FCC Test Report

(Part 27: LTE Band 4_Spot Check)

Report No.:	RF170208C16B-3
FCC ID:	H8NSFE3046
Original FCC ID:	H8NSS2FII
Test Model:	SS2FII Femtocell Multi-band SOHO
Received Date:	Jun. 11, 2018
Test Date:	Sep. 03 ~ Sep. 07, 2018
Issued Date:	Sep. 10, 2018
Applicant:	ASKEY COMPUTER CORP.
Address:	10F, No. 119, Jiankang Rd., Zhonghe Dist., New Taipei City 23585, Taiwan
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.)

Testing Laboratory
2021

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Release Control Record

Issue No.	Description	Date Issued
RF170208C16B-3	Original release	Sep. 10, 2018

1 Certificate of Conformity

Product:	Femtocell
Brand:	Nokia
Test Model:	SS2FII Femtocell Multi-band SOHO
Sample Status:	Engineering sample
Applicant:	ASKEY COMPUTER CORP.
Test Date:	Sep. 03 ~ Sep. 07, 2018
Standards:	FCC Part 27, Subpart C, L FCC Part 2

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

Prepared by : Pettie Chen , **Date:** Sep. 10, 2018

Pettie Chen / Senior Specialist

Approved by : , **Date:** Sep. 10, 2018

Dylan Chiou / Project Engineer

2 Summary of Test Results

Applied Standard: FCC Part 27 & Part 2			
FCC Clause LTE Band 4	Test Item	Result	Remarks
2.1046 27.50(d)(4)	Equivalent Isotropically radiated power	Pass	Meet the requirement of limit.
2.1047	Modulation characteristics	Pass	Meet the requirement
2.1055 27.54	Frequency Stability Stay with the authorized bands of operation	Pass	Meet the requirement of limit.
2.1049 27.53(h)	Occupied Bandwidth	Pass	Meet the requirement of limit.
27.53(h)	Band Edge Measurements	Pass	Meet the requirement of limit.
27.50(d)(5)	Peak To Average Ratio	Pass	Meet the requirement of limit.
2.1051 27.53(h)	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 27.53(h)	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -37.0dB at 4265.00MHz.

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	HLA 6121	45745	Jun. 14, 2018	Jun. 13, 2019
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Aug. 08, 2018	Aug. 07, 2019
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, 2018	Aug. 07, 2019
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
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
Temperature And Humidity Chamber TERCHY	HRM-120RF	931022	Nov. 20, 2017	Nov. 19, 2018
JFW 20dB attenuation	50HF-020-SMA	NA	NA	NA
Radio Communication Analyzer	MT8821C	6261786083	Dec. 21, 2017	Dec. 20, 2018

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 horn antenna and preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 215374.
5. The IC Site Registration No. is IC 7450F-9.

3 General Information

3.1 General Description of EUT

Product	Femtocell				
Brand	Nokia				
Test Model	SS2FII Femtocell Multi-band SOHO				
Status of EUT	Engineering sample				
Power Supply Rating	12Vdc (Adapter)				
Modulation Type	QPSK, 16QAM, 64QAM				
Operating Frequency	LTE Band 4	Channel Bandwidth 5MHz	2112.5MHz ~ 2152.5MHz		
		Channel Bandwidth 10MHz	2115.0MHz ~ 2150.0MHz		
		Channel Bandwidth 15MHz	2117.5MHz ~ 2147.5MHz		
		Channel Bandwidth 20MHz	2120.0MHz ~ 2145.0MHz		
Max. EIRP Power	LTE Band 4	Channel Bandwidth 5MHz	537.032mW (27.3dBm)		
		Channel Bandwidth 10MHz	575.440mW (27.6dBm)		
		Channel Bandwidth 15MHz	478.630mW (26.8dBm)		
		Channel Bandwidth 20MHz	562.341mW (27.5dBm)		
Emission Designator	LTE Band 4		QPSK	16QAM	64QAM
		Channel Bandwidth 10MHz	8M91G7D	8M90W7D	8M90W7D
Antenna Type	LTE Band 4: Antenna 1: PIFA antenna with 3.1dBi gain Antenna 3: PIFA antenna with 2.6dBi gain				
Antenna Connector	NA				
Accessory Device	Adapter, GPS antenna (Brand: INPAQ, model: GPSGLONASS15D-S6-0341-A, cable: 4.55m non-shielded cable w/o core)				
Data Cable Supplied	2.95m non-shielded RJ45 cable w/o core				

Note:

1. Exhibit prepared for FCC Spot Check Verification report, the format, test items and amount of spot–check test data are decided by applicant's engineering judgment, for more details please refer to declaration letter exhibit.
2. The EUT uses following adapters.

Adapter 1	
Brand	SHENZHEN FRECOM ELECTRONICS CO., LTD
Model	F24W5-120200SPAU
Input Power	100-240Vac, 50/60Hz, 0.6A
Output Power	12Vdc, 2A
Power Line	1.5m DC cable without core attached on adapter

Adapter 2	
Brand	AOEM
Model	ADS0248T-W120200(H)
Input Power	100-240Vac~50-60Hz 0.6A
Output Power	12Vdc / 2.0A
Power Line	1.55m DC cable without core attached on adapter

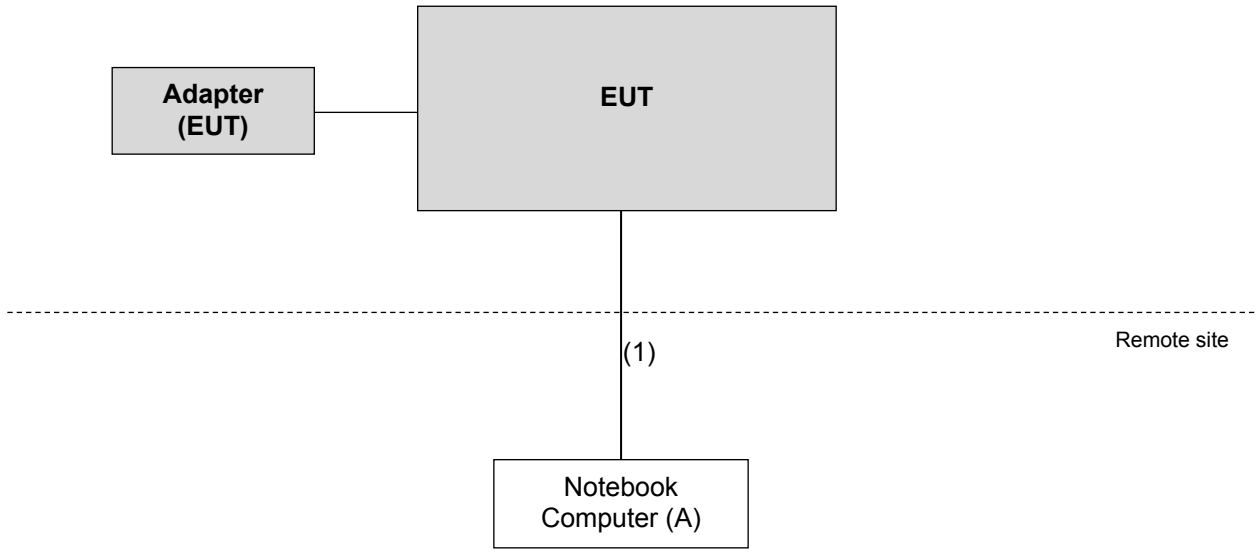
*After pre-testing, adapter 1 was the worst case for the final tests.

3. The EUT provides 2 completed transmitters and 2 receivers.

Modulation Mode	TX FUNCTION	RX FUNCTION
LTE	2TX	2RX

4. Carrier Aggregation technology supported for this device, the operation behavior is LTE Band 2 + LTE Band 4, for more details information please refer to “CA Mode” of test report.

3.2 Configuration of System under Test



3.2.1 Description of Support Units

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

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook Computer	DELL	E5410	1HC2XM1	FCC DoC Approved	-

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ45 Cable	1	10	N	0	Cat5e

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. Following channel(s) was (were) selected for the final test as listed below:

LTE Band 4

Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation
Output Power	1975 to 2375	1975(2112.5MHz), 2175(2132.5MHz), 2375(2152.5MHz)	5MHz	QPSK
	2000 to 2350	2000(2115.0MHz), 2175(2132.5MHz), 2350(2150.0MHz)	10MHz	QPSK
	2025 to 2325	2025(2117.5MHz), 2175(2132.5MHz), 2325(2147.5MHz)	15MHz	QPSK
	2050 to 2300	2050(2120.0MHz), 2175(2132.5MHz), 2300(2145.0MHz)	20MHz	QPSK
Modulation characteristics	2050 to 2300	2175(2132.5MHz)	20MHz	QPSK / 16QAM / 64QAM
Frequency Stability	2050 to 2300	2175(2132.5MHz)	20MHz	QPSK
Emission Bandwidth	2000 to 2350	2175(2132.5MHz)	10MHz	QPSK / 16QAM / 64QAM
Channel Edge	2000 to 2350	2000(2115.0MHz), 2350(2150.0MHz)	10MHz	QPSK
Peak To Average Ratio	2000 to 2350	2000(2115.0MHz), 2175(2132.5MHz), 2350(2150.0MHz)	10MHz	QPSK / 16QAM / 64QAM
Conducted Emission	2000 to 2350	2000(2115.0MHz), 2175(2132.5MHz), 2350(2150.0MHz)	10MHz	QPSK
Radiated Emission Below 1GHz	2000 to 2350	2175(2132.5MHz)	10MHz	QPSK
Radiated Emission Above 1GHz	2000 to 2350	2175(2132.5MHz)	10MHz	QPSK

Note:

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

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
Output Power	25deg. C, 69%RH	120Vac, 60Hz	Tank Wu
Modulation characteristics	25deg. C, 69%RH	120Vac, 60Hz	James Yang
Frequency Stability	24deg. C, 64%RH	120Vac, 60Hz	James Yang
Emission Bandwidth	24deg. C, 64%RH	120Vac, 60Hz	James Yang
Channel Edge	24deg. C, 64%RH	120Vac, 60Hz	James Yang
Peak To Average Ratio	24deg. C, 64%RH	120Vac, 60Hz	James Yang
Conducted Emission	24deg. C, 64%RH	120Vac, 60Hz	James Yang
Radiated Emission	25deg. C, 66%RH	120Vac, 60Hz	Greg Lin

3.4 EUT Operating Conditions

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

KDB 412172 D01 Determining ERP and EIRP v01r01

KDB 662911 D01 multiple transmitter output v02r01

ANSI/TIA/EIA-603-E 2016

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

The radiated peak output power shall be according to the specific rule Part 27.50(d)(2) that are limited to EIRP of 1640 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

4.1.2 Test Procedures

EIRP / ERP Measurement:

a. All measurements were done at low, middle and high operational frequency range. RBW and VBW is 10MHz 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.

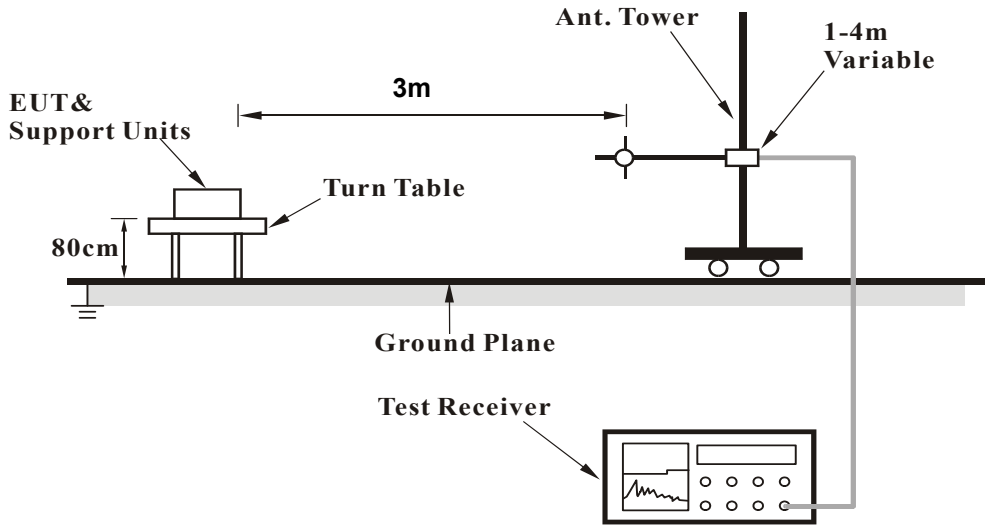
Conducted Power Measurement:

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.

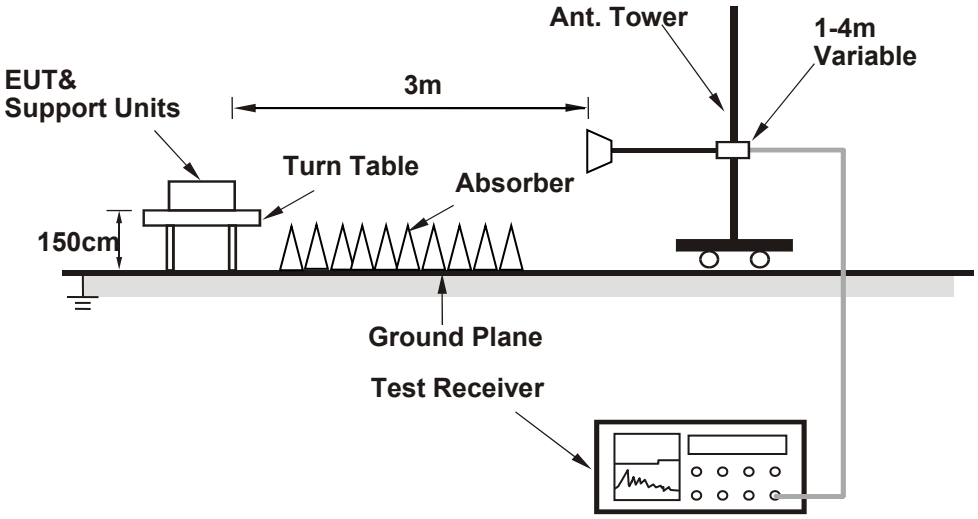
4.1.3 Test Setup

EIRP / ERP MEASUREMENT:

For Radiated Emission below or equal 1GHz

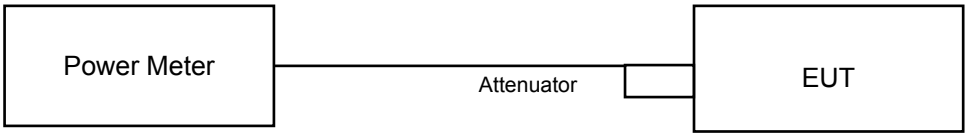


For Radiated Emission above 1GHz



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						64QAM					
			Low CH 1975		Mid CH 2175		High CH 2375		Low CH 1975		Mid CH 2175		High CH 2375		Low CH 1975		Mid CH 2175		High CH 2375	
			2112.5 MHz		2132.5 MHz		2152.5 MHz		2112.5 MHz		2132.5 MHz		2152.5 MHz		2112.5 MHz		2132.5 MHz		2152.5 MHz	
			Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1
4/5M	25	0	20.03	20.21	20.34	20.79	20.25	20.44	19.81	19.24	19.75	19.90	19.26	19.46	18.71	19.25	18.78	19.22	18.61	19.12
			Total		Total		Total		Total		Total		Total		Total		Total		Total	
			23.13		23.58		23.36		22.54		22.84		22.37		22.00		22.02		21.88	
Band / BW	RB Size	RB Offset	QPSK						16QAM						64QAM					
			Low CH 2000		Mid CH 2175		High CH 2350		Low CH 2000		Mid CH 2175		High CH 2350		Low CH 2000		Mid CH 2175		High CH 2350	
			2115 MHz		2132.5 MHz		2150 MHz		2115 MHz		2132.5 MHz		2150 MHz		2115 MHz		2132.5 MHz		2150 MHz	
			Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1
4/10M	50	0	20.37	20.53	20.26	20.90	20.20	20.52	19.55	19.83	19.61	20.03	19.52	19.61	18.82	19.24	18.98	19.45	18.58	19.06
			Total		Total		Total		Total		Total		Total		Total		Total		Total	
			23.63		23.60		23.37		22.70		22.84		22.58		22.05		22.23		21.84	
Band / BW	RB Size	RB Offset	QPSK						16QAM						64QAM					
			Low CH 2025		Mid CH 2175		High CH 2325		Low CH 2025		Mid CH 2175		High CH 2325		Low CH 2025		Mid CH 2175		High CH 2325	
			2117.5 MHz		2132.5 MHz		2147.5 MHz		2117.5 MHz		2132.5 MHz		2147.5 MHz		2117.5 MHz		2132.5 MHz		2147.5 MHz	
			Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1
4/15M	75	0	20.49	20.61	20.31	20.73	20.28	20.56	19.72	19.96	19.87	20.31	19.52	19.78	19.01	19.48	18.98	19.33	18.88	19.25
			Total		Total		Total		Total		Total		Total		Total		Total		Total	
			23.56		23.54		23.43		22.85		23.11		22.66		22.26		22.17		22.08	
Band / BW	RB Size	RB Offset	QPSK						16QAM						64QAM					
			Low CH 2050		Mid CH 2175		High CH 2300		Low CH 2050		Mid CH 2175		High CH 2300		Low CH 2050		Mid CH 2175		High CH 2300	
			2120.0 MHz		2132.5 MHz		2145.0 MHz		2120.0 MHz		2132.5 MHz		2145.0 MHz		2120.0 MHz		2132.5 MHz		2145.0 MHz	
			Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1	Chain0	Chain1
4/20M	100	0	20.21	20.76	20.14	20.77	20.10	20.33	19.70	19.96	19.40	19.77	19.48	19.68	19.05	19.13	18.70	19.13	18.60	19.02
			Total		Total		Total		Total		Total		Total		Total		Total		Total	
			23.50		23.48		23.23		22.84		22.60		22.59		22.10		21.93		21.83	

EIRP Power (dBm)

LTE Band 4

Channel Bandwidth: 5MHz

MODE		TX channel 1975					
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	2112.50	-21.9	20.0	-0.3	19.7	30.0	-10.3
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	2112.50	-16.0	26.5	-0.3	26.2	30.0	-3.8

MODE		TX channel 2175					
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	2132.50	-19.8	22.1	-0.4	21.7	30.0	-8.3
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	2132.50	-15.6	27.0	-0.4	26.6	30.0	-3.4

MODE		TX channel 2375					
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	2152.50	-20.6	21.4	-0.3	21.1	30.0	-8.9
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	2152.50	-14.8	27.6	-0.3	27.3	30.0	-2.7

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

Channel Bandwidth: 10MHz

MODE		TX channel 2000					
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	2115.00	-19.8	21.9	-0.3	21.6	30.0	-8.4
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	2115.00	-15.1	27.4	-0.3	27.1	30.0	-2.9

MODE		TX channel 2175					
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	2132.50	-22.0	19.9	-0.4	19.5	30.0	-10.5
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	2132.50	-14.6	28.0	-0.4	27.6	30.0	-2.4

MODE		TX channel 2350					
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	2150.00	-21.9	20.0	-0.3	19.7	30.0	-10.3
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	2150.00	-14.8	27.6	-0.3	27.3	30.0	-2.7

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

Channel Bandwidth: 15MHz

MODE		TX channel 2025					
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	2117.50	-21.3	20.4	-0.3	20.1	30.0	-9.9
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	2117.50	-15.8	26.7	-0.3	26.4	30.0	-3.6

MODE		TX channel 2175					
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	2132.50	-20.4	21.5	-0.4	21.1	30.0	-8.9
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	2132.50	-15.4	27.2	-0.4	26.8	30.0	-3.2

MODE		TX channel 2325					
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	2147.50	-20.8	21.1	-0.3	20.8	30.0	-9.2
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	2147.50	-15.4	27.0	-0.3	26.7	30.0	-3.3

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

Channel Bandwidth: 20MHz

MODE		TX channel 2050					
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	2120.00	-18.0	23.8	-0.3	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	2120.00	-14.7	27.8	-0.3	27.5	30.0	-2.5

MODE		TX channel 2175					
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	2132.50	-17.9	24.0	-0.4	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	2132.50	-15.9	26.7	-0.4	26.3	30.0	-3.7

MODE		TX channel 2300					
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	2145.00	-20.0	21.9	-0.3	21.6	30.0	-8.4
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	2145.00	-15.7	26.8	-0.3	26.5	30.0	-3.5

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

4.2 Modulation characteristics Measurement

4.2.1 Limits of Modulation characteristics

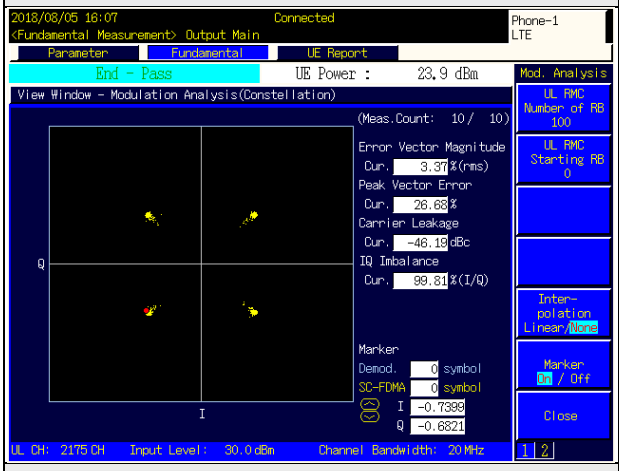
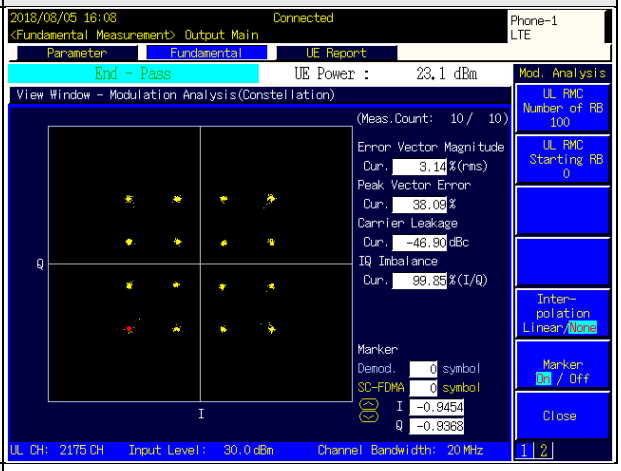
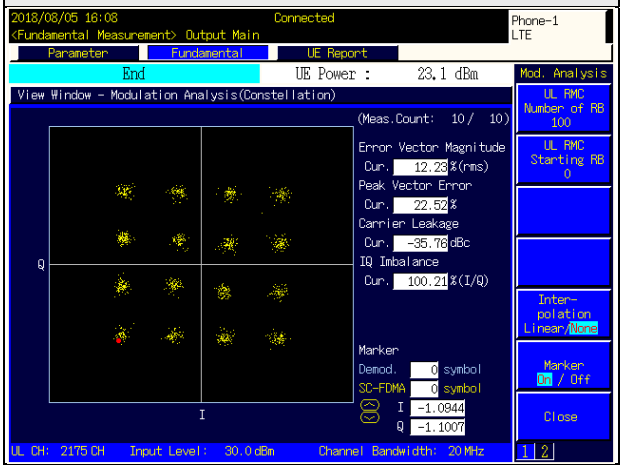
N/A

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: 2175 / Frequency (MHz): 2132.5MHz	
Channel Bandwidth: 20MHz / QPSK	Channel Bandwidth: 20MHz / 16QAM
	
Channel Bandwidth: 20MHz / 64QAM	
	

4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

According to the FCC part 2.1055 shall be tested the frequency stability. The rule is defined that" The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block." The test extreme voltage is according to the 2.1055(d)(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment and the extreme temperature rule is comply with specification of EUT -20℃ ~ 50℃.

4.3.2 Test Procedure

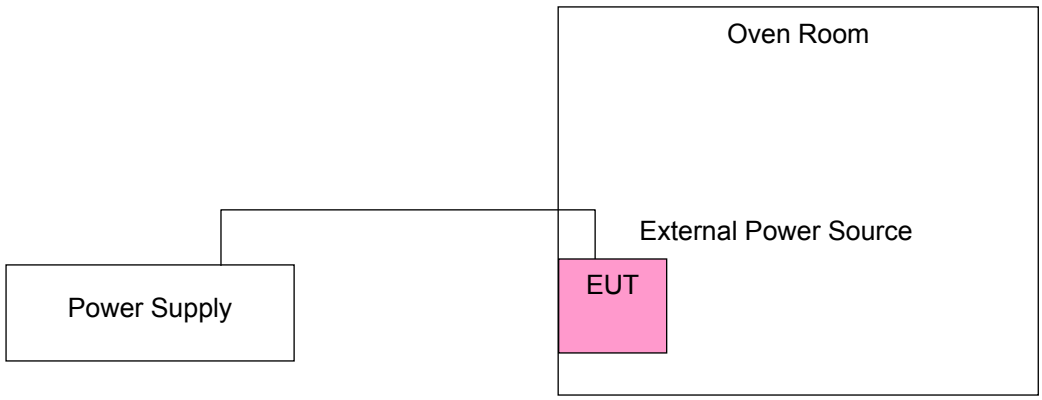
a. Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.

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 (Pass/Fail)
	LTE Band 4	
138	0.02739	Pass
120	0.12789	Pass
102	0.15268	Pass

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

Frequency Error vs. Temperature.

TEMP. (℃)	Frequency Error (ppm)	Limit (Pass/Fail)
	LTE Band 4	
50	0.14169	Pass
40	0.08762	Pass
30	0.16023	Pass
20	0.09147	Pass
10	0.01524	Pass
0	0.00223	Pass
-10	0.00162	Pass
-20	0.13682	Pass
-30	0.01639	Pass

4.4 Emission Bandwidth Measurement

4.4.1 Limits of Emission Bandwidth Measurement

-26dBc Bandwidth
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.

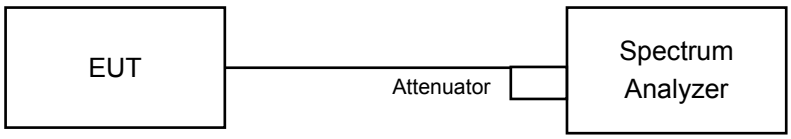
Occupied Bandwidth
The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

4.4.2 Test Procedure

-26dBc Bandwidth
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 = 100kHz and VBW = 300kHz (Channel Bandwidth: 5MHz), RBW = 200kHz and VBW = 620kHz (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.

Occupied Channel Bandwidth
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 = 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).

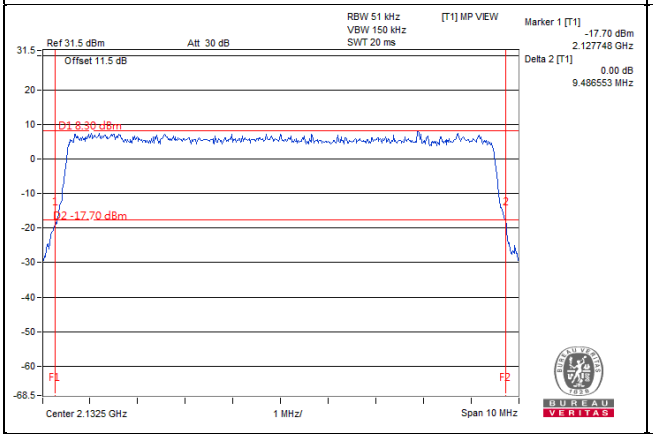
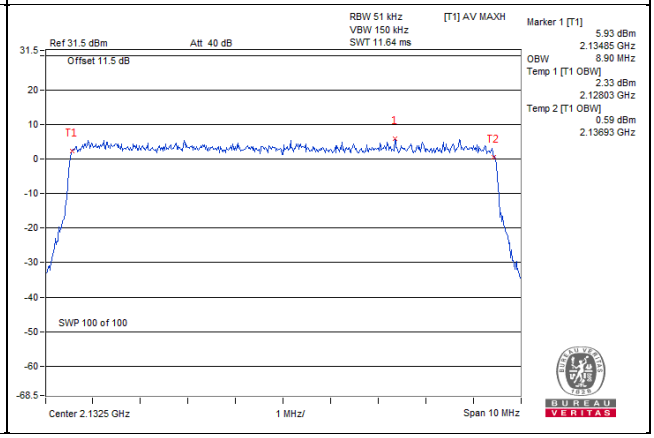
4.4.3 Test Setup



4.4.4 Test Result

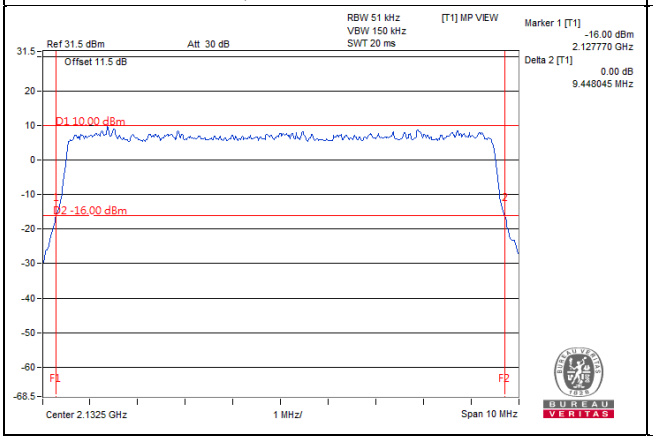
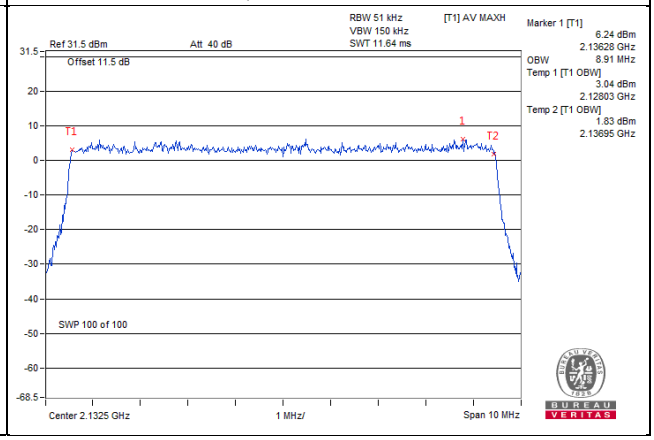
LTE Band 4 / Chain 0

Channel Bandwidth: 10MHz							
Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			Occupied Bandwidth (MHz)		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
2175	2132.5	9.49	9.45	9.47	8.90	8.90	8.90

Spectrum Plot of Worst Value	
26dBc Bandwidth	Occupied Bandwidth
QPSK / Ch 2175	QPSK / Ch 2175
	

LTE Band 4 / Chain 1

Channel Bandwidth: 10MHz							
Channel	Frequency (MHz)	26dBc Bandwidth (MHz)			Occupied Bandwidth (MHz)		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
2175	2132.5	9.45	9.44	9.41	8.91	8.90	8.90

Spectrum Plot of Worst Value	
26dBc Bandwidth	Occupied Bandwidth
QPSK / Ch 2175	QPSK / Ch 2175
	

4.5 Channel Edge Measurement

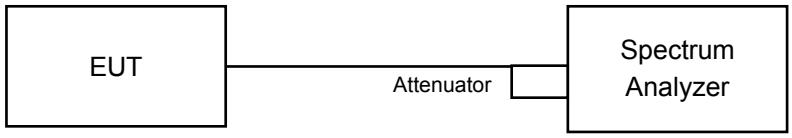
4.5.1 Limits of Band Edge Measurement

According to FCC 27.53(h) specified 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. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

Note:

This device can be impalement MIMO function, so the limit of spurious emissions needs to be reduced by 10log($Numbers_{Ant}$) according to FCC KDB 662911 D01 guidance.

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.

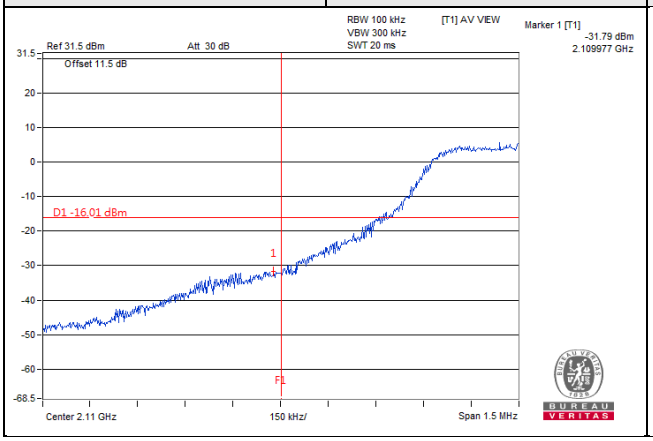
b. The center frequency of spectrum is the band edge frequency and span is 1.5MHz. RBW of the spectrum is 50kHz.

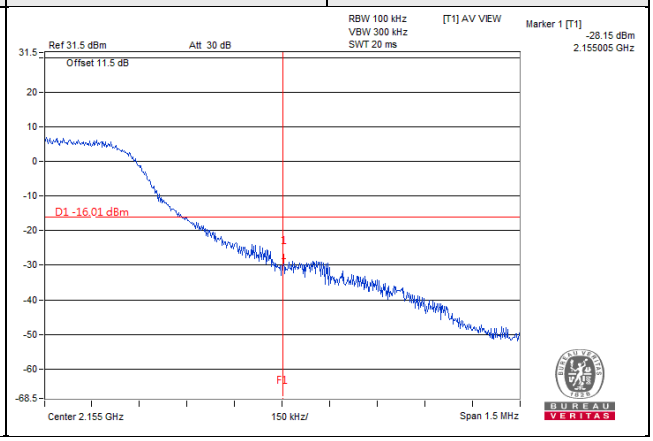
c. Record the max trace plot into the test report.

4.5.4 Test Results

LTE Band 4 / Chain 0

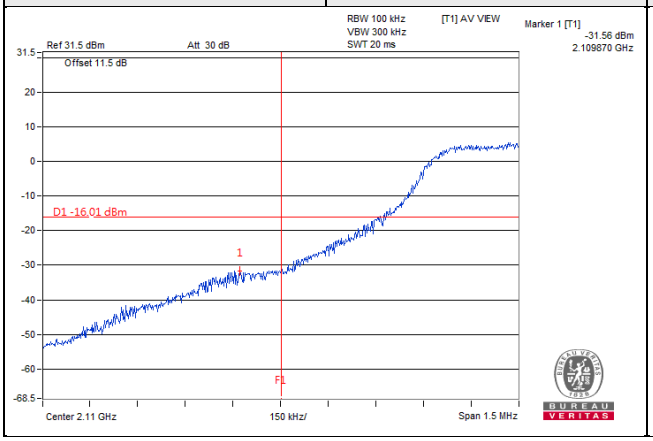
Channel Bandwidth: 10MHz			
Channel 2000	QPSK	Channel 2350	QPSK

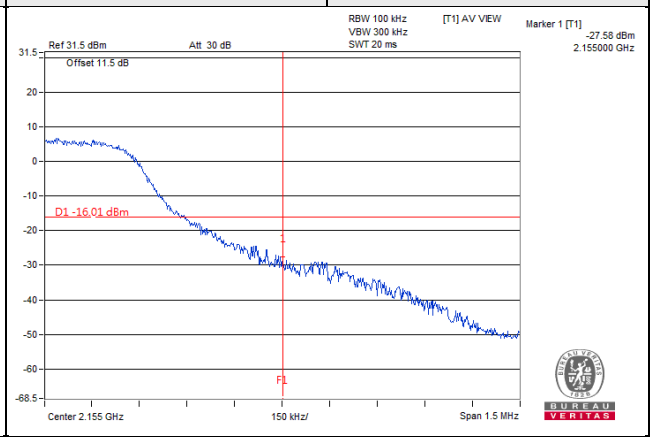




LTE Band 4 / Chain 1

Channel Bandwidth: 10MHz			
Channel 2000	QPSK	Channel 2350	QPSK



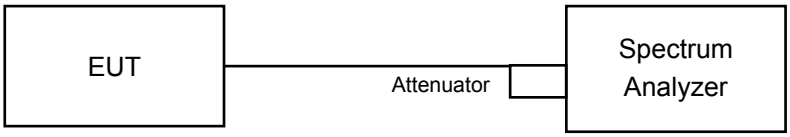


4.6 Peak to Average Ratio

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

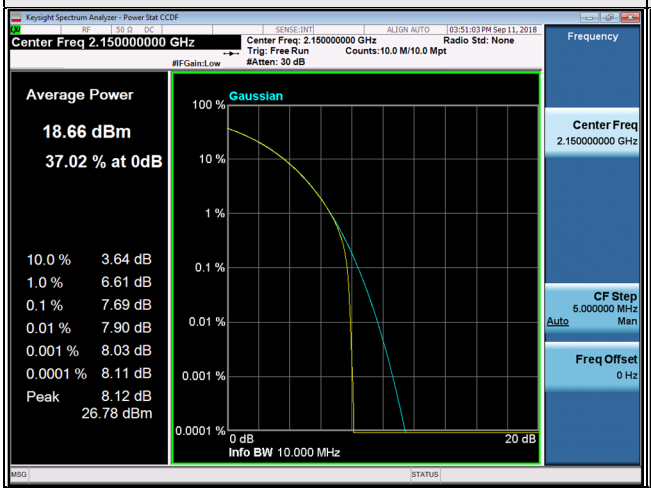
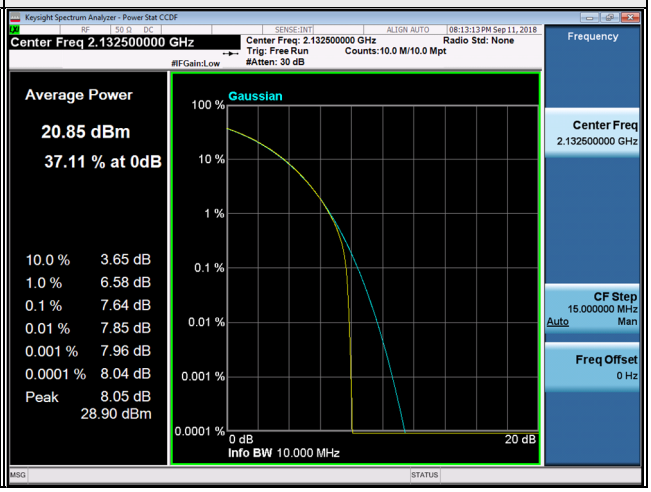
a. Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;

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 / Chain 0					LTE Band 4 / Chain 1				
Channel Bandwidth 10MHz					Channel Bandwidth 10MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM			QPSK	16QAM	64QAM
2000	2115.0	7.67	7.68	7.68	2000	2115.0	7.64	7.64	7.64
2175	2132.5	7.67	7.68	7.67	2175	2132.5	7.64	7.63	7.64
2350	2150.0	7.67	7.67	7.69	2350	2150.0	7.61	7.61	7.61

Spectrum Plot of Worst Value	
Chain 0 / 10MHz / 64QAM / Ch 2350	Chain 1 / 10MHz / QPSK / Ch 2175
	

4.7 Conducted Spurious Emissions

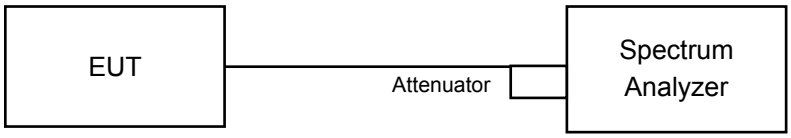
4.7.1 Limits of Conducted Spurious Emissions Measurement

In the FCC 27.53(h), On any frequency outside a licensee's frequency block, The power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB.

Note:

This device can be impalement MIMO function, so the limit of spurious emissions needs to be reduced by $10\log(Numbers_{Ant})$ according to FCC KDB 662911 D01 guidance.

4.7.2 Test Setup



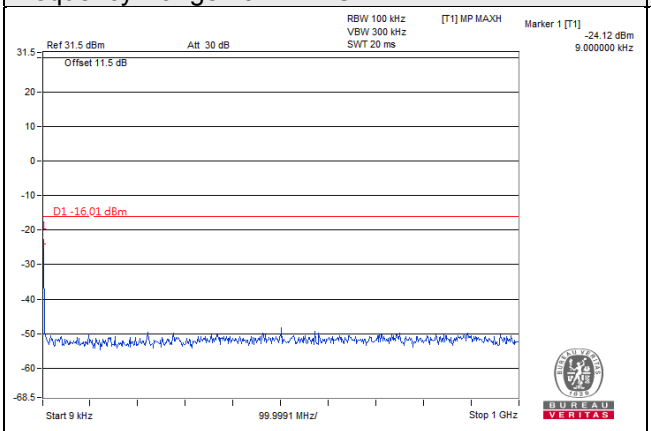
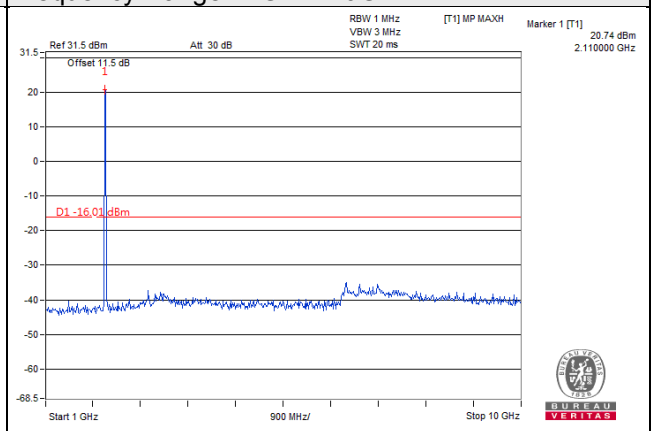
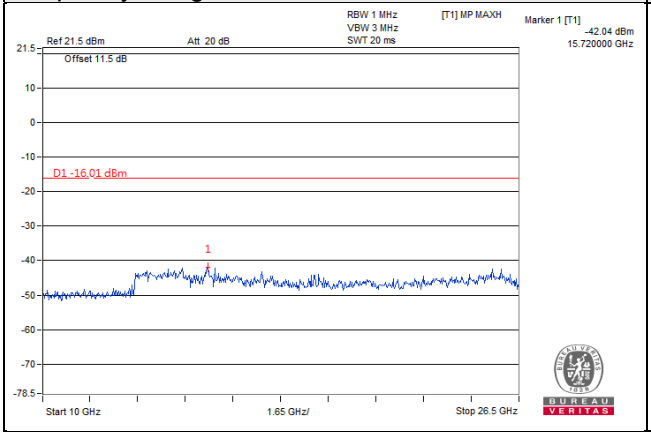
4.7.3 Test Procedure

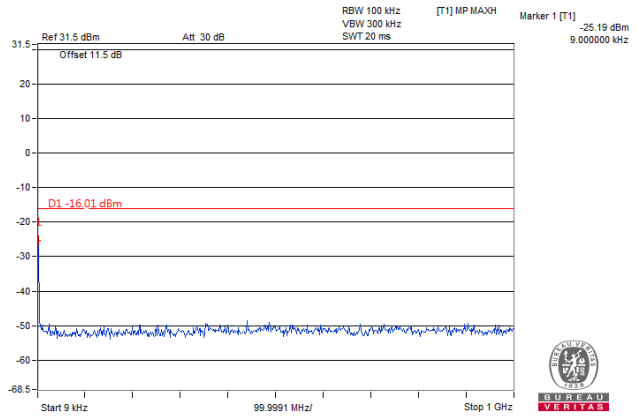
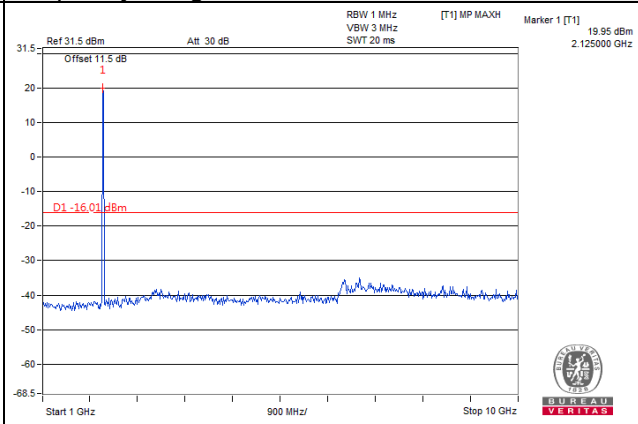
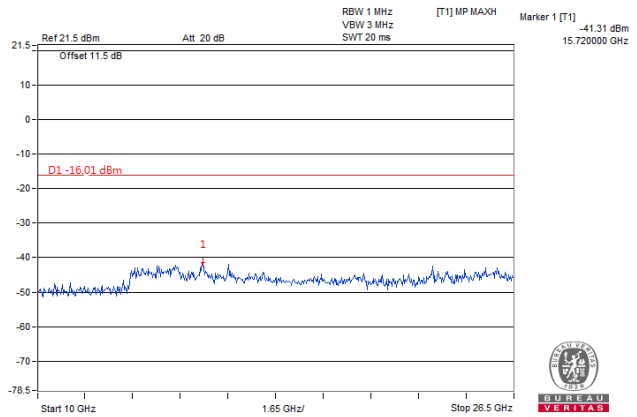
a. All measurements were done at 3 channels: low, middle and high operational frequency range.

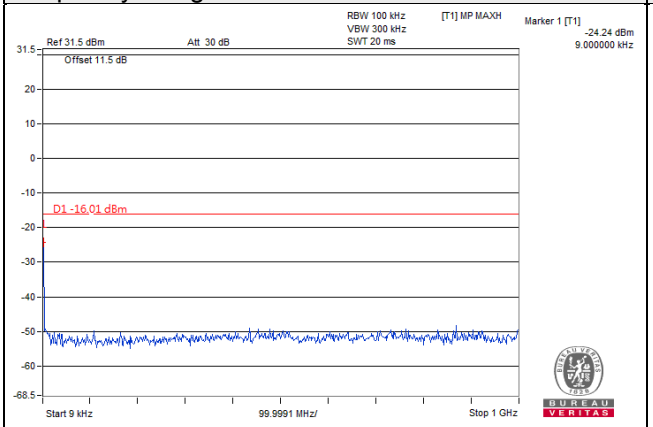
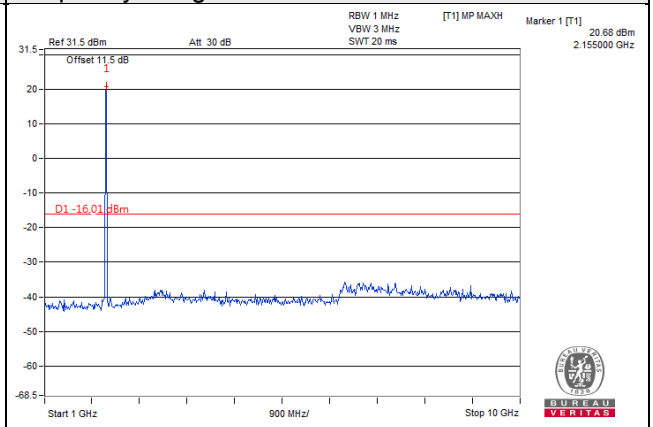
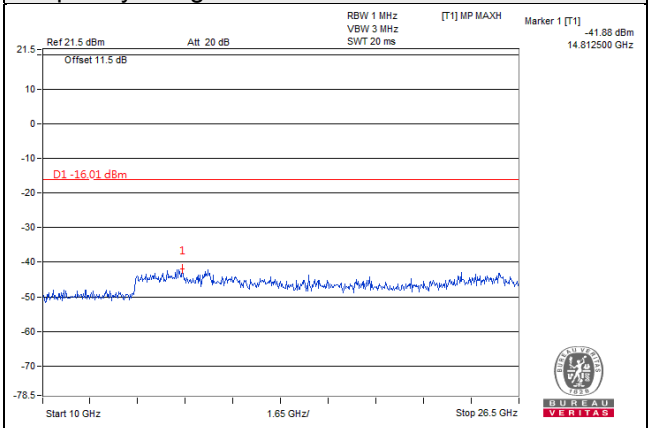
b. When the spectrum scanned from 9kHz to 20GHz for LTE Band 4, it shall be connected to the attenuator with the carried frequency.

4.7.4 Test Results

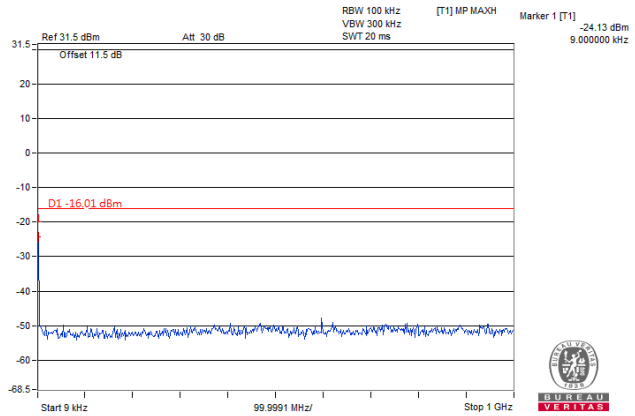
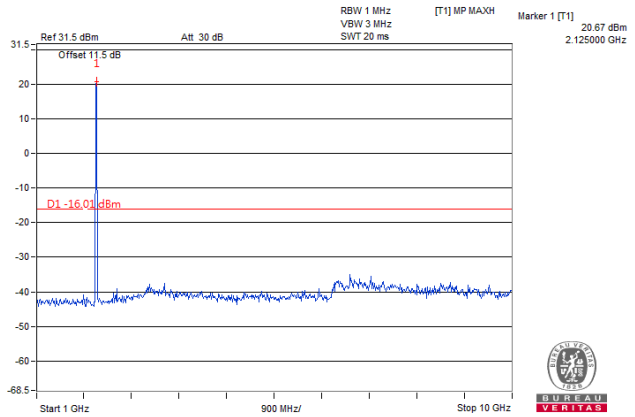
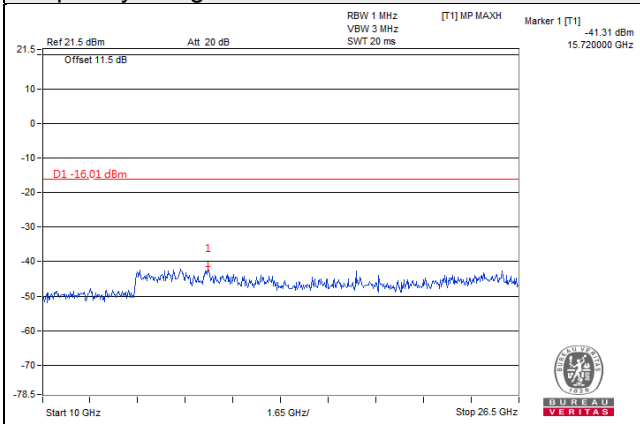
LTE Band 4 / Chain 0

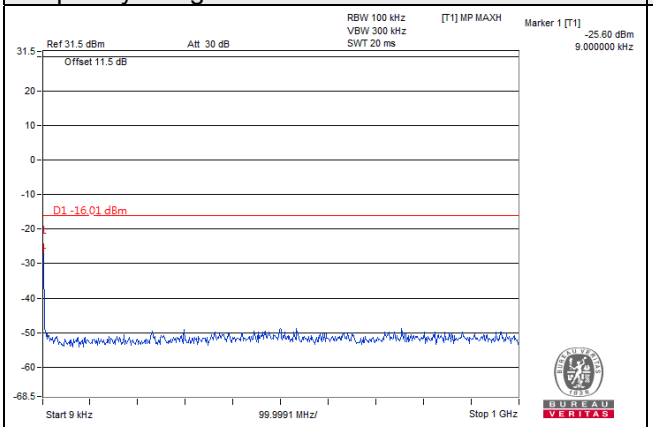
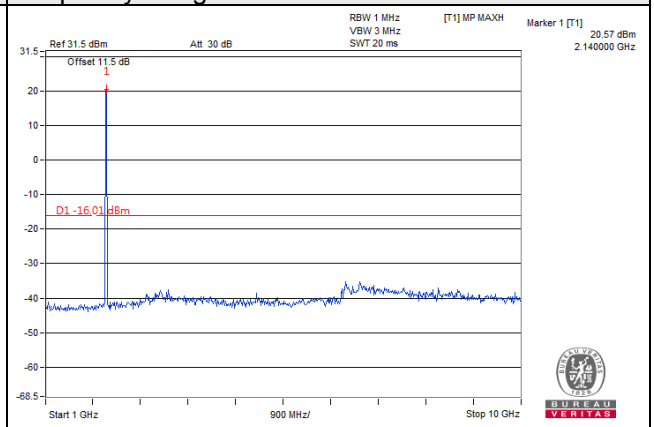
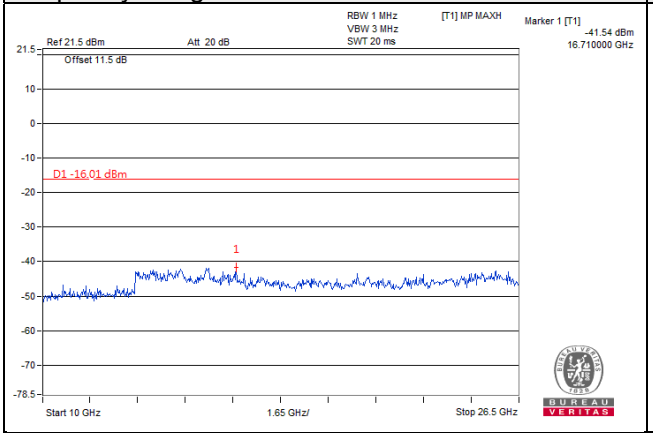
Channel Bandwidth: 10MHz	
Channel 2000	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz
	
Frequency Range : 10GHz~26.5GHz	
	

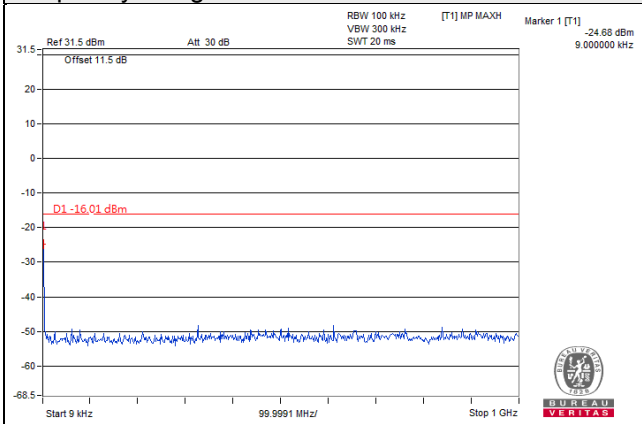
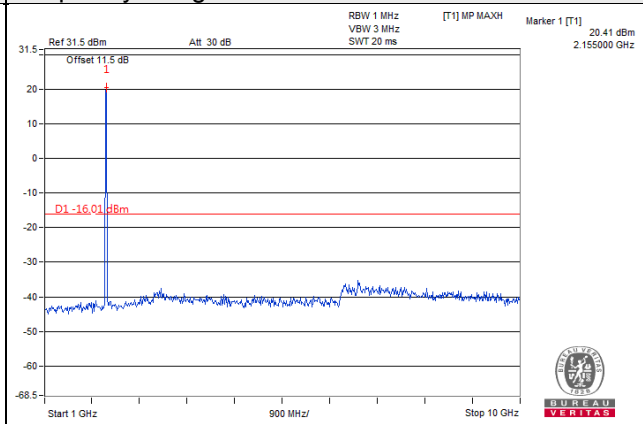
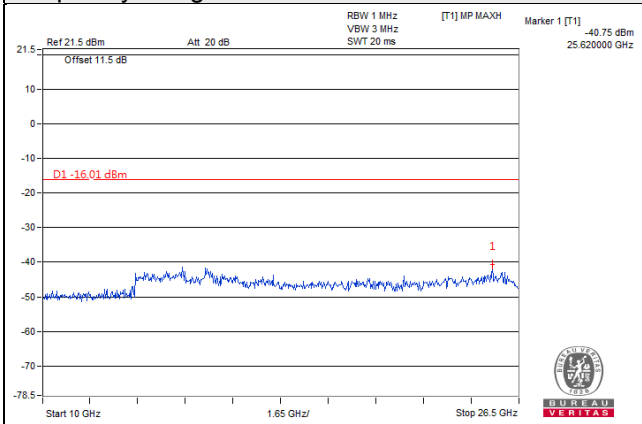
Channel Bandwidth: 10MHz	
Channel 2175	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz
	
Frequency Range : 10GHz~26.5GHz	
	

Channel Bandwidth: 10MHz	
Channel 2350	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz
	
Frequency Range : 10GHz~26.5GHz	
	

LTE Band 4 / Chain 1

Channel Bandwidth: 10MHz	
Channel 2000	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz
	
Frequency Range : 10GHz~26.5GHz	
	

Channel Bandwidth: 10MHz	
Channel 2175	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz
	
Frequency Range : 10GHz~26.5GHz	
	

Channel Bandwidth: 10MHz	
Channel 2350	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz
	
Frequency Range : 10GHz~26.5GHz	
	

4.8 Radiated Emission Measurement

4.8.1 Limits of Radiated Emission Measurement

In the FCC 27.53(h), On any frequency outside a licensee's frequency block, The power of any emission shall be attenuated 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

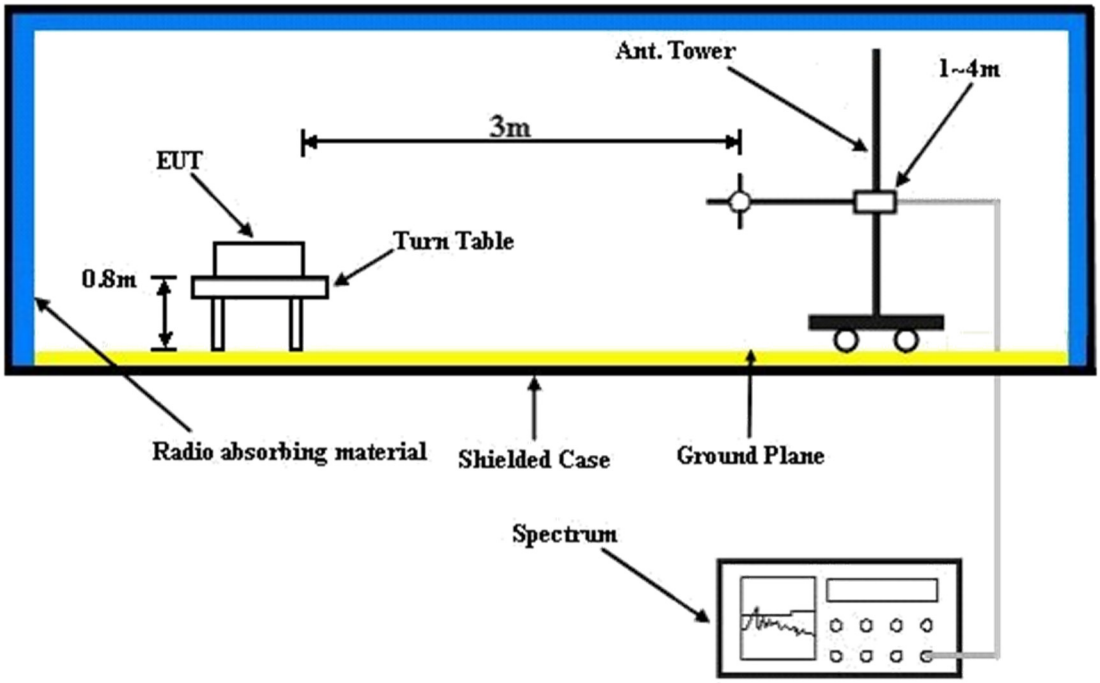
d. EIRP = Output power level of S.G – TX cable loss + Antenna gain of substitution antenna.

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: 10MHz

Mode	TX channel 2175	Frequency Range	Below 1000 MHz

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	30.97	-57.2	-36.9	-18.8	-55.7	-13.0	-42.7
2	60.07	-61.0	-64.5	-3.4	-67.9	-13.0	-54.9
3	204.60	-54.8	-62.9	-2.0	-64.9	-13.0	-51.9
4	286.08	-62.8	-67.0	-1.7	-68.7	-13.0	-55.7
5	645.95	-67.8	-71.4	3.6	-67.8	-13.0	-54.8
6	913.67	-66.2	-64.1	3.5	-60.6	-13.0	-47.6
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	33.88	-52.8	-48.4	-17.1	-65.5	-13.0	-52.5
2	118.27	-49.5	-55.4	-2.9	-58.3	-13.0	-45.3
3	213.33	-61.6	-65.3	-2.0	-67.3	-13.0	-54.3
4	286.08	-67.2	-65.7	-1.7	-67.4	-13.0	-54.4
5	745.86	-55.5	-54.4	3.8	-50.6	-13.0	-37.6
6	957.32	-68.7	-65.3	3.8	-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).

Above 1GHz

Channel Bandwidth: 10MHz

Mode	TX channel 2175	Frequency Range	Above 1000MHz

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	4240.00	-62.2	-53.5	1.0	-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	**4265.00**	**-60.6**	**-51.1**	**1.1**	**-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).

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 accredited and approved according to ISO/IEC 17025.

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

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

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