FCC Test Report

(PART 90R)

Report No.: RFBFBE-WTW-P22030942-3

FCC ID: 2AJLF-VAB-1

Test Model: VAB-1

Received Date: 2022/6/7

Test Date: 2022/7/20 ~ 2022/7/30

Issued Date: 2022/8/22

Applicant: DataRemote Incorporated

Address: 18001 Old Cutler Rd. Suite 600, Miami, FL 33157

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

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Test Location (2): B2F., No.215, Sec. 3, Beixin Rd., Xindian Dist., New Taipei City 231, Taiwan

FCC Registration / Designation Number: 788550 / TW0003
427177 / TW0011

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Release Control Record

Issue No.	Description	Date Issued
RFBFBE-WTW-P22030942-3	Original Release	2022/8/22

1 Certificate of Conformity

Product: Cellular Backup Router

Brand: DATAREMOTE

Test Model: VAB-1

Sample Status: Engineering Sample

Applicant: DataRemote Incorporated

Test Date: 2022/7/20 ~ 2022/7/30

Standards: FCC Part 90, Subpart I, R
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 : Vera Huang , **Date:** 2022/8/22

Vera Huang / Specialist

Approved by : Jeremy Lin , **Date:** 2022/8/22

Jeremy Lin / Project Engineer

2 Summary of Test Results

Applied Standard: FCC Part 90 & Part 2 (LTE 14)			
FCC Clause	**Test Item**	**Result**	**Remarks**
2.1046 90.542 (a)(7)	Effective Radiated Power	Pass	Meet the requirement of limit.
2.1047	Modulation Characteristics	Pass	Meet the requirement.
2.1055 90.539 (e)	Frequency Stability	Pass	Meet the requirement of limit.
2.1049	Occupied Bandwidth	Pass	Meet the requirement of limit.
90.210 (n)	Emission Masks	Pass	Meet the requirement of limit.
2.1053 90.543 (e)(2)(3)	Band Edge Measurements	Pass	Meet the requirement of limit.
2.1051 90.543 (e)(3)	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 90.543 (e)(f)	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -17.31 dB at 1591.00 MHz.

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	9 kHz ~ 30 MHz	3.0400 dB
	30 MHz ~ 200 MHz	2.0153 dB
	200 MHz ~ 1000 MHz	2.0224 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	1.0121 dB
	18 GHz ~ 40 GHz	1.1508 dB

2.2 Test Site and Instruments

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower Max-Full	UNAT_5+	PAD-CH6-01	N/A	N/A
Antenna Tower Controller Max-Full	MF-7802	N/A	N/A	N/A
Bi_Log Antenna Schwarzbeck	VULB9168	9168-616	2021/10/27	2022/10/26
Preamplifier Agilent	310N	187226	2022/6/14	2023/6/13
Pre-amplifier EMCI	EMC001340	980201	2021/9/15	2022/9/14
RF Coaxial Cable EMCI	5D-NM-BM	140903+140902	2022/1/15	2023/1/14
RF Coaxial Cable ETS-Lindgren	EMC104-SM-SM-10000	Cable-CH1-01(RFC-SMS-100-SMS-120+RFC-SMS-100-SMS-4	2022/6/14	2023/6/13
	RFC-SMS-100-SMS-24-IN	Cable-CH1-02(RFC-SMS-100-SMS-24)	2022/6/14	2023/6/13
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	N/A	N/A	N/A
Test Receiver Agilent	N9038A	MY52260177	2021/9/1	2022/8/31
Turn Table Max-Full	TT-1510	N/A	N/A	N/A
Turn Table Controller Max-Full	MF-7802	N/A	N/A	N/A
Boresight antenna tower fixture BV	BAF-02	8	N/A	N/A
Horn Antenna ETS-Lindgren	3117	00143293	2021/11/14	2022/11/13
Horn Antenna Schwarzbeck	BBHA 9170	BBHA9170241	2021/10/26	2022/10/25
Radio Communication Analyzer Anritsu	MT8821C	6261806803	2022/2/16	2023/2/15

Notes:
1. The test was performed in XD - 966 chamber 6.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

3 General Information

3.1 General Description of EUT

Product	Cellular Backup Router	
Brand	DATAREMOTE	
Test Model	VAB-1	
Status of EUT	Engineering Sample	
Power Supply Rating	12Vdc / 19Vdc (from adapter)	
Modulation Type	LTE	QPSK, 16QAM
Frequency Range	LTE Band 14 (Channel Bandwidth: 5 MHz)	790.5 ~ 795.5 MHz
	LTE Band 14 (Channel Bandwidth: 10 MHz)	793 MHz
Emission Designator	LTE Band 14 (Channel Bandwidth: 5 MHz)	4M49G7D
	LTE Band 14 (Channel Bandwidth: 10 MHz)	8M94G7D
Max. ERP Power	LTE Band 14 (Channel Bandwidth: 5 MHz)	162.181 mW (22.10dBm)
	LTE Band 14 (Channel Bandwidth: 10 MHz)	160.694 mW (22.06dBm)
Antenna Type	Refer to Note as below	
Accessory Device	Refer to Note as below	
Data Cable Supplied	Refer to Note as below	

Note:

1. The EUT contains following accessory devices.

AC Adapter 1	**Brand**	MOSO
	Model	MSS-V2500WR120-030E0-US
	AC Input	100-240V, 50/60Hz, 1A max.
	DC Output	12V, 2.5A
	DC Output Cable	1.5m, Non-shielded
AC Adapter 2	**Brand**	MOSO
	Model	MS-V3420R190-065L0-US
	AC Input	100-240V, 50/60Hz, 1.5A max.
	DC Output	19V, 3.42A
	DC Output Cable	1.5m, Non-shielded
Ethernet Cable 1	**Signal Line**	1.5m, Non-shielded, yellow
Ethernet Cable 2	**Signal Line**	1.5m, Non-shielded, red
Phone Cable	**Signal Line**	1.5m, Non-shielded, gray
Power Cable 1	**Model**	BGW-210
	Signal Line	1.5m, Non-shielded, black
Power Cable 2	**Model**	BGW-320
	Signal Line	1.5m, Non-shielded, white

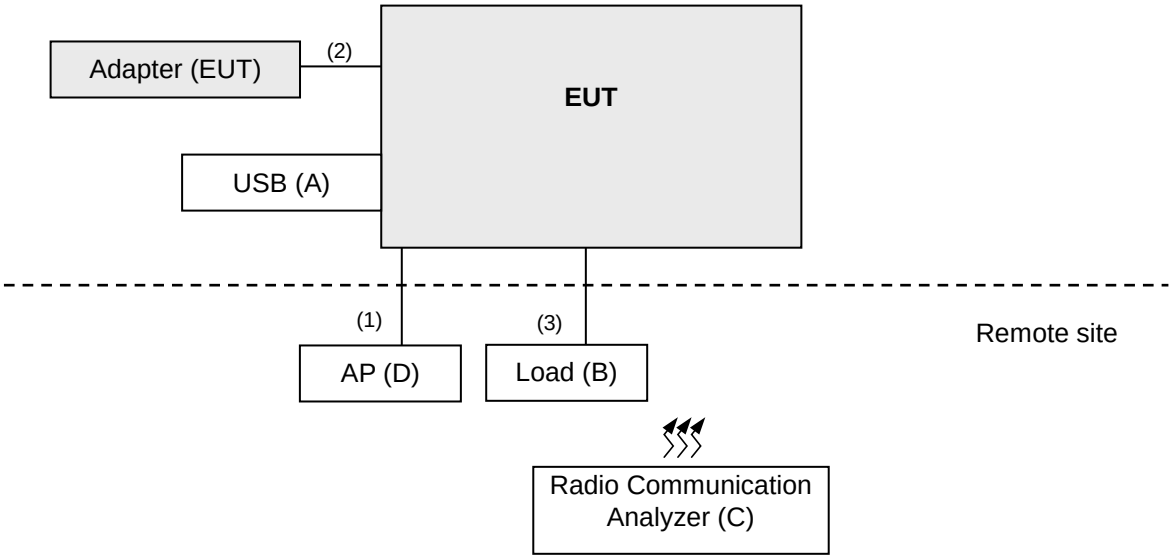
*After pretesting, Adapter 1 was the worst case and chosen for final test.

2. The antenna information is listed as below.

Antenna Type	Dipole Antenna	
Band	Antenna Gain (dBi)	
	Ant. 1	Ant. 2
LTE 14	1.65	1.65

3. Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.
4. The above EUT information is declared by manufacturer and for more detailed features description, please refers 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	USB	SanDisk	BM210257950Z	N/A	N/A	Supplied by lab
B	Load	N/A	N/A	N/A	N/A	Supplied by lab
C	Radio Communication Analyzer	Anritsu	MT8821C	6261806803	N/A	Supplied by lab
D	AP	ASUS	AC750	H7ITDV002001	NA	Supplied by lab

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ-45 Cable	4	2	No	0	Supplied by lab
2.	AC Cable	1	1.5	No	0	Supplied by applicant
3.	RJ-41 Cable	1	2	No	0	Supplied by lab

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

Band	Radiated Emission
LTE Band 14	90 degree

LTE Band 14

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	RB #
-	ERP	23305 to 23355	23305, 23330, 23355	5 MHz	QPSK, 16QAM	1 Half Full
		23330	23330	10 MHz	QPSK, 16QAM	1 Half Full
-	Modulation Characteristics	23330	23330	10 MHz	QPSK, 16QAM	Full
-	Frequency Stability	23305 to 23355	23305, 23355	5 MHz	QPSK	Full
		23330	23330	10 MHz	QPSK	Full
-	Occupied Bandwidth	23305 to 23355	23305, 23330, 23355	5 MHz	QPSK, 16QAM	Full
		23330	23330	10 MHz	QPSK, 16QAM	Full
-	Emission Mask	23305 to 23355	23305, 23330, 23355	5 MHz	QPSK, 16QAM	Full
		23330	23330	10 MHz	QPSK, 16QAM	Full
-	Band Edge	23305 to 23355	23305, 23355	5 MHz	QPSK, 16QAM	1 Half Full
		23330	23330	10 MHz	QPSK, 16QAM	1 Half Full
-	Conducted Emission	23305 to 23355	23305, 23330, 23355	5 MHz	QPSK	1
		23330	23330	10 MHz	QPSK	1
-	Radiated Emission Below 1GHz	23305 to 23355	23355	5 MHz	QPSK	1
-	Radiated Emission Above 1GHz	23305 to 23355	23305, 23330, 23355	5 MHz	QPSK	1
		23330	23330	10 MHz	QPSK	1

Note:

1. This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation. Therefore, only ERP, modulation characteristics, occupied bandwidth, emission mask and band edge, peak to average ratio items had been tested under QPSK, 16QAM mode, the other items were performed under QPSK mode only.
2. For radiated emission above 1 GHz, according to 3GPP 36.521 Section 6.6.3.1.4, choose the lowest, 5 MHz & highest channel bandwidth for final test.
3. For radiated emissions below 1 GHz, select the worst radiated emission channel for final testing.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
ERP	25 deg. C, 65 % RH	120 Vac, 60 Hz	James Yang
Modulation Characteristics	25 deg. C, 65 % RH	120 Vac, 60 Hz	James Yang
Frequency Stability	25 deg. C, 65 % RH	120 Vac, 60 Hz	James Yang
Occupied Bandwidth	25 deg. C, 65 % RH	120 Vac, 60 Hz	James Yang
Emission Mask	25 deg. C, 65 % RH	120 Vac, 60 Hz	James Yang
Band Edge	25 deg. C, 65 % RH	120 Vac, 60 Hz	James Yang
Conducted Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	James Yang
Radiated Emission Below 1GHz	26 deg. C, 62 % RH	120 Vac, 60 Hz	Charles Hsiao
Radiated Emission Above 1GHz	25 deg. C, 60 % RH	120 Vac, 60 Hz	Karl Lee

3.4 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

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

KDB 971168 D02 Misc Rev Approv License Devices v02r01

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

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 (Built-in power meter). Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

Maximum EIRP / ERP

The relevant equation for determining the maximum ERP or EIRP from the measured RF output power is given in Equation as follows:

$EIRP = P_{Meas} + G_T$

$ERP = P_{Meas} + G_T - 2.15$

where

ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas}, e.g., dBm or dBW)

P_{Meas} measured transmitter output power or PSD, in dBm or dBW

G_T gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

4.1.3 Test Setup

Conducted Power Measurement:

4.1.4 Test Results

Conducted Output Power (dBm)

LTE Band 14						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		23305	23330	23355
		Frequency (MHz)		790.5	793	795.5
5M	QPSK	1	0	22.42	22.60	22.55
		1	12	22.41	22.51	22.51
		1	24	22.55	22.51	22.46
		12	0	21.76	21.57	21.71
		12	6	21.66	21.65	21.60
		12	13	21.70	21.79	21.58
		25	0	21.63	21.58	21.75
5M	16QAM	1	0	21.69	21.62	21.67
		1	12	21.75	21.70	21.67
		1	24	21.75	21.75	21.74
		12	0	20.73	20.84	20.86
		12	6	20.98	20.94	20.83
		12	13	20.81	20.80	20.83
		25	0	20.78	20.72	20.94

LTE Band 14				
BW	MCS Index	RB Size	RB Offset	Mid
		Channel		23330
		Frequency (MHz)		793
10M	QPSK	1	0	22.50
		1	24	22.56
		1	49	22.52
		25	0	21.62
		25	12	21.69
		25	25	21.67
		50	0	21.60
10M	16QAM	1	0	21.65
		1	24	21.58
		1	49	21.62
		25	0	20.85
		25	12	20.92
		25	25	20.70
		50	0	21.00

ERP Power (dBm)

LTE Band 14						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		23305	23330	23355
		Frequency (MHz)		790.5	793	795.5
5M	QPSK	1	0	21.92	**22.10**	22.05
		1	12	21.91	22.01	22.01
		1	24	22.05	22.01	21.96
		12	0	21.26	21.07	21.21
		12	6	21.16	21.15	21.10
		12	13	21.20	21.29	21.08
		25	0	21.13	21.08	21.25
5M	16QAM	1	0	21.19	21.12	21.17
		1	12	21.25	21.20	21.17
		1	24	21.25	21.25	21.24
		12	0	20.23	20.34	20.36
		12	6	20.48	20.44	20.33
		12	13	20.31	20.30	20.33
		25	0	20.28	20.22	20.44

*ERP = Conducted + antenna gain (1.65dBi)-2.15

LTE Band 14				
BW	MCS Index	RB Size	RB Offset	Mid
		Channel		23330
		Frequency (MHz)		793
10M	QPSK	1	0	22.00
		1	24	**22.06**
		1	49	22.02
		25	0	21.12
		25	12	21.19
		25	25	21.17
		50	0	21.10
10M	16QAM	1	0	21.15
		1	24	21.08
		1	49	21.12
		25	0	20.35
		25	12	20.42
		25	25	20.20
		50	0	20.50

*ERP = Conducted + antenna gain (1.65dBi)-2.15

4.2 Modulation Characteristics Measurement

4.2.1 Limits of Modulation Characteristics

N/A

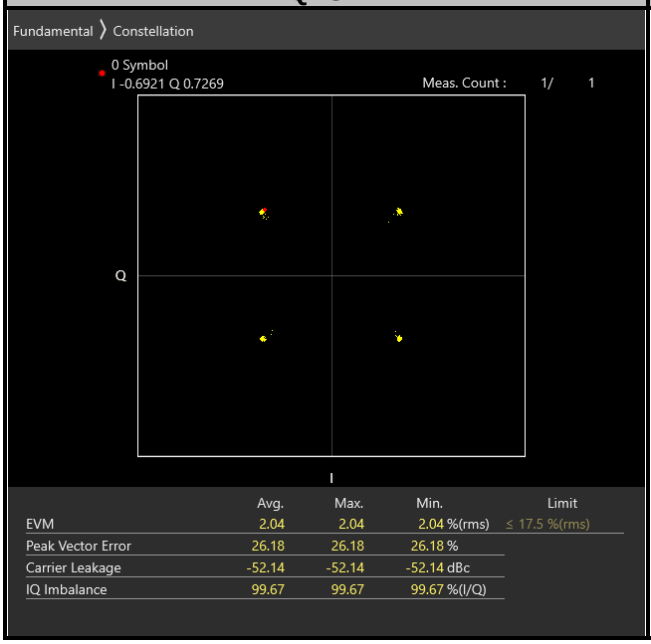
4.2.2 Test Setup

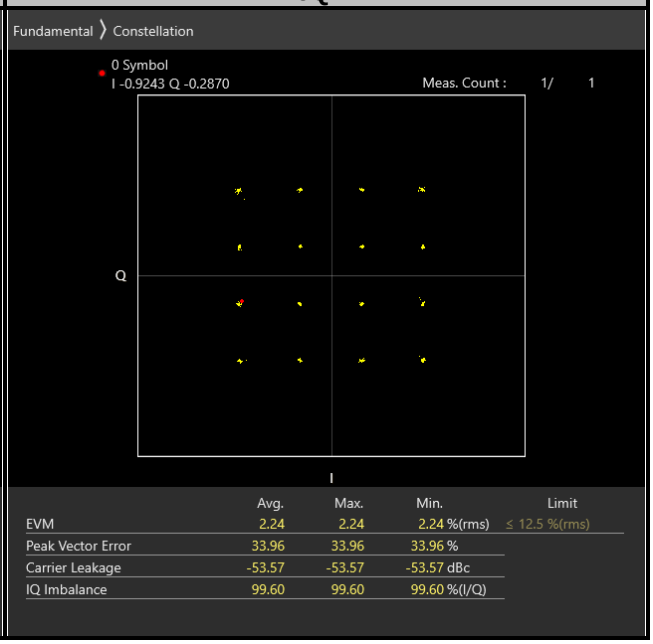
4.2.3 Test Procedure

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.

4.2.4 Test Results

Spectrum Plot of Measurement	
LTE Band 14	
Channel 23330	
QPSK	16QAM





4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

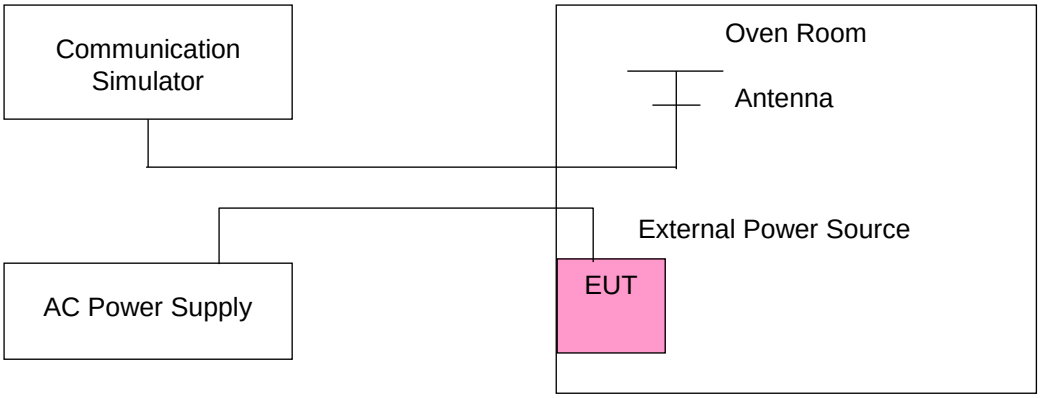
The frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 parts per million or better when AFC is locked to a base station, and 5 parts per million or better when AFC is not locked.

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)	LTE Band 14			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
108	790.5000035	0.004	795.5000014	0.002
120	790.5000036	0.005	795.5000032	0.004
132	790.5000035	0.004	795.5000036	0.005

Note: The applicant defined the normal working voltage is from 108 Vac to 132 Vac.

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 14			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	790.5000031	0.004	795.5000037	0.005
-20	790.5000037	0.005	795.5000023	0.003
-10	790.5000032	0.004	795.5000026	0.003
0	790.5000031	0.004	795.5000012	0.002
10	790.5000034	0.004	795.5000030	0.004
20	790.4999968	-0.004	795.4999988	-0.002
30	790.4999973	-0.003	795.4999988	-0.002
40	790.4999974	-0.003	795.4999974	-0.003
50	790.4999970	-0.004	795.4999966	-0.004

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 14	
	Channel Bandwidth: 10 MHz	
	Frequency (MHz)	Frequency Error (ppm)
108	793.0000013	0.002
120	793.0000032	0.004
132	793.0000025	0.003

Note: The applicant defined the normal working voltage is from 108 Vac to 132 Vac.

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 14	
	Channel Bandwidth: 10 MHz	
	Frequency (MHz)	Frequency Error (ppm)
-30	793.0000019	0.002
-20	793.0000024	0.003
-10	793.0000015	0.002
0	793.0000019	0.002
10	793.0000036	0.005
20	792.9999973	-0.003
30	792.9999978	-0.003
40	792.9999987	-0.002
50	792.9999966	-0.004

4.4 Occupied Bandwidth Measurement

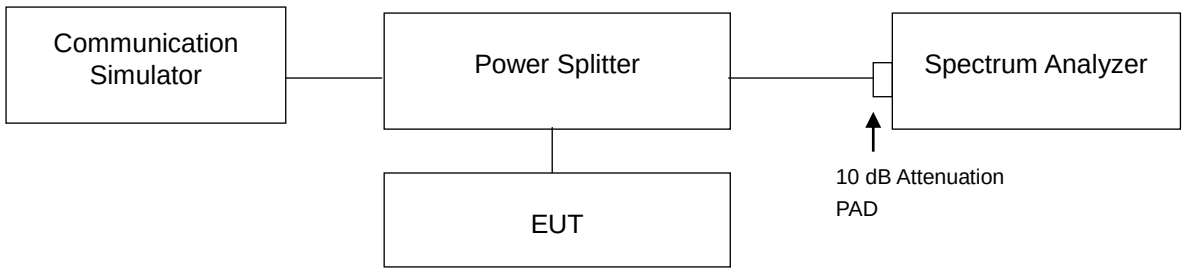
4.4.1 Limits of Occupied Bandwidth Measurement

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

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.

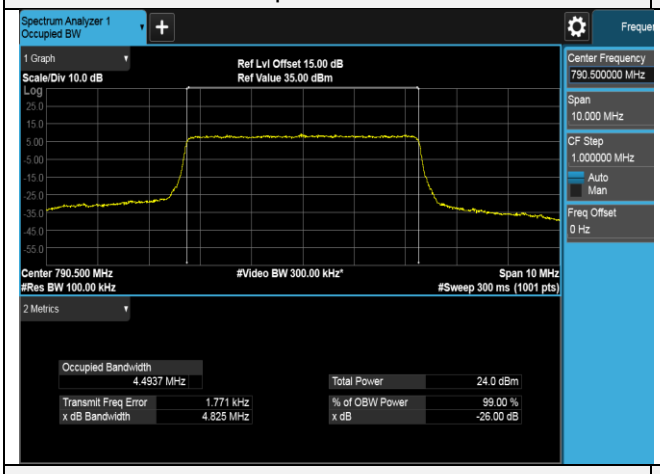
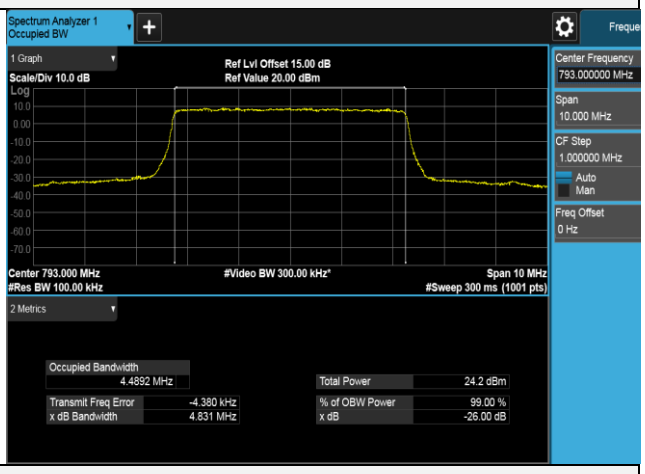
4.4.3 Test Setup



4.4.4 Test Results

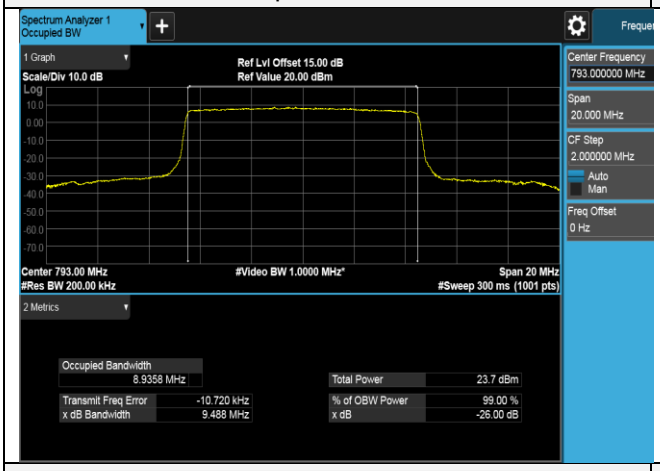
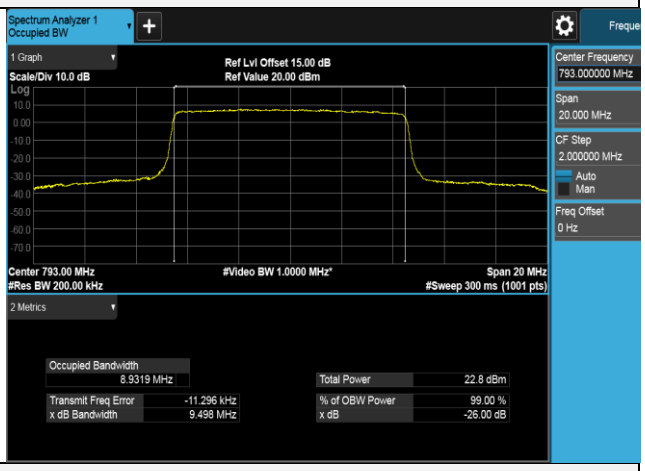
LTE Band 14 (Channel Bandwidth 5MHz)

Test Condition	Channel	Frequency (MHz)	Occupied bandwidth (MHz)	26 dB Bandwidth (MHz)
QPSK	23305	790.5	4.4937	4.825
QPSK	23330	793	4.4892	4.831
QPSK	23355	795.5	4.4899	4.824
16QAM	23305	790.5	4.4893	4.814
16QAM	23330	793	4.4874	4.807
16QAM	23355	795.5	4.4866	4.819

Spectrum Plot of Worst Value	
Occupied bandwidth	26 dB Bandwidth
	
QPSK CH 23305 (790.5MHz)	QPSK CH 23330 (793MHz)

LTE Band 14 (Channel Bandwidth 10MHz)

Test Condition	Channel	Frequency (MHz)	Occupied bandwidth (MHz)	26 dB Bandwidth (MHz)
QPSK	23330	793	8.9358	9.488
16QAM	23330	793	8.9319	9.498

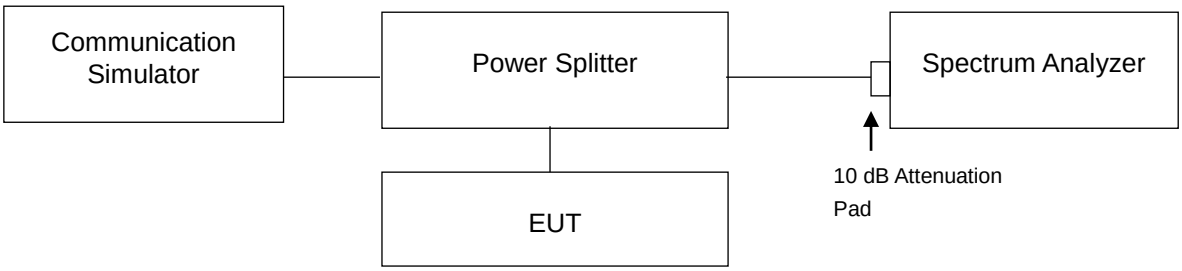
Spectrum Plot of Worst Value	
Occupied bandwidth	26 dB Bandwidth
	
QPSK CH 23330 (793MHz)	16QAM CH 23330 (793MHz)

4.5 Emission Mask Measurement

4.5.1 Limits of Emission Mask Measurement

1. On any frequency removed from the assigned frequency by more than 50 percent, but not more than100 percent of the authorized bandwidth: At least 25 dB.
2. On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
3. On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

4.5.2 Test Setup

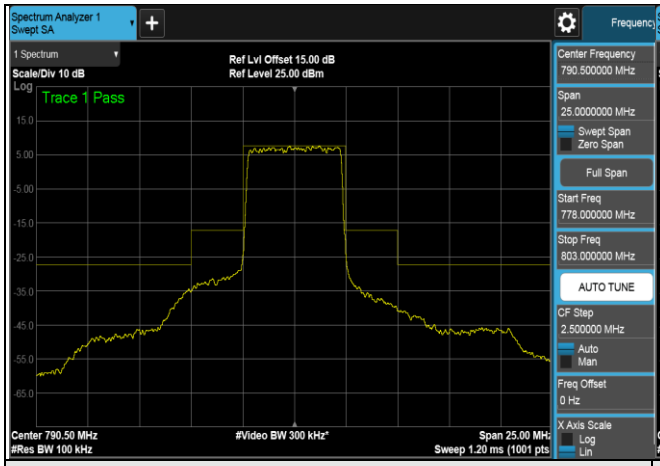


4.5.3 Test Procedures

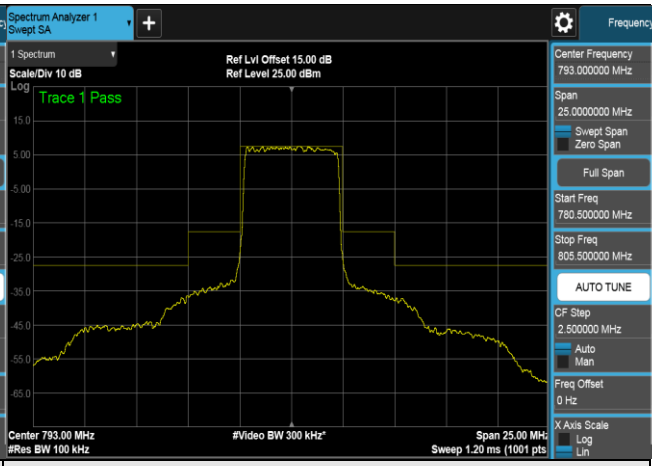
a. The measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.
b. Record the test plot.

4.5.4 Test Results

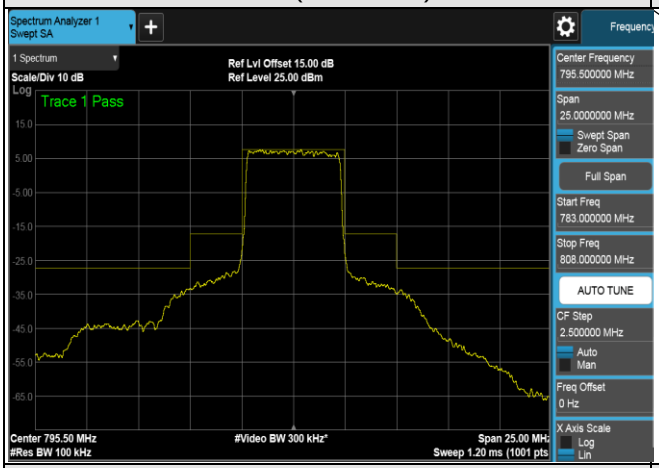
LTE Band 14 (Channel Bandwidth 5MHz)



FULL (790.5MHz)

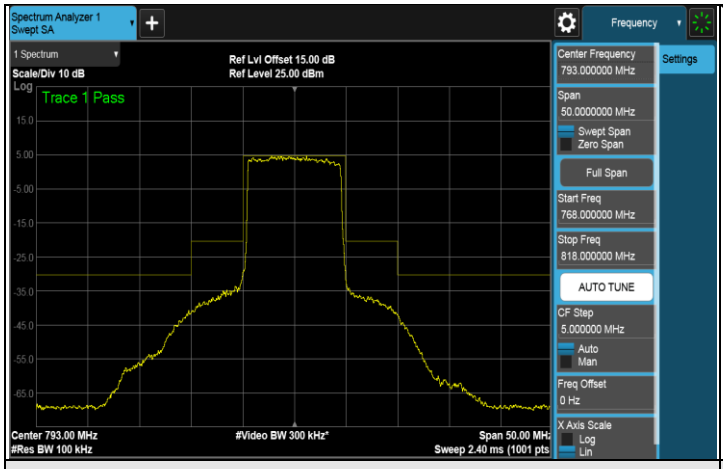


FULL (793MHz)



FULL (795.5MHz)

LTE Band 14 (Channel Bandwidth 10MHz)



FULL (793MHz)

4.6 Band Edge Measurement

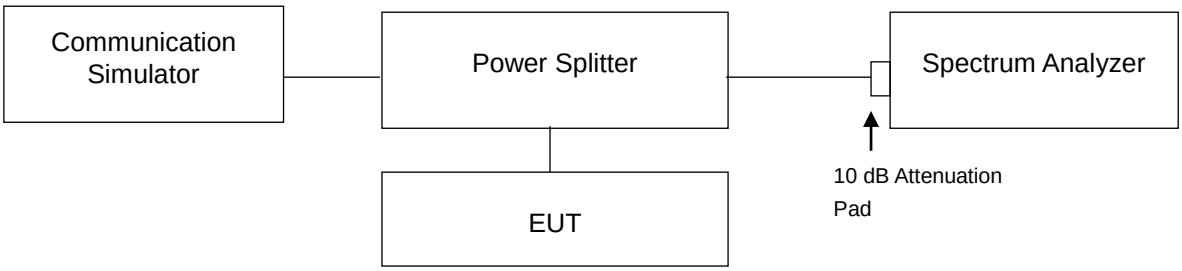
4.6.1 Limits of Band Edge Measurement

(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).

4.6.2 Test Setup



4.6.3 Test Procedures

a. All measurements were done at low and high operational frequency range.

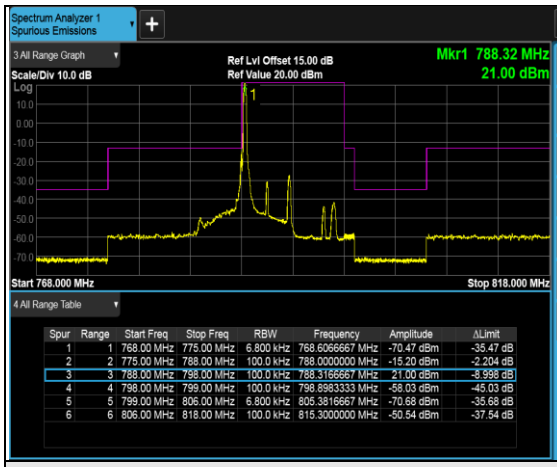
b. The detector of the spectrum is RMS, and if the device can be configured to transmit continuously (duty cycle ≥ 98%), set the (sweep time) > (number of points in sweep) × (symbol period) (e.g., by a factor of 10 × symbol period × number of points). Increasing the sweep time (i.e., slowing the sweep speed) will allow for averaging over multiple symbols.

c. The band edge measurement used the power splitter via EUT RF power connector between signal generator and spectrum analyzer. This splitter loss, attenuator loss and cable loss are the worst loss 15 dB in the transmitted path track.

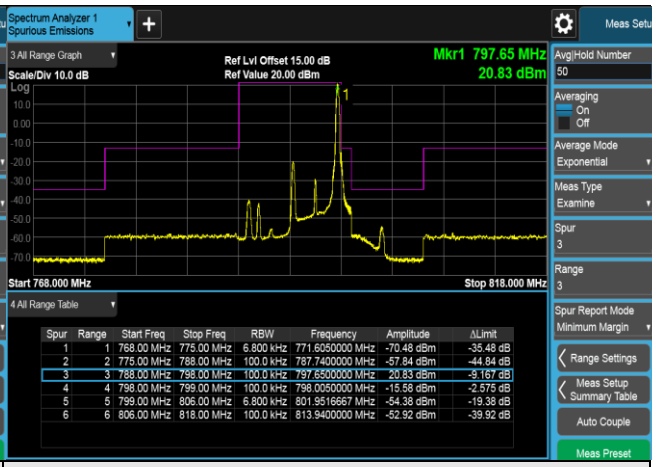
d. Record the max. trace plot into the test report.

4.6.4 Test Results

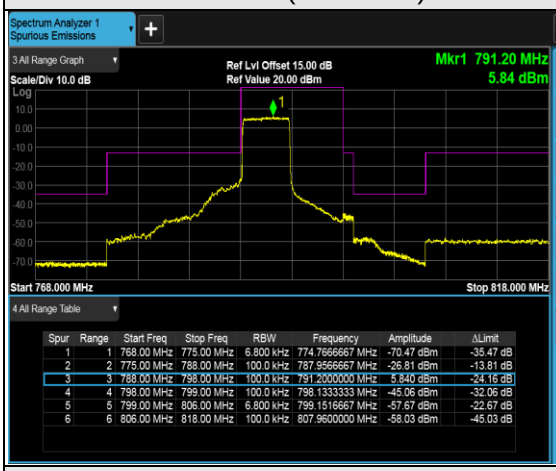
LTE Band 14 (Channel Bandwidth 5MHz)



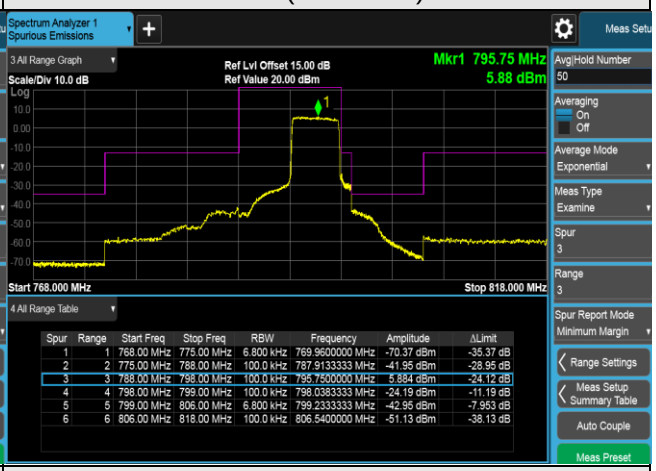
1RB (790.5MHz)



1RB (795.5MHz)

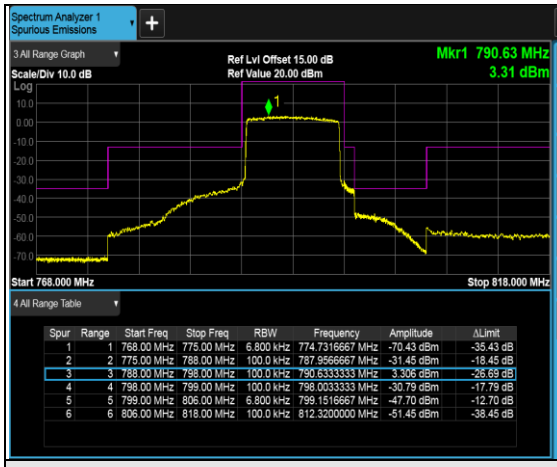


FULL (790.5MHz)

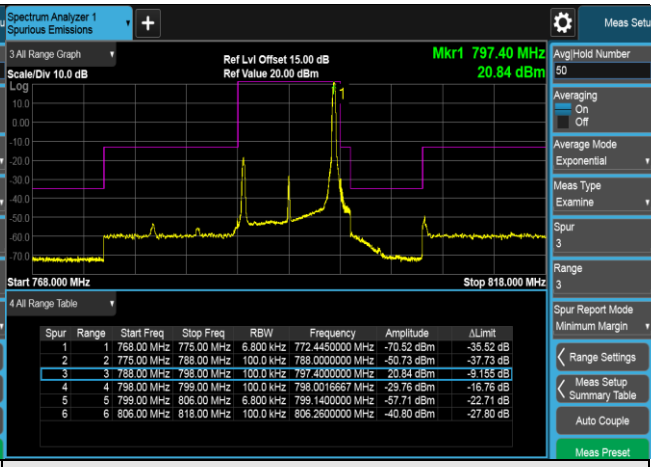


FULL (795.5MHz)

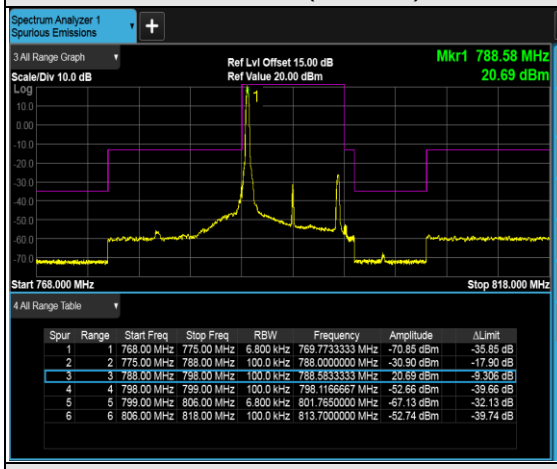
LTE Band 14 (Channel Bandwidth 10MHz)



FULL (793MHz)



1RB#MAX (793MHz)



1RB#0 (793MHz)

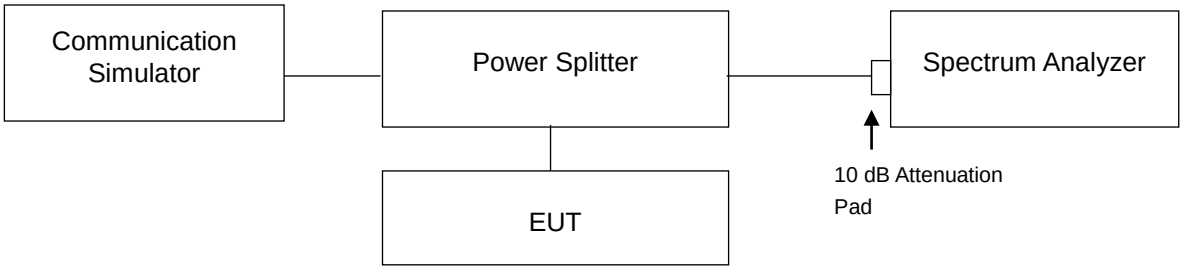
4.7 Conducted Spurious Emissions

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 is equal to -13 dBm.

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.

4.7.2 Test Setup



4.7.3 Test Procedure

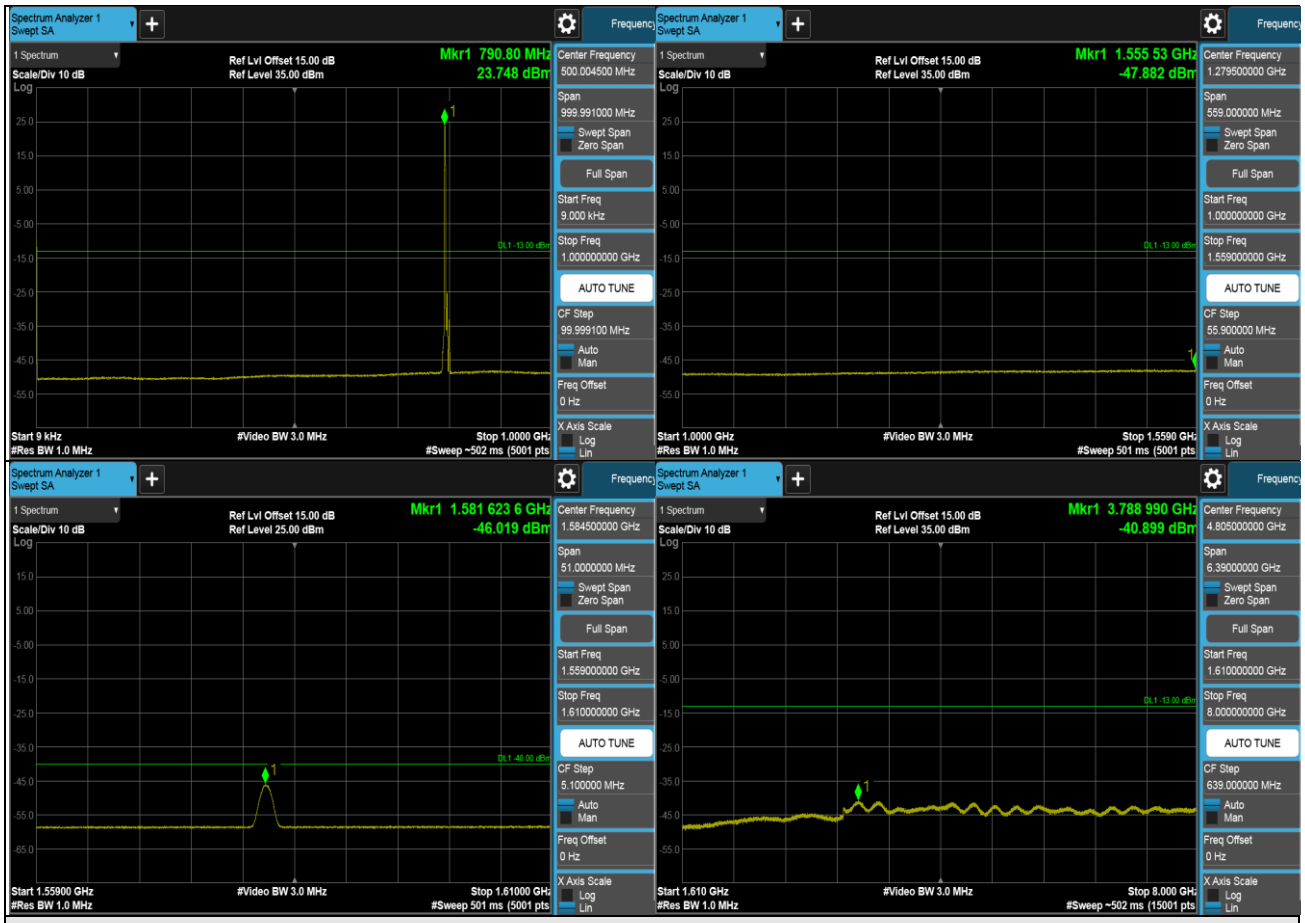
a. The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
b. The detector of the spectrum is RMS, and if the device can be configured to transmit continuously (duty cycle ≥ 98%), set the (sweep time) > (number of points in sweep) × (symbol period) (e.g., by a factor of 10 × symbol period × number of points). Increasing the sweep time (i.e., slowing the sweep speed) will allow for averaging over multiple symbols.
c. Measuring frequency range is from 9 kHz to 1 GHz. 10 dB attenuation pad is connected with spectrum. RBW = 1 MHz and VBW = 3 MHz are used for conducted emission measurement.
d. Measuring frequency range is from 1 GHz to 8 GHz. 10 dB attenuation pad is connected with spectrum. RBW = 1 MHz and VBW = 3 MHz are used for conducted emission measurement.

4.7.4 Test Results

LTE Band 14 (Channel Bandwidth 5MHz)

CH 23305 (790.5MHz)

Note: The signal over the limit in 9 kHz is from spectrum analyzer.



CH 23330 (793MHz)

Note: The signal over the limit in 9 kHz is from spectrum analyzer.

CH 23355 (795.5MHz)

Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 14 (Channel Bandwidth 10MHz)

CH 23330 (793MHz)

Note: The signal over the limit in 9 kHz is from spectrum analyzer.

4.8 Radiated Emission Measurement

4.8.1 Limits of Radiated Emission Measurement

(1) 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 (P) dB. The limit of emission is equal to -13 dBm.

(2) 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. In the semi-anechoic chamber, EUT placed on the 0.8m(below or equal 1GHz) and/or 1.5m(above 1GHz) height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.

b. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

c. Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.

d. Following C63.26 section 5.5 and 5.2.7
   - EIRP (dBm) = E (dBμV/m) + 20log(D) - 104.8; where D is the measurement distance (in the far field region) in m.
   - ERP (dBm) = E (dBμV/m) + 20log(D) - 104.8 - 2.15; where D is the measurement distance (in the far field region) in m.

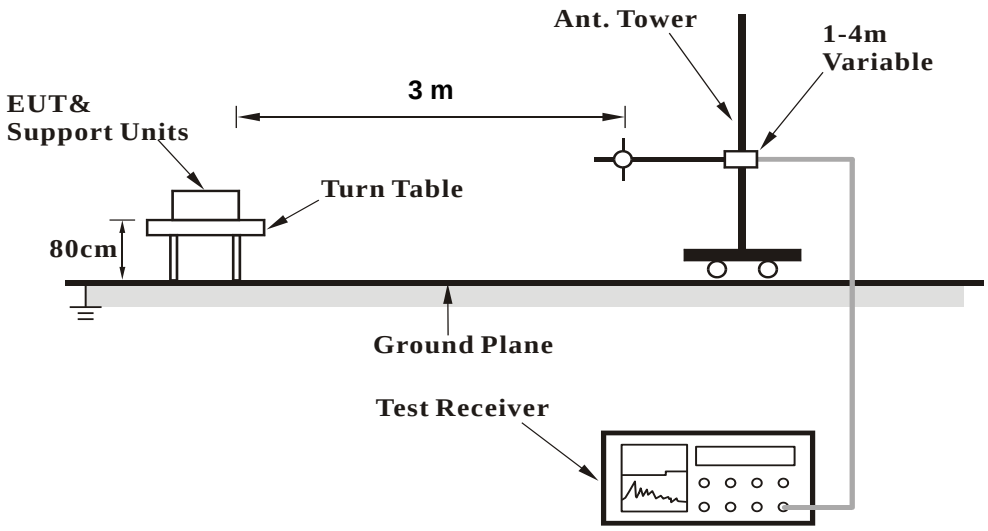
Note:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.
2. The emission levels were against the limit of frequency range 9 kHz ~ 30 MHz:
   The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

4.8.3 Deviation from Test Standard

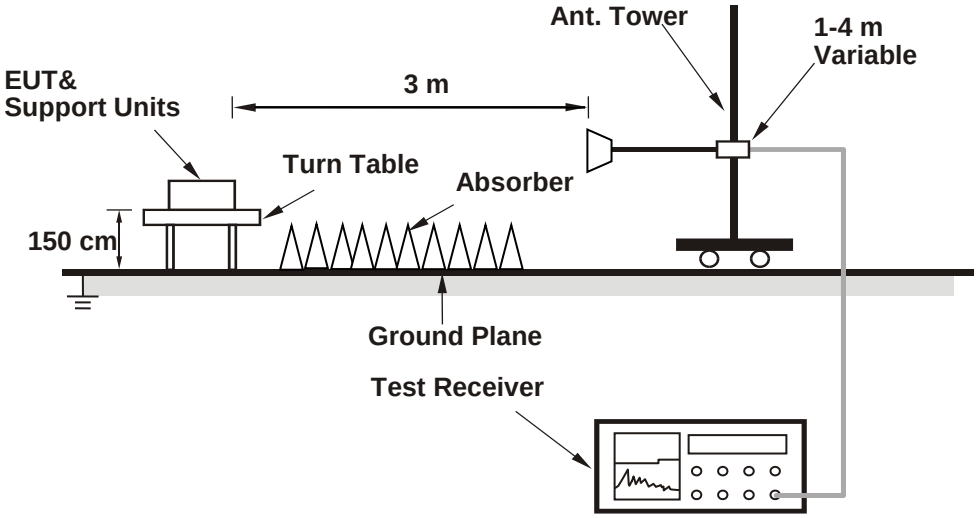
No deviation.

4.8.4 Test Setup

<Radiated Emission below or equal 1 GHz>



<Radiated Emission above 1 GHz>



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

4.8.5 Test Results

Below 1GHz

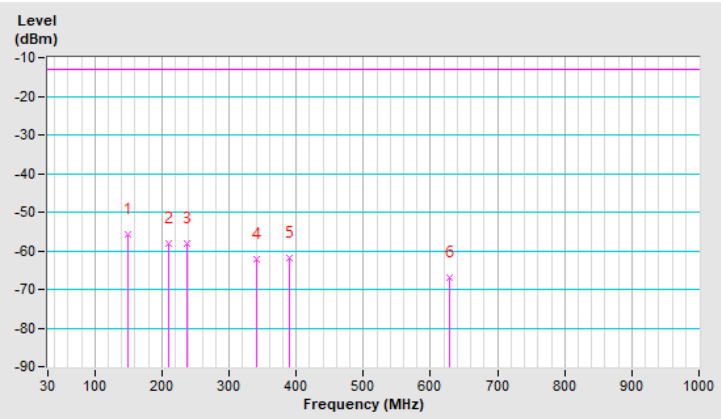
LTE Band 14, Channel Bandwidth 5MHz

Mode	TX channel 23355 (795.5MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	26deg. C, 62%RH	Input Power	120Vac, 60Hz
Tested By	Charles Hsiao		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	148.85	-55.90	-13.00	-42.90	1.76 H	140	59.13	-115.03
2	210.66	-58.00	-13.00	-45.00	1.43 H	130	60.29	-118.29
3	236.65	-58.18	-13.00	-45.18	1.95 H	326	58.74	-116.92
4	341.10	-62.05	-13.00	-49.05	1.51 H	111	51.47	-113.52
5	390.80	-61.88	-13.00	-48.88	1.45 H	144	50.46	-112.34
6	628.00	-66.85	-13.00	-53.85	1.19 H	99	40.55	-107.40

Remarks:

1. ERP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8 - 2.15
3. Margin value = ERP – Limit value.
4. The other ERP levels were very low against the limit.

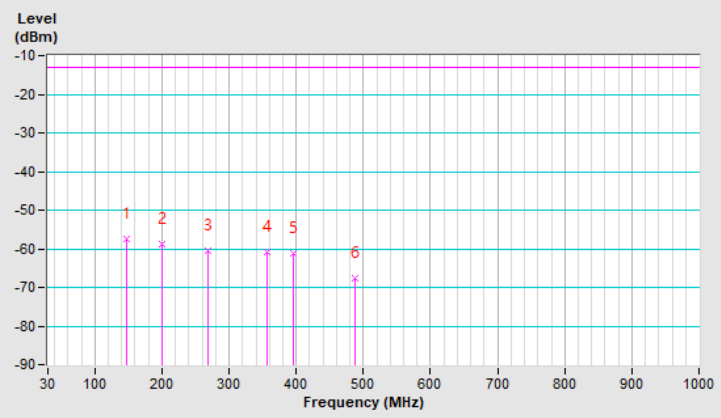


Mode	TX channel 23355 (795.5MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	26deg. C, 62%RH	Input Power	120Vac, 60Hz
Tested By	Charles Hsiao		

Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	146.82	-57.36	-13.00	-44.36	1.75 V	157	57.62	-114.98
2	199.98	-58.72	-13.00	-45.72	1.53 V	208	59.67	-118.39
3	268.50	-60.63	-13.00	-47.63	1.15 V	24	55.03	-115.66
4	356.50	-60.70	-13.00	-47.70	1.18 V	158	52.60	-113.30
5	396.50	-61.14	-13.00	-48.14	1.14 V	154	51.08	-112.22
6	487.77	-67.66	-13.00	-54.66	1.66 V	64	42.59	-110.25

Remarks:

1. ERP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8 - 2.15
3. Margin value = ERP – Limit value.
4. The other ERP levels were very low against the limit.



Above 1GHz

LTE Band 14, Channel Bandwidth: 5MHz

Mode	TX channel 23305 (790.5MHz)	Frequency Range	1GHz ~ 8GHz
Environmental Conditions	25deg. C, 60%RH	Input Power	120Vac, 60Hz
Tested By	Karl Lee		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1581.00	-58.05	-40.00	-18.05	1.72 H	95	37.20	-95.25
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1581.00	-58.24	-40.00	-18.24	2.30 V	162	37.01	-95.25

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

Mode	TX channel 23330 (793.0MHz)	Frequency Range	1GHz ~ 8GHz
Environmental Conditions	25deg. C, 60%RH	Input Power	120Vac, 60Hz
Tested By	Karl Lee		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1586.00	-58.85	-40.00	-18.85	2.96 H	108	36.36	-95.21
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1586.00	-58.59	-40.00	-18.59	1.12 V	234	36.62	-95.21

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

Mode	TX channel 23355 (795.5MHz)	Frequency Range	1GHz ~ 8GHz
Environmental Conditions	25deg. C, 60%RH	Input Power	120Vac, 60Hz
Tested By	Karl Lee		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	**1591.00**	**-57.31**	**-40.00**	**-17.31**	**2.11 H**	**145**	**37.86**	**-95.17**
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1591.00	-58.60	-40.00	-18.60	1.30 V	86	36.57	-95.17

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

LTE Band 14, Channel Bandwidth: 10MHz

Mode	TX channel 23330 (793.0MHz)	Frequency Range	1GHz ~ 8GHz
Environmental Conditions	25deg. C, 60%RH	Input Power	120Vac, 60Hz
Tested By	Karl Lee		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1586.00	-57.88	-40.00	-17.88	1.42 H	18	39.48	-97.36
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1586.00	-59.02	-40.00	-19.02	2.09 V	145	36.19	-95.21

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

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 FCC recognized accredited test firms and accredited 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

Hsin Chu EMC/RF/Telecom Lab
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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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