

FCC Test Report (Part 96: LTE Band 48)

Report No.: RF190522C29

FCC ID: QI3BEC-CBRS12

Test Model: BEC CBRS-12

Received Date: May 22, 2019

Test Date: Jun. 06 ~ Jul. 22, 2019

Issued Date: Jul. 24, 2019

Applicant: BILLION ELECTRIC CO., LTD.

Address: 8F., No. 192, Sec. 2, Zhongxing Rd., Xindian Dist., New Taipei City 231,
Taiwan (R.O.C.)

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

Lab Address: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
(R.O.C)

Test Location: No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan
Hsien 333, Taiwan, R.O.C.

**FCC Registration/
Designation Number:** 788550 / TW0003



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Release Control Record

Issue No.	Description	Date Issued
RF190522C29	Original release.	Jul. 24, 2019

1 Certificate of Conformity

Product: CBRS Cat. 12 module

Brand: BEC, BILLION

Test Model: BEC CBRS-12

Sample Status: Engineering sample

Applicant: BILLION ELECTRIC CO., LTD.

Test Date: Jun. 06 ~ Jul. 22, 2019

Standards: 47 CFR FCC Part 96

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

Prepared by : Pettie Chen , **Date:** Jul. 24, 2019
Pettie Chen / Senior Specialist

Approved by : Bruce Chen , **Date:** Jul. 24, 2019
Bruce Chen / Project Engineer

2 Summary of Test Results

47 CFR FCC Part 96			
FCC Clause	Test Item	Result	Remarks
2.1046 96.41(b)	Maximum Peak Output Power	Pass	Meet the requirement of limit.
2.1046 96.41(b)	Maximum Power Spectral Density	Pass	Meet the requirement of limit.
96.41(g)	Peak to Average Ration	Pass	Meet the requirement of limit.
2.1049	Emission Bandwidth	Pass	Meet the requirement of limit.
2.1055	Frequency Stability	Pass	Meet the requirement of limit.
2.1051 96.41(e)	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 96.41(e)	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -4.2dB at 155.12MHz.

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	9 kHz ~ 30MHz	3.04 dB
	30 MHz ~ 200 MHz	3.59 dB
	200 MHz ~ 1000 MHz	3.60 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.29 dB
	18 GHz ~ 40 GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	CBRS Cat. 12 module				
Brand	BEC, BILLION				
Test Model	BEC CBRS-12				
Status of EUT	Engineering sample				
Modulation Type	QPSK, 16QAM, 64QAM				
Operating Frequency	LTE Band 48	Channel Bandwidth 5MHz	TX: 3552.5 ~ 3697.5 MHz RX: 3552.5 ~ 3697.5 MHz		
		Channel Bandwidth 10MHz	TX: 3555 ~ 3695 MHz RX: 3555 ~ 3695 MHz		
		Channel Bandwidth 15MHz	TX: 3557.5 ~ 3692.5 MHz RX: 3557.5 ~ 3692.5 MHz		
		Channel Bandwidth 20MHz	TX: 3560 ~ 3690 MHz RX: 3560 ~ 3690 MHz		
Max. EIRP Power	LTE Band 48		QPSK	16QAM	64QAM
		Channel Bandwidth 5MHz	171.002mW (22.33dBm)	162.930mW (22.12dBm)	122.462mW (20.88dBm)
		Channel Bandwidth 10MHz	159.221mW (22.02dBm)	151.008mW (21.79dBm)	114.288mW (20.58dBm)
		Channel Bandwidth 15MHz	175.792mW (22.45dBm)	165.577mW (22.19dBm)	122.744mW (20.89dBm)
		Channel Bandwidth 20MHz	171.396mW (22.34dBm)	160.694mW (22.06dBm)	118.577mW (20.74dBm)
Emission Designator	LTE Band 48	Channel Bandwidth 5MHz	4M49G7D	4M49D7W	4M50D7W
		Channel Bandwidth 10MHz	8M97G7D	8M97D7W	8M97D7W
		Channel Bandwidth 15MHz	13M4G7D	13M4D7W	13M4D7W
		Channel Bandwidth 20MHz	17M9G7D	17M9D7W	17M9D7W
Antenna Type	PCB antenna with 14.5dBi gain Dipole antenna with 5.3dBi gain				
Antenna Connector	PCB antenna: i-pex (MHF) Dipole antenna: SMA				
Accessory Device	PoE				
Data Cable Supplied	NA				

Note:

1. The EUT uses following PoE.

Adapter	
Brand	BEC, BILLION
Model	BP035-560063PAX
Input Power	100-240Vac~50/60Hz 0.8A
Output Power	56Vdc / 0.625A

2. The EUT provides 1 completed transmitter and 4 receivers.

3. 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 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports

The worst case was found when positioned on Z-plane. Following channel(s) was (were) selected for the final test as listed below:

Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation
Maximum Output Power	55265 to 56715	55265 (3552.5MHz), 55990 (3625.0MHz), 56715 (3697.5MHz)	5MHz	QPSK, 16QAM, 64QAM
	55290 to 56690	55290 (3555.0MHz), 55990 (3625.0MHz), 56690 (3695.0MHz)	10MHz	QPSK, 16QAM, 64QAM
	55315 to 56665	55315 (3557.5MHz), 55990 (3625.0MHz), 56665 (3692.5MHz)	15MHz	QPSK, 16QAM, 64QAM
	55340 to 56640	55340 (3560.0MHz), 55990 (3625.0MHz), 56640 (3690.0MHz)	20MHz	QPSK, 16QAM, 64QAM
Frequency Stability	55265 to 56715	55265 (3552.5MHz), 56715 (3697.5MHz)	5MHz	QPSK
	55290 to 56690	55290 (3555.0MHz), 56690 (3695.0MHz)	10MHz	QPSK
	55315 to 56665	55315 (3557.5MHz), 56665 (3692.5MHz)	15MHz	QPSK
	55340 to 56640	55340 (3560.0MHz), 56640 (3690.0MHz)	20MHz	QPSK
Occupied Bandwidth	55265 to 56715	55265 (3552.5MHz), 55990 (3625.0MHz), 56715 (3697.5MHz)	5MHz	QPSK, 16QAM, 64QAM
	55290 to 56690	55290 (3555.0MHz), 55990 (3625.0MHz), 56690 (3695.0MHz)	10MHz	QPSK, 16QAM, 64QAM
	55315 to 56665	55315 (3557.5MHz), 55990 (3625.0MHz), 56665 (3692.5MHz)	15MHz	QPSK, 16QAM, 64QAM
	55340 to 56640	55340 (3560.0MHz), 55990 (3625.0MHz), 56640 (3690.0MHz)	20MHz	QPSK, 16QAM, 64QAM
Peak to Average Ratio	55265 to 56715	55265 (3552.5MHz), 55990 (3625.0MHz), 56715 (3697.5MHz)	5MHz	QPSK, 16QAM, 64QAM
	55290 to 56690	55290 (3555.0MHz), 55990 (3625.0MHz), 56690 (3695.0MHz)	10MHz	QPSK, 16QAM, 64QAM
	55315 to 56665	55315 (3557.5MHz), 55990 (3625.0MHz), 56665 (3692.5MHz)	15MHz	QPSK, 16QAM, 64QAM
	55340 to 56640	55340 (3560.0MHz), 55990 (3625.0MHz), 56640 (3690.0MHz)	20MHz	QPSK, 16QAM, 64QAM

Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation
Conducted Emission	55265 to 56715	55265 (3552.5MHz), 55990 (3625.0MHz), 56715 (3697.5MHz)	5MHz	QPSK
	55290 to 56690	55290 (3555.0MHz), 55990 (3625.0MHz), 56690 (3695.0MHz)	10MHz	QPSK
	55315 to 56665	55315 (3557.5MHz), 55990 (3625.0MHz), 56665 (3692.5MHz)	15MHz	QPSK
	55340 to 56640	55340 (3560.0MHz), 55990 (3625.0MHz), 56640 (3690.0MHz)	20MHz	QPSK
Radiated Emission Below 1GHz	55265 to 56715	55265 (3552.5MHz)	5MHz	QPSK
Radiated Emission Above 1GHz	55265 to 56715	55265 (3552.5MHz), 55990 (3625.0MHz), 56715 (3697.5MHz)	5MHz	QPSK
	55340 to 56640	55340 (3560.0MHz), 55990 (3625.0MHz), 56640 (3690.0MHz)	20MHz	QPSK

Note:

1. This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation.
2. For radiated emission below 1GHz, low, mid and high channels were pre-tested in chamber. Low channel in 5MHz was found to be the worst case and therefore had been chosen for all final tests.
3. For radiated emission above 1GHz, according to 3GPP 36.521 Section 6.6.3.1.4, choose the lowest, 5MHz & highest channel bandwidth for final test.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
Maximum Output Power	25deg. C, 63%RH	56Vdc	Jones Chang
Frequency Stability	25deg. C, 63%RH	56Vdc	Jones Chang
Occupied Bandwidth	25deg. C, 63%RH	56Vdc	Jones Chang
Peak to Average Ratio	25deg. C, 63%RH	56Vdc	Jones Chang
Condcudeted Emission	25deg. C, 63%RH	56Vdc	Jones Chang
Radiated Emission	22deg. C, 66%RH	56Vdc	Han Wu

3.3 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.	Wideband Radio Communication Tester	R&S	CMW500	151084	N/A	-
B.	PCB Antenna	N/A	N/A	N/A	N/A	Accessory (Gain: 14.5dBi)
C.	Dipole Antenna	N/A	N/A	N/A	N/A	Accessory (Gain: 5.3dBi)

No.	Signal Cable Description Of The Above Support Units
1.	N/A

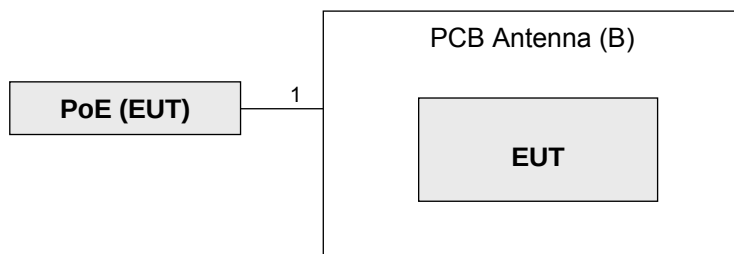
Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ45 Cable	1	1.5	N	0	-

3.3.1 Configuration of System under Test

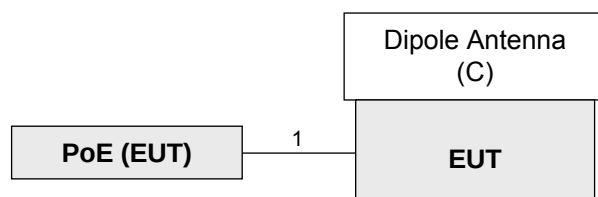
PCB antenna mode



Remote site



Dipole antenna mode



Remote site



3.4 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 96

KDB 971168 D01 Power Meas License Digital Systems v03r01

KDB 940660 D01 Part 96 CBRS Eqpt v02

ANSI/TIA/EIA-603-D-2010

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

4 Test Types and Results

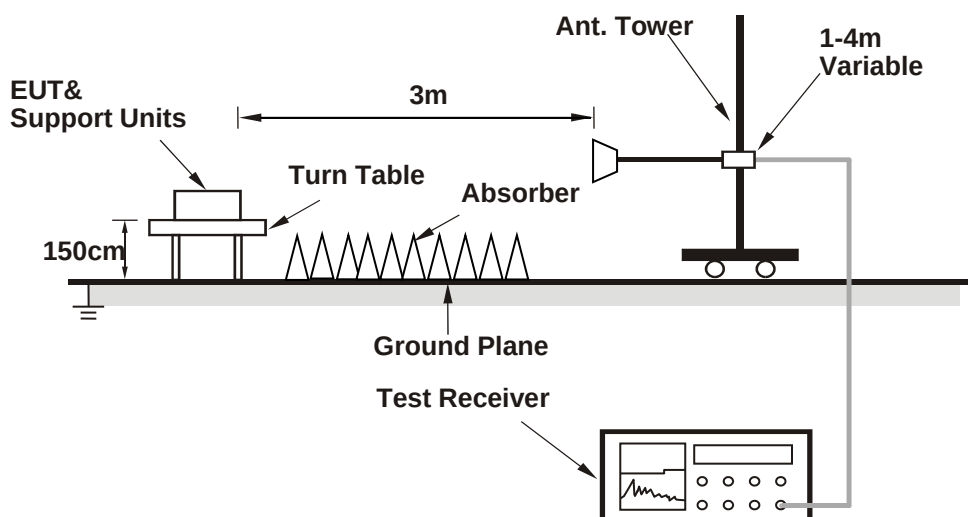
4.1 Maximum Output Power Measurement

4.1.1 Limits of Maximum Output Power Measurement

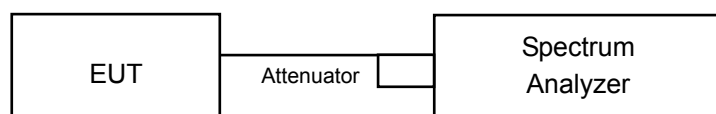
Device		Maximum Output Power (dBm/10 MHz)
☒	End User Device	23
☐	Category A CBSD	30
☐	Category B CBSD	47

4.1.2 Test Setup

Radiated Measurement Method



Conducted Measurement Method



4.1.3 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver KEYSIGHT	N9038A	MY55420137	Apr. 15, 2019	Apr. 14, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	Jun. 04, 2019	Jun. 03, 2020
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Nov. 21, 2018	Nov. 20, 2019
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Nov. 25, 2018	Nov. 24, 2019
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Nov. 25, 2018	Nov. 24, 2019
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Aug. 08, 2018	Aug. 07, 2019
Preamplifier Agilent (Above 1GHz)	8449B	3008A02367	Feb. 19, 2019	Feb. 18, 2020
RF signal cable HUBER+SUHNER&EMCI	SUCOFLEX 104 & EMC104-SM-SM80 00	CABLE-CH9-02 (248780+171006)	Jan. 19, 2019	Jan. 18, 2020
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250 795/4)	Aug. 08, 2018	Aug. 07, 2019
RF signal cable Woken	8D-FB	Cable-CH9-01	Jul. 31, 2018	Jul. 30, 2019
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower & Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
WIT Standard Temperature And Humidity Chamber	TH-4S-C	W981030	Jun. 03, 2019	Jun. 02, 2020
JFW 20dB attenuation	50HF-020-SMA	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in HwaYa Chamber 9.

4.1.4 Test Procedures

Radiated Measurement Method

1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. 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.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to peak and/or average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.
6. EIRP = Output power level of S.G + Correction Factor (including Cable loss, Antenna gain, etc...)

Conducted Measurement Method

1. Connect the DUT transmitter output to the spectrum analyzer via coaxial cable while ensuring proper impedance matching.
2. Set span to at least 1.5 times the OBW.
3. Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
4. Set VBW $\geq 3 \times$ RBW.
5. Set number of points in sweep $\geq 2 \times$ span / RBW.
6. Sweep time = auto-couple.
7. Detector = RMS (power averaging).
8. If the EUT can be configured to transmit continuously (i.e., burst duty cycle $\geq 98\%$), then set the trigger to free run.
9. If the EUT cannot be configured to transmit continuously (i.e., burst duty cycle $< 98\%$), then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Ensure that the sweep time is less than or equal to the transmission burst duration.
10. Trace average at least 100 traces in power averaging (i.e., RMS) mode.
11. Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with the band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

4.1.5 Deviation from Test Standard

No deviation.

4.1.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.1.7 Test Results

Conducted Output Power (dBm)

Band / BW	RB Size	RB Offset	QPSK			16QAM			64QAM		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			55265	55990	56715	55265	55990	56715	55265	55990	56715
			3552.5 MHz	3625 MHz	3697.5 MHz	3552.5 MHz	3625 MHz	3697.5 MHz	3552.5 MHz	3625 MHz	3697.5 MHz
48 / 5M	1	0	7.83	6.58	7.43	7.62	6.33	7.17	6.38	5.02	5.97
	1	12	7.73	6.57	7.45	7.55	6.32	7.20	6.38	5.18	5.96
	1	24	7.66	6.55	7.39	7.40	6.34	7.18	6.23	5.13	5.89
	12	0	7.15	6.50	7.43	6.93	6.26	7.16	5.67	5.07	5.94
	12	6	7.16	6.59	7.40	6.95	6.32	7.18	5.63	5.20	6.03
	12	13	7.22	6.35	7.37	6.94	6.11	7.11	5.76	4.85	5.98
	25	0	7.15	6.33	7.23	6.88	6.07	7.01	5.74	4.93	5.76

Band / BW	RB Size	RB Offset	QPSK			16QAM			64QAM		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			55290	55990	56690	55290	55990	56690	55290	55990	56690
			3555 MHz	3625 MHz	3695 MHz	3555 MHz	3625 MHz	3695 MHz	3555 MHz	3625 MHz	3695 MHz
48 / 10M	1	0	7.52	6.88	7.50	7.25	6.63	7.29	5.97	5.45	6.08
	1	24	7.35	6.78	7.50	7.14	6.50	7.26	5.96	5.23	6.05
	1	49	7.38	6.64	7.49	7.10	6.36	7.27	5.87	5.12	5.96
	25	0	7.25	6.37	7.30	7.04	6.13	7.06	5.83	4.83	5.74
	25	12	7.22	6.56	7.37	6.96	6.35	7.10	5.69	5.10	5.83
	25	25	7.02	6.63	7.39	6.76	6.36	7.11	5.53	5.09	5.81
	50	0	6.59	5.92	6.82	6.32	5.68	6.56	5.17	4.51	5.35

Band / BW	RB Size	RB Offset	QPSK			16QAM			64QAM		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			55315	55990	56665	55315	55990	56665	55315	55990	56665
			3557.5 MHz	3625 MHz	3692.5 MHz	3557.5 MHz	3625 MHz	3692.5 MHz	3557.5 MHz	3625 MHz	3692.5 MHz
48 / 15M	1	0	7.95	7.29	7.42	7.69	7.08	7.21	6.39	5.80	6.09
	1	37	7.67	6.87	7.34	7.43	6.66	7.13	6.19	5.34	5.98
	1	74	7.55	6.94	7.48	7.33	6.68	7.27	6.03	5.57	6.04
	36	0	7.39	6.75	6.99	7.13	6.47	6.72	5.84	5.31	5.43
	36	19	7.29	6.56	7.06	7.05	6.33	6.81	5.80	5.20	5.58
	36	39	7.27	6.50	6.99	7.05	6.24	6.72	5.76	4.95	5.56
	75	0	5.83	5.08	5.43	5.56	4.83	5.20	4.40	3.72	3.96

Band / BW	RB Size	RB Offset	QPSK			16QAM			64QAM		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			55340	55990	56640	55340	55990	56640	55340	55990	56640
			3560 MHz	3625 MHz	3690 MHz	3560 MHz	3625 MHz	3690 MHz	3560 MHz	3625 MHz	3690 MHz
48 / 20M	1	0	7.84	7.37	7.46	7.56	7.15	7.23	6.24	5.95	6.11
	1	50	7.60	6.90	7.22	7.38	6.63	7.01	6.21	5.35	5.76
	1	99	7.52	6.96	7.38	7.31	6.73	7.15	6.10	5.51	5.99
	50	0	7.02	6.15	6.54	6.80	5.93	6.33	5.67	4.70	5.01
	50	25	6.83	6.19	6.44	6.55	5.91	6.23	5.38	4.66	4.95
	50	50	6.89	6.08	6.59	6.61	5.83	6.31	5.31	4.56	5.20
	100	0	4.68	3.87	4.73	4.41	3.60	4.45	3.11	2.43	3.13

EIRP Power

Band / BW	RB Size	RB Offset	QPSK			16QAM			64QAM		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			55265	55990	56715	55265	55990	56715	55265	55990	56715
			3552.5 MHz	3625 MHz	3697.5 MHz	3552.5 MHz	3625 MHz	3697.5 MHz	3552.5 MHz	3625 MHz	3697.5 MHz
48 / 5M	1	0	22.33	21.08	21.93	22.12	20.83	21.67	20.88	19.52	20.47
	1	12	22.23	21.07	21.95	22.05	20.82	21.70	20.88	19.68	20.46
	1	24	22.16	21.05	21.89	21.90	20.84	21.68	20.73	19.63	20.39
	12	0	21.65	21.00	21.93	21.43	20.76	21.66	20.17	19.57	20.44
	12	6	21.66	21.09	21.90	21.45	20.82	21.68	20.13	19.70	20.53
	12	13	21.72	20.85	21.87	21.44	20.61	21.61	20.26	19.35	20.48
	25	0	21.65	20.83	21.73	21.38	20.57	21.51	20.24	19.43	20.26

Band / BW	RB Size	RB Offset	QPSK			16QAM			64QAM		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			55290	55990	56690	55290	55990	56690	55290	55990	56690
			3555 MHz	3625 MHz	3695 MHz	3555 MHz	3625 MHz	3695 MHz	3555 MHz	3625 MHz	3695 MHz
48 / 10M	1	0	22.02	21.38	22.00	21.75	21.13	21.79	20.47	19.95	20.58
	1	24	21.85	21.28	22.00	21.64	21.00	21.76	20.46	19.73	20.55
	1	49	21.88	21.14	21.99	21.60	20.86	21.77	20.37	19.62	20.46
	25	0	21.75	20.87	21.80	21.54	20.63	21.56	20.33	19.33	20.24
	25	12	21.72	21.06	21.87	21.46	20.85	21.60	20.19	19.60	20.33
	25	25	21.52	21.13	21.89	21.26	20.86	21.61	20.03	19.59	20.31
	50	0	21.09	20.42	21.32	20.82	20.18	21.06	19.67	19.01	19.85

Band / BW	RB Size	RB Offset	QPSK			16QAM			64QAM		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			55315	55990	56665	55315	55990	56665	55315	55990	56665
			3557.5 MHz	3625 MHz	3692.5 MHz	3557.5 MHz	3625 MHz	3692.5 MHz	3557.5 MHz	3625 MHz	3692.5 MHz
48 / 15M	1	0	22.45	21.79	21.92	22.19	21.58	21.71	20.89	20.30	20.59
	1	37	22.17	21.37	21.84	21.93	21.16	21.63	20.69	19.84	20.48
	1	74	22.05	21.44	21.98	21.83	21.18	21.77	20.53	20.07	20.54
	36	0	21.89	21.25	21.49	21.63	20.97	21.22	20.34	19.81	19.93
	36	19	21.79	21.06	21.56	21.55	20.83	21.31	20.30	19.70	20.08
	36	39	21.77	21.00	21.49	21.55	20.74	21.22	20.26	19.45	20.06
	75	0	20.33	19.58	19.93	20.06	19.33	19.70	18.90	18.22	18.46

Band / BW	RB Size	RB Offset	QPSK			16QAM			64QAM		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			55340	55990	56640	55340	55990	56640	55340	55990	56640
			3560 MHz	3625 MHz	3690 MHz	3560 MHz	3625 MHz	3690 MHz	3560 MHz	3625 MHz	3690 MHz
48 / 20M	1	0	22.34	21.87	21.96	22.06	21.65	21.73	20.74	20.45	20.61
	1	50	22.10	21.40	21.72	21.88	21.13	21.51	20.71	19.85	20.26
	1	99	22.02	21.46	21.88	21.81	21.23	21.65	20.60	20.01	20.49
	50	0	21.52	20.65	21.04	21.30	20.43	20.83	20.17	19.20	19.51
	50	25	21.33	20.69	20.94	21.05	20.41	20.73	19.88	19.16	19.45
	50	50	21.39	20.58	21.09	21.11	20.33	20.81	19.81	19.06	19.70
	100	0	19.18	18.37	19.23	18.91	18.10	18.95	17.61	16.93	17.63

4.2 Frequency Stability Measurement

4.2.1 Limits of Frequency Stability Measurement

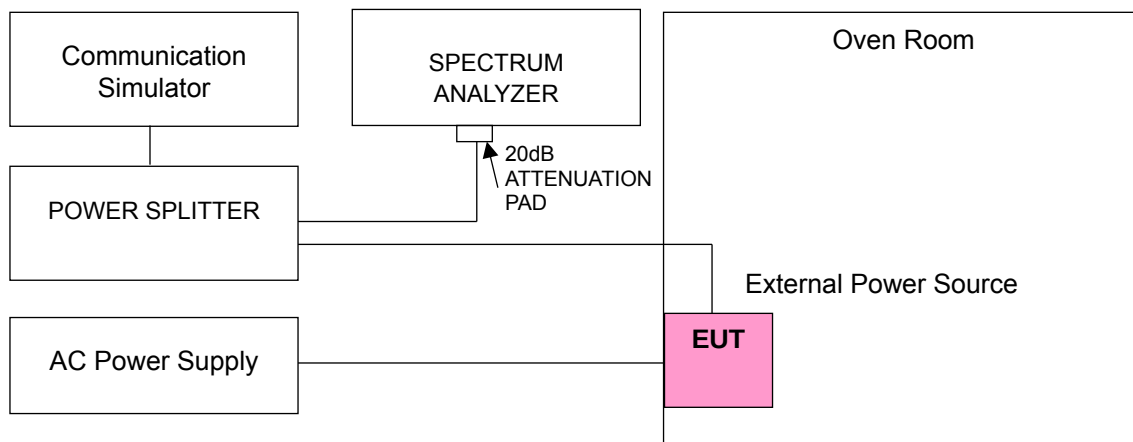
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency band.

4.2.2 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 AC 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.

NOTE: The frequency error was recorded frequency error from the communication simulator.

4.2.3 Test Setup



4.2.4 Test Results

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 48, Channel Bandwidth: 5MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
50.4	3552.500002	0.001	3697.500000	0.001
56.0	3552.500003	0.001	3697.500000	0.001
61.6	3552.500002	0.001	3697.500000	0.001

Note: The applicant defined the normal working voltage is from 50.4Vdc to 61.6Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 48, Channel Bandwidth: 5MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	3552.500001	0.000	3697.500000	0.001
-20	3552.500003	0.001	3697.500000	0.001
-10	3552.500001	0.000	3697.500000	0.001
0	3552.500003	0.001	3697.500000	0.001
10	3552.500002	0.001	3697.500000	0.001
20	3552.499998	-0.001	3697.500000	-0.001
30	3552.499999	0.000	3697.500000	-0.001
40	3552.499997	-0.001	3697.500000	-0.001
50	3552.499997	-0.001	3697.500000	0.000
60	3552.499997	-0.001	3697.500000	-0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 48, Channel Bandwidth: 10MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
50.4	3555.000001	0.000	3695.000000	0.001
56.0	3555.000002	0.001	3695.000000	0.001
61.6	3555.000003	0.001	3695.000000	0.001

Note: The applicant defined the normal working voltage is from 50.4Vdc to 61.6Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 48, Channel Bandwidth: 10MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	3555.000003	0.001	3695.000000	0.001
-20	3555.000004	0.001	3695.000000	0.000
-10	3555.000003	0.001	3695.000000	0.001
0	3555.000002	0.001	3695.000000	0.001
10	3555.000001	0.000	3695.000000	0.000
20	3554.999999	0.000	3695.000000	0.000
30	3554.999997	-0.001	3695.000000	-0.001
40	3554.999999	0.000	3695.000000	0.000
50	3554.999997	-0.001	3695.000000	-0.001
60	3554.999998	-0.001	3695.000000	-0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 48, Channel Bandwidth: 15MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
50.4	3557.500002	0.001	3692.500000	0.000
56.0	3557.500004	0.001	3692.500000	0.001
61.6	3557.500001	0.000	3692.500000	0.001

Note: The applicant defined the normal working voltage is from 50.4Vdc to 61.6Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 48, Channel Bandwidth: 15MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	3557.500002	0.001	3692.500000	0.001
-20	3557.500002	0.001	3692.500000	0.000
-10	3557.500003	0.001	3692.500000	0.001
0	3557.500002	0.000	3692.500000	0.001
10	3557.500003	0.001	3692.500000	0.000
20	3557.499997	-0.001	3692.500000	-0.001
30	3557.499996	-0.001	3692.500000	-0.001
40	3557.499997	-0.001	3692.500000	-0.001
50	3557.499998	-0.001	3692.500000	-0.001
60	3557.499997	-0.001	3692.500000	-0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 48, Channel Bandwidth: 20MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
50.4	3560.000001	0.0005	3690.000000	0.0003
56.0	3560.000004	0.0011	3690.000000	0.0007
61.6	3560.000004	0.0003	3690.000000	0.0005

Note: The applicant defined the normal working voltage is from 50.4Vdc to 61.6Vdc.

Frequency Error vs. Temperature

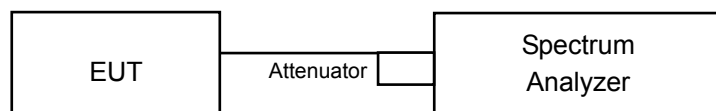
Temp. (°C)	LTE Band 48, Channel Bandwidth: 20MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	3560.000004	0.0006	3690.000000	0.0007
-20	3560.000002	0.0004	3690.000000	0.0011
-10	3560.000004	0.0011	3690.000000	0.0006
0	3560.000002	0.0005	3690.000000	0.0004
10	3560.000002	0.0004	3690.000000	0.0008
20	3559.999998	-0.0006	3690.000000	-0.0006
30	3559.999998	-0.0005	3690.000000	-0.0008
40	3559.999999	-0.0003	3690.000000	-0.0006
50	3559.999997	-0.0007	3690.000000	-0.0010
60	3559.999998	-0.0005	3690.000000	-0.0005

4.3 Emission Bandwidth Measurement

4.3.1 Emission Bandwidth Measurement

Reference only

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.3.4 Test Procedure

Occupied Bandwidth:

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.

26dBc Bandwidth:

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW =100 kHz (5 MHz bandwidth), 200 kHz (10 MHz bandwidth), 300 kHz (15 MHz bandwidth), 430 kHz (20 MHz bandwidth). 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 emissions are attenuated at least 26 dB below the transmitter power.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

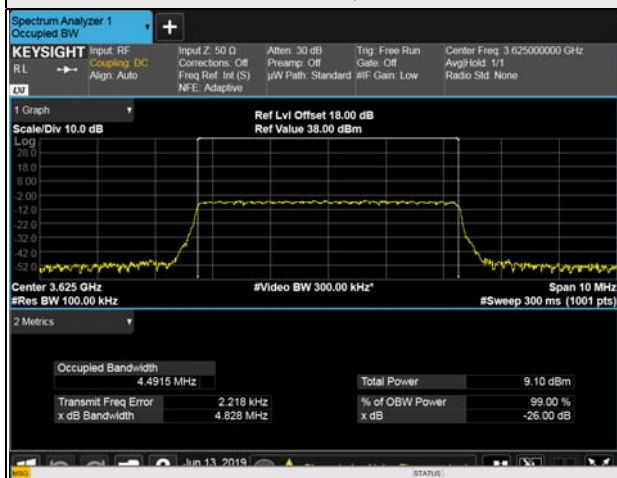
4.3.7 Test Result (-26dB Bandwidth)

LTE Band 48

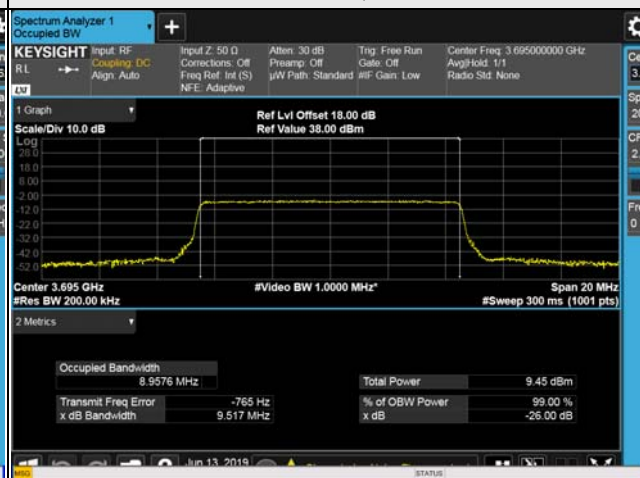
LTE Band 48, Channel Bandwidth 5MHz				
Channel	Frequency (MHz)	26dB Bandwidth (MHz)		
		QPSK	16QAM	64QAM
55265	3552.5	4.80	4.79	4.79
55990	3625.0	4.83	4.78	4.77
56715	3697.5	4.82	4.79	4.78
LTE Band 48, Channel Bandwidth 10MHz				
Channel	Frequency (MHz)	26dB Bandwidth (MHz)		
		QPSK	16QAM	64QAM
55290	3555.0	9.50	9.49	9.50
55990	3625.0	9.50	9.50	9.48
56690	3695.0	9.52	9.49	9.49
LTE Band 48, Channel Bandwidth 15MHz				
Channel	Frequency (MHz)	26dB Bandwidth (MHz)		
		QPSK	16QAM	64QAM
55315	3557.5	14.25	14.21	14.22
55990	3625.0	14.18	14.23	14.20
56665	3692.5	14.25	14.24	14.21
LTE Band 48, Channel Bandwidth 20MHz				
Channel	Frequency (MHz)	26dB Bandwidth (MHz)		
		QPSK	16QAM	64QAM
55340	3560.0	19.03	19.01	19.00
55990	3625.0	19.02	19.00	18.97
56640	3690.0	19.02	19.00	19.02

Spectrum Plot of Worst Value

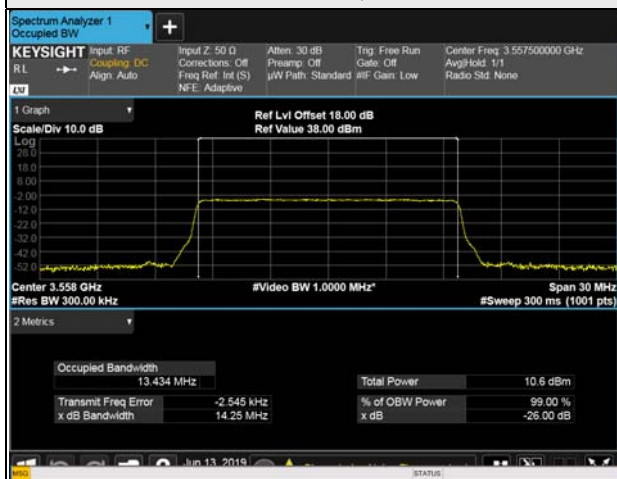
5MHz / QPSK



10MHz / QPSK



15MHz / QPSK



20MHz / QPSK

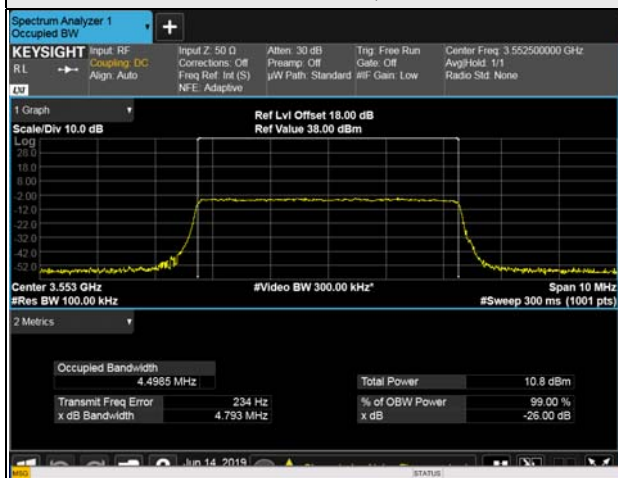


4.3.8 Test Result (Occupied Bandwidth)

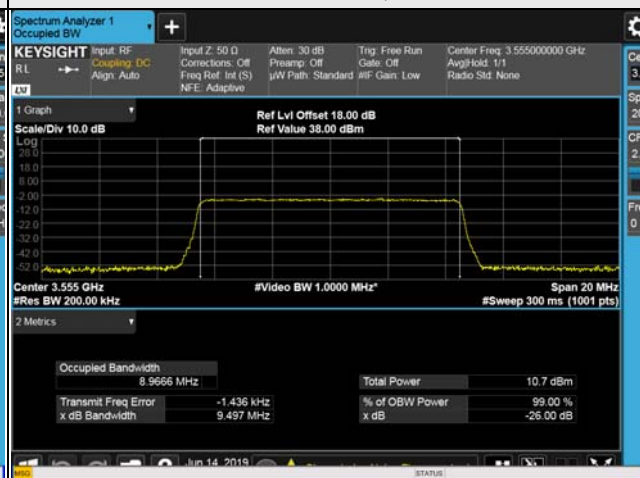
LTE Band 48, Channel Bandwidth 5MHz				
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)		
		QPSK	16QAM	64QAM
55265	3552.5	4.49	4.48	4.50
55990	3625.0	4.49	4.49	4.49
56715	3697.5	4.49	4.48	4.49
LTE Band 48, Channel Bandwidth 10MHz				
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)		
		QPSK	16QAM	64QAM
55290	3555.0	8.97	8.97	8.97
55990	3625.0	8.96	8.96	8.95
56690	3695.0	8.96	8.96	8.95
LTE Band 48, Channel Bandwidth 15MHz				
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)		
		QPSK	16QAM	64QAM
55315	3557.5	13.43	13.43	13.43
55990	3625.0	13.47	13.43	13.24
56665	3692.5	13.43	13.43	13.43
LTE Band 48, Channel Bandwidth 20MHz				
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)		
		QPSK	16QAM	64QAM
55340	3560.0	17.90	17.90	17.92
55990	3625.0	17.98	17.84	17.80
56640	3690.0	17.91	17.91	17.92

Spectrum Plot of Worst Value

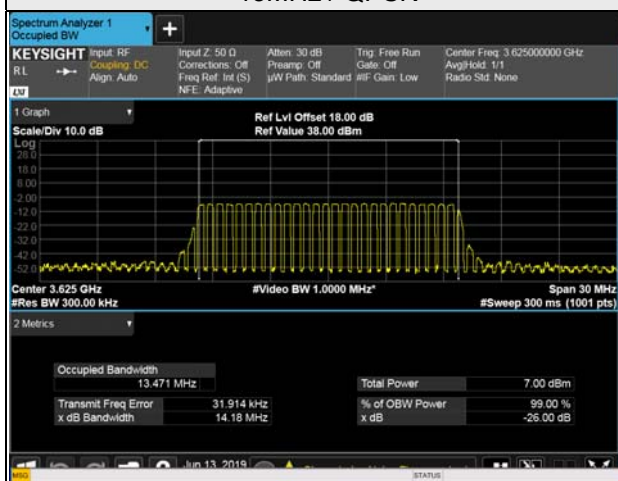
5MHz / 64QAM



10MHz / 64QAM



15MHz / QPSK



20MHz / QPSK

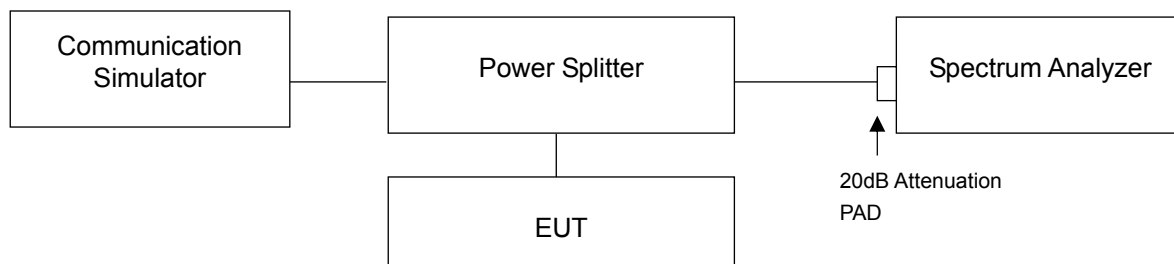


4.4 Peak to Average Ratio Measurement

4.4.1 Limits of Peak to Average Ratio Measurement

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB

4.4.2 Test Setup



4.4.3 Test Procedures

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

4.4.4 Test Results

LTE Band 48

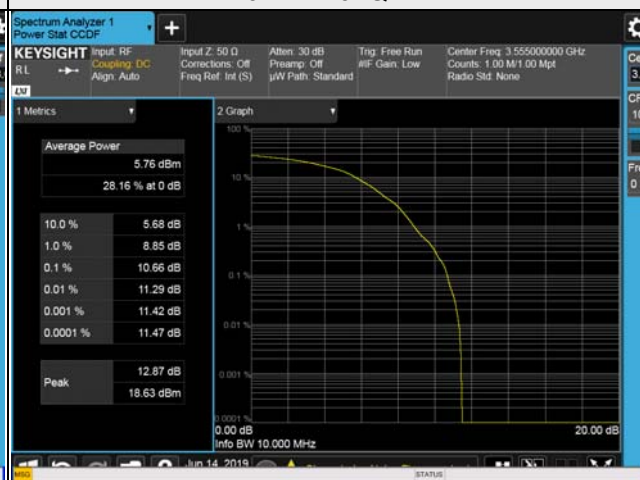
LTE Band 48, Channel Bandwidth 5MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
55265	3552.5	7.51	9.55	10.32
55990	3625.0	7.54	8.80	10.03
56715	3697.5	7.44	9.75	10.10
LTE Band 48, Channel Bandwidth 10MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
55290	3555.0	7.41	8.69	10.66
55990	3625.0	6.48	9.60	10.08
56690	3695.0	7.35	8.60	9.70
LTE Band 48, Channel Bandwidth 15MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
55315	3557.5	6.78	9.22	9.31
55990	3625.0	6.62	8.79	9.51
56665	3692.5	6.64	8.75	9.17
LTE Band 48, Channel Bandwidth 20MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
55340	3560.0	6.66	8.95	10.56
55990	3625.0	6.42	8.99	9.42
56640	3690.0	8.32	8.85	9.22

Spectrum Plot of Worst Value

5MHz / 64QAM



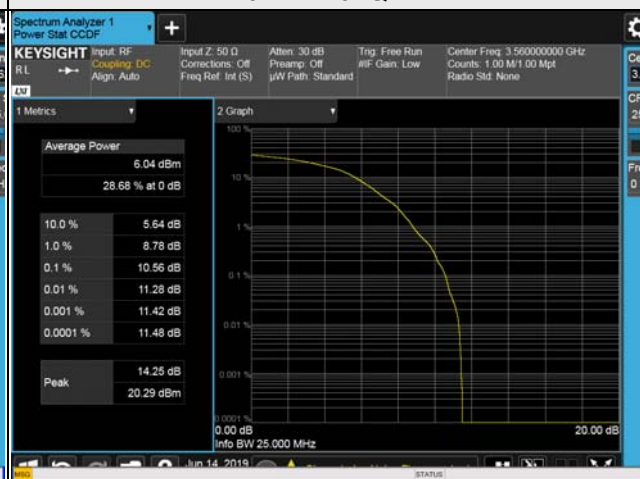
10MHz / 64QAM



15MHz / 64QAM



20MHz / 64QAM

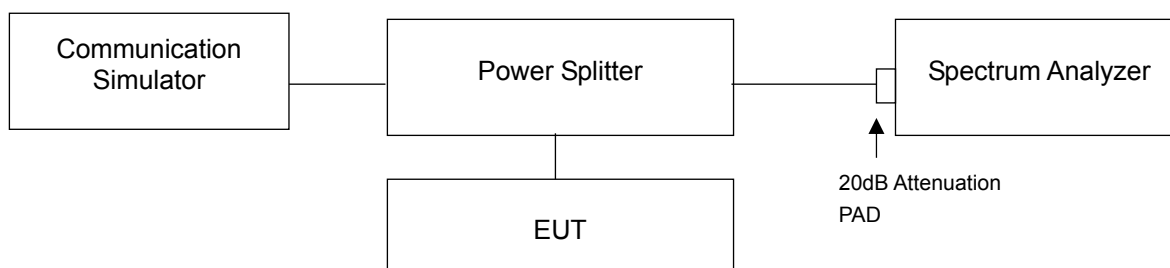


4.5 Conducted Spurious Emissions

4.5.1 Limits of Conducted Spurious Emissions Measurement

Power of any emissions outside the Fundamental	Limit
Within 0-10MHz above the Assigned Channel	-13 dBm/MHz
Within 0-10MHz below the Assigned Channel	
Greater than 0-10MHz above the Assigned Channel	-25 dBm/MHz
Greater than 0-10MHz below the Assigned Channel	
Power of any emission below 3530MHz	-40 dBm/MHz
Power of any emission above 3720MHz	

4.5.2 Test Setup



4.5.3 Test Procedure

- The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
- Measuring frequency range is from 9 kHz to 37 GHz. 20dB attenuation pad is connected with spectrum. RBW=300kHz and VBW=1MHz (For 9kHz~1GHz) and RBW=1MHz and VBW=3MHz (For 1GHz~37GHz) is used for conducted emission measurement.
- Measuring frequency band edge, 20dB attenuation pad is connected with spectrum. 1% of the fundamental emission bandwidth is used for conducted emission measurement.
- For 5 MHz channel BW mode, extend the 1% range from 1M to 2M above and below the channel edge and then reduce the limit further by $10 \log(1000/51) = 13\text{dB}$ (i.e. total $-13 + -13 = -26\text{dB}$) to compensate for the integration from 51k to 1M.

4.5.4 Test Results

LTE Band 48, Channel Bandwidth 5MHz

Channel 55265 (3552.5MHz)

1RB



Full RB

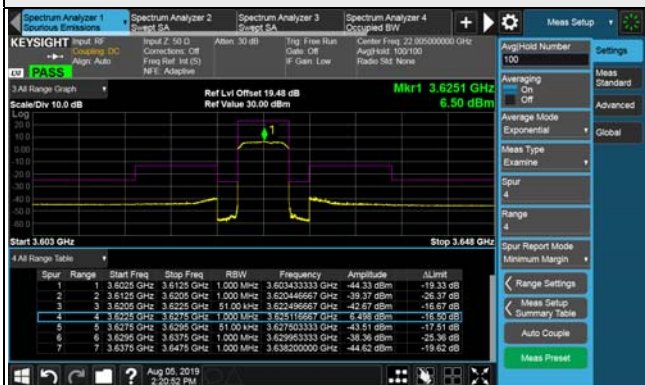


Channel 55990 (3625.0MHz)

1RB



Full RB



Channel 56715 (3697.5MHz)

1RB



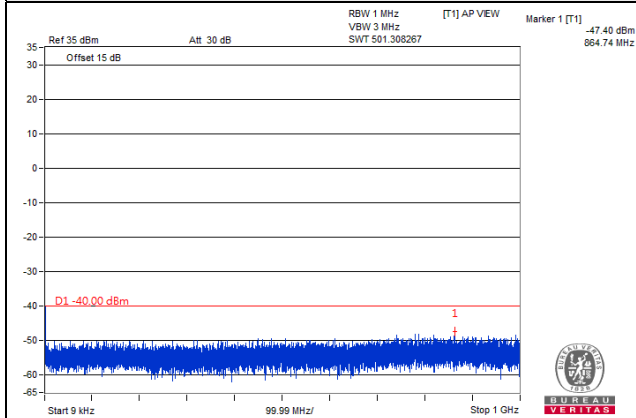
Full RB



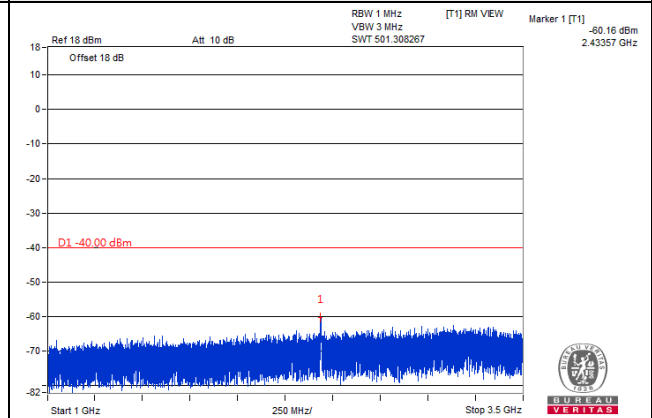
LTE Band 48, Channel Bandwidth 5MHz

Channel 55265 (3552.5MHz)

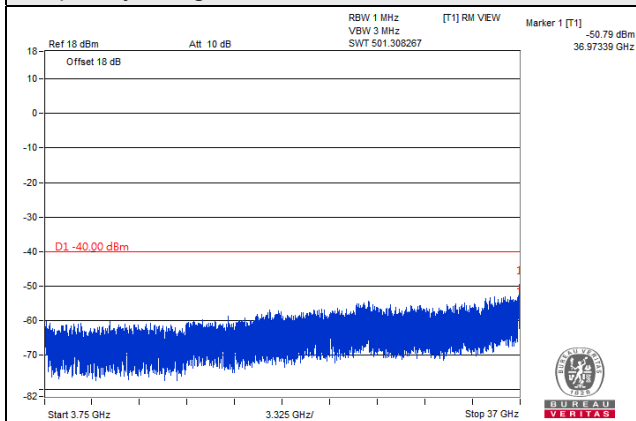
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3.5GHz



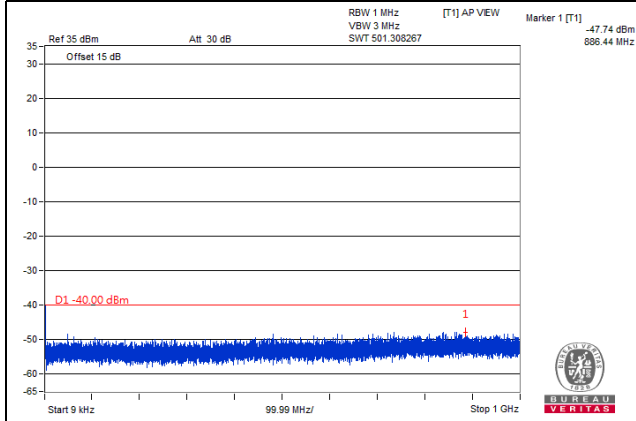
Frequency Range : 3.75GHz~37GHz



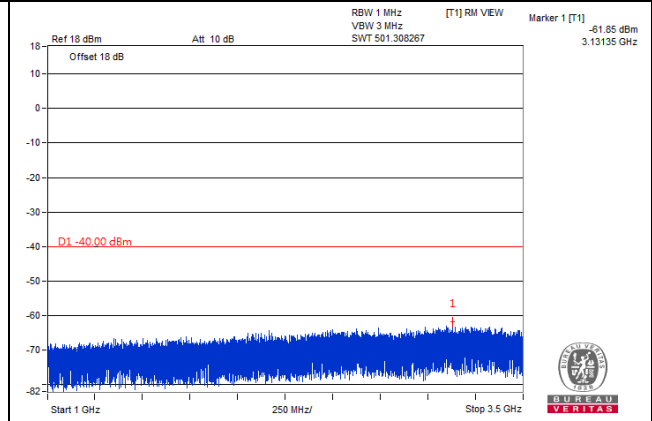
LTE Band 48, Channel Bandwidth 5MHz

Channel 55990 (3625.0MHz)

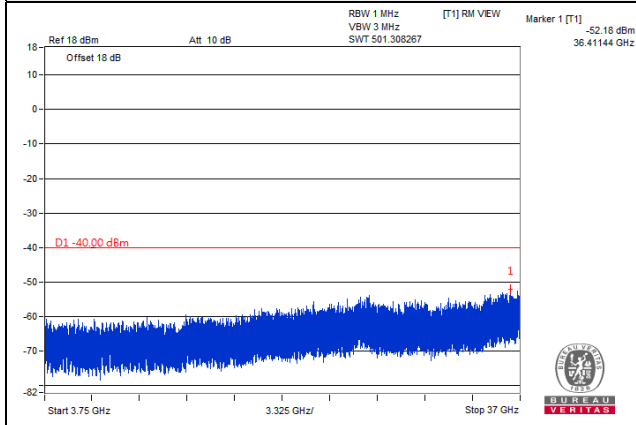
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3.5GHz



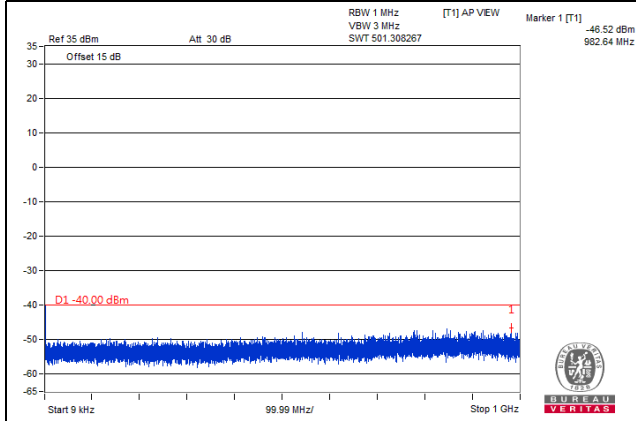
Frequency Range : 3.75GHz~37GHz



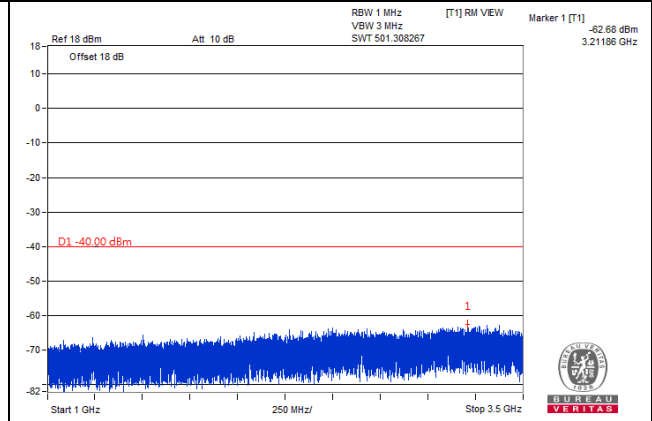
LTE Band 48, Channel Bandwidth 5MHz

Channel 56715 (3697.50MHz)

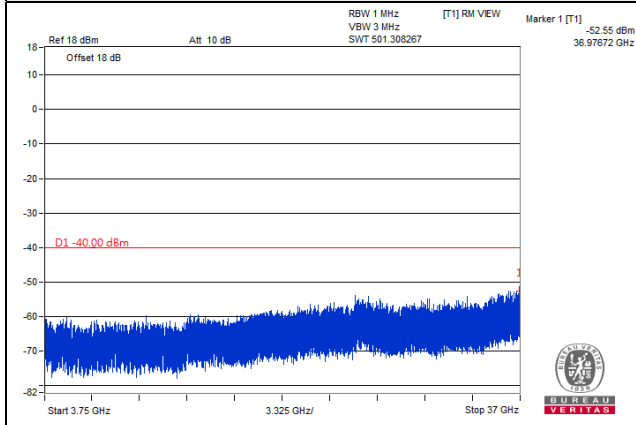
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3.5GHz



Frequency Range : 3.75GHz~37GHz



LTE Band 48, Channel Bandwidth 10MHz

Channel 55290 (3555.0MHz)

1RB

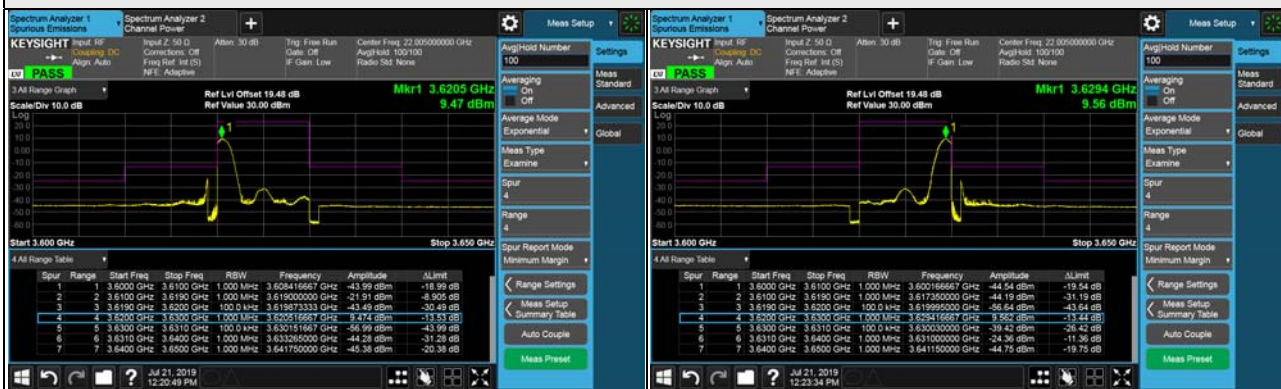


Full RB



Channel 55990 (3625.00MHz)

1RB



Full RB



Channel 56690 (3695.0MHz)

1RB



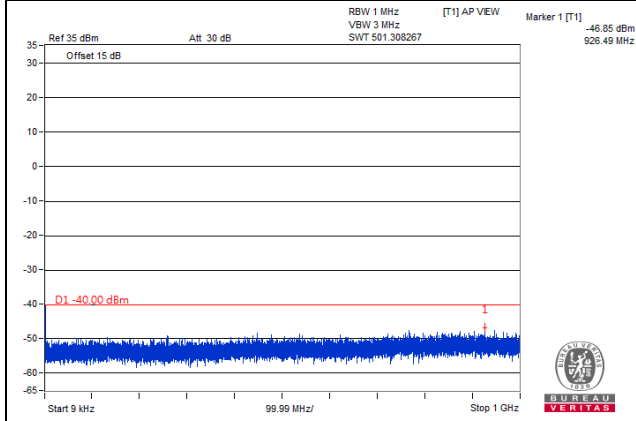
Full RB



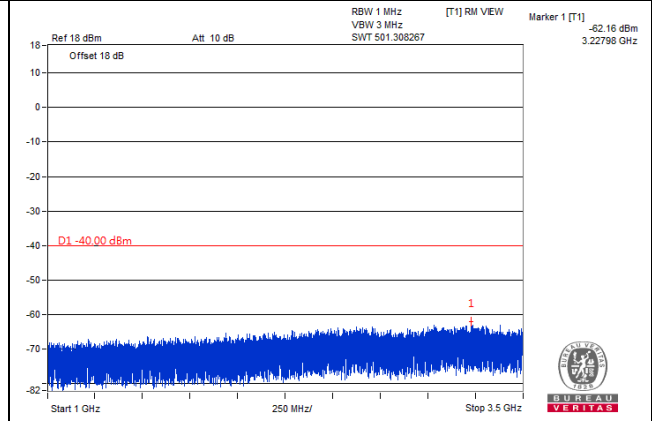
LTE Band 48, Channel Bandwidth 10MHz

Channel 55290 (3555.0MHz)

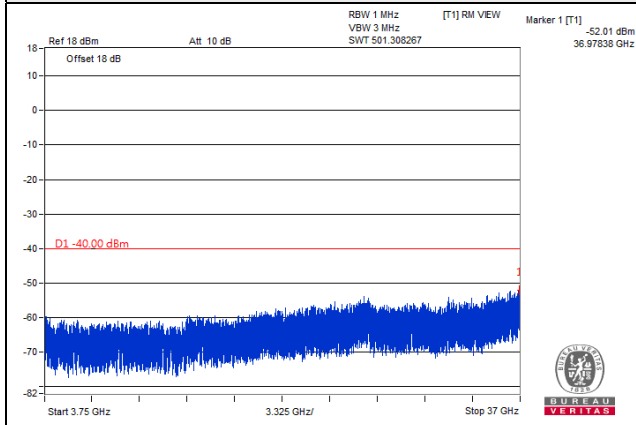
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3.5GHz



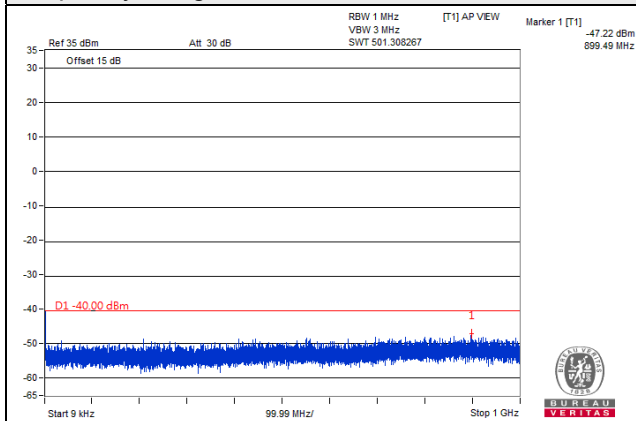
Frequency Range : 3.75GHz~37GHz



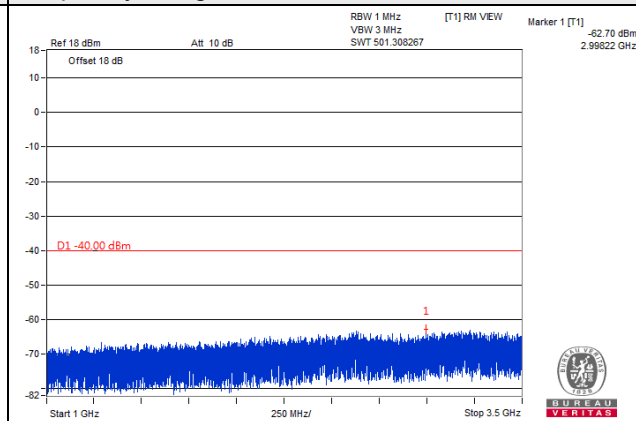
LTE Band 48, Channel Bandwidth 10MHz

Channel 55990 (3625.00MHz)

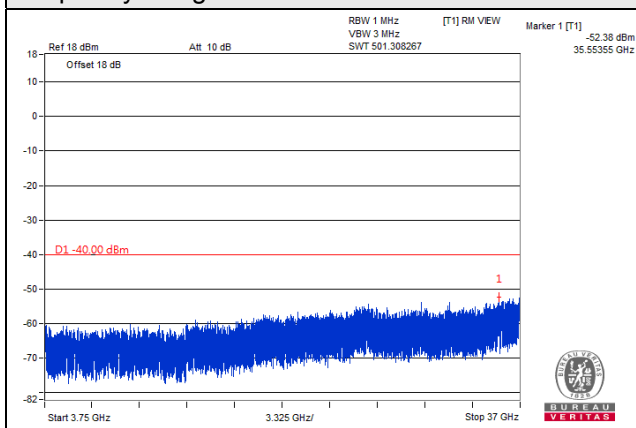
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3.5GHz



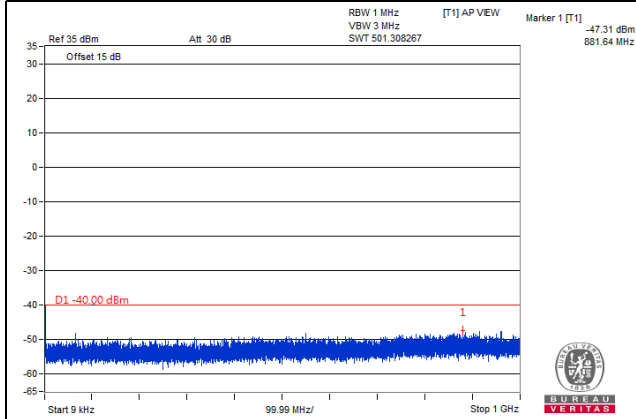
Frequency Range : 3.75GHz~37GHz



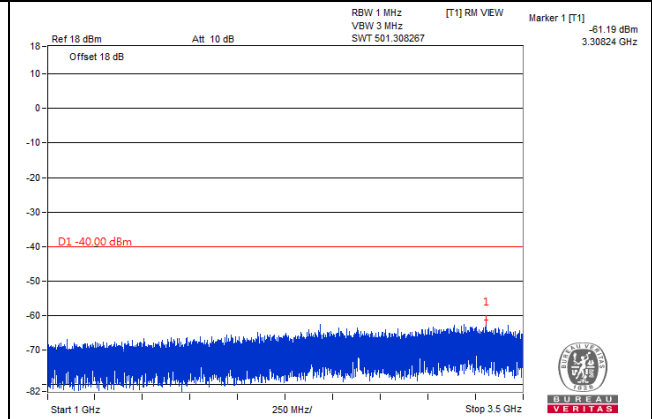
LTE Band 48, Channel Bandwidth 10MHz

Channel 56690 (3695.0MHz)

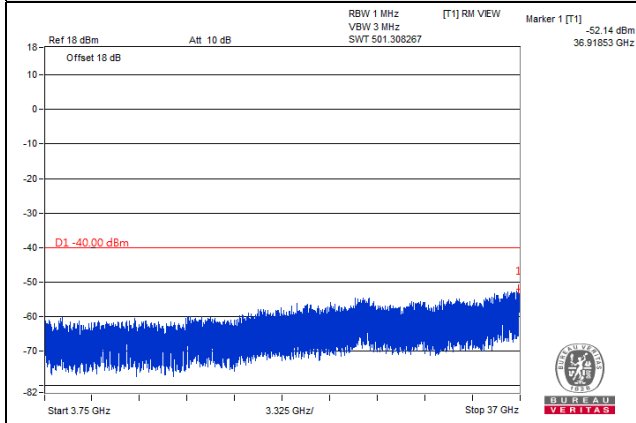
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3.5GHz



Frequency Range : 3.75GHz~37GHz



LTE Band 48, Channel Bandwidth 15MHz

Channel 55315 (3557.50MHz)

1RB



Full RB

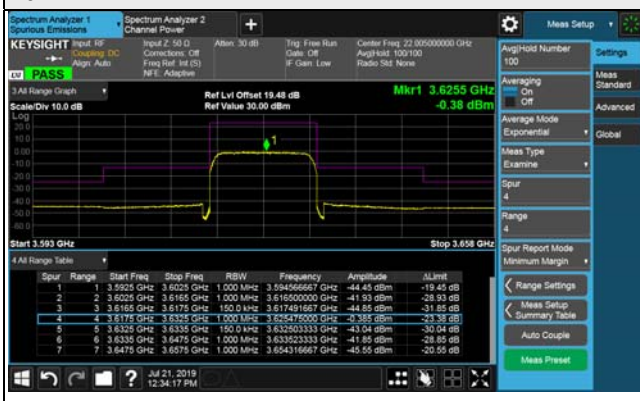


Channel 55990 (3625.0MHz)

1RB



Full RB



Channel 56665 (3692.5MHz)

1RB



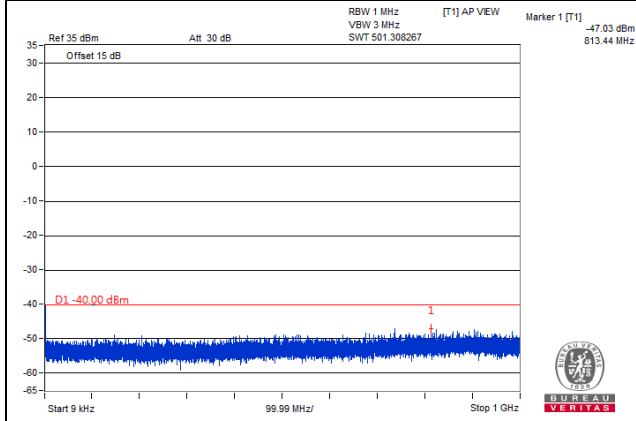
Full RB



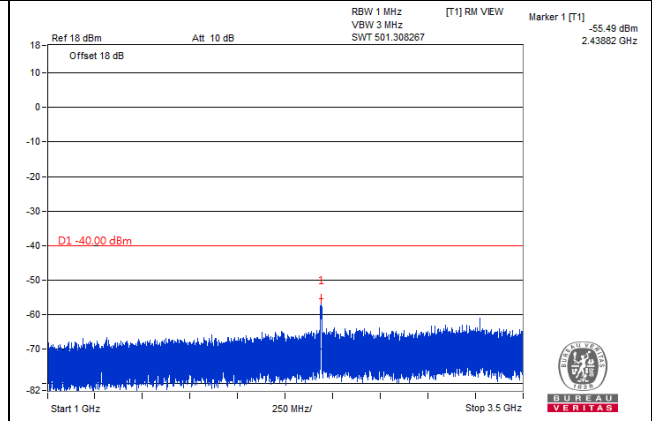
LTE Band 48, Channel Bandwidth 15MHz

Channel 55315 (3557.50MHz)

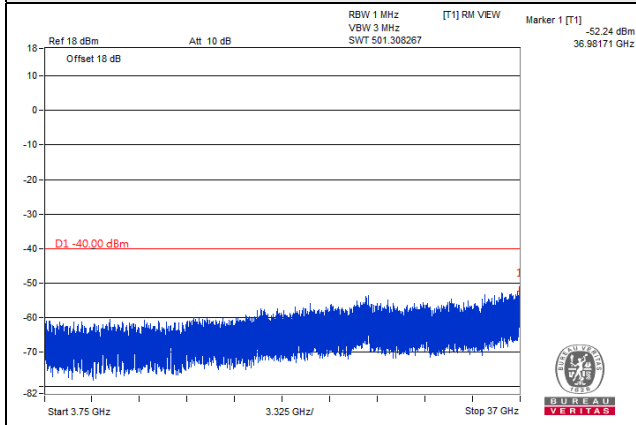
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3.5GHz



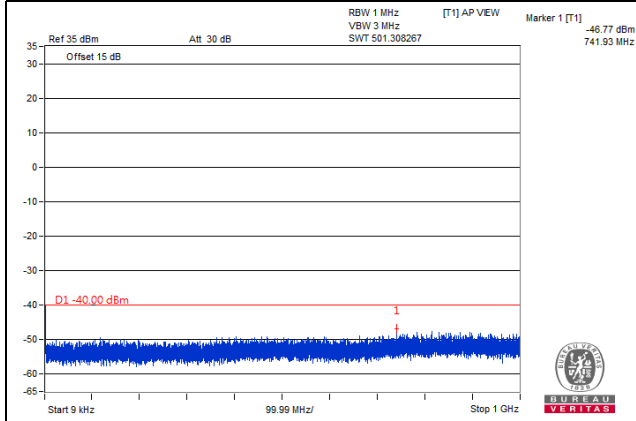
Frequency Range : 3.75GHz~37GHz



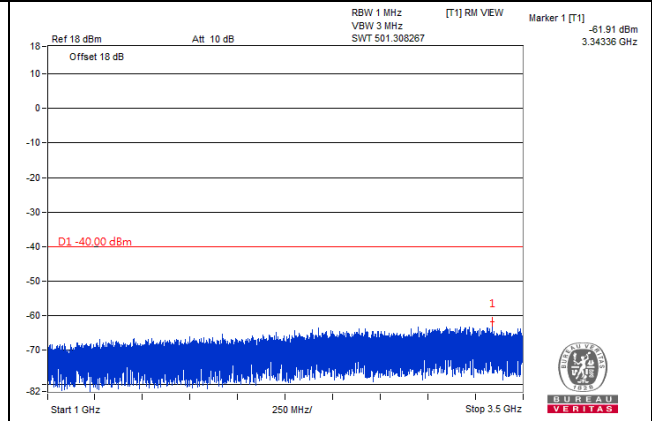
LTE Band 48, Channel Bandwidth 15MHz

Channel 55990 (3625.0MHz)

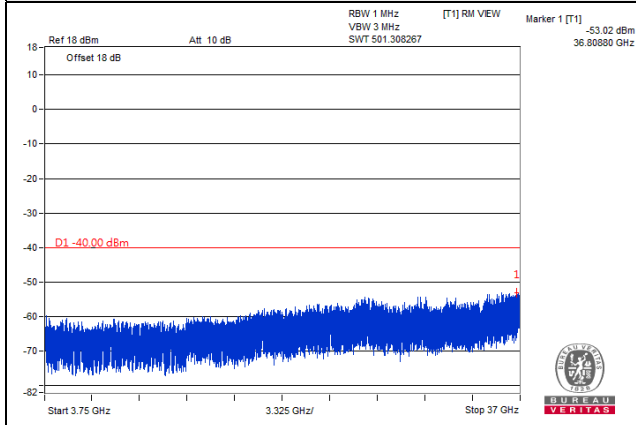
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3.5GHz



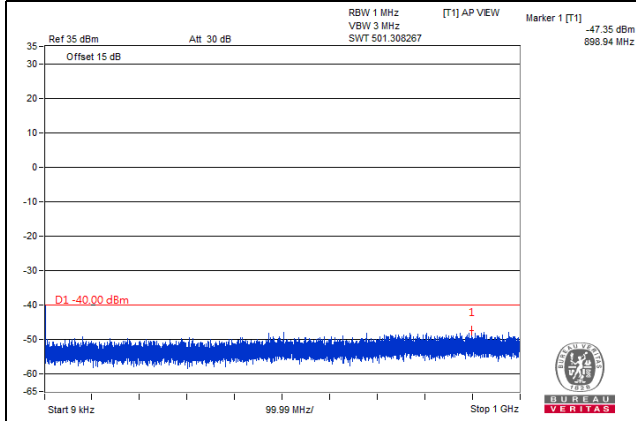
Frequency Range : 3.75GHz~37GHz



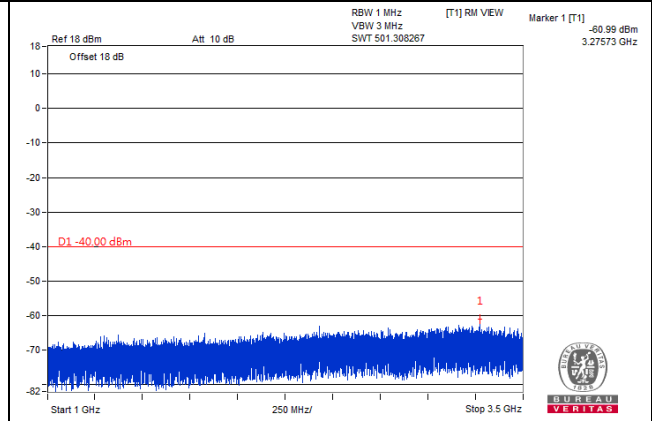
LTE Band 48, Channel Bandwidth 15MHz

Channel 56665 (3692.50MHz)

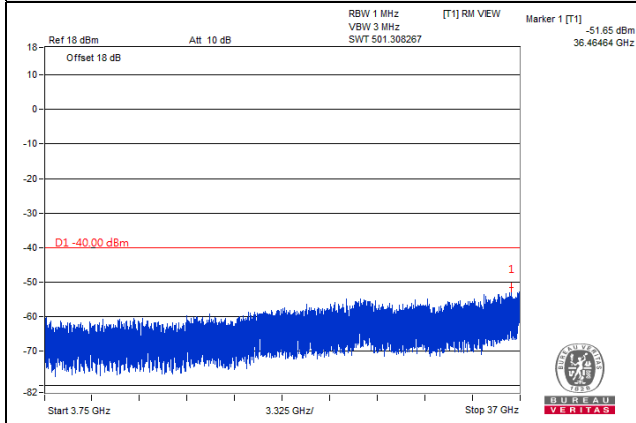
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3.5GHz



Frequency Range : 3.75GHz~37GHz



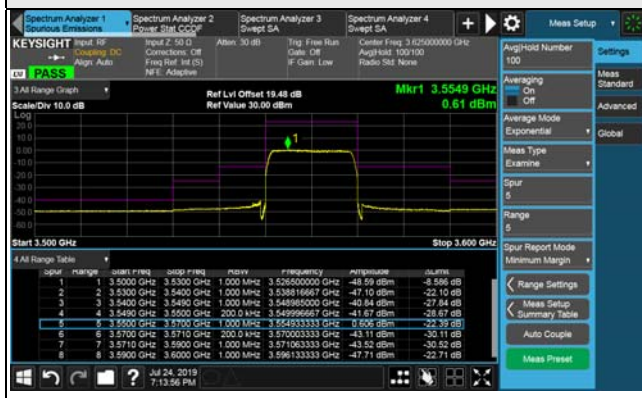
LTE Band 48, Channel Bandwidth 20MHz

Channel 55340 (3560.0MHz)

1RB



Full RB



Channel 55990 (3625.0MHz)

1RB



Full RB



Channel 56640 (3690.0MHz)

1RB



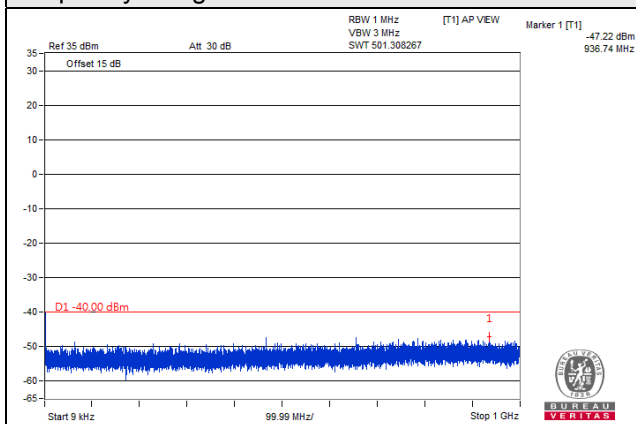
Full RB



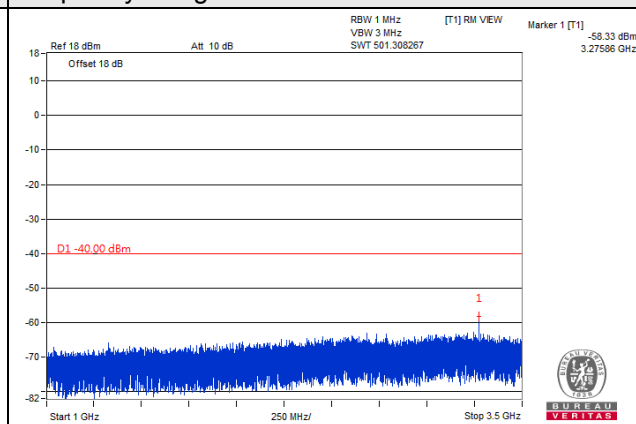
LTE Band 48, Channel Bandwidth 20MHz

Channel 55340 (3560.0MHz)

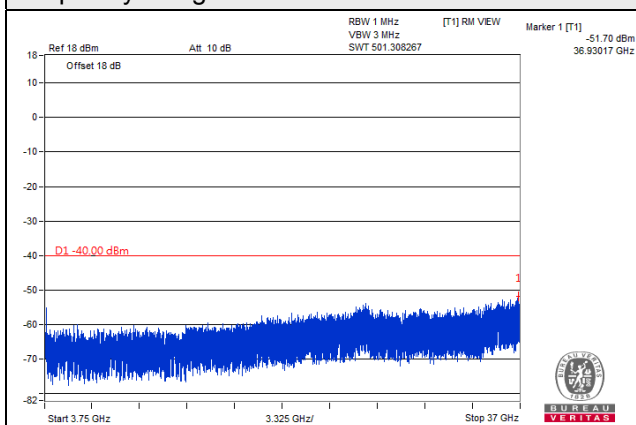
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3.5GHz



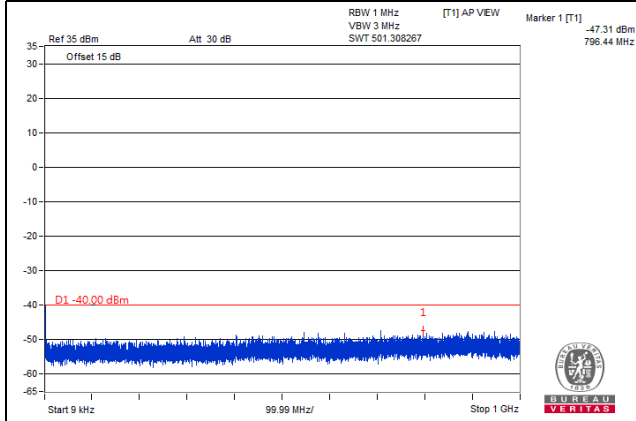
Frequency Range : 3.75GHz~37GHz



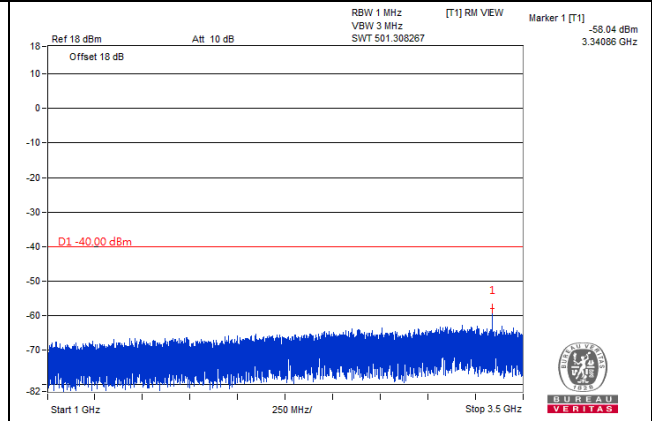
LTE Band 2, Channel Bandwidth 20MHz

Channel 55990 (3625.0MHz)

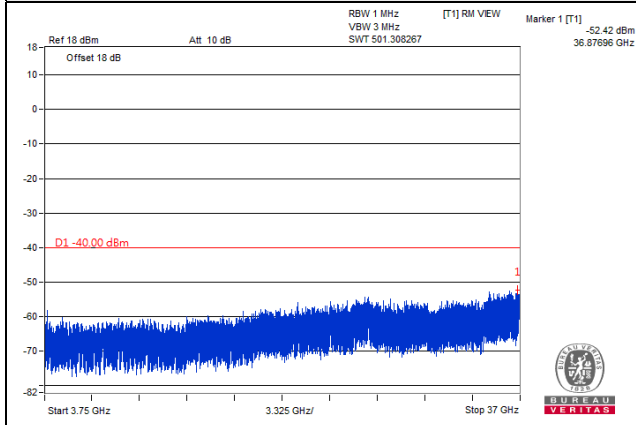
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3.5GHz



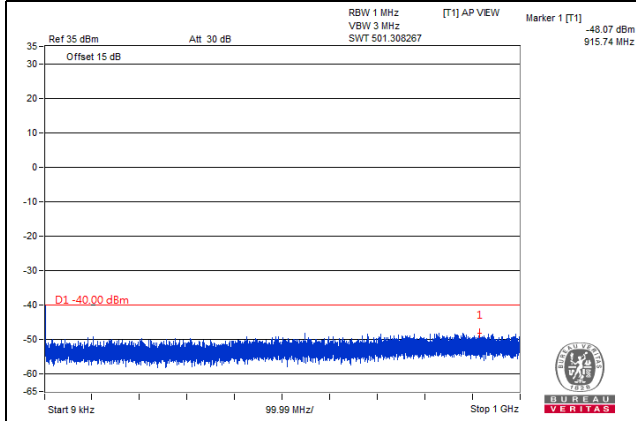
Frequency Range : 3.75GHz~37GHz



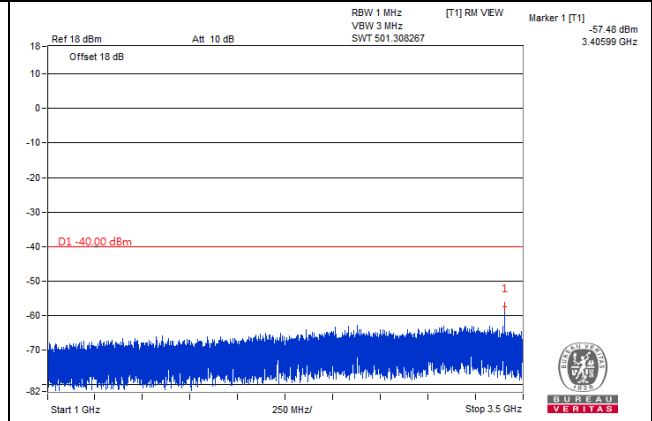
LTE Band 48, Channel Bandwidth 20MHz

Channel 56640 (3690.0MHz)

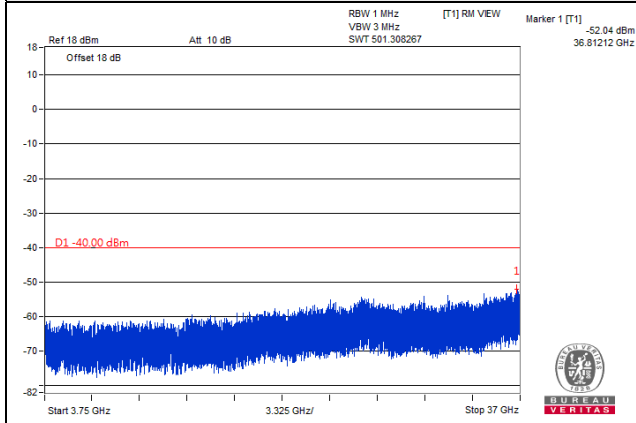
Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~3.5GHz



Frequency Range : 3.75GHz~37GHz



4.6 Radiated Emission Measurement

4.6.1 Limits of Radiated Emission Measurement

The power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40dBm/MHz.

4.6.2 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.6.3 Test Procedures

- a. Substitution method is used for EIRP measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- b. The substitution antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value" of step a. Record the power level of S.G
- c. $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}.$
- d. ERP power can be calculated form EIRP power by subtracting the gain of dipole, $ERP \text{ power} = EIRP \text{ power} - 2.15dBi.$

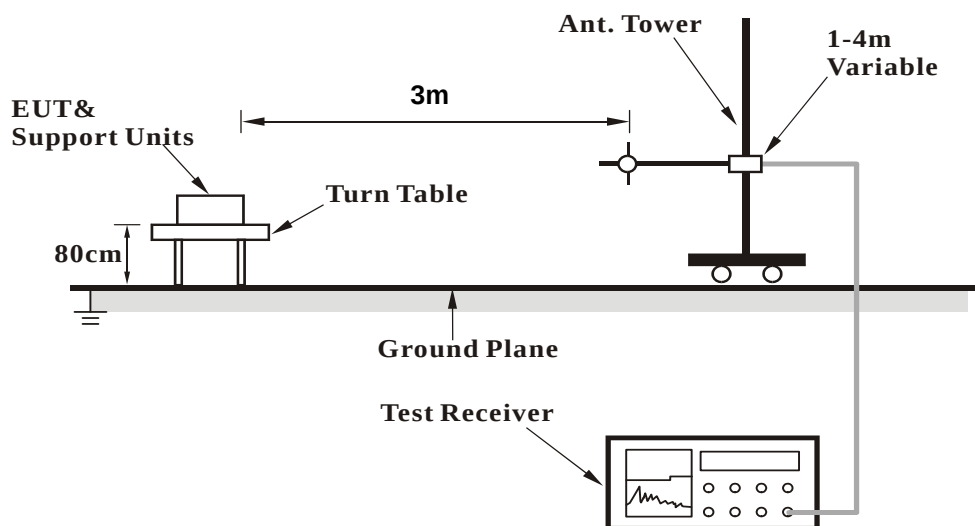
Note: The resolution bandwidth of spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz.

4.6.4 Deviation from Test Standard

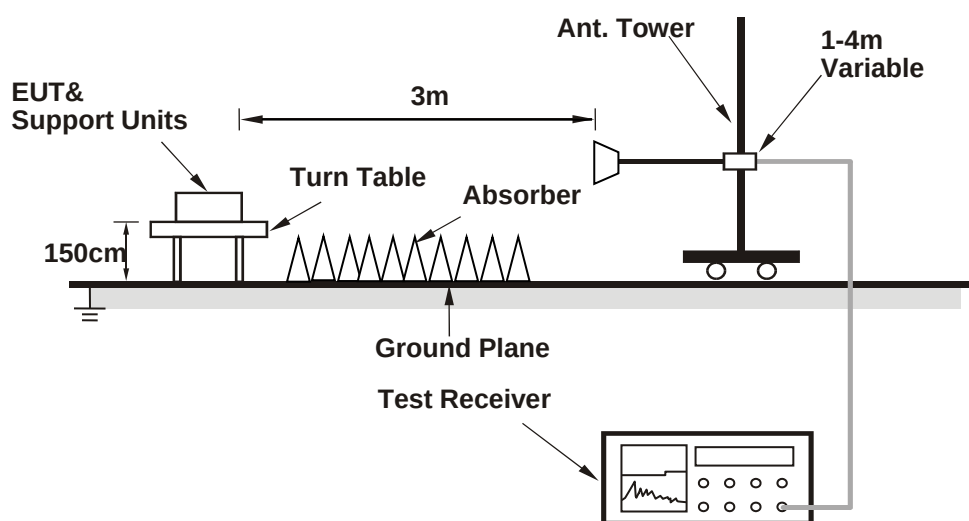
No deviation.

4.6.5 Test Set Up

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

4.6.6 Test Results

Test was done with 50ohm terminator on antenna port.

Below 1GHz Data :

LTE Band 48

PCB antenna mode

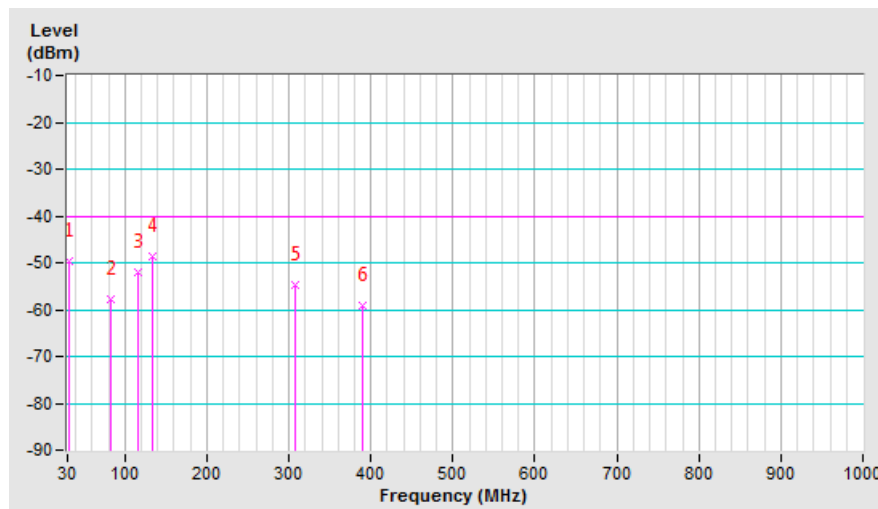
Channel Bandwidth: 5 MHz / QPSK

Mode	TX channel 55265 (3552.5MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	31.94	-53.1	-31.4	-18.3	-49.7	-40.0	-9.7
2	82.38	-52.3	-58.1	0.4	-57.7	-40.0	-17.7
3	116.33	-44.2	-49.2	-3.0	-52.2	-40.0	-12.2
4	133.79	-42.8	-45.5	-3.3	-48.8	-40.0	-8.8
5	307.42	-50.5	-58.7	3.9	-54.8	-40.0	-14.8
6	389.87	-58.6	-62.6	3.4	-59.2	-40.0	-19.2

Remarks:

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

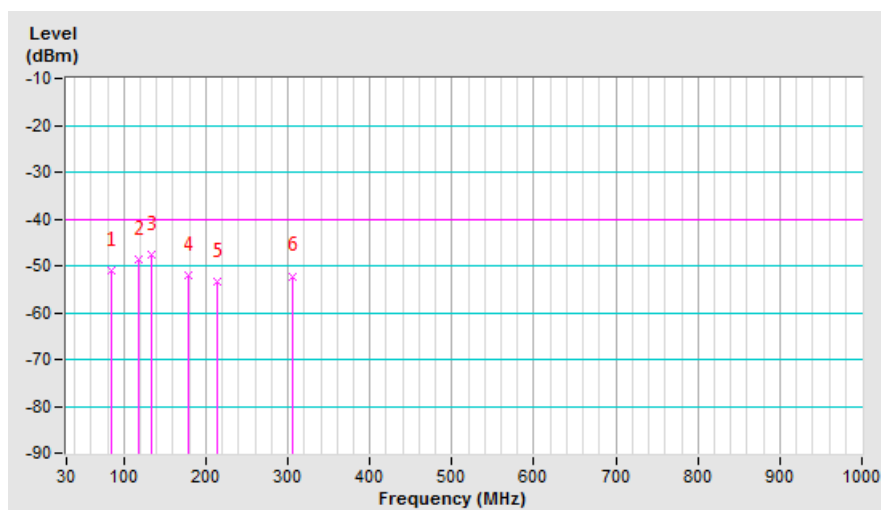


Mode	TX channel 55265 (3552.5MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	85.29	-45.4	-51.2	0.3	-50.9	-40.0	-10.9
2	118.27	-41.9	-45.6	-2.9	-48.5	-40.0	-8.5
3	133.79	-43.6	-44.2	-3.3	-47.5	-40.0	-7.5
4	179.38	-48.7	-49.2	-2.9	-52.1	-40.0	-12.1
5	214.30	-49.7	-51.3	-2.0	-53.3	-40.0	-13.3
6	306.45	-52.3	-56.1	3.9	-52.2	-40.0	-12.2

Remarks:

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



Above 1GHz

LTE Band 48, Channel Bandwidth 5MHz

Mode	TX channel 55265 (3552.5MHz)	Frequency Range	1GHz ~ 37GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7105.00	-64.5	-46.4	0.7	-45.7	-40.0	-5.7
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7105.00	-64.5	-46.8	0.7	-46.1	-40.0	-6.1

Remarks:

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

Mode	TX channel 55990 (3625.0MHz)	Frequency Range	1GHz ~ 37GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7250.00	-64.0	-46.2	0.9	-45.3	-40.0	-5.3
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7250.00	-64.6	-46.7	0.9	-45.8	-40.0	-5.8

Remarks:

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

Mode	TX channel 56715 (3697.5MHz)	Frequency Range	1GHz ~ 37GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7395.00	-64.7	-46.1	0.9	-45.2	-40.0	-5.2
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7395.00	-64.4	-46.7	0.9	-45.8	-40.0	-5.8

Remarks:

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

LTE Band 48, Channel Bandwidth 20MHz

Mode	TX channel 55340 (3560.0MHz)	Frequency Range	1GHz ~ 37GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7120.00	-64.4	-46.4	0.7	-45.7	-40.0	-5.7
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7120.00	-65.1	-47.4	0.7	-46.7	-40.0	-6.7

Remarks:

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

Mode	TX channel 55990 (3625.00MHz)	Frequency Range	1GHz ~ 37GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7250.00	-64.6	-46.8	0.9	-45.9	-40.0	-5.9
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7250.00	-64.5	-46.6	0.9	-45.7	-40.0	-5.7

Remarks:

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

Mode	TX channel 56640 (3690.00MHz)	Frequency Range	1GHz ~ 37GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7380.00	-64.4	-45.9	0.9	-45.0	-40.0	-5.0
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7380.00	-64.7	-47.0	0.9	-46.1	-40.0	-6.1

Remarks:

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

Dipole antenna mode

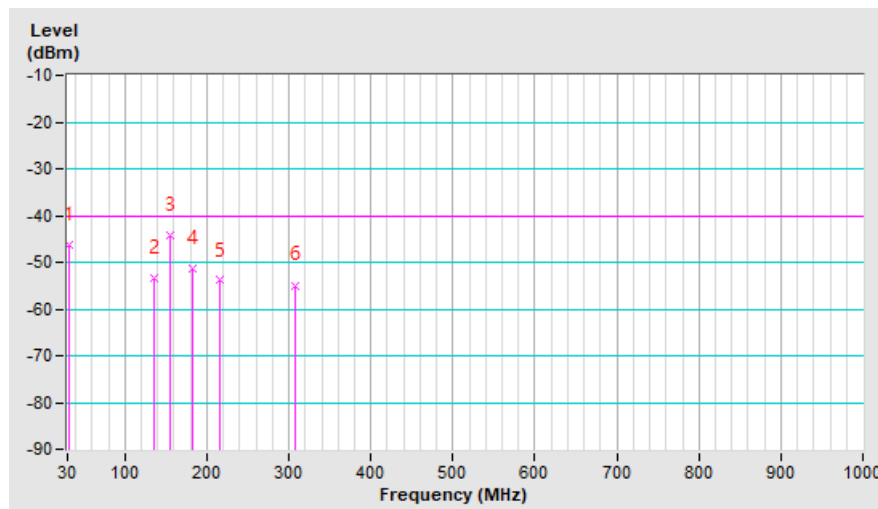
Channel Bandwidth: 5 MHz / QPSK

Mode	TX channel 55265 (3552.5MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	31.41	-49.9	-27.7	-18.6	-46.3	-40.0	-6.3
2	135.43	-47.5	-50.3	-3.2	-53.5	-40.0	-13.5
3	155.12	-39.7	-41.3	-2.9	-44.2	-40.0	-4.2
4	181.83	-43.3	-48.5	-3.0	-51.5	-40.0	-11.5
5	215.57	-45.6	-51.9	-2.0	-53.9	-40.0	-13.9
6	308.35	-50.7	-58.8	3.9	-54.9	-40.0	-14.9

Remarks:

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

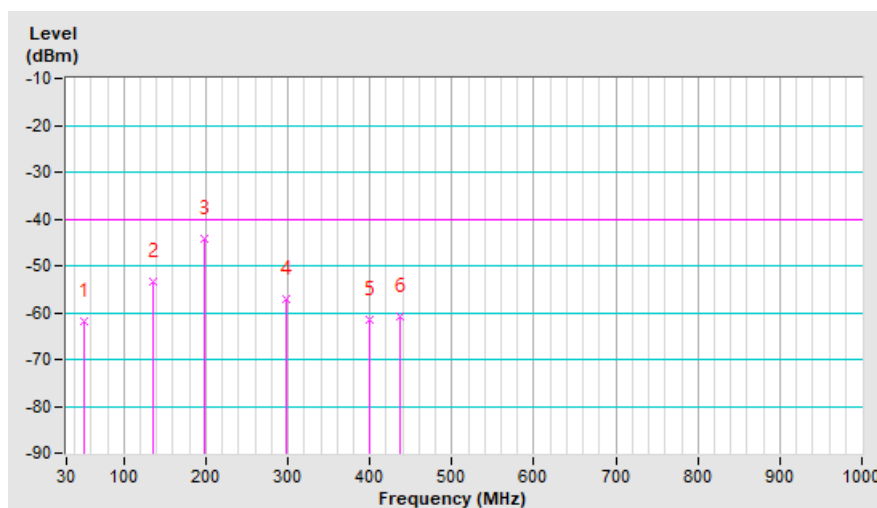


Mode	TX channel 55265 (3552.5MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	51.09	-54.4	-54.2	-7.5	-61.7	-40.0	-21.7
2	135.43	-50.0	-50.2	-3.2	-53.4	-40.0	-13.4
3	198.70	-43.5	-42.0	-2.4	-44.4	-40.0	-4.4
4	297.10	-56.9	-55.4	-1.7	-57.1	-40.0	-17.1
5	399.72	-60.7	-64.8	3.3	-61.5	-40.0	-21.5
6	436.28	-60.9	-64.5	3.6	-60.9	-40.0	-20.9

Remarks:

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



Above 1GHz

LTE Band 48, Channel Bandwidth 5MHz

Mode	TX channel 55265 (3552.5MHz)	Frequency Range	1GHz ~ 37GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7105.00	-64.8	-46.7	0.7	-46.0	-40.0	-6.0
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7105.00	-64.4	-46.7	0.7	-46.0	-40.0	-6.0

Remarks:

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

Mode	TX channel 55990 (3625.0MHz)	Frequency Range	1GHz ~ 37GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7250.00	-64.4	-46.6	0.9	-45.7	-40.0	-5.7
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7250.00	-65.0	-47.1	0.9	-46.2	-40.0	-6.2

Remarks:

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

Mode	TX channel 56715 (3697.5MHz)	Frequency Range	1GHz ~ 37GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7395.00	-64.8	-46.2	0.9	-45.3	-40.0	-5.3
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7395.00	-64.6	-46.9	0.9	-46.0	-40.0	-6.0

Remarks:

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

LTE Band 48, Channel Bandwidth 20MHz

Mode	TX channel 55340 (3560.0MHz)	Frequency Range	1GHz ~ 37GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7120.00	-65.0	-47.0	0.7	-46.3	-40.0	-6.3
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7120.00	-64.4	-46.7	0.7	-46.0	-40.0	-6.0

Remarks:

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

Mode	TX channel 55990 (3625.00MHz)	Frequency Range	1GHz ~ 37GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7250.00	-64.6	-46.8	0.9	-45.9	-40.0	-5.9
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7250.00	-64.3	-46.4	0.9	-45.5	-40.0	-5.5

Remarks:

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

Mode	TX channel 56640 (3690.00MHz)	Frequency Range	1GHz ~ 37GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7380.00	-65.0	-46.5	0.9	-45.6	-40.0	-5.6
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1	7380.00	-64.4	-46.7	0.9	-45.8	-40.0	-5.8

Remarks:

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

5 Pictures of Test Arrangements

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

Appendix – Information 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

Hsin Chu EMC/RF Lab/Telecom Lab

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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