

Nemko Korea CO., Ltd.

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FCC EVALUATION REPORT FOR CERTIFICATION

Applicant :**TheK Corp.****Suite 1202, Owners Tower, 16-5 Sunae-Dong,****Bundang-Gu, Sungnam-Si, Gyunggi-Do, Korea, 463-825****Dates of Issue : April, 5, 2007****Test Report No. : NK2HR055****Test Site : Nemko Korea Co., Ltd.****FCC ID****U6JKWG100-E****Brand Name****-****TheK Corp.****CONTACT PERSON****Suite 1202, Owners Tower, 16-5 Sunae-Dong,
Bundang-Gu, Sungnam-Si, Gyunggi-Do, Korea, 463-825
Mr. Nam-Yong Kim
Telephone No. : +82-70-7449-9355****Applied Standard:****FCC 47 CFR Part 15 & 2****FCC 47 CFR Part 22H & Part 24E****Classification:****FCC Class B Device****Equipment Class:****Public Mobile Services****EUT Type:****Dual-Band GSM WLL Telephone**

The device bearing the brand name and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2003.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.



Tested By : S. Lee
Engineer



Reviewed By : H.H. Kim
Manager & Chief Engineer

TABLE OF CONTENTS

1. Scope	4
2. Introduction (Site Description)	5
3. Test Conditions & EUT Information	6
4. Measuring Instrument Calibration	8
5. Summary of Test Results	9
6. Recommendation / Conclusion	10
7. Test Equipment	11
8. Description of Test	12
8.1 Conducted Emission	12
8.2 Radiated Emission	13
8.3 Effective Radiated Power / Equivalent Isotropic Radiated Power	14
8.4 Radiated Spurious & Harmonic Emission	15
8.5 Occupied Bandwidth / 26dB Emission Bandwidth	17
8.6 Spurious and Harmonic Emissions at Antenna Terminal	18
8.7 Frequency Stability / Temperature Variation	21
9. Test Data	22
9.1 Effective Radiated Power (ERP)	22
9.2 Equivalent Isotropic Radiated Power (EIRP)	23
9.3 Conducted Output Power	24
9.4 Occupied Bandwidth / 26dB Emission Bandwidth	25
9.5 Field Strength of Spurious Radiations	26
9.6 Radiated Spurious & Harmonic Emission (GSM850)	28
9.7 Radiated Spurious & Harmonic Emission (PCS1900)	30
9.8 Frequency Stability / Temperature Variation (GSM850)	32
9.9 Frequency Stability / Temperature Variation (PCS1900)	34
9.10 AC Power LINE Conducted Emission	36

10. Emission Designator	41
11. Test Plots (GSM850)	42
12. Test Plots (PCS1900)	48
13. Maximum Permissible Exposure	54
Appendix A: Labelling Requirement	56
Appendix B: Photographs of Test Set-up	57
Appendix C: EUT Photographs	60
Appendix D: Schematic Diagram	72
Appendix E: Block Diagram	73
Appendix F: USER'S Manual	74
Appendix G: Operational Description	75
Appendix H: Turn up Procedure	76

1. Scope

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC Part 15 & Part 22 & 24.

Responsible Party:	TheK Corp.
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Manufacturer:	TheK Corp. Suite 1202, Owners Tower, 16-5 Sunae-Dong, Bundang-Gu, Sungnam-Si, Gyunggi-Do, Korea, 463-825
Factory:	Ya Bang Electronics(Dong Guan) Co,Ltd. Zhen Wen West road, Shi Jie Town DongGuan City, Guangdong Province, P.R.China

- FCC ID: U6JKWG100-E
- Model: KWG100-E
- Brand Name: -
- EUT Type: Dual-Band GSM WLL Telephone
- Electric Rating: Adapter(Input:AC100-240V, 0.2A,Output:DC5V,1A)
- Equipment Class: Public Mobile Services
- Applied Standard: FCC 47 CFR Part 15 & 2
- Test Procedure(s): FCC 47 CFR Part 22H &24E
- Dates of Test: ANSI C63.4 (2003), TIA/EIA603
- Place of Tests: March 28, 2007 to April 3, 2007
- Test Report No.: Nemko Korea Co., Ltd.
NK2HR055

2. Introduction (Site Description)

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-2003) was used in determining radiated and conducted emissions emanating from **TheK Corp.**

FCC ID : **U6JKWG100-E**

These measurement tests were conducted at **Nemko Korea Co., Ltd.**

The site address is 300-2, Osan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, GyeongGi-Do, KOREA.

The area of Nemko Korea Corporation Ltd. Test Site is located in a mountain area at 80 kilometers (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 kilometers (18miles) south-southeast from central Seoul.

It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.

The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 2003.



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Fig. 1. The map above shows the Seoul in Korea vicinity area.
The map also shows Nemko Korea Corporation Ltd. and Incheon Airport.

3. Test Conditions & EUT Information

Operating During Test

The EUT was tested at the lowest channel, middle channel and the highest channel with the maximum RF Power and all data recorded in the report. During the all test, the power was supplied through the Adapter. Internal Battery of this phone is for backup purpose only.

Environmental Conditions

Temperature	21 °C ~ 25 °C
Relative Humidity	35% ~ 75%

Description of EUT

Frequency Range	GSM850	Tx : 824.2MHz ~ 848.8MHz Rx : 869.2MHz ~ 893.8MHz
	PCS1900	Tx : 1850.2MHz ~ 1909.8MHz Rx : 1930.2MHz ~ 1989.8MHz
Output Power	GSM850	1.169W ERP (30.68dBm)
	PCS1900	1.455W EIRP (31.63dBm)
Emission Designator	250KGXW	
Modulation(s)	GSM	
Frequency Tolerances	±0.00025%(2.5ppm)	
Antenna Type	External	
Dimensions (L X W X H)	190 X 180 X 75mm	
Weight	700g(with Battery)	
Operating Conditions	Storage : -30 °C ~ +60 °C	
Voltage	Adapter(Input:100-240 Vac 0.2A, Output:5 Vdc 1A)	

EUT & Support Equipment

GSM phone (EUT)	TheK Corp. FCC ID: U6JKWG100-E	S/N: N/A
Adaptor	N/A Model : HY-SW0501000A 1.75m Unshielded DC power cable	S/N: N/A
Wireless Communications Test Set	Agilent Model : E5515C	S/N: GB43193659

4. Measuring Instrument Calibration

All measurements were made with instruments calibrated according to the recommendation by manufacturer. Measurement of radiated emissions and conducted emissions were made with instruments conforming to American National Standards Institute, ANSI C63.4-2003.

The calibration of measuring instrument, including any accessories that may affect test results, were performed according to the recommendation by manufacturer.

- End of page -

5. Summary of Test Results

The EUT has been tested according to the following specification:

Description of Test	FCC Rule	Result
Modulation Characteristics	§2.1047	Complies
ERP / EIRP Measurement	§2.1046 §22.913(a) §24.232(b)	Complies
Conducted Output Power	§2.1046(a) §22.913(a) §24.232(a)	Complies
Occupied Bandwidth / 26dB Bandwidth	§2.1049(h)	Complies
Spurious Emission at antenna Terminals	§2.1051 §22.917(a) §24.238(a)	Complies
Field Strength of spurious Radiation	§2.1053 §22.917(a) §24.238(a)	Complies
Frequency Stability / Temperature Variation	§2.1055 §22.355 §24.235	Complies
Band Edge	§22.917(a) §24.238(a)	Complies
AC Power Line Conducted Emission	§15.207	Complies

6. Recommendation / Conclusion

The data collected shows that the TheK Corp. Dual-Band GSM WLL Telephone. FCC ID: U6JKWG100-E complies with all the requirements of Parts 2 & 22 & 24 of the FCC Rules.

The highest emission observed was at **0.18 MHz** for conducted emissions with a Q.P margin of **4.4 dB**, at **214.83 MHz** for radiated emissions with a margin of **9.0 dB**.

7. Test Equipment List

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	*Test Receiver	R & S	ESCS 30	833364/020	Aug. 17 2006	1year
2	*Test Receiver	R & S	ESCS 30	100302	Dec. 04 2006	1year
3	Amplifier	Agilent	8447F	3113A04549	Aug. 17 2006	1year
4	Amplifier	HP	8447F	2805A03427	Aug. 07 2006	1year
5	*Amplifier	HP	8447F	2805A03351	Oct. 25 2006	1year
6	*Amplifier	HP	8449B	3008A00107	Mar.06 2007	1year
7	Spectrum Analyzer	Advantest	R3265A	45060401	Dec.04 2006	1year
8	*Spectrum Analyzer	HP	8568B	1912A00573	Oct.25 2006	1year
9	Spectrum Analyzer	HP	8566B	267A03469	Mar.06 2007	1year
10	*Biconical Log Antenn	ARA	LPB-2520/A	1180	Feb.28 2007	1year
11	Biconical Log Antenna	ARA	LBP-2520/A	1209	Dec.14 2006	1year
12	*Trilog-Broadband Antenna	Schwarzbeck	VULB9168	9168-257	Mar.15 2007	1year
13	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-474	May.09 2006	1year
14	*Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-508	Oct. 30 2006	1year
15	Signal Generater	R & S	SMP02	833286/003	Aug. 07 2006	1year
16	*LISN	R & S	ESH3-Z5	833874/006	Nov.02 2006	1year
17	*LISN	Kyoritsu	KNW-407	8-1034-10	Mar.16 2007	1year
18	*Spectrum Analyzer	Agilent	E4440A	MY44303257	Nov.29 2006	1year
19	*Communications Test Set	Agilent	E5515C	GB43193659	Jun.09 2006	1year
20	*Position Controller	DAEIL EMC	N/A	N/A	N/A	N/A
21	*Turn Table	DAEIL EMC	N/A	N/A	N/A	N/A
22	*Antenna Mast	DAEIL EMC	N/A	N/A	N/A	N/A
23	*Anechoic Chamber	EM Eng.	N/A	N/A	N/A	N/A
24	*Shielded Room	EM Eng.	N/A	N/A	N/A	N/A
25	*Position Controller	Inn-co	CO2000	N/A	N/A	N/A
26	*Turn Table	Inn-co	DS1200S	N/A	N/A	N/A
27	*Antenna Mast	Inn-co	AS2000P	N/A	N/A	N/A
28	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A

*) Test equipment used during the test

8. Description of Tests

8.1 Conducted Emissions

The Line conducted emission test facility is located inside a 4 X 7 X 2.5 meter shielded enclosure. It is manufactured by EM engineering.

The shielding effectiveness of the shielded room is in accordance with MIL-STD-285 or NSA 65-6. A 1m X 1.5m wooden table 0.8m height is placed 0.4m away from the vertical wall and 1.5m away from the side of wall of the shielded room Rohde & Schwarz (ESH3-Z5) and Kyoritsu (KNW-407) of the 50ohm/50uH Line Impedance Stabilization Network(LISN) are bonded to the shielded room. The EUT is powered from the Rohde & Schwarz LISN and the support equipment is powered from the Kyoritsu LISN. Power to the LISN s are filtered by high-current high insertion loss Power line filters. The purpose of filter is to attenuate ambient signal interference and this filter is also bonded to shielded enclosure. All electrical cables are shielded by tinned copper zipper tubing with inner diameter of 1/2".

If DC power device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the LISNs,

All interconnecting cables more than 1 meter were shortened by non inductive bundling (serpentine fashion) to a 1 meter length.

Sufficient time for EUT, support equipment and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT.

The spectrum was scanned from 150kHz to 30MHz with 20msec sweep time.

The frequency producing the maximum level was re-examined using the EMI test receiver. (Rohde & Schwarz ESCS30).

The detector function were set to CISPR quasi-peak mode & average mode.

The bandwidth of receiver was set to 9KHz. The EUT, support equipment and interconnecting cables were arranged and manipulated to maximize each EME emission.

Each emission was maximized by; switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; which ever determined the worst case emission.

Each EME reported was calibrated using the R&S signal generator.

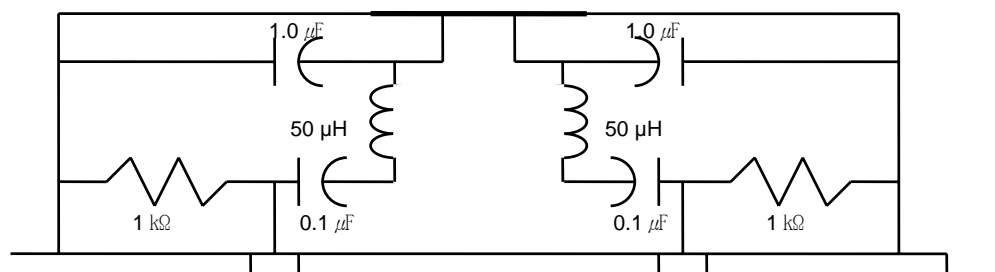


Fig. 2. LISN Schematic Diagram

8.2 Radiated Emissions

Preliminary measurement were made indoors at 3 meter using broad band antennas, broadband amplifier and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The Technology configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna was note for each frequency found. The spectrum was scanned from 30 to 1000MHz using Biconical log Antenna (ARA, LPB-2520/A).

Final Measurements were made outdoors at 3 or 10m test range using Logbicon Super Antenna (Schwarzbeck, VULB 9166). The test equipment was placed on a wooden table.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

Each frequency found during pre-scan measurements was reexamined and investigated using EMI test receiver.(ESCS30).

The detector function were set to CISPR quasi-peak and peak mode and the bandwidth of the receiver were set to 120KHz and 1MHz depending on the frequency or type of signal.

The half wave dipole antenna was tuned to the frequency found during preliminary radiated measurements.

The EUT support equipment and interconnecting cables were reconfigured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8m high non-metallic 1.0X 1.5 meter table.

The EUT, support equipment and interconnecting cables were re-arranged and manipulated to maximize each EME emission.

The turntable containing the Technology was rotated; the antenna height was varied 1 to 4meter and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; which ever determined the worst case emission.

Each EME reported was calibrated using the R/S signal generator.

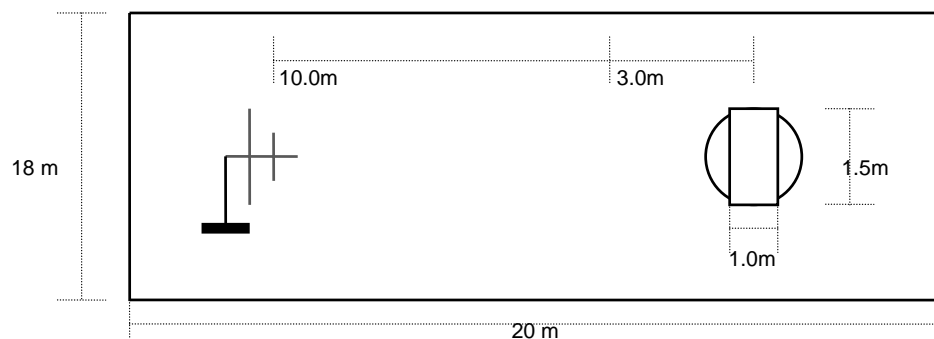


Fig. 3. Dimensions of Outdoor Test Site

8.3 Effective Radiated Power / Equivalent Isotropic Radiated Power

Test Set-up

Effective Radiated Power Output and Equivalent Isotropic Radiated Power output Measurements by Substitution Method according to ANSI/TIA/EIA-603-A-2003.

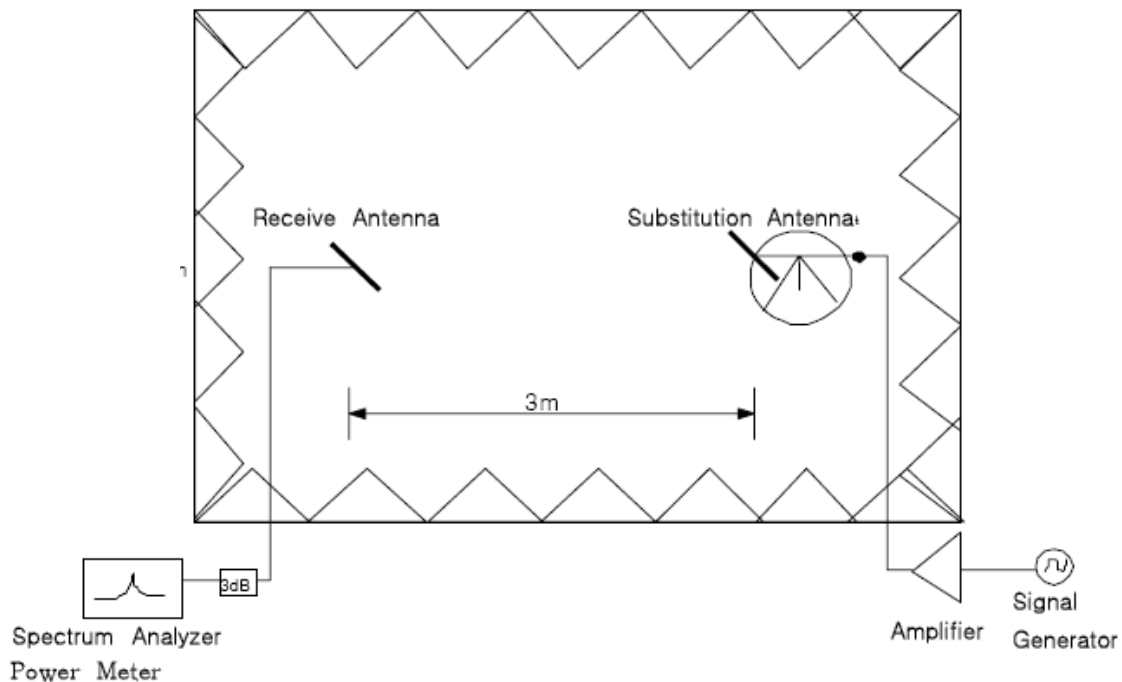


Figure 4. Diagram of ERP/EIRP test Set-up

The EUT was set on a non-conductive turntable in a semi anechoic chamber.

In the corner of the chamber there was a communication antenna, which was connected to the BS simulator located outside the chamber. The radiated power from the EUT was measured with an antenna fixed to a antenna tower.

The tower and turn table were remotely controlled to turn the EUT and change the antenna polarization. The measured signal was routed from the measuring antenna to the spectrum analyzer. The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.

Test Method

- The maximum power level was searched by moving the turn table and measuring antenna and manipulating the EUT. This level (P_{EUT}) was recorded.
- The EUT was replaced with a substituting antenna.
- The substituting antenna was fed with the power (P_{Subst_TX}) giving a convenient reading on the spectrum analyzer. That reading (P_{Subst_RX}) on spectrum analyzer was recorded.
- The Spectrum Analyzer used to measure EUT was set RBW 1 MHz, VBW 1 MHz and Peak detection mode.

8.4 Radiated Spurious & Harmonic Emission

Test Set-up

Effective Radiated Power Output and Equivalent Isotropic Radiated Power output Measurements by Substitution Method according to ANSI/TIA/EIA-603-A-2003.

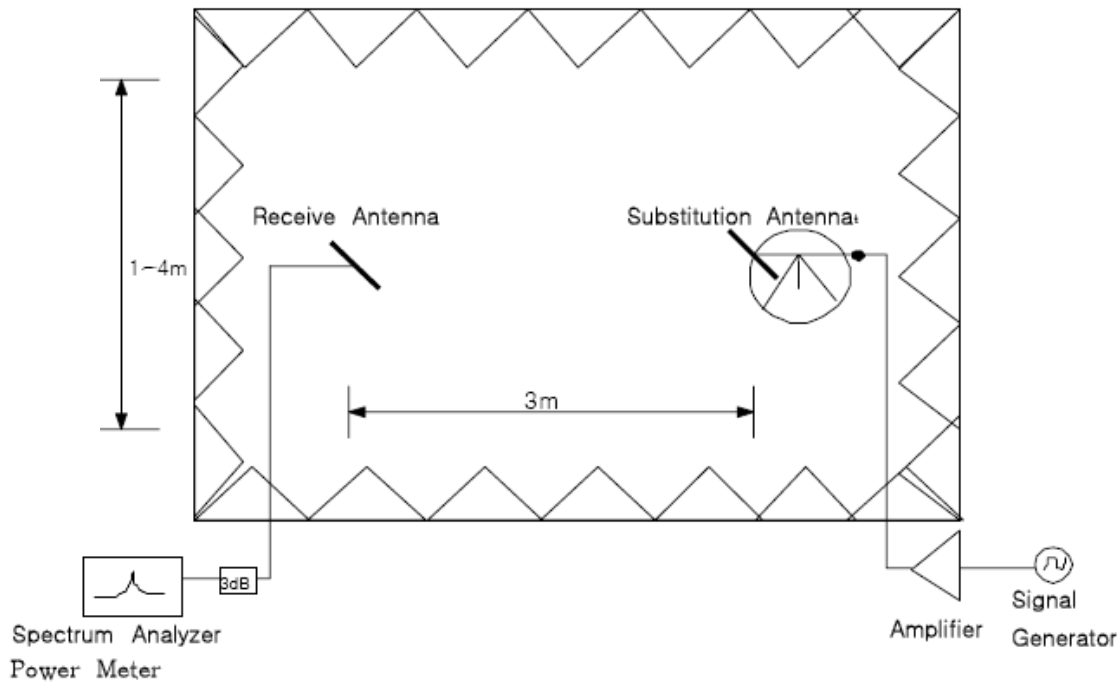


Figure 5. Diagram of Radiated Spurious & Harmonic test Set-up

The EUT was set on a non-conductive turntable in a semi anechoic chamber.

In the corner of the chamber there was a communication antenna, which was connected to the BS simulator located outside the chamber. The radiated power from the EUT was measured with an antenna fixed to a antenna tower.

The tower and turn table were remotely controlled to turn the EUT and change the antenna polarization. The measured signal was routed from the measuring antenna to the spectrum analyzer. The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.

Test Method

- The maximum power level was searched by moving the turn table and measuring antenna and manipulating the EUT. This level (P_{EUT}) was recorded.
- The EUT was replaced with a substituting antenna.
- The substituting antenna was fed with the power (P_{Subst_TX}) giving a convenient reading on the spectrum analyzer. That reading (P_{Subst_RX}) on spectrum analyzer was recorded.
- The Spectrum Analyzer used to measure EUT was set RBW 1 MHz, VBW 1 MHz and Peak detection mode.

CALCULATION

The formula below was used to calculate the ERP/EIRP of the EUT.

$P_{\text{subst_TX[dBm]}}$, $P_{\text{subst_RX[dBm]}}$, $L_{\text{Cable[dB]}}$ and $G_{\text{substitute_antenna[dBd]}}$ factors are combined in one correction factor.

$$P_{\text{ERP[W]}} = \frac{10^{(P_{\text{sust_Tx[dBm]}} + P_{\text{EUT[dBm]}} - P_{\text{subst_Rx[dBm]}}) + G_{\text{subst_antenna[dBd]}} - L_{\text{cable[dB]}}}}{1000}$$

where the variables are as follows:

$P_{\text{EUT [dBm]}}$	Measured power level from the EUT
$P_{\text{Subst_TX [dBm]}}$	Power fed to the substituting antenna
$P_{\text{Subst_RX [dBm]}}$	Power received with the spectrum analyzer
$G_{\text{Substitute_antenna [dBd]}}$	Gain of the substitutive antenna over dipole (dBi – 2.15dB)
$L_{\text{Cable [dB]}}$	Loss of the cable between signal generator and the substituting antenna

8.5 Occupied Bandwidth / 26dB Emission Bandwidth

Occupied Bandwidth

The EUT was setup to maximum output power at its lowest channel.
The occupied bandwidth was measured using a spectrum analyzer.
The measurements are repeated for the highest and a middle channel.
The EUT's occupied bandwidth is measured as the width of the signal between two points, one below the carrier center frequency and one above the carrier frequency, outside of which all emissions are attenuated at least 26dB below the transmitter power.
Plots of the EUT's occupied bandwidth are shown.

26dB Emission Bandwidth

The transmitter output is connected to the spectrum analyzer.
The RBW of spectrum analyzer is set to approximately 1% of the emission bandwidth And peak detection is used.
The emission bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 26dB.

8.6 Spurious and Harmonic Emissions at Antenna Terminal

8.6.1 Occupied Bandwidth Emission Limits

- (a) On any frequency outside a license's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB.
- (b) Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater.
However, in the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 1% of the emission bandwidth of the fundamental emission of the transmitter may be employed.
The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.
- (c) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.
- (d) The measurement of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

BLOCK	Frequency Range (MHz) Transmitter (Tx)	Frequency Range (MHz) Receiver (Rx)
A* Low +A	824 ~ 835	869 ~ 880
B	835 ~ 845	880 ~ 890
A* High	845 ~ 846.5	890 ~ 891.5
B*	846.5 ~ 849	891.5 ~ 894

Table 1. Cellular Service Frequency Blocks

BLOCK	Frequency Range (MHz) Transmitter (Tx)	Frequency Range (MHz) Receiver (Rx)
A	1850 ~ 1865	1930 ~ 1745
B	1870 ~ 1885	1950 ~ 1965
C	1895 ~ 1910	1975 ~ 1990
D	1865 ~ 1870	1945 ~ 1950
E	1885 ~ 1890	1965 ~ 1970
F	1890 ~ 1895	1970 ~ 1975

Table 2. Broadband PCS Service Frequency Blocks

8.6.2 Conducted Spurious Emission

Minimum standard:

On any frequency outside a license frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43+10\log(P)$ dB.

Limit equivalent to -13dBm, calculation shown below.

$$43 + 10\log(1.679 \text{ W}) = 45.25 \text{ dB}$$

$$32.25\text{dBm} - 45.25 \text{ dB} = -13 \text{ dBm}$$

Compliance with the out-of-band emissions requirement is based on test being performed with an analyzer resolution bandwidth of 1MHz. However in the 1MHz band immediately outside and adjacent to the frequency block a resolution bandwidth of at least 1% of the fundamental emissions bandwidth may be employed.

Test Procedure:

The EUT was setup to maximum output power at its lowest channel.

The Resolution BW of the analyzer is set to 1% of the emission bandwidth to show compliance with the -13dBm limit, in the 1MHz bands immediately outside and adjacent to the edge of the frequency block.

The measurements are repeated for the EUT's highest channel. For the Out-of-Band measurements a 1MHz RBW was used to scan from 10MHz to 20GHz.

A display line was placed at -13dBm to show compliance. The high, lowest and a middle channel were tested for out of band measurements.

Plots are shown.

8.7 Frequency Stability / Temperature Variation

The frequency stability of the transmitter is measured by:

- a.) Temperature: The temperature is carried from -30°C to +60°C using an environmental chamber.
- b.) Primary Supply Voltage: The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

Specification: The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ ($\pm 2.5\text{ppm}$) of the center frequency.

Time Period and Procedure:

1. The carrier frequency of the transmitter and the individual oscillators is measured at room temperature (20°C to 25°C to provide a reference).
2. The equipment is subjected to an overnight "soak" at -30°C without any power applied.
3. After the overnight "soak" at -30°C (Usually 14~16 hours), the equipment is turned on in a "standby" condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter and the individual oscillators is made within three minutes interval after applying to the transmitter.
4. Frequency measurements are made at 10°C interval up to room temperature. At least a period of one and one half-hour is provided to allow stabilization of the equipment at each temperature level.
5. Again the transmitter carrier frequency and the individual oscillators is measured at room temperature to begin measurement of the upper temperature levels.
6. Frequency measurements are at 10 intervals starting at -30°C up to +60°C allowing at least two hours at each temperature for stabilization. In all measurements the frequency is measured within three minutes after re-applying power to the transmitter.
7. The artificial load is mounted external to the temperature chamber.

9. Test Data

9.1 Effective Radiated Power (ERP)

EUT Mode : GSM850

Measurement Result :

Frequency (MHz)	Ant. Pol.	P _{EUT} (dBm)	P _{TX} (dBm)	P _{RX} (dBm)	G _{antenna} (dBd)	L _{Cable} (dBm)	ERP (dBm)	Limit (dBm)
824.2	H	-14.19	0.00	-39.77	0.99	1.85	24.72	38.45
	V	-11.19	0.00	-39.49	0.99	1.85	27.44	
836.6	H	-12.87	0.00	-37.62	1.32	1.72	24.35	38.45
	V	-8.54	0.00	-37.60	1.32	1.72	28.66	
848.8	H	-12.38	0.00	-38.00	1.62	1.64	25.60	38.45
	V	-7.22	0.00	-37.92	1.62	1.64	30.68	

Table 8. Radiated Measurements at 3meters

9.2 Equivalent Isotropic Radiated Power (EIRP)

EUT Mode : PCS1900

Measurement Result:

Frequency (MHz)	Ant. Pol.	P _{EUT} (dBm)	P _{TX} (dBm)	P _{RX} (dBm)	G _{antenna} (dBi)	L _{Cable} (dBm)	EIRP (dBm)	Limit (dBm)
1850.2	H	-18.32	0.00	-33.63	10.40	2.69	23.02	33
	V	-9.50	0.00	-33.42	10.40	2.69	31.63	
1880.0	H	-21.31	0.00	-33.55	10.43	2.64	20.03	33
	V	-11.42	0.00	-33.55	10.43	2.64	29.92	
1909.8	H	-22.20	0.00	-33.43	10.44	2.59	19.08	33
	V	-12.69	0.00	-33.52	10.44	2.59	28.68	

Table 8. Radiated Measurements at 3meters

9.3 Conducted Output Power

Measurement Result:

EUT Mode	Channel	Frequency (MHz)	Measurement Power (dBm)
GSM850	128	824.2	32.30
	190	836.6	32.71
	251	848.8	32.88

Measurement Result:

EUT Mode	Channel	Frequency (MHz)	Measurement Power (dBm)
PCS1900`	512	1850.2	27.54
	661	1880.0	28.12
	810	1909.8	28.59

9.4 Occupied Bandwidth / 26dB Emission Bandwidth

Measurement Result:

EUT Mode	Channel	Frequency (MHz)	Occupied BW (KHz)	26dB Emission BW (KHz)
GSM850	128	824.2	247	311
	190	836.6	248	312
	251	848.8	247	312

Measurement Result:

EUT Mode	Channel	Frequency (MHz)	Occupied BW (KHz)	26dB Emission BW (KHz)
PCS1900	512	1850.2	246	317
	661	1880.0	243	314
	810	1909.8	247	313

- End of page -

9.5 Field Strength of spurious Radiations

► GSM 850MHz TCH mode

Frequency (MHz)	Reading (dB μ V/m)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
151.95	36.7	H	-9.6	27.1	43.5	16.4
166.27	38.3	H	-9.6	28.7	43.5	14.8
214.83	45.7	H	-11.2	34.5	43.5	9.0
260.00	39.0	V	-11.3	27.7	46.0	18.3
300.00	39.0	H	-9.4	29.6	46.0	16.4
432.54	35.6	V	-6.8	28.8	46.0	17.2

Radiated Measurements at 3meters

► PCS TCH mode

Frequency (MHz)	Reading (dB μ V/m)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
166.27	38.0	H	-9.6	28.4	43.5	15.1
250.02	38.3	H	-11.8	26.5	46.0	19.5
260.00	38.4	H	-11.3	27.1	46.0	18.9
299.99	39.1	H	-9.4	29.7	46.0	16.3
432.55	35.6	V	-6.8	28.8	46.0	17.2
864.45	24.0	H	1.9	25.9	46.0	20.1

Radiated Measurements at 3meters

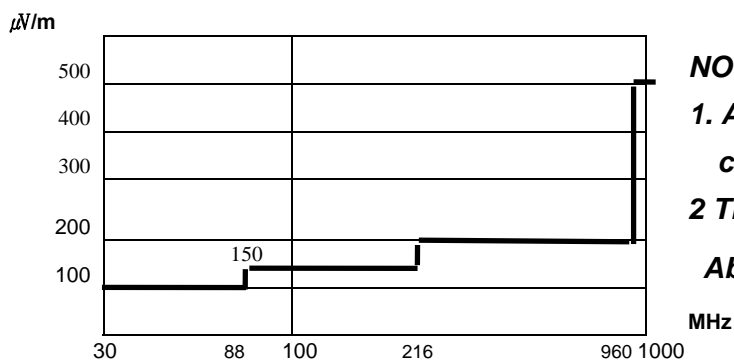


Fig. 1. Limits at 3 meters

NOTES:

1. All modes were measured and the worst-case emission was reported.

2 The radiated limits are shown on Figure 1.

Above 1GHz the limit is 500 μ V/m.

NOTES:

1. **Pol. H=Horizontal, V=Vertical*
2. ***AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.*
3. *Measurements using CISPR quasi-peak mode.*
4. *The limit is on the FCC Part section 15.109(a).*

9.6 Radiated Spurious & Harmonic Emission (GSM850)

CH128 (824.2MHz)

Freq. (MHz)	Ant. Pol.	P _{EUT} (dBm)	P _{TX} (dBm)	P _{RX} (dBm)	G _{antenna} (dBd)	L _{Cable} (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1648.40	H	-40.59	0.00	-1.12	7.51	2.39	-34.35	-13	21.35
	V	-40.07	0.00	-0.83	7.51	2.39	-34.12	-13	21.12
2472.60	H	-57.28	0.00	-2.88	8.34	2.80	-48.86	-13	35.86
	V	-49.30	0.00	-2.66	8.34	2.80	-41.10	-13	28.10
3296.80	H	-62.04	0.00	-4.59	10.38	3.57	-50.64	-13	37.64
	V	-63.53	0.00	-4.15	10.38	3.57	-52.57	-13	39.57
4121.00	H	---					---		
	V	---					---		
4945.20	H	---					---		
	V	---					---		
5769.40	H	-63.99	0.00	-10.95	10.95	5.00	-47.09	-13	34.09
	V	-61.72	0.00	-10.51	10.95	5.00	-45.26	-13	32.26
6593.60	H	-66.51	0.00	-13.71	10.00	5.33	-48.13	-13	35.13
	V	-63.68	0.00	-13.14	10.00	5.33	-45.87	-13	32.87

CH190 (836.6MHz)

Freq. (MHz)	Ant. Pol.	P _{EUT} (dBm)	P _{TX} (dBm)	P _{RX} (dBm)	G _{antenna} (dBd)	L _{Cable} (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1648.40	H	-42.98	0.00	-1.08	7.62	2.42	-36.70	-13	23.70
	V	-38.96	0.00	-0.82	7.62	2.42	-32.94	-13	19.94
2472.60	H	-55.11	0.00	-3.12	8.42	2.81	-46.38	-13	33.38
	V	-47.45	0.00	-2.84	8.42	2.81	-39.00	-13	26.00
3296.80	H	-64.45	0.00	-4.41	10.58	3.56	-53.02	-13	40.02
	V	-65.79	0.00	-3.97	10.58	3.56	-54.80	-13	41.80
4183.00	H	---					---		
	V	-64.86	0.00	-8.30	10.54	4.12	-50.12	-13	37.12
5019.60	H	---					---		
	V	---					---		
5856.20	H	-62.70	0.00	-11.17	10.91	5.06	-45.68	-13	32.68
	V	-58.36	0.00	-10.71	10.91	5.06	-41.80	-13	28.80
6692.80	H	-63.97	0.00	-13.63	10.08	5.29	-45.55	-13	32.55
	V	-61.39	0.00	-13.11	10.08	5.29	-43.49	-13	30.49

CH251 (848.8MHz)

Freq. (MHz)	Ant. Pol.	P _{EUT} (dBm)	P _{TX} (dBm)	P _{RX} (dBm)	G _{antenna} (dBd)	L _{Cable} (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1697.60	H	-43.73	0.00	-1.03	7.73	2.44	-37.41	-13	24.41
	V	-41.08	0.00	-0.80	7.73	2.44	-34.99	-13	21.99
2546.40	H	-51.32	0.00	-3.01	8.50	2.83	-42.64	-13	29.64
	V	-44.24	0.00	-3.36	8.50	2.83	-35.21	-13	22.21
3395.20	H	-65.50	0.00	-4.24	10.79	3.55	-54.02	-13	41.02
	V	-65.81	0.00	-3.79	10.79	3.55	-54.78	-13	41.78
4244.00	H	---					---		
	V	---					---		
5092.80	H	---					---		
	V	---					---		
5941.60	H	-59.14	0.00	-11.10	10.88	5.07	-42.23	-13	29.23
	V	-57.61	0.00	-10.65	10.88	5.07	-41.15	-13	28.15
6790.40	H	-61.62	0.00	-13.52	10.17	5.24	-43.17	-13	30.17
	V	-59.08	0.00	-13.06	10.17	5.24	-41.09	-13	28.09

Note: 1. All modes of operation were investigated and the worst -case emission are reported.

2. “---” means that the emission level is too low to be measured

- End of page -

9.7 Radiated Spurious & Harmonic Emission (PCS1900)

CH512 (1850.2MHz)

Freq. (MHz)	Ant. Pol.	P _{EUT} (dBm)	P _{TX} (dBm)	P _{RX} (dBm)	G _{antenna} (dBi)	L _{Cable} (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
3700.40	H	-49.89	0.00	-11.33	12.66	3.79	-29.69	-13	16.69
	V	-48.91	0.00	-11.38	12.66	3.79	-28.66	-13	15.66
5550.60	H	-49.32	0.00	-9.55	13.15	4.67	-31.29	-13	18.29
	V	-49.26	0.00	-9.14	13.15	4.67	-31.64	-13	18.64
7400.80	H	-61.55	0.00	-17.64	11.01	5.43	-38.33	-13	25.33
	V	-57.85	0.00	-17.32	11.01	5.43	-34.95	-13	21.95
9251.00	H	-61.10	0.00	-18.97	11.70	6.12	-36.55	-13	23.55
	V	-57.88	0.00	-19.21	11.70	6.12	-33.09	-13	20.09
11101.20	H	-66.18	0.00	-24.06	11.66	6.66	-37.12	-13	24.12
	V	---					---		
12951.40	H	-64.22	0.00	-23.45	13.62	7.08	-34.23	-13	21.23
	V	-64.93	0.00	-23.45	13.62	7.08	-35.41	-13	22.41

CH661 (1880.0MHz)

Freq. (MHz)	Ant. Pol.	P _{EUT} (dBm)	P _{TX} (dBm)	P _{RX} (dBm)	G _{antenna} (dBi)	L _{Cable} (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
3760.00	H	-53.09	0.00	-10.55	12.71	3.84	-33.67	-13	20.67
	V	-51.85	0.00	-10.63	12.71	3.84	-32.35	-13	19.35
5640.00	H	-48.36	0.00	-9.87	13.14	4.72	-30.07	-13	17.07
	V	-53.16	0.00	-9.49	13.14	4.72	-35.25	-13	22.25
7520.00	H	-64.71	0.00	-17.77	11.28	5.54	-41.20	-13	28.20
	V	-62.24	0.00	-17.45	11.28	5.54	-39.05	-13	26.05
9400.00	H	-64.89	0.00	-19.06	11.59	5.77	-40.01	-13	27.01
	V	-62.21	0.00	-19.32	11.59	5.77	-37.07	-13	24.07
11280.00	H	---					---		
	V	---					---		
13160.00	H	-63.15	0.00	-24.55	13.33	7.11	-32.38	-13	19.38
	V	-62.77	0.00	-24.11	13.33	7.11	-32.44	-13	19.44

CH810 (1909.8MHz)

Freq. (MHz)	Ant. Pol.	P _{EUT} (dBm)	P _{TX} (dBm)	P _{RX} (dBm)	G _{antenna} (dBi)	L _{Cable} (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
3819.60	H	47.45	0.00	-9.87	12.74	3.87	-28.71	-13	15.71
	V	49.94	0.00	-9.96	12.74	3.87	-31.11	-13	18.11
5729.40	H	50.77	0.00	-10.62	13.11	4.91	-31.95	-13	18.95
	V	48.51	0.00	-10.20	13.11	4.91	-30.11	-13	17.11
7639.20	H	61.95	0.00	-17.85	11.46	5.61	-38.25	-13	25.25
	V	63.17	0.00	-17.53	11.46	5.61	-39.79	-13	26.79
9549.00	H	62.32	0.00	-19.26	11.85	5.84	-37.05	-13	24.05
	V	58.30	0.00	-19.51	11.85	5.84	-32.78	-13	19.78
11458.80	H	---					---		
	V	---					---		
13368.60	H	---					---		
	V	65.89	0.00	-26.32	12.97	7.37	-33.97	-13	20.97

Note: 1. All modes of operation were investigated and the worst -case emission are reported.

2. “---” means that the emission level is too low to be measured

- End of page -

9.8 Frequency Stability / Temperature Variation (GSM850)

Test Mode : Set to Middle channel (836.6MHz)

Deviation Limit : $\pm 2.5\text{ppm}$

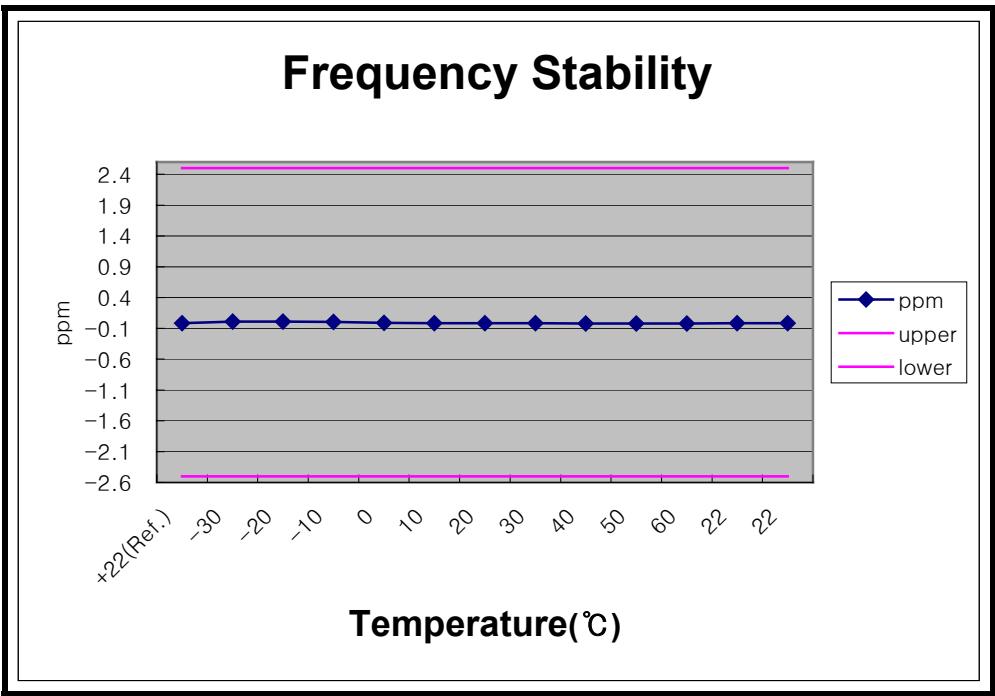
Measurement Result :

Voltage (%)	Power (Vac)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	PPM
100%	120	+22(Ref.)	836,599,985	-15	-0.0179
100%		-30	836,600,007	7	0.0084
100%		-20	836,600,009	9	0.0108
100%		-10	836,600,005	5	0.0060
100%		0	836,599,993	-7	-0.0084
100%		10	836,599,989	-11	-0.0131
100%		20	836,599,988	-12	-0.0143
100%		30	836,599,985	-15	-0.0179
100%		40	836,599,983	-17	-0.0203
100%		50	836,599,983	-17	-0.0203
100%		60	836,599,984	-16	-0.0191
85%	102	22	836,599,987	-13	-0.0155
115%	138	22	836,599,986	-14	-0.0167
Battery End point	-	-	-	-	-

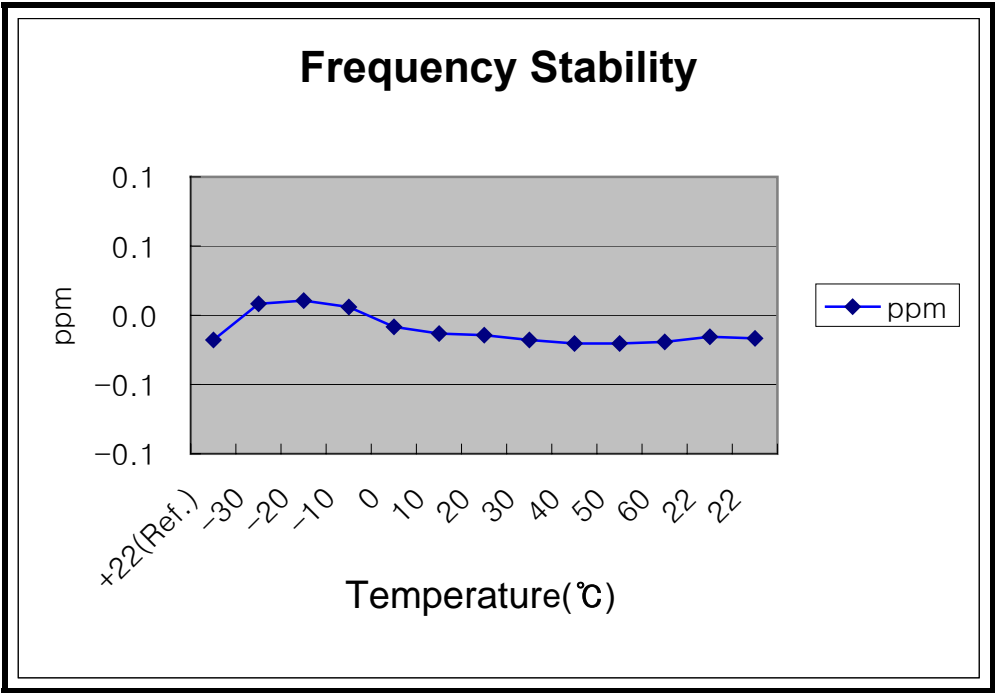
*The temperature is varied from -30°C to +60°C using an environmental chamber.

*Internal Battery of this phone is for backup purpose only.

9.8.1 Frequency Stability Graph (GSM850)



Zoom In



9.9 Frequency Stability / Temperature Variation (PCS1900)

Test Mode : Set to Middle channel (1880.0MHz)

Deviation Limit : $\pm 2.5\text{ppm}$

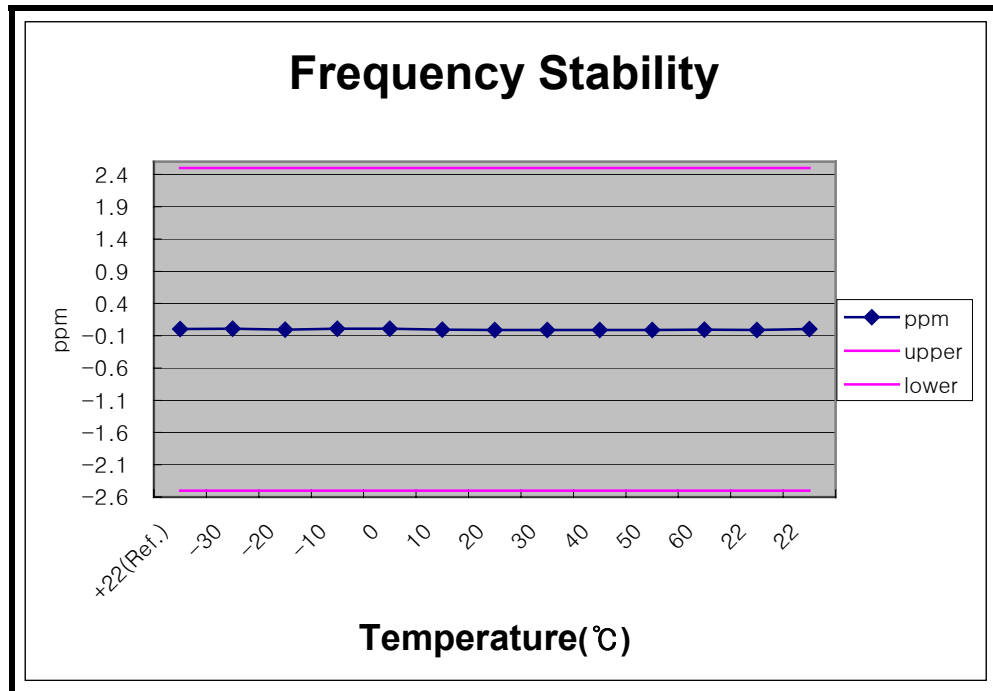
Measurement Result :

Voltage (%)	Power (Vac)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	PPM
100%	120	+22(Ref.)	1,880,000,010	10	0.0053
100%		-30	1,880,000,017	17	0.0090
100%		-20	1,879,999,989	-11	-0.0059
100%		-10	1,880,000,016	16	0.0085
100%		0	1,880,000,014	14	0.0074
100%		10	1,879,999,990	-10	-0.0053
100%		20	1,879,999,985	-15	-0.0080
100%		30	1,879,999,983	-17	-0.0090
100%		40	1,879,999,984	-16	-0.0085
100%		50	1,879,999,978	-22	-0.0117
100%		60	1,879,999,987	-13	-0.0069
85%	102	22	1,879,999,986	-14	-0.0074
115%	138	22	1,880,000,012	12	0.0064
Battery End point	-	-	-	-	-

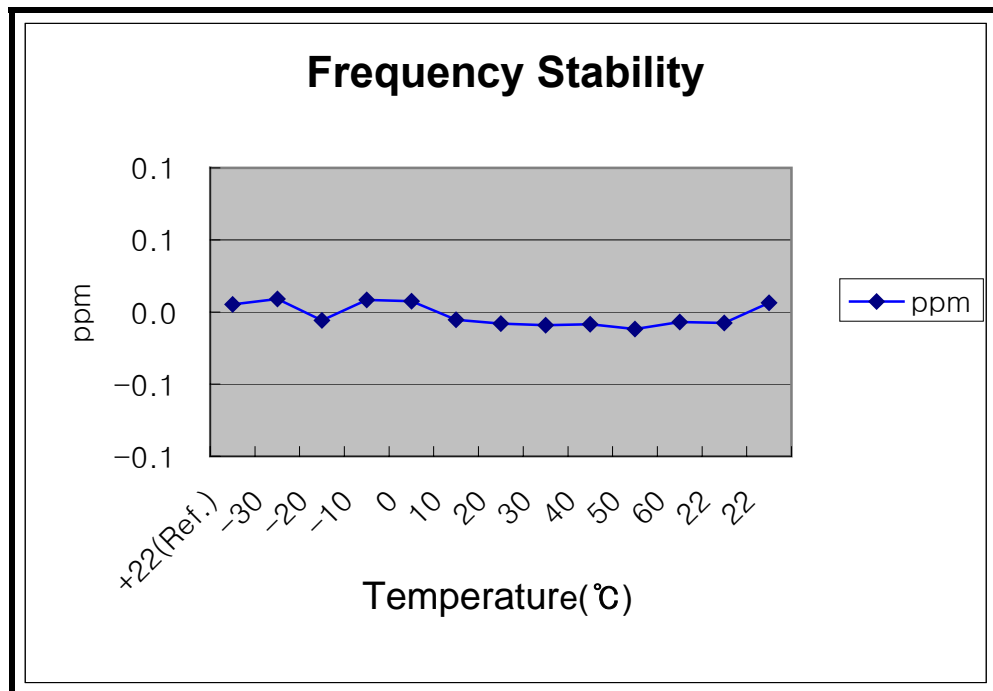
*The temperature is varied from -30°C to +60°C using an environmental chamber.

*Internal Battery of this phone is for backup purpose only.

9.9.1 Frequency Stability Graph (PCS1900)



Zoom In



9.10 AC Power LINE Conducted Emission

Measurement Result :

► GSM 850MHz TCH mode

Frequency (MHz)	Level(dB μ V)		Line	Limit(dB μ V)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.15	54.9	30.2	N	66.0	56.0	11.1	25.8
0.18	57.7	43.1	N	64.5	54.5	6.8	11.4
0.24	49.3	38.5	L	62.1	52.1	12.8	13.6
0.30	44.4	35.1	N	60.2	50.2	15.8	15.1
0.36	39.1	33.0	N	58.7	48.7	19.6	15.7
2.04	30.3	16.6	L	56.0	46.0	25.7	29.4

Line Conducted Emissions Tabulated Data

► PCS TCH mode

Frequency (MHz)	Level(dB μ V)		Line	Limit(dB μ V)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.18	60.1	45.4	L	64.5	54.5	4.4	9.1
0.24	50.8	41.1	L	62.1	52.1	11.3	11.0
0.30	45.7	38.6	L	60.2	50.2	14.5	11.6
0.36	41.1	34.4	L	58.7	48.7	17.6	14.3
0.53	34.6	28.9	N	56.0	46.0	21.4	17.1
0.82	34.2	26.2	N	56.0	46.0	21.8	19.8

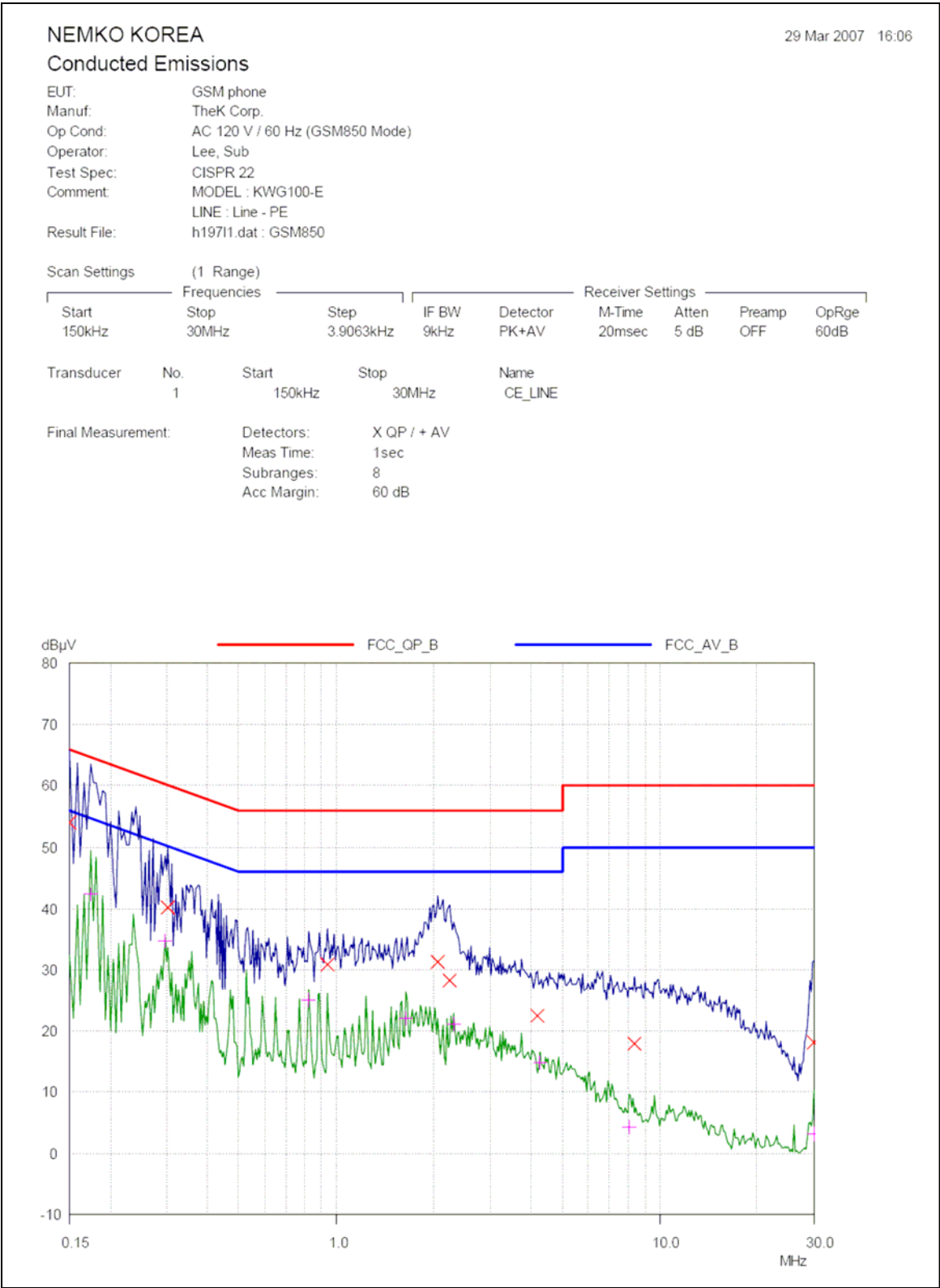
Line Conducted Emissions Tabulated Data

NOTES:

1. Measurements using CISPR quasi-peak mode & average mode.
2. All modes of operation were investigated and the worst -case emission are reported. See attached Plots.
3. LINE : L =Line , N = Neutral
4. The limit is on the FCC Part section 15.107(a).

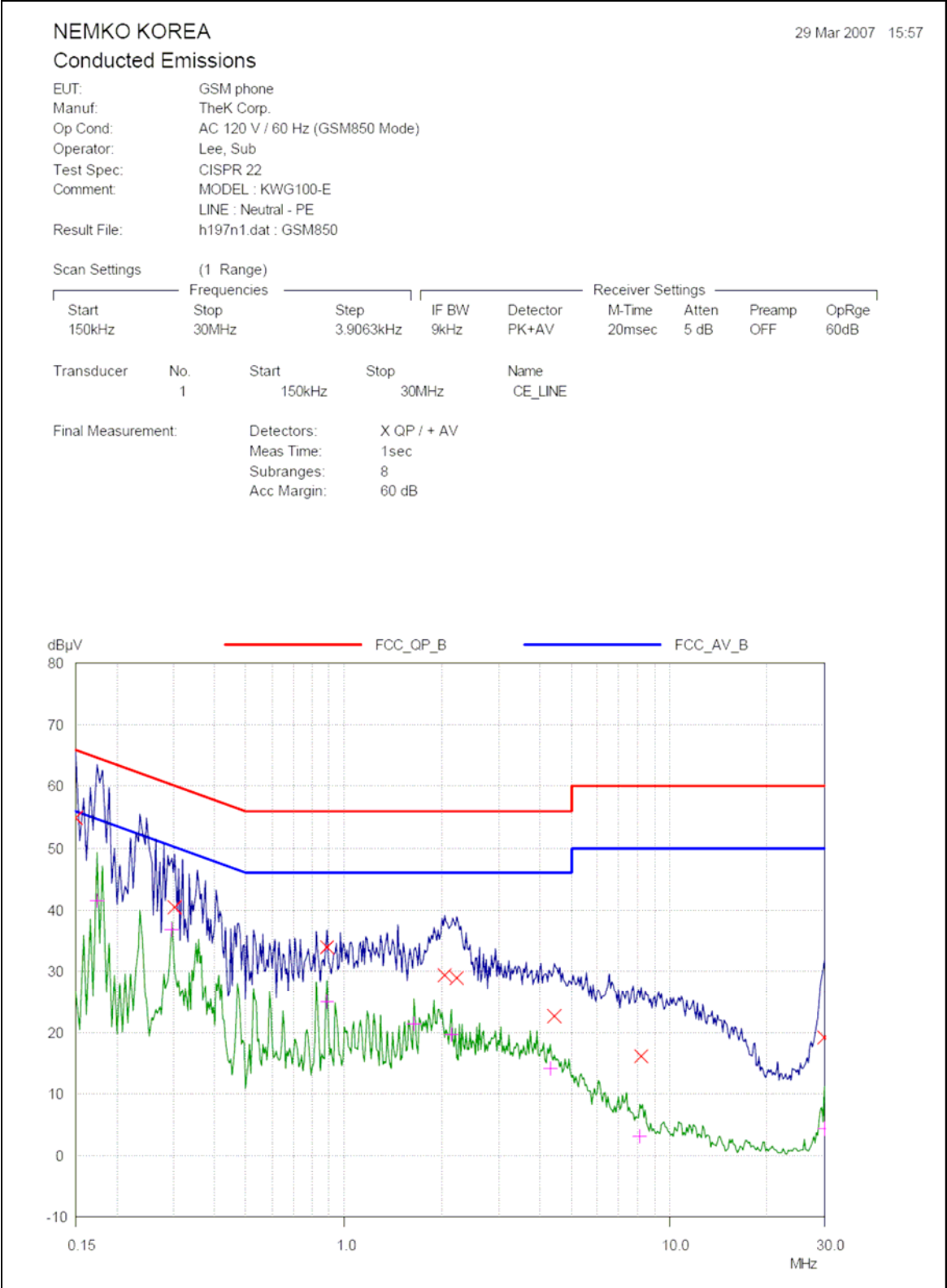
PLOTS OF EMISSIONS

● **Conducted Emission at the Mains port (GSM 850MHz TCH mode, Line)**



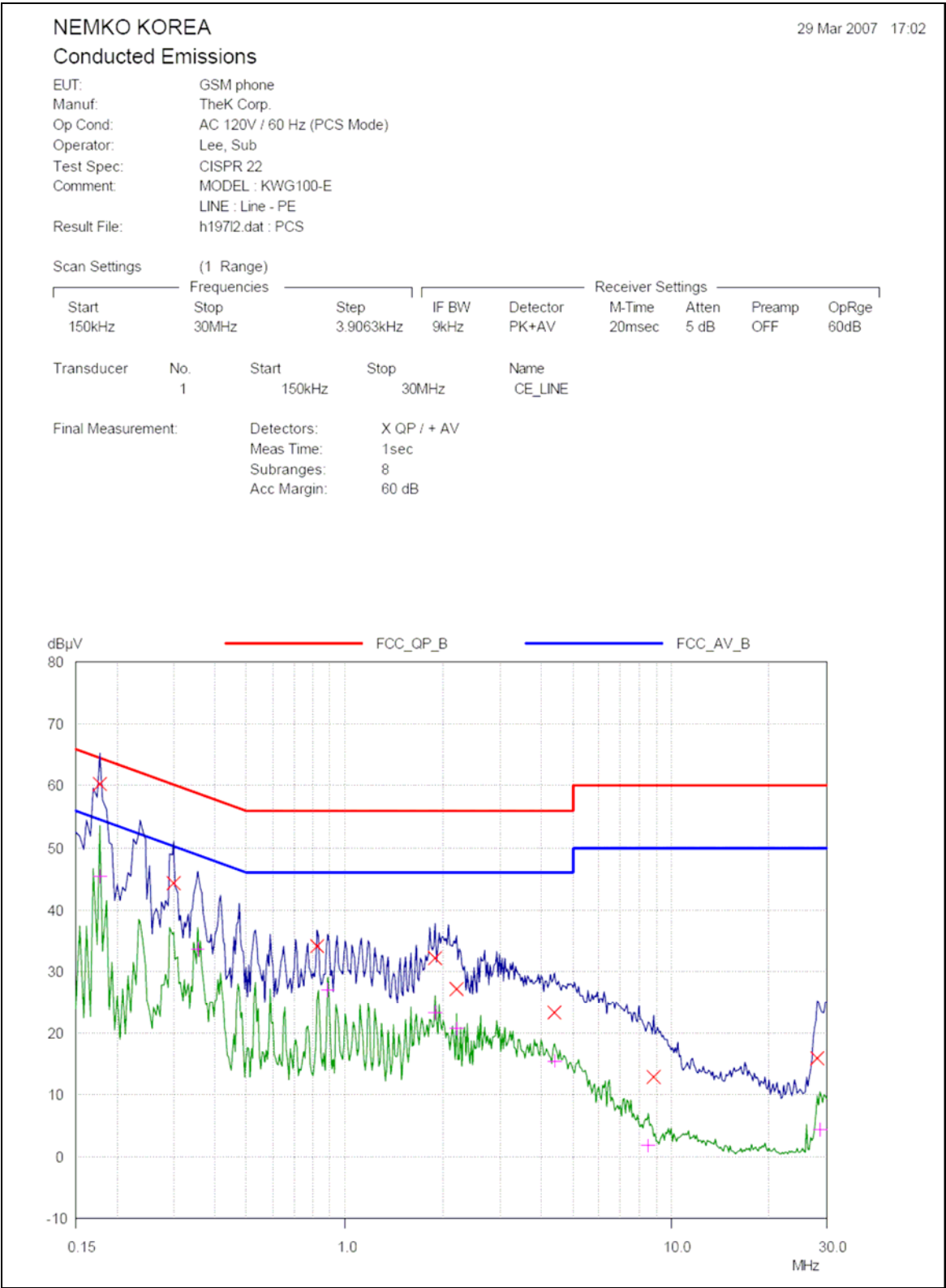
PLOTS OF EMISSIONS

● **Conducted Emission at the Mains port (GSM 850MHz TCH mode, Neutral)**



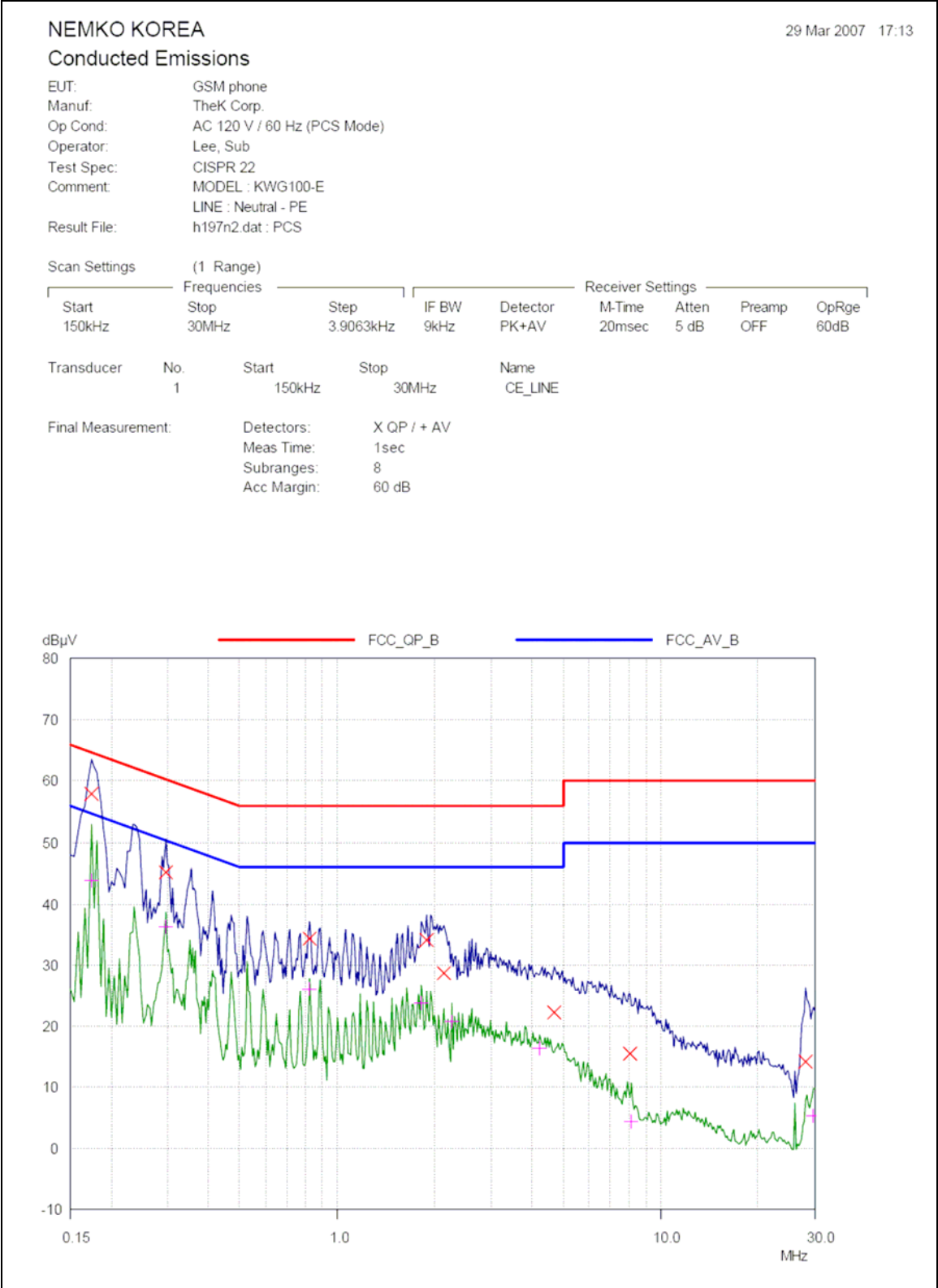
PLOTS OF EMISSIONS

● **Conducted Emission at the Mains port (PCS TCH mode, Line)**



PLOTS OF EMISSIONS

● **Conducted Emission at the Mains port (PCS TCH mode, Neutral)**



10. Emission Designator

Emission Designator

Emission Designator = 250KGXW

GSM Bandwidth = 250KHz

G = Phase Modulation

X = Cases not otherwise covered

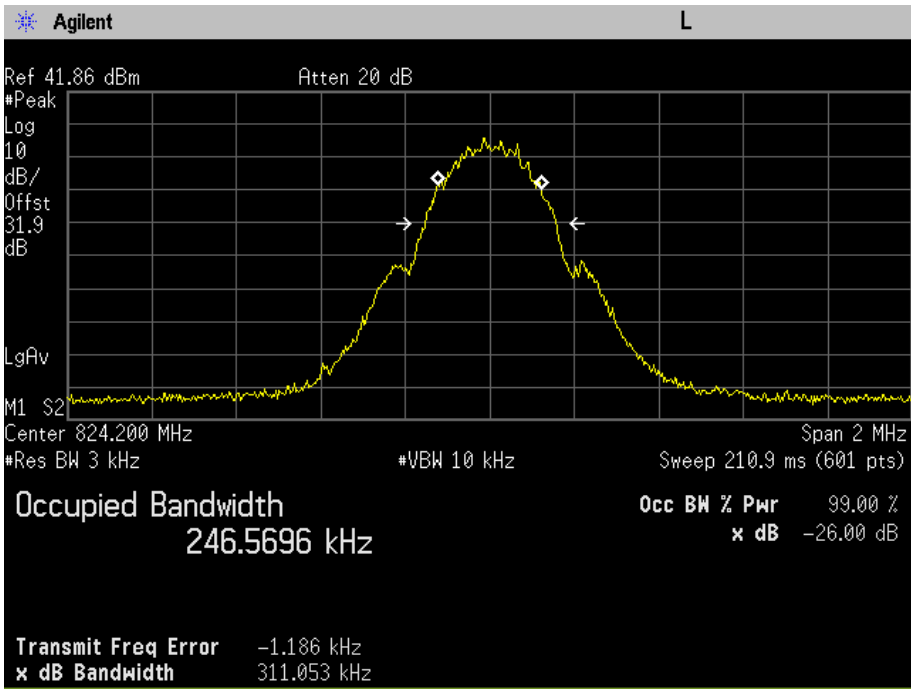
W = Combination (Audio/Data)

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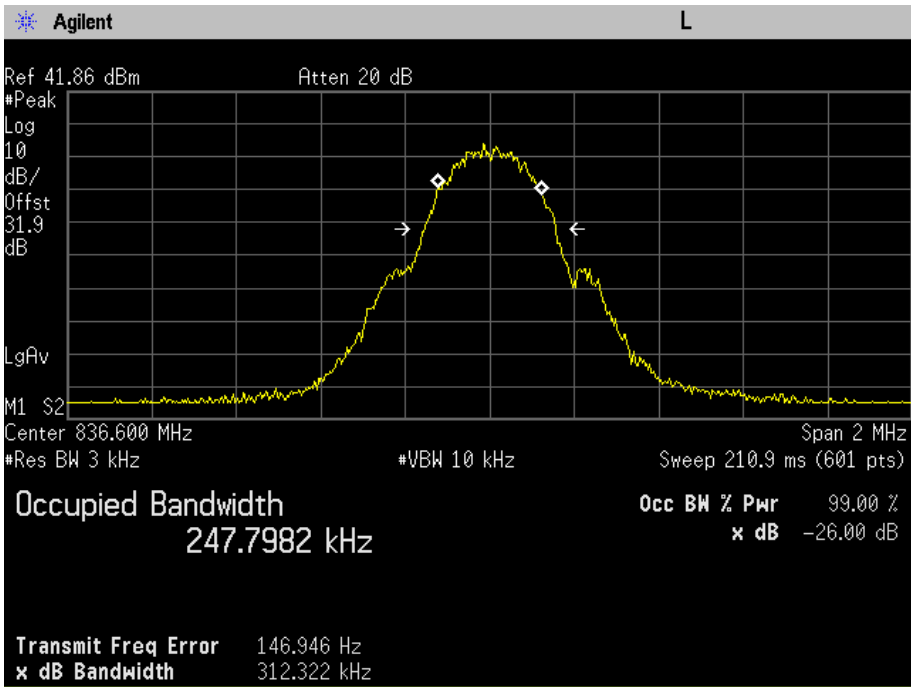
11. Test Plots (GSM850)

● Occupied Bandwidth / 26dB Bandwidth

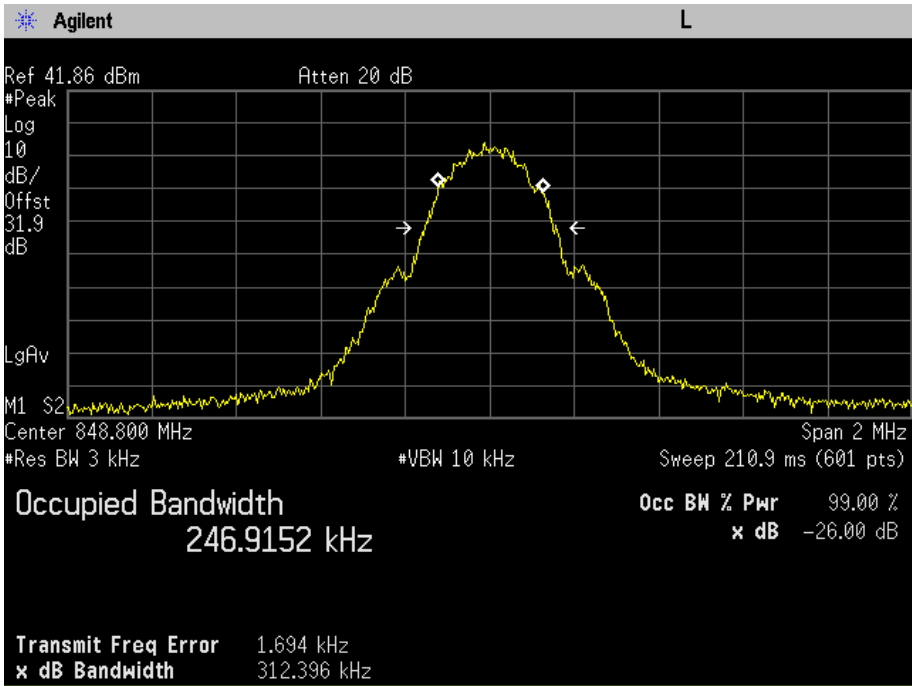
Channel 128



Channel 190



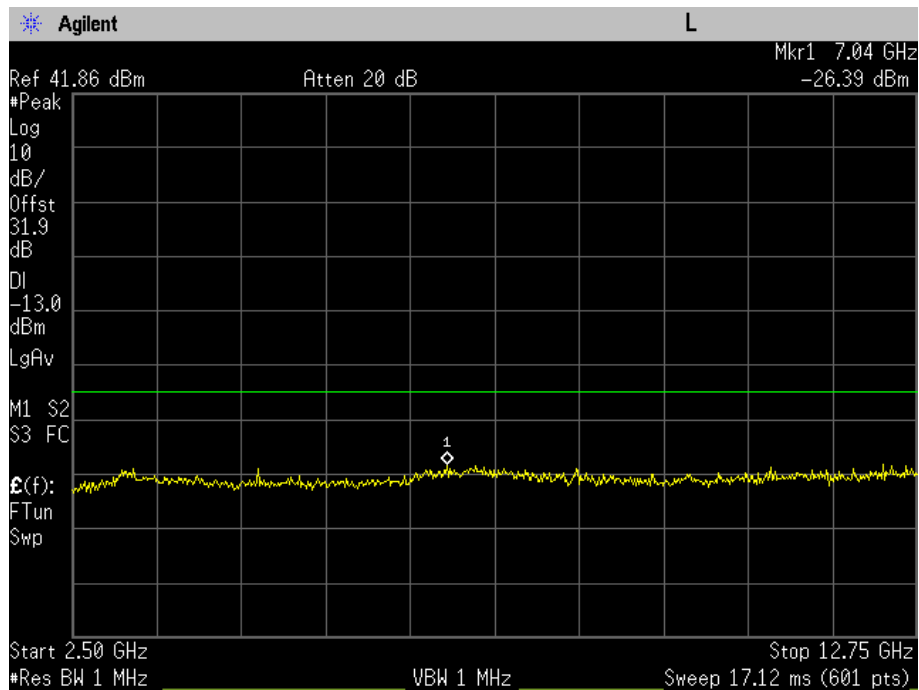
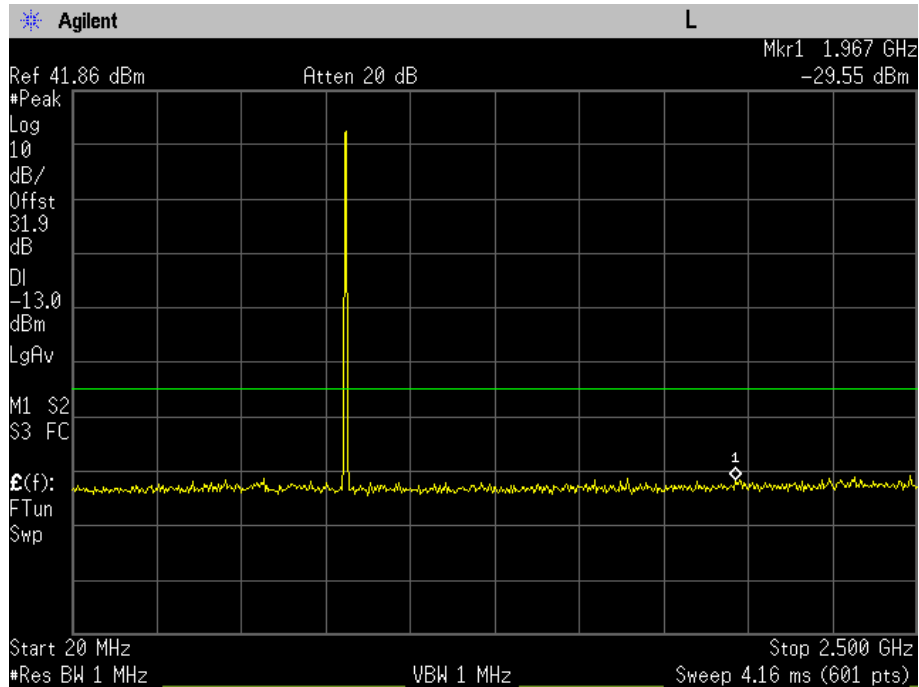
Channel 251



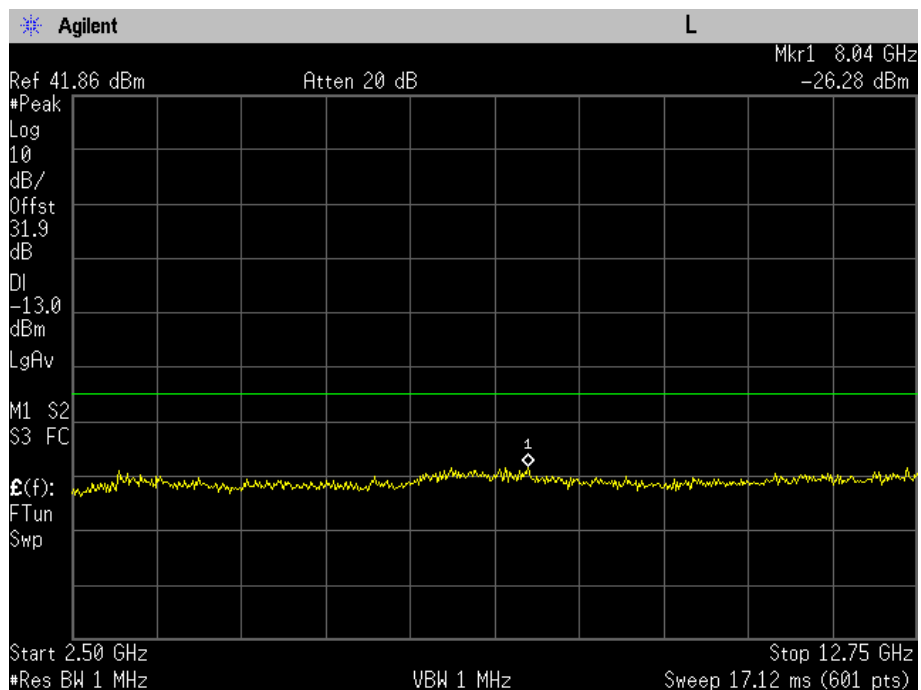
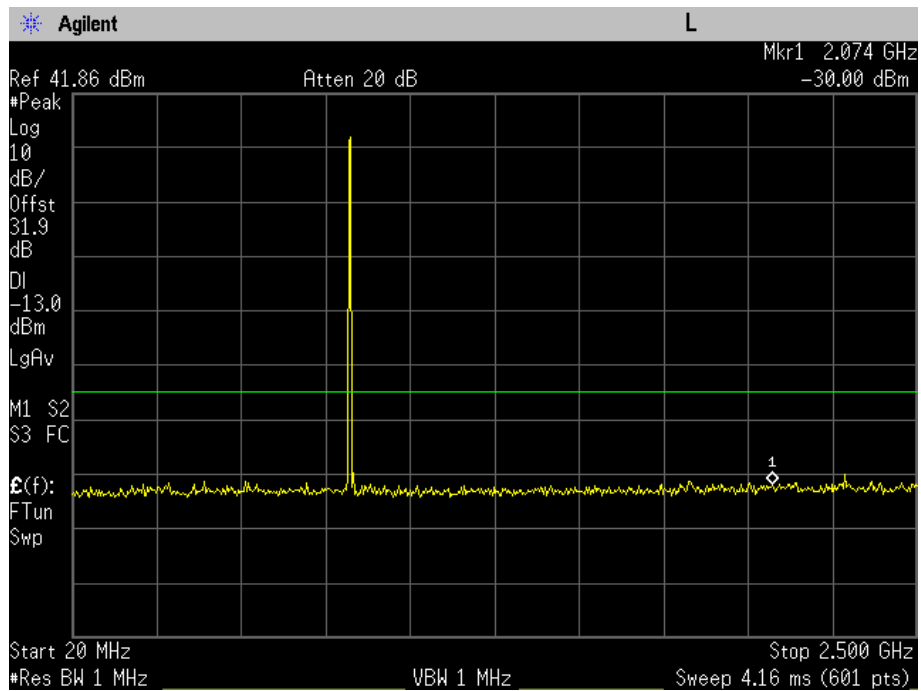
- End of page -

● **Spurious Emission at antenna Terminals**

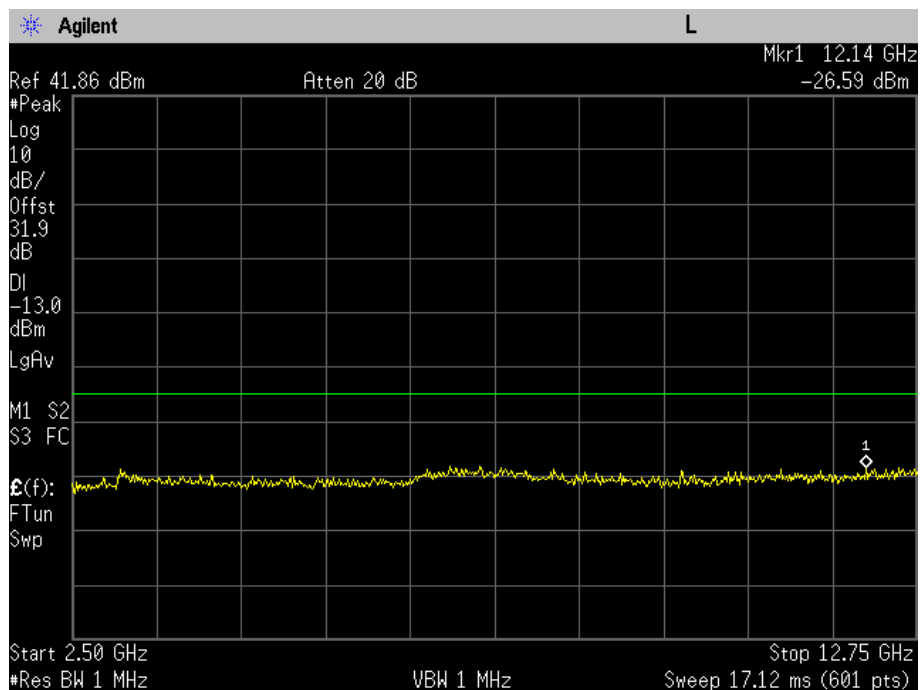
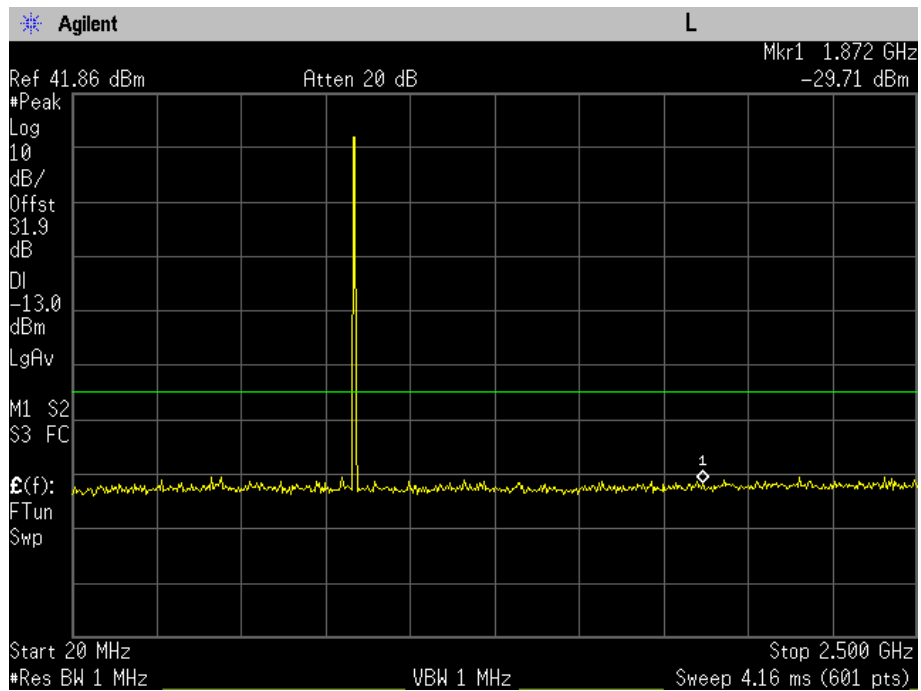
Channel 128



Channel 190

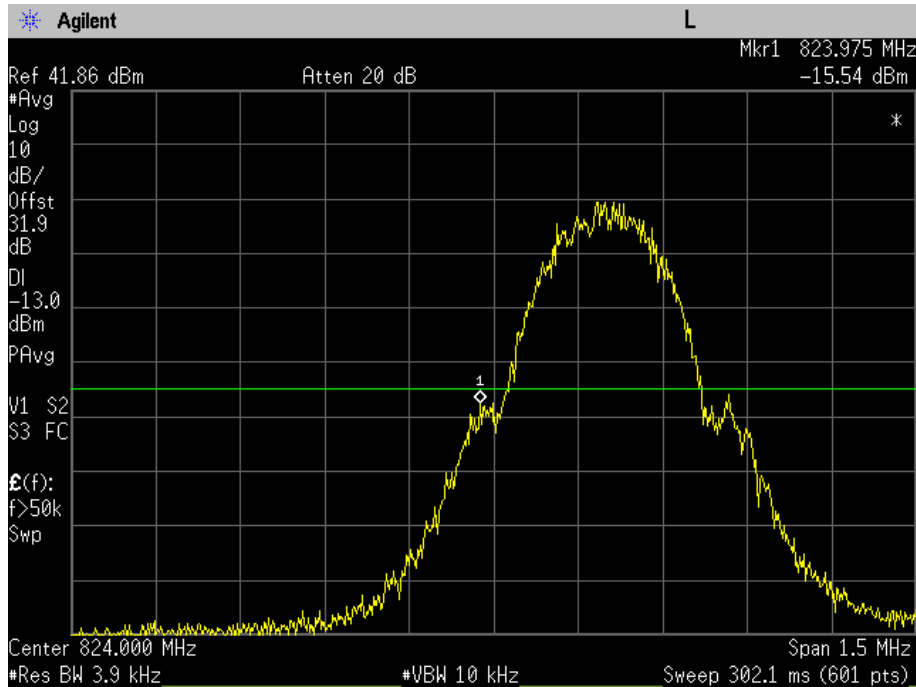


Channel 251

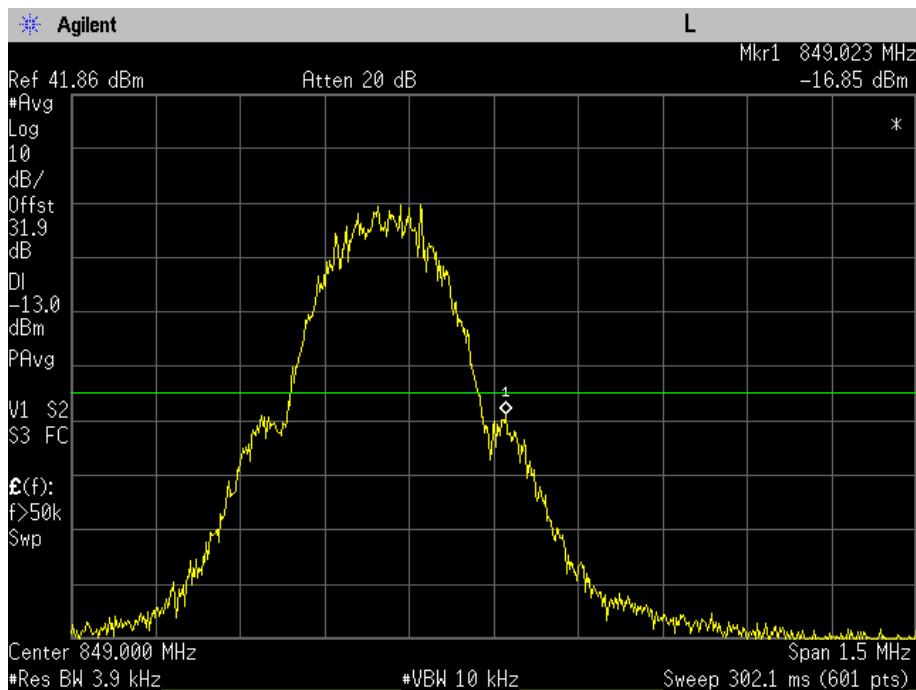


● **Band Edge**

Channel 128



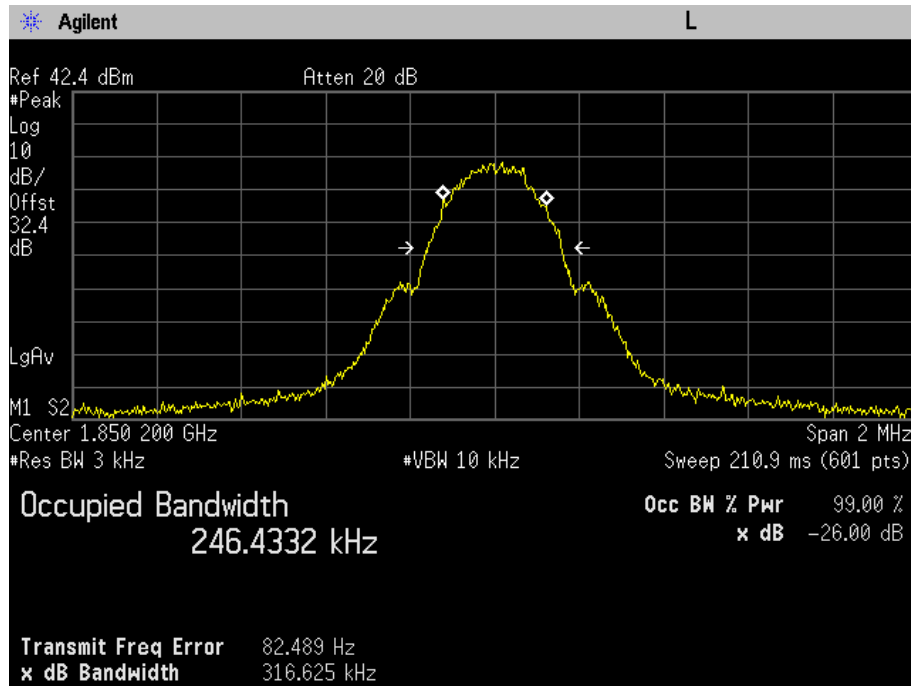
Channel 251



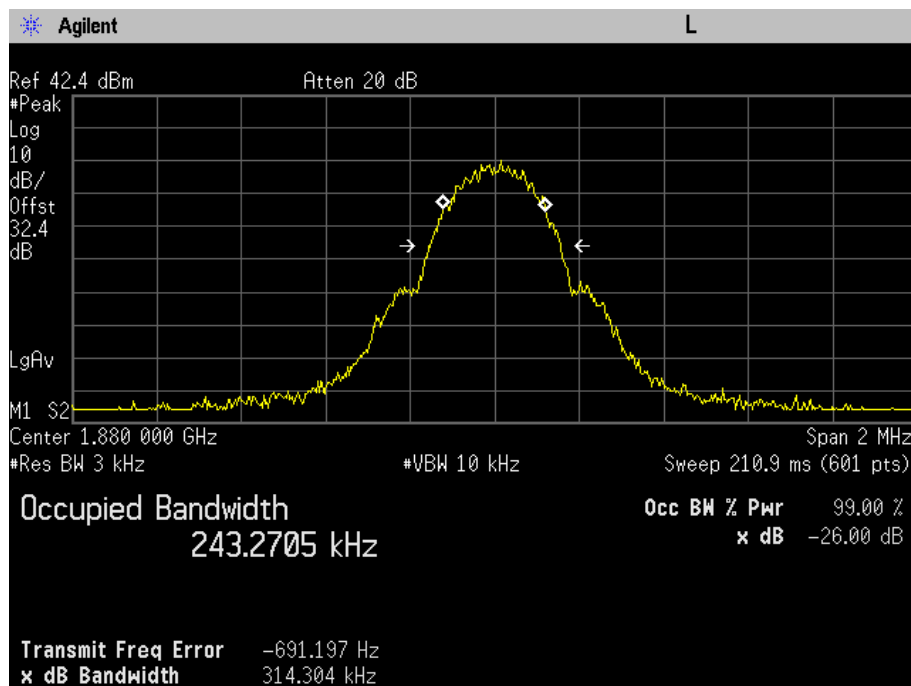
12. Test Plots (PCS1900)

● Occupied Bandwidth / 26dB Bandwidth

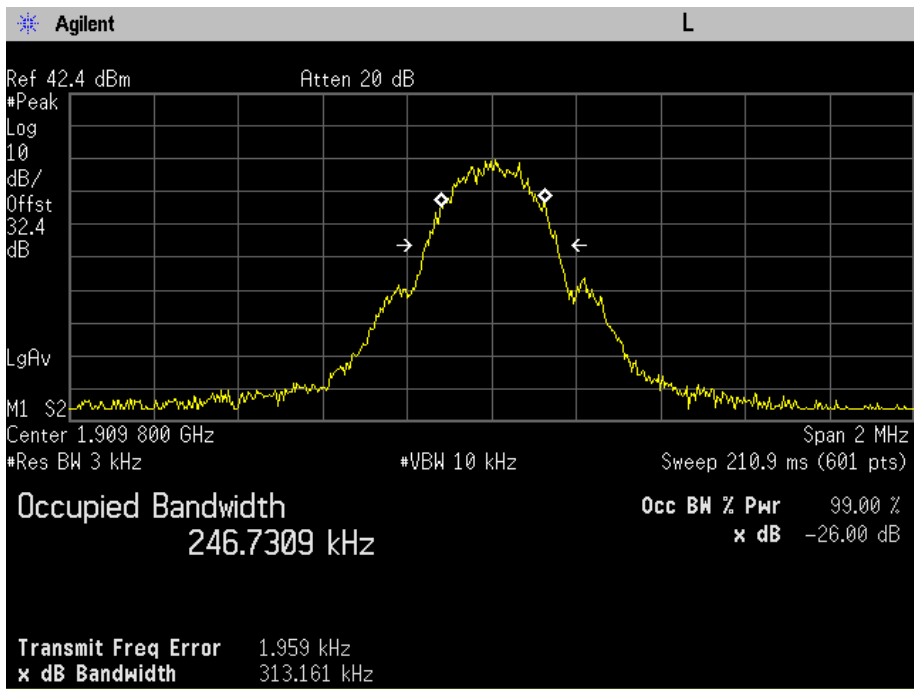
Channel 512



Channel 661



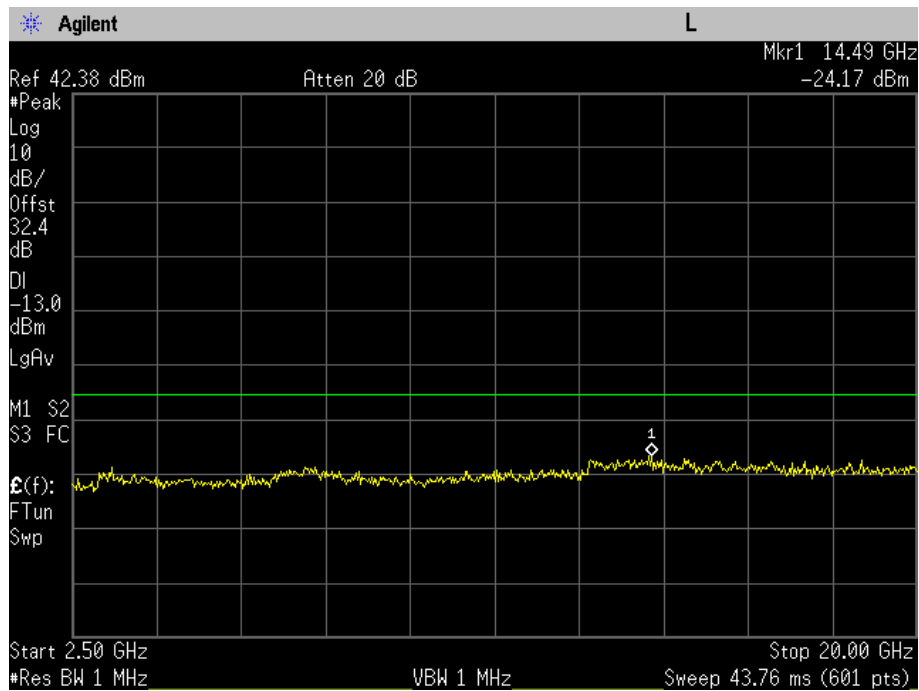
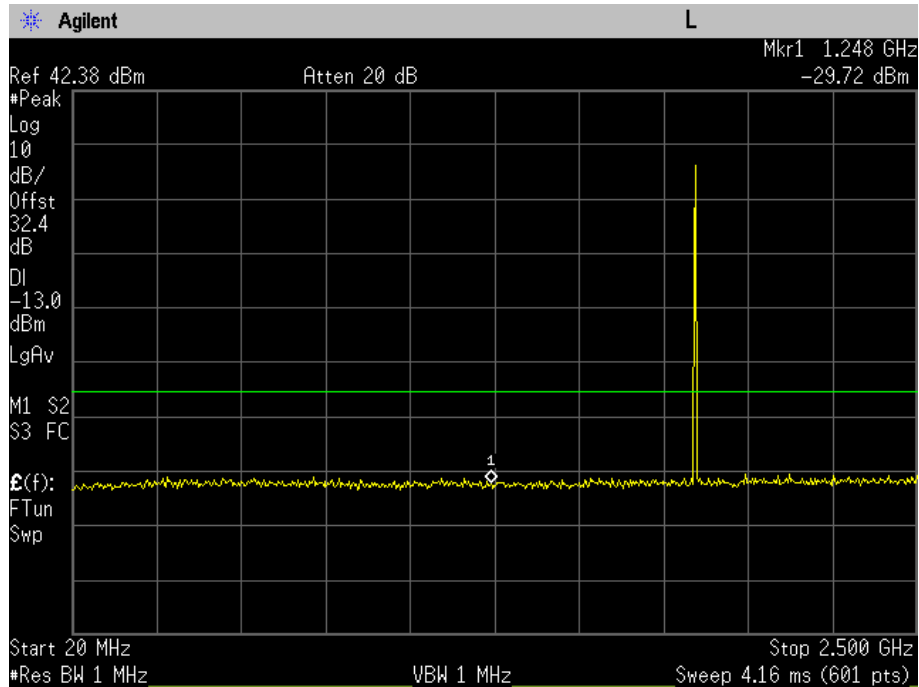
Channel 810



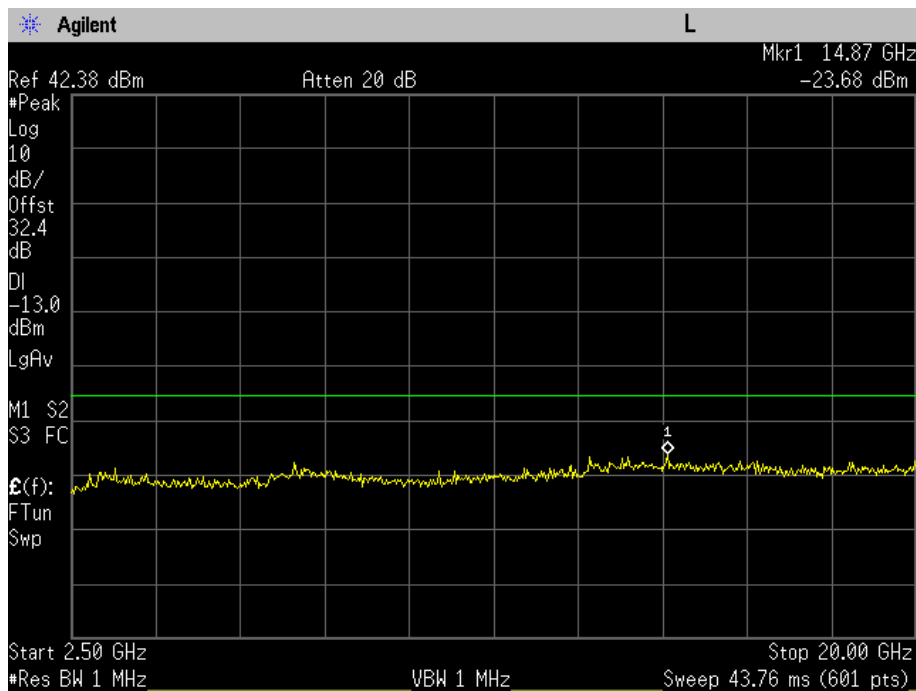
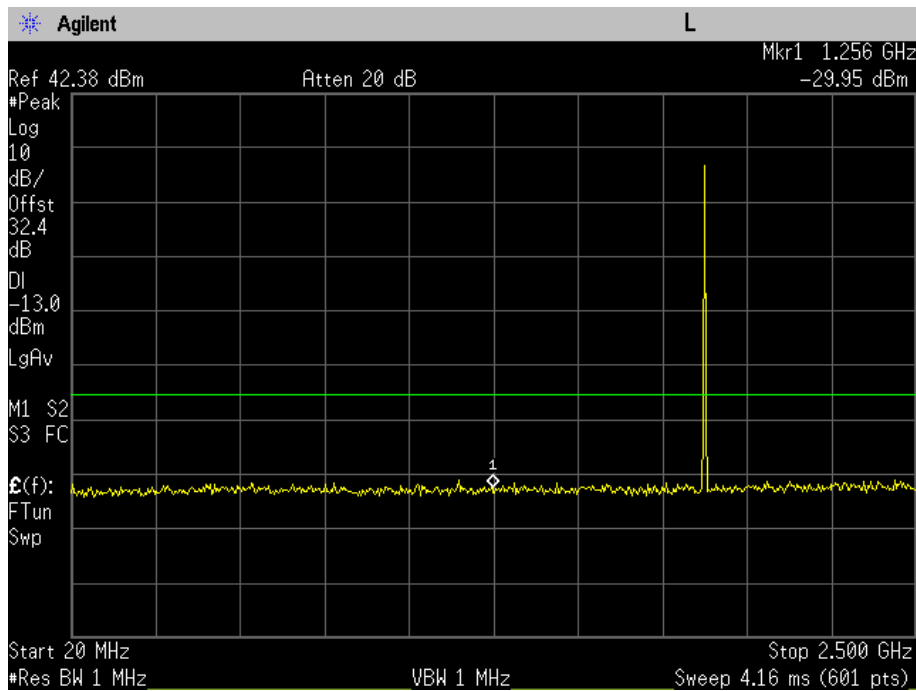
- End of page -

● Spurious Emission at antenna Terminals

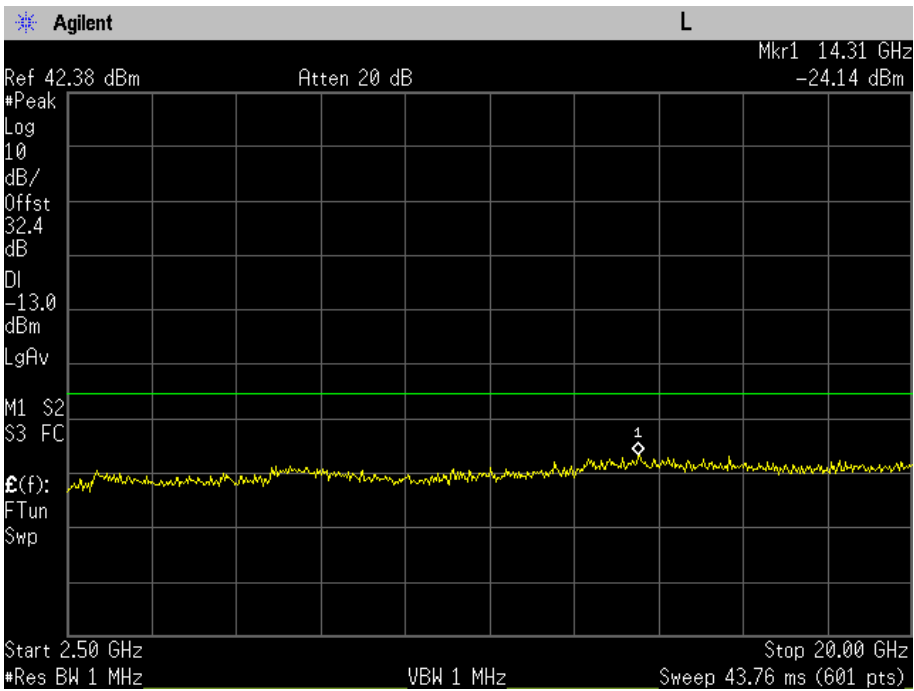
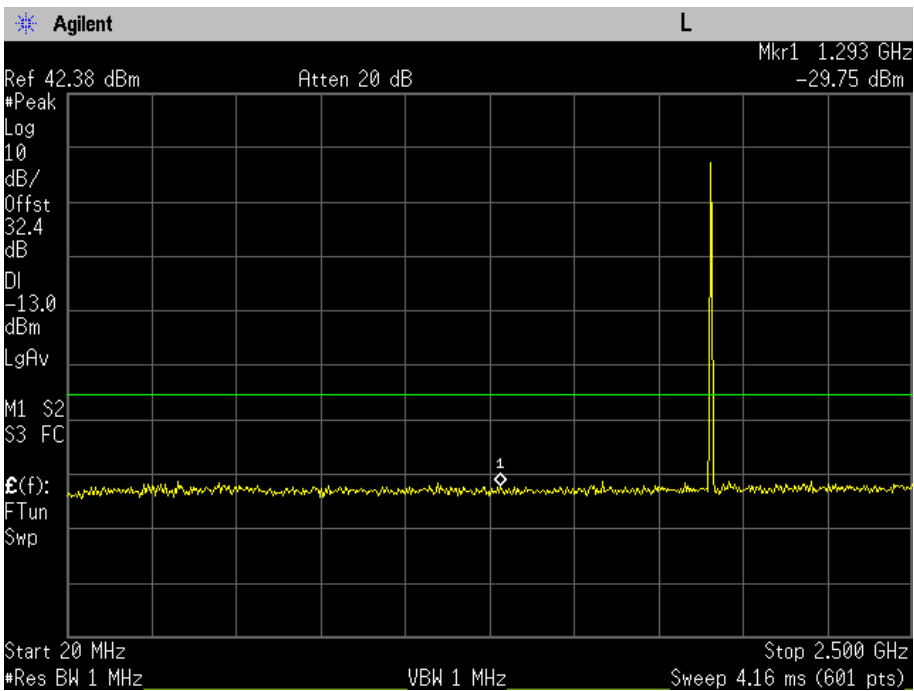
Channel 512



Channel 661

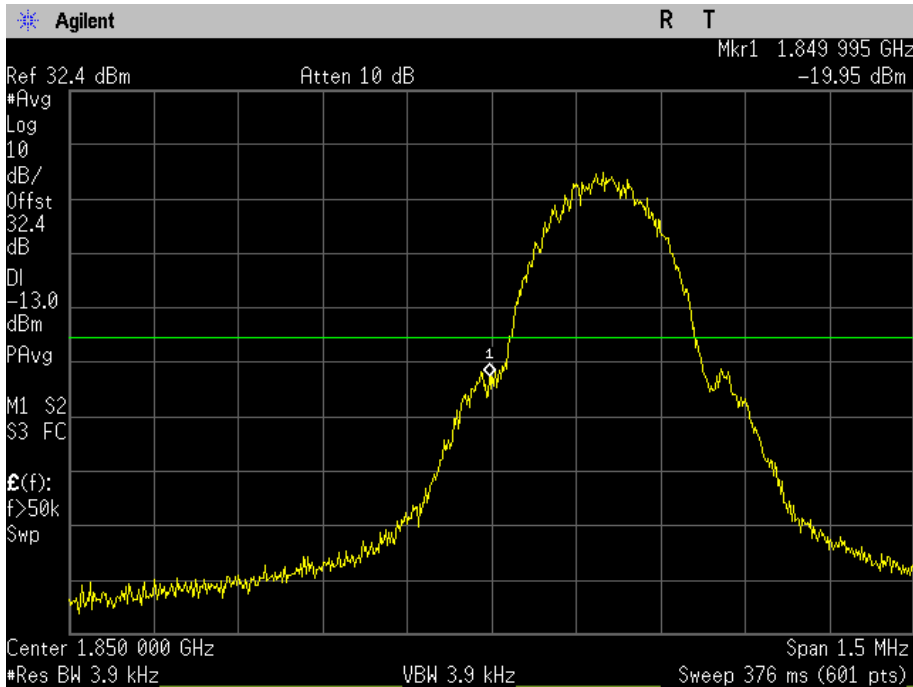


Channel 810

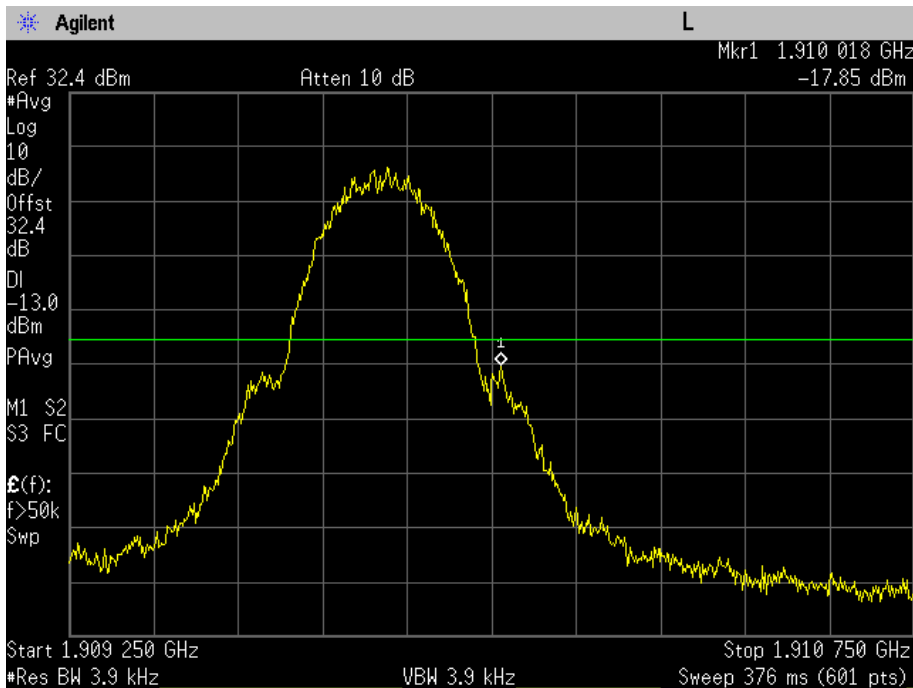


● **Band Edge**

Channel 512



Channel 810



13. MAXIMUM PERMISSIBLE EXPOSURE

RF Exposure Limit

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the

Environmental of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
(A) Limits for occupational / Contral Exposure				
30 - 300	61.4	0.163	1	6
300 - 1500	...	...	F/300	6
1500 - 100000	...	...	5	6
(B) Limits for General Population / Uncontrolled Exposure				
30 - 300	27.5	0.073	0.2	30
300 - 1500	...	...	F/1500	30
1500 - 100000	...	...	1	30

F = Frequency (MHz)

Fries formula

Fries transmission formula : $P_d = (P_{out} * G) / (4 * \pi * r^2)$

$$r = \sqrt{((P_{out} * G) / 4 * \pi * P_d)}$$

Where

P_d = Power density in mW/cm²

P_{out} = Output power to antenna in mW

G = Gain of antenna in linear scale

π = 3.1416

r = Distance between observation point center of the radiator in cm

P_d is the limit of MPE, F/1500 mW/cm²(GSM850)and 1 mW/cm²(PCS). If we know the Maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

TEST DATA

Test Result

The maximum antenna gain is 1dBi or 1.26(Numeric)

Output power into antenna and RF Exposure Distance

Channel	Frequency (MHz)	Output Power to Antenna(mW)	RF Exposure Distance (cm)
128	824.2	1698.20	17.60
190	836.6	1866.40	18.32
251	848.8	1940.90	18.54
512	1850.2	732.80	8.57
661	1880.0	798.00	8.95
810	1909.8	753.40	8.69

MPE Safe Distance =18.54cm