FCC Test Report (Part 90R)

Report No.:	RF190819E05-3
FCC ID:	NKRM18QF
Test Model:	M18QA
Series Model:	M14QA
Received Date:	Aug. 19, 2019
Test Date:	Sep. 02 to 19, 2019
Issued Date:	Oct. 18, 2019
Applicant:	Wistron NeWeb Corporation
Address:	20 Park Ave. II, Hsinchu Science Park, Hsinchu 308, Taiwan
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
Test Location:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
FCC Registration / Designation Number:	723255 / TW2022

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The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

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Release Control Record

Issue No.	Description	Date Issued
RF190819E05-3	Original release	Oct. 18, 2019

1 Certificate of Conformity

Product:	M2M DATA MODULE
Brand:	Wistron NeWeb Corporation
Test Model:	M18QA
Series Model:	M14QA
Sample Status:	ENGINEERING SAMPLE
Applicant:	Wistron NeWeb Corporation
Test Date:	Sep. 02 to 19, 2019
Standards:	FCC Part 90, Subpart R

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:** Oct. 18, 2019

Claire Kuan / Specialist

Approved by : _____ , **Date:** Oct. 18, 2019

Clark Lin / Technical Manager

2 Summary of Test Results

Applied Standard: FCC Part 90 & Part 2			
FCC Clause	Test Item	Result	Remarks
2.1046 90.542(a)(7)	Radiated Power	PASS	Meet the requirement of limit.
2.1047	Modulation characteristics	PASS	Meet the requirement
2.1055 90.213 90.539	Frequency Stability	PASS	Meet the requirement of limit.
2.1049 90.209	Occupied Bandwidth	PASS	Meet the requirement of limit.
2.1051 90.543	Emission Mask	PASS	Meet the requirement of limit.
---	Peak To Average Ratio	PASS	Meet the requirement of limit.
2.1051 90.543	Conducted Spurious Emissions	PASS	Meet the requirement of limit.
2.1053 90.543	Radiated Spurious Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -30.91dB at 3162MHz.

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

2.1 Measurement Uncertainty

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

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.0 dB
	30MHz ~ 1GHz	4.9 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.1 dB
	6GHz ~ 18GHz	4.9 dB
	18GHz ~ 40GHz	5.2 dB

2.2 Test Site and Instruments

For radiated spurious emissions test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Keysight	N9038A	MY54450088	July 03, 2019	July 02, 2020
Pre-Amplifier EMCI	EMC001340	980142	May 30, 2019	May 29, 2020
Loop Antenna Electro-Metrics	EM-6879	264	Jan. 22, 2019	Jan. 21, 2020
RF Cable	NA	LOOPCAB-001	Jan. 14, 2019	Jan. 13, 2020
RF Cable	NA	LOOPCAB-002	Jan. 14, 2019	Jan. 13, 2020
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-01	Oct. 30, 2018	Oct. 29, 2019
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Nov. 22, 2018	Nov. 21, 2019
RF Cable	8D	966-4-1	Mar. 19, 2019	Mar. 18, 2020
RF Cable	8D	966-4-2	Mar. 19, 2019	Mar. 18, 2020
RF Cable	8D	966-4-3	Mar. 19, 2019	Mar. 18, 2020
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-4-01	Sep. 27, 2018	Sep. 26, 2019
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Nov. 25, 2018	Nov. 24, 2019
Pre-Amplifier EMCI	EMC12630SE	980385	Aug. 15, 2019	Aug. 14, 2020
RF Cable	EMC104-SM-SM-1200	160923	Jan. 28, 2019	Jan. 27, 2020
RF Cable	104 RF cable	131215	Jan. 10, 2019	Jan. 09, 2020
RF Cable	EMC104-SM-SM-6000	180418	May 03, 2019	May 02, 2020
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 28, 2019	Jan. 27, 2020
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 25, 2018	Nov. 24, 2019
RF Cable	EMC102-KM-KM-1200	160924	Jan. 28, 2019	Jan. 27, 2020
RF Cable	EMC102-KM-KM-1200	160925	Jan. 28, 2019	Jan. 27, 2020
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	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 966 Chamber No. 4.
3. Loop antenna was used for all emissions below 30 MHz.
4. Tested Date: Sep. 02 to 19, 2019

For other test items:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSV40	100964	June 04, 2019	June 03, 2020
Spectrum Analyzer Agilent	E4446A	MY48250253	July 24, 2019	July 23, 2020
Power meter Anritsu	ML2495A	1014008	May 13, 2019	May 12, 2020
Power sensor Anritsu	MA2411B	0917122	May 13, 2019	May 12, 2020
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020
AC Power Source Extech Electronics	6205	1440452	NA	NA
DC Power Supply Topward	6603D	795558	NA	NA
Temperature & Humidity Chamber Giant Force	GTH-150-40-SP-AR	MAA0812-008	Jan. 09, 2019	Jan. 08, 2020
True RMS Clamp Meter FLUKE	325	31130711WS	May 21, 2019	May 20, 2020
ESG Vector signal generator Agilent	E4438C	MY45094468/005 506 602 UK6 UNJ	Nov. 19, 2018	Nov. 18, 2019
Mech Switch Absorptive Mini-Circuits	MSP4TA-18+	0140	Feb. 11, 2019	Feb. 10, 2020
FXD ATTEN Mini-Circuits	BW-S3W2+	MN71981	Feb. 11, 2019	Feb. 10, 2020
Software	ADT_RF Test Software V6.6.5.4	NA	NA	NA
LTE Wireless Communication Test Set Keysight	E7515A	MY55340229	May 29, 2019	May 28, 2020

NOTE: 1. The test was performed in Oven room 2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: Sep. 13, 2019

3 General Information

3.1 General Description of EUT

Product	M2M DATA MODULE		
Brand	Wistron NeWeb Corporation		
Test Model	M18QA		
Series Model	M14QA		
Status of EUT	ENGINEERING SAMPLE		
Power Supply Rating	DC 3.8V from host equipment		
Modulation Type	QPSK, 16QAM		
Operating Frequency	LTE Band 14		790.5MHz ~ 795.5MHz
Max. ERP Power	LTE Band 14 (Channel Bandwidth 5MHz)		23.85 dBm
	LTE Band 14 (Channel Bandwidth 10MHz)		23.76 dBm
Emission Designator	LTE Band 14	Channel Bandwidth 5MHz	QPSK: 4M51G7D
			16QAM: 4M51D7W
		Channel Bandwidth 10MHz	QPSK: 8M98G7D
			16QAM: 8M98D7W
Antenna Type	Refer to Note		
Antenna Connector	Refer to Note		
Accessory Device	NA		
Data Cable Supplied	NA		

Note:

1. All models are listed as below.

No.	Model Name	Support Spec.	
		LTE	GPS
1	M18QA	CAT4, LTE B2/4/5/12/14, WCDMA B2/5	No
2	M14QA	CAT1 , LTE B2/4/5/12/14, WCDMA B2/5	No
Note: From the above models, model: M18QA was selected as representative model for the test and its data was recorded in this report.			

2. The antennas provided to the EUT, please refer to the following table:

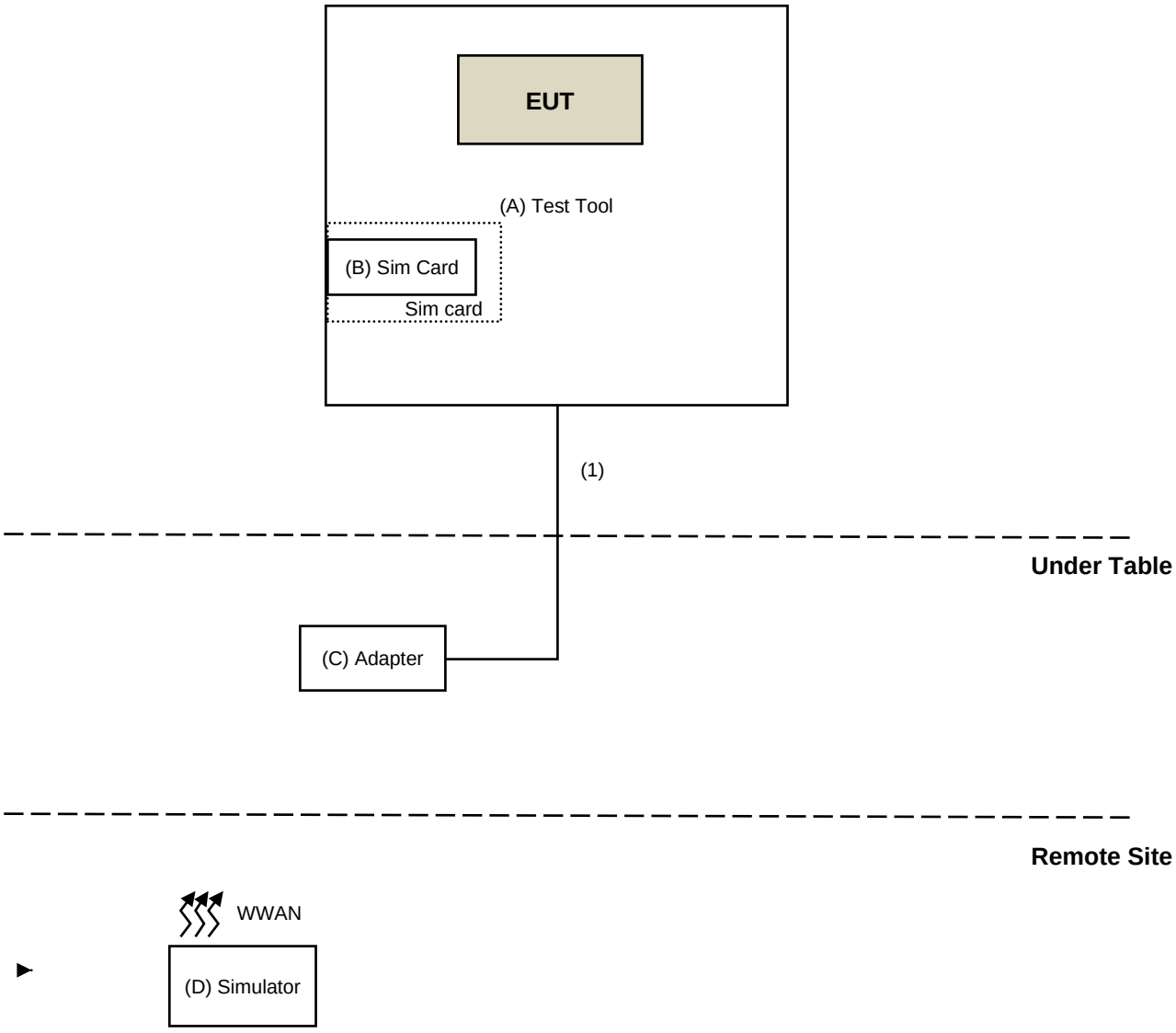
For GPS						
Antenna No.	Brand	Model	Antenna Net Gain (dBi)	Frequency Range (MHz)	Antenna Type	Connector Type
GPS	Master	98619ZSAX029	2.24	1559~1606	Dipole	SMA

For WWAN							
Antenna No.	RF Chain No.	Brand	Model	Antenna Net Gain (dBi)	Frequency Range (MHz)	Antenna Type	Connector Type
1	Main	Wieson	GY115	Please refer to below table	Please refer to below table	Dipole	SMA
2	Aux	Wieson	GY115	Please refer to below table	Please refer to below table	Dipole	SMA

Antenna gain list			
Band	Freq. Range (MHz)	Gain (dBi)	
		Ant 1 (Main)	Ant 2 (Aux)
WCDMA II (B2)	1850~1910	1.56	1.56
WCDMA V (B5)	824~849	3.2	3.2
LTE Band (2)	1850~1910	1.56	1.56
LTE Band (4)	1710~1755	1.62	1.62
LTE Band (5)	824~849	3.2	3.2
LTE Band (12)	698~716	1.49	1.49
LTE Band (13)	777~787	1.66	1.66
LTE Band (14)	788~798	1.60	1.60

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

3.2 Configuration of System under Test



3.2.1 Description of Support Units

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

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Test Tool	NA	NA	NA	NA	Supplied by client
B.	Sim Card	R&S	CRT-Z3	NA	NA	Provided by Lab
C.	Adapter	L.E.I	MU24-Y120200-A1	NA	NA	Supplied by client
D.	Simulator	Keysight	E7515A	MY55340229	NA	Provided by Lab

Note:

1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	1.5	No	0	Supplied by client

3.3 Test Mode Applicability and Tested Channel Detail

LTE Band 14

TEST ITEM	AVAILABLE CHANNEL	TESTED CHANNEL	CHANNEL BANDWIDTH	MODULATION	MODE
ERP	23305 to 23355	23305, 23330, 23355	5MHz	QPSK/16QAM	1RB / 0 RB offset
	23330	23330	10MHz	QPSK/16QAM	1RB / 0 RB offset
Frequency Stability	23305 to 23355	23305, 23330, 23355	5MHz	QPSK	-
	23330	23330	10MHz	QPSK	-
Occupied Bandwidth	23305 to 23355	23305, 23330, 23355	5MHz	QPSK/16QAM	Full RB
	23330	23330	10MHz	QPSK/16QAM	Full RB
Emission Mask	23305 to 23355	23305	5MHz	QPSK	1 RB / 0 RB Offset
		23355			1 RB / 24 RB Offset
		23305, 23355			25 RB / 0 RB Offset
	23330	23355	10MHz	QPSK	1 RB / 0 RB Offset
					1 RB / 49 RB Offset
					50 RB / 0 RB Offset
Peak to Average Ratio	23305 to 23355	23305, 23330, 23355	5MHz	QPSK/16QAM	Full RB
	23330	23330	10MHz	QPSK/16QAM	Full RB
Conducted Emission	23305 to 23355	23305, 23330, 23355	5MHz	QPSK	1RB / 0 RB offset
	23330	23330	10MHz	QPSK	1RB / 0 RB offset
Radiated Emission	23305 to 23355	23305, 23330, 23355	5MHz	QPSK	1RB / 0 RB offset
	23330	23330	10MHz	QPSK	1RB / 0 RB offset

NOTE:
All supported modulation types were evaluated.The Worst case of QPSK was selected. Therefore, the Frequency Stability, Condcudeted Emission and Radiated Emission were presented under QPSK mode only.

Test Condition:

Test Item	Environmental Conditions	Input Power (System)	Tested By
Output Power	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin
Frequency Stability	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin
Occupied Bandwidth	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin
Emission Mask	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin
Peak to Average Ratio	25deg. C, 60%RH	120Vac, 60Hz	Jynuchun Lin
Conducted Emission	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin
Radiated Emission	23deg. C, 74%RH	120Vac, 60Hz	Andy Ho

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 90, Subpart R

KDB 971168 D01 Power Meas License Digital Systems v03r01

ANSI/TIA/EIA-603-E 2016

ANSI 63.26-2015

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 and Antenna Height

According to 90.542(a)(7), Portable stations (hand-held devices) transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 3 watts ERP.

4.1.2 Test Procedures

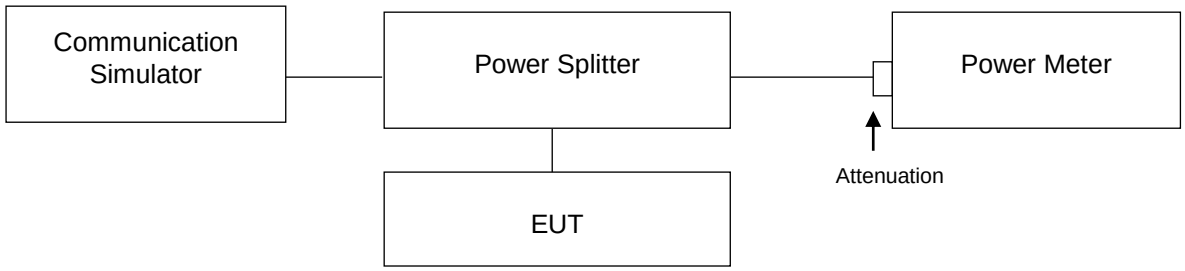
Conducted Power Measurement:

The EUT was set up for the maximum power with LTE link data modulation and link up with simulator. Set the EUT to transmit under low, middle and high channel and difference RB size/ RB offset for difference bandwidth record the power level shown on power meter.

EIRP / ERP Measurement:

a. EIRP = Conducted Output power level + Antenna gain.
b. ERP power can be calculated form EIRP power by subtracting the gain of dipole, ERP power = EIRP power - 2.15dBi.
c. ERP = Conducted Output power level + Antenna gain (dBi) - Isotropically Factor (2.15dB).

4.1.3 Test Setup



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

4.1.4 Test Results

CONDUCTED OUTPUT POWER

LTE Band 14

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low CH	Mid CH	High CH		Low CH	Mid CH	High CH	
			23305	23330	23335		23305	23330	23335	
			790.5	793	795.5		790.5	793	795.5	
			MHz	MHz	MHz		MHz	MHz	MHz	
14 / 5M	1	0	24.20	24.21	24.40	0	22.93	22.98	22.98	1
	1	12	23.97	24.09	24.03	0	22.94	23.11	23.04	1
	1	24	24.07	24.12	23.18	0	22.78	23.18	22.92	1
	12	0	23.08	23.11	23.13	1	22.10	22.08	22.11	2
	12	6	23.26	23.20	23.12	1	22.15	22.08	22.12	2
	12	13	23.20	23.14	23.19	1	22.14	22.13	22.01	2
	25	0	23.07	23.12	23.14	1	22.23	21.98	22.07	2

Band / BW	RB Size	RB Offset	QPSK	3GPP MPR (dB)	16QAM	3GPP MPR (dB)
			Mid CH		Mid CH	
			23330		23330	
			793		793	
			MHz		MHz	
14 / 10M	1	0	24.31	0	23.11	1
	1	24	23.89	0	24.03	1
	1	49	23.88	0	23.09	1
	25	0	23.03	1	22.14	2
	25	12	23.06	1	22.16	2
	25	25	23.14	1	22.05	2
	50	0	23.12	1	22.13	2

ERP POWER

LTE Band 14

Band 14 / 5M 1RB#0

Test Mode	QPSK			16QAM		
	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
	23305	23330	23355	23305	23330	23355
	790.5	793	795.5	790.5	793	795.5
	MHz	MHz	MHz	MHz	MHz	MHz
Max Cond. Power (dBm)	24.20	24.21	24.40	22.93	22.98	22.98
Gain (dBi)	1.6	1.6	1.6	1.6	1.6	1.6
Isotropically Factor (dB)	2.15	2.15	2.15	2.15	2.15	2.15
Max ERP Power (dBm)	23.65	23.66	23.85	22.38	22.43	22.43

Band 14 / 10M 1RB#0

Test Mode	QPSK	16QAM
	Mid CH	Mid CH
	23330	23330
	793	793
	MHz	MHz
Max Cond. Power (dBm)	24.31	23.11
Gain (dBi)	1.6	1.6
Isotropically Factor (dB)	2.15	2.15
Max ERP Power (dBm)	23.76	22.56

4.2 Modulation characteristics Measurement

4.2.1 Limits of Modulation characteristics

N/A

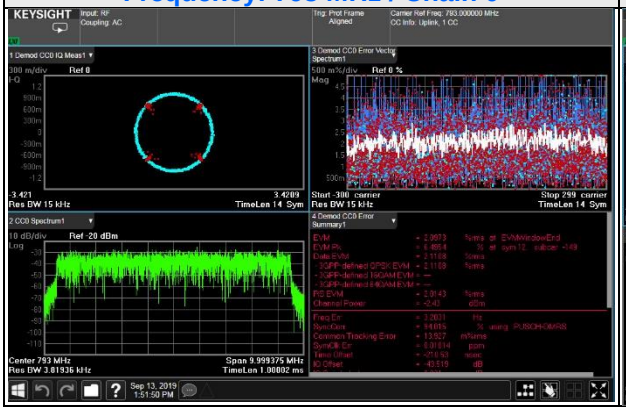
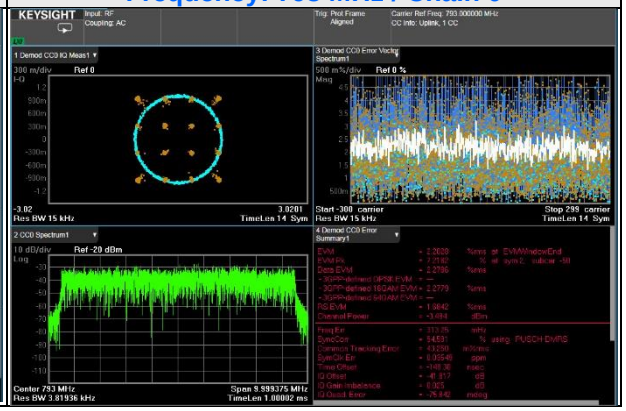
4.2.2 Test Procedure

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 14

QPSK / Channel Bandwidth: 10MHz / Frequency: 793 MHz / Chain 0	16QAM / Channel Bandwidth: 10MHz / Frequency: 793 MHz / Chain 0
	

4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stabiliity Measurement

Follow the 90.213 1.5 ppm is for base and fixed station. 2.5 ppm is for mobile station.
Follow the 90.539 frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 parts per million.

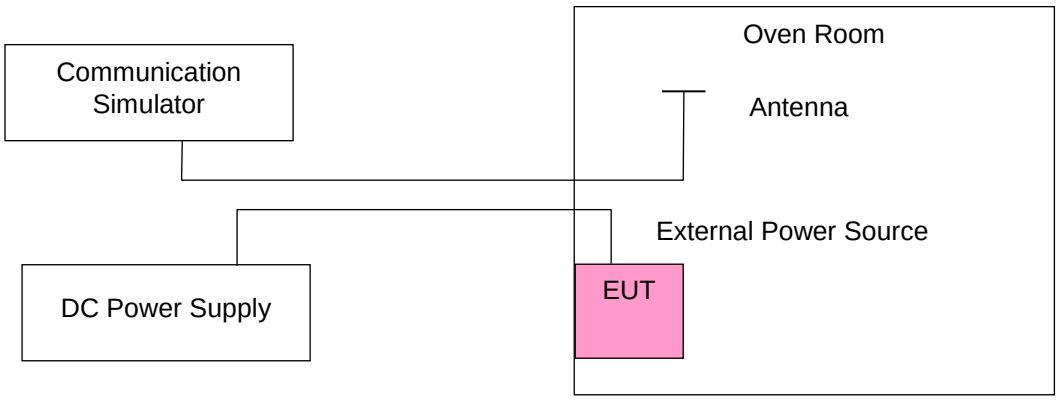
4.3.2 Test Procedure

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 DC 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.

4.3.3 Test Setup



4.3.4 Test Results

LTE Band 14

Voltage (Volts)	Frequency Error (ppm)		Limit (ppm)
	5MHz	10MHz	
3.23	0.026	0.062	1.25
4.37	0.047	0.042	1.25

Temp. (℃)	Frequency Error (ppm)		Limit (ppm)
	5MHz	10MHz	
60	0.040	0.057	1.25
50	0.035	0.048	1.25
40	0.033	0.037	1.25
30	0.048	0.054	1.25
20	0.055	0.032	1.25
10	0.042	0.028	1.25
0	0.057	0.026	1.25
-10	0.042	0.050	1.25
-20	0.040	0.062	1.25
-30	0.032	0.045	1.25

4.4 Occupied Bandwidth Measurement

4.4.1 Limits of Occupied Bandwidth Measurement

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

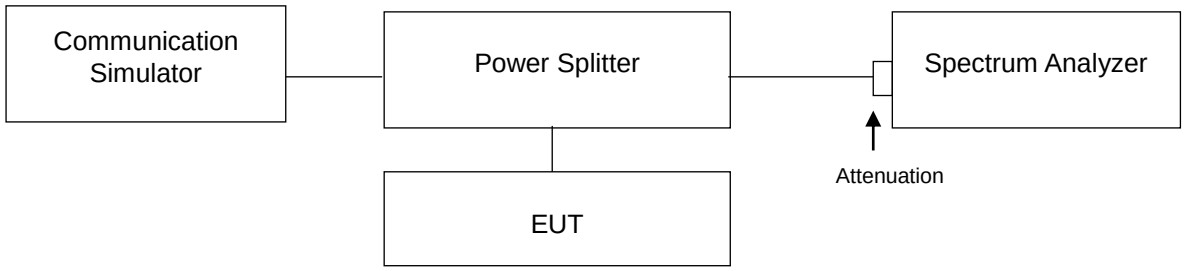
4.4.2 Test Procedure

All measurements were done at low, middle and high operational frequency range, RB of the spectrum is 1% of occupied bnadwidth and VB of the spectrum is 3 times RBW. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW≥1% x OBW and VBW≥3 x VBW.

Occupied Bandwdith Measurement:
Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

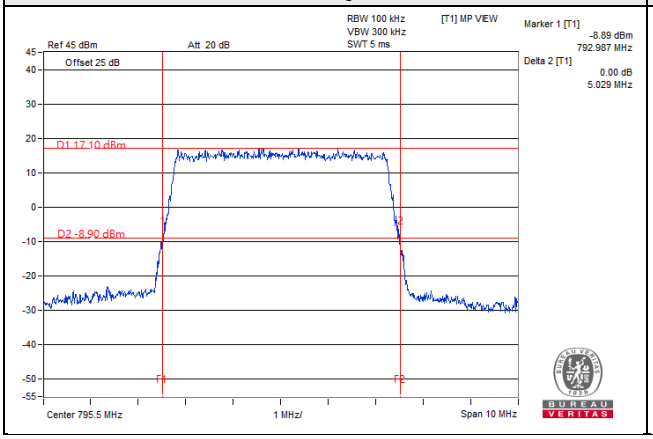
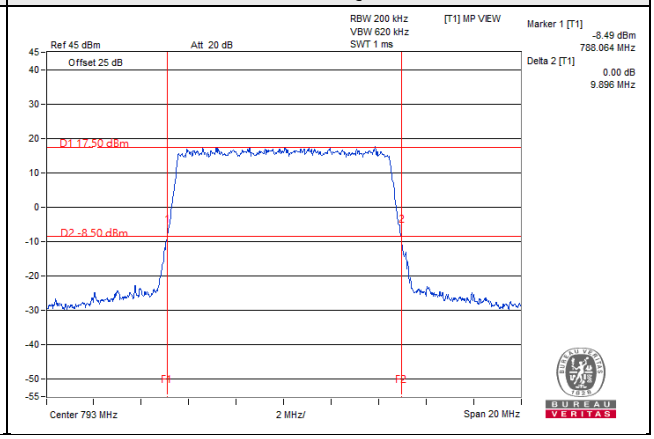
26 dB Bandwidth Measurement:
The emission bandwidth is defined as the width of the signal between two points,one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26dB below the transmitter power.

4.4.3 Test Setup



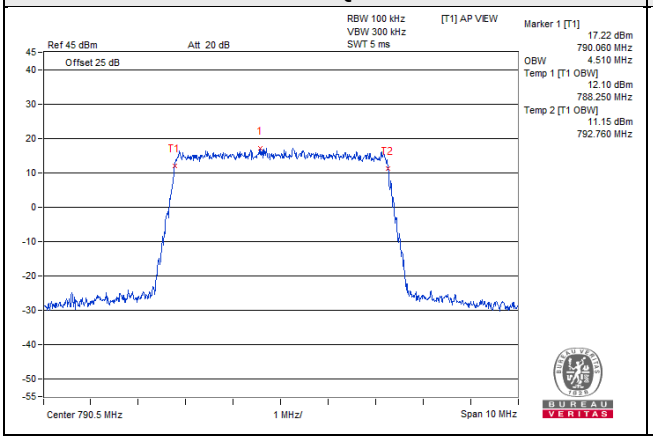
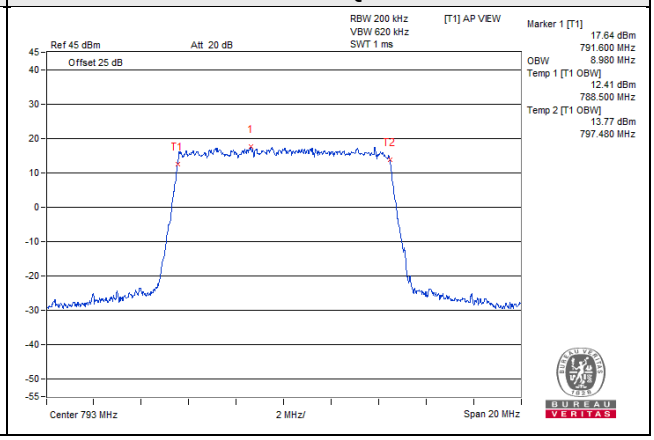
4.4.4 Test Result (-26dB Bandwidth)

LTE Band 14							
Channel Bandwidth 5MHz				Channel Bandwidth 10MHz			
Channel	Frequency (MHz)	-26dB Bandwidth (MHz)		Channel	Frequency (MHz)	-26dB Bandwidth (MHz)	
		QPSK	16QAM			QPSK	16QAM
23305	790.5	5.00	4.98	23330	793	9.89	9.87
23330	793	4.98	4.99				
23355	795.5	5.02	4.99				

Spectrum Plot of Worst Value	
5MHz / QPSK	10MHz / QPSK
	

4.4.5 Test Result (Occupied Bandwidth)

LTE Band 14							
Channel Bandwidth 5MHz				Channel Bandwidth 10MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)		Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM			QPSK	16QAM
23305	790.5	4.51	4.51	23330	793	8.98	8.98
23330	793	4.50	4.50				
23355	795.5	4.49	4.51				

Spectrum Plot of Worst Value	
5MHz / QPSK	10MHz / QPSK
	

4.5 Emission Mask Measurement

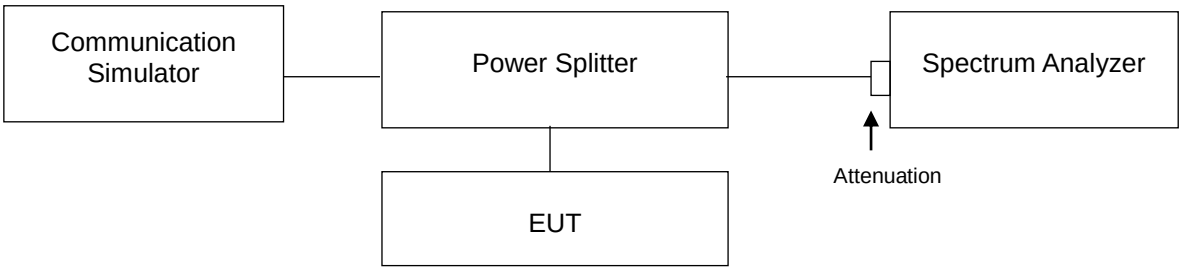
4.5.1 Limits of Emission Mask Measurement

Per 90.543(e), Emission mask requirements
For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:
(1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations.(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations.(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.(4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

4.5.2 Test Procedures

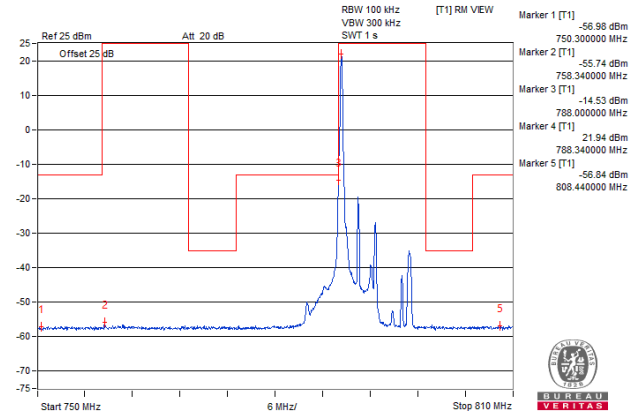
1. The power was measured with Spectrum Analyzer. All measurements were done at low and high operational frequency range.
2. The measurement used the power splitter via EUT RF power connector between signal generator and spectrum analyzer.
3. Record the test plot.

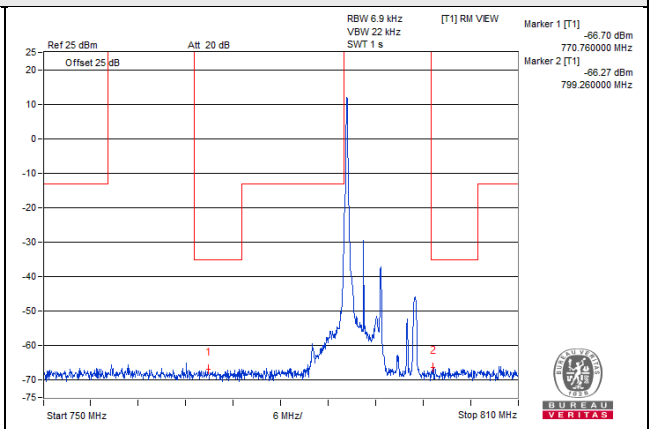
4.5.3 Test Setup



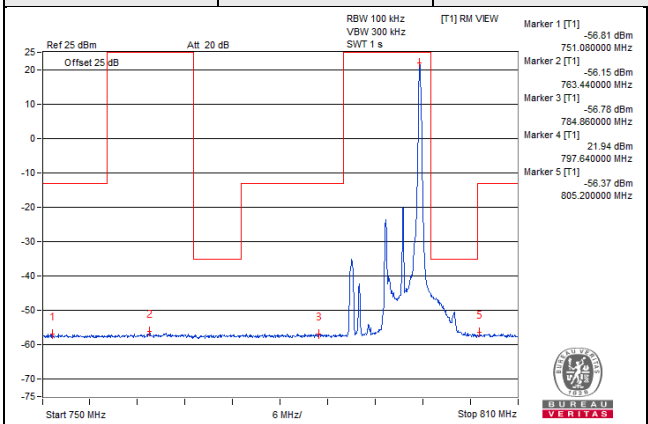
4.5.4 Test Results

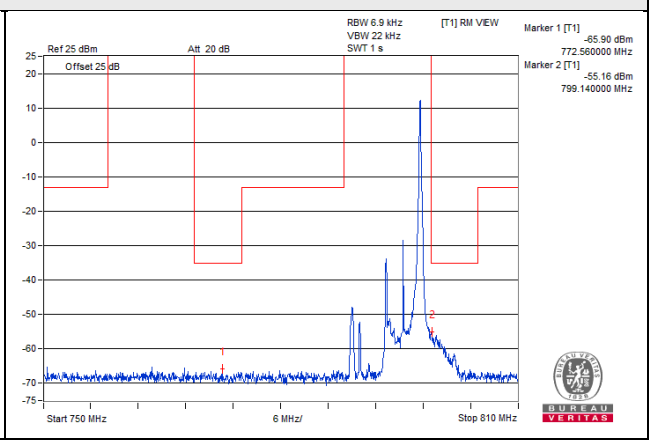
LTE Band 14		
Channel Bandwidth 5MHz QPSK		
Channel	23305	1 RB



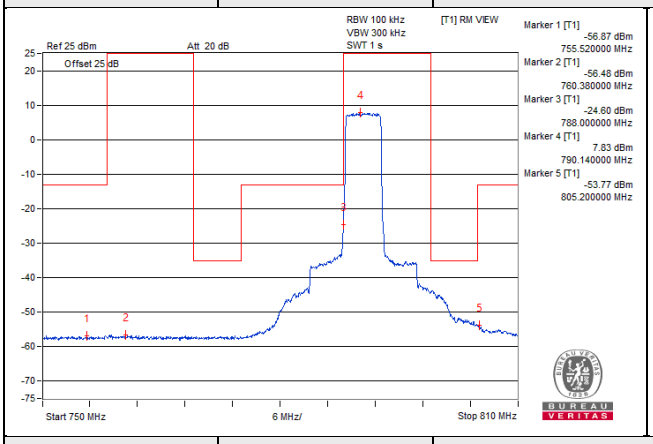


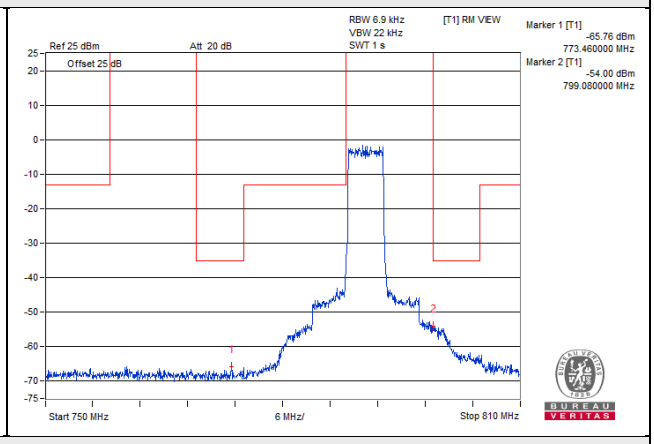
Channel	23355	1 RB



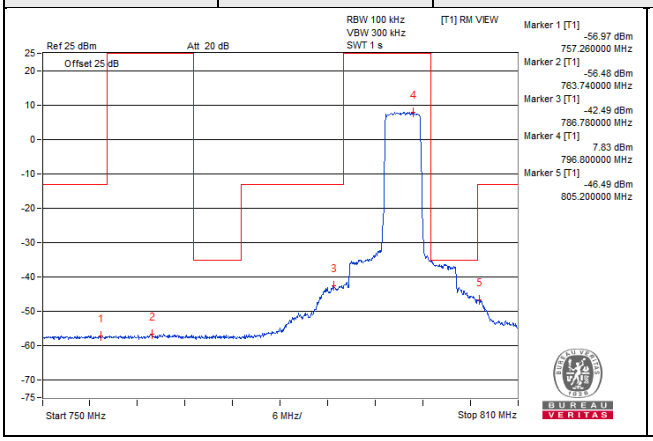


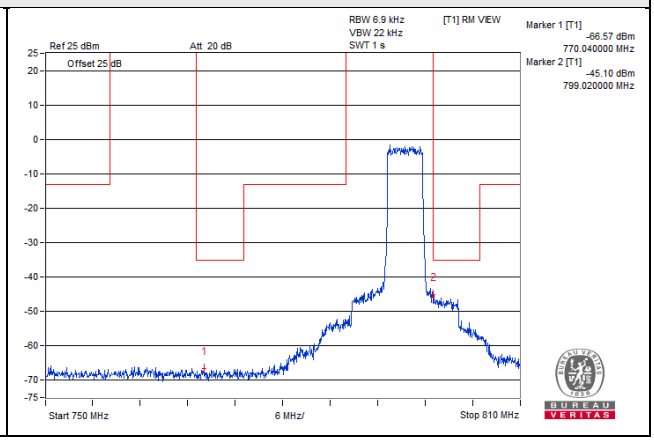
LTE Band 14		
Channel Bandwidth 5MHz QPSK		
Channel	23305	25 RB



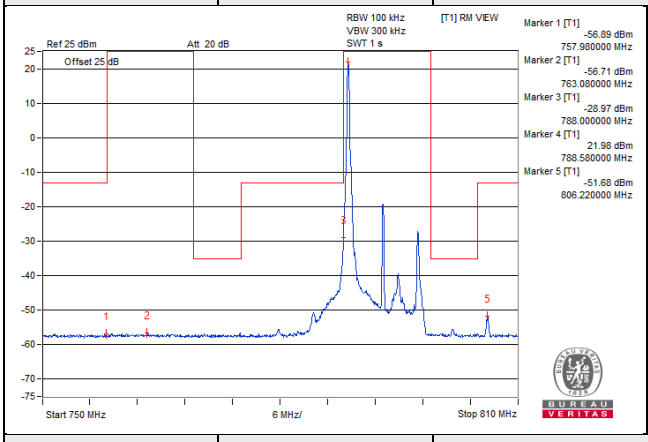


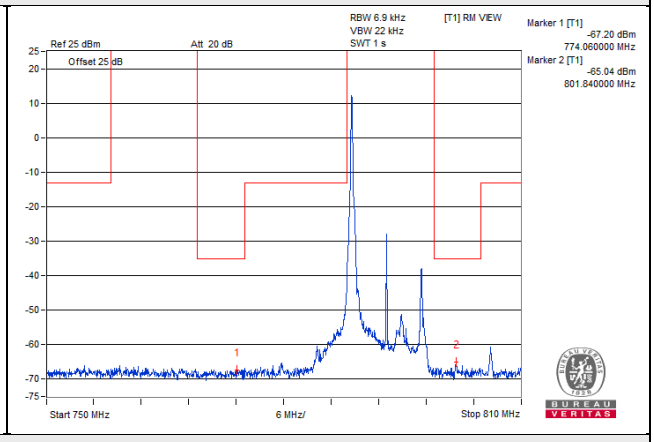
Channel	23355	25 RB



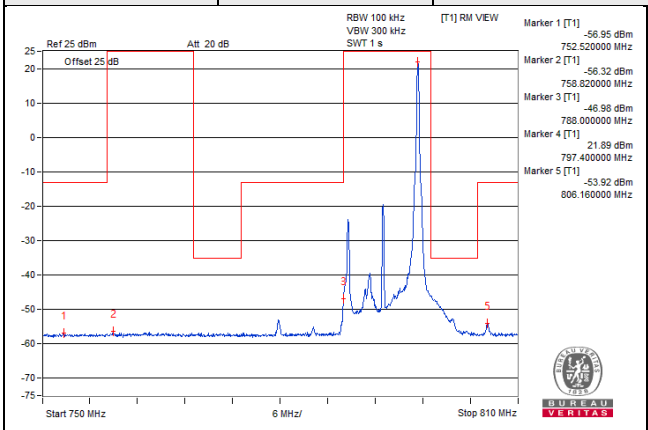


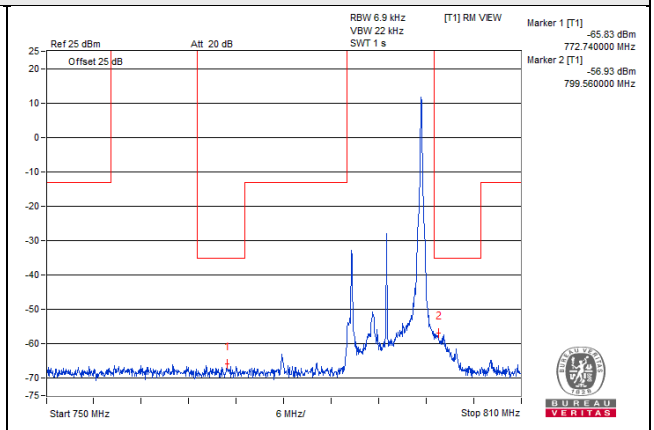
LTE Band 14		
Channel Bandwidth 10MHz QPSK		
Channel	23330	1 RB#0



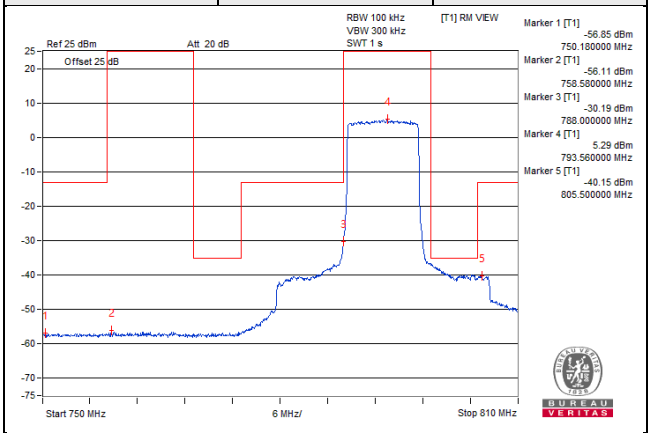


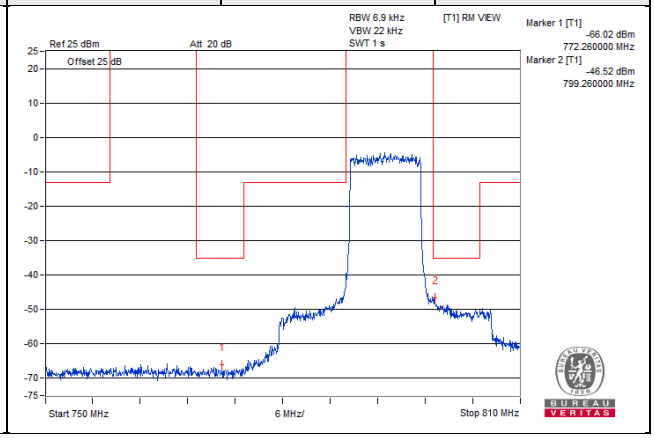
Channel	23330	1 RB#Max





Channel	23330	50 RB	Channel	23330	50 RB



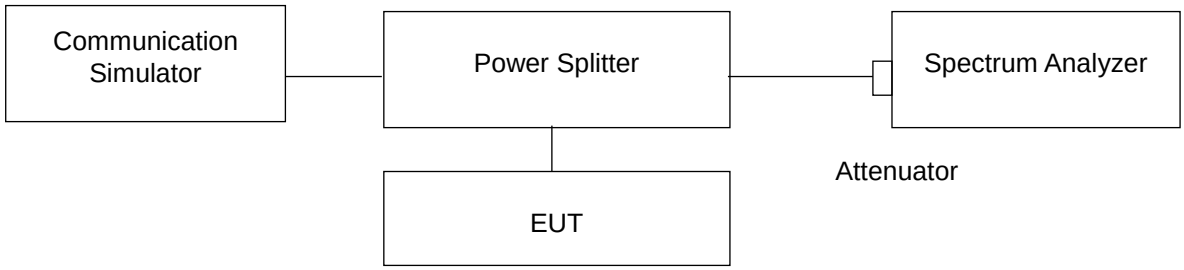


4.6 Peak To Average Power Ratio

4.4.1 Limits of Peak To Average Power Ratio Measurement

The peak to average power ratio (PAPR) of the equipment shall not exceed 13 dB for more than 0.1% of the time, using a signal that corresponds to the highest PAPR during periods of continuous transmission.

4.4.2 Test Setup

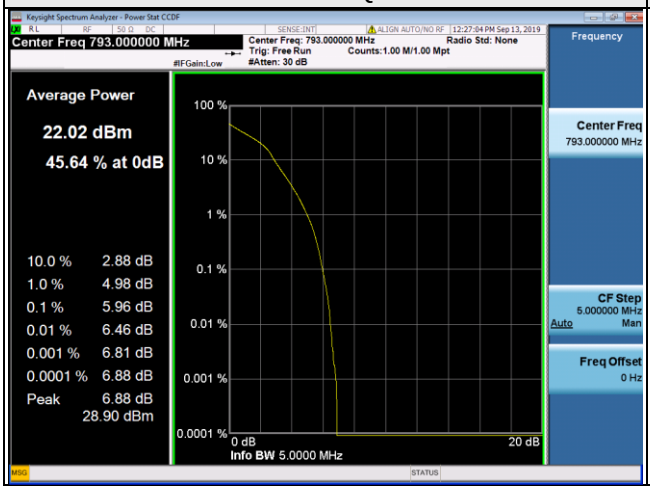
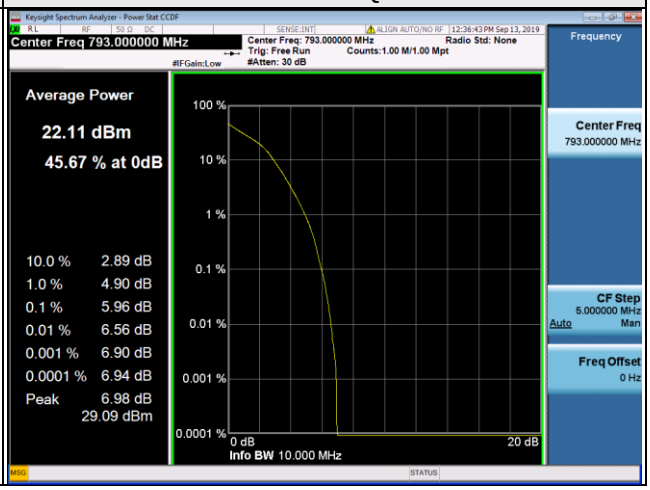


4.4.3 Test Procedures

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

4.4.4 Test Results

LTE Band 14							
Channel Bandwidth 5MHz				Channel Bandwidth 10MHz			
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		Channel	Frequency (MHz)	Peak To Average Ratio (dB)	
		QPSK	16QAM			QPSK	16QAM
23305	790.5	5.05	5.93	23330	793	5.06	5.96
23330	793	5.07	5.96				
23355	795.5	5.04	5.91				

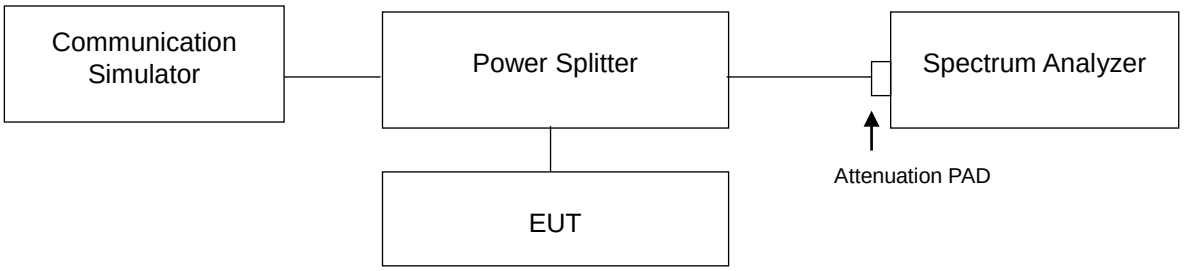
Spectrum Plot of Worst Value	
5MHz / 16QAM	10MHz / 16QAM
	

4.7 Conducted Spurious Emissions

4.7.1 Limits of Conducted Spurious Emissions Measurement

The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 +10 log10(P) dB. The limit of emission equal to –13dBm.

4.7.2 Test Setup



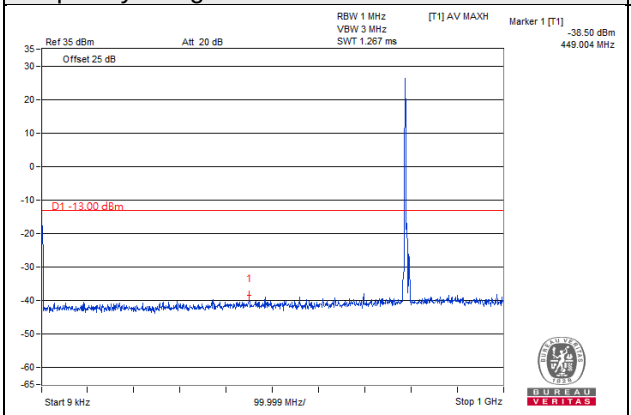
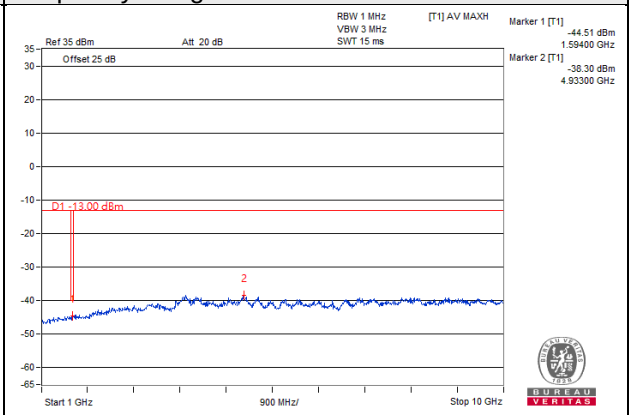
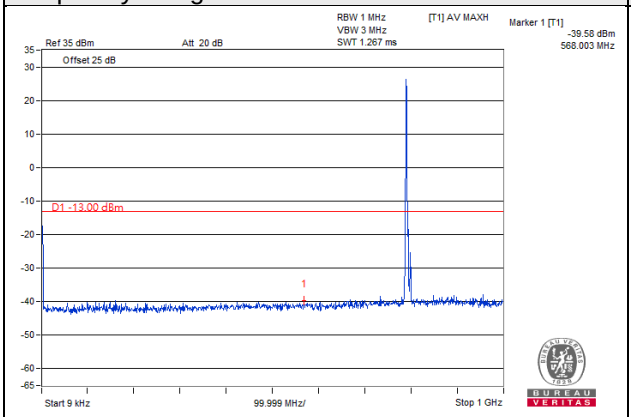
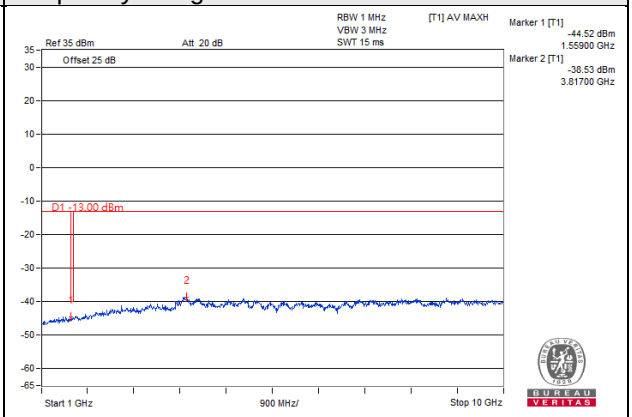
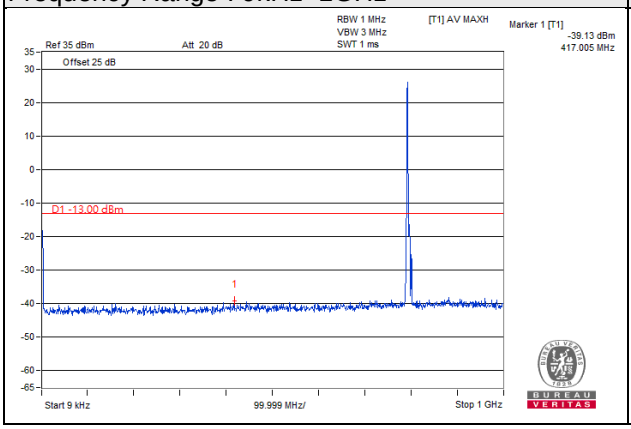
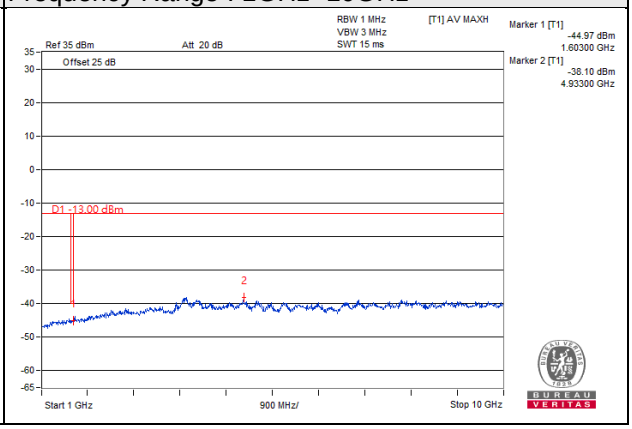
4.7.3 Test Procedure

a. The EUT was set up for the maximum peak power with LTE link data modulation. The power was measured with Spectrum Analyzer.

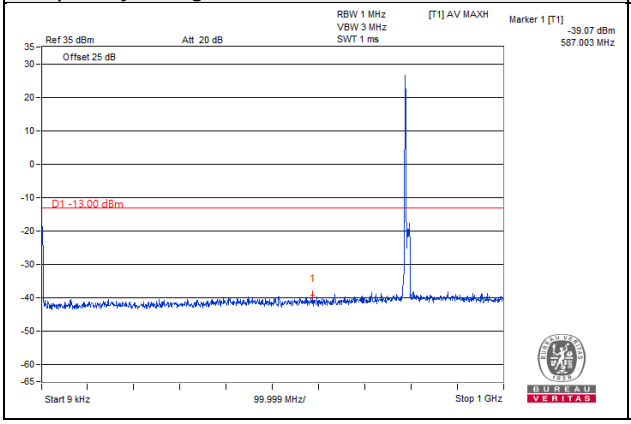
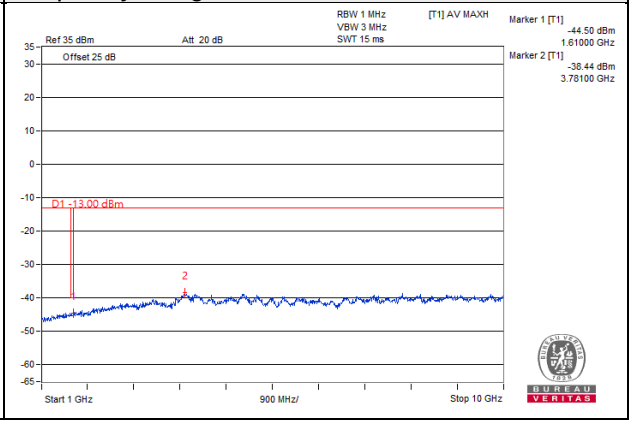
b. The conducted spurious emission used the power splitter via EUT RF power connector between signal generator and spectrum analyzer.

c. When the spectrum scanned from 9kHz to the tenth harmonic of the highest fundamental frequency, it shall be connected to the band reject filter attenuated the carried frequency. The spectrum set RBW: 1 MHz and VBW=3*RBW is used for measurement.

4.7.4 Test Results

LTE Band 14 Channel Bandwidth: 5MHz	
Channel 23305	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz
	
Channel 23330	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz
	
Channel 23355	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz
	

Note: The signal of 9kHz is IF signal from test instrument.

LTE Band 14 Channel Bandwidth: 10MHz	
Channel 23330	
Frequency Range : 9kHz~1GHz	Frequency Range : 1GHz~10GHz
	

Note: The signal of 9kHz is IF signal from test instrument.

4.8 Radiated Emission Measurement

4.8.1 Limits of Radiated Emission Measuremen

The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 +10 log10(P) dB. The limit of emission equal to –13dBm

4.8.2 Test Procedure

a. Substitution method is used for EIRP measurement. In the semi-anechoic chamber, EUT placed on the 0.8m/1.5m 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.

b. Follow ANSI 63.26 section 5.2.7 d), EIRP Value (dBm) = Read Value (dBμV/m) - Correction Factor @ 3m

c. Correction Factor (dB) @ 3m = 20log(D) − 104.8; where D is the measurement distance @3m =-95.26dB

d. ERP power can be calculated form EIRP power by subtracting the gain of dipole, ERP power = EIRP power - 2.15dBi.

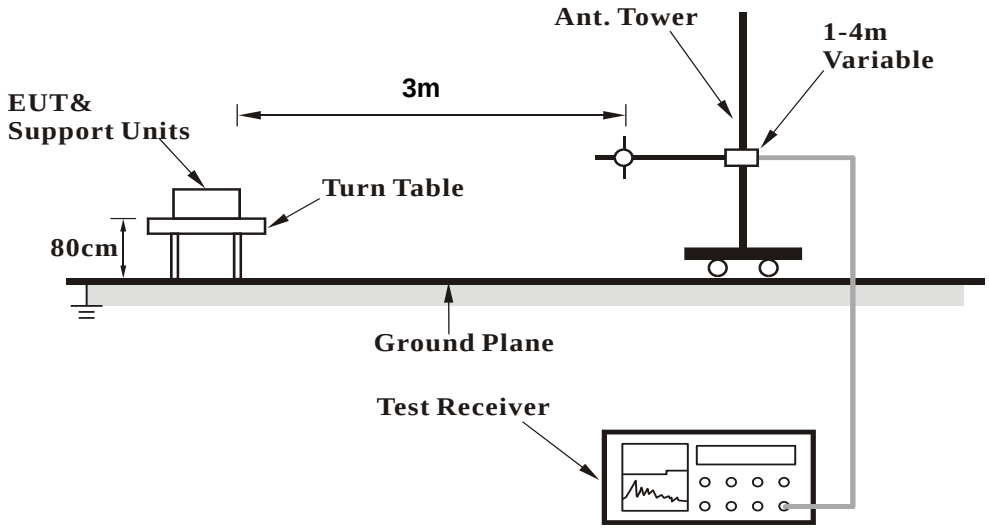
NOTE: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.

4.8.3 Deviation from Test Standard

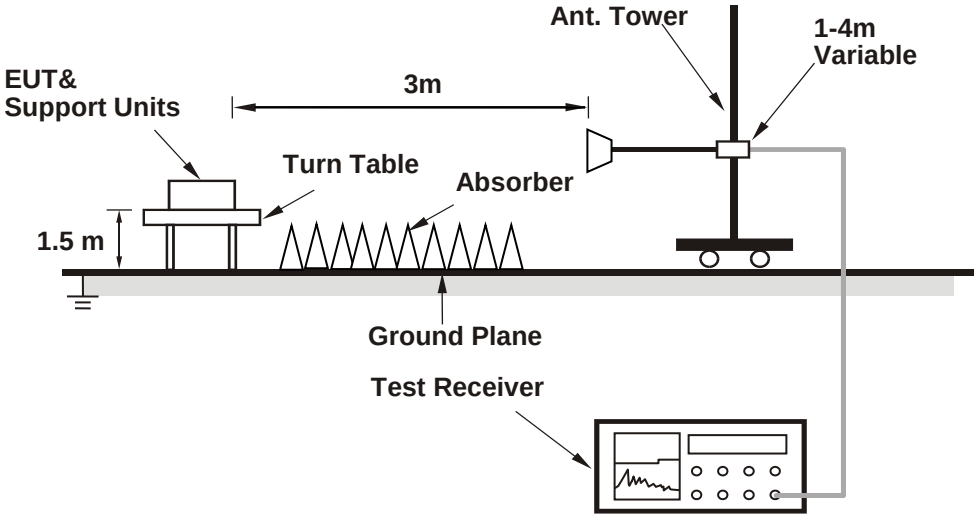
No deviation.

4.8.4 Test Setup

For Radiated emission below 1GHz



For Radiated emission above 1GHz



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

4.8.5 Test Results

Below 1GHz

LTE Band 14: 5MHz

Mode	TX channel 23305	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 M						
No.	Freq. (MHz)	Reading (dB μV/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	209.67	37.73	-95.26	-57.53	-13	-44.53
2	263.81	39.77	-95.26	-55.49	-13	-42.49
3	287.8	30.16	-95.26	-65.10	-13	-52.10
4	315.76	38.56	-95.26	-56.70	-13	-43.70
5	777.87	32.37	-95.26	-62.89	-13	-49.89
6	936.74	32.62	-95.26	-62.64	-13	-49.64
Antenna Polarity & Test Distance: Vertical at 3 M						
No.	Freq. (MHz)	Reading (dB μV/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	99.5	41.81	-95.26	-53.45	-13	-40.45
2	94.58	38.01	-95.26	-57.25	-13	-44.25
3	185.22	30.51	-95.26	-64.75	-13	-51.75
4	219.87	27.45	-95.26	-67.81	-13	-54.81
5	240.48	35.96	-95.26	-59.30	-13	-46.30
6	863.28	36.84	-95.26	-58.42	-13	-45.42

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), EIRP Value (dBm) = E (dBμV/m) - Correction Factor @ 3m.
2. Correction Factor (dB) = 20log(D) − 104.8; where D is the measurement distance @3m.

Mode	TX channel 23330	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 M						
No.	Freq. (MHz)	Reading (dBμV/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	215.61	35.5	-95.26	-59.76	-13	-46.76
2	264.92	40.34	-95.26	-54.92	-13	-41.92
3	288.49	35.21	-95.26	-60.05	-13	-47.05
4	315.25	37.08	-95.26	-58.18	-13	-45.18
5	778.76	33.7	-95.26	-61.56	-13	-48.56
6	944.52	32.01	-95.26	-63.25	-13	-50.25
Antenna Polarity & Test Distance: Vertical at 3 M						
No.	Freq. (MHz)	Reading (dBμV/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	108.42	39.84	-95.26	-55.42	-13	-42.42
2	103.04	36.05	-95.26	-59.21	-13	-46.21
3	191.4	34.42	-95.26	-60.84	-13	-47.84
4	224.39	30.25	-95.26	-65.01	-13	-52.01
5	239.5	38.16	-95.26	-57.10	-13	-44.10
6	865.85	34.02	-95.26	-61.24	-13	-48.24

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), EIRP Value (dBm) = E (dBμV/m) - Correction Factor @ 3m.
2. Correction Factor (dB) = 20log(D) − 104.8; where D is the measurement distance @3m.

Mode	TX channel 23355	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 M						
No.	Freq. (MHz)	Reading (dBμV/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	215.44	32.21	-95.26	-63.05	-13	-50.05
2	269.69	32.95	-95.26	-62.31	-13	-49.31
3	294.95	29.08	-95.26	-66.18	-13	-53.18
4	319.47	33.63	-95.26	-61.63	-13	-48.63
5	783.88	35.47	-95.26	-59.79	-13	-46.79
6	946.86	34.51	-95.26	-60.75	-13	-47.75
Antenna Polarity & Test Distance: Vertical at 3 M						
No.	Freq. (MHz)	Reading (dBμV/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	112.28	38.13	-95.26	-57.13	-13	-44.13
2	108.32	41.72	-95.26	-53.54	-13	-40.54
3	194.81	32.56	-95.26	-62.70	-13	-49.70
4	225.67	27.42	-95.26	-67.84	-13	-54.84
5	241.59	39.5	-95.26	-55.76	-13	-42.76
6	876.13	34.21	-95.26	-61.05	-13	-48.05

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), EIRP Value (dBm) = E (dBμV/m) - Correction Factor @ 3m.
2. Correction Factor (dB) = 20log(D) − 104.8; where D is the measurement distance @3m.

LTE Band 14: 10MHz

Mode	TX channel 23330	Frequency Range	Below 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 M						
No.	Freq. (MHz)	Reading (dBμV/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	189.38	35.55	-95.26	-59.71	-13	-46.71
2	236.35	40.07	-95.26	-55.19	-13	-42.19
3	269.2	28.22	-95.26	-67.04	-13	-54.04
4	298.96	34.05	-95.26	-61.21	-13	-48.21
5	756.17	34.67	-95.26	-60.59	-13	-47.59
6	905.67	30.66	-95.26	-64.60	-13	-51.60
Antenna Polarity & Test Distance: Vertical at 3 M						
No.	Freq. (MHz)	Reading (dBμV/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	57.56	37.35	-95.26	-57.91	-13	-44.91
2	80.26	34.5	-95.26	-60.76	-13	-47.76
3	146.21	31.39	-95.26	-63.87	-13	-50.87
4	185.02	24.42	-95.26	-70.84	-13	-57.84
5	212.94	38.22	-95.26	-57.04	-13	-44.04
6	843.3	35.92	-95.26	-59.34	-13	-46.34

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), EIRP Value (dBm) = E (dBμV/m) - Correction Factor @ 3m.
2. Correction Factor (dB) = 20log(D) − 104.8; where D is the measurement distance @3m.

Above 1GHz

LTE Band 14: 5MHz

Mode	TX channel 23305	Frequency Range	Above 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 M						
No.	Freq. (MHz)	Reading (dBμV/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	1581	42.94	-95.26	-52.32	-13	-39.32
2	2371.5	40.76	-95.26	-54.50	-13	-41.50
3	3162	48.52	-95.26	-46.74	-13	-33.74
Antenna Polarity & Test Distance: Vertical at 3 M						
No.	Freq. (MHz)	Reading (dBμV/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	1581	47.18	-95.26	-48.08	-13	-35.08
2	2371.5	43.79	-95.26	-51.47	-13	-38.47
3	**3162**	**51.35**	**-95.26**	**-43.91**	**-13**	**-30.91**

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), EIRP Value (dBm) = E (dBμV/m) - Correction Factor @ 3m.
2. Correction Factor (dB) = 20log(D) − 104.8; where D is the measurement distance @3m.

Mode	TX channel 23330	Frequency Range	Above 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 M						
No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	1586	37.5	-95.26	-57.76	-13	-44.76
2	2379	35.15	-95.26	-60.11	-13	-47.11
3	3172	45.16	-95.26	-50.10	-13	-37.10
Antenna Polarity & Test Distance: Vertical at 3 M						
No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	1586	40.4	-95.26	-54.86	-13	-41.86
2	2379	42.07	-95.26	-53.19	-13	-40.19
3	3172	48.06	-95.26	-47.20	-13	-34.20

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), EIRP Value (dBm) = E (dBμV/m) - Correction Factor @ 3m.
2. Correction Factor (dB) = 20log(D) − 104.8; where D is the measurement distance @3m.

Mode	TX channel 23355	Frequency Range	Above 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 M						
No.	Freq. (MHz)	Reading (dBμV/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	1591	37.03	-95.26	-58.23	-13	-45.23
2	2386.5	39.98	-95.26	-55.28	-13	-42.28
3	3182	42.38	-95.26	-52.88	-13	-39.88
Antenna Polarity & Test Distance: Vertical at 3 M						
No.	Freq. (MHz)	Reading (dBμV/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	1591	43.82	-95.26	-51.44	-13	-38.44
2	2386.5	44.85	-95.26	-50.41	-13	-37.41
3	3182	48.44	-95.26	-46.82	-13	-33.82

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), EIRP Value (dBm) = E (dBμV/m) - Correction Factor @ 3m.
2. Correction Factor (dB) = 20log(D) − 104.8; where D is the measurement distance @3m.

LTE Band 14: 10MHz

Mode	TX channel 23330	Frequency Range	Above 1000 MHz

Antenna Polarity & Test Distance: Horizontal at 3 M						
No.	Freq. (MHz)	Reading (dBμV/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	1586	41.3	-95.26	-53.96	-13	-40.96
2	2379	41.37	-95.26	-53.89	-13	-40.89
3	3172	45.89	-95.26	-49.37	-13	-36.37
Antenna Polarity & Test Distance: Vertical at 3 M						
No.	Freq. (MHz)	Reading (dBμV/m)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	1586	46.03	-95.26	-49.23	-13	-36.23
2	2379	39.82	-95.26	-55.44	-13	-42.44
3	3172	49.55	-95.26	-45.71	-13	-32.71

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), EIRP Value (dBm) = E (dBμV/m) - Correction Factor @ 3m.
2. Correction Factor (dB) = 20log(D) − 104.8; where D is the measurement distance @3m.

5 Pictures of Test Arrangements

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

Appendix – Information of the Testing Laboratories

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

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

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

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