

FCC Test Report (Part 22)

Report No.: RF200306C24

FCC ID: 2AARNWLTPH-8M

Test Model: WLTPH-8M

Received Date: Mar. 06, 2020

Test Date: Mar. 18 ~ Apr. 15, 2020

Issued Date: Apr. 21, 2020

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FCC Registration / 788550 / TW0003

Designation Number:



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Release Control Record

Issue No.	Description	Date Issued
RF200306C24	Original release	Apr. 21, 2020

1 Certificate of Conformity

Product: LTE Module

Brand: PHIHONG

Test Model: WLTPH-8M

Sample Status: Engineering Sample

Applicant: PHIHONG TECHNOLOGY CO., LTD.

Test Date: Mar. 18 ~ Apr. 15, 2020

Standards: FCC Part 22, Subpart H

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:** Apr. 21, 2020
Pettie Chen / Senior Specialist

Approved by : Bruce Chen , **Date:** Apr. 21, 2020
Bruce Chen / Senior Project Engineer

2 Summary of Test Results

Applied Standard: FCC Part 22 & Part 2			
FCC Clause	Test Item	Result	Remarks
2.1046 22.913 (a)	Effective radiated power	Pass	Meet the requirement of limit.
2.1047	Modulation Characteristics	Pass	Meet the requirement
22.913 (d)	Peak To Average Ratio	Pass	Meet the requirement of limit.
2.1055 22.355	Frequency Stability	Pass	Meet the requirement of limit.
2.1049	Occupied Bandwidth	Pass	Meet the requirement of limit.
22.917	Band Edge Measurements	Pass	Meet the requirement of limit.
2.1051 22.917	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 22.917	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -33.1dB at 141.06MHz.

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

2.1 Measurement Uncertainty

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

Measurement	Frequency	Expanded Uncertainty (k=2) ($\pm$)
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.04 dB
	30MHz ~ 200MHz	3.86 dB
	200MHz ~ 1000MHz	3.87 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Test Site and Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESIB7	100187	May 30, 2019	May 29, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	Jun. 10, 2019	Jun. 09, 2020
MXG Vector signal generator KEYSIGHT	N5182B	MY53052282	Dec. 23, 2019	Dec. 22, 2020
Radio Communication Analyzer Anritsu	MT8821C	6261806803	Jan. 18, 2020	Jan. 17, 2021
BILOG Antenna SCHWARZBECK	VULB9168	9168-161	Nov. 08, 2019	Nov. 07, 2020
BILOG Antenna SCHWARZBECK	VULB9168	9168-171	Nov. 11, 2019	Nov. 10, 2020
HORN Antenna SCHWARZBECK	9120D	209	Nov. 24, 2019	Nov. 23, 2020
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Nov. 24, 2019	Nov. 23, 2020
Preamplifier Agilent (Below 1GHz)	8447D	2944A10738	Aug. 20, 2019	Aug. 19, 2020
Preamplifier Agilent (Above 1GHz)	8449B	3008A02367	Feb. 18, 2020	Feb. 17, 2021
RF Coaxial Cable WOKEN With 5dB PAD	8D-FB	Cable-CH3-01	Aug. 20, 2019	Aug. 19, 2020
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH3-03 (223653/4)	Aug. 20, 2019	Aug. 19, 2020
RF signal cable HUBER+SUHNER& EMCI	SUCOFLEX 104&EMC104-SM -SM-8000	Cable-CH3-03 (309224+170907)	Aug. 20, 2019	Aug. 19, 2020
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Standard Temperature And Humidity Chamber	MHU-225AU	920842	May 31, 2019	May 30, 2020
JFW 20dB attenuation	50HF-020-SMA	NA	NA	NA
True RMS Clamp Meter Fluke	325	31130711WS	May 21, 2019	May 20, 2020
DC power supply	U8002A	MY56330015	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 3.

3 General Information

3.1 General Description of EUT

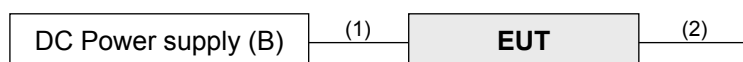
Product	LTE Module		
Brand	PHIHONG		
Test Model	WLTPH-8M		
Sample Status	Engineering Sample		
Power Supply Rating	3.8Vdc 10Vdc~35Vdc (for DC power supply)		
Modulation Type	WCDMA: BPSK, QPSK HSDPA: BPSK HSUPA: QPSK LTE: QPSK, 16QAM		
Operating Frequency	WCDMA Band 5	826.4~846.6MHz	
	LTE Band 5 (Channel Bandwidth 1.4MHz)	824.7~848.3MHz	
	LTE Band 5 (Channel Bandwidth 3MHz)	825.5~847.5MHz	
	LTE Band 5 (Channel Bandwidth 5MHz)	826.5~846.5MHz	
	LTE Band 5 (Channel Bandwidth 10MHz)	829.0~844.0MHz	
Max. ERP Power	WCDMA Band 5	214.783mW (23.32dBm)	
		QPSK	16QAM
	LTE Band 5 (Channel Bandwidth 1.4MHz)	216.272mW (23.35dBm)	173.780mW (22.40dBm)
	LTE Band 5 (Channel Bandwidth 3MHz)	224.388mW (23.51dBm)	179.887mW (22.55dBm)
	LTE Band 5 (Channel Bandwidth 5MHz)	220.293mW (23.43dBm)	178.649mW (22.52dBm)
	LTE Band 5 (Channel Bandwidth 10MHz)	224.905mW (23.52dBm)	166.341mW (22.21dBm)
Emission Designator	WCDMA Band 5	4M16F9W	
		QPSK	16QAM
	LTE Band 5 (Channel Bandwidth 1.4MHz)	1M09G7D	1M09D7W
	LTE Band 5 (Channel Bandwidth 3MHz)	2M70G7D	2M70D7W
	LTE Band 5 (Channel Bandwidth 5MHz)	4M49G7D	4M49D7W
	LTE Band 5 (Channel Bandwidth 10MHz)	8M96G7D	8M96D7W
Antenna Type	Refer to Note as below		
Antenna Connector	Refer to Note as below		
Accessory Device	NA		
Cable Supplied	NA		

Note:

1. The following antennas were provided to the EUT.

Antenna No.	Brand	Model	Antenna Gain(dBi)	Antenna Type	Connector Type
LTE0EM99-AP150L1	Brito	LTE EMBEDDED ANTENNA	2	PCB	SMA ST. PLUG

3.2 Configuration of System under Test



Remote site



3.2.1 Description of Support Units

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

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Radio Communication Analyzer	Anritsu	MT8821C	6261806803	NA	-
B.	DC Power Supply	Topward	33010D	807748	NA	-

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Power cable	1	1	-	0	-
2.	USB cable	1	1	Y	0	-

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 on Z-plane. Following channel(s) was (were) selected for the final test as listed below.

WCDMA Band 5

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Mode
-	ERP	4132 to 4233	4132 (826.4MHz), 4182 (836.4MHz), 4233 (846.6MHz)	WCDMA, HSDPA, HSUPA
-	Modulation Characteristics	4132 to 4233	4182 (836.4MHz)	WCDMA, HSDPA, HSUPA
-	Frequency Stability	4132 to 4233	4132 (826.4MHz), 4233 (846.6MHz)	WCDMA
-	Occupied Bandwidth	4132 to 4233	4132 (826.4MHz), 4182 (836.4MHz), 4233 (846.6MHz)	WCDMA, HSDPA, HSUPA
-	Band Edge	4132 to 4233	4132 (826.4MHz), 4233 (846.6MHz)	WCDMA, HSDPA, HSUPA
-	Peak To Average Ratio	4132 to 4233	4132 (826.4MHz), 4182 (836.4MHz), 4233 (846.6MHz)	WCDMA, HSDPA, HSUPA
-	Conducted Emission	4132 to 4233	4132 (826.4MHz), 4182 (836.4MHz), 4233 (846.6MHz)	WCDMA, HSDPA, HSUPA
-	Radiated Emission Below 1GHz	4132 to 4233	4233 (846.6MHz)	WCDMA
-	Radiated Emission Above 1GHz	4132 to 4233	4132 (826.4MHz), 4182 (836.4MHz), 4233 (846.6MHz)	WCDMA

Note:

1. This device was tested under all modulations. The worst case of conducted output power was found in WCDMA modulation. Therefore, only ERP, modulation characteristics, occupied bandwidth, band edge and peak to average ratio items had been tested under WCDMA, HSDPA and HSUPA mode, the other items were performed under WCDMA mode only.
2. For radiated emission below 1GHz, select the worst radiated emission (above 1GHz) channel for final testing.

LTE Band 5

EUT Configure Mode	Test item	Available channel	Tested channel	Channel Bandwidth	Modulation	Mode
-	ERP	20407 to 20643	20407(824.7MHz), 20525(836.5MHz), 20643(848.3MHz)	1.4MHz	QPSK / 16QAM	1 RB / 0 RB Offset
		20415 to 20635	20415(825.5MHz), 20525(836.5MHz), 20635(847.5MHz)	3MHz	QPSK / 16QAM	1 RB / 0 RB Offset
		20425 to 20625	20425(826.5MHz), 20525(836.5MHz), 20625(846.5MHz)	5MHz	QPSK / 16QAM	1 RB / 0 RB Offset
		20450 to 20600	20450(829.0MHz), 20525(836.5MHz), 20600(844.0MHz)	10MHz	QPSK / 16QAM	1 RB / 0 RB Offset
-	Modulation characteristics	20450 to 20600	20525(836.5MHz)	10MHz	QPSK / 16QAM	50 RB / 0 RB Offset
-	Frequency Stability	20407 to 20643	20407(824.7MHz), 20643(848.3MHz)	1.4MHz	QPSK	6 RB / 0 RB Offset
		20415 to 20635	20415(825.5MHz), 20635(847.5MHz)	3MHz	QPSK	15 RB / 0 RB Offset
		20425 to 20625	20425(826.5MHz), 20625(846.5MHz)	5MHz	QPSK	25 RB / 0 RB Offset
		20450 to 20600	20450(829.0MHz), 20600(844.0MHz)	10MHz	QPSK	50 RB / 0 RB Offset
-	Occupied Bandwidth	20407 to 20643	20407(824.7MHz), 20525(836.5MHz), 20643(848.3MHz)	1.4MHz	QPSK / 16QAM	6 RB / 0RB Offset
		20415 to 20635	20415(825.5MHz), 20525(836.5MHz), 20635(847.5MHz)	3MHz	QPSK / 16QAM	15 RB / 0RB Offset
		20425 to 20625	20425(826.5MHz), 20525(836.5MHz), 20625(846.5MHz)	5MHz	QPSK / 16QAM	25RB / 0RB Offset
		20450 to 20600	20450(829.0MHz), 20525(836.5MHz), 20600(844.0MHz)	10MHz	QPSK / 16QAM	50RB / 0RB Offset
-	Band Edge	20407 to 20643	20407(824.7MHz), 20643(848.3MHz)	1.4MHz	QPSK	1 RB / 0 RB Offset 1 RB / 5 RB Offset 6 RB / 0 RB Offset
		20415 to 20635	20415(825.5MHz), 20635(847.5MHz)	3MHz	QPSK	1 RB / 0 RB Offset 1 RB / 14 RB Offset 15 RB / 0 RB Offset
		20425 to 20625	20425(826.5MHz), 20625(846.5MHz)	5MHz	QPSK	1 RB / 0 RB Offset 1 RB / 24 RB Offset 25 RB / 0 RB Offset
		20450 to 20600	20450(829.0MHz), 20600(844.0MHz)	10MHz	QPSK	1 RB / 0 RB Offset 1 RB / 49 RB Offset 50 RB / 0 RB Offset

EUT Configure Mode	Test item	Available channel	Tested channel	Channel Bandwidth	Modulation	Mode
-	Peak to Average Ratio	20407 to 20643	20407(824.7MHz), 20525(836.5MHz), 20643(848.3MHz)	1.4MHz	QPSK / 16QAM	1 RB / 0 RB Offset
		20415 to 20635	20415(825.5MHz), 20525(836.5MHz), 20635(847.5MHz)	3MHz	QPSK / 16QAM	1 RB / 0 RB Offset
		20425 to 20625	20425(826.5MHz), 20525(836.5MHz), 20625(846.5MHz)	5MHz	QPSK / 16QAM	1 RB / 0 RB Offset
		20450 to 20600	20450(829.0MHz), 20525(836.5MHz), 20600(844.0MHz)	10MHz	QPSK / 16QAM	1 RB / 0 RB Offset
-	Conducted Emission	20407 to 20643	20407(824.7MHz), 20525(836.5MHz), 20643(848.3MHz)	1.4MHz	QPSK / 16QAM	1 RB / 0 RB Offset
		20415 to 20635	20415(825.5MHz), 20525(836.5MHz), 20635(847.5MHz)	3MHz	QPSK	1 RB / 0 RB Offset
		20425 to 20625	20425(826.5MHz), 20525(836.5MHz), 20625(846.5MHz)	5MHz	QPSK / 16QAM	1 RB / 0 RB Offset
		20450 to 20600	20450(829.0MHz), 20525(836.5MHz), 20600(844.0MHz)	10MHz	QPSK	1 RB / 0 RB Offset
-	Radiated Emission Below 1GHz	20450 to 20600	20525(836.5MHz)	10MHz	QPSK	1 RB / 0 RB Offset
-	Radiated Emission Above 1GHz	20407 to 20643	20407(824.7MHz), 20525(836.5MHz), 20643(848.3MHz)	1.4MHz	QPSK	1 RB / 0 RB Offset
		20425 to 20625	20425(826.5MHz), 20525(836.5MHz), 20625(846.5MHz)	5MHz	QPSK	1 RB / 0 RB Offset
		20450 to 20600	20450(829.0MHz), 20525(836.5MHz), 20600(844.0MHz)	10MHz	QPSK	1 RB / 0 RB Offset

Note:

1. For radiated emission below 1GHz, select the worst radiated emission (above 1GHz) channel for final testing.
2. 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.
3. The conducted output power for QPSK and 16QAM, measured value of QPSK is higher than 16QAM mode. Therefore, only ERP, Modulation characteristics, occupied bandwidth and Peak to average ratio items had been tested under QPSK and 16QAM modes, the other test items were performed under QPSK mode only.

Test Condition:

Test Item	Environmental Conditions	Input Power (system)	Tested By
ERP	25deg. C, 70%RH	3.8Vdc	Willy Cheng
Modulation Characteristics	24deg. C, 64%RH	3.8Vdc	Willy Cheng
Frequency Stability	24deg. C, 64%RH	3.8Vdc	Willy Cheng
Occupied Bandwidth	24deg. C, 64%RH	3.8Vdc	Willy Cheng
Band Edge	24deg. C, 64%RH	3.8Vdc	Willy Cheng
Peak To Average Ratio	24deg. C, 64%RH	3.8Vdc	Willy Cheng
Conducted Emission	24deg. C, 64%RH	3.8Vdc	Willy Cheng
Radiated Emission	22deg. C, 68%RH	120Vac, 60Hz	Adair Peng

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 22

ANSI 63.26-2015

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

References Test Guidance:

KDB 971168 D01 Power Meas License Digital Systems v03r01

ANSI/TIA/EIA-603-E 2016

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 7 watts e.r.p.

4.1.2 Test Procedures

Conducted Power Measurement:

The EUT was set up for the maximum power with WCDMA, 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

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

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

where

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

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

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

4.1.3 Test Setup

Conducted Power Measurement:



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

4.1.4 Test Results

Conducted Output Power (dBm)

Band	WCDMA V		
TX Channel	4132	4182	4233
Rx Channel	4357	4407	4458
Frequency (MHz)	826.4	836.4	846.6
RMC 12.2K	23.46	23.47	23.42
HSDPA Subtest-1	23.40	23.44	23.39
HSDPA Subtest-2	23.33	23.41	23.33
HSDPA Subtest-3	22.82	22.90	22.83
HSDPA Subtest-4	22.72	22.85	22.73
HSUPA Subtest-1	23.35	23.39	23.35
HSUPA Subtest-2	21.31	21.33	21.29
HSUPA Subtest-3	22.33	22.40	22.36
HSUPA Subtest-4	21.22	21.29	21.27
HSUPA Subtest-5	23.26	23.30	23.28

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20407	20525	20643
		Frequency (MHz)		824.7	836.5	848.3
1.4M	QPSK	1	0	23.18	23.50	23.20
		1	2	23.48	23.49	23.28
		1	5	23.41	23.49	23.21
		3	0	23.33	23.35	23.36
		3	1	23.38	23.39	23.38
		3	3	23.34	23.35	23.37
		6	0	22.40	22.57	22.60
	16QAM	1	0	22.29	22.55	22.25
		1	2	22.30	22.32	22.24
		1	5	22.27	22.44	22.33
		3	0	22.44	22.54	22.52
		3	1	22.47	22.48	22.50
		3	3	22.52	22.44	22.45
		6	0	21.46	21.57	21.40

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20415	20525	20635
		Frequency (MHz)		825.5	836.5	847.5
3M	QPSK	1	0	23.40	23.66	23.52
		1	7	23.62	23.65	23.65
		1	14	23.54	23.38	23.53
		8	0	22.64	22.54	22.63
		8	3	22.64	22.58	22.54
		8	7	22.42	22.59	22.57
		15	0	22.48	22.66	22.56
	16QAM	1	0	22.32	22.70	22.50
		1	7	22.25	22.13	22.57
		1	14	22.39	22.31	22.35
		8	0	21.19	21.45	21.54
		8	3	21.49	21.42	21.41
		8	7	21.44	21.62	21.51
		15	0	21.41	21.59	21.66

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20425	20525	20625
		Frequency (MHz)		826.5	836.5	846.5
5M	QPSK	1	0	23.46	23.58	23.39
		1	12	23.56	23.50	23.57
		1	24	23.34	23.53	23.26
		12	0	22.56	22.60	22.66
		12	6	22.53	22.62	22.74
		12	13	22.60	22.62	22.55
		25	0	22.58	22.63	22.54
	16QAM	1	0	22.67	22.50	22.24
		1	12	22.51	22.61	22.37
		1	24	22.62	22.40	22.14
		12	0	21.43	21.54	21.63
		12	6	21.31	21.73	21.72
		12	13	21.36	21.53	21.45
		25	0	21.52	21.45	21.39

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20450	20525	20600
		Frequency (MHz)		829	836.5	844
10M	QPSK	1	0	23.36	23.67	23.44
		1	24	23.50	23.50	23.27
		1	49	23.23	23.31	23.37
		25	0	22.62	22.63	22.57
		25	12	22.62	22.68	22.52
		25	25	22.61	22.59	22.50
		50	0	22.61	22.61	22.66
	16QAM	1	0	22.30	22.18	22.36
		1	24	22.23	22.29	22.20
		1	49	22.22	22.29	21.99
		25	0	21.46	21.56	21.53
		25	12	21.52	21.52	21.61
		25	25	21.50	21.71	21.49
		50	0	21.57	21.58	21.51

ERP Power (dBm)

Band	WCDMA V		
TX Channel	4132	4182	4233
Rx Channel	4357	4407	4458
Frequency (MHz)	826.4	836.4	846.6
RMC 12.2K	23.31	23.32	23.27
HSDPA Subtest-1	23.25	23.29	23.24
HSDPA Subtest-2	23.18	23.26	23.18
HSDPA Subtest-3	22.67	22.75	22.68
HSDPA Subtest-4	22.57	22.70	22.58
HSUPA Subtest-1	23.20	23.24	23.20
HSUPA Subtest-2	21.16	21.18	21.14
HSUPA Subtest-3	22.18	22.25	22.21
HSUPA Subtest-4	21.07	21.14	21.12
HSUPA Subtest-5	23.11	23.15	23.13

*ERP = Conducted + antenna gain (2dBi)-2.15

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20407	20525	20643
		Frequency (MHz)		824.7	836.5	848.3
1.4M	QPSK	1	0	23.03	23.35	23.05
		1	2	23.33	23.34	23.13
		1	5	23.26	23.34	23.06
		3	0	23.18	23.20	23.21
		3	1	23.23	23.24	23.23
		3	3	23.19	23.20	23.22
		6	0	22.25	22.42	22.45
	16QAM	1	0	22.14	22.40	22.10
		1	2	22.15	22.17	22.09
		1	5	22.12	22.29	22.18
		3	0	22.29	22.39	22.37
		3	1	22.32	22.33	22.35
		3	3	22.37	22.29	22.30
		6	0	21.31	21.42	21.25

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20415	20525	20635
		Frequency (MHz)		825.5	836.5	847.5
3M	QPSK	1	0	23.25	23.51	23.37
		1	7	23.47	23.50	23.50
		1	14	23.39	23.23	23.38
		8	0	22.49	22.39	22.48
		8	3	22.49	22.43	22.39
		8	7	22.27	22.44	22.42
		15	0	22.33	22.51	22.41
	16QAM	1	0	22.17	22.55	22.35
		1	7	22.10	21.98	22.42
		1	14	22.24	22.16	22.20
		8	0	21.04	21.30	21.39
		8	3	21.34	21.27	21.26
		8	7	21.29	21.47	21.36
		15	0	21.26	21.44	21.51

*ERP = Conducted + antenna gain (2dBi)-2.15

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20425	20525	20625
		Frequency (MHz)		826.5	836.5	846.5
5M	QPSK	1	0	23.31	23.43	23.24
		1	12	23.41	23.35	23.42
		1	24	23.19	23.38	23.11
		12	0	22.41	22.45	22.51
		12	6	22.38	22.47	22.59
		12	13	22.45	22.47	22.40
		25	0	22.43	22.48	22.39
	16QAM	1	0	22.52	22.35	22.09
		1	12	22.36	22.46	22.22
		1	24	22.47	22.25	21.99
		12	0	21.28	21.39	21.48
		12	6	21.16	21.58	21.57
		12	13	21.21	21.38	21.30
		25	0	21.37	21.30	21.24

LTE Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20450	20525	20600
		Frequency (MHz)		829	836.5	844
10M	QPSK	1	0	23.21	23.52	23.29
		1	24	23.35	23.35	23.12
		1	49	23.08	23.16	23.22
		25	0	22.47	22.48	22.42
		25	12	22.47	22.53	22.37
		25	25	22.46	22.44	22.35
		50	0	22.46	22.46	22.51
	16QAM	1	0	22.15	22.03	22.21
		1	24	22.08	22.14	22.05
		1	49	22.07	22.14	21.84
		25	0	21.31	21.41	21.38
		25	12	21.37	21.37	21.46
		25	25	21.35	21.56	21.34
		50	0	21.42	21.43	21.36

*ERP = Conducted + antenna gain (2dBi)-2.15

4.2 Modulation Characteristics Measurement

4.2.1 Limits of Modulation Characteristics

N/A

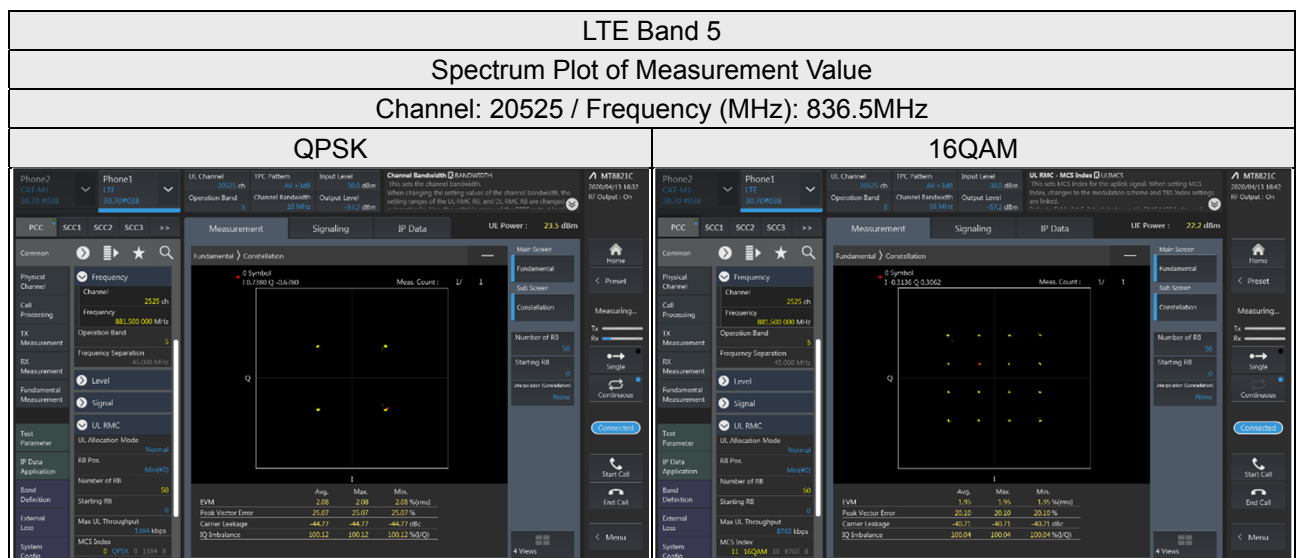
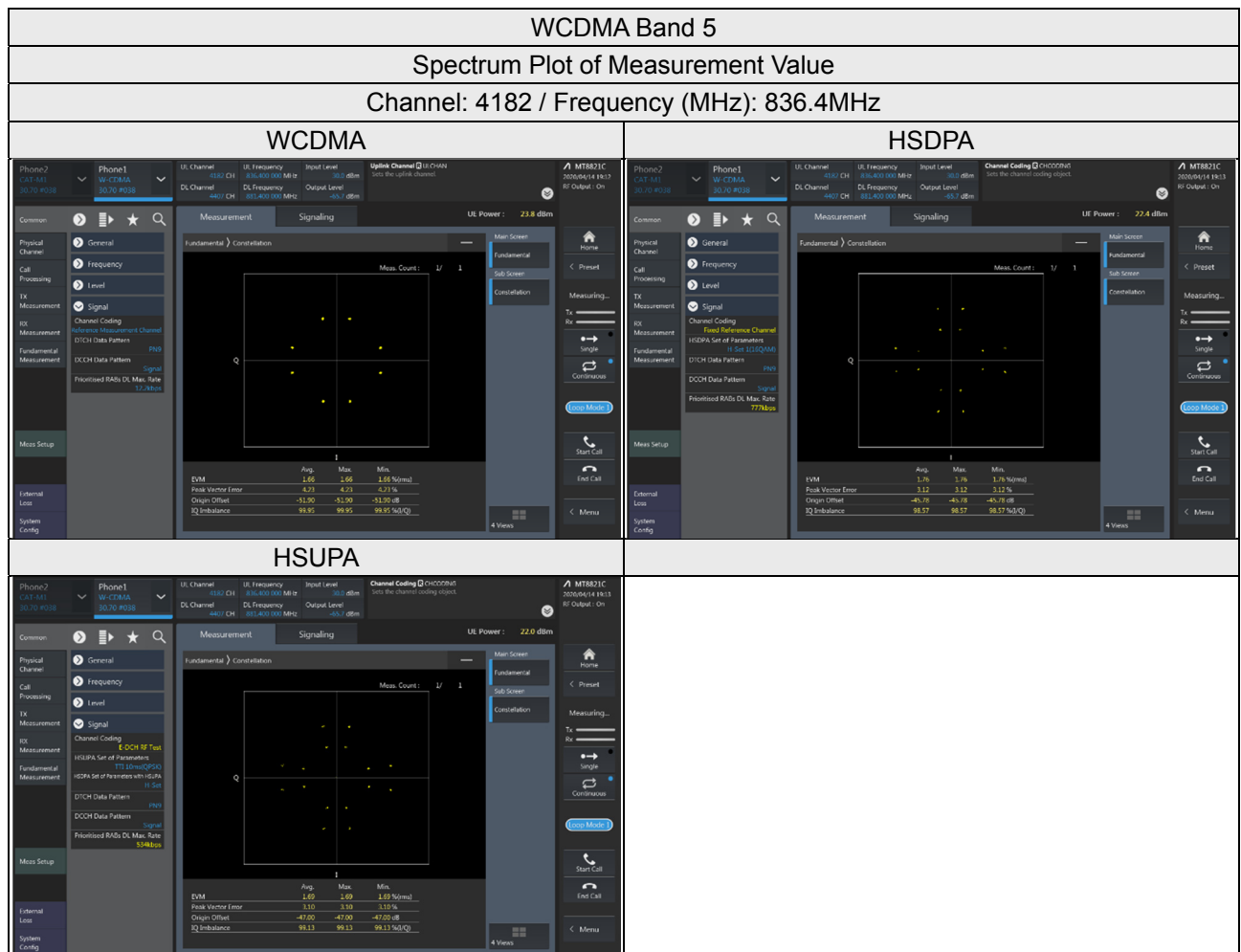
4.2.2 Test Procedure

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

4.2.3 Test Setup



4.2.4 Test Results



4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

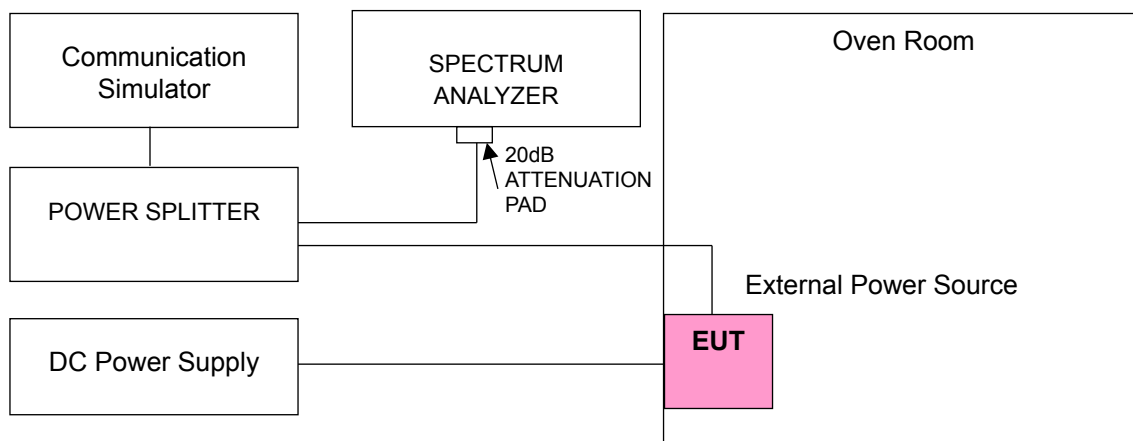
1.5 ppm is for base and fixed station. 2.5 ppm is for mobile station.

4.3.2 Test Procedure

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ 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 Band 5			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
10	826.400002	0.003	846.600001	0.001
12	826.400002	0.003	846.600002	0.003
35	826.400003	0.004	846.600001	0.001

Note: The applicant defined the normal working voltage is from 10Vdc to 35Vdc.

Frequency Error vs. Temperature

Temp. (°C)	WCDMA Band 5			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-40	826.400001	0.001	846.600003	0.004
-30	826.400001	0.001	846.600003	0.004
-20	826.400004	0.005	846.600001	0.002
-10	826.400004	0.005	846.600002	0.002
0	826.400002	0.003	846.600002	0.003
10	826.400002	0.002	846.600003	0.004
20	826.399997	-0.004	846.599998	-0.002
30	826.399998	-0.002	846.599998	-0.003
40	826.399998	-0.002	846.599997	-0.004
50	826.399998	-0.002	846.599996	-0.004
60	826.399997	-0.004	846.599997	-0.004
70	826.399998	-0.002	846.599996	-0.004
85	826.399997	-0.004	846.599997	-0.004

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 5			
	Channel Bandwidth: 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
10	824.700001	0.002	848.300003	0.003
12	824.700002	0.002	848.300002	0.002
35	824.700004	0.004	848.300003	0.003

Note: The applicant defined the normal working voltage is from 10Vdc to 35Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 5			
	Channel Bandwidth: 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-40	824.699998	-0.002	848.299998	-0.003
-30	824.699998	-0.003	848.299996	-0.004
-20	824.699998	-0.003	848.299996	-0.004
-10	824.700001	0.001	848.300002	0.002
0	824.700004	0.004	848.300002	0.003
10	824.700003	0.003	848.300002	0.003
20	824.700002	0.002	848.300002	0.002
30	824.700003	0.004	848.300004	0.004
40	824.699997	-0.004	848.299997	-0.004
50	824.699996	-0.005	848.299998	-0.002
60	824.699998	-0.003	848.299999	-0.002
70	824.699998	-0.003	848.299996	-0.005
85	824.699998	-0.002	848.299997	-0.004

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 5			
	Channel Bandwidth: 3 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
10	825.500002	0.002	847.500001	0.001
12	825.500001	0.002	847.500002	0.002
35	825.500003	0.003	847.500002	0.003

Note: The applicant defined the normal working voltage is from 10Vdc to 35Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 5			
	Channel Bandwidth: 3 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-40	825.499996	-0.004	847.499997	-0.003
-30	825.499998	-0.002	847.499998	-0.002
-20	825.499998	-0.002	847.499999	-0.002
-10	825.500004	0.005	847.500002	0.003
0	825.500001	0.002	847.500004	0.004
10	825.500004	0.004	847.500004	0.005
20	825.500001	0.002	847.500002	0.002
30	825.500001	0.001	847.500003	0.003
40	825.499998	-0.003	847.499996	-0.005
50	825.499997	-0.004	847.499998	-0.002
60	825.499997	-0.003	847.499997	-0.004
70	825.499997	-0.004	847.499998	-0.002
85	825.499999	-0.002	847.499997	-0.003

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 5			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
10	826.500002	0.002	846.500002	0.002
12	826.500002	0.002	846.500002	0.002
35	826.500001	0.002	846.500003	0.003

Note: The applicant defined the normal working voltage is from 10Vdc to 35Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 5			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-40	826.499996	-0.004	846.499998	-0.002
-30	826.499996	-0.005	846.499998	-0.003
-20	826.499997	-0.004	846.499997	-0.004
-10	826.500004	0.005	846.500001	0.001
0	826.500003	0.003	846.500004	0.004
10	826.500002	0.002	846.500002	0.003
20	826.500003	0.004	846.500003	0.004
30	826.500003	0.004	846.500004	0.004
40	826.499999	-0.001	846.499999	-0.001
50	826.499997	-0.003	846.499996	-0.004
60	826.499997	-0.004	846.499998	-0.002
70	826.499999	-0.001	846.499999	-0.001
85	826.499999	-0.001	846.499998	-0.002

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 5			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
10	829.000004	0.005	844.000004	0.005
12	829.000001	0.001	844.000003	0.004
35	829.000003	0.003	844.000003	0.003

Note: The applicant defined the normal working voltage is from 10Vdc to 35Vdc.

Frequency Error vs. Temperature

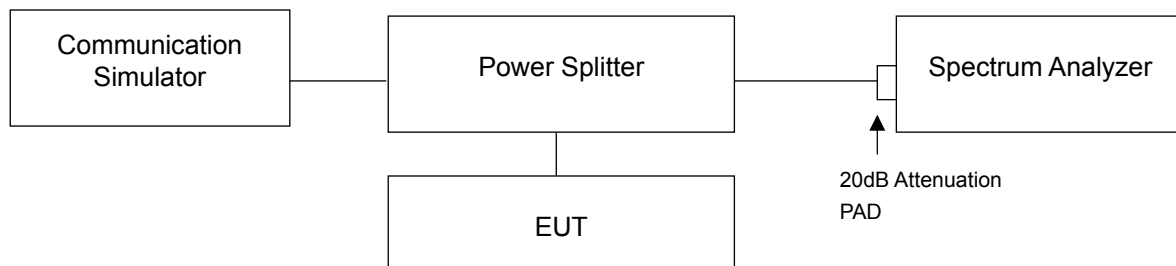
Temp. (°C)	LTE Band 5			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-40	828.999997	-0.003	843.999996	-0.005
-30	828.999997	-0.003	843.999998	-0.002
-20	828.999999	-0.001	843.999996	-0.005
-10	829.000002	0.002	844.000002	0.002
0	829.000003	0.003	844.000003	0.003
10	829.000003	0.004	844.000004	0.004
20	829.000003	0.003	844.000002	0.003
30	829.000002	0.002	844.000002	0.002
40	828.999996	-0.005	843.999998	-0.002
50	828.999997	-0.004	843.999997	-0.004
60	828.999997	-0.004	843.999996	-0.004
70	828.999997	-0.003	843.999998	-0.002
85	828.999997	-0.004	843.999997	-0.004

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.

4.4.2 Test Setup



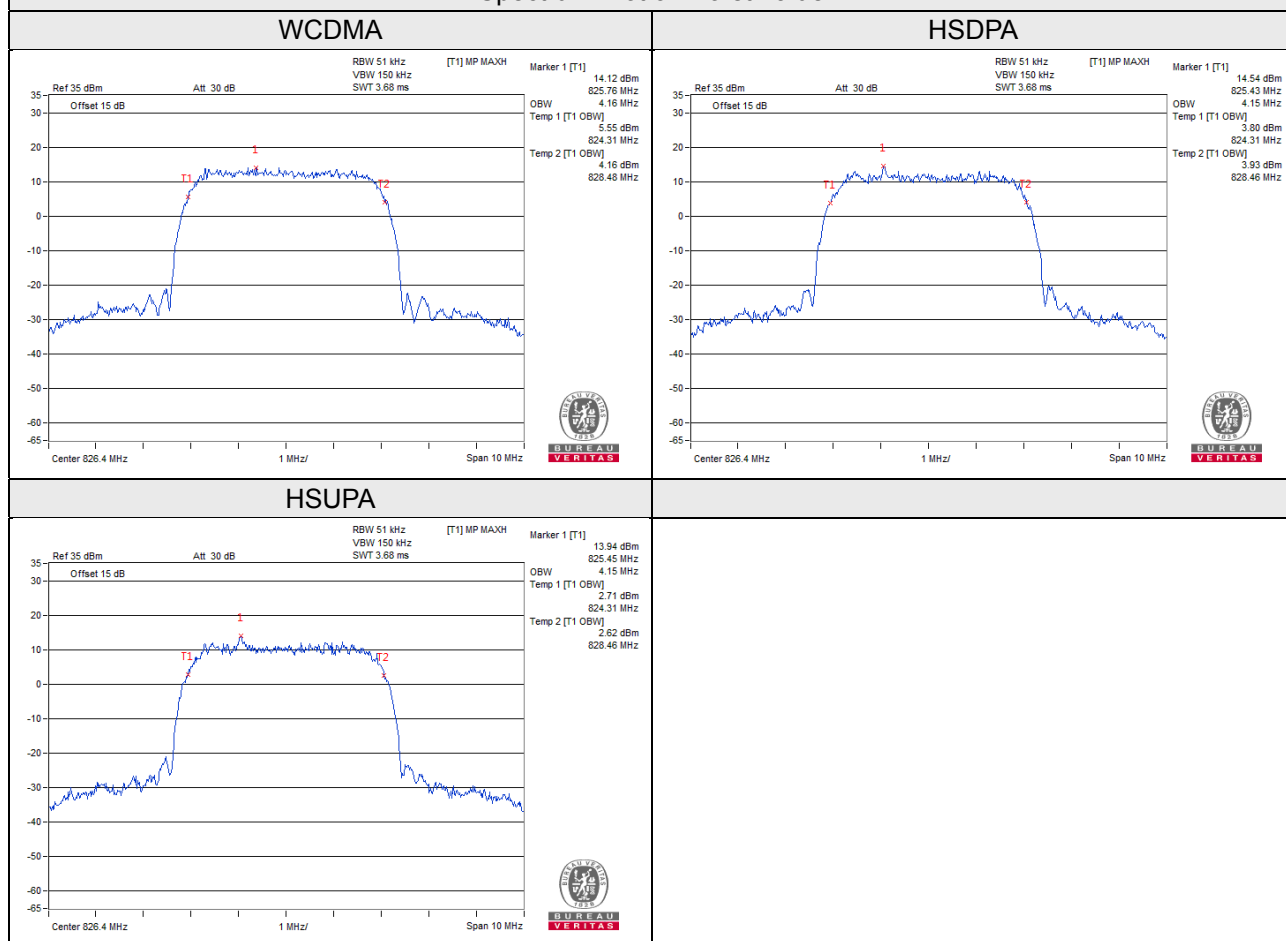
4.4.3 Test Result

Occupied Bandwidth

WCDMA Band 5

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)		
		WCDMA	HSDPA	HSUPA
4132	826.4	4.16	4.15	4.15
4182	836.4	4.16	4.15	4.13
4233	846.6	4.13	4.15	4.13

Spectrum Plot of Worst Value

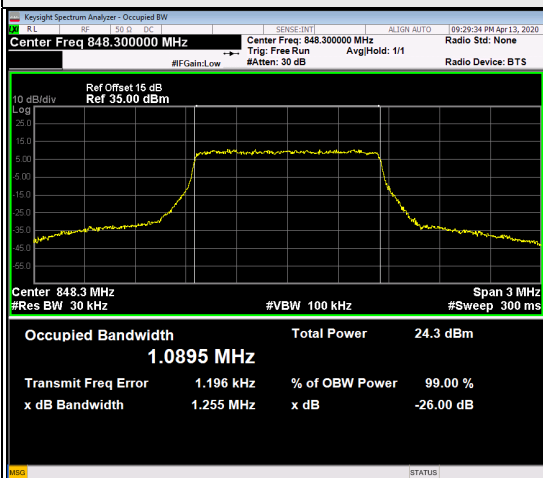


LTE Band 5

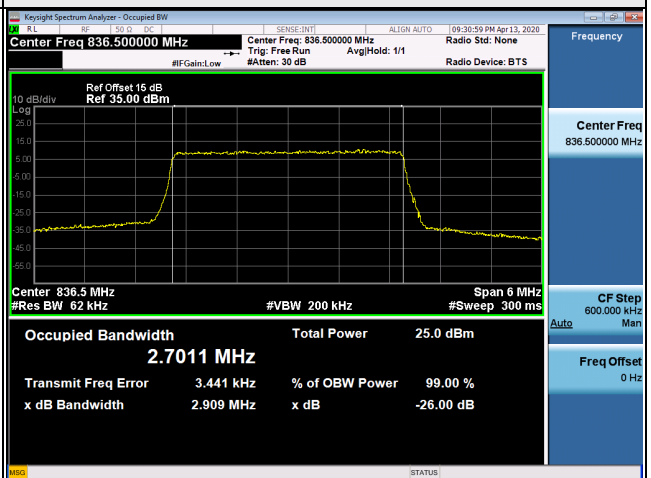
LTE Band 5, Channel Bandwidth 1.4MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
20407	824.7	1.09	1.09
20525	836.5	1.09	1.09
20643	848.3	1.09	1.09
LTE Band 5, Channel Bandwidth 3MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
20415	825.5	2.70	2.70
20525	836.5	2.70	2.69
20635	847.5	2.70	2.69
LTE Band 5, Channel Bandwidth 5MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
20425	826.5	4.49	4.49
20525	836.5	4.49	4.49
20625	846.5	4.49	4.49
LTE Band 5, Channel Bandwidth 10MHz			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	
		QPSK	16QAM
20450	829.0	8.96	8.96
20525	836.5	8.94	8.95
20600	844.0	8.96	8.95

Spectrum Plot of Worst Value

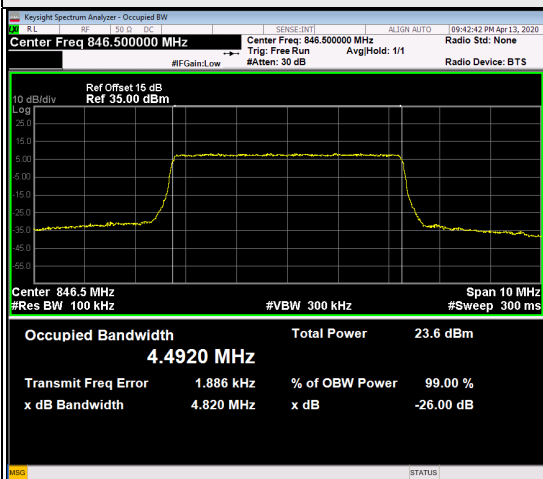
1.4MHz / 16QAM



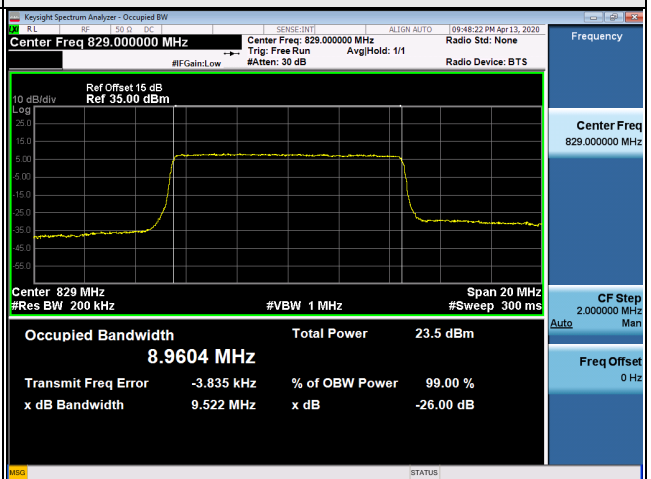
3MHz / QPSK



5MHz / 16QAM



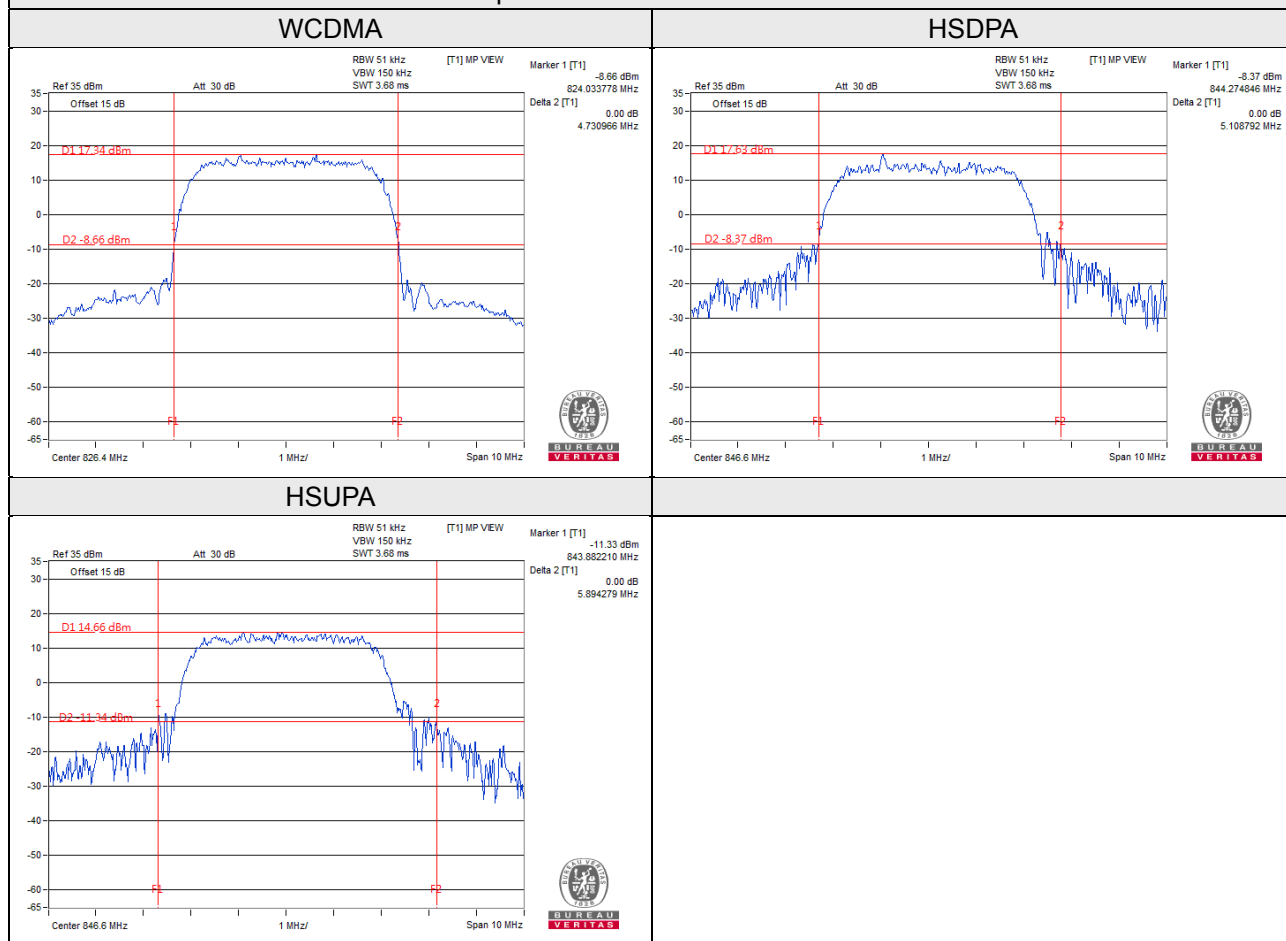
10MHz / 16QAM



26dB Bandwidth
WCDMA Band 5

Channel	Frequency (MHz)	26dB Bandwidth (MHz)		
		WCDMA	HSDPA	HSUPA
4132	826.4	4.73	4.67	4.72
4182	836.4	4.70	4.71	4.72
4233	846.6	4.70	5.11	5.89

Spectrum Plot of Worst Value

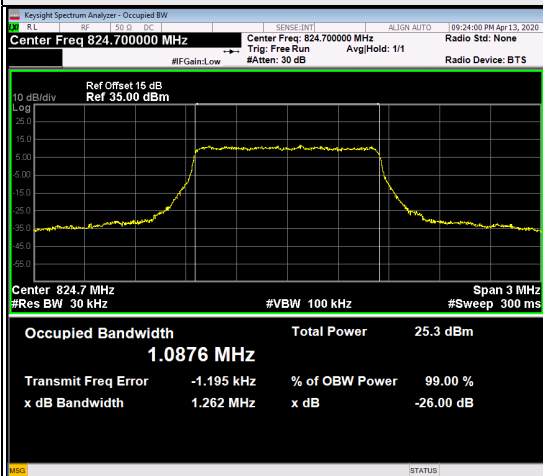


LTE Band 5

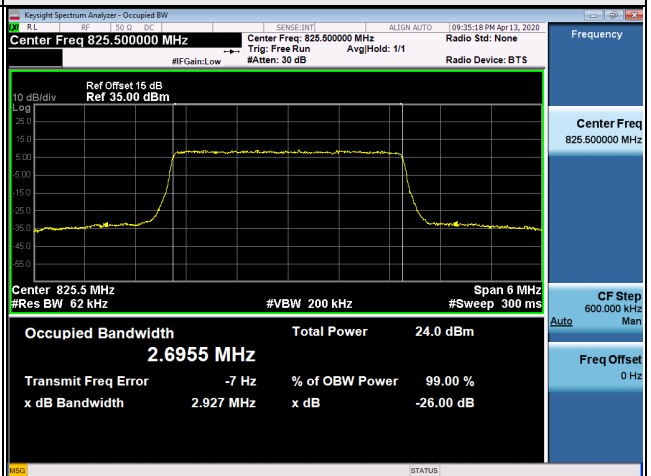
LTE Band 5, Channel Bandwidth 1.4MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
20407	824.7	1.26	1.25
20525	836.5	1.25	1.25
20643	848.3	1.25	1.26
LTE Band 5, Channel Bandwidth 3MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
20415	825.5	2.92	2.93
20525	836.5	2.91	2.92
20635	847.5	2.92	2.90
LTE Band 5, Channel Bandwidth 5MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
20425	826.5	4.81	4.81
20525	836.5	4.81	4.81
20625	846.5	4.82	4.82
LTE Band 5, Channel Bandwidth 10MHz			
Channel	Frequency (MHz)	26dB Bandwidth (MHz)	
		QPSK	16QAM
20450	829.0	9.52	9.52
20525	836.5	9.50	9.51
20600	844.0	9.54	9.52

Spectrum Plot of Worst Value

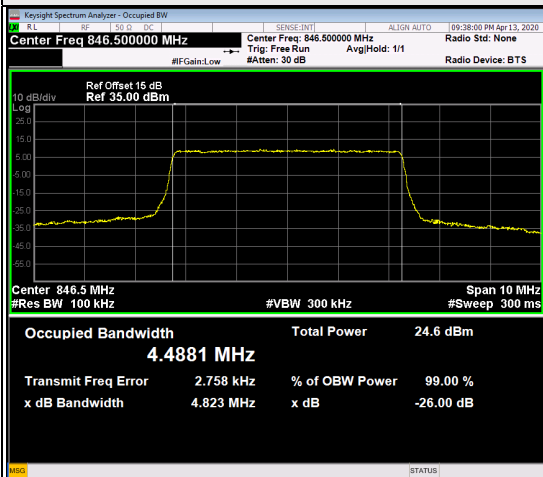
1.4MHz / QPSK



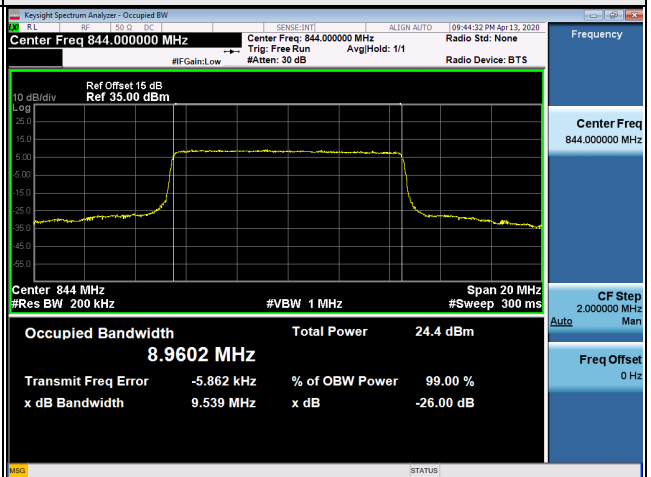
3MHz / 16QAM



5MHz / QPSK



10MHz / QPSK

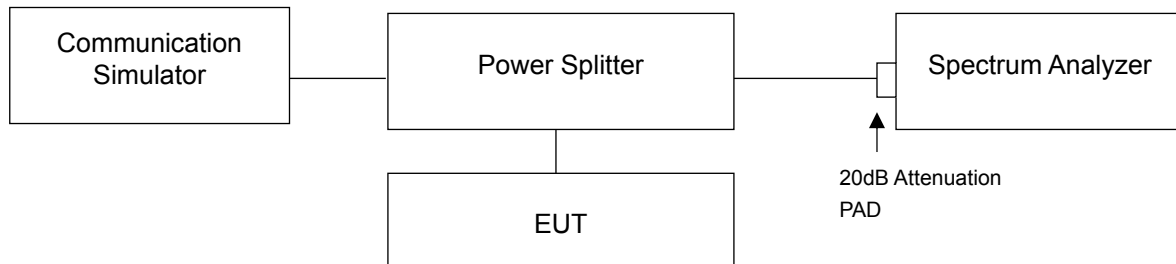


4.5 Band Edge Measurement

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

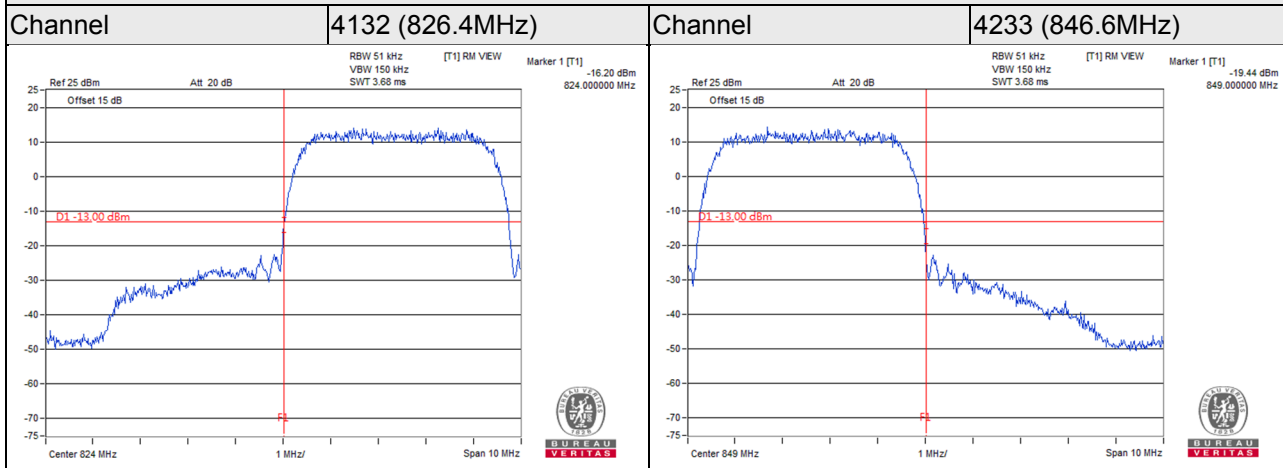


4.5.3 Test Procedures

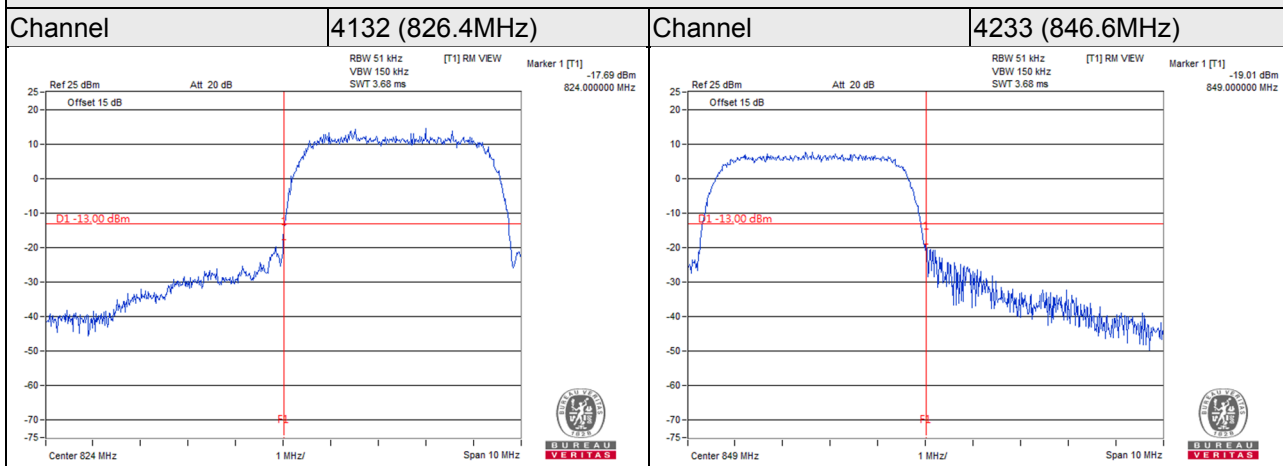
- All measurements were done at low and high operational frequency range.
- The center frequency of spectrum is the band edge frequency and span is 10MHz. RB of the spectrum is 51kHz and VB of the spectrum is 150kHz (WCDMA / HSDPA / HSUPA).
- The center frequency of spectrum is the band edge frequency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

4.5.4 Test Results

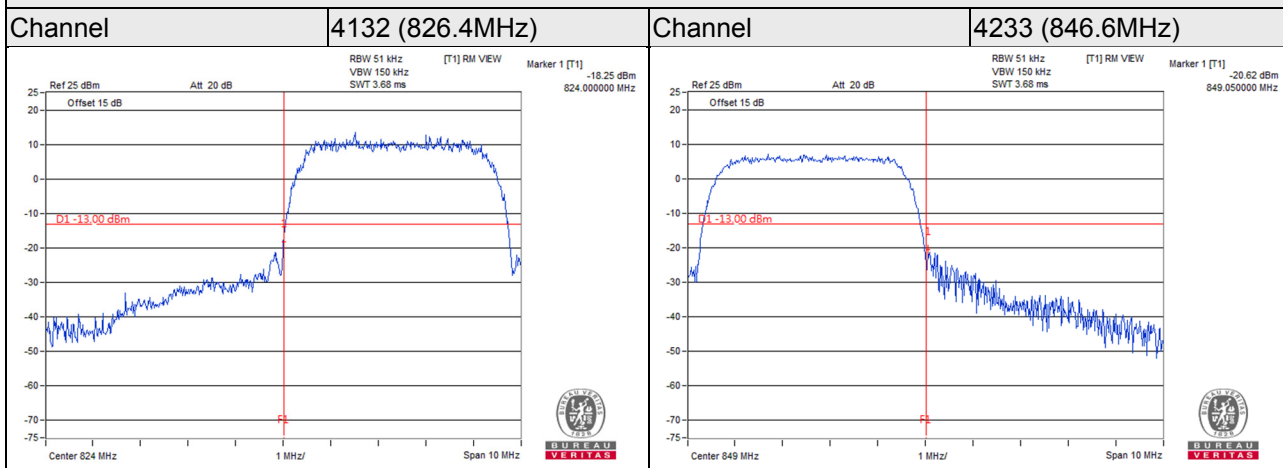
WCDMA



HSDPA



HSUPA



LTE Band 5, Channel Bandwidth 1.4MHz

Channel 20407
(824.7MHz)

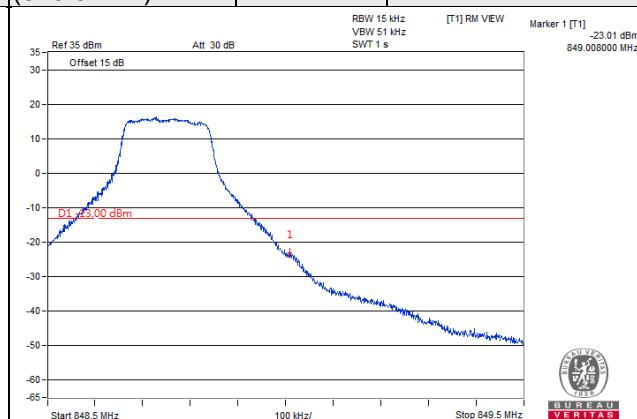
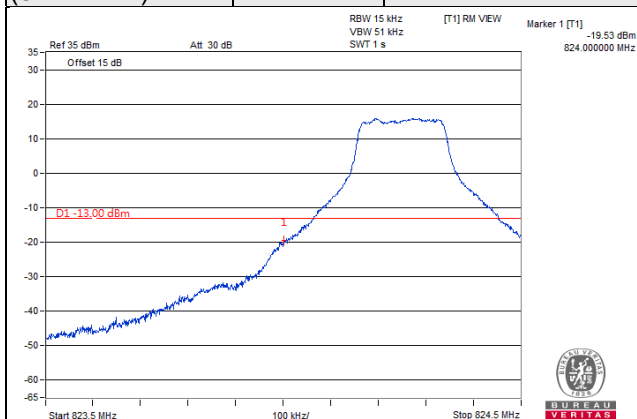
QPSK

1 RB / 0 RB Offset

Channel 20643
(848.3MHz)

QPSK

1 RB / 5 RB Offset



Channel 20407
(824.7MHz)

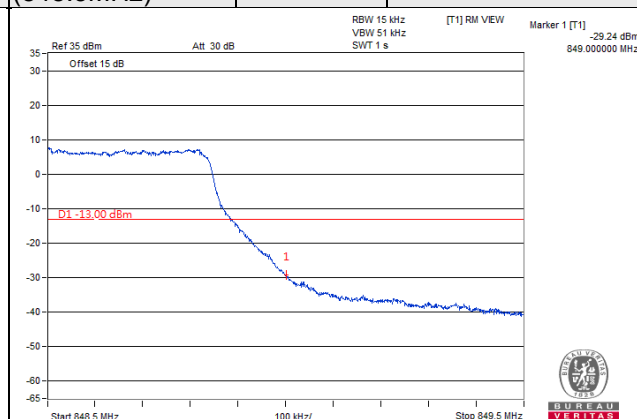
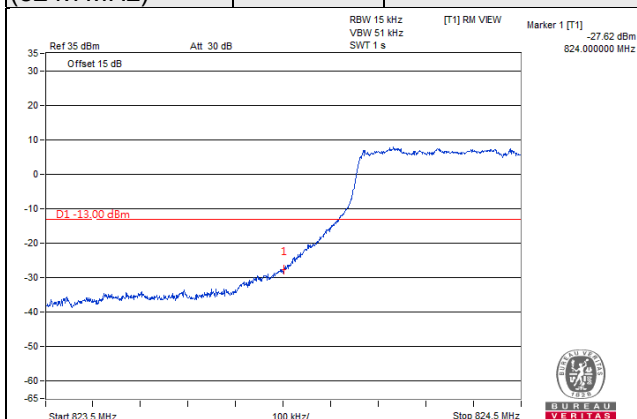
QPSK

6 RB / 0 RB Offset

Channel 20643
(848.3MHz)

QPSK

6 RB / 0 RB Offset



LTE Band 5, Channel Bandwidth 3MHz

Channel 20415
(825.5MHz)

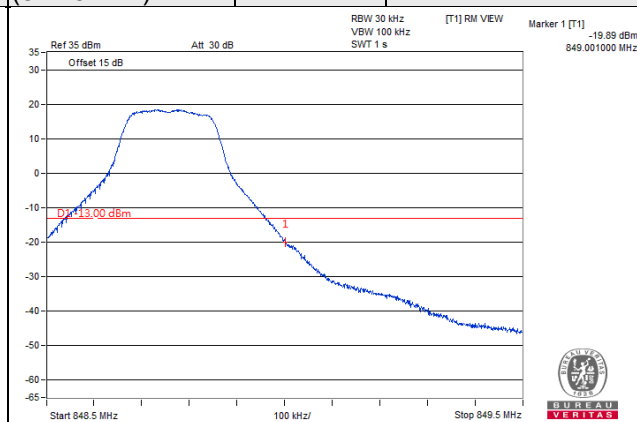
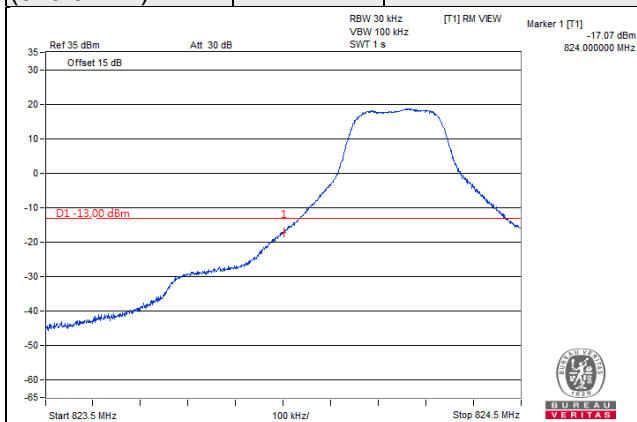
QPSK

1 RB / 0 RB Offset

Channel 20635
(847.5MHz)

QPSK

1 RB / 14 RB Offset



Channel 20415
(825.5MHz)

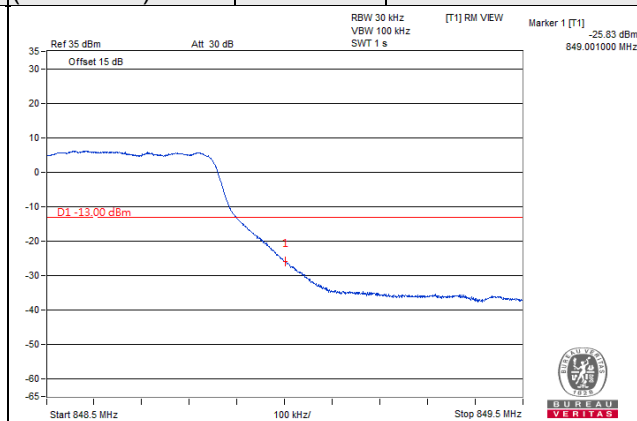
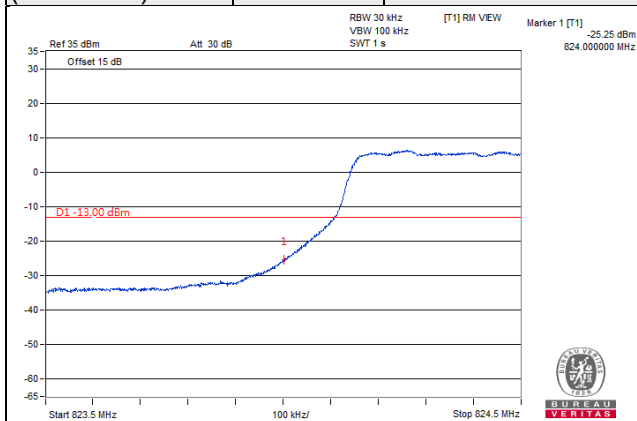
QPSK

15 RB / 0 RB Offset

Channel 20635
(847.5MHz)

QPSK

15 RB / 0 RB Offset



LTE Band 5, Channel Bandwidth 5MHz

Channel 20425
(826.5MHz)

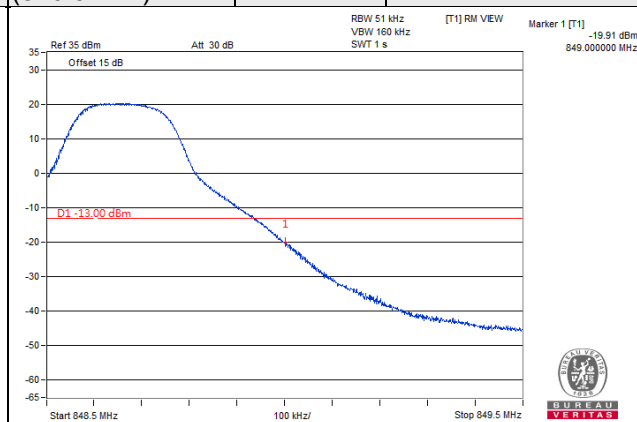
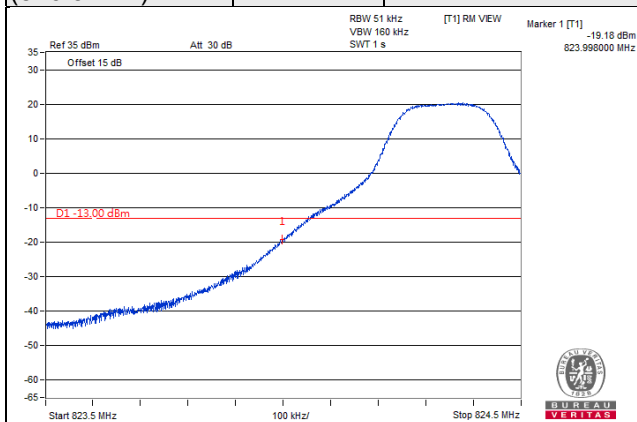
QPSK

1 RB / 0 RB Offset

Channel 20625
(846.5MHz)

QPSK

1 RB / 24 RB Offset



Channel 20425
(826.5MHz)

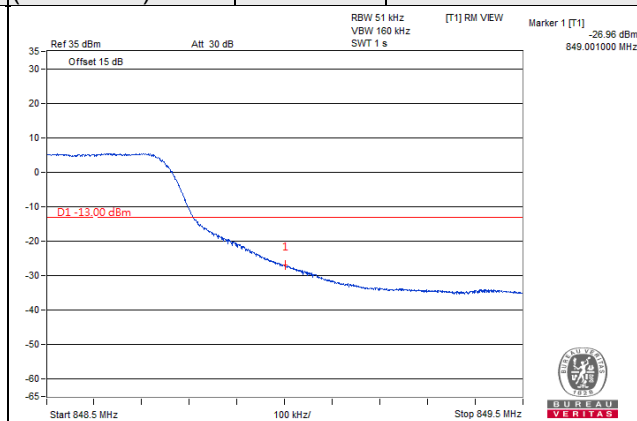
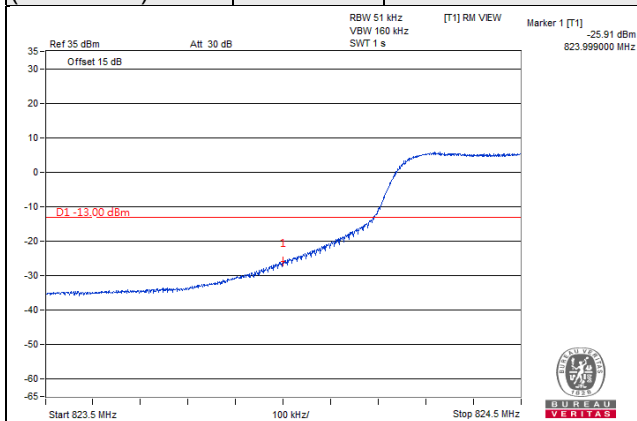
QPSK

25 RB / 0 RB Offset

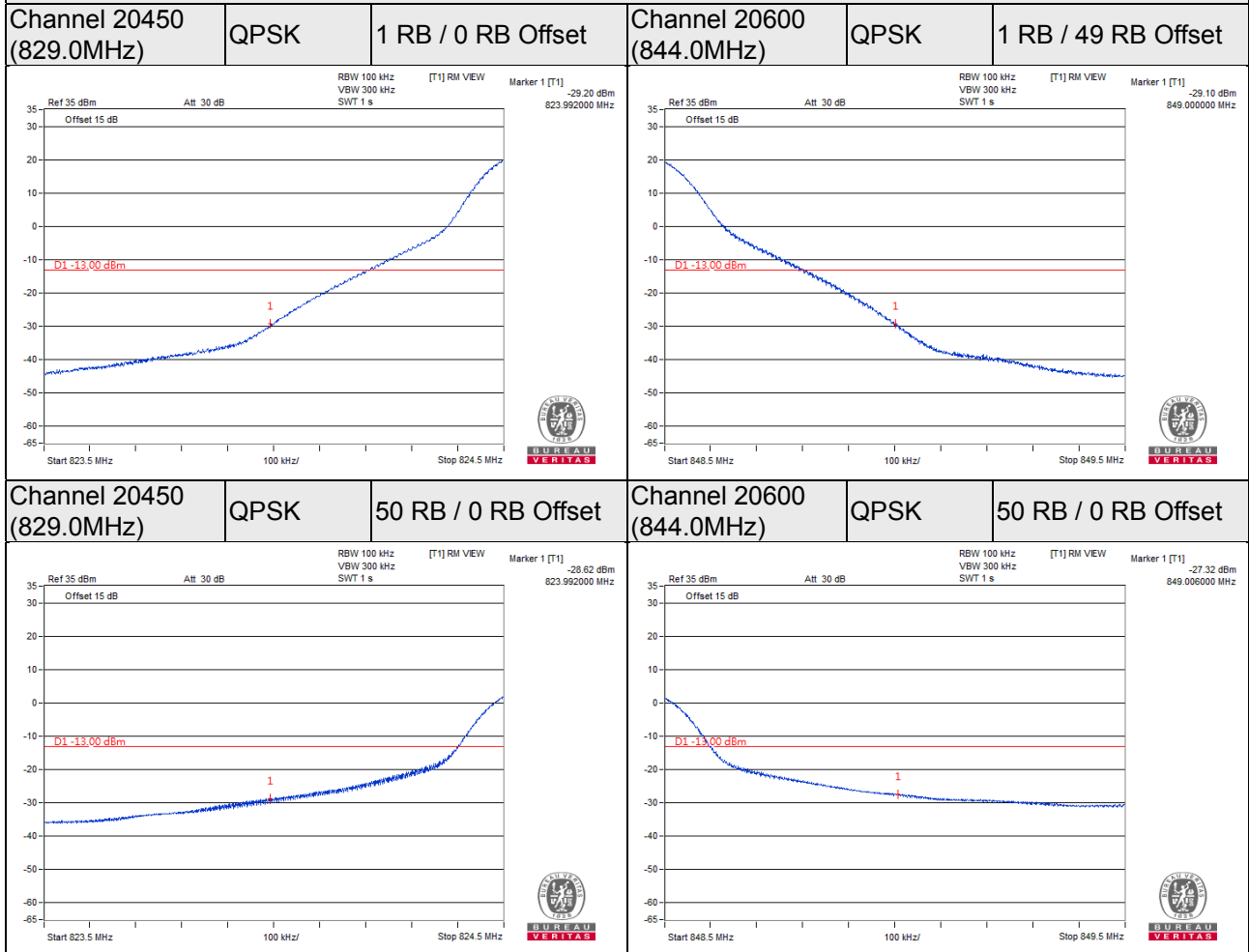
Channel 20625
(846.5MHz)

QPSK

25 RB / 0 RB Offset



LTE Band 5, Channel Bandwidth 10MHz

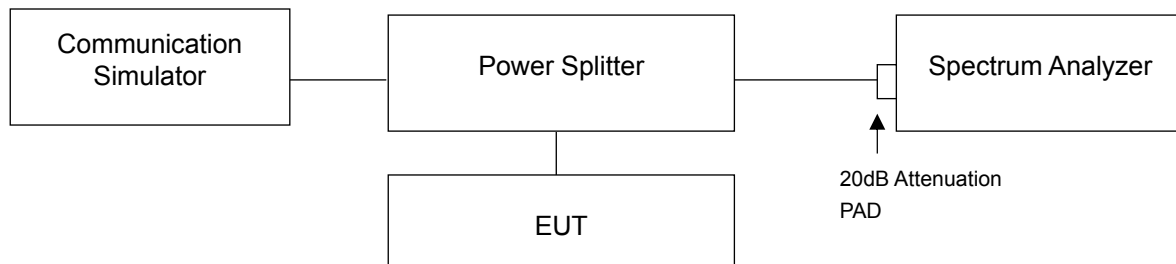


4.6 Peak to Average Ratio

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

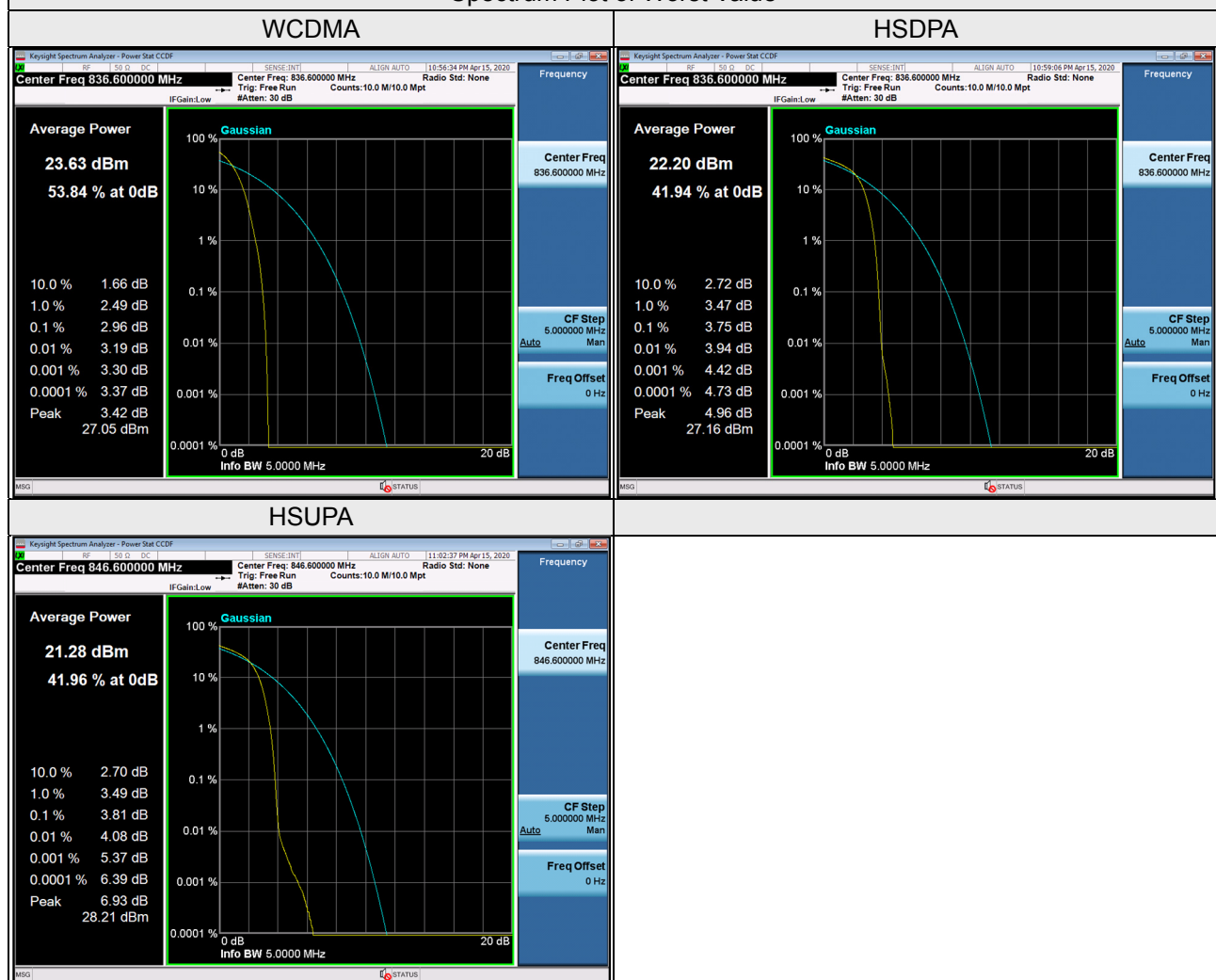
- Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth;
- Set the number of counts to a value that stabilizes the measured CCDF curve;
- Record the maximum PAPR level associated with a probability of 0.1%.

4.6.4 Test Results

WCDMA Band 5

Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		WCDMA	HSDPA	HSUPA
4132	826.4	2.85	3.73	3.77
4182	836.4	2.96	3.75	3.75
4233	846.6	2.91	3.69	3.81

Spectrum Plot of Worst Value

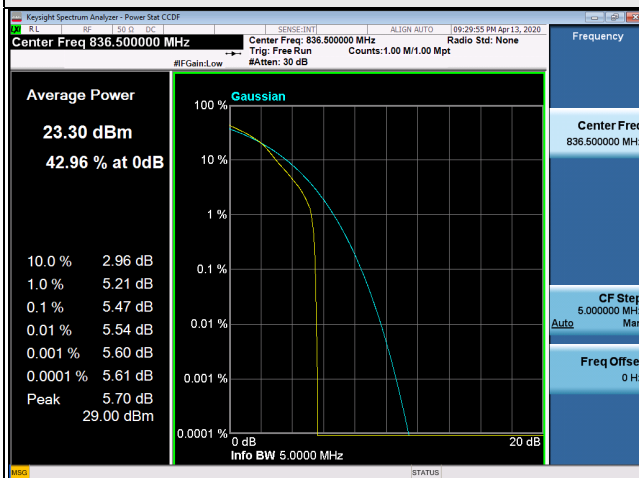


LTE Band 5

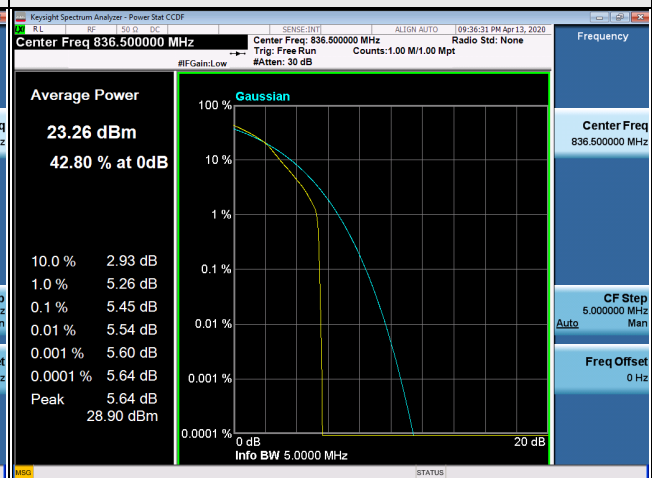
LTE Band 5, Channel Bandwidth 1.4MHz			
Channel	Frequency (MHz)	Peak To Average Ratio (dB)	
		QPSK	16QAM
20407	824.7	3.75	4.68
20525	836.5	4.48	5.47
20643	848.3	4.49	5.31
LTE Band 5, Channel Bandwidth 3MHz			
Channel	Frequency (MHz)	Peak To Average Ratio (dB)	
		QPSK	16QAM
20415	825.5	3.71	4.69
20525	836.5	4.60	5.45
20635	847.5	4.17	5.06
LTE Band 5, Channel Bandwidth 5MHz			
Channel	Frequency (MHz)	Peak To Average Ratio (dB)	
		QPSK	16QAM
20425	826.5	3.72	4.76
20525	836.5	4.65	5.44
20625	846.5	3.69	4.58
LTE Band 5, Channel Bandwidth 10MHz			
Channel	Frequency (MHz)	Peak To Average Ratio (dB)	
		QPSK	16QAM
20450	829.0	3.67	4.79
20525	836.5	4.61	5.44
20600	844.0	3.74	4.79

Spectrum Plot of Worst Value

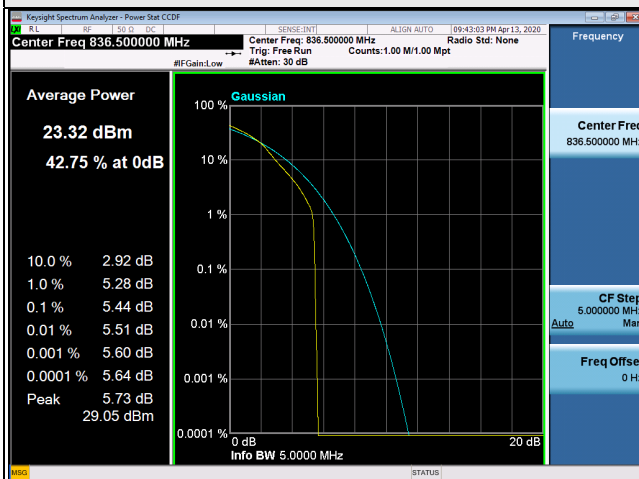
1.4MHz / 16QAM



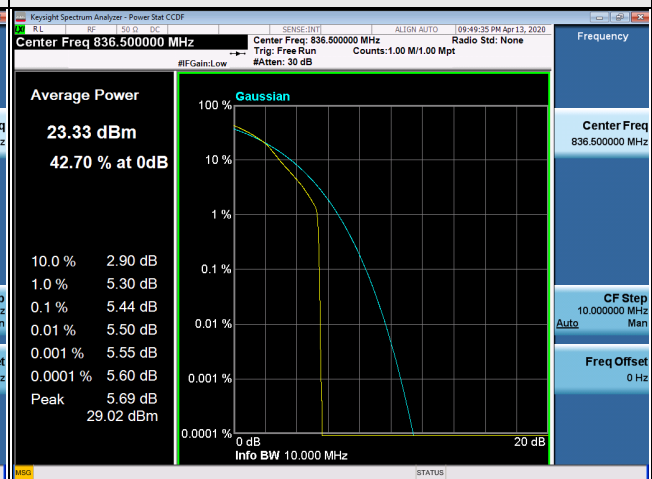
3MHz / 16QAM



5MHz / 16QAM



10MHz / 16QAM

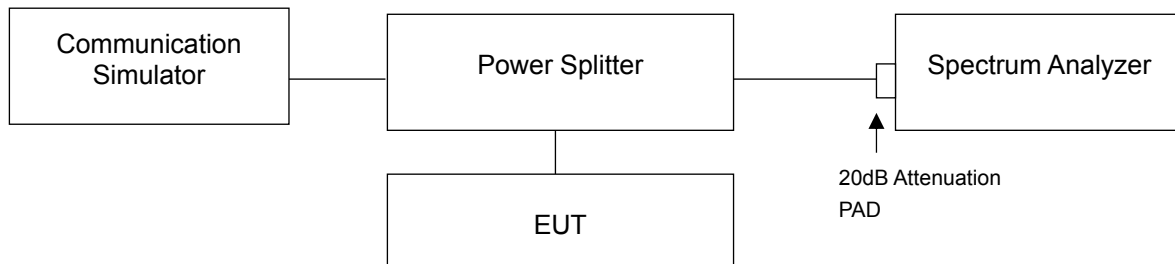


4.7 Conducted Spurious Emissions

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 -13dBm .

4.7.2 Test Setup



4.7.3 Test Procedure

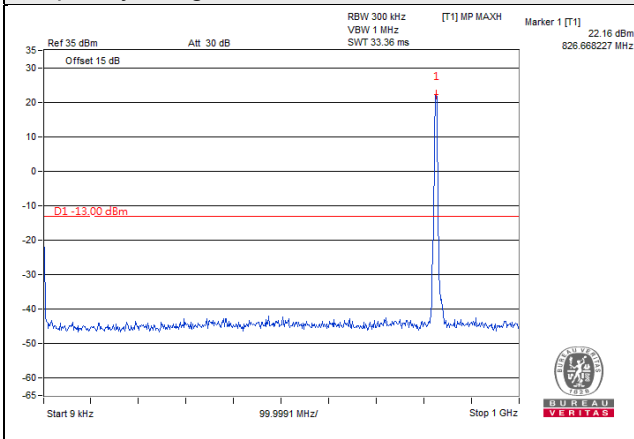
- The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
- Measuring frequency range is from 9kHz to 9GHz /10GHz. 20dB attenuation pad is connected with spectrum. RBW=100 kHz/300 kHz and VBW=300 kHz/1MHz is used for conducted emission (below 1GHz) measurement. RBW=1MHz and VBW=3MHz is used for conducted emission (above 1GHz) measurement.

4.7.4 Test Results

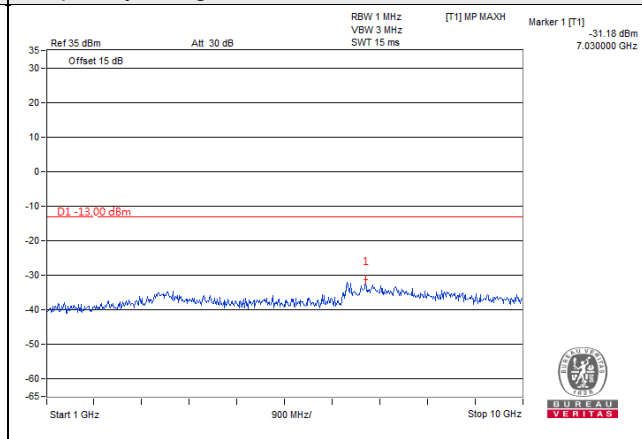
WCDMA

Channel 4132 (826.4MHz)

Frequency Range : 9kHz~1GHz

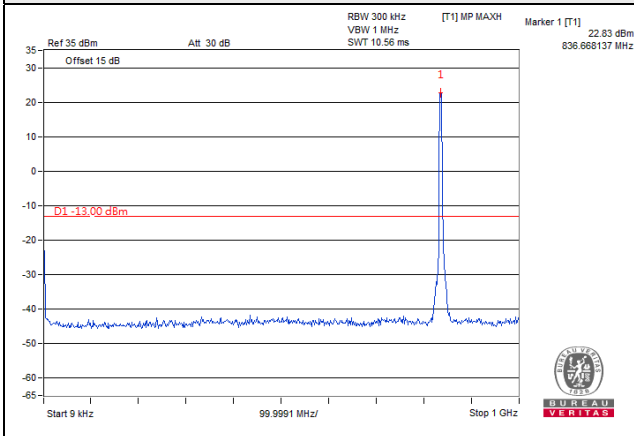


Frequency Range : 1GHz~10GHz

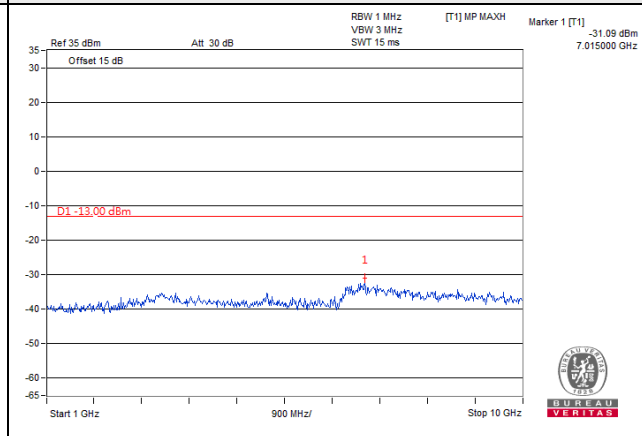


Channel 4182 (836.4MHz)

Frequency Range : 9kHz~1GHz

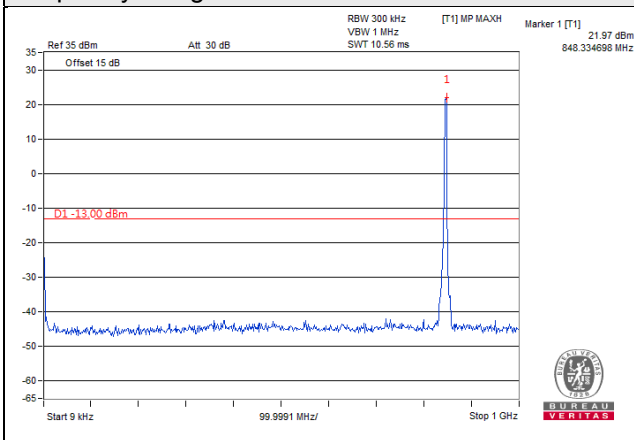


Frequency Range : 1GHz~10GHz

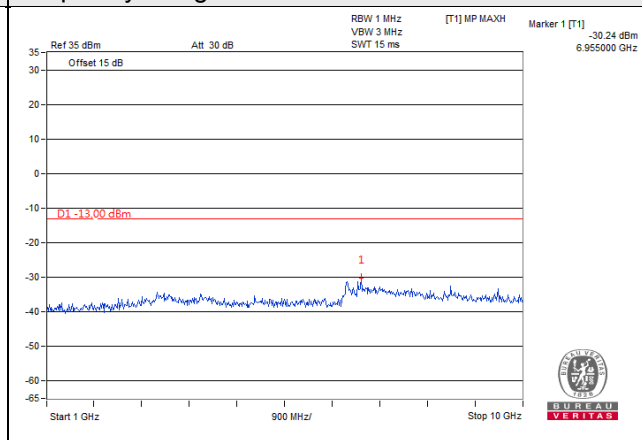


Channel 4233 (846.6MHz)

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

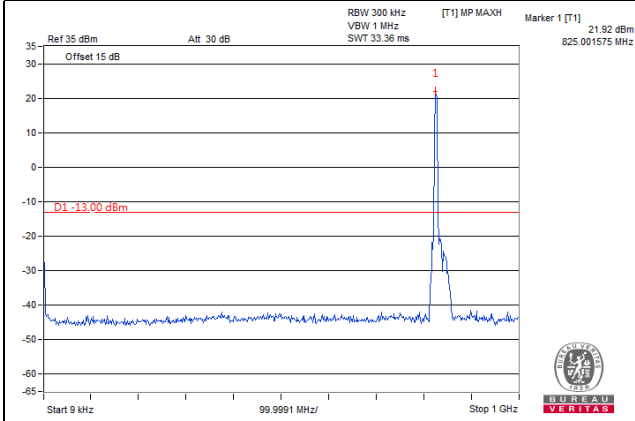


*The 9kHz signal over the limit is from Spectrum.

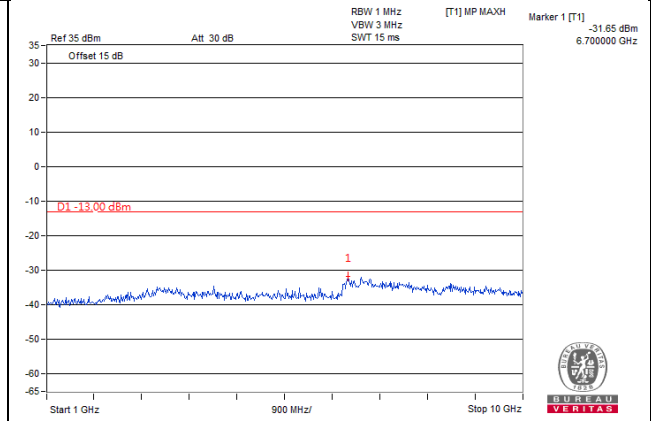
HSDPA

Channel 4132 (826.4MHz)

Frequency Range : 9kHz~1GHz

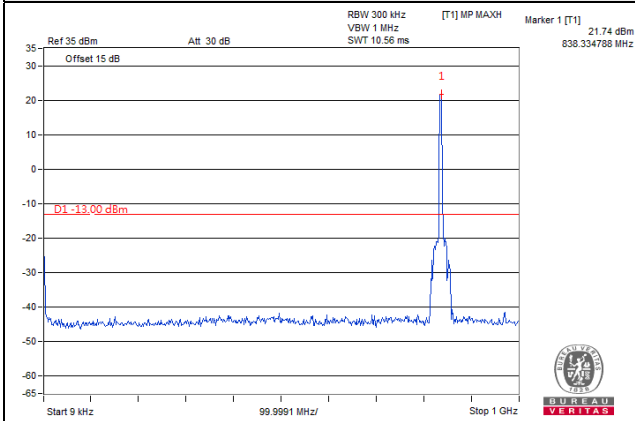


Frequency Range : 1GHz~10GHz

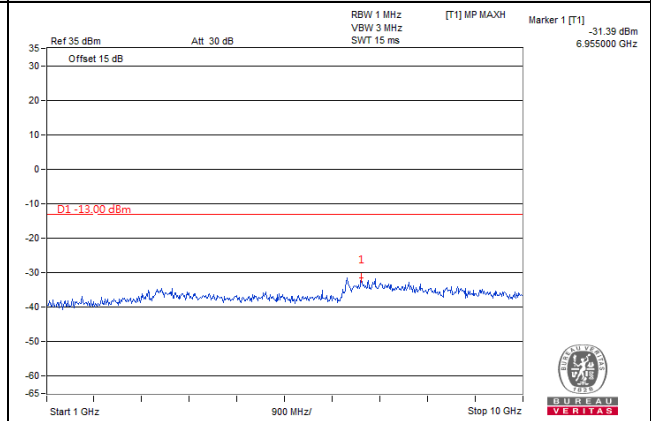


Channel 4182 (836.4MHz)

Frequency Range : 9kHz~1GHz

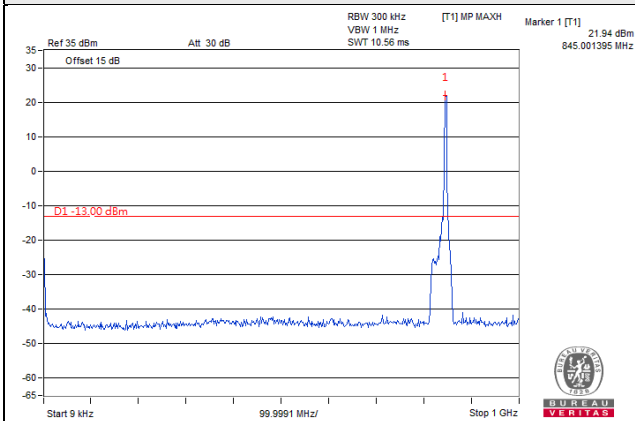


Frequency Range : 1GHz~10GHz

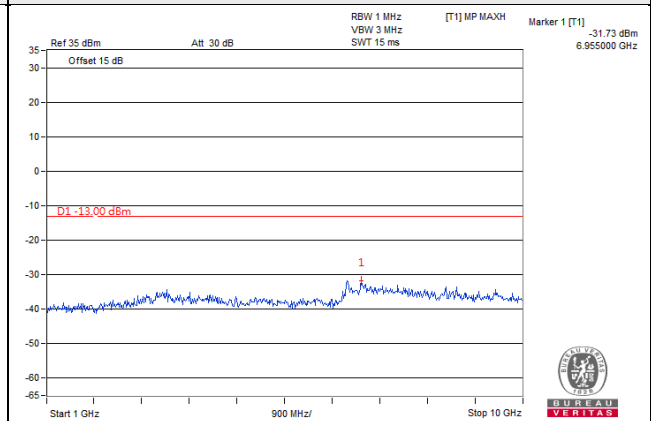


Channel 4233 (846.6MHz)

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

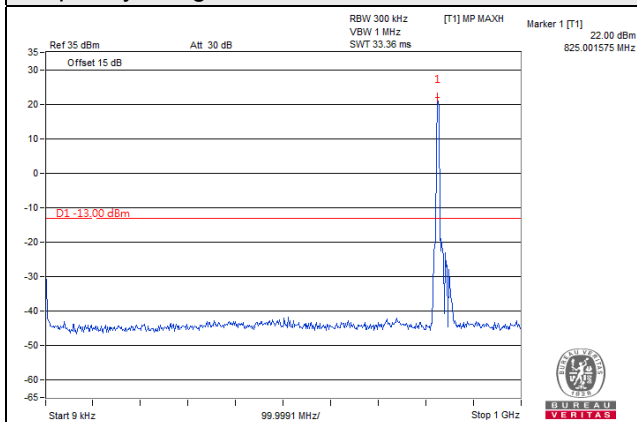


*The 9kHz signal over the limit is from Spectrum.

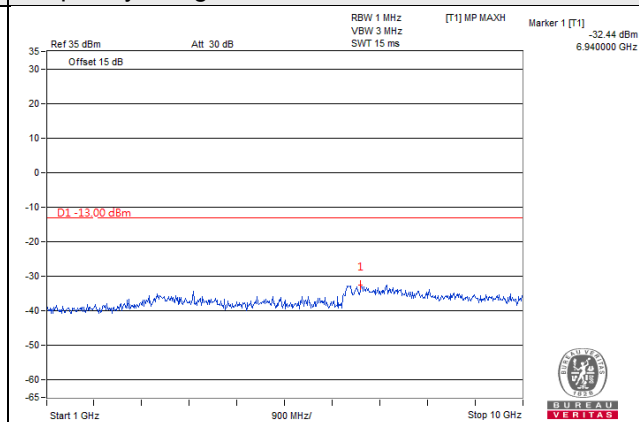
HSUPA

Channel 4132 (826.4MHz)

Frequency Range : 9kHz~1GHz

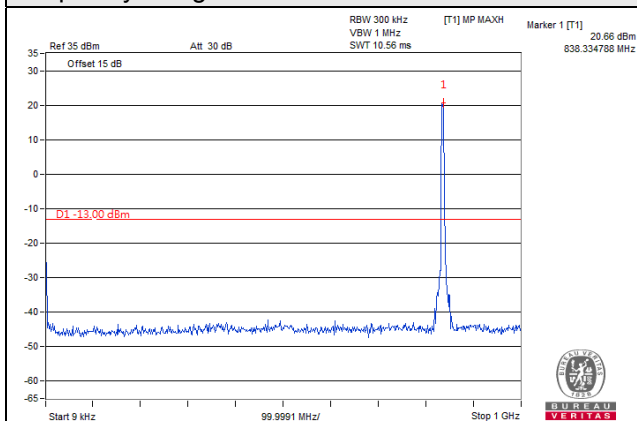


Frequency Range : 1GHz~10GHz

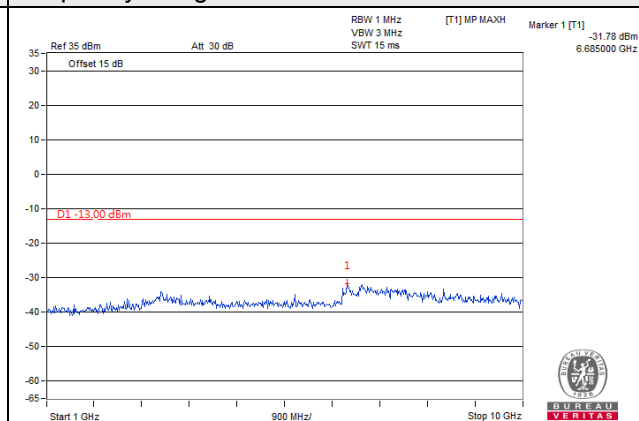


Channel 4182 (836.4MHz)

Frequency Range : 9kHz~1GHz

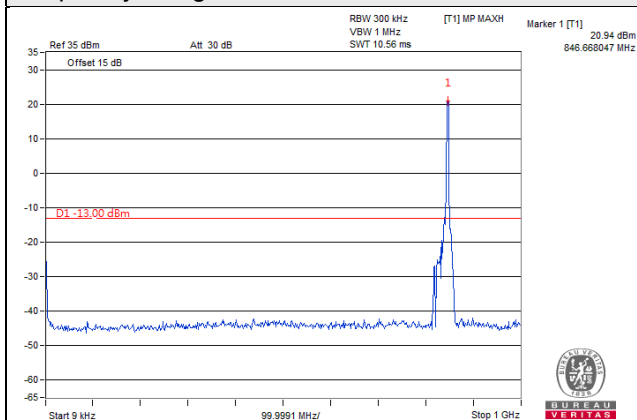


Frequency Range : 1GHz~10GHz

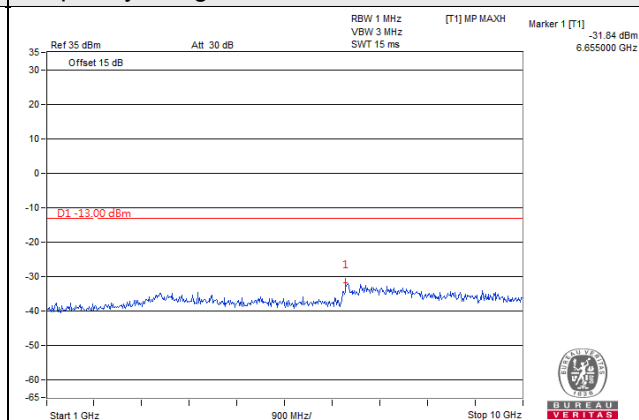


Channel 4233 (846.6MHz)

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

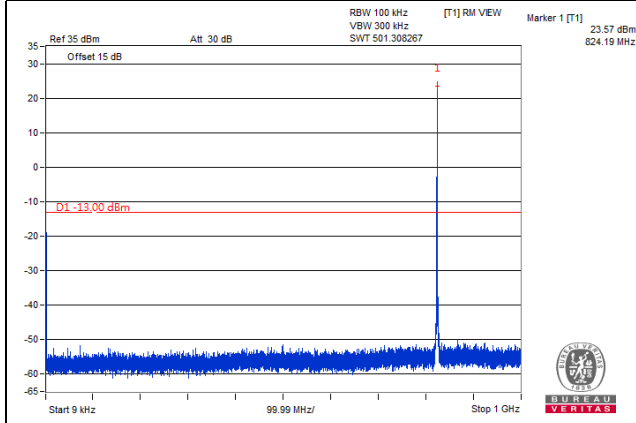


*The 9kHz signal over the limit is from Spectrum.

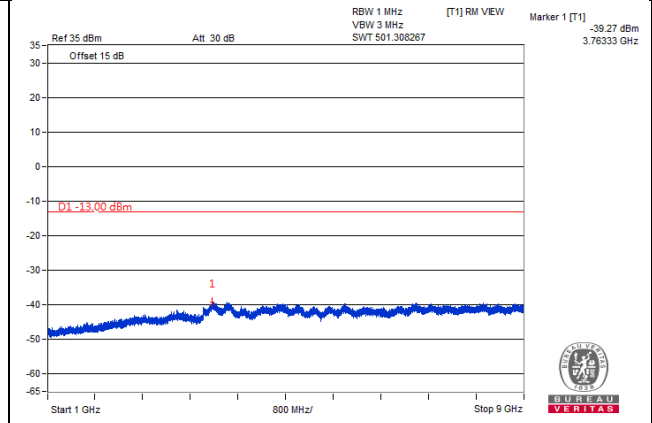
LTE Band 5, Channel Bandwidth 1.4MHz

Channel 20407 (824.7MHz)

Frequency Range : 9kHz~1GHz

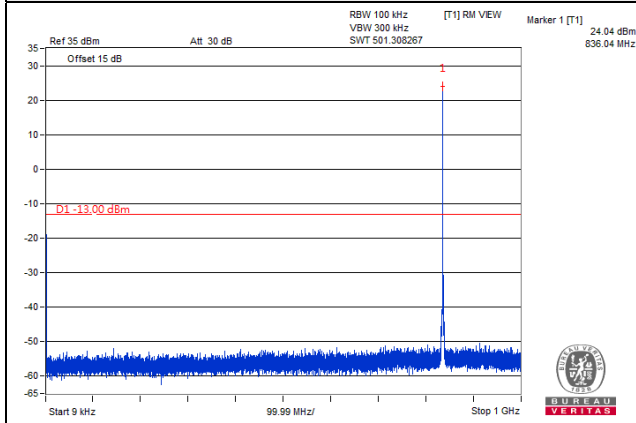


Frequency Range : 1GHz~9GHz

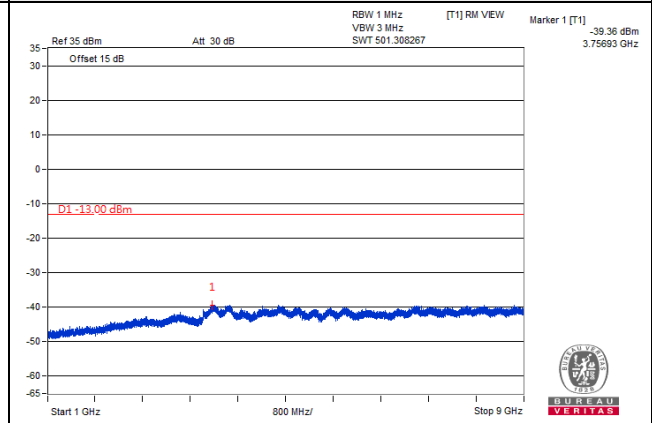


Channel 20525 (836.5MHz)

Frequency Range : 9kHz~1GHz

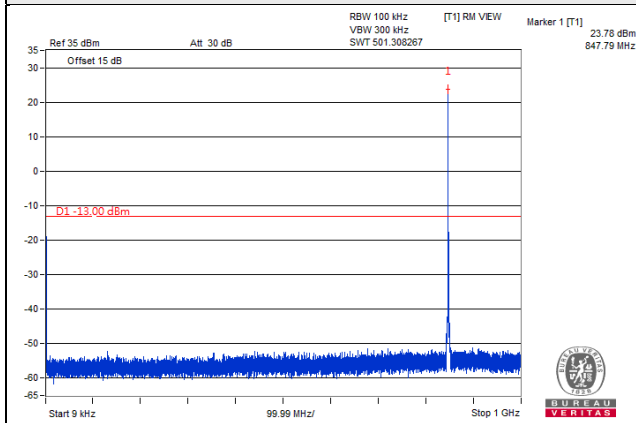


Frequency Range : 1GHz~9GHz

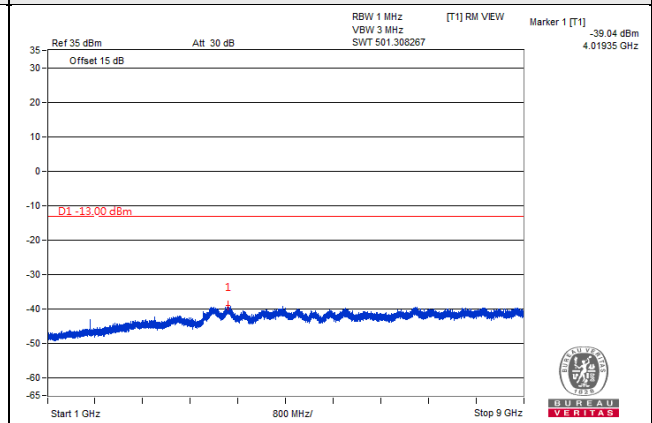


Channel 20643 (848.3MHz)

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~9GHz

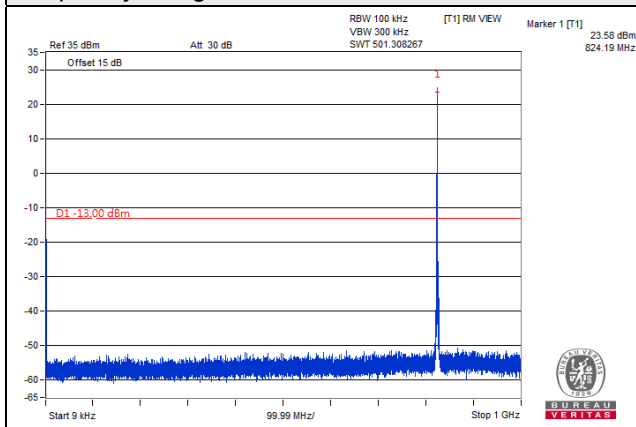


*The 9kHz signal over the limit is from Spectrum.

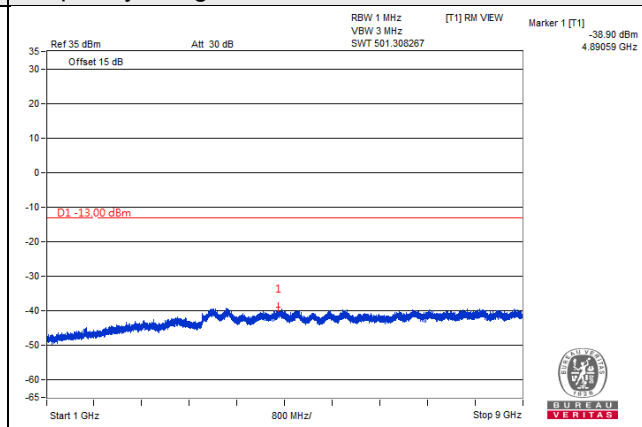
LTE Band 5, Channel Bandwidth 3MHz

Channel 20415 (825.5MHz)

Frequency Range : 9kHz~1GHz

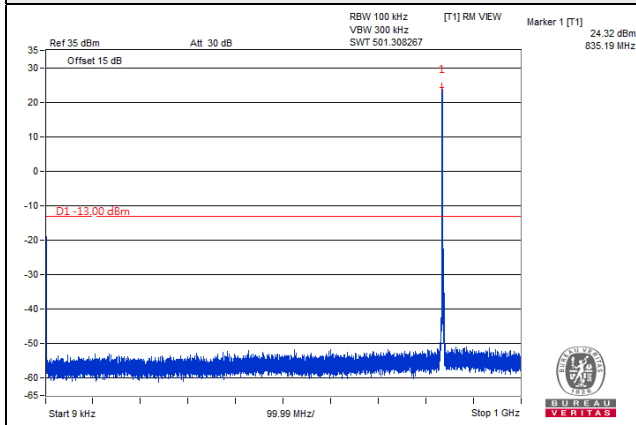


Frequency Range : 1GHz~9GHz

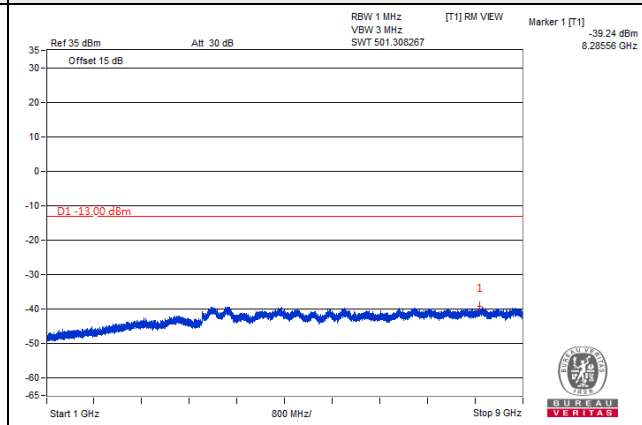


Channel 20525 (836.5MHz)

Frequency Range : 9kHz~1GHz

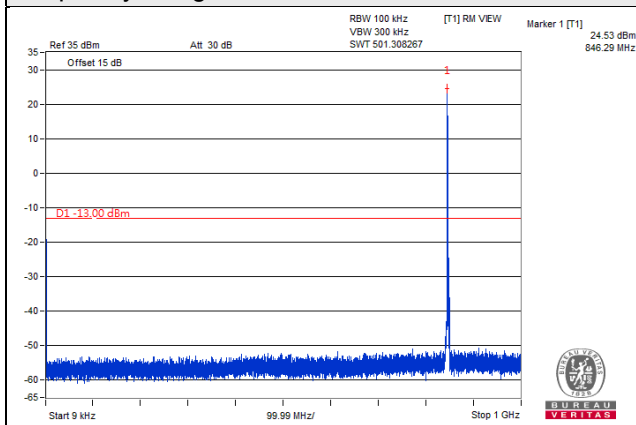


Frequency Range : 1GHz~9GHz

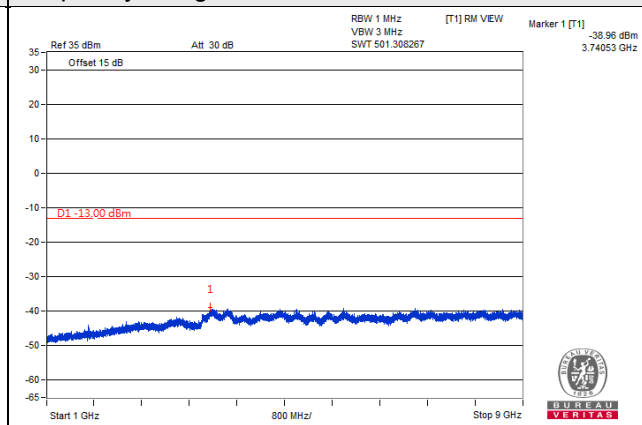


Channel 20635 (847.5MHz)

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~9GHz

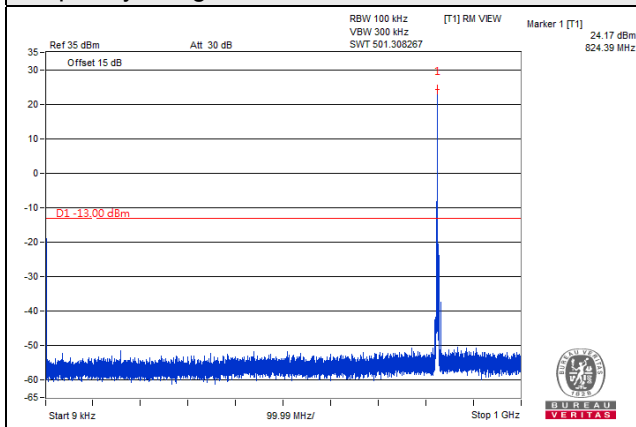


*The 9kHz signal over the limit is from Spectrum.

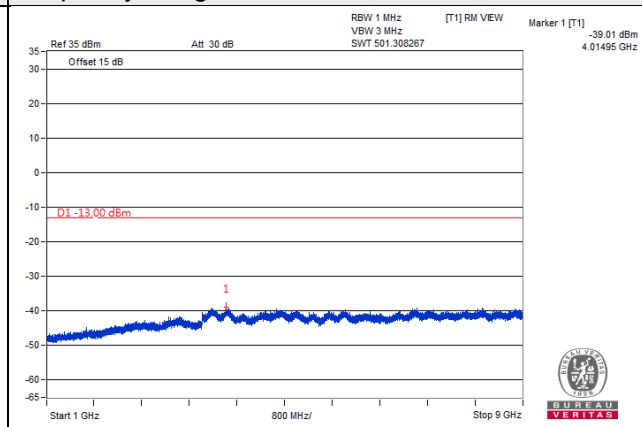
LTE Band 5, Channel Bandwidth 5MHz

Channel 20425 (826.5MHz)

Frequency Range : 9kHz~1GHz

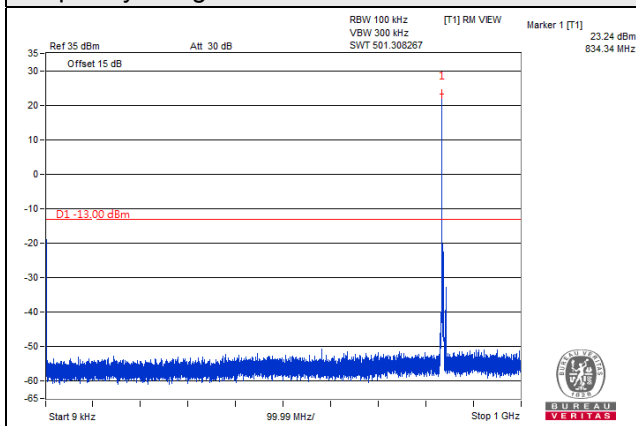


Frequency Range : 1GHz~9GHz

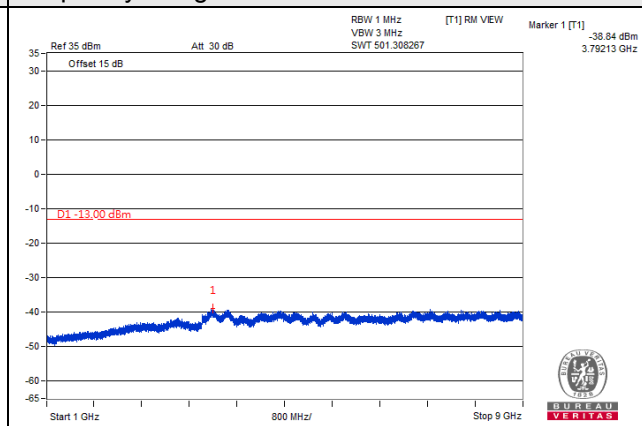


Channel 20525 (836.5MHz)

Frequency Range : 9kHz~1GHz

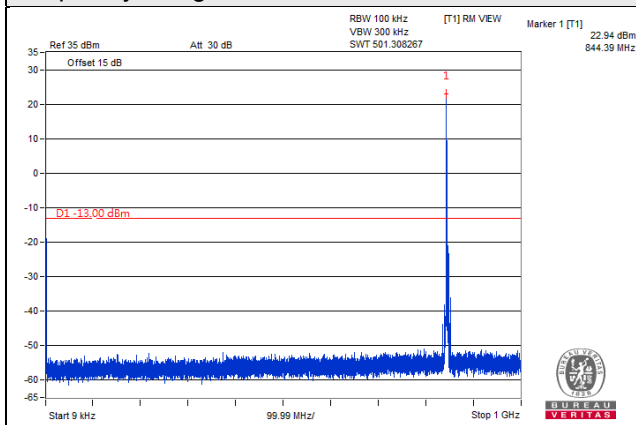


Frequency Range : 1GHz~9GHz

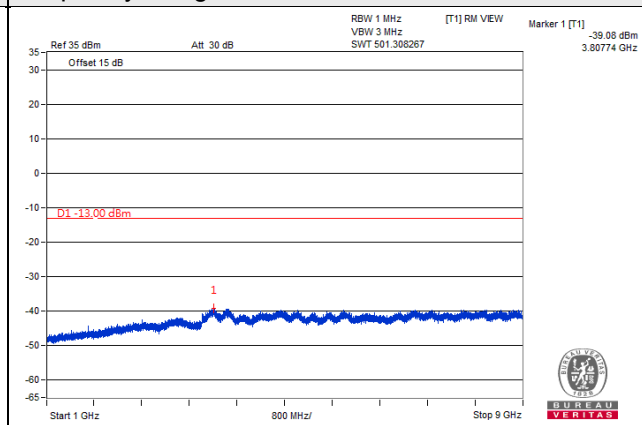


Channel 20625 (846.5MHz)

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~9GHz

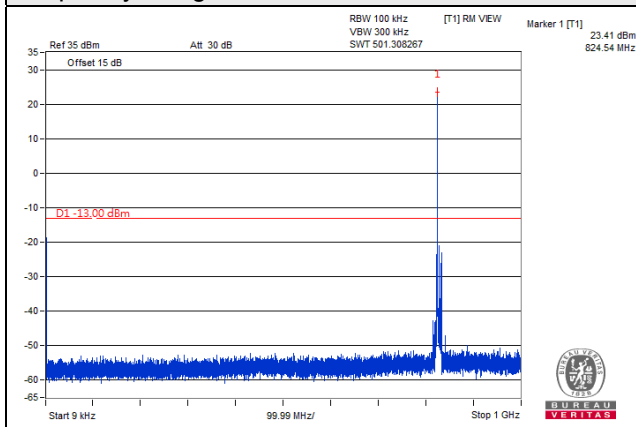


*The 9kHz signal over the limit is from Spectrum.

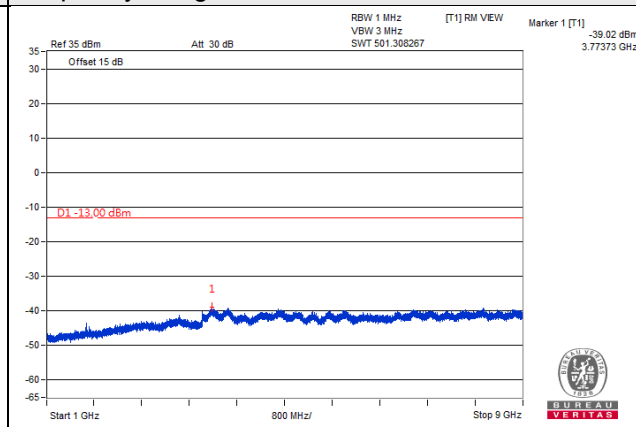
LTE Band 5, Channel Bandwidth 10MHz

Channel 20450 (829.0MHz)

Frequency Range : 9kHz~1GHz

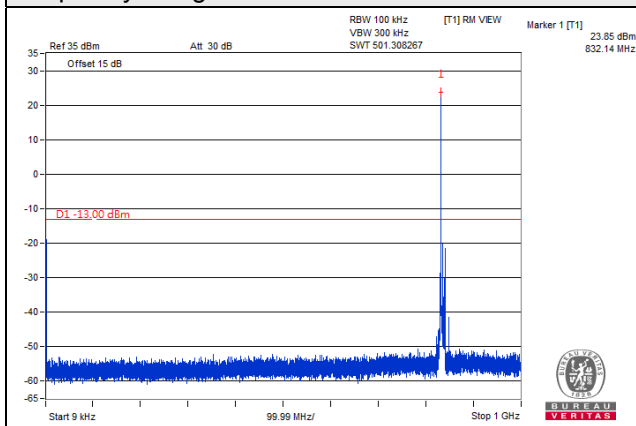


Frequency Range : 1GHz~9GHz

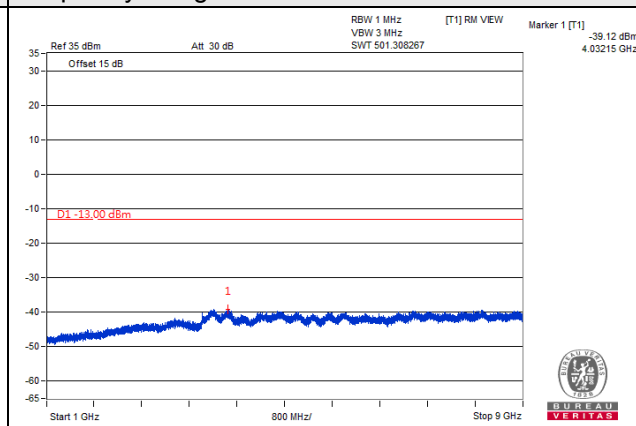


Channel 20525 (836.5MHz)

Frequency Range : 9kHz~1GHz

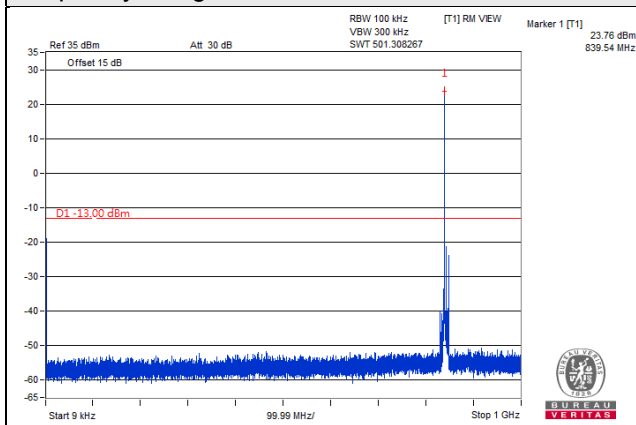


Frequency Range : 1GHz~9GHz

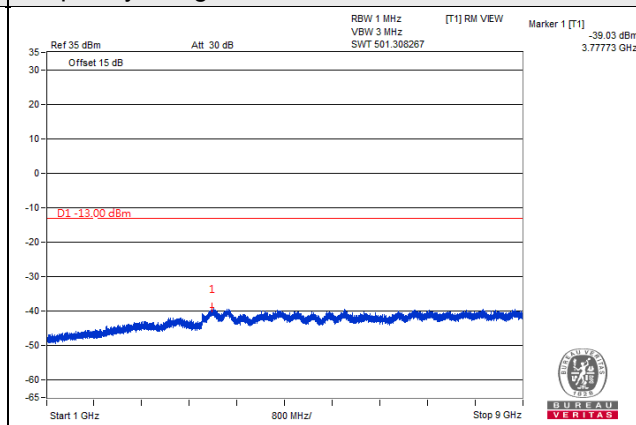


Channel 20600 (844.0MHz)

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~9GHz



*The 9kHz signal over the limit is from Spectrum.

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 equal to -13dBm .

4.8.2 Test Procedure

- a. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m (below or equal 1 GHz) and/or 1.5 m (above 1 GHz) 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 horn 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. $\text{EIRP} = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}$.
- d. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, $\text{E.R.P power} = \text{E.I.R.P power} - 2.15\text{dBi}$.

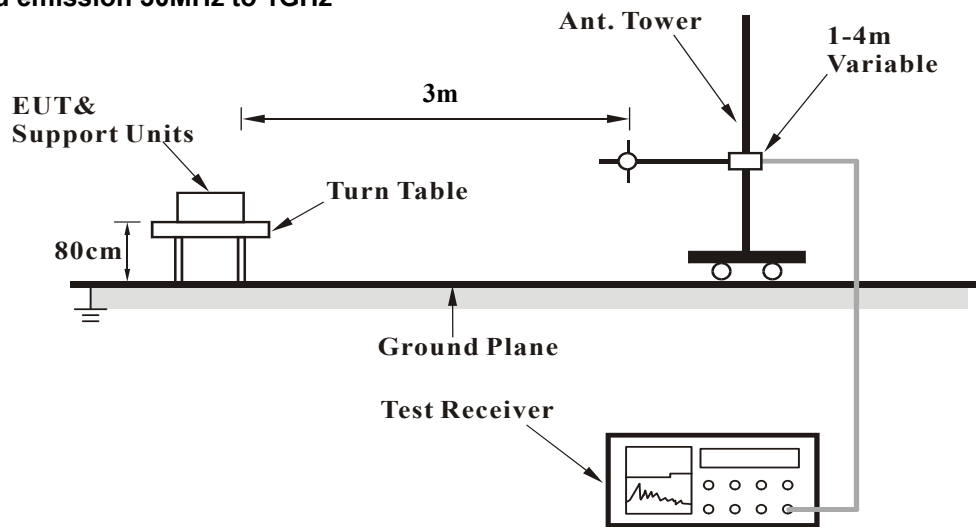
NOTE: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.

4.8.3 Deviation from Test Standard

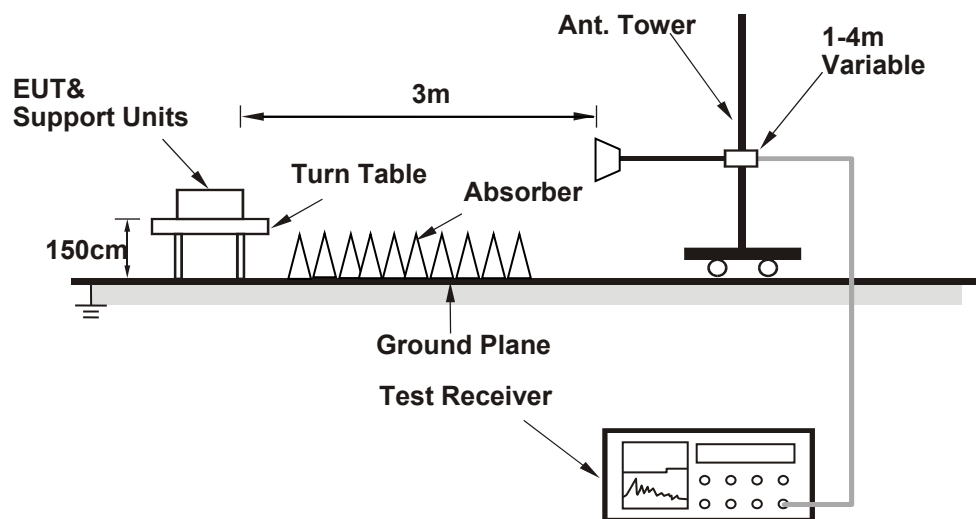
No deviation.

4.8.4 Test Setup

For radiated emission 30MHz to 1GHz



For radiated emission above 1GHz



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

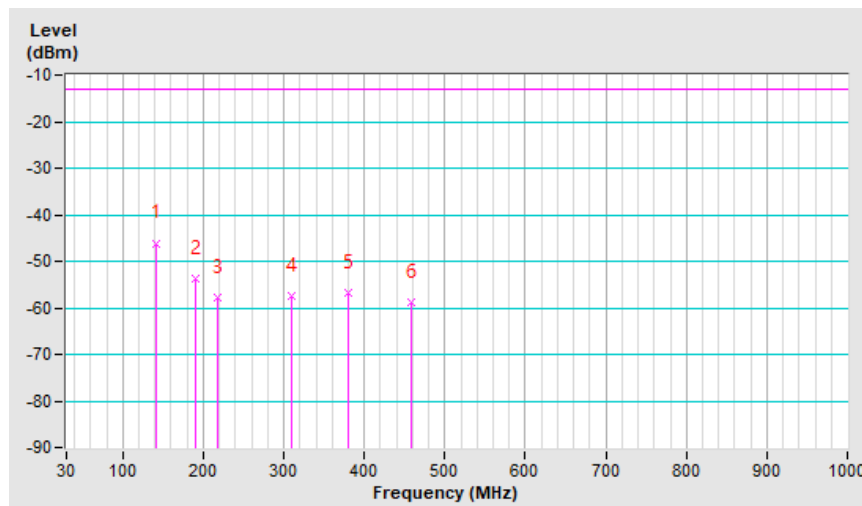
4.8.5 Test Results

Below 1GHz

WCDMA Band 5

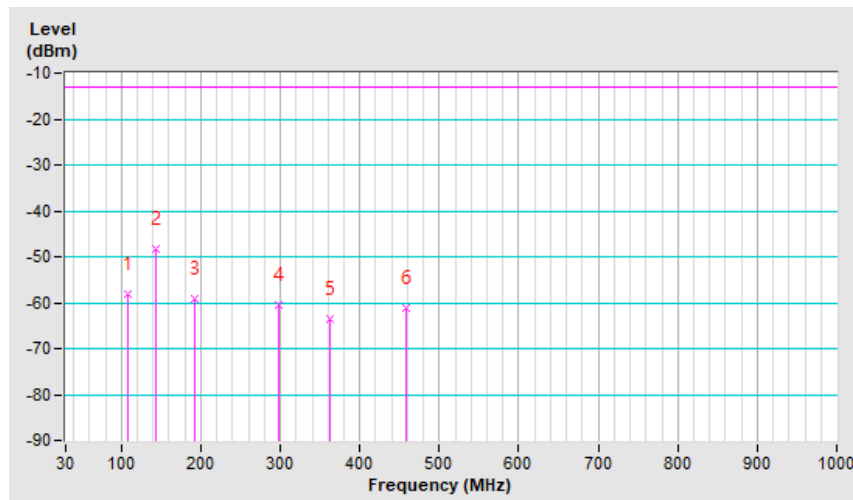
Mode	TX channel 4232 (846.6MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	23deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	141.06	-38.4	-45.8	-0.3	-46.1	-13.0	-33.1
2	190.26	-43.1	-57.9	4.2	-53.7	-13.0	-40.7
3	218.38	-46.9	-63.1	5.4	-57.7	-13.0	-44.7
4	309.75	-51.5	-62.6	5.1	-57.5	-13.0	-44.5
5	380.04	-53.0	-62.2	5.3	-56.9	-13.0	-43.9
6	458.77	-56.7	-63.7	5.0	-58.7	-13.0	-45.7



Mode	TX channel 4232 (846.6MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	23deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

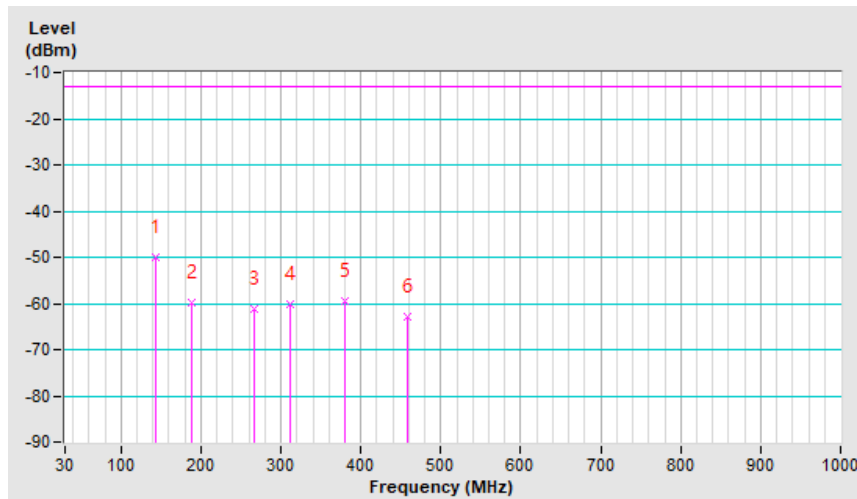
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	107.32	-48.2	-58.6	0.5	-58.1	-13.0	-45.1
2	142.46	-43.2	-47.9	-0.3	-48.2	-13.0	-35.2
3	191.67	-54.5	-63.6	4.4	-59.2	-13.0	-46.2
4	297.10	-59.1	-65.5	5.1	-60.4	-13.0	-47.4
5	363.17	-61.1	-68.9	5.2	-63.7	-13.0	-50.7
6	457.36	-59.2	-66.1	5.0	-61.1	-13.0	-48.1



LTE Band 5, Channel Bandwidth: 10MHz

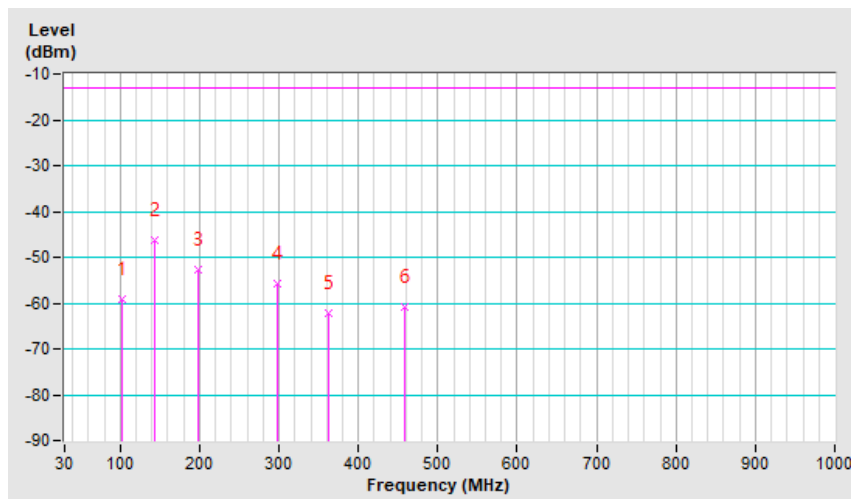
Mode	TX channel 20525 (836.5MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	23deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	142.46	-42.7	-49.8	-0.3	-50.1	-13.0	-37.1
2	188.86	-49.1	-63.9	4.1	-59.8	-13.0	-46.8
3	267.58	-54.7	-66.4	5.3	-61.1	-13.0	-48.1
4	311.16	-54.3	-65.4	5.1	-60.3	-13.0	-47.3
5	380.04	-55.5	-64.7	5.3	-59.4	-13.0	-46.4
6	457.36	-60.9	-67.9	5.0	-62.9	-13.0	-49.9



Mode	TX channel 20525 (836.5MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	23deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	103.10	-49.4	-60.1	0.8	-59.3	-13.0	-46.3
2	142.46	-41.3	-46.0	-0.3	-46.3	-13.0	-33.3
3	197.29	-48.6	-58.0	5.2	-52.8	-13.0	-39.8
4	297.10	-54.5	-60.8	5.1	-55.7	-13.0	-42.7
5	363.17	-59.6	-67.4	5.2	-62.2	-13.0	-49.2
6	458.77	-59.0	-65.9	5.0	-60.9	-13.0	-47.9



Above 1GHz
WCDMA Band 5

Mode	TX channel 4132 (826.4MHz)	Frequency Range	1GHz ~ 10GHz
Environmental Conditions	23deg. C, 67%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1652.80	-59.5	-63.0	5.5	-57.5	-13.0	-44.5
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1652.80	-59.9	-62.1	5.5	-56.6	-13.0	-43.6

Mode	TX channel 4182 (836.4MHz)	Frequency Range	1GHz ~ 10GHz
Environmental Conditions	23deg. C, 67%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1672.80	-59.9	-63.1	5.5	-57.6	-13.0	-44.6
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1672.80	-60.1	-62.1	5.5	-56.6	-13.0	-43.6

Mode	TX channel 4233 (846.6MHz)	Frequency Range	1GHz ~ 10GHz
Environmental Conditions	23deg. C, 67%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1693.20	-59.6	-62.7	5.6	-57.1	-13.0	-44.1
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1693.20	-59.9	-61.8	5.6	-56.2	-13.0	-43.2

LTE Band 5, Channel Bandwidth: 1.4MHz

Mode	TX channel 20407 (824.7MHz)	Frequency Range	1GHz ~ 10GHz
Environmental Conditions	23deg. C, 67%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

Antenna Polarity & Test Distance: Horizontal at 3 M

No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1649.40	-59.1	-62.6	5.5	-57.1	-13.0	-44.1

Antenna Polarity & Test Distance: Vertical at 3 M

No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1649.40	-55.5	-57.7	5.5	-52.2	-13.0	-39.2

Mode	TX channel 20525 (836.5MHz)	Frequency Range	1GHz ~ 10GHz
Environmental Conditions	23deg. C, 67%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

Antenna Polarity & Test Distance: Horizontal at 3 M

No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1673.00	-59.2	-62.5	5.5	-57.0	-13.0	-44.0

Antenna Polarity & Test Distance: Vertical at 3 M

No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1673.00	-55.1	-57.1	5.5	-51.6	-13.0	-38.6

Mode	TX channel 20643 (848.3MHz)	Frequency Range	1GHz ~ 10GHz
Environmental Conditions	23deg. C, 67%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

Antenna Polarity & Test Distance: Horizontal at 3 M

No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1696.60	-59.2	-62.3	5.6	-56.7	-13.0	-43.7

Antenna Polarity & Test Distance: Vertical at 3 M

No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1696.60	-55.8	-57.6	5.6	-52.0	-13.0	-39.0

LTE Band 5, Channel Bandwidth: 5MHz

Mode	TX channel 20425 (826.5MHz)	Frequency Range	1GHz ~ 10GHz
Environmental Conditions	23deg. C, 67%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1653.00	-59.2	-62.7	5.5	-57.2	-13.0	-44.2
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1653.00	-55.2	-57.5	5.5	-52.0	-13.0	-39.0

Mode	TX channel 20525 (836.5MHz)	Frequency Range	1GHz ~ 10GHz
Environmental Conditions	23deg. C, 67%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1673.00	-59.1	-62.4	5.5	-56.9	-13.0	-43.9
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1673.00	-55.4	-57.4	5.5	-51.9	-13.0	-38.9

Mode	TX channel 20625 (846.5MHz)	Frequency Range	1GHz ~ 10GHz
Environmental Conditions	23deg. C, 67%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1693.00	-59.0	-62.1	5.6	-56.5	-13.0	-43.5
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1693.00	-55.6	-57.6	5.6	-52.0	-13.0	-39.0

LTE Band 5, Channel Bandwidth: 10MHz

Mode	TX channel 20450 (829.0MHz)	Frequency Range	1GHz ~ 10GHz
Environmental Conditions	23deg. C, 67%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1658.00	-59.2	-62.6	5.5	-57.1	-13.0	-44.1
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1658.00	-55.0	-57.1	5.5	-51.6	-13.0	-38.6

Mode	TX channel 20525 (836.5MHz)	Frequency Range	1GHz ~ 10GHz
Environmental Conditions	23deg. C, 67%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1673.00	-59.4	-62.6	5.5	-57.1	-13.0	-44.1
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1673.00	-54.9	-56.9	5.5	-51.4	-13.0	-38.4

Mode	TX channel 20600 (844.0MHz)	Frequency Range	1GHz ~ 10GHz
Environmental Conditions	23deg. C, 67%RH	Input Power	120Vac, 60Hz
Tested By	Adair Peng		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1688.00	-59.5	-62.5	5.5	-57.0	-13.0	-44.0
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1688.00	-55.5	-57.4	5.5	-51.9	-13.0	-38.9

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 and approved according to ISO/IEC 17025.

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

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

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