

FCC Test Report

(Part 27: LTE Band 4, 13)

Report No.: RF190528D02-2

FCC ID: P27TP20213425

Test Model: INTTP20213425

Received Date: May 28, 2019

Test Date: Jul. 5 to 18, 2019

Issued Date: Jul. 19, 2019

Applicant: Sercomm Corp.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

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**FCC Registration /
Designation Number:** 198487 / TW2021



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Release Control Record

Issue No.	Description	Date Issued
RF190528D02-2	Original release.	Jul. 19, 2019

1 Certificate of Conformity

Product: Verizon LTE

Brand: Verizon

Test Model: INTTP20213425

Sample Status: Engineering sample

Applicant: Sercomm Corp.

Test Date: Jul. 5 to 18, 2019

Standards: FCC Part 27, Subpart C

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by :



Date: Jul. 19, 2019

Celia Chen / Supervisor

Approved by :



Date: Jul. 19, 2019

Rex Lai / Associate Technical Manager

2 Summary of Test Results

Applied Standard: FCC Part 27 & Part 2				
FCC Clause		Test Item	Result	Remarks
LTE Band 4	LTE Band 13			
2.1046 27.50(d)(3)	2.1046 27.50(b)(9)	Equivalent Isotropically Radiated Power	Pass	Meet the requirement of limit.
2.1047	2.1047	Modulation characteristics	Pass	Meet the requirement
27.50(d)(5)	----	Peak To Average Ratio	Pass	Meet the requirement of limit.
2.1055 27.54	2.1055 27.54	Frequency Stability Stay with the authorized bands of operation	Pass	Meet the requirement of limit.
2.1049 27.53(h)	2.1049 27.53(c)	Emission Bandwidth	Pass	Meet the requirement of limit.
2.1051 27.53(h)	2.1051 27.53(c)	Band Edge Measurements	Pass	Meet the requirement of limit.
2.1051 27.53(h)	2.1051 27.53(c)	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1051 27.53(h)	2.1051 27.53(c)	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -27.25dB at 4233.32MHz.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) ($\pm$)
Radiated Emissions up to 1 GHz	30MHz ~ 1000MHz	5.43 dB
Radiated Emissions above 1 GHz	1GHz ~ 40GHz	5.42 dB

2.2 Test Site and Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
HP Preamplifier	8447D	2432A03504	Feb. 20, 2019	Feb. 19, 2020
HP Preamplifier	8449B	3008A01201	Feb. 21, 2019	Feb. 20, 2020
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Feb. 20, 2019	Feb. 19, 2020
Agilent TEST RECEIVER	N9038A	MY51210129	Mar. 05, 2019	Mar. 04, 2020
Schwarzbeck Antenna	VULB 9168	139	Nov. 26, 2018	Nov. 25, 2019
Schwarzbeck Antenna	VHBA 9123	480	Jun. 3, 2019	Jun. 2, 2021
Schwarzbeck Horn Antenna	BBHA-9170	212	Nov. 25, 2018	Nov. 24, 2019
Schwarzbeck Horn Antenna	BBHA 9120-D1	D130	Nov. 25, 2018	Nov. 24, 2019
ADT. Turn Table	TT100	0306	NA	NA
ADT. Tower	AT100	0306	NA	NA
Software	Radiated_V7.6.15.9.5	NA	NA	NA
SUHNER RF cable With 4dB PAD	SF102	Cable-CH6-01	Aug. 13, 2018	Aug. 12, 2019
SUHNER RF cable With 3/4dB PAD	SF102	Cable-CH8-3.6m	Aug. 13, 2018	Aug. 12, 2019
KEYSIGHT MIMO Powermeasurement Test set	U2021XA	U2021XA-001	Jun. 11, 2019	Jun. 10, 2020
KEYSIGHT Spectrum Analyzer	N9030A	MY54490260	Aug. 3, 2018	Aug. 2, 2019
Loop Antenna EMCI	LPA600	270	Aug. 11, 2017	Aug. 10, 2019
EMCO Horn Antenna	3115	00028257	Nov. 25, 2018	Nov. 24, 2019
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	NA	NA
ROHDE & SCHWARZ Spectrum Analyzer	FSV40	101042	Sep. 27, 2018	Sep. 26, 2019
Anritsu Power Sensor	MA2411B	0738404	Apr. 16, 2019	Apr. 15, 2020
Anritsu Power Meter	ML2495A	0842014	Apr. 16, 2019	Apr. 15, 2020
Temperature & Humidity Chamber	MHU-225AU	920409	May 24, 2019	May 23, 2020
DIGITAL POWER METER IDRC	CP-240	240515	Sep. 13, 2018	Sep. 12, 2019
AC Power Source ExTech	CFW-105	E000603	NA	NA

- NOTE:** 1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in Chamber No. 6.

3 General Information

3.1 General Description of EUT

Product	Verizon LTE		
Brand	Verizon		
Test Model	INTTP20213425		
Status of EUT	Engineering sample		
Power Supply Rating	12Vdc (adapter)		
Modulation Type	QPSK, 16QAM, 64QAM		
Operating Frequency	LTE Band 4	Channel Bandwidth 10MHz	2115.0MHz ~ 2150.0MHz
		Channel Bandwidth 20MHz	2120.0MHz ~ 2145.0MHz
	LTE Band 13	Channel Bandwidth 10MHz	746MHz ~ 756MHz
Max. EIRP Power	LTE Band 4	Channel Bandwidth 10MHz	325.087mW (25.12dBm)
		Channel Bandwidth 20MHz	288.403mW (24.60dBm)
Max. ERP Power	LTE Band 13	Channel Bandwidth 10MHz	327.341mW (25.15dBm)
Antenna Type	LTE Band 4	Dipole antenna with 2.5dBi gain	
	LTE Band 13	Dipole antenna with 1.0dBi gain	
Antenna Connector	RP-SMA		
Accessory Device	Adapter		
Data Cable Supplied	Non-shielded GPS Antenna (9m)*2		

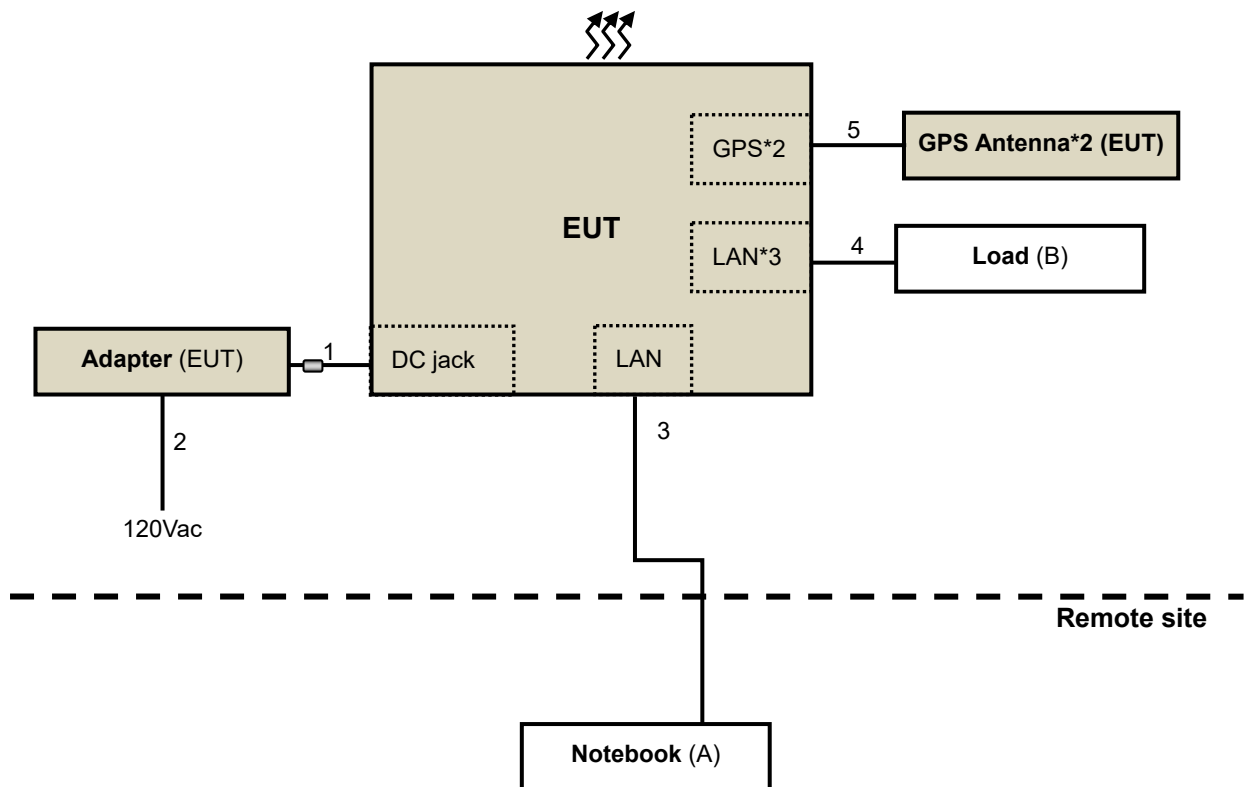
Note:

1. The EUT uses following adapter.

Brand	PHIHONG
Model	PSA120U-120L6
Input Power	100-240Vac, 1.6A, 50-60Hz
Output Power	12Vdc, 9A
Power Line	Non-shielded AC 3 Pin (1.8m)
	Non-shielded DC cable (1.5m) with one ferrite core

2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Configuration of System under Test



3.2.1 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E5410	BW33YM1	N/A	Provided by Lab
B.	Load	N/A	N/A	N/A	N/A	Provided by Lab

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as communication partners to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC cable	1	1.5	N	1	Supplied by client
2.	AC power cord	1	1.8	N	0	Supplied by client
3.	LAN cable	1	10.0	N	0	Provided by Lab
4.	LAN cable	3	1.0	N	0	Provided by Lab
5.	GPS Antenna	2	9	N	0	Supplied by client

Note: The core(s) is(are) originally attached to the cable(s).

3.3 Test Mode Applicability and Tested Channel Detail

The EUT was tested under following modes:

LTE Band 4

Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation
EIRP	2000 to 2350	2000, 2175, 2350	10MHz	QPSK, 16QAM, 64QAM
	2050 to 2300	2050, 2175, 2300	20MHz	QPSK, 16QAM, 64QAM
Modulation characteristics	2000 to 2350	2175	10MHz	QPSK, 16QAM, 64QAM
Frequency Stability	2000 to 2350	2175	10MHz	QPSK
Emission Bandwidth	2000 to 2350	2000, 2175, 2350	10MHz	QPSK, 16QAM, 64QAM
	2050 to 2300	2050, 2175, 2300	20MHz	QPSK, 16QAM, 64QAM
Band Edge	2000 to 2350	2000, 2350	10MHz	QPSK
	2050 to 2300	2050, 2300	20MHz	QPSK
Peak to Average Ratio	2000 to 2350	2000, 2175, 2350	10MHz	QPSK, 16QAM, 64QAM
	2050 to 2300	2050, 2175, 2300	20MHz	QPSK, 16QAM, 64QAM
Conducted Emission	2000 to 2350	2000, 2175, 2350	10MHz	QPSK
	2050 to 2300	2050, 2175, 2300	20MHz	QPSK
Radiated Emission Below 1GHz	2000 to 2350	2000	10MHz	QPSK
	2050 to 2300	2050	20MHz	QPSK
Radiated Emission Above 1GHz	2000 to 2350	2000, 2175, 2350	10MHz	QPSK
	2050 to 2300	2050, 2175, 2300	20MHz	QPSK

LTE Band 13

Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation
ERP	5230	5230	10MHz	QPSK, 16QAM, 64QAM
Modulation characteristics	5230	5230	10MHz	QPSK, 16QAM, 64QAM
Frequency Stability	5230	5230	10MHz	QPSK
Emission Bandwidth	5230	5230	10MHz	QPSK, 16QAM, 64QAM
Band Edge	5230	5230	10MHz	QPSK
Peak to Average Ratio	5230	5230	10MHz	QPSK, 16QAM, 64QAM
Conducted Emission	5230	5230	10MHz	QPSK
Radiated Emission Below 1GHz	5230	5230	10MHz	QPSK
Radiated Emission Above 1GHz	5230	5230	10MHz	QPSK

Note:

1. For radiated emission below 1 GHz, the low, mid and high channels were pre-tested in chamber. The low channel was the worst case and chosen for final test.
2. The conducted output power for QPSK /16QAM / 64QAM, measured value of QPSK is higher than 16QAM / 64QAM mode. Therefore, the Frequency Stability, Band Edge, Conducted Emission and Radiated Emission were performed under QPSK mode only.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
EIRP	30deg. C, 83%RH	120Vac, 60Hz	Ian Chang
Modulation characteristics	20deg. C, 76%RH	120Vac, 60Hz	Saxon Lee
Frequency Stability	20deg. C, 76%RH	120Vac, 60Hz	Saxon Lee
Emission Bandwidth	20deg. C, 76%RH	120Vac, 60Hz	Saxon Lee
Band Edge	20deg. C, 76%RH	120Vac, 60Hz	Saxon Lee
Peak To Average Ratio	20deg. C, 76%RH	120Vac, 60Hz	Saxon Lee
Conducted Emission	20deg. C, 73%RH	120Vac, 60Hz	Saxon Lee
Radiated Emission	31deg. C, 78%RH	120Vac, 60Hz	Ian Chang

3.4 EUT Operating Conditions

The EUT makes a call to the communication simulator. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

3.5 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC 47 CFR Part 2

FCC 47 CFR Part 27

KDB 971168 D01 Power Meas License Digital Systems v03r01

ANSI/TIA/EIA-603-E 2016

ANSI 63.26-2015

Note: All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 Output Power Measurement

4.1.1 Limits of Output Power Measurement

For Band 4: The radiated peak output power shall be according to the specific rule Part 27.50(d)(3).

For Band 13: The radiated peak output power shall be according to the specific rule Part 27.50(b)(9).

4.1.2 Test Procedures

EIRP / ERP Measurement:

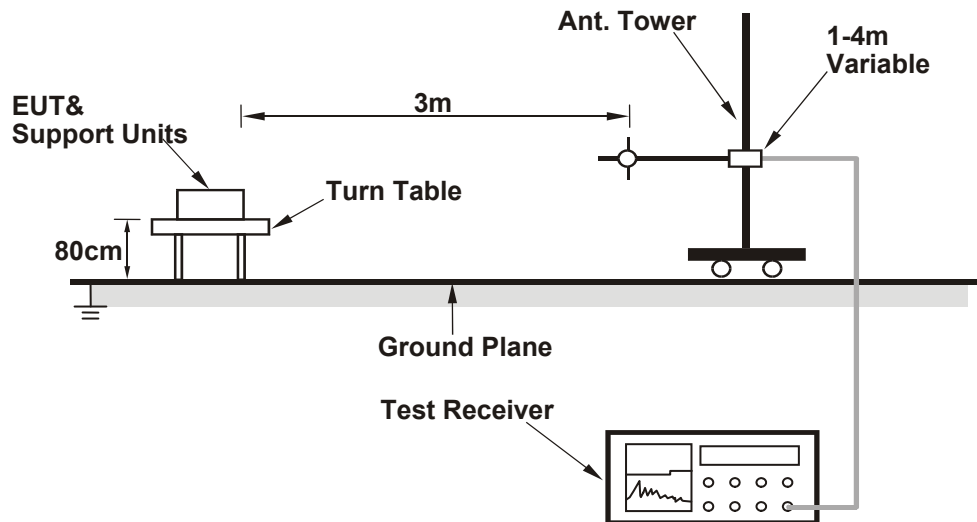
- a. All measurements were done at low, middle and high operational frequency range. RWB and VBW is 5MHz for LTE Mode.
- b. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m(below or equal 1GHz) and/or 1.5m(above 1GHz) height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- c. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value" of step b. Record the power level of S.G
- d. $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}$. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, $E.R.P \text{ power} = E.I.R.P \text{ power} - 2.15\text{dBi}$.

Conducted Power Measurement:

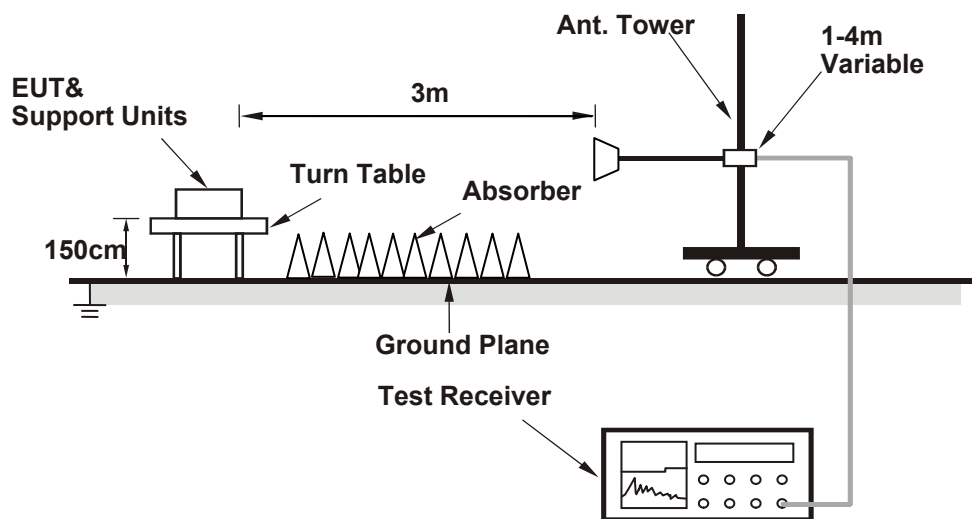
A power sensor was used on the output port of the EUT. A power meter was used to read the response of the power sensor. Record the power level.

4.1.3 Test Setup

EIRP / ERP Measurement: For Radiated Emission below or equal 1GHz

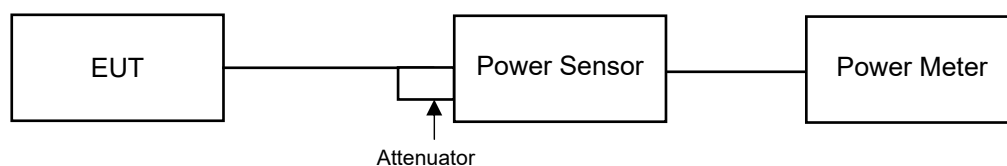


For Radiated Emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

Conducted Power Measurement:



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.4 Test Results

Conducted Output Power (dBm)

LTE Band 4 (Channel Bandwidth 10MHz):

CH	Frequency (MHz)	CONDUCTED OUTPUT POWER (dBm)								
		QPSK			16QAM			64QAM		
		Chain 0	Chain 1	Total	Chain 0	Chain 1	Total	Chain 0	Chain 1	Total
2000	2115	17.19	17.35	20.28	17.13	17.26	20.21	17.06	17.19	20.14
2175	2132.5	17.13	17.24	20.20	17.08	17.20	20.15	17.02	17.08	20.06
2350	2150	17.11	17.28	20.21	17.09	17.24	20.18	17.00	17.16	20.09

LTE Band 4 (Channel Bandwidth 20MHz):

CH	Frequency (MHz)	CONDUCTED OUTPUT POWER (dBm)								
		QPSK			16QAM			64QAM		
		Chain 0	Chain 1	Total	Chain 0	Chain 1	Total	Chain 0	Chain 1	Total
2050	2120	17.14	17.28	20.22	17.10	17.26	20.19	17.04	17.23	20.15
2175	2132.5	17.10	17.26	20.19	17.06	17.22	20.15	17.00	17.12	20.07
2300	2145	17.08	17.25	20.18	17.05	17.22	20.15	17.01	17.15	20.09

LTE Band 13 (Channel Bandwidth 10MHz):

CH	Frequency (MHz)	CONDUCTED OUTPUT POWER (dBm)								
		QPSK			16QAM			64QAM		
		Chain 0	Chain 1	Total	Chain 0	Chain 1	Total	Chain 0	Chain 1	Total
5230	751	17.21	17.36	20.30	17.18	17.28	20.24	17.12	17.22	20.18

EIRP Power (dBm)

LTE Band 4

Channel Bandwidth: 10MHz

Modulation Type: QPSK					
Channel	Frequency (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)
2000	2115.00	-16.79	17.11	8.01	25.12
2175	2132.50	-17.14	16.82	8.06	24.88
2350	2150.00	-17.60	16.40	8.13	24.53
Modulation Type: 16QAM					
Channel	Frequency (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)
2000	2115.00	-16.97	16.93	8.01	24.94
2175	2132.50	-17.34	16.62	8.06	24.68
2350	2150.00	-17.78	16.22	8.13	24.35
Modulation Type: 64QAM					
Channel	Frequency (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)
2000	2115.00	-17.07	16.83	8.01	24.84
2175	2132.50	-17.44	16.52	8.06	24.58
2350	2150.00	-17.82	16.18	8.13	24.31

Note: EIRP (dBm) = S.G Power Value (dBm) + Correction Factor (dB).

Channel Bandwidth: 20MHz

Modulation Type: QPSK					
Channel	Frequency (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)
2050	2120.00	-17.34	16.58	8.02	24.60
2175	2132.50	-17.76	16.20	8.06	24.26
2300	2145.00	-18.13	15.86	8.11	23.97
Modulation Type: 16QAM					
Channel	Frequency (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)
2050	2120.00	-17.51	16.41	8.02	24.43
2175	2132.50	-17.87	16.09	8.06	24.15
2300	2145.00	-18.21	15.78	8.11	23.89
Modulation Type: 64QAM					
Channel	Frequency (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)
2050	2120.00	-17.69	16.23	8.02	24.25
2175	2132.50	-18.06	15.9	8.06	23.96
2300	2145.00	-18.36	15.63	8.11	23.74

Note: EIRP (dBm) = S.G Power Value (dBm) + Correction Factor (dB).

LTE Band 13

Channel Bandwidth: 10MHz

Modulation Type: QPSK

Channel	Frequency (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)
5230	751.00	17.24	-1.19	26.34	25.15

Modulation Type: 16QAM

Channel	Frequency (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)
5230	751.00	17.07	-1.36	26.34	24.98

Modulation Type: 64QAM

Channel	Frequency (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)
5230	751.00	16.95	-1.48	26.34	24.86

Note: ERP (dBm) = S.G Power Value (dBm) + Correction Factor (dB).

4.2 Modulation characteristics Measurement

4.2.1 Limits of Modulation characteristics

N/A

4.2.2 Test Procedure

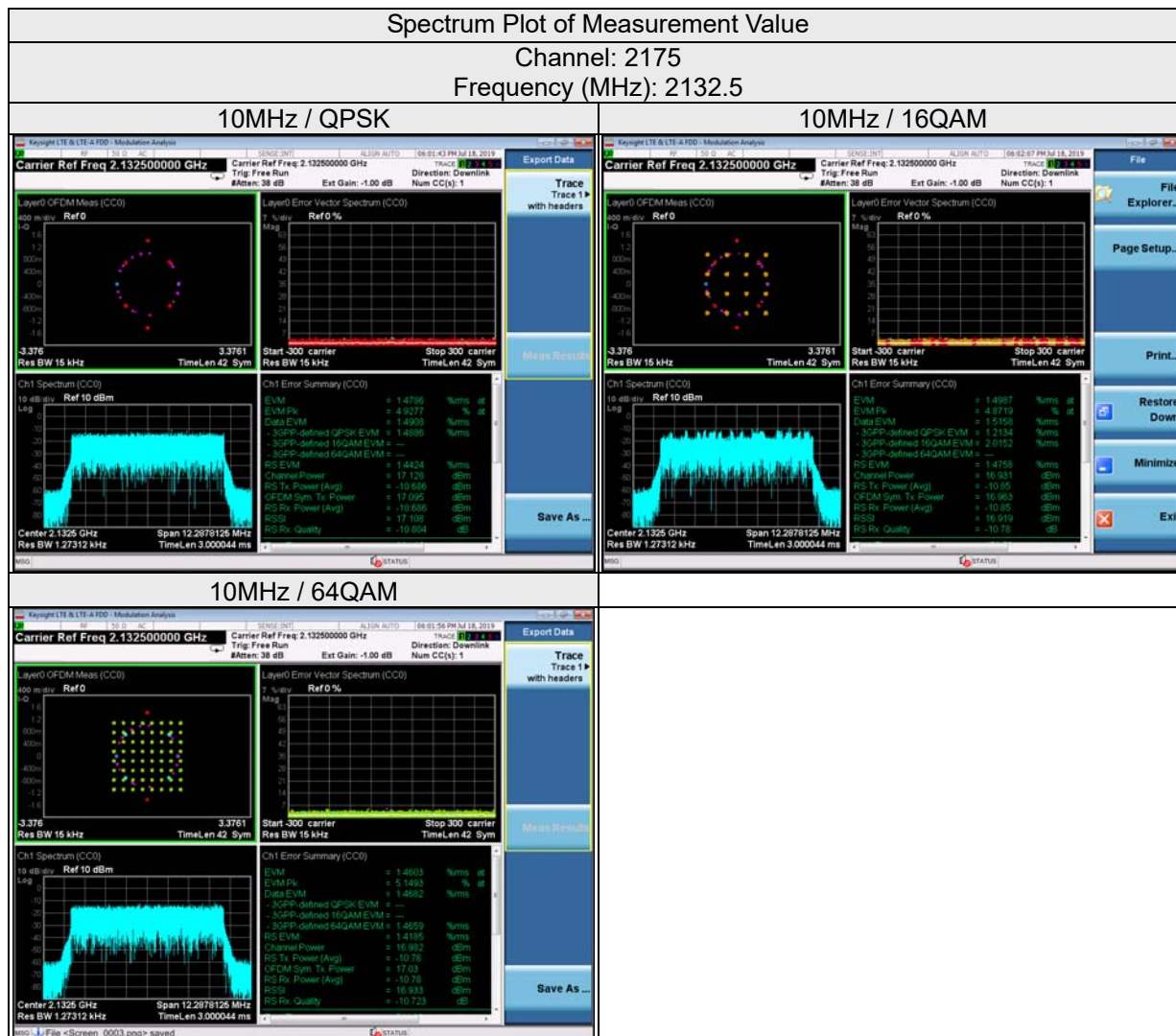
Connect the EUT to Communication Simulator via the antenna connector, the frequency band is set as EUT supported Modulation and Channels, the EUT output is matched with 50 ohm load, the waveform quality and constellation of the EUT was tested.

4.2.3 Test Setup



4.2.4 Test Results

LTE Band 4



LTE Band 13

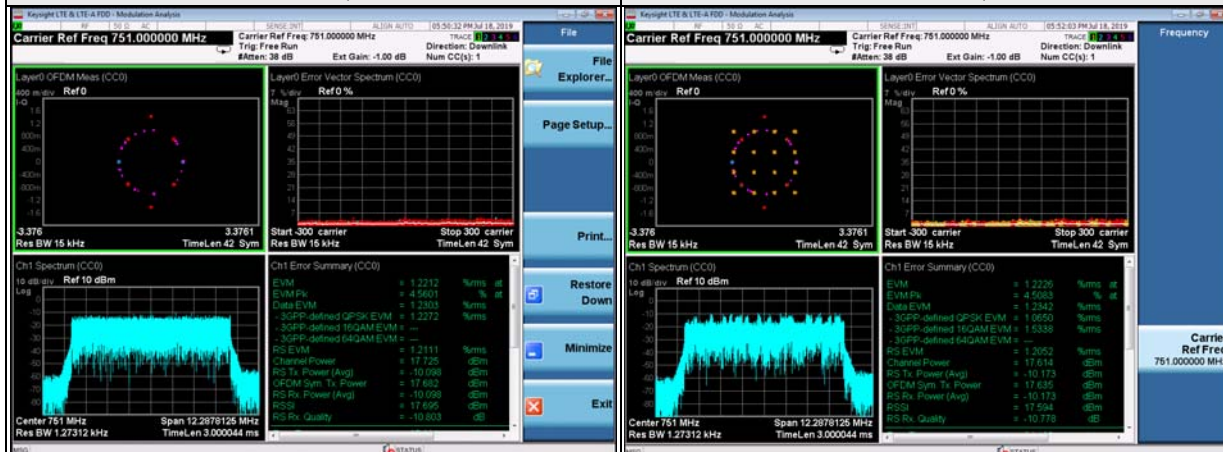
Spectrum Plot of Measurement Value

Channel: 5230

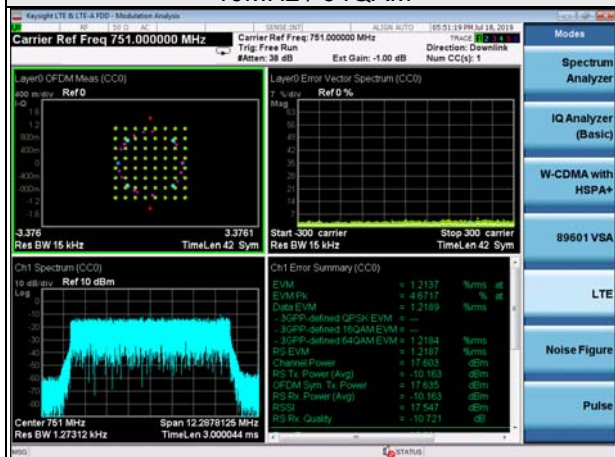
Frequency (MHz): 751

10MHz / QPSK

10MHz / 16QAM



10MHz / 64QAM



4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

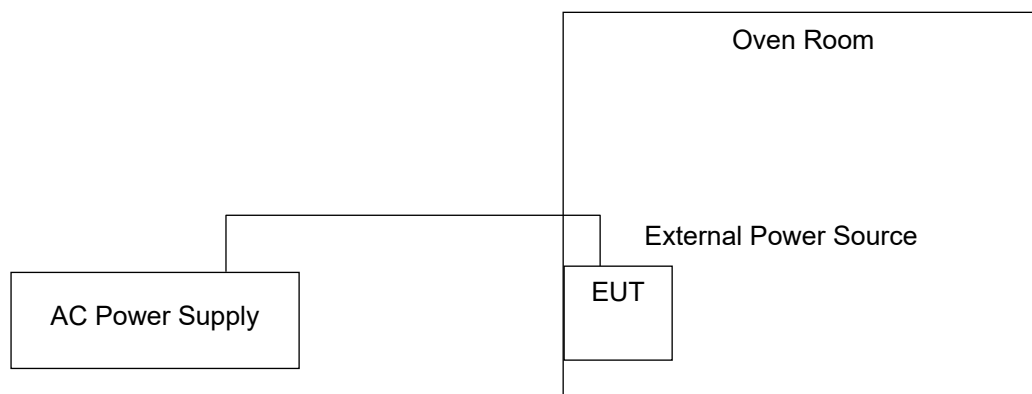
According to the FCC part 2.1055 shall be tested the frequency stability. The rule is defined that "The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block." The test extreme voltage is according to the 2.1055(d)(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment and the extreme temperature rule is comply with specification of EUT $-30^{\circ}\text{C} \sim 75^{\circ}\text{C}$.

4.3.2 Test Procedure

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the AC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

Note: The frequency error was recorded frequency error from the communication simulator.

4.3.3 Test Setup



4.3.4 Test Results

Frequency Error vs. Voltage

Voltage (Volts)	Frequency Error (ppm)	
	LTE Band 4	LTE Band 13
102	0.0046893318	0.0133155792
120	0.0042203986	0.0119840213
138	0.0042203986	0.0106524634

Note: The applicant defined the normal working voltage is from 102Vac to 138Vac.

Frequency Error vs. Temperature

Temp. (°C)	Frequency Error (ppm)	
	LTE Band 4	LTE Band 13
75	0.0051582649	0.0133155792
70	0.0046893318	0.0119840213
60	0.0046893318	0.0119840213
50	0.0042203986	0.0106524634
40	0.0037514654	0.0106524634
30	0.0037514654	0.0106524634
20	0.0037514654	0.0093209055
10	0.0032825322	0.0093209055
0	0.0032825322	0.0079893475
-10	0.0032825322	0.0079893475
-20	0.0028135991	0.0066577896
-30	0.0023446659	0.0066577896

4.4 Emission Bandwidth Measurement

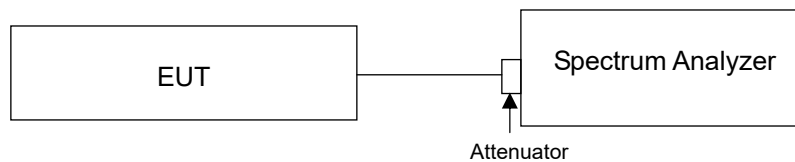
4.4.1 Limits of Emission Bandwidth Measurement

N/A

4.4.2 Test Procedure

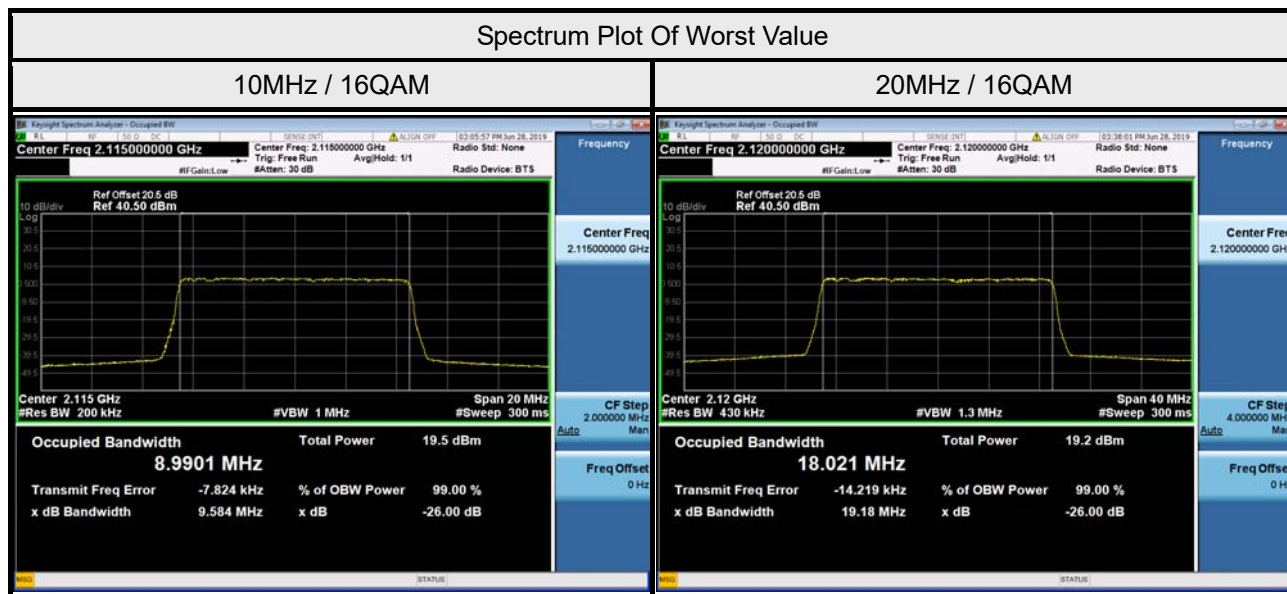
The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW = 200kHz and VBW = 1MHz (Channel Bandwidth: 10MHz) and RBW = 430kHz and VBW = 1.3MHz (Channel Bandwidth: 20MHz). The 26dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 26dB.

4.4.3 Test Setup

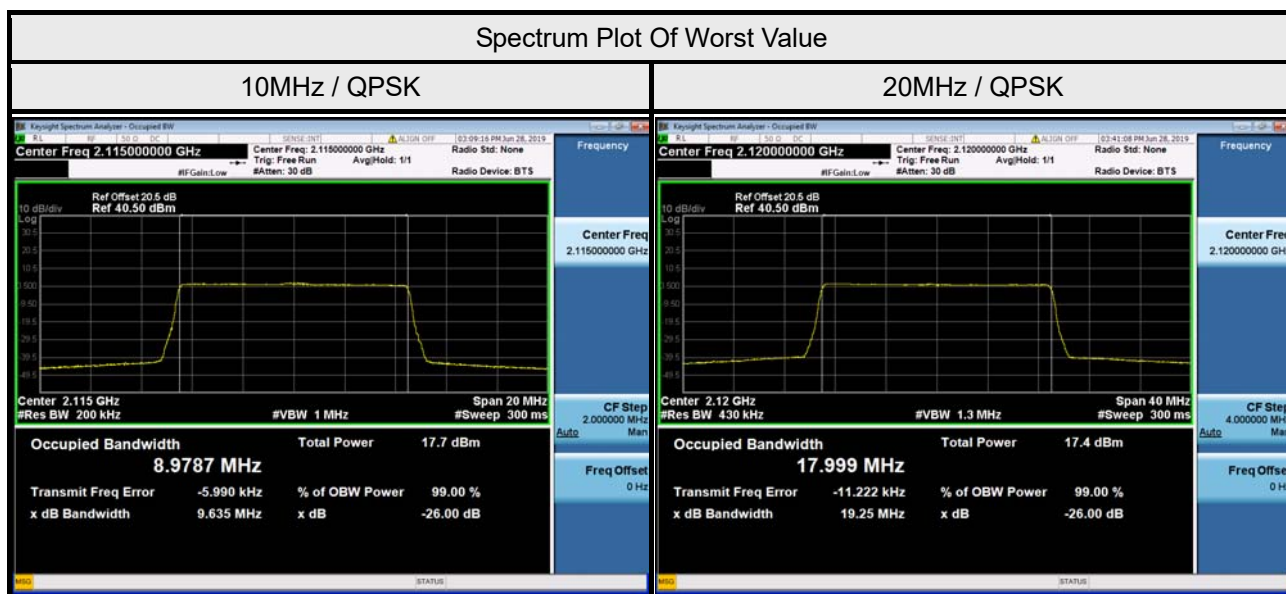


4.4.4 Test Result

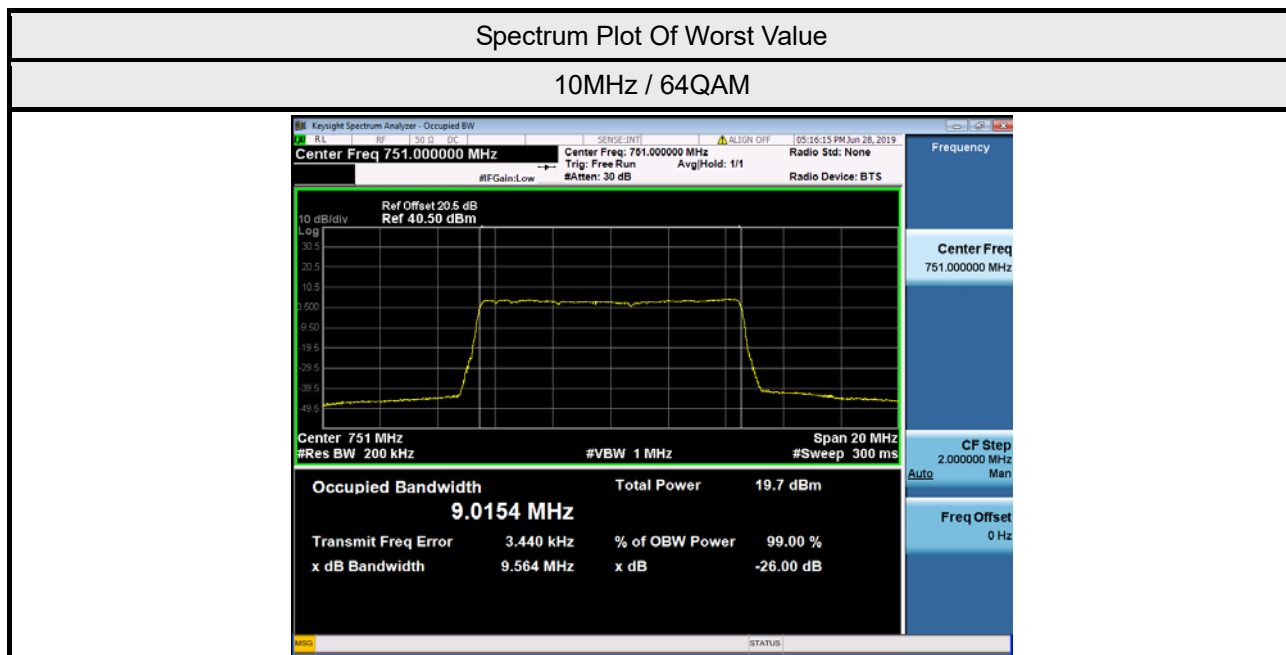
LTE Band 4							
Channel Bandwidth 10MHz							
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)					
		QPSK		16QAM		64QAM	
		Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1
2000	2115	8.98	8.98	8.99	8.99	8.98	8.98
2175	2132.5	8.98	8.97	8.98	8.98	8.98	8.98
2350	2150	8.98	8.98	8.99	8.99	8.98	8.98
Channel Bandwidth 20MHz							
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)					
		QPSK		16QAM		64QAM	
		Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1
2050	2120	18.00	18.00	18.02	18.02	18.01	18.01
2175	2132.5	17.97	17.96	17.98	17.98	17.98	17.97
2300	2145	17.93	17.94	17.96	17.95	17.94	17.95



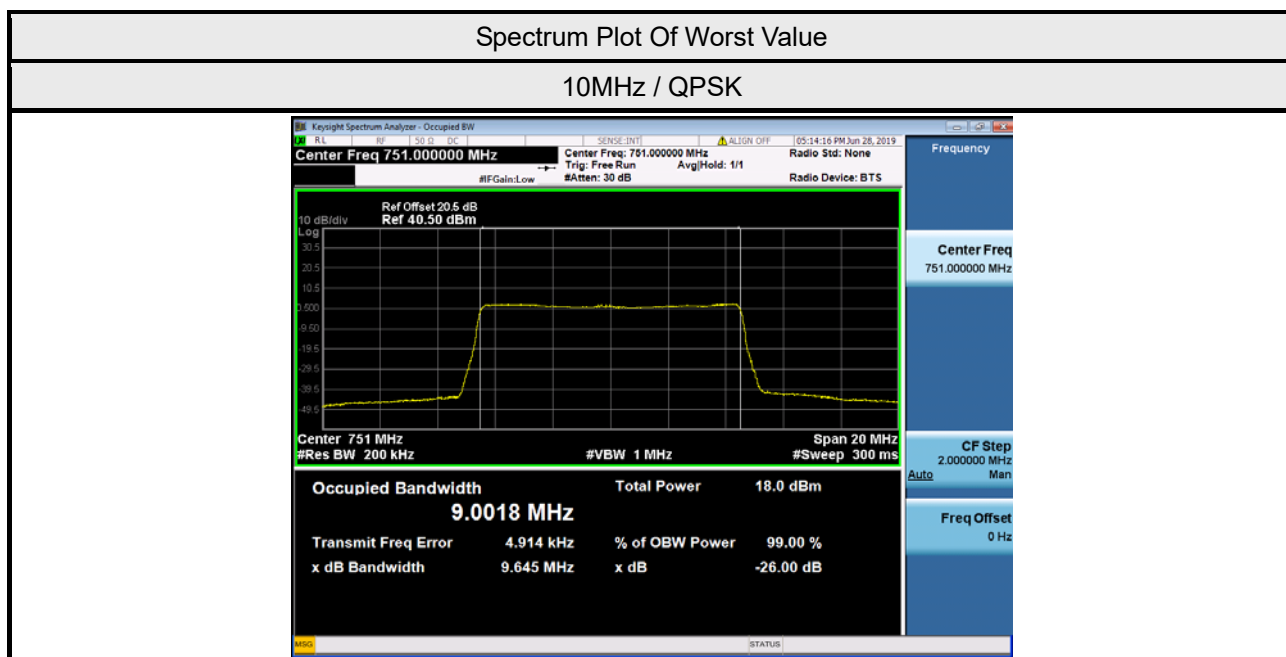
LTE Band 4							
Channel Bandwidth 10MHz							
Channel	Frequency (MHz)	26dBc Bandwidth (MHz)					
		QPSK		16QAM		64QAM	
		Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1
2000	2115	9.60	9.64	9.58	9.59	9.54	9.56
2175	2132.5	9.60	9.59	9.58	9.57	9.56	9.54
2350	2150	9.62	9.59	9.56	9.54	9.55	9.54
Channel Bandwidth 20MHz							
Channel	Frequency (MHz)	26dBc Bandwidth (MHz)					
		QPSK		16QAM		64QAM	
		Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1
2050	2120	19.24	19.25	19.18	19.16	19.17	19.13
2175	2132.5	19.21	19.17	19.15	19.16	19.14	19.12
2300	2145	19.18	19.16	19.10	19.12	19.09	19.07



LTE Band 13							
Channel Bandwidth 10MHz							
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)					
		QPSK		16QAM		64QAM	
		Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1
5230	751	9.00	9.00	9.01	9.01	9.01	9.02



LTE Band 13							
Channel Bandwidth 10MHz							
Channel	Frequency (MHz)	26dBc Bandwidth (MHz)					
		QPSK		16QAM		64QAM	
		Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1
5230	751	9.64	9.65	9.58	9.57	9.56	9.56



4.5 Band Edge Measurement

4.5.1 Limits of Band Edge Measurement

For LTE Band 4

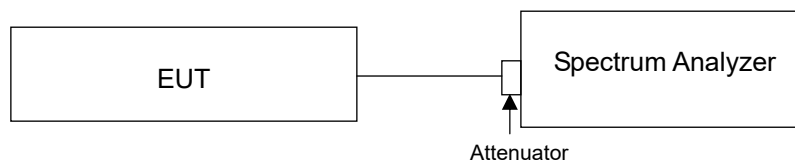
According to FCC 27.53(h) for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB.

For LTE Band 13

According to FCC 27.53(c) (2) for 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.

Note: The results for each of the transmit chains shall be individually compared with the limits after these limits have been reduced by $10 \times \log (N)$ (number of active transmit chains).

4.5.2 Test Setup



4.5.3 Test Procedures

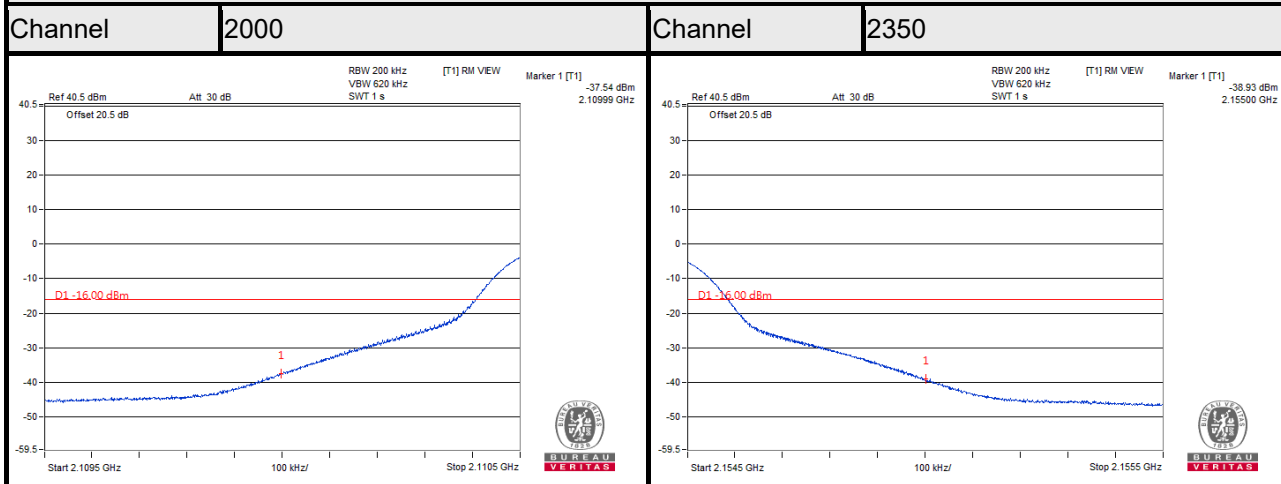
- The EUT was set up for the rated peak power. The power was measured with Spectrum Analyzer. All measurements were done at 2 channels: low and high operational frequency range.
- The center frequency of spectrum is the band edge frequency and span is 200kHz. RB of the spectrum is 200kHz and VB of the spectrum is 620kHz (LTE Channel Bandwidth 10MHz).
- The center frequency of spectrum is the band edge frequency and span is 400kHz. RB of the spectrum is 430kHz and VB of the spectrum is 1300kHz (LTE Channel Bandwidth 20MHz).
- Record the max trace plot into the test report.

4.5.4 Test Results

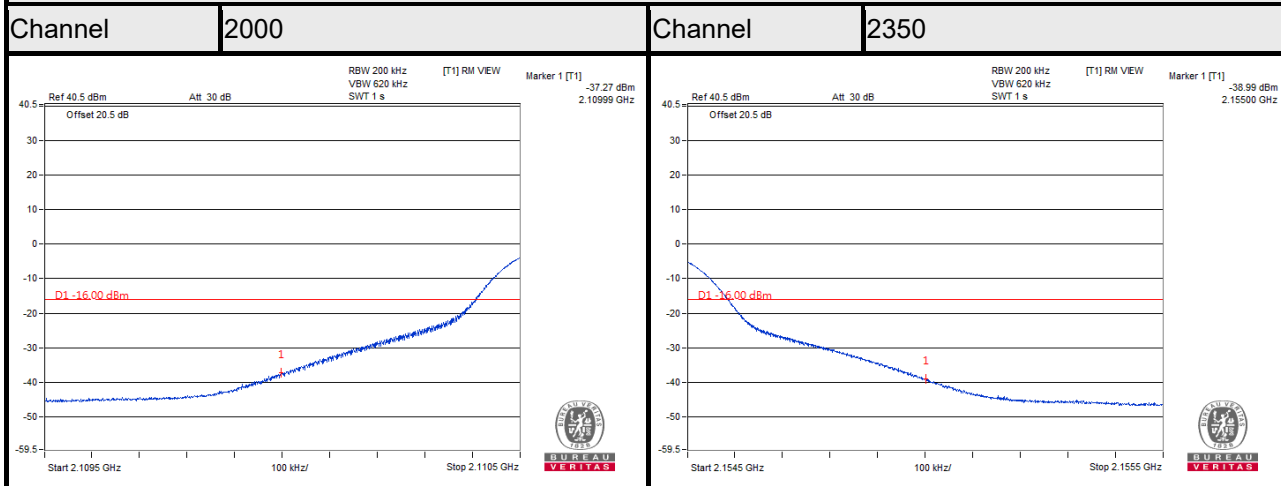
LTE Band 4

Channel Bandwidth 10MHz

Chain 0



Chain 1

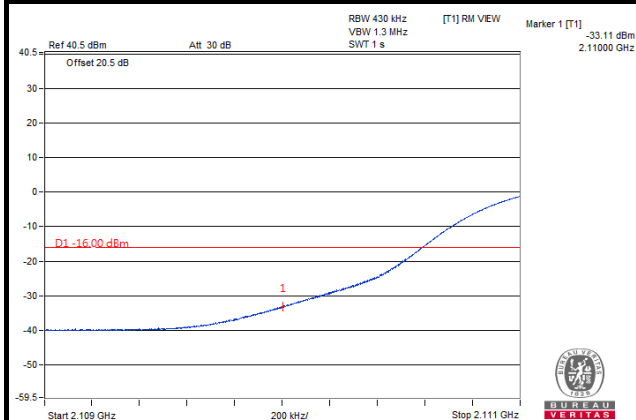


LTE Band 4

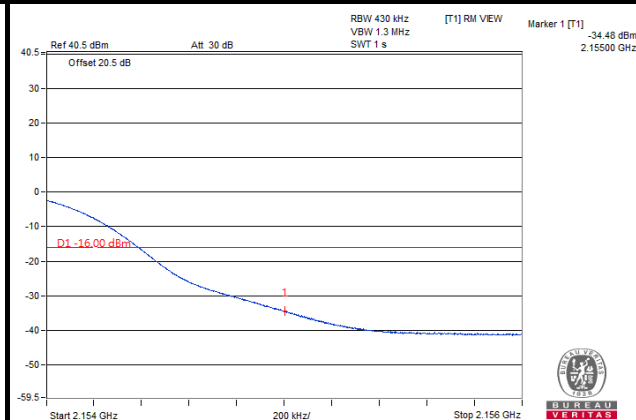
Channel Bandwidth 20MHz

Chain 0

Channel 2050

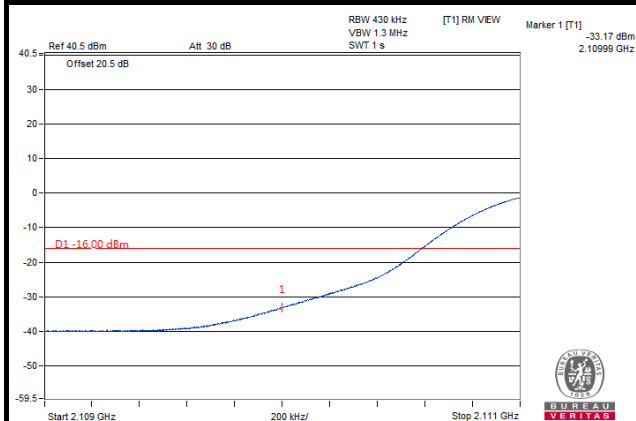


Channel 2300

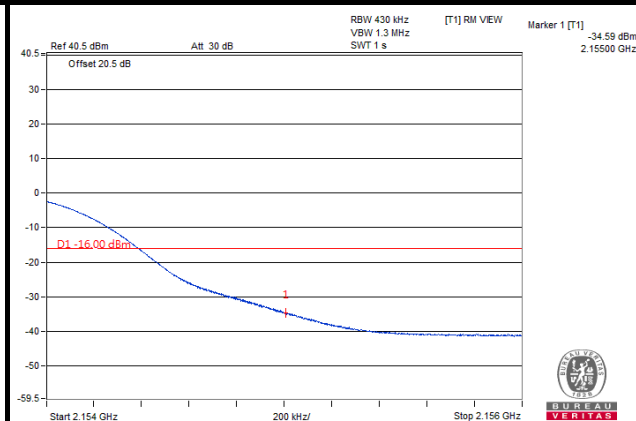


Chain 1

Channel 2050



Channel 2300

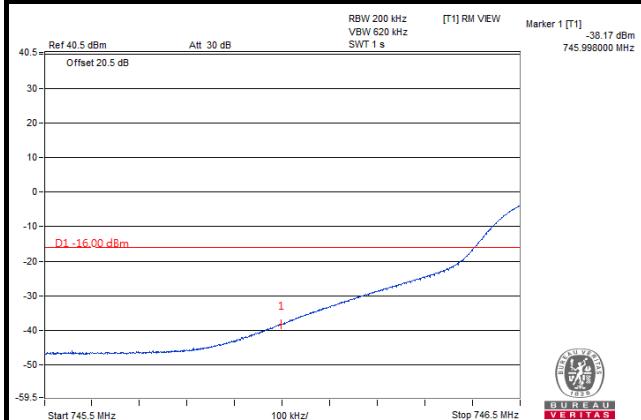


LTE Band 13

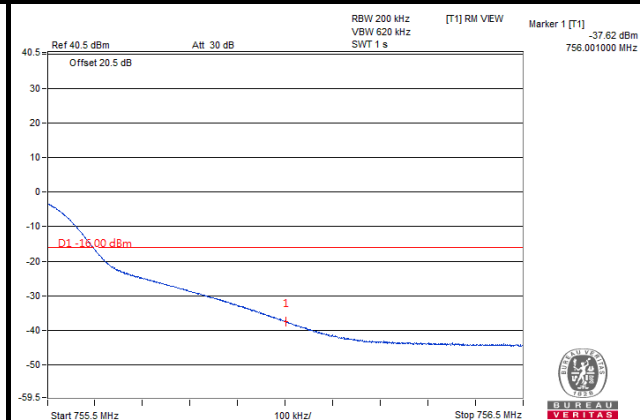
Channel Bandwidth 10MHz

Chain 0

Channel 5230

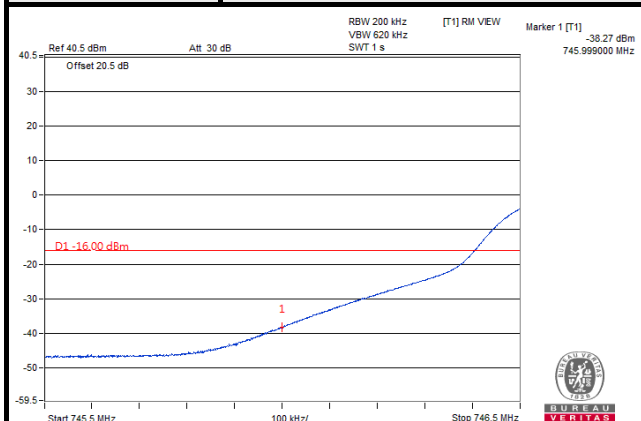


Channel 5230

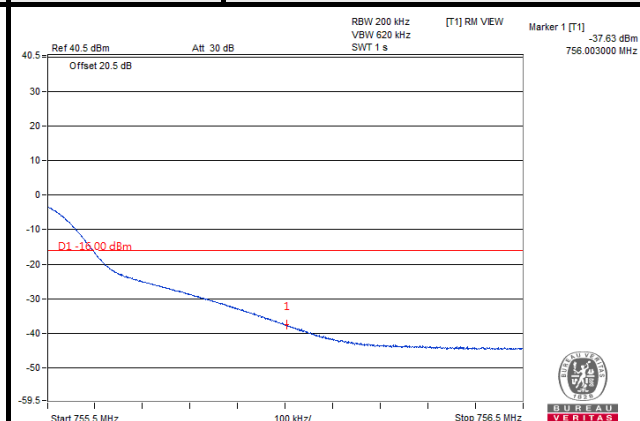


Chain 1

Channel 5230



Channel 5230

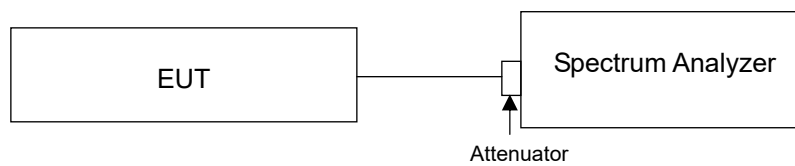


4.6 Peak to Average Ratio

4.6.1 Limits of Peak to Average Ratio Measurement

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB

4.6.2 Test Setup

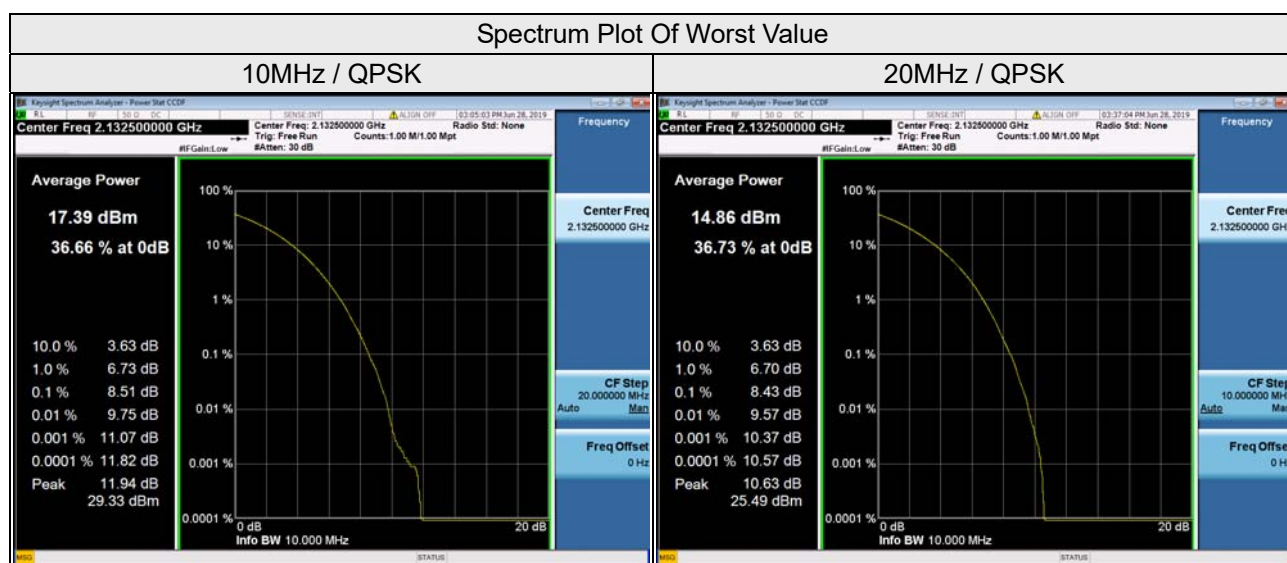


4.6.3 Test Procedures

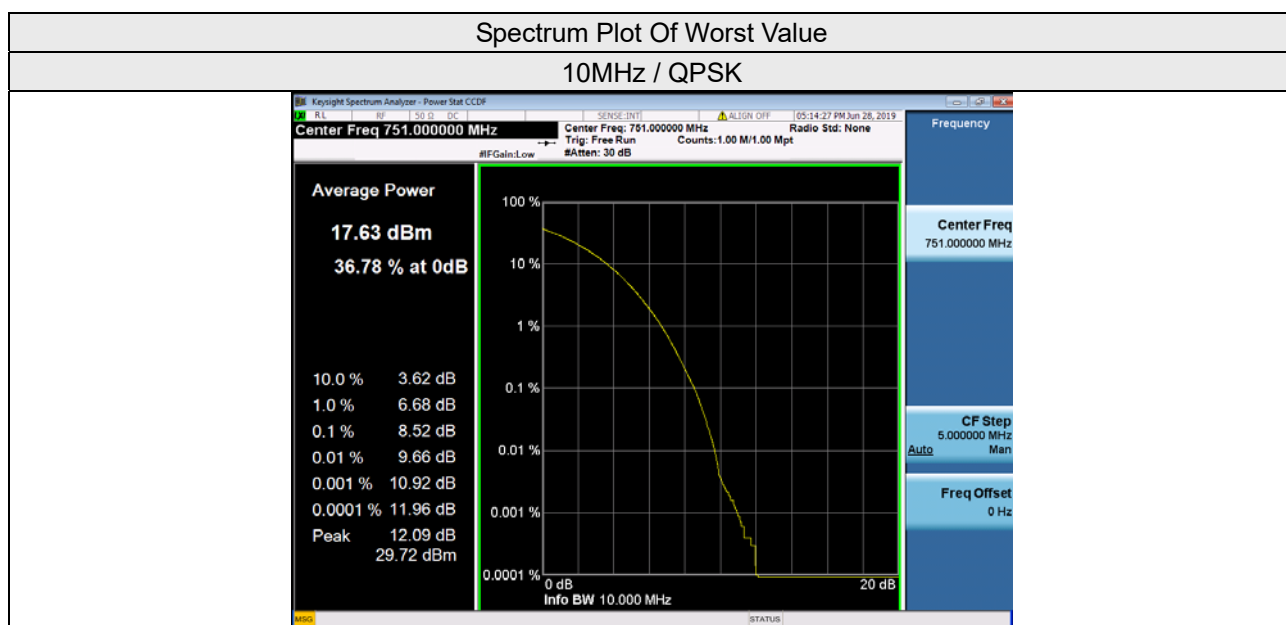
- Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth;
- Set the number of counts to a value that stabilizes the measured CCDF curve;
- Record the maximum PAPR level associated with a probability of 0.1%.

4.6.4 Test Results

LTE Band 4							
Channel Bandwidth 10MHz							
Channel	Frequency (MHz)	Peak To Average Ratio (dB)					
		QPSK		16QAM		64QAM	
		Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1
2000	2115.0	8.49	8.39	8.45	8.32	8.39	8.30
2175	2132.5	8.51	8.42	8.48	8.40	8.36	8.37
2350	2150.0	8.42	8.39	8.38	8.35	8.32	8.32
Channel Bandwidth 20MHz							
Channel	Frequency (MHz)	Peak To Average Ratio (dB)					
		QPSK		16QAM		64QAM	
		Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1
2050	2120.0	8.34	8.39	8.32	8.35	8.30	8.32
2175	2132.5	8.43	8.42	8.39	8.37	8.35	8.35
2300	2145.0	8.38	8.41	8.33	8.36	8.29	8.34



LTE Band 13							
Channel Bandwidth 10MHz							
Channel	Frequency (MHz)	Peak To Average Ratio (dB)					
		QPSK		16QAM		64QAM	
		Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1
5230	751.0	8.51	8.52	8.47	8.48	8.42	8.45



4.7 Conducted Spurious Emissions

4.7.1 Limits of Conducted Spurious Emissions Measurement

For LTE Band 4

According to FCC 27.53(h) for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB.

For LTE Band 13

According to FCC 27.53(c) (2) for 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.

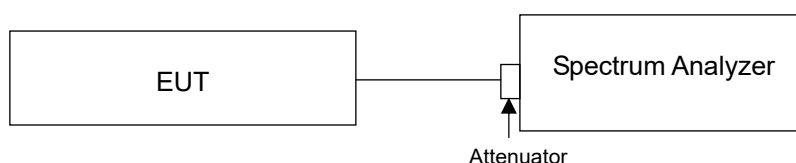
According to FCC 27.53(c) (3) for on all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $76 + 10 \log (P)$ dB in a 6.25 kHz band segment, for base and fixed stations.

Part 27.53 (f) For operations in the 746-758 MHz, 775-788 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.

Note:

1. The results for each of the transmit chains shall be individually compared with the limits after these limits have been reduced by $10 \times \log (N)$ (number of active transmit chains).
2. The other emission levels were very low against the limit in the band 1559-1610

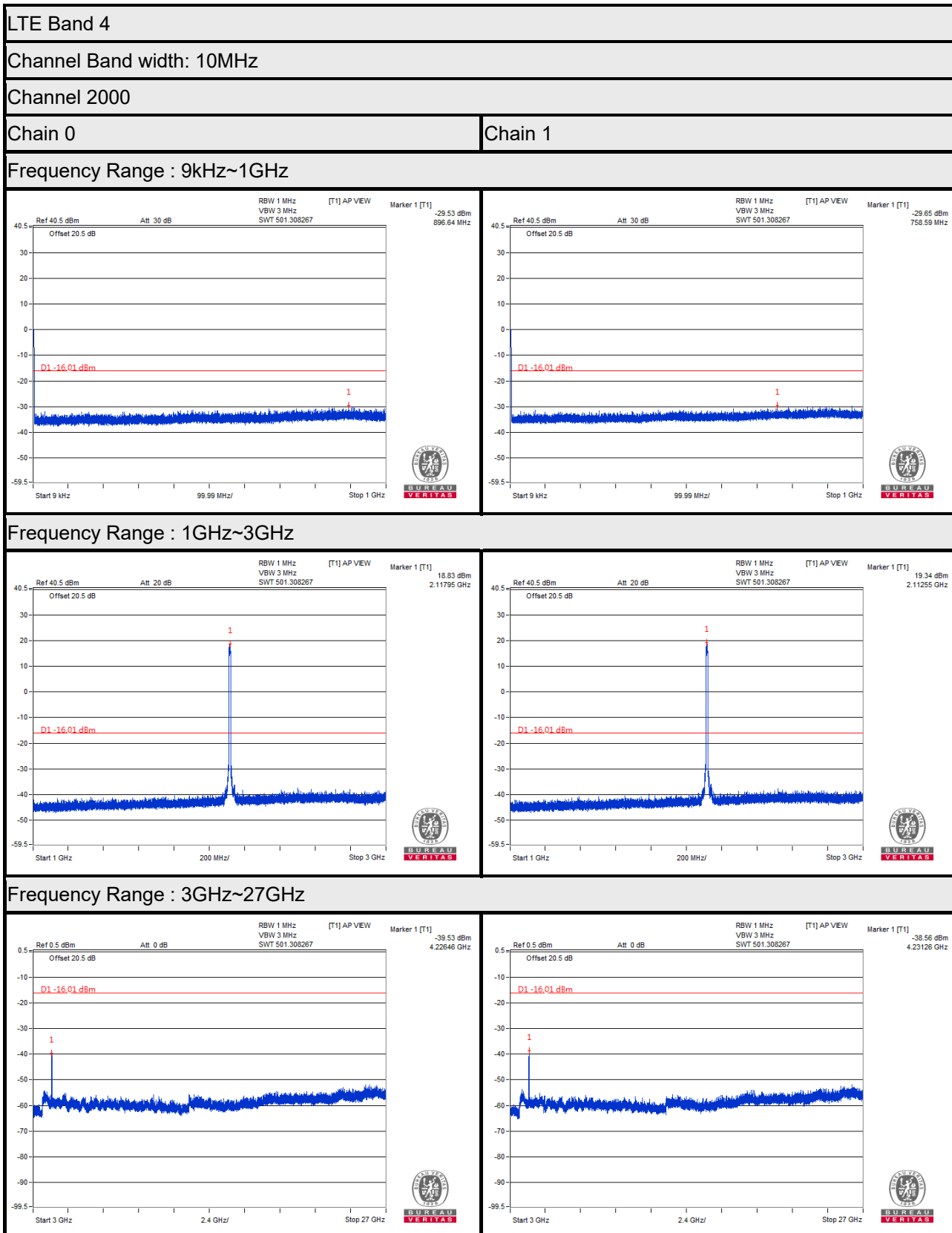
4.7.2 Test Setup



4.7.3 Test Procedure

- a. All measurements were done at 3 channels: low, middle and high operational frequency range.
- b. When the spectrum scanned from 9kHz to 27GHz, it shall be connected to the 20dB pad attenuated the carried frequency. The spectrum set RB = 1MHz, VB = 3MHz. (LTE Band 4)
- c. When the spectrum scanned from 9kHz to 27GHz, it shall be connected to the 20dB pad attenuated the carried frequency. The spectrum set RB = 100kHz, VB = 300kHz for frequency range: 9kHz~1GHz, RB = 1MHz, VB = 3MHz for frequency range: 1GHz~27GHz, RB = 6.25kHz, VB = 20kHz for frequency range: 763MHz ~ 775MHz and 793MHz ~ 805MHz. (LTE Band 13)

4.7.4 Test Results



LTE Band 4

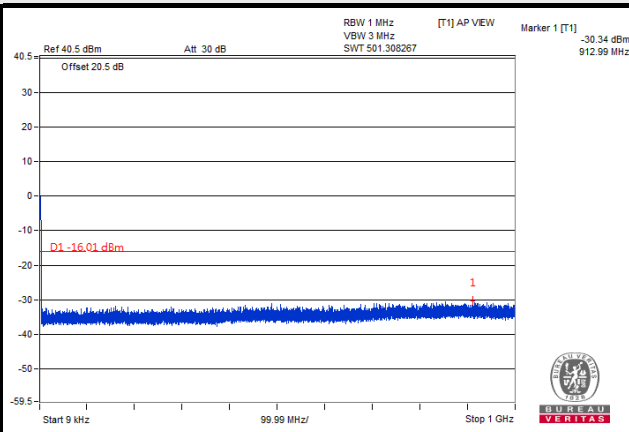
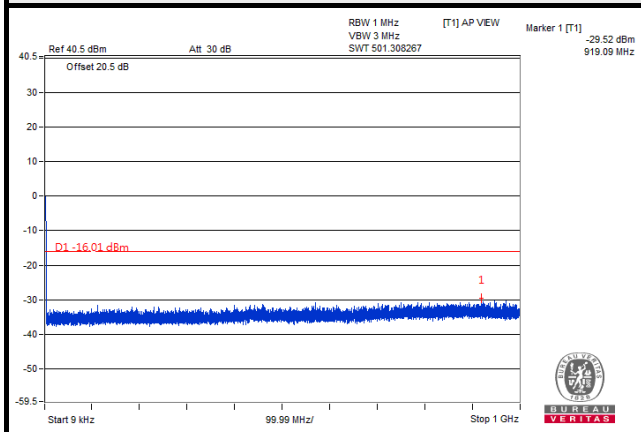
Channel Band width: 10MHz

Channel 2175

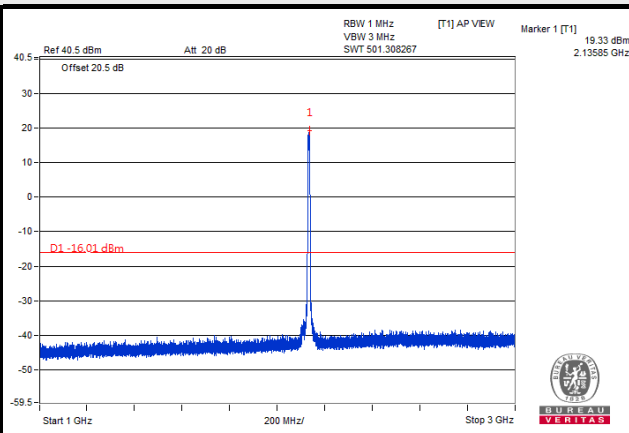
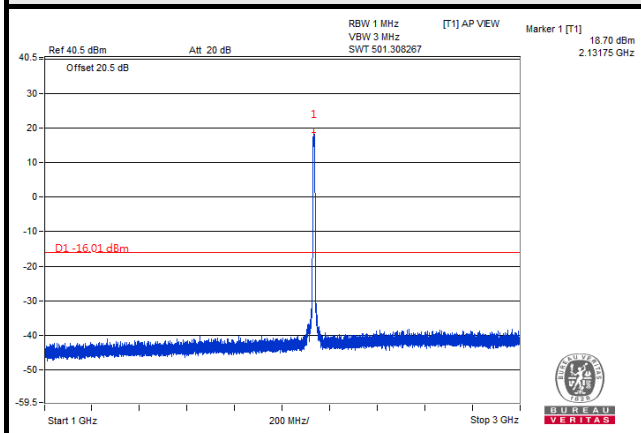
Chain 0

Chain 1

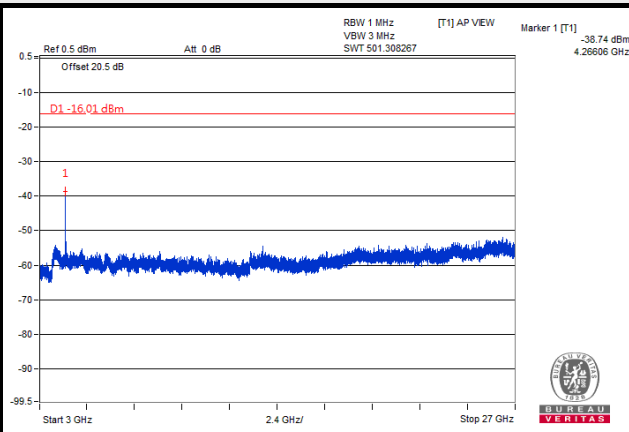
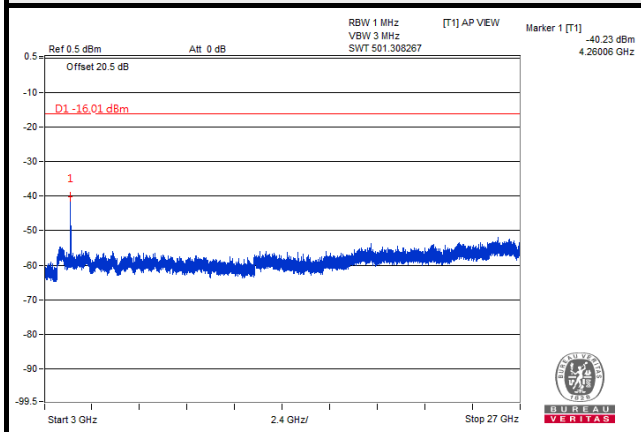
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3GHz



Frequency Range : 3GHz~27GHz



LTE Band 4

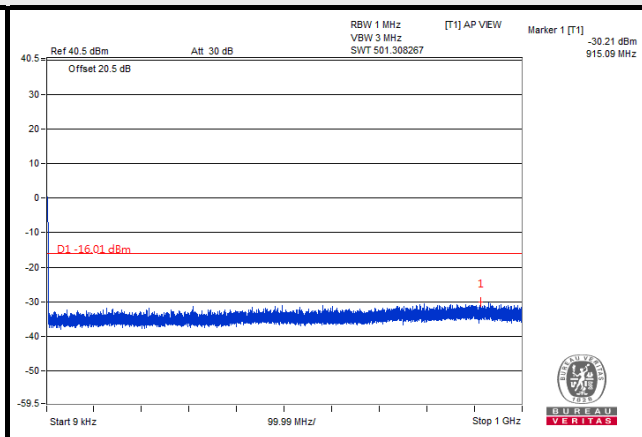
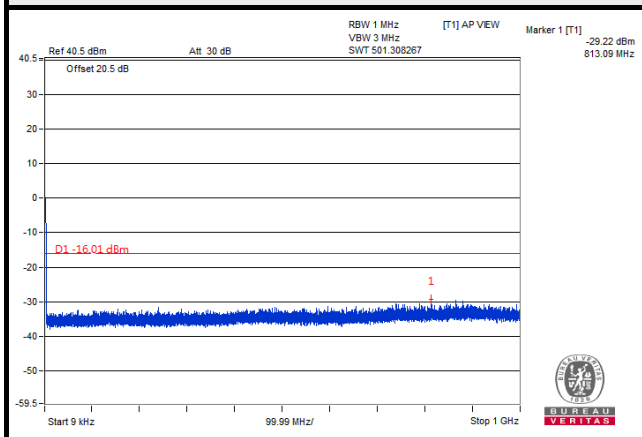
Channel Band width: 10MHz

Channel 2350

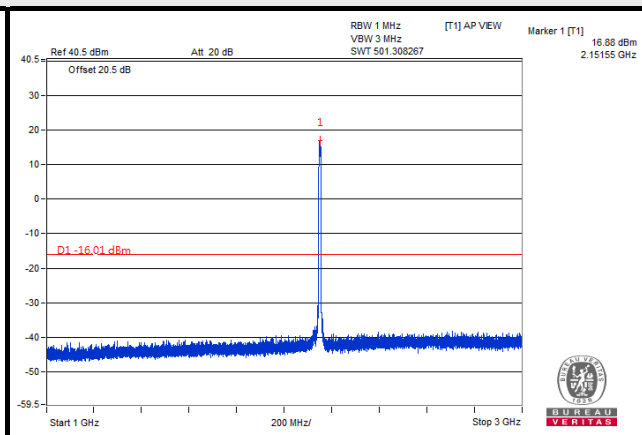
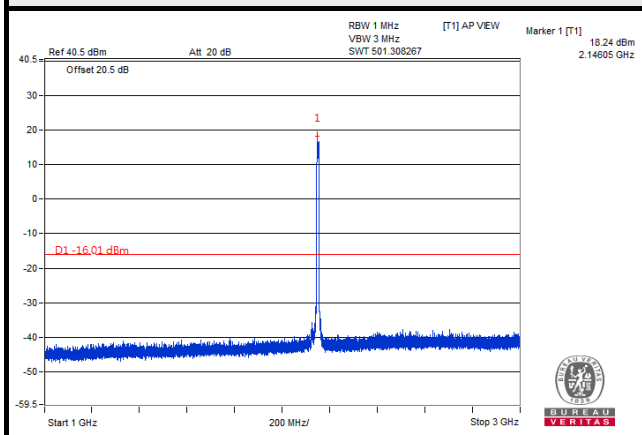
Chain 0

Chain 1

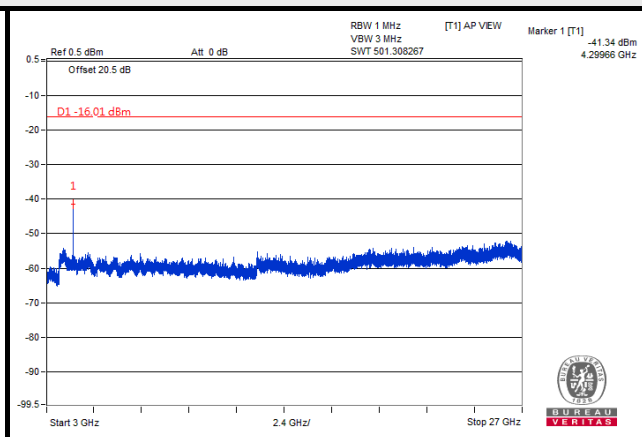
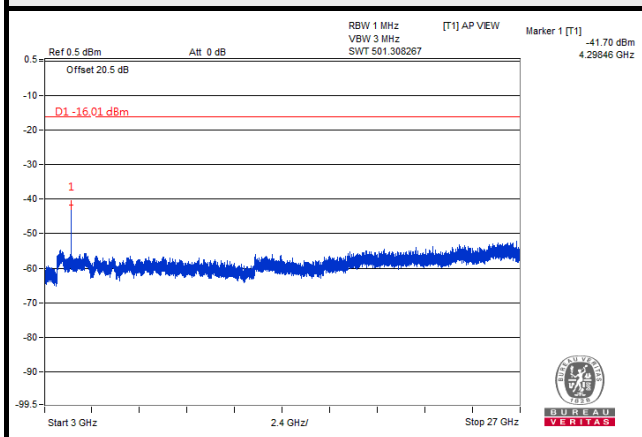
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3GHz



Frequency Range : 3GHz~27GHz



LTE Band 4

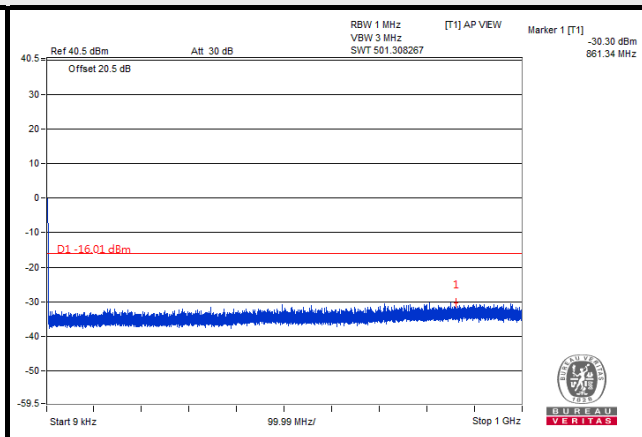
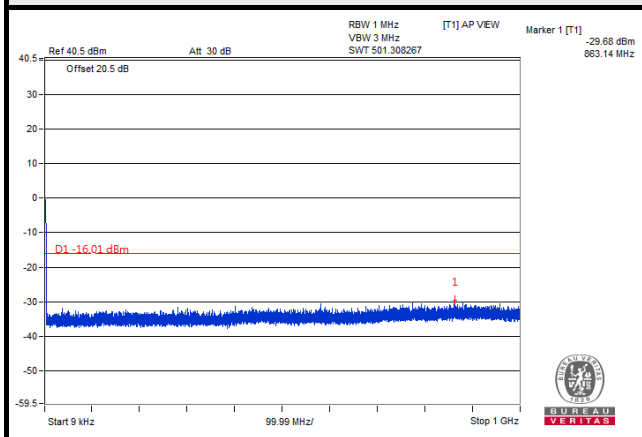
Channel Band width: 20MHz

Channel 2050

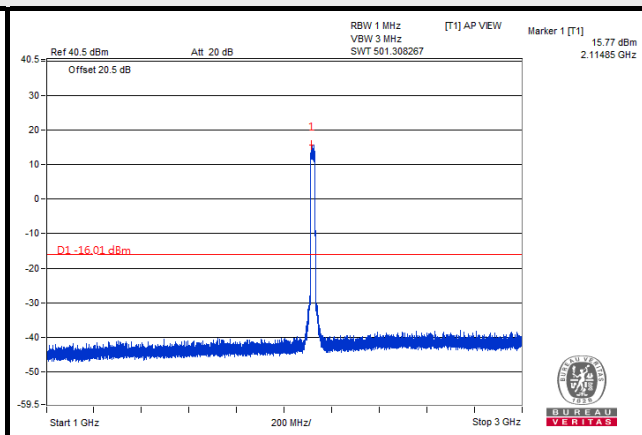
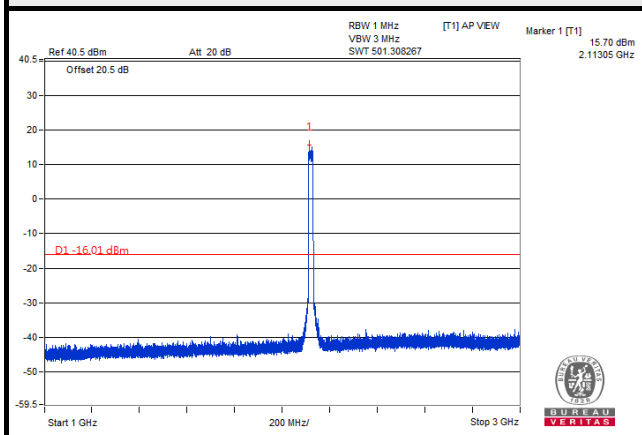
Chain 0

Chain 1

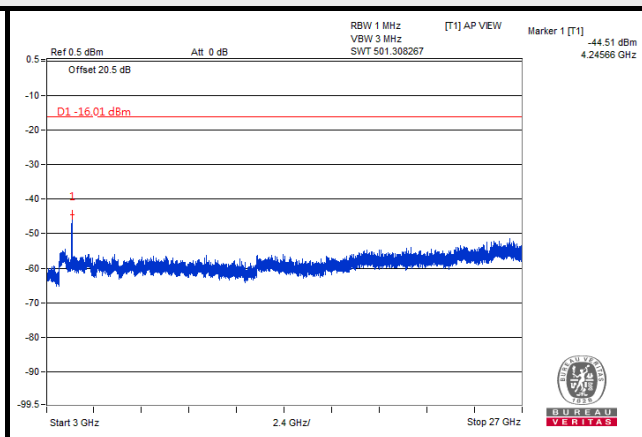
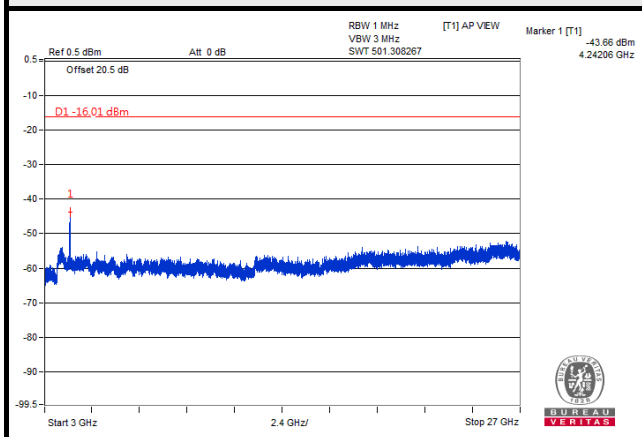
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3GHz



Frequency Range : 3GHz~27GHz



LTE Band 4

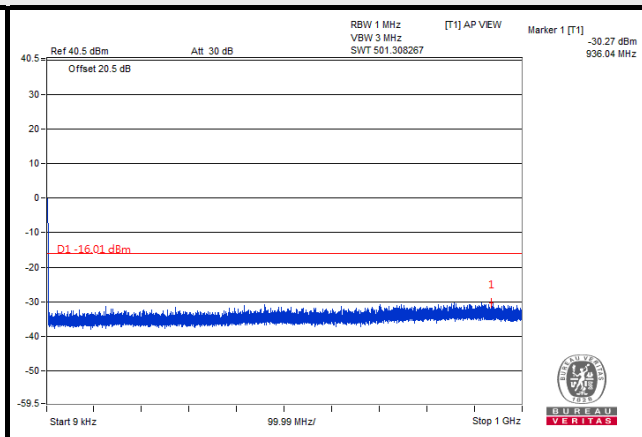
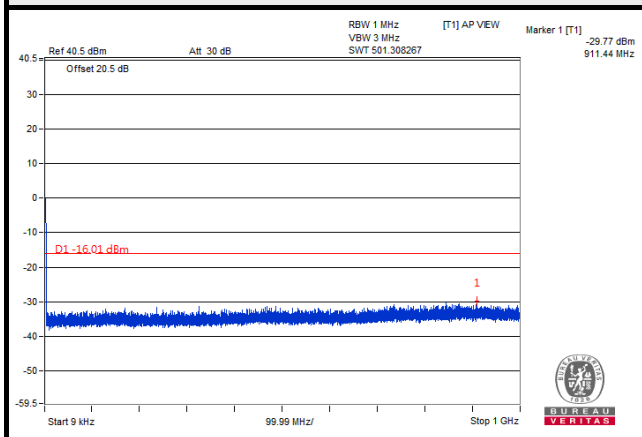
Channel Band width: 20MHz

Channel 2175

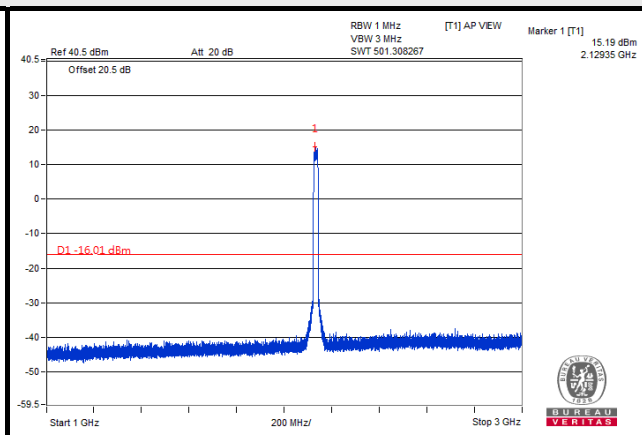
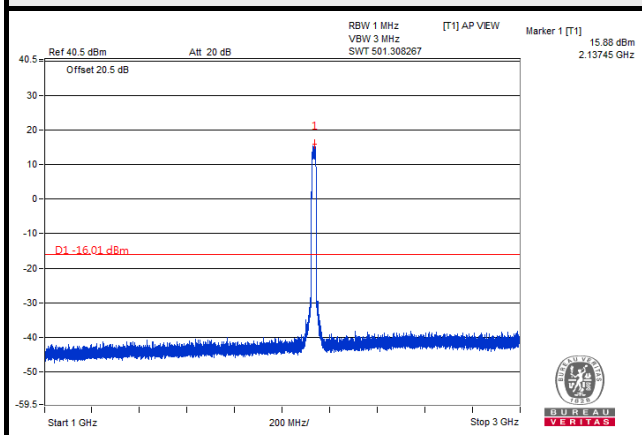
Chain 0

Chain 1

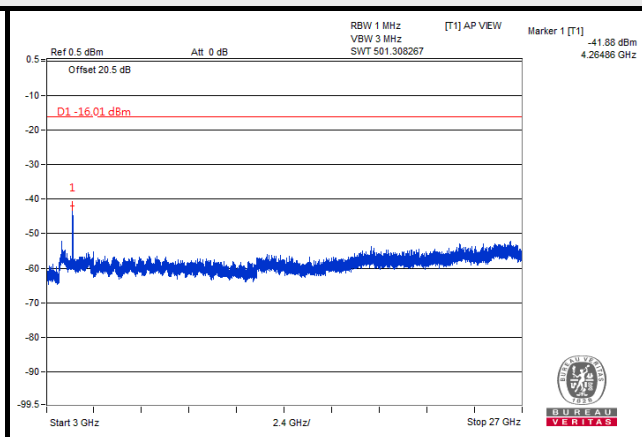
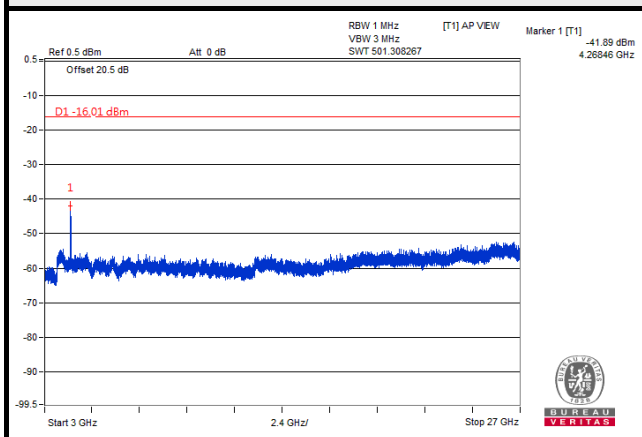
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3GHz



Frequency Range : 3GHz~27GHz



LTE Band 4

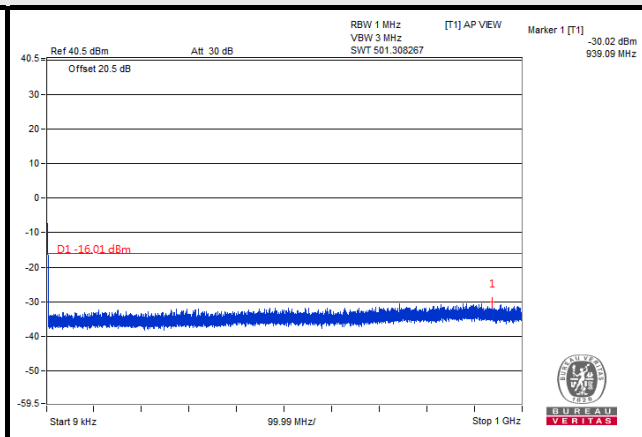
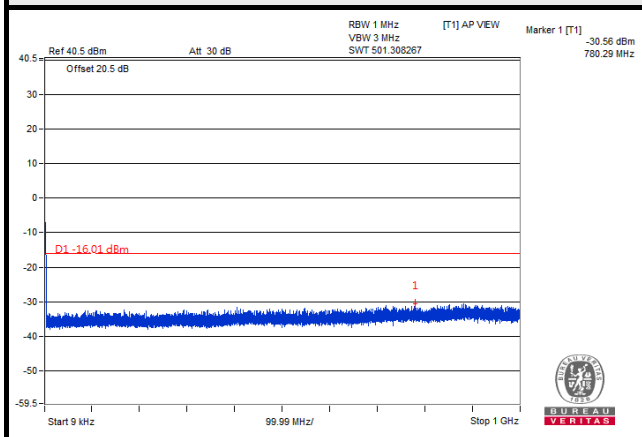
Channel Band width: 20MHz

Channel 2300

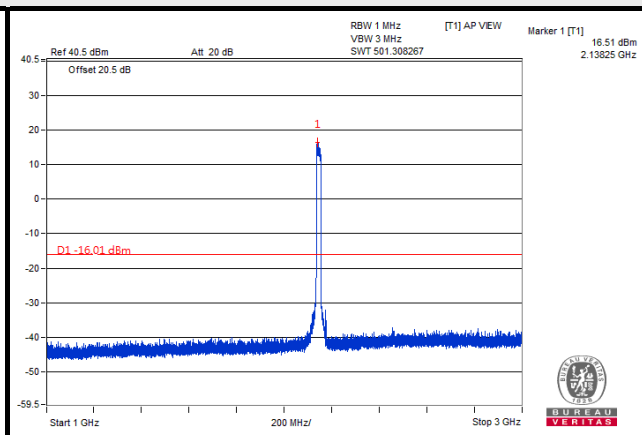
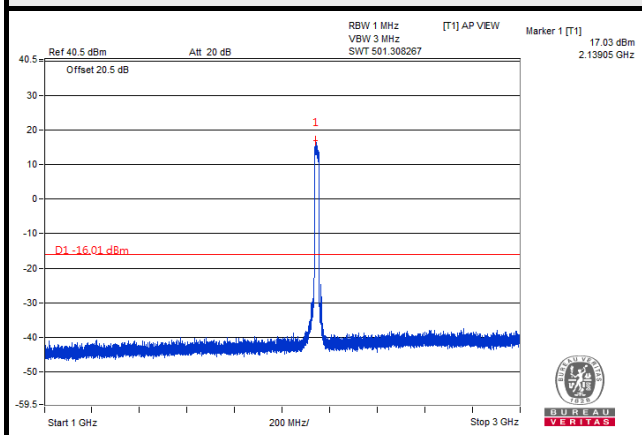
Chain 0

Chain 1

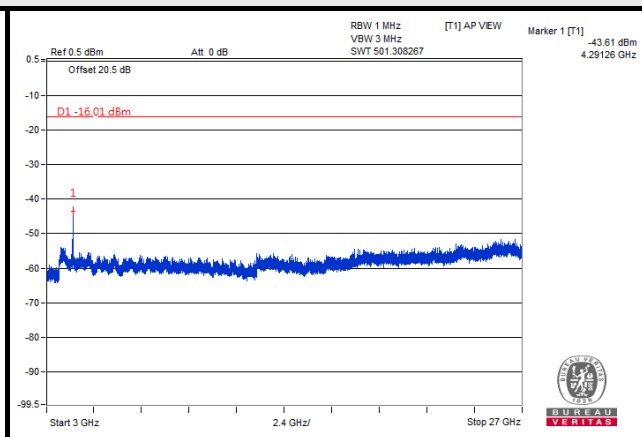
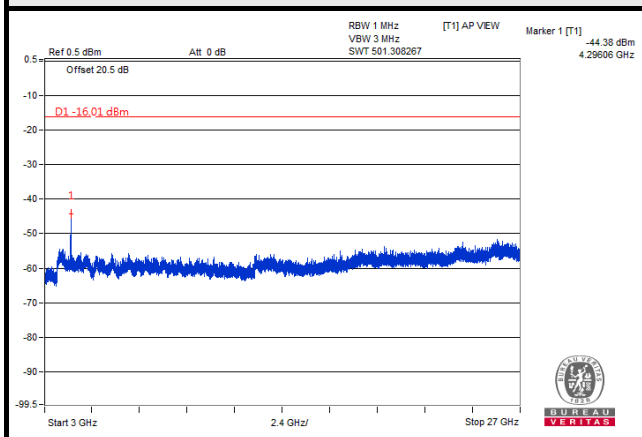
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3GHz



Frequency Range : 3GHz~27GHz



LTE Band 13

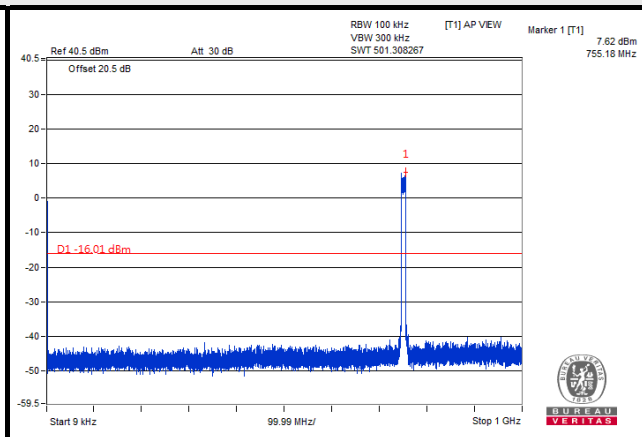
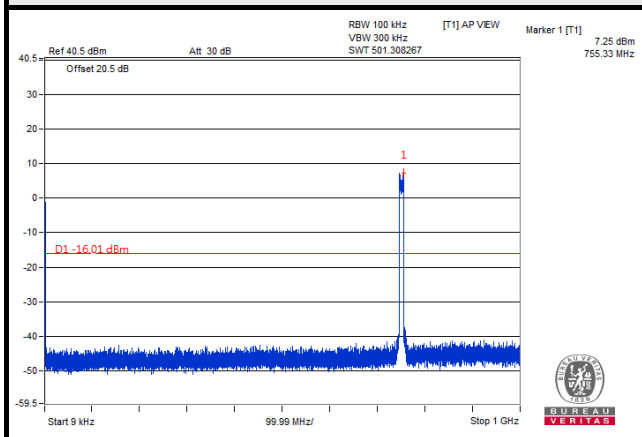
Channel Band width: 10MHz

Channel 5230

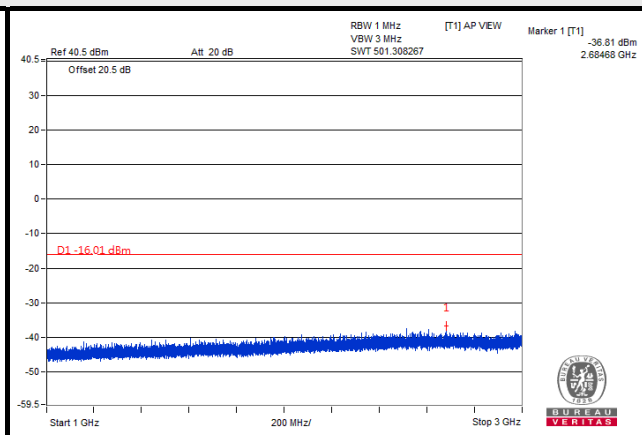
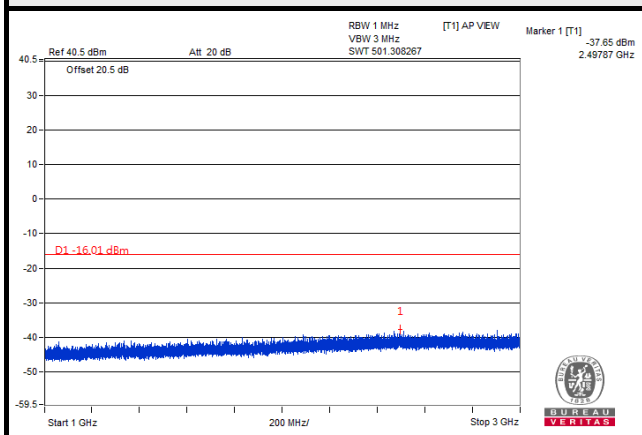
Chain 0

Chain 1

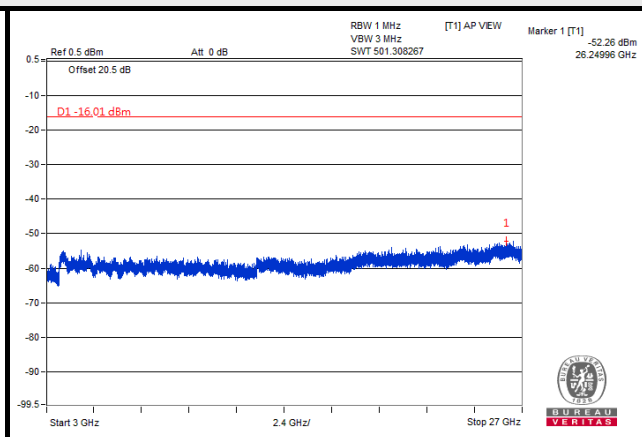
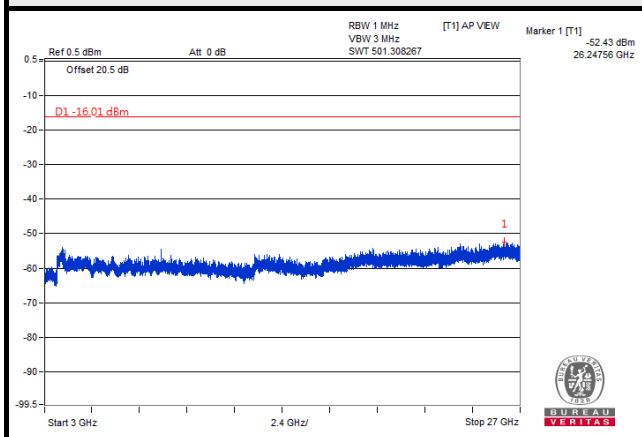
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3GHz



Frequency Range : 3GHz~27GHz



LTE Band 13

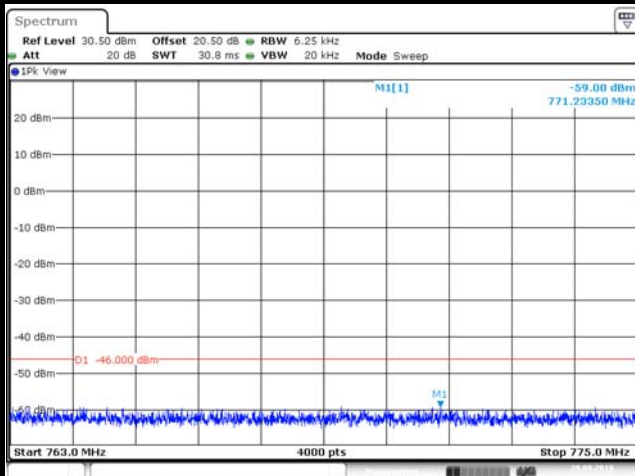
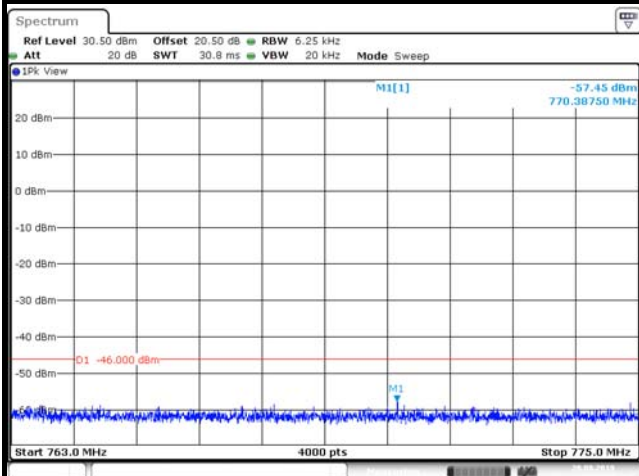
Channel Band width: 10MHz

Channel 5230

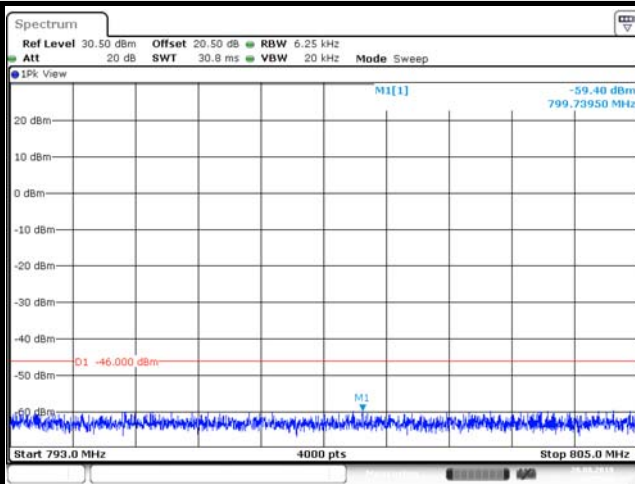
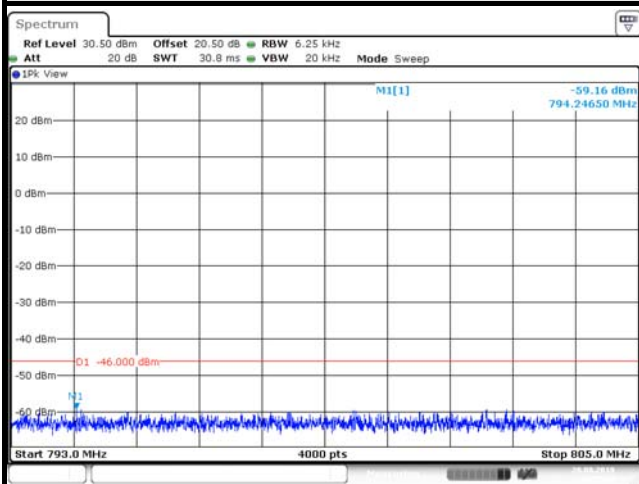
Chain 0

Chain 1

Frequency Range : 763MHz~775MHz



Frequency Range : 793MHz~805MHz



4.8 Radiated Emission Measurement

4.8.1 Limits of Radiated Emission Measurement

For LTE Band 4

According to FCC 27.53(h) for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB.

For LTE Band 13

According to FCC 27.53(c) (2) for 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.

4.8.2 Test Procedure

- a. The power was measured with R&S Spectrum Analyzer. All measurements were done at 3 channels (low, middle and high channel of operational frequency range.)
- b. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- c. The substitution antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value" of step b. Record the power level of S.G
- d. $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution antenna}$.

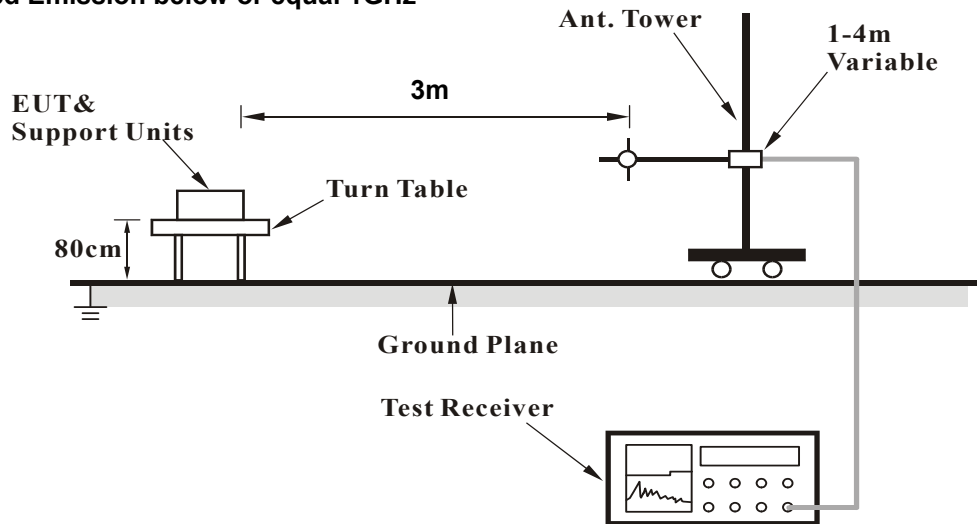
Note: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.

4.8.3 Deviation from Test Standard

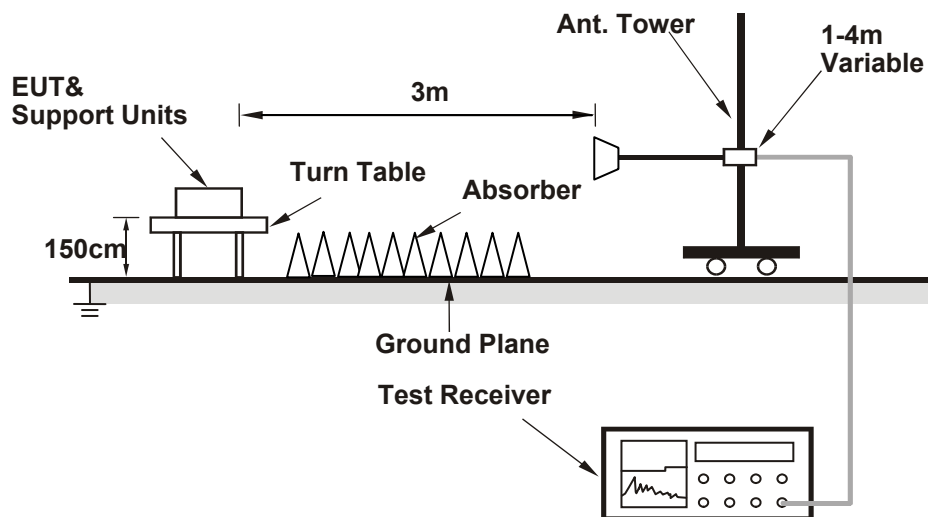
No deviation.

4.8.4 Test Setup

For Radiated Emission below or equal 1GHz



For Radiated Emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.8.5 Test Results

Below 1GHz

LTE Band 4

Channel Bandwidth: 10MHz

Mode	TX channel 2000	Frequency Range	Below 1000 MHz
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Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	185.08	-60.45	-81.57	13.22	-68.35	-13.00	-55.35
2	224.97	-61.03	-81.67	12.80	-68.87	-13.00	-55.87
3	275.05	-67.30	-85.65	15.46	-70.19	-13.00	-57.19
4	325.00	-57.98	-75.74	16.97	-58.77	-13.00	-45.77
5	374.96	-67.27	-85.15	18.25	-66.90	-13.00	-53.90
6	499.96	-69.78	-87.09	21.29	-65.80	-13.00	-52.80
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	35.82	-63.48	-80.47	13.26	-67.21	-13.00	-54.21
2	224.97	-56.72	-76.99	12.80	-64.19	-13.00	-51.19
3	325.00	-62.56	-79.46	16.97	-62.49	-13.00	-49.49
4	374.96	-64.21	-81.81	18.25	-63.56	-13.00	-50.56
5	474.99	-71.54	-90.44	20.87	-69.57	-13.00	-56.57
6	624.97	-74.91	-93.04	24.33	-68.71	-13.00	-55.71

NOTE: Power Value(dBm) = S.G Power Value(dBm) + Correction Factor(dB)

Channel Bandwidth: 20MHz

Mode	TX channel 2050	Frequency Range	Below 1000 MHz
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Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	184.72	-62.03	-83.11	13.24	-69.87	-13.00	-56.87
2	224.97	-61.19	-81.83	12.80	-69.03	-13.00	-56.03
3	275.05	-66.67	-85.02	15.46	-69.56	-13.00	-56.56
4	325.00	-57.70	-75.46	16.97	-58.49	-13.00	-45.49
5	374.96	-66.00	-83.88	18.25	-65.63	-13.00	-52.63
6	499.96	-68.71	-86.02	21.29	-64.73	-13.00	-51.73
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	33.03	-61.27	-80.41	12.98	-67.43	-13.00	-54.43
2	224.97	-58.32	-78.59	12.80	-65.79	-13.00	-52.79
3	325.00	-63.18	-80.08	16.97	-63.11	-13.00	-50.11
4	374.96	-63.95	-81.55	18.25	-63.30	-13.00	-50.30
5	474.99	-72.21	-91.11	20.87	-70.24	-13.00	-57.24
6	499.96	-72.38	-90.81	21.29	-69.52	-13.00	-56.52

NOTE: Power Value(dBm) = S.G Power Value(dBm) + Correction Factor(dB)

LTE Band 13

Channel Bandwidth: 10MHz

Mode	TX channel 5230	Frequency Range	Below 1000 MHz
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Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	183.14	-61.53	-82.42	13.33	-69.09	-13.00	-56.09
2	224.97	-59.66	-80.30	12.80	-67.50	-13.00	-54.50
3	275.05	-66.65	-85.00	15.46	-69.54	-13.00	-56.54
4	325.00	-57.81	-75.57	16.97	-58.60	-13.00	-45.60
5	374.96	-64.67	-82.55	18.25	-64.30	-13.00	-51.30
6	445.52	-73.21	-91.41	20.28	-71.13	-13.00	-58.13
7	499.96	-68.93	-86.24	21.29	-64.95	-13.00	-51.95
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	35.70	-63.46	-80.57	13.23	-67.34	-13.00	-54.34
2	184.84	-65.37	-86.82	13.23	-73.59	-13.00	-60.59
3	224.97	-57.92	-78.19	12.80	-65.39	-13.00	-52.39
4	325.00	-62.05	-78.95	16.97	-61.98	-13.00	-48.98
5	374.96	-62.11	-79.71	18.25	-61.46	-13.00	-48.46
6	474.99	-72.98	-91.88	20.87	-71.01	-13.00	-58.01
7	713.61	-71.37	-90.09	25.30	-64.79	-13.00	-51.79

NOTE: Power Value(dBm) = S.G Power Value(dBm) + Correction Factor(dB)

Above 1GHz

LTE Band 4

Channel Bandwidth: 10MHz

Mode	TX channel 2000	Frequency Range	Above 1000MHz
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Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	4231.89	-61.84	-68.97	13.33	-55.64	-13.00	-42.64
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	4233.32	-46.47	-53.58	13.33	-40.25	-13.00	-27.25

NOTE: Power Value(dBm) = S.G Power Value(dBm) + Correction Factor(dB)

Mode	TX channel 2175	Frequency Range	Above 1000MHz
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Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	4268.67	-59.80	-67.00	13.36	-53.64	-13.00	-40.64
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	4263.65	-52.44	-59.72	13.36	-46.36	-13.00	-33.36

NOTE: Power Value(dBm) = S.G Power Value(dBm) + Correction Factor(dB)

Mode	TX channel 2350	Frequency Range	Above 1000MHz
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Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	4302.54	-62.98	-70.23	13.39	-56.84	-13.00	-43.84
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	4305.23	-53.33	-60.78	13.39	-47.39	-13.00	-34.39

NOTE: Power Value(dBm) = S.G Power Value(dBm) + Correction Factor(dB)

Channel Bandwidth: 20MHz

Mode	TX channel 2050	Frequency Range	Above 1000MHz
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Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	4243.19	-64.03	-71.18	13.34	-57.84	-13.00	-44.84
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	4244.84	-49.42	-56.59	13.34	-43.25	-13.00	-30.25

NOTE: Power Value(dBm) = S.G Power Value(dBm) + Correction Factor(dB)

Mode	TX channel 2175	Frequency Range	Above 1000MHz
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Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	4266.69	-61.01	-68.21	13.36	-54.85	-13.00	-41.85
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	4261.59	-51.47	-58.73	13.35	-45.38	-13.00	-32.38

NOTE: Power Value(dBm) = S.G Power Value(dBm) + Correction Factor(dB)

Mode	TX channel 2300	Frequency Range	Above 1000MHz
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Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	4836.36	-61.71	-68.84	13.66	-55.18	-13.00	-42.18
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	4837.45	-52.99	-59.94	13.66	-46.28	-13.00	-33.28

NOTE: Power Value(dBm) = S.G Power Value(dBm) + Correction Factor(dB)

LTE Band 13

Channel Bandwidth: 10MHz

Mode	TX channel 5230	Frequency Range	Above 1000MHz
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Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	1506.39	-53.96	-63.78	8.36	-55.42	-13.00	-42.42
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	1506.30	-40.99	-50.89	8.36	-42.53	-13.00	-29.53

NOTE: Power Value(dBm) = S.G Power Value(dBm) + Correction Factor(dB)

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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