SGS-CSTC Standards Technical Services Ltd.

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TEST REPORT

Application No.:	SZEM1504001818HR (SGS SH No.: SHEM1504000976HR)
Applicant:	Sunwave Communications Co., Ltd
Manufacturer:	Sunwave Communications Co., Ltd
Factory:	Sunwave Communications Co., Ltd
Product Name:	Remote Unit
Product Description:	The RU conducts digital-analog conversion and power amplification of the input signals.
Model No.:	iDAS-R211
Trade Mark:	CROSSFIRE
FCC ID:	2AEJ4R211CD
Standards:	FCC Part 2 , FCC Part 27 KDB 935210 D02 Signal Booster Certification v02r01
Date of Receipt:	2015-04-15
Date of Test:	2015-04-17 to 2015-05-07
Date of Issue:	2015-05-08
Test Result :	**Pass***

* In the configuration tested, the EUT detailed in this report complied with the standards specified above. Please refer to section 3 of this report for further details.

Authorized Signature:

Jack Zhang
EMC Laboratory Manager

2 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
00		2015-05-08		Original

Authorized for issue by:				
Tested By		Chris Zhong **(Chris Zhong) /Project Engineer**		2015-05-07 **Date**
Prepared By		Hedy Wen. **(Hedy Wen) /Clerk**		2015-05-08 **Date**
Checked By		Jim Huang **(Jim Huang) /Reviewer**		2015-05-08 **Date**

3 Test Summary

Test Item	FCC part 2	FCC part 27	Result
RF Output Power	2.1046	27.50	PASS
Conducted Emission Mask	2.1051	N/A	PASS
Conducted Spurious Emissions	2.1051	27.53	PASS
Conducted Spurious Emissions Limitations	2.1051	N/A	PASS
Band Edge	2.1051	27.53	PASS
Radiated Spurious Emissions	2.1053	27.53	PASS
Radiated Emissions Limitations	2.1053	N/A	PASS
Occupied Bandwidth	2.1049	N/A	PASS
Frequency Stablility	2.1055	27.54	PASS

4 Contents

5 General Information

5.1 Client Information

Applicant:	Sunwave Communications Co., Ltd
Address of Applicant:	Sunwave Building 581 Huoju Avenue, Binjiang District, Hangzhou, P.R.China Zip: 310053
Manufacturer:	Sunwave Communications Co., Ltd
Address of Manufacturer:	Sunwave Building 581 Huoju Avenue, Binjiang District, Hangzhou, P.R.China Zip: 310053
Factory:	Sunwave Communications Co., Ltd
Address of Factory:	Sunwave Building 581 Huoju Avenue, Binjiang District, Hangzhou, P.R.China Zip: 310053

5.2 General Description of E.U.T.

Product Name:	Remote Unit
Model No.:	iDAS-R211
Trade Mark:	CROSSFIRE
Sample Type:	Fixed production
Antenna Gain:	12.5dBi
Power Supply:	AC120V 60Hz
Optical Fiber:	100cm (unshielded)
DC Cable:	120cm (unshielded)

5.3 Details of E.U.T.

Type of Modulation:	LTE
Frequency Band:	Downlink 728MHz to 746MHz include the Modulation:LTE Downlink 746MHz to 757MHz include the Modulation:LTE
ALC Function	The system continuously monitors the input power. Once the detected input power is greater than nominal input power (0dBm for downlink and -50dBm for uplink), the signal will be reduced to nominal input power by automatically adjusting attenuation. Note: NO AGC function in iDAS system.

5.4 Standards Applicable for Testing

The standard used was FCC part 2 & FCC part 27

5.5 Test Location

All tests were performed at:
SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch E&E Lab,
No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.
Tel: +86 755 2601 2053 Fax: +86 755 2671 0594
No tests were sub-contracted.

5.6 Other Information Requested by the Customer

None.

5.7 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L2929)**

  CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **VCCI**

  The 10m Semi-anechoic chamber and Shielded Room (7.5m x 4.0m x 3.0m) of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

- **FCC – Registration No.: 556682**

  SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 556682.

- **Industry Canada (IC)**

  Two 3m Semi-anechoic chambers of SGS-CSTC Standards Technical Services Co., Ltd. have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1 & 4620C-2.

6 Equipment Used during Test

RE in Chamber					
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Due date (yyyy-mm-dd)**
1	3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEL0017	2015-06-10
2	EMI Test Receiver	Agilent Technologies	N9038A	SEL0312	2015-09-16
3	EMI Test software	AUDIX	E3	SEL0050	N/A
4	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEL0015	2015-10-24
5	Double-ridged horn (1-18GHz)	ETS-LINDGREN	3117	SEL0006	2015-10-24
6	Horn Antenna (18-26GHz)	ETS-LINDGREN	3160	SEL0076	2015-10-24
7	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEL0053	2015-05-16
8	Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEL0168	2015-10-24
9	Coaxial cable	SGS	N/A	SEL0027	2015-05-29
10	Coaxial cable	SGS	N/A	SEL0189	2015-05-29
11	Coaxial cable	SGS	N/A	SEL0121	2015-05-29
12	Coaxial cable	SGS	N/A	SEL0178	2015-05-29
13	Band filter	Amindeon	82346	SEL0094	2015-05-16
14	Barometer	Chang Chun	DYM3	SEL0088	2015-05-16
15	DC Power Supply	Zhao Xin	RXN-305D	SEL0117	2015-10-24
16	Humidity/ Temperature Indicator	Shanhai Qixiang	ZJ1-2B	SEL0103	2015-10-24
17	Signal Generator (10M-27GHz)	Rohde & Schwarz	SMR27	SEL0067	2015-05-16
18	Signal Generator	Rohde & Schwarz	SMY01	SEL0155	2015-10-24
19	Loop Antenna	Beijing Daze	ZN30401	SEL0203	2015-06-04

RF Conducted Test					
1	ESG VECTOR SIGNAL GENERATOR	Agilent Technologies Inc	E4438C	SEL0253	2016-4-26
2	Spectrum Analyzer	Rohde&Schwarz	FSU 20Hz-43GHz	SEL0270	2016-04-25
3	Signal Analyzer	Keysight	N9020A 10Hz-8.4GHz	SEL0372	2016-02-18
4	Attenuator	Sunwave	AT30-P-N200R2A	SW0102021 0001	2016-02-18
5	Temperature Chamber	GW Technologies Inc	VT4001	SEL0043	2016-02-18
6	Transformer	MeiTian Technologies Inc	TOGC2J-5	SEA4701D	2016-02-18

Note: The calibration interval is one year, all the instruments are valid.

7 Test Results

7.1 E.U.T. test conditions

Input voltage:	AC 120V	
Test voltage	Normal	AC120V
	Extreme	AC102V~AC138V
Operating Environment:		
Test Temperature:	Normal	22°C ~26°C
	Extreme	-30~50°C
Humidity:	46%~56% RH	
Atmospheric Pressure:	990~1005mbar	
Test Requirement:	The RF output power of the EUT was measured at the antenna port, by adjusting the input power of signal generter to drive the EUT to get to maximum output power point and keep the EUT at maximum gain setteing for all tests. The device should be tested on downlink.	
	For detail test Modulation and Frequency, please refer to 7.2.	

Remark:

FIBER-OPTIC AND OTHER SIMILAR RF DISTRIBUTION SYSTEMS

Fiber-optic distribution systems are a type of in-building radiation system that receives RF signals from an antenna, distributes the signal over fiber-optic cable, and then retransmits at another location for example within a building or tunnel. Most fiber-optic systems are signal boosters; however, some may be repeaters. These systems generally have two enclosures typically called host (or local or donor unit) and remote. Some systems may also have an optional expander box for fan-out to multiple remotes. The system transmits downlink signals from the remote unit to handsets, portables, or clients, and transmits uplink signals via from the host unit. Usually but not always the uplink goes through an intermediate amplifier to a “donor” antenna. Therefore both uplink and downlink must be tested, unless filing effectively documents how connection of uplink to donor antenna with or without an intermediate amplifier will be prevented, such as for always only a cabled connection to a base station. Fiber-optic systems are not amplifiers (AMP equipment class) – they are equipment class TNB or PCB. The same approval procedures also apply for multiple-enclosure systems connected by coax cable.

Synonyms and related terms: in-building radiation system, coverage enhancer, distributed antenna system, fiber-optic distribution system, converter, donor anten

Typical in-building or distributed antenna systems can consist of five different components (enclosures), not counting antennas:

1) host unit

a) transmits uplink to base station via antenna thru coax, ***passive interface unit*** , or ***active interface unit*** (amplifier)

b) sends base-station downlink via fiber-optic or coax to ***remote***

c) receives handset uplink via fiber-optic or coax from ***remote***

d) optional connection to ***expansion unit*** via fiber-optic

e) separate FCC ID from ***remote***, unless electrically identical

f) ***non-transmitting host unit***

i) connects directly to a base station via coax cable but does not connect to antenna or amplifier

ii) Part 15 digital device subject to Verification, no FCC ID

2) remote unit
a) receives base-station downlink via fiber-optic or coax from ***host***, transmits via antenna to handsets
b) returns handset uplink via fiber-optic or coax to ***host***
c) separate FCC ID from ***remote***, unless electrically identical

3) expansion unit
a) fiber-optic or coax from ***host***
b) fiber-optic or coax fan-out to ***remote(s)***
c) Part 15 digital device subject to Verification, no FCC ID
4) *passive interface unit*
a) contains attenuators, splitters, combiners
b) coax cable connection between ***host*** and base-station
c) passive device, no FCC ID
5) *active interface unit*
a) amplifies uplink signal from ***host unit*** for transmit by donor antenna
b) attenuates downlink from donor antenna
c) coax cable connection between ***host*** and ***active interface unit***
d) usually has separate FCC ID; in some cases could be combined/included with ***host*** as one enclosure

GENERAL DEFINITIONS FOR CERTIFICATION PURPOSES:
The following three general definitions follow from those stated in the Part 22 and 24 rule sections as listed above. Two of the definitions replace previous EAB internal definitions given for booster, repeater and extender. The general term “extender” is the same as booster, but booster should be used rather than extender. The general term “translator” is the same as repeater, but repeater should be used rather than translator.
External radio frequency power amplifier (ERFPA) - any device which, (1) when used in conjunction with a radio transmitter signal source, is capable of amplification of that signal, and (2) is not an integral part of a radio transmitter as manufactured. The EAS equipment class AMP is used only for an ERFPA device inserted between a transmitter (TNB/PCB) and an antenna (has only one antenna port) ***Booster*** is a device that automatically reradiates signals from base transmitters without channel translation, for the purpose of improving the reliability of existing service by increasing the signal strength in dead spots. An “in-building radiation system” is a signal booster. These devices are not intended to extend the size of coverage from the originating base station. A booster can be either single or multiple channels***.***
Repeater is a device that retransmits the signals of other stations. Repeaters are different from boosters in that they can include frequency translation and can extend coverage beyond the design of the original base station. A repeater is typically single channel but can also be multiple channels.
ERFPA (AMP) and boosters/repeaters (TNB/PCB) can generally be authorized for all rule parts except 15 and 18.
Tests should be done with each typical signal. e.g., for F3E emissions use 2500 Hz with 2.5 or 5 kHz deviation. Use of CW signal for some tests is acceptable in lieu of actual emission, in some cases when CW signal gives worst case.
The GX system working principle: the RF signal coupled from BTS is transferred into optical signal, and then transmitted via a fiber to remote unit.the remote re-transfers the optical signal back to RF signal, through the frequency translation and after power amplifiers,can extend the BTS coverage to another desired area, the GX system is compliant with the description about repeater in FCC rules, So **the Equipment belongs to the repeater and TNB class.**

7.2 Test Procedure & Measurement Data

Test Bandwidth and Frequency

Downlink: 728MHz to 746MHz

LTEBandwidth	Lowest frequency(MHz)	Middle frequency(MHz)	Highest frequency(MHz)
5MHz	730.5	737	743.5
15MHz	735.5	737	738.5

Downlink: 746MHz to 757MHz

LTE Bandwidth	Lowest frequency(MHz)	Middle frequency(MHz)	Highest frequency(MHz)
5MHz	748.5	751.5	754.5
10MHz	751.0	751.5	752.0

Remark:

1) We test the downlink in the band and test the respective frequency as above table;

7.2.1 RF Output Power

Test Requirement: FCC part 27.50(b)(4)& FCC part 27.50 (c)(3

Test Method: Section D.3(K) of KDB 935210 D02 Signal Booster Certification v02r01

EUT Operation:

Status: Drive the EUT to maximum output power.

Conditions: Normal conditions

Application: Cellular Band RF output ports

Test Configuration:

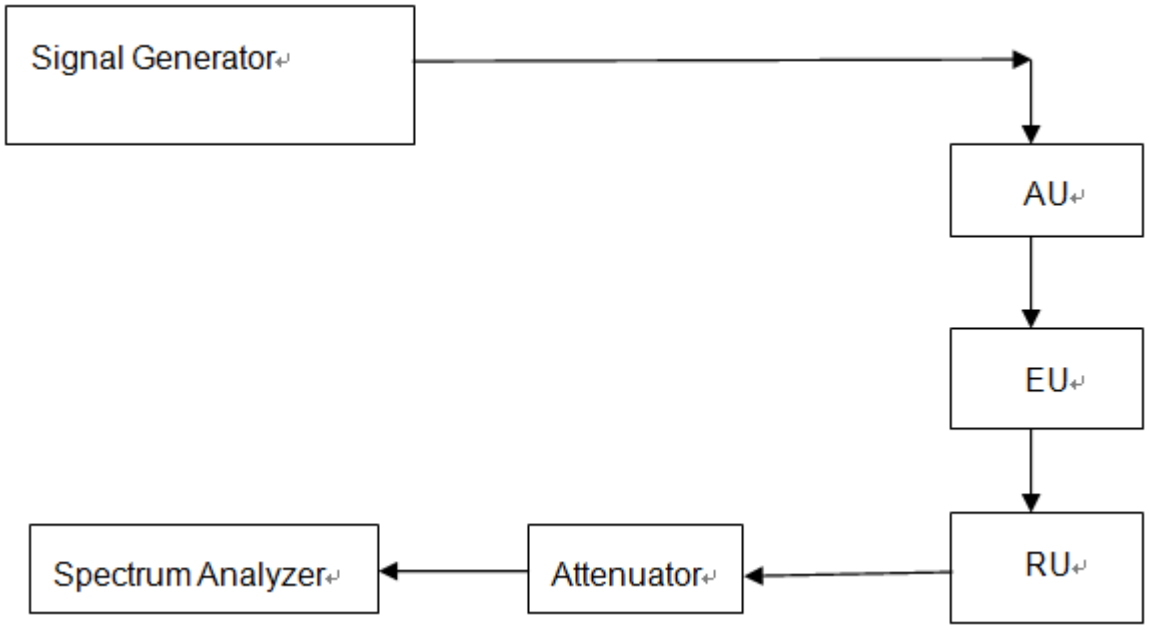


Fig.1 RF Output Power test configuration

Test Procedure:

RF output power test procedure:

For part 27:

a) Connect the equipment as illustrated, when the output power is over the max value of the Spectrum Analyzer, add the attenuator to avoid destroying the facility.

b) Set the signal power level of the Signal Generator to 0dBm, and the modulation of the signal is 64QAM

c) Set the center frequency of the spectrum analyzer to the assigned transmitter frequency, key the transmitter, and set the level of the carrier to the full scale reference line.

d1) Adjust the spectrum analyzer for the following settings:

1) Resolution Bandwidth >>1% the carrier bandwidth,

2) Video Bandwidth refer to standard requirement.

d2) Use spectrum analyzer channel power measurement function;

e) Record the frequencies and levels of carrier power;

f) Calculate the signal link way loss and final power value.

Remark:

The system continuously monitors the input power.

Once the detected input power is greater than nominal input power (0dBm for downlink and -50dBm for uplink), the signal will be reduced to nominal input power by automatically adjusting attenuation.

Note: NO AGC function in iDAS system.

7.2.1.1 Measurement Record:

RF Coducted Power:
Downlink: 728MHz to 746MHz

LTEBandwidth	Lowest frequency (dBm)	Middle frequency (dBm)	Highest frequency (dBm)
5MHz	42.5	43.2	42.2
15MHz	43.0	42.9	42.9

Downlink: 746MHz to 757MHz

LTE Bandwidth	Lowest frequency (dBm)	Middle frequency (dBm)	Highest frequency (dBm)
5MHz	42.9	43.1	43.1
10MHz	43.1	43.1	43.1

ERP:
Downlink: 728MHz to 746MHz

Band width	Frequency (MHz)	Conducted RF Power(dBm)	Antenna Gain(dBd)	ERP(dBm)	ERP Limit (dBm)	Margin(dB)	Result
5MHz	730.5	42.5	10.35	52.85	60.00	7.15	Pass
	737.0	43.2	10.35	53.55	60.00	6.45	Pass
	743.5	42.2	10.35	52.55	60.00	7.45	Pass
15MHz	735.5	43.0	10.35	53.35	60.00	6.65	Pass
	737.0	42.9	10.35	53.25	60.00	6.75	Pass
	738.5	42.9	10.35	53.25	60.00	6.75	Pass

Downlink: 746MHz to 757MHz

Band width	Frequency (MHz)	Conducted RF Power(dBm)	Antenna Gain(dBd)	ERP(dBm)	ERP Limit (dBm)	Margin(dB)	Result
5MHz	748.5	42.9	10.35	53.25	60.00	6.75	Pass
	751.5	43.1	10.35	53.45	60.00	6.55	Pass
	754.5	43.1	10.35	53.45	60.00	6.55	Pass
10MHz	751.0	43.1	10.35	53.45	60.00	6.55	Pass
	751.5	43.1	10.35	53.45	60.00	6.55	Pass
	752.0	43.1	10.35	53.45	60.00	6.55	Pass

Note: The customer stated that the EUT is designed to operate with a maximum antenna gain of 12.5dBi. As the limit is an ERP limit the gain in dBi has been converted to dBd. The dBd value was calculated as:

12.5dBi-2.15dB=10.35dBd

7.2.2 Conducted Spurious Emissions

Test Requirement:	FCC part 27.53(h)
Test Method:	Section D.3(h) of KDB 935210 D02 Signal Booster Certification v02r01
EUT Operation:	
Status:	Drive the EUT to maximum output power.
Conditions:	Normal conditions
Application:	Cellular Band RF output ports

Test Configuration:

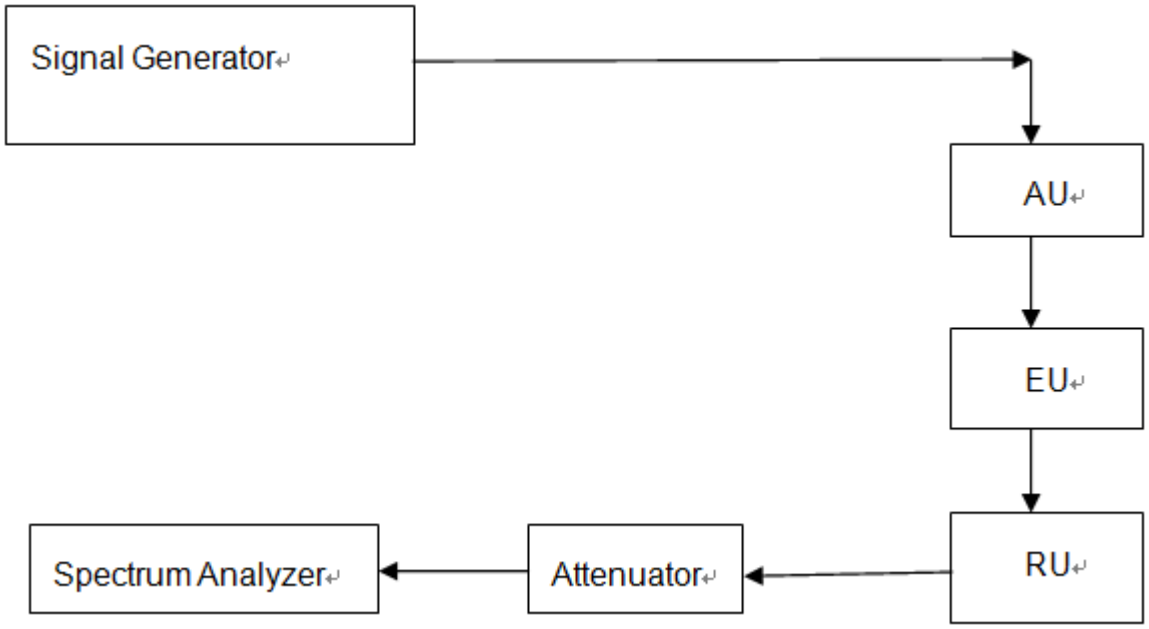


Fig.2. Conducted Spurious Emissions test configuration

Test Procedure:

Conducted Emissions test procedure:

a) Connect the equipment as illustrated, with the notch filter by-passed, when the output power is over the max value of the Spectrum Analyzer, add the attenuator to avoid destroying the facility.

b) Set the center frequency of the spectrum analyzer to the assigned transmitter frequency, key the transmitter, and set the level of the carrier to the full scale reference line.

c) add one 64QAM modulation signal to the EUT, and the level of the signal is 0dBm.

d) Adjust the spectrum analyzer for the following settings:

1) Resolution Bandwidth,(base the standard, apply the different set),her is 100KHz for frequency band less than 1GHz, 1MHz for frequency over 1GHz;

2) Video Bandwidth refer to standard requirement.

e) Adjust the center frequency of the spectrum analyzer for incremental coverage of the range from:

1) the lowest radio frequency generated in the equipment, it can be 9KHz base the test method, here select 30MHz as lowest frequency start point;

2) the highest radion frequency shall higher than 10 times of carrier frequency;

f) Record the frequencies and levels of spurious emissions from step e)

Remark:

The notch filter is used for avoid the EUT fundamental carrier output power making the spectrum overload and the harmonic spurious brought by it.

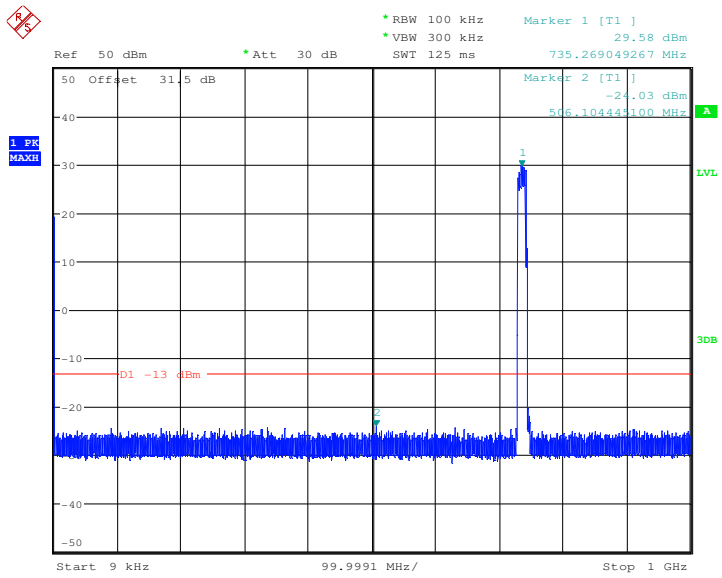
When the EUT fundamental carrier is not enough to make the status, the notch filter could be not used.

7.2.2.1 Measurement Record:

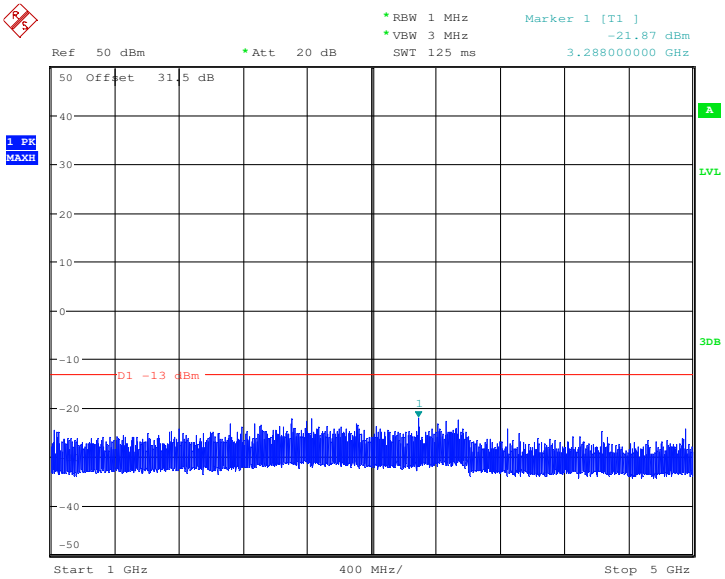
1.Downlink: 728MHz ~ 746MHz(LTE)

1.1 lowest frequency:

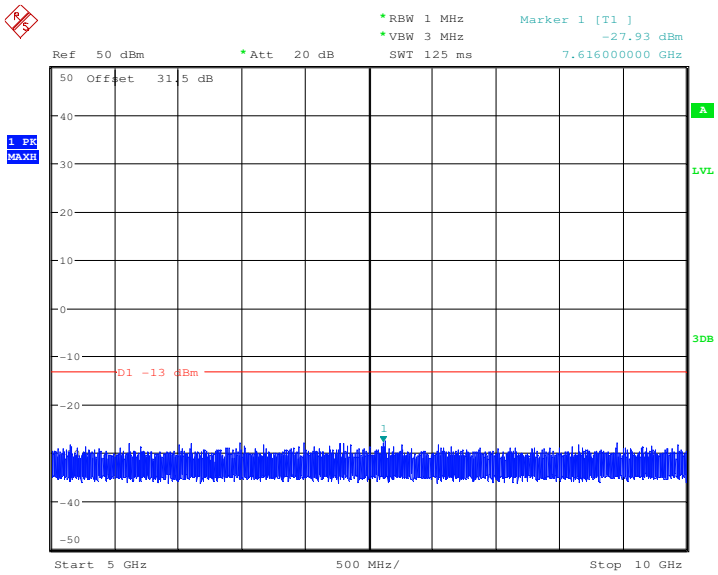
9KHz to 1GHz



1GHz to 5GHz

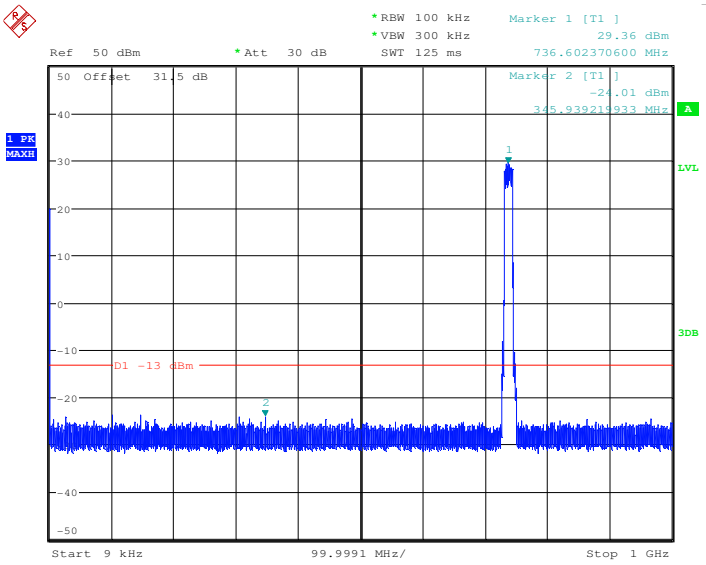


5GHz to 10GHz

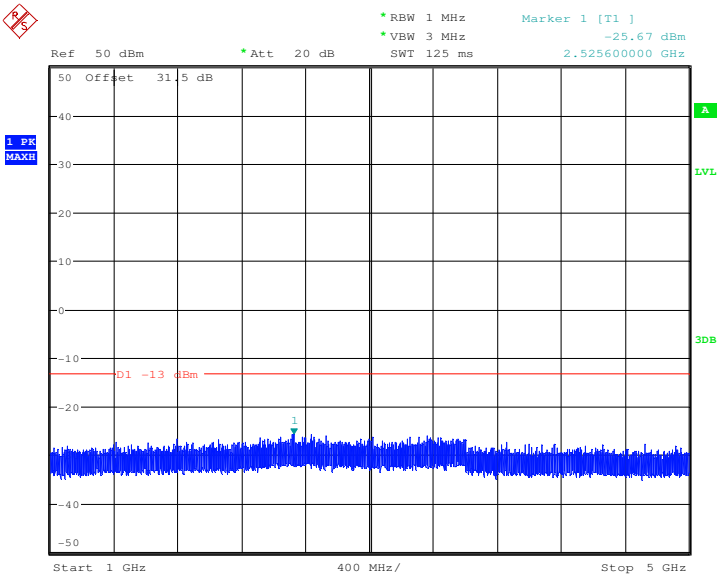


1.2 Middle frequency

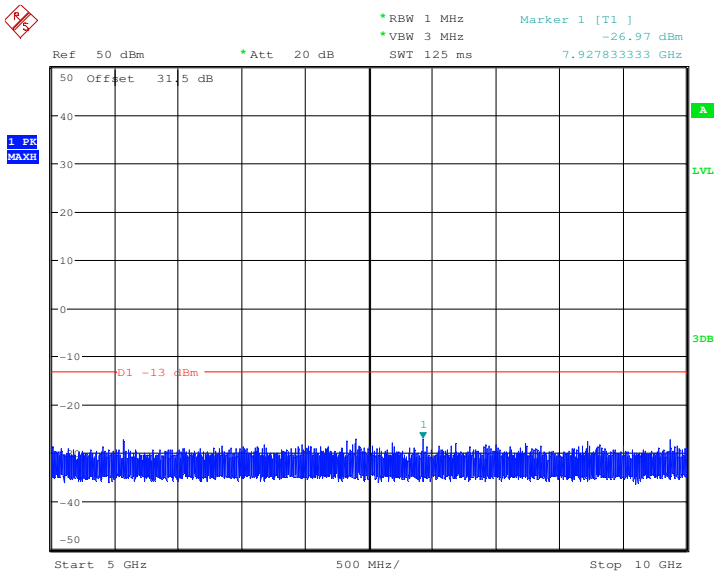
9KHz to 1GHz



1GHz to 5GHz

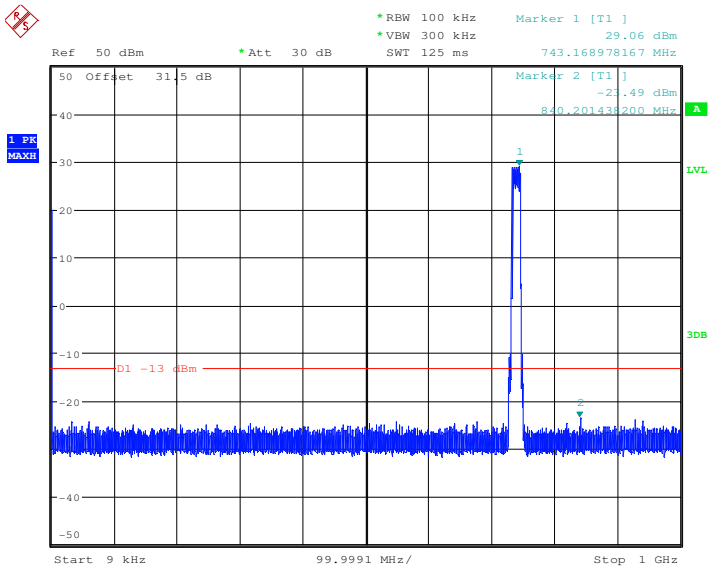


5GHz to 10GHz

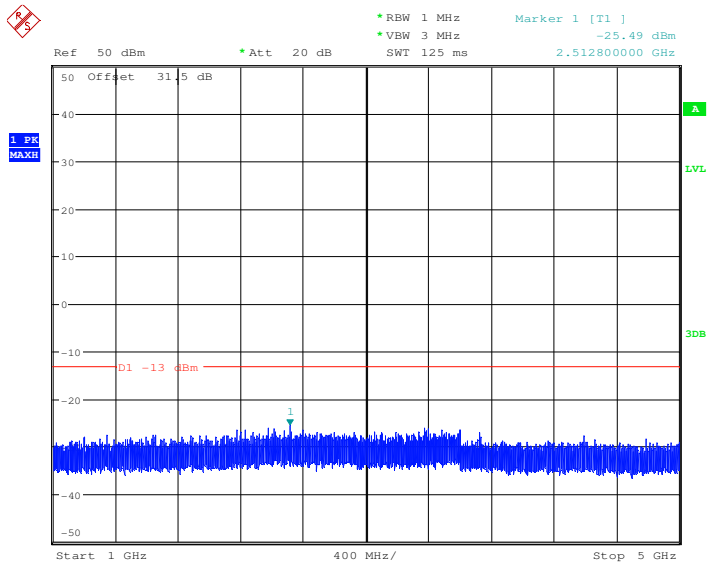


1.3 highest frequency

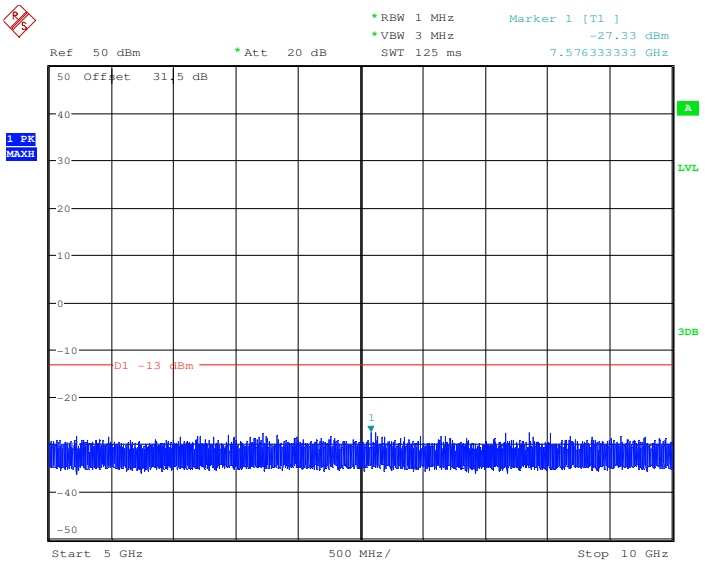
9KHz to 1GHz



1GHz to 5GHz



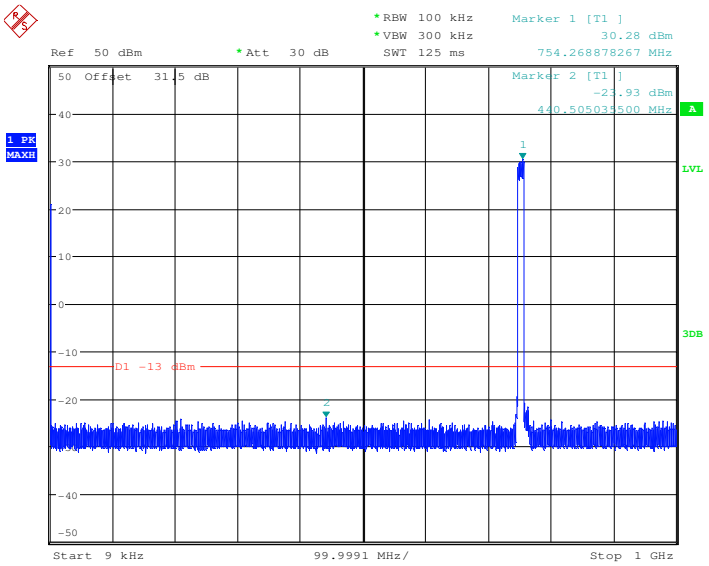
5GHz to 10GHz



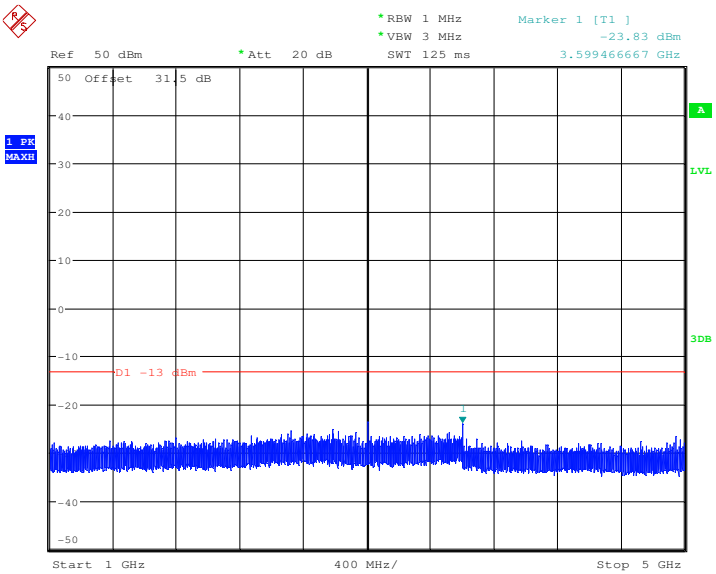
2.Downlink: 746MHz ~ 757MHz(LTE)

2.1 lowest frequency:

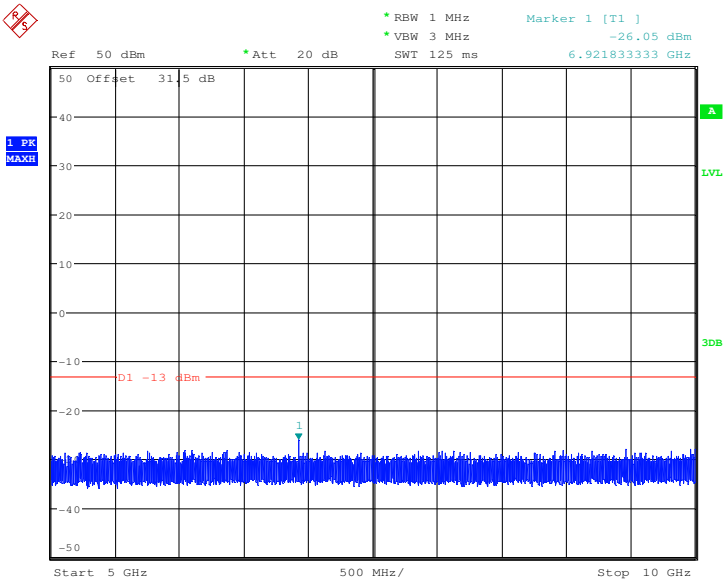
9KHz to 1GHz



1GHz to 5GHz

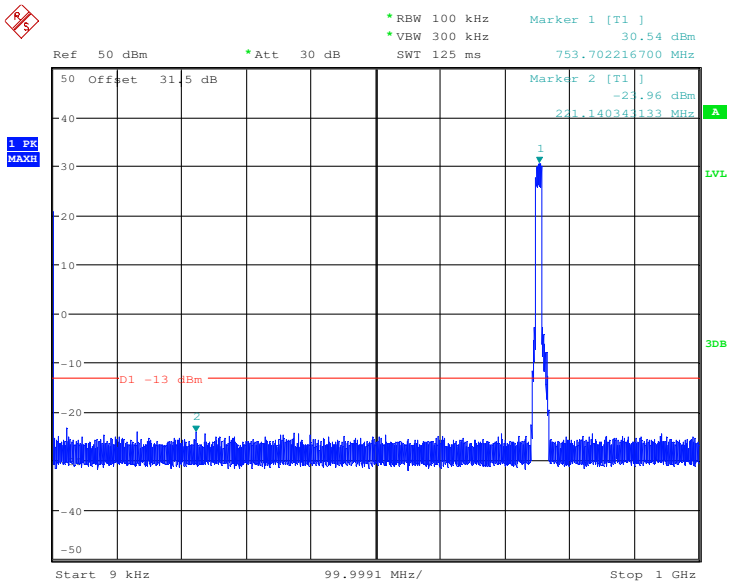


5GHz to 10GHz

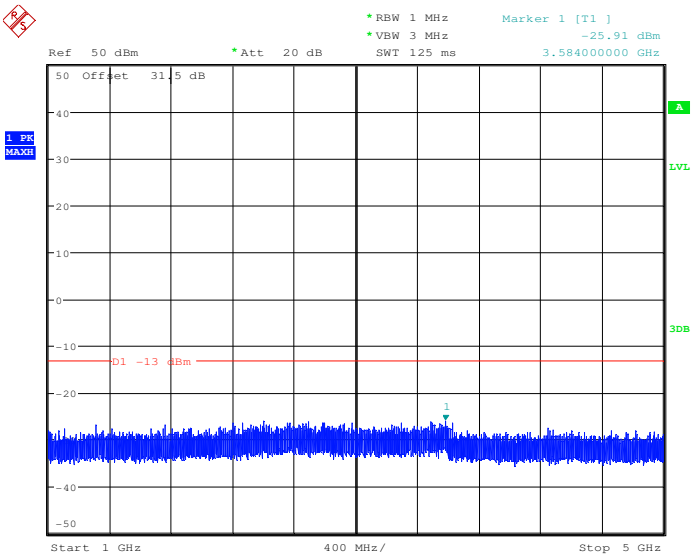


2.2 Middle frequency

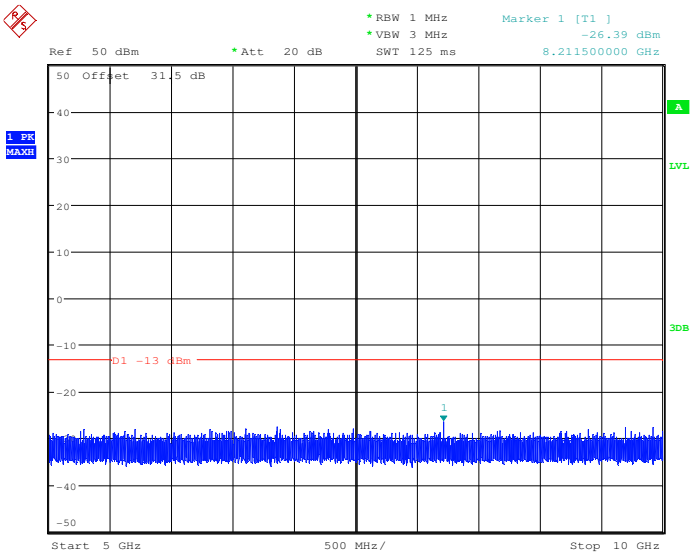
9KHz to 1GHz



1GHz to 5GHz

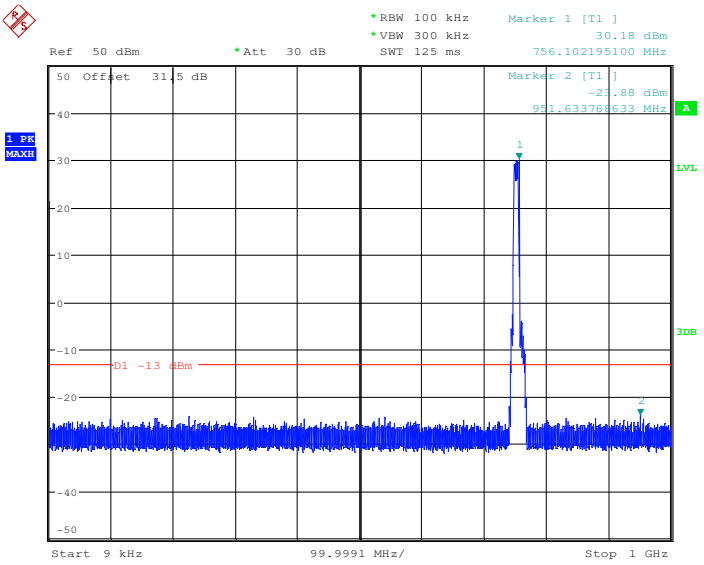


5GHz to 10GHz

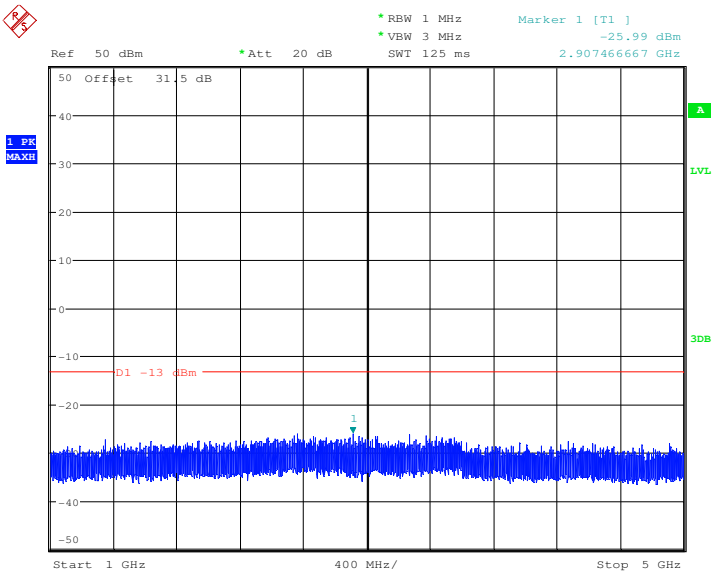


2.3 highest frequency

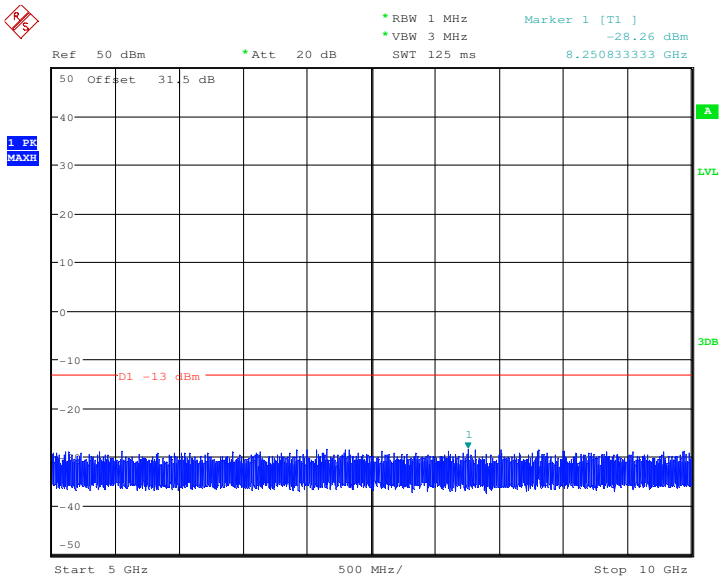
9KHz to 1GHz



1GHz to 5GHz



5GHz to 10GHz



7.2.3 Band Edge

Test Requirement: FCC part 27.53(h)

Test Method: Section D.3(i) of KDB 935210 D02 Signal Booster Certification v02r01

EUT Operation:

Status: Drive the EUT to maximum output power.

Conditions: Normal conditions

Application: Cellular Band RF output ports

Test Configuration:

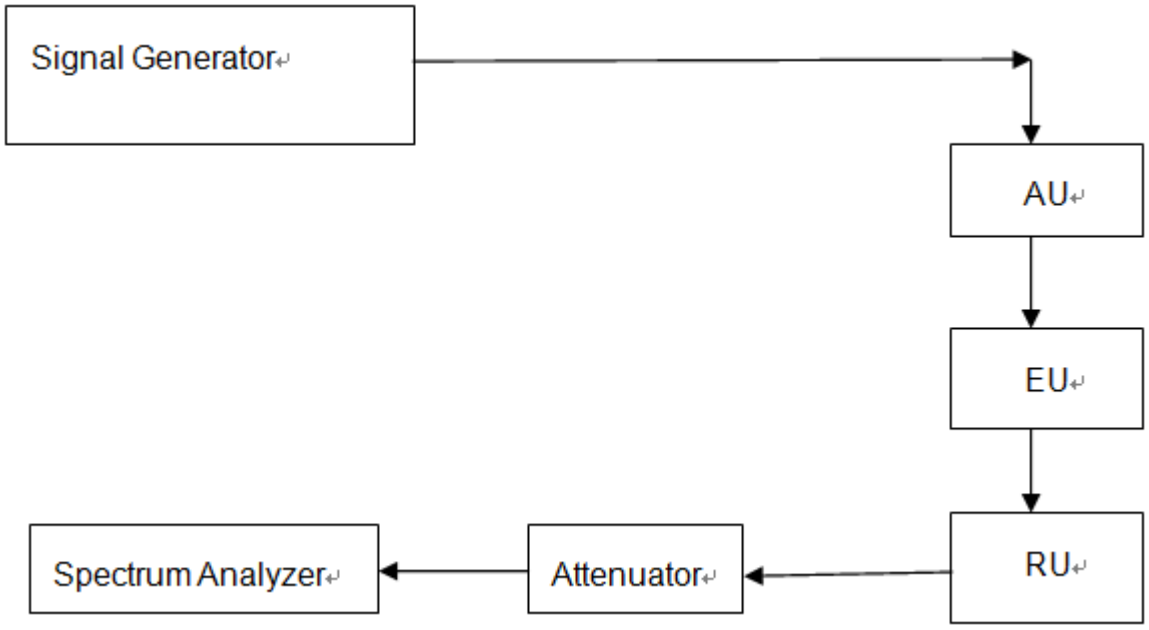


Fig.3. Band edge and Intermodulation test configuration

Test Procedure: Conducted Emissions test procedure:

a) Connect the equipment as illustrated, with the notch filter by-passed, when the output power is over the max value of the Spectrum Analyzer, add the attenuator to avoid destroying the facility.

b) Set the center frequency of the spectrum analyzer to the assigned transmitter frequency, key the transmitter, and set the level of the carrier to the full scale reference line.

c) Add one 64QAM modulation signal and the level of the signal is 0dBm to the signal generator.

d) Adjust the spectrum analyzer for the following settings:

1) Resolution Bandwidth,(base the standard, apply the different set),here is 100KHz for frequency band less than 1GHz, 1MHz for frequency over 1GHz;

2) Video Bandwidth refer to standard requirement.

e) Adjust the center frequency of the spectrum analyzer for incremental coverage of the range from:

1) the lowest radio frequency generated in the equipment, it can be 9KHz base the test method, here select 30MHz as lowest frequency start point;

2) the highest radion frequency shall higher than 10 times of carrier frequency;

f) Record the frequencies and levels of spurious emissions from step e)

Remark:

1)The notch filter is used for avoid the EUT fundamental carrier output power making the spectrum overload and the harmonic spurious brought by it.

When the EUT fundamental carrier is not enough to make the status, the notch filter could be not used.

2)At maximum drive level, for each modulation: two tests (high-, low-band edge) with two tones

Limit usually is -13dBm conducted.

3)Not needed for Single Channel systems.

4) NO AGC function in iDAS system.

Test Frequency:

Downlink: 728MHz to 746MHz

LTEBandwidth	Lowest frequency(MHz)	Highest frequency(MHz)
5MHz	730.5	743.5
15MHz	735.5	738.5

Downlink: 746MHz to 757MHz

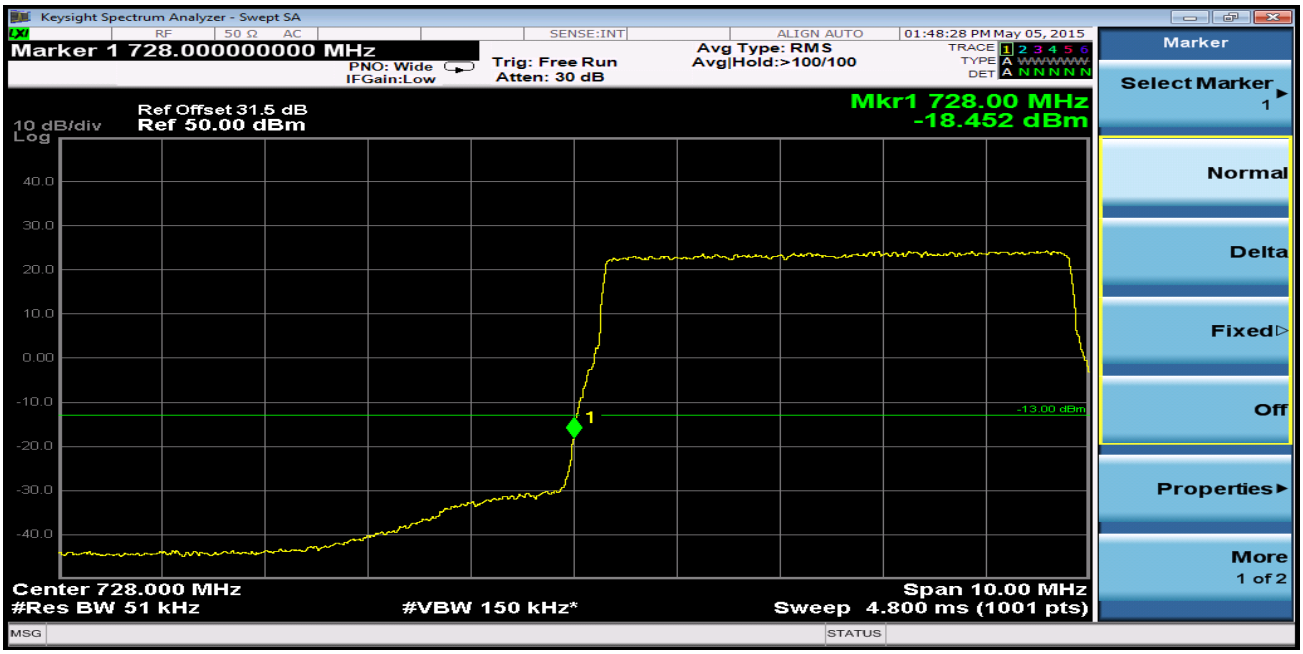
LTE Bandwidth	Lowest frequency(MHz)	Highest frequency(MHz)
5MHz	748.5	754.5
10MHz	751.0	752.0

7.2.3.1 Measurement Record:

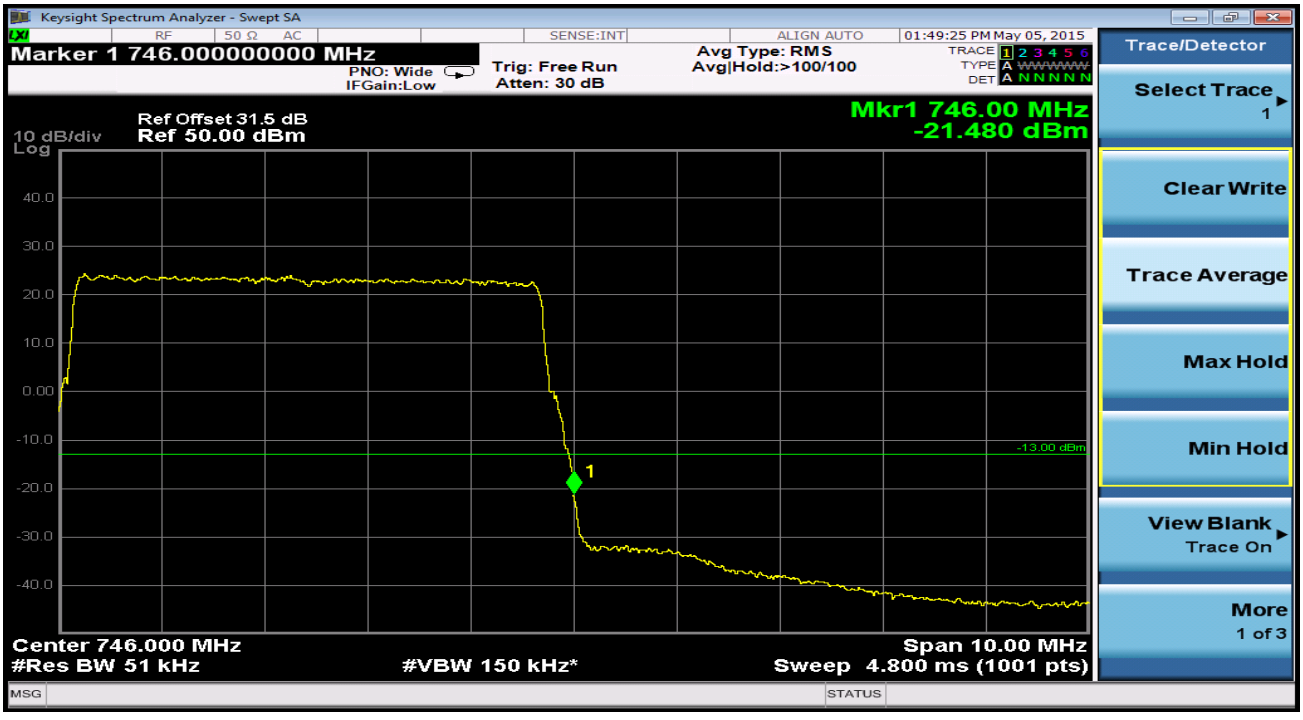
Downlink: 728MHz to 746MHz(LTE Mode)

1. 5MHz bandwidth

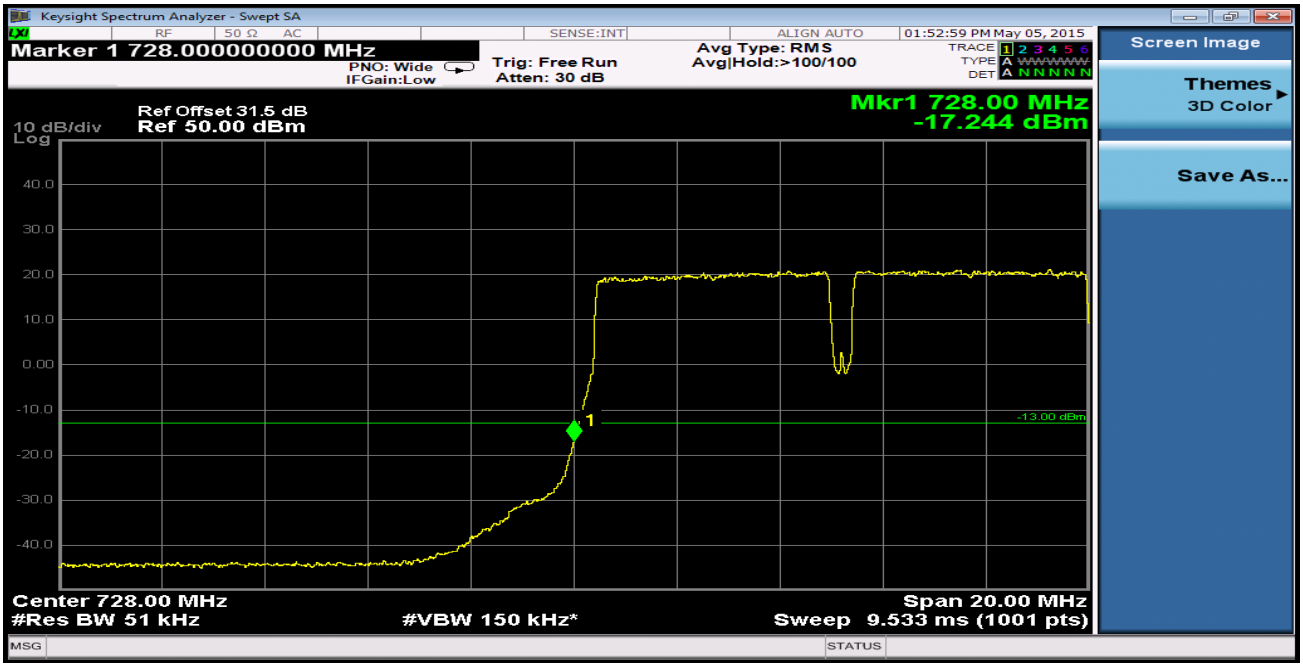
1.1 one signal input (Level=0dBm, modulation= LTE(64QAM),Frequency=730.5MHz) —Lower Edge



1.2 one signal input(Level=0dBm, modulation= LTE(64QAM),Frequency=743.5MHz) —Upper Edge

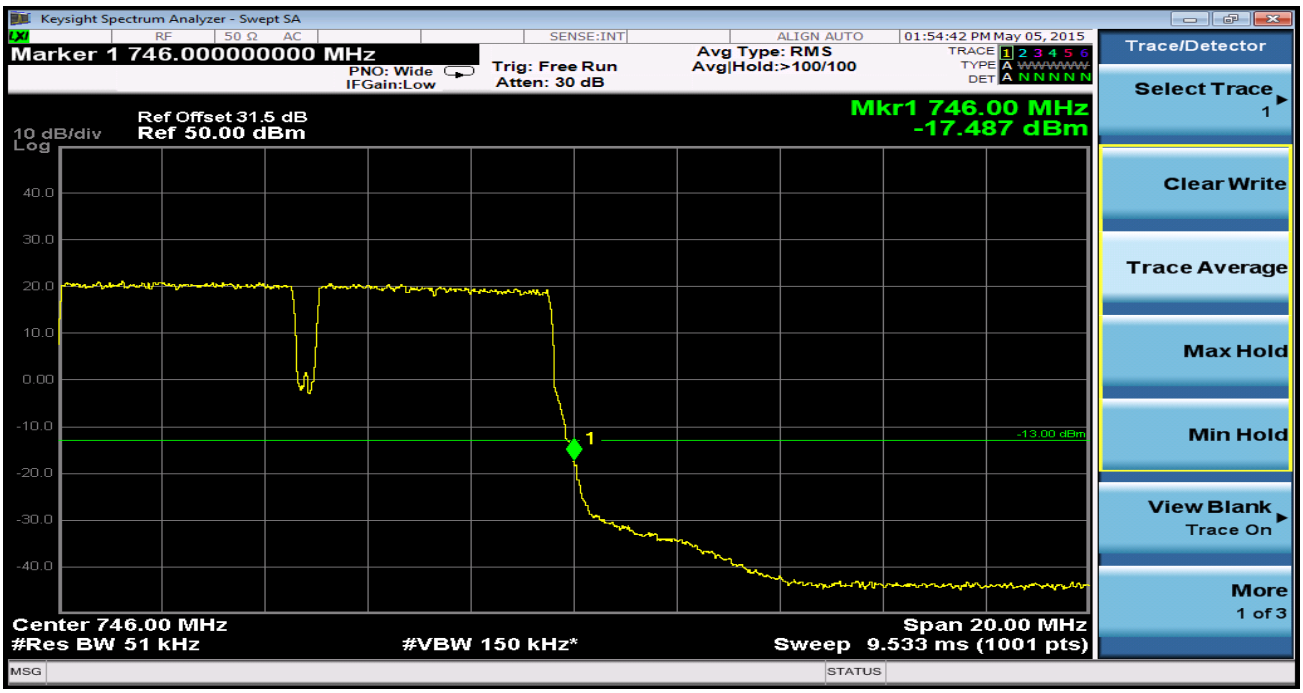


1.3 two signal input(Level=0dBm, modulation= LTE(64QAM),Frequency1=730.5MHz, Frequency1=735.5MHz) —Lower Edge



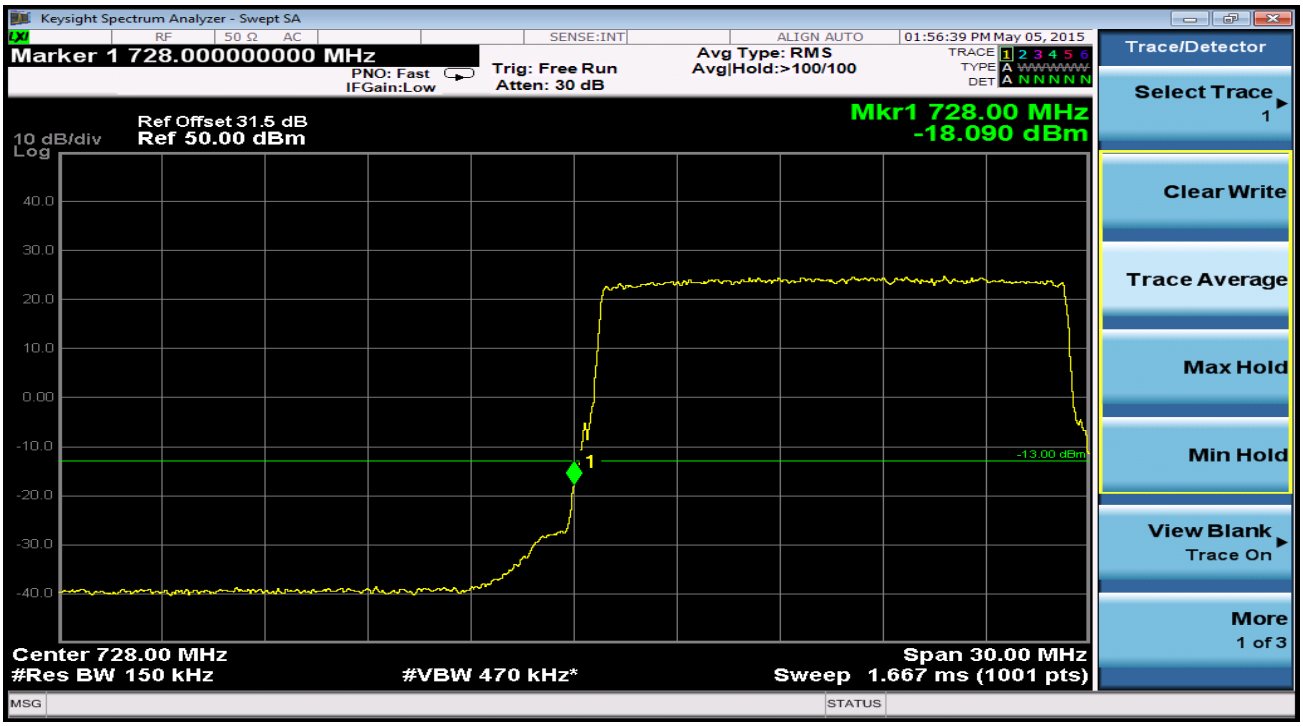
1.4 two signal input(Level=0dBm, modulation= LTE(64QAM),Frequency1=743.5MHz, Frequency1=738.5MHz)

—Upper Edge

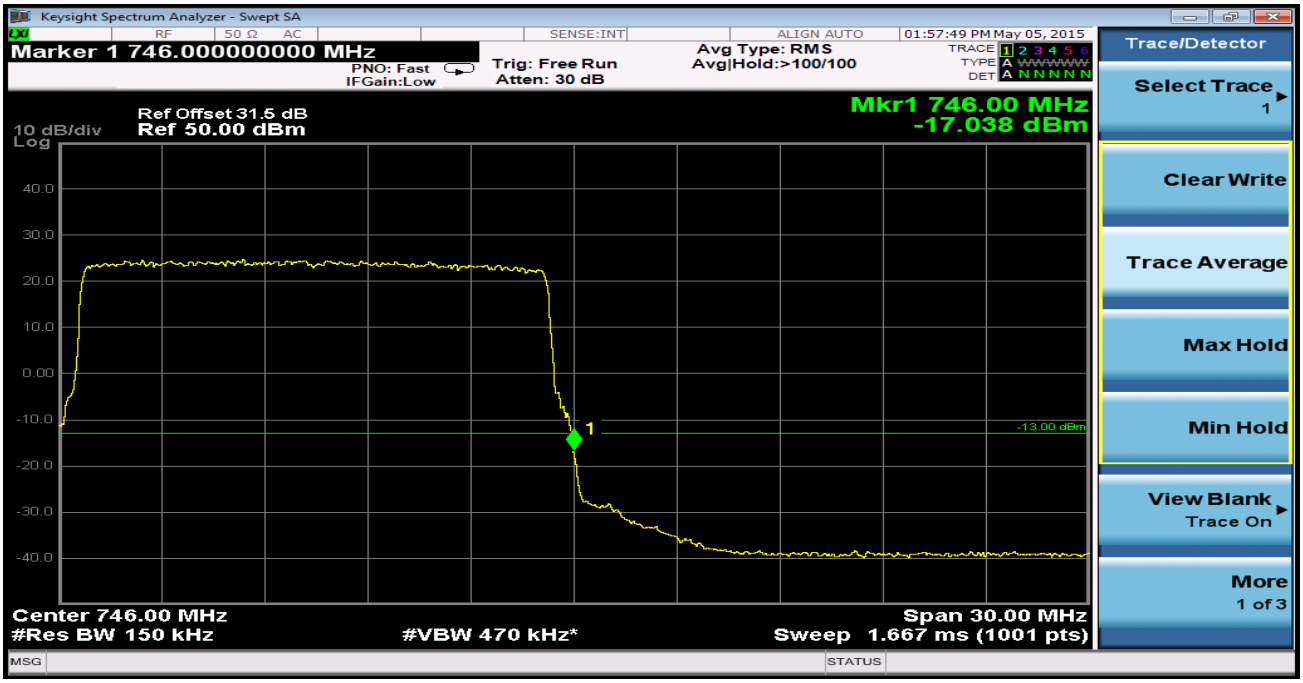


2. 15MHz bandwidth

2.1 one signal input(Level=0dBm, modulation= LTE(64QAM),Frequency1=735.5MHz) —Lower Edge



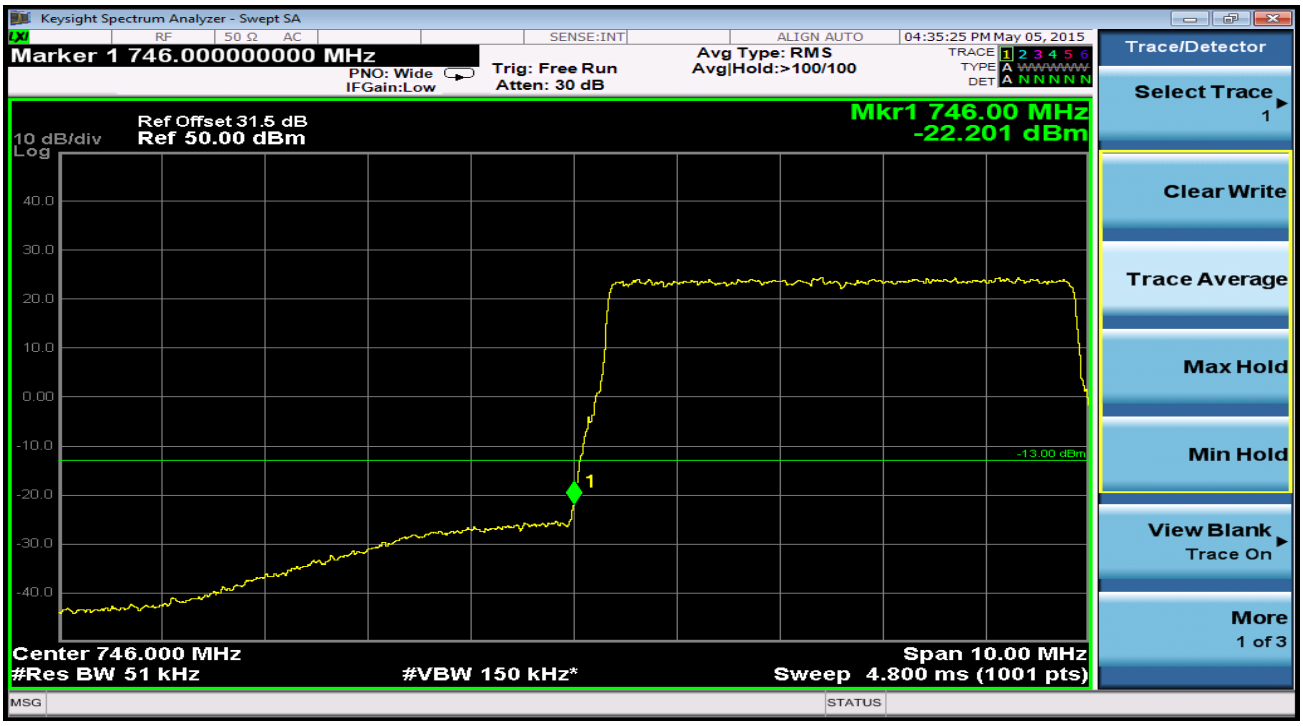
2.2 one signal input(Level=0dBm, modulation= LTE(64QAM),Frequency1=738.5MHz) —Upper Edge



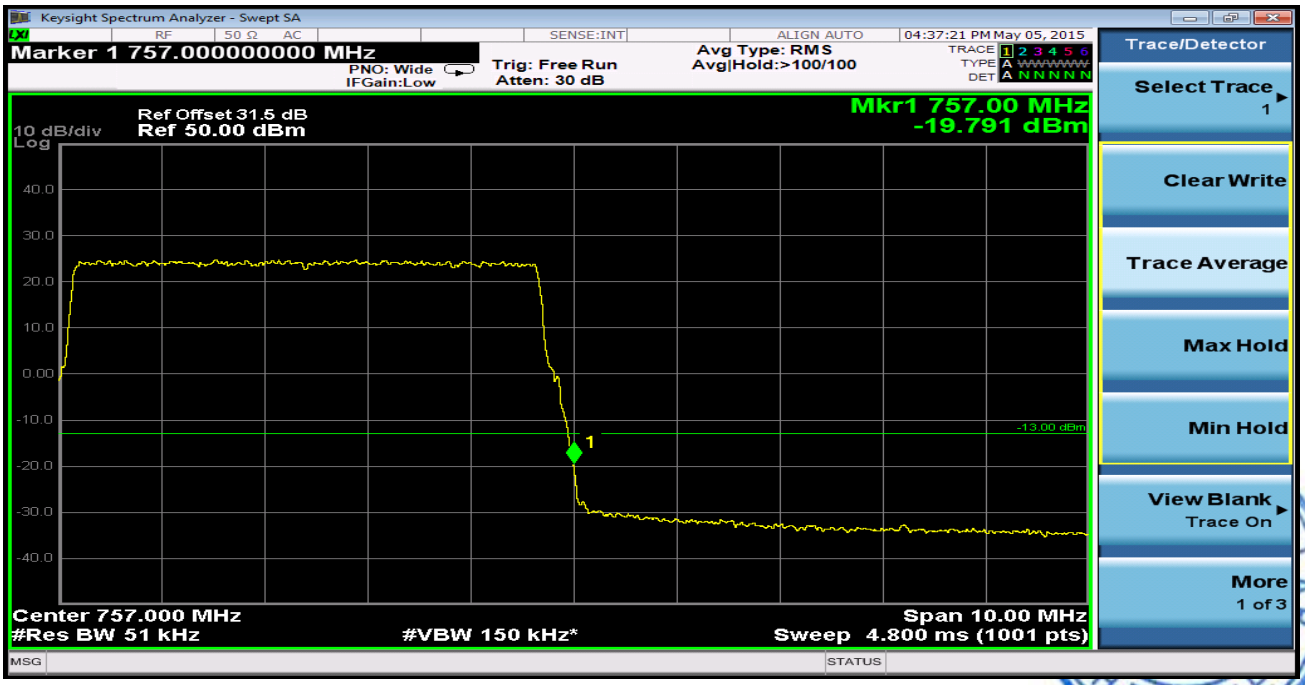
Downlink: 746MHz to 757MHz(LTE Mode)

1. 5MHz bandwidth

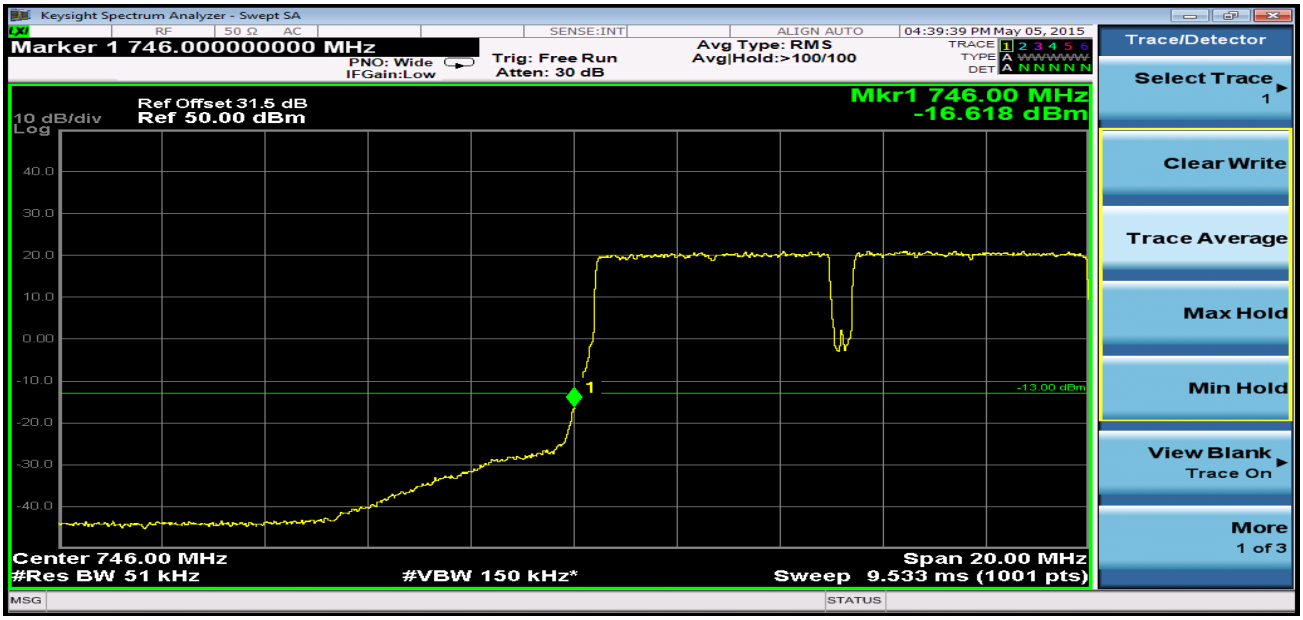
1.1 one signal input(Level=0dBm, modulation= LTE(64QAM),Frequency1=748.5MHz) —Lower Edge



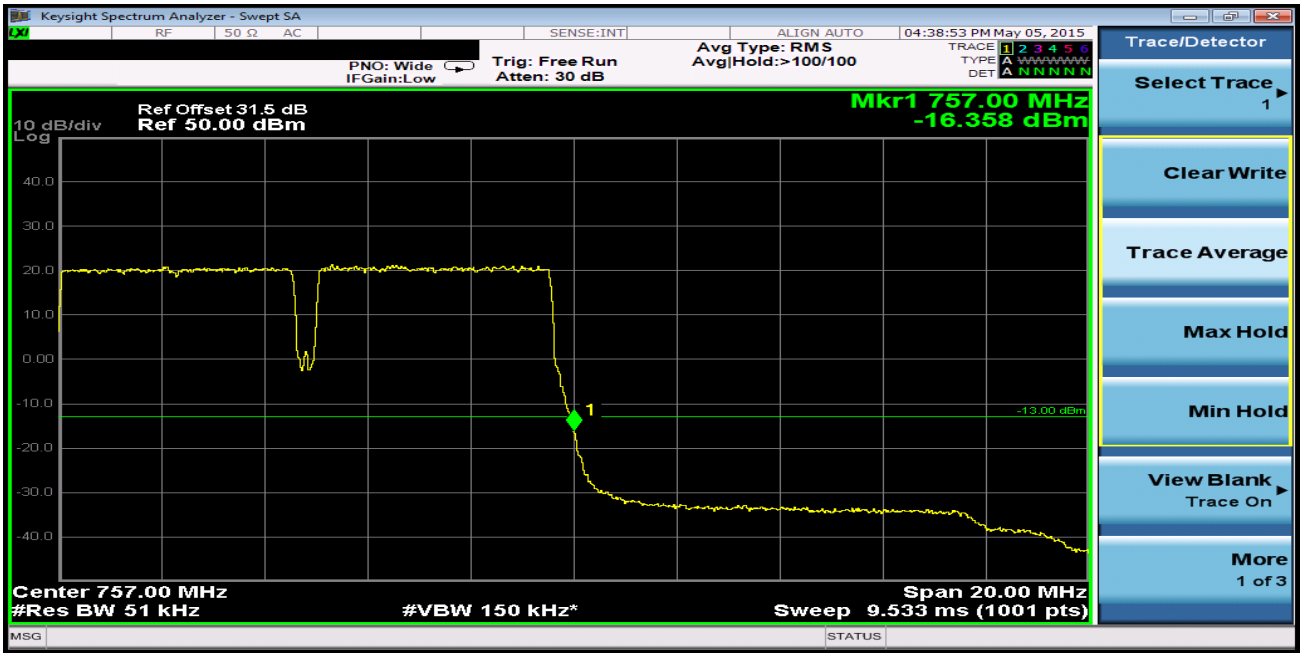
1.2 one signal input(Level=0dBm, modulation= LTE(64QAM),Frequency1=754.5MHz) —Upper Edge



1.3 two signal input(Level=0dBm, modulation= LTE(64QAM),Frequency1=748.5MHz, Frequency1=753.5MHz) —Lower Edge

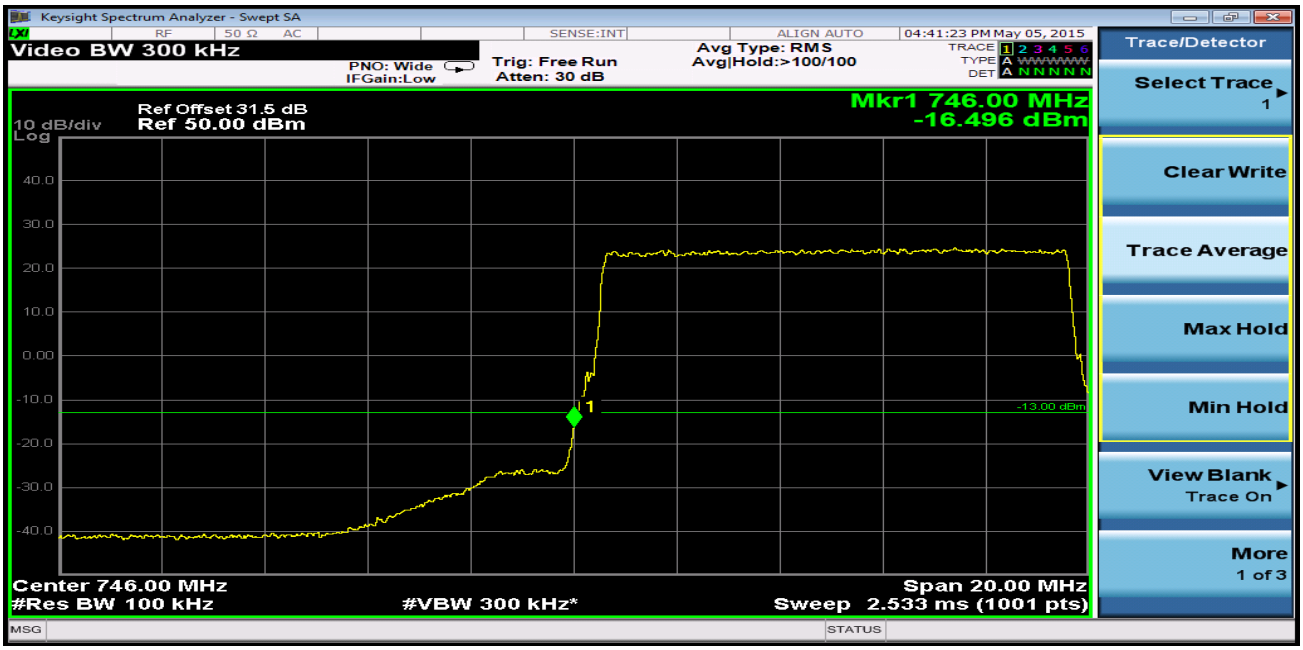


1.4 two signal input(Level=0dBm, modulation= LTE(64QAM),Frequency1=754.5MHz, Frequency1=749.5MHz) —Upper Edge

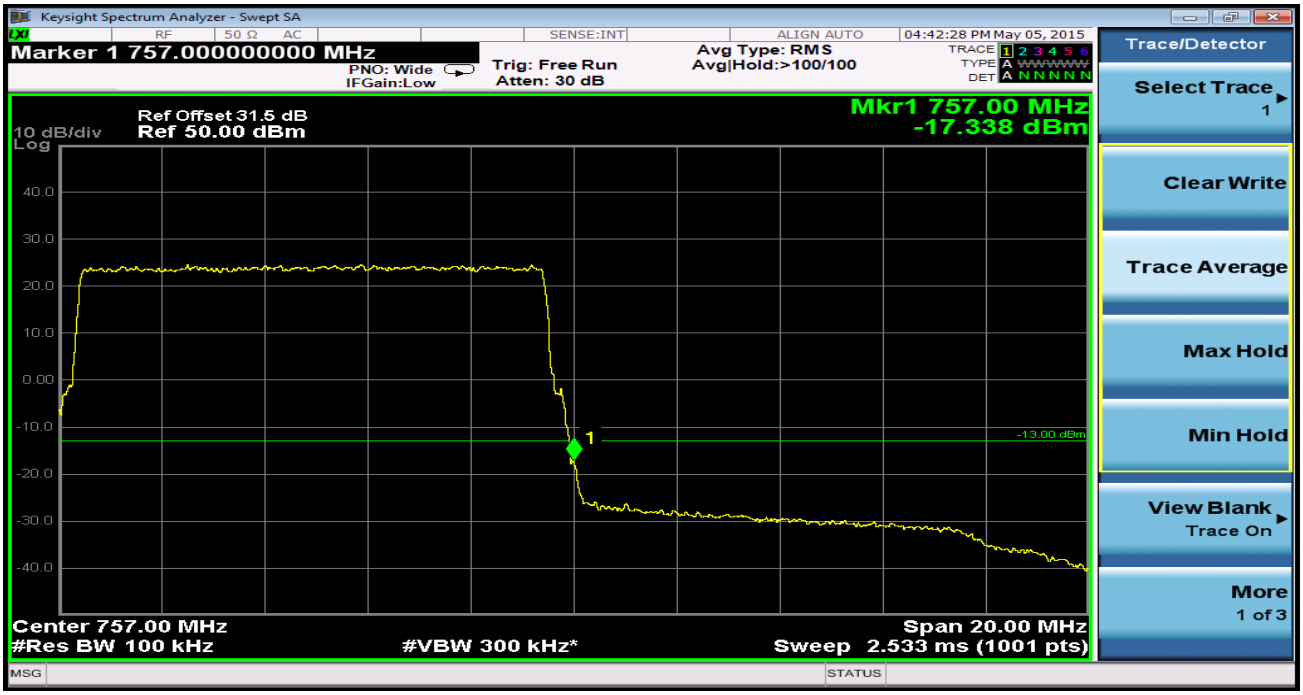


2. 10MHz bandwidth

2.1 one signal input(Level=0dBm, modulation= LTE(64QAM),Frequency1=751MHz) —Lower Edge



2.2 one signal input (Level=0dBm, modulation= LTE(64QAM),Frequency1=752MHz)—Upper Edge



7.2.4 Radiated Spurious Emissions

Test Requirement: & FCC part 27.53(h)

Test Method: Section D.3(g) of KDB 935210 D02 Signal Booster Certification v02r01

EUT Operation:

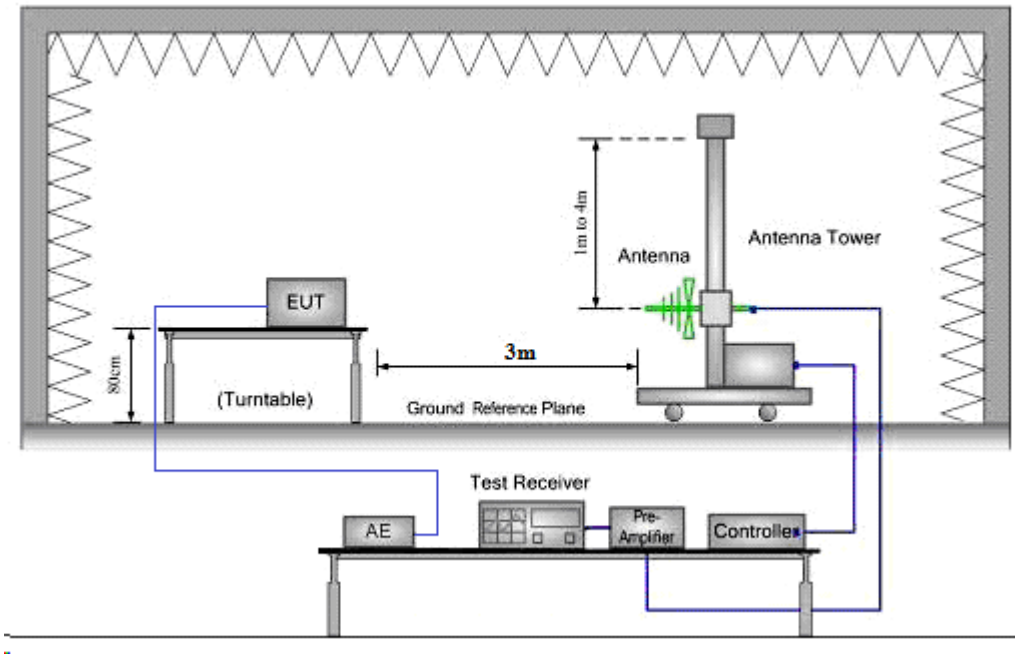
Status: Drive the EUT to maximum output power.

Conditions: Normal conditions

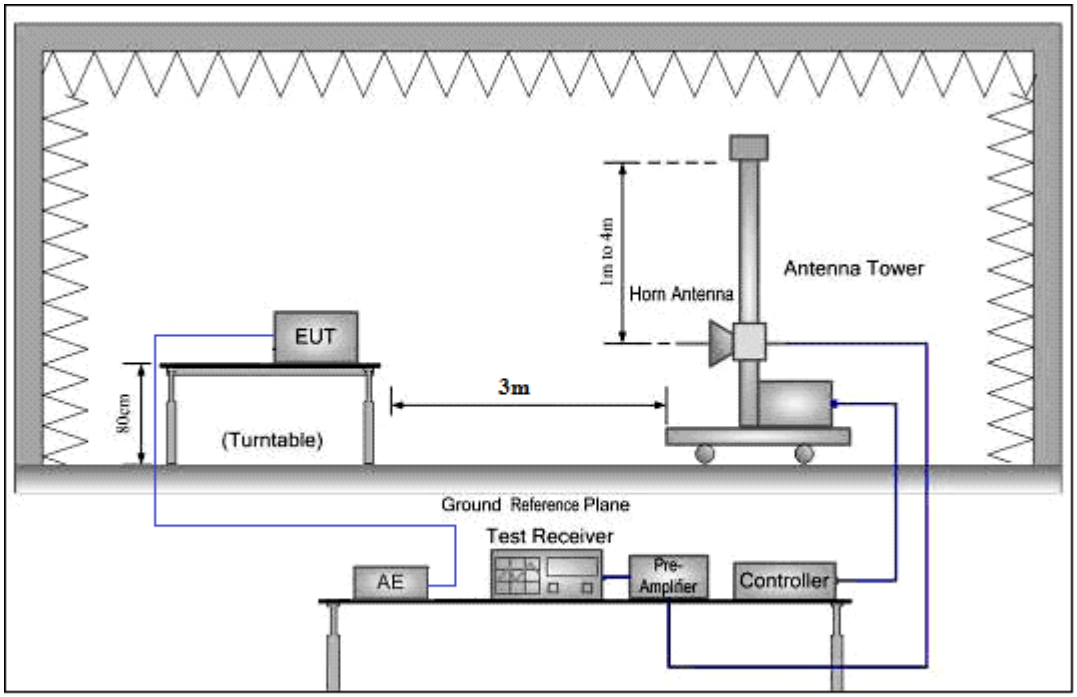
Application: Enclosure

Test Configuration:

30MHz to 1GHz emissions:



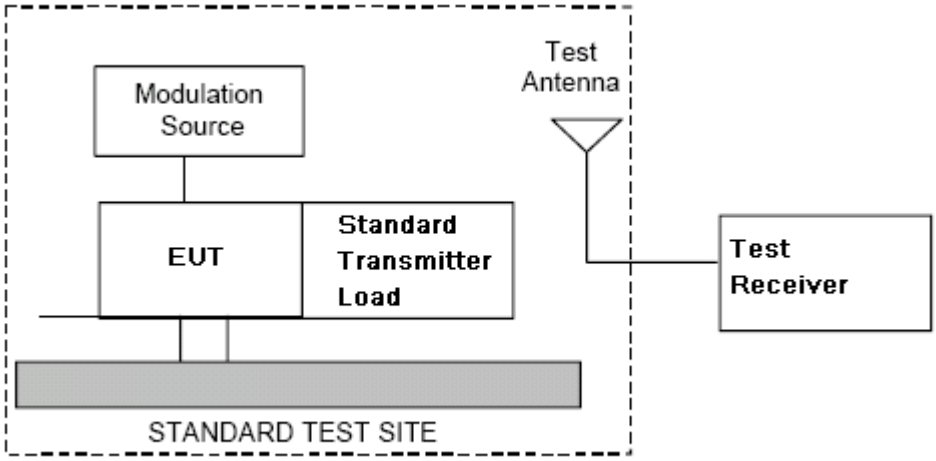
1GHz to 40GHz emissions:



Test Procedure:

1. Test the background noise level with all the test facilities;
2. Keep one transmitting path, all other connectors shall be connected by normal power or RF leads;
3. Select the suitable RF notch filter to avoid the test receiver or spectrum analyzer produce unwanted spurious emissions;
4. Keep the EUT continuously transmitting in max power;
5. Read the radiated emissioins of the EUT enclosure.

Radiated Emissions Test Procedure:



a) Connect the equipment as illustrated.

b) Adjust the spectrum analyzer for the following settings:

1) Resolution Bandwidth = 100 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1GHz.

2) Video Bandwidth = 300 kHz for spurious emissions below 1 GHz, and 3 MHz for spurious emissions above 1 GHz.

3) Sweep Speed slow enough to maintain measurement calibration.

4) Detector Mode = Positive Peak.

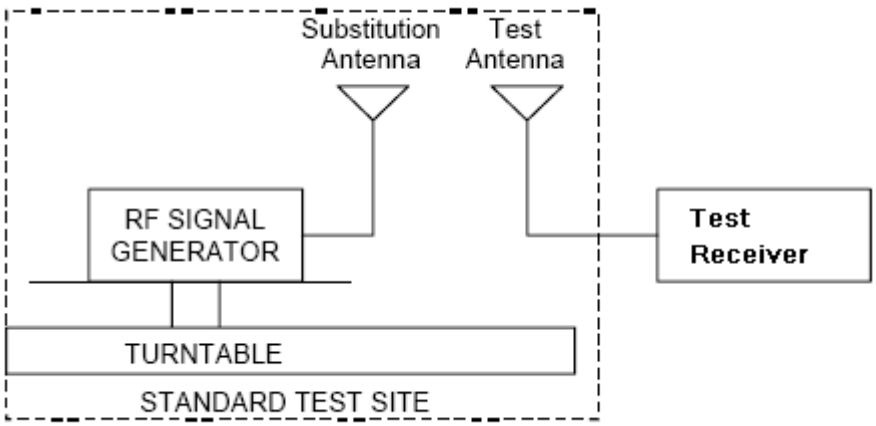
c) Place the transmitter to be tested on the turntable in the standard test site, The transmitter is transmitting into a nonradiating load that is placed on the turntable. The RF cable to this load should be of minimum length.

d) Measurements shall be made from30MHz to 10 tims of fundamental carrier, except for the region close to the carrier equal to ± the carrier bandwidth.

e) Key the transmitter without modulation or normal modulation base the standard.

f) For each spurious frequency, raise and lower the test antenna from 1 m to 4 m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Then the turntable should be rotated 360° to determine the maximum reading. Repeat this procedure to obtain the highest possible reading. Record this maximum reading.

g) Repeat step f) for each spurious frequency with the test antenna polarized vertically.



h) Reconnect the equipment as illustrated.

i) Keep the spectrum analyzer adjusted as in step b).

j) Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At the lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground.

k) Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.

l) Repeat step k) with both antennas vertically polarized for each spurious frequency.

m) Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps k) and l) by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula:

Pd(dBm) = *Pg*(dBm) – *cable loss* (dB) + *antenna gain* (dB)

where:

Pd is the dipole equivalent power and

Pg is the generator output power into the substitution antenna.

NOTE:

1)It is permissible to use other antennas provided they can be referenced to a dipole.

2) For below 1GHz signal, the *antenna gain* (dB) is dBd, and for above 1GHz signal, the *antenna gain* (dB) is dBi.

3)Effective radiated power (e.r.p) refers to the radiation of a half wave tuned dipole instead of an isotropic antenna. There is a constant difference of 2.15 dB between e.i.r.p.
and e.r.p.e.r.p (dBm) = e.i.r.p. (dBm) – 2.15

4)For this test ,the AU and EU are put outside of the chamber, connect to the RU through the optical fiber

7.2.4.1 Measurement Record:

No emissions were detected within 20dB below the limit for the Downlink direction.

Downlink 728MHz to 746MHz

Lowest channel					
Frequency	Spurious Emission Level			Limit	Over limit
(MHz)	(Deg)	Polaxis	(dBm)	dBm	(dB)
53.760	269	H	-68.3	-13.0	-55.3
113.160	336	H	-61.7	-13.0	-48.7
154.740	125	H	-70.3	-13.0	-57.3
226.020	247	H	-65.2	-13.0	-52.2
371.550	117	H	-61.6	-13.0	-48.6
624.000	150	H	-59.6	-13.0	-46.6
3375.000	224	H	-48.1	-13.0	-35.1
4590.000	130	H	-46.9	-13.0	-33.9
5460.000	325	H	-45.8	-13.0	-32.8
6675.000	115	H	-40.1	-13.0	-27.1
8085.000	245	H	-42.4	-13.0	-29.4
9780.000	218	H	-42.1	-13.0	-29.1

Lowest channel					
Frequency	Spurious Emission Level			Limit	Over limit
(MHz)	(Deg)	Polaxis	(dBm)	dBm	(dB)
54.091	145	V	-64.0	-13.0	-51.0
80.490	74	V	-64.5	-13.0	-51.5
111.975	85	V	-63.4	-13.0	-50.4
184.440	92	V	-68.1	-13.0	-55.1
371.550	96	V	-61.0	-13.0	-48.0
624.000	90	V	-57.4	-13.0	-44.4
3330.000	109	V	-45.7	-13.0	-32.7
4215.000	210	V	-49.2	-13.0	-36.2
5415.000	240	V	-47.1	-13.0	-34.1
6975.000	321	V	-42.9	-13.0	-29.9
7995.000	250	V	-44.4	-13.0	-31.4
8895.000	315	V	-41.6	-13.0	-28.6

Middle channel					
Frequency	Spurious Emission Level			Limit	Over limit
(MHz)	(Deg)	Polaxis	(dBm)	dBm	(dB)
41.603	231	H	-69.6	-13.0	-56.6
113.160	353	H	-61.7	-13.0	-48.7
187.410	122	H	-66.3	-13.0	-53.3
371.550	145	H	-61.6	-13.0	-48.6
624.000	114	H	-59.6	-13.0	-46.6
941.790	156	H	-59.3	-13.0	-46.3
3375.000	225	H	-48.1	-13.0	-35.1
4590.000	152	H	-46.9	-13.0	-33.9
5460.000	334	H	-45.8	-13.0	-32.8
6900.000	225	H	-40.0	-13.0	-27.0
8085.000	213	H	-42.4	-13.0	-29.4
9240.000	242	H	-40.7	-13.0	-27.7

Middle channel					
Frequency	Spurious Emission Level			Limit	Over limit
(MHz)	(Deg)	Polaxis	(dBm)	dBm	(dB)
41.880	236	V	-63.0	-13.0	-50.0
80.490	345	V	-64.5	-13.0	-51.5
113.160	184	V	-63.2	-13.0	-50.2
184.440	121	V	-68.1	-13.0	-55.1
371.550	192	V	-61.0	-13.0	-48.0
624.000	215	V	-57.4	-13.0	-44.4
3240.000	252	V	-44.1	-13.0	-31.1
4215.000	183	V	-49.2	-13.0	-36.2
5115.000	302	V	-48.5	-13.0	-35.5
6510.000	241	V	-45.3	-13.0	-32.3
7665.000	160	V	-45.5	-13.0	-32.5
9240.000	202	V	-41.9	-13.0	-28.9

Highest channel					
Frequency	Spurious Emission Level			Limit	Over limit
(MHz)	(Deg)	Polaxis	(dBm)	dBm	(dB)
41.603	161	H	-69.6	-13.0	-56.6
80.490	342	H	-71.1	-13.0	-58.1
113.160	184	H	-61.7	-13.0	-48.7
187.410	125	H	-66.3	-13.0	-53.3
371.550	128	H	-61.6	-13.0	-48.6
624.000	125	H	-59.6	-13.0	-46.6
3413.093	257	H	-50.7	-13.0	-37.7
4590.000	184	H	-46.9	-13.0	-33.9
5460.000	305	H	-45.8	-13.0	-32.8
6900.000	242	H	-40.0	-13.0	-27.0
8085.000	248	H	-42.4	-13.0	-29.4
9240.000	203	H	-40.7	-13.0	-27.7

Highest channel					
Frequency	Spurious Emission Level			Limit	Over limit
(MHz)	(Deg)	Polaxis	(dBm)	dBm	(dB)
53.760	181	V	-64.0	-13.0	-51.0
80.490	72	V	-64.5	-13.0	-51.5
113.160	84	V	-63.2	-13.0	-50.2
184.440	95	V	-68.1	-13.0	-55.1
371.550	98	V	-61.0	-13.0	-48.0
624.000	97	V	-57.4	-13.0	-44.4
3795.000	119	V	-50.6	-13.0	-37.6
5055.000	220	V	-48.2	-13.0	-35.2
5820.000	250	V	-47.2	-13.0	-34.2
6840.000	312	V	-44.1	-13.0	-31.1
7665.000	280	V	-45.5	-13.0	-32.5
8895.000	305	V	-41.6	-13.0	-28.6

Downlink 746MHz to 757MHz

Lowest channel					
Frequency	Spurious Emission Level			Limit	Over limit
(MHz)	(Deg)	Polaxis	(dBm)	dBm	(dB)
41.221	291	H	-69.7	-13.0	-56.7
81.493	342	H	-71.0	-13.0	-58.0
113.160	185	H	-61.7	-13.0	-48.7
187.410	124	H	-66.3	-13.0	-53.3
371.550	186	H	-61.6	-13.0	-48.6
624.000	122	H	-59.6	-13.0	-46.6
3468.578	214	H	-51.4	-13.0	-38.4
4590.000	184	H	-46.9	-13.0	-33.9
5460.000	301	H	-45.8	-13.0	-32.8
6570.000	245	H	-39.8	-13.0	-26.8
8085.000	225	H	-42.4	-13.0	-29.4
9240.000	201	H	-40.7	-13.0	-27.7

Lowest channel					
Frequency	Spurious Emission Level			Limit	Over limit
(MHz)	(Deg)	Polaxis	(dBm)	dBm	(dB)
41.880	332	V	-63.0	-13.0	-50.0
80.490	155	V	-64.5	-13.0	-51.5
113.160	144	V	-63.2	-13.0	-50.2
184.440	116	V	-68.1	-13.0	-55.1
371.550	152	V	-61.0	-13.0	-48.0
624.000	224	V	-57.4	-13.0	-44.4
3795.000	154	V	-50.6	-13.0	-37.6
5025.000	331	V	-48.3	-13.0	-35.3
5820.000	225	V	-47.2	-13.0	-34.2
6840.000	205	V	-44.1	-13.0	-31.1
7995.000	131	V	-44.4	-13.0	-31.4
9240.000	161	V	-41.9	-13.0	-28.9

Middle channel					
Frequency	Spurious Emission Level			Limit	Over limit
(MHz)	(Deg)	Polaxis	(dBm)	dBm	(dB)
53.760	299	H	-68.3	-13.0	-55.3
113.160	346	H	-61.7	-13.0	-48.7
226.020	185	H	-65.2	-13.0	-52.2
371.550	227	H	-61.6	-13.0	-48.6
624.000	167	H	-59.6	-13.0	-46.6
1033.860	190	H	-58.6	-13.0	-45.6
3810.000	254	H	-53.2	-13.0	-40.2
4590.000	180	H	-46.9	-13.0	-33.9
5460.000	305	H	-45.8	-13.0	-32.8
6420.000	145	H	-41.9	-13.0	-28.9
8085.000	215	H	-42.4	-13.0	-29.4
9540.000	268	H	-42.4	-13.0	-29.4

Middle channel					
Frequency	Spurious Emission Level			Limit	Over limit
(MHz)	(Deg)	Polaxis	(dBm)	dBm	(dB)
41.880	181	V	-63.0	-13.0	-50.0
80.490	72	V	-64.5	-13.0	-51.5
113.160	85	V	-63.2	-13.0	-50.2
184.440	94	V	-68.1	-13.0	-55.1
371.550	97	V	-61.0	-13.0	-48.0
624.000	98	V	-57.4	-13.0	-44.4
4215.000	159	V	-49.2	-13.0	-36.2
5415.000	240	V	-47.1	-13.0	-34.1
6360.000	210	V	-46.1	-13.0	-33.1
6975.000	315	V	-42.9	-13.0	-29.9
8205.000	220	V	-45.3	-13.0	-32.3
9810.000	305	V	-41.6	-13.0	-28.6

Highest channel					
Frequency	Spurious Emission Level			Limit	Over limit
(MHz)	(Deg)	Polaxis	(dBm)	dBm	(dB)
39.730	291	H	-70.1	-13.0	-57.1
53.760	343	H	-68.3	-13.0	-55.3
113.160	182	H	-61.7	-13.0	-48.7
226.020	125	H	-65.2	-13.0	-52.2
371.550	184	H	-61.6	-13.0	-48.6
624.000	126	H	-59.6	-13.0	-46.6
3555.000	255	H	-52.6	-13.0	-39.6
4590.000	182	H	-46.9	-13.0	-33.9
5460.000	304	H	-45.8	-13.0	-32.8
6570.000	225	H	-39.8	-13.0	-26.8
7995.000	213	H	-43.7	-13.0	-30.7
9240.000	252	H	-40.7	-13.0	-27.7

Highest channel					
Frequency	Spurious Emission Level			Limit	Over limit
(MHz)	(Deg)	Polaxis	(dBm)	dBm	(dB)
41.880	299	V	-63.0	-13.0	-50.0
80.490	346	V	-64.5	-13.0	-51.5
184.440	185	V	-68.1	-13.0	-55.1
371.550	128	V	-61.0	-13.0	-48.0
624.000	190	V	-57.4	-13.0	-44.4
876.450	217	V	-59.2	-13.0	-46.2
3352.483	254	V	-46.3	-13.0	-33.3
4215.000	180	V	-49.2	-13.0	-36.2
5415.000	305	V	-47.1	-13.0	-34.1
6510.000	245	V	-45.3	-13.0	-32.3
7995.000	169	V	-44.4	-13.0	-31.4
9240.000	204	V	-41.9	-13.0	-28.9

Remark:

The cabinet radiation was measured with the equipment transmitting a CW signal into a non-radiating 50 Ohm load at maximum output power on a signal frequency .

Measured were performed in the lowest, middle and hightest frequency for the Downlink.

The spectrum was searched from 30MHz to 26GHz (10th Harmonic) for downlink.

7.2.5 Occupied Bandwidth

Test Method: FCC part 2.1049

The spectral shape of the output should look similar to input for all modulations.

EUT Operation:

Status: Drive the EUT to maximum output power. .

Conditions: Normal conditions

Application: Cellular Band RF output ports

Test Configuration:

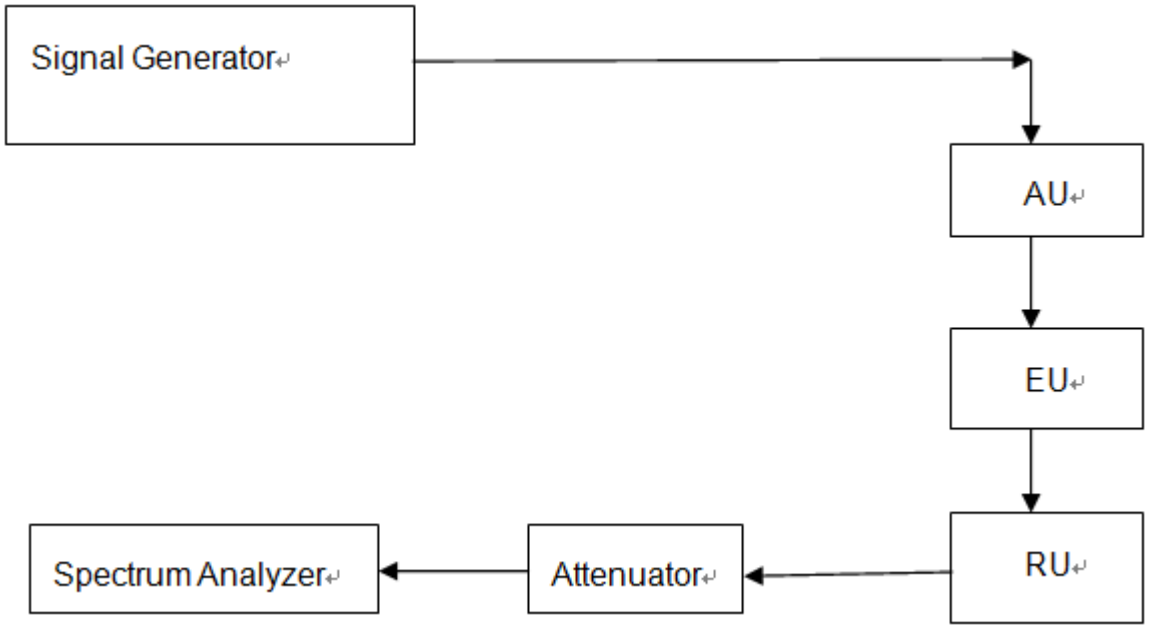


Fig.2. Conducted Spurious Emissions test configuration

Test Procedure:

a) Set the spectrum analyzer RBW 300 Hz or >1%&<2% emission bandwidth of carrier.

b) Capture the trace of input signal;

c) Connect the equipment as illustrated;

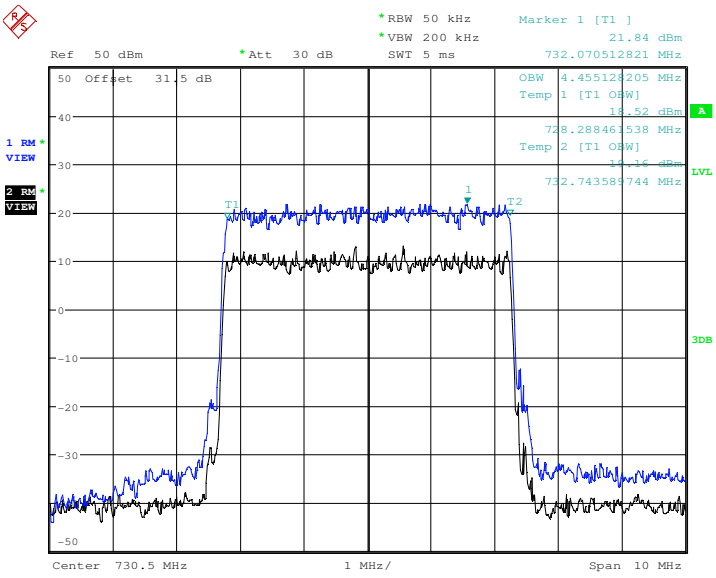
d) Capture the trace of output signal;

e) The signal add at the signal generator is 0dBm, and the modulation of the signal is 64QAM

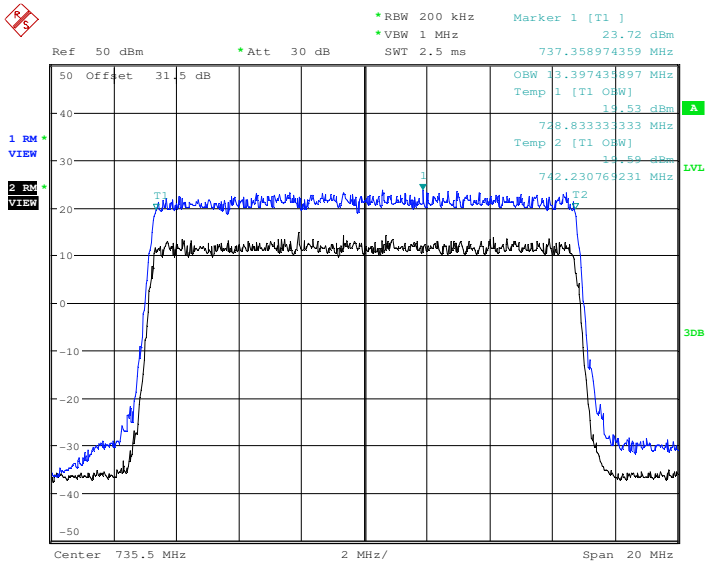
7.2.5.1 Measurement Record:

1.Downlink:728MHz to 746MHz(LTE mode)

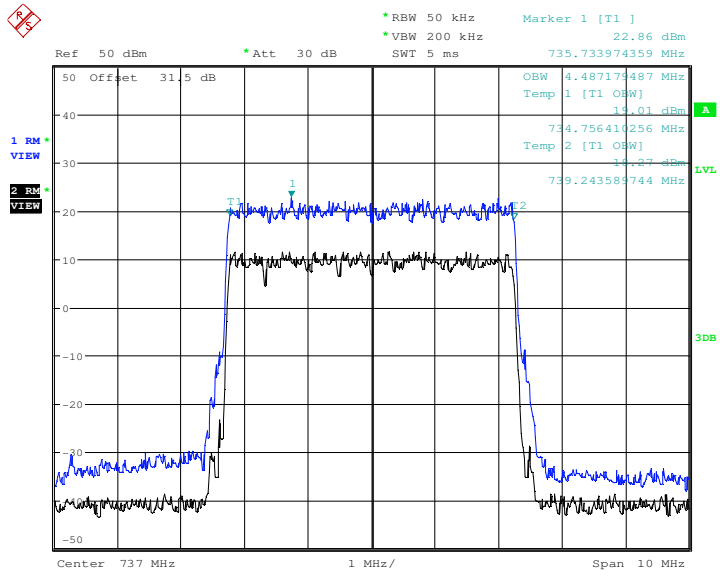
1.1 lowest frequency – 5MHz bandwidth



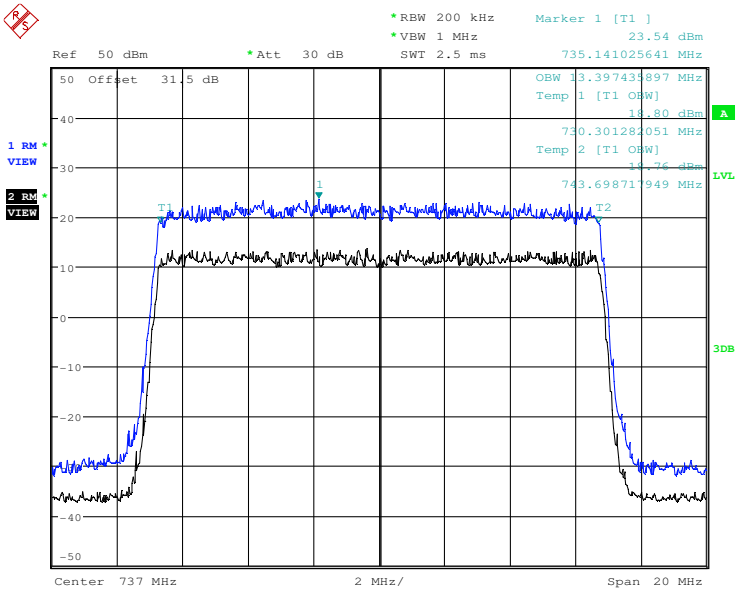
1.2 lowest frequency-- 15MHz bandwidth



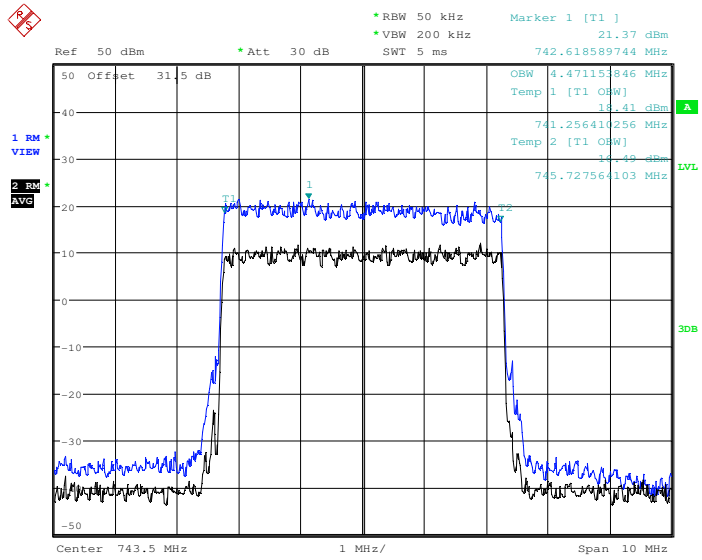
1.3 middle frequency-- 5MHz bandwidth



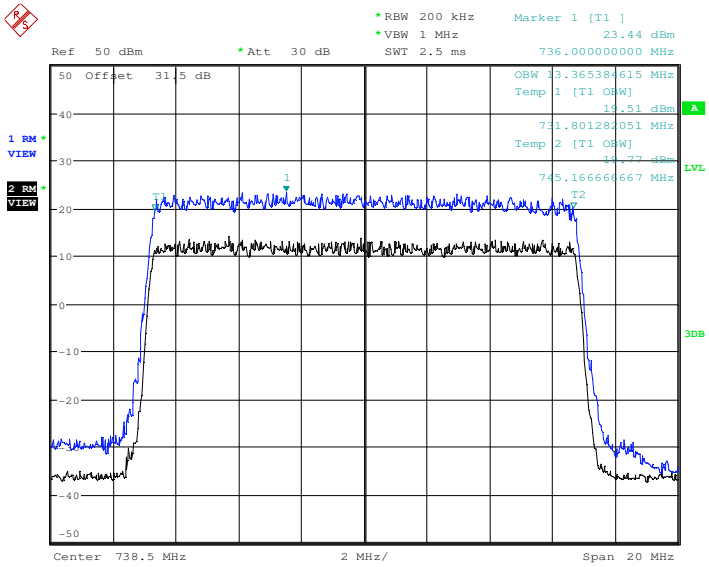
1.4 middle frequency-- 15MHz bandwidth



1.5 highest frequency—5MHz bandwidth

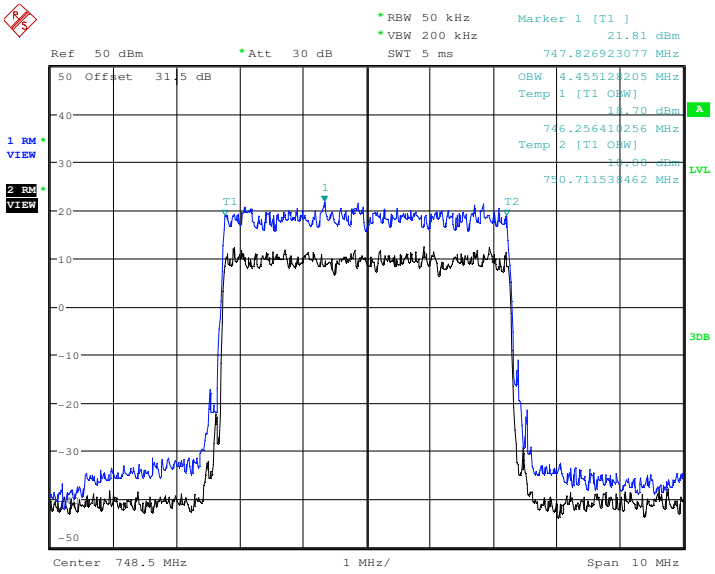


1.6 highest frequency--15MHz bandwidth

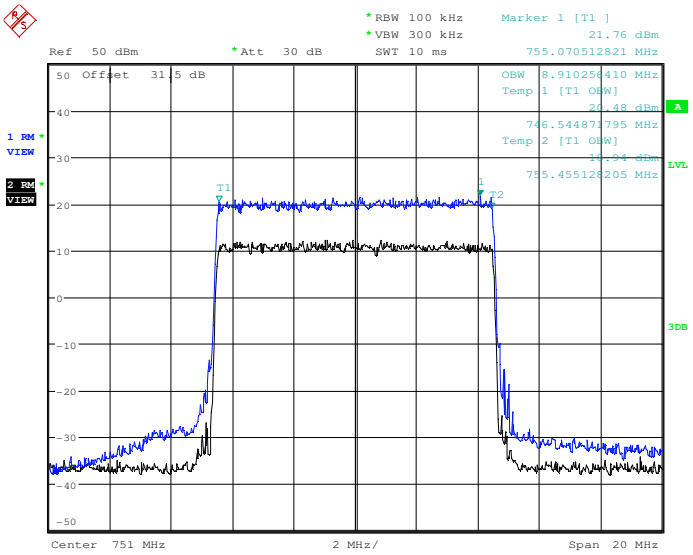


2.Downlink:746MHz to 757MHz(LTE mode)

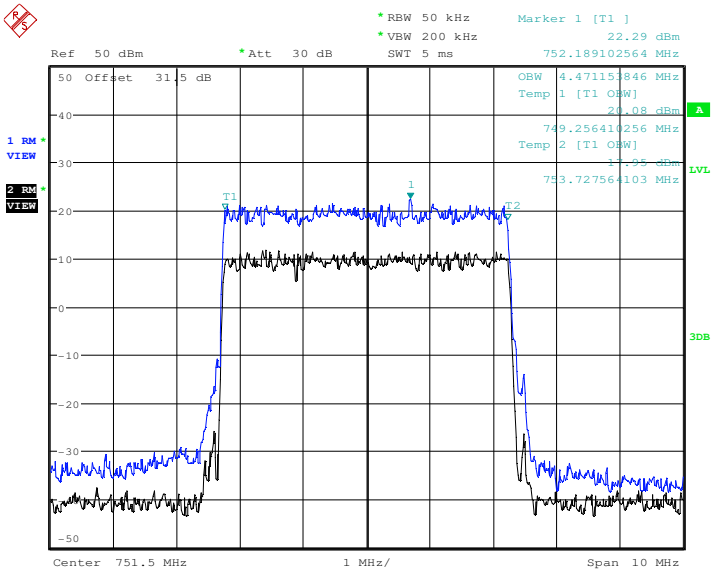
2.1 lowest frequency – 5MHz bandwidth



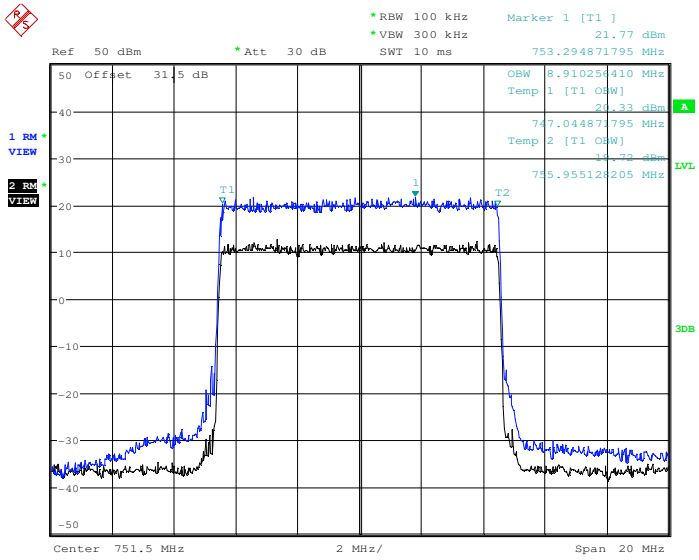
2.2 lowest frequency-- 10MHz bandwidth



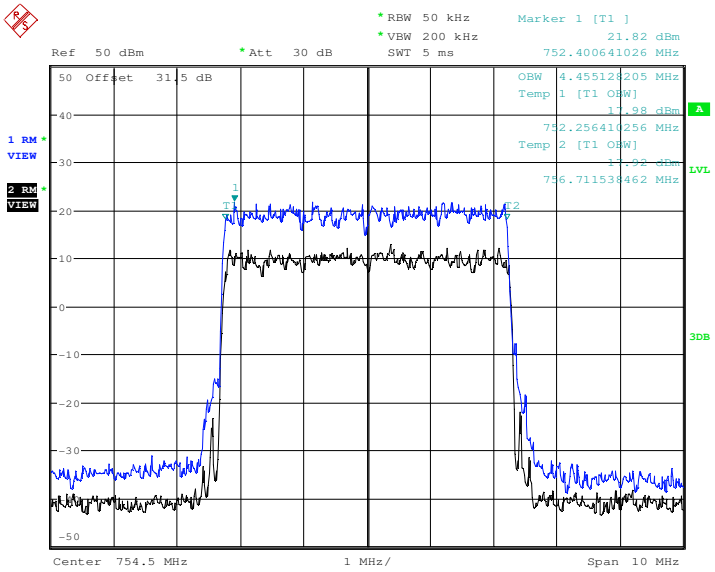
2.3 middle frequency-- 5MHz bandwidth



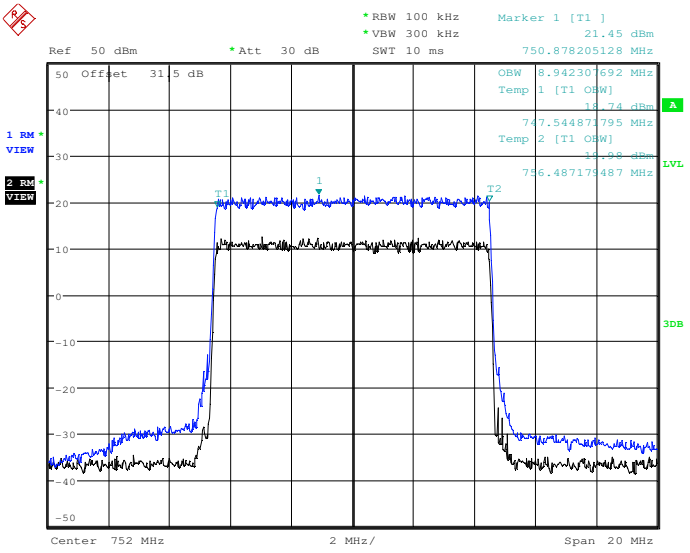
2.4 middle frequency-- 10MHz bandwidth



2.5 highest frequency—5MHz bandwidth



2.6 highest frequency--10MHz bandwidth



7.2.6 Out of Band Rejection

Test Requirement: Section D.3(l) of KDB 935210 D02 Signal Booster Certification v02r01

Test for rejection of out of band signals. Filter freq. response plots are acceptable.

Test Method: Section D.3(l) of KDB 935210 D02 Signal Booster Certification v02r01

EUT Operation:

Status: Drive the EUT to maximum output power. .

Conditions: Normal conditions

Application: Cellular Band RF output ports

Test Configuration:

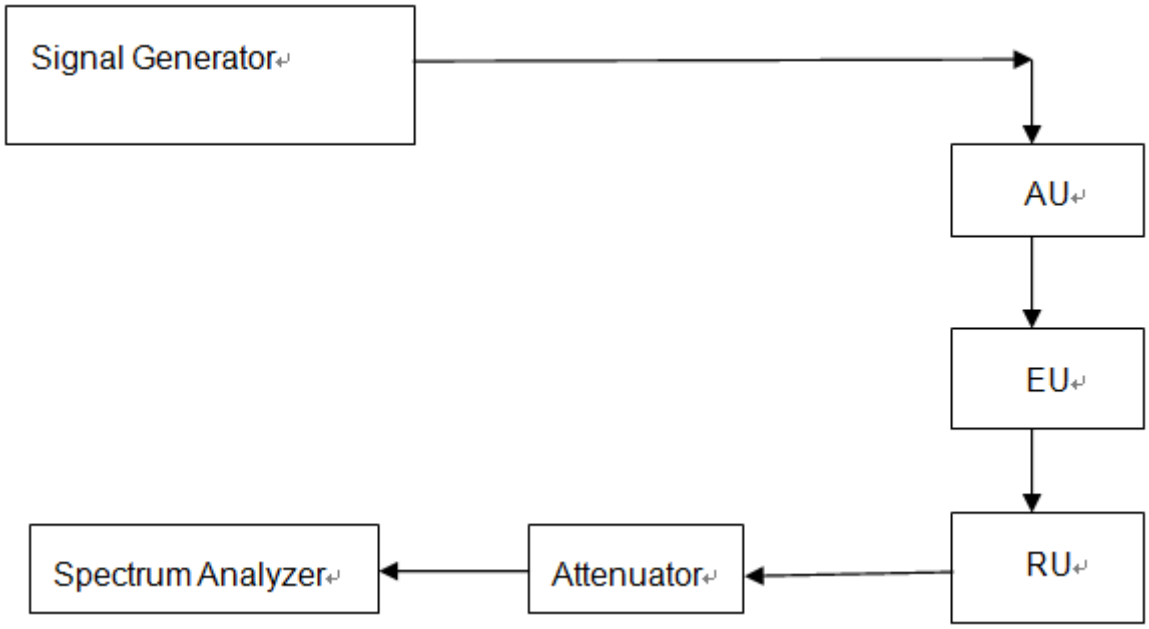


Fig.4. Out of Band rejection test configuration

Test Procedure:

1. Connect the equipment as illustrated;

2. Test the background noise level with all the test facilities;

3. Keep one transmitting path, all other connectors shall be connected by normal power or RF leads;

4. Select the attenuator to avoid the test receiver or spectrum analyzer being destroied;

5. Keep the EUT continuously transmitting in max power;

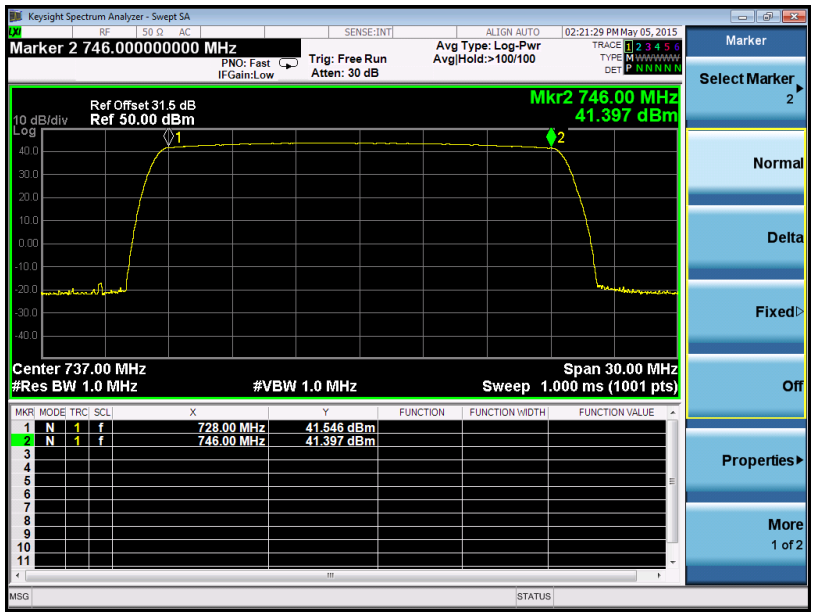
6. Signal generator sweep from the frequency more lower than the product frequency to the frequency more higher than it, find the product band filter characteristic;

· CW signal rather than typical signal is acceptable (for FM).

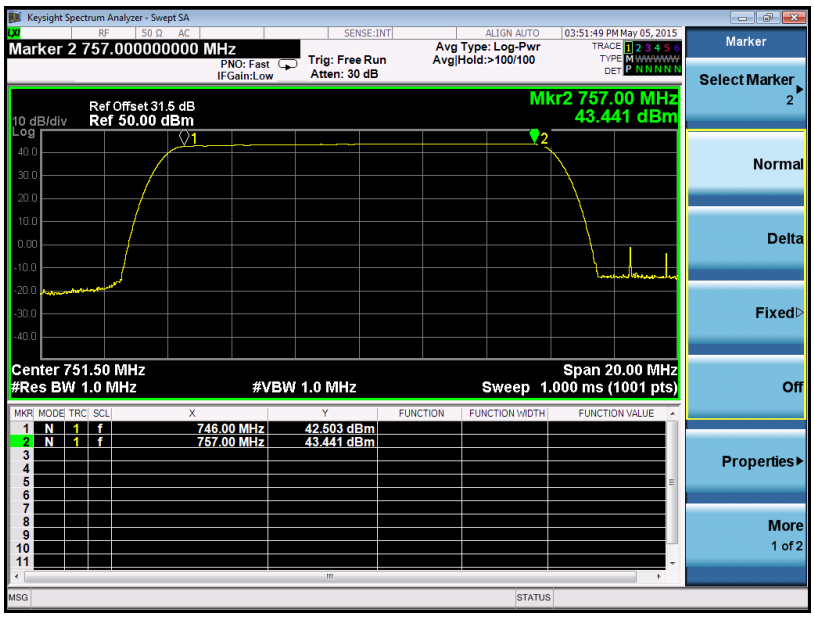
· Multiple band filter will need test each other.

7.2.6.1 Measurement Record:

Downlink: 728MHz to 746MHz



Downlink: 746MHz to 757MHz



7.2.7 Frequency Stability

Test Requirement: FCC part 27.54

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

EUT Operation:

Status: Drive the EUT to maximum output power.

Conditions: Temperature conditions, voltage conditions

Application: Cellular Band RF output ports

Test Procedure:

1. Temperature conditions:
   a) The RF output port of the EUT was connected to Frequency Meter;
   b) Set the working Frequency in the middle channel;
   c) record the 20℃ and norminal voltage frequency value as reference point;
   d) vary the temperature from -40℃ to 50℃ with step 10℃
   e) when reach a temperature point, keep the temperature banlance at least 1 hour to make the product working in this status;
   f) read the frequency at the relative temperature.

2. Voltage conditions:
   a) record the 20℃ and norminal voltage frequency value as reference point;
   b) vary the voltage from -15% norminal voltage to +15% voltage;
   c) read the frequency at the relative voltage.

7.2.7.1 Measurement Record:

Frequency Stability vs temperature:

1.Test for Downlink: 728~746MHz (middle channel=737MHz)

Temperature(℃)	Frequency(MHz)	Tolerance(ppm)
50	737.0000032	0.00434193
40	737.0000025	0.00339213
30	737.0000024	0.00325645
20	737.0000018	0.00244233
10	737.0000021	0.00284939
0	737.0000023	0.00312076
-10	737.0000016	0.00217096
-20	737.0000036	0.00488467
-30	737.0000031	0.00420624
-40	737.0000027	0.00366350

2.Test for Downlink: 746~746MHz (middle channel=751MHz)

Temperature(℃)	Frequency(MHz)	Tolerance(ppm)
50	751.0000029	0.00386152
40	751.0000028	0.00372836
30	751.0000031	0.00412783
20	751.0000016	0.00213049
10	751.0000023	0.00306258
0	751.0000027	0.00359521
-10	751.0000034	0.00452730
-20	751.0000030	0.00399467
-30	751.0000033	0.00439414
-40	751.0000025	0.00332890

--The End of Report--