



**BM83 - MCHP OTA DSP Tuning
- Application Note**

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1 INTRODUCTION

This document describes the on-the-fly DSP tuning feature in DSP GUI of the Configuration Tool. The tool shall allow the user to edit the Configuration Parameters and apply the same on the DUT. The configuration tool now shall be able to connect to the DUT over BLE and apply the parameters to the DSP, using DSP tuning procedure, in AUDIO/VOICE mode. Using this, the users can tune the DSP audio parameters and compare the audio performance, without having to reset the DUT. Below are the requirements of this feature

➔ Reset Parameters

- Resets the configuration data to Flash Configuration Data.

Note: To reset only selective set of parameters, the PC tool, can use “Write Parameters” / “Tune DSP Params” with the original values to the DUT.

➔ Reset DSP

- Resets the DSP.

Note: The parameters are not reset as part of this procedure. The PC tool user needs to explicitly do “Reset Parameters”

➔ Reset DUT

- Resets the DUT.

Note: The parameters are reset as part of this procedure. The PC tool user needs to explicitly do “Save Parameters”, if required to save the parameters to flash.

➔ Save Parameters to Flash

- Save the configuration parameters to Flash (runtime section). This allows the parameters to be available after power cycle also.

➔ Restore Factory Default Settings

- Re-store the Configuration Data back to Factory Settings. This also resets the DUT after restoring the Configuration Data. The PC tuning tool should re-connect to the DUT after power-cycle.

➔ Tune DSP Params

- Used for DSP tuning, this command is used to apply the DSP tuning parameters to the DSP, and to the Configuration Data Store, on-the-fly.

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2 DYNAMIC OTA DSP TUNING

This feature can be used to Tune DSP parameters dynamically in Audio / Voice mode to check and compare performance. Following parameters are supported.

2.1 Voice DSP Tuning Parameters

The Voice functions are used to suppress ambient noise, echo and other call interferences during voice calls using following features to increase the quality of voice.

- High-pass filter for SPK/ MIC paths (HPF) — Remove low-frequency board/background noise
- Noise Reduction (NR)
- Echo Cancellation (EC)/ Suppression (ES) — Lin-ear/ non-linear echo cancellations
- Comfort noise insertion for MIC paths — Insert comfort noise to maintain stable noise level
- 5-band EQs for SPK/MIC paths — Compensate frequency imperfection
- MIC and Speaker Gain Controller
- Equalizer

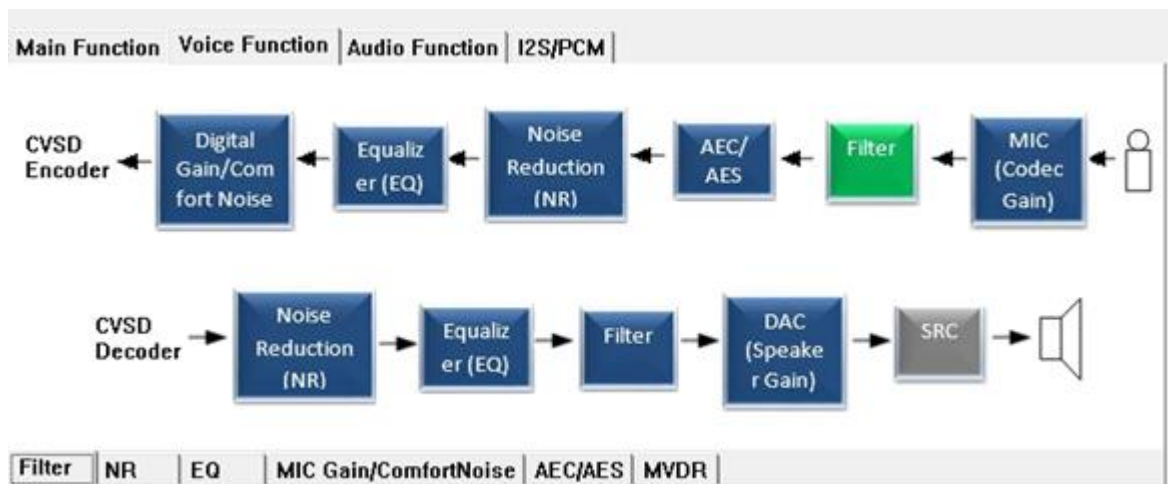


Figure 1 Voice Parameters

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2.2 Audio DSP Tuning Parameters

The Audio processing is used to enhance the audio listening experience for following functionalities:

- 5-band EQ for SPK
- Multi-band dynamic range compression (MB-DRC)
- Virtual bass (VB) enhancement — Enhance the bass using psychoacoustic algorithm
- Audio widening (AW) process — Make speakers placed close apart sound like being placed far apart from each other

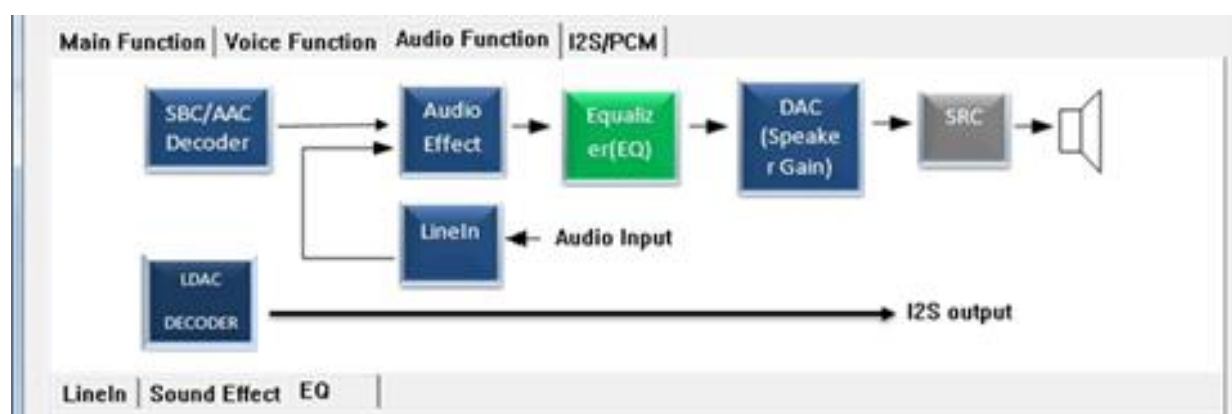


Figure 2 Audio Parameters

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3 OTA DSP TUNING SETUP AND PROCEDURE

3.1 Setup Requirements

Select BM70/BM70/71 PICTail board as shown below and connect it over the UART cable to the PC. Connected BM70/BM70/71 board is used as a dongle at PC side to OTA tune DUT over BLE connection. Below are the steps to setup the BM70/71 PICTail board.

1. Extract the BM70/71 FW and UI tool provide along with the BM83 SDK (**@ Tools -> Config Tool -> BM70 FW and Tool for OTA DSP Tuning**)
2. Open **IS187x_202_BLEDK3v2.00_UI v2.13** tool and download the FW on to the BM70/71 PICTail board. Also, put the BM70/71 dongle into Manual Pattern mode using the **IS187x_202_BLEDK3v2.00_UI v2.13** tool
3. Reset the board and launch the OTA DSP tuning tool through BM83 Config tool to connect to the BM70/71 board for OTA DSP tuning.

For details on how to download the FW and use the UI tool, please refer to the [BM70/71 user guide](#)



Figure 3 BM70/71 PICTail board

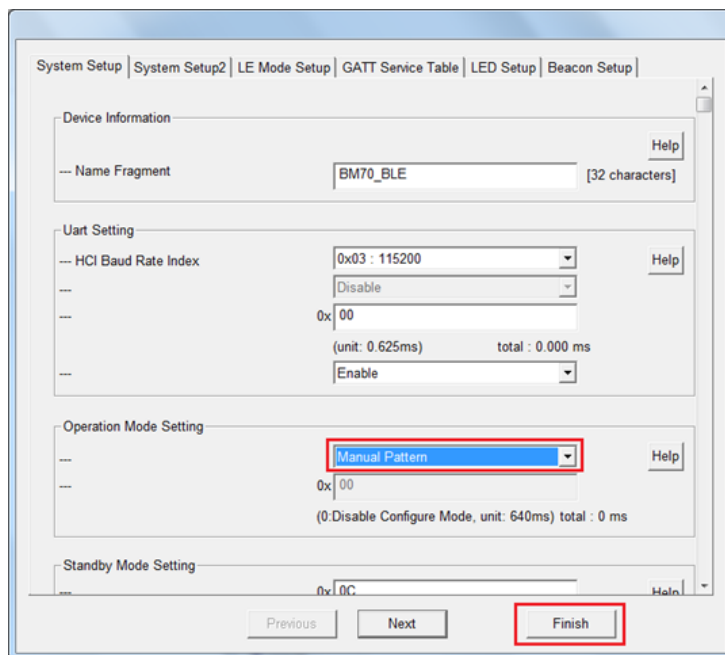


Figure 4 BM70/71 Manual Pattern mode Setting

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3.2 BLE Connection (OTA DSP tuning) Setup

STEP 1: Click on **BLE Settings** menu in menu bar -> **UART and BLE Connect** to open OTA tuning dialog box

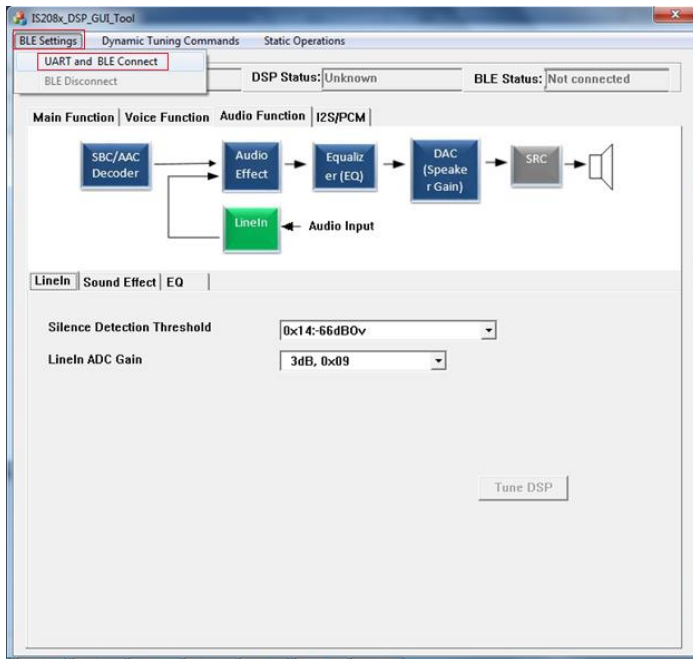


Figure 5 OTA tuning setup dialog launch option in menu bar

STEP 2: In OTA tuning dialog select BM70/71 dongles comport and appropriate baud rate and click on connect to establish UART connection with BM70/71 dongle. Once the connection is established you could see the Link status and Tuning status in the status combo boxes

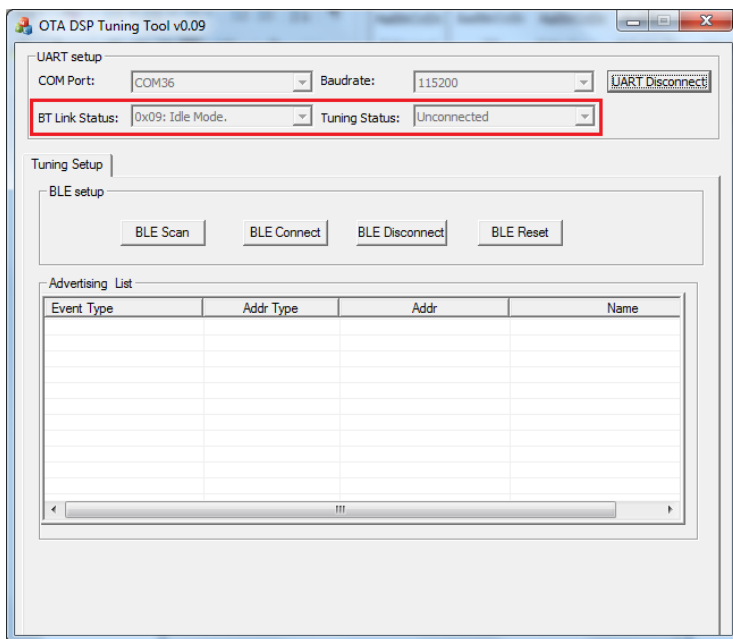


Figure 6 UART connection setup with BM70/71 dongle

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STEP 3: Once connection is setup BLE scan, BLE connect, BLE disconnect and BLE reset button will be enabled. Click on BLE scan button to get the list of advertising devices.

NOTE: In case of BM70 dongle is not responsive and not able to scan, do software reset by clicking on BLE Reset button and hard reset by clicking on Reset button in BM70/71 board, and try once again scanning. And click on BLE Reset button to enable scan button if scan button is not enabled at any point of time but this will terminate your BLE connection.

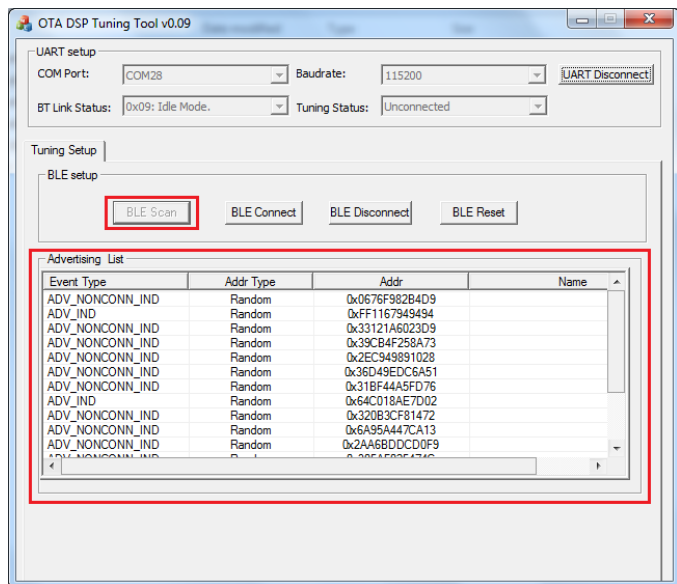


Figure 7 Scan for BM83 OTA DSP Tuning devices

STEP 4: To setup the OTA tuning connection select the device in advertising list and click on BLE Connect button as shown in Figure 38(a). Once the connection is setup you will get pop up saying connection is setup and status bar in main tool window and OAT Tuning dialog gets updated Figure 38(b).

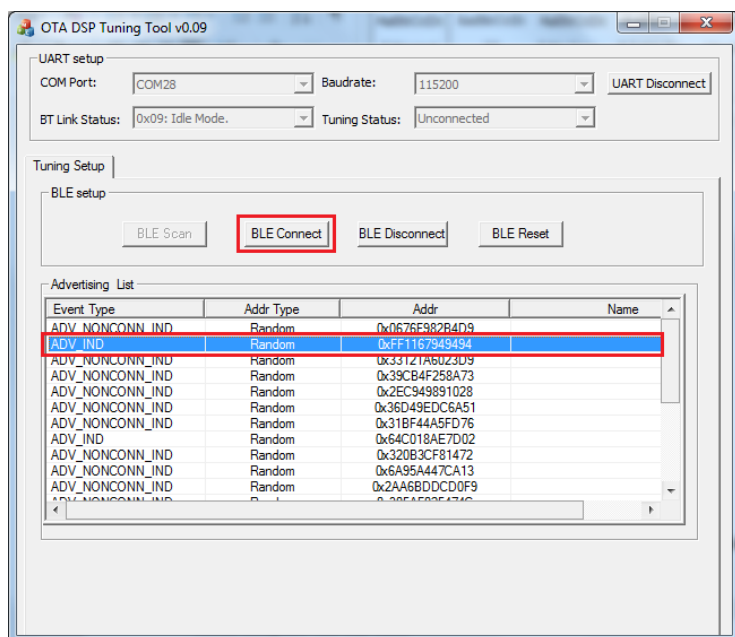


Figure 8 BLE Connection setup.

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STEP 5: Once the Connection is setup, status bar in the main window will get updated showing current status of BLE, DUT and DSP. And reads the device flash and updates GUI with read flash data of BM83

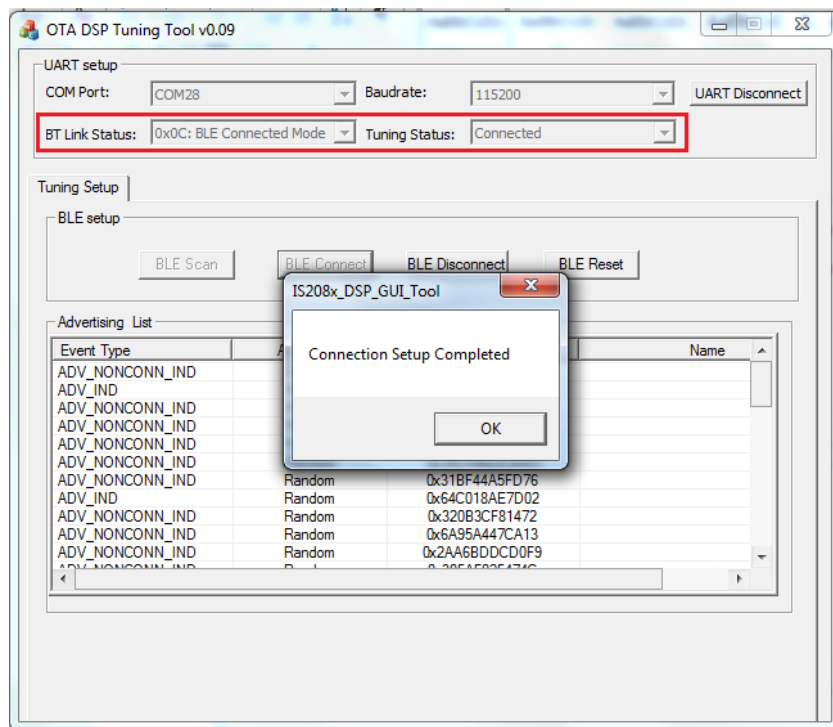


Figure 9 BLE Connection Setup completed

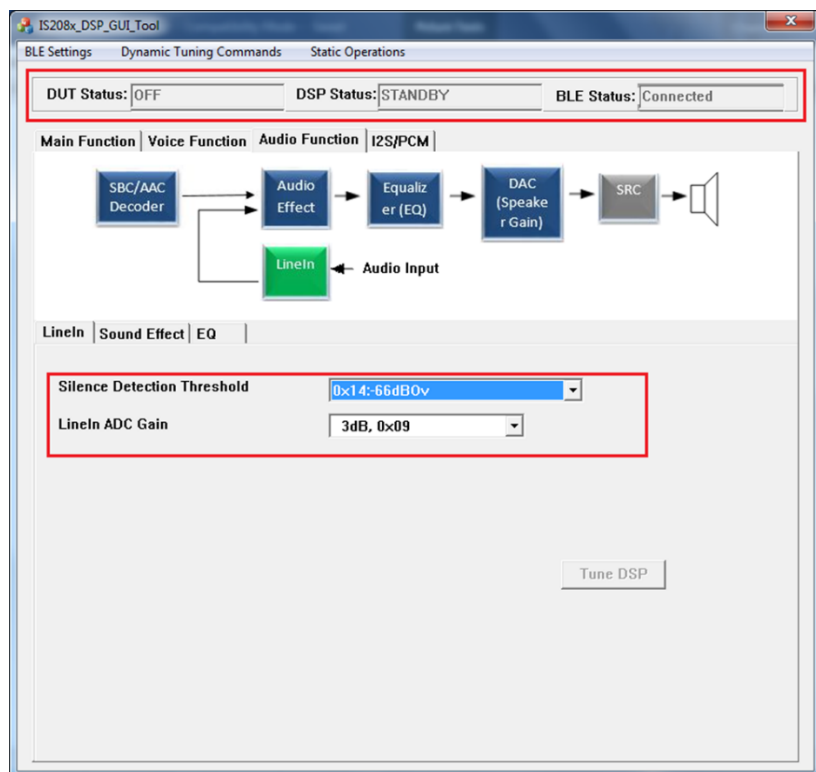


Figure 10 Status Bar in OTA DSP Tuning tool

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3.3 Tuning DSP Parameters

After the connection with DUT is setup over BLE. User can change any parameter and click on “Tune DSP” button, to tune a particular DSP parameter. Please note the following requirements / limitations for DSP Tune parameters.

1. Tune DSP parameters can be done only when Audio / Voice is setup. Tune DSP Parameters is not allowed in IDLE mode.
2. Only related parameters are available for tuning, based on Audio / Voice mode. i.e only Audio parameters are available for tuning in Audio mode, similarly for Voice mode. All other pages are disabled for tuning in a particular audio mode.
3. Enabling/Disable of a feature (Audio/Voice effects), dynamically using Tune DSP parameters, is not supported. Please ensure to enable/disable features, based on which feature is to be tuned in static mode and flash the Config UI table to DUT before starting the OTA DSP tuning.

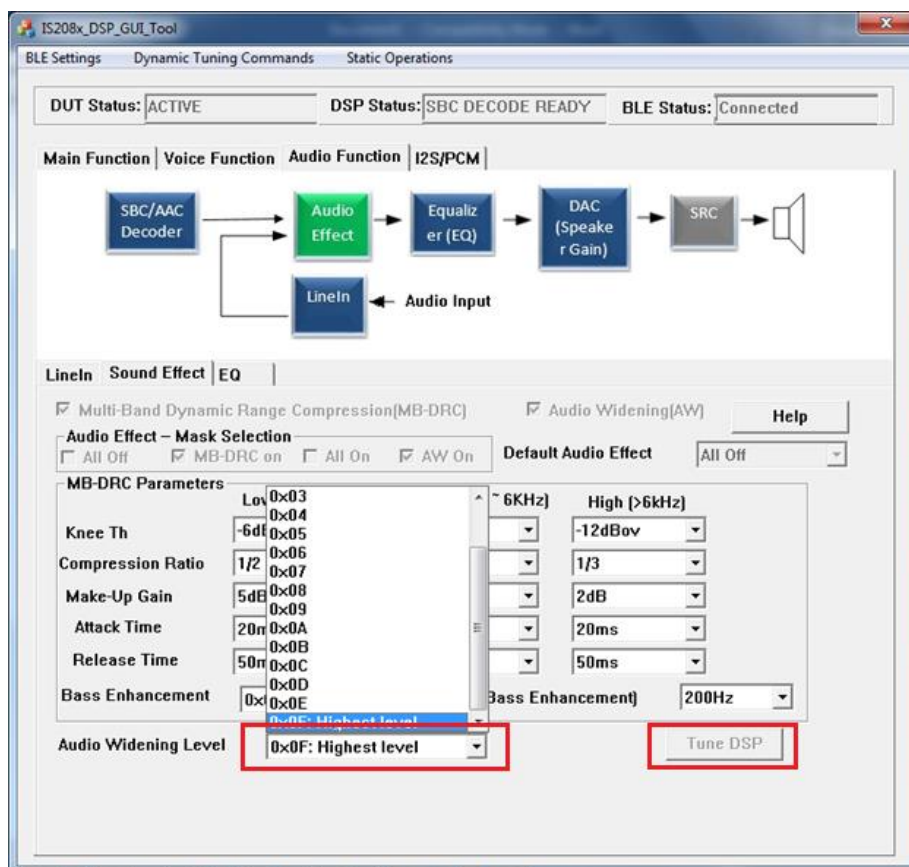


Figure 11 Changing DSP parameter

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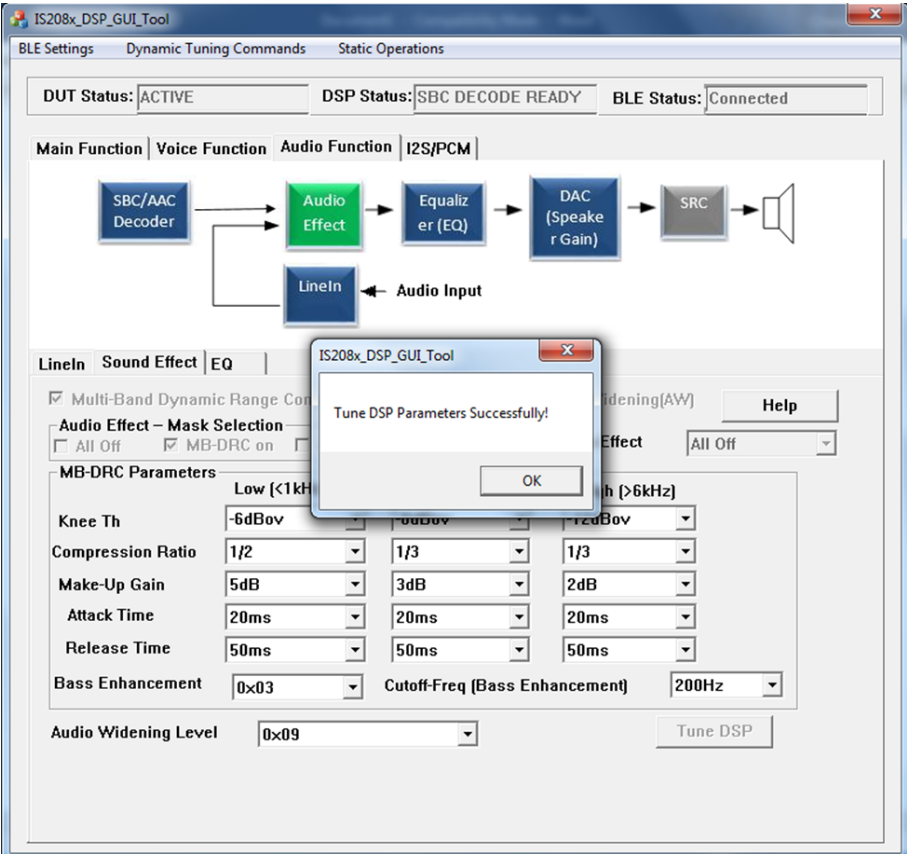


Figure 12 Tune DSP Parameters Successful

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3.4 Dynamic OTA Tuning Commands

Following commands are provided as part of this feature.

➔ Reset Parameters

- Resets the configuration data to Flash Configuration Data.

Note: To reset only selective set of parameters, the PC tool, can use “Write Parameters” / “Tune DSP Params” with the original values to the DUT.

➔ Reset DSP

- Resets the DSP.

Note: The parameters are not reset as part of this procedure. The PC tool user needs to explicitly do “Reset Parameters”

➔ Reset DUT

- Resets the DUT.

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- Re-store the Configuration Data back to Factory Settings. This also resets the DUT after restoring the Configuration Data. The PC tuning tool should re-connect to the DUT after power-cycle.

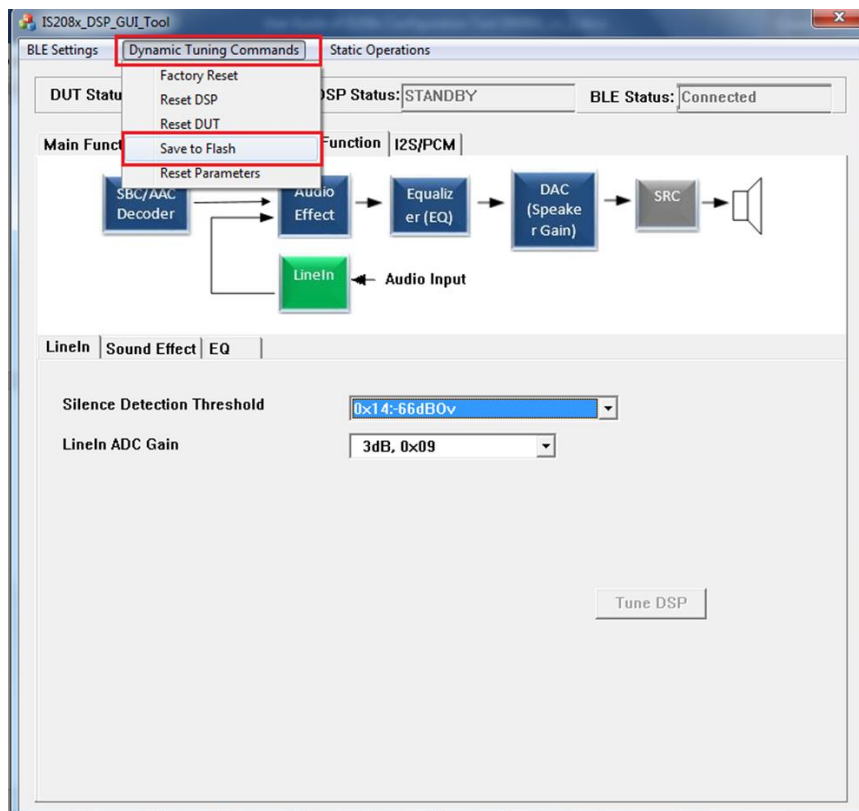


Figure 13 OTA DSP tuning commands

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3.5 BLE Disconnection (OTA DSP Tuning)

The BLE connection can be removed by clicking on BLE Disconnect menu option as shown below. Once the BLE connection is removed, the static configuration is reloaded.

NOTE: In case of BM70 dongle is not responsive and not able to scan, do software reset by clicking on BLE Reset button and hard reset by clicking on Reset button in BM70/71 board, and try once again scanning. And click on BLE Reset button to enable scan button if scan button is not enabled at any point of time but this will terminate your BLE connection.

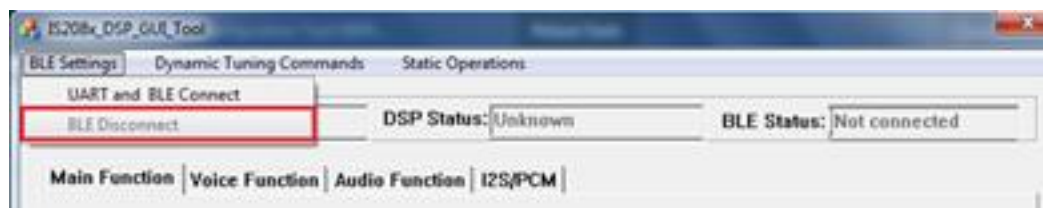


Figure 14 BLE Disconnect menu option

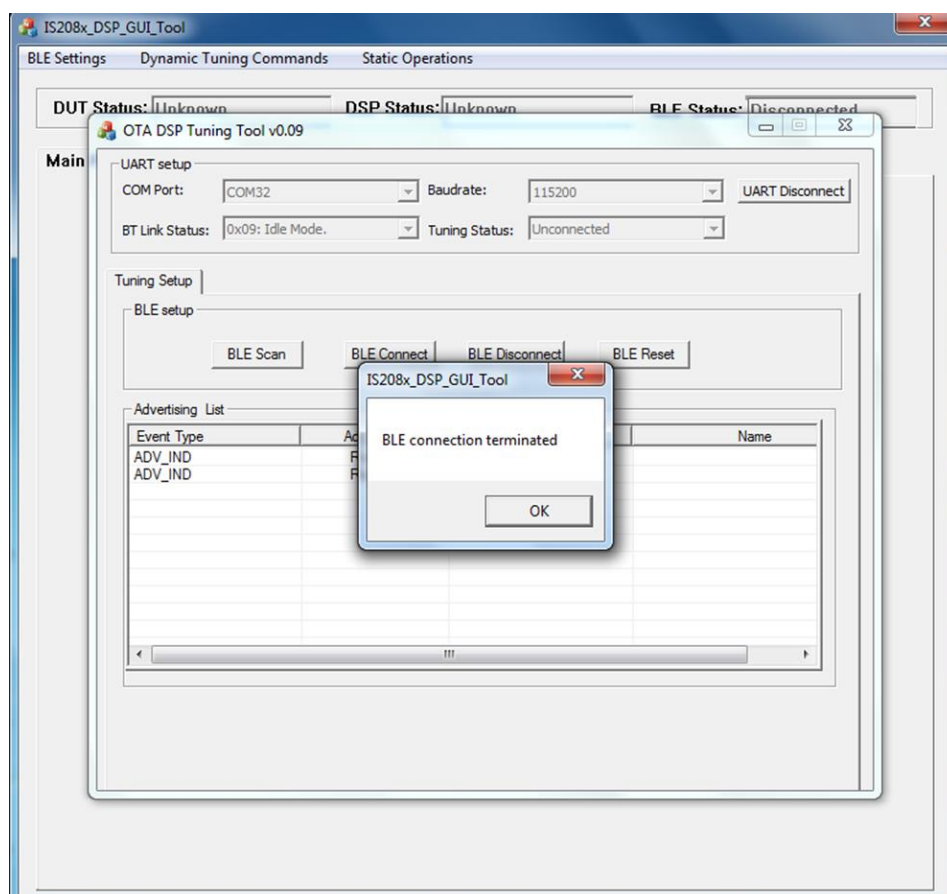


Figure 15 BLE Connection terminated

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5 REVISION HISTORY

Version	Date	History
R01	18/04/2019	Initial Version
R02	11/06/2019	Added BM70 FW and UI tool details, to be provided along with BM83 SDK for OTA DSP Tuning use.