

## Nemko Korea CO., Ltd.

300-2, Osan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, KOREA

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### FCC EVALUATION REPORT FOR CERTIFICATION

**Applicant :****C-motech Co., Ltd.****8,9F Yongsan Bldg. Yoido-dong, Youngdungpo-Gu****Seoul, Korea, (Post code : 150-871)****Dates of Issue : March, 30, 2007****Test Report No. : NK2HR040****Test Site : Nemko Korea Co., Ltd.****FCC ID****TARCCC-650****Brand Name****C-motech****C-motech Co., Ltd.****Contact Person****8,9F Yongsan Bldg, Yoido-dong,****Youngdungpo-gu, Seoul Korea (150-871)****Mr. Byung-Young Choi****Telephone No. : +82 2 369-9881****Applied Standard:****FCC 47 CFR Part 15 & 2****FCC 47 CFR Part 22H****Classification:****FCC Class B Device****Equipment Class:****Public Mobile Services****EUT Type:****Single Band CDMA 1x EVDO Pcmcia Card Modem**

*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**

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## 1. Scope

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*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.*

<b>Responsible Party :</b>	C-motech Co., Ltd.
<b>Contact Person :</b>	Mr. Byung-Young Choi Tel No. : +82 2 369 9881
<b>Manufacturer :</b>	C-motech Co., Ltd. 8,9F Yongsan Bldg., Yoido-dog, Youngdungpo-gu, Seoul Korea (150-871)

- FCC ID: TARCCC-650
- Model: CCC-650
- Brand Name: C-motech
- EUT Type: Single Band CDMA 1x EVDO Pcmcia Card Modem
- Electric Rating: +3.3VDC from Pcmcia Card slot
- Interface Type: Pcmcia Card
- Equipment Class: Public Mobile Service
- Classification: FCC Class B
- Applied Standard: FCC 47 CFR Part 15 & 2  
FCC 47 CFR Part 22H
- Test Procedure(s): ANSI C63.4 (2003), DA 02-2138(2002)
- Dates of Test: March 13, 2007 to March 27, 2007
- Place of Tests: Nemko Korea Co., Ltd.
- Test Report No.: NK2HR040

## 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 **C-motech Co., Ltd.**

FCC ID : **TARCCC-650**

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 (18 miles) 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.

#### Environmental Conditions

Temperature	20°C ~ 25°C
Relative Humidity	30% ~ 55%

#### Description of EUT

Clock	X302 (32.768kHz), X301 (48MHz)	
Chipset(s)	U301(MSM6500)	
	U206(RFR6000), U106(RFT6100)	
Interface	Express Card slot	
Frequency Band	Tx	824.70 ~ 848.31MHz
	Rx	869.70 ~ 893.31MHz
Output Power	Cellular : ERP 0.622W(27.94dBm)	
Type of Oscillation	PLL Synthesizer & VCTCXO (19.2MHz)	
Modulation Method	Tx : OQPSK / Rx : QPSK	
Emission Designator	1M28F9W	
Number of channels	20CH for CDMA	
Antenna Type	Monopole Antenna	
Antenna Gain	-2.0 dBi ± 0.5	
Dimensions	88.5mm x 54.0mm x 5.0mm	
Weight	Approx.40g	
Operating Conditions	-40°C ~ +70°C (Storage), 95% (non-condensing)	

### **Support Equipment (Part 15)**

Notebook PC (Built-in EUT)	Dell ASIA PACIFIC SDN. Model: PPT(Latitude D400) Adaptor : Dell Model : SA90PS0-00 1.8m unshielded AC cable, 1.5m shielded DC cable	S/N: N/A  S/N: N/A
Wireless Communications Test Set	Agilent Model : E5515C	S/N: GB43193659
USB Mouse	Suzhou Logitech Electronics Co., Ltd. Model : M-UR69 1.6m shielded USB cable	S/N: LNA31701862
Serial Mouse	CHIC TECHNOLOGY CORP. Model : SMP2000WX 1.6m unshielded USB cable	S/N: N/A
Printer	Hewlett Packard Company Model : C6411A Adaptor : YOKOGAWA Model : C6409-60152 1.8m unshielded AC cable, 1.5m shielded DC cable, 1.6m shielded USB cable	S/N: N/A  S/N: N/A

## 4. Measuring Instrument Calibration

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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

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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)	Complies
Conducted Output Power	§2.1046(a) §22.913(a)	Complies
Occupied Bandwidth / 26dB Emission Bandwidth	§2.1049(h) (i)	Complies
Spurious Emission at antenna Terminals	§2.1051 §22.917(a)	Complies
Field Strength of spurious Radiations	§2.1053 §22.917(a)	Complies
Frequency Stability / Temperature Variation	§2.1055 §22.355	Complies
Band Edge	§22.905	Complies
AC Power Line Conducted Emission	§15.107	Complies

## 6. Recommendation / Conclusion

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The data collected shows that the **C-motech Co., Ltd.**

FCC ID : **TARCCC-650, Single Band CDMA 1xEVDO Pcmcia Card Modem.**

The highest emission observed was at **0.20MHz** for conducted emissions with a Average margin of **10.5 dB**, at **855.02MHz** for radiated emissions with a margin of **1.1 dB**.

## 7. Sample Calculation

### 7.1 Radiation for Part 15

$$\text{dB } \mu V = 20 \log_{10} (\mu V/m)$$

$$\mu V = 10^{(\text{dB } \mu V/20)}$$

#### EX. 1.

@165.0 MHz

Class B limit = 30.0 dB  $\mu V/m$

Reading = 38.2 dB  $\mu V$  (calibrated level)

Antenna factor + Cable Loss + Amplifier Gain = -12.9 dB

Total = 25.30 dB  $\mu V/m$

Margin = 30.0 – 25.30 = 4.70

4.70 dB below the limit

### 7.2 Radiation for Part 22

The formula below was used to calculate the ERP 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.

$$P_{\text{ERP[W]}} = \frac{10^{(P_{\text{subst\_TX[dBm]}} + P_{\text{EUT[dBm]}} - P_{\text{subst\_RX[dBm]}} + G_{\text{substitute\_antenna[dBd]}} - L_{\text{cable[dB]}})/10}}{1000}$$

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
$L_{\text{Cable [dB]}}$	Loss of the cable between signal generator and the substituting antenna

## 8. Test Equipment List

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	Test Receiver	R & S	ESCS 30	833364/020	Aug. 07 2006	1year
2	*Test Receiver	R & S	ESCS 30	100302	Dec. 04 2006	1year
3	Amplifier	HP	8447F	3113A04549	Aug. 07 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	HP	8566B	267A03469	Mar. 06 2007	1year
8	*Spectrum Analyzer	Agilent	E4440A	MY44303257	Nov.29 2006	1year
9	*Biconical Log-Perio. Antenna	ARA	LBP-2520/A	1209	Dec. 14 2006	1year
10	*Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-474	Apr. 05 2006	1year
11	*Biconical Log Antenn	ARA	LPB-2520/A	1180	Feb. 28 2007	1year
12	Signal Generater	R & S	SMP02	833286/003	Aug. 17 2006	1year
13	*LISN	R & S	ESH3-Z5	833874/006	Nov. 02 2006	1year
14	*Position Controller	DAEIL EMC	N/A	N/A	N/A	N/A
15	*Turn Table	DAEIL EMC	N/A	N/A	N/A	N/A
16	*Antenna Mast	DAEIL EMC	N/A	N/A	N/A	N/A
17	*Anechoic Chamber	EM Eng.	N/A	N/A	N/A	N/A
18	*Shielded Room	EM Eng.	N/A	N/A	N/A	N/A
19	*Position Controller	Inn-co	CO2000	N/A	N/A	N/A
20	*Turn Table	Inn-co	DS1200S	N/A	N/A	N/A
21	*Antenna Mast	Inn-co	AS2000P	N/A	N/A	N/A
22	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
23	*Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-508	Oct. 30 2006	1year
24	*Communications Test Set	Agilent	E5515C	GB43193659	Jun.09 2006	1year
25	*Spectrum Analyzer	Agilent	E4440A	MY44022567	Dec.05 2006	1year
26	*Signal Generator	Anritsu	68245B	983206	Dec.06 2006	1year
27	*Spectrum Analyzer	Agilent	E4440A	MY44303257	Nov.29 2006	1year

\*) Test equipment used during the test

## 9. Description of Tests

### 9.1 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.

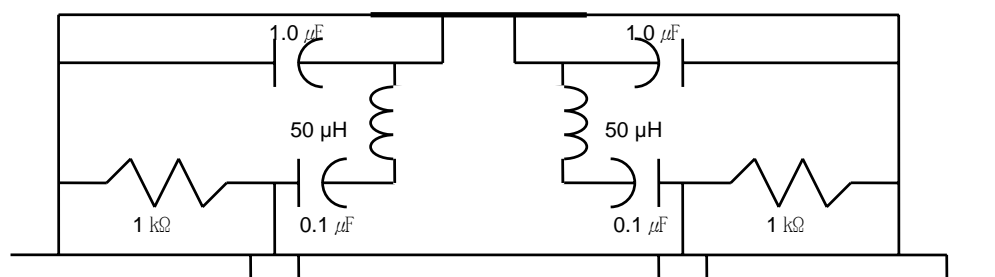


Fig. 2. LISN Schematic Diagram

## 9.2 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 re configured 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 turn table 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.

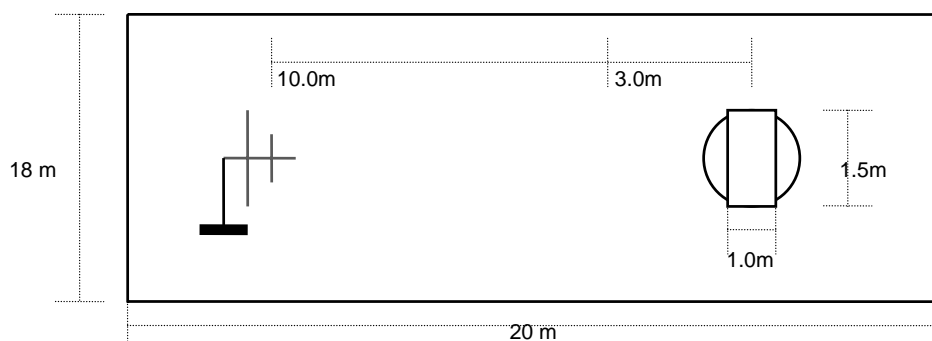


Fig. 3. Dimensions of Outdoor Test Site

### 9.3 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.

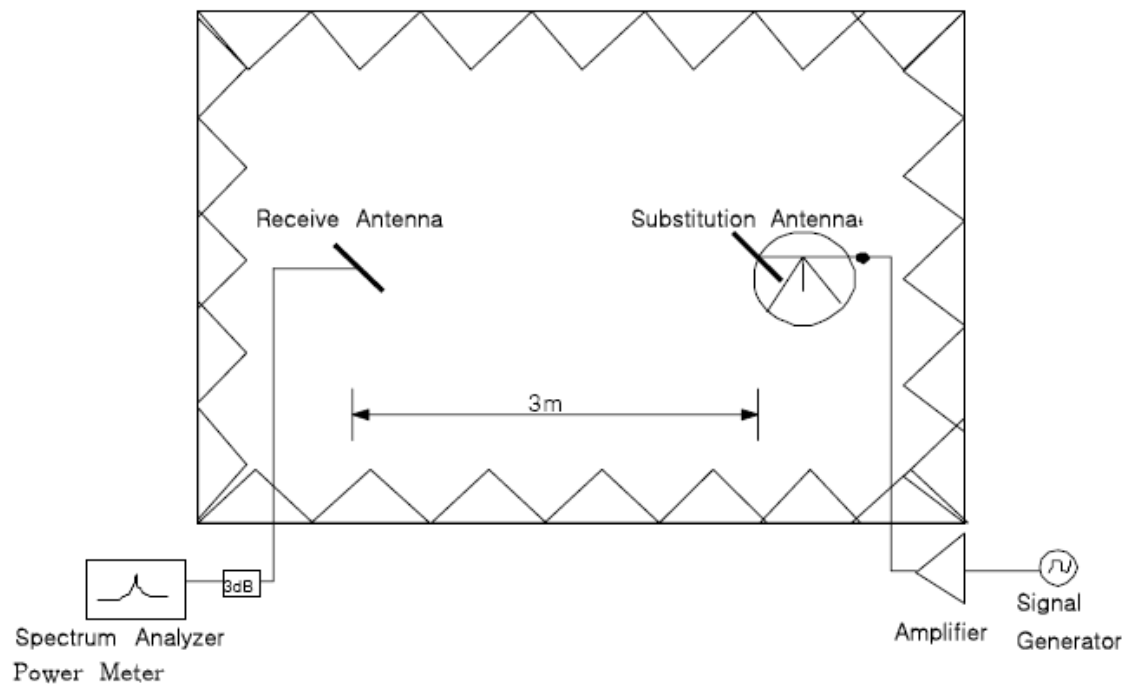


Figure 4. Diagram of ERP/EIRP test Set-up

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.

## 9.4 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.

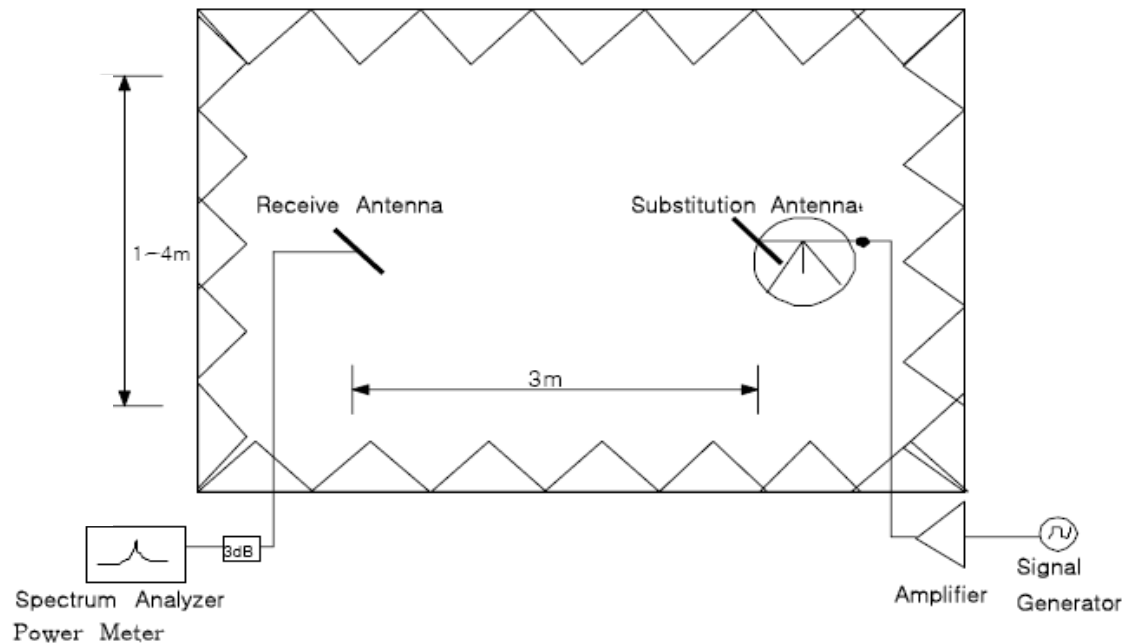


Figure 5. Diagram of Radiated Spurious & Harmonic test Set-up

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.

## 9.5 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 herein.

### 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.

## 9.6 Spurious and Harmonic Emissions at Antenna Terminal

### 9.6.1 Occupied Bandwidth Emission Limits

- (a) On any frequency outside a licensee'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**

## 9.6.2 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.

$$43 + 10\log(0.622 \text{ W}) = 40.94 \text{ dB}$$

$$27.94 \text{ dBm} - 40.94 \text{ dB} = -13 \text{ dBm}$$

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 10GHz.

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.

## 9.7 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 a three minute 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.

## 9.8 Output Power Variation

### Test Condition to measure the Output Power

This device was tested under all RCs and SOs and worst case is reported with 1x EVDO FTAP & RTAP with “All Up” power control bits. (MS protocol rev. number 6)

1. If the mobile station supports Reverse TCH RC1 and Forward TCH RC 1, set-up a call using Fundamental Channel Test Mode 1 (RC 1/1) with 9600bps data rate only.
2. Under RC1 C.S0011, Table 3 parameters were applied.
3. If the mobile station supports the RC3 Reverse FCH, RC3 Reverse SCH0 and demodulation of RC3, RC4, RC5, set-up a call using Supplemental Channel Test Mode 3 (RC 3/3) with 9600bps fundamental channel and 9600bps SCH0 data rate.
4. Under RC3 C.S0011, Table 4 was applied.

**Table 3 Test Parameters for Maximum RF Output Power for RC 1**

Parameter	Units	Value
$\bar{I}_{or}$	dBm/1.23 MHz	-104
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

**Table 4 Test Parameters for Maximum RF Output Power for RC 3**

Parameter	Units	Value
$\bar{I}_{or}$	dBm/1.23 MHz	-86
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

## 10. Test Data

### 10.1 AC Power Line Conducted Emissions

FCC ID : TARCCC-650

#### ► Cellular 1xEVDO mode

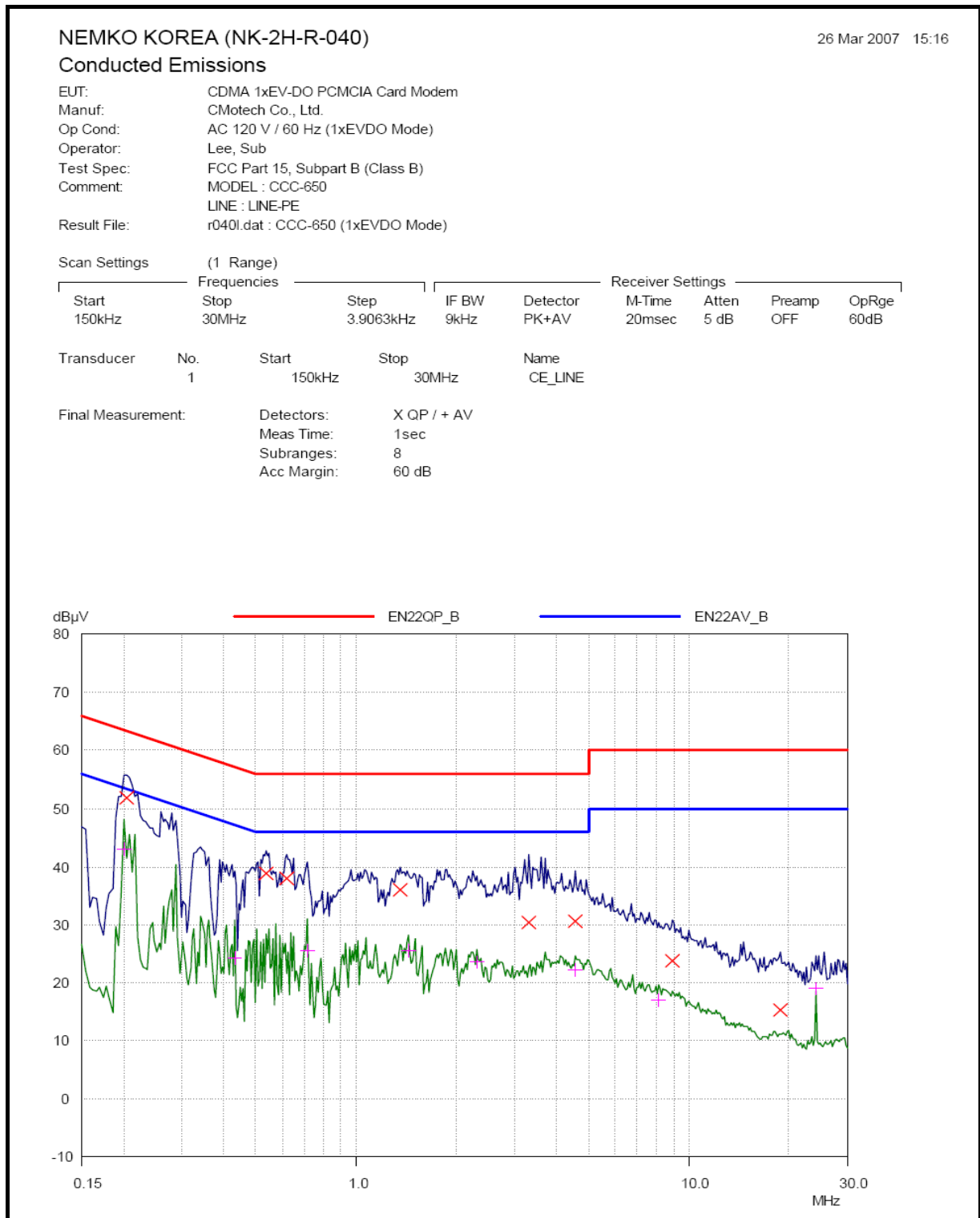
Frequency (MHz)	Level(dB $\mu$ V)		Line	Limit(dB $\mu$ V)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.20	52.8	43.1	N	63.6	53.6	10.8	10.5
0.26	44.4	33.3	N	61.4	51.4	17.0	18.1
0.34	40.2	29.4	L	59.2	49.2	19.0	19.8
0.42	37.3	26.1	N	57.4	47.4	20.1	21.3
3.20	33.1	22.8	N	56.0	46.0	22.9	23.2
3.71	31.3	21.0	L	56.0	46.0	24.7	25.0

**Table 10.1.1 Line Conducted Emissions Tabulated Data**

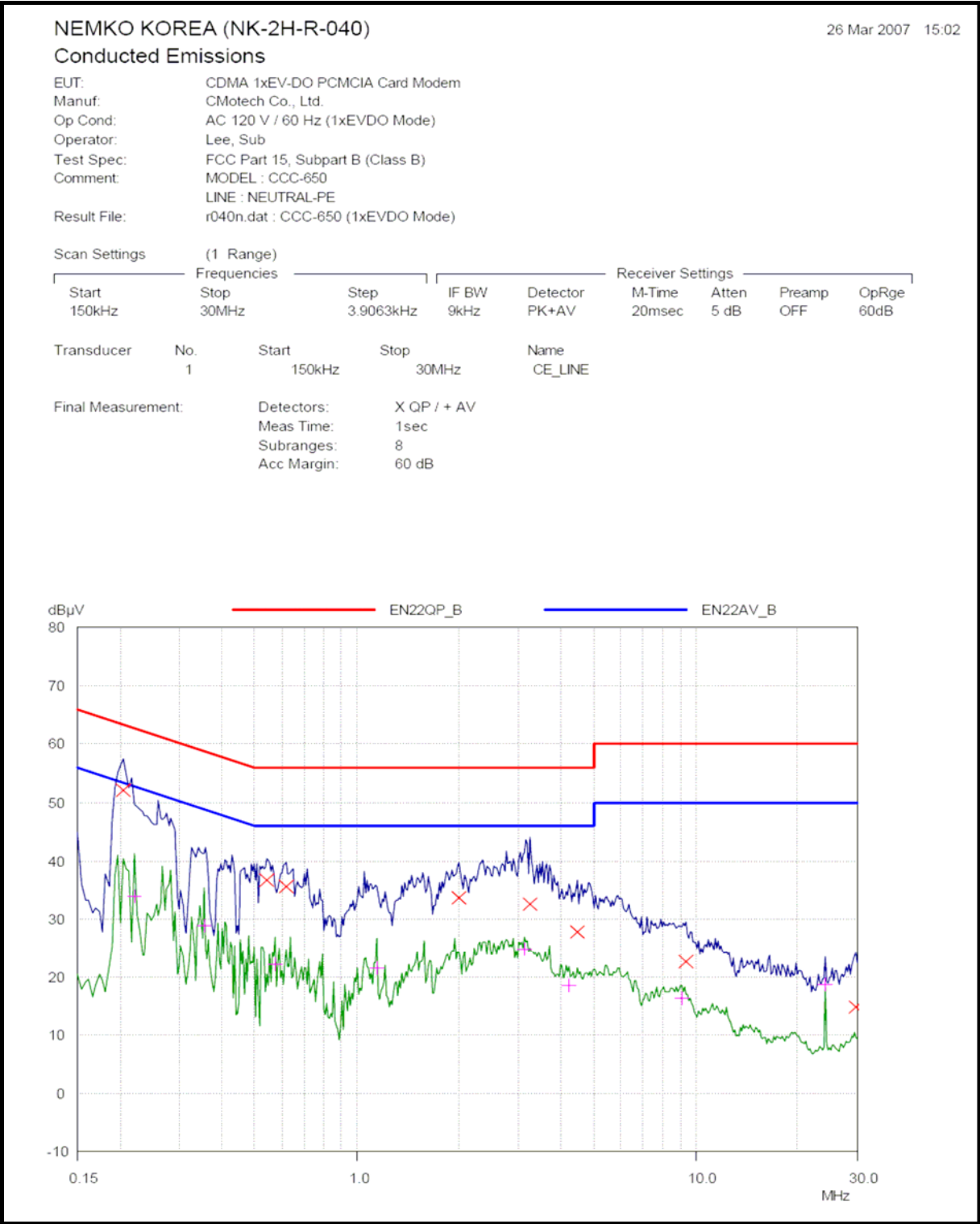
#### NOTES:

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).

**Conducted Emission at the Mains port (Cellular 1xEVDO mode, Line)**



● **Conducted Emission at the Mains port (Cellular 1xEVDO mode, Neutral)**



## 10.2 Field Strength of Radiated Emissions (30MHz ~ 1GHz)

FCC ID : TARCCC-650

### ► Cellular 1xEVDO mode

Frequency (MHz)	Reading (dB $\mu$ V/m)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
165.92	29.9	H	-9.5	20.4	43.5	23.1
387.46	33.1	H	-8.2	24.9	46.0	21.1
815.72	30.3	H	0.8	31.1	46.0	14.9
816.77	37.2	H	0.9	38.1	46.0	7.9
855.02	43.2	H	1.7	44.9	46.0	1.1
856.10	43.1	H	1.7	44.8	46.0	1.2

Table 10.2.1. Radiated Measurements at 3meters

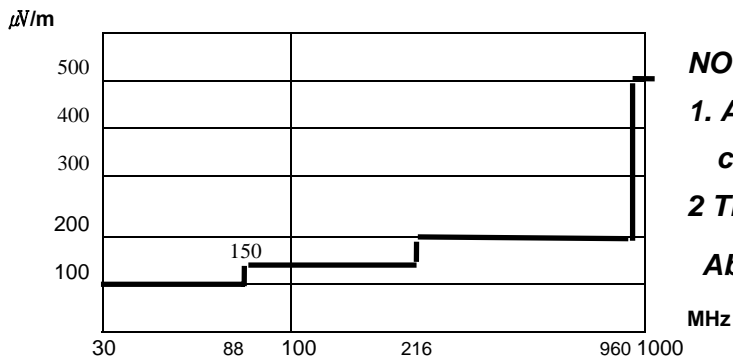


Fig. 4. Limits at 3 meters

#### NOTES:

1. All modes were measured and the worst-case emission was reported.
  - 2 The radiated limits are shown on Figure 4.
- Above 1GHz the limit is 500  $\mu$ 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).

### 10.3 Effective Radiated Power (ERP)

#### Measurement Results :

#### CDMA2000 1x (Antenna IN)

Frequency (MHz)	*EUT Pol.	Ant. Pol.	P <sub>EUT</sub> (dBm)	P <sub>TX</sub> (dBm)	P <sub>RX</sub> (dBm)	G <sub>antenna</sub> (dBd)	L <sub>Cable</sub> (dBm)	ERP (dBm)	Limit (dBm)
824.70	H	H	-20.09	0.00	-39.60	1.00	1.83	18.68	38.45
		V	-22.30	0.00	-39.28	1.00	1.83	16.15	
	E1	H	-16.85	0.00	-39.60	1.00	1.83	21.92	
		V	-19.15	0.00	-39.28	1.00	1.83	19.30	
	E2	H	-17.73	0.00	-39.60	1.00	1.83	21.04	
		V	-16.83	0.00	-39.28	1.00	1.83	21.62	
835.89	H	H	-19.52	0.00	-37.62	1.30	1.72	17.68	38.45
		V	-22.88	0.00	-37.60	1.30	1.72	14.30	
	E1	H	-15.61	0.00	-37.62	1.30	1.72	21.59	
		V	-19.96	0.00	-37.60	1.30	1.72	17.22	
	E2	H	-16.54	0.00	-37.62	1.30	1.72	20.66	
		V	-16.06	0.00	-37.60	1.30	1.72	21.12	
848.31	H	H	-20.20	0.00	-37.99	1.61	1.64	17.76	38.45
		V	-22.79	0.00	-37.91	1.61	1.64	15.09	
	E1	H	-14.74	0.00	-37.99	1.61	1.64	23.22	
		V	-18.51	0.00	-37.91	1.61	1.64	19.37	
	E2	H	-15.41	0.00	-37.99	1.61	1.64	22.55	
		V	-16.39	0.00	-37.91	1.61	1.64	21.49	

## CDMA2000 1x (Antenna OUT)

Frequency (MHz)	*EUT Pol.	Ant. Pol.	P <sub>EUT</sub> (dBm)	P <sub>TX</sub> (dBm)	P <sub>RX</sub> (dBm)	G <sub>antenna</sub> (dBd)	L <sub>Cable</sub> (dBm)	ERP (dBm)	Limit (dBm)
824.70	H	H	-16.77	0.00	-39.60	1.00	1.83	22.00	38.45
		V	-18.75	0.00	-39.28	1.00	1.83	19.70	
	E1	H	-13.46	0.00	-39.60	1.00	1.83	25.31	
		V	-14.67	0.00	-39.28	1.00	1.83	23.78	
	E2	H	-14.16	0.00	-39.60	1.00	1.83	24.61	
		V	-13.27	0.00	-39.28	1.00	1.83	25.18	
835.89	H	H	-17.77	0.00	-37.62	1.30	1.72	19.43	38.45
		V	-19.60	0.00	-37.60	1.30	1.72	17.58	
	E1	H	-12.81	0.00	-37.62	1.30	1.72	24.39	
		V	-17.35	0.00	-37.60	1.30	1.72	19.83	
	E2	H	-14.31	0.00	-37.62	1.30	1.72	22.89	
		V	-13.53	0.00	-37.60	1.30	1.72	23.65	
848.31	H	H	-18.79	0.00	-37.99	1.61	1.64	19.17	38.45
		V	-17.03	0.00	-37.91	1.61	1.64	20.85	
	E1	H	-12.53	0.00	-37.99	1.61	1.64	25.43	
		V	-16.97	0.00	-37.91	1.61	1.64	20.91	
	E2	H	-14.48	0.00	-37.99	1.61	1.64	23.48	
		V	-14.18	0.00	-37.91	1.61	1.64	23.70	

# Measurement Results :

## 1x EV-DO (Antenna IN)

Frequency (MHz)	*EUT Pol.	Ant. Pol.	P <sub>EUT</sub> (dBm)	P <sub>TX</sub> (dBm)	P <sub>RX</sub> (dBm)	G <sub>antenna</sub> (dBd)	L <sub>Cable</sub> (dBm)	ERP (dBm)	Limit (dBm)
824.70	H	H	-18.93	0.00	-39.60	1.00	1.83	19.84	38.45
		V	-19.20	0.00	-39.28	1.00	1.83	19.25	
	E1	H	-17.93	0.00	-39.60	1.00	1.83	20.84	
		V	-17.21	0.00	-39.28	1.00	1.83	21.24	
	E2	H	-16.99	0.00	-39.60	1.00	1.83	21.78	
		V	-15.55	0.00	-39.28	1.00	1.83	22.90	
835.89	H	H	-16.83	0.00	-37.62	1.30	1.72	20.37	38.45
		V	-17.06	0.00	-37.60	1.30	1.72	20.12	
	E1	H	-13.29	0.00	-37.62	1.30	1.72	23.91	
		V	-14.56	0.00	-37.60	1.30	1.72	22.62	
	E2	H	-14.63	0.00	-37.62	1.30	1.72	22.57	
		V	-12.18	0.00	-37.60	1.30	1.72	25.00	
848.31	H	H	-16.61	0.00	-37.99	1.61	1.64	21.35	38.45
		V	-15.95	0.00	-37.91	1.61	1.64	21.93	
	E1	H	-13.85	0.00	-37.99	1.61	1.64	24.11	
		V	-14.30	0.00	-37.91	1.61	1.64	23.58	
	E2	H	-16.47	0.00	-37.99	1.61	1.64	21.49	
		V	-13.10	0.00	-37.91	1.61	1.64	24.78	

## 1x EV-DO (Antenna IN)

Frequency (MHz)	*EUT Pol.	Ant. Pol.	P <sub>EUT</sub> (dBm)	P <sub>TX</sub> (dBm)	P <sub>RX</sub> (dBm)	G <sub>antenna</sub> (dBd)	L <sub>Cable</sub> (dBm)	ERP (dBm)	Limit (dBm)
824.70	H	H	-14.77	0.00	-39.60	1.00	1.83	24.00	38.45
		V	-15.41	0.00	-39.28	1.00	1.83	23.04	
	E1	H	-11.97	0.00	-39.60	1.00	1.83	26.80	
		V	-12.66	0.00	-39.28	1.00	1.83	25.79	
	E2	H	-13.56	0.00	-39.60	1.00	1.83	25.21	
		V	-10.66	0.00	-39.28	1.00	1.83	27.79	
835.89	H	H	-14.55	0.00	-37.62	1.30	1.72	22.65	38.45
		V	-14.76	0.00	-37.60	1.30	1.72	22.42	
	E1	H	-10.31	0.00	-37.62	1.30	1.72	26.89	
		V	-10.99	0.00	-37.60	1.30	1.72	26.19	
	E2	H	-11.99	0.00	-37.62	1.30	1.72	25.21	
		V	-9.70	0.00	-37.60	1.30	1.72	27.48	
848.31	H	H	-14.05	0.00	-37.99	1.61	1.64	23.91	38.45
		V	-14.49	0.00	-37.91	1.61	1.64	23.39	
	E1	H	-11.12	0.00	-37.99	1.61	1.64	26.84	
		V	-11.78	0.00	-37.91	1.61	1.64	26.10	
	E2	H	-12.99	0.00	-37.99	1.61	1.64	24.97	
		V	-9.94	0.00	-37.91	1.61	1.64	27.94	

Table 10.3.1 Radiated Measurements at 3meters

## 10.4 Conducted Output Power

### Measurement Results :

Band	Channel	Frequency (MHz)	1x EVDO		TDSO SO32 Loopback (dBm)
			FTAP (dBm)	RTAP (dBm)	
Cellular	1013	824.70	24.96	23.22	23.65
	363	835.89	25.06	23.68	24.03
	777	848.31	24.96	23.62	23.87

**Table 10.4.1 Conducted Output Power**

## 10.5 Occupied Bandwidth / 26dB Emission Bandwidth

### Measurement Results :

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	26dB Emission Bandwidth (MHz)
1013	824.70	1.279	1.401
363	835.89	1.283	1.418
777	848.31	1.273	1.404

## 10.6 Radiated Spurious & Harmonic Emission

### Measurement Results: Antenna OUT Positions

#### CH1013 ( 824.70MHz)

Freq. (MHz)	*EUT Pol.	Ant. Pol.	P <sub>EUT</sub> (dBm)	P <sub>TX</sub> (dBm)	P <sub>RX</sub> (dBm)	G <sub>antenna</sub> (dBd)	L <sub>Cable</sub> (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1649.40	E2	H	-53.01	0.00	-1.12	7.51	2.39	-46.77	-13	33.77
1649.40	E2	V	-54.88	0.00	-0.83	7.51	2.39	-48.93	-13	35.93
2474.10	H	H	-50.51	0.00	-2.89	8.34	2.80	-42.08	-13	29.08
2474.10	E2	V	-50.45	0.00	-2.67	8.34	2.80	-42.24	-13	29.24
3298.80	E1	H	-63.62	0.00	-4.58	10.38	3.57	-52.23	-13	39.23
3298.80	E1	V	-63.45	0.00	-4.14	10.38	3.57	-52.89	-13	39.89
4123.50			---					---		
4123.50			---					---		

#### CH363 ( 835.89MHz)

Freq. (MHz)	*EUT Pol.	Ant. Pol.	P <sub>EUT</sub> (dBm)	P <sub>TX</sub> (dBm)	P <sub>RX</sub> (dBm)	G <sub>antenna</sub> (dBd)	L <sub>Cable</sub> (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1671.78	E1	H	-55.69	0.00	-1.08	7.62	2.41	-49.40	-13	36.40
1671.78	E2	V	-52.66	0.00	-0.82	7.62	2.41	-46.63	-13	33.63
2507.67	H	H	-56.44	0.00	-3.11	8.42	2.81	-47.72	-13	34.72
2507.67	E2	V	-53.02	0.00	-2.83	8.42	2.81	-44.58	-13	31.58
3343.56	E1	H	-63.58	0.00	-4.42	10.57	3.56	-52.15	-13	39.15
3343.56	E1	V	-63.56	0.00	-3.98	10.57	3.56	-52.57	-13	39.57
4179.45			---					---		
4179.45			---					---		

**CH363 ( 835.89MHz)**

Freq. (MHz)	*EUT Pol.	Ant. Pol.	P <sub>EUT</sub> (dBm)	P <sub>TX</sub> (dBm)	P <sub>RX</sub> (dBm)	G <sub>antenna</sub> (dBd)	L <sub>Cable</sub> (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1696.62	H	H	-52.44	0.00	-1.04	7.73	2.44	-46.11	-13	33.11
1696.62	E2	V	-51.11	0.00	-0.80	7.73	2.44	-45.02	-13	32.02
2544.93	H	H	-52.88	0.00	-3.35	8.50	2.83	-43.86	-13	30.86
2544.93	E1	V	-52.81	0.00	-3.01	8.50	2.83	-44.13	-13	31.13
3393.24	H	H	-62.31	0.00	-4.24	10.78	3.55	-50.84	-13	37.84
3393.24	H	V	-61.51	0.00	-3.80	10.78	3.55	-50.48	-13	37.48
4241.55			---					---		
4241.55			---					---		

**Note:** The test data show the worst emission level from the three-azimuth.

**Remark** “---” means that the emission level is too low to be measured

“ \* “Please see the Appendix B.

- End of page -

## 10.7 Frequency Stability / Temperature Variation

Test Mode : Set to Middle channel ( 835.89MHz )

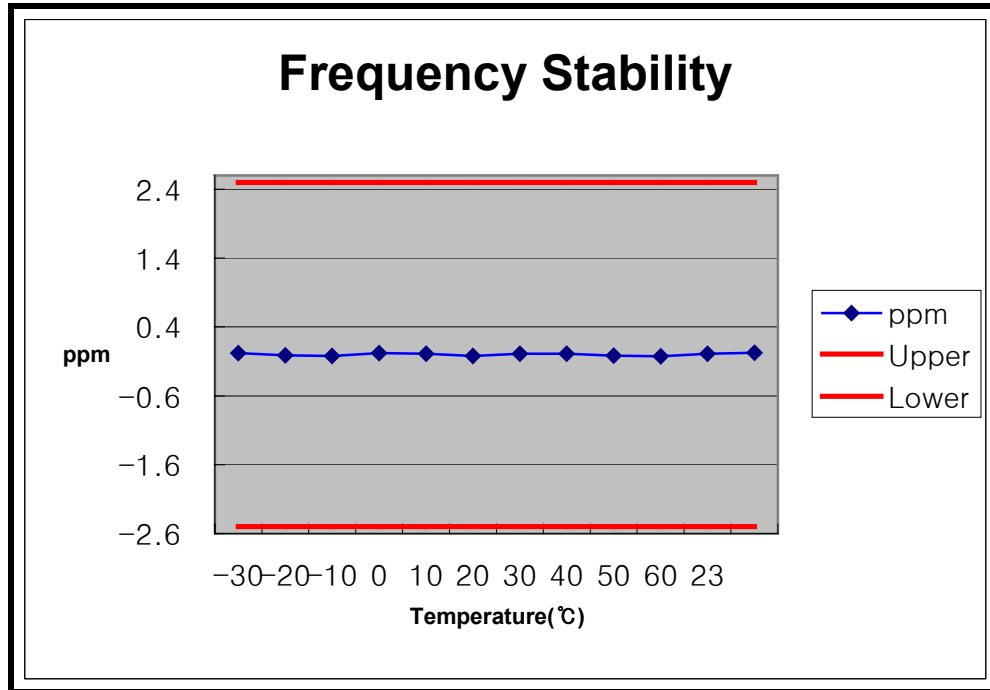
Deviation Limit :  $\pm 2.5\text{ppm}$

Measurement Result :

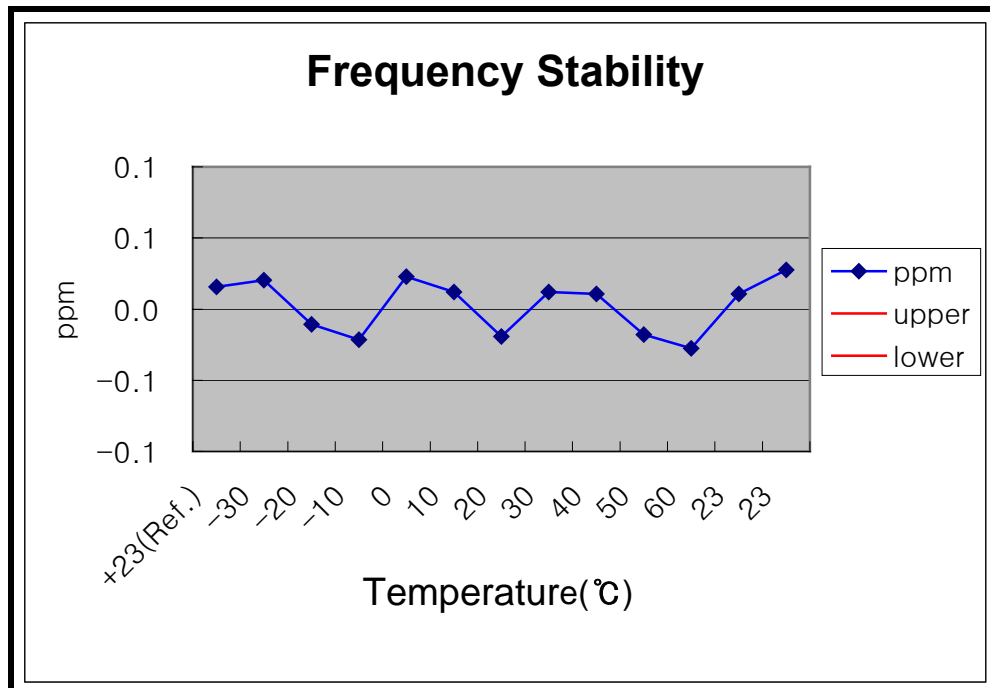
Voltage (%)	Power (Vdc)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	ppm
100%	3.3	+23(Ref.)	835,890,013	13	0.0156
100%		-30	835,890,017	17	0.0203
100%		-20	835,889,991	-9	-0.0108
100%		-10	835,889,982	-18	-0.0215
100%		0	835,890,019	19	0.0227
100%		10	835,890,010	10	0.0120
100%		20	835,889,984	-16	-0.0191
100%		30	835,890,010	10	0.0120
100%		40	835,890,009	9	0.0108
100%		50	835,889,985	-15	-0.0179
100%		60	835,889,977	-23	-0.0275
85%	2.805	23	835,890,009	9	0.0108
115%	3.795	23	835,890,023	23	0.0275

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

### Frequency Stability Graph



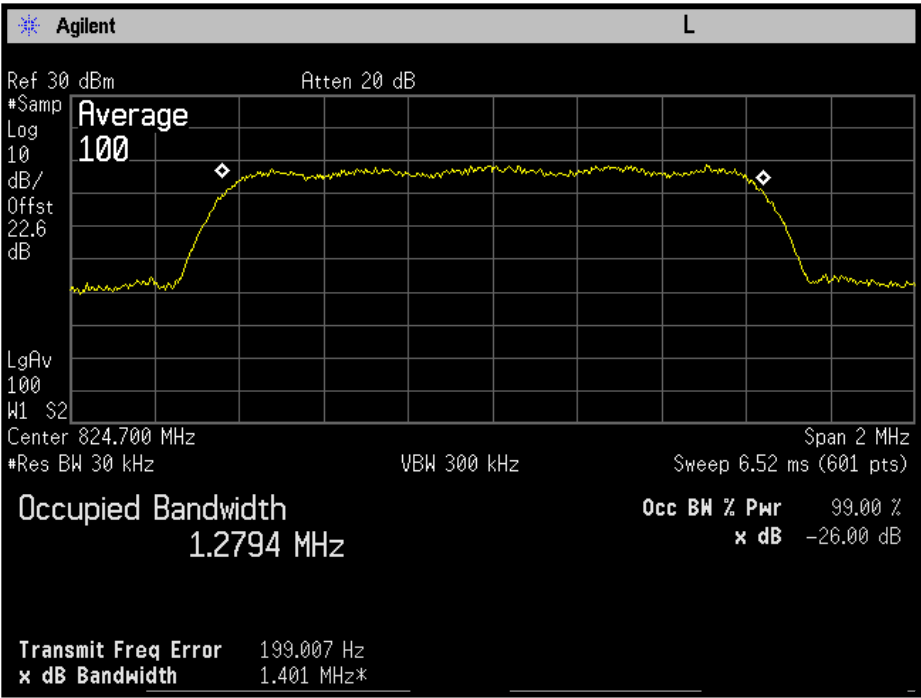
### Zoom In



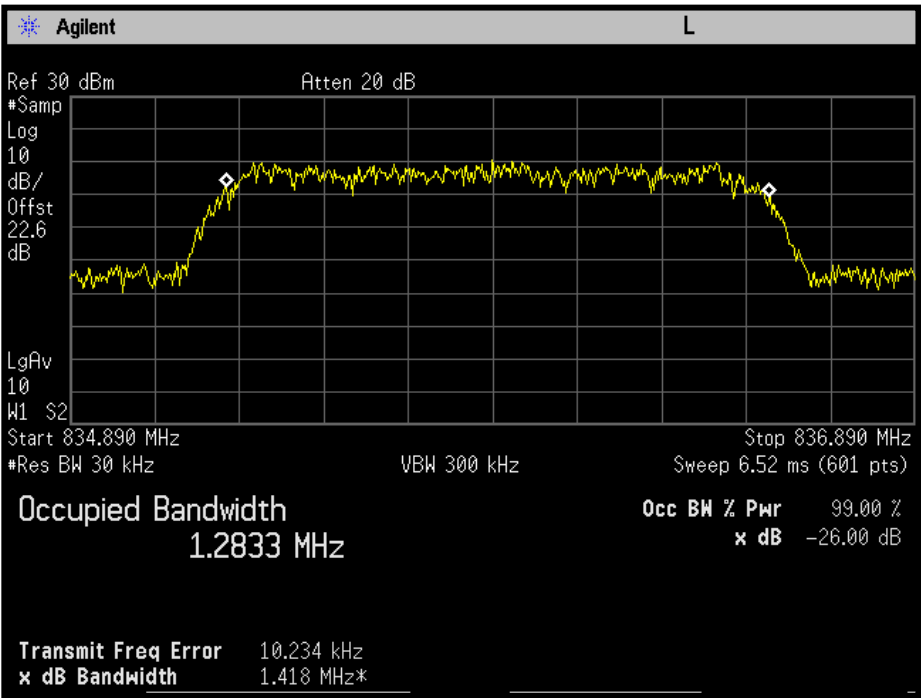
# 11. Test Plots

● Occupied Bandwidth / 26dB Bandwidth

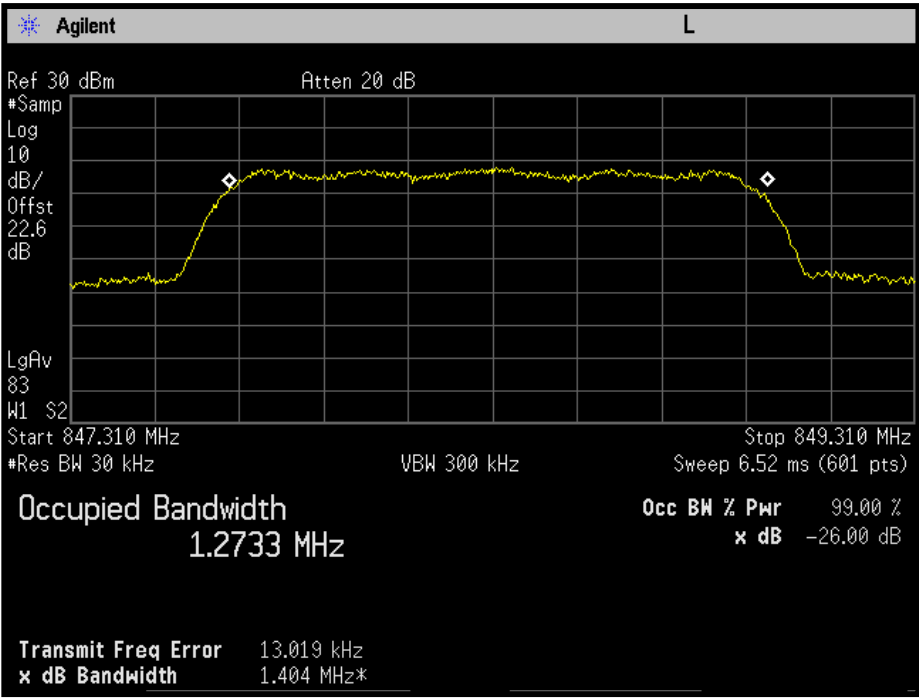
Low Channel



Middle Channel

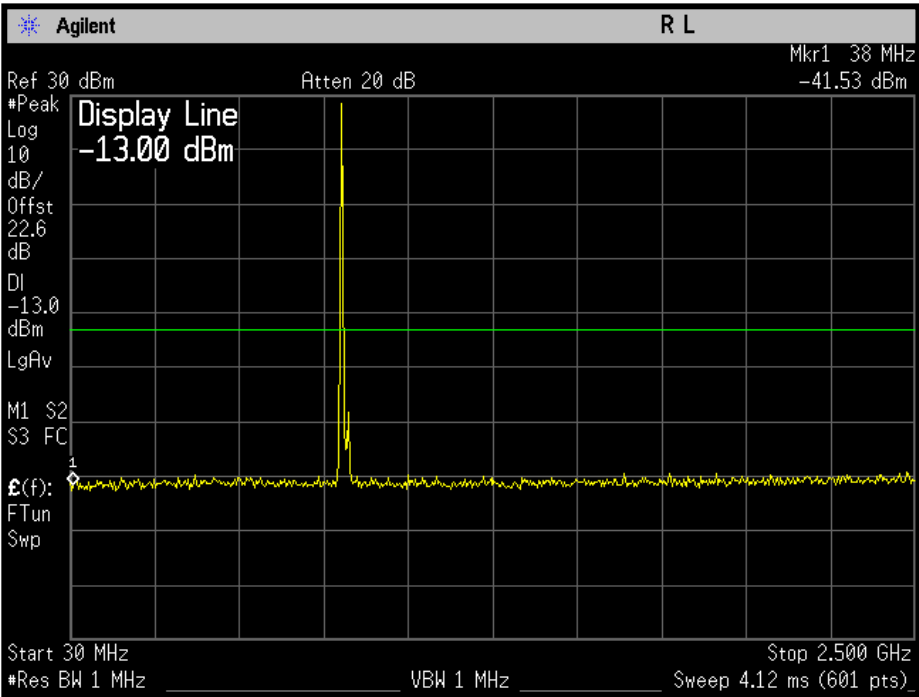


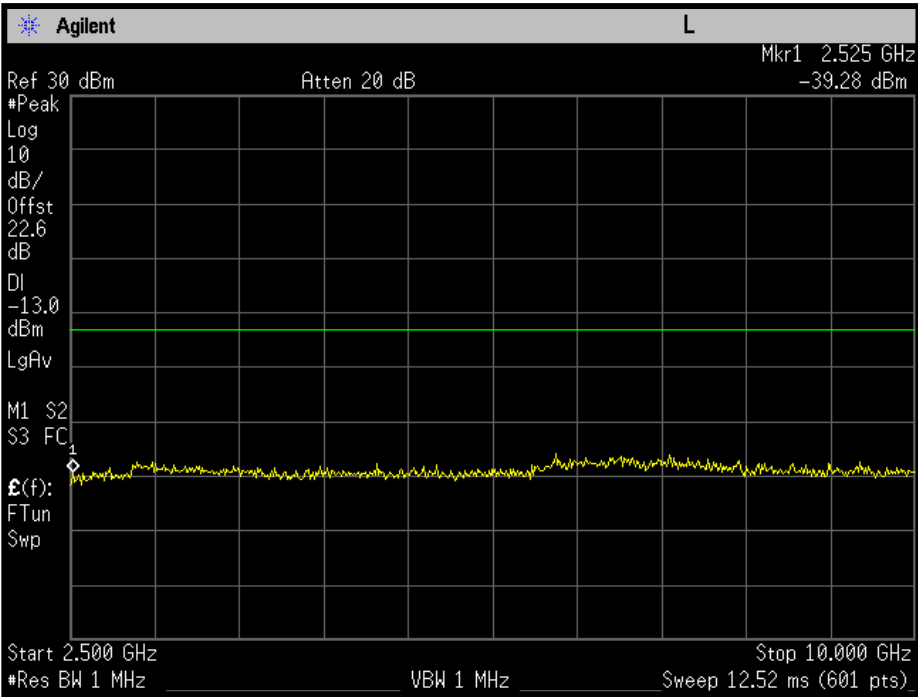
High Channel



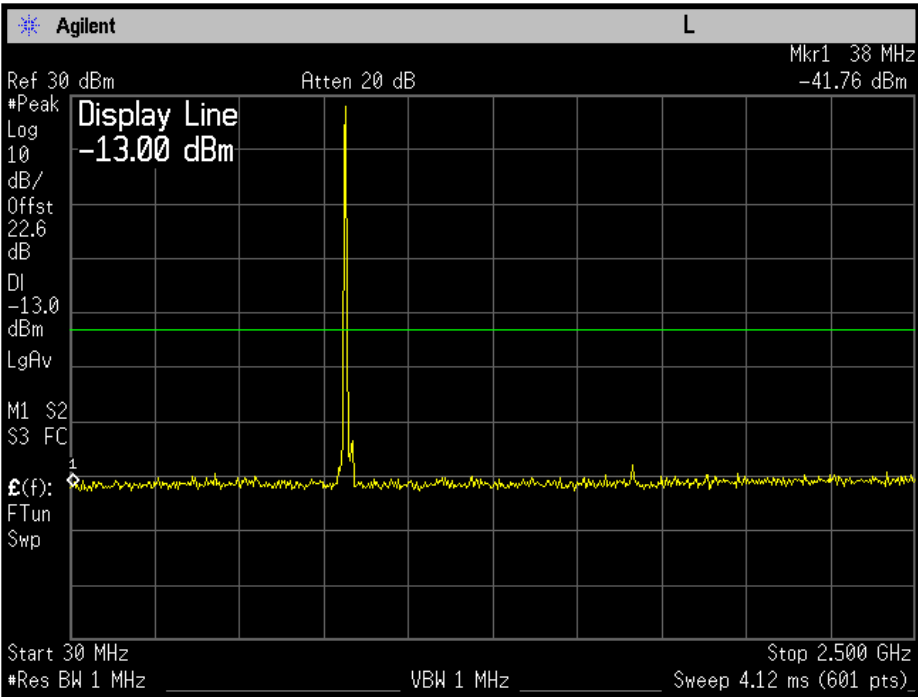
● Spurious Emission at antenna Terminals

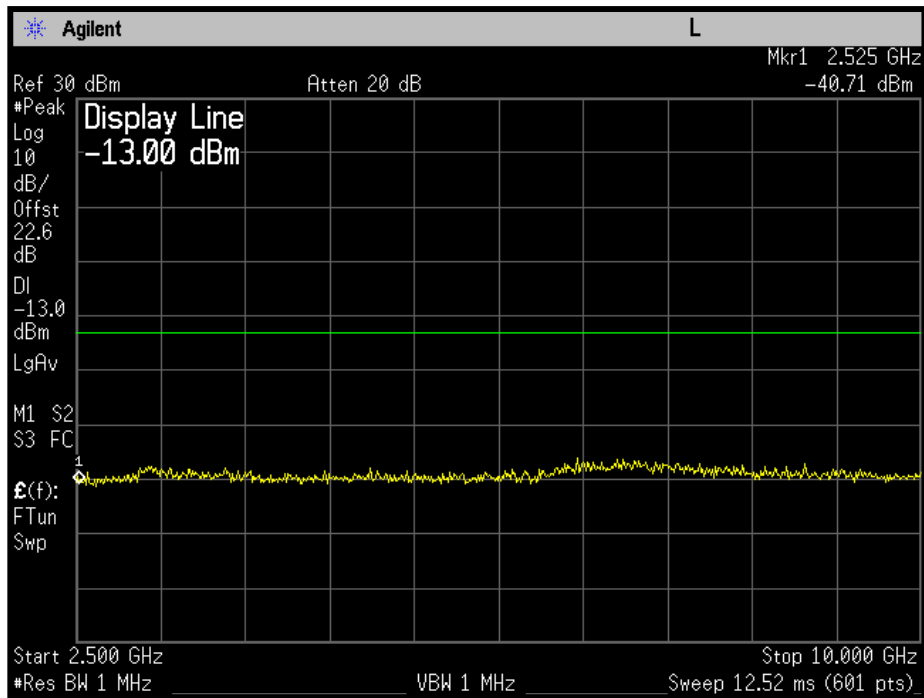
Low Channel



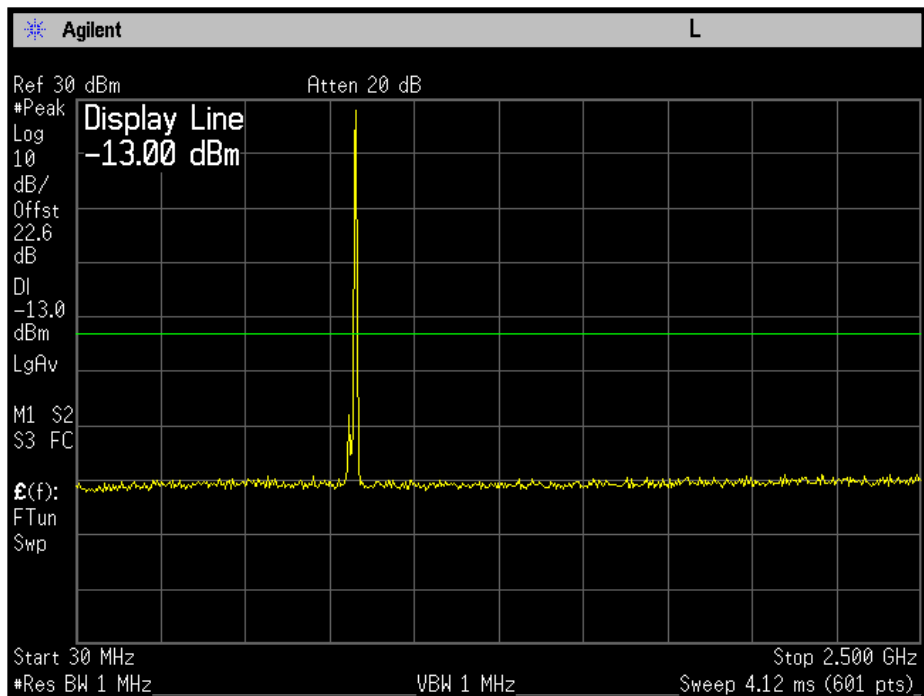


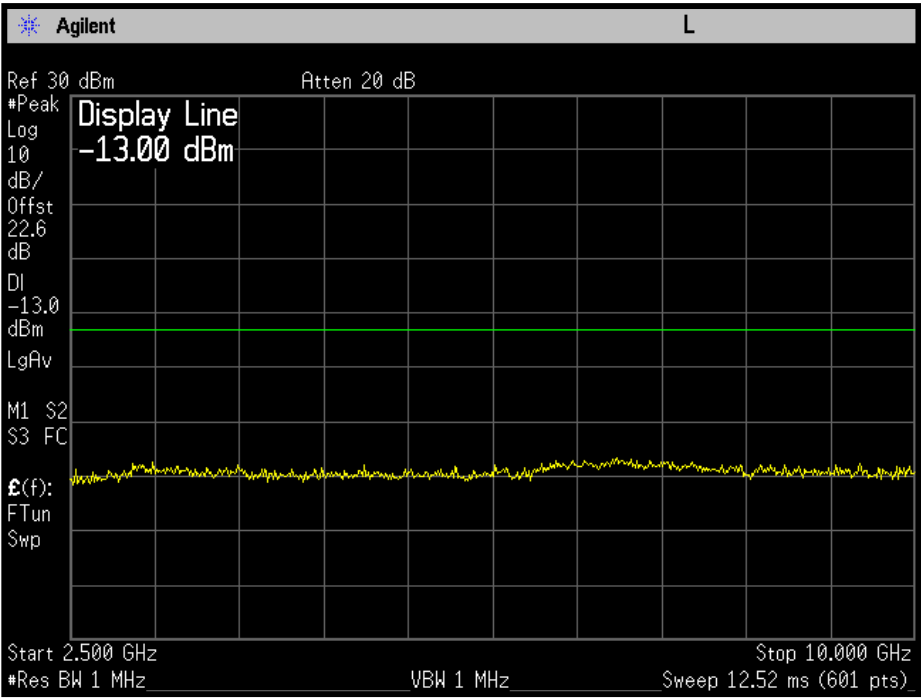
**Middle Channel**





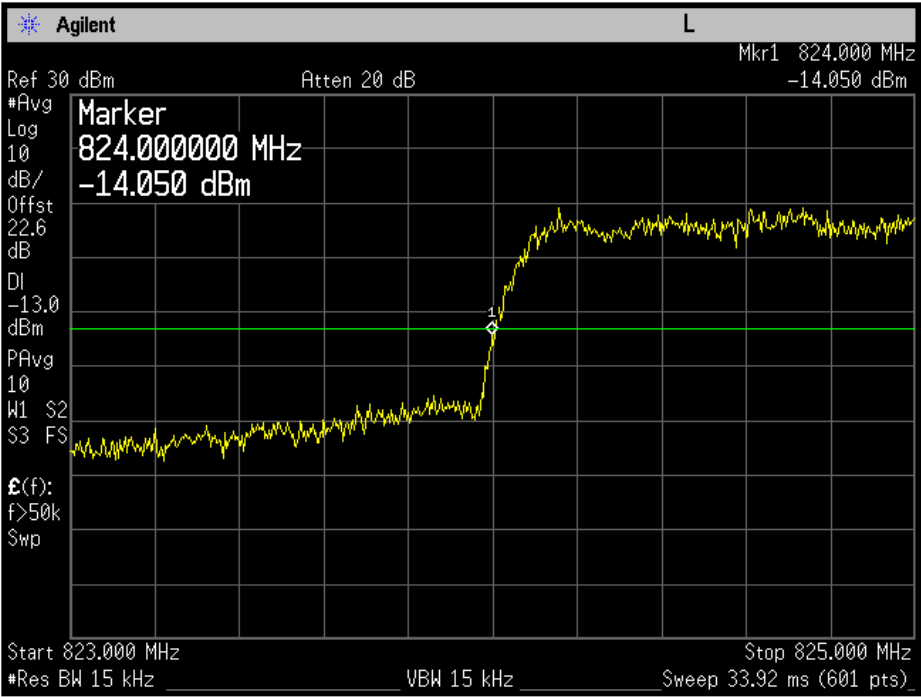
### High Channel

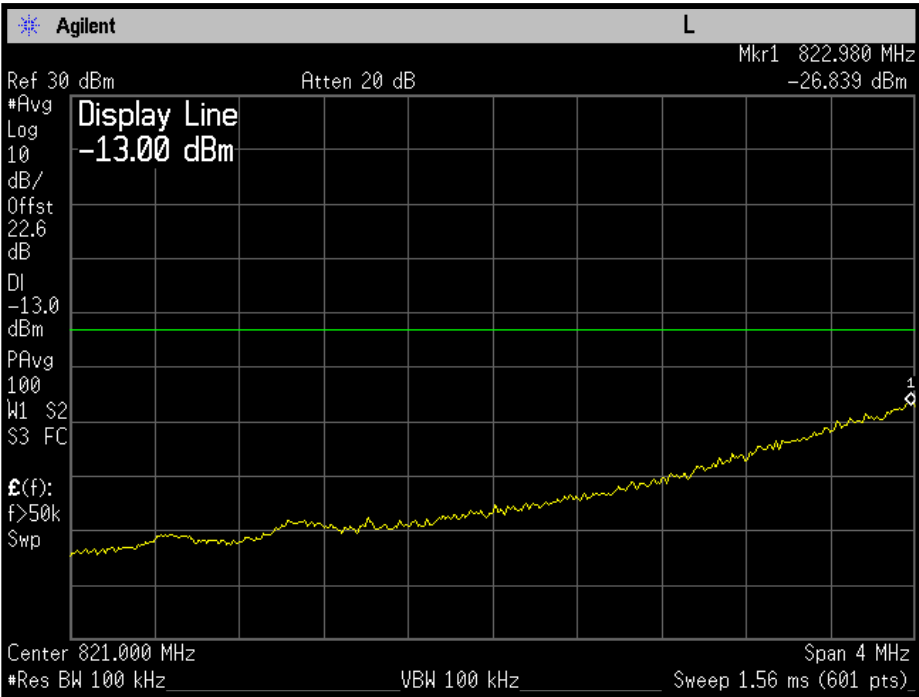




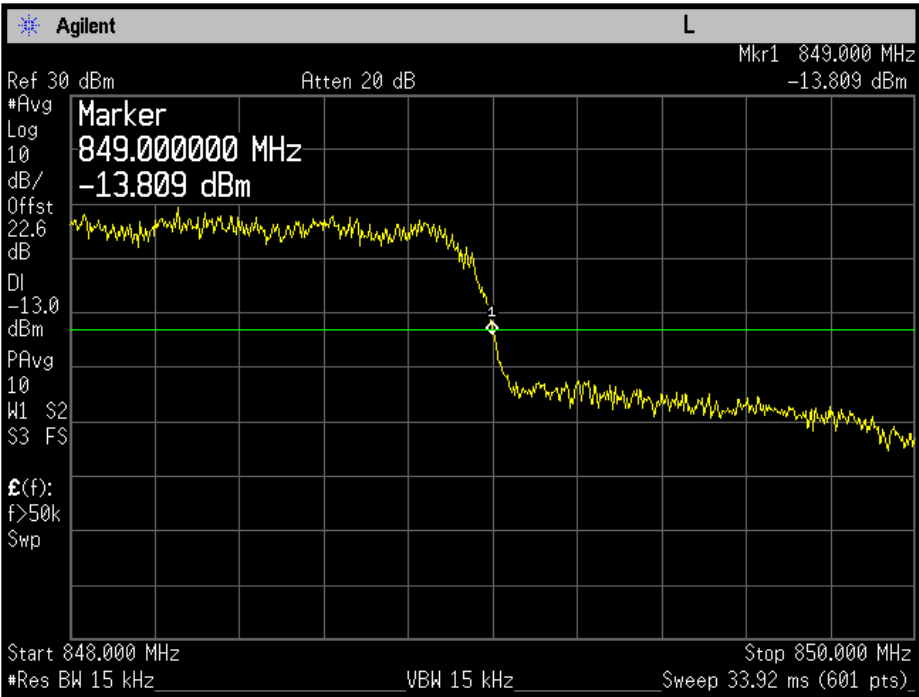
● **Band Edge**

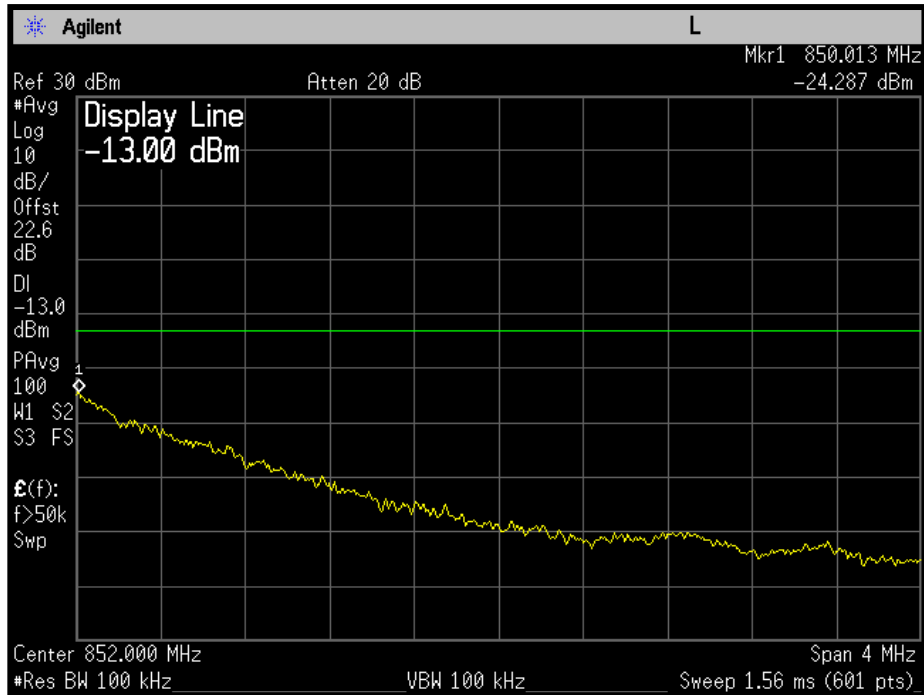
**Low Channel**





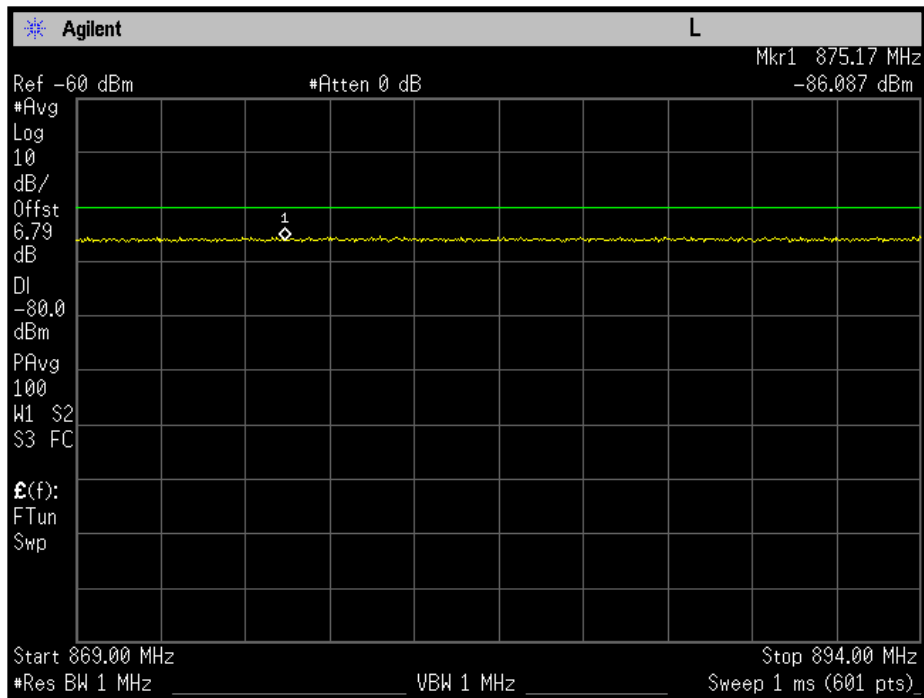
**High Channel**



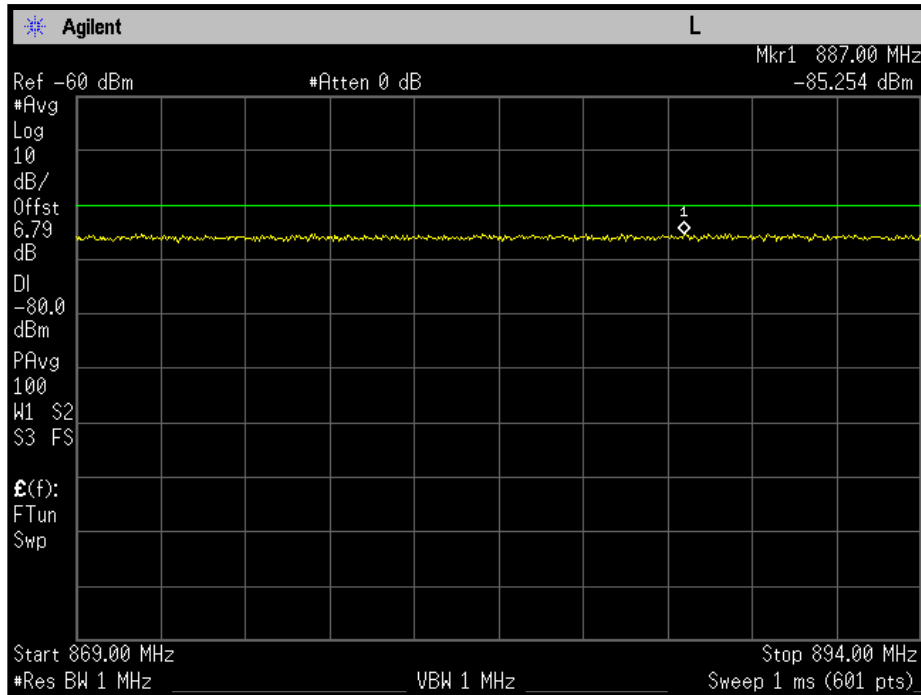


● Emission in Receiver Critical Band

Low Channel



### Middle Channel



### High Channel

