

FCC Test Report (Part 90R)

Report No.: RFBEOP-WTW-P20100005-3

FCC ID: NKRM18QAG

Test Model: M18QAG

Received Date: Oct. 04, 2020

Test Date: Oct. 13 to 14, 2020

Issued Date: Nov. 12, 2020

Applicant: Wistron NeWeb Corporation

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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Test Location: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan

**FCC Registration /
Designation Number:** 723255 / TW2022



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Release Control Record

Issue No.	Description	Date Issued
RFBEOP-WTW-P20100005-3	Original release	Nov. 12, 2020

1 Certificate of Conformity

Product: M2M DATA MODULE

Brand: Wistron NeWeb Corporation

Test Model: M18QAG

Sample Status: ENGINEERING SAMPLE

Applicant: Wistron NeWeb Corporation

Test Date: Oct. 13 to 14, 2020

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:** Nov. 12, 2020
Claire Kuan / Specialist

Approved by :  _____, **Date:** Nov. 12, 2020
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 -22.28dB at 1581MHz.

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

2.1 Measurement Uncertainty

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

Measurement	Frequency	Expanded Uncertainty (k=2) (\pm)
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.1 dB
	30MHz ~ 1GHz	5.4 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.0 dB
	1GHz ~ 40GHz	5.3 dB
	40GHz ~ 200GHz	5.4 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 06, 2020	July 05, 2021
Pre-Amplifier EMCI	EMC001340	980142	May 25, 2020	May 24, 2021
Loop Antenna Electro-Metrics	EM-6879	264	Feb. 18, 2020	Feb. 17, 2021
RF Cable	NA	LOOPCAB-001	Jan. 08, 2020	Jan. 07, 2021
RF Cable	NA	LOOPCAB-002	Jan. 08, 2020	Jan. 07, 2021
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-05	Apr. 28, 2020	Apr. 27, 2021
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Nov. 11, 2019	Nov. 10, 2020
RF Cable	8D	966-3-1	Mar. 17, 2020	Mar. 16, 2021
RF Cable	8D	966-3-2	Mar. 17, 2020	Mar. 16, 2021
RF Cable	8D	966-3-3	Mar. 17, 2020	Mar. 16, 2021
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Sep. 24, 2020	Sep. 23, 2021
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Nov. 24, 2019	Nov. 23, 2020
Pre-Amplifier EMCI	EMC12630SE	980384	Jan. 15, 2020	Jan. 14, 2021
RF Cable	EMC104-SM-SM-1500	180504	Apr. 29, 2020	Apr. 28, 2021
RF Cable	EMC104-SM-SM-2000	180601	June 09, 2020	June 08, 2021
RF Cable	EMC104-SM-SM-6000	180602	June 09, 2020	June 08, 2021
Spectrum Analyzer Keysight	N9030A	MY54490679	July 13, 2020	July 12, 2021
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 15, 2020	Jan. 14, 2021
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 24, 2019	Nov. 23, 2020
RF Cable	EMC102-KM-KM-1200	160924	Jan. 15, 2020	Jan. 14, 2021
RF Cable	EMC-KM-KM-4000	200214	Mar. 11, 2020	Mar. 10, 2021
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	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. 3.
3. Tested Date: Oct. 14, 2020

For other test items:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSV40	100964	May 29, 2020	May 28, 2021
Spectrum Analyzer Keysight	N9030A	MY54490679	July 13, 2020	July 12, 2021
Power meter Anritsu	ML2495A	1529002	July 22, 2020	July 21, 2021
Power sensor Anritsu	MA2411B	1339443	July 22, 2020	July 21, 2021
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 14, 2020	Apr. 13, 2021
DC Power Supply Topward	6603D	795558	NA	NA
Temperature & Humidity Chamber Giant Force	GTH-150-40-SP-AR	MAA0812-008	Jan. 16, 2020	Jan. 15, 2021
True RMS Clamp Meter FLUKE	325	31130711WS	June 06, 2020	June 05, 2021
Mech Switch Absorptive Mini-Circuits	MSP4TA-18+	0140	Feb. 10, 2020	Feb. 09, 2021
FXD ATTEN Mini-Circuits	BW-S3W2+	MN71981	Feb. 10, 2020	Feb. 09, 2021
Software	ADT_RF Test Software V6.6.5.4	NA	NA	NA

- 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: Oct. 13, 2020

3 General Information

3.1 General Description of EUT

Product	M2M DATA MODULE		
Brand	Wistron NeWeb Corporation		
Test Model	M18QAG		
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)	23.32 dBm	
	LTE Band 14 (Channel Bandwidth 10MHz)	23.23 dBm	
Emission Designator	LTE Band 14	Channel Bandwidth 5MHz	QPSK: 4M48G7D
			16QAM: 4M48D7W
	LTE Band 14	Channel Bandwidth 10MHz	QPSK: 8M92G7D
			16QAM: 8M94D7W
Antenna Type	Refer to Note		
Antenna Connector	Refer to Note		
Accessory Device	NA		
Data Cable Supplied	NA		

Note:

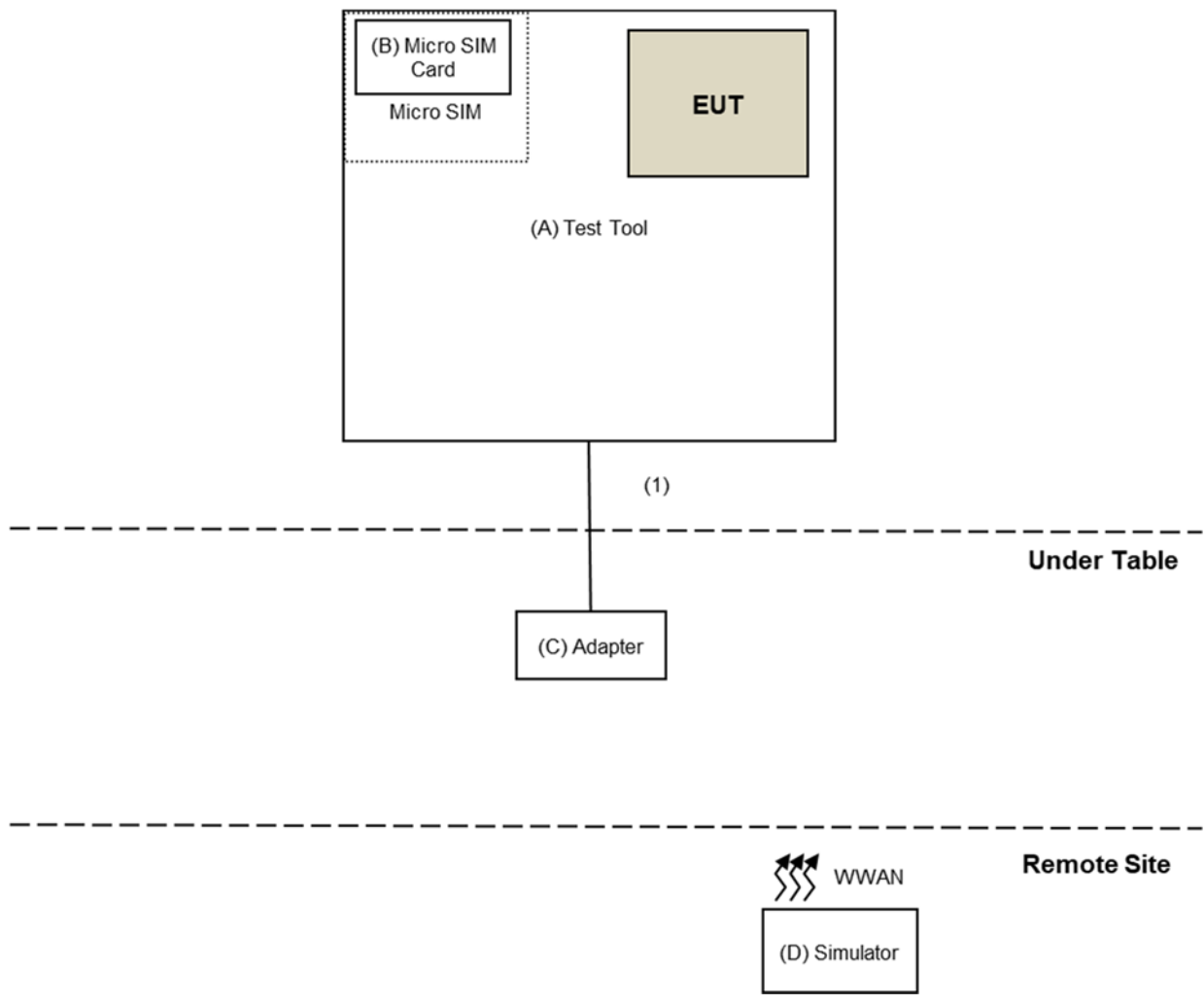
1. The antennas provided to the EUT, please refer to the following table:

For GPS					
Antenna No.	Band	Freq. Range (MHz)	Antenna Net Gain (dBi)	Antenna Type	Connector Type
1	GPS	1602	2.24	Dipole	SMA
For WWAN					
Antenna No.	Band	Freq. Range (MHz)	Antenna Net Gain (dBi)	Antenna Type	Connector Type
2	LTE / WCDMA (2)	1850~1910	1.56	Dipole	SMA
	LTE / WCDMA (4)	1710~1755	1.62	Dipole	SMA
	LTE / WCDMA (5)	824~849	3.2	Dipole	SMA
	LTE / WCDMA (12)	699~716	1.49	Dipole	SMA
	LTE / WCDMA (14)	788~798	1.66	Dipole	SMA

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

3. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

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	WNC	NA	NA	NA	Supplied by client
B.	SIM Card	R&S	CRT-Z3	NA	NA	Provided by Lab
C.	Adapter	I.T.E	MU24-Y120200-A1	NA	NA	Supplied by client
D.	Simulator	Anritsu	MT8820C	6201127458	NA	Provided by Lab

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	1.8	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	23330	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, 62%RH	120Vac, 60Hz	Charlie Yang
Frequency Stability	25deg. C, 62%RH	120Vac, 60Hz	Charlie Yang
Occupied Bandwidth	25deg. C, 62%RH	120Vac, 60Hz	Charlie Yang
Emission Mask	25deg. C, 62%RH	120Vac, 60Hz	Charlie Yang
Peak to Average Ratio	25deg. C, 62%RH	120Vac, 60Hz	Charlie Yang
Conducted Emission	25deg. C, 62%RH	120Vac, 60Hz	Charlie Yang
Radiated Emission Below 1GHz	24deg. C, 75%RH	120Vac, 60Hz	Tom Yang
Radiated Emission Above 1GHz	24deg. C, 75%RH	120Vac, 60Hz	Tom Yang

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 and references

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

Test standard:

FCC 47 CFR Part 2

FCC 47 CFR Part 90, Subpart R

ANSI/TIA/EIA-603-E 2016

ANSI 63.26-2015

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

References Test Guidance:

KDB 971168 D01 Power Meas License Digital Systems v03r01

All test items have been performed as a reference to the above KDB test guidance.

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

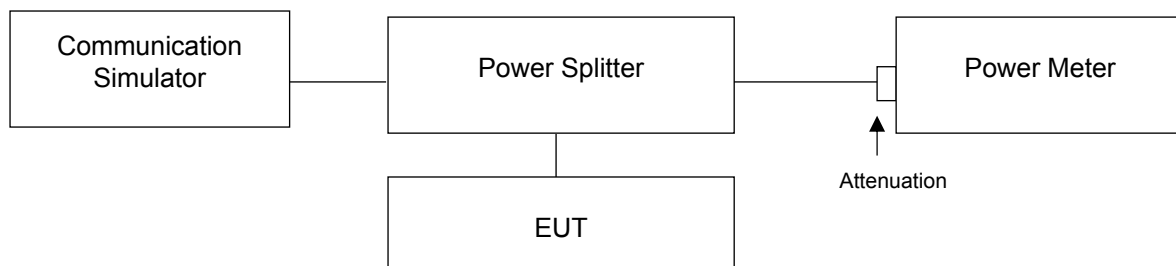
Conducted Power Measurement:

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:

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

4.1.3 Test Setup



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						
14 / 5M	1	0	23.81	23.35	23.40	0	22.75	22.76	22.28	1	
	1	12	23.64	23.71	23.54	0	22.33	22.67	22.58	1	
	1	24	23.26	23.51	22.64	0	22.23	22.49	22.55	1	
	12	0	22.39	22.57	22.66	1	21.35	21.72	21.66	2	
	12	6	22.50	22.55	22.68	1	21.37	21.55	21.49	2	
	12	13	22.54	22.59	22.63	1	21.50	21.51	21.60	2	
	25	0	22.52	22.60	22.67	1	21.52	21.57	21.76	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	23.72		0	23.65		1
	1	24	23.43		0	23.61		1
	1	49	23.41		0	22.73		1
	25	0	22.61		1	21.49		2
	25	12	22.64		1	21.62		2
	25	25	22.62		1	21.60		2
	50	0	22.64		1	21.55		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)	23.81	23.35	23.40	22.75	22.76	22.28
Gain (dBi)	1.66	1.66	1.66	1.66	1.66	1.66
Isotropically Factor (dB)	2.15	2.15	2.15	2.15	2.15	2.15
Max ERP Power (dBm)	23.32	22.86	22.91	22.26	22.27	21.79

Band 14 / 10M 1RB#0

Test Mode	QPSK		16QAM	
	Mid CH		Mid CH	
	23330		23330	
	793		793	
	MHz		MHz	
Max Cond. Power (dBm)	23.72		23.65	
Gain (dBi)	1.66		1.66	
Isotropically Factor (dB)	2.15		2.15	
Max ERP Power (dBm)	23.23		23.16	

4.2 Modulation Characteristics Measurement

4.2.1 Limits of Modulation Characteristics

N/A

4.2.2 Test Procedure

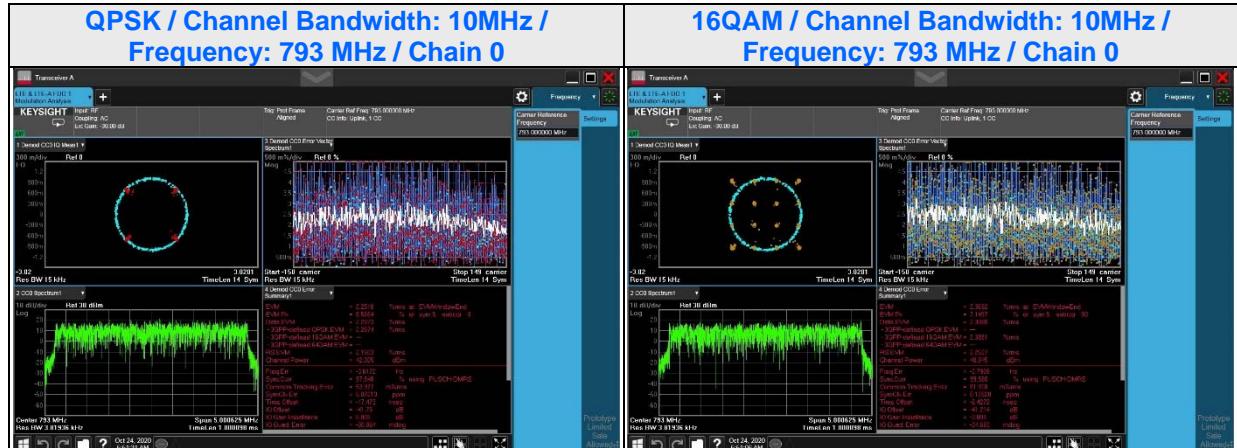
Connect the EUT to Communication Simulator via the antenna connector, the frequency band is set as EUT supported Modulation and Channels, the EUT output is matched with 50 ohm load, the waveform quality and constellation of the EUT was tested.

4.2.3 Test Setup



4.2.4 Test Results

LTE Band 14



4.3 Frequency Stability Measurement

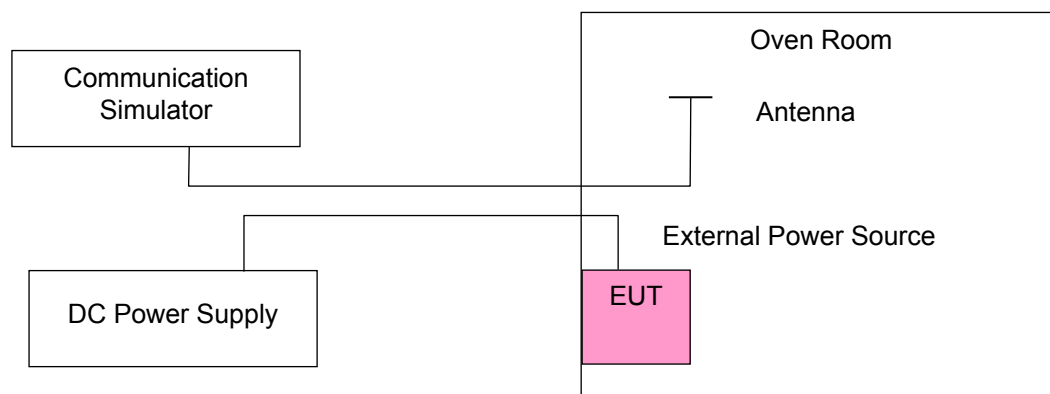
4.3.1 Limits of Frequency Stability Measurement

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

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

4.3.3 Test Setup



4.3.4 Test Results

LTE Band 14

Frequency Error vs. Voltage			Limit (ppm)	Pass/Fail
Voltage (Volts)	Test result (ppm)			
	5M	10M		
3.3	0.040	0.055	±2.5	Pass
4.2	0.044	0.033	±2.5	Pass

Frequency Error vs. Temperature			Limit (ppm)	Pass/Fail
Temp. (°C)	Test result (ppm)			
	5M	10M		
60	0.049	0.048	±2.5	Pass
50	0.037	0.043	±2.5	Pass
40	0.037	0.044	±2.5	Pass
30	0.059	0.039	±2.5	Pass
20	0.035	0.053	±2.5	Pass
10	0.037	0.062	±2.5	Pass
0	0.038	0.053	±2.5	Pass
-10	0.048	0.035	±2.5	Pass
-20	0.053	0.029	±2.5	Pass
-30	0.052	0.047	±2.5	Pass

4.4 Emission Bandwidth Measurement

4.4.1 Limits of Emission 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

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with $RBW \geq 1\% \times OBW$ and $VBW \geq 3 \times VBW$.

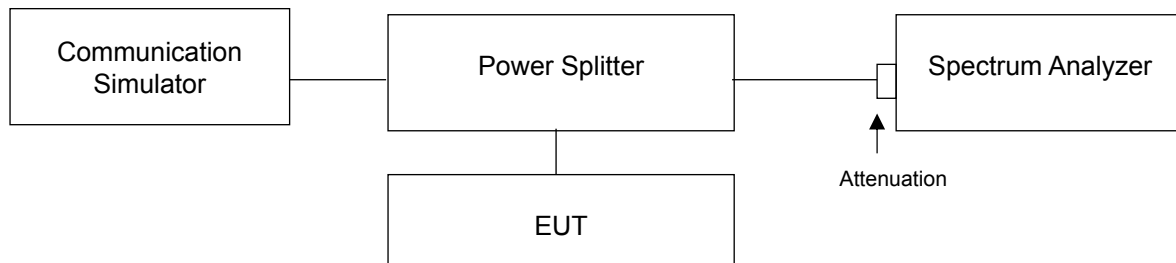
Occupied Bandwidth Measurement:

Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

26 dB Bandwidth Measurement:

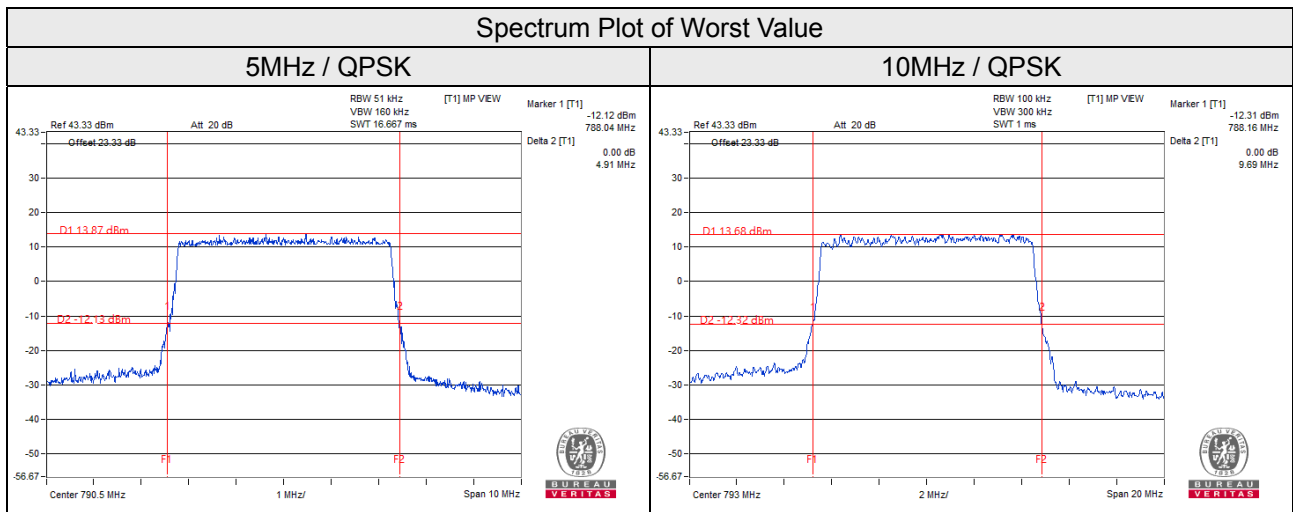
The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26dB below the transmitter power.

4.4.3 Test Setup



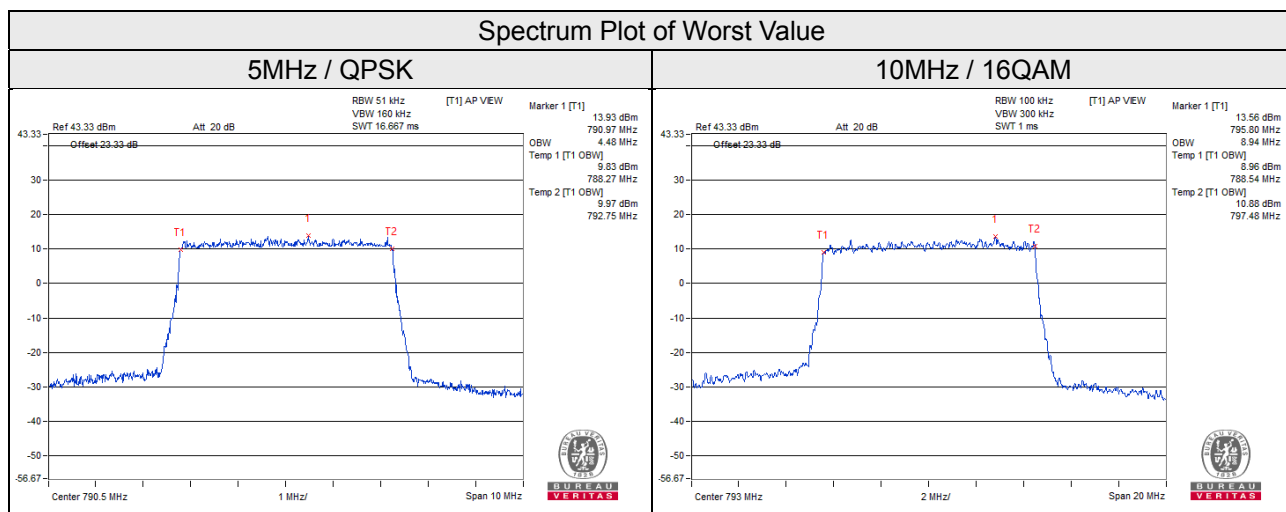
4.4.4 Test Result (-26dB Bandwidth)

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	4.91	4.88	23330	793	9.69	9.69
23330	793	4.90	4.87				
23355	795.5	4.85	4.88				



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	4.48	4.48	23330	793	8.92	8.94
23330	793	4.48	4.48				
23355	795.5	4.48	4.47				



4.5 Emission Mask Measurement

4.5.1 Limits of Emission Mask Measurement

Per 90.543(e), Emission mask requirements

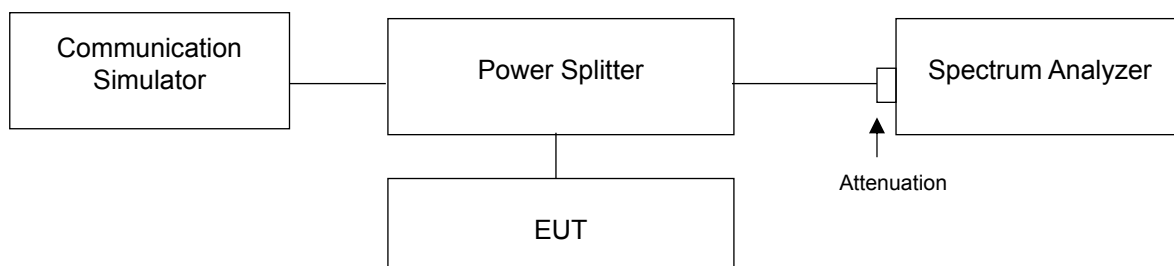
For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(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.

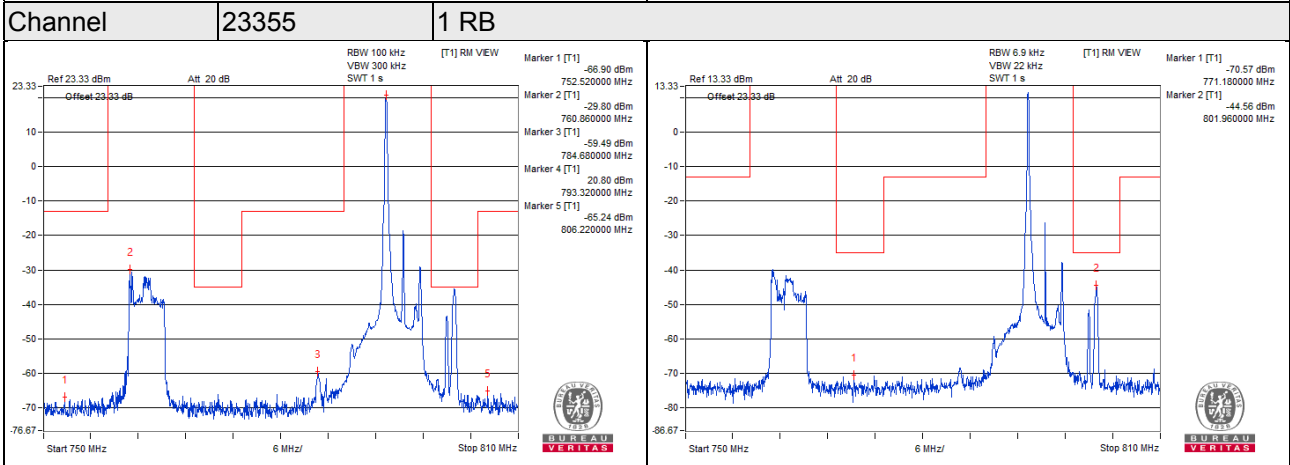
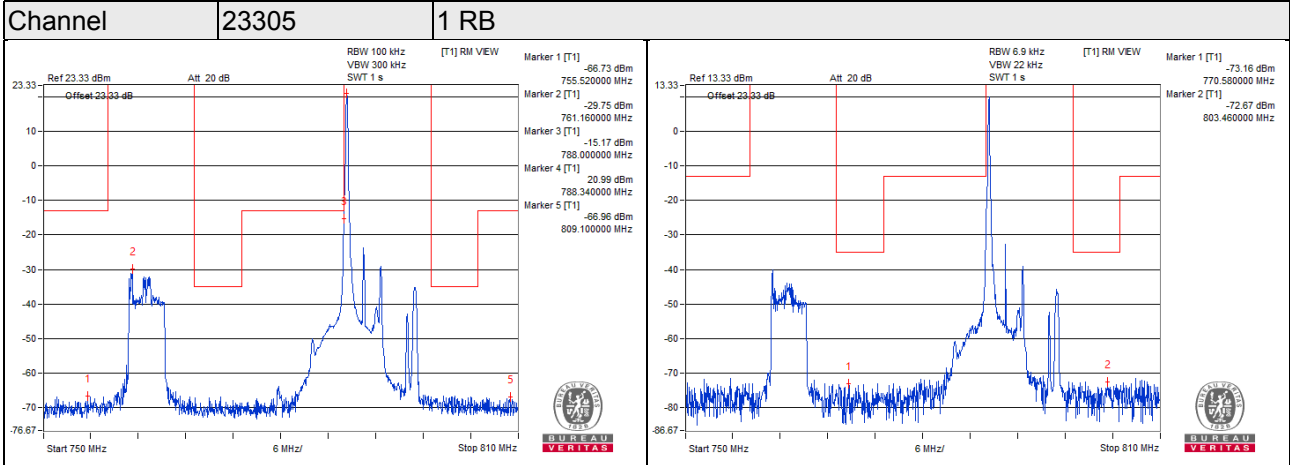
4.5.3 Test Setup



4.5.4 Test Results

LTE Band 14

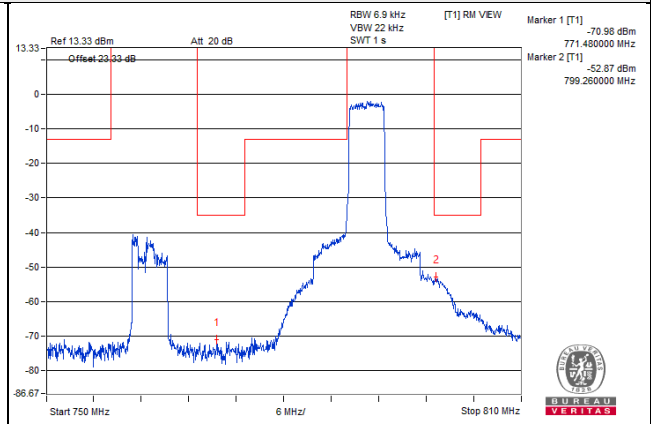
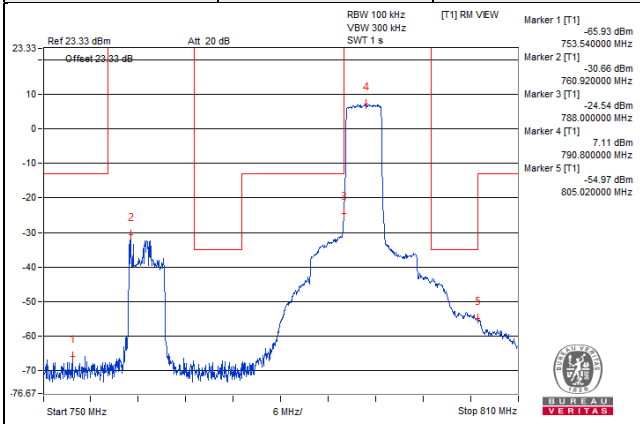
Channel Bandwidth 5MHz QPSK



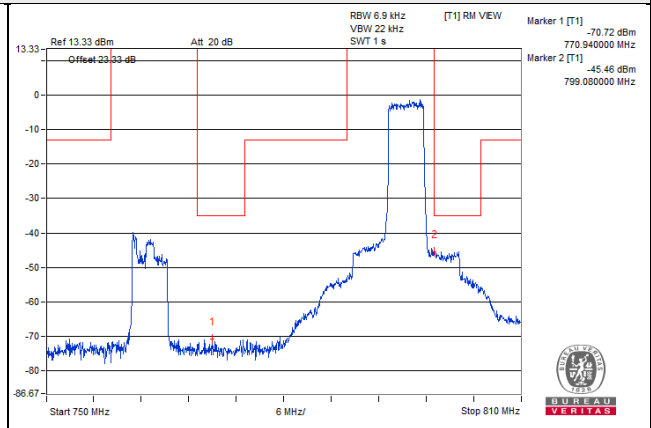
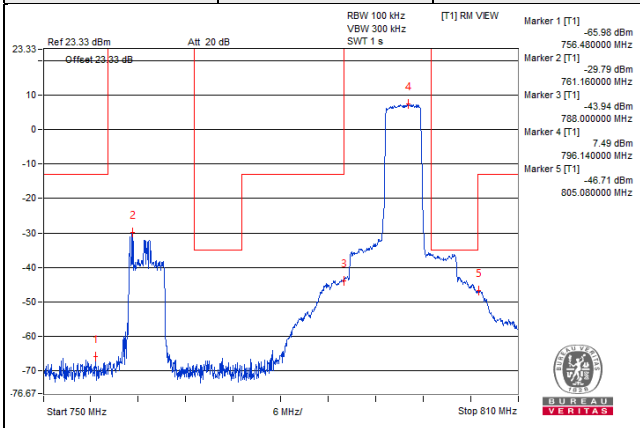
LTE Band 14

Channel Bandwidth 5MHz QPSK

Channel 23305 25 RB



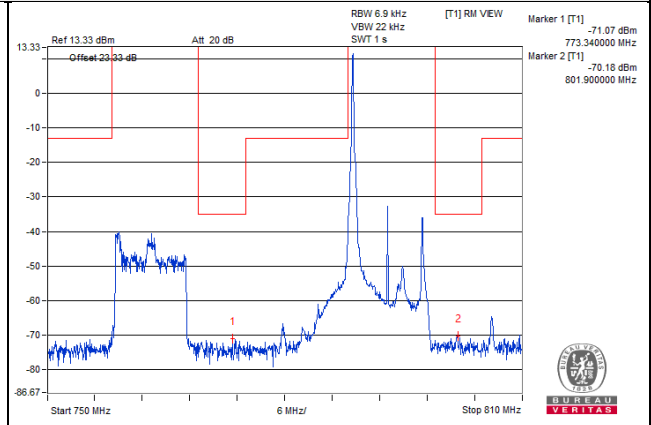
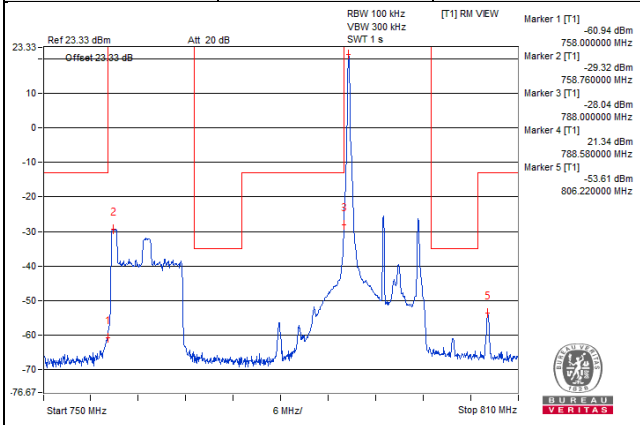
Channel 23355 25 RB



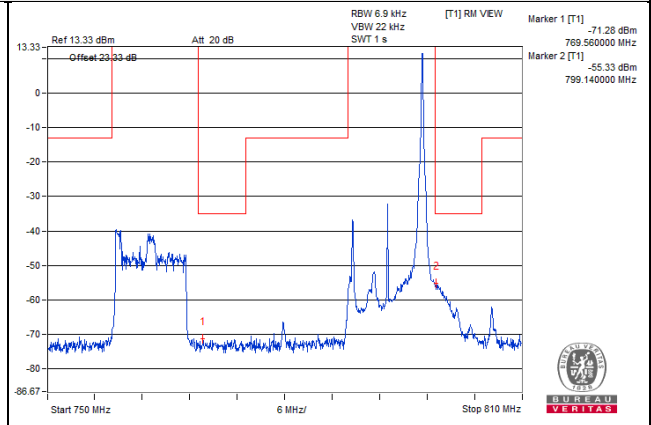
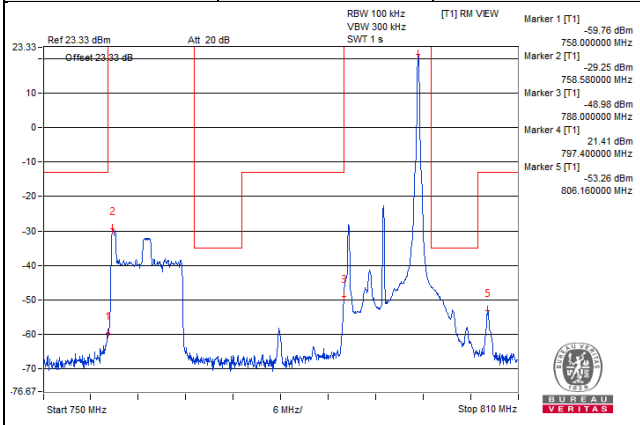
LTE Band 14

Channel Bandwidth 10MHz QPSK

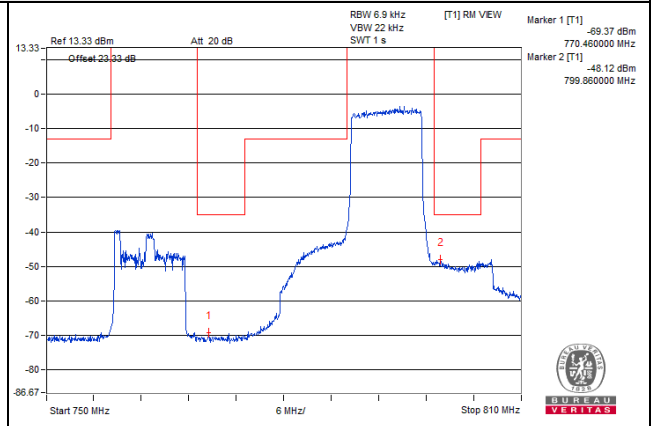
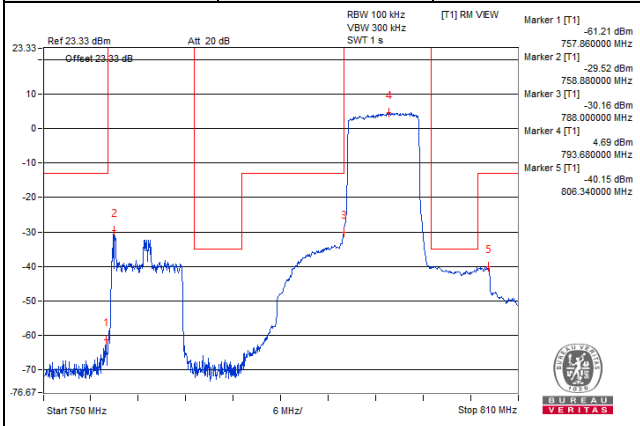
Channel 23330 1 RB#0



Channel 23330 1 RB#Max



Channel 23330 50 RB

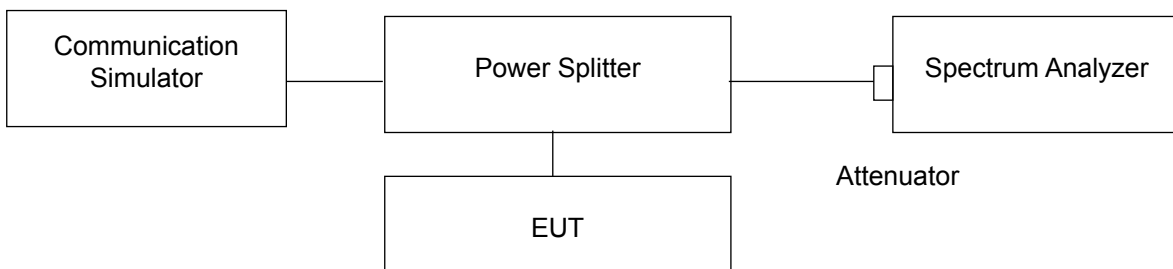


4.6 Peak To Average Power Ratio

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

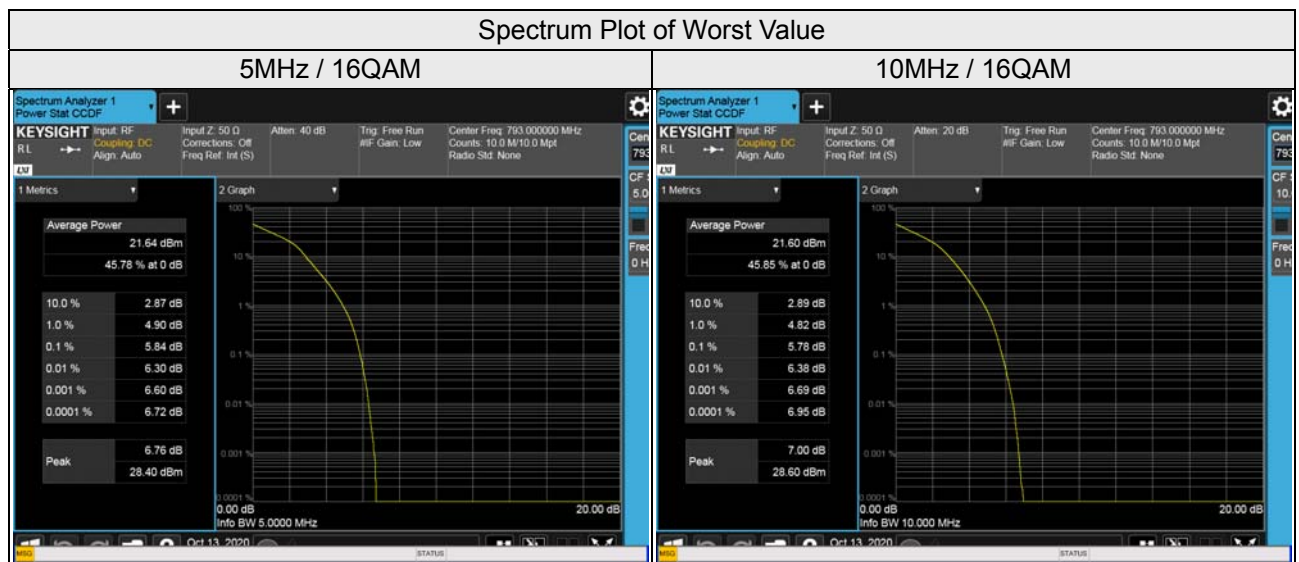


4.4.3 Test Procedures

1. Set resolution/measurement bandwidth \geq 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	4.97	5.81	23330	793	4.92	5.78
23330	793	4.98	5.84				
23355	795.5	4.91	4.92				

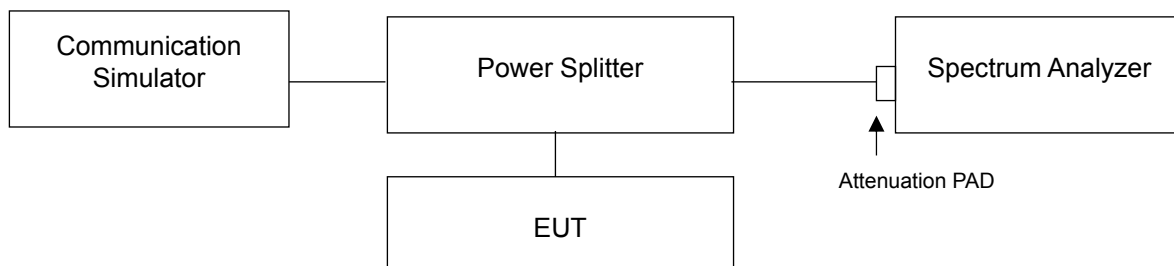


4.7 Conducted Spurious Emissions

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 $43 + 10 \log_{10}(P)$ dB. The limit of emission equal to -13dBm .

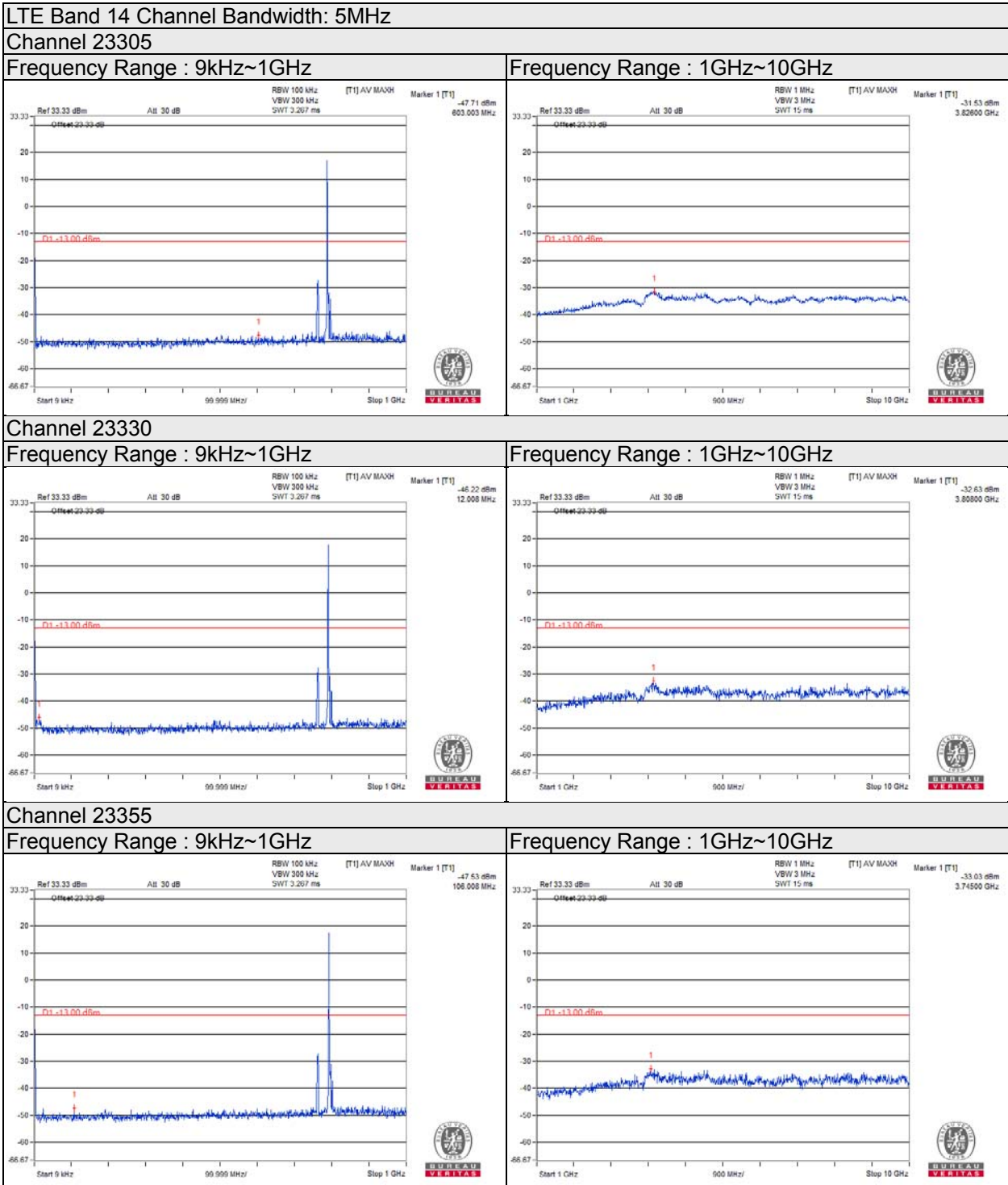
4.7.2 Test Setup



4.7.3 Test Procedure

- The EUT was set up for the maximum peak power with LTE link data modulation. The power was measured with Spectrum Analyzer.
- The conducted spurious emission used the power splitter via EUT RF power connector between signal generator and spectrum analyzer.
- 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

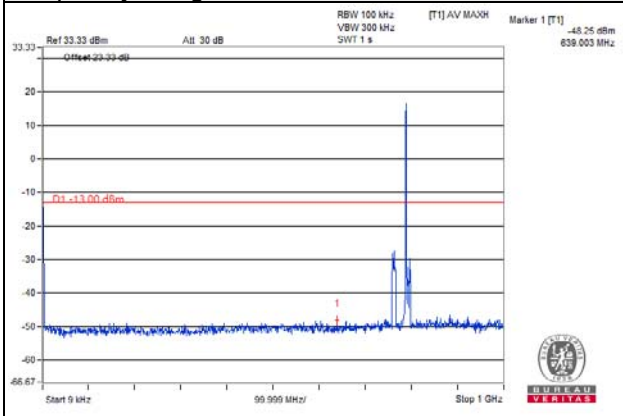


Note: The signal of 9kHz is IF signal from test instrument.

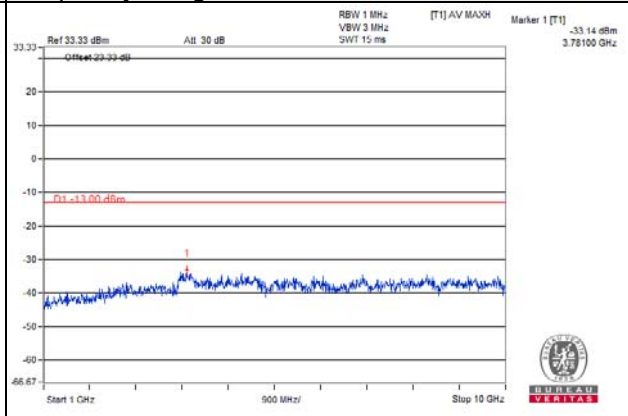
LTE Band 14 Channel Bandwidth: 10MHz

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 $43 + 10 \log_{10}(P)$ dB. The limit of emission equal to -13dBm

For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

4.8.2 Test Procedure

- a. The field strength was measured with Spectrum Analyzer.
- b. 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 field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor.
- c. Perform a field strength measurement and then mathematically convert the measured field strength level to EIRP level.
- d. Follow ANSI 63.26 section 5.2.7 d), Emission Value (dBm) = Read Value (dB μ V/m) - Correction Factor @ 3m
- e. Correction Factor (dB) @ 3m = $20\log(D) - 104.8$; where D is the measurement distance @3m = -95.26dB

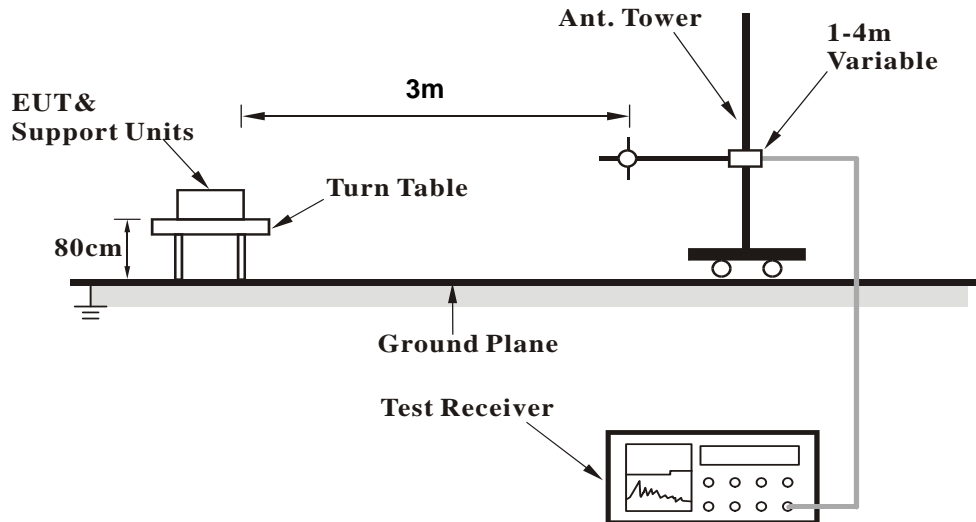
NOTE: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.

4.8.3 Deviation from Test Standard

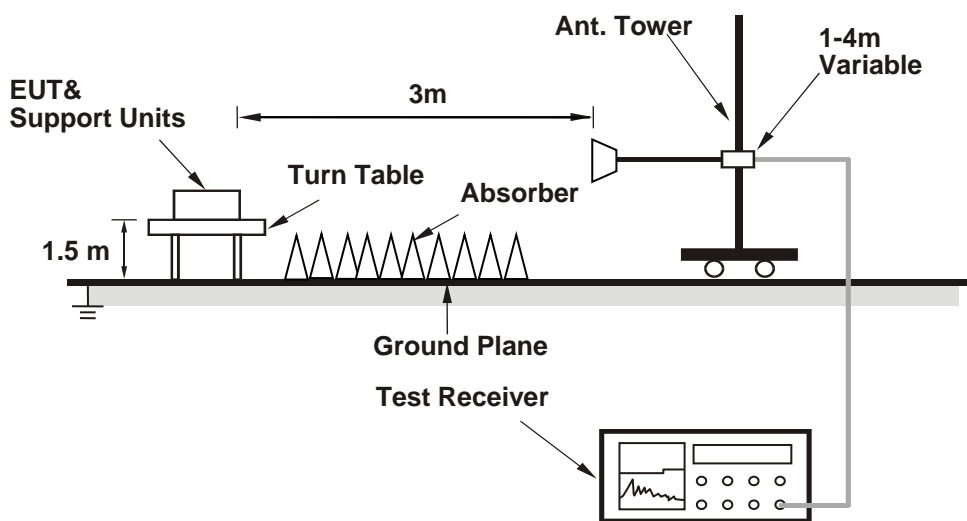
No deviation.

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
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Antenna Polarity & Test Distance: Horizontal at 3 M						
No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	30.59	29.89	-95.26	-65.37	-13	-52.37
2	109.17	24.78	-95.26	-70.48	-13	-57.48
3	149.2	24.73	-95.26	-70.53	-13	-57.53
4	196.93	26.77	-95.26	-68.49	-13	-55.49
5	309.93	24.9	-95.26	-70.36	-13	-57.36
6	486.1	29.11	-95.26	-66.15	-13	-53.15
Antenna Polarity & Test Distance: Vertical at 3 M						
No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	30.59	31.79	-95.26	-63.47	-13	-50.47
2	48.14	29.65	-95.26	-65.61	-13	-52.61
3	106.6	24.79	-95.26	-70.47	-13	-57.47
4	159.63	26.43	-95.26	-68.83	-13	-55.83
5	197.74	22.77	-95.26	-72.49	-13	-59.49
6	380.61	26.62	-95.26	-68.64	-13	-55.64

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), Emission Value (dBm) = E (dB μ V/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
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Antenna Polarity & Test Distance: Horizontal at 3 M

No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	30.56	29.76	-95.26	-65.50	-13	-52.50
2	109.08	24.82	-95.26	-70.44	-13	-57.44
3	149.11	24.75	-95.26	-70.51	-13	-57.51
4	196.81	26.94	-95.26	-68.32	-13	-55.32
5	309.82	24.79	-95.26	-70.47	-13	-57.47
6	485.97	29.12	-95.26	-66.14	-13	-53.14

Antenna Polarity & Test Distance: Vertical at 3 M

No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	30.67	31.78	-95.26	-63.48	-13	-50.48
2	47.98	29.59	-95.26	-65.67	-13	-52.67
3	106.67	24.72	-95.26	-70.54	-13	-57.54
4	159.58	26.35	-95.26	-68.91	-13	-55.91
5	197.8	22.62	-95.26	-72.64	-13	-59.64
6	380.66	26.49	-95.26	-68.77	-13	-55.77

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), Emission Value (dBm) = E (dB μ V/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
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Antenna Polarity & Test Distance: Horizontal at 3 M

No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	30.75	29.74	-95.26	-65.52	-13	-52.52
2	109.24	24.68	-95.26	-70.58	-13	-57.58
3	149.02	24.7	-95.26	-70.56	-13	-57.56
4	196.92	26.97	-95.26	-68.29	-13	-55.29
5	309.85	24.85	-95.26	-70.41	-13	-57.41
6	485.97	29.17	-95.26	-66.09	-13	-53.09

Antenna Polarity & Test Distance: Vertical at 3 M

No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	30.67	31.73	-95.26	-63.53	-13	-50.53
2	48.11	29.68	-95.26	-65.58	-13	-52.58
3	106.68	24.7	-95.26	-70.56	-13	-57.56
4	159.65	26.31	-95.26	-68.95	-13	-55.95
5	197.79	22.76	-95.26	-72.50	-13	-59.50
6	380.47	26.59	-95.26	-68.67	-13	-55.67

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), Emission Value (dBm) = E (dB μ V/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
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Antenna Polarity & Test Distance: Horizontal at 3 M

No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	30.81	29.76	-95.26	-65.50	-13	-52.50
2	109.19	24.77	-95.26	-70.49	-13	-57.49
3	149.14	24.86	-95.26	-70.40	-13	-57.40
4	196.88	26.96	-95.26	-68.30	-13	-55.30
5	309.91	24.79	-95.26	-70.47	-13	-57.47
6	486	29	-95.26	-66.26	-13	-53.26

Antenna Polarity & Test Distance: Vertical at 3 M

No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	30.69	31.63	-95.26	-63.63	-13	-50.63
2	48.26	29.55	-95.26	-65.71	-13	-52.71
3	106.64	24.8	-95.26	-70.46	-13	-57.46
4	159.77	26.35	-95.26	-68.91	-13	-55.91
5	197.95	22.71	-95.26	-72.55	-13	-59.55
6	380.7	26.49	-95.26	-68.77	-13	-55.77

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), Emission Value (dBm) = E (dB μ V/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
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Antenna Polarity & Test Distance: Horizontal at 3 M						
No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	1581	32.43	-95.26	-62.83	-40	-22.83
2	2371.5	32.81	-95.26	-62.45	-13	-49.45
3	3162	33.29	-95.26	-61.97	-13	-48.97
4	3952.5	33.72	-95.26	-61.54	-13	-48.54
Antenna Polarity & Test Distance: Vertical at 3 M						
No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	1581	32.98	-95.26	-62.28	-40	-22.28
2	2371.5	32.93	-95.26	-62.33	-13	-49.33
3	3162	33.72	-95.26	-61.54	-13	-48.54
4	3952.5	34.14	-95.26	-61.12	-13	-48.12

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), Emission Value (dBm) = E (dB μ V/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
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Antenna Polarity & Test Distance: Horizontal at 3 M

No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	1586	32.5	-95.26	-62.76	-40	-22.76
2	2379	32.9	-95.26	-62.36	-13	-49.36
3	3172	33.4	-95.26	-61.86	-13	-48.86
4	3965	33.59	-95.26	-61.67	-13	-48.67

Antenna Polarity & Test Distance: Vertical at 3 M

No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	1586	32.83	-95.26	-62.43	-40	-22.43
2	2379	32.92	-95.26	-62.34	-13	-49.34
3	3172	33.76	-95.26	-61.50	-13	-48.50
4	3965	34.32	-95.26	-60.94	-13	-47.94

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), Emission Value (dBm) = E (dB μ V/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
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Antenna Polarity & Test Distance: Horizontal at 3 M

No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	1591	32.43	-95.26	-62.83	-40	-22.83
2	2386.5	32.88	-95.26	-62.38	-13	-49.38
3	3182	33.39	-95.26	-61.87	-13	-48.87
4	3977.5	33.82	-95.26	-61.44	-13	-48.44

Antenna Polarity & Test Distance: Vertical at 3 M

No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	1591	32.84	-95.26	-62.42	-40	-22.42
2	2386.5	32.92	-95.26	-62.34	-13	-49.34
3	3182	33.6	-95.26	-61.66	-13	-48.66
4	3977.5	34.32	-95.26	-60.94	-13	-47.94

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), Emission Value (dBm) = E (dB μ V/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
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Antenna Polarity & Test Distance: Horizontal at 3 M

No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	1586	32.59	-95.26	-62.67	-40	-22.67
2	2379	32.77	-95.26	-62.49	-13	-49.49
3	3172	33.31	-95.26	-61.95	-13	-48.95
4	3965	33.8	-95.26	-61.46	-13	-48.46

Antenna Polarity & Test Distance: Vertical at 3 M

No.	Freq. (MHz)	Reading (dB μ V/m)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
1	1586	32.75	-95.26	-62.51	-40	-22.51
2	2379	32.94	-95.26	-62.32	-13	-49.32
3	3172	33.75	-95.26	-61.51	-13	-48.51
4	3965	34.2	-95.26	-61.06	-13	-48.06

Remarks:

1. Follow ANSI 63.26 section 5.2.7 d), Emission Value (dBm) = E (dB μ V/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:

Lin Kou EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

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Tel: 886-3-6668565

Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab

Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

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