FCC Test Report

(Part 27: LTE Band 4, 13)

Report No.:	RF180731E06-3
FCC ID:	PKRNVWR1000
Test Model:	R1000
Received Date:	Jul. 31, 2018
Test Date:	Aug. 02 ~ Aug. 05, 2018
Issued Date:	Aug. 08, 2018
Applicant:	Novatel Wireless, Inc.
Address:	9605 Scranton Road Suite 300, San Diego, CA 92121 United States
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan, R.O.C.
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)
FCC Registration / Designation Number:	788550 / TW0003

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Release Control Record

Issue No.	Description	Date Issued
RF180731E06-3	Original release.	Aug. 08, 2018

1 Certificate of Conformity

Product: 4G LTE Wireless Router

Brand: Inseego

Test Model: R1000

Sample Status: Engineering sample

Applicant: Novatel Wireless, Inc.

Test Date: Aug. 02 ~ Aug. 05, 2018

Standards: FCC Part 27, Subpart C, L, F

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 EMC characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** Aug. 08, 2018

Polly Chien / Specialist

Approved by : _____ , **Date:** Aug. 08, 2018

Bruce Chen / Project Engineer

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)(4)	2.1046 27.50(b)(10)	Equivalent Isotropically Radiated Power	Pass	Meet the requirement of limit.
----	----	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(m)(6)	2.1049 27.53(m)(6)	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 -26.6dB at 71.71MHz.

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) (±)
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.59 dB
	200MHz ~1000MHz	3.60 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Test Site and Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver KEYSIGHT	N9038A	MY55420137	Apr. 11, 2018	Apr. 10, 2019
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	May 29, 2018	May 28, 2019
BILOG Antenna SCHWARZBECK	VULB9168	9168-148	Dec. 11, 2017	Dec. 10, 2018
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Dec. 12, 2017	Dec. 11, 2018
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Dec. 01, 2017	Nov. 30, 2018
Loop Antenna EMCI	EM-6879	269	Aug. 11, 2017	Aug. 10, 2018
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Aug. 08, 2017	Aug. 07, 2018
Preamplifier Agilent (Above 1GHz)	8449B	3008A01638	Feb. 22, 2018	Feb. 21, 2019
RF signal cable HUBER+SUHNER&EMCI	SUCOFLEX 104 & EMC104-SM-SM8000	CABLE-CH9-02 (248780+171006)	Jan. 15, 2018	Jan. 14, 2019
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250795/4)	Aug. 08, 2017	Aug. 07, 2018
RF signal cable Woken	8D-FB	Cable-CH9-01	Jul. 31, 2018	Jul. 30, 2019
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower &Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
WIT Standard Temperature And Humidity Chamber	TH-4S-C	W981030	Jun. 04, 2018	Jun. 03, 2019
JFW 20dB attenuation	50HF-020-SMA	NA	NA	NA

Note:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 9.
3. The FCC Designation Number is TW0003. The number will be varied with the Lab location and scope as attached.
4. The IC Site Registration No. is IC 7450F-9.

3 General Information

3.1 General Description of EUT

Product	4G LTE Wireless Router			
Brand	Inseego			
Test Model	R1000			
Status of EUT	Engineering sample			
Power Supply Rating	4.5 Vdc (Battery:1.5Vdc*3) 54Vdc (PoE)			
Modulation Type	QPSK, 16QAM			
Operating Frequency	LTE Band 4	Channel Bandwidth 5MHz	1712.5MHz ~ 1752.5MHz	
		Channel Bandwidth 10MHz	1715.0MHz ~ 1750.0MHz	
		Channel Bandwidth 15MHz	1717.5MHz ~ 1747.5MHz	
		Channel Bandwidth 20MHz	1720.0MHz ~ 1745.0MHz	
	LTE Band 13	Channel Bandwidth 5MHz	779.5MHz ~ 784.5MHz	
		Channel Bandwidth 10MHz	782MHz	
Max. EIRP Power	LTE Band 4	Channel Bandwidth 5MHz	316.228mW (25.0dBm)	
		Channel Bandwidth 10MHz	288.403mW (24.6dBm)	
		Channel Bandwidth 15MHz	389.045mW (25.9dBm)	
		Channel Bandwidth 20MHz	331.131mW (25.2dBm)	
Max. ERP Power	LTE Band 13	Channel Bandwidth 5MHz	309.030mW (24.9dBm)	
		Channel Bandwidth 10MHz	269.153mW (24.3dBm)	
Emission Designator			QPSK	16QAM
	LTE Band 4	Channel Bandwidth 5MHz	4M48G7D	4M9W7D
		Channel Bandwidth 10MHz	8M97G7D	8M97W7D
		Channel Bandwidth 15MHz	13M49G7D	13M48W7D
		Channel Bandwidth 20MHz	17M95G7D	17M97W7D
	LTE Band 13	Channel Bandwidth 5MHz	4M49G7D	4M49W7D
		Channel Bandwidth 10MHz	8M95G7D	8M95W7D
Antenna Type	Refer to Note for more details			
Antenna Connector	Refer to Note for more details			
Accessory Device	PoE			
Data Cable Supplied	1.0m non-shielded Ethernet cable without core			

Note:

1. The EUT consumes power from the following PoE.

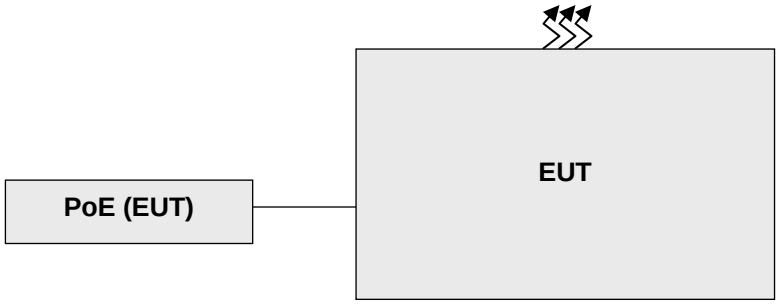
Brand	Leader
Model	UNA3-6540240-I1
Input Power	100-240Vac, 50/60Hz, 2.0A
Output Power	54Vdc, 2.4A
Power Line	1.8m non shielded AC power cable without core 1.4m DC power cable without core

2. The EUT uses following antennas.

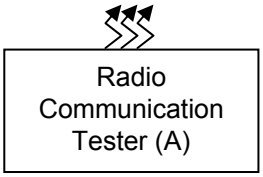
Frequency Range (MHz)	Antenna Type	Model	Antenna Connector	*Cable Length	Antenna Gain (dBi)
LTE Band 4	PCB	C037-511495	i-pex(MHF)	130mm	2.98
LTE Band 13					0.25

3.2 Configuration of System under Test

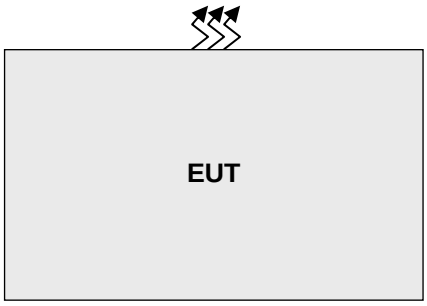
Mode A



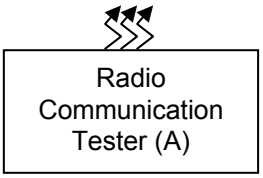
Remote site



Mode B



Remote site



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.	Radio Communication Tester	Anritsu	MT8820C	6201010284	NA	-

Note:

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

3.3 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on X-plane for LTE Band 4 and Z-plane for LTE Band 13. Following channel(s) was (were) selected for the final test as listed below:

Test results are presented in the report as below.

Test Mode	Test Condition
A	EUT with battery
B	EUT with adapter

LTE Band 4

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
A	Output Power	19975 to 20375	19975(1712.50MHz), 20175(1732.50MHz), 20375(1752.50MHz)	5MHz	QPSK	1 RB / 24 RB Offset
		20000 to 20350	20000(1715.00MHz), 20175(1732.50MHz), 20350(1750.00MHz)	10MHz	QPSK	1 RB / 49 RB Offset
		20025 to 20325	20025(1717.50MHz), 20175(1732.50MHz), 20325(1747.50MHz)	15MHz	QPSK	1 RB / 74 RB Offset
		20050 to 20300	20050(1720.00MHz), 20175(1732.50MHz), 20300(1745.00MHz)	20MHz	QPSK	1 RB / 99 RB Offset
A	Modulation characteristics	20050 to 20300	20175(1732.50MHz),	20MHz	QPSK	1 RB / 99 RB Offset
A	Frequency Stability	19975 to 20375	19975(1712.50MHz)	5MHz	QPSK	1 RB / 0 RB Offset
		20000 to 20350	20000(1715.00MHz)	10MHz	QPSK	1 RB / 0 RB Offset
		20025 to 20325	20025(1717.50MHz)	15MHz	QPSK	1 RB / 0 RB Offset
		20050 to 20300	20050(1720.00MHz)	20MHz	QPSK	1 RB / 0 RB Offset
A	Occupied Bandwidth	19975 to 20375	19975(1712.50MHz), 20175(1732.50MHz), 20375(1752.50MHz)	5MHz	QPSK, 16QAM	25 RB / 0 RB Offset
		20000 to 20350	20000(1715.00MHz), 20175(1732.50MHz), 20350(1750.00MHz)	10MHz	QPSK, 16QAM	50 RB / 0 RB Offset
		20025 to 20325	20025(1717.50MHz), 20175(1732.50MHz), 20325(1747.50MHz)	15MHz	QPSK, 16QAM	75 RB / 0 RB Offset
		20050 to 20300	20050(1720.00MHz), 20175(1732.50MHz), 20300(1745.00MHz)	20MHz	QPSK, 16QAM	100 RB / 0 RB Offset
A	Band Edge	19975 to 20375	19975(1712.50MHz), 20375(1752.50MHz)	5MHz	QPSK	1 RB / 0 RB Offset 1 RB / 24 RB Offset 25 RB / 0 RB Offset
		20000 to 20350	20000(1715.00MHz), 20350(1750.00MHz)	10MHz	QPSK	1 RB / 0 RB Offset 1 RB / 49 RB Offset 50 RB / 0 RB Offset
		20025 to 20325	20025(1717.50MHz), 20325(1747.50MHz)	15MHz	QPSK	1 RB / 0 RB Offset 1 RB / 74 RB Offset 75 RB / 0 RB Offset
		20050 to 20300	20050(1720.00MHz), 20300(1745.00MHz)	20MHz	QPSK	1 RB / 0 RB Offset 1 RB / 99 RB Offset 100 RB / 0 RB Offset

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
A	Conducted Emission	19975 to 20375	19975(1712.50MHz), 20175(1732.50MHz), 20375(1752.50MHz)	5MHz	QPSK	1 RB / 0 RB Offset
		20000 to 20350	20000(1715.00MHz), 20175(1732.50MHz), 20350(1750.00MHz)	10MHz	QPSK	1 RB / 0 RB Offset
		20025 to 20325	20025(1717.50MHz), 20175(1732.50MHz), 20325(1747.50MHz)	15MHz	QPSK	1 RB / 0 RB Offset
		20050 to 20300	20050(1720.00MHz), 20175(1732.50MHz), 20300(1745.00MHz)	20MHz	QPSK	1 RB / 0 RB Offset
A, B	Radiated Emission Below 1GHz	19975 to 20375	19975(1712.50MHz)	5MHz	QPSK	1 RB / 0 RB Offset
		20000 to 20350	20000(1715.00MHz)	10MHz	QPSK	1 RB / 0 RB Offset
		20025 to 20325	20025(1717.50MHz)	15MHz	QPSK	1 RB / 0 RB Offset
		20050 to 20300	20050(1720.00MHz)	20MHz	QPSK	1 RB / 0 RB Offset
A	Radiated Emission Above 1GHz	19975 to 20375	19975(1712.50MHz), 20175(1732.50MHz), 20375(1752.50MHz)	5MHz	QPSK	1 RB / 0 RB Offset
		20000 to 20350	20000(1715.00MHz), 20175(1732.50MHz), 20350(1750.00MHz)	10MHz	QPSK	1 RB / 0 RB Offset
		20025 to 20325	20025(1717.50MHz), 20175(1732.50MHz), 20325(1747.50MHz)	15MHz	QPSK	1 RB / 0 RB Offset
		20050 to 20300	20050(1720.00MHz), 20175(1732.50MHz), 20300(1745.00MHz)	20MHz	QPSK	1 RB / 0 RB Offset

LTE Band 13

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
A	Output Power	23205 to 23255	23205(779.50MHz), 23230(782.00MHz), 23255(784.50MHz)	5MHz	QPSK	1 RB / 0 RB Offset
		23230	23230(782.00MHz)	10MHz	QPSK	1 RB / 0 RB Offset
A	Modulation characteristics	23230	23230(782.0MHz),	10MHz	QPSK	1 RB / 0 RB Offset
A	Frequency Stability	23205 to 23255	23230(782.00MHz)	5MHz	QPSK	1 RB / 0 RB Offset
A	Emission Bandwidth	23205 to 23255	23205(779.50MHz), 23230(782.00MHz), 23255(784.50MHz)	5MHz	QPSK, 16QAM	25 RB / 0 RB Offset
		23230	23230(782.00MHz)	10MHz	QPSK, 16QAM	50 RB / 0 RB Offset
A	Channel Edge	23205 to 23255	23205(779.50MHz), 23255(784.50MHz)	5MHz	QPSK	1 RB / 0 RB Offset 1 RB / 24 RB Offset 25 RB / 0 RB Offset
		23230	23230(782.00MHz)	10MHz	QPSK	1 RB / 0 RB Offset 1 RB / 49 RB Offset 50 RB / 0 RB Offset
A	Conducted Emission	23205 to 23255	23205(779.50MHz), 23230(782.00MHz), 23255(784.50MHz)	5MHz	QPSK	1 RB / 0 RB Offset
		23230	23230(782.00MHz)	10MHz	QPSK	1 RB / 0 RB Offset
A, B	Radiated Emission Below 1GHz	23205 to 23255	23205(779.50MHz)	5MHz	QPSK	1 RB / 0 RB Offset
		23230	23230(782.00MHz)	10MHz	QPSK	1 RB / 0 RB Offset
A	Radiated Emission Above 1GHz	23205 to 23255	23205(779.50MHz), 23230(782.00MHz), 23255(784.50MHz)	5MHz	QPSK	1 RB / 0 RB Offset
		23230	23230(782.00MHz)	10MHz	QPSK	1 RB / 0 RB Offset

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 and 16QAM, measured value of QPSK is higher than 16QAM mode. Therefore, only Emission Bandwidth had been tested under QPSK and 16QAM modes, the others test items were performed under QPSK mode only.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
Output Power	24deg. C, 64%RH	120Vac, 60Hz	Match Tsui
Modulation characteristics	24deg. C, 64%RH	120Vac, 60Hz	Match Tsui
Frequency Stability	24deg. C, 64%RH	54Vdc	Match Tsui
Emission Bandwidth	24deg. C, 64%RH	120Vac, 60Hz	Match Tsui
Channel Edge	24deg. C, 64%RH	120Vac, 60Hz	Match Tsui
Conducted Emission	24deg. C, 64%RH	120Vac, 60Hz	Match Tsui
Radiated Emission Below 1GHz	22deg. C, 66%RH	120Vac, 60Hz 4.5Vdc	Han Wu
Radiated Emission Above 1GHz	22deg. C, 66%RH	120Vac, 60Hz	Han Wu

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-C 2004

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

Mobile / Portable station are limited to 1 watts e.i.r.p for LTE Band 4 and 3 watts e.r.p for LTE Band 13.

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 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 = Output power level of S.G – TX cable loss + 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 power = E.I.R.P power - 2.15dBi.

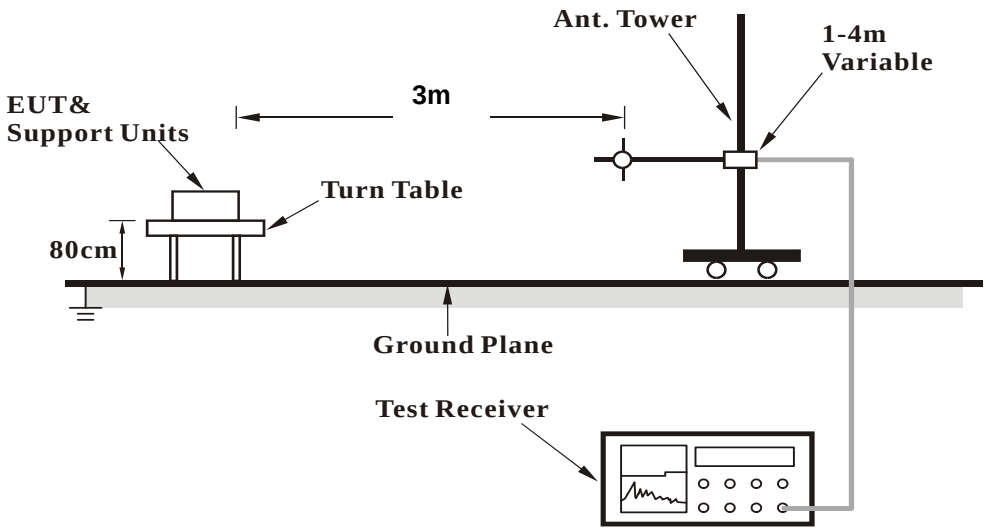
Conducted Power Measurement:

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.

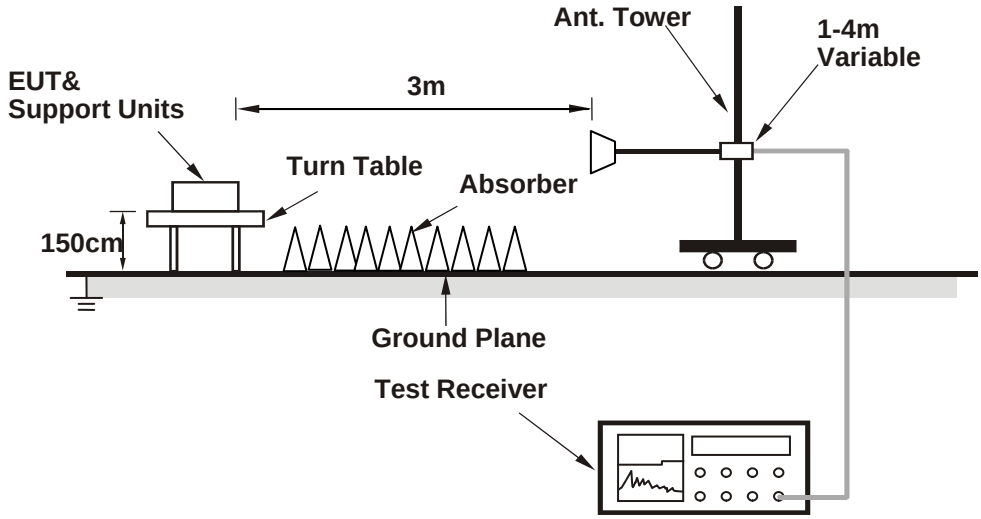
4.1.3 Test Setup

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)

Band / BW	RB Size	RB Offset	QPSK			16QAM		
			Low CH 19975	Mid CH 20175	High CH 20375	Low CH 19975	Mid CH 20175	High CH 20375
			1712.5 MHz	1732.5 MHz	1752.5 MHz	1712.5 MHz	1732.5 MHz	1752.5 MHz
4 / 5M	1	0	24.82	23.91	24.34	23.50	22.71	23.10
	1	12	24.72	23.83	24.21	23.57	22.71	23.31
	1	24	24.61	23.57	24.11	23.39	22.57	22.93
	12	0	23.67	22.77	23.23	22.56	21.61	22.16
	12	6	23.44	22.48	23.06	22.51	21.57	21.98
	12	13	23.32	22.42	22.91	22.27	21.42	21.89
	25	0	23.71	22.68	23.12	22.56	21.63	22.22
Band / BW	RB Size	RB Offset	QPSK			16QAM		
			Low CH 20000	Mid CH 20175	High CH 20350	Low CH 20000	Mid CH 20175	High CH 20350
			1715 MHz	1732.5 MHz	1750 MHz	1715 MHz	1732.5 MHz	1750 MHz
4 / 10M	1	0	24.84	23.98	24.40	23.67	22.74	23.21
	1	24	24.75	23.79	24.28	23.64	22.72	23.23
	1	49	24.55	23.57	24.07	23.54	22.54	22.96
	25	0	23.75	22.78	23.31	22.67	21.60	22.17
	25	12	23.54	22.64	23.09	22.47	21.48	22.07
	25	25	23.44	22.48	23.02	22.41	21.44	21.93
	50	0	23.67	22.76	23.26	22.66	21.73	22.27
Band / BW	RB Size	RB Offset	QPSK			16QAM		
			Low CH 20025	Mid CH 20175	High CH 20325	Low CH 20025	Mid CH 20175	High CH 20325
			1717.5 MHz	1732.5 MHz	1747.5 MHz	1717.5 MHz	1732.5 MHz	1747.5 MHz
4 / 15M	1	0	24.92	24.01	24.45	23.79	22.87	23.36
	1	37	24.80	23.87	24.36	23.73	22.88	23.32
	1	74	24.54	23.61	24.16	23.56	22.65	23.13
	36	0	23.82	22.83	23.31	22.70	21.76	22.13
	36	19	23.67	22.66	23.09	22.59	21.60	22.06
	36	39	23.52	22.56	23.10	22.47	21.48	21.89
	75	0	23.73	22.75	23.36	22.65	21.78	22.24

Band / BW	RB Size	RB Offset	QPSK			16QAM		
			Low CH 20050	Mid CH 20175	High CH 20300	Low CH 20050	Mid CH 20175	High CH 20300
			1720 MHz	1732.5 MHz	1745 MHz	1720 MHz	1732.5 MHz	1745 MHz
4 / 20M	1	0	24.96	24.04	24.53	23.93	22.97	23.49
	1	50	24.84	23.94	24.43	23.75	22.89	23.39
	1	99	24.59	23.71	24.25	23.60	22.64	23.25
	50	0	23.84	22.89	23.44	22.69	21.84	22.23
	50	25	23.62	22.67	23.25	22.64	21.73	22.19
	50	50	23.57	22.62	23.14	22.51	21.63	22.09
	100	0	23.78	22.85	23.31	22.78	21.84	22.36

Band / BW	RB Size	RB Offset	QPSK			16QAM		
			Low CH 23205	Mid CH 23230	High CH 23255	Low CH 23205	Mid CH 23230	High CH 23255
			779.5 MHz	782 MHz	784.5 MHz	779.5 MHz	782 MHz	784.5 MHz
13 / 5M	1	0	22.93	23.01	22.95	21.94	22.02	21.91
	1	12	22.89	22.94	22.91	21.81	21.88	21.80
	1	24	22.68	22.78	22.63	21.64	21.80	21.61
	12	0	21.93	22.00	21.99	20.89	21.02	20.93
	12	6	21.89	21.95	21.83	20.83	20.95	20.88
	12	13	21.83	21.92	21.78	20.77	20.91	20.81
	25	0	21.78	21.88	21.74	20.75	20.89	20.76

Band / BW	RB Size	RB Offset	QPSK	16QAM
			Mid CH 23230	Mid CH 23230
			782MHz	782MHz
13 / 10M	1	0	22.12	21.09
	1	24	22.06	21.02
	1	49	22.03	20.92
	25	0	21.21	20.02
	25	12	21.18	19.92
	25	25	21.15	19.89
	50	0	21.11	19.82

EIRP Power (dBm)

LTE Band 4

Channel Bandwidth: 5MHz

MODE		TX channel 19975					
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	1712.50	-15.7	22.4	0.7	23.1	30.0	-6.9
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	1712.50	-14.5	23.4	0.7	24.1	30.0	-5.9

MODE		TX channel 20175					
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	1732.50	-15.3	23.1	0.6	23.7	30.0	-6.3
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	1732.50	-13.9	24.4	0.6	**25.0**	30.0	-5.0

MODE		TX channel 20375					
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	1752.50	-15.7	23.1	0.5	23.6	30.0	-6.4
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	1752.50	-14.5	24.3	0.5	24.8	30.0	-5.2

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

Channel Bandwidth: 10MHz

MODE		TX channel 20000					
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	1715.00	-15.7	22.4	0.7	23.1	30.0	-6.9
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	1715.00	-14.0	23.9	0.7	**24.6**	30.0	-5.4

MODE		TX channel 20175					
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	1732.50	-15.8	22.6	0.6	23.2	30.0	-6.8
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	1732.50	-14.5	23.8	0.6	24.4	30.0	-5.6

MODE		TX channel 20350					
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	1750.00	-15.8	23.0	0.5	23.5	30.0	-6.5
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	1750.00	-15.3	23.5	0.5	24.0	30.0	-6.0

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

Channel Bandwidth: 15MHz

MODE		TX channel 20025					
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	1717.50	-14.5	23.6	0.7	24.3	30.0	-5.7
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	1717.50	-12.8	25.2	0.7	**25.9**	30.0	-4.1

MODE		TX channel 20175					
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	1732.50	-15.0	23.4	0.6	24.0	30.0	-6.0
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	1732.50	-14.0	24.3	0.6	24.9	30.0	-5.1

MODE		TX channel 20325					
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	1747.50	-14.8	23.9	0.5	24.4	30.0	-5.6
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	1747.50	-14.0	24.7	0.5	25.2	30.0	-4.8

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

Channel Bandwidth: 20MHz

MODE		TX channel 20050					
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	1720.00	-14.7	23.5	0.7	24.2	30.0	-5.8
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	1720.00	-14.1	23.9	0.7	24.6	30.0	-5.4

MODE		TX channel 20175					
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	1732.50	-15.0	23.4	0.6	24.0	30.0	-6.0
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	1732.50	-14.4	23.9	0.6	24.5	30.0	-5.5

MODE		TX channel 20300					
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	1745.00	-14.5	24.2	0.5	24.7	30.0	-5.3
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	1745.00	-14.0	24.7	0.5	**25.2**	30.0	-4.8

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

LTE Band 13

Channel Bandwidth: 5MHz

MODE		TX channel 23205					
Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	779.50	-8.7	17.3	4.0	21.3	34.8	-13.5
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	779.50	-7.2	20.9	4.0	**24.9**	34.8	-9.9

MODE		TX channel 23230					
Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	782.00	-8.2	17.8	4.0	21.8	34.8	-13.0
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	782.00	-7.7	20.2	4.0	24.2	34.8	-10.6

MODE		TX channel 23255					
Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	784.50	-8.2	17.9	4.0	21.9	34.8	-12.9
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	784.50	-7.2	20.7	4.0	24.7	34.8	-10.1

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

Channel Bandwidth: 10MHz

MODE	TX channel 23230						
Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	782.00	-8.4	17.6	4.0	21.6	34.8	-13.2
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	782.00	-7.6	20.3	4.0	**24.3**	34.8	-10.5

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

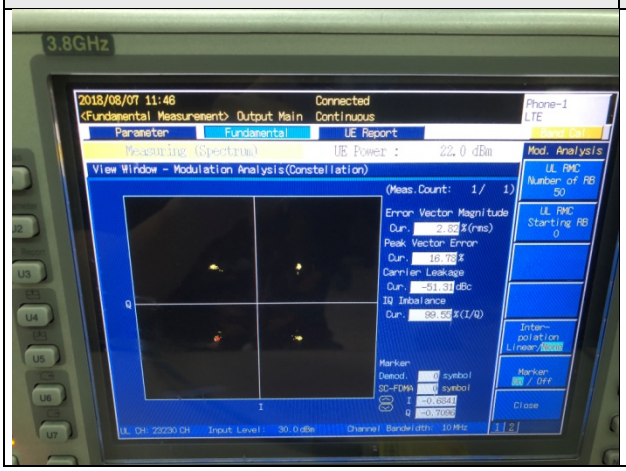
4.2.2 Test Procedure

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	
Spectrum Plot of Measurement Value	
Channel: 20175 / Frequency (MHz): 1732.5MHz	
Channel Bandwidth: 20MHz / QPSK	Channel Bandwidth: 20MHz / 16QAM

LTE Band 13	
Spectrum Plot of Measurement Value	
Channel: 23230 / Frequency (MHz): 782.0MHz	
Channel Bandwidth: 10MHz / QPSK	Channel Bandwidth: 10MHz / 16QAM
	

4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stabiliity 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℃ ~ 50℃.

4.3.2 Test Procedure

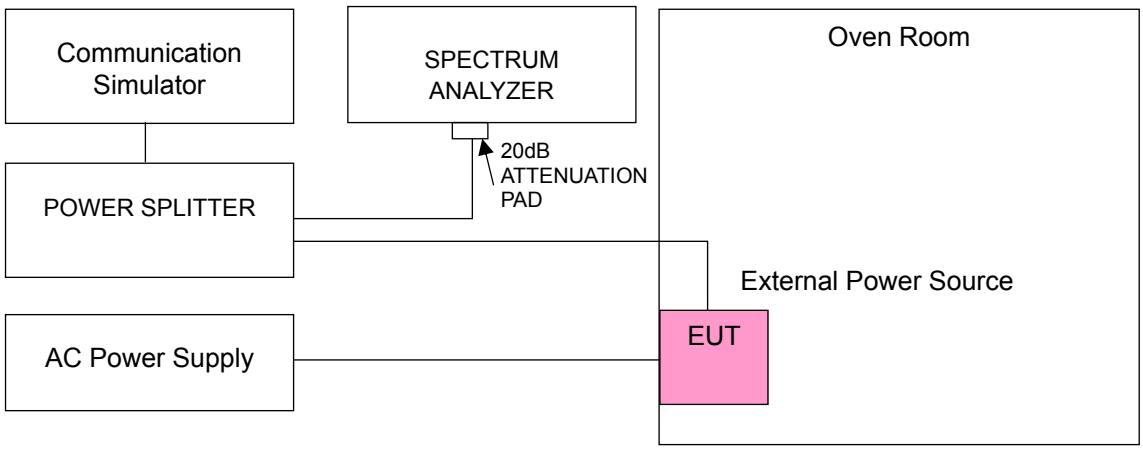
a. Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.

b. 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.

c. The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the ±0.5 ℃ 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)						Limit (ppm)
	LTE Band 4				LTE Band 13		
	5MHz	10MHz	15MHz	20MHz	5MHz	10MHz	
54	0.001	0.001	0.002	0.001	0.003	0.003	2.5
45.9	0.001	0.002	0.001	0.001	0.001	0.002	2.5
62.1	0.001	0.002	0.002	0.001	0.003	0.005	2.5

Note: The applicant defined the normal working voltage is from 45.9Vdc to 62.1Vdc.

Frequency Error vs. Temperature

Voltage (Volts)	Frequency Error (ppm)						Limit (ppm)
	LTE Band 4				LTE Band 13		
	5MHz	10MHz	15MHz	20MHz	5MHz	10MHz	
-30	0.001	0.002	0.002	0.002	0.002	0.004	2.5
-20	0.002	0.001	0.002	0.001	0.002	0.002	2.5
-10	0.001	0.002	0.002	0.002	0.004	0.002	2.5
0	0.001	0.002	0.001	0.001	0.005	0.003	2.5
10	0.002	0.002	0.002	0.002	0.002	0.005	2.5
20	-0.001	-0.002	-0.002	-0.001	-0.003	-0.005	2.5
30	-0.001	-0.001	-0.002	-0.002	-0.004	-0.002	2.5
40	-0.001	-0.002	-0.002	-0.002	-0.005	-0.003	2.5
50	-0.001	-0.002	-0.002	-0.002	-0.002	-0.003	2.5

4.4 Emission Bandwidth Measurement

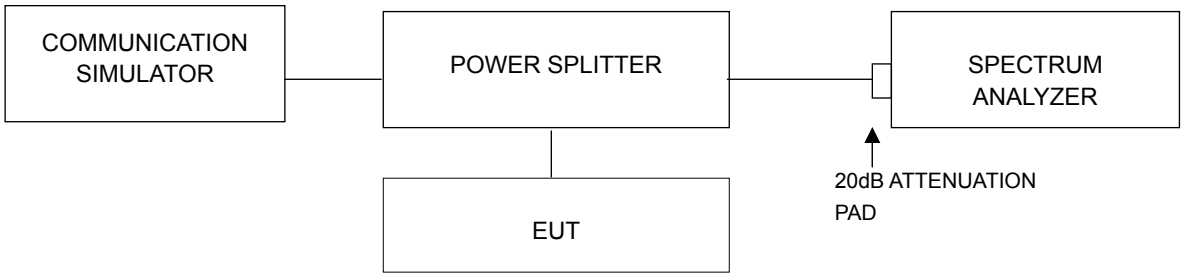
4.4.1 Limits of Emission Bandwidth Measurement

According to FCC 27.53(m)(6) specified that emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26dB below the transmitter power.

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 = 30kHz and VBW = 100kHz (Channel Bandwidth: 1.4MHz), RBW = 51kHz and VBW = 150kHz (Channel Bandwidth: 3MHz and 5MHz), RBW = 100kHz and VBW = 300kHz (Channel Bandwidth: 10MHz), RBW = 200kHz and VBW = 620kHz (Channel Bandwidth: 15MHz) and RBW = 430kHz and VBW = 1.2MHz (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: 5MHz					
Channel	Frequency (MHz)	26dBc Bandwidth (MHz)		Occupied Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
19975	1712.5	4.766	4.782	4.489	4.490
20175	1732.5	4.767	4.773	4.486	4.489
20375	1752.5	4.766	4.780	4.487	4.490

Channel Bandwidth: 10MHz					
Channel	Frequency (MHz)	26dBc Bandwidth (MHz)		Occupied Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
20000	1715.0	9.496	9.500	8.973	8.968
20175	1732.5	9.499	9.490	8.961	8.965
20350	1750.0	9.483	9.486	8.969	8.974

Channel Bandwidth: 15MHz					
Channel	Frequency (MHz)	26dBc Bandwidth (MHz)		Occupied Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
20025	1717.5	14.249	14.251	13.494	13.478
20175	1732.5	14.249	14.254	13.471	13.469
20325	1747.5	14.250	14.241	13.489	13.483

Channel Bandwidth: 20MHz					
Channel	Frequency (MHz)	26dBc Bandwidth (MHz)		Occupied Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
20050	1720.0	19.006	19.035	17.949	17.970
20175	1732.5	19.017	19.014	17.917	17.939
20300	1745.0	19.018	19.022	17.952	17.974

26dBc Bandwidth	
Spectrum Plot of Worst Value	
5MHz / 16QAM	10MHz / 16QAM
15MHz / 16QAM	20MHz / 16QAM

Occupied Bandwidth	
Spectrum Plot of Worst Value	
5MHz / 16QAM	10MHz / 16QAM
15MHz / QPSK	20MHz / 16QAM

LTE Band 13

Channel Bandwidth: 5MHz					
Channel	Frequency (MHz)	26dBc Bandwidth (MHz)		Occupied Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
23205	779.5	4.778	4.766	4.487	4.487
23230	782.0	4.791	4.775	4.491	4.490
23255	784.5	4.768	4.763	4.481	4.483

Channel Bandwidth: 10MHz					
Channel	Frequency (MHz)	26dBc Bandwidth (MHz)		Occupied Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
23230	782.0	9.478	9.489	8.956	8.950

26dBc Bandwidth

Spectrum Plot of Worst Value

5MHz / QPSK

10MHz / 16QAM

Occupied Bandwidth

Spectrum Plot of Worst Value

5MHz / QPSK

10MHz / QPSK

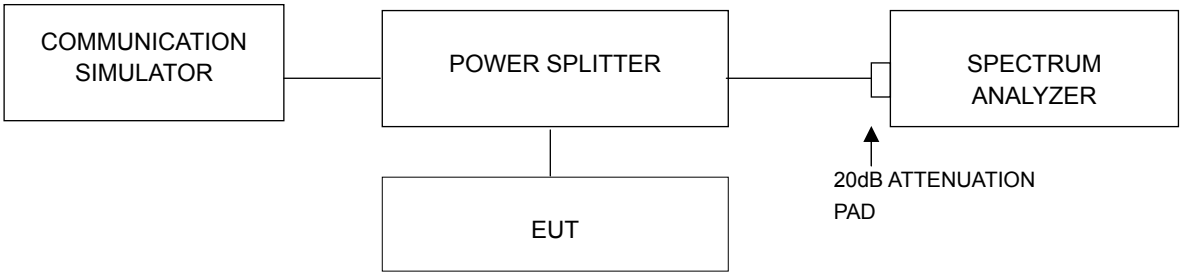
4.5 Channel Edge Measurement

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 log10 (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.

4.5.2 Test Setup



4.5.3 Test Procedures

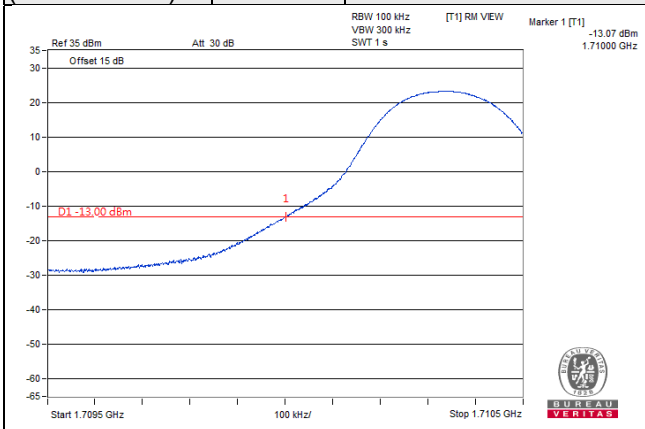
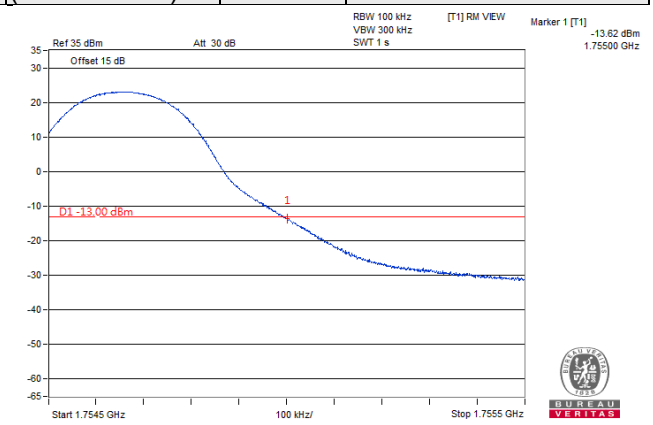
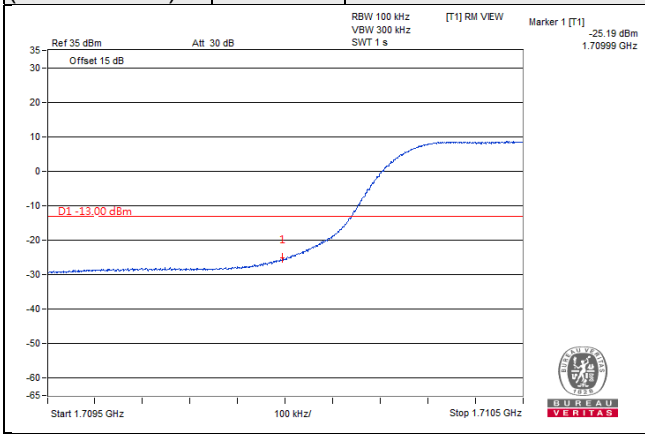
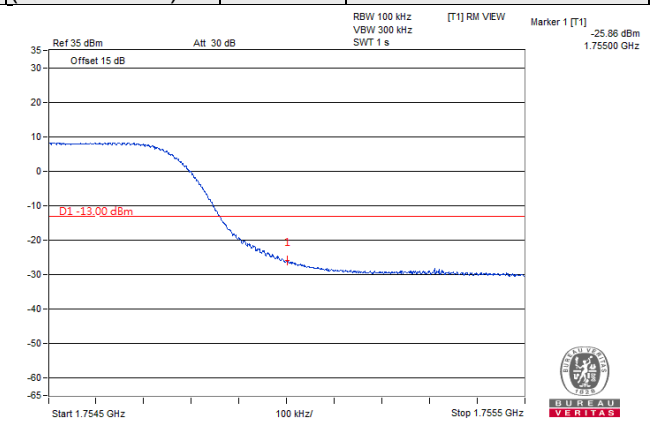
a. The EUT was set up for the rated peak power. The power was measured with Spectrum Analyzer. All measurements were done at 3 channels: low, middle and high operational frequency range.

b. The center frequency of spectrum is the band edge frequency and span is 1.5MHz. RBW = 51kHz and VBW = 150kHz (Channel Bandwidth: 5MHz), RBW = 100kHz and VBW = 300kHz (Channel Bandwidth: 10MHz), RBW = 200kHz and VBW = 620kHz (Channel Bandwidth: 15MHz) and RBW = 430kHz and VBW = 1.2MHz (Channel Bandwidth: 20MHz).

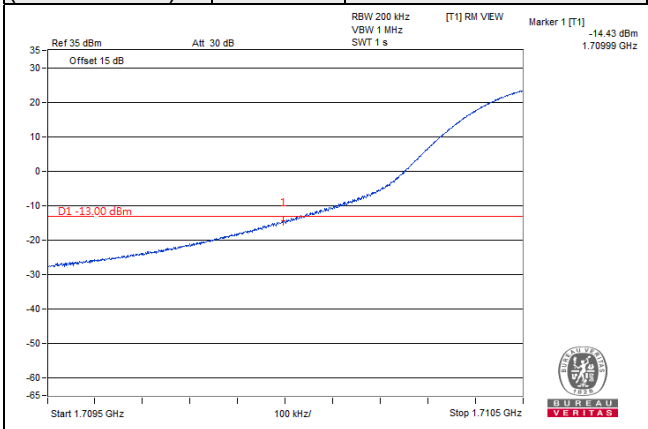
c. Record the max trace plot into the test report.

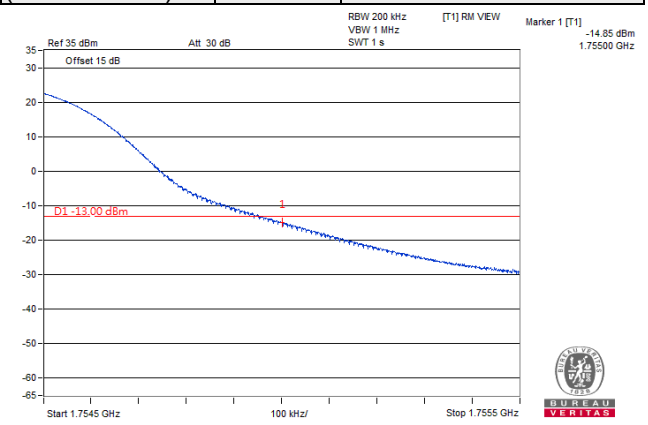
4.5.4 Test Results

LTE Band 4

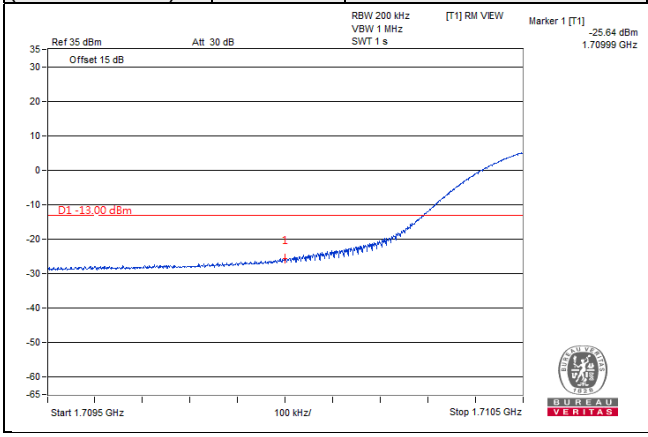
Channel Bandwidth: 5MHz					
Channel 19975 (1712.50MHz)	QPSK	1 RB / 0 RB Offset	Channel 20375 (1752.50MHz)	QPSK	1 RB / 24 RB Offset
					
Channel 19975 (1712.50MHz)	QPSK	25 RB / 0 RB Offset	Channel 20375 (1752.50MHz)	QPSK	25 RB / 0 RB Offset
					

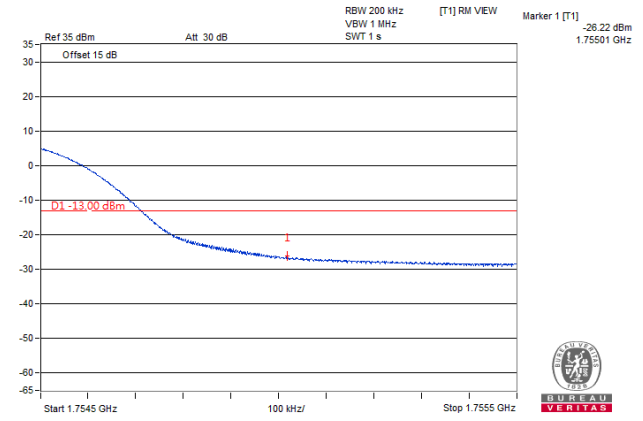
Channel Bandwidth: 10MHz					
Channel 20000 (1715.00MHz)	QPSK	1 RB / 0 RB Offset	Channel 20350 (1750.00MHz)	QPSK	1 RB / 49 RB Offset



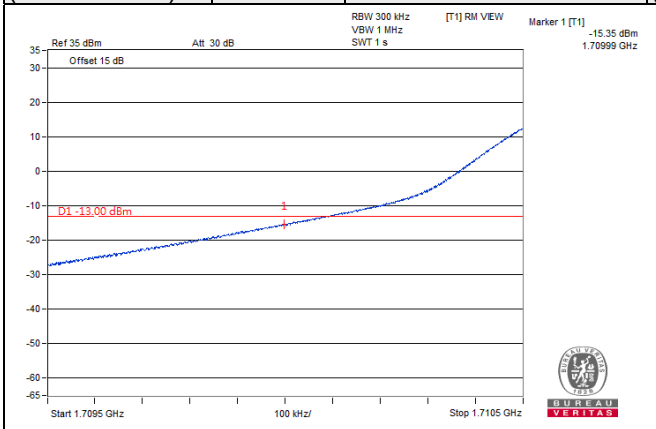


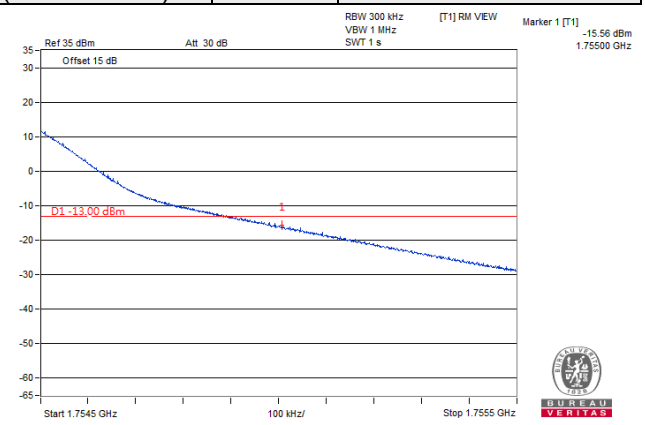
Channel 20000 (1715.00MHz)	QPSK	50 RB / 0 RB Offset	Channel 20350 (1750.00MHz)	QPSK	50 RB / 0 RB Offset



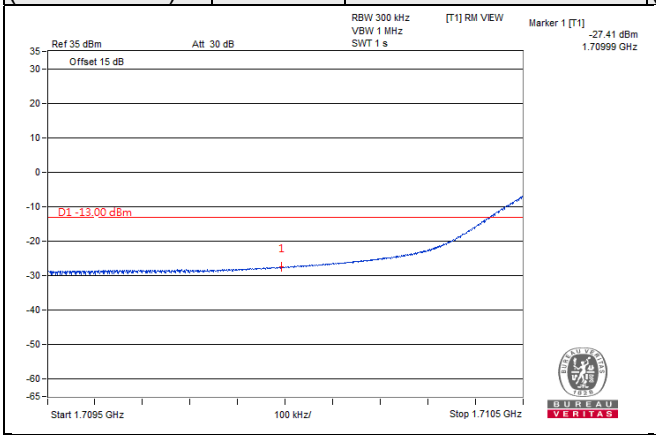


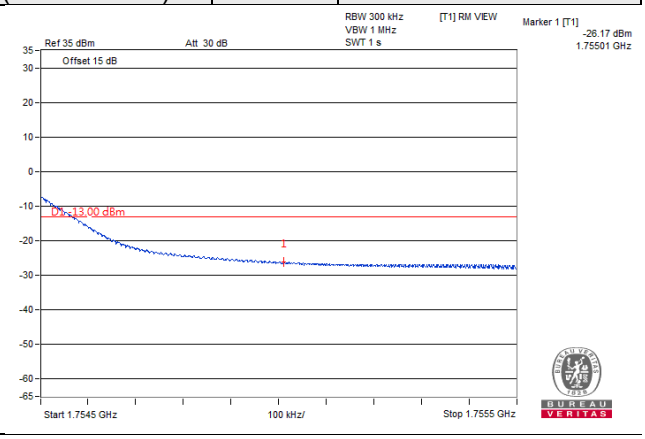
Channel Bandwidth: 15MHz					
Channel 20025 (1717.50MHz)	QPSK	1 RB / 0 RB Offset	Channel 20325 (1747.50MHz)	QPSK	1 RB / 74 RB Offset



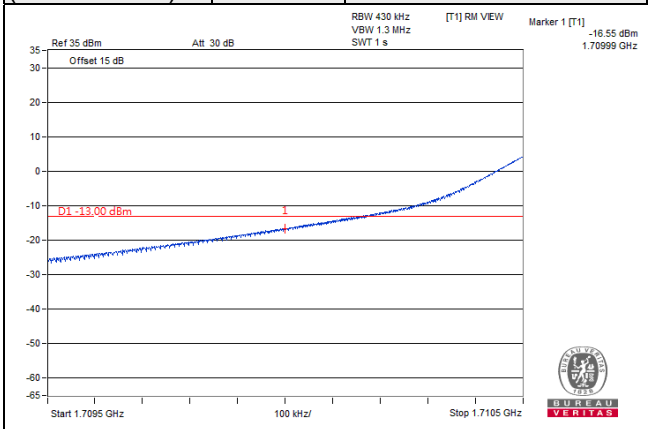


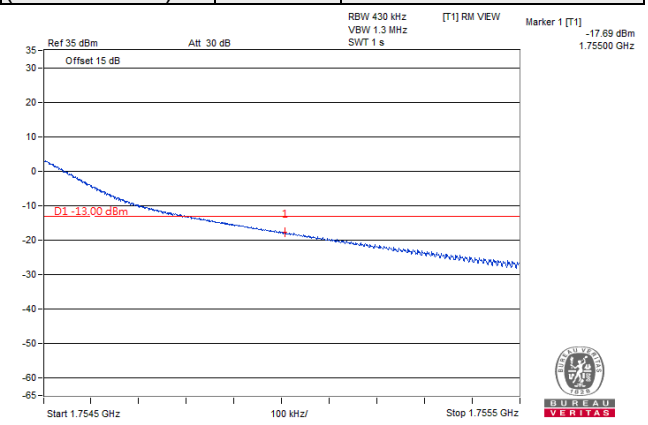
Channel 20025 (1717.50MHz)	QPSK	75 RB / 0 RB Offset	Channel 20325 (1747.50MHz)	QPSK	75 RB / 0 RB Offset



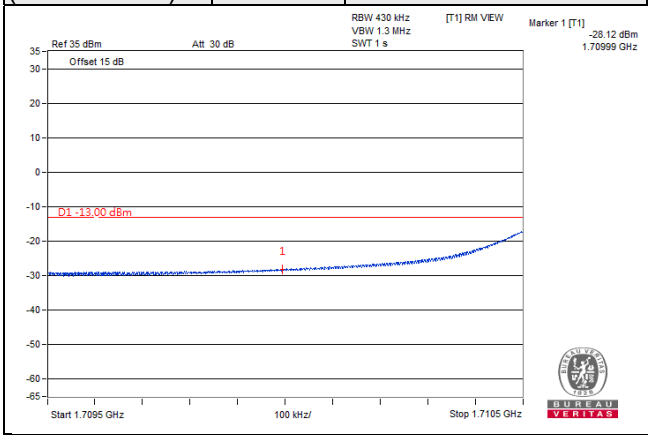


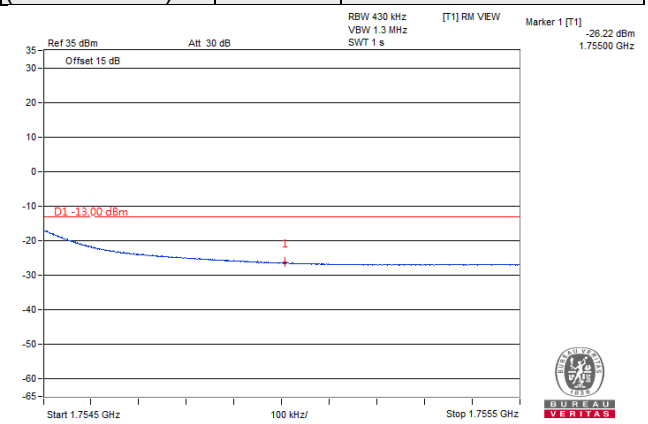
Channel Bandwidth: 20MHz					
Channel 20050 (1720.00MHz)	QPSK	1 RB / 0 RB Offset	Channel 20300 (1745.00MHz)	QPSK	1 RB / 99 RB Offset





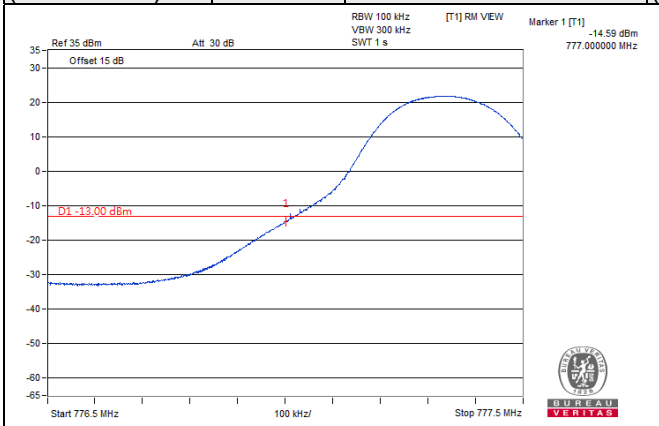
Channel 20050 (1720.00MHz)	QPSK	100 RB / 0 RB Offset	Channel 20300 (1745.00MHz)	QPSK	100 RB / 0 RB Offset

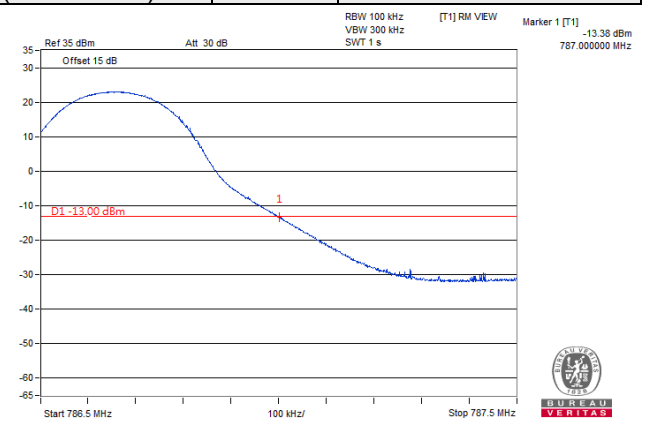




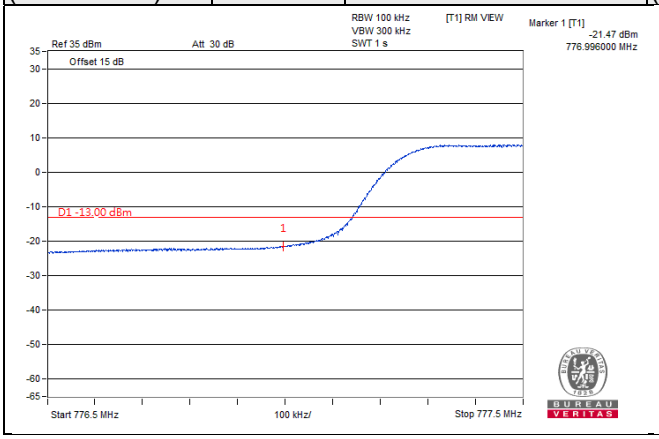
LTE Band 13

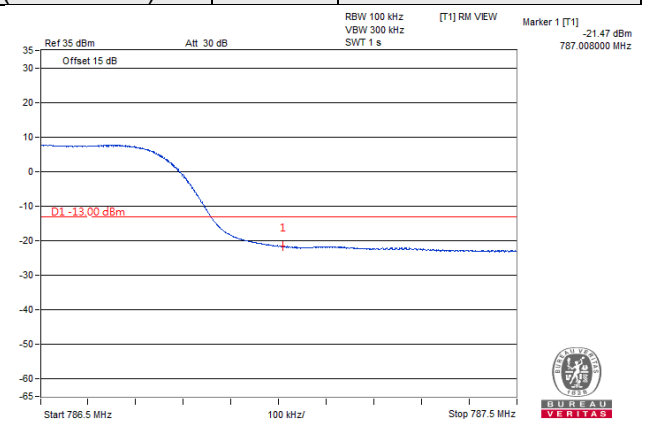
Channel Bandwidth: 5MHz					
Channel 23205 (779.50MHz)	QPSK	1 RB / 0 RB Offset	Channel 23255 (784.50MHz)	QPSK	1 RB / 24 RB Offset

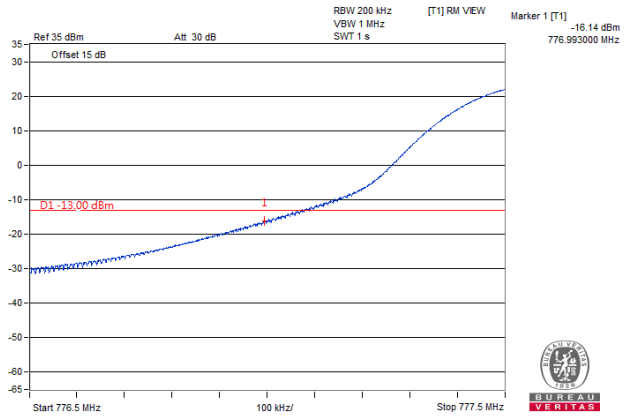
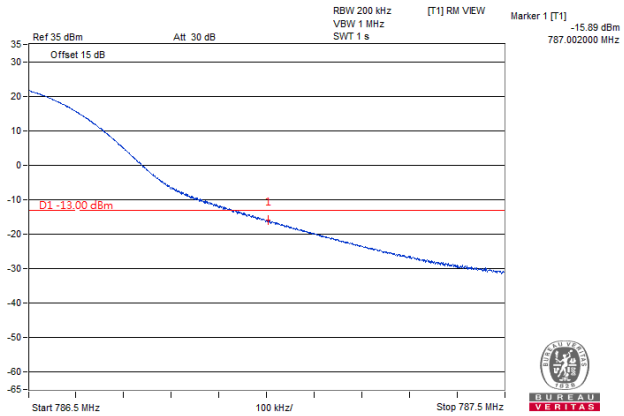
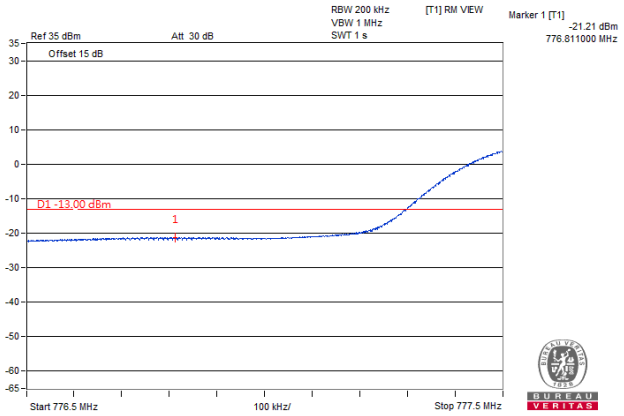
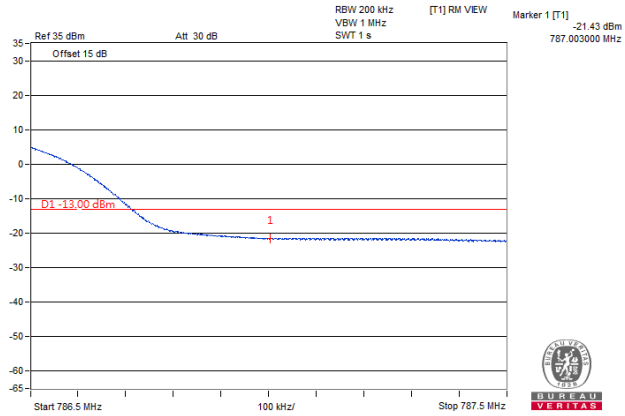




Channel 23205 (779.50MHz)	QPSK	25 RB / 0 RB Offset	Channel 23255 (784.50MHz)	QPSK	25 RB / 0 RB Offset





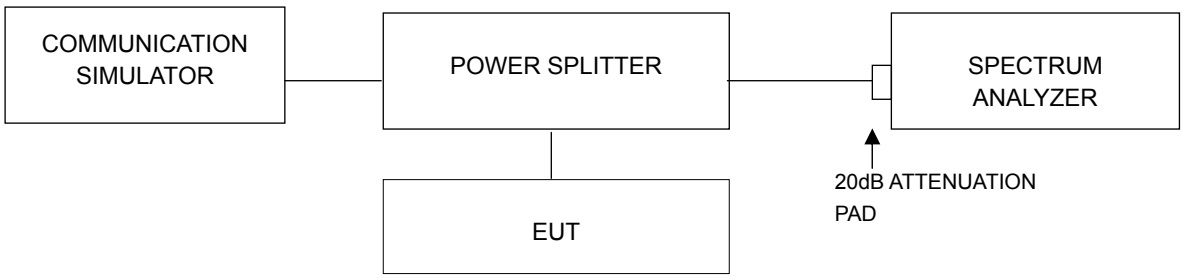
Channel Bandwidth: 10MHz					
Channel 23230 (782.00MHz)	QPSK	1 RB / 0 RB Offset	Channel 23230 (782.00MHz)	QPSK	1 RB / 49 RB Offset
					
Channel 23230 (782.00MHz)	QPSK	50 RB / 0 RB Offset	Channel 23230 (782.00MHz)	QPSK	50 RB / 0 RB Offset
					

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

a. Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;

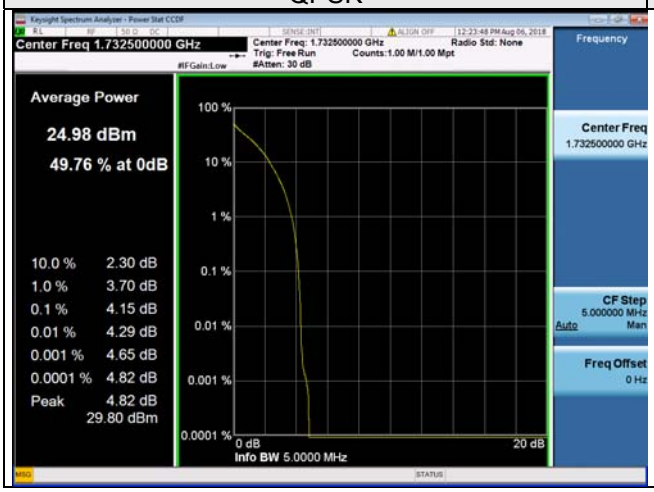
b. Set the number of counts to a value that stabilizes the measured CCDF curve;

c. Record the maximum PAPR level associated with a probability of 0.1%.

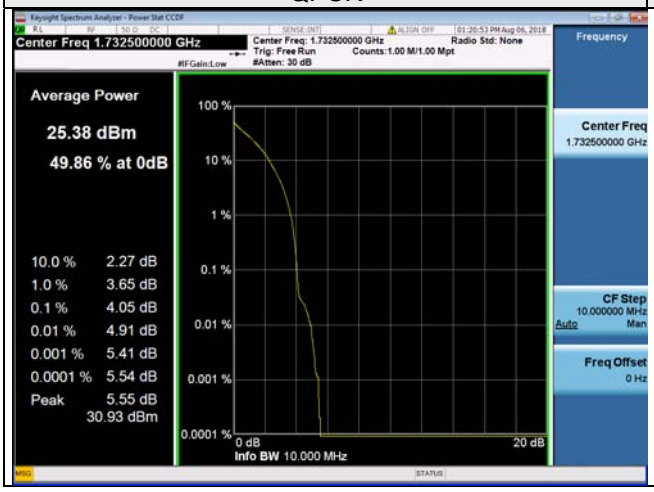
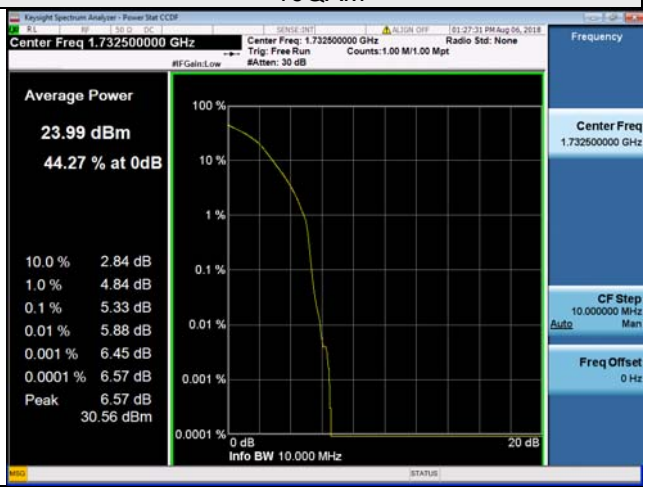
4.6.4 Test Results

LTE Band 4

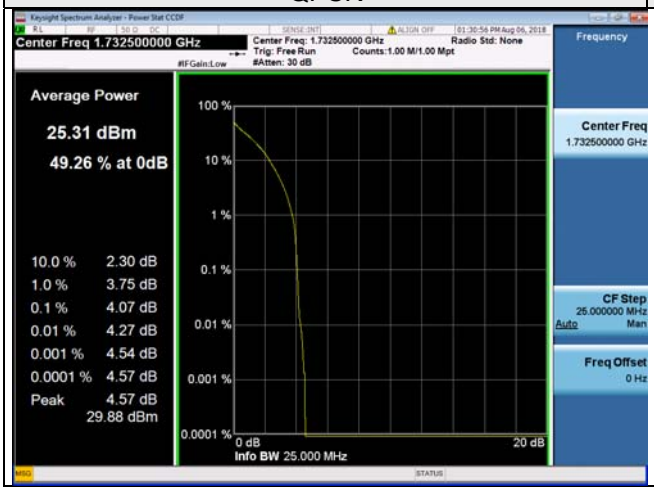
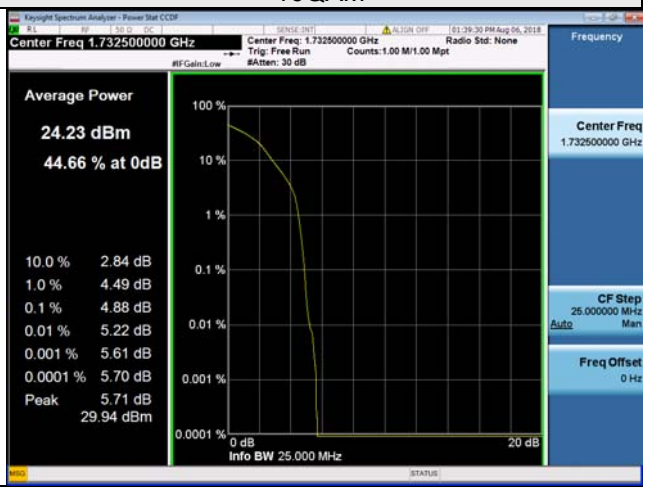
Channel Bandwidth: 5MHz			
Channel	Frequency (MHz)	Peak To Average Ratio (dB)	
		QPSK	16QAM
19975	1712.5	3.71	4.80
20175	1732.5	4.15	5.23
20375	1752.5	4.09	5.12

SPECTRUM PLOT OF WORST VALUE	
QPSK	16QAM
	

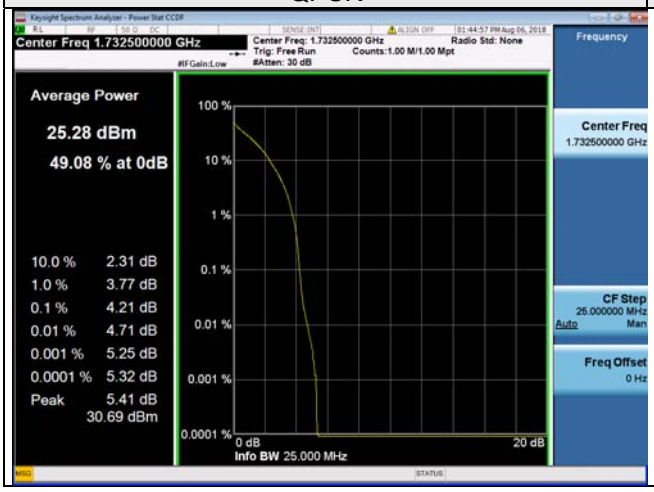
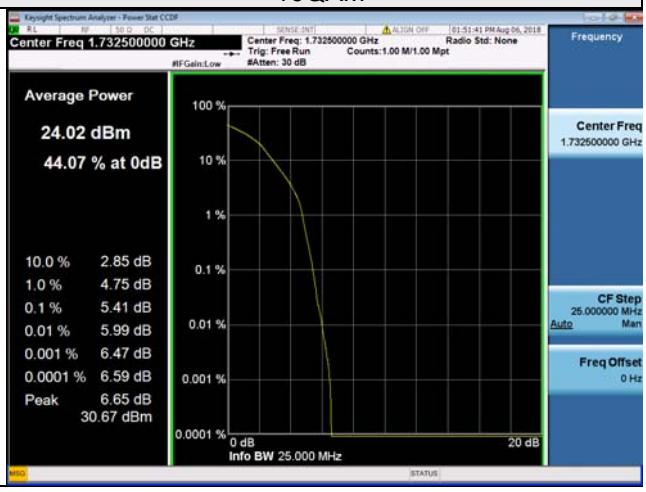
Channel Bandwidth: 10MHz			
Channel	Frequency (MHz)	Peak To Average Ratio (dB)	
		QPSK	16QAM
20000	1715.0	3.63	4.88
20175	1732.5	4.05	5.33
20350	1750.0	3.84	5.00

SPECTRUM PLOT OF WORST VALUE	
QPSK	16QAM
	

Channel Bandwidth: 15MHz			
Channel	Frequency (MHz)	Peak To Average Ratio (dB)	
		QPSK	16QAM
20025	1717.5	3.38	4.58
20175	1732.5	4.07	4.88
20325	1747.5	3.56	4.56

SPECTRUM PLOT OF WORST VALUE	
QPSK	16QAM
	

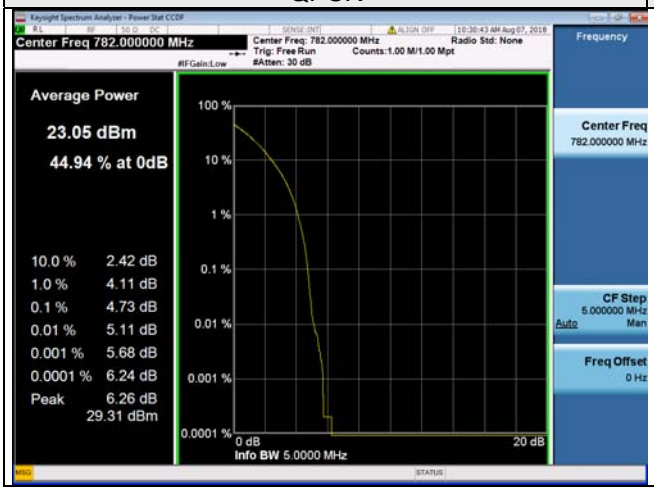
Channel Bandwidth: 20MHz			
Channel	Frequency (MHz)	Peak To Average Ratio (dB)	
		QPSK	16QAM
20050	1720.0	3.59	4.96
20175	1732.5	4.21	5.41
20300	1745.0	3.73	5.07

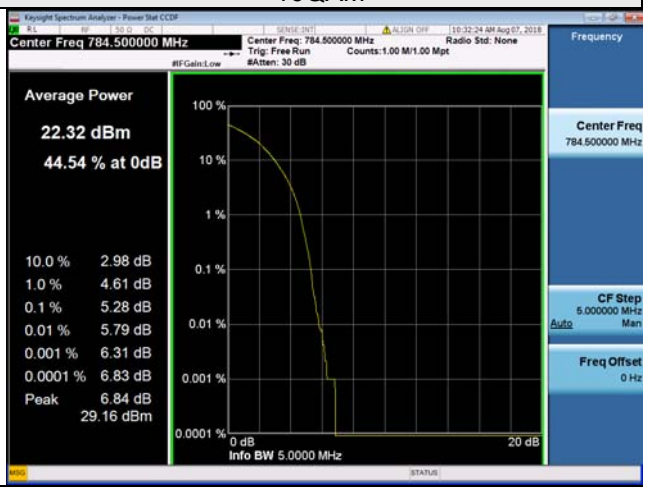
SPECTRUM PLOT OF WORST VALUE	
QPSK	16QAM
	

LTE Band 13

Channel Bandwidth: 5MHz			
Channel	Frequency (MHz)	Peak To Average Ratio (dB)	
		QPSK	16QAM
23205	779.5	4.22	5.02
23230	782.0	4.73	5.23
23255	784.5	4.53	5.28

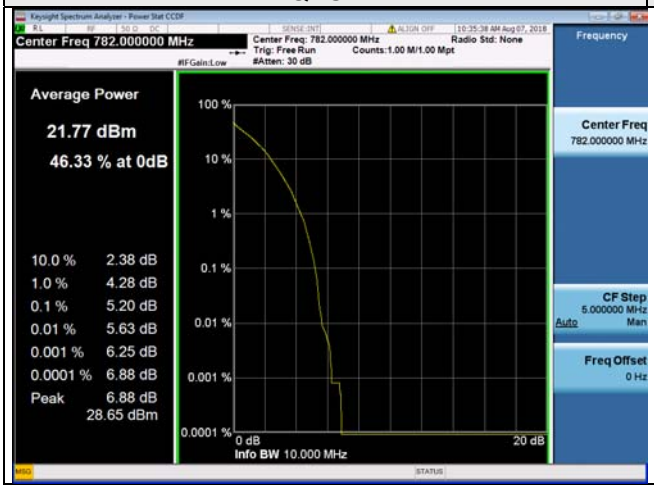
SPECTRUM PLOT OF WORST VALUE	
QPSK	16QAM

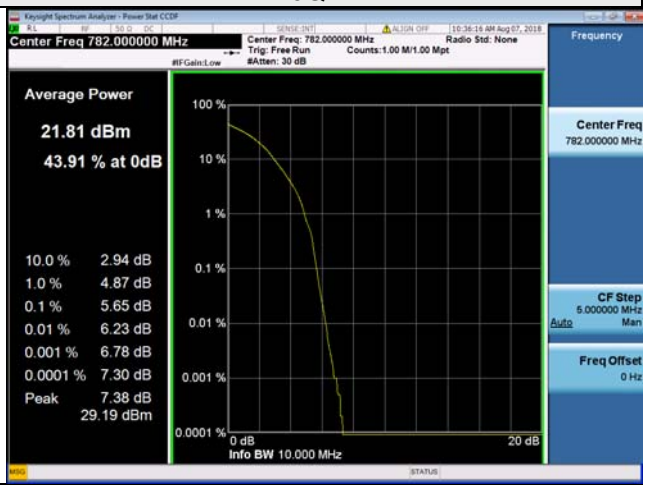




Channel Bandwidth: 10MHz			
Channel	Frequency (MHz)	Peak To Average Ratio (dB)	
		QPSK	16QAM
23230	782.0	5.20	5.65

SPECTRUM PLOT OF WORST VALUE	
QPSK	16QAM





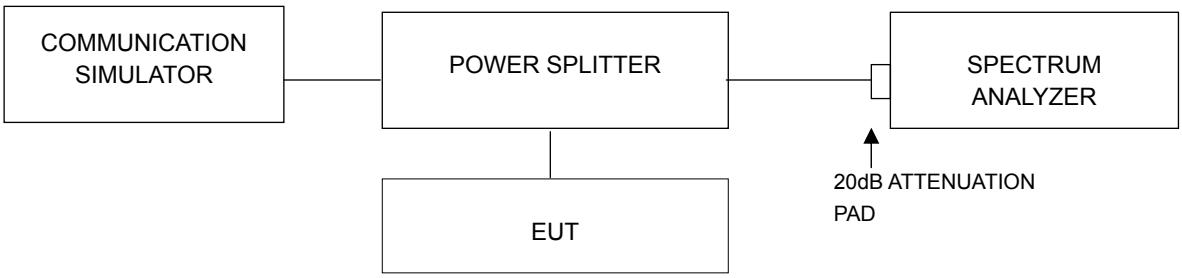
4.7 Conducted Spurious Emissions

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 log10 (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.

4.7.2 Test Setup



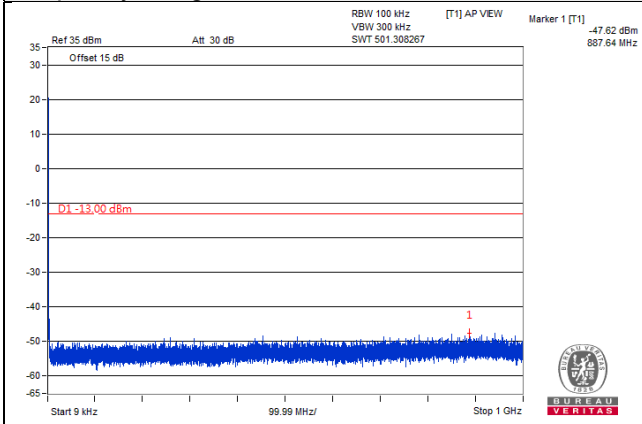
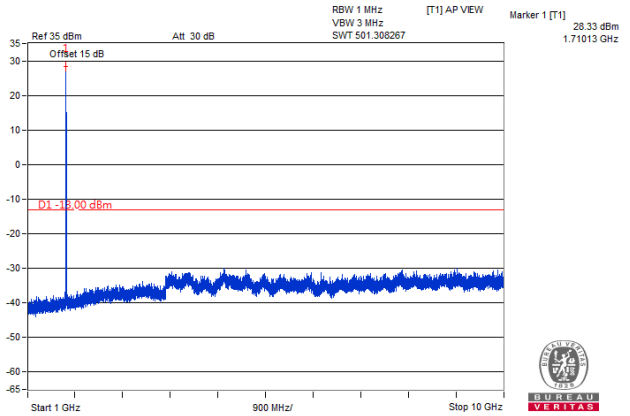
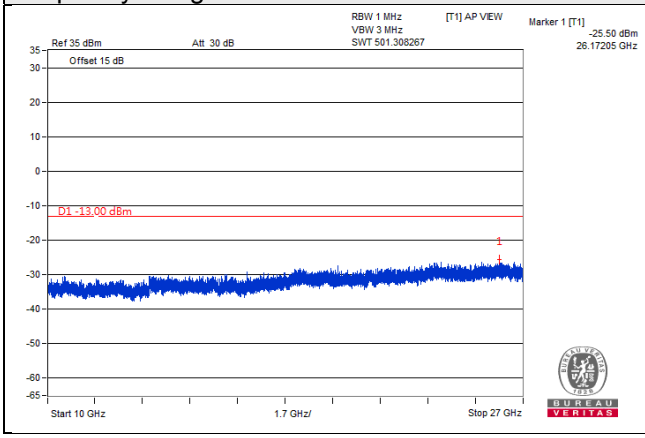
4.7.3 Test Procedure

a. All measurements were done at 3 channels: low, middle and high operational frequency range.

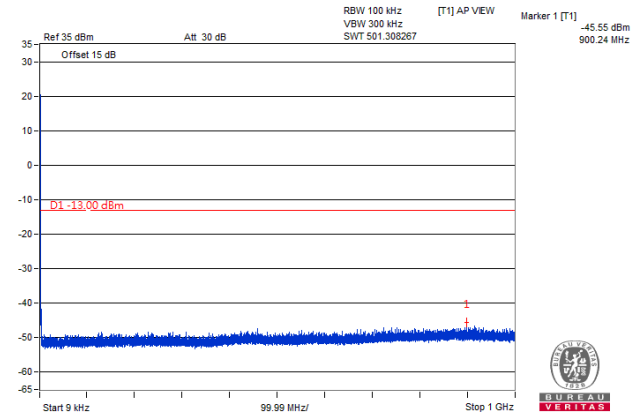
b. When the spectrum scanned from 9kHz to 27GHz, it shall be connected to the 20dB pad attenuated the carried frequency. The spectrum set RB = 1MHz, VB = 3MHz.

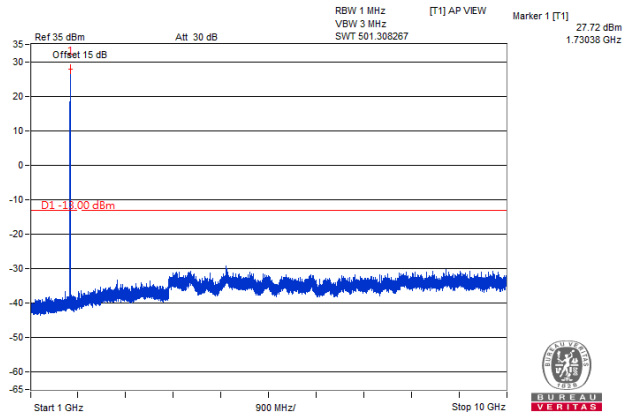
4.7.4 Test Results

LTE Band 4

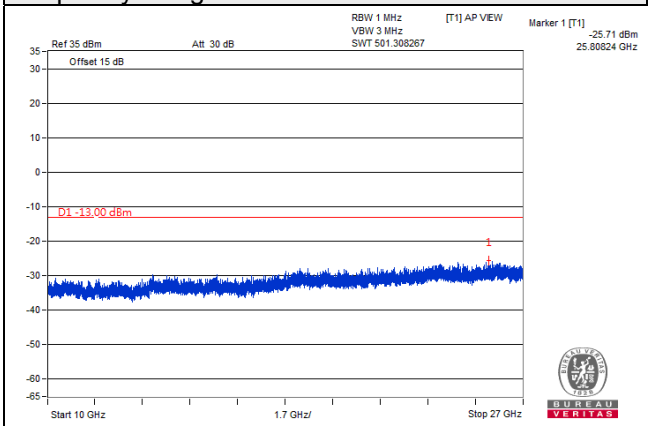
Channel Bandwidth: 5MHz	
Channel 19975 (1712.50MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz
	
Frequency Range : 10GHz~27GHz	
	

Channel Bandwidth: 5MHz	
Channel 20175 (1732.50MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz

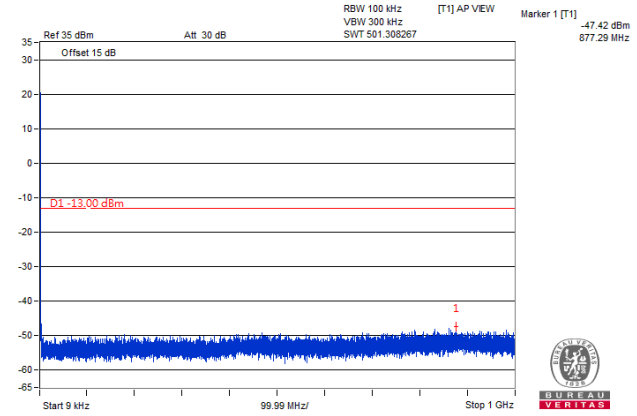


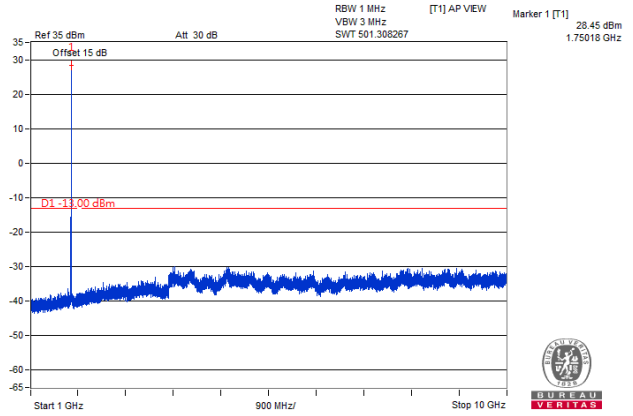


Frequency Range : 10GHz~27GHz	

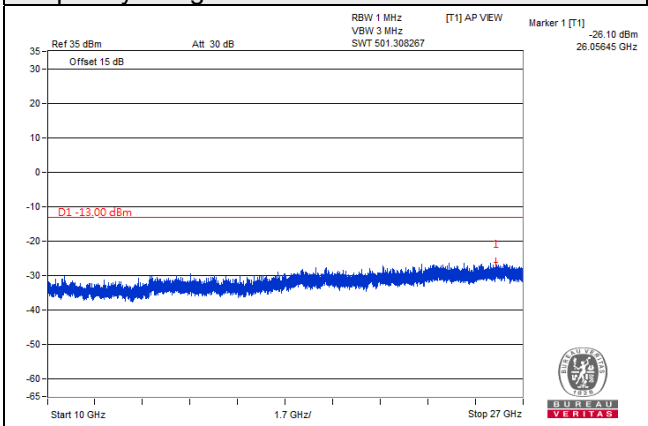


Channel Bandwidth: 5MHz	
Channel 20375 (1752.50MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz

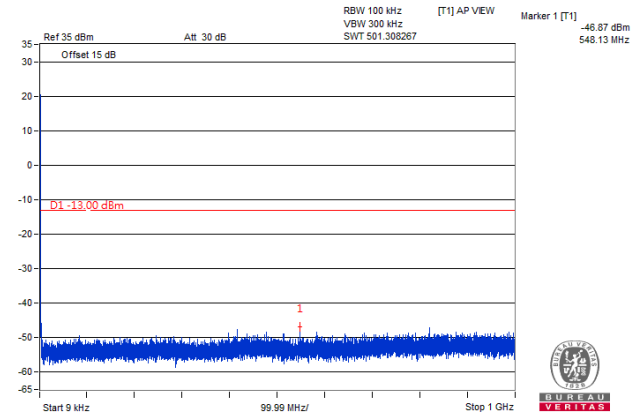


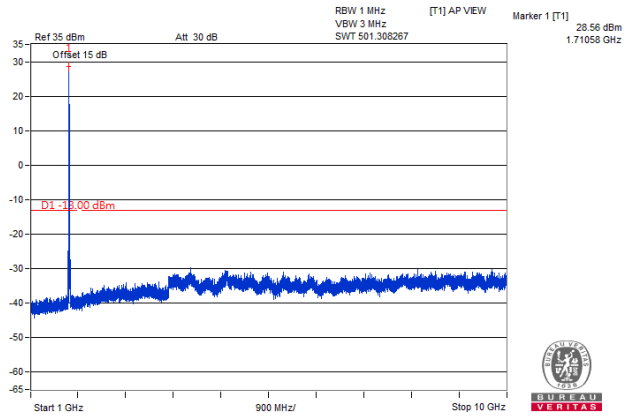


Frequency Range : 10GHz~27GHz	

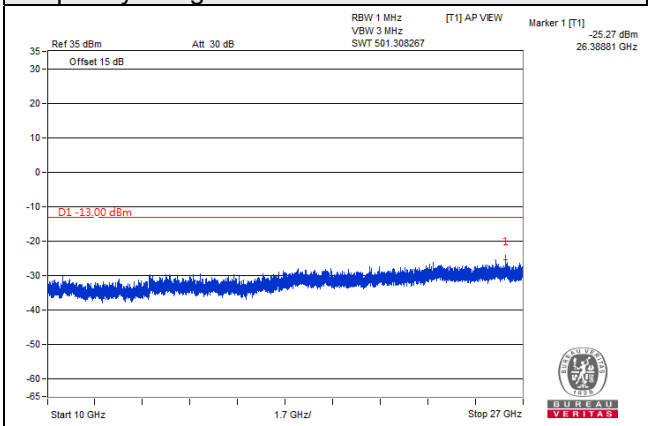


Channel Bandwidth: 10MHz	
Channel 20000 (1715.00MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz

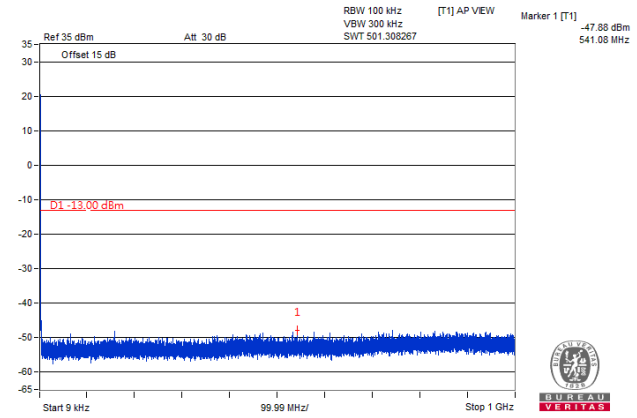


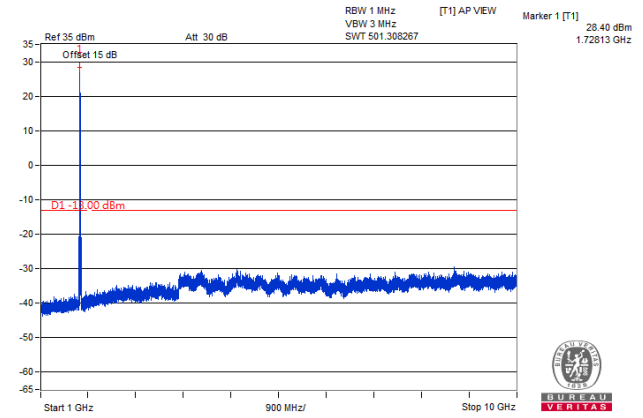


Frequency Range : 10GHz~27GHz	

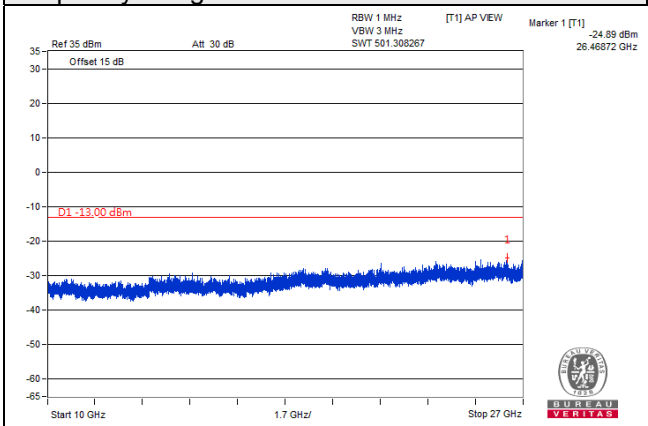


Channel Bandwidth: 10MHz	
Channel 20175 (1732.50MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz

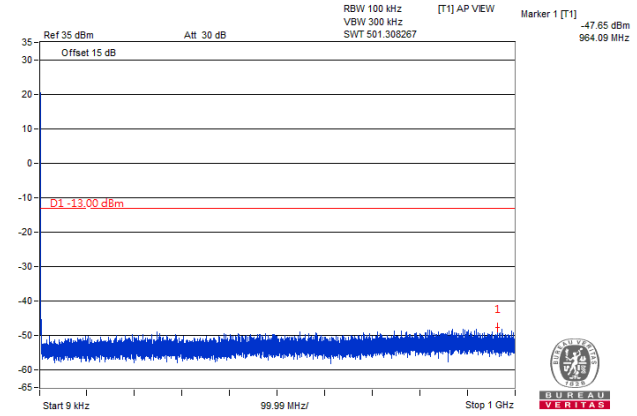


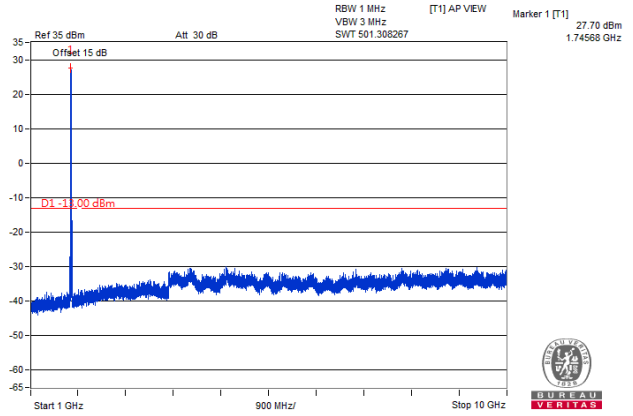


Frequency Range : 10GHz~27GHz	

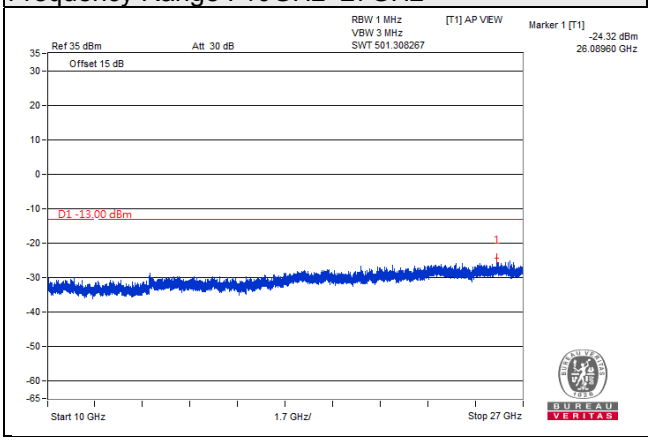


Channel Bandwidth: 10MHz	
Channel 20350 (1750.00MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz

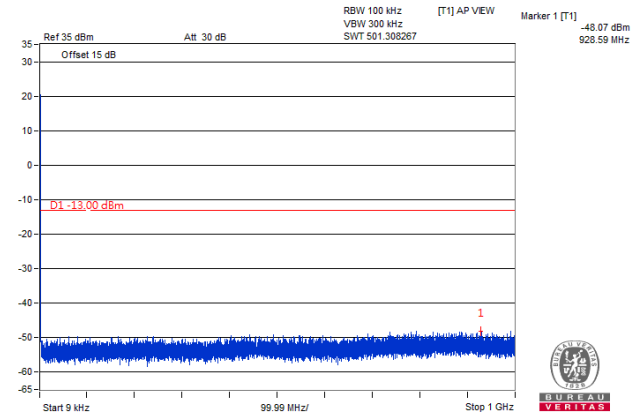


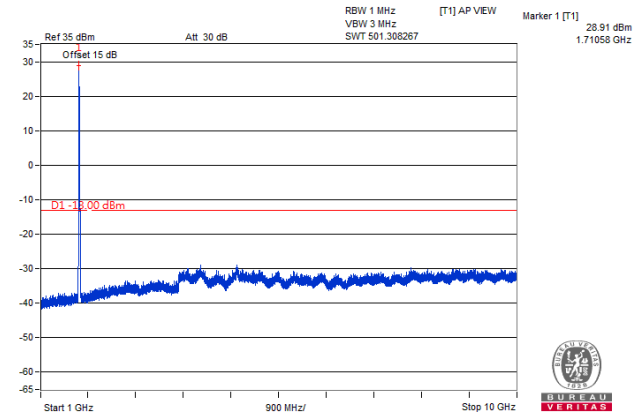


Frequency Range : 10GHz~27GHz	

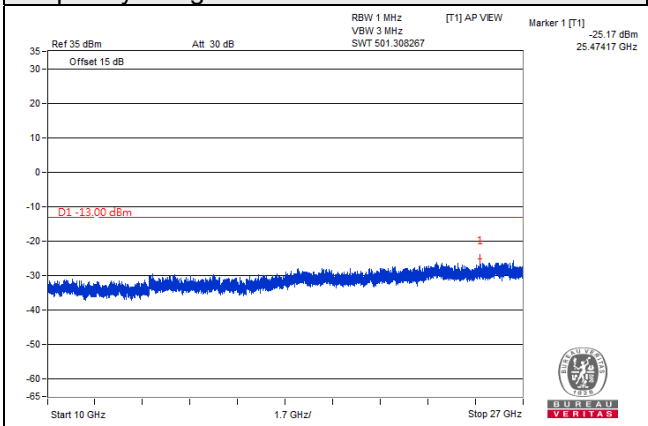


Channel Bandwidth: 15MHz	
Channel 20025 (1717.50MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz

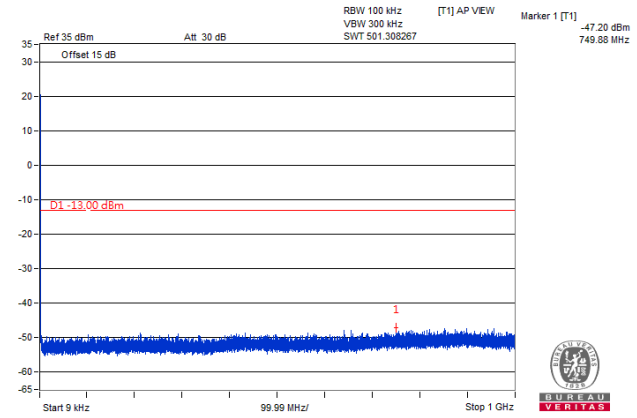


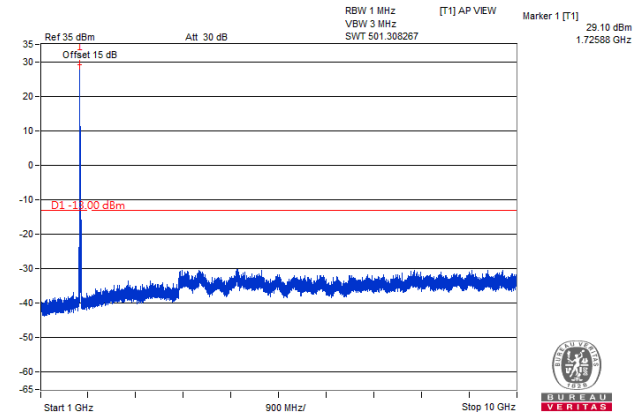


Frequency Range : 10GHz~27GHz	

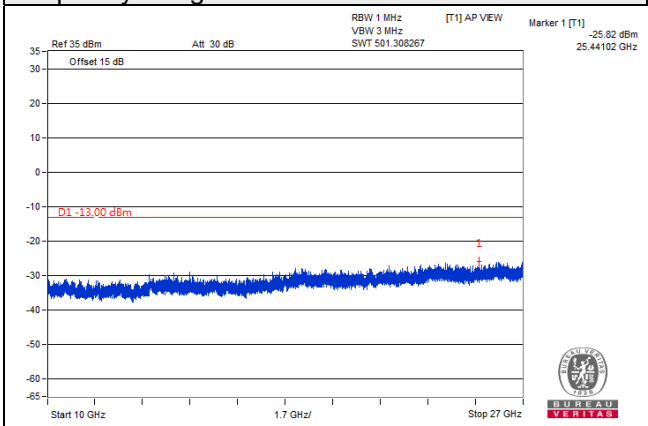


Channel Bandwidth: 15MHz	
Channel 20175 (1732.50MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz

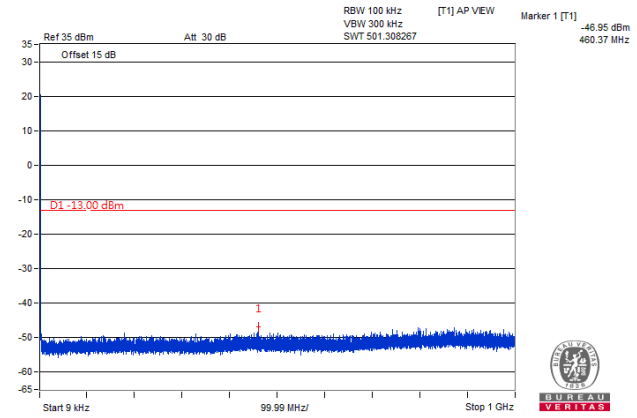


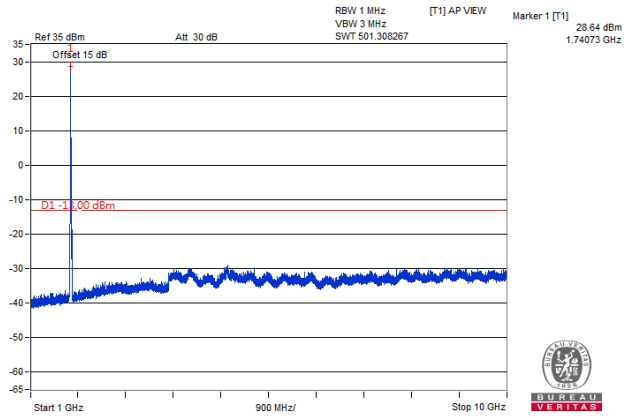


Frequency Range : 10GHz~27GHz	

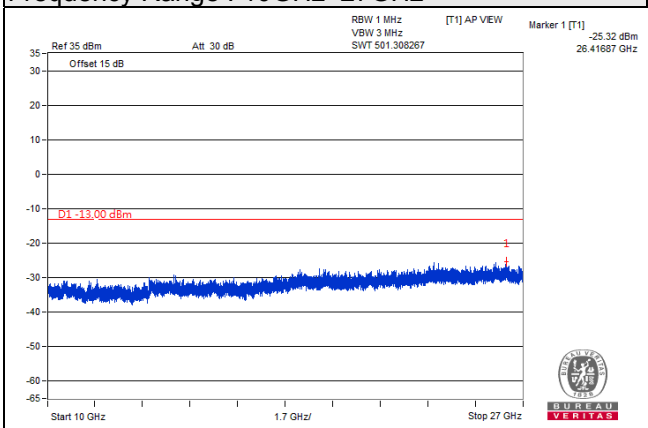


Channel Bandwidth: 15MHz	
Channel 20325 (1747.50MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz

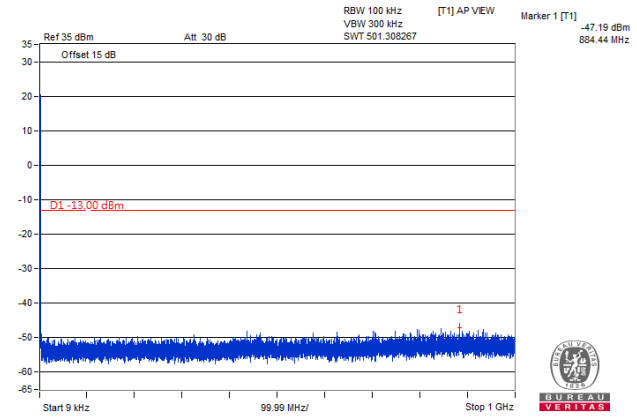


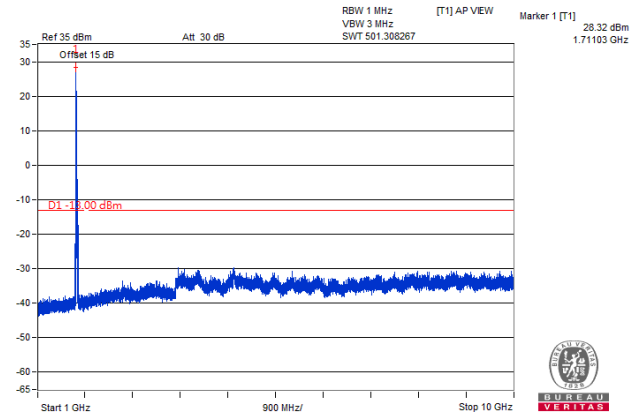


Frequency Range : 10GHz~27GHz	

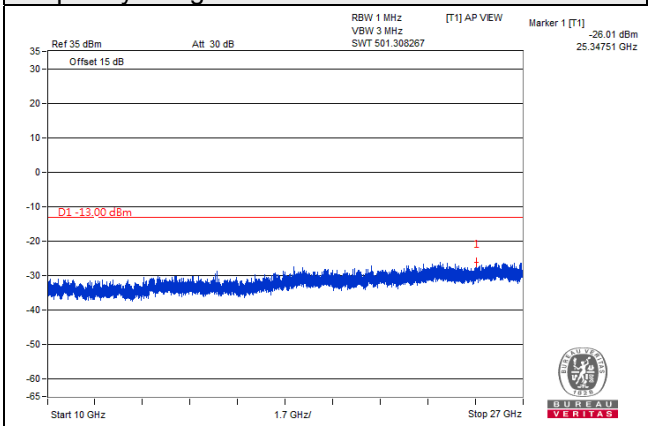


Channel Bandwidth: 20MHz	
Channel 20050 (1720.00MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz

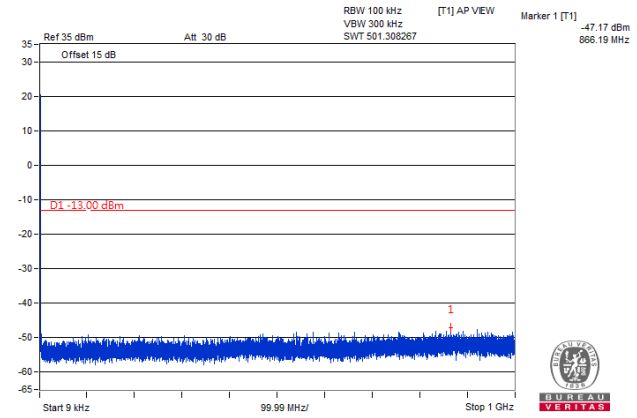


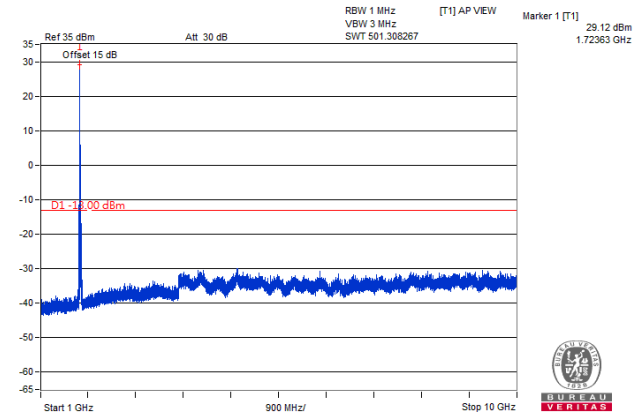


Frequency Range : 10GHz~27GHz	

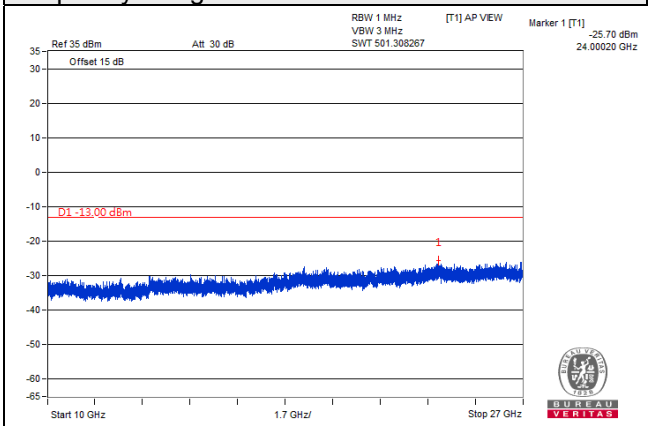


Channel Bandwidth: 20MHz	
Channel 20175 (1732.50MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz

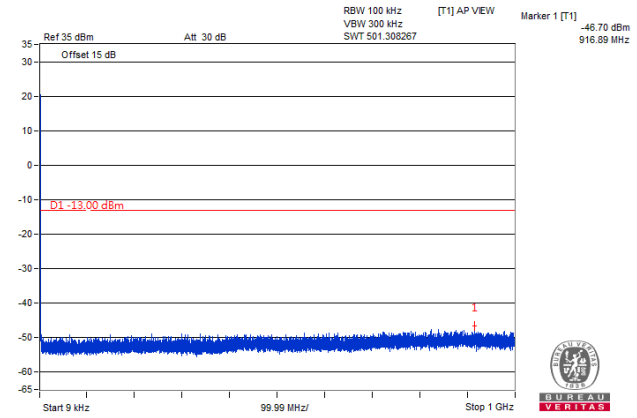


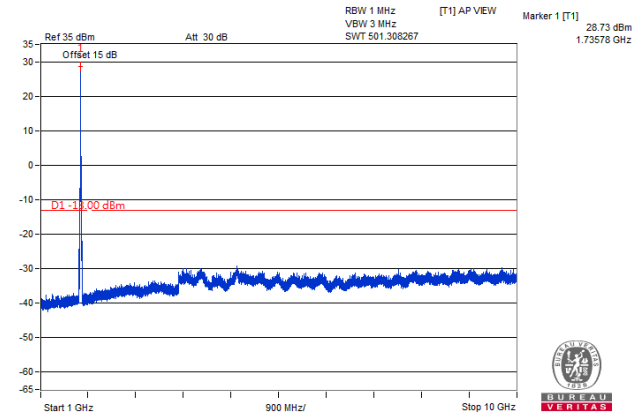


Frequency Range : 10GHz~27GHz	

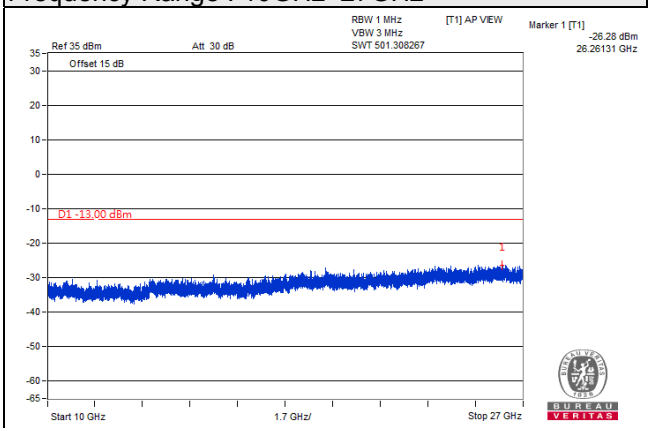


Channel Bandwidth: 20MHz	
Channel 20300 (1745.00MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz

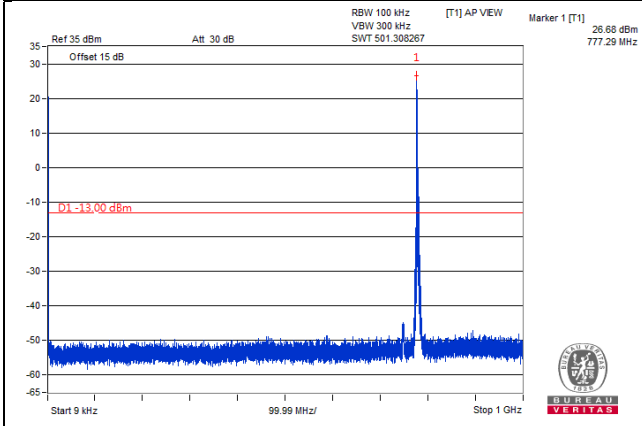
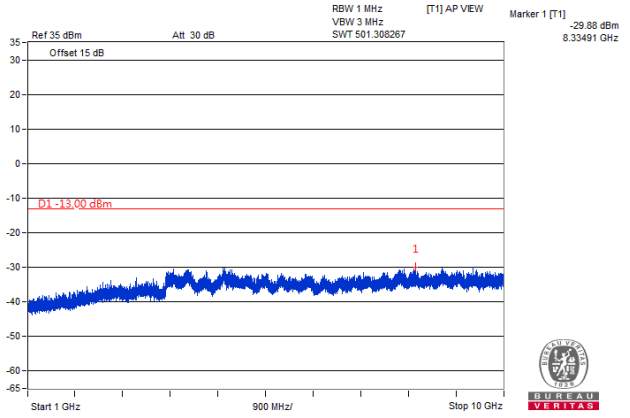
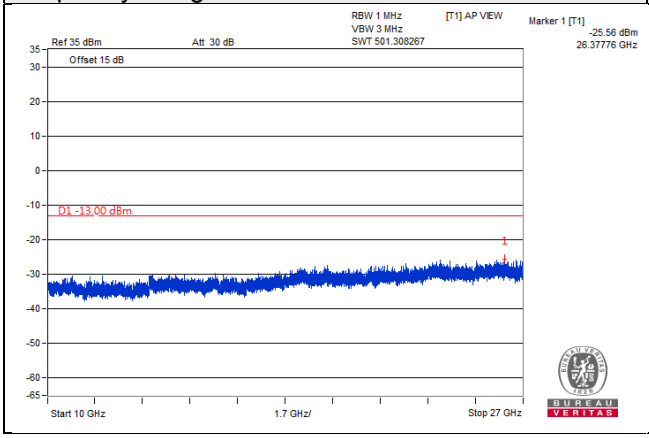




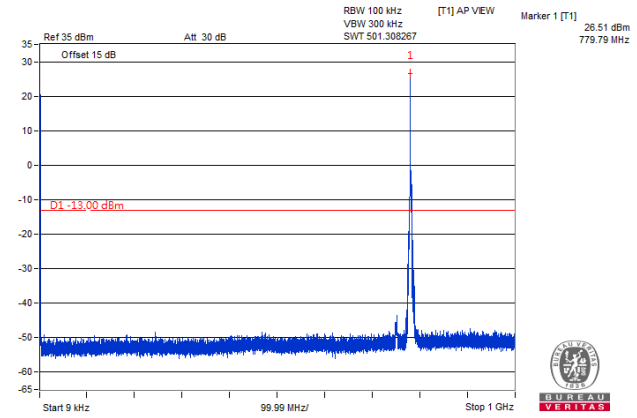
Frequency Range : 10GHz~27GHz	

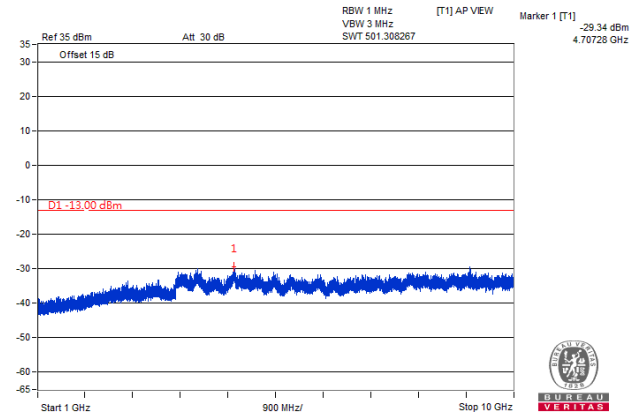


LTE Band 13

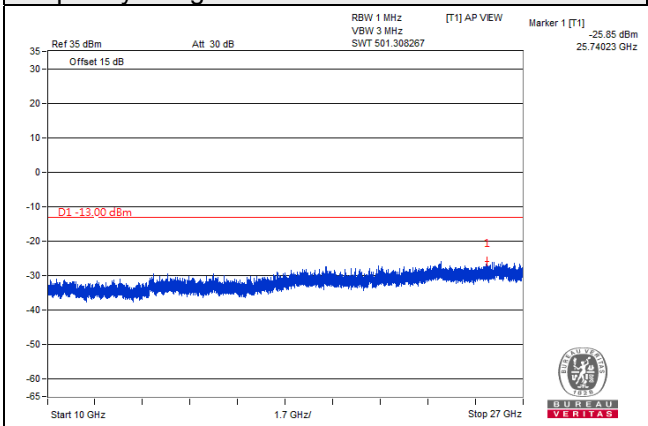
Channel Bandwidth: 5MHz	
Channel 23205 (779.50MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz
	
Frequency Range : 10GHz~27GHz	
	

Channel Bandwidth: 5MHz	
Channel 23230 (782.00MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz

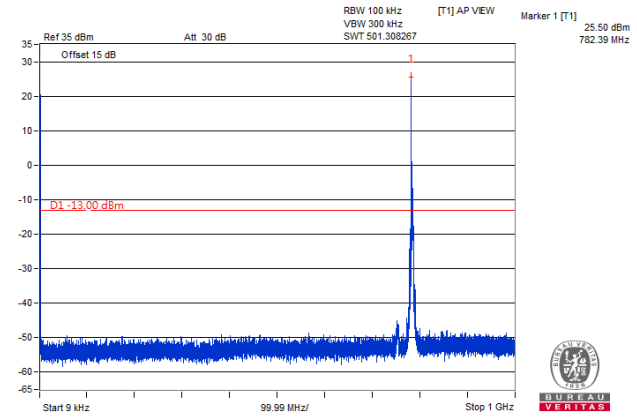


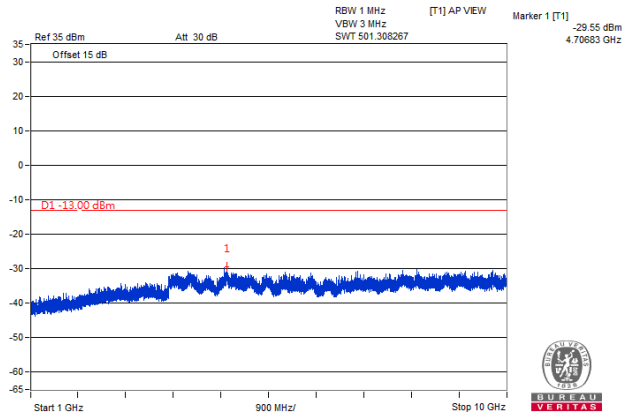


Frequency Range : 10GHz~27GHz	

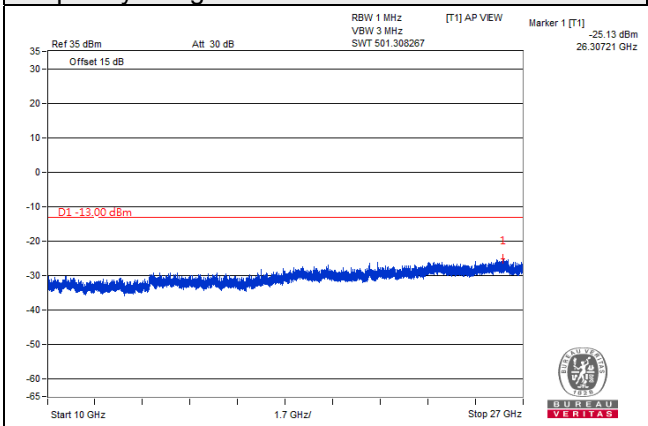


Channel Bandwidth: 5MHz	
Channel 23255 (784.50MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz

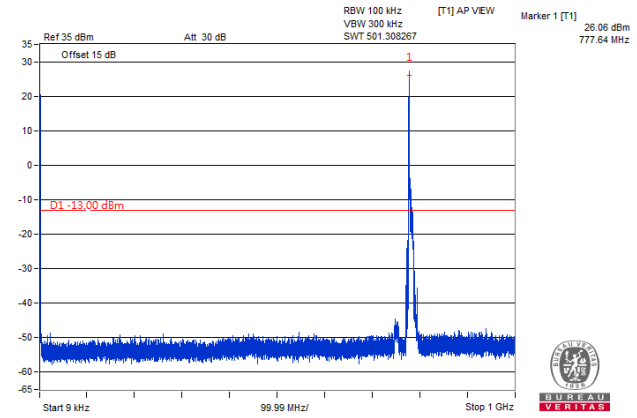


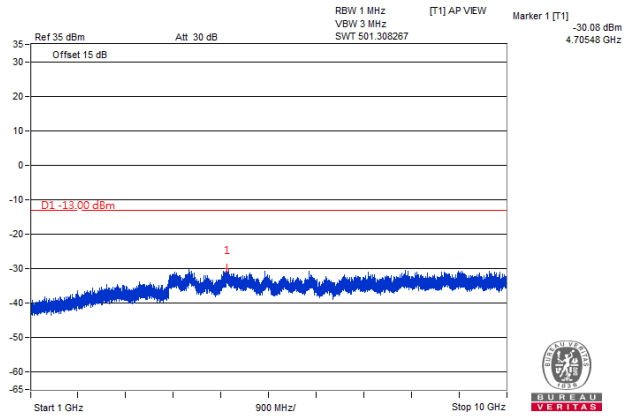


Frequency Range : 10GHz~27GHz	

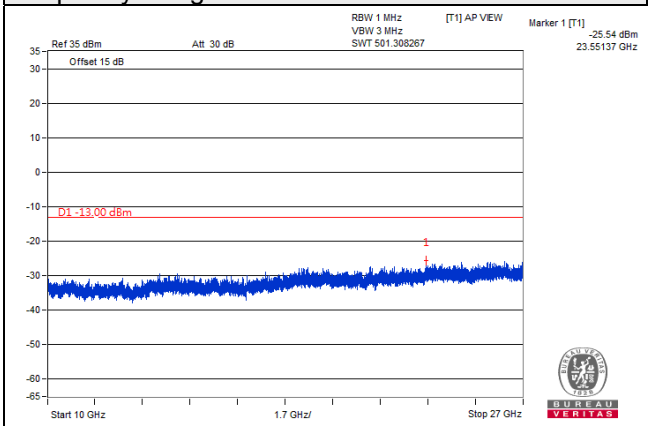


Channel Bandwidth: 10MHz	
Channel 23230 (782.00MHz)	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz





Frequency Range : 10GHz~27GHz	



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 log10 (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

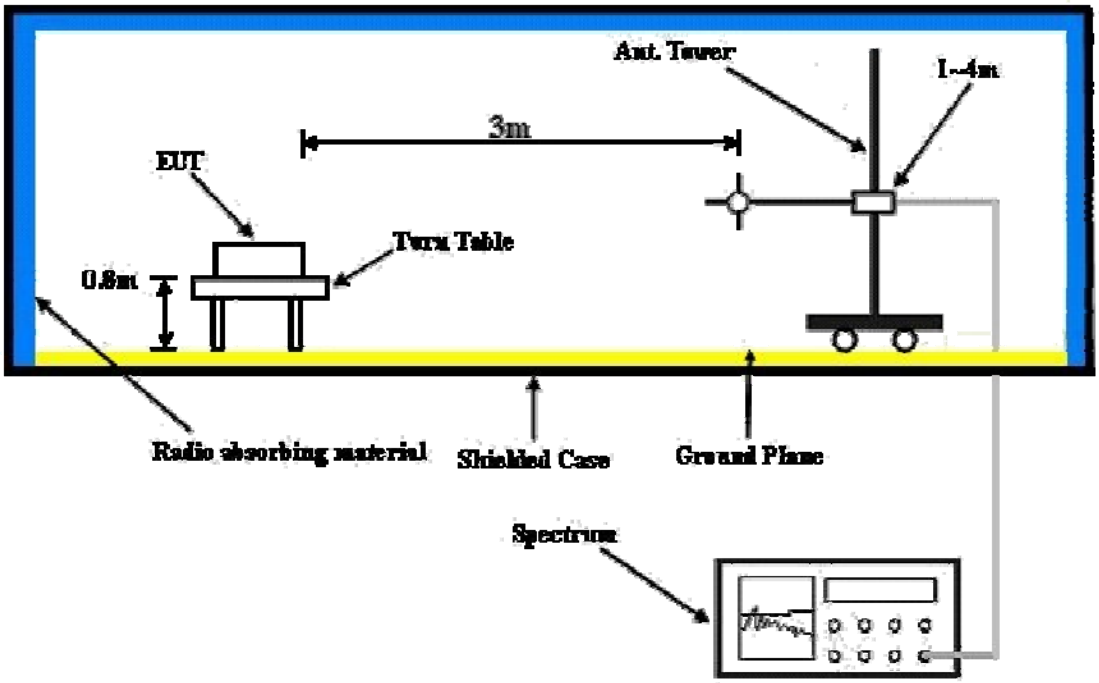
d. EIRP = Output power level of S.G – TX cable loss + Antenna gain of substitution antenna.

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 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: 5MHz

Mode	TX channel 19975 (1712.50MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu	Test Mode	A

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	42.61	-46.9	-33.2	-11.8	-45.0	-13.0	-32.0
2	51.34	-50.4	-44.3	-7.3	-51.6	-13.0	-38.6
3	98.87	-56.7	-63.9	-1.4	-65.3	-13.0	-52.3
4	173.56	-53.0	-57.6	-2.8	-60.4	-13.0	-47.4
5	220.12	-49.3	-55.5	-1.9	-57.4	-13.0	-44.4
6	580.96	-66.1	-68.8	3.8	-65.0	-13.0	-52.0
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	51.34	-43.2	-43.1	-7.3	-50.4	-13.0	-37.4
2	67.83	-41.6	-47.5	-1.0	-48.5	-13.0	-35.5
3	90.14	-51.4	-57.5	-0.2	-57.7	-13.0	-44.7
4	192.96	-53.7	-52.6	-2.6	-55.2	-13.0	-42.2
5	224.00	-51.6	-53.9	-2.1	-56.0	-13.0	-43.0
6	429.64	-60.3	-64.2	3.5	-60.7	-13.0	-47.7

Remarks:

1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 19975 (1712.50MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu	Test Mode	B

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	59.10	-50.1	-50.8	-3.8	-54.6	-13.0	-41.6
2	101.78	-54.5	-61.2	-1.6	-62.8	-13.0	-49.8
3	159.01	-61.2	-63.5	-2.8	-66.3	-13.0	-53.3
4	202.66	-54.1	-60.0	-2.1	-62.1	-13.0	-49.1
5	235.64	-59.4	-65.1	-1.5	-66.6	-13.0	-53.6
6	580.96	-63.1	-65.8	3.8	-62.0	-13.0	-49.0
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	44.55	-54.2	-51.7	-10.9	-62.6	-13.0	-49.6
2	79.47	-60.4	-65.9	0.6	-65.3	-13.0	-52.3
3	117.30	-63.9	-67.9	-2.9	-70.8	-13.0	-57.8
4	181.32	-59.2	-59.6	-3.0	-62.6	-13.0	-49.6
5	194.90	-54.4	-52.9	-2.6	-55.5	-13.0	-42.5
6	248.25	-62.7	-61.7	-1.5	-63.2	-13.0	-50.2

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Channel Bandwidth: 10MHz

Mode	TX channel 20000 (1715.00MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu	Test Mode	A

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	47.46	-47.5	-38.1	-9.2	-47.3	-13.0	-34.3
2	114.39	-54.1	-59.2	-2.8	-62.0	-13.0	-49.0
3	170.65	-53.9	-58.1	-2.8	-60.9	-13.0	-47.9
4	224.97	-49.8	-55.9	-1.9	-57.8	-13.0	-44.8
5	307.42	-66.9	-75.1	3.9	-71.2	-13.0	-58.2
6	580.96	-65.6	-68.3	3.8	-64.5	-13.0	-51.5
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	47.46	-36.9	-35.6	-9.2	-44.8	-13.0	-31.8
2	90.14	-55.1	-61.2	-0.2	-61.4	-13.0	-48.4
3	132.82	-50.2	-51.1	-3.3	-54.4	-13.0	-41.4
4	219.15	-48.6	-50.5	-2.0	-52.5	-13.0	-39.5
5	360.77	-62.3	-66.7	4.0	-62.7	-13.0	-49.7
6	430.61	-51.2	-55.1	3.5	-51.6	-13.0	-38.6

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 20000 (1715.00MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu	Test Mode	B

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	101.78	-53.8	-60.5	-1.6	-62.1	-13.0	-49.1
2	159.98	-60.2	-62.5	-3.0	-65.5	-13.0	-52.5
3	202.66	-53.8	-59.7	-2.1	-61.8	-13.0	-48.8
4	221.09	-53.3	-59.5	-1.9	-61.4	-13.0	-48.4
5	294.81	-66.4	-67.7	-1.8	-69.5	-13.0	-56.5
6	580.96	-61.3	-64.0	3.8	-60.2	-13.0	-47.2
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	41.64	-53.4	-50.1	-12.3	-62.4	-13.0	-49.4
2	67.83	-54.3	-60.2	-1.0	-61.2	-13.0	-48.2
3	90.14	-54.8	-60.9	-0.2	-61.1	-13.0	-48.1
4	138.64	-61.4	-61.2	-3.2	-64.4	-13.0	-51.4
5	193.93	-54.0	-52.7	-2.6	-55.3	-13.0	-42.3
6	245.34	-60.3	-59.9	-1.6	-61.5	-13.0	-48.5

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Channel Bandwidth: 15MHz

Mode	TX channel 20025 (1717.50MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu	Test Mode	A

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	48.43	-48.6	-39.9	-8.7	-48.6	-13.0	-35.6
2	**71.71**	**-33.5**	**-39.3**	**-0.3**	**-39.6**	**-13.0**	**-26.6**
3	119.24	-55.8	-60.5	-3.1	-63.6	-13.0	-50.6
4	181.32	-53.1	-58.3	-3.0	-61.3	-13.0	-48.3
5	221.09	-48.8	-55.0	-1.9	-56.9	-13.0	-43.9
6	580.96	-67.0	-69.7	3.8	-65.9	-13.0	-52.9
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	44.55	-32.6	-30.1	-10.9	-41.0	-13.0	-28.0
2	92.08	-50.3	-56.6	-0.6	-57.2	-13.0	-44.2
3	141.55	-63.0	-62.4	-3.0	-65.4	-13.0	-52.4
4	194.90	-54.4	-52.9	-2.6	-55.5	-13.0	-42.5
5	221.09	-50.0	-52.1	-1.9	-54.0	-13.0	-41.0
6	429.64	-55.0	-58.9	3.5	-55.4	-13.0	-42.4

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 20025 (1717.50MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu	Test Mode	B

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	66.86	-48.7	-54.1	-1.5	-55.6	-13.0	-42.6
2	101.78	-53.3	-60.0	-1.6	-61.6	-13.0	-48.6
3	123.12	-52.8	-57.2	-3.1	-60.3	-13.0	-47.3
4	261.83	-53.6	-56.7	-1.6	-58.3	-13.0	-45.3
5	359.80	-60.0	-66.7	4.0	-62.7	-13.0	-49.7
6	580.96	-61.3	-64.0	3.8	-60.2	-13.0	-47.2
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	67.83	-52.7	-58.6	-1.0	-59.6	-13.0	-46.6
2	90.14	-57.0	-63.1	-0.2	-63.3	-13.0	-50.3
3	191.02	-54.4	-53.6	-2.7	-56.3	-13.0	-43.3
4	204.60	-56.7	-56.6	-2.0	-58.6	-13.0	-45.6
5	247.28	-61.1	-60.4	-1.5	-61.9	-13.0	-48.9
6	580.96	-65.8	-67.5	3.8	-63.7	-13.0	-50.7

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Channel Bandwidth: 20MHz

Mode	TX channel 20050 (1720.00MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu	Test Mode	A

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	74.62	-50.9	-56.8	0.1	-56.7	-13.0	-43.7
2	113.42	-54.7	-59.7	-2.7	-62.4	-13.0	-49.4
3	205.57	-52.1	-58.2	-2.0	-60.2	-13.0	-47.2
4	233.70	-54.0	-59.8	-1.7	-61.5	-13.0	-48.5
5	388.90	-67.1	-71.2	3.4	-67.8	-13.0	-54.8
6	580.96	-65.7	-68.4	3.8	-64.6	-13.0	-51.6
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	48.43	-42.9	-41.9	-8.7	-50.6	-13.0	-37.6
2	89.17	-44.5	-50.7	-0.1	-50.8	-13.0	-37.8
3	139.61	-64.3	-64.0	-3.1	-67.1	-13.0	-54.1
4	202.66	-54.2	-53.6	-2.1	-55.7	-13.0	-42.7
5	232.73	-53.6	-54.5	-1.6	-56.1	-13.0	-43.1
6	580.96	-66.0	-67.7	3.8	-63.9	-13.0	-50.9

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 20050 (1720.00MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu	Test Mode	B

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	101.78	-53.0	-59.7	-1.6	-61.3	-13.0	-48.3
2	127.00	-52.3	-55.5	-3.3	-58.8	-13.0	-45.8
3	224.00	-51.2	-57.3	-2.1	-59.4	-13.0	-46.4
4	279.29	-59.8	-62.6	-1.6	-64.2	-13.0	-51.2
5	388.90	-52.3	-56.4	3.4	-53.0	-13.0	-40.0
6	580.96	-62.6	-65.3	3.8	-61.5	-13.0	-48.5
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	52.310	-52.4	-52.6	-6.8	-59.4	-13.0	-46.4
2	82.380	-53.3	-58.2	0.4	-57.8	-13.0	-44.8
3	137.670	-63.3	-63.3	-3.2	-66.5	-13.0	-53.5
4	174.530	-58.9	-59.7	-2.8	-62.5	-13.0	-49.5
5	194.900	-55.0	-53.5	-2.6	-56.1	-13.0	-43.1
6	276.380	-69.7	-64.8	-1.6	-66.4	-13.0	-53.4

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

LTE Band 13

Channel Bandwidth: 5MHz

Mode	TX channel 23205 (779.50MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu	Test Mode	A

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	65.89	-53.0	-60.4	-1.9	-62.3	-13.0	-49.3
2	101.78	-56.8	-65.7	-1.6	-67.3	-13.0	-54.3
3	164.83	-60.0	-65.6	-2.9	-68.5	-13.0	-55.5
4	188.11	-55.6	-63.3	-2.7	-66.0	-13.0	-53.0
5	204.60	-53.5	-61.6	-2.0	-63.6	-13.0	-50.6
6	231.76	-55.0	-63.2	-1.6	-64.8	-13.0	-51.8
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	67.83	-52.8	-60.8	-1.0	-61.8	-13.0	-48.8
2	101.78	-56.2	-65.1	-1.6	-66.7	-13.0	-53.7
3	194.90	-54.8	-55.4	-2.6	-58.0	-13.0	-45.0
4	244.37	-62.0	-64.1	-1.4	-65.5	-13.0	-52.5
5	276.38	-70.0	-67.2	-1.6	-68.8	-13.0	-55.8
6	580.96	-62.1	-65.9	3.8	-62.1	-13.0	-49.1

Remarks:

1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 23205 (779.50MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu	Test Mode	B

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	41.64	-45.4	-33.1	-12.3	-45.4	-13.0	-32.4
2	101.78	-51.9	-60.8	-1.6	-62.4	-13.0	-49.4
3	159.01	-58.2	-62.7	-2.8	-65.5	-13.0	-52.5
4	223.03	-52.0	-60.2	-2.0	-62.2	-13.0	-49.2
5	499.48	-62.2	-68.3	3.8	-64.5	-13.0	-51.5
6	579.99	-61.4	-66.3	3.8	-62.5	-13.0	-49.5
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	52.31	-50.8	-53.1	-6.8	-59.9	-13.0	-46.9
2	140.58	-61.7	-63.4	-3.0	-66.4	-13.0	-53.4
3	193.93	-54.3	-55.2	-2.6	-57.8	-13.0	-44.8
4	244.37	-60.5	-62.6	-1.4	-64.0	-13.0	-51.0
5	568.35	-54.0	-58.2	3.7	-54.5	-13.0	-41.5
6	591.63	-52.4	-55.4	3.8	-51.6	-13.0	-38.6

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Channel Bandwidth: 10MHz

Mode	TX channel 23230 (782.00MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu	Test Mode	A

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	33.88	-42.0	-24.1	-17.1	-41.2	-13.0	-28.2
2	65.89	-51.5	-58.9	-1.9	-60.8	-13.0	-47.8
3	101.78	-55.2	-64.1	-1.6	-65.7	-13.0	-52.7
4	226.91	-53.8	-62.1	-1.7	-63.8	-13.0	-50.8
5	490.75	-66.1	-72.3	3.7	-68.6	-13.0	-55.6
6	580.96	-65.2	-70.0	3.8	-66.2	-13.0	-53.2
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	68.80	-51.9	-59.8	-0.8	-60.6	-13.0	-47.6
2	88.20	-55.2	-63.5	-0.2	-63.7	-13.0	-50.7
3	141.55	-63.2	-64.7	-3.0	-67.7	-13.0	-54.7
4	193.93	-54.0	-54.9	-2.6	-57.5	-13.0	-44.5
5	247.28	-60.1	-61.6	-1.5	-63.1	-13.0	-50.1
6	580.96	-66.0	-69.8	3.8	-66.0	-13.0	-53.0

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 23230 (782.00MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu	Test Mode	B

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	40.67	-49.1	-36.0	-13.1	-49.1	-13.0	-36.1
2	101.78	-54.8	-63.6	-1.6	-65.2	-13.0	-52.2
3	159.01	-60.8	-65.2	-2.8	-68.0	-13.0	-55.0
4	226.91	-53.3	-61.7	-1.7	-63.4	-13.0	-50.4
5	399.57	-69.0	-75.3	3.3	-72.0	-13.0	-59.0
6	580.96	-62.5	-67.3	3.8	-63.5	-13.0	-50.5
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	71.71	-43.6	-51.4	-0.3	-51.7	-13.0	-38.7
2	101.78	-54.5	-63.4	-1.6	-65.0	-13.0	-52.0
3	192.96	-54.2	-55.3	-2.6	-57.9	-13.0	-44.9
4	260.86	-61.4	-61.0	-1.5	-62.5	-13.0	-49.5
5	490.75	-63.3	-69.3	3.7	-65.6	-13.0	-52.6
6	580.96	-61.7	-65.5	3.8	-61.7	-13.0	-48.7

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Above 1GHz

Channel Bandwidth: 5MHz

Mode	TX channel 19975 (1712.50MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

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	3425.00	-62.8	-54.2	1.3	-52.9	-13.0	-39.9
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	3425.00	-60.7	-52.6	1.3	-51.3	-13.0	-38.3

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 20175 (1732.50MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

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	3465.00	-63.9	-55.5	1.4	-54.1	-13.0	-41.1
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	3465.00	-61.0	-53.2	1.4	-51.8	-13.0	-38.8

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 20375 (1752.50MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

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	3505.00	-63.3	-55.1	1.5	-53.6	-13.0	-40.6
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	3505.00	-60.0	-52.4	1.5	-50.9	-13.0	-37.9

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Channel Bandwidth: 10MHz

Mode	TX channel 20000 (1715.00MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

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	3430.00	-61.9	-53.4	1.4	-52.0	-13.0	-39.0
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	3430.00	-59.4	-51.4	1.4	-50.0	-13.0	-37.0

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 20175 (1732.50MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

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	3465.00	-62.4	-54.0	1.4	-52.6	-13.0	-39.6
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	3465.00	-61.0	-53.2	1.4	-51.8	-13.0	-38.8

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 20350 (1750.00MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

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	3500.00	-63.8	-55.6	1.5	-54.1	-13.0	-41.1
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	3500.00	-60.9	-53.3	1.5	-51.8	-13.0	-38.8

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Channel Bandwidth: 15MHz

Mode	TX channel 20025 (1717.50MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

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	3435.00	-64.1	-55.5	1.3	-54.2	-13.0	-41.2
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	3435.00	-61.1	-53.0	1.3	-51.7	-13.0	-38.7

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 20175 (1732.50MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

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	3465.00	-62.6	-54.2	1.4	-52.8	-13.0	-39.8
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	3465.00	-60.5	-52.7	1.4	-51.3	-13.0	-38.3

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 20325 (1747.50MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

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	3495.00	-62.5	-54.3	1.5	-52.8	-13.0	-39.8
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	3495.00	-58.7	-51.1	1.5	-49.6	-13.0	-36.6

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Channel Bandwidth: 20MHz

Mode	TX channel 20050 (1720.00MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

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	3440.00	-61.9	-53.4	1.3	-52.1	-13.0	-39.1
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	3440.00	-59.3	-51.3	1.3	-50.0	-13.0	-37.0

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 20175 (1732.50MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

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	3465.00	-63.0	-54.6	1.4	-53.2	-13.0	-40.2
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	3465.00	-61.1	-53.3	1.4	-51.9	-13.0	-38.9

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 20300 (1745.00MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

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	3490.00	-62.2	-54.0	1.5	-52.5	-13.0	-39.5
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	3490.00	-59.0	-51.4	1.5	-49.9	-13.0	-36.9

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

LTE Band 13

Channel Bandwidth: 5MHz

Mode	TX channel 23205 (779.50MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1559.00	-53.4	-45.7	1.3	-44.4	-13.0	-31.4
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1559.00	-55.0	-48.2	1.3	-46.9	-13.0	-33.9

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 23230 (782.00MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1564.00	-54.0	-46.2	1.2	-45.0	-13.0	-32.0
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1564.00	-53.1	-46.2	1.2	-45.0	-13.0	-32.0

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 23255 (784.50MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1569.00	-54.8	-46.9	1.2	-45.7	-13.0	-32.7
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1569.00	-55.2	-48.3	1.2	-47.1	-13.0	-34.1

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Channel Bandwidth: 10MHz

Mode	TX channel 23230 (782.00MHz)	Frequency Range	Above 1000MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1564.00	-53.8	-46.0	1.2	-44.8	-13.0	-31.8
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1564.00	-55.9	-48.9	1.2	-47.7	-13.0	-34.7

Remarks:
1. Output Power (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

5 Pictures of Test Arrangements

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

Appendix – Information on 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 FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

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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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