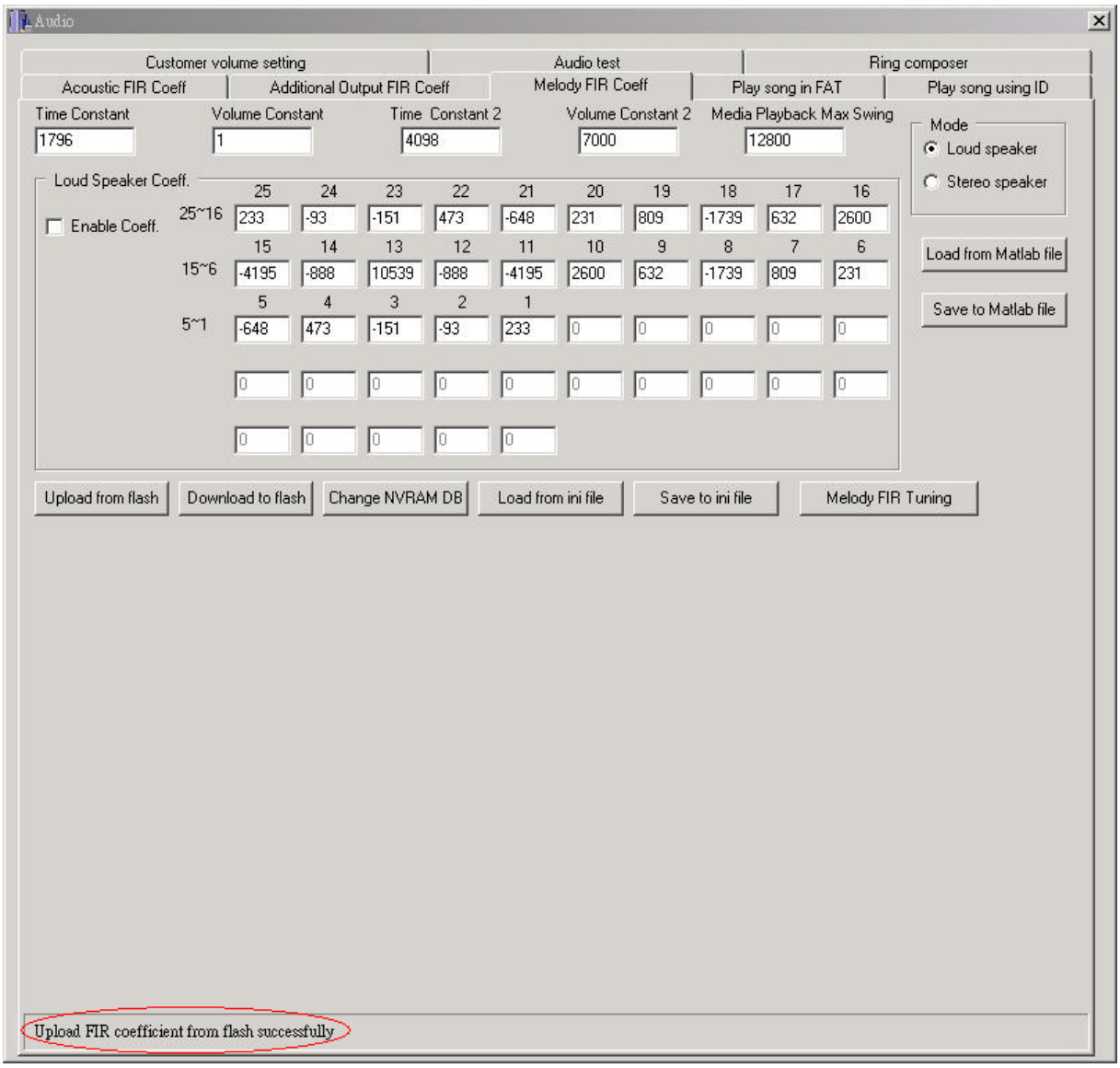

Figure 251 ***Result of upload melody FIR coefficient from flash***

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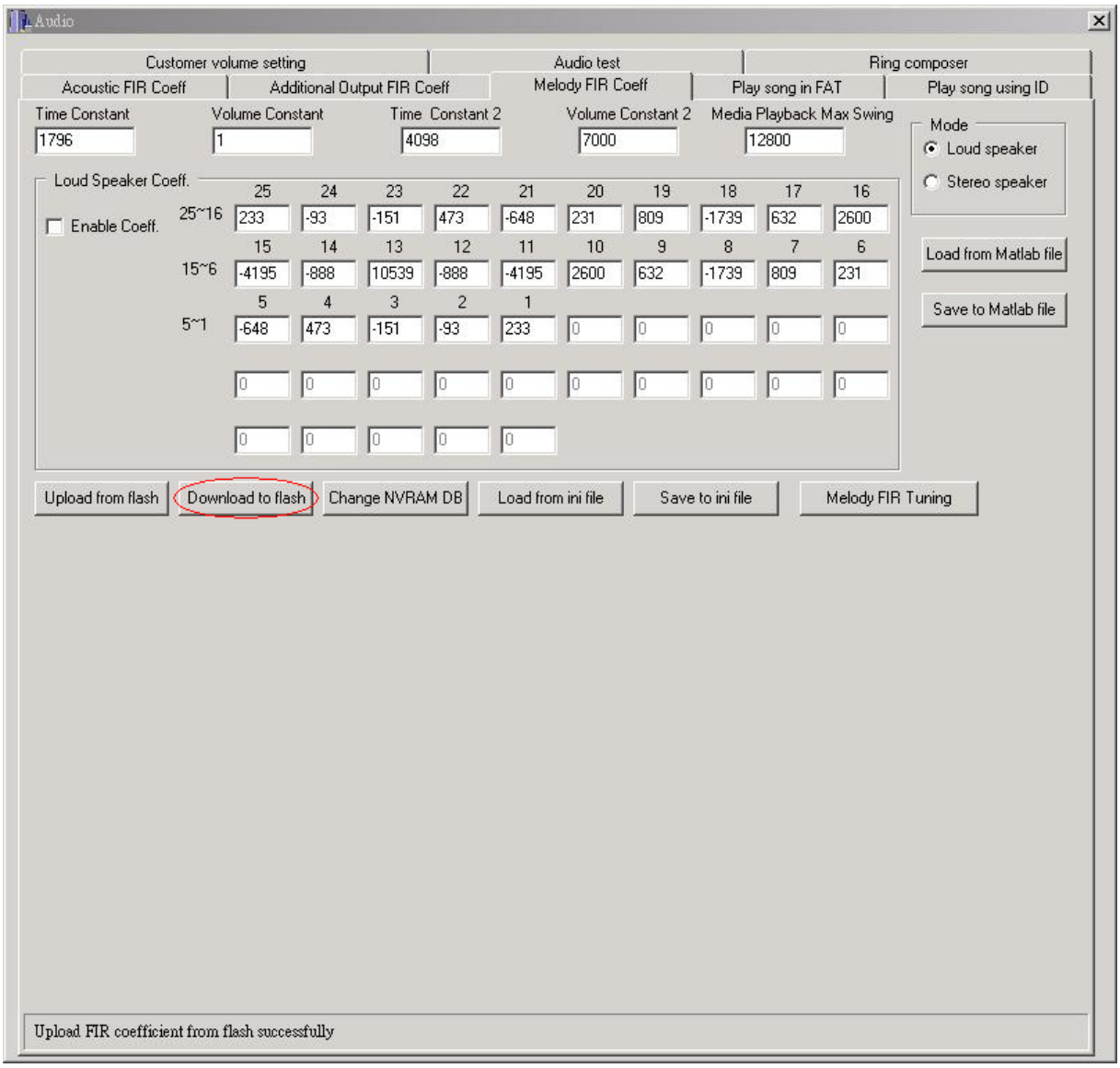

Figure 252 ***Click [Download to flash] button to save coefficient to flash***

User can click [Change NVRAM DB] button to change NVRAM database file.

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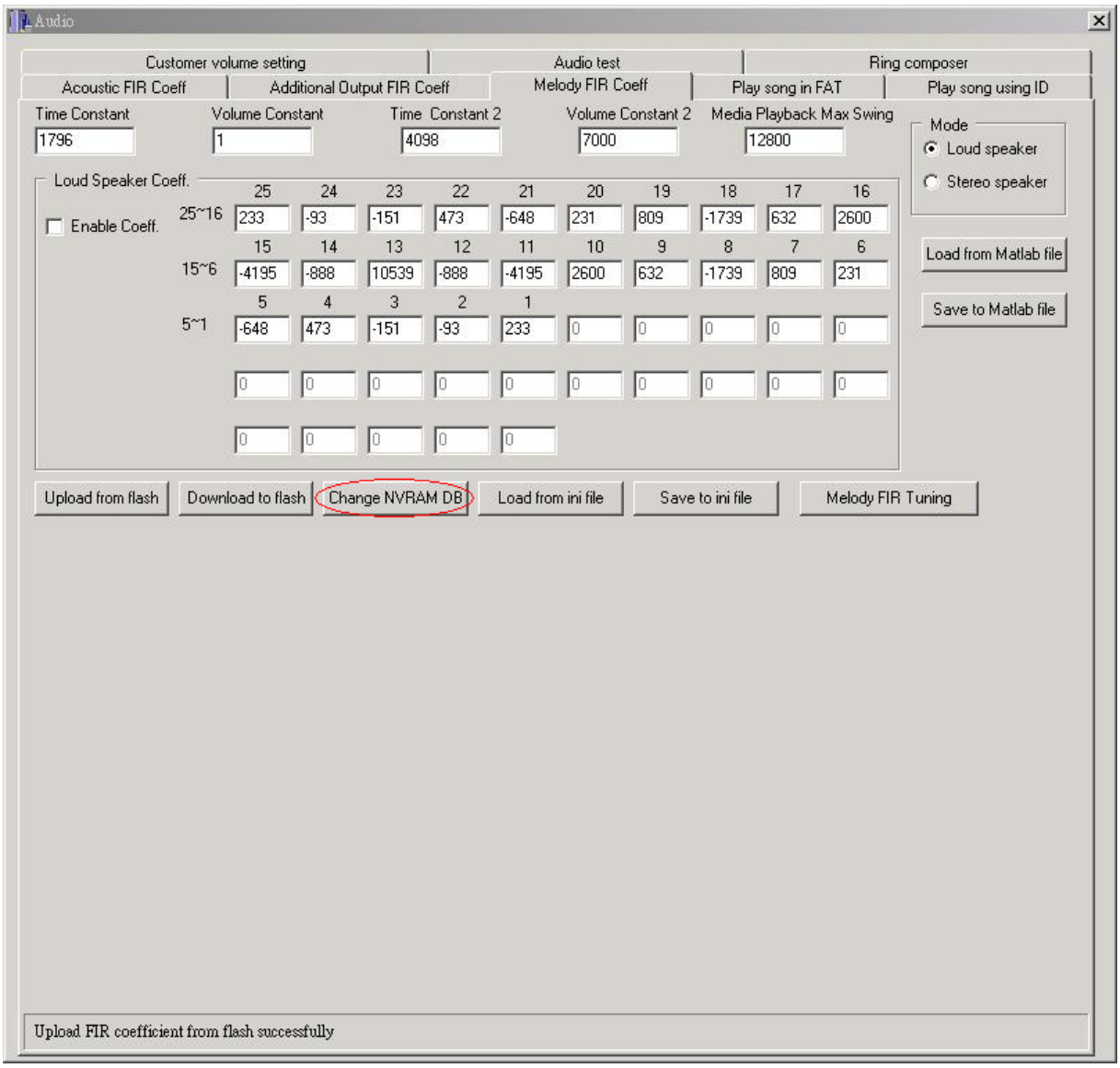

Figure 253 ***Click [Change NVRAM DB] button to change NVRAM database file***

3.8.3.2 Read and write melody FIR coefficient in file

User can click [Load from file] button to read melody FIR coefficient from file and click [Save to file] button to save melody FIR coefficient to file.

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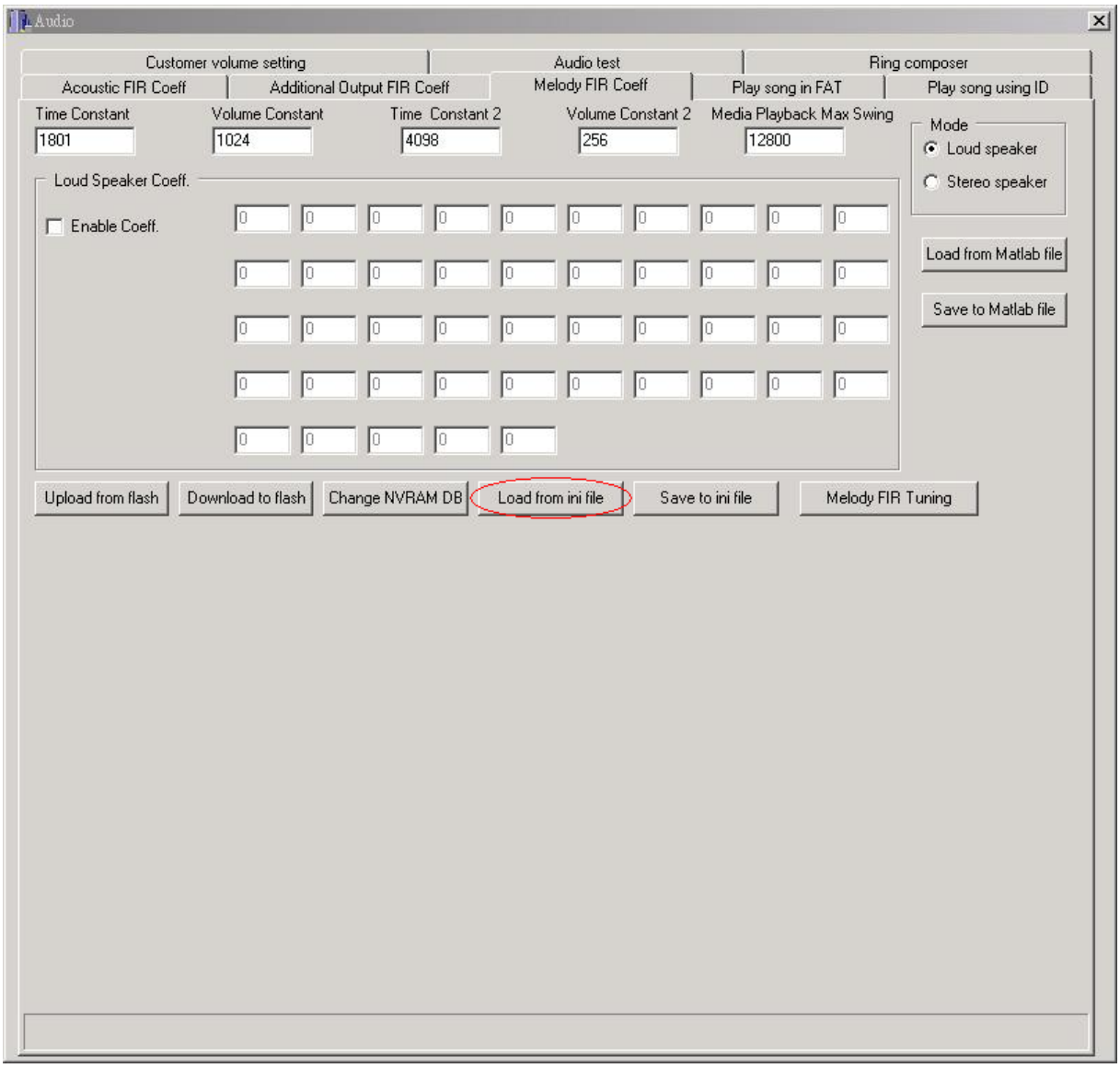

Figure 254 ***Click [Load from ini file] to read coefficient from file***

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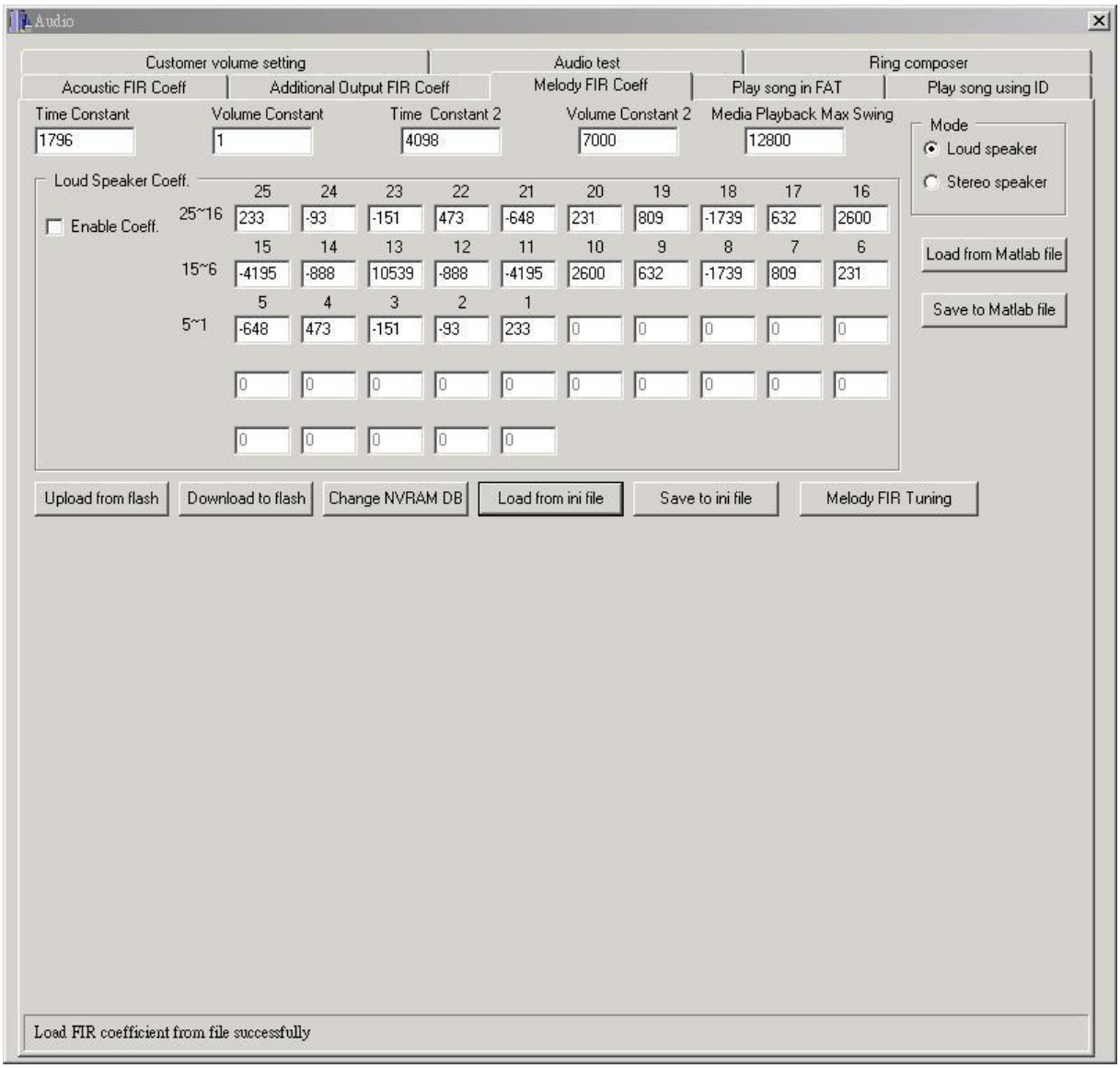

Figure 255 ***Melody FIR coefficient result***

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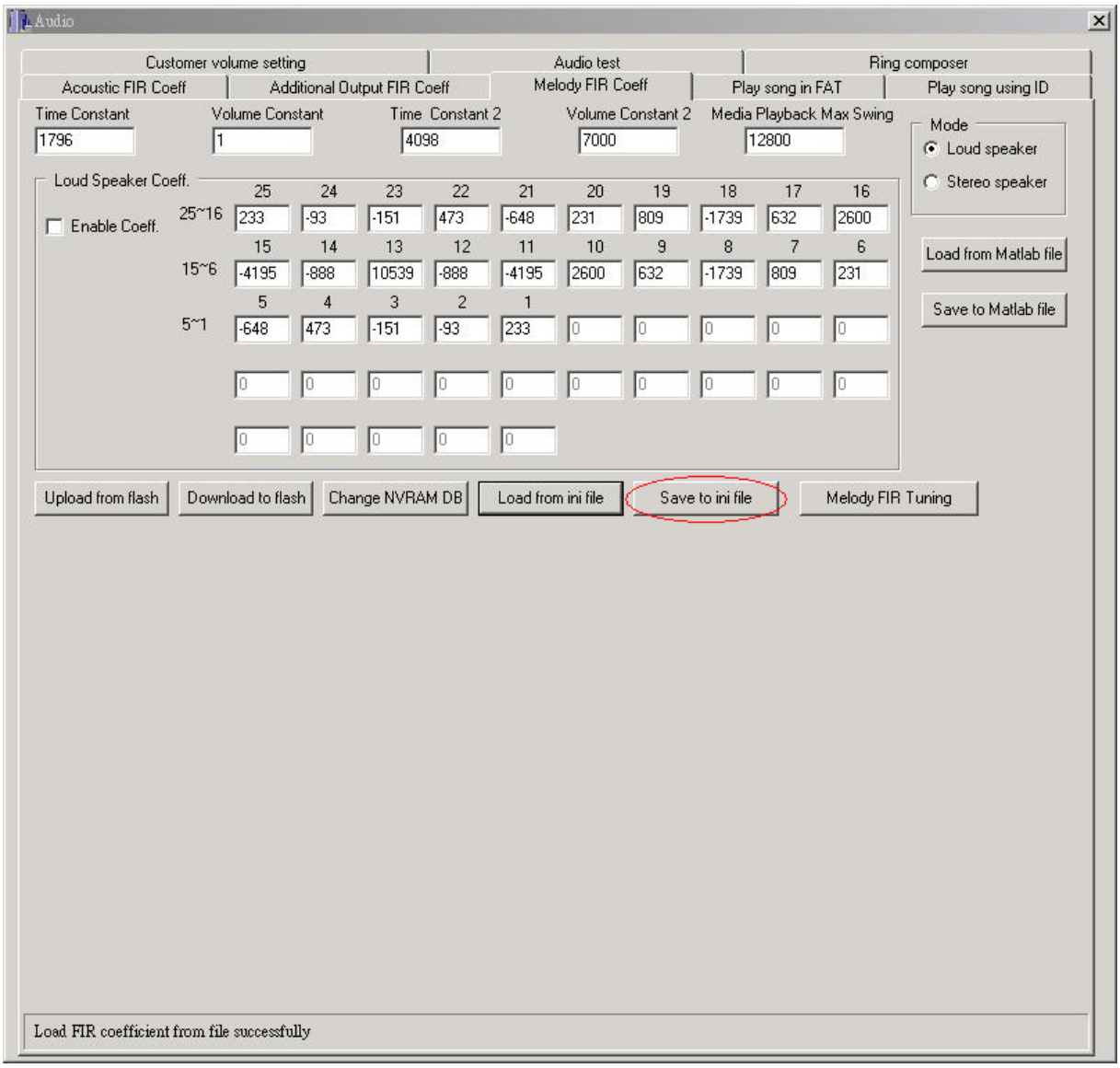

Figure 256 ***Click [Save to ini file] to save coefficient to file***

The following is a template of FIR coefficient file. User will get the text file after saving FIR coefficient to file. Each value must be followed with a comma. Please follow the file format if you want to change the value in file.

[Acoustic FIR-Coefficient]
Time Constant=1796
Volume Constant=1
Time Constant 2=4098
Volume Constant 2=7000
Media Playback Max Swing=12800
8k Input (mic)=123,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
8k Output (speaker)=214,-299,-47,-466,385,-1208,335,-409,-1272,897,-2175,871,2676,-15396,16384,16384,-15396,2676,871,-2175,897,-1272,-409,335,-1208,385,-466,-47,-299,214
8k Input (earphone)=32767,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
8k Output (earphone)=32767,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0

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active output FIR index=0
Additional 8k 1st Output=32767,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
Additional 8k 2nd Output=32767,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
Additional 8k 3rd Output=32767,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
Additional 8k 4th Output=32767,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
Additional 8k 5th Output=32767,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
Melody Output (loud speaker)=233,-93,-151,473,-648,231,809,-1739,632,2600,-4195,-888,10539,-888,-4195,2600,632,-1739,809,231,-648,473,-151,-93,233,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
Melody Output (stereo speaker)=233,-93,-151,473,-648,231,809,-1739,632,2600,-4195,-888,10539,-888,-4195,2600,632,-1739,809,231,-648,473,-151,-93,233,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0

3.8.3.3 Read and write melody FIR coefficient in Matlab file

User can click [Load from Matlab file] button to read melody FIR coefficient from file generated by Matlab and click [Save to Matlab file] button to save melody FIR coefficient to file that can be an input file of Matlab.

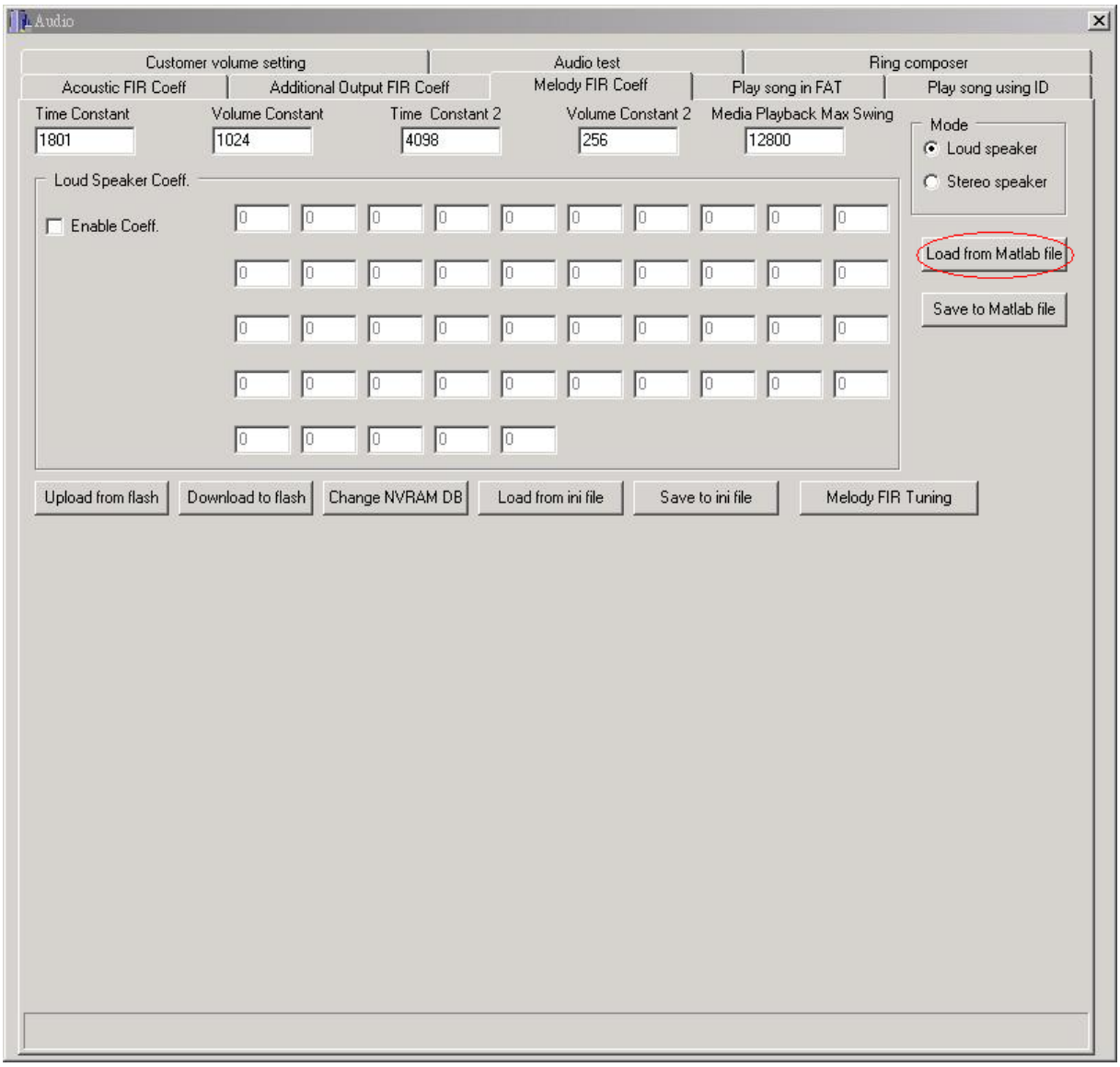

Figure 257 ***Click [Load from Matlab file] button to read file generated by Matlab***

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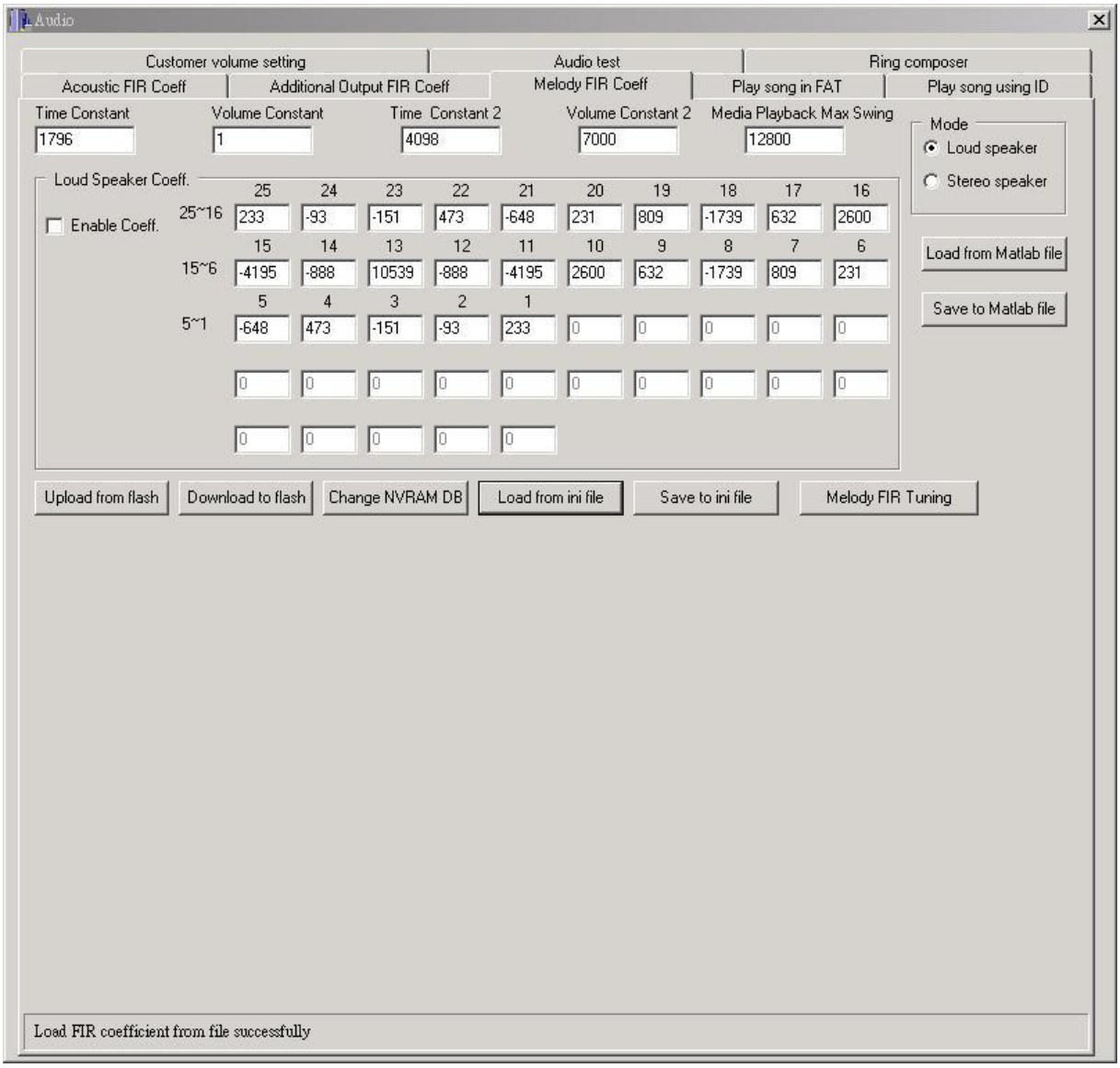

Figure 258 ***Melody FIR coefficient result***

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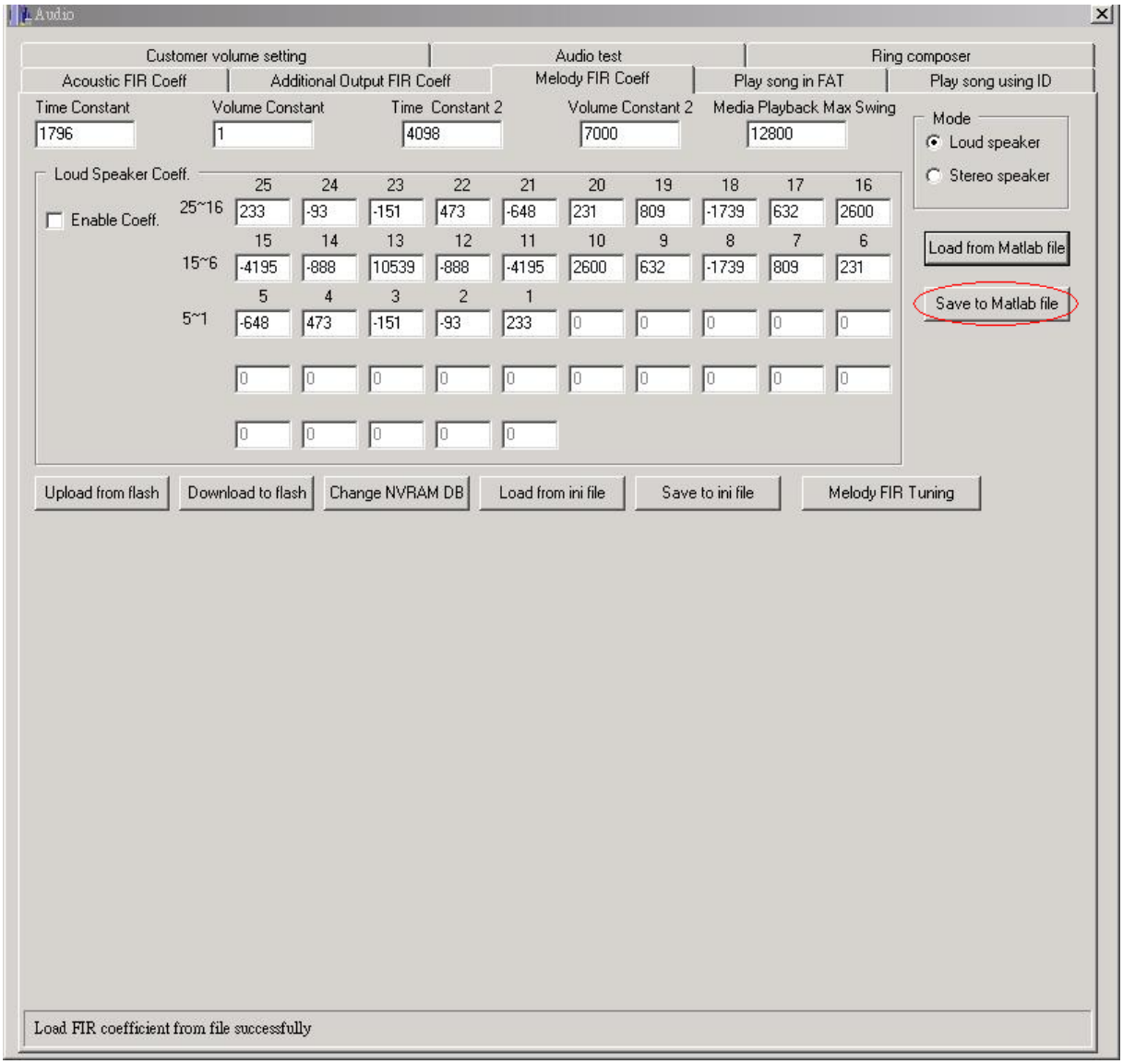

Figure 259 ***Click [Save to Matlab file] button to save to file that can be accepted by Matlab***

The following is a template of melody FIR coefficient file that generated by clicking [Save to Malab file] button. The first line indicates the number of melody FIR coefficient.

25
233
-93
-151
473
-648
231
809
-1739
632
2600

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-4195
-888
10539
-888
-4195
2600
632
-1739
809
231
-648
473
-151
-93
233

3.8.4 AEC (Acoustic Echo Cancellation)

User can use AEC page to do acoustic echo cancellation. META supports loud speaker mode and normal mode AEC calibration. META will generate audcoff_default.h, output speech FIR file (only loud speaker mode) and volume gain file automatically and display mechanism result. audcoff_default.h is C file format. Output speech FIR file and volume gain file are INI file format. User can integrate audcoff_default.h into target load source, use speech output FIR coefficient page to open output speech FIR file and use custom volume setting to open volume gain file.

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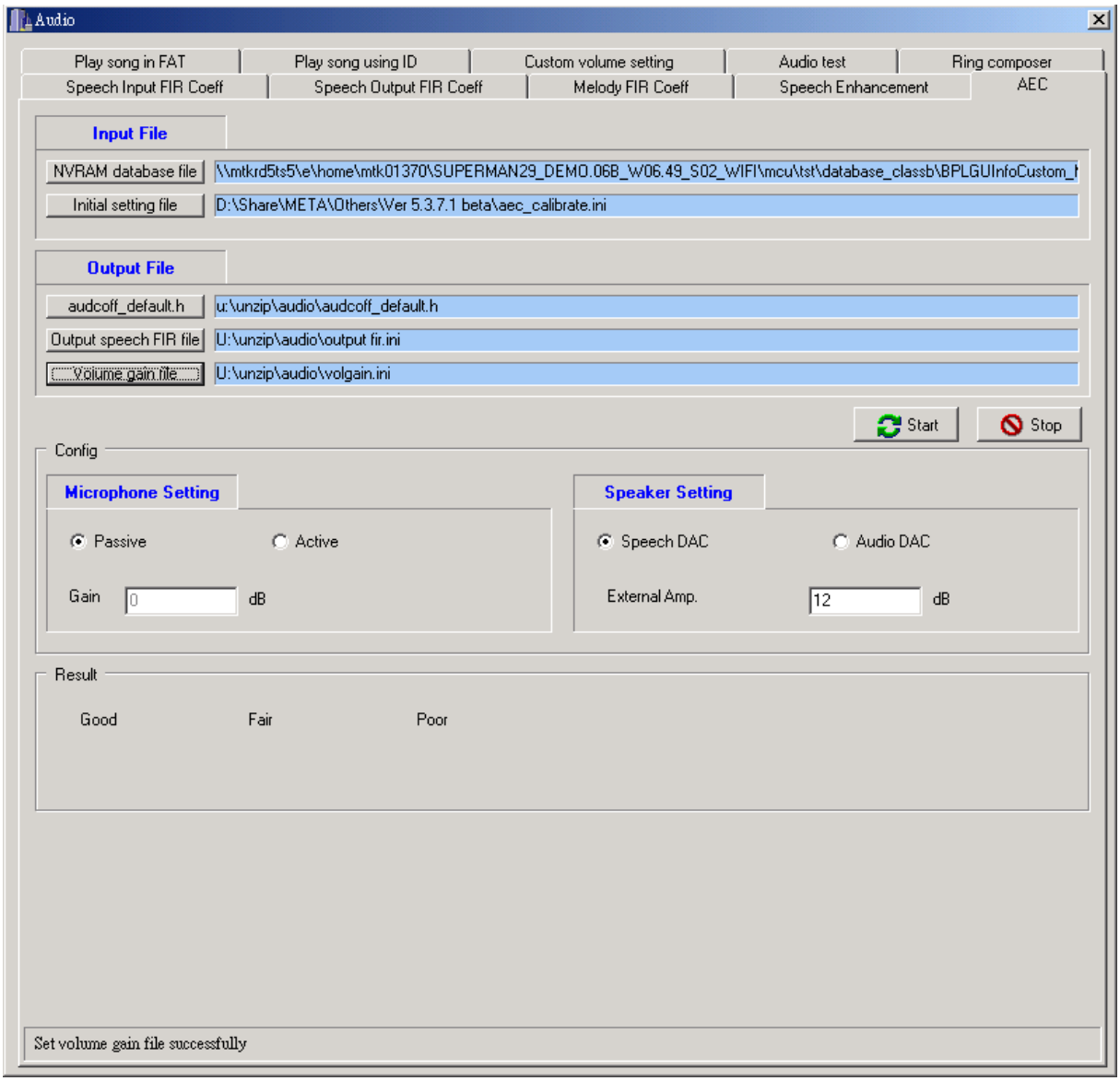

Figure 260 ***AEC***

User can execute AEC calibration by following steps:

1) Setup NVRAM database file and initial setting file. The default initial setting file is aec_calibrate.ini.
2) Setup output files. Output files contain audcoff_default.h, output speech FIR file and volume gain file.
3) Click [Start] button to start AEC calibration.
4) META will generate output files automatically and display mechanism result.

3.8.5 Audio testing

User can use audio testing function to test weather audio device (speaker or buzzer) generates correct frequency. META audio tool provide two ways to generate certain frequencies, one is by imelody and another is by keypad tone.

3.8.5.1 iMelody Audio Testing

User can start imelody audio test by following steps:

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1) Select style, duration, frequency and instrument and then set volume (range: 0~6).
2) Click [Start] button to start audio test.

VALUE	STYLE	RATIO OF NOTE TO REST PERIOD
S0	Natural Style (rest between notes), default	20:1
S1	Continues Style (no rest between notes)	No rest
S2	Staccato Style (shorter notes and longer reset period)	1:1

Figure 261 ***Style format of iMelody***

VALUE	DURATION
0	Full note
1	1/2 note
2	1/4 note
3	1/8 note
4	1/16 note
5	1/32 note

Figure 262 ***Duration format of iMelody***

Note:

12. If you want to know more detail about iMelody format, please refer to document [iMelody, Infrared Data Association, Specifications for Ir Mobile Communications (IrMC)], the document could be download from http://www.irda.org/standards/pubs/iMelody.pdf

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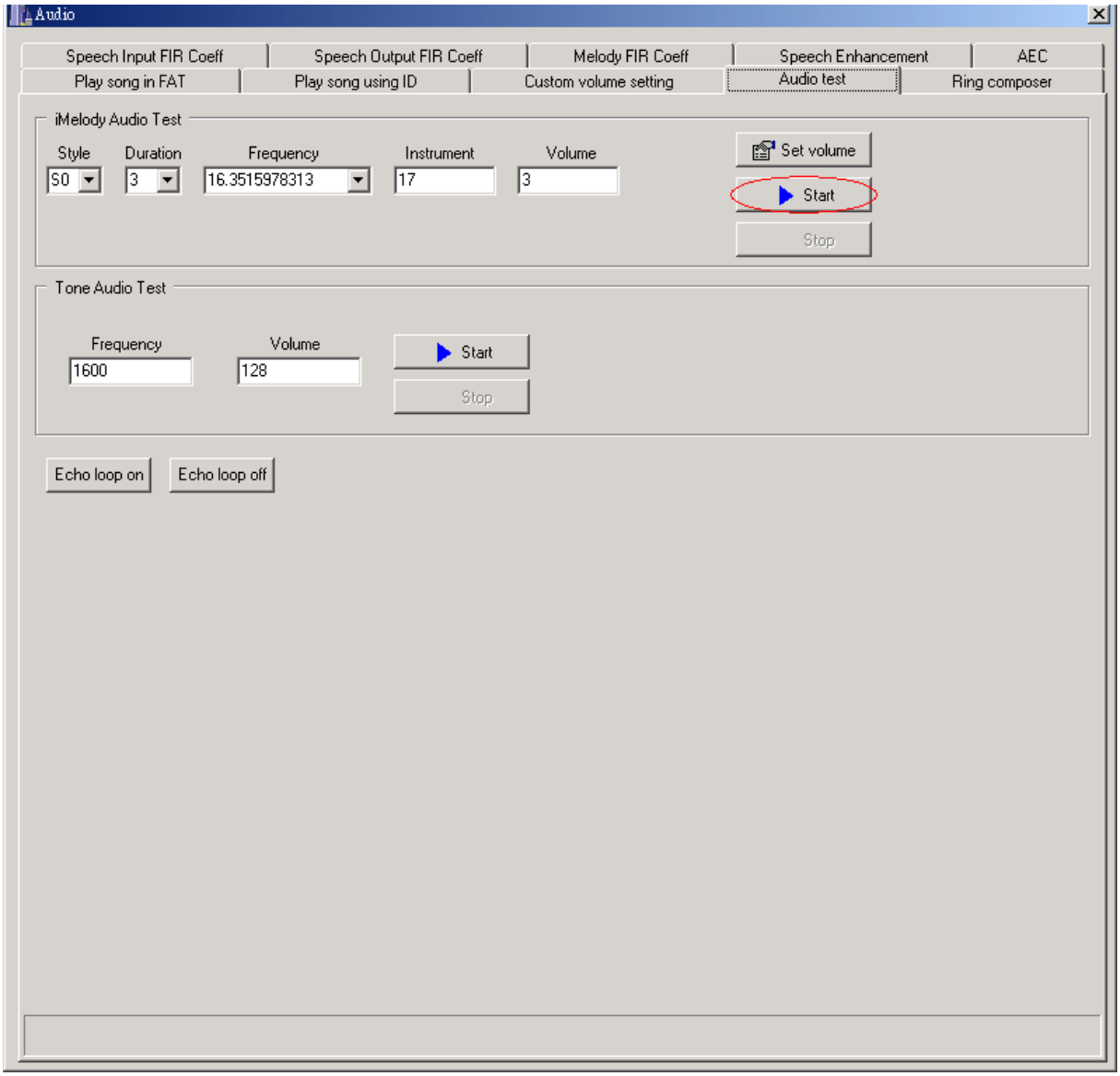

Figure 263 ***Click [Start] button to start iMelody audio testing***

User can click [Stop] button to stop imelody audio test.

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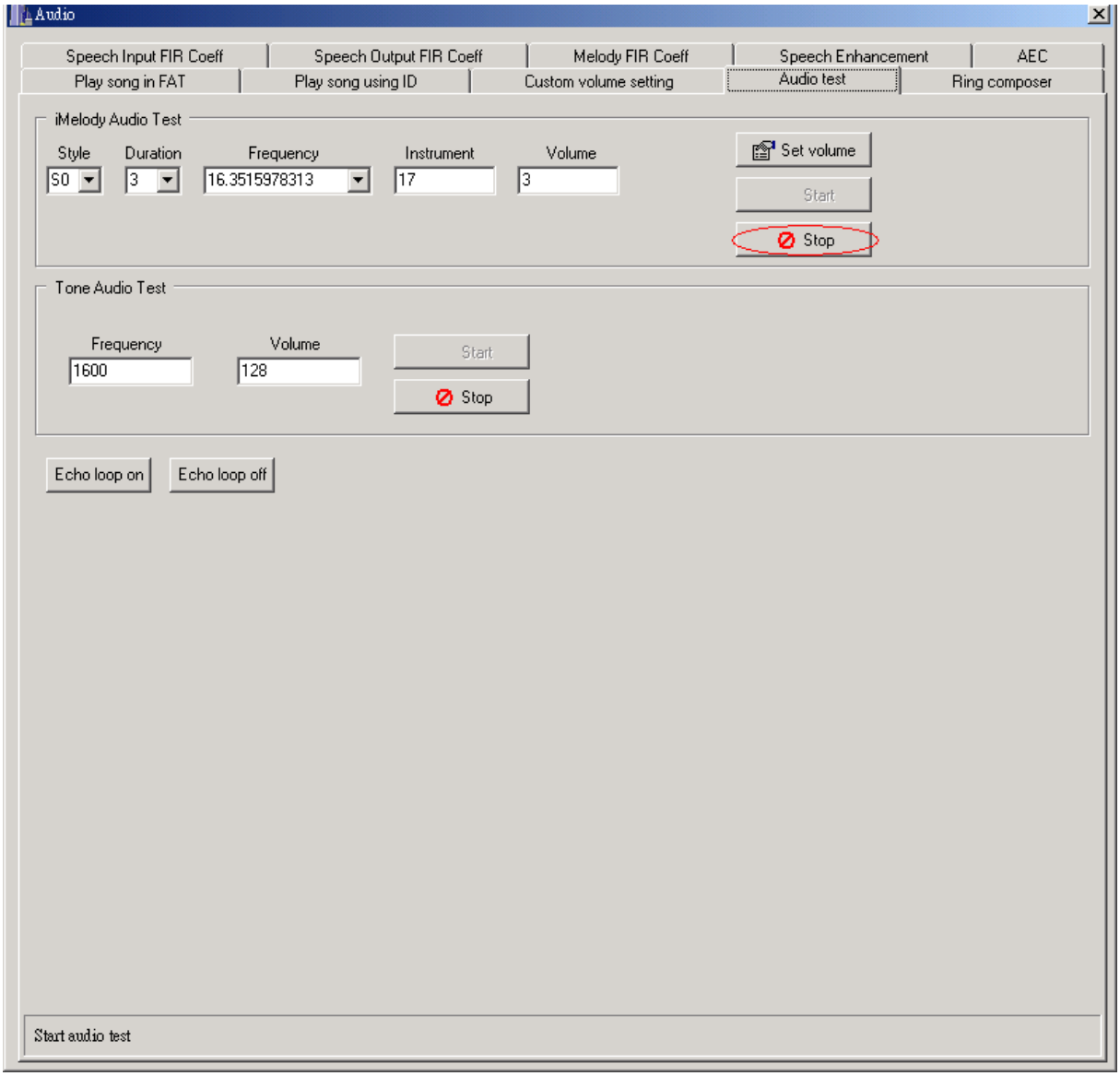

Figure 264 ***Click [Stop] button to stop testing***

3.8.5.2 Tone Audio Testing

User can start imelody audio test by following steps:

1) Enter frequency and tone volume (range: 0~255).

2) Click [Start] button to start audio test.

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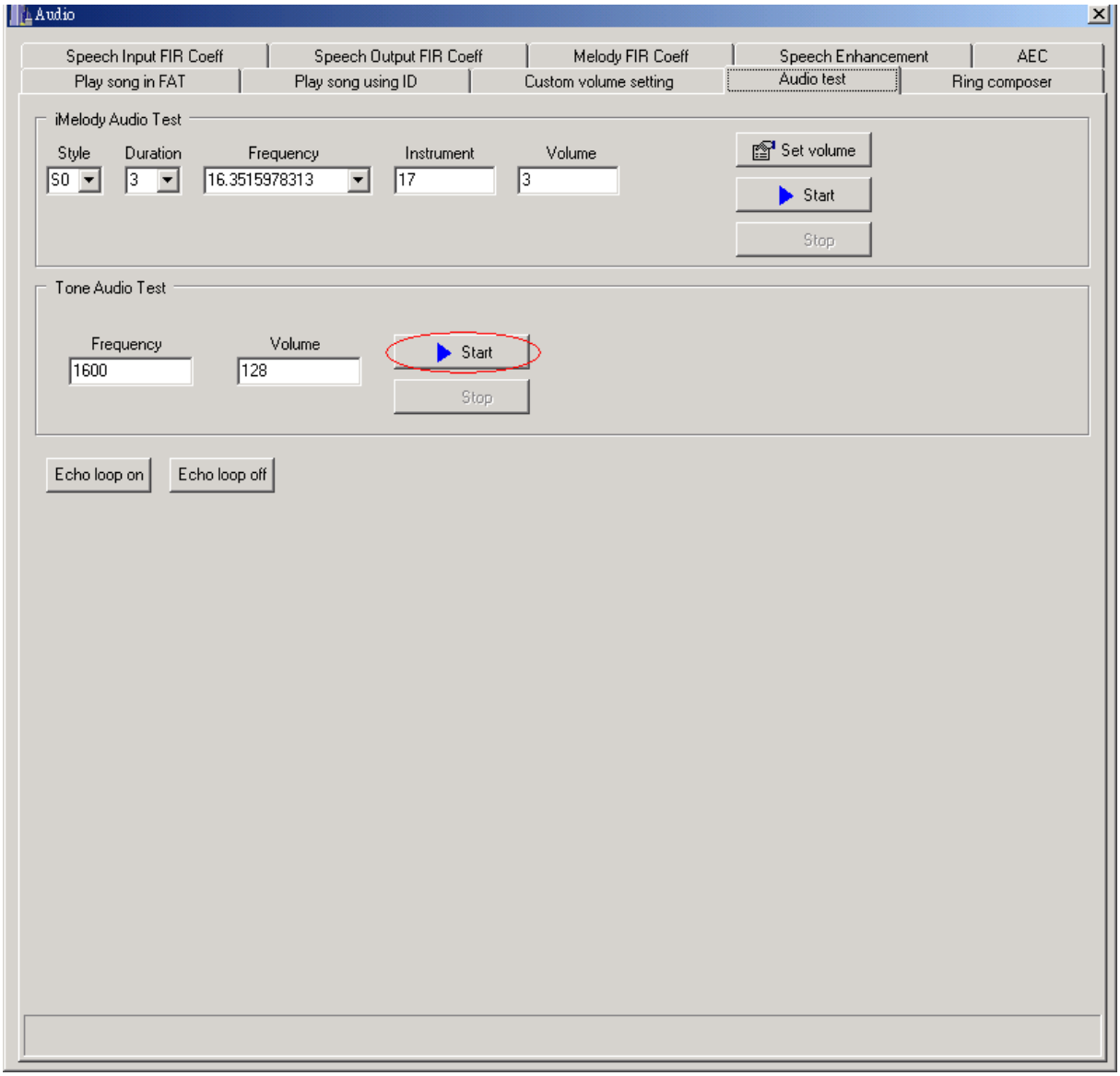

Figure 265 ***Click [Start] button to start keypad tone audio testing***

User can click [Stop] button to stop imelody audio test.

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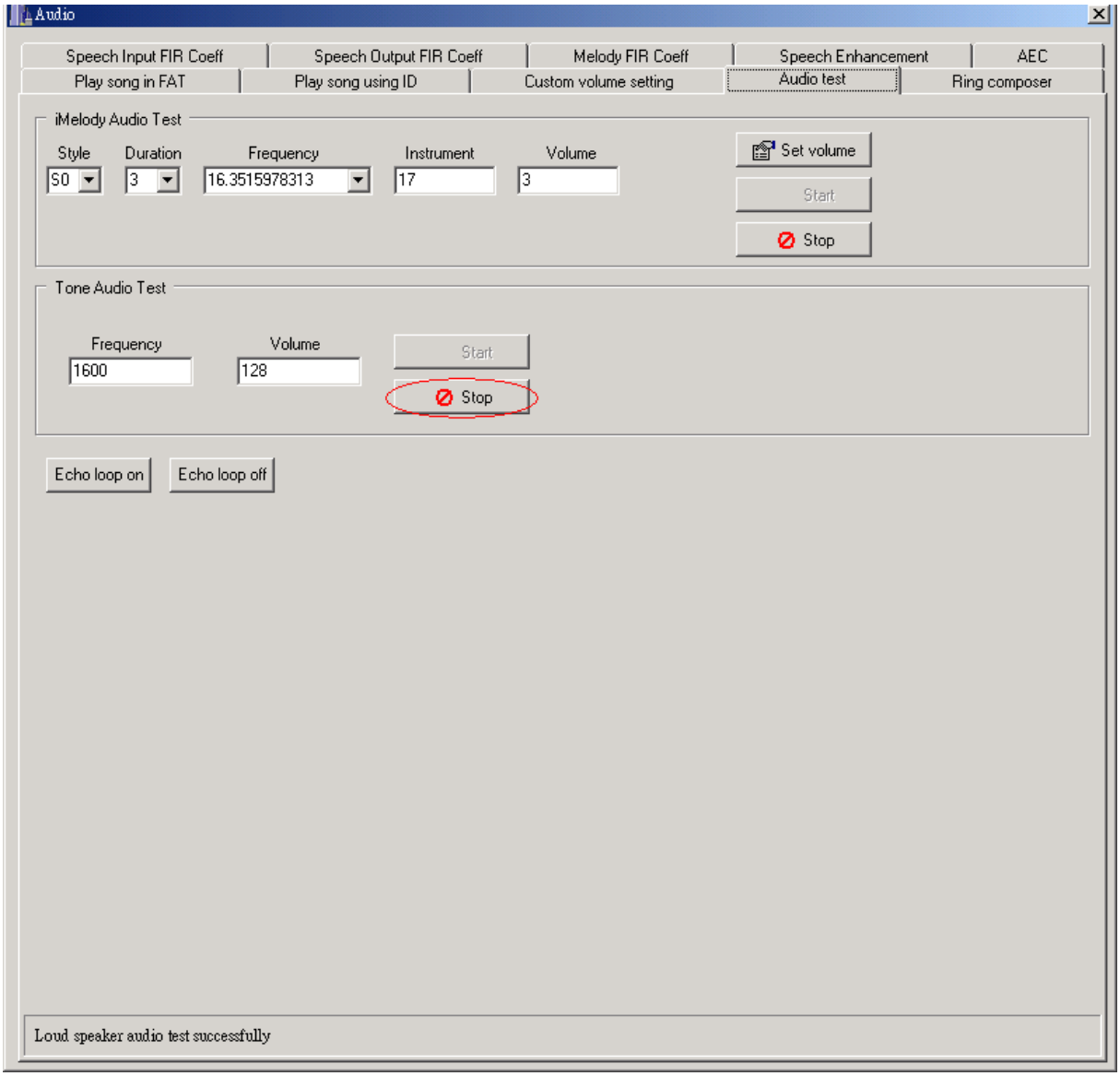

Figure 266 ***Click [Stop] button to start keypad tone audio testing***

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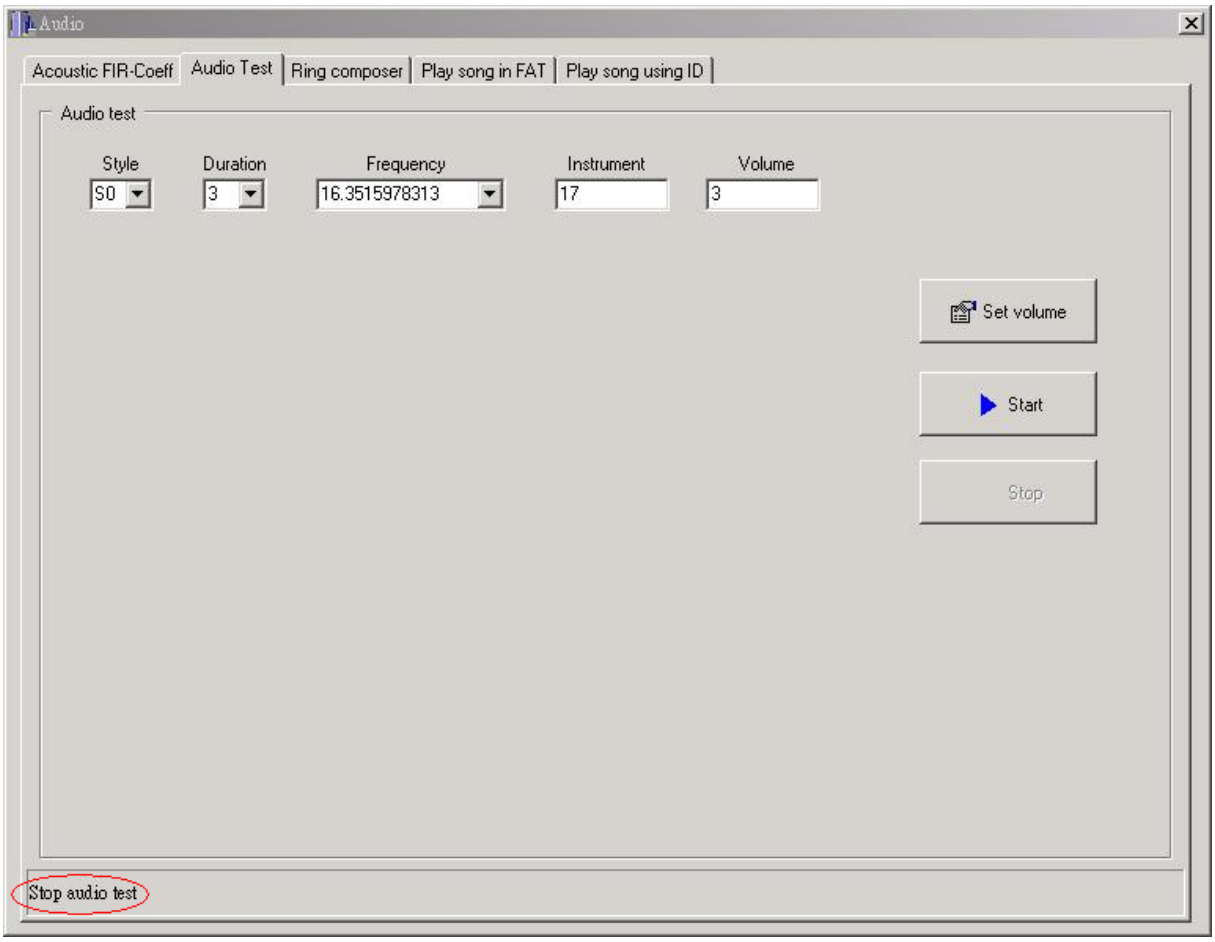

Figure 267 ***[Start] Button is enabled and result is shown***

3.8.6 Ring composer

User can use the ring composer window to compose, play, save and load iMelody songs.

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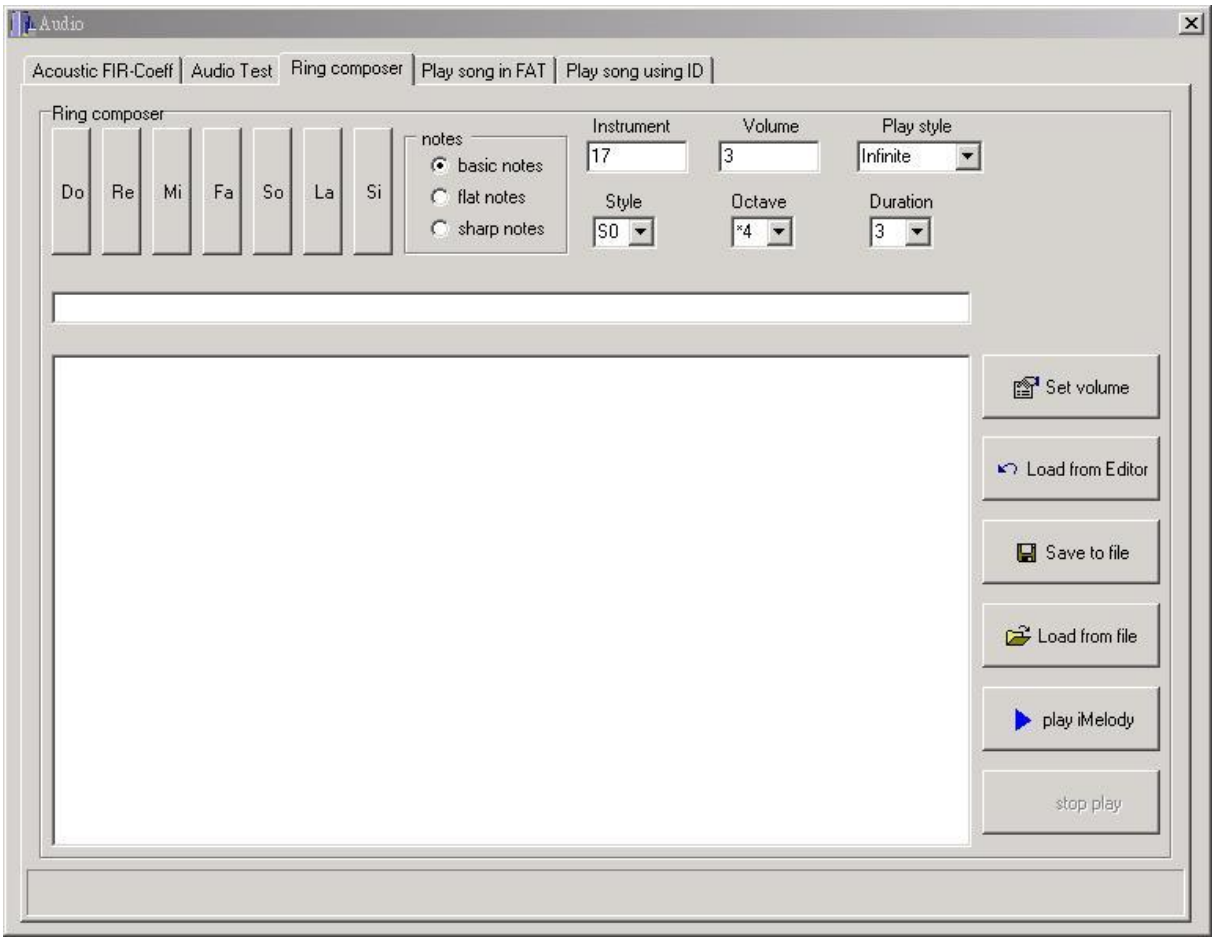

Figure 268 ***Ring composer window***

Note:

13. If you want to know more detail about iMelody format, please refer to document [iMelody, Infrared Data Association, Specifications for Ir Mobile Communications (IrMC)], the document could be download from http://www.irda.org/standards/pubs/iMelody.pdf

User can compose iMelody song by following steps:

1) Chose notes (basic, flat or sharp), instrument, volume, play style, style, octave, and duration you want to compose and then click [Do] ,[Re], [Mi], [Fa], [So], [La], or [Si] button.
2) Click [Load from Editor] button.
3) Click [play iMelody] button.

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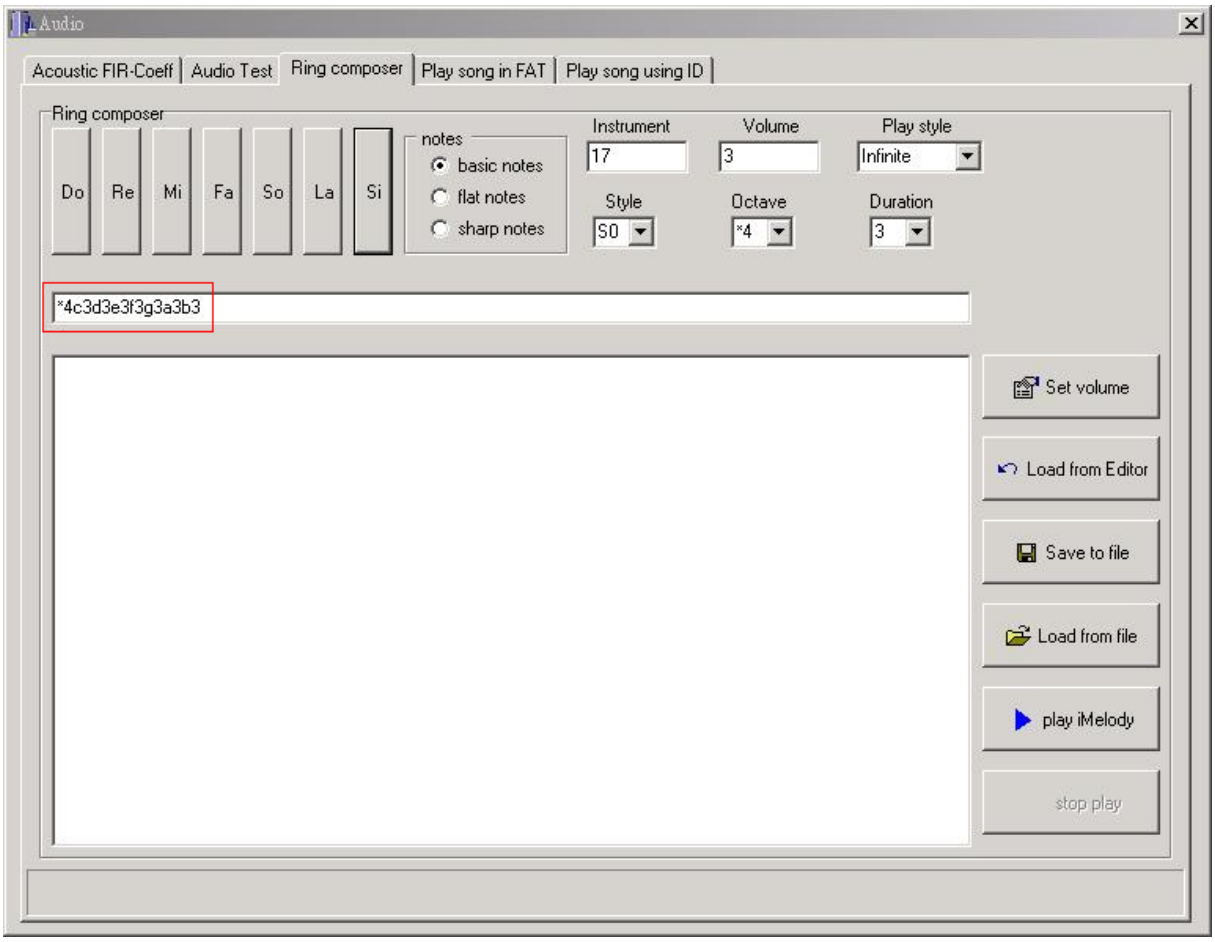

Figure 269 ***Composed imelody is shown after clicking [Do], [Re], [Mi], [Fa], [So], [La] or [Si] button***

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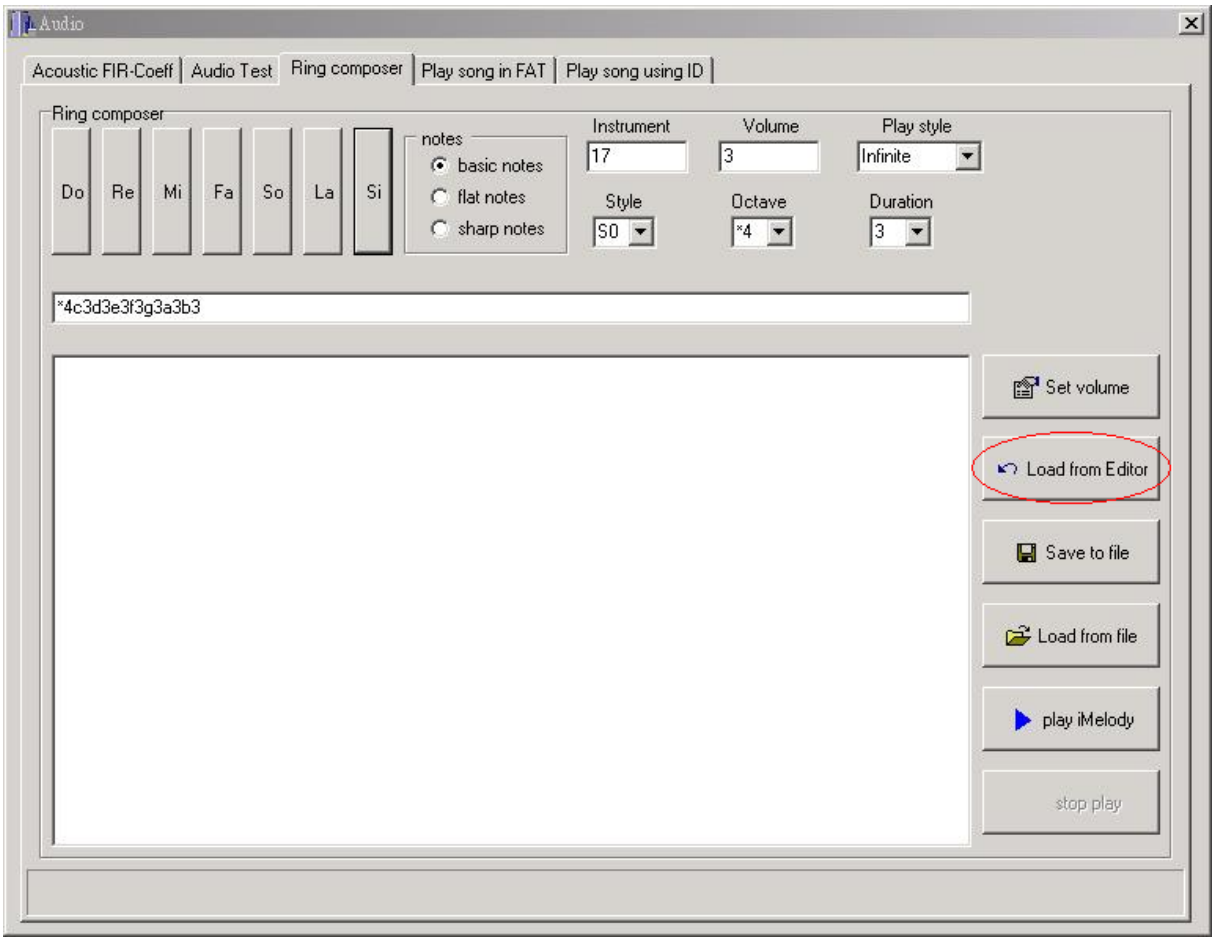

Figure 270 ***Click [Load form Editor] button***

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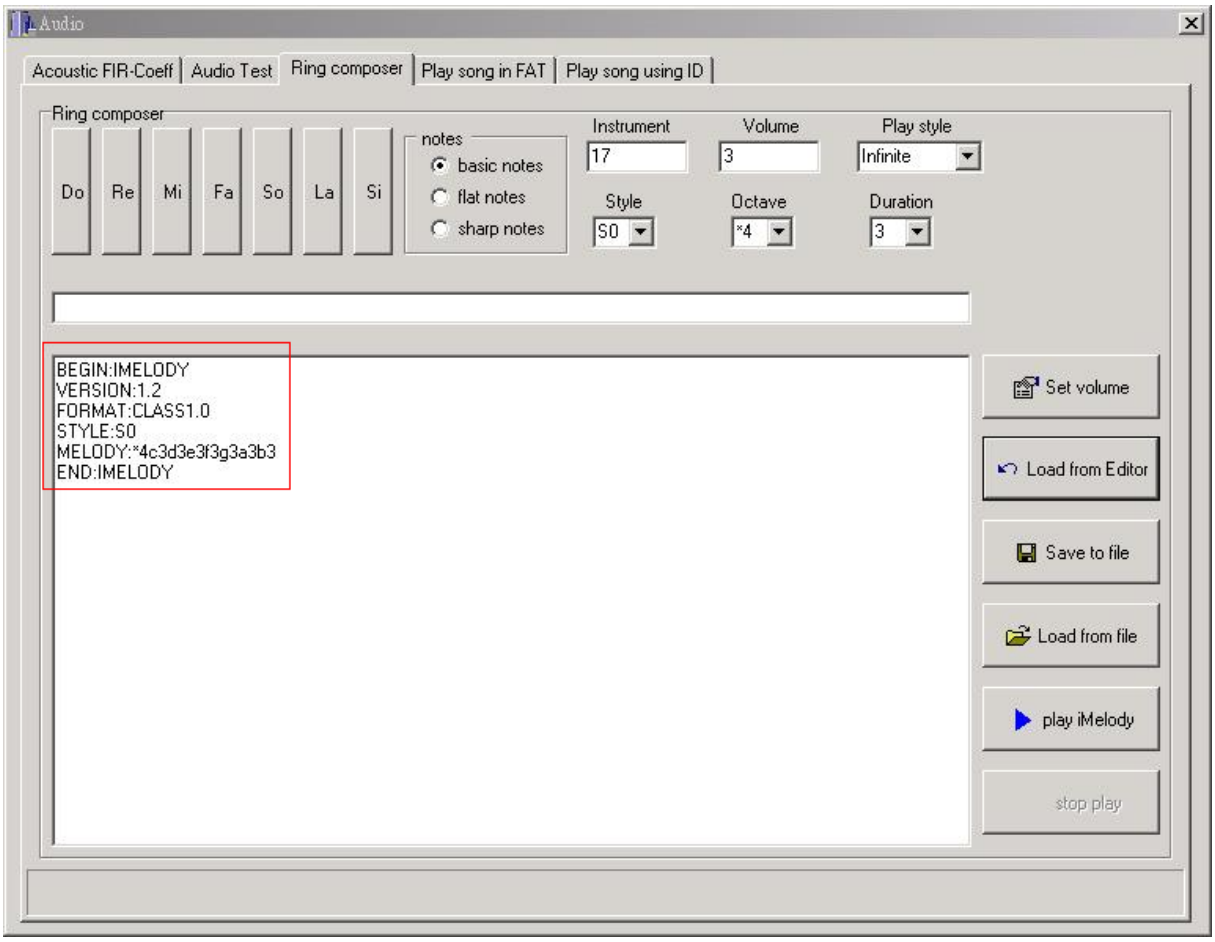

Figure 271 ***Composed iMelody song is shown***

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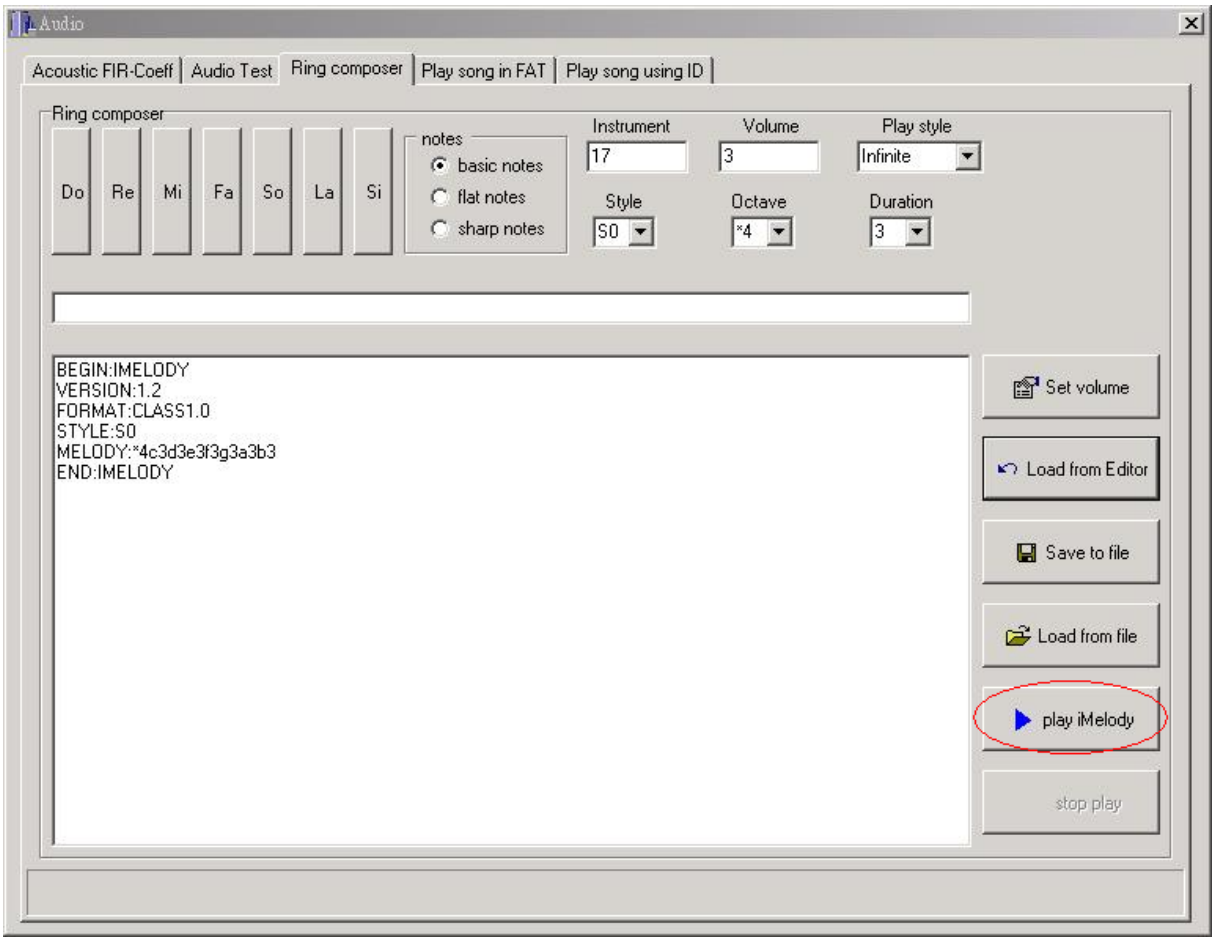

Figure 272 ***Click [play iMelody] button***

User can click [Stop play] button to stop playing iMelody song.

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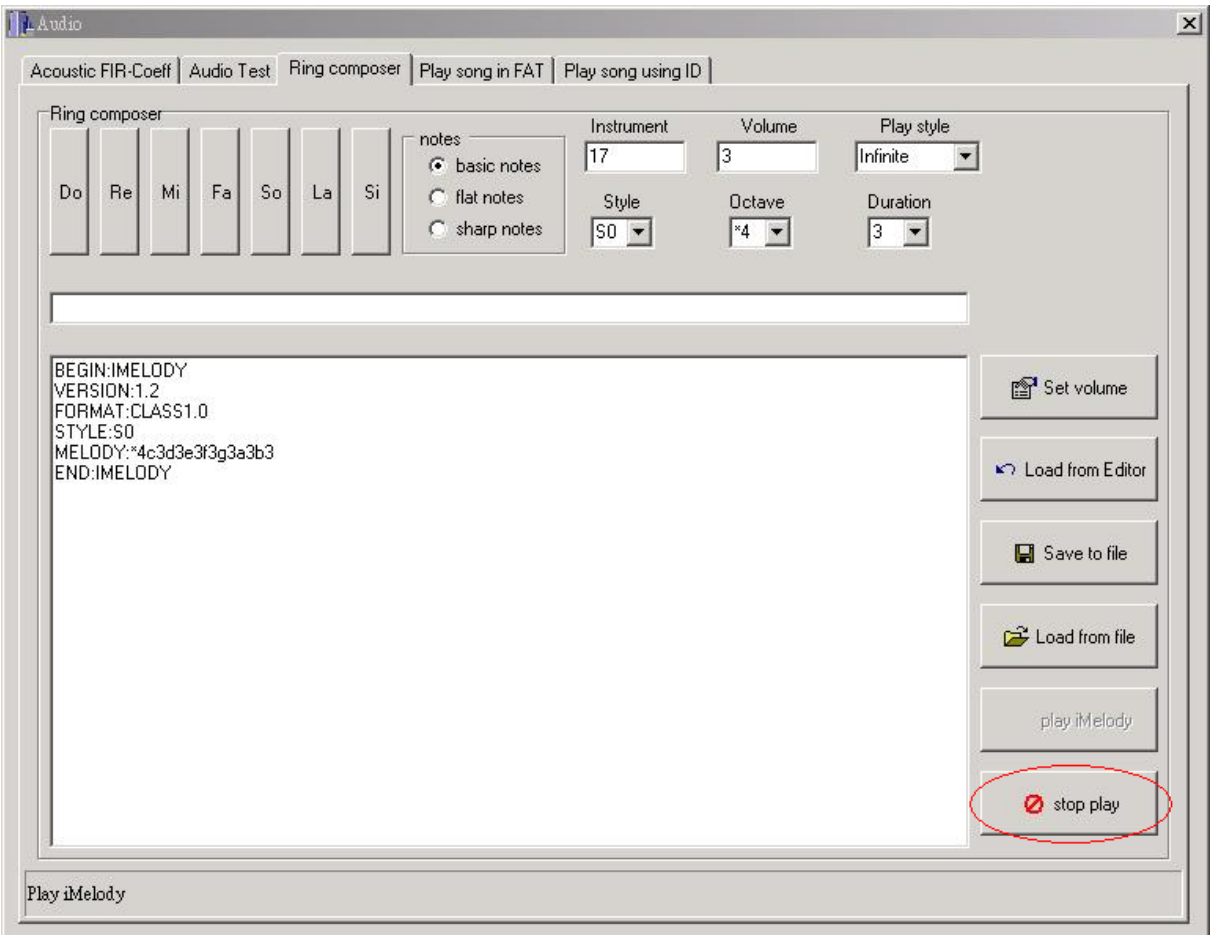

Figure 273 ***Click [stop play] button***

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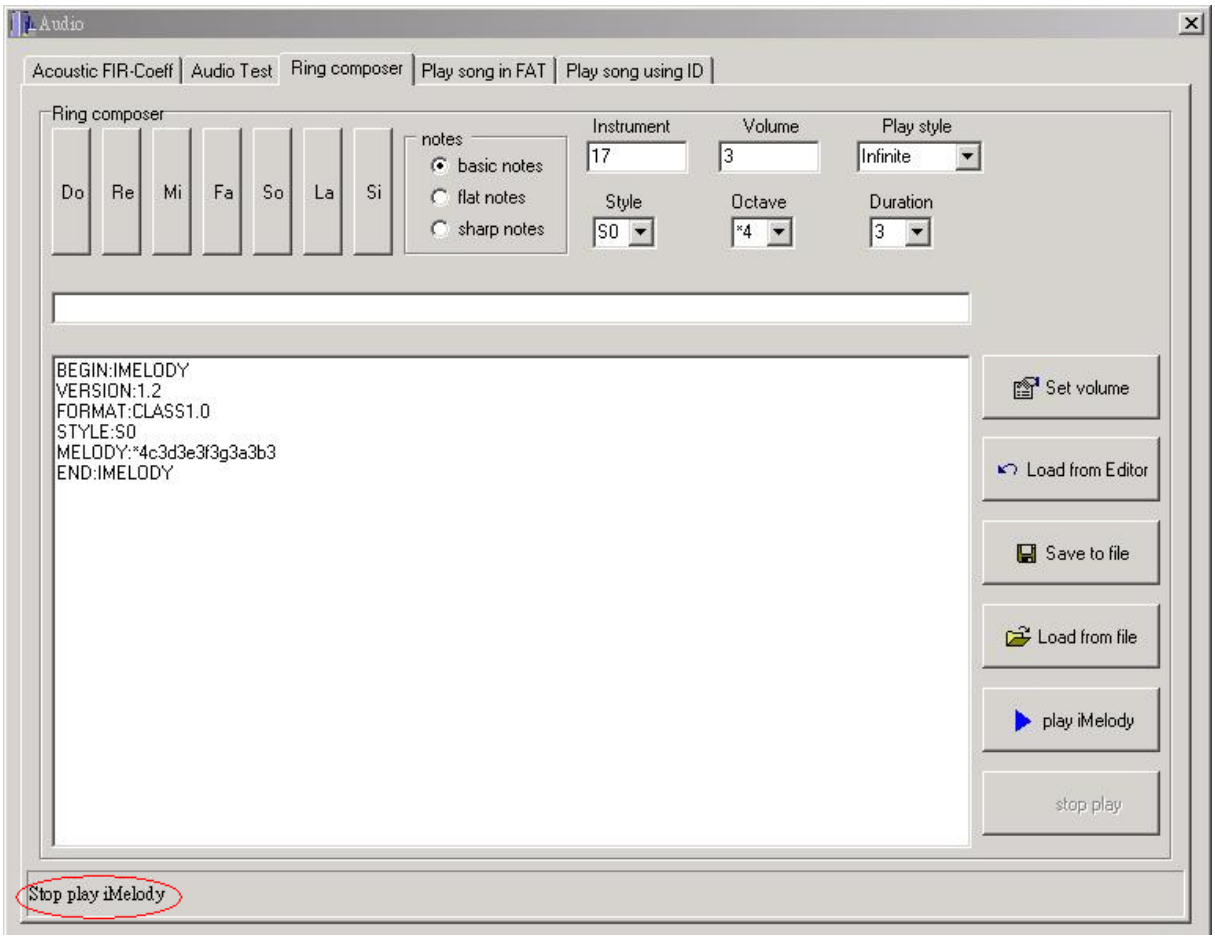

Figure 274 ***Result of stop play iMelody***

3.8.7 Play song in FAT

The Play song in FAT provides an interface for user to play Midi and iMelody files in FAT.

User can play song in FAT by following steps:

14. Enter volume (range: 0~6) and choose playing style.
15. Select file type.
16. Choose midi or iMelody file.

- Click [Play] button to start play song in FAT.
- User can click [Stop play] button to stop playing. [Play] button will be enabled after [Stop play] button is clicked.

Note: The song file name support ASCII only

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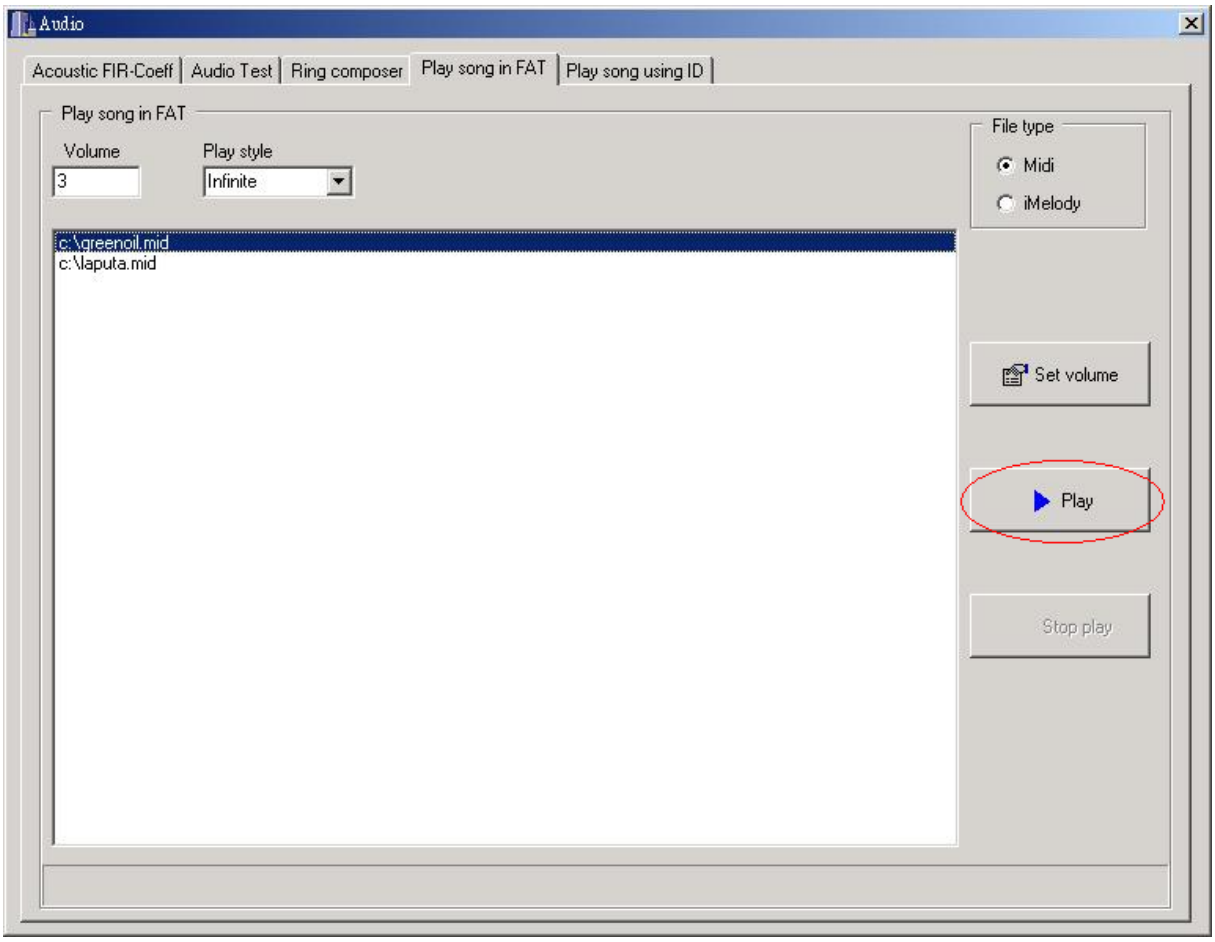

Figure 275 ***Click [Play] to start playing song in FAT***

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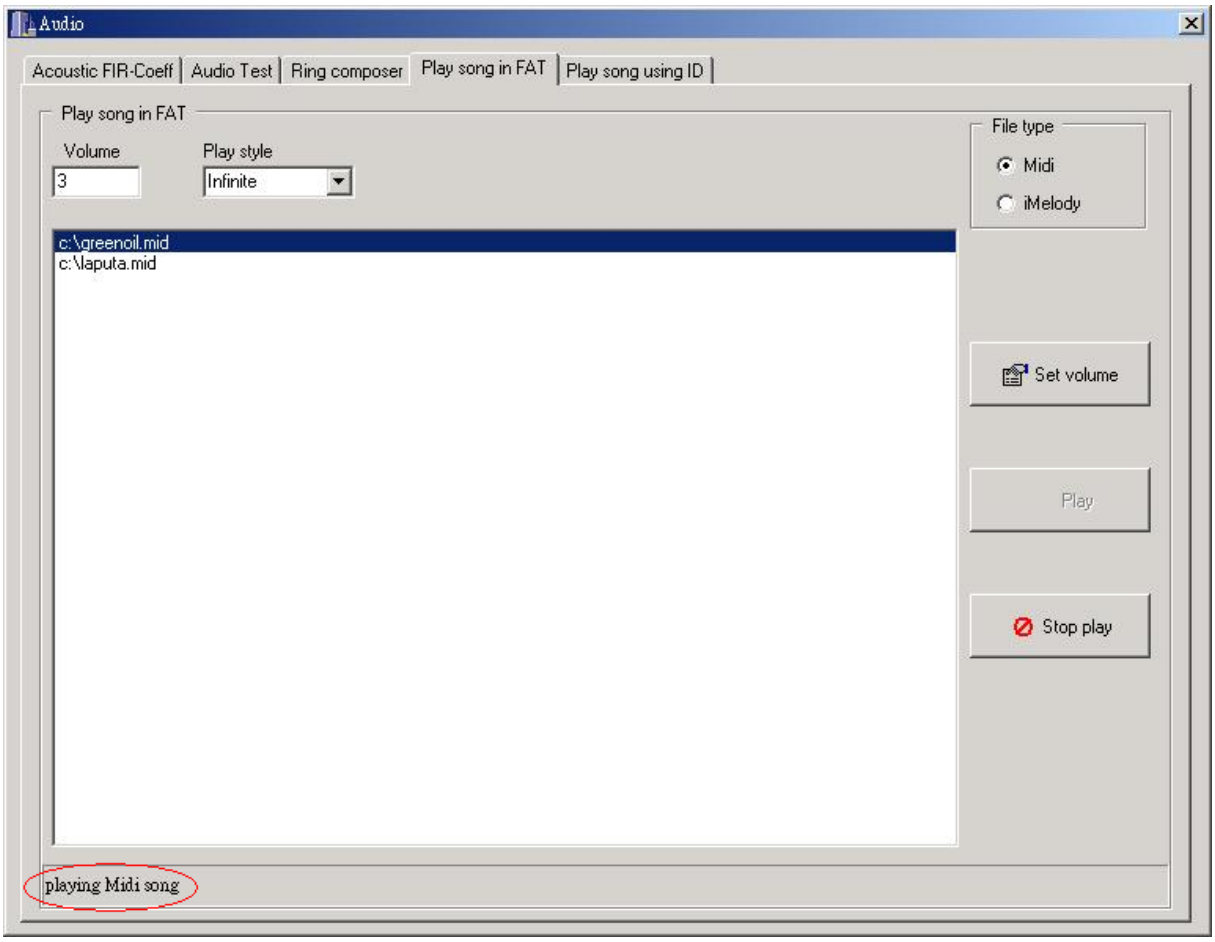

Figure 276 ***Result of playing song in FAT***

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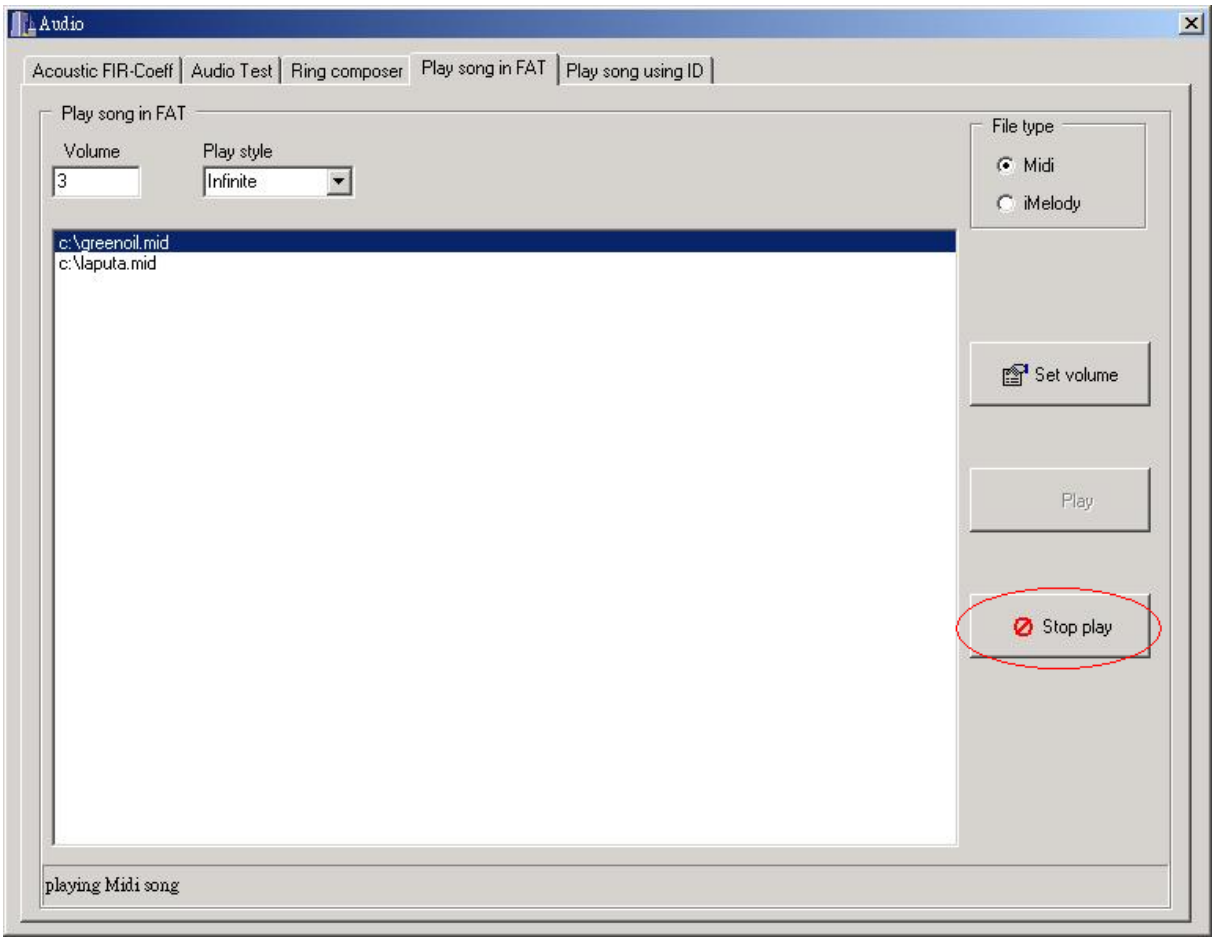

Figure 277 ***Click [Stop play] button to stop playing song in FAT***

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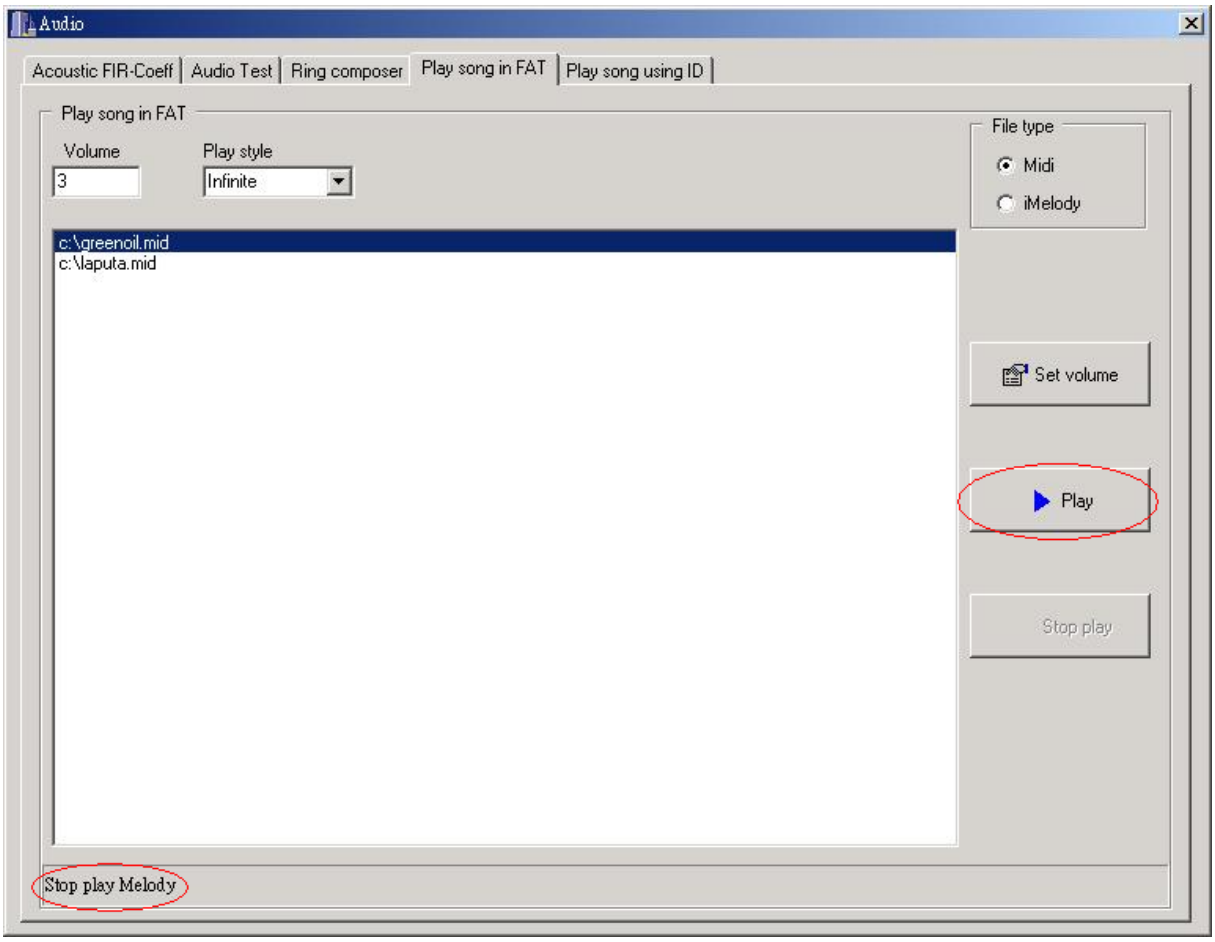

Figure 278 ***Result of stop playing song in FAT***

3.8.8 Customer volume setting

User can use customer volume setting window to adjust volume level of each tone and volume gain of each volume level and generate customer volume setting C file. There are total five tone volume gain can be adjusted by META audio tool, they are keypad tone, microphone, speech tone, side tone and melody. The range of volume gain of each level is between 0 ~ 255. There are three tone volume level can be adjusted by META audio tool. They are keypad tone, speech and melody. The range of volume level of these tones is level 0 ~ level 6.

In order to provide user the capability to fine tune music volume. META audio tool provide 16-level volume setting for melody in each mode and TV out. User shall define max volume and step of each level. MediaTek target software will evaluate volume gain value according to max volume and step of each level. For audio play and video play, 16 level setting will be used. Other applications will use level 0~6.

In current MediaTek target software design, if target hardware supports TV out function, for melody, microphone and side tone, MediaTek target will change audio output path to TV and use TV out volume gain setting when TV cable is plugged in. The volume level setting is same as melody. TV out is not an audio mode, MediaTek target only use its gain setting to replace original audio mode audio type gain setting when play audio from TV.

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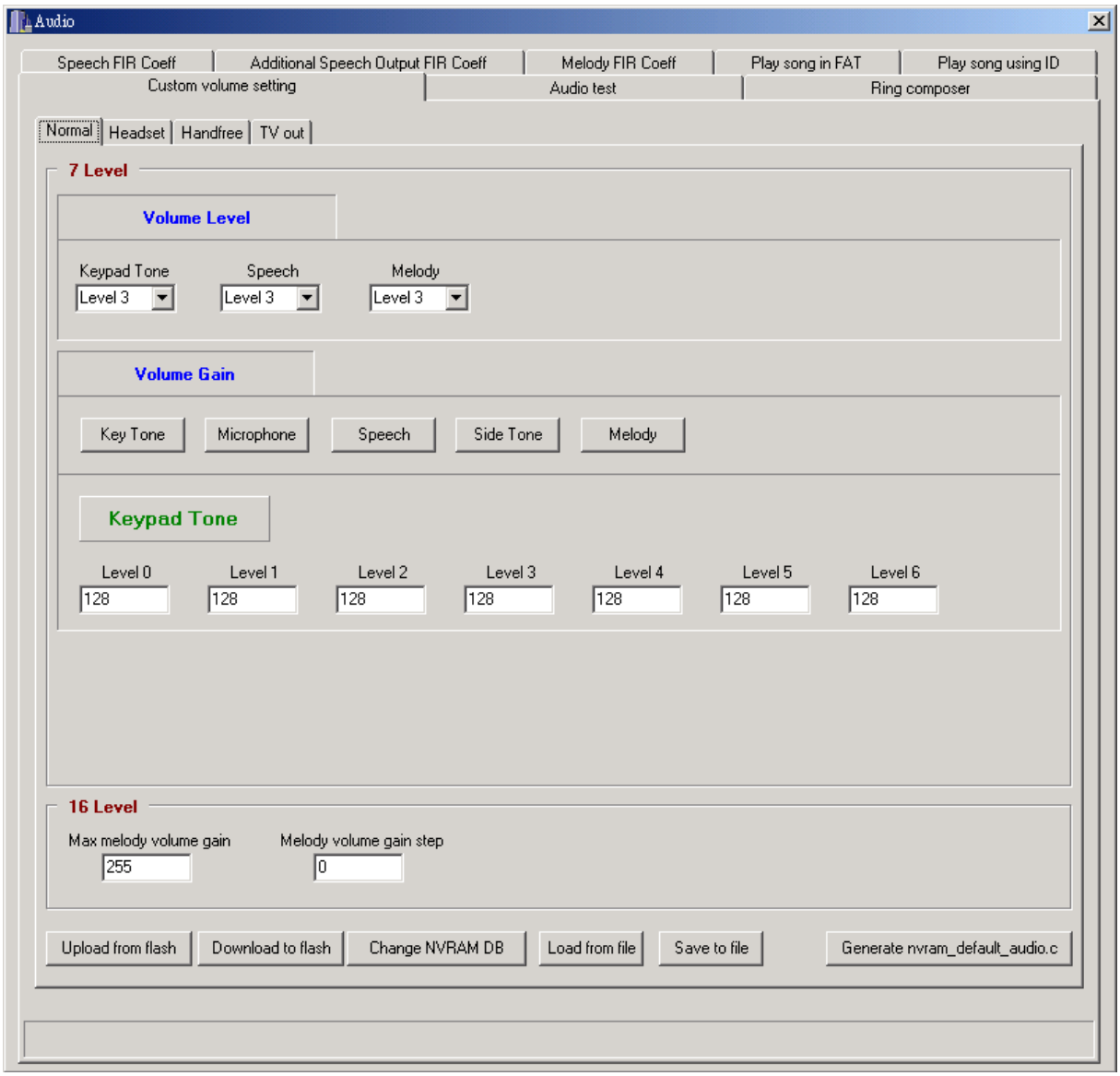

Figure 279 ***Customer volume setting window***

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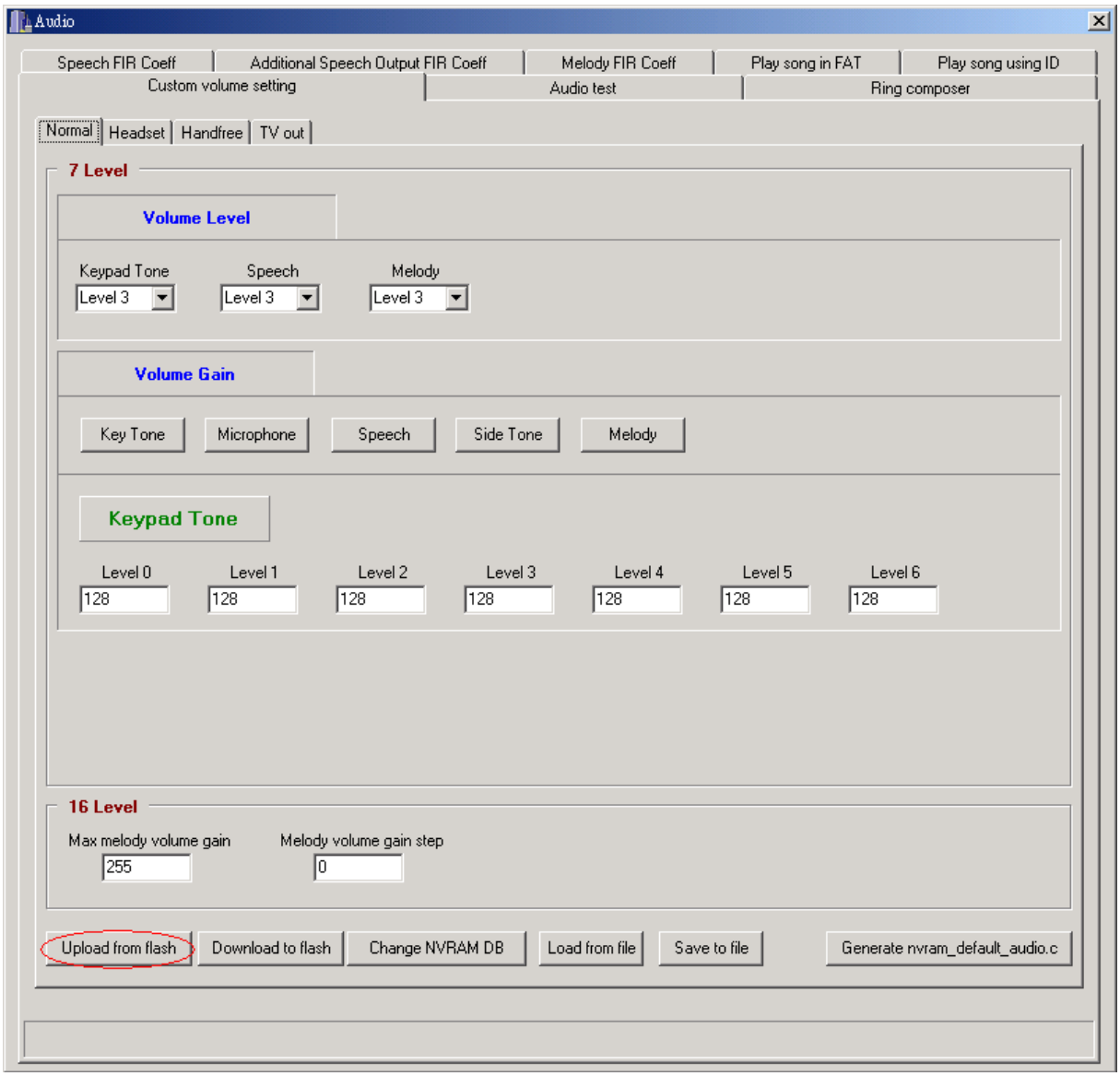

Figure 280 ***Click [Upload from flash] button to read customer volume setting from flash***

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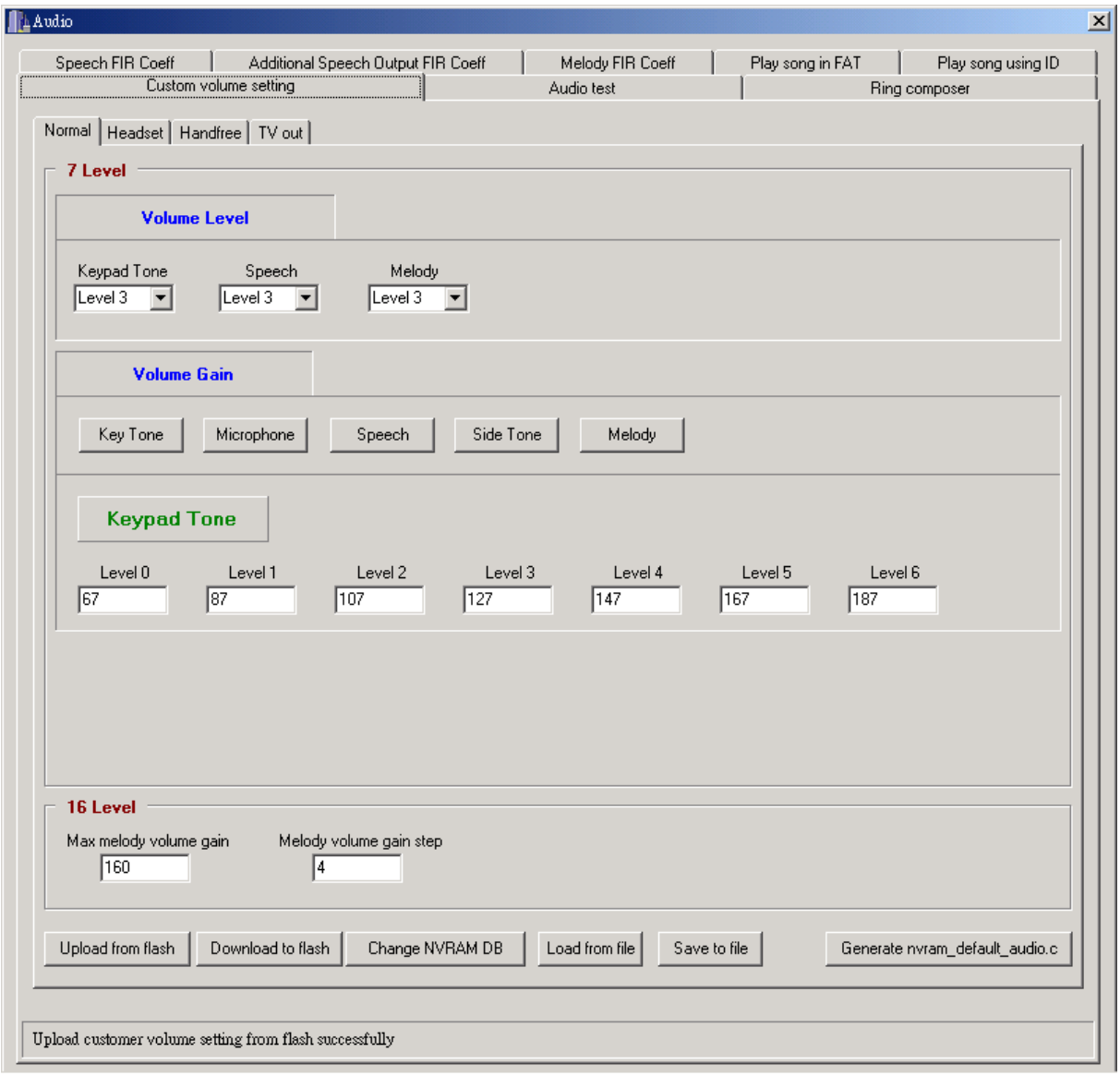

Figure 281 ***Result of upload from flash***

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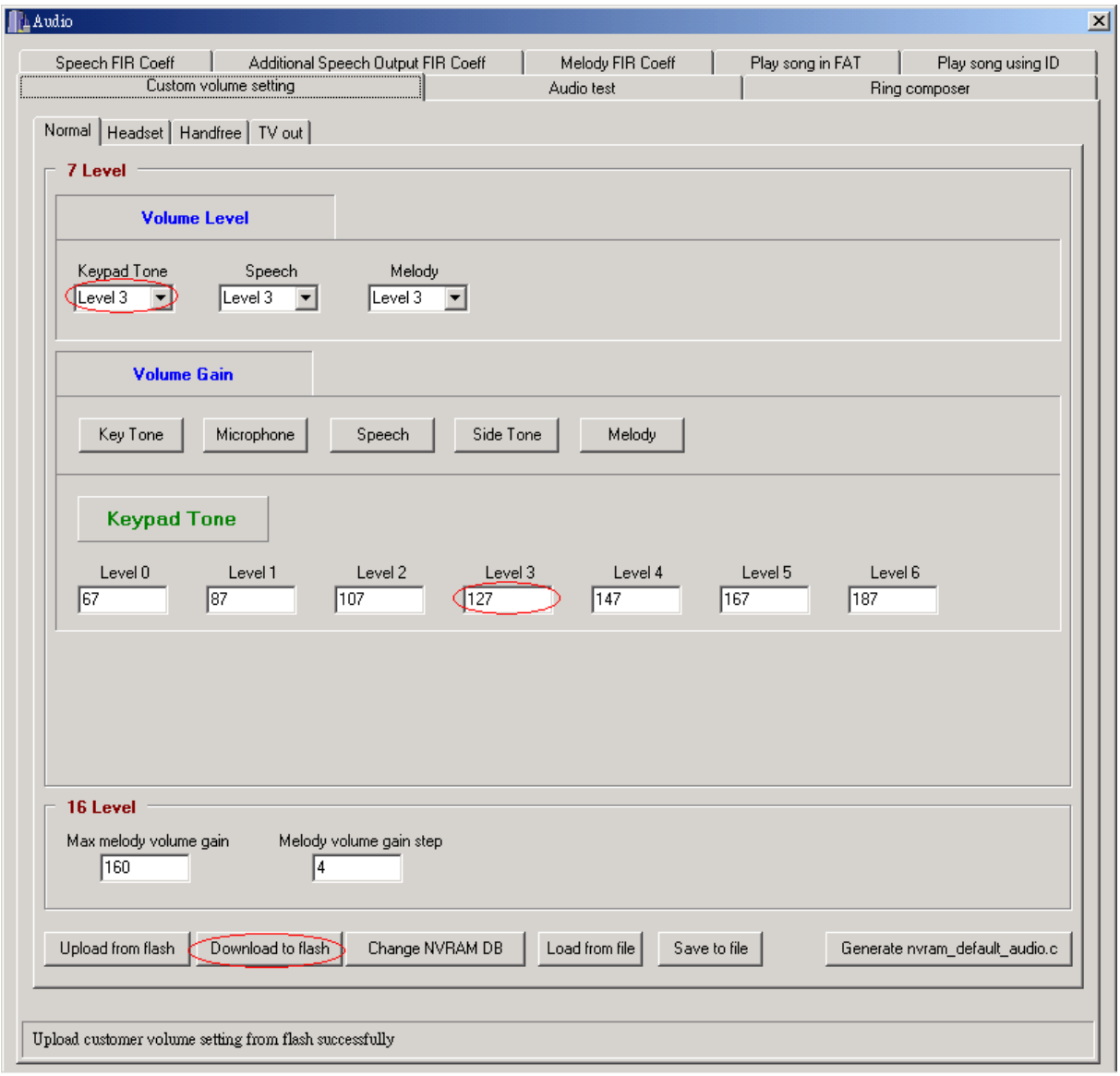

Figure 282 ***Adjust volume level, change volume gain, and then press [Download to flash] button to apply the new setting***

User can click [Change NVRAM DB] button to change NVRAM database file.

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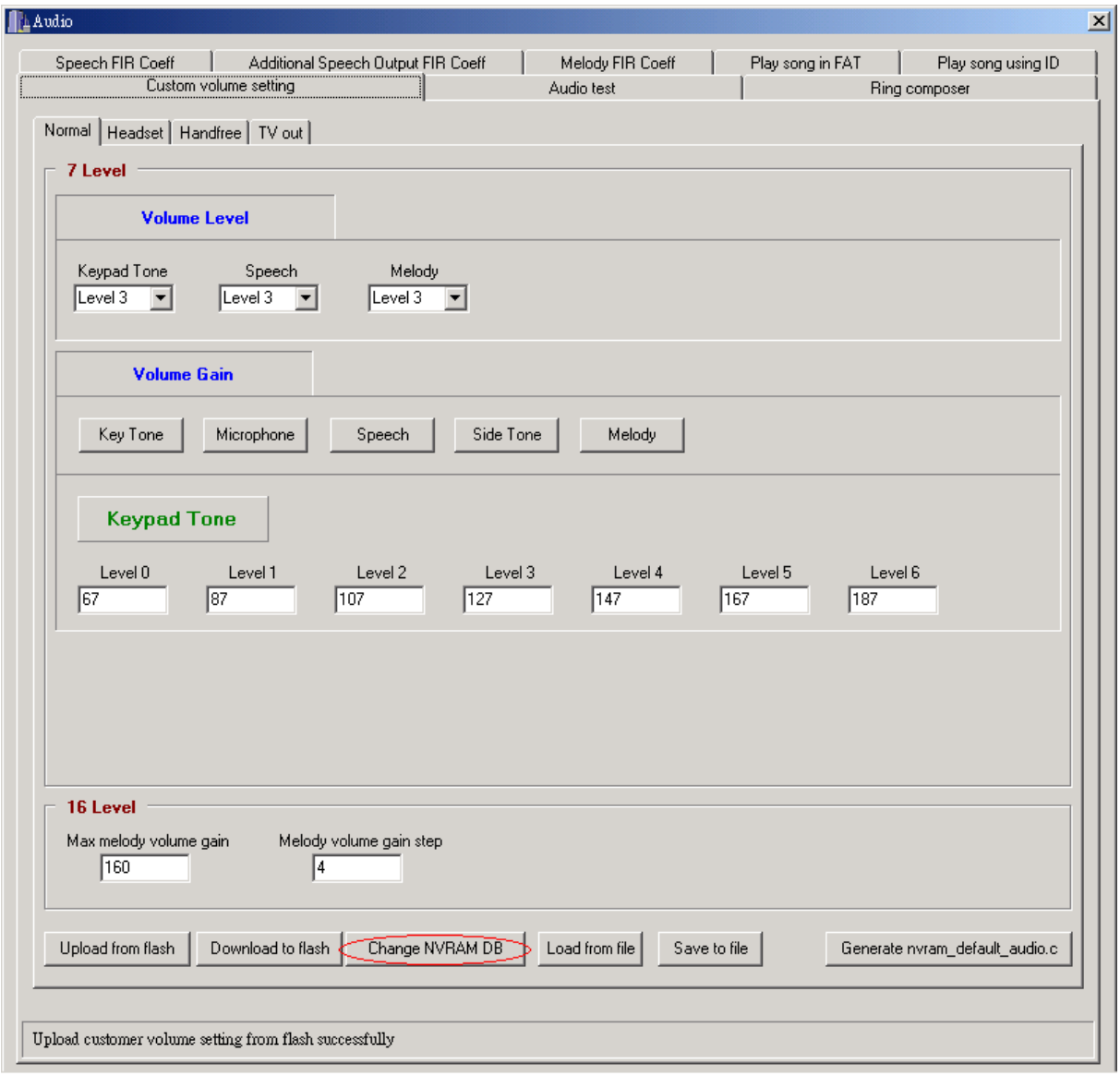

Figure 283 ***Click [Change NVRAM DB] button to change NVRAM database file***

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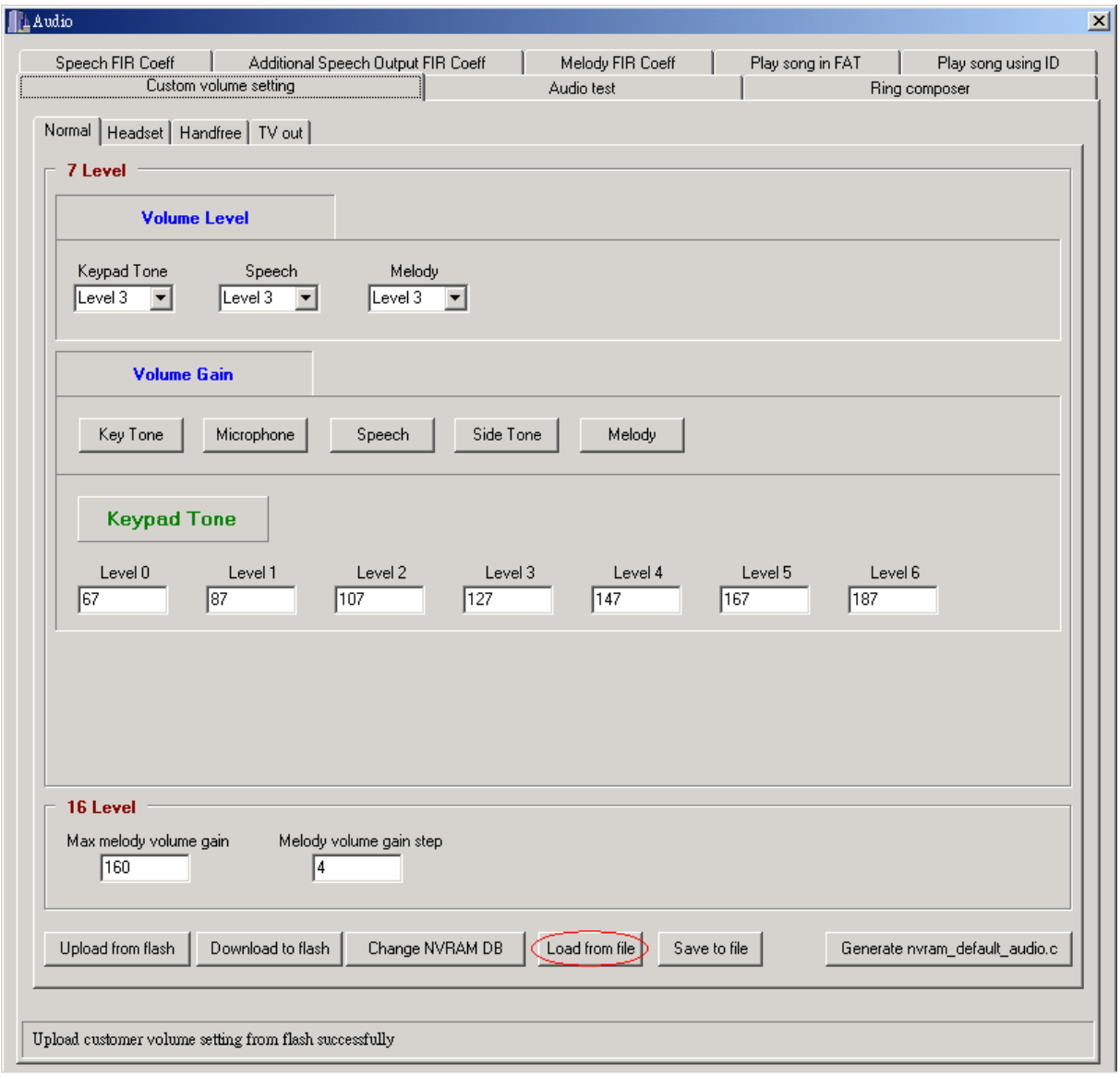

Figure 284 ***Click [Load from file] button to read customer setting from text file***

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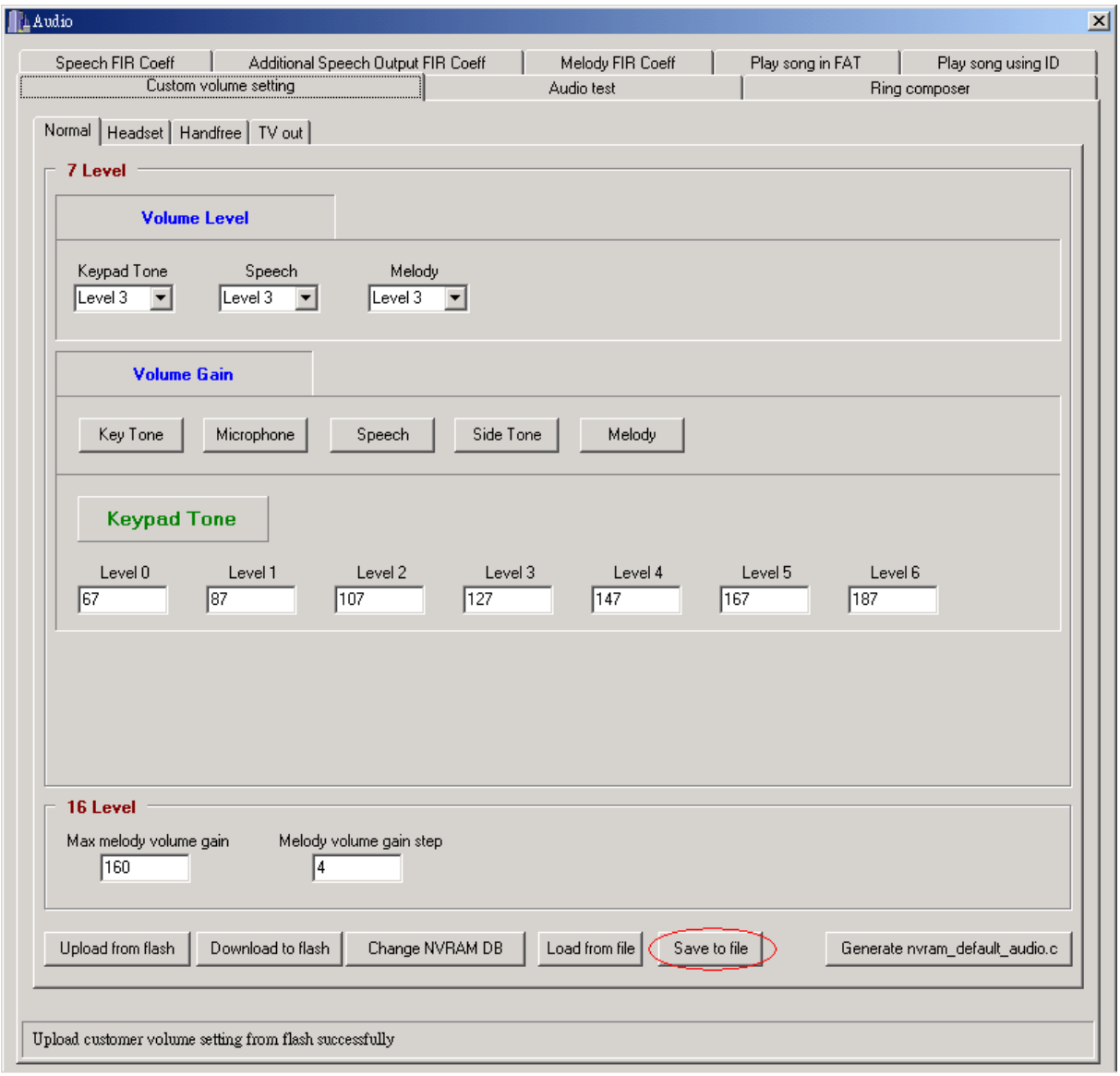

Figure 285 ***Click [Save to file] button to save customer volume setting to text file***

The following is a template file of customer volume setting. The file is generated by clicking [Save to file] button. Note: from w0932 version, the file format has been changed.

[Normal Volume Level]
Keypad Tone=3
Speech Tone=3
Melody=3
[Headset Volume Level]
Keypad Tone=3
Speech Tone=3
Melody=3
[Handfree Volume Level]
Keypad Tone=3
Speech Tone=3

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Melody=3
[Normal Volume Gain]
Keypad Tone Level 0=67
Keypad Tone Level 1=87
Keypad Tone Level 2=107
Keypad Tone Level 3=127
Keypad Tone Level 4=147
Keypad Tone Level 5=167
Keypad Tone Level 6=187
Microphone Level 3=240
Microphone Level 4=240
Speech Tone Level 0=64
Speech Tone Level 1=80
Speech Tone Level 2=96
Speech Tone Level 3=112
Speech Tone Level 4=128
Speech Tone Level 5=144
Speech Tone Level 6=160
Side Tone Level 0=0
Melody Level 0=16
Melody Level 1=32
Melody Level 2=48
Melody Level 3=64
Melody Level 4=80
Melody Level 5=96
Melody Level 6=112
Side Tone Level 3=80
[Headset Volume Gain]
Keypad Tone Level 0=67
Keypad Tone Level 1=87
Keypad Tone Level 2=107
Keypad Tone Level 3=127
Keypad Tone Level 4=147
Keypad Tone Level 5=167
Keypad Tone Level 6=187
Microphone Level 3=180
Microphone Level 4=180
Speech Tone Level 0=32
Speech Tone Level 1=64
Speech Tone Level 2=96
Speech Tone Level 3=128
Speech Tone Level 4=160
Speech Tone Level 5=192
Speech Tone Level 6=224
Side Tone Level 0=0
Melody Level 0=16
Melody Level 1=32
Melody Level 2=48
Melody Level 3=64
Melody Level 4=80
Melody Level 5=96

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Melody Level 6=112
Side Tone Level 3=80
[Handfree Volume Gain]
Keypad Tone Level 0=67
Keypad Tone Level 1=87
Keypad Tone Level 2=107
Keypad Tone Level 3=127
Keypad Tone Level 4=147
Keypad Tone Level 5=167
Keypad Tone Level 6=187
Microphone Level 3=120
Microphone Level 4=120
Speech Tone Level 0=16
Speech Tone Level 1=16
Speech Tone Level 2=32
Speech Tone Level 3=48
Speech Tone Level 4=64
Speech Tone Level 5=80
Speech Tone Level 6=96
Side Tone Level 0=0
Melody Level 0=40
Melody Level 1=80
Melody Level 2=96
Melody Level 3=112
Melody Level 4=200
Melody Level 5=240
Melody Level 6=255
Side Tone Level 3=80
[16 Level Max Melody Volume Gain]
Normal Max Melody Volume Gain=112
Headset Max Melody Volume Gain=112
Handfree Max Melody Volume Gain=112
TV Out Max Melody Volume Gain=112
[16 Level Melody Volume Gain Step]
Normal Melody Volume Gain Step=4
Headset Melody Volume Gain Step=4
Handfree Melody Volume Gain Step=4
TV Out Melody Volume Gain Step=4
[TV Out Volume Gain]
TV Out Volume Gain 0=4
TV Out Volume Gain 1=61
TV Out Volume Gain 2=94
TV Out Volume Gain 3=127
TV Out Volume Gain 4=164
TV Out Volume Gain 5=180
TV Out Volume Gain 6=196

3.8.8.1 Generating customer volume setting C file

User can click [Generate nvram_default_audio.c] button to generate customer volume setting C file.

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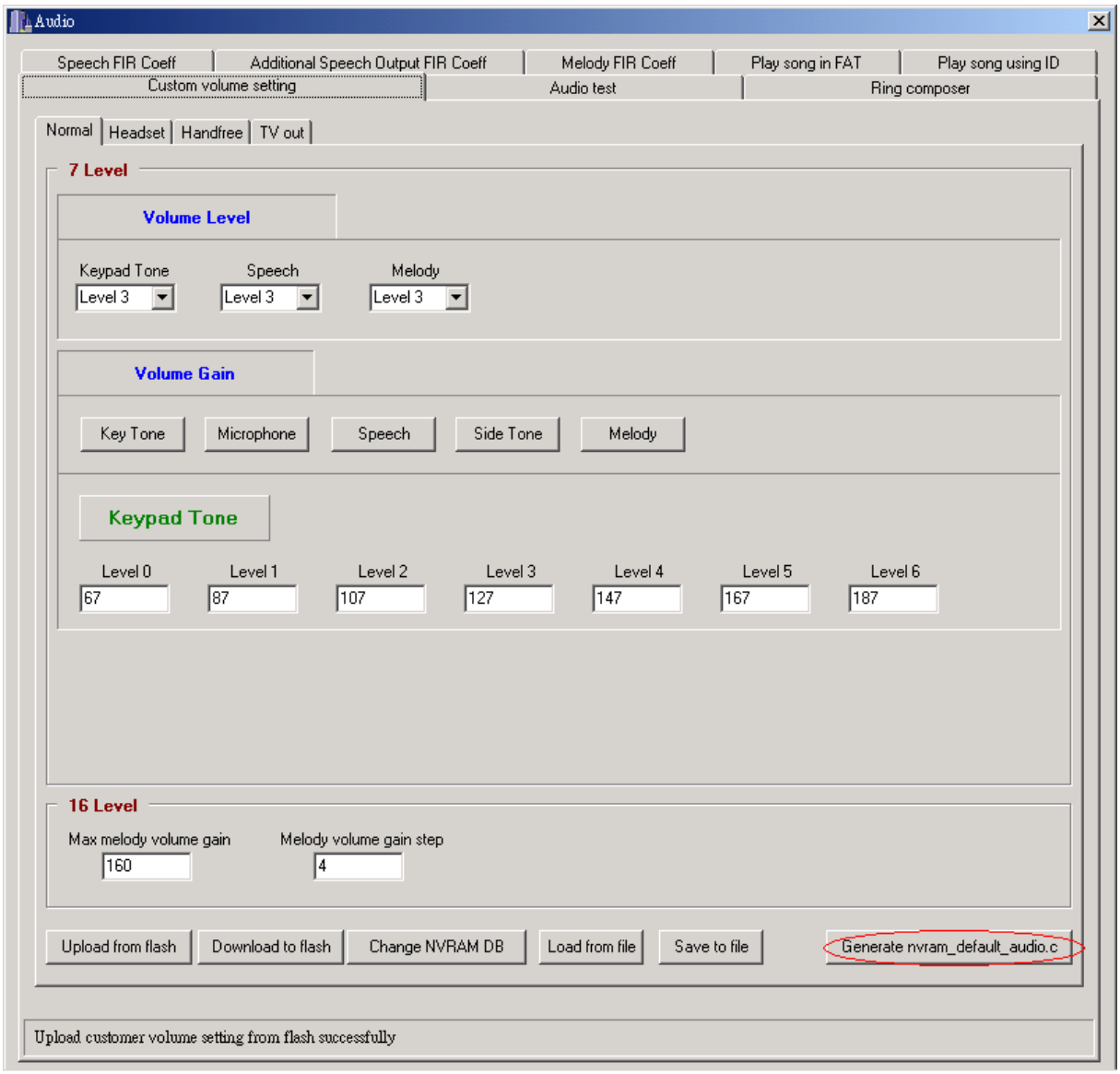

Figure 286 ***Click [Generate nvram_default_audio.c] button to generate customer volume setting C file***

The following file is a template of customer volume setting C file.

```
#include "kal_release.h"

#define GAIN_NOR_MED_VOL_MAX      112
#define GAIN_HED_MED_VOL_MAX      112
#define GAIN_HND_MED_VOL_MAX      112
#define GAIN_TVO_VOL_MAX      112
#define GAIN_NOR_MED_VOL_STEP      4
#define GAIN_HED_MED_VOL_STEP      4
#define GAIN_HND_MED_VOL_STEP      4
#define GAIN_TVO_VOL_STEP      4

#define GAIN_TVO_VOL0      4
#define GAIN_TVO_VOL1      61
```


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```
#define GAIN_TVO_VOL2      94
#define GAIN_TVO_VOL3      127
#define GAIN_TVO_VOL4      164
#define GAIN_TVO_VOL5      180
#define GAIN_TVO_VOL6      196
/* define Gain For Normal */
/* speaker, microphone, loudspeaker, buzzer */
#define GAIN_NOR_KEY_VOL      3
#define GAIN_NOR_KEY_VOL0     67
#define GAIN_NOR_KEY_VOL1     87
#define GAIN_NOR_KEY_VOL2     107
#define GAIN_NOR_KEY_VOL3     127
#define GAIN_NOR_KEY_VOL4     147
#define GAIN_NOR_KEY_VOL5     167
#define GAIN_NOR_KEY_VOL6     187

#define GAIN_NOR_MIC_VOL      3
#define GAIN_NOR_MIC_VOL3     240
#define GAIN_NOR_MIC_VOL4     240

#define GAIN_NOR_SPH_VOL      3
#define GAIN_NOR_SPH_VOL0     64
#define GAIN_NOR_SPH_VOL1     80
#define GAIN_NOR_SPH_VOL2     96
#define GAIN_NOR_SPH_VOL3     112
#define GAIN_NOR_SPH_VOL4     128
#define GAIN_NOR_SPH_VOL5     144
#define GAIN_NOR_SPH_VOL6     160

#define GAIN_NOR_SID_VOL      3
#define GAIN_NOR_SID_VOL3     80

#define GAIN_NOR_MED_VOL      3
#define GAIN_NOR_MED_VOL0     16
#define GAIN_NOR_MED_VOL1     32
#define GAIN_NOR_MED_VOL2     48
#define GAIN_NOR_MED_VOL3     64
#define GAIN_NOR_MED_VOL4     80
#define GAIN_NOR_MED_VOL5     96
#define GAIN_NOR_MED_VOL6     112

/* define Gain For Headset */
/* speaker, microphone, loudspeaker, buzzer */
#define GAIN_HED_KEY_VOL      3
#define GAIN_HED_KEY_VOL0     67
#define GAIN_HED_KEY_VOL1     87
#define GAIN_HED_KEY_VOL2     107
#define GAIN_HED_KEY_VOL3     127
#define GAIN_HED_KEY_VOL4     147
#define GAIN_HED_KEY_VOL5     167
#define GAIN_HED_KEY_VOL6     187
```


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```
#define GAIN_HED_MIC_VOL      3
#define GAIN_HED_MIC_VOL3     180
#define GAIN_HED_MIC_VOL4     180

#define GAIN_HED_SPH_VOL      3
#define GAIN_HED_SPH_VOL0     32
#define GAIN_HED_SPH_VOL1     64
#define GAIN_HED_SPH_VOL2     96
#define GAIN_HED_SPH_VOL3     128
#define GAIN_HED_SPH_VOL4     160
#define GAIN_HED_SPH_VOL5     192
#define GAIN_HED_SPH_VOL6     224

#define GAIN_HED_SID_VOL      3
#define GAIN_HED_SID_VOL3     80

#define GAIN_HED_MED_VOL      3
#define GAIN_HED_MED_VOL0     16
#define GAIN_HED_MED_VOL1     32
#define GAIN_HED_MED_VOL2     48
#define GAIN_HED_MED_VOL3     64
#define GAIN_HED_MED_VOL4     80
#define GAIN_HED_MED_VOL5     96
#define GAIN_HED_MED_VOL6     112

/* define Gain For Handfree */
/* speaker, microphone, loudspeaker, buzzer */
#define GAIN_HND_KEY_VOL      3
#define GAIN_HND_KEY_VOL0     67
#define GAIN_HND_KEY_VOL1     87
#define GAIN_HND_KEY_VOL2     107
#define GAIN_HND_KEY_VOL3     127
#define GAIN_HND_KEY_VOL4     147
#define GAIN_HND_KEY_VOL5     167
#define GAIN_HND_KEY_VOL6     187

#define GAIN_HND_MIC_VOL      3
#define GAIN_HND_MIC_VOL3     120
#define GAIN_HND_MIC_VOL4     120

#define GAIN_HND_SPH_VOL      3
#define GAIN_HND_SPH_VOL0     16
#define GAIN_HND_SPH_VOL1     16
#define GAIN_HND_SPH_VOL2     32
#define GAIN_HND_SPH_VOL3     48
#define GAIN_HND_SPH_VOL4     64
#define GAIN_HND_SPH_VOL5     80
#define GAIN_HND_SPH_VOL6     96

#define GAIN_HND_SID_VOL      3
```


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```
#define GAIN_HND_SID_VOL3     80

#define GAIN_HND_MED_VOL      3
#define GAIN_HND_MED_VOL0     40
#define GAIN_HND_MED_VOL1     80
#define GAIN_HND_MED_VOL2     96
#define GAIN_HND_MED_VOL3     112
#define GAIN_HND_MED_VOL4     200
#define GAIN_HND_MED_VOL5     240
#define GAIN_HND_MED_VOL6     255

kal_uint8 const NVRAM_EF_CUST_ACOUSTIC_DATA_DEFAULT[] = {
    /* Normal: Call Tone, Keypad Tone, Microphone, GMI Tone, Speech Tone, Side Tone */
    GAIN_NOR_CTN_VOL0,    GAIN_NOR_CTN_VOL1,    GAIN_NOR_CTN_VOL2,    GAIN_NOR_CTN_VOL3,
GAIN_NOR_CTN_VOL4, GAIN_NOR_CTN_VOL5, GAIN_NOR_CTN_VOL6,
    GAIN_NOR_KEY_VOL0,    GAIN_NOR_KEY_VOL1,    GAIN_NOR_KEY_VOL2,    GAIN_NOR_KEY_VOL3,
GAIN_NOR_KEY_VOL4, GAIN_NOR_KEY_VOL5, GAIN_NOR_KEY_VOL6,
    GAIN_NOR_MIC_VOL0,    GAIN_NOR_MIC_VOL1,    GAIN_NOR_MIC_VOL2,    GAIN_NOR_MIC_VOL3,
GAIN_NOR_MIC_VOL4, GAIN_NOR_MIC_VOL5, GAIN_NOR_MIC_VOL6,
    GAIN_NOR_GMI_VOL0,    GAIN_NOR_GMI_VOL1,    GAIN_NOR_GMI_VOL2,    GAIN_NOR_GMI_VOL3,
GAIN_NOR_GMI_VOL4, GAIN_NOR_GMI_VOL5, GAIN_NOR_GMI_VOL6,
    GAIN_NOR_SPH_VOL0,    GAIN_NOR_SPH_VOL1,    GAIN_NOR_SPH_VOL2,    GAIN_NOR_SPH_VOL3,
GAIN_NOR_SPH_VOL4, GAIN_NOR_SPH_VOL5, GAIN_NOR_SPH_VOL6,
    GAIN_NOR_SID_VOL0,    GAIN_NOR_SID_VOL1,    GAIN_NOR_SID_VOL2,    GAIN_NOR_SID_VOL3,
GAIN_NOR_SID_VOL4, GAIN_NOR_SID_VOL5, GAIN_NOR_SID_VOL6,
    GAIN_NOR_MED_VOL0,    GAIN_NOR_MED_VOL1,    GAIN_NOR_MED_VOL2,    GAIN_NOR_MED_VOL3,
GAIN_NOR_MED_VOL4, GAIN_NOR_MED_VOL5, GAIN_NOR_MED_VOL6,

    /* Headset: Call Tone, Keypad Tone, Microphone, GMI Tone, Speech Tone, Side Tone */
    GAIN_HED_CTN_VOL0,    GAIN_HED_CTN_VOL1,    GAIN_HED_CTN_VOL2,    GAIN_HED_CTN_VOL3,
GAIN_HED_CTN_VOL4, GAIN_HED_CTN_VOL5, GAIN_HED_CTN_VOL6,
    GAIN_HED_KEY_VOL0,    GAIN_HED_KEY_VOL1,    GAIN_HED_KEY_VOL2,    GAIN_HED_KEY_VOL3,
GAIN_HED_KEY_VOL4, GAIN_HED_KEY_VOL5, GAIN_HED_KEY_VOL6,
    GAIN_HED_MIC_VOL0,    GAIN_HED_MIC_VOL1,    GAIN_HED_MIC_VOL2,    GAIN_HED_MIC_VOL3,
GAIN_HED_MIC_VOL4, GAIN_HED_MIC_VOL5, GAIN_HED_MIC_VOL6,
    GAIN_HED_GMI_VOL0,    GAIN_HED_GMI_VOL1,    GAIN_HED_GMI_VOL2,    GAIN_HED_GMI_VOL3,
GAIN_HED_GMI_VOL4, GAIN_HED_GMI_VOL5, GAIN_HED_GMI_VOL6,
    GAIN_HED_SPH_VOL0,    GAIN_HED_SPH_VOL1,    GAIN_HED_SPH_VOL2,    GAIN_HED_SPH_VOL3,
GAIN_HED_SPH_VOL4, GAIN_HED_SPH_VOL5, GAIN_HED_SPH_VOL6,
    GAIN_HED_SID_VOL0,    GAIN_HED_SID_VOL1,    GAIN_HED_SID_VOL2,    GAIN_HED_SID_VOL3,
GAIN_HED_SID_VOL4, GAIN_HED_SID_VOL5, GAIN_HED_SID_VOL6,
    GAIN_HED_MED_VOL0,    GAIN_HED_MED_VOL1,    GAIN_HED_MED_VOL2,    GAIN_HED_MED_VOL3,
GAIN_HED_MED_VOL4, GAIN_HED_MED_VOL5, GAIN_HED_MED_VOL6,

    /* Handfree: Call Tone, Keypad Tone, Microphone, GMI Tone, Speech Tone, Side Tone */
    GAIN_HND_CTN_VOL0,    GAIN_HND_CTN_VOL1,    GAIN_HND_CTN_VOL2,    GAIN_HND_CTN_VOL3,
GAIN_HND_CTN_VOL4, GAIN_HND_CTN_VOL5, GAIN_HND_CTN_VOL6,
    GAIN_HND_KEY_VOL0,    GAIN_HND_KEY_VOL1,    GAIN_HND_KEY_VOL2,    GAIN_HND_KEY_VOL3,
GAIN_HND_KEY_VOL4, GAIN_HND_KEY_VOL5, GAIN_HND_KEY_VOL6,
    GAIN_HND_MIC_VOL0,    GAIN_HND_MIC_VOL1,    GAIN_HND_MIC_VOL2,    GAIN_HND_MIC_VOL3,
GAIN_HND_MIC_VOL4, GAIN_HND_MIC_VOL5, GAIN_HND_MIC_VOL6,
```


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GAIN_HND_GMI_VOL0, GAIN_HND_GMI_VOL1, GAIN_HND_GMI_VOL2, GAIN_HND_GMI_VOL3, GAIN_HND_GMI_VOL4, GAIN_HND_GMI_VOL5, GAIN_HND_GMI_VOL6,
GAIN_HND_SPH_VOL0, GAIN_HND_SPH_VOL1, GAIN_HND_SPH_VOL2, GAIN_HND_SPH_VOL3, GAIN_HND_SPH_VOL4, GAIN_HND_SPH_VOL5, GAIN_HND_SPH_VOL6,
GAIN_HND_SID_VOL0, GAIN_HND_SID_VOL1, GAIN_HND_SID_VOL2, GAIN_HND_SID_VOL3, GAIN_HND_SID_VOL4, GAIN_HND_SID_VOL5, GAIN_HND_SID_VOL6,
GAIN_HND_MED_VOL0, GAIN_HND_MED_VOL1, GAIN_HND_MED_VOL2, GAIN_HND_MED_VOL3, GAIN_HND_MED_VOL4, GAIN_HND_MED_VOL5, GAIN_HND_MED_VOL6,

/* Normal volume: CTN, SPK, MIC, BUZ, SPH, SID, MED */
GAIN_NOR_CTN_VOL, GAIN_NOR_KEY_VOL, GAIN_NOR_MIC_VOL, GAIN_NOR_GMI_VOL, GAIN_NOR_SPH_VOL, GAIN_NOR_SID_VOL, GAIN_NOR_MED_VOL,
/* Headset volume: CTN, SPK, MIC, BUZ, SPH, SID, MED */
GAIN_HED_CTN_VOL, GAIN_HED_KEY_VOL, GAIN_HED_MIC_VOL, GAIN_HED_GMI_VOL, GAIN_HED_SPH_VOL, GAIN_HED_SID_VOL, GAIN_HED_MED_VOL,
/* Handfree volume: CTN, SPK, MIC, BUZ, SPH, SID, MED */
GAIN_HND_CTN_VOL, GAIN_HND_KEY_VOL, GAIN_HND_MIC_VOL, GAIN_HND_GMI_VOL, GAIN_HND_SPH_VOL, GAIN_HND_SID_VOL, GAIN_HND_MED_VOL

/* Normal, Headset, Handfree mode melody volume gains */
, GAIN_NOR_MED_VOL_MAX, GAIN_HED_MED_VOL_MAX, GAIN_HND_MED_VOL_MAX, GAIN_TVO_VOL_MAX,
/* Normal, Headset, Handfree mode melody volume gain steps */
GAIN_NOR_MED_VOL_STEP, GAIN_HED_MED_VOL_STEP, GAIN_HND_MED_VOL_STEP, GAIN_TVO_VOL_STEP,
/* TV out volume gains*/
GAIN_TVO_VOL0, GAIN_TVO_VOL1, GAIN_TVO_VOL2, GAIN_TVO_VOL3, GAIN_TVO_VOL4, GAIN_TVO_VOL5, GAIN_TVO_VOL6
};

3.8.9 Acoustic FIR tuning

Acoustic FIR tuning window is used to get frequency response curve of original and compensated FIR and generates FIR coefficient file automatically. User can click [Acoustic FIR tuning] button to show acoustic FIR tuning window. Acoustic FIR tuning support R&S UPL, R&S UPV, Acqua, Microtronix and Vita equipment file format.

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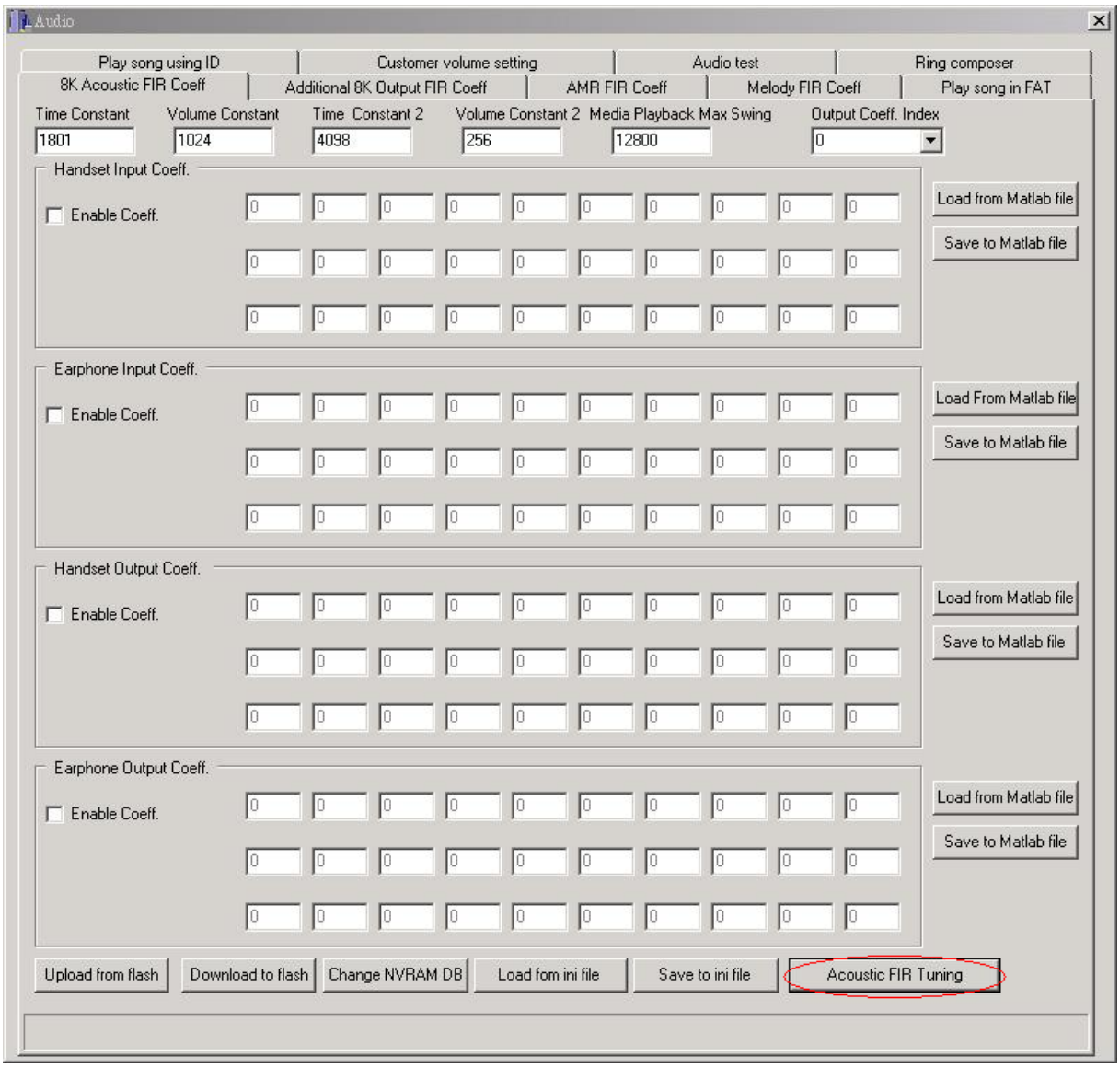

Figure 287 ***Click [Acoustic FIR tuning] button to show acoustic FIR tuning window***

3.8.9.1 Tuning procedure

Note:

1. ”FIR scale” is changed to “FIR offset (in dB)
2. “Target file” settings is used to replace the “Idealize” to specify the wanted FIR.
3. “Estimated LR” calculation will be triggered if a UPL ABS file or ACUQA txt file is specified.

The tuning procedure is as follows:

1) Select equipment type (there are three equipment output file type, they are Acqua, Microtronix, UPL, UPV, and Vita), setup input file, output TX FIR file or output RX FIR file.
2) Input taps of FIR coefficient and FIR scale, FIR scale will adjust digital gain. The maximum value of FIR scale is 1.
3) If User configure target frequency response CheckBox is checked, user can click the [Load target file] to load target frequency response file. Go to step 5. Otherwise, select boundary type, each boundary type has different upper and lower bound.
4) Click [Idealize] button to generate ideal wanted frequency response curve (red curve).
5) Click [Run] button to generate frequency response curve of original + FIR compensated (black curve).

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6) Adjust wanted frequency response curve by drag wanted frequency response curve or updated value of editor.
7) Repeat step 4) and 5) until the frequency response curve of original + FIR compensated (black curve) is inside boundary curve (green curve).

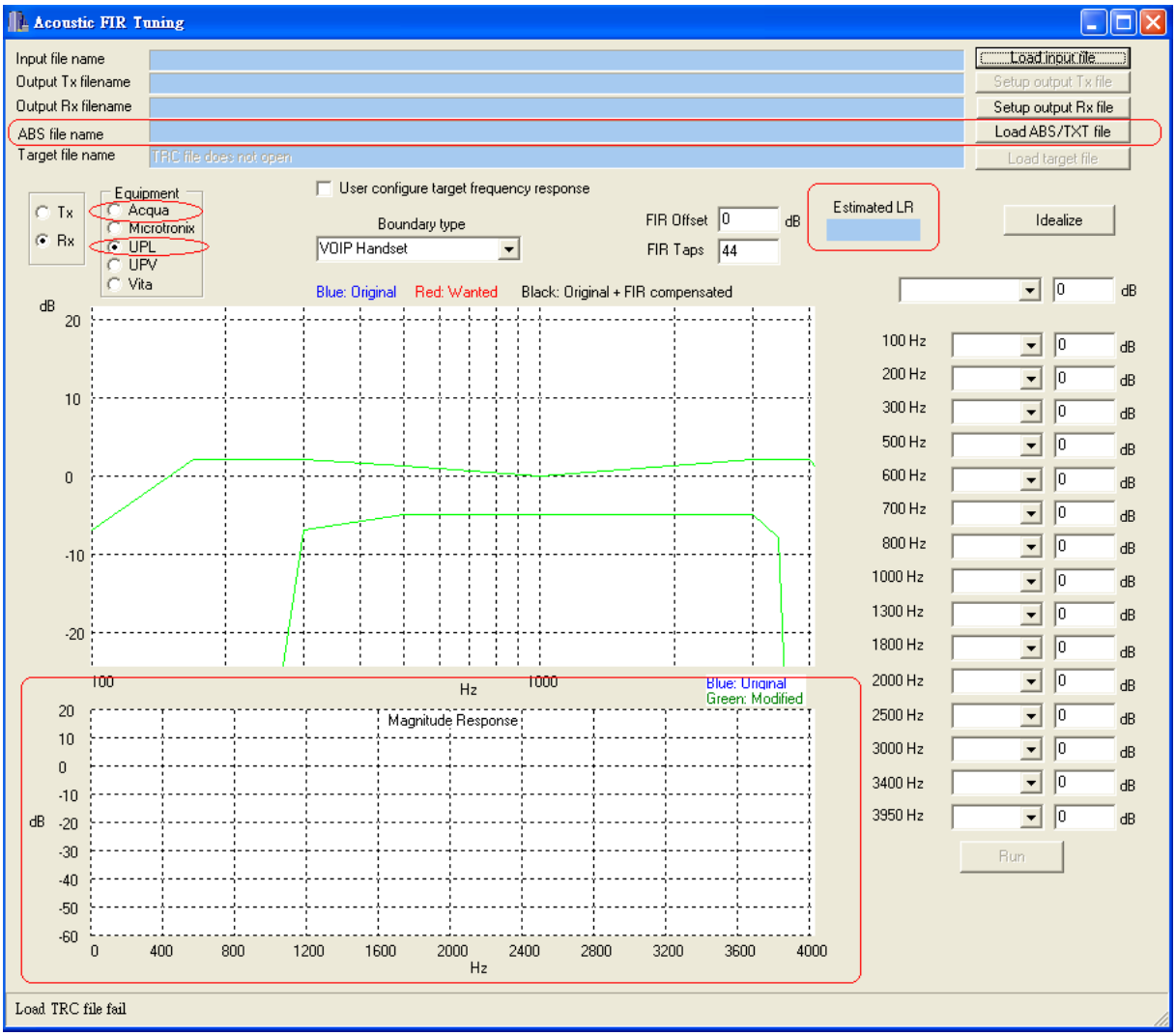

Figure 288 ***New functions supported for ACUQA and UPL.***

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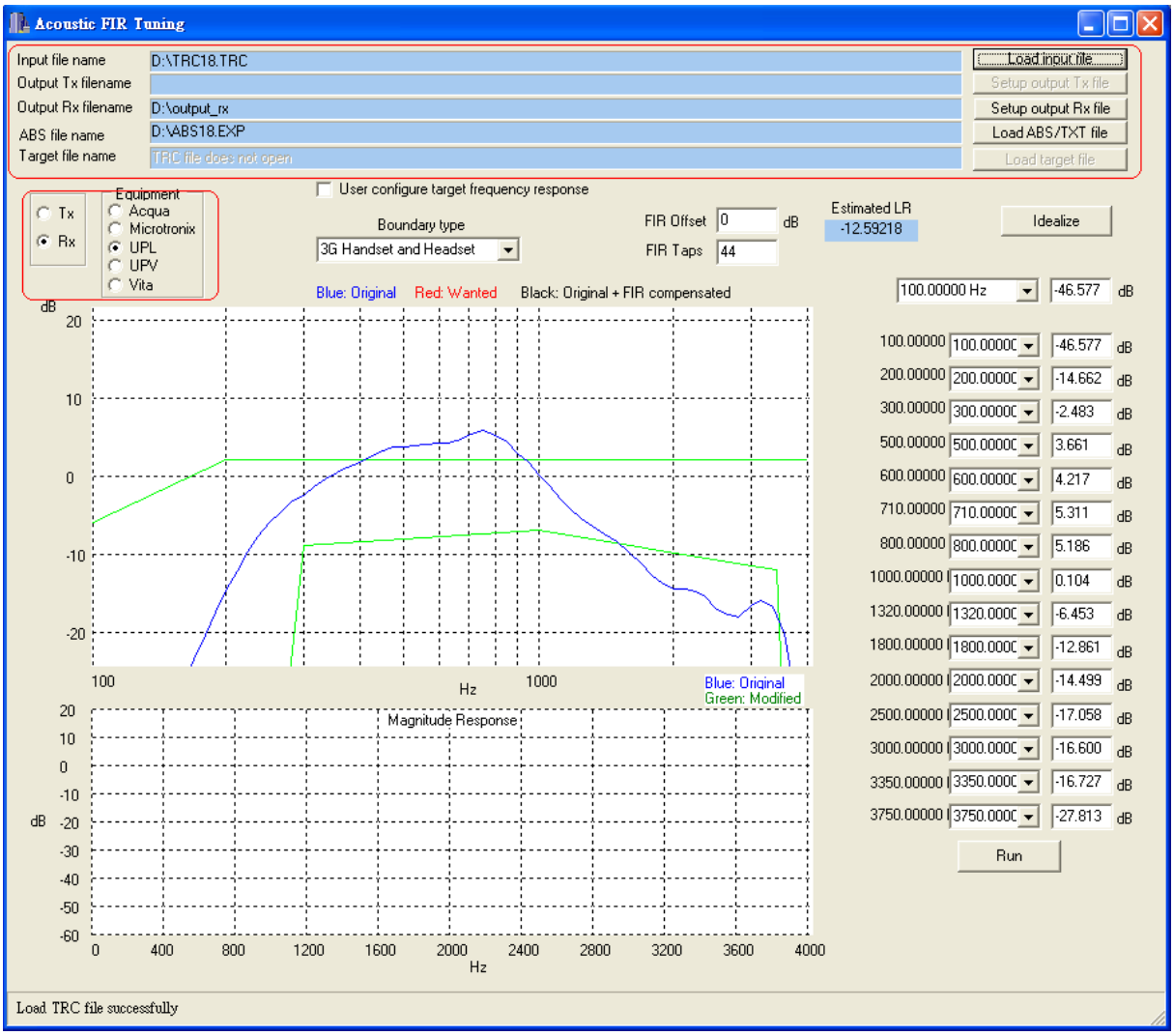

Figure 289 ***Setup input TRC file and output RX FIR file***

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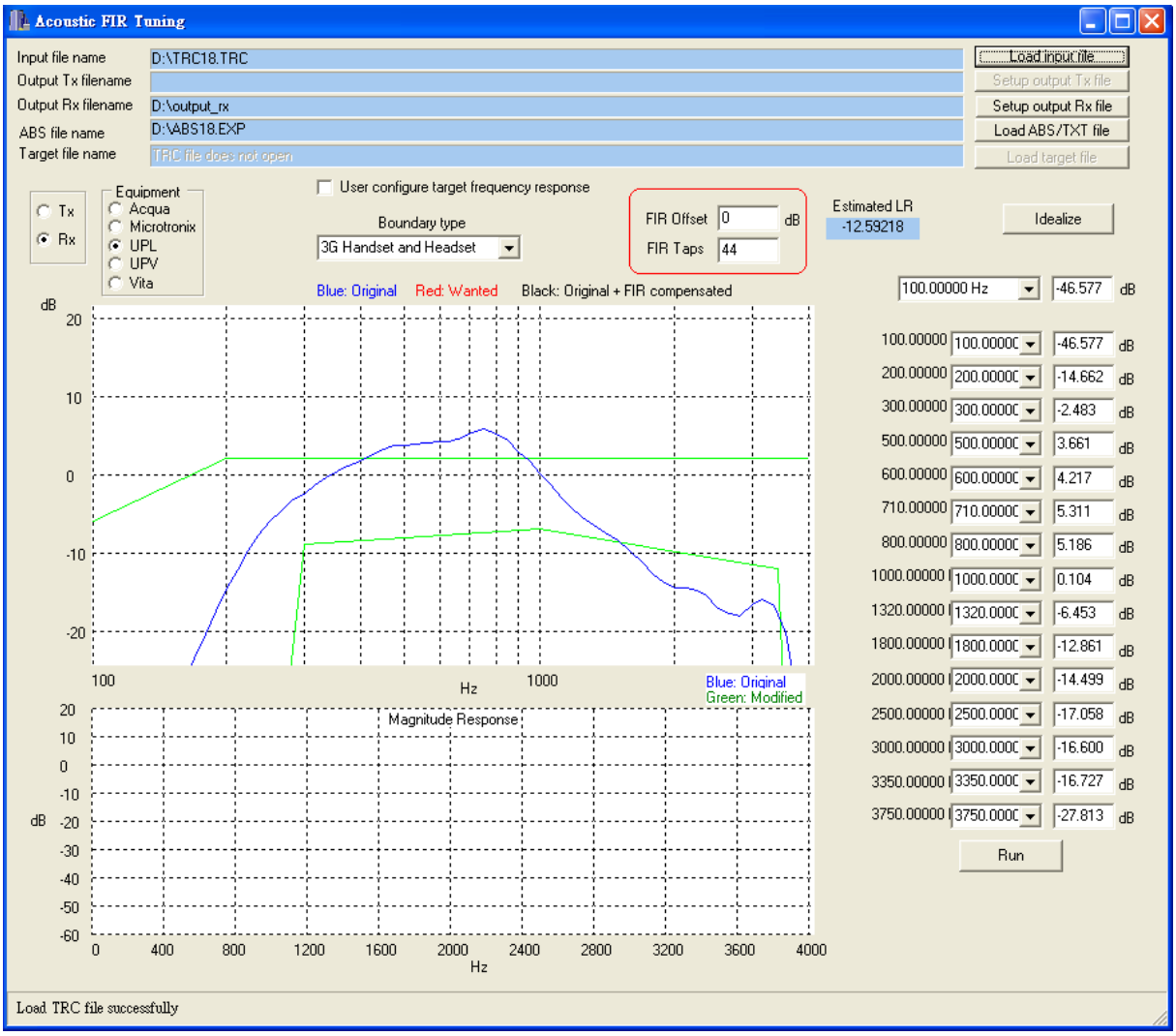

Figure 290 ***Input taps of FIR coefficient and FIR offset (in dB)***

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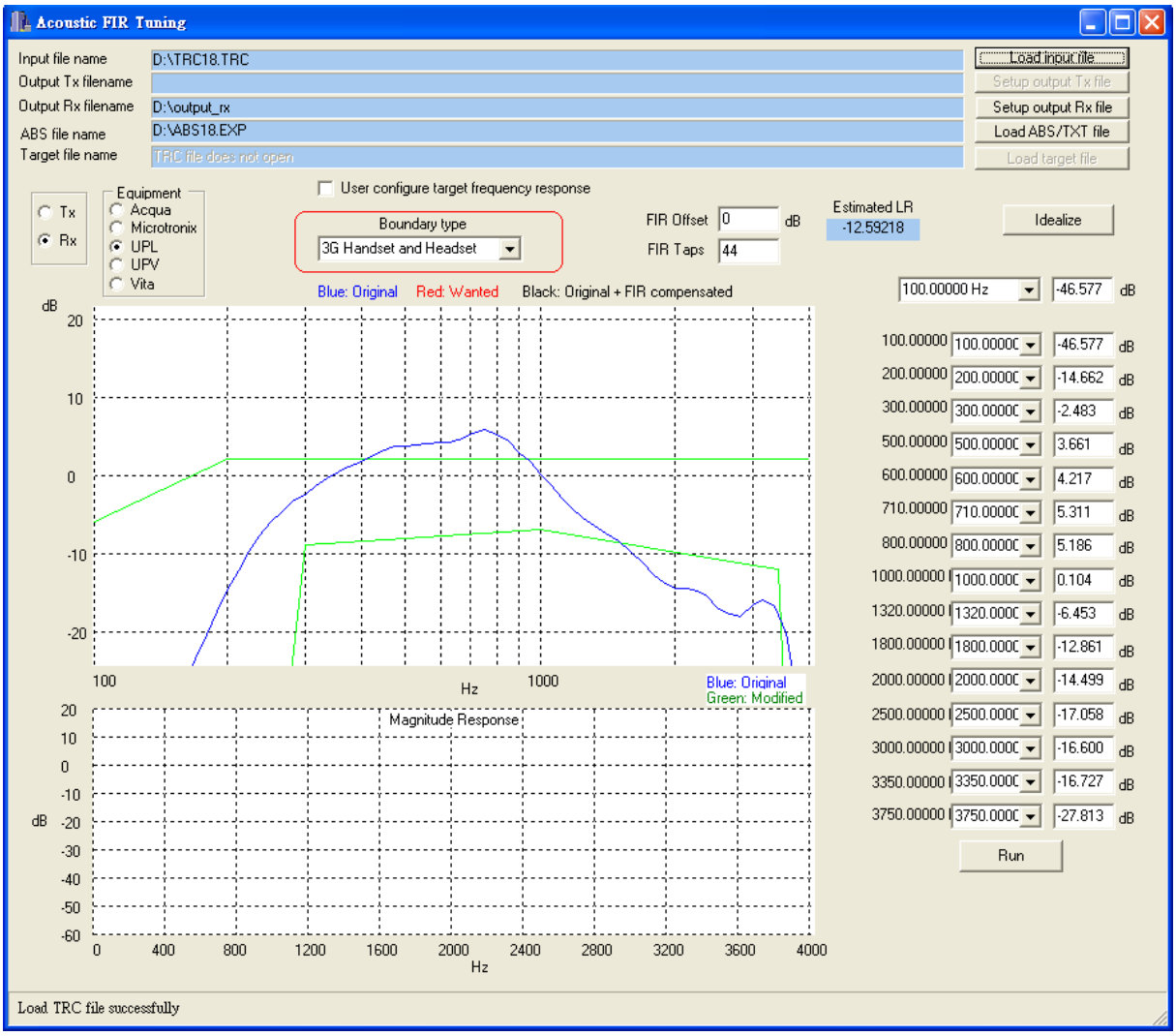

Figure 291 ***Select boundary type***

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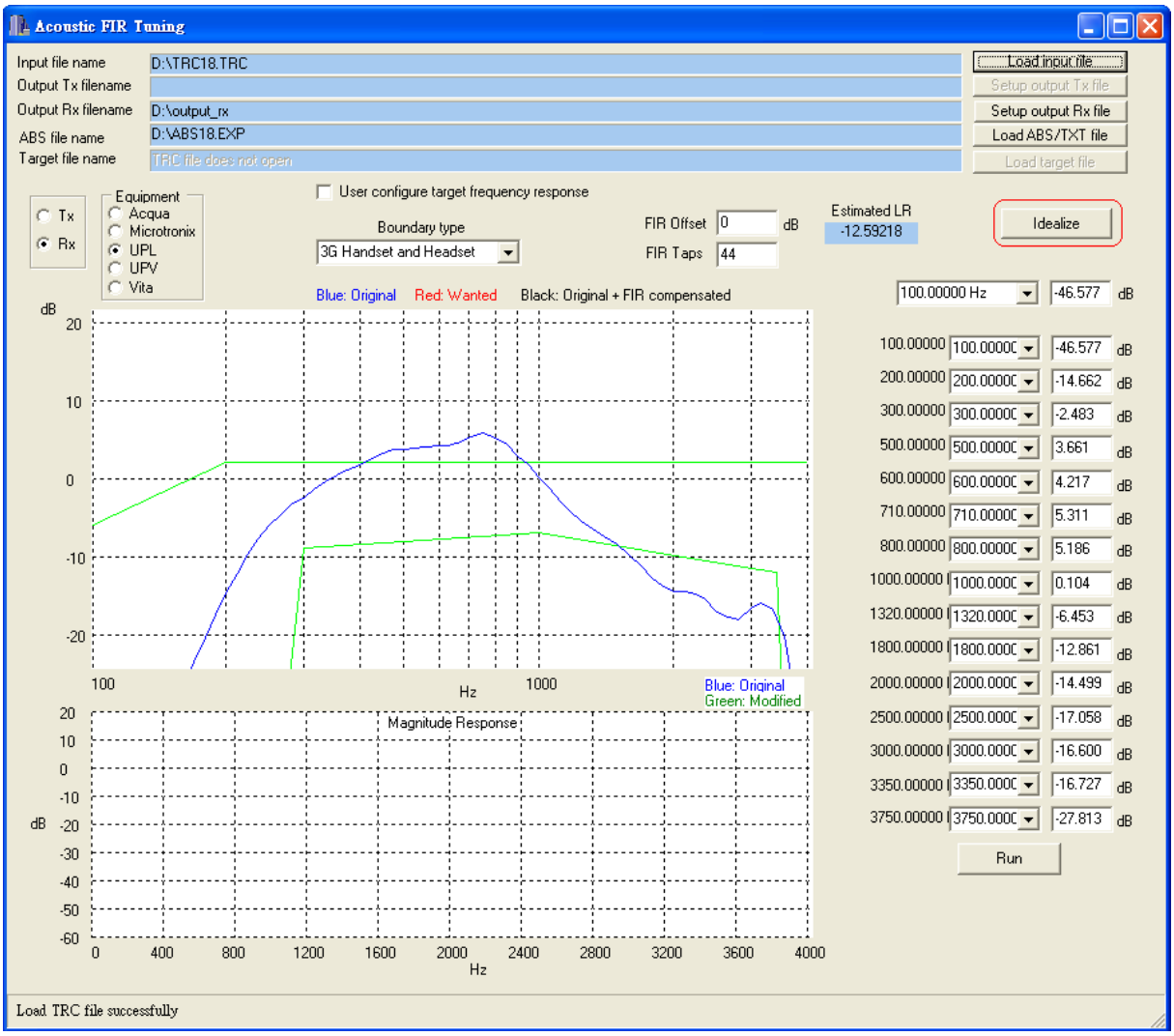

Figure 292 ***Click [Idealize] button to generate ideal wanted frequency response curve***

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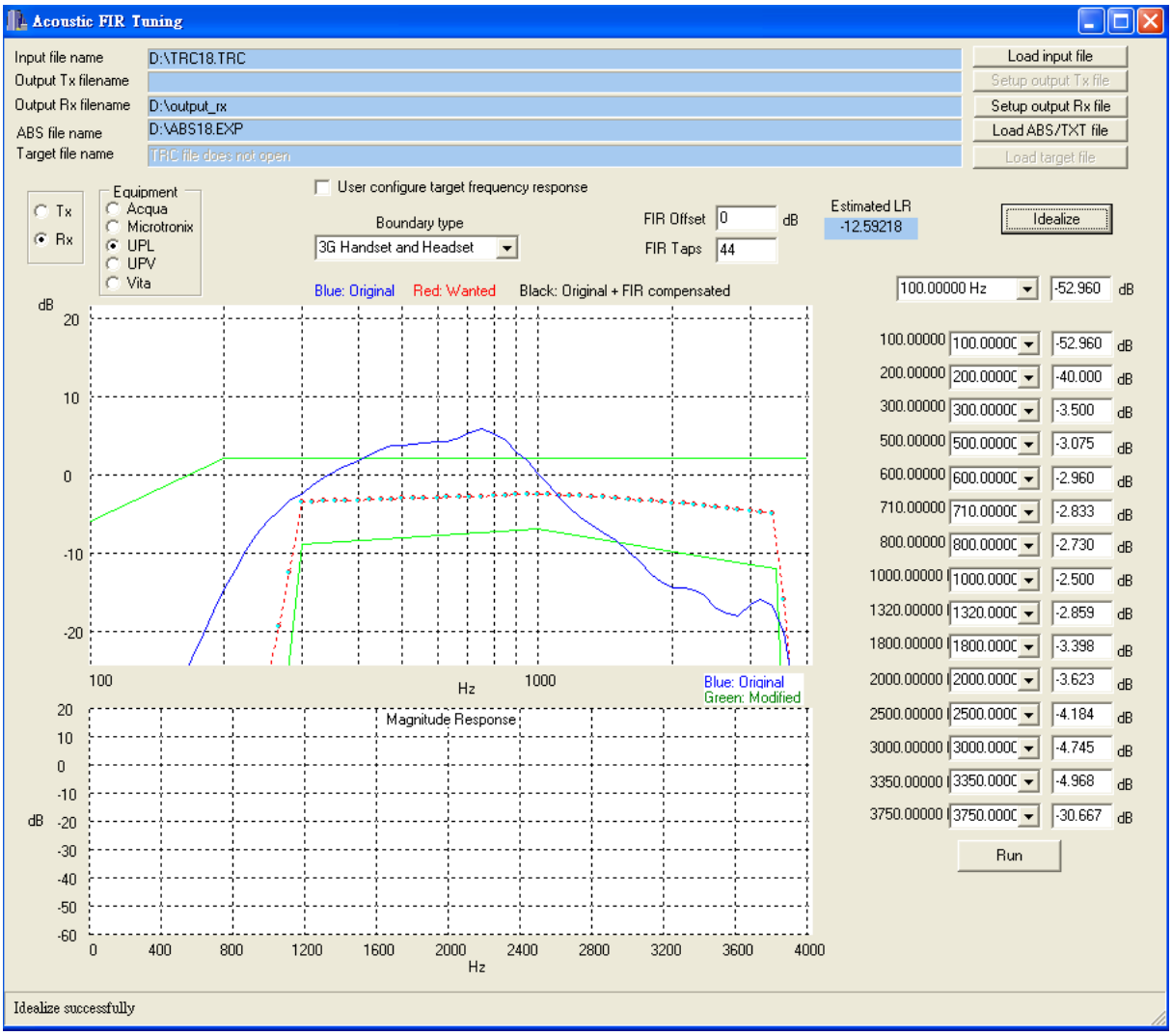

Figure 293 ***Ideal wanted frequency response curve result***

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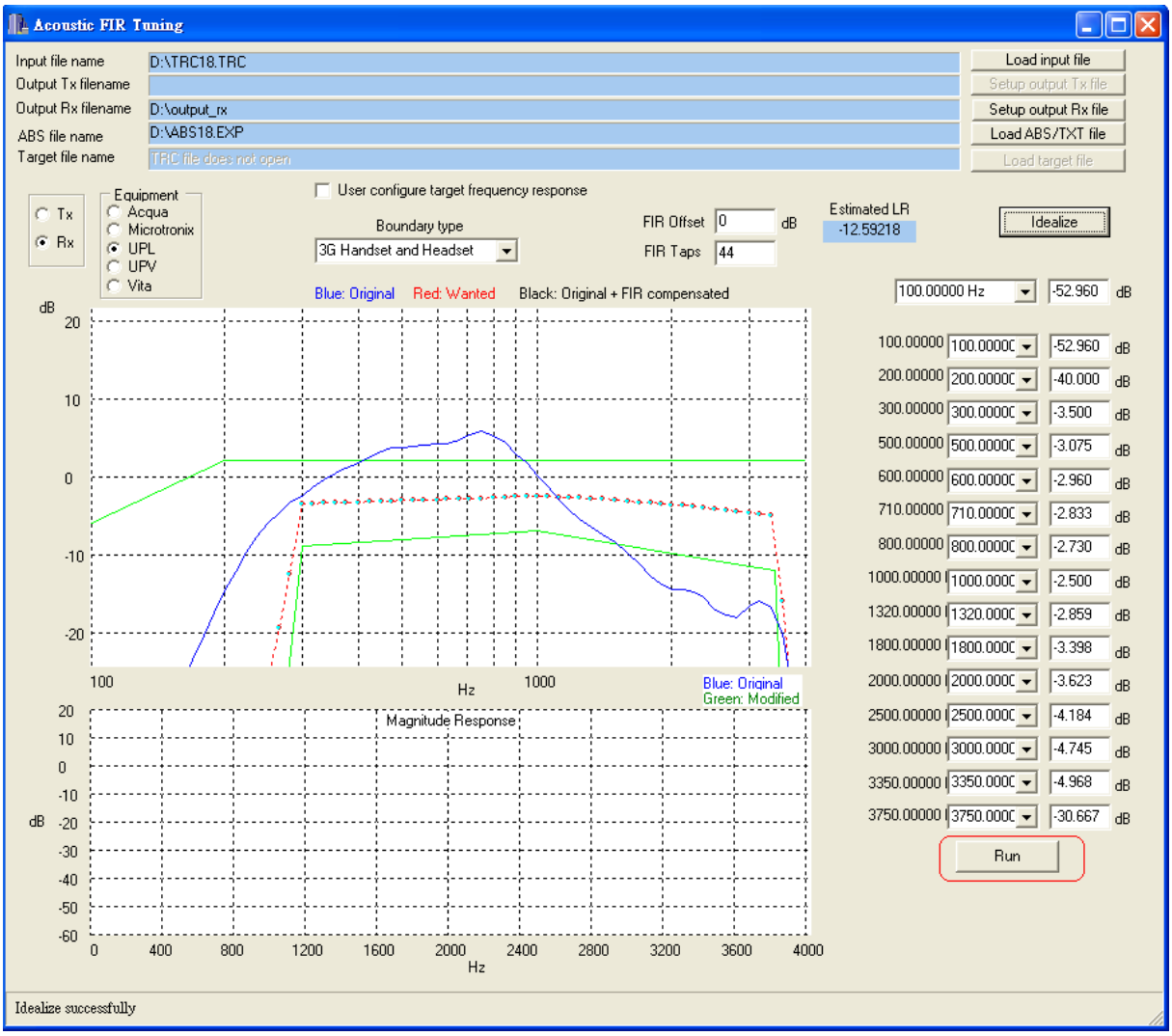

Figure 294 ***Click [Run] button to generate frequency response curve of original + FIR compensated***

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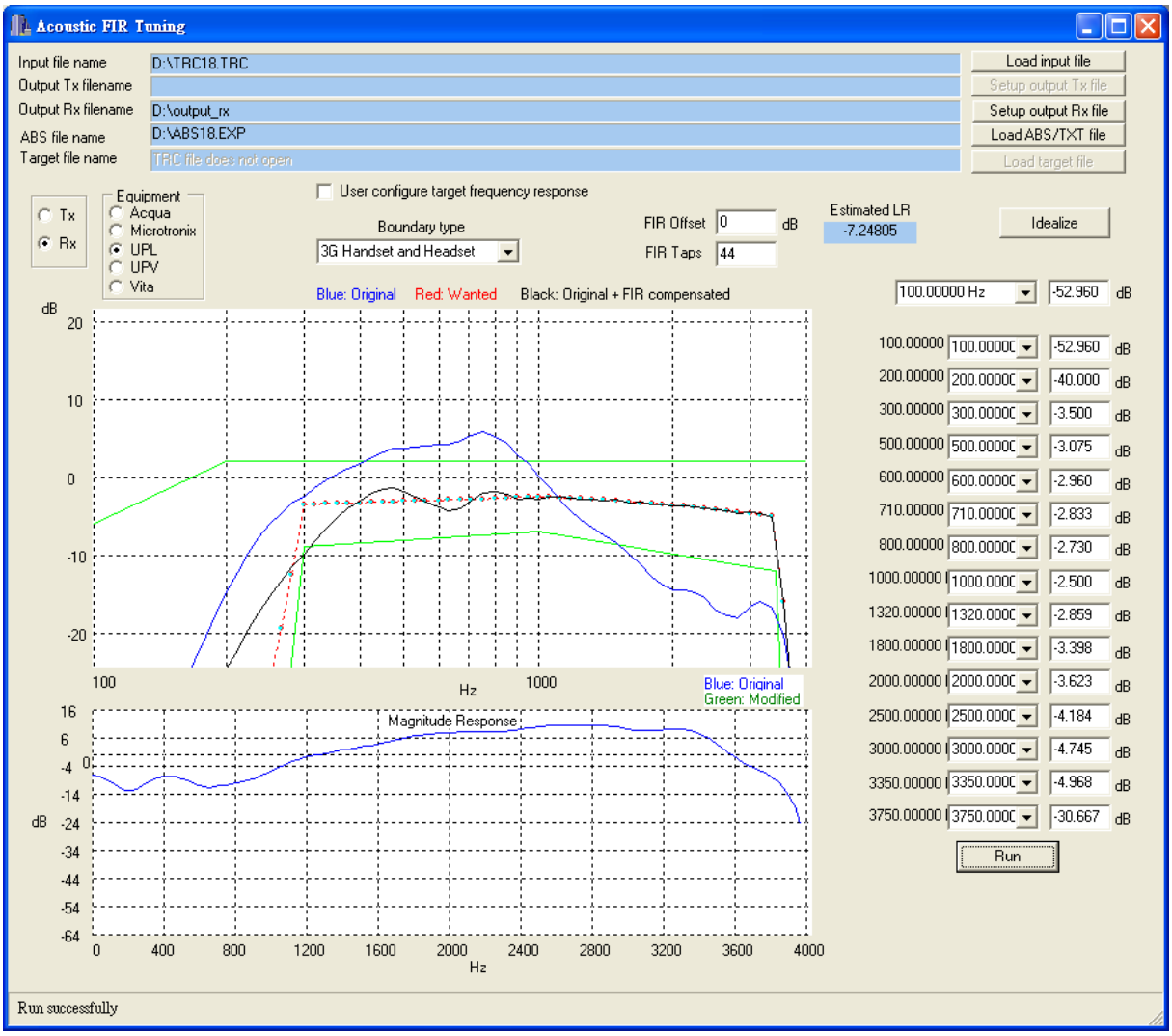

Figure 295 ***Result of frequency response curve of original + FIR compensated***

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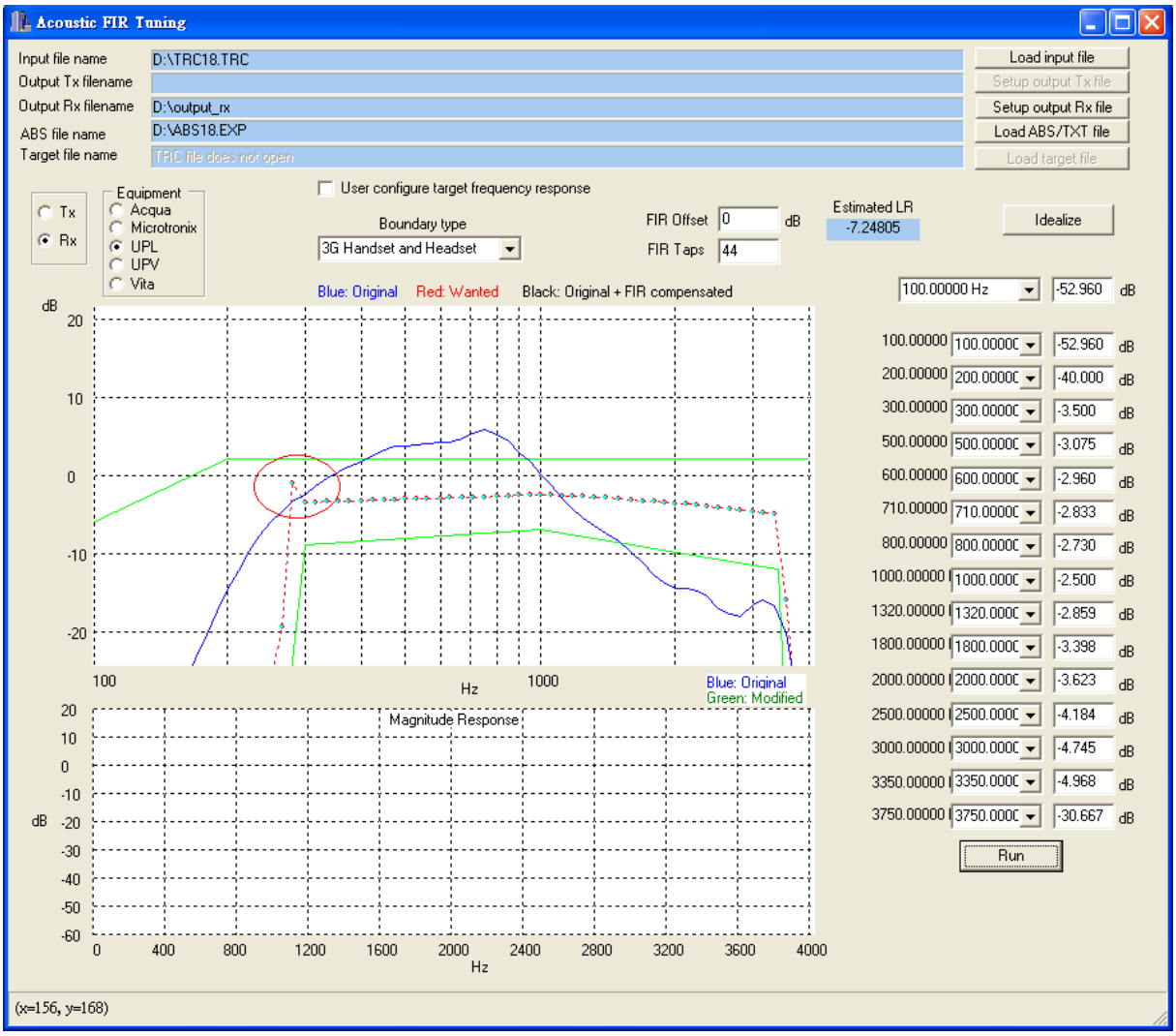

Figure 296 ***Adjust wanted frequency response curve***

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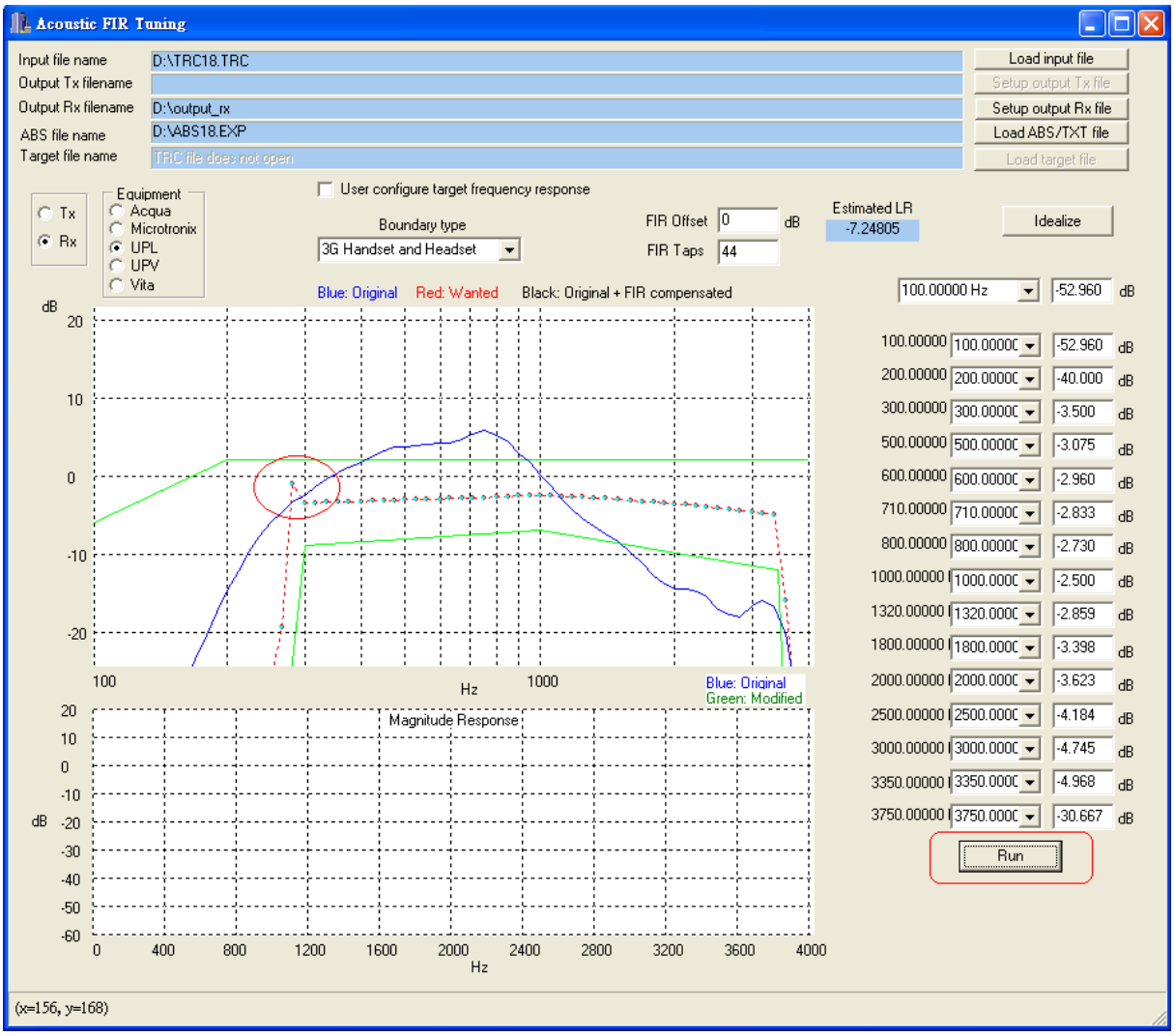

Figure 297 ***Click [Run] button to generate frequency response curve of original + FIR compensated***

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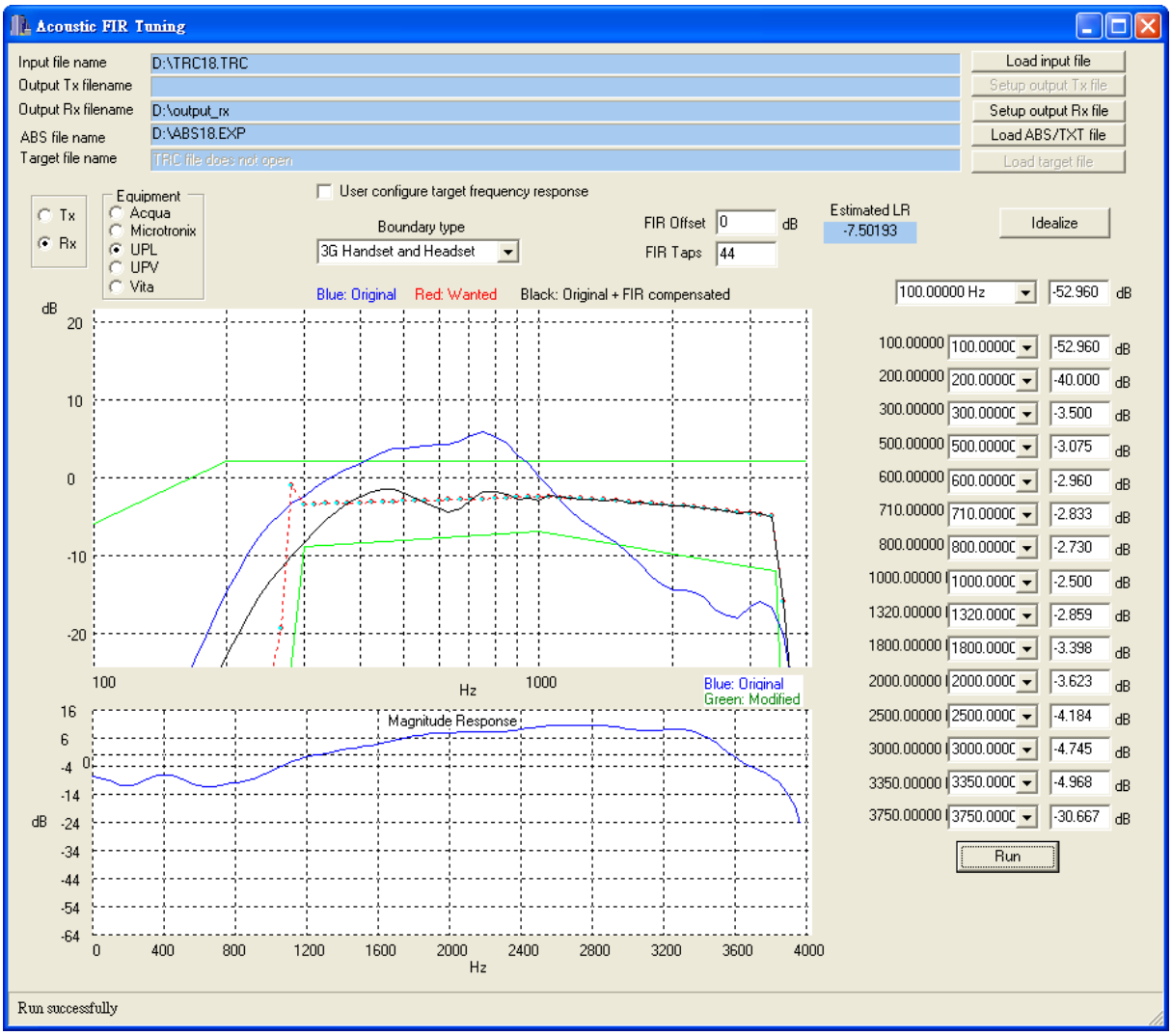

Figure 298 ***The frequency response curve of original + FIR compensated is inside boundary curve***

The following is a template FIR coefficient file, user will get the file after click [Run] button. The number of first line indicates taps of FIR coefficient.

44
212
-575
120
-400
218
-415
148
47
-1074
692
-405
-30
-266
3526

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-2930
3752
-963
2082
-2169
6575
-6913
16383
16383
-6913
6575
-2169
2082
-963
3752
-2930
3526
-266
-30
-405
692
-1074
47
148
-415
218
-400
120
-575
212

3.8.9.2 Load Customized Spec

Except the well-known specs provided by META Tool, from v6.1044.0, Customers can load self-defined spec into META Tool with the following rules:

- Format: T/RX_Boundary_Spec#=freq,upper_limit,lower_limit (# should be 1~19)
- can not appear: freq,-,- // upper_limit and lower_limit can not be "-" at the same time
- freq must bigger than 0
- upper_limit >= lower_limit
- use "Linear_Auto" as spec's "(see note 2)":
- Don't put any space or tab characters in every spec definition. For example, "TX_Boundary_Spec1=100,6, -" has a space character before "-" will cause spec file loading incorrectly.

Example:

```
; for RX settings
[RX Spec]
RX_Boundary_Spec1=100,6,-
RX_Boundary_Spec2=200,6,-
RX_Boundary_Spec3=300,6,-6
RX_Boundary_Spec4=1000,6,-6
RX_Boundary_Spec5=2000,8,-6
```


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RX_Boundary_Spec6=3400,8,-6
RX_Boundary_Spec7=4000,8,-
[TX Spec]
TX_Boundary_Spec1=100,-12,-
TX_Boundary_Spec2=200,Linear_Auto,-
TX_Boundary_Spec3=300,Linear_Auto,-12
TX_Boundary_Spec4=1000,0,Linear_Auto
TX_Boundary_Spec5=2000,0,-6
TX_Boundary_Spec7=3400,4,-9
TX_Boundary_Spec8=4000,0,-

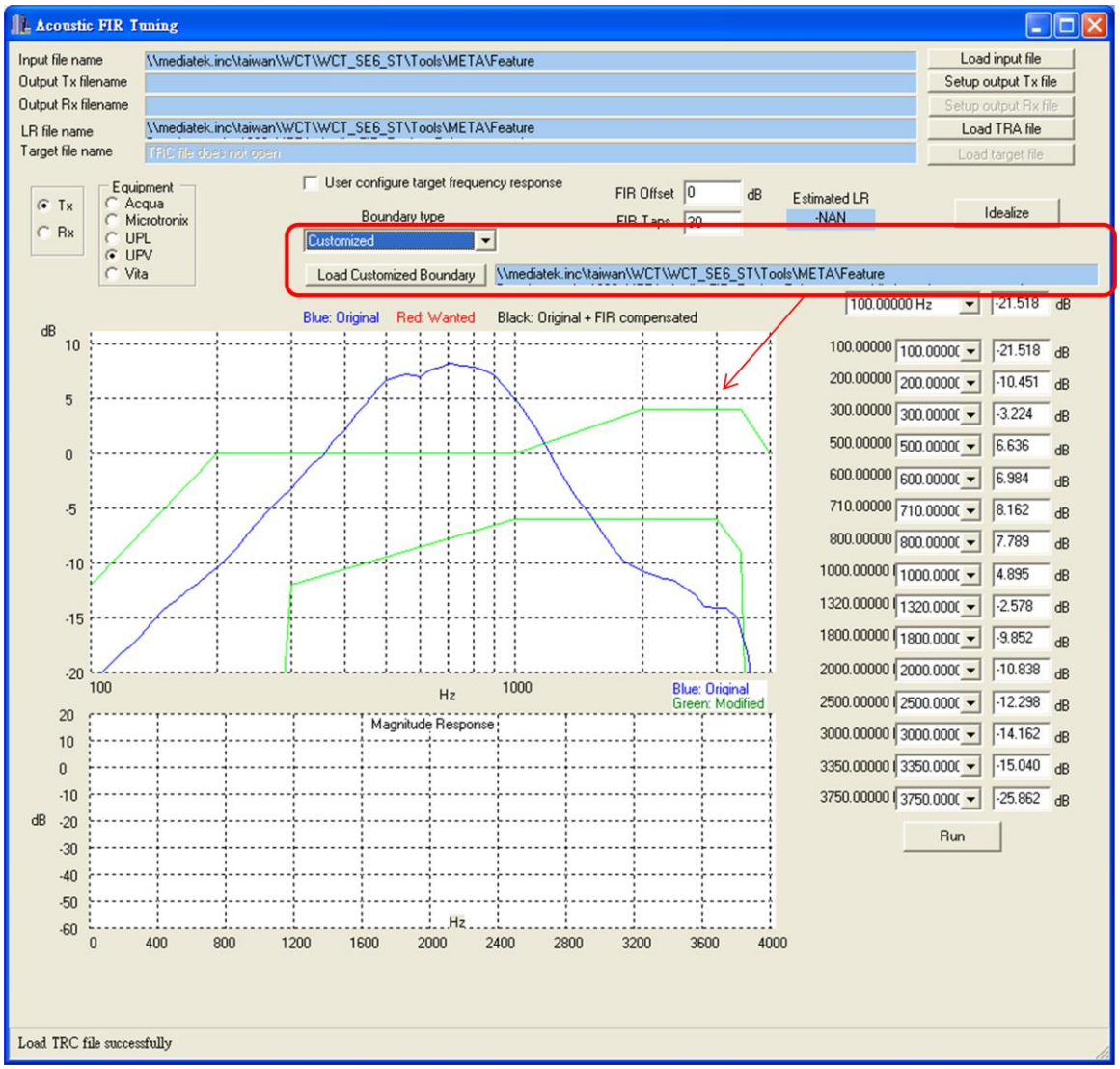

Figure 299 ***Select "Boundary Type" as "Customized", and Press "Load Customized Boundary" to load the customized spec file***

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3.8.10 Melody FIR tuning

Melody FIR tuning window is used to get frequency response curves of the original and compensated FIRs and generates the FIR coefficient files automatically. Users can click the [Melody FIR tuning] button to show melody FIR tuning window.

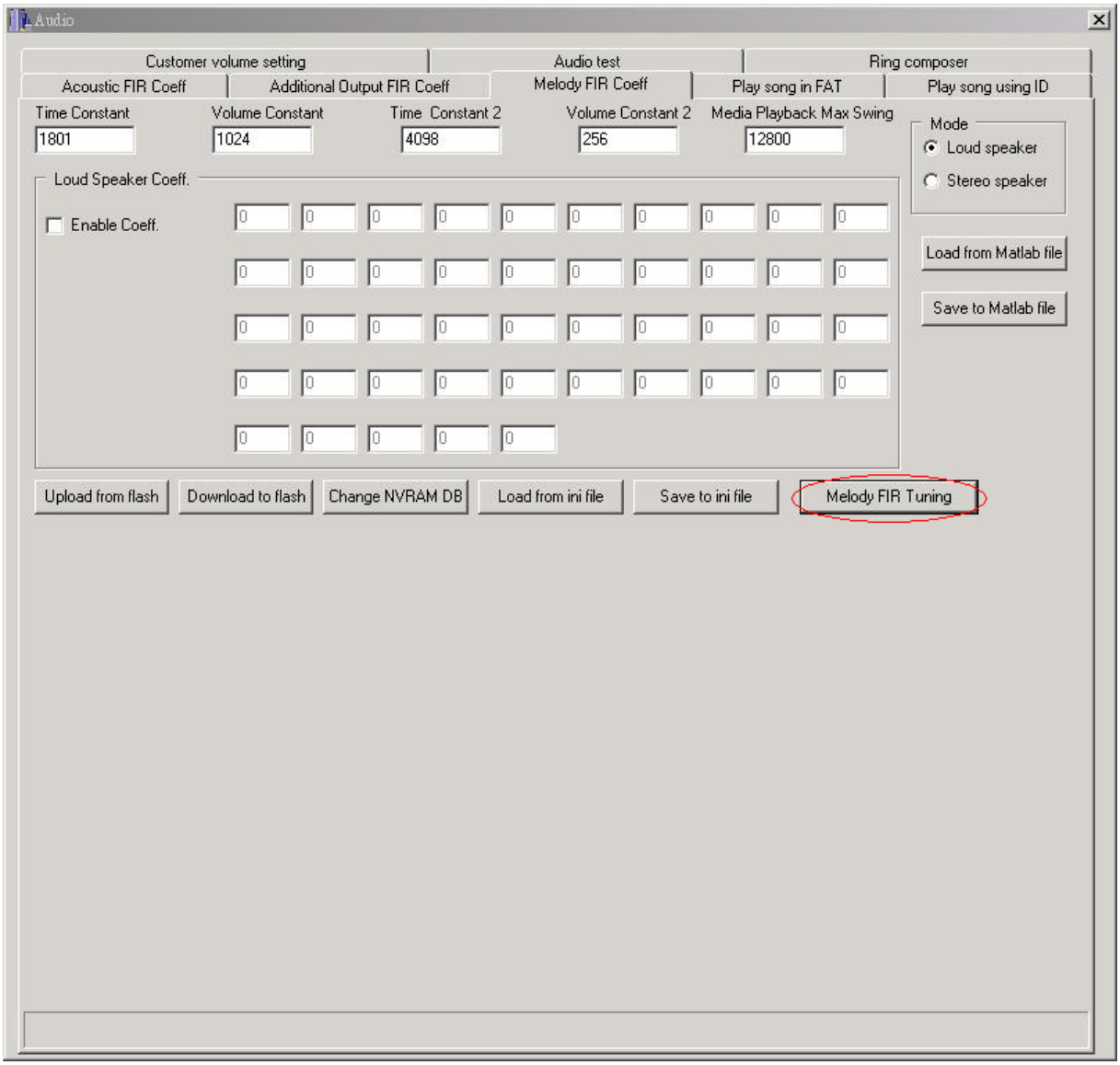

Figure 300 ***Click [Melody FIR tuning] button to show Melody FIR tuning window***

3.8.10.1 Tuning procedure

The tuning procedure is as follows:

1) Set up output file by clicking [Setup output file] button.
2) Input digital scale.
3) Input magnitude (unit: dB) of each frequency (0 Hz, 60 Hz, …. , 16000 Hz)
4) Click [Run] button to generate a frequency response curve and melody FIR coefficient

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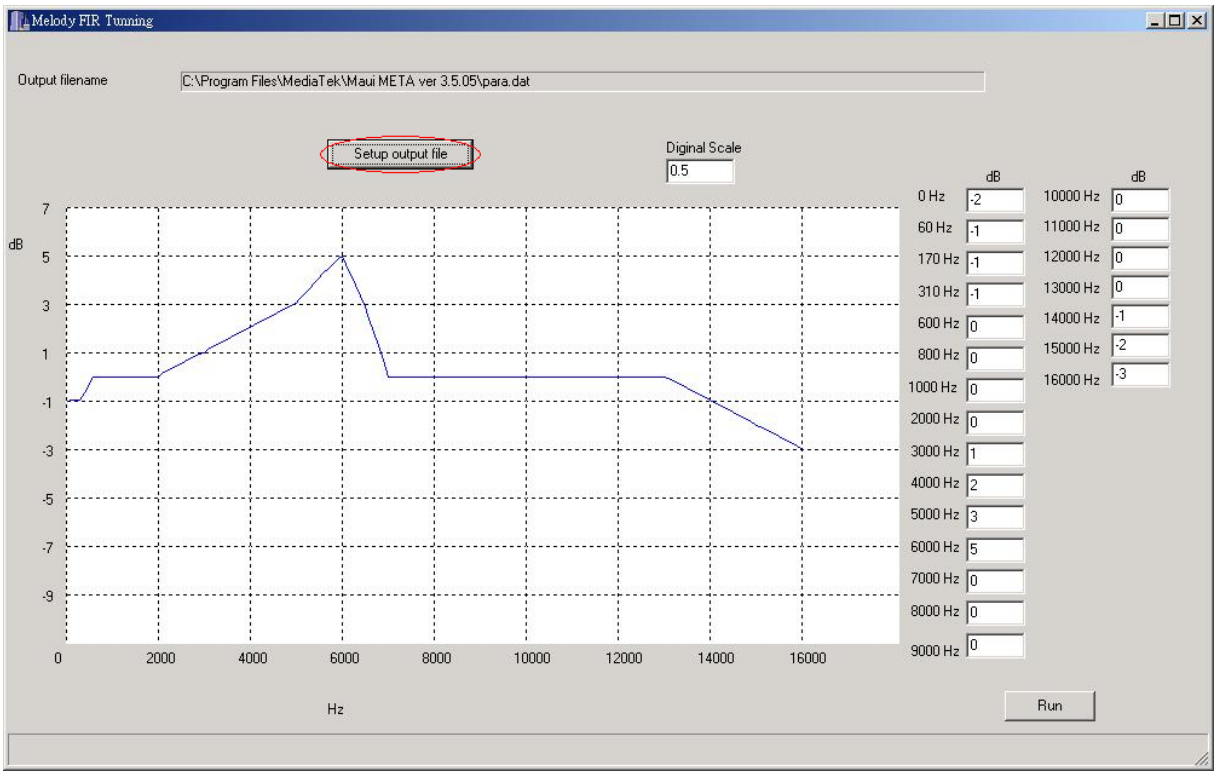

Figure 301 ***Set up output file by clicking [Setup output file] button***

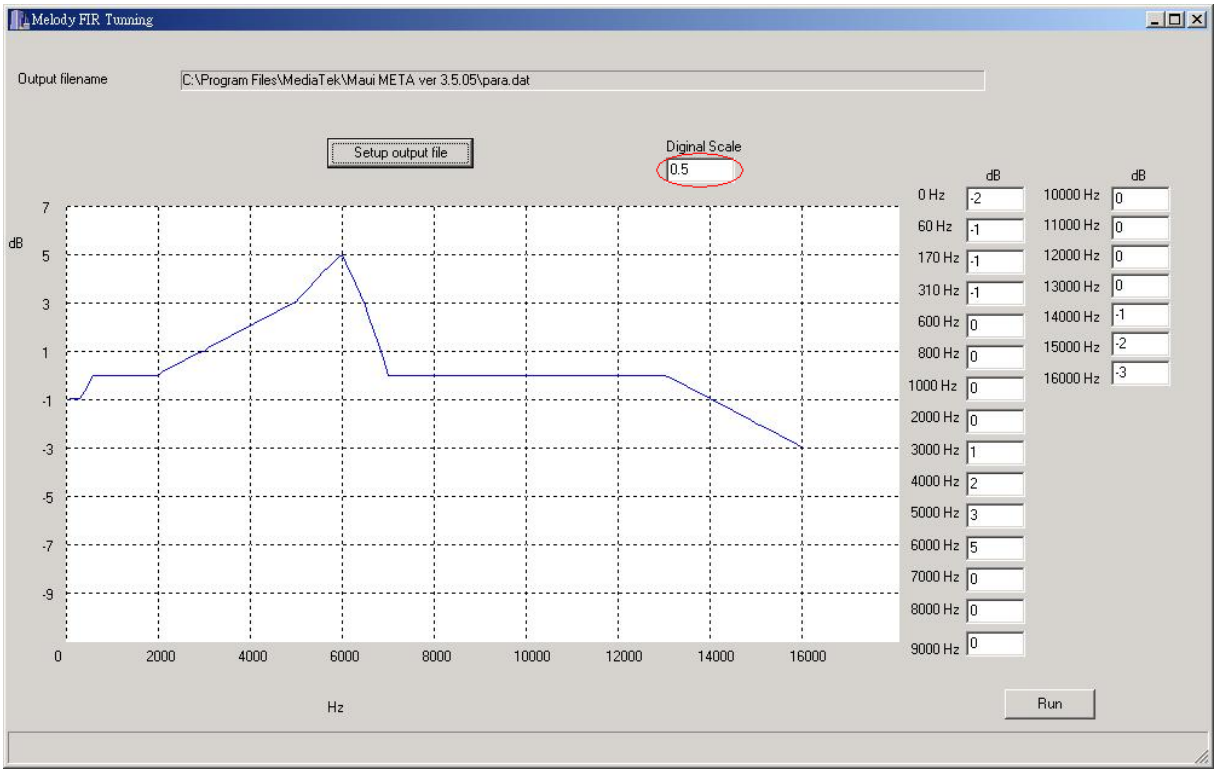

Figure 302 ***Input digital scale***

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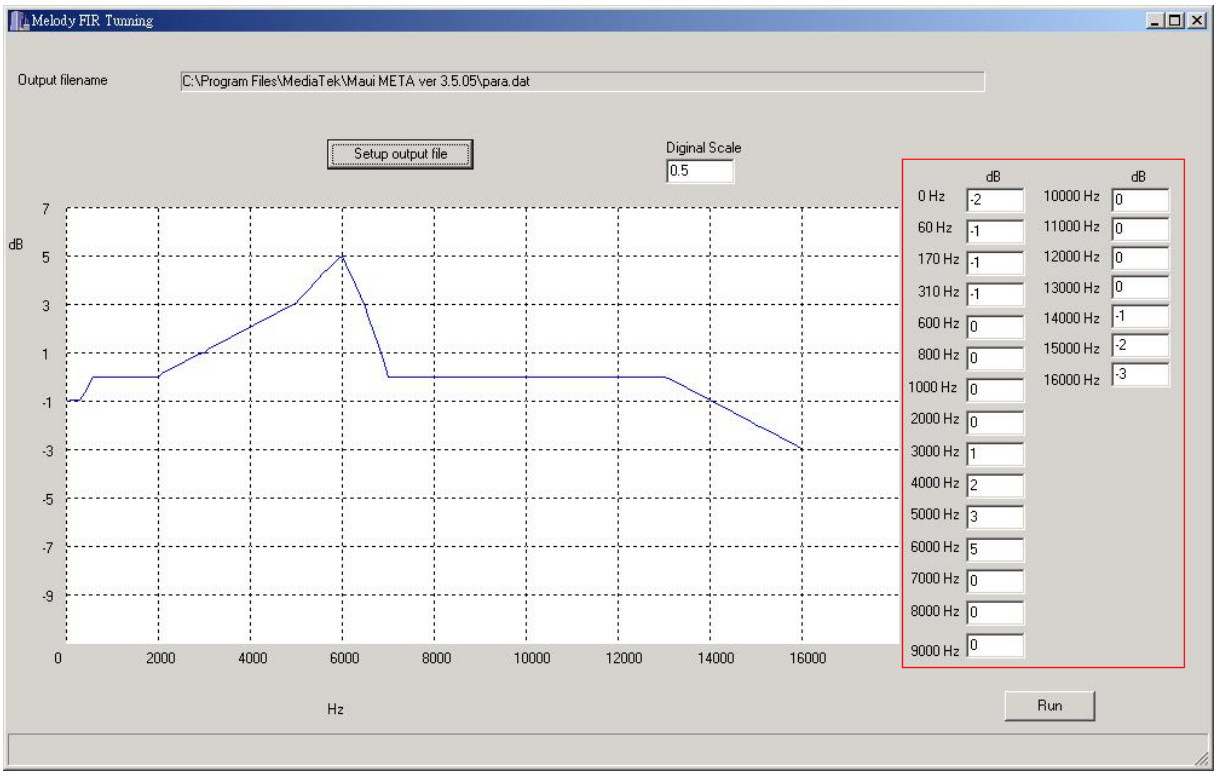

Figure 303 ***Input magnitude (unit: dB) of each frequency (0 Hz, 60 Hz, …. , 16000 Hz)***

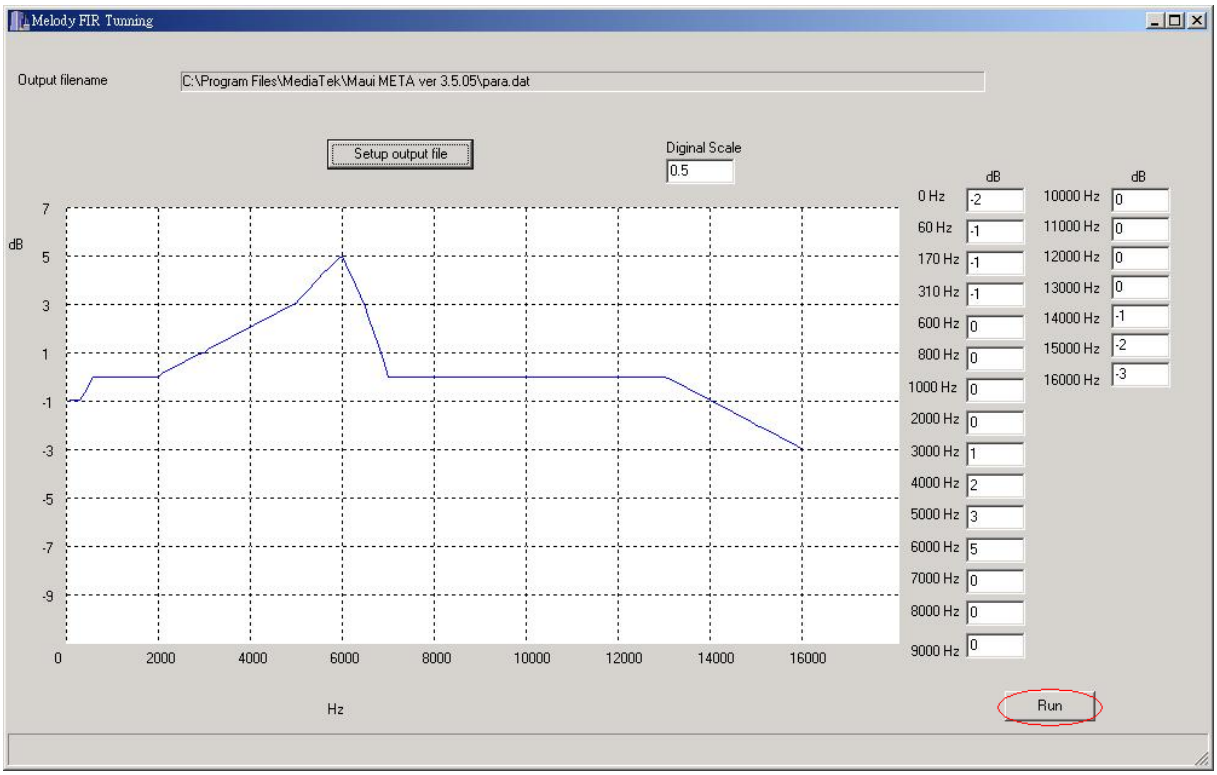

Figure 304 ***Click [Run] button to generate a frequency response curve and melody FIR coefficient***

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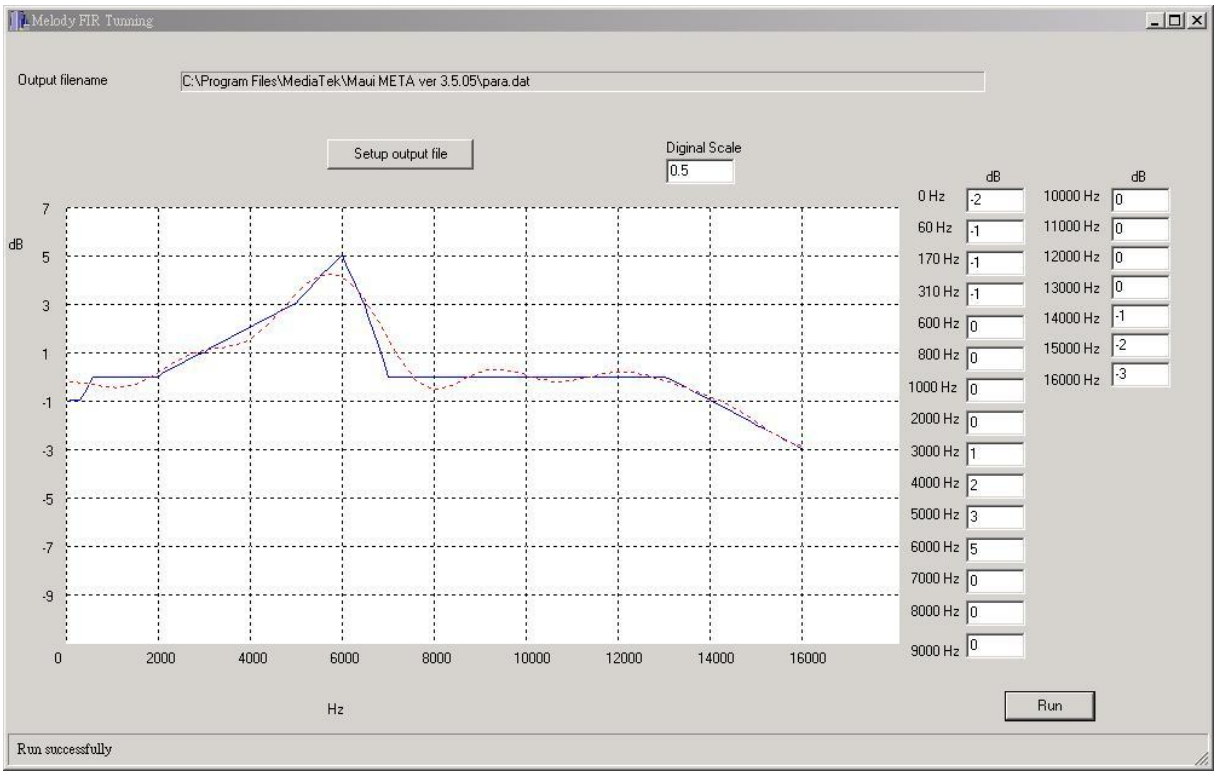

Figure 305 ***Result of frequency response curve***

The following is a template of FIR coefficient file, users will get the file after clicking the [Run] button. The number of the first line indicates taps of FIR coefficient.

25
36
327
163
-320
-473
162
532
592
-889
-949
-1062
1163
16383
1163
-1062
-949
-889
592
532
162

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-473
-320
163
327
36

3.8.11 Quick Speech Tuning

Users can use quick speech tuning function to fine tune the speech parameters which are dispersed in original functions “Custom Volume Setting”,”Speech Enhancement”, and “Speech Input/Output FIR Coeff”. The relevant NVRAM LIDs here are NVRAM_EF_AUDIO_PARAM_LID and NVRAM_EF_CUST_ACOUSTIC_DATA_LID.

Most importantly, to ease users’ efforts of setting correct value, tool will auto-check the correctness and notify user with red label. Besides, the parameter settings, runtimely play a wave file is also supported in “Taste” button (The button will be enabled when phone supports) With the “Taste” function, users don’t need to reboot the phone in the parameter fine-tune procedure.

Quick Speech Tuning window supports wide-band audio tuning depending on NVRAM database. User can do wide-band FIR tuning with wide-band speech input FIR and wide-band speech output FIR, and wide-band speech enhancement when user switches Wide-Band check box .The relevant wide-band NVRAM LIDs here are NVRAM_EF_AUDIO_WB_SPEECH_INPUT_FIR_LID, NVRAM_EF_AUDIO_WB_SPEECH_MODE_PARAM_LID, and NVRAM_EF_AUDIO_WB_SPEECH_OUTPUT_FIR_LID.

Note:
The GUI will be different based on the following criteria:

1. Mode (Handset, Headset, Handsfree, BT earphone)
2. BB_Chip
3. NVRAM audio parameter structures. (LID: NVRAM_EF_AUDIO_PARAM_LID)
4. Wide band NVRAM audio parameter structures.(LID: NVRAM_EF_AUDIO_WB_SPEECH_INPUT_FIR_LID, NVRAM_EF_AUDIO_WB_SPEECH_MODE_PARAM_LID, NVRAM_EF_AUDIO_WB_SPEECH_OUTPUT_FIR_LID)
5. Users can assign the step size (?dB/Step) of DL PGA to change the GUI control property. For example, if the user assigns the step size as 4 dB/step in Handset mode. Then the second biggest PGA gain will be 8-4 = 4 dB, not 6 dB. If the target supports digital gain tuning, the minimum step size will be 1 dB/Step, while if the digital gain is not supported by the phone, the step size can only be the multiplies of the unit step size (e.g. 3 dB/Step for Audio Buffer, 2 dB/Step for Voice Buffer).

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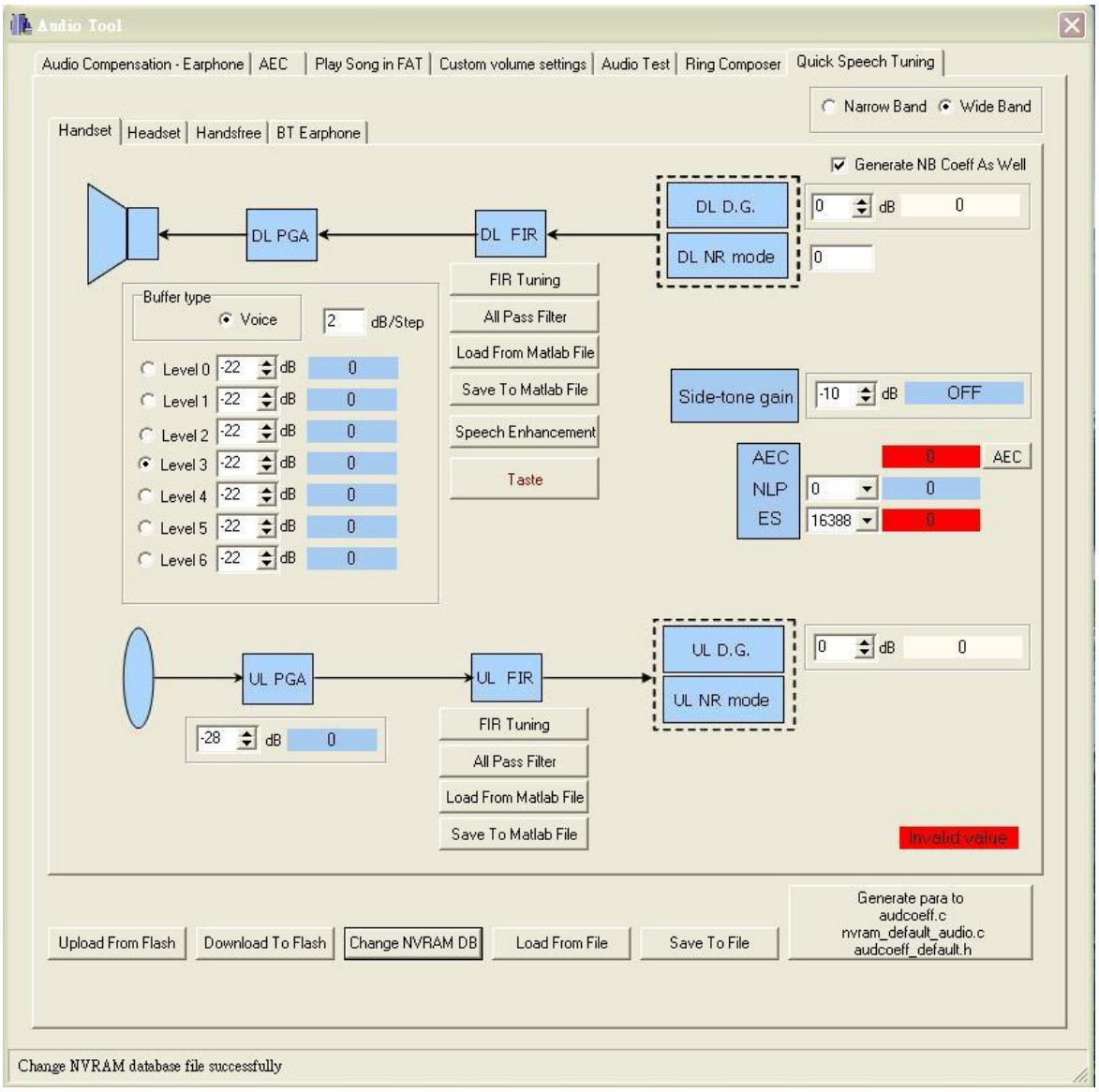

Figure 306 ***Quick Speech Tuning***

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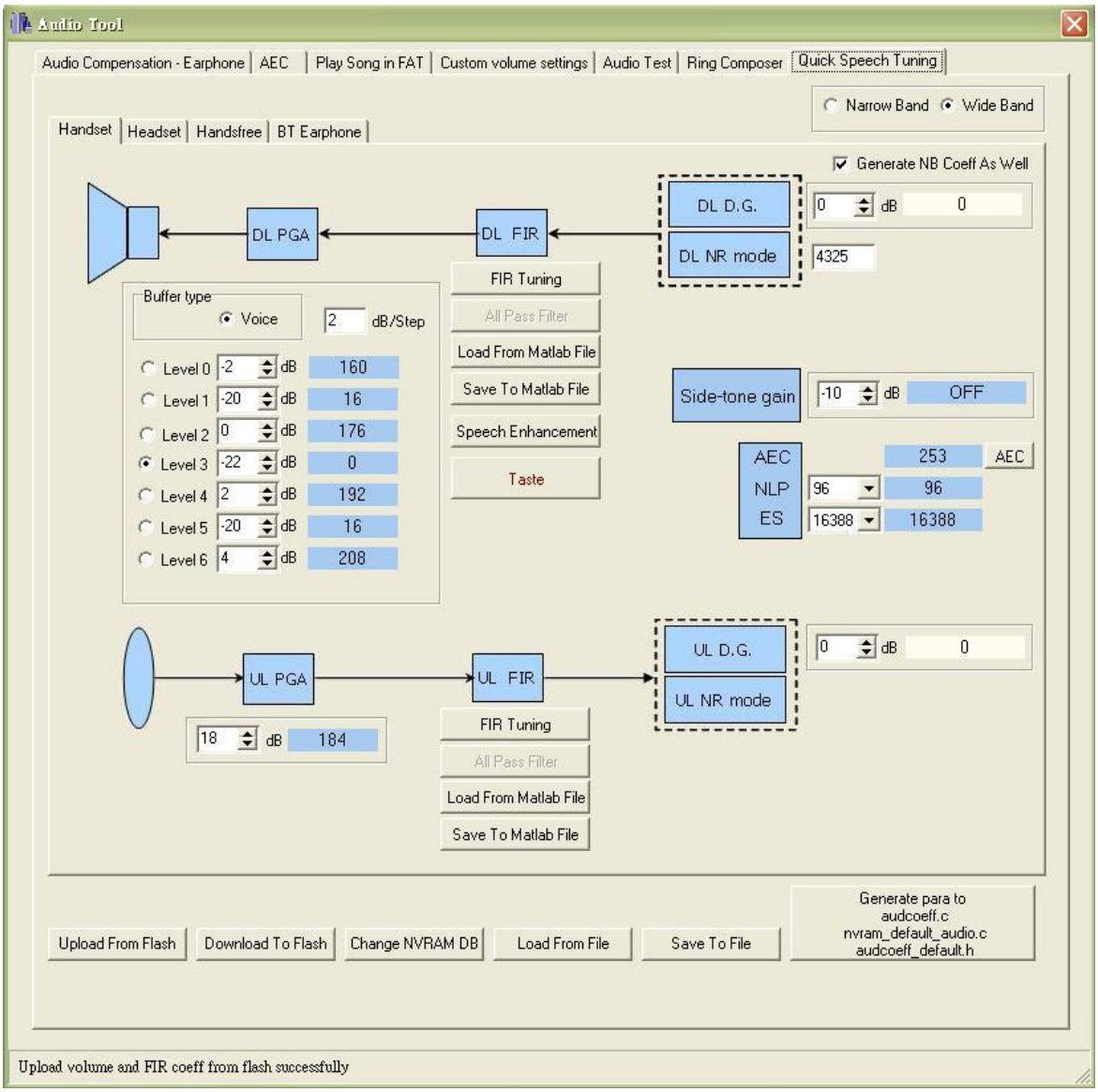

Figure 307 ***Upload from Flash***

3.8.11.1 Taste

User can select a PCM wave file to play. The output device (Handset, Headset, or Handsfree) will be automatically set based on where user press the "Taste" button in Quick Speech Tuning GUI.

Note:
Two types of playing will be triggered based on target resources:

4. Store in target dynamic-allocated buffer first if the buffer is bigger than the wave file users tried to play. The benefit is that even the transmission speed is low such as buadrate is 115200, the wave playing will still be fluent because the wave data was uploaded in target already.
5. Wave data transmission and playing are at the same time when target dynamic-allocated buffer is not bigger enough to store the entire wave data. In this way, the transmission speed will be critical for wave playing performance.

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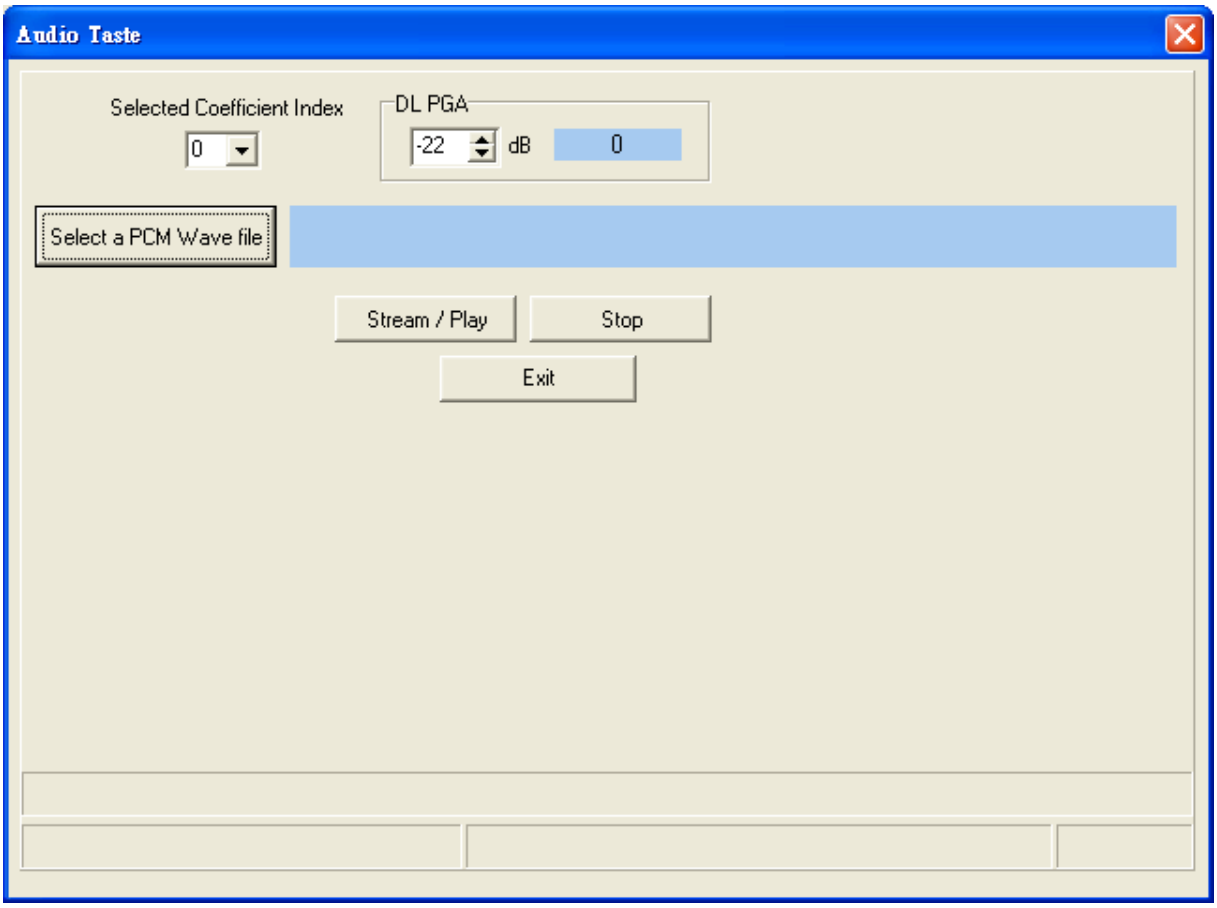

Figure 308 ***Taste function***

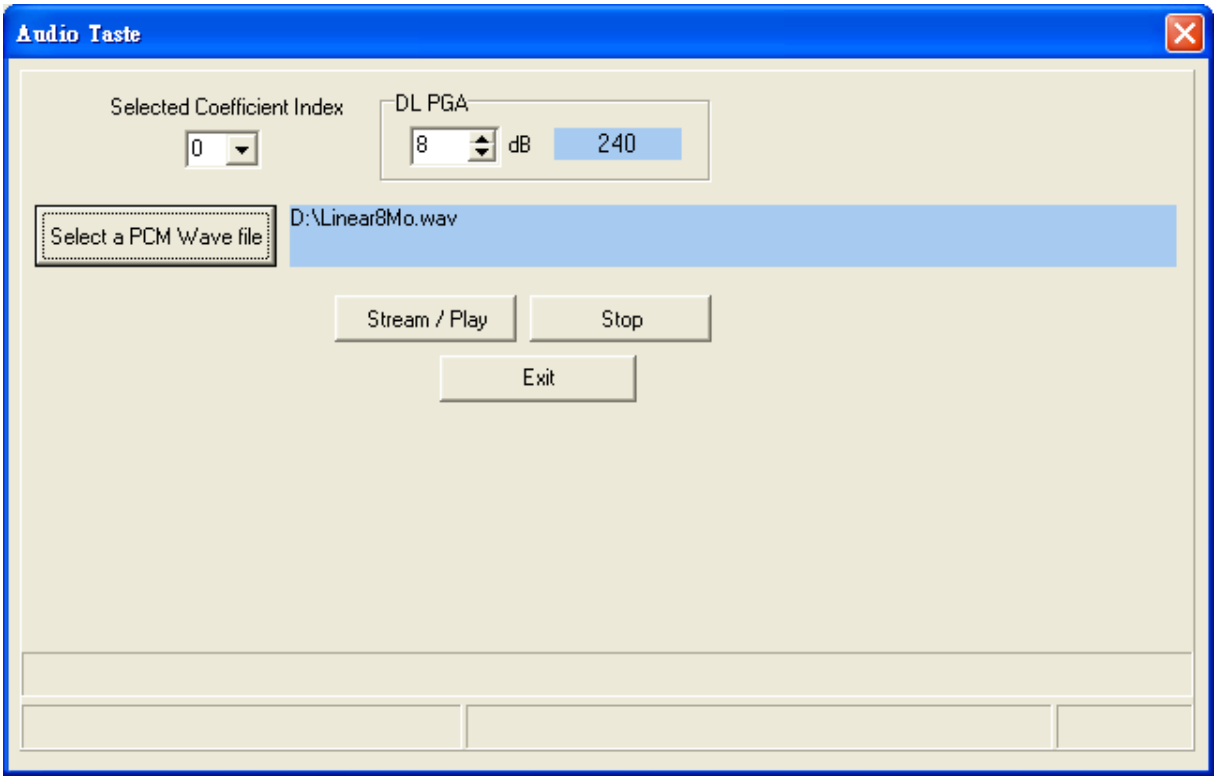

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Figure 309 ***Set the DL gain and select a PCM wave file***

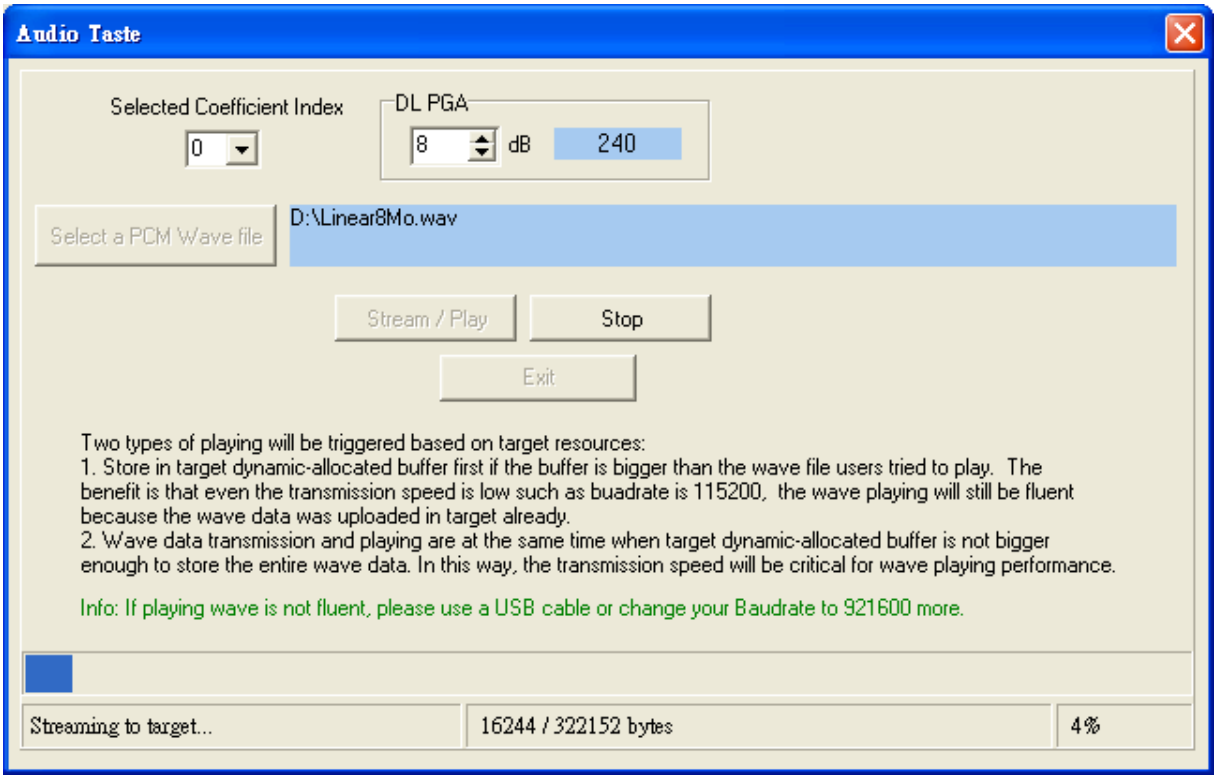

Figure 310 ***Press the button "Stream/Play"***

3.8.11.2 Wide-Band FIR Tuning

Please refer 3.8.9.1 tuning procedure. Wide-Band FIR Tuning procedure is transparent to Narrow-Band Acoustic FIR Tuning.

Note:

1. "FIR scale" is changed to "FIR offset (in dB)
2. "Target file" settings is used to replace the "Idealize" to specify the wanted FIR.
3. "Estimated LR" (NB, WB) calculation will be triggered if a UPL ABS file or ACUQA txt file is specified.
4. "Estimated LR-NB" can active when "Generate NB Coeff As Well" is checked in Quick Speech Tuning.

The tuning procedure is as follows:

1) Select equipment type (there are two equipment output file type, they are Acqua, and UPL), setup input file, output TX FIR file or output RX FIR file.
2) Input taps of FIR coefficient and FIR scale, FIR scale will adjust digital gain. The maximum value of FIR scale is 1.
3) If User configure target frequency response CheckBox is checked, user can click the [Load target file] to load target frequency response file. Go to step 5. Otherwise, select boundary type, each boundary type has different upper and lower bound.
4) Click [Idealize] button to generate ideal wanted frequency response curve (red curve).
5) Click [Run] button to generate frequency response curve of original + FIR compensated (black curve).
6) Adjust wanted frequency response curve by drag wanted frequency response curve or updated value of editor.
7) Repeat step 4) and 5) until the frequency response curve of original + FIR compensated (black curve) is inside boundary curve (green curve).

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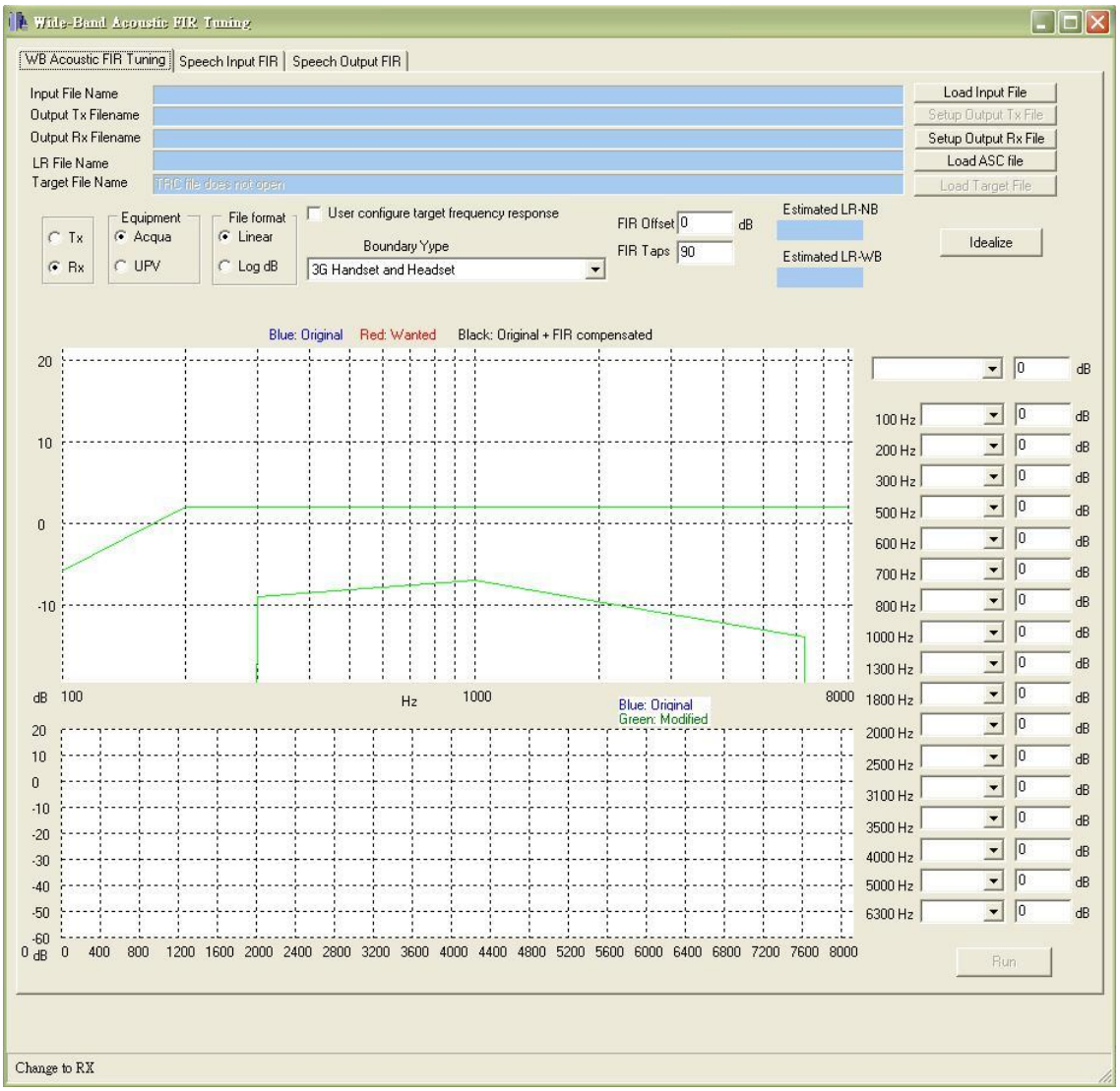

Figure 311 ***Wide-Band Acoustic FIR Tuning***

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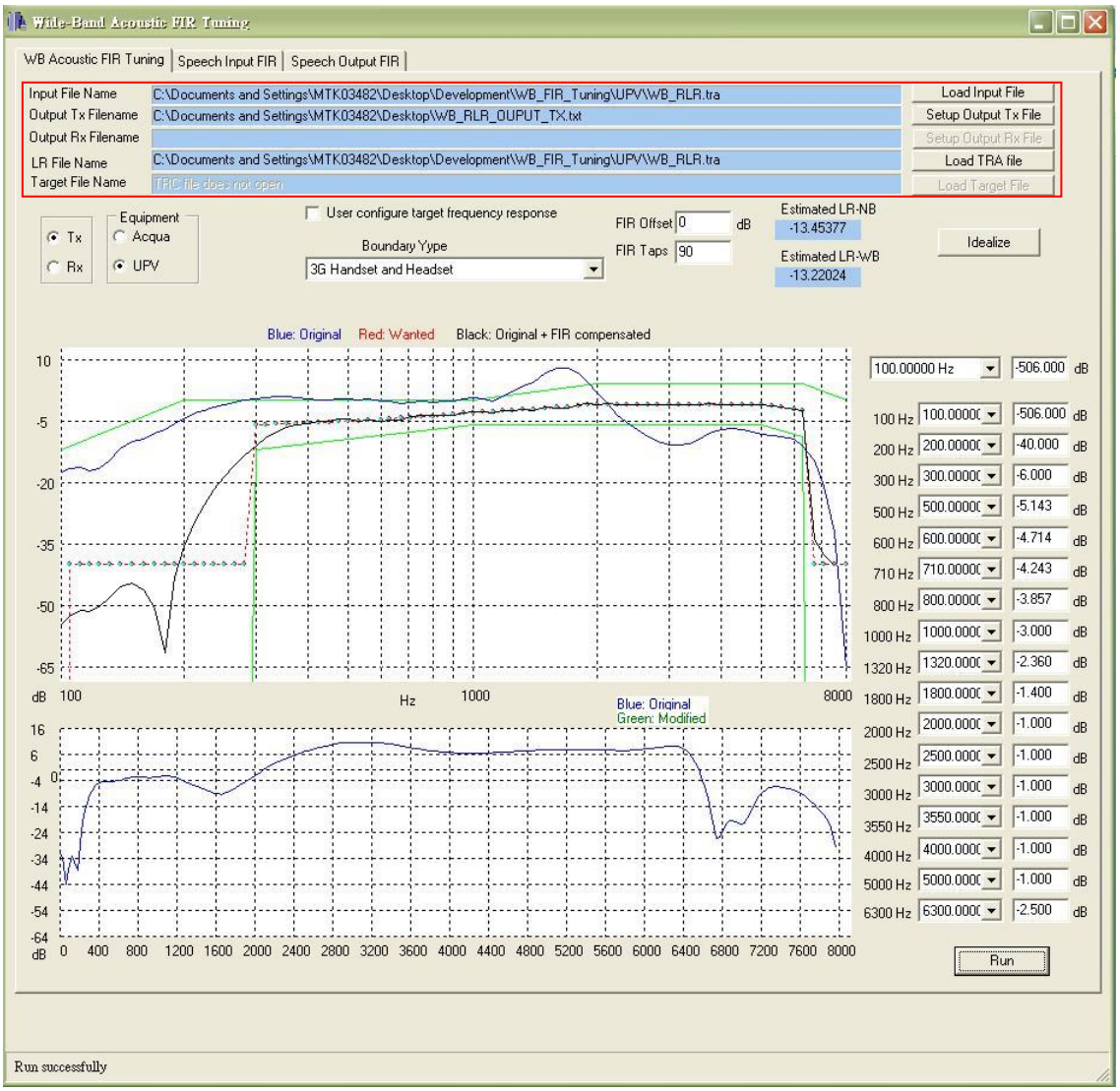

Figure 312 ***Setup Input and Output File***

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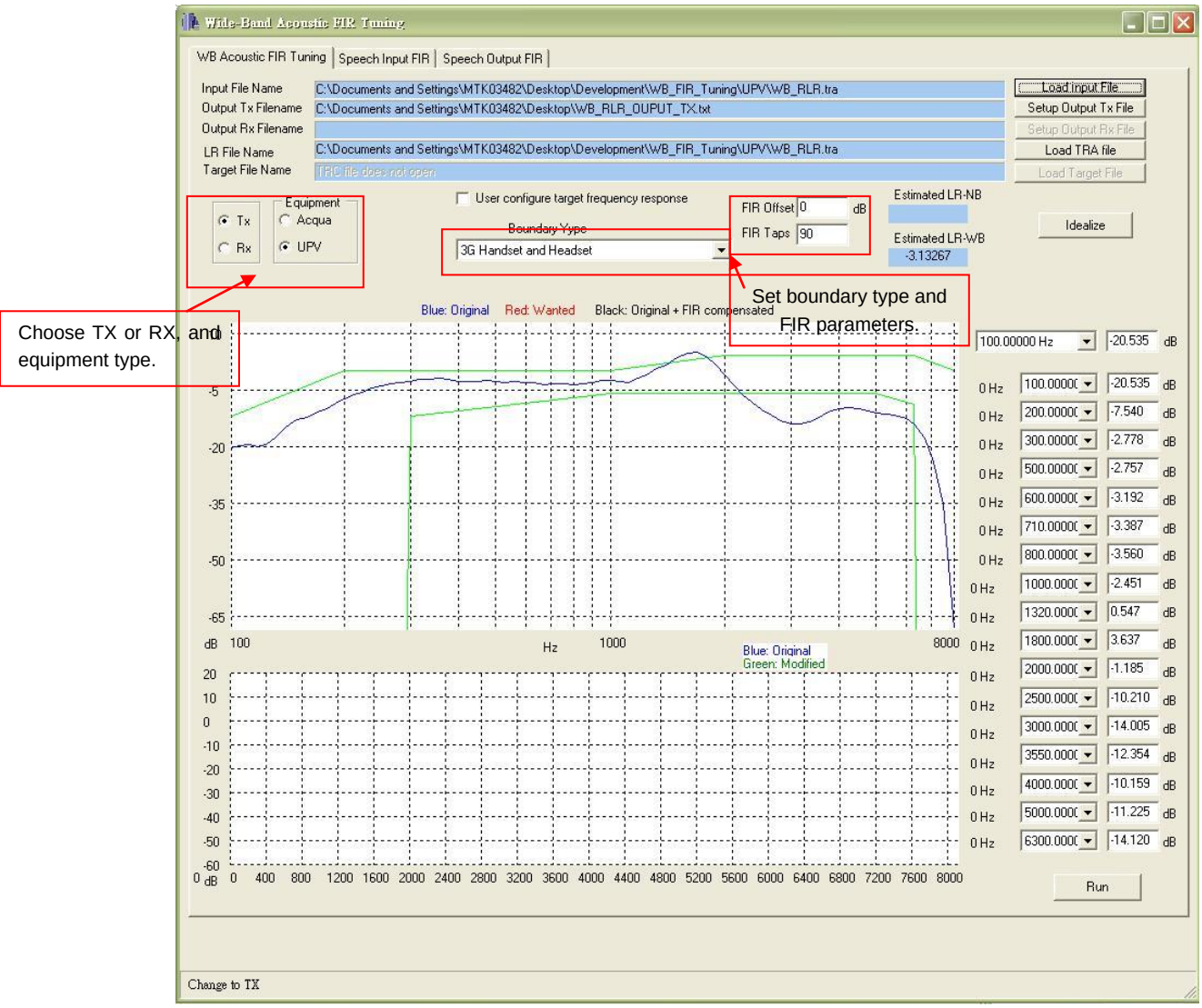

Figure 313 ***Set Mode, Equipment, Boundary Type, And FIR Parameters***

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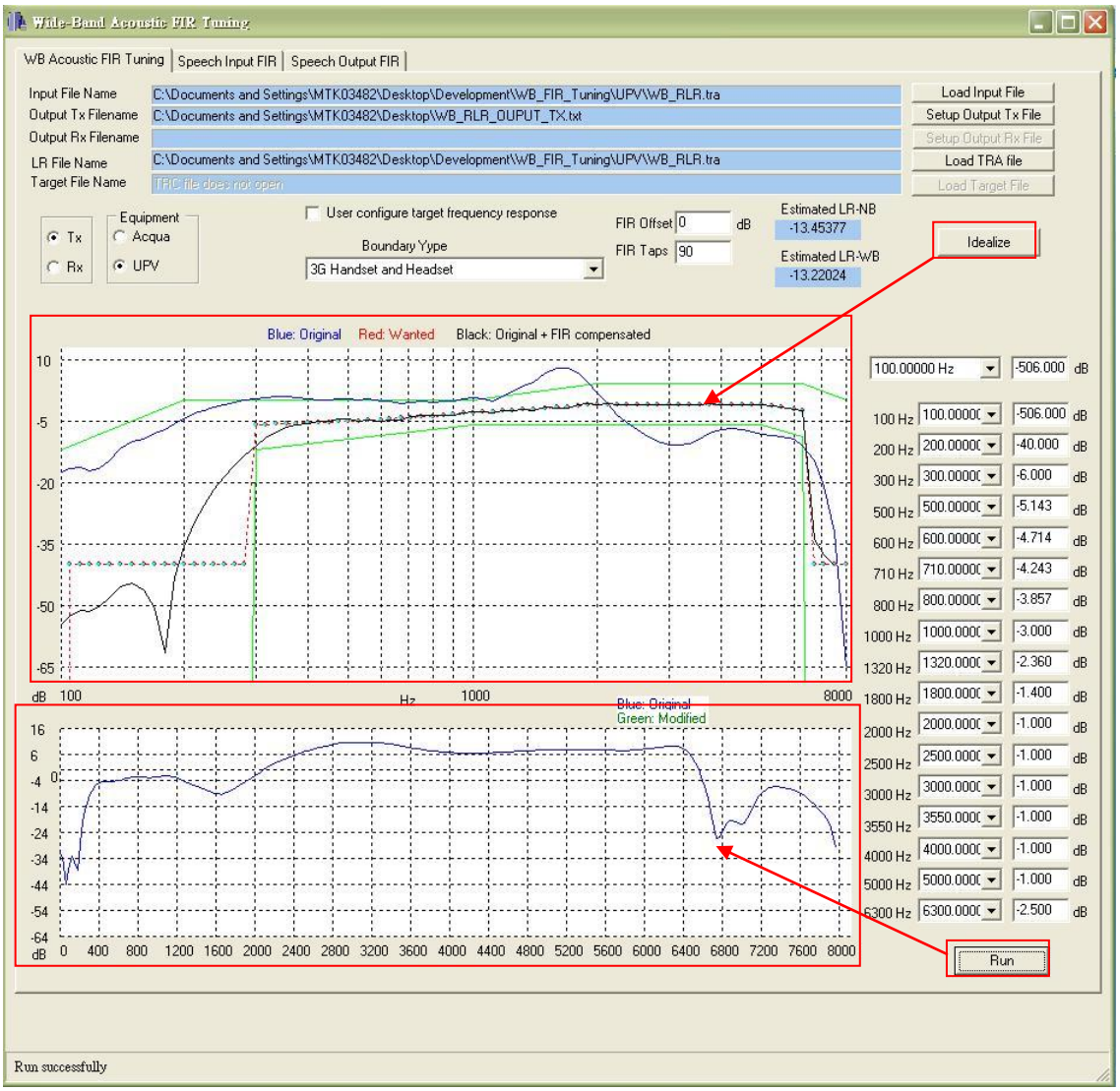

Figure 314 ***Wide-Band Acustic FIR Tuning (Afrer Pressing Run)***

3.8.11.3 Wide-Band Speech Input FIR

User can set wide-band speech input FIR parameters in Speech Input FIR page. Index tab depends on chosen mode when user clicks FIR tuning button from Quick Speech Tuning window. After user runs wide-band acoustic FIR tuning RX mode, tuning parameters will generate automatically. The range of acoustic FIR coefficient is -32768 ~ 32767. There are four group of speech input coefficient. There are up to 90 words in each group of coefficient.

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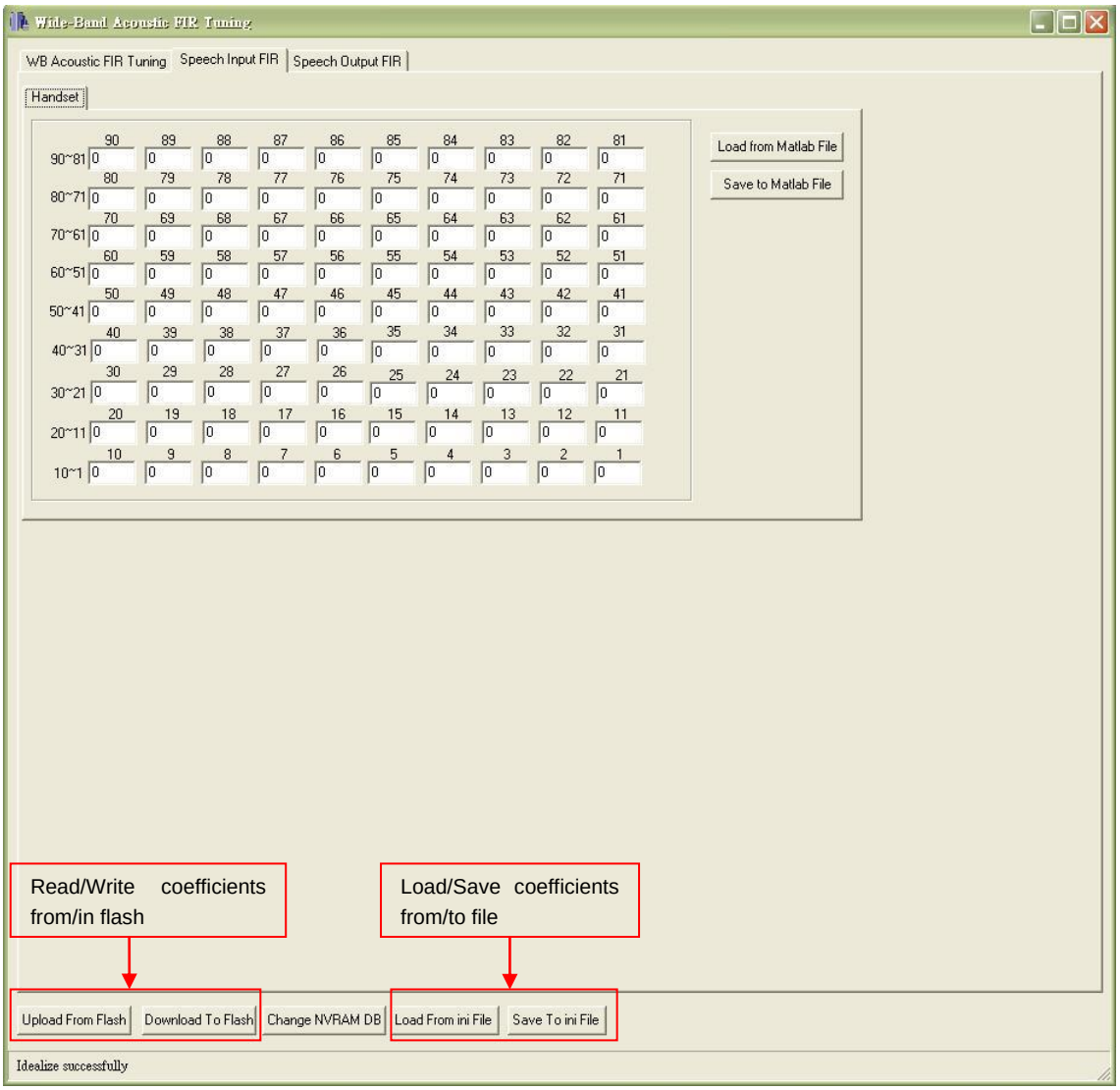

Figure 315 ***Wide-Band Speech Input FIR***

3.8.11.4

User can set wide-band speech output FIR parameters in Speech Output FIR page. Index tab depends on chosen mode when user clicks FIR tuning button from Quick Speech Tuning window. After user runs wide-band acoustic FIR tuning TX mode, tuning parameters will generate automatically. The range of acoustic FIR coefficient is -32768 ~ 32767. There are four group of speech output coefficient. There are up to 90 words in each group of coefficient.

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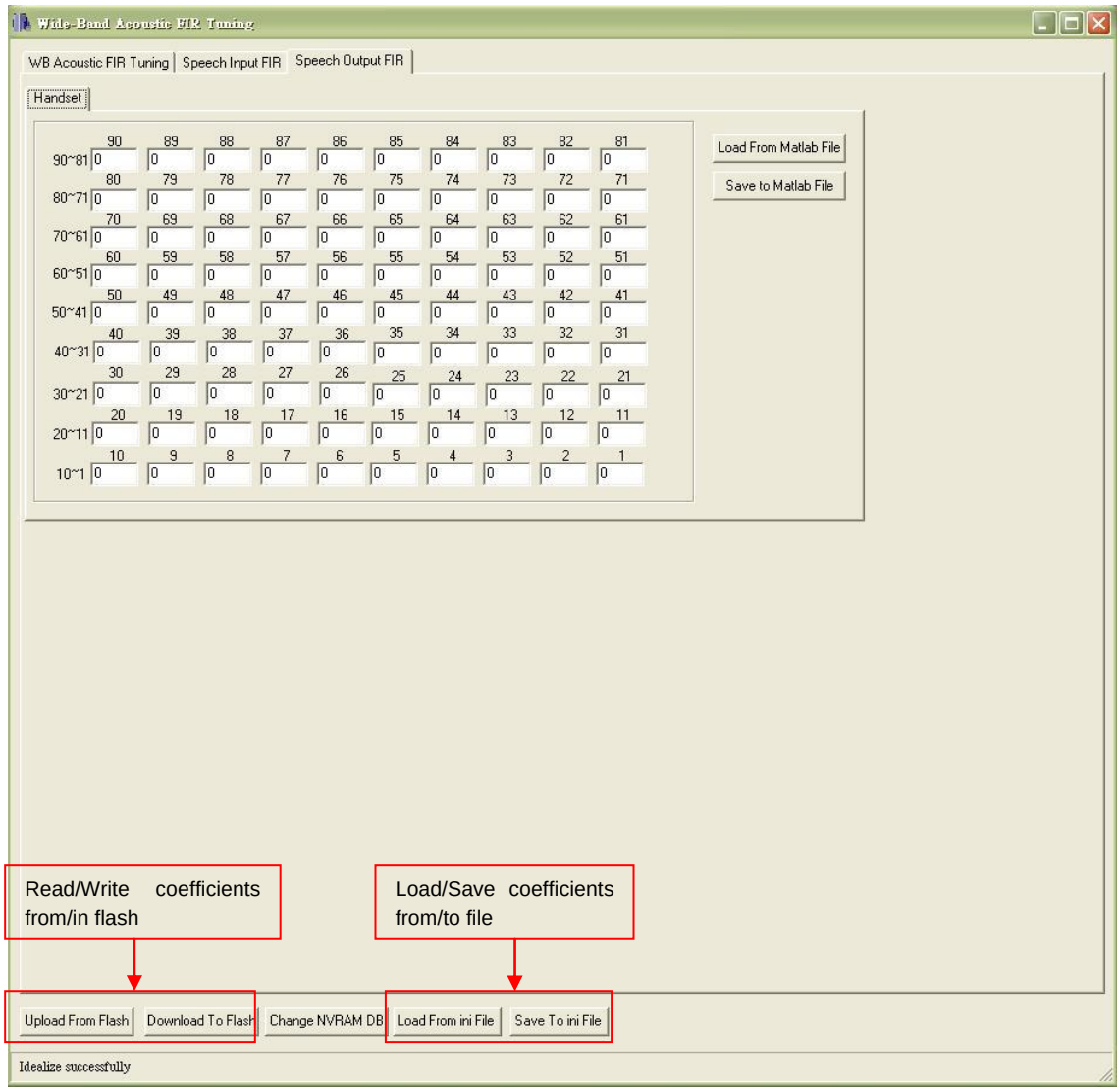

Figure 316 ***Wide-Band Speech Output FIR***

3.8.11.5 Wide-Band and Narrow-Band Switch

User can switch wide-band and narrow-band FIR tuning. Wide-band FIR tuing can support 90 taps from 0 to 8000 Hz. Narrow band only support at most 44 taps from 0 to 4000 Hz. Generate NB Coeff As Well can generate narrow-band FIR Coeff as well when wide-band FIR coefficients generate.

User can click FIR tuning to tune wide-band FIR. Wide band FIR tuning window extends FIR Tuning, including wide-band speech input coeff and speech output coeff. It is very similar with narrow-band FIR tuning.

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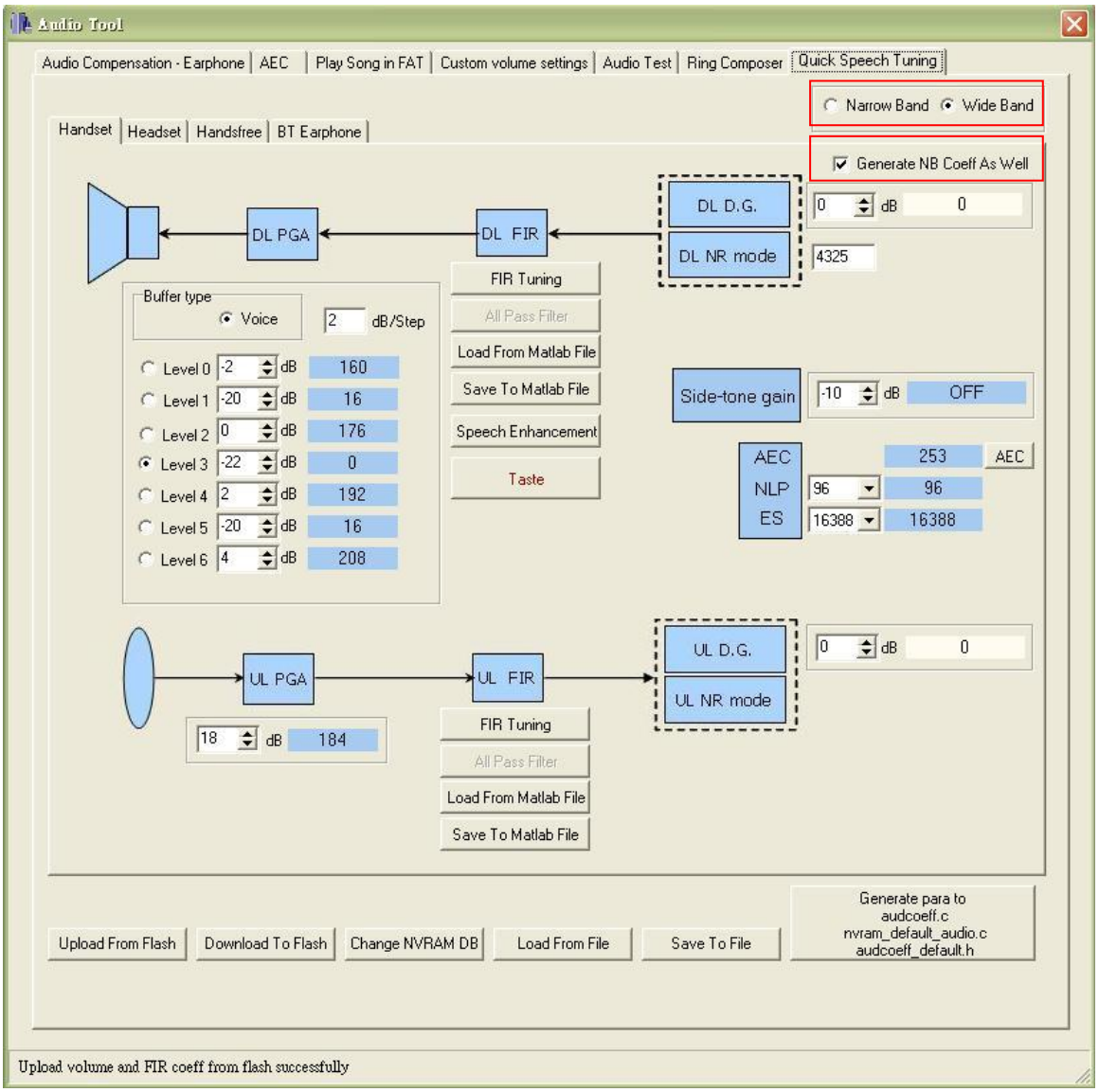

Figure 317 ***Select Wide Band and Check The "Generate NB Coeff As Well"***

3.8.12 Speech Input Coeff

Speech Input Coeff window provides interface for user to read or write coefficient in flash, ini file or Matlab file and generating C file. The window also provides graphical acoustic FIR Tuning. User can click these buttons shown on window to read coefficient from flash, write coefficient to flash, load coefficient from file and save coefficient to file. All values are in decimal format. The range of acoustic FIR coefficient is -32768 ~ 32767. There are four group of coefficient, they are normal input coefficient, handset input coefficient, handsfree input coefficient, BT earphone input coefficient. There are up to 45 words in each group of coefficient.

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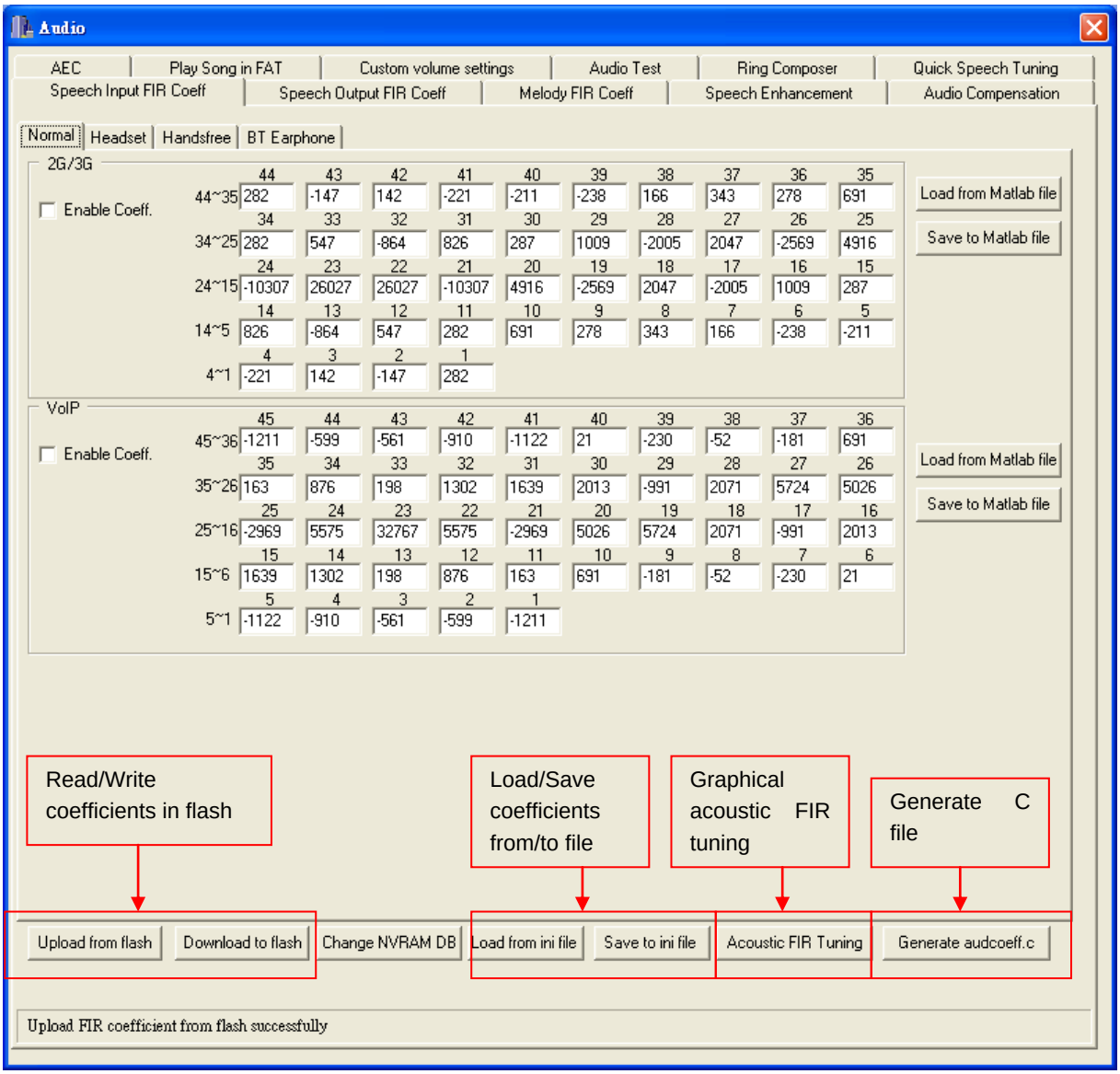

Figure 318 ***Speech Input Coeff (Normal)***

3.8.13 Speech Output Coeff

Speech Output Coeff window provides interface for user to read or write coefficient in flash, ini file or Matlab file and generate C file. The window also provides graphical acoustic FIR Tuning. User can click these buttons shown on window to read coefficient from flash, write coefficient to flash, load coefficient from file and save coefficient to file. All values are in decimal format. The range of acoustic FIR coefficient is -32768 ~ 32767. There are four group of speech output coefficient. There are up to 45 words in each group of coefficient.

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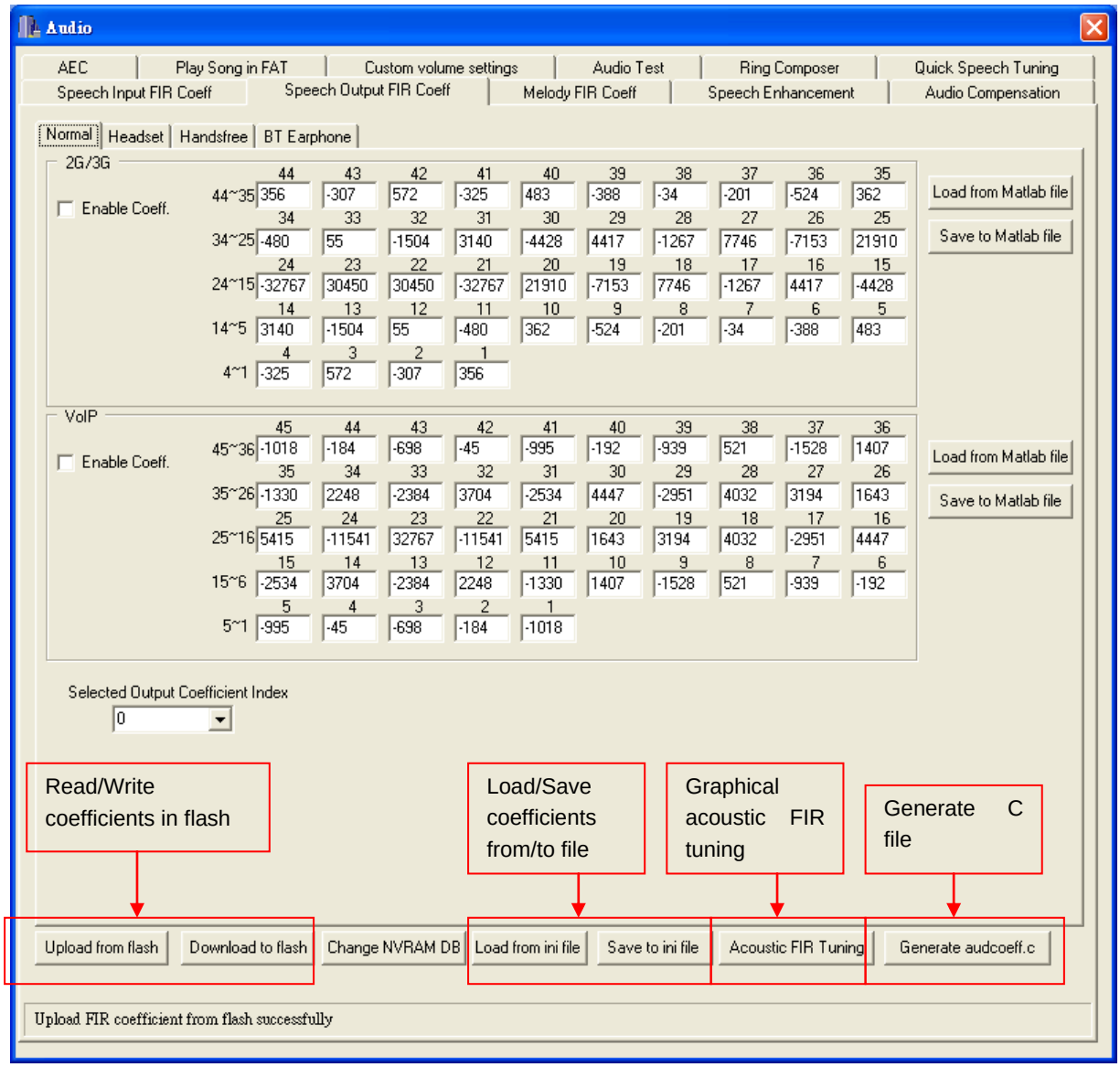

Figure 319 ***Speech Output Coeff (Normal)***

3.8.14 Speech Enhancement

Speech Output Coeff window provides interface for user to read or write coefficient in flash, ini file and generate C file. There are three groups of speech enhancement values, Mode dependent, Common, and Volume. The numbers of coefficients are queried from the database file and display on the window.

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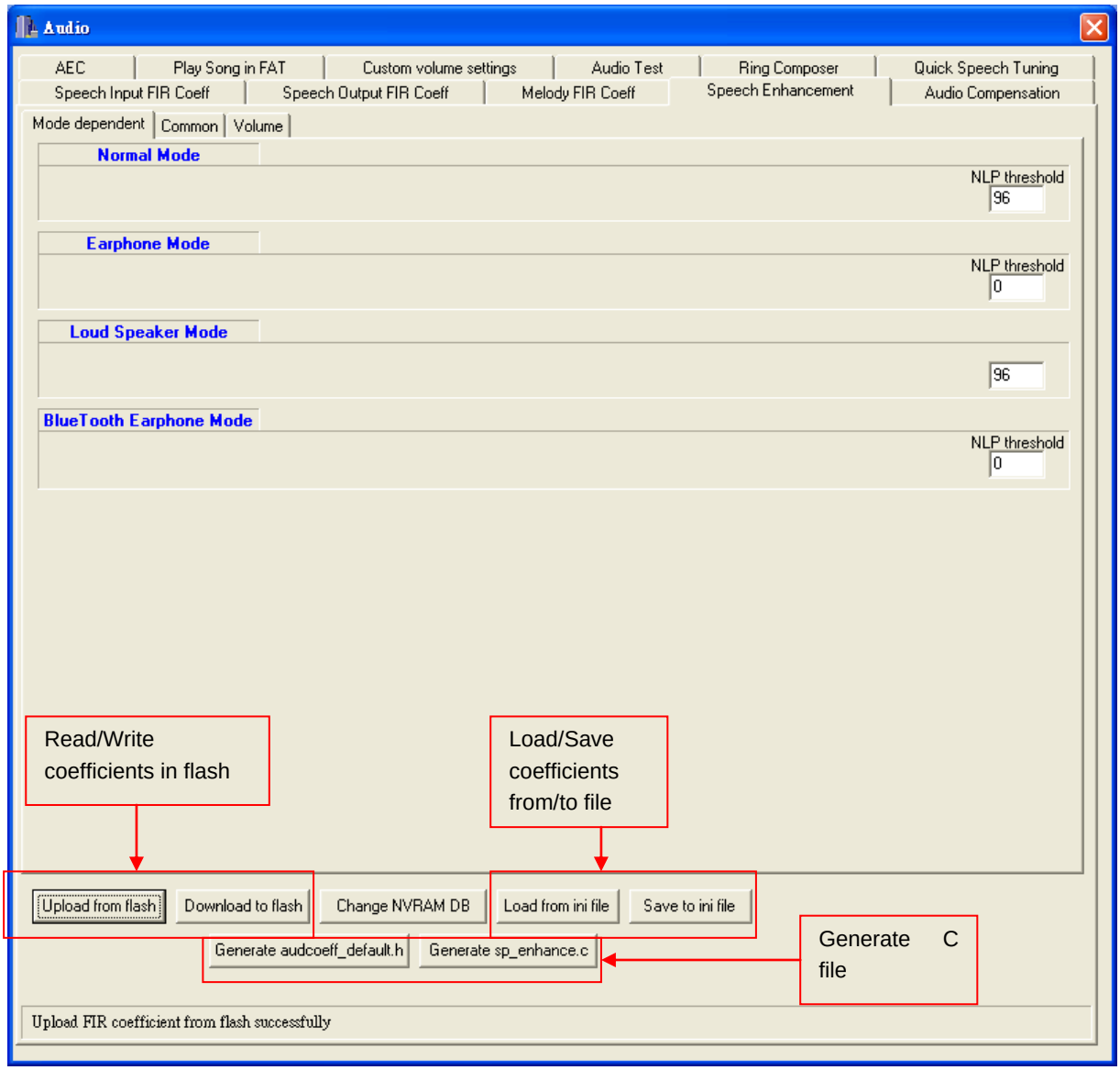

Figure 320 ***Speech Enhancement (Mode dependent)***

3.8.15 Audio Compensation

Audio compensation window provides an interface for users to read or write coefficients in Flash ("Upload from Flash"/"Download to Flash") and the ini file ("Load from ini file"/"Save to ini file"), to generate C file ("Generate aud_common.c) and to do runtime tuning. The audio compensation FIR coefficients are separated by different modes such as Loud Speaker and Earphone modes.

"Runtime Tuning" process: Users can switch to "Play song in FAT" to play a song and during the period of song playing, users can drag and drop the magnitude bars (Low/Middle/High Frequency) and listen to the tuning effects runtime without re-booting the phone.

Note: Runtime tuning functionality is supported by SW load after W09.52

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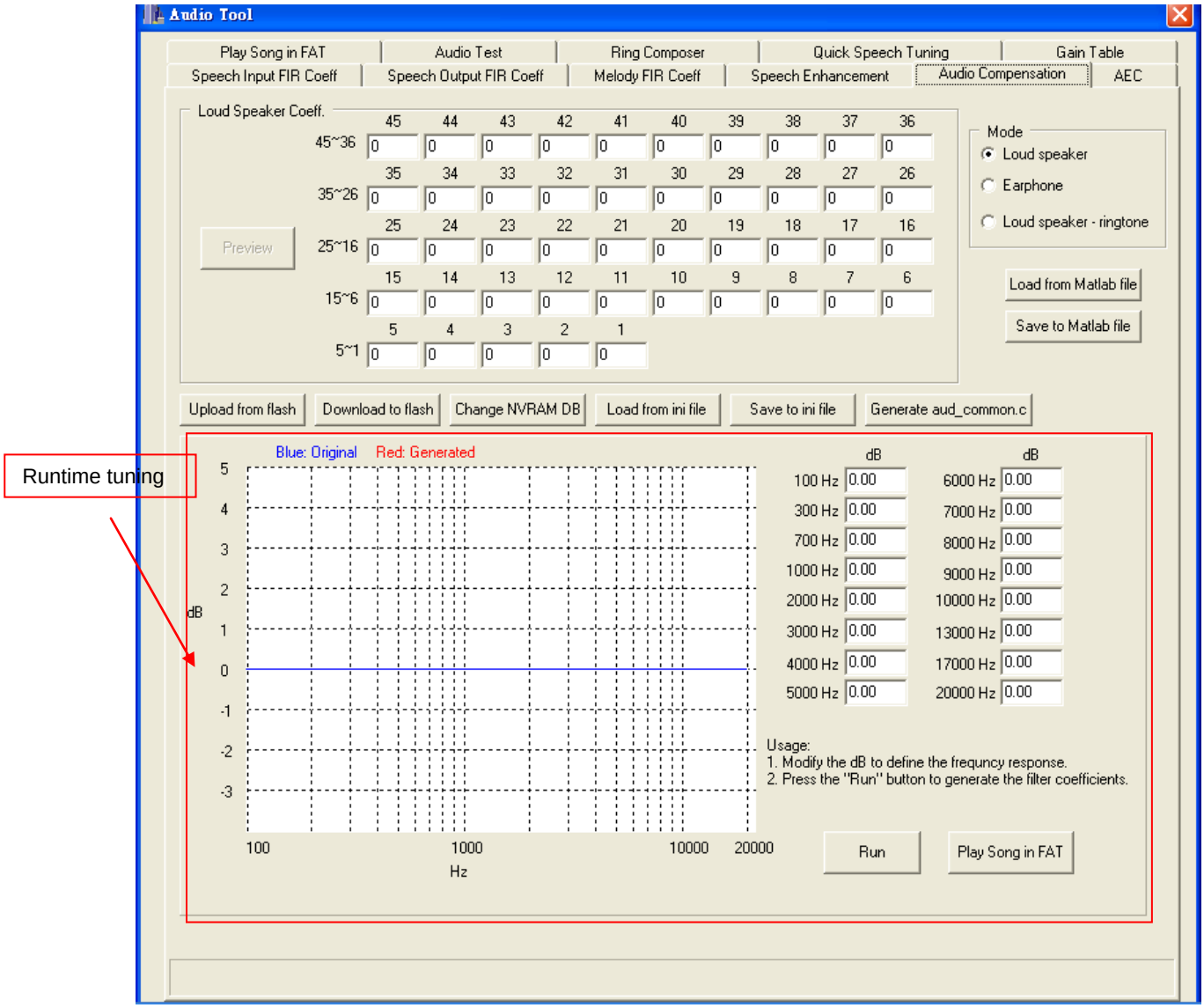

Figure 321 ***Audio Enhancement (Loud Speaker Mode) after v6.1024.0***

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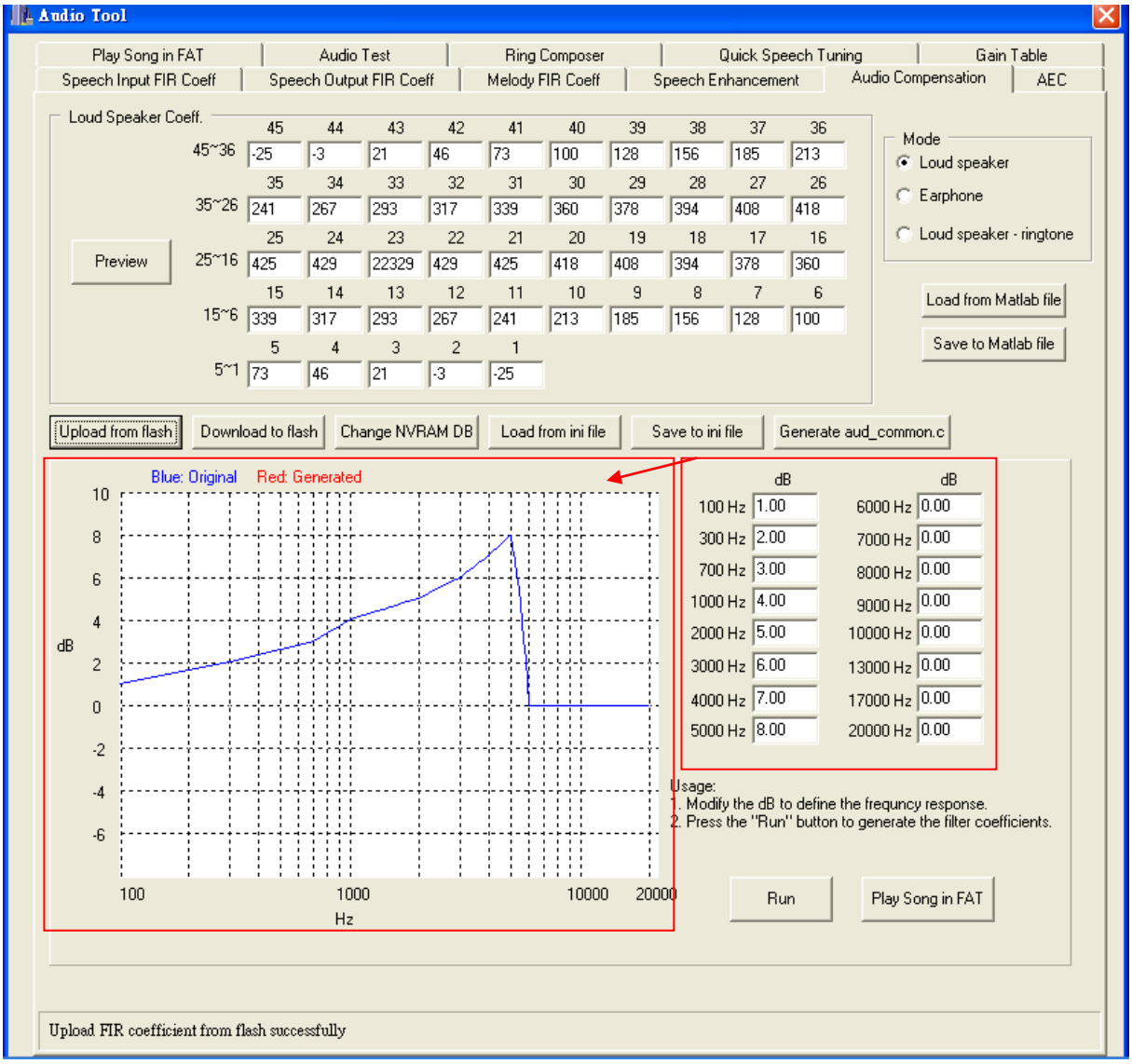

Figure 322 ***Audio Enhancement (modify the frequency response that users want)***

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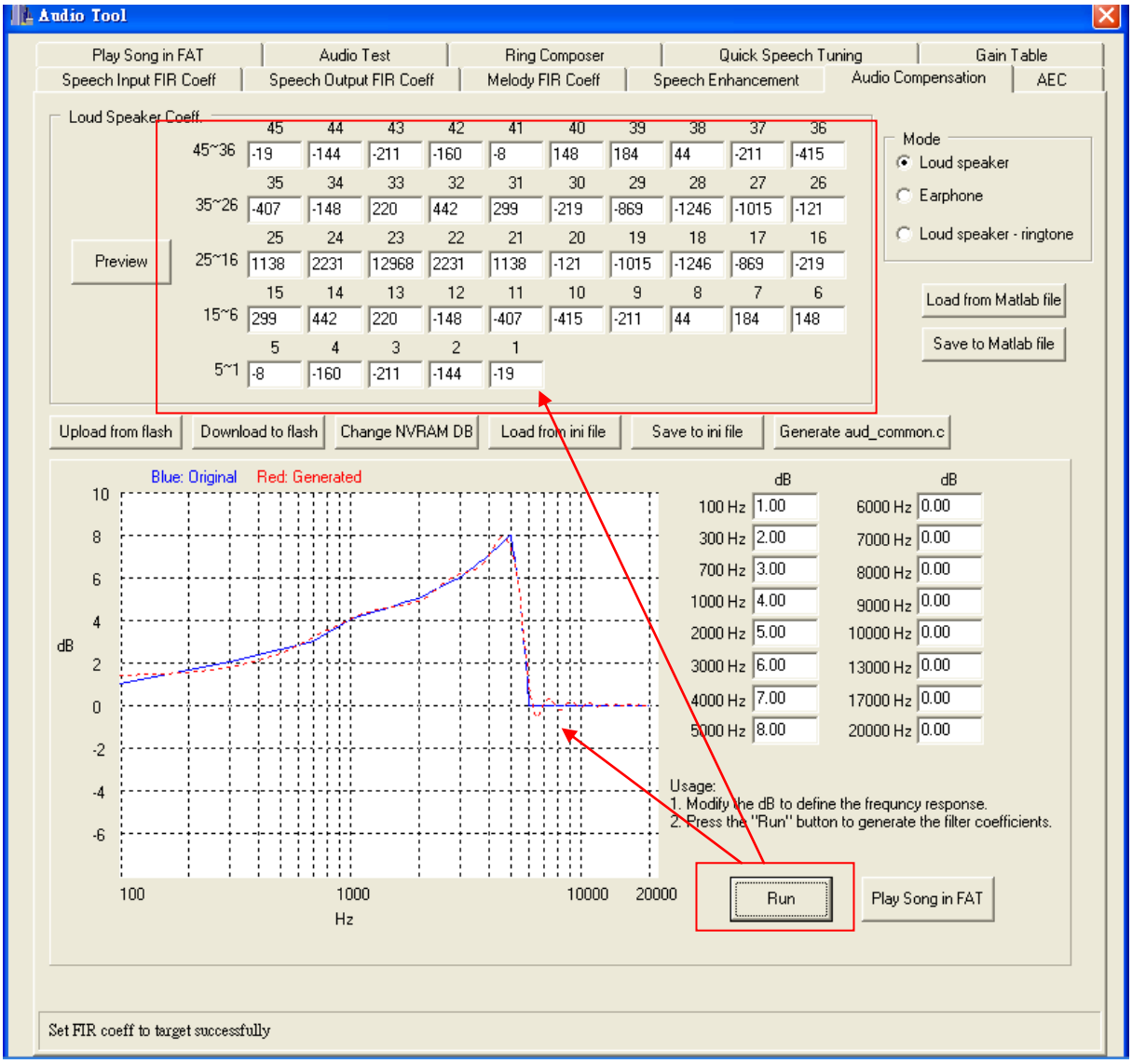

Figure 323 ***Audio Enhancement (pressing the "Run" button will change the coefficients)***

3.8.15.1 Audio Compensation Software FIR

Audio Compensation window also support software FIR version. It supports 3 sample rates, 48000, 24000 and, 12000. It enhances audio compensation ablitily by software simulation.

Note:

- NVRAM_EF_AUDIO_SWFIR_LID
- Support from META v6.1112.0

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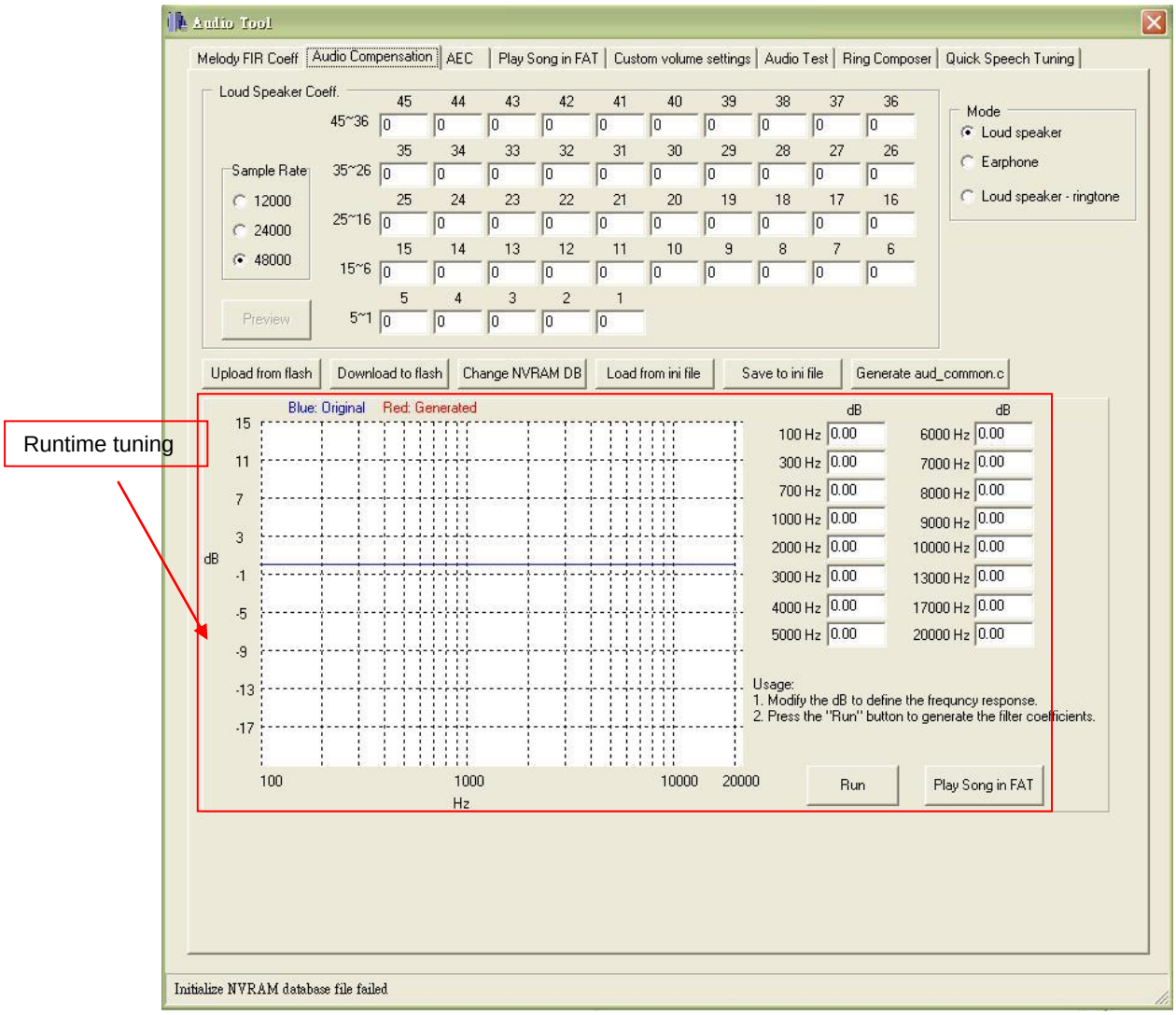

Figure 324 ***Audio Enhancement (Loud Speaker Mode) after v6.1112.0***

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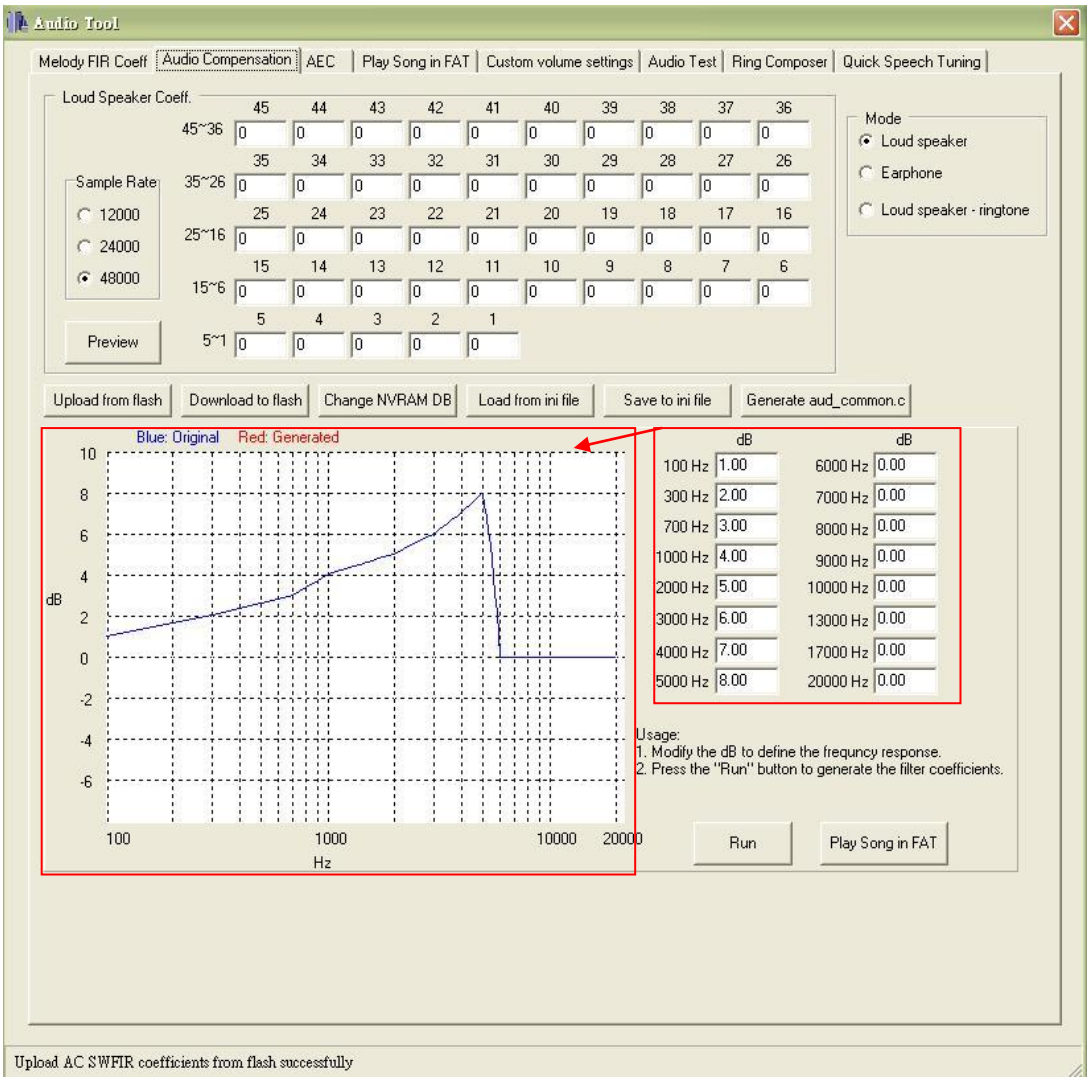

Figure 325 ***Audio Enhancement (modify the frequency response that users want)***

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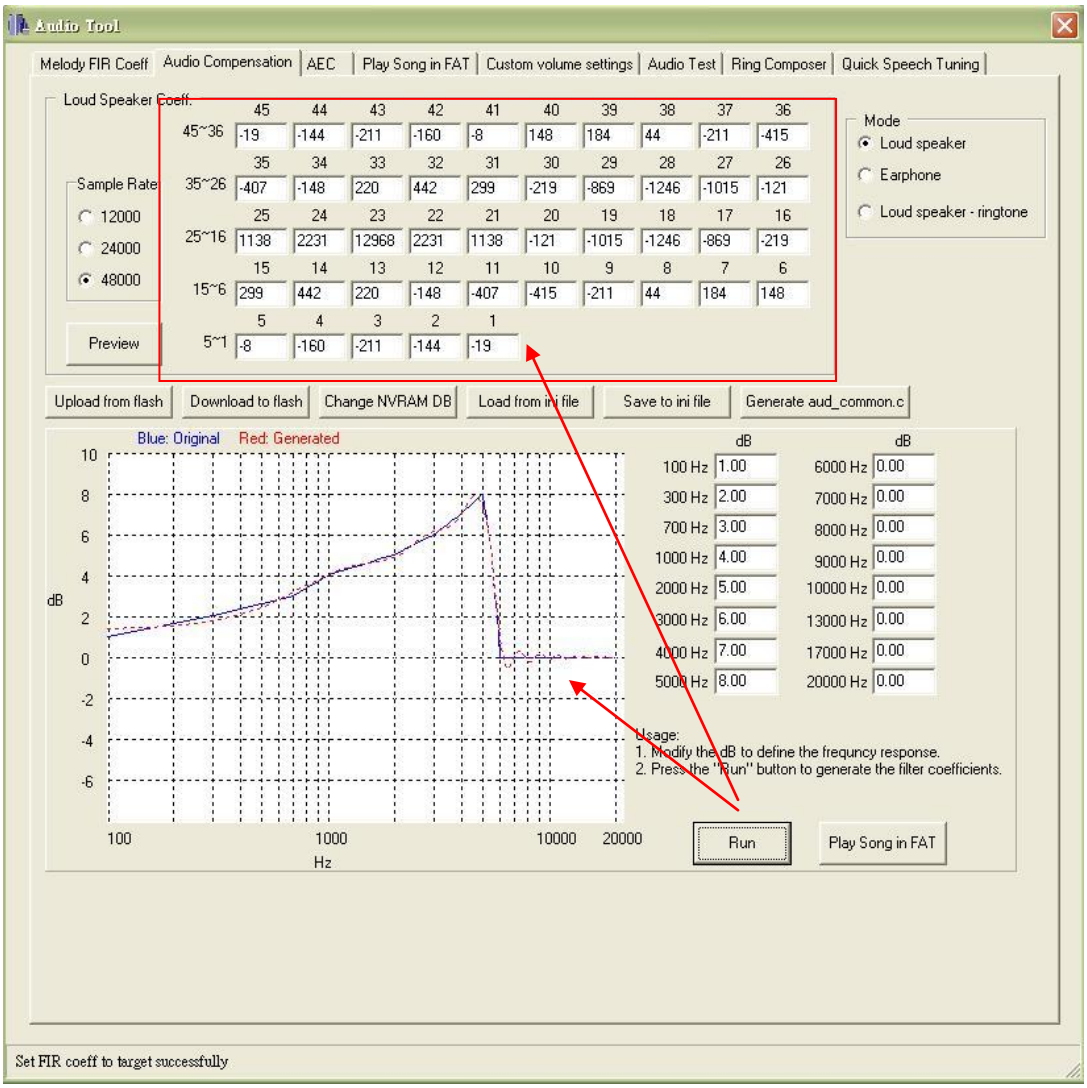

Figure 326 ***Audio Enhancement (pressing the "Run" button will change the coefficients)***

3.8.16 Audio Compensation – loud speaker

Audio compensation – loud speaker window provides an interface for users to read or write coefficients in Flash ("Upload from Flash"/"Download to Flash") and the ini file ("Load from ini file"/"Save to ini file"), to generate C file ("Generate aud_common.c) and to do runtime tuning.

For common use, user can tune loud speaker setting with Tuning Option. Tuning Option provides 4 options: Normal Speaker Box, Side Speaker Box, Custom Tuning I, and Custom Tuning II. User can choose Normal Speaker Box for the target with normal speaker without any setting. Also use Side Speaker Box for the target with side speaker.

If target supports BesLouness feature, there are two gain boost option settings in META. Gain Boost Option provides ability to set gain boost. Gain Boost Tuning provides 4 types tuning: Standard, High, Aggressive, and Custom. Standard, High, and Aggressive have different default settings. User can customize gain Boost Tuning with Custom setting.

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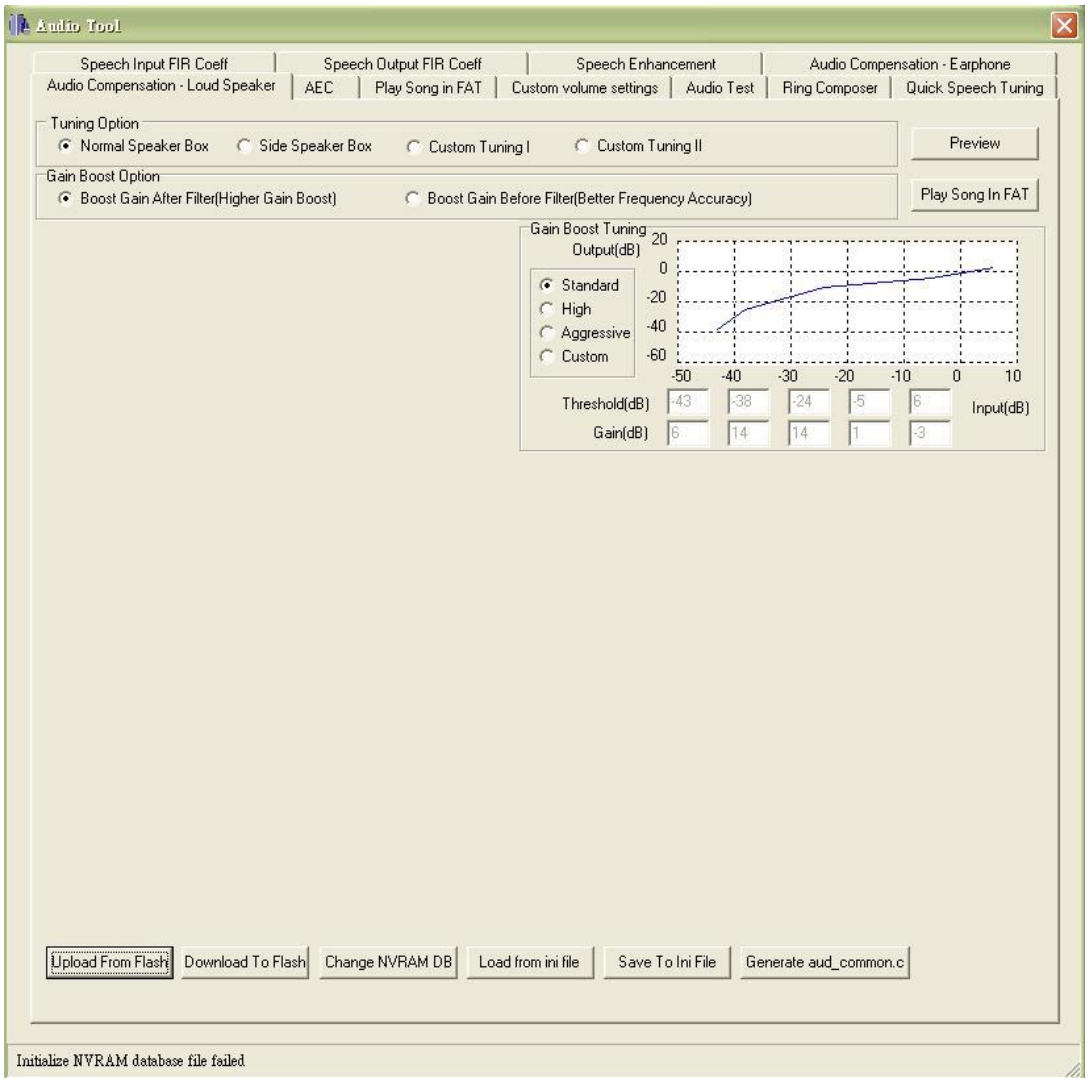

Figure 327 ***Audio Compensation – Loud Speaker***

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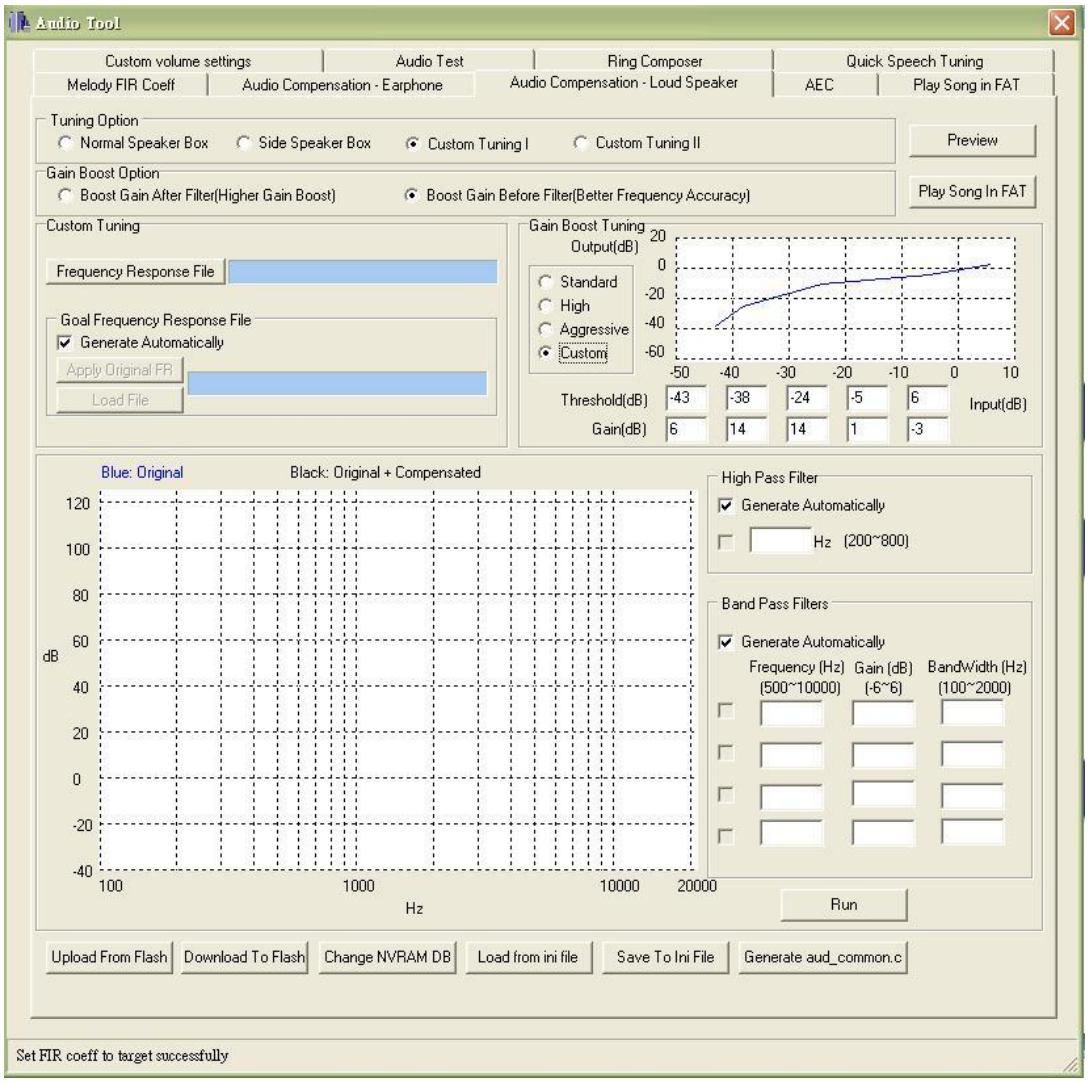

Figure 328 ***Audio Compensation – Loud Speaker(Custom Tuning)***

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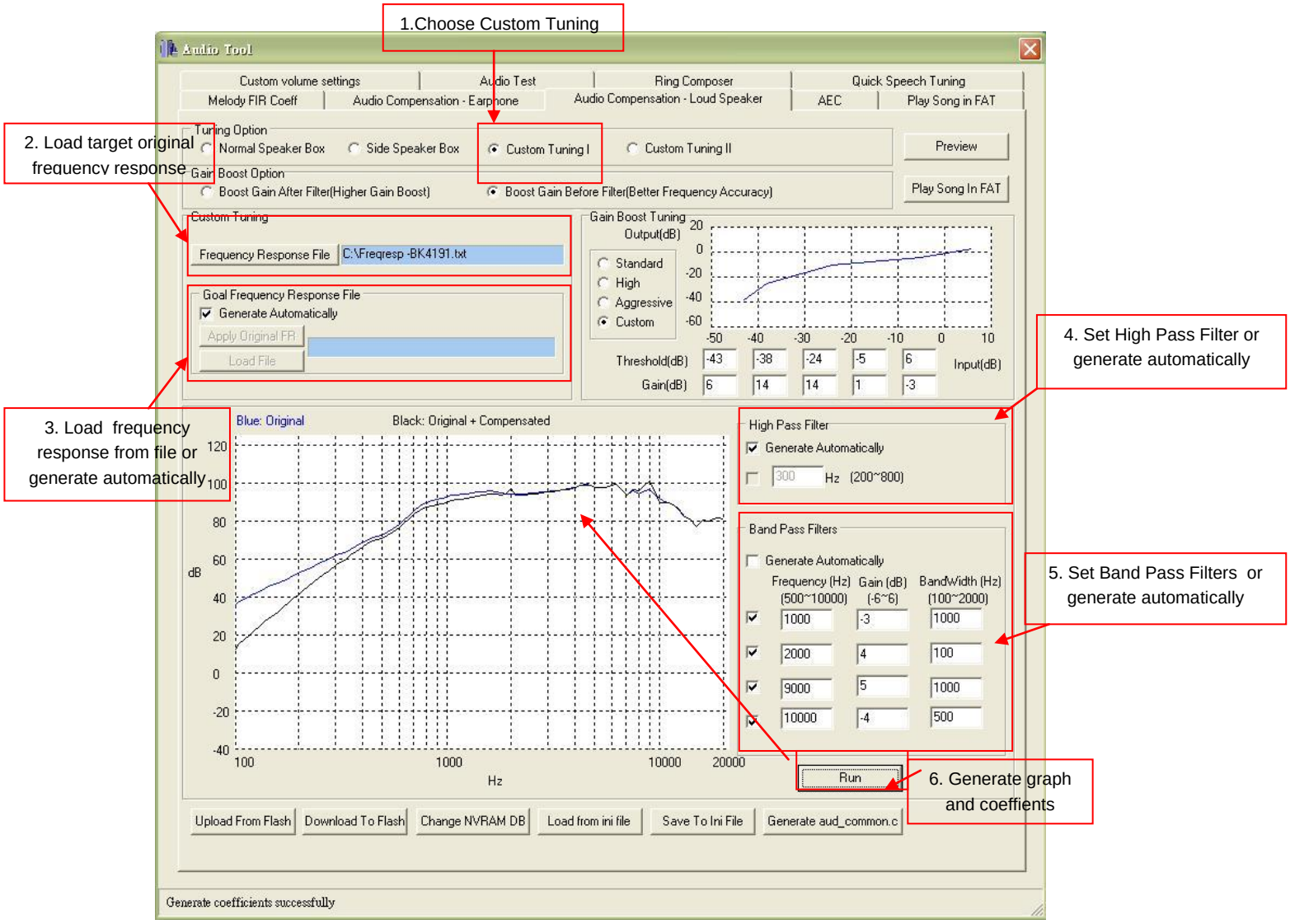

Figure 329 ***Audio Compensation – Loud Speaker(Generate Parameters)***

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3.9 Baseband function

There are many functions in baseband tool: Auxiliary ADC, baseband register read/write, PMIC register read/write and battery level editor. User can switch to baseband tool by selecting [Baseband] from main selection menu.

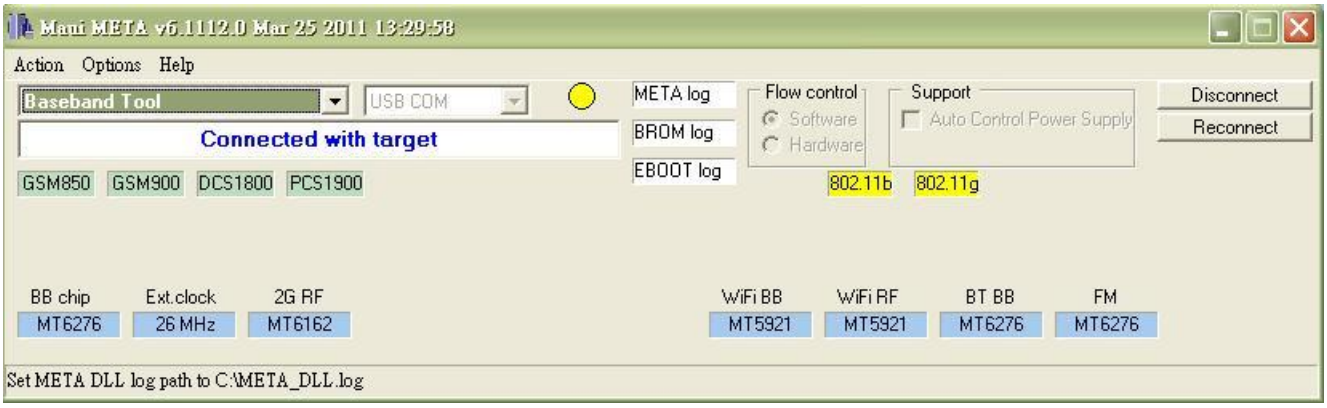

Figure 330 ***Select [Baseband] from main selection menu***

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3.9.1 Auxiliary ADC

User can use auxiliary ADC window to measure the slope and offset of auxiliary ADC. For MT6205 and MT6205B, there are 5 ADC channels. For MT6218, MT6218B and MT6219, there are 7 ADC channels.

Execute this operation by following steps:
1) Select ADC channel by clicking ADC 0~6 button.
2) Key in the input voltage and measuring count of 1'st measurement.
3) Click [Start] button to sample the ADC data.
4) Key in the input voltage and measuring count of 2'nd measurement.
5) Click [Start] button to sample the ADC data.
6) The ADC slope and offset is shown on the Result row.
7) If the evaluated result is permitted, click [Apply] button.

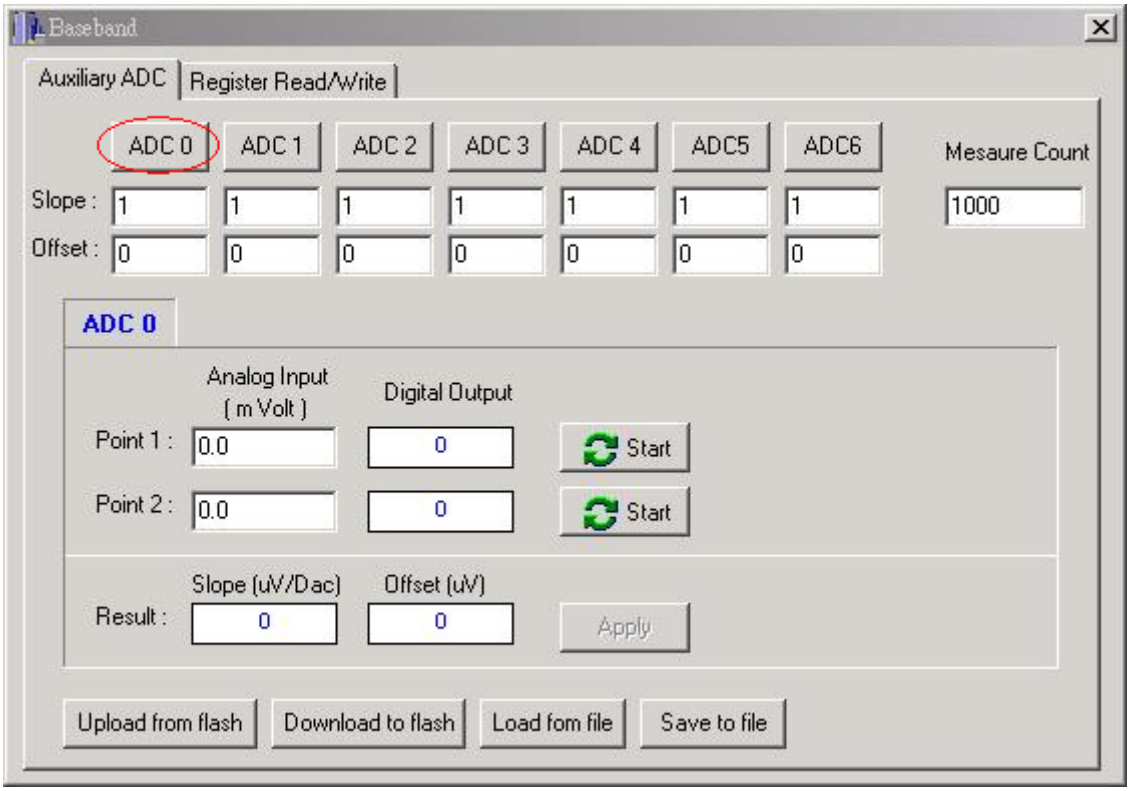

Figure 331 ***Click [ADC 0] button***

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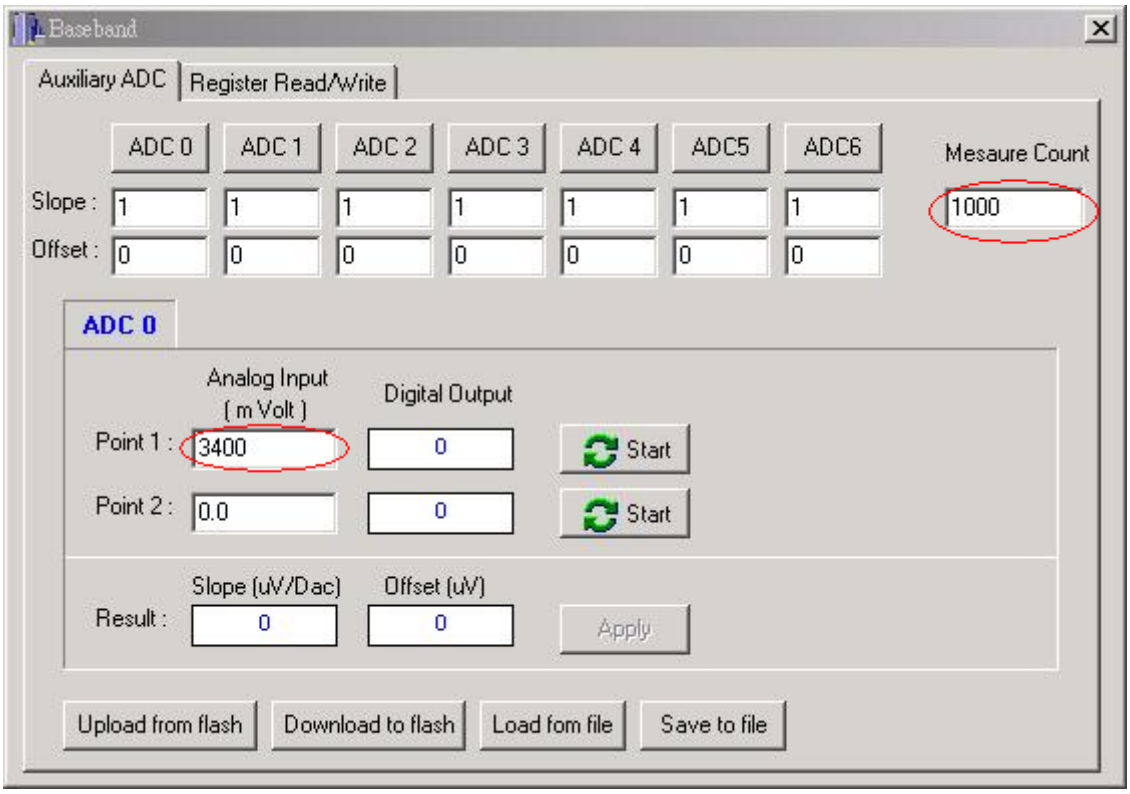

Figure 332 ***Key in the input voltage and measuring count of 1'st measurement***

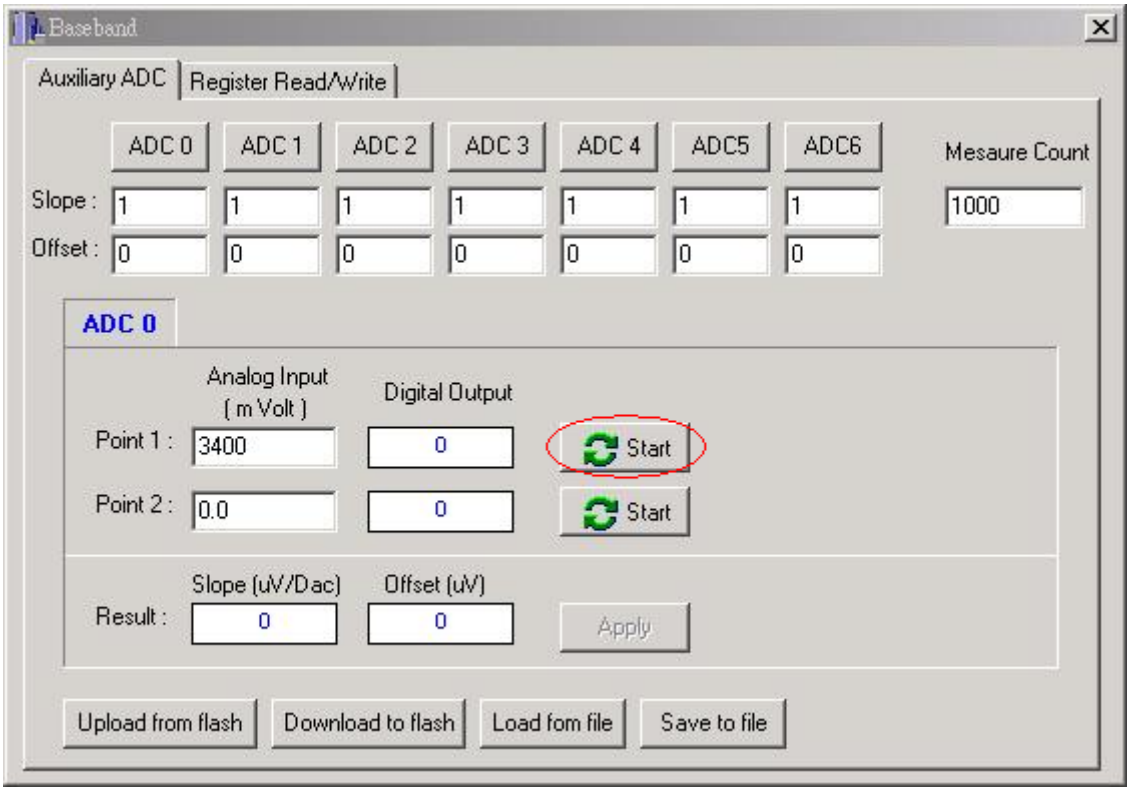

Figure 333 ***Click [Start] button of Point 1 to sample the ADC data***

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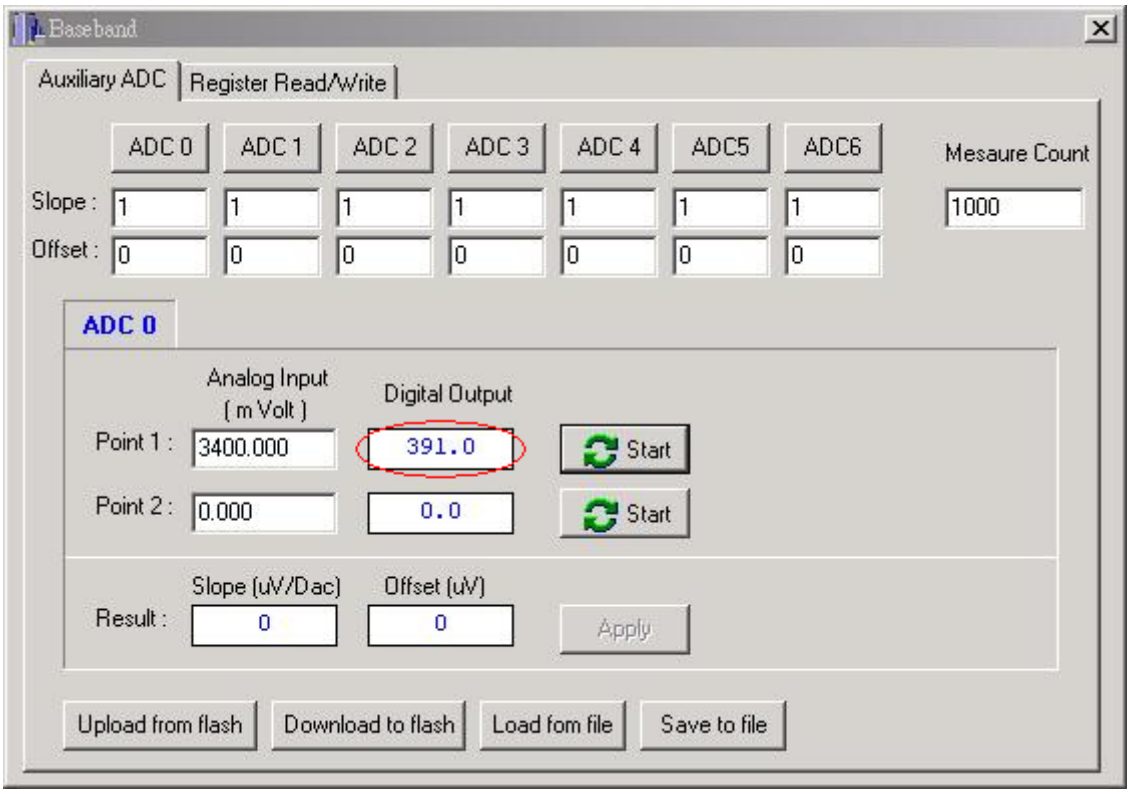

Figure 334 ***Result of 1st measurement***

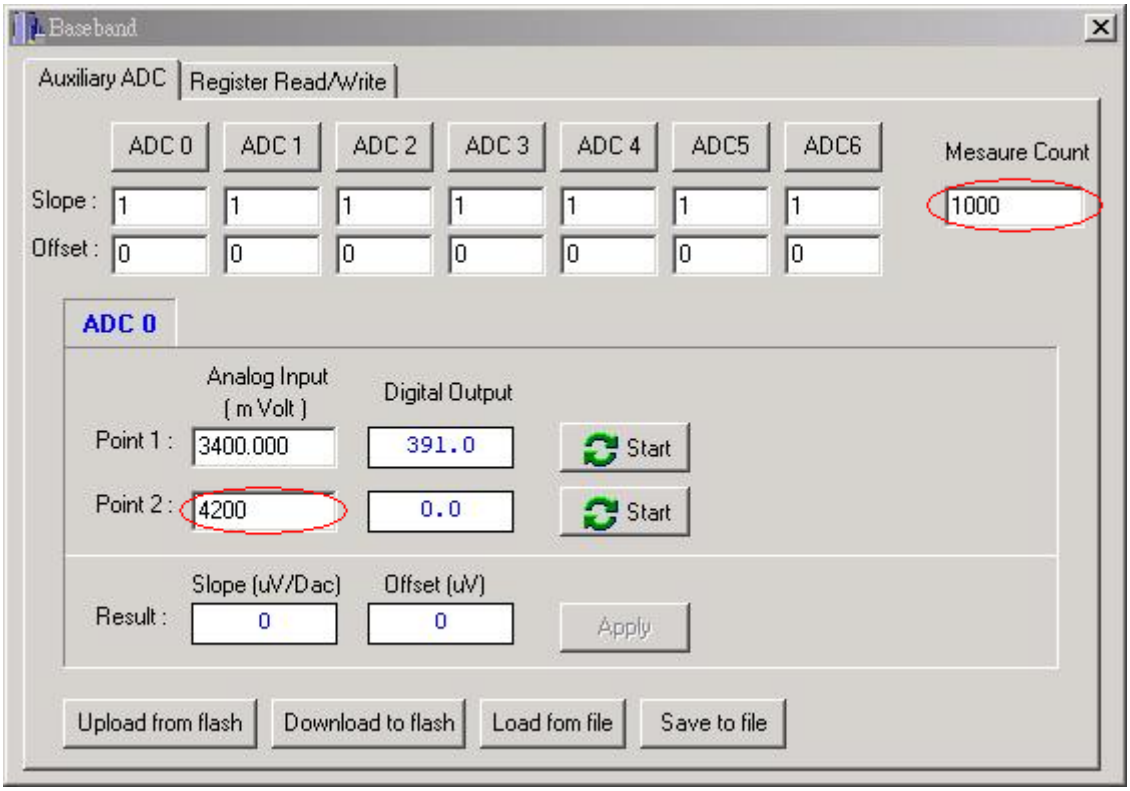

Figure 335 ***Key in the input voltage and measuring count of 2'st measurement***

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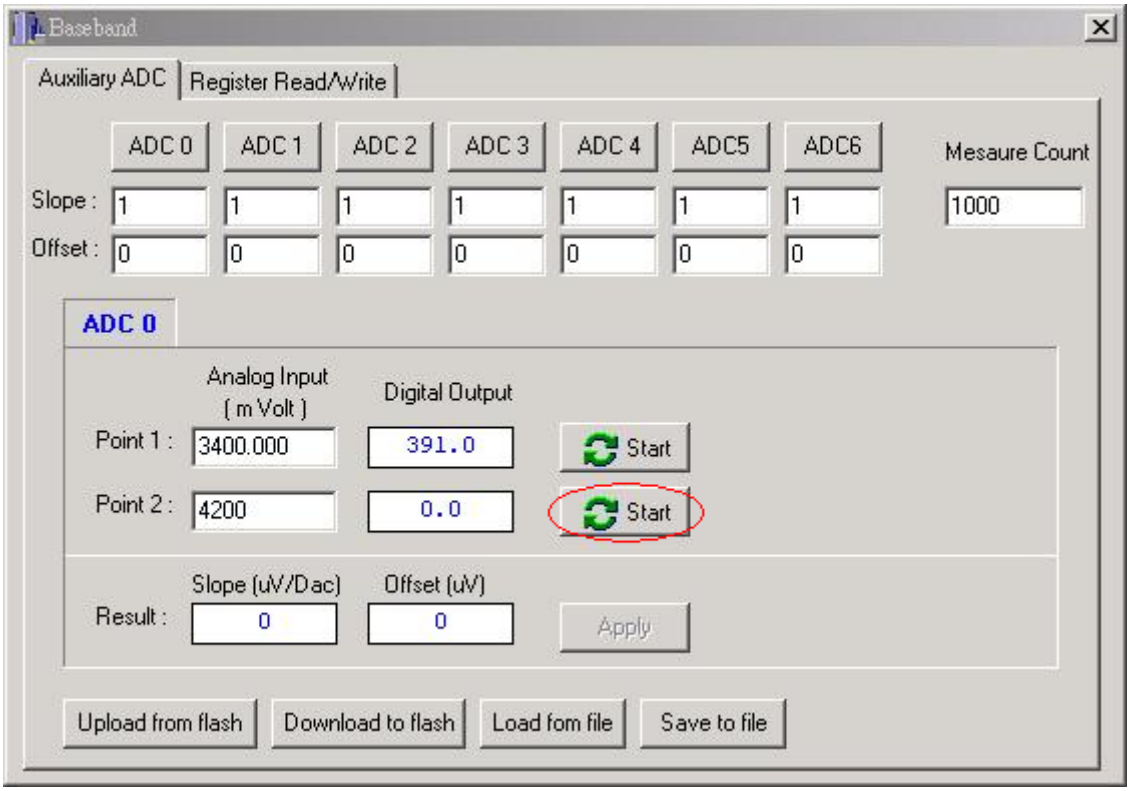

Figure 336 ***Click [Start] button of Point 2 to sample the ADC data***

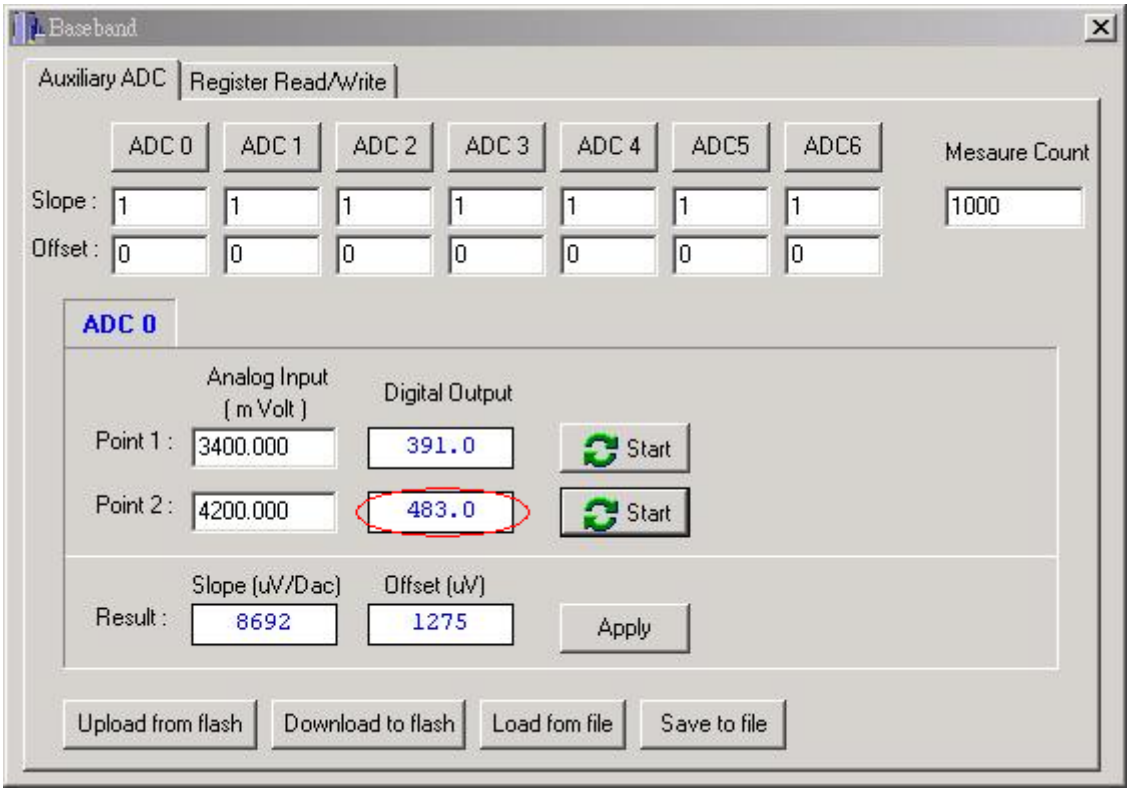

Figure 337 ***Result of 2nd measurement***

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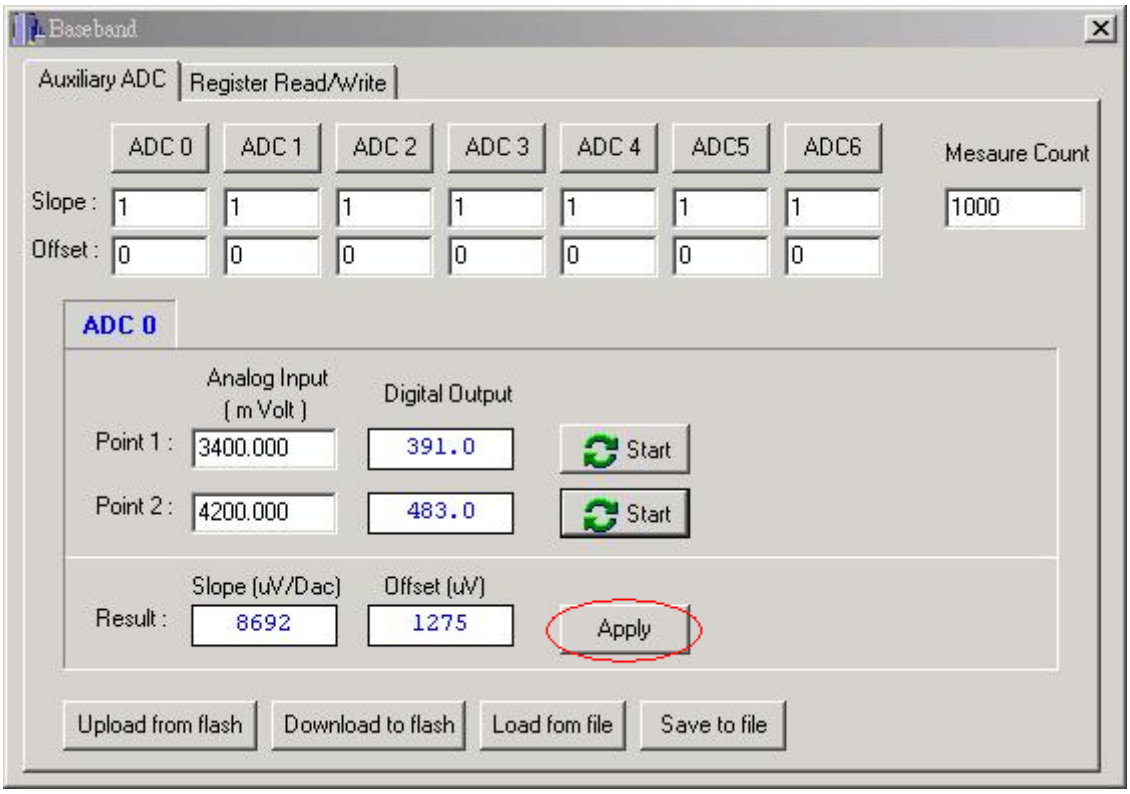

Figure 338 ***Click [Apply] button***

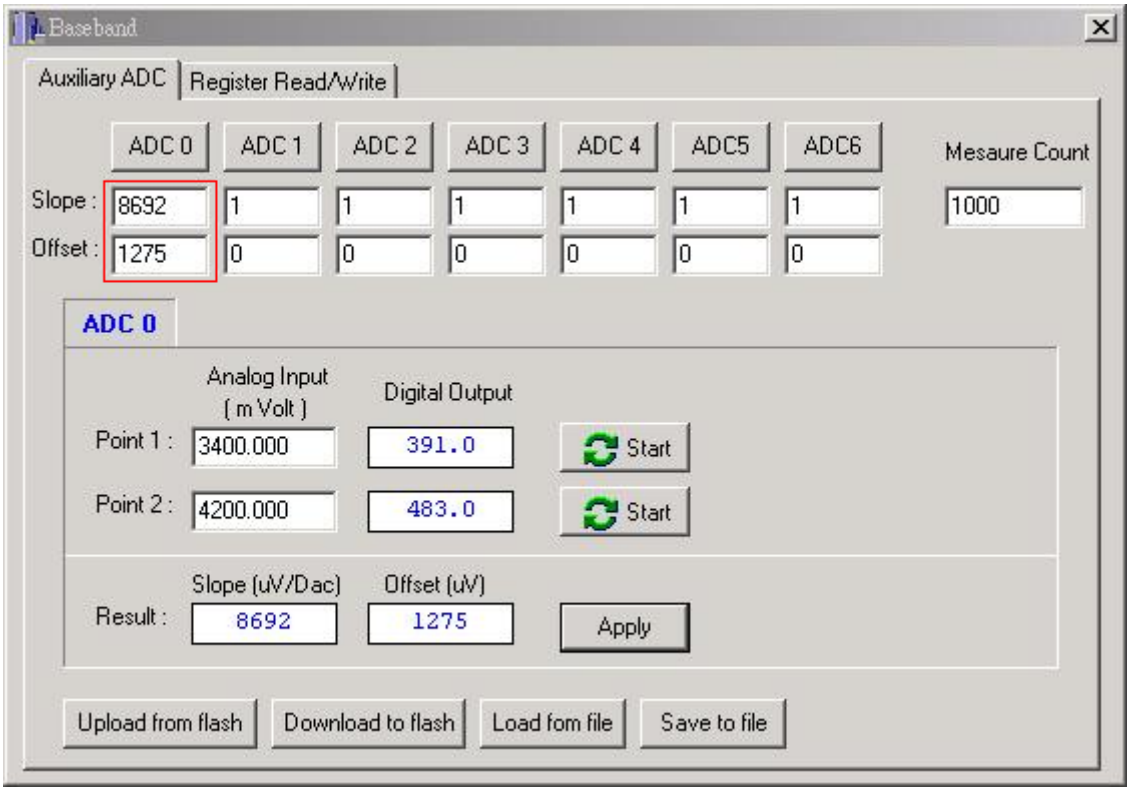

Figure 339 ***Result after Clicking [Apply] button***

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3.9.1.1 Upload and download ADC slope and offset value in flash

User can click [Upload from flash] button to read ADC slope and offset value from flash and click [Download to flash] button to write ADC slope and offset value to flash.

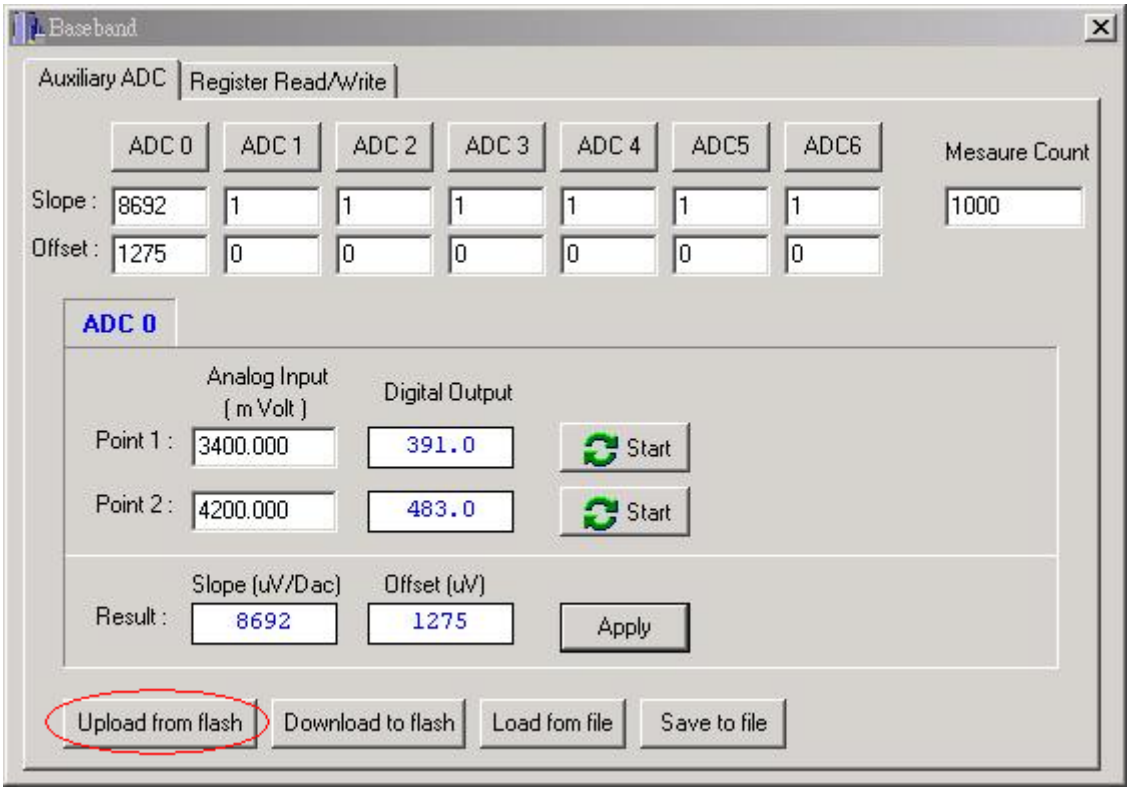

Figure 340 ***Click [Upload from flash] button to read slope and offset from flash***

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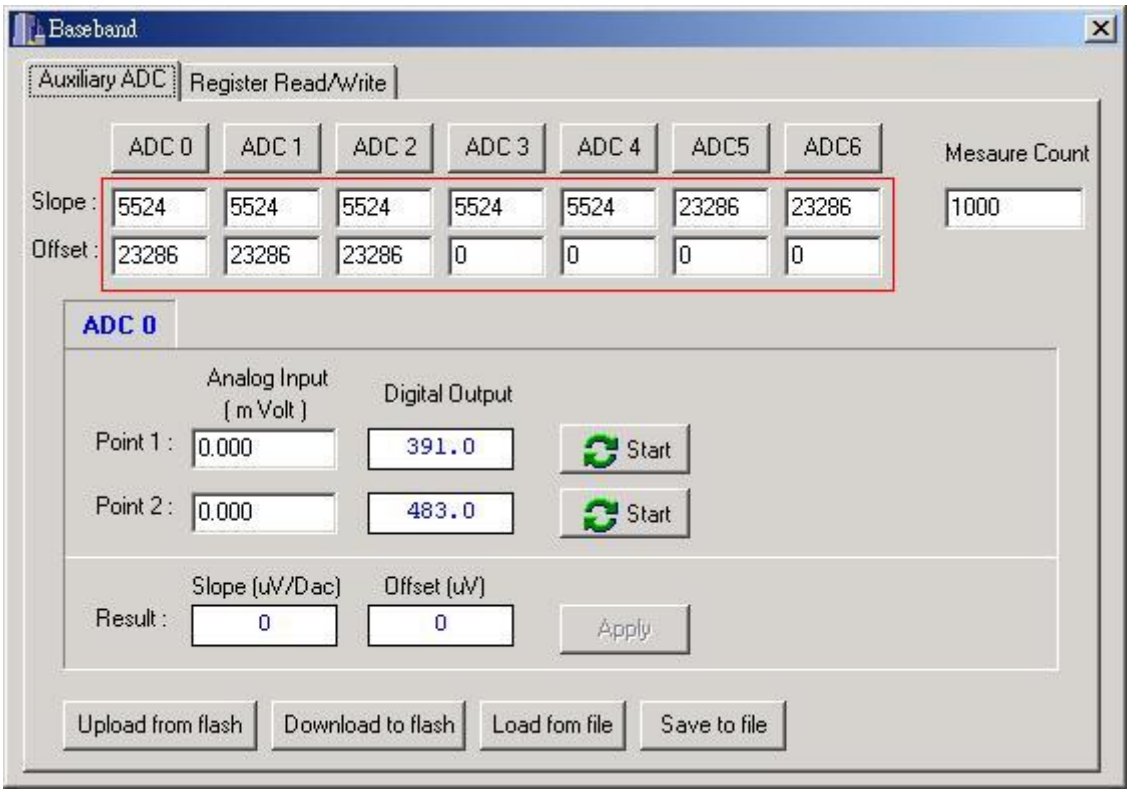

Figure 341 ***Result of auxiliary ADC slope and offset***

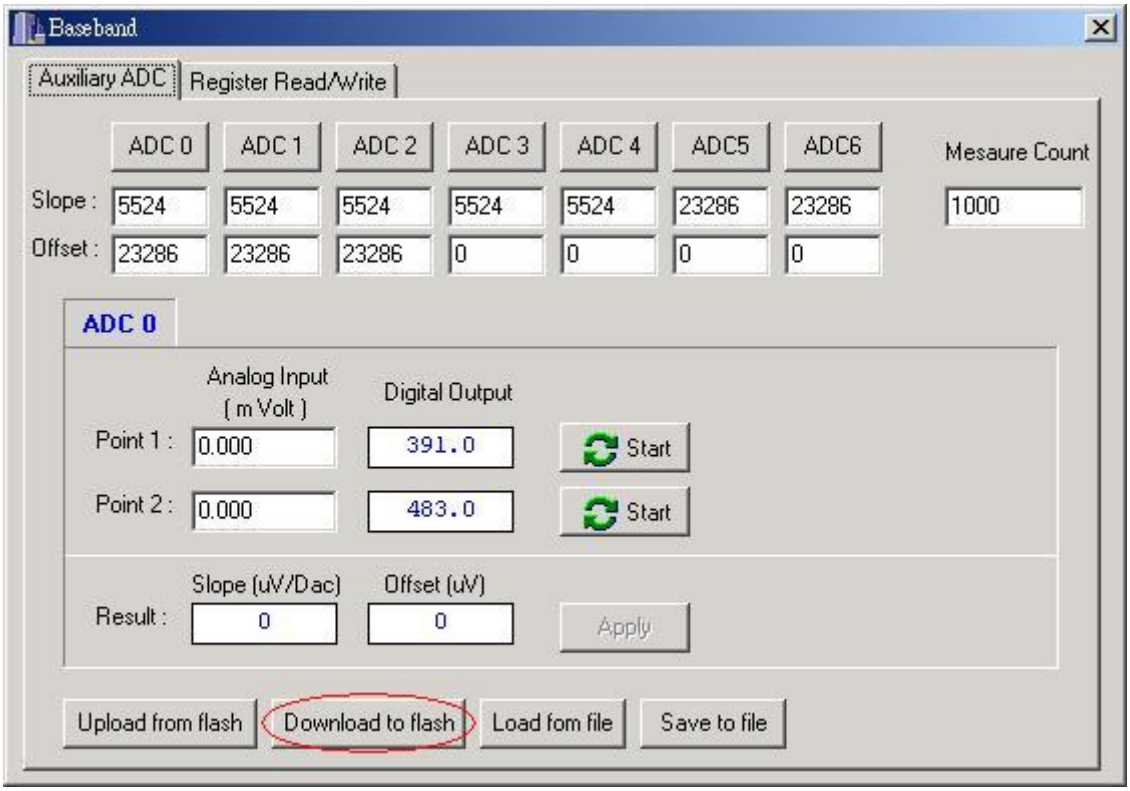

Figure 342 ***Click [Download to flash] button to write slope and offset value to flash***

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3.9.1.2 Read and write ADC slope and offset in file

User can click [Load from file] button to read ADC slope and offset value in file and click [Save to file] button to write ADC slope and offset value to file.

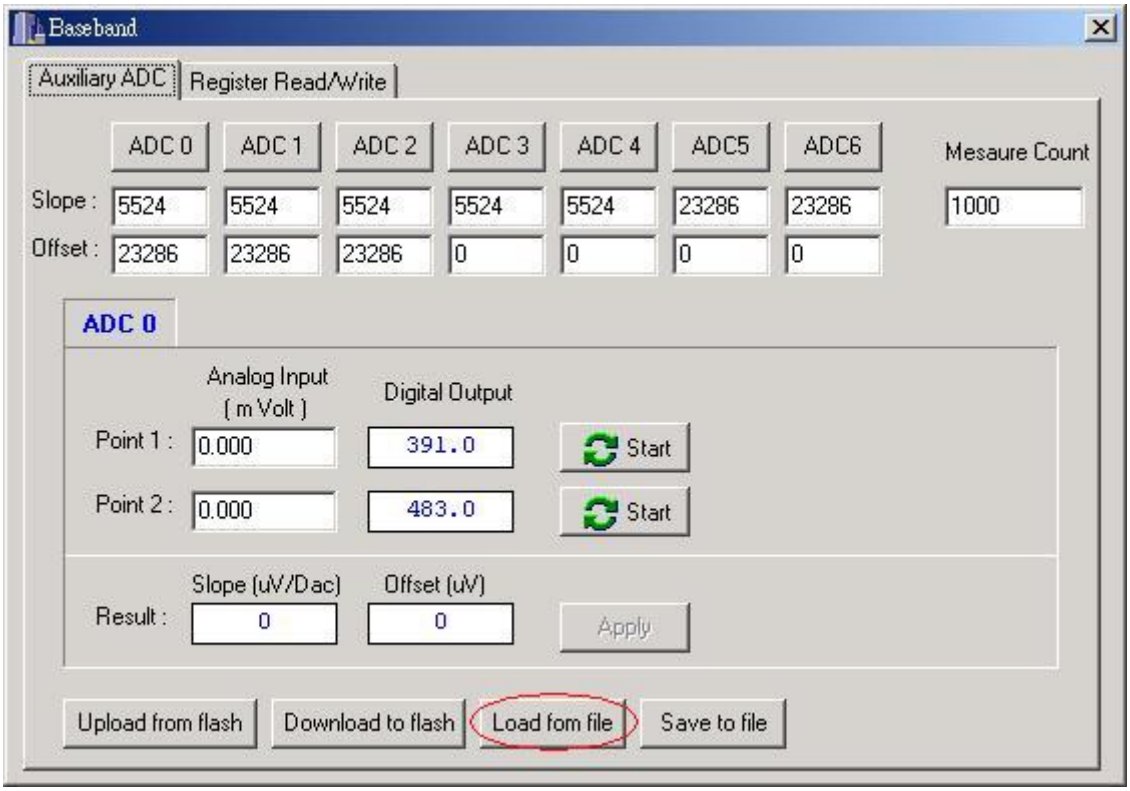

Figure 343 ***Click [Load from file] button to read slope and offset value from file***

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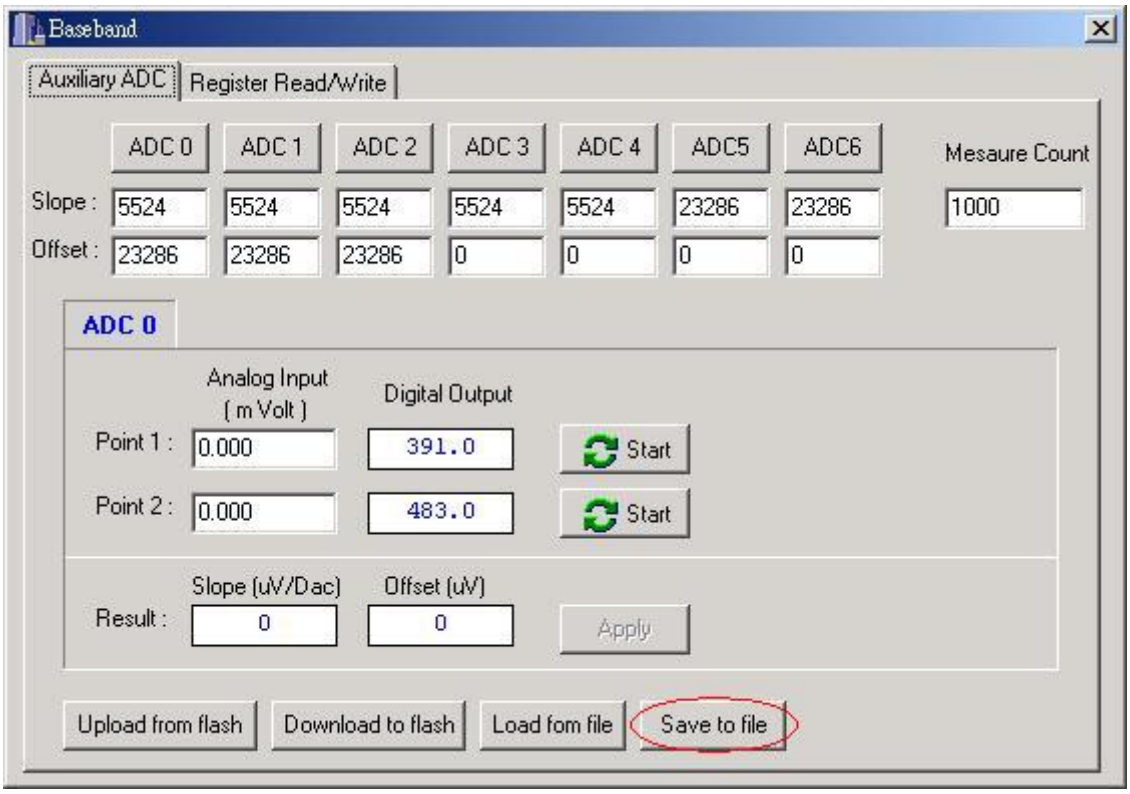

Figure 344 ***Click [Save to file] button to write slope and offset value to file***

The following is a template of auxiliary ADC file. User will get the text file after saving ADC offset and slope to file. Each value must be followed with a comma. Please follow the file format if you want to change the value in file.

[ADC control]
offset=23286,23286,23286,0,0,0,0
slope=5524,5524,5524,5524,5524,23286,23286

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3.9.2 Baseband Register read/write

This operation is used to read or write the register of baseband chip.

User can read register by following steps:
1) Input address of register by hex base.
2) Click [Read] button.
3) Register value is shown on value filed.
4) User can click [Value (Hex)] button to toggle the value base (Hex or Dec).

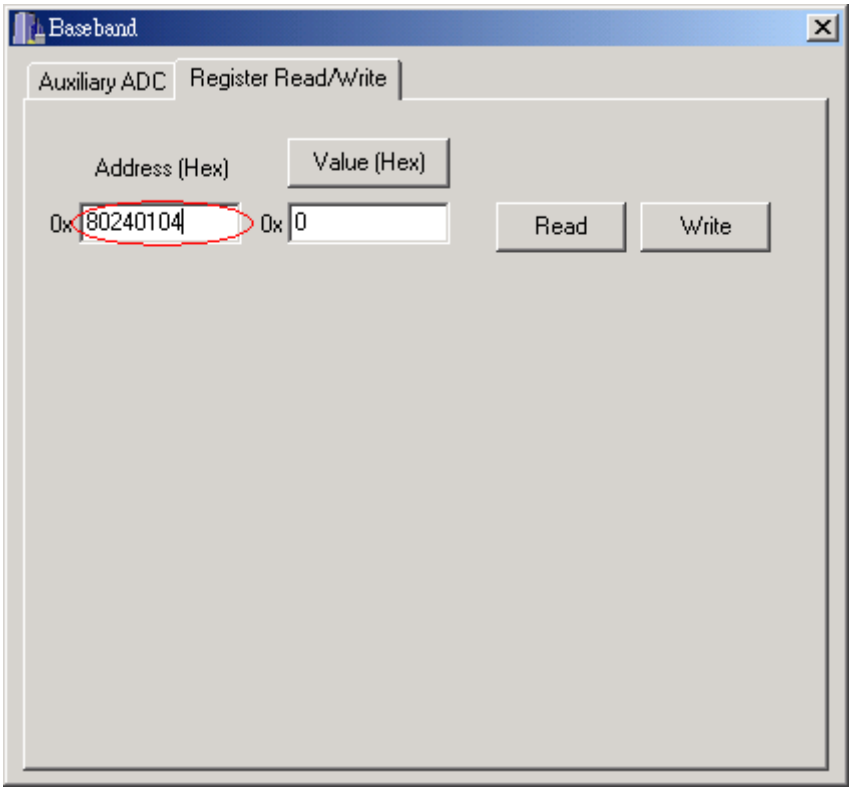

Figure 345 ***Input address of register by hex base***

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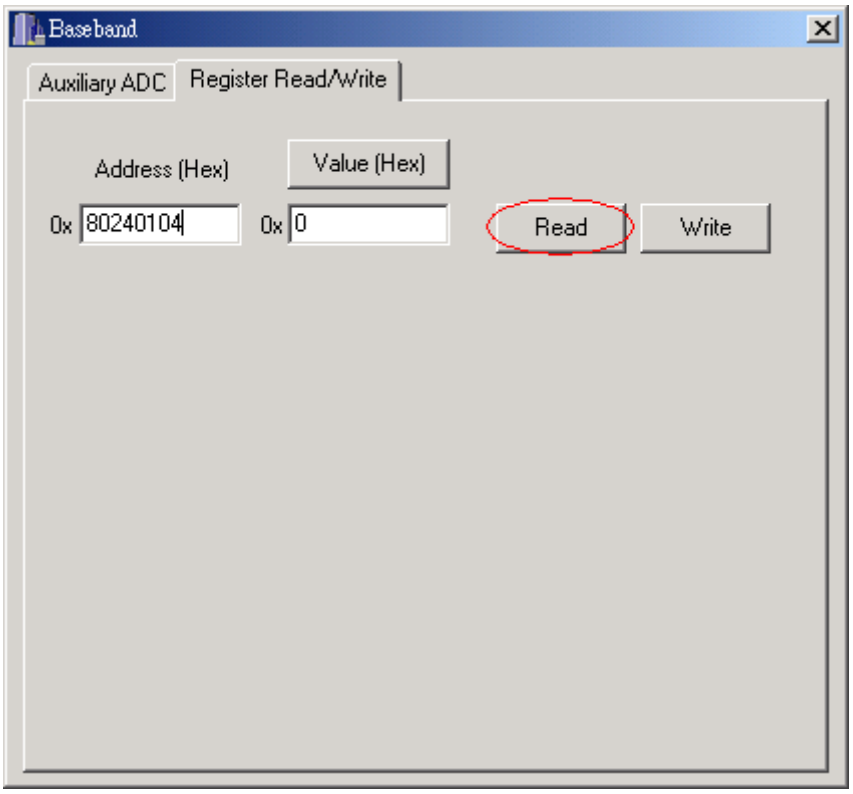

Figure 346 ***Click [Read] button to read value from register***

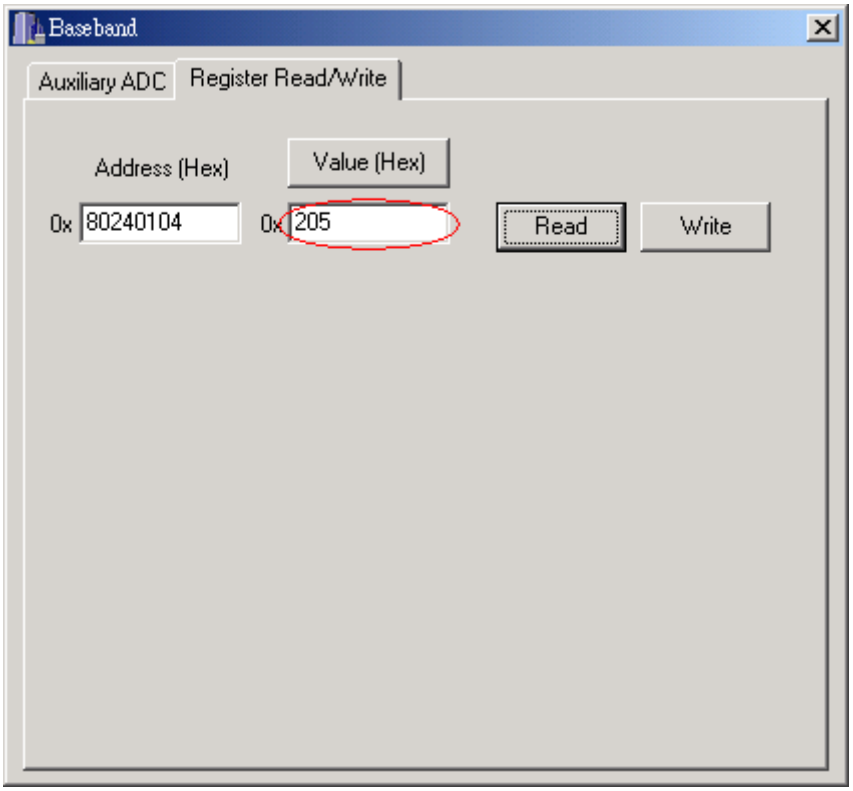

Figure 347 ***Register value is shown on value filed***

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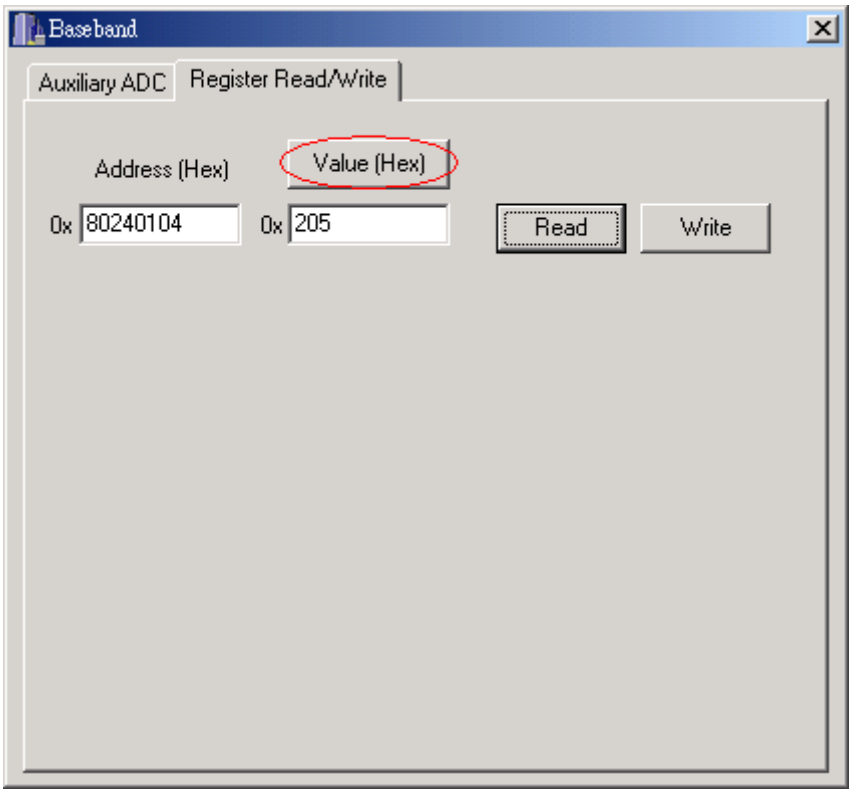

Figure 348 ***click [Value (Hex)] button to toggle the value base to Dec***

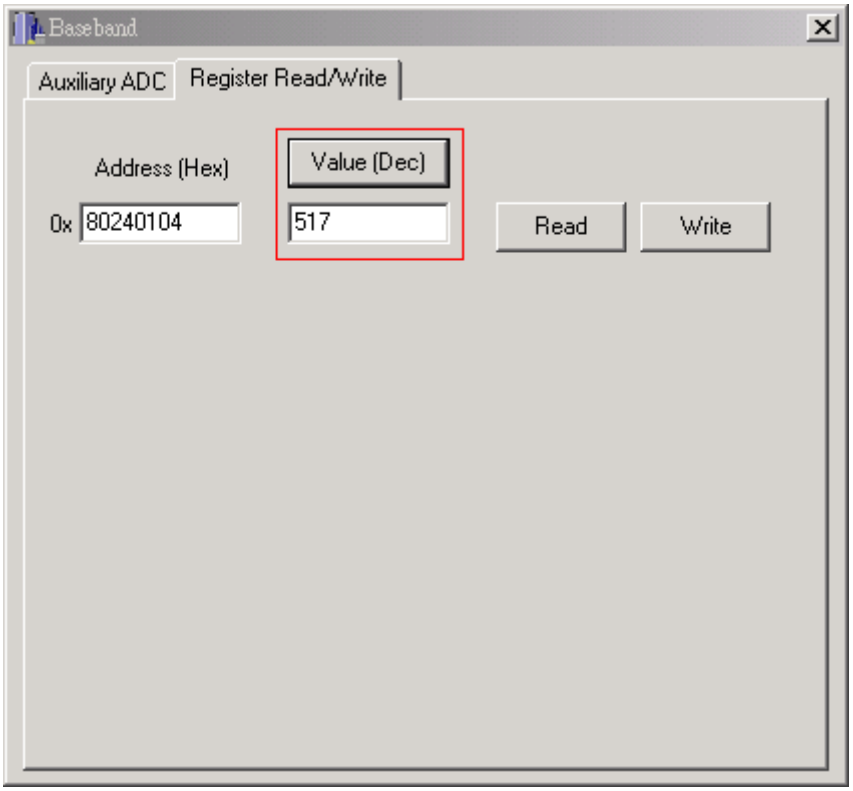

Figure 349 ***Result after toggling the value base to Dec***

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User can write register by following steps:
1) Input address of register by hex base.
2) Input value in the value field (User can click [Value (Hex)] button to toggle the value base (Hex or Dec)).
3) Click [write] button.

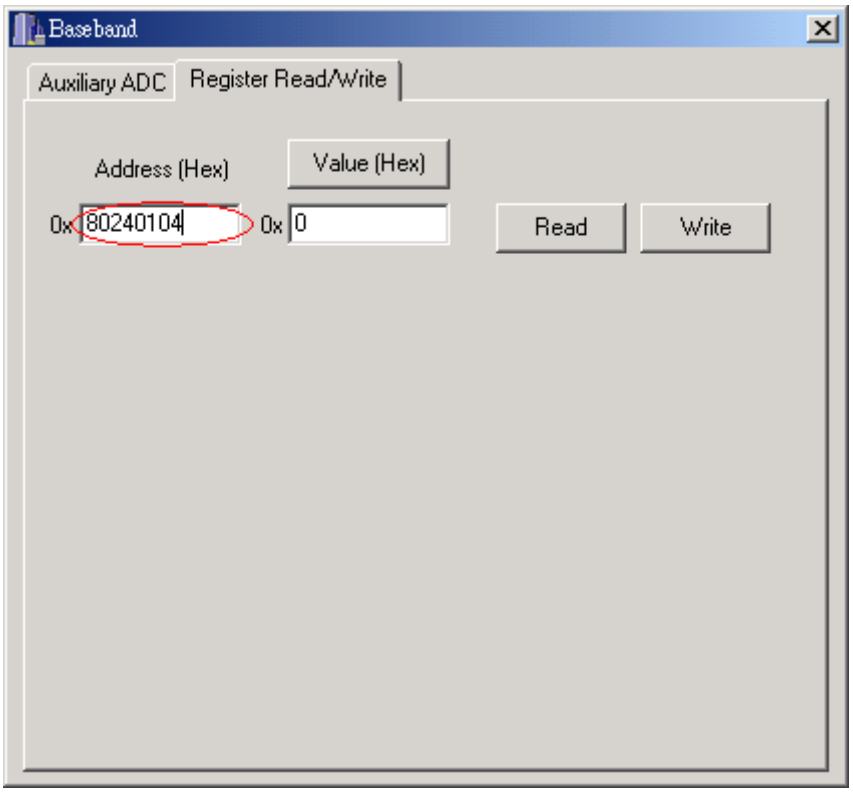

Figure 350 ***Input address of register by hex base***

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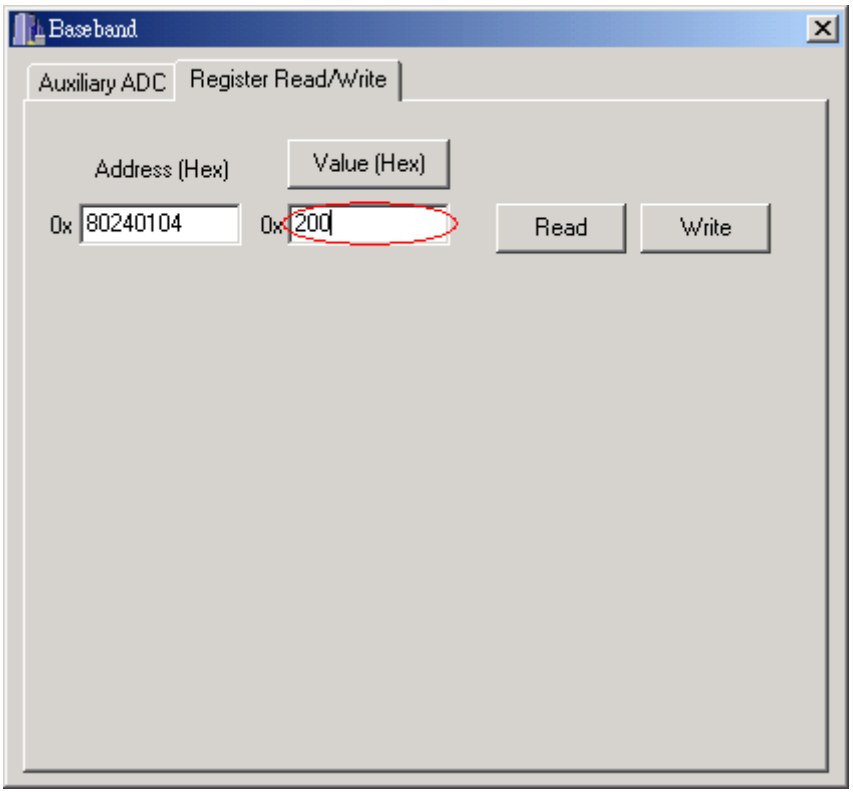

Figure 351 ***Input value in the value field***

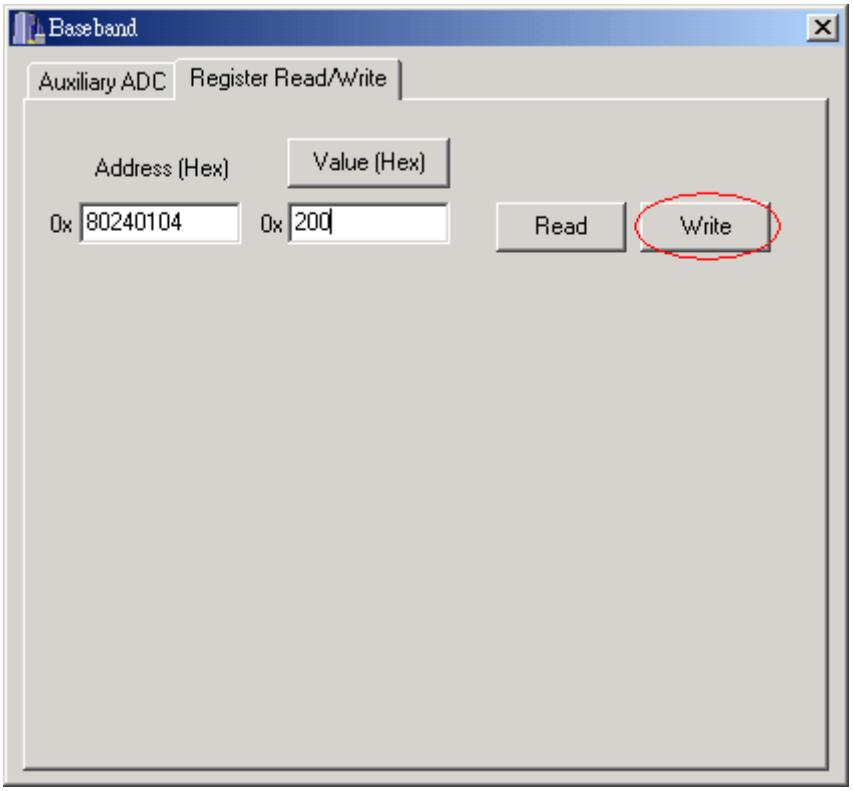

Figure 352 ***Click [write] button to write value to register***

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3.9.3 PMIC Register read/write

This operation is used to read or write the register of PMIC chip.

User can read register by following steps:
1) Input address of register by hex base.
2) Click [Read] button.
3) Register value is shown on value filed.
4) User can click [Value (Hex)] button to toggle the value base (Hex or Dec).

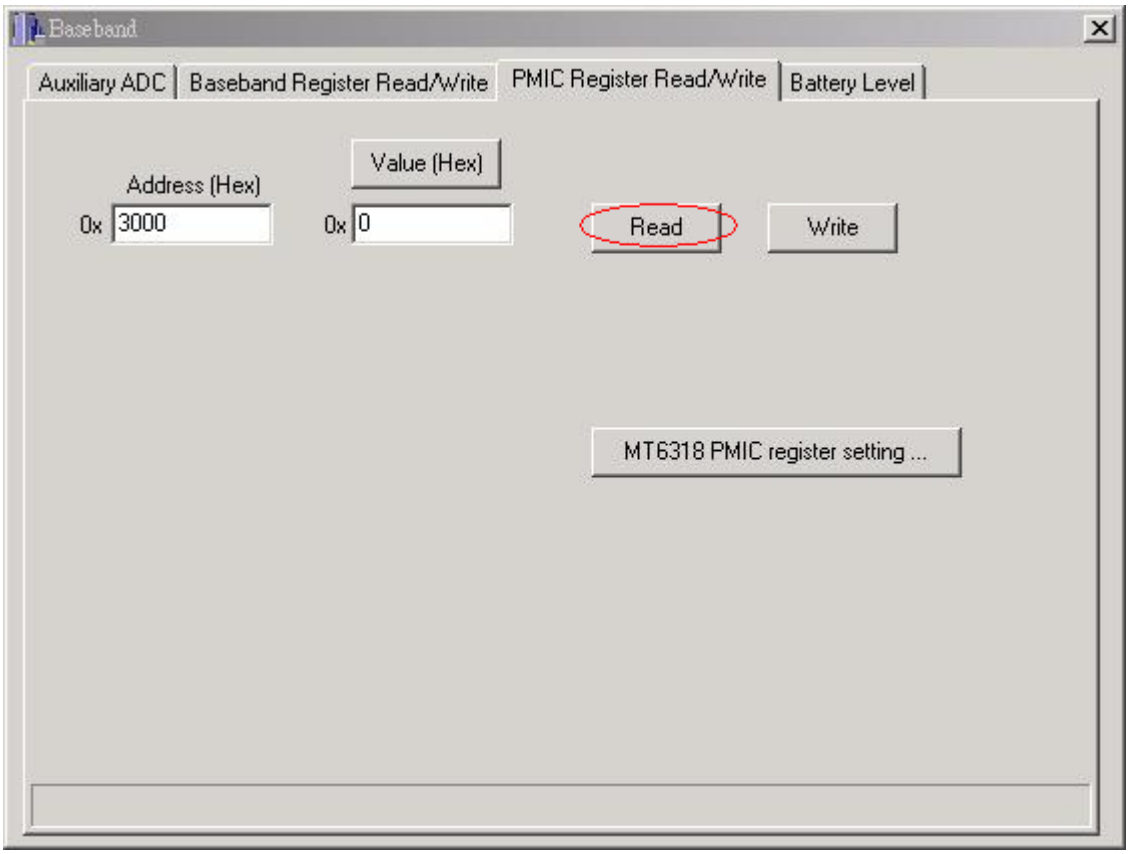

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Figure 353 ***Register value is shown on value filed***

User can write register by following steps:
1) Input address of register by hex base.
2) Input value in the value field (User can click [Value (Hex)] button to toggle the value base (Hex or Dec)).
3) Click [write] button.

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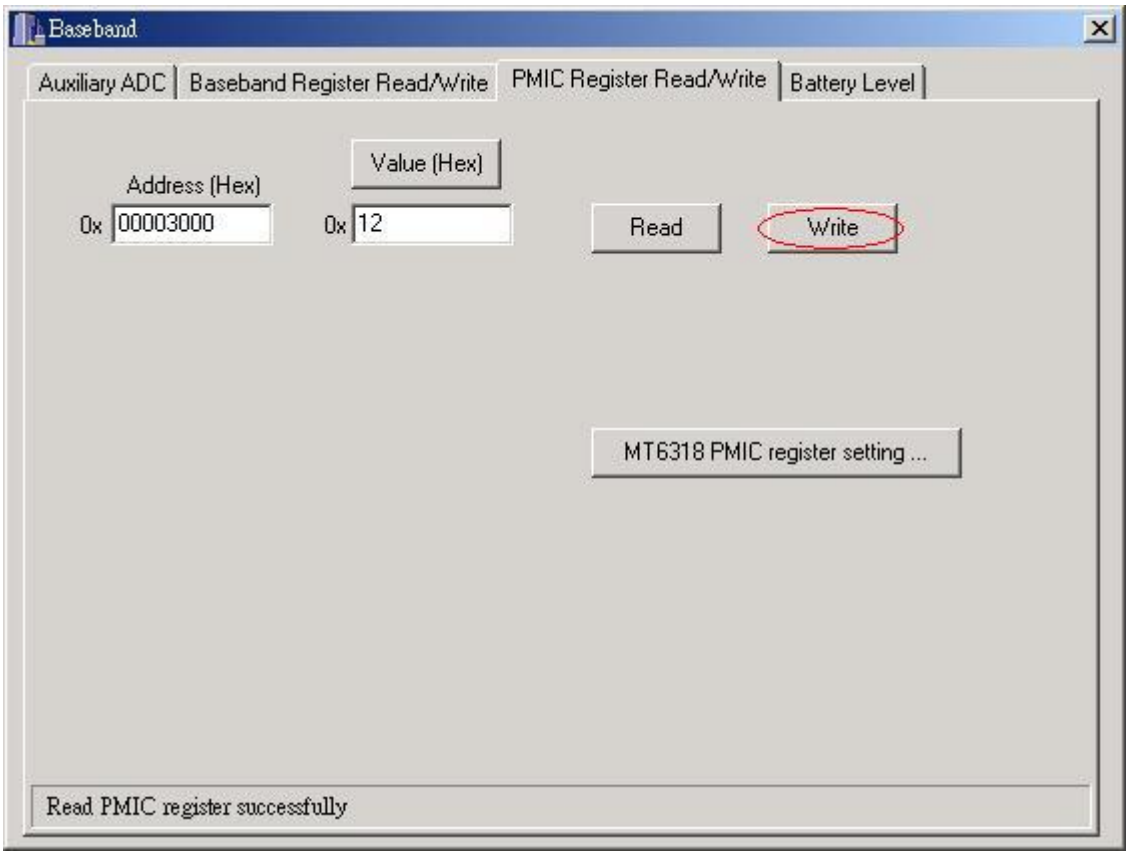

Figure 354 ***Click [write] button to write value to register***

User can click [MT6318 PMIC register setting…] to display MT6318 PMIC register setting window.

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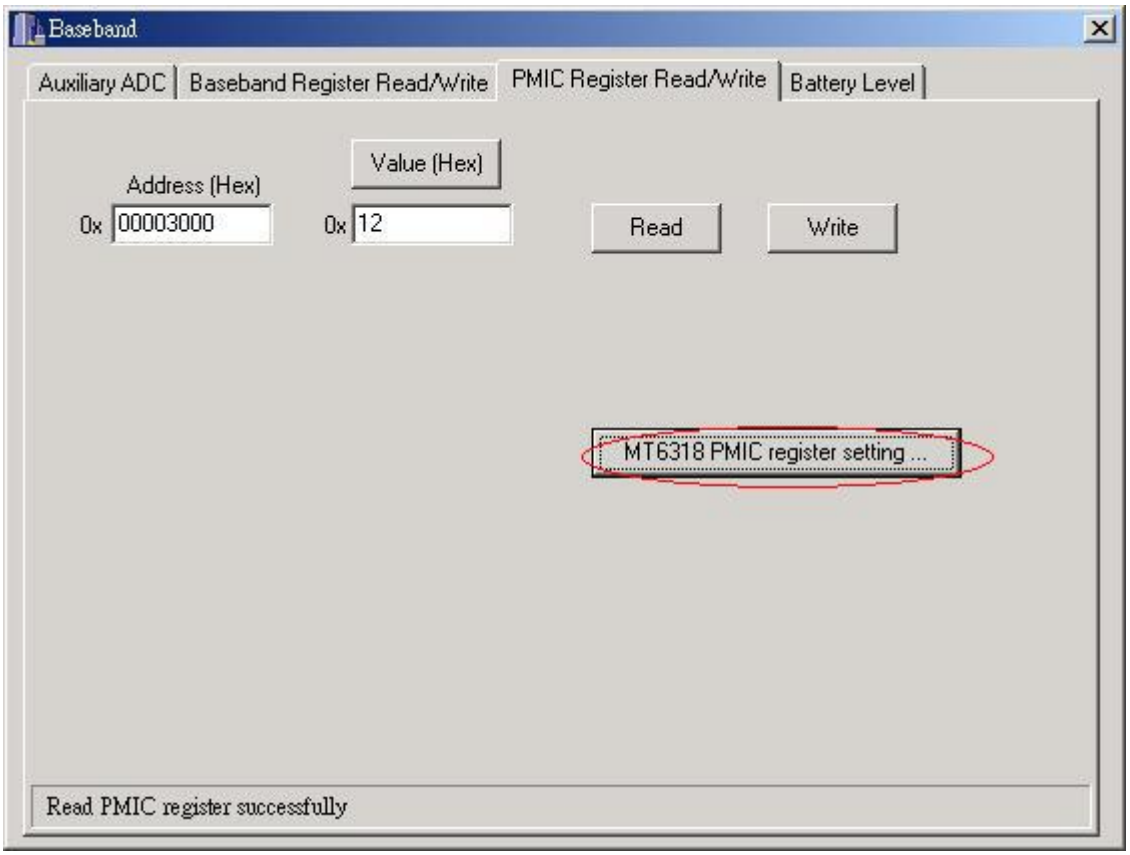

Figure 355 ***Click [MT6318 PMIC register setting…] button***

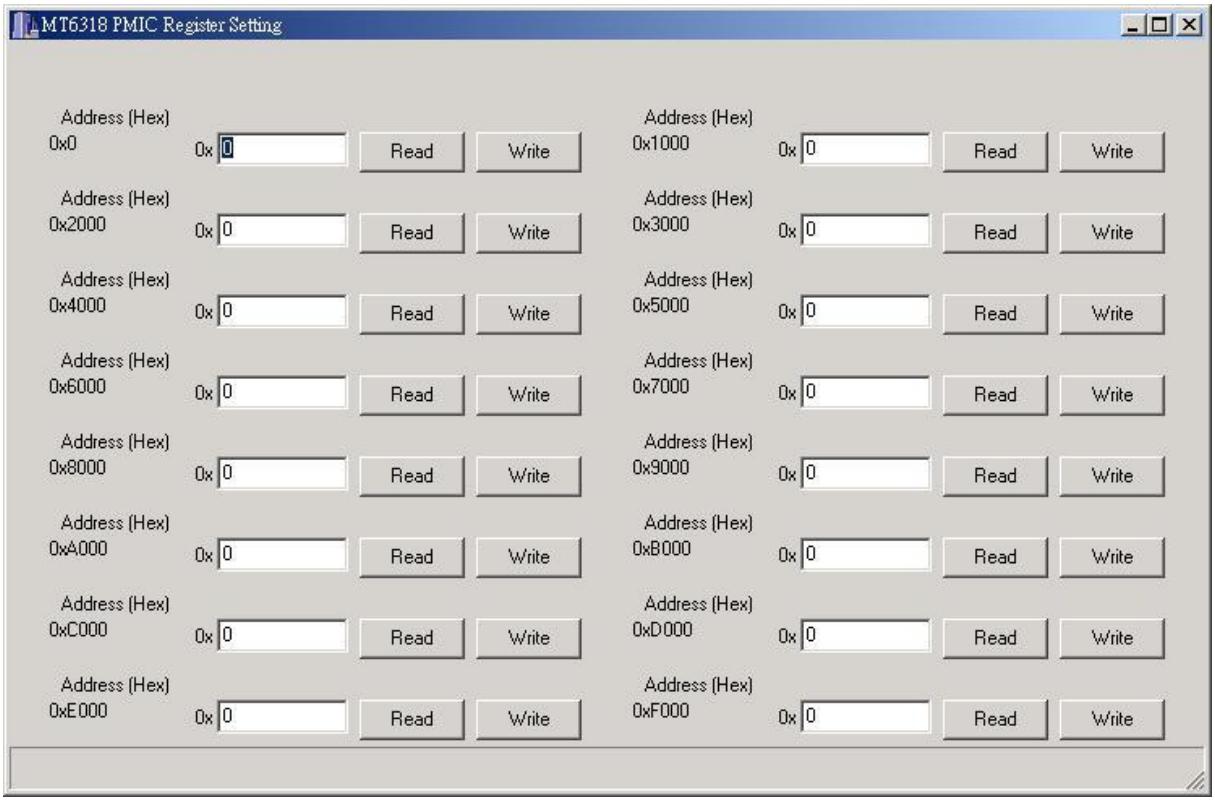

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Figure 356 ***MT6318 PMIC register setting window***

3.9.4 Battery level editor

User can use battery level window to set voltage of each battery level. There are 4 battery level can be adjusted. They are battery level 0, 1, 2 and 3. Shutdown, no MO call and low battery warning are all belong to battery level 0 .

3.9.4.1 Upload and download voltage setting of each battery level in flash

User can click [Upload from flash] button to read voltage setting of each battery level from flash and click [Download to flash] button to write voltage setting of each battery level to flash.

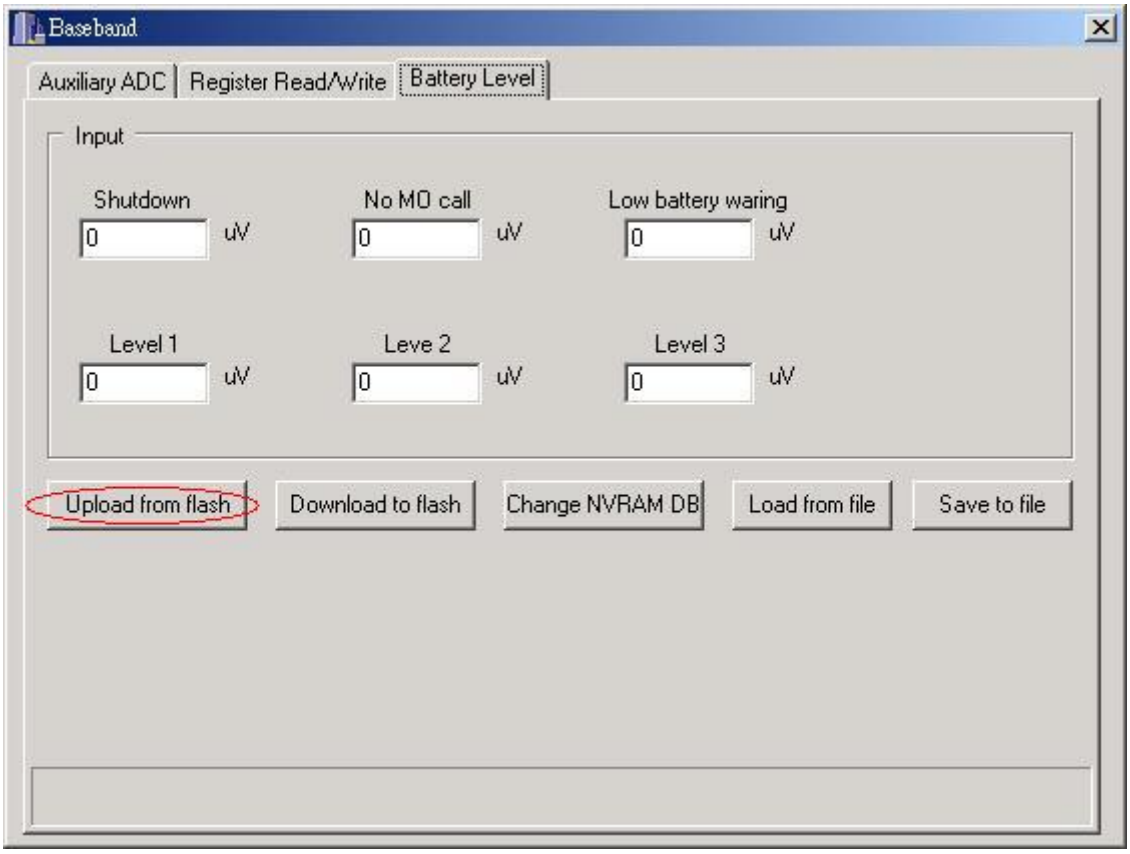

Figure 357 ***Click [Upload from flash] button to read voltage setting of each battery level from flash***

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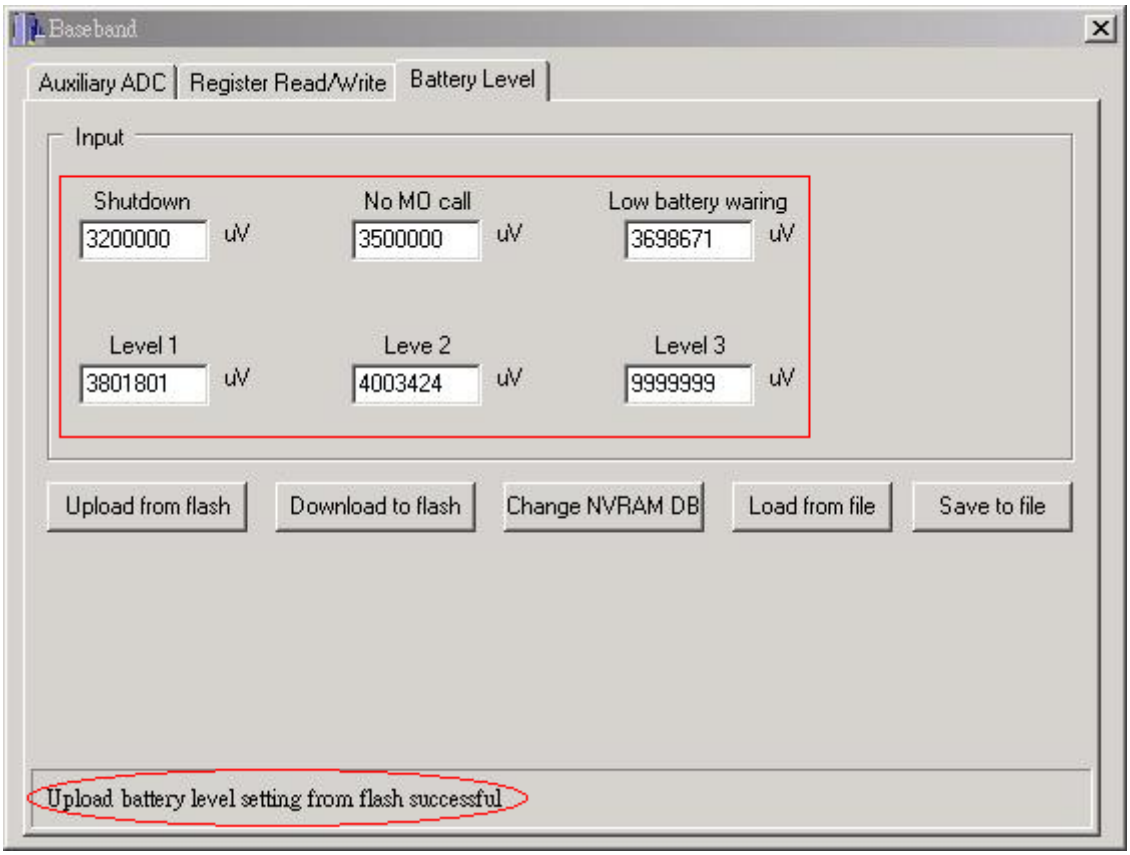

Figure 358 ***Result of voltage setting of each battery level***

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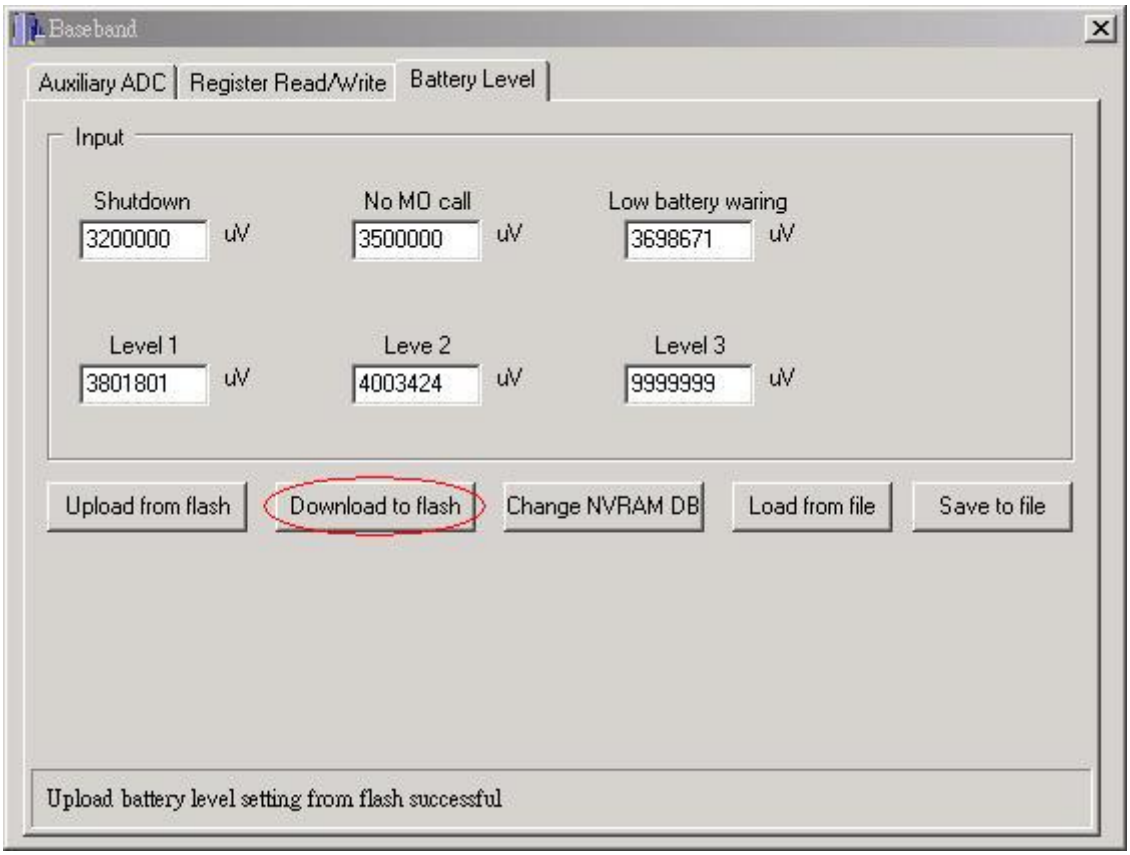

Figure 359 ***Click [Download to flash] button to write voltage setting of each battery level to flash***

If User wants to change NVRAM database file, he can click [Change NVRAM DB] button.

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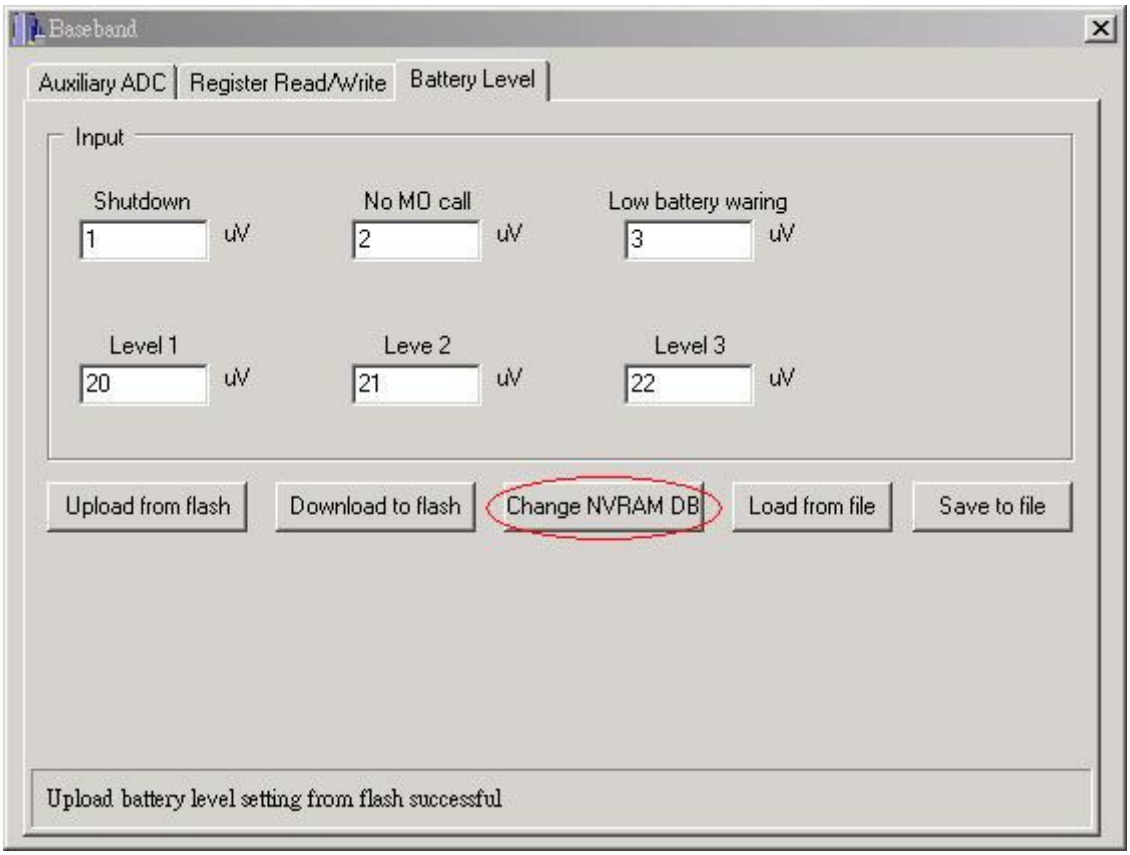

Figure 360 ***Click [Change NVRAM DB] button to change NVRAM database file***

3.9.4.2 Read and write voltage setting of each battery level in file

User can click [Load from file] button to read voltage setting of each battery level in file and click [Save to file] button to write voltage setting of each battery level to file.

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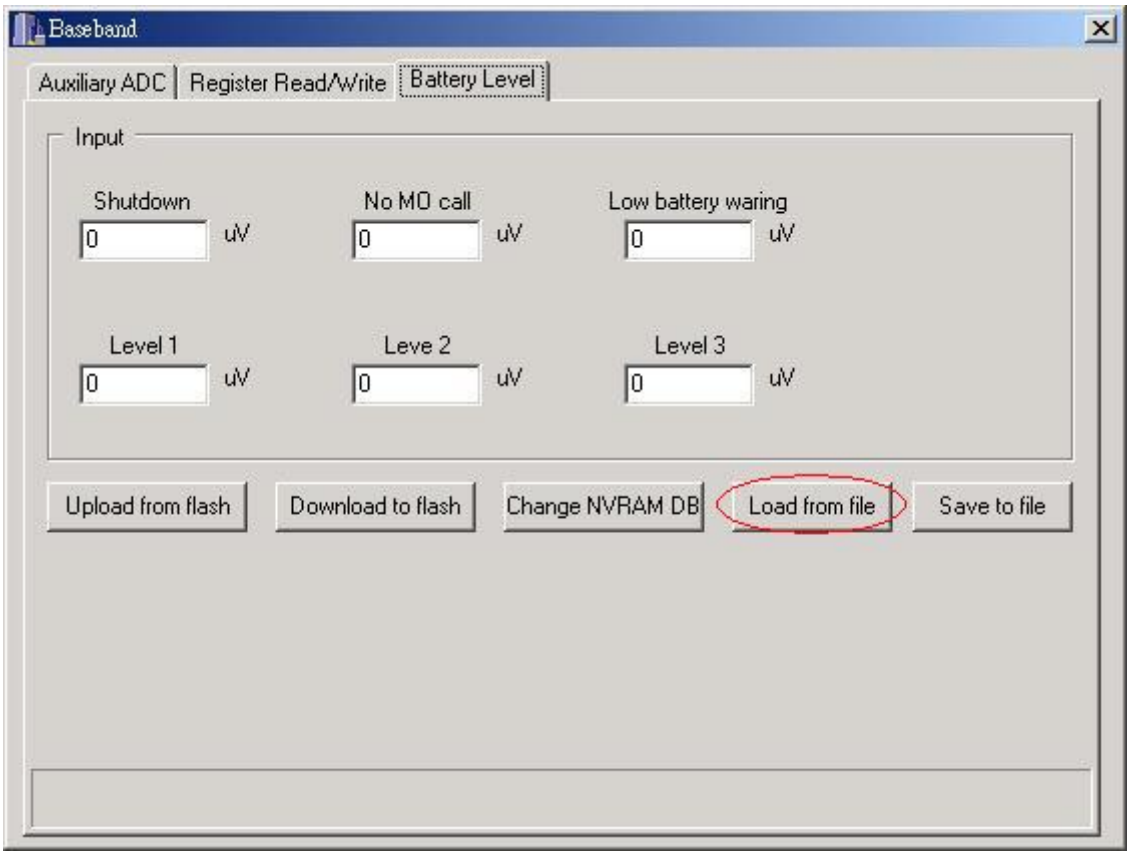

Figure 361 ***Click [Load from file] button to read voltage setting of each battery level from file***

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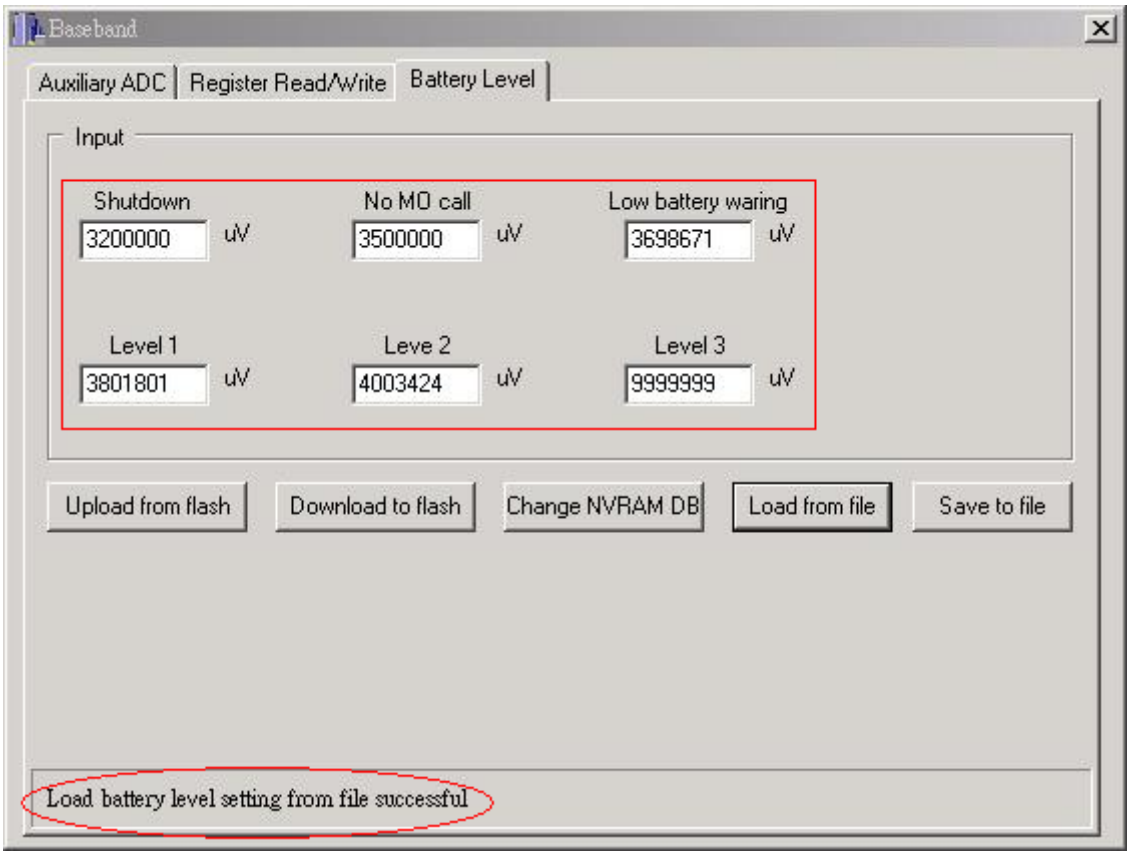

Figure 362 ***Result of voltage setting of each battery level***

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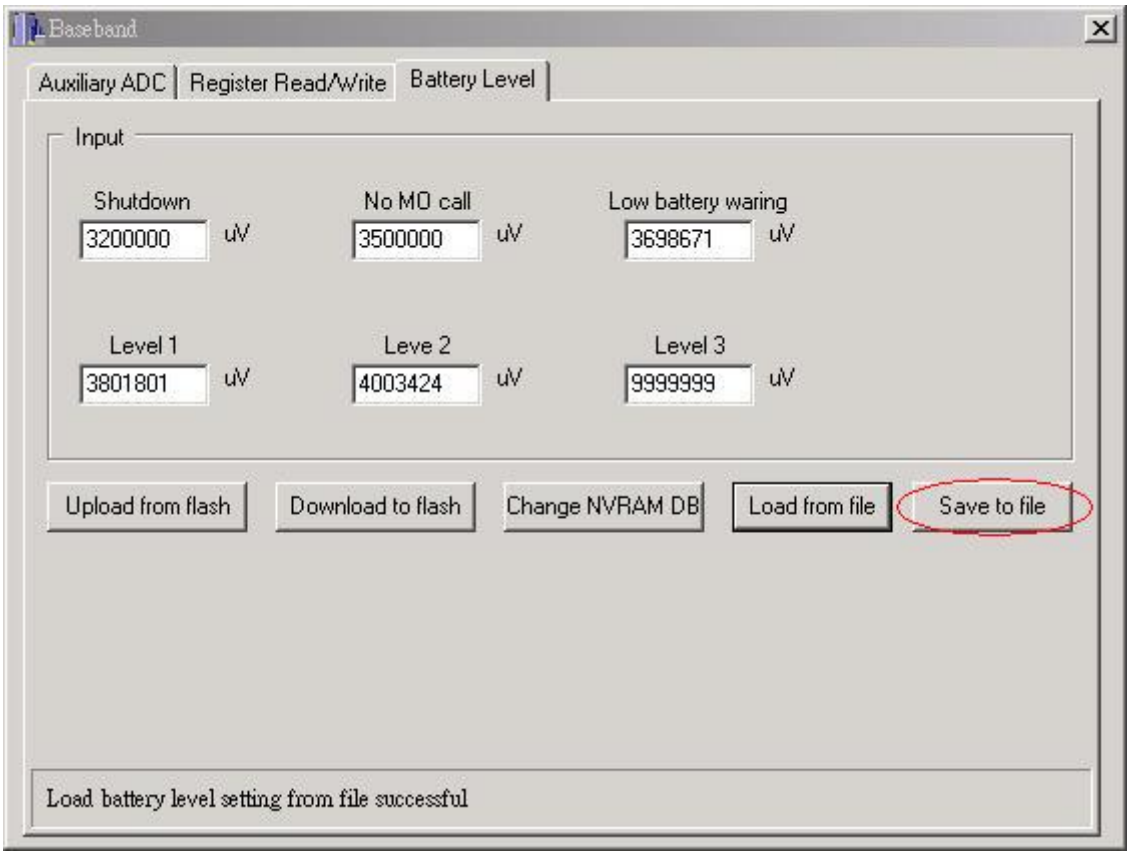

Figure 363 ***Click [Save to file] button to save voltage setting of each battery level***

The following is a template file of voltage setting of each battery level. User will get the text file after saving voltage setting of each battery level to file.

[Battery level]
Shutdown voltage=3200000
No MO call voltage=3500000
Low battery warning voltage=3698671
Level 1 votage=3801801
Level 2 votage=4003424
Level 3 votage=9999999

3.9.5 LED backlight level setting

User can use LED page of babeband tool to set LED backlight level. The range of LED backlight level is 0~5 Level 0 stands to turn off LED. Level 5 stands maximum bright level.

User can set LED backlight level by following steps:
1) Input LED bright level.
2) Click [Set] button.

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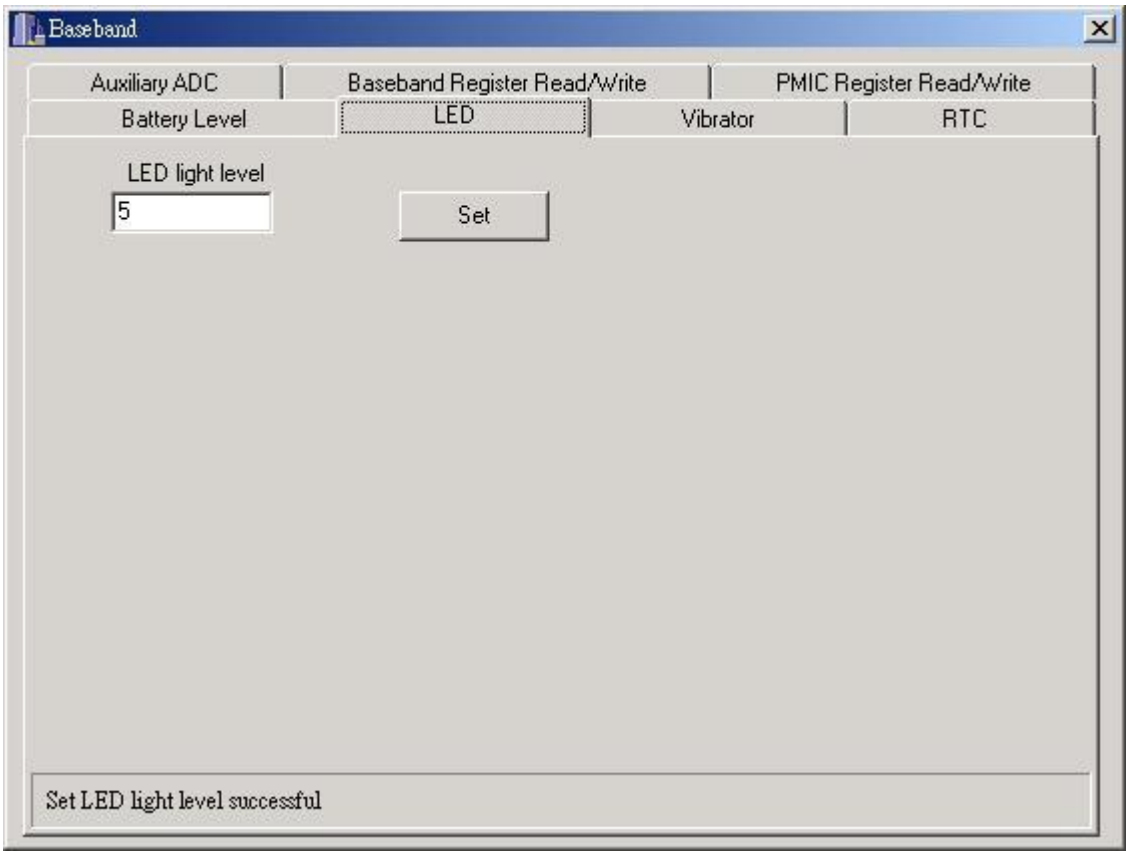

Figure 364 ***LED backlight level setting***

3.9.6 Vibrator on/off

User can use vibrator page of baseband tool to turn on/off vibrator.

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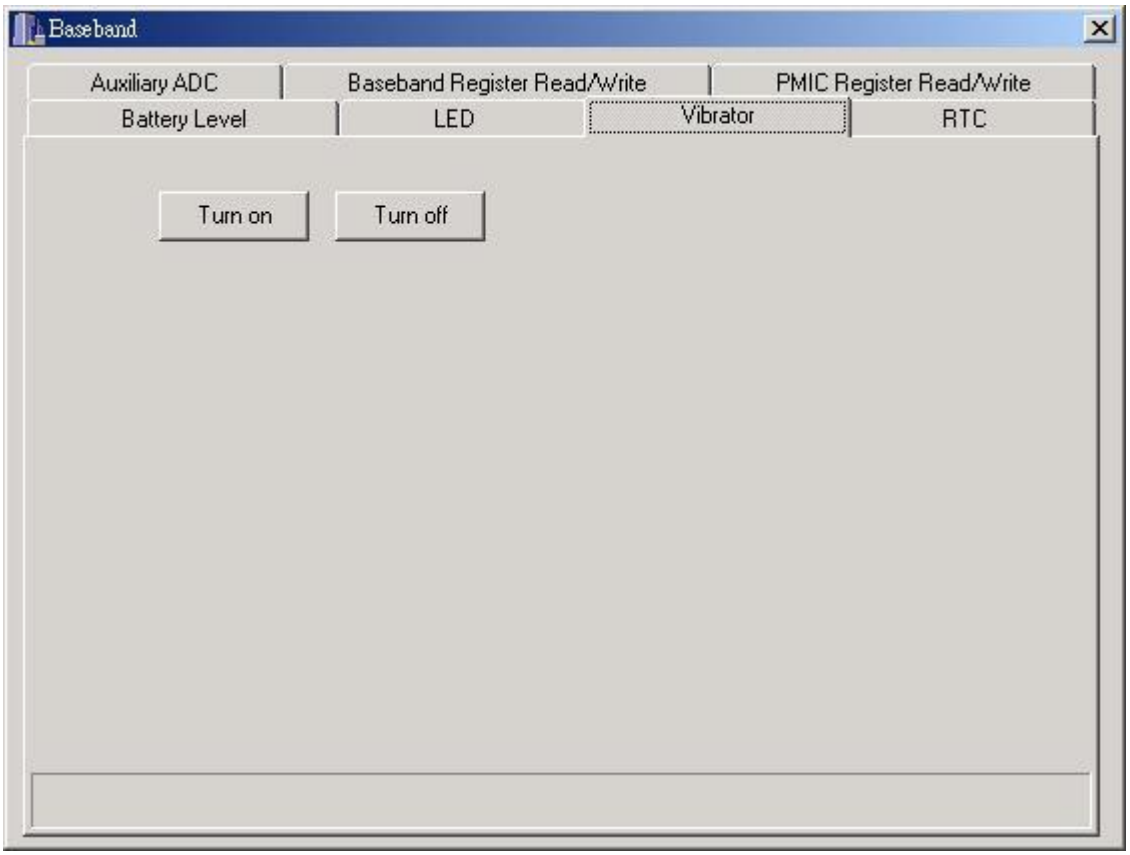

Figure 365 ***Vibrator on/off***

3.9.7 RTC time query

User can RTC page of baseband tool to query RTC time.

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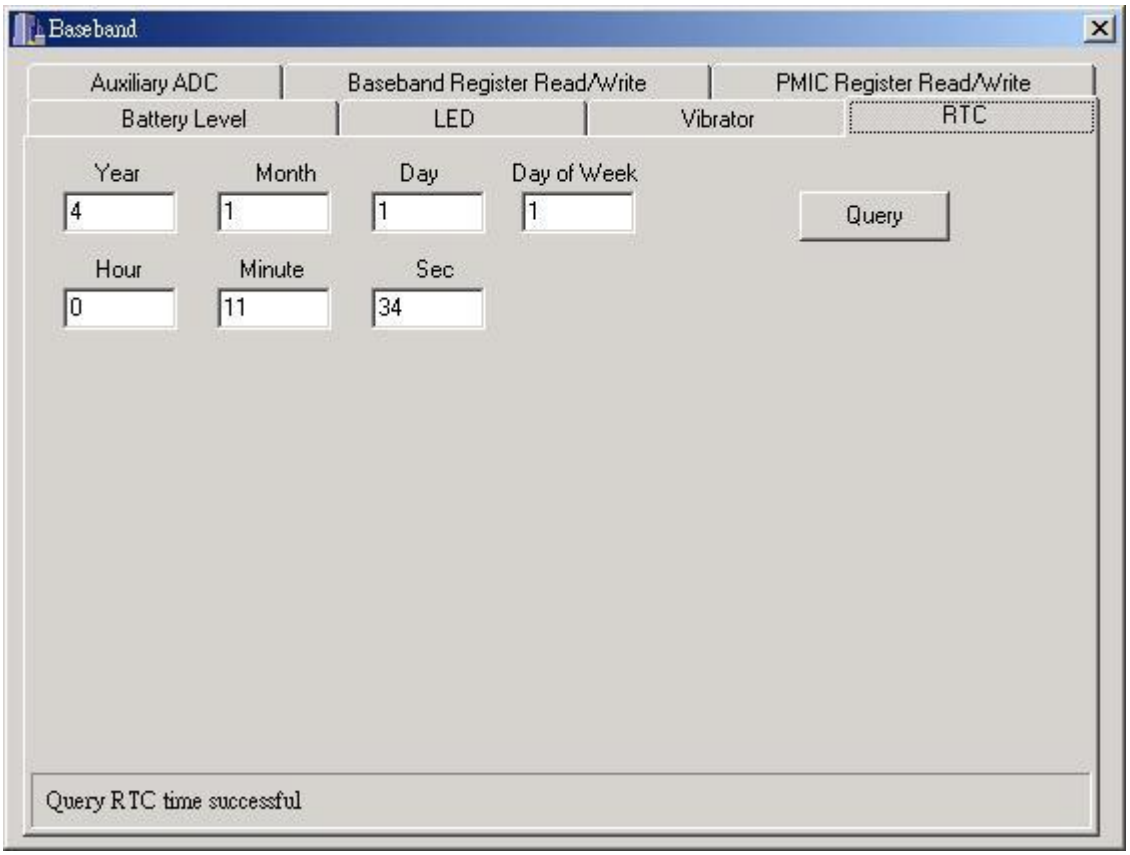

Figure 366 ***RTC time query***

3.10 MMI Data Download

User can use MMI data download window to download full screen, associate, EMS, midi and iMelody files to FAT. User can switch to MMI data download window by selecting [MMI data download] from main selection menu.

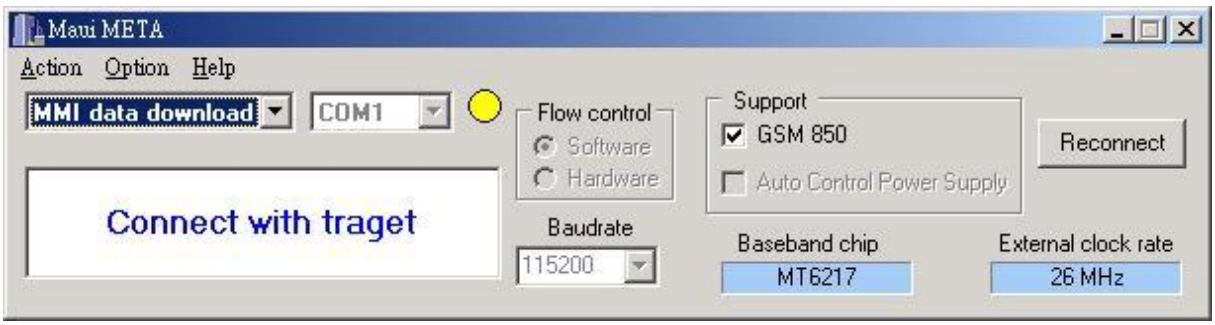

Figure 367 ***Select [MMI data download] from main selection menu***

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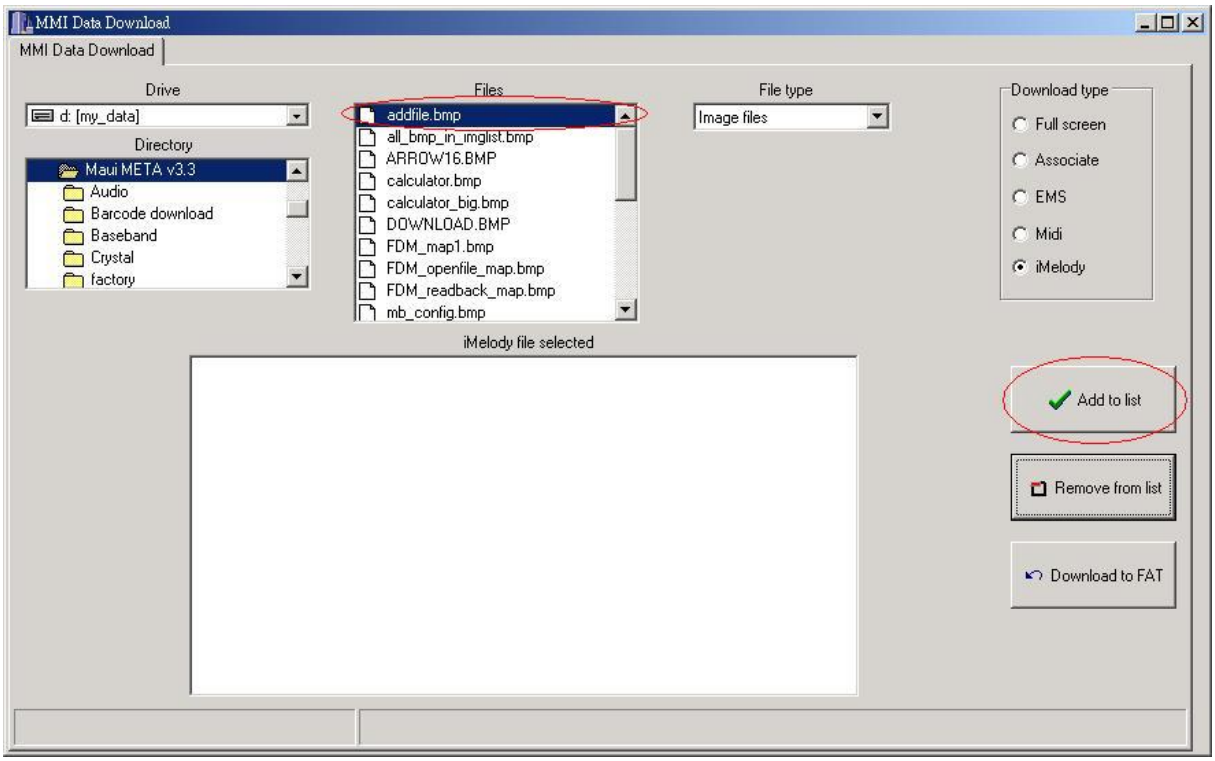

Figure 368 ***Choose file and then click [Add to list] button to add file to file selected list***

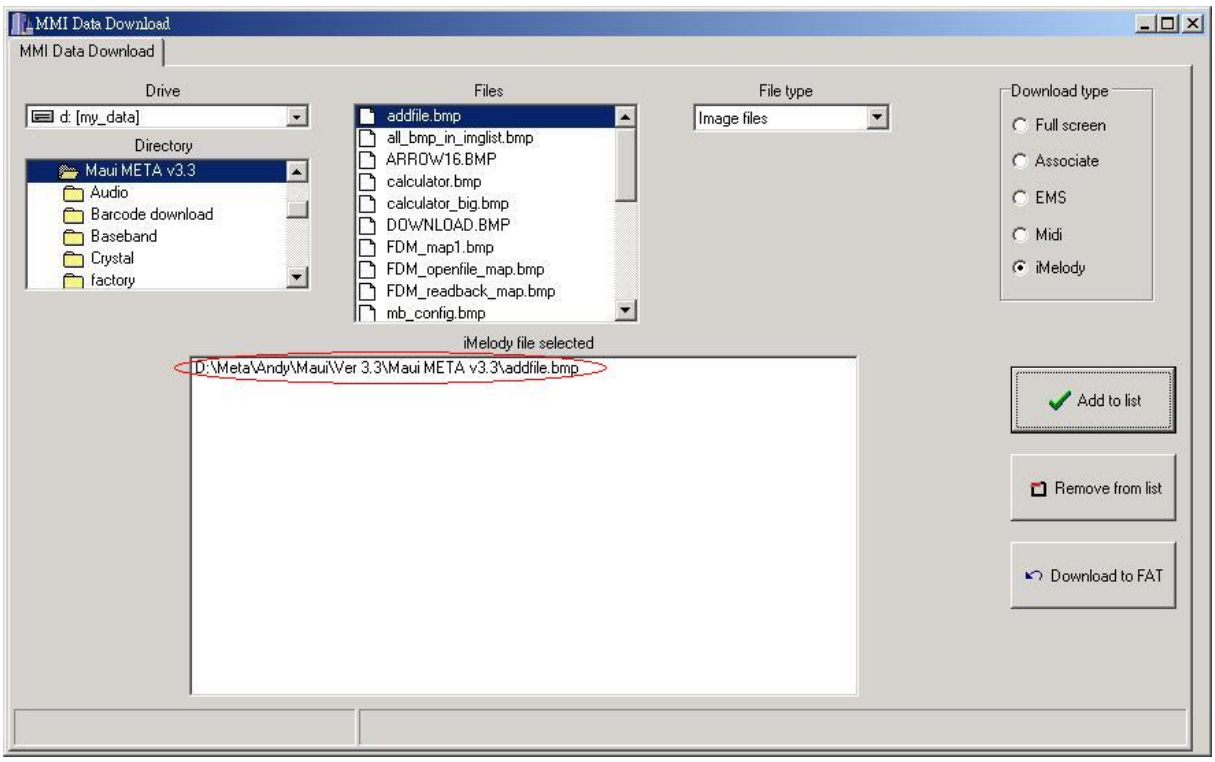

Figure 369 ***Result of adding file to list***

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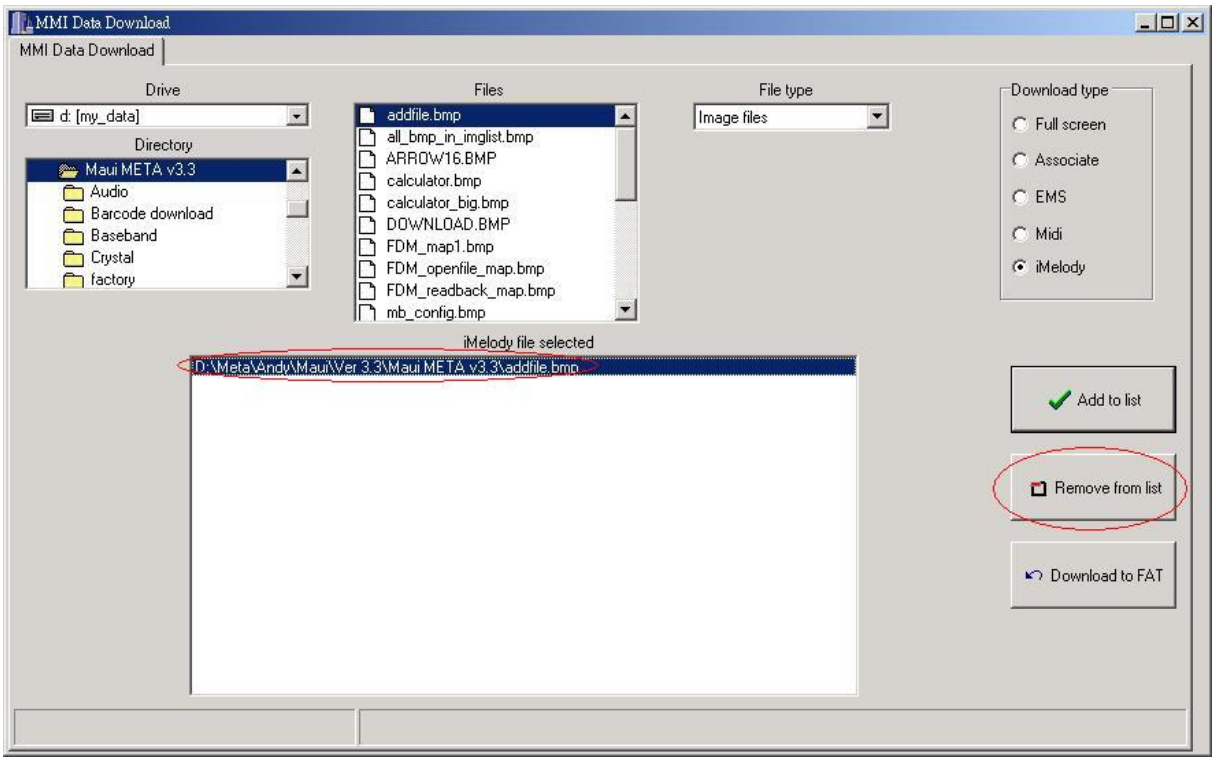

Figure 370 ***Select file and then click [Remove from list] button to remove file from selected list***

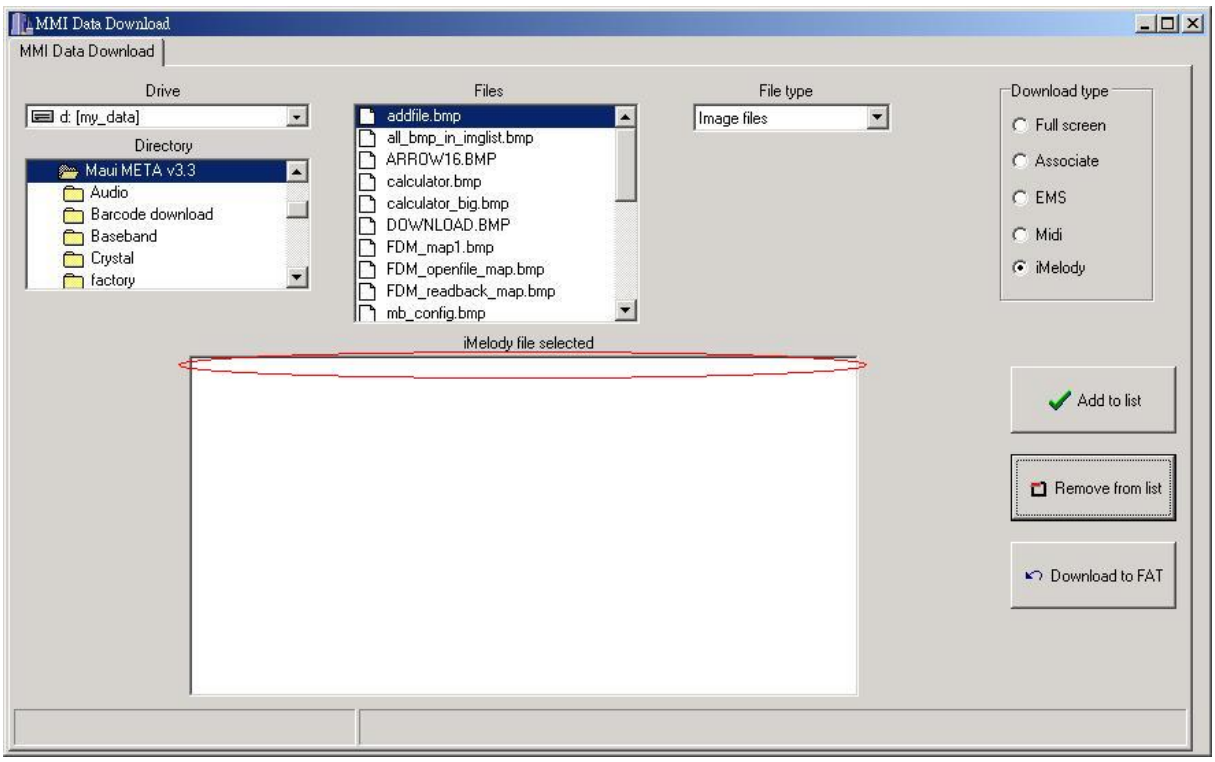

Figure 371 ***Result of removing file from list***

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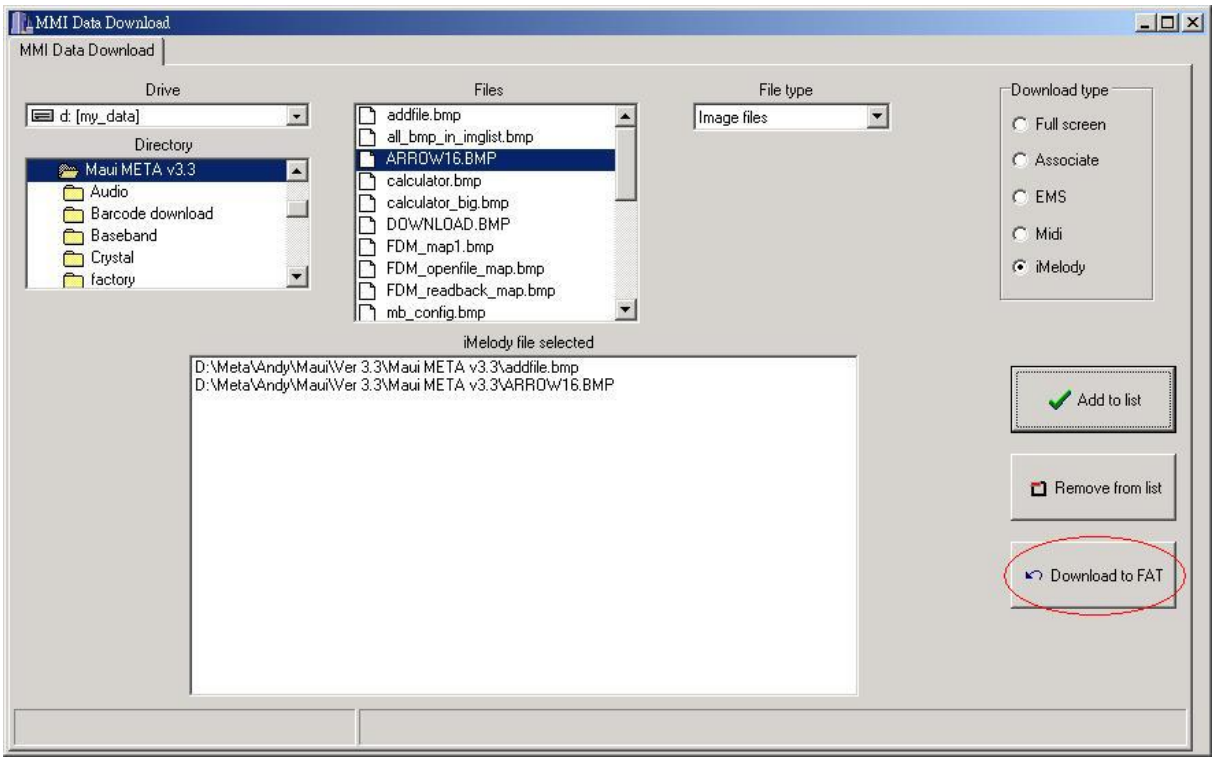

Figure 372 ***Click [Download to FAT] button to download all selected files to FAT***

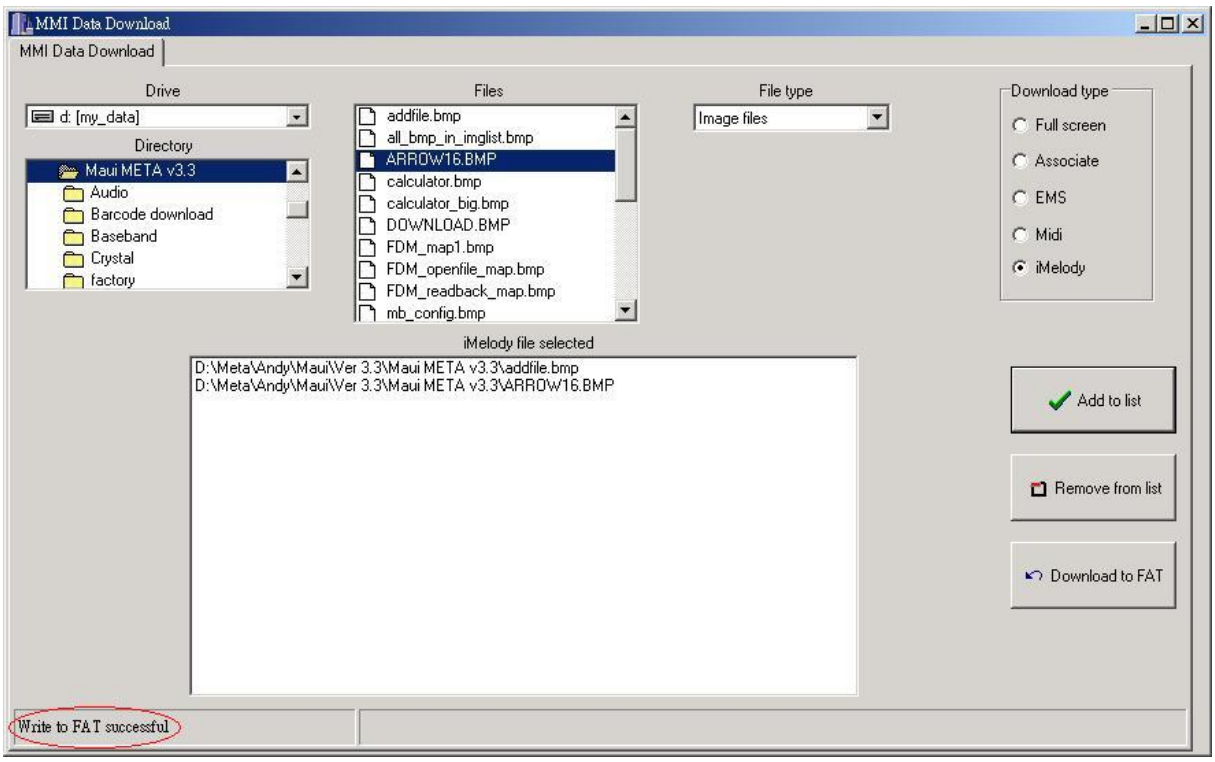

Figure 373 ***Result of downloading selected files to FAT***

When user close MMI data download window. The MMI data download data type, default FAT path, maximum file count, default local file will be saved to MF_Setup.txt. The following is a template of MF_Setup.txt.

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```
[MMI data download table]
download_type =imelody
; the default download_type when enter MMI data download window

[Default fullscreen file table]
DEFAULT_FULLSCREEN_PATH = c:\def_image\fullscreen\
; default full screen FAT path, full screen files will be downloaded to this FAT path
MAX_FULLSCREEN_FILE_COUNT = 5
; maximum full screen file count to download to FAT
default_fullscreen_file_count=5
; selected full screen file count
default_fullscreen_file1=D:\Meta\Andy\Maui\ver 3.2\Maui META v3.2\Output\addfile.bmp
default_fullscreen_file2=D:\Meta\Andy\Maui\ver 3.2\Maui META v3.2\Output\w1.bmp
default_fullscreen_file3=D:\Meta\Andy\Maui\ver 3.2\Maui META v3.2\Output\w2.bmp
default_fullscreen_file4=D:\Meta\Andy\Maui\ver 3.2\Maui META v3.2\Output\w3.bmp
default_fullscreen_file5=D:\Meta\Andy\Maui\ver 3.2\Maui META v3.2\ARROW16.BMP
; selected full screen file name

[Default assoicate file table]
DEFAULT_ASSOCIATE_PATH = c:\def_image\assoicate\
; default associate FAT path, associate files will be downloaded to this FAT path
MAX_ASSOCIATE_FILE_COUNT = 5
; maximum associate file count to download to FAT
default_assoicate_file_count=5
; selected associate file count

default_assoicate_file1=D:\Meta\Andy\Maui\ver 3.2\Maui META v3.2\addfile.bmp
default_assoicate_file2=D:\Meta\Andy\Maui\ver 3.2\Maui META v3.2\all_bmp_in_imglist.bmp
default_assoicate_file3=D:\Meta\Andy\Maui\ver 3.2\Maui META v3.2\ARROW16.BMP
default_assoicate_file4=D:\Meta\Andy\Maui\ver 3.2\Maui META v3.2\calculator.bmp
default_assoicate_file5=D:\Meta\Andy\Maui\ver 3.2\Maui META v3.2\calculator_big.bmp
; selected associate file name

[Default EMS file table]
DEFAULT_EMS_PATH = c:\def_image\ems\
; default EMS FAT path, EMS files will be downloaded to this FAT path
MAX_EMS_FILE_COUNT = 5
; maximum EMS file count to download to FAT
default_EMS_file_count=1
; selected EMS file count
default_EMS_file1=D:\Meta\Andy\Maui\ver 3.2\Maui META v3.2\calculator_big.bmp
; selected EMS file name

[Default midi file table]
DEFAULT_MIDI_PATH = c:\def_sound\other\
; default midi FAT path, midi files will be downloaded to this FAT path
MAX_MIDI_FILE_COUNT = 5
; maximum midi file count to download to FAT
default_midi_file_count=5
; selected midi file count
```


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default_midi_file1=D:\Meta\Midi\Midi song\doraemon.mid
default_midi_file2=D:\Meta\Midi\Midi song\empire.mid
default_midi_file3=D:\Meta\Midi\Midi song\greenoil.mid
default_midi_file4=D:\Meta\Midi\Midi song\laputa.mid
default_midi_file5=D:\Meta\Midi\Midi song\mission.mid
; selected midi file name

[Default imelody file table]
DEFAULT_IMELODY_PATH = c:\def_sound\imelody\
; default iMelody FAT path, iMelody files will be downloaded to this FAT path
MAX_IMELODY_FILE_COUNT = 5
; maximum iMelody file count to download to FAT
default_imelody_file_count=5
; selected iMelody file count
default_imelody_file1=D:\Meta\iMelody\90210.imy
default_imelody_file2=D:\Meta\iMelody\90210_1.imy
default_imelody_file3=D:\Meta\iMelody\abdelaze.imy
default_imelody_file4=D:\Meta\iMelody\adams.imy
default_imelody_file5=D:\Meta\iMelody\agadoo.imy
; selected iMelody file name

3.11 IMEI Download

User can use IMEI download window to upload/download IMEI from/to flash or load/save IMEI from/to file. User can switch to IMEI download window by selecting [IMEI download] button from main selection menu.

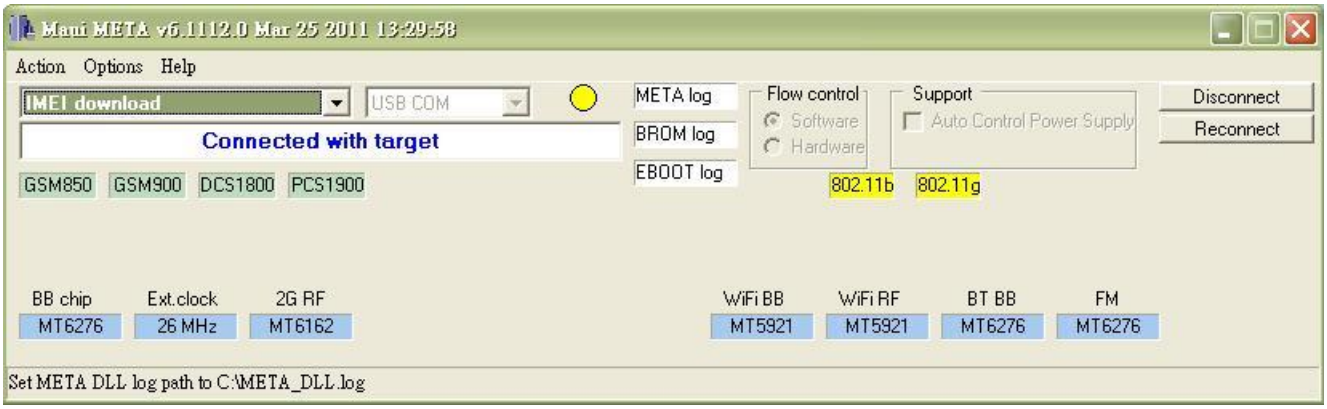

Figure 374 ***Select [IMEI download] button from main selection menu***

3.11.1.1 Change NVRAM database file

User can click [Change NVRAM Database File] button to change NVRAM database file.

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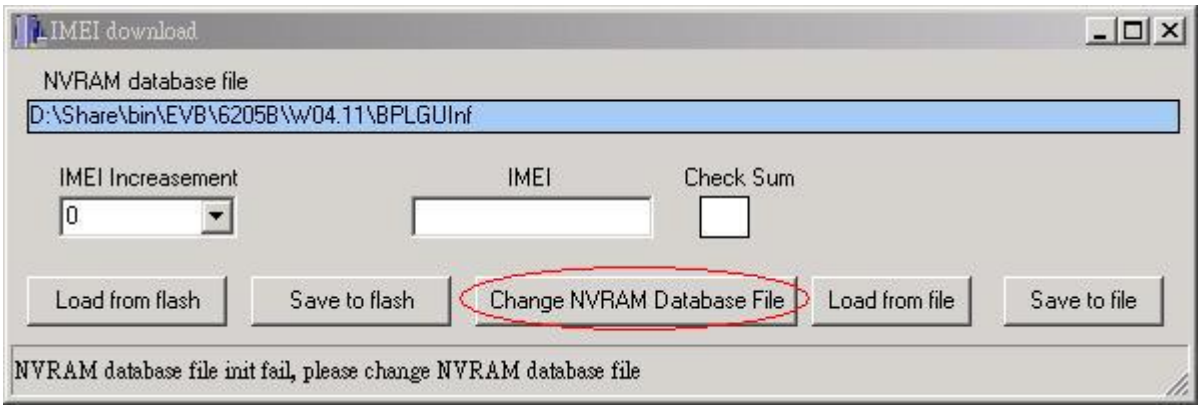

Figure 375 ***Click [Change NVRAM Database File] button to change NVRAM database file***

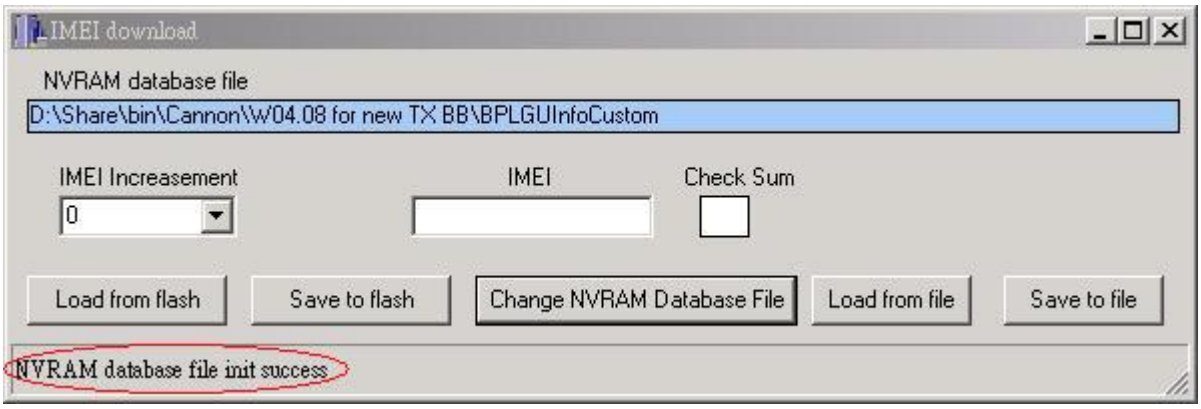

Figure 376 ***Result of change NVRAM database file***

3.11.1.2 Upload and download IMEI in flash

User can click [Load from flash] button to read IMEI from flash and click [Save to flash] button to save IMEI to flash. After user click [Save to flash] button, the IMEI field will increase as indicated in IMEI increasement.

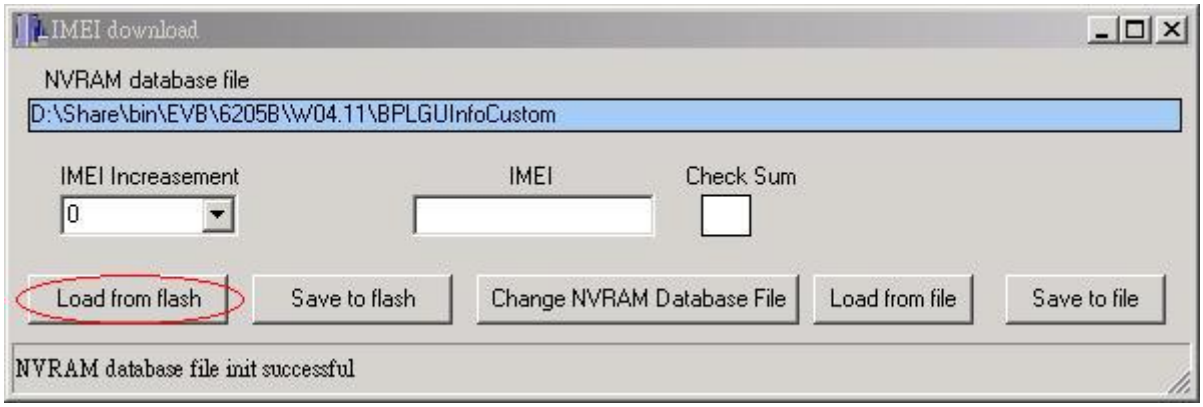

Figure 377 ***Click [Upload from flash] button to read IMEI from flash***

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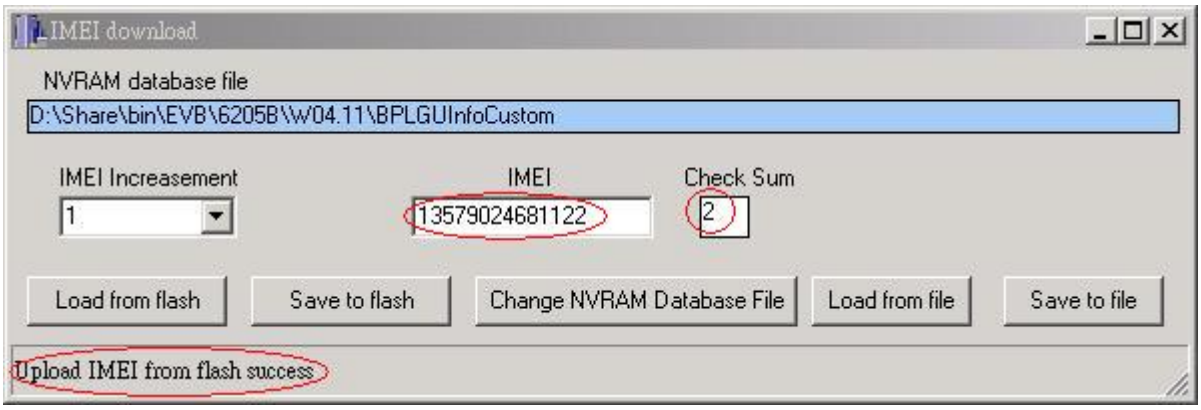

Figure 378 ***Result of load IMEI from flash***

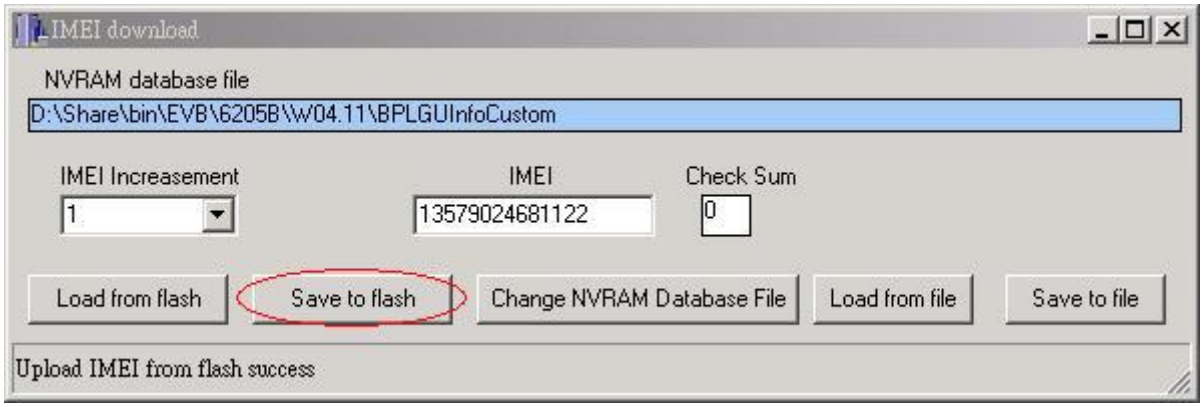

Figure 379 ***Click [Save to flash] button to write IMEI to flash***

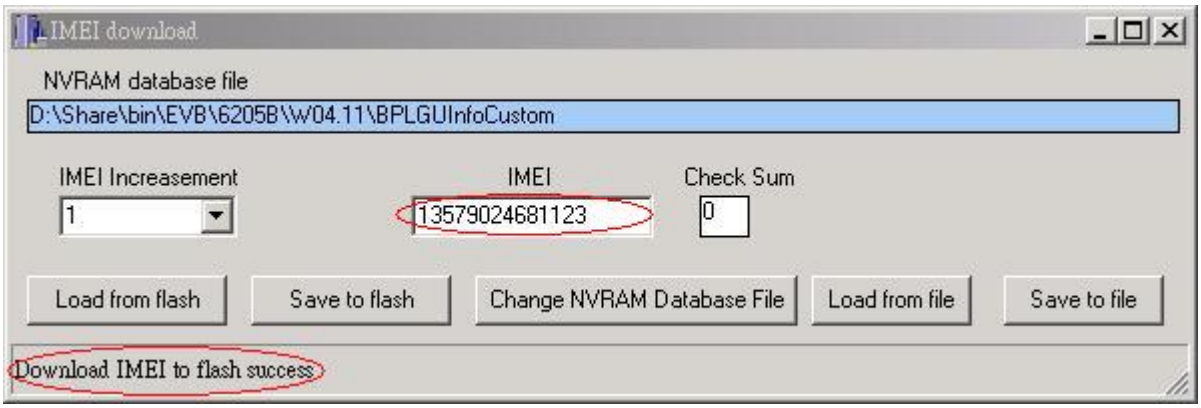

Figure 380 ***Result of save IMEI to flash***

3.11.1.3 Read and write IMEI in file

User can click [Load from file] button to load IMEI from file and click [Save to file] button to save IMEI to file.

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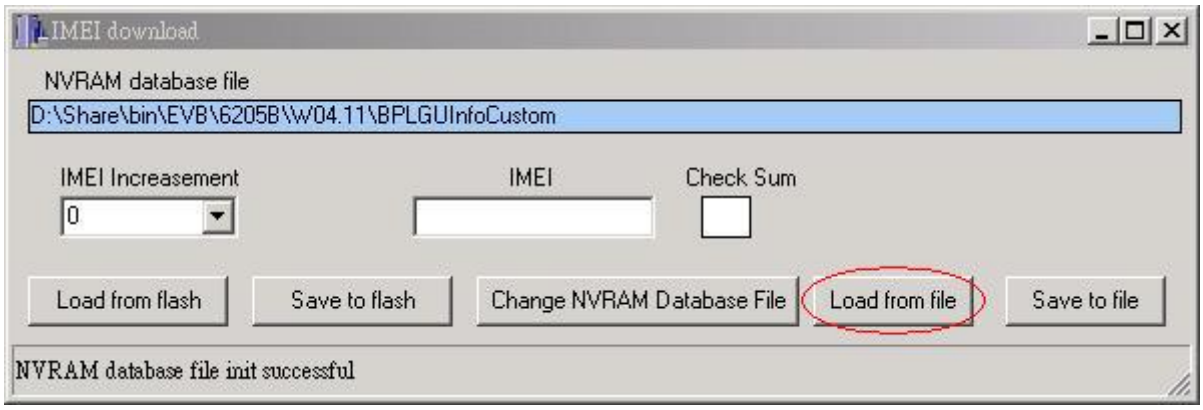

Figure 381 ***Click [Load from file] button to read IMEI from file***

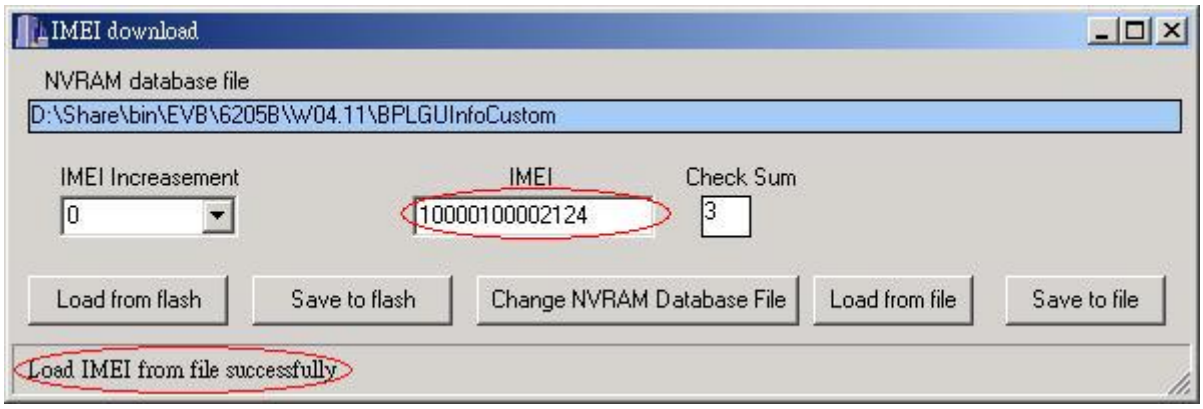

Figure 382 ***Result of load IMEI from file***

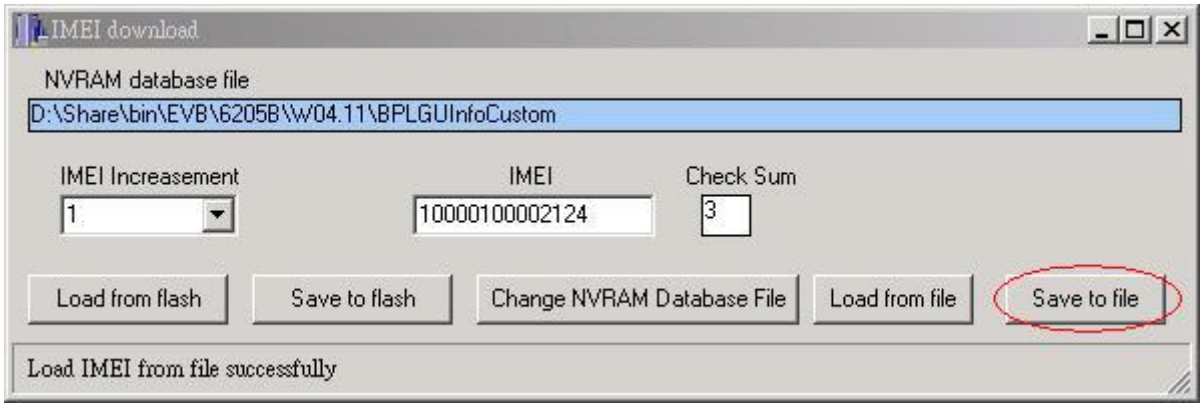

Figure 383 ***Click [Save to file] button to write IMEI to file***

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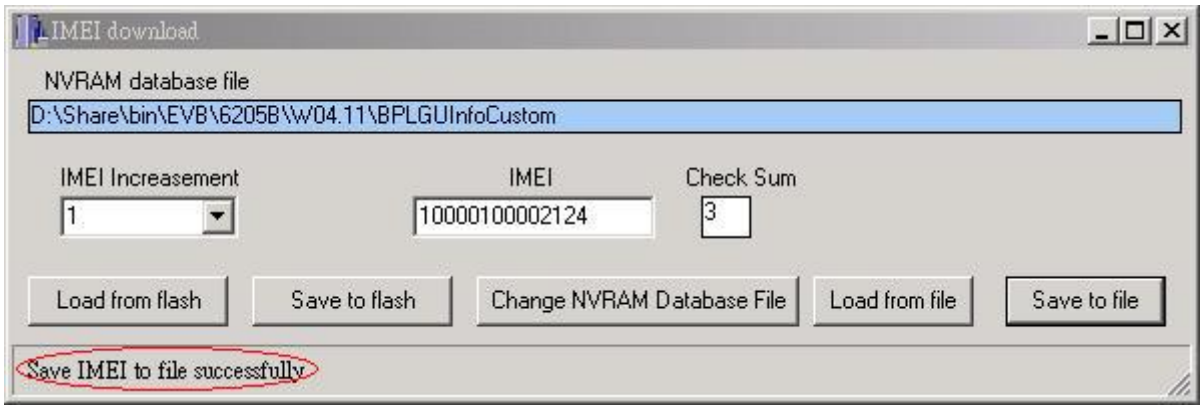

Figure 384 ***Result of save IMEI to file***

The following is a template file that contains IMEI. User will get the text file after saving IMEI to file. Please follow the file format if you want to change the value in file.

[IMEI]
IMEI=10000100002124

3.12 Get Version

User can use Get version window to get version of baseband chip, ECO, DSP firmware, DSP patch, software, hardware and melody. User can switch to get version window by selecting [Get version] from main selection menu.

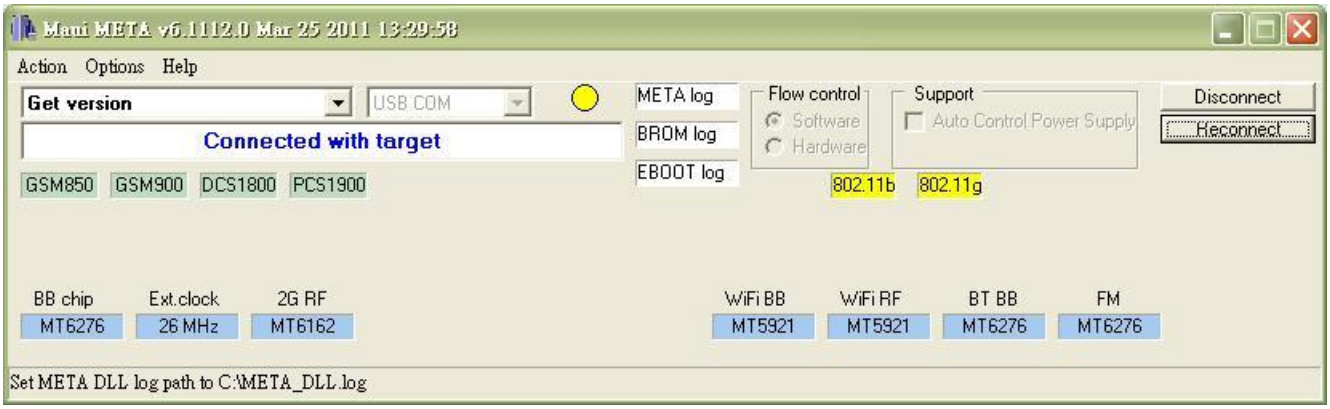

Figure 385 ***Select [Get version] from main selection menu***

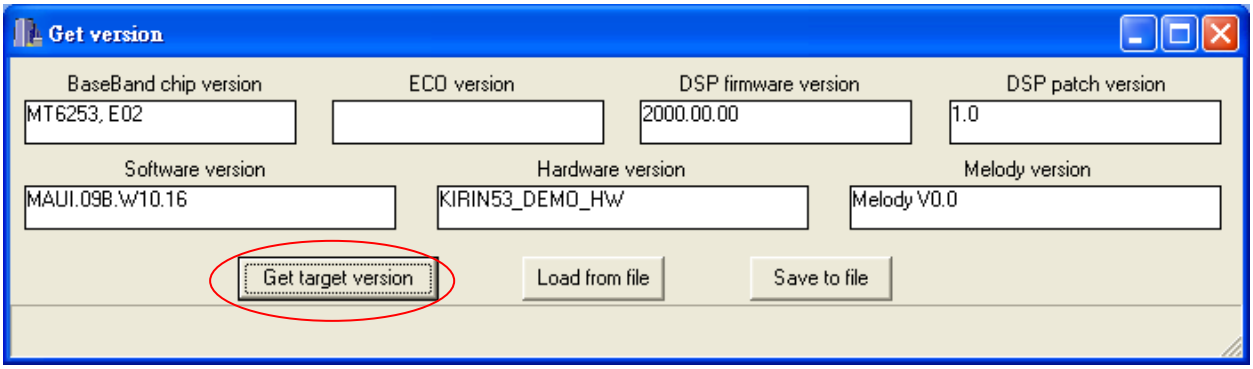

Figure 386 ***Click [Get target version] button to get version***

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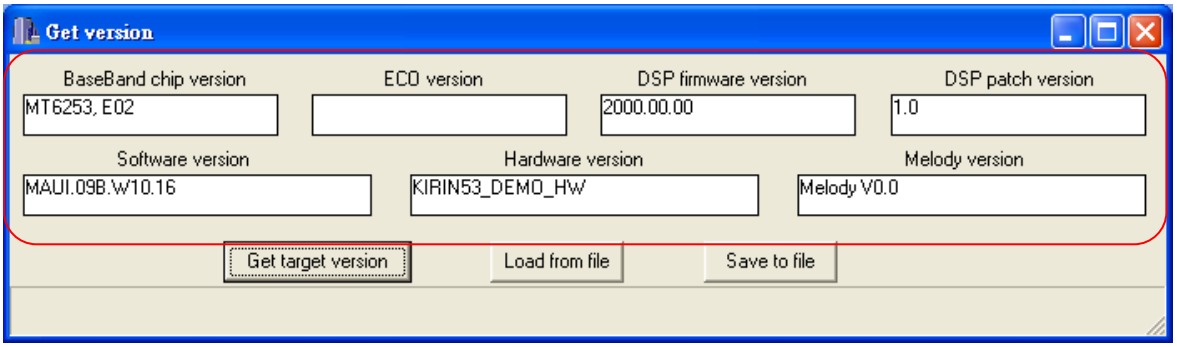

Figure 387 ***Result of getting target version***

3.13 Barcode Download

User can use barcode download window to upload/download barcode from/to flash or load/save barcode from/to file. User can switch to barcode download window by selecting [Barcode download] from main selection menu.

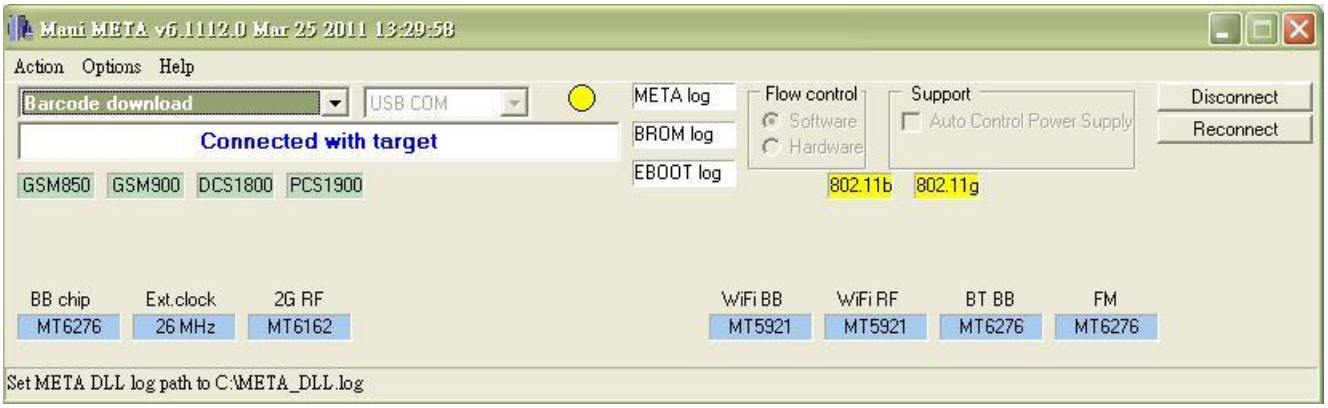

Figure 388 ***Select [Barcode download] from main selection menu***

3.13.1.1 Upload and download barcode in flash

User can click [Load from flash] button to read barcode from flash and click [Save to flash] button to save barcode to flash.

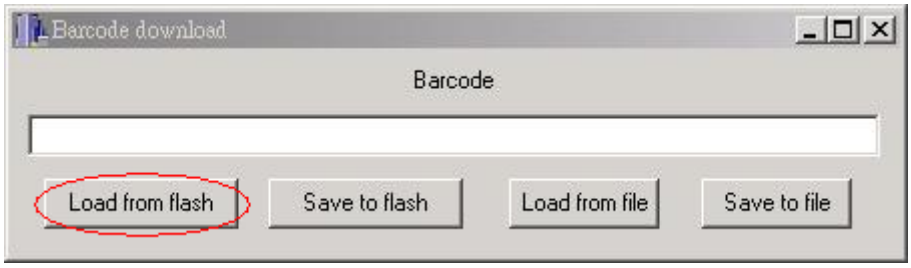

Figure 389 ***Click [Load from flash] button to read barcode from flash***

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Figure 390 ***Click [Save to flash] button to write barcode to flash***

3.13.1.2 Read and write barcode in file

User can click [Load from file] button to read barcode from file and click [Save to file] button to save barcode to file.

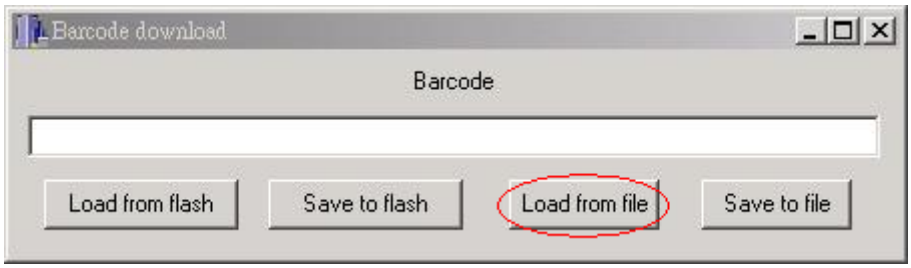

Figure 391 ***Click [Load from file] button to read barcode from file***

Figure 392 ***Click [Save to file] button to write barcode to file***

The following is a template file that contains barcode. User will get the text file after saving barcode to file. Please follow the file format if you want to change the value in file.

[Barcode]
Barcode=012345678901234567

3.14 Update Parameter

User can use update parameter window to upload/download RX path loss, AFC, APC and ADC calibration parameter or load/save RX path loss, AFC, APC and ADC calibration from/to file. User can switch to update parameter window by selecting [Update parameter] from main selection menu.

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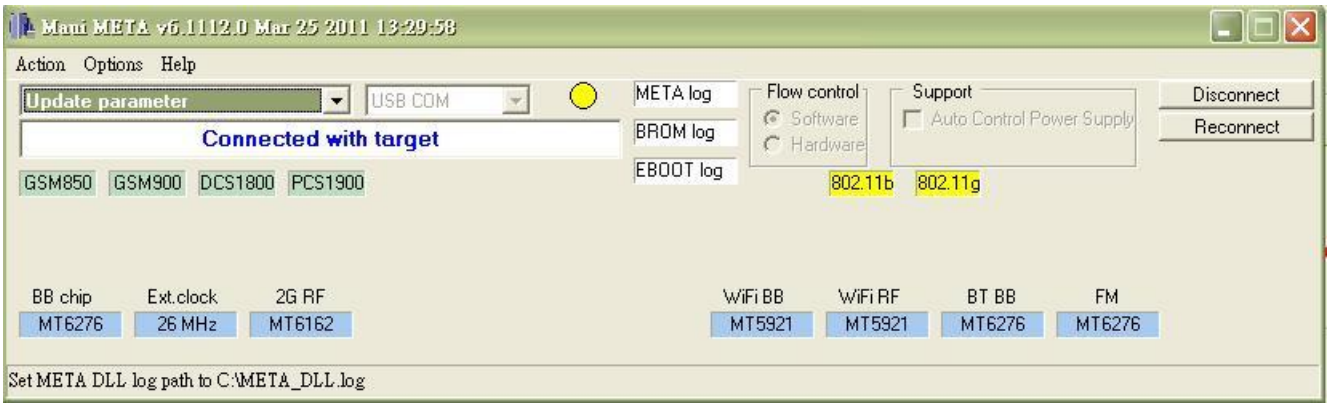

Figure 393 ***Select [Update parameter] from main selection menu***

3.14.1.1 Upload and download parameter in flash

User can choose parameter that he wants to update and then click [Upload from flash] button to upload selected parameter from flash and click [Download to flash] button to save selected parameter to flash. User can change NVRAM database file by clicking [Change NVRAM DB] button.

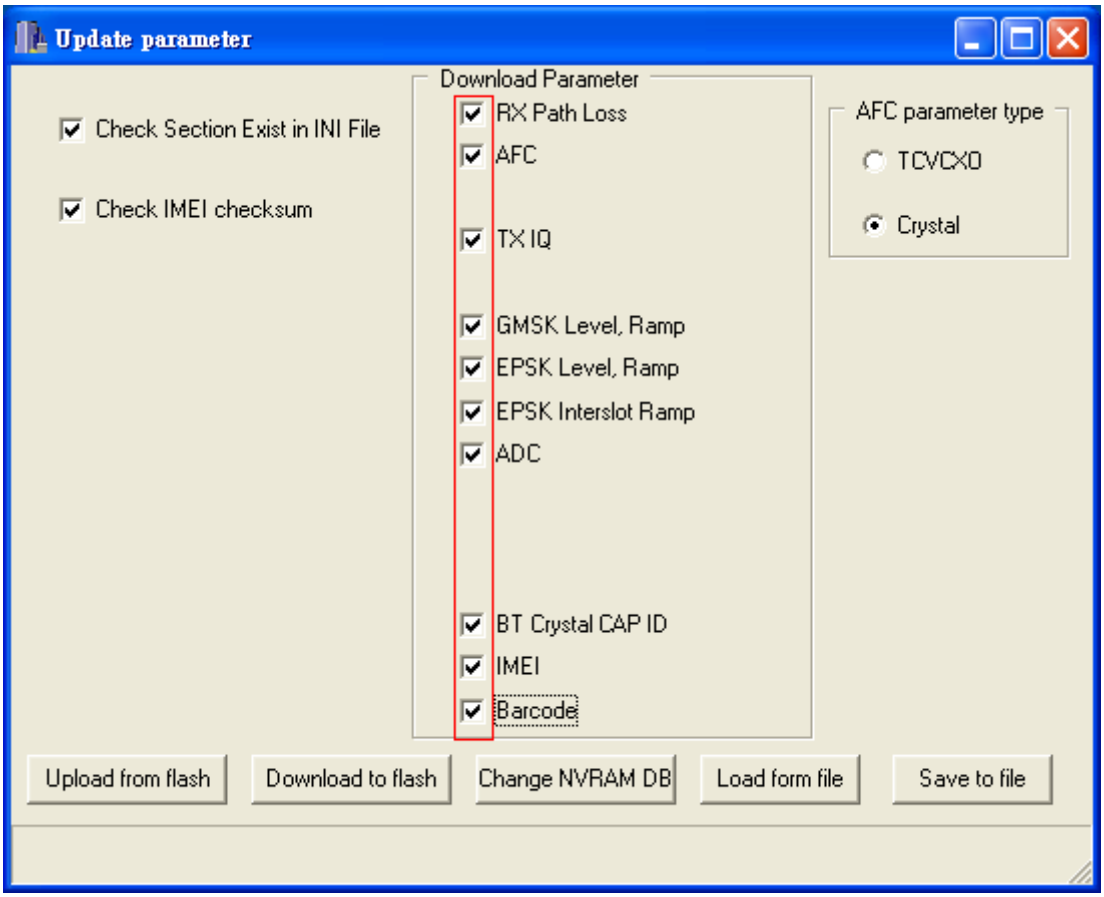

Figure 394 ***Click which parameter you want to update***

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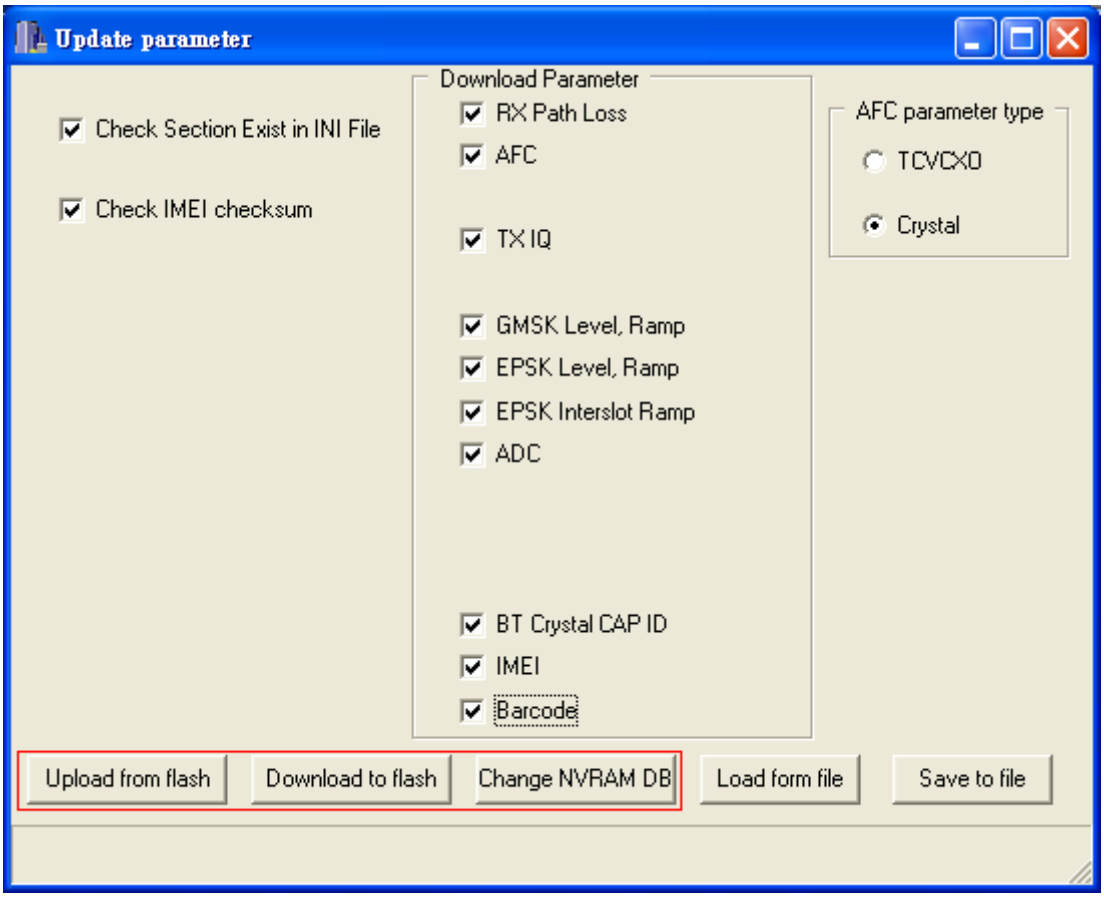

Figure 395 ***Buttons related to NVRAM access***

3.14.1.2 Read and write parameter in file

User can choose parameter that he wants to update and then click [Load from file] button to read selected parameter from file and click [Save to file] button to save selected parameter to file.

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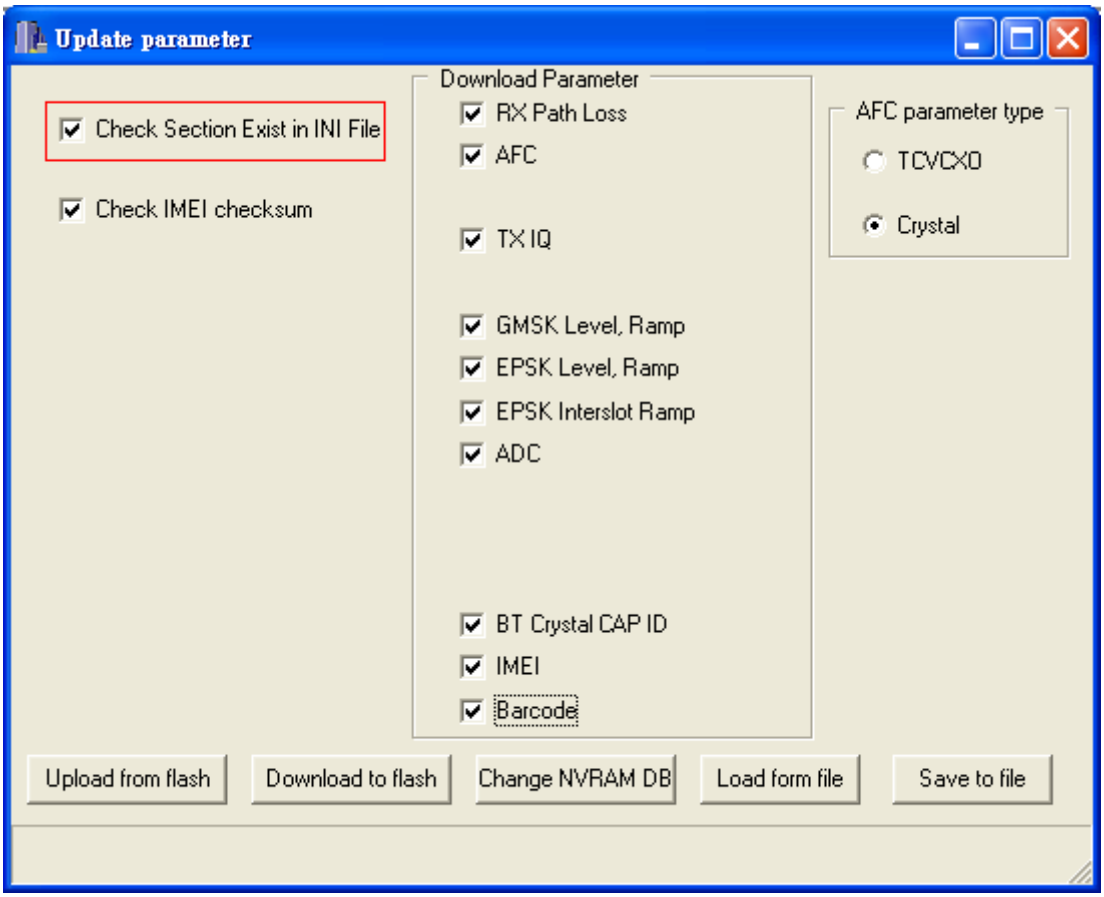

Figure 396 ***Click [Check Section Exist in INI File] checkbox to check each parameter section exist in INI file***

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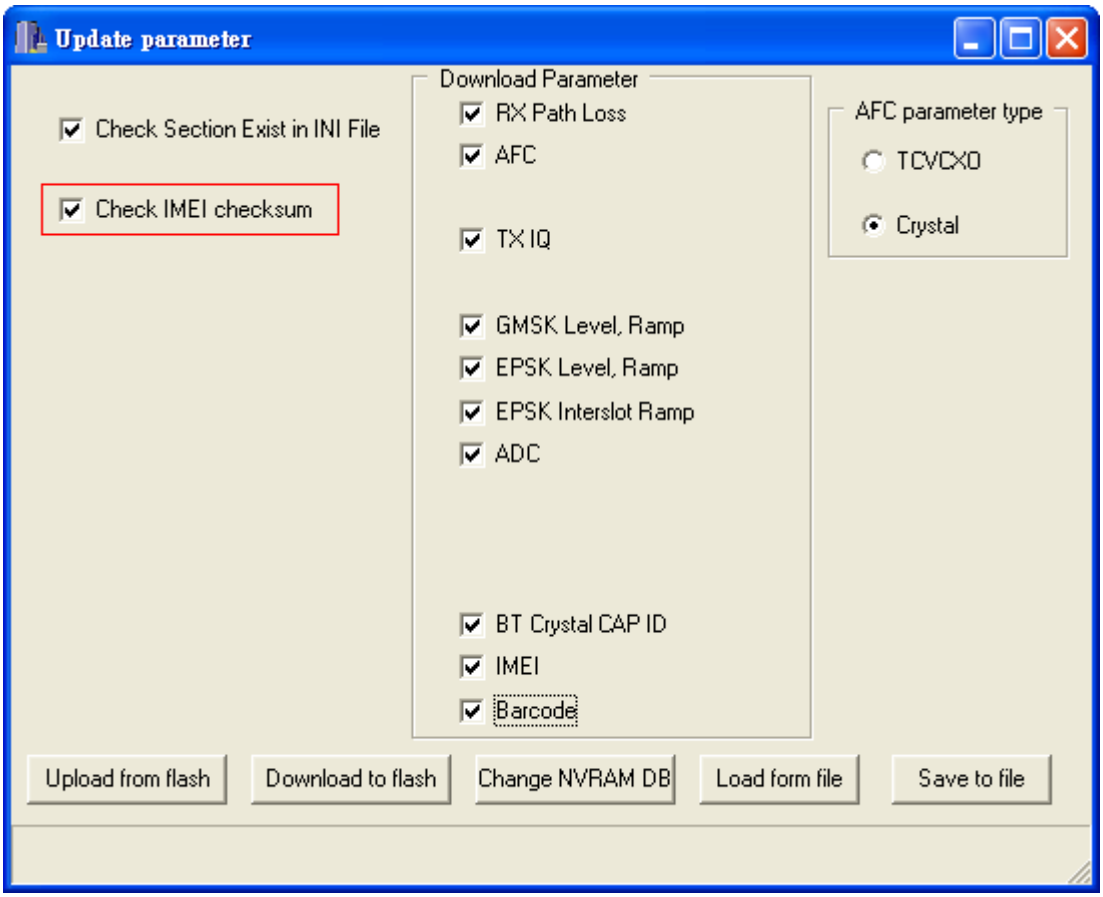

Figure 397 ***"Check IMEI checksum" CheckBox to decide if IMEI checksum need to be checked***

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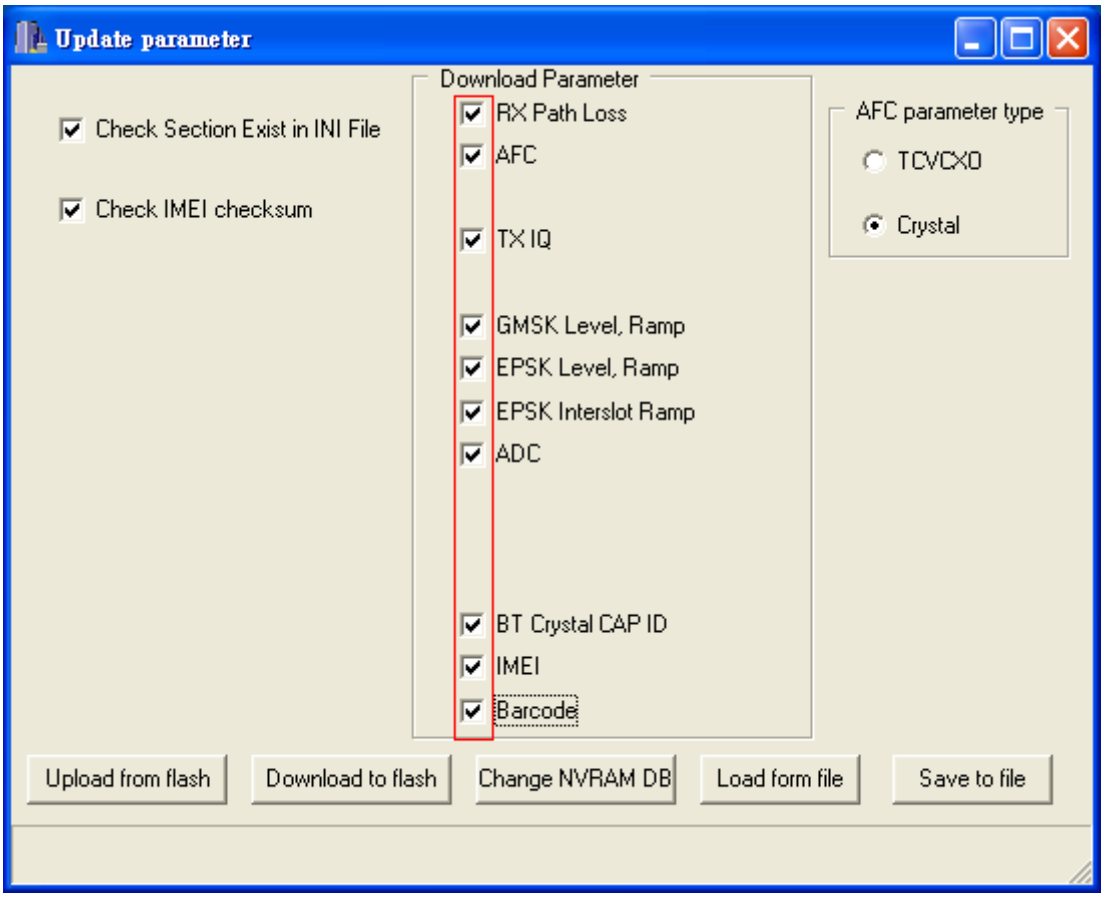

Figure 398 ***Click which parameter you want to update***

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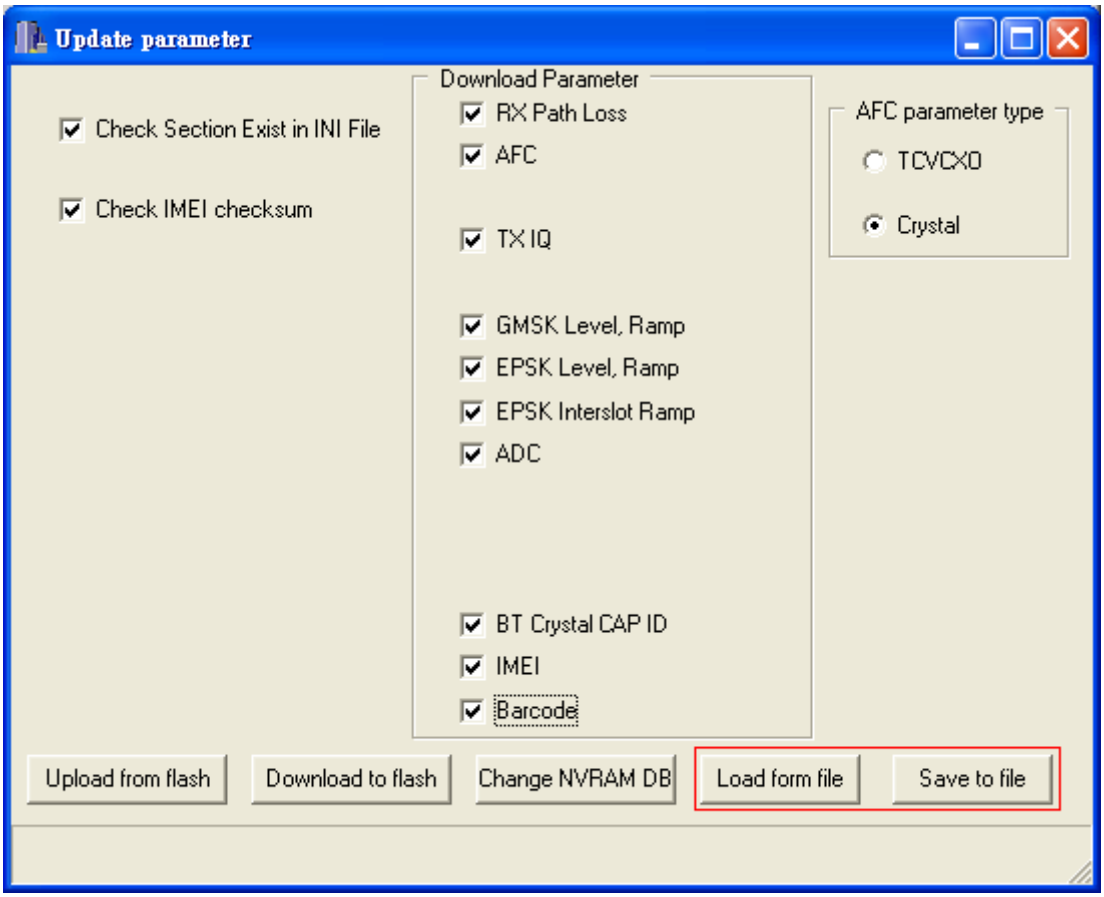

Figure 399 ***Buttons related to INI file access***

3.15 FAT Editor

User can use FAT editor window to read, write, delete files in FAT and get FAT disk information which contains sector per cluster, FAT total size and FAT free space. User can select multiple local or FAT files one time. User can switch to FAT editor window by selecting [FAT editor] from main selection menu.

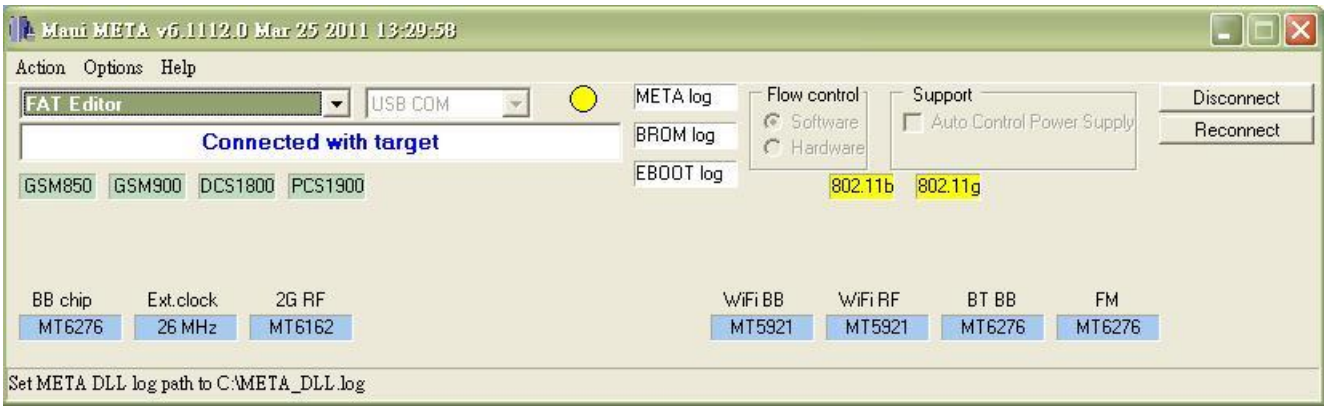

Figure 400 ***Select [FAT editor] from main selection menu***

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3.15.1 Get Directory List

The [Get Directory List] function helps the user get the directory list under the [Current FAT path]

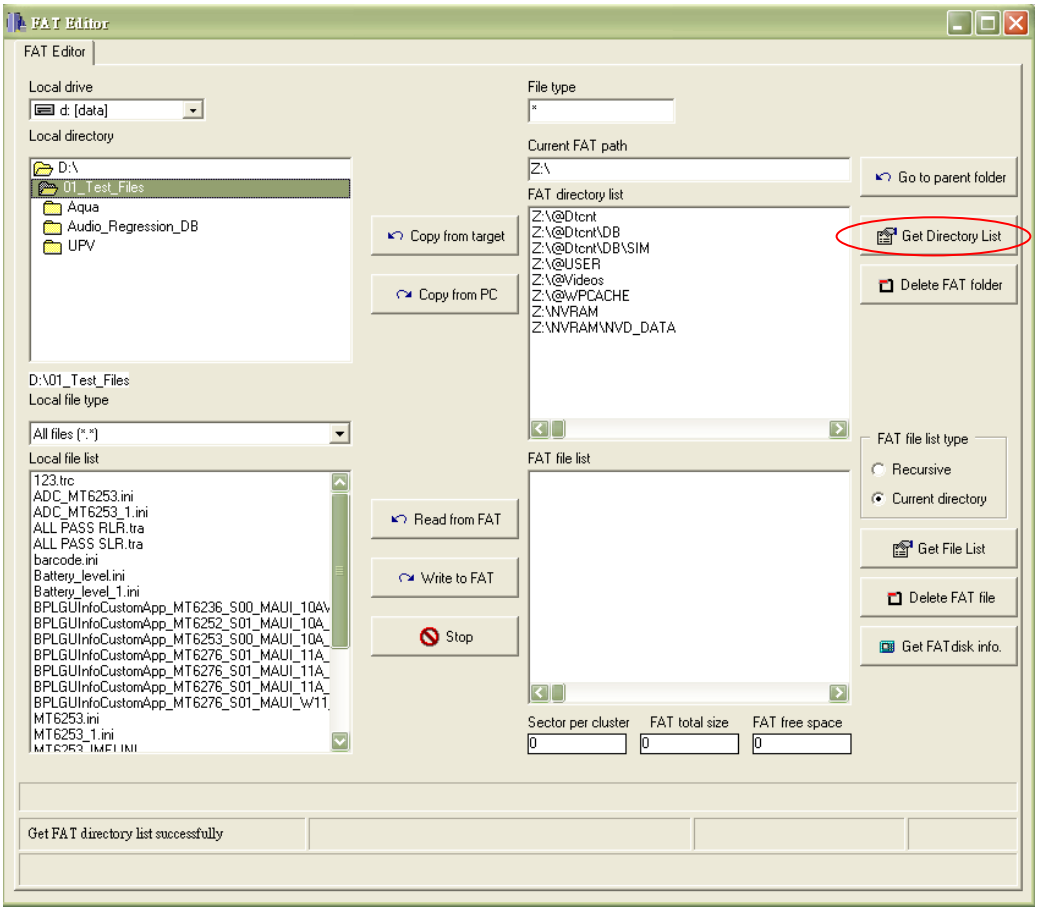

Figure 401 ***Click [Get directory list] button to get all FAT directory list***

3.15.2 Get File List

The [Get File List] function helps the user get the file list under the [Current FAT path].

If the recursive file list type is selected, all of the files in the [Current FAT path] and files in the sub-folders are listed by recursive search.

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If the current directory file list type is selectd, only the files in the [Current FAT path] are listed.

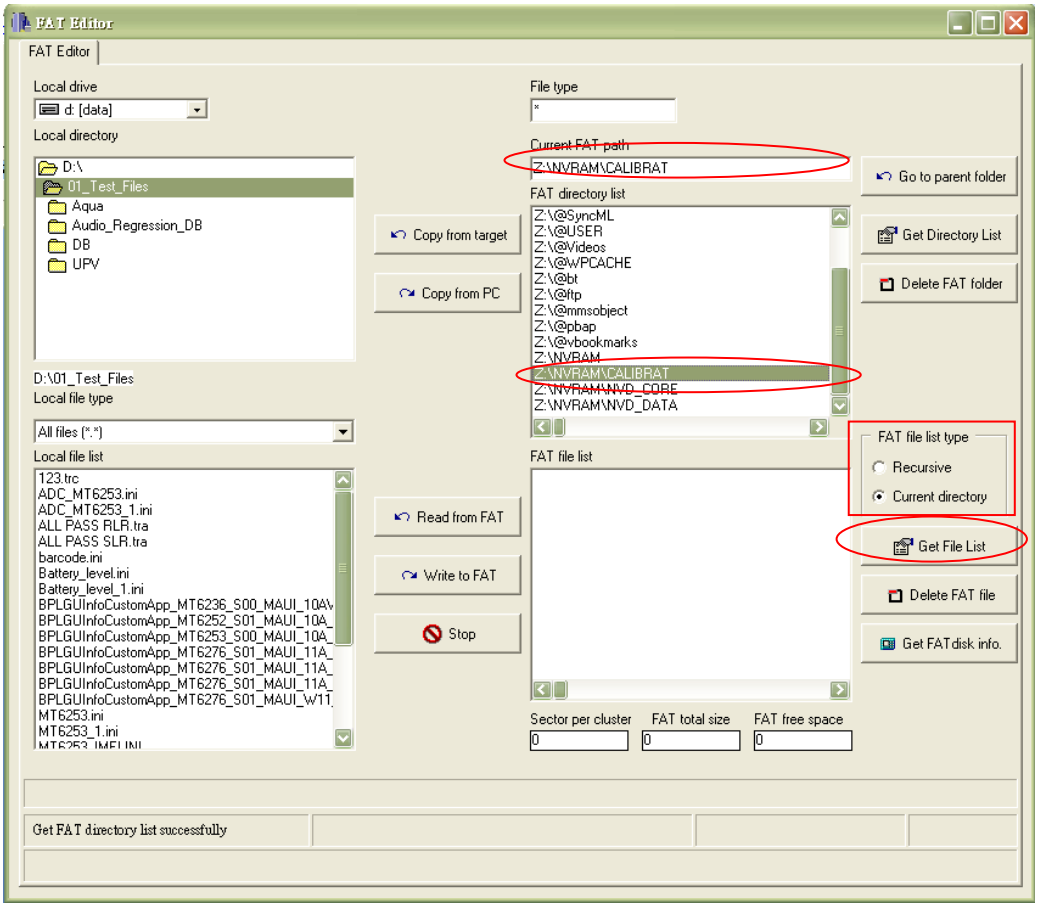

Figure 402 ***Enter FAT path and then click [Get File List] button to get FAT file list***

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3.15.3 Write to FAT

[Write to FAT] function provides the file access that the file can be transferred to the target side. Multiple selection of the file is allowed.

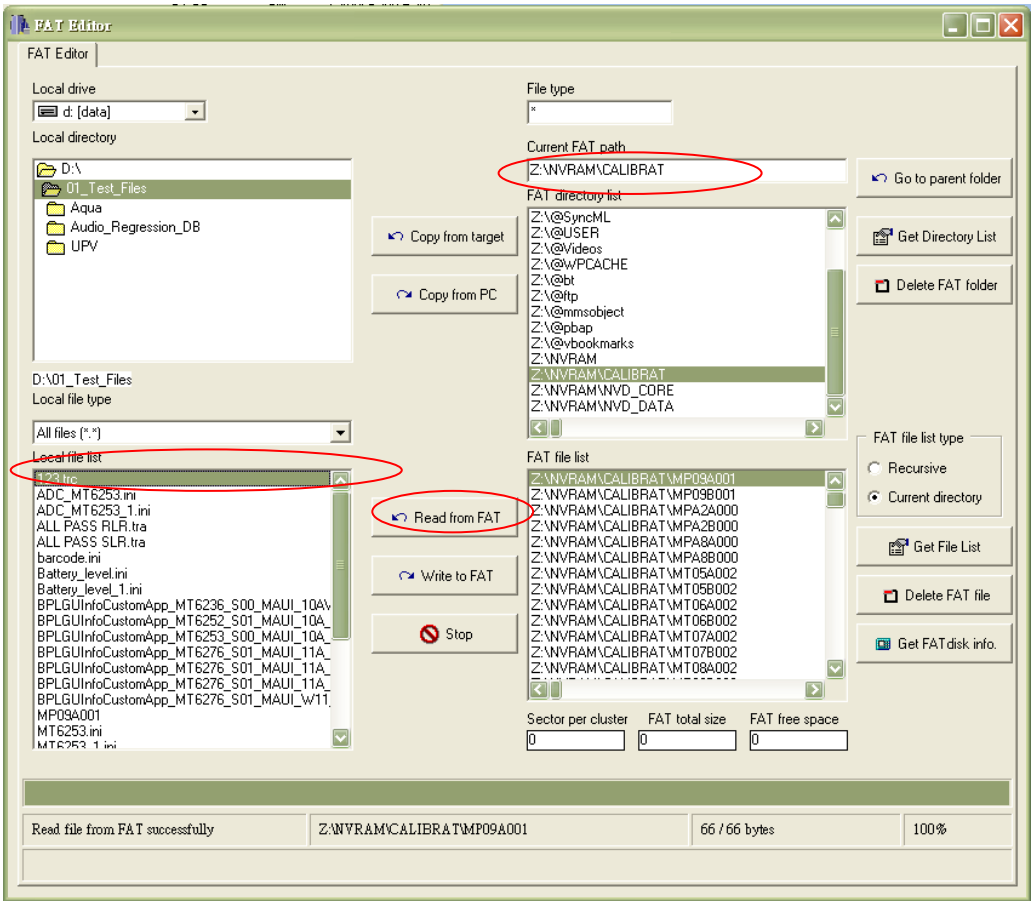

Figure 403 ***Select local file, enter FAT path and then click [Write to FAT] button to write file to FAT***

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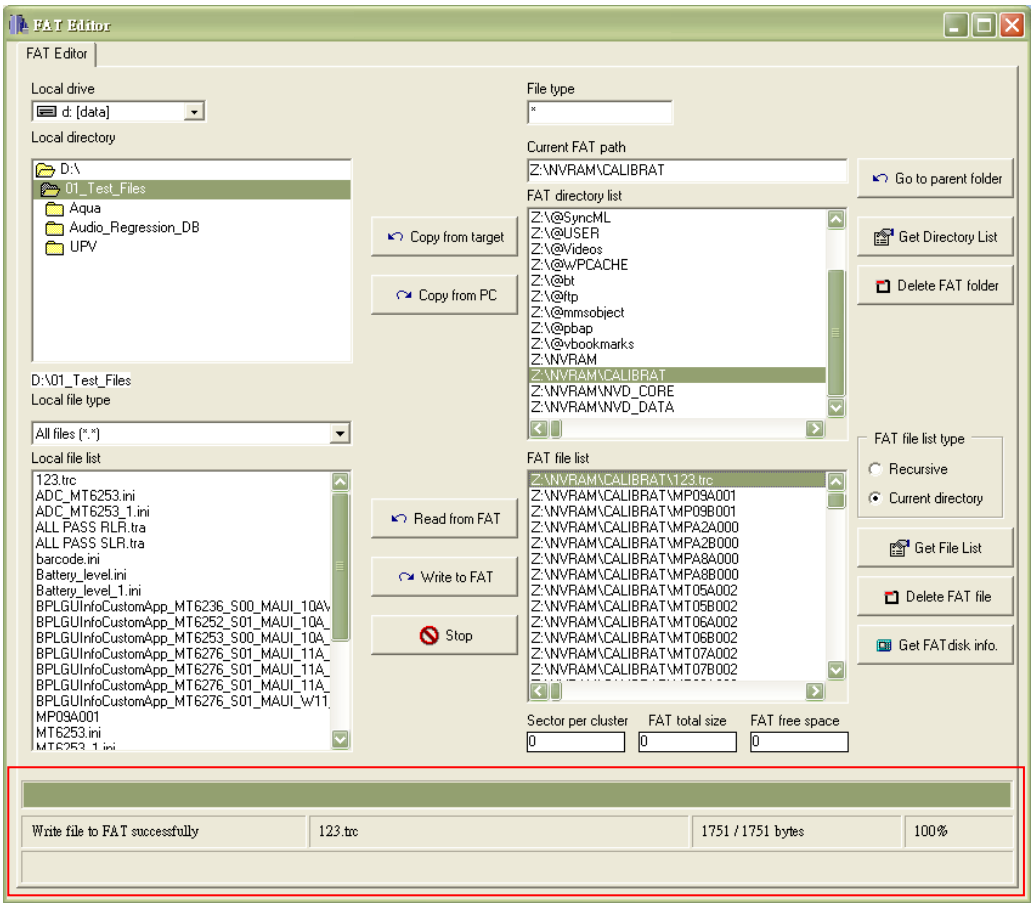

Figure 404 ***Result of writing file to FAT***

3.15.4 Read from FAT

[Read from FAT] function provides the file access that the file can be transferred from the target side to host side.Multiple selection of the file is allowed.

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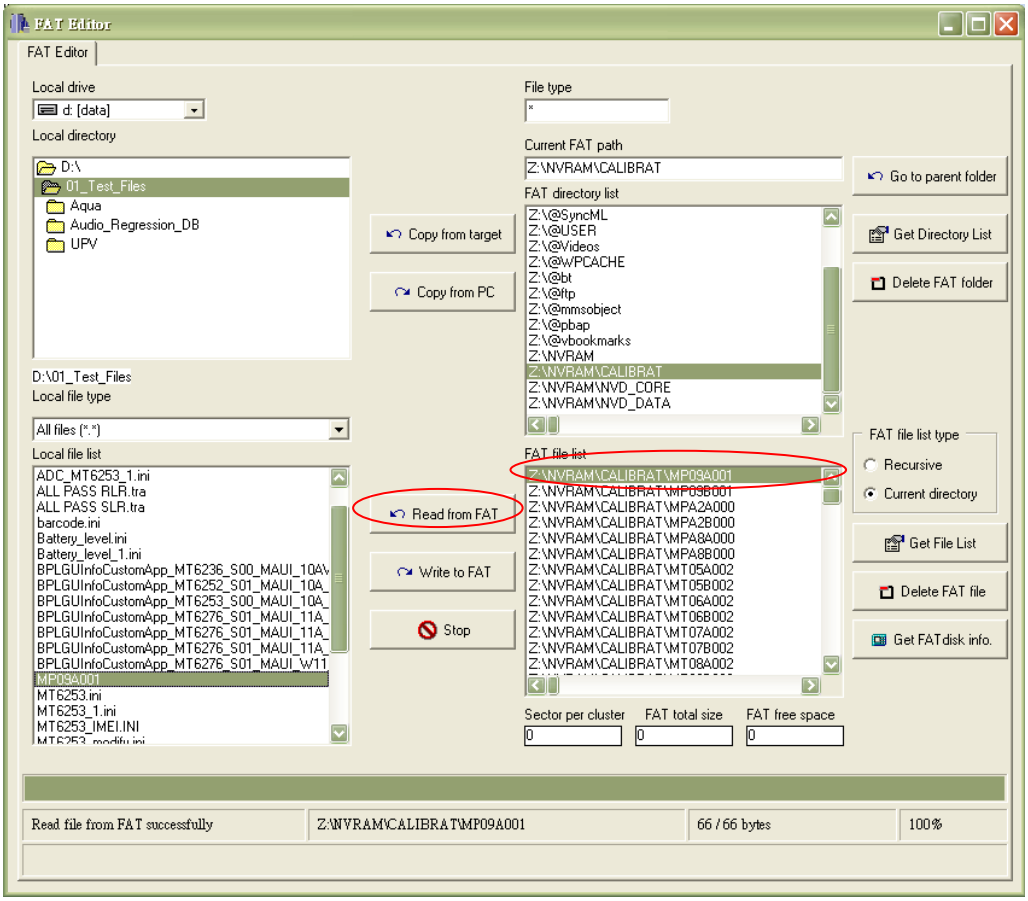

Figure 405 ***Select FAT file and then click [Read from FAT] button to read file from FAT***

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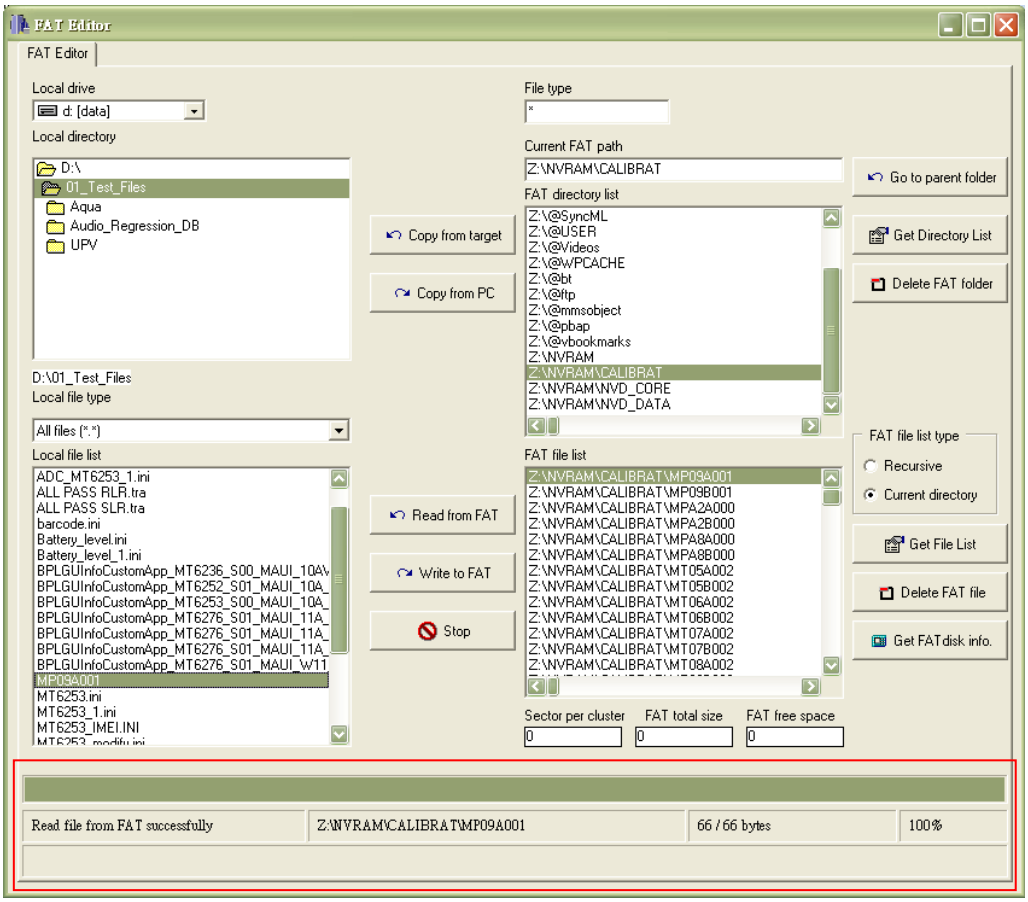

Figure 406 ***Result of reading FAT file***

3.15.5 Delete FAT file

[Delete FAT file] provides the function to delete FAT files on target file system. Multiple selection is allowed.

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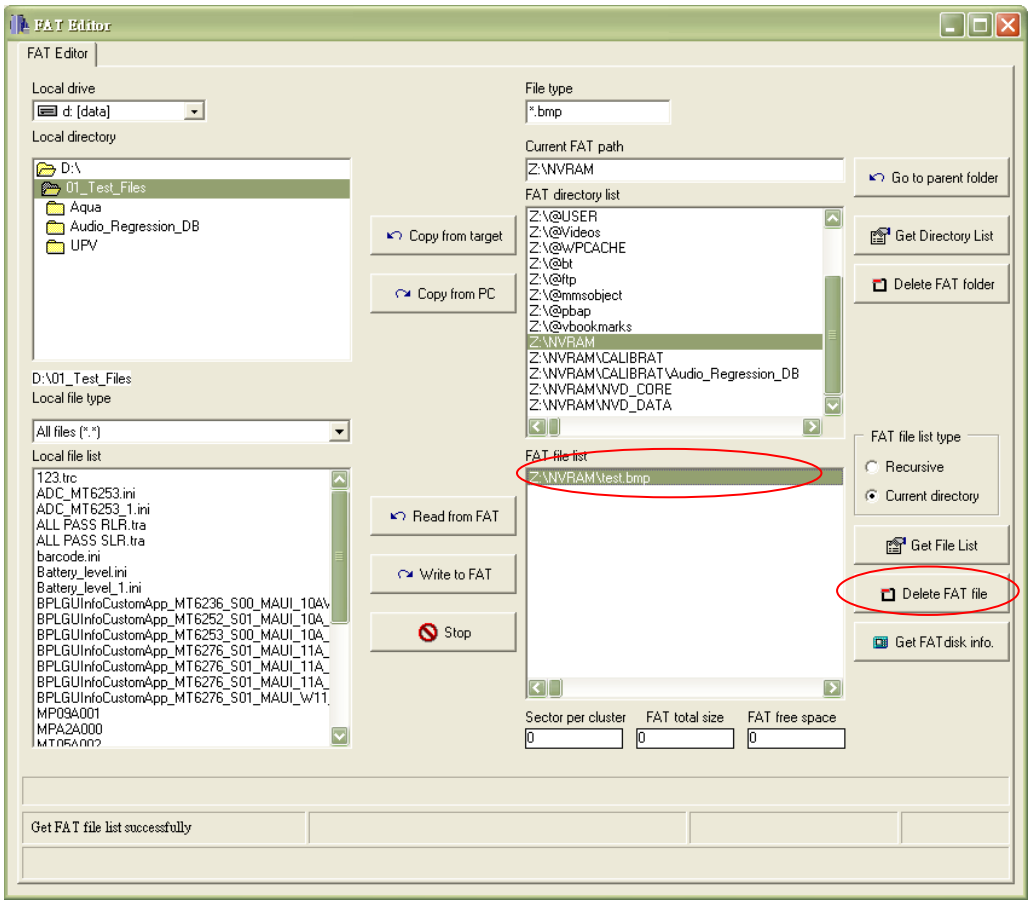

Figure 407 ***Select FAT file then click [Delete from FAT] button to delete FAT file***

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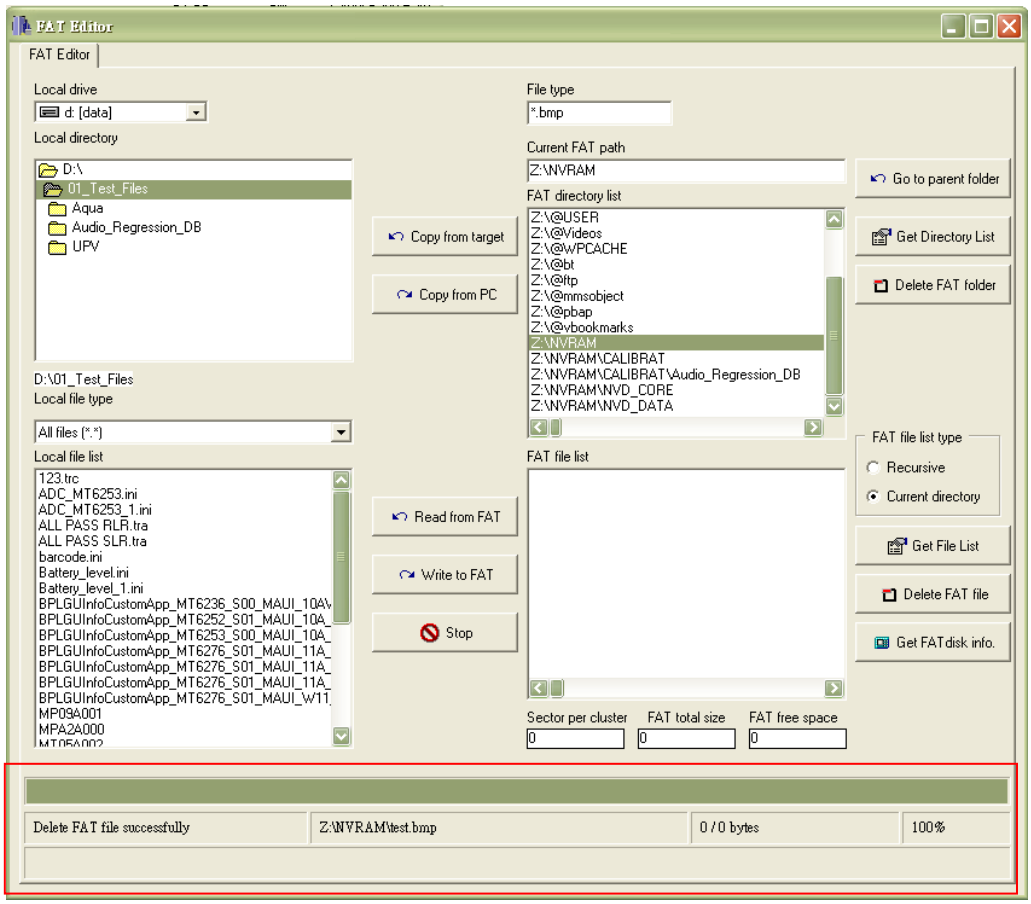

Figure 408 ***Result of deleting FAT file***

3.15.6 Get FAT disk info

[Get FAT disk info] gets the disk size and sector / cluster information of the file system on the target side.

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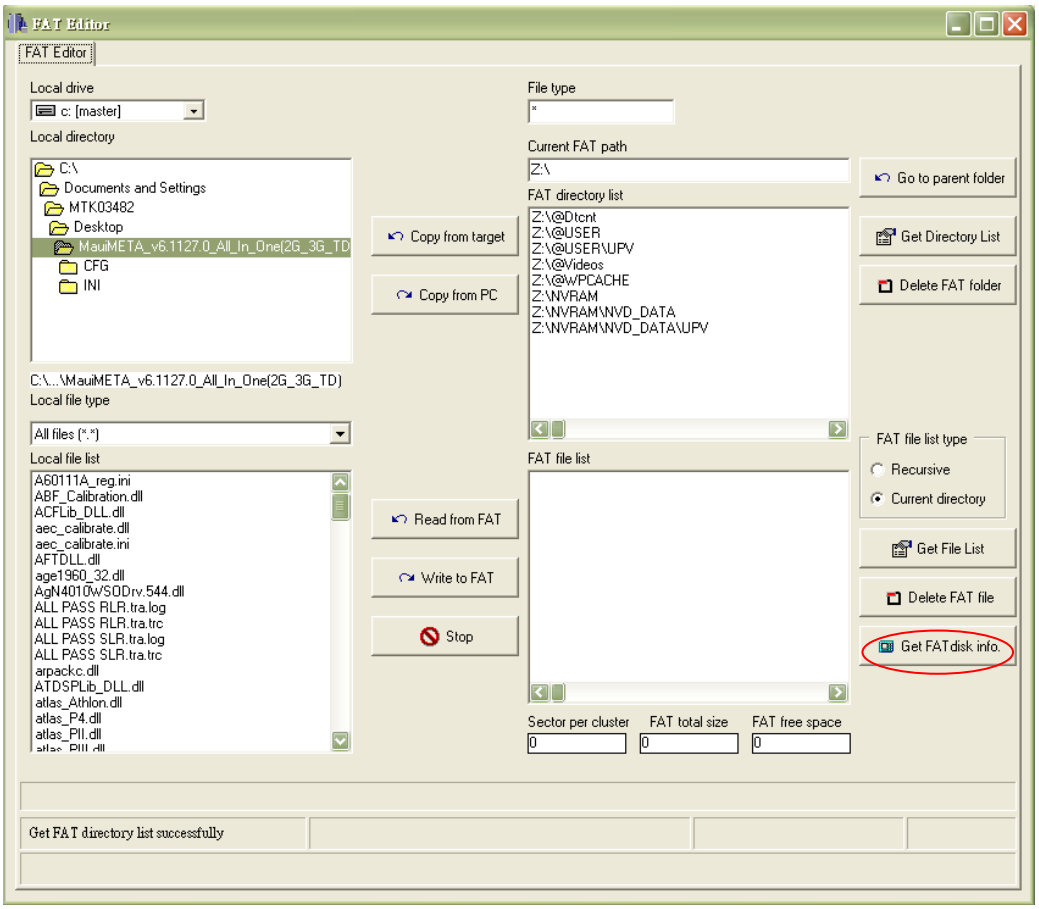

Figure 409 ***Click [Get FAT disk info.] button to get FAT disk information***

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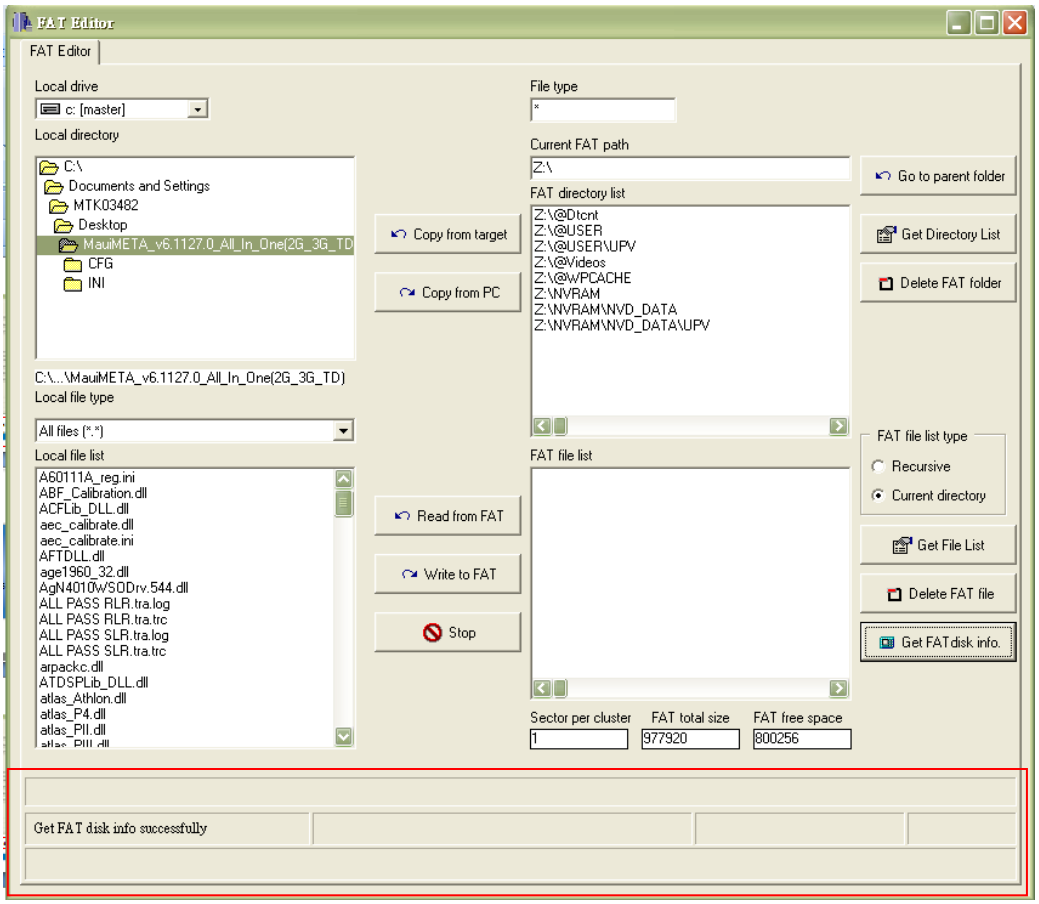

Figure 410 ***Result of getting FAT disk info.***

3.15.7 Copy from target

[Copy from target] enables the user to copy one folder recursively to the host side.

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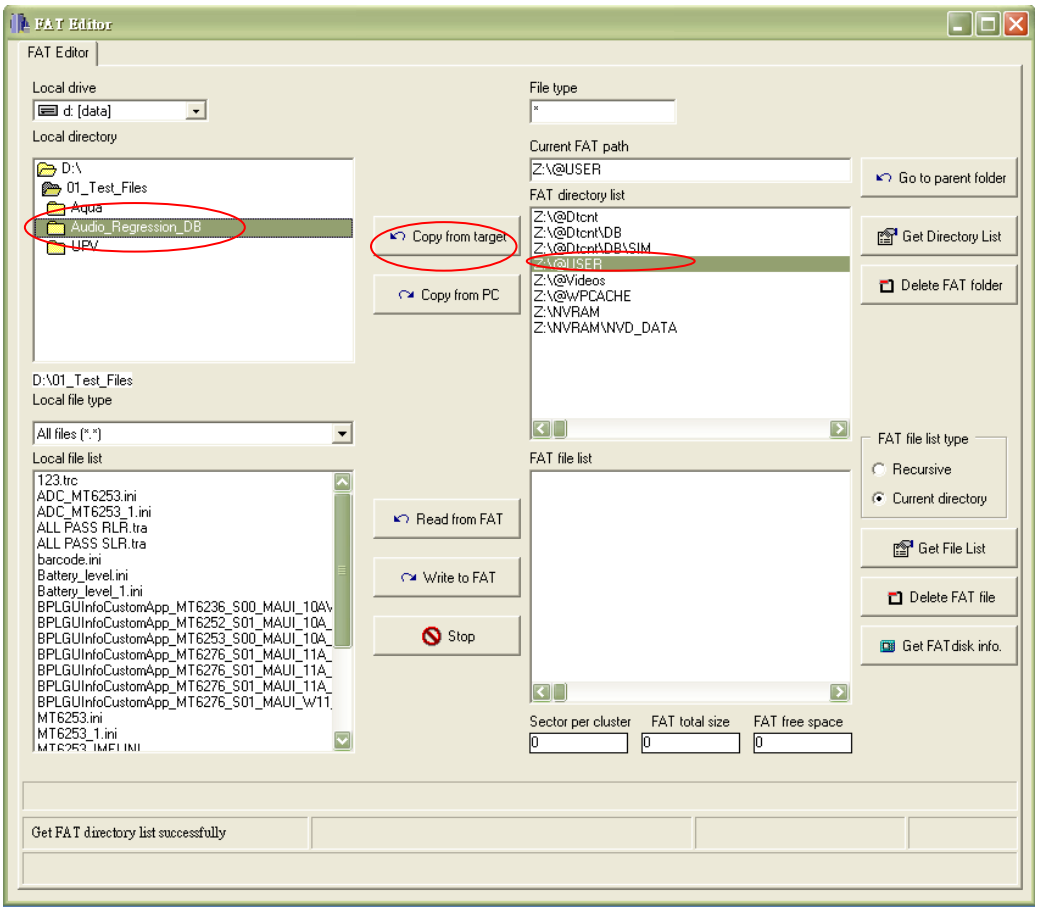

Figure 411 ***Select the source folder to be copied to the host side and the destination folder on the host side and then the click [Copy from target]***

3.15.8 Copy from PC

[Copy from PC] enables the user to copy one folder recursively to the target side.

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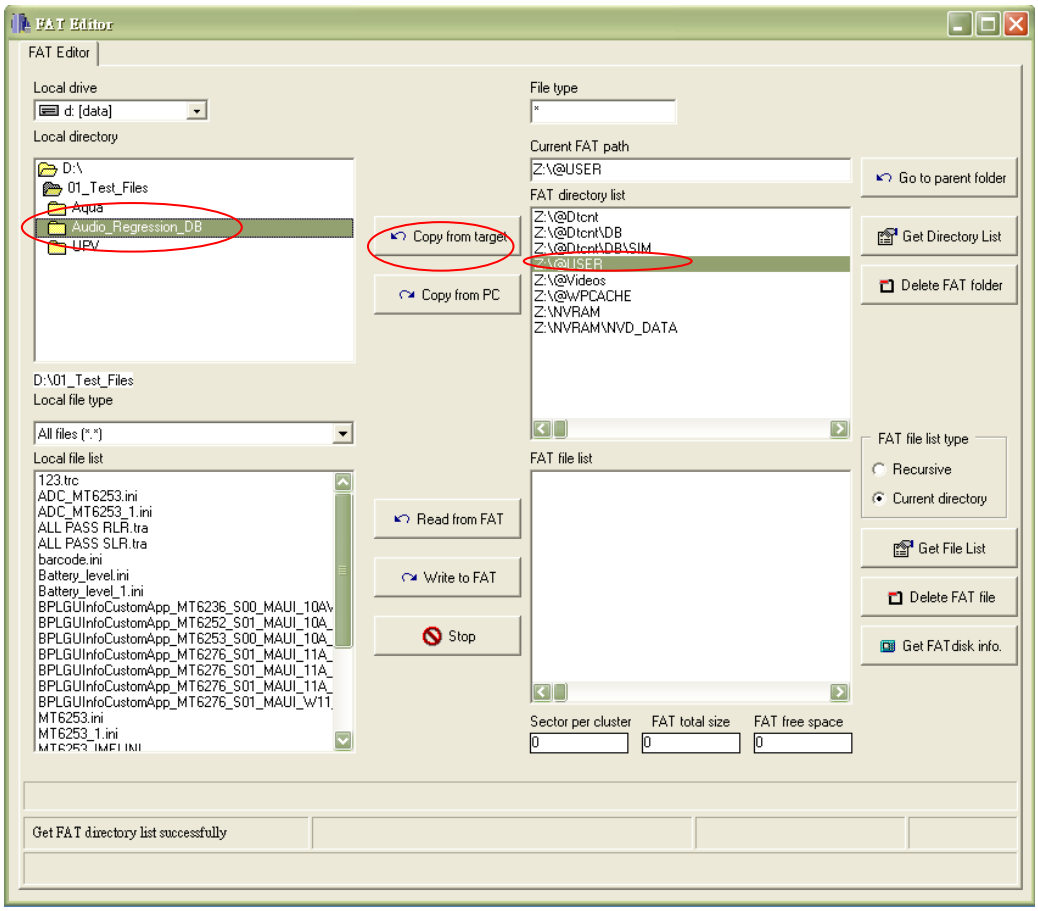

Figure 412 ***Select the source folder to be copied to the target side and the destination folder on the target side and then the click [Copy from PC]***

3.16 Database Change

User can use database change window to get database change list between two NVRAM database files and FAT free space. User can switch to database change window by selecting [Database change] from main selection menu.

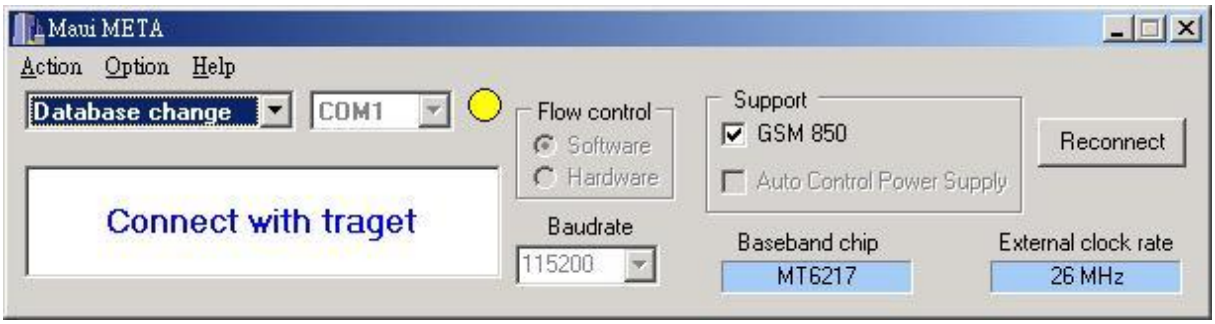

Figure 413 ***Select [Database change] from main selection menu***

User can click [Get FAT free space] button to get FAT free space of old database file, NVRAM size of old database file, overhead of transforming from old NVRAM database to new NVRAM database and NVRAM size of new database file.

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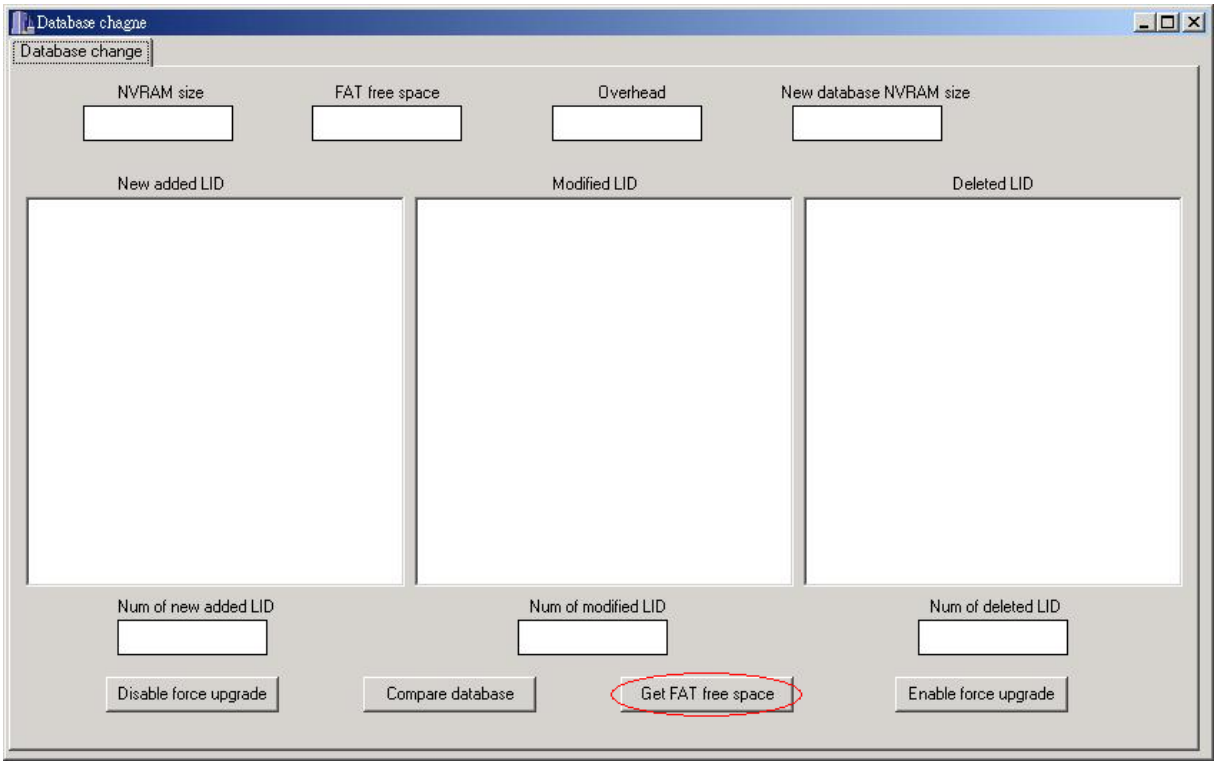

Figure 414 ***Click [Get FAT free space] button to get NVRAM size, FAT free space, overhead and new database NVRAM size***

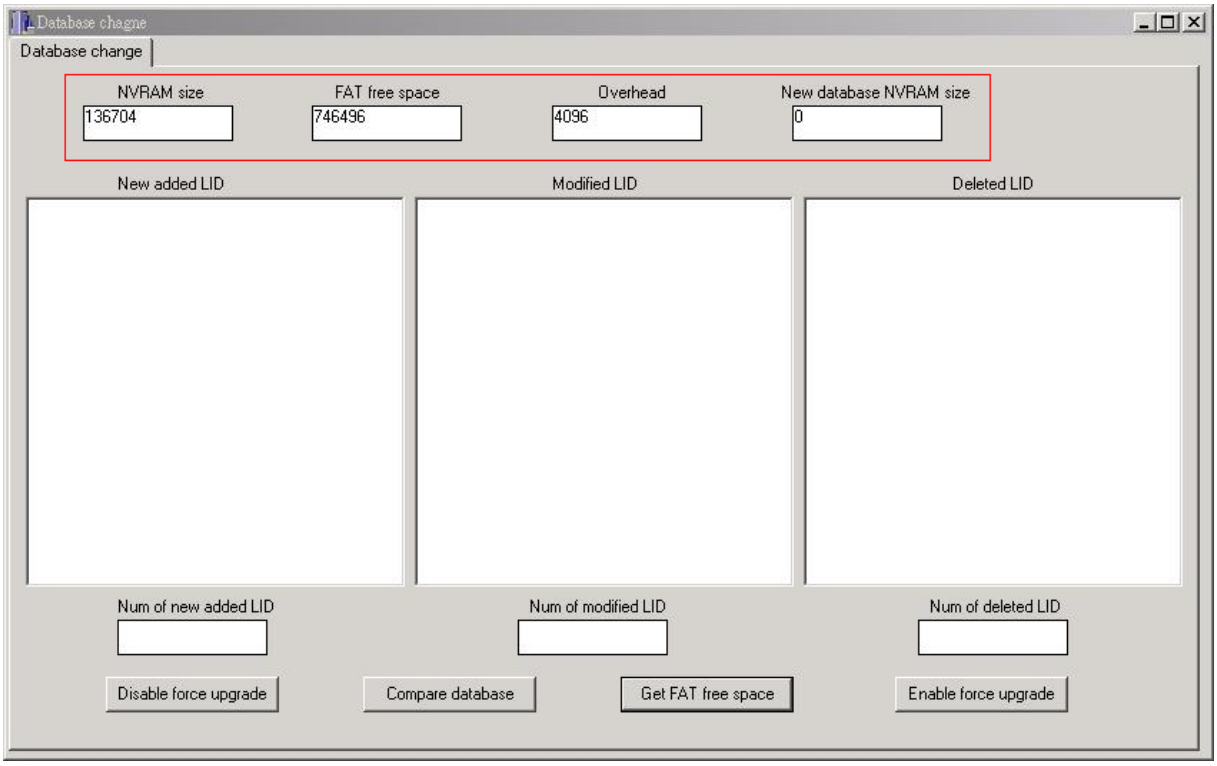

Figure 415 ***Result of getting FAT free space***

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User can click [Compare database] button to get difference between two NVRAM database files. These differences include modified LID list, deleted LID list, number of new added LID, number of modified LID and number of deleted LID. META will also get NVRAM size, FAT free space, overhead and new database NVRAM size when user click [Compare database] button.

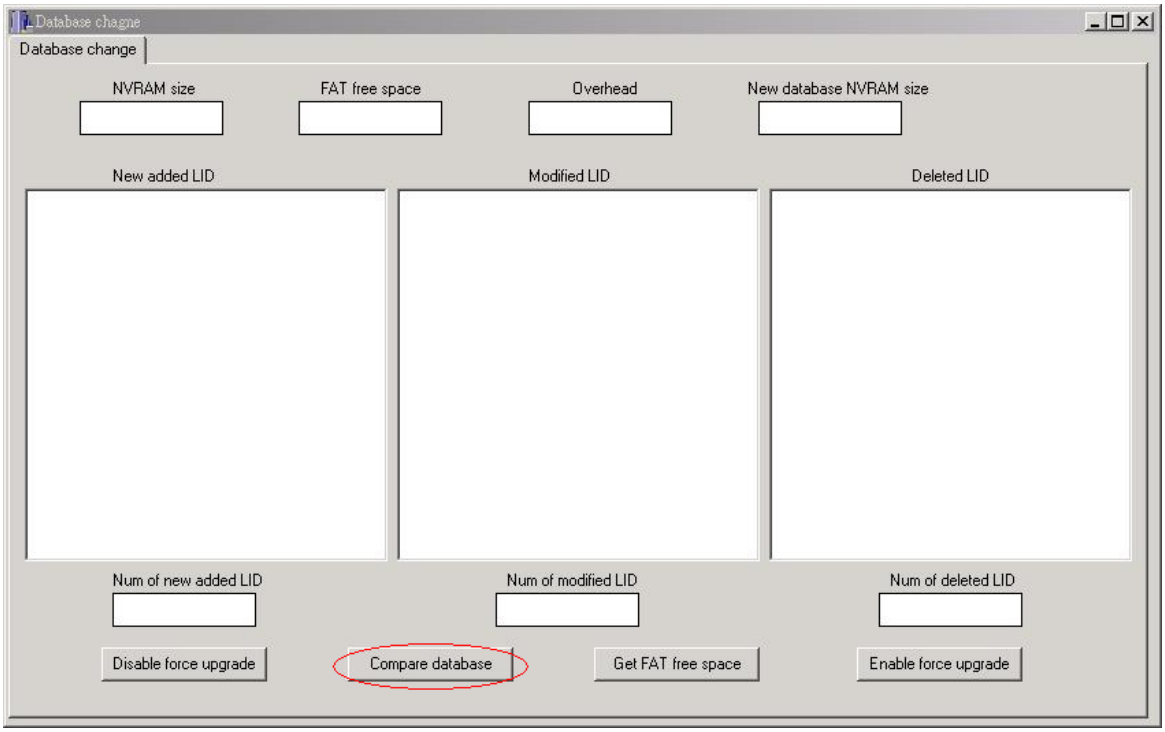

Figure 416 ***Click [Compare database] button to get difference list between two NVRAM database files***

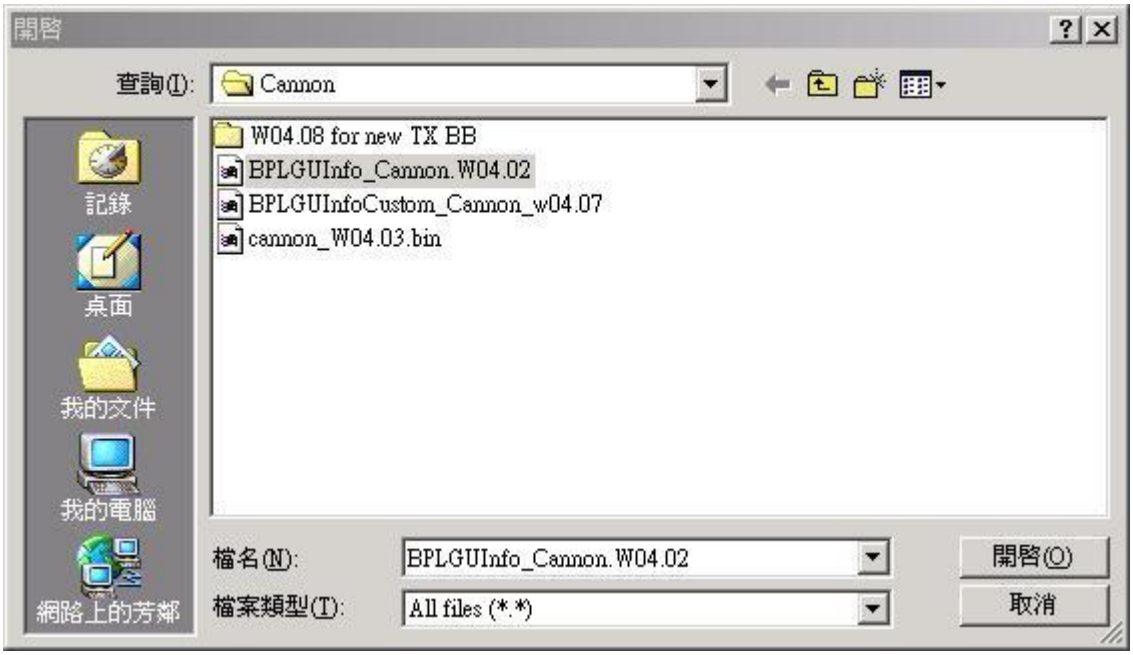

Figure 417 ***Open first NVRAM database file***

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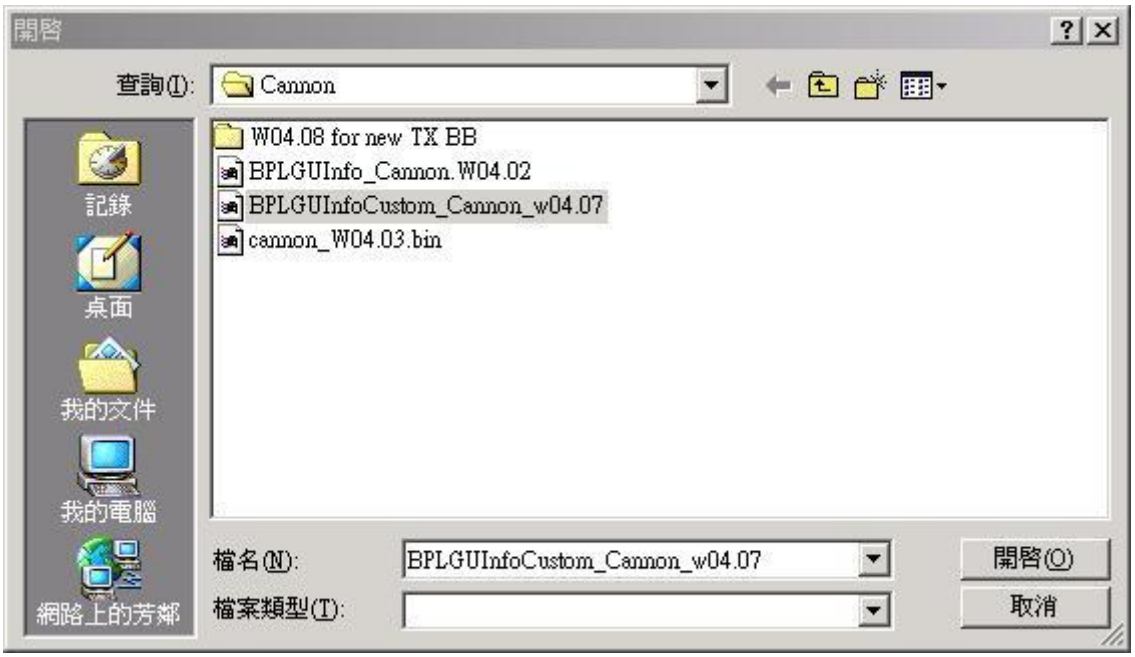

Figure 418 ***Open second NVRAM database file***

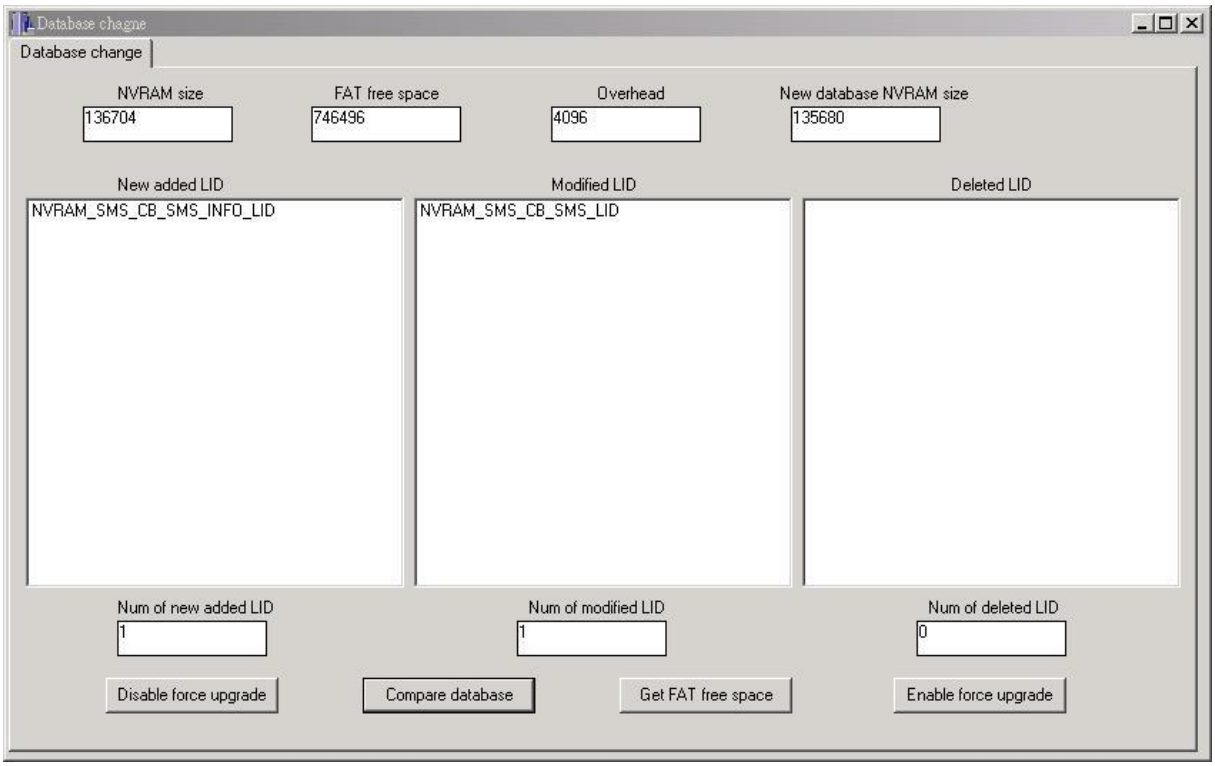

Figure 419 ***Result of comparing NVRAM database***

User can click [Enable force upgrade] button to upgrade difference LID from old format to new format and click [Disable force upgrade] button to disable upgrade difference LID from old format to new format.

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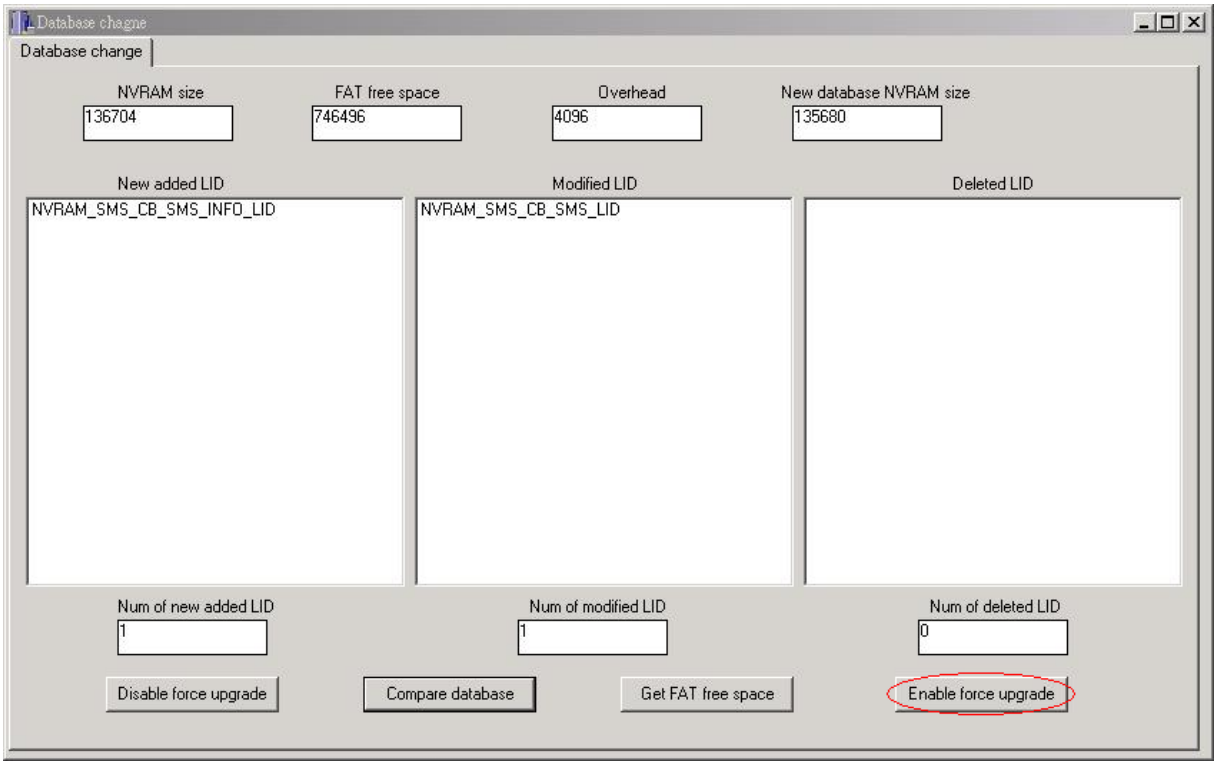

Figure 420 ***Click [Enable force upgrade] button to upgrade difference LID from old format to new format***

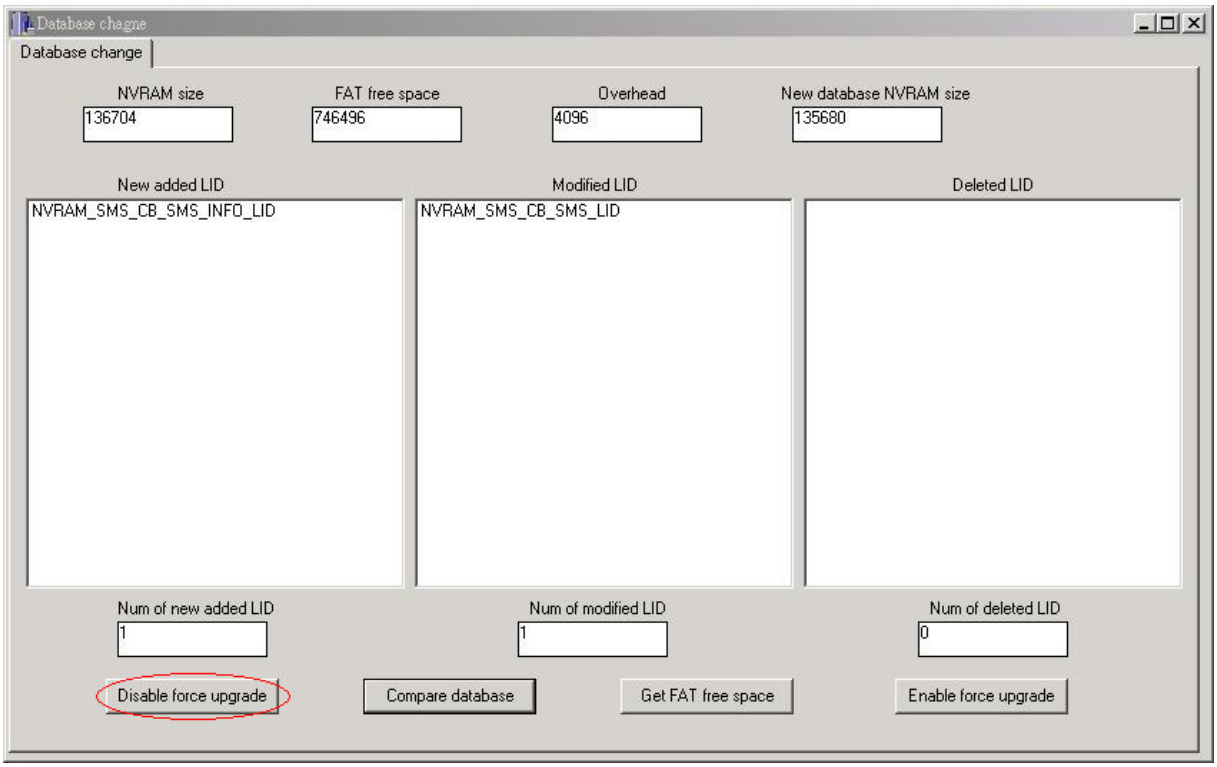

Figure 421 ***Click [Disable force upgrade] button to disable upgrade difference LID from old format to new format***

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3.17 Setting

User can use setting window to get or set mobile setting. User can switch to setting window by selecting [Setting] from main selection menu.

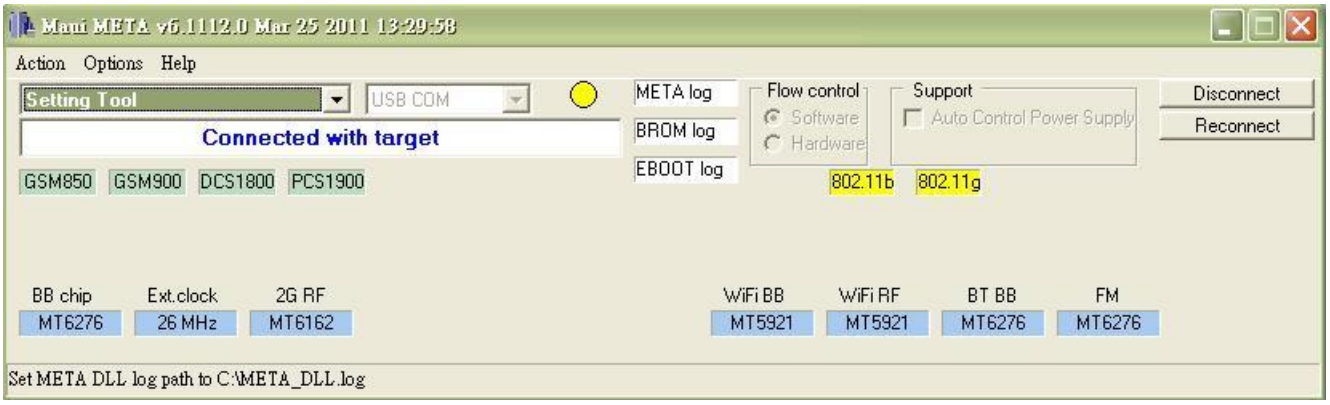

Figure 422 ***Select [Setting] from main selection menu***

3.17.1 RAC preference setting

User can use RAC preference setting window to get or set mobile class, PLMN selection and GPRS attach mode setting of mobile.

3.17.1.1 Upload and download band setting in flash

User can click [Upload from flash] button to read RAC preference setting from flash and click [Download to flash] button to write band setting to flash.

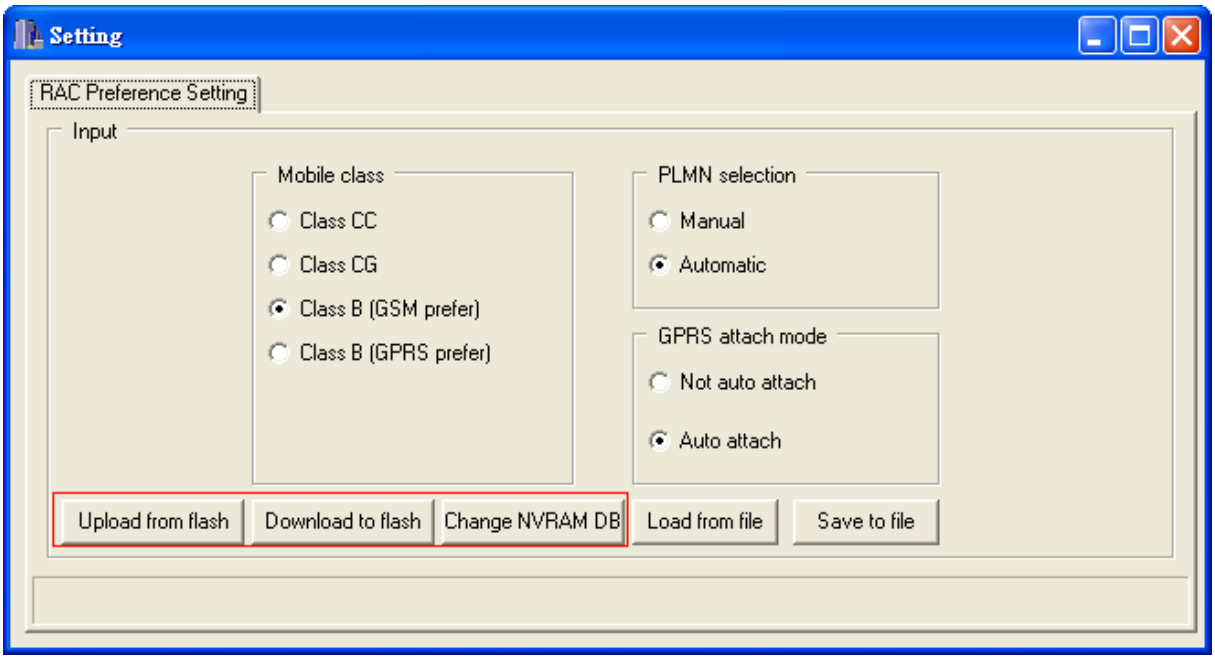

Figure 423 ***Buttons related to NVRAM access***

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3.17.1.2 Read and write band setting in file

User can click [Load from file] button to read band setting in file and click [Save to file] button to write band setting to file.

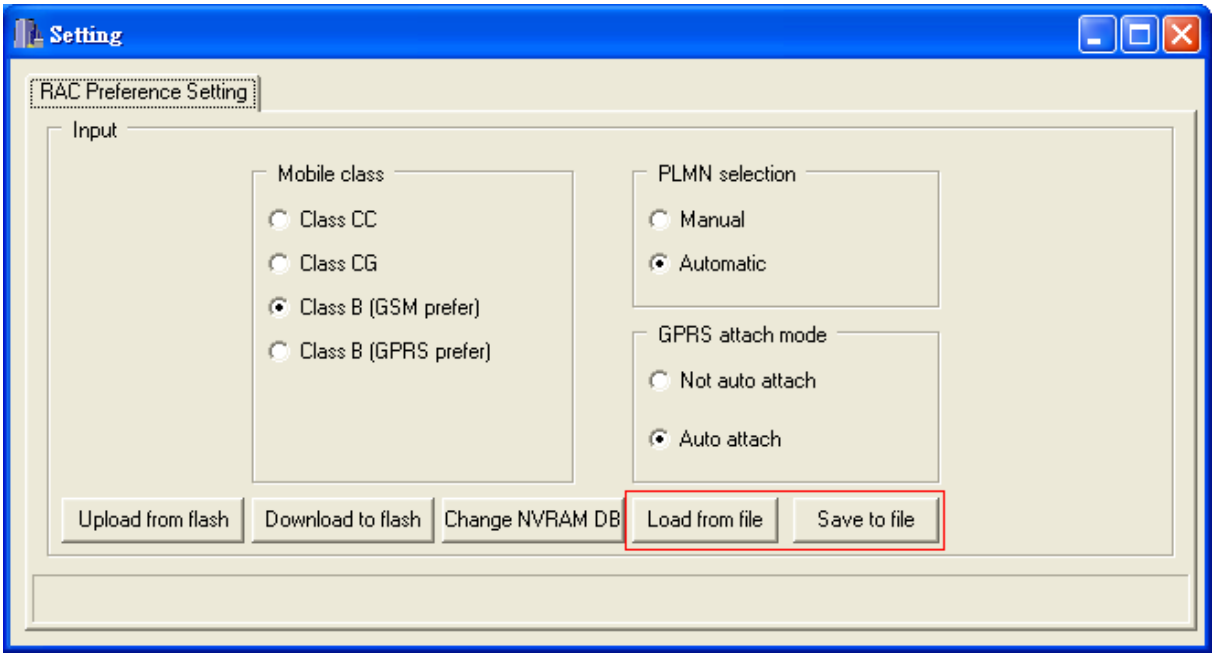

Figure 424 ***Buttons related to INI file access***

The following is a template file of band setting. User will get the text file after saving band RAC preference setting to file.
[RAC preference setting]
PLMN selection=Automatic
Mobile class=Class B(GSM)
GPRS attach mode=Not auto

3.18 CMMB Tool

The CMMB tool provides the following features for users to verify CMMB RF performance.

- Select band and automatic scan of CMMB services
- Select service to retrieve signal strength and quality (RSSI, SNR and BER, LDPC, RS)

Users can switch to the CMMB tool by selecting [CMMB Tool] from main menu.

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.

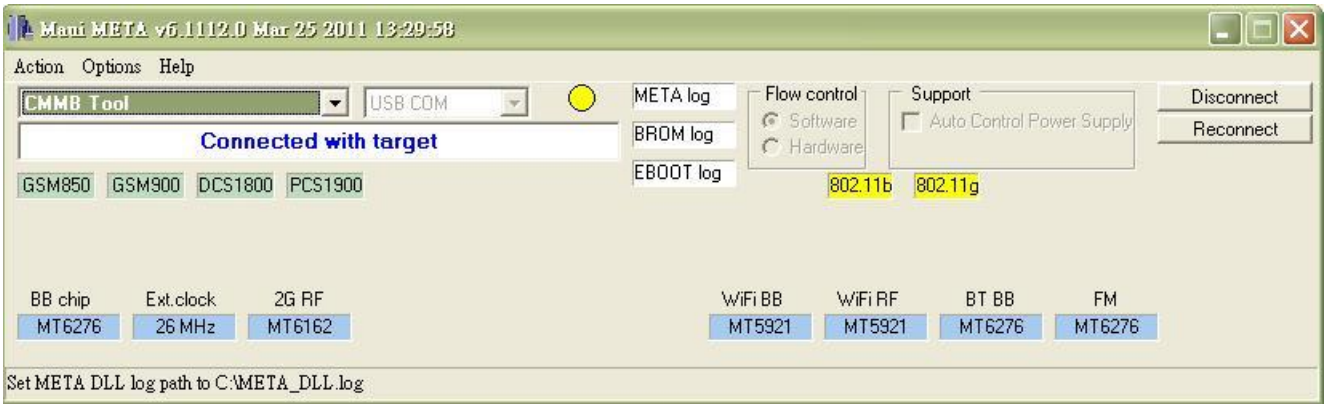

Figure 425 ***Select [CMMB Tool] from main selection menu***

3.18.1 Select band and automatically scan of CMMB services

Users can follow the below procedure to set frequency:

4.4.1 Select band (CHINA_U).

4.4.1 Click [Auto scan].

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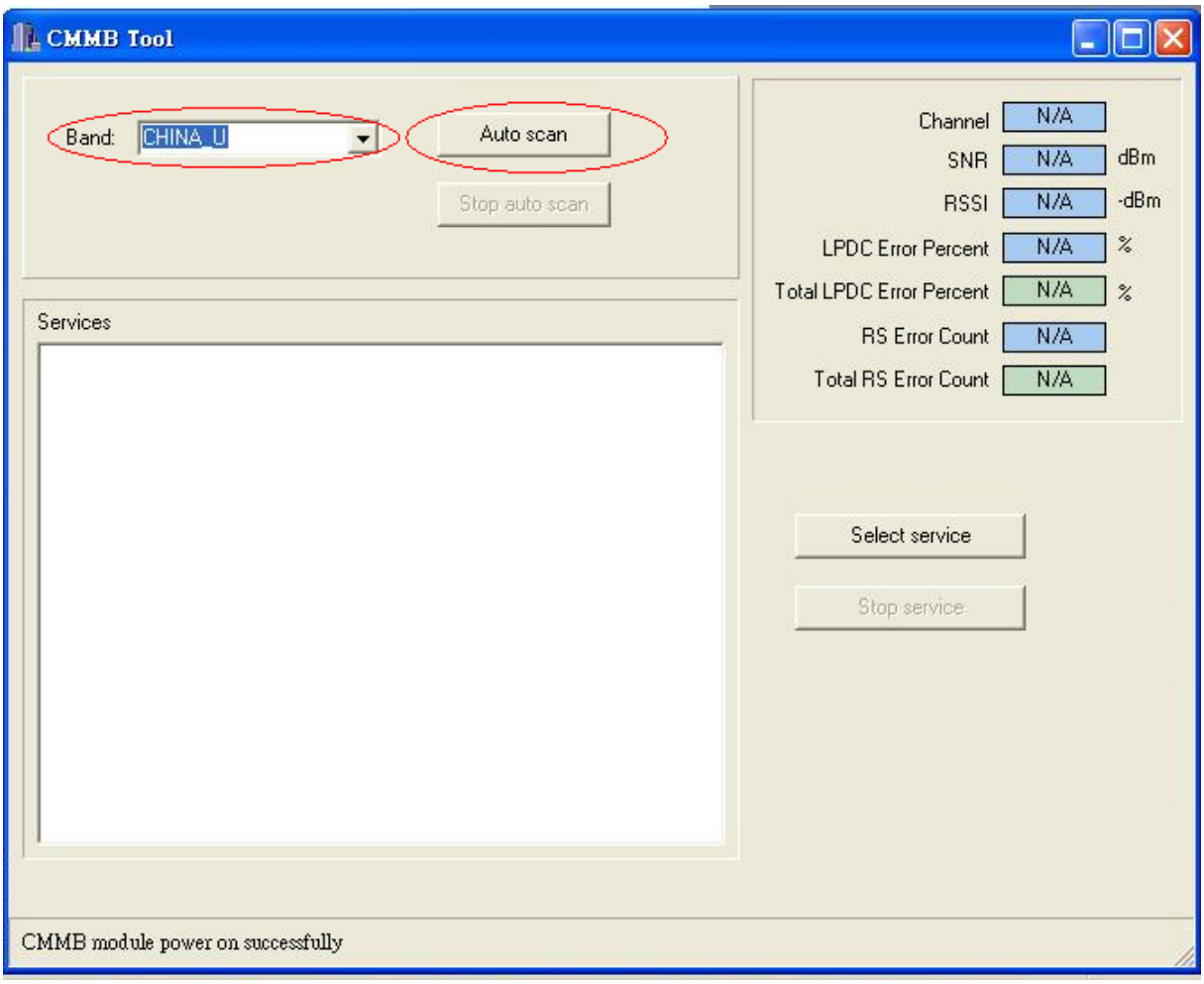

Figure 426 ***Select Band and Click [Auto Scan]***

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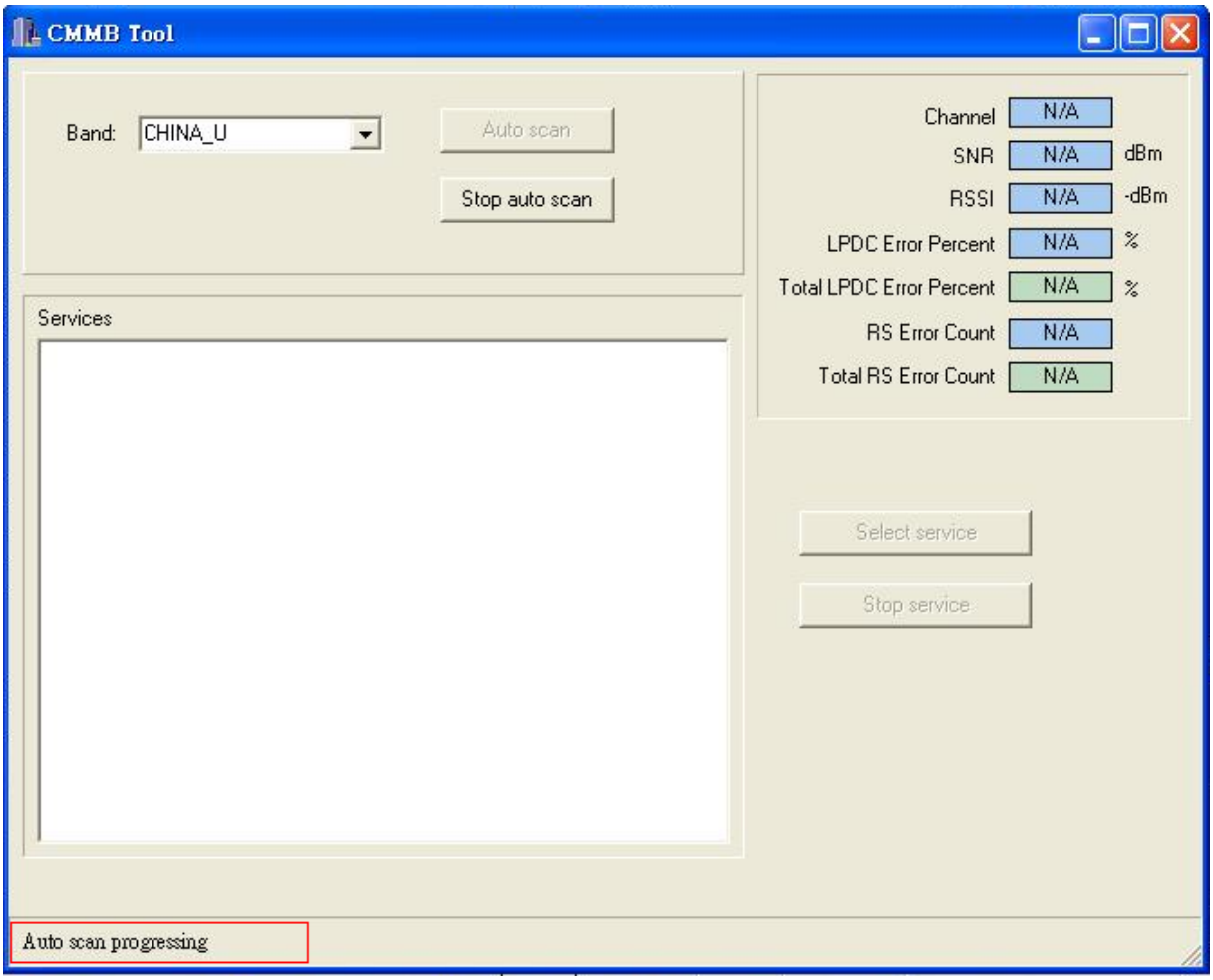

Figure 427 ***Auto Scan Progressing***

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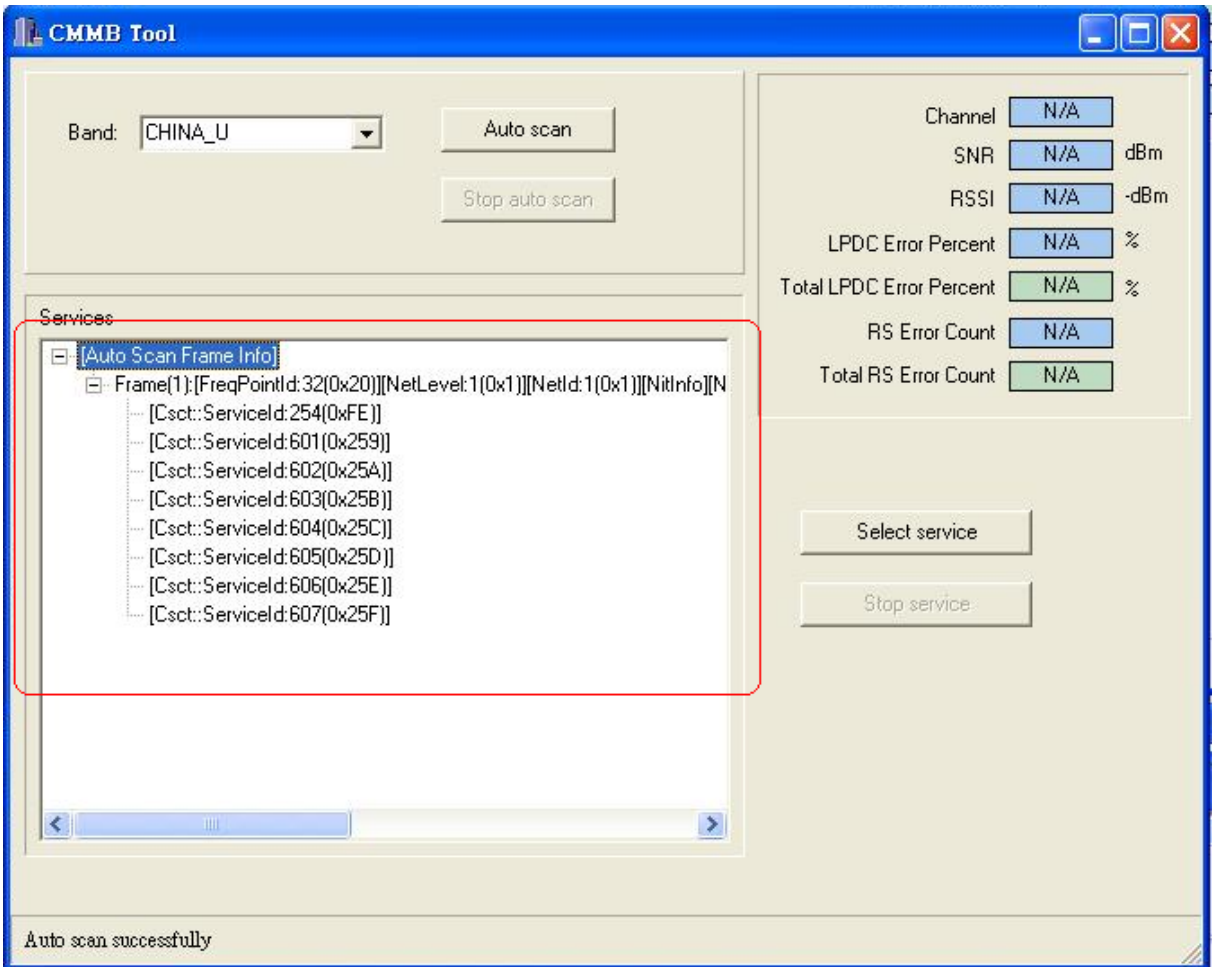

Figure 428 ***Results of Auto Scan***

3.18.2 Select service to retrieve signal strength and quality

Users can follow the below procedures to monitor the CMMB RF performance via signal strength retrieval after selecting a specific service.

1. Select a service from the left-side tree view of services.
2. Click [Select service] button to select a specific service.
3. Click [Stop service] button when users want to perform other operations such as selecting another service.

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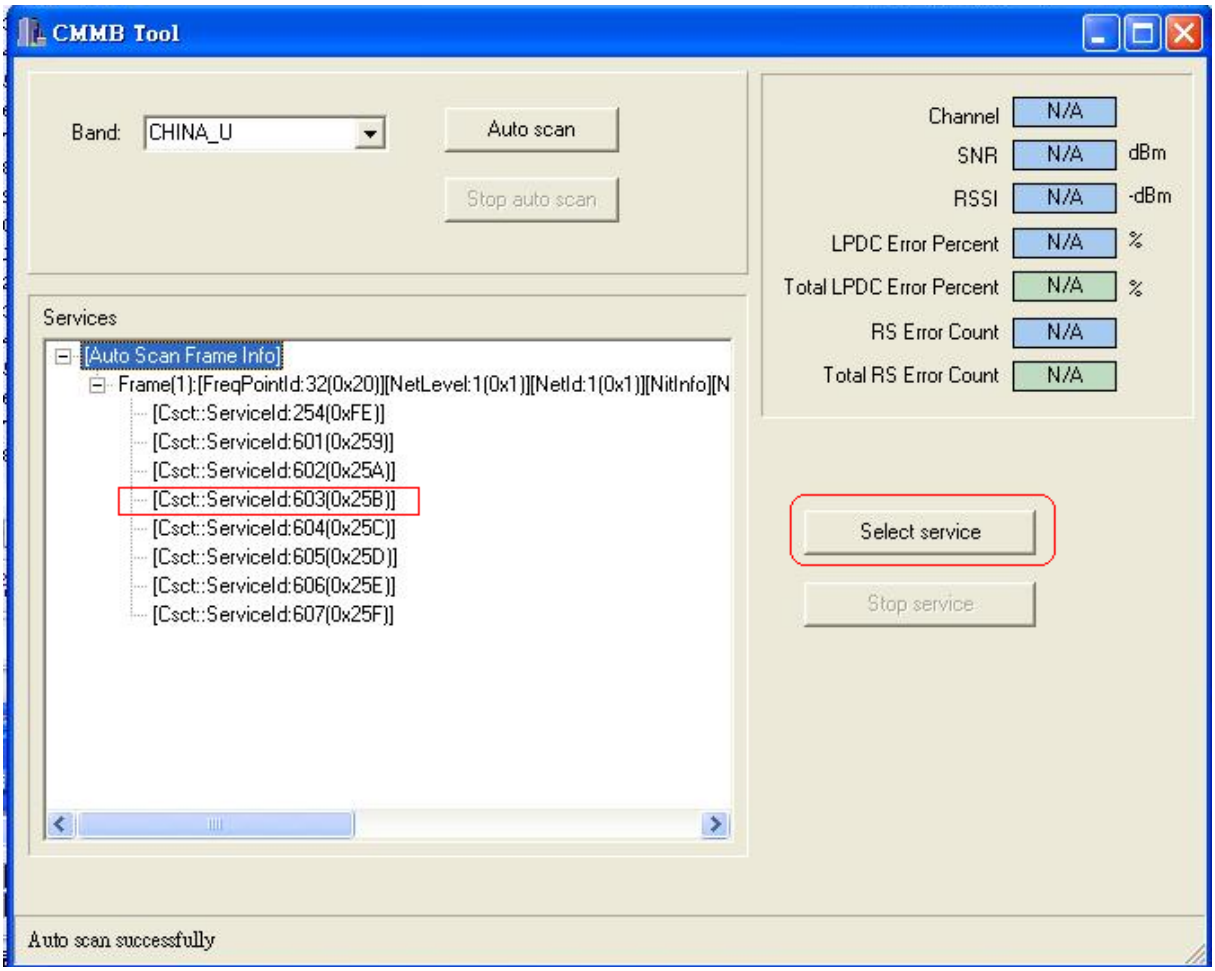

Figure 429 ***Select a specific service and click [Select service]***

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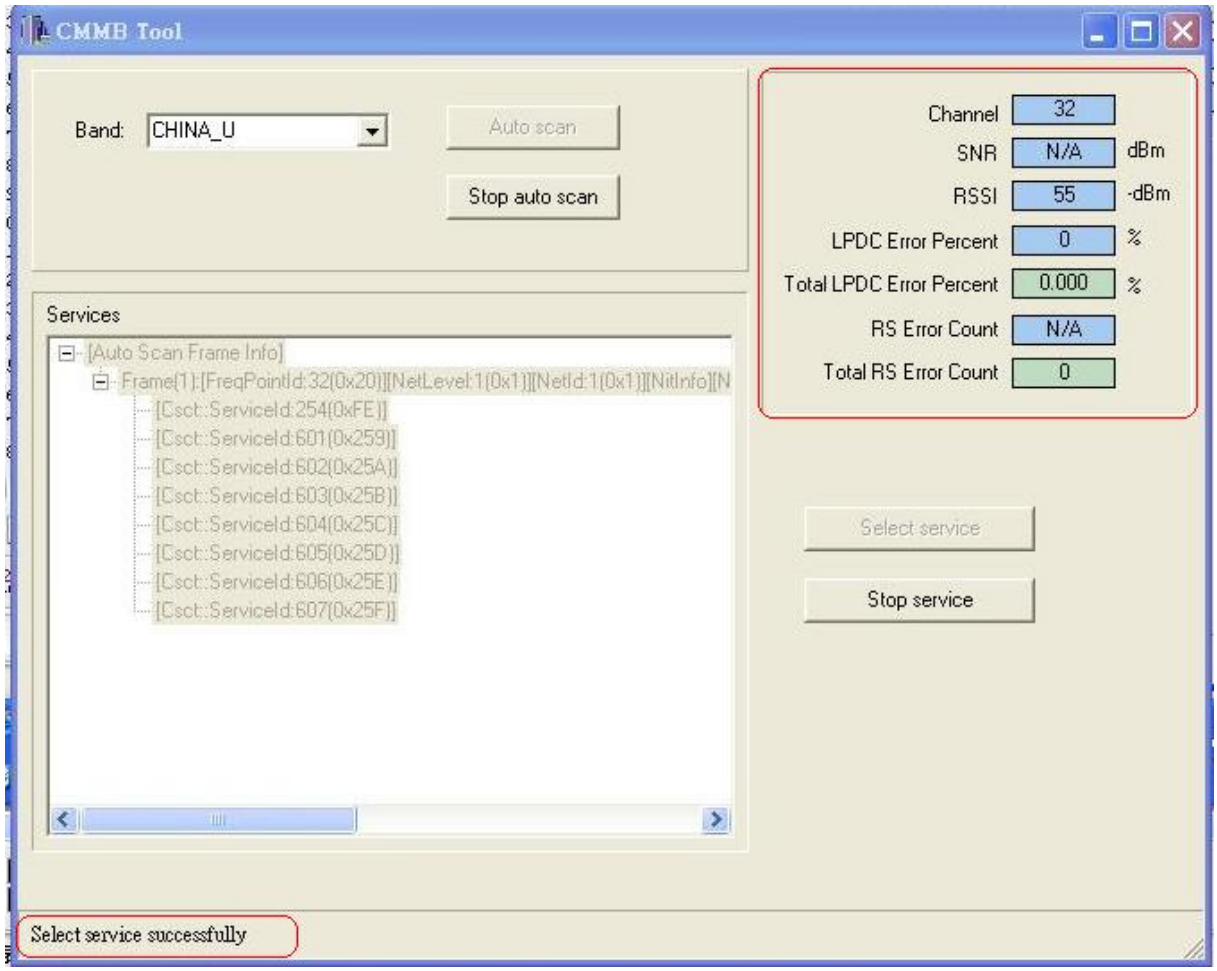

Figure 430 ***Signal Strength information is displayed.***

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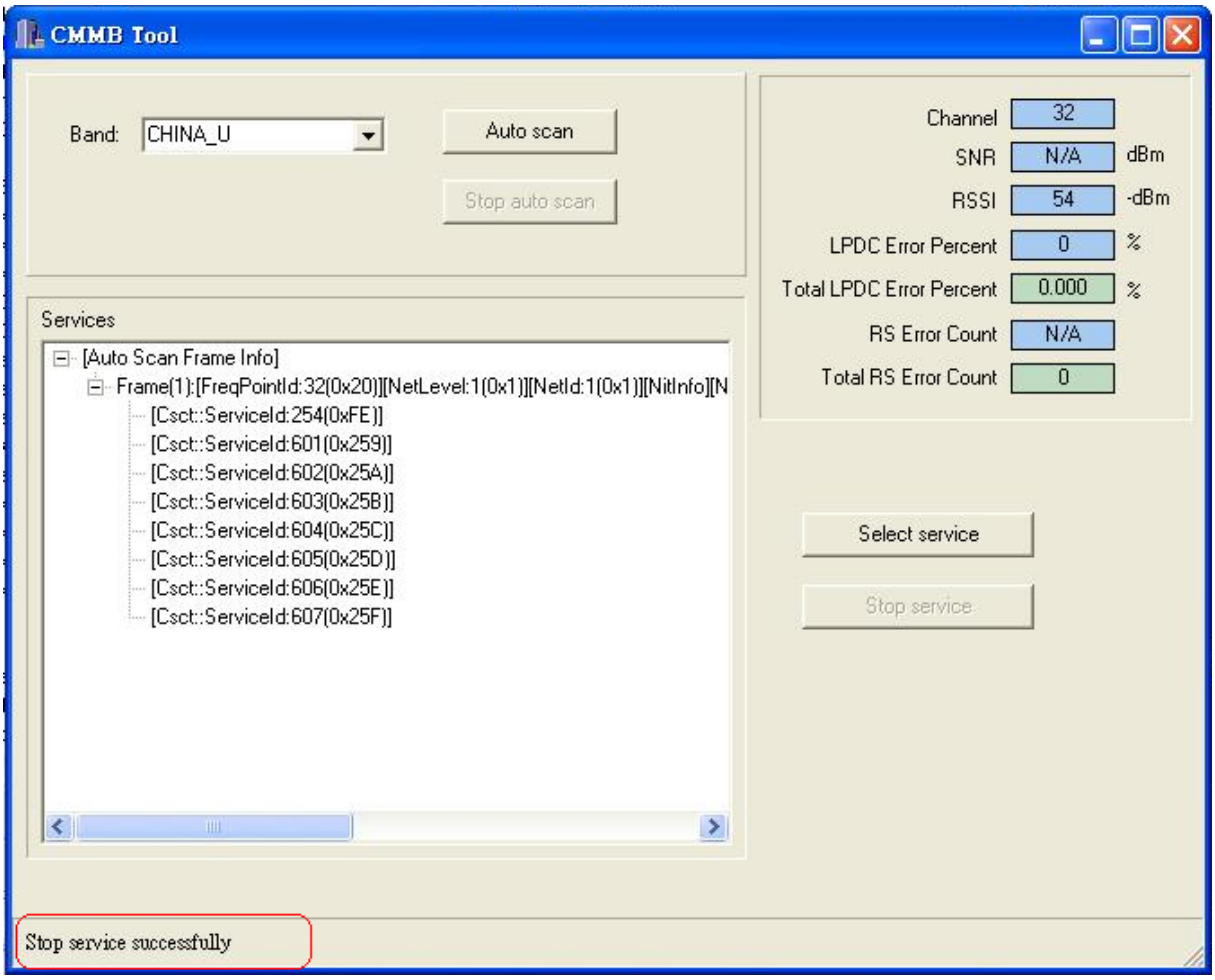

Figure 431 ***Stop current service***

3.19 MATV Tool

Users can use MATV tool to evaluate the MT5192 mobile TV chip. The MATV tool UI is divided into 3 groups (as labeled in Figure 432)

1. Country/Region Setting (for Country/Region selection/setting).
2. Channel List (for channel scan, channel entry modification, select channel entry).
3. Channel quality (the predefined channel quality criteria are listed in the UI).

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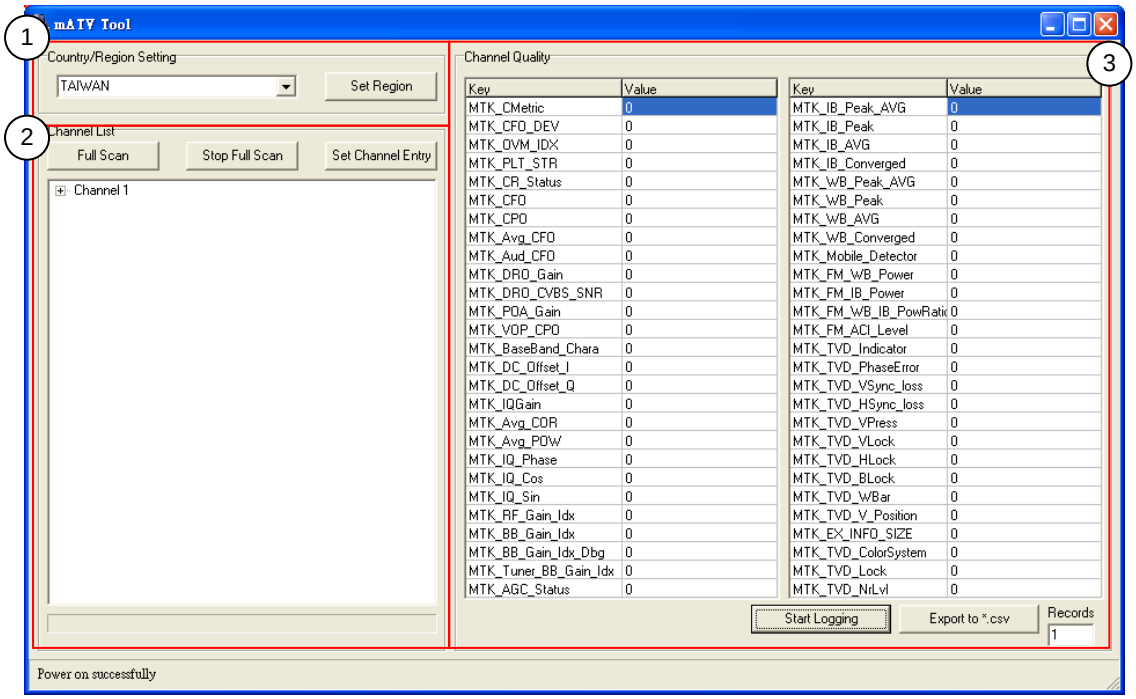

Figure 432 ***MATV Tool overview***

The user first selects country/region from the combo-box and then clicks the “Set Region” button. The message is displayed after a successful operation.

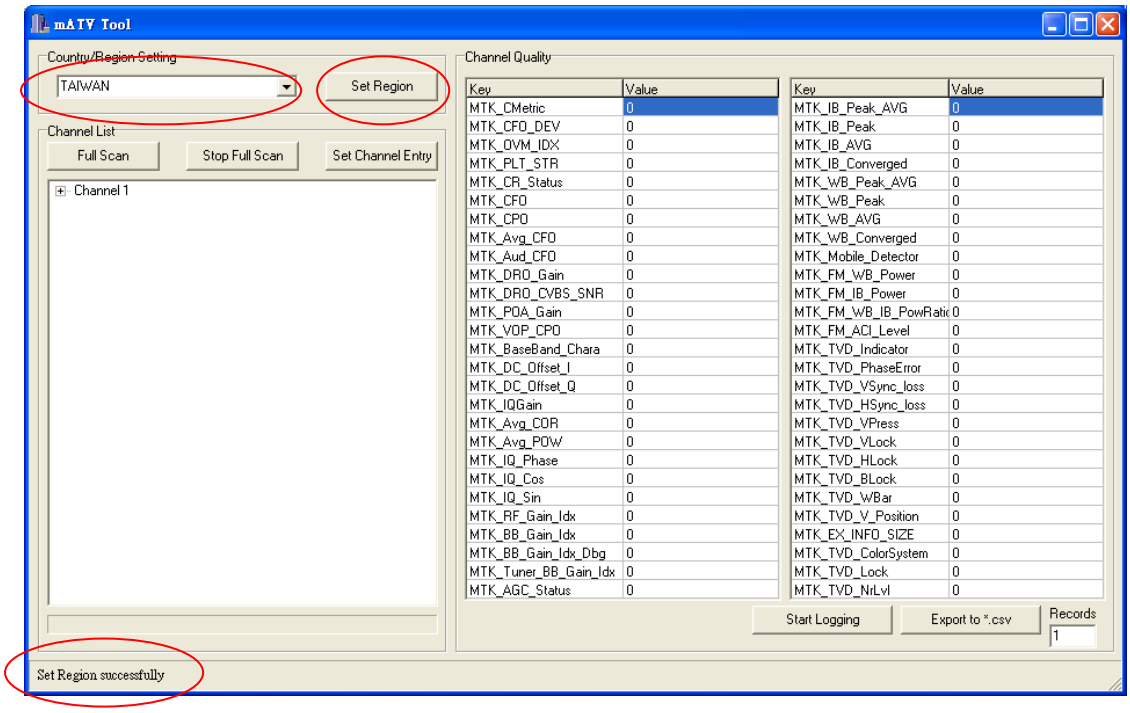

Figure 433 ***Set Country/Region***

After the user clicks the “Full Scan” button, the full scan operation will be activated. The GUI will keep updating the full scan progress. The user can stop the full scan by clicking the “Stop Full Scan”.

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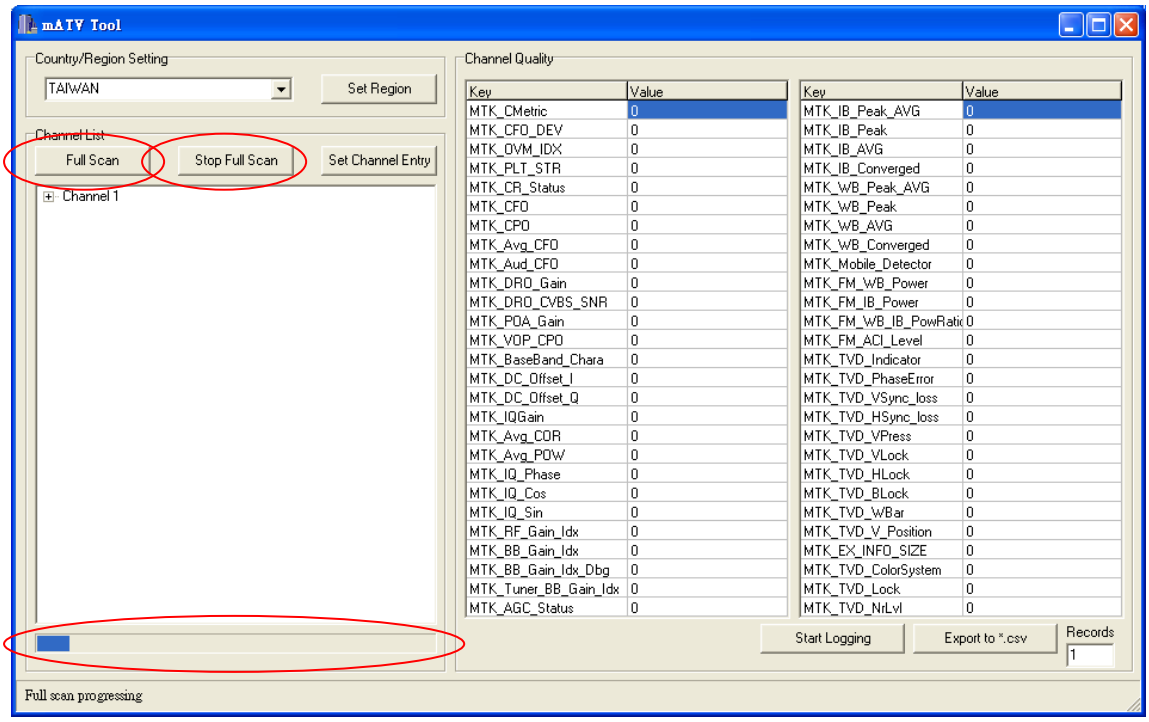

Figure 434 ***Full Scan***

After the user selects one valid channel (a channel entry with a flag equals 1) from the Channel List, he/she can click “Start Logging” button. The user can check the channel properties such as freqeuncy, sound system, color system and valid flag in the GUI. By clicking the leaf node for the second time, the channel property can be modified and be set to the target side MATV module by clicking the “Set Channel Entry” button.

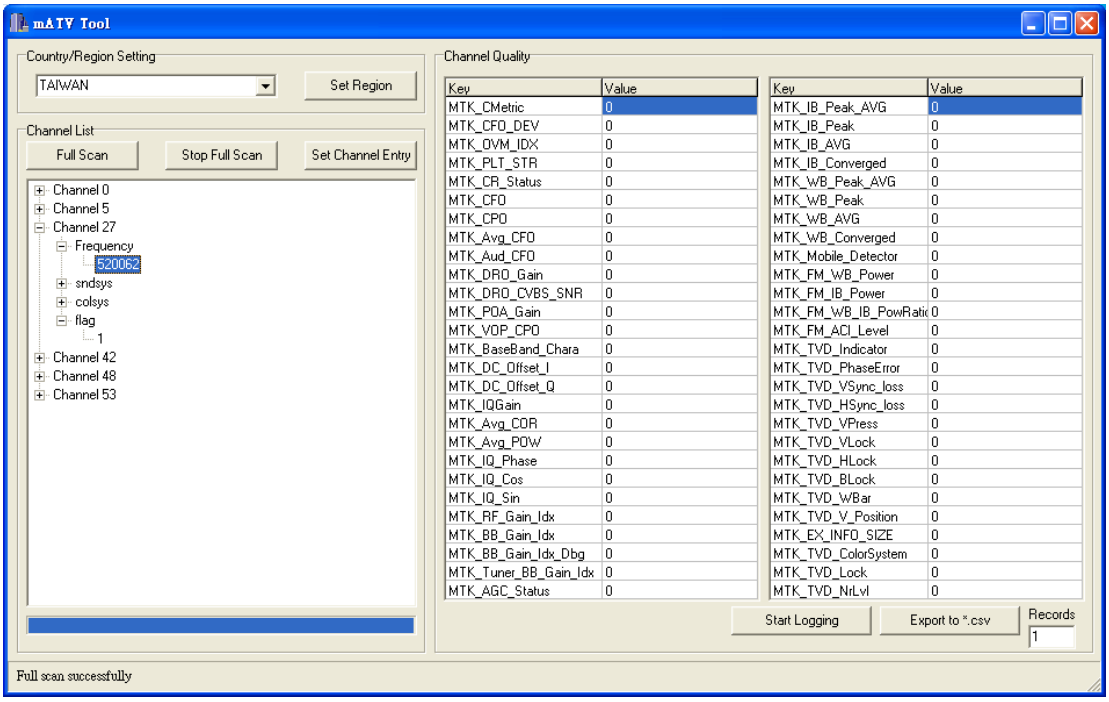

Figure 435 ***Channel Quality***

The channel quality is periodically updated onto GUI.

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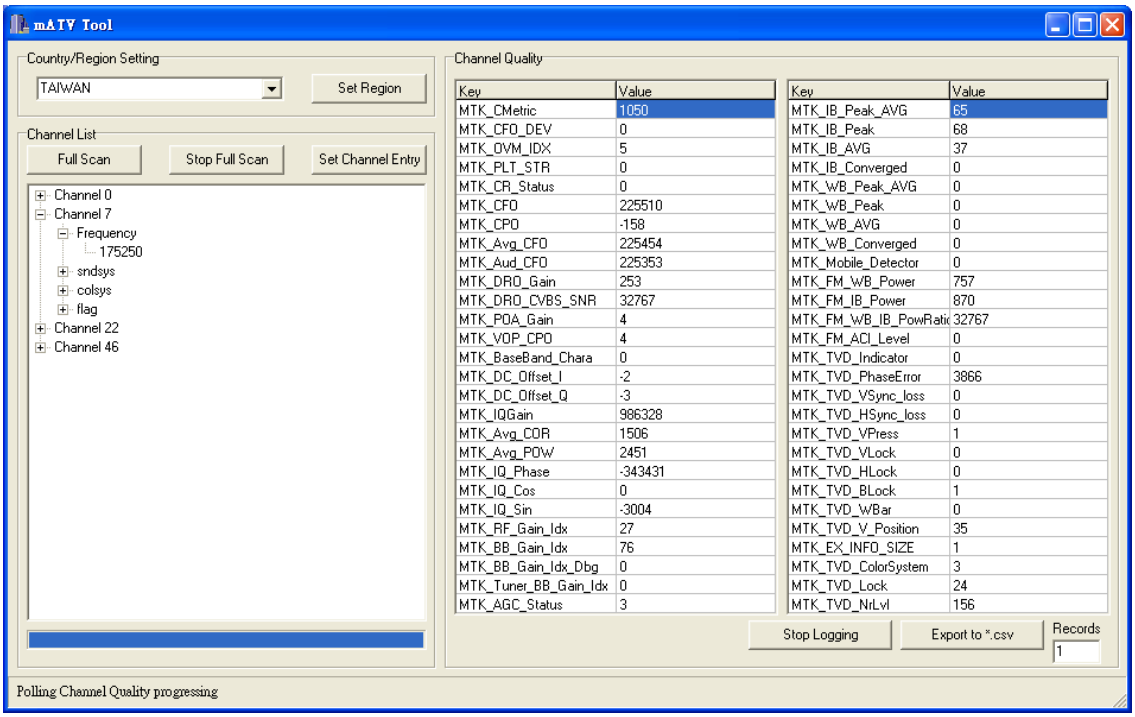

Figure 436 ***Polling channel quality***

3.20 3G RF Tool

After META opens COM port, reads NVRAM database and reset target to test mode, user can start to do all calibration and testing. User can switch to 3G RF tool by selecting [3G RF tool] from main selection menu.

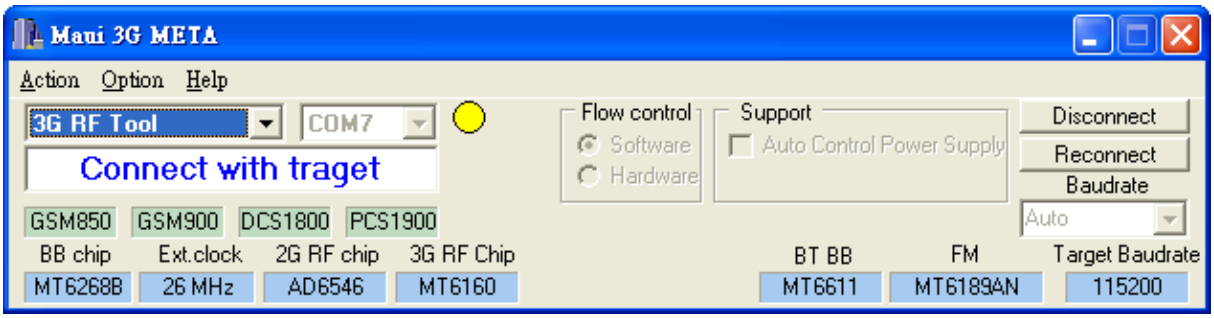

Figure 437 ***Select [3G RF Tool] from main selection menu***

3.20.1 AFC

User can input BAND, UARFCN, AFC DAC value, Gain (dB) and LNA Mode(High/Middle/Low) and then click [Start] button to measure the frequency error.

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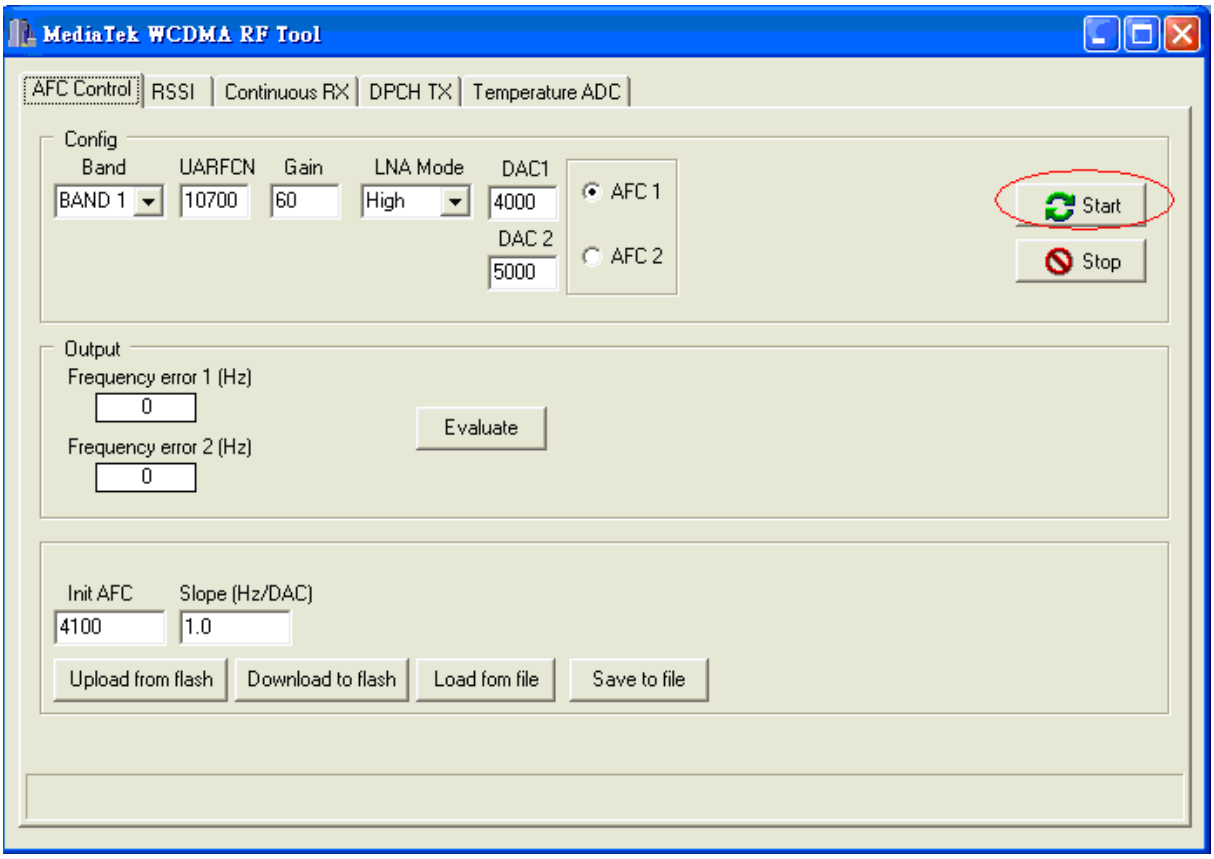

Figure 438 ***Click [Start] button to start testing***

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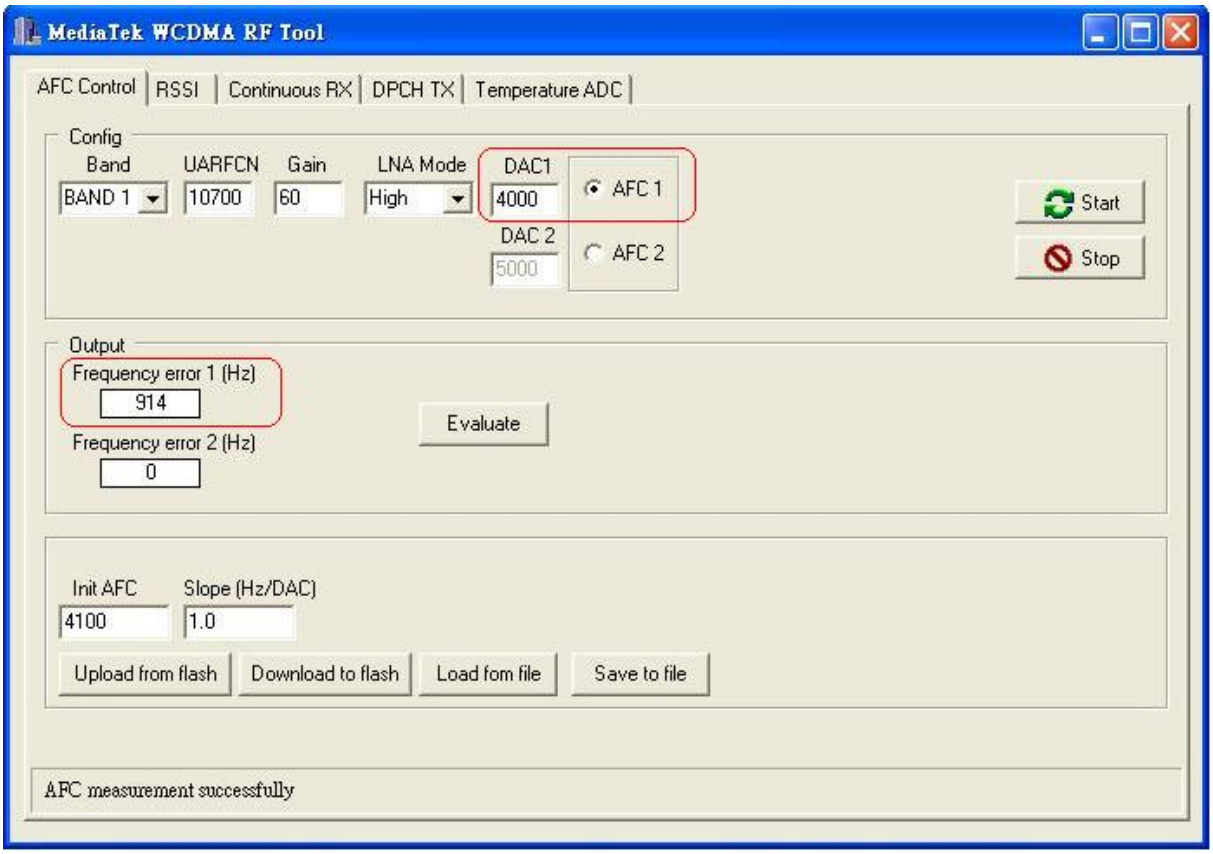

Figure 439 ***Measurement result of AFC DAC 1***

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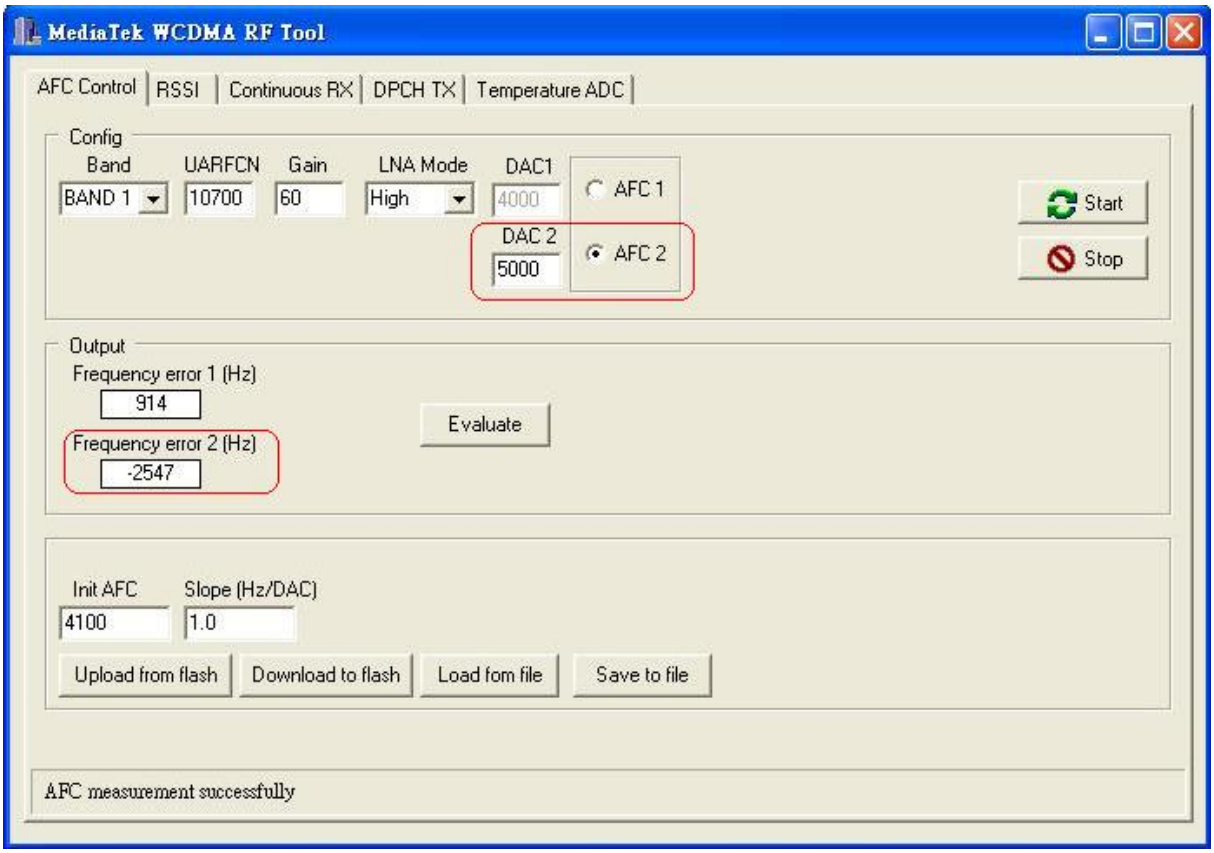

Figure 440 ***Measurement result of AFC DAC 2***

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3.20.1.1 Evaluate

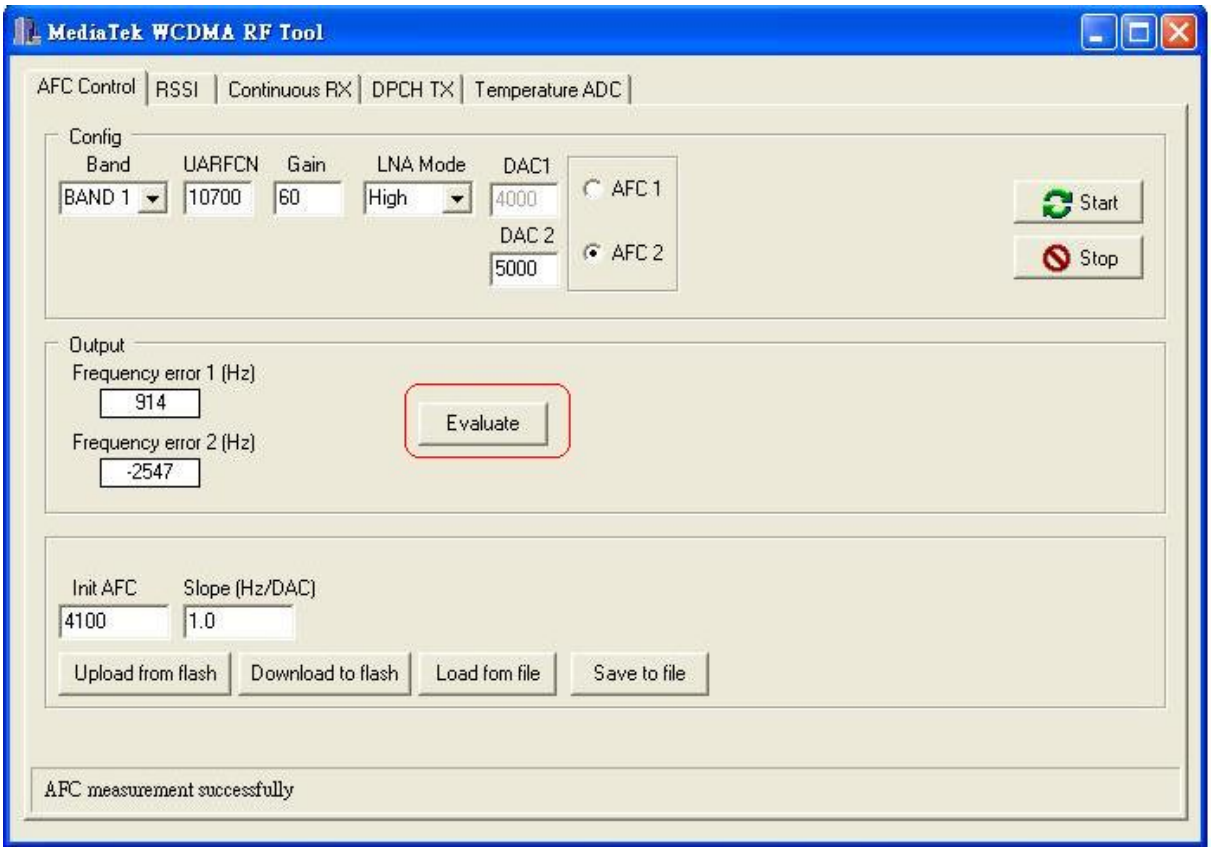

Figure 441 ***Click [Evaluate] button to calculate the Init AFC DAC and Slope***

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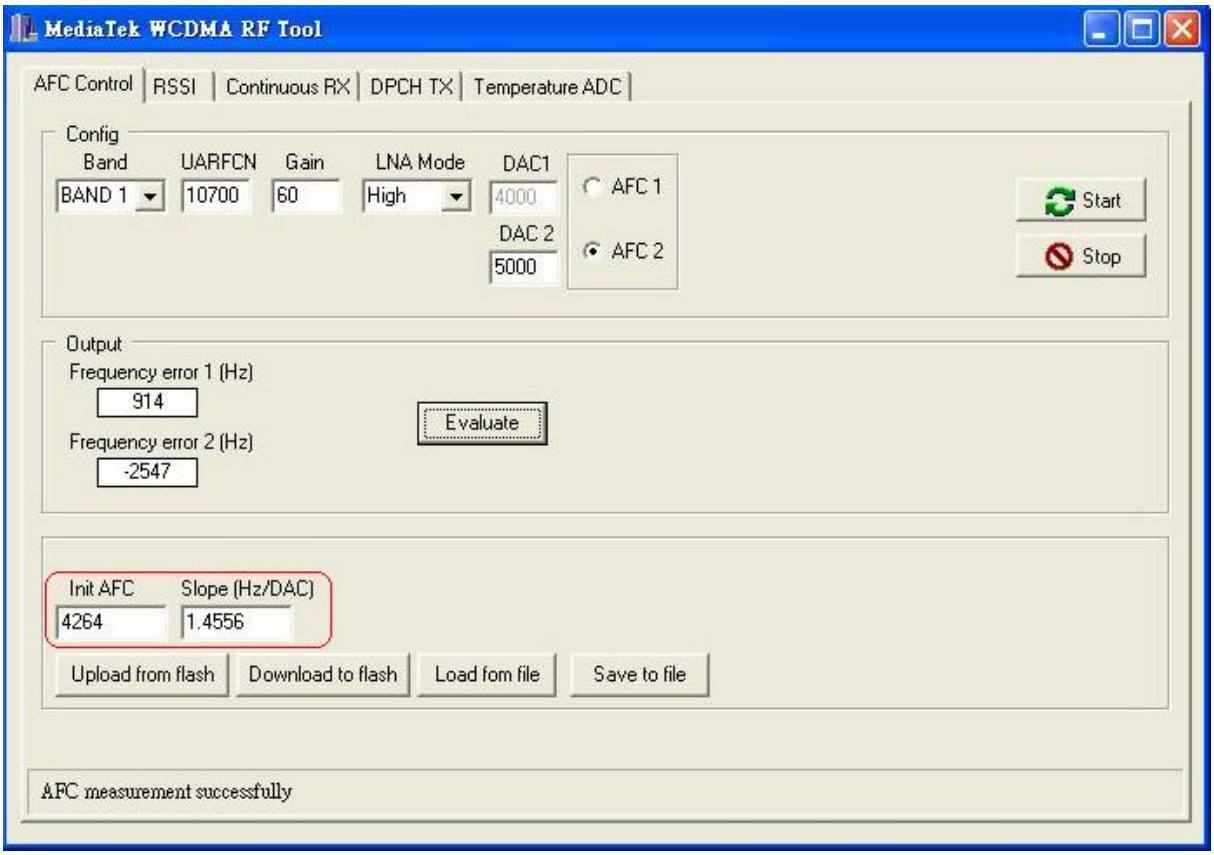

Figure 442 ***The result is displayed.***

Note:

Slope = $\overline{\Delta f_1} - \overline{\Delta f_2} \Big/ DAC_2 - DAC_1$, where DAC1 and DAC2 are AFC DAC value, and $\overline{\Delta f_1}$ and $\overline{\Delta f_2}$ are averaged frequency error measured at MS.

3.20.1.1.a Upload and download the AFC value in flash

Users can click [Upload from flash] button to read initial AFC and slope value from flash and click [Download to flash] button to write initial AFC and slope value to flash.

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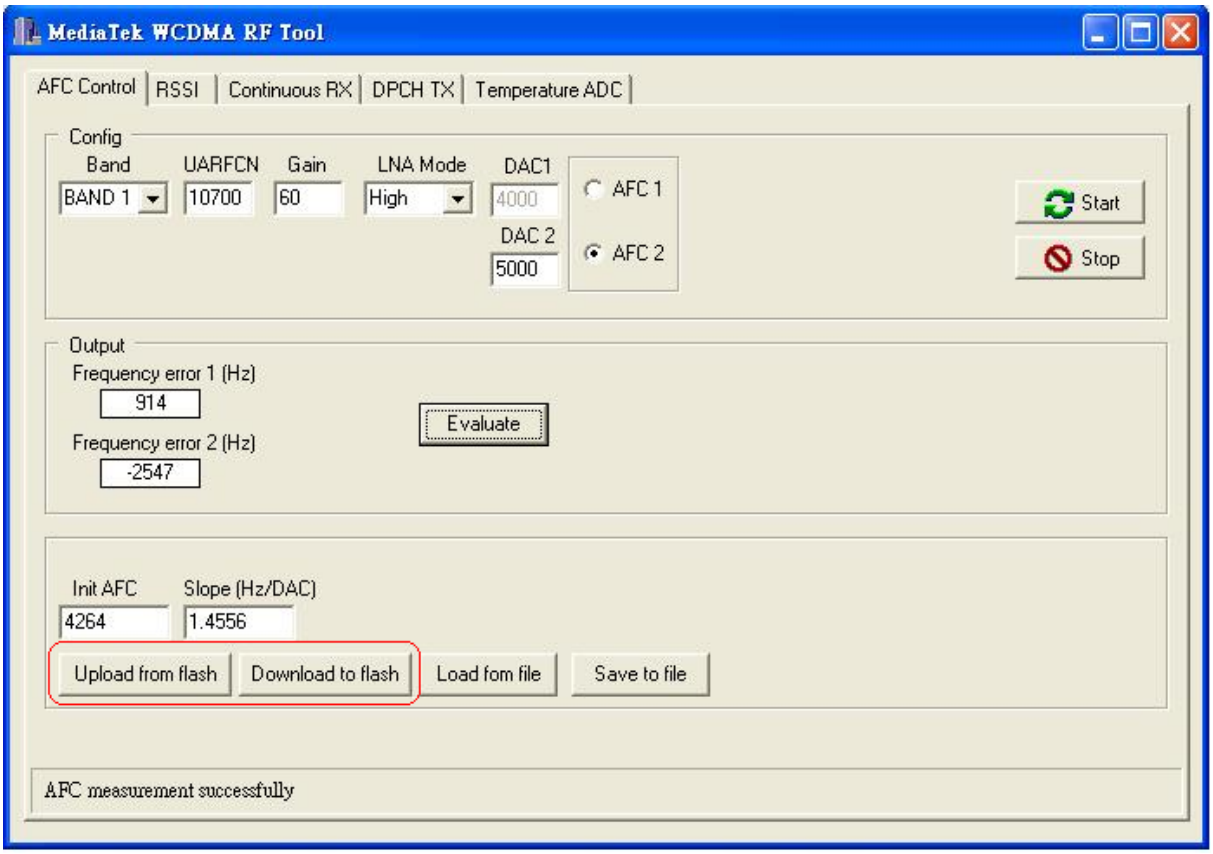

Figure 443 ***[Upload from flash] and [Download to flash] button***

3.20.1.2 Load and save the AFC value with INI file

Users can click [Load from file] button to load initial AFC and slope value from file and click [Save to file] button to save initial AFC and slope value to file.

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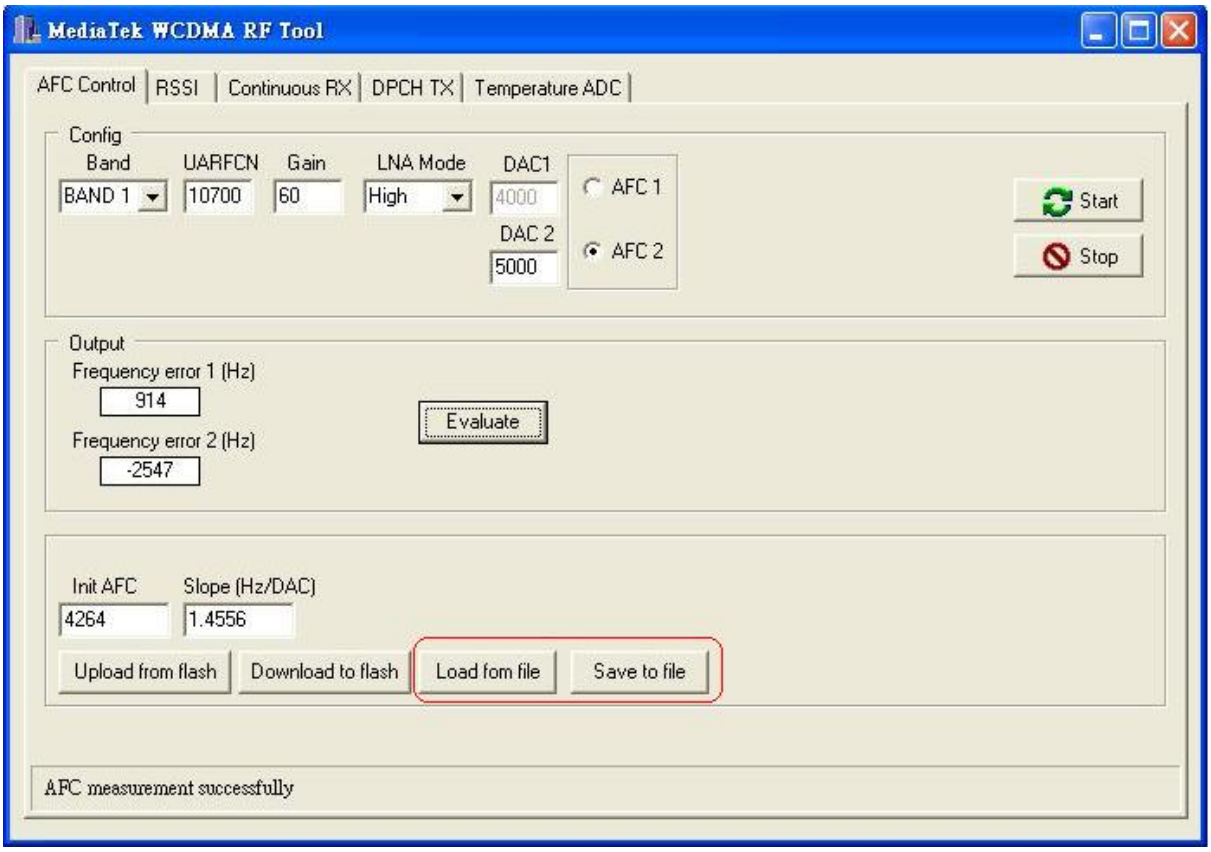

Figure 444 ***[Load from file] and [Save to file] buttons***

The following is a template file of AFC control. User will get the text file after saving initial value and slope. Please follow the file format if you want to change the value in file.

[AFC control]
Initial value=4264
Slope=1.4561

Note: Since AFC unit is shared between GSM/GPRS/EDGE RF chip and WCDMA RF Chip, so the AFC value is stored in the same NVRAM LID as [RF Tool].

3.20.2 RSSI

RSSI function is used for measuring the power of the indicated channel. User can key in UARFCN, channel number, temperature index (0~7), gain (dB) and then click [Start] button.

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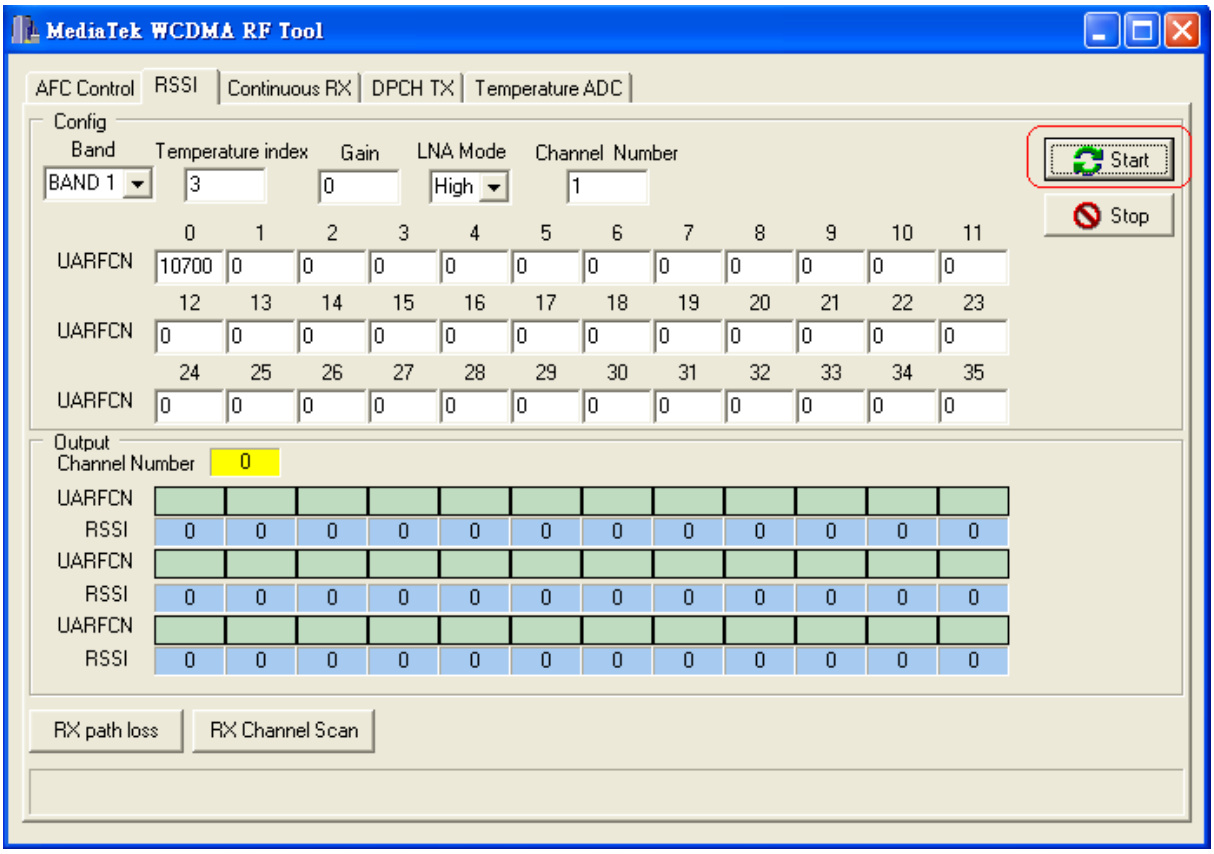

Figure 445 ***Click [Start] button to start power measurement***

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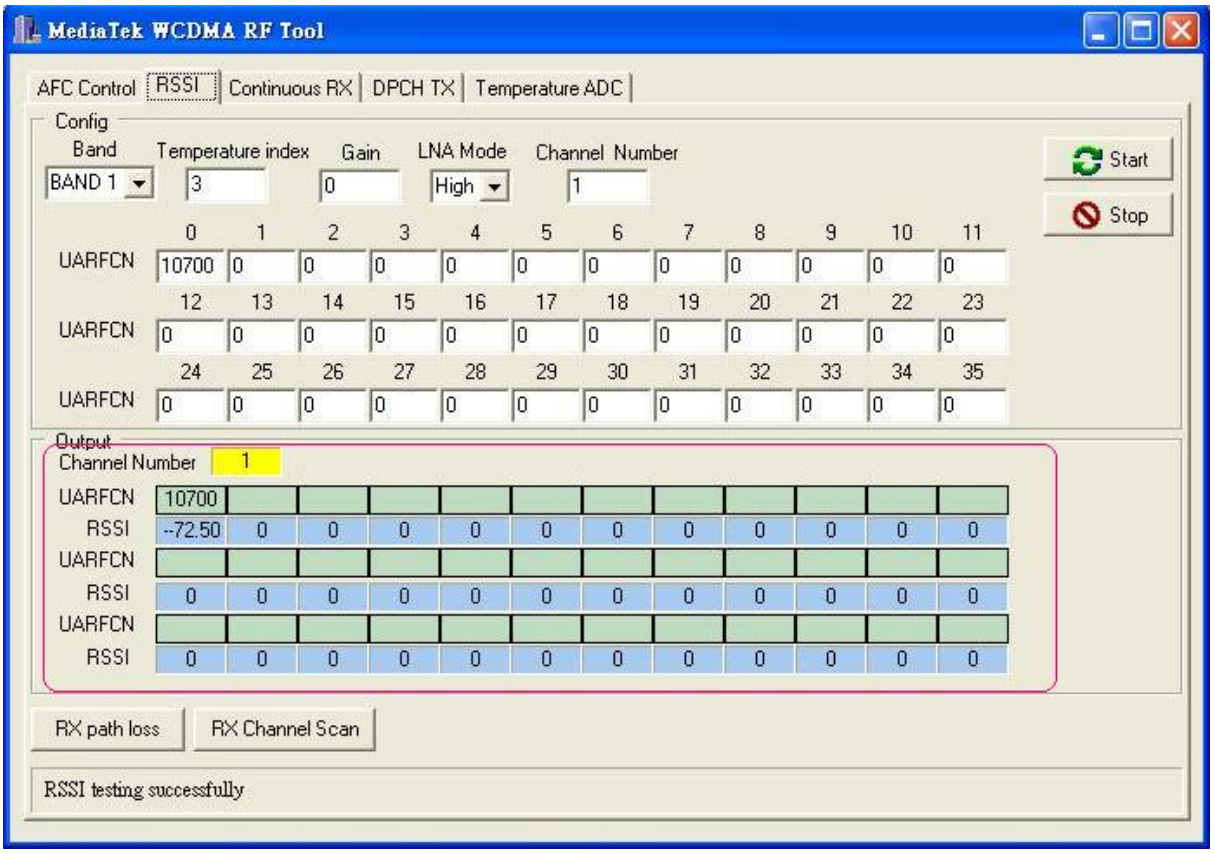

Figure 446 ***RSSI result***

The difference of the downlink cell power and the average power of RSSI done by MS is the RX loss. User can save to flash or file by clicking [RX path loss] button. Please refer to section 3.20.2.1.

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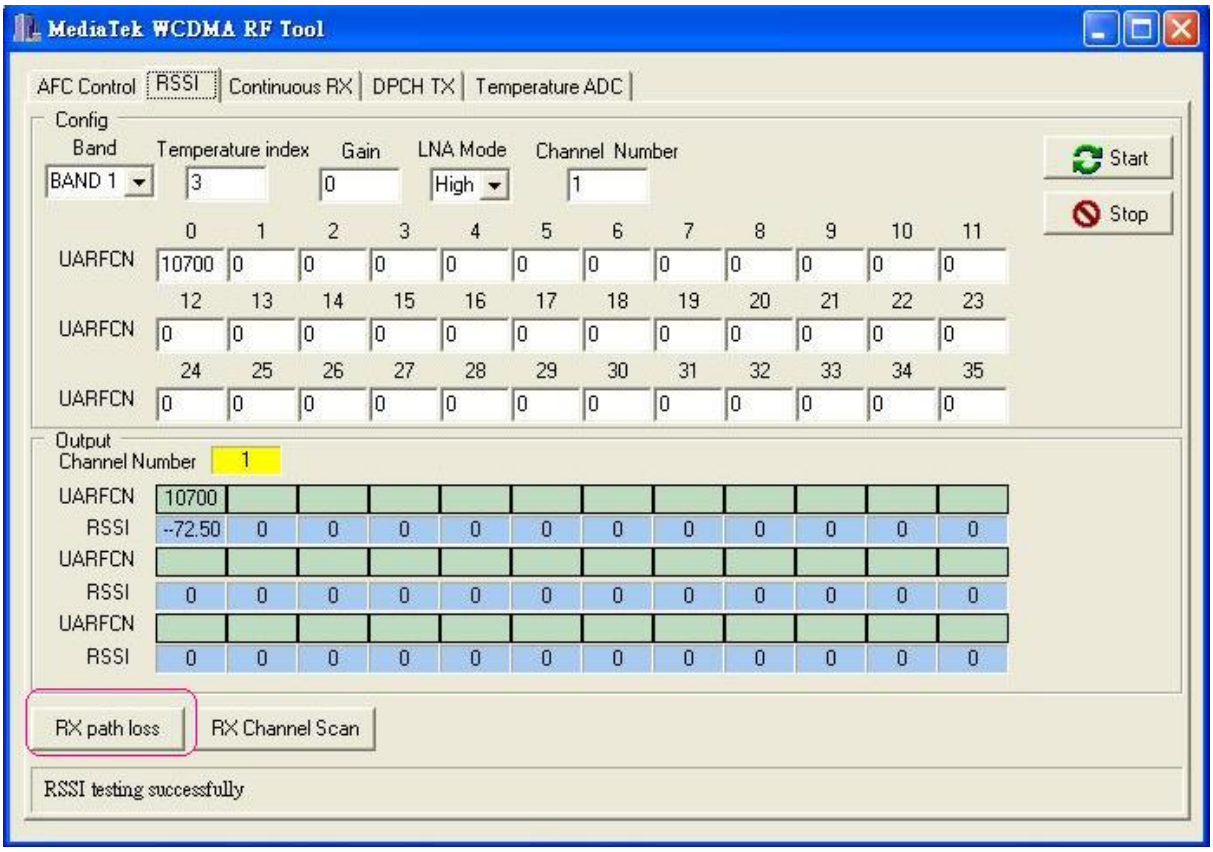

Figure 447 ***Click [RX path loss] button***

3.20.2.1 RX path loss

User can upload or download sub band and path loss values from or to flash. User can load and save these values to files in PC, too. The RX path loss stored in flash of MS will compensate the difference of the downlink cell power and the average power of measurement by WCDMA RF module.

User can set RX path loss for each band. If the max ARFCN of the (N-1)th and Nth are A, B and the Nth RX loss is C dB, that means MS will set the RX path loss to C for the ARFCN from A+1 to B. The 1st RX loss is set for ARFCNs that are equal and less than 1st ARFCN. The order of max ARFCN and RX loss are from left to right, from up to down. Please refer to Figure 18 .

Example: WCDMA BAND1

UARFCN	10562	10631	10700	10838	0	0	0	0	0	0	0	0	0	0	0
LNA_H_Loss	7.25	7.75	7.50	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LNA_M_Loss	8.00	7.50	8.25	7.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LNA_L_Loss	8.25	7.75	8.75	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note that the value 0 in UARFCN represents the end of setting.

UARFCN 10562 ~ 10562: 7.25/8.00/8.25 dB (Depends on the operation mode of LNA)
UARFCN 10563 ~ 10631: 7.75/7.50/7.75 dB
UARFCN 10632 ~ 10700: 7.50/8.25/8.75 dB
UARFCN 10701 ~ 10838: 8.00/7.75/8.00 dB

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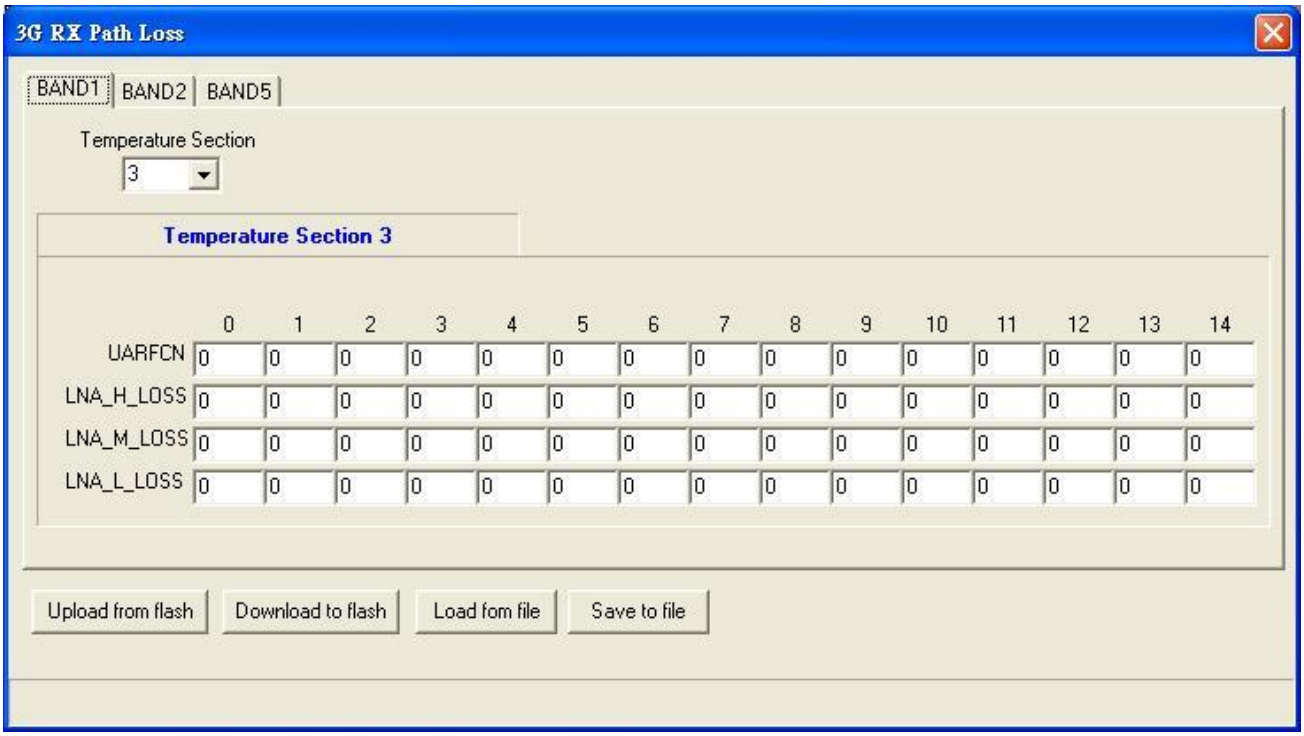

Figure 448 ***Click [Upload from flash] button to read value from flash***

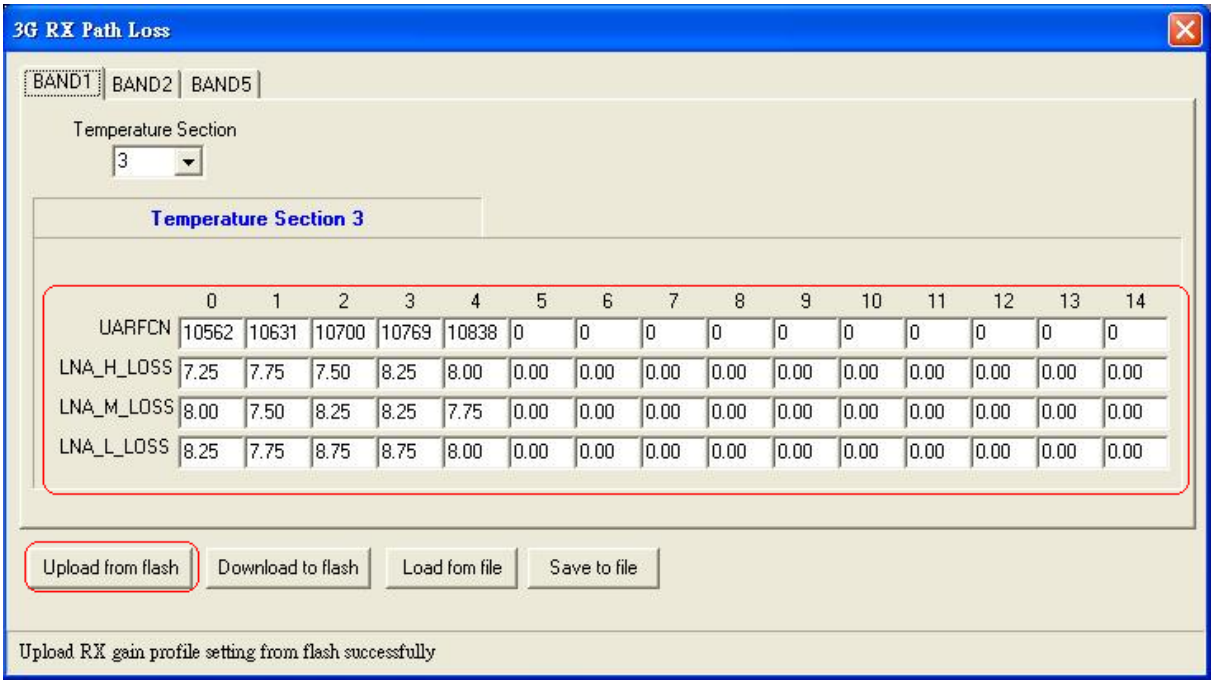

Figure 449 ***Result of sub band and RX path loss value read from flash***

3.20.2.2 RX path loss file format

There is a special text file format when you save the RX path loss values. Please follow the file format if you want to change the value in file. Each number must be followed with a comma.

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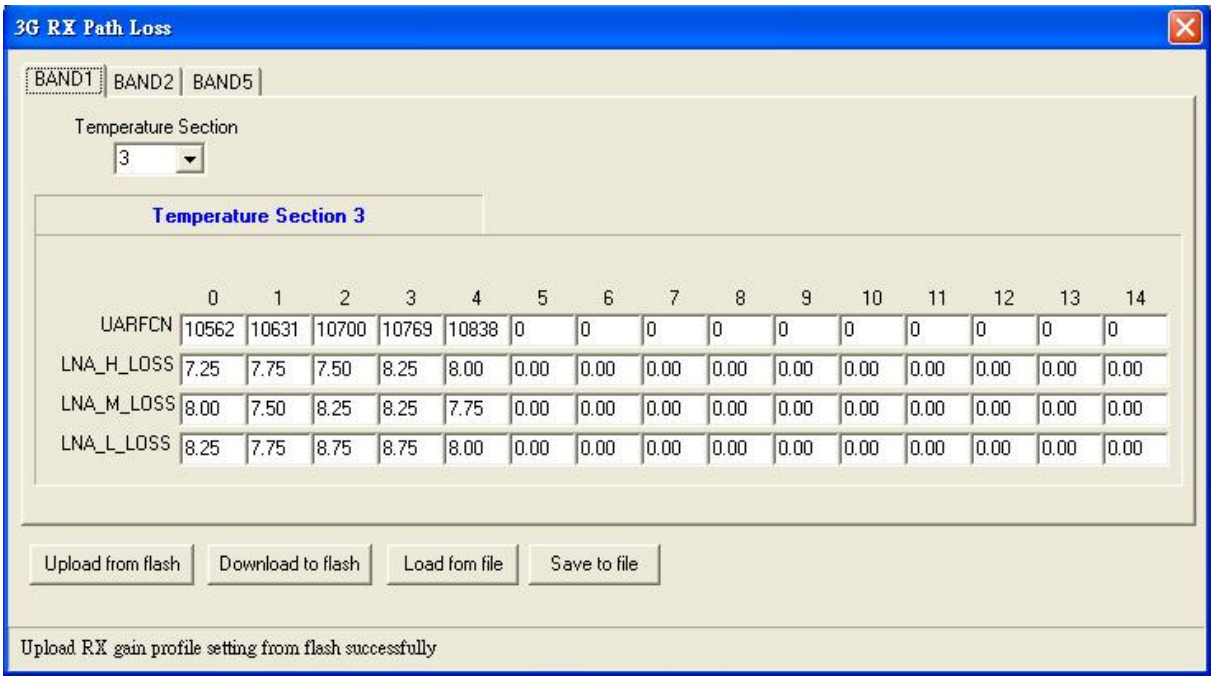

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
UARFCN	10562	10631	10700	10769	10838	0	0	0	0	0	0	0	0	0	0
LNA_H_LOSS	7.25	7.75	7.50	8.25	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LNA_M_LOSS	8.00	7.50	8.25	8.25	7.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LNA_L_LOSS	8.25	7.75	8.75	8.75	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 450 ***Path loss values***

Users will get a text file after saving them. The following is a template file that contains RX path loss. Users will get the text file after saving UARFCN and RX loss to file. Each value must be followed with a comma. Please follow the file format if you want to change the value in file. The UARFCN field is corresponding to the UARFCN field in RX Path Loss window (Figure 450) and RX loss field by Temperature is corresponding to the LNA_H_Loss, LNA_M_Loss, and LNA_L_Loss field, too.

[WCDMA BAND1 RX loss]
Temperature 0 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0
Temperature 0 RX loss high
mode=7.250,7.750,7.500,8.250,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 0 RX loss mid
mode=8.000,7.500,8.250,8.250,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 0 RX loss low
mode=8.250,7.750,8.750,8.750,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 1 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0
Temperature 1 RX loss high
mode=7.250,7.750,7.500,8.250,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 1 RX loss mid
mode=8.000,7.500,8.250,8.250,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 1 RX loss low
mode=8.250,7.750,8.750,8.750,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0
Temperature 2 RX loss high
mode=7.250,7.750,7.500,8.250,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 RX loss mid
mode=8.000,7.500,8.250,8.250,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 RX loss low
mode=8.250,7.750,8.750,8.750,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0

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Temperature 3 RX loss high
mode=7.250,7.750,7.500,8.250,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 RX loss mid
mode=8.000,7.500,8.250,8.250,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 RX loss low
mode=8.250,7.750,8.750,8.750,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0
Temperature 4 RX loss high
mode=7.250,7.750,7.500,8.250,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 RX loss mid
mode=8.000,7.500,8.250,8.250,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 RX loss low
mode=8.250,7.750,8.750,8.750,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0
Temperature 5 RX loss high
mode=7.250,7.750,7.500,8.250,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 RX loss mid
mode=8.000,7.500,8.250,8.250,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 RX loss low
mode=8.250,7.750,8.750,8.750,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 6 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0
Temperature 6 RX loss high
mode=7.250,7.750,7.500,8.250,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 6 RX loss mid
mode=8.000,7.500,8.250,8.250,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 6 RX loss low
mode=8.250,7.750,8.750,8.750,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 7 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0
Temperature 7 RX loss high
mode=7.250,7.750,7.500,8.250,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 7 RX loss mid
mode=8.000,7.500,8.250,8.250,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 7 RX loss low
mode=8.250,7.750,8.750,8.750,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
[WCDMA BAND2 RX loss]
Temperature 0 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0
Temperature 0 RX loss high
mode=7.750,7.750,7.750,7.500,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 0 RX loss mid
mode=7.500,7.500,7.250,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 0 RX loss low
mode=7.500,7.000,7.000,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 1 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0
Temperature 1 RX loss high
mode=7.750,7.750,7.750,7.500,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 1 RX loss mid
mode=7.500,7.500,7.250,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 1 RX loss low
mode=7.500,7.000,7.000,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0

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Temperature 2 RX loss high
mode=7.750,7.750,7.750,7.500,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 RX loss mid
mode=7.500,7.500,7.250,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 RX loss low
mode=7.500,7.000,7.000,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0
Temperature 3 RX loss high
mode=7.750,7.750,7.750,7.500,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 RX loss mid
mode=7.500,7.500,7.250,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 RX loss low
mode=7.500,7.000,7.000,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0
Temperature 4 RX loss high
mode=7.750,7.750,7.750,7.500,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 RX loss mid
mode=7.500,7.500,7.250,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 RX loss low
mode=7.500,7.000,7.000,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0
Temperature 5 RX loss high
mode=7.750,7.750,7.750,7.500,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 RX loss mid
mode=7.500,7.500,7.250,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 RX loss low
mode=7.500,7.000,7.000,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 6 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0
Temperature 6 RX loss high
mode=7.750,7.750,7.750,7.500,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 6 RX loss mid
mode=7.500,7.500,7.250,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 6 RX loss low
mode=7.500,7.000,7.000,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 7 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0
Temperature 7 RX loss high
mode=7.750,7.750,7.750,7.500,8.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 7 RX loss mid
mode=7.500,7.500,7.250,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 7 RX loss low
mode=7.500,7.000,7.000,7.500,7.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
[WCDMA BAND5 RX loss]
Temperature 0 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0
Temperature 0 RX loss high
mode=7.500,7.750,8.250,8.250,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 0 RX loss mid
mode=7.500,7.750,8.000,7.750,9.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 0 RX loss low
mode=7.500,7.500,8.250,8.500,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 1 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0

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Temperature 1 RX loss high
mode=7.500,7.750,8.250,8.250,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 1 RX loss mid
mode=7.500,7.750,8.000,7.750,9.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 1 RX loss low
mode=7.500,7.500,8.250,8.500,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0
Temperature 2 RX loss high
mode=7.500,7.750,8.250,8.250,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 RX loss mid
mode=7.500,7.750,8.000,7.750,9.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 RX loss low
mode=7.500,7.500,8.250,8.500,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0
Temperature 3 RX loss high
mode=7.500,7.750,8.250,8.250,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 RX loss mid
mode=7.500,7.750,8.000,7.750,9.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 RX loss low
mode=7.500,7.500,8.250,8.500,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0
Temperature 4 RX loss high
mode=7.500,7.750,8.250,8.250,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 RX loss mid
mode=7.500,7.750,8.000,7.750,9.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 RX loss low
mode=7.500,7.500,8.250,8.500,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0
Temperature 5 RX loss high
mode=7.500,7.750,8.250,8.250,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 RX loss mid
mode=7.500,7.750,8.000,7.750,9.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 RX loss low
mode=7.500,7.500,8.250,8.500,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 6 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0
Temperature 6 RX loss high
mode=7.500,7.750,8.250,8.250,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 6 RX loss mid
mode=7.500,7.750,8.000,7.750,9.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 6 RX loss low
mode=7.500,7.500,8.250,8.500,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 7 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0
Temperature 7 RX loss high
mode=7.500,7.750,8.250,8.250,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 7 RX loss mid
mode=7.500,7.750,8.000,7.750,9.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 7 RX loss low
mode=7.500,7.500,8.250,8.500,8.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000

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3.20.2.3 RX Channel Scan

Users can use the function to scan the interference of WCDMA downlink channels in the surrending environment. Three noise-less channels (Low/Middle/High UARFCN) will be displayed. The channel information can be use as a reference when users would like to choose a noise-less channel to do RF testing.

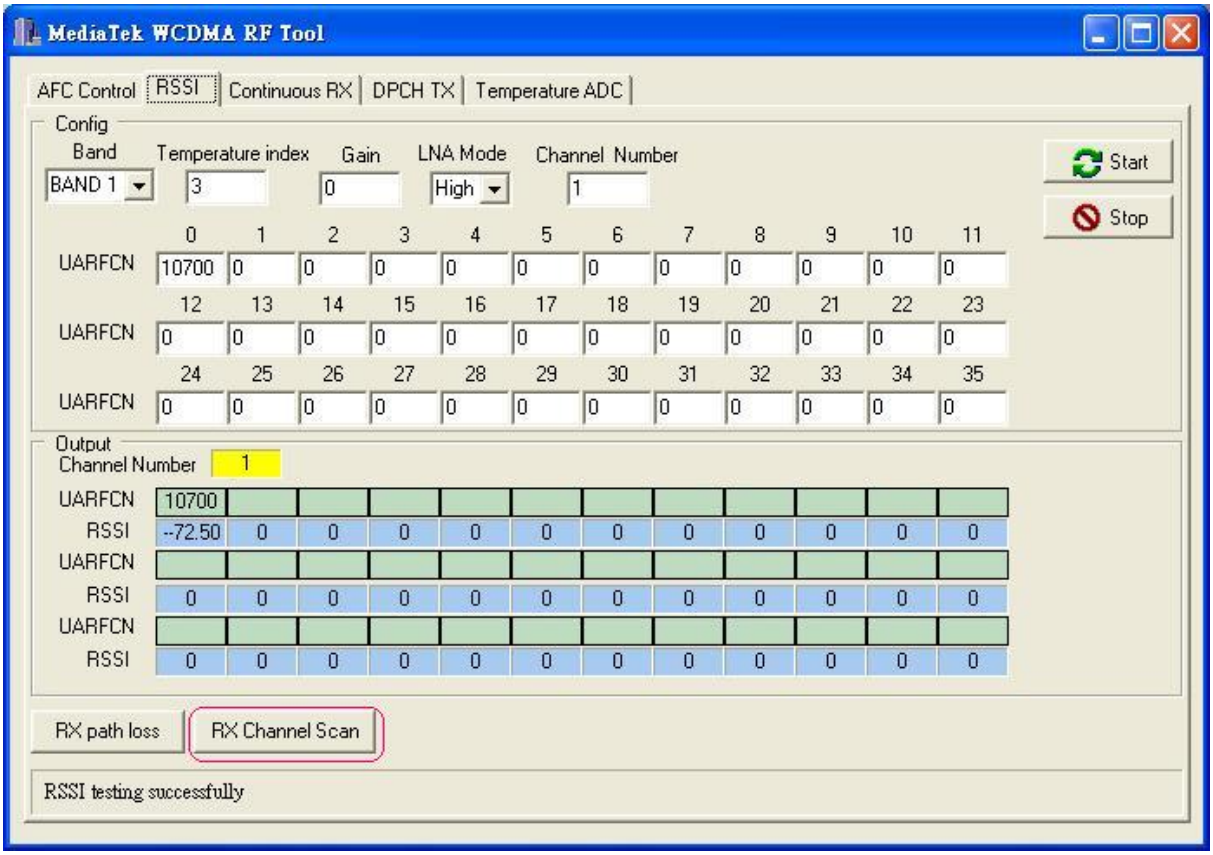

Figure 451 ***Click [RX Channel Scan] button***

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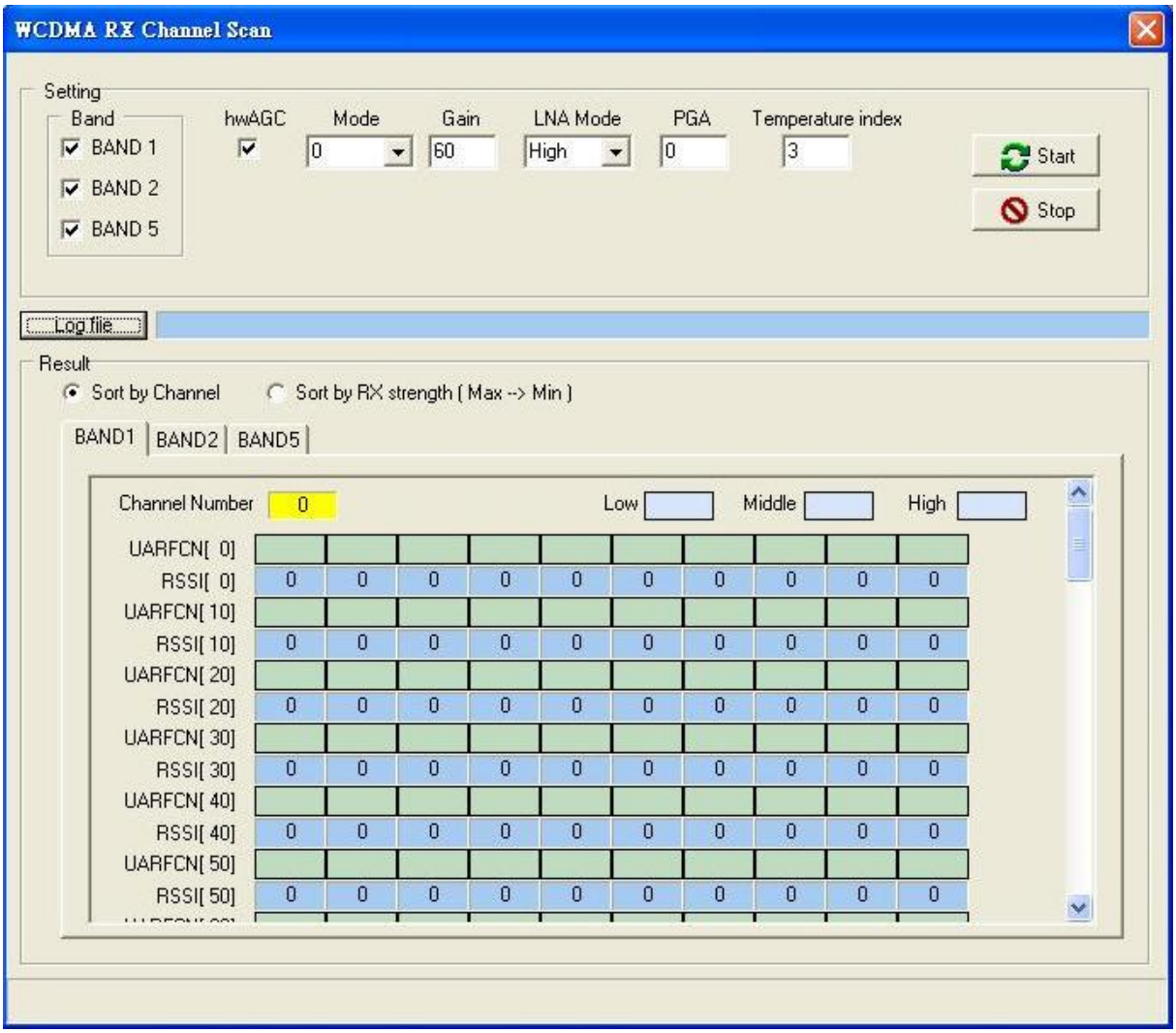

Figure 452 ***Initial GUI of RX Channel Scan***

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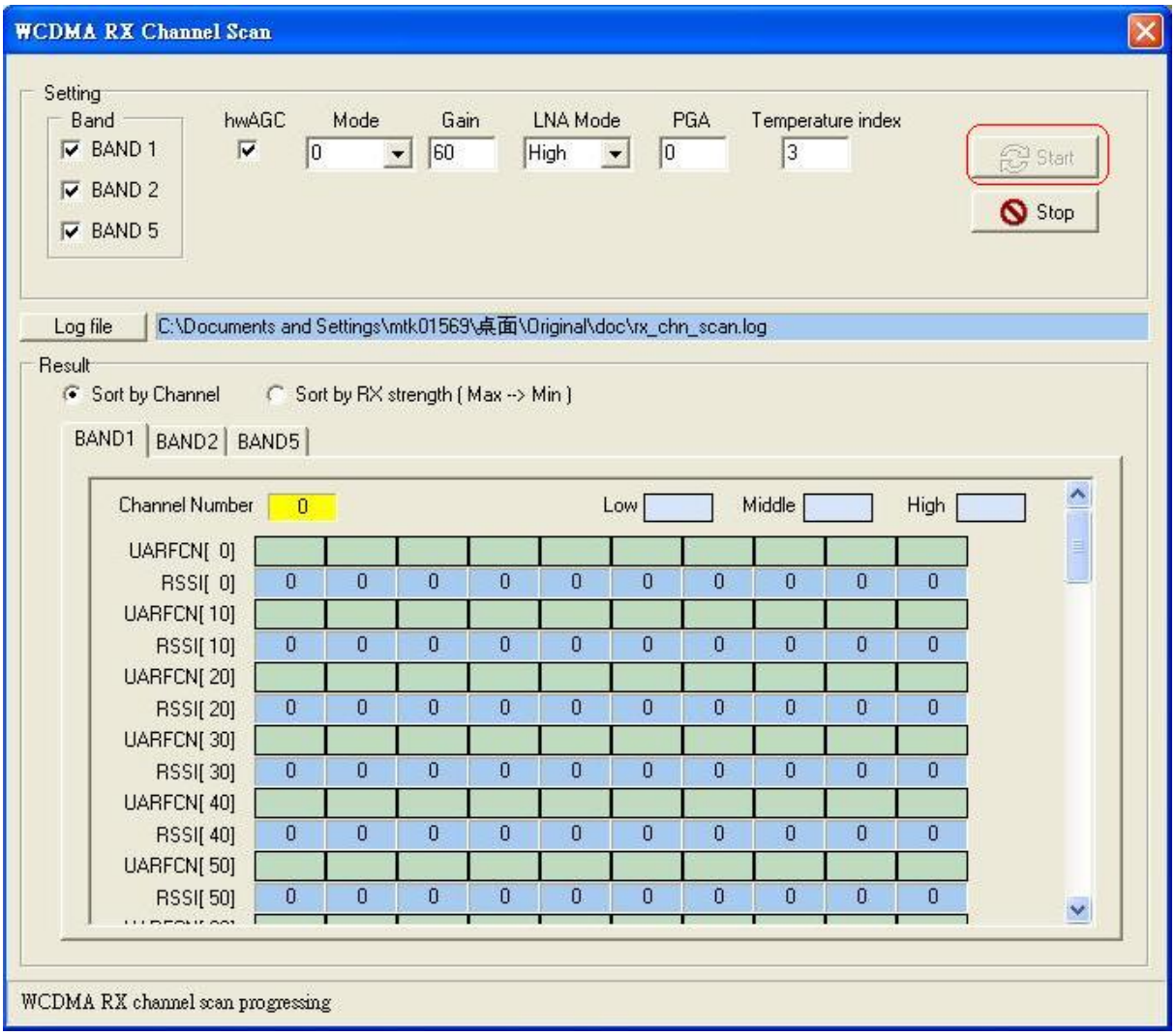

Figure 453 ***Click [Start] button***

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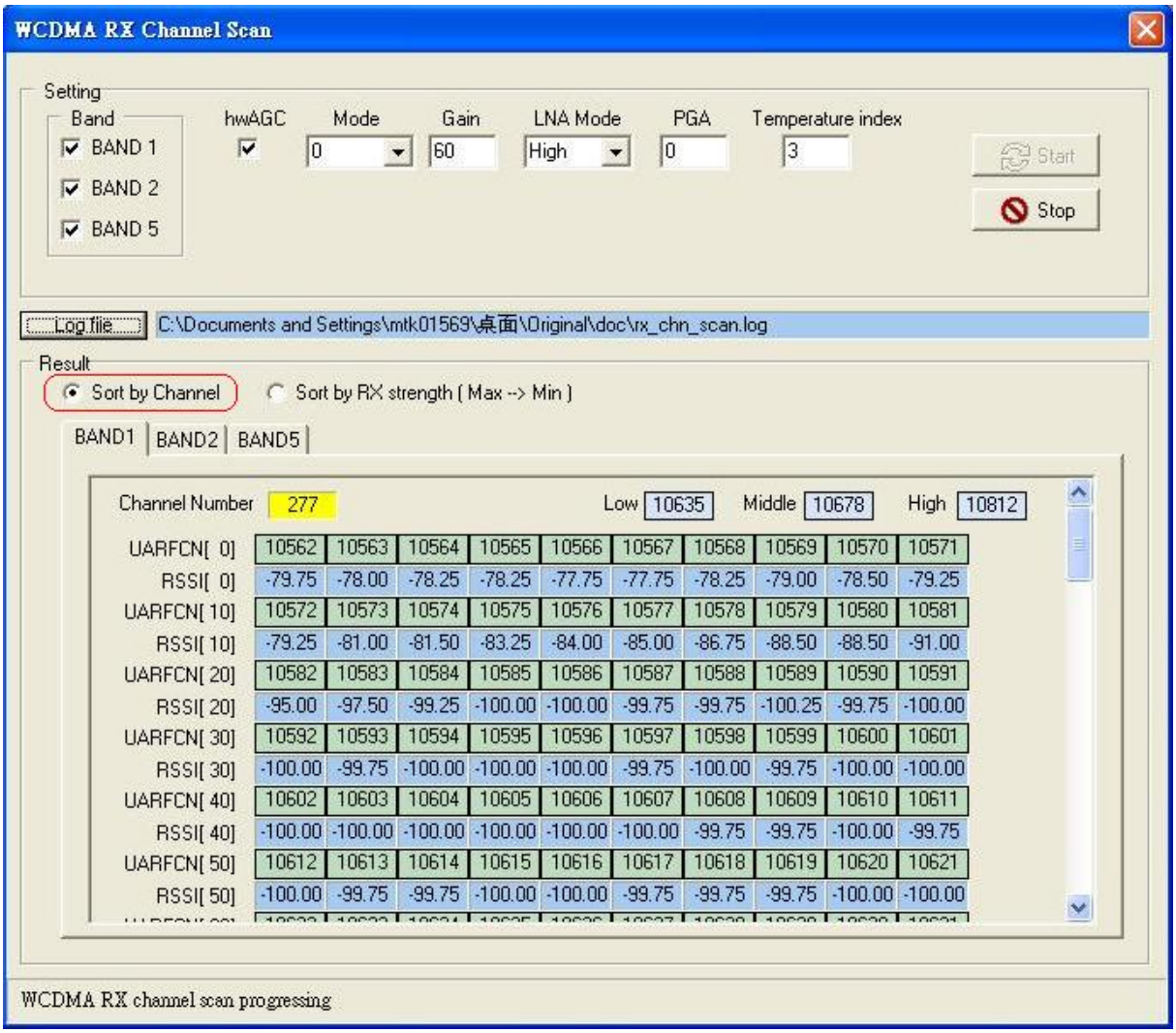

Figure 454 ***RX Channel Scan result is displayed. (Sort by Channel)***

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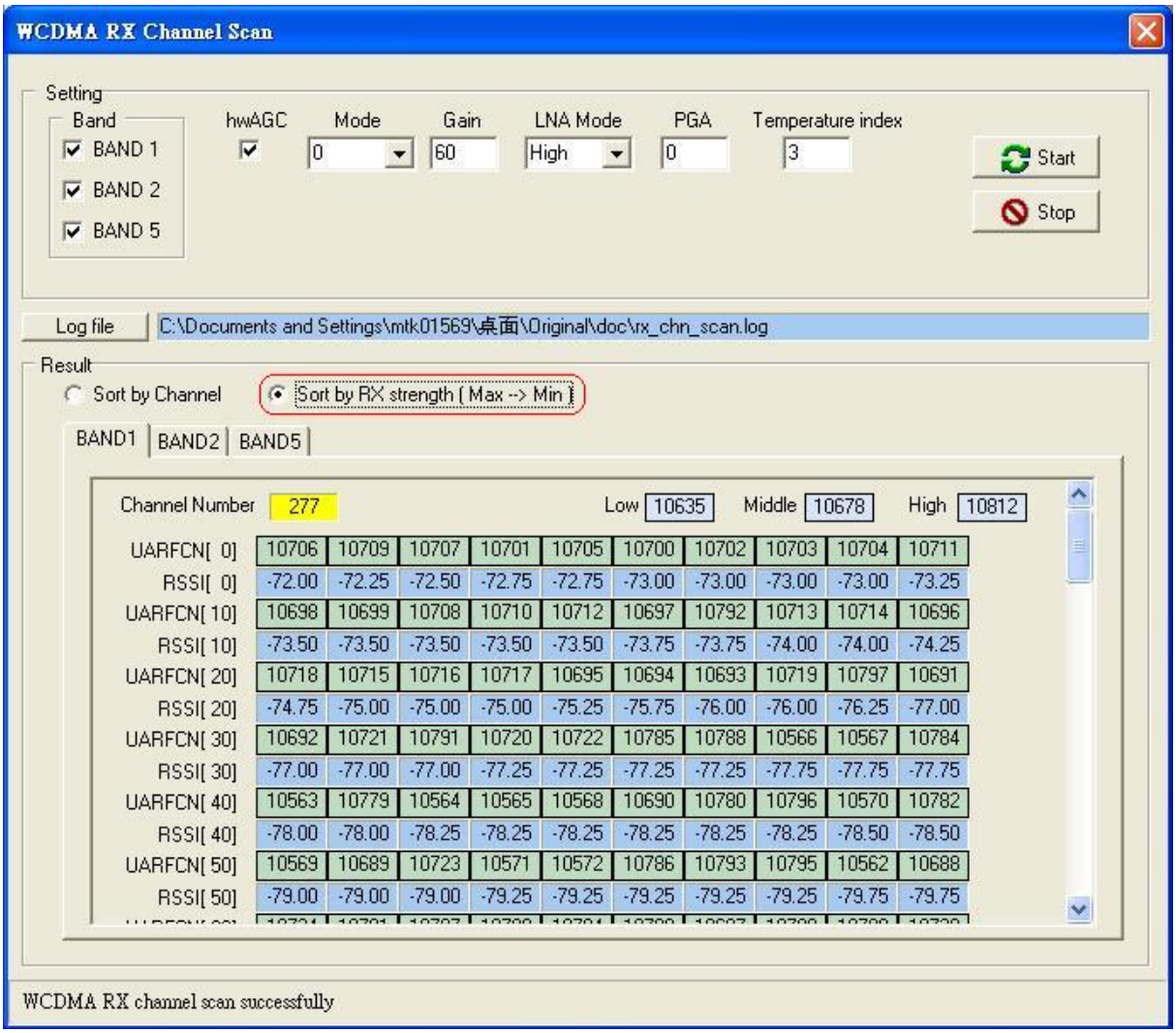

Figure 455 ***RX Channel Scan result is displayed. (Sort by RX strength from Max to Min)***

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Figure 456 ***Three noise-less channels are recommended to users.***

3.20.3 Continuous RX

Continue RX is used for observing RX IQ. User can input band, UARFCN, Gain (dB) for Mode = 0, LNA Mode (High/Middle/Low) for Mode =1 and PGA for Mode = 1, and hwAGC. After selecting the testing settings to control target, click [Start] button to do continuous RX testing. When users wants to stop RX, he can click [Stop] button.

MS will start to do continuous RX of the UARFCN with the corresponding settings set by user after getting the continuous RX command from META. It will test RX function of RF module.

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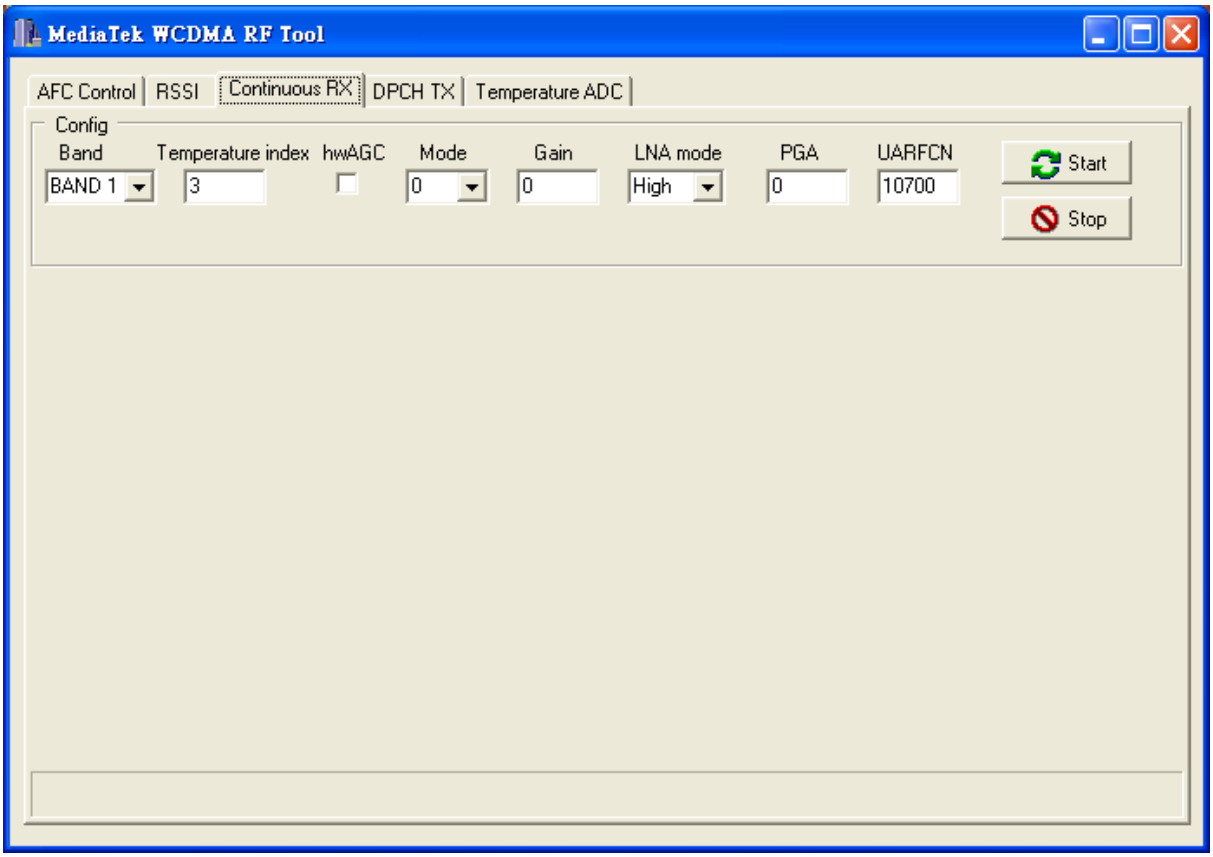

Figure 457 ***GUI of Continuous RX***

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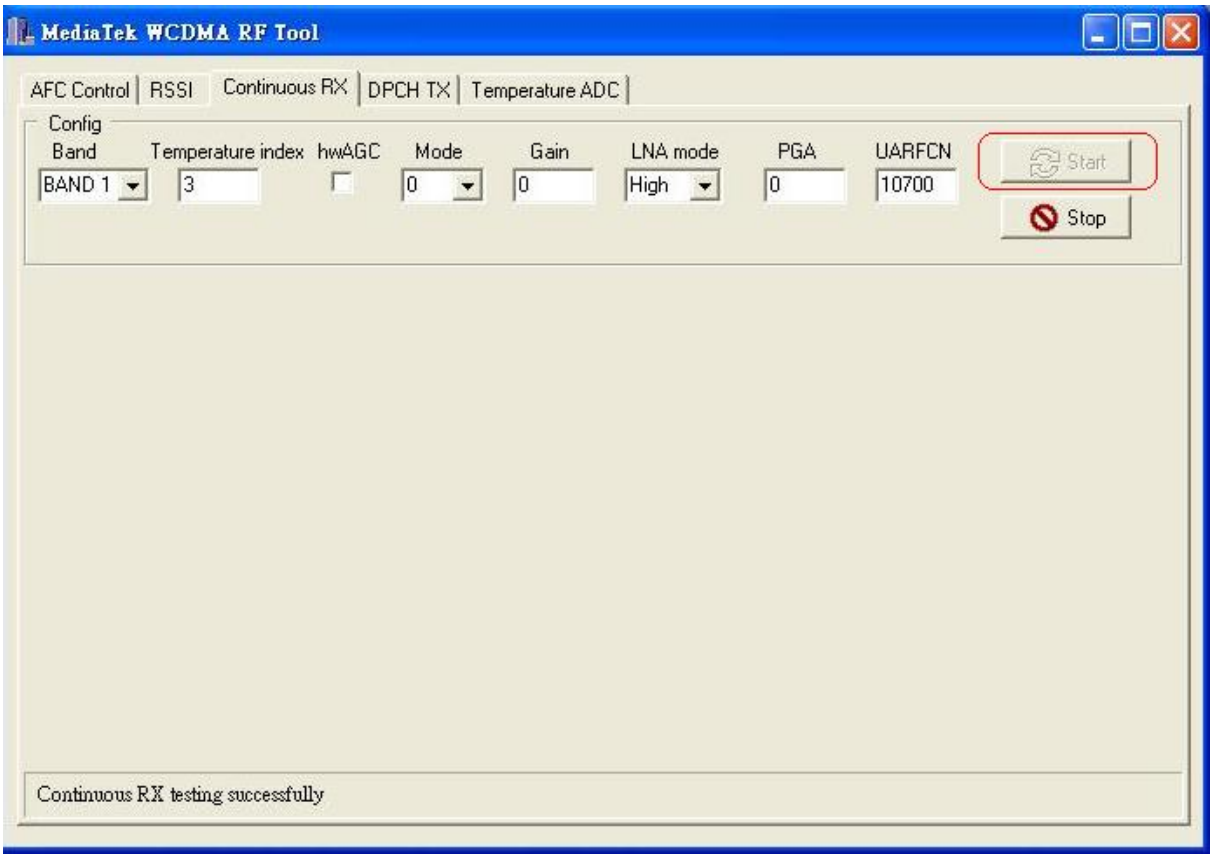

Figure 458 ***Click [Start] button to start continuous RX testing***

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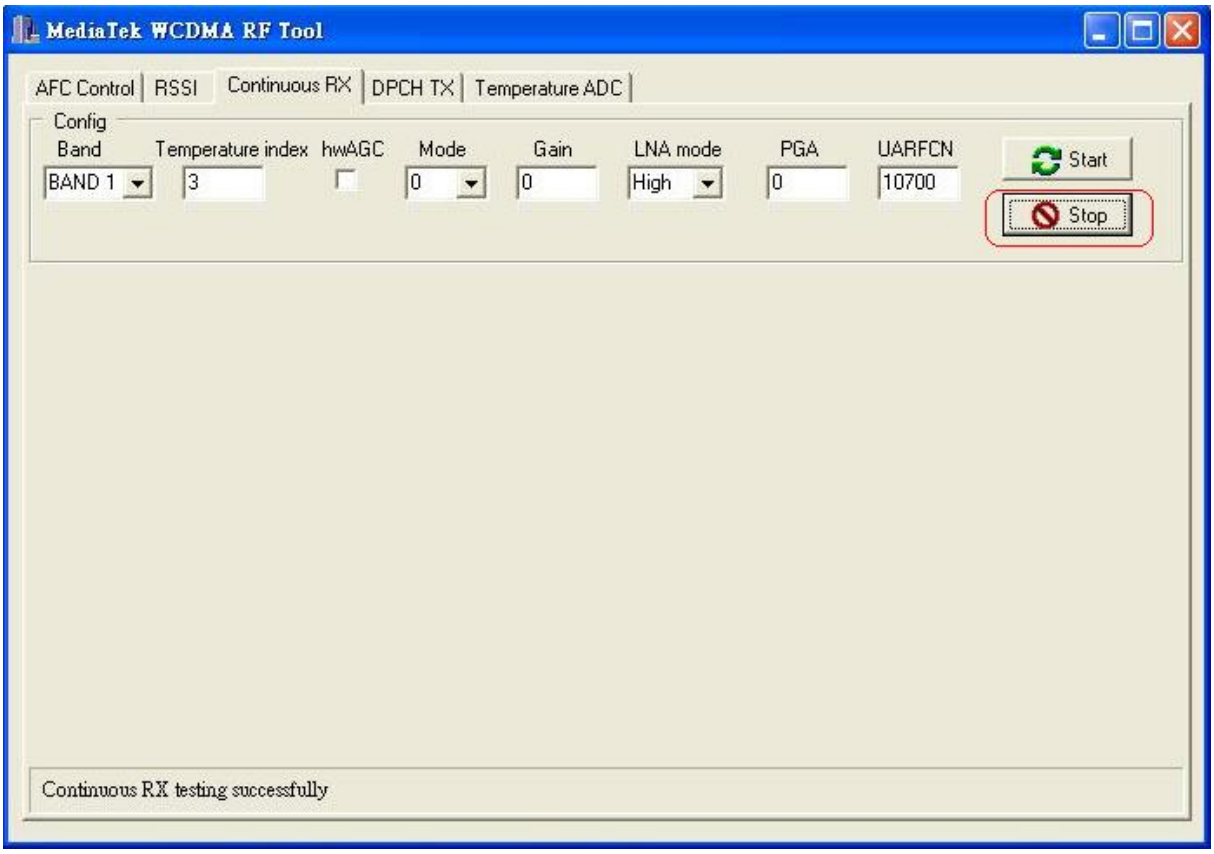

Figure 459 ***Click [Stop] button to stop continuous RX testing***

3.20.4 DPCH TX

DPCH TX is used for TX Power testing. User can input UARFCN value, AFC DAC value, TPC index and then click [Start] button to start TX Power test. After starting TX Power test, user can click [Stop] button to stop it.

MS will start to do TX on the UARFCN assigned by user after getting the DPCH TX command from META. It will test TX function of RF module in MS.

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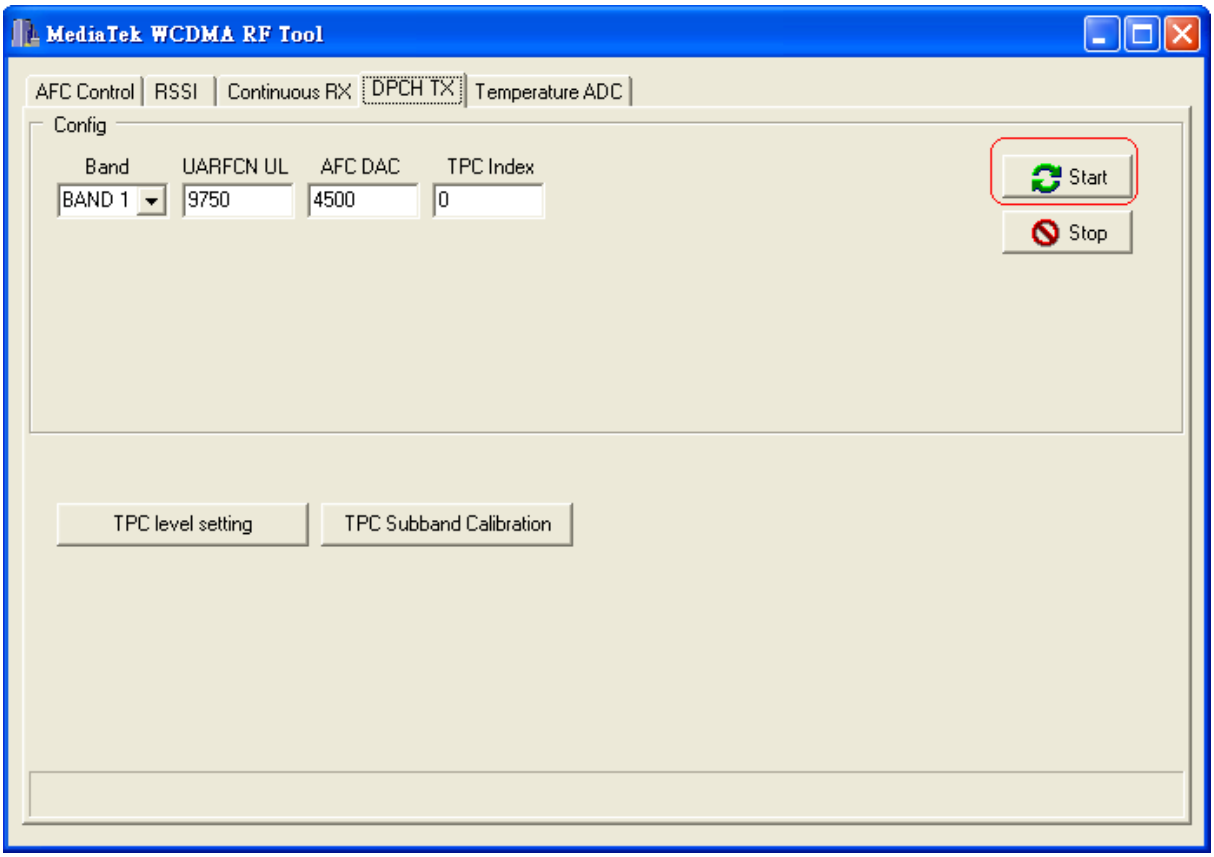

Figure 460 ***Click [Start] button to start testing***

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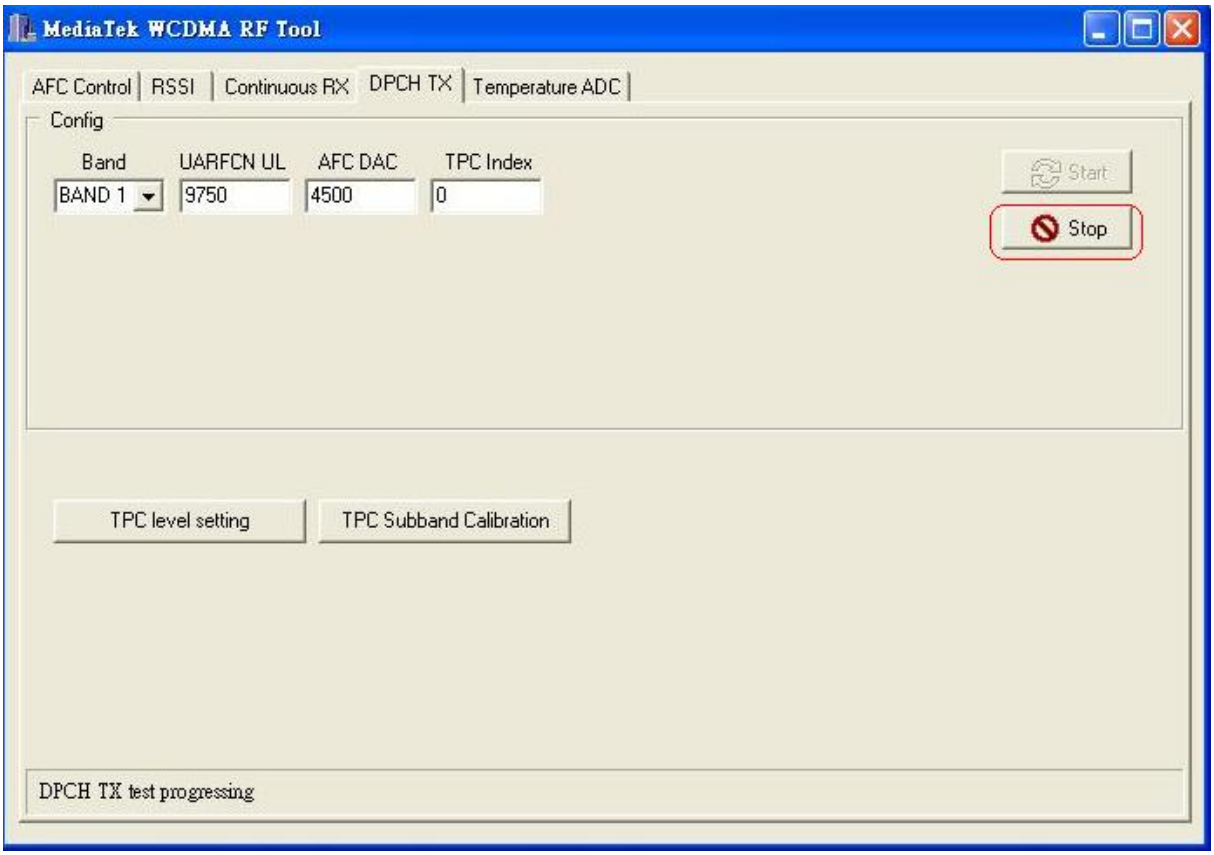

Figure 461 ***Click [Stop] button to stop testing***

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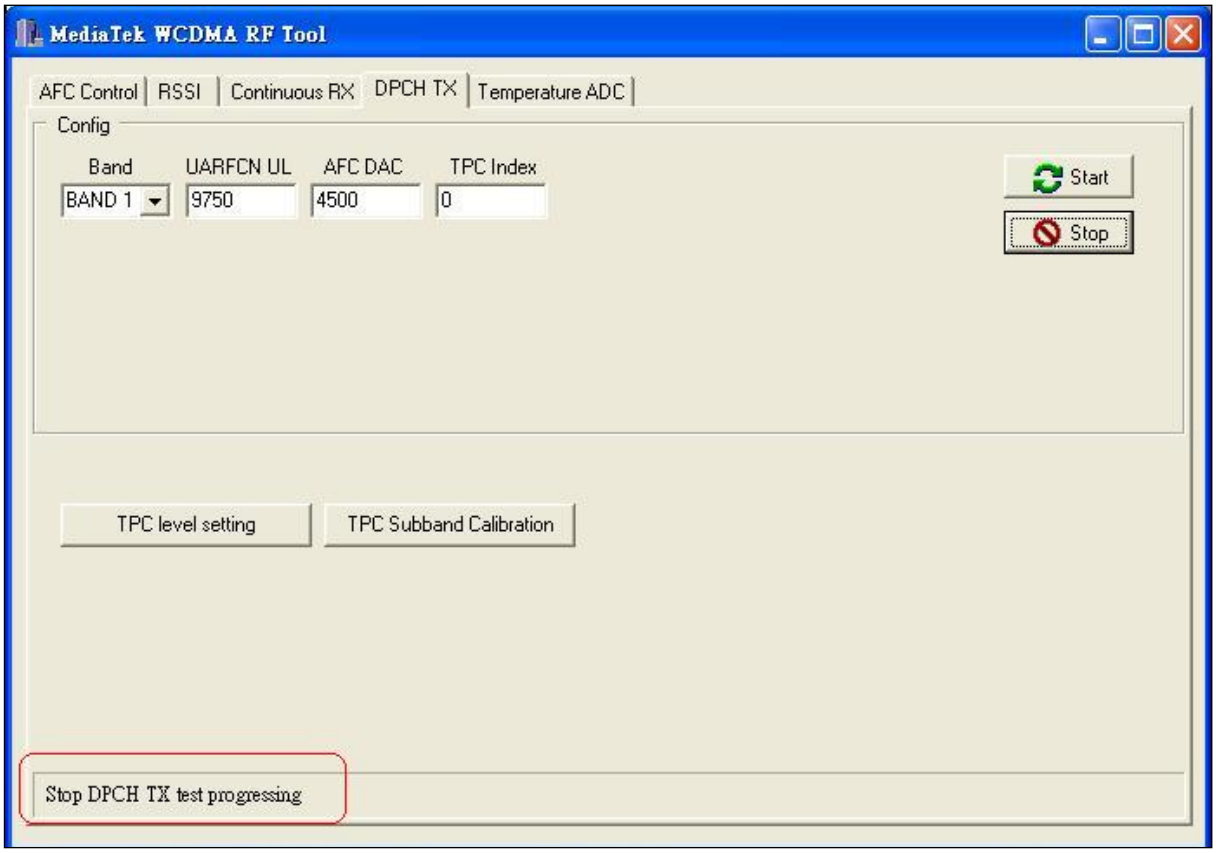

Figure 462 ***MS stop TX testing after user click [Stop] button***

3.20.4.1 TPC level setting

User can click [TPCl level setting] button to show the DPCH TX Profile.

This operation is used for fine tune TX configuration and profiles, and save these settings to MS's nvram or INI file. User can input UARFCN, AFC DAC value, TPC index, then click [Start] button to test TX power level. MS will start to transmit RF signal with the parameters set by user after MS get the command from META. RF engineer can measure the transmitted power of MS by Agilent 8960 or other measurement instruments.

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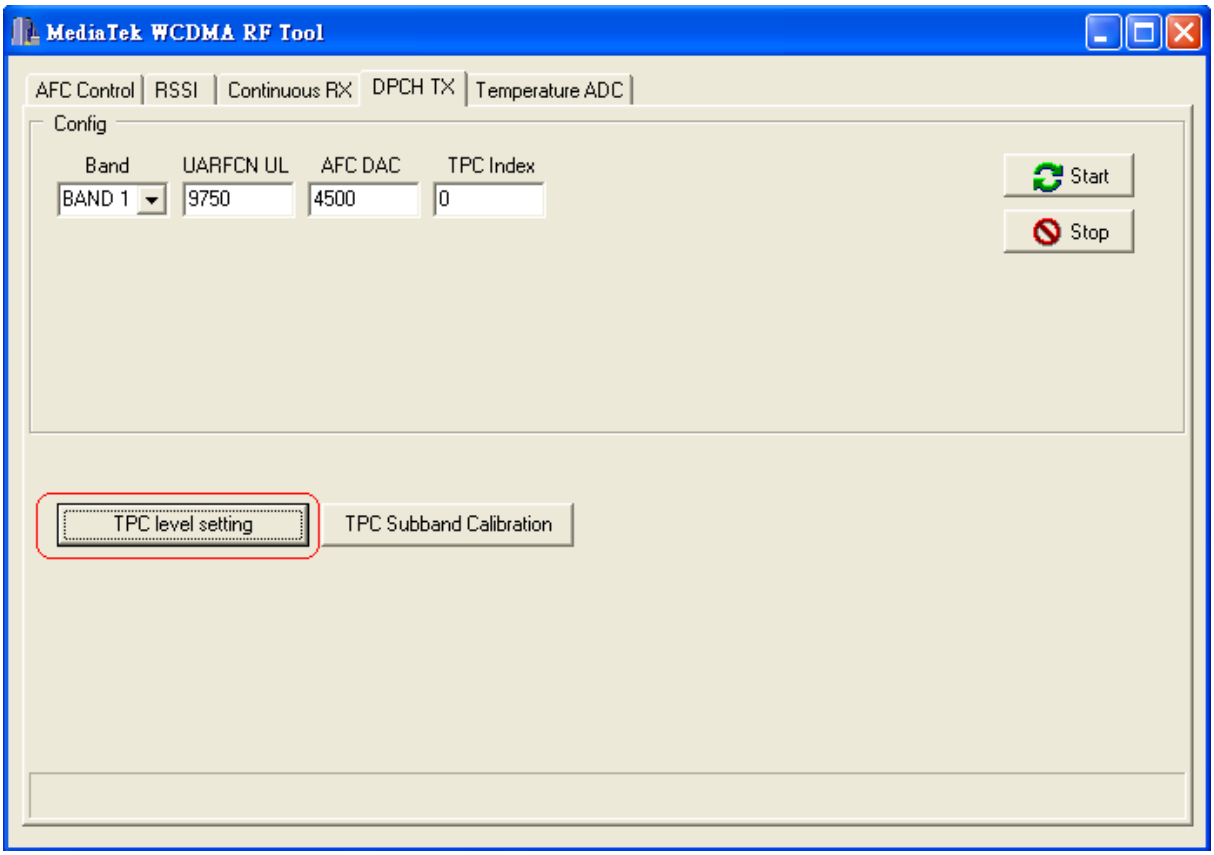

Figure 463 ***Click [TPC level setting] button to change TPC profiles.***

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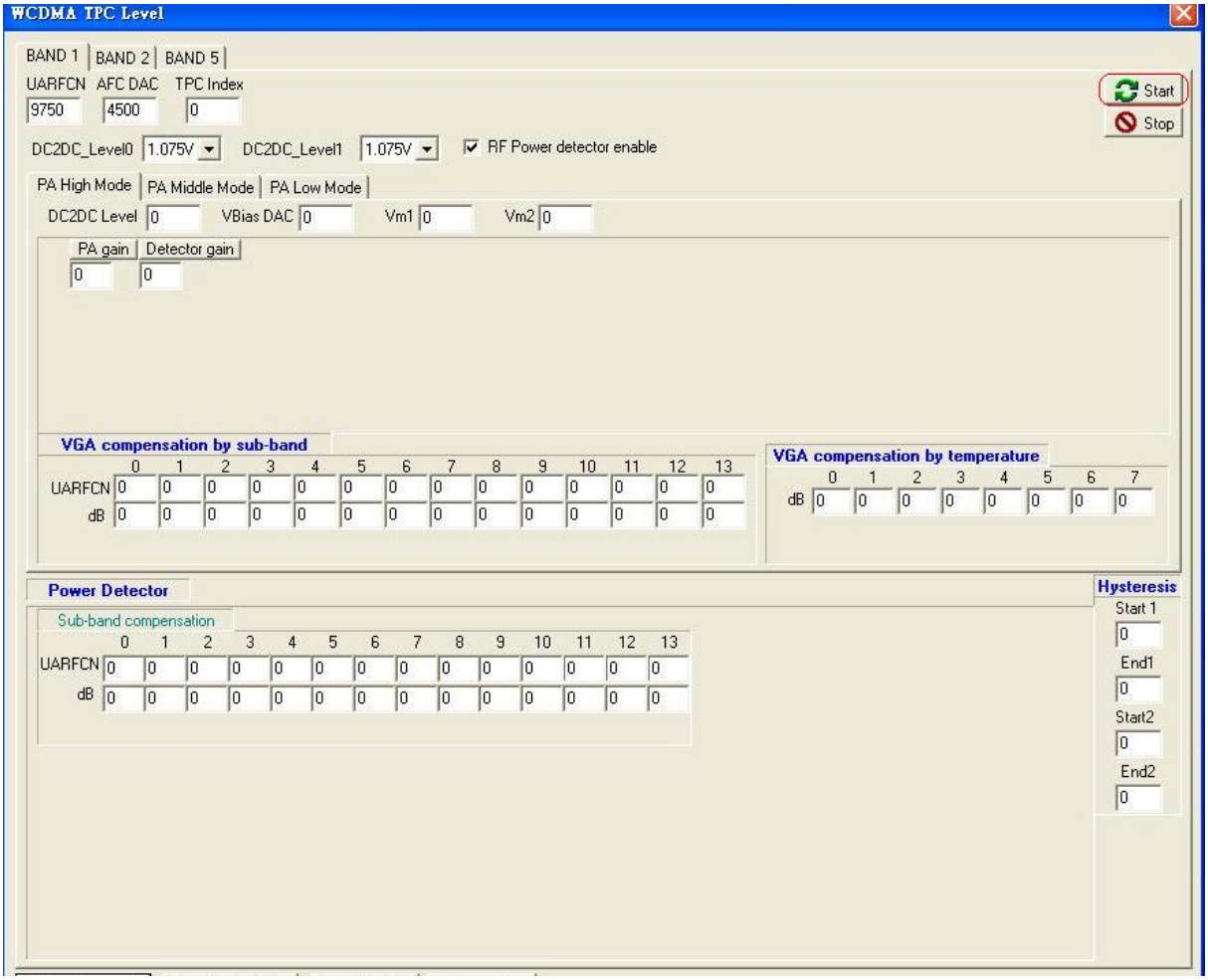

Figure 464 ***Click [Start] button to start TX Power testing.***

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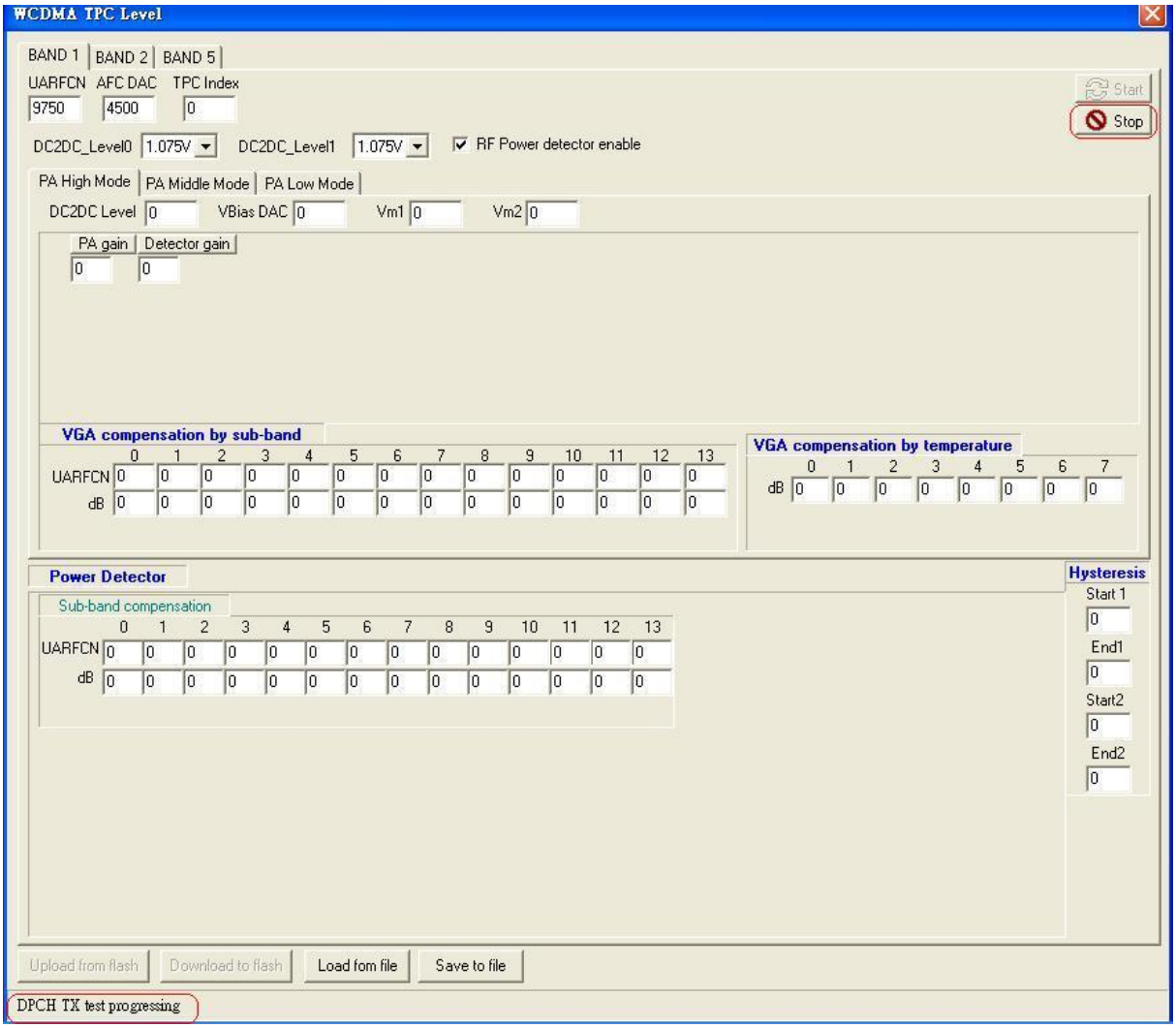

Figure 465 ***Click [Stop] button to stop TX level testing.***

Note:

- PA gain: the field specifies the PA gain among different TPC index. Bigger PA gain resulting smaller TPC power. PA gain will work under PA High/Middle/Low 3 modes.
- PD gain: the field specifies the power detector gain to control the power detector performance. Bigger PD gain reports bigger TPC power detector report. The power detector works in PA High Mode only.
- VGA compensation by sub-band: This 2x14 array compensates the power in dB among different UARFCNs under PA High/Middle/Low modes.
- Power Detector-Subband compensation: This 2x14 array compensates the power in dB that reports from power detector among different UARFCNs.
- Hysteresis (Start1, End1, Start2, End2): Start1~ End1: specifies the TPC index range that can be suppored in PA High and Middle mode. Start2~End2: specifies the TPC index range that can be supported in PA Middle and Low mode.

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3.20.4.2 TPC level setting for 8-level PA control

The tool will auto detect the target capability and select the 8-level PA control UI for users to config the PA control. The UI is basically divided into 4 groups

1 TX parameters: DPCH TX parameter to do basic TX control in META mode
- 1.1 UARFCN
- 1.2 AFC DAC
- 1.3 TPC index
- 1.4 PA Mode
- 1.5 Power detector enable: (power detector output power control mechanism)

2 PA control: Configures the 8-level PA control parameters including the following parameters
- 2.1 PA mode
- 2.2 PRF (Upper Limit of this level)
- 2.3 PA Gain
- 2.4 DC2DC level
- 2.5 VBias DAC
- 2.6 Vm1
- 2.7 Vm2
- 2.8 Hysterisis (Start1/End1: High/middle intersection, Start2/End2: Middle/low intersection)

3 TX compensation: Configures the compensation values including the following parameters
- 3.1 Coupler loss for 3 PA modes
- 3.2 Phase compensation for 3 PA modes
- 3.3 Compensation by temperature for 3 PA modes
- 3.4 Subband compensation
  - 3.4.1 PA compensation
  - 3.4.2 Power Detector (Coupler loss) subband compensation

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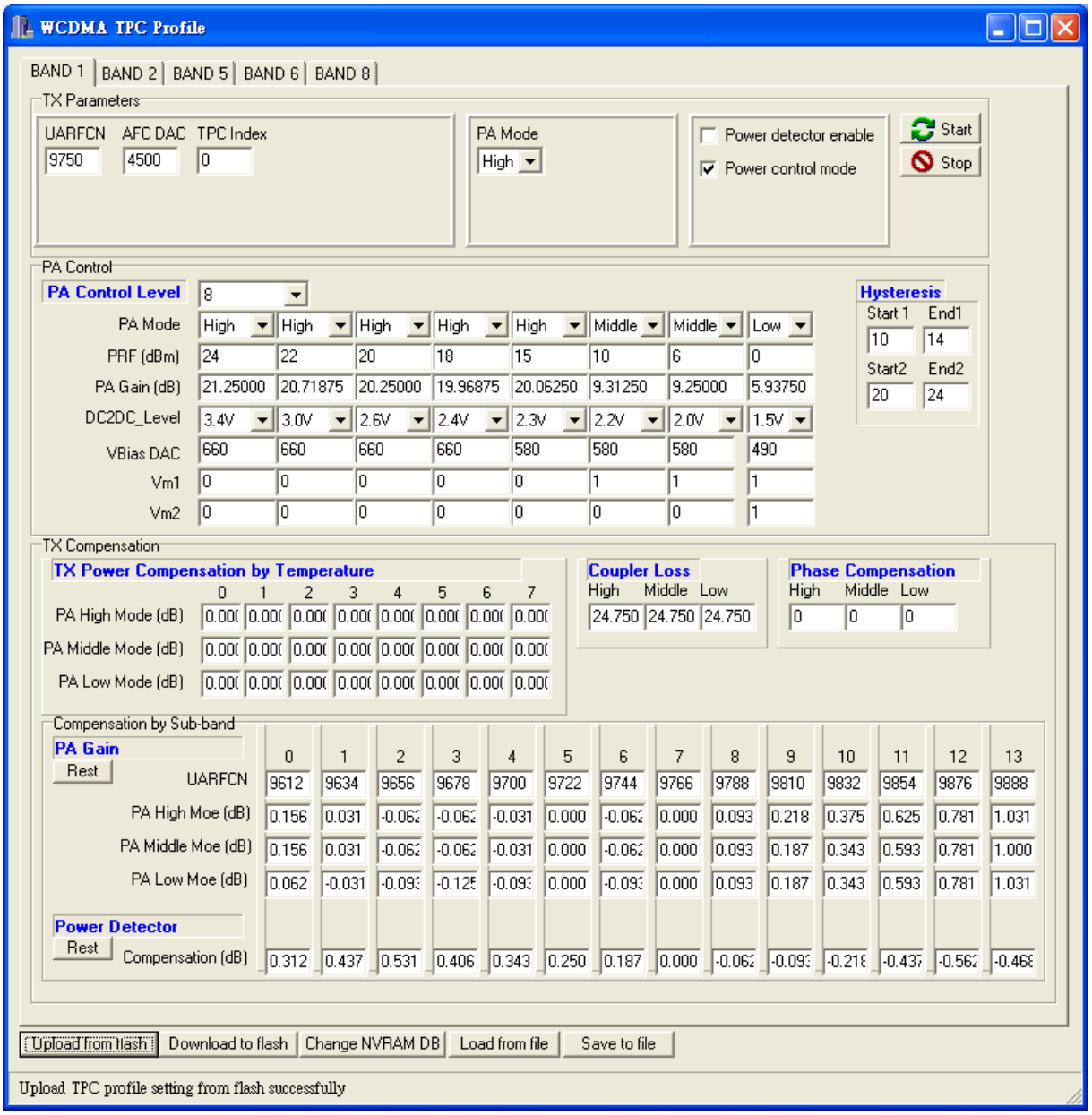

Figure 466 ***Overview of 8-level PA control setting.***

3.20.4.3 TPC Subband Calibration

User can click [TPC Subband Calibration] button to do TX subband calibration.

In TPC Subband Calibration, users need to load the corresponding CFG file, INI file, NVRAM database, and select the bands, PA mode number, and testing instruments(Agilent8960), and then click [Start] button.

After calibration is complete successfully, users can save the calibration result to an INI file (click [Generate INI file] button) to apply for the same phone design of hardware modal.

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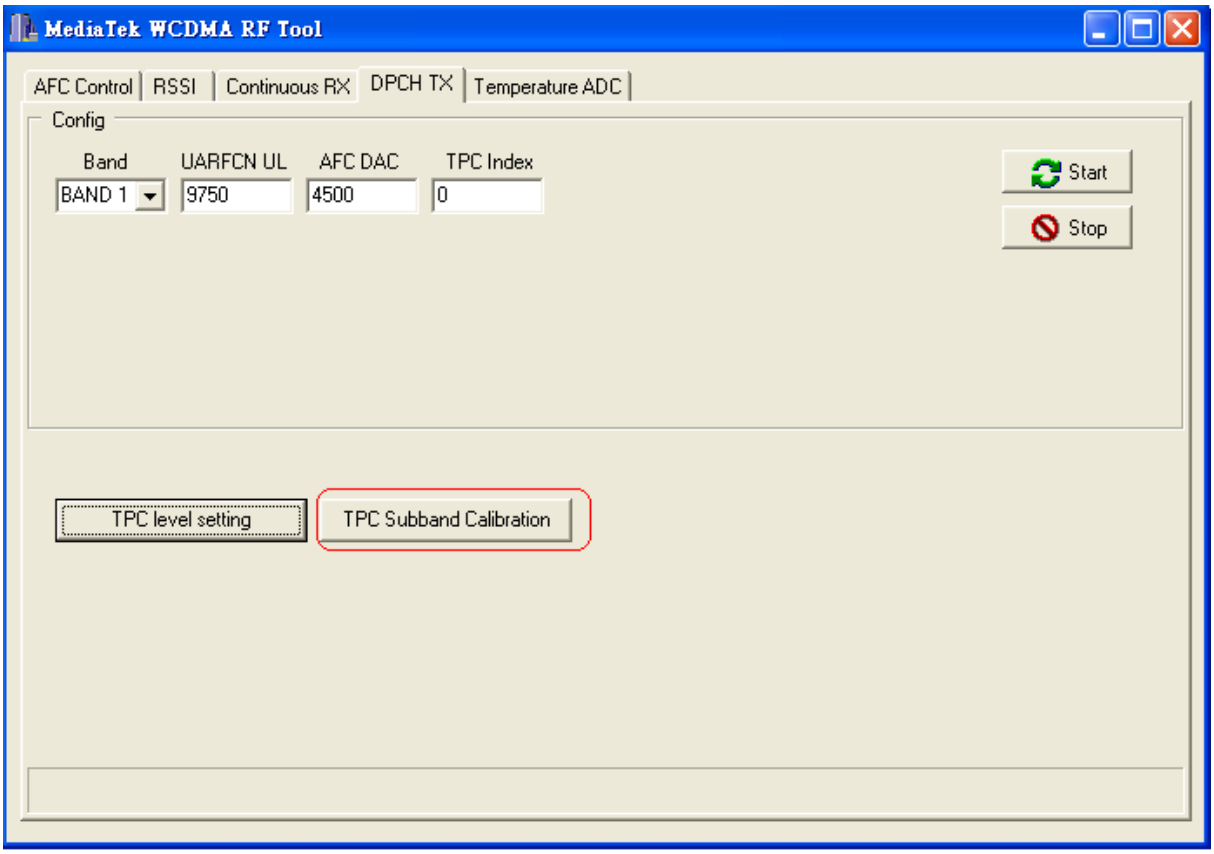

Figure 467 ***Click [TPC Subband Calibration] button***

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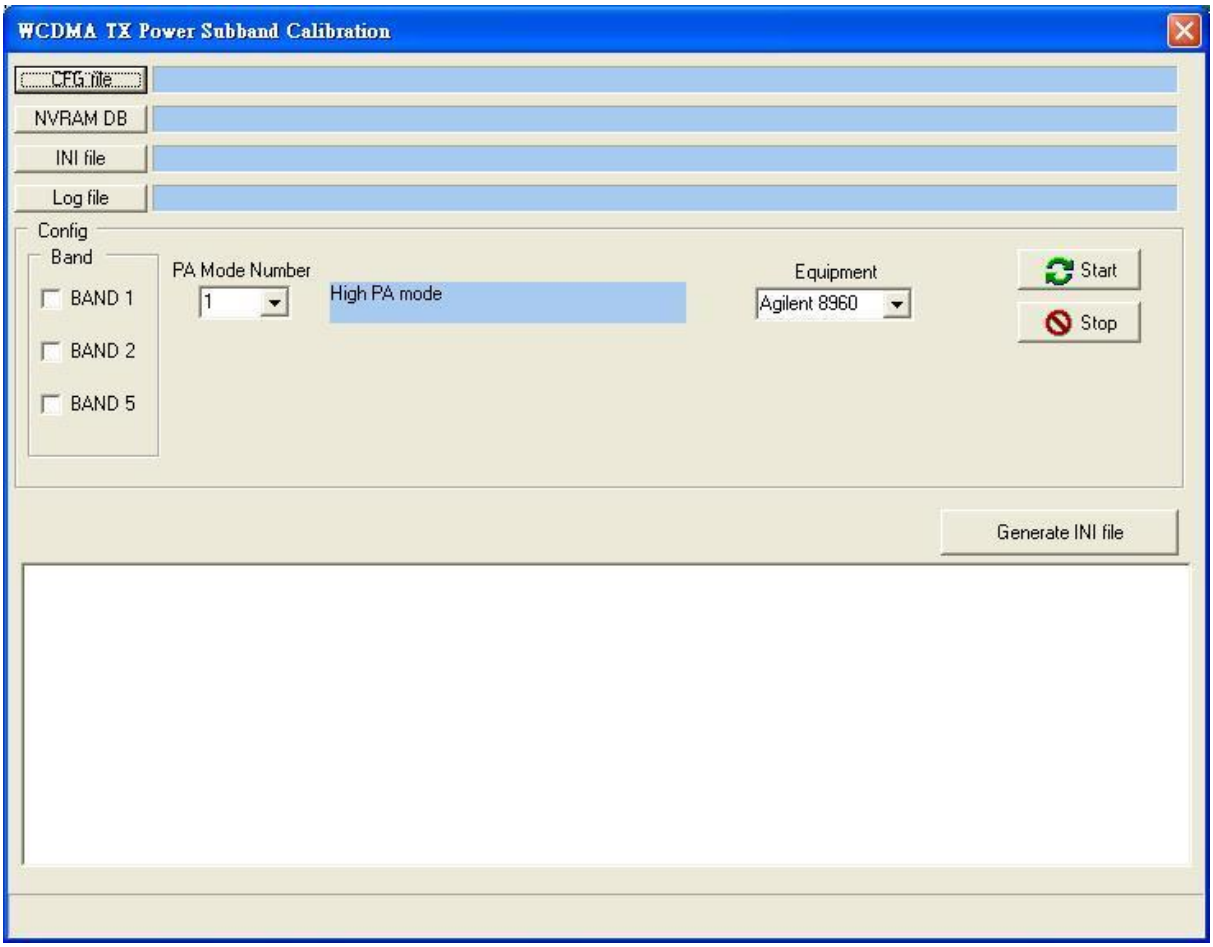

Figure 468 ***TX Power Subband window***

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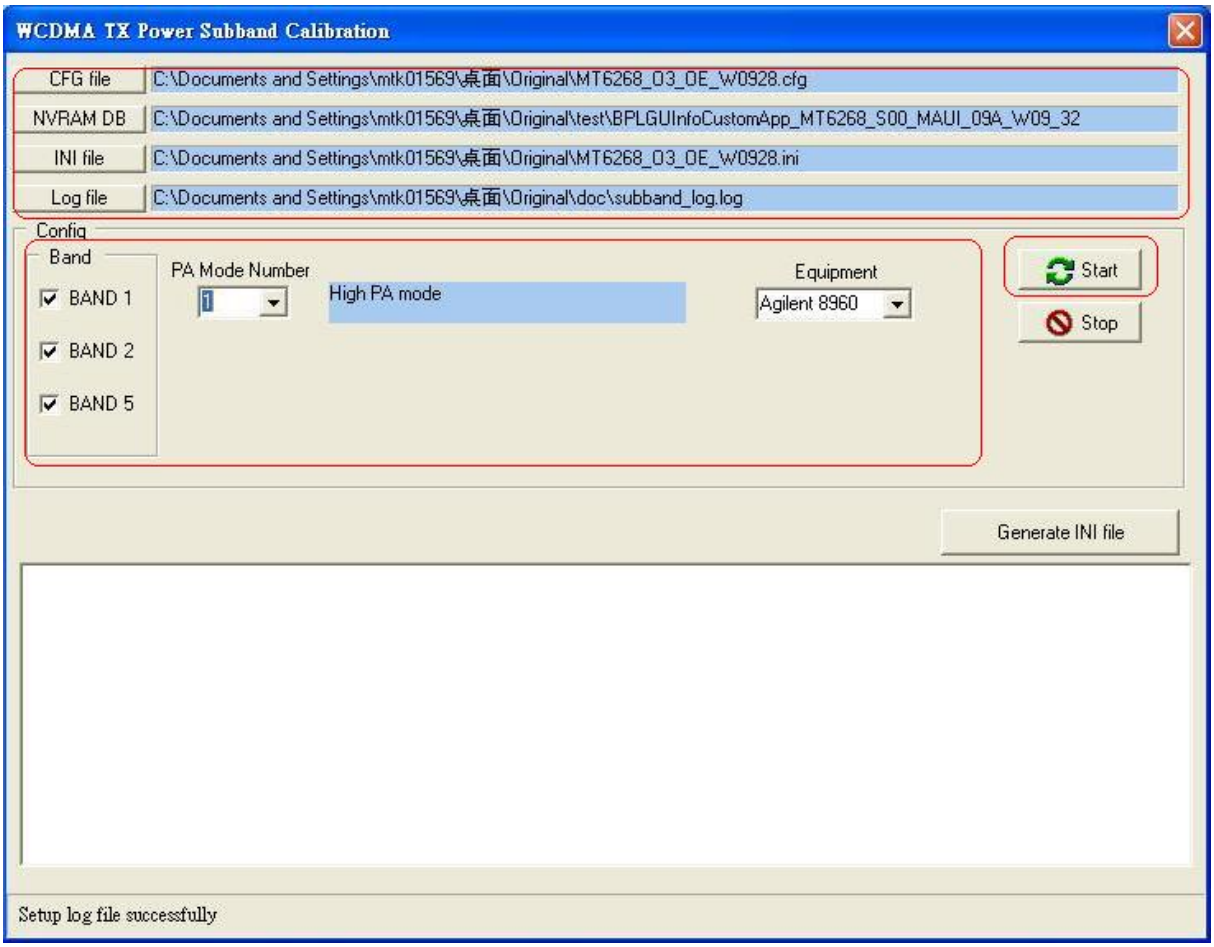

Figure 469 ***Click [Start] button to start TX subband calibration***

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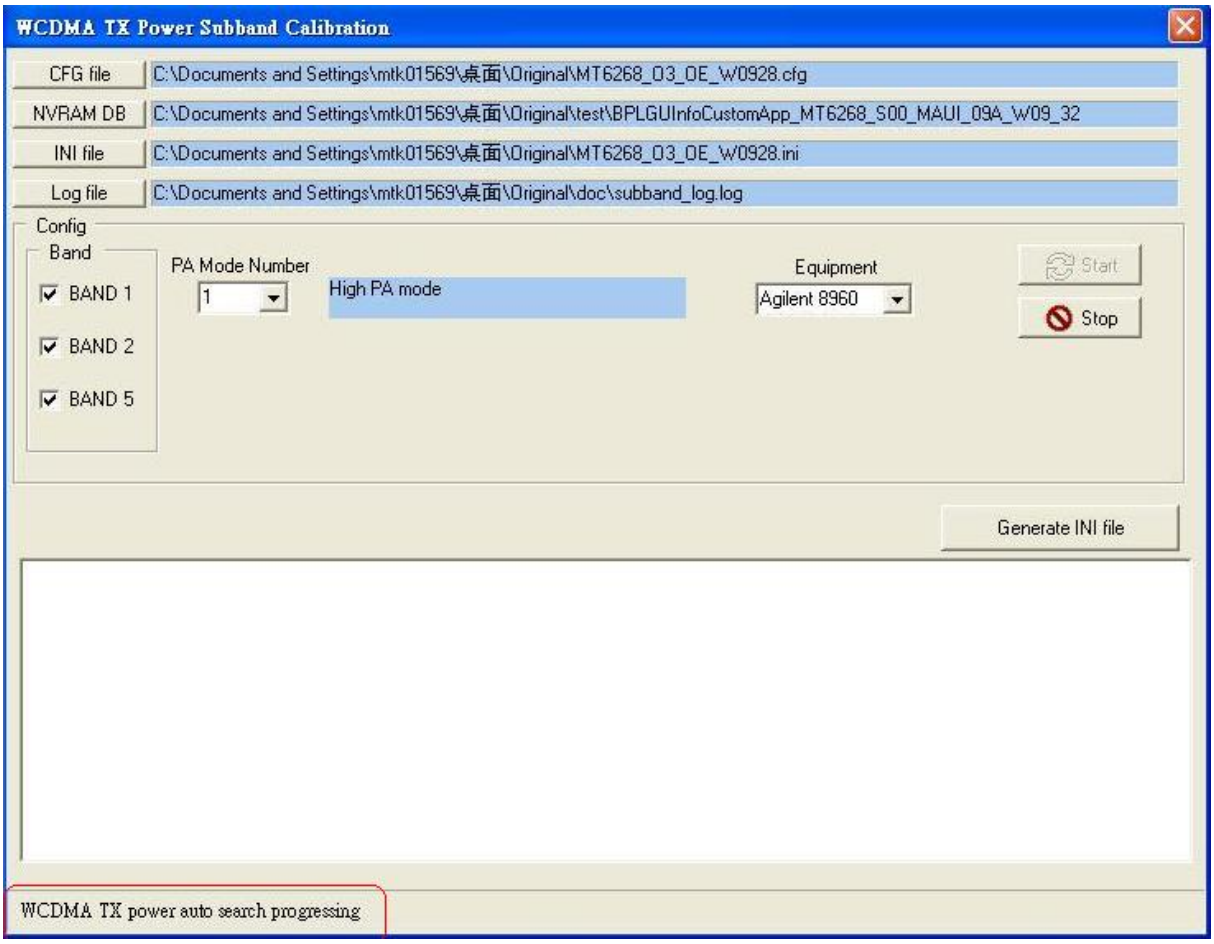

Figure 470 ***TX subband calibration is progressing***

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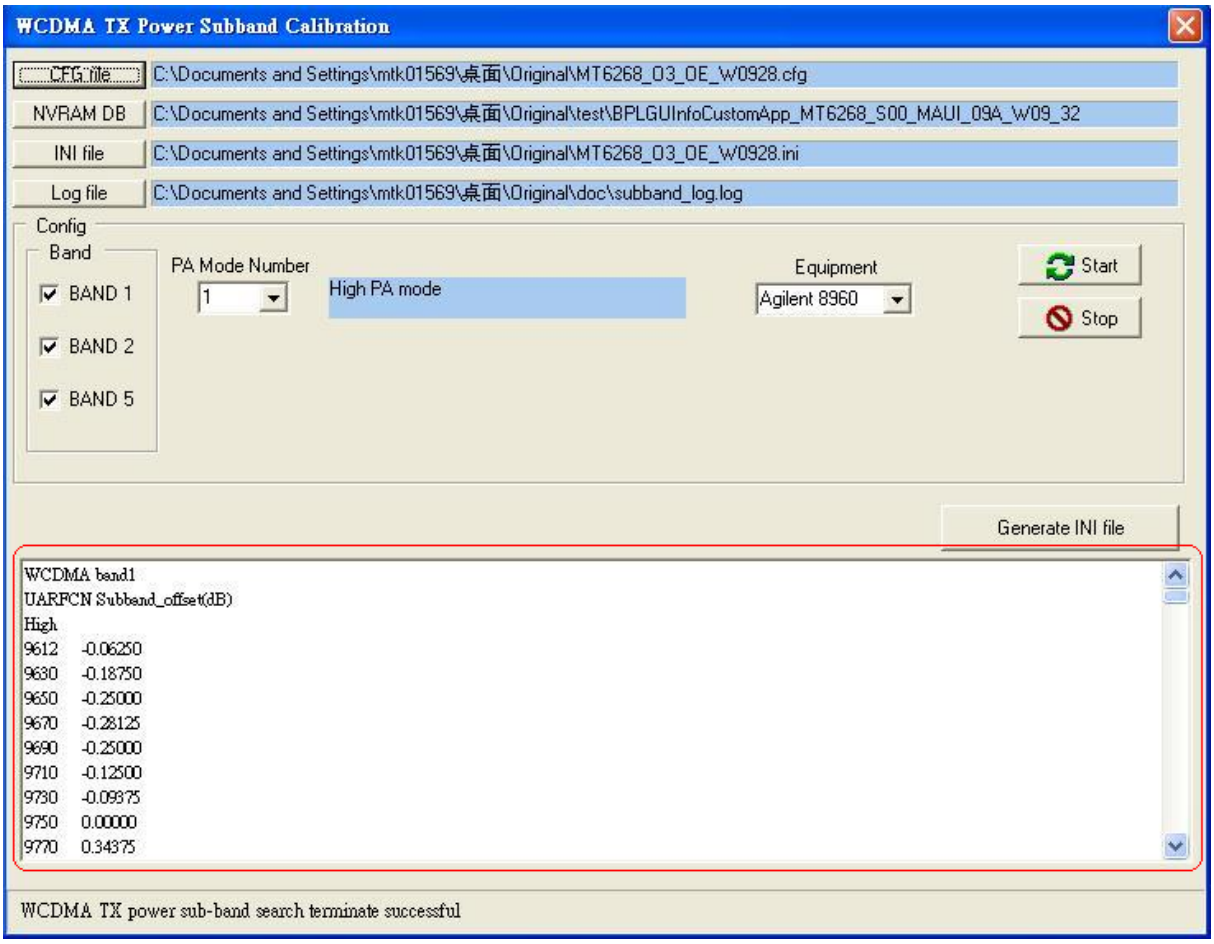

Figure 471 ***Calibration result is displayed when the entire calibration is done.***

3.20.4.3.a Generate INI file (INI file format)

User can click [Generate INI file] button to save the calibration result to INI file.
Here we extract BAND1 calibraiton result as a sample.

[WCDMA BAND1 TPC]
DC2DC DAC, PA high mode=0
VBias DAC, PA high mode=660
Vm1, PA high mode=0
Vm2, PA high mode=0
VGA DAC, PA high mode=315,116,0,0,0

VBias DAC, PA middle mode=580
Vm1, PA middle mode=1
Vm2, PA middle mode=0
VGA DAC, PA middle
mode=303,0,0,0

3.20.5 Temperature ADC

Temperature ADC is used for measure the characteristics of ADC channel among different temperatures.
Users can input the measure count and click [Read] button to trigger MS to report the measurement of ADC Channel 5 which is our temperature ADC channel.

Users can also save the DAC0~7 settings to NVRAM or INI file.

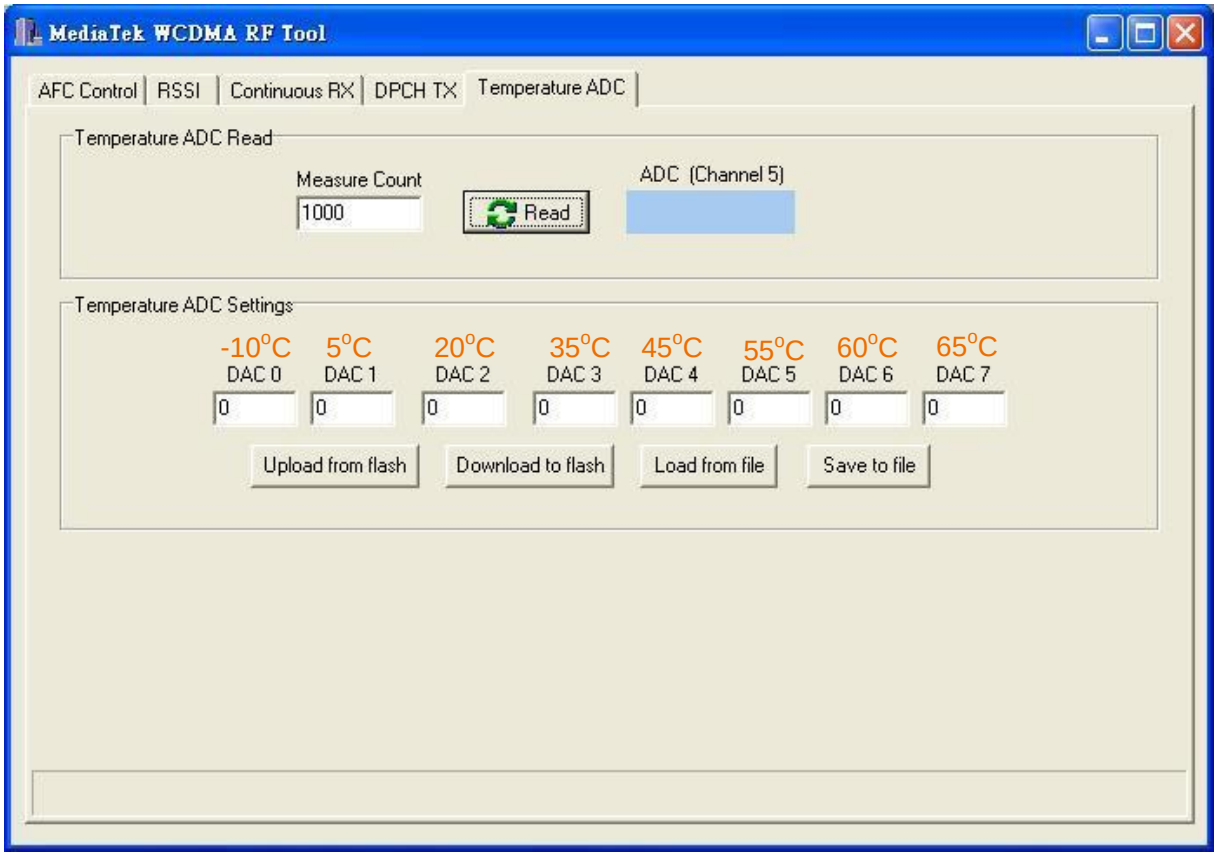

Figure 472 ***Temperature ADC GUI***

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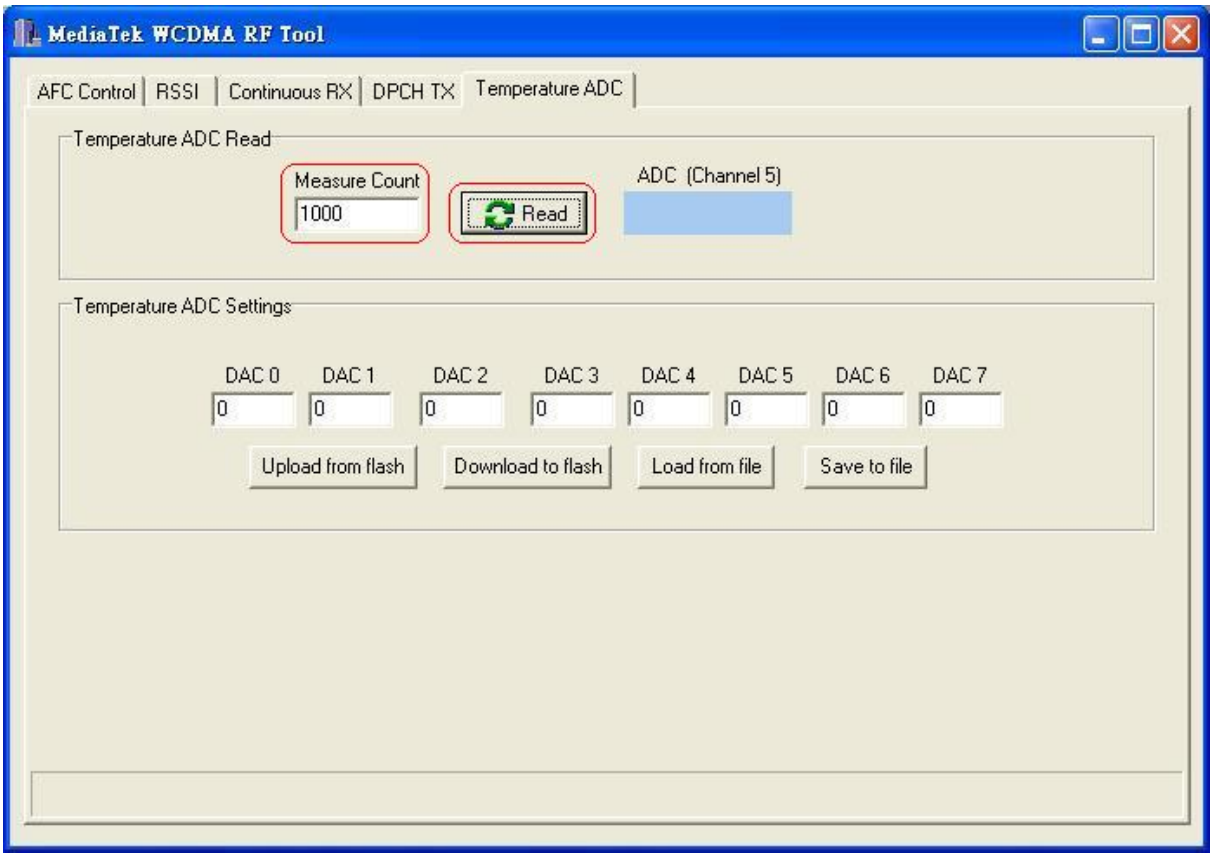

Figure 473 ***Input Measure Count and click [Read] button***

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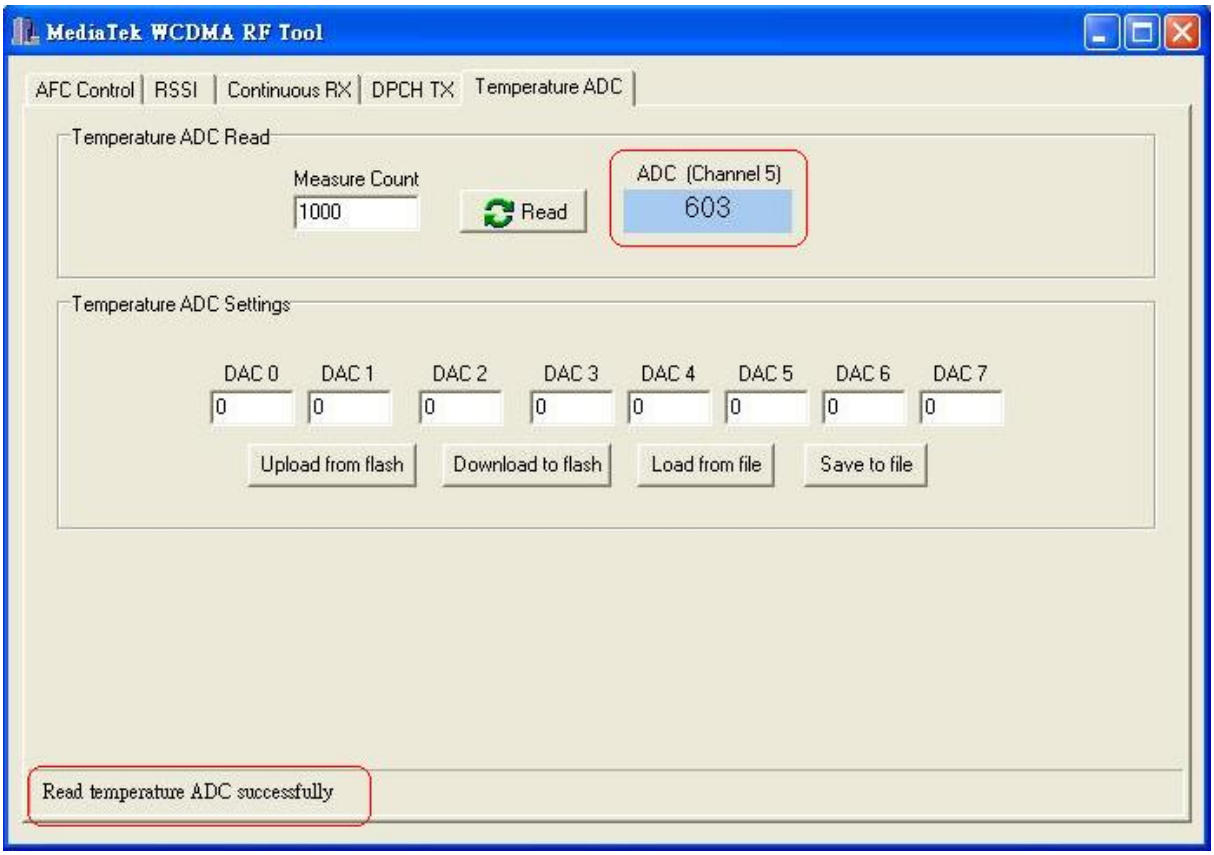

Figure 474 ***The ADC measurement is displayed after Click [Read] button***

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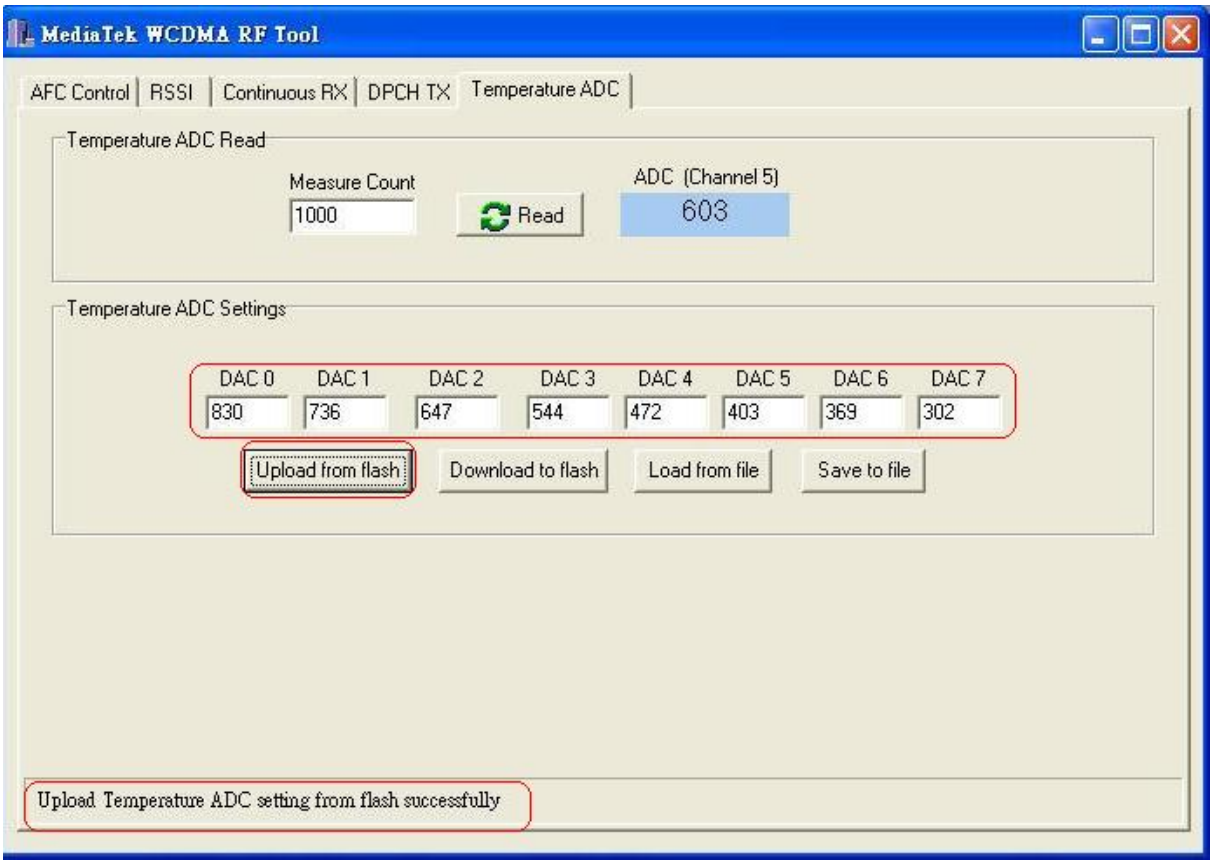

Figure 475 ***Click the [Upload from flash], and the result is displayed.***

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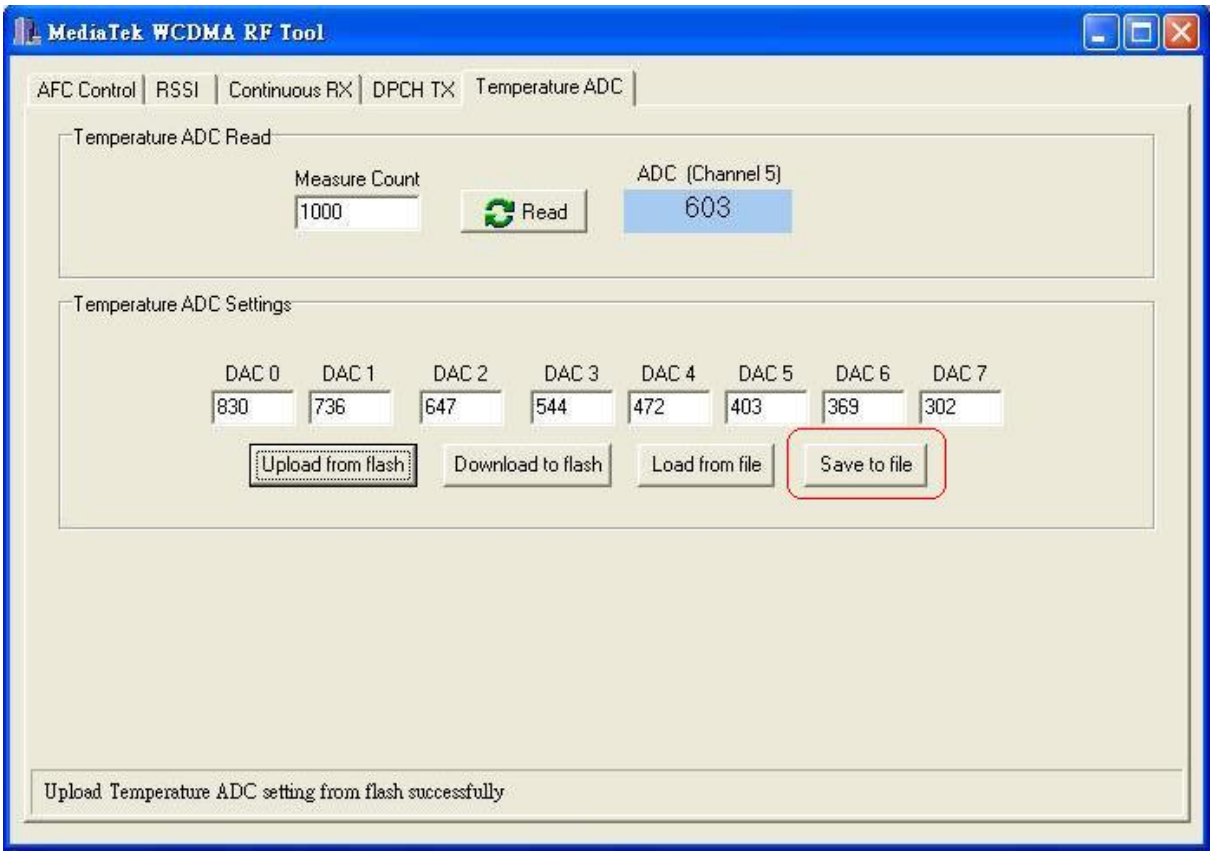

Figure 476 ***Click the [Save to file] button***

INI file format sample is as follows:
[WCDMA Temperature Sensor]
ADC0=830
ADC1=736
ADC2=647
ADC3=544
ADC4=472
ADC5=403
ADC6=369
ADC7=302

3.21 3G TD RF Tool

After META opens COM port, reads NVRAM database and reset target to test mode, user can start to do all calibration and testing. User can switch to 3G TD RF tool by selecting [3G TD RF tool] from main selection menu.

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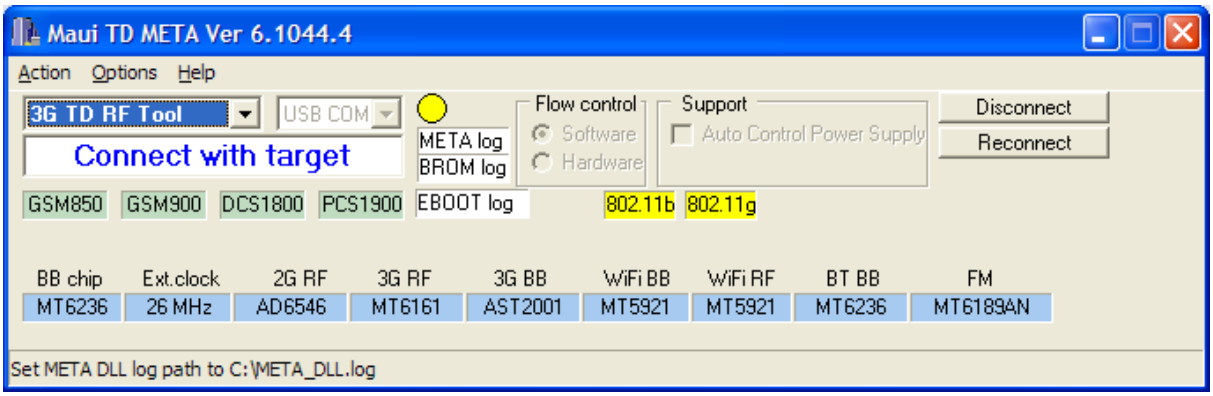

Figure 477 ***Select [3G TD RF Tool] from main selection menu***

3.21.1 AFC TX Control

User can input BAND, UARFCN, APC Data, AFC DAC value, PA Mode (High/Mid/Low) and then click [Start] button to do TX burst and measure the frequency error on the tester.

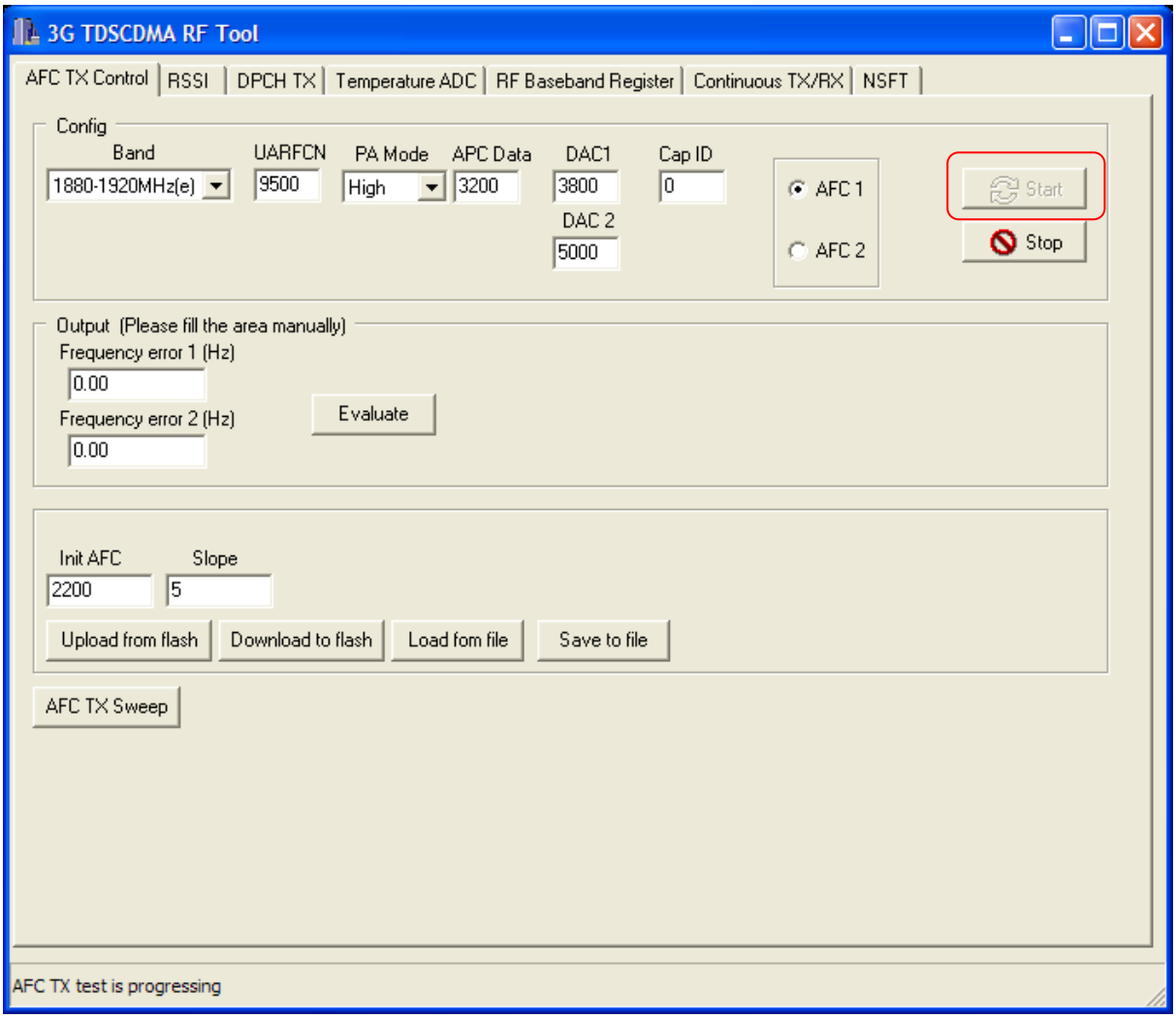

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Figure 478 ***Click [Start] button to start testing***

3.21.1.1 Evaluate

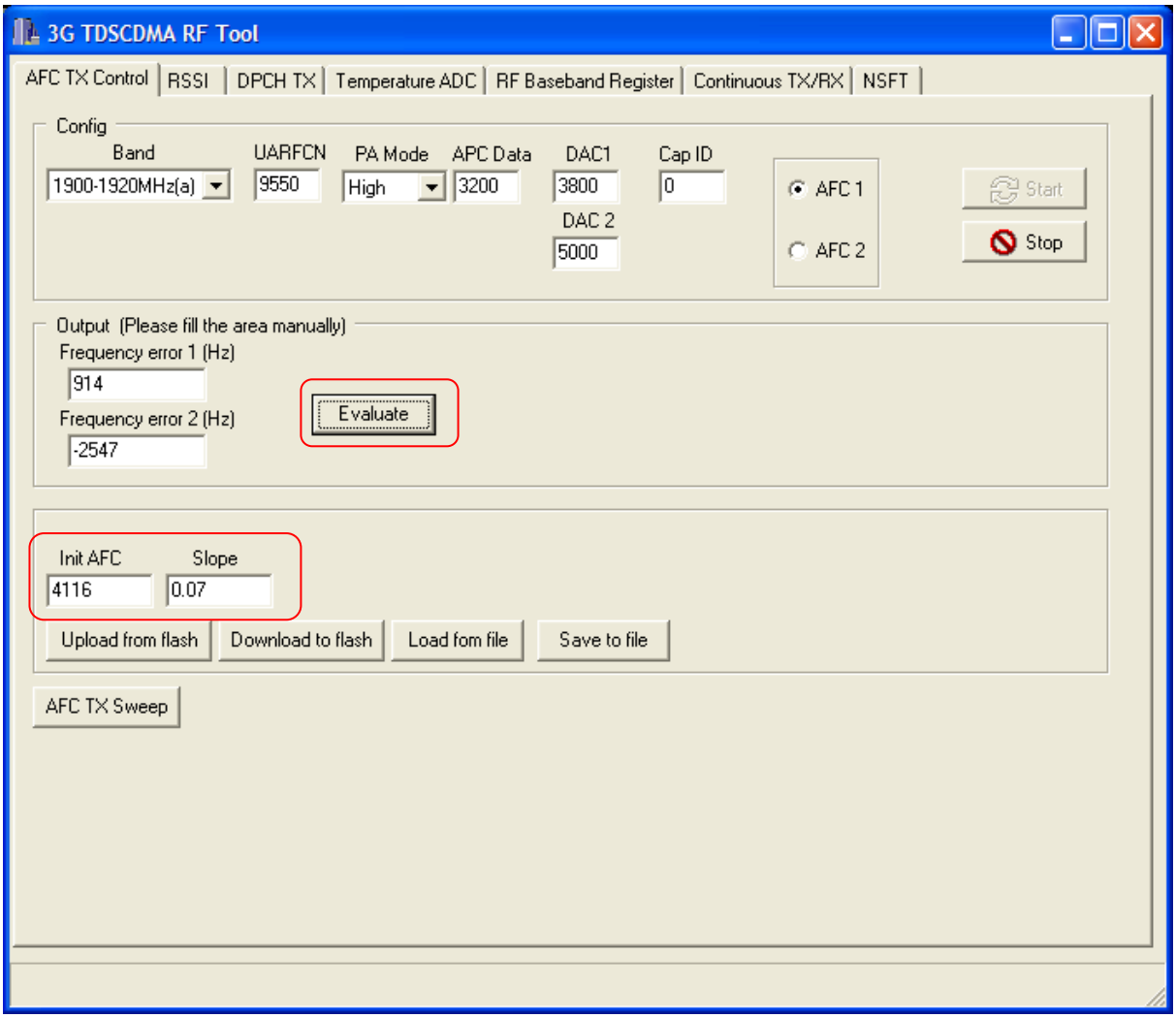

Figure 479 ***Click [Evaluate] button to calculate the Init AFC DAC and Slope***

Note:

Slope = $\overline{\Delta f_1} - \overline{\Delta f_2} \big/ DAC_2 - DAC_1$, where DAC1 and DAC2 are AFC DAC value, and $\overline{\Delta f_1}$ and $\overline{\Delta f_2}$ are averaged frequency error measured at the tester.

3.21.1.2 Upload and download the AFC value in flash

Users can click [Upload from flash] button to read initial AFC and slope value from flash and click [Download to flash] button to write initial AFC and slope value to flash.

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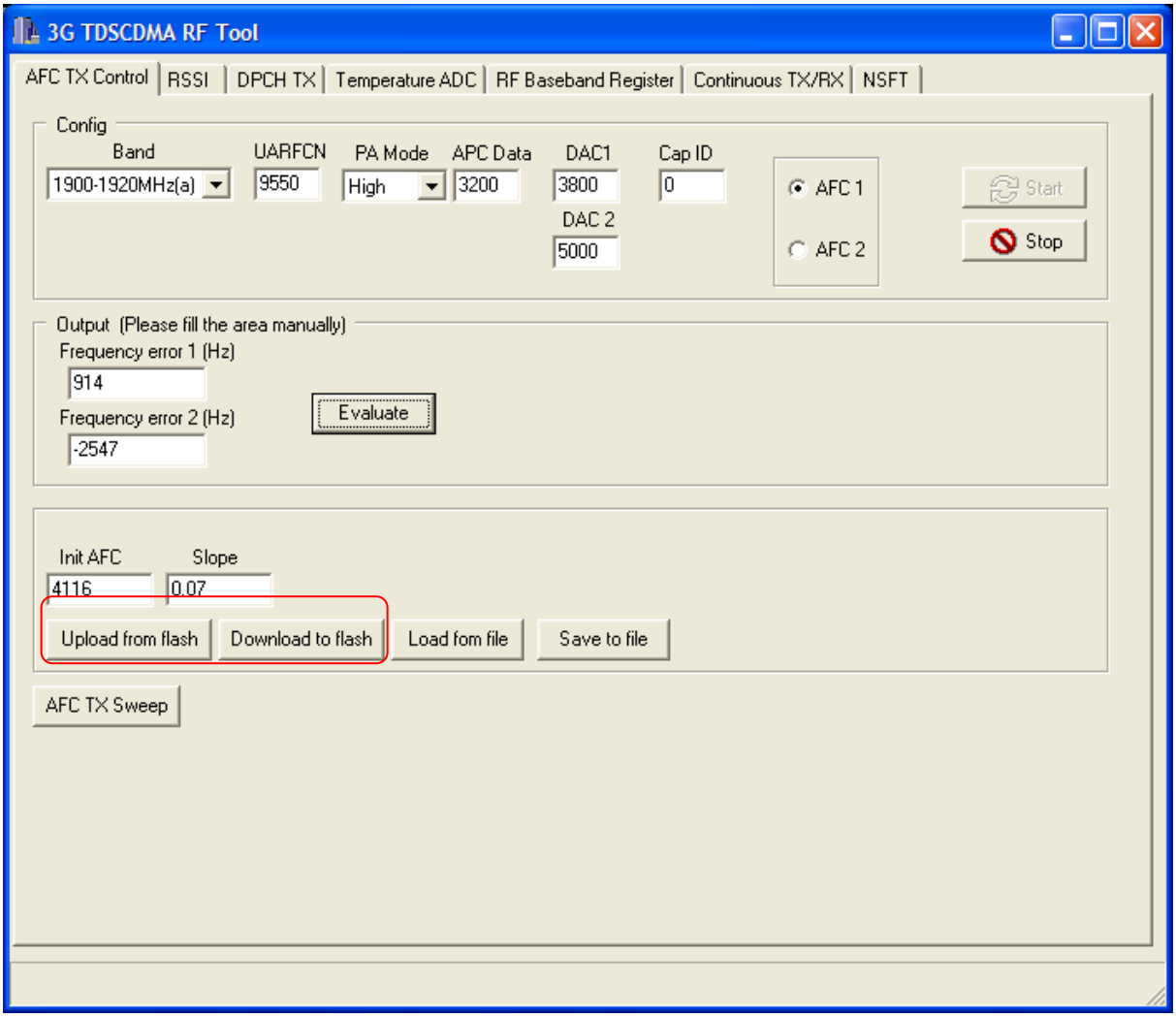

Figure 480 ***[Upload from flash] and [Download to flash] button***

3.21.1.3 Load and save the AFC value with INI file

Users can click [Load from file] button to load initial AFC and slope value from file and click [Save to file] button to save initial AFC and slope value to file.

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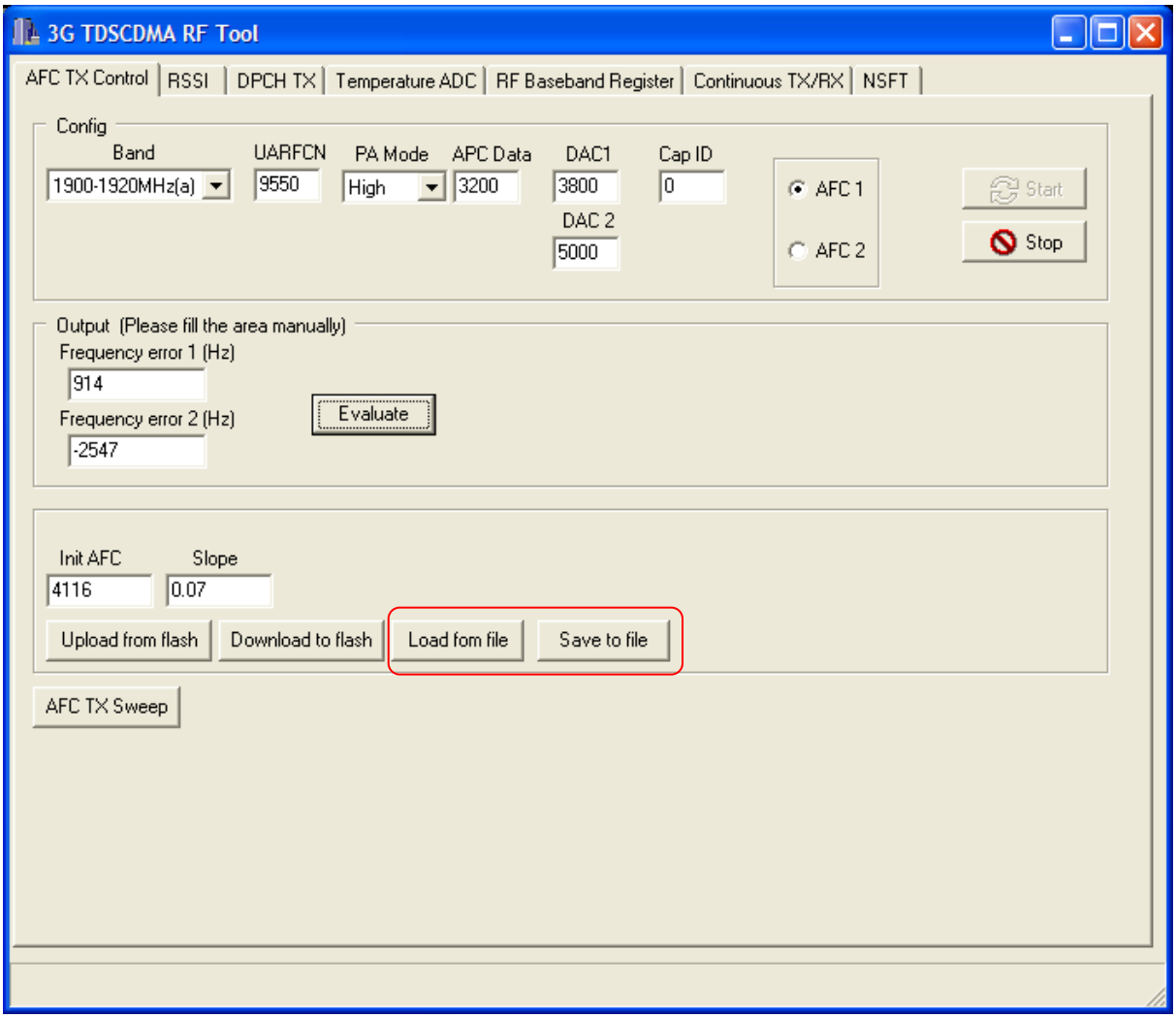

Figure 481 ***[Load from file] and [Save to file] buttons***

The following is a template file of AFC control. User will get the text file after saving initial value and slope. Please follow the file format if you want to change the value in file.

[TDSCDMA AFC control]
Initial value=4116
Slope=0.0700

3.21.2 RSSI

RSSI function is used for measuring the power of the indicated channel. User can select Band, UARFCN, AFC DAC, LNA mode (High/Mid/Low), gain (dB) and then click [Start] button.

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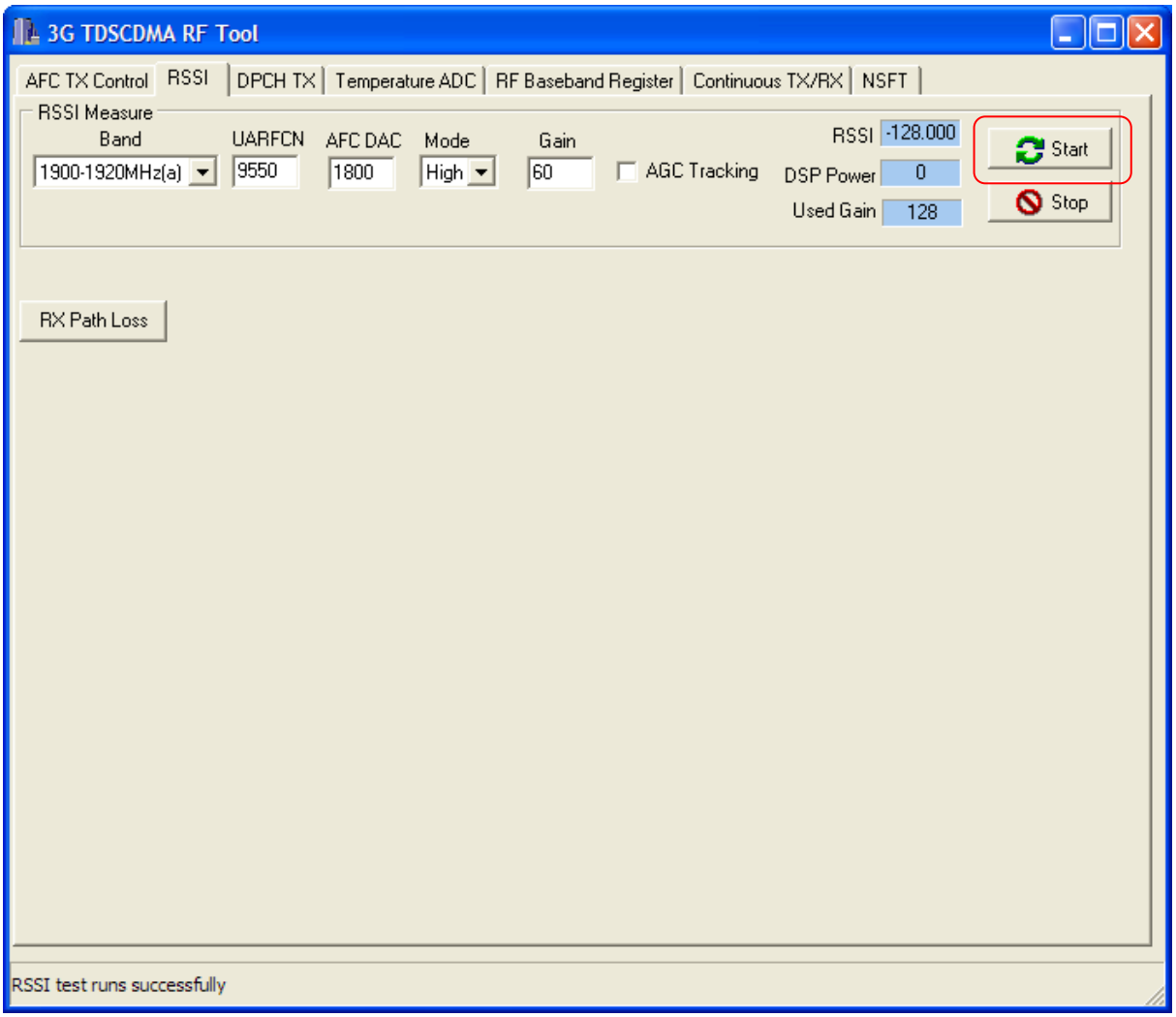

Figure 482 ***Click [Start] button to start power measurement***

The difference of the downlink cell power and the average power of RSSI done by UE is the RX loss. User can save to flash or file by clicking [RX path loss] button. Please refer to section 3.20.2.1.

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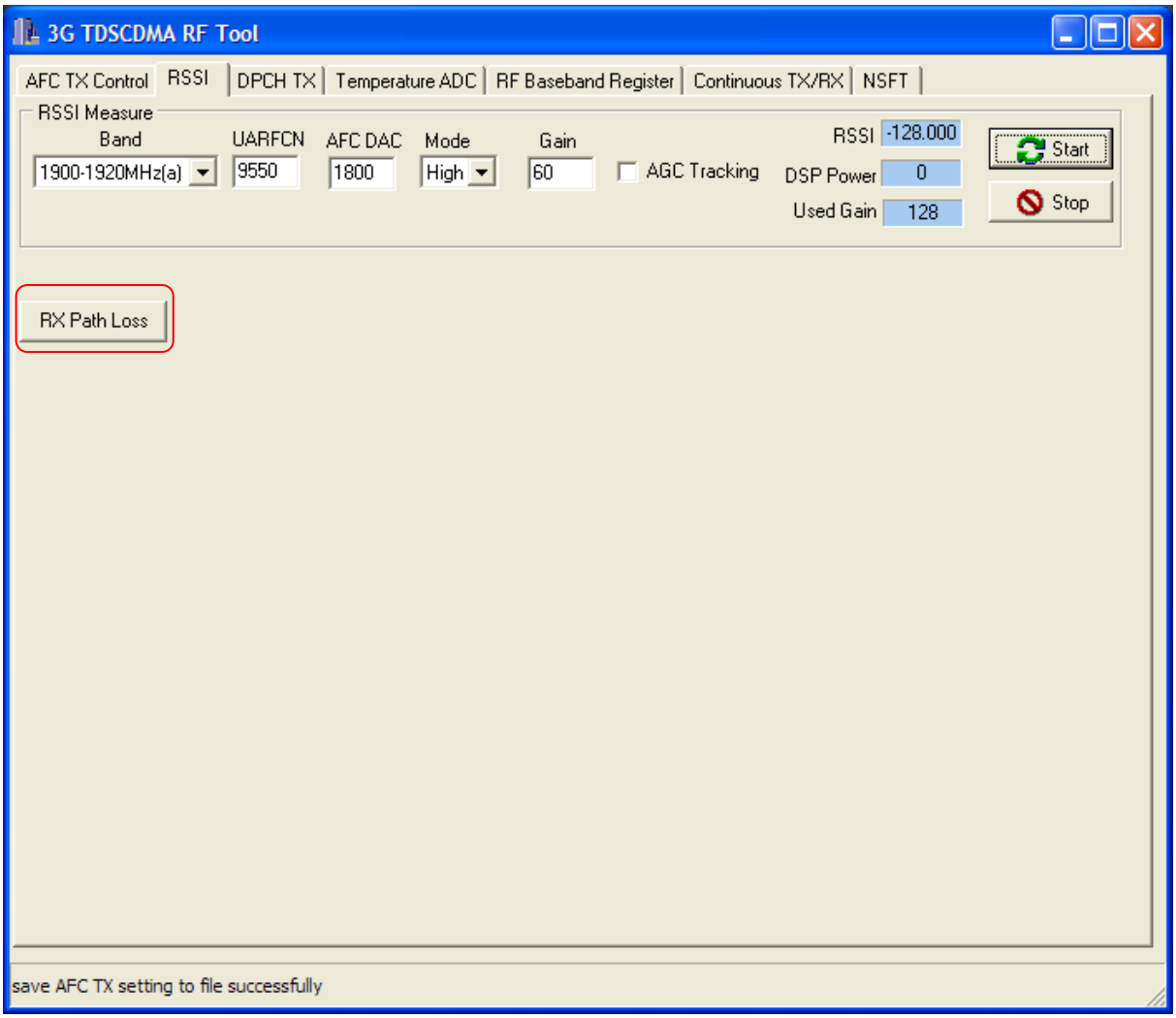

Figure 483 ***Click [RX path loss] button***

3.21.2.1 RX path loss

User can upload or download sub-band and path loss values from or to flash. User can load and save these values to files in PC, too. The RX path loss stored in flash of UE will compensate the path loss in RX path.

The Frequency Section divide the frequency band by 15 sub-bands, and each sub-band is ended by UARFCN setting.

The Temperature Section provide 8-level temperature compensation (refer to 3.21.4). For each temperature interval, temperature compensation is applied for LNA High/Mid/Low mode.

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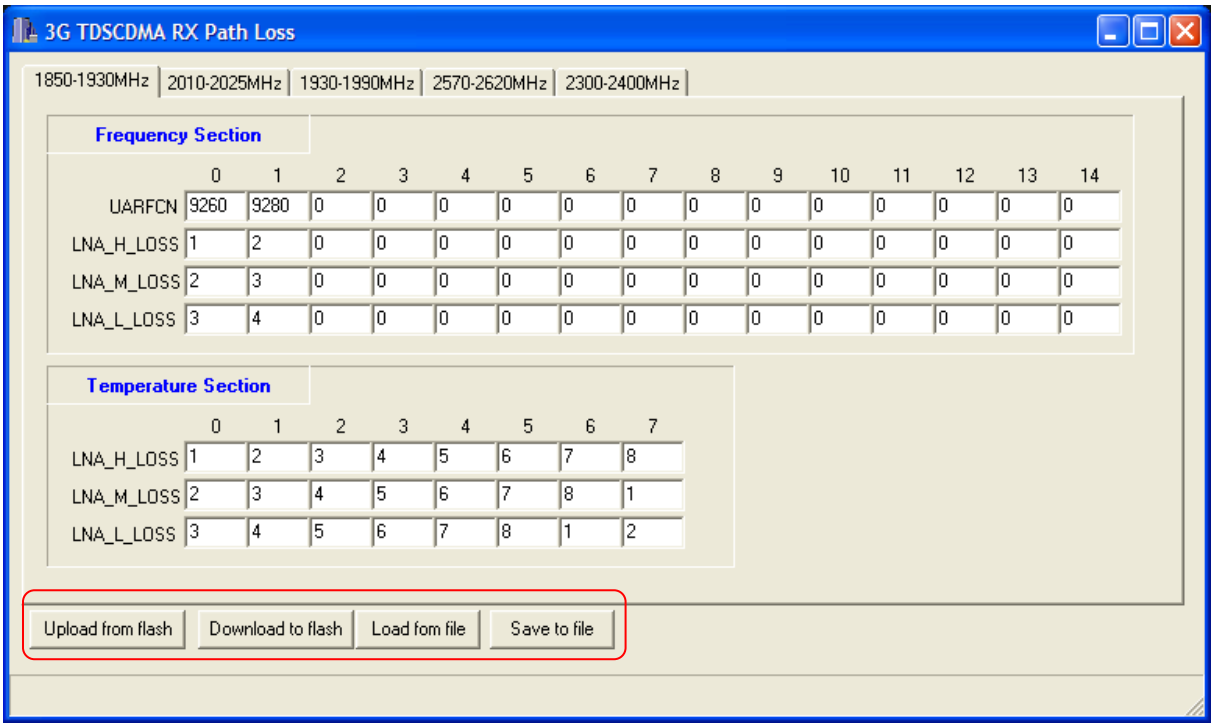

Figure 484 ***Click [Upload from flash]/[Download to flash]/[Load from file]/[Save to file] button to read/write value to flash or read/write value to INI file***

3.21.2.2 RX path loss file format

There is a special text file format when you save the RX path loss values. Please follow the file format if you want to change the value in file. Each number must be followed with a comma.

Users will get a text file after saving them. The following is a template file that contains RX path loss. Users will get the text file after saving UARFCN and RX loss to file. Each value must be followed with a comma. Please follow the file format if you want to change the value in file. The UARFCN field is corresponding to the UARFCN field in RX Path Loss window (Figure 484 Figure 450) and RX loss field by Temperature is corresponding to the RX loss high, RX loss middle, and RX loss low fields, too.

[TDSCDMA 1850-1930MHz RX loss]
Subband Max UARFCN=0,0,0,0,0,0,0,0,0,0,0,0,0,0
Subband RX loss high
mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Subband RX loss middle
mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Subband RX loss low
mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Temperature RX loss high mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Temperature RX loss middle mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Temperature RX loss low mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
[TDSCDMA 2010-2025MHz RX loss]
Subband Max UARFCN=0,0,0,0,0,0,0,0,0,0,0,0,0,0
Subband RX loss high
mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000

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Subband RX loss middle
mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Subband RX loss low
mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Temperature RX loss high mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Temperature RX loss middle mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Temperature RX loss low mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
[TDSCDMA 1930-1990MHz RX loss]
Subband Max UARFCN=0,0,0,0,0,0,0,0,0,0,0,0,0,0
Subband RX loss high
mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Subband RX loss middle
mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Subband RX loss low
mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Temperature RX loss high mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Temperature RX loss middle mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Temperature RX loss low mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
[TDSCDMA 2570-2620MHz RX loss]
Subband Max UARFCN=0,0,0,0,0,0,0,0,0,0,0,0,0,0
Subband RX loss high
mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Subband RX loss middle
mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Subband RX loss low
mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Temperature RX loss high mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Temperature RX loss middle mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Temperature RX loss low mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
[TDSCDMA 2300-2400MHz RX loss]
Subband Max UARFCN=0,0,0,0,0,0,0,0,0,0,0,0,0,0
Subband RX loss high
mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Subband RX loss middle
mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Subband RX loss low
mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Temperature RX loss high mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Temperature RX loss middle mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000
Temperature RX loss low mode=0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000

3.21.3 DPCH TX

DPCH TX is used for TX Power testing. User can input Band, UARFCN, AFC DAC value, PA Mode, APC Data, the traffic direction of timeslot (TS1 ~ TS5) and Modulation of each timeslot. By clicking [Start] button the UE will start to do TX on the UARFCN assigned by user.

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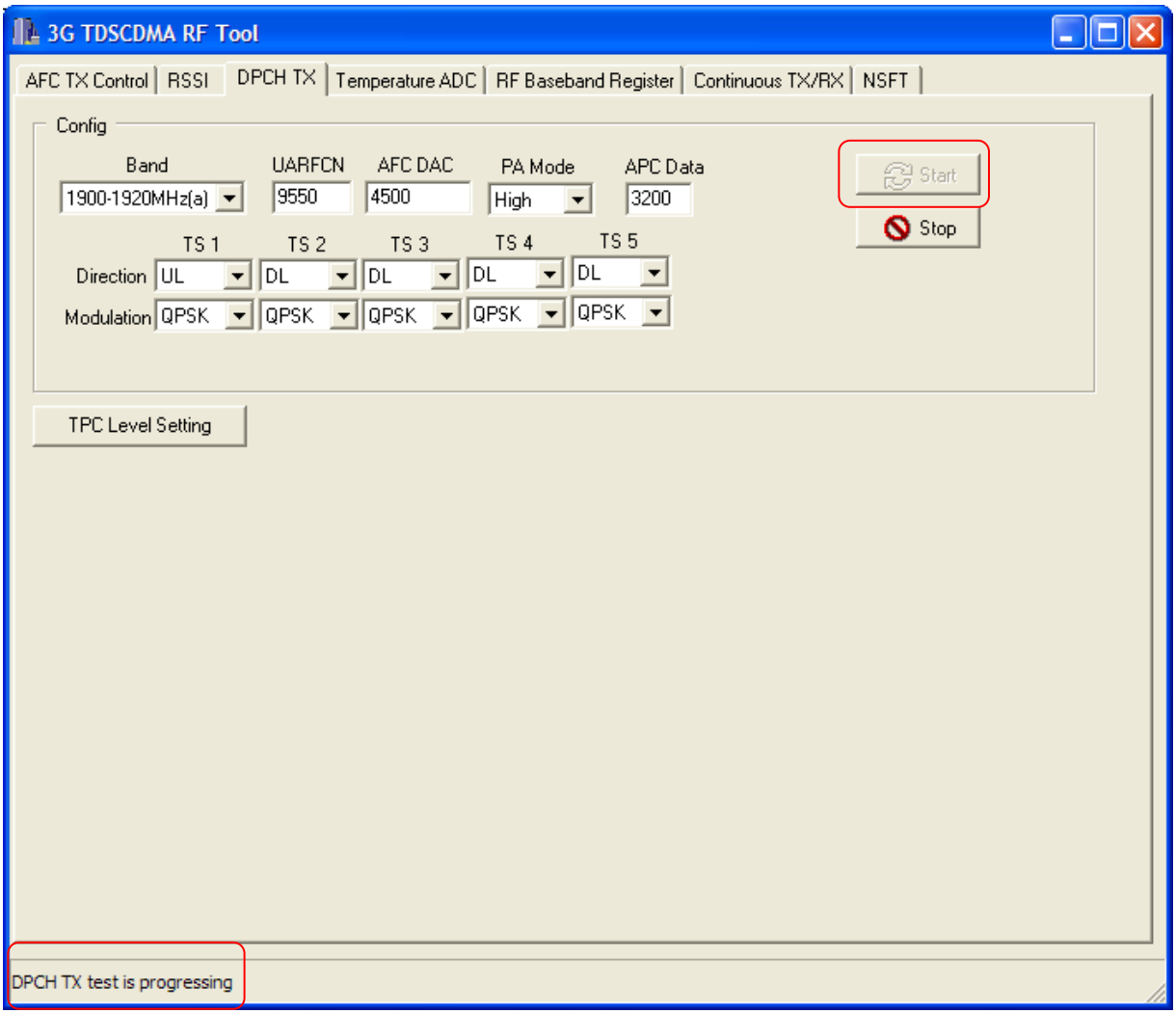

Figure 485 ***Click [Start] button to start testing***

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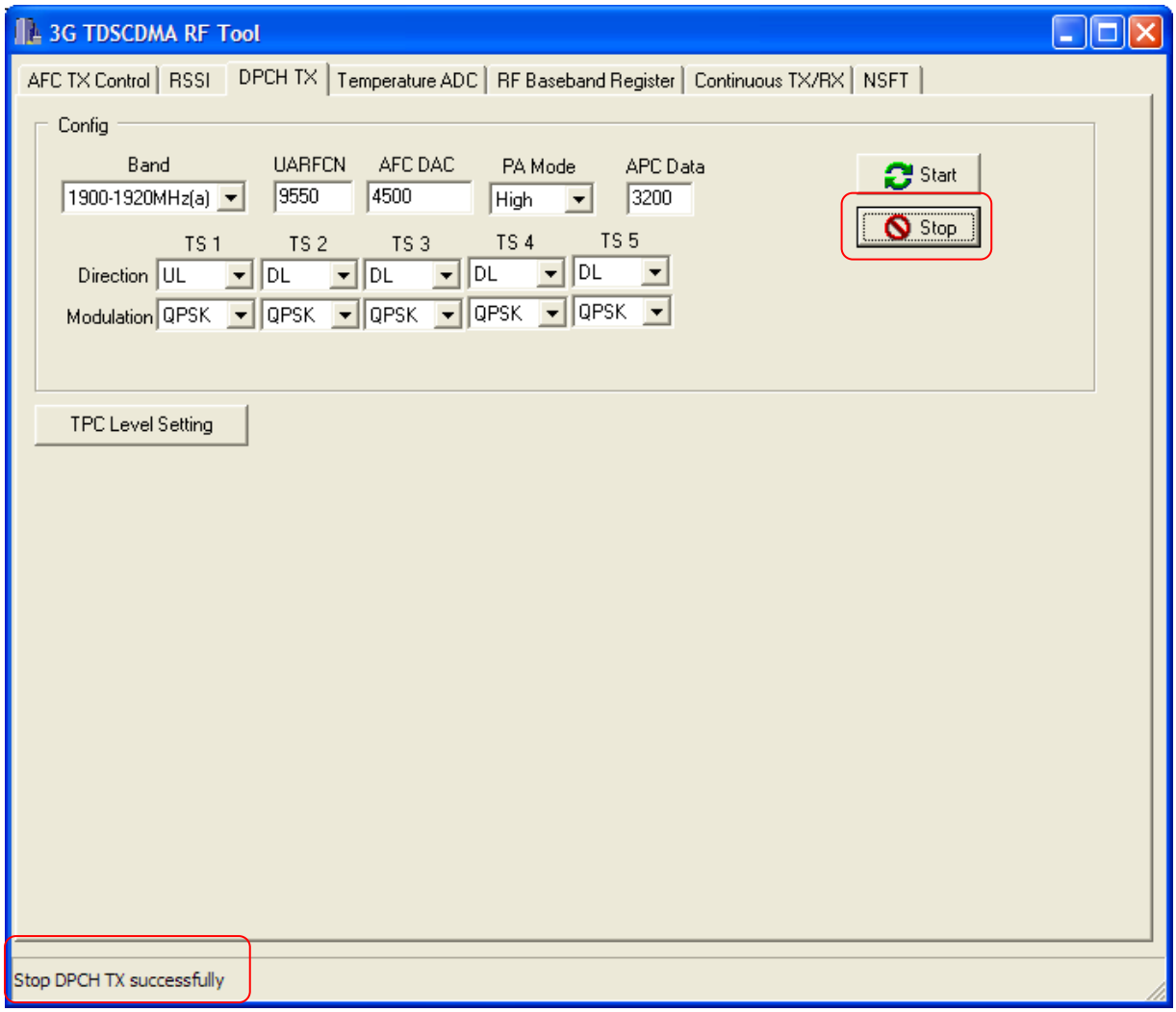

Figure 486 ***Click [Stop] button to stop testing***

3.21.3.1 TPC level setting

User can click [TPCl level setting] button to show the DPCH TX Profile.
This operation is used for fine tune TX configuration and profiles, and save these settings to UE's nvram or INI file.
UE will start to transmit RF signal with the parameters set by user after UE get the command from META.

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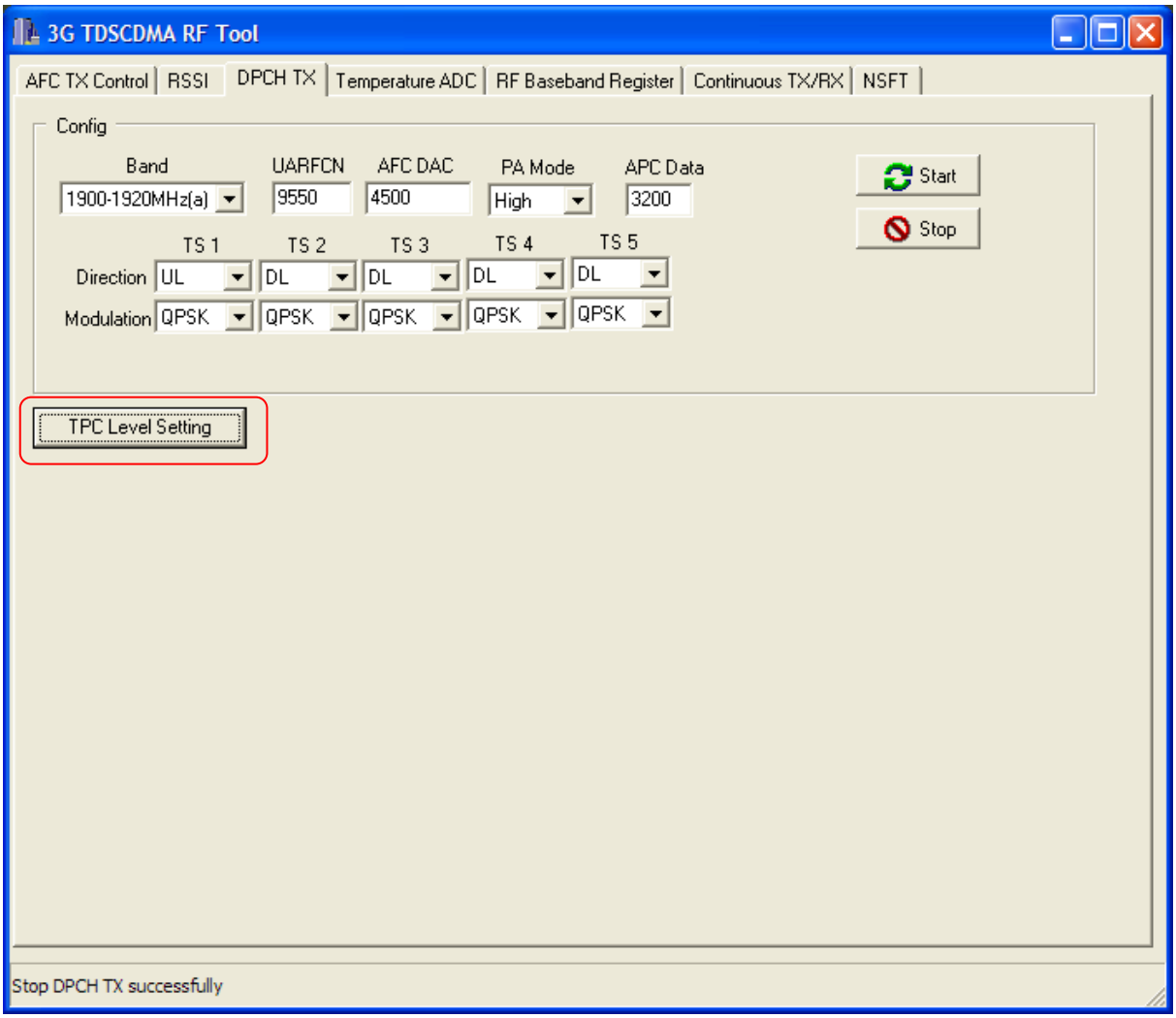

Figure 487 ***Click [TPC level setting] button to change TPC profiles.***

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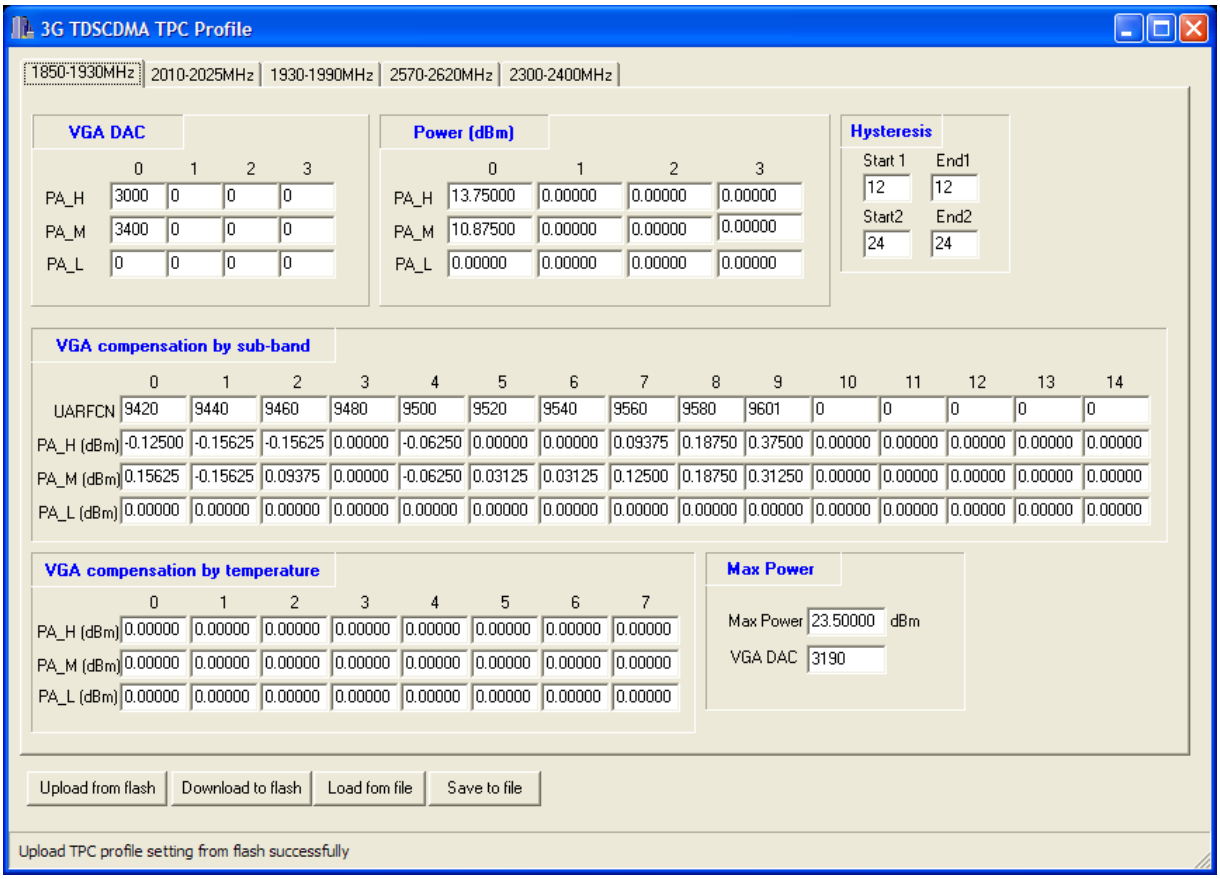

Figure 488 ***Click [Upload from flash]/[Download to flash]/[Load from file]/[Save to file] button to read/write value to flash or read/write value to INI file***

User can upload or download these relevant values by sub-band from or to flash. User can load or save these values form or to files in PC, too.

VGA DAC and Power(dBm):

VGA DAC section can set 4-level power's VGA DAC values respectively at PA High/Middle/Low Gain mode.
Power(dBm) section is power values at antenna port corresponding to VGA DAC values. The power values get by testing.Usually,we get the power values in calibration progression.
We can calculate TX power VGA DAC value according to the value in table(except Max power is according to below Max Power section),for example:
PA High Gain Mode : 20dBm DAC value= (20-13.75)x32+3000
PA Middle Gain Mode: 5dBm DAC value= (5 -10.876)x32+3400
Note: So far,we only support 1-level power point.

Hysteresis:

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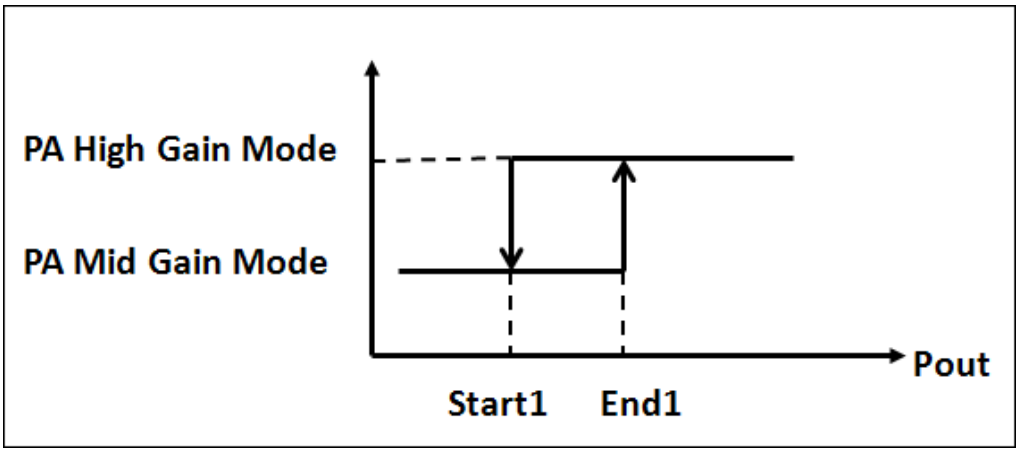

Tx Power from high to low: when Pout >= Start1(12dBm), PA work at high gain mode
when Pout < Start1(12dBm), PA work at Mid gain mode
Tx Power from low to high: when Pout >= End1(12dBm), PA work at high gain mode
when Pout < End1(12dBm), PA work at Mid gain mode
Note: So far,We can't support Start2 and End2 options.

VGA Compenstion By Sub-band:
We can set 15 frequency points at most for power compensation at every sub-band. Power compensation at the different frequency is applied for PA High/Middle/Low Gain Mode.

VGA Compenstion By temperature:
The Temperature Section provide 8-level temperature compensation (refer to 3.21.4). For each temperature interval, temperature compensation is applied for PA High/Mid/Low Gain mode.

Max Power:
Max Power section can limit max output power. VGA DAC value is corresponding to Max Power.
In Tx calibration, We will correct the max power DAC value .

3.21.4 Temperature ADC

Temperature ADC is used for measure the characteristics of ADC channel among different temperatures.
Users can input the measure count and click [Read] button to trigger UE to report the measurement of ADC Channel 5 which is our temperature ADC channel.

Users can also save the DAC0~7 settings to NVRAM or INI file.

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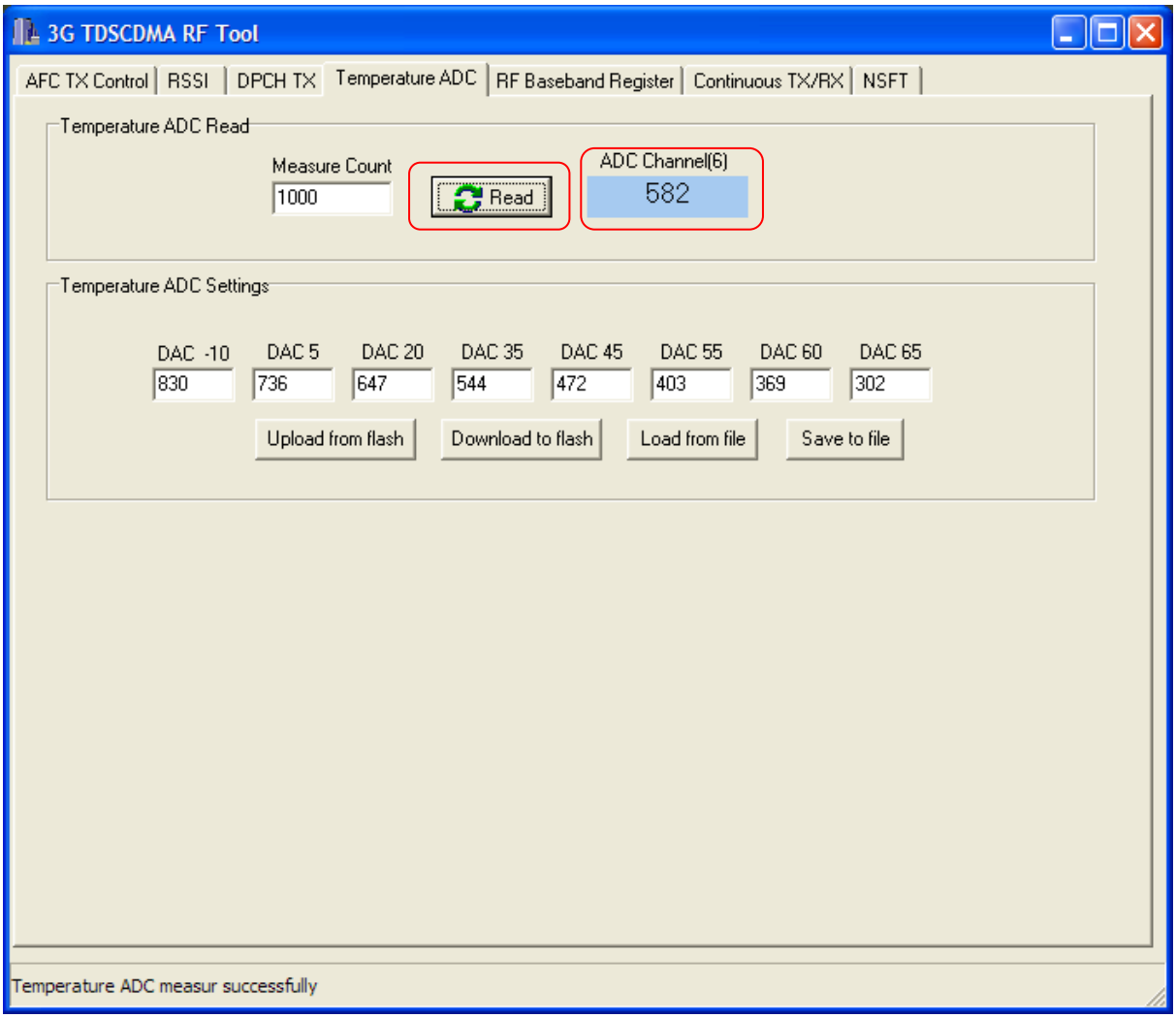

Figure 489 ***Input Measure Count and click [Read] button and the measurement result is shown***

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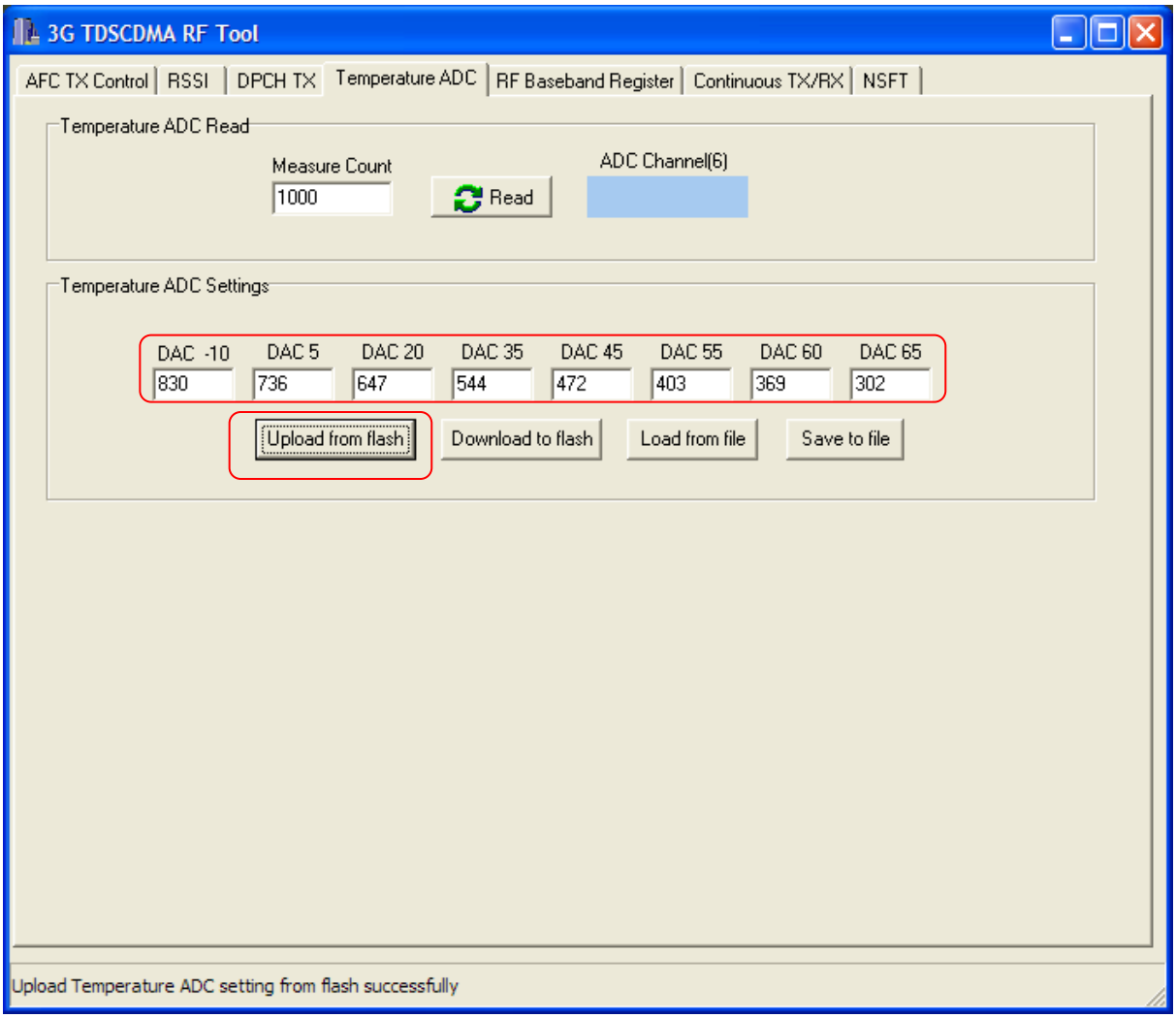

Figure 490 ***Click the [Upload from flash], and the result is displayed.***

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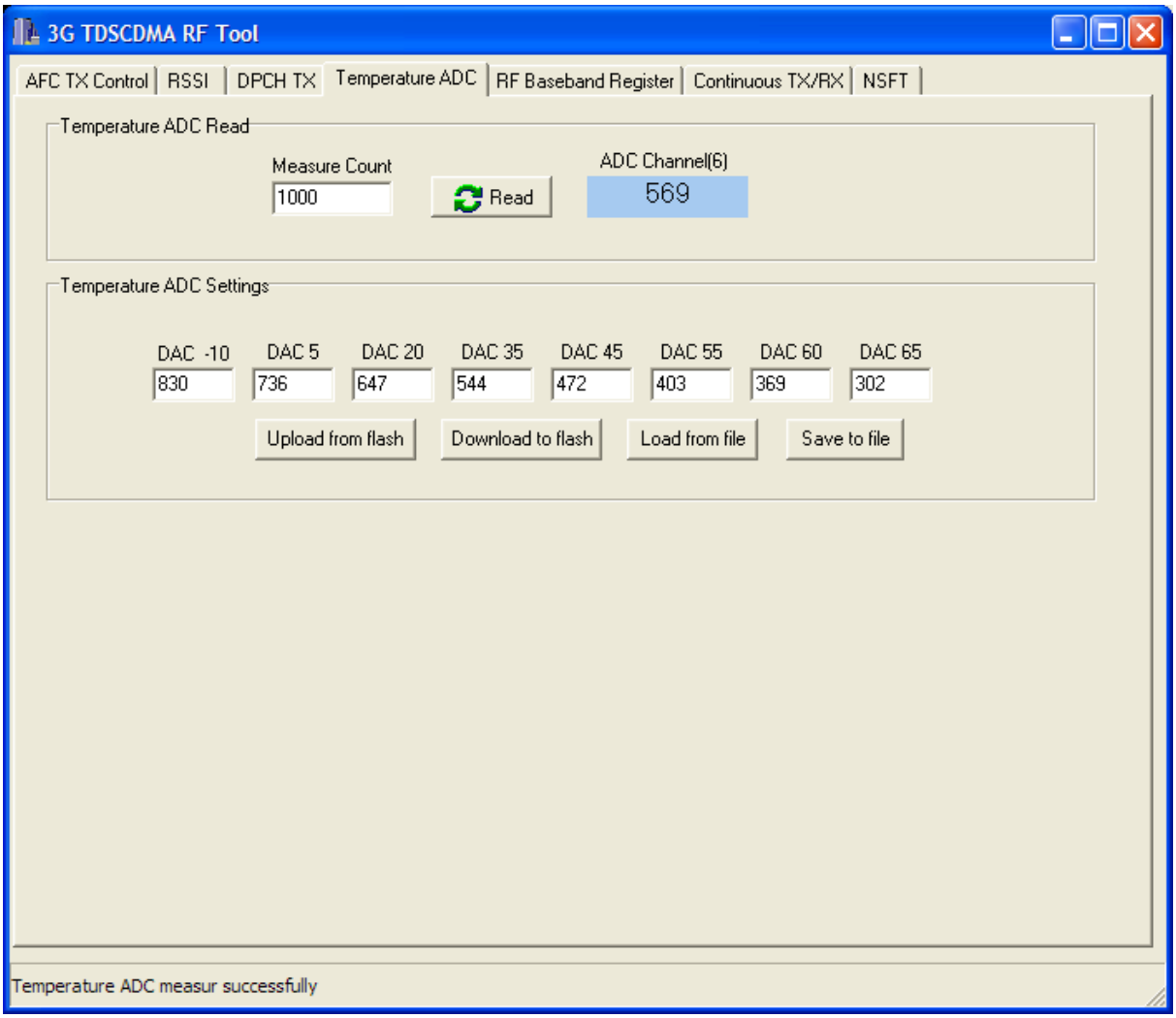

Figure 491 ***Click the [Download to flash]/[Load from file]/[Save to file] button to read/write data to/from flash or read/write data to/from file***

INI file format sample is as follows:
[TDSCDMA Temperature Sensor]
ADC0=830
ADC1=736
ADC2=647
ADC3=544
ADC4=472
ADC5=403
ADC6=369
ADC7=302

3.21.5 Baseband Register

This page provides basic functions for baseband register read/write for debugging.

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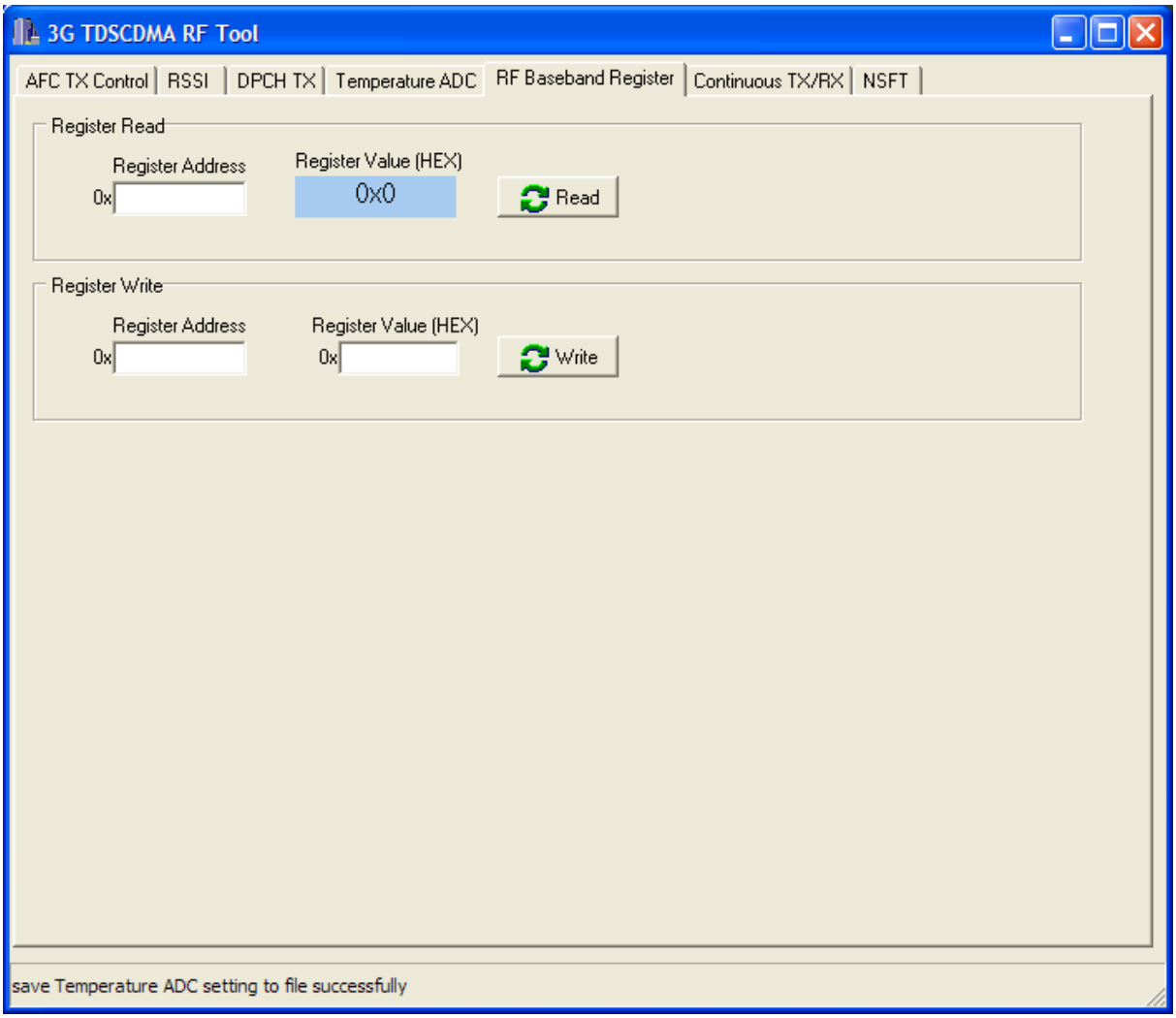

Figure 492 ***Baseband Register Read/Write GUI***

3.21.6 Continuous TX/RX

Continue TX/RX is used for observing TX/RX IQ signal. User can input band, UARFCN and TX/RX mode. After selecting the testing settings to control target, click [Start] button to do continuous TX/RX testing. When user wants to stop RX, he can click [Stop] button.

UE will start to do continuous TX/RX of the UARFCN with the corresponding settings set by user after getting the continuous TX/RX command from META.

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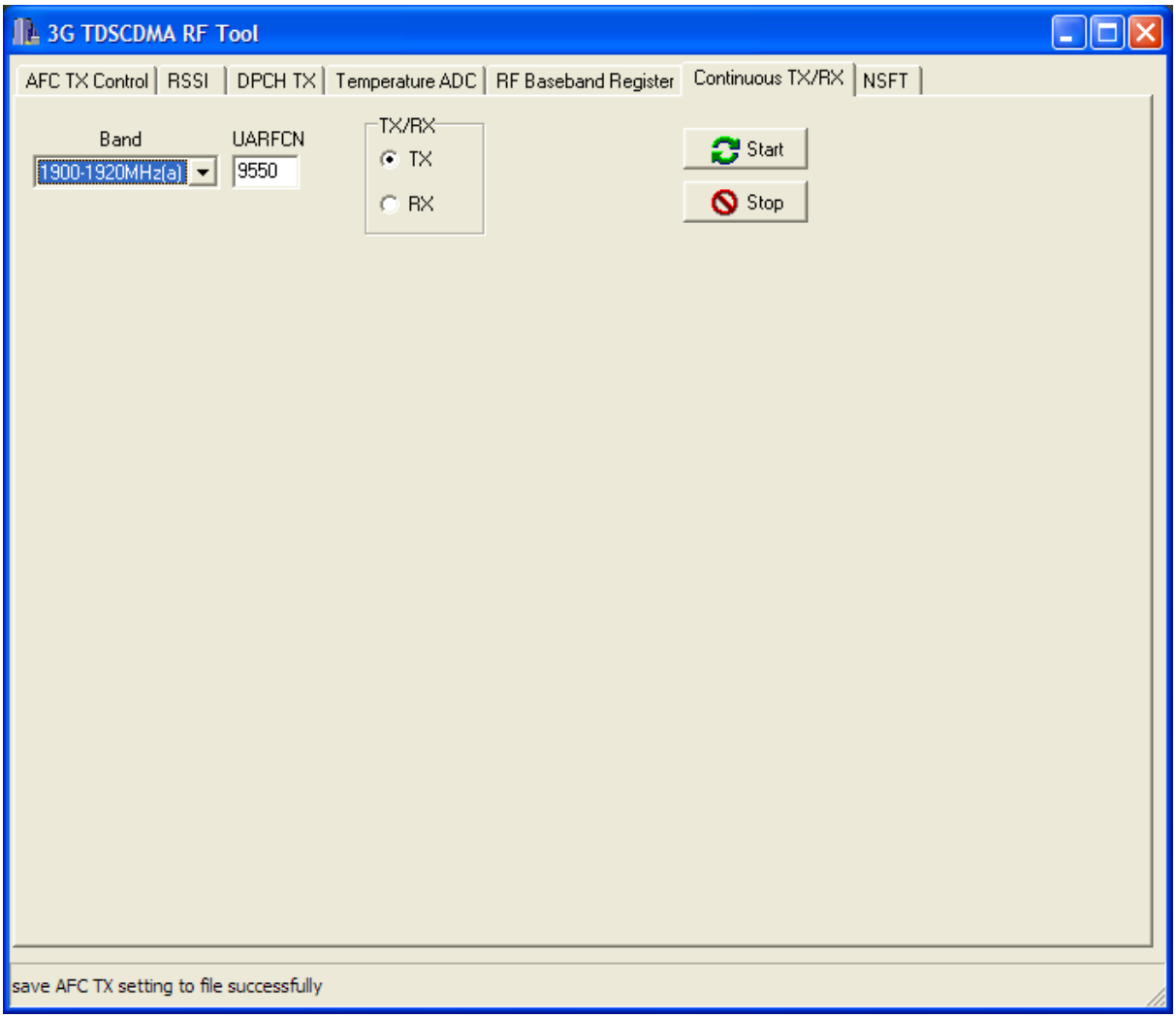

Figure 493 ***GUI of Continuous TX/RX***

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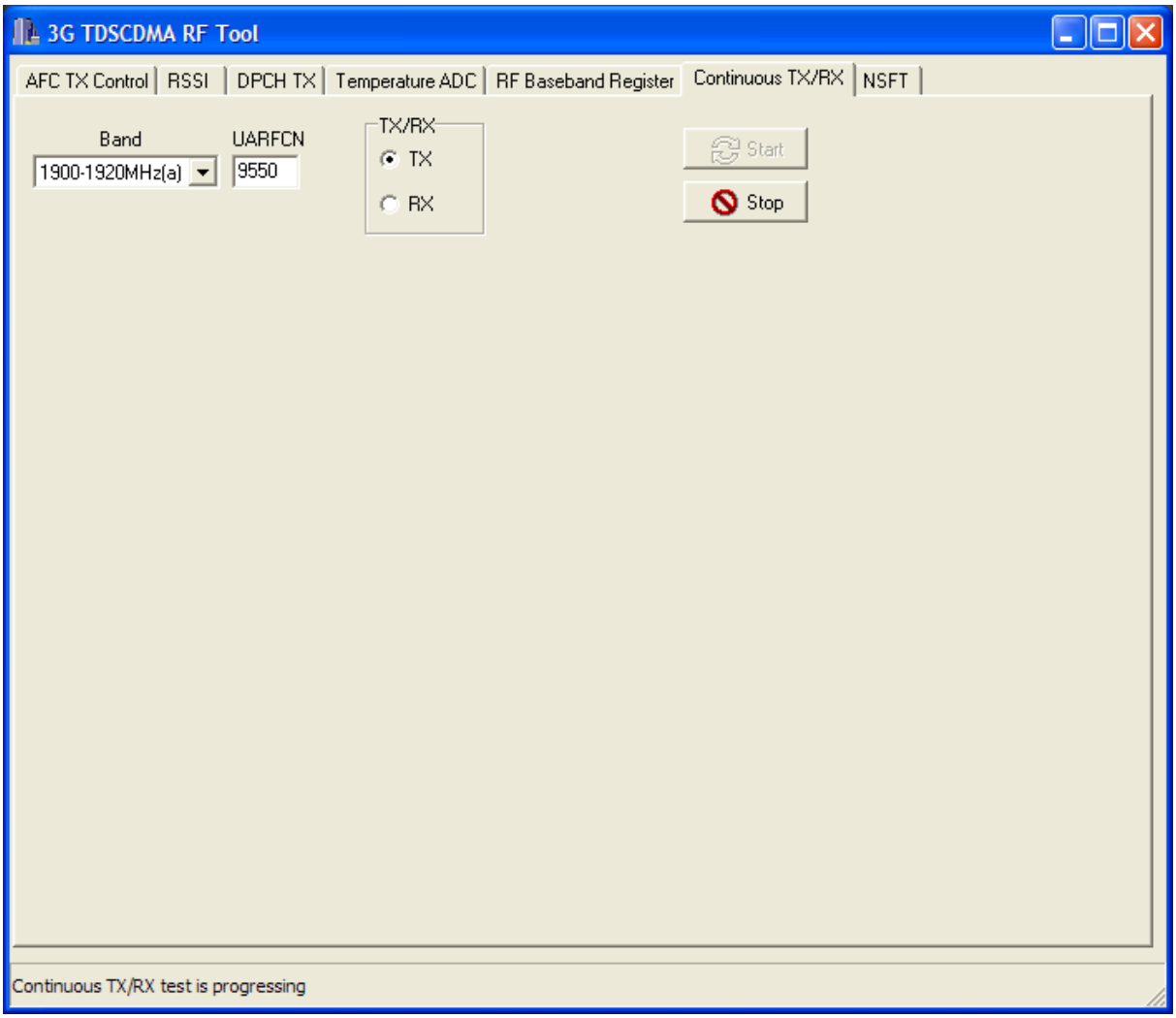

Figure 494 ***Click [Start] button to start continuous TX/RX testing***

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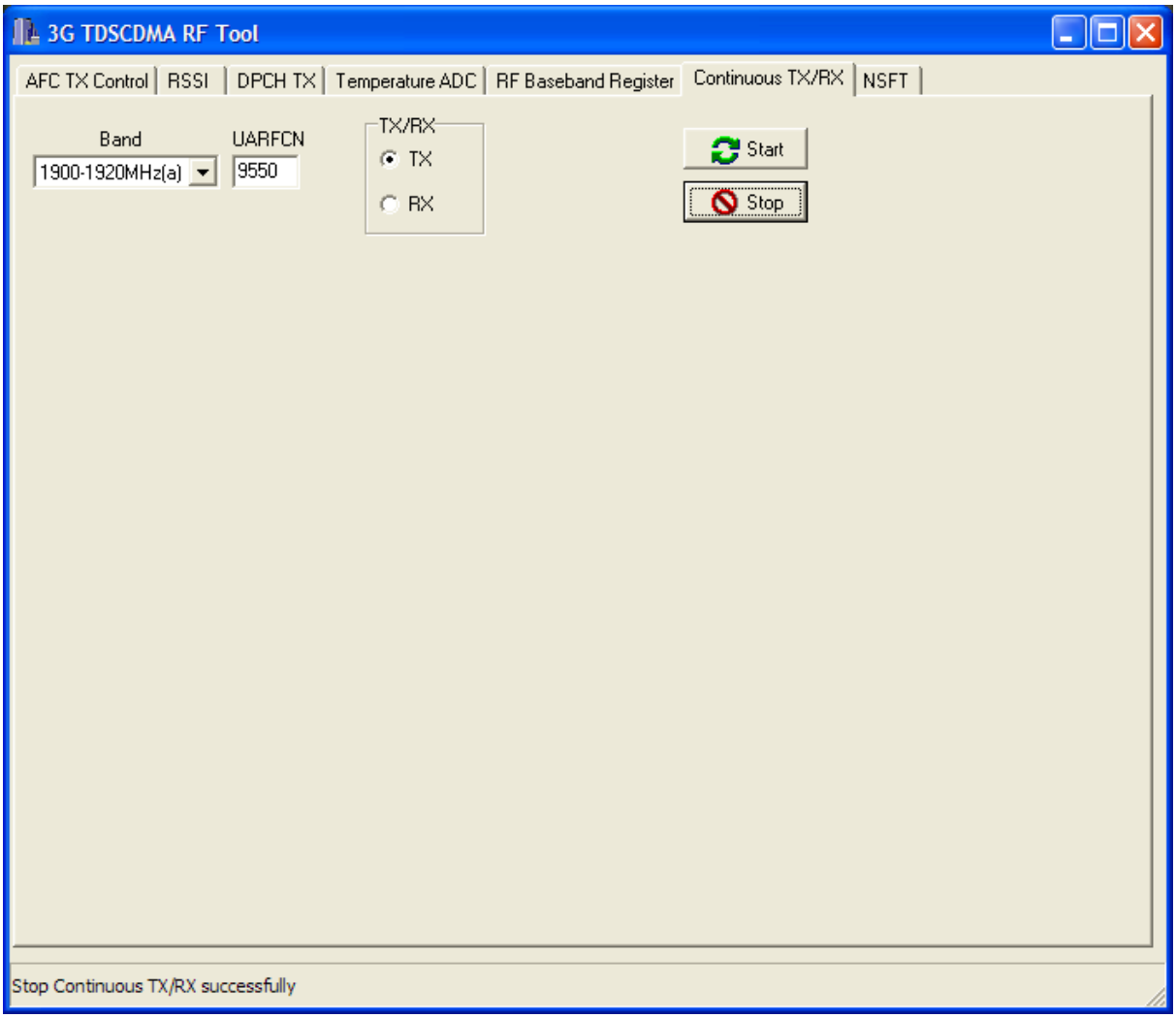

Figure 495 ***Click [Stop] button to stop continuous RX testing***

3.21.7 NSFT

NSFT page provides function for user to evaluate/test the NSFT function manually. By specifying the parameters in the GUI, the user can establish a NSFT session and do the performance test.

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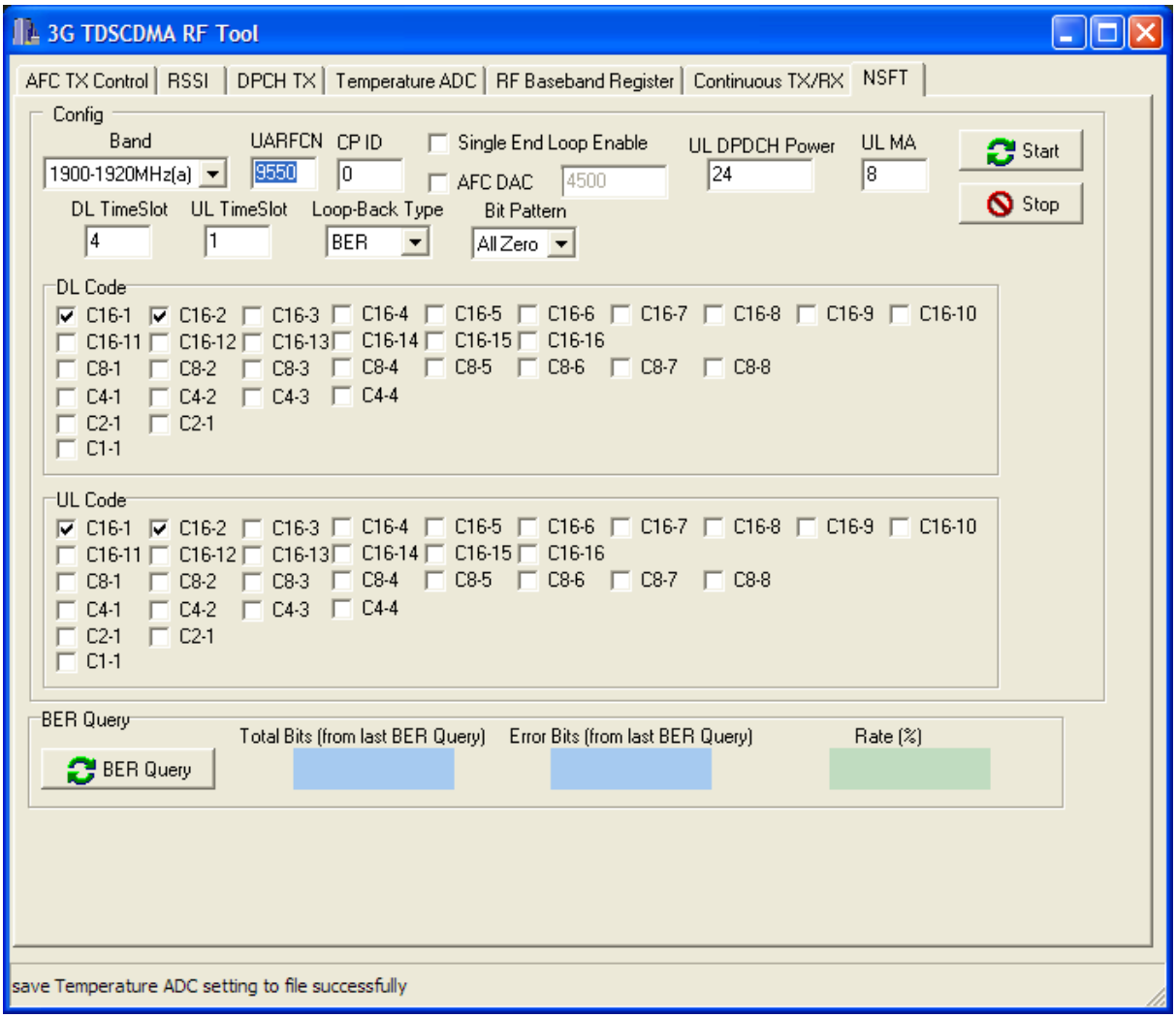

Figure 496 ***NSFT***

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4 META-Factory

User can switch to META factory mode by selecting [Factory Mode] from main selection menu. The tool controls equipment and target to do the calibration procedure. Before using this tool, user must install driver of GPIB card. The META factory mode supports the following equipment:

- Radio Communication Tester (RCT): Agilent 8960 and R&S CMU 200.
- Power supply: Agilent 663x2, 661x, and E3631A series and Keithley 2306 power supply.
- BT tester: R&S CBT.
- WiFi tester: Litepoint IQView and Agilent N4010A.
  Note: From 5.0912.0's META WiFi calibration with LitePoint IQView, users have to setup the runtime environment (VC2005 runtime, Microsoft .NET Framework 2.0, Matlab component runtime MCR v7.6). Please contact the IQView seller to get the All-in-one installer "Runtime Library for IQfact v1.1(MCR7.6 inside).exe". META Tool will pop-up warning message if the PC doesn't installed IQView runtime environment.

Figure 497 ***Warning message when META check the IQView runtime environment fail.***

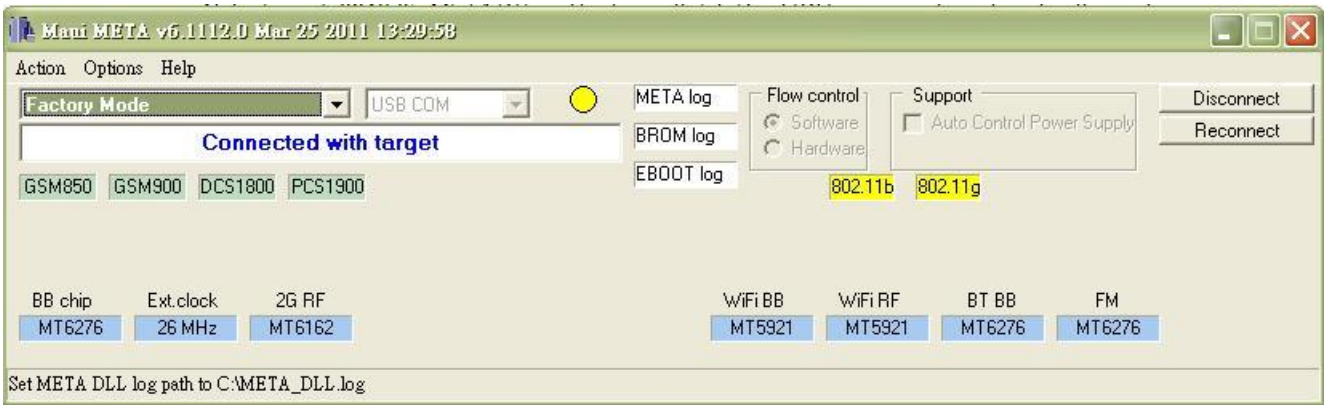

Figure 498 ***Select [Meta factory] from main selection menu***

4.1 Setup files

User must open NVRAM database file, configuration file, calibration data initial file, result file, setup logging file and calibration data result path. META factory will save these 5 files setting to MF_Setup.txt file before closed. User can use previous setting or open other files. The previous setting is saved in MF_Setup.txt of META install folder.

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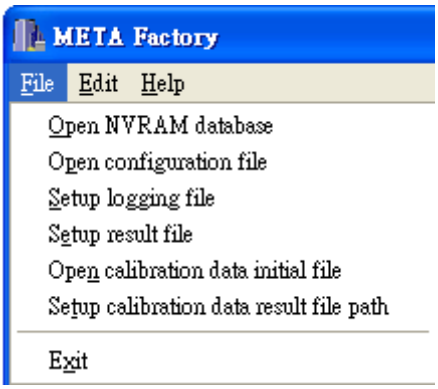

Figure 499 ***Setup files***

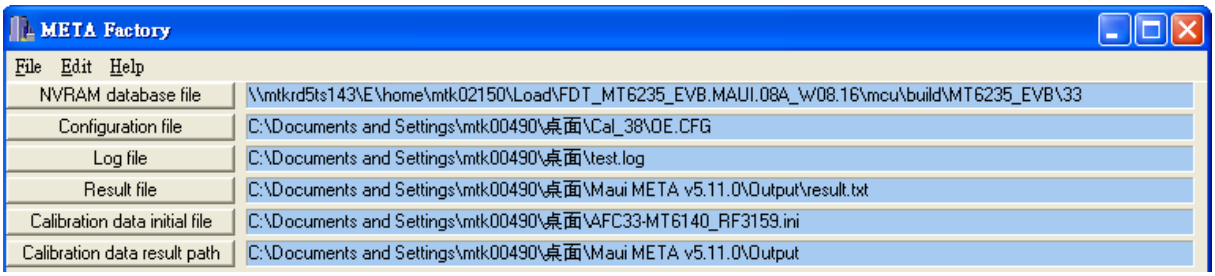

Figure 500 ***Current file setting***

The following is a template of MF_Setup.txt that contains current file setting.

[META factory]

NVRAM database file= \\mtkrd5ts143\E\home\mtk02150\Load\FDT_MT6235_EVB.MAUI.08A_W08.16\mcu\build\MT6235_EVB\33 Slope \ BPLGUInfoCustomApp_MT6235_S00_MAUI_08A_W08_16

Configuration file=C:\Documents and Settings\mtk00490\桌面\Cal_38\OE.CFG

Logging file=C:\Documents and Settings\mtk00490\桌面\test.log

Calibration data initial file=C:\Documents and Settings\mtk00490\桌面\AFC33-MT6140_RF3159.ini

Result file=C:\Documents and Settings\mtk00490\桌面\Maui META v5.11.0\Output\result.txt

Calibration data result path=C:\Documents and Settings\mtk00490\桌面\Maui META v5.11.0\Output

4.1.1 Configuration file

This file is used to keep the configurable data, which can be modified by the phone maker's setting to co-operate in their factory production line. The unit of "time out" value is in milliseconds. If the communication time between the tool and equipment is greater than the timeout value, the tool will show a time out error message.

Note:

- After the semicolon are the comments. Please refer to the calibration procedure in Section 4.2 for detailed information.
- RF engineers must fine-tune the C values (GSM900_C, DCS1800_C, etc.) for their RF module. The best C value is that the target can issue the TX power to meet the specification between MAX_P and MIN_P after writing the new scale factor to the Flash.

The following is the template of the configuration file.

[META version]

META version= ver 5.0836.0 ; specify META version

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```
; the following section is Agilent 8960 specific
[8960 Initialization]
8960 GPIB Address = GPIB0::15::INSTR
Time Out = 5000
GSM400 cable loss = -1.0
GSM850 cable loss = -1.0
GSM900 cable loss = -1.0
DCS1800 cable loss = -1.5
PCS1900 cable loss = -1.5
;"8960 GPIB Address" is GPIB address of Agilent 8960.
;"xxx cable loss" is cable loss between Agilent 8960 and MS of each band.

; the following section is R&S CMU 200 specific
[CMU200 Initialization]
; GPIB address and timeout setting
CMU200 GPIB Address =GPIB0::20::INSTR
Time Out =10000 ; unit: ms
; input cable loss of each GSM band
GSM400 input cable loss = 0.2
GSM850 input cable loss = 0.4
GSM900 input cable loss = 0.5
DCS1800 input cable loss = 0.8
PCS1900 input cable loss = 0.9
; input cable loss of BT
BT input cable loss = 1.5
; output cable loss of each GSM band
GSM400 output cable loss = 0.2
GSM850 output cable loss = 0.4
GSM900 output cable loss = 0.5
DCS1800 output cable loss = 0.8
PCS1900 output cable loss = 0.9
; output cable loss of each BT
BT output cable loss = 1.5

; the following section is R&S CBT specific
[CBT Initialization]
; GPIB address and timeout setting
CBT GPIB Address =GPIB0::20::INSTR
Time Out =10000 ; unit: ms
; input and output cable loss for BT calibration
BT input cable loss = 1.5
BT output cable loss = 1.5

; the following section is LitePoint IQView specific
[IQview Initialization]
; IP address and timeout setting
IQview IP Address = 172.21.110.253
Time Out =5000 ; unit: ms
; cable loss for WiFi 2.4 GHz and 5 GHz
```


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```
2.4G Cable loss = -3
5G Cable loss   = -3

; the following section is  specific
[Agilent N4010A Initialization]
; alias name, USB address, and timeout setting
;VISA Alias Name = UsbDevice1
;VISA Address = USB0::2391::4607::JAGUAR::0::INSTR
VISA Alias Name = TCPIP::172.22.184.182::INSTR
VISA Address = TCPIP::172.22.184.182::INSTR
Time Out = 5000
2.4G Cable loss = -3
5G Cable loss   = -3

; specify bands that are to be calibrated
[Frequency Bank]
bank = 0x1C
; GSM850 0x02
; GSM900 0x04
; DCS1800 0x08
; PCS1900 0x10
; The meaning of “0x1C” is that META will do GSM900, DCS1800 and PCS1900 band auto calibration.

; following section is used during TX PCL and crystal TRX offset calibration
[C0 for each Bank]
arfcn_C0_GSM = 65
arfcn_C0_DCS = 700
arfcn_C0_PCS = 660
arfcn_C0_GSM850 = 190
;Channel number for GSM, DCS and PCS bank.
;Set the calibrated channels for GSM, DCS, PCS and GSM850.

; specify the downlink cell power of RCT
[Downlink power]
P_DL = -60

; following section is used during IP2 calibration
[IP2 table]
; channel of each band
IP2_arfcn_C0_GSM850 = 220
IP2_arfcn_C0_GSM = 100
IP2_arfcn_C0_DCS = 730
IP2_arfcn_C0_PCS = 690
;Skyworks 74045, 74117, 74400 related parameters
IP2_CAL_P_DL_ON_SKY = -30
IP2_CAL_P_DL_OFF_SKY = -120
;MT6139, MT6140 related parameters
IP2_CAL_P_DL_ON_MT = -25
IP2_CAL_P_DL_OFF_MT = -120
IP2_GAIN = 65
IP2_N_PM = 200
```


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```
IP2_M_PM = 4
;Skyworks 74045 related parameters
IP2_ICORRECTION1_SKY74045 = -40
IP2_QCORRECTION1_SKY74045 = -40
IP2_ICORRECTION2_SKY74045 =  40
IP2_QCORRECTION2_SKY74045 =  40
;Skyworks 74117, 74400 related parameters
IP2_ICORRECTION1_SKY74117 = -40
IP2_QCORRECTION1_SKY74117 = -40
IP2_ICORRECTION2_SKY74117 =  40
IP2_QCORRECTION2_SKY74117 =  40
IP2_AMCODEI1 = 64
IP2_AMCODEQ1 = 64
IP2_AMCODEI2 = 191
IP2_AMCODEQ2 = 191
IP2_MAX_IDC_SKY74045 = 50
IP2_MAX_QDC_SKY74045 = 50
IP2_MAX_IDC_SKY74117 = 50
IP2_MAX_QDC_SKY74117 = 50
IP2_MAX_IDC_MT6139 = 50
IP2_MAX_QDC_MT6139 = 50
IP2_CHECK_P_DL_ON = -30
IP2_CHECK_P_DL_OFF = -120

; following section is used during AFC slope calibration
[AFC Calibration]
;Set ARFCN, Band, and measurement counts in AFC calibration
;AFC_BAND: GSM, DCS, PCS, GSM850
AFC_BAND = GSM
AFC_ARFCN = 65
N_AFC = 10
; DAC1 and DAC2 are for VCTCXO solution
DAC1=4000
DAC2=5000
; CRYSTAL_DAC1 and CRYSTAL_DAC2 are for crystal solution
CRYSTAL_DAC1=3800
CRYSTAL_DAC2=4200
; N_AFC is testing frames number of AFC
; DAC1, DAC2, CRYSTAL_DAC1, and CRYSTAL_DAC2 are used when 2 step AFC slope calibration is applied.
For 33 step AFC slope calibration, AFC DAC value is read from calibration data initial file.

; following section is used during AFC slope calibration
[AFC table]
MAX_INIT_AFC_DAC = 65535
MIN_INIT_AFC_DAC = 0
MAX_AFC_SLOPE = 5.000
MIN_AFC_SLOPE = 0.000
; MAX_INIT_AFC_DAC is the maximum limitation of initial AFC DAC value
; MIN_INIT_AFC_DAC is the minimum limitation of initial AFC DAC value
; MAX_AFC_SLOPE is the maximum limitation of AFC slope
; MIN_AFC_SLOPE is the minimum limitation of AFC slope
```


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```
; following section is used during crystal CAP ID and TRX offset calibration
[Crystal AFC Calibration]
;CRYSTAL_AFC_BAND: GSM, DCS, PCS, GSM850
CRYSTAL_AFC_BAND = GSM
CRYSTAL_AFC_ARFCN = 65
; Following PCL of each band is used during crystal TRX offset calibration
CRYSTAL_AFC_GSM850_PCL  = 14
CRYSTAL_AFC_GSM900_PCL  = 14
CRYSTAL_AFC_DCS1800_PCL = 7
CRYSTAL_AFC_PCS1900_PCL = 7
;For AD6548 Adaptive AFC search (Start)
CRYSTAL_AFC_CAL_CAP_ID=31
CRYSTAL_AFC_CAL_DAC_HIGH=8191
CRYSTAL_AFC_CAL_DAC_MID=4096
CRYSTAL_AFC_CAL_DAC_LOW=0
CRYSTAL_AFC_CAL_DYNAMIC_RANGE_FREQ_ERR_PPM= 5
;Adaptive DAC1 = search Dac - CRYSTAL_AFC_CAL_DAC_DIS_DEC
CRYSTAL_AFC_CAL_DAC_DIS_DEC = 200
;Adaptive DAC2 = search Dac + CRYSTAL_AFC_CAL_DAC_DIS_INC
CRYSTAL_AFC_CAL_DAC_DIS_INC = 200
CRYSTAL_AFC_CAL_DAC_RECURSIVE_TIMES = 20
;For AD6548 Adaptive AFC search (End)

; Following parameters are used during crystal CAP ID calibration
;Set AFC DAC for searching CAPID to achieve Min. frequency error.
CRYSTAL_AFC_CAL_DAC = 4096
;Following parameters are used for dynamic range check with calibrated CAPID
CRYSTAL_AFC_CHECK_DAC1 = 0
CRYSTAL_AFC_CHECK_DAC2 = 8191
CRYSTAL_AFC_MIN_FREQ_ERR_PPM = -10.0
CRYSTAL_AFC_MAX_FREQ_ERR_PPM = 10.0
CRYSTAL_CAPID_ACCURACY_MIN_FREQ_ERR_PPM = -2.0
CRYSTAL_CAPID_ACCURACY_MAX_FREQ_ERR_PPM = 2.0
; Following parameters are used during crystal TRX offset calibration
CRYSTAL_AFC_MAX_AFC_TRACK_INIT_FREQ_ERR = 20
CRYSTAL_AFC_FREQ_ERR_MEASUSE_COUNT = 10
CRYSTAL_AFC_RECURSIVE_TIMES = 20
CRYSTAL_AFC_MIN_CAP_ID = 0
CRYSTAL_AFC_MAX_CAP_ID = 63
CRYSTAL_AFC_MIN_TRX_OFFSET =-30
CRYSTAL_AFC_MAX_TRX_OFFSET = 30

; following section is used during RX path loss calibration
[RX measurement samples]
N_PM = 5
M_PM = 4
; refer to section 3.2.1 for the limitation N_PM * M_PM <=2000
; N_PM is testing frames number of RX
; M_PM is samples per frame. Max value is 4.
```


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; following section is used during RX path loss calibration
[RX path loss table]
GSM850_MAX_RX_LOSS = 3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.0000,
GSM850_MIN_RX_LOSS = -3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.0000,
; GSM850_MAX_RX_LOSS is the maximum limitation of GSM850 RX path loss
; GSM850_MIN_RX_LOSS is the minimum limitation of GSM850 RX path loss
GSM850_MAX_RX_LOSS_MIDDLE = 5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.0000,
GSM850_MIN_RX_LOSS_MIDDLE = -5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.0000,
; GSM850_MAX_RX_LOSS_MIDDLE is the maximum limitation of GSM850 RX path loss (middle mode)
; GSM850_MIN_RX_LOSS_MIDDLE is the minimum limitation of GSM850 RX path loss (middle mode)
GSM850_MAX_RX_LOSS_LOW = 5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.0000,
GSM850_MIN_RX_LOSS_LOW = -5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.0000,
; GSM850_MAX_RX_LOSS_LOW is the maximum limitation of GSM850 RX path loss (low mode)
; GSM850_MIN_RX_LOSS_LOW is the minimum limitation of GSM850 RX path loss (low mode)

GSM900_MAX_RX_LOSS = 3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.0000,
GSM900_MIN_RX_LOSS= -3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.0000,
; GSM900_MAX_RX_LOSS is the maximum limitation of GSM900 RX path loss
; GSM900_MIN_RX_LOSS is the minimum limitation of GSM900 RX path loss
GSM900_MAX_RX_LOSS_MIDDLE = 5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.0000,
GSM900_MIN_RX_LOSS_MIDDLE = -5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.0000,
; GSM900_MAX_RX_LOSS_MIDDLE is the maximum limitation of GSM900 RX path loss (middle mode)
; GSM900_MIN_RX_LOSS_MIDDLE is the minimum limitation of GSM900 RX path loss (middle mode)
GSM900_MAX_RX_LOSS_LOW = 5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.0000,
GSM900_MIN_RX_LOSS_LOW = -5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.0000,
; GSM900_MAX_RX_LOSS_LOW is the maximum limitation of GSM900 RX path loss (low mode)
; GSM900_MIN_RX_LOSS_LOW is the minimum limitation of GSM900 RX path loss (low mode)

DCS1800_MAX_RX_LOSS = 3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.0000,
DCS1800_MIN_RX_LOSS=-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.0000,
; DCS1800_MAX_RX_LOSS is the maximum limitation of DCS1800 RX path loss
; DCS1800_MIN_RX_LOSS is the minimum limitation of DCS1800 RX path loss
DCS1800_MAX_RX_LOSS_MIDDLE = 5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.0000,
DCS1800_MIN_RX_LOSS_MIDDLE = -5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.0000,
; DCS1800_MAX_RX_LOSS_MIDDLE is the maximum limitation of DCS1800 RX path loss (middle mode)
; DCS1800_MIN_RX_LOSS_MIDDLE is the minimum limitation of DCS1800 RX path loss (middle mode)
DCS1800_MAX_RX_LOSS_LOW = 5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.0000,
DCS1800_MIN_RX_LOSS_LOW = -5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.0000,
; DCS1800_MAX_RX_LOSS_LOW is the maximum limitation of DCS1800 RX path loss (low mode)
; DCS1800_MIN_RX_LOSS_LOW is the minimum limitation of DCS1800 RX path loss (low mode)

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PCS1900_MAX_RX_LOSS = 3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.000,3.0000,
PCS1900_MIN_RX_LOSS= -3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.000,-3.0000,
; PCS1900_MAX_RX_LOSS is the maximum limitation of PCS1900 RX path loss
; PCS1900_MIN_RX_LOSS is the minimum limitation of PCS1900 RX path loss
PCS1900_MAX_RX_LOSS_MIDDLE = 5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.0000,
PCS1900_MIN_RX_LOSS_MIDDLE = -5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.0000,
; PCS1900_MAX_RX_LOSS_MIDDLE is the maximum limitation of PCS1900 RX path loss (middle mode)
; PCS1900_MIN_RX_LOSS_MIDDLE is the minimum limitation of PCS1900 RX path loss (middle mode)
PCS1900_MAX_RX_LOSS_LOW = 5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.000,5.0000,
PCS1900_MIN_RX_LOSS_LOW = -5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.000,-5.0000,
; PCS1900_MAX_RX_LOSS_LOW is the maximum limitation of PCS1900 RX path loss (low mode)
; PCS1900_MIN_RX_LOSS_LOW is the minimum limitation of PCS1900 RX path loss (low mode)

[IRR W coefficient calibration]
; IRR_W_NEGATIVE_IF_CALIBRATION_BAND=GSM, GSM850, DCS, PCS
IRR_W_NEGATIVE_IF_CALIBRATION_BAND=GSM
IRRW_RETRY_COUNT=73

; The following section is used during TX IQ calibration
[TX IQ table]
; Following parameters are used both for GMSK and EPSK TX IQ calibration
TX_IQ_MEASUREMENT_COUNT = 20
;TX_IQ_BAND: GSM, DCS, PCS, GSM850
TX_IQ_BAND = GSM
TX_IQ_ARFCN = 65
TX_IQ_PCL = 15
;Set the criteria in DC offset and gain imbalance for IQ calibration
TX_IQ_DC_OFFSET_MAX = -38
TX_IQ_GAIN_IMBALANCE_MAX = -35
; The following setting is for MT6140 (i.e. ESPK TX IQ calibration) only
TX_IQ_BAND_HIGH = DCS
TX_IQ_ARFCN_HIGH = 700
TX_IQ_PCL_HIGH = 5
TX_IQ_DC_OFFSET_MAX_HIGH = -38
TX_IQ_GAIN_IMBALANCE_MAX_HIGH = -35

; The following section is used during TX FB DAC calibration for OthelloE
[TX FB DAC table]
;TX_FB_DAC_LOW_BAND, TX_FB_DAC_HIGH_BAND: GSM, DCS, PCS, GSM850
TX_FB_DAC_LOW_BAND = GSM
TX_FB_DAC_LOW_ARFCN = 70
TX_FB_DAC_LOW_TARGET_POWER = 18.1
TX_FB_DAC_HIGH_BAND = DCS
TX_FB_DAC_HIGH_ARFCN = 700
TX_FB_DAC_HIGH_TARGET_POWER = 19.2
;Set APC DAC and the FB DAC slope in TX FB DAC calibration
TX_FB_DAC_APC_DAC = 592
TX_FB_DAC_C = 1.1

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```
; The following section is used during TX PCL calibration
[TX PCL table]
; xxx_CAL_PCL for RFMD 3140, 3159, Skyworks 77340, Renesas PF08155B PA
; xxx_2CAL_PCL for Skyworks 77328, 77316, 77331, 77506 PA
; xxx_6CAL_PCL, xxx_6CAL_DAC for Axiom502 PA
; xxx_EPSK_2CAL_PCL for Skyworks 77316, 77331 PA
; xxx_EPSK_4CAL_PCL for RFMD 3159, Skyworks 77340 PA
; The following parameters are for GMSK APC calibration
; Calibrated PCL of 3 point PCL calibration
GSM850_CAL_PCL = 17, 12, 5,
; Calibrated PCL of 2 point PCL calibration
GSM850_2CAL_PCL = 19, 5,
; Calibrated PCL of 4 point PCL calibration
GSM850_4CAL_PCL = 15,12,10,6,
; Calibrated PCL of 6 point PCL calibration
GSM850_6CAL_PCL = 19,17,15,10,8,6,
; Calibrated PCL of 6 DAC calibration
GSM850_6CAL_DAC = 90,160,223,398,493,549,
; Calibrated PCL of full PCL calibration
GSM850_PCL    = 19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,
; Specify the PCL need to be check when do APC calibration check
GSM850_CHECK_PCL = 19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,
; Specify the max power of each PCL that is used during APC calibration check
GSM850_MAX_P = 6,8,10,12,13.8,15.8,17.8,19.8,21.8,23.8,25.8,27.8,29.5,31,32.8,
; Specify the target power of each PCL
GSM850_WANTED_P = 5.2,7,9,11,13,15,17,19,21,23,25,27,29,30.5,32.2,
; Specify the min power of each PCL that is used during APC calibration check
GSM850_MIN_P = 4,6,8,10,12,14,16,18,20,22,24,26,28.5,30,31.7

; A weighted value is used for TX power level calibration. Please refer to section 4.2.10.
GSM850_C = 5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,
; Adjust calibrated Pout at each PCL, unit is dB
GSM850_CORRECTION = -0.4,0,0.2,0.2,0.2,0.1,0.1,0,-0.1,-0.1,0,0,-0.1,-0.1,0,

; The following parameters are for EPSK APC calibration and has same meaning as same meaning as above parameters
; calibrated PCL for 3-point PCL calibration
GSM850_EPSK_CAL_PCL = 17,12,5,
; calibrated PCL for 1-point PCL calibration
GSM850_EPSK_1CAL_PCL = 5
; calibrated PCL for 2-point PCL calibration
GSM850_EPSK_2CAL_PCL = 19,5,
; calibrated PCL for 4-point PCL calibration
GSM850_EPSK_4CAL_PCL = 15,12,10,6,
; calibrated PCL for full PCL calibration
GSM850_EPSK_PCL    = 19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,
; checked PCL for full PCL check
GSM850_EPSK_CHECK_PCL = 19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,
; the max limit of the calibrated power for each PCL
GSM850_EPSK_MAX_P = 6,8,10,12,13.8,15.8,17.8,19.8,21.8,23.8,25.8,27.8,27.8,27.8,27.8,
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; the target value of the calibrated power for each PCL
GSM850_EPSK_WANTED_P = 5.2,7,9,11,13,15,17,19,21,23,25,26.5,26.5,26.5,26.5,
; the min limit of the calibrated power for each PCL
GSM850_EPSK_MIN_P = 4,6,8,10,12,14,16,18,20,22,24,26,26,26,26,
; the slope of power VS. APC DAC (unit  DAC/dB)
GSM850_EPSK_C = 5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,
; the corection value for FHC 1-point/2-point/3-point/4-point calibration
GSM850_EPSK_CORRECTION = -0.4,0,0.2,0.2,0.2,0.1,0.1,0,-0.1,-0.1,0,0,-0.1,-0.1,0,

GSM900_CAL_PCL = 17, 12, 5,
GSM900_2CAL_PCL = 19, 5,
GSM900_4CAL_PCL = 15,12,10,6,
GSM900_6CAL_PCL = 19,17,15,10,8,6,
GSM900_6CAL_DAC = 90,160,223,398,493,549,
GSM900_PCL    = 19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,
GSM900_CHECK_PCL = 19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,
GSM900_MAX_P = 6, 8, 10,12,13.8,15.8,17.8,19.8,21.8,23.8,25.8,27.8,29.5,31,32.8,
GSM900_WANTED_P = 5.2,7,9,11,13,15,17,19,21,23,25,27,29,30.5,32.2,
GSM900_MIN_P = 4,6,8,10,12,14,16,18,20,22,24,26,28.5,30,31.7
GSM900_C = 5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,
GSM900_CORRECTION = -0.4,-0.2,0,0.2,0.2,0.2,0.2,0,-0.1,-0.2,-0.1,-0.1,-0.1,-0.1,0,

GSM900_EPSK_CAL_PCL = 17, 12, 5,
GSM900_EPSK_1CAL_PCL = 5
GSM900_EPSK_2CAL_PCL = 19, 5,
GSM900_EPSK_4CAL_PCL = 15,12,10,6,
GSM900_EPSK_PCL    = 19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,
GSM900_EPSK_CHECK_PCL = 19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,
GSM900_EPSK_MAX_P = 6, 8, 10,12,13.8,15.8,17.8,19.8,21.8,23.8,25.8,27.8,27.8,27.8,27.8,
GSM900_EPSK_WANTED_P = 5.2,7,9,11,13,15,17,19,21,23,25,26.5,26.5,26.5,26.5,
GSM900_EPSK_MIN_P = 4,6,8,10,12,14,16,18,20,22,24,26,26,26,26,
GSM900_EPSK_C = 1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,
GSM900_EPSK_CORRECTION = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,


DCS1800_CAL_PCL = 13,8,1,
DCS1800_2CAL_PCL = 15,0,
DCS1800_4CAL_PCL = 14,11,9,5,
DCS1800_6CAL_PCL = 13,10,8,5,3,1,
DCS1800_6CAL_DAC = 75,178,250,404,495,548,
DCS1800_PCL    = 15,14,13,12,11,10, 9, 8, 7, 6, 5,4,3,2,1,0,
DCS1800_CHECK_PCL  = 15,14,13,12,11,10, 9, 8, 7, 6, 5,4,3,2,1,0,
DCS1800_MAX_P = 2, 3.5, 5,7,9,11,12.5,14.5,16.5,18.5,20.5,22.5,24.5,26.5,28,31,
DCS1800_WANTED_P = 1.2,2.5,4.3,6.2,8,10,12,14,16,18,20,22,24,26,27.5,29.2,
DCS1800_MIN_P = -0.5,1.5,3.5,5,7,9,11,13,15,17,19,21,23,25,27,28.7,
DCS1800_C = 5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,
DCS1800_CORRECTION = 0.4,0.4,0.2,0,-0.1,0,0,0,0,0,0,0,0,0,0,0.4,

DCS1800_EPSK_CAL_PCL = 13, 8, 1,
DCS1800_EPSK_1CAL_PCL = 0
DCS1800_EPSK_2CAL_PCL = 15, 0,
```


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DCS1800_EPSK_4CAL_PCL = 14,11,9,5,
DCS1800_EPSK_PCL = 15,14,13,12,11,10, 9, 8, 7, 6, 5,4,3,2,1,0,
DCS1800_EPSK_CHECK_PCL = 15,14,13,12,11,10, 9, 8, 7, 6, 5,4,3,2,1,0,
DCS1800_EPSK_MAX_P = 2, 3.5, 5,7,9,11,13,15,17,19,21,23,25,27,27,27,
DCS1800_EPSK_WANTED_P = 1.2,2.5,4.3,6.2,8,10,12,14,16,18,20,22,24,26,26,26,
DCS1800_EPSK_MIN_P = -0.5,1.5,3.5,5,7,9,11,13,15,17,19,21,23.5,25.5,25.5,25.5,
DCS1800_EPSK_C = 5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,
DCS1800_EPSK_CORRECTION = 0.4,0.4,0.2,0,-0.1,0,0,0,0,0,0,0,0,0,0,0.4,

PCS1900_CAL_PCL = 13, 8, 1,
PCS1900_2CAL_PCL = 15, 0,
PCS1900_4CAL_PCL = 14,11,9,5,
PCS1900_6CAL_PCL = 13,10,8,5,3,1,
PCS1900_6CAL_DAC = 75,178,250,404,495,548,
PCS1900_PCL = 15,14,13,12,11,10, 9, 8, 7, 6, 5,4,3,2,1,0,
PCS1900_CHECK_PCL = 15,14,13,12,11,10, 9, 8, 7, 6, 5,4,3,2,1,0,
PCS1900_MAX_P = 2, 3.5, 5,7,9,11,12.5,14.5,16.5,18.5,20.5,22.5,24.5,26.5,28,30,
PCS1900_WANTED_P = 1.2,2.5,4.3,6.2,8,10,12,14,16,18,20,22,24,26,27.5,29.0,
PCS1900_MIN_P = -0.5,1.5,3.5,5,7,9,11,13,15,17,19,21,23,25,26.7,28.5,
PCS1900_C = 5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,
PCS1900_CORRECTION = 0.4,0.2,0.2,0,-0.1,0,0,0,-0.1,-0.1,-0.2,-0.2,-0.2,-0.1,0,0.4,

PCS1900_EPSK_CAL_PCL = 13, 8, 1,
PCS1900_EPSK_1CAL_PCL = 0
PCS1900_EPSK_2CAL_PCL = 15, 0,
PCS1900_EPSK_4CAL_PCL = 14,11,9,5,
PCS1900_EPSK_PCL = 15,14,13,12,11,10, 9, 8, 7, 6, 5,4,3,2,1,0,
PCS1900_EPSK_CHECK_PCL = 15,14,13,12,11,10, 9, 8, 7, 6, 5,4,3,2,1,0,
PCS1900_EPSK_MAX_P = 2, 3.5, 5,7,9,11,12.5,14.5,16.5,18.5,20.5,22.5,25,27,27,27,
PCS1900_EPSK_WANTED_P = 1.2,2.5,4.3,6.2,8,10,12,14,16,18,20,22,24,25.5,25.5,25.5,
PCS1900_EPSK_MIN_P = -0.5,1.5,3.5,5,7,9,11.5,13.5,15.5,17.5,19.5,21.5,23.5,25,25,25,
PCS1900_EPSK_C = 1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,
PCS1900_EPSK_CORRECTION = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,

TSC = 5
;the maximum iterations to calibrate one power control level
Recursive Times = 5
APC Delta = 0.1 ; if power level is in the range of (wanted power level – APC delta, wanted power level + APC delta), jump to calibrate next power level
; TSC is the cell TSC value in Agilent 8960
; WANTED_P is wanted power in dBm for corresponding PCL
; MAX_P is MAX limitation power in dBm for corresponding PCL
; MIN_P is MIN limitation power in dBm for corresponding PCL
; C is a weighted value used for TX power level calibration. Please refer to section 4.2.10.
; MAX_P, WANTED_P, MIN_P and C can be integer or floating point.

; The following parameters are used for fast handset calibration (FHC) only
; Upper and lower limit of APC DAC
MIN_GMSK_GSM850_APC_DAC = 100
MIN_GMSK_GSM900_APC_DAC = 100
MIN_GMSK_DCS1800_APC_DAC = 100

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MIN_GMSK_PCS1900_APC_DAC = 100
MAX_GMSK_GSM850_APC_DAC = 900
MAX_GMSK_GSM900_APC_DAC = 900
MAX_GMSK_DCS1800_APC_DAC = 770
MAX_GMSK_PCS1900_APC_DAC = 770
MIN_EPSK_GSM850_APC_DAC = 300
MIN_EPSK_GSM900_APC_DAC = 300
MIN_EPSK_DCS1800_APC_DAC = 300
MIN_EPSK_PCS1900_APC_DAC = 300
MAX_EPSK_GSM850_APC_DAC = 630
MAX_EPSK_GSM900_APC_DAC = 630
MAX_EPSK_DCS1800_APC_DAC = 630
MAX_EPSK_PCS1900_APC_DAC = 630
; Measurement samples
; The more samples, the more accurate in fitting curve for ourput power versus APC DAC
FHC_UTS_GMSK_GSM850_MEASURE_SAMPLES = 44
FHC_UTS_GMSK_GSM900_MEASURE_SAMPLES = 44
FHC_UTS_GMSK_DCS1800_MEASURE_SAMPLES = 44
FHC_UTS_GMSK_PCS1900_MEASURE_SAMPLES = 44
FHC_UTS_EPSK_GSM850_MEASURE_SAMPLES = 44
FHC_UTS_EPSK_GSM900_MEASURE_SAMPLES = 44
FHC_UTS_EPSK_DCS1800_MEASURE_SAMPLES = 44
FHC_UTS_EPSK_PCS1900_MEASURE_SAMPLES = 44

; for FHC TX sub-band calibration
; FHC TX sub-band check procedure on/off
FHC_UTS_TX_SUBBAND_FLATNESS_CALBRATE=1
; calibrated the subband on the max arfcn
TX_SUBBAND_CALIBRATED_ON_MAX_ARFCN=1

; for TX Sub-band calibration (both traditional / FHC)
GSM850_SUBBAND_FLATNESS_RANGE=0.3
GSM900_SUBBAND_FLATNESS_RANGE=0.3
DCS1800_SUBBAND_FLATNESS_RANGE=0.3
PCS1900_SUBBAND_FLATNESS_RANGE=0.3

; for TX sub-band calibration (FHC)
; the sample APC DAC range that could cover the power drift
FHC_MAX_PCL_DAC_DELTA_RANGE=100
; number of samples for the TX sub-band fitting curve
FHC_MAX_PCL_DAC_DELTA_SAMPLE=4
; for Skyworks PA pedestal calibration
SKY77328_DAC_Delta=10
SKY77328_GSM850_M  = 16.8
SKY77328_GSM850_TARGET_PCL  = 19
; the max output power for the high APC DC offset calibration
SKY77328_GSM850_MAX_HIGH_APC_DC_OFFSET_P = -3.5
; the wanted output power for the high APC DC offset calibration
SKY77328_GSM850_WANTED_HIGH_APC_DC_OFFSET_P  = -4
; the min output power for the high APC DC offset calibration
SKY77328_GSM850_MIN_HIGH_APC_DC_OFFSET_P = -4.5
```


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; the max output power for the low APC DC offset calibration
SKY77328_GSM850_MAX_LOW_APC_DC_OFFSET_P = -3.5
; the wanted output power for the low APC DC offset calibration
SKY77328_GSM850_WANTED_LOW_APC_DC_OFFSET_P = -4
; the min output power for the low APC DC offset calibration
SKY77328_GSM850_MIN_LOW_APC_DC_OFFSET_P = -4.5

SKY77328_GSM900_M = 16.8
SKY77328_GSM900_TARGET_PCL = 19
SKY77328_GSM900_MAX_HIGH_APC_DC_OFFSET_P = -3.5
SKY77328_GSM900_WANTED_HIGH_APC_DC_OFFSET_P = -4
SKY77328_GSM900_MIN_HIGH_APC_DC_OFFSET_P = -4.5
SKY77328_GSM900_MAX_LOW_APC_DC_OFFSET_P = -3.5
SKY77328_GSM900_WANTED_LOW_APC_DC_OFFSET_P = -4
SKY77328_GSM900_MIN_LOW_APC_DC_OFFSET_P = -4.5

SKY77328_DCS1800_M = 17.78
SKY77328_DCS1800_TARGET_PCL = 15
SKY77328_DCS1800_MAX_HIGH_APC_DC_OFFSET_P = -3.5
SKY77328_DCS1800_WANTED_HIGH_APC_DC_OFFSET_P = -4
SKY77328_DCS1800_MIN_HIGH_APC_DC_OFFSET_P = -4.5
SKY77328_DCS1800_MAX_LOW_APC_DC_OFFSET_P = -3.5
SKY77328_DCS1800_WANTED_LOW_APC_DC_OFFSET_P = -4
SKY77328_DCS1800_MIN_LOW_APC_DC_OFFSET_P = -4.5

SKY77328_PCS1900_M = 17.78
SKY77328_PCS1900_TARGET_PCL = 15
SKY77328_PCS1900_MAX_HIGH_APC_DC_OFFSET_P = -3.5
SKY77328_PCS1900_WANTED_HIGH_APC_DC_OFFSET_P = -4
SKY77328_PCS1900_MIN_HIGH_APC_DC_OFFSET_P =-4.5
SKY77328_PCS1900_MAX_LOW_APC_DC_OFFSET_P = -3.5
SKY77328_PCS1900_WANTED_LOW_APC_DC_OFFSET_P = -4
SKY77328_PCS1900_MIN_LOW_APC_DC_OFFSET_P = -4.5

; the temperature used for closed-loop power control calibration
TXPC_CAL_TEMP=25
; the Maximum acceptable APC DAC if the closed-loop power control is turned on (GMSK)
TXPC_GMSK_MAX_APC_DAC=900
; the Minimum acceptable APC DAC if the closed-loop power control is turned on (GMSK)
TXPC_GMSK_MIN_APC_DAC=30
; the Maximum acceptable APC DAC if the closed-loop power control is turned on (EPSK)
TXPC_EPSK_MAX_APC_DAC=950
; the Minimum acceptable APC DAC if the closed-loop power control is turned on (EPSK)
TXPC_EPSK_MIN_APC_DAC=30
; the maximum acceptable subband compensation (dB) if the closed-loop power control is turned on
TXPC_MAX_SUBBAND_COMP=10.0
; the minimum acceptable subband compensation (dB) if the closed-loop power control is turned on
TXPC_MIN_SUBBAND_COMP=-10.0

; The following section is used during TX PCL calibration for OthelloE
[TX slope skew table]

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TX_SLOPE_SKEW_TARGET_POWER_GSM850 = 14.2
TX_SLOPE_SKEW_TARGET_POWER_GSM900 = 14.2
TX_SLOPE_SKEW_TARGET_POWER_DCS1800 = 14.2
TX_SLOPE_SKEW_TARGET_POWER_PCS1900 = 13.8
TX_SLOPE_SKEW_MAX_POWER_DIFF = 1.5

; The following section is used during ADC calibration
[ADC table]
ADC_V1 = 3400
ADC_V2 = 4200
ADC_CHECK_VOLTAGE = 3600
NORMAL_VOLTAGE = 3800
MAX_BATTERY_ADC_SLOPE = 5300.0
MIN_BATTERY_ADC_SLOPE = 5100.0
MAX_BATTERY_ADC_OFFSET = 100000000
MIN_BATTERY_ADC_OFFSET = 0
BATTERY_CHANNEL = 0
CHARGER_CHANNEL = 3
ADC_RESISTANCE = 0.33
MAX_VOLTAGE_DIFFERENCE = 0.04
MAX_CURRENT_DIFFERENCE = 0.02
ADC_MEASUREMENT_COUNT = 1000
; ADC_V1 is the voltage of ADC calibration point 1, unit = mV
; ADC_V2 is the voltage of ADC calibration point 2, unit = mV
; ADC_CHECK_VOLTAGE is the voltage of ADC calibration voltage check, unit = mV
; NORMAL_VOLTAGE is the voltage of power supply after calibration finish, unit = mV
; MAX_BATTERY_ADC_SLOPE is the maximum limitation of battery ADC slope
; MIN_BATTERY_ADC_SLOPE is the minimum limitation of battery ADC slope
; MAX_BATTERY_ADC_OFFSET is the maximum limitation of battery ADC offset
; MIN_BATTERY_ADC_OFFSET is the minimum limitation of battery ADC offset
; BATTERY_CHANNEL is the first channel to do ADC calibration
; CHARGER_CHANNEL is the second channel to do ADC calibration
; ADC_RESISTANCE is the resistance when do ADC current limitation check
; MAX_VOLTAGE_DIFFERENCE is the maximum voltage difference between voltage of power supply and estimated voltage, unit = V
; MAX_CURRENT_DIFFERENCE is the maximum current difference, unit = A
; ADC_MEASUREMENT_COUNT is the ADC measurement count

; The following section is used during CV calibration. CV calibration is only needed for those baseband chips that integrated with PMIC chip such as MT6223.
[CV table]
MIN_CV_STEP = 11
MAX_CV_STEP = 17

; The following section is used during WiFi TX power calibration.
[WiFi common]
WiFi_Support = 0x06
; 802.11a 0x01
; 802.11b 0x02
; 802.11g 0x04

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```
; The following section is used during WiFi TX power calibration.
[WiFi TX power table]
; unit of xxx_MAX_P: dBm
; unit of xxx_WANTED_P: dBm
; unit of xxx_MIN_P: dBm
; unit of xxx_CHANNEL: MHz
; unit of xxx_RATE: MHz

CCK_MAX_P = 15.0
CCK_WANTED_P = 14.0
CCK_MIN_P = 13.0
CCK_C = 3
CCK_Delta = 0.5
802.11B_CAL_CHANNEL = 2412,2447,2484,
802.11B_CHECK_CHANNEL = 2412,2417,2422,2427,2432,2437,2442,2447,2452,2457,2462,2467,2472,2484,
CCK_CAL_RATE = 1
CCK_CHECK_RATE = 1


OFDM_MAX_P = 12.0
OFDM_WANTED_P = 11.0
OFDM_MIN_P = 10.0
OFDM_C = 3
OFDM_Delta = 0.5
802.11G_CAL_CHANNEL = 2412,2447,2484,
802.11G_CHECK_CHANNEL = 2412,2417,2422,2427,2432,2437,2442,2447,2452,2457,2462,2467,2472,2484,
OFDM_CAL_RATE = 54
OFDM_CHECK_RATE = 54
Recursive Times=10

; The following section is used during WIFI Crystal CAP ID calibration
[WiFi Crystal CAP ID]
WiFi_MAX_CAP_ID = 127
WiFi_MIN_CAP_ID = 0
WiFi_Center_Freq_MHz = 2412
WiFi_Min_Freq_Error_PPM = 5
WiFi_TX_RATE = 54.0
WiFi_TX_GAIN = 60
WiFi_RECURSIVE_TIMES = 20

; The following section is used during BT crystal CAP ID calibration.
[BT common]
BT_DOWNLINK_POWER = -70
BD Address = 692d47dc6601
Inquiry enable = yes

; The following section is used during BT crystal CAP ID calibration.
[BT crystal CAP ID table]
; Configure parameters for calibration with BT tester, MT6601 and MT6611 support calibration without BT tester
; Unit of BT_CRYSTAL_FREQ_ACCURACY: kHz
BT_CRYSTAL_CAP_ID1 = 1
```


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BT_CRYSTAL_CAP_ID2 = 127
BT_CRYSTAL_CHANNEL = 39
BT_CRYSTAL_MAX_FREQ_ACCURACY = 25
; configure parameters for calibration without BT tester, only MT6611 supports calibration without BT tester
MIN_POLL_COUNT = 399999
WANTED_POLL_COUNT = 400000
MAX_POLL_COUNT = 400001

; The following section is used during NSFT
[NSFT Common]
; GSM450 0x01
; GSM850 0x02
; GSM900 0x04
; DCS1800 0x08
; PCS1900 0x10
NSFT_bank = 0x1E
TSC = 5
; BCH ARFCN by Band (should be different from the TCH)
BCH_ARFCN_GSM850 = 190
BCH_ARFCN_GSM900 = 65
BCH_ARFCN_DCS1800 = 670
BCH_ARFCN_PCS1900 = 660
; Test TCH ARFCN by Band
; the test channel list in GSM850 in this example there 2 test channels
TCH_ARFCN_GSM850 = 170, 251
TCH_ARFCN_GSM900 = 40, 80,
TCH_ARFCN_DCS1800 = 700, 885,
TCH_ARFCN_PCS1900 = 700, 810,
; Muti-measurment count
MEASUREMENT_COUNT = 5
; Used time slot
E_TCH_TIMESLOT = 3

[NSFT GMSK TX]
BCH_CELL_POWER = -85
TCH_CELL_POWER = -85
; Test pcl by band by channel
; the following entry specifies the number of test channels in GSM850 (in the example is 2 should be the same for all bands)
TEST_GSM850_CHANNEL_NUM = 2
; the following entry specifies the PCL of the test channels in this example PCL 5 and 19 will be tested on channel 170 and channel 251
PCL_IN_GSM850_ARFCN_1 = 5, 19
TEST_GSM900_CHANNEL_NUM = 2
PCL_IN_GSM900_ARFCN_1 = 5, 19
TEST_DCS1800_CHANNEL_NUM = 2
PCL_IN_DCS1800_ARFCN_1 = 0, 15
TEST_PCS1900_CHANNEL_NUM = 2
PCL_IN_PCS1900_ARFCN_1 = 0, 15
; the following entries specifies the TXP measurement will be done or not for the PCL 1: yes 0: no in this example the PCL 5, of GSM850 will be done, PCL 19 will be skipped, DCS1800 PCL0 will be done, PCL 15 will be skipped

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GMSK_TX_TXP_Enabled=1, 0
; the following entries specifies the PVT measurement will be done or not for the PCL. 1: yes 0: no

GMSK_TX_PVT_Enabled=1, 1
; the following entries specifies the PFER measurement will be done or not for the PCL. 1: yes 0: no
GMSK_TX_PFER_Enabled=1, 0
; the following entries specifies the ORFS measurement will be done or not for the PCL. 1: yes 0: no
GMSK_TX_ORFS_Enabled=1, 0

[NSFT BER]
BCH_CELL_POWER = -85
TCH_CELL_POWER = -106
E_TCH_MS_TX_LEVEL = 5
E_NUM_OF_BITS_TO_TEST = 10000
; Note: if no SBER or LBBER is specified, the default setting uses LBBER (loop-back BER)
; if both is turned on, LBBER is used for limit check (SBER only serves as an indicator to SNR)
; if the target software does not support SBER, the configurations will be ignored and use LBBER
SBER=0; indicates the BER is fetched from single-end BER (supported since 10AW1032MP)
LBBER=1; indicates the BER is fetched from loop-back BER (supported since 10AW1032MP)

[NSFT EPSK TX]
; Coding scheme in EPSK MCS5 = 5, MCS6 = 6, MCS7 = 7
MCS = 5
BCH_CELL_POWER = -85
TCH_CELL_POWER = -85
TEST_GSM850_CHANNEL_NUM = 1
PCL_IN_GSM850_ARFCN_1 = 5, 19
TEST_GSM900_CHANNEL_NUM = 1
PCL_IN_GSM900_ARFCN_1 = 5, 19
TEST_DCS1800_CHANNEL_NUM = 1
PCL_IN_DCS1800_ARFCN_1 = 0, 15
TEST_PCS1900_CHANNEL_NUM = 1
PCL_IN_PCS1900_ARFCN_1 = 0, 15
EPSK_TX_TXP_Enabled=1, 0
EPSK_TX_PVT_Enabled=1, 1
EPSK_TX_EMA_Enabled=1, 0
EPSK_TX_ORFS_Enabled=1, 0

[NSFT CHECK]
; GMSK Power Min/Max Critira
GSM850_MAX_P = 6.0,8.0,10.0,12.0,15.5,16.0,18.0,20.0,22.0,25.0,26.0,28.0,30.0,31.5,34.2,
GSM850_MIN_P = 4.0,6.0,8.0,10.0,12.0,14.0,16.0,18.0,20.0,22.0,24.0,26.0,28.0,29.5,31.2,
GSM900_MAX_P = 6.0,8.0,10.0,12.0,15.5,16.0,18.0,20.0,22.0,25.0,26.0,28.0,30.0,31.5,34.2,
GSM900_MIN_P = 4.0,6.0,8.0,10.0,12.0,14.0,16.0,18.0,20.0,22.0,24.0,26.0,28.0,29.5,31.2,
DCS1800_MAX_P = 2.0,3.5,5.3,7.2,9.0,12.0,13.0,15.0,17.0,19.0,21.0,23.0,25.0,27.5,28.5,31.2,
DCS1800_MIN_P = -0.5,1.5,3.3,5.2,7.0,8.0,11.0,13.0,15.0,15.0,15.0,15.0,15.0,15.0,15.0,15.0,
PCS1900_MAX_P = 0.5,2.5,4.5,6.5,8.5,10.5,13.0,14.5,16.5,18.5,20.5,22.5,24.5,26.5,28.5,31.0,
PCS1900_MIN_P = -0.5,1.5,3.5,5.5,7.5,9.5,11.5,13.5,15.5,17.5,19.5,21.5,23.0,23.0,26.5,26.0,
; EPSK Power Min/Max Critria

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```
GSM850_EPSK_MAX_P = 5.5,7.5,9.5,11.5,13.5,15.5,17.5,19.5,21.5,23.5,25.5,28.5,28.5,28.5,28.5,
GSM850_EPSK_MIN_P = 4.5,6.5,8.5,10.5,12.5,14.5,16.5,18.5,20.5,22.5,24.5,26.3,26.3,26.3,26.3,
GSM900_EPSK_MAX_P = 6.5,7.5,9.5,11.5,13.5,15.5,17.5,19.5,21.5,23.5,25.5,28.5,28.5,28.5,28.5,
GSM900_EPSK_MIN_P = 4.5,6.5,8.5,10.5,12.0,14.5,16.5,18.5,20.5,22.5,24.5,25.0,25.0,25.0,25.0,
DCS1800_EPSK_MAX_P = 0.8,2.5,4.5,6.5,8.5,10.5,12.5,14.5,16.5,18.5,20.5,22.5,24.5,28.0,28.0,28.0,
DCS1800_EPSK_MIN_P = -0.8,1.5,3.5,5.0,7.0,9.0,11.0,13.5,15.5,17.5,19.5,21.5,22.5,25.0,25.0,25.0,
PCS1900_EPSK_MAX_P = 1.2,2.5,4.5,6.5,8.5,10.5,12.5,14.5,16.5,18.5,20.5,22.5,24.5,28.0,28.0,28.0,
PCS1900_EPSK_MIN_P = -1.2,1.5,3.5,5.0,7.0,9.0,11.5,13.5,15.5,17.5,19.5,21.5,23.5,24.0,24.0,24.0,
; Frequency and Phase Error Max Critiria for GMSK
GSM850_Freq_Error_Limit = 85
GSM850_Phase_Error_Peak_Limit = 20
GSM850_Phase_Error_RMS_Limit = 5
;--------------------------------
GSM900_Freq_Error_Limit = 90
GSM900_Phase_Error_Peak_Limit = 20
GSM900_Phase_Error_RMS_Limit = 5
;--------------------------------
DCS1800_Freq_Error_Limit = 180
DCS1800_Phase_Error_Peak_Limit = 20
DCS1800_Phase_Error_RMS_Limit = 5
;--------------------------------
PCS1900_Freq_Error_Limit = 190
PCS1800_Phase_Error_Peak_Limit = 20
PCS1900_Phase_Error_RMS_Limit = 5
; Modulation Accuracy Measurement Max Critiria for EPSK
GSM850_EPSK_95P_EVM = 15
GSM850_EPSK_95P_MAGERR = 10
GSM850_EPSK_95P_PHERR = 10
GSM850_EPSK_EVM_PK = 30
GSM850_EPSK_EVM_RMS = 9
GSM850_EPSK_MAGERR_PK = 17.7
GSM850_EPSK_MAGERR_RMS = 12.5
GSM850_EPSK_PHERR_PK = 200
GSM850_EPSK_PHERR_RMS = 5
GSM850_EPSK_ORIG_OFFSET = -30.0
;--------------------------------
GSM900_EPSK_95P_EVM = 15
GSM900_EPSK_95P_MAGERR = 10
GSM900_EPSK_95P_PHERR = 10
GSM900_EPSK_EVM_PK = 30
GSM900_EPSK_EVM_RMS = 9
GSM900_EPSK_MAGERR_PK = 17.7
GSM900_EPSK_MAGERR_RMS = 12.5
GSM900_EPSK_PHERR_PK = 200
GSM900_EPSK_PHERR_RMS = 5
GSM900_EPSK_ORIG_OFFSET = -30.0
;--------------------------------
DCS1800_EPSK_95P_EVM = 15
DCS1800_EPSK_95P_MAGERR = 10
DCS1800_EPSK_95P_PHERR = 10
DCS1800_EPSK_EVM_PK = 30
```


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```
DCS1800_EPSK_EVM_RMS = 9
DCS1800_EPSK_MAGERR_PK = 17.7
DCS1800_EPSK_MAGERR_RMS = 12.5
DCS1800_EPSK_PHERR_PK = 200
DCS1800_EPSK_PHERR_RMS = 5
DCS1800_EPSK_ORIG_OFFSET = -30.0
;--------------------------------
PCS1900_EPSK_95P_EVM = 15
PCS1900_EPSK_95P_MAGERR = 10
PCS1900_EPSK_95P_PHERR = 10
PCS1900_EPSK_EVM_PK = 30
PCS1900_EPSK_EVM_RMS = 9
PCS1900_EPSK_MAGERR_PK = 17.7
PCS1900_EPSK_MAGERR_RMS = 12.5
PCS1900_EPSK_PHERR_PK = 200
PCS1900_EPSK_PHERR_RMS = 5
PCS1900_EPSK_ORIG_OFFSET = -30.0
; Modulation Spectrum Enable
; Set the mearuement offset frequency in ORFS Modulation Spectrum
;(-100,100,-200,200,-250,250,-400,400,-600,600,-800,800,-1000,1000,-1200,1200,-1400,1400,-1600,1600,-
1800,1800)
;ORFS_MOD_ENABLE = 1,0,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
ORFS_MOD_ENABLE = 1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,
;Set the mearuement offset frequency in ORFS Switching Spectrum Enable
; Switching Spectrum Enable
;(-400,400,-600,600,-1200,1200,-1800,1800)
;ORFS_SW_ENABLE = 1,0,0,1,0,0,0,0,
ORFS_SW_ENABLE = 1,1,1,1,1,1,1,1,
; GMSK Modulation Spectrum Min/Max Critiria (kHZ)
;                                                    (-1800,-1600,-1400,-1200,-1000,-800,-600,-400,-250,-200,-
100,100,200,250,400,600,800,1000,1200,1400,1600,1800)
GSM850_ORFS_MOD    =    0.5,0.5,-30.0,-30.0,-33.0,-33.0,-55.0,-55.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-
60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,
GSM900_ORFS_MOD    =    0.5,0.5,-30.0,-30.0,-33.0,-33.0,-55.0,-55.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-
60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,
DCS1800_ORFS_MOD    =    0.5,0.5,-30.0,-30.0,-33.0,-33.0,-50.0,-50.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-
60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,
PCS1900_ORFS_MOD    =    0.5,0.5,-30.0,-30.0,-33.0,-33.0,-55.0,-55.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-
60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,
; GMSK Switching Spectrum Min/Max Critiria (kHZ)
; (-1800,-1200,-600,-400,400,600,1200,1800)
GSM850_ORFS_SW = -19.0,-19.0,-21.0,-21.0,-21.0,-21.0,-24.0,-24.0,
GSM900_ORFS_SW = -19.0,-19.0,-21.0,-21.0,-21.0,-21.0,-24.0,-24.0,
DCS1800_ORFS_SW = -15.0,-15.0,-21.0,-21.0,-21.0,-21.0,-24.0,-24.0,
PCS1900_ORFS_SW = -19.0,-19.0,-21.0,-21.0,-21.0,-21.0,-24.0,-24.0,
; EPSK Modulation Spectrum Min/Max Critria (kHZ)
;                                                    (-1800,-1600,-1400,-1200,-1000,-800,-600,-400,-250,-200,-
100,100,200,250,400,600,800,1000,1200,1400,1600,1800)
EPSK_GSM850_ORFS_MOD    =    0.5,0.5,-30.0,-30.0,-33.0,-33.0,-55.0,-55.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-
60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,
```


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EPSK_GSM900_ORFS_MOD = 0.5,0.5,-30.0,-30.0,-33.0,-33.0,-55.0,-55.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,
EPSK_DCS1800_ORFS_MOD = 0.5,0.5,-30.0,-30.0,-33.0,-33.0,-55.0,-55.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,
EPSK_PCS1900_ORFS_MOD = 0.5,0.5,-30.0,-30.0,-33.0,-33.0,-55.0,-55.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,-60.0,
; EPSK Switching Spectrum Min/Max Critiria (kHZ)
; (-1800,-1200,-600,-400,400,600,1200,1800)
EPSK_GSM850_ORFS_SW = -19.0,-19.0,-21.0,-21.0,-21.0,-21.0,-24.0,-24.0,
EPSK_GSM900_ORFS_SW = -19.0,-19.0,-21.0,-21.0,-21.0,-21.0,-24.0,-24.0,
EPSK_DCS1800_ORFS_SW = -19.0,-19.0,-21.0,-21.0,-21.0,-21.0,-24.0,-24.0,
EPSK_PCS1900_ORFS_SW = -19.0,-19.0,-21.0,-21.0,-21.0,-21.0,-24.0,-24.0,
;BER Ratio Max Critiria(%)
BER_RATIO_MAX = 2.0

4.1.1.1 CFG file editor

Users can choose the kind of CFG parameter that he wants to edit on the META factory window. There are 6 kinds of CFG parameters, including common, TCVCXO AFC, crystal AFC, RX path loss, TX PCL and ADC CFG parameters.

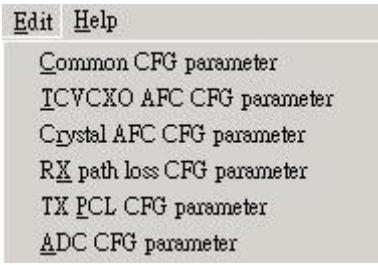

Figure 501 ***Choose Edit then select which CFG parameter to edit***

4.1.1.1.a Common CFG parameters

Users can click [Common CFG parameter] to show the Common CFG parameter window. Users can click [Load from CFG file] button to read the common CFG parameters from the CFG file and click [Save to CFG file] to save the common CFG parameters to the CFG file.

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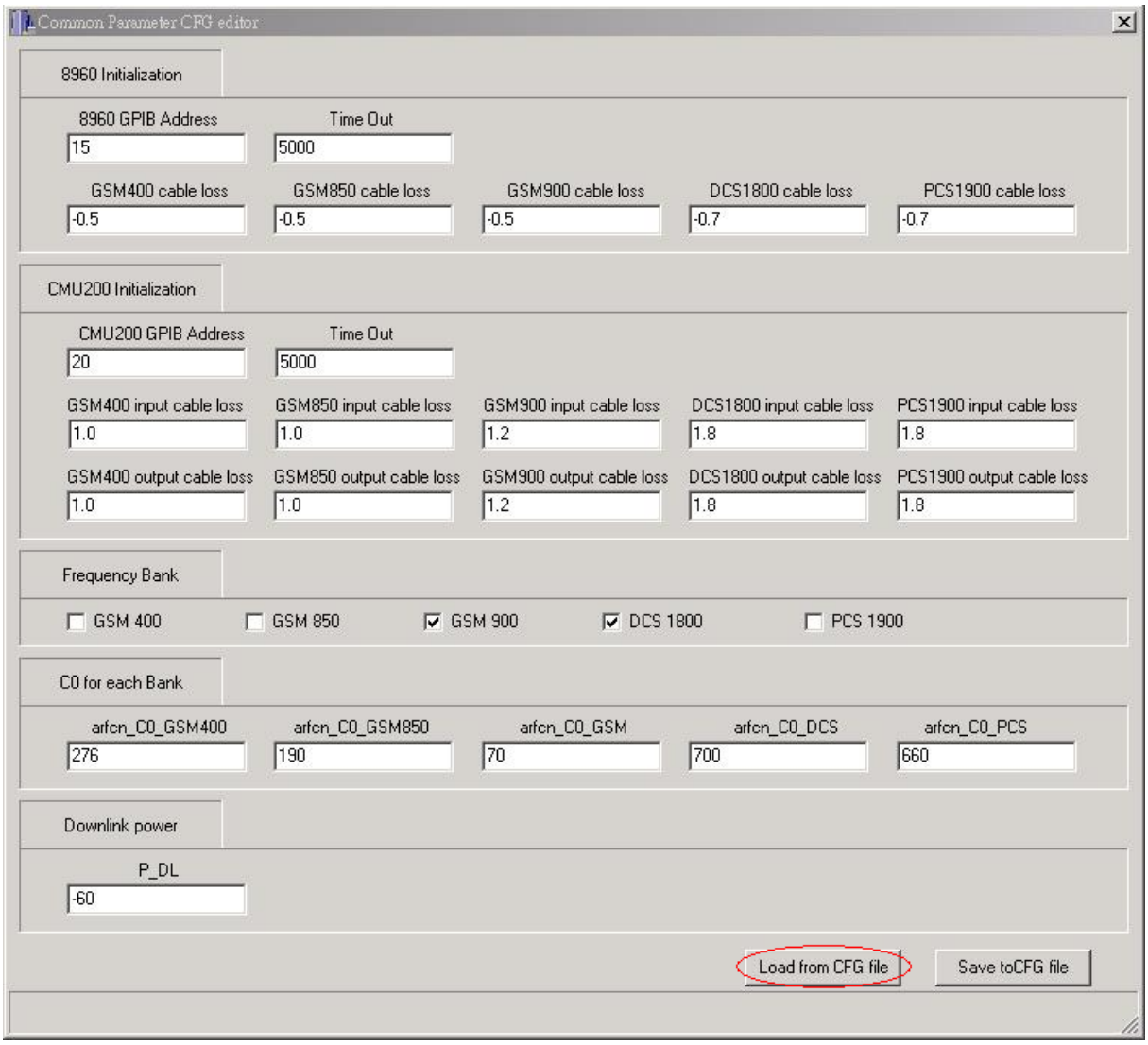

Figure 502 ***Click [Load from CFG file] button to read common CFG parameters from CFG file***

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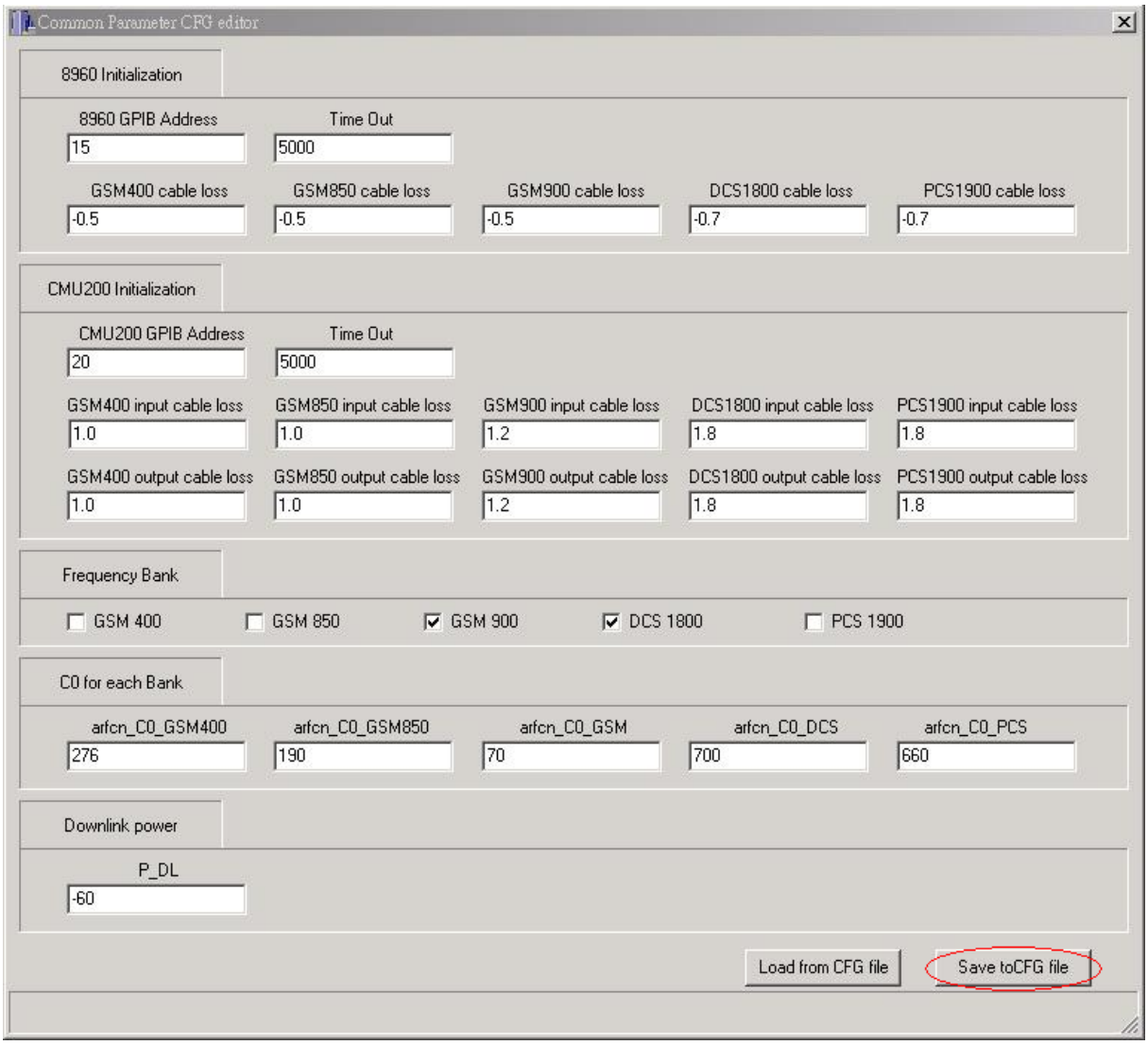

Figure 503 ***Click [Save to CFG file] to save common CFG parameters to CFG file***

4.1.1.1.b TCVCXO AFC CFG parameters

Users can click [TCVCXO AFC CFG parameter] to show the TCVCXO AFC CFG parameter window. Users can click [Load from CFG file] button to read TCVCXO AFC CFG parameters from the CFG file and click [Save to CFG file] to save TCVCXO AFC CFG parameters to the CFG file.

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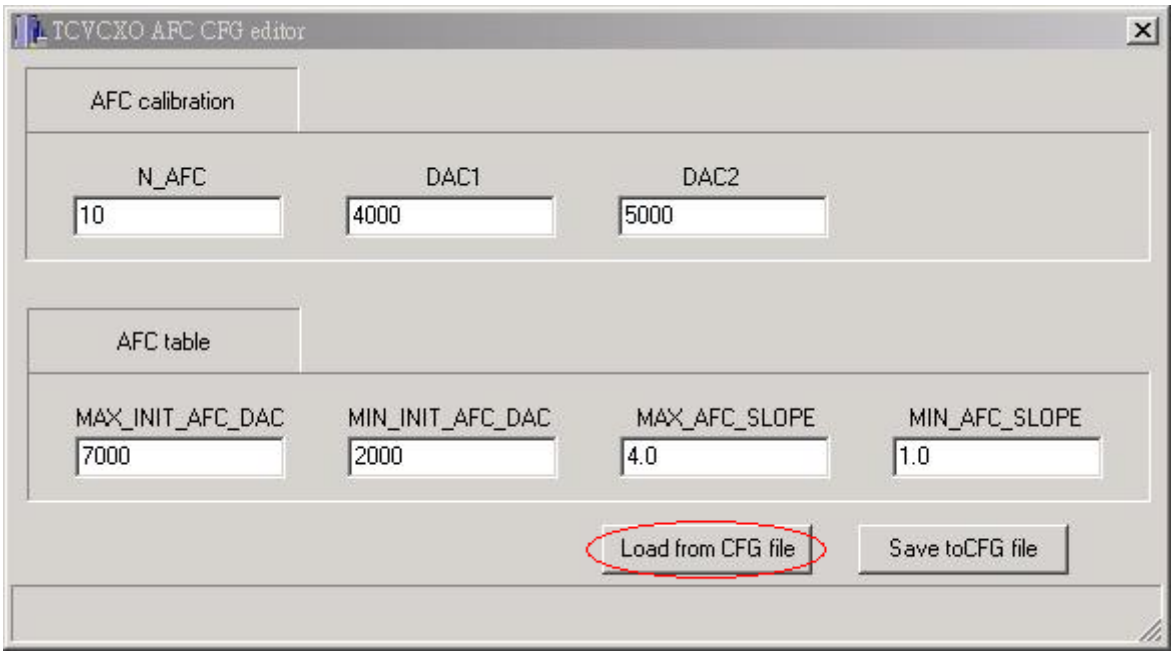

Figure 504 ***Click [Load from CFG file] button to read TCVCXO AFC CFG parameters from CFG file***

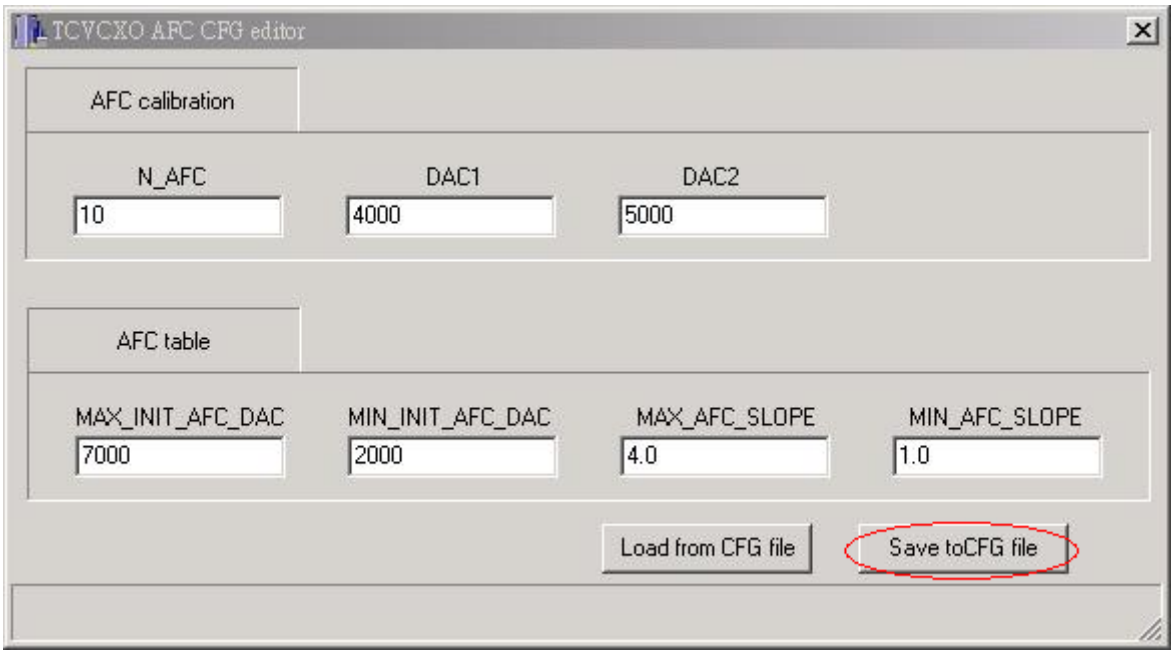

Figure 505 ***Click [Save to CFG file] to save TCVCXO AFC CFG parameters to CFG file***

4.1.1.1.c Crystal AFC CFG parameters

Users can click [Crystal AFC CFG parameter] to show the crystal AFC CFG parameter window. Users can click [Load from CFG file] button to read crystal AFC CFG parameters from the CFG file and click [Save to CFG file] to save the crystal AFC CFG parameters to the CFG file.

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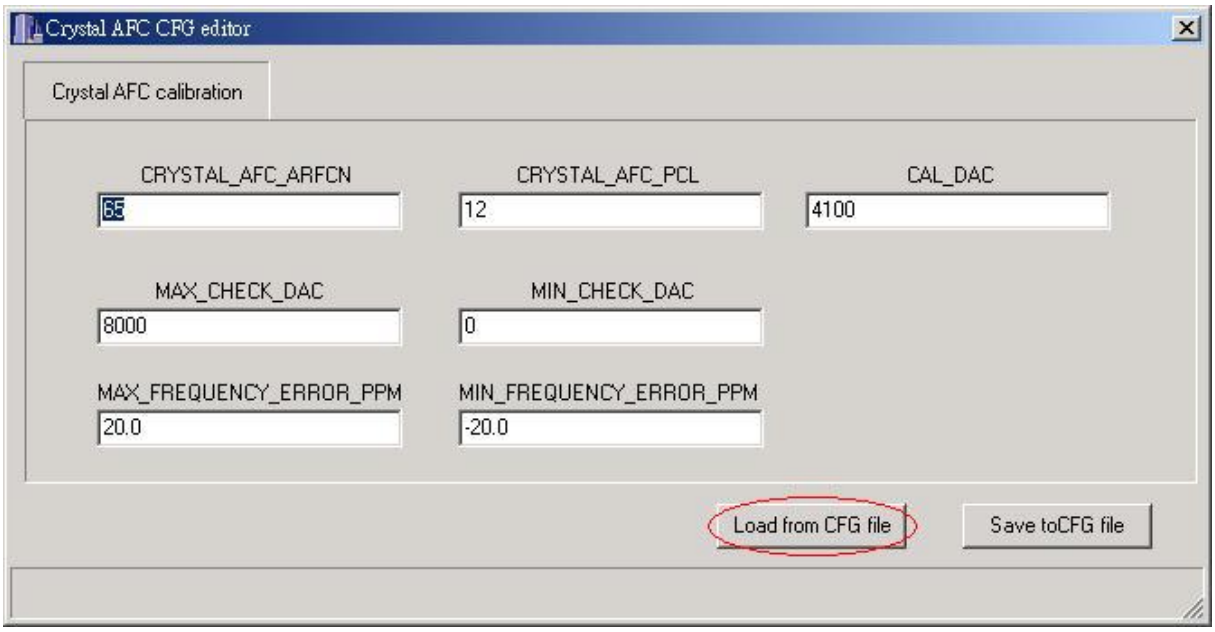

Figure 506 ***Click [Load from CFG file] button to read crystal AFC CFG parameters from CFG file***

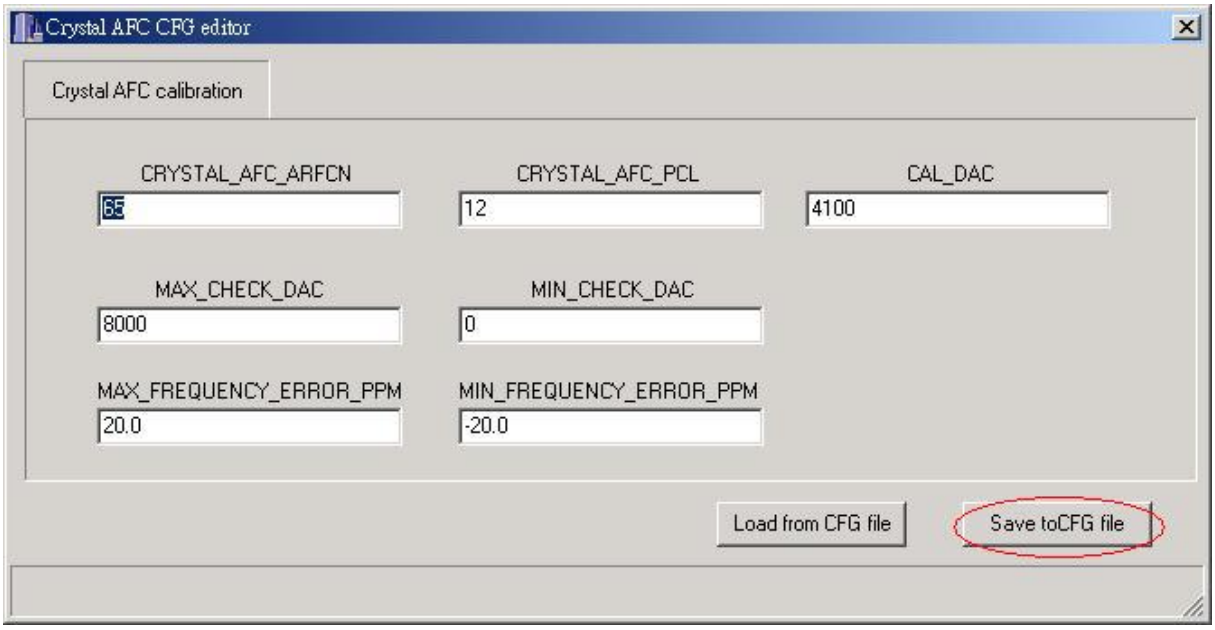

Figure 507 ***Click [Save to CFG file] to save crystal AFC CFG parameters to CFG file***

4.1.1.1.d RX path loss CFG parameters

Users can click [RX path loss CFG parameter] to show RX path loss CFG parameter window. Users can click [Load from CFG file] button to read RX path loss CFG parameters from the CFG file and click [Save to CFG file] to save RX path loss CFG parameters to the CFG file.

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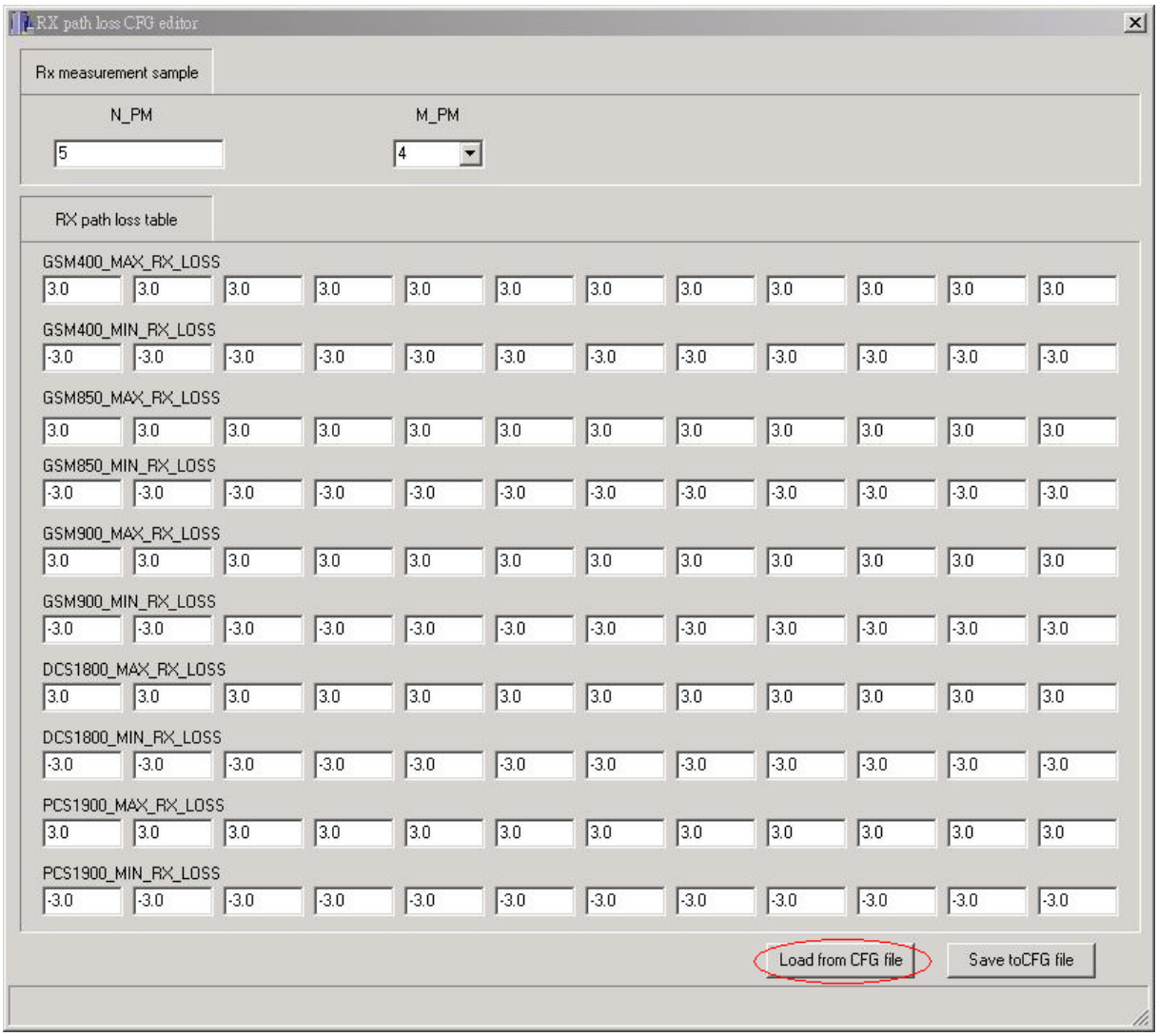

Figure 508 ***Click [Load from CFG file] button to read RX path loss CFG parameters from CFG file***

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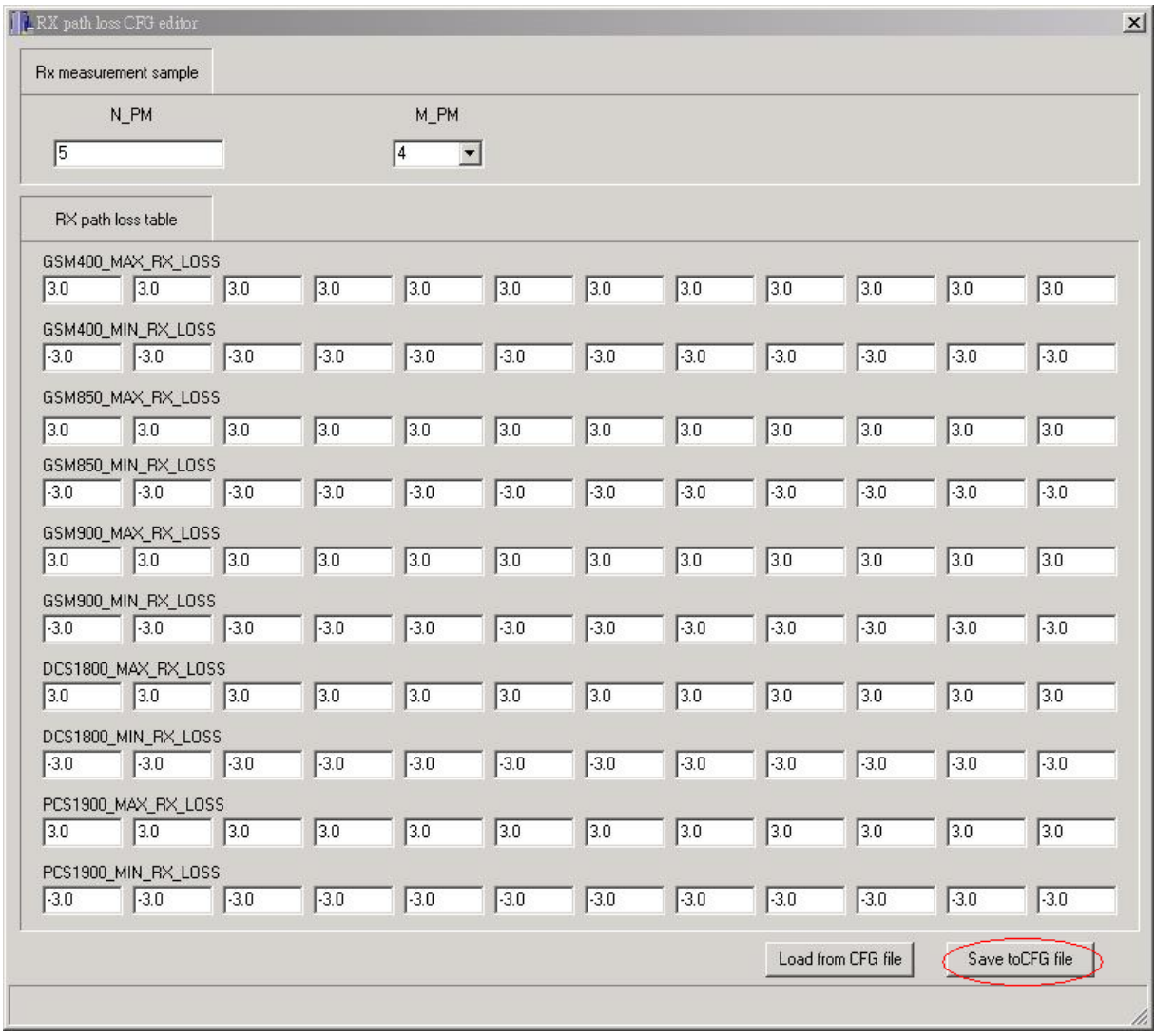

Figure 509 ***Click [Save to CFG file] to save RX path loss CFG parameters to CFG file***

4.1.1.1.e TX PCL CFG parameters

Users can click [TX PCL CFG parameter] to show TX PCL CFG parameter window. Users can click [Load from CFG file] button to read TX PCL CFG parameters from the CFG file and click [Save to CFG file] to save TX PCL CFG parameters to the CFG file.

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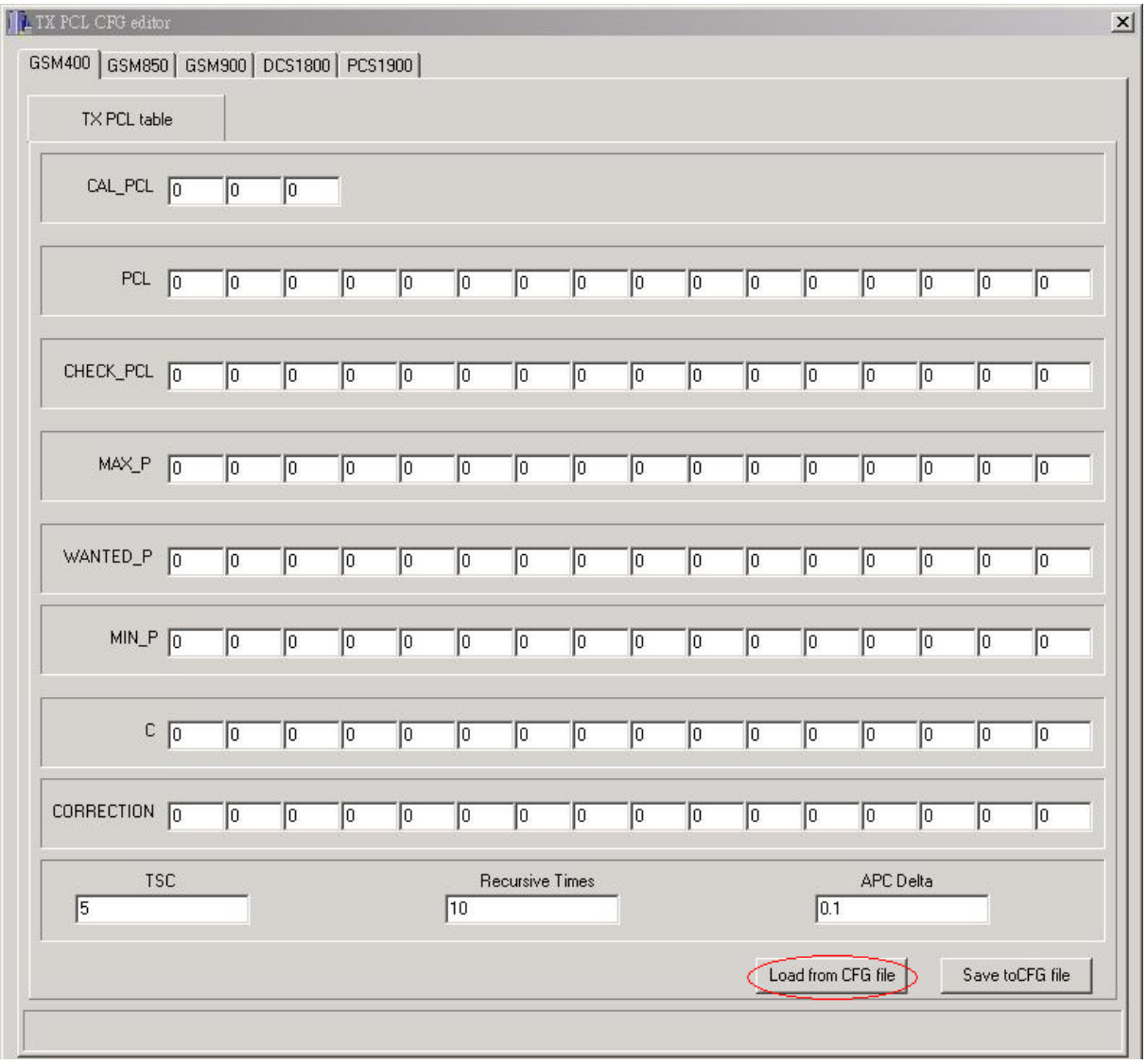

Figure 510 ***Click [Load from CFG file] button to read TX PCL CFG parameters from CFG file***

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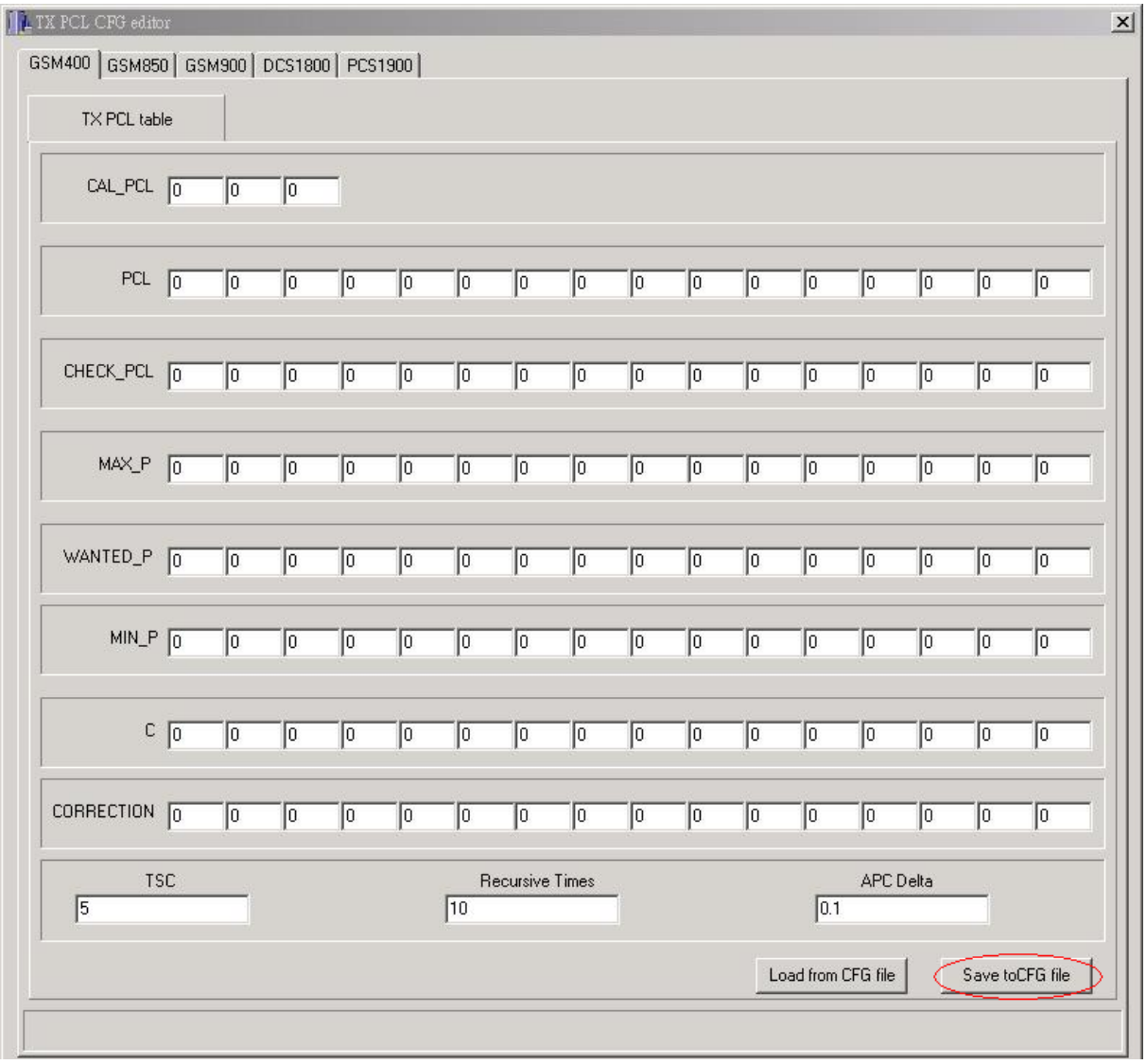

Figure 511 ***Click [Save to CFG file] to save TX PCL CFG parameters to CFG file***

4.1.1.1.f TX PCL CFG parameters

Users can click [TX PCL CFG parameter] to show TX PCL CFG parameter window. Users can click [Load from CFG file] button to read TX PCL CFG parameters from the CFG file and click [Save to CFG file] to save TX PCL CFG parameters to the CFG file.

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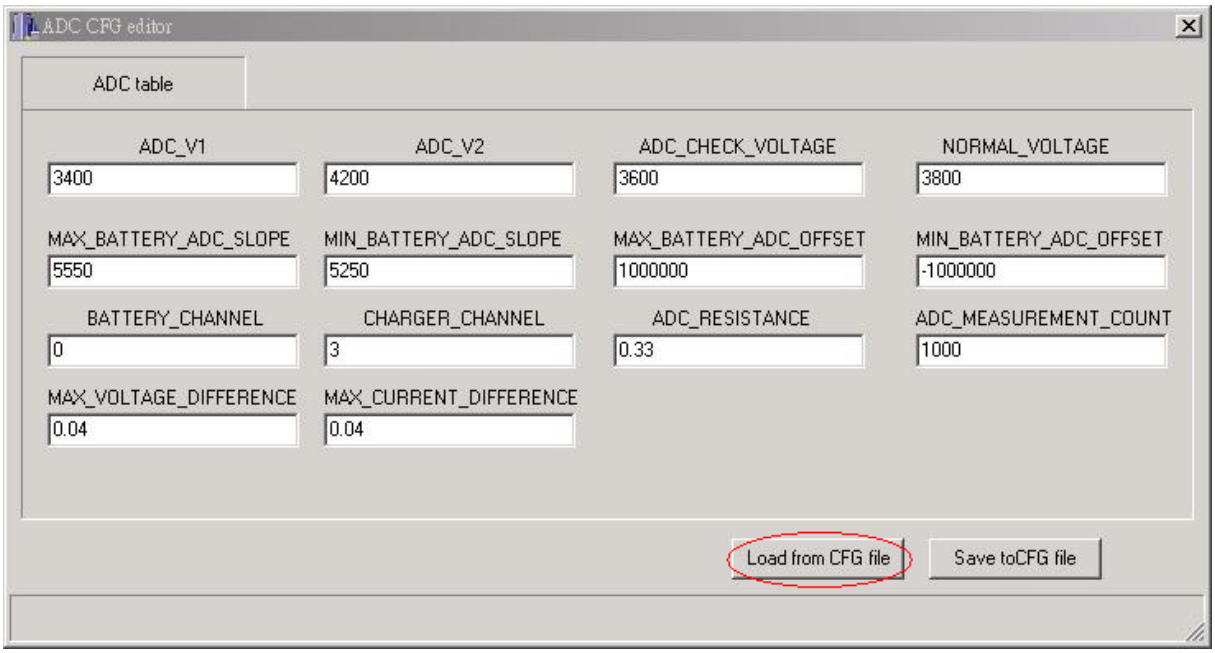

Figure 512 ***Click [Load from CFG file] button to read TX PCL CFG parameters from CFG file***

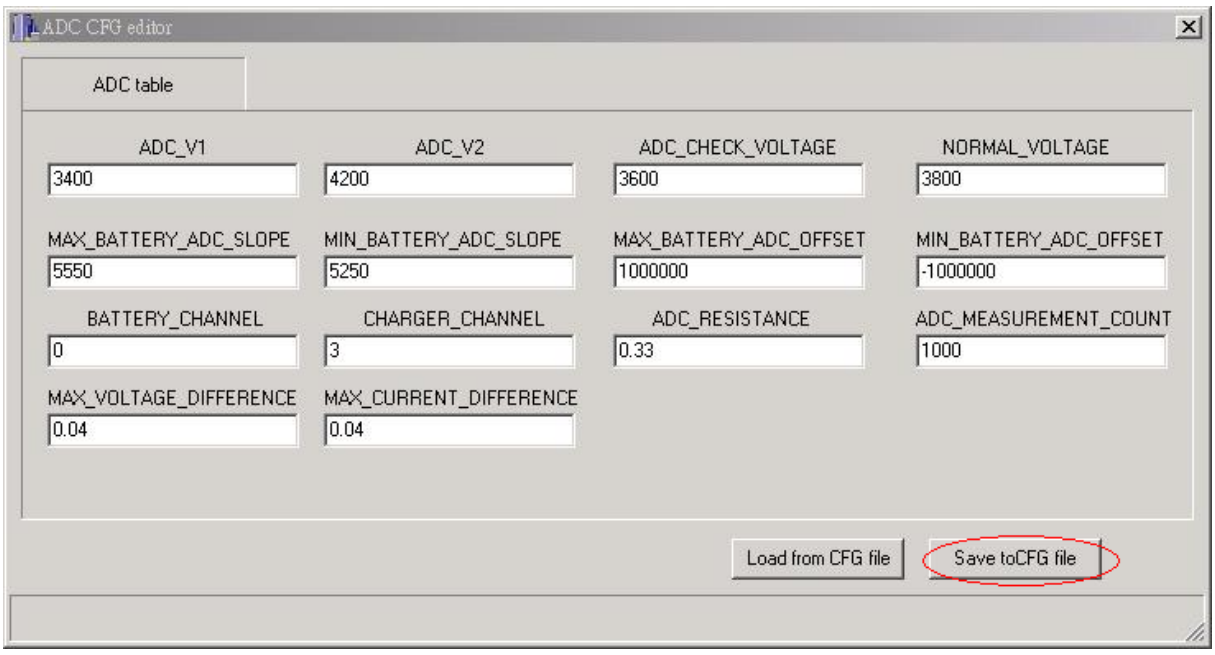

Figure 513 ***Click [Save to CFG file] to save TX PCL CFG parameters to CFG file***

4.1.2 Logging file

The logging file is the history of the given parameters and output values evaluated during calibration procedure. The content of the logging file can be different based on the real phone module design.

The logging file contains the following record.

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1. Label. It is input by the user on the “Logging file label” in META factory window.
2. ID. When you use the same label to calibrate N times, the tool will keep the ID from 0 to N-1for all N times testing.
3. System date and time: The META factory tool logs system time automatically.
   Example:
   2002/8/22 PM 03:58:45
4. The commands and values are sent to the target.
   Example:
   Target< TX: ARFCN = 60, TSC = 5, power = 12, frames = 200, dac value = 4768
5. The commands and values are sent to Agilent 8960.
   Example:
   Agilent 8960< initial
   Agilent 8960< reset
   Agilent 8960< operating mode: test mode
   Agilent 8960< BCH ARFCN: 60

6. Values are read from the target:
   Example:
   Target> FB detection=5, Freq Error=21, the square of Deviation=50.66
7. TX power is measured by Agilent 8960:
   Example:
   Agilent 8960> power = -660
8. delta s and delta L
   delta s is Δs defined in section 4.2.10 and delta L is ΔL defined in section 4.2.8.
   Example:
   delta s = 27
   delta L = 19

4.1.3 Result file

The file is used to store all calibration results, the result include start ID (i.e. barcode), rx path loss value, AFC slope and offset, TX power (dBm) and battery ADC slope and offset.

4.1.4 Calibration data initial file

This file is used to keep the default calibration data, normally provided by RF engineer. The tool will read these values as initial calibration values. These values will be different for each mobile model. This file can be acquired in R&D phase via META LAB tool assistance. Therefore, each file is corresponding to the META_LAB window UI.

Note:

- The max. ARFCN in EGSM is 1023. If the initial value in max. ARFCN is 1024, the tool will adopt 1023 in the calibration procedure.
- RF engineers must fine-tune the TX level values (initial scale factor) of the supported band to speed up TX power control level calibration. The better TX level initial value will keep the calibration results more precise to meet the specification. If the initial TX level value is not suitable for the RF module, the TX power calibration results will be out of specification.

The following is a template of the calibration data initial file. Each value must be followed with a comma. Please follow the file format if you want to change the value in the file.

[META version]

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```
META version= ver 3.5
; META version

[GSM900 level, ramp]
APC dc offset=115
; APC dc offset: the field specify the pedestal value of the APC unit. The APC D/A converter
; is powered up biased on the offset value specified by the field.
TX power level=57,66,76,90,106,124,147,177,213,258,315,387,478,561,675,675
; profile 0 refer to PCL 19, profile 1 refer to PCL 18, ….., profile 14 refer to PCL 5
profile 0 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,228,255,255,255
profile 0 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 1 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,225,255,255,255
profile 1 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 2 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 2 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 3 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 3 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 4 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 4 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 5 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 5 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 6 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 6 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 7 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 7 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 8 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 8 ramp down=255,255,239,197,138,78,32,10,0,0,0,0,0,0,0,0
profile 9 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 9 ramp down=255,239,197,138,78,32,10,0,0,0,0,0,0,0,0,0
profile 10 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 10 ramp down=255,239,197,138,78,32,10,0,0,0,0,0,0,0,0,0
profile 11 ramp up=0,0,0,0,0,0,2,4,8,26,65,143,219,250,255,255
profile 11 ramp down=255,239,197,138,78,32,10,0,0,0,0,0,0,0,0,0
profile 12 ramp up=0,0,0,0,0,0,0,2,4,8,26,65,143,219,250,255
profile 12 ramp down=255,239,197,138,78,32,10,0,0,0,0,0,0,0,0,0
profile 13 ramp up=0,0,0,0,0,0,0,2,4,8,26,65,143,219,250,255
profile 13 ramp down=255,239,197,138,78,32,10,0,0,0,0,0,0,0,0,0
profile 14 ramp up=0,0,0,0,0,0,0,2,4,8,26,65,143,219,250,255
profile 14 ramp down=255,239,197,138,78,32,10,0,0,0,0,0,0,0,0,0
profile 15 ramp up=0,0,0,0,0,0,0,2,4,8,26,65,143,219,250,255
profile 15 ramp down=255,239,197,138,78,32,10,0,0,0,0,0,0,0,0,0
Subband max arfcn=40,82,124,1023,-1,0,0,0,0,0,0
Subband mid level=11,11,11,11,19,19,19,19,19,19,19
Subband high weight=1.000,1.000,1.000,1.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Subband low weight=1.000,1.000,1.000,1.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
;Subband mid level: the level above or equal the [suband mid level] will be multiplied by [Subband low weight],
                    and the level below [Subband mid level] will be multiplied by [Subband high weight].
;Subband high weight: each entry of the ramp profile of level below [Subband mid level] will be multiplied by
                    [Subband high weight].
;Subband low weight: each entry of the ramp profile of level above or equal [Subband mid level] will be multiplied
                    by  [Subband low weight].
```


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Battery compensate, low voltage, low temperature=1
Battery compensate, low voltage, mid temperature=1
Battery compensate, low voltage, high temperature=1
Battery compensate, mid voltage, low temperature=1
Battery compensate, mid voltage, mid temperature=1
Battery compensate, mid voltage, high temperature=1
Battery compensate, high voltage, low temperature=1
Battery compensate, high voltage, mid temperature=1
Battery compensate, high voltage, high temperature=1
; These 3x3 array compensate the APC scaling factor under low/mid/high voltage/temperature

[DCS1800 level, ramp]
APC dc offset=115
TX power level=51,58,67,78,91,106,126,147,172,203,238,285,340,408,474,540
; profile 0 refer to PCL 15, profile 1 refer to PCL 14, ….., profile 15 refer to PCL 0
profile 0 ramp up=0,0,0,0,1,2,4,8,32,70,145,185,232,252,255,255
profile 0 ramp down=255,255,239,197,138,78,32,10,2,0,0,0,0,0,0,0
profile 1 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,250,255,255
profile 1 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 2 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,250,255,255
profile 2 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 3 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,250,255,255
profile 3 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 4 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,250,255,255
profile 4 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 5 ramp up=0,0,0,0,1,2,4,8,30,65,143,219,250,255,255,255
profile 5 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 6 ramp up=0,0,0,0,1,2,4,8,30,65,143,219,250,255,255,255
profile 6 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 7 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 7 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 8 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 8 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 9 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 9 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 10 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 10 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 11 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 11 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 12 ramp up=0,0,0,0,0,0,1,2,4,8,30,65,143,219,255,255
profile 12 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 13 ramp up=0,0,0,0,0,0,1,2,4,8,30,65,143,219,255,255
profile 13 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 14 ramp up=0,0,0,0,0,0,0,3,7,24,60,130,179,239,255,255
profile 14 ramp down=255,239,209,158,97,60,20,7,0,0,0,0,0,0,0,0
profile 15 ramp up=0,0,0,0,0,0,0,3,7,24,60,130,179,239,255,255
profile 15 ramp down=255,239,209,158,97,60,20,7,0,0,0,0,0,0,0,0
Subband max arfcn=520,560,600,630,660,680,720,730,750,800,885
Subband mid level=4,4,4,4,4,4,4,4,4,4
Subband high weight=1.050,1.040,1.030,1.020,1.010,1.000,1.000,0.995,0.990,0.985,0.9800
Subband low weight=1.100,1.050,1.010,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000

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;Subband mid level: the level above or equal the [suband mid level] will be multiplied by [Subband low weight], and the level below [Subband mid level] will be multiplied by [Subband high weight].
;Subband high weight: each entry of the ramp profile of level below [Subband mid level] will be multiplied by [Subband high weight].
;Subband low weight: each entry of the ramp profile of level above or equal [Subband mid level] will be multiplied by [Subband low weight].
Battery compensate, low voltage, low temperature=1
Battery compensate, low voltage, mid temperature=1
Battery compensate, low voltage, high temperature=1
Battery compensate, mid voltage, low temperature=1
Battery compensate, mid voltage, mid temperature=1
Battery compensate, mid voltage, high temperature=1
Battery compensate, high voltage, low temperature=1
Battery compensate, high voltage, mid temperature=1
Battery compensate, high voltage, high temperature=1
; These 3x3 array compensate the APC scaling factor under low/mid/high voltage/temperature

[PCS1900 level, ramp]
APC dc offset=115
TX power level=60,68,77,89,103,116,134,156,182,217,260,310,373,454,565,675
; profile 0 refer to PCL 15, profile 1 refer to PCL 14, ….., profile 15 refer to PCL 0
profile 0 ramp up=0,0,0,0,0,0,2,7,24,60,120,172,232,255,255,255
profile 0 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 1 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 1 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 2 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 2 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 3 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 3 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 4 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 4 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 5 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 5 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 6 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 6 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 7 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 7 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 8 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 8 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 9 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 9 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 10 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 10 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 11 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 11 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 12 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 12 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 13 ramp up=0,0,0,0,0,1,2,4,8,30,65,143,219,255,255,255
profile 13 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
profile 14 ramp up=0,0,0,0,0,1,2,4,8,24,60,120,172,232,255,255
profile 14 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0

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profile 15 ramp up=0,0,0,0,0,1,2,4,8,24,56,120,172,232,255,255
profile 15 ramp down=255,255,239,209,158,107,65,20,7,0,0,0,0,0,0,0
Subband max arfcn=520,560,600,630,660,680,720,730,750,800,810
Subband mid level=7,7,7,7,7,7,7,7,7,7,7
Subband high weight=1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Subband low weight=1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
;Subband mid level: the level above or equal the [suband mid level] will be multiplied by [Subband low weight], and the level below [Subband mid level] will be multiplied by [Subband high weight].
;Subband high weight: each entry of the ramp profile of level below [Subband mid level] will be multiplied by [Subband high weight].
;Subband low weight: each entry of the ramp profile of level above or equal [Subband mid level] will be multiplied by [Subband low weight].
Battery compensate, low voltage, low temperature=1
Battery compensate, low voltage, mid temperature=1
Battery compensate, low voltage, high temperature=1
Battery compensate, mid voltage, low temperature=1
Battery compensate, mid voltage, mid temperature=1
Battery compensate, mid voltage, high temperature=1
Battery compensate, high voltage, low temperature=1
Battery compensate, high voltage, mid temperature=1
Battery compensate, high voltage, high temperature=1
; These 3x3 array compensate the APC scaling factor under low/mid/high voltage/temperature
[GSM900 Sub band, RX loss]
Max ARFCN=15,30,45,60,75,80,100,124,975,1000,1023,-1
RX loss=-1.125,-1.000,-1.000,-1.125,-1.250,-1.250,-0.750,-0.500,-0.500,-0.875,-1.250,0.0000
RX loss middle=2.000,0.875,2.250,2.500,1.750,1.750,0.000,0.000,0.000,0.000,0.000,0.0000
; RX loss middle represents the middle mode rx loss (dB)
RX loss low=4.000,3.875,4.250,5.500,6.750,7.750,0.000,0.000,0.000,0.000,0.000,0.0000
; RX loss low represents the low mode rx loss (dB)
[DCS1800 Sub band, RX loss]
Max ARFCN=550,590,620,650,680,710,740,770,810,850,885,-1
RX loss=-0.375,-0.750,-0.875,-0.875,-1.000,-1.000,-0.750,-0.750,-0.875,-0.750,-0.125,0.0000
RX loss middle=2.000,0.875,2.250,2.500,1.750,1.750,0.000,0.000,0.000,0.000,0.000,0.0000
RX loss low=4.000,3.875,4.250,5.500,6.750,7.750,0.000,0.000,0.000,0.000,0.000,0.0000
[PCS1900 Sub band, RX loss]
Max ARFCN=550,810,-1,0,0,0,0,0,0,0,0,0
RX loss=-4.000,-4.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
RX loss middle=2.000,0.875,2.250,2.500,1.750,1.750,0.000,0.000,0.000,0.000,0.000,0.0000
RX loss low=4.000,3.875,4.250,5.500,6.750,7.750,0.000,0.000,0.000,0.000,0.000,0.0000
[GMSK Closed-Loop TXPC]
; GSM850 closed-loop detector target value of each PCL
GSM850 TXPC=800,920,1040,1160,1280,1400,1520,1640,1760,1880,2000,2120,2240,2360,2480,2600
; GSM850 closed-loop detector target value for different temperature intervals
GSM850 TXPC Temperature Compensation=2202,2202,2201,2196,2195,2195,2194,2193
; GSM900 closed-loop detector target value of each PCL
GSM900 TXPC=1210,1315,1421,1508,1614,1722,1830,1941,2054,2166,2277,2379,2494,2571,2664,2664
; GSM900 closed-loop detector target value for different temperature intervals
GSM900 TXPC Temperature Compensation=2231,2226,2222,2220,2218,2217,2215,2214
; DCS1800 closed-loop detector target value of each PCL
DCS1800 TXPC=800,920,1040,1160,1280,1400,1520,1640,1760,1880,2000,2120,2240,2360,2480,2600
; DCS1800 closed-loop detector target value for different temperature intervals

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DCS1800 TXPC Temperature Compensation=2267,2263,2259,2257,2249,2247,2246,2245
; PCS1900 closed-loop detector target value of each PCL
PCS1900 TXPC=800,920,1040,1160,1280,1400,1520,1640,1760,1880,2000,2120,2240,2360,2480,2600
; PCS1900 closed-loop detector target value for different temperature intervals
PCS1900 TXPC Temperature Compensation=2234,2231,2214,2208,2207,2202,2200,2198
calibrated=0
[EPSK Closed-Loop TXPC]
GSM850 TXPC=1566,1630,1694,1759,1822,1889,1953,2014,2077,2143,2207,2253,2253,2253,2253,2253
GSM850 TXPC Temperature Compensation=2202,2202,2201,2196,2195,2195,2194,2193
GSM900 TXPC=1606,1669,1732,1797,1860,1927,1990,2054,2120,2180,2247,2293,2293,2293,2293,2293
GSM900 TXPC Temperature Compensation=2231,2226,2222,2220,2218,2217,2215,2214
DCS1800 TXPC=1491,1557,1621,1684,1748,1811,1875,1941,2004,2068,2129,2201,2263,2311,2311,2311
DCS1800 TXPC Temperature Compensation=2267,2263,2259,2257,2249,2247,2246,2245
PCS1900 TXPC=1487,1551,1614,1677,1747,1807,1871,1934,2001,2065,2127,2199,2261,2310,2310,2310
PCS1900 TXPC Temperature Compensation=2234,2231,2214,2208,2207,2202,2200,2198

[IR W Coefficients]
; image part of the calibration result
W image=134,104,363,357,360,342,341,315,97,0,0,0,0,0,0,0,0,0,0,0
; real part of the calibration result
W real=1048,1092,1509,1561,1568,1572,1638,1626,-7,0,0,0,0,0,0,0,0,0,0,0

[AFC control]
Initial value=4531
Slope=2.5425

[ADC control]
offset=-23466,-23466,-23466,-3796,-23466
slope=5391,5391,5391,5383,5391

4.1.5 Setup calibration data result file path

User can setup the folder of calibration result file by clicking [Setup calibration data result file path] in File pull down menu. All calibration data files of each calibrated phone are saved in this folder. The format of file name of these calibration data files are xxx.cal, where xxx is barcode specified on META factory mode window.

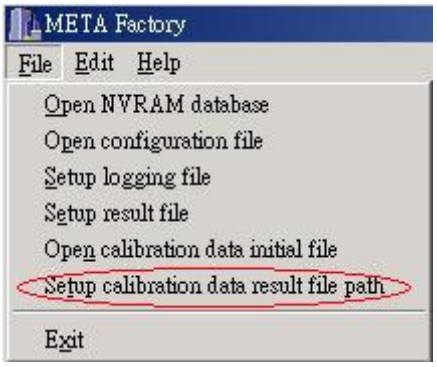

Figure 514 ***Click [Setup calibration data result file path] to show calibration data result file path window***

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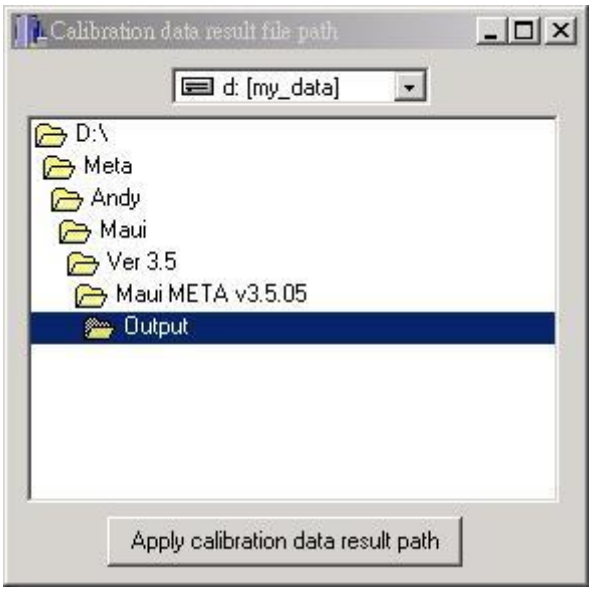

Figure 515 ***Calibration data result file path window***

User can change drive and folder and then click [Apply calibration data result path] button to apply calibration data result file path.

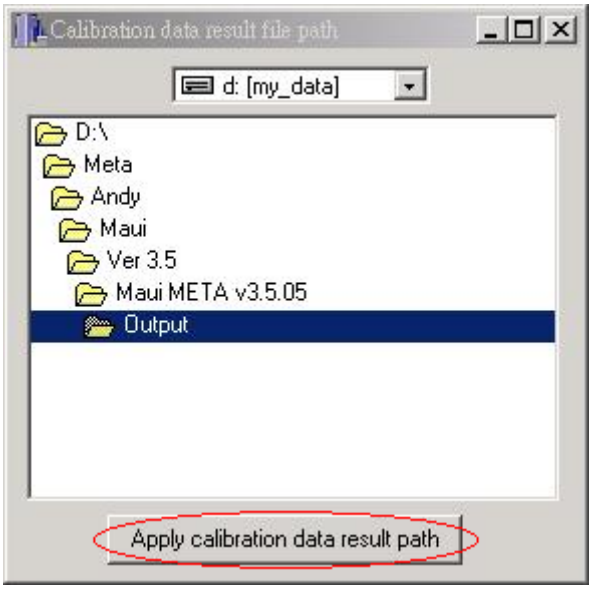

Figure 516 ***click [Apply calibration data result path] button to apply calibration data result file path***

4.2 2G Calibration Procedure

Following is the calibration procedure of META factory.

4.2.1 Initialization

1. Configure META-DLL.
2. Agilent 8960 or R&S CMU 200 Configuration and the cable loss compensation.

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3. Open configuration file and import the default RF calibration from initial data file. These default RF calibration data will be written down to NVRAM.

4.2.1.1 Configuration File

Parameter	Default Value	Description	Unit
[Downlink power]			
P_DL	-60	Downlink power setting	dBm

4.2.2 Adaptive AFC DAC pre-search mechanism for RF chip, AD6548

The following calibration algorithm is used when the RF chip ID queried by META_Rf_GetRFID is RF_ID_AD6548.

1 Command Agilent 8960 or R&S CMU 200 to set BAND to CRYSTAL_AFC_BAND, TCH channel to CRYSTAL_AFC_ARFCN and downlink power to P_{DL} (in dBm), TSC value and respective MS uplink PCL to CRYSTAL_AFC_PCL.

2 Command MS to set Crystal CAP ID (CRYSTAL_AFC_CAL_CAP_ID in CFG file) by META_Rf_SetCrystalCapId.

3 Issue NB (normal burst) TX request to MS via META DLL, NB TX on CRYSTAL_AFC_ARFCN with request TX PCL of CRYSTAL_AFC_PCL, AFC DAC value of CRYSTAL_AFC_CAL_DAC_LOW and burst type of NB_TX_RANDOM_WITH_TSC.

4 Command the Agilent 8960 or R&S CMU 200 to measure the received MS uplink frequency errors and store the measured results into Ferr_Low.

5 Issue NB (normal burst) TX request to MS via META DLL, NB TX on CRYSTAL_AFC_ARFCN with requested TX PCL of CRYSTAL_AFC_PCL, AFC DAC value of CRYSTAL_AFC_CAL_DAC_HIGH and burst type of NB_TX_RANDOM_WITH_TSC.

6 Command the Agilent 8960 or R&S CMU 200 to measure the received MS uplink frequency error, Ferr_High.

7 Issue NB (normal burst) TX request to MS via META_DLL interface, NB TX on CRYSTAL_AFC_ARFCN with requested TX PCL of CRYSTAL_AFC_PCL, AFC DAC value of Search DAC (initialized with CRYSTAL_AFC_CAL_DAC_MID and converged by binary search) and burst type of NB_TX_RANDOM_WITH_TSC.

8 Command the Agilent 8960 or R&S CMU 200 to measure the received MS uplink frequency error, Ferr_Search.

9 Calculate the following values:

9.1 Ferr_Low_ppm = Ferr_Low/Center Freq. of ARFCN

9.2 Ferr_High_ppm = Ferr_High/Center Freq. of ARFCN

9.3 Ferr_Search_ppm = Ferr_Search/Center Freq. of ARFCN

10 Repeat Steps 7~9 until | (Ferr_High_ppm - Ferr_Search_ppm) – (Ferr_Search_ppm - Ferr_Low_ppm) | <= CRYSTAL_AFC_CAL_DYNAMIC_RANGE_FREQ_ERR_PPM by adjusting Search DAC with the following rules:

10.1 If((| (Ferr_High_ppm - Ferr_Search_ppm) | - | (Ferr_Search_ppm - Ferr_Low_ppm) |) > 0)
min_search_dac = Search DAC;
else max_search_dac = Search DAC;

10.2 Search DAC = (min_search_dac + max_search_dac)/2;

10.3 Note: min_search_dac is initialized by CRYSTAL_AFC_CAL_DAC_LOW
max_serach_dac is initialized by CRYSTAL_AFC_CAL_DAC_HIGH

11 In Crystal AFC calibration procedures, we replace the setting of CRYSTAL_AFC_CAL_DAC, CRYSTAL_DAC1, and CRYSTAL_DAC2 in CFG file with Search DAC, CRYSTAL_AFC_CAL_DAC_DIS_DEC, and CRYSTAL_AFC_CAL_DAC_DIS_INC:

11.1 CRYSTAL_AFC_CAL_DAC → Search DAC

11.2 CRYSTAL_DAC1 → (Search DAC - CRYSTAL_AFC_CAL_DAC_DIS_DEC)

11.3 CRYSTAL_DAC2 → (Search DAC + CRYSTAL_AFC_CAL_DAC_DIS_INC)

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4.2.3 2-step AFC slope calibration

The following calibration algorithm is used when the returned value of Calibration_33Steps of MS capability of META_Rf_QueryMSCapabilityEx2 is 0.

1. Command Agilent 8960 or R&S CMU 200 to set band to AFC_BAND, BCCH carrier on AFC_ARFCN (1~124) and downlink power of P_{DL} (in dBm),
2. Issues AFC testing request to MS via META_DLL interface, test AFC on arfcn_C0_xxx over N_AFC sample, with request gain of –35- P_{DL} and AFC DAC value of DAC_1
3. Wait for the averaged frequency error $\overline{\Delta f_1}$ to be reported from META_DLL interface,
4. Issue AFC testing request to MS via META_DLL interface, test AFC on arfcn_C0_xxx over N_AFC sample, with request gain of –35- P_{DL} and AFC DAC value of DAC_2.
5. Wait for the averaged frequency error $\overline{\Delta f_2}$ reported from META_DLL interface.
6. Slope = $\overline{\Delta f_1} - \overline{\Delta f_2} \big/ DAC_2 - DAC_1$, therefore slope_inv = 4096 /(slope Afc_Slope_factor)
7. AFC equation $y - \overline{\Delta f_1} = -slope \times (x - DAC_1)$. In order to get the initial value, set y = 0, then initial value should be $\overline{\Delta f_1} \big/ slope + DAC_1$
8. Write $slope_inv$ and initial value to the target via META_DLL interface

Note:

- P_{DL} is the value of P_DL in [Downlink power] section in the configuration file.
- DAC_1 is the value of DAC1 in [AFC Calibration] section in the configuration file.
- DAC_2 is the value of DAC2 in [AFC Calibration] section in the configuration file.
- Afc_Slope_factor at step 6 is evaluated by the following formula:
  Afc_Slope_factor = 1.0 for GSM 900 band
  Afc_Slope_factor = 900.0/1800.0 for DCS 1800 band.
  Afc_Slope_factor = 900.0/1900.0 for PCS 1900 band
  Afc_Slope_factor = 900.0/850.0 for GSM 850 band

4.2.3.1 Configuration File

Parameter	Default Value	Description	Unit
[AFC Calibration]			
FINE_SYNC_SB	5	number of SB in FHC DTS fine sync stage	N/A
EXTRA_FB	2	number of extra FB in FHC DTS AFC calibration step	N/A
AFC_BAND	GSM	Calibration band for AFC calibration	Frequency Band
AFC_ARFCN	70	Calibration channel for AFC calibration of BCH	ARFCN
N_AFC	10	number of times in ACF calibration	
DAC1	4000	Test point 1 when calibrate AFC slope for TCVCX0	DAC
DAC2	5000	Test point 2 when calibrate AFC slope for TCVCX0	DAC

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CRYSTAL_DAC1	3800	Test point 1 when calibrate AFC slope for crystal	DAC
CRYSTAL_DAC2	4200	Test point 2 when calibrate AFC slope for crystal	DAC
[AFC table]			
MAX_INIT_AFC_DAC	65535	Max. value of calibrated AFC DAC	DAC
MIN_INIT_AFC_DAC	0	Min. value of calibrated AFC DAC	DAC
MAX_AFC_SLOPE	5.0	Max. value of calibrated AFC slope	
MIN_AFC_SLOPE	0.0	Min. value of calibrated AFC slope	
[Crystal AFC Calibration]			
CRYSTAL_AFC_BAND	GSM	Crystal AFC calibration band	N/A
CRYSTAL_AFC_ARFCN	65	ARFCN used for Crystal AFC calibration	ARFCN
CRYSTAL_AFC_GSM850_PCL	12	PCL used for GSM850 band Crystal AFC calibration	PCL
CRYSTAL_AFC_GSM900_PCL	12	PCL used for GSM900 band Crystal AFC calibration	PCL
CRYSTAL_AFC_DCS1800_PCL	12	PCL used for DCS1800 band Crystal AFC calibration	PCL
CRYSTAL_AFC_PCS1900_PCL	12	PCL used for PCS1900 band Crystal AFC calibration	PCL
CRYSTAL_AFC_CAL_DAC	4100	AFC DAC value used in CAP ID calibration	N/A
CRYSTAL_AFC_CHECK_DAC1	0	AFC DAC value used in Cystal AFC dynamic range checking	N/A
CRYSTAL_AFC_CHECK_DAC2	8000	AFC DAC value used in Cystal AFC dynamic range checking	N/A
CRYSTAL_AFC_MIN_FREQ_ERR_PPM	-17.0	The lower limit of Crystal AFC dynamic range	PPM
CRYSTAL_AFC_MAX_FREQ_ERR_PPM	17.0	The upper limit of Cyrstal AFC dynamic range	PPM
CRYSTAL_CAPID_ACCURACY_MIN_FREQ_ERR_PPM	-2.0	The lower limit of accuracy of the Crystal AFC calibration for check the frequency error of the CAP ID calibration result	PPM
CRYSTAL_CAPID_ACCURACY_MAX_FREQ_ERR_PPM	2.0	The upper limit of accuracy of the Crystal AFC calibration for check the frequency error of the CAP ID calibration result	PPM
CRYSTAL_AFC_RECURSIVE_TIMES	20	The maximum number of iteration for calibration flow	N/A
CRYSTAL_AFC_MIN_CAP_ID	0	The lower limit of CAP ID calibration result	N/A
CRYSTAL_AFC_MAX_CAP_ID	63	The upper limit of CAP ID calibration result	N/A
MAX_CRYSTAL_CAL_CAP_ID	-1	The maximum CAP ID used for CAP ID binary search	N/A
MIN_CRYSTAL_CAL_CAP_ID	-1	The minimum CAP ID used for CAP ID binary search	N/A

4.2.4 33-step AFC slope calibration

The following calibration algorithm is used when the returned value of Calibration_33Steps of MS capability of META_Rf_QueryMSCapabilityEx2 is 1.

1. If using Agilent 8960, configure its operation mode to CW mode. If CMU 200 is used, configure its cell band to AFC_BAND as specified in the configuration file.
2. Configure frequency offset of radio communication tester (RCT) to 67.7 kHz.

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3. If using CMU 200, configure its transmission mode to continuous transmission, bit modulation to off, and initialize the RF generator.
4. Set target AFC sine wave detection flag to true via META_DLL interface.
5. If using Agilent 8960, configure its generation frequency to central frequency of AFC_ARFCN, where AFC_ARFCN is specified in the configuration file. If using CMU 200, configure its downlink ARFCN to AFC_ARFCN.
6. Configure the cell power of RCT to P_DL, where P_DL is specified in the configuration file.
7. If AFC_BAND equals PCS, set the target frequency band 1900 selection flag to 1 via the META_DLL interface. If AFC_BAND equals DCS, set the target frequency band 1900 selection flag to 0.
8. Issue target to do AFC measurement for each AFC DAC specified in [Crystal AFC control] section of calibration data initial file. And save measurement results to afc_cnf[] array.
9. Set start_afc_idx to the first index that satisfies the following condition:
   s_afc_cnf[start_afc_idx].freqOffset < 30000 and s_afc_cnf[start_afc_idx].fcb_ok_number > 0
10. Set end_afc_idx to the last index that satisfies the following condition:
   s_afc_cnf[start_afc_idx].freqOffset < 30000 and s_afc_cnf[start_afc_idx].fcb_ok_number > 0
11. For each element from index = start_afc_idx to index = end_afc_idx, do the following assignment:
   xo_afc_data.XO_SlopeAreaData[i-i_start_afc_idx].min_dac = xo_afc_data.XO_SlopeAreaData[i].min_dac;
   xo_afc_data.XO_SlopeAreaData[i-i_start_afc_idx].min_freq = xo_afc_data.XO_SlopeAreaData[i].min_freq;
12. For each element from index = (end_afc_idx-start_afc_idx+1) to index = (XO_SlopeArea_Num-1), do the following assignment:
   xo_afc_data.XO_SlopeAreaData[i].min_dac = -1;
   xo_afc_data.XO_SlopeAreaData[i].min_freq = 0;
13. For each element from index = 0 to index = (i_end_afc_idx-i_start_afc_idx-1), find one index that meets the condition (xo_afc_data.XO_SlopeAreaData[i].min_freq * xo_afc_data.XO_SlopeAreaData[i+1].min_freq < 0), and then do the following assignment:
Slope = (double)(xo_afc_data.XO_SlopeAreaData[i].min_freq - xo_afc_data.XO_SlopeAreaData[i+1].min_freq) / (double)(xo_afc_data.XO_SlopeAreaData[i+1].min_dac - xo_afc_data.XO_SlopeAreaData[i].min_dac);
Slope_inv = (int)(RF_AFC_SLOPE_DENOMINATOR * (xo_afc_data.XO_SlopeAreaData[i+1].min_dac - xo_afc_data.XO_SlopeAreaData[i].min_dac)) / (xo_afc_data.XO_SlopeAreaData[i].min_freq - xo_afc_data.XO_SlopeAreaData[i+1].min_freq) / Afc_Slope_factor;
m_sDefault_value = ((xo_afc_data.XO_SlopeAreaData[i].min_freq/Slope)+ xo_afc_data.XO_SlopeAreaData[i].min_dac);
14. Writes Slope_inv and initial AFC DAC value and xo_afc_data to target NVRAM via META_DLL interface.

Note:

- Afc_Slope_factor at step 13 is evaluated by the following formula.
  Afc_Slope_factor = 1.0 for GSM 900 band.
  Afc_Slope_factor = 900.0/1800.0 for DCS 1800 band.
  Afc_Slope_factor = 900.0/1900.0 for PCS 1900 band.
  Afc_Slope_factor = 900.0/850.0 for GSM 850 band.

4.2.4.1 Configuration File

Please refer to section 4.2.3.1

4.2.5 Crystal AFC calibration

1. Command Agilent 8960 or R&S CMU 200 to set BAND to CRYSTAL_AFC_BAND, TCH channel to CRYSTAL_AFC_ARFCN and downlink power to P_{DL} (in dBm), TSC value and respective MS uplink PCL to CRYSTAL_AFC_PCL.

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2. Pre-check if suitable cap_id exists by setting cap_id = 0 and then issue NB (normal burst) TX request to MS via META DLL, NB TX on CRYSTAL_AFC_ARFCN with request TX PCL of CRYSTAL_AFC_PCL, AFC DAC value of CAL_DAC and burst type of NB_TX_RANDOM_WITH_TSC.
3. Command the Agilent 8960 or R&S CMU 200 to measure the received MS uplink frequency error Ferr 0.
4. Pre-check if suitable cap_id exists by setting cap_id=max_cap_id and then issue NB (normal burst) TX request to MS via META DLL, NB TX on CRYSTAL_AFC_ARFCN with request TX PCL of CRYSTAL_AFC_PCL, AFC DAC value of CAL_DAC and burst type of NB_TX_RANDOM_WITH_TSC.
5. Command the Agilent 8960 or R&S CMU 200 to measure the received MS uplink frequency error Ferr_max.
6. If Ferr0 * Ferr_max > 0, the pre-check procedure will fail, and the crystal AFC calibration is aborted. Otherwise, go to step 7.
7. Set first_cap_id = 0 , last_cap_id = max_cap_id, cal_cap_id and min_cap_id to the value of cap_id specified in ini file, and min_Ferr = infinity.
8. Issues NB (normal burst) TX request to MS via META_DLL interface, NB TX on CRYSTAL_AFC_ARFCN with request TX PCL of CRYSTAL_AFC_PCL, AFC DAC value of CAL_DAC and burst type of NB_TX_RANDOM_WITH_TSC.
9.Command the Agilent 8960 or R&S CMU 200 to measure the received MS uplink frequency error Ferr N.
If Ferr N is small than min_Ferr, set min_Ferr = Ferr N and min_cap_id = cal_cap_id.
10. Adjust first_cap_id, last_cap_id and cal_cal_cap_id by the following rule:
If Ferr N < 0 at step 9, set last_cap_id = cal_CapIdFreqErr.cap_id.
If Ferr N > 0 at step 9, set first_cap_id = cal_CapIdFreqErr.cap_id + 1.
cal_cap_id = (first_cap_id+last_cap_id) /2.
11.Repeat from step 7 to step 10 until first_cap_id >= last_cap_id.
12. Issues NB (normal burst) TX request to MS via META DLL, NB TX on CRYSTAL_AFC_ARFCN with request TX PCL of CRYSTAL_AFC_PCL, AFC DAC value of MIN_CHECK_DAC.
13. Command the Agilent 8960 or R&S CMU 200 to measure the received MS uplink frequency error Ferr C.
Set Fppm C= Ferr C/center frequency of CRYSTAL_AFC_ARFCN .
14.If Fppm C < 0 and Fppm C<d_MIN_FREQUENCY_ERROR_PPM, the check result is pass, otherwise the check result is fail. If Fppm C >= 0 and Fppm C > d_MAX_FREQUENCY_ERROR_PPM, the check result is pass, otherwise the check result is fail. Record the check result as result(min).
15. Repeat step 12 ~ 14, by set AFC DAC value of MAX_CHECK_DAC. Record the check result at step 14 as result(max).
16. If one of reulst(min) and result(max) is pass and another is fail, the min_cap_id need to be fined tune to let result(min) and result(max) all pass check as described at step 14. Go to step 17. If reulst(min) and result(max) are all fail, the crystal calibration check is fail. If If reulst(min) and result(max) are all pass, , the crystal calibration check is pass, go to step 18.
17. min_cap_id fine tune as follows:
If(Fppm C < d_MAX_FREQUENCY_ERROR_PPM && Fppm C >=0) at step 14, min_cap_id = min_cap_id -1;
Otherwise min_cap_id = min_cap_id +1. Go to step 12.
18.Write min_cap_id to target via META-DLL interface if the check result is pass.
19. Run the 2 or 33 step AFC slope calibration algorithm as described in previous section.

Note:

- The value of max_cap_id at step 7 is defined as follows:
  - max_cap_id = 127 for CMOSEDGE, AERO2, AERO2E, and ALICEG2S transceivers
  - max_cap_id = 511 for AG2550 transceiver
  - max_cap_id = 63 for other transceivers

4.2.5.1 Configuration File

Please refer to section 4.2.3.1

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4.2.6 Crystal TRX offset calibration

1. If Agilent 8960 is used, configure its operation mode to GSM BCH+TCH.
2. If the return value of Calibration_33Steps of MS capability of META_Rf_QueryMSCapabilityEX2 is 1, set target AFC sine wave detection flag to false via META_DLL interface.
3. Set AFC_DAC to initial AFC DAC value get from 2 or 33 step AFC slope calibration.
4. Issues AFC testing request to MS via META_DLL interface, test AFC on first arfcn_C0_xxx channel need to be calibrated over N_AFC sample, with request gain of –35- P_{DL} and AFC DAC value of initial value get from TCVCXO AFC calibration algorithm at step.
5. Get FreqOffset from target via META_DLL interface.
6. Evaluate new AFC_DAC by the following formula:
   AFC_DAC = ((0.5*FreqOffset/slope)+ AFC_DAC); where slope is from 2 or 33 step AFC slope calibration.
7. Repeat steps 4~6 until FreqOffset is less than CRYSTAL_AFC_MAX_AFC_TRACK_INIT_FREQ_ERR specified in configuration file.
8. Command Radio Communication Tester (RCT) to set BAND to GSM band, TCH on arfcn_C0_xxx and downlink power of P_{DL} (in dBm), TSC value and respected MS uplink PCL of CRYSTAL_AFC_PCL.
9. Issue NB (normal burst) TX request to MS via META DLL, NB TX on arfcn_C0_xxx with request TX PCL of CRYSTAL_AFC_GSM900_PCL, AFC DAC value of initial value get from 2 or 33 step AFC slope calibration algorithm or with MASK_AFC_TRACKING (i.e AFC_init | MASK_AFC_TRACKING) to turn on AFC tracking and burst type of NB_TX_RANDOM_WITH_TSC.
10. Command RCT to measure the received MS uplink frequency error Ferr named FreqErr. Set FreqErr_last = FreqErr.
11. Evaluate tx_afc_offset = FreqErr / (1.0*4096/AfcSlope), where AfcSlope is slope value get from 2 or 33 step AFC slope calibration algorithm.
12. Set tx_afc_offset_last = tx_afc_offset.
13. If FreqErr >= 0, set tx_afc_offset= tx_afc_offset-1; otherwise, set tx_afc_offset= tx_afc_offset+1.
14. If FreqErr < Abs_double(FreqErr_min), set FreqErr_min = FreqErr and tx_afc_offset_min = tx_afc_offset.
15. Write tx_afc_offset to target NVRAM through META_DLL interface.
16. Iterate step 8~15 until FreqErr_last * FreqErr >=0 or iteration count reaches CRYSTAL_AFC_TRX_OFFSET_RECURSIVE_TIMES.
17. Iterate step 4~16, until all bands specified in configuration file are complete.

Note:

- CMU 200 set to non-signalling mode when do CAPID calibration and AFC slope & offset calibration. And CMU 200 set to signaling mode when do TRX offset calibration.
- arfcn_C0_xxx is specified in [C0 for each Bank] section of configuration file.
- P_{DL} is value of P_DL in [Downlink power] section in configuration file.
- MASK_AFC_TRACKING = 0x8000
- CRYSTAL_AFC_BAND, CRYSTAL_AFC_ARFCN , CRYSTAL_AFC_GSM900_PCL CRYSTAL_AFC_CAL_DAC, CRYSTAL_AFC_MIN_CHECK_DAC, CRYSTAL_AFC_MAX_CHECK_DAC , CRYSTAL_AFC_MIN_FREQ_ERR_PPM,CRYSTAL_AFC_MAX_FREQ_ERR_PPM, CRYSTAL_AFC_FREQ_ERR_MEASUSE_COUNT, and CRYSTAL_AFC_TRX_OFFSET_RECURSIVE_TIMES are values specified in [Crystal AFC Calibration] section in configuration file.

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4.2.7 RF path loss calibration

1. Command Agilent 8960 or R&S CMU 200 to set BCCH carrier on ARFCN1 and downlink power of P_{DL} (in dBm),
2. Via META-DLL itnerface, Issues PM request on ARFCN1 over N_PM frames and M_PM samples per frame, with request gain of –35- P_{DL}
3. Wait $P_{DL,rep}$ reported from META-DLL interface, the path loss on ARFCN1 could be evaluated as ΔL_1 (dB)= P_{DL} - $P_{DL,rep}$
4. Repeat step 1~3, until path loss $\Delta L_2 \sim \Delta L_n$ for first band need to be calibrated, where n is up to 12, are complete.
5. Repeat step 1~4, until path loss table for all band MS supported are complete.
6. Write the updated path loss table $L + \Delta L$ to target via META-DLL interface

Note: ARFCN can be acquired from the path loss table for each band. It is the "Max ARFCN" for each band in initial data file. -1 means the end of ARFCN. L is value of "RX loss" for each band in initial data file. P_{DL} P_DL, N_PM and M_PM are read from configuration file.

4.2.7.1 Configuration File

Parameter	Default Value	Description	Unit
[RX path loss table]			
GSM850_MAX_RX_LOSS	3.0*	Uppler limit of RX loss for GSM850	dB
GSM850_MIN_RX_LOSS	-3.0*	Lower limit of RX loss for GSM850	dB
GSM900_MAX_RX_LOSS	3.0*	Uppler limit of RX loss for GSM900	dB
GSM900_MIN_RX_LOSS	-3.0*	Lower limit of RX loss for GSM900	dB
DCS1800_MAX_RX_LOSS	3.0*	Uppler limit of RX loss for DCS1800	dB
DCS1800_MIN_RX_LOSS	-3.0*	Lower limit of RX loss for DCS1800	dB
PCS1900_MAX_RX_LOSS	3.0*	Uppler limit of RX loss for PCS1900	dB
PCS1900_MIN_RX_LOSS	-3.0*	Lower limit of RX loss for PCS1900	dB
[RX measurement samples]			
N_PM	5	Sample number per frame	N/A
M_PM	4	Number of Sample frames	N/A
The default value is an array and the elements are set to the same value.			

4.2.8 MT6162 RX path loss calibration

The calibration is to eliminate the path loss for high/middle/low LNA path.

4.2.8.1 MT6162 RX path loss calibration (steps)

1. Run RX path loss calibration for LNA high mode as section 4.2.7
2. Command Agilent 8960 or R&S CMU 200 to set BCCH carrier on ARFCN1 and downlink power of P_{DL_mode} (in dBm), (as specified by CFG entry 2G_LNA_MIDDLE/ 2G_LNA_LOW)

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3. Via META-DLL itnerface, Issues PM request on ARFCN1 over N_PM frames and M_PM samples per frame, with request gain of –35- P_{DL_mode}
4. Wait $P_{DL,rep}$ reported from META-DLL interface, the path loss on ARFCN1 could be evaluated as ΔL_1 (dB)= P_{DL_mode} - $P_{DL,rep}$
5. Repeat step 2~4, until path loss $\Delta L_2 \sim \Delta L_n$ for first band need to be calibrated, where n is up to 12, are complete.
6. Repeat step 2~5, until path loss table for all band MS supported are complete.
7. Repeat 2 ~ 6 untile middle & low mode is calibrated
8. Write the updated path loss table $L + \Delta L$ to target via META-DLL interface to NVRAM LID NVRAM_EF_L1_LNAPATHLOSS_LID

Note: ARFCN can be acquired from the path loss table for each band. It is the "Max ARFCN" for each band in initial data file. -1 means the end of ARFCN. L is value of "RX loss" for each band in initial data file for high mode. P_{DL_mode} P_DL, N_PM and M_PM are read from configuration file. The NVRAM LID NVRAM_EF_L1_LNAPATHLOSS_LID only consists of middle/low mode loss value and reuse the subband definition of high mode.

4.2.8.2 Configuration File

Parameter	Default Value	Description	Unit
[RX path loss table]			
GSM850_MAX_RX_LOSS_MIDDLE	3.0*	Upper limit of RX loss for LNA-middle mode of GSM850	dB
GSM850_MIN_RX_LOSS_MIDDLE	-3.0*	Lower limit of RX loss for LNA-middle mode of GSM850	dB
GSM850_MAX_RX_LOSS_LOW	3.0*	Upper limit of RX loss for LNA-low mode of GSM850	dB
GSM850_MIN_RX_LOSS_LOW	-3.0*	Lower limit of RX loss for LNA-low mode of GSM850	dB
GSM900_MAX_RX_LOSS_MIDDLE	3.0*	Upper limit of RX loss for LNA-middle mode of GSM900	dB
GSM900_MIN_RX_LOSS_MIDDLE	-3.0*	Lower limit of RX loss for LNA-middle mode of GSM900	dB
GSM900_MAX_RX_LOSS_LOW	3.0*	Upper limit of RX loss for LNA-low mode of GSM900	dB
GSM900_MIN_RX_LOSS_LOW	-3.0*	Lower limit of RX loss for LNA-low mode of GSM900	dB
DCS1800_MAX_RX_LOSS_MIDDLE	3.0*	Upper limit of RX loss for LNA-middle mode of DCS1800	dB
DCS1800_MIN_RX_LOSS_MIDDLE	-3.0*	Lower limit of RX loss for LNA-middle mode of DCS1800	dB
DCS1800_MAX_RX_LOSS_LOW	3.0*	Upper limit of RX loss for LNA-low mode of DCS1800	dB
DCS1800_MIN_RX_LOSS_LOW	-3.0*	Lower limit of RX loss for LNA-low mode of DCS1800	dB
PCS1900_MAX_RX_LOSS_MIDDLE	3.0*	Upper limit of RX loss for LNA-middle mode of PCS1900	dB
PCS1900_MIN_RX_LOSS_MIDDLE	-3.0*	Lower limit of RX loss for LNA-middle mode of PCS1900	dB
PCS1900_MAX_RX_LOSS_LOW	3.0*	Upper limit of RX loss for LNA-low mode of PCS1900	dB
PCS1900_MIN_RX_LOSS_LOW	-3.0*	Lower limit of RX loss for LNA-low mode of PCS1900	dB

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```
The default value is an array and the elements are set to the same value.
```

4.2.8.3 MT6162 RX path loss calibration (sample code)

```
bool __fastcall T_META_factory_calibration::RxLnaPathLoss_Cal(void)
{
   if(!m_pCal->RfCapability.capability.MiddleLowLnaCalibration)
   {
      return true;
   }
   AnsiString as_all_arfcn, as_arfcn;
   char tempbuf[256];
   PostMessage(
         ctrl.hPostMsgDestHandle,
         WM_MF_RF_PM_BEGIN,
         0,
         0
         );
   log->Add( "\n" + DateToStr(Date()) +  " " + CurrentTimeStr() +
         " ================== Path loss LNA middle/low calibration begin ===================="
         );
   if( ! m_rct_ctrl.RCT_ApplicationFormat( m_pRct, AGE_APP_FORMAT_GSM_GPRS ) )
   {
      CalErrorHandler( WM_MF_AGE8960_SET_OPERATION_MODE_FAIL );
      log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
                        " FAIL :"+
                        m_pRct->age.as_TaModel + " < application format = GSM/GPRS"
                       );
      return false;
   }
   if(! m_rct_ctrl.RCT_operatingMode( m_pRct, OPERATING_MODE_GSM_BCH ))
   {
      CalErrorHandler( WM_MF_AGE8960_SET_OPERATION_MODE_FAIL );
      if ( frmFatcory->rbAgilent8960->Checked )
      {
         log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
               " FAIL :"+
               " Agilent 8960< Operation mode = GSM BCH"
               );
      }
      else
      {
         log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
               " FAIL :"+
               " cmu200 < Band = Operation mode = GSM BCH"
               );
      }
      return false;
   }
   if( ! m_rct_ctrl.RCT_Config_CableLoss( m_pRct ) )
```


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```
{
   CalErrorHandler( WM_MF_RCT_SET_CABLE_LOSS_FAIL );
   log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
                    " FAIL : "+
                    m_pRct->as_RCT + " < config cable loss"
                  );
   return false;
}
FrequencyBand eFreqBand = FrequencyBand850;
for (int J=0; J< FrequencyBandCount; J++)
{
   for ( int K=0; K < PLTABLE_SIZE; K++)
      MF_rf_pm_power[J][K] = 0;
}
CHECK_TERMINATE_BY_USER
l1cal_agcPathLoss_T path_loss;
m_pCal->s_cal_obj.pc_RF_AGC_Obj->Get_PathLoss(path_loss);
// middle/low mode
l1cal_lnaPathLoss_T lna_path_loss;
m_pCal->s_cal_obj.pc_RF_AGC_Obj->Get_LnaPathLoss(lna_path_loss);
int vi_Band;
while (eFreqBand < FrequencyBandCount)
{
   switch (eFreqBand)
   {
      case FrequencyBand850:
      {
         if (! IsFreqBankSupported(  m_asFreqBank, eFreqBand))
         {
            eFreqBand++;
            continue;
         }
         vi_Band = age1960_GSM850_BAND;
         break;
      }
      case FrequencyBand900:
      {
         if (! IsFreqBankSupported(  m_asFreqBank, eFreqBand))
         {
            eFreqBand++;
            continue;
         }
         vi_Band = age1960_EGSM_BAND;
         break;
      }
      case FrequencyBand1800:
      {
         if (! IsFreqBankSupported(  m_asFreqBank, eFreqBand))
         {
            eFreqBand++;
            continue;
```


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```
        }
        vi_Band = age1960_DCS1800_BAND;
        break;
    }
    case FrequencyBand1900:
    {
        if (! IsFreqBankSupported(  m_asFreqBank, eFreqBand))
        {
            eFreqBand++;
            continue;
        }
        vi_Band = age1960_PCS1900_BAND;
        break;
    }
    default:
    {
        return false;
    }
} // switch
CHECK_TERMINATE_BY_USER;
if (!m_pCal->s_cal_obj.pc_RF_AGC_Obj->RxLossSectionExist(m_pCal->as_IniFile.c_str(), eFreqBand))
{
    CalErrorHandler(WM_MF_RF_PM_INI_FAIL);
    log->Add(DateToStr(Date()) +  " " + CurrentTimeStr() +
                    " FAIL :"+
                    " RX pathloss section is not in initial file: " + FreqBand_To_Str(eFreqBand)
                  );
    return false;
}
if( ! m_rct_ctrl.RCT_cellBand( m_pRct, vi_Band ) )
{
    CalErrorHandler( WM_MF_AGE8960_SET_BAND_FAIL );
    Trace_Err( "%s < band = %s", m_pRct->as_RCT.c_str(), FreqBand_To_Str( eFreqBand).c_str());
    return false;
}
Trace( "%s < band = %s", m_pRct->as_RCT.c_str(), FreqBand_To_Str( eFreqBand).c_str());
if( ! m_rct_ctrl.RCT_PowTranCont( m_pRct ) )
{
    CalErrorHandler( WM_MF_AGE8960_SET_BAND_FAIL );
    if ( frmFatcory->rbAgilent8960->Checked )
    {
        log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
                " FAIL :"+
                " Agilent 8960< Band = " + ViBand_To_Str( vi_Band )
                );
    }
    else
    {
        log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
                " FAIL :"+
                " cmu200 < Band = " + ViBand_To_Str( vi_Band )
```


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```
                );
        }
        return false;
    }
    CHECK_TERMINATE_BY_USER;
    if (IsFreqBankSupported(  m_asFreqBank, eFreqBand))
    {
        RestartTimerCal(WM_MF_RF_SELECT_BAND_FAIL);
        if(eFreqBand == FrequencyBand1900)
        {
            if(META_Rf_SelectFrequencyBand1900_r(  m_pCal->i_MainMETAHandle,  1,  MF_SelectBand_cnf_cb,
      &MF_SelectBand_token, NULL) !=  META_SUCCESS)
            {
                CalErrorHandler( WM_MF_RF_PM_SELECT_BAND_FAIL );
                log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
                        " FAIL:  Target < set Band1900 flag = 1 "
                        );
                return false;
            }
            log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
                    " Target < set Band1900 flag = 1"
                    );
        }
        else
        {
            if(META_Rf_SelectFrequencyBand1900_r(  m_pCal->i_MainMETAHandle,  0,  MF_SelectBand_cnf_cb,
      &MF_SelectBand_token, NULL) !=  META_SUCCESS)
            {
                CalErrorHandler( WM_MF_RF_PM_SELECT_BAND_FAIL );
                log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
                        " FAIL:  Target < set Band1900 flag = 0 "
                        );
                return false;
            }
            log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
                    " Target < set Band1900 flag = 0"
                    );
        }

        SUSPEND_CAL_THREAD;
    }
    char *modestr[] = {"Middle", "Low"};
    for(int lna_mode=0;lna_mode<2;lna_mode++)
    {
        Trace("----------------- Calibrate LNA %s mode -----------------", modestr[lna_mode]);
        if( ! m_rct_ctrl.RCT_cellPower( m_pRct, d_CELL_POWER_2G_LNA[lna_mode] ) )
        {
            CalErrorHandler( WM_MF_AGE8960_SET_POWER_FAIL );
            Trace_Err(log_str.sprintf("%s  <  Power  =  %lf  dBm",  m_pRct->as_RCT.c_str(),
      d_CELL_POWER_2G_LNA[lna_mode]));
            return false;
```


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```
 }
 Trace(log_str.sprintf("%s < Power = %lf dBm", m_pRct->as_RCT.c_str(),
d_CELL_POWER_2G_LNA[lna_mode]));
 for ( int I=0; I< PLTABLE_SIZE; I++)
 {
    short s_pm_arfcn = path_loss.agcPathLoss[eFreqBand][I].max_arfcn;
    if ( s_pm_arfcn != MF_RF_LAST_ELEMENT )
    {
       if ( s_pm_arfcn >=1024)
          s_pm_arfcn = 1023;

       CHECK_TERMINATE_BY_USER;
       if( ! m_rct_ctrl.RCT_BCHARFCN( m_pRct, s_pm_arfcn ) )
       {
          CalErrorHandler( WM_MF_RCT_SET_BCH_ARFCN_FAIL );
          Trace_Err( "%s < BCH = %d", m_pRct->as_RCT.c_str(), s_pm_arfcn);
          return false;
       }
       Trace( "%s < BCH = %d", m_pRct->as_RCT.c_str(), s_pm_arfcn);
       CHECK_TERMINATE_BY_USER;
       {
          Sleep( 200 );  // wait Agilent 8960 ready!
       }
       RfPm_Req MF_rf_pm_req;
       MF_rf_pm_req.arfcn = s_pm_arfcn;
       MF_rf_pm_req.sampleNoPerFrame = cM_PM;
       MF_rf_pm_req.gain = (MF_RF_GAIN_TO_BE_SUB - d_CELL_POWER_2G_LNA[lna_mode])
*AVG_POWER_PC_SIDE_MULTIPLY ;
       MF_rf_pm_req.frames = iN_PM;
       RestartTimerCal( WM_MF_RF_PM_FAIL );
       if( META_Rf_PM_r( m_pCal->i_MainMETAHandle, &MF_rf_pm_req, MF_rf_pm_cnf_cb,
&MF_rf_pm_token, NULL ) != META_SUCCESS )
       {
          CalErrorHandler( WM_MF_RF_PM_FAIL );
          log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
                " FAIL: "+
                " Target < PM : ARFCN = " + IntToStr( s_pm_arfcn ) +
                " sample per frame = " + IntToStr( cM_PM) +
                " gain = " + IntToStr( MF_rf_pm_req.gain ) +
                " frames = " + IntToStr( iN_PM)
                );
          return false;
       } // if
       CHECK_TERMINATE_BY_USER;
       log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
             " Target < PM : ARFCN = " + IntToStr( s_pm_arfcn) +
             ", sample per frame = " + IntToStr( cM_PM) +
             ", gain = " + IntToStr( MF_rf_pm_req.gain ) +
             ", frames = " + IntToStr( iN_PM)
             );
       SUSPEND_CAL_THREAD;
```


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```
STOP_RF;
log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
      " Target > power  = " + Double_To_AnsiString(MF_rf_pm_cnf->power/8.0)
      );
// (db)
MF_rf_pm_power[eFreqBand][ I ] =
   (d_CELL_POWER_2G_LNA[lna_mode]  -  1.0  *  (MF_rf_pm_cnf-
>power)/AVG_POWER_PC_SIDE_MULTIPLY );
float gain_offset;
if(lna_mode == 0)
{
   gain_offset  =  lna_path_loss.lnaPathLoss[eFreqBand][I].gain_offset_middle  +
( MF_rf_pm_power[eFreqBand][ I ]*GAIN_OFFSET_PC_MULTIPLY);
}
else if(lna_mode == 1)
{
   gain_offset  =  lna_path_loss.lnaPathLoss[eFreqBand][I].gain_offset_low  +
( MF_rf_pm_power[eFreqBand][ I ]*GAIN_OFFSET_PC_MULTIPLY);
}
if( gain_offset <= -128 || gain_offset >= 127)
{
   CalErrorHandler( WM_MF_RF_PM_FAIL );
   log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
         " FAIL: "+
         " Target < PM : ARFCN = " + IntToStr( s_pm_arfcn ) +
         " sample per frame = " + IntToStr( cM_PM) +
         " gain = " + IntToStr( MF_rf_pm_req.gain ) +
         " frames = " + IntToStr( iN_PM) +
         " path loss = " + Double_To_AnsiString( gain_offset / GAIN_OFFSET_PC_MULTIPLY )
         );
   return false;
}
if(lna_mode == 0)
{
   lna_path_loss.lnaPathLoss[eFreqBand][I].gain_offset_middle +=
      (signed char)( MF_rf_pm_power[eFreqBand][ I ]*GAIN_OFFSET_PC_MULTIPLY);
   sprintf(tempbuf,  "%2.3f",
lna_path_loss.lnaPathLoss[eFreqBand][I].gain_offset_middle/GAIN_OFFSET_PC_MULTIPLY);
   m_pCal->as_ResultBuf = m_pCal->as_ResultBuf + tempbuf + ", ";
}
else if(lna_mode == 1)
{
   lna_path_loss.lnaPathLoss[eFreqBand][I].gain_offset_low +=
      (signed char)( MF_rf_pm_power[eFreqBand][ I ]*GAIN_OFFSET_PC_MULTIPLY);
   sprintf(tempbuf,  "%2.3f",
lna_path_loss.lnaPathLoss[eFreqBand][I].gain_offset_low/GAIN_OFFSET_PC_MULTIPLY);
   m_pCal->as_ResultBuf = m_pCal->as_ResultBuf + tempbuf + ", ";
}
log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
      " delta L = " +
      IntToStr((signed char)( MF_rf_pm_power[eFreqBand][ I ]*GAIN_OFFSET_PC_MULTIPLY))+
```


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```
                "\n"
                );
            CHECK_TERMINATE_BY_USER;
        }
        else // if ( as_arfcn.ToInt() != MF_RF_LAST_ELEMENT )
        {
            CHECK_TERMINATE_BY_USER;
            break;
        } // else
    } // for 1 Band
    m_pCal->s_cal_obj.pc_RF_AGC_Obj->Set_LnaPathLoss(lna_path_loss);
    WriteAGCCalResultToFile(as_ID+".cal",Application->ExeName, m_pCal->b_CalResultPath, eFreqBand );
  } // LNA mode iteration
  eFreqBand++;
} // while ( eFreqBand <= 5 )
CHECK_TERMINATE_BY_USER;
log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
      " ================== Path loss LNA middle/low calibration end ==================== \n "
      );
return true;
}
```

4.2.9 W coefficient calibration

Since the RX architecture of MT6251 is Low-IF, image rejection compensation is used to cancel the un-wanted image signal down-converted into in-band. The purpose of IR W calibration is to provide the proper initial W coefficients for IR compensation to cancel the image signal. W coefficient might be un-stable depending on the environment condition. If tool detects the calibration result is un-stable, it will trigger W coefficient calibration process again. Thus, a maximum retry count [IRRW_RETRY_COUNT] is defined in *.cfg file to stop the calibration process. Note that IRRW_RETRY_COUNT should be less than or equal to 73 for MT6251. W coefficient has an offset between different IF, and this offset will also be obtained during calibration process. The default band use to calibrate W coefficient offset is GSM900, however, it can be configured by modifying [IRR_W_NEGATIVE_IF_CALIBRATION_BAND] in *.cfg file.

4.2.9.1 W coefficient calibration (steps)

1. Command Agilent 8960 or R&S CMU 200 to set BCCH carrier on the predefined ARFCN for calibration and downlink power of P_{DL} (in dBm),

   For MT6251: GSM850 {189}, GSM900: {36}, DCS1800: {575, 700, 824}, PCS1900: {562, 662, 762}
2. Via META-DLL itnerface, Issues PM request on the predefined ARFCN over N_PM frames and M_PM samples per frame, with request gain of –35- P_{DL}
3. Repeat step 1~3, sweep over all predefined ARFCN for the specified frequency band.
4. Repeat step 1~4, until all MS supported bands are complete.
5. Select frequency band as the defined by IRR_W_NEGATIVE_IF_CALIBRATION_BAND in the CFG
6. Command Agilent 8960 or R&S CMU200 to the predefined ARFCN for calibration and downlink power of P_{DL} (in dBm)

   For MT6251: GSM850: {203}, GSM900: {38}, DCS1800: {814}, PCS1900: {774}
7. Via META-DLL itnerface, Issues PM (META_Rf_IrPm_r) request on the predefined ARFCN over N_PM frames and M_PM samples per frame, with request gain of –35- P_{DL}
8. Get the calibration result via META-DLL interface (META_Rf_GetSpecialCoef_r)

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9. If any of the calibration result equals to INVALID_W_COEF (32765), then add the arfcn for retry
10. Repeat 1 ~ 9 until all the remaining result is not invalid
11. Write the calibration data to NVRAM_EF_L1_RFSPECIALCOEF_LID

4.2.9.2 W coefficient calibration (sample code)

```
    if(m_pCal->s_CalItem.b_irw_cal && m_pCal->s_cal_obj.pc_RF_IRW_Obj->Check_IRW_Coefficients_Supported()
        )
    {
        Trace(log_str.sprintf(" ================ IRR W coefficient calibration band %s begin ================= ", ViBand_To_Str( vi_Band ).c_str()) );
#ifndef _UT_
        if( ! m_rct_ctrl.RCT_cellPower( m_pRct, m_dIRRW_P_DL ) )
        {
            CalErrorHandler( WM_MF_AGE8960_SET_POWER_FAIL );
            Trace_Err(log_str.sprintf("%s < Power = %lf dBm", m_pRct->as_RCT.c_str(), m_dIRRW_P_DL));
            return false;
        }
        Trace(log_str.sprintf("%s < Power = %lf dBm", m_pRct->as_RCT.c_str(), m_dIRRW_P_DL));
#endif // #ifndef _UT_
        AnsiString log_str;
        vector<short> avgw_cal_arfcn;
        m_pCal->s_cal_obj.pc_RF_IRW_Obj->Get_AverageW_MidChannel(eFreqBand, m_pCal->ui_2g_rf_id, avgw_cal_arfcn);
        for(int i=0;i<avgw_cal_arfcn.size();i++)
        {
#ifndef _UT_
            if( ! m_rct_ctrl.RCT_BCHARFCN( m_pRct, avgw_cal_arfcn[i] ) )
            {
                CalErrorHandler( WM_MF_RCT_SET_BCH_ARFCN_FAIL );
                Trace_Err(log_str.sprintf("%s < BCH ARFCN = %d", m_pRct->as_RCT, avgw_cal_arfcn[i]));
                return false;
            }
#endif // #ifndef _UT_

            CHECK_TERMINATE_BY_USER;
            Trace(log_str.sprintf("%s < BCH ARFCN = %d", m_pRct->as_RCT, avgw_cal_arfcn[i]));

            {
                Sleep( 200 );  // wait Agilent 8960 ready!
            }

            // if Agilent 8960 not read, target will get error power!
            RfPm_Req MF_rf_pm_req;
            MF_rf_pm_req.arfcn = avgw_cal_arfcn[i];
            MF_rf_pm_req.sampleNoPerFrame = cM_PM;
            MF_rf_pm_req.gain = (-37 - m_dIRRW_P_DL) *AVG_POWER_PC_SIDE_MULTIPLY ; //(LNA, Mixer, LPF1) = (28, 10, -6) = -2dB (power Gain) = -16 (tool setting)
            MF_rf_pm_req.frames = iN_PM;

            RestartTimerCal( WM_MF_RF_PM_FAIL );
```


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```
            if( META_Rf_PM_r( m_pCal->i_MainMETAHandle, &MF_rf_pm_req, MF_rf_pm_cnf_cb,
&MF_rf_pm_token, NULL ) != META_SUCCESS )
            {
               CalErrorHandler( WM_MF_RF_PM_FAIL );
               log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
                     " FAIL: "+
                     " Target < PM : ARFCN = " + IntToStr( avgw_cal_arfcn[i] ) +
                     " sample per frame = " + IntToStr( cM_PM) +
                     " gain = " + IntToStr( MF_rf_pm_req.gain ) +
                     " frames = " + IntToStr( iN_PM)
                     );
               return false;
            } // if

            CHECK_TERMINATE_BY_USER;
            log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
                  " Target < PM : ARFCN = " + IntToStr( avgw_cal_arfcn[i]) +
                  ", sample per frame = " + IntToStr( cM_PM) +
                  ", gain = " + IntToStr( MF_rf_pm_req.gain ) +
                  ", frames = " + IntToStr( iN_PM)
                  );
            //  Sleep(100);// delay for power measurement

            SUSPEND_CAL_THREAD;
            STOP_RF;
         }
         // negative IF channel
         FrequencyBand negative_if_band =
Get_FreqBandFromStr(m_asIRR_W_NEGATIVE_IF_CALIBRATION_BAND);
         if(eFreqBand == negative_if_band)
         {

#ifndef _UT_
            if( ! m_rct_ctrl.RCT_BCHARFCN( m_pRct, m_pCal->s_cal_obj.pc_RF_IRW_Obj-
>Get_NegativeIFChannel(negative_if_band, m_pCal->ui_2g_rf_id) ) )
            {
               CalErrorHandler( WM_MF_RCT_SET_BCH_ARFCN_FAIL );
               Trace_Err(log_str.sprintf("%s < BCH ARFCN = %d", m_pRct->as_RCT, m_pCal-
>s_cal_obj.pc_RF_IRW_Obj->Get_NegativeIFChannel(negative_if_band, m_pCal->ui_2g_rf_id)));
               return false;
            }
#endif // #ifndef _UT_

            CHECK_TERMINATE_BY_USER;
            Trace(log_str.sprintf("%s < BCH ARFCN = %d", m_pRct->as_RCT, m_pCal-
>s_cal_obj.pc_RF_IRW_Obj->Get_NegativeIFChannel(negative_if_band, m_pCal->ui_2g_rf_id)));

            {
               Sleep( 200 );  // wait Agilent 8960 ready!
            }
```


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```
            // if Agilent 8960 not read, target will get error power!
            RfPm_Req MF_rf_pm_req;
            MF_rf_pm_req.arfcn = m_pCal->s_cal_obj.pc_RF_IRW_Obj->Get_NegativeIFChannel(negative_if_band, m_pCal->ui_2g_rf_id);
            MF_rf_pm_req.sampleNoPerFrame = cM_PM;
            MF_rf_pm_req.gain = (-37 - m_dIRRW_P_DL) *AVG_POWER_PC_SIDE_MULTIPLY ;
            MF_rf_pm_req.frames = iN_PM;

            RestartTimerCal( WM_MF_RF_PM_FAIL );
            if( META_Rf_PM_r( m_pCal->i_MainMETAHandle, &MF_rf_pm_req, MF_rf_pm_cnf_cb, &MF_rf_pm_token, NULL ) != META_SUCCESS )
            {
               CalErrorHandler( WM_MF_RF_PM_FAIL );
               log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
                     " FAIL: "+
                     " Target < PM : ARFCN = " + IntToStr( m_pCal->s_cal_obj.pc_RF_IRW_Obj->Get_NegativeIFChannel(negative_if_band, m_pCal->ui_2g_rf_id) ) +
                     " sample per frame = " + IntToStr( cM_PM) +
                     " gain = " + IntToStr( MF_rf_pm_req.gain ) +
                     " frames = " + IntToStr( iN_PM)
                     );
               return false;
            } // if

            CHECK_TERMINATE_BY_USER;
            log->Add( DateToStr(Date()) +  " " + CurrentTimeStr() +
                  " Target < PM : ARFCN = " + IntToStr( m_pCal->s_cal_obj.pc_RF_IRW_Obj->Get_NegativeIFChannel(negative_if_band, m_pCal->ui_2g_rf_id)) +
                  ", sample per frame = " + IntToStr( cM_PM) +
                  ", gain = " + IntToStr( MF_rf_pm_req.gain ) +
                  ", frames = " + IntToStr( iN_PM)
                  );

            SUSPEND_CAL_THREAD;
            STOP_RF;
         }
         Trace(log_str.sprintf(" ================ IRR W coefficient calibration band %s end ================= ", ViBand_To_Str( vi_Band ).c_str()) );
      }

bool __fastcall T_META_factory_calibration::IRWRetry_Cal(void)
{
   if(!m_pCal->s_cal_obj.pc_RF_IRW_Obj->Get_AverageW_NeedRetry())
   {
      Trace("Don't need IRR W coefficient retry calibration");
      return true;
   }
   AnsiString as_all_arfcn, as_arfcn;

   PostMessage(
         ctrl.hPostMsgDestHandle,
```


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```
            WM_MF_RF_IRR_RETRY,
            0,
            0
            );

    Trace(" ================== IRR W coefficient retry calibration begin ==================");
#ifndef _UT_
    if( ! m_rct_ctrl.RCT_ApplicationFormat( m_pRct, AGE_APP_FORMAT_GSM_GPRS ) )
    {
        CalErrorHandler( WM_MF_AGE8960_SET_OPERATION_MODE_FAIL );
        Trace_Err(m_pRct->age.as_TaModel + " < application format = GSM/GPRS");
        return false;
    }

    if(! m_rct_ctrl.RCT_operatingMode( m_pRct, OPERATING_MODE_GSM_BCH ))
    {
        CalErrorHandler( WM_MF_AGE8960_SET_OPERATION_MODE_FAIL );
        Trace_Err(log_str.sprintf("%s < Operation mode = GSM BCH", m_pRct->as_RCT.c_str()));
        return false;
    }
    Trace(log_str.sprintf("%s < Operation mode = GSM BCH", m_pRct->as_RCT.c_str()));

    if( ! m_rct_ctrl.RCT_Config_CableLoss( m_pRct ) )
    {
        CalErrorHandler( WM_MF_RCT_SET_CABLE_LOSS_FAIL );
        Trace_Err(m_pRct->as_RCT + " < config cable loss");
        return false;
    }
#endif
    FrequencyBand eFreqBand = FrequencyBand850;

    int vi_Band;
    while (eFreqBand < FrequencyBandCount)
    {
        switch (eFreqBand)
        {
            case FrequencyBand850:
                {
                    if (! IsFreqBankSupported(  m_asFreqBank, eFreqBand))
                    {
                        eFreqBand++;
                        continue;
                    }
                    vi_Band = age1960_GSM850_BAND;
                }
                break;

            case FrequencyBand900:
                {
                    if (! IsFreqBankSupported(  m_asFreqBank, eFreqBand))
                    {
```


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```
                eFreqBand++;
                continue;
            }
            vi_Band = age1960_EGSM_BAND;
        }
        break;

    case FrequencyBand1800:
        {
            if (! IsFreqBankSupported(  m_asFreqBank, eFreqBand))
            {
                eFreqBand++;
                continue;
            }
            vi_Band = age1960_DCS1800_BAND;
        }
        break;

    case FrequencyBand1900:
        {
            if (! IsFreqBankSupported(  m_asFreqBank, eFreqBand))
            {
                eFreqBand++;
                continue;
            }
            vi_Band = age1960_PCS1900_BAND;
        }
        break;

    default:
        assert(false);
        break;
    } // switch

    CHECK_TERMINATE_BY_USER;

#ifndef _UT_
    if( ! m_rct_ctrl.RCT_cellBand( m_pRct, vi_Band ) )
    {
        CalErrorHandler( WM_MF_AGE8960_SET_BAND_FAIL );
        Trace_Err(log_str.sprintf("%s < Band = %s", m_pRct->as_RCT.c_str(),
ViBand_To_Str( vi_Band ).c_str() ));
        return false;
    }
    Trace(log_str.sprintf("%s < Band = %s", m_pRct->as_RCT.c_str(), ViBand_To_Str( vi_Band ).c_str() ));

    if( ! m_rct_ctrl.RCT_PowTranCont( m_pRct ) )
    {
        CalErrorHandler( WM_MF_AGE8960_SET_BAND_FAIL );
        Trace_Err(log_str.sprintf("%s < continuous transmission", m_pRct->as_RCT.c_str()));
        return false;
```


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```
    }
    Trace(log_str.sprintf("%s < continuous transmission", m_pRct->as_RCT.c_str()));

    CHECK_TERMINATE_BY_USER;

    //if(!m_rct_ctrl.RCT_cellPower_ex(m_pRct, m_dIRRW_P_DL)
    if( ! m_rct_ctrl.RCT_cellPower( m_pRct, m_dIRRW_P_DL ) )
    {
      CalErrorHandler( WM_MF_AGE8960_SET_POWER_FAIL );
      Trace_Err(log_str.sprintf("%s < Power = %lf dBm", m_pRct->as_RCT.c_str(), m_dIRRW_P_DL));
      return false;
    }
    Trace(log_str.sprintf("%s < Power = %lf dBm", m_pRct->as_RCT.c_str(), m_dIRRW_P_DL));

    CHECK_TERMINATE_BY_USER;
#endif // #ifndef _UT_
    if(m_pCal->s_cal_obj.pc_RF_IRW_Obj->Check_IRW_Coefficients_Supported())
    {
      std::vector<S_IRW_RETRY_ENTRY_T> retry_channels;
      std::vector<S_IRW_RETRY_ENTRY_T>::iterator retry_channel_iterator;
      FrequencyBand negative_if_band =
Get_FreqBandFromStr(m_asIRR_W_NEGATIVE_IF_CALIBRATION_BAND);
      Select1900Band(eFreqBand);
      Trace("==========================================");
      Trace(log_str.sprintf("Retry Band = %s", ViBand_To_Str( vi_Band ).c_str() ));
      for(int i=1;i<=m_iIRRW_RETRY_COUNT;i++)
      {
        Trace(log_str.sprintf("+++++++++++ Round %d +++++++++++", i));
        m_pCal->s_cal_obj.pc_RF_IRW_Obj->Get_AverageW_RetryEntry(eFreqBand, negative_if_band,
m_pCal->ui_2g_rf_id, retry_channels);
        if(retry_channels.begin() == retry_channels.end())
        {
          break;
        }
        for(retry_channel_iterator = retry_channels.begin();retry_channel_iterator != retry_channels.end();
retry_channel_iterator++)
        {
          int arfcn = retry_channel_iterator->arfcn + ( (i/2) * ((i%2) ? 1 : -1));
#ifndef _UT_
          if( ! m_rct_ctrl.RCT_BCHARFCN( m_pRct, arfcn ) )
          {
            CalErrorHandler( WM_MF_RCT_SET_BCH_ARFCN_FAIL );
            Trace_Err(log_str.sprintf("%s < BCH ARFCN = %d", m_pRct->as_RCT, arfcn ));
            return false;
          }
#endif // #ifndef _UT_

          CHECK_TERMINATE_BY_USER;
          Trace(log_str.sprintf("%s < BCH ARFCN = %d", m_pRct->as_RCT, arfcn ));
          Trace(log_str.sprintf("wait 200 ms for %s output power stable", m_pRct->as_RCT.c_str()));
          {
```


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```
                Sleep( 200 );  // wait Agilent 8960 ready!
            }
            Trace(log_str.sprintf("wait 200 ms for %s output power stable done", m_pRct->as_RCT.c_str()));

            // if Agilent 8960 not read, target will get error power!
            RfIrPm_Req rf_irpm_req;
            RfPm_Cnf rf_pm_cnf;
            rf_irpm_req.m_Pm.arfcn = arfcn;
            rf_irpm_req.m_Pm.sampleNoPerFrame = cM_PM;
            rf_irpm_req.m_Pm.gain = (-37 - m_dIRRW_P_DL) *AVG_POWER_PC_SIDE_MULTIPLY ;
            rf_irpm_req.m_Pm.frames = iN_PM;
            rf_irpm_req.m_IfFlag = retry_channel_iterator->if_flag;

            if( META_Rf_IrPm_r( m_pCal->i_MainMETAHandle, 2000, &rf_irpm_req, &rf_pm_cnf) !=
META_SUCCESS )
            {
                CalErrorHandler( WM_MF_RF_PM_FAIL );
                Trace_Err(log_str.sprintf("Target PM: ARFCN = %d sample per frame = %d gain = %d frames =
%d",
                        arfcn,
                        cM_PM,
                        rf_irpm_req.m_Pm.gain,
                        iN_PM));
                return false;
            }
            CHECK_TERMINATE_BY_USER;
            Trace(log_str.sprintf("Target PM: ARFCN = %d sample per frame = %d gain = %d frames = %d",
                        arfcn,
                        cM_PM,
                        rf_irpm_req.m_Pm.gain,
                        iN_PM));
            STOP_RF;
        }
    }
    m_pCal->s_cal_obj.pc_RF_IRW_Obj->Get_AverageW_RetryEntry(eFreqBand, negative_if_band,
m_pCal->ui_2g_rf_id, retry_channels);
    if(retry_channels.size() > 0)
    {
        CalErrorHandler(WM_MF_RF_IRR_RETRY_FAIL);
        Trace_Err("IRR W coefficient calibraiton is unable to converge");
        for(retry_channel_iterator = retry_channels.begin();retry_channel_iterator != retry_channels.end();
retry_channel_iterator++)
        {
            Trace_Err(log_str.sprintf("failed channel: %d, if_flag (%d)", retry_channel_iterator->arfcn,
retry_channel_iterator->if_flag));
        }
        return false;
    }
}

eFreqBand++;
```


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```
} // while ( eFreqBand <= 5 )

if( m_pCal->s_cal_obj.pc_RF_IRW_Obj->Check_IRW_Coefficients_Supported() )
{
    AnsiString log_str;
    RestartTimerCal(WM_MF_RF_SELECT_BAND_FAIL);
    m_pCal->s_cal_obj.pc_RF_IRW_Obj->ConfirmCallback = ::CNF_MF;
    m_pCal->s_cal_obj.pc_RF_IRW_Obj->REQ_Read_From_Runtime_Start(m_pCal->ui_2g_rf_id);
    SUSPEND_CAL_THREAD;
    CHECK_TERMINATE_BY_USER;

    E_METAAPP_RESULT_T state = m_pCal->s_cal_obj.pc_RF_IRW_Obj->Get_ConfirmState();
    if (state != METAAPP_SUCCESS)
    {
        if (METAAPP_NVRAM_LID_VER_NOT_SUPPORT == state)
        {
            CalErrorHandler(WM_MF_NVRAM_EF_L1_RFSPECIALCOEF_LID_VERNO_FAIL);
            Trace_Err("NVRAM_EF_L1_RFSPECIALCOEF_LID version is not support, please update META to
latest version. ");
        }
        else
        {
            CalErrorHandler(WM_MF_NVRAM_IRRW_GET_FAIL);
            Trace("Target > Get L1 runtime RF special coefficients");
        }
        return false;
    }
    RestartTimerCal(WM_MF_RF_SELECT_BAND_FAIL);
    m_pCal->s_cal_obj.pc_RF_IRW_Obj->ConfirmCallback = ::CNF_MF;
    m_pCal->s_cal_obj.pc_RF_IRW_Obj->REQ_Write_To_NVRAM_Start();
    SUSPEND_CAL_THREAD;
    CHECK_TERMINATE_BY_USER;

    state = m_pCal->s_cal_obj.pc_RF_IRW_Obj->Get_ConfirmState();
    if (state != METAAPP_SUCCESS)
    {
        if (METAAPP_NVRAM_LID_VER_NOT_SUPPORT == state)
        {
            CalErrorHandler(WM_MF_NVRAM_EF_L1_RFSPECIALCOEF_LID_VERNO_FAIL);
            Trace_Err("NVRAM_EF_L1_RFSPECIALCOEF_LID version is not support, please update META to
latest version. ");
        }
        else
        {
            CalErrorHandler(WM_MF_NVRAM_IRRW_WRITE_FAIL);
            Trace_Err("Target < Write IR W coefficients to NVRAM");
        }
        return false;
    }
    Trace("Target < Write IR W coefficients to NVRAM");
    RF_AvgW_Coef_T avgw;
```


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```
        char buf[512];
        m_pCal->s_cal_obj.pc_RF_IRW_Obj->Get_AverageW(avgw);
        Array_To_String_short(buf, avgw.w_re, 19 , ',');
        Trace(log_str.sprintf("IR W coefficients real:%s", buf));
        m_pCal->as_ResultBuf =  m_pCal->as_ResultBuf +" \n IRW real, "+ buf +"\n";
        Array_To_String_short(buf, avgw.w_im, 19 , ',');
        Trace(log_str.sprintf("IR W coefficients image:%s", buf));
        m_pCal->as_ResultBuf =  m_pCal->as_ResultBuf +" \n IRW image, "+ buf +"\n";
        // write result file;
        WriteIRWCalResultToFile(as_ID+".cal", Application->ExeName, m_pCal->b_CalResultPath);
    }

    CHECK_TERMINATE_BY_USER;

    Trace(" ==================== IRR W coefficient retry calibration end ==================== \n ");
    PostMessage(
            ctrl.hPostMsgDestHandle,
            WM_MF_RF_IRR_RETRY_DONE,
            0,
            0
            );
    return true;
}
```

4.2.10 IP2 Calibration

4.2.10.1 MT6139, MT6140 IP2 calibration

1. Configure Radio Communication Tester (RCT) to set BCCH carrier as IP2_arfcn_C0_xxx, TCH channel as IP2_arfcn_TCH_xxx.
2. Configure RCT to set downlink power as IP2_CAL_P_DL_OFF.
3. Writes amcodeI = IP2_AMCODEI1, amcodeQ = IP2_AMCODEQ1, rxamcalmode=0 to target NVRAM via META_DLL interface.
4. Issues PM request on ARFCN = IP2_arfcn_C0_xxx-30 over IP2_N_PM frames and IP2_M_PM samples per frame, with request gain of IP2_GAIN*8 Via META_DLL interface.
5. Get acodeI, acodeQ from target RF transceiver register via META_DLL interface.
6. Set mode of CW2 of RF transceiver to standby mode via META_DLL interface.
7. Write acodeI, acodeQ, rxamcalmode=1 to target NVRAM via META-DLL interface.
8. Issues PM request on ARFCN= IP2_arfcn_C0_xxx-30 over IP2_N_PM frames and IP2_M_PM samples per frame, with request gain of IP2_GAIN*8 Via META-DLL interface.
9. Set MDC1_I[0] = iOffset; MDC1[0] =qOffset; where iOffset and qOffset if derived from PM result of step 8.
10. Command Radio Communication Tester (RCT) to set downlink power as IP2_CAL_P_DL_ON.
11. Issues PM request on ARFCN = IP2_arfcn_C0_xxx-30 over IP2_N_PM frames and IP2_M_PM samples per frame, with request gain of IP2_GAIN*8 Via META-DLL interface.
12. Set MDC1_I[1] = iOffset; MDC1[1] =qOffset; where iOffset and qOffset if derived from PM result of step 11.
13. Repeat step 2~12 by set amcodeI= IP2_AMCODEI2, amcodeQ= IP2_AMCODEQ2.
14. Command RCT to set downlink power as IP2_CAL_P_DL_OFF.
15. Evaluates amcode_I = -1.0*offset_I/slope_I, where slope_I= (MDC2_I[1]-MDC1_I[1] –(MDC2_I[0]-MDC1_I[0])) / (IP2_AMCODEI2 - IP2_AMCODEI1), offset_I= MDC2_I[0]-MDC1_I[0] - slope_I* IP2_AMCODEI1. amcode_Q. = -1.0*offset_Q/slope_Q, where slope_Q= (MDC2_Q[1]-MDC1_Q[1] –(MDC2_Q[0]-MDC1_Q[0])) / (IP2_AMCODEQ2 - IP2_AMCODEQ1), offset_Q= MDC2_Q[0]-MDC1_Q[0] - slope_Q* IP2_AMCODEI1.

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16. Writes amcode_I, amcode_Q evaluated from step15 and rxamcalmode=0 to target NVRAM via META-DLL interface.
17. Issues PM request on ARFCN= IP2_arfcn_C0_xxx-30 over IP2_N_PM frames and IP2_M_PM samples per frame, with request gain of IP2_GAIN*8 Via META-DLL interface.
18. Get acode_I, acode_Q from target RF transceiver register via META-DLL interface.
19. Writes acode_I, acode_Q derived from step 18 and rxamcalmode=2 to target NVRAM via META-DLL interface.
20. Repeat step 1~19 for each band need to be calibrated, until acode_I,acode_Q, amcode_I, amcode_Q of each band is calibrated.
21. Command RCT to set BCCH carrier as IP2_arfcn_C0_xxx, TCH channel as IP2_arfcn_TCH_xxx.
22. Command RCT to set downlink power as IP2_CHECK_P_DL_ON.
23. Issues PM request on ARFCN= IP2_arfcn_C0_xxx-30 over IP2_N_PM frames and IP2_M_PM samples per frame, with request gain of IP2_GAIN*8 Via META-DLL interface.
24. If abs(iOffset) > IP2_MAX_IDC or abs(qOffset) > IP2_MAX_QDC, where iOffset and qOffset is derived from PM result of step 23. IP2 check fail, abort IP2 check procedure. Otherwise, IP2 check pass. Set MDCI[0]=iOffset, MDCQ[0]=qOffset
25. Repeat step 21~23 by set RCT downlink power as IP2_CAL_P_DL_OFF. Set MDCI[1]=iOffset, MDCQ[1]=qOffset
26. Check if abs(DCI)> IP2_MAX_IDC or abs(DCQ) > IP2_MAX_QDC, where DCI = MDCI[0] - MDCI[1];
    DCQ = MDCQ[0] - MDCQ[1].
27. Repeat step 21~ 26 for each band need to be calibrated, until iOffset and qOffset of each band is checked.

Note:

- IP2_arfcn_C0_xxx, IP2_arfcn_TCH_xxx, IP2_CAL_P_DL_OFF, P2_CAL_P_DL_ON, IP2_AMCODEI1, IP2_AMCODEQ1, IP2_AMCODEI2, IP2_AMCODEQ2, IP2_N_PM, IP2_M_PM, IP2_GAIN, IP2_MAX_IDC and IP2_MAX_QDC are specified in configuration file.

4.2.10.2 Skyworks 74045, 74117, 74400 IP2 calibration

1. Command Radio Communication Tester (RCT) to set BCCH carrier as IP2_arfcn_C0_xxx, TCH channel as IP2_arfcn_TCH_xxx.
2. Command RCT to set downlink power as IP2_CAL_P_DL_ON.
3. Writes icorrection= IP2_ICORRECTION1, qcorrection= IP2_QCORRECTION1to target NVRAM via META-DLL interface.
4. Issues PM request on ARFCN= IP2_arfcn_C0_xxx-30 over IP2_N_PM frames and IP2_M_PM samples per frame, with request gain of IP2_GAIN*8 Via META-DLL interface.
5. Set DC_I [0] = iOffset; DC_Q[0] =qOffset; where iOffset and qOffset if derived from PM result of step 4.
6. Repeat step 2~5 by set icorrection= IP2_ICORRECTION2, qcorrection= IP2_QCORRECTION2.
7. Evaluates icorrection = - offset_I/slope_I, where slope_I= (DC_I[1] - DC_I[0]) / (IP2_ICORRECTION2 - IP2_ICORRECTION1), offset_I= DC_I[0] - slope_I* IP2_ICORRECTION1. qcorrection = - offset_Q/slope_Q, where slope_Q= (DC_Q[1] - DC_Q[0]) / (IP2_QCORRECTION2 - IP2_QCORRECTION1), offset_Q= DC_I[0] - slope_Q* IP2_QCORRECTION1.
8. Repeat step 2~7 for each band need to be calibrated, until icorrection and qcorrection of each band is calibrated.
9. Writes icorrection, qcorrection evaluated from step7 to target NVRAM via META-DLL interface.
10. Command RCT to set BCCH carrier as IP2_arfcn_C0_xxx, TCH channel as IP2_arfcn_TCH_xxx.
11. Command Radio Communication Tester (RCT) to set downlink power as IP2_CHECK_P_DL_ON.
12. Issues PM request on ARFCN= IP2_arfcn_C0_xxx-30 over IP2_N_PM frames and IP2_M_PM samples per frame, with request gain of IP2_GAIN*8 Via META-DLL interface.

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13. If abs(iOffset) > IP2_MAX_IDC or abs(qOffset) > IP2_MAX_QDC, where iOffset and qOffset is derived from PM result of step 23. IP2 check fail, abort IP2 check procedure. Otherwise, IP2 check pass.
14. Repeat step 10~13 for each band need to be calibrated, until iOffset and qOffset of each band is checked.

Note:

- IP2_arfcn_C0_xxx, IP2_arfcn_TCH_xxx, IP2_CAL_P_DL_ON, IP2_ICORRECTION1 IP2_QCORRECTION1, IP2_ICORRECTION2, IP2_QCORRECTION2, IP2_N_PM, IP2_M_PM, IP2_GAIN, IP2_MAX_IDC and IP2_MAX_QDC are specified in configuration file.

4.2.11 TX FB DAC calibration

1. If Agilent 8960 is used, configure its operation mode to GSM BCH + TCH.
2. Configure TX parameters of radio communication tester (RCT). The TX parameters include multiple measurement count, trigger way, and trigger delay.
3. If it is not required to calibrate GMSK APC, read GMSK APC ramp profile from NVRAM via META_DLL interface.
4. Read ad6546tx calibration data from NVRAM via META_DLL interface.
5. Set target AM_FB_DAC of all supported bands to 0 via META_DLL interface.
6. Set band, ARFCN, and target power of high and low bands to parameters as configured in configuration file.
band[0] = TX_FB_DAC_LOW_BAND;
band[1] = TX_FB_DAC_HIGH_BAND;
arfcn[0] = TX_FB_DAC_LOW_ARFCN;
arfcn[1] = TX_FB_DAC_HIGH_ARFCN;
target_power[0] = TX_FB_DAC_LOW_TARGET_POWER;
target_power[1] = TX_FB_DAC_HIGH_TARGET_POWER.
7. Set i = 0.
8. Configure band of RCT to band[i].
9. Configure ARFCN of TCH of RCT to arfcn[i] and ARFCN of BCH to the channel instead of that of TCH.
10. Calculate pcl = dBm_To_PCL(band_index, d_target_power[i]), where dBm_To_PCL() converts nominal power to PCL.
11. Configure the TX level of RCT to pcl.
12. Set target APC DAC of level pcl to TX_FB_DAC_APC_DAC – high_apc_dc_offset, where TX_FB_DAC_APC_DAC is specified in configuration file.
13. Command target to transmit normal burst via META_DLL interface.
14. Read TX power from RCT and save it to virTX[i] variable.
15. Evaluate eva_fb_dac[i] = (virTX[i] - target_power[i]) / TX_FB_DAC_C, where TX_FB_DAC_C is specified in configuration file. If eva_fb_dac[i] is larger than MAX_OTHELLOE_TX_FB_DAC, set eva_fb_dac[i] = MAX_OTHELLOE_TX_FB_DAC. If eva_fb_dac[i] is lower than MIN_OTHELLOE_TX_FB_DAC, set eva_fb_dac[i] = MIN_OTHELLOE_TX_FB_DAC.
16. Set I = 1, and go to step 8.
17. Set the following fields of ad6546tx parameters and then write it to NVRAM via META_DLL interface.
ad6546tx.s_CalData[NV_OTHELLO_BAND_GSM850].c_AM_FB_DAC = c_eva_fb_dac[0];
ad6546tx.s_CalData[NV_OTHELLO_BAND_GSM900].c_AM_FB_DAC = c_eva_fb_dac[0];
ad6546tx.s_CalData[NV_OTHELLO_BAND_DCS1800].c_AM_FB_DAC = c_eva_fb_dac[1];
ad6546tx.s_CalData[NV_OTHELLO_BAND_PCS1900].c_AM_FB_DAC = c_eva_fb_dac[1].

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4.2.12 TX power control level (PCL) calibration

4.2.12.1 RFMD 3140, 3146, 3166, 3196, 3198, 4180 and Skyworks 77340 3 point GMSK TX power control level (PCL) calibration

1. Command radio communication tester (RCT) to set TCH channel as arfcn_C0_xxx, TSC value and respected MS uplink PCL.
2. Issue the TX command to target with the parameter of arfcn_C0_xxx, testing period in frames, AFC DAC initial value gotten in 2 or 33 steps AFC slope calibration and TX power in PCL.
3. Command the RCT to measure the received GMSK MS uplink power, and check whether it is in the range specified by the configuration file.
4. Follow 3, if it is in the range. Jump to step 5. Otherwise, adjust APC DAC value s as $s + \Delta s$ $\Delta s = c_n \times (P_{wanted} - P_{meas})$, where s is the range of 0~1023 and c_n is unique is unique for each PCL calibration.
5. Get APC control voltage V_set by the following formula
   V_set = (APC DC offset + s) / 1024.0 * 2.8 * 15.0 / 25.0, where APC DC offset is value specified in section [level, ramp] in initial file.
6. Repeat step 1~5 for 3 PCL (PCL_low, PCL_mid, PCL_h), until V_set_low, V_set_mid and V_set_h are complete.
7. Calculate Rload_high by PCL_h, V_set_h, PCL_mid, V_set_mid and the following formula
   Rload_high=[(8/3/√2*(V_set_h - V_set_mid))/(√PCL_h - √PCL_mid)]^2.
8. Calculate K1_high using the following formula
   K1_high = 8/3/√2*V_set_mid – √(Rload_high*PCL_mid).
9. Calculate Vset of each power level from PCLmax to PCLmid by the following formula
   Vset=3/8*√2*(√(Rload_high*PCL_power)+K1_high), where PCL_power =
   (10^((P_{wanted} + Correction)/10))/1000, Correction is listed in [TX PCL table] section of CFG file.
10. Calculate Rload_low by PCL_mid, Vset_mid, PCL_low, Vset_low and the following formula
    Rload_low=[(8/3/√2*(V_set_mid - V_set_low))/(√PCL_mid - √PCL_low)]^2.
11. Calculate K1_low by the following formula
    K1_low= 8/3/√2*V_set_mid – √(Rload_low*PCL_mid).
12. Calculate Vset of each power level from PCL_mid to PCL_min by the following formula
    Vset=3/8*√2*(√(Rload_low*PCL_power)+K1_low), where PCL_power =
    (10^((P_{wanted} + Correction)/10))/1000, Correction is listed in [TX PCL table] section of CFG file.
13. Calculate scaling factor of each power level by the following formula
    scaling factor = V_set*1024.0/2.8 * 25.0 / 15.0 – APC DC offset.
14. Repeat step 1~13 for each band, until the whole scale factor are complete.
15. Write the scaling factor and ramp-profile to target via META-DLL interface.
16. Check power of each PCL is inside the range. If power of each PCL is inside the range, TX PCL check pass. Otherwise, TX PCL check fail.

Note:

- arfcn_C0_xxx could be at the middle of the band. Its specified in [C0 for each Bank] section of configuration file.
- c_n is the value of GSM850_C, GSM900_C, DCS1800_C, PCS1900_C in configuration file.
- Correction is value of GSM850_CORRECTION, GSM900_CORRECTION, DCS1800_CORRECTION, and PCS1900_CORRECTION in configuration file.
- Pwanted is the value of GSM850_WANTED_P, GSM900_WANTED_P, DCS1800_WANTED_P, and PCS1900_WANTED_P in configuration file.
- Pmeas is TX power measurement by RCT.

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- PCL_low, PCL_mid, PCL_h corresponding the lowest power PCL, middle power PCL and highest power PCL in GSM850_CAL_PCL, GSM900_CAL_PCL, DCS1800_CAL_PCL and PCS1900_CAL_PCL in configuration file. For example GSM900_CAL_PCL = 17, 12, 5, then PCL_low=17, PCL_mid=12 and PCL_h=5.
- The range at step 3 is GSM850_MIN_P <= range <= GSM850_MAX_P, GSM900_MIN_P <= range <= GSM900_MAX_P, DCS1800_MIN_P <= range <= DCS1800_MAX_P, and PCS1900_MIN_P <= range <= PCS1900_MAX_P. These MAX_P and MAX_P values are read from configuration file.

4.2.12.2 RFMD3159, Skyworks 77340, and Skyworks 77344 4-point EPSK TX power control level (PCL) calibration

1. Command radio communication tester (RCT) to set TCH channel as arfcn_C0_xxx, TSC value and respected MS uplink PCL.
2. Issue the TX command to the target with the parameter of arfcn_C0_xxx, testing period in frames, DAC initial value gotten in AFC calibration and TX power in PCL.
3. Command RCT to measure the received EPSK MS uplink power, and check whether it is in the range specified in the configuration file.
4. If it is in the range specified in the configuration file. Jump to step 5. Otherwise, adjust APC DAC value s as $s + \Delta s$, $\Delta s = c_n \times (P_{wanted} - P_{meas})$, where s is the range of 0~1023 and c_n is unique for each PCL calibration. Record DAC value as DAC[band][index], and Power[band][index], where index range is 0~3.
5. Repeat steps 1~4 for 4 PCL specified at xxx_EPSK_4CAL_PCL of the configuration file.
6. Repeat steps 1~5 for all bands that are need to be calibrated and specified at the band of Section [Frequency Bank] in the configuration file.
7. Query target high band and low band ITC values by calling META_QueryITC_PCL_r(itc), high band itc = (s_itc_pcl.pcl & 0xFFFF0000) >> 16, and low band itc = s_itc_pcl.pcl & 0x0000FFFF.
8. Evaluate slope1, slope2 and offset of each band specified at the band of Section [Frequency Bank] in the configuration file as follows.

slope1[band] = (DAC[band][3] - DAC[band][2]) / (Power[band][3] - Power[band][2])
slope2[band] = (DAC[band][1] - DAC[band][0]) / (Power[band][1] - Power[band][0])
offset[band] = DAC[band][1] - (DAC[band][2] - (Power[band][2] - Power[band][1]) * slope1[band])

9. Evaluate DAC value for uncalibrated PCL as follows:

If (pcl <= itc_pcl), DAC[band][i] = DAC[band][3] - (Power[band][3] - (Pwanted + Pcorrection)) * slope1[band].
If (pcl == itc_pcl+1), DAC[band][i] = DAC[band][3] - (Power][3] - (Pwanted + Pcorrection)) * slope1[band] + offset[band].
Otherwise, DAC[band][i] = DAC[band][1]-(Power[band][1] - (Pwanted + Pcorrection)) * slope2[band].

Note:

- arfcn_C0_xxx is in the middle channel of the band. arfcn_C0_xxx is specified in [C0 for each Bank] section of configuration file.
- c_n is the value of GSM850_EPSK_C, GSM900_EPSK_C, DCS1800_EPSK_C and PCS1900_EPSK_C in the configuration file.
- Pwanted is the value of GSM850_EPSK_WANTED_P, GSM900_EPSK_WANTED_P, DCS1800_EPSK_WANTED_P and PCS1900_EPSK_WANTED_P in the configuration file.
- Pcorrection is the value of GSM850 EPSK_CORRECTION, GSM900_ EPSK_CORRECTION, DCS1800_ EPSK_CORRECTION and PCS1900_ EPSK_CORRECTION in the configuration file.
- Pmeas is the EPSK TX power measurement by RCT.
- The range at step 3 is GSM850_EPSK_MIN_P<= range <= GSM850_EPSK_MAX_P, GSM900_EPSK_MIN_P <= range <= GSM900_EPSK_MAX_P, DCS1800_EPSK_MIN_P<= range <= DCS1800_EPSK_MAX_P, and PCS1900_EPSK_MIN_P <= range <= PCS1900_EPSK_MAX_P. The values of xxx_EPSK_MAX_P and xxx_EPSK_MAX_P are read from the configuration file.

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4.2.12.3 Renesas PF08155B and 88130B three point GMSK TX power control level (PCL) calibration

1. Command radio communication tester (RCT) to set TCH channel as arfcn_C0_xxx, TSC value and respected MS uplink PCL.
2. Issue the TX command to the target with the parameter of arfcn_C0_xxx, testing period in frames, DAC initial value gotten in 2 or 33 steps AFC slope calibration and TX power in PCL.
3. Command the RCT to measure the received MS uplink power, and check whether it is in the range specified by the configuration file.
4. Follow 3, if it is in the range. Jump to step 5. Otherwise, adjust APC DAC value s as $s + \Delta s$ $\Delta s = c_n \times (P_{wanted} - P_{meas})$, where s is the range of 0~1023 and c_n is unique for each PCL calibration.
5.Repeat steps 1~4 for 3 PCL (PCL_low, PCL_mid, PCL_hi) and records the measure GMSK TX power as P_low, P_mid and P_hi and PCL DAC as PDAC_low, PDAC_mid and PDAC_hi.
6. Repeat step 1~5 for each band need to be calibrated.
7. Calculate Pout using the following formula
PV_low = √(50.0*pow(10, (P_low+switch_loss)/10.0)/1000.0).
8.Calculate Vramp_low using the following formula
Vramp_low = (apc_dc_offset+PDAC_low)/pow(2.0, 10.0) * 2.8.
9. Repeat steps 7~8 for PV_mid, Vramp_mid, PV_hi and Vramp_hi.
10.Calculate al, bl, ah and bh using the following formula

- al = { PV_mid - PV_low - RENESAS_PF08151B_CONST * [pow(Vramp_mid, 2.0)-pow(Vramp_low,2.0)]}/[2*RENESAS_PF08151B_CONST *(Vramp_mid-Vramp_low)];
- bl = PV_low - RENESAS_PF08151B_CONST * pow(Vramp_low + al, 2.0);
- ah = { PV_hi – PV_mid - RENESAS_PF08151B_CONST * [pow(Vramp_hi, 2.0)-pow(Vramp_mid,2.0)] }/[2*RENESAS_PF08151B_CONST *(Vramp_hi - Vramp_mid)];
- bh = PV_hi - RENESAS_PF08151B_CONST * pow(Vramp_hi + ah,2.0);

11. Evaluate scaling factor of each power level by the following formula

- PV = √{ 50*pow[10.0, (switch_loss + P_{wanted} + correction)/10.0]/1000.0} ;
- If Evaluating PCL is large than PCL_mid, calculate Vramp by the following formula
  Vramp = √[(PV - bl)/RENESAS_PF08151B_CONST] - al;
  Else if evaluating PCL is small than PCL_mid, calculate Vramp by the following formula
  Vramp = √[(PV - bh)/RENESAS_PF08151B_CONST] - ah;

12. scaling factor = [Vramp_Eval * pow(2.0,10.0)] / 2.8 - apc_dc_offset;
13. Repeat steps 10~12 for each band, until the whole scale factor are complete.
14.Write the scaling factor and ramp-profile to target via META-DLL interface.
15. Check power of each PCL is inside the range. If power of each PCL is inside the range, TX PCL check result is passed. Otherwise, TX PCL check result is fail.

Note:

- arfcn_C0_XXX is at the middle of the band. arfcn_C0_XXX is specified in [C0 for each Bank] section of configuration file.
- c_n is the value of GSM850_C, GSM900_C, DCS1800_C, PCS1900_C in configuration file.
- Correction is value of GSM850_CORRECTION, GSM900_CORRECTION, DCS1800_CORRECTION, and PCS1900_CORRECTION in configuration file.
- Pwanted is the value of GSM850_WANTED_P, GSM900_WANTED_P, DCS1800_WANTED_P, PCS1900_WANTED_P in configuration file.
- Pmeas is GMSK TX power measurement by Agilent 8960 or R&S CMU 200.
- s is the value of TX level in initial file.

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- PCL_low, PCL_mid, PCL_h corresponding the lowest power PCL, middle power PCL and highest power PCL in GSM850_CAL_PCL, GSM900_CAL_PCL, DCS1800_CAL_PCL and PCS1900_CAL_PCL in configuration file. For example GSM900_CAL_PCL = 17, 12, 5, then PCL_low=17, PCL_mid=12 and PCL_h=5.
- The range at step 3 is GSM850_MIN_P<= range <= GSM850_MAX_P, GSM900_MIN_P <= range <= GSM900_MAX_P, DCS1800_MIN_P <= range <= DCS1800_MAX_P and PCS1900_MIN_P <= range <= PCS1900_MAX_P. These MAX_P and MAX_P values are read from configuration file.
- RENESAS_PF08151B_CONST = 3.1303.
- Switch loss is the value of GSM850_SWITCH_LOSS = 1.2, GSM_SWITCH_LOSS = 1.2, DCS1800_SWITCH_LOSS = 1.3 and PCS1900_SWITCH_LOSS = 1.3.

4.2.12.4 Skyworks 77328 APC DC offset calibration

1. Command Agilent 8960 or R&S CMU 200 to set TCH channel as arfcn_C0_XXX, TSC value and respected MS uplink PCL.
2. Issue the TX command to the target with the parameter of arfcn_C0_XXX, testing period in frames, DAC initial value gotten in AFC calibration and TX power in PCL.
3. Command the Agilent 8960 or R&S CMU 200 to measure the received MS uplink power, and check whether it is in the range specified by the configuration file.
4. Follow 3, if it is in the range. Jump to step 5. Otherwise, adjust APC DC offset s as $s + \Delta s$ $\Delta s = c_n \times (P_{wanted} - P_{meas})$, where s is the range of 0~1023 and c_n is unique for APC DC offset calibration.
5. Repeat step 1~4 for low APC DC offset and high APC DC offset.
6. Repeat step 1~5 until all band specified in configuration file is complete.

Note:

- arfcn_C0_XXX is specified in [C0 for each Bank] section in configuration file.
- For band GSM850 and GSM900, PCL at step 1 is 19. For band DCS1800 and PCS1900, PCL at step 1 is 15.
- c_n is the value of GSM850_C, GSM900_C, DCS1800_C, PCS1900_C in configuration file.
- If high APC DC offset is calibrated, Pwanted is the value of SKY77328_GSM850_WANTED_HIGH_APC_DC_OFFSET_P, SKY77328_GSM900_WANTED_HIGH_APC_DC_OFFSET_P, SKY77328_DCS1800_WANTED_HIGH_APC_DC_OFFSET_P,and SKY77328_PCS1900_WANTED_HIGH_APC_DC_OFFSET_P in configuration file. Otherwise, Pwanted is the value of SKY77328_GSM850_MAX_LOW_APC_DC_OFFSET_P, SKY77328_GSM900_WANTED_LOW_APC_DC_OFFSET_P, SKY77328_DCS1800_WANTED_LOW_APC_DC_OFFSET_P,and SKY77328_PCS1900_WANTED_LOW_APC_DC_OFFSET_P in configuration file.
- Pmeas is GMSK TX power measurement by RCT.
- If high APC DC offset is calibrated, the range at step 3 is GSM850_MIN_P<= range <= GSM850_MAX_P, XXX_MIN_HIGH_APC_DC_OFFSET_P <= range <= XXX_MAX_HIGH_APC_DC_OFFSET_P. Otherwise, the range at step 3 is GSM850_MIN_P<= range <= GSM850_MAX_P, XXX_MIN_LOW_APC_DC_OFFSET_P <= range <= XXX_ MAX_LOW_APC_DC_OFFSET_P

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4.2.12.5 Skyworks 77328 2 point TX power control level (PCL) calibration

1. Command radio communication tester (RCT) to set TCH channel as arfcn_C0_XXX, TSC value and respected MS uplink PCL.
2. Issue the TX command to target with the parameter of arfcn_C0_XXX, testing period in frames, DAC initial value gotten in AFC calibration and TX power in PCL.
3. Command the RCT to measure the received MS uplink power, and check whether it is in the range specified by the configuration file.
4. 4. Follow 3, if it is in the range. Jump to step 4. Otherwise, adjust APC DAC value s as $s + \Delta s$ $\Delta s = c_n \times (P_{wanted} - P_{meas})$, where s is the range of 0~1023 and c_n is unique for each PCL calibration.
5. Repeat step 1~4 for 2 PCL (PCL_h, PCL_l). Record the APC DAC value used as DAC_h and DAC_l and APC power as Ph and Pl.
6. Evaluate threshold DAC using DACth=(DAC_l(10^((Ph-Pl)/M))-DAC_h)/(10^((Ph-Pl)/M)-1).
7. Evaluate Poff using Poff=Pl-Mlog(DAC_l-DACth)
8. Evaluate DAC value of target PCL using DAC=DACth+10^((Ptarget – Poff)/M).
9. Issue the TX command to target with the parameter of arfcn_C0_xxx, testing period in frames, DAC initial value gotten in AFC calibration and TX power in target PCL.
10. Command the Radio Communication Tester (RCT) to measure the received MS uplink power, and check whether it is in the range specified by the configuration file. The measure power is named as Ptargetmeas.
11. Calculate new DACthnew using DACthnew=DAC-10^((Ptargetmeas-Poff)/M).
12. Calculate new M and Poff using Mnew=(Ph-Pl)/(log(DAC_h-DACthnew)-log(DAC_l-DACthnew). Poffnew=Pl-Mnew*log(DAC_l-DACthnew).
13. Calculate DACdelta=abs(DACth-DACthnew), set DACth=DACthnew, Poff=Poffnew and M=Mnew.
14. Repeat steps 11~13 until DACdelta calculated at step 13 is less than DAC Delta sepecified in CFG file.
15. Check Ptargetmeas is within the range of Ptarget-APC Delta to Ptarget+APC Delta.
16. If Ptargetmeas is not within the desired tolerance range at step 15 and loop count is less than Recursive Times specified in configuration file. Increase loop count and go to step 8. If loop count is large than Recursive Times, calibration failed and abort calibration procedure.
17. Calculate DAC of each PCL using formula DAC=DACth+10^((Pwanted-Poff)/M).
18. Repeat step 1~17 for each band, until the whole scale factor are complete.
19. Write the scaling factor and ramp-profile to target via META-DLL interface.
20. Check power of each PCL is inside the range. If power of each PCL is inside the range, TX PCL check pass. Otherwise, TX PCL check fail.

Note:

- arfcn_C0_xxx could be at the middle of the band. It is specified in [C0 for each Bank] section of configuration file.
- c_n is the value of GSM850_C, GSM900_C, DCS1800_C, PCS1900_C in configuration file.
- Correction is value of GSM850_CORRECTION, GSM900_CORRECTION, DCS1800_CORRECTION, and PCS1900_CORRECTION in configuration file.
- Pwanted is the value of GSM850_WANTED_P, GSM900_WANTED_P, DCS1800_WANTED_P, PCS1900_WANTED_P in configuration file.
- Pmeas is TX power measurement by Radio Communication Tester (RCT).
- The initial value of s is the value of TX power level of [xxx level, ramp] in initial file.
- The range at step 4 is GSM850_MIN_P <= range <= GSM850_MAX_P, GSM900_MIN_P <= range <= GSM900_MAX_P, DCS1800_MIN_P <= range <= DCS1800_MAX_P, and PCS1900_MIN_P <= range <= PCS1900_MAX_P. These MAX_P and MAX_P values are read from configuration file.
- The initial value of M of each band at step 6 is SKY77328_GSM850_M, SKY77328_GSM900_M, SKY77328_DCS1800_M, and SKY77328_PCS1900_M in configuration file.

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- The target PCL of each band is step 9 is SKY77328_GSM850_TARGET_PCL, SKY77328_GSM900_TARGET_PCL, SKY77328_DCS1800_TARGET_PCL, and SKY77328_PCS1900_TARGET_PCL in configuration file.

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4.2.12.6 Skyworks 77316 and 77331 2-point GMSK and EPSK TX power control level (PCL) calibration

1. Command radio communication tester (RCT) to set TCH channel as arfcn_C0_xxx, TSC value and respected MS uplink PCL.
2. Issue the GMSK TX command to the target with the parameter of arfcn_C0_xxx, testing period in frames, DAC initial value gotten in AFC calibration and TX power in PCL.
3. Command the RCT to measure the received MS uplink power, and check whether it is in the range specified in the configuration file.
4. If it is in the range specified in the configuration file, jump to step 5. Otherwise, adjust scale factor s as $s + \Delta s$ $\Delta s = c_n \times (P_{wanted} - P_{meas})$, in the range of 0~1023 and c_n is unique for each PCL calibration.
5. Repeat steps 1~4 for 3 PCL (PCL_low, PCL_hi) and record the measured GMSK TX power as P_low, P_hi and PCL DAC as PDAC_low, and PDAC_hi.
6. Repeat step 1~5 for each band.
7. Command Agilent 8960 or R&S CMU 200 to set the PDTCH channel as arfcn_C0_xxx, TSC value and respected MS uplink PCL.
8. Issue the EPSK TX command to the target with the parameter of arfcn_C0_xxx, testing period in frames, DAC initial value gotten in AFC calibration and TX power in PCL.
9. Command the Agilent 8960 or R&S CMU 200 to measure the received MS EPSK uplink power, and check whether it is in the range specified in the configuration file.
10. If it is in the range specified in the configuration file, go back to step 5. Otherwise, adjust the scale factor s as $\Delta s = c_n \times (P_{wanted} - P_{meas})$, in the range of 0~1023 and c_n is unique for each PCL calibration.
11. Repeat steps 7~10 for 2 PCLs (EPCL_low, EPCL_hi) and record the measured EPSK TX power as EP_low and EP_hi and PCL DAC as EPDAC_low, and EPDAC_hi.
12. Repeat steps 7~11for each band.
13. Calculate the offset and slope of GMSK TX power using the following formula:
    offset = PDAC_low
    slope= (PDAC_hi – PDAC_low) / (P_hi –P_low).
14. Calculate the scaling factor of each PCL using the following formula:
    scaling factor = (P_{wanted} + correction - P_low) * slope+ offset.
15. Repeat step 13~14 for each band.
16. Calculate the offset and slope of EPSK TX power using the following formula:
    offset_epsk = EPDAC_low
    slope_epsk = (EPDAC_hi – EPDAC_low) / (EP_hi – EP_low).
17. Calculate the scaling factor of EPSK TX power of each PCL using the following formula:
scaling factor = (P_{wanted_epsk} + correction_epsk - EP_low) * slope_epsk+ offset_epsk.
18. Repeat steps 16~17 for each band need to be calibrated.

Note:

- arfcn_C0_xxx is in the middle of the band.
- c_n at step 4 is the value of GSM850_C, GSM900_C, DCS1800_C, PCS1900_C in the configuration file.
- c_n at step 10 is the value of GSM850_EPSK_C, GSM900_EPSK_C, DCS1800_EPSK_C, PCS1900_EPSK_C in the configuration file.
- Correction is the values of GSM850_CORRECTION, GSM900_CORRECTION, DCS1800_CORRECTION, and PCS1900_CORRECTION in the configuration file.
- Correction_epsk is the value of GSM850_EPSK_CORRECTION, GSM900_EPSK_CORRECTION, DCS1800_EPSK_CORRECTION, and PCS1900_EPSK_CORRECTION in the configuration file.

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- Pwanted is the value of GSM850_WANTED_P, GSM900_WANTED_P, DCS1800_WANTED_P, PCS1900_WANTED_P in the configuration file.
- Pwanted_epsk is the value of GSM850_EPSK_WANTED_P, GSM900_EPSK_WANTED_P, DCS1800_EPSK_WANTED_P, PCS1900_EPSK_WANTED_P in configuration file.
- Pmeas at step 4 is GMSK TX power measurement by Agilent 8960 or R&S CMU 200.
- Pmeas at step 10 is EPSK TX power measurement by Agilent 8960 or R&S CMU 200.
- The initial value of s is TX power level of [xxx level, ramp] or [EPSK xxx level, ramp] section.
- PCL_low and PCL_h are corresponding to the lowest power PCL and highest power PCL in GSM850_2CAL_PCL, GSM900_2CAL_PCL, DCS1800_2CAL_PCL and PCS1900_2CAL_PCL in configuration file. For example GSM900_2CAL_PCL = 17, 5, then PCL_low=17 and PCL_h=5.
- The range at step 3 is GSM850_MIN_P<= range <= GSM850_MAX_P, GSM900_MIN_P <= range <= GSM900_MAX_P, DCS1800_MIN_P <= range <= DCS1800_MAX_P, and PCS1900_MIN_P <= range <= PCS1900_MAX_P. These MAX_P and MAX_P values are read from configuration file.
- The range at step 9 is GSM850_EPSK_MIN_P<= range <= GSM850_EPSK_MAX_P, GSM900_EPSK_MIN_P<= range <= GSM900_EPSK_MAX_P, DCS1800_EPSK_MIN_P<= range <= DCS1800_EPSK_MAX_P, and PCS1900_EPSK_MIN_P<= range <= PCS1900_EPSK_MAX_P. These xxx_EPSK_MIN_P and xxx_EPSK_MAX_P values are read from configuration file.

4.2.12.7 Renesas RPF88130B, RPF88143B, RPF88144B, RPF88150B, RPF89007B three point GMSK TX power control level (PCL) calibration

1. Command radio communication tester (RCT) to set TCH channel as arfcn_C0_xxx, TSC value and respected MS uplink PCL.
2. Issue the TX command to the target with the parameter of arfcn_C0_xxx, testing period in frames, DAC initial value gotten in 2 or 33 steps AFC slope calibration and TX power in PCL.
3. Command the RCT to measure the received MS uplink power.
4. Repeat step 1 ~ 3 until PCL_low, PCL_mid, PCL_h power is measured
6. Repeat step 1 ~ 5 for each band need to be calibrated.
7. Evaluate EffectiveDAC_low, EffectiveDAC_mid, EffectiveDAC_h as the following formula
PCL_DAC * subband_weighting * last_ramp_up_value / 255 + apc_dc_offset
8. Evaluate Vramp_low, Vramp_mid, Vramp_h as the following formula
Vramp = VAPC * DIVISION / 1023 * (EffectiveDAC)
9. Evaluate ***al*** as the following formula
$(Pout_mid - PCL_low - K(Vramp_mid^2 - Vramp_low^2)) \;/\; (2*K*(Vramp_mid - Vramp_low))$
10. Evaluate ***ah*** as the following formula
$(Pout_h - PCL_mid - K(Vramp_h^2 - Vramp_mid^2)) \;/\; (2*K*(Vramp_h - Vramp_mid))$
11. Evaluate ***bl*** as the following formula
$Pout_low - K * (Vramp_low + \boldsymbol{al})^2$
12. Evaluate ***bh*** as the following formula
$Pout_mid - K * (Vramp_mid + \boldsymbol{ah})^2$
13. Evaluate PCL DAC for each PCL level of the specified band as the following
13.1 Evaluate Vramp_eval for the PCL as the following formula
For PCL greater than PCL_mid
$Vramp_eval = \sqrt{((wanted_P + correction - \boldsymbol{bl})/K)} - \boldsymbol{al}$
Else
$Vramp_eval = \sqrt{((wanted_P + correction - \boldsymbol{bh})/K)} - \boldsymbol{ah}$
13.2 Evaluate the PCL DAC as(Vramp_eval / (Vapc * DIVISION) * 1023 – apc_dc_offset) * 255 / (subband_weighting * last_ramp_up_value)
14. Repeat steps 1 ~ 13 for each band, until the whole scale factor are complete.
15.Write the scaling factor and ramp-profile to target via META-DLL interface.

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Note:

- arfcn_C0_XXX is at the middle of the band. arfcn_C0_XXX is specified in [C0 for each Bank] section of configuration file.
- c_n is the value of GSM850_C, GSM900_C, DCS1800_C, PCS1900_C in configuration file.
- Correction is value of GSM850_CORRECTION, GSM900_CORRECTION, DCS1800_CORRECTION, and PCS1900_CORRECTION in configuration file.
- Pwanted is the value of GSM850_WANTED_P, GSM900_WANTED_P, DCS1800_WANTED_P, PCS1900_WANTED_P in configuration file.
- Pmeas is GMSK TX power measurement by Agilent 8960 or R&S CMU 200.
- s is the value of TX level in initial file.
- PCL_low, PCL_mid, PCL_h corresponding the lowest power PCL, middle power PCL and highest power PCL in GSM850_CAL_PCL, GSM900_CAL_PCL, DCS1800_CAL_PCL and PCS1900_CAL_PCL in configuration file. For example GSM900_CAL_PCL = 17, 12, 5, then PCL_low=17, PCL_mid=12 and PCL_h=5.
- Pout_low, Pout_mid, Pout_h corresponding to the measurement result of PCL_low, PCL_mid, PCL_h
- Vramp_low, Vramp_mid, Vramp_h are the Vramp value for PCL_low, PCL_mid, PCL_h
- EffectiveDAC_low, EffectiveDAC_mid, EffectiveDAC_h are the effective DAC value for PCL_low, PCL_mid, and PCL_h
- subband_weighting is the subband_weighting for the arfcn_C0_XXX
- last_ramp_up_value is the last ramp up value of the ramp profile to the specified PCL
- The range at step 3 is GSM850_MIN_P<= range <= GSM850_MAX_P, GSM900_MIN_P <= range <= GSM900_MAX_P, DCS1800_MIN_P <= range <= DCS1800_MAX_P and PCS1900_MIN_P <= range <= PCS1900_MAX_P. These MAX_P and MAX_P values are read from configuration file.
- K is PA-specific constant value
  - RPF88130B, RPF88143B, RPF88144B series use the following constant value for low-band and high-band
    - RPF88130B_K_LB = -23.441
    - RPF88130B_K_HB = -9.603
  - RPF88150B series uses the following constant value for low-band and high-band
    - RPF88150B_K_LB = -17.254
    - RPF88150B_K_HB = -8.989
  - RPF89007B series uses the following constant value for low-band and high-band
    - RPF89007B_K_LB = -16.3
    - RPF89007B_L_HB = -5.0
- DIVISION is the ratio between Vramp and Vapc
  - RPF88130B_DIVISION = 3/4 (for RPF88130B, RPF88143B, RPF88144B series)
  - RPF88150B_DIVISION = 36/46 (for RPF88150B series)
  - RPF89007B_DIVISION = 36/46 (for RPF89007B series)

4.2.12.8 GMSK Full TX power control level (PCL) calibration

1. Command radio communication tester (RCT) to TCH channel as arfcn_C0_xxx, TSC value and respected MS uplink PCL.
2. Issue the TX command to target with the parameter of arfcn_C0_xxx, testing period in frames, AFC DAC value gotten from 2 or 33 steps AFC calibration and TX power in PCL.
3. Command RCT to measure the received MS uplink power, and check whether it is in the range specified by the configuration file.
4. Follow 3, if it is in the range. Jump to step 5. Otherwise, adjust scale factor s as $s + \Delta s$, $\Delta s = c_n \times (P_{wanted} - P_{meas})$, where s is the range of 0~1023 and c_n is unique for each PCL calibration.

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5. Repeat step 1~4 for each PCL, until all PCL are complete
6. Repeat step 1~5 for each band to be calibrated.
7. Write the scale factor and ramp-profile to target via META-DLL interface.
8. Check power of each PCL is inside the range. If power of each PCL is inside the range, TX PCL check result is passed. Otherwise, TX PCL check result is fail.

Note:

- arfcn_C0_xxx could be at the middle of the band. arfcn_C0_xxx is specified in [C0 for each Bank] section of configuration file.
- c_n is the value of GSM850_C, GSM900_C, DCS1800_C, PCS1900_C in configuration file.
- Pwanted is the value of GSM850_WANTED_P, GSM900_WANTED_P, DCS1800_WANTED_P, PCS1900_WANTED_P in configuration file.
- Pmeas is TX power measurement by RCT.
- The initial value of s is from TX power level of [xxx level, ramp] section of calibration data initial file.
- The range at step 3 is GSM850_MIN_P <= range <= GSM850_MAX_P, GSM900_MIN_P <= range <= GSM900_MAX_P, DCS1800_MIN_P <= range <= DCS1800_MAX_P, and PCS1900_MIN_P <= range <= PCS1900_MAX_P. These MAX_P and MAX_P values are read from configuration file.

4.2.12.9 EPSK Full TX power control level (PCL) calibration

1. Command radio communication tester (RCT) to PDTCH channel as arfcn_C0_xxx, TSC value and respected MS uplink PCL, coding scheme MCS5.
2. Issue the TX command to target with the parameter of arfcn_C0_xxx, testing period in frames, AFC DAC gotten from 2 or 33 steps AFC calibration and TX power in PCL.
3. Command the RCT to measure the received MS EPSK uplink power, and check whether it is in the range specified by the configuration file.
4. Follow 3, if it is in the range. Jump to step 5. Otherwise, adjust scale factor s as $s + \Delta s$, $\Delta s = c_n \times (P_{wanted} - P_{meas})$, where s is the range of 0~1023 and c_n is unique for each PCL calibration
5. Repeat step 1~4 for each PCL, until all PCL are complete
6. Repeat step 1~5 for each band need to be calibrated.
7. Write the scale factor and ramp-profile to target via META-DLL interface.
8. Check power of each PCL is inside the range. If power of each PCL is inside the range, TX PCL check result is passed. Otherwise, TX PCL check result is fail.

Note:

- arfcn_C0_xxx could be at the middle of the band. arfcn_C0_xxx is specified in [C0 for each Bank] section of configuration file.
- c_n is the value of GSM850_EPSK_C, GSM900_EPSK_C, DCS1800_EPSK_C and PCS1900_EPSK_C in configuration file.
- Pwanted is the value of GSM850_EPSK_WANTED_P, GSM900_EPSK_WANTED_P, DCS1800_EPSK_WANTED_P, and PCS1900_EPSK_WANTED_P in configuration file.
- Pmeas is EPSK TX power measurement by RCT.
- The initial value of s is from TX power level of [xxx GSM900 level, ramp] section of calibration data initial file.
- The range at step 3 is GSM850_EPSK_MIN_P<= range <= GSM850_EPSK_MAX_P, GSM900_EPSK_MIN_P <= range <= GSM900_EPSK_MAX_P, DCS1800_EPSK_MIN_P<= range <=

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DCS1800_EPSK_MAX_P, and PCS1900_EPSK_MIN_P <= range <= PCS1900_EPSK_MAX_P. These xxx_EPSK_MAX_P and xxx_EPSK_MAX_P values are read from configuration file.

4.2.13 TX sub-band calibration

Traditional TX sub-band calibration is initiated after the TX PCL calibration is done.
Currently, only MT6253 and AD6546 can apply the TX sub-band calibration flow

1. Command radio communication tester (RCT) to TCH channel as the mid-channel of the sub-band, TSC value and respected MS uplink PCL.
2. Issue the TX command to target on the mid-channel of the sub-band, testing period in frames, AFC DAC value gotten from 2- or 33-step AFC calibration and TX power in max. PCL.
   2.1 Save the APC DAC (scale factor) of max. PCL to s_last_dac and s_original_dac
3. Command RCT to measure the received MS uplink power, and check whether it is in the range specified by the configuration file (SUBBAND_FLATNESS_RANGE).
4. Following 3, if it is in the range, jump to step 5. Otherwise, adjust scale factor s to $s + \Delta s$, $\Delta s = c_n \times (P_{wanted} - P_{meas})$, in which s is in the range from 0 to 1023 and c_n is unique for each PCL calibration.
   4.1 Derive weighting as s_last_dac / s_original_dac (Note: $s_last_dac = s_last_dac + \Delta s$).
   4.2 Evaluate the next C_n as $c_n = \Delta s / (P_{wanted} - P_{meas})$.
5. Repeat steps 1~4 for each PCL, until all subbands are complete (except the sub-band which includes C0).
6. Repeat steps 1~5 for each band to be calibrated.
7. Write the ramp profile to target via META-DLL interface.
8. Check whether power of each PCL is within the range. If power of each PCL is within the range, the TX PCL check result is pass. Otherwise, the TX PCL check result is fail.

Note:

- Before applying sub-band calibration, the high/log weight of the INI file should be set to 1.0
- SUBBAND_FLATNESS_RANGE is specified by band in the CFG file (in TX PCL table section) which specifies the calibration target value as the wanted power ± FLATNESS_RANGE
  GSM850_SUBBAND_FLATNESS_RANGE (default: 0.3)
  GSM900_SUBBAND_FLATNESS_RANGE (default: 0.3)
  DCS1800_SUBBAND_FLATNESS_RANGE (default: 0.3)
  PCS1900_SUBBAND_FLATNESS_RANGE (default: 0.3)
- Sub-band section is defined in the INI of the ramp profile section. The entry is defined in sub-band max arfcn. The entry specifies the boundary of the sub-band (e.g. DCS1800, sub-band max arfcn=520, 560, 600, 630, 660, 680, 720, 730, 750, 800, 885, the last subband contains ARFCN 801-885)
- The mid-channel of ths sub-band is decied by two max. ARFCN (e.g., the first mid-channel of the sub-band is 520, the second mid-channel is 540).
- If the sub-band contains the C0 channel, the calibration will be skipped on this sub-band.
- Since the traditional calibration is done iteratively, there is no check procedure in traditional TX sub-band calibration and the TX sub-band calibration will fail if one of the sub-band calibration fails to meet the pass criteria (wanted power± FLATNESS_RANGE) after trying “Recursive Times” iterations.
- The number of maximum recursive iterations is defined in the TX PCL table section in the CFG file.

4.2.14 GMSK TX IQ calibration

1. Command Radio Communication Tester (RCT) to set cell band as TX_IQ_BAND, TCH channel as TX_IQ_ARFCN, TSC value and uplink PCL as TX_IQ_PCL.
2. Get BB TX parameter of layer 1 auto calibration by META_DLL interface.

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3. Set offset_I= offset_I1, offset_Q=offset_Q1, trim_I=trim_I1, trim_Q=trim_Q1 and then replace trim_I, trim_Q, offset_I and offset_Q of target BB TX parameter by META_DLL interface.
4. Issue target to transmit normal burst by setting ARFCN as TX_IQ_ARFCN, tsc as TSC, PCL as TX_IQ_PCL, frame number as 1000, and afc DAC value as us_Default_value which get from AFC calibration.
5. Get original offset from RCT and save it as OOS1. Get IQ imbalance from RCT and save it as SBS1.
6. Repeate steps 3~5 until SBS2, SBS3, OOS2, OOS3, and OOS4 are get.
7. Calculate PSBS1, PSBS2, and PSBS3 by the following formula
PSBSi = exp(SBSi/10.0*ln10.0)); were i=1,2,3, where exp means exponential e, and ln means natural logarithm
8. Calculate POOS1, POOS2, POOS3 and POOS4 by the following formula
POOSi = exp(OOSi/10.0*ln10.0)), where i=1,2,3,4.
9. Evaluate optimal trim_I and trim_Q by the following formula
Xt = 14*(PSBS3-PSBS2) / (2*(PSBS3+PSBS2-2*PSBS1));
Opt_trim_I = Xt/2.0;
Opt_trim_Q = -1.0*(Xt - Opt_trim_I);
10. Evaluate optimal offset_I and offset_Q by the following formula
Opt_offset_I = 30*3*(POOS4 - POOS3) / [2*(POOS4+POOS3+2*POOS2-4*POOS1)];
Opt_offset_Q = 30*(POOS4+POOS3-4*POOS2+2*POOS1) / [2*(POOS4+POOS3+2*POOS2-4*POOS1)];
11. Replace trim_I, trim_Q, offset_I and offset_Q of target BB TX parameter via META_DLL interface by Opt_trimI, Opt_trimQ, Opt_offset_I and Opt_offset_Q.
12. Issue target to transmit normal burst by setting ARFCN as TX_IQ_ARFCN, tsc as TSC, PCL as TX_IQ_PCL, frame number as 1000, and afc DAC value as us_Default_value which get from 2 or 33 step AFC slope calibration.
13. Get original offset from RCT and save it as OOS_check. And get IQ imbalance from RCT and save it as SBS_check;
14. If OOS_check is large than TX_IQ_DC_OFFSET_MAX or SBS_check is large than TX_IQ_GAIN_IMBALANCE_MAX set calibrated flag of BB TX parameter to 0. Otherwise, set calibrated flag of BB TX parameter to 0xBF.
14. Write BB TX parameter to target NVRAM by META_DLL itnerface.
15. If OOS_check is large than TX_DC_0FFSET_MAX, calibration result is fail. Otherwise, calibration result is passed.

Note:

- TX_IQ_BAND, TX_IQ_ARFCN, TX_IQ_PCL, TX_IQ_GAIN_IMBALANCE_MAX and TX_IQ_DC_OFFSET_MAX are specified in configuration file.
- offset_I1= 0, offset_Q1=0, offset_I2=0, offset_Q2=30, offset_I3=30, offset_Q3=-30, offset_I4=-30, offset_Q4=-30,
- trim_I1=0, trim_Q1=0, trim_I2=7, trim_Q2=-7, trim_I3=-7, trim_Q3=7.
- GMSK TX IQ calibration is used by transceivers except MT6140. GMSK TX IQ calibration only calibrates one band.

4.2.15 EPSK TX IQ calibration

1. Command Radio Communication Tester (RCT) to set its cell band as TX_IQ_BAND, TCH channel as TX_IQ_ARFCN, TSC value and uplink PCL as TX_IQ_PCL.
2. Get target BB TX parameter of layer via META_DLL interfac.
3. Set offset_I= offset_I1, offset_Q=offset_Q1, trim_I=trim_I1, trim_Q=trim_Q1, phasesel = phasesel1 and then replace trim_I, trim_Q, offset_I, offset_Q and phasesel of target BB TX parameter via META_DLL interface.
4. Issue target to transmit normal burst by setting ARFCN as TX_IQ_ARFCN, tsc as TSC, PCL as TX_IQ_PCL, frame number as 1000, and afc DAC value as us_Default_value which get from AFC calibration.
5. Get original offset from RCT and save it as OOS1. Get IQ imbalance from RCT and save it as SBS1.
6. Repeat steps 3~5 until SBS2, SBS3, OOS2, OOS3, and OOS4 are get.

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7. Calculate PSBS1, PSBS2, and PSBS3 by the following formula
PSBSi = exp(SBSi/10.0*ln10.0)); were i=1,2,3, where exp means exponential e, and ln means natural logarithm
8. Calculate POOS1, POOS2, POOS3 and POOS4 by the following formula
POOSi = exp(OOSi/10.0*ln10.0)), where i=1,2,3,4, ln means natural logarithm
9.Evaluate optimal trim_I and trim_Q by following formula
Xt = 14*(PSBS3-PSBS2) / (2*(PSBS3+PSBS2-2*PSBS1));
Opt_trim_I = Xt/2.0;
Opt_trim_Q = -1.0*(Xt - Opt_trim_I);
10.Evaluate optimal offset_I and offset_Q by following formula
Opt_offset_I = 30*3*(POOS4 - POOS3) / [2*(POOS4+POOS3+2*POOS2-4*POOS1)];
Opt_offset_Q = 30*(POOS4+POOS3-4*POOS2+2*POOS1) / [2*(POOS4+POOS3+2*POOS2-4*POOS1)];
11.Evaluse optimal phasesel by following formula
Opt_phasesel = ((norm_phasesel^2 + 4 * PSBS1 – 4 * PSBS4) / (2 * norm_phasesel)) / 6.28 * 360.
Where norm_phasesel = phasesel * 6.28 / 360.
12.Replace trim_I, trim_Q, offset_I, offset_Q and phasesel of target BB TX parameter via META_DLL interface by Opt_trimI, Opt_trimQ, Opt_offset_I, Opt_offset_Q and Opt_phasesel.
13. Issue target to transmit normal burst by setting ARFCN as TX_IQ_ARFCN, tsc as TSC, PCL as TX_IQ_PCL, frame number as 1000, and afc DAC value as us_Default_value which get from AFC calibration.
14. Get original offset from RCT and save it as OOS_check. And get IQ imbalance from RCT and save it as SBS_check;
15. If OOS_check is large than TX_IQ_DC_OFFSET_MAX or SBS_check is large than TX_IQ_GAIN_IMBALANCE_MAX set calibrated flag of BB TX parameter to 0. Otherwise, set calibrated flag of BB TX parameter to 0xBF.
16. Write BB TX parameter to target NVRAM by META_DLL interface.
17. If OOS_check is large than TX_DC_0FFSET_MAX, calibration is fail. Otherwise, calibration is pass.
18. Repeats step 1~17 until low band and high band TX IQ calibration are finished.

Note:

- TX_IQ_BAND, TX_IQ_ARFCN, TX_IQ_PCL, TX_IQ_GAIN_IMBALANCE_MAX and TX_IQ_DC_OFFSET_MAX are specified in configuration file.
- offset_I1= 0, offset_Q1=0, offset_I2=0, offset_Q2=30, offset_I3=30, offset_Q3=-30, offset_I4=-30, offset_Q4=-30,
- trim_I1=0, trim_Q1=0, trim_I2=7, trim_Q2=-7, trim_I3=-7, trim_Q3=7.
- Phasesel1=0, Phasesel2=0, phasesel3=0, and phasesel4=3.
- EPSK TX IQ calibration is used by MT6140 transceiver. EPSK TX IQ calibration calibrates low band and high band.

4.2.16 TX slope skew calibration

1. If CMU 200 is used, initialize its basic RF mode. If Agilent 8960 is used, set its operation mode to EGPRS BCH + PDTCH.
2. Read ad6546tx calibration data from NVRAM via META_DLL interface.
3. If CMU 200 is used, configure its input/output cable loss and ARFCN to arfcn_C0_xxx, where arfcn_C0_xxx is specified in the configuration file. If Agilent 8960 is used, configure its cell band, PDTCH ARFCN to arfcn_C0_xxx, BCH ARFCN to channel other than arfcn_C0_xxx, training sequence to TSC (specified in the configuration file), and coding scheme to MCS5, TX power measurement mode to the array mode.
4. Set slop_skew[0] = 0, s_slop_skew[1] = 7, and i = 0.
5. Set target slope skew to slop_skew[i] via META_DLL interface.
6. Command target to transmit EPSK TX burst via META_DLL interface.

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7. Measure modulation depth from radio communication tester (RCT). And save it to virTX[i] variable.
8. Evaluate slope and eva_slope_skew by the following formula.
slope = (slop_skew[1] - slop_skew[0]) / (virTX[1] - virTX[0]);
eval_slope_skew = (tx_slope_skew_target_power - virTX[0]) * slope;
If eval_slope_skew is large than 7, set eval_slope_skew to 7. If eval_slope_skew is lower than -4, set eval_slope_skew to -4.
9. Repeat steps 4~8 until all bands need to be calibrated are done.
10. Write eval_slope_skew of all bands need to be calibrated to NVRAM via META_DLL interface.

Note:

- The modulation depth of step 7 should be evaluated by the following formula:
  - Find the max value in the middle part of the array of measurement result from RCT.
    Maximum = max(Array[NoOfPoints/4 : NoOfPoints * 3/4]);
  - Find the two min values and calculate the average of them
    Min1 = min(Array[0: NoOfPoints/2])
    Min2 = min(Array[NoOfPoints/2: NoOfPoints-1])
    Minimum = (Min1 + Min2)/2
  - Calculate modulation depth
    MD = Maximum – Minimum.

4.2.17 MT6276 + MT6162 closed-loop power control calibration

The closed-loop power control mechanism utilizes the power detector on the RF chip as loop-back control. The calibration consists of 3 parts and then the check mechanism to check the closed-loop power control margin. All of the following calibrations must be calibrated after the TX power calibration. All of the calibration is determined by the capability (GMSKClosedLoopPowerControl or EPSKClosedLoopPowerControl). If the capability is turned on, the closed-loop power control takes effect.

1. By PCL compensation: Calibrate the detector target value of each power level.
2. Temperature compensation (if any): Evaluate the temperature compensation of each temperature interval.
3. Subband detector coupler loss compensation: Calibrate the coupler loss of subband.
4. Power control calibration result check by the configured margin.

4.2.17.1 MT6276 + MT6162 closed-loop power control calibration (By-PCL compensation)

4.2.17.1.a MT6276 + MT6162 closed-loop power control calibration (By-PCL compensation - steps)

The By-PCL compensation is actually a simple power sweep over all calibrated power levels.

1. Issue the TX command to target with the parameter of arfcn_C0_xxx, testing period in frames, AFC DAC gotten from 2 or 33 steps AFC calibration and TX power in PCL.
2. Repeat step 1 for each PCL, until all PCL are complete
3. Repeat step 1 ~ 2 for each band need to be calibrated.
4. Get calibration result from the L1 runtime value after calibration via META DLL interface(META_Rf_GetTXPCDetectorValueGMSK or META_Rf_GetTXPCDetectorValueEPSK)
5. Write the runtime value to NVRAM LID (NVRAM_EF_L1_GMSK_TXPC_LID or NVRAM_EF_L1_EPSK_TXPC_LID)

Note:

- arfcn_C0_xxx could be at the middle of the band. arfcn_C0_xxx is specified in [C0 for each Bank] section of configuration file.

4.2.17.1.b MT6276 + MT6162 closed-loop power control calibration (By-PCL compensation –sample code)

Given

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- mod: current modulation
- txpc_table: the calibration data
- txpc_cl_pd_ptr: power detector measurement class object
- txpc_cl_ptr: closed-loop calibrataion NVRAM access class object

```
bool __fastcall T_META_factory_calibration::Traditional_TXPCCL_Cal(E_MODULATION mod, l1cal_txpc_T
&txpc_table, IRFTXPCCL_PD_INT * txpc_cl_pd_ptr, CRFTXPCCL* txpc_cl_ptr )
{
   FrequencyBand eFreqBand = FrequencyBand850;
   while (eFreqBand < FrequencyBandCount)
   {
      if (!IsFreqBankSupported(m_asFreqBank, eFreqBand))
      {
         eFreqBand++;
         continue;
      }
      Trace("Band = " + FreqBand_To_Str(eFreqBand));
      // By PCL compensation by sweeping through all PCL
      if(!PCLSweep(
            false /* do not do measurement */,
            4 /* frames */,
            eFreqBand,
            mod,
            NULL /* don't need measurement result */))
      {
         Trace_Err("PCL Sweep failed");
         return false;
      }
      CHECK_TERMINATE_BY_USER;
      eFreqBand++;
   } // while
   return true;
} // end of TXPC CAL

bool __fastcall T_META_factory_calibration::PCLSweep(bool do_measurement_on_tester, short
measurement_frames, FrequencyBand eFreqBand, E_MODULATION mod, double *pcl_power)
{
   short s_ARFCN;
   Trace("PCL sweep");
   switch (eFreqBand)
   {
      case FrequencyBand850:
      {
         s_ARFCN = m_sARFCN_C0_GSM850;
         break;
      }

      case FrequencyBand900:
      {
         s_ARFCN = m_sARFCN_C0_GSM;
         break;
      }
```


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```
    case FrequencyBand1800:
    {
        s_ARFCN = m_sARFCN_C0_DCS;
        break;
    }

    case FrequencyBand1900:
    {
        s_ARFCN = m_sARFCN_C0_PCS;
        break;
    }
} // switch
if(do_measurement_on_tester)
{
    if( ! m_rct_ctrl.RCT_cellBand( m_pRct, FreqBand_To_AgeBand(eFreqBand) ) )
    {
        CalErrorHandler( WM_MF_AGE8960_SET_BAND_FAIL );
        Trace_Err(m_pRct->as_RCT + " < Band = " + ViBand_To_Str(  FreqBand_To_AgeBand(eFreqBand) ));
        return false;
    }
}
CHECK_TERMINATE_BY_USER;

for( int N=0;N < Get_PCL_Count(eFreqBand); N++)
{
    // DUT TX
    S_DUT_TX_T tx_settings;
    tx_settings.mod = mod;
    tx_settings.band_index = FreqBand_To_BandIdx(eFreqBand);
    tx_settings.bch = s_ARFCN;
    tx_settings.tch = s_ARFCN;
    tx_settings.afc_dac = m_sDefault_value;
    tx_settings.frames = measurement_frames;
    tx_settings.tsc = m_cTSC;
    tx_settings.pcl = m_sPCL[mod][eFreqBand][N];
    tx_settings.cs = CodingSchemeMCS5;
    tx_settings.pattern = NB_TX_ALL_ZEROS_WITHOUT_TSC;//NB_TX_RANDOM_WITH_TSC;
    if(!DUT_TX(tx_settings))
    {
        Trace_Err("DUT_TX failed");
        return false;
    }
    CHECK_TERMINATE_BY_USER;
    if(do_measurement_on_tester)
    {
        if(mod == GMSK)
        {
            // GMSK
            if( ! m_rct_ctrl.RCT_ReadTxPower( m_pRct, m_virTX ) )
            {
```


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```
                CalErrorHandler( WM_MF_RCT_READ_TX_POWER_FAIL );
                Trace_Err(m_pRct->as_RCT + " < read TX power ");
                return false;
            }
        }
        else
        {
            // EPSK
            if( ! m_rct_ctrl.RCT_ReadTxPower_EPSK( m_pRct, m_virTX) )
            {
                CalErrorHandler( WM_MF_RCT_READ_TX_POWER_FAIL );
                Trace_Err(m_pRct->as_RCT + " < read TX power ");
                return false;
            }
        }
        Trace("%s < read TX power (%.3lf)", m_pRct->as_RCT.c_str(), m_virTX);
    }
    STOP_RF;
  } // for N
  return true;
}
```

4.2.17.2 MT6276 + MT6162 closed-loop power control calibration (Temperature compensation)

The temperature compensation is determined by the capability ClosedLoopPowerControlTemperature. This calibratioin is used to adjust the temperature compensation for the closed-loop power control. All the temperature compensation is done in Max PCL.

4.2.17.2.a MT6276 + MT6162 closed-loop power control calibration (Temperature compensation – steps)

1. Find the temperature interval for calibration by linear search

   Boundaries of temperature intervals are defined as {-10℃, 5℃, 20℃, 35℃, 45℃, 55℃, 60℃, 65℃ } each of the interval represents the temperature target value of each temperature interval. The temperature compensation value acts as target value. The compensation is combined with the by-PCL compensation. eg. The current temperature is 30℃, the temperature compensation is {700, 800, 900, 1000, 1100, 1200, 1300, 1400} and the by-PCL compensation of the Max PCL is 800. (calibrated in 20℃. Then we'll know that due to temperature effect, the detector measurement result will be 900. We'll take 900 – 800 + 800 as the target value for the loop-back control.
2. Calculate the reference DAC value for calibration by interpolating the DAC value
3. Measure the temperature sensor report and then evaluate the adjustment amount by the equation
4. Add adjustment to all of the temperature compensation
5. Write calibration data to NVRAM_EF_L1_GMSK_TXPC_LID or NVRAM_EF_L1_EPSK_TXPC_LID

4.2.17.2.b MT6276 + MT6162 closed-loop power control calibration (Temperature compensation – sample code)

Given

- cal_temperature: calibration temperature defined by CFG entry TXPC_CAL_TEMP
- measurement_value: power detector report value of cal_temperature
- min_limit: minimum value of power detector report
- max_limit: maximum value of power detector report
- ref_curve: (8-element array of DAC value, represents the initial temperature offset of different temperature intervals)

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- result_array: (8-element array of DAC value, represents the calibrated temperature offset of different temperature intervals)

```
int temperature_array[] = {INT_MIN, -10, 5, 20, 35, 45, 55, 60, 65 };
int cal_interval = 0;
for(int i=1;i<=8;i++)
{
   if(cal_temperature <= temperature_array[i])
   {
      cal_interval = i;
      if(i == 1)
      {
         Trace_Err("Current temperature is below %d posibly the configuration is wrong", temperature_array[i]);
         return false;
      }
      break;
   }
}
Trace("Current temperature is in %d ~ %d", temperature_array[cal_interval-1], temperature_array[cal_interval]);
unsigned short m_usREF_ADC  = ref_curve[cal_interval-2] +
    ((ref_curve[cal_interval-1] - ref_curve[cal_interval-2])*
     (cal_temperature - temperature_array[cal_interval-1]) /
     (temperature_array[cal_interval] - temperature_array[cal_interval-1]));
Trace("Current temperature reference point is evaluated as %3d", m_usREF_ADC);
float fdata;

Trace("Calibration ref point TADC %3d = %4d", cal_temperature, m_usREF_ADC);
for(int i=0;i<8;i++)
{
   Trace(" TADC %3d = %4d", temperature_array[i+1], ref_curve[i]);
   fdata = (measurement_value - m_usREF_ADC) + ref_curve[i];
   fdata += (fdata>=0) ? 0.5 : -0.5 ;
   Trace(" Calibrated TADC %3d = %4d (%4d+%4d)",
      temperature_array[i+1],
      (unsigned short) fdata,
      ref_curve[i],
      (measurement_value - m_usREF_ADC));
   result_array[i] = (unsigned short) fdata;
}
// check if the ADC range is valid (MIN ~ MAX)
for(int i = 0; i < 8; i++)
{
   if( result_array[i] < min_limit ||
      result_array[i] > max_limit)
   {
      Trace_Err("Temperature compensation check: %4d should be [%d, %d]",
            result_array[i], min_limit, max_limit);
     return false;
   }
}
```


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4.2.17.3 MT6276 + MT6162 closed-loop power control calibration (Subband compensation)

The power detector measurement result is affected by the coupler. To eliminate the coupler loss in subband, we have to do a power sweep over frequency to determine the coupler loss compared to mid-channel.

4.2.17.3.a MT6276 + MT6162 closed-loop power control calibration (Subband compensation - steps)

1. Sweep the Max PCL power over all subband
2. Get the L1 runtime by the META interface (META_Rf_GetTXPCSubbandCompensationGMSK or META_Rf_GetTXPCSubbandCompensationEPSK)
3. Write calibration data (subband compensation to NVRAM_L1_<band>_RAMPTABLE_LID or NVRAM_L1_EPSL<band>_RAMPTABLE_LID

4.2.17.3.b MT6276 + MT6162 closed-loop power control calibration (Subband compensation – sample code)

```
bool __fastcall T_META_factory_calibration::ChannelSweep(
      bool do_measurement_on_tester
      , short measurement_frames
      , FrequencyBand eFreqBand
      , E_MODULATION mod
      , int pcl
      , double *channel_power
      )
{
   short subband_count;
   if(do_measurement_on_tester)
   {
      if( ! m_rct_ctrl.RCT_cellBand( m_pRct, FreqBand_To_AgeBand(eFreqBand) ) )
      {
         CalErrorHandler( WM_MF_AGE8960_SET_BAND_FAIL );
         Trace_Err(m_pRct->as_RCT + " < Band = " + ViBand_To_Str(  FreqBand_To_AgeBand(eFreqBand) ));
         return false;
      }
   }
   if(mod == GMSK)
   {
      m_pCal->s_cal_obj.pc_RF_APC_Obj->Get_SubBandCount(FreqBand_To_BandIdx(eFreqBand),
subband_count);
   }
   else
   {
      m_pCal->s_cal_obj.pc_RF_EPSK_APC_Obj->Get_SubBandCount(FreqBand_To_BandIdx(eFreqBand),
subband_count);
   }
   for(int i=0;i<subband_count;i++)
   {
      short s_ARFCN;
      if(mod == GMSK)
      {
         m_pCal->s_cal_obj.pc_RF_APC_Obj->Get_SubBandMidChannel(FreqBand_To_BandIdx(eFreqBand),   i,
s_ARFCN);
      }
```


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```
        else
        {
            m_pCal->s_cal_obj.pc_RF_EPSK_APC_Obj-
>Get_SubBandMidChannel(FreqBand_To_BandIdx(eFreqBand), i, s_ARFCN);
        }
        // DUT TX
        S_DUT_TX_T tx_settings;
        tx_settings.mod = mod;
        tx_settings.band_index = FreqBand_To_BandIdx(eFreqBand);
        tx_settings.bch = s_ARFCN;
        tx_settings.tch = s_ARFCN;
        tx_settings.afc_dac = m_sDefault_value;
        tx_settings.frames = measurement_frames;
        tx_settings.tsc = m_cTSC;
        tx_settings.pcl = pcl;
        tx_settings.cs = CodingSchemeMCS5;
        tx_settings.pattern = NB_TX_RANDOM_WITH_TSC;
        if(!DUT_TX(tx_settings))
        {
            Trace_Err("DUT_TX failed");
            return false;
        }
        CHECK_TERMINATE_BY_USER;
        if(do_measurement_on_tester)
        {
            if(mod == GMSK)
            {
                if (!m_rct_ctrl.RCT_MSTXLevel(m_pRct, pcl))
                {
                    CalErrorHandler( WM_MF_AGE8960_SET_MS_TX_LEVEL_FAIL );
                    Trace_Err(m_pRct->as_RCT + " < MS TX level = " + IntToStr(pcl)
                        );
                    return false;
                }
                // GMSK
                if( ! m_rct_ctrl.RCT_TCHARFCN( m_pRct, s_ARFCN ) )
                {
                    CalErrorHandler( WM_MF_AGE8960_SET_TCH_ARFCN_FAIL );
                    Trace_Err(m_pRct->as_RCT + " < TCH ARFCN = " + IntToStr( s_ARFCN )
                        );
                    return false;
                }
                if( ! m_rct_ctrl.RCT_ReadTxPower( m_pRct, m_virTX ) )
                {
                    CalErrorHandler( WM_MF_RCT_READ_TX_POWER_FAIL );
                    Trace_Err(m_pRct->as_RCT + " < read TX power ");
                    return false;
                }
            }
            else
            {
```


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```
            if (!m_rct_ctrl.RCT_PDTCHMSTxLevel(m_pRct, pcl))
            {
                CalErrorHandler( WM_MF_AGE8960_SET_MS_TX_LEVEL_FAIL );
                Trace_Err(m_pRct->as_RCT + " < MS TX level = " + IntToStr(pcl)
                        );
                return false;
            }
            // EPSK
            if( ! m_rct_ctrl.RCT_PDTCHARFCN( m_pRct, s_ARFCN ) )
            {
                CalErrorHandler( WM_MF_AGE8960_SET_TCH_ARFCN_FAIL );
                Trace_Err(m_pRct->as_RCT + " < PDTCH ARFCN = " + IntToStr( s_ARFCN )
                        );
                return false;
            }
            if( ! m_rct_ctrl.RCT_ReadTxPower_EPSK( m_pRct, m_virTX) )
            {
                CalErrorHandler( WM_MF_RCT_READ_TX_POWER_FAIL );
                Trace_Err(m_pRct->as_RCT + " < read TX power ");
                return false;
            }
        }
        Trace("%s < read TX power on ARFCN (%4d) (%.3lf)", m_pRct->as_RCT.c_str(), s_ARFCN, m_virTX);
        channel_power[i] = m_virTX;
    }
    STOP_RF;
  }
  return true;
}
```

4.2.17.4 MT6276 + MT6162 closed-loop power control check

If the closed-loop power control is turned on, the APC DAC will be adjusted by detector loop-back control. To ensure that the closed-loop power control have enough margin. The user has to set the minimum/maximum APC DAC to check the margin. There're two parts of check

1. By-PCL check: To check whether there is enough margins for loop-back power control at each power level.
2. Subband comepensation check: To check whether the compensation is not over a reasonable range.

4.2.17.4.a MT6276 + MT6162 closed-loop power control check (By-PCL check)

The values are set by TXPC_GMSK_MIN_APC_DAC/TXPC_GMSK_MAX_APC_DAC and TXPC_EPSK_MINX_APC_DAC/ TXPC_EPSK_MAX_APC_DAC in CFG file.

1. Check all APC DAC value in calibrated ramptable structure (for GMSK)
    1. If any of the APC DAC value is smaller TXPC_GMSK_MIN_APC_DAC or larger than TXPC_GMSK_MAX_APC_DAC, the check fails
    2. Otherwise, the check passes
2. Check all APC DAC value in calibrated ramptable structure (for EPSK)
    1. If any of the APC DAC value is smaller TXPC_EPSK_MIN_APC_DAC or larger than TXPC_EPSK_MAX_APC_DAC, the check fails
    2. Otherwise, the check passes

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4.2.17.4.b MT6276 + MT6162 closed-loop power control check (subband compensation check)

The values are set by TXPC_MIN_SUBBAND_COMP/ TXPC_MAX_SUBBAND_COMP in CFG file.

1. Check all the subband compensation value in calibrated ramptable structure (high_weighting, the unit is 1/32 dB in this field)
    1. If any of the high_weighting DAV value is smaller than TXPC_MIN_SUBBAND_COMP or larger than TXPC_MAX_SUBBAND_COMP, the check fails
    2. Otherwise, the check passes

4.2.18 Fast Handset Calibration (FHC)

Mobile phone calibration during manufacturing typically involves making a set of a transmitter and a receiver measured at a number of different frequencies and power levels.

Traditionally making such measurements has entailed stepping through a number of test points (each point consists of a specific frequency and power level), which configure the mobile station and the test set, make the measurement and then return the results. This traditional method has a high overhead in time taken to do the configuration and return the results.

Fast handset calibration can significantly reduce time taken to perform these steps by storing the sequence of test points on both the mobile station and the test set: triggering the automatic execution of the sequence without intermediate intervention by the controller and then reading back all the measurement results in a single operation. This can be done for both the uplink and the downlink. In the case of the uplink the test set makes the required measurements on the signals transmitted from the mobile station. For the downlink the mobile station makes the measurements on the signals transmitted from the test set. In Agilent 8960, FDT (Fast Device Tune) technology is used for FHC. In CMU 200, Smart Alignment technology is used for FHC.

Fast handset calibration can be divided into 2 parts: downlink test sequence (DTS) and uplink test sequence (UTS).

4.2.18.1 Downlink Test Sequence (DTS)

DTS contains AFC auto calibration and path loss auto calibration. The procedure of DTS is described as follows:

1. If Agilent 8960 is used, configure operation mode of Agilent 8960 to FDT. In CMU 200, it is operated under non-signaling mode.

2. If CMU200 is used and if crystal component and 33 step AFC slope calibration algorithm are used, do the following because of smart alignment limitation of CMU200, we can't set more than 100 burst to do FHC DTS:

2.1 Configure the RX calibration signal reference levels in timeslots 0 to -60 dbm.

2.2 Configure the ramping to ON state.

2.3 Configure the RX calibration signal frequency table to be DTS frequency in first TDMA frame, and the rest of TDMA frame frequency to be OFF.

2.4.Set target DTS parameters rf_dts_req.afc_cal = true.

2.5 Set rf_dts_req.pl_cal = false.

2.6 Set rf_dts_req.sync_sb_num = 5

2.7 Set rf_dts_req.power = d_P_DL * 8

2.8 Set rf_dts_req.AfcDSS.band to the band of first RX path loss channel.

2.9 Set rf_dts_req.AfcDSS.band to the ARFCN of first RX path loss channel.

2.10 Set rf_dts_req.AfcDSS. linear_cal = false for 33 step AFC calibration

2.11Set rf_dts_req.AfcDSS.dac_value[i] = xo_afc_data.XO_SlopeAreaData[i].min_dac; 0≤i<33, where xo_afc_data is read from [Crystal AFC control] section of calibration data initial file.

2.12 Set rf_dts_req.AfcDSS.gain to (-35-D_PL)*8.

2.13 Set rf_dts_req.AfcDSS.repeat_cnt to N_AFC; where N_AFC is specified in [AFC Calibration] of the configuration file.

2.14 Set rf_dts_req.AfcDSS.capid_cal to true.

2.15 Set rf_dts_req.AfcDSS.capid_min to 0, and set rf_dts_req.AfcDSS.capid_max to maximum value of crystal CAP ID.

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2.16 Command target to start DTS via META_DLL interface.
2.17 After getting the result back, store in rf_dts_get_33Step_AFC_result_cnf.AfcResult and rf_dts_get_33Step_AFC_result_cnf.DtsmInfo for AFC calibration result.
2.18 Set b_afc_cal = false to indicate that AFC calibration is finished and won't do again in the following steps.
2.19 Set b_33_afc_cal_on_CMU200 = true to indicate that it is the case to do 33 step AFC calibration on CMU200
3 In Agilent 8960 and CMU200, configure the DTS test count as follows:
3.1 If both AFC and RX path loss need to be calibrated, test count = 3 + s_pl_arfcn_count, where s_pl_arfcn_count is number of ARFCN required to do RX path loss calibration.
3.2 If only RX path loss needs to be calibrated, test count = 2 + s_pl_arfcn_count.
3.3 If only AFC needs to be calibrated, test count = 2.
4. Configure the DTS repeat count of step 1 of Agilent 8960 to 10 for roughly FB synchronization.
5. Configure the DTS frequency of step 1 of Agilent 8960 to the first channel of RX path loss which needs to be calibrated.
6. Configure the DTS burst type of time slots 0~5 except timeslot 1 of step1 of Agilent 8960 to dummy burst. And configure the DTS burst type of timeslot 1 to FCB burst.
7. Configure downlink power of step 1 to P_DL, where P_DL is specified in configuration file.
8. If AFC doesn't need to be calibrated, go to step 11. Otherwise, configure the DTS repeat count of step 2 of Agilent 8960 as follows:
8.1 If TCVCXO component is used, repeat count = 2.
8.2 If Crystal component and 2-step AFC slope calibration algorithm are used, repeat count = 20 + 2 * (N_AFC + 2), where N_AFC is specified in INI file.
8.3 If Crystal component and 33 step AFC slope calibration algorithm are used, repeat count = 20 + 33 * (N_AFC + 2), where N_AFC is specified in INI file.
9. Configure the DTS frequency of step 1 to the first channel of RX path loss which needs to be calibrated.
10. Configure the DTS burst type of timeslots 0~5 except timeslot 1 of step 2 of Agilent 8960 to dummy burst. And configure the DTS burst type of timeslot 1 to FCB burst.
11. Configure downlink power of step 2 to P_DL, where P_DL is specified in configuration file.
12. If RX path loss doesn't need to be calibrated, go to step 15. If AFC doesn't need to be calibrated, set the current step to 2. Otherwise, set the current step to 3.
13. Configure the DTS repeat count of current step to 5 for finely SB synchronization.
14. Configure the DTS frequency of current step to the central frequency of the first calibrated RX path loss channel.
15. Configure the DTS burst type of time slot 0 to FSB burst, and configure DTS burst type of time slots 1~5 to dummy burst.
16. Configure the DTS downlink power of current step to P_DL.
17. Add RX path loss channels to DTS.
17.1 Set DTS repeat count of each RX path loss channel to 1.
17.2 Add the central frequency of each RX path loss channel to DTS frequency.
17.3 Configure the DTS burst type of time slots 0~5 to dummy burst.
17.4 Configure the DTS downlink power to P_DL.
18. If Agilent 8960 is used, command Agilent 8960 to start DTS. If CMU200 is used, command CMU200 to initialize RF Generator.
19. Set target DTS parameters via META_DLL interface as follows:
19.1 If AFC needs to be calibrated, rf_dts_req.afc_cal is set to true. Otherwise, rf_dts_req.afc_cal is set to false.
19.2 If RX path loss needs to be calibrated, rf_dts_req.pl_cal is set to true. Otherwise, rf_dts_req.pl_cal is set to false.
19.3 Set rf_dts_req.sync_sb_num to 5.
19.4 Set rf_dts_req.power to P_DL * 8.
19.5 Set rf_dts_req.AfcDSS.band to the band of first RX path loss channel.
19.6 Set rf_dts_req.AfcDSS.band to the ARFCN of first RX path loss channel.

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19.7 If 2 step AFC slope calibration is used, rf_dts_req.AfcDSS.linear_cal is set to true. Otherwise, rf_dts_req.AfcDSS.linear_cal is set to false.
19.8 rf_dts_req.AfcDSS.dac_value[] array is set using the following rules:
19.8.1 If 2 step AFC slope calibration is used and TCVCXO component is used,
rf_dts_req.AfcDSS.dac_value[0] = DAC1;
rf_dts_req.AfcDSS.dac_value[1] = DAC2; where DAC1 and DAC2 are specified in [AFC Calibration] of the configuration file.
19.8.2 If 2 step AFC slope calibration is used and crystal component is used,
rf_dts_req.AfcDSS.dac_value[0] = CRYSTAL_DAC1;
rf_dts_req.AfcDSS.dac_value[1]=CRYSTAL_DAC2; where CRYSTAL_DAC1 and CRYSTAL_DAC2 are specified in [AFC Calibration] of configuration file.
19.8.3 If 33 step AFC slope calibration is used,
rf_dts_req.AfcDSS.dac_value[i] = xo_afc_data.XO_SlopeAreaData[i].min_dac; 0≤i<33, where xo_afc_data is read from [Crystal AFC control] section of calibration data initial file.
19.9 Set rf_dts_req.AfcDSS.gain to (-35-D_PL)*8.
19.10 Set rf_dts_req.AfcDSS.repeat_cnt to N_AFC; where N_AFC is specified in [AFC Calibration] of the configuration file.
19.11 If TCVCXO component is used, set rf_dts_req.AfcDSS.capid_cal to false. Otherwise, set rf_dts_req.AfcDSS.capid_cal to true.
19.12 Set rf_dts_req.AfcDSS.capid_min to 0, and set rf_dts_req.AfcDSS.capid_max to maximum value of crystal CAP ID.
19.13 Set rf_dts_req.step_cnt to RX path loss channel number of high band or low band.
19.14 Assign each element of rf_dts_req.PathLossDSS[] array.
19.14.1 rf_dts_req.PathLossDSS[i].band = pl_freqband[i]; where pl_freqband[i] is frequency band of each RX path loss channel.
19.14.2 rf_dts_req.PathLossDSS[i].arfcn = pl_arfcn[i]; where pl_arfcn[i] is ARFCN of each RX path loss channel.
19.14.3 rf_dts_req.PathLossDSS[i].gain[gain_idx] = (-35 - P_DL) * 8;
19.14.4 rf_dts_req.PathLossDSS[i].repeat_cnt = 1
20. Command target to start DTS via META_DLL interface.
21. If Agilent 8960 is used, stop Agilent 8960 DTS. If CMU200 is used, abort the RF generator.
22. Get DTS result rf_dts_cnf from target via META_DLL interface. If b_33_afc_cal_on_CMU200 = true, copy rf_dts_get_33Step_AFC_result_cnf.AfcResult and rf_dts_get_33Step_AFC_result_cnf.DtsmInfo to rf_dts_get_result_cnf.AfcResult and rf_dts_get_result_cnf.DtsmInfo for 33 step AFC calibration result by using CMU200.
23. If AFC need to be calibrated, do the following setting
23.1 If 2 step AFC slope calibration is used,
nvram_afc.s_InitAfcDac = rf_dts_cnf.AfcResult.init_dac_value;
nvram_afc.i_AfcSlopeInv = rf_dts_cnf.AfcResult.slope / Afc_Slope_factor;
23.2 If 33 step AFC slope calibration is used
Find one element to satisfy the condition:
rf_dts_cnf.AfcResult.freq_offset[i] * rf_dts_cnf.AfcResult.freq_offset[i+1] <= 0
And then do the following assignment:
Slope = (rf_dts_cnf.AfcResult.freq_offset[i]-rf_dts_cnf.AfcResult.freq_offset[i+1]) /
(rf_dts_req.AfcDSS.dac_value[i+1] - rf_dts_req.AfcDSS.dac_value[i]);
Slope_inv = (4096 / (Slope *Afc_Slope_factor));
Default_value = ((rf_dts_cnf.AfcResult.freq_offset[i]/Slope) + rf_dts_req.AfcDSS.dac_value[i]);
nvram_afc.s_InitAfcDac = Default_value;
nvram_afc.i_AfcSlopeInv = Slope_inv;
24. Find the first index that satisfy the following conditions, and save it to start_afc_idx
abs(rf_dts_cnf.AfcResult.freq_offset[i]) < 30000 and rf_dts_cnf.AfcResult.fcb_ok_number[i] > 0.
25. Find the last index that satisfies the following conditions, and save it to end_afc_idx

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abs(rf_dts_cnf.AfcResult.freq_offset[i]) < 30000 and rf_dts_cnf.AfcResult.fcb_ok_number[i] > 0.

26. For each element from start_afc_idx to end_afc_idx, do the following assignment:
xo_afc_data.XO_SlopeAreaData[i-i_start_afc_idx].min_dac = rf_dts_req.AfcDSS.dac_value[i];
xo_afc_data.XO_SlopeAreaData[i-i_start_afc_idx].min_freq = rf_dts_cnf.AfcResult.freq_offset[i];
27. For each element from end_afc_idx-start_afc_idx+1 to 32, do the following assignment:
xo_afc_data.XO_SlopeAreaData[i-i_start_afc_idx].min_dac = -1;
xo_afc_data.XO_SlopeAreaData[i-i_start_afc_idx].min_freq = 0;
28. If RX path loss needs to be calibrated, evaluate the RX path loss of each channel using the following formula:
pm_power = (P_DL - rf_dts_cnf.PLResult.power[i]/8);
path_loss.agcPathLoss[rf_dts_req.PathLossDSS[i].band][i].gain_offset = (pm_power*8);
29. Repeat steps 2~27 until low and high band has been calibrated.
30. If AFC is calibrated, write the following calibration data to target NVRAM via META_DLL interface.
30.1 Write AFC slope and initial AFC DAC value to target NVRAM.
30.2 If crystal component is used, write crystal CAP ID to target NVRAM.
30.3 If crystal component and 33 step AFC slope calibration are used, write crystal AFC data to target NVRAM.
31. If RX path loss is calibrated, write RX path loss calibration data to target NVRAM via META_DLL interface.
32. If AFC is calibrated, do the following checking.
32.1 If AFC slope and initial AFC DAC are in the range specified in [AFC table] section of the configuration file, AFC slope and initial AFC DAC check result is passed. Otherwise, if AFC slope and initial AFC DAC check result fails, abort checking procedure.
32.2 If crystal component is used, do the following checking:
If cap_id > CRYSTAL_AFC_MAX_CAP_ID or cap_id < CRYSTAL_AFC_MIN_CAP_ID, CAP ID check result is failed, and abort the check procedure. Otherwise, CAP ID check result is passed. CRYSTAL_AFC_MIN_CAP_ID and CRYSTAL_AFC_MAX_CAP_ID are specified in [Crystal AFC Calibration] section of configuration file.
33. If RX path loss is calibrated, check RX path loss of each channel is in the range specified in [RX path loss table] section of the configuration file. If the RX path loss of each calibrated channel is in the range, RX path loss check result is “passed.” Otherwise, RX path loss check result is “failed.

4.2.18.2 Uplink Test Sequence (UTS)

UTS contains APC auto calibration. The procedure of UTS is described as follows:
1. Configure operation mode of Agilent 8960 to FDT.
2. If MT6140 transceiver is used, query its ITC PCL via META_DLL interface. The ITC PCL result is saved to itc_pcl. Calculate high band and low band itc_pcl as follows:
high_band_itc_pcl = (s_itc_pcl.pcl & 0xFFFF0000) >> 16;
low_band_itc_pcl = (s_itc_pcl.pcl & 0x0000FFFF);
3. Configure TX power parameters of UTS of Agilent 8960. TX power parameters contain capturing all burst, auto fetching highest power, and manually configuring target burst power.
If GPRS of MS capability of target is not supported, burst count = 1. Otherwise, burst count = 4. Configure burst count of UTS of Agilent 8960.
4. Find the ARFCN with sub-band high weighting to be closest to 1.
5. Calculate apc_dac_step using the following formula:
5.1 If MT6140 transceiver is used and modulation type is EPSK, do the following assignment:

```
apc_dac_step = (max_apc_dac - min_apc_dac) / (measure_samples/2 - 1);
if ((max_apc_dac - min_apc_dac) % (measure_samples/2 - 1))
{
        apc_dac_step++;
}
```

5.2 Otherwise, do the following assignment:

```
apc_dac_step = (max_apc_dac - min_apc_dac) / (measure_samples - 1);
if ((max_apc_dac - min_apc_dac) % (measure_samples - 1))
{
```


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```
            apc_dac_step++;
      }
```

6. Calculate total_step_count using the following formula:

```
     total_step_count = measure_samples / burst_count;
     if (measure_samples % burst_count)
     {
          total_step_count++;
     }
```

7. Calculate uts_num using the following formula:

```
    uts_num = measure_samples / (burst_count * 50);
    if (s_measure_samples % (burst_count * 50))
    {
         uts_num++;
    }
```

8. Calculate cur_step_count using the following formula:

```
   cur_step_count = min(total_step_count, 50);
```

9. Configure step count of Agilent 8960 FDT UTS as cur_step_count.
10. Configure the frequency of steps 1~ cur_step_count to the central frequency of channel specified in [C0 for each Bank] section of the configuration file.
11. Configure burst modulation of burst 0~burst_count of Agilent 8960 FDT.
12. Configure the expected power of each burst to largest calibrated power as specified in configuration file.
13. Query the TX power step frame number from Agient 8960 and then save it to frame_num.
14. Command Agilent 8960 to initiate FDT TX power measurement.
15. Repeat query until FDT TX power measurement initialization is done.
16. Set target UTS related parameters as follows:
16.1 Set req.ApcUSS[i].band to the current calibrated frequency band.
16.2 Set req.ApcUSS[i].arfcn to the channel specified in [C0 for each Bank] section of the configuration file.
16.3 Set req.ApcUSS[i].timeslot_per_frame to burst_count.
16.4 Set req.ApcUSS[i].apc_dac_pcl_sel to 1 (i.e. APC DAC selection).
16.5 Set req.ApcUSS[i].repeat_cnt to frame_num got at step 13.
16.6 Set req.ApcUSS[i].afc_dac_value to initial AFC DAC from 2 or 33 step AFC slope calibration.
16.7 Set req.ApcUSS[i].tsc to TSC, where TSC is specified in [TX PCL table] section of the configuration file.
16.8 Set req.ApcUSS[i].pattern to NB_TX_RANDOM_WITH_TSC.
16.9 Set req.ApcUSS[i].pattern_data to 0.
16.10 Set req.ApcUSS[i].apc_dac_pcl_value[j] of time slots 0~3 as follows:
16.10.1 If MT6140 transceiver is used and current modulation mode is EPSK, do the following assignment:
16.10.1.1 If j ≤ 1, req.ApcUSS[i].apc_dac_pcl_value[j] = (max_apc_dac - ((2*i + j) * apc_dac_step));
16.10.1.2 If j > 1, req.ApcUSS[i].apc_dac_pcl_value[j] = req.ApcUSS[i].apc_dac_pcl_value[j-2];
16.10.2 Otherwise, do the following assignment:
req.ApcUSS[i].apc_dac_pcl_value[j] = (max_apc_dac - ((4*i + j) * apc_dac_step));
16.11 Set req.ApcUSS[i].pa_vbias_val[j] to the value specified in [PA Vbias] section of calibration data initial file; where 0≤ j ≤ 3.
16.12 If modulation type is GMSK, set req.ApcUSS[i].cs[j] to CodingSchemeCS1. Otherwise, set req.ApcUSS[i].cs[j] to CodingSchemeMCS5.
17. Command target to start FDT UTS.
18. Fetch uplink TX power from Agilent 8960 and save it to all_burst_power[] array.
19. Abort uplink TX power measurement.
20. Evaluate APC DAC of each PCL using the following formula:
20.1 If MT6140 transceiver is used and current modulation type is EPSK, do the following assignment:
20.1.1 If (wanted_p[mod][pcl_idx] >= all_burst_power_hl[pa_mod_idx][0]),

```
     slope = 1.0 * (all_apc_dac_hl[pa_mod_idx][1] - s_all_apc_dac_hl[pa_mod_idx][0]) /
```


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(d_all_burst_power_hl[pa_mod_idx][1] - all_burst_power_hl[pa_mod_idx][0]);
epsk_apc_profile.s_ramp_table[e_bandsel].rampData.power[pcl_idx] = slope * (wanted_p[mod][pcl_idx] + correction[mod][pcl_idx] - all_burst_power_hl[pa_mod_idx][0]) + all_apc_dac_hl[pa_mod_idx][0]) / (arfcn_weight * battery_compensate[mod]);

20.1.2 if (wanted_p[mod][pcl_idx] <= all_burst_power_hl[pa_mod_idx][bp_idx]) &&
(wanted_p[mod][pcl_idx] >= all_burst_power_hl[pa_mod_idx][bp_idx+1]))
slope = 1.0 * (all_apc_dac_hl[pa_mod_idx][bp_idx+1] - all_apc_dac_hl[pa_mod_idx][bp_idx]) /
(all_burst_power_hl[pa_mod_idx][bp_idx+1] - all_burst_power_hl[pa_mod_idx][bp_idx]);
epsk_apc_profile.s_ramp_table[e_bandsel].rampData.power[pcl_idx] = slope * (wanted_p[mod][pcl_idx] + correction[mod][pcl_idx]- all_burst_power_hl[pa_mod_idx][bp_idx]) + all_apc_dac_hl[pa_mod_idx][bp_idx]) / (arfcn_weight * battery_compensate[mod]);

20.1.3 if (wanted_p[mod][pcl_idx] <= all_burst_power_hl[pa_mod_idx][s_measure_samples/2-1]),
slope=1.0*(all_apc_dac_hl[pa_mod_idx][s_measure_samples/2-1]-
all_apc_dac_hl[pa_mod_idx][measure_samples/2-2]) /
(all_burst_power_hl[pa_mod_idx][measure_samples/2-1]-
all_burst_power_hl[pa_mod_idx][s_measure_samples/2-2]);

21. If transceiver is not MT6140 or modulation type is GMSK, do the following assignment.

20.2 If (wanted_p[mod][pcl_idx] >= all_burst_power[0]),
slope = 1.0 * (all_apc_dac[0] - all_apc_dac[1]) / (all_burst_power[0] - all_burst_power[1]);
If modulation type is GMSK, s_gmsk_apc_profile[e_bandsel].rampData.power[pcl_idx] = slope * (wanted_p[mod][pcl_idx] + correction[mod][pcl_idx] - all_burst_power[0]) + all_apc_dac[0]) / (arfcn_weight * battery_compensate[mod]);
If modulation type is EPSK, s_epsk_apc_profile.s_ramp_table[e_bandsel].rampData.power[pcl_idx] = slope * (wanted_p[mod][pcl_idx] + correction[mod][pcl_idx] - all_burst_power[0]) + all_apc_dac[0]) / (arfcn_weight * battery_compensate[mod]);

20.3 If ((wanted_p[mod][pcl_idx] <= all_burst_power[bp_idx]) &&
(wanted_p[mod][pcl_idx] >= all_burst_power[bp_idx+1]))
slope = 1.0 * (all_apc_dac[bp_idx+1] - all_apc_dac[bp_idx]) /
(all_burst_power[bp_idx+1] - all_burst_power[bp_idx]);
If modulation type is GMSK, gmsk_apc_profile[e_bandsel].rampData.power[pcl_idx] = slope * (wanted_p[mod][pcl_idx] + correction[mod][pcl_idx] - all_burst_power[bp_idx]) + all_apc_dac[bp_idx]) / (arfcn_weight * battery_compensate[mod]);
If modulation type is EPSK, epsk_apc_profile.s_ramp_table[e_bandsel].rampData.power[pcl_idx] = slope * (wanted_p[mod][pcl_idx] + correction[mod][pcl_idx] - all_burst_power[bp_idx]) + all_apc_dac[bp_idx]) / (arfcn_weight * battery_compensate[mod]);

20.4 If (wanted_p[mod][pcl_idx] <= all_burst_power[s_measure_samples-1]),
slope = 1.0 * (all_apc_dac[s_measure_samples-1] - all_apc_dac[measure_samples-2]) /
(all_burst_power[measure_samples-1] - all_burst_power[measure_samples-2]);
If modulation type is GMSK, gmsk_apc_profile[e_bandsel].rampData.power[pcl_idx] = slope * (wanted_p[mod][pcl_idx] + correction[mod][pcl_idx] - all_burst_power[s_measure_samples-1]) + all_apc_dac[measure_samples-1]) / (arfcn_weight * battery_compensate[mod]);
If modulation type is EPSK, epsk_apc_profile.s_ramp_table[e_bandsel].rampData.power[pcl_idx] = slope * (wanted_p[mod][pcl_idx] + correction[mod][pcl_idx] - all_burst_power[measure_samples-1]) + all_apc_dac[measure_samples-1]) / (arfcn_weight * battery_compensate[mod]);

21. If current modulation type is GMSK, write GMSK APC profile to target NVRAM via META_DLL interface.
22. If current modulation type is EPSK, write EPSK APC profile to target NVRAM via META_DLL interface.
23. Repeat steps 3~22 until all bands need to be calibrated are finish.
24. If MT6140 transceiver is used, write PA Vbias to target NVRAM via META_DLL interface.

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4.2.18.3 Uplink Test Sequence (UTS) for MT6162 EPSK TX PCL calibration

The MT6162 EPSK calibration is different from other RF chips. The calibration relies on a sutiable initial value that is generated by a traditional calibration.

4.2.18.3.a Uplink Test Sequence (UTS) for MT6162 EPSK TX PCL calibration (steps)

1. Configure the Agilent 8960 FDT or R&S SmartAlignment parameters for calibration
2. Assign all of the PCL of a frequency band to FHC UTS interface
3. Do power sweep of all PCL of a frequency band
4. Evaluate the target value by 1/32 dBm/DAC
5. Repeat 1 ~ 4 for all supported frequency band

4.2.18.3.b Uplink Test Sequence (UTS) for MT6162 EPSK TX PCL calibration (sample code)

```
bool __fastcall T_META_factory_calibration::FHC_UTS_MT6162_EPSK_Cal(void)
{
   Trace(" ========================= FDT UTS MT6162 calibration begin ========================
");
   FrequencyBand eFreqBand = FrequencyBand850;
   while (eFreqBand < FrequencyBandCount)
   {
      if (!IsFreqBankSupported(m_asFreqBank, eFreqBand))
      {
         eFreqBand++;
         continue;
      }
      Trace(" ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++ ");
      Trace("Band = %s", FreqBand_To_Str(eFreqBand).c_str());
      E_BANDSEL e_bandsel = FreqBand_To_BandIdx(eFreqBand);
      char c_pcl_count = Get_PCL_Count(eFreqBand);
      // fixed in single slot
      char c_step_count = c_pcl_count;
      int apc_mod[MOD_COUNT];
      apc_mod[GMSK] = APC_MOD_GMSK;
      apc_mod[EPSK] = APC_MOD_EPSK;
      AnsiString as_mod[MOD_COUNT] = {"GMSK", "EPSK"};
      for (E_MODULATION mod = EPSK; mod < MOD_COUNT; mod++)
      {
         if (!(m_pCal->i_APC_mod & apc_mod[mod]))
         {
            continue;
         }
         Trace(" ------------------------------------------------------------ ");
         Trace("Modulation = %s", as_mod[mod].c_str());
         // first sample
         S_RCT_FDT_TX_BURST_POWER_T all_burst_power[4];
         double PCL_power[16];
         if(!FHC_UTS_PCLSweep(
                  true/* do measurement*/,
                  1,
                  eFreqBand /* frequency band */,
                  mod /* modulation */,
```


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```
                m_dWANTED_P[mod][eFreqBand][c_pcl_count-1] /* expected power */,
                PCL_power))
        {
            Trace_Err("FHC UTS PCL Sweep failed");
            return false;
        }
        /// interpolation
        if(!PCL_Interpolation_MT6162(eFreqBand, mod, PCL_power, true /* interpolation */))
        {
            Trace_Err("Interpolation error");
            return false;
        }
        WriteEpskAPCCalResultToFile(as_ID+".cal",Application->ExeName,          m_pCal->b_CalResultPath,
FreqBand_To_BandIdx(eFreqBand) );
        WriteEpskInterslotrampToFile(as_ID+".cal",Application->ExeName,          m_pCal->b_CalResultPath,
FreqBand_To_BandIdx(eFreqBand));
    } // modulation
    eFreqBand++;
  }
  // Write ramptable to NVRAM
  {
    RestartTimerCal ( WM_MF_SET_SUBBAND_WEIGHTING_FAIL );
    m_pCal->s_cal_obj.pc_RF_EPSK_APC_Obj->ConfirmCallback = ::CNF_MF;
    m_pCal->s_cal_obj.pc_RF_EPSK_APC_Obj->REQ_Write_APC_To_NVRAM_Start(m_pCal->ui_2g_rf_id,
m_pCal->s_bandsel);
    CHECK_TERMINATE_BY_USER;
    SUSPEND_CAL_THREAD;
    E_METAAPP_RESULT_T state = m_pCal->s_cal_obj.pc_RF_EPSK_APC_Obj->Get_ConfirmState();
    if (state != METAAPP_SUCCESS)
    {
        if (METAAPP_NVRAM_LID_VER_NOT_SUPPORT == state)
        {
            CalErrorHandler(WM_MF_NVRAM_EF_L1_RAMPTABLE_xxx_LID_VERNO_FAIL);
            Trace_Err("NVRAM_EF_L1_RAMPTABLE_xxx_LID version is not support, please update META to
latest version. ");
        }
        else
        {
            CalErrorHandler( WM_MF_SET_SUBBAND_WEIGHTING_FAIL );
            Trace_Err("Target < Write TX ramptable to NVRAM fail.");
        }
        return false;
    }
  }
  if(m_pCal->s_CalItem.b_tx_subband_cal &&
        m_pCal->RfCapability.capability.EPSKClosedLoopPowerControl)
  {
    if(!TXPCCL_Cal(EPSK))
    {
        return false;
    }
```


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```
    }
    Trace(" ========================= FDT UTS MT6162 calibration end ========================
");
    PostMessage(
            ctrl.hPostMsgDestHandle,
            WM_MF_RF_UTS_DONE,
            0,
            0
            );
    return true;
}
/**
 *
 * @param[IN] eFreqBand frequency band
 * @param[IN] mod modulation
 * @param[IN] pcl_power measured sample PCL power
 * @param[IN] compensate do compensation or not
 */
bool __fastcall T_META_factory_calibration::PCL_Interpolation_MT6162(
        FrequencyBand eFreqBand
        , E_MODULATION mod
        , double *pcl_power
        , bool compensate
        )
{
    bool b_state = true;
    S_EPSK_RAMP_T s_epsk_apc_profile;
    l1cal_rampTable_T s_gmsk_apc_profile[MAX_SUPPORT_BAND_NUM];
    l1cal_rampTable_T& ramp_table = (mod == GMSK) ?
        s_gmsk_apc_profile[FreqBand_To_BandIdx(eFreqBand)] :
        s_epsk_apc_profile.s_ramp_table[FreqBand_To_BandIdx(eFreqBand)];
    if(compensate)
    {
        m_pCal->s_cal_obj.pc_RF_EPSK_APC_Obj->Get_ApcProfile(s_epsk_apc_profile);
    }
    char pcl_idx = Get_PCL_Count(eFreqBand)-1;
    {
        for (char step_idx = 0; step_idx < Get_PCL_Count(eFreqBand); step_idx++)
        {
            if (pcl_idx < 0)
            {
                break;
            }
            if(compensate)
            {
                short compensation = (m_dWANTED_P[mod][eFreqBand][pcl_idx] - pcl_power[step_idx]) * 32.0 /*
MT6162 PGA slope */ + 0.5;
                Trace("PCL[%2d]: Difference %7.3lf, Compensate %5d to from %5d to %5d",
                        pcl_idx,
                        m_dWANTED_P[mod][eFreqBand][pcl_idx] - pcl_power[step_idx],
                        compensation,
```


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```
                ramp_table.rampData.power[pcl_idx],
                ramp_table.rampData.power[pcl_idx] + compensation);
            ramp_table.rampData.power[pcl_idx] += compensation;
        }
        else
        {
            if ((pcl_power[step_idx] > m_dMAX_P[mod][eFreqBand][pcl_idx]) ||
                (pcl_power[step_idx] < m_dMIN_P[mod][eFreqBand][pcl_idx])
              )
            {
                Trace(log_str.sprintf("%s > read TX power = %7.3lf  (Out of range), min = %7.3lf, max = %7.3lf, diff =
%7.3lf",
                        m_pRct->as_RCT.c_str(),
                        pcl_power[step_idx],
                        m_dMIN_P[mod][eFreqBand][pcl_idx],
                        m_dMAX_P[mod][eFreqBand][pcl_idx],
                        (pcl_power[step_idx] - m_dWANTED_P[mod][eFreqBand][pcl_idx])
                        )
                    );
            }
            else
            {
                Trace(log_str.sprintf("%s > read TX power = %7.3lf  (    Pass    ), min = %7.3lf, max = %7.3lf, diff =
%7.3lf",
                        m_pRct->as_RCT.c_str(),
                        pcl_power[step_idx],
                        m_dMIN_P[mod][eFreqBand][pcl_idx],
                        m_dMAX_P[mod][eFreqBand][pcl_idx],
                        (pcl_power[step_idx] - m_dWANTED_P[mod][eFreqBand][pcl_idx])
                        )
                    );
            }
        }
        pcl_idx--;
    }
}
if(compensate)
{
    m_pCal->s_cal_obj.pc_RF_EPSK_APC_Obj->Set_ApcProfile(s_epsk_apc_profile);
    RestartTimerCal ( WM_MF_SET_SUBBAND_WEIGHTING_FAIL );
    m_pCal->s_cal_obj.pc_RF_EPSK_APC_Obj->ConfirmCallback = ::CNF_MF;
    m_pCal->s_cal_obj.pc_RF_EPSK_APC_Obj->REQ_RfEPSKSetRampTable_Start(m_pCal->ui_2g_rf_id,
FreqBand_To_BandIdx(eFreqBand));
    CHECK_TERMINATE_BY_USER;
    SUSPEND_CAL_THREAD;
    E_METAAPP_RESULT_T state = m_pCal->s_cal_obj.pc_RF_EPSK_APC_Obj->Get_ConfirmState();
    if (state != METAAPP_SUCCESS)
    {
        if (METAAPP_NVRAM_LID_VER_NOT_SUPPORT == state)
        {
            CalErrorHandler(WM_MF_NVRAM_EF_L1_RAMPTABLE_xxx_LID_VERNO_FAIL);
```


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```
            Trace_Err("NVRAM_EF_L1_RAMPTABLE_xxx_LID version is not support, please update META to latest version. ");
        }
        else
        {
            CalErrorHandler( WM_MF_SET_SUBBAND_WEIGHTING_FAIL );
            Trace_Err("Target < set TX ramptable fail.");
        }
        b_state = false;;
    }
  }
  return b_state;
}
```

4.2.18.4 UTS for TX sub-band calibration

The TX sub-band calibration is added after the TX PCL calibration and the calibration is done by evaluate the sub-band weighting on the fitting curve of the sub-band. That is, the META Tool will sample the output power of each sub-band (except the sub-band containing C0 channel) and derive the fitting curve.

So far, only MT6253 and AD6546 can apply the TX sub-band calibration flow.

1. The fitting curve of a sub-band is derived by sampling FHC_MAX_PCL_DAC_DELTA_SAMPLES samples starting from Max_PCL_APC_DAC - FHC_MAX_PCL_DAC_DELTA_RANGE to Max_PCL_APC_DAC + FHC_MAX_PCL_DAC_DELTA_RANGE; that is, the interval of APC DAC in each sample is 2 * FHC_MAX_PCL_DAC_DELTA_RANGE/(FHC_MAX_PCL_DAC_DELTA_SAMPLES-1).
2. Configure the tester to enter FDT (for Agilent 8960)
3. Configure the tester to measure TX power on the mid-channel of the sub-band.
4. Configure TX power parameters of UTS. TX power parameters include capturing all burst, auto-fetching the highest power, and manually configuring target burst power.
5. Configure the step count of the tester to the number of sub-bands.
6. Configure the frequency of steps 1 till the number of sub-bands to the central frequency of the mid-channel for each sub-band specified in the INI file.
7. Configure burst modulation of burst 0 of Agilent 8960 FDT.
8. Configure the expected power of burst 0 to wanted power of Max. PCL as specified in configuration file.
9. Set target UTS-related parameters as follows: (i from 0 to (number of TX sub-band - 1)*FHC_MAX_PCL_DAC_DELTA_SAMPLES).
   9.1 Set req.ApcUSS[i/ FHC_MAX_PCL_DAC_DELTA_SAMPLES].band to the current calibrated frequency band.
   9.2 Set req.ApcUSS[i/ FHC_MAX_PCL_DAC_DELTA_SAMPLES].arfcn to the mid-channel of the TX sub-band.
   9.3 Set req.ApcUSS[i/ FHC_MAX_PCL_DAC_DELTA_SAMPLES].timeslot_per_frame to 1.
   9.4 Set req.ApcUSS[i/ FHC_MAX_PCL_DAC_DELTA_SAMPLES].apc_dac_pcl_sel to 1 (i.e. APC DAC selection).
   9.5 Set req.ApcUSS[i/ FHC_MAX_PCL_DAC_DELTA_SAMPLES].repeat_cnt to frame_num got at step 13.
   9.6 Set req.ApcUSS[i/ FHC_MAX_PCL_DAC_DELTA_SAMPLES].afc_dac_value as initial AFC DAC from 2- or 33-step AFC slope calibration.
   9.7 Set req.ApcUSS[i/ FHC_MAX_PCL_DAC_DELTA_SAMPLES].tsc to TSC, where TSC is specified in [TX PCL table] section of the configuration file.
   9.8 Set req.ApcUSS[i/ FHC_MAX_PCL_DAC_DELTA_SAMPLES].pattern to NB_TX_RANDOM_WITH_TSC.
   9.9 Set req.ApcUSS[i/ FHC_MAX_PCL_DAC_DELTA_SAMPLES].pattern_data to 0.
   9.10 Set req.ApcUSS[i/ FHC_MAX_PCL_DAC_DELTA_SAMPLES].apc_dac_pcl_value[0] as follows:
      9.10.1 Let min_sample_dac = Max PCL calibrated APC DAC - FHC_MAX_PCL_DAC_DELTA_RANGE
      9.10.2 Let max_sample_dac = Max PCL calibrated APC DAC + FHC_MAX_PCL_DAC_DELTA_RANGE

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9.10.2 req.ApcUSS[i/ FHC_MAX_PCL_DAC_DELTA_SAMPLES].apc_dac_pcl_value[0] = (min_sample_dac + (i% FHC_MAX_PCL_DAC_DELTA_SAMPLES)* 2 *FHC_MAX_PCL_DAC_DELTA_RANGE/(FHC_MAX_PCL_DAC_DELTA_SAMPLES-1);

9.11 If modulation type is GMSK, set req.ApcUSS[i/ FHC_MAX_PCL_DAC_DELTA_SAMPLES].cs[j] to CodingSchemeCSNone, otherwise set to CodingSchemeCS5.

10. Start FHC and fetch the measurement result.

11. Derive fitting curve ofeach sub-band every FHC_MAX_PCL_DAC_DELTA_SAMPLES samples.

12. Interpolate the APC DAC of the Max. PCL for each sub-band on its fitting curve as DAC_1

12.1 The weighting of the sub-band is evaluated as DAC_1/calibrated APC DAC of the Max. PCL

12.2. Repeat step 12 until all sub-band weighting evaluations for the frequency band are done.

Note:

- The FHC TX sub-band calibration check procedure can be activated by setting FHC_UTS_TX_SUBBAND_FLATNESS_CALBRATE=1.
- FHC_UTS_TX_SUBBAND_FLATNESS_CALBRATE is defined in the TX PCL table of the CFG file.

[TX PCL table]
FHC_UTS_TX_SUBBAND_FLATNESS_CALBRATE=1
FHC_UTS_XXXX_GMSK_MATH_MODE = 0 : linear, 1: cubic spline interpolation
- XXXX = GSM850, GSM900, DCS1800, PCS1900

FHC_UTS_GMSK_APC_DAC_MODE = 0: step, 1: log mode in APC DAC Interleaving
FHC_UTS_GSM850_GMSK_APC_LOG_SPACE_OFFSET is the log space offset value when FHC_UTS_GMSK_APC_DAC_MODE sets to 1

4.3 3G Calibration Procedure

The section depicts WCDMA-relevant calibration items only.
Users can switch to META factory mode by selecting [Factory Mode] from main selection menu. The tool controls equipment and target to do the calibration procedure. Before using this tool, user must install driver of GPIB card. The META factory mode supports the following equipment for WCDMA-relevant calibration items.

- Radio Communication Tester (RCT): Agilent 8960 and R&S CMU 200.

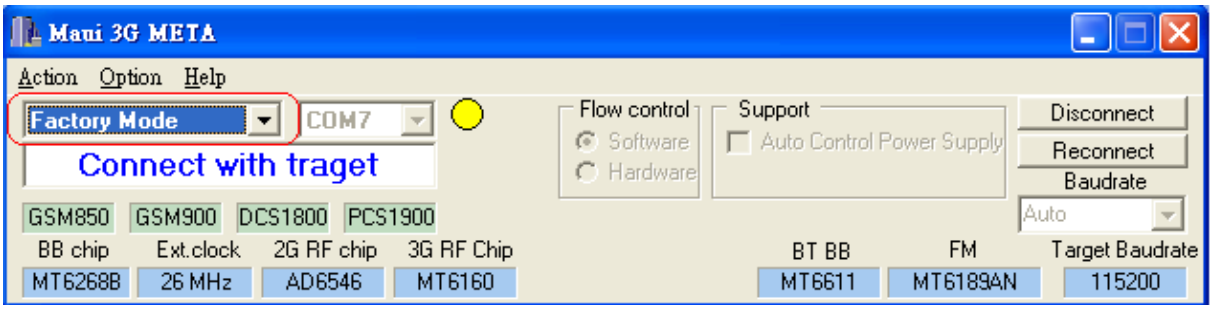

Figure 517 ***Select [Factory Mode] from main selection menu***

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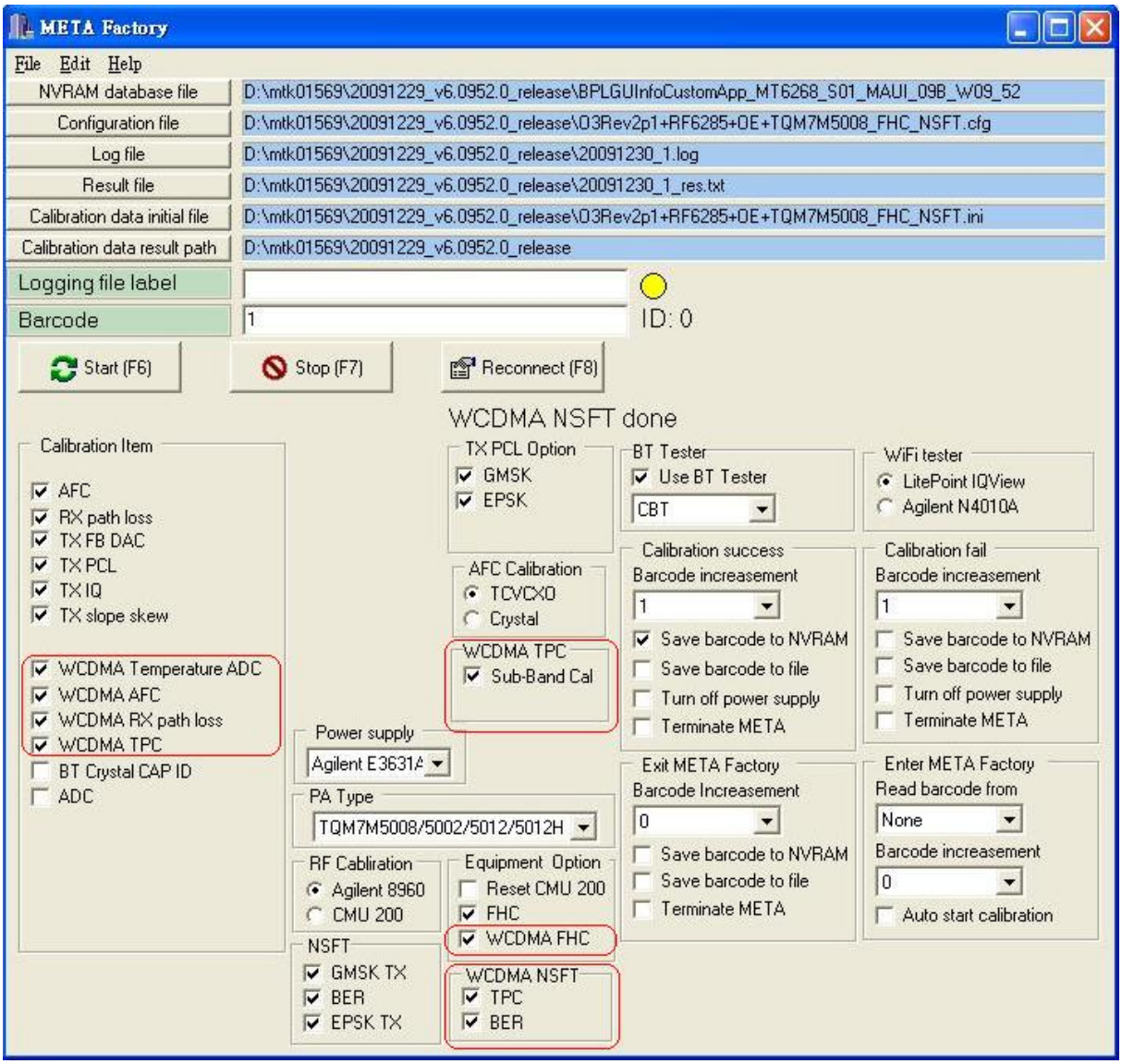

Figure 518 ***GUI of "META Factory". The red parts are WCDMA-relevant features.***

4.3.1 Setup files

User must open NVRAM database file, configuration file, calibration data initial file, result file, setup logging file and calibration data result path. META factory will save these 5 files setting to MF_Setup.txt file before closed. User can use previous setting or open other files. The previous setting is saved in MF_Setup.txt of META install folder.

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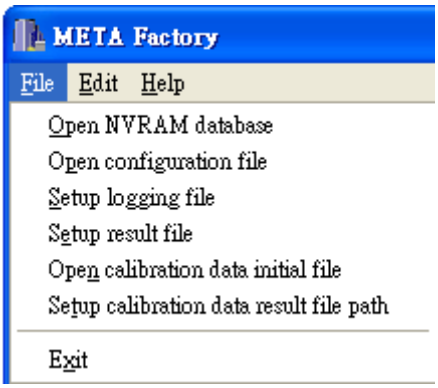

Figure 519 ***Setup files***

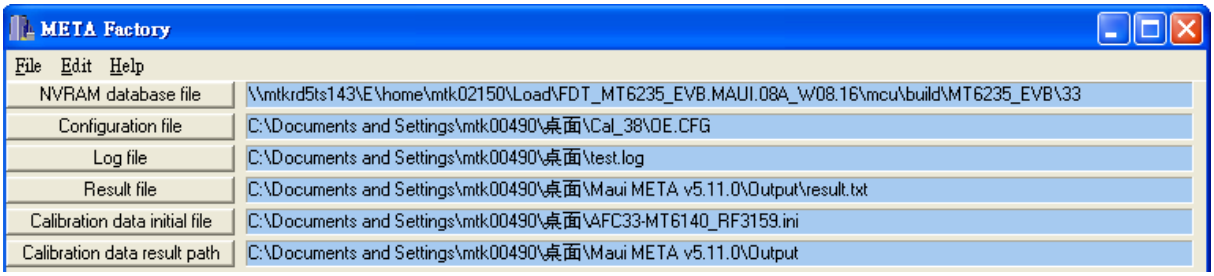

Figure 520 ***Current file setting***

The following is a template of MF_Setup.txt that contains current file setting.
[META factory]
NVRAM database file= \\mtkrd5ts143\E\home\mtk02150\Load\FDT_MT6235_EVB.MAUI.08A_W08.16\mcu\build\MT6235_EVB\33 Slope \ BPLGUInfoCustomApp_MT6235_S00_MAUI_08A_W08_16
Configuration file=C:\Documents and Settings\mtk00490\桌面\Cal_38\OE.CFG
Logging file=C:\Documents and Settings\mtk00490\桌面\test.log
Calibration data initial file=C:\Documents and Settings\mtk00490\桌面\AFC33-MT6140_RF3159.ini
Result file=C:\Documents and Settings\mtk00490\桌面\Maui META v5.11.0\Output\result.txt
Calibration data result path=C:\Documents and Settings\mtk00490\桌面\Maui META v5.11.0\Output

4.3.1.1 Configuration file

This file is used to keep the configurable data, which could be modified by the phone maker's setting to co-operate in their factory production line. The "Time out" value is in unit of millisecond. If the communication time between tool and equipment is higher than the time out value, the tool will show a time out error message.

Note:

0. After the semicolon are the comments. Please refer to the calibration procedure in section 4.2 for detailed information.
1. RF engineers must fine-tune the C values (GSM900_C, DCS1800_C, etc.) for their RF module. The best C value is that the target can issue the TX power to meet the specification between MAX_P and MIN_P after writing the new scale factor to the Flash.

Parameter	Description
[8960 Initialization]	
WCDMA BAND1 input cable loss	cable loss setting in 8960 for WCDMA band1

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WCDMA BAND1 output cable loss	cable loss setting in 8960 for WCDMA band1
WCDMA BAND2 input cable loss	cable loss setting in 8960 for WCDMA band2
WCDMA BAND2 output cable loss	cable loss setting in 8960 for WCDMA band2
WCDMA BAND5 input cable loss	cable loss setting in 8960 for WCDMA band5
WCDMA BAND5 output cable loss	cable loss setting in 8960 for WCDMA band5
[CMU200 Initialization]	
WCDMA BAND1 input cable loss	cable loss setting in CMU200 for WCDMA band1
WCDMA BAND1 output cable loss	cable loss setting in CMU200 for WCDMA band1
WCDMA BAND2 input cable loss	cable loss setting in CMU200 for WCDMA band2
WCDMA BAND2 output cable loss	cable loss setting in CMU200 for WCDMA band2
WCDMA BAND5 input cable loss	cable loss setting in CMU200 for WCDMA band5
WCDMA BAND5 output cable loss	cable loss setting in CMU200 for WCDMA band5
[WCDMA Common]	
WCDMA_BAND	WCDMA band configuration in hexadecimal expression, band1=0x01, band2=0x02, band3=0x04, band4=0x08, band5=0x10, tri-band1,2,5=1+2+10=0x13
[WCDMA temperature ADC table]	
WCDMA_TADC_CURRENT_TEMPERATURE	set the ambient temperature when calibration
[WCDMA AFC table]	if using 2G AFC calibration, don't need to calibrate 3G AFC again.
WCDMA_AFC_BAND	set which band for WCDMA AFC calibration
WCDMA_AFC_P_DL	set the DL cell power for AFC calibration
WCDMA_AFC_UARFCN_DL	set the DL cell channel for AFC calibration
WCDMA_AFC_MEASURE_COUNT	set the measured count for AFC calibration
WCDMA_AFC_DAC1	set the AFC_DAC1 for AFC calibration
WCDMA_AFC_DAC2	set the AFC_DAC2 for AFC calibration
WCDMA_MAX_INIT_AFC_DAC	upper check limit for the calibrated result of initial AFC DAC
WCDMA_MIN_INIT_AFC_DAC	lower check limit for the calibrated result of initial AFC DAC
WCDMA_MAX_AFC_SLOPE	upper check limit for the calibrated result of initial AFC slope
WCDMA_MIN_AFC_SLOPE	lower check limit for the calibrated result of initial AFC slope
[WCDMA RSSI/LNA table]	
WCDMA_RSSI_GAIN_TABLE_CHANGE_FOR_CAL_MODE	set the gain table for RSSI calibration, (default: 1) Mode 1: change to temp gain table, and change it back, allow higher cell power in LNA high gain mode calibration Mode 0: no gain table change operation
WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_HIGH_MODE	DL cell power for LNA high mode calibration in CAL_Mode=1
WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_MID_MODE	DL cell power for LNA mid mode calibration in CAL_Mode=1

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WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_LOW_MODE	DL cell power for LNA low mode calibration in CAL_Mode=1
WCDMA_RSSI_P_DL	DL cell power for LNA high mode calibration in CAL_Mode=0
WCDMA_LNA_MID_MODE_P_DL	DL cell power for LNA mid mode calibration in CAL_Mode=0
WCDMA_LNA_LOW_MODE_P_DL	DL cell power for LNA low mode calibration in CAL_Mode=0
WCDMA_RSSI_COUNT	set the measured count for RSSI calibration
WCDMA_RSSI_TEMPERATURE_INDEX	set the temperature index for RSSI calibration, default=3 is room temperature
WCDMA_RSSI_BAND1_TEMPERATURE_OFFSET	set the RSSI compensation over temperature for band1.
WCDMA_RSSI_BAND2_TEMPERATURE_OFFSET	set the RSSI compensation over temperature for band2.
WCDMA_RSSI_BAND5_TEMPERATURE_OFFSET	set the RSSI compensation over temperature for band5.
BAND1_MAX_RX_LOSS	upper check limit for the RSSI calibrated result in band1
BAND1_MIN_RX_LOSS	lower check limit for the RSSI calibrated result in band1
BAND2_MAX_RX_LOSS	upper check limit for the RSSI calibrated result in band2
BAND2_MIN_RX_LOSS	lower check limit for the RSSI calibrated result in band2
BAND5_MAX_RX_LOSS	upper check limit for the RSSI calibrated result in band5
BAND5_MIN_RX_LOSS	lower check limit for the RSSI calibrated result in band5
[WCDMA TPC table]	
WCDMA_TPC_RECURSIVE_TIMES	the maximum recursive times for TPC calibration
WCDMA_TPC_CAL_SUBBAND_INDEX	the subband index of channel for TPC calibration, index=7 is the mid channel.
WCDMA_TPC_CAL_TYPE	set the measured type of instrument for TPC calibration, (default=1) Type 0: measure the average TX power by instrument. Type 1: set the instrument triggered by RF_RISE and measure the 1st slot power.
BAND1_WCDMA_TPC_PA_HIGH_GAIN_MAX	the upper check limit for the PA_GAIN in high power mode in band1
BAND1_WCDMA_TPC_PA_MID_GAIN_MAX	the upper check limit for the PA_GAIN in mid power mode in band1
BAND1_WCDMA_TPC_PA_LOW_GAIN_MAX	the upper check limit for the PA_GAIN in low power mode in band1
BAND1_WCDMA_TPC_PA_HIGH_GAIN_MIN	the lower check limit for the PA_GAIN in high power mode in band1
BAND1_WCDMA_TPC_PA_MID_GAIN_MIN	the lower check limit for the PA_GAIN in mid power mode in band1

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BAND1_WCDMA_TPC_PA_LOW_GAIN_MIN	the lower check limit for the PA_GAIN in low power mode in band1
BAND2_WCDMA_TPC_PA_HIGH_GAIN_MAX	the upper check limit for the PA_GAIN in high power mode in band2
BAND2_WCDMA_TPC_PA_MID_GAIN_MAX	the upper check limit for the PA_GAIN in mid power mode in band2
BAND2_WCDMA_TPC_PA_LOW_GAIN_MAX	the upper check limit for the PA_GAIN in low power mode in band2
BAND2_WCDMA_TPC_PA_HIGH_GAIN_MIN	the lower check limit for the PA_GAIN in high power mode in band2
BAND2_WCDMA_TPC_PA_MID_GAIN_MIN	the lower check limit for the PA_GAIN in mid power mode in band2
BAND2_WCDMA_TPC_PA_LOW_GAIN_MIN	the lower check limit for the PA_GAIN in low power mode in band2
BAND5_WCDMA_TPC_PA_HIGH_GAIN_MAX	the upper check limit for the PA_GAIN in high power mode in band5
BAND5_WCDMA_TPC_PA_MID_GAIN_MAX	the upper check limit for the PA_GAIN in mid power mode in band5
BAND5_WCDMA_TPC_PA_LOW_GAIN_MAX	the upper check limit for the PA_GAIN in low power mode in band5
BAND5_WCDMA_TPC_PA_HIGH_GAIN_MIN	the lower check limit for the PA_GAIN in high power mode in band5
BAND5_WCDMA_TPC_PA_MID_GAIN_MIN	the lower check limit for the PA_GAIN in mid power mode in band5
BAND5_WCDMA_TPC_PA_LOW_GAIN_MIN	the lower check limit for the PA_GAIN in low power mode in band5
BAND1_WCDMA_TPC_POWER_DETECTOR_GAIN_MAX	the upper check limit for the PDET_GAIN in band1
BAND1_WCDMA_TPC_POWER_DETECTOR_GAIN_MIN	the lower check limit for the PDET_GAIN in band1
BAND2_WCDMA_TPC_POWER_DETECTOR_GAIN_MAX	the upper check limit for the PDET_GAIN in band2
BAND2_WCDMA_TPC_POWER_DETECTOR_GAIN_MIN	the lower check limit for the PDET_GAIN in band2
BAND5_WCDMA_TPC_POWER_DETECTOR_GAIN_MAX	the upper check limit for the PDET_GAIN in band5
BAND5_WCDMA_TPC_POWER_DETECTOR_GAIN_MIN	the lower check limit for the PDET_GAIN in band5
BAND1_WCDMA_TPC_SUBBAND_POWER_OFFSET_DB_COMP_MAX	the upper check limit for the PA_GAIN offset over sub-band in band1
BAND1_WCDMA_TPC_SUBBAND_POWER_OFFSET_DB_COMP_MIN	the lower check limit for the PA_GAIN offset over sub-band in band1
BAND2_WCDMA_TPC_SUBBAND_POWER_OFFSET_DB_COMP_MAX	the upper check limit for the PA_GAIN offset over sub-band in band2
BAND2_WCDMA_TPC_SUBBAND_POWER_OFFSET_DB_COMP_MIN	the lower check limit for the PA_GAIN offset over sub-band in band2
BAND5_WCDMA_TPC_SUBBAND_POWER_OFFSET_DB_COMP_MAX	the upper check limit for the PA_GAIN offset over sub-band in band5

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BAND5_WCDMA_TPC_SUBBAND_POWER_OFFSET_DB_COMP_MIN	the lower check limit for the PA_GAIN offset over sub-band in band5
BAND1_WCDMA_TPC_SUBBAND_POWER_DETECTOR_POWER_OFFSET_DB_COMP_MAX	the upper check limit for the PDET_GAIN offset over sub-band in band1
BAND1_WCDMA_TPC_SUBBAND_POWER_DETECTOR_POWER_OFFSET_DB_COMP_MIN	the lower check limit for the PDET_GAIN offset over sub-band in band1
BAND2_WCDMA_TPC_SUBBAND_POWER_DETECTOR_POWER_OFFSET_DB_COMP_MAX	the upper check limit for the PDET_GAIN offset over sub-band in band2
BAND2_WCDMA_TPC_SUBBAND_POWER_DETECTOR_POWER_OFFSET_DB_COMP_MIN	the lower check limit for the PDET_GAIN offset over sub-band in band2
BAND5_WCDMA_TPC_SUBBAND_POWER_DETECTOR_POWER_OFFSET_DB_COMP_MAX	the upper check limit for the PDET_GAIN offset over sub-band in band5
BAND5_WCDMA_TPC_SUBBAND_POWER_DETECTOR_POWER_OFFSET_DB_COMP_MIN	the lower check limit for the PDET_GAIN offset over sub-band in band5
WCDMA_TPC_CAL_POWER_INDEX_FOR_PGA_MIDDLE_PA_MODE	the TPC index for TPC calibration power level in middle mode, power level = (max power) - (power index)
WCDMA_TPC_DELTA	the error range for TPC recursive calibration
WCDMA_TPC_POWER_DETECTOR_CHECK_INDEX	the check power index for PDET
WCDMA_TPC_POWER_DETECTOR_ERROR_RANGE	the check limit for PDET error
WCDMA_TPC_PA_MODE_SUBBAND_CAL_NUM	specify the number of subband calibration by PA mode, num = 1: PA Mid mode num = 2: PA High,Middle mode num = 3: PA High,Middle,Low mode
BAND1_TPC_UARFCN_UL	specify the channel of TPC calibration for band1
BAND2_TPC_UARFCN_UL	specify the channel of TPC calibration for band2
BAND5_TPC_UARFCN_UL	specify the channel of TPC calibration for band5
BAND1_TPC_WANTED_P_OFFSET	specify the offset of TX max power back-off for band1, max power = 24dBm + offset
BAND2_TPC_WANTED_P_OFFSET	specify the offset of TX max power back-off for band2, max power = 24dBm + offset
BAND5_TPC_WANTED_P_OFFSET	specify the offset of TX max power back-off for band5, max power = 24dBm + offset

The following is the template of configuration file. Here are only WCDMA-relevant CFG settings.

[META version]
META version= ver 6.0952.0

[8960 Initialization]
8960 GPIB Address =GPIB0::15::INSTR
Time Out =5000
GSM400 cable loss = -0.2
GSM850 cable loss = -0.4
GSM900 cable loss = -0.4

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DCS1800 cable loss = -0.7
PCS1900 cable loss = -0.7
WCDMA BAND1 input cable loss = -1.9
WCDMA BAND1 output cable loss = -1.9
WCDMA BAND2 input cable loss = -1.9
WCDMA BAND2 output cable loss = -1.9
WCDMA BAND5 input cable loss = -1.0
WCDMA BAND5 output cable loss = -1.0

[CMU200 Initialization]
CMU200 GPIB Address =GPIB0::20::INSTR
Time Out =5000
GSM400 input cable loss = 0.2
GSM850 input cable loss = 0.2
GSM900 input cable loss = 0.5
DCS1800 input cable loss = 0.7
PCS1900 input cable loss = 0.8
GSM400 output cable loss = 0.2
GSM850 output cable loss = 0.2
GSM900 output cable loss = 0.5
DCS1800 output cable loss = 0.7
PCS1900 output cable loss = 0.8
WCDMA BAND1 input cable loss = 1.2
WCDMA BAND1 output cable loss = 1.2
WCDMA BAND2 input cable loss = 1.2
WCDMA BAND2 output cable loss = 1.2
WCDMA BAND5 input cable loss = 0.7
WCDMA BAND5 output cable loss = 0.7

[WCDMA Common]
WCDMA_BAND = 0x13
; Band1 0x01
; Band2 0x02
; Band3 0x04
; Band4 0x08
; Band5 0x10

[WCDMA temperature ADC table]
WCDMA_TADC_CURRENT_TEMPERATURE = 25

[WCDMA AFC table]
WCDMA_AFC_BAND = BAND1
WCDMA_AFC_P_DL = -70
WCDMA_AFC_UARFCN_DL = 10700
WCDMA_AFC_MEASURE_COUNT = 10
WCDMA_AFC_DAC1 = 4200
WCDMA_AFC_DAC2 = 5000
WCDMA_MAX_INIT_AFC_DAC = 5200
WCDMA_MIN_INIT_AFC_DAC = 4000
WCDMA_MAX_AFC_SLOPE = 5.0
WCDMA_MIN_AFC_SLOPE = 1.0

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[WCDMA RSSI/LNA table]

WCDMA_RSSI_GAIN_TABLE_CHANGE_FOR_CAL_MODE = 1
; default: 1

; mode 1: change to temp gain table, and change it back
WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_HIGH_MODE= -70
WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_MID_MODE = -50
WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_LOW_MODE = -30

; mode 0: no gain table change operation
WCDMA_RSSI_P_DL = -90
WCDMA_LNA_MID_MODE_P_DL = -60
WCDMA_LNA_LOW_MODE_P_DL = -30

WCDMA_RSSI_COUNT = 10
WCDMA_RSSI_TEMPERATURE_INDEX = 3
WCDMA_RSSI_BAND1_TEMPERATURE_OFFSET = -1,-1,0,0,0,0,1,1,
WCDMA_RSSI_BAND2_TEMPERATURE_OFFSET = -1,-1,0,0,0,0,1,1,
WCDMA_RSSI_BAND5_TEMPERATURE_OFFSET = -1,-1,0,0,0,0,1,1,

BAND1_MAX_RX_LOSS =
12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,
BAND1_MIN_RX_LOSS = -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000,
BAND2_MAX_RX_LOSS =
12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,
BAND2_MIN_RX_LOSS = -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000,
BAND5_MAX_RX_LOSS =
12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,12.000,
BAND5_MIN_RX_LOSS = -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000, -3.000,

[WCDMA TPC table]
WCDMA_TPC_RECURSIVE_TIMES = 30
WCDMA_TPC_CAL_SUBBAND_INDEX = 7

WCDMA_TPC_CAL_TYPE = 0
; WCDMA_TPC_CAL_TYPE = 0 // original
; WCDMA_TPC_CAL_TYPE = 1 // new RF_RISE

BAND1_WCDMA_TPC_PA_HIGH_GAIN_MAX = 500
BAND1_WCDMA_TPC_PA_MID_GAIN_MAX = 500
BAND1_WCDMA_TPC_PA_LOW_GAIN_MAX = 313
BAND1_WCDMA_TPC_PA_HIGH_GAIN_MIN = 100
BAND1_WCDMA_TPC_PA_MID_GAIN_MIN = 100
BAND1_WCDMA_TPC_PA_LOW_GAIN_MIN = 100

BAND2_WCDMA_TPC_PA_HIGH_GAIN_MAX = 500

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BAND2_WCDMA_TPC_PA_MID_GAIN_MAX = 500
BAND2_WCDMA_TPC_PA_LOW_GAIN_MAX = 313
BAND2_WCDMA_TPC_PA_HIGH_GAIN_MIN = 100
BAND2_WCDMA_TPC_PA_MID_GAIN_MIN = 100
BAND2_WCDMA_TPC_PA_LOW_GAIN_MIN = 100

BAND5_WCDMA_TPC_PA_HIGH_GAIN_MAX = 500
BAND5_WCDMA_TPC_PA_MID_GAIN_MAX = 500
BAND5_WCDMA_TPC_PA_LOW_GAIN_MAX = 319
BAND5_WCDMA_TPC_PA_HIGH_GAIN_MIN = 100
BAND5_WCDMA_TPC_PA_MID_GAIN_MIN = 100
BAND5_WCDMA_TPC_PA_LOW_GAIN_MIN = 100

BAND1_WCDMA_TPC_POWER_DETECTOR_GAIN_MAX = 200
BAND1_WCDMA_TPC_POWER_DETECTOR_GAIN_MIN = 50
BAND2_WCDMA_TPC_POWER_DETECTOR_GAIN_MAX = 200
BAND2_WCDMA_TPC_POWER_DETECTOR_GAIN_MIN = 50
BAND5_WCDMA_TPC_POWER_DETECTOR_GAIN_MAX = 200
BAND5_WCDMA_TPC_POWER_DETECTOR_GAIN_MIN = 50

BAND1_WCDMA_TPC_SUBBAND_POWER_OFFSET_DB_COMP_MAX = 2
BAND1_WCDMA_TPC_SUBBAND_POWER_OFFSET_DB_COMP_MIN = -2
BAND2_WCDMA_TPC_SUBBAND_POWER_OFFSET_DB_COMP_MAX = 4
BAND2_WCDMA_TPC_SUBBAND_POWER_OFFSET_DB_COMP_MIN = -4
BAND5_WCDMA_TPC_SUBBAND_POWER_OFFSET_DB_COMP_MAX = 3
BAND5_WCDMA_TPC_SUBBAND_POWER_OFFSET_DB_COMP_MIN = -3

BAND1_WCDMA_TPC_SUBBAND_POWER_DETECTOR_POWER_OFFSET_DB_COMP_MAX = 2
BAND1_WCDMA_TPC_SUBBAND_POWER_DETECTOR_POWER_OFFSET_DB_COMP_MIN = -2
BAND2_WCDMA_TPC_SUBBAND_POWER_DETECTOR_POWER_OFFSET_DB_COMP_MAX = 4
BAND2_WCDMA_TPC_SUBBAND_POWER_DETECTOR_POWER_OFFSET_DB_COMP_MIN = -4
BAND5_WCDMA_TPC_SUBBAND_POWER_DETECTOR_POWER_OFFSET_DB_COMP_MAX = 3
BAND5_WCDMA_TPC_SUBBAND_POWER_DETECTOR_POWER_OFFSET_DB_COMP_MIN = -3

WCDMA_TPC_CAL_POWER_INDEX_FOR_PGA_MIDDLE_PA_MODE = 18
WCDMA_TPC_DELTA = 0.5
WCDMA_TPC_POWER_DETECTOR_CHECK_INDEX = 5
WCDMA_TPC_POWER_DETECTOR_ERROR_RANGE =0.5

; specify the number of subband calibration by PA mode
; num = 1: PA Middle mode
; num = 2: PA High,Middle mode
; num = 3: PA High,Middle,Low mode
WCDMA_TPC_PA_MODE_SUBBAND_CAL_NUM = 3

BAND1_TPC_UARFCN_UL = 9750
BAND2_TPC_UARFCN_UL = 9400
BAND5_TPC_UARFCN_UL = 4180

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BAND1_TPC_WANTED_P_OFFSET = -1
BAND2_TPC_WANTED_P_OFFSET = -1
BAND5_TPC_WANTED_P_OFFSET = -0.5

WCDMA_PA_MODE_CAL_NUM = 3

[WCDMA FHC Factory Settings]

; 0: linear, 1: cubic
FHC_WCDMA_MATH_MODE =1

BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 40
BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -40
BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_NUM = 4
BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 40
BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -40
BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM = 4
BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 40
BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -40
BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_NUM = 4

BAND2_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 40
BAND2_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -40
BAND2_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_NUM = 4
BAND2_PA_MID_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 40
BAND2_PA_MID_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -40
BAND2_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM = 4
BAND2_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 40
BAND2_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -40
BAND2_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_NUM = 4

BAND5_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 40
BAND5_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -40
BAND5_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_NUM = 4
BAND5_PA_MID_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 40
BAND5_PA_MID_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -40
BAND5_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM = 4
BAND5_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 40
BAND5_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -40
BAND5_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_NUM = 4

; In slot unit
STEP_DURATION_FOR_Agilent8960 = 30
RETUNE_DURATION_FOR_Agilent8960 = 30
GAIN_STABLE_TIME_FOR_Agilent8960 = 9

[WCDMA NSFT Common Settings]
; BER from tester=Y // get ber from tester and single-ended BER both
; BER from tester=N // get single-ended ber only

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BER from tester = Y

[WCDMA NSFT Test Case_1]
Uplink Channel = 9612
Downlink Channel = 10562
Cable Loss Input (dB) = -1.9
Cable Loss Output (dB) = -1.9
Max Power Average High (dBm) = 24.0
Max Power Average Low (dBm) = 19.0
Frequency Error Peak (Hz) = 195.0
;EVM RMS Average (%) = 17.5
IQ OriginOffset (dB) = -25.0
ACLR 5M (dB) = -33.0
ACLR 10M (dB) = -43.0
SEM1 Margin (dB) = 3
SEM2 Margin (dB) = 3
SEM3 Margin (dB) = 3
SEM4 Margin (dB) = 3
Min Power Average High (dBm) = -50
BER Level (dBm) = -70.0
BER Limit (%) = 0.1
;Max Power Peak High = 24.0
;Max Power Peak Low = 19.0
;EVM Peak Max = 17.5
EVM RMS Max= 17.5
IQ Imbalance = -15.0
OBW MAX = 5.0

[WCDMA NSFT Test Case_2]
Uplink Channel = 9888
Downlink Channel = 10838
Cable Loss Input (dB) = -1.9
Cable Loss Output (dB) = -1.9
Max Power Average High (dBm) = 24.0
Max Power Average Low (dBm) = 19.0
Frequency Error Peak (Hz) = 195.0
;EVM RMS Average (%) = 17.5
IQ OriginOffset (dB) = -25.0
ACLR 5M (dB) = -33.0
ACLR 10M (dB) = -43.0
SEM1 Margin (dB) = 3
SEM2 Margin (dB) = 3
SEM3 Margin (dB) = 3
SEM4 Margin (dB) = 3
Min Power Average High (dBm) = -50
BER Level (dBm) = -70.0
BER Limit (%) = 0.1
EVM RMS Max = 17.5
IQ Imbalance = -15.0
OBW Max = 5.0

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[WCDMA NSFT Test Case_3]
Uplink Channel = 9262
Downlink Channel = 9662
Cable Loss Input (dB) = -1.9
Cable Loss Output (dB) = -1.9
Max Power Average High (dBm) = 24.0
Max Power Average Low (dBm) = 19.0
Frequency Error Peak (Hz) = 195.0
;EVM RMS Average (%) = 17.5
IQ OriginOffset (dB) = -25.0
ACLR 5M (dB) = -33.0
ACLR 10M (dB) = -43.0
SEM1 Margin (dB) = 3
SEM2 Margin (dB) = 3
SEM3 Margin (dB) = 3
SEM4 Margin (dB) = 3
Min Power Average High (dBm) = -50
BER Level (dBm) = -70.0
BER Limit (%) = 0.1
;Max Power Peak High = 24.0
;Max Power Peak Low = 19.0
;EVM Peak Max = 17.5
EVM RMS Max = 17.5
IQ Imbalance = -15.0
OBW Max = 5.0

[WCDMA NSFT Test Case_4]
Uplink Channel = 9538
Downlink Channel = 9938
Cable Loss Input (dB) = -1.9
Cable Loss Output (dB) = -1.9
Max Power Average High (dBm) = 24.0
Max Power Average Low (dBm) = 19.0
Frequency Error Peak (Hz) = 195.0
;EVM RMS Average (%) = 17.5
IQ OriginOffset (dB) = -25.0
ACLR 5M (dB) = -33.0
ACLR 10M (dB) = -43.0
SEM1 Margin (dB) = 3
SEM2 Margin (dB) = 3
SEM3 Margin (dB) = 3
SEM4 Margin (dB) = 3
Min Power Average High (dBm) = -50
BER Level (dBm) = -70.0
BER Limit (%) = 0.1
;Max Power Peak High = 24.0
;Max Power Peak Low = 19.0
;EVM Peak Max = 17.5
EVM RMS Max = 17.5
IQ Imbalance = -15.0
OBW Max = 5.0

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[WCDMA NSFT Test Case_5]
Uplink Channel = 4132
Downlink Channel = 4357
Cable Loss Input (dB) = -1.0
Cable Loss Output (dB) = -1.0
Max Power Average High (dBm) = 24.0
Max Power Average Low (dBm) = 19.0
Frequency Error Peak (Hz) = 195.0
;EVM RMS Average (%) = 17.5
IQ OriginOffset (dB) = -25.0
ACLR 5M (dB) = -33.0
ACLR 10M (dB) = -43.0
SEM1 Margin (dB) = 3
SEM2 Margin (dB) = 3
SEM3 Margin (dB) = 3
SEM4 Margin (dB) = 3
Min Power Average High (dBm) = -50
BER Level (dBm) = -70.0
BER Limit (%) = 0.1
;Max Power Peak High = 24.0
;Max Power Peak Low = 19.0
;EVM Peak Max = 17.5
EVM RMS Max = 17.5
IQ Imbalance = -15.0
OBW Max = 5.0

[WCDMA NSFT Test Case_6]
Uplink Channel = 4233
Downlink Channel = 4458
Cable Loss Input (dB) = -1.0
Cable Loss Output (dB) = -1.0
Max Power Average High (dBm) = 24.0
Max Power Average Low (dBm) = 19.0
Frequency Error Peak (Hz) = 195.0
;EVM RMS Average (%) = 17.5
IQ OriginOffset (dB) = -25.0
ACLR 5M (dB) = -33.0
ACLR 10M (dB) = -43.0
SEM1 Margin (dB) = 3
SEM2 Margin (dB) = 3
SEM3 Margin (dB) = 3
SEM4 Margin (dB) = 3
Min Power Average High (dBm) = -50
BER Level (dBm) = -70.0
BER Limit (%) = 0.1
;Max Power Peak High = 24.0
;Max Power Peak Low = 19.0
;EVM Peak Max = 17.5
EVM RMS Max = 17.5
IQ Imbalance = -15.0

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OBW Max = 5.0

4.3.1.2 Logging file

The logging file is the history of the given parameters and output values evaluated during calibration procedure. The content of the logging file can be different based on the real phone module design.

4.3.1.3 Result file

The file is used to store all calibration results, the result include start ID (i.e. barcode), rx path loss value, AFC slope and offset, TX power (dBm) and battery ADC slope and offset.

4.3.1.4 Calibration data initial file

This file is used to keep the default calibration data, normally provided by RF engineer. The tool will read these values as initial calibration values. These values will be different for each mobile model. This file can be acquired in R&D phase via META LAB tool assistance. Therefore, each file is corresponding to the META_LAB window UI.

Parameter	Description
[AFC control]	
Initial value	the initial AFC DAC value, 13bit correspond to 2.8V
Slope	the slope of AFC DAC, refered to 900MHz, unit: Hz/DAC
[WCDMA Temperature Sensor]	
ADC0	the temperature ADC value at -10 degree
ADC1	the temperature ADC value at 5 degree
ADC2	the temperature ADC value at 20 degree
ADC3	the temperature ADC value at 35 degree
ADC4	the temperature ADC value at 45 degree
ADC5	the temperature ADC value at 55 degree
ADC6	the temperature ADC value at 60 degree
ADC7	the temperature ADC value at 65 degree
[WCDMA BAND1 RX loss] (here, using WCDMA Band1 for example)	
Temperature 0 Max UARFCN	specify the channel for RSSI calibration in temperature range 0
Temperature 0 RX loss high mode	the RX path loss offset in LNA high mode in temperature range 0
Temperature 0 RX loss mid mode	the RX path loss offset in LNA mid mode in temperature range 0
Temperature 0 RX loss low mode	the RX path loss offset in LNA low mode in temperature range 0
Temperature 1 Max UARFCN	specify the channel for RSSI calibration in temperature range 1
Temperature 1 RX loss high mode	the RX path loss offset in LNA high mode in temperature range 1
Temperature 1 RX loss mid mode	the RX path loss offset in LNA mid mode in temperature range 1

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Temperature 1 RX loss low mode	the RX path loss offset in LNA low mode in temperature range 1
Temperature 2 Max UARFCN	specify the channel for RSSI calibration in temperature range 2
Temperature 2 RX loss high mode	the RX path loss offset in LNA high mode in temperature range 2
Temperature 2 RX loss mid mode	the RX path loss offset in LNA mid mode in temperature range 2
Temperature 2 RX loss low mode	the RX path loss offset in LNA low mode in temperature range 2
Temperature 3 Max UARFCN	specify the channel for RSSI calibration in temperature range 3 (room temperature)
Temperature 3 RX loss high mode	the RX path loss offset in LNA high mode in temperature range 3 (room temperature)
Temperature 3 RX loss mid mode	the RX path loss offset in LNA mid mode in temperature range 3 (room temperature)
Temperature 3 RX loss low mode	the RX path loss offset in LNA low mode in temperature range 3 (room temperature)
Temperature 4 Max UARFCN	specify the channel for RSSI calibration in temperature range 4
Temperature 4 RX loss high mode	the RX path loss offset in LNA high mode in temperature range 4
Temperature 4 RX loss mid mode	the RX path loss offset in LNA mid mode in temperature range 4
Temperature 4 RX loss low mode	the RX path loss offset in LNA low mode in temperature range 4
Temperature 5 Max UARFCN	specify the channel for RSSI calibration in temperature range 5
Temperature 5 RX loss high mode	the RX path loss offset in LNA high mode in temperature range 5
Temperature 5 RX loss mid mode	the RX path loss offset in LNA mid mode in temperature range 5
Temperature 5 RX loss low mode	the RX path loss offset in LNA low mode in temperature range 5
Temperature 6 Max UARFCN	specify the channel for RSSI calibration in temperature range 6
Temperature 6 RX loss high mode	the RX path loss offset in LNA high mode in temperature range 6
Temperature 6 RX loss mid mode	the RX path loss offset in LNA mid mode in temperature range 6
Temperature 6 RX loss low mode	the RX path loss offset in LNA low mode in temperature range 6
Temperature 7 Max UARFCN	specify the channel for RSSI calibration in temperature range 7
Temperature 7 RX loss high mode	the RX path loss offset in LNA high mode in temperature range 7
Temperature 7 RX loss mid mode	the RX path loss offset in LNA mid mode in temperature range 7
Temperature 7 RX loss low mode	the RX path loss offset in LNA low mode in temperature range 7
[WCDMA BAND1 TPC] (here, using WCDMA Band1 for example)	
DC2DC LEVEL0	specify the DC-DC voltage for PA VCC low level(not used in 8-level PA control)
DC2DC LEVEL1	specify the DC-DC voltage for PA VCC high level(not used in 8-level PA control)

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DC2DC LEVEL, PA high mode	specify the DC-DC level for PA high mode(not used in 8-level PA control)
VBias DAC, PA high mode	specify the Vbias DAC value for PA high mode, 10bit correspond to 2.8V(not used in 8-level PA control)
Vm1, PA high mode	specify the Vmode1 logic for PA high mode, (not used in 8-level PA control)
Vm2, PA high mode	specify the Vmode2 logic for PA high mode, (not used in 8-level PA control)
VGA DAC, PA high mode	the TPC calibrated value in PA high mode, the first is PA_GAIN, the secend is PDET_GAIN (the second one is coupler loss for PA-high mode for 8-level PA control)
Subband max uarfcn, PA high mode	specify the channel for TPC calibration in PA high-mode
Subband power offset dB, PA high mode	the TX power compensation over subband in PA high-mode
Temperature compensation offset dB, PA high mode	the TX power compensation over temperature in PA high-mode
DC2DC LEVEL, PA middle mode	specify the DC-DC level for PA mid mode(not used in 8-level PA control)
VBias DAC, PA middle mode	specify the Vbias DAC value for PA mid-mode, 10bit correspond to 2.8V(not used in 8-level PA control)
Vm1, PA middle mode	specify the Vmode1 logic for PA mid-mode, (not used in 8-level PA control)
Vm2, PA middle mode	specify the Vmode2 logic for PA mid-mode, (not used in 8-level PA control)
VGA DAC, PA middle mode	the TPC calibrated PA_GAIN value in PA mid-mode (and couplwer loss in PA-mid mode for 8-level PA control)
Subband max uarfcn, PA middle mode	specify the channel for TPC calibration in PA mid-mode
Subband power offset dB, PA middle mode	the TX power compensation over subband in PA mid-mode
Temperature compensation offset dB, PA middle mode	the TX power compensation over temperature in PA mid-mode
DC2DC LEVEL, PA low mode	specify the DC-DC level for PA low-mode (not used in 8-level PA control)
VBias DAC, PA low mode	specify the Vbias DAC value for PA low-mode, 10bit correspond to 2.8V(not used in 8-level PA control)
Vm1, PA low mode	specify the Vmode1 logic for PA low-mode, (not used in 8-level PA control)
Vm2, PA low mode	specify the Vmode2 logic for PA low-mode, (not used in 8-level PA control)
VGA DAC, PA low mode	the TPC calibrated PA_GAIN value in PA low-mode (and coupler loss in PA low-mode for 8-level PA control)
Subband max uarfcn, PA low mode	specify the channel for TPC calibration in PA low-mode
Subband power offset dB, PA low mode	the TX power compensation over subband in PA low-mode
Temperature compensation offset dB, PA low mode	the TX power compensation over temperature in PA low-mode
Start1	the power index of 1st hysteresis from PA mid to high mode
End1	the power index of 1st hysteresis from PA high to mid mode

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Start2	the power index of 2nd hysteresis from PA low to mid mode
End2	the power index of 2nd hysteresis from PA mid to low mode
Power detector subband max uarfcn	specify the channel for TPC calibration for power detector
Power detector subband power offset dB	the power detector compensation over subband
PA OCTLEVEL Sections	Number of active levels of 8-level PA control (3~8)
PA OCTLEVEL PA Phase Compensation	Phase compensation of 3 PA modes
PA OCTLEVEL PMU Level PA Mode	PA mode of the specified level control
PA OCTLEVEL PMU Level Prf	The RF power upper limit of the specified level control
PA OCTLEVEL PMU Level Dc2Dc	DC2DC level of the specified level control
PA OCTLEVEL PMU Level VBias	VBias of the specified level control
PA OCTLEVEL PMU Level Vm1	Vm1 of the specified level control
PA OCTLEVEL PMU Level Vm2	Vm2 of the specified level control
PA OCTLEVEL PMU Level PA Gain	PA gain of the specified level control

The following is a template of the calibration data initial file. Each value must be followed with a comma. Please follow the file format if you want to change the value in the file.

[WCDMA Temperature Sensor]
ADC0=841
ADC1=764
ADC2=692
ADC3=605
ADC4=544
ADC5=487
ADC6=458
ADC7=397
[WCDMA BAND1 RX loss]
Temperature 0 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0
Temperature 0 RX loss high mode=-0.500,-1.000,0.500,0.000,-0.250,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 0 RX loss mid mode=1.500,0.750,2.250,0.000,-0.500,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 0 RX loss low mode=4.000,3.250,3.750,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 1 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0
Temperature 1 RX loss high mode=-0.500,-1.000,0.500,0.000,-0.250,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 1 RX loss mid mode=1.500,0.750,2.250,0.000,-0.500,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 1 RX loss low mode=4.000,3.250,3.750,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 2 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0
Temperature 2 RX loss high
mode=0.500,0.000,1.500,1.000,0.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 RX loss mid
mode=2.500,1.750,3.250,1.000,0.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000

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Temperature 2 RX loss low mode=5.000,4.250,4.750,-1.000,-1.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0
Temperature 3 RX loss high mode=0.500,0.000,1.500,1.000,0.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 RX loss mid mode=2.500,1.750,3.250,1.000,0.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 RX loss low mode=5.000,4.250,4.750,-1.000,-1.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0
Temperature 4 RX loss high mode=0.500,0.000,1.500,1.000,0.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 RX loss mid mode=2.500,1.750,3.250,1.000,0.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 RX loss low mode=5.000,4.250,4.750,-1.000,-1.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0
Temperature 5 RX loss high mode=0.500,0.000,1.500,1.000,0.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 RX loss mid mode=2.500,1.750,3.250,1.000,0.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 RX loss low mode=5.000,4.250,4.750,-1.000,-1.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 6 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0
Temperature 6 RX loss high mode=1.500,1.000,2.500,2.000,1.750,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 6 RX loss mid mode=3.500,2.750,4.250,2.000,1.500,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 6 RX loss low mode=6.000,5.250,5.750,-1.000,-1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 7 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0
Temperature 7 RX loss high mode=1.500,1.000,2.500,2.000,1.750,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 7 RX loss mid mode=3.500,2.750,4.250,2.000,1.500,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 7 RX loss low mode=6.000,5.250,5.750,-1.000,-1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000

[WCDMA BAND2 RX loss]
Temperature 0 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0
Temperature 0 RX loss high mode=0.000,-0.500,-0.500,0.500,-0.500,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 0 RX loss mid mode=1.750,1.500,1.000,1.750,1.500,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 0 RX loss low mode=3.500,3.000,2.750,3.000,4.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 1 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0
Temperature 1 RX loss high mode=0.000,-0.500,-0.500,0.500,-0.500,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 1 RX loss mid mode=1.750,1.500,1.000,1.750,1.500,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000

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Temperature 1 RX loss low mode=3.500,3.000,2.750,3.000,4.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 2 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0
Temperature 2 RX loss high
mode=1.000,0.500,0.500,1.500,0.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 RX loss mid
mode=2.750,2.500,2.000,2.750,2.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 RX loss low
mode=4.500,4.000,3.750,4.000,5.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0
Temperature 3 RX loss high
mode=1.000,0.500,0.500,1.500,0.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 RX loss mid
mode=2.750,2.500,2.000,2.750,2.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 RX loss low
mode=4.500,4.000,3.750,4.000,5.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0
Temperature 4 RX loss high
mode=1.000,0.500,0.500,1.500,0.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 RX loss mid
mode=2.750,2.500,2.000,2.750,2.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 RX loss low
mode=4.500,4.000,3.750,4.000,5.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0
Temperature 5 RX loss high
mode=1.000,0.500,0.500,1.500,0.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 RX loss mid
mode=2.750,2.500,2.000,2.750,2.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 RX loss low
mode=4.500,4.000,3.750,4.000,5.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 6 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0
Temperature 6 RX loss high
mode=2.000,1.500,1.500,2.500,1.500,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 6 RX loss mid
mode=3.750,3.500,3.000,3.750,3.500,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 6 RX loss low
mode=5.500,5.000,4.750,5.000,6.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 7 Max UARFCN=9662,9700,9800,9869,9938,0,0,0,0,0,0,0,0,0,0
Temperature 7 RX loss high
mode=2.000,1.500,1.500,2.500,1.500,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 7 RX loss mid
mode=3.750,3.500,3.000,3.750,3.500,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 7 RX loss low
mode=5.500,5.000,4.750,5.000,6.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000

[WCDMA BAND5 RX loss]
Temperature 0 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0
Temperature 0 RX loss high mode=-0.500,-0.750,-0.250,-0.500,-0.250,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 0 RX loss mid mode=0.250,0.250,0.500,0.500,0.500,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000

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Temperature 0 RX loss low mode=0.250,0.250,0.500,0.250,0.500,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 1 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0
Temperature 1 RX loss high mode=-0.500,-0.750,-0.250,-0.500,-0.250,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 1 RX loss mid mode=0.250,0.250,0.500,0.500,0.500,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 1 RX loss low mode=0.250,0.250,0.500,0.250,0.500,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 2 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0
Temperature 2 RX loss high
mode=0.500,0.250,0.750,0.500,0.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 RX loss mid
mode=1.250,1.250,1.500,1.500,1.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 RX loss low
mode=1.250,1.250,1.500,1.250,1.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0
Temperature 3 RX loss high
mode=0.500,0.250,0.750,0.500,0.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 RX loss mid
mode=1.250,1.250,1.500,1.500,1.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 RX loss low
mode=1.250,1.250,1.500,1.250,1.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0
Temperature 4 RX loss high
mode=0.500,0.250,0.750,0.500,0.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 RX loss mid
mode=1.250,1.250,1.500,1.500,1.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 RX loss low
mode=1.250,1.250,1.500,1.250,1.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0
Temperature 5 RX loss high
mode=0.500,0.250,0.750,0.500,0.750,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 RX loss mid
mode=1.250,1.250,1.500,1.500,1.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 RX loss low
mode=1.250,1.250,1.500,1.250,1.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 6 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0
Temperature 6 RX loss high
mode=1.500,1.250,1.750,1.500,1.750,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 6 RX loss mid
mode=2.250,2.250,2.500,2.500,2.500,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 6 RX loss low
mode=2.250,2.250,2.500,2.250,2.500,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 7 Max UARFCN=4357,4382,4408,4433,4458,0,0,0,0,0,0,0,0,0,0
Temperature 7 RX loss high
mode=1.500,1.250,1.750,1.500,1.750,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 7 RX loss mid
mode=2.250,2.250,2.500,2.500,2.500,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 7 RX loss low
mode=2.250,2.250,2.500,2.250,2.500,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000

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[WCDMA BAND8 RX loss]

Temperature 0 Max UARFCN=2937,2975,3013,3051,3088,0,0,0,0,0,0,0,0,0,0
Temperature 0 RX loss high mode=-0.500,-1.000,-0.750,-0.750,-0.500,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 0 RX loss mid mode=-0.250,0.000,0.000,0.000,0.250,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 0 RX loss low mode=0.250,0.250,0.500,0.250,0.500,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 1 Max UARFCN=2937,2975,3013,3051,3088,0,0,0,0,0,0,0,0,0,0
Temperature 1 RX loss high mode=-0.500,-1.000,-0.750,-0.750,-0.500,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 1 RX loss mid mode=-0.250,0.000,0.000,0.000,0.250,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 1 RX loss low mode=0.250,0.250,0.500,0.250,0.500,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.000,-1.0000
Temperature 2 Max UARFCN=2937,2975,3013,3051,3088,0,0,0,0,0,0,0,0,0,0
Temperature 2 RX loss high
mode=0.500,0.000,0.250,0.250,0.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 RX loss mid
mode=0.750,1.000,1.000,1.000,1.250,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 2 RX loss low
mode=1.250,1.250,1.500,1.250,1.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 Max UARFCN=2937,2975,3013,3051,3088,0,0,0,0,0,0,0,0,0,0
Temperature 3 RX loss high
mode=0.500,0.000,0.250,0.250,0.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 RX loss mid
mode=0.750,1.000,1.000,1.000,1.250,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 3 RX loss low
mode=1.250,1.250,1.500,1.250,1.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 Max UARFCN=2937,2975,3013,3051,3088,0,0,0,0,0,0,0,0,0,0
Temperature 4 RX loss high
mode=0.500,0.000,0.250,0.250,0.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 RX loss mid
mode=0.750,1.000,1.000,1.000,1.250,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 4 RX loss low
mode=1.250,1.250,1.500,1.250,1.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 Max UARFCN=2937,2975,3013,3051,3088,0,0,0,0,0,0,0,0,0,0
Temperature 5 RX loss high
mode=0.500,0.000,0.250,0.250,0.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 RX loss mid
mode=0.750,1.000,1.000,1.000,1.250,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 5 RX loss low
mode=1.250,1.250,1.500,1.250,1.500,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.000,0.0000
Temperature 6 Max UARFCN=2937,2975,3013,3051,3088,0,0,0,0,0,0,0,0,0,0
Temperature 6 RX loss high
mode=1.500,1.000,1.250,1.250,1.500,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 6 RX loss mid
mode=1.750,2.000,2.000,2.000,2.250,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 6 RX loss low
mode=2.250,2.250,2.500,2.250,2.500,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000

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Temperature 7 Max UARFCN=2937,2975,3013,3051,3088,0,0,0,0,0,0,0,0,0,0
Temperature 7 RX loss high
mode=1.500,1.000,1.250,1.250,1.500,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 7 RX loss mid
mode=1.750,2.000,2.000,2.000,2.250,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000
Temperature 7 RX loss low
mode=2.250,2.250,2.500,2.250,2.500,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.000,1.0000

[WCDMA BAND1 TPC]
DC2DC LEVEL0=1.225V
DC2DC LEVEL1=3.400V
Subband max uarfcn, PA high
mode=9612,9634,9656,9678,9700,9722,9750,9766,9788,9810,9832,9854,9876,9888
Subband power offset dB, PA high mode=-0.09375,-0.53125,-0.78125,-0.90625,-0.78125,-0.50000,0,0.00000,1.25000,1.96875,2.53125,2.93750,3.21875,3.312500
Temperature compensation offset dB, PA high
mode=0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.000000
Subband max uarfcn, PA middle
mode=9612,9634,9656,9678,9700,9722,9750,9766,9788,9810,9832,9854,9876,9888
Subband power offset dB, PA middle mode=0.34375,-0.18750,-0.59375,-0.84375,-0.87500,-0.62500,0,0.00000,1.34375,2.18750,2.87500,3.40625,3.81250,3.968750
Temperature compensation offset dB, PA middle
mode=0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.000000
Subband max uarfcn, PA low
mode=9612,9634,9656,9678,9700,9722,9750,9766,9788,9810,9832,9854,9876,9888
Subband power offset dB, PA low mode=-0.75000,-1.15625,-1.31250,-1.28125,-1.03125,-0.62500,0,0.00000,0.87500,1.28125,1.59375,1.68750,1.62500,1.531250
Temperature compensation offset dB, PA low
mode=0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.000000
Power detector subband max
uarfcn=9612,9634,9656,9678,9700,9722,9750,9766,9788,9810,9832,9854,9876,9888
Power detector subband power offset dB=1.46875,1.59375,1.40625,1.12500,0.81250,0.53125,0,0.00000,-0.34375,-0.56250,-0.59375,-0.53125,-0.37500,-0.250000
Start1=12
End1=14
Start2=22
End2=24
DC2DC LEVEL, PA high mode=1
VBias DAC, PA high mode=660
Vm1, PA high mode=0
Vm2, PA high mode=0
VGA DAC, PA high mode=296,204
DC2DC LEVEL, PA middle mode=0
VBias DAC, PA middle mode=550
Vm1, PA middle mode=1
Vm2, PA middle mode=0
VGA DAC, PA middle mode=238,204
DC2DC LEVEL, PA low mode=0
VBias DAC, PA low mode=490
Vm1, PA low mode=1
Vm2, PA low mode=1

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VGA DAC, PA low mode=161,204
; number of enabled sections for 8-level PA control (3~8)
PA OCTLEVEL Sections=8
; phase compensation value (degree)
PA OCTLEVEL PA Phase Compensation=-70,0,70
; PA mode of each level (H: high mode, M: middle mode, L: low mode)
PA OCTLEVEL PMU Level PA Mode=H,H,H,H,H,M,M,L
; PRF the upper bound of the specified level
PA OCTLEVEL PMU Level Prf=24,22,20,18,15,11,6,0
; DC2DC level of the specified level
PA OCTLEVEL PMU Level Dc2Dc=3.4V,3.0V,2.6V,2.4V,2.3V,2.2V,2.0V,1.5V,
; Vbias of the specified level
PA OCTLEVEL PMU Level VBias=0,0,0,0,0,0,0,0
; vm1 of the specified level
PA OCTLEVEL PMU Level Vm1=0,0,0,0,0,1,1,1
; vm2 of the specified level
PA OCTLEVEL PMU Level Vm2=0,0,0,0,0,0,0,1
; PA gain of the specified level (dB)
PA OCTLEVEL PMU Level PA
Gain=17.93750,17.40625,16.96875,16.68750,16.37500,7.50000,7.21875,3.875000

[WCDMA BAND2 TPC]
DC2DC LEVEL0=1.225V
DC2DC LEVEL1=3.400V
Subband max uarfcn, PA high
mode=9262,9284,9306,9328,9350,9372,9400,9416,9438,9460,9482,9504,9526,9538
Subband power offset dB, PA high mode=0.40625,-0.62500,-0.96875,-0.87500,-0.65625,-
0.37500,0.00000,0.00000,0.46875,0.50000,0.00000,-0.43750,0.31250,1.281250
Temperature compensation offset dB, PA high
mode=0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.000000
Subband max uarfcn, PA middle
mode=9262,9284,9306,9328,9350,9372,9400,9416,9438,9460,9482,9504,9526,9538
Subband power offset dB, PA middle mode=0.71875,-0.59375,-1.34375,-1.59375,-1.34375,-0.87500,-
0.18750,0.00000,1.09375,1.50000,1.15625,0.25000,0.46875,1.750000
Temperature compensation offset dB, PA middle
mode=0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.000000
Subband max uarfcn, PA low
mode=9262,9284,9306,9328,9350,9372,9400,9416,9438,9460,9482,9504,9526,9538
Subband power offset dB, PA low mode=0.34375,-0.75000,-1.12500,-1.06250,-0.78125,-0.46875,-
0.06250,0.00000,0.34375,0.43750,0.06250,-0.37500,0.12500,1.031250
Temperature compensation offset dB, PA low
mode=0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.000000
Power detector subband max
uarfcn=9262,9284,9306,9328,9350,9372,9400,9416,9438,9460,9482,9504,9526,9538
Power detector subband power offset
dB=0.43750,0.81250,0.56250,0.28125,0.09375,0.00000,0.0,0.00000,0.56250,0.65625,0.84375,0.50000,0.03125,
-0.437500
Start1=12
End1=14
Start2=23
End2=24

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DC2DC LEVEL, PA high mode=1
VBias DAC, PA high mode=660
Vm1, PA high mode=0
Vm2, PA high mode=0
VGA DAC, PA high mode=296,216
DC2DC LEVEL, PA middle mode=0
VBias DAC, PA middle mode=550
Vm1, PA middle mode=1
Vm2, PA middle mode=0
VGA DAC, PA middle mode=238,216
DC2DC LEVEL, PA low mode=0
VBias DAC, PA low mode=490
Vm1, PA low mode=1
Vm2, PA low mode=1
VGA DAC, PA low mode=161,216
; number of enabled sections for 8-level PA control (3~8)
PA OCTLEVEL Sections=8
; phase compensation value (degree)
PA OCTLEVEL PA Phase Compensation=-70,0,70
; PA mode of each level (H: high mode, M: middle mode, L: low mode)
PA OCTLEVEL PMU Level PA Mode=H,H,H,H,H,M,M,L
; PRF the upper bound of the specified level
PA OCTLEVEL PMU Level Prf=24,22,20,18,15,11,6,0
; DC2DC level of the specified level
PA OCTLEVEL PMU Level Dc2Dc=3.4V,3.0V,2.6V,2.4V,2.3V,2.2V,2.0V,1.5V,
; Vbias of the specified level
PA OCTLEVEL PMU Level VBias=0,0,0,0,0,0,0,0
; vm1 of the specified level
PA OCTLEVEL PMU Level Vm1=0,0,0,0,0,1,1,1
; vm2 of the specified level
PA OCTLEVEL PMU Level Vm2=0,0,0,0,0,0,0,1
; PA gain of the specified level (dB)
PA OCTLEVEL PMU Level PA
Gain=23.31250,22.59375,21.93750,21.37500,21.18750,10.00000,9.43750,6.343750

[WCDMA BAND5 TPC]
DC2DC LEVEL0=1.225V
DC2DC LEVEL1=3.400V
Subband max uarfcn, PA high
mode=4132,4140,4148,4156,4164,4172,4183,4188,4195,4203,4210,4218,4226,4233
Subband power offset dB, PA high
mode=1.43750,1.28125,1.15625,0.96875,0.62500,0.28125,0.0,0.00000,0.31250,0.53125,0.65625,0.78125,0.937
50,1.093750
Temperature compensation offset dB, PA high
mode=0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.000000
Subband max uarfcn, PA middle
mode=4132,4140,4148,4156,4164,4172,4183,4188,4195,4203,4210,4218,4226,4233
Subband power offset dB, PA middle mode=0.50000,0.93750,1.21875,1.28125,1.06250,0.71875,0,0.00000,-
0.78125,-0.96875,-0.75000,-0.15625,0.65625,1.437500
Temperature compensation offset dB, PA middle
mode=0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.000000

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Subband max uarfcn, PA low
mode=4132,4140,4148,4156,4164,4172,4183,4188,4195,4203,4210,4218,4226,4233
Subband power offset dB, PA low mode=1.34375,0.93750,0.46875,0.06250,-0.18750,-
0.25000,0,0.00000,0.37500,0.59375,0.75000,0.84375,0.90625,0.937500
Temperature compensation offset dB, PA low
mode=0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.000000
Power detector subband max
uarfcn=4132,4140,4148,4156,4164,4172,4183,4188,4195,4203,4210,4218,4226,4233
Power detector subband power offset dB=-0.40625,-0.43750,-
0.09375,0.00000,0.09375,0.15625,0.00000,0.00000,-0.12500,-0.15625,-0.28125,-0.43750,-0.53125,-0.593750
Start1=12
End1=14
Start2=22
End2=24
DC2DC LEVEL, PA high mode=1
VBias DAC, PA high mode=660
Vm1, PA high mode=0
Vm2, PA high mode=0
VGA DAC, PA high mode=296,213
DC2DC LEVEL, PA middle mode=0
VBias DAC, PA middle mode=550
Vm1, PA middle mode=1
Vm2, PA middle mode=0
VGA DAC, PA middle mode=238,213
DC2DC LEVEL, PA low mode=0
VBias DAC, PA low mode=490
Vm1, PA low mode=1
Vm2, PA low mode=1
VGA DAC, PA low mode=161,213
; number of enabled sections for 8-level PA control (3~8)
PA OCTLEVEL Sections=8
; phase compensation value (degree)
PA OCTLEVEL PA Phase Compensation=-70,0,70
; PA mode of each level (H: high mode, M: middle mode, L: low mode)
PA OCTLEVEL PMU Level PA Mode=H,H,H,H,H,M,M,L
; PRF the upper bound of the specified level
PA OCTLEVEL PMU Level Prf=24,22,20,18,15,11,6,0
; DC2DC level of the specified level
PA OCTLEVEL PMU Level Dc2Dc=3.4V,3.0V,2.6V,2.4V,2.3V,2.2V,2.0V,1.5V,
; Vbias of the specified level
PA OCTLEVEL PMU Level VBias=0,0,0,0,0,0,0,0
; vm1 of the specified level
PA OCTLEVEL PMU Level Vm1=0,0,0,0,0,1,1,1
; vm2 of the specified level
PA OCTLEVEL PMU Level Vm2=0,0,0,0,0,0,0,1
; PA gain of the specified level (dB)
PA OCTLEVEL PMU Level PA
Gain=17.93750,17.40625,16.96875,16.68750,16.37500,7.50000,7.21875,3.875000

[WCDMA BAND8 TPC]
DC2DC LEVEL0=1.225V

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DC2DC LEVEL1=3.400V
Subband max uarfcn, PA high
mode=2712,2724,2736,2748,2760,2772,2787,2796,2807,2818,2829,2840,2851,2863
Subband power offset dB, PA high
mode=0.75000,0.65625,0.68750,0.78125,0.62500,0.46875,0.28125,0.00000,0.31250,0.50000,0.87500,1.21875,1.59375,1.906250
Temperature compensation offset dB, PA high
mode=0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.000000
Subband max uarfcn, PA middle
mode=2712,2724,2736,2748,2760,2772,2787,2796,2807,2818,2829,2840,2851,2863
Subband power offset dB, PA middle mode=-1.65625,-1.21875,-0.56250,-0.03125,0.28125,0.37500,0.15625,0.00000,-0.65625,-0.59375,0.00000,0.93750,1.84375,2.375000
Temperature compensation offset dB, PA middle
mode=0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.000000
Subband max uarfcn, PA low
mode=2712,2724,2736,2748,2760,2772,2787,2796,2807,2818,2829,2840,2851,2863
Subband power offset dB, PA low mode=-0.12500,-0.34375,-0.46875,-0.50000,-0.43750,-0.25000,-0.03125,0.00000,0.03125,0.06250,0.21875,0.59375,1.15625,1.781250
Temperature compensation offset dB, PA low
mode=0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.00000,0.000000
Power detector subband max
uarfcn=2712,2724,2736,2748,2760,2772,2787,2796,2807,2818,2829,2840,2851,2863
Power detector subband power offset dB=-0.12500,0.15625,0.46875,0.53125,0.53125,0.31250,0.03125,0.00000,0.12500,0.21875,0.25000,0.37500,-0.03125,-0.312500
Start1=12
End1=14
Start2=22
End2=24
DC2DC LEVEL, PA high mode=1
VBias DAC, PA high mode=660
Vm1, PA high mode=0
Vm2, PA high mode=0
VGA DAC, PA high mode=296,213
DC2DC LEVEL, PA middle mode=0
VBias DAC, PA middle mode=550
Vm1, PA middle mode=1
Vm2, PA middle mode=0
VGA DAC, PA middle mode=238,213
DC2DC LEVEL, PA low mode=0
VBias DAC, PA low mode=490
Vm1, PA low mode=1
Vm2, PA low mode=1
VGA DAC, PA low mode=161,213
; number of enabled sections for 8-level PA control (3~8)
PA OCTLEVEL Sections=8
; phase compensation value (degree)
PA OCTLEVEL PA Phase Compensation=-70,0,70
; PA mode of each level (H: high mode, M: middle mode, L: low mode)
PA OCTLEVEL PMU Level PA Mode=H,H,H,H,H,M,M,L
; PRF the upper bound of the specified level

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PA OCTLEVEL PMU Level Prf=24,22,20,18,15,11,6,0
; DC2DC level of the specified level
PA OCTLEVEL PMU Level Dc2Dc=3.4V,3.0V,2.6V,2.4V,2.3V,2.2V,2.0V,1.5V,
; Vbias of the specified level
PA OCTLEVEL PMU Level VBias=0,0,0,0,0,0,0,0
; vm1 of the specified level
PA OCTLEVEL PMU Level Vm1=0,0,0,0,0,1,1,1
; vm2 of the specified level
PA OCTLEVEL PMU Level Vm2=0,0,0,0,0,0,0,1
; PA gain of the specified level (dB)
PA OCTLEVEL PMU Level PA
Gain=17.93750,17.40625,16.96875,16.68750,16.37500,7.50000,7.21875,3.875000

4.3.1.5 Setup calibration data result file path

User can setup the folder of calibration result file by clicking [Setup calibration data result file path] in File pull down menu. All calibration data files of each calibrated phone are saved in this folder. The format of file name of these calibration data files are xxx.cal, where xxx is barcode specified on META factory mode window.

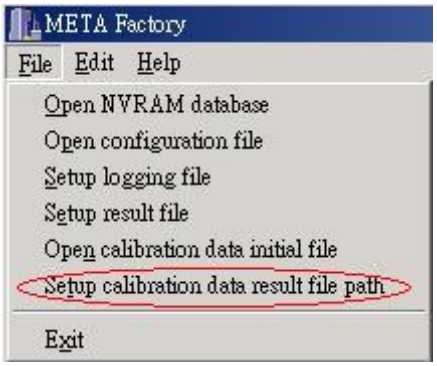

Figure 521 ***Click [Setup calibration data result file path] to show calibration data result file path window***

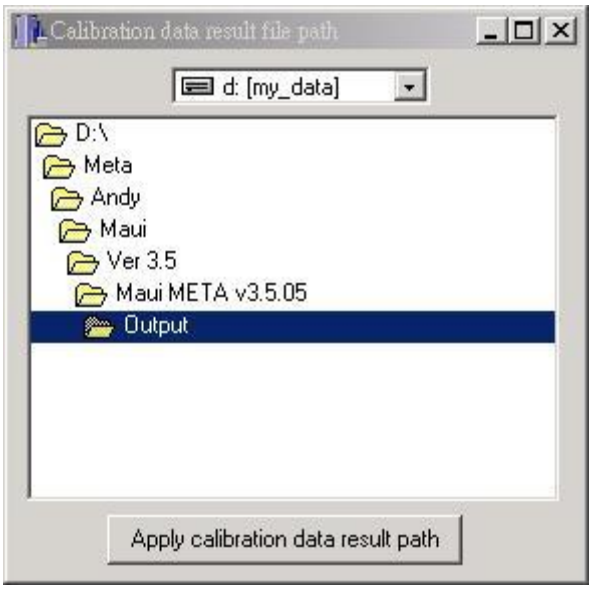

Figure 522 ***Calibration data result file path window***

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User can change drive and folder and then click [Apply calibration data result path] button to apply calibration data result file path.

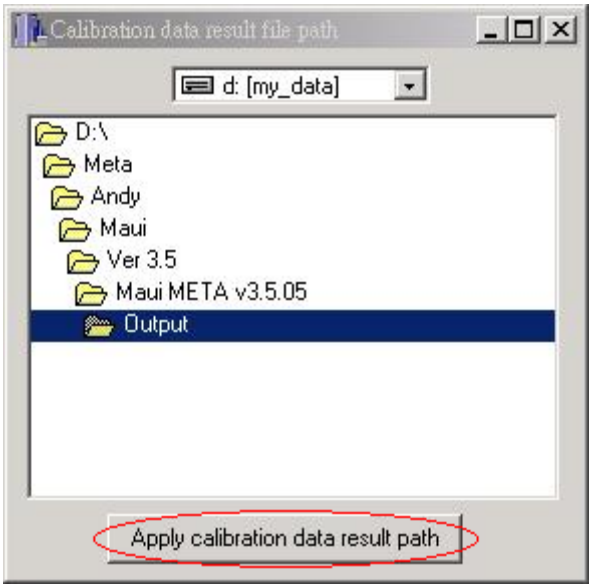

Figure 523 ***click [Apply calibration data result path] button to apply calibration data result file path***

4.3.2 Calibration procedure

Following is the calibration procedure of META factory.

4.3.2.1 Initialization

4. Configure META-DLL.
5. Agilent 8960 or R&S CMU 200 Configuration and the cable loss compensation.
6. Open configuration file and import the default RF calibration from initial data file. These default RF calibration data will be written down to NVRAM which depends on which calibration item users choose.

4.3.2.2 WCDMA Temperature ADC calibration

The calibration is to calibrate the AUX_ADC voltage from temperature sensor. Baseband determines the ambient temperature according to the temperature ADC and then can compensate some RF parameters in which temperature range.
Note:

1. In WCDMA TPC calibration, the following sections of CFG file will be adopted:
1 [WCDMA temperature ADC table]]

Calibration steps:

1 Command MS to perform ADC measurement in ADC channel: 5, and store the measurement result in us_current_adc.
(META DLL API: META_BB_ADCGetMeaSumData, use 1000 as measure count)
2 Based on the section in the INI file: [WCDMA Temperature Sensor], calculate the following values:
(nvram_temp_adc here represents the NVRAm structure of LID: NVRAM_EF_UL1_TEMP_DAC_LID)
2.1 m_usWCDMA_TADC_REF_ADC__10 = nvram_temp_adc.tempdacData[0]; // INI's ADC0
2.2 m_usWCDMA_TADC_REF_ADC_5 = nvram_temp_adc.tempdacData[1]; // INI's ADC1
2.3 m_usWCDMA_TADC_REF_ADC_20 = nvram_temp_adc.tempdacData[2]; /// INI's ADC2

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2.4 m_usWCDMA_TADC_REF_ADC_25 = nvram_temp_adc.tempdacData[2] + ((nvram_temp_adc.tempdacData[3]-nvram_temp_adc.tempdacData[2])*(25-20)/(35-20));
2.5 m_usWCDMA_TADC_REF_ADC_35 = nvram_temp_adc.tempdacData[3]; // INI's ADC3
2.6 m_usWCDMA_TADC_REF_ADC_45 = nvram_temp_adc.tempdacData[4]; // INI's ADC4
2.7 m_usWCDMA_TADC_REF_ADC_55 = nvram_temp_adc.tempdacData[5]; // INI's ADC5
2.8 m_usWCDMA_TADC_REF_ADC_60 = nvram_temp_adc.tempdacData[6]; // INI's ADC6
2.9 m_usWCDMA_TADC_REF_ADC_65 = nvram_temp_adc.tempdacData[7]; // INI's ADC7

3 According to the us_current_adc measured in step 1, and apply the following formula to calculate the temperature ADC. (m_fWCDMA_TADC_CURRENT_TEMPERATURE here is the value of CFG's WCDMA_TADC_CURRENT_TEMPERATURE.

3.1 For ADC0 // -10
3.1.1 float fdata = (us_current_adc - m_usWCDMA_TADC_REF_ADC_25)***10.0**/(m_fWCDMA_TADC_CURRENT_TEMPERATURE +20.0)+m_usWCDMA_TADC_REF_ADC__10;
3.1.2 fdata += (fdata>=0) ? 0.5 : -0.5 ;
3.1.3 nvram_temp_adc.tempdacData[0] = (unsigned short) fdata;

3.2 For ADC1 // 5
3.2.1 float fdata = (us_current_adc - m_usWCDMA_TADC_REF_ADC_25)*25/(m_fWCDMA_TADC_CURRENT_TEMPERATURE+20.0)+m_usWCDMA_TADC_REF_ADC_5;
3.2.2 fdata += (fdata>=0) ? 0.5 : -0.5 ;
3.2.3 nvram_temp_adc.tempdacData[1] = (unsigned short) fdata;

3.3 For ADC2 // 20
3.3.1 float fdata = (us_current_adc - m_usWCDMA_TADC_REF_ADC_25)*40.0/(m_fWCDMA_TADC_CURRENT_TEMPERATURE +20.0)+m_usWCDMA_TADC_REF_ADC_20;
3.3.2 fdata += (fdata>=0) ? 0.5 : -0.5 ;
3.3.3 nvram_temp_adc.tempdacData[2] = (unsigned short) fdata;

3.4 For ADC3 // 35
3.4.1 float fdata = (us_current_adc - m_usWCDMA_TADC_REF_ADC_25)*55.0/(m_fWCDMA_TADC_CURRENT_TEMPERATURE +20.0)+m_usWCDMA_TADC_REF_ADC_35;
3.4.2 fdata += (fdata>=0) ? 0.5 : -0.5 ;
3.4.3 nvram_temp_adc.tempdacData[3] = (unsigned short) fdata;

3.5 For ADC4 // 45
3.5.1 float fdata = (us_current_adc - m_usWCDMA_TADC_REF_ADC_25)*65.0/(m_fWCDMA_TADC_CURRENT_TEMPERATURE +20.0)+m_usWCDMA_TADC_REF_ADC_45;
3.5.2 fdata += (fdata>=0) ? 0.5 : -0.5 ;
3.5.3 nvram_temp_adc.tempdacData[4] = (unsigned short) fdata;

3.6 For ADC5 // 55
3.6.1 float fdata = (us_current_adc - m_usWCDMA_TADC_REF_ADC_25)*75.0/(m_fWCDMA_TADC_CURRENT_TEMPERATURE +20.0)+m_usWCDMA_TADC_REF_ADC_55;
3.6.2 fdata += (fdata>=0) ? 0.5 : -0.5 ;
3.6.3 nvram_temp_adc.tempdacData[5] = (unsigned short) fdata;

3.7 For ADC6 // 60
3.7.1 float fdata = (us_current_adc - m_usWCDMA_TADC_REF_ADC_25)*80.0/(m_fWCDMA_TADC_CURRENT_TEMPERATURE +20.0)+m_usWCDMA_TADC_REF_ADC_60;
3.7.2 fdata += (fdata>=0) ? 0.5 : -0.5 ;
3.7.3 nvram_temp_adc.tempdacData[6] = (unsigned short) fdata;

3.8 For ADC7 // 65
3.8.1 float fdata = (us_current_adc - m_usWCDMA_TADC_REF_ADC_25)*85.0/(m_fWCDMA_TADC_CURRENT_TEMPERATURE +20.0)+m_usWCDMA_TADC_REF_ADC_65;
3.8.2 fdata += (fdata>=0) ? 0.5 : -0.5 ;
3.8.3 nvram_temp_adc.tempdacData[7] = (unsigned short) fdata;

4 Write the calibration result: nvram_temp_adc structure to MS's NVRAM.

4.1 NVRAM LID: NVRAM_EF_UL1_TEMP_DAC_LID

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4.2 META DLL API: META_NVRAM_3G_Compose_tempdacData and META_NVRAM_Write

4.3.2.3 WCDMA AFC calibration 2-step AFC slope calibration

The calibration is to calibrate the VCTCXO parameter init_AFC and slope to keep the initial frequency close to zero and well AFC tracking.

Note:

1. In WCDMA TPC calibration, the following sections of CFG file will be adopted:
2 [8960 Initialization]/ [CMU200 Initialization]
3 [WCDMA AFC table]

Calibration steps:

9. Command radio communication tester (RCT, ex: Agilent 8960/ R&S CMU 200) to set the following environment:
   1.1 DPCH channel type to RMC12.2 kbps.
   1.2 Cell power based on the CFG file: WCDMA_AFC_P_DL (in dBm).
   1.3 Downlink channel based on the CFG file: WCDMA_AFC_UARFCN_DL

2 Command MS to perform WCDMA AFC measurement via META DLL API: META_3Grf_AFC with the following settings (afc here represents the strcture of URfTestCmdAFC of META DLL API), and store the AFC measurement result: frequency error reported from MS)
   2.1 afc.dl_freq = WCDMA_AFC_UARFCN_DL in CFG file
   2.2 afc.hwAGC = true;
   2.3 afc.mode = 0;
   2.4 afc.gain = (short) ((-15 - WCDMA_AFC_P_DL in CFG file) * 4.0);
   2.5 afc.LNAmode = 0;
   2.6 afc.pga = 0;
   2.7 afc.afc_dac = WCDMA_AFC_DAC1 in CFG file

3 Repeat step 2 for CFG's WCDMA_AFC_MEASURE_COUNT times and calculate the average value of the WCDMA_AFC_MEASURE_COUNT -time frequency error. Store the averaged frequency error in $\overline{\Delta f_1}$.

4 Repeat step 2~3, but for afc.afc_dac, using CFG's WCDMA_AFC_DAC2, and store the averaged frequency eror in $\overline{\Delta f_2}$

5 Calcuate the Slope = ($\overline{\Delta f_1} - \overline{\Delta f_2} \big/ DAC_2 - DAC_1$), slope_inv = 4096 /(Slope*Afc_Slope_factor)
   5.1 DAC1 here represents the CFG's WCDMA_AFC_DAC1
   5.2 DAC2 here represents the CFG's WCDMA_AFC_DAC2.
   5.3 Afc_Slope_factor is calculated based on the WCDMA_AFC_BAND in CFG file.

6 Calculate the afc_dac_initial_value = $\overline{\Delta f_1} \big/ slope + DAC_1$

7 Write the slope_inv and afc_dac_initial_value to MS's NVRAM.
   7.1 NVRAM LID: NVRAM_EF_L1_AFCDATA_LID
   7.2 META DLL API: META_NVRAM_SetRecFieldValue and META_NVRAM_Write

8 Write $slope_inv$ and initial value to the target via META_DLL interface

Note:

- DAC1 here represents the CFG's WCDMA_AFC_DAC1
- DAC2 here represents the CFG's WCDMA_AFC_DAC2.
- Afc_Slope_factor at step 5 is evaluated by the following formula:
  Afc_Slope_factor = 900.0 / 2140.0 for WCDMA band 1
  Afc_Slope_factor = 900.0 / 1960.0 for WCDMA band 2

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Afc_Slope_factor = 900.0 / 1842.5 for WCDMA band 3
Afc_Slope_factor = 900.0 / 2132.5 for WCDMA band 4
Afc_Slope_factor = 900.0 / 881.5 for WCDMA band 5
Afc_Slope_factor = 900.0 / 880.0 for WCDMA band 6
Afc_Slope_factor = 900.0 / 2655.0 for WCDMA band 7
Afc_Slope_factor = 900.0 / 942.5 for WCDMA band 8
Afc_Slope_factor = 900.0 / 1862.4 for WCDMA band 9
Afc_Slope_factor = 900.0 / 2145.0 for WCDMA band 10

4.3.2.4 WCDMA RX path loss calibration

The calibration is to calibrate the RX path loss, to keep Baseband can measure the RSSI accurately.

Note:

1. In WCDMA RX path loss calibration, the following sections of CFG file will be adopted:
   - [8960 Initialization]/ [CMU200 Initialization]
   - [WCDMA Common]
   - [WCDMA RSSI/LNA table]

Calibration steps:

1. Command radio communication tester (RCT, ex: Agilent 8960/ R&S CMU 200) to set the following environment:
   1.1 DPCH channel type to RMC12.2 kbps.
   1.2 CPICH level to -10
   1.3 PICH level to -15
   1.4 P-CCPCH level to -12
   1.5 DPCH level to -15
2 Set the RX path loss settings to MS's NVRAM (LID: NVRAM_EF_UL1_PATHLOSS_BAND1_LID for WCDMA band 1) based on the INI file's section: [WCDMA BAND1 RX loss] for WCDMA band 1, [WCDMA BAND2 RX loss] for WCDMA band 2…etc.
   2.1 NVRAM LID:
   NVRAM_EF_UL1_PATHLOSS_BAND1_LID for WCDMA band1
   NVRAM_EF_UL1_PATHLOSS_BAND2_LID for WCDMA band2
   NVRAM_EF_UL1_PATHLOSS_BAND3_LID for WCDMA band3
   NVRAM_EF_UL1_PATHLOSS_BAND4_LID for WCDMA band4
   NVRAM_EF_UL1_PATHLOSS_BAND5_LID for WCDMA band5
   NVRAM_EF_UL1_PATHLOSS_BAND6_LID for WCDMA band6
   NVRAM_EF_UL1_PATHLOSS_BAND7_LID for WCDMA band7
   NVRAM_EF_UL1_PATHLOSS_BAND8_LID for WCDMA band8
   NVRAM_EF_UL1_PATHLOSS_BAND9_LID for WCDMA band9
   NVRAM_EF_UL1_PATHLOSS_BAND10_LID for WCDMA band10
3 Command MS to change gain table based on the WCDMA_RSSI_GAIN_TABLE_CHANGE_FOR_CAL_MODE to reduce the channel interference for RX path loss calibration. (Default: the WCDMA_RSSI_GAIN_TABLE_CHANGE_FOR_CAL_MODE is set to be 1, i.e. ask target to change gain table for RX path loss calibration)
   3.1 META DLL API: META_3Grf_ReplaceGainTableforCal
4 Repeat the following steps among different LNA modes (high→Middle->Low mode accordingly) of each WCDMA band based on the setting: WCDMA_BAND in CFG file to calibration RX path loss.
   4.1 Modify the following configurationds of Agilen8960 or R&S CMU 200
      4.1.1 Set cable loss of RCT according the CFG settings such as "WCDMA BAND1 input cable loss" in section "[8960 Initialization]" or "[CMU200 Initialization]".

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4.1.2 Set uplink channel frequency of RCT to be the middle of uplink channel of each WCDMA band to ensure the speration of uplink and downlink channel to be more thant 30 MHz to avoid the channel interference.

4.1.3 Set cell power of RCT based on the rule here:

4.1.3.1 If WCDMA_RSSI_GAIN_TABLE_CHANGE_FOR_CAL_MODE is set to 1 specified in CFG file, set cell power to be
WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_HIGH_MODE for LNA high mode;
WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_MID_MODE for LNA middle mode;
WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_LOW_MODE for LNA low mode;

4.1.3.2 If WCDMA_RSSI_GAIN_TABLE_CHANGE_FOR_CAL_MODE is not 1 specified in CFG file, set cell power to be
WCDMA_RSSI_P_DL for LNA high mode;
WCDMA_LNA_MID_MODE_P_DL for LNA middle mode;
WCDMA_LNA_LOW_MODE_P_DL for LNA low mode

4.1.4 Set the downlink channel of RCT as the channel specified in INI file. Based on the temperature index specified in CFG (WCDMA_RSSI_TEMPERATURE_INDEX), use the corresponding “Max UARFCN” in INI file.
For example, if WCDMA_RSSI_TEMPERATURE_INDEX is set to be 3, use the settings of “Temperature 3 Max UARFCN” accordingly.

4.2 Command MS to perform WCDMA RSSI measurement via META DLL API: META_3Grf_Rssi with the following settings (rssi here represents the strcture of URfTestCmdRSSI of META DLL API), and store the RSSI measurement result to be us_rssi)

4.2.1 rssi.num_freq = 1;

4.2.2 rssi.temperature = WCDMA_RSSI_TEMPERATURE_INDEX in CFG file

4.2.3 rssi.hwAGC = true;

4.2.4 rssi.mode = 0;

4.2.5 rssi.gain = (short) ((-15 – step 4.1.3’s cell power among different LNA modes) * 4.0);

4.2.6 rssi.LNAmode = 0: LNA high mode, 1: LNA middle mode, 2: LNA low mode

4.2.7 rssi.pga = 0;

4.2.8 rssi.dl_freq[0] = the channel specified in the INI file, ex, “Temperature 3 Max UARFCN”.

4.3 Repeat step 4.2 for several times until the RSSI measurement are finished in all channels specified in INI file. Note: 0 specified in INI’s “Max UARFCN” indicated the end of UARFCN settings.

4.4 According to the RX path loss settings of step 2 in MS, calculate the rx path loss with the following formula

4.4.1 c_loss = the path loss specified in INI file when WCDMA_RSSI_TEMPERATURE_INDEX is set to be 3
“Temperature 3 RX loss high mode” for LNA high mode
“Temperature 3 RX loss mid mode” for LNA middle mode
“Temperature 3 RX loss low mode” for LNA low mode.

4.4.2 new_c_loss = c_loss + (step 4.1.3’s cell power among different LNA modes * 4.0) – step 4.2’s us_rssi

4.5 Perform the RX path loss compesation for temperatures (0~7) based on CFG’s WCDMA_RSSI_BAND1_TEMPERATURE_OFFSET for WCDMA band1.

4.5.1 new_c_loss_by_temp = new_c_loss + d_offset*4.0; d_offset is the settings of CFG file.
For example, for BAND1, if
WCDMA_RSSI_BAND1_TEMPERATURE_OFFSET = -1,-1,0,0,0,0,1,1,
d_offset = -1 for temperature 0 ~1;
d_offset = 0 for temperature 2~5;
d_offset = 1 for temperature 6~7

4.6 After RX path loss of 3 LNA modes are calibrated, write the calibration result: new_c_loss_by_temp to MS’s NVRAM (as step 2)

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5 After all WCDMA bands are calibrated (using step 4's calibration flow), change the gain table to be state 2 with META DLL API : META_3Grf_ReplaceGainTableforCal to reverse the gain table state back before we perform RX path loss calibration.

6 Make sure the new_c_loss calicauted in step 4.4 which must pass the value check based on the CFG's BAND1_MAX_RX_LOSS and BAND1_MIN_RX_LOSS for WCDMA band1.
new_c_loss must be within the range of [BAND1_MIN_RX_LOSS, BAND1_MAX_RX_LOSS] .
If the value check failed, the calibration will be reported failure, and stop the calibration procedure.

4.3.2.5 WCDMA TPC calibration

The calibration is to calibrate the PA_GAIN (power amplifier gain), PDET_GAIN (power detector gain), and subband compensation (power compensation, power detector compensation) to keep TX power transmission accurately.

Note:

1. In WCDMA TPC calibration, the following sections of CFG file will be adopted:
4 [8960 Initialization]/ [CMU200 Initialization]
5 [WCDMA Common]
6 [WCDMA TPC table]

Calibration steps:

1. Command radio communication tester (RCT, ex: Agilent 8960/CMU 200) to set the following environment:
   1.1 DPCH channel type to RMC12.2 kbps.
   1.2 Cell power: -70 (in dBm).
   1.3 Set channel power measurement-relevant settings
      1.3.1 Trigger Source: Immedate
      1.3.2 Measure count: 5
      1.3.3 Interval: 100 us
      1.3.4 Timeout: 3 seconds

2 Set the TPC (transmit power control) profile settings to MS's NVRAM (LID: NVRAM_EF_UL1_TXDAC_BAND1_LID for WCDMA band 1) based on the INI file's section: [WCDMA BAND1 TPC] for WCDMA band 1, [WCDMA BAND2 TPC] for WCDMA band 2…etc.
   2.1 NVRAM LID:
      NVRAM_EF_UL1_TXDAC_BAND1_LID for WCDMA band1
      NVRAM_EF_UL1_TXDAC_BAND2_LID for WCDMA band2
      NVRAM_EF_UL1_TXDAC_BAND3_LID for WCDMA band3
      NVRAM_EF_UL1_TXDAC_BAND4_LID for WCDMA band4
      NVRAM_EF_UL1_TXDAC_BAND5_LID for WCDMA band5
      NVRAM_EF_UL1_TXDAC_BAND6_LID for WCDMA band6
      NVRAM_EF_UL1_TXDAC_BAND7_LID for WCDMA band7
      NVRAM_EF_UL1_TXDAC_BAND8_LID for WCDMA band8
      NVRAM_EF_UL1_TXDAC_BAND9_LID for WCDMA band9
      NVRAM_EF_UL1_TXDAC_BAND10_LID for WCDMA band10

3 Command MS to change power control mode to be 0 via META DLL API: META_3Grf_SetPowerControlMode. Set mode to be 0 will set power detector in manual mode which indicates that during this period, power detector will not affect the DPCH TX power transmission.

4 Repeat the following steps of each WCDMA band based on the setting: WCDMA_BAND in CFG file.
   4.1 Set cable loss of RCT according the CFG settings such as "WCDMA BAND1 input cable loss" in section "[8960 Initialization]" or "[CMU200 Initialization]".
   4.2 Set downlink channel frequency of RCT to be the middle of downlink channel of each WCDMA band to ensure the speration of uplink and downlink channel to be more thant 30 MHz to avoid the channel interference.
   4.3 Set uplink channel frequency of RCT to be the BAND1_TPC_UARFCN_UL in CFG for BADN1 calibration, BAND2_TPC_UARFCN_UL for BAND2 calibration, and vice versa.

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4.4 Set MS's subband compensation settings: pwr_offset_dB in the structure of ul1cal_txdacData_T_B to be all 0 for all channels for subband calibration via META DLL API: META_3Grf_SetTxDacData_B.

4.5 Calibrate the PA gain of PA Middle mode with the following steps to find the PA gain that MS will transmit the power closest to the goal power (d_goal_power) which is based on the CFGs: WCDMA_TPC_CAL_POWER_INDEX_FOR_PGA_MIDDLE_PA_MODE and BAND1_TPC_WANTED_P_OFFSET for WCDMA band1. For example. If WCDMA_TPC_CAL_POWER_INDEX_FOR_PGA_MIDDLE_PA_MODE = 18 and BAND1_TPC_WANTED_P_OFFSET = -1, the goal power (d_goal_power) for middle PA mode is: 24-(18)+(-1) = 17 dBm.

4.5.1 Set the MS's PA gain which is stored in temp_tpc_data_by_band.txdacData.power_dac[1].vga_dac[8] to us_cur_pa_gain. If the measurement is the first time, us_cur_pa_gain will be he value specified in INI's "VGA DAC, PA middle mode". (temp_tpc_data_by_band here represent the structure of ul1cal_txdacData_T_B)

4.5.2 Command MS to transmit power via META DLL API: META_3Grf_TxDpch with the following parameters (dpch_tx here represents the structure of URfTestCmdTxDPCh):

4.5.2.1 dpch_tx.ul_freq = CFG's BAND1_TPC_UARFCN_UL for Band 1

4.5.2.2 dpch_tx.psc = 0;

4.5.2.3 dpch_tx.sc_code = 0;

4.5.2.4 dpch_tx.power_ctrl_mode = 1

4.5.2.5 dpch_tx.pa_mode = 1; // 0: PA high mode, 1: PA middle mode, 2: PA low mode

4.5.2.6 dpch_tx.idx = CFG's WCDMA_TPC_CAL_POWER_INDEX_FOR_PGA_MIDDLE_PA_MODE;

4.5.2.7 dpch_tx.afc_dac = the initial value of AFC calibrated in WCDMA AFC calibration

4.5.2.8 dpch_tx.dpcch_pwr = 8;

4.5.2.9 dpch_tx.dpdch_pwr = 15;

4.5.2.10 dpch_tx.rf_band =1; // 1 for Band 1, 2 for Band 2,…etc.

4.5.2.11 dpch_tx.vm1 = 0;

4.5.2.12 dpch_tx.vm2 = 0;

4.5.2.13 dpch_tx.dc2dc_dac = 0;

4.5.2.14 dpch_tx.vbias_dac = 0;

4.5.2.15 dpch_tx.apc_dac = 0;

4.5.2.16 dpch_tx.pwr_det = false;

4.5.3 Command RCT to measure channel power, and store the measurement result in d_meas_power.

4.5.4 Command MS to report power detector result via META DLL API: META_3Grf_GetPwrDtMeasureResult, and store the power detector report in us_pdt_val.

4.5.5 Check is the calibration should continues with the following rule

4.5.5.1 If d_meas_power is within the range [d_goal_power - WCDMA_TPC_DELTA, d_goal_power + WCDMA_TPC_DELTA]: finialize the PA gain with the formula:

4.5.5.1.1 us_cur_pa_gain = us_cur_pa_gain – (d_goal_power - d_meas_pwr)*16.0;

4.5.5.1.2 Go to step 4.5.7

4.5.5.2 Else

4.5.5.2.1 If the measurement is the first-time, us_cur_pa_gain = us_cur_pa_gain – (d_goal_power - d_meas_pwr)*16.0; and store the d_meas_power to d_prev_power, and us_cur_pa_gain to us_prev_pa_gain for future usage, and go to step 4.5.1

4.5.5.2.2 Else use the previous power measurement result: (d_prev_power)

4.5.5.2.2.1 if((d_goal_power - d_prev_pwr)*(d_goal_power – d_meas_power) < 0) double d_slope = (us_prev_pa_gain - us_cur_pa_gain)/(d_prev_pwr - d_meas_pwr);

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double d_data = us_cur_pa_gain - d_slope * d_meas_pwr;
double d_data = d_goal_power*d_slope + d_data;
us_cur_pa_gain = (unsigned short) d_data;

4.5.5.2.2.2 else
us_cur_pa_gain = us_cur_pa_gain – (d_goal_power - d_meas_pwr)*16.0;

4.5.6 Repeat step 4.5.1 ~ 4.5.5 after try CFG's WCDMA_TPC_RECURSIVE_TIMES times if the calibration never reaches the step 4.5.5.1

4.5.7 Check if the calibrated PA gain meets the criteria specified in CFG file: the PA gain should be within [BAND1_WCDMA_TPC_PA_MID_GAIN_MIN, BAND1_WCDMA_TPC_PA_MID_GAIN_MAX] for WCDMA Band1. If the check failed, the calibration stops and report failure immediately.

4.5.8 Calculate Power Detector Gain (PDET_GAIN) with the following formula:

4.5.8.1 double d_real_pwr_det_p = (1.0*us_pwr_det_report/32.0)+ 80.0;

4.5.8.2 double d_wanted_pwr_det_p = d_meas_pwr – CFG's BAND1_TPC_WANTED_P_OFFSET;

4.5.8.3 unsigned short us_eva_pwr_det_gain = (unsigned short)((u1_pwr_det_gain)+(d_wanted_pwr_det_p - d_real_pwr_det_p)*8.0);
u1_pwr_det_gain is the value of the second element of "VGA DAC, PA high mode" in INI file.

4.5.8.4 Check if us_eva_pwr_det_gain is within [BAND2_WCDMA_TPC_POWER_DETECTOR_GAIN_MIN,BAND1_WCDMA_TPC_POWER_DETECTOR_GAIN_MAX] for WCDMA Band1. If the check failed, the calibration stops and report failure immediately.

4.5.9 Store the calibrated PA gain and Power Detector gain with the following rule:

4.5.9.1 temp_tpc_data_by_band.txdacData.power_dac[1].vga_dac[8]= us_cur_pa_gain,

4.5.9.2 temp_tpc_data_by_band.txdacData.power_dac[0].vga_dac[9] = us_eva_pwr_det_gain;

4.5.10 Perform subband compensation calibration:

4.5.10.1 Write the calibrated PA gain and Power Detector gain to MS via META DLL API: META_3Grf_SetTxDacData_B

4.5.10.2 Command MS to perform DPCH_TX as step 4.5.2. This operation is used to get the calibrated TX performance on the calibration channel because at this time, MS is working with right PA gain and Power Detector gain.

4.5.10.3 Command RCT to perform channel power measurement, and store the result in d_basis_meas_pwr;

4.5.10.4 Command MS to report power detector value, and store the report in us_basis_meas_pd_rep.

4.5.10.5 double d_basis_pd_rep_dbm = (1.0*us_basis_meas_pd_rep/32.0)-80.0;

4.5.10.6 Based on the INI's "Subband max uarfcn, PA middle mode" to get the subband settings, and assign the uarfcn to the dpch_tx.ul_freq. Here, we use temp_tpc_data_by_band.txdacData.power_dac[pa_mode].vga_comp_by_subband[s_idx].max_uarfcn to store the INI's settings. pa_mode = 1 for Middle mode, s_idx = 0~13. Note: 0 indicates the end of the max_uarfcn settings, and at most 15 max_uarfcn subband settings for each PA modes.

4.5.10.7 Command MS to perform DPCH TX as in step 4.5.2

4.5.10.8 Command RCT to perform channel power measurement and store the result in d_meas_pwr

4.5.10.9 Command MS to report power detector value and store the report in us_meas_pd_rep.

4.5.10.10 Perform the following formual to calculate the power compensation

4.5.10.10.1 double d_dif_pwr = d_basis_meas_pwr - d_meas_pwr;

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4.5.10.10.2 Check if d_dif_power is within the range of CFG's [BAND1_WCDMA_TPC_SUBBAND_POWER_OFFSET_DB_COMP_MIN, BAND1_WCDMA_TPC_SUBBAND_POWER_OFFSET_DB_COMP_MAX] for Band 1. If check failed, then stop the entire calibration, and report the failure.

4.5.10.10.3 double d_after_scale = d_dif_pwr*32.0;

4.5.10.10.4 Store the d_after_scale to temp_tpc_data_by_band.txdacData.power_dac[1: for pa middle mode].vga_comp_by_subband[s_idx].pwr_offset_dB for later NVRAM writing operation, s_idx = 0~13 depends which max_uarfcn is adopted in calibration.

4.5.10.11 Perform the following formula to calculate the power detector compensation

4.5.10.11.1 double d_pd_rep_dbm = (1.0*us_meas_pd_rep/32.0)-80;

4.5.10.11.2 double d_dif_pd_dBm = d_meas_pwr – CFG's BAND1_TPC_WANTED_P_OFFSET - d_pd_rep_dbm;

4.5.10.11.3 Check if d_dif_pd_dBm is within the range of [BAND1_WCDMA_TPC_SUBBAND_POWER_DETECTOR_POWER_OFFSET_DB_COMP_MIN, BAND1_WCDMA_TPC_SUBBAND_POWER_DETECTOR_POWER_OFFSET_DB_COMP_MAX]. If check failed, stop the calibration and report the failure immediately.

4.5.10.11.4 double d_after_scale = d_dif_pwr*32.0;

4.5.10.11.5 Store the d_after_scale to temp_tpc_data_by_band.txdacData.pwr_dt_data.pwr_dt_comp_by_subband[s_idx].pwr_offset_dB for later NVRAM writing operation; s_idx = 0~13 depends which max_uarfcn is adopted in calibration.

4.5.10.12 Repeat step 4.5.10.1~4.5.10.11 to calibrate all subband compensation among different channels.

Note: the power detector compensation is only calibrated when PA mode = middle mode.

4.5.11 Calibrate the PA gain of PA high mode with the following steps:

4.5.11.1 Adjust the goal power based on the PA gain calibrated in step 4.5.9, because MS had better to transmit the closest power in the same TPC index even in different PA modes (PA high or PA middle modes).

4.5.11.2 Set RCT's target power based on 24-((START1+END1)/2) of INI file.

4.5.11.3 Command MS to transmit power via META DLL API: META_3Grf_TxDpch with the following parameters (dpch_tx here represents the structure of URfTestCmdTxDPCh):

4.5.11.3.1 dpch_tx.ul_freq = CFG's BAND1_TPC_UARFCN_UL for Band 1

4.5.11.3.2 dpch_tx.psc = 0;

4.5.11.3.3 dpch_tx.sc_code = 0;

4.5.11.3.4 dpch_tx.power_ctrl_mode = 1

4.5.11.3.5 dpch_tx.pa_mode = 1; // 0: PA high mode, 1: PA middle mode, 2: PA low mode

4.5.11.3.6 dpch_tx.idx = INI's (START1+END1)/2 ;

4.5.11.3.7 dpch_tx.afc_dac = the initial value of AFC calibrated in WCDMA AFC calibration

4.5.11.3.8 dpch_tx.dpcch_pwr = 8;

4.5.11.3.9 dpch_tx.dpdch_pwr = 15;

4.5.11.3.10 dpch_tx.no_loop_ctrl = true;

4.5.11.3.11 dpch_tx.rf_band = 1; // 1 for Band1, 2 for Band2, …etc

4.5.11.3.12 dpch_tx.vm1 = 0;

4.5.11.3.13 dpch_tx.vm2 = 0;

4.5.11.3.14 dpch_tx.dc2dc_dac = 0;

4.5.11.3.15 dpch_tx.vbias_dac = 0;

4.5.11.3.16 dpch_tx.apc_dac = 0;

4.5.11.3.17 dpch_tx.pwr_det = false;

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4.5.11.4 Command RCT to perform channel power measurement, and store the result to d_goal_power.

4.5.11.5 Set the target power of RCT as d_goal_power.

4.5.11.6 Repeat step 4.5.1~4.5.6 except the dpch_tx.pa_mode is set to be 0 for PA high mode, and dpch_tx.idx = INI's (START2+END2)/2.

4.5.11.7 Check if the calibrated PA gain meets the criteria specified in CFG file: the PA gain should be within [BAND1_WCDMA_TPC_PA_HIGH_GAIN_MIN, BAND1_WCDMA_TPC_PA_HIGH_GAIN_MAX] for WCDMA Band1. If the check failed, the calibration stops and report failure immediately.

4.5.11.8 If CFG's WCDMA_TPC_PA_MODE_SUBBAND_CAL_NUM bigger than 1, perform subband compensation calibration (power compensation only, no need to perform power detector compensation calibration) as step 4.5.10 except this time, PA mode = 0 for PA high mode, and only power compensation calibration only, no power detector compensation calibration.

4.5.12 Calibrate the PA gain of PA low mode with the following steps:

4.5.12.1 Adjust the goal power based on the PA gain of PA middle mode calibrated in step 4.5, because MS had better to transmit the closest power in the same TPC index even in different PA modes (PA middle/PA low modes).

4.5.12.2 Set RCT's target power based on 24-((START2+END2)/2) of INI file.

4.5.12.3 Command MS to transmit power via META DLL API: META_3Grf_TxDpch with the following parameters (dpch_tx here represents the structure of URfTestCmdTxDPCh):

4.5.12.3.1 dpch_tx.ul_freq = CFG's BAND1_TPC_UARFCN_UL for Band 1

4.5.12.3.2 dpch_tx.psc = 0

4.5.12.3.3 dpch_tx.sc_code = 0;

4.5.12.3.4 dpch_tx.power_ctrl_mode = 1

4.5.12.3.5 dpch_tx.pa_mode = 1; // 0: PA high mode, 1: PA middle mode, 2: PA low mode

4.5.12.3.6 dpch_tx.idx = INI's (START2+END2)/2 ;

4.5.12.3.7 dpch_tx.afc_dac = the initial value of AFC calibrated in WCDMA AFC calibration

4.5.12.3.8 dpch_tx.dpcch_pwr = 8;

4.5.12.3.9 dpch_tx.dpdch_pwr = 15;

4.5.12.3.10 dpch_tx.no_loop_ctrl = true;

4.5.12.3.11 dpch_tx.rf_band = 1; // 1 for Band1, 2 for Band2, …etc

4.5.12.3.12 dpch_tx.vm1 = 0;

4.5.12.3.13 dpch_tx.vm2 = 0;

4.5.12.3.14 dpch_tx.dc2dc_dac = 0;

4.5.12.3.15 dpch_tx.vbias_dac = 0;

4.5.12.3.16 dpch_tx.apc_dac = 0;

4.5.12.3.17 dpch_tx.pwr_det = false;

4.5.12.4 Command RCT to perform channel power measurement, and store the result to d_goal_power.

4.5.12.5 Set the target power of RCT as d_goal_power.

4.5.13 Repeat step 4.5.1~4.5.6 except the dpch_tx.pa_mode is set to be 2 for PA low mode , and dpch_tx.idx = INI's (START2+END2)/2

4.5.14 Check if the calibrated PA gain meets the criteria specified in CFG file: the PA gain should be within [BAND1_WCDMA_TPC_PA_LOW_GAIN_MIN, BAND1_WCDMA_TPC_PA_LOW_GAIN_MAX] for WCDMA Band1. If the check failed, the calibration stops and report failure immediately.

4.5.15 If CFG's WCDMA_TPC_PA_MODE_SUBBAND_CAL_NUM bigger than 2, perform subband compensation calibration (power compensation only, no need to perform power detector compensation calibration) as step 4.5.10 except this time, PA mode = 2 for PA low mode, and only power compensation calibration only, no power detector compensation calibration.

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4.6 Write the calibration result (PA gain, Power detector gain, subband power compensation, subband power detector calibration) to MS's NVRAM.

4.6.1 NVRAM LID: NVRAM_EF_UL1_TXDAC_BAND1_LID for WCDMA band1
NVRAM_EF_UL1_TXDAC_BAND2_LID for WCDMA band2
NVRAM_EF_UL1_TXDAC_BAND3_LID for WCDMA band3
NVRAM_EF_UL1_TXDAC_BAND4_LID for WCDMA band4
NVRAM_EF_UL1_TXDAC_BAND5_LID for WCDMA band5
NVRAM_EF_UL1_TXDAC_BAND6_LID for WCDMA band6
NVRAM_EF_UL1_TXDAC_BAND7_LID for WCDMA band7
NVRAM_EF_UL1_TXDAC_BAND8_LID for WCDMA band8
NVRAM_EF_UL1_TXDAC_BAND9_LID for WCDMA band9
NVRAM_EF_UL1_TXDAC_BAND10_LID for WCDMA band10

5 Command MS to change power control mode to be 1 via META DLL API: META_3Grf_SetPowerControlMode. Set mode to be 1 will set power detector in automatici mode which indicates that during this period, power detector will affect the DPCH TX power transmission.

4.3.2.6 WCDMA Fast Handset Calibration (FHC) on Agilen8960

In WCDMA fast handset calibration, WCDMA RX path loss and WCDMA TPC calibration can be calibrated with one iteration with the following steps for each band.
Note:
1. For Agilent 8960, at most 20 power steps * 20 frequency steps is supported in one iteration.
2. Before using FHC in Factory, users should run traditional calibration at least one time to tune the settings of the INI file.
3. In FHC calibration, the following sections of CFG file will be adopted:

7 [8960 Initialization]
8 [WCDMA Common]
9 [WCDMA RSSI/LNA table]
10 [WCDMA TPC table]
11 [WCDMA FHC Factory Settings]

Calibration Steps:

1. Command radio communication tester (RCT, ex: Agilent 8960) to set the following environment:
   1.1 DPCH channel type to RMC12.2 kbps.
   1.2 Power control mode: MANUAL.
   1.3 Frequency measurement mode: MANUAL.
   1.4 Freqency generator control mode: MANUAL
   1.5 AGWN state: OFF

2 Set the RX path loss settings to MS's NVRAM (LID: NVRAM_EF_UL1_PATHLOSS_BAND1_LID for WCDMA band 1) based on the INI file's section: [WCDMA BAND1 RX loss] for WCDMA band 1, [WCDMA BAND2 RX loss] for WCDMA band 2…etc.

2.1 NVRAM LID:
NVRAM_EF_UL1_PATHLOSS_BAND1_LID for WCDMA band1
NVRAM_EF_UL1_PATHLOSS_BAND2_LID for WCDMA band2
NVRAM_EF_UL1_PATHLOSS_BAND3_LID for WCDMA band3
NVRAM_EF_UL1_PATHLOSS_BAND4_LID for WCDMA band4
NVRAM_EF_UL1_PATHLOSS_BAND5_LID for WCDMA band5
NVRAM_EF_UL1_PATHLOSS_BAND6_LID for WCDMA band6
NVRAM_EF_UL1_PATHLOSS_BAND7_LID for WCDMA band7
NVRAM_EF_UL1_PATHLOSS_BAND8_LID for WCDMA band8
NVRAM_EF_UL1_PATHLOSS_BAND9_LID for WCDMA band9
NVRAM_EF_UL1_PATHLOSS_BAND10_LID for WCDMA band10

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3 Set the TPC (transmit power control) profile settings to MS's NVRAM (LID: NVRAM_EF_UL1_TXDAC_BAND1_LID for WCDMA band 1) based on the INI file's section: [WCDMA BAND1 TPC] for WCDMA band 1, [WCDMA BAND2 TPC] for WCDMA band 2…etc.

3.1 NVRAM LID:

NVRAM_EF_UL1_TXDAC_BAND1_LID for WCDMA band1
NVRAM_EF_UL1_TXDAC_BAND2_LID for WCDMA band2
NVRAM_EF_UL1_TXDAC_BAND3_LID for WCDMA band3
NVRAM_EF_UL1_TXDAC_BAND4_LID for WCDMA band4
NVRAM_EF_UL1_TXDAC_BAND5_LID for WCDMA band5
NVRAM_EF_UL1_TXDAC_BAND6_LID for WCDMA band6
NVRAM_EF_UL1_TXDAC_BAND7_LID for WCDMA band7
NVRAM_EF_UL1_TXDAC_BAND8_LID for WCDMA band8
NVRAM_EF_UL1_TXDAC_BAND9_LID for WCDMA band9
NVRAM_EF_UL1_TXDAC_BAND10_LID for WCDMA band10

4 Set MS's subband compensation settings: pwr_offset_dB in the structure of ul1cal_txdacData_T_B to be all 0 for all channels for subband calibration via META DLL API: META_3Grf_SetTxDacData_B

5 Command MS to change gain table based on the WCDMA_RSSI_GAIN_TABLE_CHANGE_FOR_CAL_MODE to reduce the channel interference for RX path loss calibration. (Default: the WCDMA_RSSI_GAIN_TABLE_CHANGE_FOR_CAL_MODE is set to be 1, i.e. ask target to change gain table for RX path loss calibration)

5.1 META DLL API: META_3Grf_ReplaceGainTableforCal

6 Command MS to change power control mode to be 0 via META DLL API: META_3Grf_SetPowerControlMode. Set mode to be 0 will set power detector in manual mode which indicates that during this period, power detector will not affect the DPCH TX power transmission.

7 Set cable loss of RCT according the CFG settings such as "WCDMA BAND1 input cable loss" in section "[8960 Initialization]" or "[CMU200 Initialization]".

8 Configure RCT's power step arrangement with the following rules.

8.1 For RX part:

8.1.1 Power step will be initialized according to the CFG's settings

8.1.1.1 If WCDMA_RSSI_GAIN_TABLE_CHANGE_FOR_CAL_MODE equals to 1

8.1.1.1.1 1st power: WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_HIGH_MODE
8.1.1.1.2 2nd power: WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_MID_MODE
8.1.1.1.3 3rd power: WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_LOW_MODE

8.1.1.2 Else

8.1.1.2.1 1st power: WCDMA_RSSI_P_DL
8.1.1.2.2 2nd power: WCDMA_LNA_MID_MODE_P_DL
8.1.1.2.3 3rd power: WCDMA_LNA_LOW_MODE_P_DL

8.1.2 Note: Since the number of power step of TX and RX should be the same in each iteration, the rest of RX power steps will be set as the 3rd power settings when the number of TX power step is bigger than RX power step for calibration.

8.2 For TX part:

8.2.1 Power step (unit: dBm) will be initialized according to the CFG's settings and INI's settings. For clear explanation, here we use the following settings for Band 1 FHC calibration.

8.2.1.1 CFG and INI files for PA high mode

8.2.1.1.1 INI's "Start1=11", "End1=11",
8.2.1.1.2 CFG's "BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 40",
8.2.1.1.3 CFG's "BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -40",
8.2.1.1.4 CFG's "BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_NUM = 4",

8.2.1.2 CFG and INI files for PA middle mode

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8.2.1.2.1 CFG's "WCDMA_TPC_CAL_POWER_INDEX_FOR_PGA_MIDDLE_PA_MODE = 18"
8.2.1.2.2 CFG's "BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 30",
8.2.1.2.3 CFG's "BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -30"
8.2.1.2.4 CFG's "BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM = 4"
8.2.1.3 CFG and INI files for PA low mode
8.2.1.3.1 INI's "Start2=22"," End2=22",
8.2.1.3.2 CFG's "BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 40",
8.2.1.3.3 CFG's "BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -40"
8.2.1.3.4 CFG's "BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_NUM = 4"
8.2.1.4 1st power: 24 -((11+11)/2) + Ceil(((-40) + (40- (-40))/(4-1)*(4-1))/16) = 16 (high)
8.2.1.5 2nd power: 24 -((11+11)/2) + Ceil(((-40) + (40- (-40))/(4-1)*(4-2))/16) = 14 (high)
8.2.1.6 3rd power: 24 -((11+11)/2) + Ceil(((-40) + (40- (-40))/(4-1)*(4-3))/16) = 12 (high)
8.2.1.7 4th power: 24 -((11+11)/2) + Ceil(((-40) + (40- (-40))/(4-1)*(4-4))/16) = 10 (high)
8.2.1.8 5th power: 24 -((11+11)/2) + Ceil(((-30) + (30- (-30))/(4-1)*(4-1))/16) = 15 (middle)
8.2.1.9 6th power: 24 -((11+11)/2) + Ceil(((-30) + (30- (-30))/(4-1)*(4-2))/16) = 14 (middle)
8.2.1.10 7th power: 24 -((11+11)/2) + Ceil(((-30) + (30- (-30))/(4-1)*(4-3))/16) = 12 (middle)
8.2.1.11 8th power: 24 -((11+11)/2) + Ceil(((-30) + (30- (-30))/(4-1)*(4-4))/16) = 11 (middle)
8.2.1.12 9st power: 24 -(18) + Ceil(((-30) + (30- (-30))/(4-1)*(4-1))/16) = 8 (middle)
8.2.1.13 10th power: 24 -(18) + Ceil(((-30) + (30- (-30))/(4-1)*(4-2))/16) = 7 (middle)
8.2.1.14 11th power: 24 -(18) + Ceil(((-30) + (30- (-30))/(4-1)*(4-3))/16)= 5 (middle)
8.2.1.15 12h power: 24 -(18) + Ceil(((-30) + (30- (-30))/(4-1)*(4-4))/16) = 4 (middle)
8.2.1.16 13th power: 24 -((22+22)/2) + Ceil(((-30) + (30- (-30))/(4-1)*(4-1))/16) = 4 (middle)
8.2.1.17 14th power: 24 -((22+22)/2) + Ceil(((-30) + (30- (-30))/(4-1)*(4-2))/16) = 3 (middle)
8.2.1.18 15th power: 24 -((22+22)/2) + Ceil(((-30) + (30- (-30))/(4-1)*(4-3))/16) = 1 (middle)
8.2.1.19 16th power: 24 -((22+22)/2) + Ceil(((-30) + (30- (-30))/(4-1)*(4-4))/16) = 0 (middle)
8.2.1.20 17th power: 24 -((22+22)/2) + Ceil(((-40) + (40- (-40))/(4-1)*(4-1))/16) = 5 (low)
8.2.1.21 18th power: 24 -((22+22)/2) + Ceil(((-40) + (40- (-40))/(4-1)*(4-2))/16) = 4 (low)
8.2.1.22 19th power: 24 -((22+22)/2) + Ceil(((-40) + (40- (-40))/(4-1)*(4-3))/16) = 0 (low)
8.2.1.23 20th power: 24 -((22+22)/2) + Ceil(((-40) + (40- (-40))/(4-1)*(4-4))/16) = -1 (low)
8.2.1.24 Note: the 24 dBm here indicates the max TX power when TPC index equals to 0.

9 Configure RCT's frequency step arrangement with the following rule:
9.1 For RX part:
9.1.1 Frequency step will be initialized as the INI's settings: "Temperature 3 Max UARFCN" when CFG's WCDMA_RSSI_TEMPERATURE_INDEX equeals to 3. Take "Temperature 3 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0" in section "WCDMA BAND1 RX loss" for example
9.1.1.1 1st channel: 10562
9.1.1.2 2nd channel: 10631
9.1.1.3 3rd channel: 10700
9.1.1.4 4th channel: 10769
9.1.1.5 5th channel: 10838
9.1.1.6 Note: Since the number of frequency step of TX and RX should be the same in each iteration, the rest of RX frequency steps will be set as the middle downlink channel of each band when the number of TX frequency step is bigger than RX frequency step for calibration.
9.2 For TX part
9.2.1 Frequency step will be initialized as the CFG's BAND1_TPC_UARFCN_UL and INI's "Subband max uarfcn, PA high mode". Take "BAND1_TPC_UARFCN_UL = 9750" in CFG file and "Subband max uarfcn, PA high

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mode=9612,9630,9650,9670,9700,9720,9750,9770,9790,9810,9830,9850,9870,9888" in section "WCDMA BAND1 TPC" for example:

9.2.1.1 1st channel: 9750 (because BAND1_TPC_UARFCN_UL = 9750)
9.2.1.2 2nd channel: 9612
9.2.1.3 3rd channel: 9630
9.2.1.4 4th channel: 9650
9.2.1.5 5th channel: 9670
9.2.1.6 6th channel: 9700
9.2.1.7 7 th channel: 9720
9.2.1.8 8 th channel: 9770
9.2.1.9 9 th channel: 9790
9.2.1.10 10 th channel: 9810
9.2.1.11 11 th channel: 9830
9.2.1.12 12 th channel: 9850
9.2.1.13 13 th channel: 9870
9.2.1.14 14 th channel: 9888
9.2.1.15 Note: Since the number of frequency step of TX and RX should be the same in each iteration, the rest of TX frequency steps will be set as the middle uplink channel of each band when the number of RX frequency step is bigger than TX frequency step for calibration.

10 Query if RCT is ready for FHC iteration.

11 Command MS to perform FHC operation via META DLL API: META_3Grf_FHC_NoWaitResult with the following parameters (here target_fhc_req represents the structure of UL1D_RF_FHC_REQ_T):
Note: each invoking of META_3Grf_FHC_NoWaitResult represents one iteration. The number iterations are required depends on the number of frequency steps and power steps that users use to calibrate for the current band within the limitation of RCTs.

11.1 target_fhc_req.no_loop_ctrl = true;
11.2 target_fhc_req.pwr_det = false;
11.3 target_fhc_req.afc_dac = the initial value of AFC calibrated in WCDMA AFC calibration
11.4 target_fhc_req.power_ctrl_mode = CFG's PWR_CTRL_MODE (usually, set 2)
11.5 target_fhc_req.vm1[band][pa_mode] = INI's "Vm1, PA high mode=0", or "Vm1, PA middle mode=1", or "Vm1, PA low mode=1" for different PA modes (pa_mode = 0: high, 1: middle, 2: low) of each band (band = 0: band1, 1: band2, 2:band3, …etc)
11.6 target_fhc_req.vm2[band][pa_mode] = INI's "Vm2, PA high mode=0", or "Vm2, PA middle mode=1", or "Vm2, PA low mode=1" for different PA modes (pa_mode = 0: high, 1: middle, 2: low) of each band (band = 0: band1, 1: band2, 2:band3, …etc)
11.7 target_fhc_req.dc2dc_dac[band][pa_mode] = INI's "DC2DC LEVEL, PA high mode=0", or "DC2DC LEVEL, PA middle mode=1", or "DC2DC LEVEL, PA low mode=1" for different PA modes (pa_mode = 0: high, 1: middle, 2: low) of each band (band = 0: band1, 1: band2, 2:band3, …etc)
11.8 target_fhc_req.vbias_dac[band][pa_mode] = INI's "VBias DAC, PA high mode=0", or "VBias DAC, PA middle mode=1", or "VBias DAC, PA low mode=1" for different PA modes (pa_mode = 0: high, 1: middle, 2: low) of each band (band = 0: band1, 1: band2, 2:band3, …etc)
11.9 target_fhc_req.init_tx_onoff = 0 (or CFG's "INIT_TX_ONOFF")
11.10 target_fhc_req.ready_tx_onoff = 0 (or CFG's "READY_TX_ONOFF")
11.11 target_fhc_req.init_pa_mode = 0 (or CFG's "INIT_PA_MODE")
11.12 target_fhc_req.ready_pa_mode = 0 (or CFG's "READY_PA_MODE")
11.13 target_fhc_req.init_pa_gain = 0 (or CFG's "INIT_PA_GAIN")
11.14 target_fhc_req.ready_pa_gain = 0 (or CFG's "READY_PA_GAIN")
11.15 target_fhc_req.init_vga_dac_tpc_idx = 0 (or CFG's "INIT_VGA_DAC_TPC_IDX")
11.16 target_fhc_req.ready_vga_dac_tpc_idx = 0 (or CFG's "READY_VGA_DAC_TPC_IDX")
11.17 target_fhc_req. temperature = CFG's "WCDMA_RSSI_TEMPERATURE_INDEX"

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11.18 target_fhc_req.hwAGC = true;
11.19 target_fhc_req.gain_init = (short) ((-15 – CFG's WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_HIGH_MODE or CFG's WCDMA_RSSI_P_DL depends on the CFG's WCDMA_RSSI_GAIN_TABLE_CHANGE_FOR_CAL_MODE) * 4.0);
11.20 target_fhc_req.init_condition = 0 (or CFG's "INIT_CONDITION_FOR_Agilent8960")
11.21 target_fhc_req.step_duration = 30 (or CFG's "STEP_DURATION_FOR_Agilent8960)
11.22 target_fhc_req.ready_duration = 0 (or CFG's "READY_DURATION_FOR_Agilent8960")
11.23 target_fhc_req.retune_duration = 30 (or CFG's "RETUNE_DURATION_FOR_Agilent8960")
11.24 target_fhc_req.gain_stable_time = 9 (or CFG's "GAIN_STABLE_TIME_FOR_Agilent8960")
11.25 target_fhc_req.max_vga_dac = 0 (or CFG's "MAX_VGA_DAC_FOR_Agilent8960")
11.26 target_fhc_req.min_vga_dac = 0 (or CFG's "MIN_VGA_DAC_FOR_Agilent8960")
11.27 target_fhc_req.jump_vga_dac = 0 (or CFG's "JUMP_VGA_DAC_FOR_Agilent8960")
11.28 target_fhc_req.odd_record = 0 (or CFG's "ODD_RECORD")
11.29 target_fhc_req. freq_start_idx = 0
11.30 target_fhc_req.freq_count = the max number of freq steps of TX and RX need to be adopted in this iteration.
11.31 target_fhc_req.dl_band[0~39] = 1 for band1, 2 for band2, 3 for band3, ..etc
11.32 target_fhc_req. dl_freq[0~39] should be synchronous with the settings as step 9.1.
11.32.1 target_fhc_req. dl_freq[0] = 10562
11.32.2 target_fhc_req. dl_freq[1] = 10631
11.32.3 target_fhc_req. dl_freq[2] = 10700
11.32.4 target_fhc_req. dl_freq[3] = 10769
11.32.5 target_fhc_req. dl_freq[4] = 10838
11.32.6 target_fhc_req. dl_freq[5~39] = the middle downlink channel of current band during calibration
11.33 target_fhc_req.ul_band[0~39] = 1 for band1, 2 for band2, 3 for band3, ..etc
11.34 target_fhc_req.ul_freq[0~39] should be synchronous with the settings as step 9.2
11.34.1 target_fhc_req.ul_freq[0] = 9750
11.34.2 target_fhc_req.ul_freq[1] = 9612
11.34.3 target_fhc_req.ul_freq[2] = 9630
11.34.4 target_fhc_req.ul_freq[3] = 9650
11.34.5 target_fhc_req.ul_freq[4] = 9670
11.34.6 target_fhc_req.ul_freq[5] = 9700
11.34.7 target_fhc_req.ul_freq[6] = 9720
11.34.8 target_fhc_req.ul_freq[7] = 9750
11.34.9 target_fhc_req.ul_freq[8] = 9770
11.34.10 target_fhc_req.ul_freq[9] = 9790
11.34.11 target_fhc_req.ul_freq[10] = 9810
11.34.12 target_fhc_req.ul_freq[11] = 9830
11.34.13 target_fhc_req.ul_freq[12] = 9850
11.34.14 target_fhc_req.ul_freq[13] = 9870
11.34.15 target_fhc_req.ul_freq[14] = 9888
11.34.16 target_fhc_req.ul_freq[15~39] = the middle uplink channel of current band during calibration
11.35 target_fhc_req.pd_gain[0~39] = the second element of INI's "VGA DAC, PA high mode", take INI's "VGA DAC, PA high mode=296,122" for example, use 122.
11.36 target_fhc_req.pwr_count = the max number of power steps of TX and RX need to be adopted in this iteration.
11.37 target_fhc_req.pwr_start_idx = 0;
11.38 target_fhc_req.pa_gain_start_idx = 0;

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11.39 target_fhc_req.pd_gain_start_idx = CFG's "BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_NUM" + "BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM" for band1

11.40 target_fhc_req.pa_mode[0~39] arrangement depends on CFG's "BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_NUM", "BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM", and "BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_NUM".

11.40.1 Take "BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_NUM = 4" "BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM = 4" "BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM = 4" for example:

11.40.1.1 pa_mode[0~3] = 0 ; // 0: pa high mode

11.40.1.2 pa_mode[4~15] = 1; // 1: pa middle mode

11.40.1.3 pa_mode[16~19] = 2; // 2: pa low mode

11.40.2 Arrangement rule is according to the calibration algorithm designed for MT6160: calibrate the PA gain of PA middle mode first, and then adjust the goal power for PA high and PA low modes to calibrate PA gain.

11.40.2.1 PA high mode (the step number is: CFG's "BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_NUM"): used to calibrate the pa_gain of PA high mode and subband power compensation for PA high mode.

11.40.2.2 PA middle mode (the step number is: CFG's BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM): the arrangement here is because we need to base on the pa_gain calibrated in PA middle mode to predict the power of the same TPC index in different modes (PA middle mode, and PA high mode)

11.40.2.3 PA middle mode (the step number is: CFG's BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM): used to calibrate the pa gain of PA middle mode, subband power compensation for PA middle mode, and subband power detector compensation.

11.40.2.4 PA middle mode (the step number is: CFG's BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM) :the arrangement here is because we need to base on the pa_gain calibrated in PA middle mode to predict the power of the same TPC index in different modes (PA middle mode, and PA low mode)

11.40.2.5 PA low mode (the step number is: CFG's BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM): used to calibrate the pa_gain of PA low mode and subband power compensation for PA low mode.

11.41 target_fhc_req.vga_dac_tpc_idx[0~39] will be assigned according to the following rules:

11.41.1 Depends on CFG's settings:

11.41.1.1 "BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_NUM"

11.41.1.2 "BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM"

11.41.1.3 "BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_NUM"

11.41.1.4 "WCDMA_TPC_CAL_POWER_INDEX_FOR_PGA_MIDDLE_PA_MODE"

11.41.2 Depends on INI's settings

11.41.2.1 "Start1",

11.41.2.2 "End1",

11.41.2.3 "Start2",

11.41.2.4 "End2",

11.41.3 Take "WCDMA_TPC_CAL_POWER_INDEX_FOR_PGA_MIDDLE_PA_MODE = 18", "BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_NUM = 4", "BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM = 4", "BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_NUM = 4", "Start1=11", "End1=11", "Start2=22"," End2=22" for example

11.41.4 vga_dac_tpc_idx[0~3]= 11 (because use the tpc index as (Start1+End1)/2), and BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_NUM = 4)

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11.41.5 vga_dac_tpc_idx[4~7] = 11 (because use the tpc index as (Start1+End1)/2), and BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM = 4)

11.41.6 vga_dac_tpc_idx[8~11] = 18 (because use the tpc index as WCDMA_TPC_CAL_POWER_INDEX_FOR_PGA_MIDDLE_PA_MODE and BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM = 4)

11.41.7 vga_dac_tpc_idx[12~15] = 22 (because use the tpc index as (Start2+End2)/2, and BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM = 4)

11.41.8 vga_dac_tpc_idx[16~19] = 22 (because use the tpc index as (Start2+End2)/2, and BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_NUM = 4)

11.41.9 vga_dac_tpc_idx[20~39]: don't care.

11.42 target_fhc_req.pa_gain[0~39] will be assigned according to the following rules: (here we take Band1 for example)

11.42.1 Depends on CFG's settings:

11.42.1.1 "BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE"

11.42.1.2 "BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE"

11.42.1.3 "BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_NUM"

11.42.1.4 "BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE"

11.42.1.5 "BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE"

11.42.1.6 "BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM"

11.42.1.7 "BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE"

11.42.1.8 "BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE"

11.42.1.9 "BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_NUM"

11.42.2 Depends on INI's settings of each band

11.42.2.1 "VGA DAC, PA high mode"

11.42.2.2 "VGA DAC, PA middle mode"

11.42.2.3 "VGA DAC, PA low mode"

11.42.3 Take the followings for example:

"BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 40"
"BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -40"
"BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_NUM = 4"
"BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 30"
"BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -30"
"BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM = 4"
"BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 40"
"BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -40"
"BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_NUM = 4"
"VGA DAC, PA high mode=296,122"
"VGA DAC, PA middle mode=239"
"VGA DAC, PA low mode=166"

11.42.4 Due to "BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 40"
"BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -40"
"BAND1_PA_HIGH_FHC_WCDMA_TPC_PA_GAIN_NUM = 4",
"VGA DAC, PA high mode=296,122"

11.42.4.1 target_fhc_req.pa_gain[0] = 296+ ((-40) + (40- (-40))/(4-1) *(0)) = 256

11.42.4.2 target_fhc_req.pa_gain[1] = 296+ ((-40) + (40- (-40))/(4-1) *(1)) = 283

11.42.4.3 target_fhc_req.pa_gain[2] = 296+ ((-40) + (40- (-40))/(4-1) *(2)) = 309

11.42.4.4 target_fhc_req.pa_gain[3] = 296+ ((-40) + (40- (-40))/(4-1) *(3)) = 336

11.42.5 Due to "BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 30"
"BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -30"
"BAND1_PA_MID_FHC_WCDMA_TPC_PA_GAIN_NUM = 4"
"VGA DAC, PA middle mode=239

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11.42.5.1 target_fhc_req.pa_gain[4] = 239+ ((-30) + (30- (-30))/(4-1) *(0)) = 209
11.42.5.2 target_fhc_req.pa_gain[5] = 239+ ((-30) + (30- (-30))/(4-1) *(1)) = 229
11.42.5.3 target_fhc_req.pa_gain[6] = 239+ ((-30) + (30- (-30))/(4-1) *(2)) = 349
11.42.5.4 target_fhc_req.pa_gain[7] = 239+ ((-30) + (30- (-30))/(4-1) *(3)) = 369
11.42.5.5 target_fhc_req.pa_gain[8] = 239+ ((-30) + (30- (-30))/(4-1) *(0)) = 209
11.42.5.6 target_fhc_req.pa_gain[9] = 239+ ((-30) + (30- (-30))/(4-1) *(1)) = 229
11.42.5.7 target_fhc_req.pa_gain[10] = 239+ ((-30) + (30- (-30))/(4-1) *(2)) = 349
11.42.5.8 target_fhc_req.pa_gain[11]= 239+ ((-30) + (30- (-30))/(4-1) *(3)) = 369
11.42.5.9 target_fhc_req.pa_gain[12] = 239+ ((-30) + (30- (-30))/(4-1) *(0)) = 209
11.42.5.10target_fhc_req.pa_gain[13] = 239+ ((-30) + (30- (-30))/(4-1) *(1)) = 229
11.42.5.11target_fhc_req.pa_gain[14] = 239+ ((-30) + (30- (-30))/(4-1) *(2)) = 349
11.42.5.12target_fhc_req.pa_gain[15] = 239+ ((-30) + (30- (-30))/(4-1) *(3)) = 369

11.42.6 Due to “BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_UP_RANGE = 40”
“BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_DOWN_RANGE = -40”
“BAND1_PA_LOW_FHC_WCDMA_TPC_PA_GAIN_NUM = 4”
“VGA DAC, PA low mode=166”

11.42.6.1 target_fhc_req.pa_gain[16] = 166+ ((-40) + (40- (-40))/(4-1) *(0)) = 126
11.42.6.2 target_fhc_req.pa_gain[17] = 166+ ((-40) + (40- (-40))/(4-1) *(1)) = 153
11.42.6.3 target_fhc_req.pa_gain[18] = 166+ ((-40) + (40- (-40))/(4-1) *(2)) = 179
11.42.6.4 target_fhc_req.pa_gain[19] = 166+ ((-40) + (40- (-40))/(4-1) *(3)) = 206
11.42.6.5 target_fhc_req.pa_gain[20~39] = assign the value the same as target_fhc_req.pa_gain[19].

12 Enter a while loop to query MS if FHC operation is complete by invoke the META DLL API: META_3Grf_QueryFHCResult_r. After trying 10 seconds, report failure if MS didn’t complete FHC operation.

13 Applying the following formula to post-process the measurement result reported from RCT and MS.

13.1 For RX path loss, the result reported from MS is stored in UL1D_RF_FHC_CNF_T.rssi[0~399]. The rssi result is arranged with the formula: rssi[i+j*frequency step], where i: 0~power count-1, j:0~frequency count-1; i.e. {rssi-1, rssi-2,…rssi-power ocunt} for 1st RX frequency, then followed by {rssi-1, rssi-2, …rssi-power count} for 2nd RX frequency,…and vice versa.

13.1.1 Take the BAND 1’s settings in step 8.1and step 9.1 for example if
“WCDMA_RSSI_GAIN_TABLE_CHANGE_FOR_CAL_MODE = 1” in CFG
“WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_HIGH_MODE= -70” in CFG,
“WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_MID_MODE = -50” in CFG,
“WCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE_LOW_MODE = -30” in CFG,

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"Temperature 3 Max UARFCN=10562,10631,10700,10769,10838,0,0,0,0,0,0,0,0,0,0" in INI

```
[idx] UARFCN, dl_pwr, us_rssi (d_rssi)
[0]   10562,  -70.00000,  -285(-71.25000)
[1]   10562,  -50.00000,  -285(-71.25000)
[2]   10562,  -30.00000,  -285(-71.25000)
[20]   10631,  -70.00000,  -389(-97.25000)
[21]   10631,  -50.00000,  -389(-97.25000)
[22]   10631,  -30.00000,  -389(-97.25000)
[40]   10700,  -70.00000,  -320(-80.00000)
[41]   10700,  -50.00000,  -321(-80.25000)
[42]   10700,  -30.00000,  -319(-79.75000)
[60]   10769,  -70.00000,  -331(-82.75000)
[61]   10769,  -50.00000,  -329(-82.25000)
[62]   10769,  -30.00000,  -332(-83.00000)
[80]   10838,  -70.00000,  -392(-98.00000)
[81]   10838,  -50.00000,  -393(-98.25000)
[82]   10838,  -30.00000,  -393(-98.25000)
```

13.1.2 Apply the same procedure as step 4.4 to 4.5 in Section "MT6162 RX path loss calibration"

13.2 For TPC

13.2.1 PA gain should be calculated based on the measurement result reported from RCT which is arranged with the formula: meas_power[i+j*frequency step], where i: 0~power count-1, j:0~frequency count-1; i.e. { meas_power i-1, meas_power -2,…meas_power -power ocunt} for 1st TX frequency, then followed by { meas_power-1, meas_power -2, …meas_power -power count} for 2nd TX frequency,…and vice versa.

13.2.1.1 Adopt interpolation to calculate the PA gain based on the following sequence

13.2.1.1.1 Calcualte the PA Gain of PA middle mode from the the relationship of "PA gain v.s. emitted power" according to the wanted power as the procedures in section "WCDMA TPC calibration"

13.2.1.1.2 Apply the step 13.2.1.1.1's PA gain to estimate the corresponding emitted power of PA middle mode when TPC index is (Start1+End1)/2

13.2.1.1.3 Based on the estimatation of the emitted power calculated from step 13.2.1.1.2 to calucate the corresponding PA Gain of PA high mode.

13.2.1.1.4 Apply the step 13.2.1.1.1's PA gain to estimate the corresponding emitted power of PA middle mode when TPC index is (Start2+End2)/2

13.2.1.1.5 Based on the estimatation of the emitted power calculated from step 13.2.1.1.4 to calucate the corresponding PA Gain of PA Low mode

13.2.1.2 Apply the PA gain check mechanism as step 4.5.11.7 in Section "WCDMA TPC calibration"

13.2.2 Power detector gain should be calculated based on the result reported from MS (stored in UL1D_RF_FHC_CNF_T.pwr_det_value[0~19], where pwr_det_value[0]: store the power detector report of the 1st TX frequency, pwr_det_value[1]: store the power detector report of the 2nd TX frequency…and vice versa.

13.2.2.1 Apply the Power detector gain calculation as step 4.5.8 in Section "WCDMA TPC calibration". Note: the d_meas_pwr in step 4.5.8 will be corresponding to the meas_powe-N, where N is based on the value of step 11.39's target_fhc_req.pd_gain_start_idx.

13.2.2.2 Apply the Power detector gain check as step 4.5.8.4 in Section "WCDMA TPC calibration".

13.2.3 Subband compensation:

13.2.3.1 For power compensation

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13.2.3.1.1 Apply interpolation to estimate the emitted power of different TX frequencies based on the PA gain of PA High/Middle/Low modes calculated in step 13.2.1.

13.2.3.1.2 Calculate the power difference (dBm) of the estimated power of different TX frequencies and the estimated power of the frequency as CFG's "BAND1/2/3…10_TPC_UARFCN_UL".

13.2.3.1.3 Note: how many PA modes' power compensation will be calculated is still based on the CFG's "WCDMA_TPC_PA_MODE_SUBBAND_CAL_NUM". Please refer to Section "WCDMA TPC calibration".

13.2.3.2 For power detector compensation

13.2.3.2.1 Apply the following formula to calculate the power detector compensation of different TX frequencies

13.2.3.2.1.1 us_cal_pd_gain = the second element of INI's "VGA DAC, PA high mode",

13.2.3.2.1.2 u2_pwr_det_value = the power detector report from MS, i.e. UL1D_RF_FHC_CNF_T.pwr_det_value[0~19]

13.2.3.2.1.3 u1_pd_gain = the calibrated power detector gain of step 13.2.2.

13.2.3.2.1.4 double d_real_pwr_det_p = (1.0*u2_pwr_det_value/32.0) -80;

13.2.3.2.1.5 double d_estimate_pwr_det_p = 1.0*(us_cal_pd_gain-u1_pd_gain)/8.0 + d_real_pwr_det_p;

13.2.3.2.1.6 double d_dif_pd_dBm = d_meas_pwr_for_pwr_det – CFG's "BAND1_TPC_WANTED_P_OFFSET" - d_estimate_pwr_det_p; where d_meas_pwr_for_pwr_det is the power measurement of the RCT.

13.2.3.2.1.7 Apply the same procedures of step 4.5.10.11.3 to step 4.5.10.11.5 in Section "WCDMA TPC calibration"

14 Write calibration result to MS's NVRAM (Please refer to the section: "MT6162 RX path loss calibration" and "WCDMA TPC calibration"

15 Command MS to change gain table to be state 2 to reverse the gain table state back before we perform FHC's RX path loss calibration.

15.1 META DLL API: META_3Grf_ReplaceGainTableforCal

16 Command MS to change power control mode to be 1 via META DLL API: META_3Grf_SetPowerControlMode. Set mode to be 1 will set power detector in automatic mode which indicates that during this period, power detector will affect the DPCH TX power transmission.

4.3.2.7 WCDMA TPC Calibration (MT6276 8-level PA control calibration)

The MT6276 introduced 8-level PA control to further reduce the talking current. The calibration is basically the same as MT6268 + MT6160.

4.3.2.7.a WCDMA TPC Calibration (MT6276 8-level PA control calibration - steps)

1 Calibrate PA gain of specified level control by evaluating PA gain of next step with the slope 1/32 (dB/DAC)

2 Repeat 1 until all active level controls are calibrated

3 Calibrate coupler loss for 3 PA modes in 3 points

3.1 High mode: Middle point of hysteresis Start1 & End1

3.2 Low mode: Middle pointer of hysteresis Start2 & End2

3.3 Middle mode: Middle pointer of high mode & low mode calibration point

4 Subband calibration (if any)

4.3.2.7.b WCDMA TPC Calibration (MT6276 8-level PA control calibration - sample code)

```
bool __fastcall T_META_factory_calibration::WCDMA_Tpc_MT6162_Cal(void)
{
   AnsiString as_all_arfcn, as_arfcn;
```


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```
PostMessage(ctrl.hPostMsgDestHandle,
        WM_MF_WCDMA_RF_TPC_BEGIN,
        0,
        0
        );

Trace(" ================== WCDMA TPC calibration begin (MT6162) ================== ");
// tester pre-setting
// no-arguments: app format, operating mode, DPCH_RMC12, cell_power
// argument: trigger mode
{
    if (!m_rct_ctrl.RCT_ApplicationFormat(m_pRct, AGE_APP_FORMAT_WCDMA))
    {
        CalErrorHandler(WM_MF_AGE8960_SET_OPERATION_MODE_FAIL);
        Trace_Err(m_pRct->age.as_TaModel + " < application format = WCDMA");
        return false;
    }
    if (!m_rct_ctrl.RCT_operatingMode(m_pRct, OPERATING_MODE_WCDMA_FDD))
    {
        CalErrorHandler(WM_MF_AGE8960_SET_OPERATION_MODE_FAIL);
        Trace_Err(m_pRct->as_RCT + " < Operation mode = WCDMA FDD");
        return false;
    }
    Trace(m_pRct->as_RCT + " < Operation mode = WCDMA FDD");
    if (!m_rct_ctrl.RCT_WCDMA_DPCH_RMC12(m_pRct))
    {
        CalErrorHandler(WM_MF_AGE8960_SET_OPERATION_MODE_FAIL);
        log->Add(DateToStr(Date()) +  " " + CurrentTimeStr() +
                " FAIL : " +
                m_pRct->as_RCT +
                " < RMC 12.2Kbps mode"
                );
        return false;
    }
    Trace(m_pRct->as_RCT + " < RMC 12.2Kbps mode");
    if (!m_rct_ctrl.RCT_WCDMA_CellPower(m_pRct, m_dWCDMA_TPC_P_DL))
    {
        CalErrorHandler(WM_MF_AGE8960_SET_POWER_FAIL);
        Trace_Err(m_pRct->as_RCT + " < Power = "  +
                Double_To_AnsiString(m_dWCDMA_TPC_P_DL) + " dBm");
        return false;
    }
    Trace(m_pRct->as_RCT + " < Power = "  +
            Double_To_AnsiString(m_dWCDMA_TPC_P_DL) + " dBm");
    if (m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->Get_ConfirmState() != METAAPP_SUCCESS)
    {
        CalErrorHandler(WM_MF_WCDMA_SET_PWR_CTRL_MODE_FAIL);
        Trace_Err("Target < Set Power Control Mode "
                );
        return false;
    }
```


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```
Trace("[Info] set Power Control Mode 0.");
if(m_u1WCDMA_TPC_PWR_CAL_TYPE != WCDMA_TPC_CAL_TYPE_TX_TRIGGER_IMMEDIATE)
{
   if(m_pRct->device_type == AGILENT_8960)
   {
      if (!m_rct_ctrl.RCT_WCDMA_Config_ChannelPower(m_pRct,
               0,    // 5
               age1960_TRIG_RF_RISE,//age1960_TRIG_AUTO,
               AGE1963_WCDMA_CHANNEL_POWER_TRIGGER_DELAY,    // 0
               6667,//AGE1963_WCDMA_CHANNEL_POWER_INTERVAL,        // 10
               AGE1960_IQ_TUNNING_TRIGGER_QUALIFIER_ON,       //1
               3       //3
               ))
      {
         CalErrorHandler(WM_MF_RCT_CONFIG_WCDMA_CHANNEL_POWER_FAIL);
         Trace_Err("config channel power ");
         return false;
      }
      Sleep(3000);  // wait for tester to be stable, otherwise, the first power measurement will fail
   }
   else // CMU200
   {
      if (!m_rct_ctrl.RCT_WCDMA_Config_ChannelPower(m_pRct,
               1,
               cmu200_TRIG_IFPOWER,
               AGE1963_WCDMA_CHANNEL_POWER_TRIGGER_DELAY,    // useless
               6667, // useless
               AGE1960_IQ_TUNNING_TRIGGER_QUALIFIER_ON,// useless
               3 // useless
               ))
      {
         CalErrorHandler(WM_MF_RCT_CONFIG_WCDMA_CHANNEL_POWER_FAIL);
         log->Add(DateToStr(Date()) +  " " + CurrentTimeStr() +
               " FAIL: config channel power "
               );
         return false;
      }
   }
}
else // immediate
{
   if (!m_rct_ctrl.RCT_WCDMA_Config_ChannelPower(m_pRct,
            AGE1963_WCDMA_CHANNEL_POWER_MEASURE_COUNT,
            age1960_TRIG_IMMEDIATE,
            AGE1963_WCDMA_CHANNEL_POWER_TRIGGER_DELAY,
            AGE1963_WCDMA_CHANNEL_POWER_INTERVAL,
            AGE1960_IQ_TUNNING_TRIGGER_QUALIFIER_ON,
            AGE1963_WCDMA_READ_CHANNEL_POWER_TIMEOUT
            ))
   {
      CalErrorHandler(WM_MF_RCT_CONFIG_WCDMA_CHANNEL_POWER_FAIL);
```


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```
            Trace_Err("config channel power "
                );
            return false;
        }
    }
}

// max p for high / mid / low PA mode
AnsiString as_max_p[3];
AnsiString as_wanted_p[3];
AnsiString as_min_p[3];
AnsiString as_c[3];

int i_visible_num = m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->Get_NvramVgaVisibleNum(m_pCal->e_bb_chip);
// set power control mode to  be 0 : to set the Power detector in manual mode!
RestartTimerCal(WM_MF_WCDMA_SET_PWR_CTRL_MODE_FAIL);
m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->ConfirmCallback =  ::CNF_MF;
m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->REQ_SetPwrCtrlMode_Start(0);
SUSPEND_CAL_THREAD;

E_WCDMA_BAND_T band = WCDMA_BAND1;
while (band < WCDMA_BAND_COUNT)
{
    CHECK_TERMINATE_BY_USER;
    if (!IsWCDMABandSupported(m_asWCDMA_BAND, band))
    {
        band++;
        continue;
    }
    for(int pa_mode = 0;pa_mode < 3;pa_mode++)
    {
        as_max_p[pa_mode]         = m_asBAND_CH_MID_MAX_P[band][pa_mode];
        as_wanted_p[pa_mode]      = m_asBAND_CH_MID_WANTED_P[band][pa_mode];
        as_min_p[pa_mode]         = m_asBAND_CH_MID_MIN_P[band][pa_mode];
        as_c[pa_mode]             = m_asBAND_CH_MID_C[band][pa_mode];
    }
    if (! m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->TpcSectionExist(m_pCal->as_IniFile.c_str(), band))
    {
        CalErrorHandler(WM_MF_INI_WCDMA_TPC_NOT_EXIST_FAIL);
        Trace_Err("WCDMA TPC INI section not exist (band" + IntToStr(band+1)+")"
            );
        return false;
    }

    if (!m_rct_ctrl.RCT_WCDMA_Config_Input_CableLoss(m_pRct, band))
    {
        CalErrorHandler( WM_MF_RCT_SET_CABLE_LOSS_FAIL );
        Trace_Err(m_pRct->as_RCT + " < config cable loss"
            );
        return false;
```


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```
    }

    if (! m_rct_ctrl.RCT_WCDMA_UARFCN_UL(m_pRct, m_usBAND_TPC_UARFCN_UL[band]))
    {
      CalErrorHandler(WM_MF_RCT_SET_WCDMA_UARFCN_UL_FAIL);
      Trace_Err(m_pRct->as_RCT + " < UARFCN UL = " +
            IntToStr(m_usBAND_TPC_UARFCN_UL[band])
            );
      return false;
    }
    Trace(m_pRct->as_RCT + " < UARFCN UL = " +
          IntToStr(m_usBAND_TPC_UARFCN_UL[band])
          );

    // set the donwlink channel unit to be "Channel" for CMU200
    if (!m_rct_ctrl.RCT_WCDMA_UARFCN_UNIT_CHN(m_pRct))
    {
      CalErrorHandler(WM_MF_RCT_SET_WCDMA_UARFCN_DL_FAIL);
      Trace_Err(m_pRct->as_RCT + " < UARFCN DL unit: Channel"
            );
      return false;
    }
    if (!m_rct_ctrl.RCT_WCDMA_UARFCN_DL(m_pRct, UARFCN_DL_DEFAULT[band]))
    {
      CalErrorHandler(WM_MF_RCT_SET_WCDMA_UARFCN_DL_FAIL);
      Trace_Err(m_pRct->as_RCT + " < UARFCN DL = " +
            IntToStr(UARFCN_DL_DEFAULT[band])
            );
      return false;
    }
    CHECK_TERMINATE_BY_USER;
    // get current tpc profile based on current band
    // since the compensation laies in tx DAC runtime value
    // if we want to calibrate the sub-band settings
    // we need to set the compensation part into 0 to target runtime settings for clean calibration
    // in this case, we always set the zero compensation to avoid access violation in UL1 code
    ul1cal_txdacData_T_B zero_subband_compensation_tpc_data_by_band = m_pCal-
>s_cal_obj.pc_WCDMA_TPC_Obj->m_sWcdmaTpc.sWcdmaTpc[band];
    {
      // 1208_v8
      if(m_u1WCDMA_PA_MODE_SUBBAND_CAL_NUM < 1) // at lease calibrate one PA mode
        m_u1WCDMA_PA_MODE_SUBBAND_CAL_NUM = 1;

      // since we want to calibrate subband, we clear all subband settings of target.
      for(int pa_mode = 0; pa_mode < WCDMA_PA_MODE_NUM; pa_mode++)
      {
        for(int sub_idx=0; sub_idx < CAL_UARFCN_SECTION; sub_idx++)
        {
          // PA gain compensation
          // 1208_v8
```


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```
zero_subband_compensation_tpc_data_by_band.txdacData.power_dac[pa_mode].vga_comp_by_subband[sub_i
dx].pwr_offset_dB = 0;
                if(m_pCal->b_wcdma_tpc_subband_cal)
                {
                    m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj-
>m_sWcdmaTpc.sWcdmaTpc[band].txdacData.power_dac[pa_mode].vga_comp_by_subband[sub_idx].pwr_offse
t_dB = 0;
                }
                // power detector compensation
                if( pa_mode == WCDMA_PA_MODE_MIDDLE)
                {
                    // 1208_v8

zero_subband_compensation_tpc_data_by_band.txdacData.pwr_dt_data.pwr_dt_comp_by_subband[sub_idx].pw
r_offset_dB = 0;
                    if(m_pCal->b_wcdma_tpc_subband_cal)
                    {
                        m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj-
>m_sWcdmaTpc.sWcdmaTpc[band].txdacData.pwr_dt_data.pwr_dt_comp_by_subband[sub_idx].pwr_offset_dB
= 0;
                    }
                }
            }
        }
        RestartTimerCal(WM_MF_WCDMA_SET_TX_DAC_DATA_RUNTIME_FAIL);
        m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->ConfirmCallback =  ::CNF_MF;
        m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->REQ_SetTxDacDataRuntime_Start(band+1,
zero_subband_compensation_tpc_data_by_band);  // band+1 is because L1's band1 is "1" not "0"
        SUSPEND_CAL_THREAD;
        if (m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->Get_ConfirmState() != METAAPP_SUCCESS)
        {
            CalErrorHandler(WM_MF_WCDMA_SET_TX_DAC_DATA_RUNTIME_FAIL);
            Trace_Err("Target < set TX dac data runtime");
            return false;
        }
        Trace("set runtime TX DAC parameter for calibration (zero compensation)");
    }

    double d_goal_power = 0.0;
    /*****************************************************
     * Calibrate 8-level PA gain
     *****************************************************/
    int subband_calibration_section[3] = {-1, -1, -1};
    if( (m_u1WCDMA_TPC_CAL_MODE_SELECT == 1 || m_u1WCDMA_TPC_CAL_MODE_SELECT == 2)
        && m_pCal->m_rWcdmaTargetCapability.capability.PaOctLevelControl )
    {
        Trace("Cal Mode: %d (1: first high mode 2: all sections)", m_u1WCDMA_TPC_CAL_MODE_SELECT);
        // arrange the calibration sequence!
        unsigned char uc_oct_lvl_cal_num = m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj-
>m_sWcdmaTpc.sWcdmaPaOctLevData[band].txPaOctLevData.octlev_num_section;
```


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```
unsigned char uc_oct_lvl_tpc_level[WCDMA_TPC_PA_OCTLEVEL_NUM_8];
double d_oct_lvl_max_p[WCDMA_TPC_PA_OCTLEVEL_NUM_8];
double d_oct_lvl_wanted_p[WCDMA_TPC_PA_OCTLEVEL_NUM_8];
double d_oct_lvl_min_p[WCDMA_TPC_PA_OCTLEVEL_NUM_8];
double d_max_p[3][WCDMA_NVRAM_TPC_VGA_DAC_VISIBLE_ELEMENT_NUM_A];
double d_wanted_p[3][WCDMA_NVRAM_TPC_VGA_DAC_VISIBLE_ELEMENT_NUM_A];
double d_min_p[3][WCDMA_NVRAM_TPC_VGA_DAC_VISIBLE_ELEMENT_NUM_A];
unsigned char uc_nv_pa_idx[WCDMA_NVRAM_TPC_VGA_DAC_VISIBLE_ELEMENT_NUM_A];
// parse INI and CFG to prepare the calibration sequence;
for(int pa_mode = 0;pa_mode < 3; pa_mode++)
{
    String_To_Array_double(as_max_p[pa_mode].c_str(), d_max_p[pa_mode], i_visible_num); // based on chip is 6268A(81) or 6268B(80)
    String_To_Array_double(as_wanted_p[pa_mode].c_str(), d_wanted_p[pa_mode], i_visible_num);
    String_To_Array_double(as_min_p[pa_mode].c_str(), d_min_p[pa_mode], i_visible_num);
}
for(int oct_lvl_index = 0; oct_lvl_index<WCDMA_TPC_PA_OCTLEVEL_NUM_8; oct_lvl_index++)
{
    int pa_mode = m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->m_sWcdmaTpc.sWcdmaPaOctLevData[band].txPaOctLevData.pmu_level_handle[WCDMA_TPC_PA_OCTLEVEL_NUM_8-1-oct_lvl_index].pa_mode;
    int prf = m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->m_sWcdmaTpc.sWcdmaPaOctLevData[band].txPaOctLevData.pmu_level_handle[WCDMA_TPC_PA_OCTLEVEL_NUM_8-1-oct_lvl_index].prf;
    if(m_u1WCDMA_TPC_CAL_MODE_SELECT == 1)
    {
        // pick the first "PA High Mode" to calibrate
        if(pa_mode ==WCDMA_PA_MODE_HIGH)
        {
            uc_oct_lvl_cal_num = 1;
            // 1208_v3 (moidfy the formula)
            uc_oct_lvl_tpc_level[0] = 24 - prf;
            uc_nv_pa_idx[0] = WCDMA_TPC_PA_OCTLEVEL_NUM_8-1-oct_lvl_index;
            d_oct_lvl_max_p[0] =  d_max_p[0][uc_oct_lvl_tpc_level[oct_lvl_index]];
            d_oct_lvl_wanted_p[0] =  d_wanted_p[0][uc_oct_lvl_tpc_level[oct_lvl_index]];
            d_oct_lvl_min_p[0] =  d_min_p[0][uc_oct_lvl_tpc_level[oct_lvl_index]];
            // 1208_v3
            DebugTrace("CFG: %.3f, %.3f, %.3f", d_oct_lvl_max_p[0], d_oct_lvl_wanted_p[0], d_oct_lvl_min_p[0]);
            break;
        }
    }
    else  // pick all to calibrate
    {
        uc_nv_pa_idx[oct_lvl_index] = WCDMA_TPC_PA_OCTLEVEL_NUM_8-1-oct_lvl_index;
        // 1208_v3 (moidfy the formula)
        uc_oct_lvl_tpc_level[oct_lvl_index] = 24 - prf;
        d_oct_lvl_max_p[oct_lvl_index] =  d_max_p[pa_mode][uc_oct_lvl_tpc_level[oct_lvl_index]];
        d_oct_lvl_wanted_p[oct_lvl_index] =  d_wanted_p[pa_mode][uc_oct_lvl_tpc_level[oct_lvl_index]];
        d_oct_lvl_min_p[oct_lvl_index] =  d_min_p[pa_mode][uc_oct_lvl_tpc_level[oct_lvl_index]];
        // 1208_v3
```


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```
            DebugTrace("CFG: %.3f, %.3f, %.3f", d_oct_lvl_max_p[oct_lvl_index],
d_oct_lvl_wanted_p[oct_lvl_index], d_oct_lvl_min_p[oct_lvl_index]);
        }
    }
    bool subband_calibrated[3] = {false, false, false};
    // start calibrate based on the above plan
    for(int oct_lvl_index = 0; oct_lvl_index<uc_oct_lvl_cal_num; oct_lvl_index++)
    {
        int prf =
            m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj-
>m_sWcdmaTpc.sWcdmaPaOctLevData[band].txPaOctLevData.pmu_level_handle[uc_nv_pa_idx[oct_lvl_index]].
prf;
        unsigned char uc_cur_pa_mode =
            m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj-
>m_sWcdmaTpc.sWcdmaPaOctLevData[band].txPaOctLevData.pmu_level_handle[uc_nv_pa_idx[oct_lvl_index]].
pa_mode;
        Trace(" ---------- %s (%s)-------------",
            as_WCDMA_PA_MODE[uc_cur_pa_mode].c_str(), as_WCDMA_BANDs[band].c_str());
        d_goal_power = d_oct_lvl_wanted_p[oct_lvl_index] +
m_dWCDMA_WANTED_POWER_OFFSET[band];
        Trace("[Info] d_goal_power (%.2f) = %.2f + %.2f", d_goal_power, d_oct_lvl_wanted_p[oct_lvl_index],
m_dWCDMA_WANTED_POWER_OFFSET[band]);
        // set the target power of Agilent8960/CMU200
        if(m_pRct->device_type == CMU_200)
        {
            if (!m_rct_ctrl.RCT_WCDMA_ConfigAnalyzerMaxLevel(m_pRct, d_oct_lvl_wanted_p[oct_lvl_index]))
            {
                CalErrorHandler(WM_MF_AGE8960_SET_POWER_FAIL);
                Trace_Err(m_pRct->as_RCT + " < Analyzer Level power = "  +
                    Double_To_AnsiString(d_oct_lvl_wanted_p[oct_lvl_index]+10.0) + " dBm");
                return false;
            }
            Trace(" %s < Analyzer Level power = %.2f dBm", m_pRct->as_RCT.c_str(),
d_oct_lvl_wanted_p[oct_lvl_index]+10.0);
        }
        else
        {
            if (!m_rct_ctrl.RCT_WCDMA_MsTargetPower(m_pRct, d_oct_lvl_wanted_p[oct_lvl_index]))
            {
                CalErrorHandler(WM_MF_AGE8960_SET_POWER_FAIL);
                Trace_Err(m_pRct->as_RCT + " < MS target power = "  +
                    Double_To_AnsiString(d_oct_lvl_wanted_p[oct_lvl_index]) + " dBm");
                return false;
            }
        }
        unsigned short us_cur_pa_gain = m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj-
>m_sWcdmaTpc.sWcdmaPaOctLevData[band].txPaOctLevData.pmu_level_handle[uc_nv_pa_idx[oct_lvl_index]].
pa_gain;
        unsigned short us_prev_pa_gain = 0;
        double   d_prev_pwr = 0;
        Trace("[Info] Initial PA gain: %d", us_cur_pa_gain);
```


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```
unsigned char iter_times = 0;
// setup DPCH TX parameters
S_WCDMA_TPC_MEASURE_PWR_SETTINGS_T mea_req;
{
   mea_req.dpch_tx.ul_freq = m_usBAND_TPC_UARFCN_UL[band];     // configured by *.cfg
   mea_req.dpch_tx.psc = 0;
   mea_req.dpch_tx.sc_code = 0;
   mea_req.dpch_tx.power_ctrl_mode = WCDMA_TPC_MODE_INDEX;   // 1
   mea_req.dpch_tx.pa_mode = uc_cur_pa_mode;
   mea_req.dpch_tx.idx =  uc_oct_lvl_tpc_level[oct_lvl_index] ;
   mea_req.dpch_tx.afc_dac = m_sDefault_value;
   mea_req.dpch_tx.dpcch_pwr = 8;
   mea_req.dpch_tx.dpdch_pwr = 15;
   mea_req.dpch_tx.rf_band = band+1;
   /// since the power ctrl mode is 1 (HW mode), the UL1 will use the runtime value instead of the DPCH
TX input parameter
   {
      mea_req.dpch_tx.vm1 = 0;
      mea_req.dpch_tx.vm2 = 0;
      mea_req.dpch_tx.dc2dc_dac = 0;
      mea_req.dpch_tx.vbias_dac = 0;
      mea_req.dpch_tx.apc_dac = 0;
   }
   mea_req.dpch_tx.pwr_det = false;
   mea_req.bSetUlUarfcn = false;
   mea_req.bSetTargetPwr = false;
   mea_req.bGetPwrDetRep = false;
}
if(subband_calibrated[uc_cur_pa_mode] == false)
{
   // keep the subband calibration pa section
   subband_calibration_section[uc_cur_pa_mode] = uc_nv_pa_idx[oct_lvl_index];
   subband_calibrated[uc_cur_pa_mode] = true;
}
while(iter_times <= m_uiWCDMA_TPC_RECURSIVE_TIMES)
{
   bool pass = false;
   iter_times++;
   CHECK_TERMINATE_BY_USER;
   unsigned short us_pwr_det_report;
   double d_meas_pwr;
   if(!WCDMA_TPC_Measure_Power(mea_req, d_meas_pwr, us_pwr_det_report))
   {
      CalErrorHandler(WM_MF_WCDMA_RF_DPCH_TX_FAIL);
      Trace_Err("WCDMA_TPC_Measure_Power() failed");
      return false;
   }

   if(d_meas_pwr  >= d_goal_power + fabs(m_dWCDMA_TPC_DELTA) ||
         d_meas_pwr <= d_goal_power - fabs(m_dWCDMA_TPC_DELTA))
   {
```


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```
// decide next pa gain we used to try
double pwr_dif = d_goal_power - d_meas_pwr;
short  us_next_pa_gain = 0;
if(iter_times == 1) // the first iteration, used the ideal slope to find next pa gain
{
   us_next_pa_gain = us_cur_pa_gain -
(pwr_dif)*WCDMA_TPC_GAIN_SLOPE_FOR_MT6162_32;
}
else
{
   if( (d_goal_power - d_prev_pwr)*(pwr_dif) < 0)
   {
      if(d_prev_pwr != d_meas_pwr) // calculate a slope to find next pa gain
      {
         double d_slope = (us_prev_pa_gain - us_cur_pa_gain)/(d_prev_pwr - d_meas_pwr);
         double d_data = us_cur_pa_gain - d_slope * d_meas_pwr;
         d_data += (d_data>=0) ? 0.5 : -0.5 ;

         d_data = d_goal_power*d_slope + d_data;//d_offset;
         d_data += (d_data>=0) ? 0.5 : -0.5 ;

         us_next_pa_gain= (unsigned short) d_data;

      }
      else //meet saturaton, the previous power is equal to current power with different PA gain
      {
         us_next_pa_gain = WCDMA_PA_GAIN_MAX_MT6162/2;
      }
   }
   else  // (d_goal_pwr - d_prev_pwr)*(pwr_dif) > 0
   {
      us_next_pa_gain = us_cur_pa_gain -
(pwr_dif)*WCDMA_TPC_GAIN_SLOPE_FOR_MT6162_32;
   }
}
if(us_next_pa_gain == us_cur_pa_gain) // stop trying!, and return false
{
   CalErrorHandler(WM_MF_WCDMA_RF_DPCH_TX_FAIL);
   Trace_Err("next PA gain is the same as current PA gain ");
   return false;
}
if(iter_times == m_uiWCDMA_TPC_RECURSIVE_TIMES) // the last iteration
{
   CalErrorHandler(WM_MF_WCDMA_RF_DPCH_TX_FAIL);
   Trace_Err("can not find the right PA gain after try %d times, last(%d)",
         iter_times, us_cur_pa_gain);
   return false;
}
us_prev_pa_gain = us_cur_pa_gain;
us_cur_pa_gain = us_next_pa_gain;
d_prev_pwr = d_meas_pwr;
```


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```
            }
            else // reach our goal the goal_power +- delta, so the PA gain is what we want!
            {
               // PA gain calibration result
               {
                  Trace("[Result] PA Gain:%d after try %d times to reach (%.2f~%.2f) ",
                        us_cur_pa_gain, iter_times,
                        d_goal_power - fabs(m_dWCDMA_TPC_DELTA),
                        d_goal_power + fabs(m_dWCDMA_TPC_DELTA));
                  double pwr_dif = d_goal_power - d_meas_pwr;
                  short us_next_pa_gain = us_cur_pa_gain -  (pwr_dif)*16.0;
                  if(us_next_pa_gain != us_cur_pa_gain)
                  {
                     Trace("[Result] PA Gain:%d (power:%.2f) exactlly ",
                           us_next_pa_gain, d_goal_power);
                     us_cur_pa_gain = us_next_pa_gain;
                  }
                  // check if the PA gain is valid(based on cfg's settings)
                  if(us_cur_pa_gain > m_u2WCDMA_PA_GAIN_MAX[band][uc_cur_pa_mode] ||
                        us_cur_pa_gain < m_u2WCDMA_PA_GAIN_MIN[band][uc_cur_pa_mode])
                  {
                     CalErrorHandler(WM_MF_WCDMA_PA_GAIN_INVALID);
                     Trace_Err("PA gain(%d) exceed the range[%d,%d]",

us_cur_pa_gain,m_u2WCDMA_PA_GAIN_MIN[band][uc_cur_pa_mode],m_u2WCDMA_PA_GAIN_MAX[band][u
c_cur_pa_mode]);
                     return false;
                  }
                  // set the pa_gain locally for later NVRAM writing!
                  m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj-
>m_sWcdmaTpc.sWcdmaPaOctLevData[band].txPaOctLevData.pmu_level_handle[uc_nv_pa_idx[oct_lvl_index]].
pa_gain = us_cur_pa_gain;
               }
               break;
            }
            if(us_cur_pa_gain > WCDMA_PA_GAIN_MAX_MT6162)
            {
               us_cur_pa_gain = WCDMA_PA_GAIN_MAX_MT6162;
               Trace_Warn("PA Gain (%d) exceed the max limit(%d), so set to max", us_cur_pa_gain,
WCDMA_PA_GAIN_MAX_MT6162);
            }
            // set PA gain runtime value for the next PA gain calibration iteration
            {
               Trace("[Info](%d): set runtime PA gain:%d ", iter_times, us_cur_pa_gain);
               // set target PA gain in vag_dac[8]
               m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj-
>m_sWcdmaTpc.sWcdmaPaOctLevData[band].txPaOctLevData.pmu_level_handle[uc_nv_pa_idx[oct_lvl_index]].
pa_gain = us_cur_pa_gain;
               // set PA gain and PD gain to target runtimely
               RestartTimerCal(WM_MF_WCDMA_SET_TX_DAC_DATA_RUNTIME_FAIL);
               m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->ConfirmCallback =  ::CNF_MF;
```


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```
                m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->REQ_SetPaOctLevDataRuntime_Start(band);
                SUSPEND_CAL_THREAD;
                if (m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->Get_ConfirmState() != METAAPP_SUCCESS)
                {
                    CalErrorHandler(WM_MF_WCDMA_SET_TX_DAC_DATA_RUNTIME_FAIL);
                    Trace_Err("Target < Set PA Control data Runtime ");
                    return false;
                }
            }
        }// end mid channel PA/PD calibration
    }// end of 8-level PA calibration
    /*****************************************************
     * Calibrate 3-PA mode coupler loss
     *****************************************************/
    for(int pa_mode = WCDMA_PA_MODE_HIGH; pa_mode<WCDMA_PA_MODE_NUM; pa_mode++)
    {
        S_WCDMA_TPC_MEASURE_PWR_SETTINGS_T mea_req;
        {
            mea_req.dpch_tx.ul_freq = m_usBAND_TPC_UARFCN_UL[band];
            mea_req.dpch_tx.psc = 0;
            mea_req.dpch_tx.sc_code = 0;
            mea_req.dpch_tx.power_ctrl_mode = WCDMA_TPC_MODE_INDEX;
            mea_req.dpch_tx.pa_mode = pa_mode;
            mea_req.dpch_tx.idx = m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj-
>GetCouplerLossCalibrationTpcIndex(band, pa_mode);
            mea_req.dpch_tx.afc_dac = m_sDefault_value;
            mea_req.dpch_tx.dpcch_pwr = 8;
            mea_req.dpch_tx.dpdch_pwr = 15;
            mea_req.dpch_tx.rf_band = band+1;
            /// since the power ctrl mode is 1 (HW mode), the UL1 will use the runtime value instead of the DPCH
TX input parameter
            {
                mea_req.dpch_tx.vm1 = 0;
                mea_req.dpch_tx.vm2 = 0;
                mea_req.dpch_tx.dc2dc_dac = 0;
                mea_req.dpch_tx.vbias_dac = 0;
                mea_req.dpch_tx.apc_dac = 0;
            }
            mea_req.dpch_tx.pwr_det = false;
            mea_req.bSetUlUarfcn    = false;
            mea_req.bSetTargetPwr   = false;
            mea_req.bGetPwrDetRep   = true;
        }
        unsigned short us_pwr_det_report;
        double d_meas_pwr;
        double target = 24 - mea_req.dpch_tx.idx;
        if(m_pRct->device_type == CMU_200)
        {
            if (!m_rct_ctrl.RCT_WCDMA_ConfigAnalyzerMaxLevel(m_pRct,
                target ))
            {
```


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```
            CalErrorHandler(WM_MF_AGE8960_SET_POWER_FAIL);
            Trace_Err(m_pRct->as_RCT + " < Analyzer Level power = "  +
                Double_To_AnsiString(target) + " dBm");
            return false;
        }
        Trace(" %s < Analyzer Level power = %.2f dBm", m_pRct->as_RCT.c_str(),
            target+10.0);
    }
    else
    {
        if (!m_rct_ctrl.RCT_WCDMA_MsTargetPower(m_pRct,
            target))
        {
            CalErrorHandler(WM_MF_AGE8960_SET_POWER_FAIL);
            Trace_Err(m_pRct->as_RCT + " < MS target power = "  +
                Double_To_AnsiString(target) + " dBm");
            return false;
        }
    }
    if(!WCDMA_TPC_Measure_Power(mea_req, d_meas_pwr, us_pwr_det_report))
    {
        CalErrorHandler(WM_MF_WCDMA_RF_DPCH_TX_FAIL);
        Trace_Err("WCDMA_TPC_Measure_Power() failed");
        return false;
    }
    unsigned short us_eva_pwr_det_gain = 0;
    unsigned short u2_pwr_det_gain = m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj-
>m_sWcdmaTpc.sWcdmaTpc[band].txdacData.power_dac[pa_mode].vga_dac[WCDMA_NVRAM_TPC_VGA_ST
ART_INDEX_B+1];
    Trace("[Info] Initial PD gain: %d", u2_pwr_det_gain);
    // calibrate the PA gain, get the power detector report
    if(!WCDMA_Tpc_PDEvaluation(
            m_pCal->ui_wcdma_rf_id,
            band,
            mea_req.dpch_tx.idx,
            m_dWCDMA_WANTED_POWER_OFFSET[band],
            d_meas_pwr,
            us_pwr_det_report,
            u2_pwr_det_gain,
            &us_eva_pwr_det_gain))
    {
        Trace_Err("PD evaluation failed");
        return false;
    }
    // set the power detector gain (pd_gain) locally for later NVRAM writing!
    // store it in VgaDac[9]
    m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->Set_VgaDac(band, pa_mode,
WCDMA_NVRAM_TPC_VGA_START_INDEX_B+1, us_eva_pwr_det_gain);
    /// set runtime coupler loss for coupler loss subband compensation calibration
    Trace("[Info]: set runtime Coupler Loss:%d ", us_eva_pwr_det_gain);
    RestartTimerCal(WM_MF_WCDMA_SET_TX_DAC_DATA_RUNTIME_FAIL);
```


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```
            m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->ConfirmCallback =  ::CNF_MF;
            m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->REQ_SetTxDacDataRuntime_Start(band+1,        m_pCal-
>s_cal_obj.pc_WCDMA_TPC_Obj->m_sWcdmaTpc.sWcdmaTpc[band]);  // band+1 is because L1's band1 is "1"
not "0"
            SUSPEND_CAL_THREAD;
            if (m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->Get_ConfirmState() != METAAPP_SUCCESS)
            {
               CalErrorHandler(WM_MF_WCDMA_SET_TX_DAC_DATA_RUNTIME_FAIL);
               Trace_Err("Target < Set TPC settings runtimely ");
               return false;
            }
         }
      }
      if(m_pCal->b_wcdma_tpc_subband_cal )
      {
         for(int pa_mode = WCDMA_PA_MODE_HIGH; pa_mode<WCDMA_PA_MODE_NUM; pa_mode++)
         {
            S_WCDMA_TPC_MEASURE_PWR_SETTINGS_T mea_req;
            {
               mea_req.dpch_tx.ul_freq = m_usBAND_TPC_UARFCN_UL[band];
               mea_req.dpch_tx.psc = 0;
               mea_req.dpch_tx.sc_code = 0;
               mea_req.dpch_tx.power_ctrl_mode = WCDMA_TPC_MODE_INDEX;
               mea_req.dpch_tx.pa_mode = pa_mode;
               mea_req.dpch_tx.idx          =          24          -          m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj-
>m_sWcdmaTpc.sWcdmaPaOctLevData[band].txPaOctLevData.pmu_level_handle[subband_calibration_section[
pa_mode]].prf;
               mea_req.dpch_tx.afc_dac = m_sDefault_value;
               mea_req.dpch_tx.dpcch_pwr = 8;
               mea_req.dpch_tx.dpdch_pwr = 15;
               mea_req.dpch_tx.rf_band = band+1;
               /// since the power ctrl mode is 1 (HW mode), the UL1 will use the runtime value instead of the DPCH
TX input parameter
               {
                  mea_req.dpch_tx.vm1 = 0;
                  mea_req.dpch_tx.vm2 = 0;
                  mea_req.dpch_tx.dc2dc_dac = 0;
                  mea_req.dpch_tx.vbias_dac = 0;
                  mea_req.dpch_tx.apc_dac = 0;
               }
               mea_req.dpch_tx.pwr_det = false;
               mea_req.bSetUlUarfcn    = false;
               mea_req.bSetTargetPwr   = false;
               mea_req.bGetPwrDetRep   = true;
            }
            double target = 24 - mea_req.dpch_tx.idx;
            if(m_pRct->device_type == CMU_200)
            {
               if (!m_rct_ctrl.RCT_WCDMA_ConfigAnalyzerMaxLevel(m_pRct,
                  target ))
               {
```


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```
                CalErrorHandler(WM_MF_AGE8960_SET_POWER_FAIL);
                Trace_Err(m_pRct->as_RCT + " < Analyzer Level power = "  +
                        Double_To_AnsiString(target) + " dBm");
                return false;
            }
            Trace(" %s < Analyzer Level power = %.2f dBm", m_pRct->as_RCT.c_str(),
                target+10.0);
        }
        else
        {
            if (!m_rct_ctrl.RCT_WCDMA_MsTargetPower(m_pRct,
                target))
            {
                CalErrorHandler(WM_MF_AGE8960_SET_POWER_FAIL);
                Trace_Err(m_pRct->as_RCT + " < MS target power = "  +
                        Double_To_AnsiString(target) + " dBm");
                return false;
            }
        }
        if(pa_mode < m_u1WCDMA_PA_MODE_SUBBAND_CAL_NUM)
        {
            if(!WCDMA_TPC_Subband_Cal(band,        pa_mode,        mea_req.dpch_tx,        m_pCal-
>s_cal_obj.pc_WCDMA_TPC_Obj->m_sWcdmaTpc.sWcdmaTpc[band]))
            {
                CalErrorHandler(WM_MF_WCDMA_TPC_SUBBAND_CAL_FAIL);
                Trace_Err("Subband calibration in %s", as_WCDMA_BANDs[band].c_str());
                return false;
            }
        }
        else
        {
            if(m_u1WCDMA_PA_MODE_SUBBAND_CAL_NUM <= 2) // high PA or Low PA are not calibrated
with subband
            {
                // reget the TPC profile
                memcpy(m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj-
>m_sWcdmaTpc.sWcdmaTpc[band].txdacData.power_dac[pa_mode].vga_comp_by_subband,
                        m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj-
>m_sWcdmaTpc.sWcdmaTpc[band].txdacData.power_dac[WCDMA_PA_MODE_MIDDLE].vga_comp_by_subba
nd,
                        sizeof(U_sARFCN_SECTION_B)*CAL_UARFCN_SECTION);
            }
        }
        m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->Set_Subband_Compensation(band,
                pa_mode,
                m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj-
>m_sWcdmaTpc.sWcdmaTpc[band].txdacData.power_dac[pa_mode].vga_comp_by_subband,
                m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj-
>m_sWcdmaTpc.sWcdmaTpc[band].txdacData.pwr_dt_data.pwr_dt_comp_by_subband);
    }
}
```


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```
        RestartTimerCal(WM_MF_NVRAM_WCDMA_TPC_WRITE_FAIL);
        m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->ConfirmCallback = ::CNF_MF;
        m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->REQ_Write_To_NVRAM_Single_Band_Start(m_pCal-
>ui_wcdma_rf_id, m_pCal->e_bb_chip, band);
        SUSPEND_CAL_THREAD;
        if (m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->Get_ConfirmState() != METAAPP_SUCCESS)
        {
            CalErrorHandler(WM_MF_NVRAM_WCDMA_TPC_WRITE_FAIL);
            Trace_Err("Target < write WCDMA TPC to NVRAM fail.");
            return false;
        }
        Trace(" Target < write WCDMA TPC to NVRAM.");
        // Write to calibration File
        WriteWCDMATPCCalResultToFile(as_ID+".cal",Application->ExeName, m_pCal->b_CalResultPath, band);
        band++;
        CHECK_TERMINATE_BY_USER;
    } // while (band < WCDMA_BAND_COUNT)
    // set power control mode to be 1: to set the Power detector in automatic mode!
    RestartTimerCal(WM_MF_WCDMA_SET_PWR_CTRL_MODE_FAIL);
    m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->ConfirmCallback =  ::CNF_MF;
    m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->REQ_SetPwrCtrlMode_Start(1);
    SUSPEND_CAL_THREAD;
    if (m_pCal->s_cal_obj.pc_WCDMA_TPC_Obj->Get_ConfirmState() != METAAPP_SUCCESS)
    {
        CalErrorHandler(WM_MF_WCDMA_SET_PWR_CTRL_MODE_FAIL);
        log->Add(DateToStr(Date()) +  " " + CurrentTimeStr() +
                " FAIL: Target < Set Power Control Mode "
                );
        return false;
    }
    Trace("[Info] set Power Control Mode 1.");
    if (!m_pCal->b_wcdma_tpc_check)
    {
        PostMessage(
                ctrl.hPostMsgDestHandle,
                WM_MF_WCDMA_RF_TPC_CALIBRATION_DONE,
                0,
                0
                );
    }
    Trace(" ====================== WCDMA TPC calibration end (MT6162) ====================== \n
" );
    return true;
}
```

4.3.2.8 WCDMA TPC Calibration (MT6276 8-level PA control calibration – Fast Handset Calibration)

The FHC is transformed from traditional calibration that consists of one pointer per active PA level control and one point per coupler loss calibration. Thus, the calibration points are at most 11*14 = 154 steps. The FHC relies on a sutiable initial value that is derived from a traditional calibration.

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4.3.2.8.a WCDMA TPC Calibration (MT6276 8-level PA control calibration – Fast Handset Calibration - steps)

The FHC consists of the 2 stage

1 Arrange calibration plan
   1.1 Arrange the DUT steps for calibration
   1.2 Arrange the tester steps for calibration
2 Execute calibration plan
   2.1 Controls the tester as the calibration plan
   2.2 Controls the DUT as the calibration plan
   2.3 Evaluate the calibration result

4.3.2.8.b WCDMA TPC Calibration (MT6276 8-level PA control calibration – Fast Handset Calibration – sample code)

```
void CWcdmaFhcClass::ArrangeDutCalibrationPlan(std::list<SWcdmaFhcCalibrationPlan>::iterator it) throw (E_METACalibrationLibrary_STATUS_CODE)
{
   it->dutFhcParameter.no_loop_ctrl    = true;
   it->dutFhcParameter.pwr_det         = 0;
   it->dutFhcParameter.afc_dac         = afcDac;
   it->dutFhcParameter.power_ctrl_mode = m_u1FHC_WCDMA_POWER_CTRL_MODE;

   it->dutFhcParameter.init_tx_onoff        = m_bFHC_WCDMA_INIT_TX_ONOFF;
   it->dutFhcParameter.ready_tx_onoff       = m_bFHC_WCDMA_READY_TX_ONOFF;
   it->dutFhcParameter.init_pa_mode         = m_u1FHC_WCDMA_INIT_PA_MODE;
   it->dutFhcParameter.ready_pa_mode        = m_u1FHC_WCDMA_READY_PA_MODE;
   it->dutFhcParameter.init_pa_gain         = m_u2FHC_WCDMA_INIT_PA_GAIN;
   it->dutFhcParameter.ready_pa_gain        = m_u2FHC_WCDMA_READY_PA_GAIN;
   it->dutFhcParameter.init_vga_dac_tpc_idx  = m_u2FHC_WCDMA_INIT_VGA_DAC_TPC_IDX;
   it->dutFhcParameter.ready_vga_dac_tpc_idx = m_u2FHC_WCDMA_READY_VGA_DAC_TPC_IDX;

   it->dutFhcParameter.init_condition = m_bFHC_WCDMA_INIT_COND[calibrationHandle->m_rCommonCfg.i_device_type_wcdma];
   it->dutFhcParameter.step_duration = m_u1FHC_WCDMA_STEP_DURATION[calibrationHandle->m_rCommonCfg.i_device_type_wcdma];
   it->dutFhcParameter.ready_duration = m_u1FHC_WCDMA_READY_DURATION[calibrationHandle->m_rCommonCfg.i_device_type_wcdma];
   it->dutFhcParameter.retune_duration = m_u1FHC_WCDMA_RETUNE_DURATION[calibrationHandle->m_rCommonCfg.i_device_type_wcdma];
   it->dutFhcParameter.gain_stable_time = m_u1FHC_WCDMA_GAIN_STABLE_TIME[calibrationHandle->m_rCommonCfg.i_device_type_wcdma];
   it->dutFhcParameter.max_vga_dac = m_u2FHC_WCDMA_MAX_VGA_DAC[calibrationHandle->m_rCommonCfg.i_device_type_wcdma];
   it->dutFhcParameter.min_vga_dac = m_u2FHC_WCDMA_MIN_VGA_DAC[calibrationHandle->m_rCommonCfg.i_device_type_wcdma];
   it->dutFhcParameter.jump_vga_dac = m_u2FHC_WCDMA_JUMP_VGA_DAC[calibrationHandle->m_rCommonCfg.i_device_type_wcdma];
   it->dutFhcParameter.odd_record = m_u1FHC_WCDMA_ODD_RECORD;

   it->dutFhcParameter.pa_gain_start_idx = 0;
   it->dutFhcParameter.pd_gain_start_idx = 0;
```


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```
it->dutFhcParameter.hwAGC = true;
it->dutFhcParameter.gain_init = (short) ((WCDMA_TARGET_POINT - agcCalibrationInterface->m_dWCDMA_RSSI_P_DL) * WCDMA_GAIN_SCALE);
it->dutFhcParameter.temperature = agcCalibrationInterface->m_ucWCDMA_RSSI_TEMPERATURE_INDEX;

it->couplerLossTpcIndex[WCDMA_PA_MODE_HIGH] =
    apcCalibrationInterface->GetCouplerLossCalibrationTpcIndex(it->calibrationBand, WCDMA_PA_MODE_HIGH);
it->couplerLossTpcIndex[WCDMA_PA_MODE_MIDDLE] =
    apcCalibrationInterface->GetCouplerLossCalibrationTpcIndex(it->calibrationBand, WCDMA_PA_MODE_MIDDLE);
it->couplerLossTpcIndex[WCDMA_PA_MODE_LOW] =
    apcCalibrationInterface->GetCouplerLossCalibrationTpcIndex(it->calibrationBand, WCDMA_PA_MODE_LOW);

it->couplerLossPrf[WCDMA_PA_MODE_HIGH] = 24 - it->couplerLossTpcIndex[WCDMA_PA_MODE_HIGH];
it->couplerLossPrf[WCDMA_PA_MODE_MIDDLE] = 24 - it->couplerLossTpcIndex[WCDMA_PA_MODE_MIDDLE];
it->couplerLossPrf[WCDMA_PA_MODE_LOW] = 24 - it->couplerLossTpcIndex[WCDMA_PA_MODE_LOW];

it->couplerLossPaSection[WCDMA_PA_MODE_HIGH] = GetCouplerLossCalibrationSectionIndexIncreasing(it, it->couplerLossPrf[WCDMA_PA_MODE_HIGH], WCDMA_PA_MODE_HIGH);
MCL_LOG(metaHandle, "[DEBUG] coupler section(high) : %d", it->couplerLossPaSection[WCDMA_PA_MODE_HIGH]);
it->couplerLossPaSection[WCDMA_PA_MODE_MIDDLE] = GetCouplerLossCalibrationSectionIndexDecreasing(it, it->couplerLossPrf[WCDMA_PA_MODE_MIDDLE], WCDMA_PA_MODE_MIDDLE);
MCL_LOG(metaHandle, "[DEBUG] coupler section(middle): %d", it->couplerLossPaSection[WCDMA_PA_MODE_MIDDLE]);
it->couplerLossPaSection[WCDMA_PA_MODE_LOW] = GetCouplerLossCalibrationSectionIndexDecreasing(it, it->couplerLossPrf[WCDMA_PA_MODE_LOW], WCDMA_PA_MODE_LOW);
MCL_LOG(metaHandle, "[DEBUG] coupler section(low) : %d", it->couplerLossPaSection[WCDMA_PA_MODE_LOW]);

it->couplerLossPaGain[WCDMA_PA_MODE_HIGH] = apcCalibrationInterface->m_sWcdmaTpc.sWcdmaPaOctLevData[it->calibrationBand].txPaOctLevData.pmu_level_handle[ it->couplerLossPaSection[WCDMA_PA_MODE_HIGH] ].pa_gain;
it->couplerLossPaGain[WCDMA_PA_MODE_MIDDLE] = apcCalibrationInterface->m_sWcdmaTpc.sWcdmaPaOctLevData[it->calibrationBand].txPaOctLevData.pmu_level_handle[ it->couplerLossPaSection[WCDMA_PA_MODE_MIDDLE] ].pa_gain;
it->couplerLossPaGain[WCDMA_PA_MODE_LOW] = apcCalibrationInterface->m_sWcdmaTpc.sWcdmaPaOctLevData[it->calibrationBand].txPaOctLevData.pmu_level_handle[ it->couplerLossPaSection[WCDMA_PA_MODE_LOW] ].pa_gain;
it->couplerLossCouplerLoss[WCDMA_PA_MODE_HIGH] =
    apcCalibrationInterface->m_sWcdmaTpc.sWcdmaTpc[it->calibrationBand].txdacData.power_dac[WCDMA_PA_MODE_HIGH].vga_dac[9];
it->couplerLossCouplerLoss[WCDMA_PA_MODE_MIDDLE] =
    apcCalibrationInterface->m_sWcdmaTpc.sWcdmaTpc[it->calibrationBand].txdacData.power_dac[WCDMA_PA_MODE_MIDDLE].vga_dac[9];
```


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```
    it->couplerLossCouplerLoss[WCDMA_PA_MODE_LOW] =
        apcCalibrationInterface->m_sWcdmaTpc.sWcdmaTpc[it-
>calibrationBand].txdacData.power_dac[WCDMA_PA_MODE_LOW].vga_dac[9];
    ArrangeDutFrequencySteps(it);
    ArrangeDutPowerSteps(it);
}
int CWcdmaFhcClass::GetPaModeCount(std::list<SWcdmaFhcCalibrationPlan>::iterator it, unsigned int paMode)
{
    return apcCalibrationInterface->GetPaModeCount(it->calibrationBand, paMode);
}
int
CWcdmaFhcClass::GetCouplerLossCalibrationSectionIndexIncreasing(std::list<SWcdmaFhcCalibrationPlan>::iter
ator it, double prf, unsigned int paMode)
{
    return    apcCalibrationInterface->GetCouplerLossCalibrationSectionIndexIncreasing(it->calibrationBand,    prf,
paMode);
}
int
CWcdmaFhcClass::GetCouplerLossCalibrationSectionIndexDecreasing(std::list<SWcdmaFhcCalibrationPlan>::it
erator it, double prf, unsigned int paMode)
{
    return    apcCalibrationInterface->GetCouplerLossCalibrationSectionIndexDecreasing(it->calibrationBand,    prf,
paMode);
}
int    CWcdmaFhcClass::GetPaModeStartIndex(std::list<SWcdmaFhcCalibrationPlan>::iterator    it,    unsigned    int
paMode)
{
    return apcCalibrationInterface->GetPaModeStartIndex(it->calibrationBand, paMode);
}
int    CWcdmaFhcClass::GetPaModeEndIndex(std::list<SWcdmaFhcCalibrationPlan>::iterator    it,    unsigned    int
paMode)
{
    return apcCalibrationInterface->GetPaModeEndIndex(it->calibrationBand, paMode);
}
int    CWcdmaFhcClass::GetMidChannelIndex(std::list<SWcdmaFhcCalibrationPlan>::iterator    it,    unsigned    short
uarfcn)
{
    return apcCalibrationInterface->GetMidChannelIndex(it->calibrationBand, uarfcn);
}
void    CWcdmaFhcClass::ArrangeDutFrequencySteps(std::list<SWcdmaFhcCalibrationPlan>::iterator    it)    throw
(E_METACalibrationLibrary_STATUS_CODE)
{
    int i;
    int maxFreqSteps = (apcCalibrationInterface->GetFreqSteps(it->calibrationBand) >
        agcCalibrationInterface->GetFreqSteps(it->calibrationBand))    ?    apcCalibrationInterface->GetFreqSteps(it-
>calibrationBand) :
        agcCalibrationInterface->GetFreqSteps(it->calibrationBand);
    it->dutFhcParameter.freq_count = maxFreqSteps;
    /* Arrange RX frequency steps*/
    for(i=0;i<maxFreqSteps;i++)
    {
```


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```
        it->dutFhcParameter.dl_band[i] = it->calibrationBand +1;
        if(i<agcCalibrationInterface->GetFreqSteps(it->calibrationBand))
        {
            it->dutFhcParameter.dl_freq[i]          =          agcCalibrationInterface->m_sWcdmaPathLoss.sPathLoss[it-
>calibrationBand].pathlossData[0].gain_of_uarfcn[i].max_uarfcn;
        }
        else
        {
            it->dutFhcParameter.dl_freq[i] = it->dutFhcParameter.dl_freq[0];
        }
        MCL_LOG(metaHandle, "DUT RX Freq Step(%3d): %6d", i+1, it->dutFhcParameter.dl_freq[i]);
    }
    /* Arrange TX frequency steps*/
    for(i=0;i<maxFreqSteps;i++)
    {
        it->dutFhcParameter.ul_band[i] = it->calibrationBand +1;
        if(i<apcCalibrationInterface->GetFreqSteps(it->calibrationBand))
        {
            it->dutFhcParameter.ul_freq[i]          =          apcCalibrationInterface->m_sWcdmaTpc.sWcdmaTpc[it-
>calibrationBand].txdacData.power_dac[0].vga_comp_by_subband[i].max_uarfcn;
        }
        else
        {
            it->dutFhcParameter.ul_freq[i] = it->dutFhcParameter.ul_freq[0];
        }
        MCL_LOG(metaHandle, "DUT TX Freq Step(%3d): %6d", i+1, it->dutFhcParameter.ul_freq[i]);
    }
}
void     CWcdmaFhcClass::ArrangeDutPowerSteps(std::list<SWcdmaFhcCalibrationPlan>::iterator     it)     throw
(E_METACalibrationLibrary_STATUS_CODE)
{
    int i;
    int pa_mode;
    it->dutFhcParameter.pwr_count = 0;
    for(pa_mode = 0;pa_mode<3;pa_mode++)
    {
        /* Arrange Tx power steps: coupler loss calibration*/
        it->dutFhcParameter.vga_dac_tpc_idx[it->dutFhcParameter.pwr_count]                =                it-
>couplerLossTpcIndex[pa_mode];
        it->dutFhcParameter.pa_gain[it->dutFhcParameter.pwr_count] = it->couplerLossPaGain[pa_mode];
        it->dutFhcParameter.pa_mode[it->dutFhcParameter.pwr_count] = pa_mode;
        it->dutFhcParameter.pa_section[it->dutFhcParameter.pwr_count] = it->couplerLossPaSection[pa_mode];
        MCL_LOG(metaHandle, "[Coupler Loss] DUT TX Power Step(%3d): TPC index(%2d), PA mode(%d), PA
gain(%4d)",
            it->dutFhcParameter.pwr_count+1,
            it->dutFhcParameter.vga_dac_tpc_idx[it->dutFhcParameter.pwr_count],
            it->dutFhcParameter.pa_mode[it->dutFhcParameter.pwr_count],
            it->dutFhcParameter.pa_gain[it->dutFhcParameter.pwr_count]);
        it->dutFhcParameter.pwr_count++;
        /* Arrange Tx power steps: PA gain calibration*/
#ifdef __INVERSE_ORDER__
```


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```
        for(i=GetPaModeStartIndex(it, pa_mode);i <= GetPaModeEndIndex(it, pa_mode);i++)
#else
        for(i=GetPaModeEndIndex(it, pa_mode);i >= GetPaModeStartIndex(it, pa_mode);i--)
#endif
        {
            if(apcCalibrationInterface->m_sWcdmaTpc.sWcdmaPaOctLevData[it-
>calibrationBand].txPaOctLevData.pmu_level_handle[i].pa_mode != pa_mode)
            {
                break;
            }
            it->dutFhcParameter.vga_dac_tpc_idx[it->dutFhcParameter.pwr_count] =
                24 - apcCalibrationInterface->m_sWcdmaTpc.sWcdmaPaOctLevData[it-
>calibrationBand].txPaOctLevData.pmu_level_handle[ i ].prf;
            it->dutFhcParameter.pa_gain[it->dutFhcParameter.pwr_count] =
                apcCalibrationInterface->m_sWcdmaTpc.sWcdmaPaOctLevData[it-
>calibrationBand].txPaOctLevData.pmu_level_handle[ i ].pa_gain;
            it->dutFhcParameter.pa_mode[it->dutFhcParameter.pwr_count] = pa_mode;
            it->dutFhcParameter.pa_section[it->dutFhcParameter.pwr_count] = i;
            MCL_LOG(metaHandle, "[ PA Gain] DUT TX Power Step(%3d): TPC index(%2d), PA mode(%d), PA
gain(%4d)",
                it->dutFhcParameter.pwr_count+1,
                it->dutFhcParameter.vga_dac_tpc_idx[it->dutFhcParameter.pwr_count],
                it->dutFhcParameter.pa_mode[it->dutFhcParameter.pwr_count],
                it->dutFhcParameter.pa_gain[it->dutFhcParameter.pwr_count]);
            it->dutFhcParameter.pwr_count++;
        }
    }
}
void CWcdmaFhcClass::ArrangeTesterCalibrationPlan(std::list<SWcdmaFhcCalibrationPlan>::iterator it) throw
(E_METACalibrationLibrary_STATUS_CODE)
{
    int i;
    S_RCTLIB_WCDMA_FHC_MEASUREMENT_PARAM_T *param = &(it->testerFhcParameter);
    param->e_band = it->calibrationBand;
    param->d_meas_timeout_sec = 5;
    param->txPowerStepStartIndex = 0;
    param->txFrequencyStepStartIndex = 0;
    param->rxPowerStepStartIndex = 0;
    param->rxFrequencyStepStartIndex = 0;
    param->numberOfPowerSteps = 0;
    param->numberOfFrequencySteps = it->dutFhcParameter.freq_count;
    /* assign frequency step */
    for(i=0;i<param->numberOfFrequencySteps;i++)
    {
        param->rxFreqSteps[i].uarfcn = it->dutFhcParameter.dl_freq[i];
        MCL_LOG(metaHandle, "Tester RX Freq Step(%3d): %6d", i+1, it->dutFhcParameter.dl_freq[i]);
    }
    for(i=0;i<param->numberOfFrequencySteps;i++)
    {
        param->txFreqSteps[i].uarfcn = it->dutFhcParameter.ul_freq[i];
        MCL_LOG(metaHandle, "Tester TX Freq Step(%3d): %6d", i+1, it->dutFhcParameter.ul_freq[i]);
```


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```
    }
    /* assign power step: UE TX expected power*/
    for(int pa_mode = 0;pa_mode<3;pa_mode++)
    {
        /* Arrange Tx power steps: coupler loss calibration*/
        if(pa_mode == 0)
        {
            /* Max power - index (hystersis 1 center) */
            param->txPowerSteps[param->numberOfPowerSteps]  =  24  -  it-
>couplerLossTpcIndex[WCDMA_PA_MODE_HIGH];
        }
        else if(pa_mode == 1)
        {
            /* Max power - index (hystersis 1 and hystersis 2 center) */
            param->txPowerSteps[param->numberOfPowerSteps] =
                24 - it->couplerLossTpcIndex[WCDMA_PA_MODE_MIDDLE];
        }
        else if(pa_mode == 2)
        {
            /* Max power - index (hystersis 2 center) */
            param->txPowerSteps[param->numberOfPowerSteps] =
                24 - it->couplerLossTpcIndex[WCDMA_PA_MODE_LOW];
        }
        MCL_LOG(metaHandle, "[Coupler Loss] Tester TX Power Step(%3d): expected power (%3d)",
            param->numberOfPowerSteps+1,
            (int)param->txPowerSteps[param->numberOfPowerSteps]);
        param->numberOfPowerSteps++;
        /* Arrange Tx power steps: PA gain calibration*/
#ifdef __INVERSE_ORDER__
        for(i=GetPaModeStartIndex(it, pa_mode);i <= GetPaModeEndIndex(it, pa_mode);i++)
#else
        for(i=GetPaModeEndIndex(it, pa_mode);i >= GetPaModeStartIndex(it, pa_mode);i--)
#endif
        {
            if(apcCalibrationInterface->m_sWcdmaTpc.sWcdmaPaOctLevData[it-
>calibrationBand].txPaOctLevData.pmu_level_handle[i].pa_mode != pa_mode)
            {
                break;
            }
            param->txPowerSteps[param->numberOfPowerSteps] =
                apcCalibrationInterface->m_sWcdmaTpc.sWcdmaPaOctLevData[it-
>calibrationBand].txPaOctLevData.pmu_level_handle[ i ].prf;
            MCL_LOG(metaHandle, "[    PA Gain] Tester TX Power Step(%3d): expected power (%3d)",
                param->numberOfPowerSteps+1,
                (int)param->txPowerSteps[param->numberOfPowerSteps]);
            param->numberOfPowerSteps++;
        }
    }
    /* assign power step: UE RX downlink power*/
    for(i=0;i<param->numberOfPowerSteps;i++)
    {
```


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```
        if(i<3)
        {
            param->rxPowerSteps[i]                    =                    agcCalibrationInterface-
>m_dWCDMA_RSSI_P_DL_FOR_TEMP_GAIN_TABLE[i];
        }
        else
        {
            param->rxPowerSteps[i] = -90;
        }
        MCL_LOG(metaHandle, "[Rx Loss] Tester Rx Power Step(%3d): downlink power (%6.3lf)",
            i+1,
            param->rxPowerSteps[i]);
    }
}
/**
 * Descriptions: FIXME
 */
void CWcdmaFhcClass::ExecuteCalibrationPlan() throw (E_METACalibrationLibrary_STATUS_CODE)
{
    std::list<SWcdmaFhcCalibrationPlan>::iterator calibrationPlanIterator;
    for(calibrationPlanIterator = calibrationPlanList.begin();
            calibrationPlanIterator != calibrationPlanList.end();
            calibrationPlanIterator++)
    {
        MCL_LOG(metaHandle, "<<<<< Band %d >>>>>", calibrationPlanIterator->calibrationBand + 1);
        calibrationHandle->CheckIfUserTerminate();
        CheckRCTStatus(RCTLIB_WCDMA_FHC_StartIteration( &(calibrationPlanIterator->testerFhcParameter) ));
        CMETACalLibTargetWcdmaRfStopHelper rfStopHelper(metaHandle);
        calibrationHandle->CheckIfUserTerminate();
        if(META_SUCCESS    !=    META_3Grf_FHC_StartEx_r(metaHandle,    3000,    &(calibrationPlanIterator-
>dutFhcParameter) ) )
        {
            throw E_METACalibrationLibrary_STATUS_WCDMA_FHC_START_FAILED;
        }
        char buf[100];
        int n = sprintf(buf, "Polling:");
        for(int i=0;i<50;i++)
        {
            sprintf(buf + n, ".");
            if(META_SUCCESS  !=  META_3Grf_QueryFHCExResult_r(metaHandle,  3000,  &(calibrationPlanIterator-
>dutFhcResult) ) )
            {
                Sleep(100);
                continue;
            }
            break;
        }
        MCL_LOG(metaHandle, buf);
        calibrationHandle->CheckIfUserTerminate();
        CheckRCTStatus(RCTLIB_WCDMA_FHC_FetchResult(    &(calibrationPlanIterator->testerFhcParameter)    ,
&(calibrationPlanIterator->testerFhcResult) ));
```


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```
        calibrationHandle->CheckIfUserTerminate();
        EvaluateCalibrationResult(calibrationPlanIterator);
    }
}
void    CWcdmaFhcClass::EvaluateCalibrationResult(std::list<SWcdmaFhcCalibrationPlan>::iterator    it)    throw
(E_METACalibrationLibrary_STATUS_CODE)
{
    int i;
    int pa_mode;
    int frequencyStep;
    int powerStep;
    int  midChannelIndex  =  GetMidChannelIndex(it,  apcCalibrationInterface->m_usBAND_TPC_UARFCN_UL[it-
>calibrationBand]);
    if(midChannelIndex == 14)
    {
        MCL_LOG_ERROR(metaHandle, "Middle channel is not found, please check the CFG file and INI file that
the BAND*_TPC_UARFCN_UL is defined in the subband max UARFCN");
        throw E_METACalibrationLibrary_STATUS_INI_FILE_INVALID;
    }
    double subbandTargetPower[3];
    double couplerOffset[3];
    bool paSubbandSet[3] = {false, false, false};
    bool paSubbandCalibrated[14][3] = {false};
    unsigned short pagain[8];
    std::vector<tx_report_entry>* tx_report = new std::vector<tx_report_entry>;
    tx_report_entry report_ref;
    /************************************
     * Evaluate TX calibration result
     ************************************/
    if(calibrationHandle->m_rCommonCfg.wcdmaCalibrationItems.b_wcdma_apc_cal)
    {
        S_RCTLIB_WCDMA_FHC_MEASUREMENT_RESULT_T *testerResult = &(it->testerFhcResult);
        MCL_LOG(metaHandle, " ------ Evaluate TX power calibration result ------ ");
        MCL_LOG_NOTIME(metaHandle, " ID, Freq. , Power Step, %6s, %5s(IDX), mode , section, %10s, %10s,
%10s, %10s, %8s, %6s",
            "UARFCN", "Prf", "PA gain", "PD report", "TX power", "Diff.", "back-off", "result");
        /* Evaluate TX calibration result (mid channel) */
        powerStep = 0;
        for(pa_mode = 0;pa_mode<3;pa_mode++)
        {
            report_ref.frequencyStep = midChannelIndex;
            report_ref.powerStep     = powerStep;
            report_ref.uarfcn        = it->dutFhcParameter.ul_freq[midChannelIndex];
            report_ref.pRf           = it->couplerLossPrf[pa_mode];
            report_ref.paMode        = pa_mode;
            report_ref.paSection     = it->couplerLossPaSection[pa_mode];
            report_ref.paGain        = it->couplerLossPaGain[pa_mode];
            report_ref.pdReport      = it->dutFhcResult.pwr_det_value[report_ref.frequencyStep][pa_mode];
            report_ref.txPower                    =    it->testerFhcResult.d_tx_power[    midChannelIndex    *    it-
>testerFhcParameter.numberOfPowerSteps + powerStep ];
```


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```
        report_ref.targetPower = report_ref.txPower - apcCalibrationInterface-
>m_dWCDMA_WANTED_POWER_OFFSET[it->calibrationBand];
        report_ref.id = report_ref.frequencyStep*it->testerFhcParameter.numberOfPowerSteps +
powerStep;
        report_ref.tpcIndex = it->dutFhcParameter.vga_dac_tpc_idx[powerStep];
        report_ref.backOff = (int)apcCalibrationInterface->m_dWCDMA_WANTED_POWER_OFFSET[it-
>calibrationBand];
        /* evaluate initial coupler loss */
        double pd_measure_power = 1.0 * report_ref.pdReport / 32.0 - 80; // dBm
        report_ref.difference = pd_measure_power - report_ref.targetPower;
        /* Target power = (measure_power - back-off) */
        report_ref.result =
          (
          apcCalibrationInterface->m_sWcdmaTpc.sWcdmaTpc[it-
>calibrationBand].txdacData.power_dac[report_ref.paMode].vga_dac[9] +=
          -1.0 * report_ref.difference * 8.0
          );
        couplerOffset[pa_mode] = report_ref.difference;
        tx_report->push_back(report_ref);
        TxLog(report_ref);
        powerStep++;
#ifdef __INVERSE_ORDER__
        for(i=GetPaModeStartIndex(it, pa_mode);i <= GetPaModeEndIndex(it, pa_mode);i++)
#else
        for(i=GetPaModeEndIndex(it, pa_mode);i >= GetPaModeStartIndex(it, pa_mode);i--)
#endif
        {
          if(apcCalibrationInterface->m_sWcdmaTpc.sWcdmaPaOctLevData[it-
>calibrationBand].txPaOctLevData.pmu_level_handle[i].pa_mode != pa_mode)
          {
            break;
          }
          report_ref.frequencyStep = midChannelIndex;
          report_ref.powerStep = powerStep;
          report_ref.uarfcn = it->dutFhcParameter.ul_freq[midChannelIndex];
          report_ref.pRf =
            apcCalibrationInterface->m_sWcdmaTpc.sWcdmaPaOctLevData[it-
>calibrationBand].txPaOctLevData.pmu_level_handle[i].prf;
          report_ref.paMode = pa_mode;
          report_ref.paSection = i;
          pagain[report_ref.paSection] =
            report_ref.paGain =
            apcCalibrationInterface->m_sWcdmaTpc.sWcdmaPaOctLevData[it-
>calibrationBand].txPaOctLevData.pmu_level_handle[i].pa_gain;
          report_ref.pdReport = -1;
          report_ref.txPower = it->testerFhcResult.d_tx_power[ midChannelIndex * it-
>testerFhcParameter.numberOfPowerSteps + powerStep ];
          report_ref.targetPower = report_ref.pRf + apcCalibrationInterface-
>m_dWCDMA_WANTED_POWER_OFFSET[it->calibrationBand];
          if(paSubbandSet[pa_mode] == false)
          {
```


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```
                subbandTargetPower[pa_mode] = report_ref.txPower;
                paSubbandSet[pa_mode]= true;
            }
            report_ref.difference    = report_ref.txPower - report_ref.targetPower;
            report_ref.id                    =  report_ref.frequencyStep*it->testerFhcParameter.numberOfPowerSteps  +
powerStep;
            report_ref.tpcIndex      = it->dutFhcParameter.vga_dac_tpc_idx[powerStep];
            report_ref.backOff           =  (int)apcCalibrationInterface->m_dWCDMA_WANTED_POWER_OFFSET[it-
>calibrationBand];
            report_ref.result       =
                (
                apcCalibrationInterface->m_sWcdmaTpc.sWcdmaPaOctLevData[it-
>calibrationBand].txPaOctLevData.pmu_level_handle[report_ref.paSection].pa_gain +=
                report_ref.difference * 32
                );
            tx_report->push_back(report_ref);
            TxLog(report_ref);
            powerStep++;
        }
    }
}
/*****************************************
 * Evaluate TX subband compensation result
 *****************************************/
if(calibrationHandle->m_rCommonCfg.wcdmaCalibrationItems.b_wcdma_tpc_subband_cal)
{
    for(frequencyStep=0;frequencyStep<it->testerFhcParameter.numberOfFrequencySteps;frequencyStep++)
    {
        powerStep = 0;
        /* Skip the mid channel calibration result */
        if(it->testerFhcParameter.txFreqSteps[frequencyStep].uarfcn              ==              apcCalibrationInterface-
>m_usBAND_TPC_UARFCN_UL[it->calibrationBand])
        {
            continue;
        }
        for(pa_mode = 0;pa_mode<3;pa_mode++)
        {
            report_ref.frequencyStep = frequencyStep;
            report_ref.powerStep     = powerStep;
            report_ref.uarfcn        = it->dutFhcParameter.ul_freq[frequencyStep];
            report_ref.pRf           = it->couplerLossPrf[pa_mode];
            report_ref.paMode        = pa_mode;
            report_ref.paSection     = it->couplerLossPaSection[pa_mode];
            report_ref.paGain        = it->couplerLossPaGain[pa_mode];
            report_ref.pdReport      = it->dutFhcResult.pwr_det_value[report_ref.frequencyStep][pa_mode];
            report_ref.txPower                          =     it->testerFhcResult.d_tx_power[     frequencyStep     *     it-
>testerFhcParameter.numberOfPowerSteps + powerStep ];
            report_ref.targetPower                      =         report_ref.txPower         -         apcCalibrationInterface-
>m_dWCDMA_WANTED_POWER_OFFSET[it->calibrationBand];
            report_ref.id                    =  report_ref.frequencyStep*it->testerFhcParameter.numberOfPowerSteps  +
powerStep;
```


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```
            report_ref.tpcIndex      = it->dutFhcParameter.vga_dac_tpc_idx[powerStep];
            report_ref.backOff          = (int)apcCalibrationInterface->m_dWCDMA_WANTED_POWER_OFFSET[it-
>calibrationBand];
            /* coupler subband compensation: The coupler loss subband compensation is only calibrated on
WCDMA_PA_MODE_MIDDLE */
            double pd_measure_power  = 1.0 * report_ref.pdReport / 32.0 - 80; // dBm
            report_ref.difference    = pd_measure_power - report_ref.targetPower;
               /*
                * because the FHC is done in one sweep, the initial coupler loss is not determined.
                * so the couplerOffset has to be compensated
                * eg. mid channel has -1 dB, subband will has a -1 dB base
                * an real example mid channel difference -1 dB, init 200(DAC), result is 208(DAC)
                * subband has -1.3 dB difference, then the actual subband compensation is 0.3 dB
                */
            if(pa_mode == WCDMA_PA_MODE_MIDDLE)
            {
               report_ref.result    =
                  (
                  apcCalibrationInterface->m_sWcdmaTpc.sWcdmaTpc[it-
>calibrationBand].txdacData.pwr_dt_data.pwr_dt_comp_by_subband[frequencyStep].pwr_offset_dB =
                  -1.0 * report_ref.difference * 32.0 + couplerOffset[pa_mode] * 32.0
                  );
            }
            else
            {
               // N/A
               report_ref.result    = -999;
            }
            tx_report->push_back(report_ref);
            TxLog(report_ref);
            powerStep++;
            /* Evaluate PA gain & coupler loss calibration result (subabnd)*/
#ifdef __INVERSE_ORDER__
            for(i=GetPaModeStartIndex(it, pa_mode);i <= GetPaModeEndIndex(it, pa_mode);i++)
#else
            for(i=GetPaModeEndIndex(it, pa_mode);i >= GetPaModeStartIndex(it, pa_mode);i--)
#endif
            {
               if(apcCalibrationInterface->m_sWcdmaTpc.sWcdmaPaOctLevData[it-
>calibrationBand].txPaOctLevData.pmu_level_handle[i].pa_mode != pa_mode)
               {
                  break;
               }
               report_ref.frequencyStep = frequencyStep;
               report_ref.powerStep     = powerStep;
               report_ref.uarfcn        = it->dutFhcParameter.ul_freq[frequencyStep];
               report_ref.pRf           =
                  apcCalibrationInterface->m_sWcdmaTpc.sWcdmaPaOctLevData[it-
>calibrationBand].txPaOctLevData.pmu_level_handle[i].prf;
               report_ref.paMode        = pa_mode;
               report_ref.paSection     = i;
```


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```
                report_ref.paGain        = pagain[i];
                //apcCalibrationInterface->m_sWcdmaTpc.sWcdmaPaOctLevData[it-
>calibrationBand].txPaOctLevData.pmu_level_handle[i].pa_gain;
                report_ref.pdReport      = -1;
                report_ref.txPower                    =    it->testerFhcResult.d_tx_power[    frequencyStep    *    it-
>testerFhcParameter.numberOfPowerSteps + powerStep ];
                report_ref.difference    = report_ref.txPower - subbandTargetPower[pa_mode];
                report_ref.id                  =  report_ref.frequencyStep*it->testerFhcParameter.numberOfPowerSteps  +
powerStep;
                report_ref.tpcIndex      = it->dutFhcParameter.vga_dac_tpc_idx[powerStep];
                report_ref.backOff        = (int)apcCalibrationInterface->m_dWCDMA_WANTED_POWER_OFFSET[it-
>calibrationBand];
                /* evaluate tx output power subband compensation */
                if(paSubbandCalibrated[frequencyStep][pa_mode] == false)
                {
                   report_ref.targetPower   = subbandTargetPower[pa_mode];
                   report_ref.result    =
                      (
                      apcCalibrationInterface->m_sWcdmaTpc.sWcdmaTpc[it-
>calibrationBand].txdacData.power_dac[pa_mode].vga_comp_by_subband[frequencyStep].pwr_offset_dB =
                      -1.0 * report_ref.difference * 32.0
                      );
                   paSubbandCalibrated[frequencyStep][pa_mode] = true;
                }
                else
                {
                   report_ref.targetPower   = 0;
                   report_ref.result        = -999;
                }
                tx_report->push_back(report_ref);
                TxLog(report_ref);
                powerStep++;
             }
          }
       }
    }
    /*************************************
     * Evaluate RX calibration result
     *************************************/
    bool agc_check_failed = false;
    if(calibrationHandle->m_rCommonCfg.wcdmaCalibrationItems.b_wcdma_apc_cal)
    {
       MCL_LOG(metaHandle, " ------ Evaluate RX path loss calibration result ------ ");
       MCL_LOG_NOTIME(metaHandle, " ID, %7s, %6s, %6s, %6s, %5s, %5s, %8s",
          "UARFCN", "DL Pwr", "report", "RSSI", "  INI", "result", "LNA mode");
#ifdef _DEBUG
       for(frequencyStep=0;frequencyStep<it->testerFhcParameter.numberOfFrequencySteps;frequencyStep++)
#else
       for(frequencyStep=0;frequencyStep<it->dutFhcResult.freq_count;frequencyStep++)
#endif
       {
```


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```
        UL1D_RF_FHC_EX_CNF_T *result = &(it->dutFhcResult);
        for(powerStep=0;powerStep<it->testerFhcParameter.numberOfPowerSteps;powerStep++)
        {
#ifndef _DEBUG
            if(powerStep>=3)
            {
                break;
            }
#endif // #ifndef _DEBUG
            short loss;
            if(powerStep == 0)
            {
                loss                    =                    agcCalibrationInterface->m_sWcdmaPathLoss.sPathLoss[it-
>calibrationBand].pathlossData[agcCalibrationInterface-
>m_ucWCDMA_RSSI_TEMPERATURE_INDEX].gain_of_uarfcn[frequencyStep].path_loss_H;
            }
            else if(powerStep == 1)
            {
                loss                    =                    agcCalibrationInterface->m_sWcdmaPathLoss.sPathLoss[it-
>calibrationBand].pathlossData[agcCalibrationInterface-
>m_ucWCDMA_RSSI_TEMPERATURE_INDEX].gain_of_uarfcn[frequencyStep].path_loss_M;
            }
            else if(powerStep == 2)
            {
                loss                    =                    agcCalibrationInterface->m_sWcdmaPathLoss.sPathLoss[it-
>calibrationBand].pathlossData[agcCalibrationInterface-
>m_ucWCDMA_RSSI_TEMPERATURE_INDEX].gain_of_uarfcn[frequencyStep].path_loss_L;
            }
            if(it->dutFhcResult.rx_lna_mode[frequencyStep*it->dutFhcResult.pwr_count+powerStep] != powerStep)
            {
                agc_check_failed = true;
            }
            short result;
            if(frequencyStep < it->dutFhcResult.freq_count)
            {
                result =
                    -1.0 * (
                    it->dutFhcResult.rssi[frequencyStep*it->dutFhcResult.pwr_count+powerStep] -
                    loss /* L1 use the value as compensation */ - it->testerFhcParameter.rxPowerSteps[powerStep] *
4.0
                    );
                if(powerStep == 0)
                {
                    agcCalibrationInterface->m_sWcdmaPathLoss.sPathLoss[it-
>calibrationBand].pathlossData[agcCalibrationInterface-
>m_ucWCDMA_RSSI_TEMPERATURE_INDEX].gain_of_uarfcn[frequencyStep].path_loss_H = result;
                }
                else if(powerStep == 1)
                {
```


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```
                agcCalibrationInterface->m_sWcdmaPathLoss.sPathLoss[it-
>calibrationBand].pathlossData[agcCalibrationInterface-
>m_ucWCDMA_RSSI_TEMPERATURE_INDEX].gain_of_uarfcn[frequencyStep].path_loss_M = result;
            }
            else if(powerStep == 2)
            {
                agcCalibrationInterface->m_sWcdmaPathLoss.sPathLoss[it-
>calibrationBand].pathlossData[agcCalibrationInterface-
>m_ucWCDMA_RSSI_TEMPERATURE_INDEX].gain_of_uarfcn[frequencyStep].path_loss_L = result;
            }
        }
        else
        {
            result = loss;
        }
        MCL_LOG_NOTIME(metaHandle, "%3d, %6d, %6.3lf, %6d, %6.3lf, %5d, %5d, %8d",
            frequencyStep*it->dutFhcResult.pwr_count+powerStep,
            it->dutFhcParameter.dl_freq[frequencyStep],
            it->testerFhcParameter.rxPowerSteps[powerStep],
            it->dutFhcResult.rssi[frequencyStep*it->dutFhcResult.pwr_count+powerStep],
            (1.0*it->dutFhcResult.rssi[frequencyStep*it->dutFhcResult.pwr_count+powerStep] ) /
            (1.0*WCDMA_GAIN_SCALE),
            loss,
            result,
            it->dutFhcResult.rx_lna_mode[frequencyStep*it->dutFhcResult.pwr_count+powerStep]
            );
    }
  }
}
if(agc_check_failed)
{
  MCL_LOG_ERROR(metaHandle, "LNA mode does not match, please check the downlink power setting");
  throw E_METACalibrationLibrary_STATUS_WCDMA_AGC_CHECK_FAILED;
}
}
```

4.3.2.8.c WCDMA TPC Calibration (MT6276 8-level PA control calibration – Fast Handset Calibration – calibration plan demonstration)

Here's an example of calibration plan demonstration

- Pink part is mid-channel calibration plan
- Blue part is sub-band calibration plan

Mid-channel calibration plan is used to determine

1 PA gain of active PA control levels (The order is arranged from low power to high power, from high PA mode to low PA mode)
   1.1 High PA mode (section 3, 4, 5, 6, 7: ID 67 ~ 71)
   1.2 Middle PA mode (section 1, 2: ID 73 ~ 74)
   1.3 Low PA mode (section 0: ID 76)

2 Coupler loss of 3 PA modes (The PA gain used for the calibration extrapolated by the closest section for the specified PA mode)
   2.1 High mode: In this case ID 66 is the high mode coupler loss calibration step
   2.2 Middle mode: In this case ID 72 is the middle mode coupler loss calibration step

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2.3 Low mode: In this case ID 75 is the low mode coupler loss calibration step

Sub-band calibration plan is used to determine

1 PA sub-band comepensation

1.1 High PA mode PA compensation: (ID 1)

1.2 Middle PA mode PA compensation (ID 7)

1.3 Low PA mode PA compensation (ID 10)

2 Coupler loss subband compensation (ID 6)

ID	Freq.	Power Ste	UARFCN	Prf(IDX)	mode	section	PA gain	PD repor	TX pow	Diff.	back-off	result
66	6	0	9750	11(13)	0	3	650	2880	9.25	-0.25	-1	205
67	6	1	9750	15(9)	0	3	650	-1	13.42	-0.58	-1	631
68	6	2	9750	18(6)	0	4	663	-1	16.44	-0.56	-1	644
69	6	3	9750	20(4)	0	5	676	-1	18.41	-0.59	-1	657
70	6	4	9750	22(2)	0	6	696	-1	20.34	-0.66	-1	674
71	6	5	9750	24(0)	0	7	721	-1	21.99	-1.01	-1	688
72	6	6	9750	6(18)	1	1	346	2706	3.72	-0.16	-1	205
73	6	7	9750	6(18)	1	1	346	-1	3.76	-1.24	-1	306
74	6	8	9750	11(13)	1	2	367	-1	8.68	-1.32	-1	324
75	6	9	9750	1(23)	2	0	156	2615	1.18	-0.46	-1	207
76	6	10	9750	0(24)	2	0	156	-1	0.33	1.33	-1	198
0	0	0	9612	11(13)	0	3	650	2856	10.09	-1.84	-1	-999
1	0	1	9612	15(9)	0	3	650	-1	14.06	0.64	-1	-20
2	0	2	9612	18(6)	0	4	663	-1	17.02	3.6	-1	-999
3	0	3	9612	20(4)	0	5	676	-1	18.95	5.54	-1	-999
4	0	4	9612	22(2)	0	6	696	-1	20.85	7.44	-1	-999
5	0	5	9612	24(0)	0	7	721	-1	22.48	9.06	-1	-999
6	0	6	9612	6(18)	1	1	346	2632	3.35	-2.1	-1	62
7	0	7	9612	6(18)	1	1	346	-1	3.37	-0.39	-1	12
8	0	8	9612	11(13)	1	2	367	-1	8.16	4.39	-1	-999
9	0	9	9612	1(23)	2	0	156	2566	1.51	-2.32	-1	-999
10	0	10	9612	0(24)	2	0	156	-1	0.62	0.28	-1	-9

Figure 524 ***Calibration plan example of 8-level PA control FHC***

4.3.3 WCDMA NSFT

The NSFT will check the MS's performance by measuring the following metrics:

1. RX metrics

1.1 Single-ended BER/Loopback BER

2 TX metrics

2.1 Max/Min Channel Power

2.2 SEM (Spectrum Emission Mask)

2.3 OBW (Occupied Bandwidth)

2.4 ACLR (Adjacent Channel Leakage Measurement)

2.5 Waveform Quality such as EVM

2.6 ILPC (Inner Loop Power Control)

3 PRACH TX On/Off Test

CFG file Sample of one NSFT test case:

[WCDMA NSFT Common Settings]

; BER from tester=Y // get ber from tester and single-ended BER both

; BER from tester=N // get single-ended ber only

BER from tester = Y

ILPC Algo1 1dB Up Upper Limit=1.6

ILPC Algo1 1dB Up Lower Limit=0.4

ILPC Algo1 1dB Down Upper Limit=-0.4

ILPC Algo1 1dB Down Lower Limit=-1.6

ILPC Algo1 1dB Aggregate Up Upper Limit=12.3

ILPC Algo1 1dB Aggregate Up Lower Limit=7.7

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ILPC Algo1 1dB Aggregate Down Upper Limit=-7.7
ILPC Algo1 1dB Aggregate Down Lower Limit=-12.3
ILPC Algo1 2dB Up Upper Limit=3.15
ILPC Algo1 2dB Up Lower Limit=0.85
ILPC Algo1 2dB Down Upper Limit=-0.85
ILPC Algo1 2dB Down Lower Limit=-3.15
ILPC Algo1 2dB Aggregate Up Upper Limit=24.3
ILPC Algo1 2dB Aggregate Up Lower Limit=15.7
ILPC Algo1 2dB Aggregate Down Upper Limit=-15.7
ILPC Algo1 2dB Aggregate Down Lower Limit=-24.3
ILPC Algo2 Up Upper Limit=1.6
ILPC Algo2 Up Lower Limit=0.4
ILPC Algo2 None Upper Limit=0.6
ILPC Algo2 None Lower Limit=-0.6
ILPC Algo2 Down Upper Limit=-0.4
ILPC Algo2 Down Lower Limit=-1.6
ILPC Algo2 Aggregate Up Upper Limit=14.3
ILPC Algo2 Aggregate Up Lower Limit=5.7
ILPC Algo2 Aggregate None Upper Limit=1.2
ILPC Algo2 Aggregate None Lower Limit=-1.2
ILPC Algo2 Aggregate Down Upper Limit=-5.7
ILPC Algo2 Aggregate Down Lower Limit=-14.3

[WCDMA NSFT Test Case_1]
Uplink Channel = 9612
Downlink Channel = 10562
Cable Loss Input (dB) = -1.9
Cable Loss Output (dB) = -1.9
Max Power Average High (dBm) = 24.0
Max Power Average Low (dBm) = 19.0
Frequency Error Peak (Hz) = 195.0
IQ OriginOffset (dB) = -25.0
ACLR 5M (dB) = -33.0
ACLR 10M (dB) = -43.0
Min Power Average High (dBm) = -50
BER Level (dBm) = -70.0
BER Limit (%) = 0.1
EVM RMS Max= 17.5
IQ Imbalance = -15.0
OBW MAX = 5.0
; if the ILPC Test is optional, if the user do not specify the setting, the ILPC test will be skipped
ILPC Test Segments = ABCDEFGH
Max PRACH pre burst power (dBm) = -56
Max PRACH post burst power (dBm) = -56
Max Open Loop Power Error (dB) = 2
Min Open Loop Power Error (dB) = -8
PRACH Test Cell Power (dBm) = -70

Test Steps:

1 Command RCT to set the following environments

1.1 DPCH channel type to RMC12.2 kbps.

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1.2 Channel power measure count: 5
1.3 Chanel power measure trigger source: Immedate
1.4 Trigger Arm: Single
1.5 TFCI Pattern: 1
1.6 DPCH uplink scrambling code : 0
1.7 DPCH BcBd Control: Auto
1.8 Loopback type:Type1
1.9 DTCH DATA: All Zeros
1.10 Uplink Closed Loop Power Control: Active mode, Algorithm1, StepSize(1dB)
1.11 BER Test bits: 10000 for loopback BER measurement

2 Command MS to turn off 2G RF via META DLL API: META_Rf_PowerOff

3 Repeat the following steps for each test case specified in CFG file such as section “[WCDMA NSFT Test Case_1]”.

3.1 Set the folwoing environment to RCT
3.1.1 Uplink channel: CFG’s “Uplink Channel”
3.1.2 Downlink channel: CFG’s “Downlink Channel”
3.1.3 Input cable loss: CFG’s “Cable Loss Input (dB)”
3.1.4 Output cable loss: CFG’s “Cable Loss Output (dB)”
3.1.5 Cell Power: CFG’s “BER Level (dBm)”

3.2 Command MS via META DLL API: META_3Grf_NSFT_Start_Ex with the following parameters (here nsft_req: UL1D_RF_NSFT_REQ_T)
3.2.1 nsft_req.b_afc_dac_valid = false;
3.2.2 nsft_req.u1_loopbackType = 1; // type 1
3.2.3 nsft_req.u1_frame_shift = 0;
3.2.4 nsft_req.u1_rmc_type = 1 ; // 12.2k
3.2.5 The ctfc settings
3.2.5.1 For Agilen8960
3.2.5.1.1 nsft_req.u1_ctfc[0] = 0;
3.2.5.1.2 nsft_req.u1_ctfc[1] = 1;
3.2.5.1.3 nsft_req.u1_ctfc[2] = 2;
3.2.5.1.4 nsft_req.u1_ctfc[3] = 3;
3.2.5.2 For CMU200
3.2.5.2.1 nsft_req.u1_ctfc[0] = 0;
3.2.5.2.2 nsft_req.u1_ctfc[1] = 2;
3.2.5.2.3 nsft_req.u1_ctfc[2] = 1;
3.2.5.2.4 nsft_req.u1_ctfc[3] = 3;
3.2.6 nsft_req.u1_bit_pattern = 2; // All Zero
3.2.7 nsft_req.i2_dl_freq = CFG’s “Downlink Channel”
3.2.8 nsft_req.i2_dl_psc = 0;
3.2.9 nsft_req.i2_dl_ovsf = 9;
3.2.10 nsft_req.i2_ul_freq = CFG’s “Uplink Channel”
3.2.11 nsft_req.u2_ul_tfci setting
3.2.11.1 For Agilent 8960 is 1
3.2.11.2 For CMU200 is 2
3.2.12 nsft_req.u4_ul_sc_code = 0;
3.2.13 nsft_req.b_iq_pwr_valid =true ;
3.2.14 nsft_req.u1_dpcch_pwr = 8;
3.2.15 nsft_req.u1_dpdch_pwr = 15;

3.3 Command RCT to perform the TX measurements mentioned in section “TX metrics”, and ensure the measurement results can pass the check formula as follows:

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3.3.1 Max Channel Power shoud be within [CFG's "Max Power Average Low (dBm)", CFG's "Max Power Average High (dBm)"]
3.3.2 Min Channel Power should be smaller than CFG's "Min Power Average High (dBm)"
3.3.3 SEM (Spectrum Emission Mask): SEM1/2/3/4 should checked PASS by RCT.
3.3.4 OBW (Occupied Bandwidth) should be smaller than CFG's "OBW MAX".
3.3.5 ACLR (Adjacent Channel Leakage Measurement)
3.3.5.1 ADJ LOW5: smaller than CFG's "ACLR 5M (dB)" ,
3.3.5.2 ADJ UP5: smaller than CFG's "ACLR 5M (dB)"
3.3.5.3 ADJ LOW10: smaller than CFG's "ACLR 10M (dB)"
3.3.5.4 ADJ UP10: smaller than CFG's "ACLR 10M (dB)"
3.3.6 Waveform Quality
3.3.6.1 Avg. RMS EVM: smaller than CFG's "EVM RMS Max"
3.3.6.2 Avg. Original Offset: smaller than CFG's "IQ OriginOffset (dB)"
3.3.6.3 Max Freq. Error (Hz): smaller than CFG's "Frequency Error Peak (Hz)"
3.3.7 ILPC
3.3.7.1 Algorithm 1
3.3.7.1.1 1dB step up error between "ILPC Algo1 1dB Up Upper Limit" and "ILPC Algo1 1dB Up Lower Limit"
3.3.7.1.2 1dB step down error between "ILPC Algo1 1dB Down Upper Limit" and "ILPC Algo1 1dB Down Lower Limit"
3.3.7.1.3 1dB aggregate step up error between "ILPC Algo1 1dB Aggregate Up Upper Limit" and "ILPC Algo1 1dB Aggregate Up Lower Limit"
3.3.7.1.4 1dB aggregate step down error between "ILPC Algo1 1dB Aggregate Down Upper Limit" and "ILPC Algo1 1dB Aggregate Down Lower Limit"
3.3.7.1.5 2dB step up error between "ILPC Algo1 2dB Up Upper Limit" and "ILPC Algo1 2dB Up Lower Limit"
3.3.7.1.6 2dB step down error between "ILPC Algo1 2dB Down Upper Limit" and "ILPC Algo1 2dB Down Lower Limit"
3.3.7.1.7 2dB aggregate step up error between "ILPC Algo1 2dB Aggregate Up Upper Limit" and "ILPC Algo1 2dB Aggregate Up Lower Limit"
3.3.7.1.8 2dB aggregate step down error between "ILPC Algo1 2dB Aggregate Down Upper Limit" and "ILPC Algo1 2dB Aggregate Down Lower Limit"
3.3.7.2 Algorithm 2
3.3.7.2.1 step up error between "ILPC Algo2 Up Upper Limit" and "ILPC Algo2 Up Lower Limit"
3.3.7.2.2 none change error between "ILPC Algo2 None Upper Limit" and "ILPC Algo2 None Lower Limit"
3.3.7.2.3 step down error between "ILPC Algo2 Down Upper Limit" and "ILPC Algo2 Down Lower Limit"
3.3.7.2.4 step up aggregate step error between "ILPC Algo2 Aggregate Up Upper Limit" and "ILPC Algo2 Aggregate Up Lower Limit"
3.3.7.2.5 none change aggregate step error between "ILPC Algo2 Aggregate None Upper Limit" and "ILPC Algo2 Aggregate None Lower Limit"
3.3.7.2.6 step down aggregate step error between "ILPC Algo2 Aggregate Down Upper Limit" and "ILPC Algo2 Aggregate Down Lower Limit"

3.4 Command RCT to perform Loopback BER measurement if CFG's "BER from tester" is set to be "Y".
3.4.1 BER should be smaller than CFG's "BER Limit (%)"

3.5 Query the single-Ended BER from MS via META DLL API: META_3Grf_NSFT_GetBitCountForSingleEndedBER until the u4TotalBits is bigger than 10000, check if the BER is smaller than CFG's "BER Limit (%)".

3.6 Command MS to stop NSFT measurement with META DLL API: META_3Grf_TestStop.

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4 PRACH TX On/Off test (This test requires the signaling option of the RCT)
- 4.1 Configure the RCT
  - 4.1.1 Signaling mode (with signaling off)
  - 4.1.2 Uplink Primary Scrambling Code 0
  - 4.1.3 Downlink Primmary Scrambling Code 0
  - 4.1.4 Uplink Interference -70 dBm
  - 4.1.5 Constant value -10 dB
  - 4.1.6 Primary CPICH power 30 dBm
  - 4.1.7 CPICH level offset -3.3 dB
  - 4.1.8 PRACH preamble cycles 1
  - 4.1.9 PRACH preamble retransmission 4
  - 4.1.10 PRACH available sub channels 000000000001

5 Repeat the following steps for each test case specified in CFG file such as section “[WCDMA NSFT Test Case_1]”.
- 5.1.1 Configure the RCT
  - 5.1.1.1 Downlink channel: CFG’s “Downlink Channel”
  - 5.1.1.2 Uplink channel: automatic configured by the RCT
  - 5.1.1.3 Input cable loss: CFG’s “Cable Loss Input (dB)”
  - 5.1.1.4 Output cable loss: CFG’s “Cable Loss Output (dB)”
  - 5.1.1.5 Cell Power: CFG’s PRACH Test Cell Power (dBm)”
  - 5.1.1.6 evaluate init_power as the following formula
    - 5.1.1.6.1 CPICH power + constant value + uplink interference - (cell power + CPICH level offset)
  - 5.1.1.7 Max UE power: init_power + 10 dB
  - 5.1.1.8 Turn on signaling
  - 5.1.1.9 Initiate PRACH On/Off test
- 5.1.2 Configure the MS by META_3Grf_TxAccess
  - 5.1.2.1 dl_uarfcn: CFG’s “Downlink Channel”
  - 5.1.2.2 ul_uarfcn: query the uplink channel from the RCT
  - 5.1.2.3 dl_psc: 0
  - 5.1.2.4 signature: 0
  - 5.1.2.5 pa_mode: 0
  - 5.1.2.6 init_power: init power evaluated from 5.1.1.6
  - 5.1.2.7 power_step: 1
  - 5.1.2.8 max_retrans: 4
  - 5.1.2.9 asc: 6
- 5.1.3 Fetch the PRACH TX On/Off test from the RCT and check the measurement result can pass the criteria as the following
  - 5.1.3.1 pre-burst power smaller than “Max PRACH pre burst power (dBm)”
  - 5.1.3.2 post-burst power smaller than “Max PRACH post burst power (dBm)”
  - 5.1.3.3 open loop power error between ”Max Open Loop Power Error (dB)” and :Min Open Loop Power Error (dB)”

6 Command MS to turn on 2G RF via META DLL API: META_Rf_PowerOn

4.3.4 HSPA NSFT

The NSFT will check the MS’s performance by measuring the following metrics:

1 TX metrics
- 1.1 Max Channel Power
- 1.2 SEM (Spectrum Emission Mask)
- 1.3 ACLR (Adjacent Channel Leakage Measurement)

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4.3.4.1 HSPA NSFT CFG file sample (HSDPA)

[UMTS FDD HSDPA NSFT Test Case 1]
; sub test (1 ~ 4)
Sub Test=1
; downlink channel
Downlink Channel=9750
; uplinke channel
Downlink Channel=10700
; input cable loss (negative sign means loss)
Cable Loss Input (dB)=-2.3
; output cable loss (negative sign means loss)
Cable Loss Output (dB)=-2.3
; max power limit (upper bound)
Max Power Average High (dBm)=25.3
; max power limit (lower bound)
Max Power Average Low (dBm)=19.2
; ACLR limit for 5 MHz
ACLR 5M (dB)=-33.1
; ACLR limit for 10 MHz
ACLR 10M (dB)=-43.2
; SEM margin
SEM1 Margin (dB) = 3.1
SEM2 Margin (dB) = 3.2
SEM3 Margin (dB) = 3.3
SEM4 Margin (dB) = 3.4

4.3.4.2 HSPA NSFT (HSDPA steps)

Configures the tester as the following table for each test case.

Parameters	Value
DL DPCH OVSF code	20
HS-DSCH channel type	FRC
FRC Type	H-Set 1 QPSK
DPCH Frame offset	0
DL TFCI patetrn	1
Delta ACK	8
Delta NACK	8
Delta CQI	8
CQI feedback cycle	4 ms
CQI repetition factor	2
ACK/NACK repetition factor	3
UE category	8
Number of HARQ process	6
Start value for the CQI conformance test	16
Fixed CQI defining the downlink Transport Format	25
OVSF 256	40
OVSF 128	20
EAGCH channelization code	42
EHICH channelization code	22
First HSPDSCH channelization code	7

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Parameters	Value
Number of HSSCCH	1 (either 1 or 4 is ok)
HSSCCH selection	HSSCCH1
HSSCCH1 channelizaiton code	2
HSPA CPICH level	-10
HSPA PCCPCH level	-12
HSPA PICH level	-15
HSPA DPCH level	-10
HSPA EAGCH level	-20
HSPA EHICH level	-20
HSPA HSPDSCHS level	-3
HSPA HSSCCH1 level	-8
Uplink DPCH Bc/Bd Control	Manaual
Bc/Bd	Accroding to the subtest definition in TS34.121
Uplink DPCCH Slot format	1
Closed-loop power control reference	DPCCH

The test procedure consists of 3 steps

1 Preconfig the tester for NSFT (all of the parameters that are not changed through out all tests)
2 Config the tester for NSFT test case (all of the parameters that are changed by test case)
3 Start DUT NSFT
  3.1 Fetch test result
  3.2 Verify test result

4.3.4.3 HSPA NSFT CFG file sample (HSUPA)

```
[UMTS FDD HSUPA NSFT Test Case 1]
; sub test (1 ~ 5)
Sub Test=1
; downlink channel
Downlink Channel=9750
; uplinke channel
Downlink Channel=10700
; input cable loss (negative sign means loss)
Cable Loss Input (dB)=-2.3
; output cable loss (negative sign means loss)
Cable Loss Output (dB)=-2.3
; max power limit (upper bound)
Max Power Average High (dBm)=25.3
; max power limit (lower bound)
Max Power Average Low (dBm)=19.2
; ACLR limit for 5 MHz
ACLR 5M (dB)=-33.1
; ACLR limit for 10 MHz
ACLR 10M (dB)=-43.2
; SEM margin
SEM1 Margin (dB) = 3.1
SEM2 Margin (dB) = 3.2
SEM3 Margin (dB) = 3.3
SEM4 Margin (dB) = 3.4
```


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4.3.5 HSPA NSFT (HSUPA steps)

The HSUPA test flow is basically the same with HSDPA except that the power control is always TPC algorithm 2 and active bits through out the test case. Extra configurations are given in the following table

Parameters	Value
EAGCH channelization code	42
EHICH channelization code	22
E-EPDCH Max Channel codes	2SF4
E-DPCCH/DPCCH Power Offset (DeltaE-EPCCH)	6/8/8/5/0 (subtest 1 ~ 5)

The target power of each test case is listed below

Sub test	Target power (dBm)
1	7
2	15
3	8
4	19
5	13

4.3.6 Start calibration and NSFT

After 5 files are opened and set, user must click [Start] button to start auto calibration. User can click [Stop] button to stop current calibration procedure. There are many options for user to choose, these option are as follows:

- Initial value: this group indicates the initial RF and ADC calibration parameter from flash or ini file.
- Calibration item: this group indicates the calibration items, they are RF calibration and ADC calibration.
- NSFT: this group indicates the NSFT test items. The NSFT will start after all the calibration item is successfully done.
- TX PCL calibration: this group indicates the TX PCL calibration algorithm used, they are 3 PCL or full PCL calibration.
- Power supply: this group indicates the power supply type used, they are Agilent 663x2 or Agilent 661x series power supply.
- Enter META Factory: this group indicate items will be done when enter META factory mode, these items include read barcode from, barcode increase, auto start calibration.
- Exit META Factory: this group indicate items will be done when exit META factory mode, these items include barcode increase, save barcode to NVRAM, save barcode to file, terminate META.
- Calibration success: this group indicate items will be done when calibration is successful, these items include barcode increase, save barcode to NVRAM, save barcode to file, turn off power supply, terminate META.
- Calibration fail: this group indicate items will be done when calibration is fail, these items include barcode increase, save barcode to NVRAM, save barcode to file, turn off power supply, terminate META.

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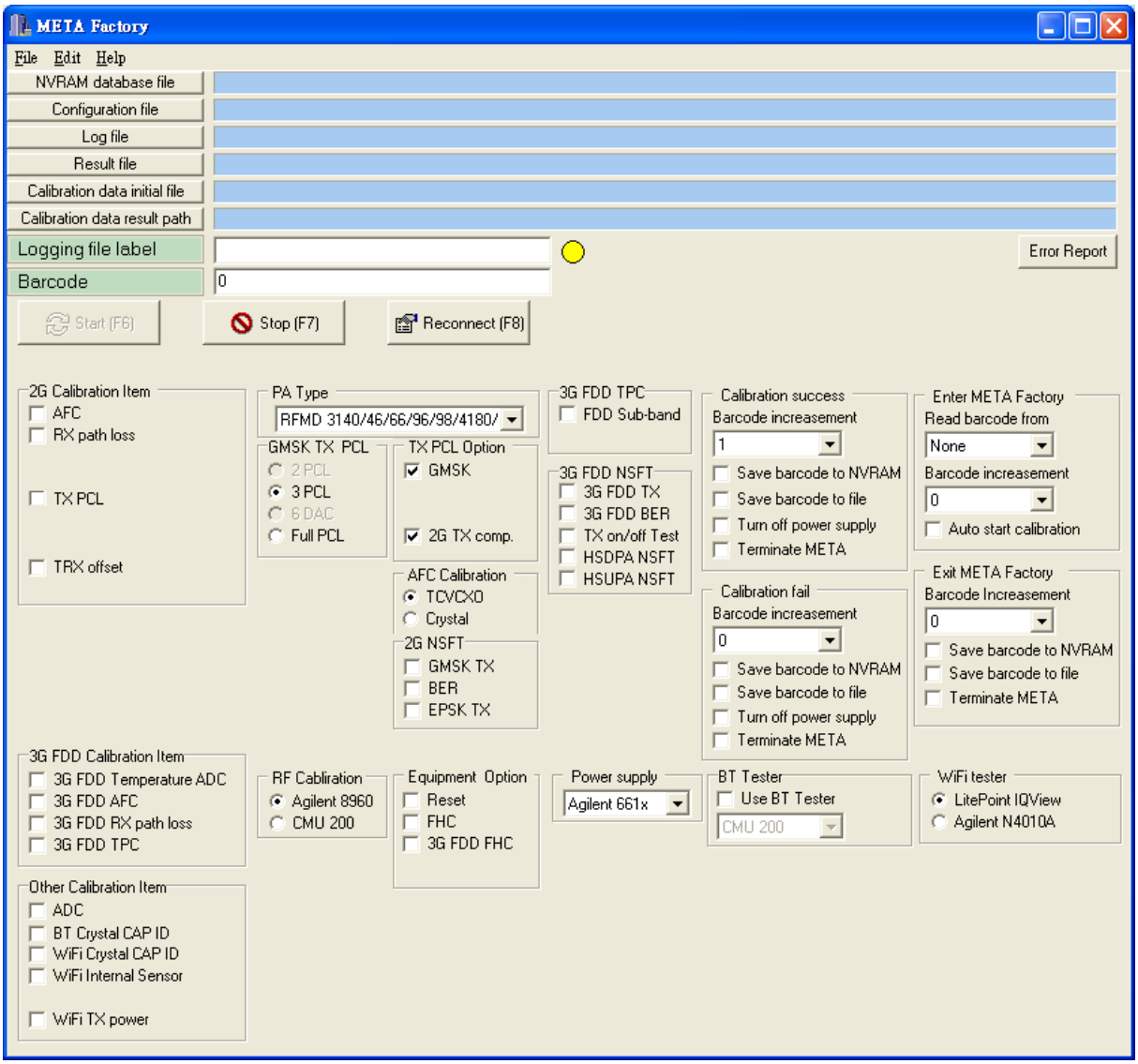

Figure 525 ***Click [Start] button to start auto calibration and NSFT***

Note: User can read the logging file after calibration done.

User can click [Reconnect] button to reconnect another mobile with META. The Boot ROM negotiation procedure will be re-initiated.

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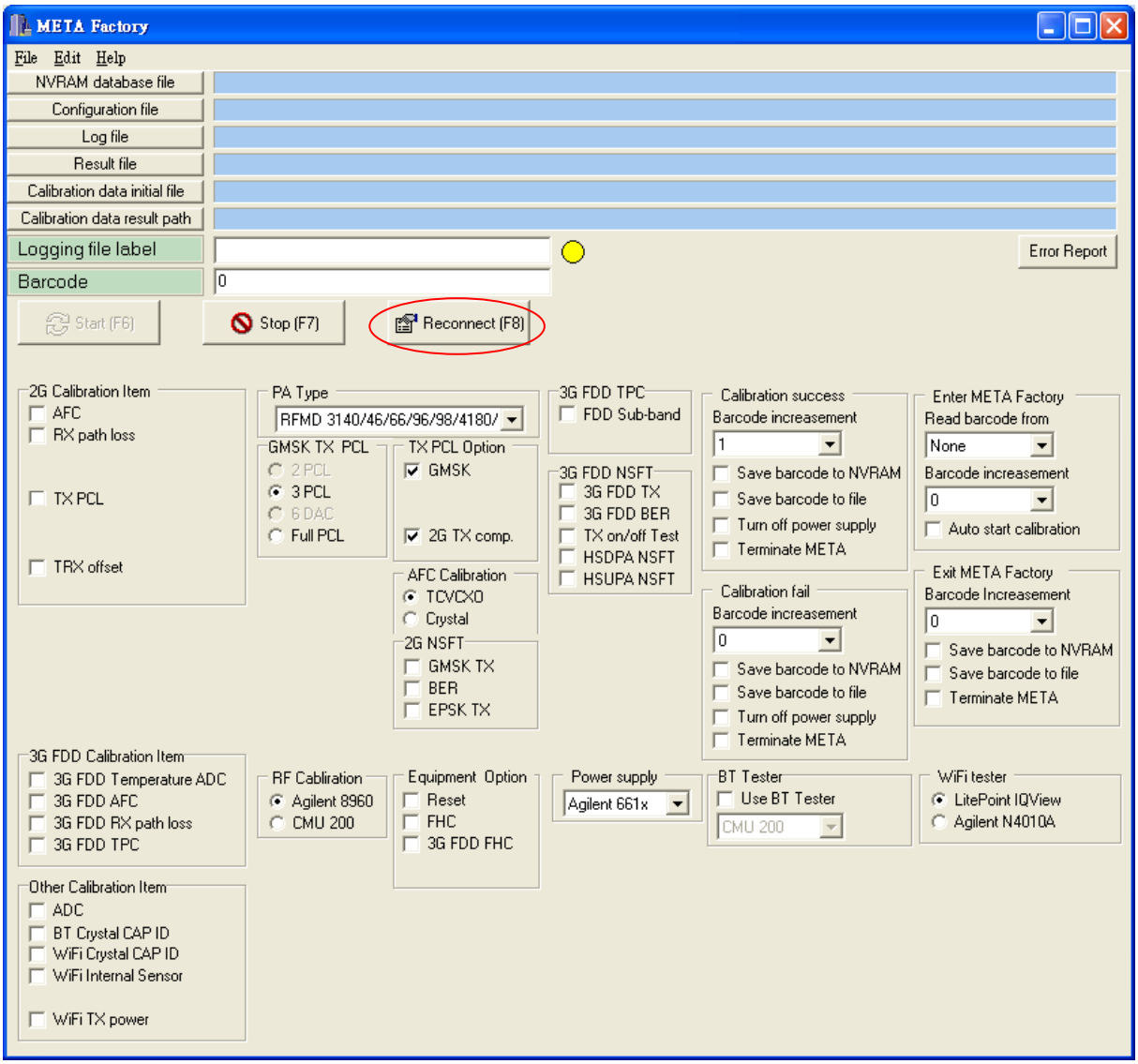

Figure 526 ***Click [Reconnect] button to reconnect META with other mobile***

4.4 TDSCDMA Calibration Procedure

4.4.1 Configuration file

4.4.1.1 Common settings

Parameter	Description
[TDSCDMA Common]	
TDSCDMA_BAND	Calibration band bit mask setting (deprecated), please use the TDSCDMA_BAND_CONFIG after v6.1208.0 Band A (0x01) Band B (0x02) Band C (0x04) Band D (0x08) Band E (**0x20**) Band F (**0x10**)

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TDSCDMA_BAND_CONFIG	Calibration band bit mask setting Band A (0x01) Band B (0x02) Band C (0x04) Band D (0x08) Band E (0x10) Band F (0x20)

- The TDSCDMA_BAND is deprecated CFG entry, and the TDSCDMA_BAND_CONFIG will overwrite the setting in TDSCDMA_BAND. For example, the below CFG setting will calibrate **Band A + Band F** instead of **Band A + Band E**

[TDSCDMA Common]
TDSCDMA_BAND=0x21
TDSCDMA_BAND_CONFIG=0x21

- The following CFG demonstrated the legacy CFG file will calibrate **Band A + Band F**

[TDSCDMA Common]
TDSCDMA_BAND=0x11

- The following CFG demonstrated the new CFG file will calibrate **Band A + Band F**

[TDSCDMA Common]
TDSCDMA_BAND_CONFIG=0x21

The mappings of the TDSCDMA_BAND_CONFIG setting in the [TDSCDMA Common] section of CFG file are defined as followed.

Operating Band	**Bit mask**	**Frequency band definition mapping in NVRAM item**
A	0x01	*B33* + B34
B	0x02	*B35* + B36
C	0x04	*B37*
D	0x08	B38
E	0x10	B40
F	0x20	*B39*
The mappings of frequency range are defined as below *B33: 1900MHz ~ 1920MHz* *B34: 2010MHz ~ 2025MHz* *B35: 1850MHz ~ 1910MHz* *B36: 1930MHz ~ 1990MHz* *B37: 1910MHz ~ 1930MHz* *B38: 2570MHz ~ 2620MHz* *B39: 1880MHz ~ 1920MHz* *B40: 2300MHz ~ 2400MHz* *The B33/B35/B37/B37 share some of common frequency range and thus the calibration data is merged into single NVRAM item for both path-loss calibration and APC calibration. (NVRAM_EF_AST_TL1_PATHLOSS_BAND33_35_37_39_LID/ NVRAM_EF_AST_TL1_TXDAC_BAND33_35_37_39_LID)* *Also, the INI file section is shared for B33/B35/B37/B39 ([TDSCDMA 1850-1930MHz RX loss]/ [TDSCDMA 1850-1930MHz TPC])*		

4.4.1.2 Tester settings

Parameter	Description
[SP6010 Initialization]	
GPIB Address	GPIB address of the tester

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Uplink cable loss	uplink cable loss setting in dB (defined as loss, the negative sign of the input is ignored)
Downlink cable loss	downlink cable loss setting in dB (defined as loss, the negative sign of the input is ignored)
[8960 Initialization]	
TDSCDMA 1850-1930MHz cable loss	cable loss for 1850-1930MHz (defined as loss, the negative sign of the input is ignored)
TDSCDMA 2010-2025MHz cable loss	cable loss for 2010-2025MHz (defined as loss, the negative sign of the input is ignored)
TDSCDMA 1930-1990MHz cable loss	cable loss for 1930-1990MHz (defined as loss, the negative sign of the input is ignored)
TDSCDMA 2570-2620MHz cable loss	cable loss for 2570-2620MHz (defined as loss, the negative sign of the input is ignored)
TDSCDMA 2300-2400MHz cable loss	cable loss for 2300-2400MHz (defined as loss, the negative sign of the input is ignored)
[8960 Intialization is defined in 2G/3G, please add the TDSCDMA in the existing CFG entry.	

4.4.2 TDSCDMA Temperature ADC calibration

4.4.2.1 Configuration File

Parameter	Description
[TDSCDMA Temperature ADC]	
CURRENT_TEMP	the ambient temperature for the temperature ADC calibration
MEASURE_COUNT	number of measurement for each sample
MAX_VALID_DAC_VALUE	Maximum valid ADC value for the temperature ADC calibration

4.4.3 TDSCDMA AFC Calibration

4.4.3.1 Configuration File

Parameter	Description
[TDSCDMA AFC table]	
TDSCDMA_AFC_UARFCN	the UARFCN used for AFC calibration
TDSCDMA_AFC_MEASURE_COUNT	number of measurement for each sample
TDSCDMA_AFC_DAC1	the AFC DAC value used for the first sample of AFC calibration
TDSCDMA_AFC_DAC2	the AFC DAC value used for the second sample of AFC calibration
TDSCDMA_MAX_INIT_AFC_DAC	Maximum AFC DAC value
TDSCDMA_MIN_INIT_AFC_DAC	Minium AFC DAC value
TDSCDMA_MAX_AFC_SLOPE	Maximum AFC slope value
TDSCDMA_MIN_AFC_SLOPE	Minimum AFC slope value

4.4.4 TDSCDMA path-loss calibration

4.4.4.1 Configuration File

Parameter	Description
[TDSCDMA RSSI table]	
TDSCDMA_RSSI_CAL_MODE_NUM	The number of LNA mode used in calibration

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TDSCDMA_RSSI_P_DL_HIGH_MODE	downlink power used in LNA high mode
TDSCDMA_RSSI_P_DL_MID_MODE	downlink power used in LNA middle mode
TDSCDMA_RSSI_P_DL_LOW_MODE	downlink power used in LNA low mode
1850-1930MHz_MAX_RX_LOSS	the maximum value for 1850-1930MHz RX loss calibration result
1850-1930MHz_MIN_RX_LOSS	the minimum value for 1850-1930MHz RX loss calibration result
2010-2025MHz_MAX_RX_LOSS	the maximum value for 2010-2025MHz RX loss calibration result
2010-2025MHz_MIN_RX_LOSS	the minimum value for 2010-2025MHz RX loss calibration result
1930-1990MHz_MAX_RX_LOSS	the maximum value for 1930-1990MHz RX loss calibration result
1930-1990MHz_MIN_RX_LOSS	the minimum value for 1930-1990MHz RX loss calibration result
2570-2620MHz_MAX_RX_LOSS	the maximum value for 2570-2620MHz RX loss calibration result
2570-2620MHz_MIN_RX_LOSS	the minimum value for 2570-2620MHz RX loss calibration result
2300-2400MHz_MAX_RX_LOSS	the maximum value for 2300-2400MHz RX loss calibration result
2300-2400MHz_MIN_RX_LOSS	the minimum value for 2300-2400MHz RX loss calibration result

4.4.5 TDSCDMA TPC calibration

4.4.5.1 Configuration File

Parameter	Description
[TDSCDMA TPC table]	
1850-1930MHz_MAX_POWER_H	Maximum PA power value of PA high mode for 1850-1930MHz (dBm)
1850-1930MHz_MAX_POWER_M	Maximum PA power value of PA middle mode for 1850-1930MHz (dBm)
1850-1930MHz_MAX_POWER_L	Maximum PA power value of PA low mode for 1850-1930MHz (dBm)
1850-1930MHz_MIN_POWER_H	Minimum PA power value of PA high mode for 1850-1930MHz (dBm)
1850-1930MHz_MIN_POWER_M	Minimum PA power value of PA middle mode for 1850-1930MHz (dBm)
1850-1930MHz_MIN_POWER_L	Minimum PA power value of PA low mode for 1850-1930MHz (dBm)
2010-2025MHz_MAX_POWER_H	Maximum PA power value of PA high mode for 2010-2025MHz (dBm)
2010-2025MHz_MAX_POWER_M	Maximum PA power value of PA middle mode for 2010-2025MHz (dBm)
2010-2025MHz_MAX_POWER_L	Maximum PA power value of PA low mode for 2010-2025MHz (dBm)
2010-2025MHz_MIN_POWER_H	Minimum PA power value of PA high mode for 2010-2025MHz (dBm)
2010-2025MHz_MIN_POWER_M	Minimum PA power value of PA middle mode for 2010-2025MHz (dBm)
2010-2025MHz_MIN_POWER_L	Minimum PA power value of PA low mode for 2010-2025MHz (dBm)

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1930-1990MHz_MAX_POWER_H	Maximum PA power value of PA high mode for 1930-1990MHz (dBm)
1930-1990MHz_MAX_POWER_M	Maximum PA power value of PA middle mode for 1930-1990MHz (dBm)
1930-1990MHz_MAX_POWER_L	Maximum PA power value of PA low mode for 1930-1990MHz (dBm)
1930-1990MHz_MIN_POWER_H	Minimum PA power value of PA high mode for 1930-1990MHz (dBm)
1930-1990MHz_MIN_POWER_M	Minimum PA power value of PA middle mode for 1930-1990MHz (dBm)
1930-1990MHz_MIN_POWER_L	Minimum PA power value of PA low mode for 1930-1990MHz (dBm)
2570-2620MHz_MAX_POWER_H	Maximum PA power value of PA high mode for 2570-2620MHz (dBm)
2570-2620MHz_MAX_POWER_M	Maximum PA power value of PA middle mode for 2570-2620MHz (dBm)
2570-2620MHz_MAX_POWER_M	Maximum PA power value of PA low mode for 2570-2620MHz (dBm)
2570-2620MHz_MIN_POWER_H	Minimum PA power value of PA high mode for 2570-2620MHz (dBm)
2570-2620MHz_MIN_POWER_M	Minimum PA power value of PA middle mode for 2570-2620MHz (dBm)
2570-2620MHz_MIN_POWER_L	Minimum PA power value of PA low mode for 2570-2620MHz (dBm)
2300-2400MHz_MAX_POWER_H	Maximum PA power value of PA high mode for 2300-2400MHz (dBm)
2300-2400MHz_MAX_POWER_M	Maximum PA power value of PA middle mode for 2300-2400MHz (dBm)
2300-2400MHz_MAX_POWER_L	Maximum PA power value of PA low mode for 2300-2400MHz (dBm)
2300-2400MHz_MIN_POWER_H	Minimum PA power value of PA high mode for 2300-2400MHz (dBm)
2300-2400MHz_MIN_POWER_M	Minimum PA power value of PA middle mode for 2300-2400MHz (dBm)
2300-2400MHz_MIN_POWER_L	Minimum PA power value of PA low mode for 2300-2400MHz (dBm)
1850-1930MHz_MAX_FREQ_COMP	Maximum output power compensation for 1850-1930MHz (dB)
1850-1930MHz_MIN_FREQ_COMP	Minimum output power compensation for 1850-1930MHz (dB)
2010-2025MHz_MAX_FREQ_COMP	Maximum output power compensation for 2010-2025MHz (dB)
2010-2025MHz_MIN_FREQ_COMP	Minimum output power compensation for 2010-2025MHz (dB)
1930-1990MHz_MAX_FREQ_COMP	Maximum output power compensation for 1930-1990MHz (dB)
1930-1990MHz_MIN_FREQ_COMP	Minimum output power compensation for 1930-1990MHz (dB)
2570-2620MHz_MAX_FREQ_COMP	Maximum output power compensation for 2570-2620MHz (dB)
2570-2620MHz_MIN_FREQ_COMP	Minimum output power compensation for 2570-2620MHz (dB)
2300-2400MHz_MAX_FREQ_COMP	Maximum output power compensation for 2300-2400MHz (dB)
2300-2400MHz_MIN_FREQ_COMP	Minimum output power compensation for 2300-2400MHz (dB)

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4.4.6 TDSCDMA NSFT

4.4.6.1 Configuration File

Parameter	Description
[TDSCDMA NSFT Test Case_X]	
Channel	UARFCN setting
Cable Loss (dB)	cable loss (defined as loss, negative sign is ignored)
Max Power Average High (dBm)	upper limit for Max power test
Max Power Average Low (dBm)	lower limit for Max power test
Min Power Average High (dBm)	uppler limit for min power test
IQ OriginOffset (dB)	upper limit for IQ OOS
ACLR 1.6M (dB)	upper limit for ACLR 1.6M test
ACLR 3.2M (dB)	upper limit for ACLR 3.2M test
BER Level (dBm)	cell power used for BER test
BER Limit (%)	limit of BER
EVM RMS Max	upper limit limit of maximum EVM (RMS) value
Frequency Error Peak (Hz)	upper limit of peak frequency error
OBW MAX	upper limit of OBW test
OFF Power (dBm)	upper limit of OFF power test
ILPC REL1POW (dB)	upper limit of ILPC REL1POW
Case_1 is defined as the first case, the user can add cases up to 80 cases for TDSCDMA NSFT by adding the CFG setting in [TDSCMA NSFT Test Cas_2] … to [TDSCDMA NSFT Test Case_80]	

4.5 Other Calibration

4.5.1 ADC calibration

1. Command output voltage of power supply to ADC_V1.
2. Measure output voltage of power supply. The output voltage is named as ADC_Measure_Voltage_0.
3. Command the target to do ADC measurement using BATTERY_CHANNEL and CHARGER_CHANNEL. The measure count is ADC_MEASUREMENT_COUNT in configuration file. The measurement result is BATTERY_ADC_Output_0 and CHARGER_ADC_Output_0.
4. Command output voltage of power supply to ADC_V2.
5. Measure output voltage of power supply. The output voltage is named as ADC_Measure_Voltage_1.
6. Command the target to do ADC measurement using BATTERY_CHANNEL and CHARGER_CHANNEL. The measure count is ADC_MEASUREMENT_COUNT in configuration file. The measurement result is BATTERY_ADC_Output_1 and CHARGER_ADC_Output_1.
7. Calculate ADC slope and offset of BATTERY_CHANNEL and CHARGER_CHANNEL by the following formula

   slope(BATTERY_CHANNEL) = (ADC_Measure_Voltage_1 - ADC_Measure_Voltage_0) / (BATTERY_ADC_Output_1 - BATTERY_ADC_Output_0)

   offset(BATTERY_CHANNEL) = ADC_Measure_Voltage_0 - slope(BATTERY_CHANNEL)* BATTERY_ADC_Output_0

   slope(CHARGER_CHANNEL) = (ADC_Measure_Voltage_1 - ADC_Measure_Voltage_0) / (CHARGER _ADC_Output_1 - CHARGER _ADC_Output_0)

   offset(CHARGER_CHANNEL) = ADC_Measure_Voltage_0 - slope(CHARGER_CHANNEL) * CHARGER_ADC_Output_0
8. Apply slope and offset of all other ADC channel except CHARGER_CHANNEL to slope(BATTERY_CHANNEL) and offset(BATTERY_CHANNEL).

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9. Save slope and offset of all ADC channel to NVRAM.
10. Get CHARGER_ADC_Predict_Voltage1 and BATTERY_ADC_Predict_Voltage1 by the following formula
    BATTERY_ADC_Predict_Voltage1 = (offset(BATTERY_CHANNEL) + slope(BATTERY_CHANNEL) *BATTERY_ADC_Output_1) /1000000.0
    CHARGER_ADC_Predict_Voltage1 = (offset(CHARGER_CHANNEL) + slope(CHARGER_CHANNEL) * CHARGER_ADC_Output_1) /1000000.0
11. Calculate current difference by the following formula
    current_difference = |BATTERY_ADC_Predict_Voltage - CHARGER_ADC_Predict_Voltage| / ADC_RESISTANCE
    If current_difference is large than MAX_CURRENT_DIFFERENCE, ADC current difference check fail, aborts ADC check procedure. Otherwise, ADC current difference check result is passed.
    Note: ADC_RESISTANCE, MAX_CURRENT_DIFFERENCE is specified in configuration file.
12. Command output voltage of power supply to ADC_CHECK_VOLTAGE, ADC_CHECK_VOLTAGE is specified in configuration file.
13. Measure output voltage of power supply. The output voltage is named as ADC_Measure_Voltage_2.
14. Command the target to do ADC measurement using BATTERY_CHANNEL. The measure count is ADC_MEASUREMENT_COUNT in configuration file. The measurement result is BATTERY_ADC_Output_2.
15. Get BATTERY_ADC_Predict_Voltage2 and CHARGER_ADC_Predict_Voltage2 by the following formula
    BATTERY_ADC_Predict_Voltage2 = (offset(BATTERY_CHANNEL) + slope(BATTERY_CHANNEL) *BATTERY_ADC_Output_2) /1000000.0
16. Calculate the voltage difference by the following formula
    voltage_difference = | BATTERY_ADC_Predict_Voltage2 - ADC_Measure_Voltage_2|
    If voltage_difference is large than MAX_VOLTAGE_DIFFERENCE, ADC voltage difference check is fail, Otherwise, ADC current difference check pass.

4.5.1.1 The Aux. ADC is cabliraed before shipment

The following table shows the chips which Aux. ADC is calibrated before shipment. Therefore, the ADC calibration can be skipped in these chips. Otherwise, the warning window will pop-out to notify user about this information when checking the ADC calibration check box as shown in Figure 528.

Chip	Aux. ADC is calibrated before shipment
MT6255	O

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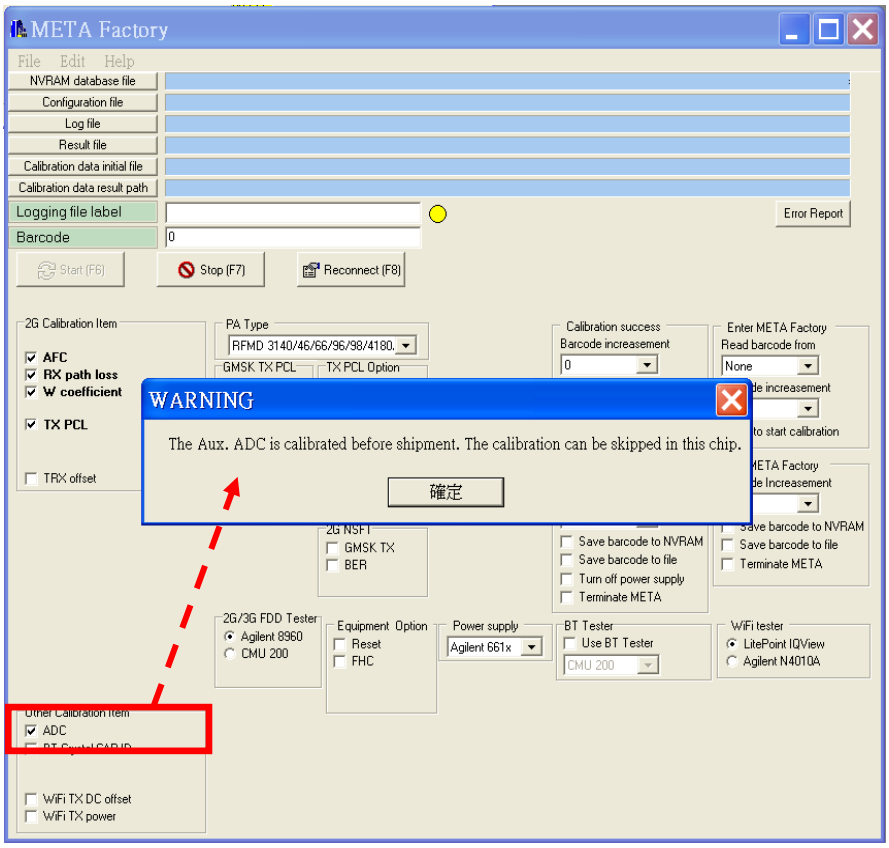

Figure 527 ***Check [ADC check box] pop-out warning window which shows that Aux ADC is calibrated***

Note:

- The value of ADC_V1, ADC_V2, ADC_CHECK_VOLTAGE, MAX_BATTERY_ADC_SLOPE, MIN_BATTERY_ADC_SLOPE, MAX_BATTERY_ADC_OFFSET, MIN_BATTERY_ADC_OFFSET, BATTERY_CHANNEL, CHARGER_CHANNEL, ADC_RESISTANCE, MAX_VOLTAGE_DIFFERENCE, MAX_CURRENT_DIFFERENCE and ADC_MEASUREMENT_COUNT is specified in section [ADC table] of the configuration file.

4.5.2 CV calibration

Const voltage (CV) calibration is only applicable for those baseband chips that have been integrated with PMIC chips such as MT6223. The procedure of CV calibration is described as follows:

1. Initialize power supply.
2. Configure power supply output voltage = 4.2 V and current limit = CURRENT_LIMIT mA, where CURRENT_LIMIT is specified in configuration file.
3. Write charger control register, enable charger mode.
4. Change CV calibration register and read CV flag from charger status register repeat. Stop change CV calibration register repeat when CV flag equal to 1. Record CV calibration register value as PMU and step as CvStep.
5. Write PMU to NVRAM.
6. If CvStep is in the rage MIN_CV_STEP ~ MAX_CV_STEP, calibration result is “passed.” Otherwise, calibration result is “failed.”

Note:

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The value of CV calibration register is as follows:

```
cv_cal_reg[32][3] =
  {
    {0, 1, 4}, // step 0
    {0, 1, 5}, //  1
    {0, 1, 6}, //  2
    {0, 1, 7}, //  3
    {0, 1, 0}, //  4
    {0, 1, 1}, //  5
    {0, 1, 2}, //  6
    {0, 1, 3}, //  7
    {0, 0, 4}, //  8
    {0, 0, 5}, //  9
    {0, 0, 6}, // 10
    {0, 0, 7}, // 11
    {0, 0, 0}, // 12
    {0, 0, 1}, // 13
    {0, 0, 2}, // 14
    {0, 0, 3}, // 15
    {1, 1, 4}, // 16
    {1, 1, 5}, // 17
    {1, 1, 6}, // 18
    {1, 1, 7}, // 19
    {1, 1, 0}, // 20
    {1, 1, 1}, // 21
    {1, 1, 2}, // 22
    {1, 1, 3}, // 23
    {1, 0, 4}, // 24
    {1, 0, 5}, // 25
    {1, 0, 6}, // 26
    {1, 0, 7}, // 27
    {1, 0, 0}, // 28
    {1, 0, 1}, // 29
    {1, 0, 2}, // 30
    {1, 0, 3}  // 31
  };
```

4.5.3 WiFi Crystal CAP ID calibration

1. Set CAP ID (WiFi_MAX_CAP_ID, and WiFi_MIN_CAP_ID in *.cfg file separately), which is stored in MCR 0x401 bit 21~27 via META_DLL_interface: META_WiFi_MACReg32Read_r() and META_WiFi_MACReg32Write_r().
2. Issue the TX command to the target with the parameter of WiFi_TX_RATE, WiFi_Center_Freq_MHz, and WiFi_TX_GAIN. WiFi_Center_Freq_MHz is 802.11B_CAL_CHANNEL or 802.11G_CAL_CHANNEL is specified in the configuration file. If 802.11B TX capability is supported, WiFi_TX_RATE should be CCK_CAL_RATE. Otherwise, WiFi_TX_RATE should be OFDM_CAL_RATE.
3. Command the Wi-Fi tester to measure the frequency error value; e.g.
   WiFi_MAX_CAP_ID → Freq_Err_Meas_H
   WiFi_MIN_CAP_ID → Freq_Err_Meas_L
7. Check if (Freq_Err_Meas_L * Freq_Err_Meas_H > 0). If yes, stop the operation.
   If no, keep on adjusting the CAP ID to find the minimum frequency error (Repeat Steps 1~3)

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8. Check if the minimum frequency error can meet the WiFi_Min_Freq_Error_PPM specified in *.cfg file.
9. Write the CAP ID into target's NVRAM via the META-DLL interface.
10. Write the CAP ID into the *.cal file.

4.5.4 WiFi Internal Sensor calibration

1. Set MCR: 0x178 bit31 --> 0 (turn off)
2. Set MCR: 0x178 bit31 --> 1 (turn on)
3. Set MCR: 0x178 bit12~27 --> 0x03F
4. Query if MCR: 0x178 bit28 == 0, if it is 1, means busy, keep querying!
5. Query MCR: 0x178 bit0~5 --> raw_data[n], n starts from 0
6. Set MCR: 0x178 bit30 --> 1 (do this operation twice)
7. Repeat Steps 5~6 for get raw_data[1~3]
8. Calculate the average of raw_data[0~3]
9. Store the results into NVRAM and *.cal file
10. Set MCR: 0x178 bit31 --> 0 (turn off)

4.5.5 WiFi TX DC offset calibration

1. Trigger target WiFi module to do TX DC offset calibration via META_DLL interface.
2. Get WIFi TX DC offset calibration result from target via META_DLL interface.
3. Save WiFi TX DC offset calibration result through META_DLL interface.

4.5.6 WiFi TX power calibration

1. Issue the TX command to target with the parameter of XXX_CAL_CHANNEL, XXX_CAL_RATE. XXX_CAL_CHANNEL is 802.11B_CAL_CHANNEL or 802.11G_CAL_CHANNEL are specified in configuration file. If 802.11B TX power is calibrated, XXX_CAL_RATE should be CCK_CAL_RATE. Otherwise, XXX_CAL_RATE should be OFDM_CAL_RATE.
2. Command the WiFi tester to measure the received MS uplink power, and check whether it is in the range specified by the configuration file.
3. Follow 2, if it is in the range. Jump to step 4. Otherwise, adjust scale factor s as $s + \Delta s$ $\Delta s = c_n \times (P_{wanted} - P_{meas})$, where s is the range of 0~63 and c_n is unique for each WiFi TX power calibration.
4. Repeat step 1~3 for each channel XXX_CAL_CHANNEL specified in configuration file.
5. Repeat step 1~4 for each band, until all band WiFi_Support specified in configuration file are complete.
6. Interpolate WiFi TX power DAC for those channels that is not calibrated.
7. Write WiFi TX power DAC to target NVRAM via META-DLL interface.
8. Check TX power of each channel is inside the range. If power of each PCL is inside the range, TX power calibration check result is passed. Otherwise, TX power calibration check result is fail. Where channels are 802.11B_CHECK_CHANNEL or 802.11G_CHECK_CHANNEL specified in configuration file. If 802.11B TX power is checked, CCK_CHECK_RATE is used. Otherwise, OFDM_CHECK_RATE is used.
9. If WiFi ALC is support, get ALC value from target WiFi module at step 3.
10. Interpolate WiFi ALC value for those channels that are not calibrated.
11. Write ALC to target NVRAM via META-DLL interface.

Note:

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- c_n is the value of CCK_C or OFDM_C in configuration file. If 802.11B TX power is calibrated, CCK_C is used. Otherwise, OFDM_C is used.
- Pwanted is the value of CCK_WANTED_P or OFDM_WANTED_P in configuration file. If 802.11B TX power is calibrated, CCK_WANTED_P is used. Otherwise, OFDM_WANTED_P is used.
- Pmeas is TX power measurement by WiFi equipment such as Litepoint IQView or Agilent N4010A.
- The initial value of s is from [WiFi TX power 2.4G] or [WiFi TX power 5G] sections of calibration data initial file.
- The range at step 2 is CCK_MIN_P <= range <= CCK_MAX_P or OFDM_MIN_P <= range <= OFDM_MAX_P. These MAX_P and MAX_P values are read from configuration file.

4.5.7 BT crystal CAP ID calibration

BT module must be powered on via META_DLL interface before calibration starts.

4.5.7.1 With BT tester

The following calibration algorithm can be applied to all BT chips.

1. Configure BD address, downlink power, TX test mode, and TX channel of BT tester.
2. If enquiry is enabled in configuration file, trigger BT tester to enquiry BT module.
3. Write CAP_ID1 to target NVRAM via META-DLL interface.
4. Force BT module to enter test mode via META-DLL interface.
5. Command BT tester to connect BT module.
6. Read frequency accuracy freq_err1 from BT tester.
7. Command BT tester to release connection.
8. Repeat steps 3~7. CAP_ID2 is written to target NVRAM at step 3. And frequency accuracy freq_err2 is read from BT tester at step 6.
9. Evaluate optimal CAP_ID via the following formula:
CAP_ID = CAP_ID1 - 1.0* freq_err1*(CAP_ID1- CAP_ID2)/(CAP_ID1 - CAP_ID2).
10. Write CAP_ID to target NVRAM via META-DLL interface.
11. Force BT module to enter the test mode via the META-DLL interface.
12. Command BT tester to connect to the BT module.
13. Read frequency accuracy freq_err from BT tester.
14. Command BT tester to release connection.
15. Check if freq_err is in the range specified in the configuration file. If freq_err is in the range, calibration result is “passed.” Otherwise, calibration result is “failed.”

Note:

- BT downlink power and BD address at step 1 is specified in [BT common] section of configuration file.
- Enquiry enabled at step 2 is specified in BT common section of configuration file.
- Uplink channel of BT tester, CAP_ID1 and CAP_ID2 is specified in [BT crystal CAP ID table] of configuration file.
- The range at step 15 is value of BT_CRYSTAL_MAX_FREQ_ACCURACY specified in [BT crystal CAP ID table] of configuration file.

4.5.7.2 Without BT tester

The following calibration algorithm cannot be applied to MT6601.
1. Set the following initial value:
   min_poll_count_diff = 800000
2. Read initial cal_cap_id from [BT Info] section of calibration data initial file.

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3. Enable PCM SYNC signal of target via META-DLL interface.
4. Set cal_cap_id to target via META-DLL interface.
5. Send start BT crystal clock command to target via META-DLL interface.
6. Get poll_count from target via META-DLL interface.
7. Calculate poll_count_diff = abs(poll count - 400000). If (poll_count_diff < min_poll_count_diff), do the following setting.
   min_poll_count_diff = poll_count_diff
   min_poll_count = poll_count
   min_cap_id = cal_cap_id
8. Adjust last_cap_id or first_cap_id by the following statement
   If (poll_count < 400000), last_cap_id = cal_cap_id - 1;
   Else if (poll_count > TARGET_POLL_COUNT), first_cap_id = cal_cap_id + 1;
9. Go to step 10 if the following condition occur. Otherwise, go to step 4.
   first_cap_id >= last_cap_id or
   pre_cap_id == cal_cap_id or
   TARGET_POLL_COUNT == poll_count
10. Wrtie min_cap_id to target NVRAM via META_DLL interface.
11. If (min_poll_count > MAX_POLL_COUNT) or (min_poll_count < MIN_POLL_COUNT), the calibration result is "passed." Otherwise, the calibration result is "passed," where MAX_POLL_COUNT and MIN_POLL_COUNT are specified in [BT crystal CAP ID table] section of the configuration file.

4.6 Start calibration and NSFT

After 5 files are opened and set, user must click [Start] button to start auto calibration. User can click [Stop] button to stop current calibration procedure. There are many options for user to choose, these option are as follows:

- Initial value: this group indicates the initial RF and ADC calibration parameter from flash or ini file.
- Calibration item: this group indicates the calibration items, they are RF calibration and ADC calibration.
- NSFT: this group indicates the NSFT test items. The NSFT will start after all the calibration item is successfully done.
- TX PCL calibration: this group indicates the TX PCL calibration algorithm used, they are 3 PCL or full PCL calibration.
- Power supply: this group indicates the power supply type used, they are Agilent 663x2 or Agilent 661x series power supply.
- Enter META Factory: this group indicate items will be done when enter META factory mode, these items include read barcode from, barcode increase, auto start calibration.
- Exit META Factory: this group indicate items will be done when exit META factory mode, these items include barcode increase, save barcode to NVRAM, save barcode to file, terminate META.
- Calibration success: this group indicate items will be done when calibration is successful, these items include barcode increase, save barcode to NVRAM, save barcode to file, turn off power supply, terminate META.
- Calibration fail: this group indicate items will be done when calibration is fail, these items include barcode increase, save barcode to NVRAM, save barcode to file, turn off power supply, terminate META.

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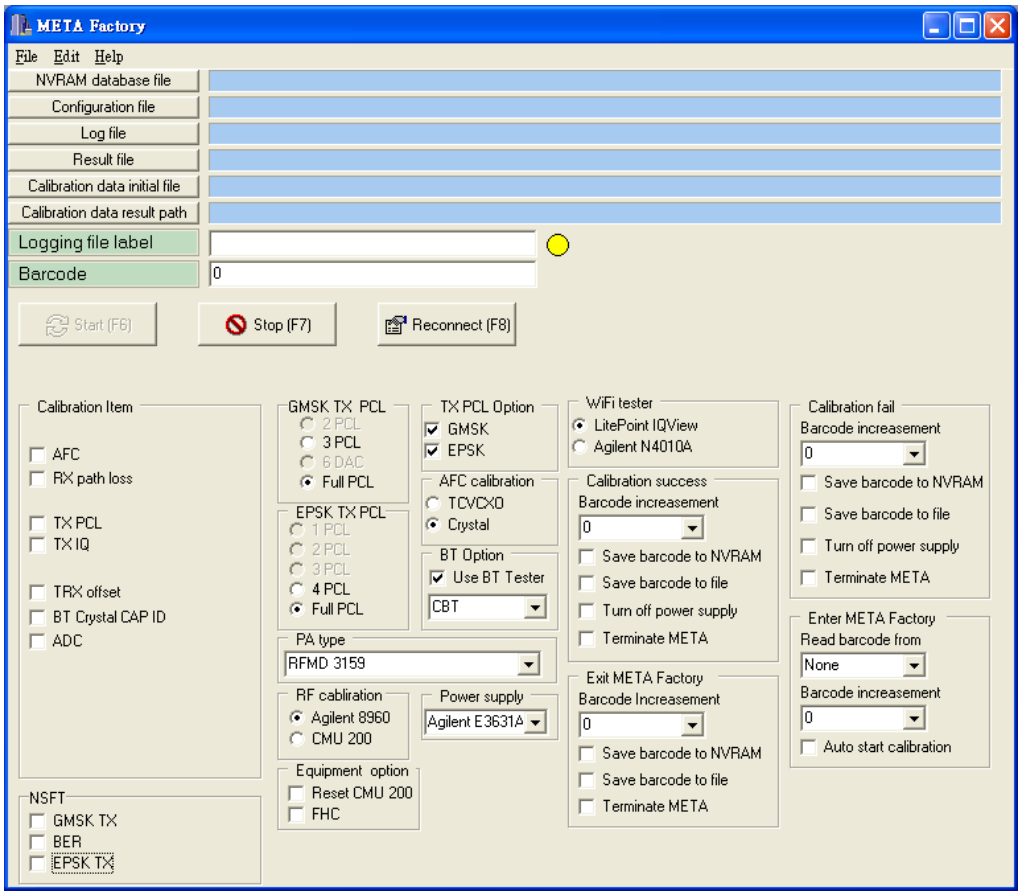

Figure 528 ***Click [Start] button to start auto calibration and NSFT***

Note: User can read the logging file after calibration done.

[NSFT GMSK TX]
; test channel number
TEST_GSM850_CHANNEL_NUM = 3
; GMSK TX measurements enabled bits, each corresponding to a PCL in the PCL_IN_XXX_ARFCN_<n>
; the number of each enabled bits settings will be the same as the PCL number in each ARFCN
GMSK_TX_PVT_Enabled=1,

User can click [Reconnect] button to reconnect another mobile with META. The Boot ROM negotiation procedure will be re-initiated.

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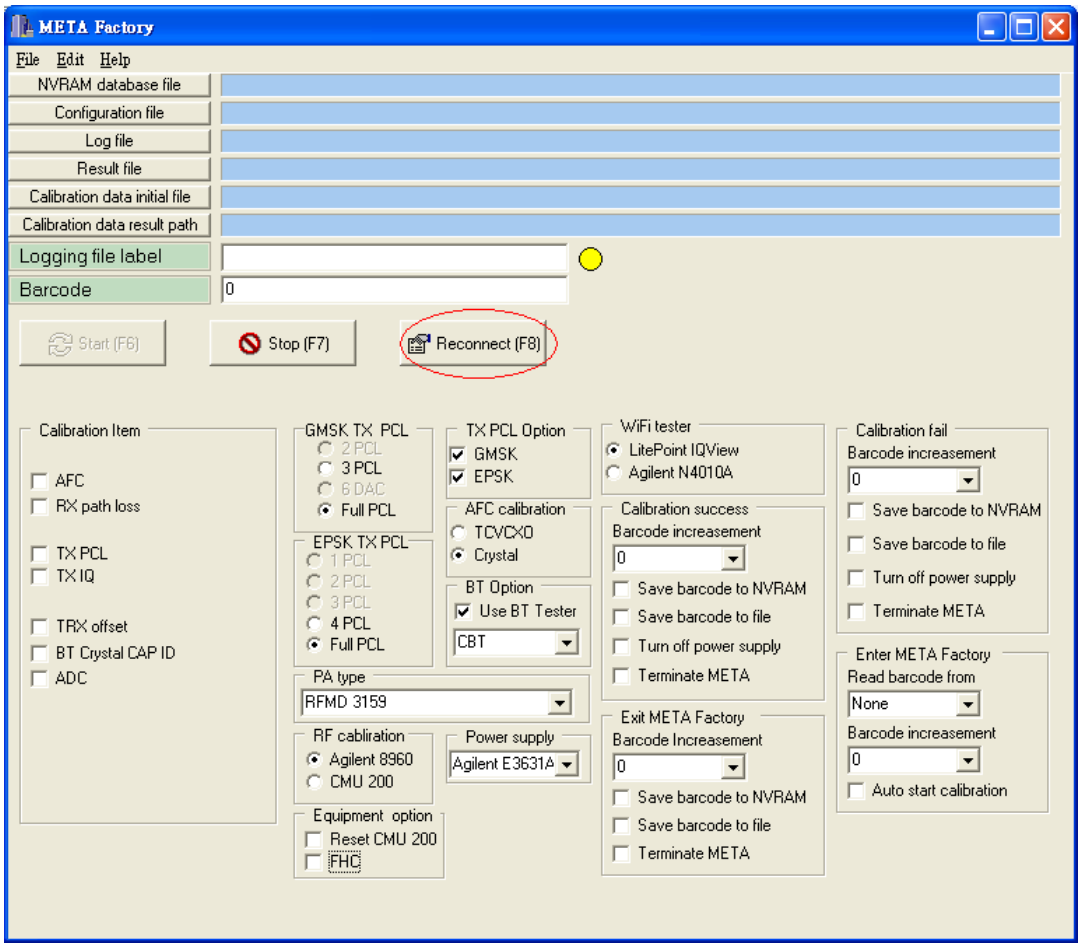

Figure 529 ***Click [Reconnect] button to reconnect META with other mobile***

4.7 Calibration Trouble shooting

Sometimes the calibration will fail due to UART cable connection unstable or some other errors happened during calibration. For further analysis, the Configuration file, Log file, and Calibration data initial file used in the calibration are mandatory.

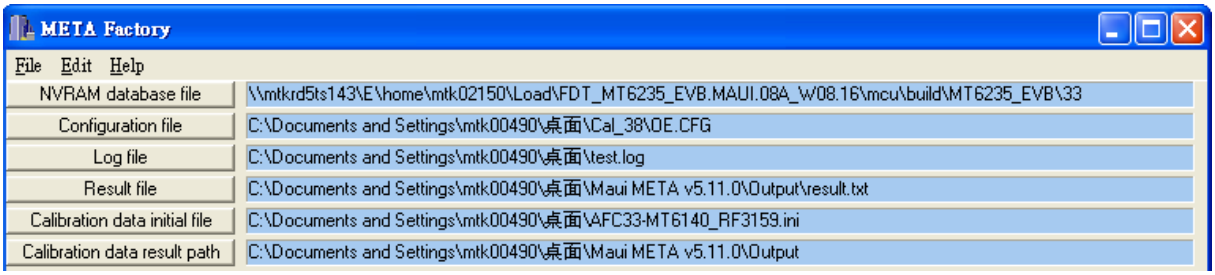

Figure 530 ***Calibration related file settings***

The META DLL log is also mandatory and the path is shown in the META main form.

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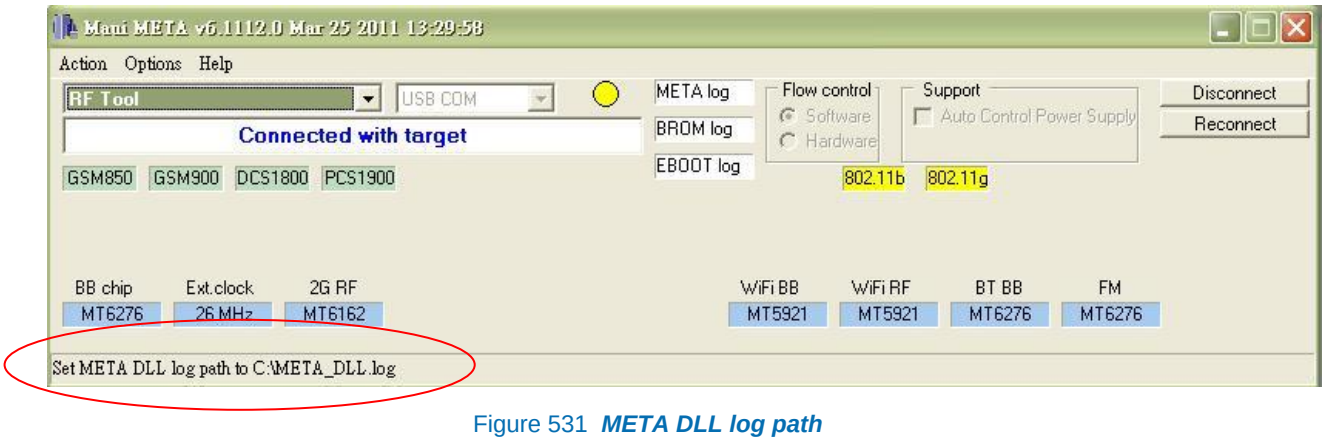

Figure 531 ***META DLL log path***

The platform related information such as BB chip, RF chip, and other peripherials is also needed (as shown in Figure 532)

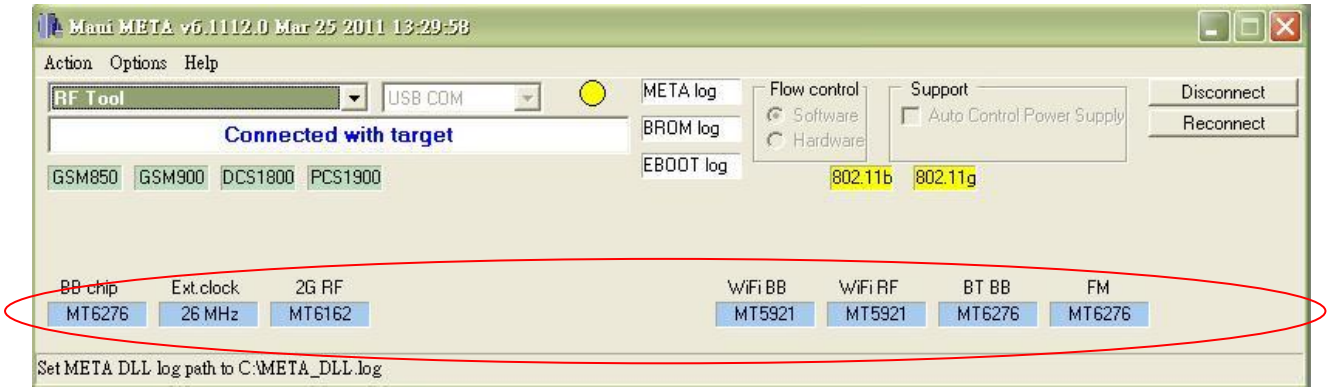

Figure 532 ***Platform hardware information***

For target software issue reproduce, the software version is also needed. Please provide the software load version information. (The software version information can be read from the “Get Version” function in META tool as shown in Figure 387).

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