

FCC Test Report

(PART 24)

Report No.: RFBEIH-WTW-P21090617-1

FCC ID: 2AK5B-HB2

Test Model: HB2LW1NA1

Received Date: Sep. 15, 2021

Test Date: Oct. 01, ~ Oct. 15, 2021

Issued Date: Nov. 24, 2021

Applicant: Latch Systems, Inc.

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

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FCC Registration /
Designation Number: 788550 / TW0003



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Release Control Record

Issue No.	Description	Date Issued
RFBEIH-WTW-P21090617-1	Original Release	Nov. 24, 2021

1 Certificate of Conformity

Product: Hub

Brand: LATCH

Test Model: HB2LW1NA1

Sample Status: Engineering Sample

Applicant: Latch Systems, Inc.

Test Date: Oct. 01, ~ Oct. 15, 2021

Standards: FCC Part 24, Subpart E

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 :

Lena Wang

Date:

Nov. 24, 2021

Lena Wang / Specialist

Approved by :

Jeremy Lin

Date:

Nov. 24, 2021

Jeremy Lin / Project Engineer

2 Summary of Test Results

Applied Standard: FCC Part 24 & Part 2			
FCC Clause	Test Item	Result	Remarks
2.1046 24.232	Effective Isotropic Radiated Power	Pass	Meet the requirement of limit.
2.1047	Modulation Characteristics	Pass	Meet the requirement.
24.232(d)	Peak to Average Ratio	Pass	Meet the requirement of limit.
2.1055 24.235	Frequency Stability	Pass	Meet the requirement of limit.
2.1049	Occupied Bandwidth	Pass	Meet the requirement of limit.
24.238	Band Edge Measurements	Pass	Meet the requirement of limit.
2.1051 24.238	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 24.238	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -19.84 dB at 36.79 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	3.04 dB
	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~ 1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

2.2 Test Site and Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver KEYSIGHT	N9038A	MY55420137	Apr. 09, 2021	Apr. 08, 2022
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100039	Jun. 10, 2021	Jun. 09, 2022
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Nov. 06, 2020	Nov. 05, 2021
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Nov. 22, 2020	Nov. 21, 2021
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Nov. 22, 2020	Nov. 21, 2021
Loop Antenna TESEQ	HLA 6121	45745	Jul. 21, 2021	Jul. 20, 2022
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Jun. 05, 2021	Jun. 04, 2022
Preamplifier Agilent (Above 1GHz)	8449B	3008A02367	Feb. 17, 2021	Feb. 16, 2022
RF signal cable HUBER+SUHNER&EMCI	SUCOFLEX 104 & EMC104-SM- SM8000	CABLE-CH9-02 (248780+171006)	Jan. 16, 2021	Jan. 15, 2022
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9- (250795/4)	Jan. 16, 2021	Jan. 15, 2022
RF signal cable Woken	8D-FB	Cable-CH9-01	Jun. 05, 2021	Jun. 04, 2022
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	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
JFW 20dB attenuation	50HF-020-SMA	NA	NA	NA
True RMS Clamp Meter Fluke	325	31130711WS	Jun. 02, 2021	Jun. 01, 2022
Radio Communication Analyzer Anritsu	MT8820C	6201300640	Aug. 26, 2021	Aug. 25, 2023
Temperature & Humidity Chamber	GTH-120-40-CP-AR	MAA1306-019	Sep. 10, 2021	Sep. 09, 2022
AC Power Source EEC	6905S	1991553	NA	NA

- Note: 1. The calibration interval of the above test instruments is 12 / 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 9.

3 General Information

3.1 General Description of EUT

Product	Hub		
Brand	LATCH		
Test Model	HB2LW1NA1		
Status of EUT	Engineering Sample		
Power Supply Rating	12.0 Vdc (adapter)		
Modulation Type	WCDMA	BPSK, QPSK	
	HSDPA	BPSK	
	HSUPA	QPSK	
	LTE	QPSK, 16QAM	
Frequency Range	WCDMA	1852.4 ~ 1907.6 MHz	
	LTE Band 2 (Channel Bandwidth: 1.4 MHz)	1850.7 ~ 1909.3 MHz	
	LTE Band 2 (Channel Bandwidth: 3 MHz)	1851.5 ~ 1908.5 MHz	
	LTE Band 2 (Channel Bandwidth: 5 MHz)	1852.5 ~ 1907.5 MHz	
	LTE Band 2 (Channel Bandwidth: 10 MHz)	1855.0 ~ 1905.0 MHz	
	LTE Band 2 (Channel Bandwidth: 15 MHz)	1857.5 ~ 1902.5 MHz	
	LTE Band 2 (Channel Bandwidth: 20 MHz)	1860.0 ~ 1900.0 MHz	
Max. EIRP Power	WCDMA	329.610 mW (25.18 dBm)	
		QPSK	16QAM
	LTE Band 2 (Channel Bandwidth: 1.4 MHz)	338.844 mW (25.30 dBm)	266.073 mW (24.25 dBm)
	LTE Band 2 (Channel Bandwidth: 3 MHz)	338.065 mW (25.29 dBm)	268.534 mW (24.29 dBm)
	LTE Band 2 (Channel Bandwidth: 5 MHz)	338.065 mW (25.29 dBm)	266.686 mW (24.26 dBm)
	LTE Band 2 (Channel Bandwidth: 10 MHz)	338.065 mW (25.29 dBm)	265.461 mW (24.24 dBm)
	LTE Band 2 (Channel Bandwidth: 15 MHz)	337.287 mW (25.28 dBm)	268.534 mW (24.29 dBm)
	LTE Band 2 (Channel Bandwidth: 20 MHz)	334.195 mW (25.24 dBm)	268.534 mW (24.29 dBm)
Emission Designator	WCDMA	4M07F9W	
	LTE Band 2 (Channel Bandwidth: 1.4 MHz)	1M09D7W	
	LTE Band 2 (Channel Bandwidth: 3 MHz)	2M70G7D	
	LTE Band 2 (Channel Bandwidth: 5 MHz)	4M49D7W	
	LTE Band 2 (Channel Bandwidth: 10 MHz)	8M98G7D	
	LTE Band 2 (Channel Bandwidth: 15 MHz)	13M5G7D	
	LTE Band 2 (Channel Bandwidth: 20 MHz)	18M0D7W	
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.

Product	Brand	Model	Description
Adapter	APD	WB-24J12FU	I/P: 100-240 Vac, 50/60 Hz, 0.7 A O/P: 12 Vdc, 2 A 1.5m non shielded, without core

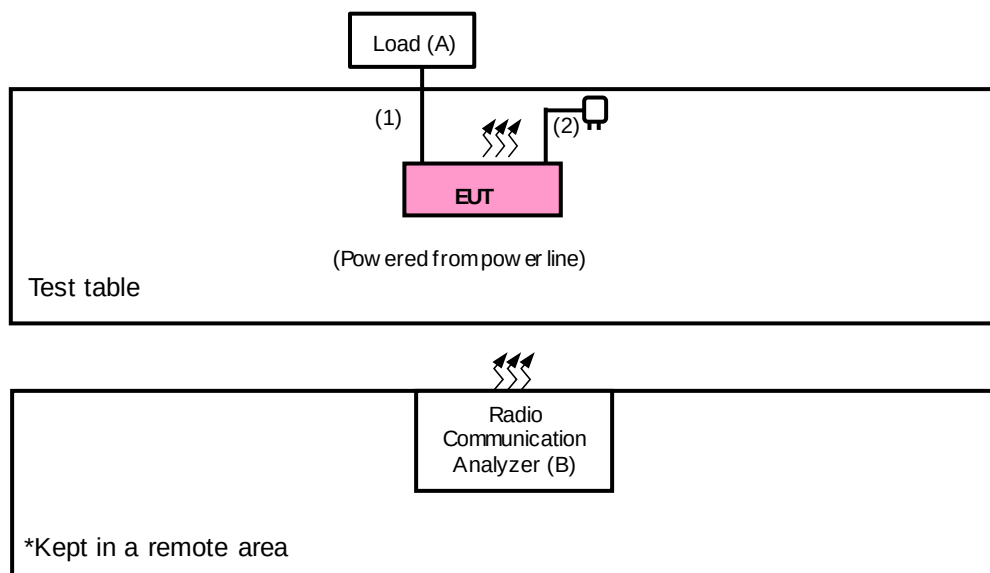
2. The antenna information is listed as below.

Antenna Type		PIFA						
Band		WCDMA		LTE				
		2	5	2	4	5	12	13
Gain	Ant. 1 (Main)	2.3	1.3	2.3	2.8	1.3	1.1	1.1
	Ant. 2 (Div, Rx only)	2.6	2.5	2.6	2.8	2.5	2.8	2.8

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

<Radiated Emission Test> & <E.I.R.P. 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.

No.	Product	Brand	Model No.	Serial No.	FCC ID
A	Load	N/A	N/A	N/A	N/A
B	Radio Communication Analyzer	Anritsu	MT8820C	6201300640	N/A

No.	Signal Cable Description Of The Above Support Units
1.	LAN Cable: 3m
2.	DC Output Cable: 1.5m

Note:

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

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
WCDMA	X-plane
LTE Band 2	X-plane

WCDMA

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Mode
-	EIRP	9262 to 9538	9262, 9400, 9538	WCDMA
-	Modulation Characteristics	9262 to 9538	9400	WCDMA
-	Frequency Stability	9262 to 9538	9262, 9538	WCDMA
-	Occupied Bandwidth	9262 to 9538	9262, 9400, 9538	WCDMA
-	Band Edge	9262 to 9538	9262, 9538	WCDMA
-	Peak to Average Ratio	9262 to 9538	9262, 9400, 9538	WCDMA
-	Conducted Emission	9262 to 9538	9262, 9400, 9538	WCDMA
-	Radiated Emission	9262 to 9538	9262, 9400, 9538	WCDMA

Note: For radiated emissions below 1 GHz, select the worst radiated emission channel for final testing.

LTE Band 2

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	EIRP	18607 to 19193	18607, 18900, 19193	1.4 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		18615 to 19185	18615, 18900, 19185	3 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		18625 to 19175	18625, 18900, 19175	5 MHz	QPSK, 16QAM	1 RB / 24 RB Offset
		18650 to 19150	18650, 18900, 19150	10 MHz	QPSK, 16QAM	1 RB / 49 RB Offset 1 RB / 0 RB Offset
		18675 to 19125	18675, 18900, 19125	15 MHz	QPSK, 16QAM	1 RB / 37 RB Offset
		18700 to 19100	18700, 18900, 19100	20 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
-	Modulation Characteristics	18700 to 19100	18900	20 MHz	QPSK, 16QAM	100 RB / 0 RB Offset
-	Frequency Stability	18607 to 19193	18607, 19193	1.4 MHz	QPSK	1 RB / 0 RB Offset
		18615 to 19185	18615, 19185	3 MHz	QPSK	1 RB / 0 RB Offset
		18625 to 19175	18625, 19175	5 MHz	QPSK	1 RB / 0 RB Offset
		18650 to 19150	18650, 19150	10 MHz	QPSK	1 RB / 0 RB Offset
		18675 to 19125	18675, 19125	15 MHz	QPSK	1 RB / 0 RB Offset
		18700 to 19100	18700, 19100	20 MHz	QPSK	1 RB / 0 RB Offset
-	Occupied Bandwidth	18607 to 19193	18607, 18900, 19193	1.4 MHz	QPSK, 16QAM	6 RB / 0 RB Offset
		18615 to 19185	18615, 18900, 19185	3 MHz	QPSK, 16QAM	15 RB / 0 RB Offset
		18625 to 19175	18625, 18900, 19175	5 MHz	QPSK, 16QAM	25 RB / 0 RB Offset
		18650 to 19150	18650, 18900, 19150	10 MHz	QPSK, 16QAM	50 RB / 0 RB Offset
		18675 to 19125	18675, 18900, 19125	15 MHz	QPSK, 16QAM	75 RB / 0 RB Offset
		18700 to 19100	18700, 18900, 19100	20 MHz	QPSK, 16QAM	100 RB / 0 RB Offset
-	Peak to Average Ratio	18607 to 19193	18607, 18900, 19193	1.4 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		18615 to 19185	18615, 18900, 19185	3 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		18625 to 19175	18625, 18900, 19175	5 MHz	QPSK, 16QAM	1 RB / 24 RB Offset
		18650 to 19150	18650, 18900, 19150	10 MHz	QPSK, 16QAM	1 RB / 49 RB Offset 1 RB / 0 RB Offset
		18675 to 19125	18675, 18900, 19125	15 MHz	QPSK, 16QAM	1 RB / 37 RB Offset
		18700 to 19100	18700, 18900, 19100	20 MHz	QPSK, 16QAM	1 RB / 0 RB Offset

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	Band Edge	18607 to 19193	18607	1.4 MHz	QPSK	1 RB / 0 RB Offset
			19193	1.4 MHz	QPSK	6 RB / 0 RB Offset
		18615 to 19185	18615	3 MHz	QPSK	1 RB / 5 RB Offset
			19185	3 MHz	QPSK	6 RB / 0 RB Offset
		18625 to 19175	18625	5 MHz	QPSK	1 RB / 0 RB Offset
			19175	5 MHz	QPSK	15 RB / 0 RB Offset
		18650 to 19150	18650	10 MHz	QPSK	1 RB / 14 RB Offset
			19150	10 MHz	QPSK	15 RB / 0 RB Offset
		18675 to 19125	18675	15 MHz	QPSK	1 RB / 0 RB Offset
			19125	15 MHz	QPSK	25 RB / 0 RB Offset
		18700 to 19100	18700	20 MHz	QPSK	1 RB / 24 RB Offset
			19100	20 MHz	QPSK	25 RB / 0 RB Offset
		18607 to 19193	18607, 18900, 19193	1.4 MHz	QPSK	1 RB / 0 RB Offset
			18615, 18900, 19185	3 MHz	QPSK	50 RB / 0 RB Offset
		18625 to 19175	18625, 18900, 19175	5 MHz	QPSK	1 RB / 49 RB Offset
			18650, 18900, 19150	10 MHz	QPSK	50 RB / 0 RB Offset
		18675 to 19125	18675, 18900, 19125	15 MHz	QPSK	1 RB / 0 RB Offset
			18700, 18900, 19100	20 MHz	QPSK	75 RB / 0 RB Offset
		18700 to 19100	18700, 18900, 19100	20 MHz	QPSK	1 RB / 74 RB Offset
			18700, 18900, 19100	20 MHz	QPSK	75 RB / 0 RB Offset
-	Conducted Emission	18607 to 19193	18607, 18900, 19193	1.4 MHz	QPSK	1 RB / 0 RB Offset
		18615 to 19185	18615, 18900, 19185	3 MHz	QPSK	1 RB / 0 RB Offset
		18625 to 19175	18625, 18900, 19175	5 MHz	QPSK	1 RB / 24 RB Offset
-	Radiated Emission	18650 to 19150	18650, 18900, 19150	10 MHz	QPSK	1 RB / 49 RB Offset
		18675 to 19125	18675, 18900, 19125	15 MHz	QPSK	1 RB / 37 RB Offset
		18700 to 19100	18700, 18900, 19100	20 MHz	QPSK	1 RB / 0 RB Offset
-	Radiated Emission	18607 to 19193	18607, 18900, 19193	1.4 MHz	QPSK	1 RB / 0 RB Offset
		18625 to 19175	18625, 18900, 19175	5 MHz	QPSK	1 RB / 24 RB Offset
		18700 to 19100	18700, 18900, 19100	20 MHz	QPSK	1 RB / 0 RB Offset

Note:

1. This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation. Therefore, only EIRP, modulation characteristics, occupied bandwidth and 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
EIRP	26 deg. C, 58 % RH	120 Vac, 60 Hz	Greg Lin
Modulation Characteristics	26 deg. C, 58 % RH	120 Vac, 60 Hz	James Yang
Frequency Stability	26 deg. C, 58 % RH	120 Vac, 60 Hz	James Yang
Occupied Bandwidth	26 deg. C, 58 % RH	120 Vac, 60 Hz	James Yang
Band Edge	26 deg. C, 58 % RH	120 Vac, 60 Hz	James Yang
Peak to Average Ratio	26 deg. C, 58 % RH	120 Vac, 60 Hz	James Yang
Conducted Emission	26 deg. C, 58 % RH	120 Vac, 60 Hz	James Yang
Radiated Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	Greg Lin, Rex Wang

3.4 EUT Operating Conditions

The EUT makes a call to the communication simulator. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency

3.5 General Description of Applied Standards and references

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

Test Standard:

FCC 47 CFR Part 2

FCC 47 CFR Part 24

ANSI 63.26-2015

NOTE: 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

ANSI/TIA/EIA-603-E 2016

NOTE: 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

Mobile / Portable station are limited to 2 watts e.i.r.p.

4.1.2 Test Procedures

Conducted Power Measurement:

The EUT was set up for the maximum power with WCDMA and LTE link data modulation and link up with simulator. 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:

$$\text{EIRP} = P_{\text{Meas}} + G_T$$

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

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

EIRP / ERP Measurement:

Conducted Power Measurement:



4.1.4 Test Results

Conducted Output Power (dBm)

Band	WCDMA II		
Channel	9262	9400	9538
Frequency (MHz)	1852.4	1880.0	1907.6
RMC 12.2K	22.83	22.87	22.88
HSDPA	22.02	22.08	22.03
HSUPA	21.26	21.22	21.25

LTE Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18607	18900	19193
		Frequency (MHz)		1850.7	1880	1909.3
1.4M	QPSK	1	0	22.84	23.00	22.95
		1	2	22.92	22.80	22.89
		1	5	22.74	22.86	22.96
		3	0	21.58	21.67	21.51
		3	1	21.65	21.54	21.74
		3	3	21.55	21.80	21.57
		6	0	21.66	21.50	21.76
	16QAM	1	0	21.93	21.95	21.94
		1	2	21.90	21.78	21.93
		1	5	21.82	21.91	21.94
		3	0	20.75	20.71	20.50
		3	1	20.66	20.53	20.61
		3	3	20.57	20.55	20.58
		6	0	20.75	20.58	20.65

LTE Band 2						
BW	MCS Index	Channel		18615	18900	19185
		Frequency (MHz)		1851.5	1880	1908.5
3M	QPSK	1	0	22.74	22.86	22.99
		1	7	22.94	22.98	22.75
		1	14	22.70	22.81	22.79
		8	0	21.80	21.78	21.66
		8	3	21.80	21.65	21.59
		8	7	21.60	21.51	21.59
		15	0	21.78	21.61	21.78
	16QAM	1	0	21.94	21.78	21.91
		1	7	21.76	21.99	21.96
		1	14	21.93	21.88	21.83
		8	0	20.51	20.64	20.61
		8	3	20.55	20.75	20.60
		8	7	20.64	20.62	20.50
		15	0	20.73	20.62	20.51
BW	MCS Index	Channel		18625	18900	19175
		Frequency (MHz)		1852.5	1880	1907.5
5M	QPSK	1	0	22.70	22.97	22.73
		1	12	22.72	22.88	22.93
		1	24	22.79	22.99	22.81
		12	0	21.55	21.77	21.72
		12	6	21.77	21.64	21.77
		12	13	21.52	21.65	21.78
		25	0	21.52	21.50	21.73
	16QAM	1	0	21.96	21.77	21.80
		1	12	21.81	21.75	21.75
		1	24	21.96	21.82	21.83
		12	0	20.74	20.74	20.69
		12	6	20.62	20.67	20.77
		12	13	20.72	20.53	20.72
		25	0	20.50	20.76	20.64

LTE Band 2						
BW	MCS Index	Channel		18650	18900	19150
		Frequency (MHz)		1855	1880	1905
10M	QPSK	1	0	22.81	22.96	22.71
		1	24	22.72	22.76	22.81
		1	49	22.78	22.84	22.99
		25	0	21.62	21.74	21.60
		25	12	21.62	21.56	21.57
		25	25	21.51	21.73	21.79
		50	0	21.66	21.63	21.66
	16QAM	1	0	21.94	21.70	21.90
		1	24	21.75	21.92	21.78
		1	49	21.87	21.76	21.75
		25	0	20.59	20.80	20.66
		25	12	20.56	20.63	20.52
		25	25	20.65	20.50	20.67
		50	0	20.58	20.59	20.52
BW	MCS Index	Channel		18675	18900	19125
		Frequency (MHz)		1857.5	1880	1902.5
15M	QPSK	1	0	22.85	22.82	22.86
		1	37	22.76	22.80	22.98
		1	74	22.95	22.84	22.90
		36	0	21.52	21.67	21.59
		36	19	21.58	21.68	21.60
		36	39	21.76	21.67	21.75
		75	0	21.65	21.73	21.64
	16QAM	1	0	21.91	21.70	21.80
		1	37	21.99	21.71	21.77
		1	74	21.83	21.82	21.72
		36	0	20.64	20.57	20.75
		36	19	20.53	20.75	20.51
		36	39	20.56	20.65	20.58
		75	0	20.61	20.55	20.53

LTE Band 2						
BW	MCS Index	Channel		18700	18900	19100
		Frequency (MHz)		1860	1880	1900
20M	QPSK	1	0	22.84	22.74	22.94
		1	50	22.85	22.80	22.75
		1	99	22.82	22.74	22.72
		50	0	21.63	21.69	21.70
		50	25	21.65	21.57	21.61
		50	50	21.63	21.67	21.65
		100	0	21.54	21.65	21.67
	16QAM	1	0	21.78	21.98	21.99
		1	50	21.84	21.74	21.86
		1	99	21.79	21.87	21.86
		50	0	20.71	20.74	20.50
		50	25	20.64	20.50	20.57
		50	50	20.67	20.61	20.59
		100	0	20.66	20.61	20.67

EIRP Power (dBm)

Band	WCDMA II		
Channel	9262	9400	9538
Frequency	1852.4	1880	1907.6
RMC 12.2K	25.13	25.17	25.18
HSDPA	24.32	24.38	24.33
HSUPA	23.56	23.52	23.55

*EIRP = Conducted + antenna gain (2.3dBi)

LTE Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18607	18900	19193
		Frequency (MHz)		1850.7	1880	1909.3
1.4M	QPSK	1	0	25.14	25.30	25.25
		1	2	25.22	25.10	25.19
		1	5	25.04	25.16	25.26
		3	0	23.88	23.97	23.81
		3	1	23.95	23.84	24.04
		3	3	23.85	24.10	23.87
		6	0	23.96	23.80	24.06
	16QAM	1	0	24.23	24.25	24.24
		1	2	24.20	24.08	24.23
		1	5	24.12	24.21	24.24
		3	0	23.05	23.01	22.80
		3	1	22.96	22.83	22.91
		3	3	22.87	22.85	22.88
		6	0	23.05	22.88	22.95

*EIRP = Conducted + antenna gain (2.3dBi)

LTE Band 2						
BW	MCS Index	Channel		18615	18900	19185
		Frequency (MHz)		1851.5	1880	1908.5
3M	QPSK	1	0	25.04	25.16	25.29
		1	7	25.24	25.28	25.05
		1	14	25.00	25.11	25.09
		8	0	24.10	24.08	23.96
		8	3	24.10	23.95	23.89
		8	7	23.90	23.81	23.89
		15	0	24.08	23.91	24.08
	16QAM	1	0	24.24	24.08	24.21
		1	7	24.06	24.29	24.26
		1	14	24.23	24.18	24.13
		8	0	22.81	22.94	22.91
		8	3	22.85	23.05	22.90
		8	7	22.94	22.92	22.80
		15	0	23.03	22.92	22.81
BW	MCS Index	Channel		18625	18900	19175
		Frequency (MHz)		1852.5	1880	1907.5
5M	QPSK	1	0	25.00	25.27	25.03
		1	12	25.02	25.18	25.23
		1	24	25.09	25.29	25.11
		12	0	23.85	24.07	24.02
		12	6	24.07	23.94	24.07
		12	13	23.82	23.95	24.08
		25	0	23.82	23.80	24.03
	16QAM	1	0	24.26	24.07	24.10
		1	12	24.11	24.05	24.05
		1	24	24.26	24.12	24.13
		12	0	23.04	23.04	22.99
		12	6	22.92	22.97	23.07
		12	13	23.02	22.83	23.02
		25	0	22.80	23.06	22.94

*EIRP = Conducted + antenna gain (2.3dBi)

LTE Band 2						
BW	MCS Index	Channel		18650	18900	19150
		Frequency (MHz)		1855	1880	1905
10M	QPSK	1	0	25.11	25.26	25.01
		1	24	25.02	25.06	25.11
		1	49	25.08	25.14	25.29
		25	0	23.92	24.04	23.90
		25	12	23.92	23.86	23.87
		25	25	23.81	24.03	24.09
		50	0	23.96	23.93	23.96
	16QAM	1	0	24.24	24.00	24.20
		1	24	24.05	24.22	24.08
		1	49	24.17	24.06	24.05
		25	0	22.89	23.10	22.96
		25	12	22.86	22.93	22.82
		25	25	22.95	22.80	22.97
		50	0	22.88	22.89	22.82
BW	MCS Index	Channel		18675	18900	19125
		Frequency (MHz)		1857.5	1880	1902.5
15M	QPSK	1	0	25.15	25.12	25.16
		1	37	25.06	25.10	25.28
		1	74	25.25	25.14	25.20
		36	0	23.82	23.97	23.89
		36	19	23.88	23.98	23.90
		36	39	24.06	23.97	24.05
		75	0	23.95	24.03	23.94
	16QAM	1	0	24.21	24.00	24.10
		1	37	24.29	24.01	24.07
		1	74	24.13	24.12	24.02
		36	0	22.94	22.87	23.05
		36	19	22.83	23.05	22.81
		36	39	22.86	22.95	22.88
		75	0	22.91	22.85	22.83

*EIRP = Conducted + antenna gain (2.3dBi)

LTE Band 2						
BW	MCS Index	Channel		18700	18900	19100
		Frequency (MHz)		1860	1880	1900
20M	QPSK	1	0	25.14	25.04	25.24
		1	50	25.15	25.10	25.05
		1	99	25.12	25.04	25.02
		50	0	23.93	23.99	24.00
		50	25	23.95	23.87	23.91
		50	50	23.93	23.97	23.95
		100	0	23.84	23.95	23.97
	16QAM	1	0	24.08	24.28	24.29
		1	50	24.14	24.04	24.16
		1	99	24.09	24.17	24.16
		50	0	23.01	23.04	22.80
		50	25	22.94	22.80	22.87
		50	50	22.97	22.91	22.89
		100	0	22.96	22.91	22.97

*EIRP = Conducted + antenna gain (2.3dBi)

4.2 Modulation Characteristics Measurement

4.2.1 Limits of Modulation Characteristics

N/A

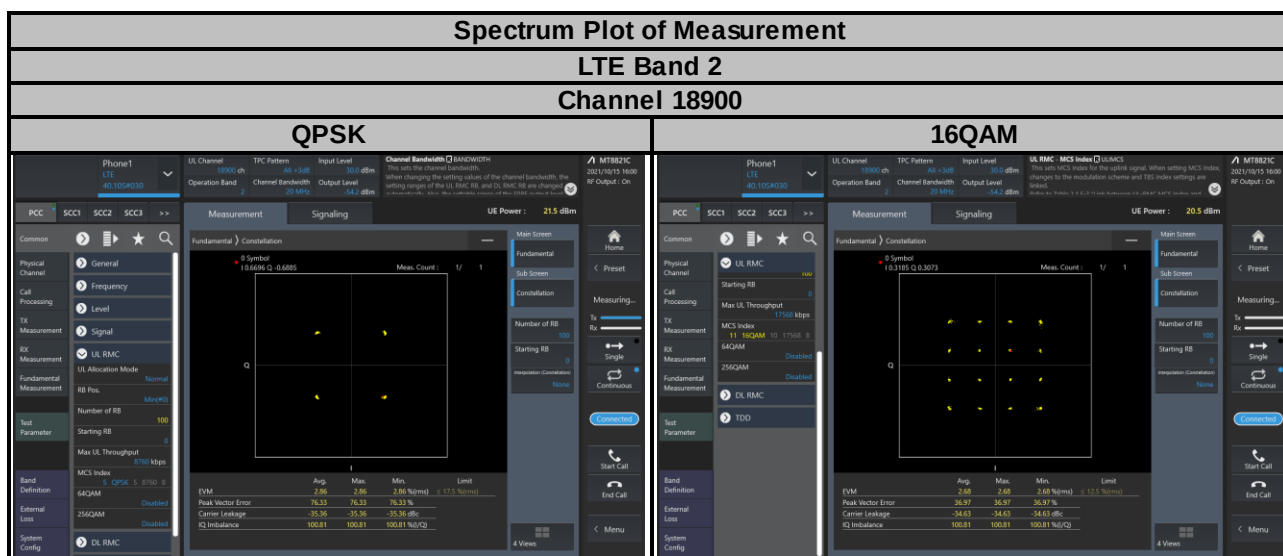
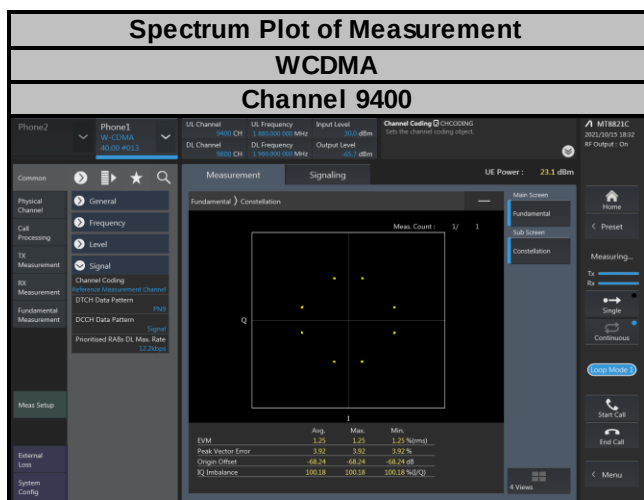
4.2.2 Test Setup



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



4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

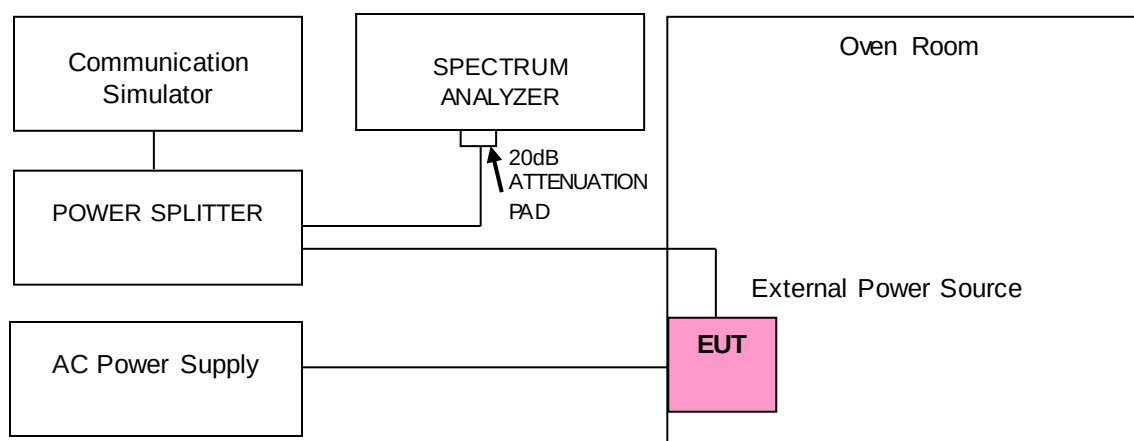
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

4.3.2 Test Procedure

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the 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 $\pm 0.5^{\circ}\text{C}$ 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.

4.3.3 Test Setup



4.3.4 Test Results

Frequency Error vs. Voltage

Voltage (Volts)	WCDMA			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
110	1852.400013	0.007	1907.600020	0.010
93.5	1852.400030	0.016	1907.600014	0.007
126.5	1852.400031	0.017	1907.600022	0.012

Note: The applicant defined the normal working voltage of the battery is from 93.5 Vac to 126.5 Vac.

Frequency Error vs. Temperature

Temp. (°C)	WCDMA			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1852.400033	0.018	1907.600024	0.013
-20	1852.400022	0.012	1907.600012	0.006
-10	1852.400025	0.013	1907.600027	0.014
0	1852.400037	0.020	1907.600035	0.018
10	1852.400017	0.009	1907.600038	0.020
20	1852.399967	-0.018	1907.599965	-0.018
30	1852.399960	-0.022	1907.599966	-0.018
40	1852.399967	-0.018	1907.599969	-0.016
50	1852.399973	-0.015	1907.599990	-0.005

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 2			
	Channel Bandwidth: 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
110	1850.700016	0.009	1909.300000	0.009
93.5	1850.700023	0.012	1909.300017	0.009
126.5	1850.700023	0.012	1909.300023	0.012

Note: The applicant defined the normal working voltage of the battery is from 93.5 Vac to 126.5 Vac.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2			
	Channel Bandwidth: 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1850.700040	0.022	1909.300038	0.020
-20	1850.700012	0.006	1909.300033	0.017
-10	1850.700035	0.019	1909.300010	0.005
0	1850.700017	0.009	1909.300034	0.018
10	1850.700031	0.017	1909.300023	0.012
20	1850.699960	-0.022	1909.299975	-0.013
30	1850.699965	-0.019	1909.299986	-0.007
40	1850.699986	-0.008	1909.299975	-0.013
50	1850.699971	-0.016	1909.299970	-0.016

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 2			
	Channel Bandwidth: 3 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
110	1851.500020	0.011	1908.500028	0.015
93.5	1851.500021	0.011	1908.500011	0.006
126.5	1851.500023	0.012	1908.500034	0.018

Note: The applicant defined the normal working voltage of the battery is from 93.5 Vac to 126.5 Vac.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2			
	Channel Bandwidth: 3 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1851.500032	0.017	1908.500010	0.005
-20	1851.500040	0.022	1908.500034	0.018
-10	1851.500040	0.022	1908.500033	0.017
0	1851.500019	0.010	1908.500035	0.018
10	1851.500034	0.018	1908.500034	0.018
20	1851.499966	-0.018	1908.499961	-0.020
30	1851.499960	-0.022	1908.499965	-0.018
40	1851.499962	-0.021	1908.499968	-0.017
50	1851.499980	-0.011	1908.499973	-0.014

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 2			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
110	1852.500023	0.012	1907.500026	0.014
93.5	1852.500025	0.013	1907.500019	0.010
126.5	1852.500039	0.021	1907.500019	0.010

Note: The applicant defined the normal working voltage of the battery is from 93.5 Vac to 126.5 Vac.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1852.500016	0.009	1907.500011	0.006
-20	1852.500032	0.017	1907.500018	0.009
-10	1852.500026	0.014	1907.500038	0.020
0	1852.500017	0.009	1907.500025	0.013
10	1852.500039	0.021	1907.500016	0.008
20	1852.499987	-0.007	1907.499965	-0.018
30	1852.499987	-0.007	1907.499964	-0.019
40	1852.499989	-0.006	1907.499979	-0.011
50	1852.499988	-0.006	1907.499986	-0.007

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 2			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
110	1855.000010	0.005	1905.000010	0.005
93.5	1855.000027	0.015	1905.000035	0.018
126.5	1855.000022	0.012	1905.000030	0.016

Note: The applicant defined the normal working voltage of the battery is from 93.5 Vac to 126.5 Vac.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1855.000025	0.013	1905.000035	0.018
-20	1855.000033	0.018	1905.000014	0.007
-10	1855.000022	0.012	1905.000013	0.007
0	1855.000026	0.014	1905.000030	0.016
10	1855.000037	0.020	1905.000020	0.010
20	1854.999960	-0.022	1904.999990	-0.005
30	1854.999978	-0.012	1904.999970	-0.016
40	1854.999961	-0.021	1904.999964	-0.019
50	1854.999968	-0.017	1904.999963	-0.019

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 2			
	Channel Bandwidth: 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
110	1857.500035	0.019	1902.500028	0.015
93.5	1857.500023	0.012	1902.500024	0.013
126.5	1857.500023	0.012	1902.500030	0.016

Note: The applicant defined the normal working voltage of the battery is from 93.5 Vac to 126.5 Vac.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2			
	Channel Bandwidth: 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1857.500034	0.018	1902.500036	0.019
-20	1857.500039	0.021	1902.500017	0.009
-10	1857.500021	0.011	1902.500014	0.007
0	1857.500015	0.008	1902.500022	0.012
10	1857.500027	0.015	1902.500038	0.020
20	1857.499972	-0.015	1902.499990	-0.005
30	1857.499971	-0.016	1902.499986	-0.007
40	1857.499980	-0.011	1902.499982	-0.009
50	1857.499962	-0.020	1902.499973	-0.014

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 2			
	Channel Bandwidth: 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
110	1860.000016	0.009	1900.000023	0.012
93.5	1860.000013	0.007	1900.000030	0.016
126.5	1860.000037	0.020	1900.000027	0.014

Note: The applicant defined the normal working voltage of the battery is from 93.5 Vac to 126.5 Vac.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2			
	Channel Bandwidth: 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1860.000035	0.019	1900.000011	0.006
-20	1860.000040	0.022	1900.000035	0.018
-10	1860.000030	0.016	1900.000039	0.021
0	1860.000024	0.013	1900.000015	0.008
10	1860.000016	0.009	1900.000028	0.015
20	1859.999985	-0.008	1899.999980	-0.011
30	1859.999975	-0.013	1899.999964	-0.019
40	1859.999988	-0.006	1899.999963	-0.019
50	1859.999969	-0.017	1899.999971	-0.015

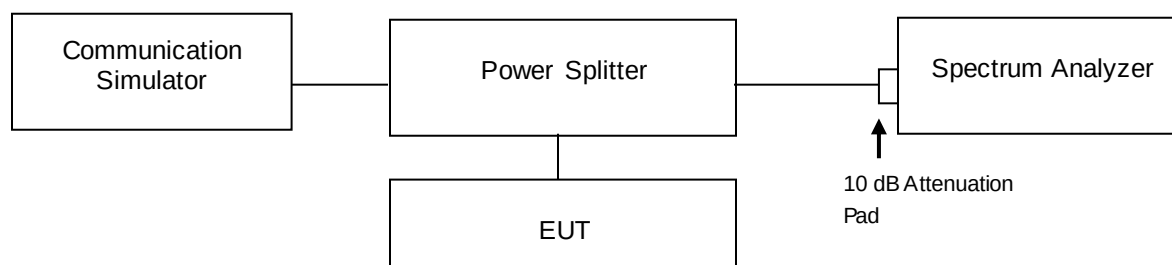
4.4 Occupied Bandwidth Measurement

4.4.1 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. Measurement method, please refer to section 5.4.4 of ANSI C63.26.

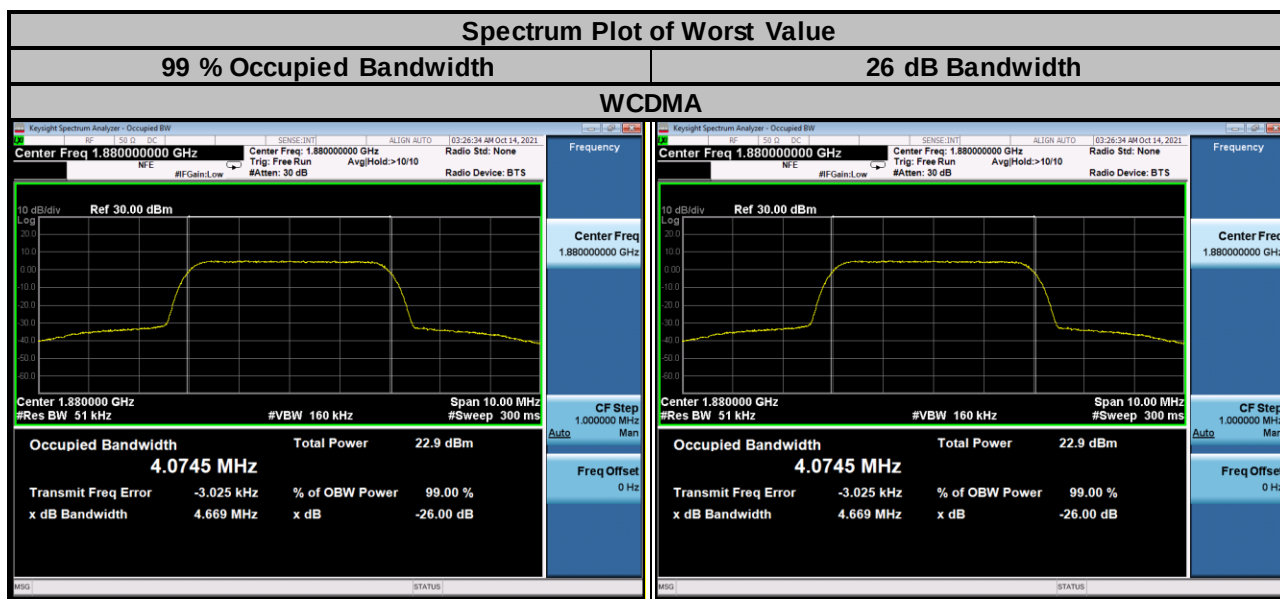
For the 26dBc bandwidth measurement method, please refer to section 5.4.3 of ANSI C63.26.

4.4.2 Test Setup



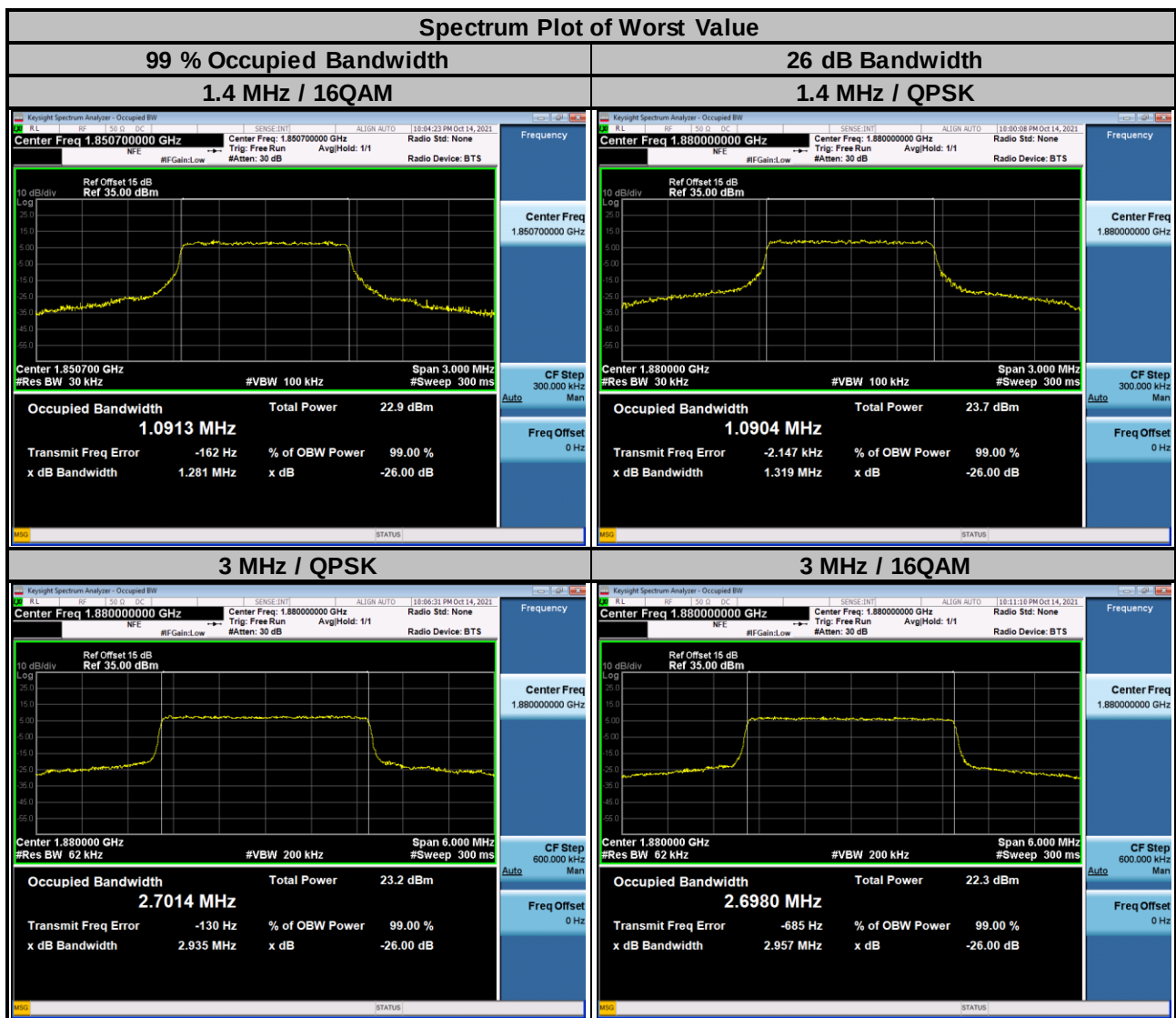
4.4.3 Test Result

WCDMA			
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
9262	1852.4	4.07	4.64
9400	1880.0	4.07	4.67
9538	1907.6	4.06	4.63



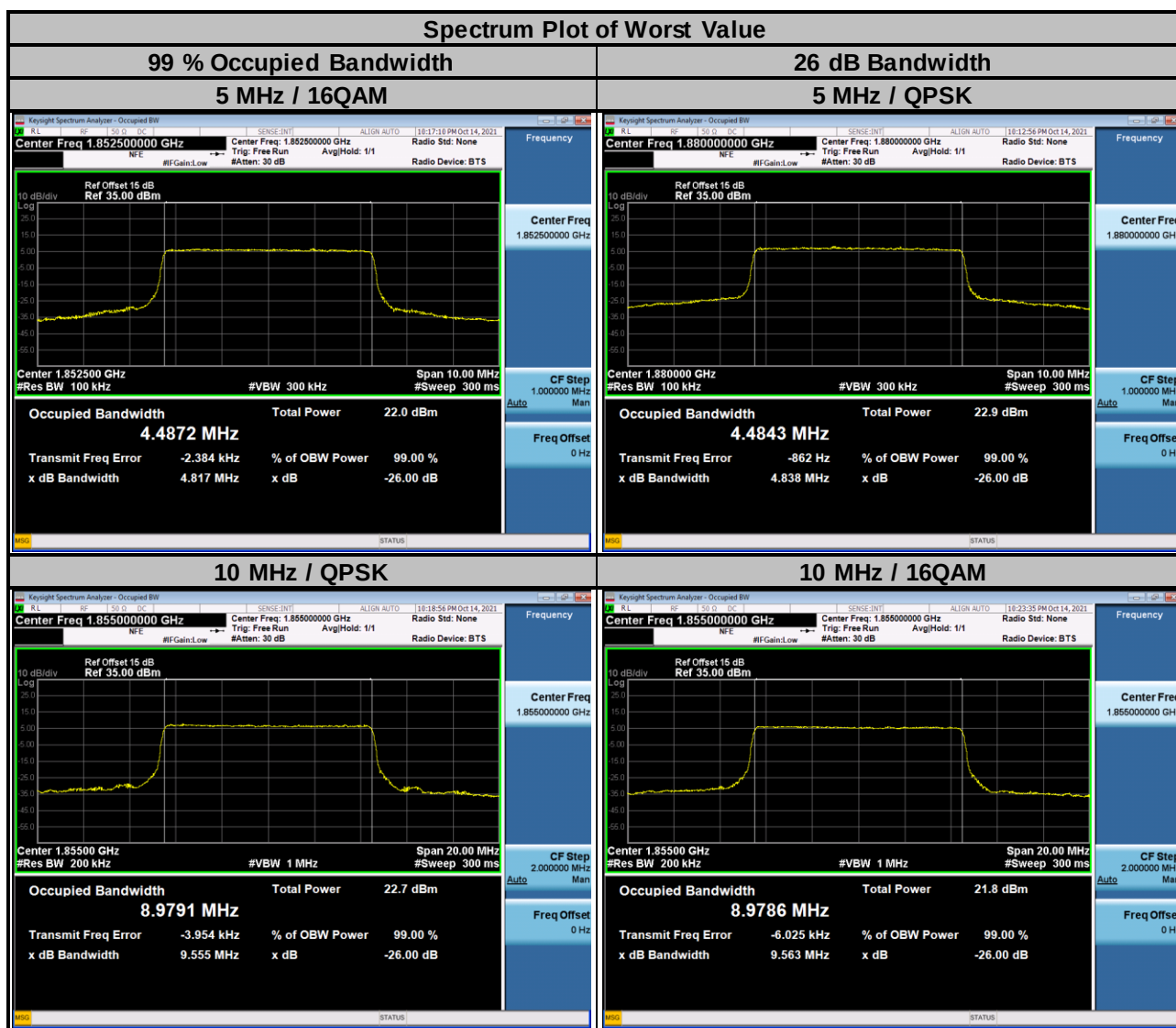
LTE Band 2					
Channel Bandwidth: 1.4 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
18607	1850.7	1.09	1.09	1.29	1.28
18900	1880.0	1.09	1.09	1.32	1.29
19193	1909.3	1.09	1.09	1.30	1.28

Channel Bandwidth: 3 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
18615	1851.5	2.70	2.70	2.93	2.94
18900	1880.0	2.70	2.70	2.94	2.96
19185	1908.5	2.70	2.69	2.93	2.93



LTE Band 2					
Channel Bandwidth: 5 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
18625	1852.5	4.48	4.49	4.82	4.82
18900	1880.0	4.48	4.49	4.84	4.83
19175	1907.5	4.48	4.48	4.81	4.81

Channel Bandwidth: 10 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
18650	1855.0	8.98	8.98	9.56	9.56
18900	1880.0	8.96	8.96	9.56	9.55
19150	1905.0	8.94	8.93	9.51	9.52



LTE Band 2					
Channel Bandwidth: 15 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
18675	1857.5	13.50	13.48	14.37	14.40
18900	1880.0	13.43	13.41	14.25	14.27
19125	1902.5	13.41	13.40	14.22	14.26

Channel Bandwidth: 20 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
18700	1860.0	18.00	18.02	19.08	19.10
18900	1880.0	17.85	17.87	19.03	19.01
19100	1900.0	17.90	17.92	19.02	19.02

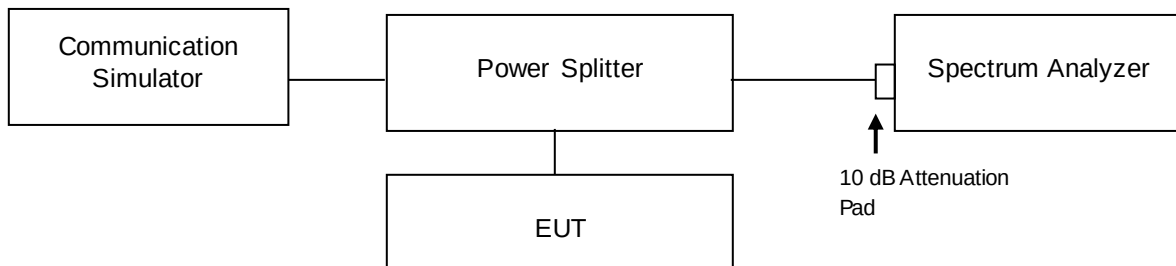


4.5 Band Edge Measurement

4.5.1 Limits of Band Edge Measurement

Power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

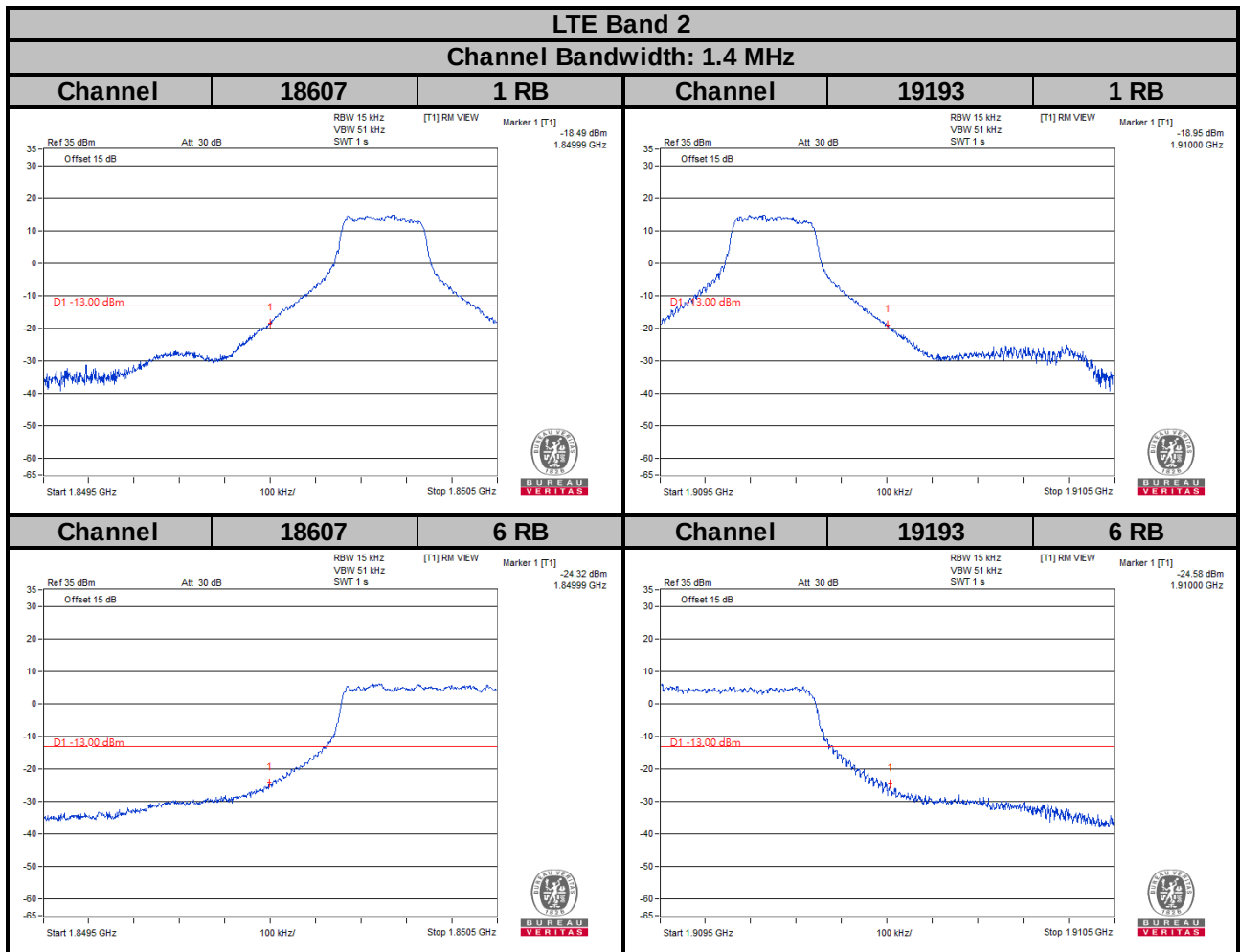
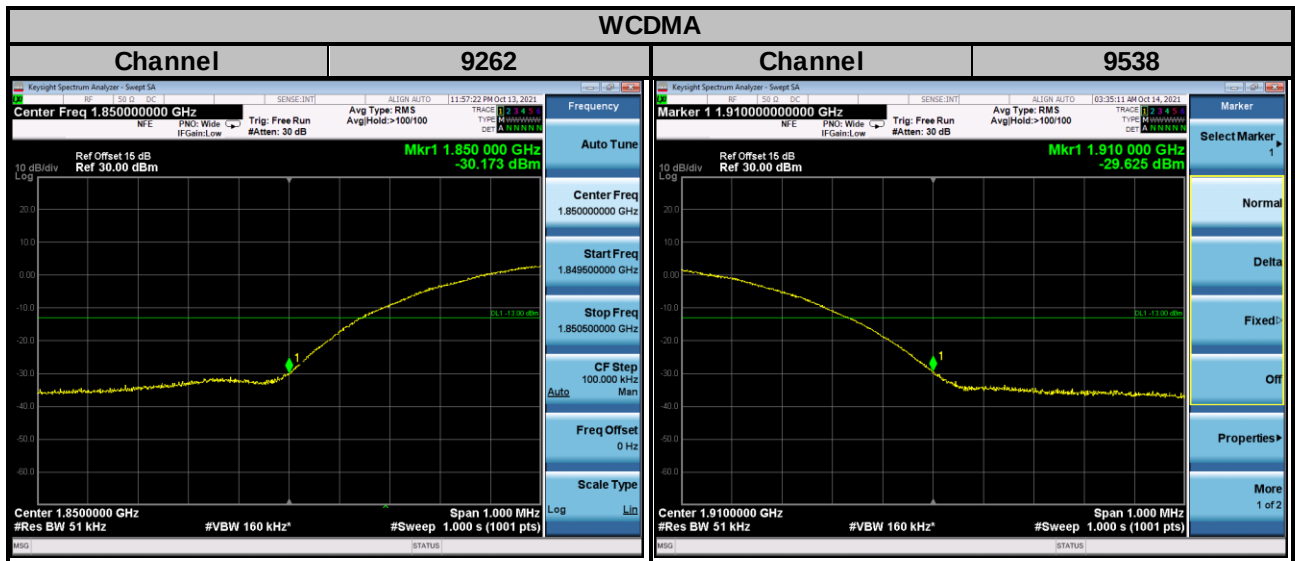
4.5.2 Test Setup

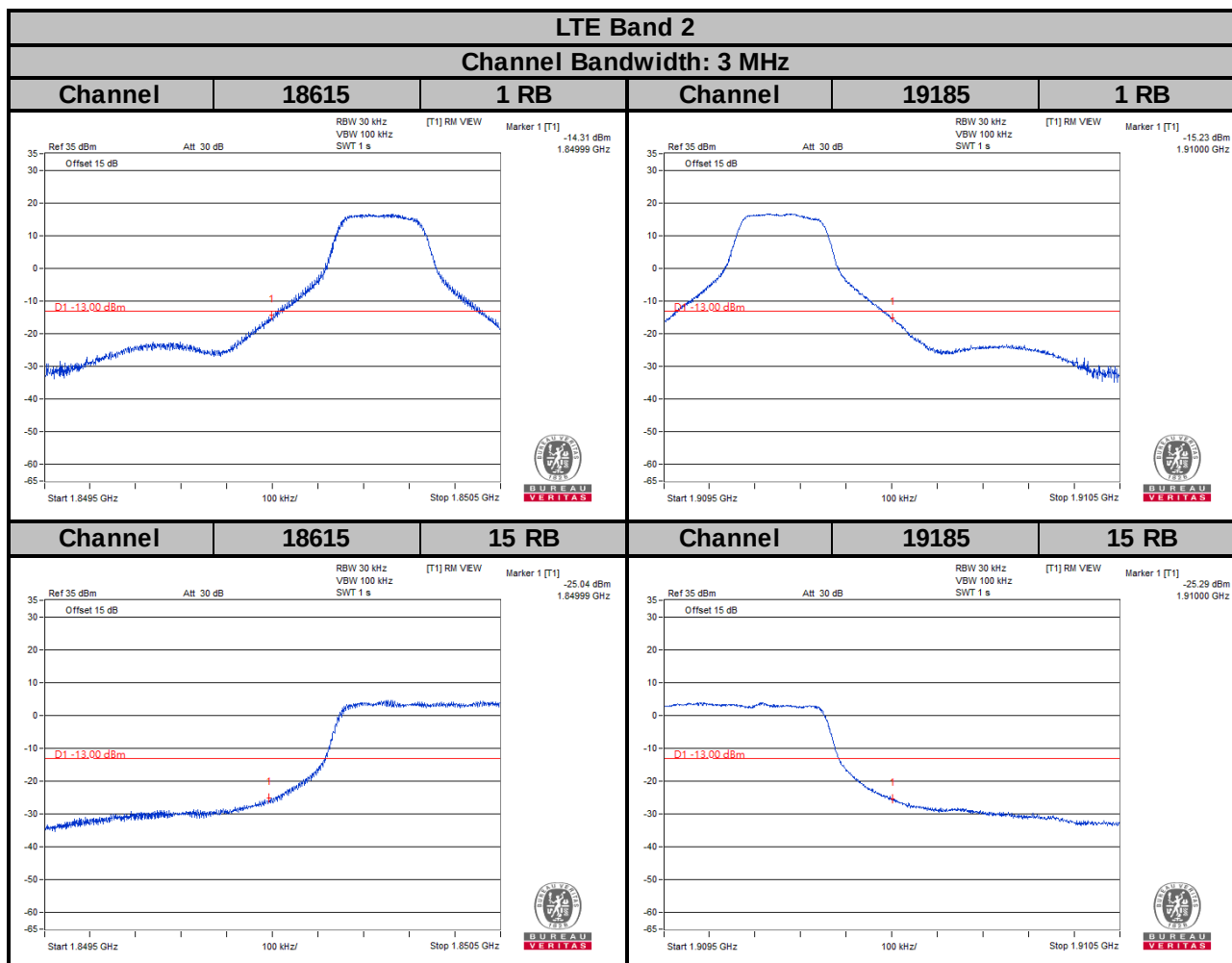


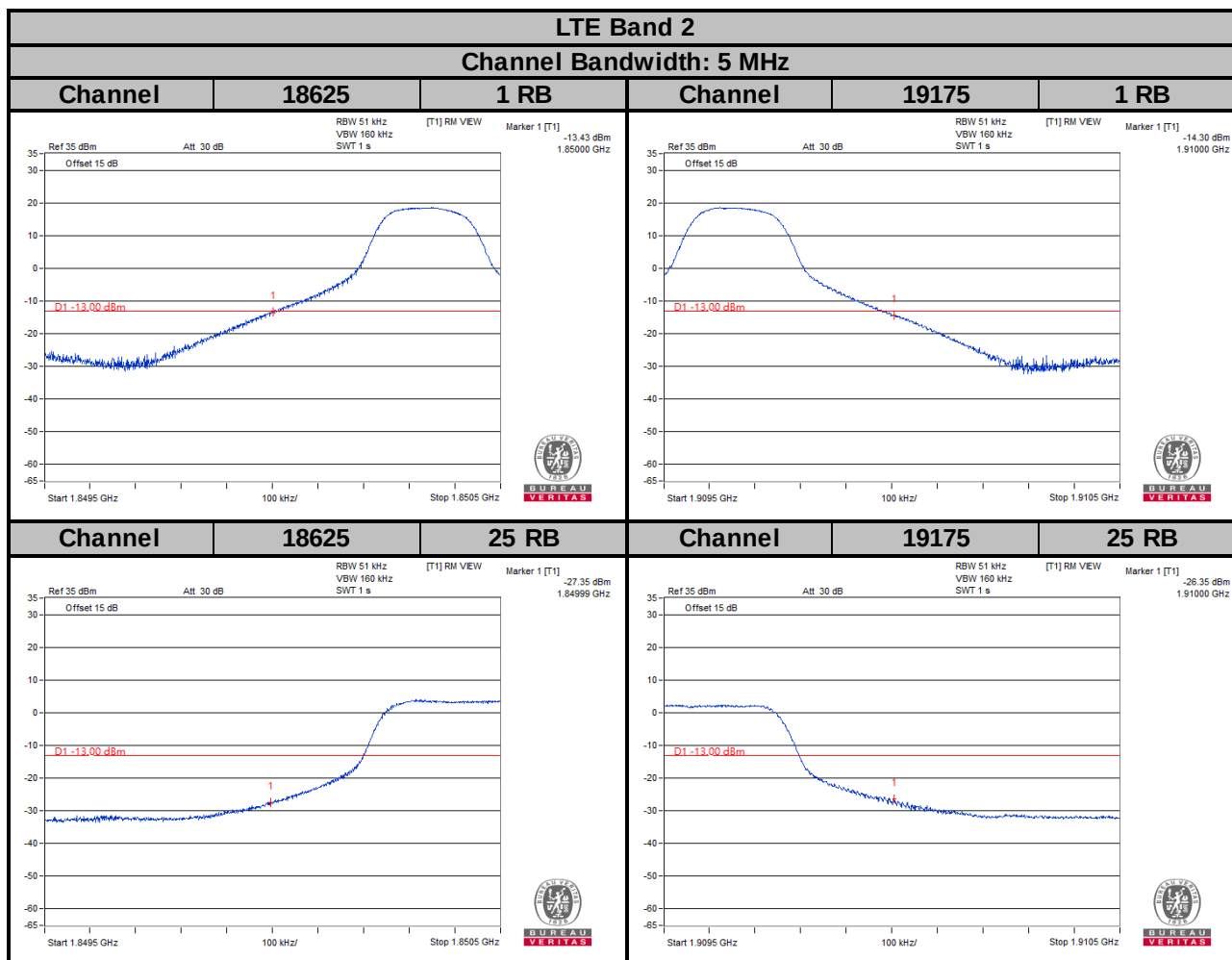
4.5.3 Test Procedures

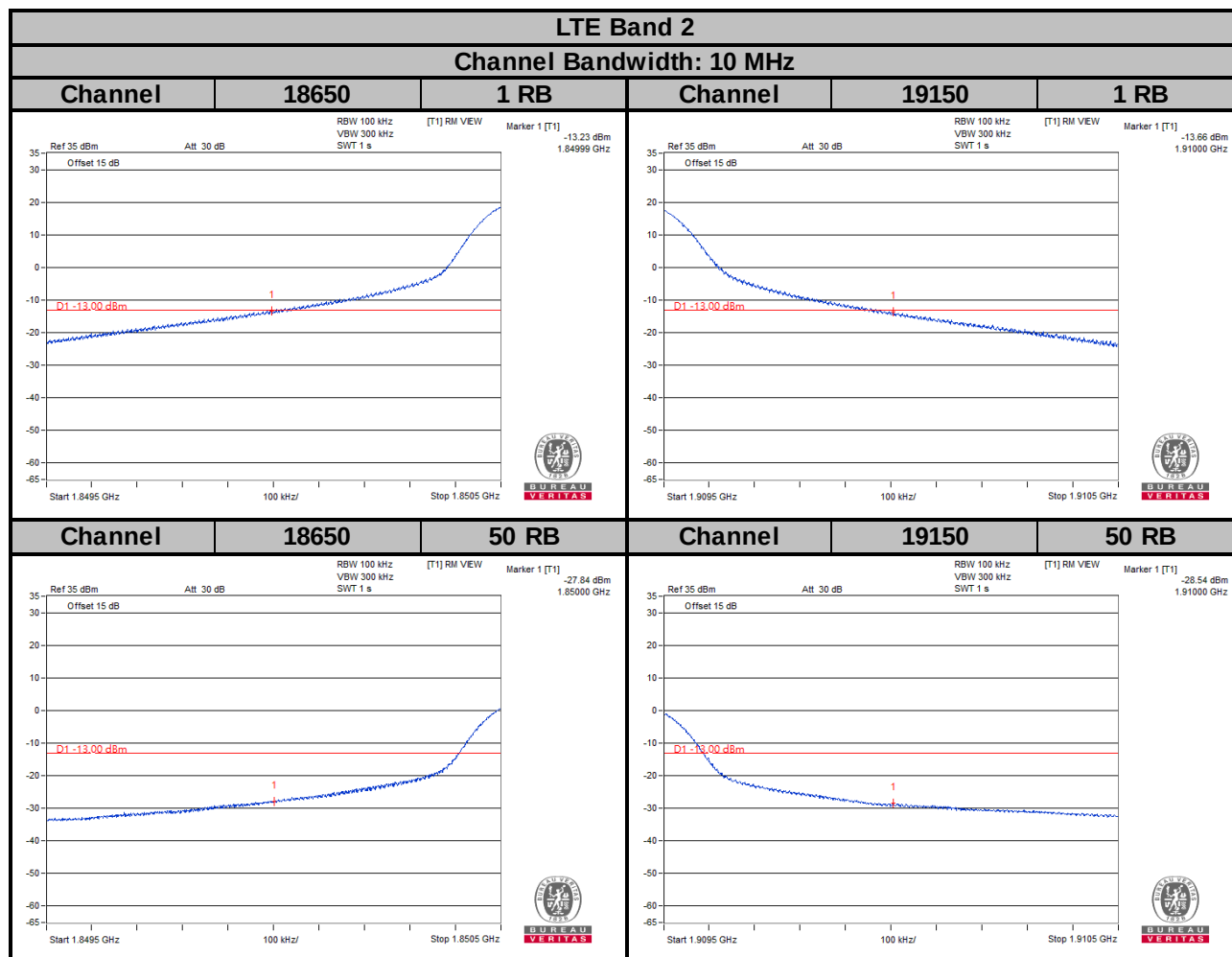
- All measurements were done at low and high operational frequency range.
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 51 kHz and VB of the spectrum is 160 kHz (WCDMA).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 15 kHz and VB of the spectrum is 51 kHz (LTE Bandwidth 1.4 MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 30 kHz and VB of the spectrum is 100 kHz (LTE Bandwidth 3 MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 51 kHz and VB of the spectrum is 160 kHz (LTE Bandwidth 5 MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 100 kHz and VB of the spectrum is 300 kHz (LTE Bandwidth 10 MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 150 kHz and VB of the spectrum is 470 kHz (LTE Bandwidth 15 MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 200 kHz and VB of the spectrum is 1 MHz (LTE Bandwidth 20 MHz).
- Record the max trace plot into the test report.

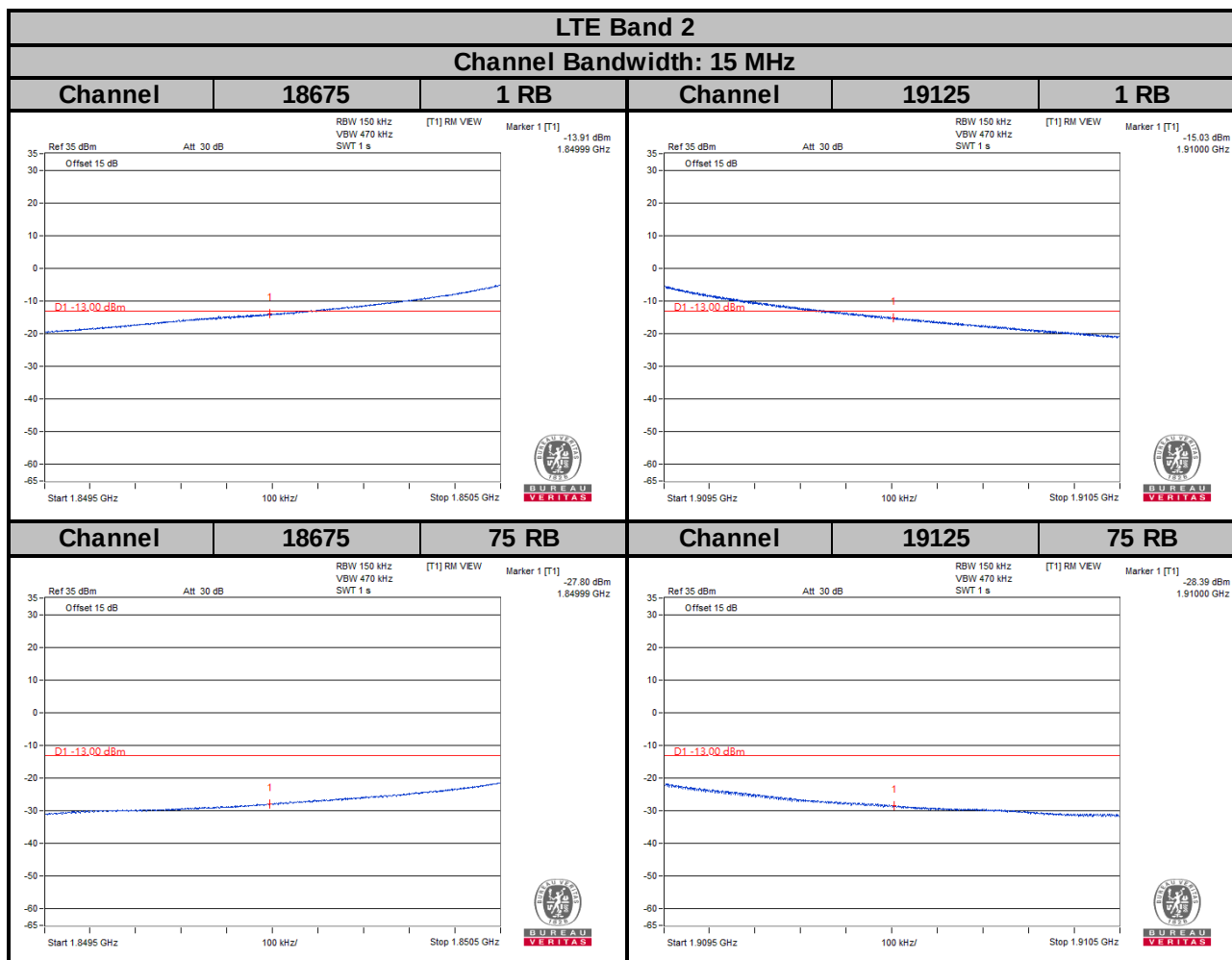
4.5.4 Test Results

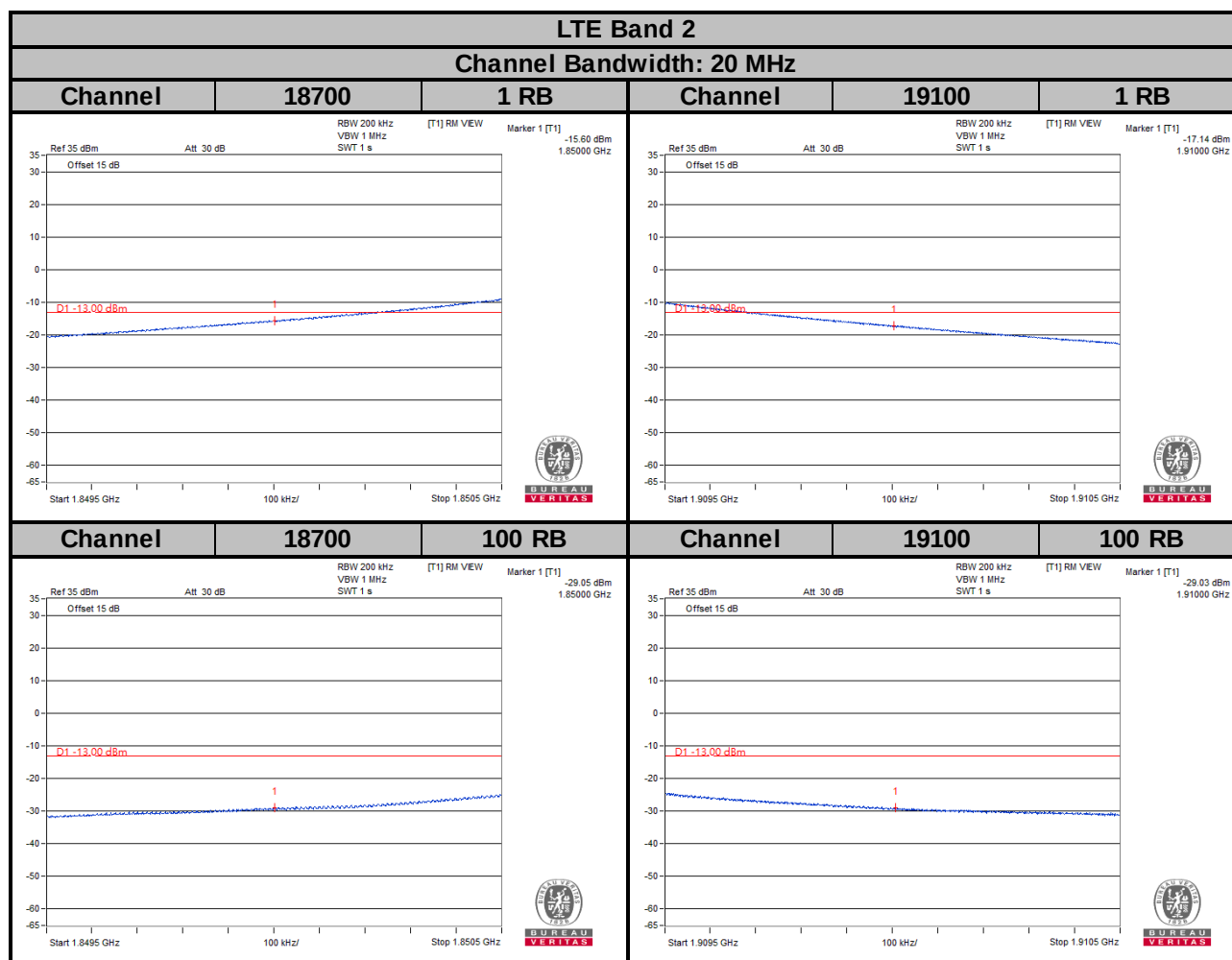










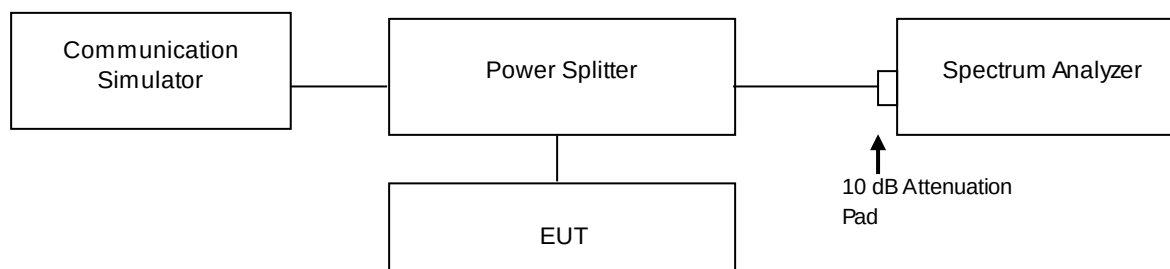


4.6 Peak to Average Ratio

4.6.1 Limits of Peak to Average Ratio Measurement

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

4.6.2 Test Setup

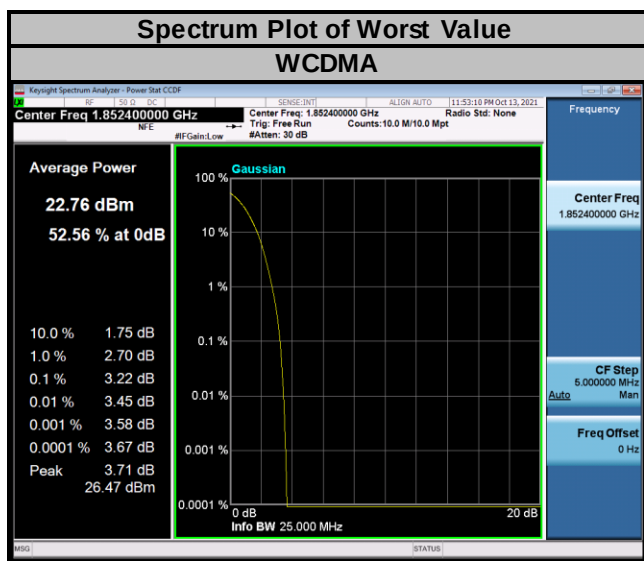


4.6.3 Test Procedures

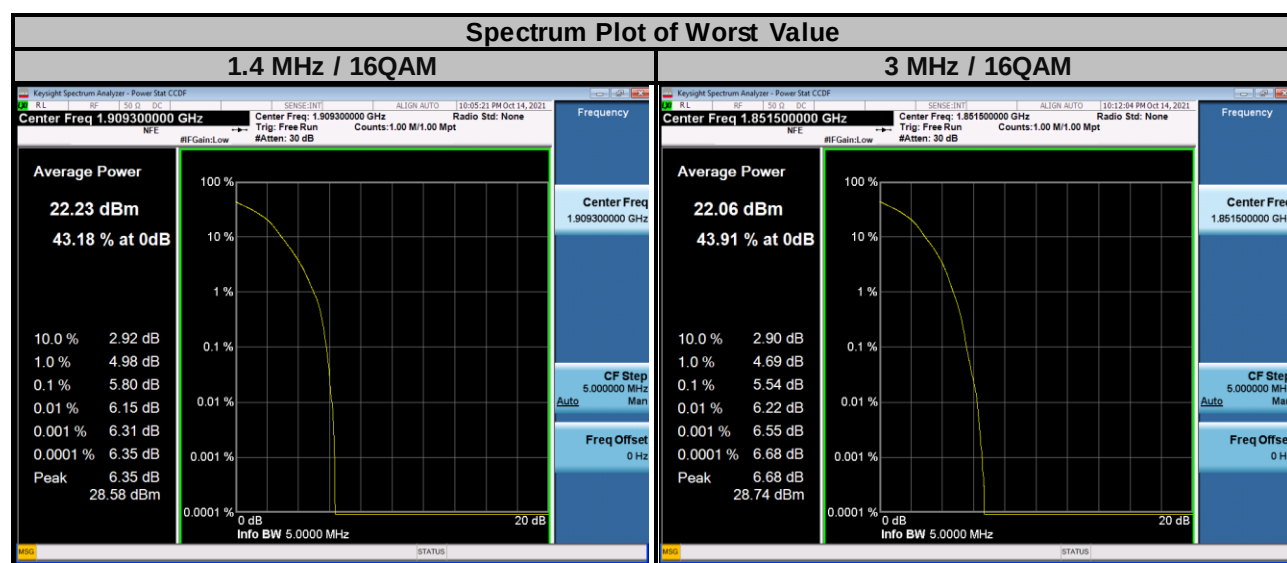
1. Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Record the maximum PAPR level associated with a probability of 0.1 %.

4.6.4 Test Results

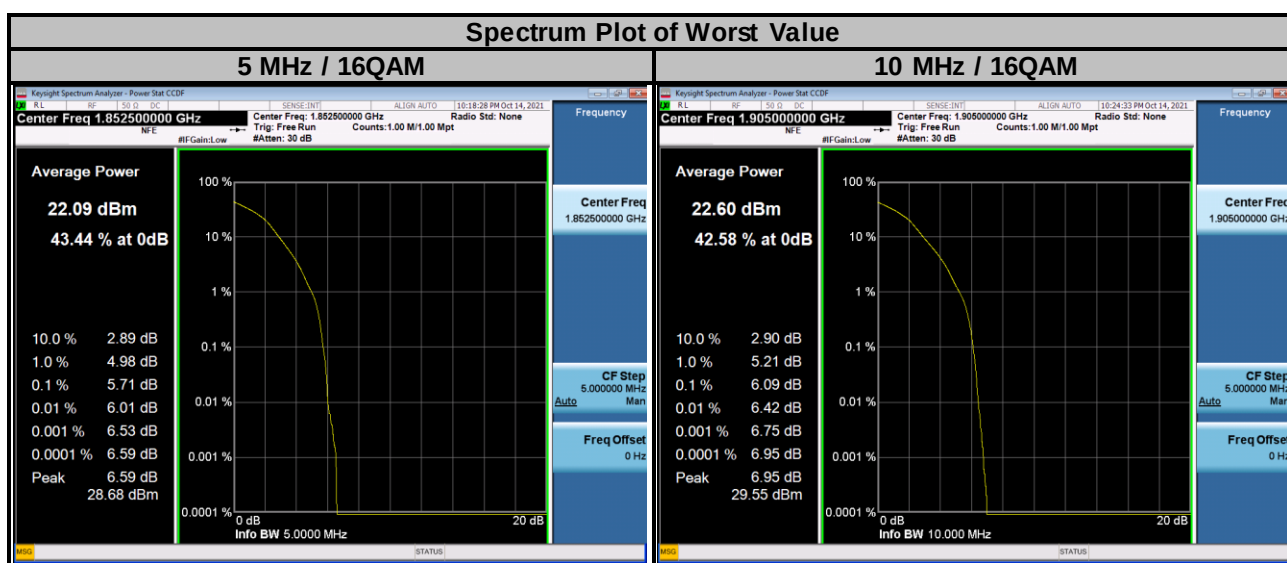
Channel	Frequency (MHz)	Peak to Average Ratio (dB)
		WCDMA
9262	1852.4	3.22
9400	1880.0	2.93
9538	1907.6	3.15



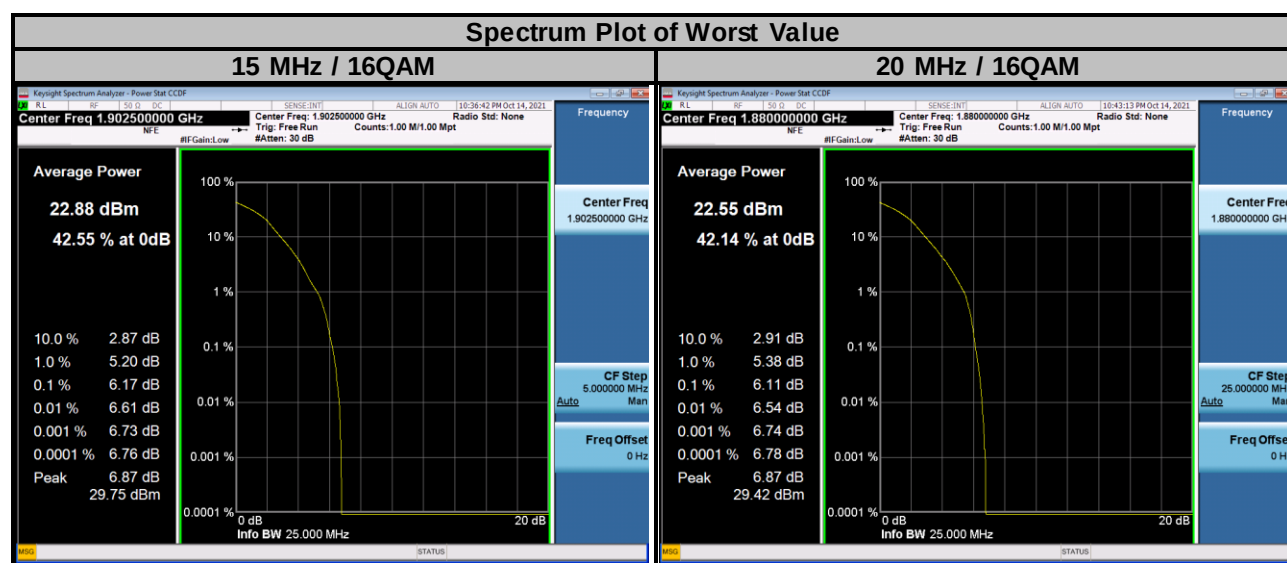
LTE Band 2							
Channel Bandwidth: 1.4 MHz				Channel Bandwidth: 3 MHz			
Channel	Frequency (MHz)	Peak to Average Ratio (dB)		Channel	Frequency (MHz)	Peak to Average Ratio (dB)	
		QPSK	16QAM			QPSK	16QAM
18607	1850.7	4.83	5.69	18615	1851.5	4.68	5.54
18900	1880.0	4.41	5.29	18900	1880.0	4.28	5.18
19193	1909.3	4.89	5.80	19185	1908.5	4.54	5.36



LTE Band 2							
Channel Bandwidth: 5 MHz				Channel Bandwidth: 10 MHz			
Channel	Frequency (MHz)	Peak to Average Ratio (dB)		Channel	Frequency (MHz)	Peak to Average Ratio (dB)	
		QPSK	16QAM			QPSK	16QAM
18625	1852.5	4.80	5.71	18650	1855.0	4.61	5.59
18900	1880.0	4.48	5.32	18900	1880.0	4.58	5.40
19175	1907.5	4.64	5.50	19150	1905.0	5.27	6.09



LTE Band 2							
Channel Bandwidth: 15 MHz				Channel Bandwidth: 20 MHz			
Channel	Frequency (MHz)	Peak to Average Ratio (dB)		Channel	Frequency (MHz)	Peak to Average Ratio (dB)	
		QPSK	16QAM			QPSK	16QAM
18675	1857.5	4.69	5.55	18700	1860.0	4.74	5.53
18900	1880.0	4.76	5.65	18900	1880.0	5.22	6.11
19125	1902.5	5.25	6.17	19100	1900.0	5.19	6.03

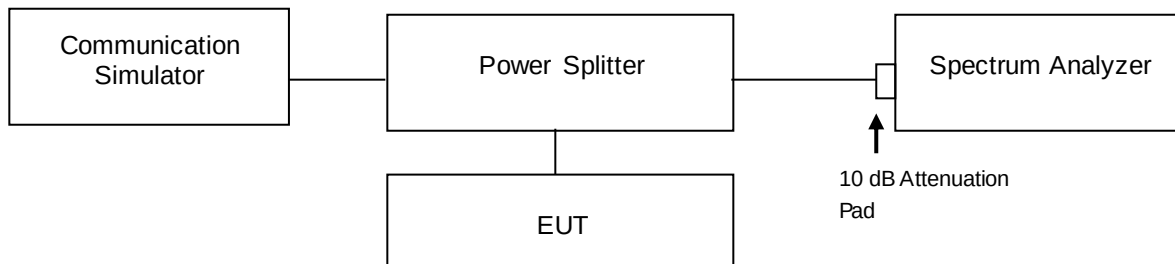


4.7 Conducted Spurious Emissions

4.7.1 Limits of Conducted Spurious Emissions Measurement

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. The emission limit equal to -13 dBm.

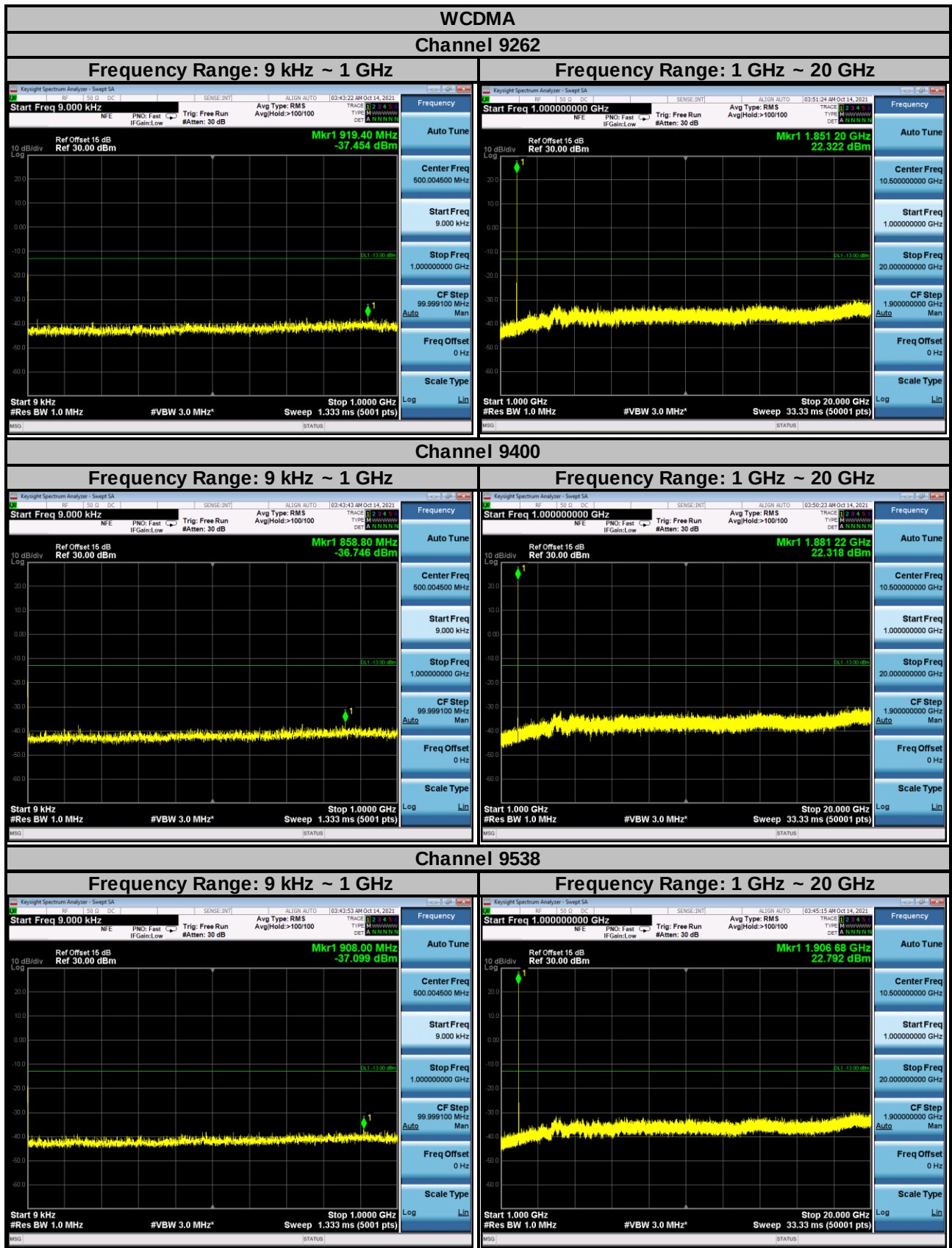
4.7.2 Test Setup



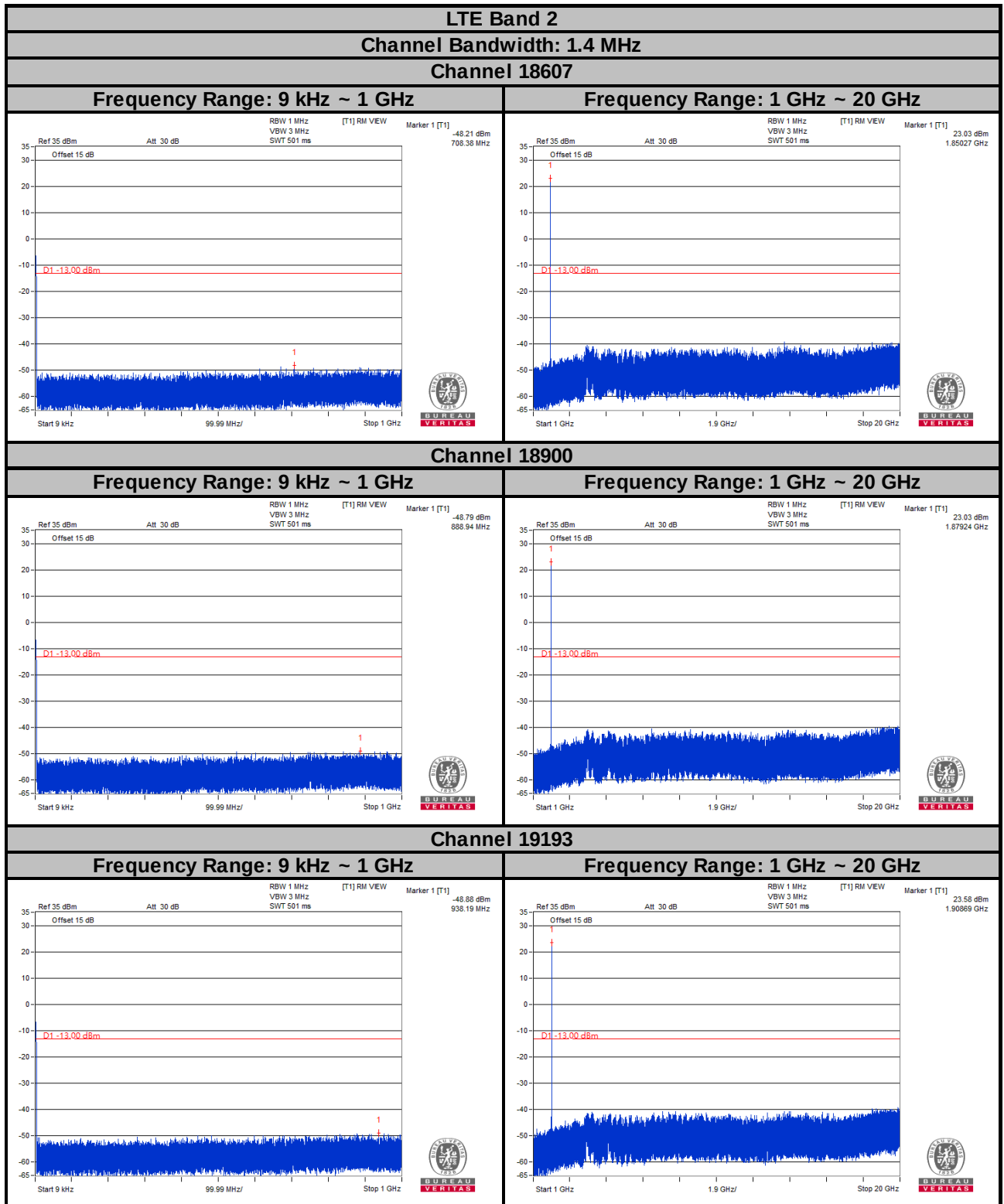
4.7.3 Test Procedure

- 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 1 GHz. 10 dB attenuation pad is connected with spectrum. RBW = 1 MHz and VBW = 3 MHz is used for conducted emission measurement.
- Measuring frequency range is from 1 GHz to 20 GHz. 10 dB attenuation pad is connected with spectrum. RBW = 1 MHz and VBW = 3 MHz is used for conducted emission measurement.

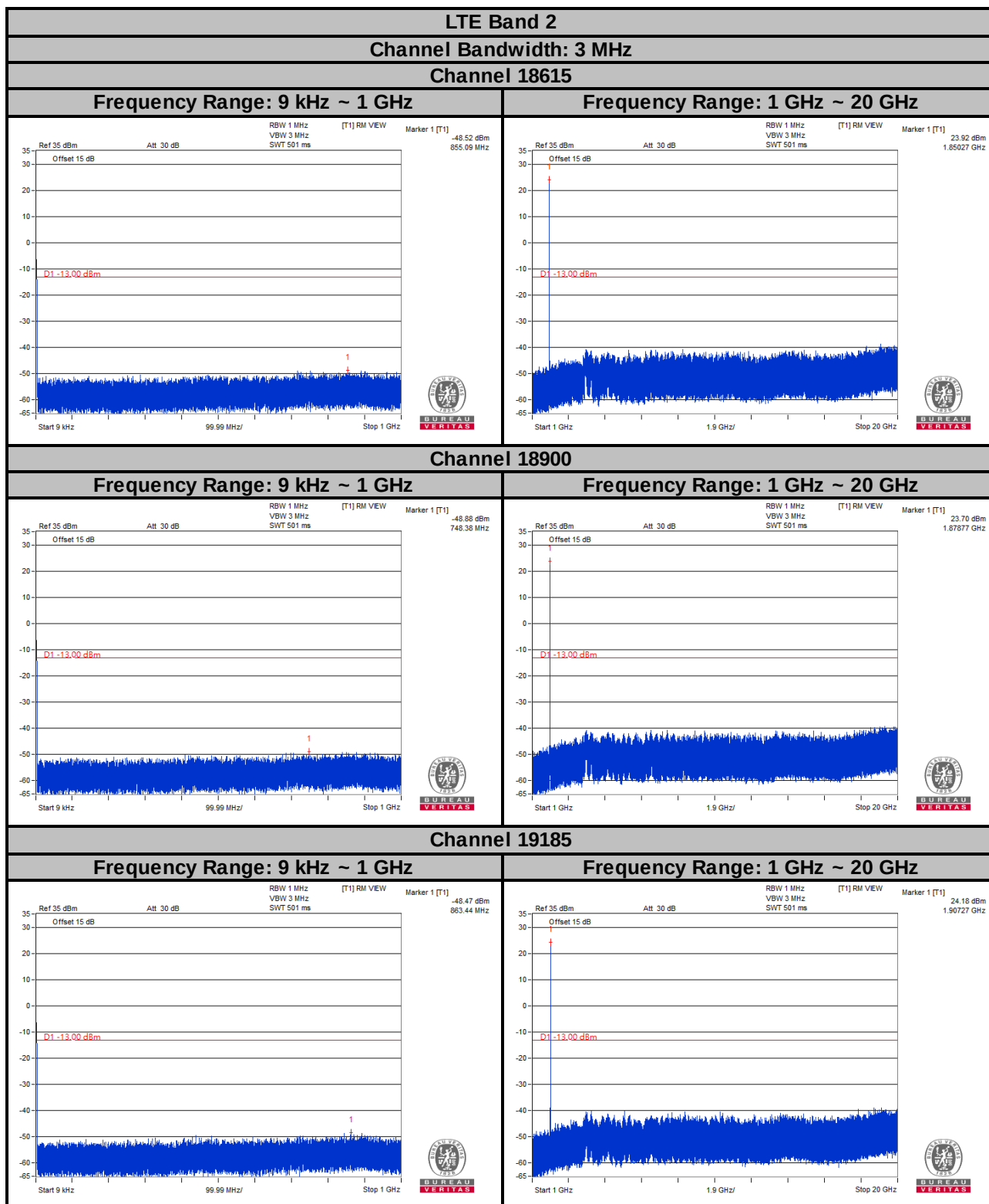
4.7.4 Test Results



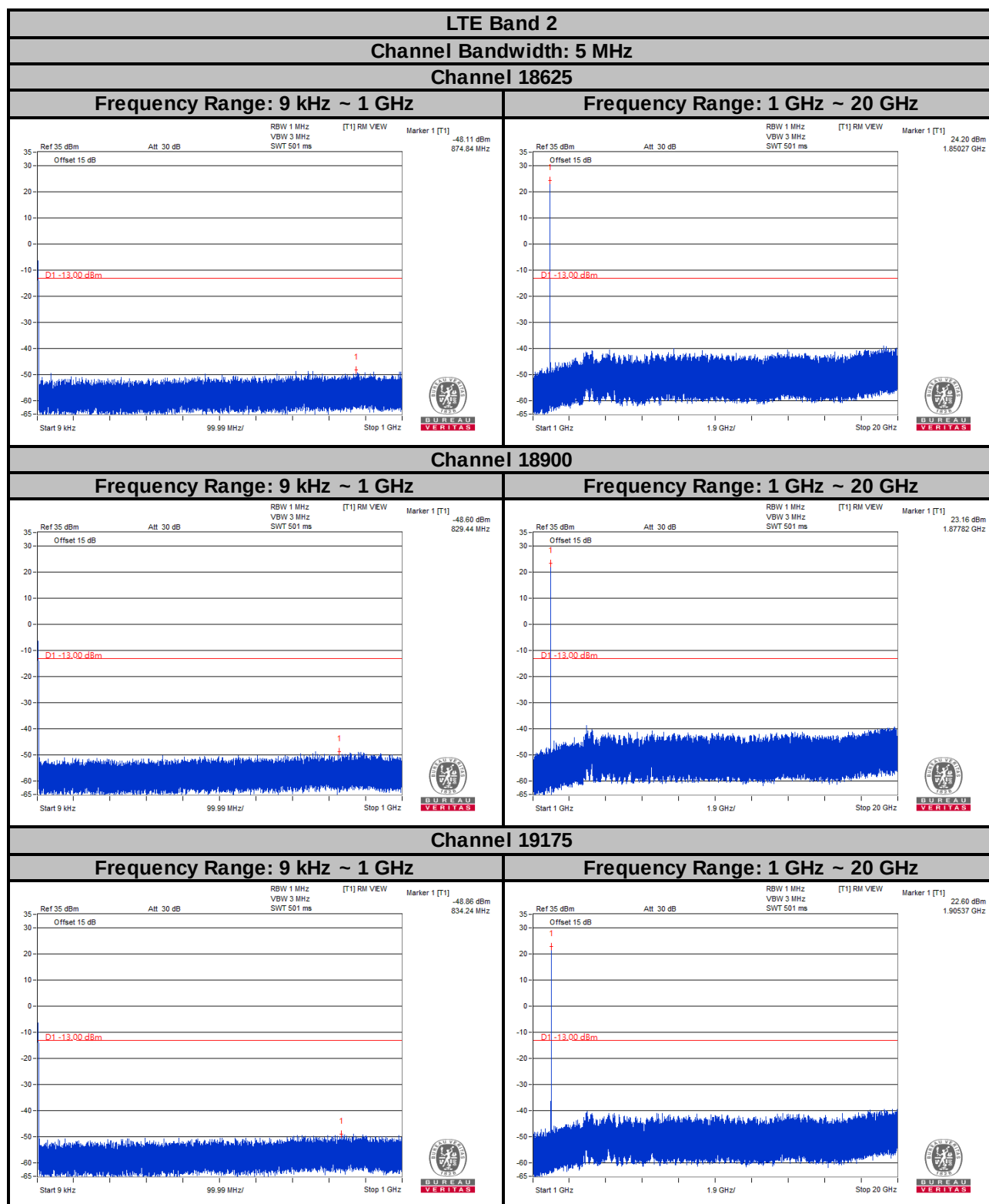
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



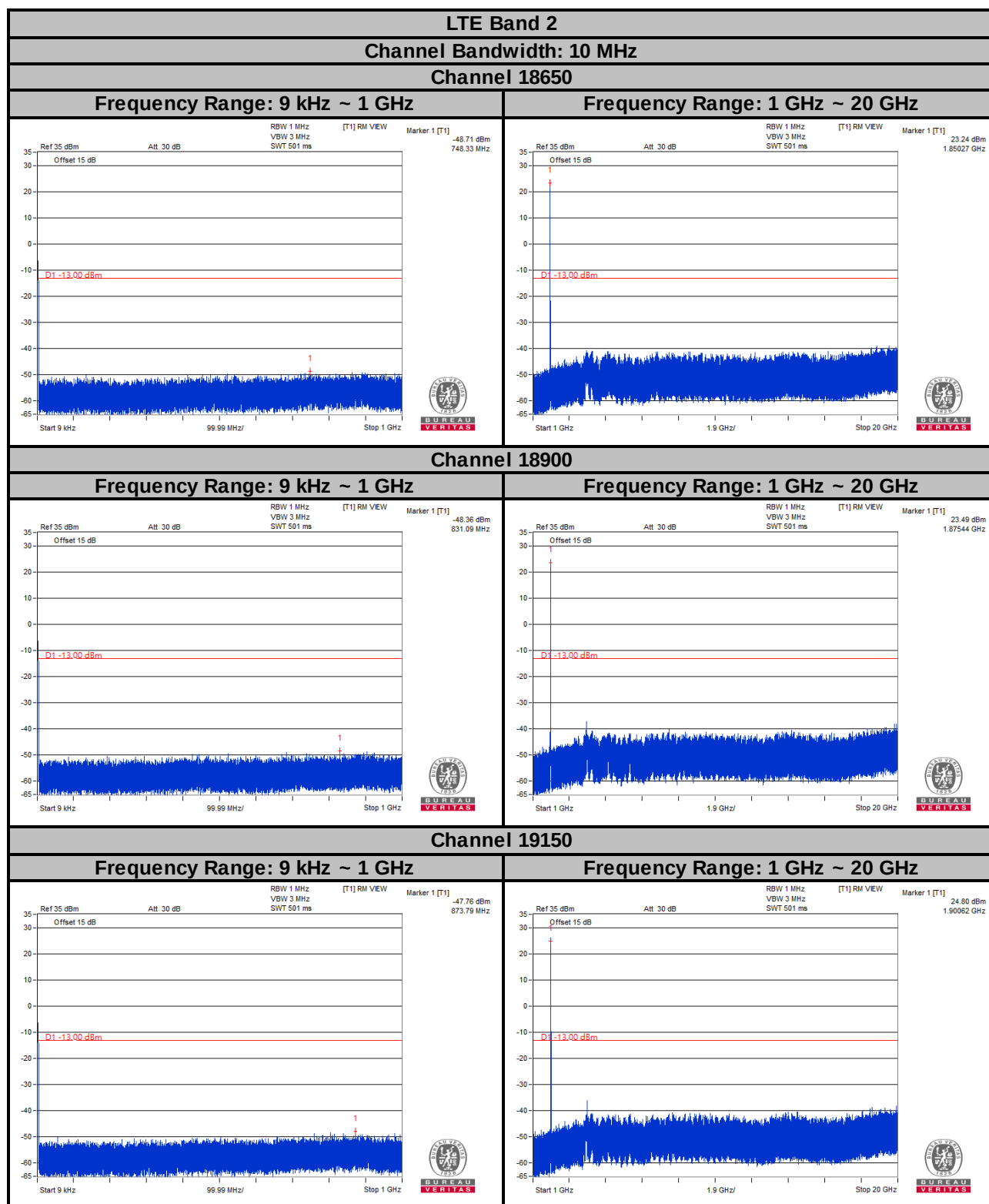
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



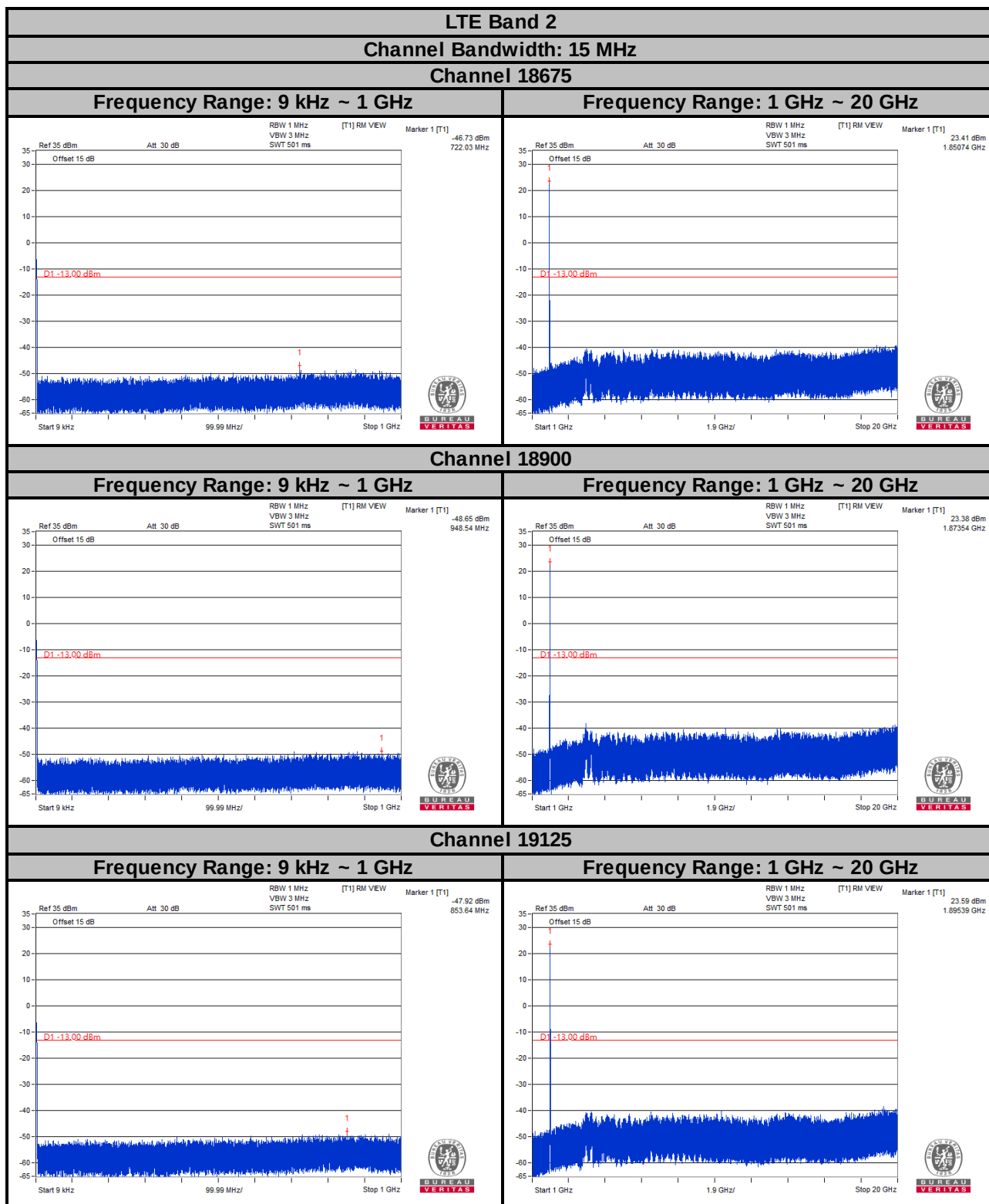
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



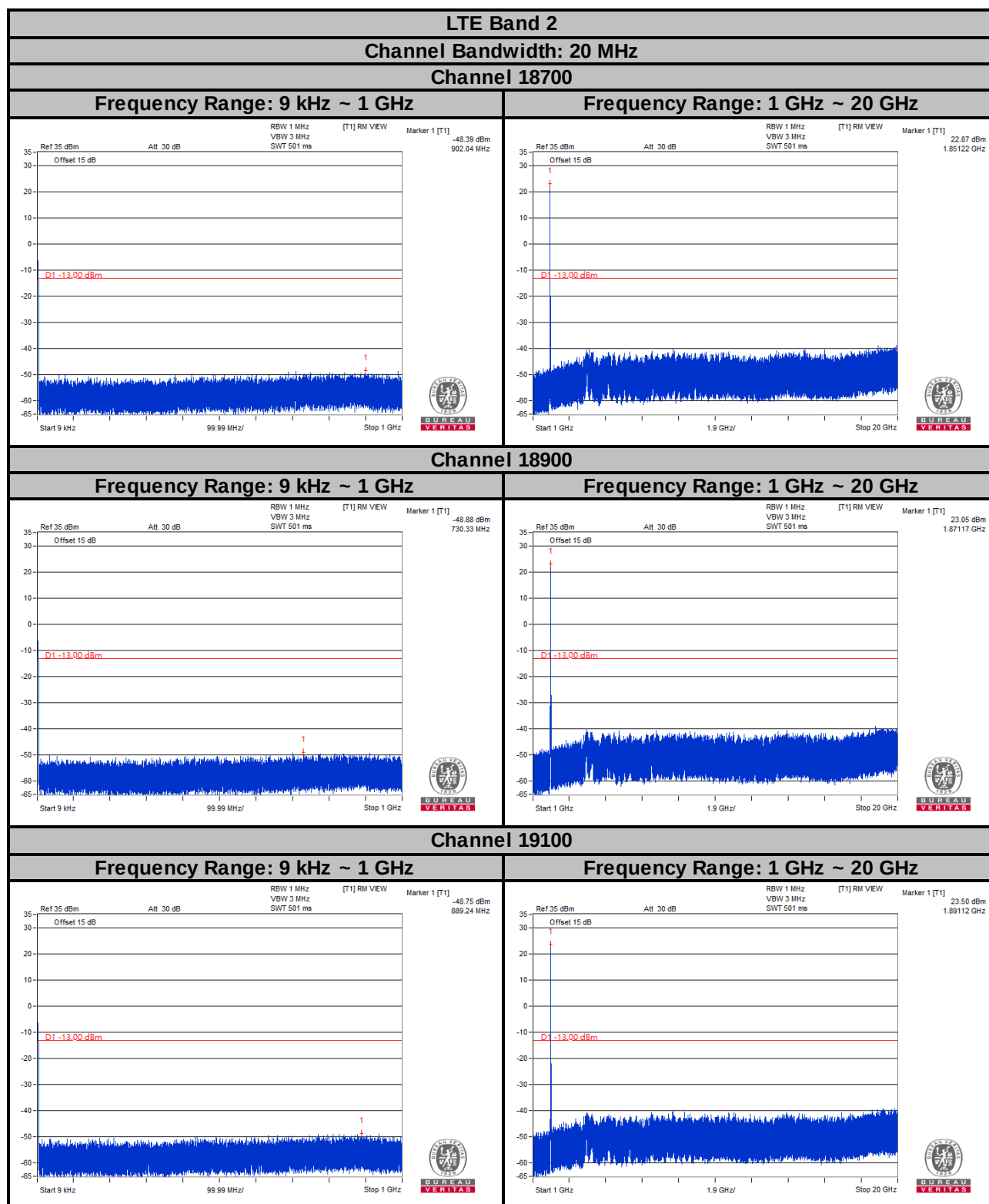
Note: The signal over the limit in 9 kHz is from spectrum analyzer.



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



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



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

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. The emission limit is equal to -13 dBm.

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
 $EIRP \text{ (dBm)} = E \text{ (dB}\mu\text{V/m)} + 20\log(D) - 104.8$; where D is the measurement distance (in the far field region) in m.
 $ERP \text{ (dBm)} = E \text{ (dB}\mu\text{V/m)} + 20\log(D) - 104.8 - 2.15$; 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 1 MHz/3 MHz.
2. The emission levels were against the limit of frequency range 9 kHz ~ 30 MHz:

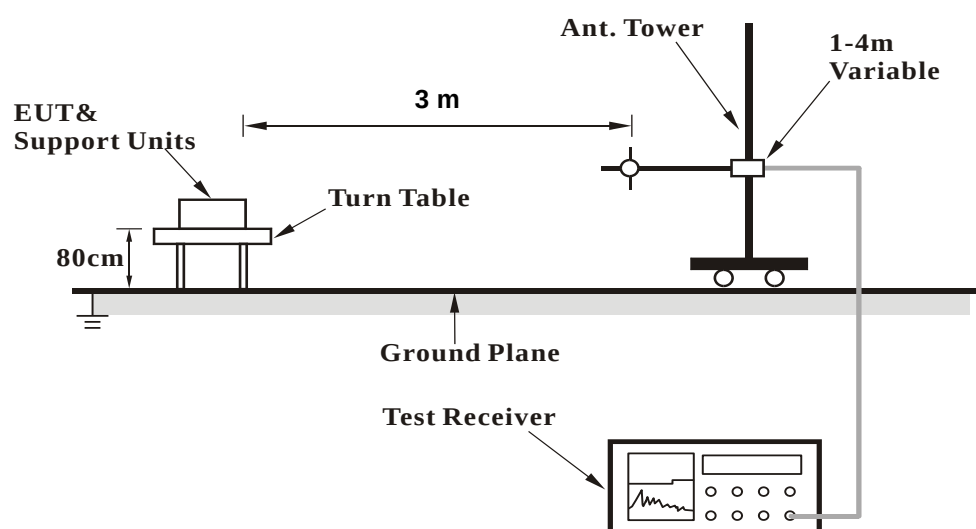
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

4.8.3 Deviation from Test Standard

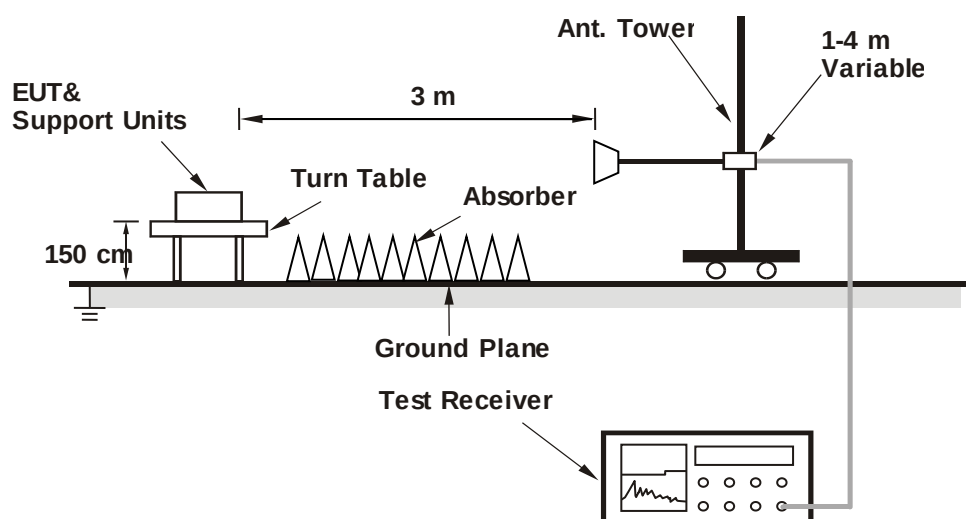
No deviation.

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

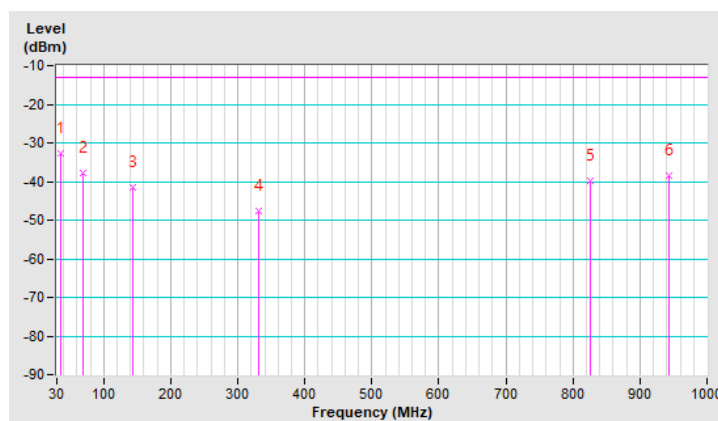
WCDMA Band 2

RF Mode	TX WCDMA Band II	Channel	CH 9400 : 1880 MHz
Frequency Range	30MHz ~ 1GHz		

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	36.79	-32.84	-13.00	-19.84	1.39 H	14	72.26	-105.10
2	69.77	-37.86	-13.00	-24.86	1.04 H	128	68.28	-106.14
3	143.49	-41.54	-13.00	-28.54	1.58 H	145	62.61	-104.15
4	330.70	-47.66	-13.00	-34.66	2.26 H	229	53.46	-101.12
5	825.40	-39.71	-13.00	-26.71	1.16 H	226	51.63	-91.34
6	943.74	-38.58	-13.00	-25.58	2.20 H	14	50.29	-88.87

Remarks:

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

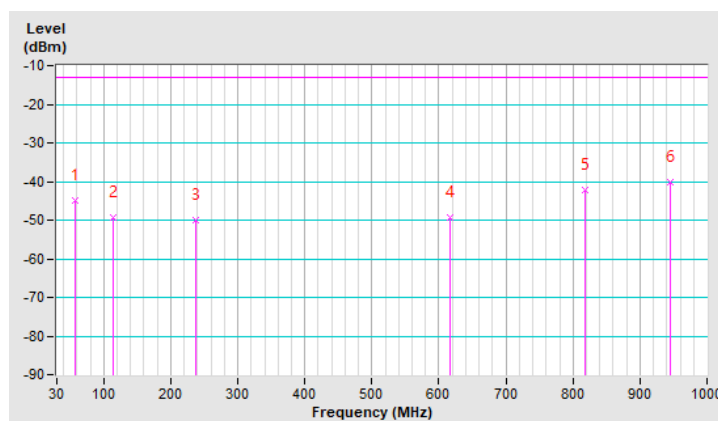


RF Mode	TX WCDMA Band II	Channel	CH 9400 : 1880 MHz
Frequency Range	30MHz ~ 1GHz		

Antenna Polarity & Test Distance : Vertical 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	58.13	-45.07	-13.00	-32.07	1.26 V	15	59.54	-104.61
2	114.39	-49.42	-13.00	-36.42	1.94 V	342	57.36	-106.78
3	236.61	-50.01	-13.00	-37.01	1.36 V	288	54.80	-104.81
4	615.88	-49.28	-13.00	-36.28	2.23 V	180	45.89	-95.17
5	817.64	-42.04	-13.00	-29.04	1.05 V	350	49.52	-91.56
6	944.71	-40.11	-13.00	-27.11	1.30 V	325	48.72	-88.83

Remarks:

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



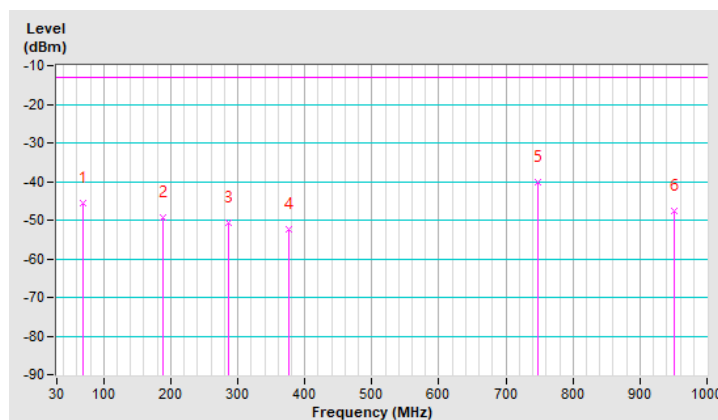
LTE Band 2, Channel Bandwidth: 1.4MHz

RF Mode	TX LTE Band II-1.4MHz	Channel	CH 18607 : 1850.7 MHz
Frequency Range	30MHz ~ 1GHz		

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	68.80	-45.52	-13.00	-32.52	1.23 H	190	60.53	-106.05
2	188.11	-49.48	-13.00	-36.48	2.35 H	215	56.74	-106.22
3	287.05	-50.68	-13.00	-37.68	3.25 H	289	51.65	-102.33
4	375.32	-52.50	-13.00	-39.50	2.14 H	198	47.87	-100.37
5	746.83	-40.20	-13.00	-27.20	1.16 H	31	52.81	-93.01
6	950.53	-47.78	-13.00	-34.78	2.31 H	133	41.00	-88.78

Remarks:

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

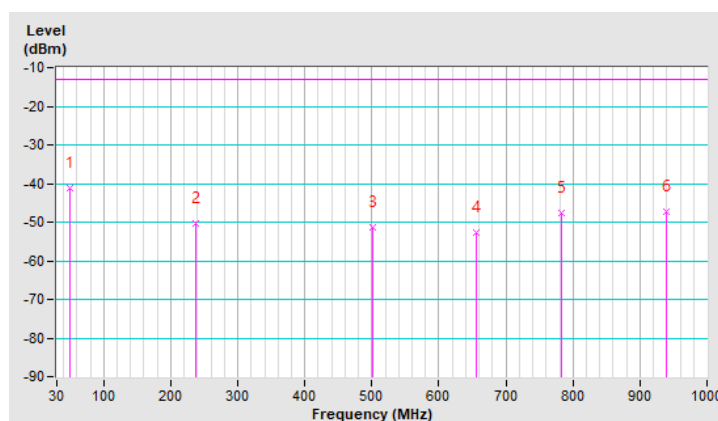


RF Mode	TX LTE Band II-1.4MHz	Channel	CH 18607 : 1850.7 MHz
Frequency Range	30MHz ~ 1GHz		

Antenna Polarity & Test Distance : Vertical 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	49.40	-41.27	-13.00	-28.27	1.05 V	229	62.87	-104.14
2	237.58	-50.30	-13.00	-37.30	2.38 V	280	54.40	-104.70
3	500.45	-51.35	-13.00	-38.35	1.77 V	215	46.20	-97.55
4	656.62	-52.76	-13.00	-39.76	2.31 V	28	41.91	-94.67
5	783.69	-47.49	-13.00	-34.49	2.22 V	258	44.46	-91.95
6	938.89	-47.17	-13.00	-34.17	2.08 V	85	41.80	-88.97

Remarks:

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



Above 1GHz

WCDMA Band 2

RF Mode	TX WCDMA Band II	Channel	CH 9262 : 1852.4 MHz
Frequency Range	1GMHz ~ 20GHz		

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	3704.80	-44.24	-13.00	-31.24	1.47 H	123	47.38	-91.62
Antenna Polarity & Test Distance : Vertical 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	3704.80	-41.65	-13.00	-28.65	1.93 V	165	49.97	-91.62

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.

RF Mode	TX WCDMA Band II	Channel	CH 9400 : 1880 MHz
Frequency Range	1GMHz ~ 20GHz		

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	3760.00	-45.09	-13.00	-32.09	1.46 H	107	46.33	-91.42
Antenna Polarity & Test Distance : Vertical 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	3760.00	-40.61	-13.00	-27.61	1.96 V	142	50.81	-91.42

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.

RF Mode	TX WCDMA Band II	Channel	CH 9538 : 1907.6 MHz
Frequency Range	1GMHz ~ 20GHz		

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	3815.20	-44.56	-13.00	-31.56	1.52 H	140	46.54	-91.10
Antenna Polarity & Test Distance : Vertical 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	3815.20	-41.47	-13.00	-28.47	2.25 V	170	49.63	-91.10

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 2, Channel Bandwidth: 1.4MHz

RF Mode	TX LTE Band II-1.4MHz	Channel	CH 18607 : 1850.7 MHz
Frequency Range	1GMHz ~ 20GHz		

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	3701.40	-35.28	-13.00	-22.28	2.94 H	236	56.35	-91.63
Antenna Polarity & Test Distance : Vertical 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	3701.40	-35.42	-13.00	-22.42	2.07 V	192	56.21	-91.63

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.

RF Mode	TX LTE Band II-1.4MHz	Channel	CH 18900 : 1880 MHz
Frequency Range	1GMHz ~ 20GHz		

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	3760.00	-35.69	-13.00	-22.69	2.93 H	233	55.73	-91.42
Antenna Polarity & Test Distance : Vertical 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	3760.00	-35.78	-13.00	-22.78	2.04 V	196	55.64	-91.42

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.

RF Mode	TX LTE Band II-1.4MHz	Channel	CH 19193 : 1909.3 MHz
Frequency Range	1GMHz ~ 20GHz		

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	3818.60	-35.44	-13.00	-22.44	2.94 H	239	55.65	-91.09
Antenna Polarity & Test Distance : Vertical 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	3818.60	-35.39	-13.00	-22.39	2.11 V	192	55.70	-91.09

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 2, Channel Bandwidth 5MHz

RF Mode	TX LTE Band II-5MHz	Channel	CH 18625 : 1852.5 MHz
Frequency Range	1GMHz ~ 20GHz		

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	3705.00	-36.06	-13.00	-23.06	2.99 H	242	55.56	-91.62
Antenna Polarity & Test Distance : Vertical 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	3705.00	-35.85	-13.00	-22.85	2.00 V	195	55.77	-91.62

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.

RF Mode	TX LTE Band II-5MHz	Channel	CH 18900 : 1880 MHz
Frequency Range	1GMHz ~ 20GHz		

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	3760.00	-35.73	-13.00	-22.73	2.93 H	239	55.69	-91.42
Antenna Polarity & Test Distance : Vertical 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	3760.00	-35.67	-13.00	-22.67	2.02 V	188	55.75	-91.42

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.

RF Mode	TX LTE Band II-5MHz	Channel	CH 19175 : 1907.5 MHz
Frequency Range	1GMHz ~ 20GHz		

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	3815.00	-35.39	-13.00	-22.39	2.90 H	242	55.71	-91.10
Antenna Polarity & Test Distance : Vertical 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	3815.00	-35.44	-13.00	-22.44	1.96 V	183	55.66	-91.10

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 2, Channel Bandwidth 20MHz

RF Mode	TX LTE Band II-20MHz	Channel	CH 18700 : 1860 MHz
Frequency Range	1GMHz ~ 20GHz		

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	3720.00	-35.64	-13.00	-22.64	2.97 H	246	55.93	-91.57
Antenna Polarity & Test Distance : Vertical 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	3720.00	-36.13	-13.00	-23.13	2.01 V	191	55.44	-91.57

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.

RF Mode	TX LTE Band II-20MHz	Channel	CH 18900 : 1880 MHz
Frequency Range	1GMHz ~ 20GHz		

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	3760.00	-35.29	-13.00	-22.29	2.98 H	245	56.13	-91.42
Antenna Polarity & Test Distance : Vertical 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	3760.00	-35.68	-13.00	-22.68	2.03 V	199	55.74	-91.42

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.

RF Mode	TX LTE Band II-20MHz	Channel	CH 19100 : 1900 MHz
Frequency Range	1GMHz ~ 20GHz		

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	3800.00	-35.36	-13.00	-22.36	2.84 H	237	55.78	-91.14
Antenna Polarity & Test Distance : Vertical 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	3800.00	-35.48	-13.00	-22.48	2.05 V	189	55.66	-91.14

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.

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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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