ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LICENSED TRANSMITTER

Test Report No.	**: W152R-D016**
AGR No.	**: A14DA-155**
Applicant	**: Airpoint Co., Ltd.**
Address	**: MIGUN TECHNO WORLD 2-CHA, 533-1, Yongsan-dong, Yuseong-gu, Daejeon, 305-500, South Korea**
Manufacturer	**: Airpoint Co., Ltd.**
Address	**: MIGUN TECHNO WORLD 2-CHA, 533-1, Yongsan-dong, Yuseong-gu, Daejeon, 305-500, South Korea**
Type of Equipment	**: ICS Repeater System**
FCC ID.	**: WYFIRES7002010**
Model Name	**: IRES-700US10-20**
Serial number	**: N/A**
Total page of Report	**: 139 pages (including this page)**
Date of Incoming	**: December 10, 2014**
Date of issue	**: February 27, 2015**

SUMMARY

The equipment complies with the regulation; **FCC CFR 47 Part 90 Subpart R, B9B Industrial Booster.**

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.

Reviewed by: Ki-Hong, Nam / Asst, Chief Engineer
ONETECH Corp.

Approved by: Sung-Ik, Han/ Managing Director
ONETECH Corp.

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

CONTENTS

PAGE

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Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
W152R-D016	February 27, 2015	Initial Issue	All

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1. VERIFICATION OF COMPLIANCE

APPLICANT : Airpoint Co., Ltd.
ADDRESS : MIGUN TECHNO WORLD 2-CHA, 533-1, Yongsan-dong, Yuseong-gu, Daejeon, 305-500, South Korea
CONTACT PERSON : Jung-nam, Lim / Research Manager
TELEPHONE NO : +82-42-484-5460
FCC ID : WYFIRES7002010
MODEL NAME : IRES-700US10-20
SERIAL NUMBER : N/A
DATE : February 27, 2015

EQUIPMENT CLASS	**B9B- Part 90 Industrial Booster**
EQUIPMENT DESCRIPTION	ICS Repeater System
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	TIA 603-C, the booster KDB and the power measurement KDB
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC 47CFR Part 90
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	No
FINAL TEST WAS CONDUCTED ON	3 m, Semi Anechoic Chamber

-. 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, 90.542(a)	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
2.1051, 90.543(c)	Band Edge	Met the Limit / PASS
2.1051, 90.543(c)(e)(f)	Spurious Emissions at Antenna Terminals	Met the Limit / PASS
2.1047, 2.1051, 90.210(b)	Emission Mask	Met the Limit / PASS
2.1053, 90.219(e)	Field strength of Spurious Radiation	Met the Limit / PASS
2.1055, 90.539(d)	Frequency Stability with Temperature variation	Met the requirement / PASS
2.1055, 90.539(d)	Frequency stability with primary voltage variation	Met the requirement / PASS
90.219(e)(2)	Noise Figure	Met the Limit / PASS
1.1307(b)	RF Exposure	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 EIA/TIA-603-C : 2004 was performed at a distance of 3 m from EUT to the antenna.

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2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 301-14, Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-862 Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-4617/ G-666/ T-1842 IC (Industry Canada) – Registration No. Site# 3736-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation No. 85

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

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3. GENERAL INFORMATION

3.1 Product Description

The Airpoint Co., Ltd., Models IRES-700US10-20 (referred to as the EUT in this report) are ICS Repeater System. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE			ICS Repeater System
LIST OF EACH OSC. or CRY. FREQ.(FREQ. >= 1 MHz)			38.4 MHz
EMISSION DESIGNATOR			G7D(LTE:QPSK), D7W(LTE:16QAM, 64QAM)
OPERATING FREQUENCY	LTE 5 M - Low	Downlink	758 MHz ~ 763 MHz
		Uplink	788 MHz ~ 793 MHz
	LTE 5 M - High	Downlink	763 MHz ~ 768 MHz
		Uplink	793 MHz ~ 798 MHz
	LTE 10 M (LTE 5 M x2)	Downlink	758 MHz ~ 768 MHz
		Uplink	788 MHz ~ 798 MHz
CHANNEL SEPARATION			LTE (5 MHz, 10 MHz)
RF OUTPUT POWER	LTE 5 M - Low	Downlink	43.03 dBm
		Uplink	30.07 dBm
	LTE 5 M - High	Downlink	43.05 dBm
		Uplink	30.03 dBm
	LTE 10 M (LTE 5 M x2)	Downlink	43.04 dBm
		Uplink	30.04 dBm
ELECTRICAL RATING			DC -48 V
OPERATING TEMPERATURE			-10 ℃ ~ 50 ℃

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

-. None

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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
IRES-700US10-20	Airpoint Co., Ltd.	WYFIRES-70010W	ICS Repeater System (EUT)	Signal Generator
SMJ100A	R/S	N/A	Signal Generator	EUT
SMBV100A	R/S	N/A	VECTOR SIGNAL GENERATOR	EUT
SMB100A	R/S	N/A	SIGNAL GENERATOR	EUT
FSV30	R/S	N/A	Spectrum Analyzer	EUT
R510	LG	N/A	Notebook	EUT
6032A	HP	N/A	DC Power Supply	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. 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. Mode: Downlink

Modulation	Channel	Frequency
LTE 5 M - Low	QPSK	760.50
	16 QAM	
	64 QAM	
LTE 5 M - High	QPSK	765.50
	16 QAM	
	64 QAM	
LTE 10 M	QPSK	763.00
	16 QAM	
	64 QAM	

2. Mode: Uplink

Modulation	Channel	Frequency
LTE 5 M - Low	QPSK	790.50
	16 QAM	
	64 QAM	
LTE 5 M - High	QPSK	795.50
	16 QAM	
	64 QAM	
LTE 10 M	QPSK	793.00
	16 QAM	
	64 QAM	

4. EUT MODIFICATIONS

-. None

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5. RF POWER OUTPUT at ANTENNA TERMINAL

5.1 Operating environment

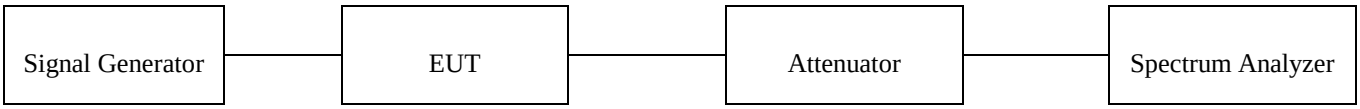
Temperature : 25 ℃

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 Center Frequency (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. (Interval)
■ -	SMJ100A	Rohde & Schwarz	Signal Generator	101038	Oct. 08, 2014 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014(1Y)

All test equipment used is calibrated on a regular basis.

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5.4 Test data for Part 2.1046, 90.542(a)

(a) The following power limits apply to the 758-768/788-798 MHz band:

(1) Fixed and base stations transmitting a signal in the 758-768 MHz band with an emission bandwidth of 1 MHz or less must not exceed an ERP of 1000 watts and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts ERP in accordance with Table 1 of this section.

(2) Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal in the 758-768 MHz band with an emission bandwidth of 1 MHz or less must not exceed an ERP of 2000 watts and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts ERP in accordance with Table 2 of this section.

(3) Fixed and base stations transmitting a signal in the 758-768 MHz band with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP accordance with Table 3 of this section.

(4) Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal in the 758-768 MHz band with an emission bandwidth greater than 1 MHz must not exceed an ERP of 2000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts/MHz ERP in accordance with Table 4 of this section.

(5) Licensees of fixed or base stations transmitting a signal in the 758-768 MHz band at an ERP greater than 1000 watts must comply with the provisions set forth in paragraph (b) of this section.

(6) Control stations and mobile stations transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 30 watts ERP.

(7) Portable stations (hand-held devices) transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 3 watts ERP.

(8) For transmissions in the 758-768 MHz and 788-798 MHz bands, licensees may employ equipment operating in compliance with either of the following measurement techniques:

(i) The maximum composite transmit power shall be measured over any interval of continuous transmission using instrumentation calibrated in terms of RMS-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, etc., so as to obtain a true maximum composite measurement for the emission in question over the full bandwidth of the channel.

(ii) A Commission-approved average power technique.

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Table 1 to §90.542(a)—Permissible Power and Antenna Heights for Base and Fixed Stations in the 758-768 MHz Band Transmitting a Signal With an Emission Bandwidth of 1 MHz or Less

Antenna height (AAT) in meters (feet)	Effective radiated power (ERP) (watts)
Above 1372 (4500)	65
Above 1220 (4000) To 1372 (4500)	70
Above 1067 (3500) To 1220 (4000)	75
Above 915 (3000) To 1067 (3500)	100
Above 763 (2500) To 915 (3000)	140
Above 610 (2000) To 763 (2500)	200
Above 458 (1500) To 610 (2000)	350
Above 305 (1000) To 458 (1500)	600
Up to 305 (1000)	1000

Table 2 to §90.542(a)—Permissible Power and Antenna Heights for Base and Fixed Stations in the 758-768 MHz Band Transmitting a Signal With an Emission Bandwidth of 1 MHz or Less

Antenna height (AAT) in meters (feet)	Effective radiated power (ERP) (watts)
Above 1372 (4500)	130
Above 1220 (4000) To 1372 (4500)	140
Above 1067 (3500) To 1220 (4000)	150
Above 915 (3000) To 1067 (3500)	200
Above 763 (2500) To 915 (3000)	280
Above 610 (2000) To 763 (2500)	400
Above 458 (1500) To 610 (2000)	700
Above 305 (1000) To 458 (1500)	1200
Up to 305 (1000)	2000

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Table 3 to §90.542(a)—Permissible Power and Antenna Heights for Base and Fixed Stations in the 758-768 MHz Band Transmitting a Signal With an Emission Bandwidth Greater Than 1 MHz

Antenna height (AAT) in meters (feet)	Effective radiated power (ERP) per MHz (watts/MHz)
Above 1372 (4500)	65
Above 1220 (4000) To 1372 (4500)	70
Above 1067 (3500) To 1220 (4000)	75
Above 915 (3000) To 1067 (3500)	100
Above 763 (2500) To 915 (3000)	140
Above 610 (2000) To 763 (2500)	200
Above 458 (1500) To 610 (2000)	350
Above 305 (1000) To 458 (1500)	600
Up to 305 (1000)	1000

Table 4 to §90.542(a)—Permissible Power and Antenna Heights for Base and Fixed Stations in the 758-768 MHz Band Transmitting a Signal With an Emission Bandwidth Greater Than 1 MHz

Antenna height (AAT) in meters (feet)	Effective radiated power (ERP) per MHz (watts/MHz)
Above 1372 (4500)	130
Above 1220 (4000) To 1372 (4500)	140
Above 1067 (3500) To 1220 (4000)	150
Above 915 (3000) To 1067 (3500)	200
Above 763 (2500) To 915 (3000)	280
Above 610 (2000) To 763 (2500)	400
Above 458 (1500) To 610 (2000)	700
Above 305 (1000) To 458 (1500)	1200
Up to 305 (1000)	2000

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5.4.1 Test data for Downlink (LTE 5 M)

-. Test Date : December 22, 2014

-. Measurement Function : Channel Power

-. Detector Mode : RMS detector

-. Test Result : Pass

Modulation	Channel	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Output Power (W)
LTE 5 M - Low	QPSK	760.50	-57.00	43.02	20.044 720
	16 QAM		-57.02	42.99	19.906 733
	64 QAM		-57.01	43.03	20.090 928
LTE 5 M - High	QPSK	765.50	-57.02	43.02	20.044 720
	16 QAM		-56.98	43.05	20.183 664
	64 QAM		-57.00	43.01	19.998 619

Tested by: hyung-kwon, Oh / Project Engineer

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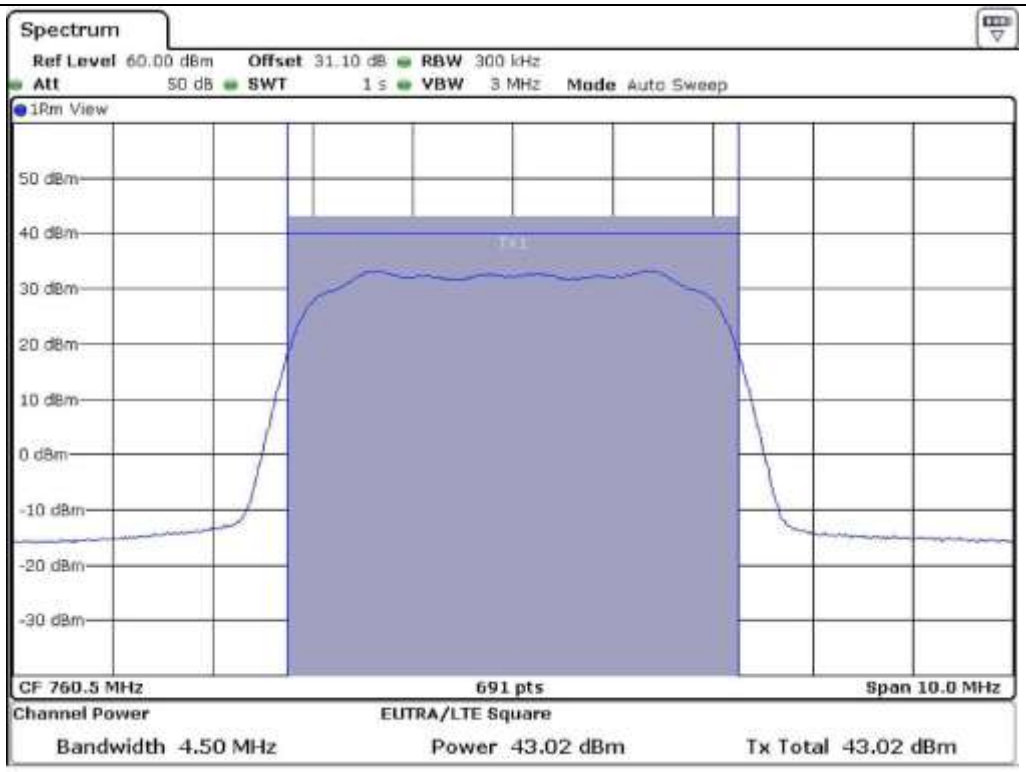
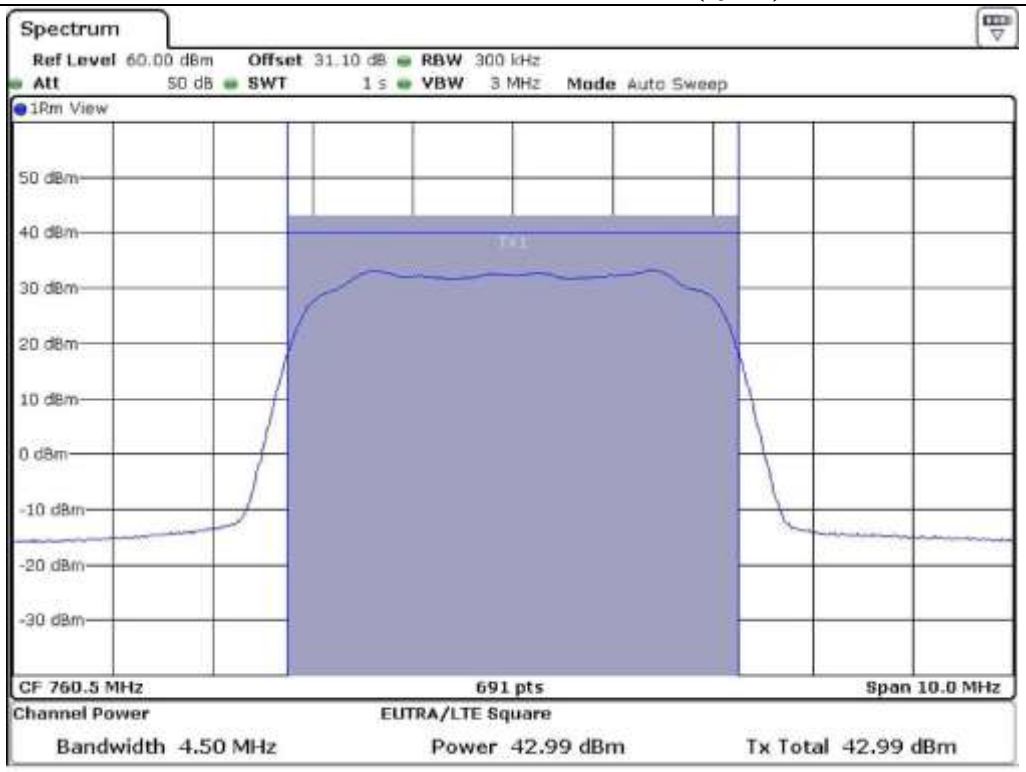


LTE 5 M – Low – RF POWER OUTPUT (QPSK)



LTE 5 M - Low – RF POWER OUTPUT (16 QAM)

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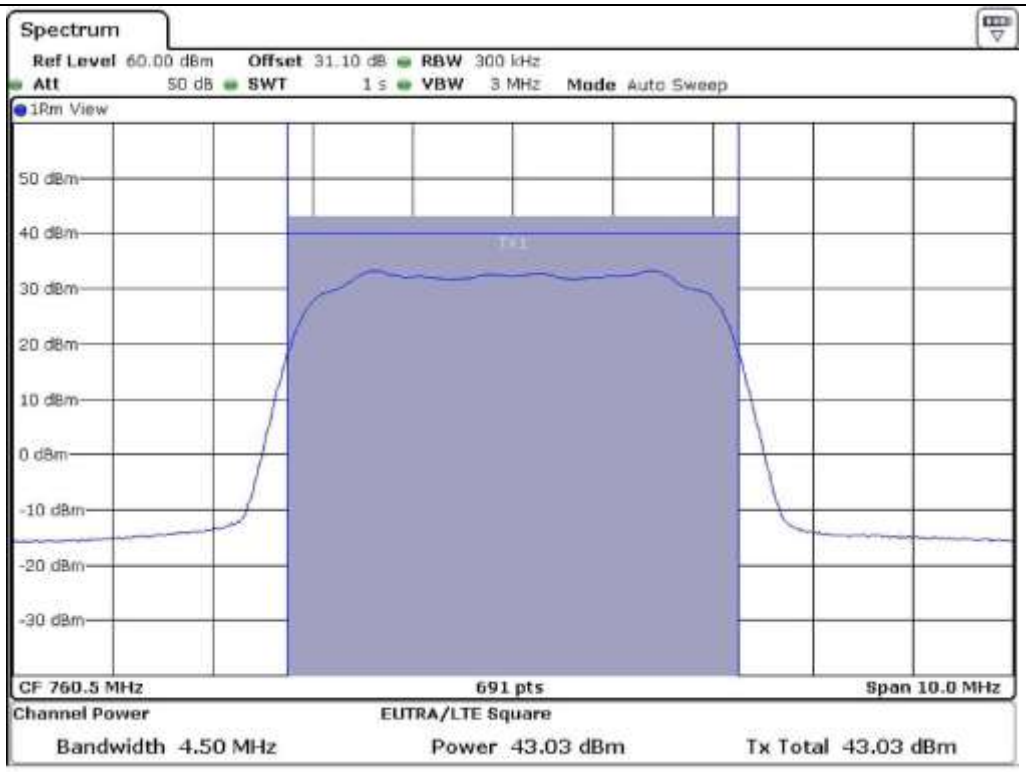

LTE 5 M - Low – RF POWER OUTPUT (64 QAM)

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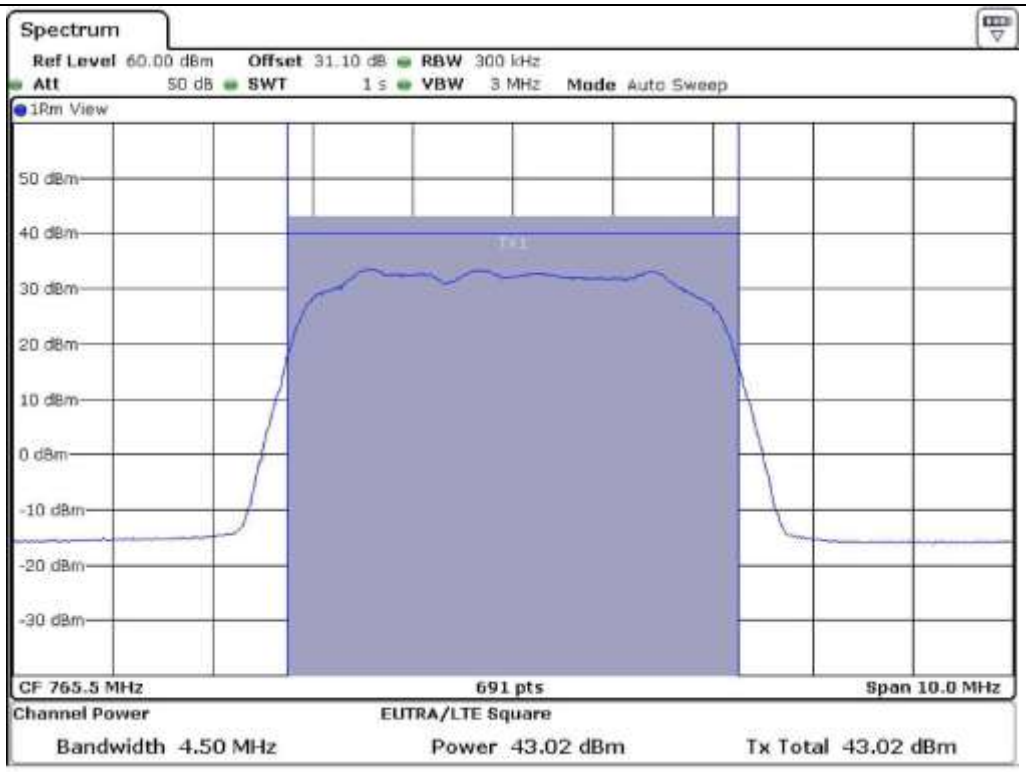
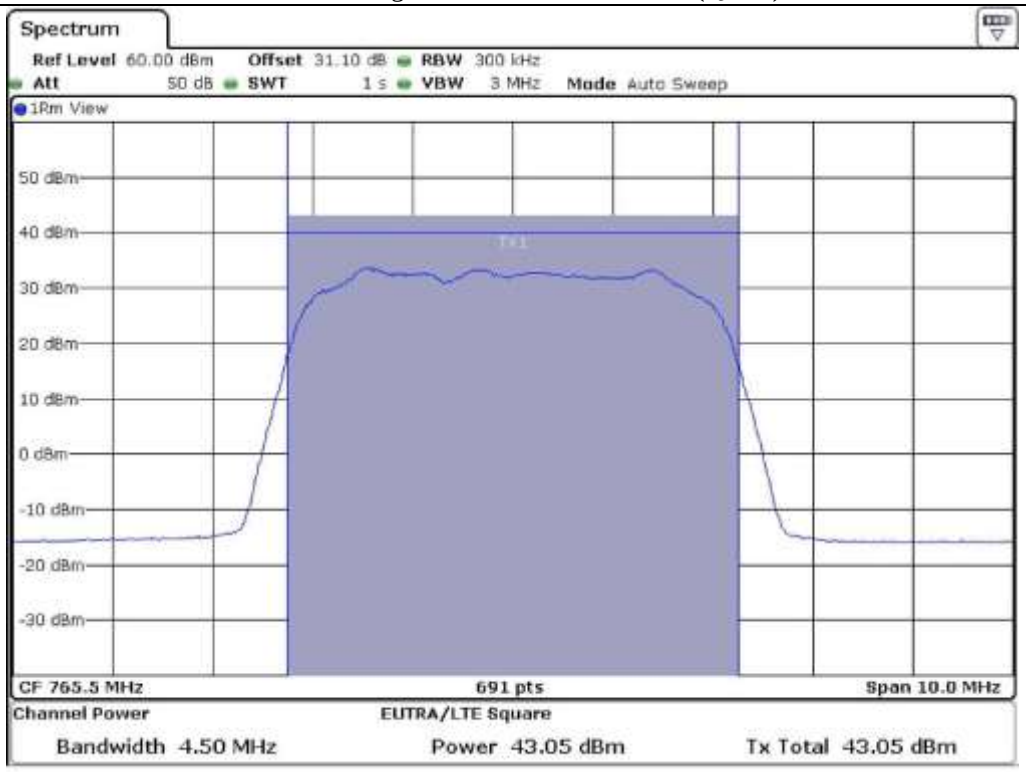


LTE 5 M - High – RF POWER OUTPUT (QPSK)



LTE 5 M - High – RF POWER OUTPUT (16 QAM)

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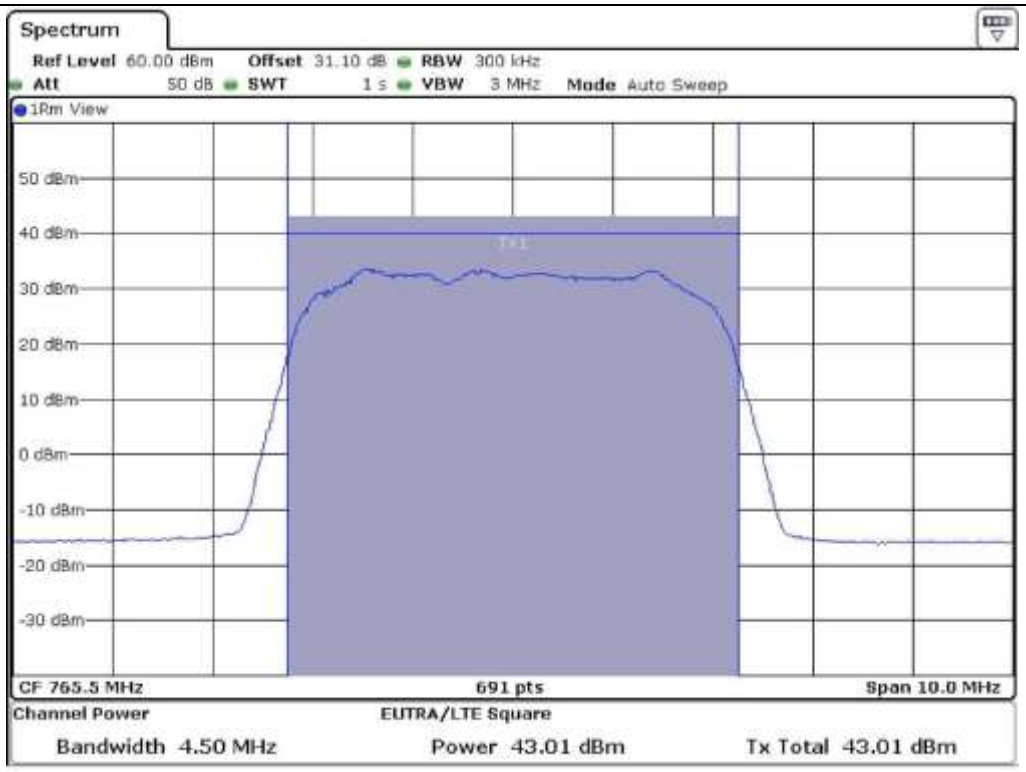

LTE 5 M - High – RF POWER OUTPUT (64 QAM)

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5.4.2 Test data for Uplink (LTE 5 M)

-. Test Date : December 22, 2014

-. Measurement Function : Channel Power

-. Detector Mode : RMS detector

-. Test Result : Pass

Modulation	Channel	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Output Power (W)
LTE 5 M - Low	QPSK	790.50	-70.01	30.07	1.016 249
	16 QAM		-70.03	29.99	0.997 700
	64 QAM		-69.98	30.05	1.011 579
LTE 5 M - High	QPSK	795.50	-70.00	30.03	1.006 932
	16 QAM		-69.99	29.99	0.997 700
	64 QAM		-70.02	30.00	1.000 000

Tested by: hyung-kwon, Oh / Project Engineer

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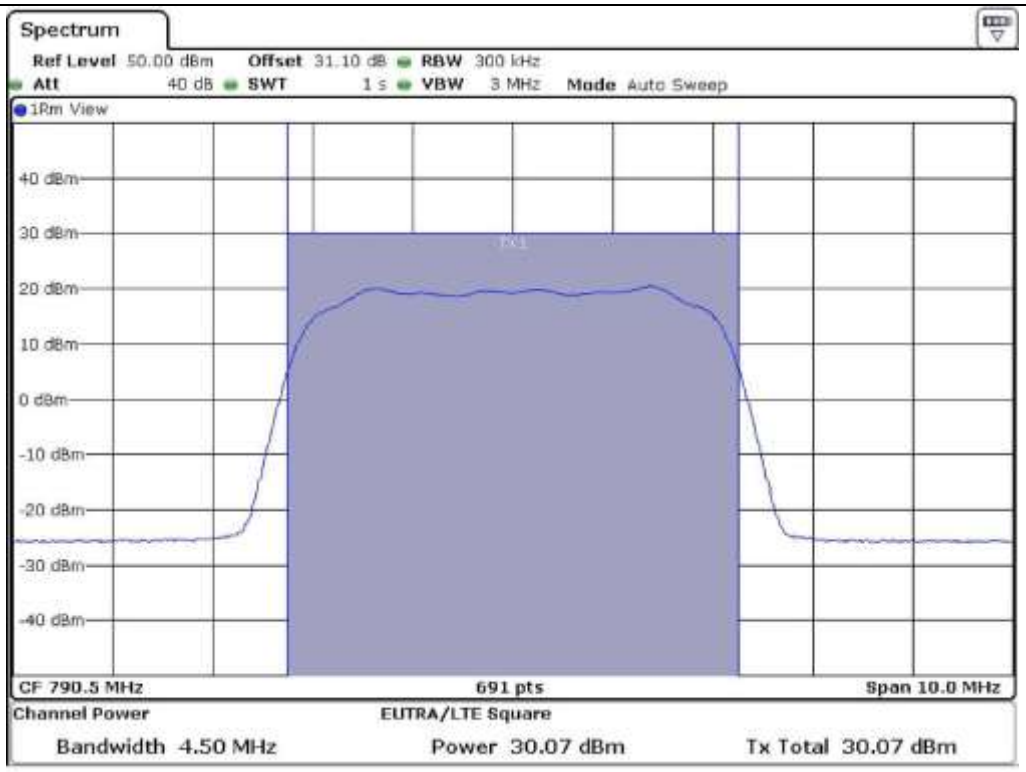
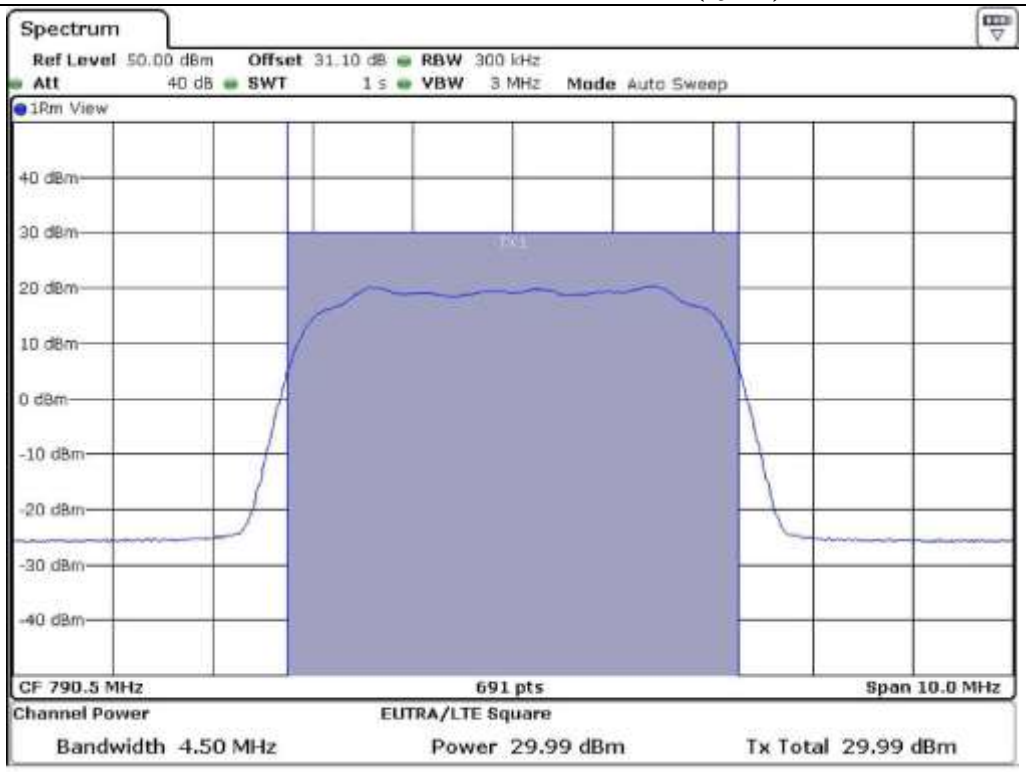


LTE 5 M – Low – RF POWER OUTPUT (QPSK)



LTE 5 M - Low – RF POWER OUTPUT (16 QAM)

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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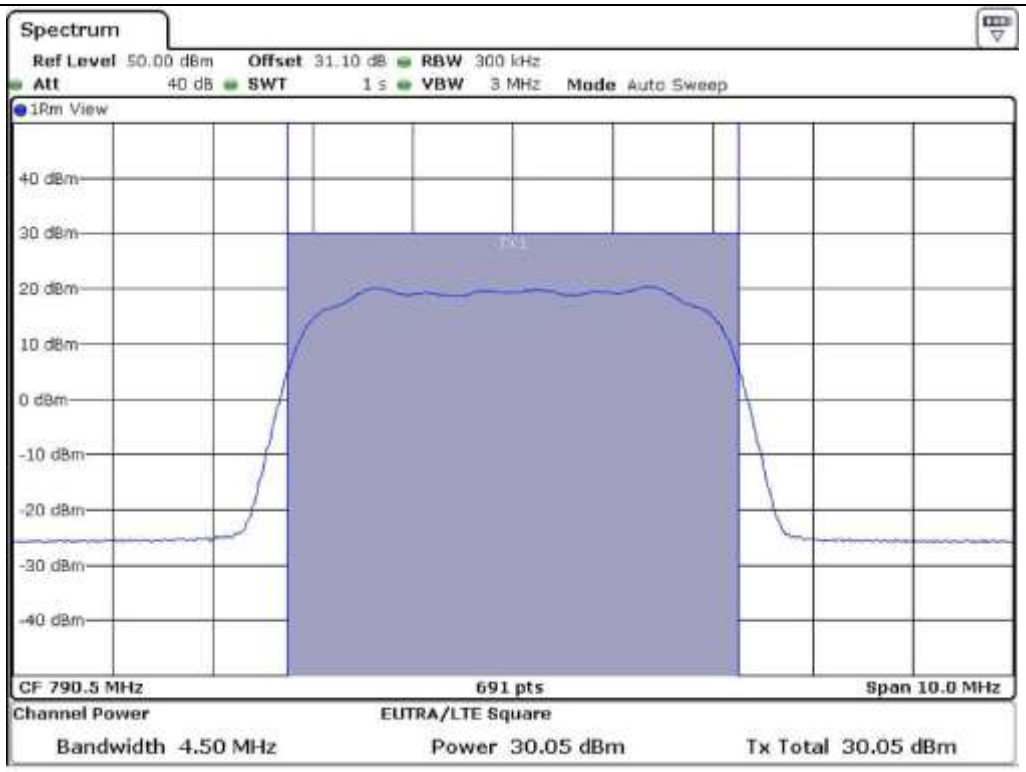

LTE 5 M - Low – RF POWER OUTPUT (64 QAM)

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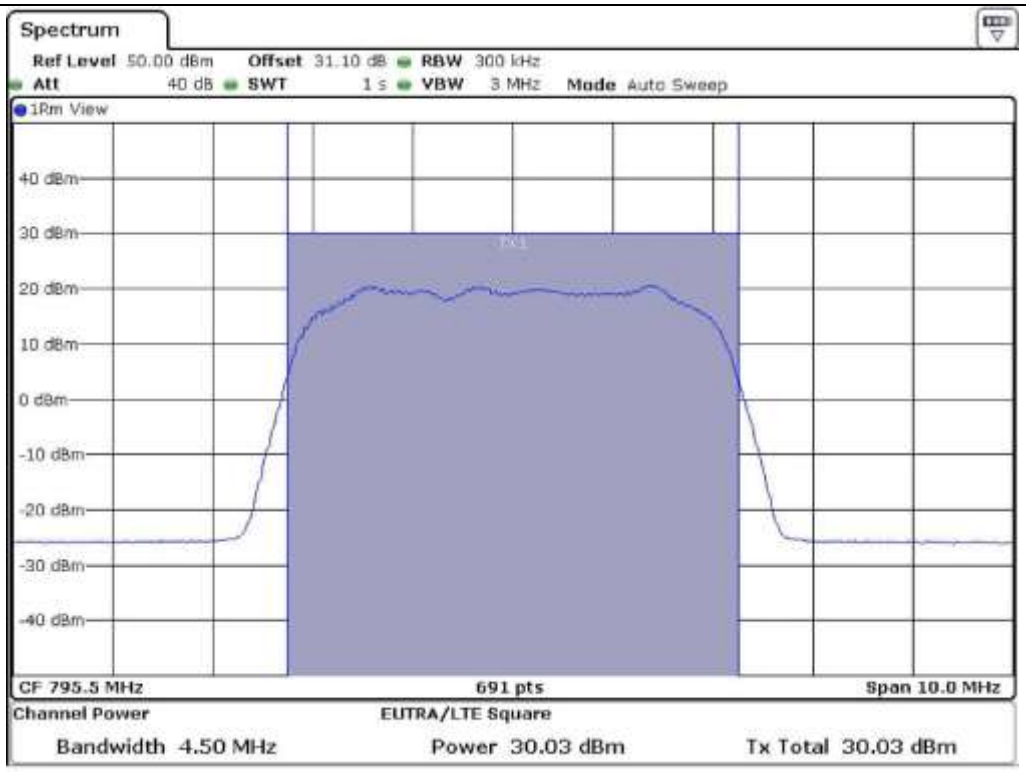
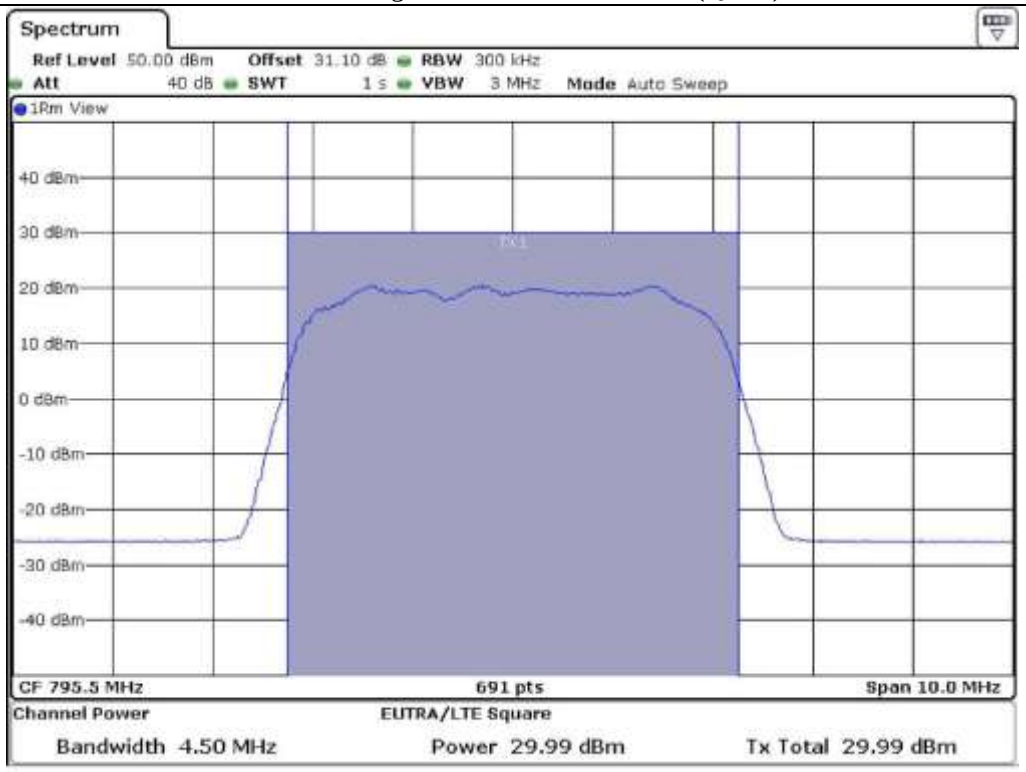


LTE 5 M - High – RF POWER OUTPUT (QPSK)



LTE 5 M - High – RF POWER OUTPUT (16 QAM)

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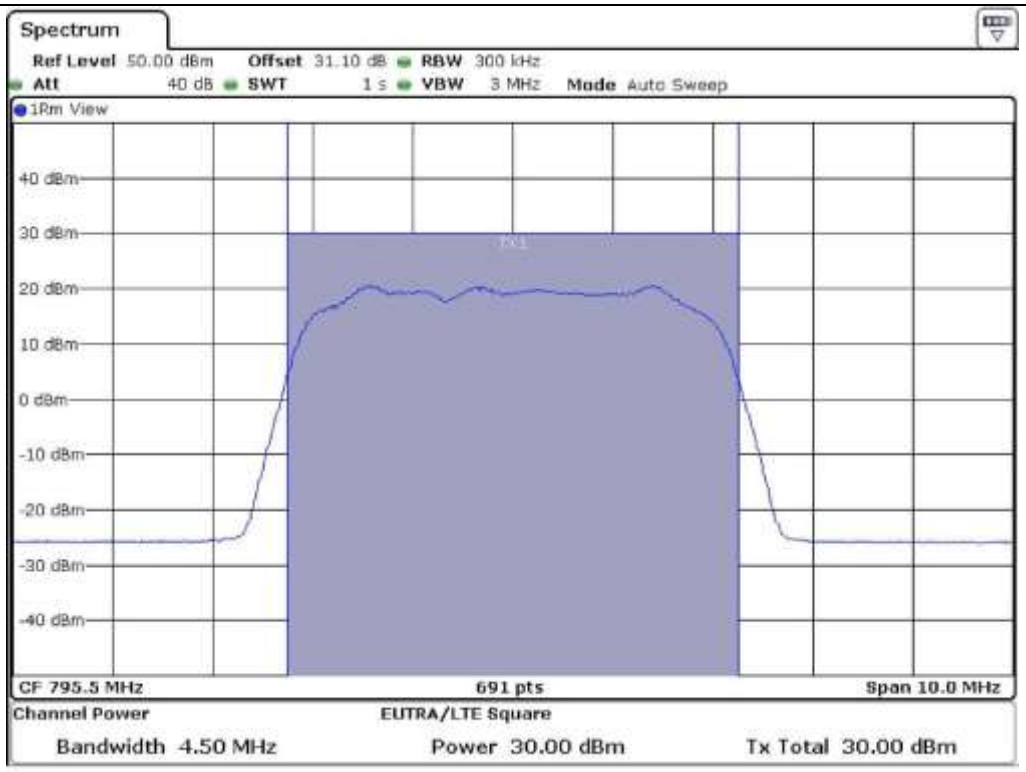

LTE 5 M - High – RF POWER OUTPUT (64 QAM)

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5.4.3 Test data for Downlink (LTE 10 M)

-. Test Date : December 22, 2014

-. Measurement Function : Channel Power

-. Detector Mode : RMS detector

-. Test Result : Pass

Modulation	Channel	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Output Power (W)
LTE 10 M	QPSK	763.00	-56.99	43.02	20.044 720
	16 QAM		-57.00	43.04	20.137 242
	64 QAM		-56.98	43.01	19.998 619

Tested by: hyung-kwon, Oh / Project Engineer

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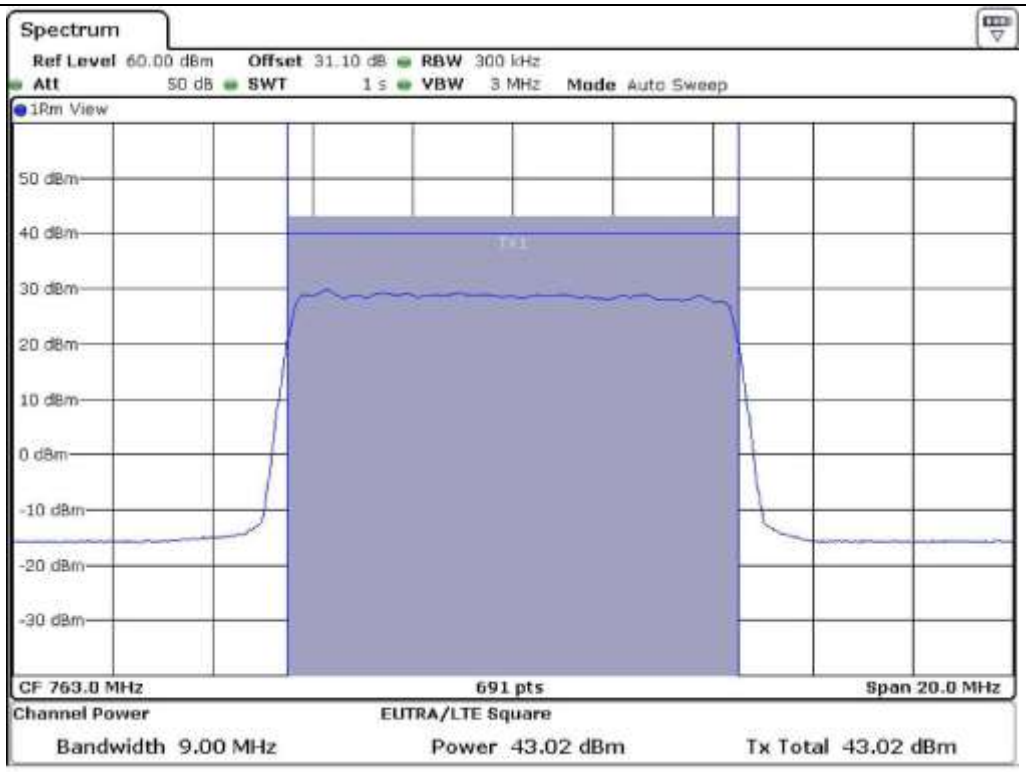
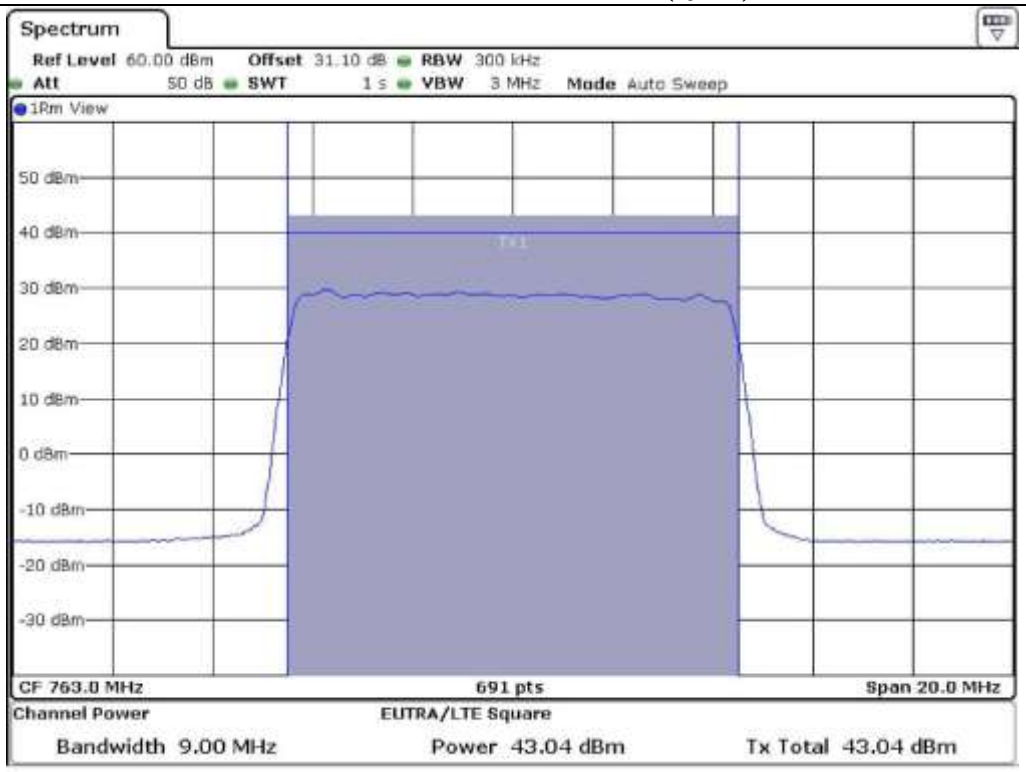


LTE 10 M – RF POWER OUTPUT (QPSK)



LTE 10 M – RF POWER OUTPUT (16 QAM)

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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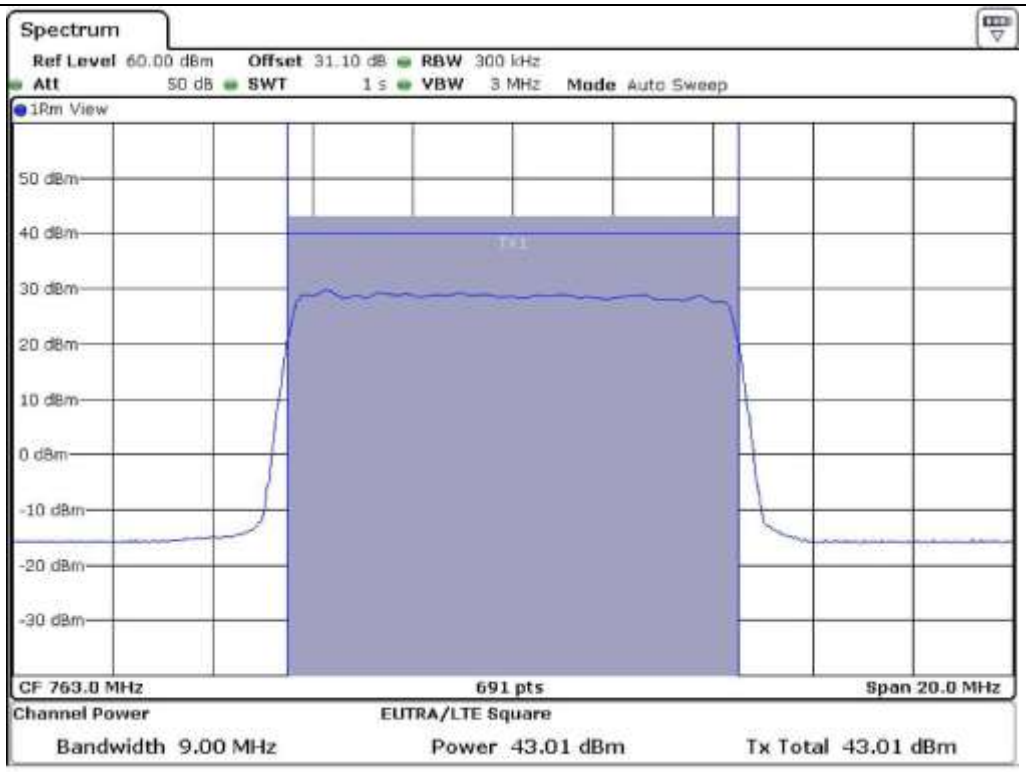

LTE 10 M – RF POWER OUTPUT (64 QAM)

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5.4.4 Test data for Uplink (LTE 10 M)

-. Test Date : December 22, 2014

-. Measurement Function : Channel Power

-. Detector Mode : RMS detector

-. Test Result : Pass

Modulation	Channel	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Output Power (W)
LTE 10 M	QPSK	793.00	-70.02	30.03	1.006 932
	16 QAM		-70.00	29.97	0.993 116
	64 QAM		-69.98	30.04	1.009 253

Tested by: hyung-kwon, Oh / Project Engineer

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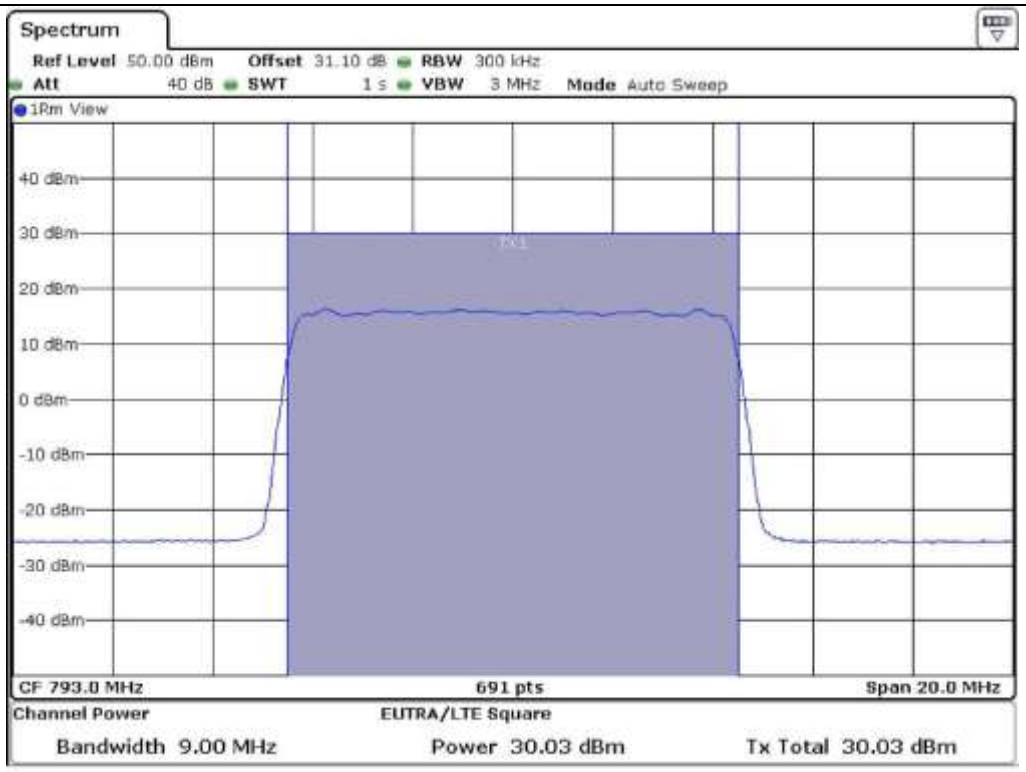
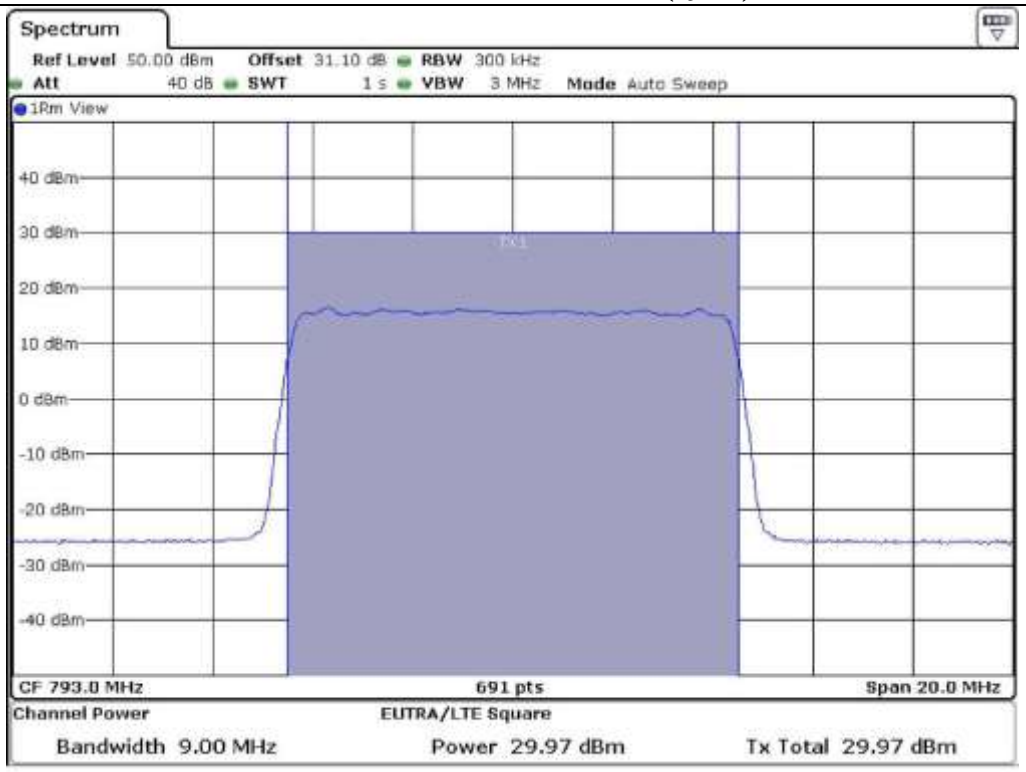


LTE 10 M – RF POWER OUTPUT (QPSK)



LTE 10 M – RF POWER OUTPUT (16 QAM)

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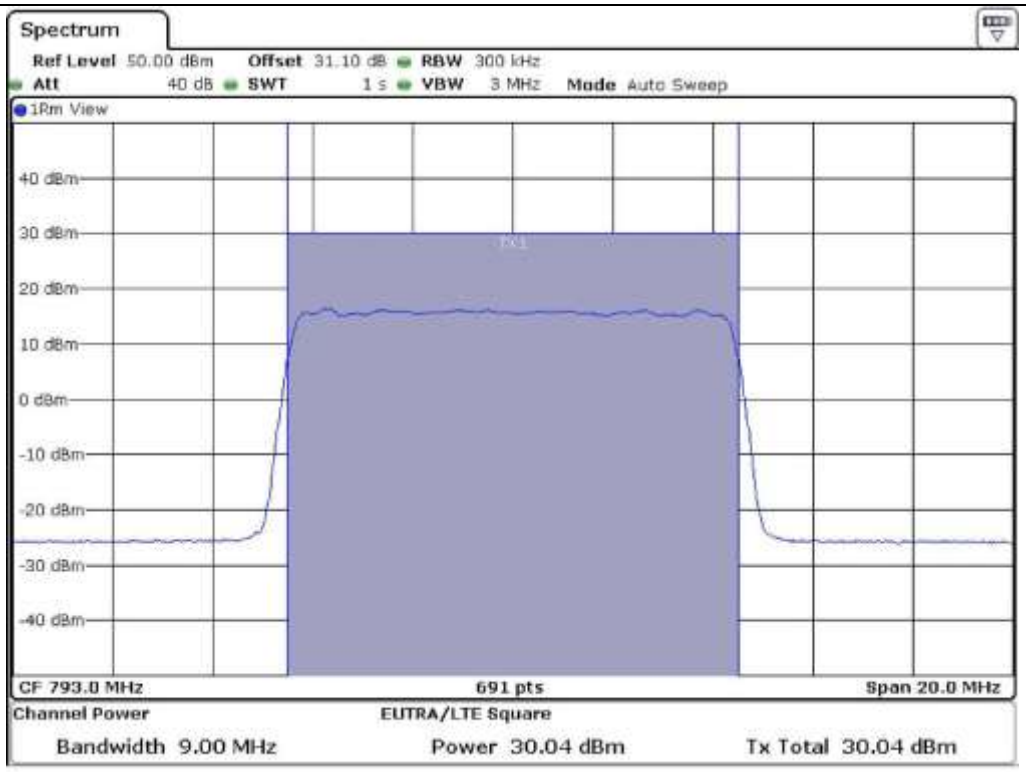

LTE 10 M – RF POWER OUTPUT (64 QAM)

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6. OCCUPIED BANDWIDTH

6.1 Operating environment

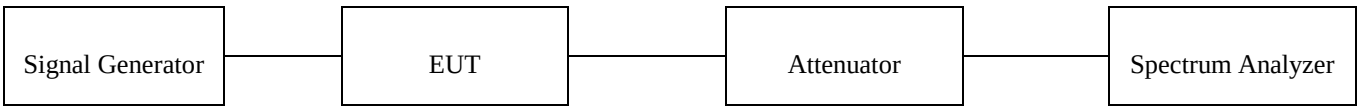
Temperature : 25 ℃

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 Center Frequency (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. (Interval)
■ -	SMJ100A	Rohde & Schwarz	Signal Generator	101038	Oct. 08, 2014 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014(1Y)

All test equipment used is calibrated on a regular basis.

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6.4 Test data for Part 2.1049

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(a) Radiotelegraph transmitters for manual operation when keyed at 16 dots per second.

(b) Other keyed transmitters—when keyed at the maximum machine speed.

(c) Radiotelephone transmitters equipped with a device to limit modulation or peak envelope power shall be modulated as follows. For single sideband and independent sideband transmitters, the input level of the modulating signal shall be 10 dB greater than that necessary to produce rated peak envelope power.

(1) Other than single sideband or independent sideband transmitters—when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.

(2) Single sideband transmitters in A3A or A3J emission modes—when modulated by two tones at frequencies of 400 Hz and 1800 Hz (for 3.0 kHz authorized bandwidth), or 500 Hz and 2100 Hz (for 3.5 kHz authorized bandwidth), or 500 Hz and 2400 Hz (for 4.0 kHz authorized bandwidth), applied simultaneously. The input levels of the tones shall be so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude.

(3) Single sideband transmitters in the A3H emission mode—when modulated by one tone at a frequency of 1500 Hz (for 3.0 kHz authorized bandwidth), or 1700 Hz (for 3.5 kHz authorized bandwidth), or 1900 Hz (for 4.0 kHz authorized bandwidth), the level of which is adjusted to produce a radio frequency signal component equal in magnitude to the magnitude of the carrier in this mode.

(4) As an alternative to paragraphs (c) (2) and (3) of this section, other tones besides those specified may be used as modulating frequencies, upon a sufficient showing of need. However, any tones so chosen must not be harmonically related, the third and fifth order intermodulation products which occur must fall within the −25 dB step of the emission bandwidth limitation curve, the seventh and ninth order products must fall within the −35 dB step of the referenced curve and the eleventh and all higher order products must fall beyond the −35 dB step of the referenced curve.

(5) Independent sideband transmitters having two channels—when modulated by 1700 Hz tones applied simultaneously to both channels. The input levels of the tones shall be so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude.

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(d) Radiotelephone transmitters without a device to limit modulation or peak envelope power shall be modulated as follows. For single sideband and independent sideband transmitters, the input level of the modulating signal should be that necessary to produce rated peak envelope power.

(1) Other than single sideband or independent sideband transmitters—when modulated by a 2500 Hz tone of sufficient level to produce at least 85 percent modulation. If 85 percent modulation is unattainable, the highest percentage modulation shall be used.

(2) Single sideband transmitters in A3A or A3J emission modes—when modulated by two tones at frequencies of 400 Hz and 1800 Hz (for 3.0 kHz authorized bandwidth), or 500 Hz and 2100 Hz (for 3.5 kHz authorized bandwidth), or 500 Hz and 2400 Hz (for 4.0 kHz authorized bandwidth), applied simultaneously. The input levels of the tones shall be so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude.

(3) Single sideband transmitters in the A3H emission mode—when modulated by one tone at a frequency of 1500 Hz (for 3.0 kHz authorized bandwidth), or 1700 Hz (for 3.5 kHz authorized bandwidth), or 1900 Hz (for 4.0 kHz authorized bandwidth), the level of which is adjusted to produce a radio frequency signal component equal in magnitude to the magnitude of the carrier in this mode.

(4) As an alternative to paragraphs (d) (2) and (3) of this section, other tones besides those specified may be used as modulating frequencies, upon a sufficient showing of need. However any tones so chosen must not be harmonically related, the third and fifth order intermodulation products which occur must fall within the −25 dB step of the emission bandwidth limitation curve, the seventh and ninth order products must fall within the −35 dB step of the referenced curve and the eleventh and all higher order products must fall beyond the −35 dB step of the referenced curve.

(5) Independent sideband transmitters having two channels—when modulated by 1700 Hz tones applied simultaneously to both channels. The input levels of the tones shall be so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude.

(e) Transmitters for use in the Radio Broadcast Services:

(1) AM broadcast transmitters for monaural operation—when amplitude modulated 85% by a 7,500 Hz input signal.

(2) AM broadcast stereophonic operation—when the transmitter operated under any stereophonic modulation condition not exceeding 100% on negative peaks and tested under the conditions specified in §73.128 in part 73 of the FCC rules for AM broadcast stations.

(3) FM broadcast transmitter not used for multiplex operation—when modulated 85 percent by a 15 kHz input signal.

(4) FM broadcast transmitters for multiplex operation under Subsidiary Communication Authorization (SCA)—when carrier is modulated 70 percent by a 15 kHz main channel input signal, and modulated an additional 15 percent simultaneously by a 67 kHz subcarrier (unmodulated).

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(5) FM broadcast transmitter for stereophonic operation—when modulated by a 15 kHz input signal to the main channel, a 15 kHz input signal to the stereophonic subchannel, and the pilot subcarrier simultaneously. The input signals to the main channel and stereophonic subchannel each shall produce 38 percent modulation of the carrier. The pilot subcarrier should produce 9 percent modulation of the carrier.

(6) Television broadcast monaural transmitters—when modulated 85% by a 15 kHz input signal.

(7) Television broadcast stereophonic sound transmitters—when the transmitter is modulated with a 15 kHz input signal to the main channel and the stereophonic subchannel, any pilot subcarrier(s) and any unmodulated auxiliary subcarrier(s) which may be provided. The signals to the main channel and the stereophonic subchannel must be representative of the system being tested and when combined with any pilot subcarrier(s) or other auxiliary subcarriers shall result in 85% deviation of the maximum specified aural carrier deviation.

(f) Transmitters for which peak frequency deviation (D) is determined in accordance with §2.202(f), and in which the modulating baseband comprises more than 3 independent speech channels—when modulated by a test signal determined in accordance with the following:

(1) A modulation reference level is established for the characteristic baseband frequency. (Modulation reference level is defined as the average power level of a sinusoidal test signal delivered to the modulator input which provides the specified value of per-channel deviation.)

(2) Modulation reference level being established, the total rms deviation of the transmitter is measured when a test signal consisting of a band of random noise extending from below 20 kHz to the highest frequency in the baseband, is applied to the modulator input through any preemphasis networks used in normal service. The average power level of the test signal shall exceed the modulation reference level by the number of decibels determined using the appropriate formula in the following table:

Number of message circuits that modulate the transmitter	**Number of dB by which the average power (Pavg) level test signal shall exceed the modulation reference level**	**Limits of Pavg (dBm0)**
More than 3, but less than 12	To be specified by the equipment manufacturer subject to FCC approval	
At least 12, but less than 60	X+2 log10 Nc	X: −2 to +2.6
At least 60, but less than 240	X+4 log10 Nc	X: −5.6 to −1.0
240 or more	X+10 log10 Nc	X: −19.6 to −15.0

Where X represents the average power in a message circuit in dBm0; Nc is the number of circuits in the multiplexed message load. Pavg shall be selected by the transmitter manufacturer and included with the technical data submitted with the application for type acceptance. (See §2.202(e) in this chapter.)

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(g) Transmitters in which the modulating baseband comprises not more than three independent channels—when modulated by the full complement of signals for which the transmitter is rated. The level of modulation for each channel should be set to that prescribed in rule parts applicable to the services for which the transmitter is intended. If specific modulation levels are not set forth in the rules, the tests should provide the manufacturer's maximum rated condition.

(h) Transmitters employing digital modulation techniques—when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

(i) Transmitters designed for other types of modulation—when modulated by an appropriate signal of sufficient amplitude to be representative of the type of service in which used. A description of the input signal should be supplied..

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6.4.1 Test data for Downlink (LTE 5 M)

-. Test Date : December 23, 2014

-. Test Result : Pass

Modulation	Channel	26 dB Bandwidth (kHz)	99 % Occupied Bandwidth (kHz)
LTE 5 M - Low	QPSK	4.69	4.07
LTE 5 M - High	QPSK	4.54	4.02

Remark: 1. According to above result, the carrier frequency shall be within the frequency block edges.

2. As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project Engineer

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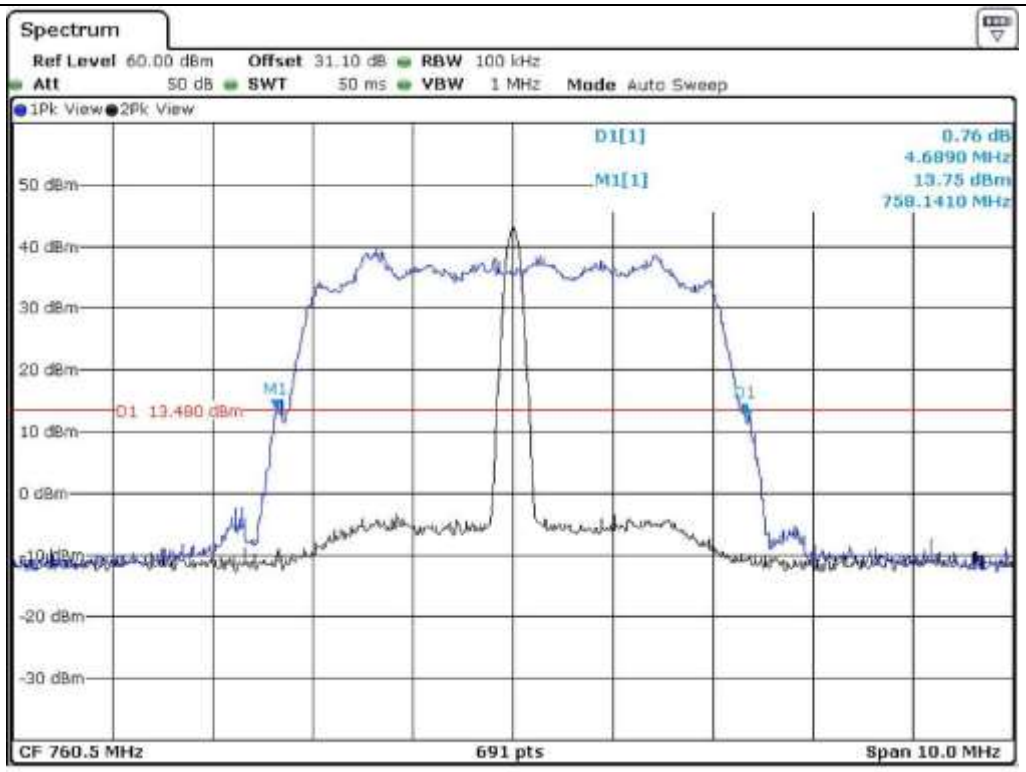
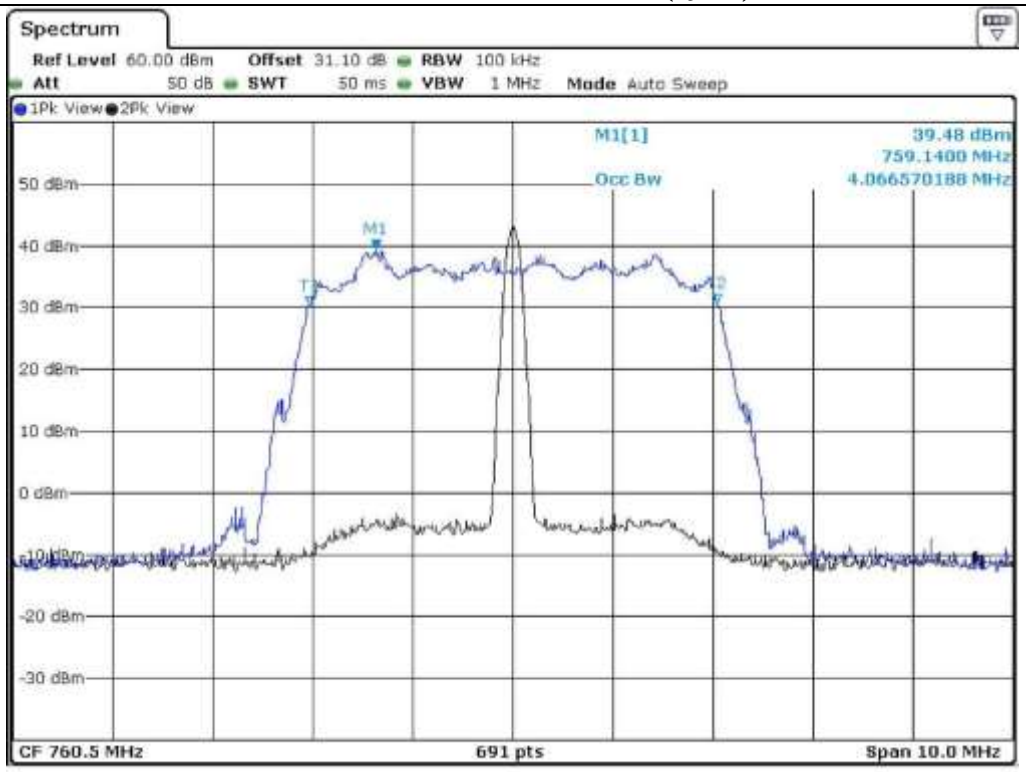


LTE 5 M - Low – 26 dB Bandwidth (QPSK)



LTE 5 M - Low – 99 % Occupied Bandwidth (QPSK)

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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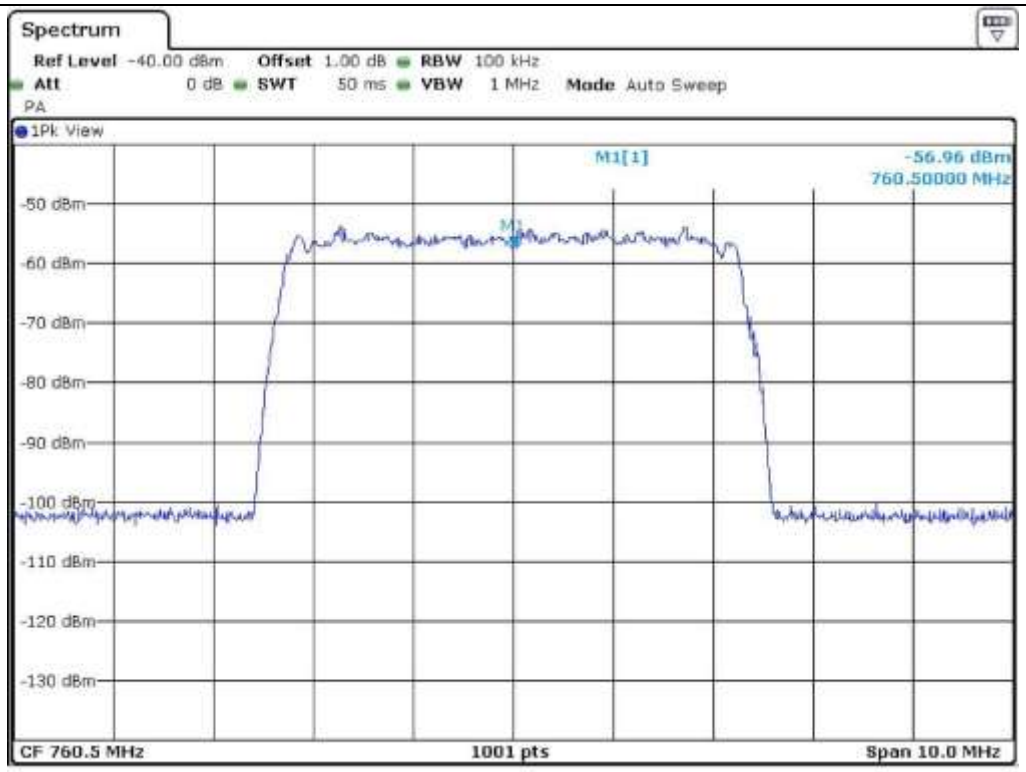

LTE 5 M - Low – Input (QPSK)

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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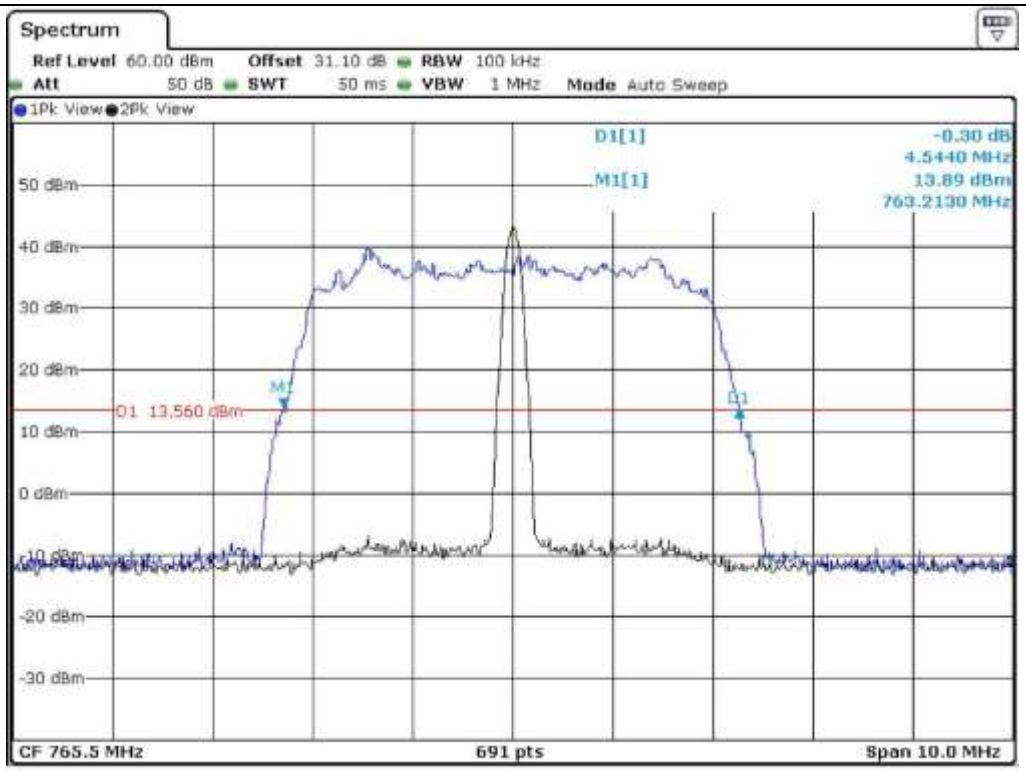
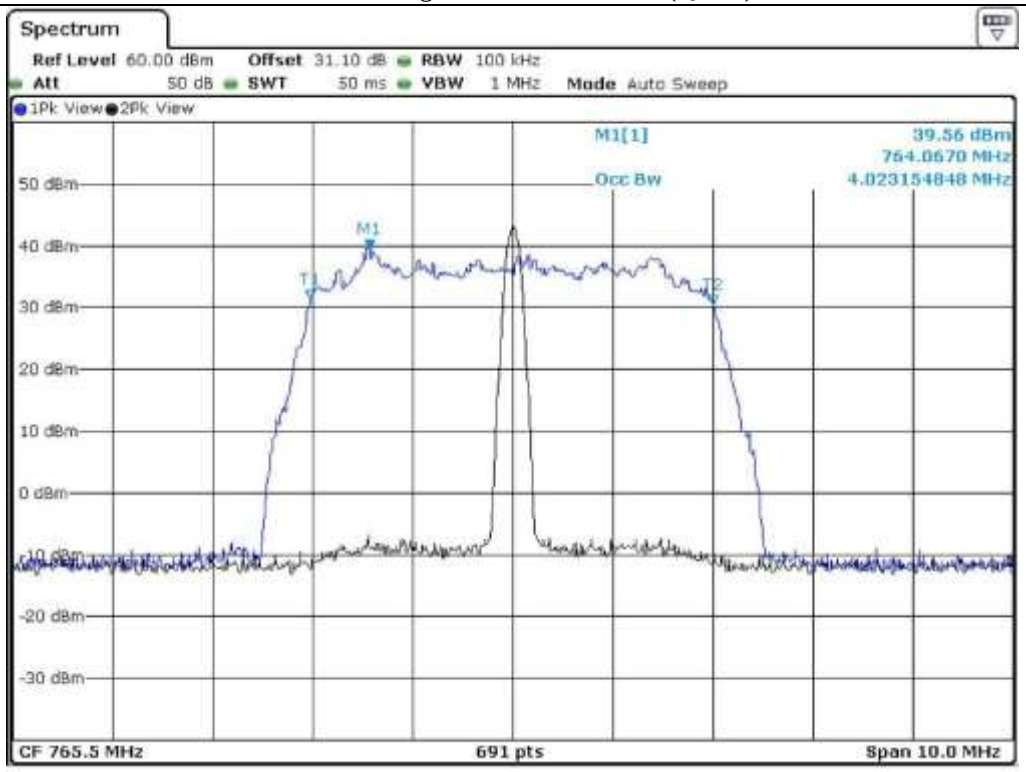
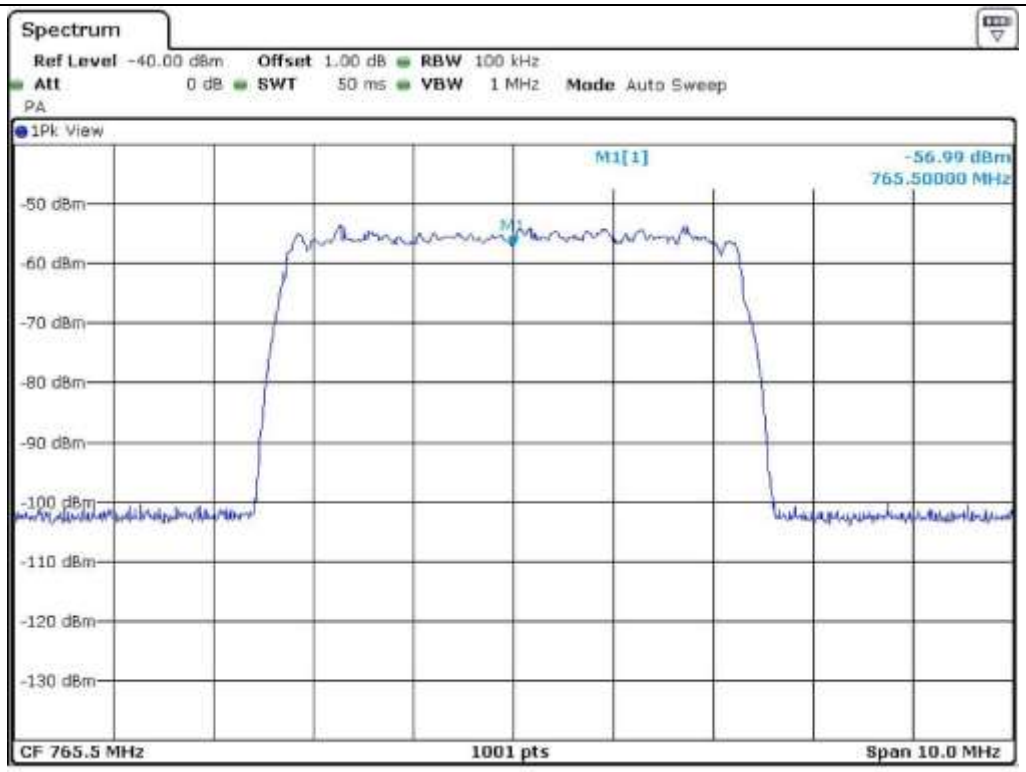


LTE 5 M - High – 26 dB Bandwidth (QPSK)



LTE 5 M - High – 99 % Occupied Bandwidth (QPSK)

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



LTE 5 M - High – Input (QPSK)

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

6.4.2 Test data for Uplink (LTE 5 M)

-. Test Date : December 23, 2014

-. Test Result : Pass

Modulation	Channel	26 dB Bandwidth (kHz)	99 % Occupied Bandwidth (kHz)
LTE 5 M - Low	QPSK	4.63	4.08
LTE 5 M - High	QPSK	4.60	4.04

Remark: 1. According to above result, the carrier frequency shall be within the frequency block edges.

2. As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project 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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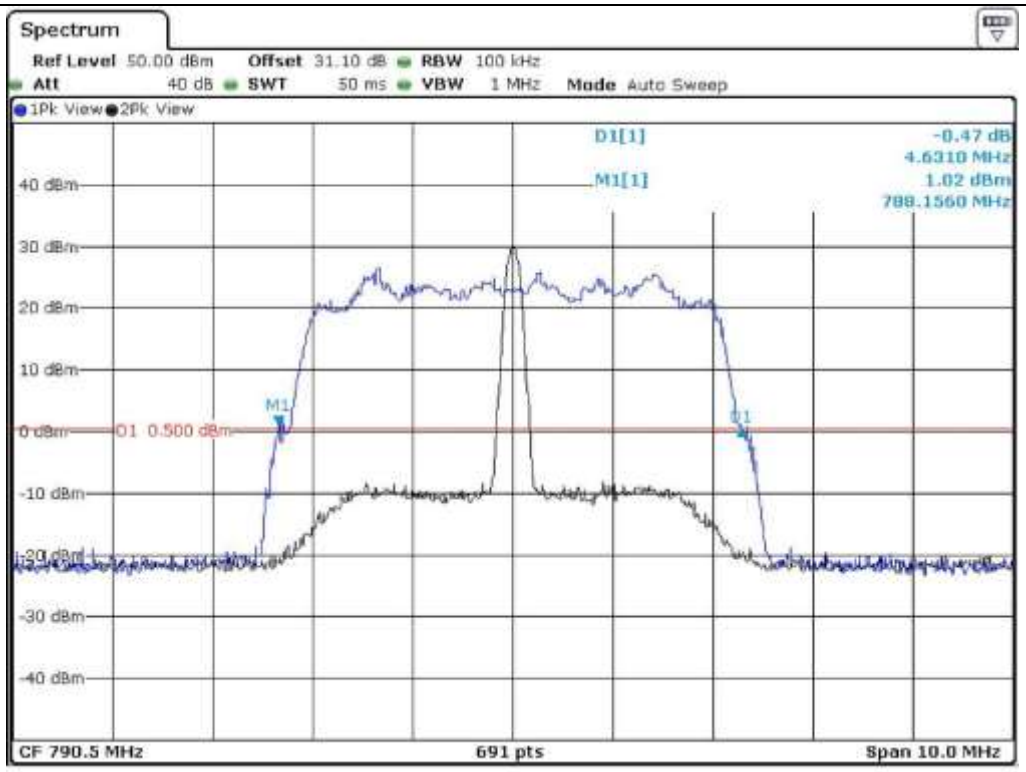
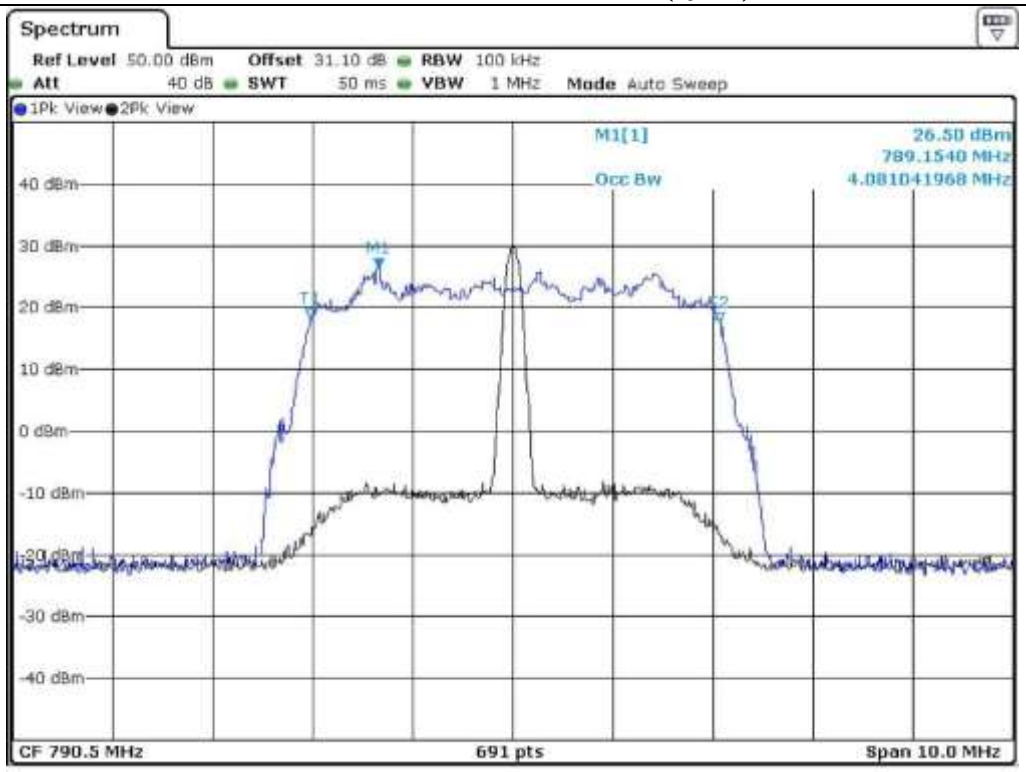
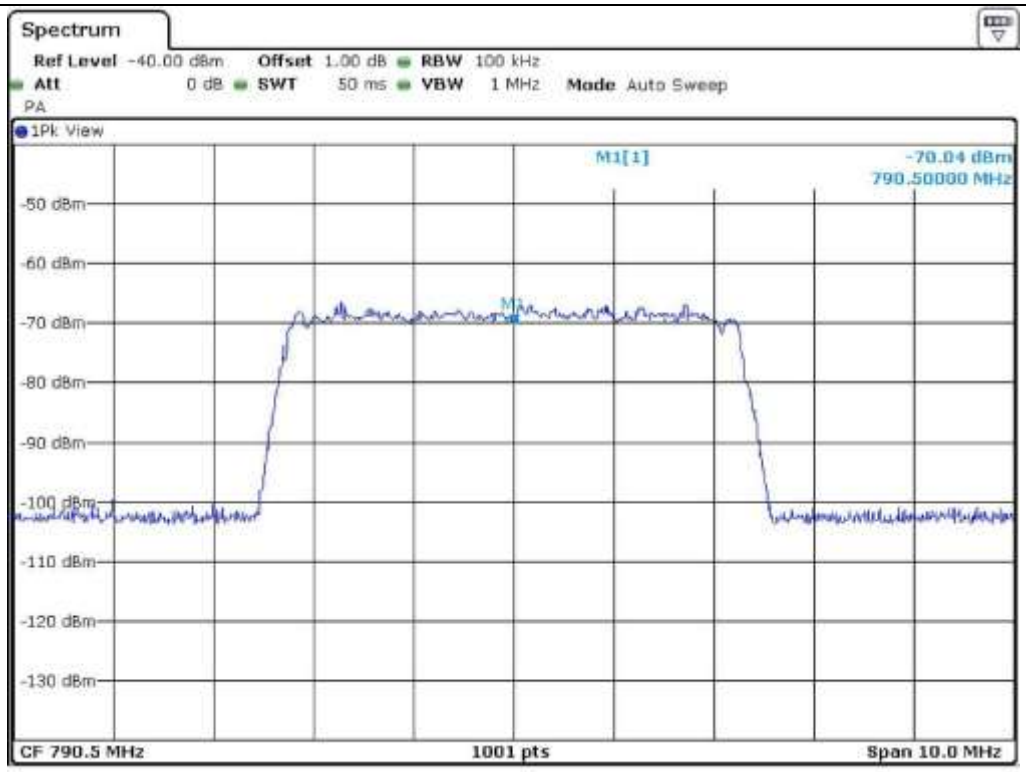


LTE 5 M - Low – 26 dB Bandwidth (QPSK)



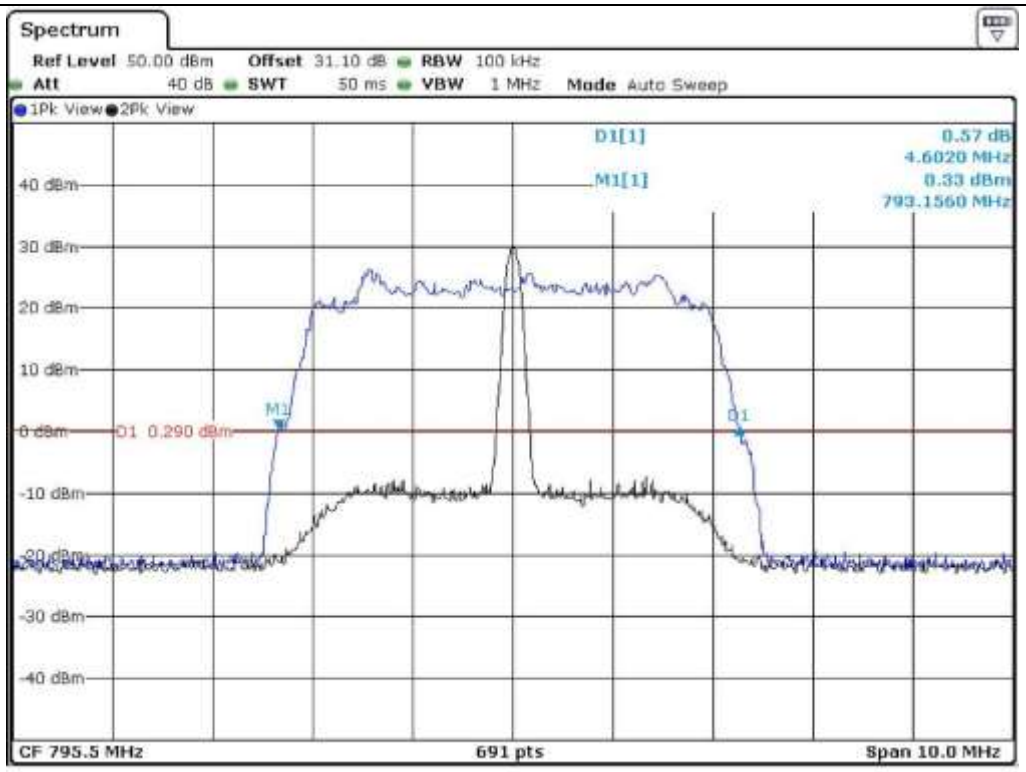
LTE 5 M - Low – 99 % Occupied Bandwidth (QPSK)

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

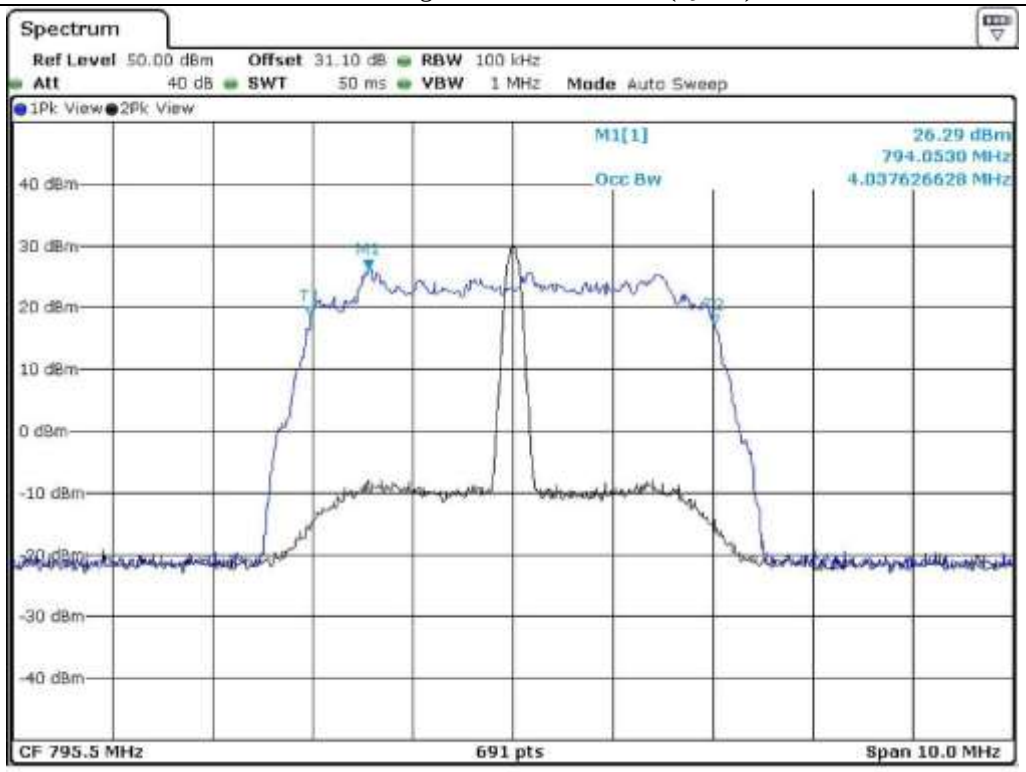


LTE 5 M - Low – Input (QPSK)

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

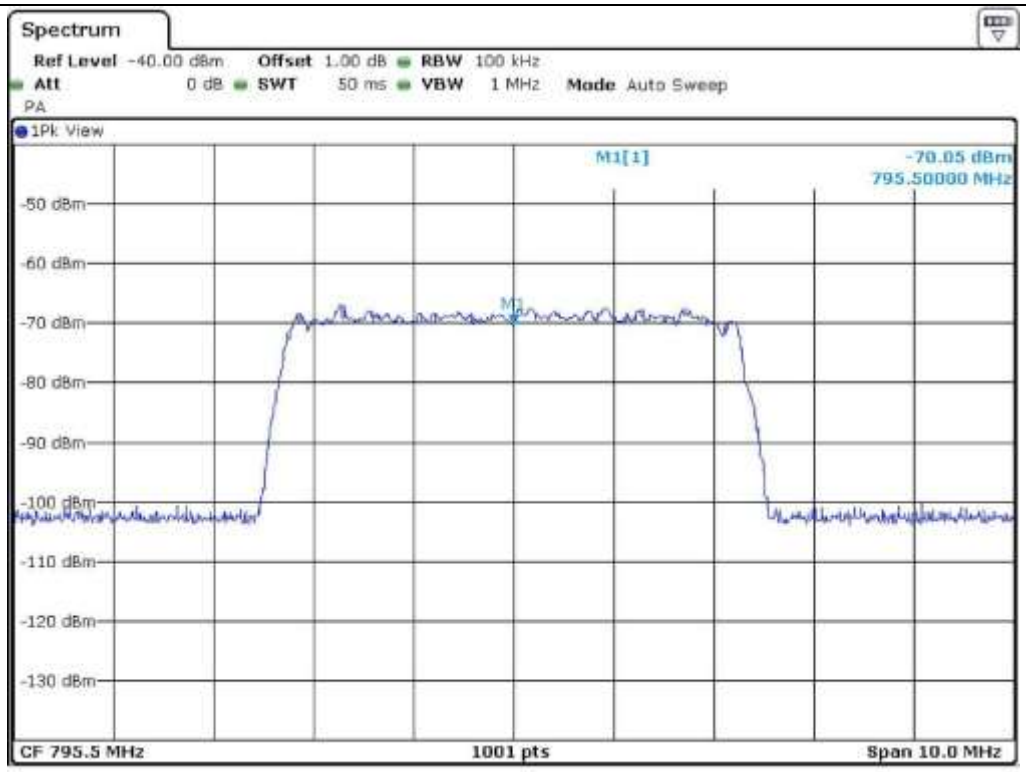


LTE 5 M - High – 26 dB Bandwidth (QPSK)



LTE 5 M - High – 99 % Occupied Bandwidth (QPSK)

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



LTE 5 M - High – Input (QPSK)

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

6.4.3 Test data for Downlink (LTE 10 M)

-. Test Date : December 23, 2014

-. Test Result : Pass

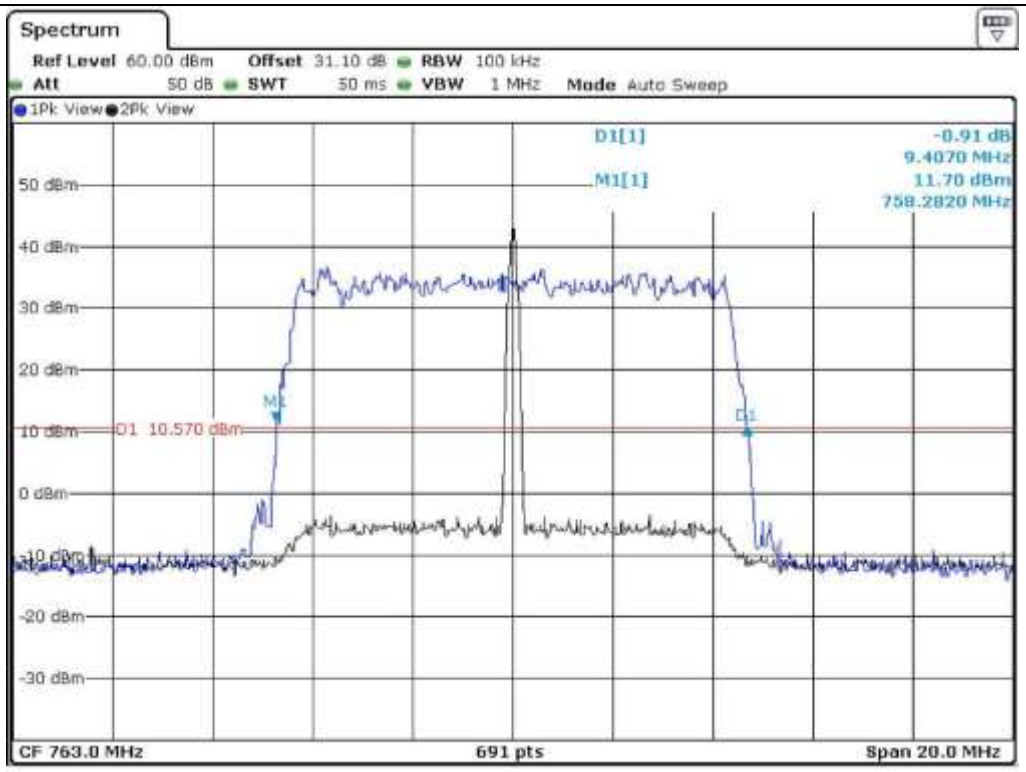
Modulation	Channel	26 dB Bandwidth (kHz)	99 % Occupied Bandwidth (kHz)
LTE 10 M	QPSK	9.41	8.65

Remark: 1. According to above result, the carrier frequency shall be within the frequency block edges.

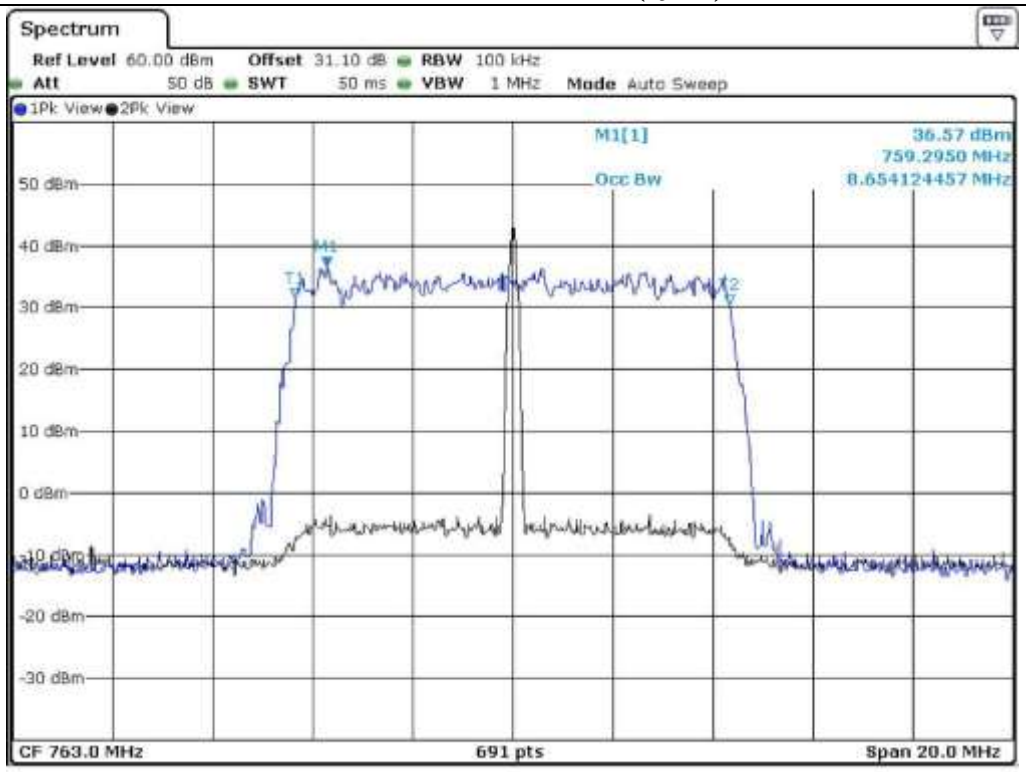
2. As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

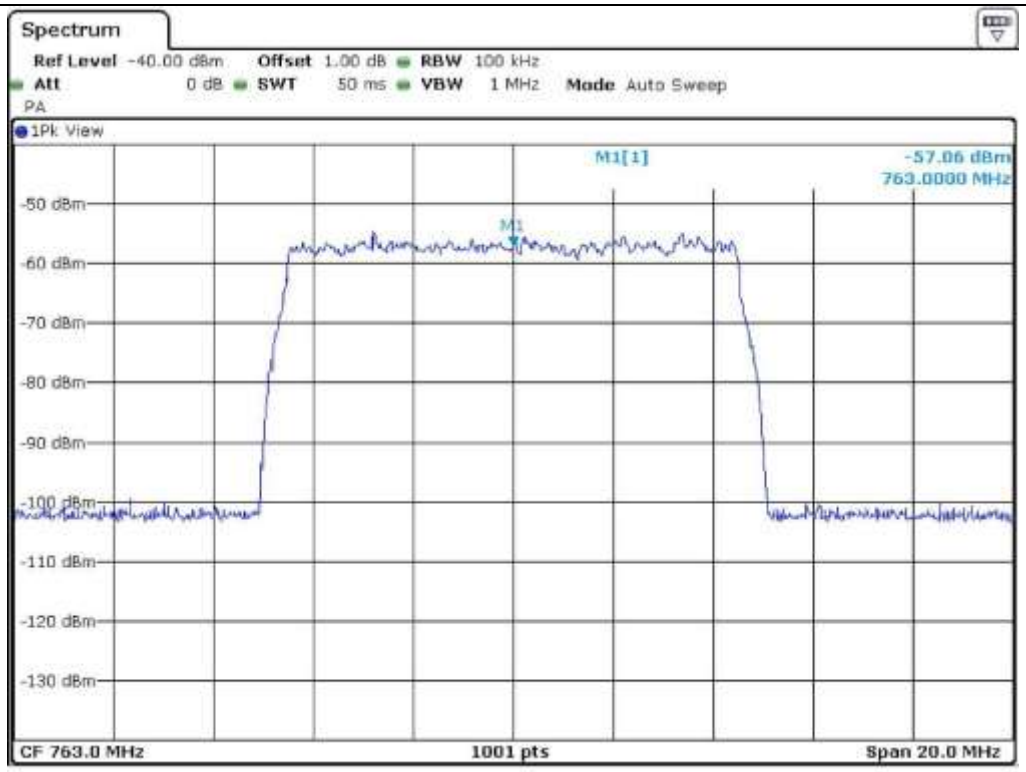


LTE 10 M – 26 dB Bandwidth (QPSK)



LTE 10 M – 99 % Occupied Bandwidth (QPSK)

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



LTE 10 M – Input (QPSK)

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

6.4.3 Test data for Uplink (LTE 10 M)

-. Test Date : December 23, 2014

-. Test Result : Pass

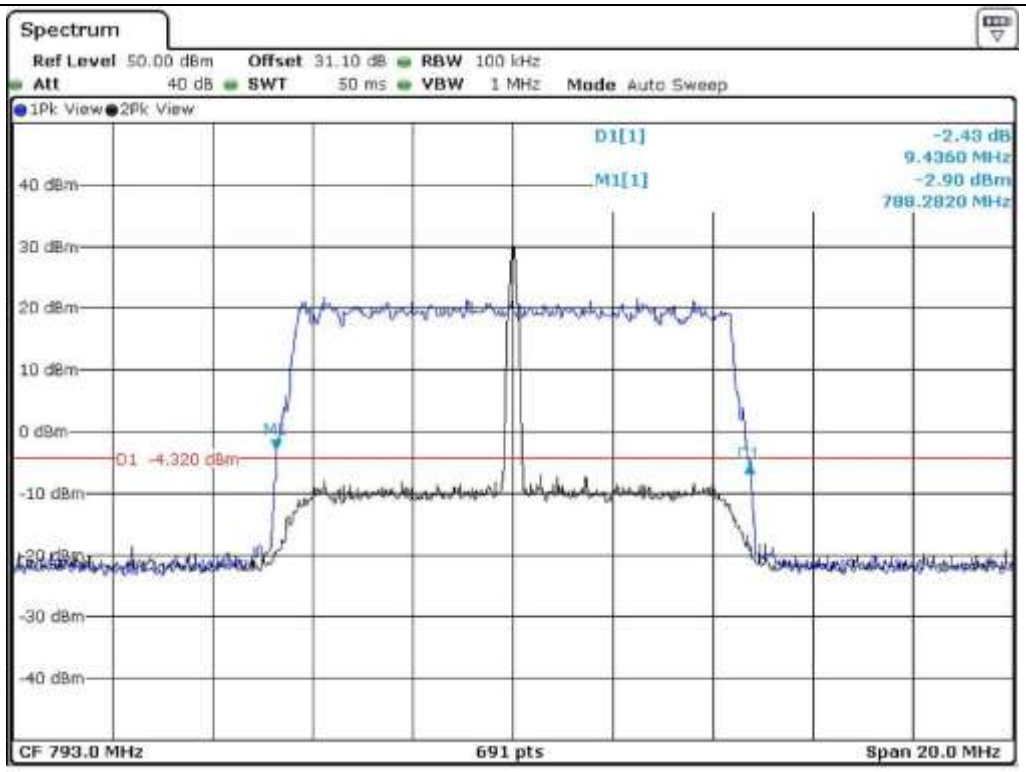
Modulation	Channel	26 dB Bandwidth (kHz)	99 % Occupied Bandwidth (kHz)
LTE 10 M	QPSK	9.44	8.68

Remark: 1. According to above result, the carrier frequency shall be within the frequency block edges.

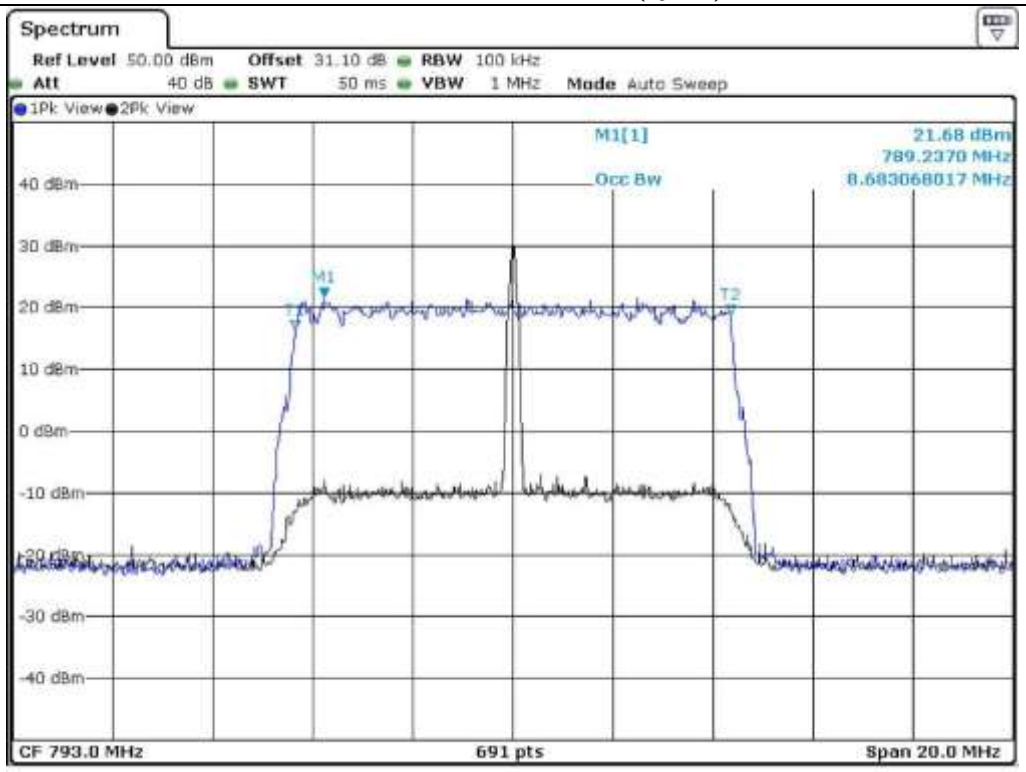
2. As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



LTE 10 M – 26 dB Bandwidth (QPSK)



LTE 10 M – 99 % Occupied Bandwidth (QPSK)

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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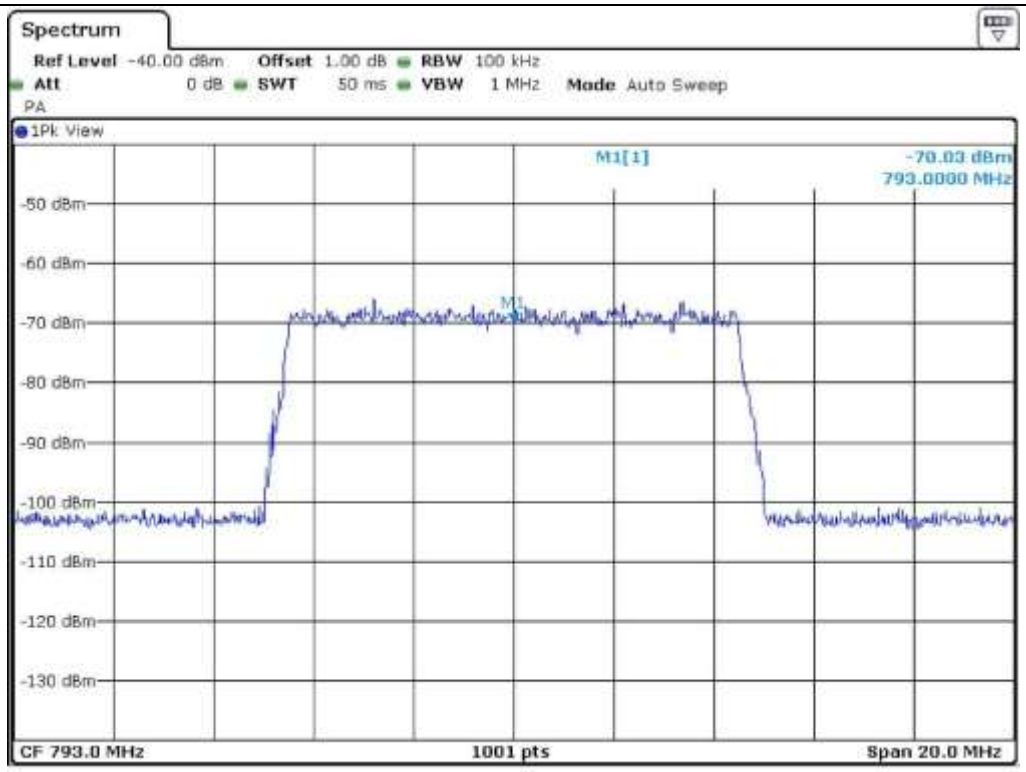


LTE 10 M – Input (QPSK)

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 Dept : 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

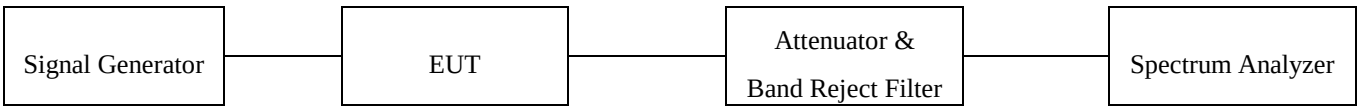
Temperature : 25 ℃

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 Center Frequency (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 20 GHz.



7.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	SMJ100A	Rohde & Schwarz	Signal Generator	101038	Oct. 08, 2014 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014(1Y)
■ -	WRCT 1850/2170 -5/40-10SSK	Wainwright Instruments GmbH	Tunable Band Reject Filter	20	Oct. 10, 2014 (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)
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7.4 Test data for Part 2.1051, 90.543(c)(e)

-. Part 2.1051

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

-. 90.543(c)(e)

(c) Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10log (P) dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

(e) For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations.

(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations.

(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.

(4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(5) Compliance with the provisions of paragraph (e)(3) 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 30 kHz may be employed.

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

7.4.1 Test data for Downlink (LTE 5 M)

-. Test Date : December 24, 2014

-. Frequency range : 30 MHz ~ 10.0 GHz

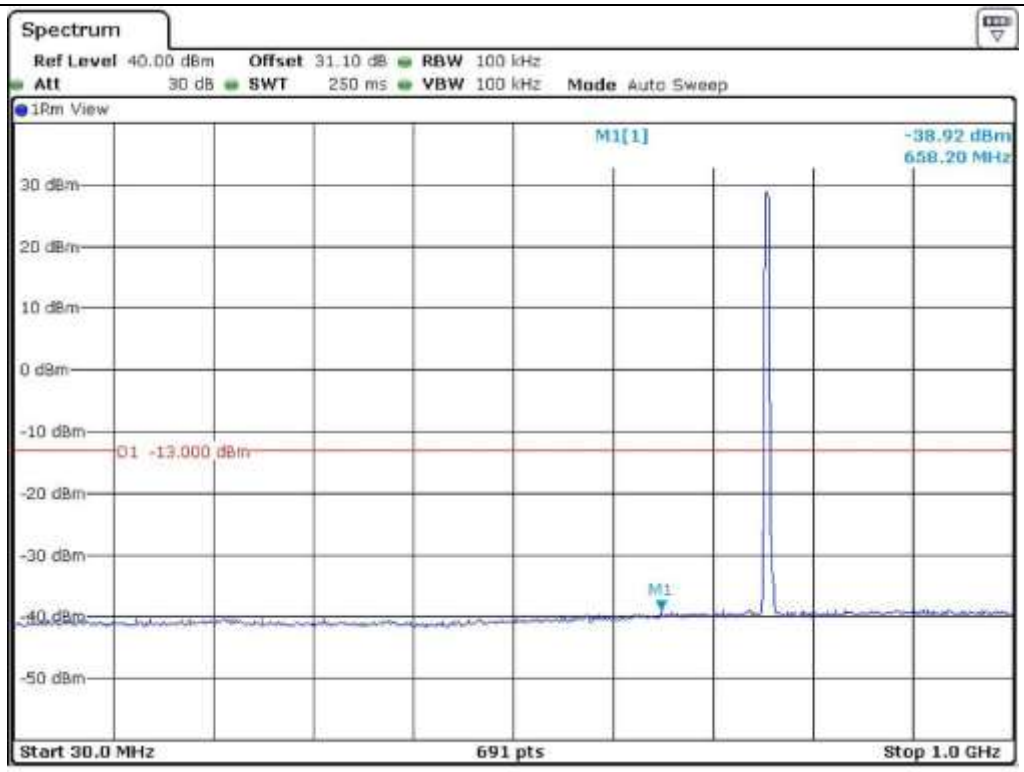
-. Result : PASSED

Modulation	Harmonic Frequency (MHz)		Measured Value (dBm)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
LTE 5 M - Low	QPSK	658.20	-38.92	0.39	-38.53	-13.00	25.53
		7 831.00	-29.87	4.72	-25.15		12.15
LTE 5 M - High	QPSK	679.20	-39.42	0.40	-39.02		26.02
		7 831.00	-30.42	4.72	-25.70		12.70
Other frequencies up to 10 GHz have margin more than 20 dB.							

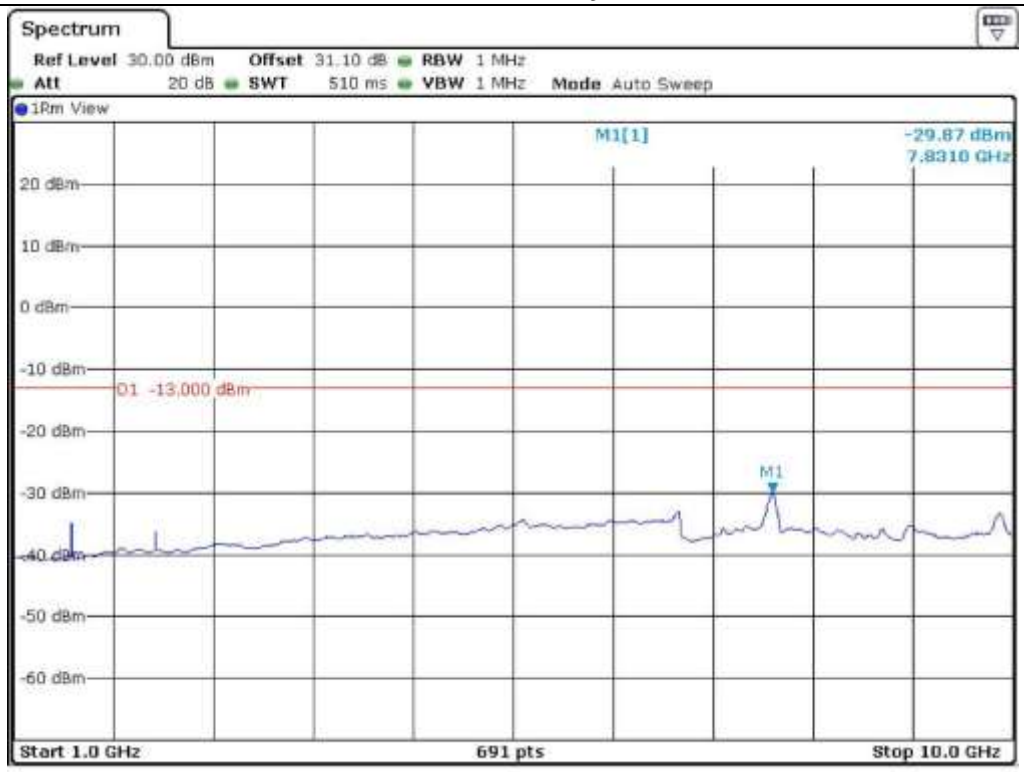
From CFR 90.543(c) : On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10log (P) dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.
As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



LTE 5 M - Low – QPSK



LTE 5 M - Low – QPSK

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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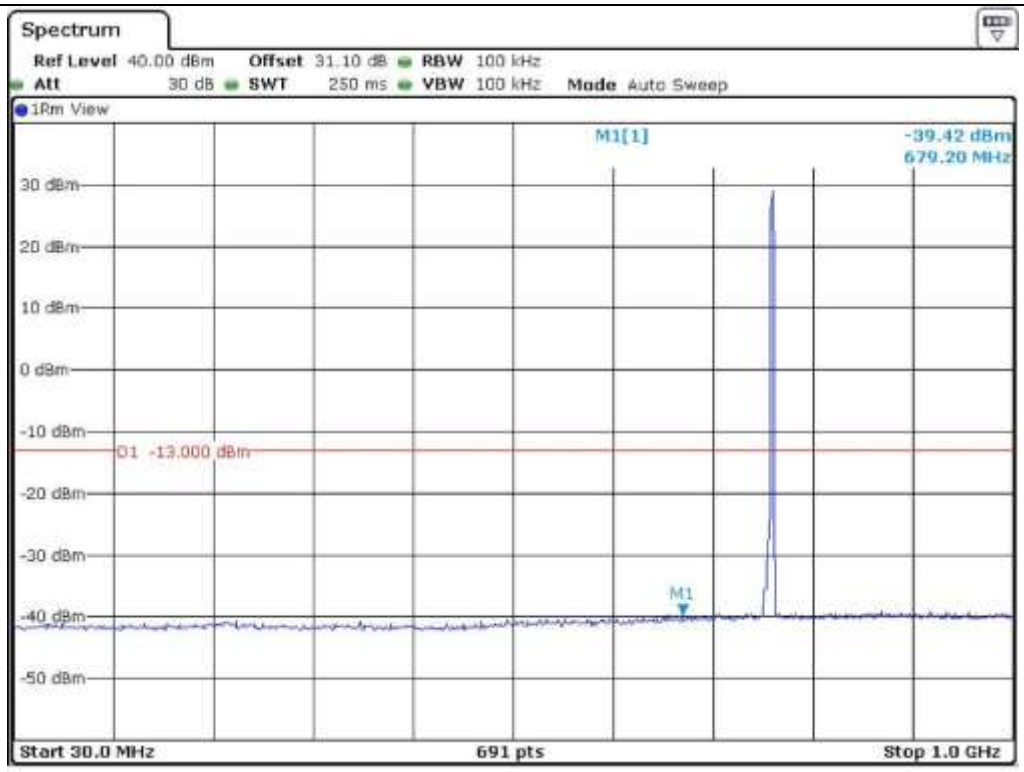
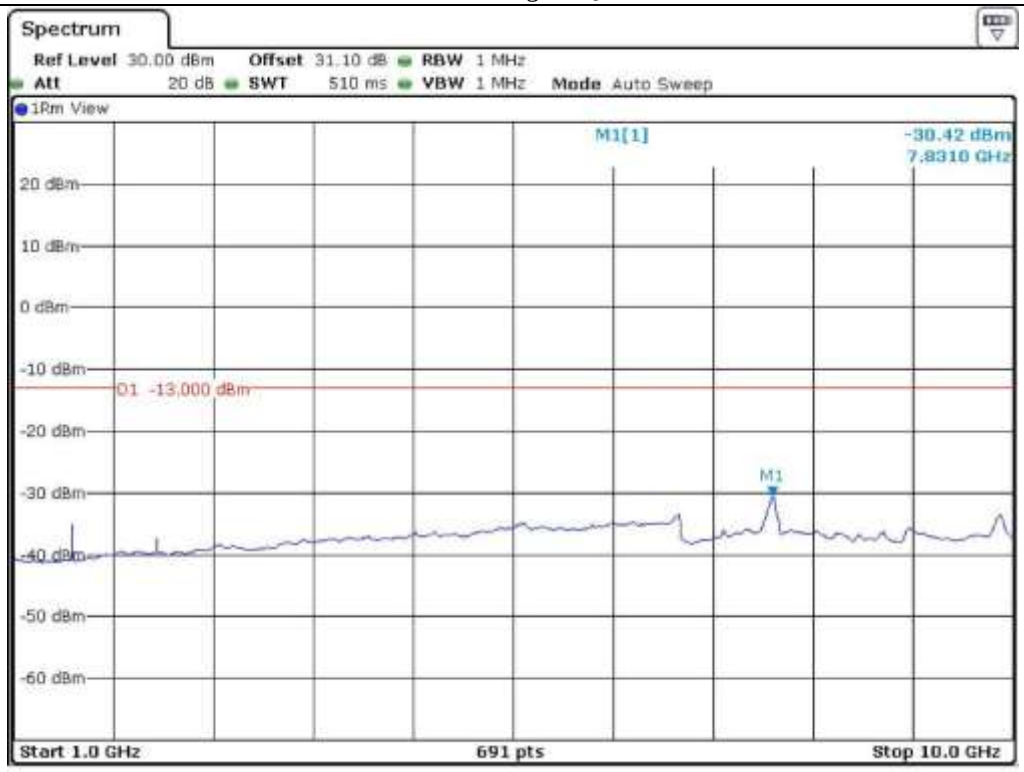


LTE 5 M - High – QPSK



LTE 5 M - High – QPSK

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 Dept : 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 Uplink (LTE 5 M)

-. Test Date : December 24, 2014

-. Frequency range : 30 MHz ~ 10.0 GHz

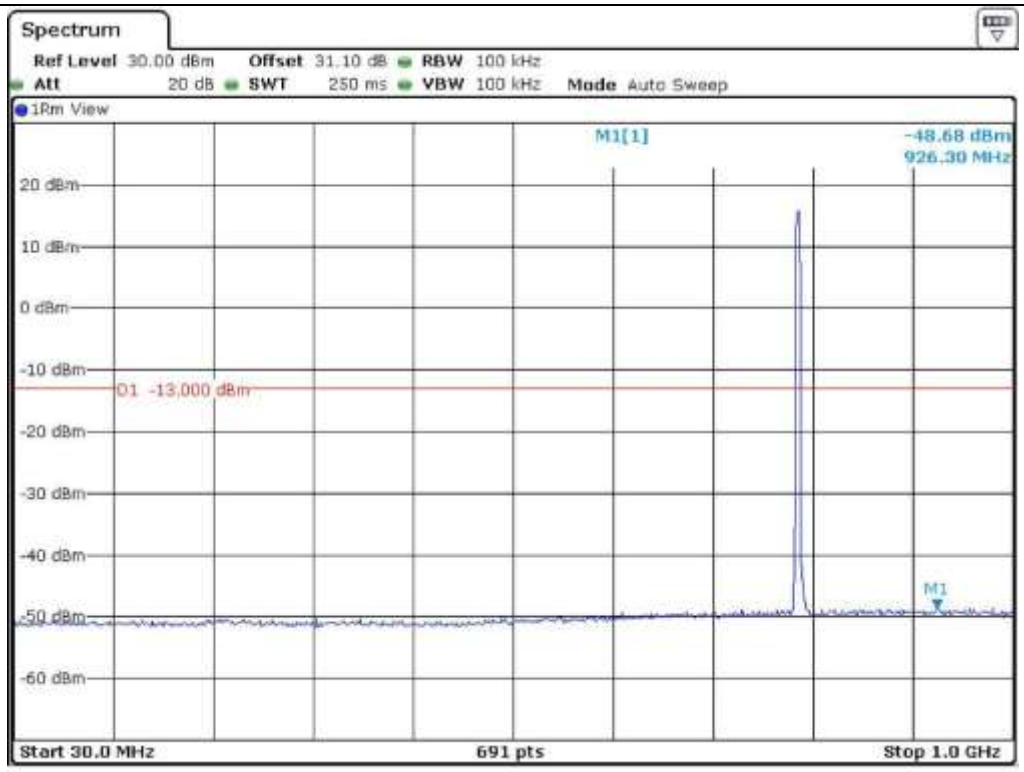
-. Result : PASSED

Modulation	Harmonic Frequency (MHz)		Measured Value (dBm)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
LTE 5 M - Low	QPSK	926.30	-48.68	0.51	-48.17	-13.00	35.17
		7 831.00	-29.71	4.72	-24.99		11.99
LTE 5 M - High	QPSK	943.10	-49.36	0.52	-48.84		35.84
		7 831.00	-30.52	4.72	-25.80		12.80
Other frequencies up to 10 GHz have margin more than 20 dB.							

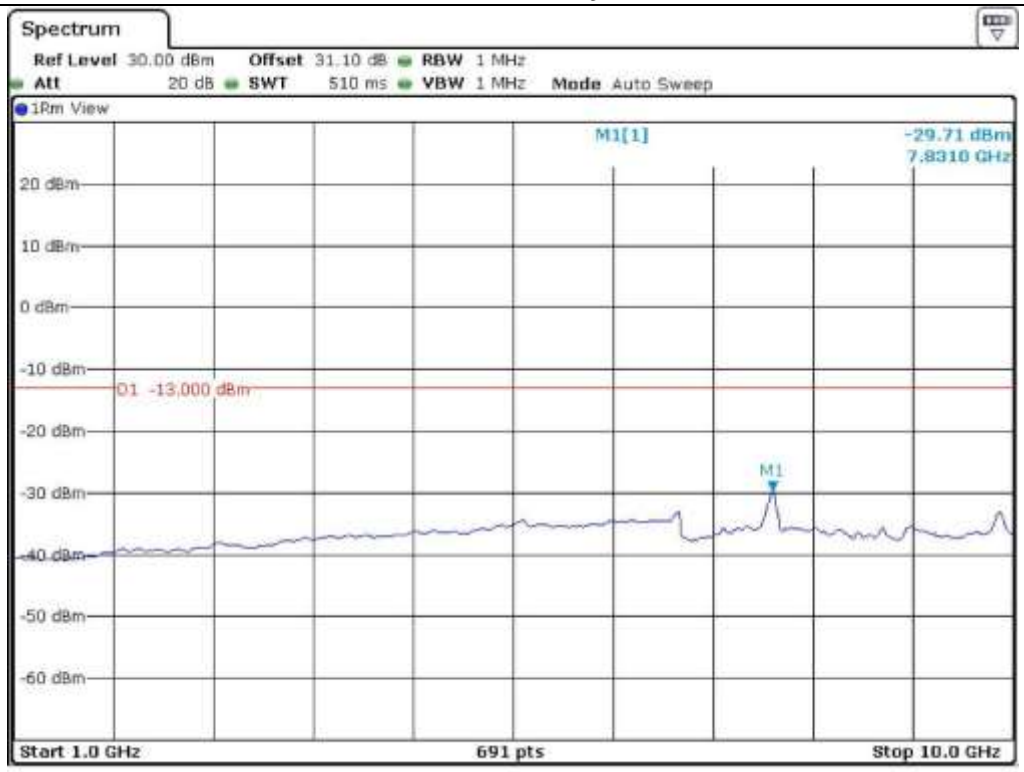
From CFR 90.543(c): On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10log (P) dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.
As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



LTE 5 M - Low – QPSK



LTE 5 M - Low – QPSK

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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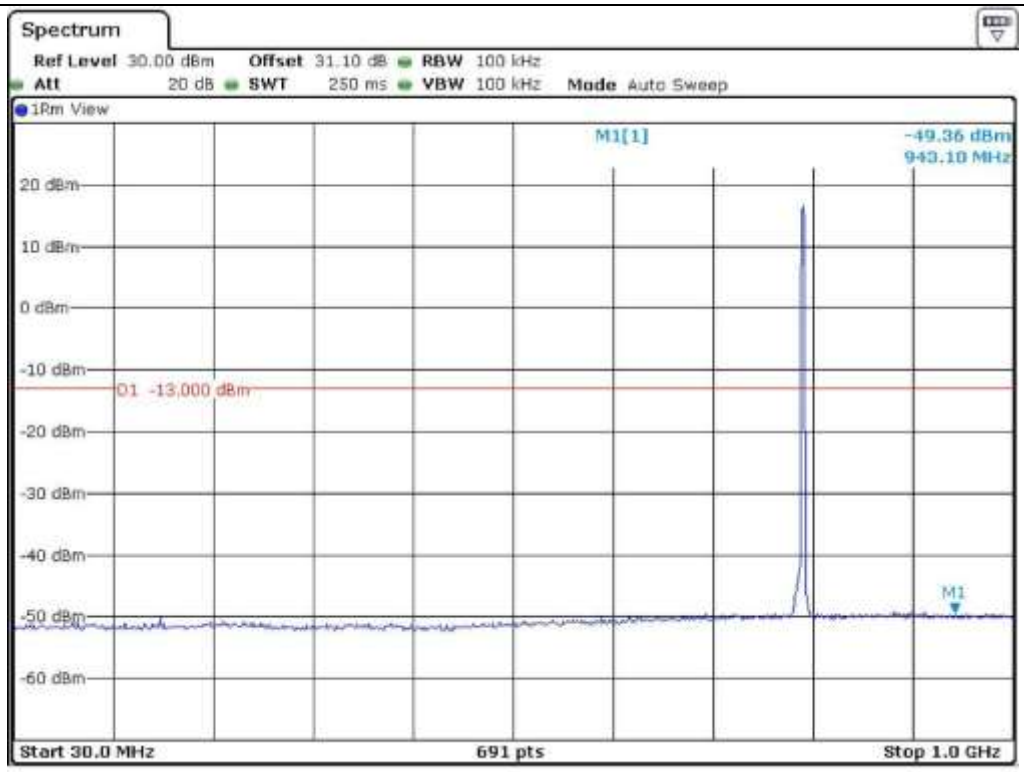
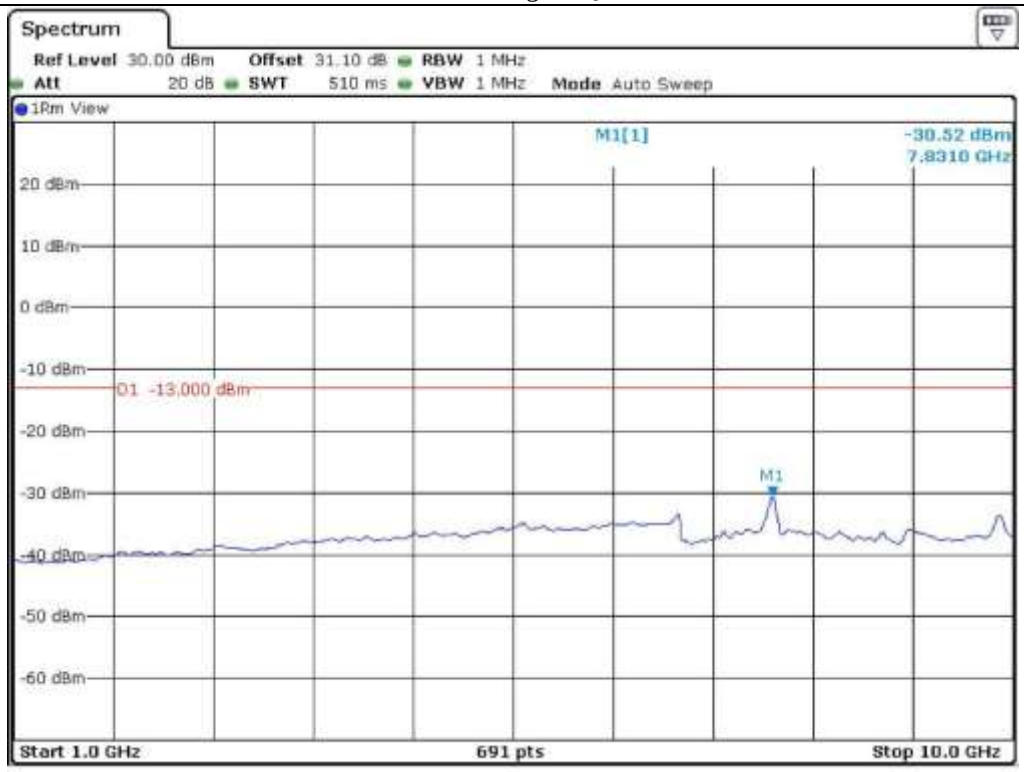


LTE 5 M - High – QPSK



LTE 5 M - High – QPSK

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

7.4.3 Test data for Downlink (LTE 10 M)

-. Test Date : December 24, 2014

-. Frequency range : 30 MHz ~ 10.0 GHz

-. Result : PASSED

Modulation	Harmonic Frequency (MHz)		Measured Value (dBm)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
LTE 10 M	QPSK	882.80	-38.58	0.48	-38.10	-13.00	25.10
		7 831.00	-29.68	4.72	-24.96		11.96
Other frequencies up to 10 GHz have margin more than 20 dB.							

According to Part 90, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0 dBm.
As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project 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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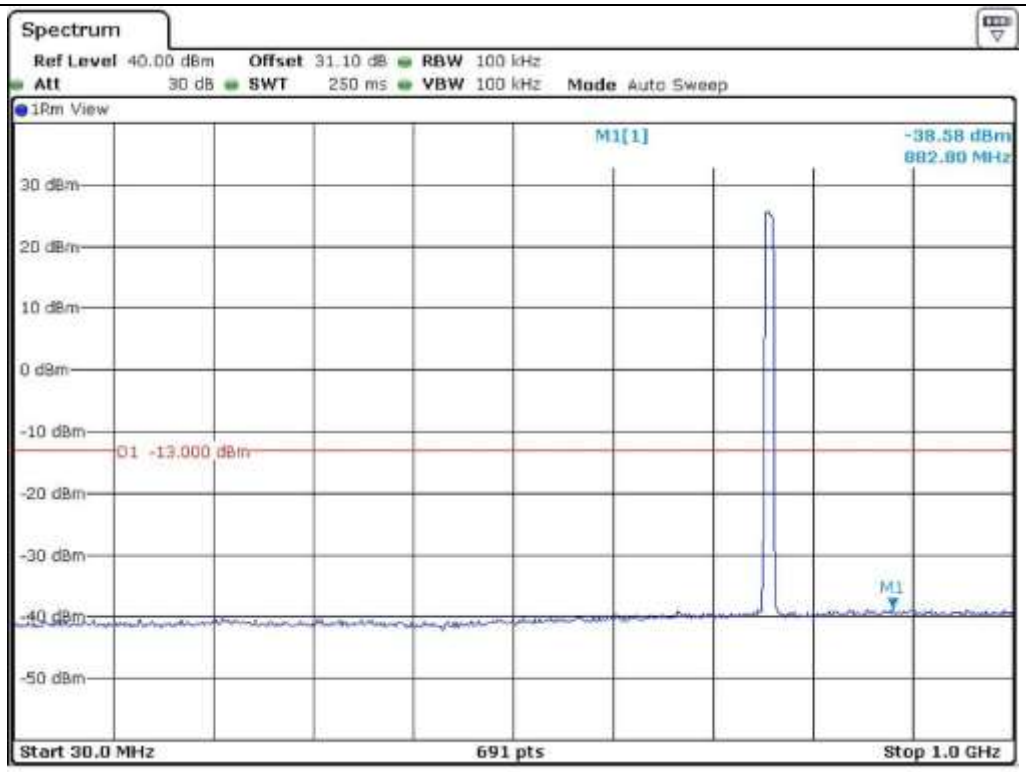
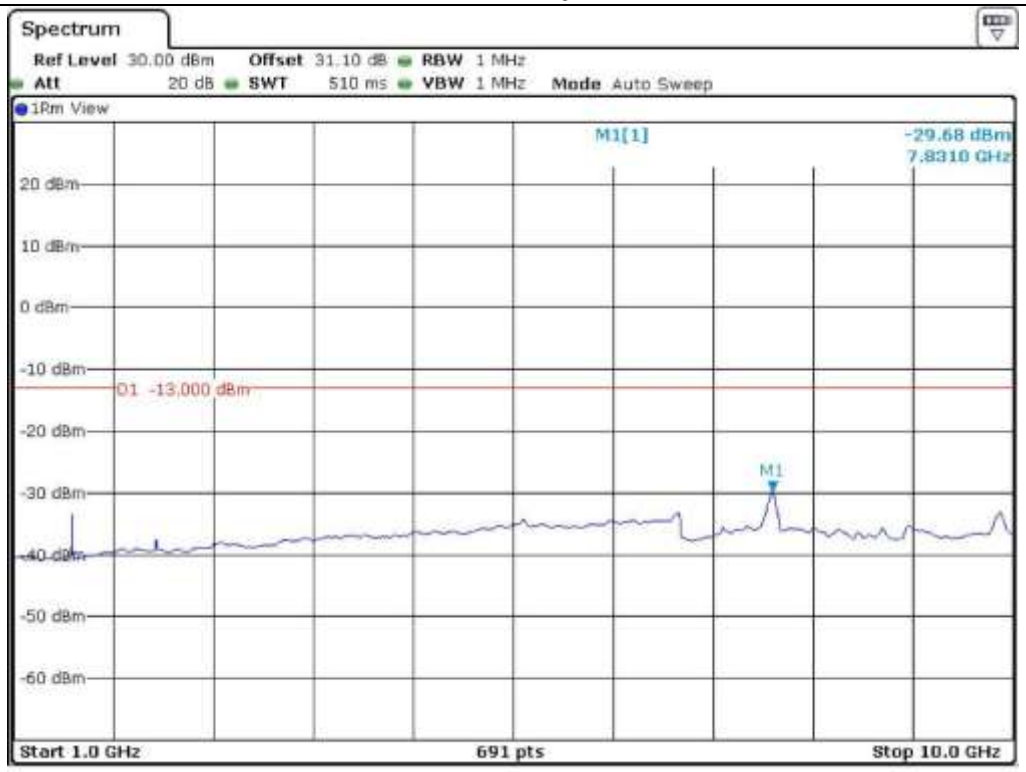


LTE 10 M – QPSK



LTE 10 M – QPSK

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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7.4.4 Test data for Uplink (LTE 10 M)

-. Test Date : December 24, 2014

-. Frequency range : 30 MHz ~ 10.0 GHz

-. Result : PASSED

Modulation	Harmonic Frequency (MHz)		Measured Value (dBm)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
LTE 10 M	QPSK	874.40	-48.73	0.47	-48.26	-13.00	35.26
		7 831.00	-29.73	4.72	-25.01		12.01
Other frequencies up to 10 GHz have margin more than 20 dB.							

According to Part 90, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0 dBm.

As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project 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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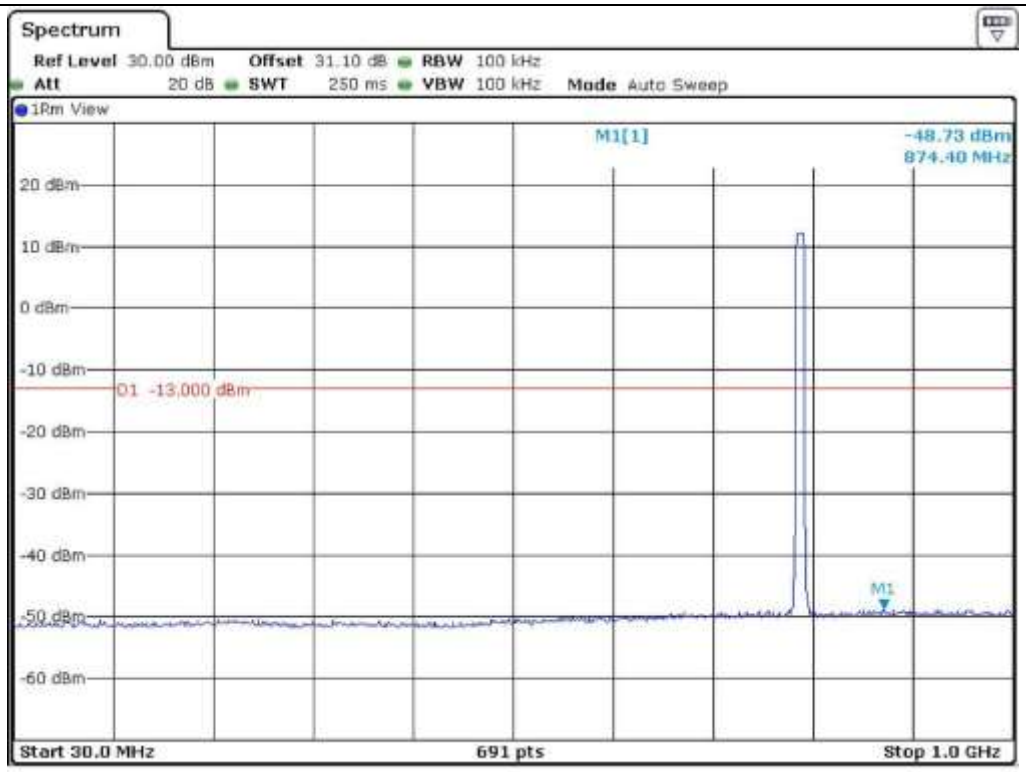
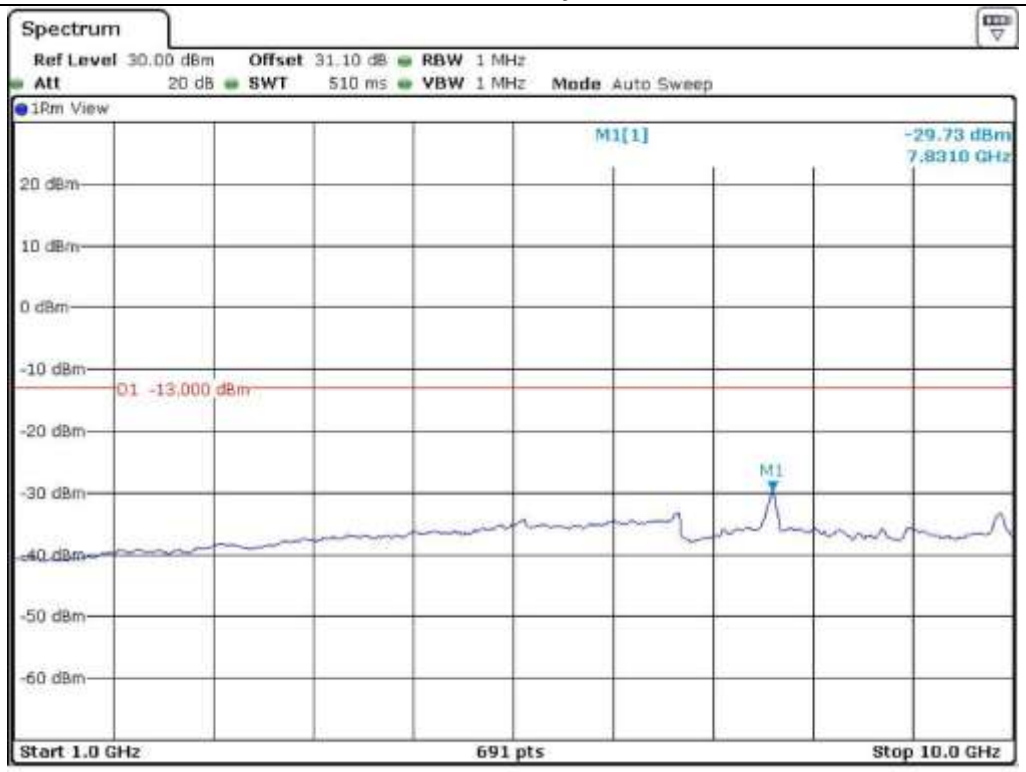


LTE 10 M – QPSK



LTE 10 M – QPSK

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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7.5 Test data for Part 2.1051, 90.543(c)(e)

-. Part 2.1051

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

-. 90.543(c)(e)

(c) Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10log (P) dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

(e) For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations.

(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations.

(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.

(4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(5) Compliance with the provisions of paragraph (e)(3) 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 30 kHz may be employed.

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

7.5.1 Test data for Downlink (LTE 5 M)

-. Test Date : December 24, 2014

-. Frequency range : 769 MHz ~ 775 MHz and 799 MHz ~ 805 MHz

-. Result : PASSED

Modulation	Harmonic Frequency (MHz)		Measured Value (dBm)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
LTE 5 M - Low	QPSK	771.54	-50.59	0.41	-50.18	-43.96	6.22
LTE 5 M - High	QPSK	769.42	-50.01	0.41	-49.60		5.64

From CFR 90.543(e)(1)&(e)(4): On all frequencies between 769 MHz ~ 775 MHz and 799 MHz ~ 805 MHz, by a factor not less than 76 + 10 log (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). AS it was not Possible to set the resolution bandwidth on the test equipment, the bandwidth was set to 10 kHz. The limit was adjusted by 10log(10 kHz / 6.25 kHz) = 2.04 dB. The limit shown in the plots for the 769 MHz to 775 MHz and 799 MHz to 805 MHz bands was set -46 dBm + 2.04 dB = -43.96 dBm

As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project 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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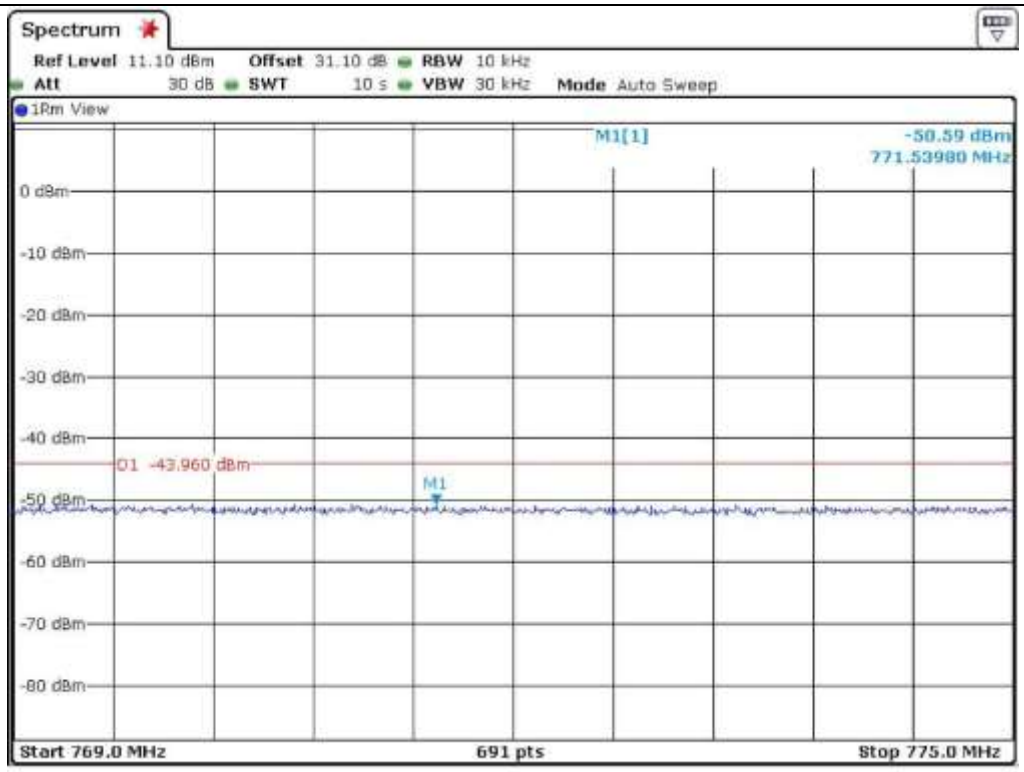
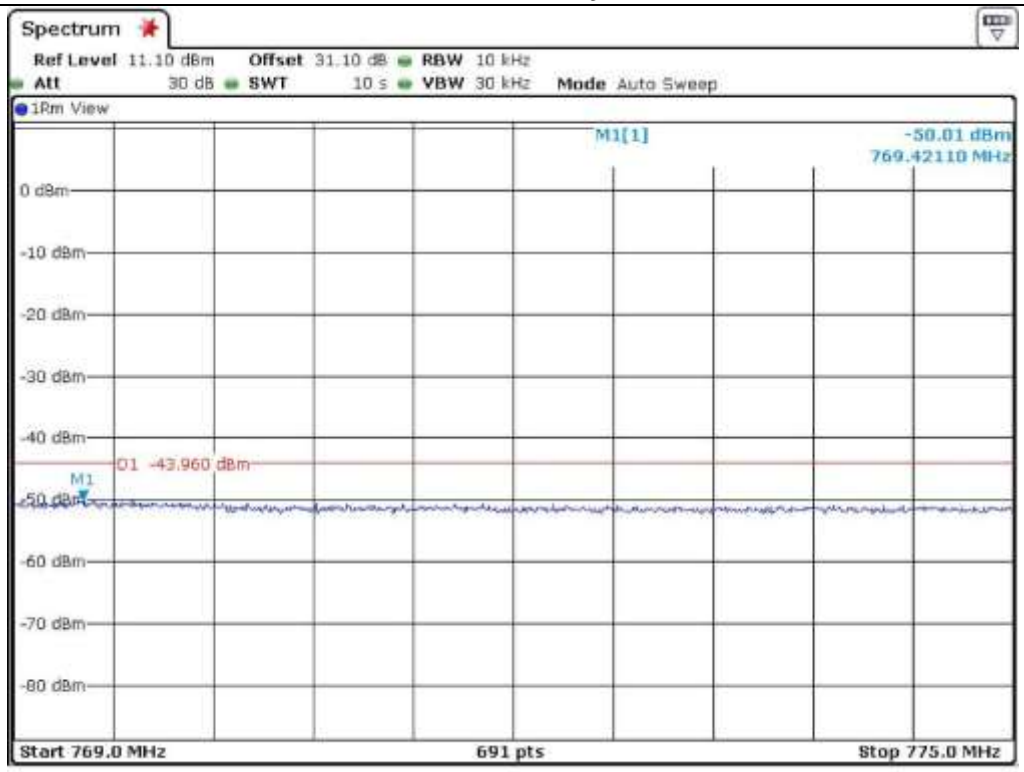


LTE 5 M - Low – QPSK



LTE 5 M - High – QPSK

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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7.5.2 Test data for Uplink (LTE 5 M)

-. Test Date : December 24, 2014

-. Frequency range : 769 MHz ~ 775 MHz and 799 MHz ~ 805 MHz

-. Result : PASSED

Modulation	Harmonic Frequency (MHz)		Measured Value (dBm)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
LTE 5 M - Low	QPSK	799.11	-58.68	0.43	-58.25	-43.96	14.29
LTE 5 M - High	QPSK	799.12	-58.10	0.43	-57.67		13.71

From CFR 90.543(e)(1)&(e)(4): On all frequencies between 769 MHz ~ 775 MHz and 799 MHz ~ 805 MHz, by a factor not less than 76 + 10 log (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). AS it was not Possible to set the resolution bandwidth on the test equipment, the bandwidth was set to 10 kHz. The limit was adjusted by 10log(10 kHz / 6.25 kHz) = 2.04 dB. The limit shown in the plots for the 769 MHz to 775 MHz and 799 MHz to 805 MHz bands was set -46 dBm + 2.04 dB = -43.96 dBm

As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project 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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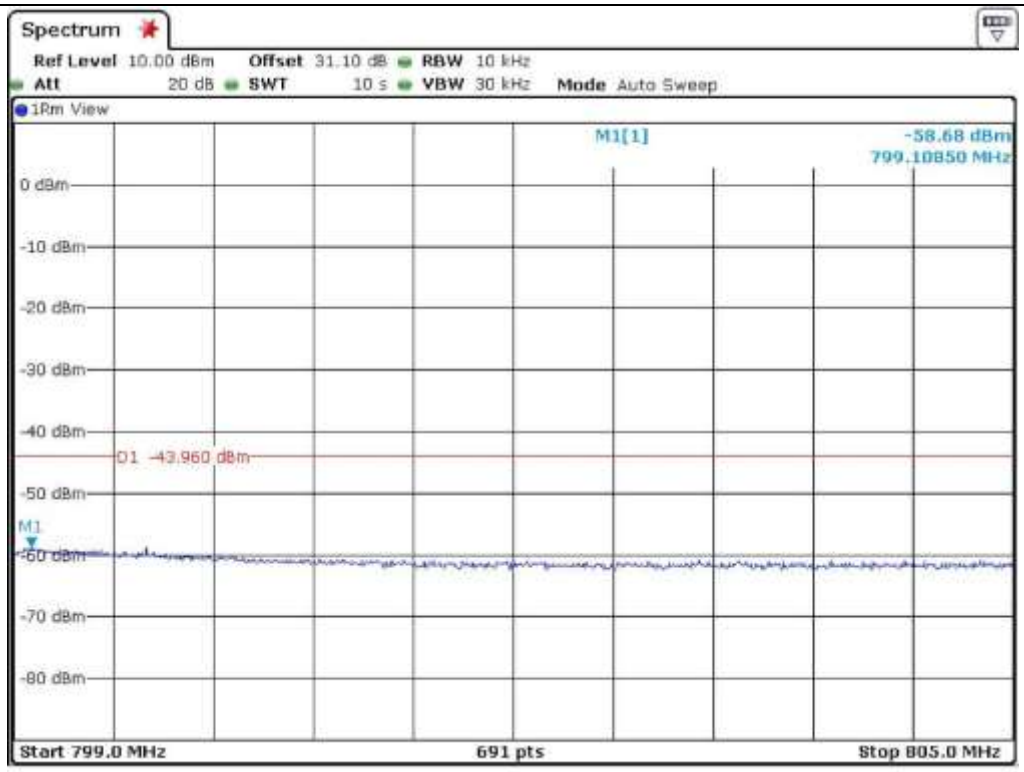
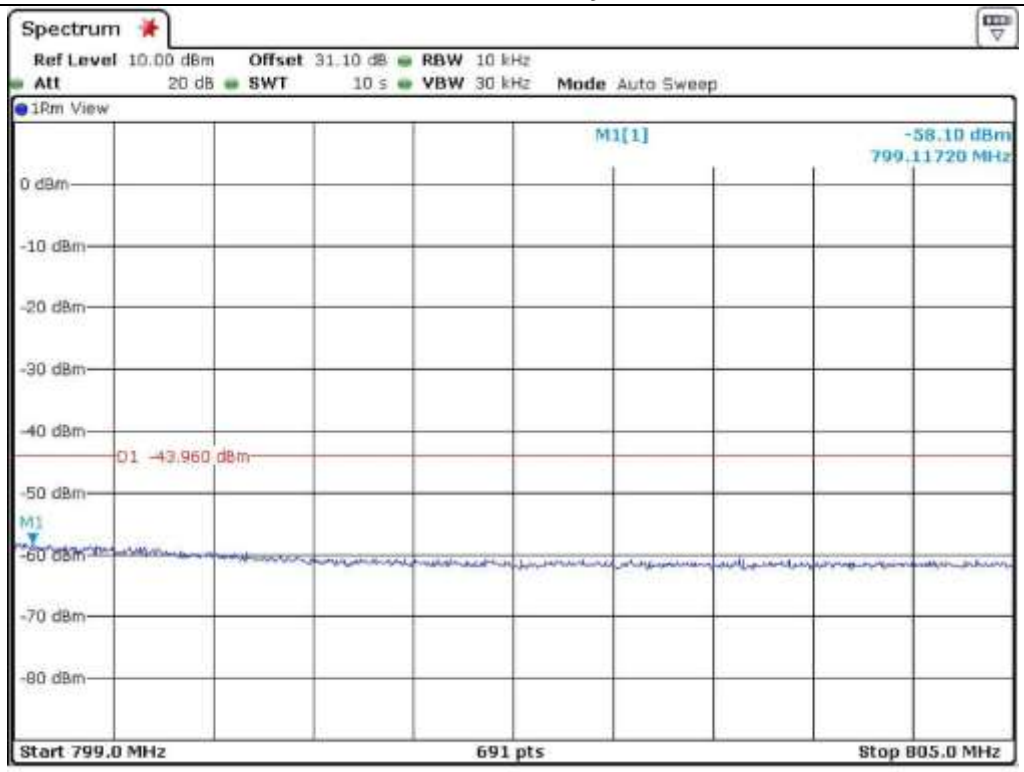


LTE 5 M - Low – QPSK



LTE 5 M - High – QPSK

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7.5.3 Test data for Downlink (LTE 10 M)

-. Test Date : December 24, 2014

-. Frequency range : 769 MHz ~ 775 MHz and 799 MHz ~ 805 MHz

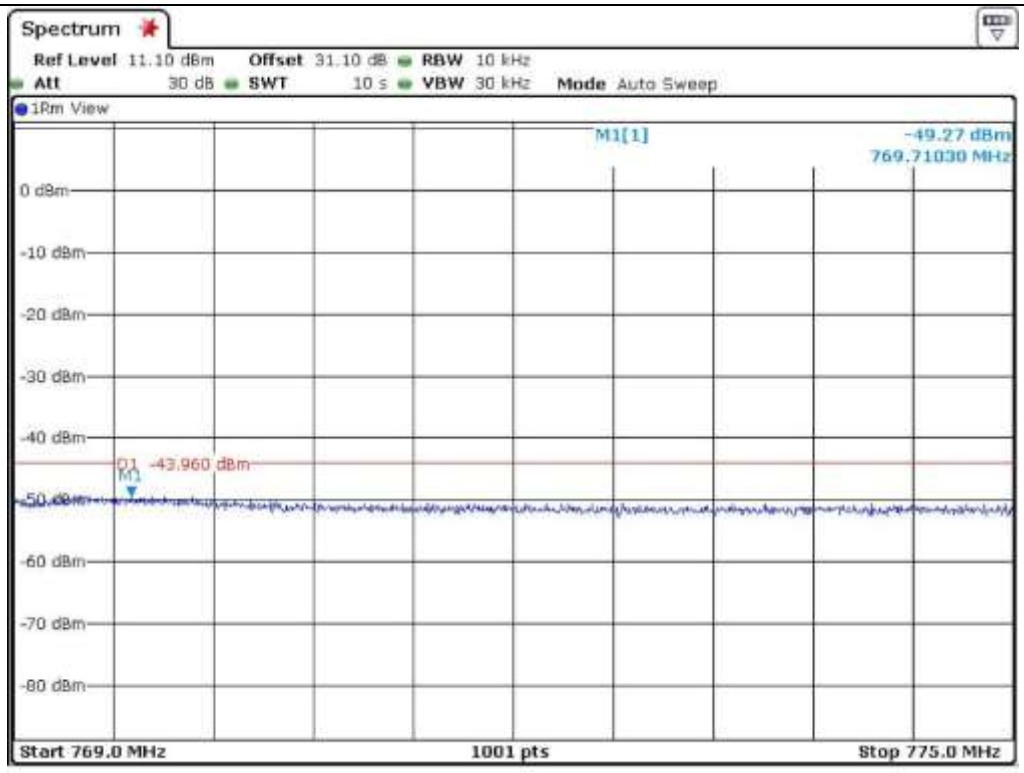
-. Result : PASSED

Modulation	Harmonic Frequency (MHz)		Measured Value (dBm)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
LTE 10 M	QPSK	769.71	-49.27	0.41	-48.86	-43.96	4.90

From CFR 90.543(e)(1)&(e)(4): On all frequencies between 769 MHz ~ 775 MHz and 799 MHz ~ 805 MHz, by a factor not less than 76 + 10 log (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). AS it was not Possible to set the resolution bandwidth on the test equipment, the bandwidth was set to 10 kHz. The limit was adjusted by 10log(10 kHz / 6.25 kHz) = 2.04 dB. The limit shown in the plots for the 769 MHz to 775 MHz and 799 MHz to 805 MHz bands was set -46 dBm + 2.04 dB = -43.96 dBm

As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project Engineer



LTE 10 M – QPSK

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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7.5.4 Test data for Uplink (LTE 10 M)

-. Test Date : December 24, 2014

-. Frequency range : 769 MHz ~ 775 MHz and 799 MHz ~ 805 MHz

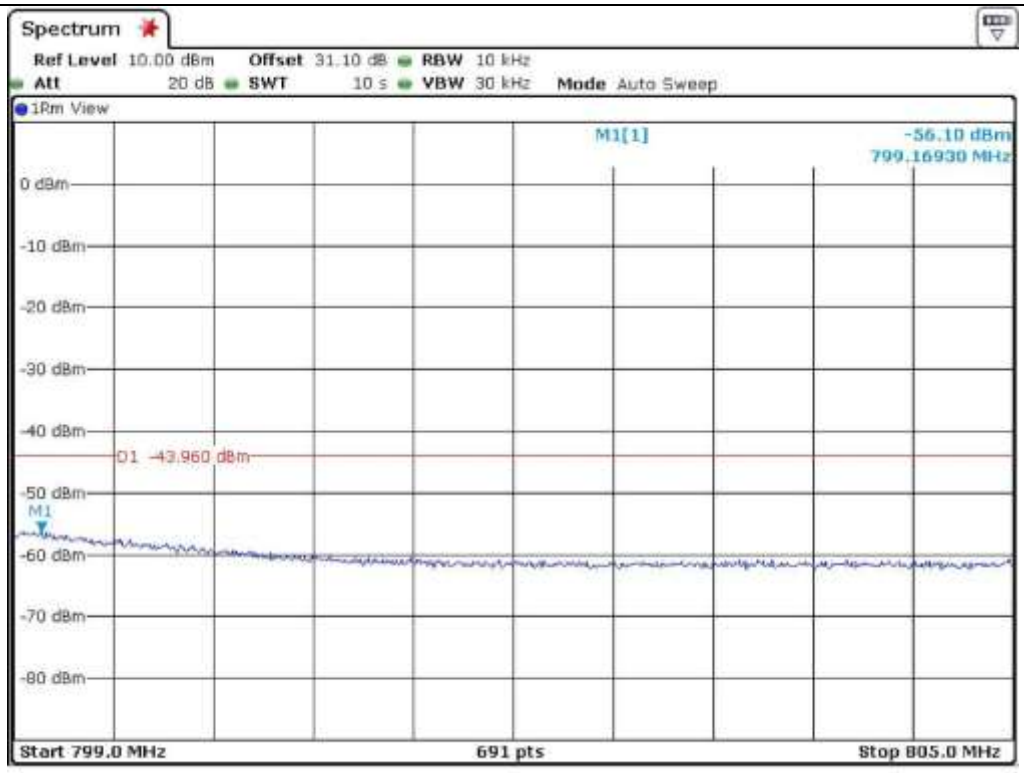
-. Result : PASSED

Modulation	Harmonic Frequency (MHz)		Measured Value (dBm)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
LTE 10 M	QPSK	799.17	-56.10	0.43	-55.67	-43.96	11.71

From CFR 90.543(e)(1)&(e)(4): On all frequencies between 769 MHz ~ 775 MHz and 799 MHz ~ 805 MHz, by a factor not less than 76 + 10 log (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). AS it was not Possible to set the resolution bandwidth on the test equipment, the bandwidth was set to 10 kHz. The limit was adjusted by 10log(10 kHz / 6.25 kHz) = 2.04 dB. The limit shown in the plots for the 769 MHz to 775 MHz and 799 MHz to 805 MHz bands was set -46 dBm + 2.04 dB = -43.96 dBm

As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project Engineer



LTE 10 M – QPSK

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7.6 Test data for Part 90.543(f)

(f) For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 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.

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

7.6.1 Test data for Downlink

-. Test Date : December 24, 2014

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

-. Result : PASSED

Modulation	Harmonic Frequency (MHz)		Measured Value (dBm)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
LTE 5 M - Low	QPSK	1 607.33	-63.29	1.16	-62.13	-40.00	22.13
LTE 5 M - High	QPSK	1 606.33	-63.29	1.16	-62.13		22.13

From CFR 90.543(f): For operations in the 758 MHz ~ 775 MHz and 788 MHz ~ 805 MHz bands, all emissions including harmonics 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.

As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project 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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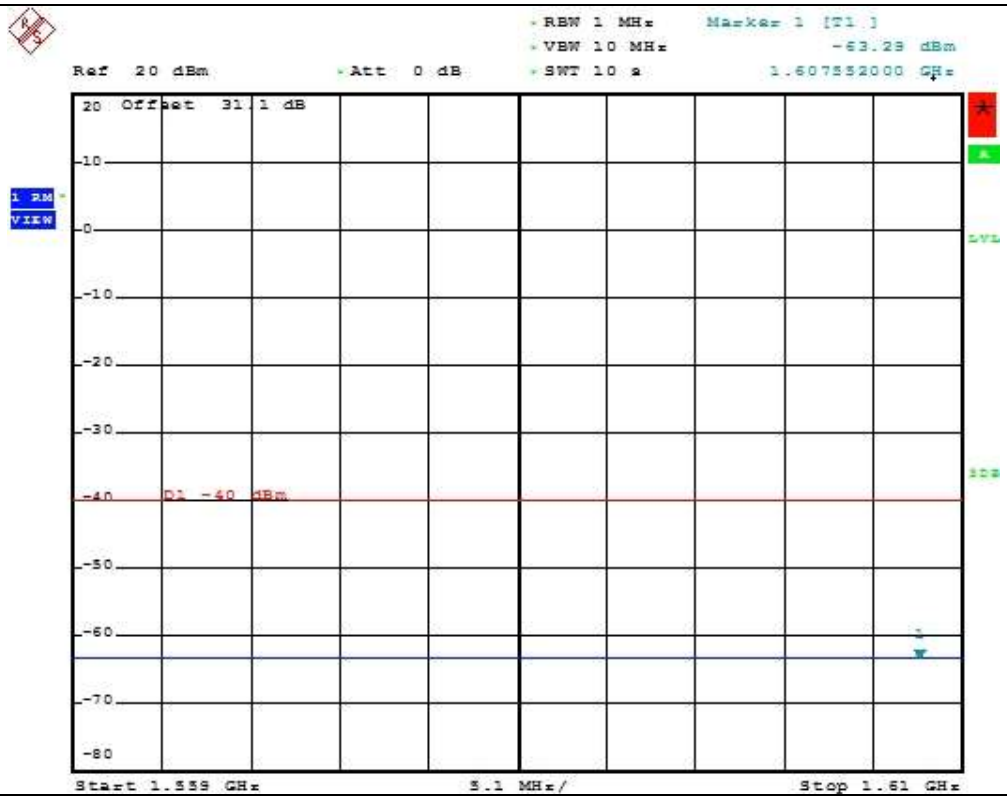
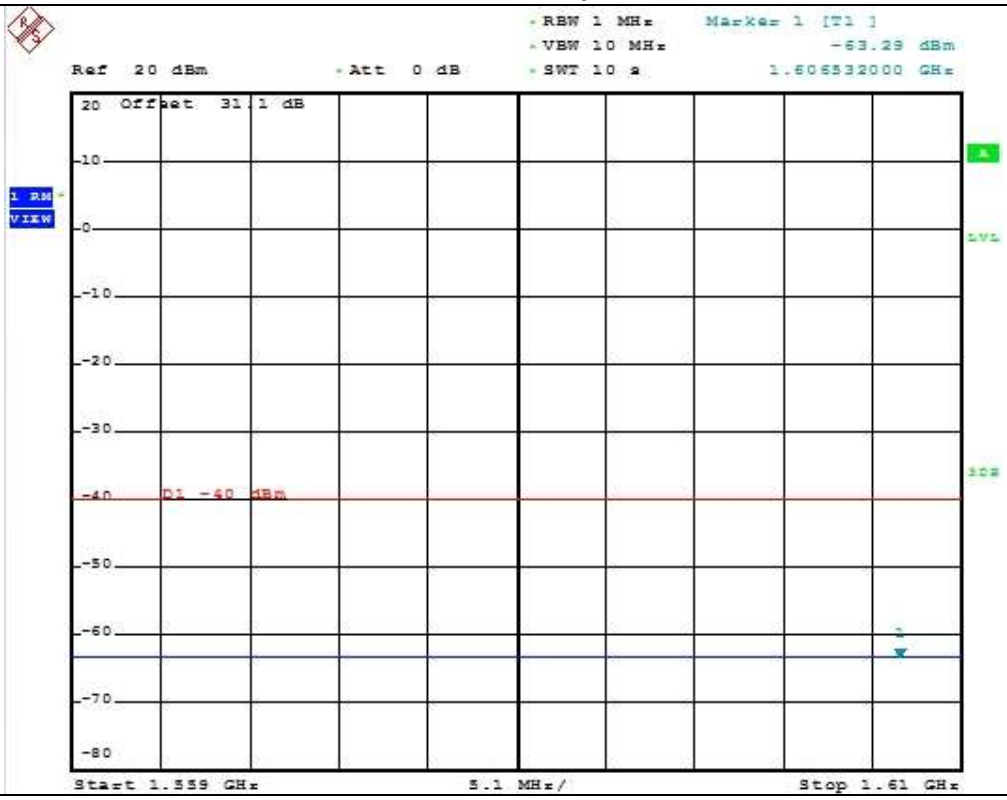


LTE 5 M - Low – QPSK



LTE 5 M - High – QPSK

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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7.6.2 Test data for Uplink

-. Test Date : December 24, 2014

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

-. Result : PASSED

Modulation	Harmonic Frequency (MHz)		Measured Value (dBm)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
LTE 5 M - Low	QPSK	1 609.49	-63.30	1.17	-62.13	-40.00	22.13
LTE 5 M - High	QPSK	1 603.71	-63.30	1.15	-62.15		22.15

From CFR 90.543(f): For operations in the 758 MHz ~ 775 MHz and 788 MHz ~ 805 MHz bands, all emissions including harmonics 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.

As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project 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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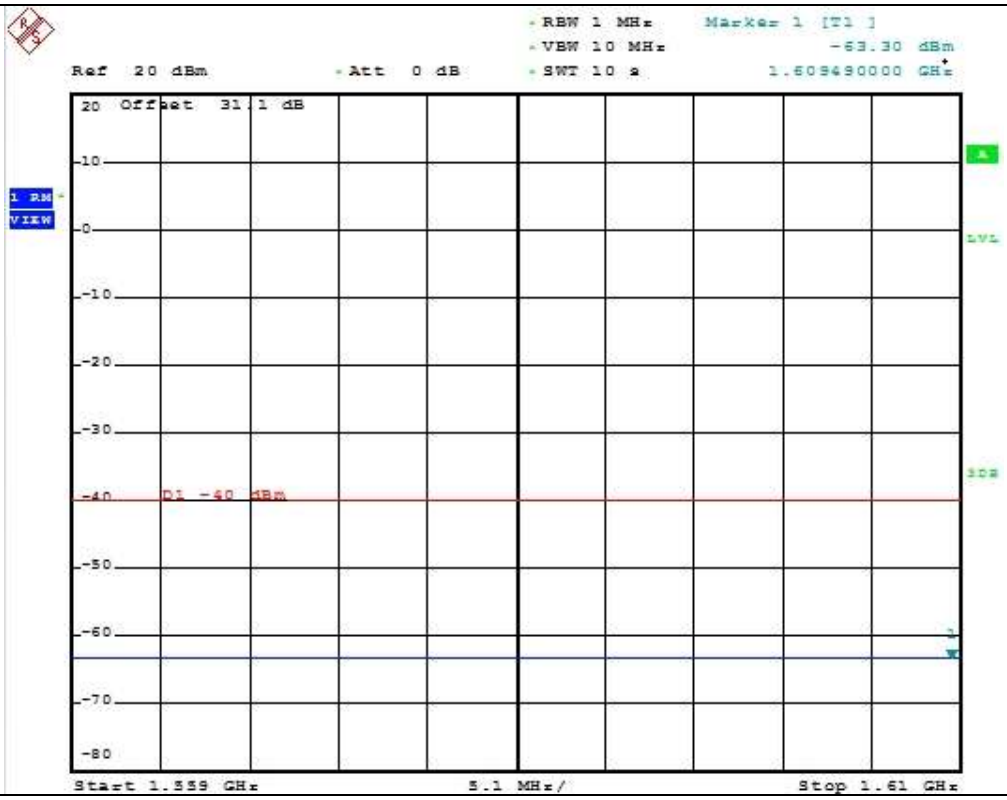
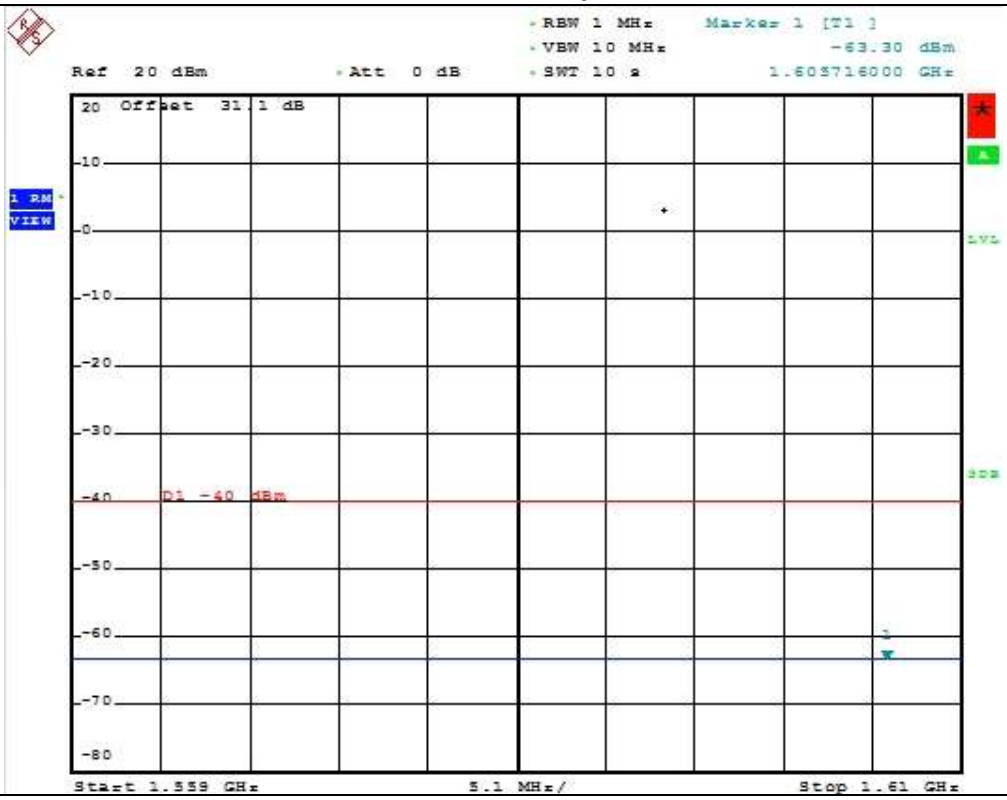


LTE 5 M - Low – QPSK



LTE 5 M - High – QPSK

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

8. Emission Masks

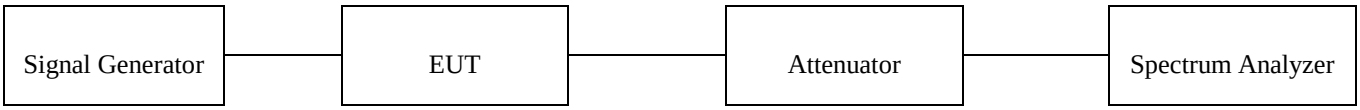
8.1 Operating environment

Temperature : 25 ℃

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 Center Frequency (low, middle, and high channels) at each band using all applicable modulation.



8.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	SMJ100A	Rohde & Schwarz	Signal Generator	101038	Oct. 08, 2014 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014(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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

8.4 Test data for Part 2.1047, 2.1051, 90.210(b)

-. Part 2.1047

(a) Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

(b) Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

(c) Single sideband and independent sideband radiotelephone transmitters which employ a device or circuit to limit peak envelope power. A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of §2.1049 for the occupied bandwidth tests.

(d) Other types of equipment. A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

-. Part 2.1051

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

-. 90.210(b)

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (o) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating under this part.

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APPLICABLE EMISSION MASKS

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25[1]	A or B	A or C
25-50	B	C
72-76	B	C
150-174[2]	B, D, or E	C, D or E
150 paging only	B	C
220-222	F	F
421-512[2 5]	B, D, or E	C, D, or E
450 paging only	B	G
806-809/851-854	B	H
809-824/854-869[3 5]	B	G
896-901/935-940	I	J
902-928	K	K
929-930	B	G
4940-4990 MHz	L or M	L or M
5850-5925[4]		
All other bands	B	C

[1] Equipment using single sideband J3E emission must meet the requirements of Emission Mask A. Equipment using other emissions must meet the requirements of Emission Mask B or C, as applicable.

[2] Equipment designed to operate with a 25 kHz channel bandwidth must meet the requirements of Emission Mask B or C, as applicable. Equipment designed to operate with a 12.5 kHz channel bandwidth must meet the requirements of Emission Mask D, and equipment designed to operate with a 6.25 kHz channel bandwidth must meet the requirements of Emission Mask E.

[3] Equipment used in this licensed to EA or non-EA systems shall comply with the emission mask provisions of §90.691 of this chapter.

[4] DSRCS Roadside Units equipment in the 5850-5925 MHz band is governed under subpart M of this part.

[5] Equipment may alternatively meet the Adjacent Channel Power limits of §90.221.

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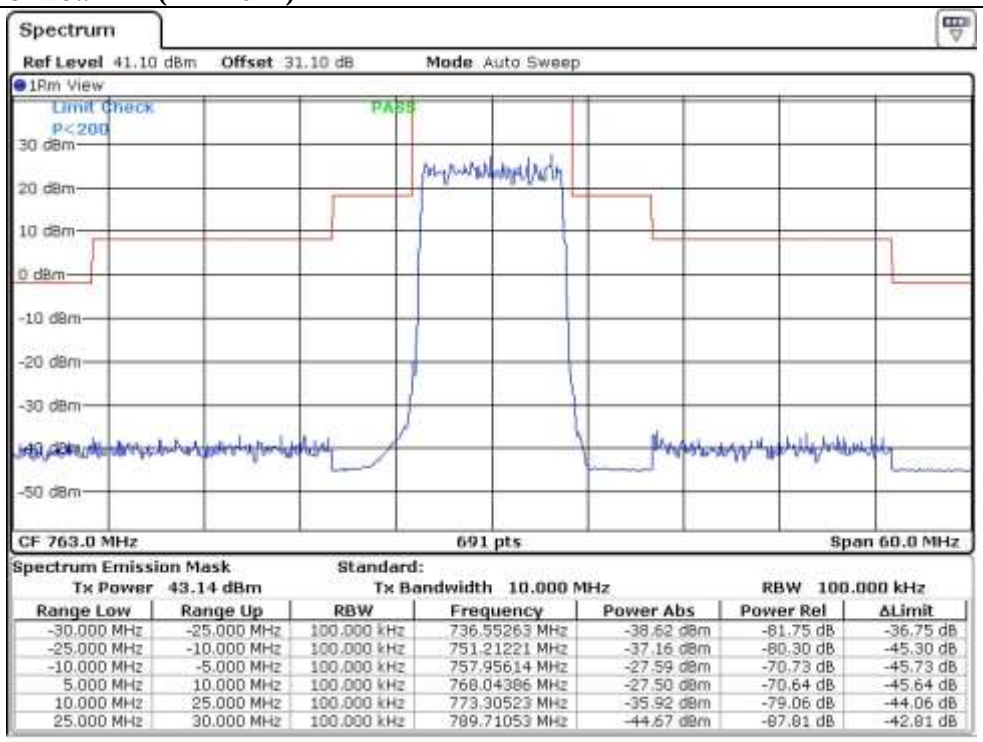
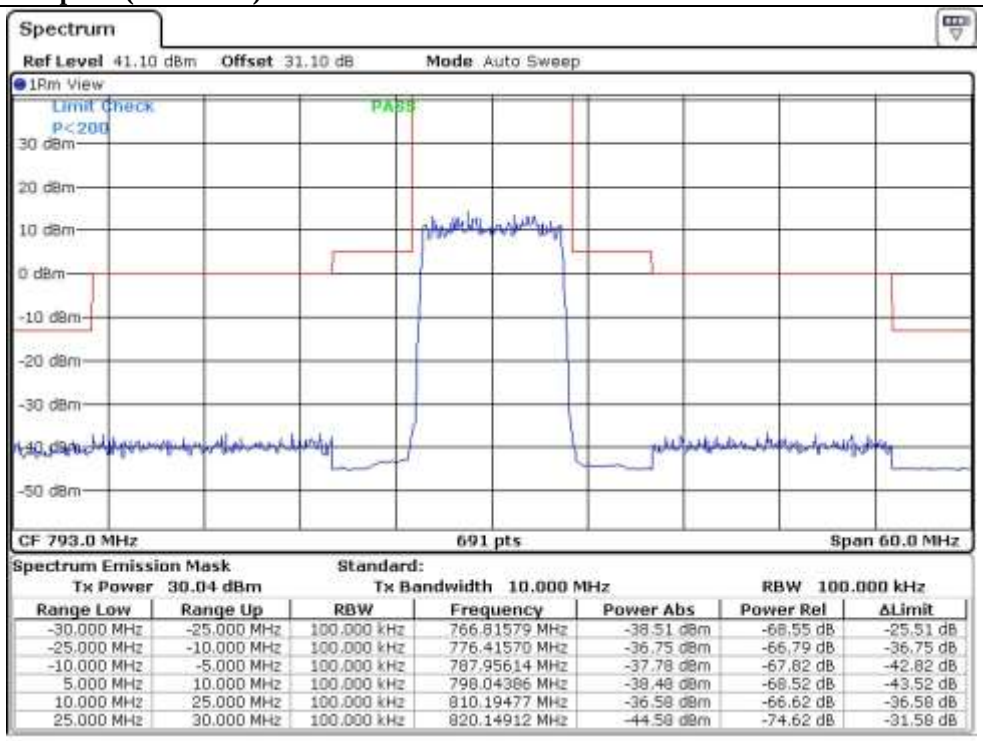
EMC Testing Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

8.4.1 Test data for Downlink (LTE 10 M)



Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-30.000 MHz	-25.000 MHz	100.000 kHz	736.55263 MHz	-38.62 dBm	-81.75 dB	-36.75 dB
-25.000 MHz	-10.000 MHz	100.000 kHz	751.21221 MHz	-37.16 dBm	-80.30 dB	-45.30 dB
-10.000 MHz	-5.000 MHz	100.000 kHz	757.95614 MHz	-27.59 dBm	-70.73 dB	-45.73 dB
5.000 MHz	10.000 MHz	100.000 kHz	768.04386 MHz	-27.50 dBm	-70.64 dB	-45.64 dB
10.000 MHz	25.000 MHz	100.000 kHz	773.30523 MHz	-35.92 dBm	-79.06 dB	-44.06 dB
25.000 MHz	30.000 MHz	100.000 kHz	789.71053 MHz	-44.67 dBm	-87.81 dB	-42.81 dB

8.4.2 Test data for Uplink (LTE 10 M)



Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-30.000 MHz	-25.000 MHz	100.000 kHz	766.81579 MHz	-38.51 dBm	-68.55 dB	-25.51 dB
-25.000 MHz	-10.000 MHz	100.000 kHz	776.41570 MHz	-36.75 dBm	-66.79 dB	-36.75 dB
-10.000 MHz	-5.000 MHz	100.000 kHz	787.95614 MHz	-37.78 dBm	-67.82 dB	-42.82 dB
5.000 MHz	10.000 MHz	100.000 kHz	798.04386 MHz	-38.48 dBm	-68.52 dB	-43.52 dB
10.000 MHz	25.000 MHz	100.000 kHz	810.19477 MHz	-36.58 dBm	-66.62 dB	-36.58 dB
25.000 MHz	30.000 MHz	100.000 kHz	820.14912 MHz	-44.58 dBm	-74.62 dB	-31.58 dB

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

9. BAND EDGE MEASUREMENT

9.1 Operating environment

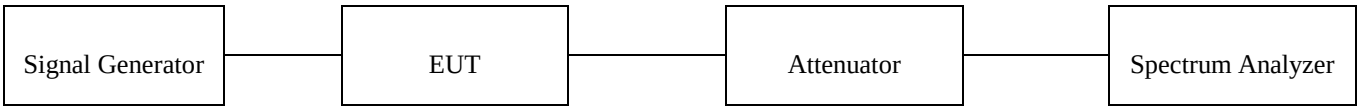
Temperature : 25 ℃

Relative humidity : 50 % R.H.

9.2 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 Center Frequency (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.



9.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	SMJ100A	Rohde & Schwarz	Signal Generator	101038	Oct. 08, 2014 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014(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 Dept : 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 for Part 2.1051, 90.543(c)

-. Part 2.1051

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

-. 90.543(c)

(c) Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10log (P) dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

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EMC Testing Dept : 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 Test data for Downlink (LTE 5 M)

-. Test Date : December 29, 2014

-. Result : PASSED

Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)	Limit (dBm)	Margin (dB)
LTE 5 M(Low & High) _QPSK	Low	757.797	-18.12	-13.00	5.12
	High	768.260	-19.91		6.91

According to Part 90, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0dBm.
As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

LTE 5 M_QPSK – Band Edge (Low Channel)

LTE 5 M_QPSK – 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 Dept : 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 data for Uplink (LTE 5 M)

-. Test Date : December 29, 2014

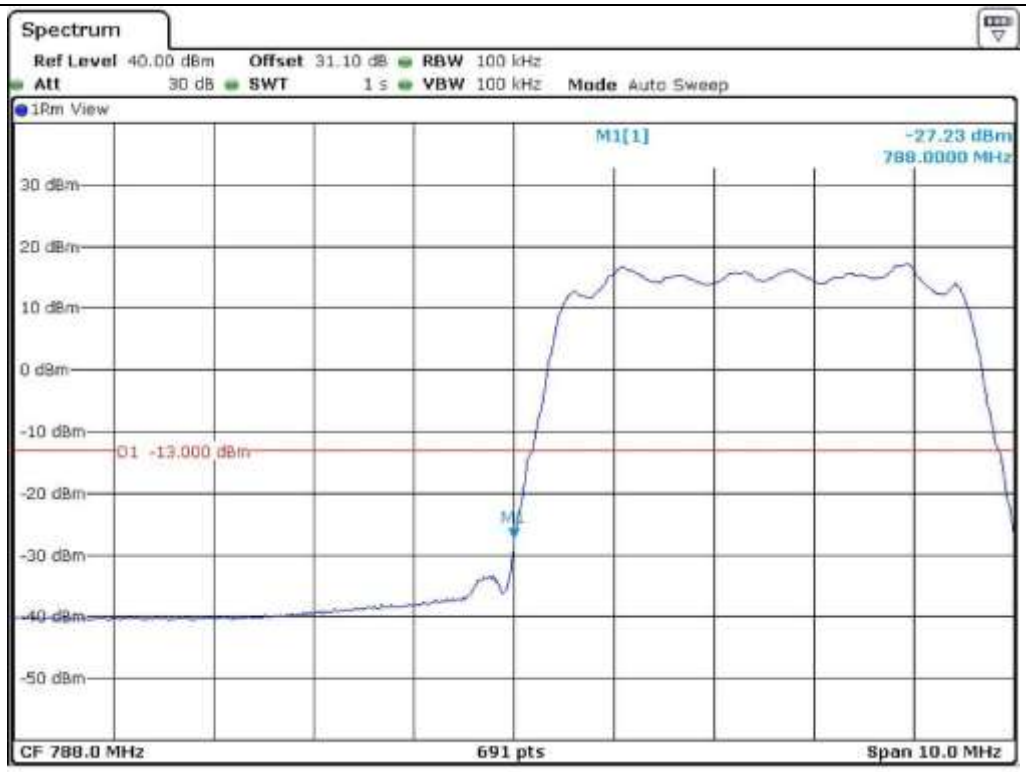
-. Result : PASSED

Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)	Limit (dBm)	Margin (dB)
LTE 5 M(Low & High) _QPSK	Low	788.000	-27.23	-13.00	14.23
	High	798.000	-29.11		16.11

According to Part 90, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0dBm.
As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



LTE 5 M_QPSK – Band Edge (Low Channel)

LTE 5 M_QPSK – 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

9.4.3 Test data for Downlink (LTE 10 M)

-. Test Date : December 29, 2014

-. Result : PASSED

Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)	Limit (dBm)	Margin (dB)
LTE 10 M_QPSK	Low	757.884	-18.12	-13.00	5.12
	High	768.029	-18.23		5.23

According to Part 90, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0dBm.
As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

LTE 10 M_QPSK – Band Edge (Low Channel)

LTE 10 M_QPSK – 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

9.4.4 Test data for Uplink (LTE 10 M)

-. Test Date : December 29, 2014

-. Result : PASSED

Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)	Limit (dBm)	Margin (dB)
LTE 10 M_QPSK	Low	787.942	-31.56	-13.00	18.56
	High	797.971	-31.07		18.07

According to Part 90, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0dBm.
As a result of preliminary testing., the formal test was performed with the maximum payload mode of worst cases for QPSK.

Tested by: hyung-kwon, Oh / Project 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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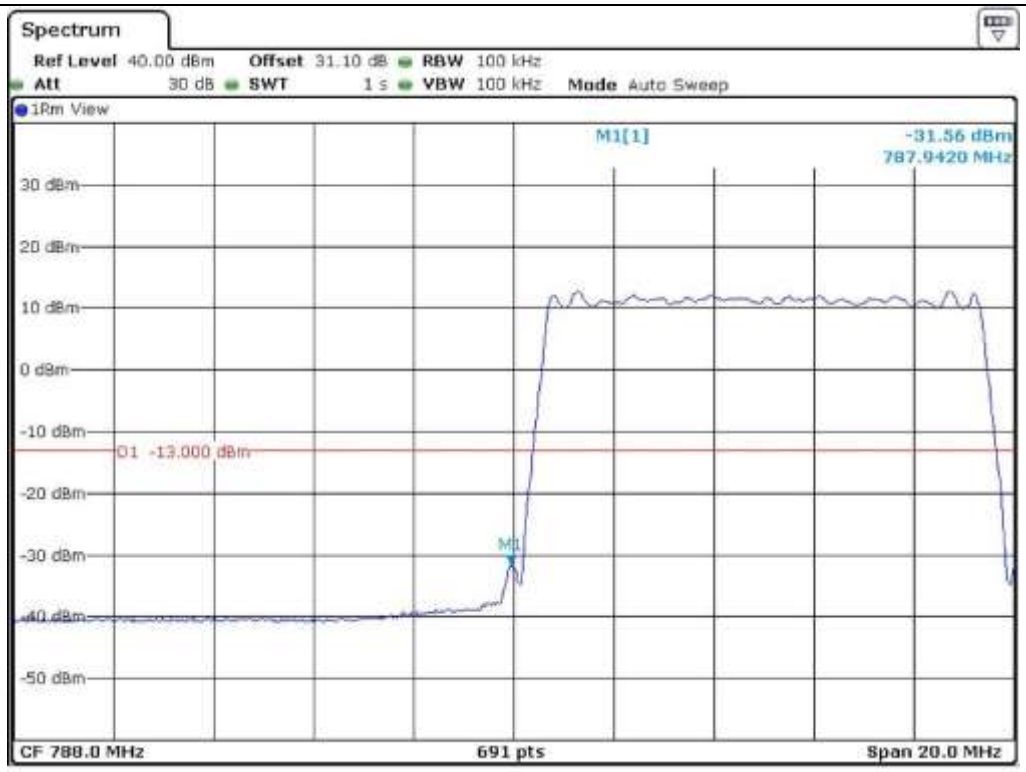
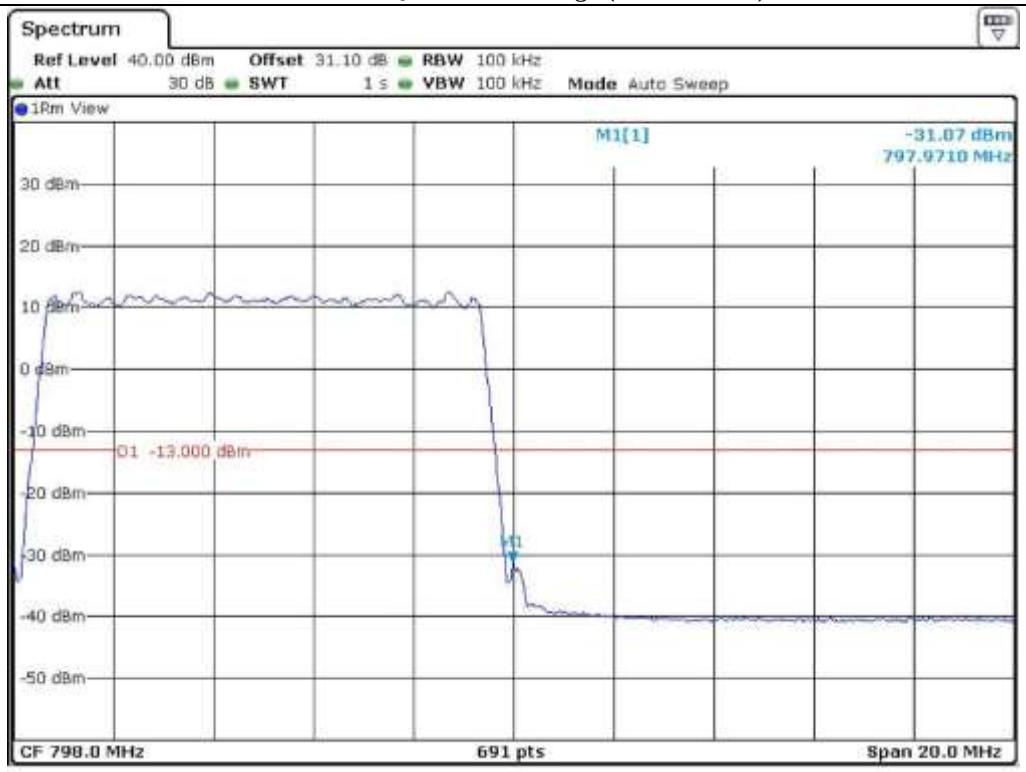


LTE 10 M_QPSK – Band Edge (Low Channel)



LTE 10 M_QPSK – 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

10. INTERMODULATION TEST

10.1 Operating environment

Temperature : 25 ℃

Relative humidity : 50 % R.H.

10.2 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 Center Frequency (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.

10.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	SMJ100A	Rohde & Schwarz	Signal Generator	101038	Oct. 08, 2014 (1Y)
■ -	SMBV100A	Rohde & Schwarz	Vector Signal Generator	260423	Jul. 30, 2014(1Y)
■ -	SMB100A	Rohde & Schwarz	Signal Generator	177648	Jul. 30, 2014(1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014(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 Dept : 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 Part 2.1051, 90.543(c)(e)

-. Part 2.1051

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

-. 90.543(c)(e)

(c) Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10log (P) dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

(e) For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations.

(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations.

(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.

(4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(5) Compliance with the provisions of paragraph (e)(3) 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 30 kHz may be employed.

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EMC Testing Dept : 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 Test Result for peak power

-. Test Date : January 26, 2015

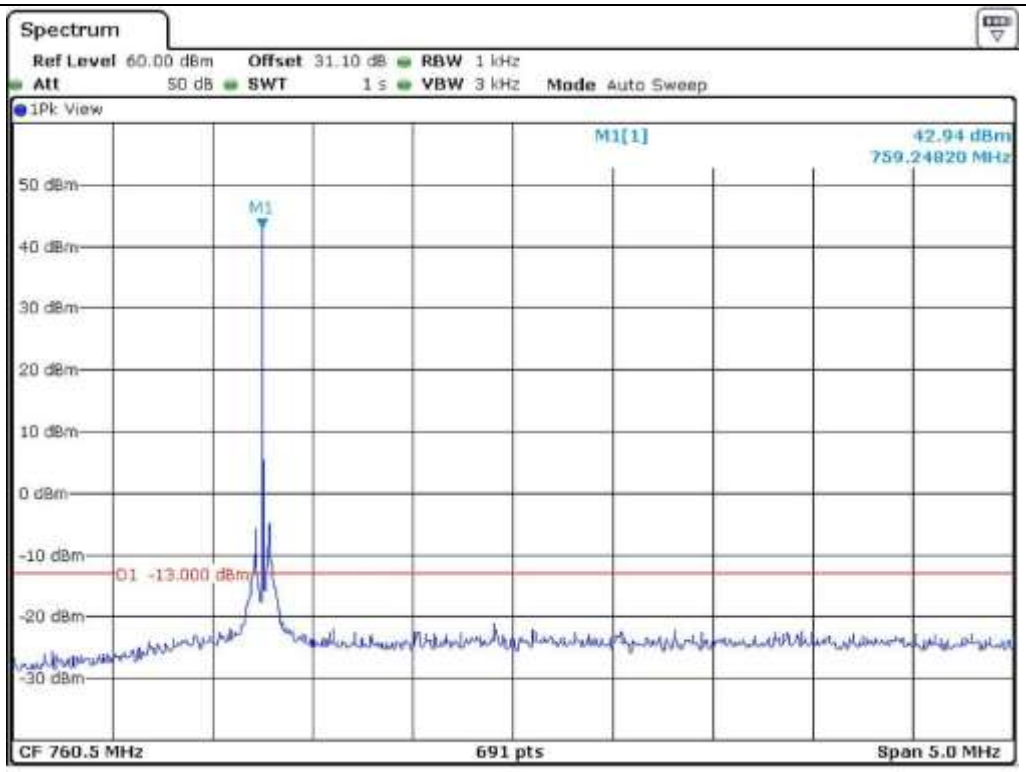
-. Test Result : Pass

-. Modulation : No-Modulation

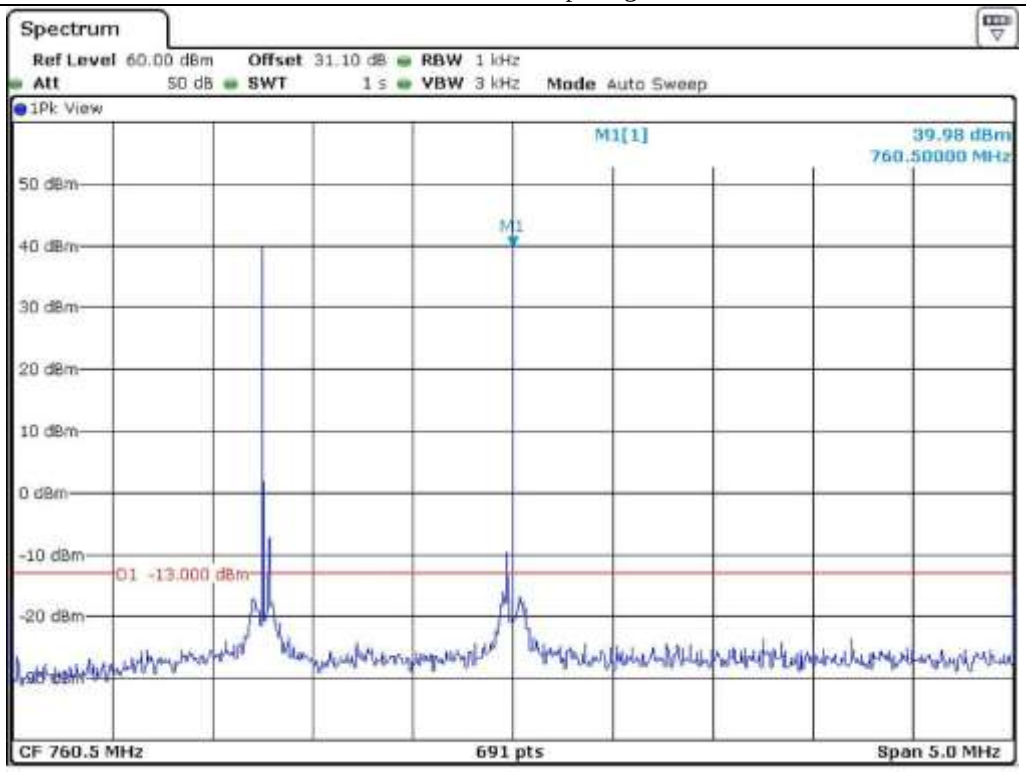
Frequency (MHz)	Number of Input Channel	Input Power (dBm)	Output Power (dBm)
759.25	1	-57.02	42.94
759.25 & 760.50	2	-57.00	39.98
759.25 & 760.50 & 761.75	3	-57.01	38.02
766.75	1	-56.98	43.04
766.75 & 765.50	2	-56.97	39.99
766.75 & 765.50 & 764.25	3	-56.99	37.96

Tested by: hyung-kwon, Oh / Project Engineer

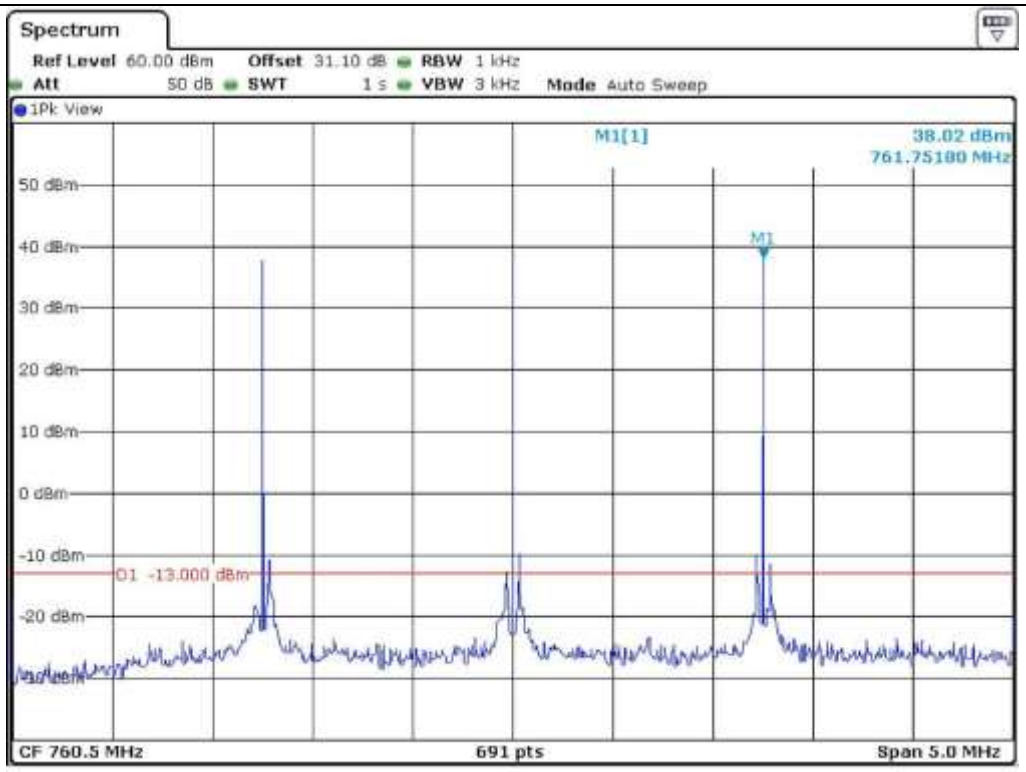
HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
EMC Testing Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



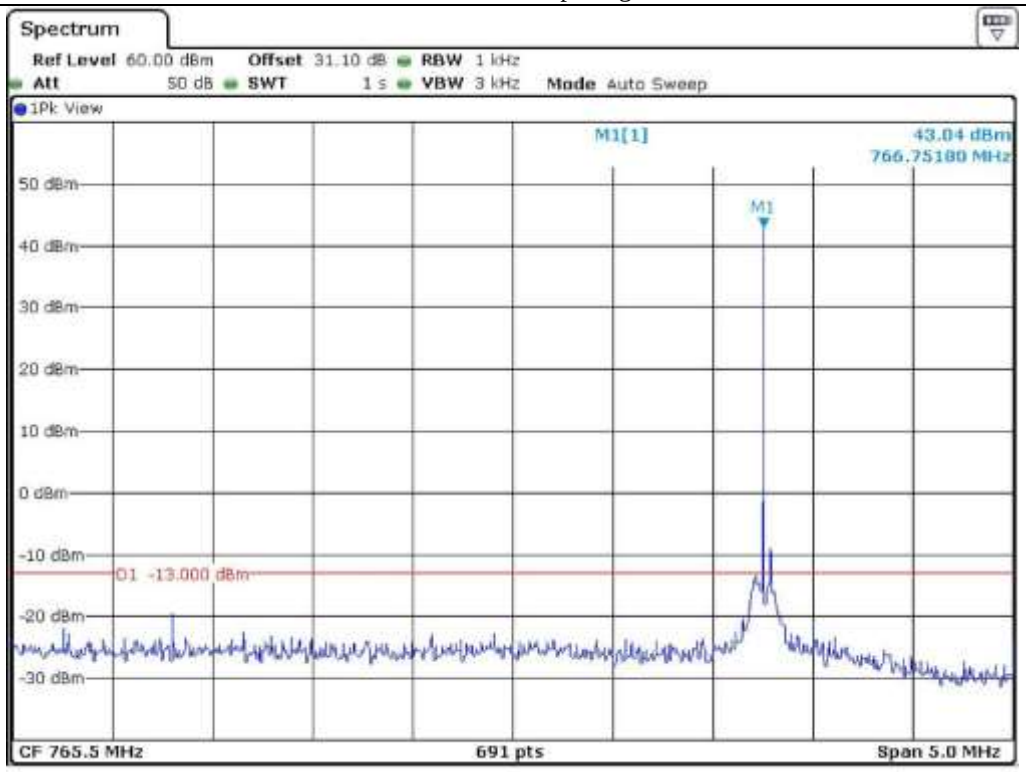
Low Channel – 1 input signal



Low Channel – 2 input signals



Low Channel – 3 input signals



High Channel – 1 input signal

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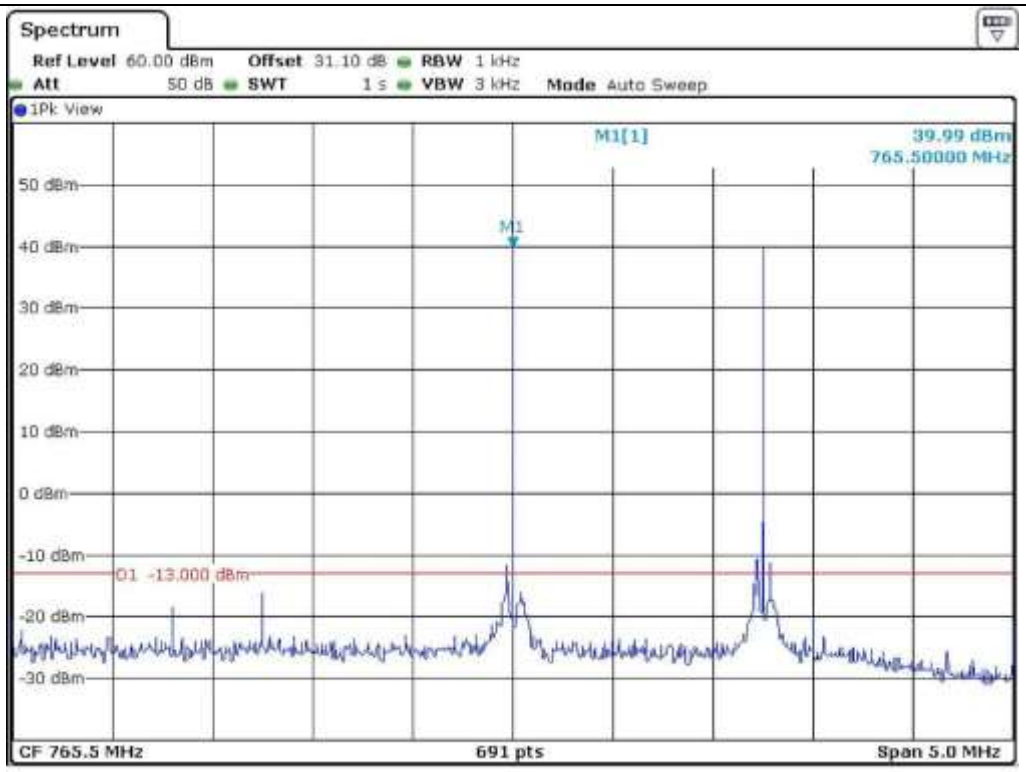
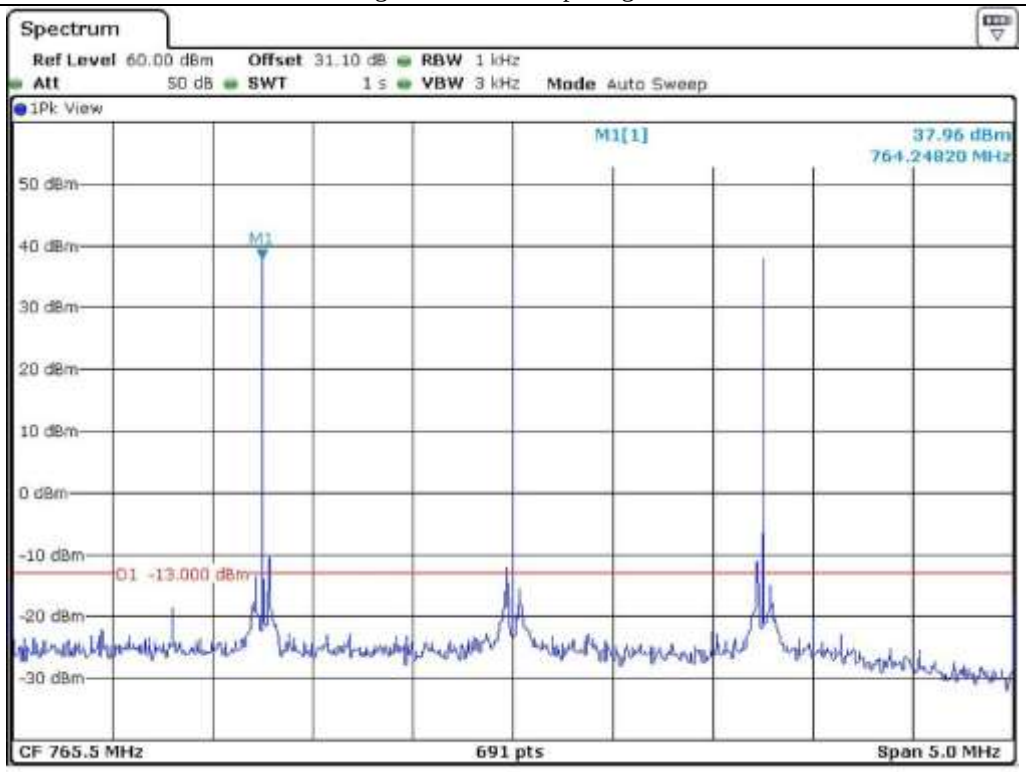
EMC Testing Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)



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)
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10.4.2 Test Result for Spurious emission

-. Test Date : January 26, 2015

-. Test Result : Pass

-. Modulation : No-Modulation

Frequency (MHz)	Number of Input Channel	Measured Value	Result
759.25	1	< -13 dBm	Pass
759.25 & 760.50	2		
759.25 & 760.50 & 761.75	3		
766.75	1	< -13 dBm	Pass
766.75 & 765.50	2		
766.75 & 765.50 & 764.25	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: hyung-kwon, Oh / Project 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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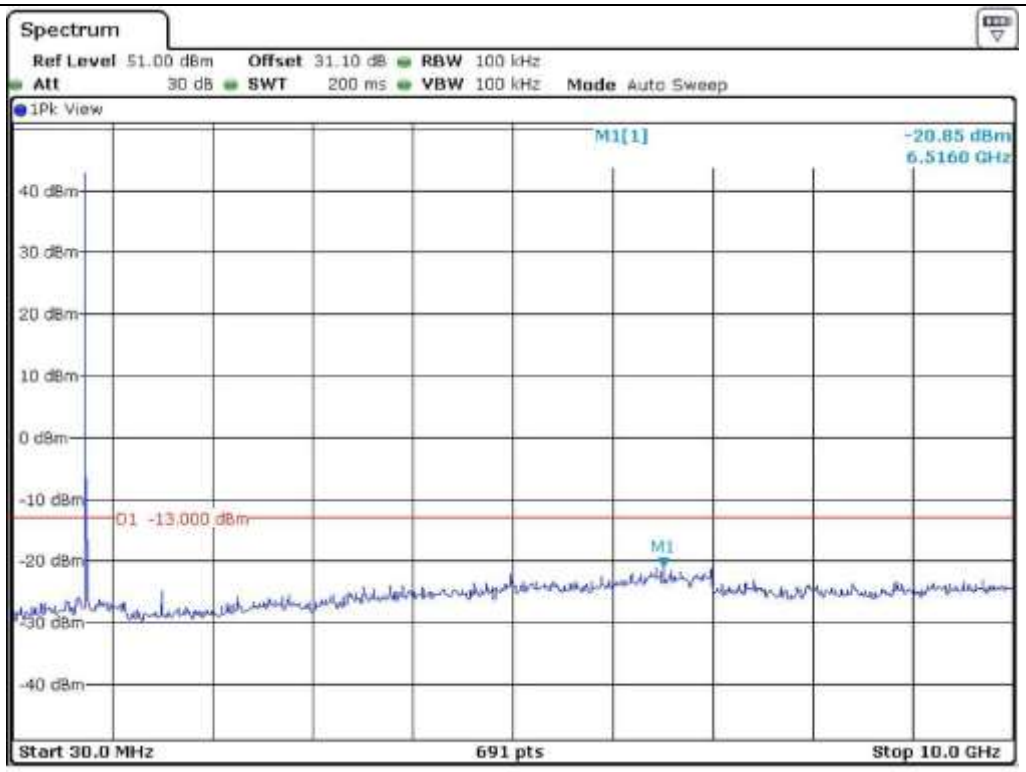
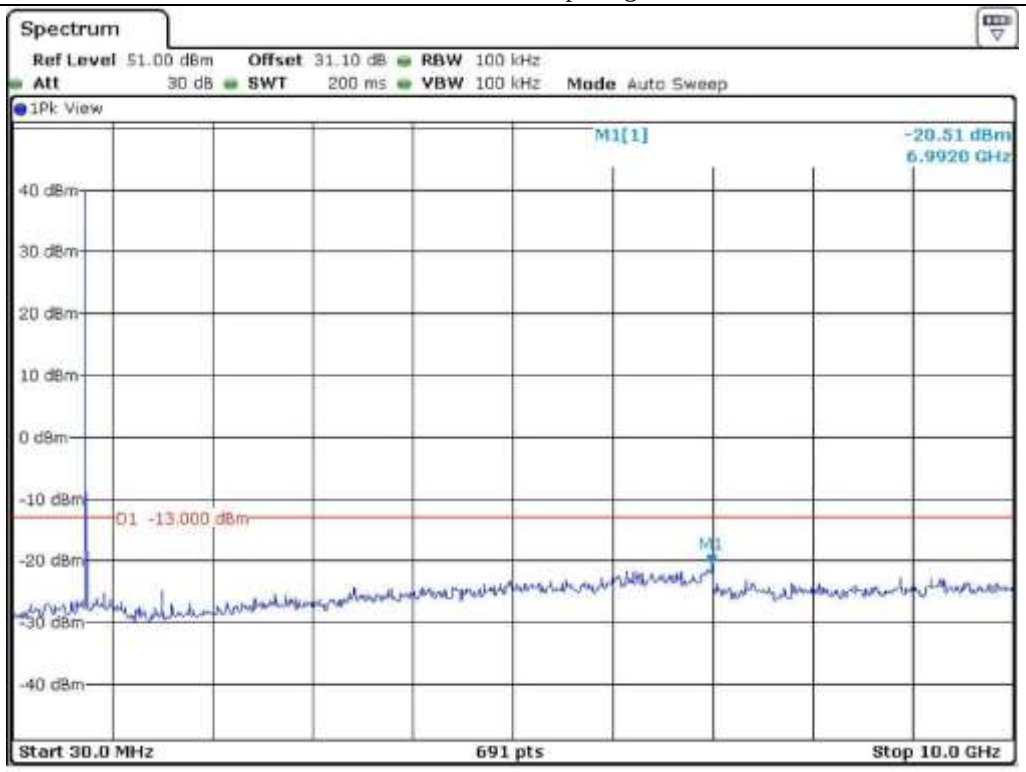
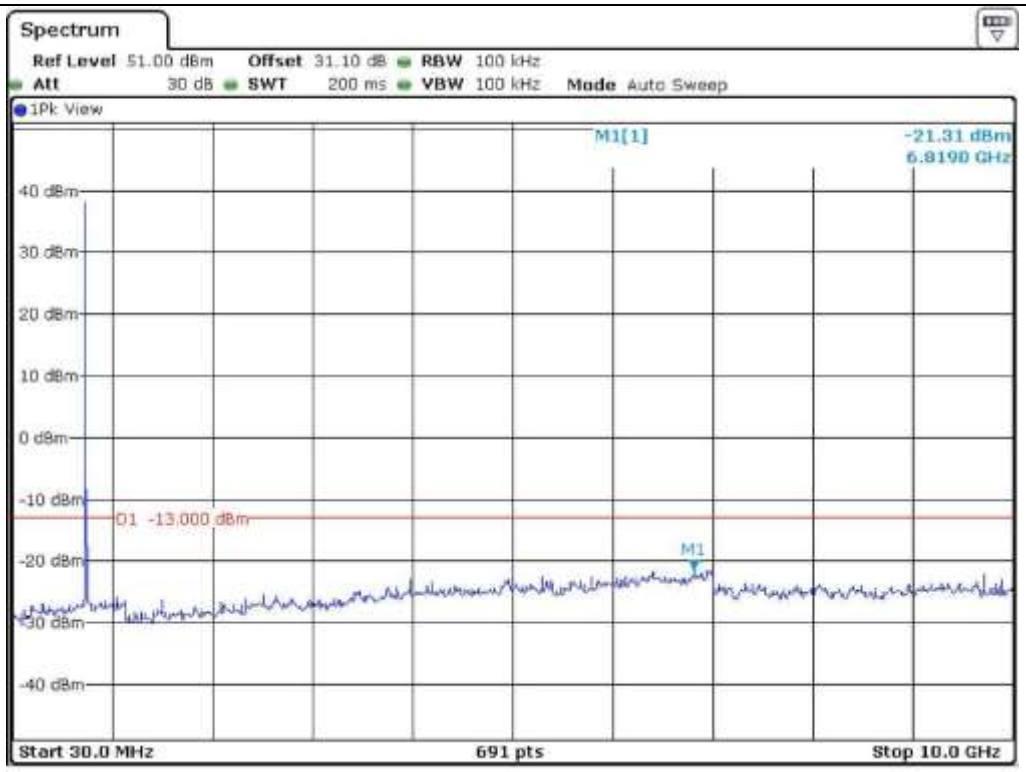


Low Channel – 1 input signal

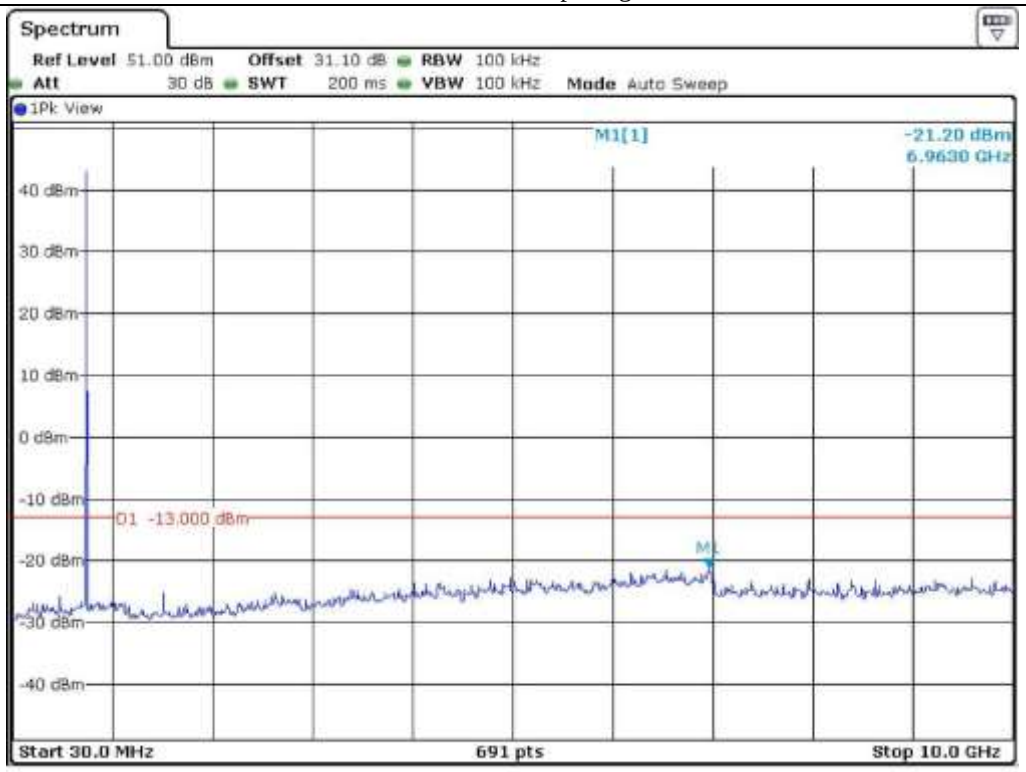


Low Channel – 2 input signals

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 Dept : 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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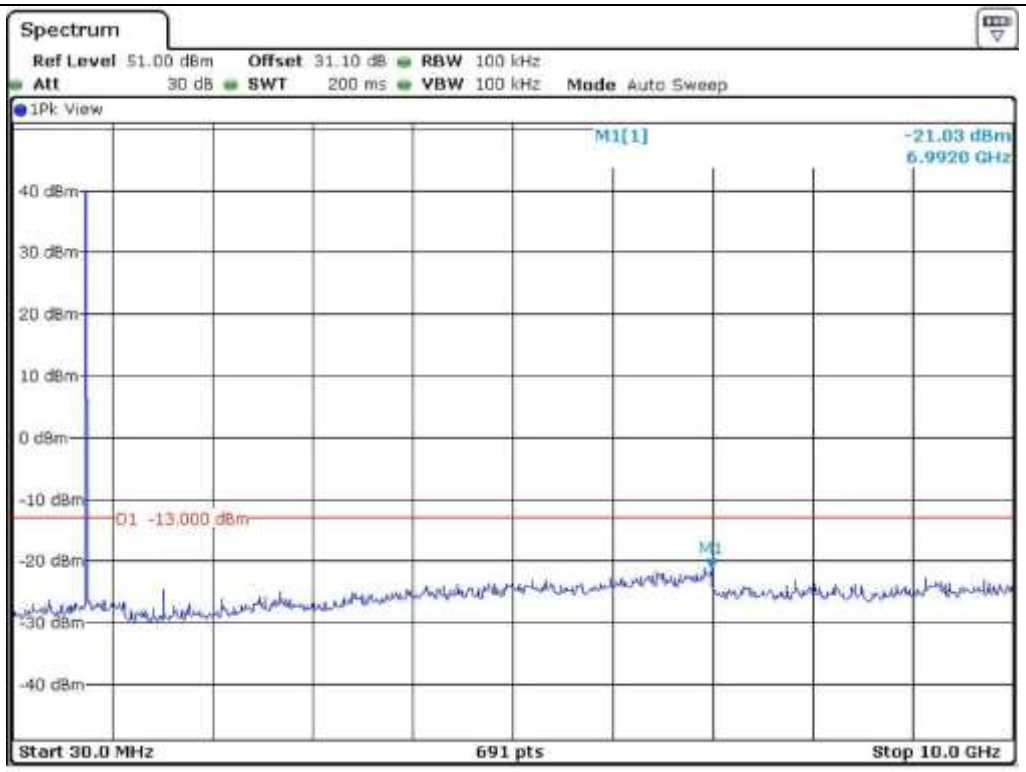
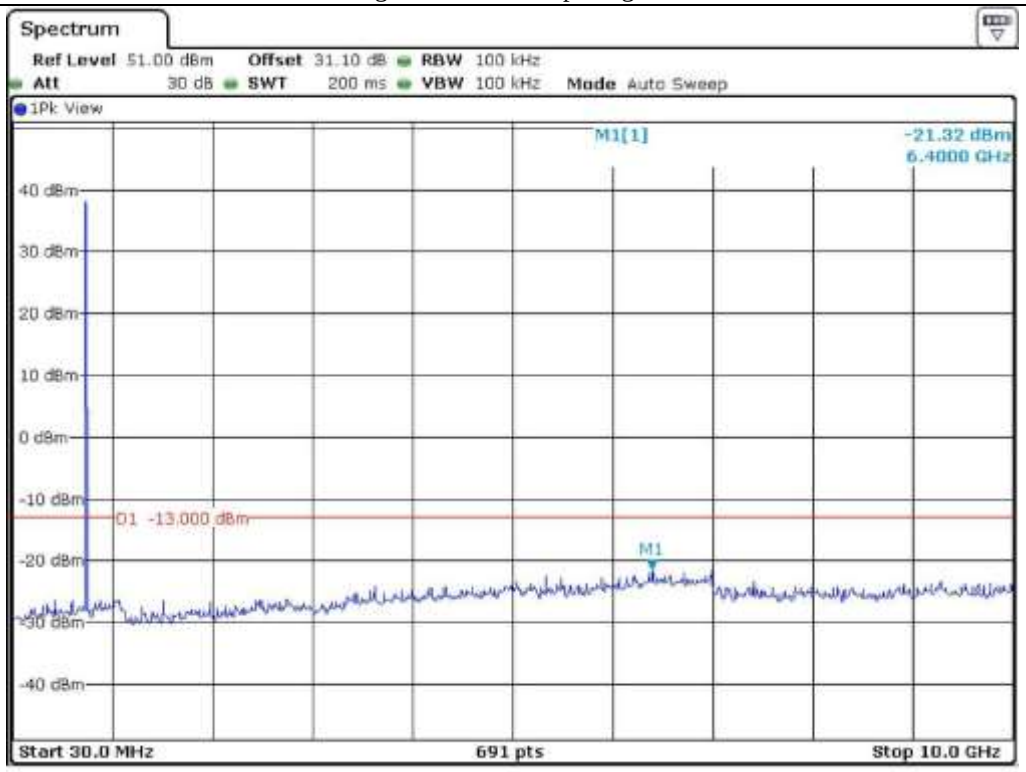


High Channel – 2 input signals



High Channel – 3 input signals

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10.5 Test data for Uplink

10.5.1 Test Result for peak power

-. Test Date : January 26, 2015

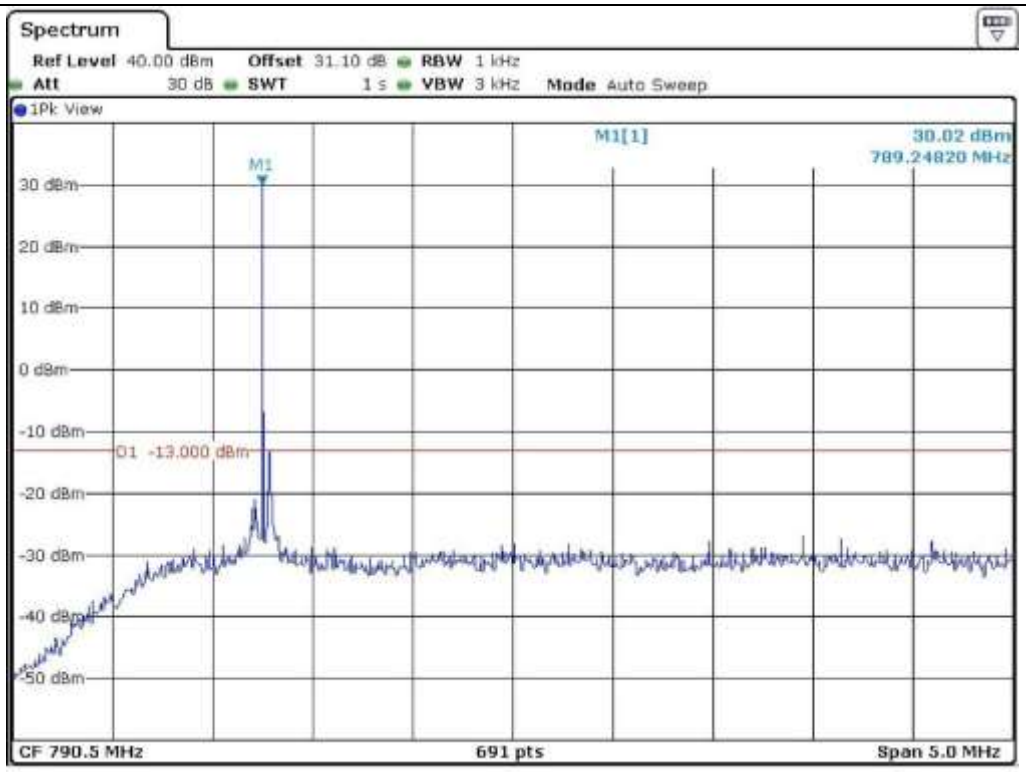
-. Test Result : Pass

-. Modulation : No-Modulation

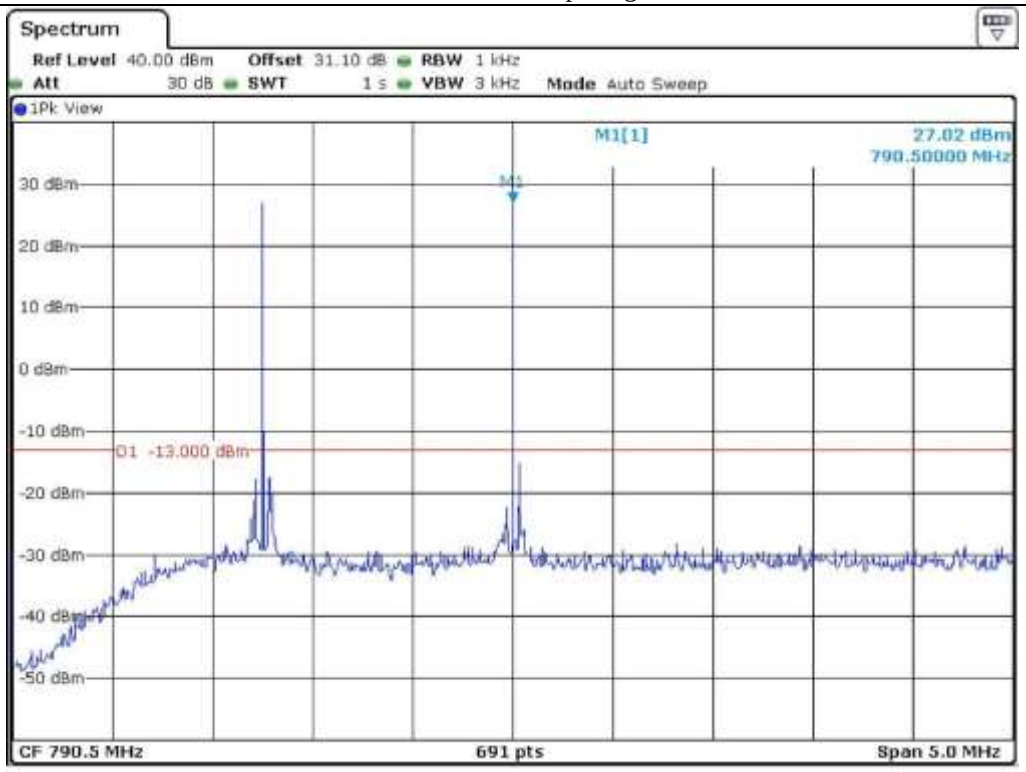
Frequency (MHz)	Number of Input Channel	Input Power (dBm)	Output Power (dBm)
789.25	1	-70.00	30.02
789.25 & 790.50	2	-69.97	27.02
789.25 & 790.50 & 791.75	3	-69.99	24.94
796.75	1	-69.98	29.99
796.75 & 795.50	2	-70.04	26.94
796.75 & 795.50 & 794.25	3	-70.02	25.00

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

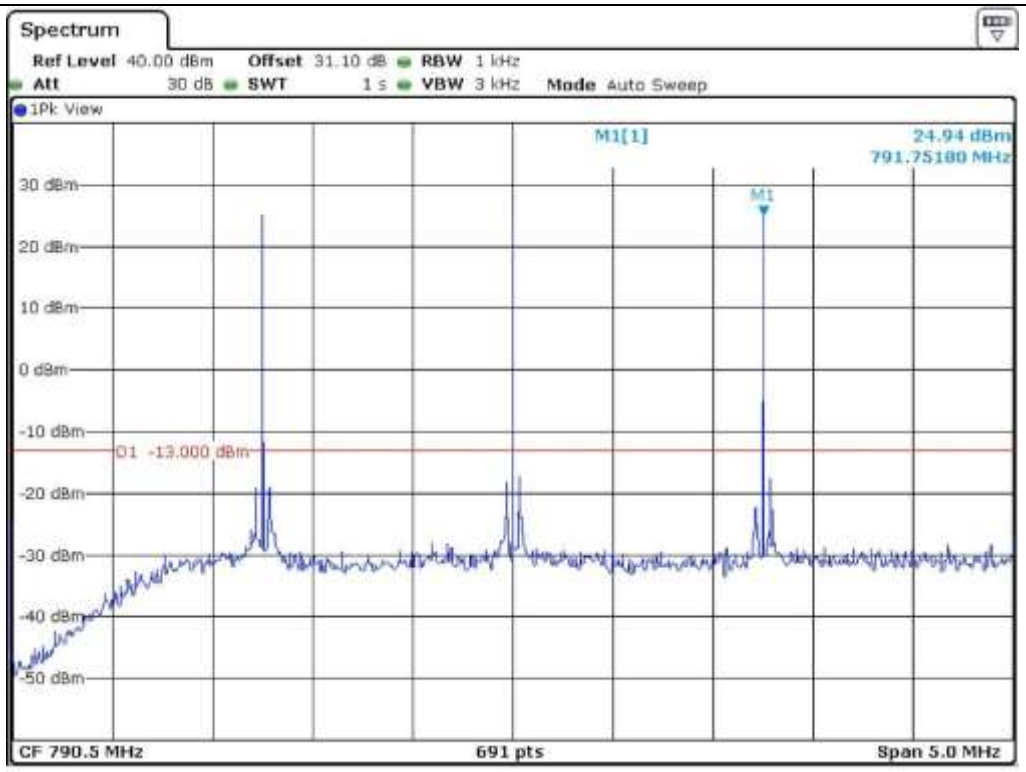


Low Channel – 1 input signal

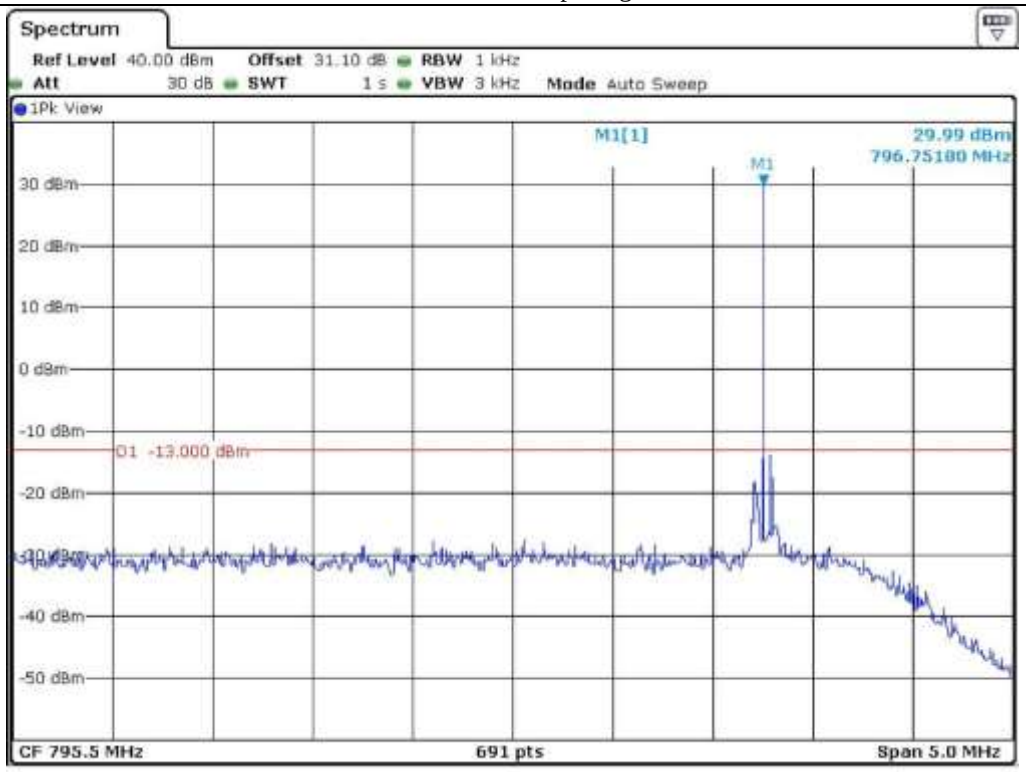


Low Channel – 2 input signals

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 Dept : 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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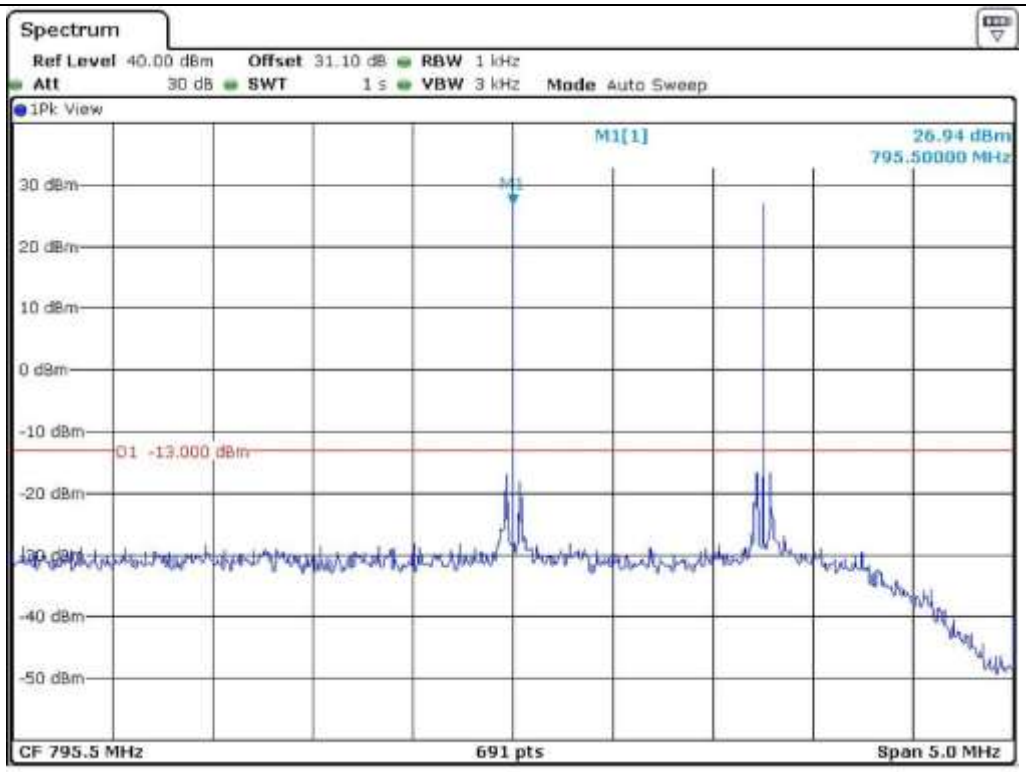
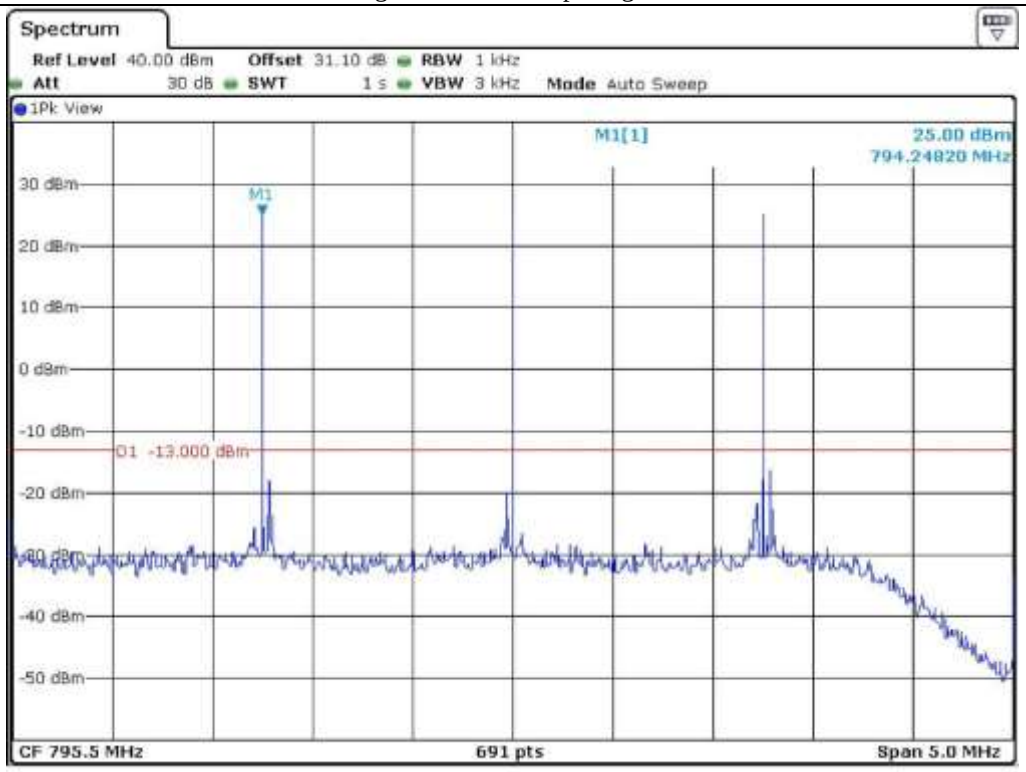


High Channel – 2 input signals



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)
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10.5.2 Test Result for Spurious emission

-. Test Date : January 26, 2015

-. Test Result : Pass

-. Modulation : No-Modulation

Frequency (MHz)	Number of Input Channel	Measured Value	Result
789.25	1	< -13 dBm	Pass
789.25 & 790.50	2		
789.25 & 790.50 & 791.75	3		
796.75	1	< -13 dBm	Pass
796.75 & 795.50	2		
796.75 & 795.50 & 794.25	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: hyung-kwon, Oh / Project 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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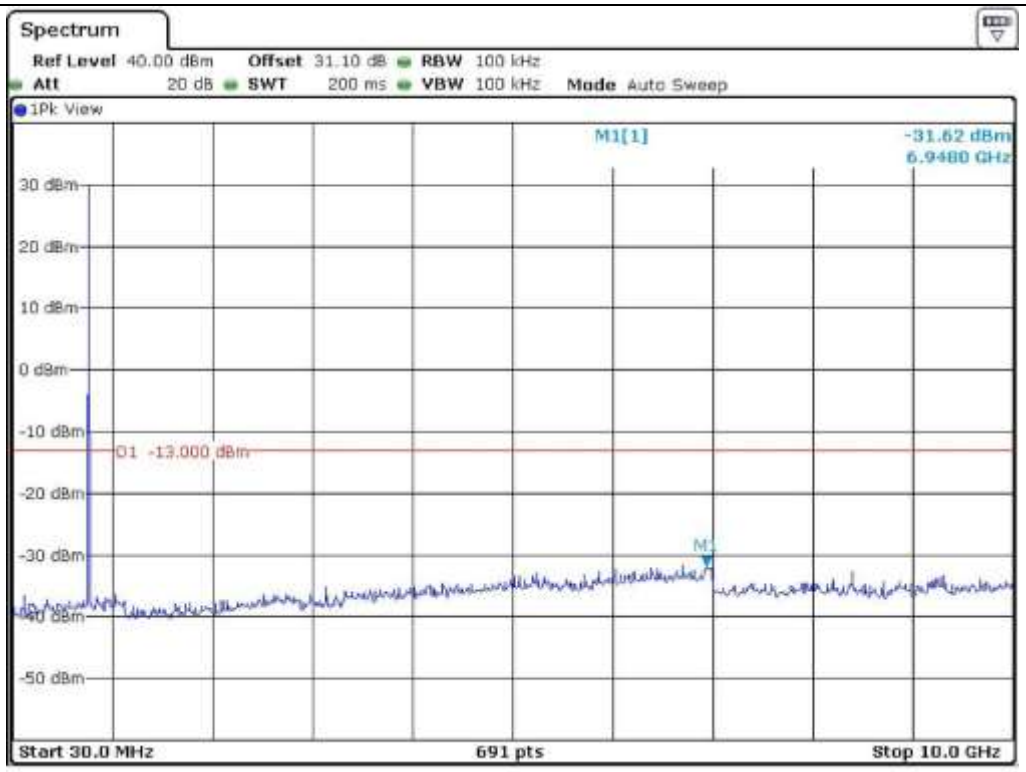
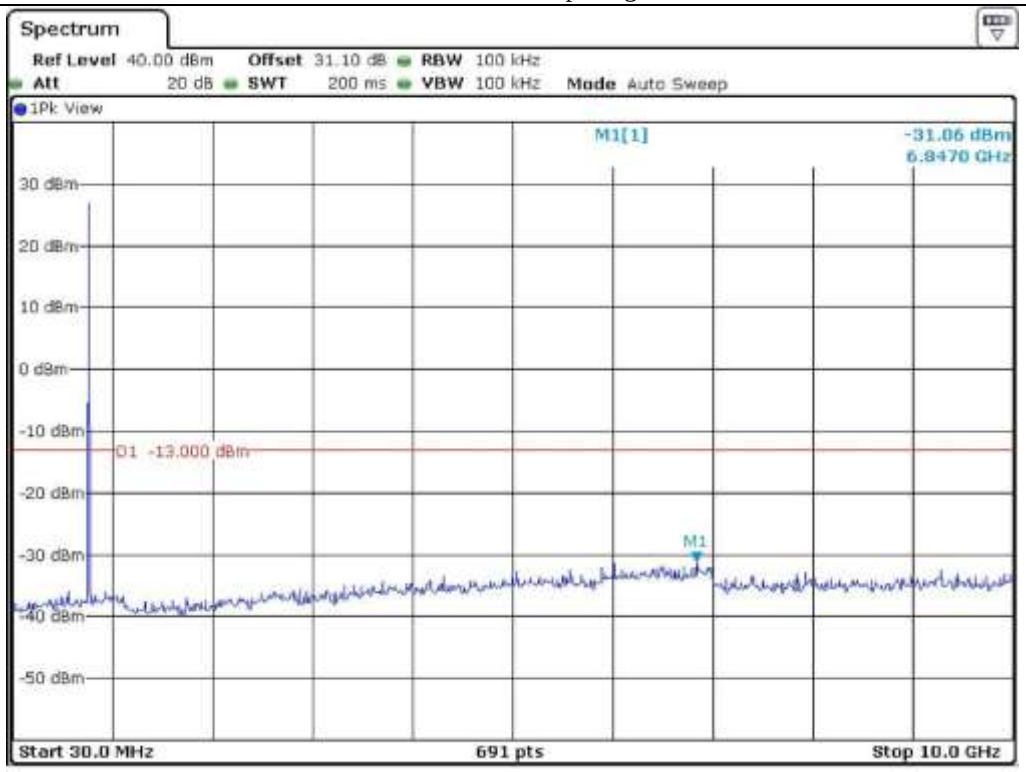


Low Channel – 1 input signal



Low Channel – 2 input signals

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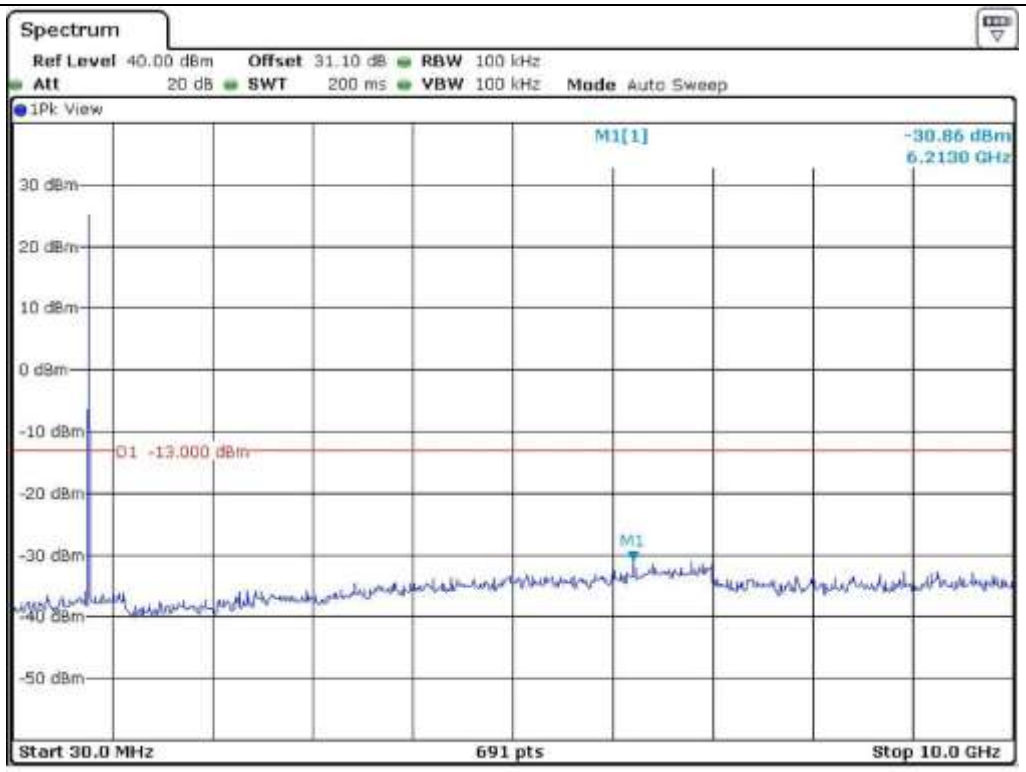
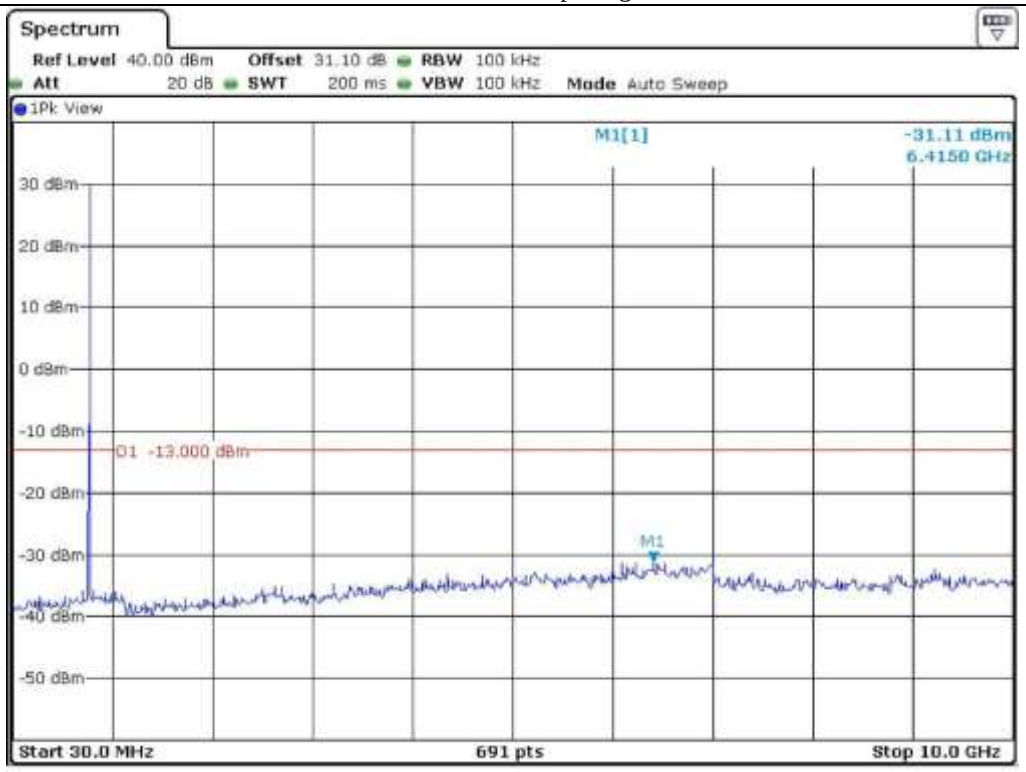


Low Channel – 3 input signals



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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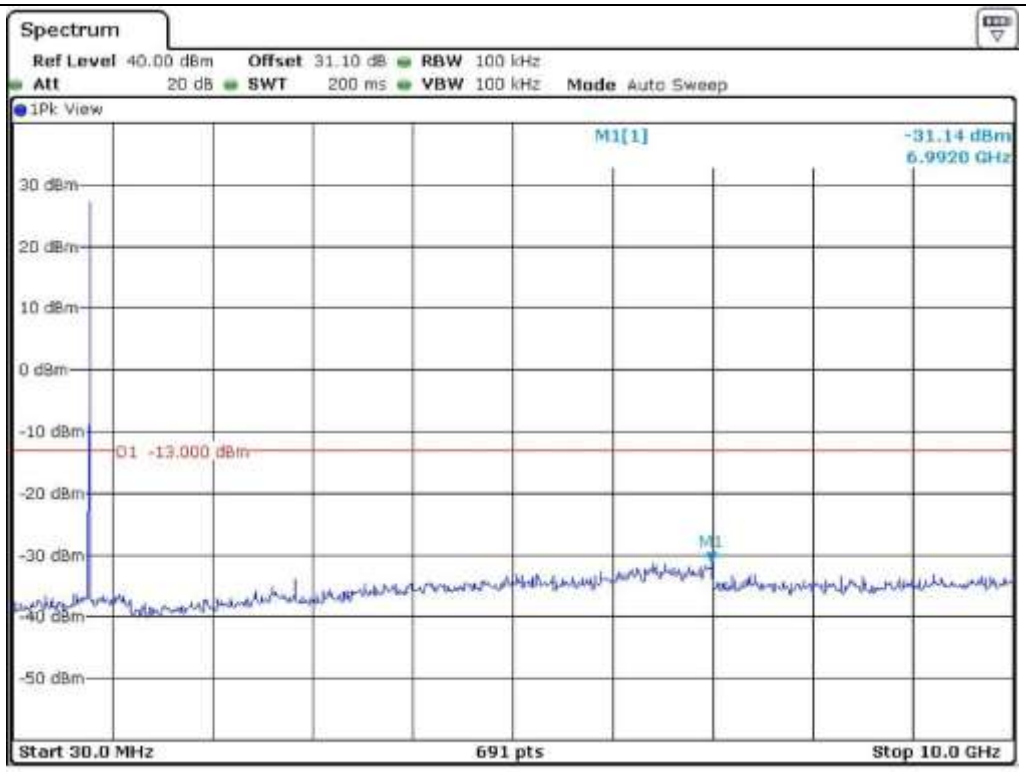
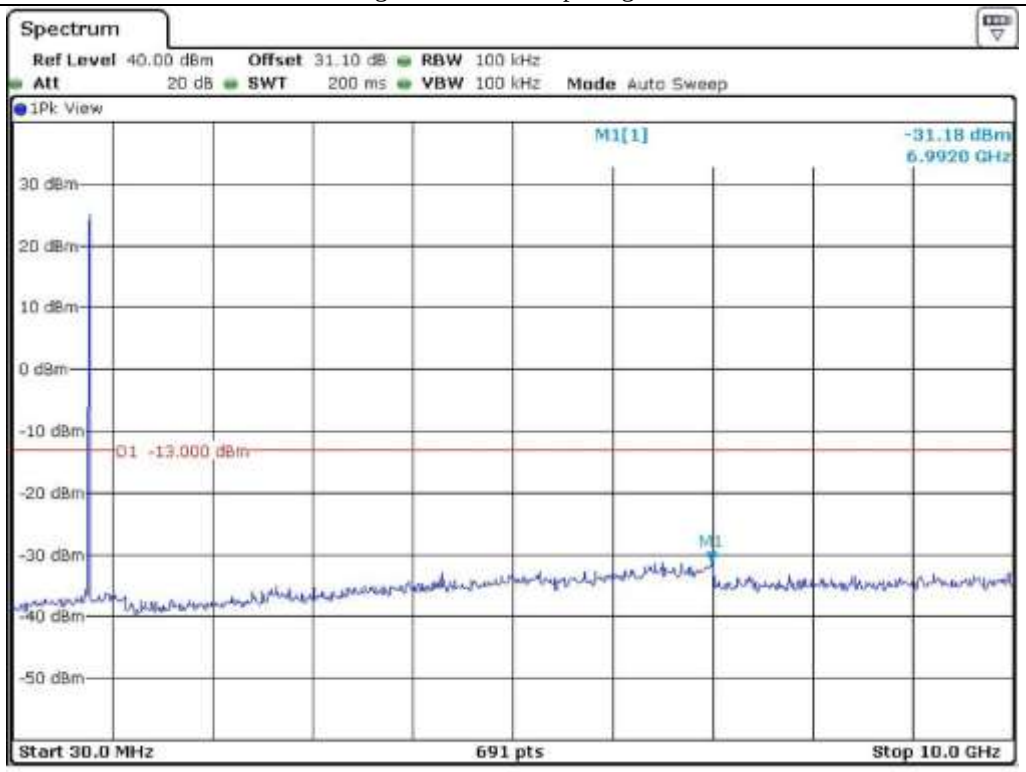


High Channel – 2 input signals



High Channel – 3 input signals

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11. FIELD STRENGTH OF SPURIOUS RADIATION

11.1 Operating environment

Temperature : 25 ℃

Relative humidity : 50 % R.H.

11.2 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.

11.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 30, 2014 (1Y)
■ -	ESCI	Rohde & Schwarz	Test Receiver	101012	Nov. 03, 2014 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Apr. 28, 2014 (1Y)
■ -	SCU-18	Rohde & Schwarz	Pre-Amplifier	10041	Nov. 25, 2014 (1Y)
■ -	DT3000	Innco System	Turn Table	930611	N/A
■ -	MA4000-EP	Innco System	Antenna Master	3320611	N/A
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-421	Jul. 10, 2014 (2Y)
■ -	3121C	EMCO	Dipole Antenna	9002-509	Jan. 21, 2014 (1Y)
■ -	YSE 500B	YoungShin Eng.	Frequency Converter	950413001	N/A
■ -	ETCR-10	DaeHa	Automatic Voltage Com.	N/A	N/A
■ -	83650L	HP	Swept CW Generator	3844A00415	Apr. 28, 2014 (1Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Sep. 05, 2013 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D294	Sep. 30, 2013 (2Y)

All test equipment used is calibrated on a regular basis.

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11.4 Test data for radiated emission(Part 2.1053, 90.219(e))

-. Part 2.1053

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

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-. 90.219(e))

(e) Device Specifications. In addition to the general rules for equipment certification in §90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.

(1) The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.

(2) The noise figure of a signal booster must not exceed 9 dB in either direction.

(3) Spurious emissions from a signal booster must not exceed −13 dBm within any 100 kHz measurement bandwidth.

(4) A signal booster must be designed such that all signals that it retransmits meet the following requirements:

(i) The signals are retransmitted on the same channels as received. Minor departures from the exact provider or reference frequencies of the input signals are allowed, provided that the retransmitted signals meet the requirements of §90.213.

(ii) There is no change in the occupied bandwidth of the retransmitted signals.

(iii) The retransmitted signals continue to meet the unwanted emissions limits of §90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin).

(5) On or after March 1, 2014, a signal booster must be labeled to indicate whether it is a Class A or Class B device, and the label must include the following advisory

(1) In on-line point-of-sale marketing materials,

(2) In any print or on-line owner's manual and installation instructions,

(3) On the outside packaging of the device, and

(4) On a label affixed to the device:

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Note. This devices that support output power higher than the 5 W ERP limit. To meet FCC 47 CFR 90.219(e)(1) and 90.219(d)(3), this product designed with below specification. Therefore, the compliance is achieved.

Airpoint does not produce antenna. To support the widest antenna range, the product is designed to support max. 15dBi antenna. Therefore, all range of antenna below 15 dBi can be used.

End-user can achieve below 5 W ERP.

[Product Specification]

Input Power Range	-80 [dBm]/Total ~ -20 [dBm]/Total	~ -33 [dBm]/Total	
Max. Gain	100 [dB]	100 [dB]	
Gain Range	40 [dB] (60 ~ 100 [dB])	40 [dB] (60 ~ 100 [dB])	
Gain Control Step	1 [dB] Step		

[Down Link]

Method) Input Power / System Gain Condition

[EIRP]

input power + system gain(1dB step) + antenna gain= output power
→ [-35.90 dBm] + Min gain(60 dB) + 15 dBi = 39.10 dBm (8.13 W)

[ERP]

ERP = EIRP - 2.15 dB

→ [39.10 dBm] - 2.15 dB = 36.95 dBm (4.95 W)

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11.4.1 Test Result for DC - 48 V Power Supply with LTE 5 M - Low

11.4.1.1 Operating Mode: Downlink

-. Test Date : January 27, 2015

-. 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 ~ 10.0 GHz

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
760.50	23.34	-80.74	1.42	V	1.69	-81.01	-	-
	22.81	-84.61		H		-84.88	-	-
771.26	27.28	-76.49	1.46	V	1.70	-76.73	-46.00	30.73
	26.57	-80.60		H		-80.84	-46.00	34.84
77.77	27.59	-90.78	1.98	V	0.51	-89.31	-13.00	76.31
122.08	36.00	-83.33	1.75	H	0.62	-82.20	-13.00	69.20
148.51	26.90	-92.37	1.70	H	0.69	-91.35	-13.00	78.35
207.58	26.5	-91.68	1.53	H	0.83	-90.98	-13.00	77.98
1 568.72	26.71	-85.76	8.81	H	2.42	-79.37	-40.00	39.37

Tabulated test data for Restricted Band

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

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

11.4.1.2 Test Data for Below 30 MHz

Humidity Level : 50 % R.H. Temperature: 25 ℃

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 90, SUBPART I, SECTION 90.219(e)(3)

Result : PASSED

EUT : ICS Repeater System Date: January 27, 2015

Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

11.4.1.3 Operating Mode: Uplink

-. Test Date : January 27, 2015

-. 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 ~ 10.0 GHz

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
790.50	22.20	-81.02	1.54	V	1.72	-81.20	-	-
	22.26	-84.47		H		-84.65	-	-
802.13	27.33	-75.56	1.58	V	1.73	-75.70	-46.00	29.70
	26.48	-79.99		H		-80.13	-46.00	34.13
77.12	27.33	-91.65	1.94	H	0.51	-90.22	-13.00	77.22
123.12	35.87	-83.46	1.74	H	0.62	-82.34	-13.00	69.34
192.15	27.01	-91.50	1.53	H	0.80	-90.77	-13.00	77.77
817.61	27.55	-78.56	1.64	H	1.74	-78.66	-13.00	65.66
1 569.11	25.49	-86.98	8.81	H	2.42	-80.60	-40.00	40.60

Tabulated test data for Restricted Band

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

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

11.4.1.4 Test Data for Below 30 MHz

Humidity Level : 50 % R.H. Temperature: 25 ℃

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 90, SUBPART I, SECTION 90.219(e)(3)

Result : PASSED

EUT : ICS Repeater System Date: January 27, 2015

Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

11.4.2 Test Result for DC - 48 V Power Supply with LTE 5 M - High

11.4.2.1 Operating Mode: Downlink

-. Test Date : January 27, 2015

-. 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 ~ 10.0 GHz

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
765.50	25.09	-78.85	1.44	V	1.69	-79.10	-	-
	24.16	-83.14		H		-83.40	-	-
773.87	28.12	-75.58	1.47	V	1.70	-75.81	-46.00	29.81
	27.42	-79.69		H		-79.92	-46.00	33.92
77.77	27.66	-90.71	1.98	V	0.51	-89.24	-13.00	76.24
122.08	36.09	-83.24	1.75	H	0.62	-82.11	-13.00	69.11
148.51	26.84	-92.43	1.70	H	0.69	-91.41	-13.00	78.41
207.58	26.37	-91.86	1.53	H	0.83	-91.16	-13.00	78.16
1 605.80	26.82	-85.95	8.98	H	2.47	-79.44	-40.00	39.44

Tabulated test data for Restricted Band

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

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

11.4.2.2 Test Data for Below 30 MHz

Humidity Level : 50 % R.H. Temperature: 25 ℃

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 90, SUBPART I, SECTION 90.219(e)(3)

Result : PASSED

EUT : ICS Repeater System Date: January 27, 2015

Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

11.4.2.3 Operating Mode: Uplink

-. Test Date : January 27, 2015

-. 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 ~ 10.0 GHz

-. Measurement distance : 3 m

-. Result : PASSED

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
795.50	24.49	-78.59	1.55	V	1.72	-78.75	-	-
	24.67	-81.95		H		-82.11	-	-
803.26	28.39	-74.46	1.59	V	1.73	-74.61	-46.00	28.61
	27.61	-78.83		H		-78.97	-46.00	32.97
77.12	27.51	-91.47	1.94	H	0.51	-90.04	-13.00	77.04
123.12	35.92	-83.41	1.74	H	0.62	-82.29	-13.00	69.29
192.15	26.94	-91.57	1.53	H	0.80	-90.84	-13.00	77.84
817.61	27.49	-78.62	1.64	H	1.74	-78.72	-13.00	65.72
1 607.14	27.33	-85.44	8.98	H	2.47	-78.93	-40.00	38.93

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

11.4.2.4 Test Data for Below 30 MHz

Humidity Level : 50 % R.H. Temperature: 25 ℃

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 90, SUBPART I, SECTION 90.219(e)(3)

Result : PASSED

EUT : ICS Repeater System Date: January 27, 2015

Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

11.4.3 Test Result for DC - 48 V Power Supply with LTE 10 M

11.4.3.1 Operating Mode: Downlink

-. Test Date : January 27, 2015

-. 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 ~ 10.0 GHz

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
763.00	23.25	-80.76	1.43	V	1.69	-81.02	-	-
	22.69	-84.67		H		-84.94	-	-
773.10	27.69	-76.03	1.47	V	1.70	-76.26	-46.00	30.26
	26.16	-80.97		H		-81.20	-46.00	35.20
77.77	27.54	-90.83	1.98	V	0.51	-89.36	-13.00	76.36
122.08	35.31	-84.02	1.75	H	0.62	-82.89	-13.00	69.89
148.51	26.85	-92.42	1.70	H	0.69	-91.40	-13.00	78.40
207.58	25.48	-92.75	1.53	H	0.83	-92.05	-13.00	79.05
1 568.47	27.22	-85.25	8.81	H	2.42	-78.86	-40.00	38.86

Tabulated test data for Restricted Band

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

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

11.4.3.2 Test Data for Below 30 MHz

Humidity Level : 50 % R.H. Temperature: 25 ℃

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 90, SUBPART I, SECTION 90.219(e)(3)

Result : PASSED

EUT : ICS Repeater System Date: January 27, 2015

Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

11.4.3.3 Operating Mode: Uplink

-. Test Date : January 27, 2015

-. 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 ~ 10.0 GHz

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Limit (dBm)	Margin (dB)
793.00	23.23	-79.92	1.54	V	1.72	-80.09	-	-
	23.63	-83.05		H		-83.22	-	-
802.84	27.50	-75.37	1.58	V	1.73	-75.51	-46.00	29.51
	26.07	-80.38		H		-80.52	-46.00	34.52
77.11	26.26	-92.72	1.94	H	0.51	-91.29	-13.00	78.29
123.12	35.83	-83.50	1.74	H	0.62	-82.38	-13.00	69.38
192.14	26.44	-92.07	1.53	H	0.80	-91.34	-13.00	78.34
817.61	26.41	-79.70	1.64	H	1.74	-79.80	-13.00	66.80
1 567.77	26.97	-85.49	8.80	H	2.42	-79.11	-40.00	39.11

Tabulated test data for Restricted Band

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

Tested by: hyung-kwon, Oh / Project 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 Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

11.4.3.4 Test Data for Below 30 MHz

Humidity Level : 50 % R.H. Temperature: 25 ℃

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 90, SUBPART I, SECTION 90.219(e)(3)

Result : PASSED

EUT : ICS Repeater System Date: January 27, 2015

Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: hyung-kwon, Oh / Project 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 Dept : 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 TEMPERATURE VARIATION

12.1 Operating environment

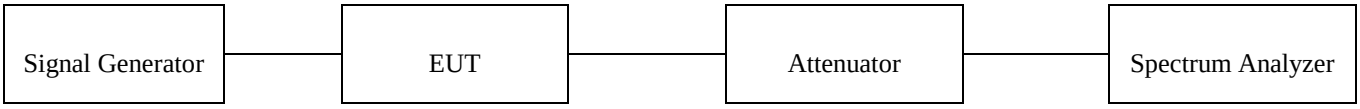
Temperature : 25 ℃

Relative humidity : 50 % 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 modulation.

Turn EUT off and set chamber temperature to -30 ℃ 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 ℃ step from -30 ℃ to +50 ℃. Repeat above method for frequency measurements every 10 ℃ step and then record all measured frequencies on each temperature step.



12.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	SMJ100A	Rohde & Schwarz	Signal Generator	101038	Oct. 08, 2014 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014 (1Y)
■ -	SSE-43CI-A	Samkun	Chamber	060712	May 15, 2014 (1Y)

All test equipment used is calibrated on a regular basis.

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EMC Testing Dept : 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 for Part 2.1055, 90.539(d)

-. Part 2.1055

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From −30° to +50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(2) From −20° to +50° centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radio beacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.

(3) From 0° to +50° centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(c) In addition to all other requirements of this section, the following information is required for equipment incorporating heater type crystal oscillators to be used in mobile stations, for which type acceptance is first requested after March 25, 1974, except for battery powered, hand carried, portable equipment having less than 3 watts mean output power.

(1) Measurement data showing variation in transmitter output frequency from a cold start and the elapsed time necessary for the frequency to stabilize within the applicable tolerance. Tests shall be made after temperature stabilization at each of the ambient temperature levels; the lower temperature limit, 0° centigrade and +30° centigrade with no primary power applied.

(2) Beginning at each temperature level specified in paragraph (c)(1) of this section, the frequency shall be measured within one minute after application of primary power to the transmitter and at intervals of no more than one minute thereafter until ten minutes have elapsed or until sufficient measurements are obtained to indicate clearly that the frequency has stabilized within the applicable tolerance, whichever time period is greater. During each test, the ambient temperature shall not be allowed to rise more than 10° centigrade above the respective beginning ambient temperature level.

(3) The elapsed time necessary for the frequency to stabilize within the applicable tolerance from each beginning ambient temperature level as determined from the tests specified in this paragraph shall be specified in the instruction book for the transmitter furnished to the user.

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

(4) When it is impracticable to subject the complete transmitter to this test because of its physical dimensions or power rating, only its frequency determining and stabilizing portions need be tested.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c), and (d) of this section. (For example measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment.)

-. 90.539(d)

Transmitters designed to operate in 769-775 MHz and 799-805 MHz frequency bands must meet the frequency stability requirements in this section.

(a) Mobile, portable and control transmitters must normally use automatic frequency control (AFC) to lock on to the base station signal.

(b) The frequency stability of base transmitters operating in the narrowband segment must be 100 parts per billion or better.

(c) The frequency stability of mobile, portable, and control transmitters operating in the narrowband segment must be 400 parts per billion or better when AFC is locked to the base station. When AFC is not locked to the base station, the frequency stability must be at least 1.0 ppm for 6.25 kHz, 1.5 ppm for 12.5 kHz (2 channel aggregate), and 2.5 ppm for 25 kHz (4 channel aggregate).

(d) The frequency stability of base transmitters operating in the wideband segment must be 1 part per million or better.

(e) The frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 parts per million or better when AFC is locked to a base station, and 5 parts per million or better when AFC is not locked.

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

12.4.1 Test data for Downlink with DC -48 V Power Supply

-. Test Date : December 30, 2014

-. Result : PASSED

Temperature (˚C)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
-30	763 000 000	763 000 089	0.116 6	Within the Authorized Frequency block
-20		763 000 090	0.118 0	
-10		763 000 089	0.116 6	
0		763 000 090	0.118 0	
10		763 000 090	0.118 0	
20		763 000 091	0.119 3	
30		763 000 090	0.118 0	
40		763 000 091	0.119 3	
50		763 000 091	0.119 3	

Tested by: hyung-kwon, Oh / Project Engineer

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12.4.2 Test data for Uplink with DC -48 V Power Supply

-. Test Date : December 30, 2014

-. Result : PASSED

Temperature (˚C)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
-30	793 000 000	793 000 091	0.114 8	Within the Authorized Frequency block
-20		793 000 092	0.116 0	
-10		793 000 093	0.117 3	
0		793 000 092	0.116 0	
10		793 000 092	0.116 0	
20		793 000 093	0.117 3	
30		793 000 093	0.117 3	
40		793 000 094	0.118 5	
50		793 000 093	0.117 3	

Tested by: hyung-kwon, Oh / Project Engineer

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13. FREQUENCY STABILITY WITH VOLTAGE VARIATION

13.1 Operating environment

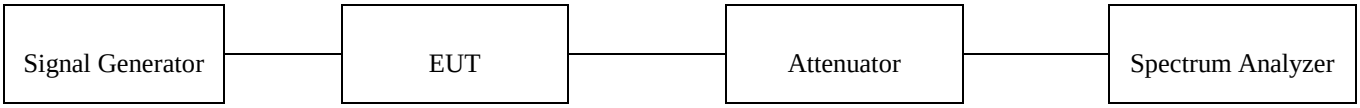
Temperature : 25 ℃

Relative humidity : 50 % R.H.

13.2 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 Center Frequency (low, middle, and high channels) at each band using all applicable modulation.

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.



13.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	SMJ100A	Rohde & Schwarz	Signal Generator	101038	Oct. 08, 2014 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014 (1Y)
■ -	53152A	HP	Frequency Counter	US39270295	Oct. 08, 2014 (1Y)

All test equipment used is calibrated on a regular basis.

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13.4 Test data for Part 2.1055, 90.539(d)

-. Part 2.1055

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From −30° to +50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(2) From −20° to +50° centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radio beacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.

(3) From 0° to +50° centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(c) In addition to all other requirements of this section, the following information is required for equipment incorporating heater type crystal oscillators to be used in mobile stations, for which type acceptance is first requested after March 25, 1974, except for battery powered, hand carried, portable equipment having less than 3 watts mean output power.

(1) Measurement data showing variation in transmitter output frequency from a cold start and the elapsed time necessary for the frequency to stabilize within the applicable tolerance. Tests shall be made after temperature stabilization at each of the ambient temperature levels; the lower temperature limit, 0° centigrade and +30° centigrade with no primary power applied.

(2) Beginning at each temperature level specified in paragraph (c)(1) of this section, the frequency shall be measured within one minute after application of primary power to the transmitter and at intervals of no more than one minute thereafter until ten minutes have elapsed or until sufficient measurements are obtained to indicate clearly that the frequency has stabilized within the applicable tolerance, whichever time period is greater. During each test, the ambient temperature shall not be allowed to rise more than 10° centigrade above the respective beginning ambient temperature level.

(3) The elapsed time necessary for the frequency to stabilize within the applicable tolerance from each beginning ambient temperature level as determined from the tests specified in this paragraph shall be specified in the instruction book for the transmitter furnished to the user.

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(4) When it is impracticable to subject the complete transmitter to this test because of its physical dimensions or power rating, only its frequency determining and stabilizing portions need be tested.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c), and (d) of this section. (For example measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment.)

-. 90.539(d)

Transmitters designed to operate in 769-775 MHz and 799-805 MHz frequency bands must meet the frequency stability requirements in this section.

(a) Mobile, portable and control transmitters must normally use automatic frequency control (AFC) to lock on to the base station signal.

(b) The frequency stability of base transmitters operating in the narrowband segment must be 100 parts per billion or better.

(c) The frequency stability of mobile, portable, and control transmitters operating in the narrowband segment must be 400 parts per billion or better when AFC is locked to the base station. When AFC is not locked to the base station, the frequency stability must be at least 1.0 ppm for 6.25 kHz, 1.5 ppm for 12.5 kHz (2 channel aggregate), and 2.5 ppm for 25 kHz (4 channel aggregate).

(d) The frequency stability of base transmitters operating in the wideband segment must be 1 part per million or better.

(e) The frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 parts per million or better when AFC is locked to a base station, and 5 parts per million or better when AFC is not locked.

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13.4.1 Test data for Downlink with DC -48 V Power Supply

-. Test Date : December 30, 2014

-. Result : PASSED

Voltage (Vac)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
- 55.2 (115 %)	763 000 000	763 000 091	0.119 3	Within the Authorized Frequency block
- 48 (100 %)		763 000 090	0.118 0	
- 40.8 (85 %)		763 000 091	0.119 3	

13.4.2 Test data for Uplink with DC -48 V Power Supply

-. Test Date : December 30, 2014

-. Result : PASSED

Voltage (Vdc)	Input Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
- 55.2 (115 %)	793 000 000	793 000 094	0.118 5	Within the Authorized Frequency block
- 48 (100 %)		793 000 093	0.117 3	
- 40.8 (85 %)		793 000 093	0.117 3	

Tested by: hyung-kwon, Oh / Project Engineer

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14. Noise Figure

14.1 Operating environment

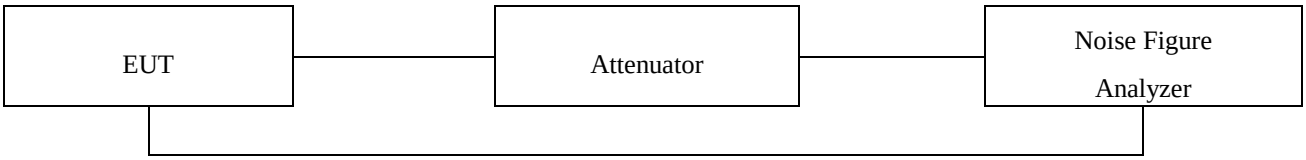
Temperature : 25 ℃

Relative humidity : 50 % R.H.

14.2 Test set-up

This test was performed to measure the noise Figure at RF antenna Connector. Specification test limit are given in Table. 13.4

The test results are provided in the associated plots.



14.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	N8973A	Agilent	Noise Figure Analyzer	G839490552	Jan. 28, 2015 (1Y)

All test equipment used is calibrated on a regular basis.

14.4 Noise Figure Limits

	Frequency range[MHz]	Noise Figure Limit[dB]
DownLink	758.0 ~ 768.0	9.0
Uplink	788.0 ~ 798.0	

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14.5 Test data for Part 90.219(e)(2))

(2) [Reserved]

(c) Licensee responsibility; interference. PLMRS licensees that operate signal boosters are responsible for their proper operation, and are responsible for correcting any harmful interference that signal booster operation may cause to other licensed communications services. Normal co-channel transmissions are not considered to be harmful interference. Licensees are required to resolve interference problems pursuant to §90.173(b). Licensees shall act in good faith regarding the operation of signal boosters and in the resolution of interference due to signal booster operation. Licensees who are unable to determine the location or cause of signal booster interference may seek assistance from the FCC to resolve such problems.

(d) Deployment rules. Deployment of signal boosters must be carried out in accordance with the rules in this paragraph.

(1) Signal boosters may be used to improve coverage in weak signal areas only.

(2) Signal boosters must not be used to extend PLMRS stations' normal operating range.

(3) Signal boosters must be deployed such that the radiated power of the each retransmitted channel, on the forward link and on the reverse link, does not exceed 5 Watts effective radiated power (ERP).

(4) Class B signal boosters may be deployed only at fixed locations; mobile operation of Class B signal boosters is prohibited after November 1, 2014.

(5) Class B signal booster installations must be registered in the FCC signal booster database that can be accessed at the following URL: www.fcc.gov/signal-boosters/registration.

(6) Good engineering practice must be used in regard to the radiation of intermodulation products and noise, such that interference to licensed communications systems is avoided. In the event of harmful interference caused by any given deployment, the FCC may require additional attenuation or filtering of the emissions and/or noise from signal boosters or signal booster systems, as necessary to eliminate the interference.

(i) In general, the ERP of intermodulation products should not exceed −30 dBm in 10 kHz measurement bandwidth.

(ii) In general, the ERP of noise within the passband should not exceed −43 dBm in 10 kHz measurement bandwidth.

(iii) In general, the ERP of noise on spectrum more than 1 MHz outside of the passband should not exceed −70 dBm in a 10 kHz measurement bandwidth.

(7) Signal booster passbands are limited to the service band or bands for which the operator is authorized. In general, signal boosters should utilize the minimum passband that is sufficient to accomplish the purpose. Except for distributed antenna systems (DAS) installed in buildings, the passband of a Class B booster should not encompass both commercial services (such as ESMR and Cellular Radiotelephone) and part 90 Land Mobile and Public Safety Services.

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(e) Device Specifications. In addition to the general rules for equipment certification in §90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.

(1) The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.

(2) The noise figure of a signal booster must not exceed 9 dB in either direction.

(3) Spurious emissions from a signal booster must not exceed −13 dBm within any 100 kHz measurement bandwidth.

(4) A signal booster must be designed such that all signals that it retransmits meet the following requirements:

(i) The signals are retransmitted on the same channels as received. Minor departures from the exact provider or reference frequencies of the input signals are allowed, provided that the retransmitted signals meet the requirements of §90.213.

(ii) There is no change in the occupied bandwidth of the retransmitted signals.

(iii) The retransmitted signals continue to meet the unwanted emissions limits of §90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin).

(5) On or after March 1, 2014, a signal booster must be labeled to indicate whether it is a Class A or Class B device, and the label must include the following advisory

(1) In on-line point-of-sale marketing materials,

(2) In any print or on-line owner's manual and installation instructions,

(3) On the outside packaging of the device, and

(4) On a label affixed to the device:

"WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. You MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation."

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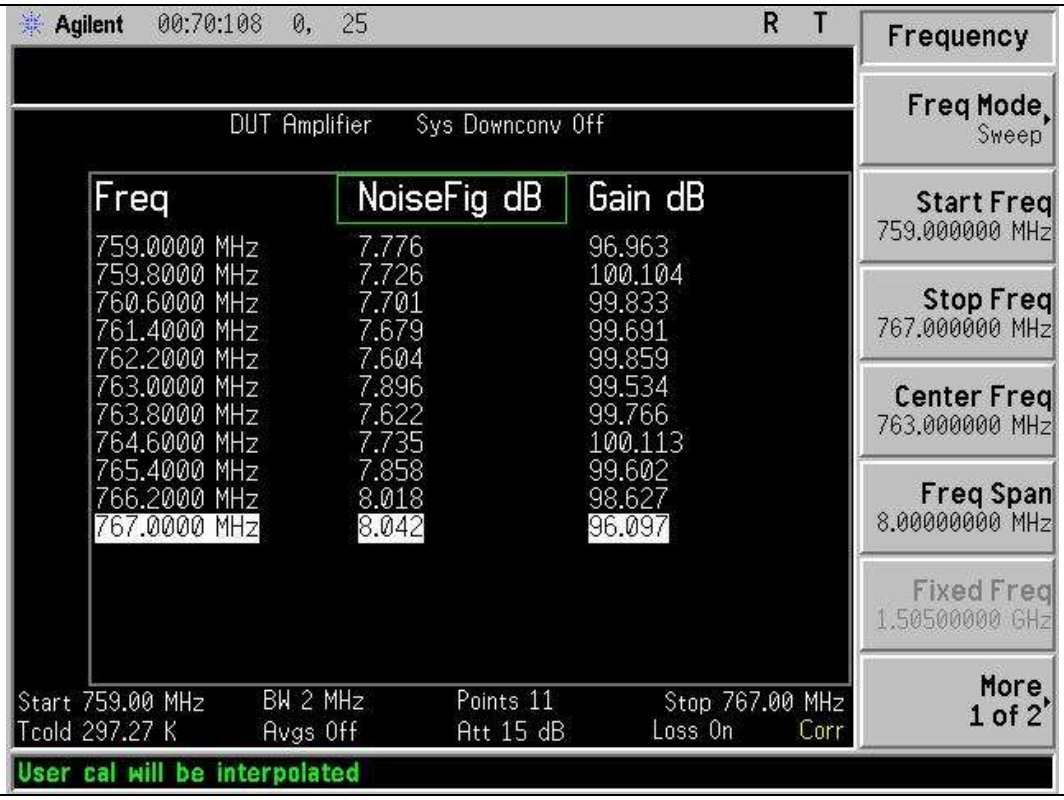
14.5.1 Test data for Downlink with Max Gain

-. Test Date : December 30, 2014

-. Result : PASSED



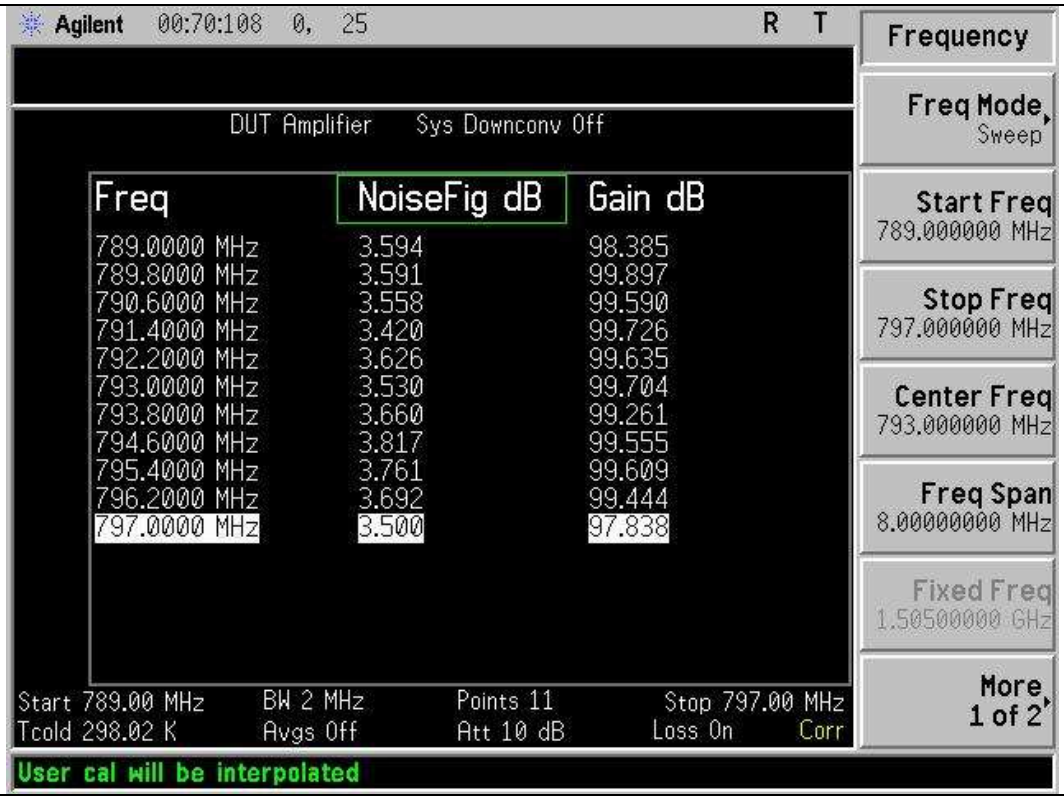
Down Link

Tested by: hyung-kwon, Oh / Project Engineer

14.5.2 Test data for Uplink with Max Gain

-. Test Date : December 30, 2014

-. Result : PASSED



Up Link

Tested by: hyung-kwon, Oh / Project Engineer

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