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Project No.: 12CA38794  
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Date: August 07, 2012  
Model No.: IRES-700 10W  
FCC ID.: WYFIRES-70010W

## **RF Test Report**

**in accordance with  
FCC Part 27 Subpart C**

**for**

## **700MHz ICS Repeater System**

**AIRPOINT CO., LTD.**

**MIGUN TECHNO WORLD 2-CHA, 533-1, YONGSAN-DONG,  
YUSEONG-GU, DAEJEON, 305-500**

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### **Summary of Test Results:**

The following tests were performed on a sample submitted for evaluation of compliance with FCC Part 27 Subpart C.

No	Reference Clause No.	FCC Part 27 Subpart C Conformance Requirements	Result	Verdict	Remark
1	§27.50(b)(3)	RF Radiated Output Power		Complied	
2	§2.1053 §27.53(c)	Spurious Radiated Emission		Complied	
3	§2.1046	Conducted Output Power		Complied	
4	§2.1049	Occupied Bandwidth 99 % and -26 dB		Complied	
5	§2.1051 §27.53(c)(f)	Spurious Emission at Antenna Terminal		Complied	
6	§2.1051 §27.53(c)	Band Edge		Complied	
7	§2.1055 §27.54	Frequency Stability		Complied	
8	KDB 935210	Out of Band Rejection		Complied	

Note : 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

### **Conclusion:**

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by UL Korea Ltd. in accordance with the procedures stated in each test requirement and specification. The test list was determined by the Applicant as being applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.



Tested by  
Kyung Duk Ko, WiSE Project Engineer  
UL Verification Services- 3014ASEO  
UL Korea Ltd.  
August 07, 2012



Tested by  
Jeawoon, Choi, WiSE Engineering Leader  
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UL Korea Ltd.  
August 07, 2012

## **Test Report Details**

Tests Performed By: UL Korea Ltd.  
33<sup>rd</sup> FL. GFC Center, 737 Yeoksam-dong, Gangnam-gu, Seoul, 135-984, Korea

Test Site: ONETECH Corp.  
301-14 Daessangryeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do,  
464-862 Korea

Applicant: AIRPOINT CO., LTD.  
MIGUN TECHNO WORLD 2-CHA, 533-1, Yongsan-dong, Yuseong-gu,  
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Product Type: 700MHz ICS Repeater System  
Model Number: IRES-700 10W

Trademark N/A

Sample Serial Number: N/A

Test standards: FCC Part 27 Subpart C  
Miscellaneous Wireless Communications Services

Sample Serial Number: N / A

Sample Receive Date: July 18, 2012

Testing Start Date: July 23, 2012

Testing Date: August 03, 2012

**Overall Results:** **Pass**

UL Korea Ltd. reports apply only to the specific test samples and test results submitted for UL's review. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL Korea Ltd. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL Korea Ltd. issued reports. This report shall not be used to claim, constitute or imply product certification, approval, or any agency of the National Authorities. This report may contain test results that are not covered by the NVLAP or KOLAS accreditation.

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## 1. General Product Information

### 1.1. Equipment Description

IRES-700 10W is the module that integrates PCS Licensed Transmitter.

### 1.2. Details of Test Equipment (EUT)

- Equipment Type : 700MHz ICS Repeater System
- Model No. : IRES-700 10W
- Trade name : AirPoint
- Type of test Equipment : Fixed type
- Operating characteristic : Miscellaneous Wireless Communications Services
- Manufacturer : AIRPOINT CO., LTD.  
MIGUN TECHNO WORLD 2-CHA, 533-1, Yongsan-dong, Yuseong-gu,  
Daejeon, 305-500 Korea

### 1.3. Equipment Configuration

The EUT is consisted of the following component provided by the manufacturer.

Use*	Product Type	Manufacturer	Model	Comments
EUT	700MHz ICS Repeater System	AIRPOINT CO., LTD.	IRES-700 10W	-

**Note:** Use = EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment. SIM - Simulator (Not Subjected to Test)

#### 1.4. Technical Data

Item	Type of Equipment
Frequency Ranges	Downlink : 746 – 757 MHz Uplink : 776 – 787 MHz
Output power	Downlink : 40 dBm Uplink : 27 dBm
Kind of modulation (s)	Downlink : QPSK, 16QAM, 64QAM Uplink : QPSK, 16QAM
Emission Designator	G7D(QPSK), D7W(16QAM, 64QAM)
Channel	Downlink : 751 MHz (1 channel, 10 MHz Bandwidth) Uplink : 782 MHz (1 channel)
Carrier	Downlink : 10 MHz Bandwidth LTE Signal Uplink : 10 MHz Bandwidth LTE Signal
Antenna Gain	Service Antenna (Downlink Tx / Uplink Rx) : 20 dBi (See Note 2) Donor Antenna (Downlink Rx / Uplink Tx) : 20 dBi (See Note 2)
Antenna Type	Service Antenna (Downlink Tx / Uplink Rx) : Omni, Panel Donor Antenna (Downlink Rx / Uplink Tx) : Panel
Repeater Gain Range	Downlink : 60 ~ 100 dB (See Note 3) Uplink : 60 ~ 100 dB (See Note 3)
Input Power level	Downlink : -20 dBm Uplink : -33 dBm
Working temperature	-20 ~ 50 °C
Supply Voltage	DC -48 V

Note ;

1. All the technical data described above were provided by the manufacturer.
2. End users and/or 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. The Antenna gain will be same or less than 20 dBi.
3. All test items are performed with maximum repeater gain 100 dB.

#### 1.5. Equipment Type :

Radio and ancillary equipment for fixed or semi-fixed use  
 Radio and ancillary equipment for vehicular mounted use  
 Radio and ancillary equipment for portable or handheld use

Stand alone    Host connected    Host connected

Self contained single unit    Module with associated connection or interface

#### 1.6. Technical descriptions and documents

The following documents was provided by the manufacturer.

No.	Document Title and Description
1	User Manual

#### 1.7. Description of additional model name

Model name	Model name Designation	Description of design
IRES-700 10W	Basic model	-

## 2. Test Specification

The following test specifications and standards have been applied and used for testing.

- 1) FCC Part 27 Subpart C  
Miscellaneous Wireless Communications Services
- 2) ANSI C63.4:2009  
American National Standard for Methods of Measurement of Radio- Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
- 3) EIA/TIA-603-C  
Land Mobile FM or PM - Communications Equipment - Measurement and Performance Standards
- 3) EIA/TIA-603-C  
Land Mobile FM or PM - Communications Equipment - Measurement and Performance Standards
- 4) KDB 953210  
Amplifier, Booster, and Repeater – Basic Items

### 3. Test Conditions

#### 3.1. Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	700MHz ICS Repeater System	AIRPOINT CO., LTD.	IRES-700 10W	-
AE	Vector Signal Generator	Rohde & Schwarz	SMJ100A	-
AE	Note PC	LG Electronics Co., Ltd.	LGR51	-

**Note:** Use = EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment. SIM - Simulator (Not Subjected to Test)

#### 3.2. Input/Output Ports

No	Port Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
1	Power Input	DC	N	N	Connected to DC Power supply
2	Radio Antenna	I/O	N	Y	-

**Note:**  
 \*AC = AC Power Port      DC = DC Power Port      N/E = Non-Electrical  
 I/O = Signal Input or Output Port (Not Involved in Process Control)  
 TP = Telecommunication Ports

#### 3.3. Power Interface

Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	-42.0 V	-	-	DC	-	Normal operating voltage
1	-48.3 V	-	-	DC	-	V <sub>MIN</sub>
2	-35.7 V	-	-	DC	-	V <sub>MAX</sub>

#### 3.4. Operating Frequencies

Mode #	Frequency tested
1	Operating frequency range Downlink : 746 – 757 MHz Uplink : 776 – 787 MHz  2 channels in the Transmitter modes of Downlink and Uplink. - Downlink : 751 MHz - Uplink : 782 MHz
2	Receiving mode

### 3.5. Operation Modes

Mode #	Description
1	Carrier on mode: Signal from the RF module was generated continuously for the representative channels (Downlink, Uplink) by the test program incorporated
2	Carrier off (Idle) mode: RF carrier was not activated by the RF module

Note :

1. The measurements of the spurious emissions for transmitter on stand-by mode were performed as the receiver spurious emissions.
2. As a result of preliminary testing, the formal test was performed with the maximum payload mode of worst cases for each mode as below:
  - **Downlink:** 64QAM among QPSK, 16QAM and 64QAM.
  - **Uplink:** 16QAM between QPSK and 16QAM.

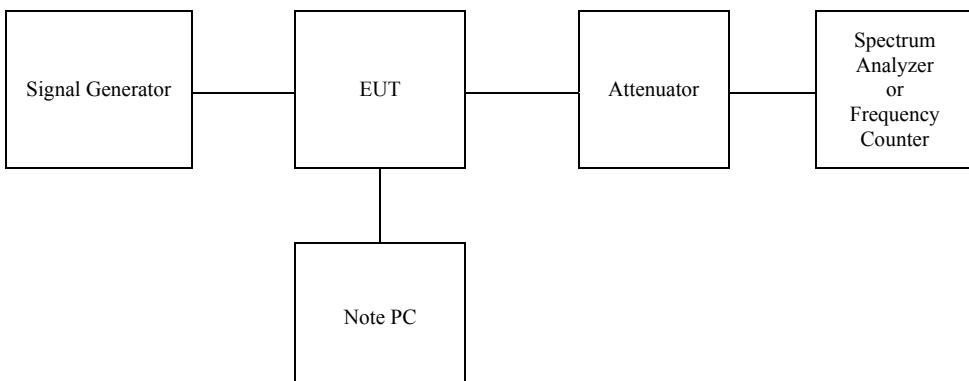
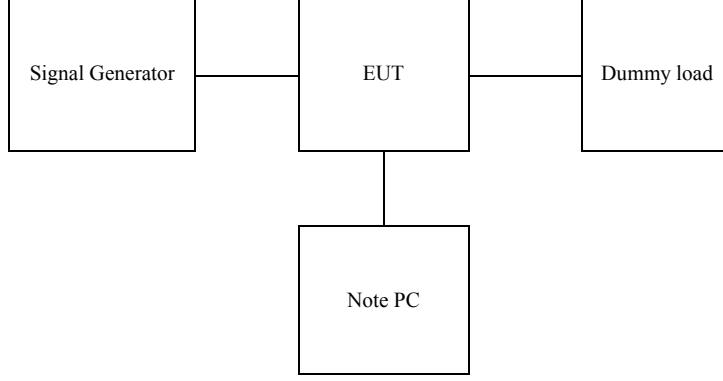
### 3.6. Environment Conditions

Parameters	Normal condition	Extreme condition
Temperature	+ 15 °C ~ +35 °C	-20 °C / +50 °C
Humidity	20% ~ 75%	No excessive condensation occur
Supply voltage	-42 Vdc (Rated nominal voltage)	-48.3 Vdc / -35.7 Vdc

Note ;

- The extreme condition is applied to the boundary limits of the declared operational environmental condition by the manufacturer.
- The operating condition for humidity requirement has not been declared in the manufacturer's specification.
- Test has been carried out for two frequencies specified above under the normal condition and for the extreme condition, minimum and maximum frequencies has been tested.

### 3.7. Test Configurations

Mode #	Description
1	 <pre>graph LR; SG[Signal Generator] --- EUT[EUT]; EUT --- Att[Attenuator]; Att --- SA[Spectrum Analyzer or Frequency Counter]; NotePC[Note PC] --- EUT;</pre>
2	 <pre>graph LR; SG[Signal Generator] --- EUT[EUT]; EUT --- DummyLoad[Dummy load]; NotePC[Note PC] --- EUT;</pre>

### 3.8. List of Test Equipment

No	Description	Manufacturer	Model	Identifier	Cal. Due
1	Spectrum Analyzer	R/S	FSP	100017	Mar. 12, 2013
2	Spectrum Analyzer	R/S	FSV30	101372	May 31, 2013
3	Signal Generator	R/S	SMJ100A	101038	Feb. 01, 2013
4	Power Attenuator	Aeroflex Weinschel	67-30-43	CA5760	Nov. 30, 2012
5	EMI Test Receiver	R/S	ESCI	101013	Oct. 23, 2012
6	EMI Test Receiver	R/S	ESU	100261	Sep. 27, 2012
7	Amplifier	Sonoma Instrument	310N	312544	Oct. 12, 2012
8	Amplifier	Sonoma Instrument	310N	312545	Oct. 12, 2012
9	High Pass Filter	Wainwright Instruments GmbH	WRCT 700/1000 -0.2/40-5SSK	0426	July. 10, 2013
10	Tunable Band Reject Filter	Aeroflex Weinschel	67-30-43	19	Oct. 21, 2012
11	TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-420	Mar. 27, 2013
12	TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-422	Mar. 27, 2013
13	Horn Antenna	Schwarzbeck	BBHA9120D	BBHA9120D29 4	Aug. 23, 2013
14	Horn Antenna	Schwarzbeck	BBHA9120D	BBHA9120D29 5	Aug. 23, 2013
15	CW Microwave Frequency Counter	R/S	53152A	US39270295	Dec. 30, 2012
16	Chamber	Samkun Tech	SSE-43CI-A	060712	Jun. 01, 2013

#### 4. Overview of Technical requirements

The following essential requirements and test specifications are relevant to the presumption of conformity FCC Part 27 Subpart C.			Reported
Reference Clause No.	Essential technical requirements	Test method	
§27.50(b)(4)	RF Power Output at Antenna Terminals	Note 1 KDB	[ X ]
§2.1053 §27.53(c)	Spurious Radiated Emission	Note 1	[ X ]
§2.1049	Occupied Bandwidth 99 % and -26 dB	Note 1	[ X ]
§2.1051 §27.53(c)	Spurious Emission at Antenna Terminal	Note 1	[ X ]
§2.1051 §27.53(c)	Band Edge	Note 1	[ X ]
§2.1055 §27.54	Frequency Stability	Note 1	[ X ]
KDB 935210	Out of Band Rejection	-	[ X ]

Note 1 : The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 MHz (ANSI C63.4-2003) and Land Mobile FM or PM - Communications Equipment - Measurement and Performance Standards (EIA/TIA-603-C)

## 5. Test Results

### 5.1. RF Output Power at Antenna Terminal

TEST: RF Output Power at Antenna Terminal							
Method	<ol style="list-style-type: none"> <li>1. The RF output of the transmitter was connected to the input of the Spectrum Analyzer through sufficient attenuation.</li> <li>2. 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 spectrum analyzer. The test was performed at using all applicable modulation.</li> <li>3. RF output power was measured by channel power measurement function of the spectrum analyzer with rms detector mode.</li> </ol>						
Reference Clause	Part27 Subpart C Section 27.50(b)(3)						
Parameters recorded during the test	<table border="1"> <tr> <td>Laboratory Ambient Temperature</td><td>25 °C</td></tr> <tr> <td>Relative Humidity</td><td>55 %</td></tr> <tr> <td>Frequency range</td><td>Measurement Point</td></tr> </table>	Laboratory Ambient Temperature	25 °C	Relative Humidity	55 %	Frequency range	Measurement Point
Laboratory Ambient Temperature	25 °C						
Relative Humidity	55 %						
Frequency range	Measurement Point						
Fully configured sample scanned over the following frequency range	<table border="1"> <tr> <td>Downlink : 746 – 757 MHz</td><td></td></tr> <tr> <td>Uplink : 776 – 787 MHz</td><td>Antenna port</td></tr> </table>	Downlink : 746 – 757 MHz		Uplink : 776 – 787 MHz	Antenna port		
Downlink : 746 – 757 MHz							
Uplink : 776 – 787 MHz	Antenna port						

### Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
Rated	1	1
Supplementary information: None		

### Limits

Fixed and base stations transmitting a signal in the 746–757 MHz, 758–763 MHz, 776–787 MHz, and 788–793 MHz bands 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.

Table 3 to §27.50—Permissible Power and Antenna Heights for Base and Fixed Stations in the 698–757 MHz, 758–763 MHz, 776–787 MHz and 788–793 MHz Bands 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

## **Test Result**

Measurement method :  Radiated  Conducted

Mode of operation : Continuous Wave

Power Gain setting : Max. 100 dB

**Table 1. Test data for RF Output Power at Antenna Terminal**

Test Mode	Frequency (MHz)	Modulation	Input (dBm)	Output (dBm)	Antenna Gain (dBd)	Correction Factor (dB)	Result (dBm/MHz E.R.P.)	Limit (dBm/MHz E.R.P)	Margin (dB)
Down link	751	QPSK	-20	40.04	17.85	-9.55	48.34	60	11.66
		16QAM	-20	40.06	17.85	-9.55	48.36	60	11.64
		64QAM	-20	40.06	17.85	-9.55	48.36	60	11.64
Up link	782	QPSK	-33	27.04	17.85	-9.55	35.34	60	24.66
		16QAM	-33	26.99	17.85	-9.55	35.29	60	24.71

### **Supplementary information:**

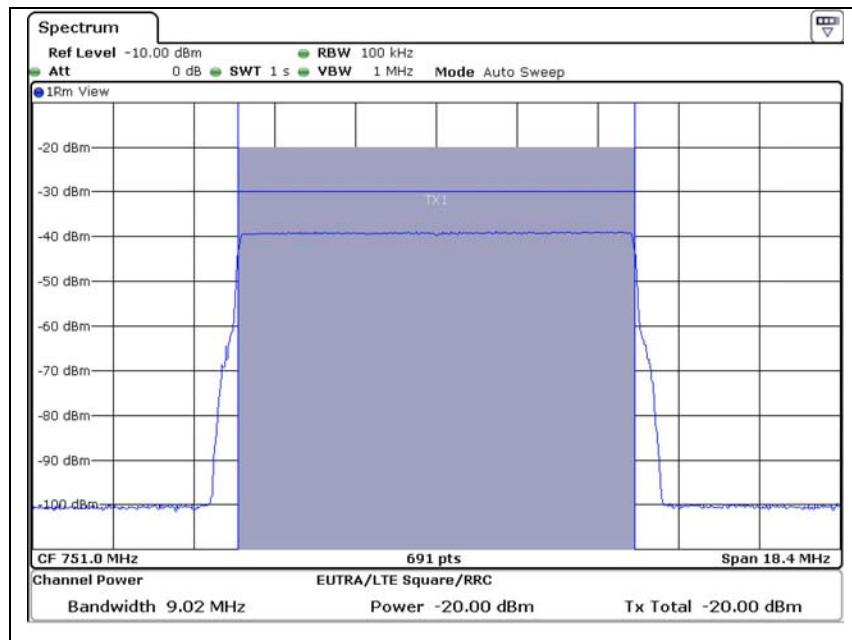
- End users and/or installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF ERP output power, because the applicant does not provide an antenna for sale with the EUT. The Antenna gain will be same or less than 20 dBi.

### **Remark**

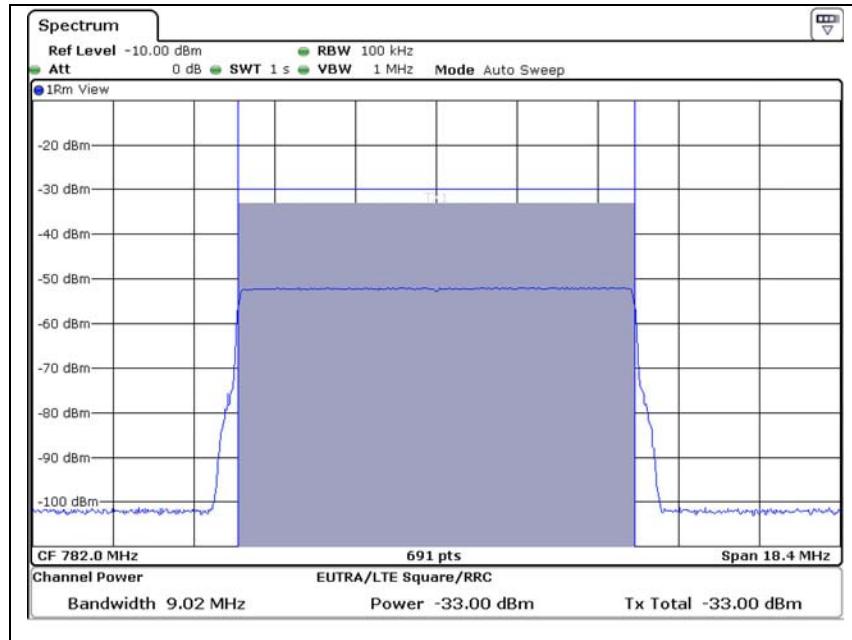
- a. Antenna gain in dBd = Antenna gain in dBi – 2.15 (dB) = 20 (dBi) – 2.15 (dB) = 17.85 (dBd)
- b. Correction factor (dB) =  $10\log(1 \text{ MHz}/\text{channel power bandwidth})$  (dB) =  $10\log(1 \text{ MHz}/9.02 \text{ MHz})$  (dB) = -9.55 (dB)
- c. Result (dBm/MHz) = Output (dBm) + Correction factor (dB) + Antenna gain (dBd)
- d. Margin (dB) = Limit (dBm/MHz E.R.P) - Result (dBm/MHz E.R.P)

### Figure 1. Input Level

#### Downlink

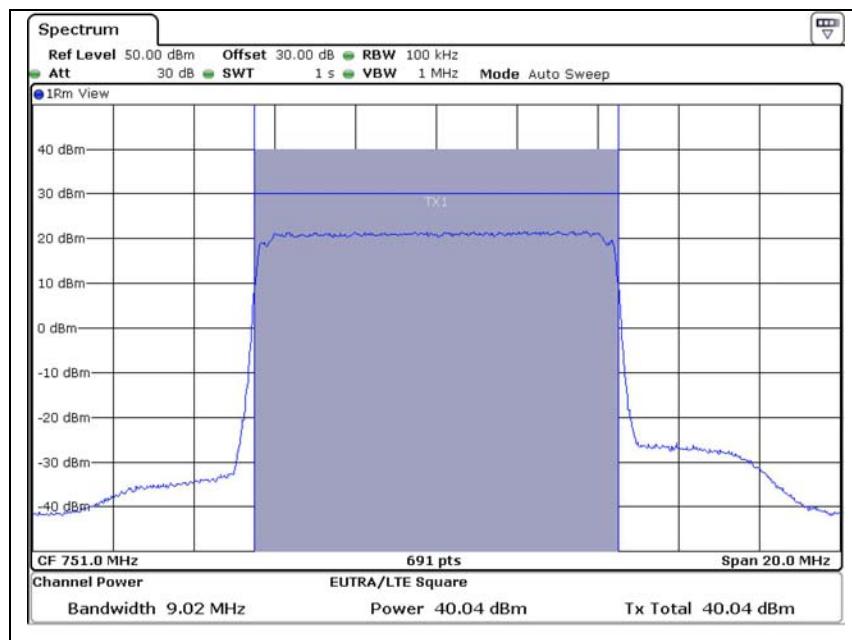


#### Uplink

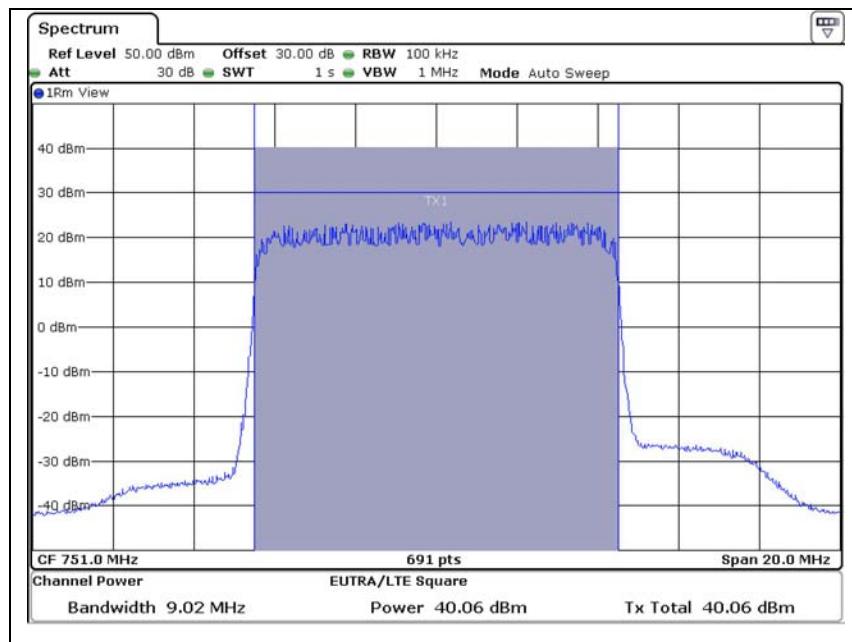


**Figure 2. Downlink**

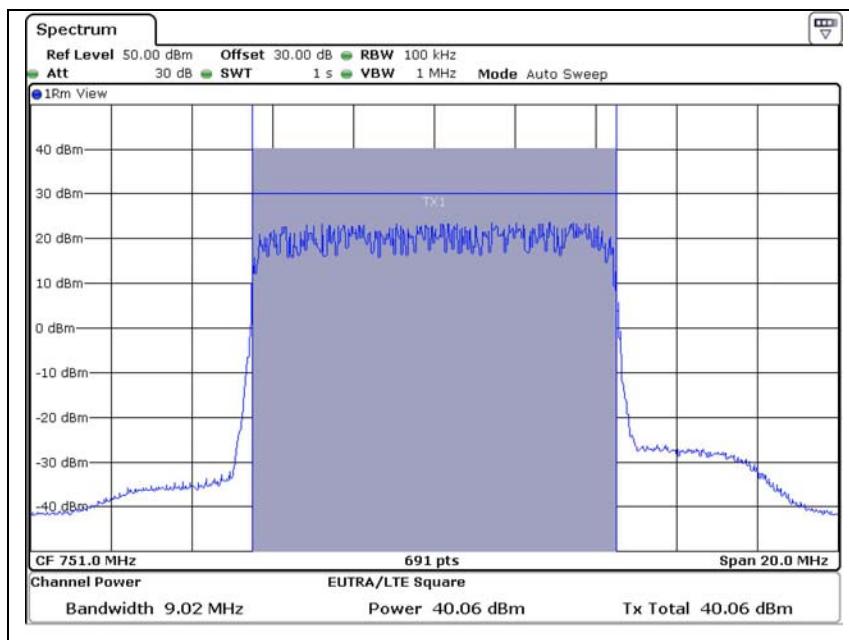
**QPSK**



**16QAM**

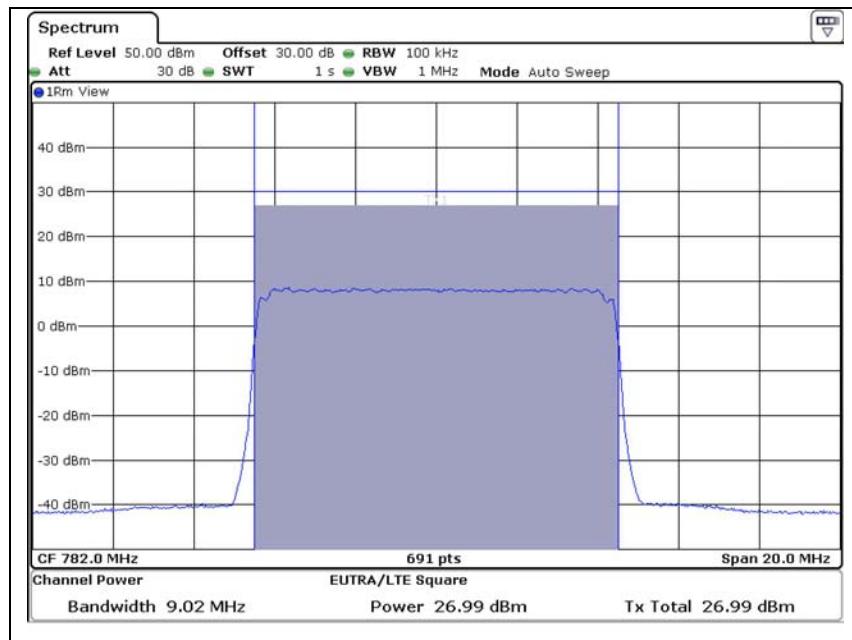


## 64QAM

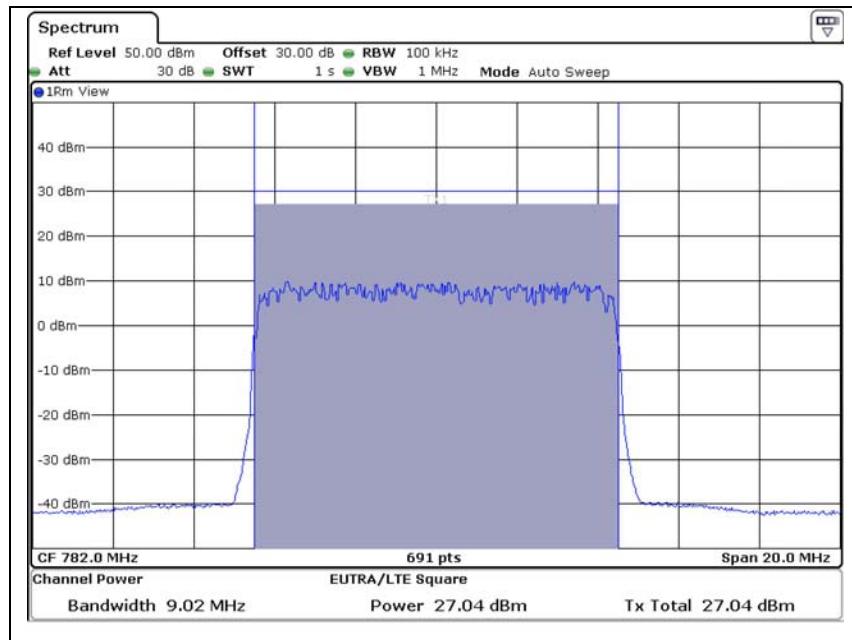


**Figure 3. Uplink**

**QPSK**



**16QAM**



## 5.2. Occupied Bandwidth 99% and -26 dB

TEST: Occupied Bandwidth 99% and -26 dB							
Method	<ol style="list-style-type: none"><li>1. 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 spectrum analyzer. The test was performed at frequencies using all applicable modulation.</li><li>2. Set resolution bandwidth (RBW) = 1 % to 3 % of the - 26 dB bandwidth.</li><li>3. Set the video bandwidth (VBW) <math>\geq 3 \times</math> RBW.</li><li>4. Detector = Peak.</li><li>5. Trace mode = max hold.</li><li>6. Sweep = auto couple.</li><li>7. Allow the trace to stabilize.</li></ol>						
Reference Clause	Part2 Subpart J Section 2.1049						
Parameters recorded during the test	<table border="1"><tr><td>Laboratory Ambient Temperature</td><td>25 °C</td></tr><tr><td>Relative Humidity</td><td>55 %</td></tr><tr><td>Frequency range</td><td>Measurement Point</td></tr></table>	Laboratory Ambient Temperature	25 °C	Relative Humidity	55 %	Frequency range	Measurement Point
Laboratory Ambient Temperature	25 °C						
Relative Humidity	55 %						
Frequency range	Measurement Point						
Fully configured sample scanned over the following frequency range	Downlink : 746 – 757 MHz Uplink : 776 – 787 MHz Antenna port						

### Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
Rated	1	1
Supplementary information: None		

### Limits

N/A

### Remark

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

## **Result**

Measurement method :  Radiated  Conducted

Mode of operation : Continuous Wave

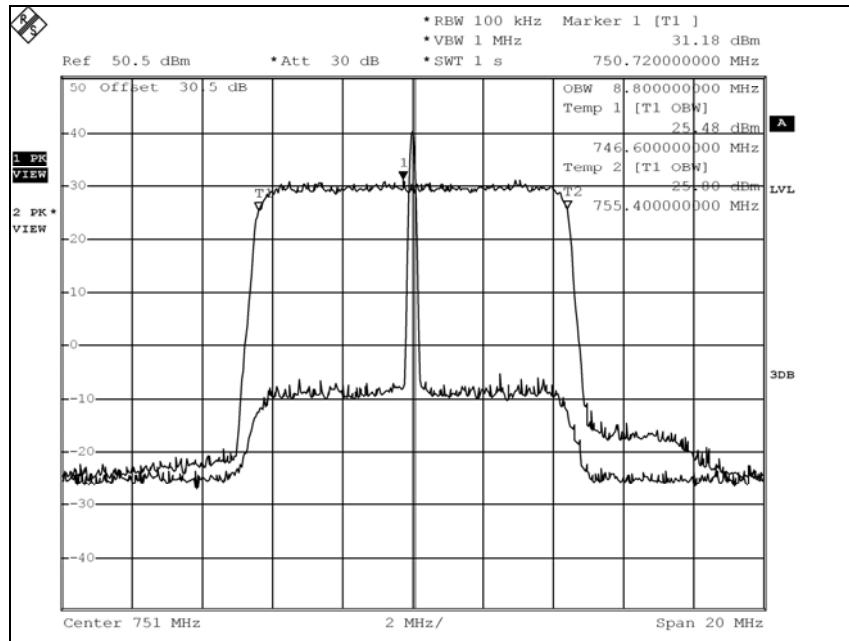
Power Gain setting : Max. 100 dB

**Table 2. Data Table of 99% and -26 dB Bandwidth**

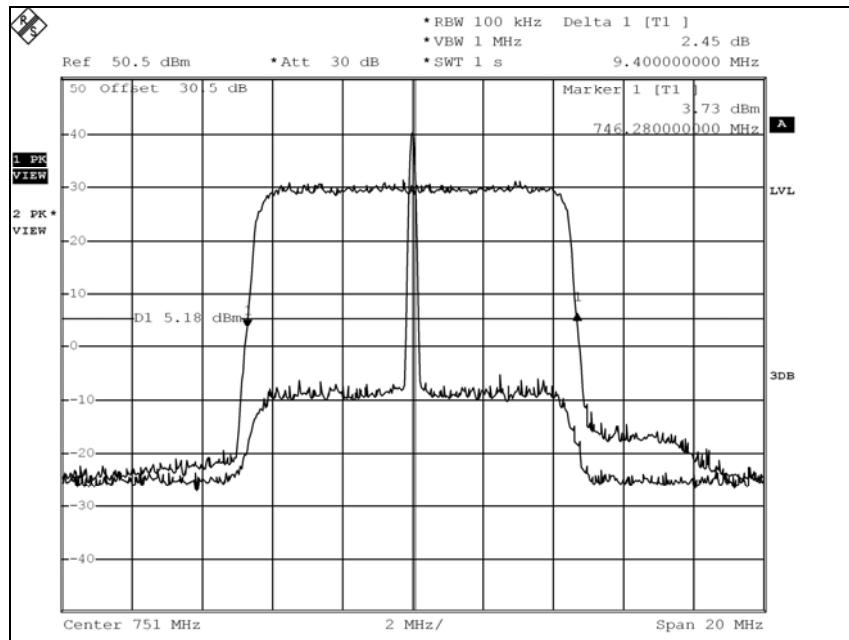
Test Mode	Frequency (MHz)	Modulation	99 % Bandwidth (MHz)	-26 dB Bandwidth (MHz)
Downlink	751	QPSK	9.40	8.80
		16QAM	9.40	8.80
		64QAM	9.40	8.80
Uplink	782	QPSK	9.40	8.80
		16QAM	9.40	8.80

**Figure 4. Downlink**

**99 % Bandwidth**

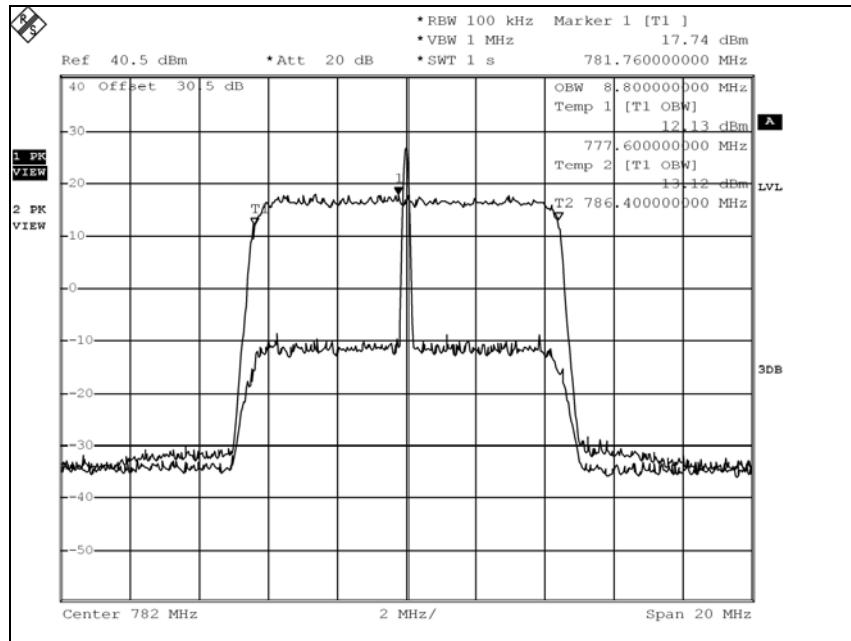


**-26 dB Bandwidth**

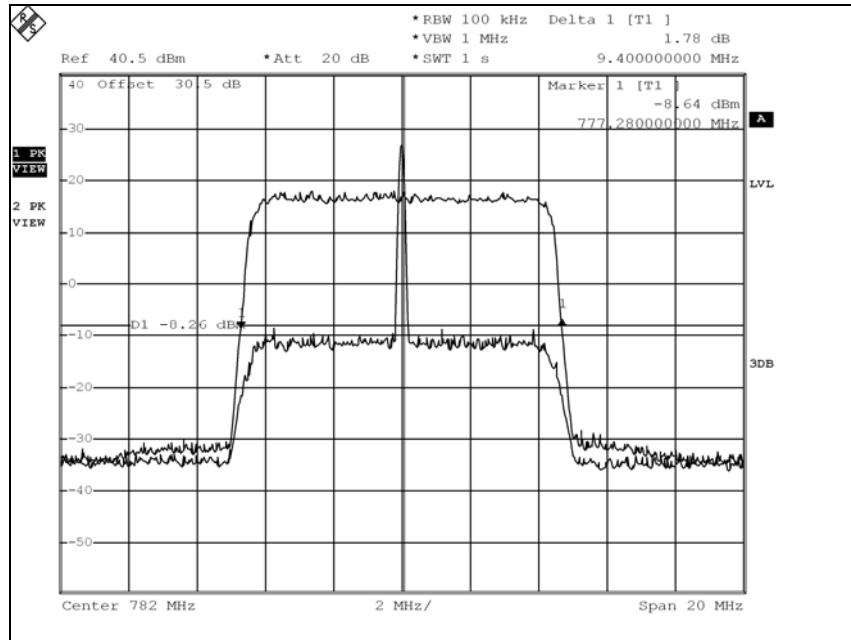


**Figure 5. Uplink**

**99 % Bandwidth**



**-26 dB Bandwidth**



### 5.3. Spurious Emission at Antenna Terminal

TEST: Spurious Emission at Antenna Terminal		
Method	<ol style="list-style-type: none"> <li>1. 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 spectrum analyzer. The test was performed at frequencies using all applicable modulation.</li> <li>2. The resolution bandwidth and video bandwidth of the spectrum analyzer was set at 1 MHz.</li> <li>3. Sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonics.</li> <li>4. Trace mode = max hold.</li> <li>5. Sweep = auto couple.</li> <li>6. Allow the trace to stabilize.</li> </ol>	
Reference Clause	Part27 Subpart C Section 27.53 (c)(f)	
Parameters recorded during the test	Laboratory Ambient Temperature	24 °C
	Relative Humidity	57 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	Downlink : 746 – 757 MHz Uplink : 776 – 787 MHz	Antenna port

### Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
Rated	1	1
Supplementary information: None		

### Limits

(c) For operations in the 746–758 MHz band and the 776–788 MHz band, 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 any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB;
- (2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB;
- (3) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than  $76 + 10 \log (P)$  dB in a 6.25 kHz band segment, for base and fixed stations;

(f) For operations in the 746–763 MHz, 775–793 MHz, and 805–806 MHz bands, emissions 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.

### Remark

- (5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;
- (6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) 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.

## **Result**

Measurement method :  Radiated  Conducted

Mode of operation : Continuous Wave

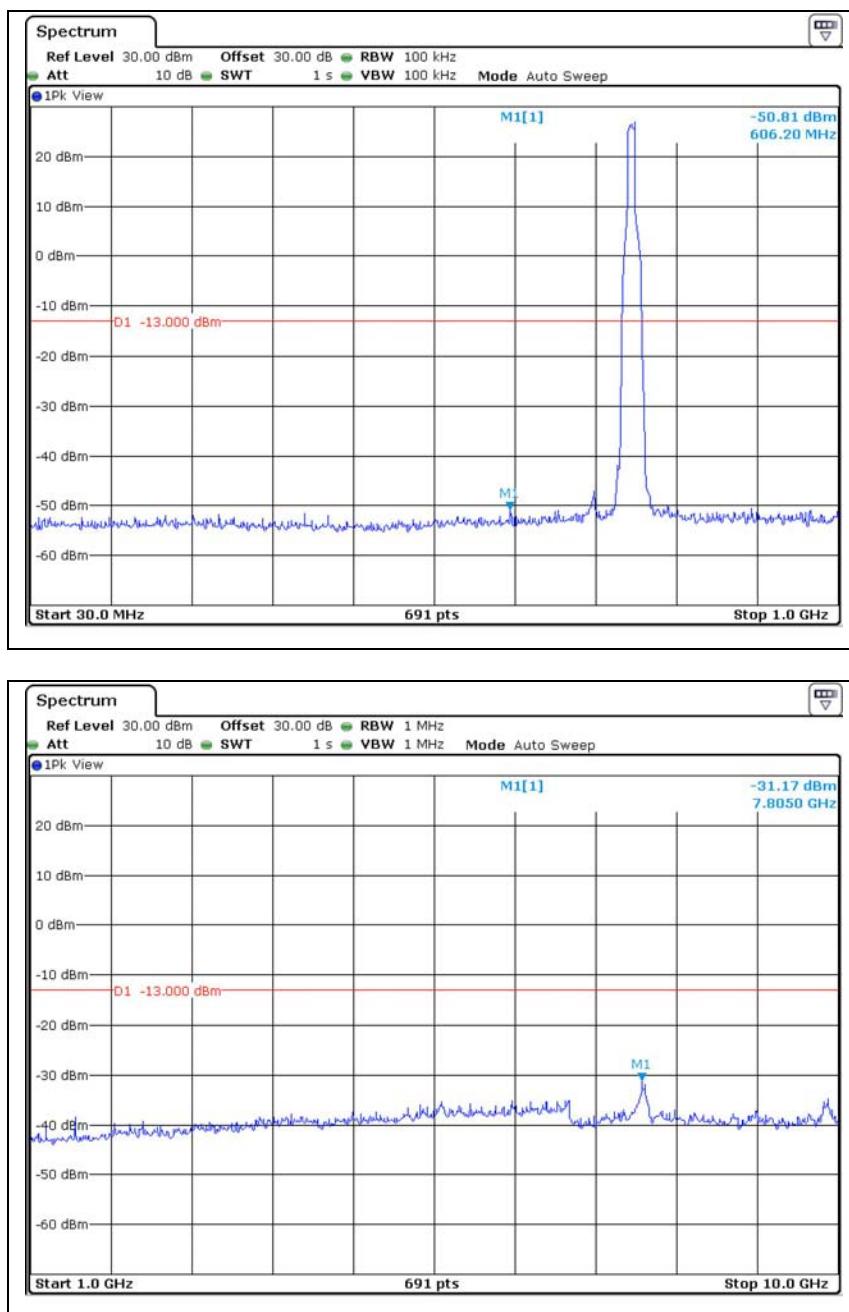
Power Gain setting : Max. 100 dB

### **5.3.1. Test Result for §27.53 (c)(1)(2)\_ 30 MHz ~ 10 GHz**

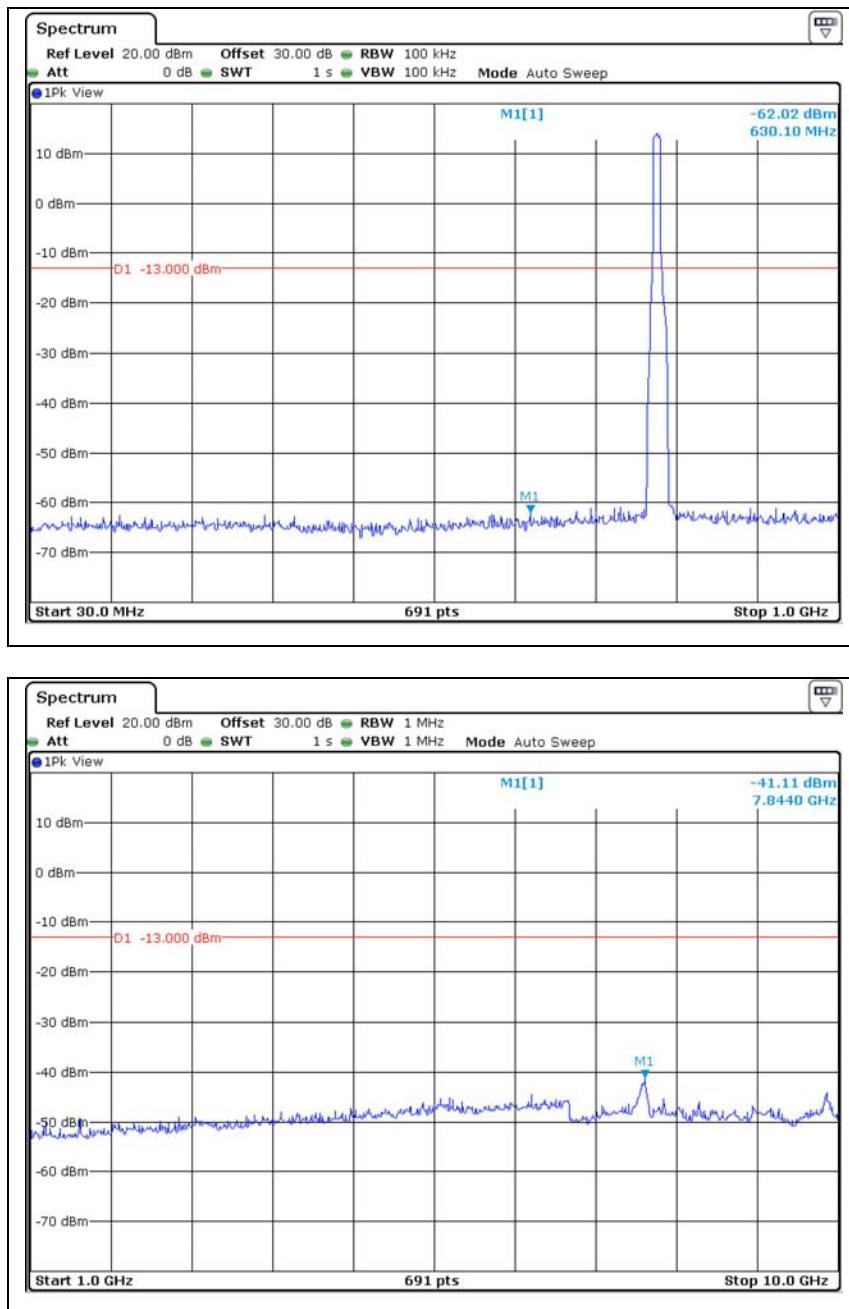
**Table 3. Data Table**

Test Mode	Frequency (MHz)	Measured (dBm)	Cable Loss (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
Downlink	606.20	-50.81	0.67	-50.14	-13	-37.14
	7 805.00	-31.17	3.50	-27.67		-14.67
Uplink	630.10	-62.02	0.67	-61.35	-13	-48.35
	7 844.00	-41.11	3.50	-37.61		-24.61
Other frequencies up to 10 GHz have margin more than 20 dB.						

**Figure 6. Downlink**



**Figure 7. Uplink**



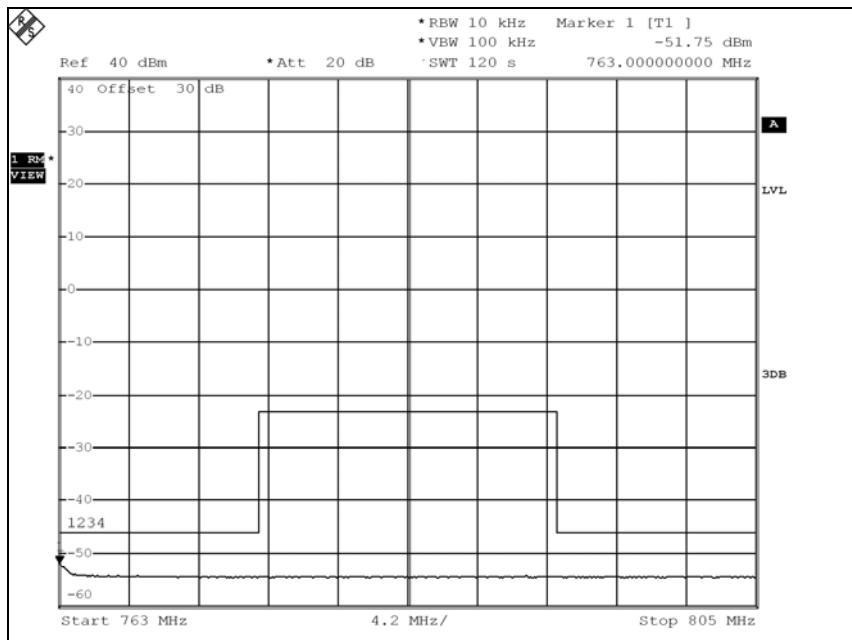
**5.3.2. Test Result for §27.53 (c)(3)\_ 763 MHz ~ 775 MHz and 793 MHz ~ 805 MHz**

**Table 4. Data Table**

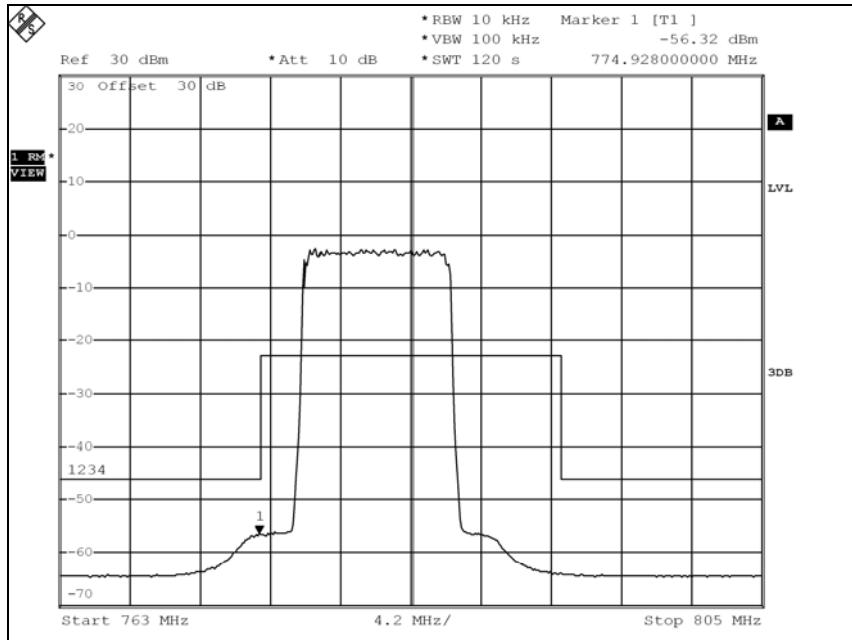
Test Mode	Frequency (MHz)	Measured (dBm)	Cable Loss (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
Downlink	763.000	-51.75	0.67	-51.08	-46	-5.08
Uplink	774.928	-56.32	0.67	-55.65		-9.65

**Figure 8. Captured images**

**Downlink**



**Uplink**



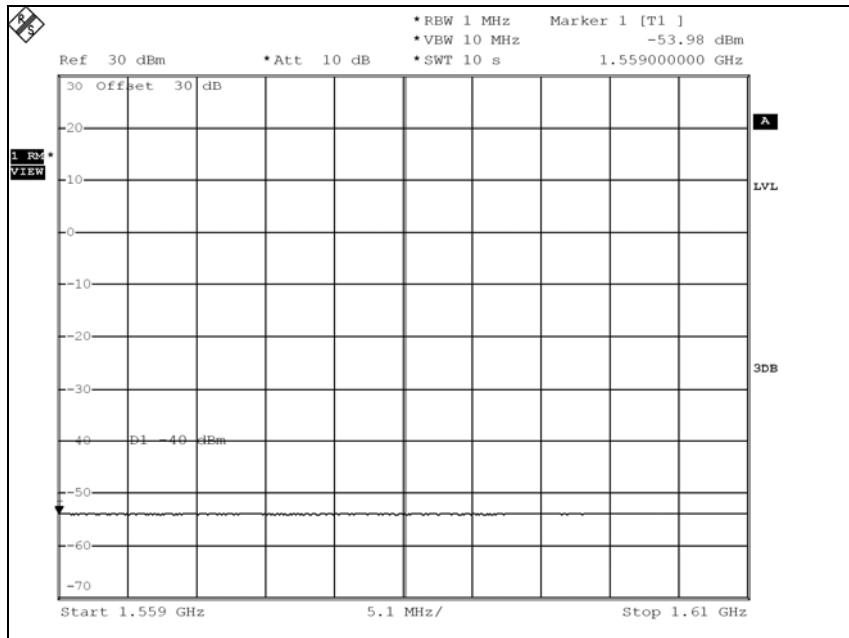
**5.3.3. Test Result for §27.53 (f)  $1\ 559\text{ MHz} \sim 1\ 610\text{ MHz}$**

**Table 5. Data Table**

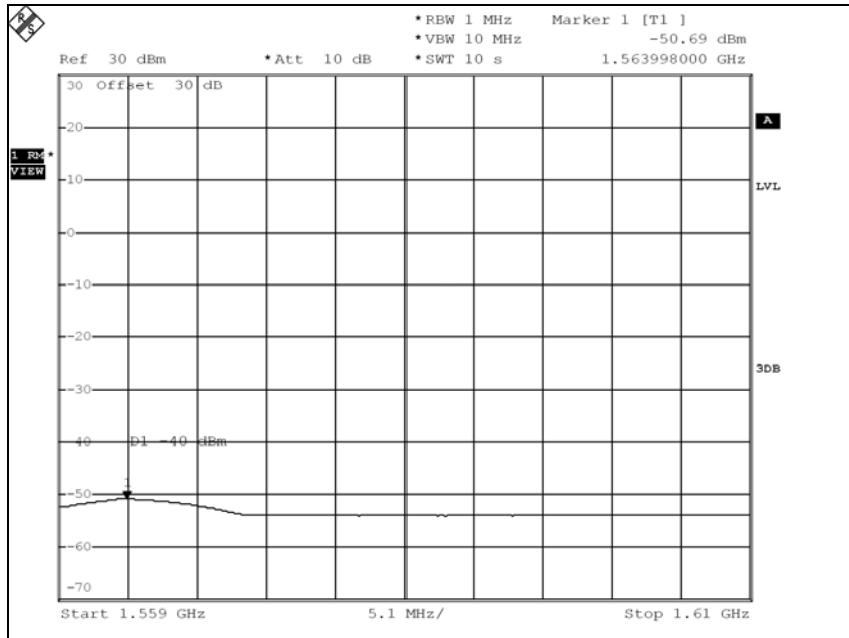
Test Mode	Frequency (MHz)	Measured (dBm)	Cable Loss (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
Downlink	1 559.000	-53.98	1.2	-52.78	-40	-12.78
Uplink	1 563.998	-50.69	1.2	-49.49		-9.49

**Figure 9. Captured images**

**Downlink**



**Uplink**



## 5.4. Band Edge Measurement

TEST: Band Edge Measurement		
Method	1. 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 spectrum analyzer. The test was performed at frequencies using all applicable modulation. 2. The resolution bandwidth and video bandwidth of the spectrum analyzer was set according to the regulation. 3. Trace mode = max hold. 4. Sweep = auto couple. 5. Allow the trace to stabilize.	
Reference Clause	Part27 Subpart C Section 27.53 (c)(1)(2)(5)	
Parameters recorded during the test	Laboratory Ambient Temperature	24 °C
	Relative Humidity	57 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	Downlink : 746 – 757 MHz Uplink : 776 – 787 MHz	Antenna port

### Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
Rated	1	1
Supplementary information: None		

### Limits

(c) For operations in the 746–758 MHz band and the 776–788 MHz band, 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 any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB;
- (2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB;

### Remark

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

## **Result**

Measurement method :  Radiated  Conducted

Mode of operation : Continuous Wave

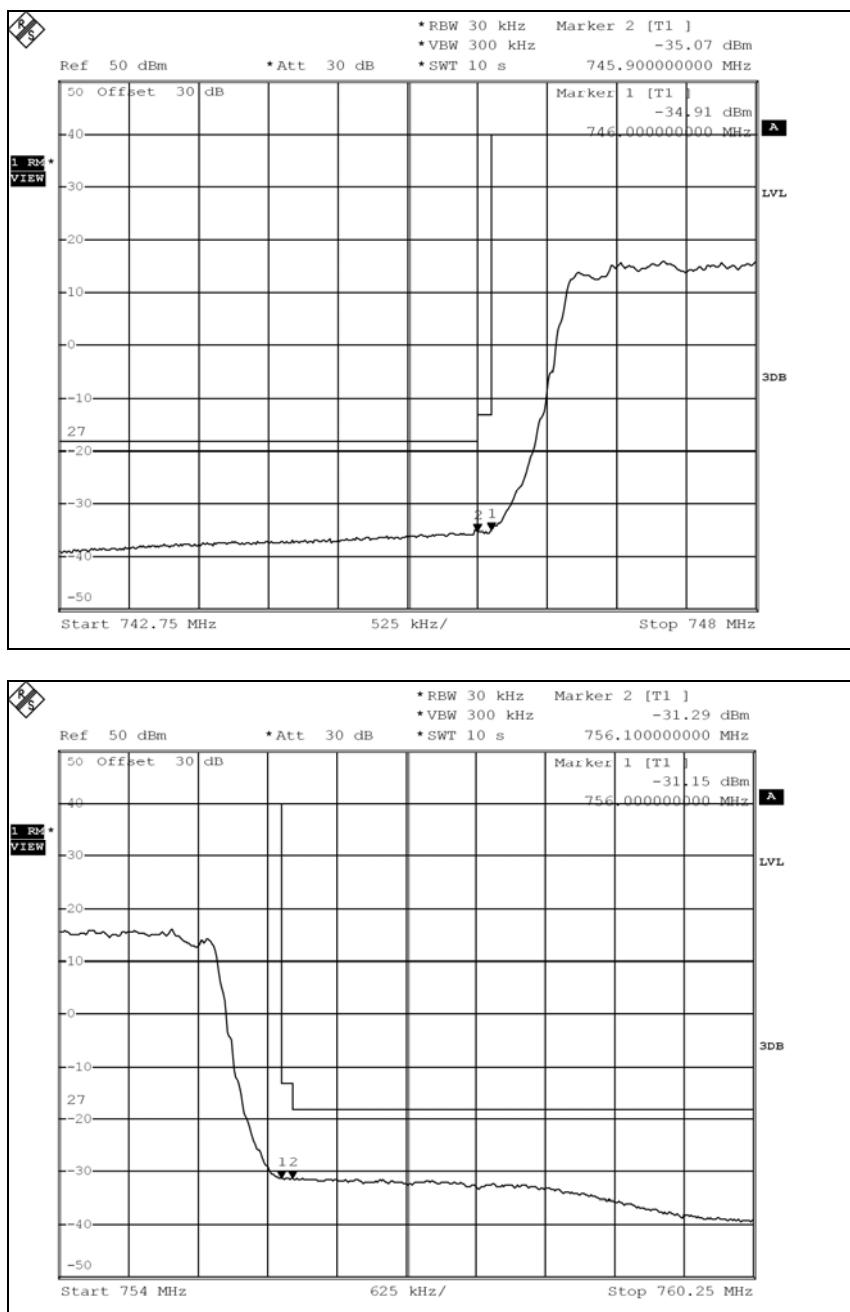
Power Gain setting : Max. 100 dB

### **5.4.1. Test Result for §27.53 (c)(1)(2)(5)**

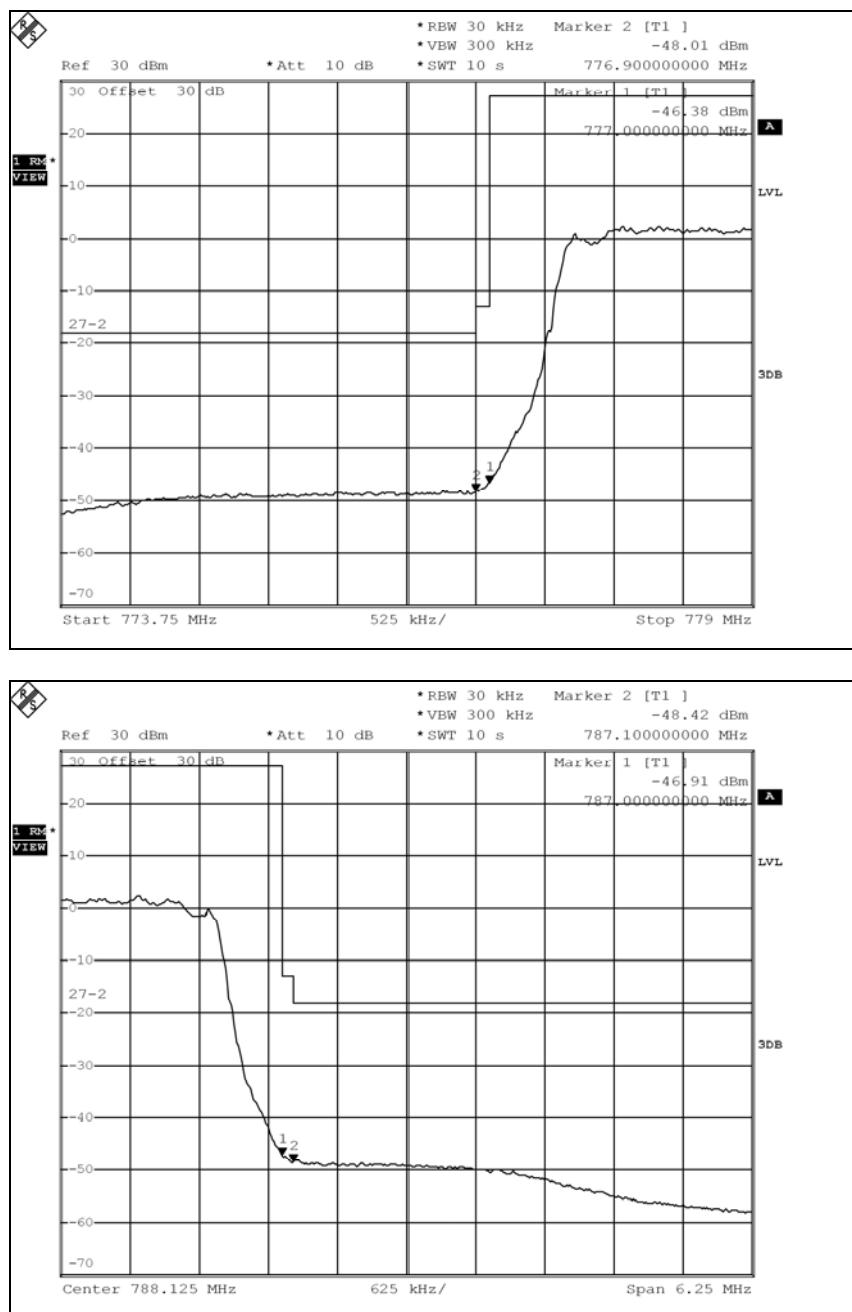
**Table 6. Data Table**

Test Mode	Frequency (MHz)	Measured (dBm)	Cable Loss (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
Downlink	745.900	-35.07	0.67	-34.40	-18.22	-16.18
	746.000	-34.91	0.67	-34.24	-13.00	-21.24
	756.000	-31.15	0.67	-30.48	-13.00	-17.48
	756.100	-31.29	0.67	-30.62	-18.22	-12.40
Uplink	776.900	-48.01	0.67	-47.34	-18.22	-29.12
	777.000	-46.38	0.67	-45.71	-13.00	-32.71
	787.000	-46.91	0.67	-46.24	-13.00	-33.24
	787.100	-48.42	0.67	-47.75	-18.22	-29.53

**Figure 10. Downlink**



**Figure 11. Uplink**



## 5.5. Field Strength of Spurious Radiation

TEST: Field Strength of Spurious Radiation							
Method	<ol style="list-style-type: none"> <li>1. 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 spectrum analyzer. The test was performed at frequencies using all applicable modulation.</li> <li>2. On a test site, the EUT shall be placed at 80cm height on a turn table, and in the position close to normal use as declared by the applicant.</li> <li>3. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.</li> <li>4. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.</li> <li>5. During the measurement of the EUT below 1 GHz, the resolution bandwidth was to 100 kHz and the video bandwidth was set to 300 kHz.</li> <li>6. During the measurement of the EUT above 1 GHz, the resolution bandwidth was to 1 MHz and the video bandwidth was set to 3 MHz.</li> <li>7. The transmitter shall be switched on; the measuring receiver shall be tuned to the frequency of the transmitter under test.</li> <li>8. The test antenna shall be raised and lowered through the specified range of height until the maximum signal level is detected by the measuring receiver.</li> <li>9. The transmitter shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.</li> <li>10. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.</li> <li>11. The maximum signal level detected by the measuring receiver shall be noted. The EUT was replaced by half-wave dipole antenna connected to a signal generator.</li> <li>12. In necessary, the input attenuator setting on the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.</li> <li>13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.</li> <li>14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring received, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.</li> <li>15. The input level to the substitution antenna shall be recorded as power level in dB m, corrected for any change of input attenuator setting of the measuring receiver.</li> <li>16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.</li> </ol>						
Reference Clause	Part27 Subpart C Section 27.53 (c)						
Parameters recorded during the test	<table border="1"> <tr> <td>Laboratory Ambient Temperature</td><td>25 °C</td></tr> <tr> <td>Relative Humidity</td><td>57 %</td></tr> <tr> <td>Frequency range</td><td>Measurement Point</td></tr> </table>	Laboratory Ambient Temperature	25 °C	Relative Humidity	57 %	Frequency range	Measurement Point
Laboratory Ambient Temperature	25 °C						
Relative Humidity	57 %						
Frequency range	Measurement Point						
Fully configured sample scanned over the following frequency range	<table border="1"> <tr> <td>Downlink : 746 – 757 MHz</td><td>Antenna port</td></tr> <tr> <td>Uplink : 776 – 787 MHz</td><td></td></tr> </table>	Downlink : 746 – 757 MHz	Antenna port	Uplink : 776 – 787 MHz			
Downlink : 746 – 757 MHz	Antenna port						
Uplink : 776 – 787 MHz							

### Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
Rated	1	2
Supplementary information: None		

## **Limits**

(c) For operations in the 746–758 MHz band and the 776–788 MHz band, 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 any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB;
- (2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB;

(f) For operations in the 746–763 MHz, 775–793 MHz, and 805–806 MHz bands, emissions 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.

## **Result**

Measurement method :  Radiated  Conducted

Mode of operation : Continuous Wave

Power Gain setting : Max. 100 dB

**Table 7. Data Table**

Test Mode	Frequency (MHz)	Reading (dBuV)	Generator Reading (dBm)	Ant. Gain (dBi)	Pol. (H/V)	Cable Loss (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
Down link	40.67	26.00	-66.40	1.14	V	0.60	-65.86	-13.00	-52.86
	51.34	27.00	-67.50	1.03	V	0.70	-65.77	-13.00	-52.77
	59.10	29.90	-63.80	1.12	V	0.80	-61.88	-13.00	-48.88
	67.83	30.20	-64.50	1.19	V	0.80	-62.51	-13.00	-49.51
	78.50	22.50	-67.20	1.98	V	0.90	-64.32	-13.00	-51.32
	839.94	15.20	-68.70	1.73	V	4.30	-62.67	-13.00	-49.67
Up link	41.64	23.00	-69.80	1.14	V	0.60	-69.26	-13.00	-56.26
	51.34	22.00	-72.50	1.03	V	0.70	-70.77	-13.00	-57.77
	67.83	30.00	-64.70	1.19	V	0.80	-62.71	-13.00	-49.71
	97.90	15.90	-63.00	2.51	V	1.00	-59.49	-13.00	-46.49
	118.27	14.30	-64.50	1.81	V	1.10	-61.59	-13.00	-48.59
	127.97	15.10	-66.80	1.65	V	1.20	-63.95	-13.00	-50.95
Other frequencies have margin more than 20 dB.									

## 5.6. Frequency Stability

TEST: Frequency Stability							
Method	<ol style="list-style-type: none"><li>1. 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 CW Microwave Frequency Counter. The test was performed at frequency using all applicable unmodulation.</li><li>2. The EUT was placed inside the temperature chamber.</li><li>3. After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.</li></ol>						
Reference Clause	Part27 Subpart C Section 27.54						
Parameters recorded during the test	<table border="1"><tr><td>Laboratory Ambient Temperature</td><td>24 °C</td></tr><tr><td>Relative Humidity</td><td>53 %</td></tr><tr><td>Frequency range</td><td>Measurement Point</td></tr></table>	Laboratory Ambient Temperature	24 °C	Relative Humidity	53 %	Frequency range	Measurement Point
Laboratory Ambient Temperature	24 °C						
Relative Humidity	53 %						
Frequency range	Measurement Point						
Fully configured sample scanned over the following frequency range	Downlink : 746 – 757 MHz Uplink : 776 – 787 MHz Antenna port						

### Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
Rated,1 and 2	1	1
Supplementary information: None		

### Limits

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

## **Result**

Measurement method :  Radiated  Conducted

Mode of operation : Continuous Wave

Power Gain setting : Max. 100 dB

**Table 8. Data Table\_Downlink (751 MHz)**

Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	-42.0	-1	-0.0013
40		-1	-0.0013
30		-1	-0.0013
20		0	0.0000
10		-1	-0.0013
0		-1	-0.0013
-10		-1	-0.0013
-20		0	0.0000
-30		-1	-0.0013

Frequency Stability versus power Supply			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
24	-48.3	-1	-0.0013
	-42.0	-1	-0.0013
	-35.7	-1	-0.0013

**Table 9. Data Table\_Uplink (782 MHz)**

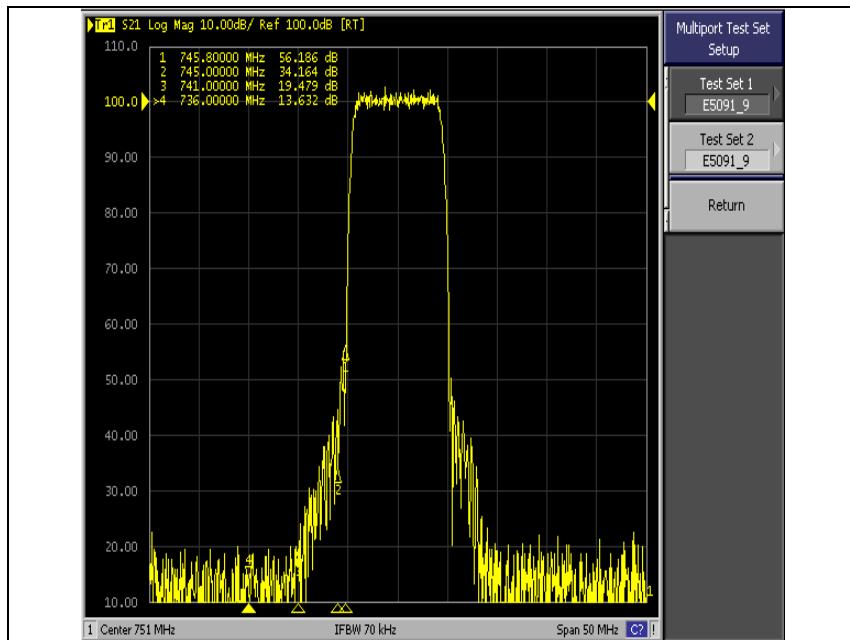
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	-42.0	-1	-0.0013
40		-1	-0.0013
30		-1	-0.0013
20		-1	-0.0013
10		0	0.0000
0		-1	-0.0013
-10		-1	-0.0013
-20		0	0.0000
-30		-1	-0.0013
Frequency Stability versus power Supply			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
24	-48.3	0	0.0000
	-42.0	0	0.0000
	-35.7	-1	-0.0013

## APPENDIX A. Out of Band Rejection

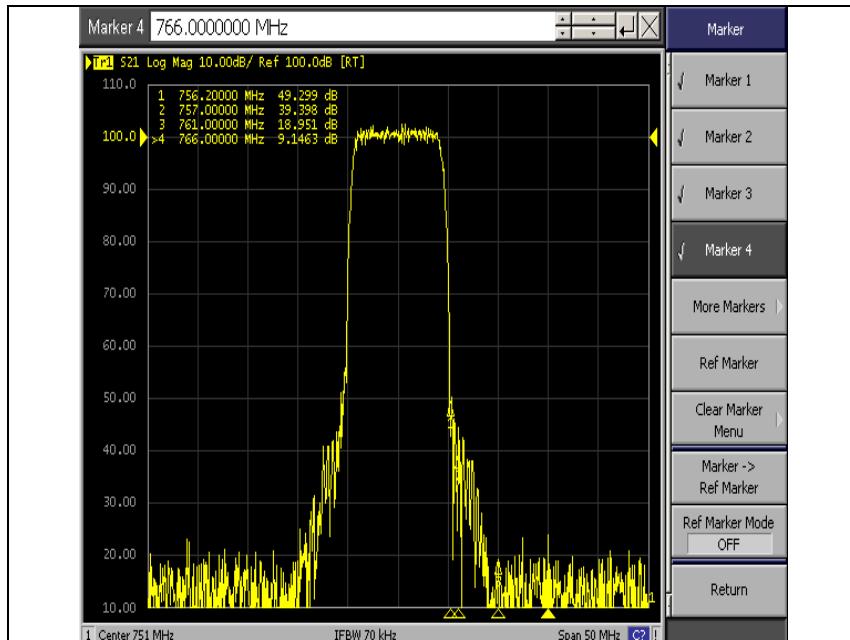
According to KDB 935210, Out of Band Rejection are tested and Filter frequency response plots for Downlink and Uplink are as below;

**Figure 12. Downlink\_751 MHz**

**Lower**

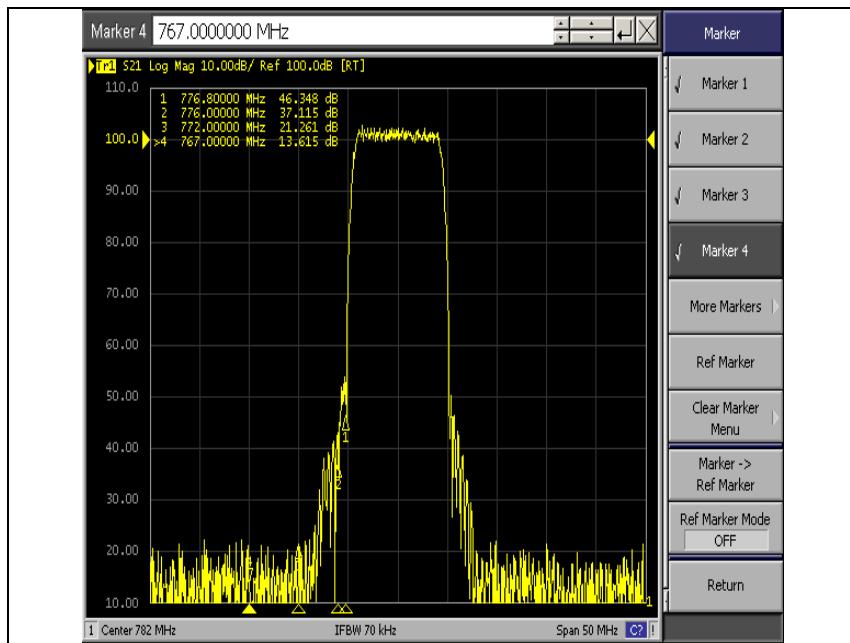


**Upper**

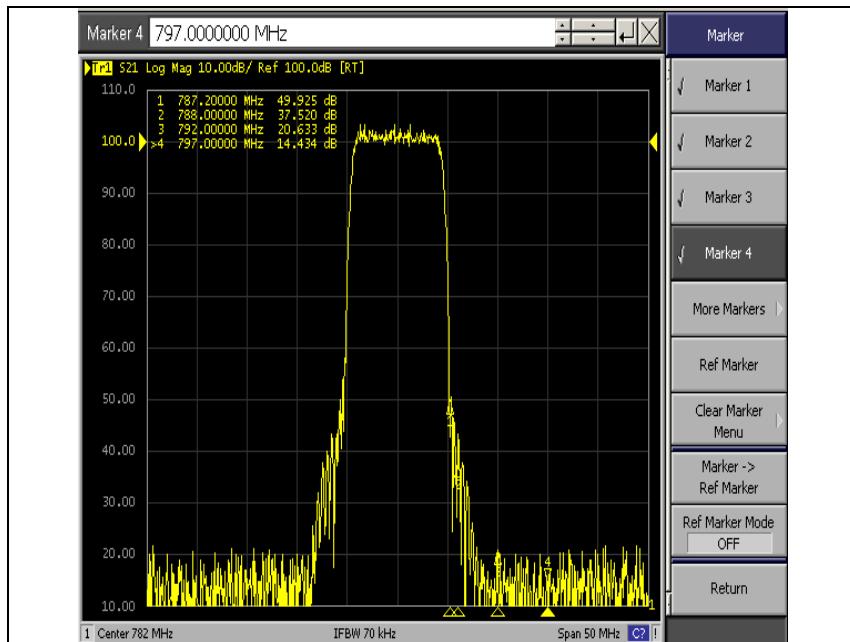


**Figure 13. Downlink\_782 MHz**

**Lower**



**Upper**



## APPENDIX B. Accreditations and Authorizations

ONETECH Corp. has been accredited / filed / authorized by the agencies listed in the following table;

Certificate	Nation	Agency	Code	Mark
Accreditation	Korea	KOLAS	No. 85	ISO/IEC 17025
Site Filing	USA	FCC	340658	Test Facility list & NSA Data
	Japan	VCCI	C-940 R-906 T-1842	Test Facility list & NSA Data
Certification	Korea	KC	KR0019	Test Facility list & NSA Data

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the “General requirements for the competent of calibration and testing laboratory”.