ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LICENSED TRANSMITTER

Test Report No.	**: E12DR-046**
AGR No.	**: A12DA-055**
Applicant	**: SOLiD , Inc**
Address	**: 10,9th Floor, SOLiD Space, Pangyoyeok-ro 220, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea 463-400**
Manufacturer	**: SOLiD , Inc**
Address	**: 10,9th Floor, SOLiD Space, Pangyoyeok-ro 220, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea 463-400**
Type of Equipment	**: SINGLE CARRIER DAS**
FCC ID.	**: W6U70L21A**
Model Name	**: SC-MRU700LTEAWS-AC**
Serial number	**: N/A**
Total page of Report	**: 116 pages (including this page)**
Date of Incoming	**: December 06, 2012**
Date of issue	**: December 26, 2012**

SUMMARY

The equipment complies with the regulation; **FCC Part 27 Subpart C.**

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

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Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
E12DR-046	December 26, 2012	Initial Issue	All

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1. VERIFICATION OF COMPLIANCE

APPLICANT	: SOLiD , Inc
ADDRESS	: 10,9th Floor, SOLiD Space, Pangyoyeok-ro 220, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea 463-400
CONTACT PERSON	: Mr. Yong-Chul, Kim / Researcher
TELEPHONE NO	: +82-31-627-6292
FCC ID	: W6U70L21A
MODEL NAME	: SC-MRU700LTEAWS-AC
SERIAL NUMBER	: N/A
DATE	: December 26, 2012

EQUIPMENT CLASS	TNB – Licensed Non-Broadcast Station Transmitter
EQUIPMENT DESCRIPTION	SINGLE CARRIER DAS
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.4: 2009, EIA/TIA-603-C
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC Part 27 Subpart C
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	No
FINAL TEST WAS CONDUCTED ON	3 m open area test site

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

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2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
2.1046(a), 27.50(b), 27.50(d)	RF Power Output at Antenna Terminals	Met the Limit / PASS
2.1047	Modulation Characteristics	PASS (See Note 1)
2.1049	Occupied Bandwidth, Bandwidth Limitation	Met the Limit / PASS
2.1049	Band Edge	Met the Limit / PASS
2.1051, 27.53(c), 27.53(h)	Spurious Emissions at Antenna Terminals	Met the Limit / PASS
2.1053, 27.53(c), 27.53(h)	Field strength of Spurious Radiation	Met the Limit / PASS
2.1055, 27.54	Frequency Stability with Temperature variation	Met the requirement / PASS
2.1055, 27.54	Frequency stability with primary voltage variation	Met the requirement / PASS
1.1307(b), 27.52	RF Safety	See Note 2

Note 1: The Equipment under Test (EUT) is a repeater which reproduces the modulated input signal, so the EUT meets the requirement

Note 2: End users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance, because the applicant does not provide an antenna for sale with the EUT

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Original Grant

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in section 2.1.

2.5 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.4: 2009 & EIA/TIA-603-C: 2004 and was performed at a distance of 10 m and 3 m from EUT to the antenna.

2.6 Test Facility

The open area test site and conducted measurement facilities are located on at 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-862, Korea. Description details of test facilities were submitted to the Commission on August 21, 2008. (Registration Number: 340658)

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3. GENERAL INFORMATION

3.1 Product Description

The SOLiD , Inc, Models SC-MRU700LTEAWS-AC (referred to as the EUT in this report) are SINGLE CARRIER DAS. The Models SC-MRU700LTEAWS-AC is called as MRU (Main Remote Unit), which cover frequency band for 700 LTE and AWS-1 band. The combination of MRU and ARU is called as ROU (Remote Optic Unit), and MRU and ARU connected with cable each other, but the RF output antenna port is located on MRU.

MRU receives TX optical signals from ODU(Optic Distribution Unit) or OEU(Optic Expansion Unit) and converts them into RF signals. The converted RF signals are amplified through High Power Amp in a corresponding Remote Unit, combined with Multiplexer and then radiated to the antenna port.

When receiving RX signals through the antenna port, this unit filters out-of-band signals in a corresponding Remote Unit and sends the results to Remote Optic Module to make electronic-optical conversion of them. After converted, the signals are sent to a upper device of ODU or OEU. MRU and ARU are composed of maximal dual band. The most difference of MRU and ARU is whether existence of optical module and RF antenna port is in it or not

The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE		SINGLE CARRIER DAS
LIST OF EACH OSC. or CRY. FREQ.(FREQ. >= 1 MHz)		8 MHz
EMISSION DESIGNATOR		F9W(CDMA, EVDO, WCDMA), D7W(LTE)
OPERATING FREQUENCY	700LTE	728 MHz – 757 MHz,
	AWS-1	2 110 MHz – 2 155 MHz
CHANNEL SEPARATION		CDMA(1.25 MHz), EVDO(1.25 MHz), WCDMA(5 MHz), LTE(10 MHz)
RF OUTPUT POWER		28 dBm
DC VOLTAGE & CURRENT INTO FINAL AMPLIFIER	700LTE	25 V, 0.76 A
	AWS-1	25 V, 0.76 A
ELECTRICAL RATING		AC 120 V and DC -48 V
OPERATING TEMPERATURE		-10 °C ~ 50 °C

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3.2 Alternative type(s)/model(s); also covered by this test report.

-. The following lists consist of the added model and their differences.

Model Name	Differences	Tested
SC-MRU700LTEAWS-AC	Basic Model	☑
SC-MRU700LTEAWS-DC	This model is identical to basic model but the AC power supply was changed to DC power supply.	☐
SC-MRU700LTEAWS-AC(N)	This model is identical to basic model but the optical connector was changed to NEMA type.	
SC-MRU700LTEAWS-DC(N)	This model is identical to basic model but the AC power supply and optical connector was changed to DC power supply and NEMA type.	

Note: 1. Applicant consigns only basic model to test, therefore this test report just guarantees the units which have been tested.

2. The Applicant/manufacturer is responsible for the compliance of all variants.

3.3 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	FCC ID	Description	Connected to
SC-MRU700LTEAWS-AC	SOLiD , Inc	W6U70L21A	SINGLE CARRIER DAS (EUT)	Signal Generator
SMJ100A	Rohde & Schwarz	N/A	Vector Signal Generator	EUT

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3.4 Mode of operation during the test

The EUT was received signal form signal generator and then each modulation was configured for maximum signal gain and bandwidth. Also the EUT supports dual band, CDMA, 1xEVDO, WCDMA and LTE band, so the EUT was tested at each Modulation. The EUT was operated in a manner representative of the typical usage of the equipment. During all testing, system components were manipulated within the confines of typical usage to maximize each emission. The applicant does not supply antenna(s) with the system, so the dummy loads were connected to the RF output ports on the EUT for radiated spurious emission testing.

For the above testing, following frequencies per channel were selected for each modulation.

1. Coverage band: AWS-1

Modulation	Channel	Frequency(MHz)	Modulation	Channel	Frequency(MHz)
CDMA/ 1xEVDO	Low	2 111.25	LTE	Low	2 115.00
	Middle	2 132.50		Middle	2 132.50
	High	2 153.75		High	2 150.00
WCDMA	Low	2 112.40			
	Middle	2 132.50			
	High	2 152.60			

2. Coverage band: 700LTE

Modulation	Channel	Frequency(MHz)
LTE	Low	733.00
	Middle	742.50
	High	752.00

4. EUT MODIFICATIONS

-. None

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5. RF POWER OUTPUT at ANTENNA TERMINAL

5.1 Operating environment

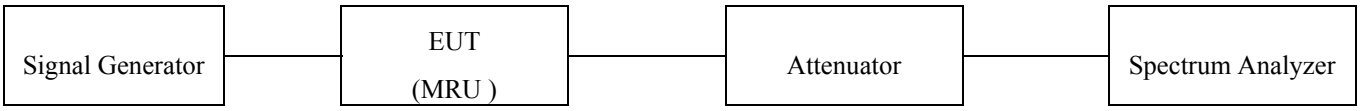
Temperature : 22 °C

Relative humidity : 50 % R.H.

5.2 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the power meter or spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation.

RF output power was measured by channel power measurement function of the spectrum analyzer with RMS detector mode.



5.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	E4432B	HP	Signal Generator	US38440950	June 01, 2012 (1Y)
■ -	SMJ100A	R/S	Signal Generator	101038	Feb. 02, 2012 (1Y)
■ -	FSP	R/S	Spectrum Analyzer	100017	Mar. 12, 2012 (1Y)
□ -	8564E	HP	Spectrum Analyzer	3650A00756	Apr. 04, 2012 (1Y)
■ -	67-30-43	Aeroflex Weinschel	Power Attenuator	CA5760	Dec. 10, 2012 (1Y)

All test equipment used is calibrated on a regular basis.

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5.4 Test data

5.4.1 Test Result for Part 27 C (AWS-1)

-. Test Date : December 10, 2012

-. Measurement Function : Channel Power

-. Detector Mode : RMS detector

-. Test Result : Pass

Modulation	Channel	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
CDMA	Low	2 111.25	-20.50	28.00	0.630 957	100.00
	Middle	2 132.50	-20.40	28.00		
	High	2 153.75	-20.20	28.00		
1xEVDO	Low	2 111.25	-20.30	28.00	0.630 957	
	Middle	2 132.50	-20.60	28.00		
	High	2 153.75	-20.50	28.00		
WCDMA	Low	2 112.40	-20.30	28.00	0.630 957	
	Middle	2 132.50	-20.10	28.00		
	High	2 152.60	-20.30	28.00		
LTE	Low	2 115.00	-20.40	28.00	0.630 957	
	Middle	2 132.50	-20.60	28.00		
	High	2 150.00	-20.30	28.00		

Tested by: Ki-Hong, Nam / Senior Engineer

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5.4.2 Test Result for Part 27 C (700LTE)

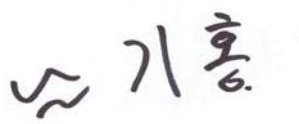
-. Test Date : December 10, 2012

-. Measurement Function : Channel Power

-. Detector Mode : RMS detector

-. Test Result : Pass

Modulation	Channel	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
LTE	Low	733.00	-20.20	28.00	0.630957	100.00
	Middle	742.50	-20.50	28.00		
	High	752.00	-20.40	28.00		



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6. OCCUPIED BANDWIDTH

6.1 Operating environment

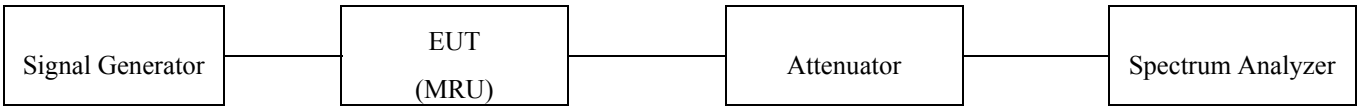
Temperature : 22 °C

Relative humidity : 50 % R.H.

6.2 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the power meter or spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation.

For the testing, the RBW was set to 1 % to 3 % of the - 26 dB bandwidth. The VBW is set to 3 times the RBW and sweep time is coupled.



6.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	E4432B	HP	Signal Generator	US38440950	June 01, 2012 (1Y)
■ -	SMJ100A	R/S	Signal Generator	101038	Feb. 02, 2012 (1Y)
■ -	FSP	R/S	Spectrum Analyzer	100017	Mar. 12, 2012 (1Y)
□ -	8564E	HP	Spectrum Analyzer	3650A00756	Apr. 04, 2012 (1Y)
■ -	67-30-43	Aeroflex Weinschel	Power Attenuator	CA5760	Dec. 10, 2012 (1Y)

All test equipment used is calibrated on a regular basis.

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6.4 Test data

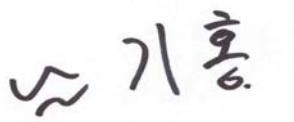
6.4.1 Test Result for Part 27 C (AWS-1)

-. Test Date : December 10, 2012

-. Test Result : Pass

Modulation	Channel	26 dB Bandwidth (kHz)	99 % Occupied Bandwidth (kHz)
CDMA	Low	1 520	1 320
	Middle	1 530	1 320
	High	1 530	1 320
1xEVDO	Low	1 520	1 320
	Middle	1 530	1 320
	High	1 520	1 320
WCDMA	Low	4 680	4 180
	Middle	4 680	4 160
	High	4 680	4 160
LTE	Low	9 840	8 960
	Middle	9 840	9 000
	High	9 880	9 000

Remark: According to above result, the carrier frequency shall be within the frequency block edges.



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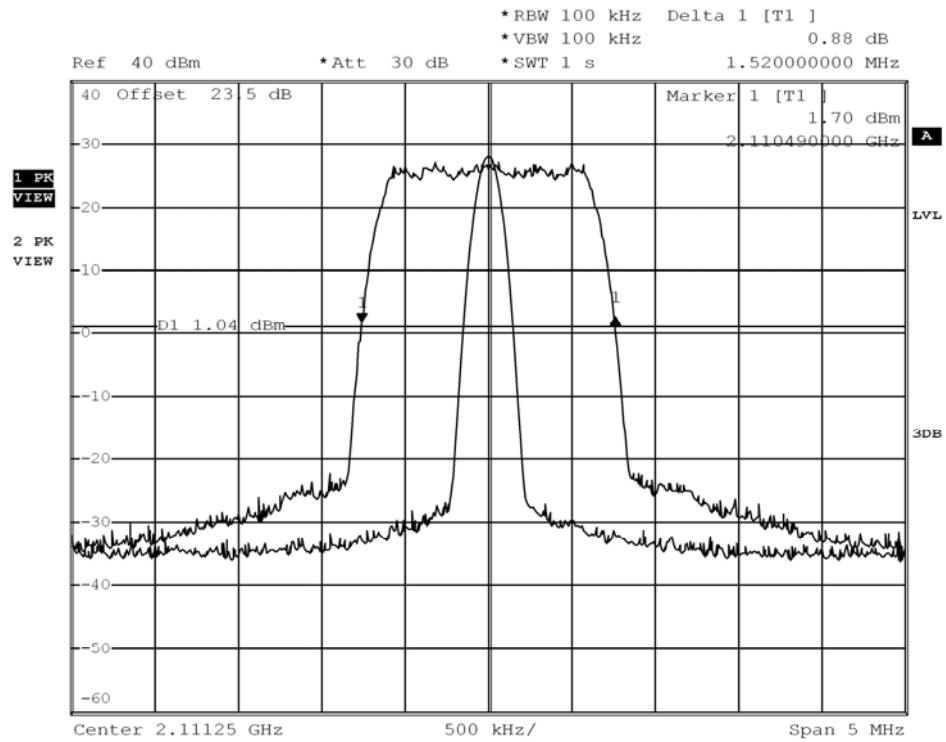
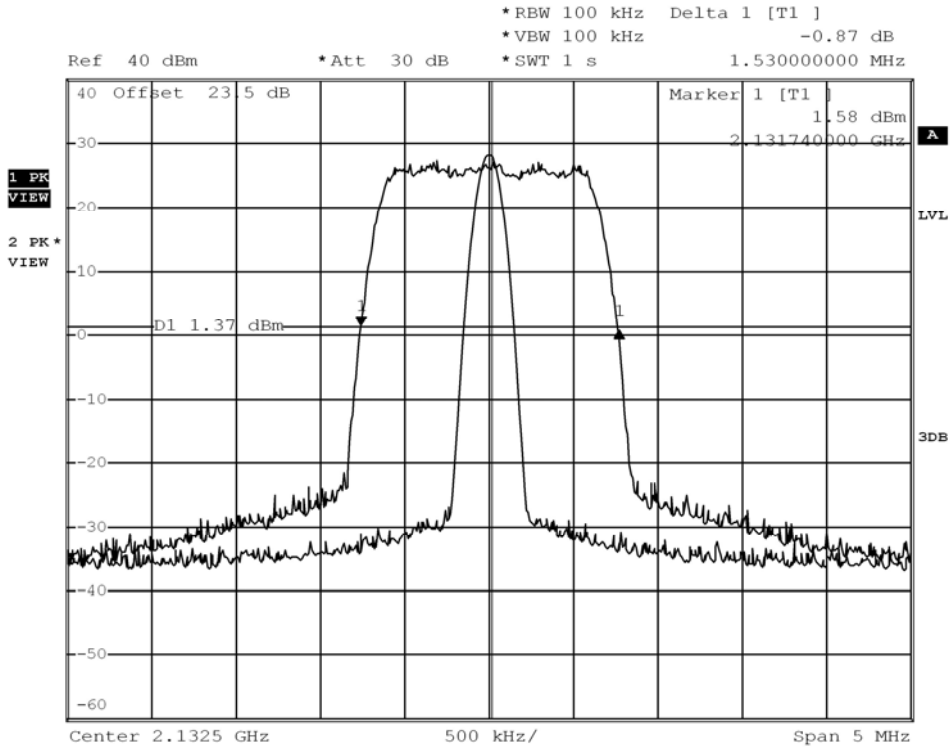
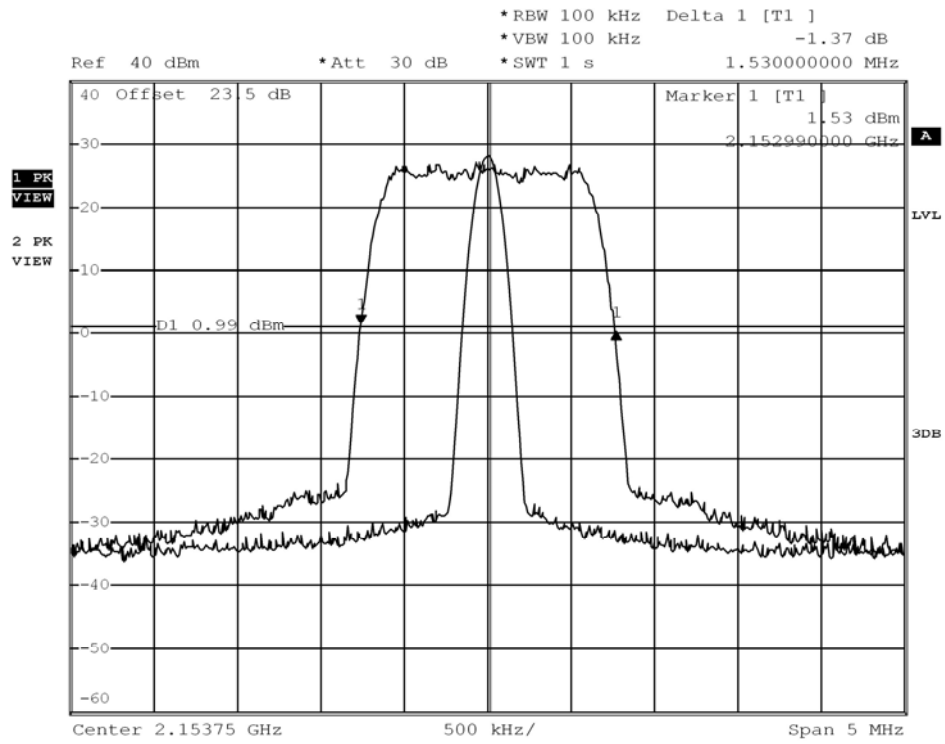


CDMA – 26 dB Bandwidth (Low Channel)



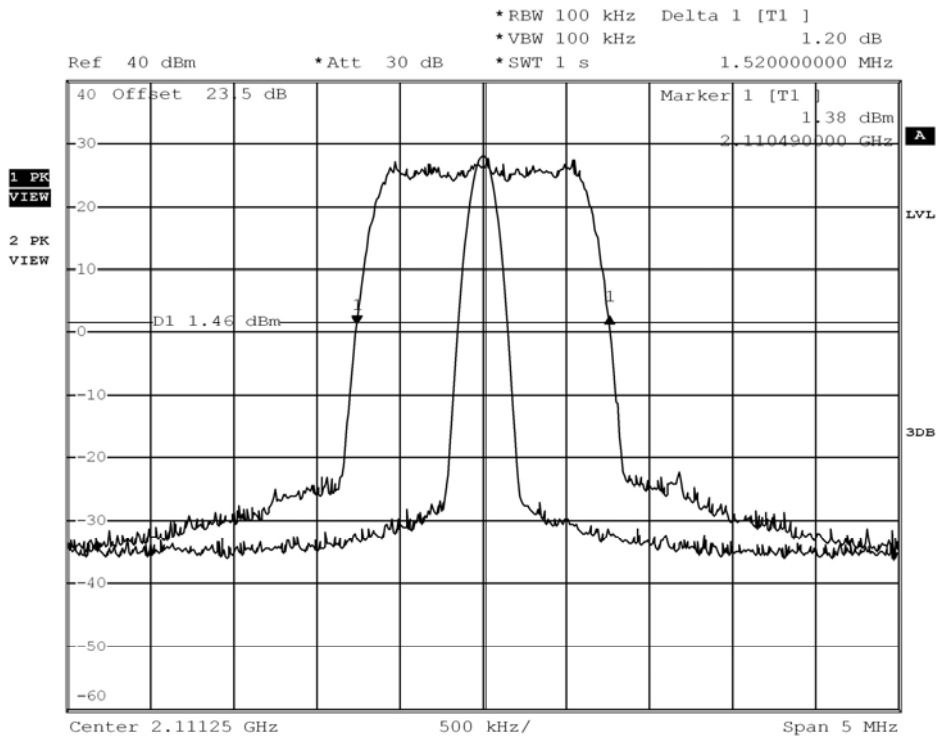
CDMA – 26 dB Bandwidth (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

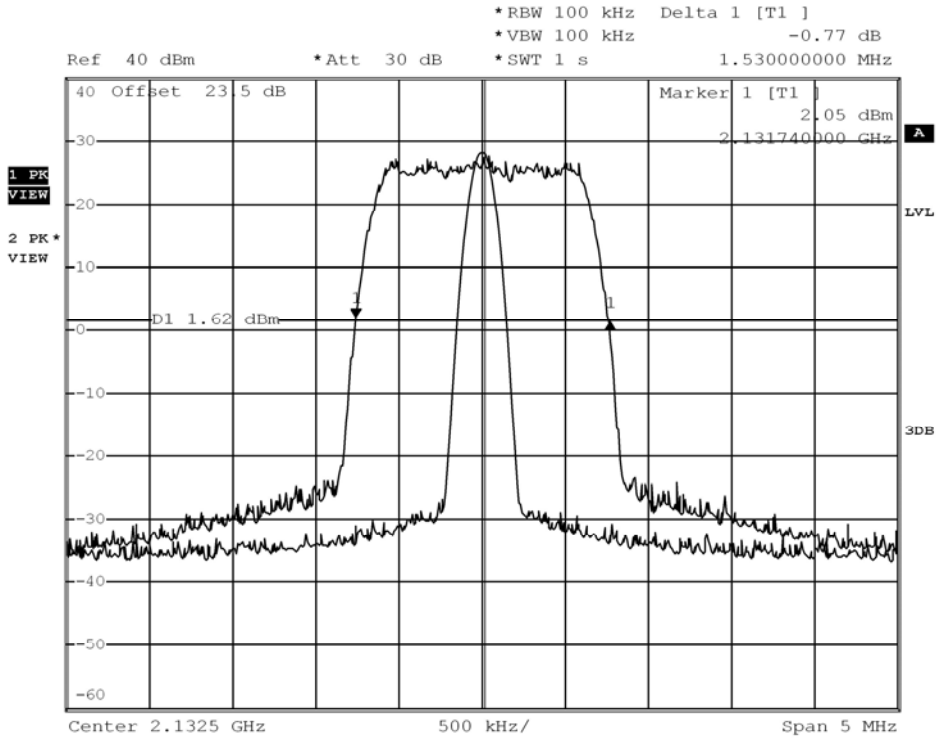


CDMA – 26 dB Bandwidth (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

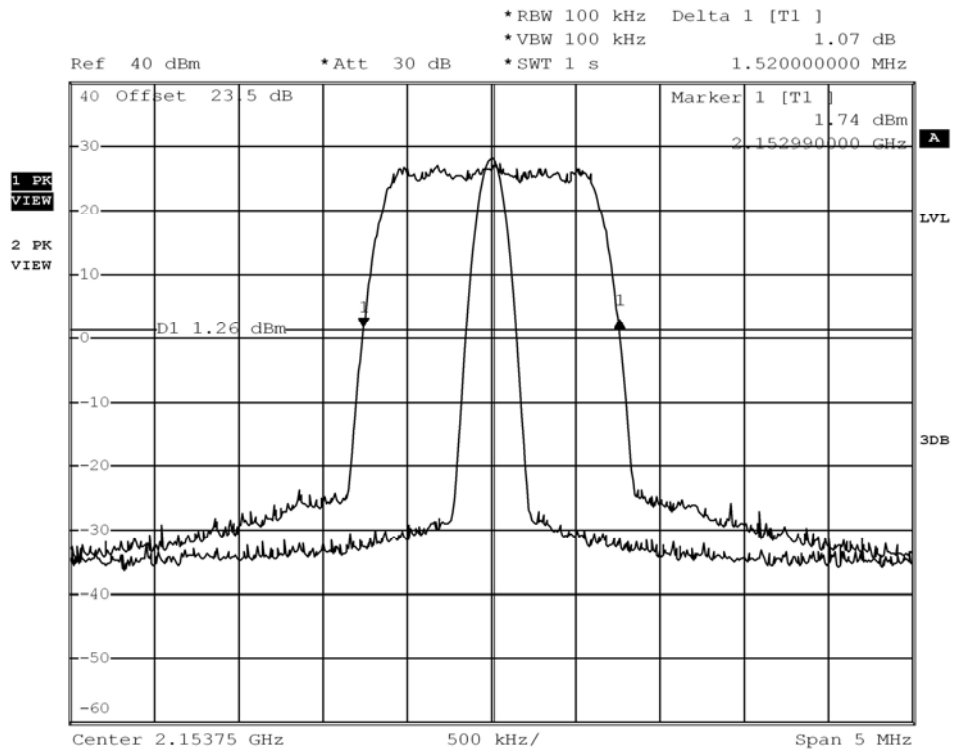


1xEVDO – 26 dB Bandwidth (Low Channel)



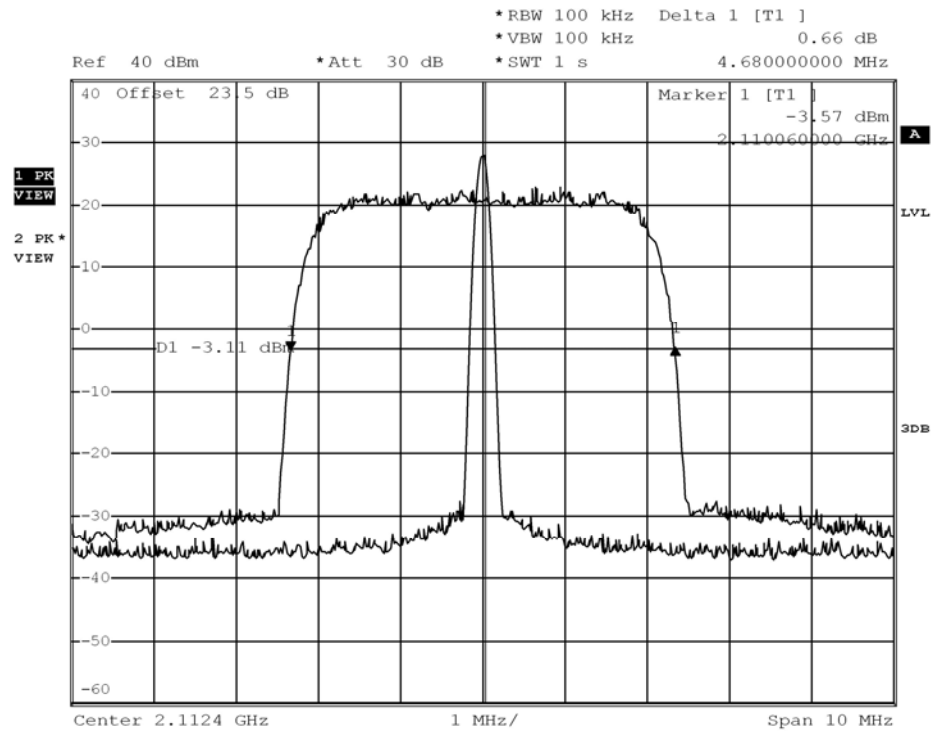
1xEVDO – 26 dB Bandwidth (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

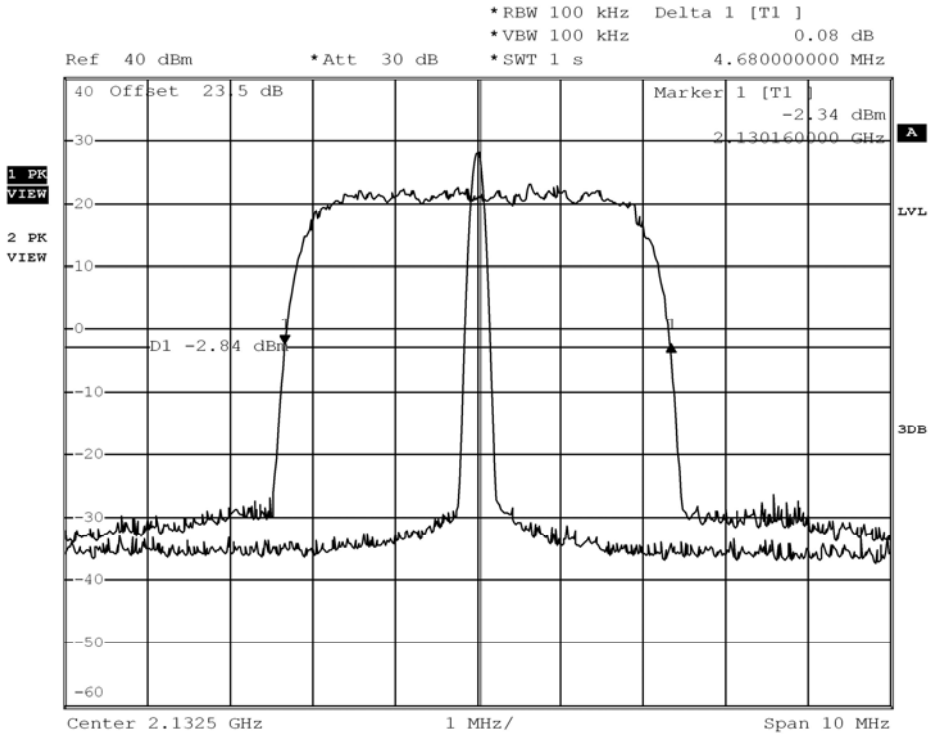


1xEVDO – 26 dB Bandwidth (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

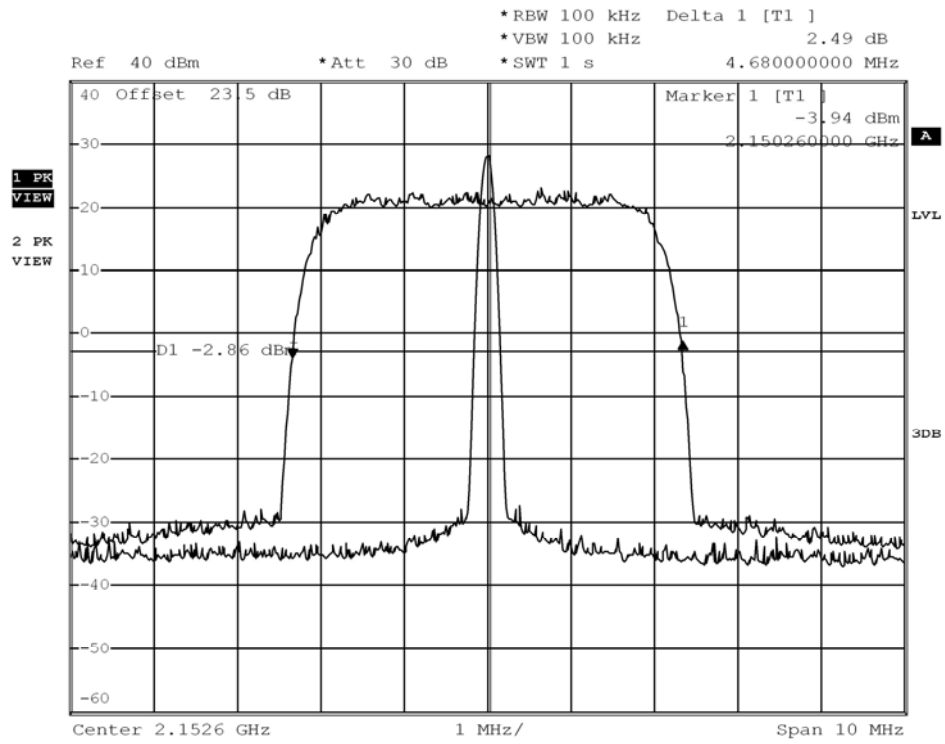


WCDMA – 26 dB Bandwidth (Low Channel)



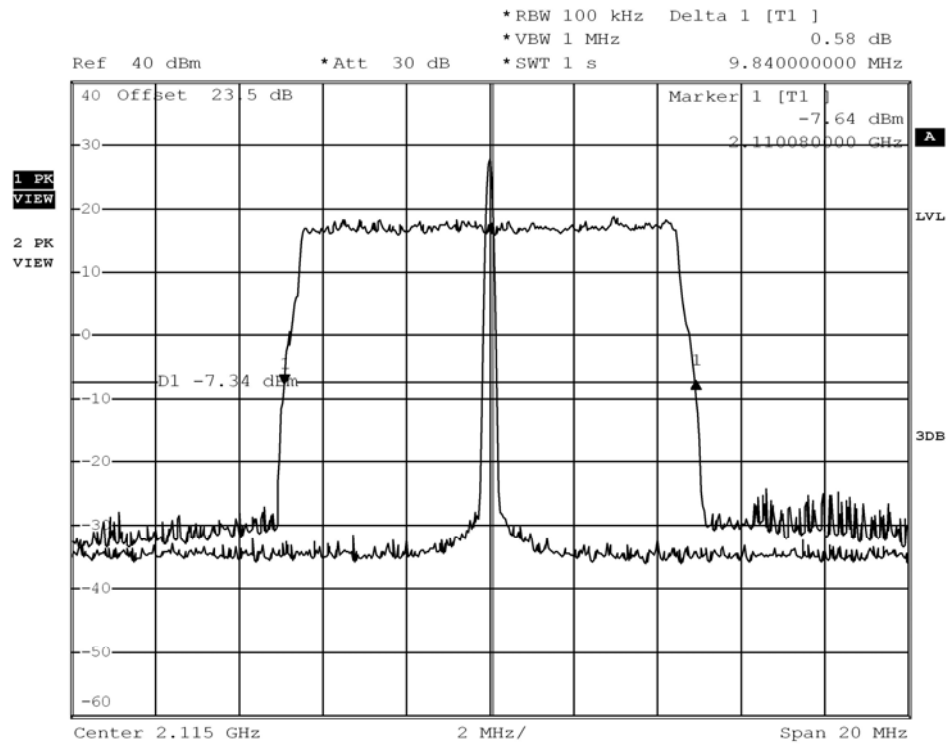
WCDMA – 26 dB Bandwidth (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

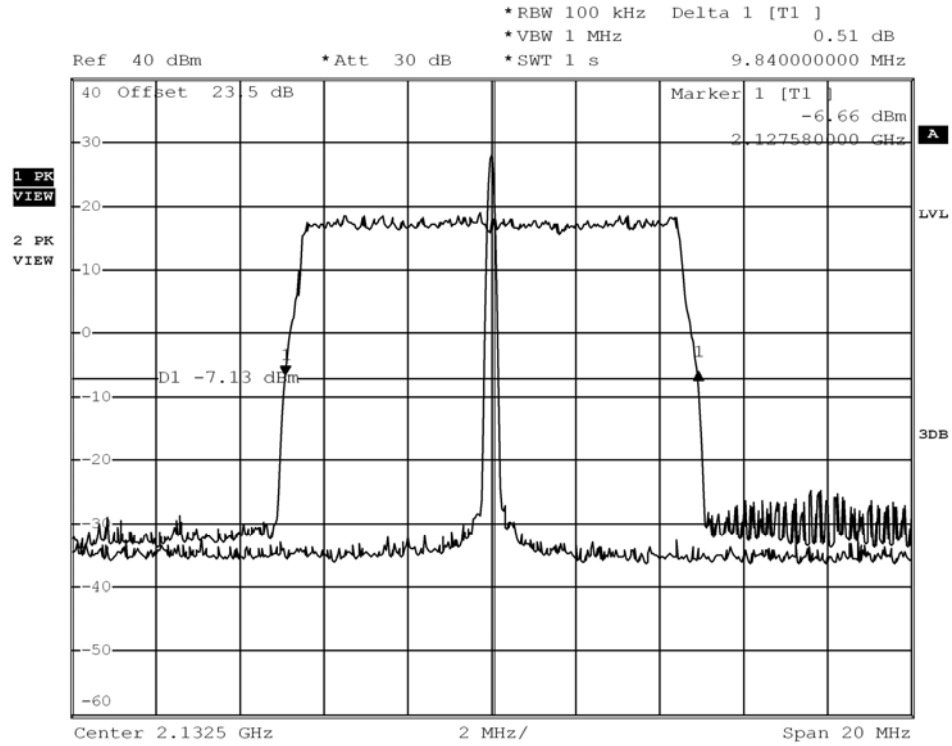


WCDMA – 26 dB Bandwidth (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

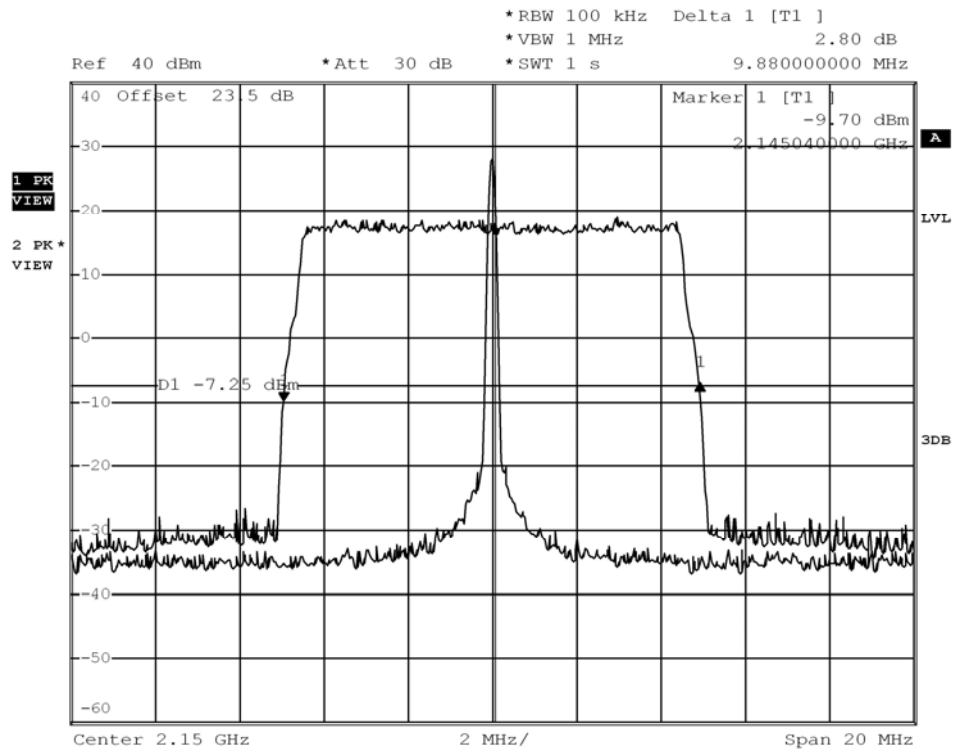


LTE – 26 dB Bandwidth (Low Channel)



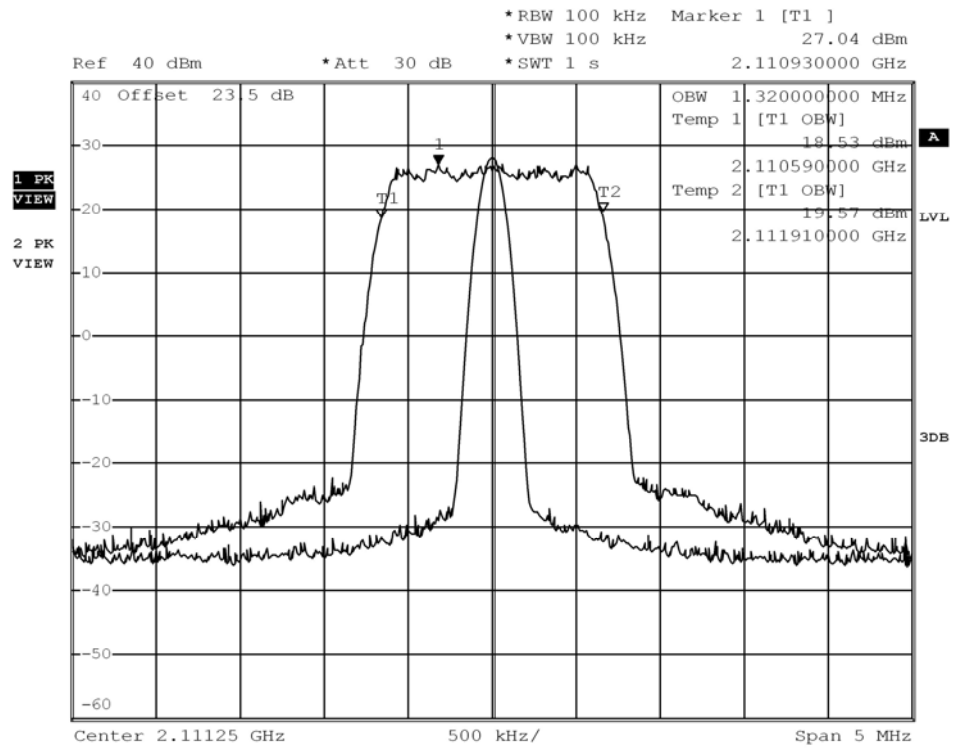
LTE – 26 dB Bandwidth (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

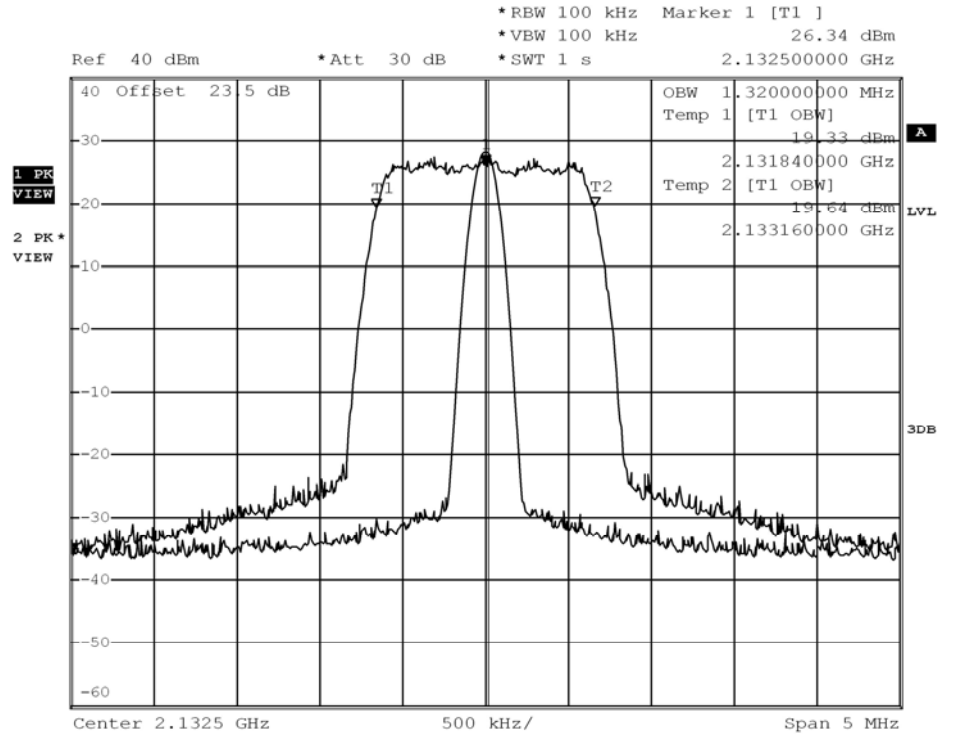


LTE – 26 dB Bandwidth (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

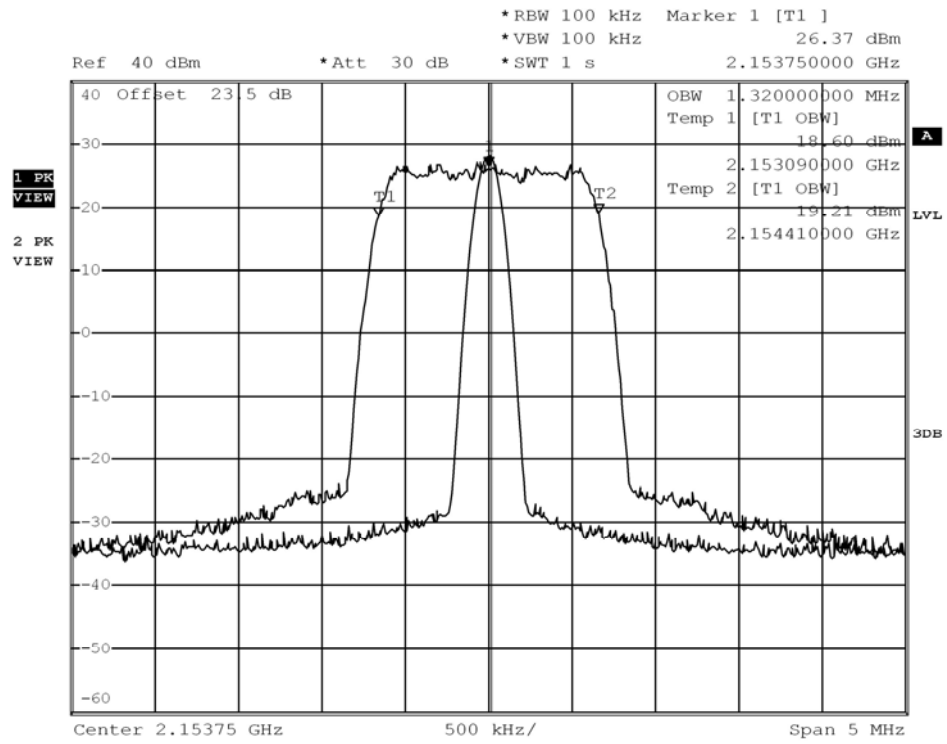


CDMA – 99 % Occupied Bandwidth (Low Channel)



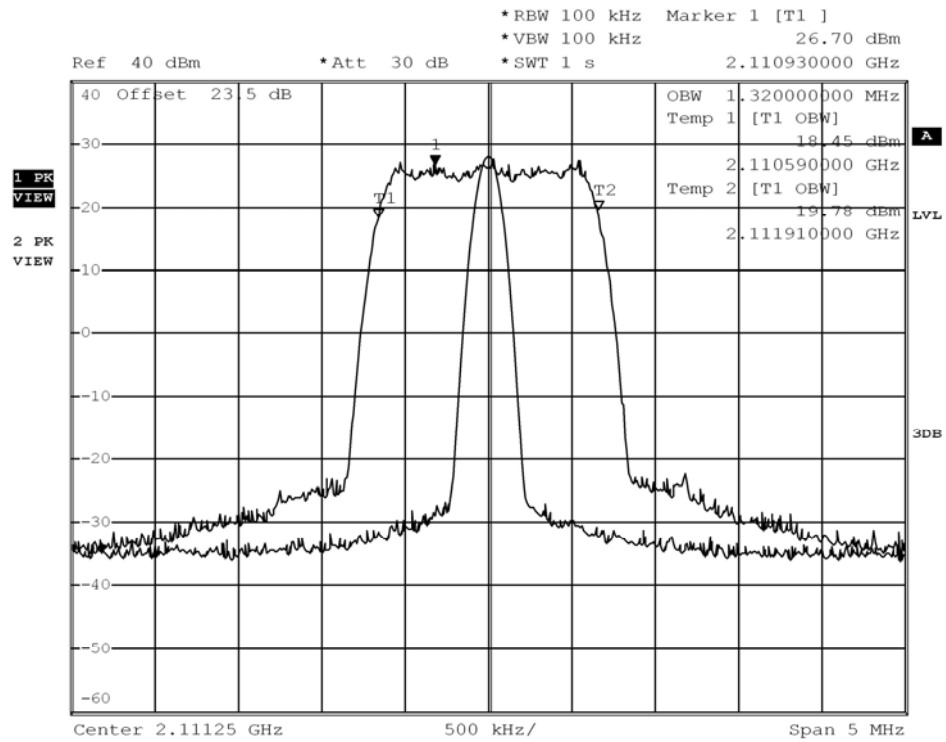
CDMA – 99 % Occupied Bandwidth (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

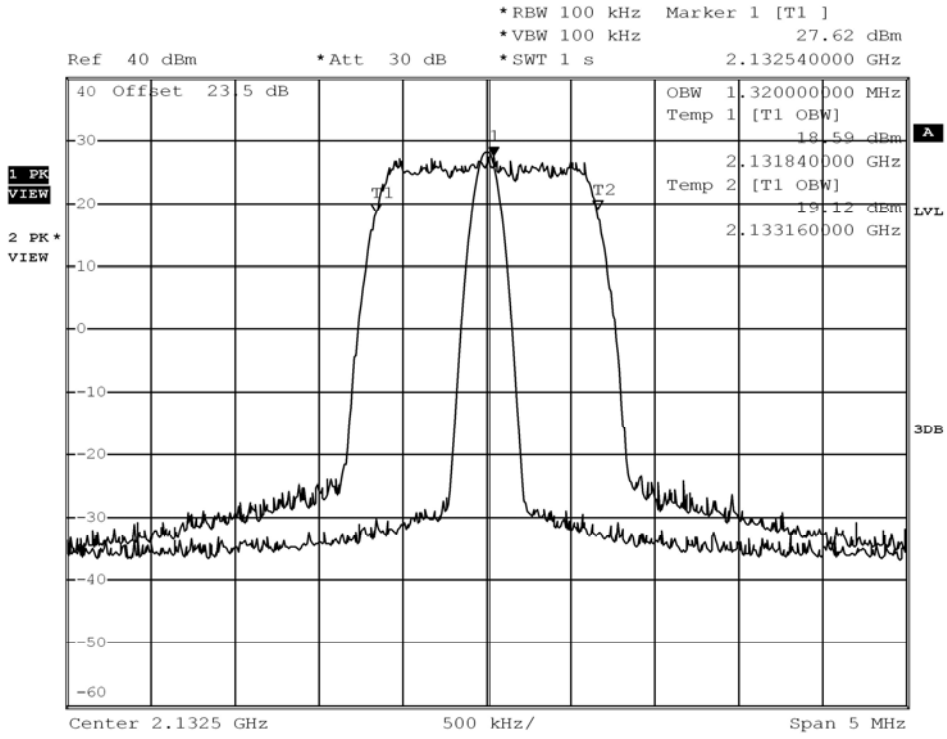


CDMA – 99 % Occupied Bandwidth (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

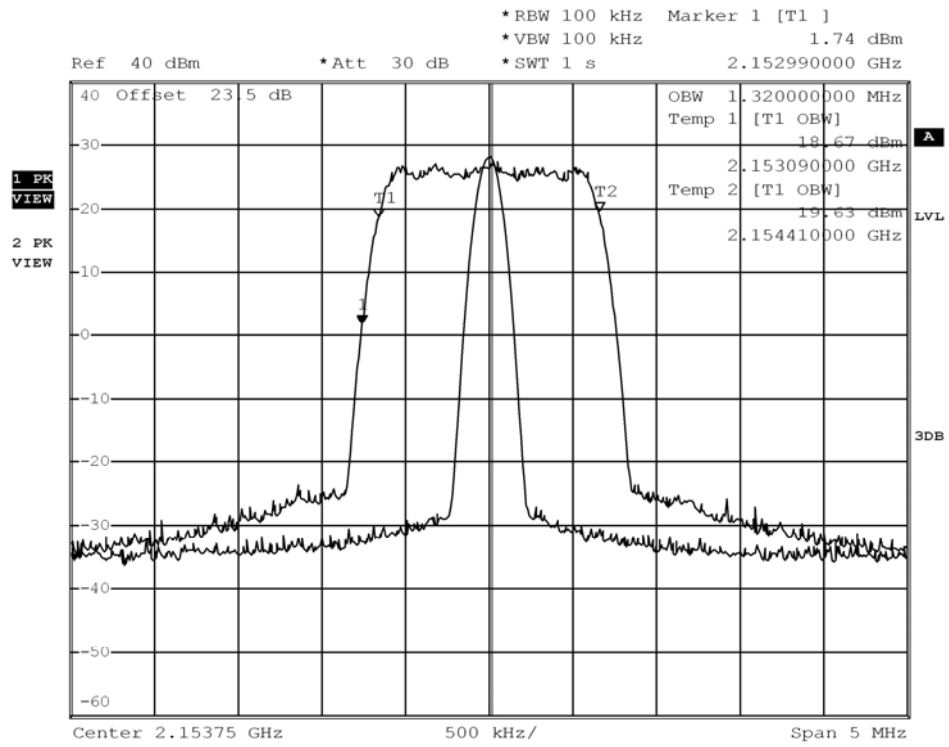


1xEVDO – 99 % Occupied Bandwidth (Low Channel)



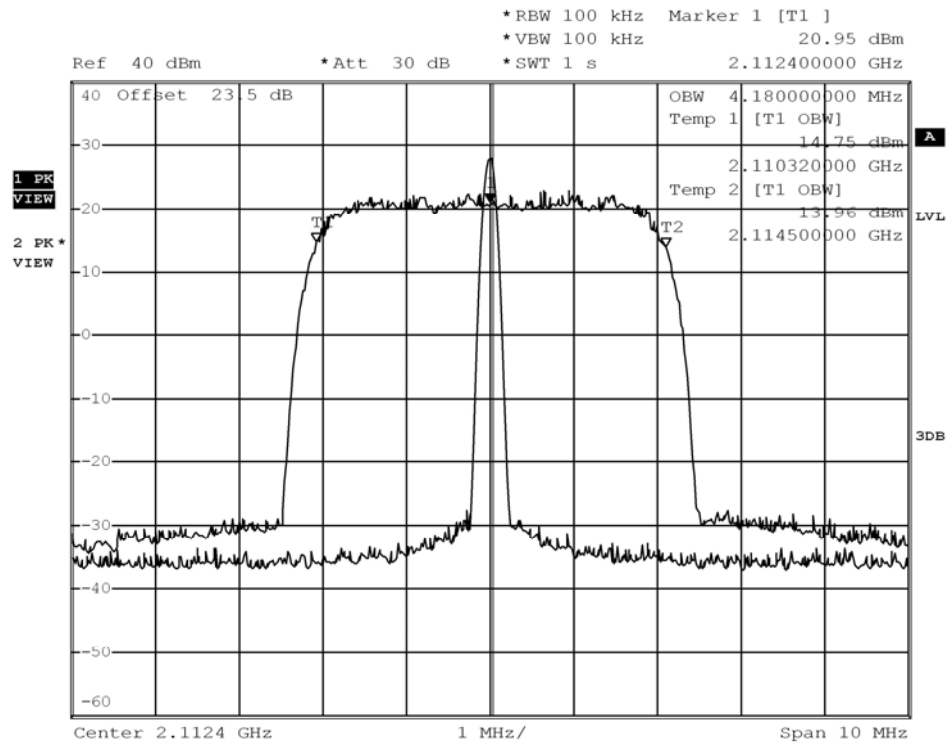
1xEVDO – 99 % Occupied Bandwidth (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

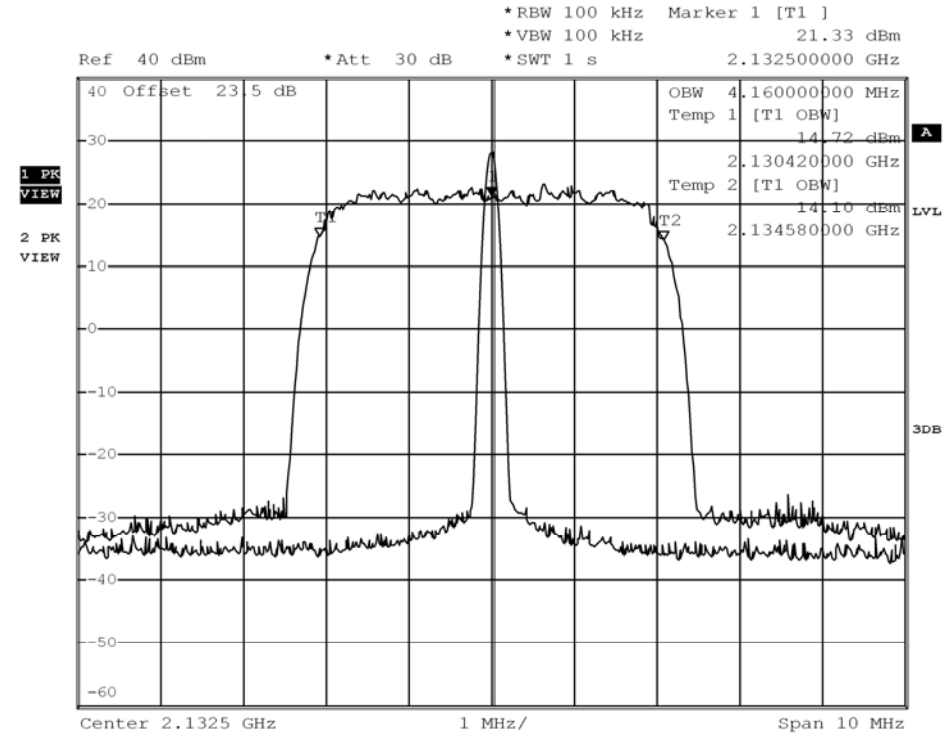


1xEVDO – 99 % Occupied Bandwidth (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

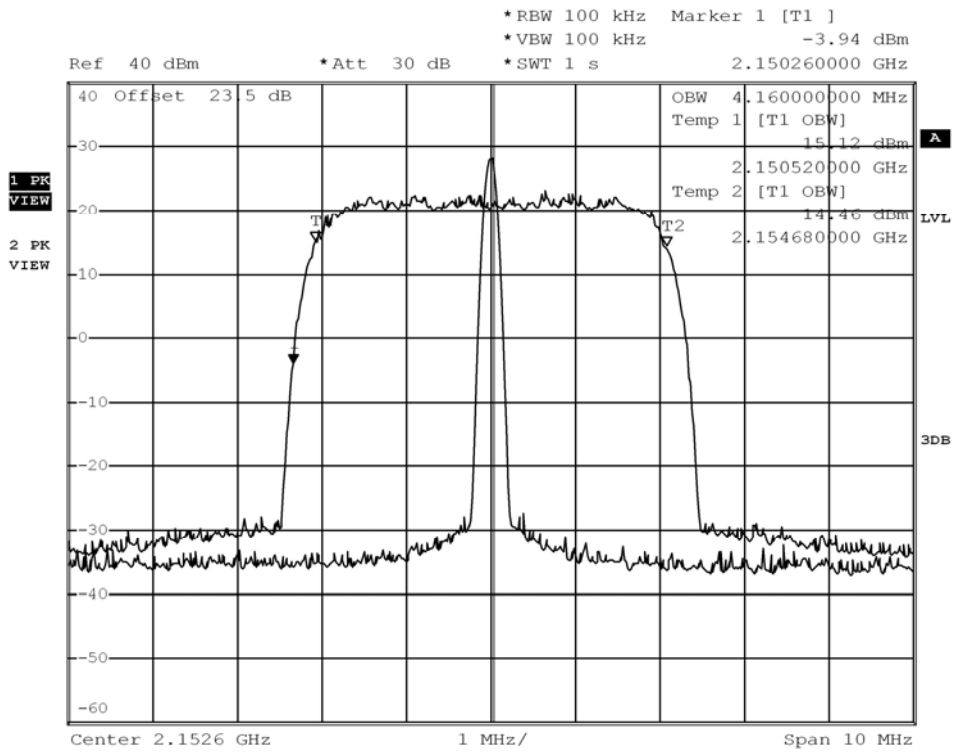


WCDMA – 99 % Occupied Bandwidth (Low Channel)



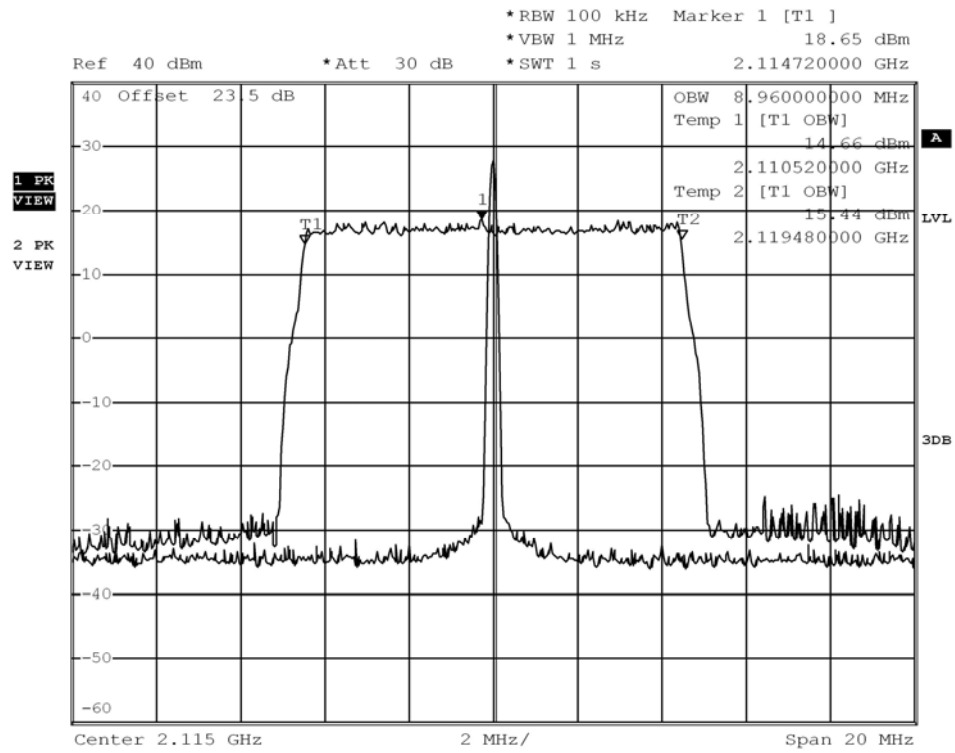
WCDMA – 99 % Occupied Bandwidth (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

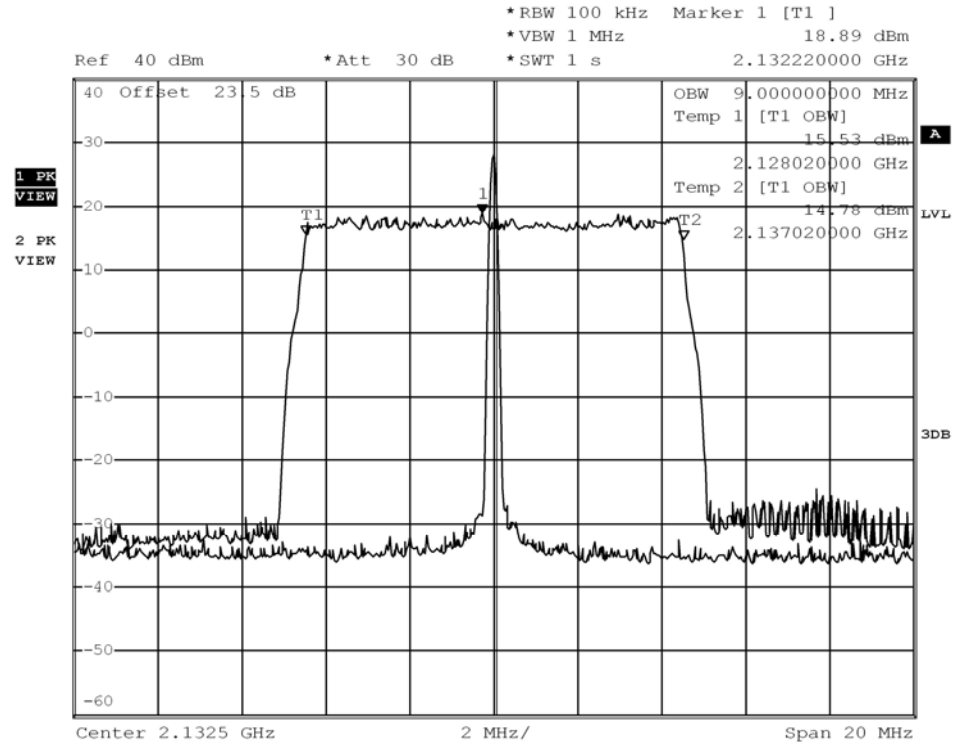


WCDMA – 99 % Occupied Bandwidth (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

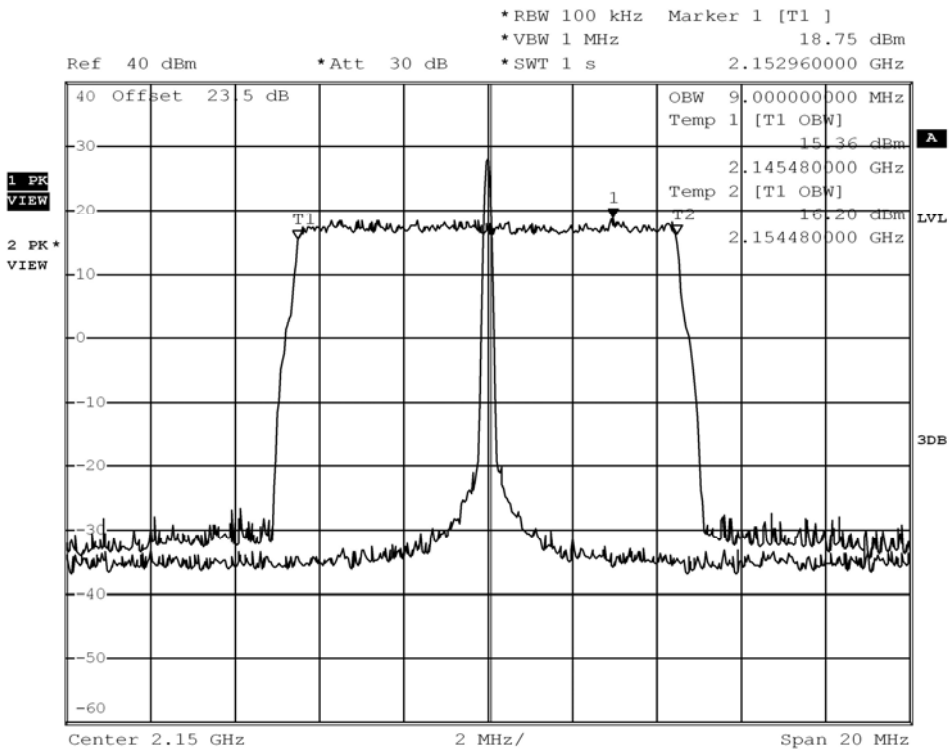


LTE – 99 % Occupied Bandwidth (Low Channel)



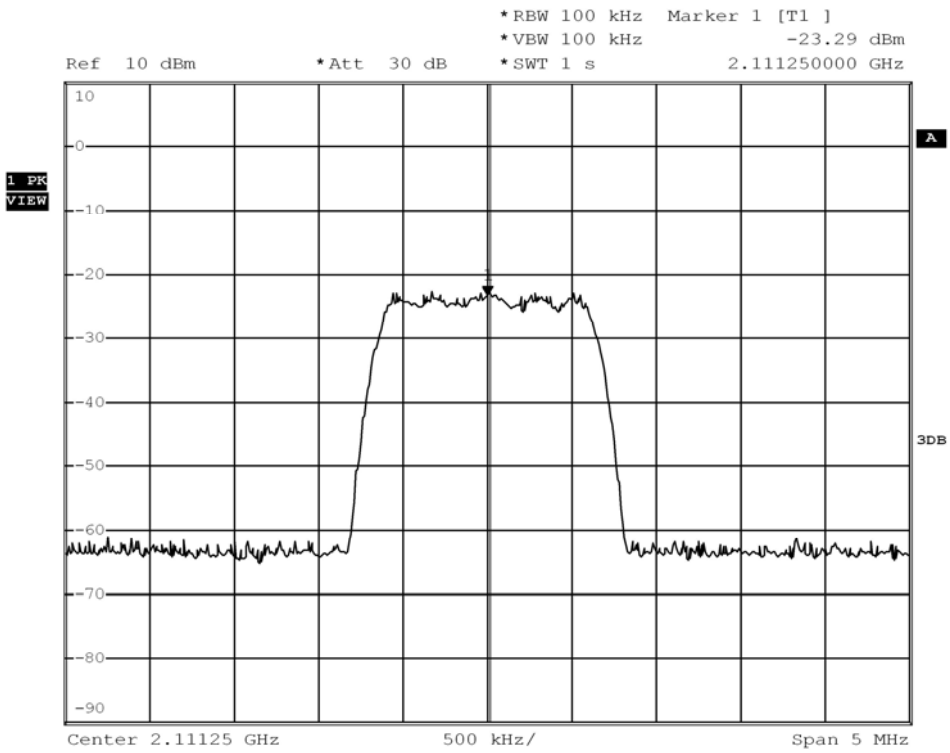
LTE – 99 % Occupied Bandwidth (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

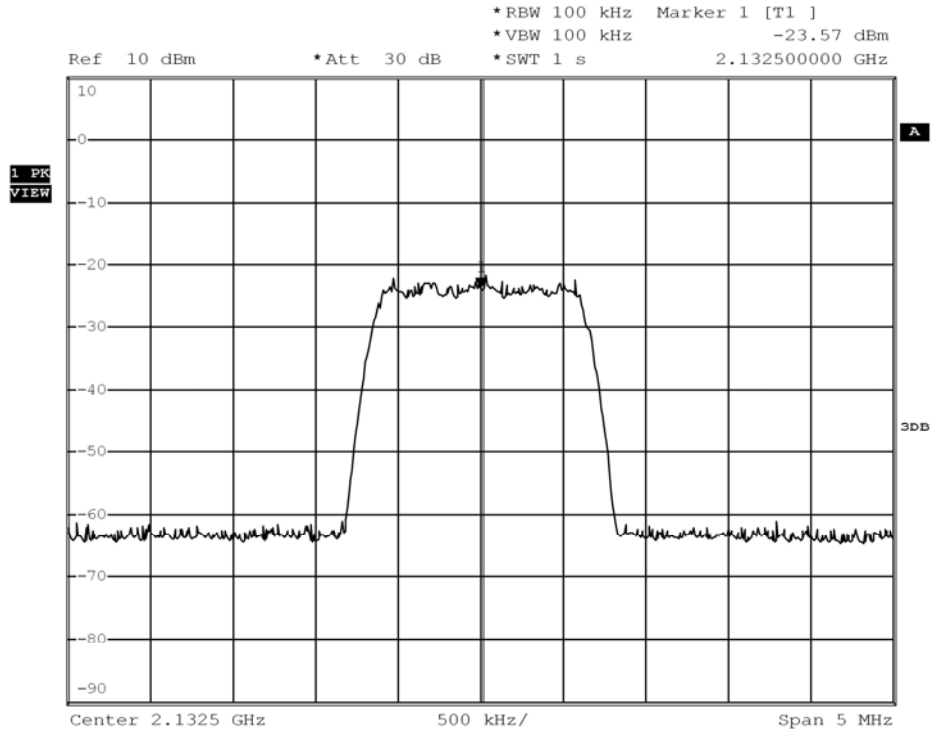


LTE – 99 % Occupied Bandwidth (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

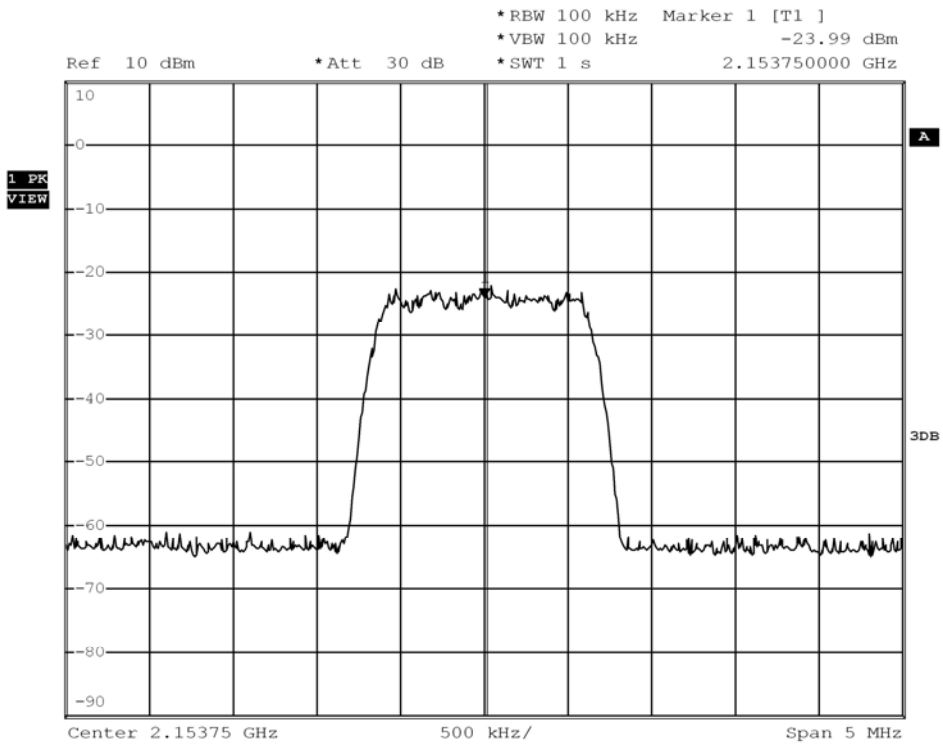


CDMA – Input (Low Channel)



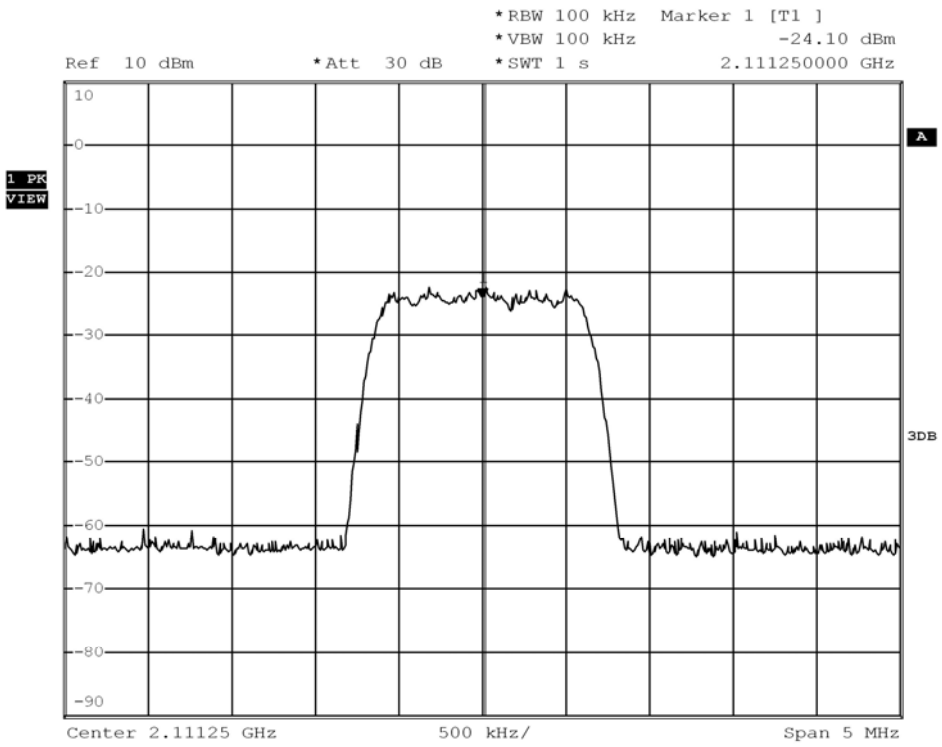
CDMA – Input (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

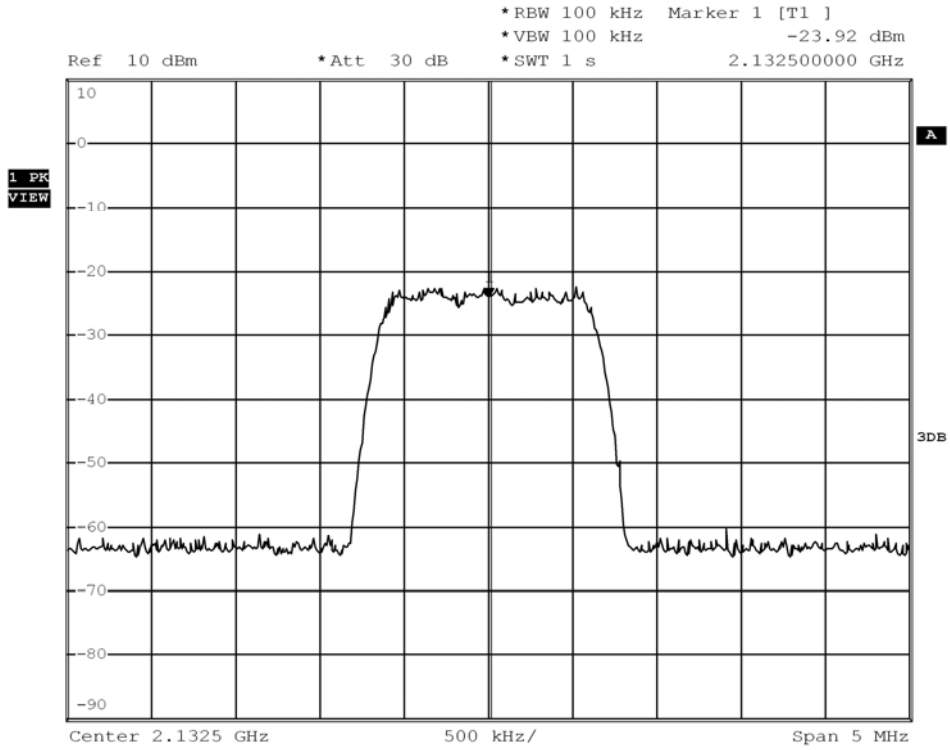


CDMA – Input (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

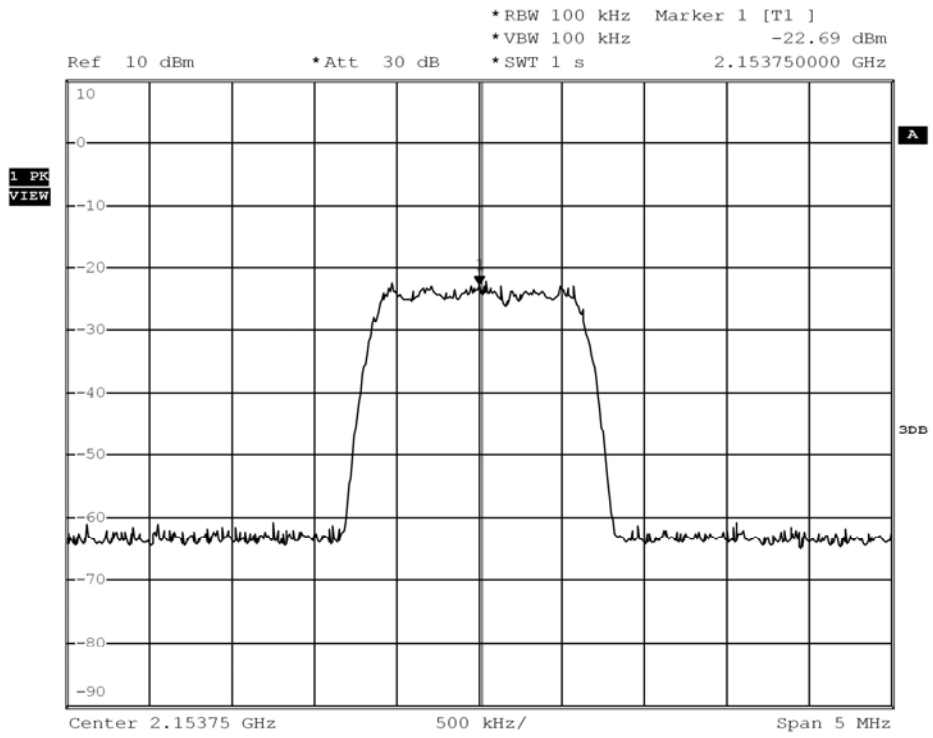


1xEVDO – Input (Low Channel)



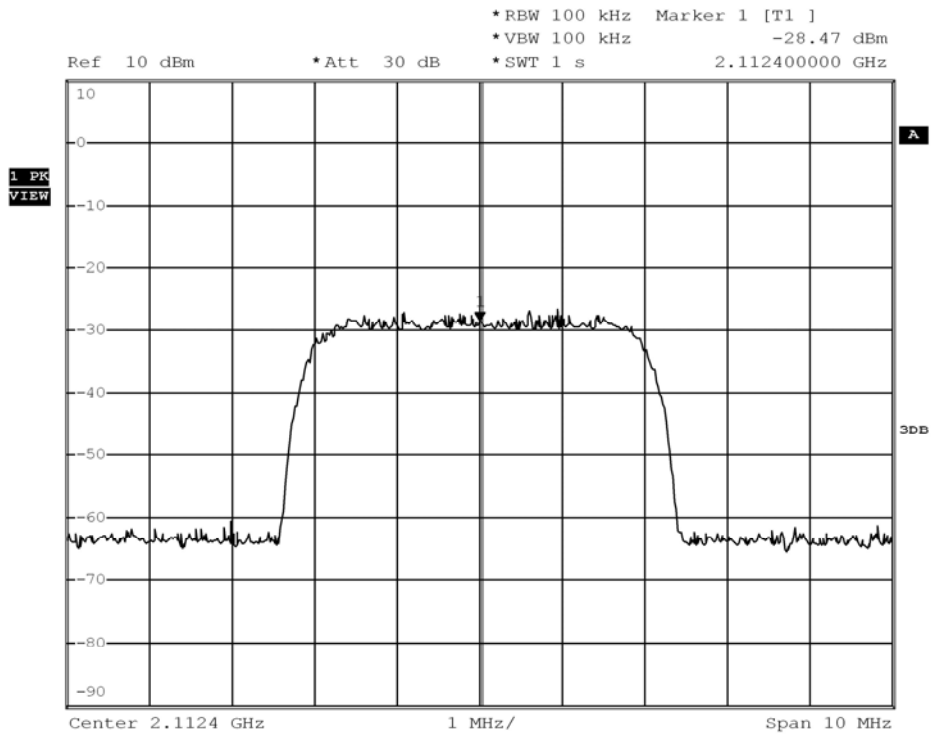
1xEVDO – Input (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

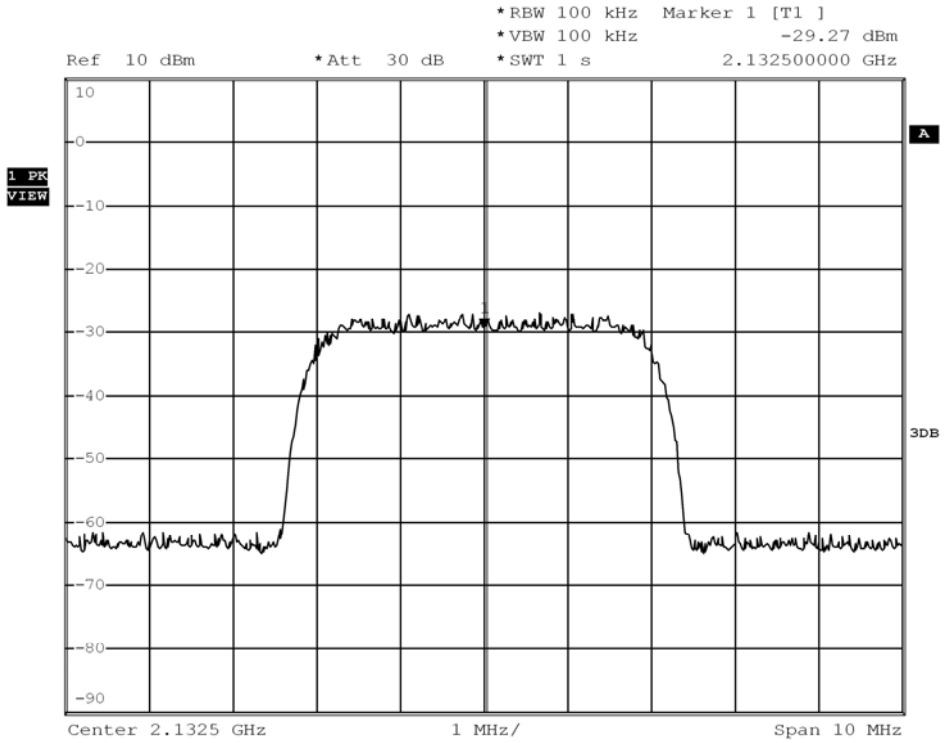


1xEVDO – Input (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

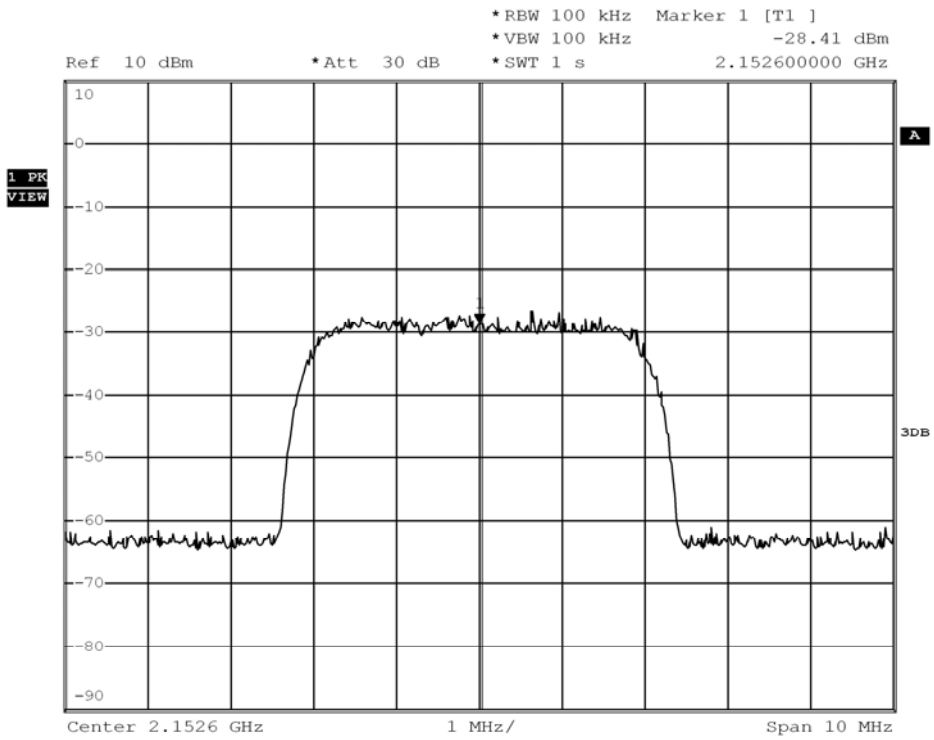


WCDMA – Input (Low Channel)



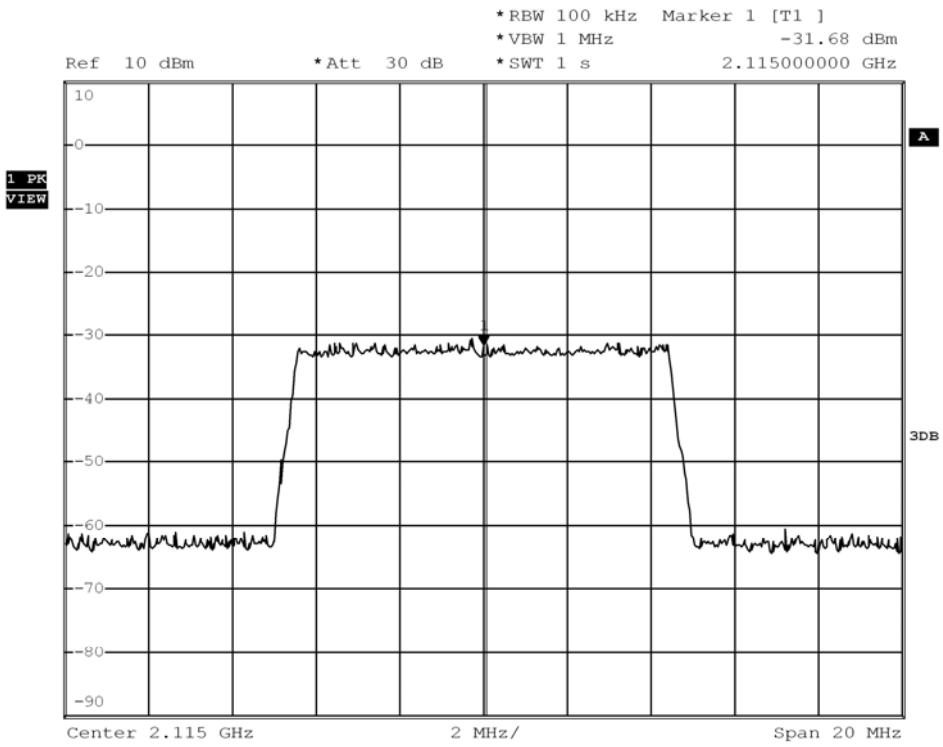
WCDMA – Input (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

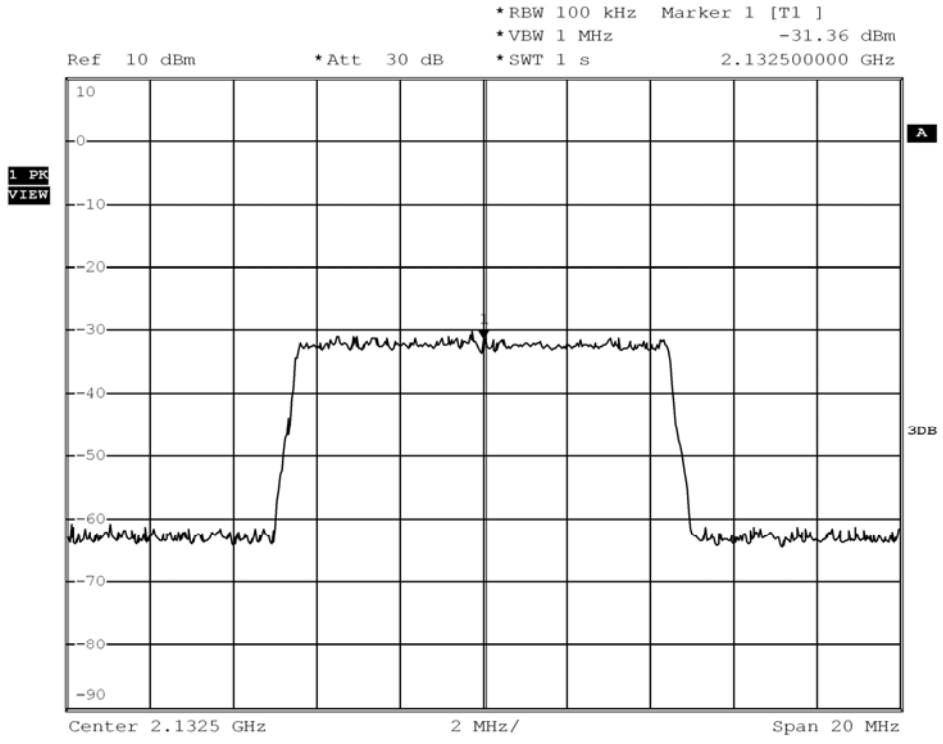


WCDMA – Input (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

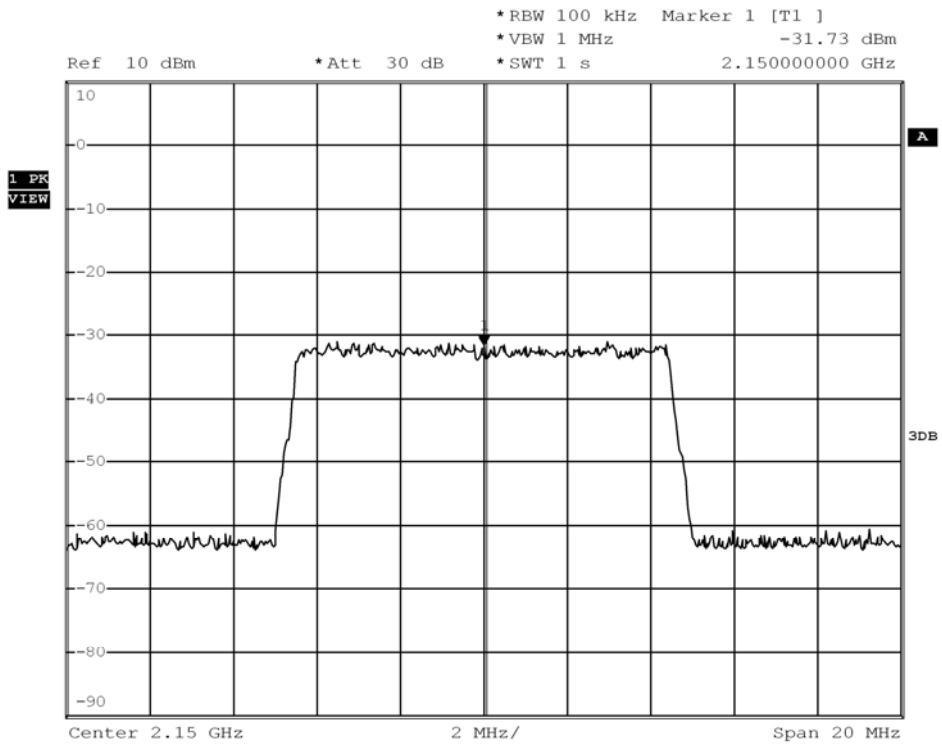


LTE – Input (Low Channel)



LTE – Input (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



LTE – Input (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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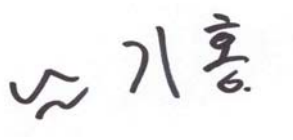
6.4.2 Test Result for Part 27 C (700LTE)

-. Test Date : December 12, 2012

-. Test Result : Pass

Modulation	Channel	26 dB Bandwidth (kHz)	99 % Occupied Bandwidth (kHz)
LTE	Low	9.840	9.000
	Middle	9.880	9.000
	High	9.840	9.000

Remark: According to above result, the carrier frequency shall be within the frequency block edges.



Tested by: Ki-Hong, Nam / Senior Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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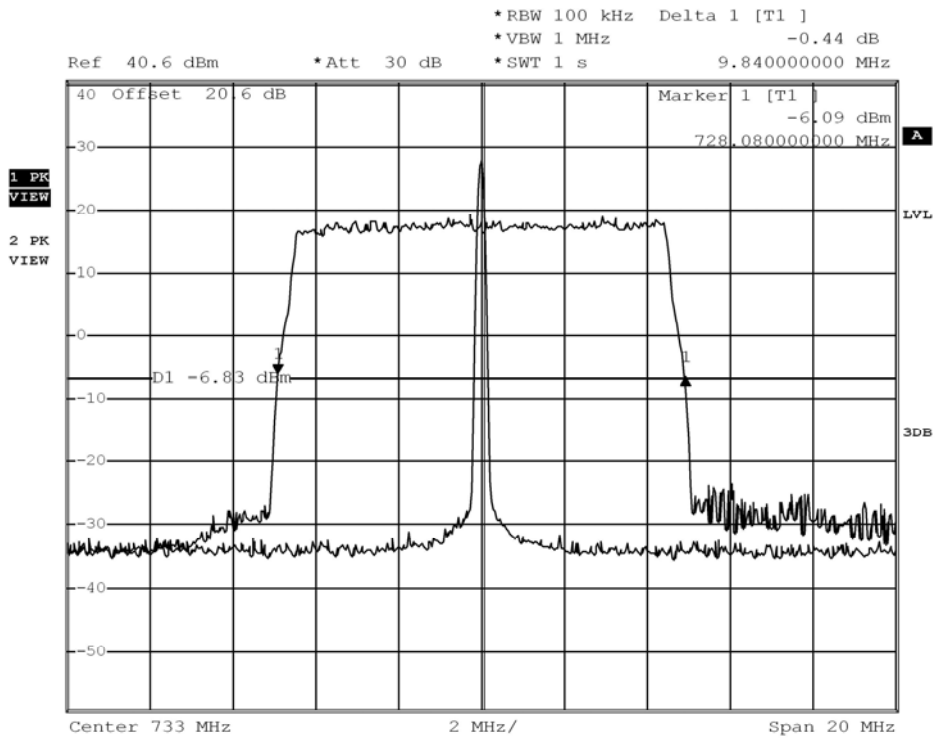
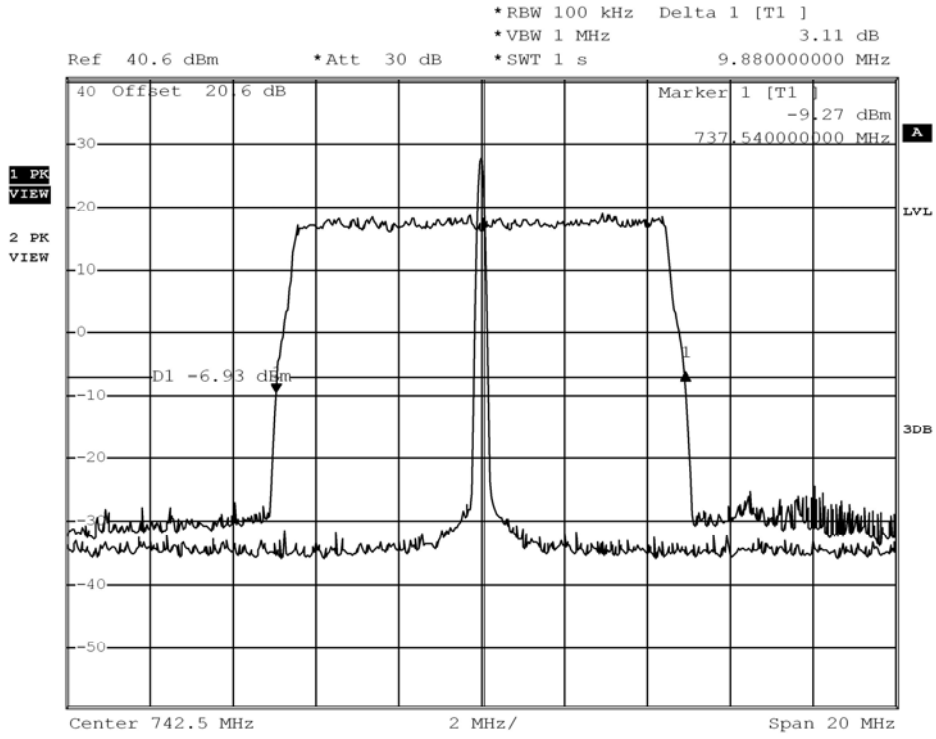


LTE – 26 dB Bandwidth (Low Channel)



LTE – 26 dB Bandwidth (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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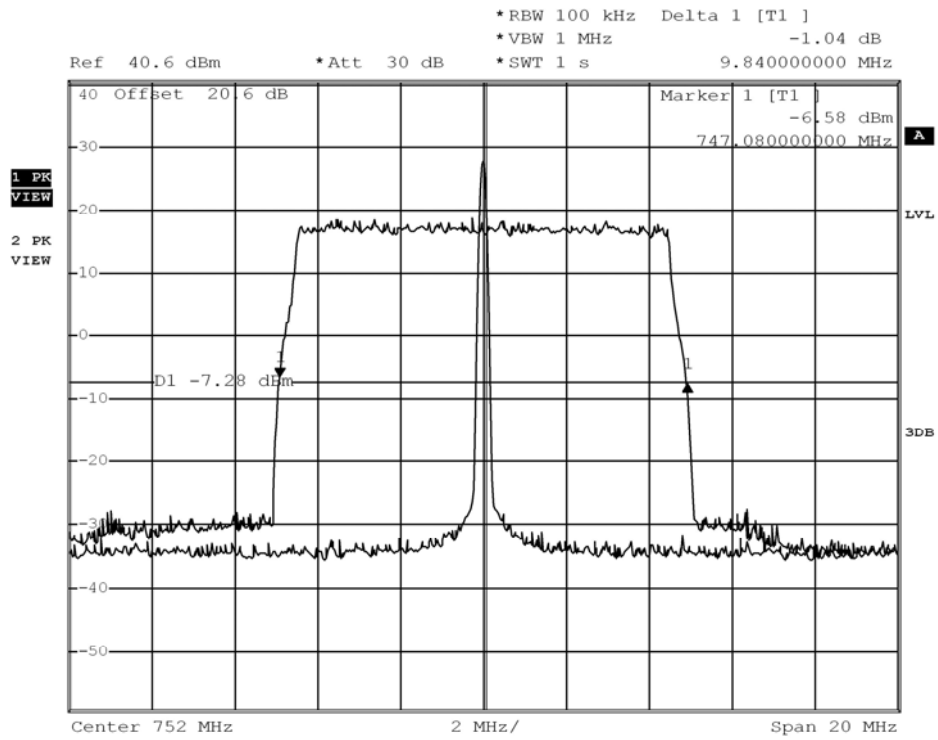
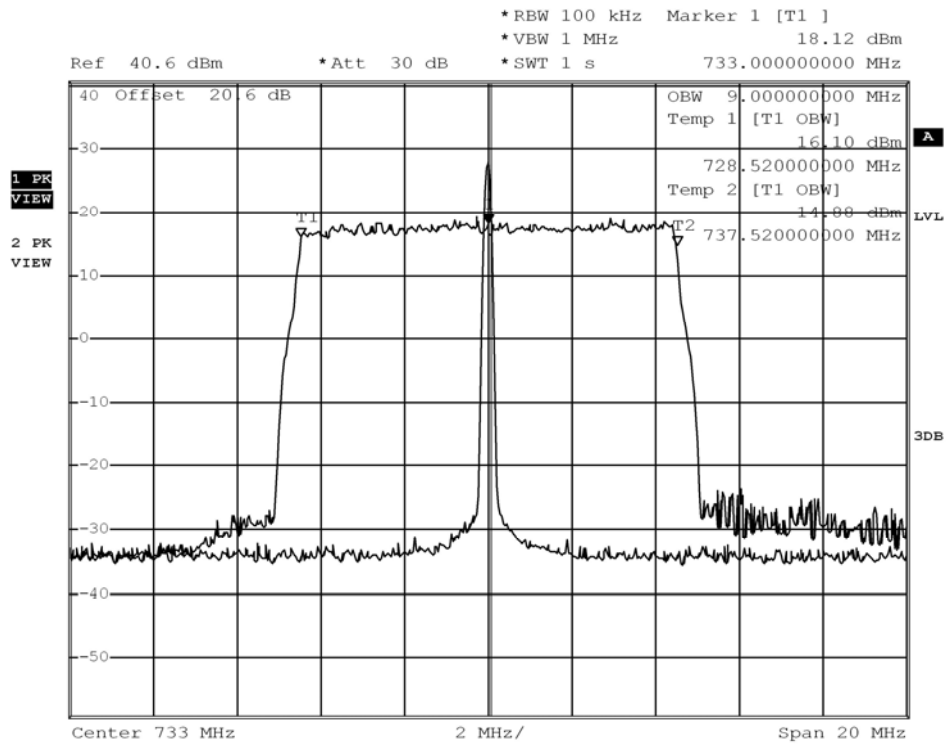
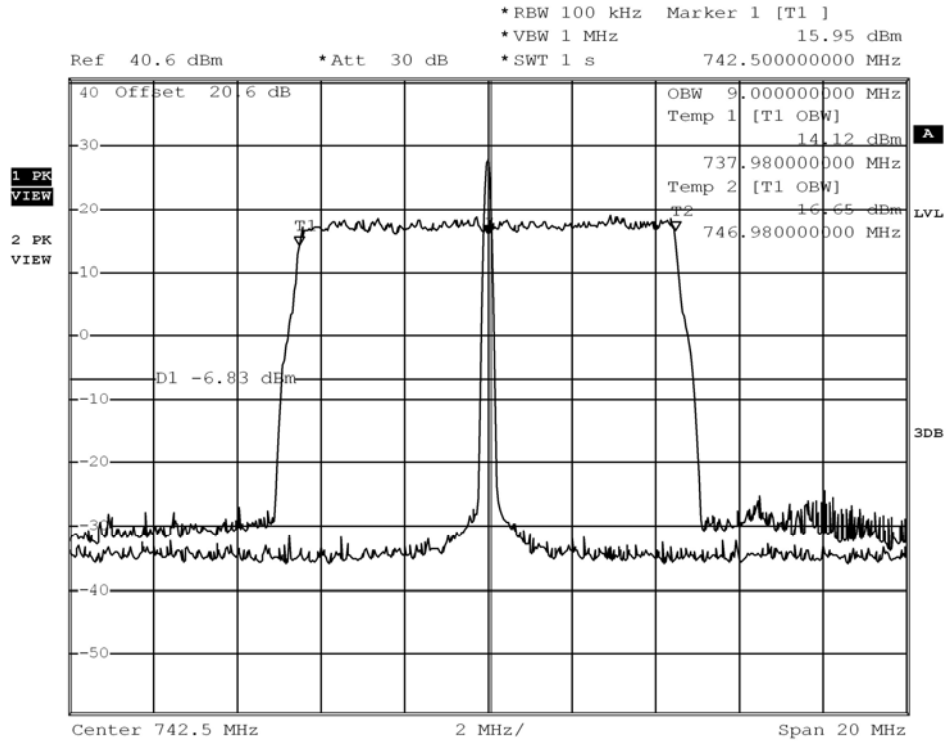


LTE – 26 dB Bandwidth (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



LTE – Occupied Bandwidth (Low Channel)



LTE – Occupied Bandwidth (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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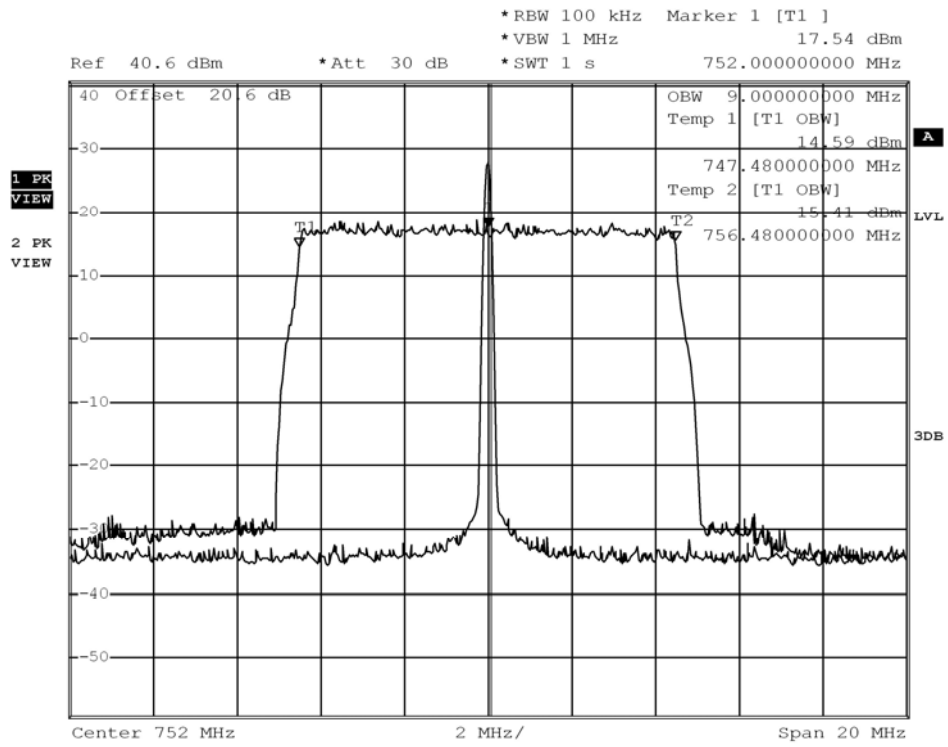
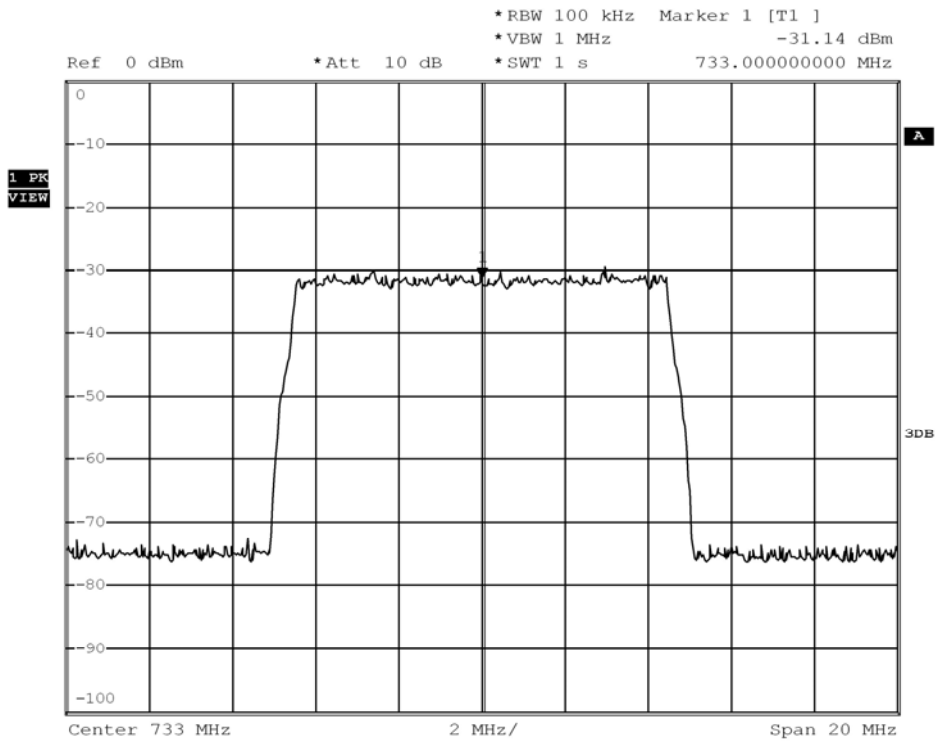
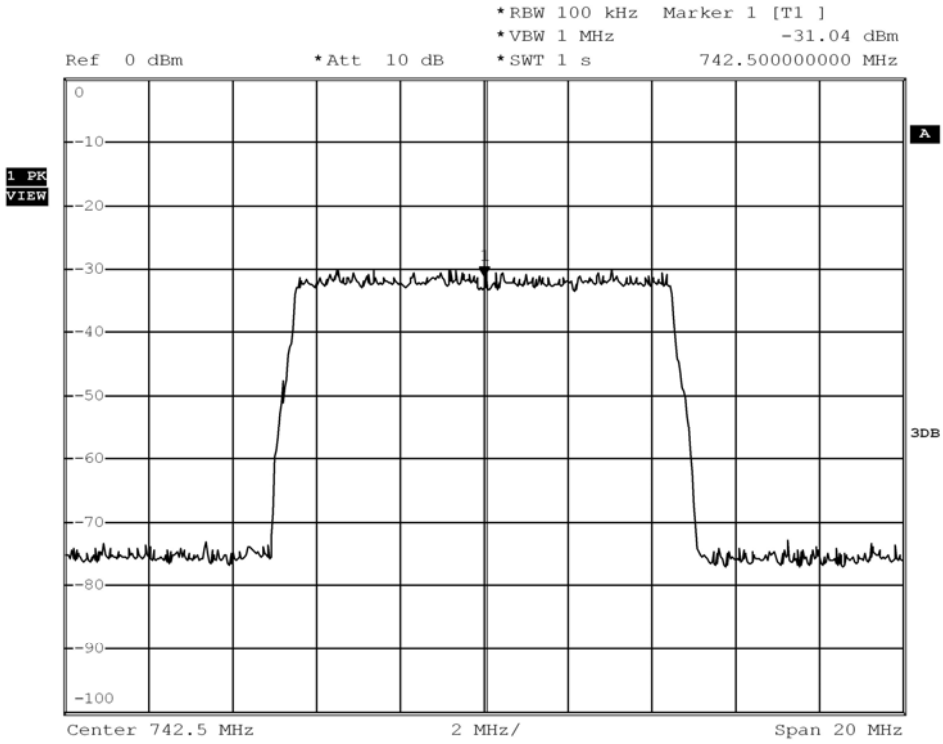


LTE – Occupied Bandwidth (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



LTE – Input (Low Channel)



LTE – Input (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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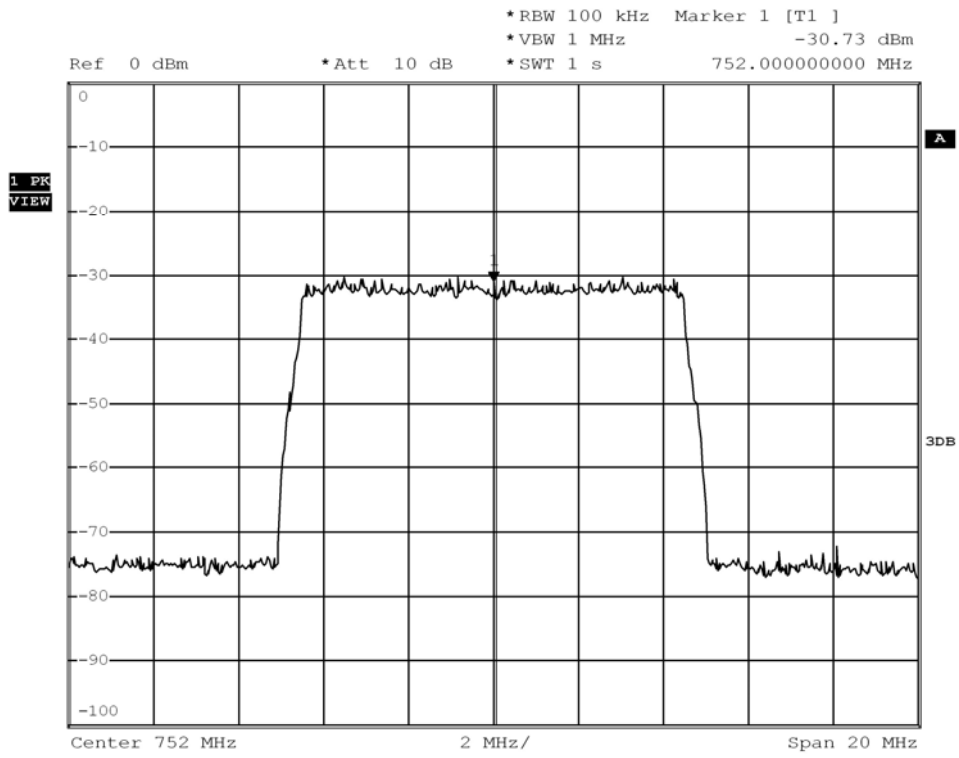


LTE – Input (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

7. SPURIOUS EMISSION AT ANTENNA TERMINAL

7.1 Operating environment

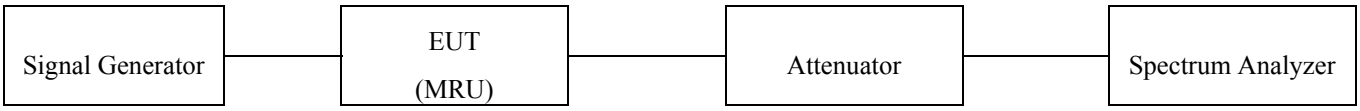
Temperature : 22 °C

Relative humidity : 50 % R.H.

7.2 Test set-up for conducted measurement

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the power meter or spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation.

The resolution bandwidth and video bandwidth of the spectrum analyzer was set at 1 MHz and sufficient scans were taken to show any out of band emissions up to 25 GHz.



7.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	E4432B	HP	Signal Generator	US38440950	June 01, 2012 (1Y)
■ -	SMJ100A	R/S	Signal Generator	101038	Feb. 02, 2012 (1Y)
■ -	FSP	R/S	Spectrum Analyzer	100017	Mar. 12, 2012 (1Y)
■ -	8564E	HP	Spectrum Analyzer	3650A00756	Apr. 04, 2012 (1Y)
■ -	67-30-43	Aeroflex Weinschel	Power Attenuator	CA5760	Dec. 10, 2012 (1Y)

All test equipment used is calibrated on a regular basis.

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7.4 Test data

7.4.1 Test Result for Part 27 C (AWS-1)

-. Test Date : December 10, 2012

-. Frequency range : 30 MHz ~ 25 GHz

-. Result : Pass

Modulation	Harmonic Frequency (MHz)		Measured Value (dBm)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
CDMA	Low	610.40	-45.83	0.50	-45.33	-13.00	-32.33
		7 040.00	-31.50	3.50	-28.00		-15.00
	Middle	697.70	-46.00	0.50	-45.50		-32.50
		7 320.00	-31.83	3.50	-28.33		-15.33
	High	652.40	-45.67	0.50	-45.17		-32.17
		7 640.00	-31.83	3.50	-28.33		-15.33
1xEVDO	Low	647.60	-45.83	0.50	-45.33	-13.00	-32.33
		7 360.00	-31.50	3.50	-28.00		-15.00
	Middle	683.10	-45.33	0.50	-44.83		-31.83
		7 200.00	-32.83	3.50	-29.33		-16.33
	High	696.10	-46.17	0.50	-45.67		-32.67
		7 240.00	-31.83	3.50	-28.33		-15.33
WCDMA	Low	678.30	-46.67	0.50	-46.17	-13.00	-33.17
		7 440.00	-32.67	3.50	-29.17		-16.17
	Middle	684.80	-46.50	0.50	-46.00		-33.00
		7 560.00	-32.17	3.50	-28.67		-15.67
	High	654.00	-46.67	0.50	-46.17		-33.17
		7 440.00	-32.50	3.50	-29.00		-16.00
LTE	Low	646.00	-46.00	0.50	-45.50	-13.00	-32.50
		7 360.00	-32.17	3.50	-28.67		-15.67
	Middle	612.00	-46.33	0.50	-45.83		-32.83
		7 600.00	-32.00	3.50	-28.50		-15.50
	High	620.10	-46.00	0.50	-45.50		-32.50
		7 360.00	-32.67	3.50	-29.17		-16.17
Other frequencies up to 25 GHz have margin more than 20 dB.							

According to Part 24E, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0 dBm.

Tested by: Ki-Hong, Nam / Senior Engineer

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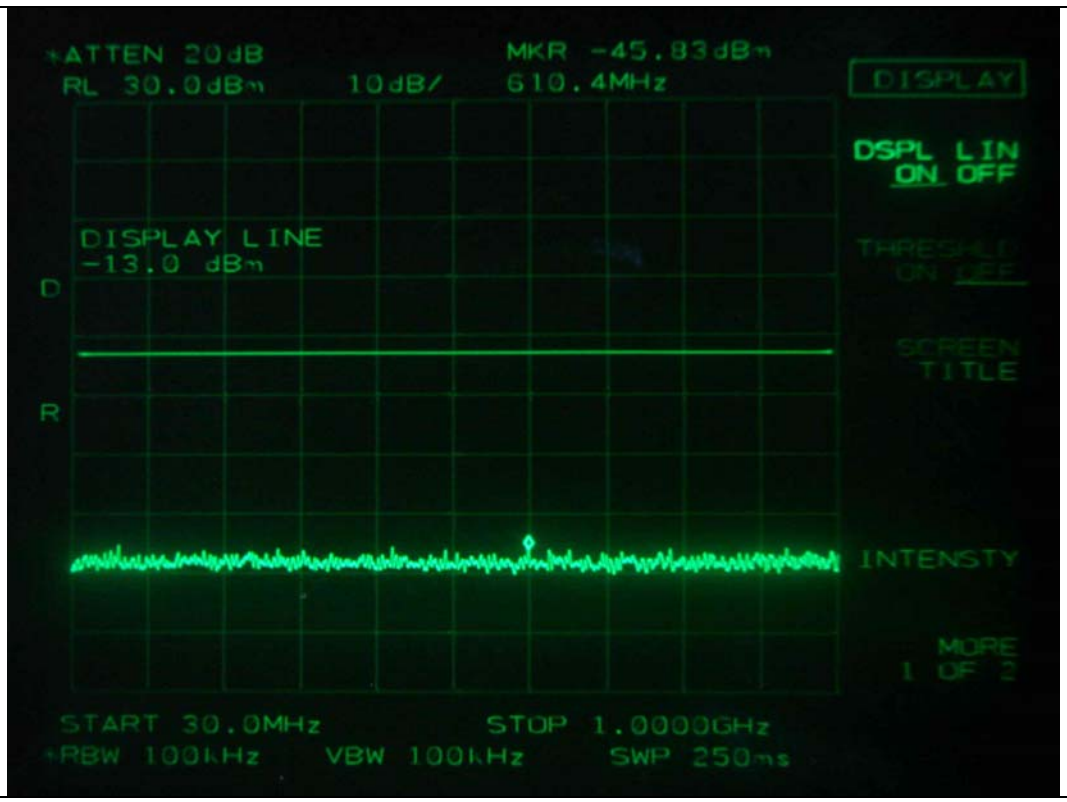
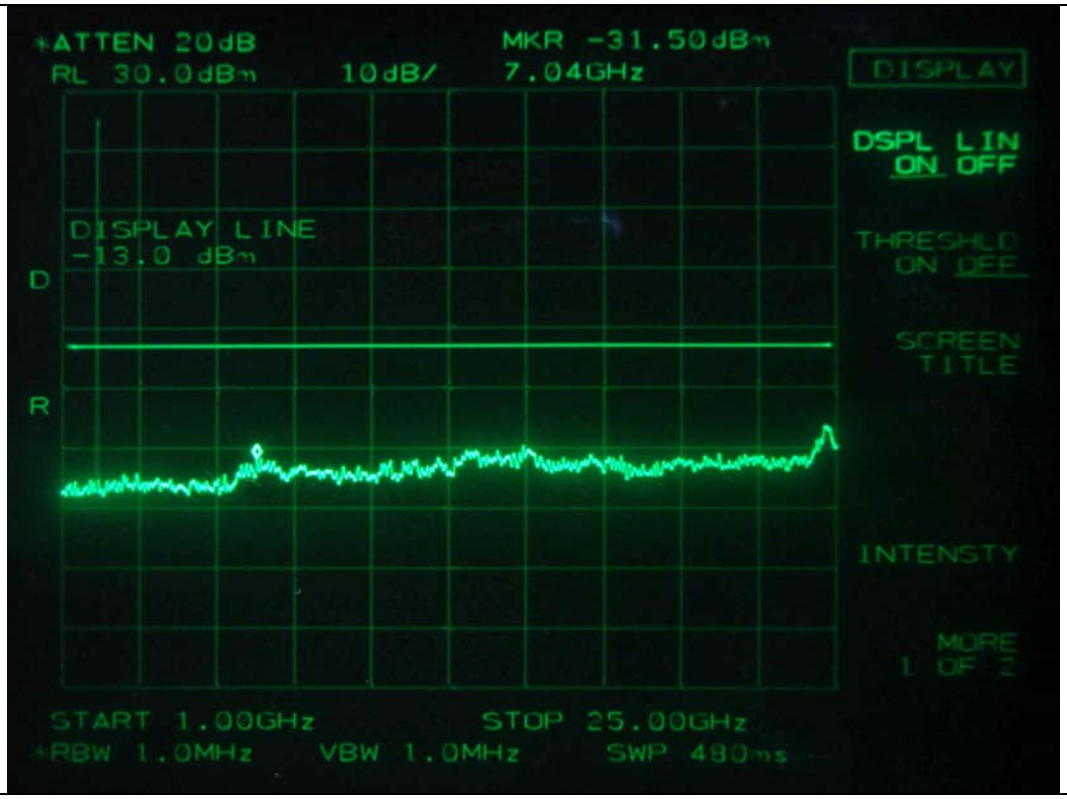


CDMA – Low Channel



CDMA – Low Channel

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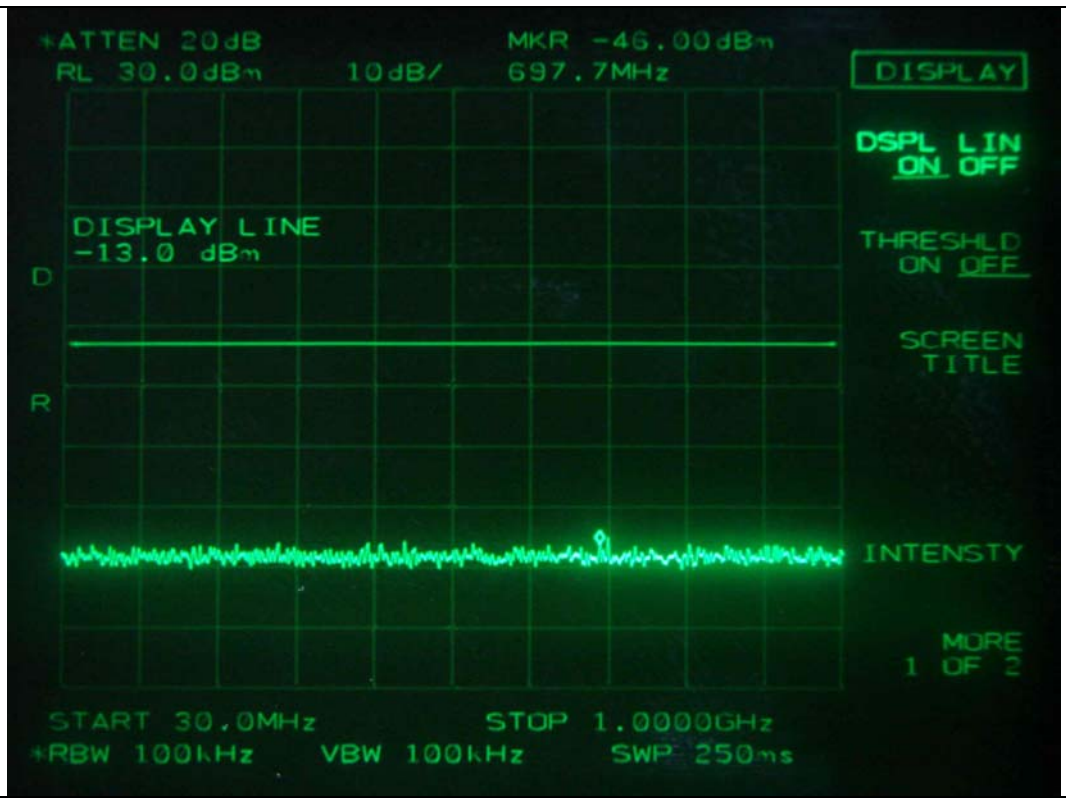
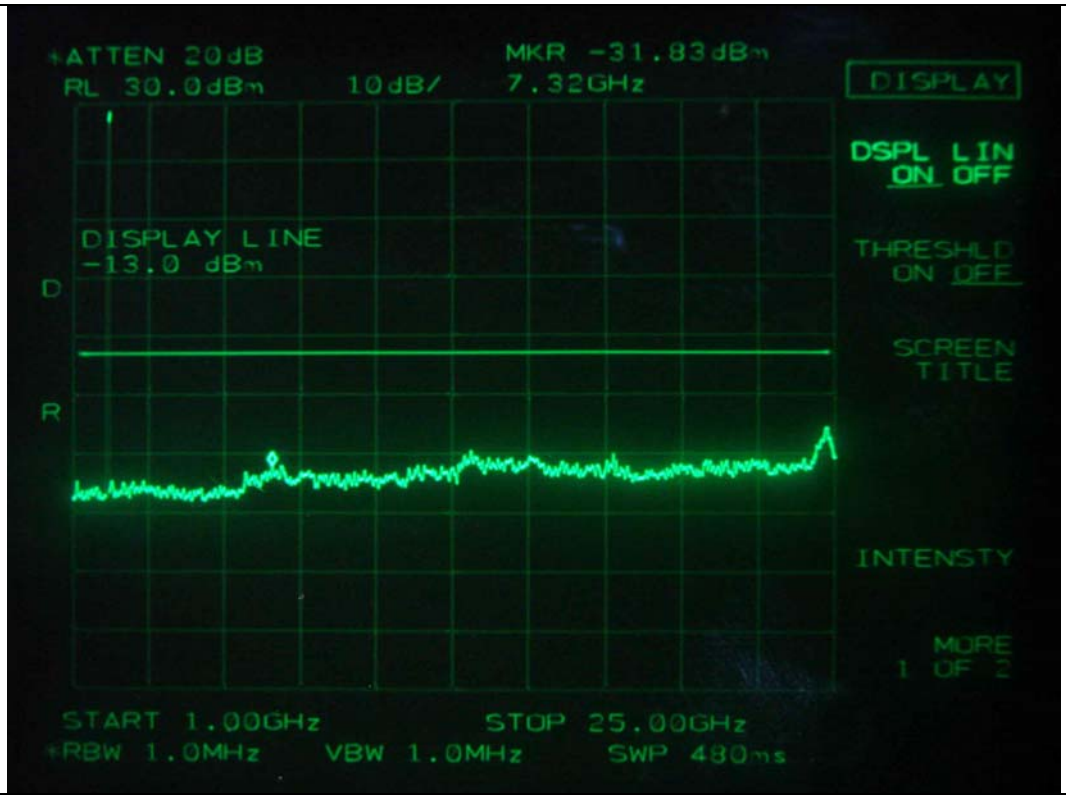


CDMA – Middle Channel



CDMA – Middle Channel

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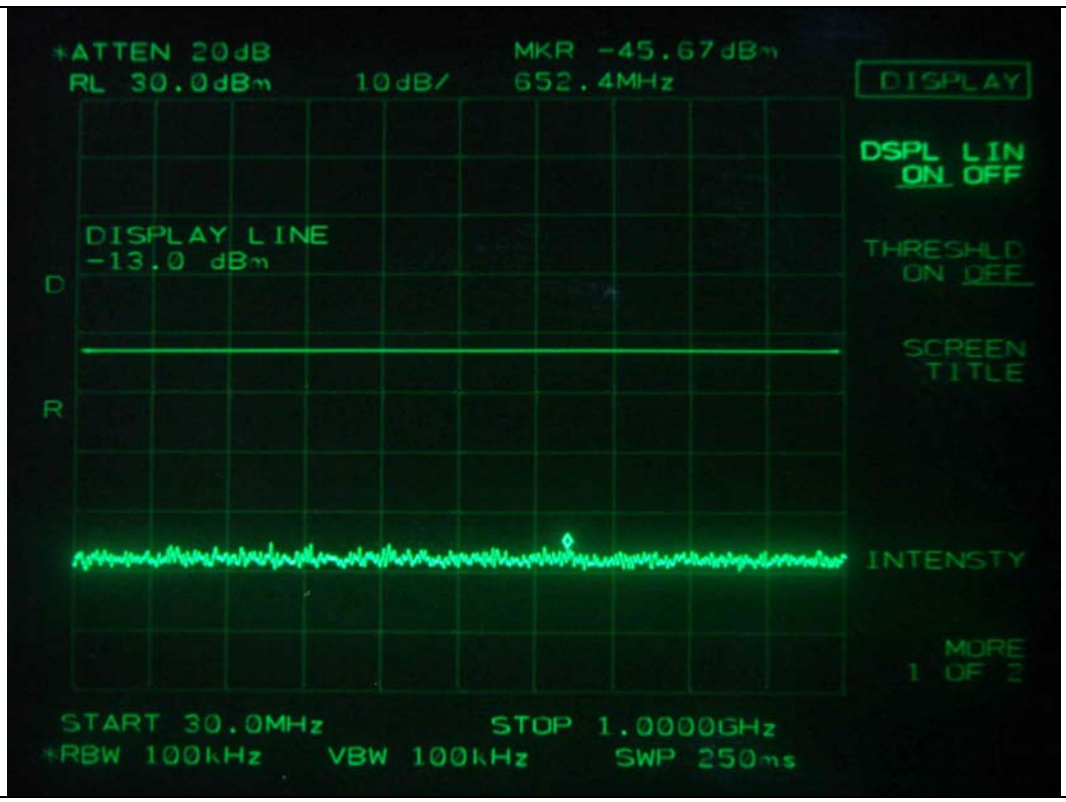
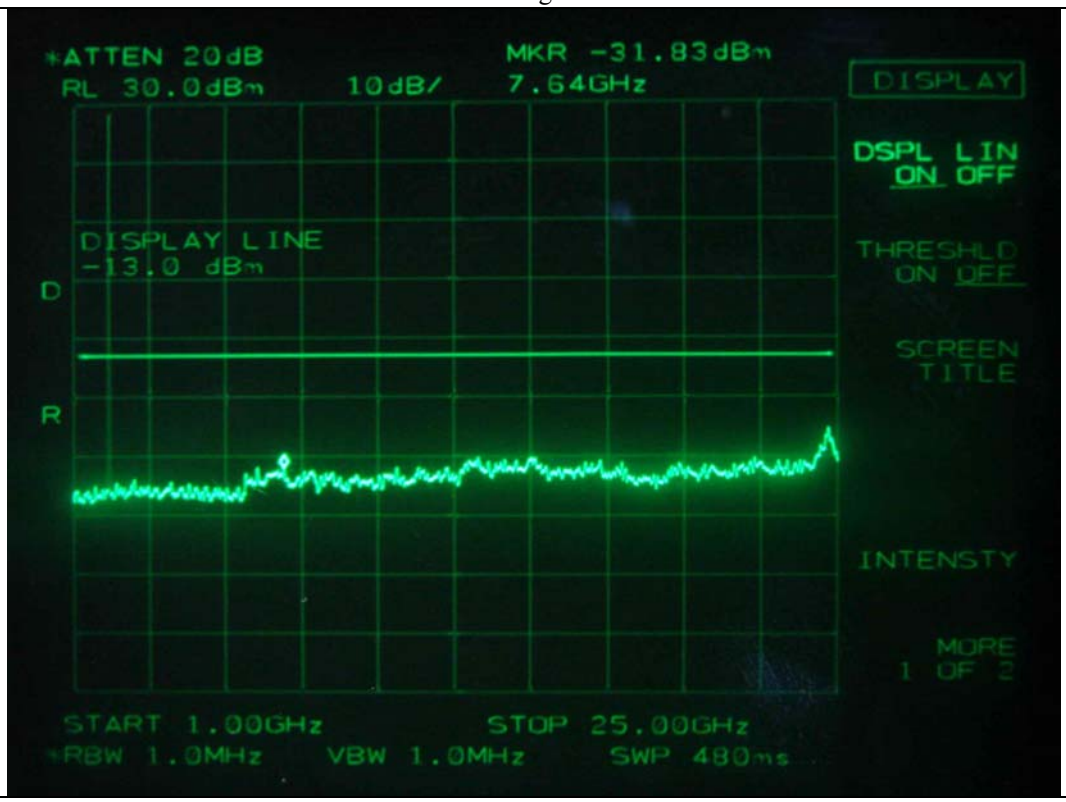


CDMA – High Channel



CDMA – High Channel

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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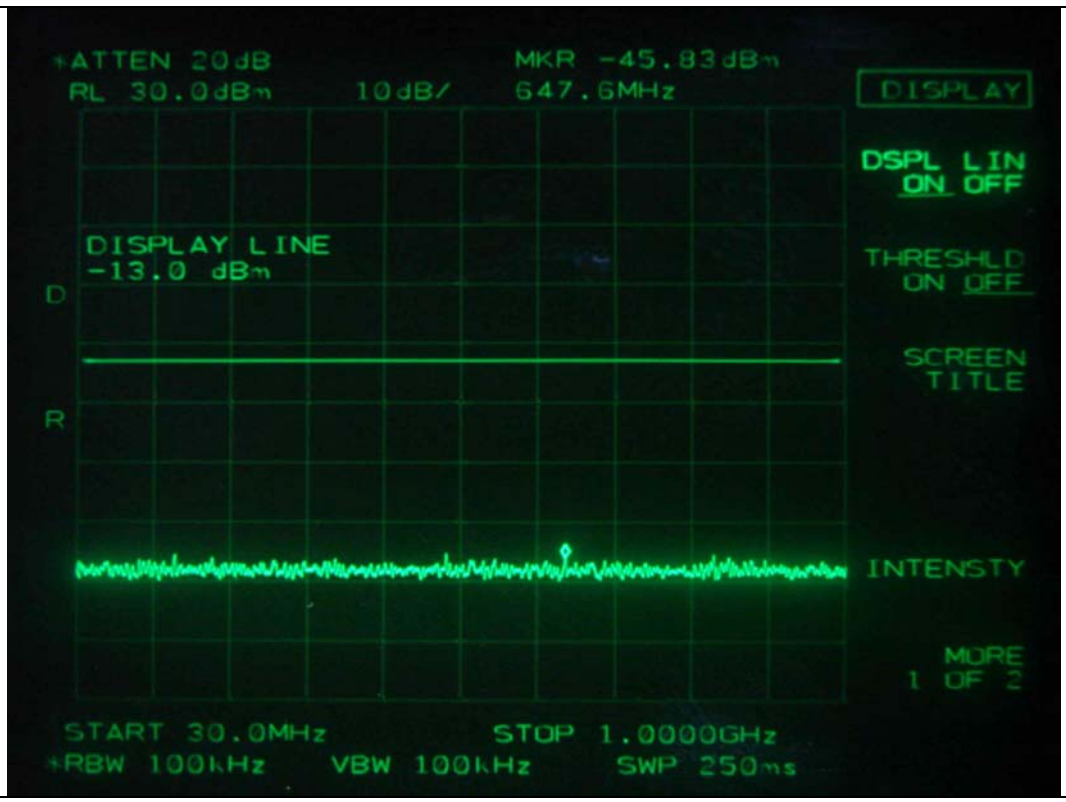
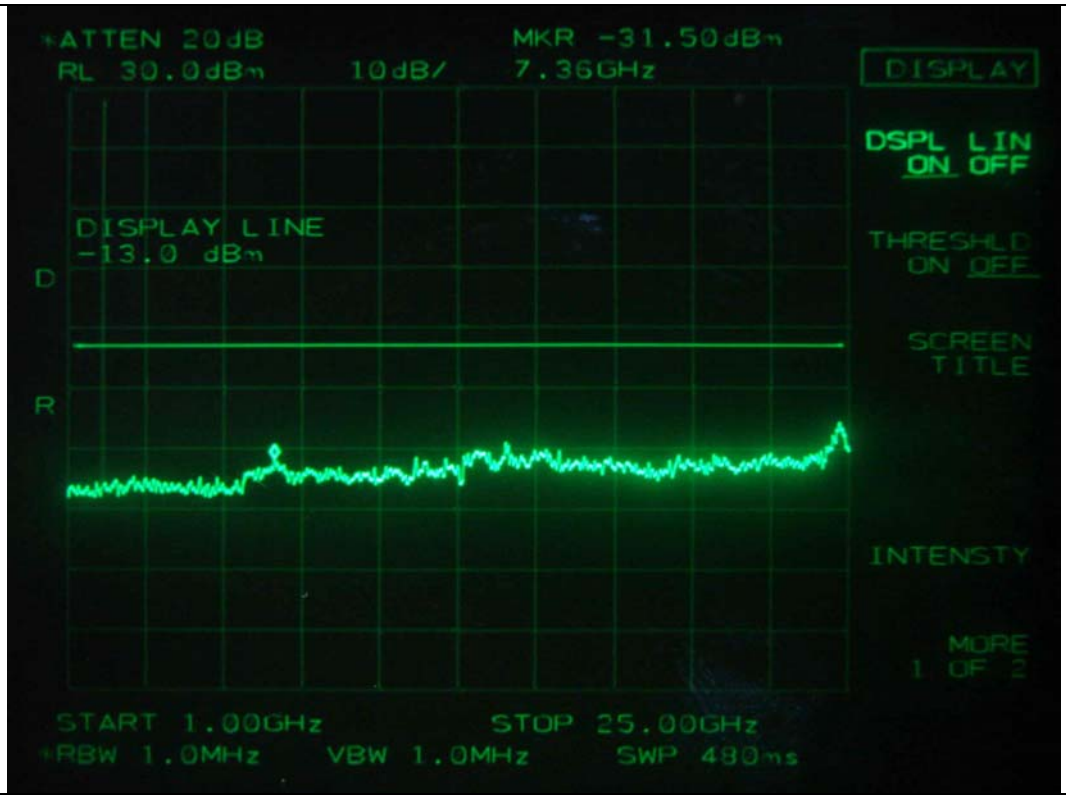


1xEVDO – Low Channel



1xEVDO – Low Channel

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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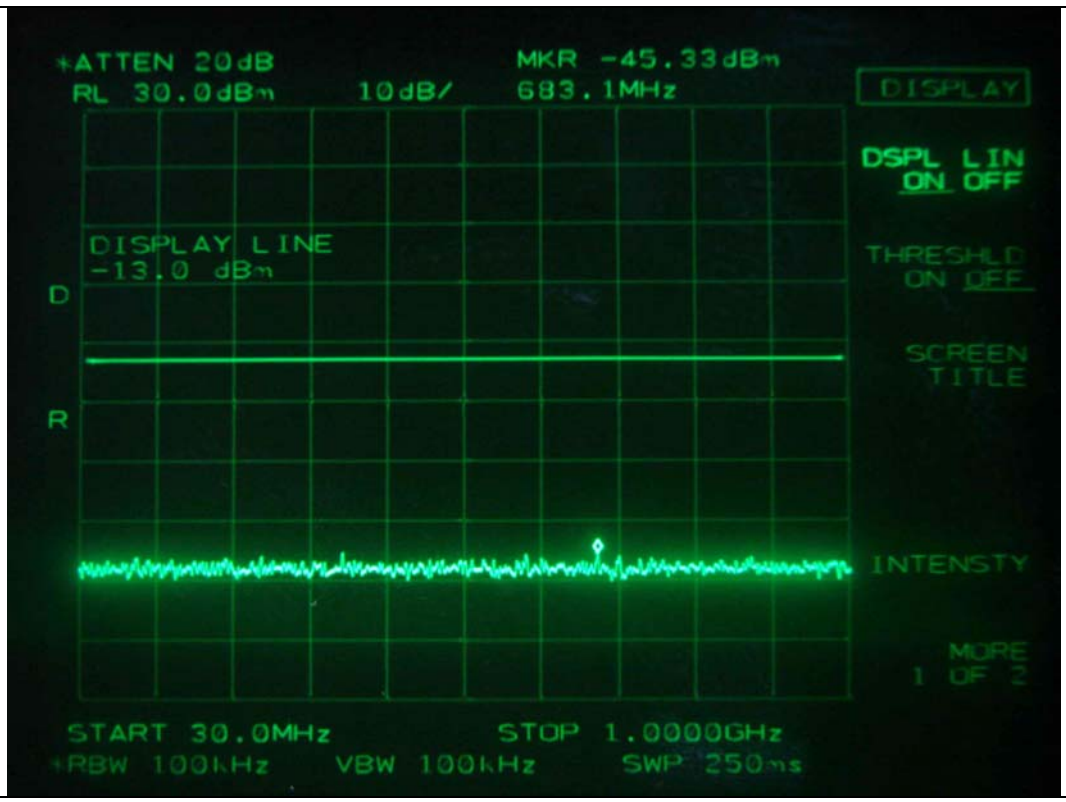
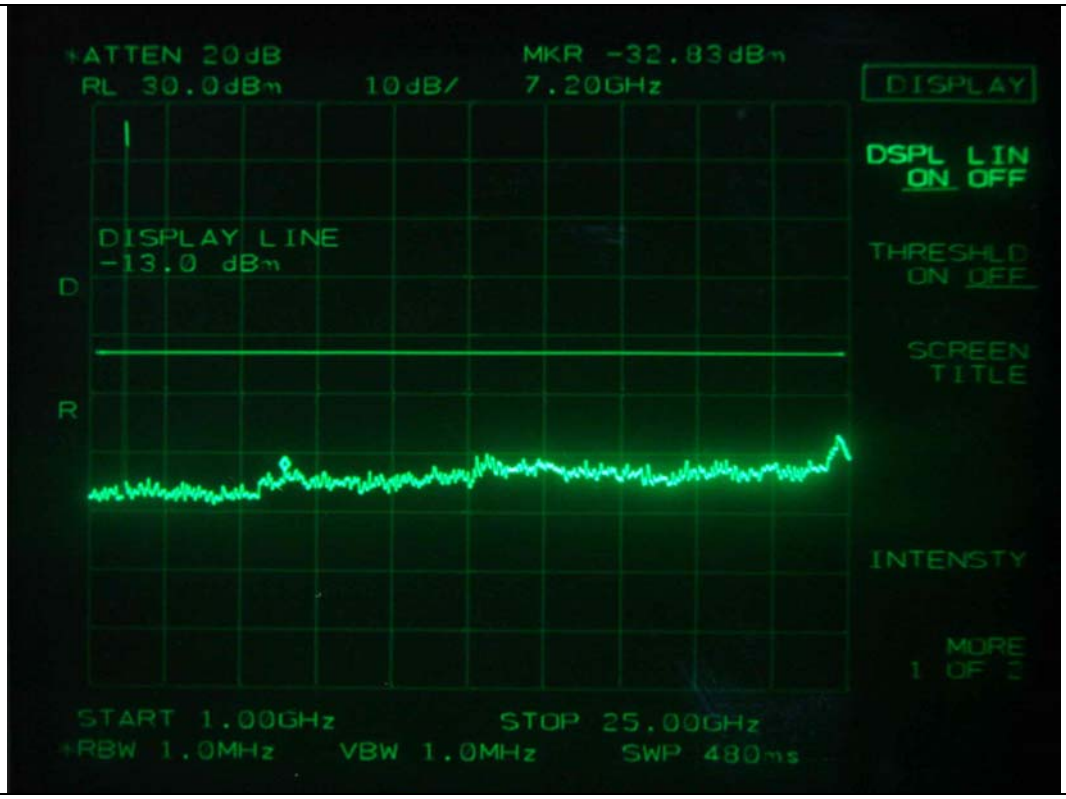


1xEVDO – Middle Channel



1xEVDO – Middle Channel

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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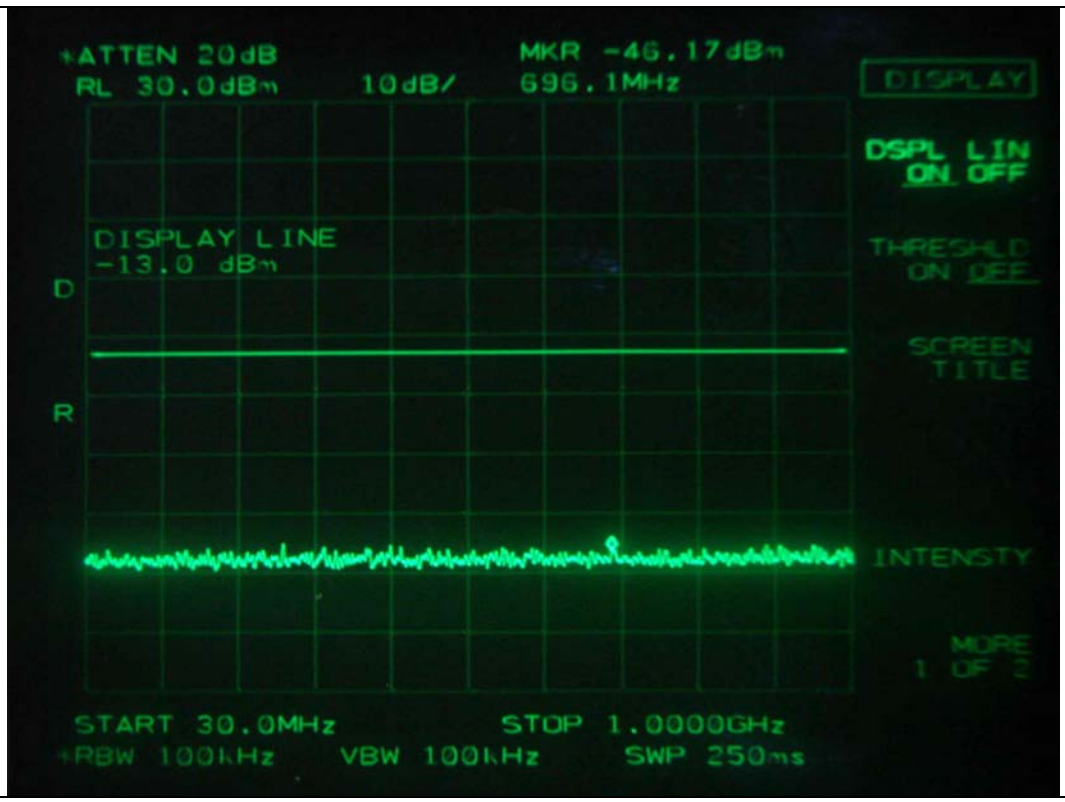
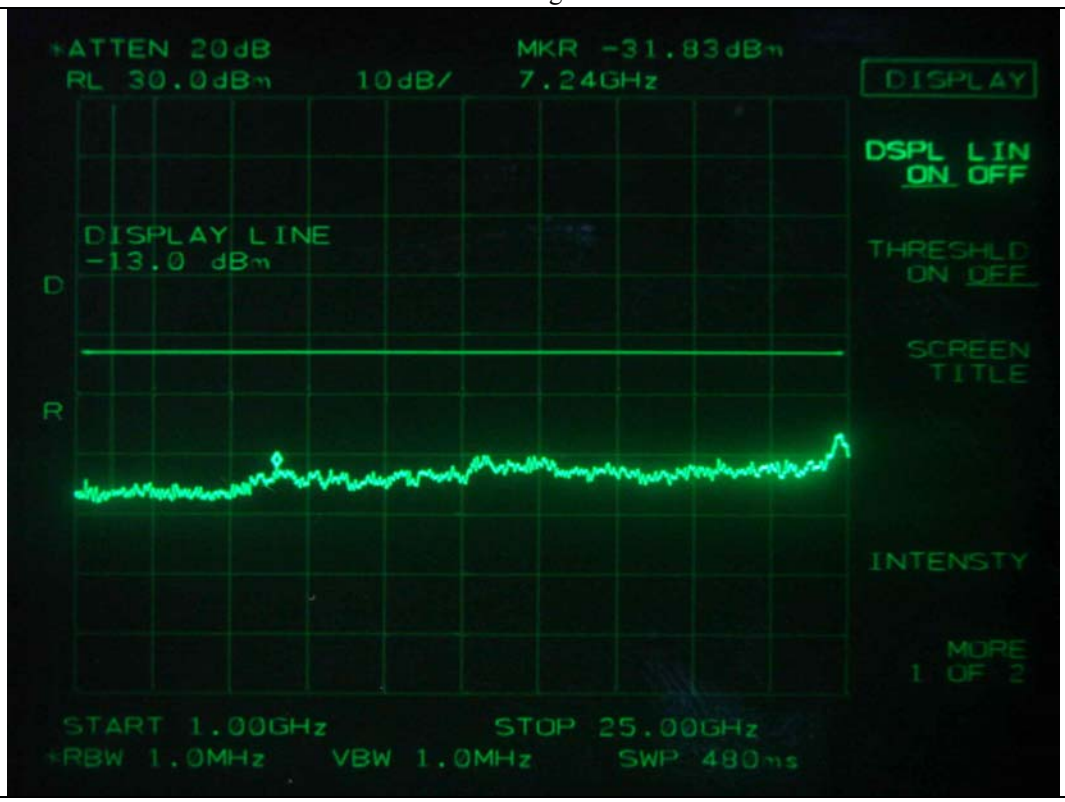


1xEVDO – High Channel



1xEVDO – High Channel

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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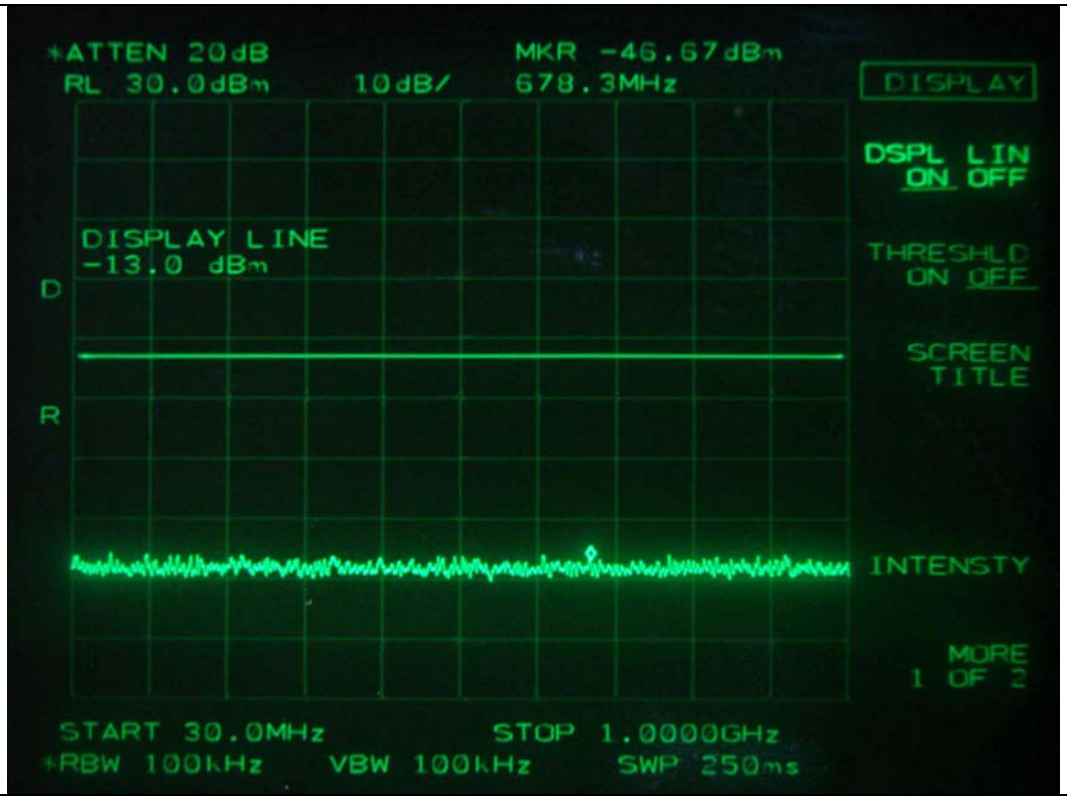
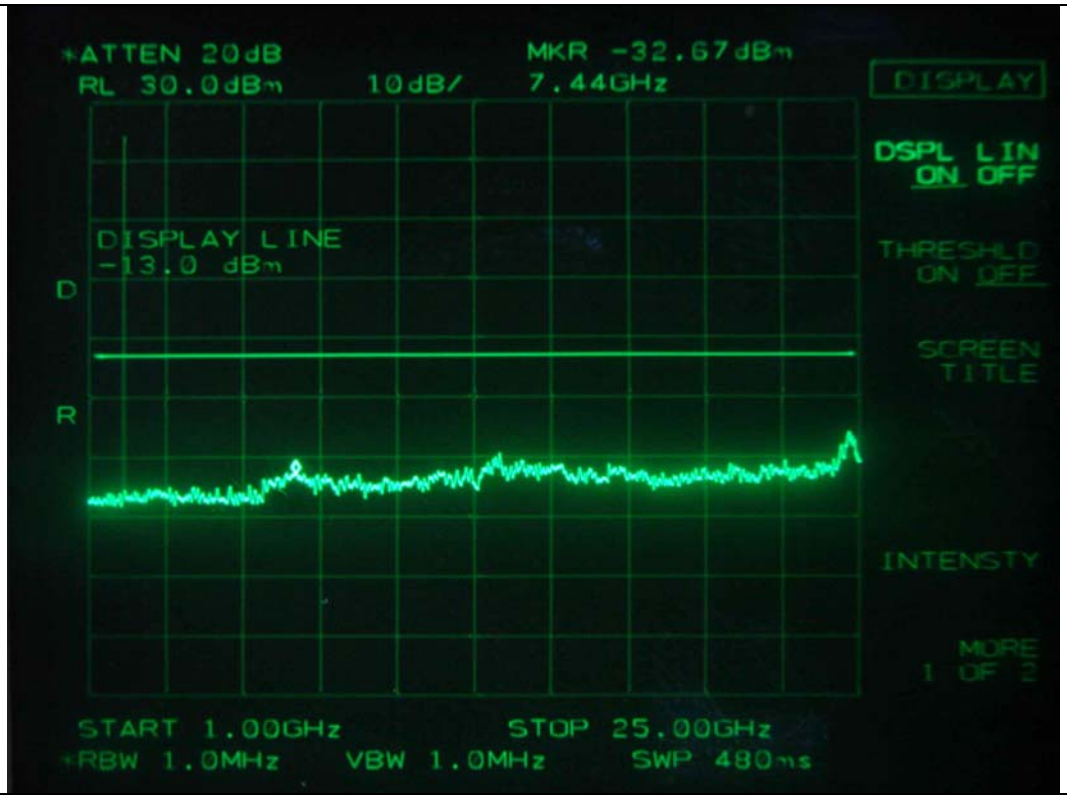


WCDMA – Low Channel



WCDMA – Low Channel

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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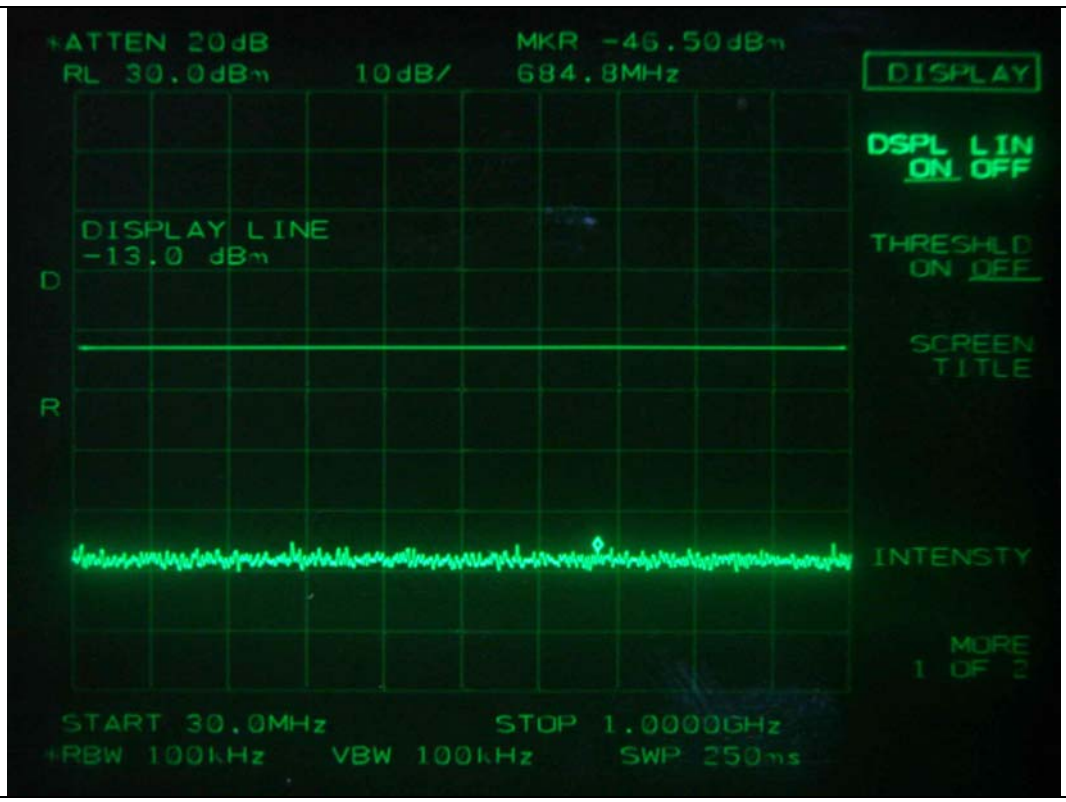
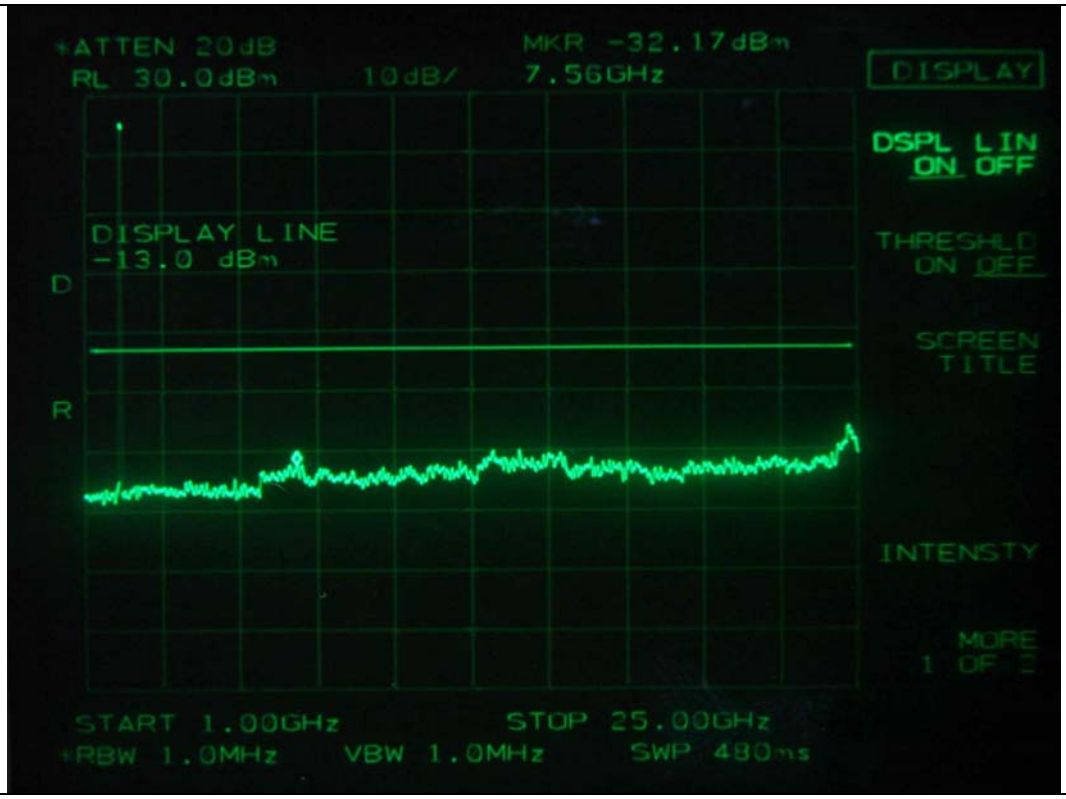


WCDMA – Middle Channel



WCDMA – Middle Channel

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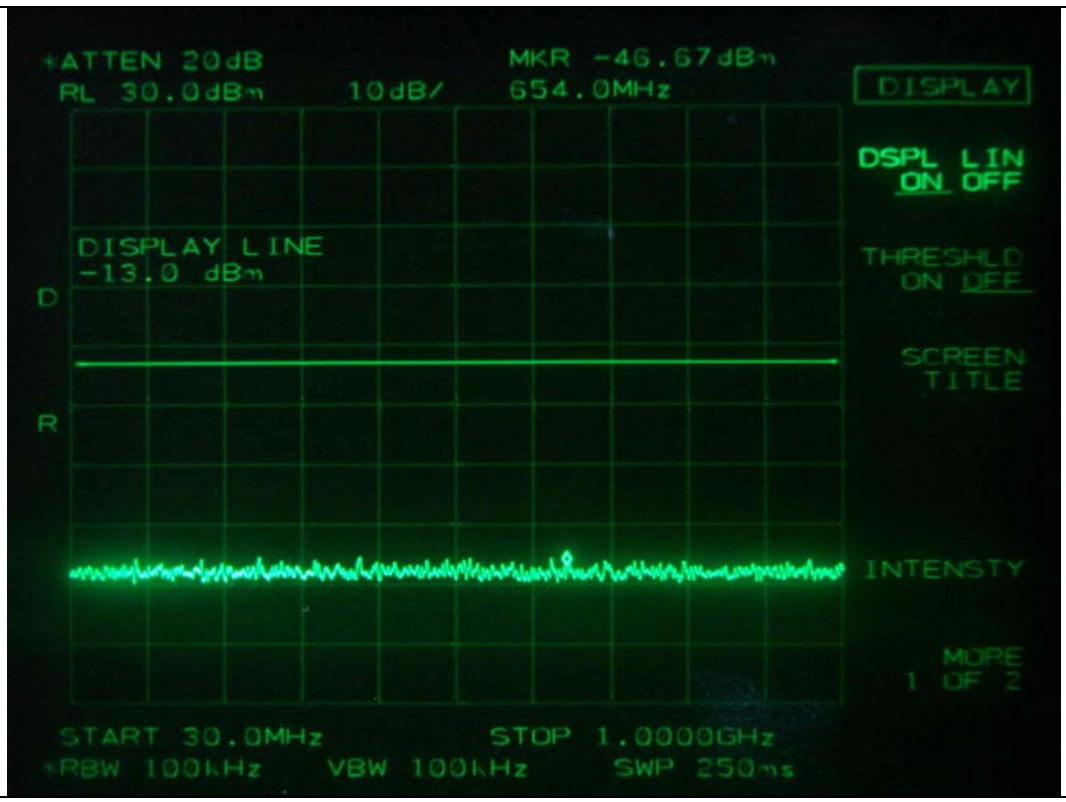
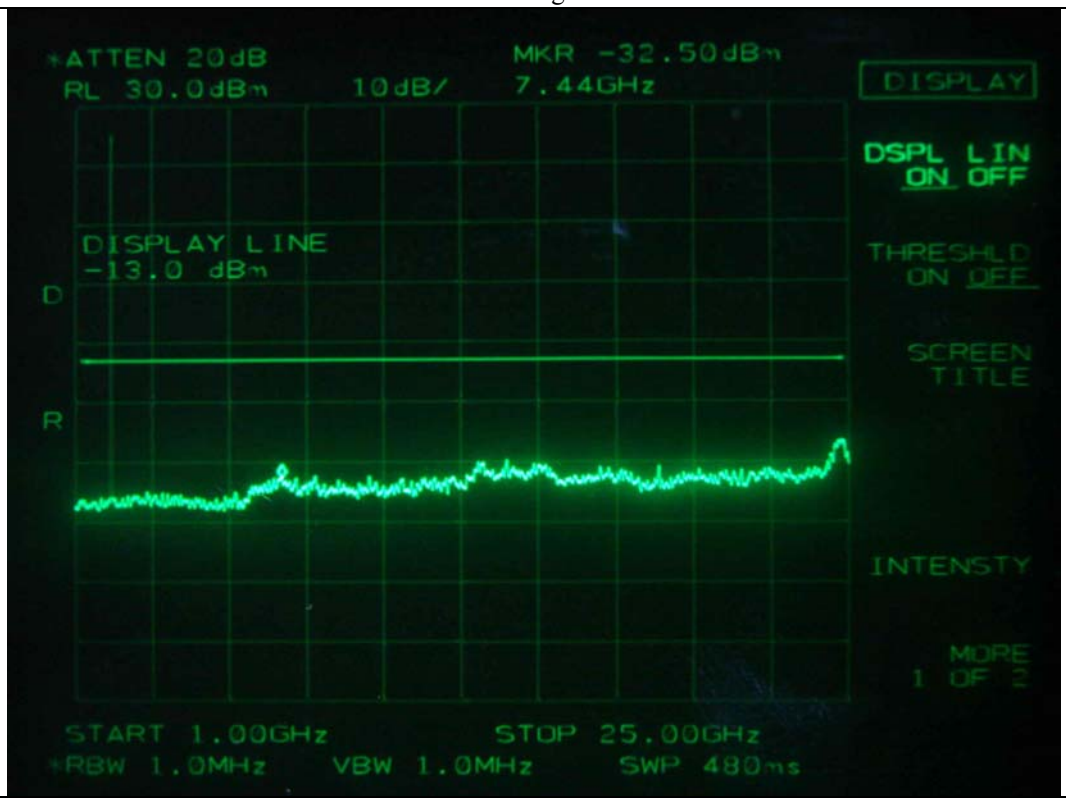


WCDMA – High Channel



WCDMA – High Channel

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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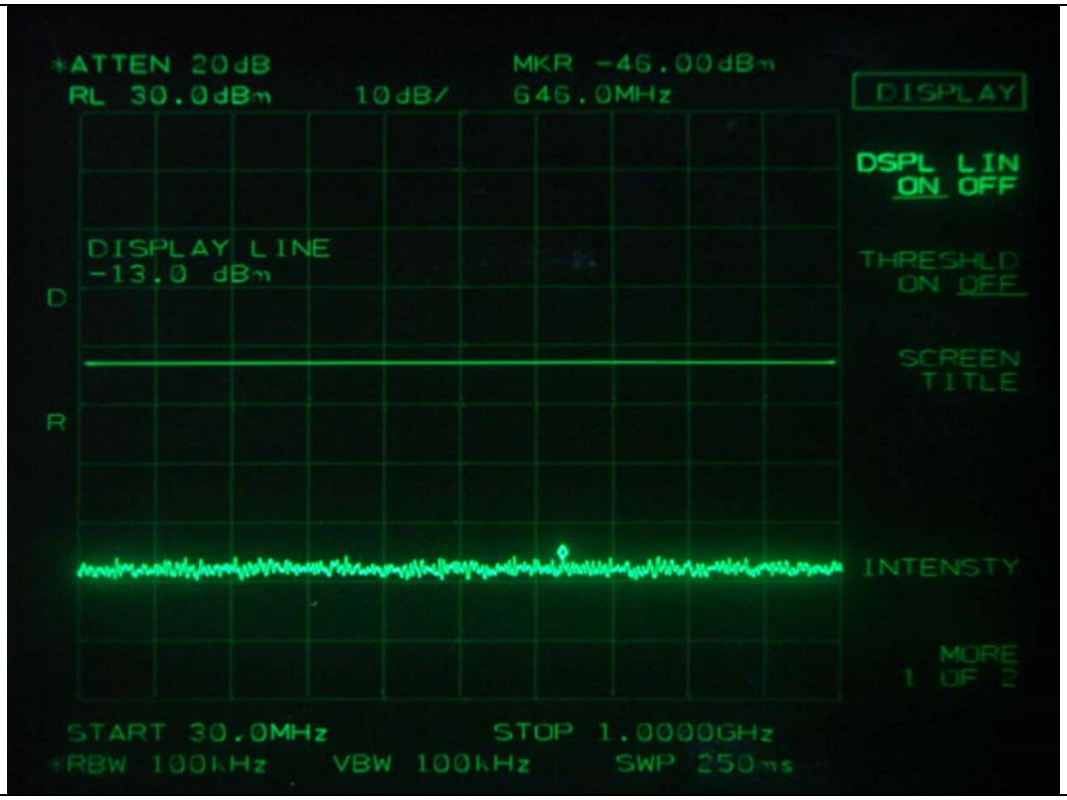
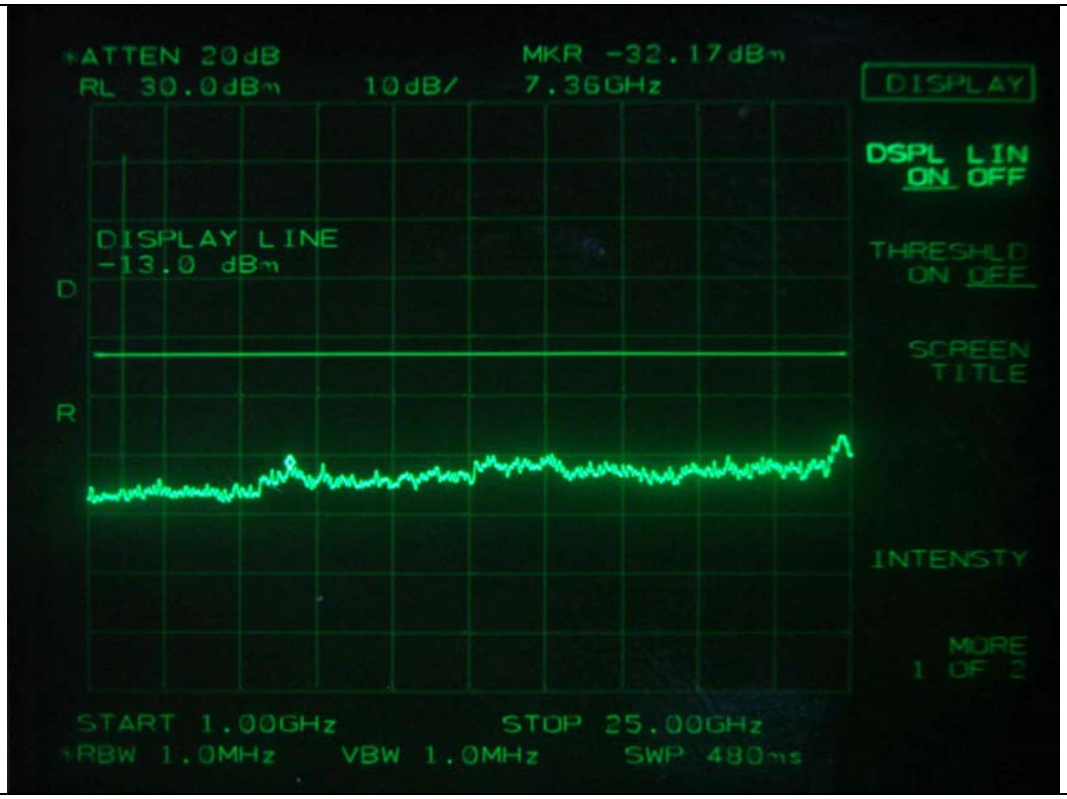


LTE – Low Channel



LTE – Low Channel

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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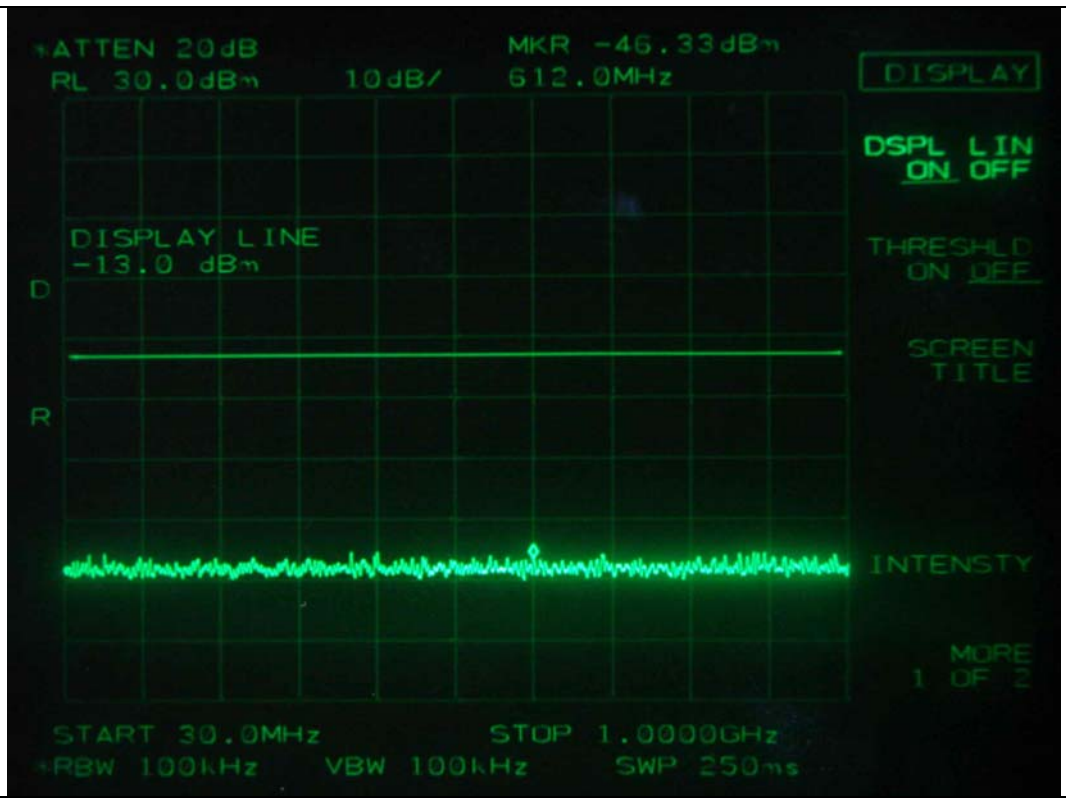
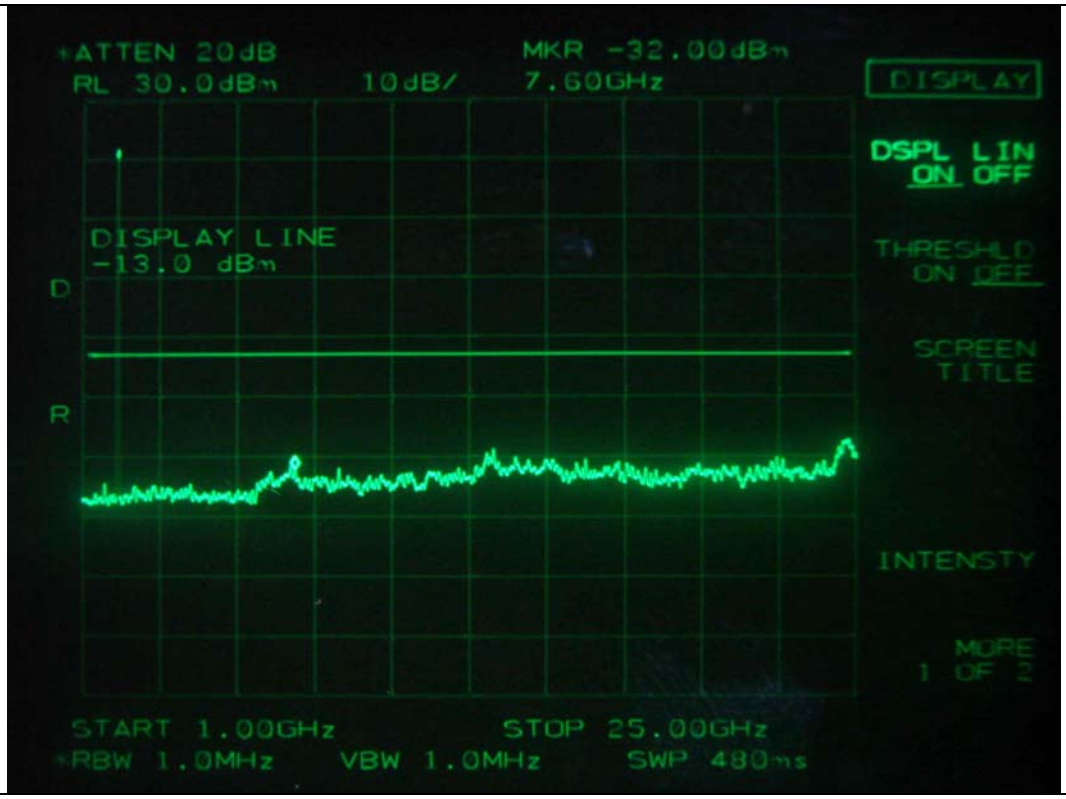


LTE – Middle Channel



LTE – Middle Channel

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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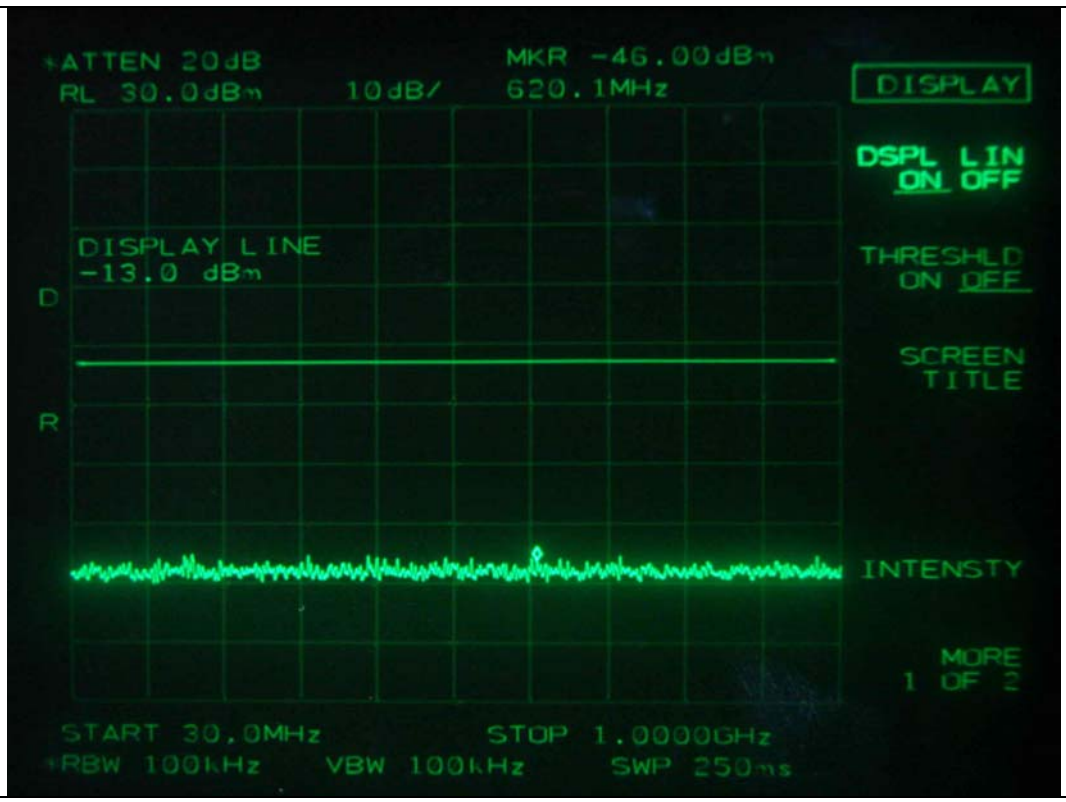
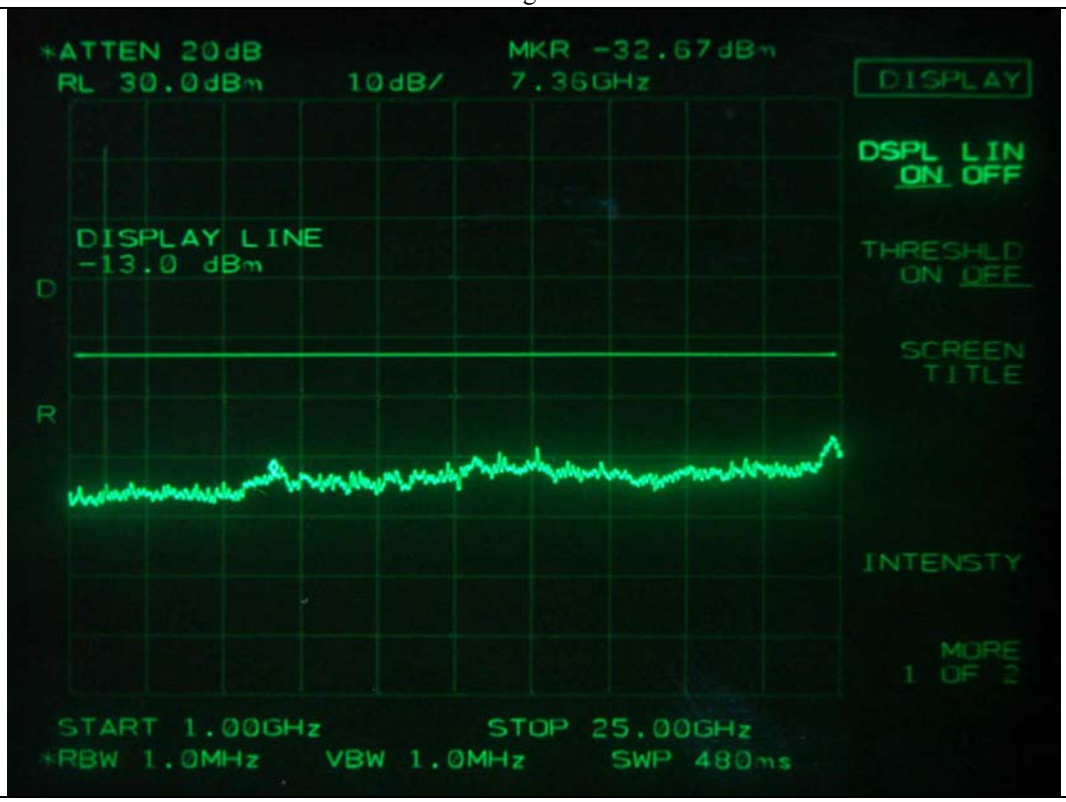


LTE – High Channel



LTE – High Channel

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

7.4.2 Test data for Part 27 C (700LTE)

7.4.2.1 Test Result for §27.53 (c)(1)

-. Test Date : December 13, 2012

-. Frequency range : 30 MHz ~ 10 GHz

-. Result : Pass

Channel	Modulation	Measured Frequency (MHz)	Measured Value (dBm)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
Low	LTE	529.600	-46.00	0.33	-45.67	-13.00	-32.67
		7 615.000	-31.83	3.50	-28.33		-15.33
Middle	LTE	552.200	-46.00	0.33	-45.67	-13.00	-32.67
		7 315.000	-31.50	3.50	-28.00		-15.00
High	LTE	534.400	-45.83	0.33	-45.50	-13.00	-32.50
		7 450.000	-31.50	3.50	-28.00		-15.00
Other frequencies up to 10 GHz have margin more than 20 dB.							

From CFR 27.53(c)(1): On any frequency outside the 746 MHz ~ 758 MHz band, the power of any emission shall be attenuated out side the band below the transmitter power (P) by at least 43 + 10log(P) dB, resulting in a limit of -13 dBm.

Tested by: Ki-Hong, Nam / Senior Engineer

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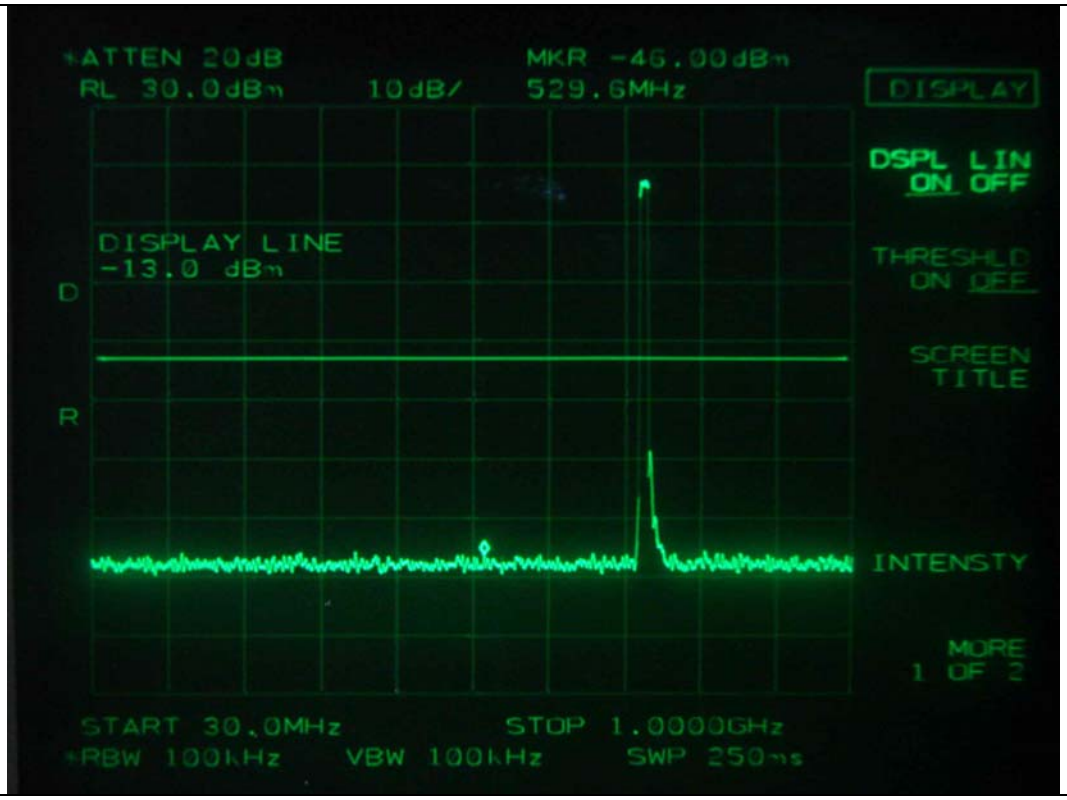
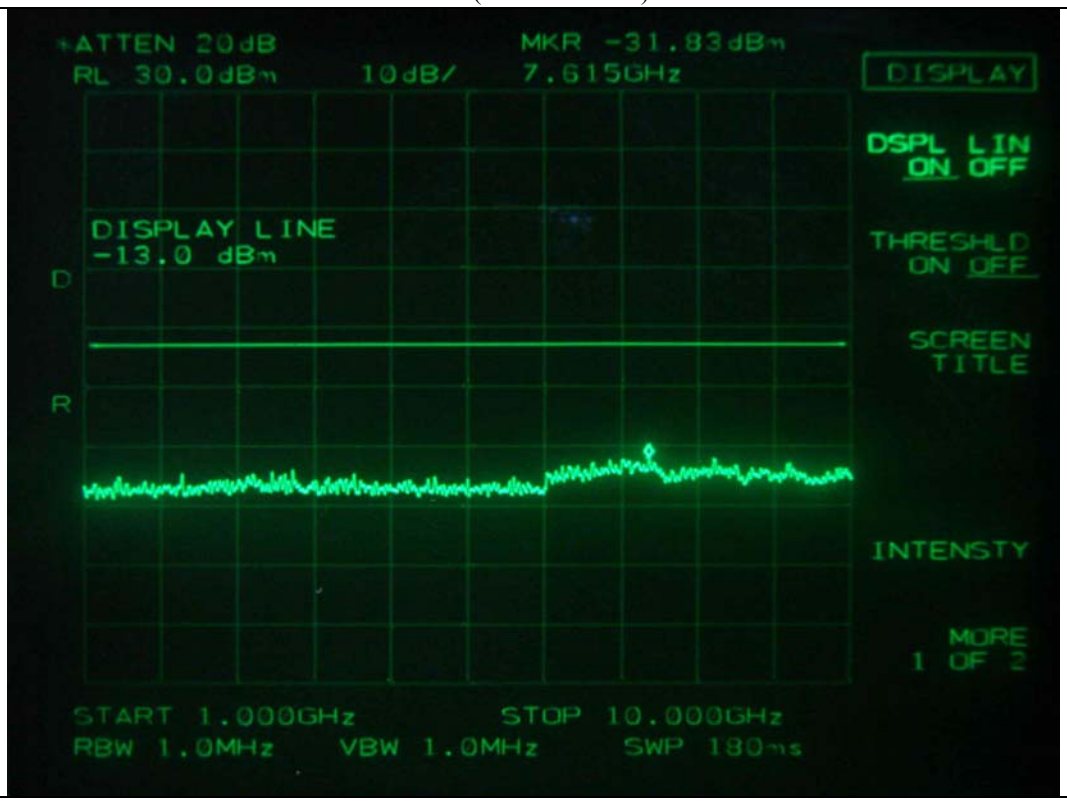
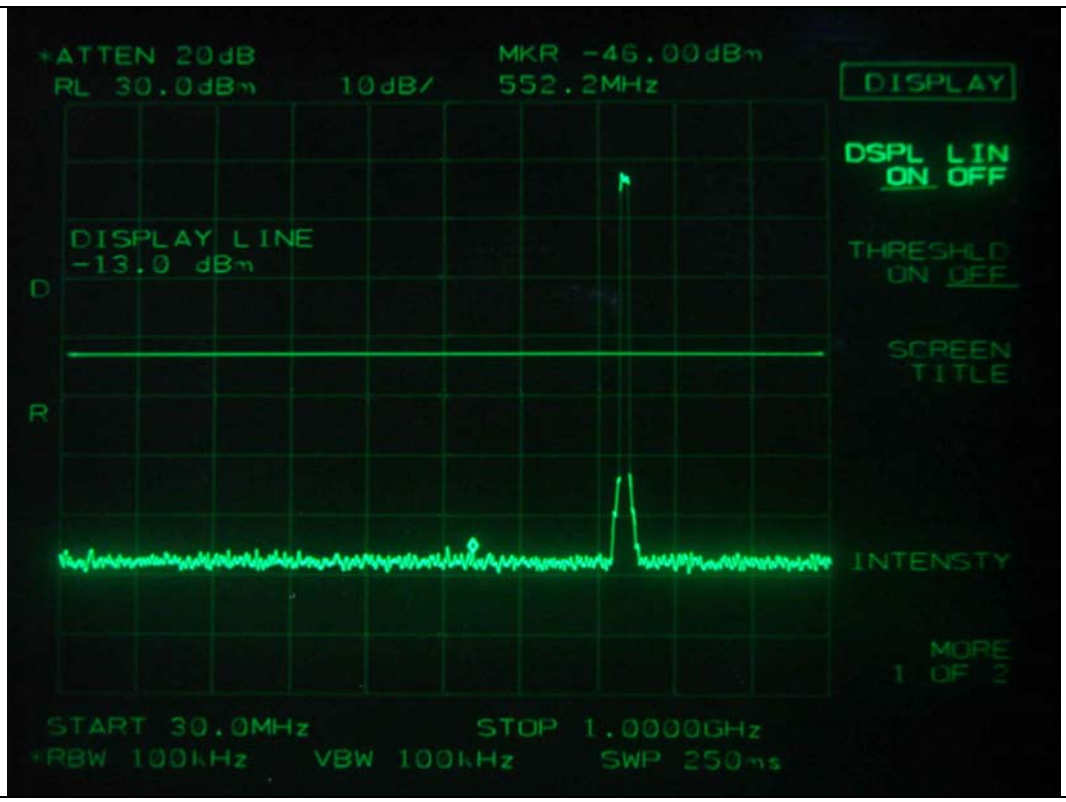


LTE (Low channel 1)

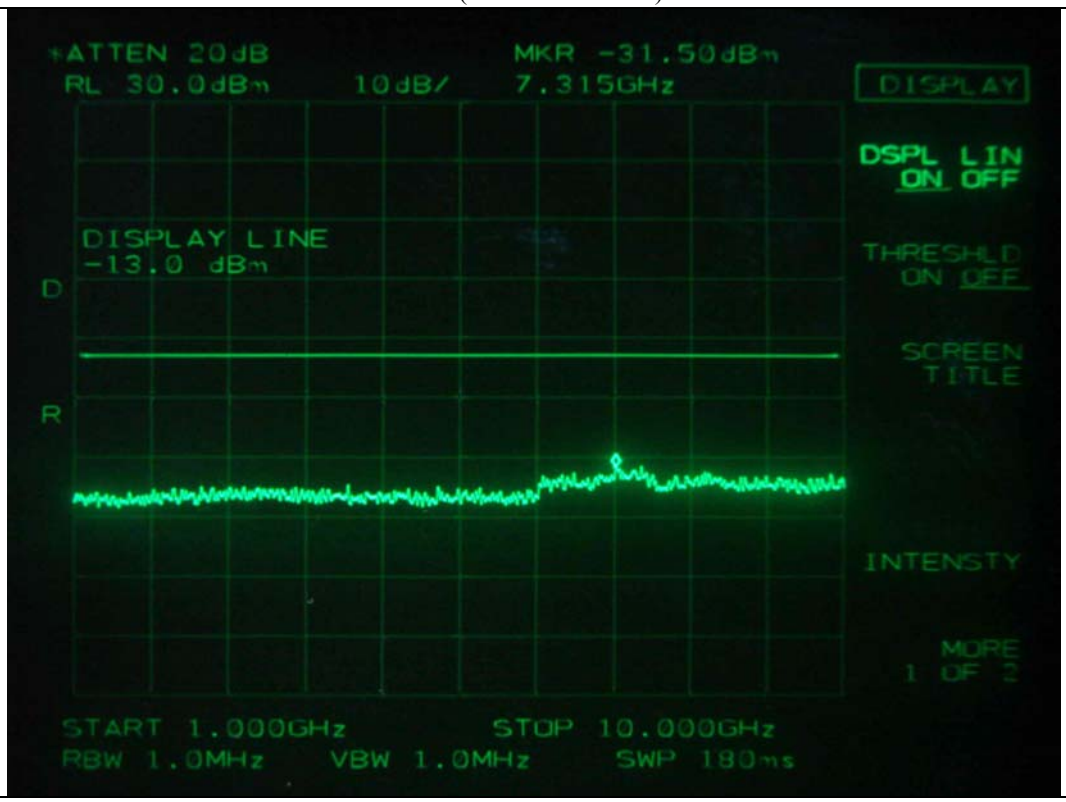


LTE (Low channel 2)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



LTE (Middle channel 1)



LTE (Middle channel 2)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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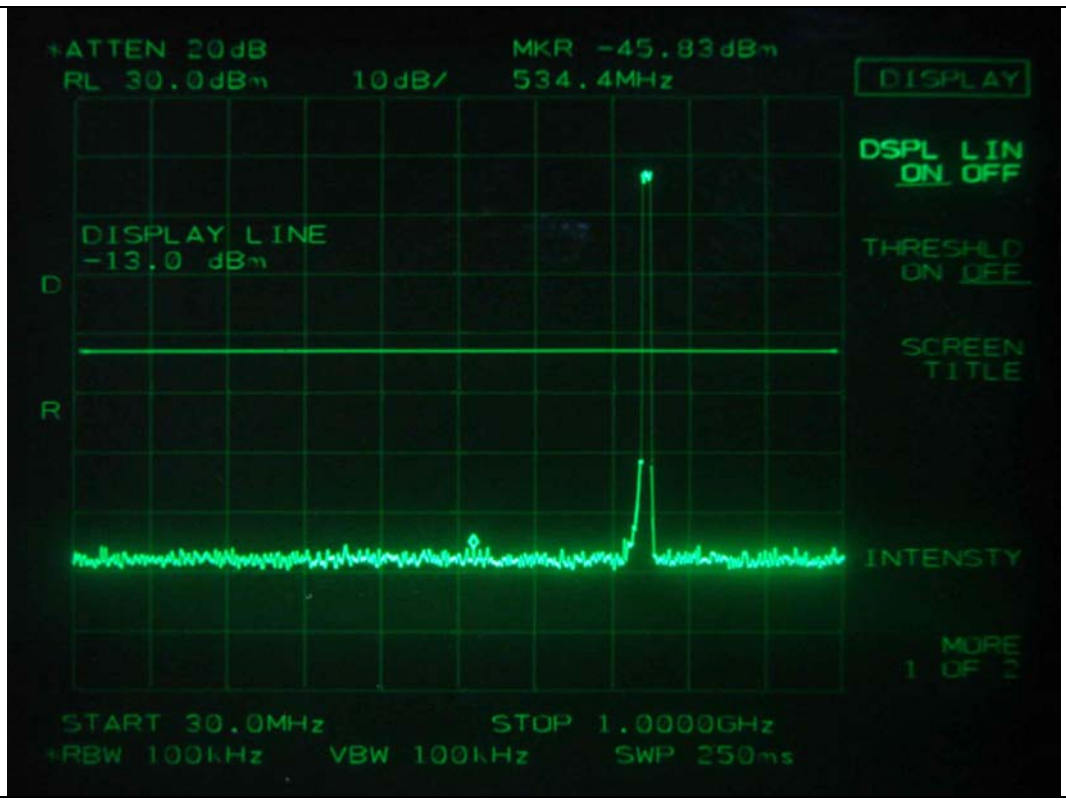
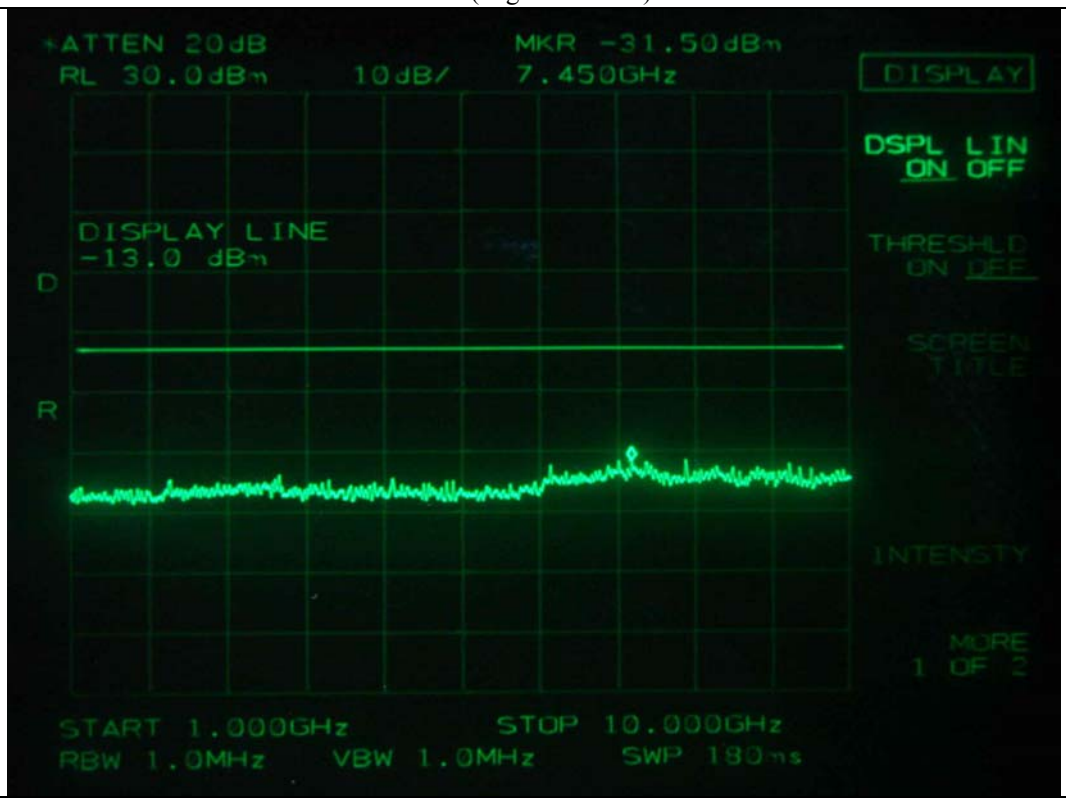


LTE (High channel 1)



LTE (High channel 2)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

7.4.2.2 Test Result for §27.53 (c)(3) & (c)(6)

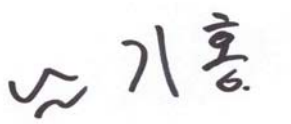
-. Test Date : December 13, 2012

-. Frequency range : 763 MHz ~ 775 MHz and 793 MHz ~ 805 MHz

-. Result : Pass

Channel	Modulation	Measured Frequency (MHz)	Measured Value (dBm)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
Low	LTE	763.000	-64.49	0.5	-63.99	-46.00	-17.99
Middle	LTE	763.000	-64.51	0.5	-64.01		-18.01
High	LTE	763.000	-64.38	0.5	-63.88		-17.88

From CFR 27.53(c)(3)&(c)(6): On all frequency between the 763 MHz ~ 775 MHz and 793 MHz ~ 805 MHz, by a factor not less than 76 + 10log(P) dB in a 6.25 kHz band segment, for base and fixed stations, resulting in a limit of -46 dBm (per 6.25 kHz measurement bandwidth)



Tested by: Ki-Hong, Nam / Senior Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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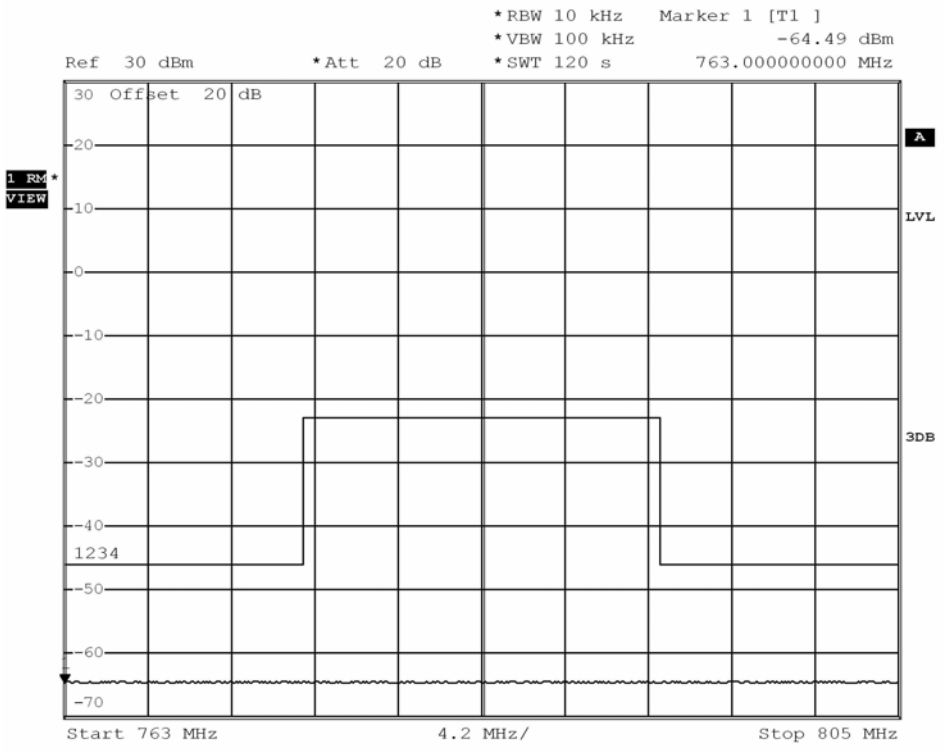
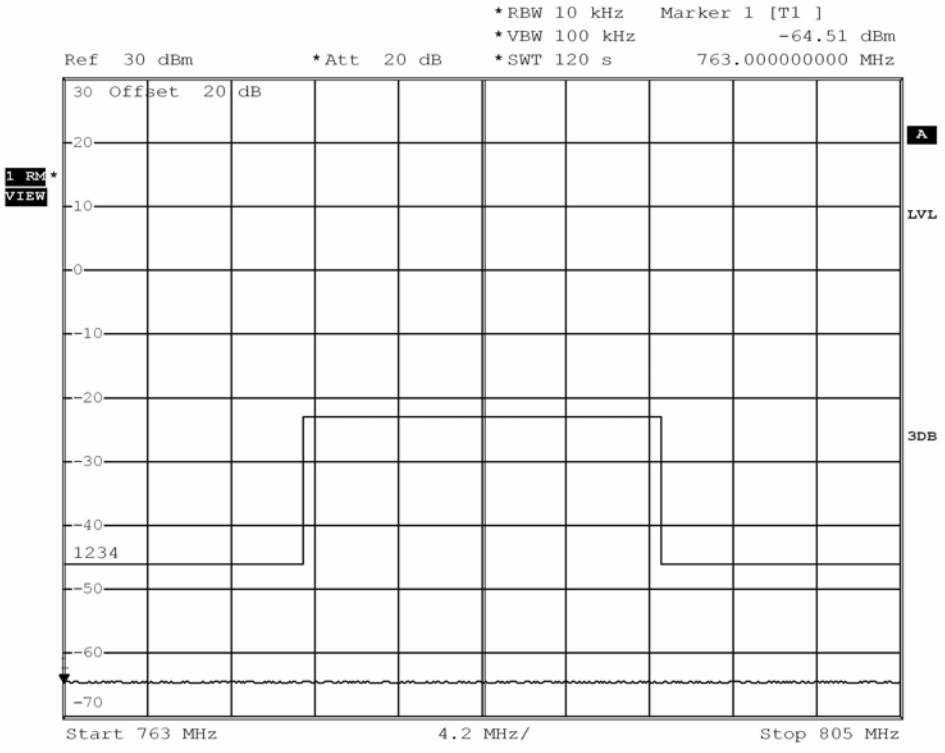
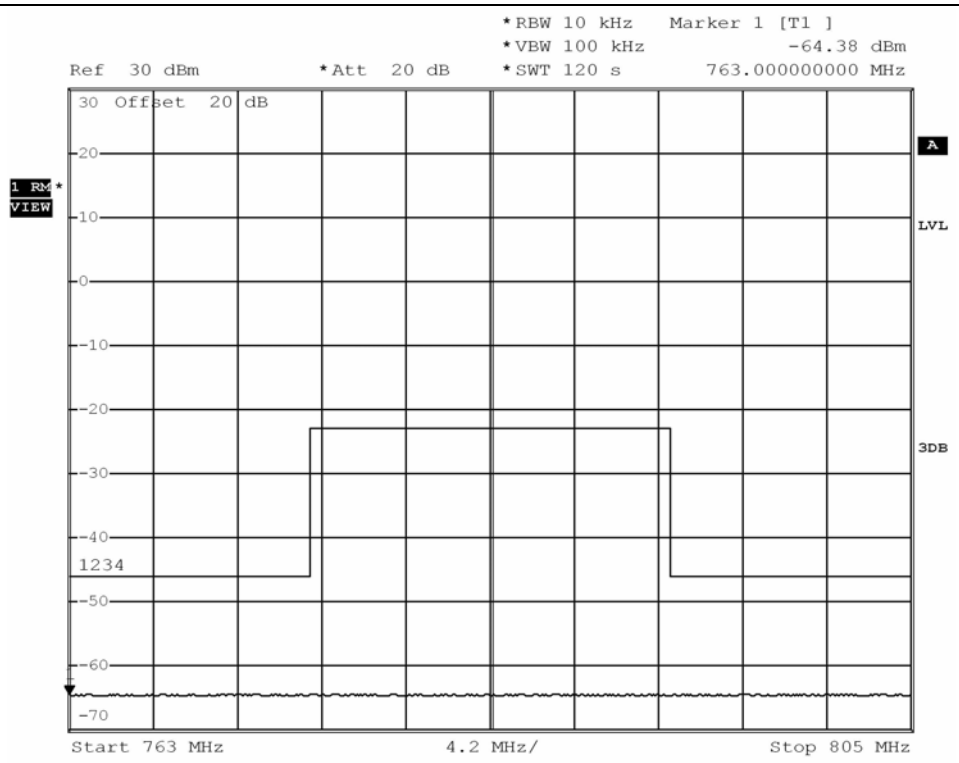


LTE (Low Channel)



LTE (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



LTE (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

7.4.2.3 Test Result for §27.53 (f)

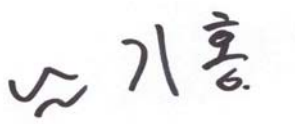
-. Test Date : December 13, 2012

-. Frequency range : 1 559 MHz ~ 1 610 MHz

-. Result : Pass

Channel	Modulation	Measured Frequency (MHz)	Measured Value (dBm)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
Low	LTE	1 559.000	-53.99	1.2	-52.79	-40.00	-12.79
Middle	LTE	1 559.000	-54.00	1.2	-52.80		-12.80
High	LTE	1 559.000	-53.97	1.2	-52.77		-12.77

From CFR 27.53(f): For operations in the 746 MHz ~ 763 MHz, 775 MHz ~ 793 MHz, and 805 MHz ~ 806 MHz bands, emissions in the band 1 559 MHz ~ 1 610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.



Tested by: Ki-Hong, Nam / Senior Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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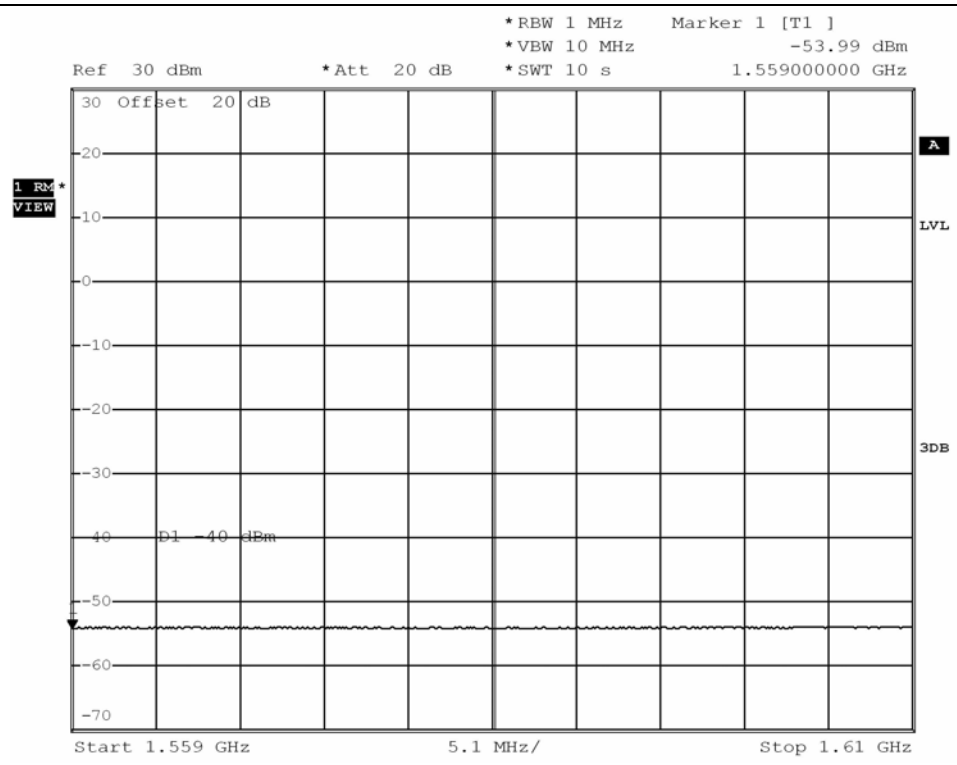
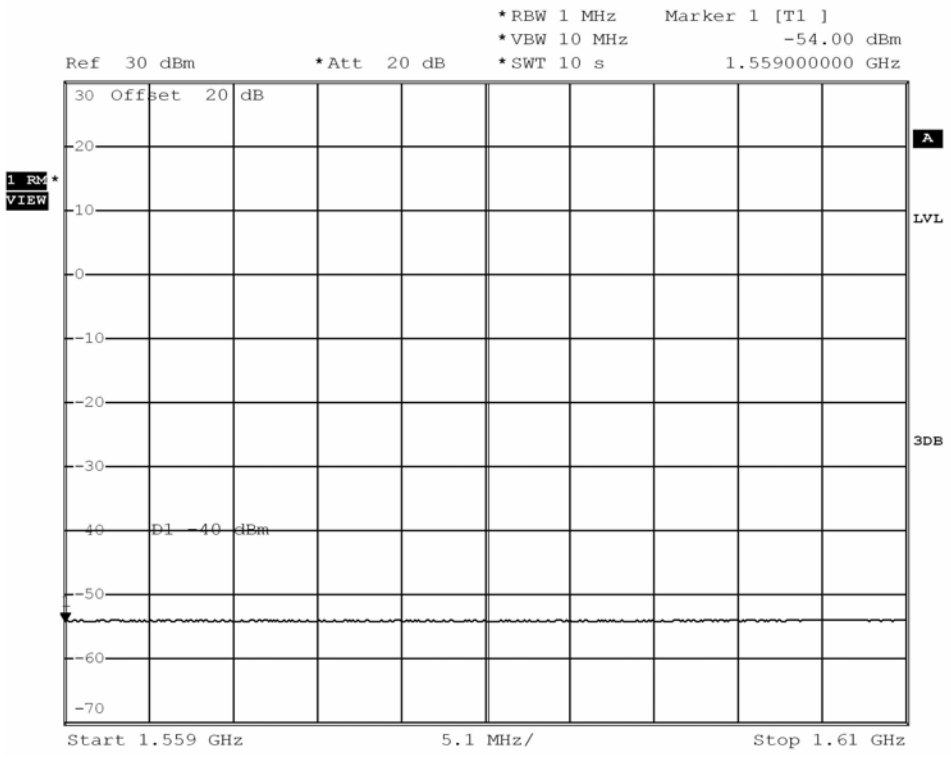
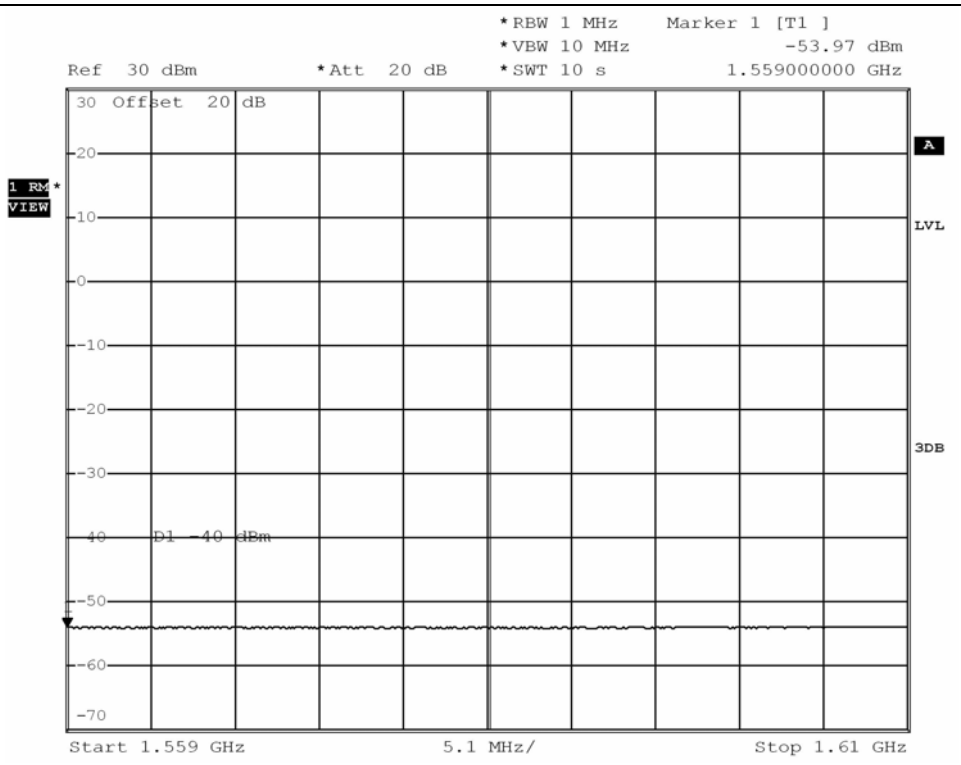


LTE (Low Channel)



LTE (Middle Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



LTE (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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7.4.2.4 Test Result for §27.53 (c)(5)

-. Test Date : December 13, 2012

-. Frequency range : 30 MHz ~ 15 GHz

-. Result : Pass

Channel	Modulation	Measured Frequency (MHz)	Measured Value (dBm)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
Low	LTE	728.000	-39.54	0.50	-39.04	-13.00	-26.04
		727.900	-42.89	0.50	-42.39	-18.22	-24.17
		723.000	-48.77	0.50	-48.27	-13.00	-35.27
High	LTE	757.000	-42.17	0.50	-41.67	-13.00	-28.67
		757.100	-49.81	0.50	-49.31	-18.22	-31.09
		762.000	-49.82	0.50	-49.32	-13.00	-36.32

From CFR 27.53(c)(5): Compliance with the provisions of paragraphs (c) (1) and (c) (2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may b employed.

Tested by: Ki-Hong, Nam / Senior Engineer

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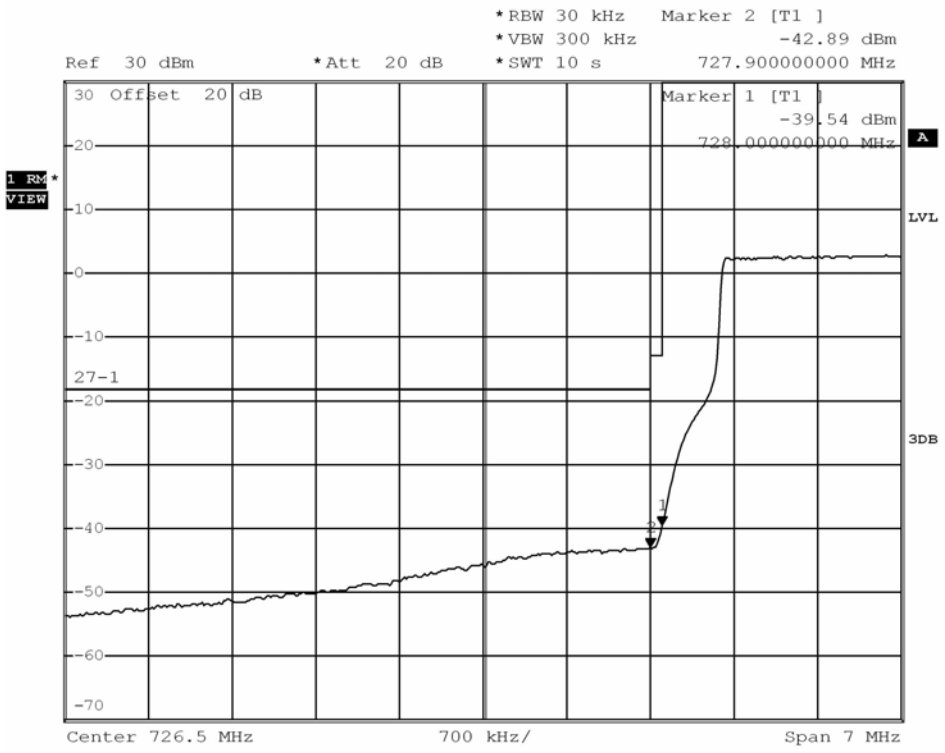
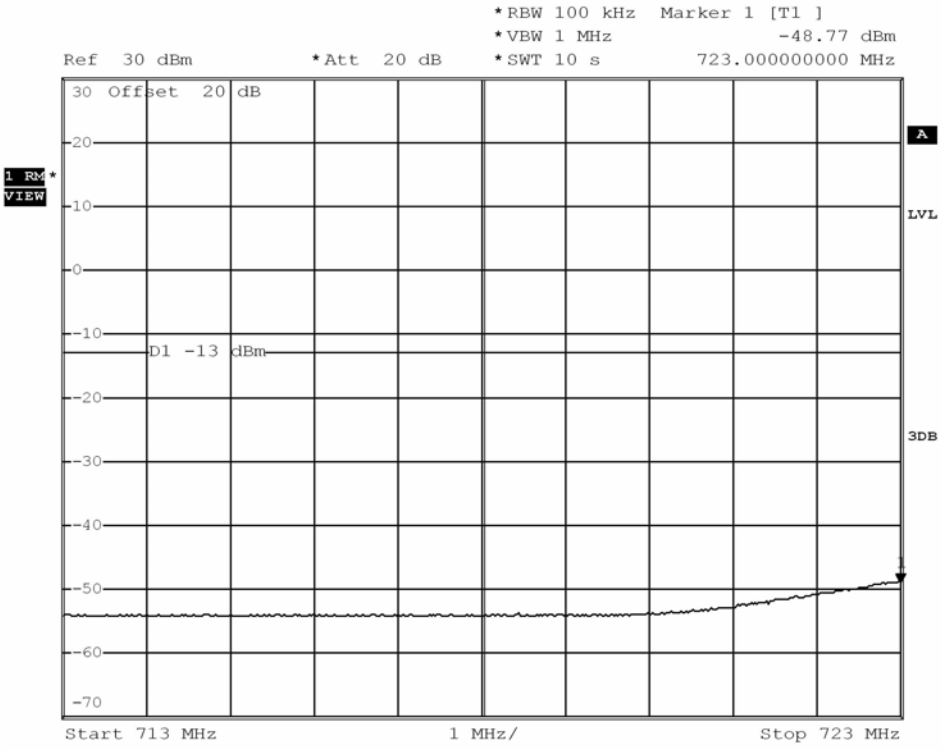


LTE (Low channel 1)



LTE (Low channel 2)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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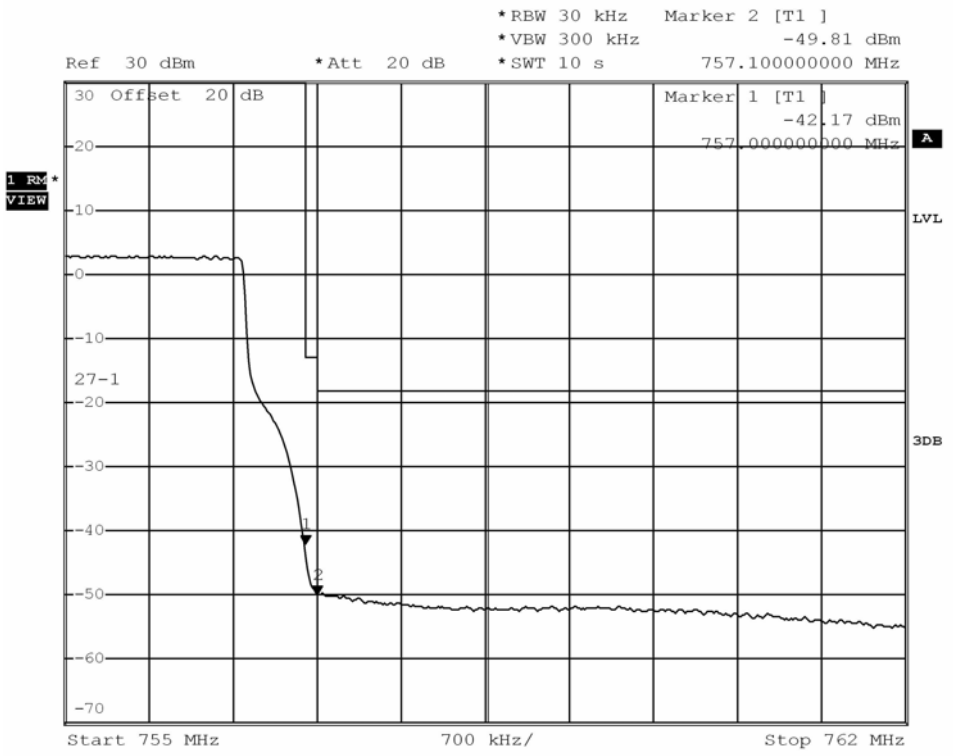
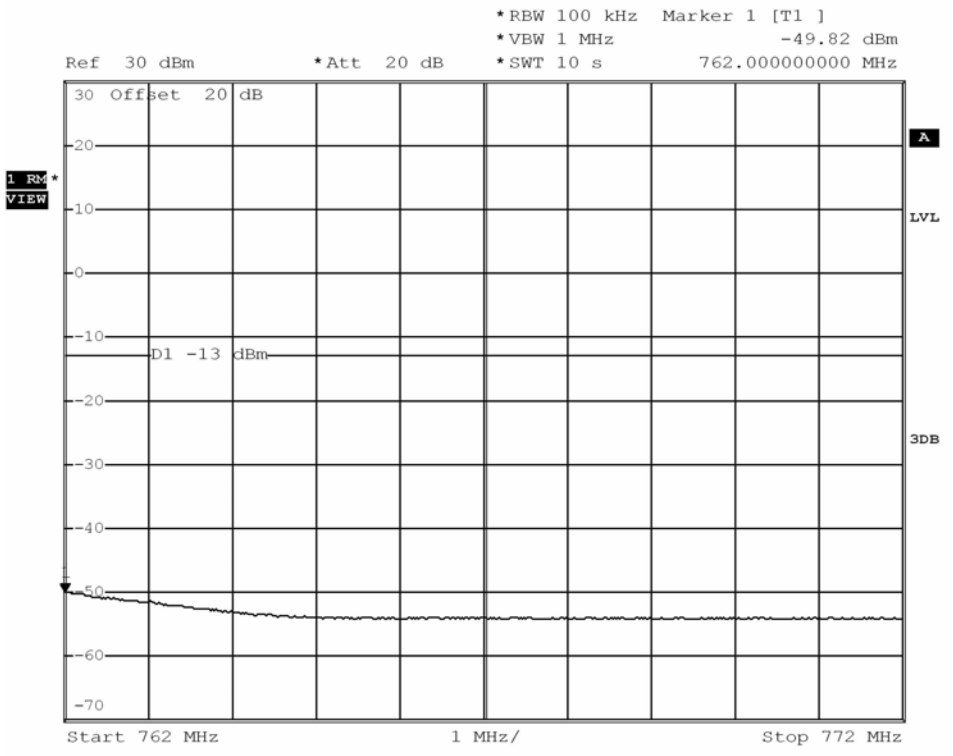


LTE (High channel 1)



LTE (High channel 2)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

8. BAND EDGE MEASUREMENT

8.1 Operating environment

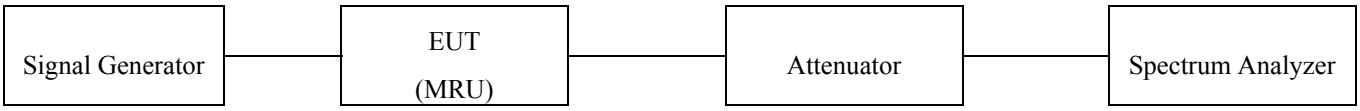
Temperature : 21 °C

Relative humidity : 50 % R.H.

8.2 Test set-up for conducted measurement

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the power meter or spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation.

The resolution bandwidth and video bandwidth of the spectrum analyzer was set according to the regulation and sufficient scans were taken to show any out of band emissions.



8.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	E4432B	HP	Signal Generator	US38440950	June 01, 2012 (1Y)
■ -	SMJ100A	R/S	Signal Generator	101038	Feb. 02, 2012 (1Y)
■ -	FSP	R/S	Spectrum Analyzer	100017	Mar. 12, 2012 (1Y)
■ -	8564E	HP	Spectrum Analyzer	3650A00756	Apr. 04, 2012 (1Y)
■ -	67-30-43	Aeroflex Weinschel	Power Attenuator	CA5760	Dec. 10, 2012 (1Y)

All test equipment used is calibrated on a regular basis.

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8.4 Test data

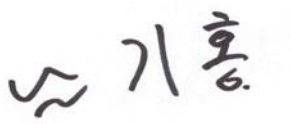
8.4.1 Test Result for Part 27 C (AWS-1)

-. Test Date : December 11, 2012

-. Result : Pass

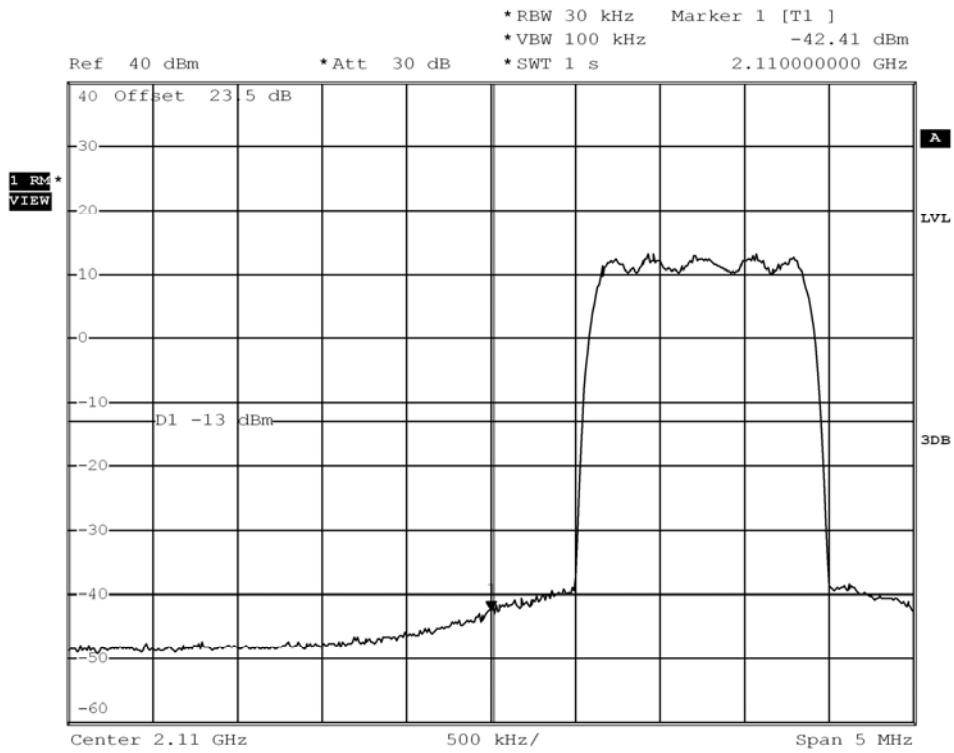
Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)	Limit (dBm)	Margin (dB)
CDMA	Low	2 110.000	-42.41	-13.00	-29.41
	High	2 155.000	-41.58		-28.58
1xEVDO	Low	2 110.000	-42.62		-29.62
	High	2 155.000	-41.13		-28.13
WCDMA	Low	2 110.000	-37.56		-24.56
	High	2 155.000	-38.29		-25.29
LTE	Low	2 110.000	-39.44		-26.44
	High	2 155.000	-39.20		-26.20

According to Part 24E, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0dBm.

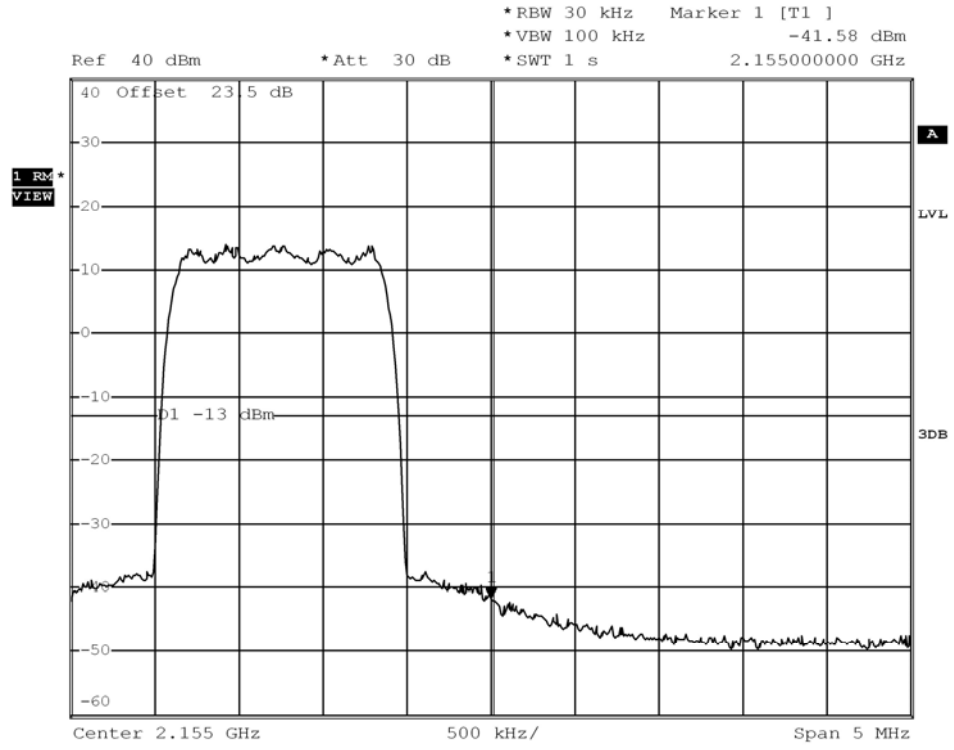


Tested by: Ki-Hong, Nam / Senior Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

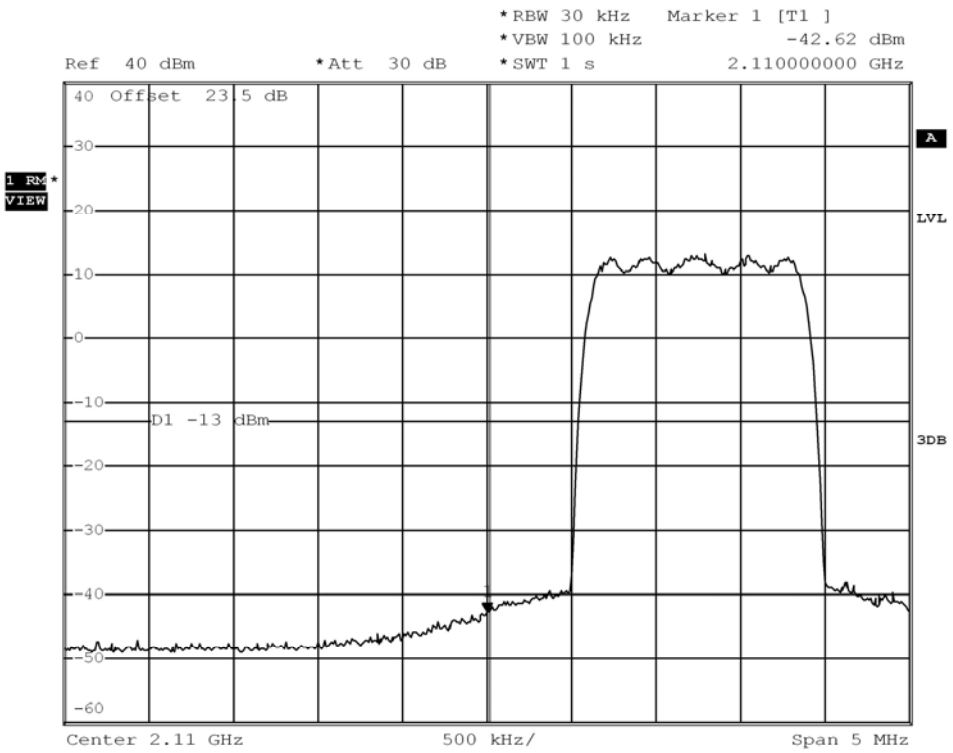


CDMA – Band Edge (Low Channel)

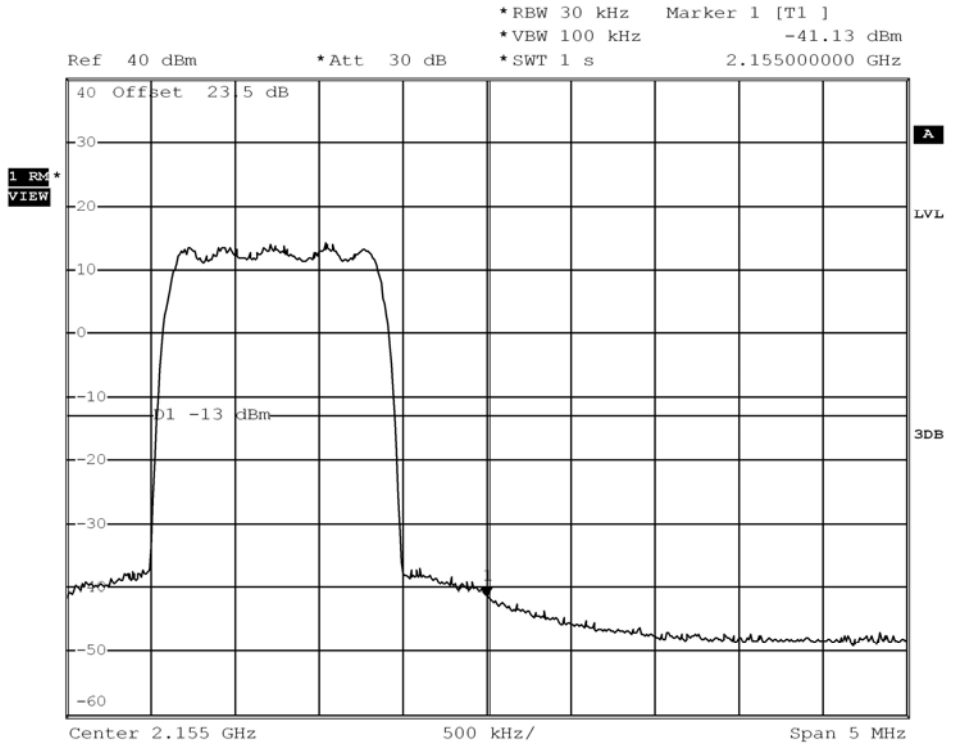


CDMA – Band Edge (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



1xEVDO – Band Edge (Low Channel)



1xEVDO – Band Edge (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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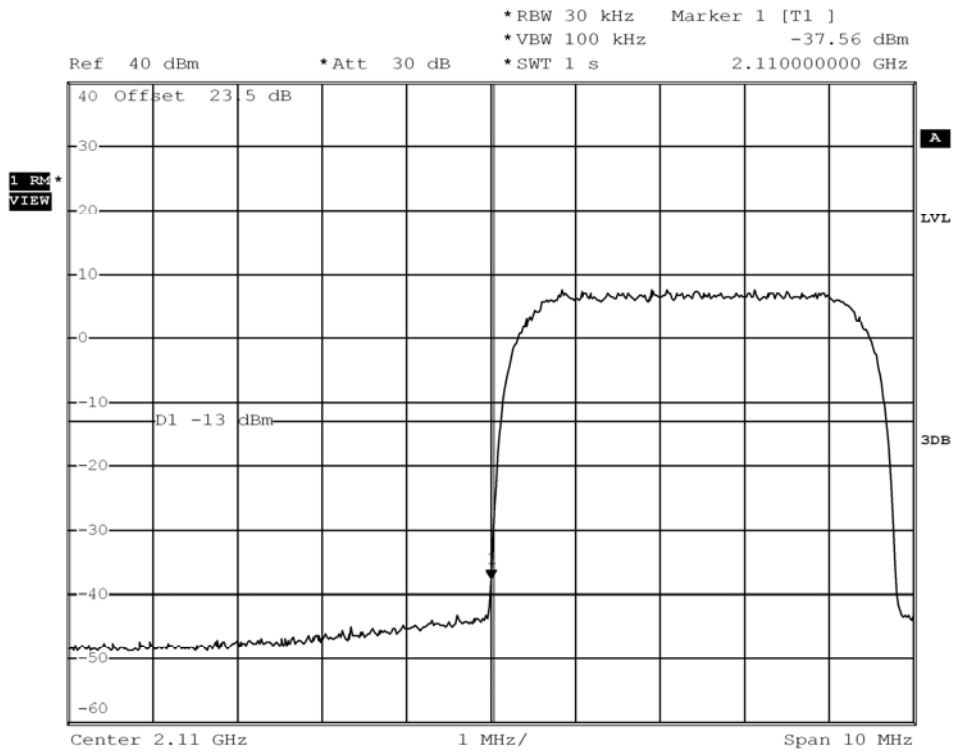
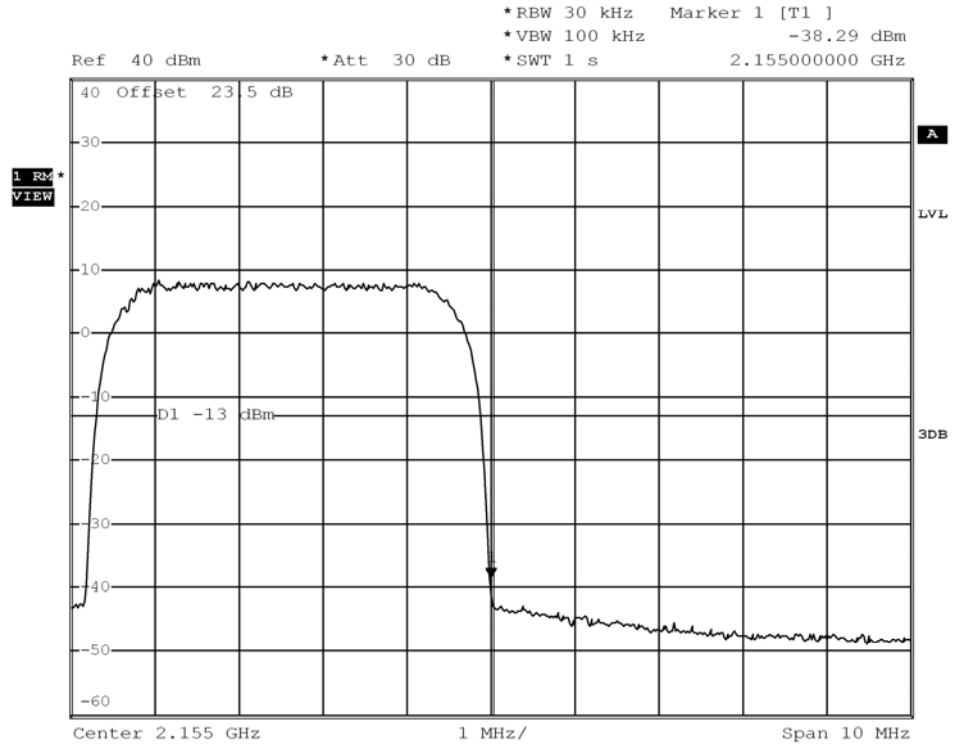


WCDMA – Band Edge (Low Channel)



WCDMA – Band Edge (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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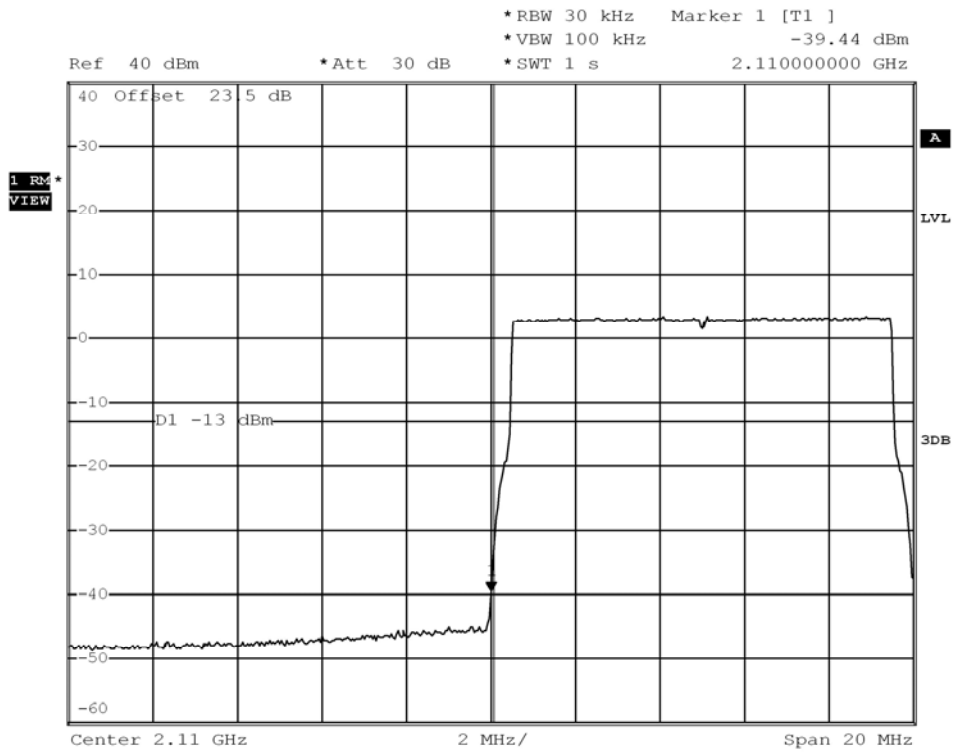
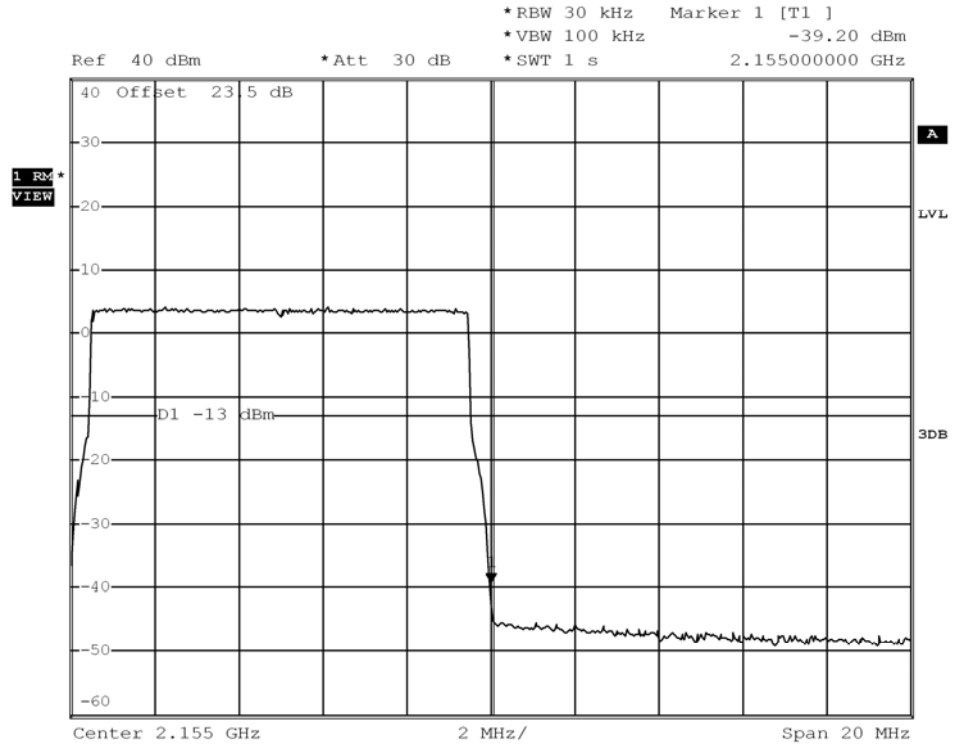


LTE – Band Edge (Low Channel)



LTE – Band Edge (High Channel)

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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9. INTERMODULATION TEST

9.1 Operating environment

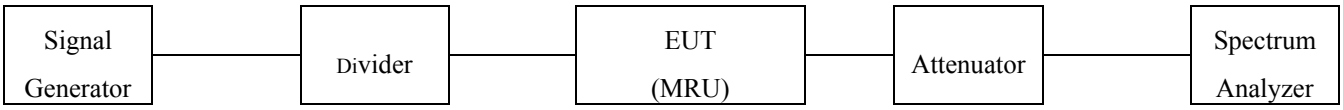
Temperature : 21 °C

Relative humidity : 50 % R.H.

9.2 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the power meter or spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation.

Two input signals are equal in level and were sent to the input of the EUT.



9.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	E4432B	HP	Signal Generator	US38440950	June 01, 2012 (1Y)
■ -	SMJ100A	R/S	Signal Generator	101038	Feb. 02, 2012 (1Y)
■ -	FSP	R/S	Spectrum Analyzer	100017	Mar. 12, 2012 (1Y)
■ -	8564E	HP	Spectrum Analyzer	3650A00756	Apr. 04, 2012 (1Y)
■ -	67-30-43	Aeroflex Weinschel	Power Attenuator	CA5760	Dec. 10, 2012 (1Y)
■ -	83650L	HP	Swept CW Generator	3844A00415	May 31, 2012(1Y)

All test equipment used is calibrated on a regular basis.

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EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

9.4 Test data

9.4.1 Test Result for Part 27 C (AWS-1)

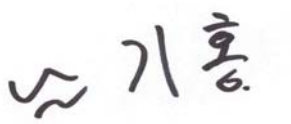
9.4.1.1 Test Result for peak power

-. Test Date : December 11, 2012

-. Test Result : Pass

-. Modulation : No-Modulation

Frequency (MHz)	Number of Input Channel	Input Power (dBm)	Output Power (dBm)
2 110.030	1	-20.40	28.00
2 110.030 & 2 110.06	2	-20.50	28.00
2 110.030 & 2 110.06 & 2 110.09	3	-20.20	28.00
2 154.970	1	-20.10	28.00
2 154.970 & 2 154.940	2	-20.30	28.00
2 154.970 & 2 154.940 & 2 154.910	3	-20.30	28.00



Tested by: Ki-Hong, Nam / Senior Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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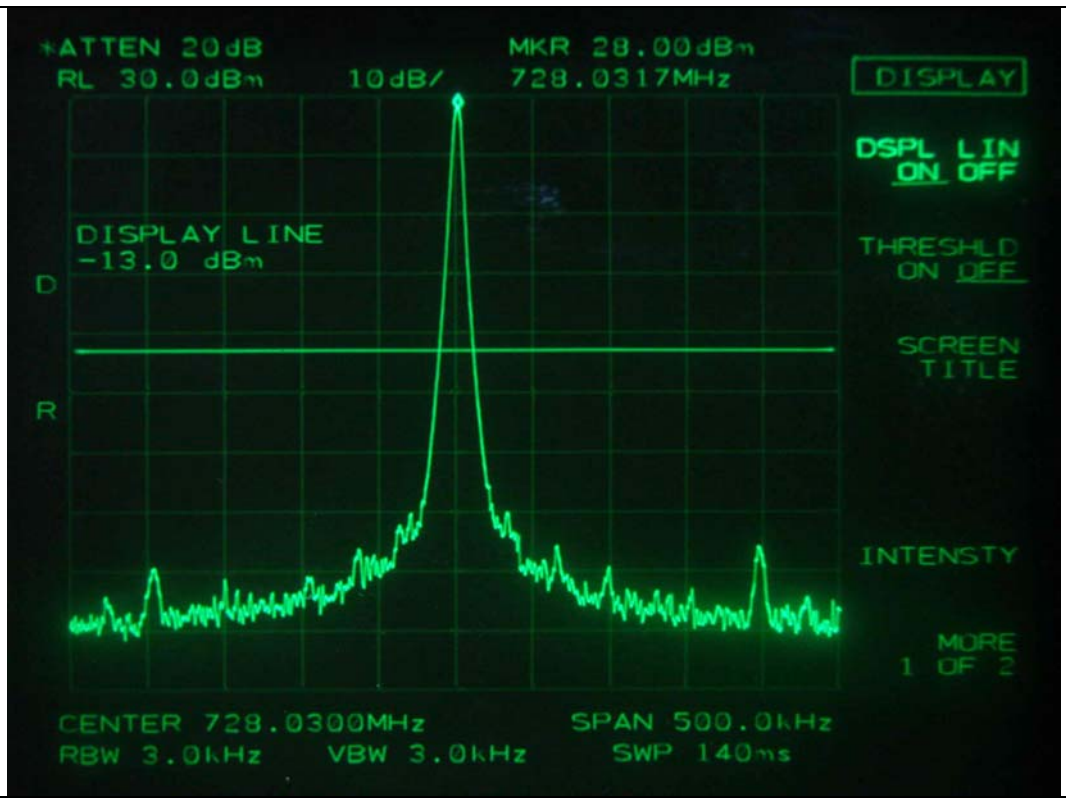
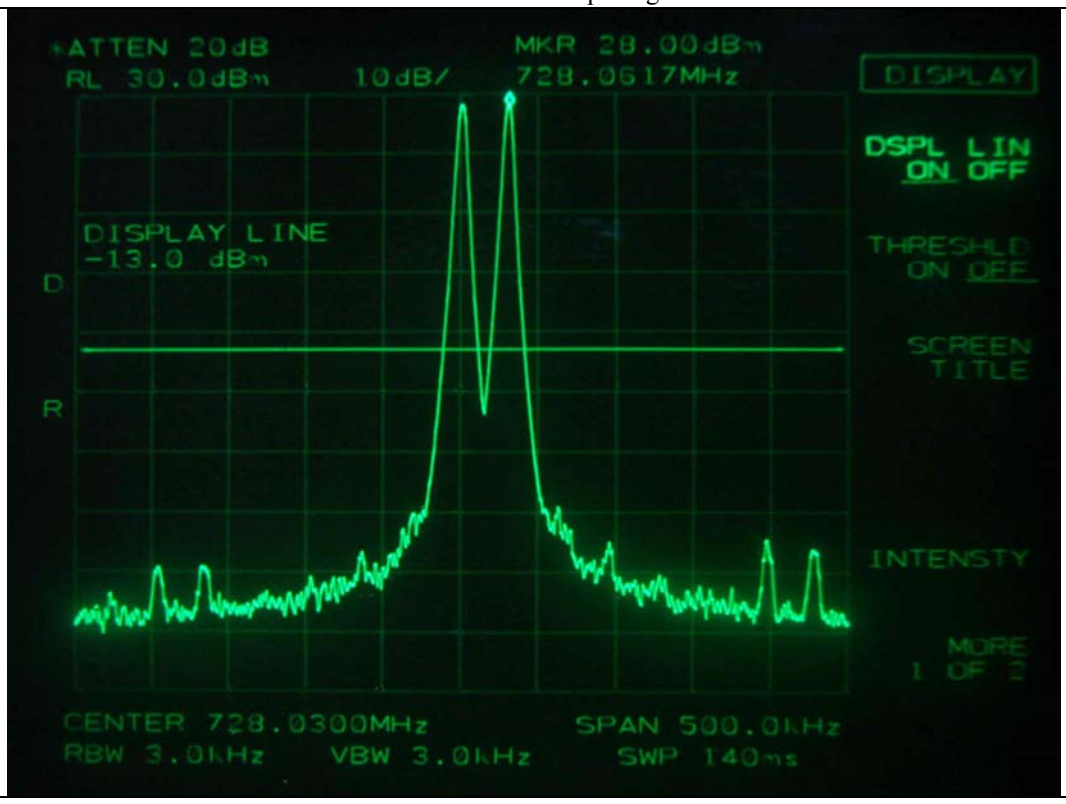
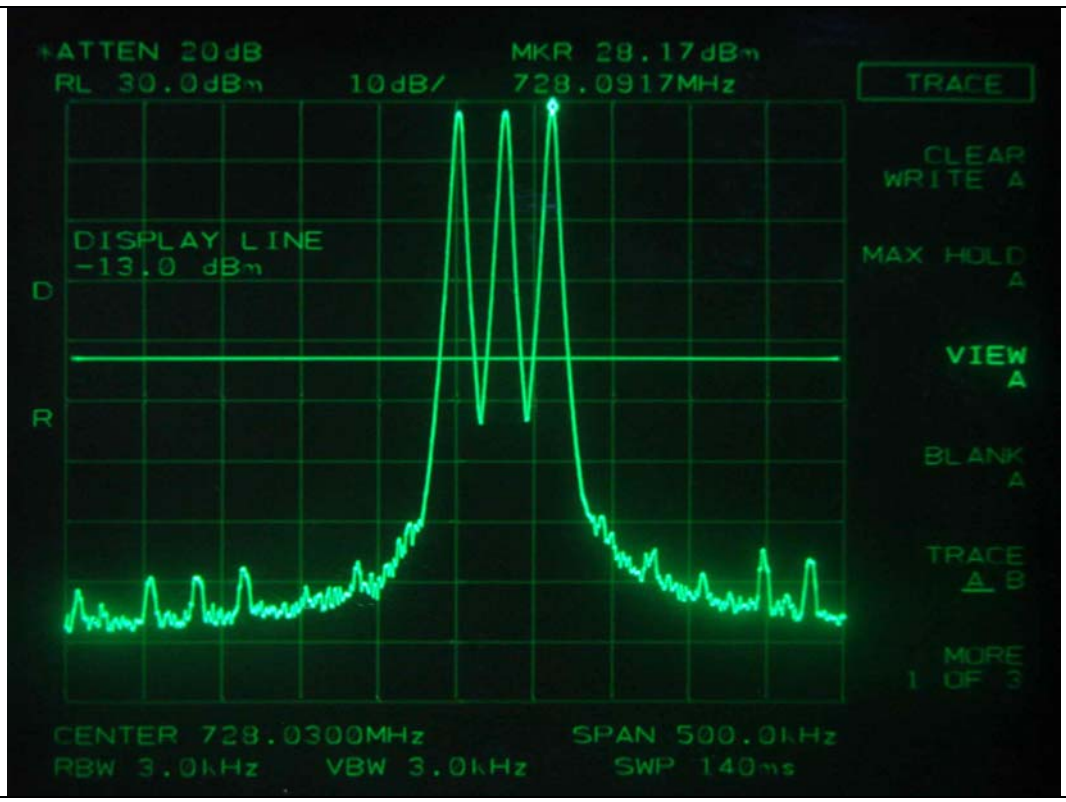


Low Channel – 1 input signal

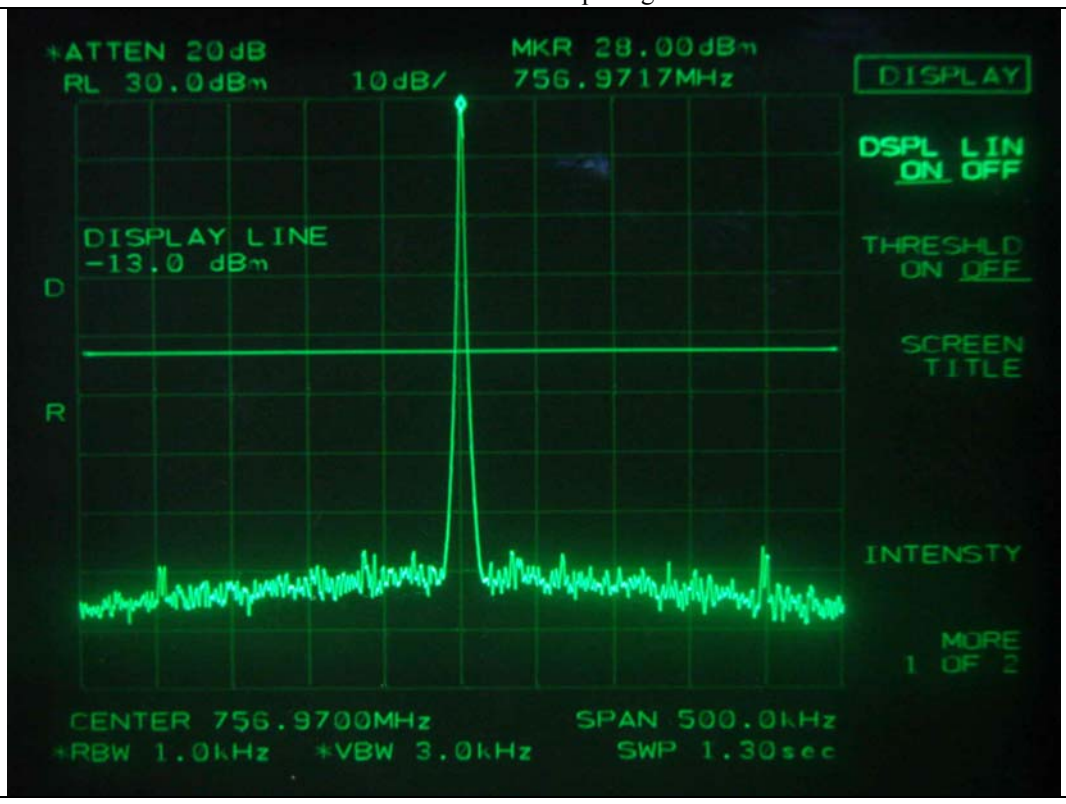


Low Channel – 2 input signals

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

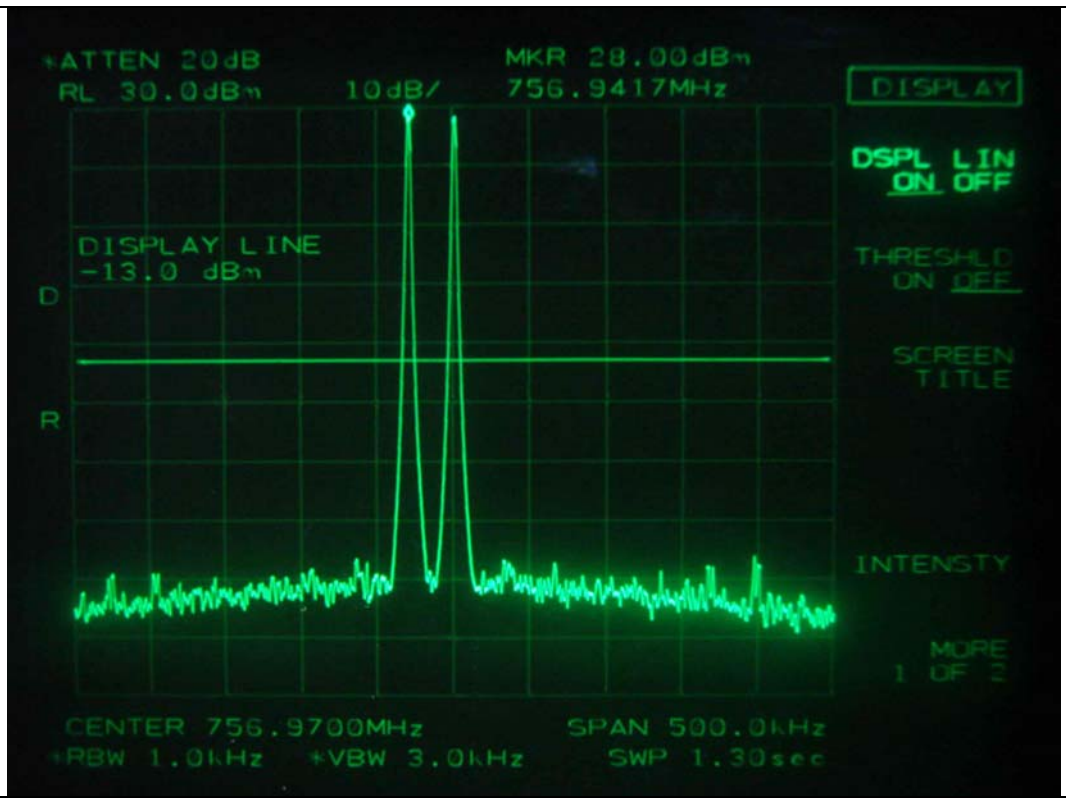


Low Channel – 3 input signals

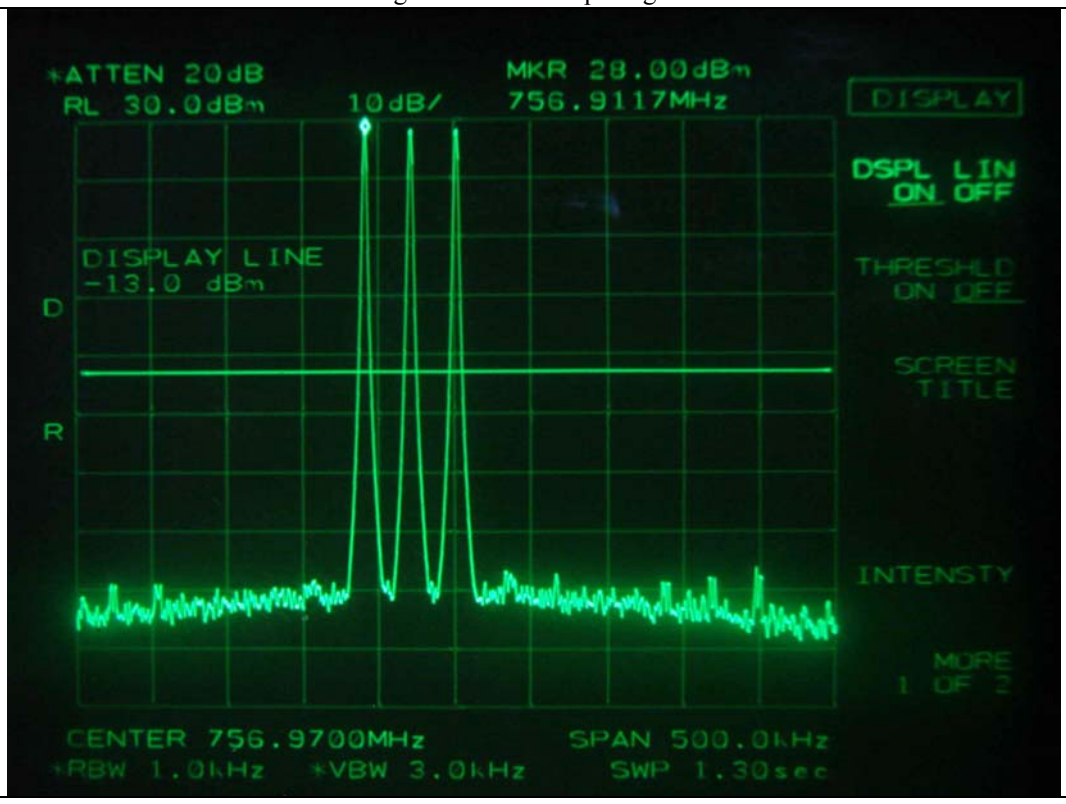


High Channel – 1 input signal

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



High Channel – 2 input signals



High Channel – 3 input signals

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

9.4.1.2 Test Result for Spurious emission

-. Test Date : December 11, 2012

-. Test Result : Pass

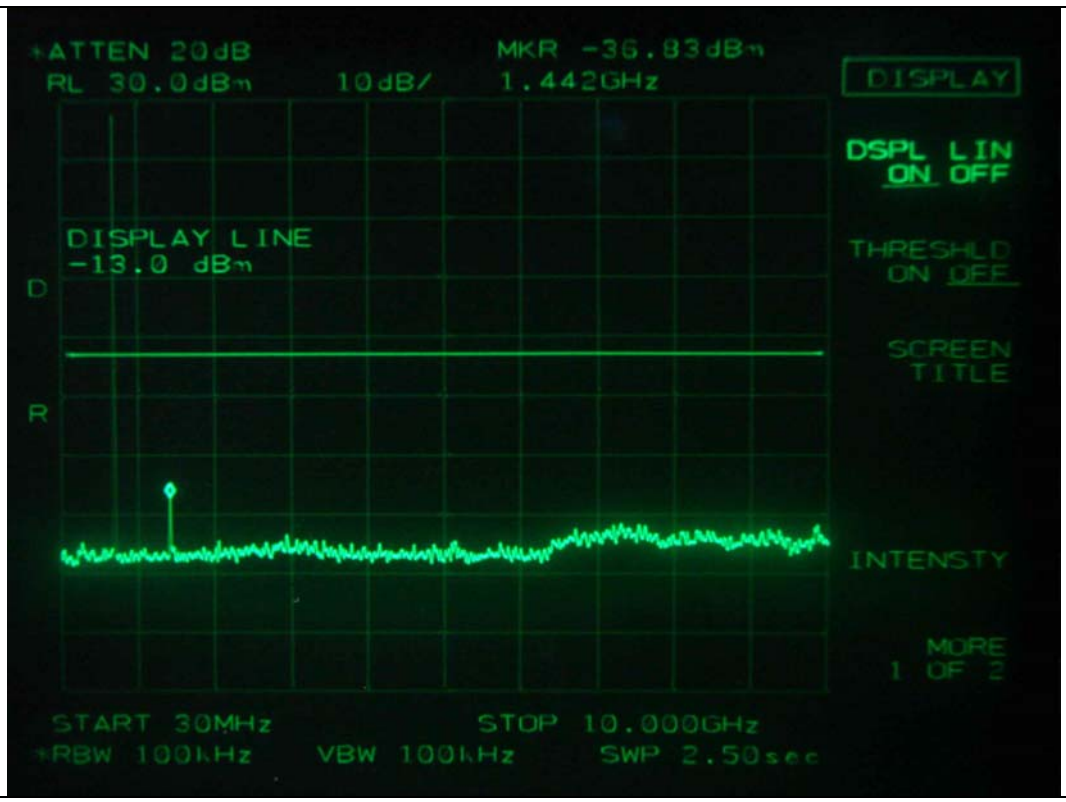
-. Modulation : No-Modulation

Frequency (MHz)	Number of Input Channel	Measured Value	Result
2 110.030	1	< -13 dBm	Pass
2 110.030 & 2 110.06	2		
2 110.030 & 2 110.06 & 2 110.09	3		
2 154.970	1	< -13 dBm	Pass
2 154.970 & 2 154.940	2		
2 154.970 & 2 154.940 & 2 154.910	3		

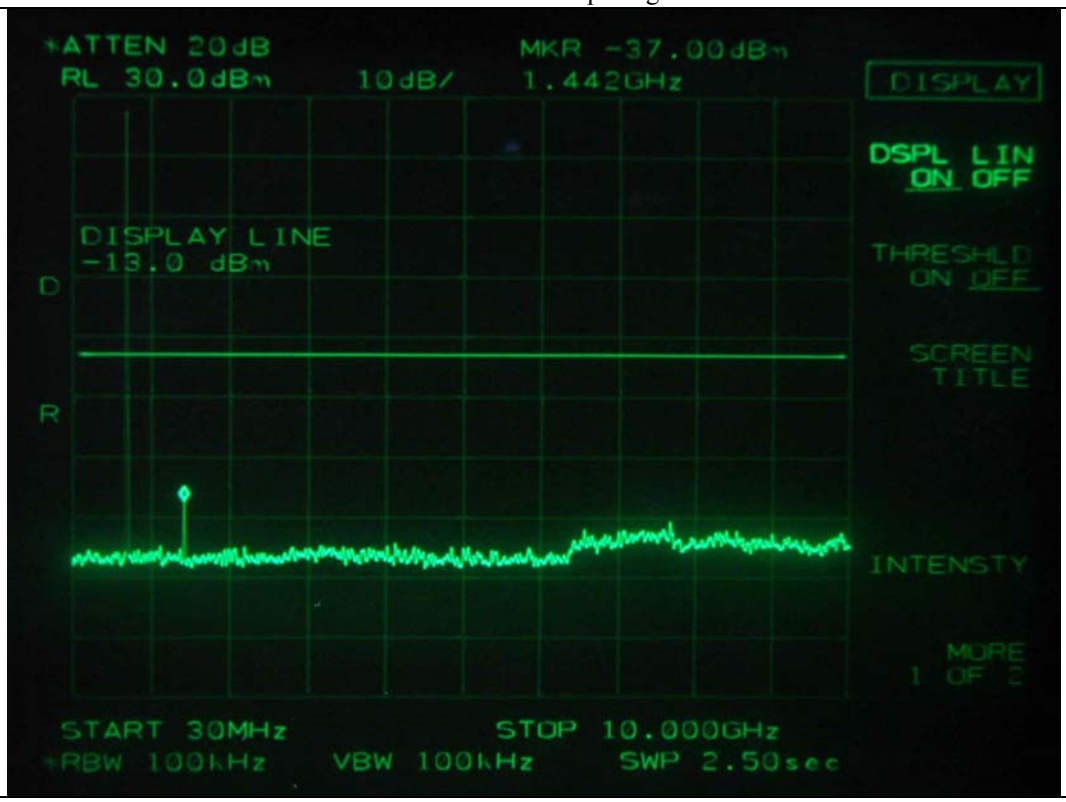
Remark: Intermodulation products must be attenuated below the rated power of the EUT at least 43 + 10log (Pw), equivalent to -13 dBm. Please refer to test data hereinafter.

Tested by: Ki-Hong, Nam / Senior Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

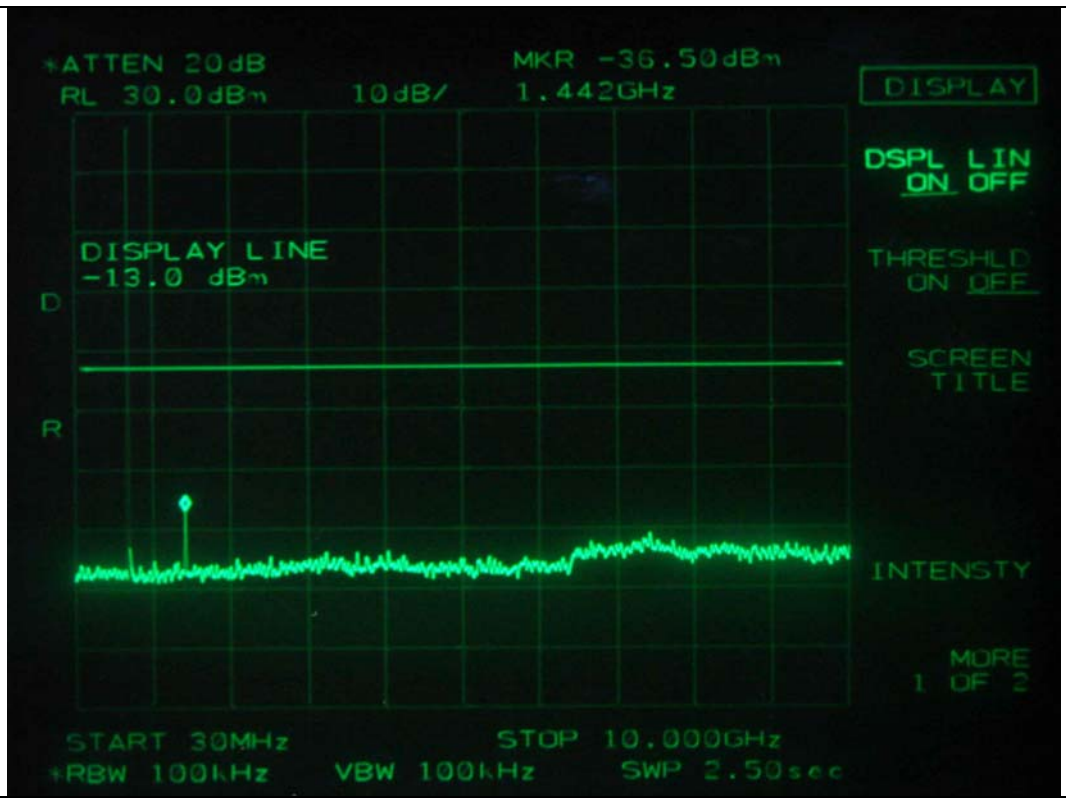


Low Channel – 1 input signal

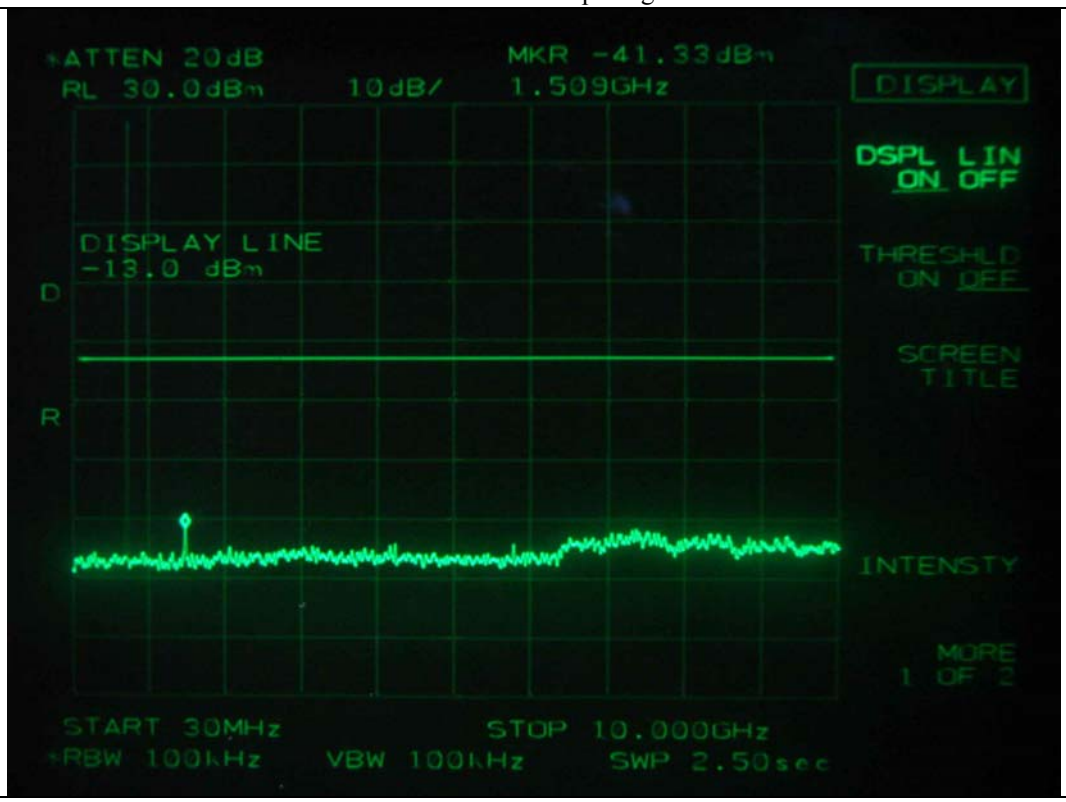


Low Channel – 2 input signals

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



Low Channel – 3 input signals



High Channel – 1 input signal

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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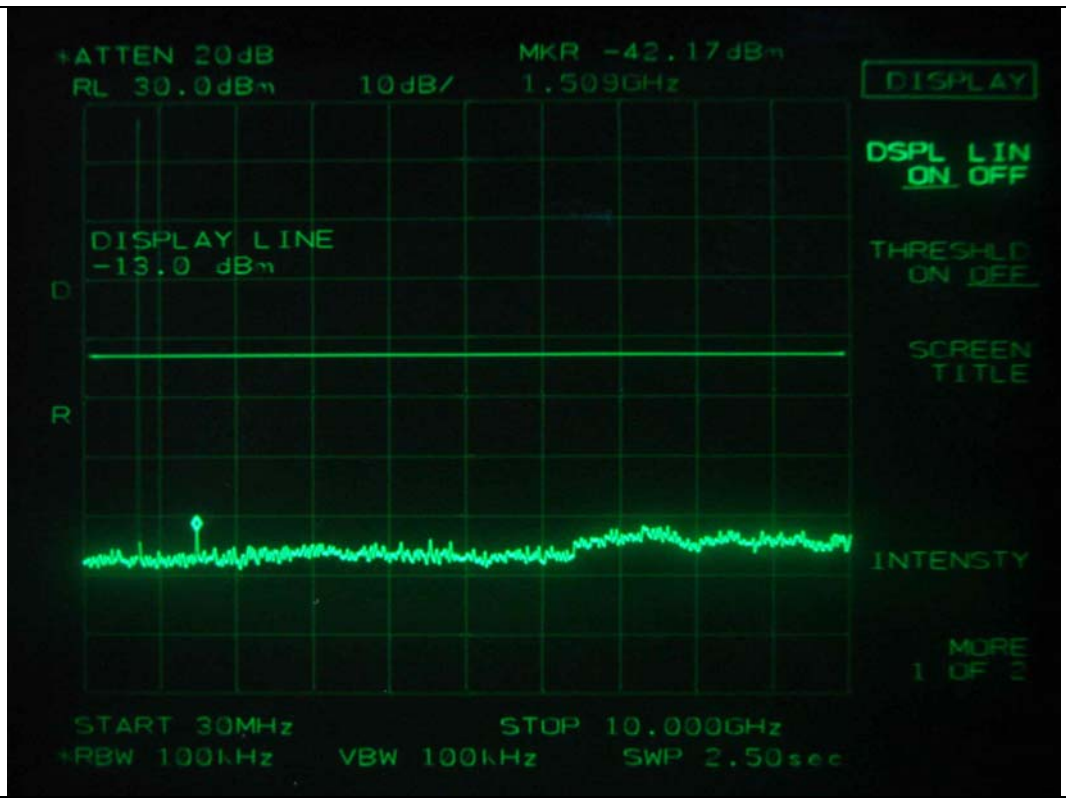
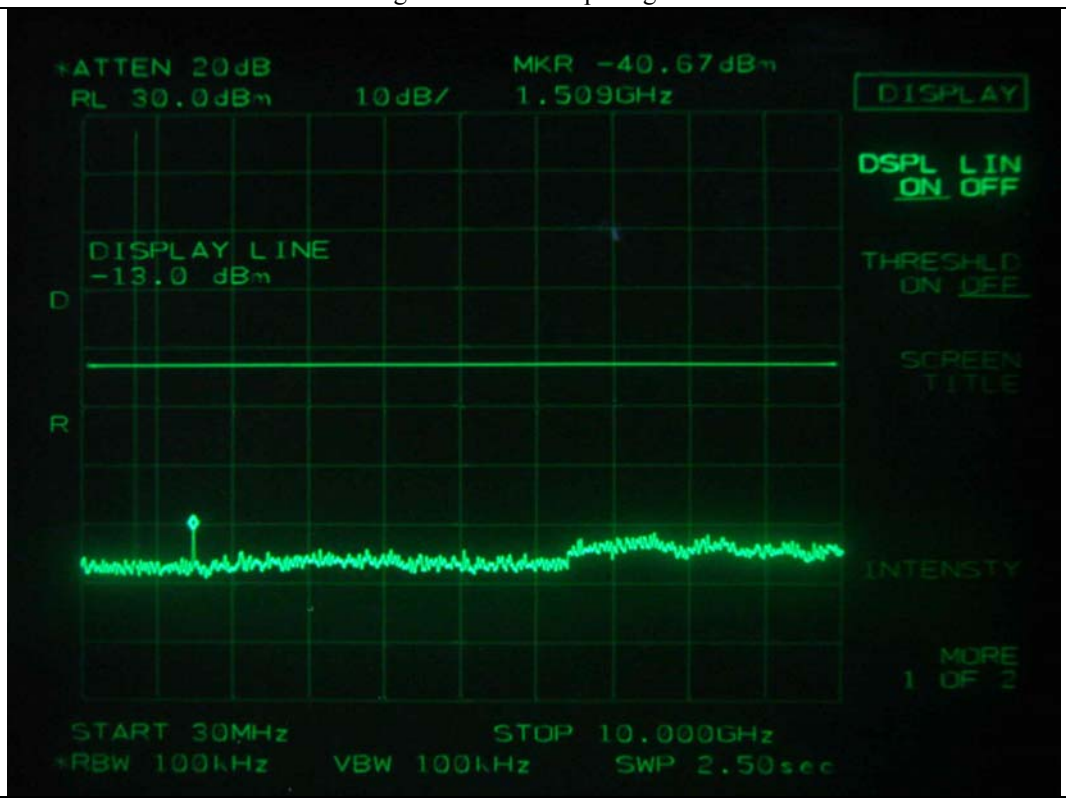


High Channel – 2 input signals



High Channel – 3 input signals

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

9.4.2 Test Result for Part 27 C (700LTE)

9.4.2.1 Test Result for peak power

-. Test Date : December 13, 2012

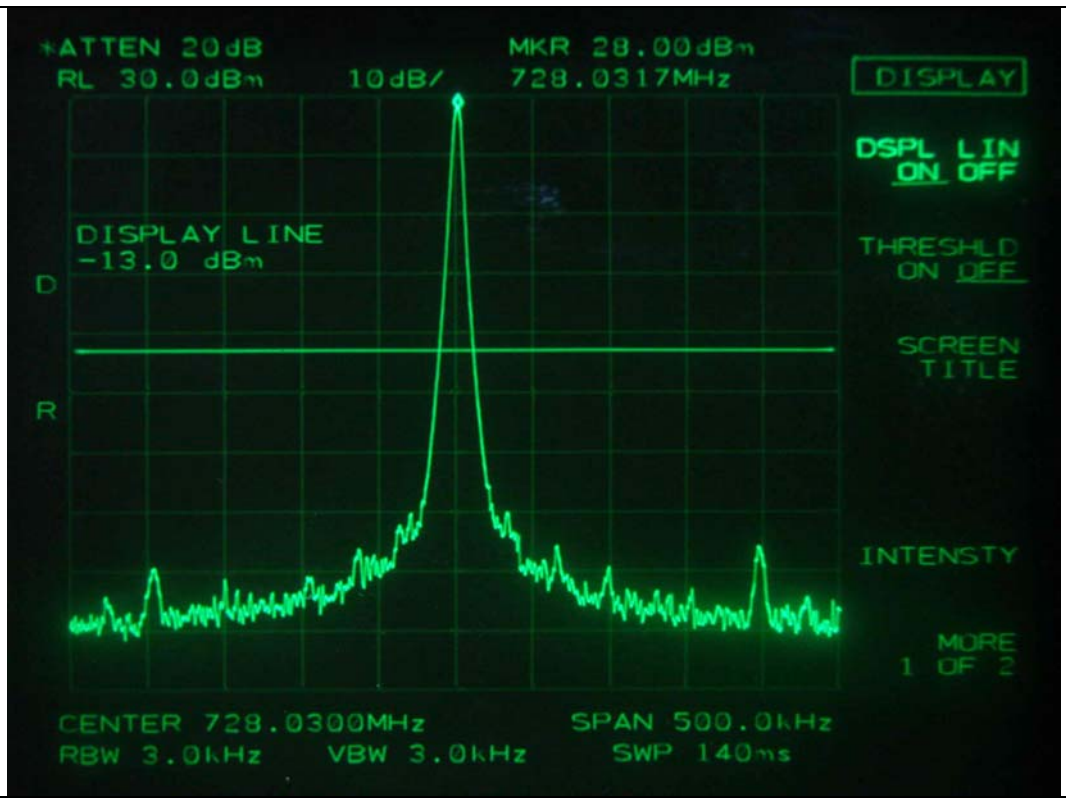
-. Test Result : Pass

-. Modulation : No-Modulation

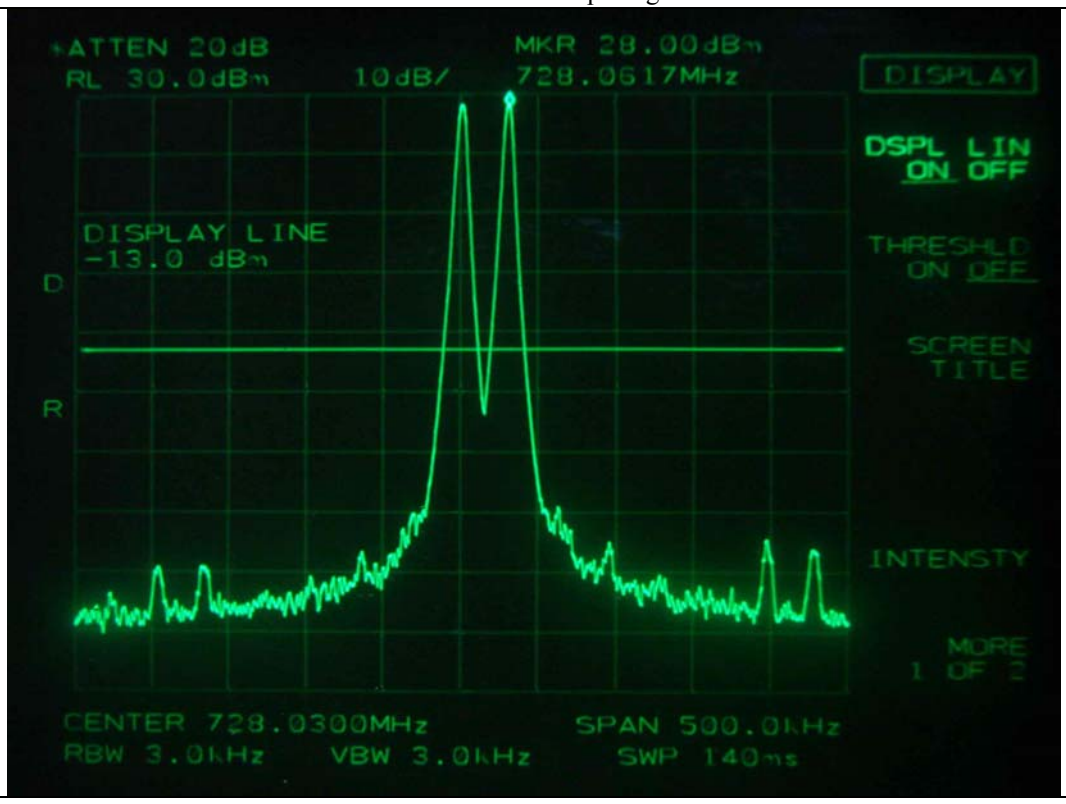
Frequency (MHz)	Number of Input Channel	Input Power (dBm)	Output Power (dBm)
728.030	1	-20.30	28.00
728.030 & 728.060	2	-20.50	28.00
728.030 & 728.06 & 728.09	3	-20.40	28.17
756.970	1	-20.20	28.00
756.970 & 756.940	2	-20.40	28.00
756.970 & 756.940 & 756.910	3	-20.10	28.00

Tested by: Ki-Hong, Nam / Senior Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

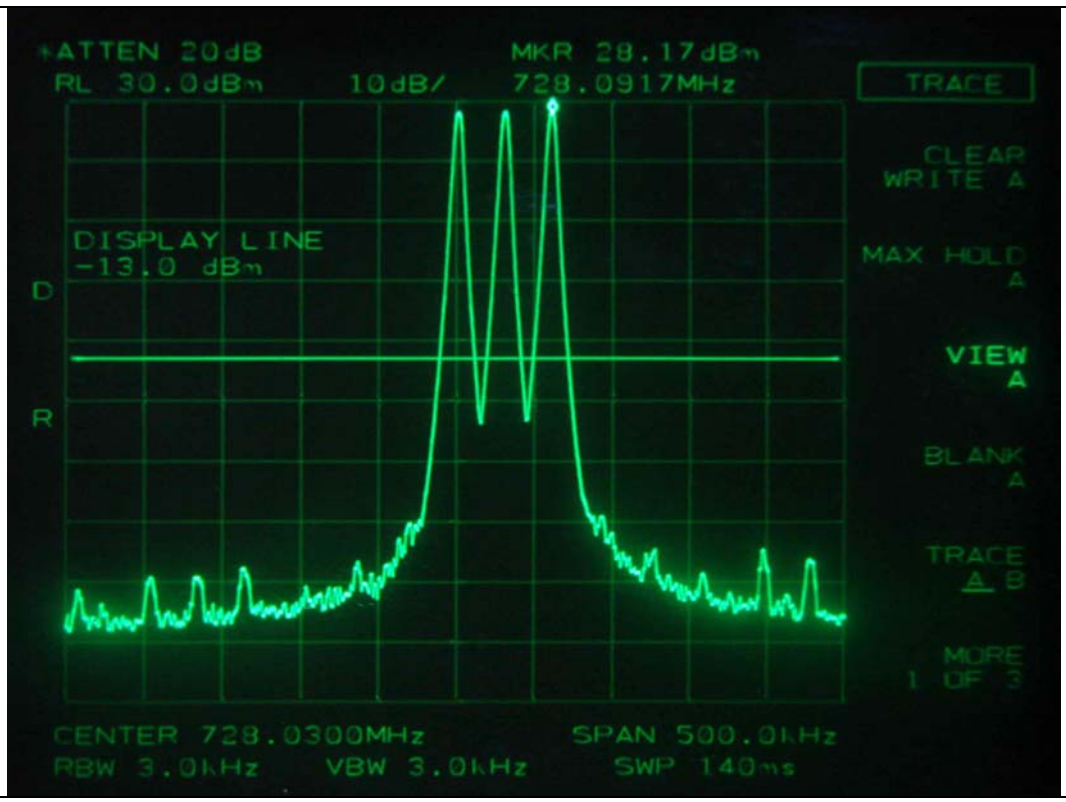


Low Channel – 1 input signal

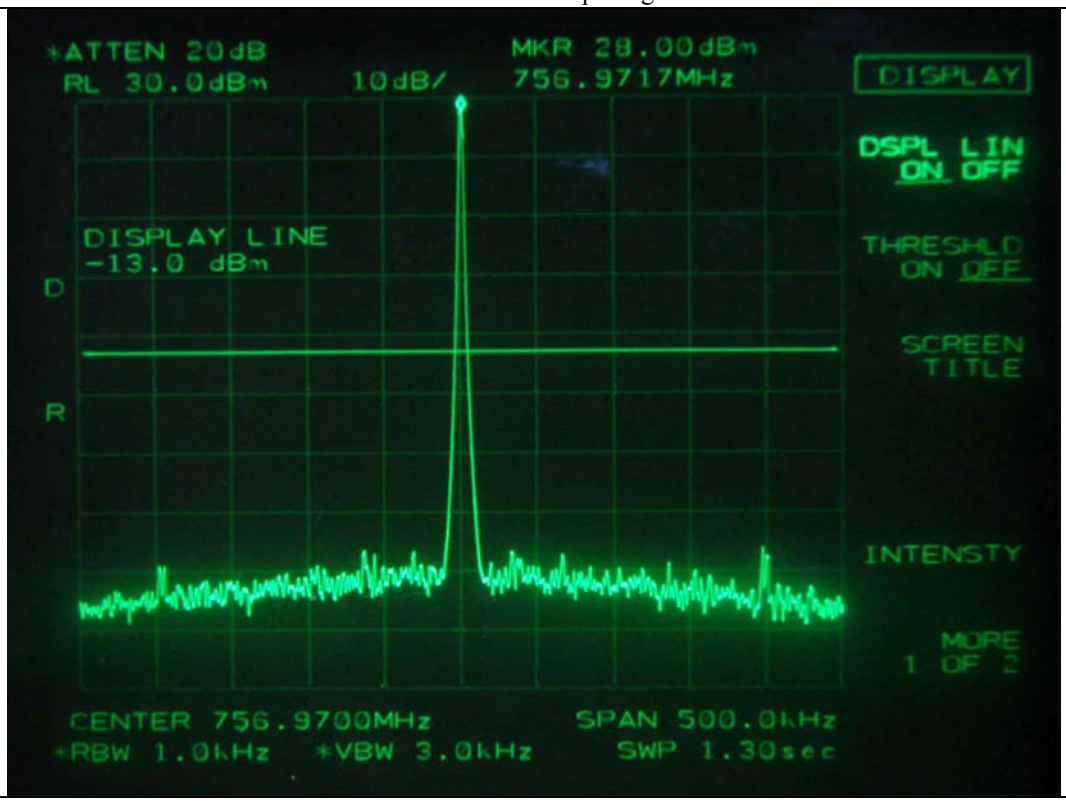


Low Channel – 2 input signals

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



Low Channel – 3 input signals



High Channel – 1 input signal

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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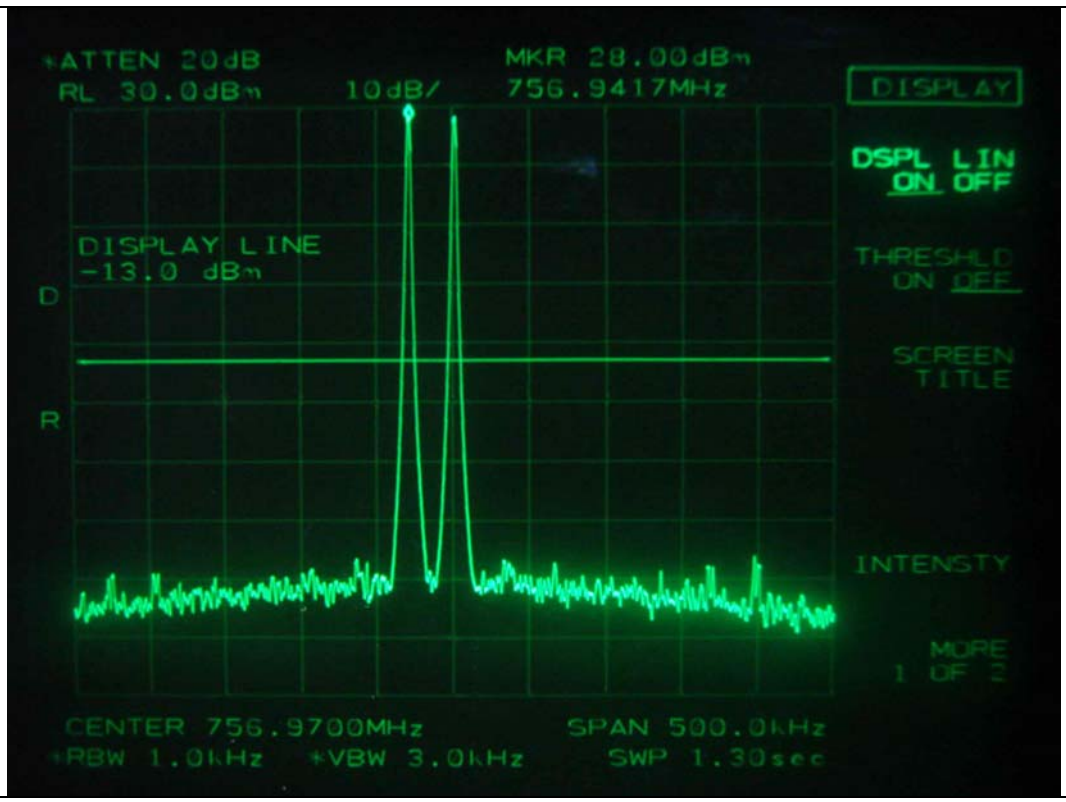
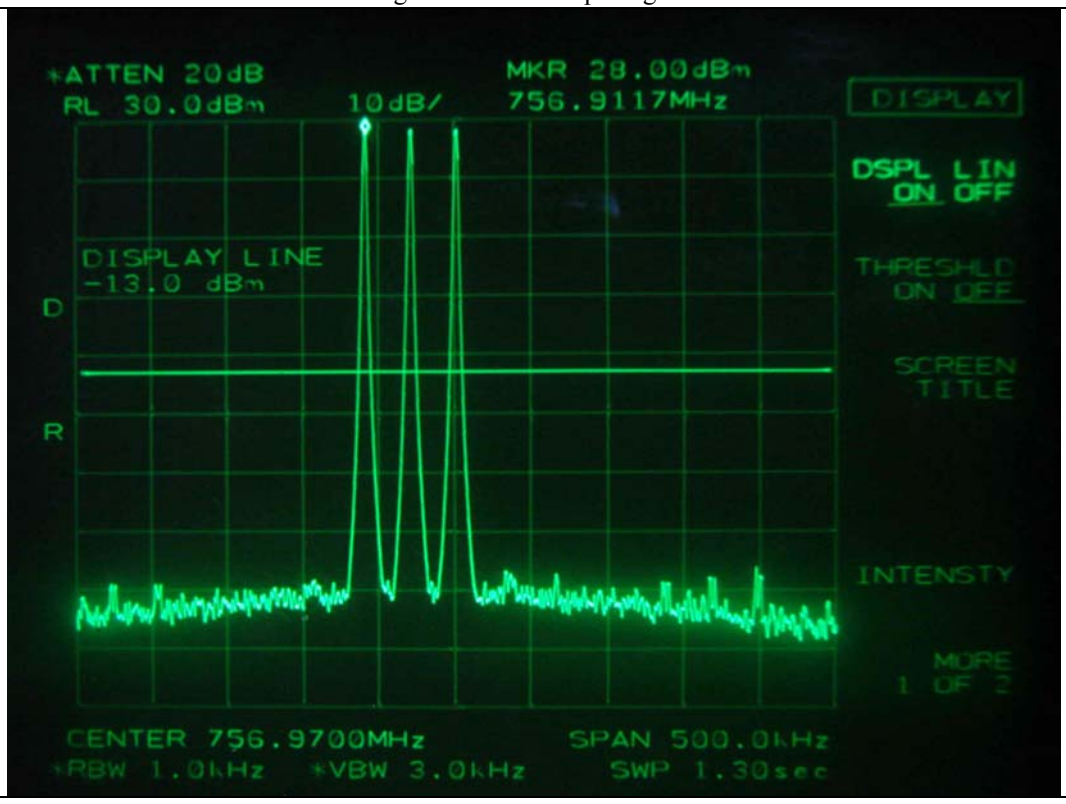


High Channel – 2 input signals



High Channel – 3 input signals

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

9.4.2.2 Test Result for Spurious emission

-. Test Date : December 13, 2012

-. Test Result : Pass

-. Modulation : No-Modulation

Frequency (MHz)	Number of Input Channel	Measured Value	Result
728.030	1	< -13 dBm	Pass
728.030 & 728.060	2		
728.030 & 728.06 & 728.09	3		
755.970	1	< -13 dBm	Pass
755.970 & 755.940	2		
755.970 & 755.940 & 755.910	3		

Remark: Intermodulation products must be attenuated below the rated power of the EUT at least 43 + 10log (Pw), equivalent to -13 dBm. Please refer to test data hereinafter.

Tested by: Ki-Hong, Nam / Senior Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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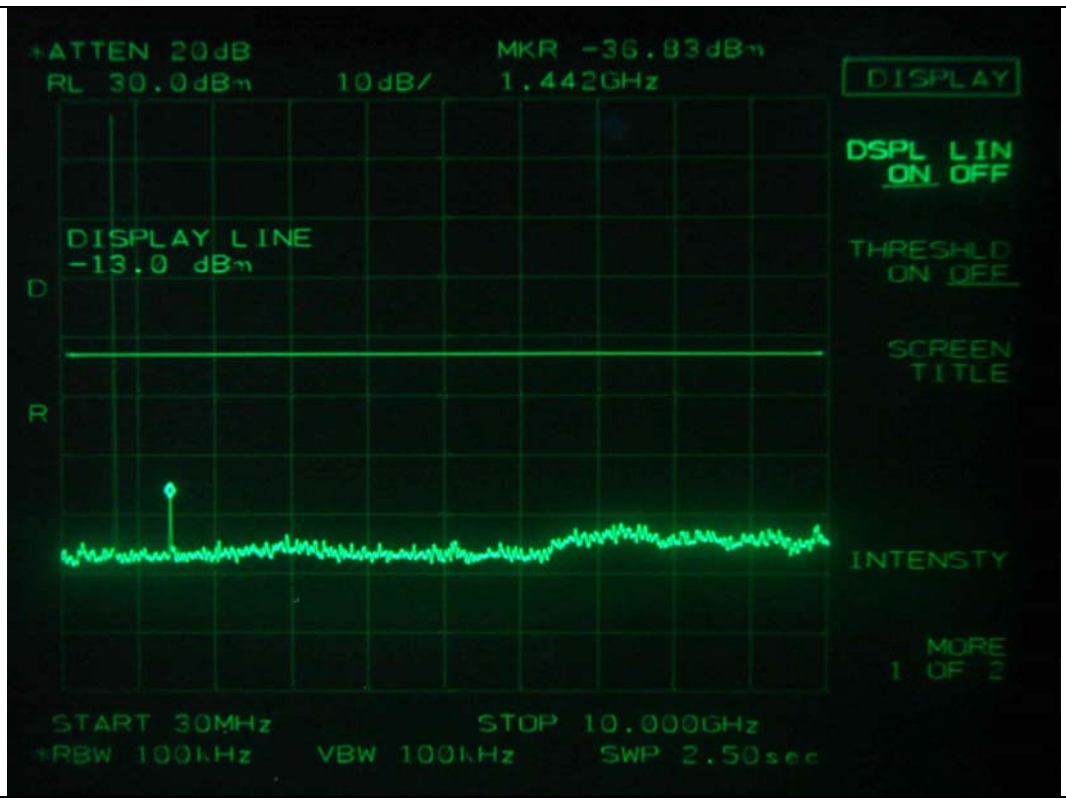
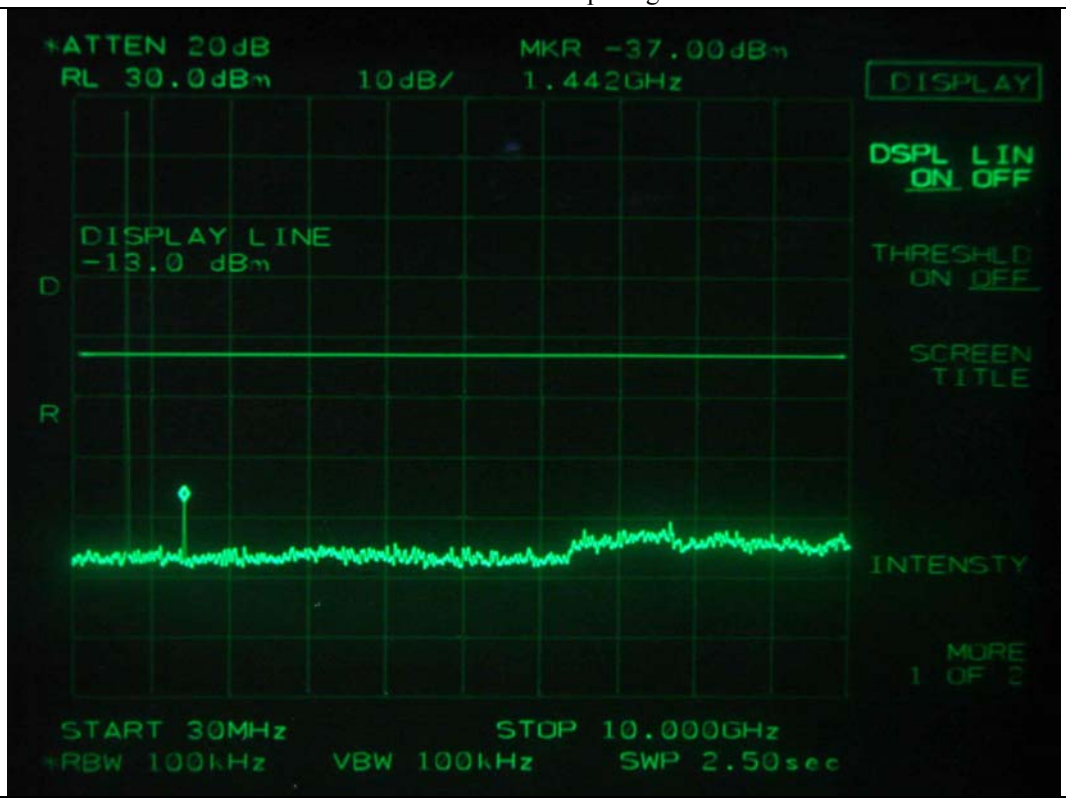
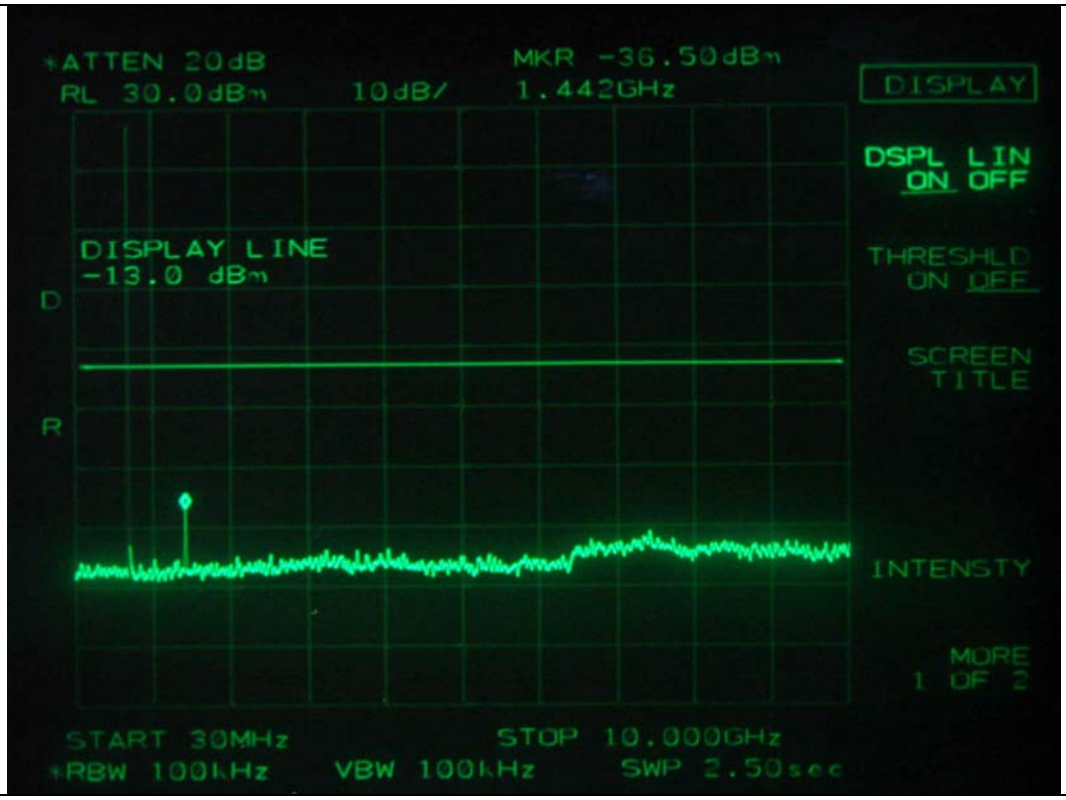


Low Channel – 1 input signal

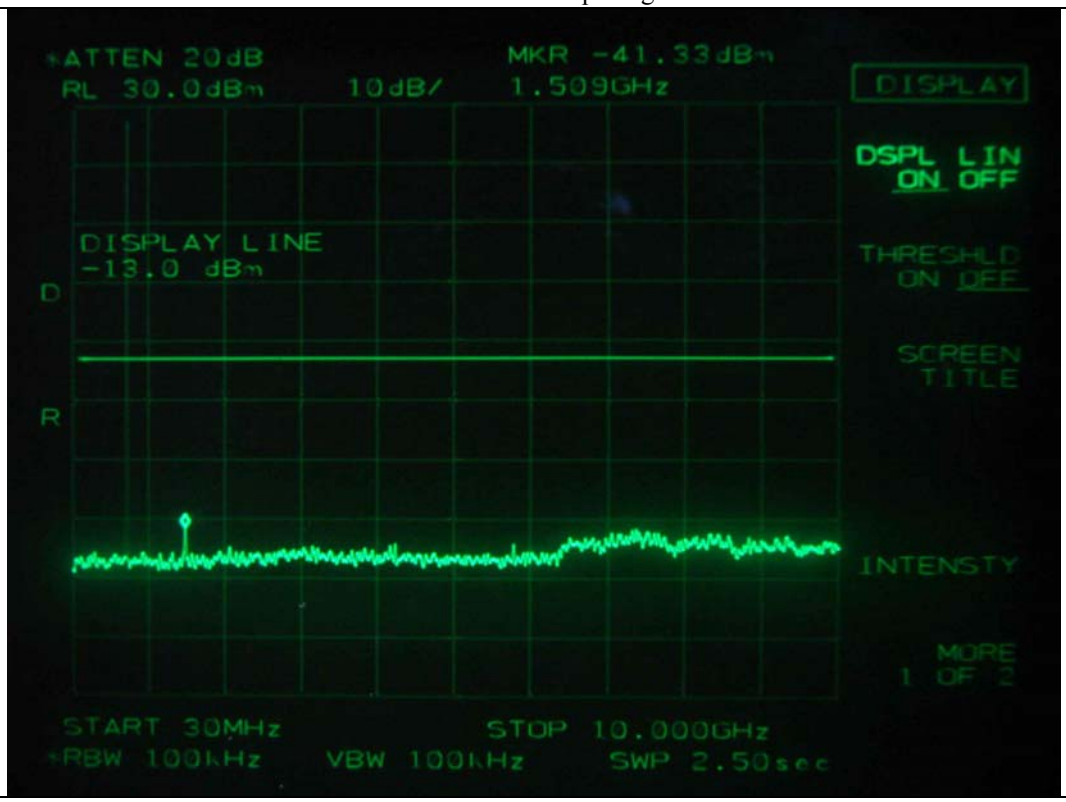


Low Channel – 2 input signals

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



Low Channel – 3 input signals



High Channel – 1 input signal

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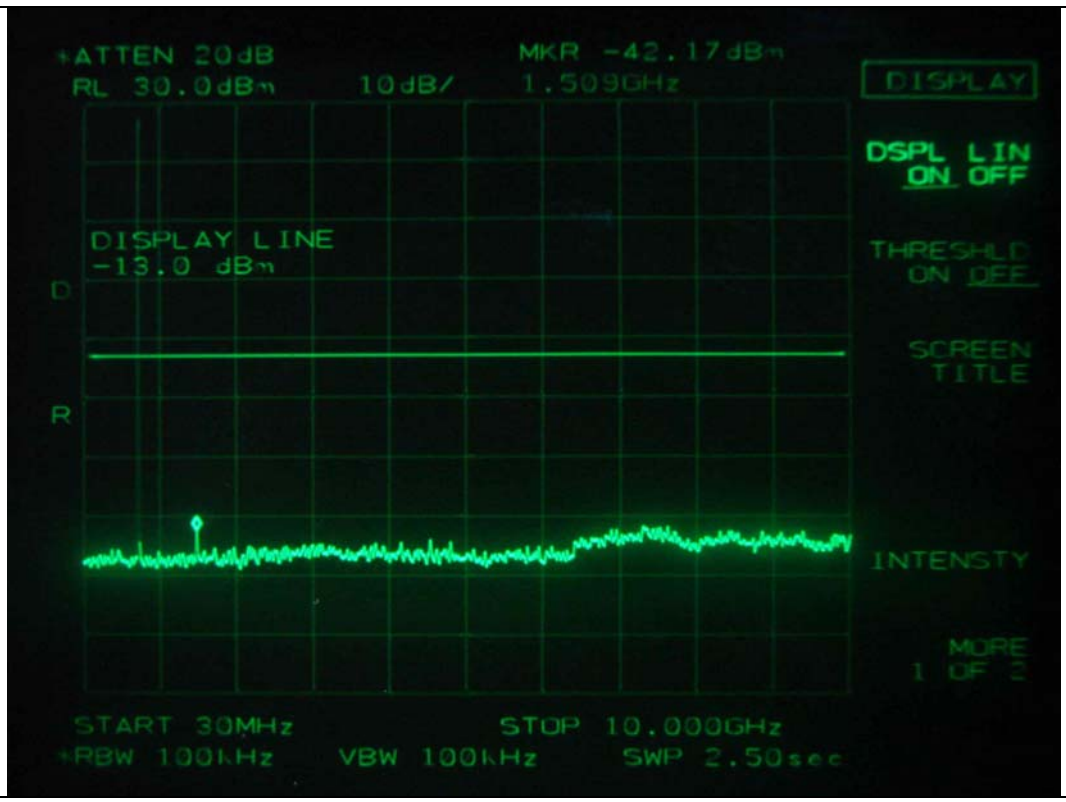
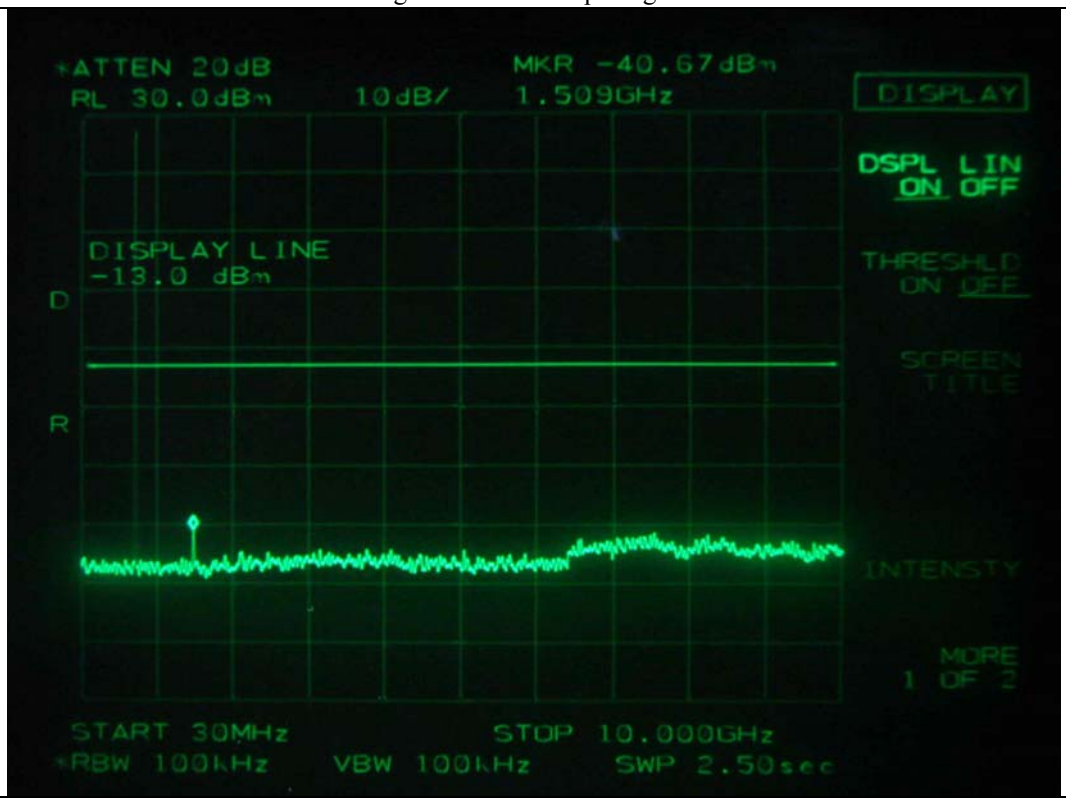


High Channel – 2 input signals



High Channel – 3 input signals

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10. FIELD STRENGTH OF SPURIOUS RADIATION

10.1 Operating environment

Temperature : 18 °C

Relative humidity : 45 % R.H.

10.2 Test set-up

The radiated emissions measurements were on the 3 m, open-field test site. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30 MHz to up to 10th harmonic of the fundamental frequency was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. The test was performed by placing the EUT on 3-orthogonal axis. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

The maximum radiated emission was recorded and used as reference for the effective radiated power measurement. The EUT was then replaced by a tuned dipole antenna or Horn antenna and was oriented for vertical polarization and then the length was adjusted to correspond to the frequency of the transmitter. The substitution antenna was connected to a signal generator with a coaxial cable. The receiving antenna height was raised and lowered again through the specified range of height until maximum signal level is detected by the measuring receiver. The signal to the substitution antenna was adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the EUT radiated power measured, corrected for the change of input attenuation setting of the measuring receiver. The signal generator level was recorded and corrected by the power loss in the cable between the signal generator and substitution antenna and further corrected for the gain of the dipole antenna or horn antenna used relative to an ideal tuned dipole antenna. The measurement was repeated with the test antenna and the substitution antenna oriented for horizontal polarization. The measure of the effective radiated power is the larger of the two levels recorded.

10.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	ESVD	Rohde & Schwarz	EMI Test Receiver	838453/018	Nov. 29, 2012 (1Y)
■ -	8564E	Hewlett-Packard	Spectrum Analyzer	3650A00756	Apr. 04, 2012 (1Y)
■ -	83051A	Agilent	Preamplifier	3950M00201	Jun. 05, 2012 (1Y)
□ -	E4432B	Hewlett-Packard	Signal Generator	US38440950	Jun. 01, 2012 (1Y)
□ -	83650L	Hewlett-Packard	Signal Generator	3844A00415	May 31, 2012 (1Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D294	Aug. 23, 2011 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 23, 2011 (2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Aug. 23, 2011 (2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Aug. 23, 2011 (2Y)
■ -	SMJ100A	R/S	Signal Generator	101038	Feb. 02, 2012 (1Y)
■ -	FSP	R/S	Spectrum Analyzer	100017	Mar. 12, 2012 (1Y)

All test equipment used is calibrated on a regular basis.

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EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4 Test data for radiated emission

10.4.1 Test Result for Part 27 C (AWS-1)

10.4.1.1 Input Voltage: AC 120 V

-. Test Date : December 18, 2012

-. Resolution bandwidth : 120 kHz (below 1 GHz), 1 MHz (above 1 GHz)

-. Video bandwidth : 300 kHz (below 1 GHz), 3 MHz (above 1 GHz)

-. Frequency range : 30 MHz ~ 20 GHz

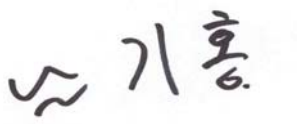
-. Measurement distance : 3 m

-. Result : Pass

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
Test Data for Low Channel								
2 110.03	52.80	-16.00	10.36	H	4.09	-9.73	-	-
	55.50	-14.50		V		-8.23	-	-
Test Data for Middle Channel								
2 132.50	52.67	-14.17	10.37	H	4.11	-7.91	-	-
	55.33	-14.83		V		-8.57	-	-
Test Data for High Channel								
2 154.97	53.00	-15.96	10.38	H	4.13	-9.71	-	-
	55.83	-14.67		V		-8.42	-	-
40.00	24.50	-59.10	1.14	H	1.00	-58.96	-13.00	-45.96
120.50	27.10	-59.60	1.75	H	2.00	-55.85	-13.00	-42.85
165.80	26.50	-59.90	2.03	H	2.30	-55.57	-13.00	-42.57
848.67	22.10	-62.80	1.61	V	5.80	-55.39	-13.00	-42.39
Other frequencies have margin more than 40 dB.								

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical



Tested by: Ki-Hong, Nam / Senior Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.1.2 Input Voltage: DC - 48 V

-. Test Date : November 18, 2011

-. Resolution bandwidth : 120 kHz (below 1 GHz), 1 MHz (above 1 GHz)

-. Video bandwidth : 300 kHz (below 1 GHz), 3 MHz (above 1 GHz)

-. Frequency range : 30 MHz ~ 20 GHz

-. Measurement distance : 3 m

-. Result : Pass

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
Test Data for Low Channel								
2 110.03	52.67	-16.13	10.36	H	4.09	-9.86	-	-
	55.33	-14.67		V		-8.40	-	-
Test Data for Middle Channel								
2 132.50	52.50	-16.34	10.37	H	4.11	-10.08	-	-
	54.00	-15.16		V		-8.90	-	-
Test Data for High Channel								
2 154.97	53.17	-15.79	10.38	H	4.13	-9.54	-	-
	56.00	-14.50		V		-8.25	-	-
45.00	25.30	-58.53	1.13	H	1.10	-58.50	-13.00	-45.50
125.50	28.50	-56.70	1.69	H	2.10	-52.91	-13.00	-39.91
262.20	27.50	-59.17	1.46	H	2.90	-54.81	-13.00	-41.81
848.67	23.12	-61.88	1.61	V	5.80	-54.47	-13.00	-41.47
Other frequencies have margin more than 40 dB.								

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

Tested by: Ki-Hong, Nam / Senior Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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10.4.2 Test Result for Part 27 C(700LTE)

10.4.2.1 Input Voltage: AC 120 V

-. Test Date : December 17, 2012

-. Resolution bandwidth : 120 kHz (below 1 GHz), 1 MHz (above 1 GHz)

-. Video bandwidth : 300 kHz (below 1 GHz), 3 MHz (above 1 GHz)

-. Frequency range : 30 MHz ~ 10 GHz

-. Measurement distance : 3 m

-. Result : Pass

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
Test Data for Low Channel								
733.00	62.50	-6.89	1.07	H	3.33	-9.15	-	-
	64.10	-5.07		V		-7.33	-	-
Test Data for Middle Channel								
743.00	62.30	-7.10	1.03	H	33.33	-3.64	-	-
	64.20	-4.93		V		-2.74	-	-
Test Data for High Channel								
752.00	63.50	-2.10	0.98	H	33.33	-3.90	-	-
	63.80	-1.20		V		-3.00	-	-
39.70	24.60	-59.00	1.14	H	1.00	-58.86	-13.00	-45.86
120.50	26.90	-59.80	1.75	H	2.00	-56.05	-13.00	-43.05
165.80	26.30	-60.10	2.03	H	2.30	-55.77	-13.00	-42.77
848.67	22.40	-62.50	1.61	V	5.80	-55.09	-13.00	-42.09

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

Tested by: Ki-Hong, Nam / Senior Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10.4.2.2 Input Voltage: DC - 48 V

-. Test Date : December 17, 2012

-. Resolution bandwidth : 120 kHz (below 1 GHz), 1 MHz (above 1 GHz)

-. Video bandwidth : 300 kHz (below 1 GHz), 3 MHz (above 1 GHz)

-. Frequency range : 30 MHz ~ 10 GHz

-. Measurement distance : 3 m

-. Result : Pass

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
Test Data for Low Channel								
733.00	62.33	-7.06	1.07	H	3.33	-5.43	-	-
	64.50	-4.67		V		-4.07	-	-
Test Data for Middle Channel								
413.00	62.67	-6.73	1.03	H	3.33	-5.49	-	-
	64.50	-4.63		V		-4.49	-	-
Test Data for High Channel								
752.00	62.50	-6.90	0.98	H	3.33	-5.40	-	-
	64.50	-4.65		V		-4.46	-	-
73.6000	25.00	-58.83	1.14	H	1.10	-50.60	-13.00	-37.60
114.4000	28.80	-57.00	1.75	H	2.10	-60.15	-13.00	-47.15
161.8000	27.50	-59.17	2.03	H	2.90	-63.61	-13.00	-50.61
184.1000	23.00	-62.00	1.61	V	5.80	-57.93	-13.00	-44.93

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

Tested by: Ki-Hong, Nam / Senior Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

11. FREQUENCY STABILITY WITH TEMPERATURE VARIATION

11.1 Operating environment

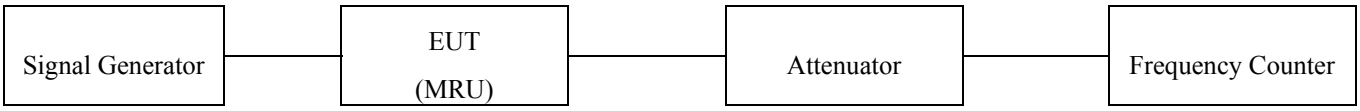
Temperature : 22 °C

Relative humidity : 52 % R.H.

11.2 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the power meter or spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable unmodulation.

Turn EUT off and set chamber temperature to -30 °C and then allow sufficient time (approximately 20 min to 30 min after chamber reach the assigned temperature) for EUT to stabilize. Turn on the EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 °C step from -30 °C to +50 °C. Repeat above method for frequency measurements every 10 °C step and then record all measured frequencies on each temperature step.



11.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
☐ -	8564E	HP	Spectrum Analyzer	3650A00756	Apr. 14, 2012 (1Y)
■ -	53152A	HP	Frequency Counter	US39270295	Dec. 10, 2012 (1Y)
■ -	SSE-43CI-A	Samkun	Chamber	060712	Jun. 01, 2012 (1Y)
■ -	SMJ100A	R/S	Signal Generator	101038	Feb. 02, 2012 (1Y)
☐ -	FSP	R/S	Spectrum Analyzer	100017	Mar. 12, 2012 (1Y)
■ -	67-30-43	Aeroflex Weinschel	Power Attenuator	CA5760	Dec. 10, 2012 (1Y)

All test equipment used is calibrated on a regular basis.

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

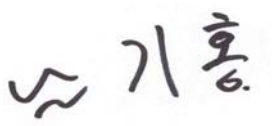
11.4 Test data

11.4.1 Test Result for Part 27 C (AWS-1)

-. Test Date : December 12, 2012

-. Result : Pass

Temperature (˚C)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
-30	2 132 500 000	2 132 500 001	0.000 5	Within the Authorized Frequency block
-20		2 132 500 001	0.000 5	
-10		2 132 500 002	0.000 9	
0		2 132 500 001	0.000 5	
10		2 132 500 002	0.000 9	
20		2 132 500 000	0.000 0	
30		2 132 500 002	0.000 9	
40		2 132 500 001	0.000 5	
50		2 132 500 001	0.000 5	



Tested by: Ki-Hong, Nam / Senior Engineer

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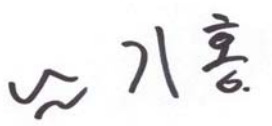
11.4.2 Test Result for Part 27 C (700LTE)

-. Test Date : December 17, 2012

-. Result : Pass

Temperature (˚C)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
-30	742 500 000	742 500 000	0.000 0	Within the Authorized Frequency block
-20		742 500 001	0.001 3	
-10		742 500 001	0.001 3	
0		742 500 000	0.000 0	
10		742 500 001	0.001 3	
20		742 500 002	0.002 7	
30		742 500 002	0.002 7	
40		742 500 002	0.002 7	
50		742 500 001	0.001 3	



Tested by: Ki-Hong, Nam / Senior Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

12. FREQUENCY STABILITY WITH VOLTAGE VARIATION

12.1 Operating environment

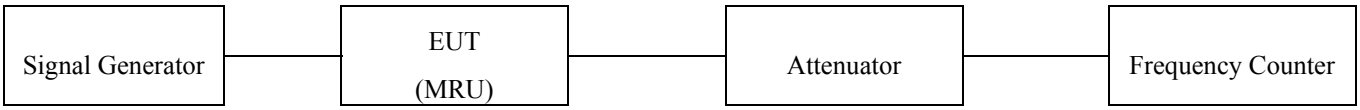
Temperature : 22 °C

Relative humidity : 52 % R.H.

12.2 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the power meter or spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable unmodulation.

The RF output port of the EUT was connected to the input of the spectrum analyzer. The signal generator was set to center frequency for each band with an un-modulated signal. The voltage of EUT set to 115 % of the nominal value and then was reduced to 85 % of nominal voltage. The output frequency was recorded at each step.



12.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
☐ -	8564E	HP	Spectrum Analyzer	3650A00756	Apr. 14, 2012 (1Y)
■ -	53152A	HP	Frequency Counter	US39270295	Dec. 10, 2012 (1Y)
■ -	SMJ100A	R/S	Signal Generator	101038	Feb. 02, 2012 (1Y)
☐ -	FSP	R/S	Spectrum Analyzer	100017	Mar. 12, 2012 (1Y)
■ -	67-30-43	Aeroflex Weinschel	Power Attenuator	CA5760	Dec. 10, 2012 (1Y)
■ -	DH-60	Dea Kwang Elec.	Slidacs	N/A	Apr. 05, 2012 (1Y)
■ -	PAS60-12	KIKISUI Elec.	DC Power Supply	CA5760	Apr. 05, 2012 (1Y)

All test equipment used is calibrated on a regular basis.

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

12.4 Test data

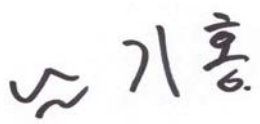
12.4.1 Test Result for 27 C (AWS)

12.4.1.1 Input Voltage: AC 120 V

-. Test Date : December 12, 2012

-. Result : PASSED

Voltage (Vac)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
138 (115 %)	2 132 500 000	2 132 500 002	0.000 9	Within the Authorized Frequency block
120 (100 %)		2 132 500 000	0.000 0	
102 (85 %)		2 132 500 001	0.000 5	



Tested by: Ki-Hong, Nam / Senior Engineer

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12.4.1.2 Input Voltage: DC -48 V

-. Test Date : December 12, 2012

-. Result : PASSED

Voltage (Vdc)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
- 55.2 (115 %)	2 132 500 000	2 132 500 002	0.000 9	Within the Authorized Frequency block
- 48 (100 %)		2 132 500 000	0.000 0	
- 40.8 (85 %)		2 132 500 002	0.000 9	

Tested by: Ki-Hong, Nam / Senior Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

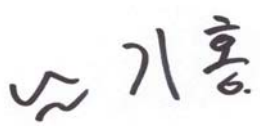
12.4.2 Test Result for Part 27 C (700LTE)

12.4.2.1 Input Voltage: AC 120 V

-. Test Date : December 17, 2012

-. Result : PASSED

Voltage (Vac)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
138 (115 %)	742 500 000	742 500 001	0.001 3	Within the Authorized Frequency block
120 (100 %)		742 500 002	0.002 7	
102 (85 %)		742 500 001	0.001 3	



Tested by: Ki-Hong, Nam / Senior Engineer

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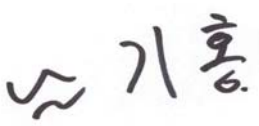
12.4.2.2 Input Voltage: DC -48 V

-. Test Date : December 17, 2012

-. Result : PASSED

Voltage (Vdc)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
- 55.2 (115 %)	742 500 000	742 500 000	0.000 0	Within the Authorized Frequency block
- 48 (100 %)		742 500 002	0.002 7	
- 40.8 (85 %)		742 500 001	0.001 3	



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13. CONDUCTED EMISSION TEST

13.1 Operating environment

Temperature : 23 °C

Relative humidity : 45 % R.H.

13.2 Test set-up

The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50 Ω / 50 μH + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

13.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	ESHS10	Rohde & Schwarz	EMI Test Receiver	834467/007	Jun. 21, 2012 (1Y)
■ -	NSLK 8128	Schwarzbeck	LISN	8128-216	Jun. 11, 2012 (1Y)
☐ -	3825/2	EMCO	LISN	9109-1867	May 30, 2012 (1Y)

All test equipment used is calibrated on a regular basis.

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13.4 Test data

13.4.1 Test Result for Part 27 C (AWS)

-. Test Date : December 11, 2012

-. Resolution bandwidth : 9 kHz

-. Frequency range : 0.15 MHz ~ 30 MHz

-. Test Result : Passed by 23.13 dB at 3.33 MHz

Frequency (MHz)	Line	Peak (dBμV)		Margin (dB)
		Emission level	Q.P Limits	
0.20	H	52.47	79.00	26.53
0.21	N	52.07	79.00	26.93
3.20	N	49.29	73.00	23.71
3.33	H	49.87	73.00	23.13
13.57	N	46.00	73.00	27.00
19.18	H	45.48	73.00	27.52
Frequency (MHz)	**Line**	**Average (dBμV)**		**Margin (dB)**
		Emission level	**Limits**	
-	-	-	-	-
-	-	-	-	-

Line Conducted Emissions Tabulated Data

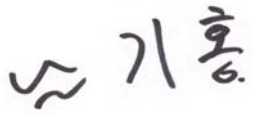
Remark : "H": Hot Line, "N": Neutral Line

Margin = Limits – Emission level

Emission level = Receiver reading value + Cable loss + Insertion loss of LISN

Average mode was not measured, because peak values were under the average limit.

See next page for an overview sweep performed with peak detector modes.



Tested by: Ki-Hong, Nam / Senior Engineer

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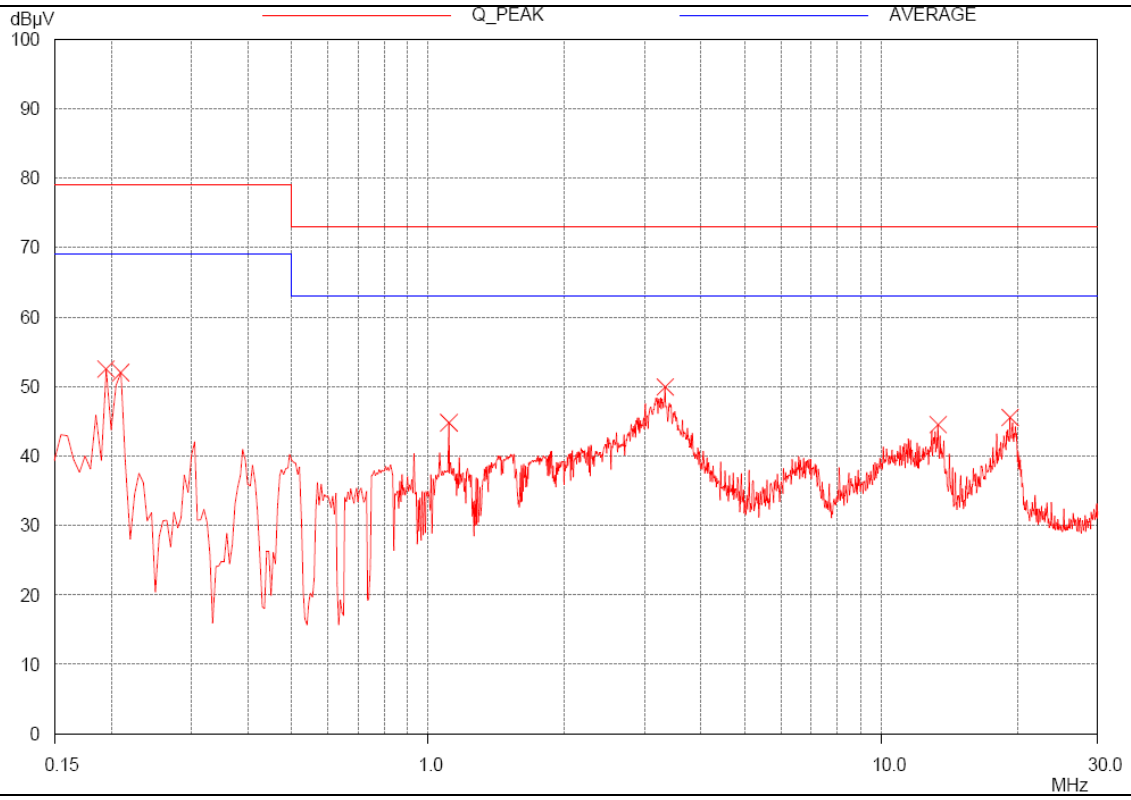
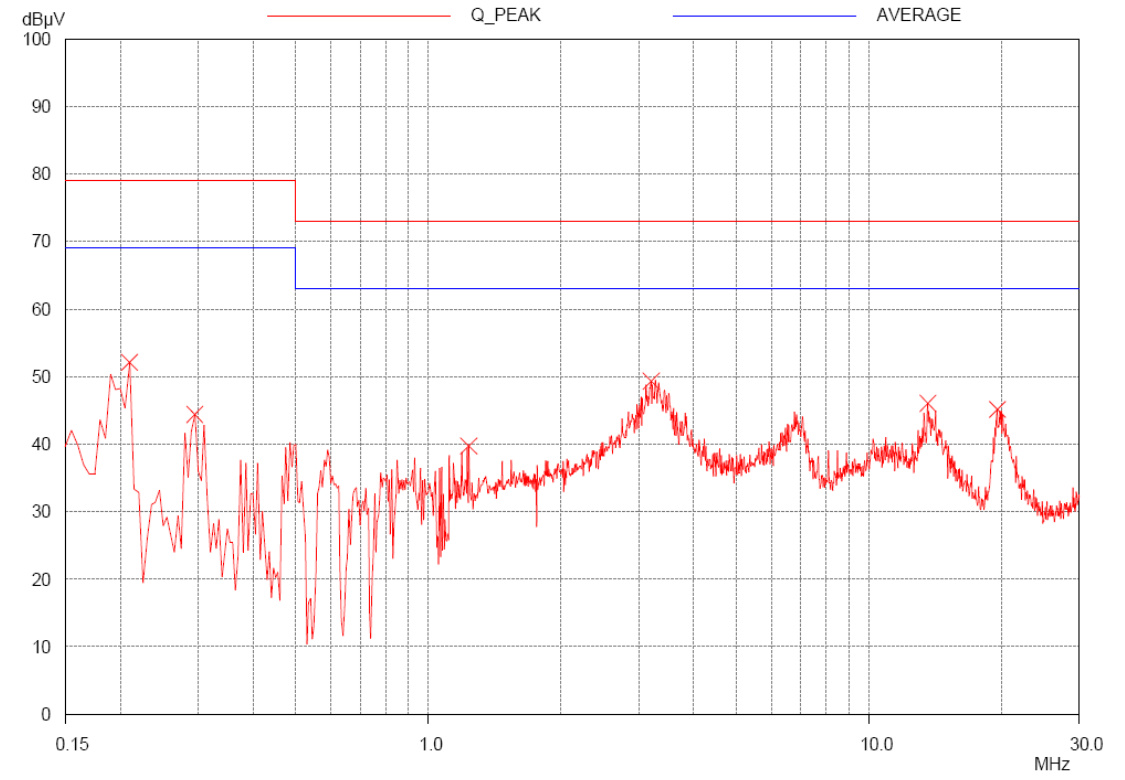


HOT LINE



NEUTRAL LINE

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13.4.2 Test Result for Part 27 C (700LTE)

-. Test Date : December 11, 2012

-. Resolution bandwidth : 9 kHz

-. Frequency range : 0.15 MHz ~ 30 MHz

-. Test Result : Passed by 22.95 dB at 3.23 MHz

Frequency (MHz)	Line	Peak (dBμV)		Margin (dB)
		Emission level	Q.P Limits	
0.19	N	54.42	79.00	24.58
0.20	H	54.77	79.00	24.23
3.21	H	48.75	73.00	24.25
3.23	N	50.05	73.00	22.95
13.56	N	46.46	73.00	26.54
19.33	H	44.72	73.00	28.28
Frequency (MHz)	**Line**	**Average (dBμV)**		**Margin (dB)**
		Emission level	**Limits**	
-	-	-	-	-
-	-	-	-	-

Line Conducted Emissions Tabulated Data

Remark : "H": Hot Line, "N": Neutral Line

Margin = Limits – Emission level

Emission level = Receiver reading value + Cable loss + Insertion loss of LISN

Average mode was not measured, because peak values were under the average limit.

See next page for an overview sweep performed with peak detector modes.

Tested by: Ki-Hong, Nam / Senior Engineer

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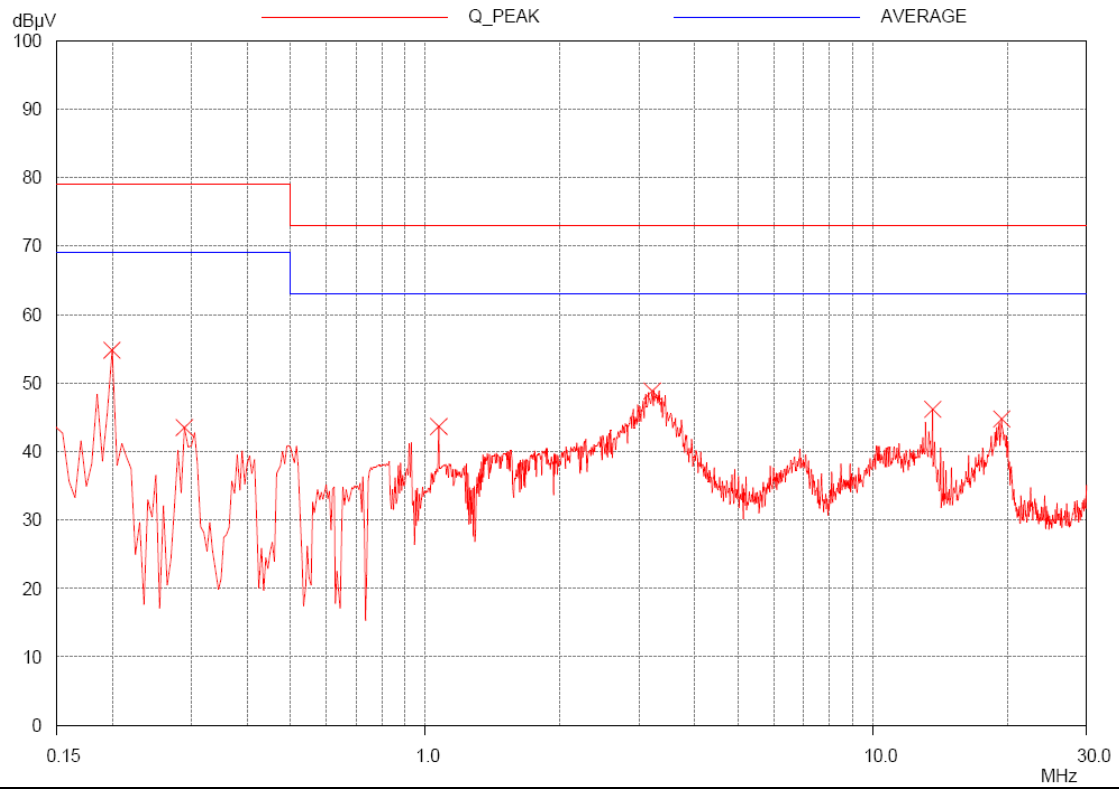
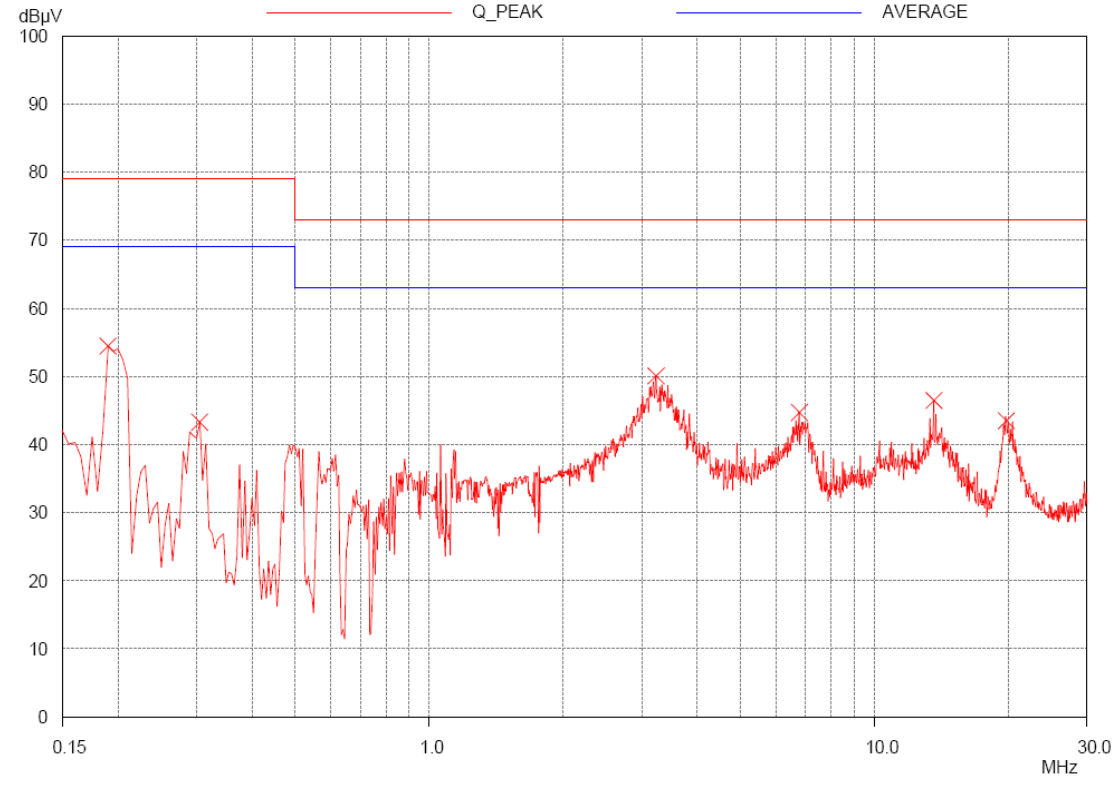


HOT LINE



NEUTRAL LINE

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14. MAXIMUM PERMISSIBLE EXPOSURE

14.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment are f/1500 mW/cm² for the frequency range between 300 MHz and 1 500 MHz and 1.0 mW/cm² for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a 1 mW/cm² exposure is calculated as follows:

$E = \sqrt{(30 * P * G)} / d$, and $S = E^2 / Z = E^2 / 377$, because 1 mW/cm² = 10 W/m²

Where

S = Power density in mW/cm², Z = Impedance of free space, 377 Ω

E = Electric filed strength in V/m, G = Numeric antenna gain, and d = distance in meter

Combing equations and rearranging the terms to express the distance as a function of the remaining variable

$d = \sqrt{(30 * P * G) / (377 * 10 S)}$

Changing to units of mW and cm, using P (mW) = P (W) / 1 000, d (cm) = 0.01 * d (m)

$d = 0.282 * \sqrt{(P * G) / S}$

Where

d = distance in cm, P = Power in mW, G = Numeric antenna gain, and S = Power density in mW/cm²

14.2 Calculated MPE Safe Distance

14.2.1 For Part 27 C (AWS-1)

According to above equation, the following result was obtained.

Peak Output Power		Antenna Gain		Safe Distance	Power Density (mW/cm²)	FCC Limit
(dBm)	(mW)	Log	Linear	(cm)	@ 20 cm Separation	(mW/cm²)
28.0	631.0	2.0	1.58	8.92	0.20	1.0

According to above table, safe safe distance, $D = 0.282 * \sqrt{631 * 1.58} = 8.92$ cm.

For getting power density at 20 cm separation in above table, following formula was used.

$S = P * G / (4\pi * R^2) = 631.0 * 1.58 / (4 * 3.14 * 20\text{^}2) = 0.20$

Where:

S = Power Density,
P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),
G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

Remark: The Power Density of the above table was calculated for single frequency.

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14.2.2 For Part 27 C (700LTE)

According to above equation, the following result was obtained.

Peak Output Power		Antenna Gain		Safe Distance	Power Density (mW/cm²)	FCC Limit
(dBm)	(mW)	Log	Linear	(cm)	@ 20 cm Separation	(mW/cm²)
28.0	631.0	2.0	1.58	12.80	0.20	0.485

According to above table, safe distance, $D = 0.282 * \sqrt{631 * 1.58/0.485} = 12.80$ cm.

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 631.0 * 1.58 / (4 * 3.14 * 20^2) = 0.20$$

Where:

S = Power Density,
P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),
G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

Remark: The Power Density of the above table was calculated for single frequency.

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