FCC Test Report

(PART 22)

Report No.: RF200709D02

FCC ID: 2AK5B-HB1

Test Model: HB1LW1NA1

Received Date: Jul. 09, 2020

Test Date: Jul. 20 ~ Sep. 09, 2020

Issued Date: Sep. 11, 2020

Applicant: Latchable, Inc.

Address: 508 West 26th Street Suite 6G New York, NY 10001

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

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

Test Location: No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan

FCC Registration / Designation Number: 788550 / TW0003

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Release Control Record

Issue No.	Description	Date Issued
RF200709D02	Original Release	Sep. 11, 2020

1 Certificate of Conformity

Product: Hub

Brand: LATCH

Test Model: HB1LW1NA1

Sample Status: Engineering Sample

Applicant: Latchable, Inc.

Test Date: Jul. 20 ~ Sep. 09, 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 : Lena Wang , **Date:** Sep. 11, 2020

Lena Wang / Specialist

Approved by : , **Date:** Sep. 11, 2020

Dylan Chiou / 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 -16.31 dB at 1688.00 MHz.

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

2.1 Measurement Uncertainty

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

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.04 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 Agilent	N9038A	MY51210203	Mar. 18, 2020	Mar. 17, 2021
Spectrum Analyzer Agilent	N9010A	MY52220314	Dec. 12, 2019	Dec. 11, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Apr. 16, 2020	Apr. 15, 2021
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-969	Nov. 24, 2019	Nov. 23, 2020
BILOG Antenna SCHWARZBECK	VULB 9168	9168-472	Nov. 08, 2019	Nov. 07, 2020
BILOG Antenna SCHWARZBECK	VULB 9168	9168-171	Nov. 11, 2019	Nov. 10, 2020
Fixed Attenuator WOKEN	MDCS18N-10	MDCS18N-10-01	Apr. 14, 2020	Apr. 13, 2021
Loop Antenna	HLA 6121	45745	Jul. 06, 2020	Jul. 05, 2021
Preamplifier EMCI	EMC 012645	980115	Oct. 08, 2019	Oct. 07, 2020
Preamplifier EMCI	EMC 184045	980116	Oct. 08, 2019	Oct. 07, 2020
Preamplifier EMCI	EMC 330H	980112	Oct. 08, 2019	Oct. 07, 2020
RF Coaxial Cable HUBER+SUHNNER	EMC104-SM-SM-8000&3000	140811+170717	Oct. 08, 2019	Oct. 07, 2020
RF Coaxial Cable HUBER+SUHNNER	SUCOFLEX 104	EMC104-SM-SM-1000(140807)	Oct. 08, 2019	Oct. 07, 2020
RF Coaxial Cable WOKEN	8D-FB	Cable-Ch10-01	Oct. 08, 2019	Oct. 07, 2020
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower &Turn Table Controller MF	MF-7802	NA	NA	NA
Radio Communication Analyzer Anritsu	MT8820C	6201300640	Aug. 19, 2019	Aug. 18, 2021
Radio Communication Analyzer Anritsu	MT8821C	6201462755	Feb. 13, 2020	Feb. 12, 2021
Spectrum Analyzer ROHDE & SCHWARZ	FSW43	101582	Mar. 31, 2020	Mar. 30, 2021
Temperature & Humidity Chamber GIANT FORCE	GTH-120-40-CP-AR	MAA1306-019	Sep. 10, 2019	Sep. 09, 2020
AC Power Source EEC	6905S	1991553	NA	NA
Digital Multimeter Fluke	87-III	70360742	Jun. 23, 2020	Jun. 22, 2021
MXG Vector signal generatorAgilent	N5182B	MY53050430	Nov. 25, 2019	Nov. 24, 2020

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 10.

3 General Information

3.1 General Description of EUT

Product	Hub	
Brand	LATCH	
Test Model	HB1LW1NA1	
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	826.4 ~ 846.6 MHz
	LTE 5 (Channel Bandwidth: 1.4 MHz)	824.7 ~ 848.3 MHz
	LTE 5 (Channel Bandwidth: 3 MHz)	825.5 ~ 847.5 MHz
	LTE 5 (Channel Bandwidth: 5 MHz)	826.5 ~ 846.5 MHz
	LTE 5 (Channel Bandwidth: 10 MHz)	829 ~ 844 MHz
Max. ERP Power	WCDMA	232.27 mW
	LTE 5 (Channel Bandwidth: 1.4 MHz)	166.72 mW
	LTE 5 (Channel Bandwidth: 3 MHz)	175.39 mW
	LTE 5 (Channel Bandwidth: 5 MHz)	185.35 mW
	LTE 5 (Channel Bandwidth: 10 MHz)	195.43 mW
Emission Designator	WCDMA	4M08F9W
	LTE 5 (Channel Bandwidth: 1.4 MHz)	1M09D7W
	LTE 5 (Channel Bandwidth: 3 MHz)	2M70G7D
	LTE 5 (Channel Bandwidth: 5 MHz)	4M49D7W
	LTE 5 (Channel Bandwidth: 10 MHz)	8M98D7W
Antenna Type	Refer to Note as below	
Accessory Device	Refer to Note as below	
Data Cable Supplied	N/A	

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

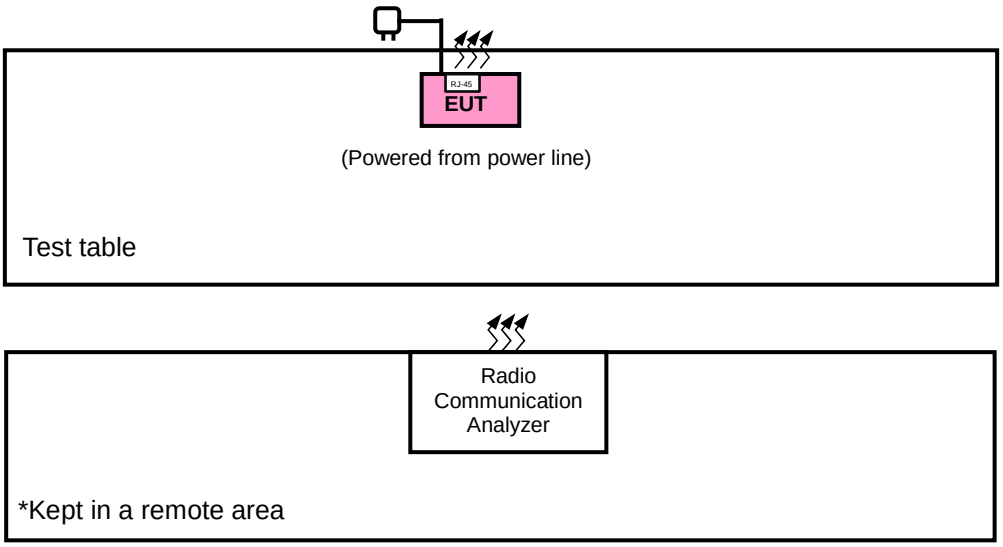
2. The antenna information is listed as below.

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)	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.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
1.	Radio Communication Analyzer	ANRITSU	MT8821C	6201462755	N/A

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	ERP	Radiated Emission
WCDMA	Y-plane	Y-axis
LTE Band 5	X-plane	X-axis

WCDMA

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Mode
-	ERP	4132 to 4233	4132, 4182, 4233	WCDMA
-	Modulation Characteristics	4132 to 4233	4182	WCDMA
-	Frequency Stability	4132 to 4233	4132, 4233	WCDMA
-	Occupied Bandwidth	4132 to 4233	4132, 4182, 4233	WCDMA
-	Band Edge	4132 to 4233	4132, 4233	WCDMA
-	Peak to Average Ratio	4132 to 4233	4132, 4182, 4233	WCDMA
-	Conducted Emission	4132 to 4233	4132, 4182, 4233	WCDMA
-	Radiated Emission	4132 to 4233	4132, 4182, 4233	WCDMA

LTE Band 5

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	ERP	20407 to 20643	20407, 20525, 20643	1.4 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		20415 to 20635	20415, 20525, 20635	3 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		20425 to 20625	20425, 20525, 20625	5 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		20450 to 20600	20450, 20525, 20600	10 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
-	Modulation Characteristics	20450 to 20600	20525	5 MHz	QPSK, 16QAM	50 RB / 0 RB Offset
-	Frequency Stability	20407 to 20643	20407, 20643	1.4 MHz	QPSK	1 RB / 0 RB Offset
		20415 to 20635	20415, 20635	3 MHz	QPSK	1 RB / 0 RB Offset
		20425 to 20625	20425, 20625	5 MHz	QPSK	1 RB / 0 RB Offset
		20450 to 20600	20450, 20600	10 MHz	QPSK	1 RB / 0 RB Offset
-	Occupied Bandwidth	20407 to 20643	20407, 20525, 20643	1.4 MHz	QPSK, 16QAM	6 RB / 0 RB Offset
		20415 to 20635	20415, 20525, 20635	3 MHz	QPSK, 16QAM	15 RB / 0 RB Offset
		20425 to 20625	20425, 20525, 20625	5 MHz	QPSK, 16QAM	25 RB / 0 RB Offset
		20450 to 20600	20450, 20525, 20600	10 MHz	QPSK, 16QAM	50 RB / 0 RB Offset
-	Band Edge	20407 to 20643	20407	1.4MHz	QPSK	1 RB / 0 RB Offset
						6 RB / 0 RB Offset
			20643	1.4MHz	QPSK	1 RB / 5 RB Offset
						6 RB / 0 RB Offset
		20415 to 20635	20415	3 MHz	QPSK	1 RB / 0 RB Offset
						15 RB / 0 RB Offset
			20635	3 MHz	QPSK	1 RB / 14 RB Offset
						15 RB / 0 RB Offset
		20425 to 20625	20425	5 MHz	QPSK	1 RB / 0 RB Offset
						25 RB / 0 RB Offset
			20625	5 MHz	QPSK	1 RB / 24 RB Offset
						25 RB / 0 RB Offset
		20450 to 20600	20450	10 MHz	QPSK	1 RB / 0 RB Offset
						50 RB / 0 RB Offset
			20600	10 MHz	QPSK	1 RB / 49 RB Offset
						50 RB / 0 RB Offset
-	Peak to Average Ratio	20407 to 20643	20407, 20525, 20643	1.4 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		20415 to 20635	20415, 20525, 20635	3 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		20425 to 20625	20425, 20525, 20625	5 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		20450 to 20600	20450, 20525, 20600	10 MHz	QPSK, 16QAM	1 RB / 0 RB Offset

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	Conducted Emission	20407 to 20643	20407, 20525, 20643	1.4 MHz	QPSK	1 RB / 0 RB Offset
		20415 to 20635	20415, 20525, 20635	3 MHz	QPSK	1 RB / 0 RB Offset
		20425 to 20625	20425, 20525, 20625	5 MHz	QPSK	1 RB / 0 RB Offset
		20450 to 20600	20450, 20525, 20600	10 MHz	QPSK	1 RB / 0 RB Offset
-	Radiated Emission	20407 to 20643	20407, 20525, 20643	1.4 MHz	QPSK	1 RB / 0 RB Offset
		20425 to 20625	20425, 20525, 20625	5 MHz	QPSK	1 RB / 0 RB Offset
		20450 to 20600	20450, 20525, 20600	10 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 ERP, 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. For radiated emission (below 1GHz) test items, the worst radiated emission (above 1GHz) mode was selected.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
ERP	25 deg. C, 65 % RH	120 Vac, 60 Hz	Jisyong Wang
Modulation Characteristics	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
Frequency Stability	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
Occupied Bandwidth	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
Band Edge	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
Peak to Average Ratio	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
Conducted Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
Radiated Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang, Cyril Chen

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

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 7 watts e.r.p.

4.1.2 Test Procedures

EIRP / ERP Measurement:

a. All measurements were done at low, middle and high operational frequency range. RBW and VBW is 5 MHz for WCDMA and 5MHz, 10 MHz for LTE mode, and VBW ≥ 3 x RBW.

b. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m (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 1 m to 4 m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.

c. 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 b. Record the power level of S.G.

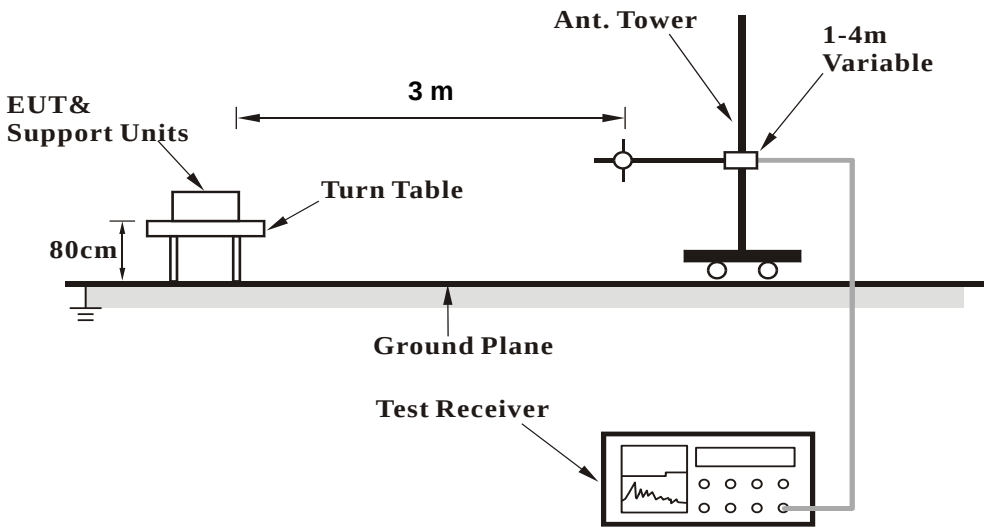
d. EIRP = Output power level of S.G – TX cable loss + Antenna gain of substitution horn. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, E.R.P power = E.I.R.P power - 2.15 dB.

Conducted Power Measurement:

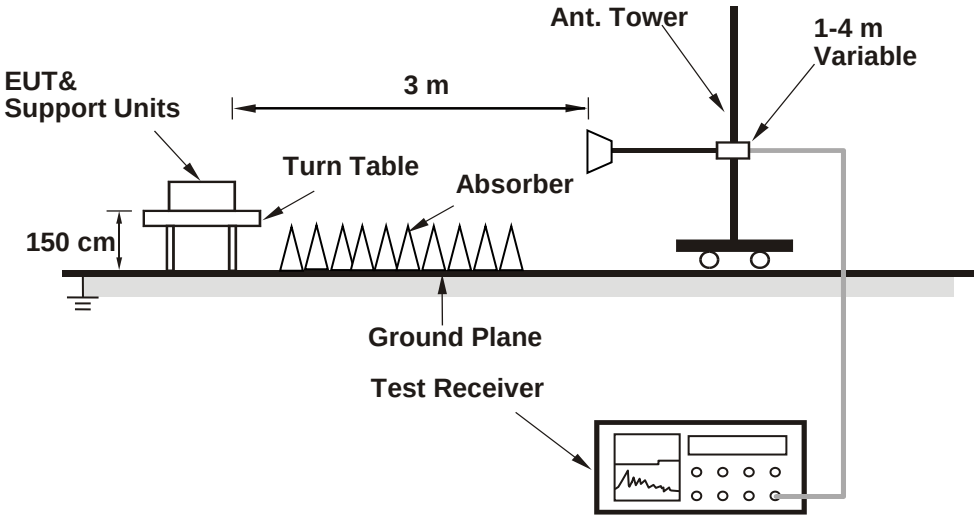
The EUT was set up for the maximum power with WCDMA and LTE link data modulation and link up with simulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

4.1.3 Test Setup

EIRP / ERP Measurement:
<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).

Conducted Power Measurement:

4.1.4 Test Results

Conducted Output Power (dBm)

Band	WCDMA V		
Channel	4132	4182	4233
Frequency (MHz)	826.4	836.4	846.6
RMC 12.2K	22.94	22.98	23.02
HSDPA Subtest-1	21.75	21.72	21.68
HSDPA Subtest-2	21.69	21.85	21.67
HSDPA Subtest-3	21.88	21.95	21.75
HSDPA Subtest-4	21.84	21.75	21.94
DC-HSDPA Subtest-1	21.76	21.68	21.84
DC-HSDPA Subtest-2	21.86	21.58	21.76
DC-HSDPA Subtest-3	21.67	21.94	21.72
DC-HSDPA Subtest-4	21.95	21.67	21.76

LTE Band 5

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		20450	20525	20600	
		Frequency (MHz)		829.0	836.5	844.0	
10M	QPSK	1	0	22.74	22.82	23.05	0
		1	24	22.65	22.71	22.92	0
		1	49	22.42	22.55	22.71	0
		25	0	21.60	21.66	21.90	1
		25	12	21.40	21.48	21.70	1
		25	25	21.32	21.39	21.58	1
		50	0	21.65	21.67	21.84	1
	16QAM	1	0	21.65	21.81	21.97	1
		1	24	21.63	21.64	21.85	1
		1	49	21.40	21.47	21.63	1
		25	0	20.59	20.61	20.78	2
		25	12	20.31	20.45	20.61	2
		25	25	20.29	20.37	20.56	2
		50	0	20.63	20.60	20.75	2

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		20425	20525	20625	
		Frequency (MHz)		826.5	836.5	846.5	
5M	QPSK	1	0	22.69	22.75	23.00	0
		1	12	22.57	22.63	22.88	0
		1	24	22.35	22.42	22.77	0
		12	0	21.54	21.62	21.89	1
		12	6	21.38	21.44	21.72	1
		12	13	21.27	21.37	21.60	1
		25	0	21.54	21.64	21.81	1
	16QAM	1	0	21.64	21.69	21.93	1
		1	12	21.48	21.56	21.86	1
		1	24	21.29	21.41	21.71	1
		12	0	20.47	20.54	20.86	2
		12	6	20.31	20.42	20.70	2
		12	13	20.21	20.34	20.54	2
		25	0	20.50	20.59	20.79	2

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		20415	20525	20635	
		Frequency (MHz)		825.5	836.5	847.5	
3M	QPSK	1	0	22.61	22.71	22.90	0
		1	7	22.49	22.62	22.79	0
		1	14	22.25	22.40	22.68	0
		8	0	21.47	21.56	21.83	1
		8	3	21.33	21.34	21.62	1
		8	7	21.19	21.26	21.50	1
		15	0	21.56	21.57	21.86	1
	16QAM	1	0	21.59	21.69	21.84	1
		1	7	21.44	21.56	21.70	1
		1	14	21.21	21.31	21.64	1
		8	0	20.33	20.34	20.81	2
		8	3	20.24	20.33	20.61	2
		8	7	20.15	20.22	20.47	2
		15	0	20.53	20.50	20.85	2

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		20407	20525	20643	
		Frequency (MHz)		824.7	836.5	848.3	
1.4M	QPSK	1	0	22.55	22.70	22.87	0
		1	2	22.41	22.55	22.76	0
		1	5	22.29	22.33	22.60	0
		3	0	21.44	21.51	21.75	0
		3	1	21.25	21.32	21.56	0
		3	3	21.16	21.16	21.44	0
		6	0	21.37	21.47	21.74	1
	16QAM	1	0	21.49	21.63	21.84	1
		1	2	21.32	21.51	21.75	1
		1	5	21.24	21.32	21.55	1
		3	0	20.29	20.41	20.61	1
		3	1	20.20	20.23	20.53	1
		3	3	20.15	20.12	20.37	1
		6	0	20.32	20.26	20.55	2

ERP Power (dBm)

WCDMA							
Plane	**Channel**	**Frequency (MHz)**	**Reading (dBm)**	**Correction Factor (dB)**	**ERP (dBm)**	**ERP (mW)**	**Polarization (H/V)**
Y	4132	826.4	-6.83	32.62	23.64	231.21	H
	4182	836.4	-6.76	32.52	23.61	229.61	
	4233	846.6	-6.84	32.65	23.66	232.27	
	4132	826.4	-14.93	32.76	15.68	36.98	V
	4182	836.4	-14.57	32.39	15.67	36.90	
	4233	846.6	-14.66	32.54	15.73	37.41	

Note: ERP (dBm) = Reading (dBm) + Correction Factor (dB) – 2.15

LTE Band 5							
Channel Bandwidth: 1.4 MHz / QPSK							
Plane	**Channel**	**Frequency (MHz)**	**Reading (dBm)**	**Correction Factor (dB)**	**ERP (dBm)**	**ERP (mW)**	**Polarization (H/V)**
X	20407	824.7	-8.43	32.62	22.04	159.96	H
	20525	836.5	-8.15	32.52	22.22	166.72	
	20643	848.3	-8.61	32.65	21.89	154.53	
	20407	824.7	-15.09	32.76	15.52	35.65	V
	20525	836.5	-14.41	32.39	15.83	38.28	
	20643	848.3	-15.03	32.54	15.36	34.36	
Channel Bandwidth: 1.4 MHz / 16QAM							
X	20407	824.7	-11.57	32.62	21.05	127.35	H
	20525	836.5	-11.29	32.52	21.23	132.74	
	20643	848.3	-11.75	32.65	20.90	123.03	
	20407	824.7	-18.23	32.76	14.53	28.38	V
	20525	836.5	-17.55	32.39	14.84	30.48	
	20643	848.3	-18.17	32.54	14.37	27.35	

Note: ERP (dBm) = Reading (dBm) + Correction Factor (dB) – 2.15

LTE Band 5							
Channel Bandwidth: 3 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (mW)	Polarization (H/V)
X	20415	825.5	-8.21	32.62	22.26	168.27	H
	20525	836.5	-7.93	32.52	22.44	175.39	
	20635	847.5	-8.39	32.65	22.11	162.55	
	20415	825.5	-14.87	32.76	15.74	37.50	V
	20525	836.5	-14.19	32.39	16.05	40.27	
	20635	847.5	-14.81	32.54	15.58	36.14	
Channel Bandwidth: 3 MHz / 16QAM							
X	20415	825.5	-9.17	32.62	21.30	134.90	H
	20525	836.5	-8.89	32.52	21.48	140.60	
	20635	847.5	-9.35	32.65	21.15	130.32	
	20415	825.5	-15.83	32.76	14.78	30.06	V
	20525	836.5	-15.15	32.39	15.09	32.28	
	20635	847.5	-15.77	32.54	14.62	28.97	

Note: ERP (dBm) = Reading (dBm) + Correction Factor (dB) – 2.15

LTE Band 5							
Channel Bandwidth: 5 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (mW)	Polarization (H/V)
X	20425	826.5	-7.97	32.62	22.50	177.83	H
	20525	836.5	-7.69	32.52	22.68	185.35	
	20625	846.5	-8.15	32.65	22.35	171.79	
	20425	826.5	-14.63	32.76	15.98	39.63	V
	20525	836.5	-13.95	32.39	16.29	42.56	
	20625	846.5	-14.57	32.54	15.82	38.19	
Channel Bandwidth: 5 MHz / 16QAM							
X	20425	826.5	-8.96	32.62	21.51	141.58	H
	20525	836.5	-8.68	32.52	21.69	147.57	
	20625	846.5	-9.14	32.65	21.36	136.77	
	20425	826.5	-15.62	32.76	14.99	31.55	V
	20525	836.5	-14.94	32.39	15.30	33.88	
	20625	846.5	-15.56	32.54	14.83	30.41	

Note: ERP (dBm) = Reading (dBm) + Correction Factor (dB) – 2.15

LTE Band 5							
Channel Bandwidth: 10 MHz / QPSK							
Plane	**Channel**	**Frequency (MHz)**	**Reading (dBm)**	**Correction Factor (dB)**	**ERP (dBm)**	**ERP (mW)**	**Polarization (H/V)**
X	20450	829.0	-7.74	32.62	22.73	187.50	H
	20525	836.5	-7.46	32.52	22.91	195.43	
	20600	844.0	-7.92	32.65	22.58	181.13	
	20450	829.0	-14.40	32.76	16.21	41.78	V
	20525	836.5	-13.72	32.39	16.52	44.87	
	20600	844.0	-14.34	32.54	16.05	40.27	
Channel Bandwidth: 10 MHz / 16QAM							
X	20450	829.0	-8.72	32.62	21.75	149.62	H
	20525	836.5	-8.44	32.52	21.93	155.96	
	20600	844.0	-8.90	32.65	21.60	144.54	
	20450	829.0	-15.38	32.76	15.23	33.34	V
	20525	836.5	-14.70	32.39	15.54	35.81	
	20600	844.0	-15.32	32.54	15.07	32.14	

Note: ERP (dBm) = Reading (dBm) + Correction Factor (dB) – 2.15

4.2 Modulation Characteristics Measurement

4.2.1 Limits of Modulation Characteristics

N/A

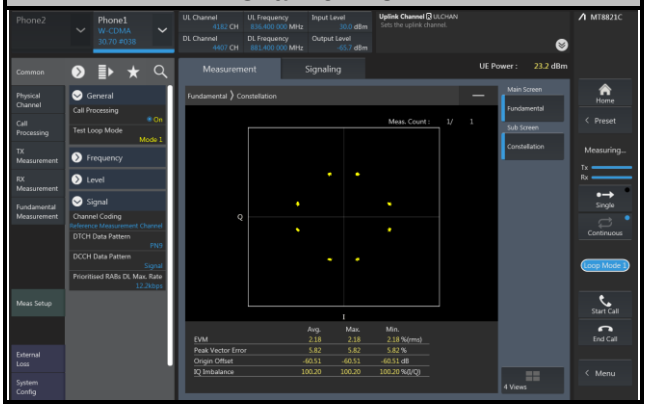
4.2.2 Test Setup

4.2.3 Test Procedure

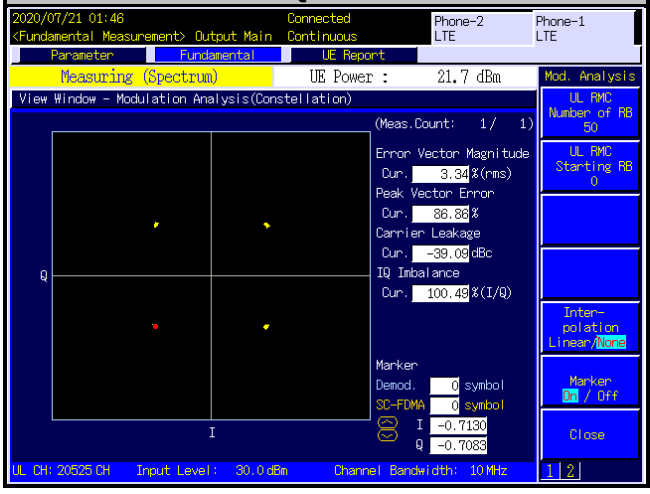
Connect the EUT to Communication Simulator via the antenna connector. The frequency band is set as EUT supported Modulation and Channels, the EUT output is matched with 50 ohm load, the waveform quality and constellation of the EUT was tested.

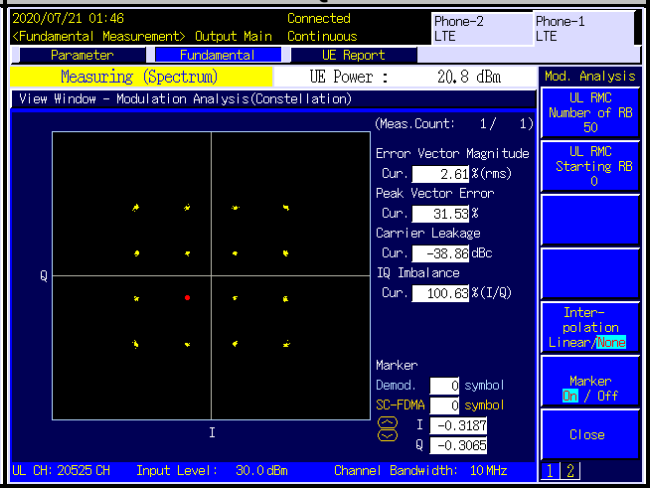
4.2.4 Test Results

Spectrum Plot of Measurement
WCDMA
Channel 4182



Spectrum Plot of Measurement	
LTE Band 5	
Channel 20525	
QPSK	16QAM





4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

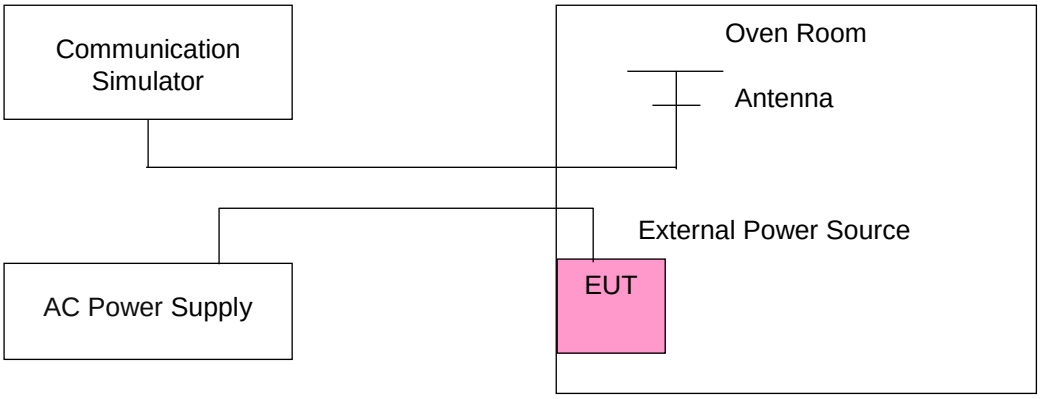
1.5 ppm is for base and fixed station. 2.5 ppm is for mobile station.

4.3.2 Test Procedure

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

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

4.3.3 Test Setup



4.3.4 Test Results

Frequency Error vs. Voltage

Voltage (Volts)	WCDMA				Limit (ppm)
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
120	826.400003	0.003	846.600002	0.002	2.5
102	826.400003	0.003	846.600003	0.003	2.5
138	826.400002	0.002	846.600002	0.002	2.5

Note: The applicant defined the normal working voltage of the battery is from 102 Vac to 138 Vac.

Frequency Error vs. Temperature

Temp. (℃)	WCDMA				Limit (ppm)
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
-30	826.400001	0.001	846.600003	0.003	2.5
-20	826.400003	0.003	846.600004	0.005	2.5
-10	826.400001	0.001	846.600002	0.003	2.5
0	826.400003	0.004	846.600004	0.005	2.5
10	826.399996	-0.005	846.599996	-0.004	2.5
20	826.399998	-0.002	846.599998	-0.002	2.5
30	826.399998	-0.003	846.599998	-0.002	2.5
40	826.399997	-0.004	846.599998	-0.003	2.5
50	826.399997	-0.004	846.599998	-0.002	2.5

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 5				Limit (ppm)
	Channel Bandwidth: 1.4 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
120	824.700004	0.004	848.300001	0.001	2.5
102	824.700004	0.004	848.300003	0.003	2.5
138	824.700002	0.003	848.300002	0.003	2.5

Note: The applicant defined the normal working voltage of the battery is from 102 Vac to 138 Vac.

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 5				Limit (ppm)
	Channel Bandwidth: 1.4 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
-30	824.700003	0.003	848.300003	0.003	2.5
-20	824.700003	0.004	848.300003	0.004	2.5
-10	824.700002	0.002	848.300003	0.004	2.5
0	824.700003	0.003	848.300004	0.005	2.5
10	824.700002	0.002	848.300003	0.003	2.5
20	824.699997	-0.003	848.299998	-0.003	2.5
30	824.699996	-0.004	848.299998	-0.003	2.5
40	824.699996	-0.004	848.299997	-0.004	2.5
50	824.699999	-0.001	848.299996	-0.004	2.5

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 5				Limit (ppm)
	Channel Bandwidth: 3 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
120	825.500002	0.003	847.500003	0.004	2.5
102	825.500002	0.003	847.500003	0.003	2.5
138	825.500001	0.001	847.500001	0.001	2.5

Note: The applicant defined the normal working voltage of the battery is from 102 Vac to 138 Vac.

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 5				Limit (ppm)
	Channel Bandwidth: 3 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
-30	825.500001	0.001	847.500002	0.002	2.5
-20	825.500003	0.004	847.500002	0.002	2.5
-10	825.500004	0.004	847.500004	0.004	2.5
0	825.500002	0.002	847.500003	0.004	2.5
10	825.500002	0.003	847.500002	0.002	2.5
20	825.499998	-0.003	847.499996	-0.005	2.5
30	825.499998	-0.002	847.499996	-0.004	2.5
40	825.499997	-0.004	847.499996	-0.004	2.5
50	825.499997	-0.003	847.499997	-0.004	2.5

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 5				Limit (ppm)
	Channel Bandwidth: 5 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
120	826.500002	0.002	846.500003	0.004	2.5
102	826.500004	0.004	846.500003	0.004	2.5
138	826.500003	0.004	846.500004	0.005	2.5

Note: The applicant defined the normal working voltage of the battery is from 102 Vac to 138 Vac.

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 5				Limit (ppm)
	Channel Bandwidth: 5 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
-30	826.500004	0.005	846.500002	0.002	2.5
-20	826.500003	0.004	846.500004	0.004	2.5
-10	826.500004	0.004	846.500001	0.001	2.5
0	826.500002	0.003	846.500003	0.003	2.5
10	826.500003	0.003	846.500004	0.004	2.5
20	826.499996	-0.005	846.499999	-0.002	2.5
30	826.499999	-0.002	846.499998	-0.002	2.5
40	826.499996	-0.005	846.499998	-0.003	2.5
50	826.499997	-0.004	846.499998	-0.002	2.5

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 5				Limit (ppm)
	Channel Bandwidth: 10 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
120	829.000001	0.001	844.000004	0.004	2.5
102	829.000002	0.002	844.000004	0.005	2.5
138	829.000003	0.003	844.000003	0.004	2.5

Note: The applicant defined the normal working voltage of the battery is from 102 Vac to 138 Vac.

Frequency Error vs. Temperature

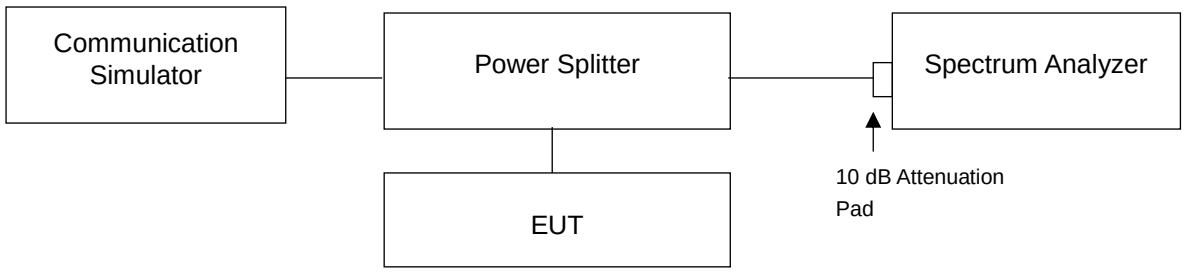
Temp. (℃)	LTE Band 5				Limit (ppm)
	Channel Bandwidth: 10 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
-30	829.000002	0.003	844.000004	0.005	2.5
-20	829.000003	0.004	844.000003	0.003	2.5
-10	829.000003	0.004	844.000003	0.003	2.5
0	829.000001	0.001	844.000002	0.002	2.5
10	829.000001	0.001	844.000001	0.002	2.5
20	828.999998	-0.003	843.999996	-0.005	2.5
30	828.999997	-0.003	843.999996	-0.004	2.5
40	828.999996	-0.005	843.999999	-0.001	2.5
50	828.999998	-0.003	843.999999	-0.002	2.5

4.4 Occupied Bandwidth Measurement

4.4.1 Test Procedure

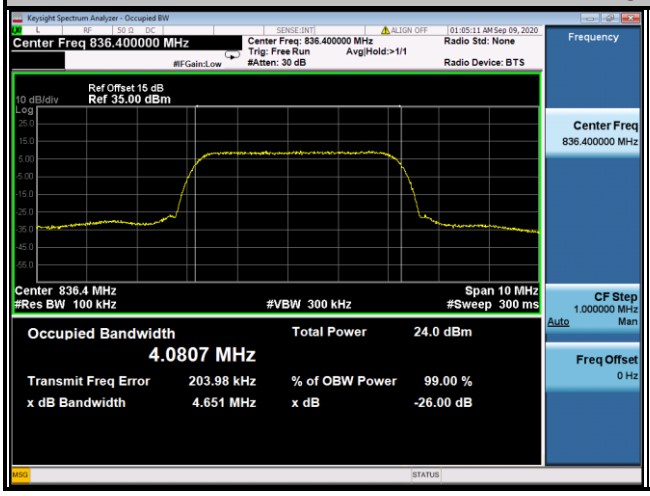
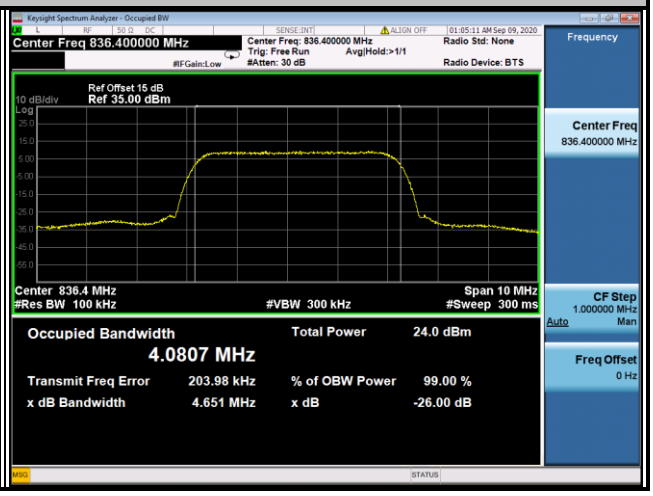
The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

4.4.2 Test Setup



4.4.3 Test Result

WCDMA			
Channel	**Frequency (MHz)**	**99 % Occupied Bandwidth (MHz)**	**26 dB Bandwidth (MHz)**
4132	826.4	4.0729	4.633
4182	836.4	4.0807	4.651
4233	846.6	4.0720	4.635

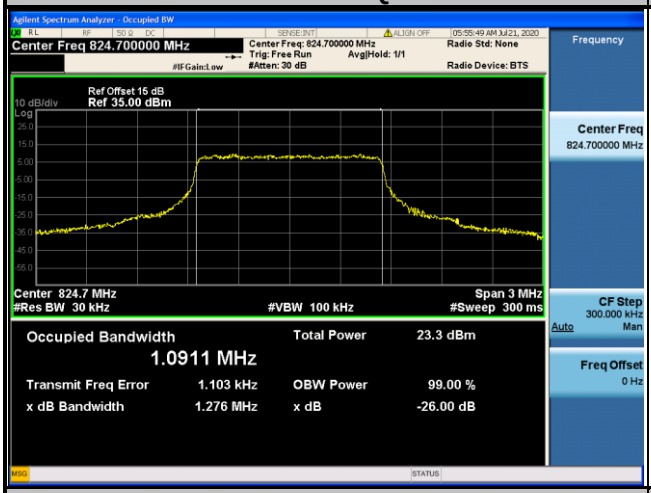
Spectrum Plot of Worst Value	
99 % Occupied Bandwidth	**26 dB Bandwidth**
WCDMA	
	

LTE Band 5					
Channel Bandwidth: 1.4 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
20407	824.7	1.0886	1.0911	1.291	1.276
20525	836.5	1.0887	1.0887	1.284	1.284
20643	848.3	1.0888	1.0894	1.292	1.286
Channel Bandwidth: 3 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
20415	825.5	2.7000	2.6973	2.932	2.928
20525	836.5	2.7000	2.6970	2.919	2.934
20635	847.5	2.7010	2.6959	2.928	2.924

Spectrum Plot of Worst Value

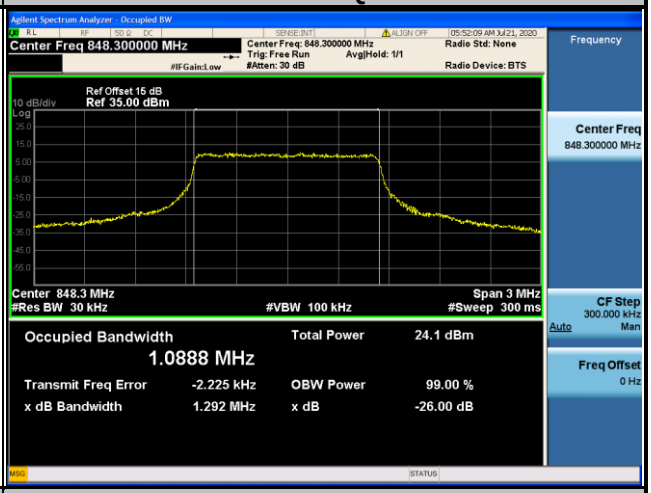
99 % Occupied Bandwidth

1.4 MHz / 16QAM

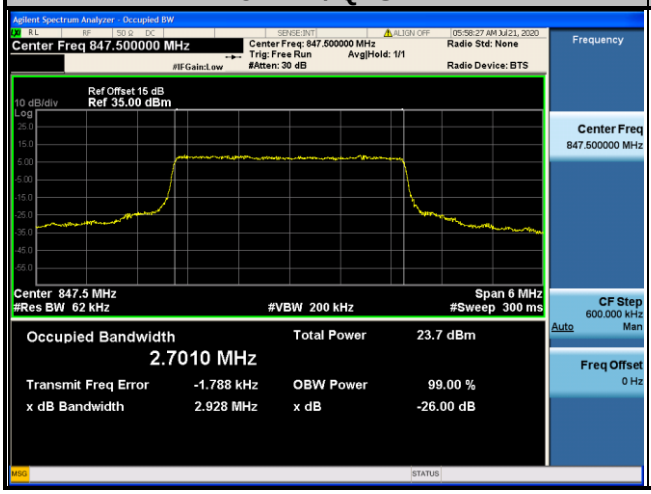


26 dB Bandwidth

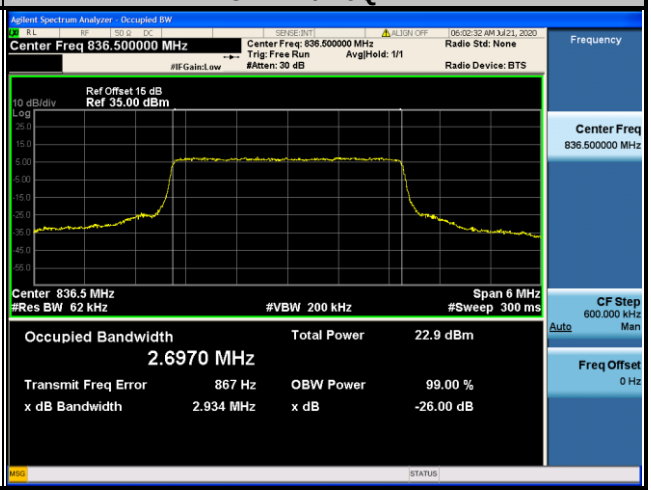
1.4 MHz / QPSK



3 MHz / QPSK



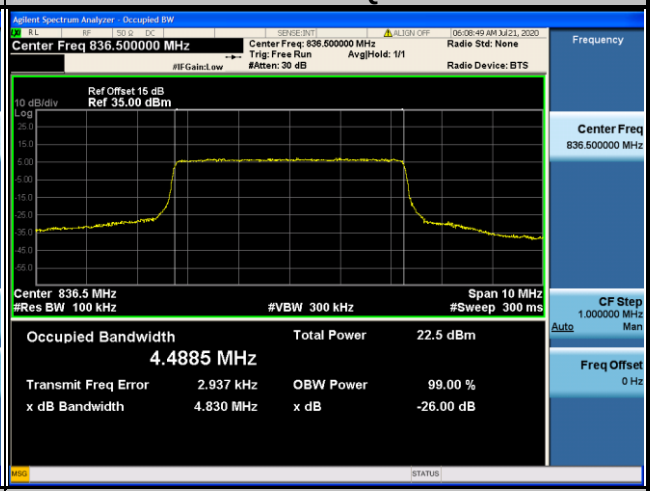
3 MHz / 16QAM



LTE Band 5					
Channel Bandwidth: 5 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
20425	826.5	4.4834	4.4853	4.803	4.815
20525	836.5	4.4840	4.4885	4.818	4.830
20625	846.5	4.4816	4.4841	4.791	4.824
Channel Bandwidth: 10 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
20450	829.0	8.9646	8.9641	9.526	9.577
20525	836.5	8.9733	8.9821	9.552	9.568
20600	844.0	8.9548	8.9496	9.523	9.514

Spectrum Plot of Worst Value

99 % Occupied Bandwidth	26 dB Bandwidth
5 MHz / 16QAM	5 MHz / 16QAM



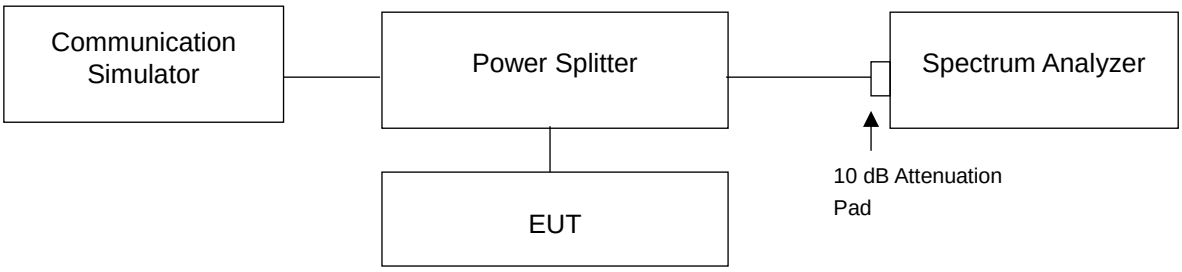
10 MHz / 16QAM	10 MHz / 16QAM

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

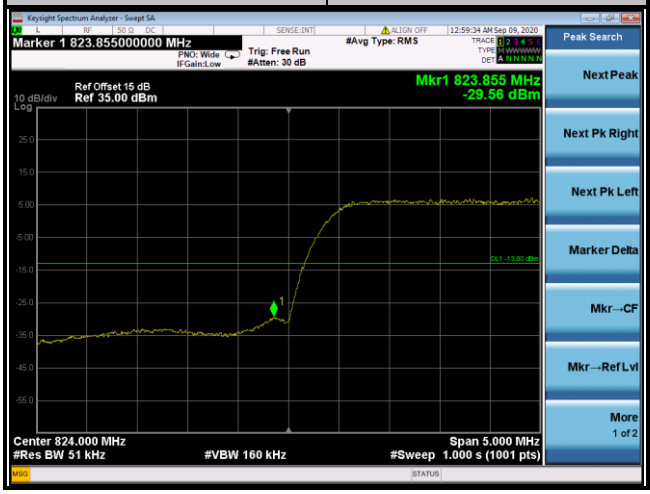


4.5.3 Test Procedures

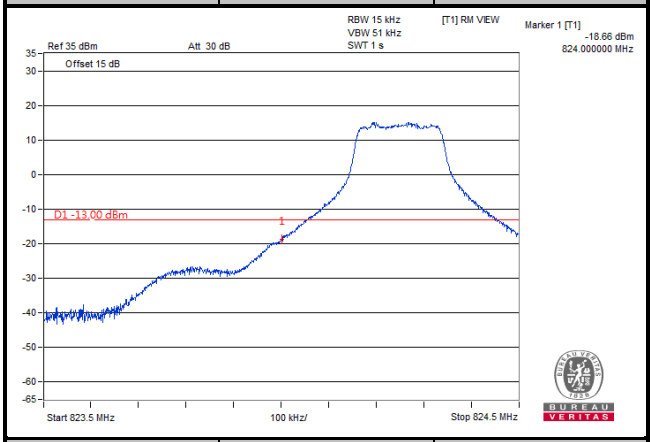
a. All measurements were done at low and high operational frequency range.
b. The center frequency of spectrum is the band edge frequency and span is 5 MHz. RB of the spectrum is 51 kHz and VB of the spectrum is 160 kHz (WCDMA).
c. The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 15 kHz and VB of the spectrum is 51 kHz (LTE Bandwidth 1.4 MHz).
d. 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).
e. 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).
f. 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).
g. Record the max trace plot into the test report.

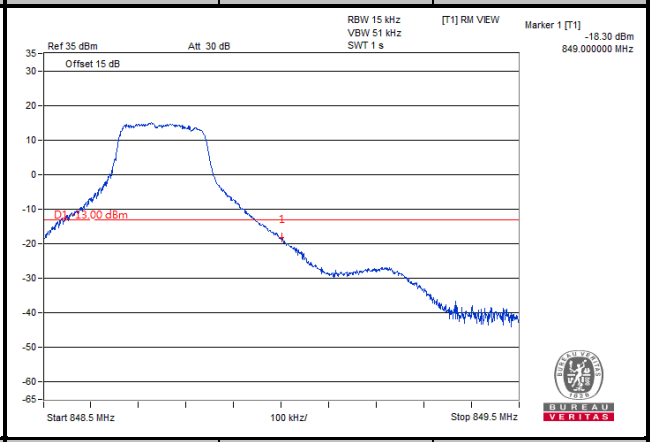
4.5.4 Test Results

WCDMA			
Channel	4132	Channel	4233

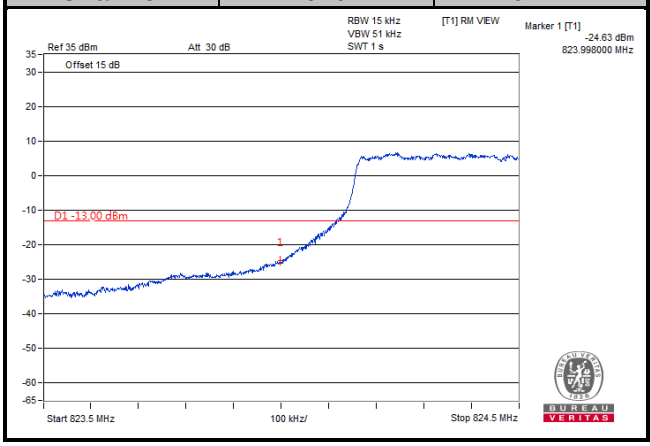


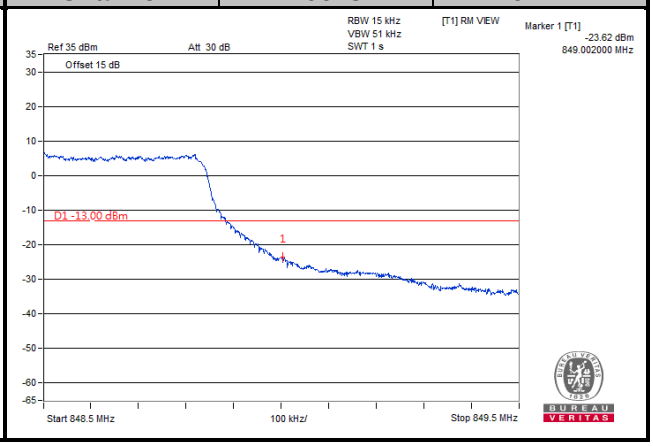
LTE Band 5					
Channel Bandwidth: 1.4 MHz					
Channel	20407	1 RB	Channel	20643	1 RB

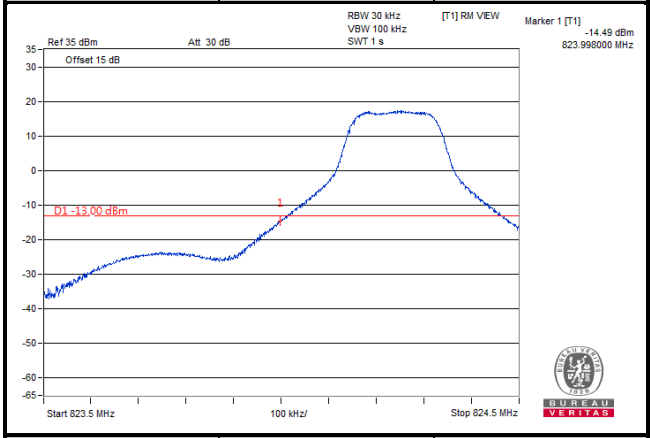
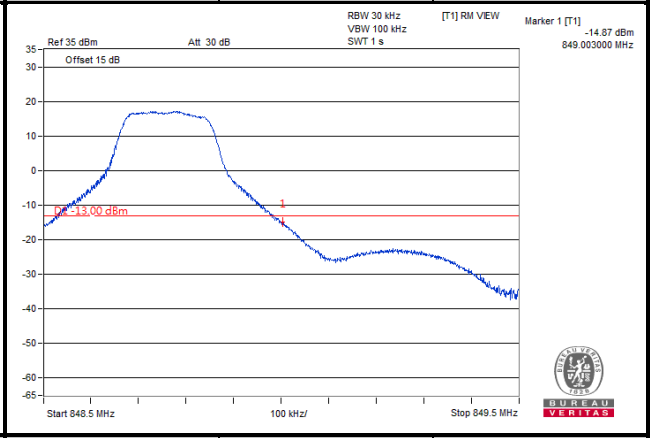
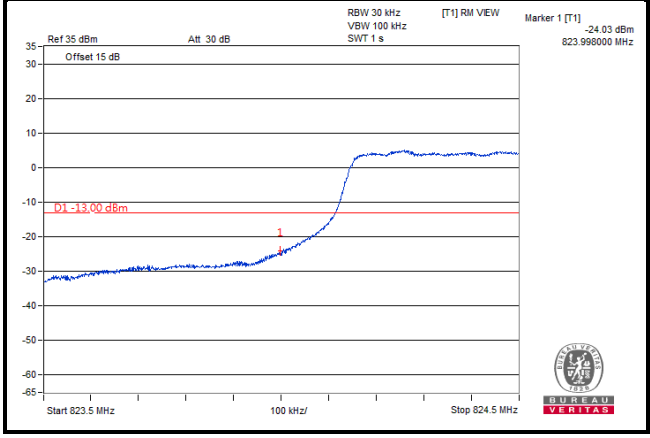
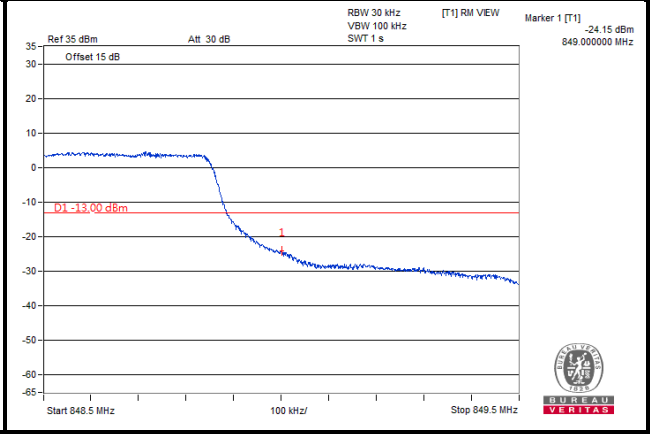


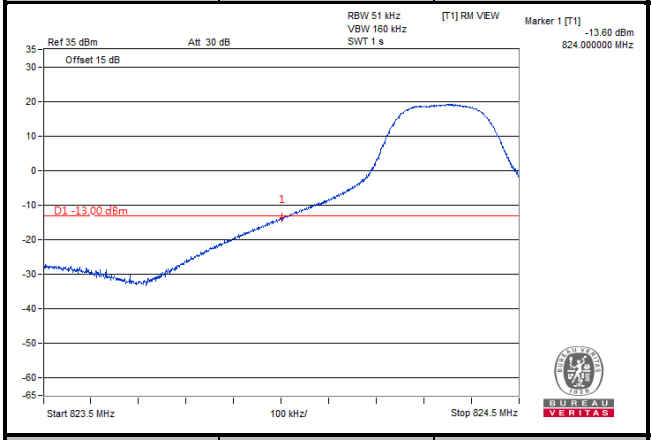
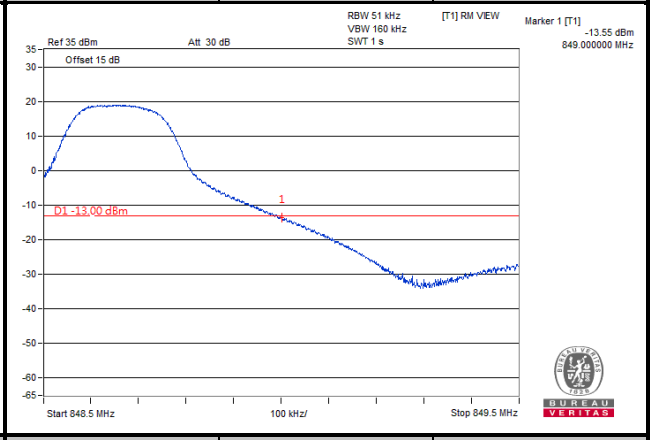
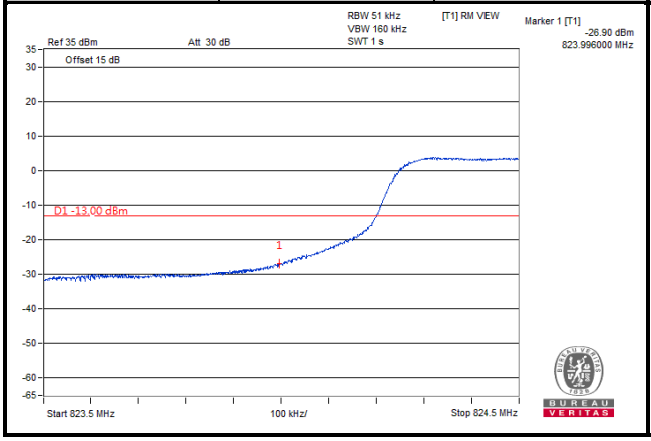
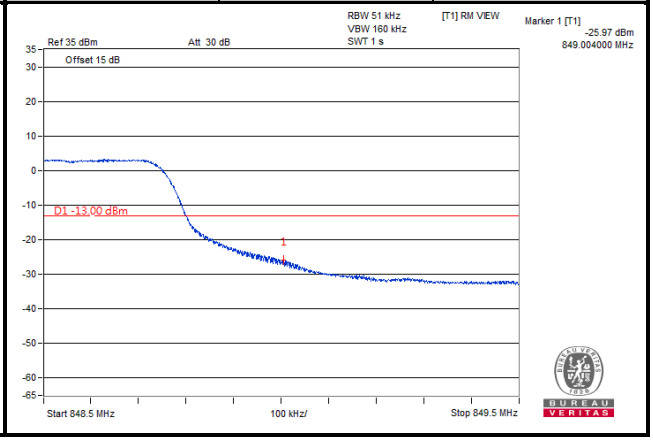


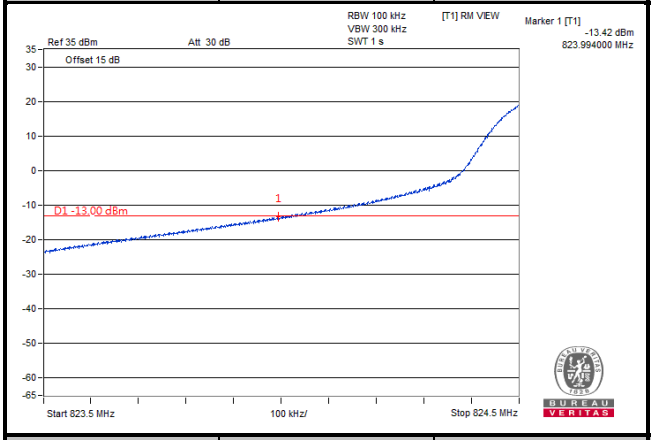
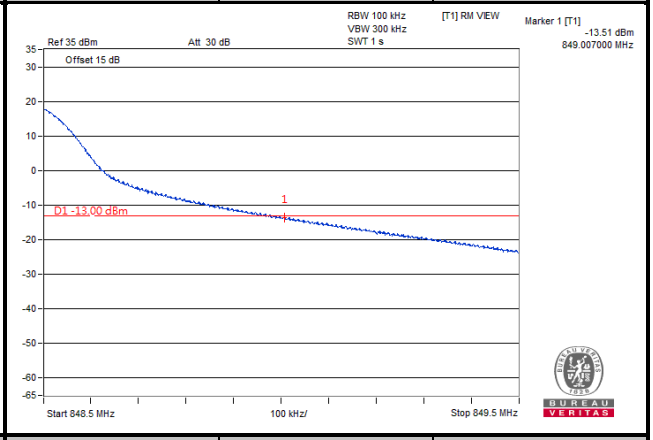
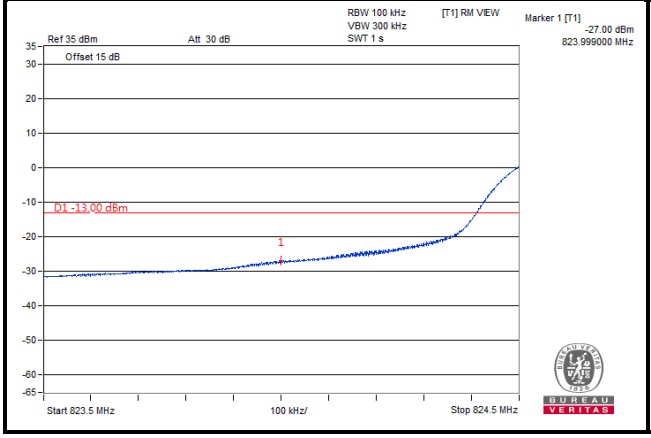
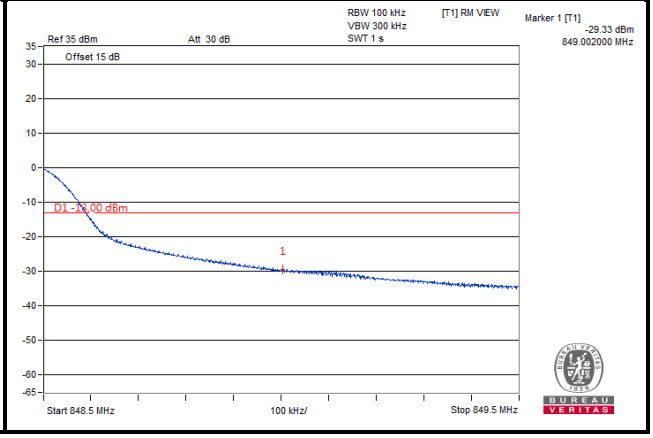
Channel	20407	6 RB	Channel	20643	6 RB





LTE Band 5					
Channel Bandwidth: 3 MHz					
Channel	20415	1 RB	Channel	20635	1 RB
					
Channel	20415	15 RB	Channel	20635	15 RB
					

LTE Band 5					
Channel Bandwidth: 5 MHz					
Channel	20425	1 RB	Channel	20625	1 RB
					
Channel	20425	25 RB	Channel	20625	25 RB
					

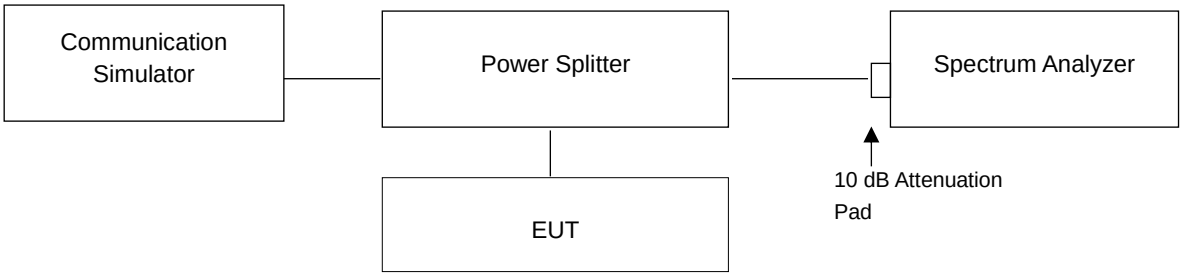
LTE Band 5					
Channel Bandwidth: 10 MHz					
Channel	20450	1 RB	Channel	20600	1 RB
					
Channel	20450	50 RB	Channel	20600	50 RB
					

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



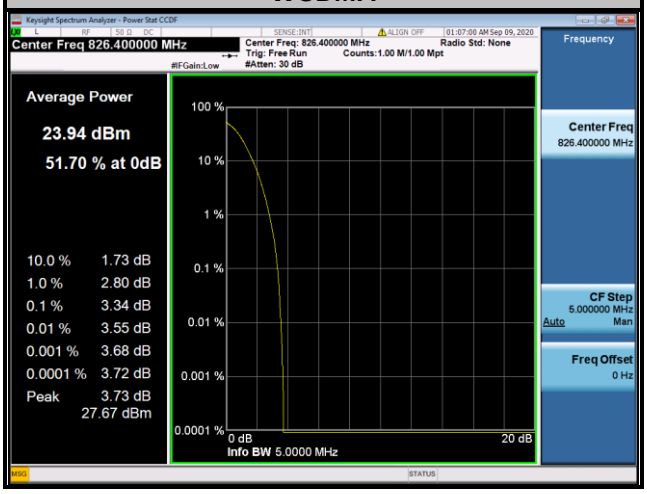
4.6.3 Test Procedures

1. Set resolution/measurement bandwidth ≥ 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
4132	826.4	3.34
4182	836.4	3.33
4233	846.6	3.29

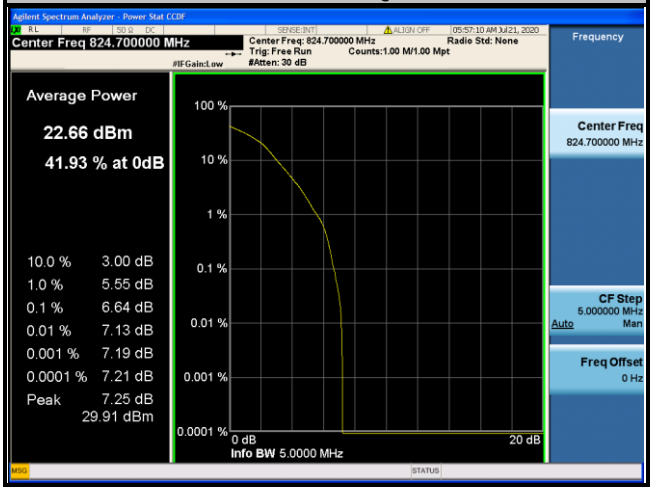
Spectrum Plot of Worst Value
WCDMA



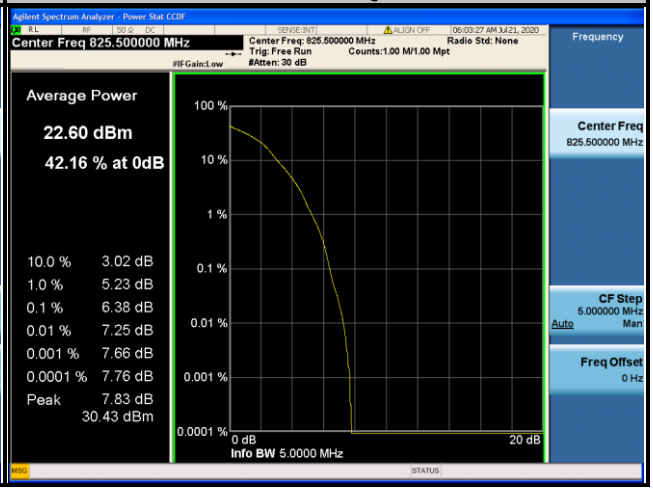
LTE Band 5							
Channel Bandwidth: 1.4 MHz				Channel Bandwidth: 3 MHz			
Channel	Frequency (MHz)	Peak to Average Ratio (dB)		Channel	Frequency (MHz)	Peak to Average Ratio (dB)	
		QPSK	16QAM			QPSK	16QAM
20407	824.7	5.62	6.64	20415	825.5	5.46	6.38
20525	836.5	5.61	6.63	20525	836.5	5.45	6.29
20643	848.3	5.43	6.47	20635	847.5	5.40	6.14

Spectrum Plot of Worst Value

1.4 MHz / 16QAM



3 MHz / 16QAM



LTE Band 5							
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
20425	826.5	5.69	6.60	20450	829.0	5.65	6.57
20525	836.5	5.65	6.52	20525	836.5	5.57	6.51
20625	846.5	5.56	6.47	20600	844.0	5.71	6.69

Spectrum Plot of Worst Value

5 MHz / QPSK

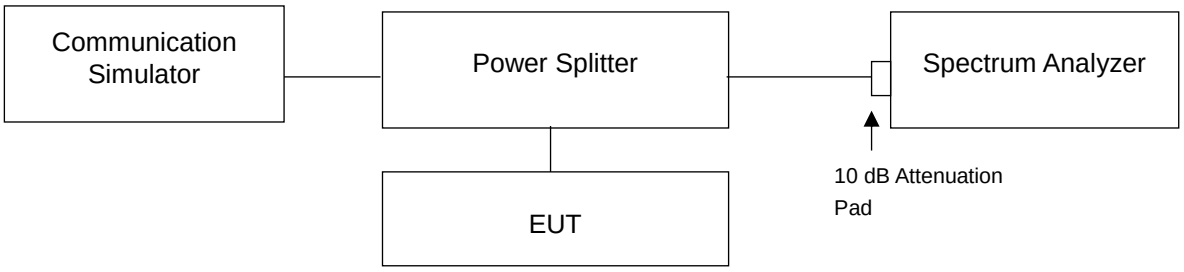
10 MHz / 16QAM

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 -13 dBm.

4.7.2 Test Setup



4.7.3 Test Procedure

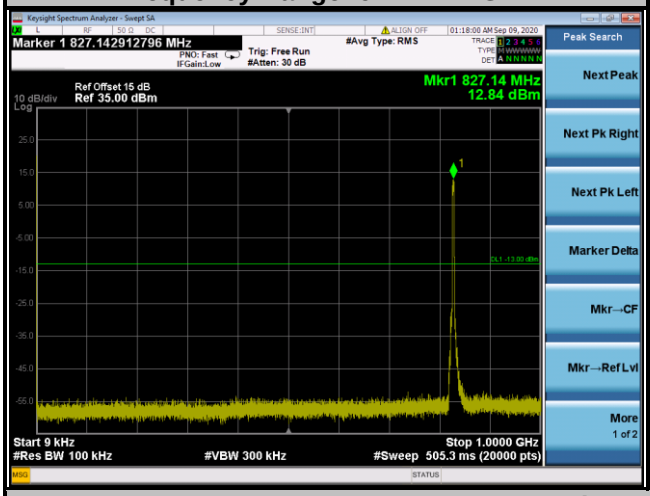
a. The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
b. Measuring frequency range is from 9 kHz to 1 GHz. 10 dB attenuation pad is connected with spectrum. RBW = 100 kHz and VBW = 300 kHz is used for conducted emission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

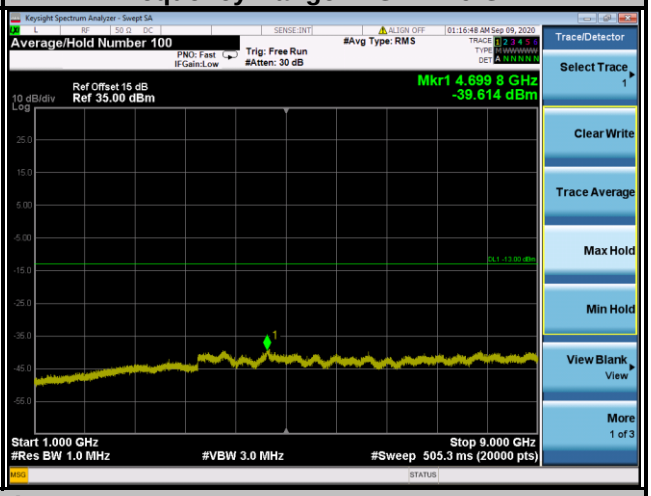
WCDMA

Channel 4132

Frequency Range: 9 kHz ~ 1 GHz

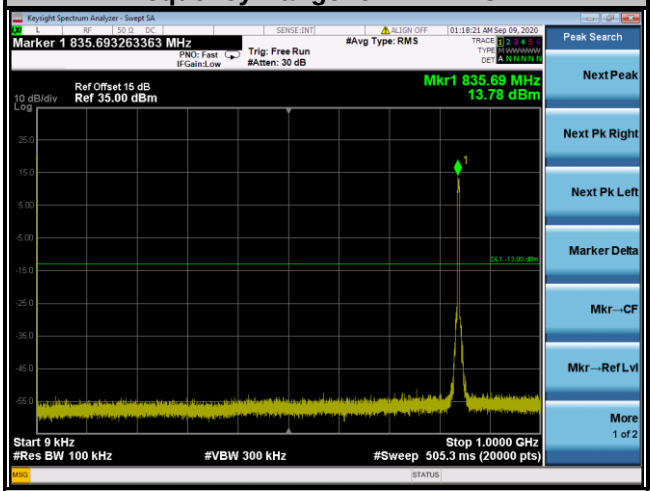


Frequency Range: 1 GHz ~ 9 GHz

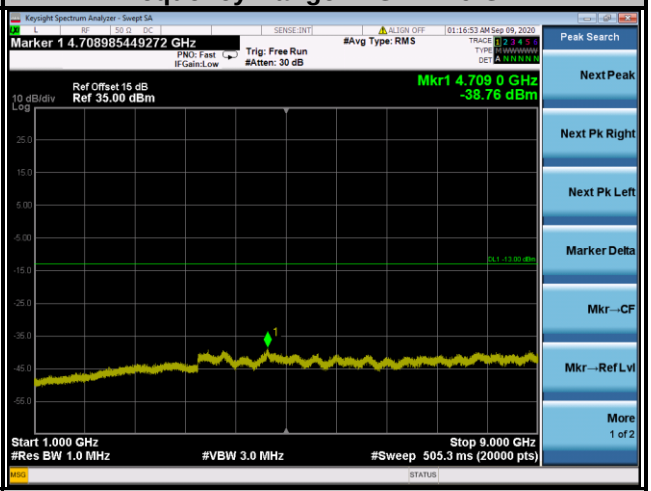


Channel 4182

Frequency Range: 9 kHz ~ 1 GHz

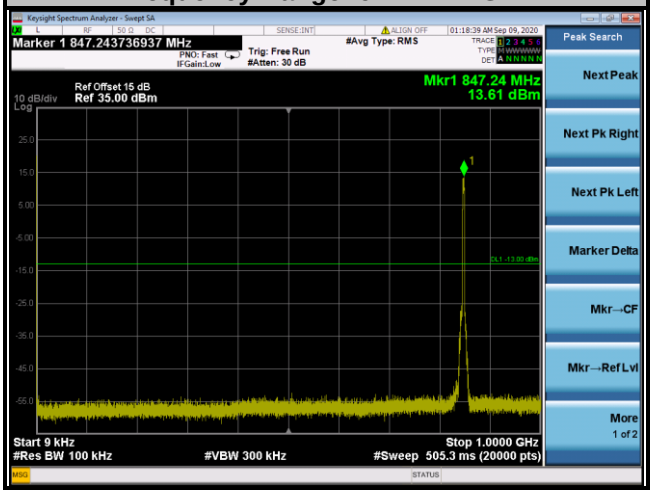


Frequency Range: 1 GHz ~ 9 GHz

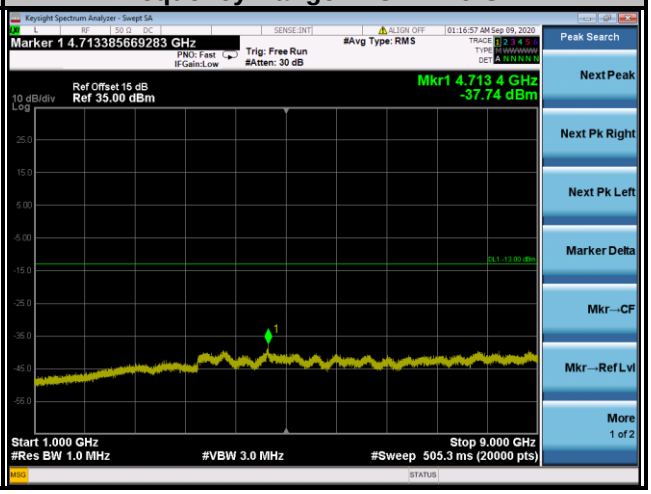


Channel 4233

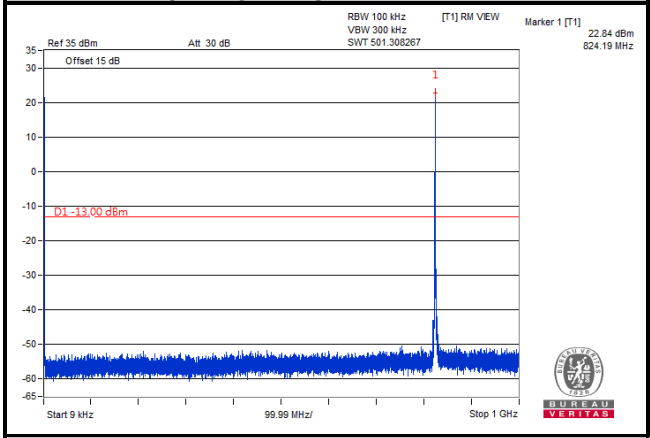
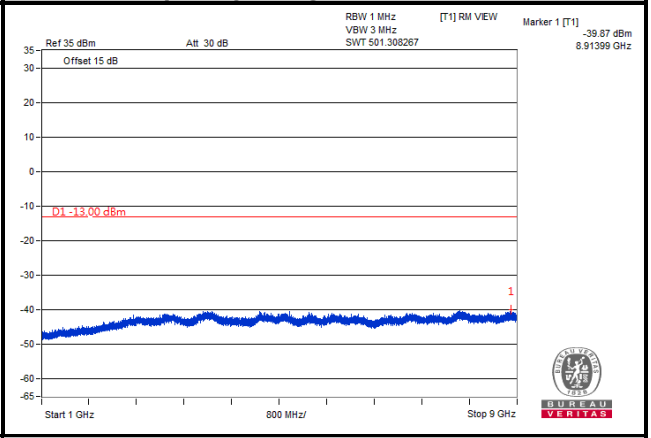
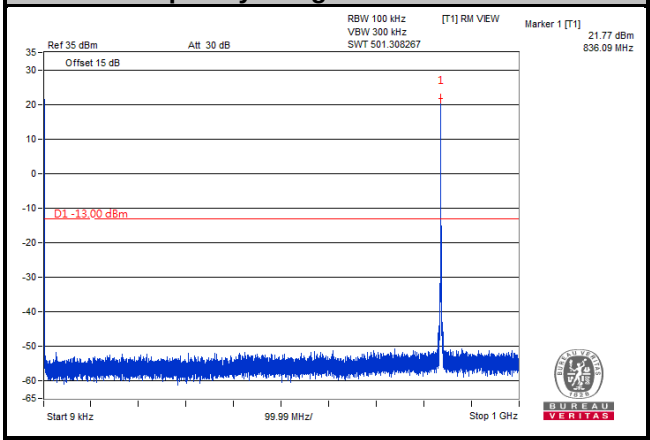
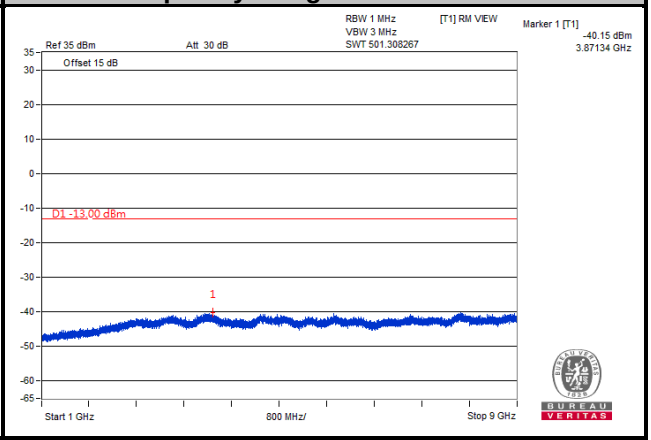
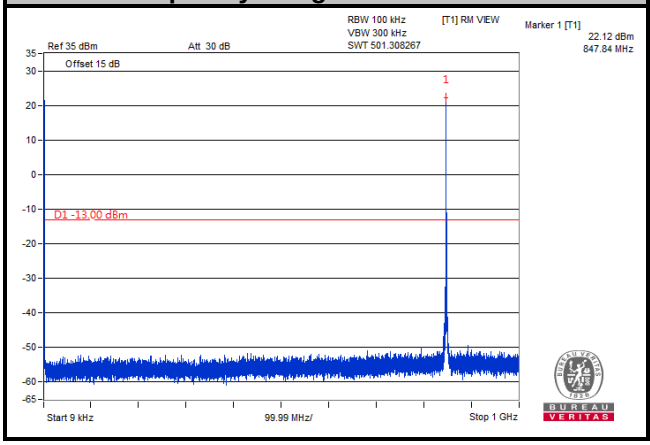
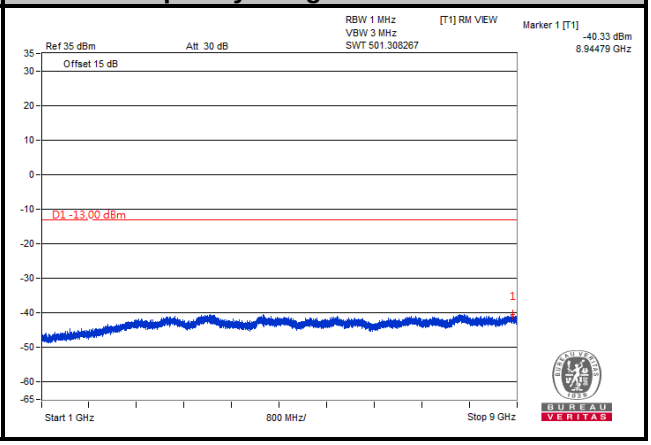
Frequency Range: 9 kHz ~ 1 GHz



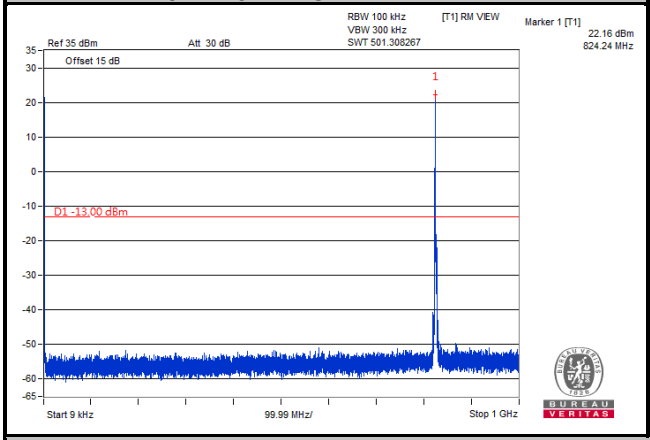
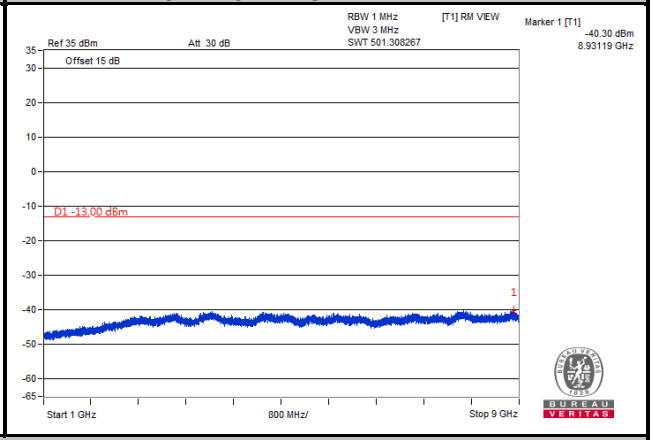
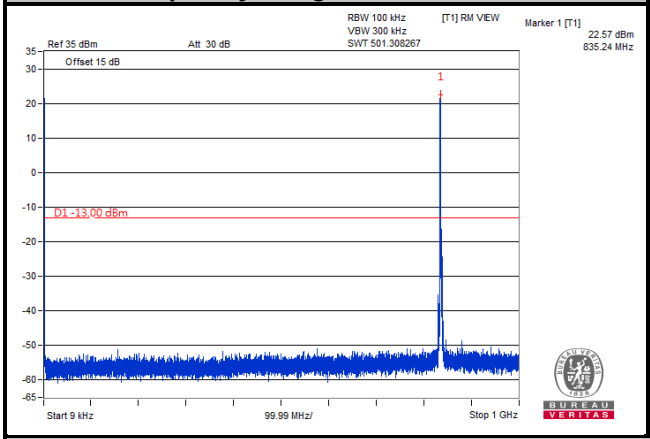
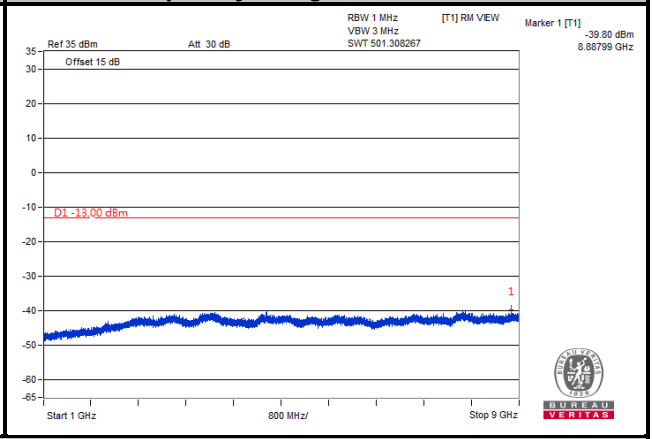
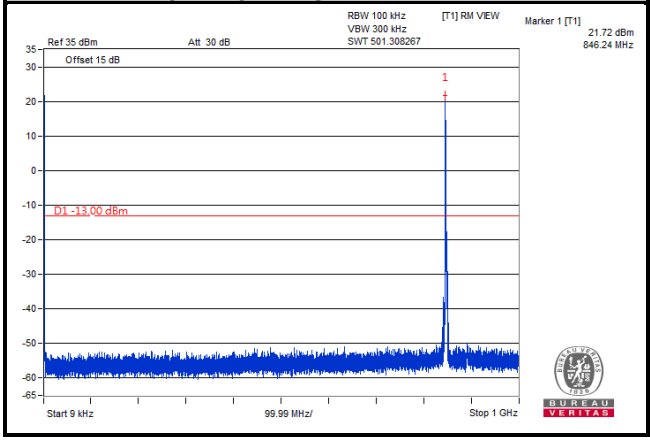
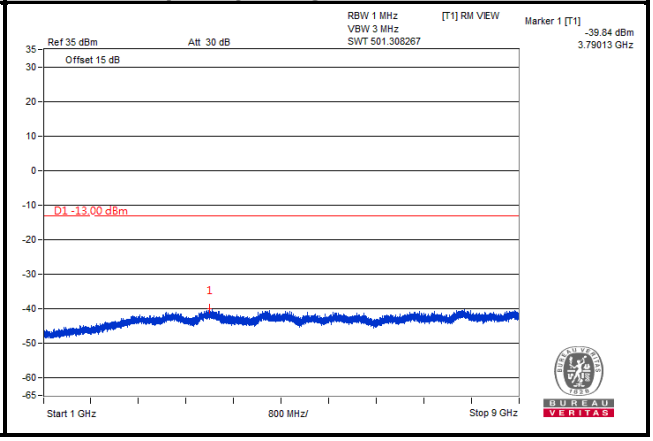
Frequency Range: 1 GHz ~ 9 GHz



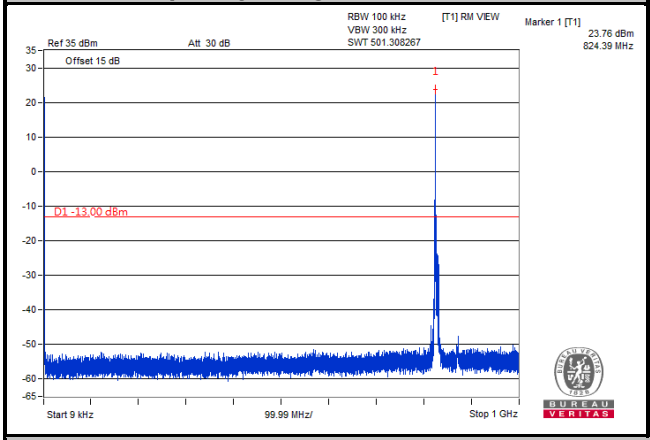
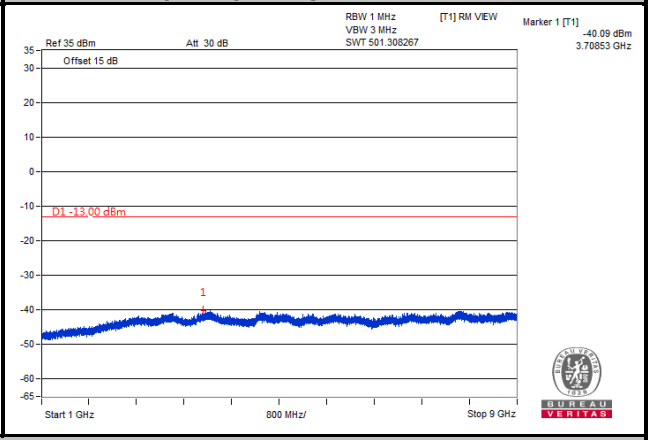
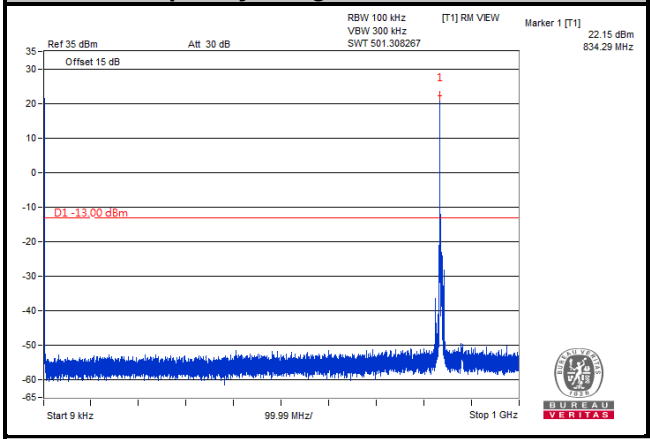
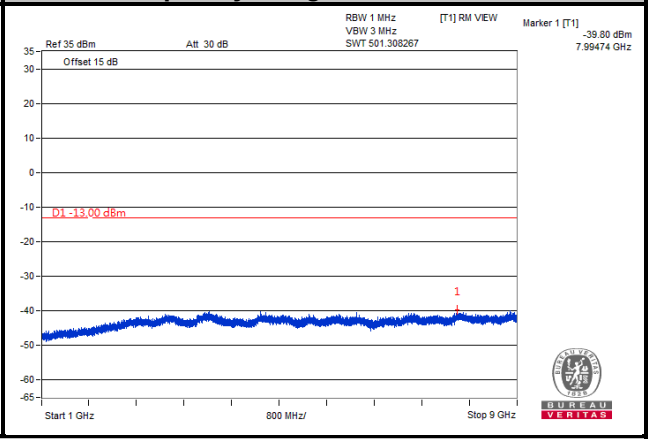
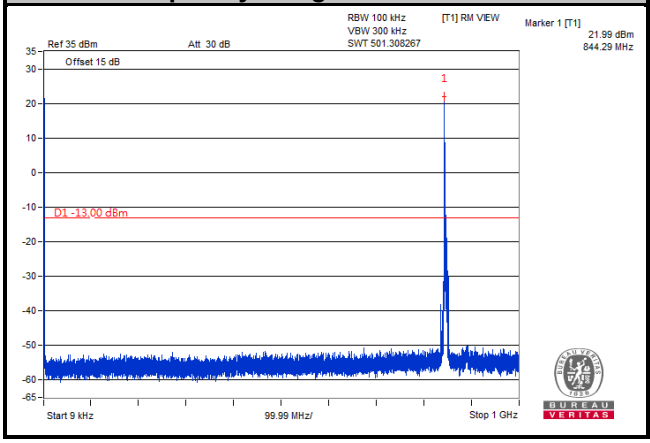
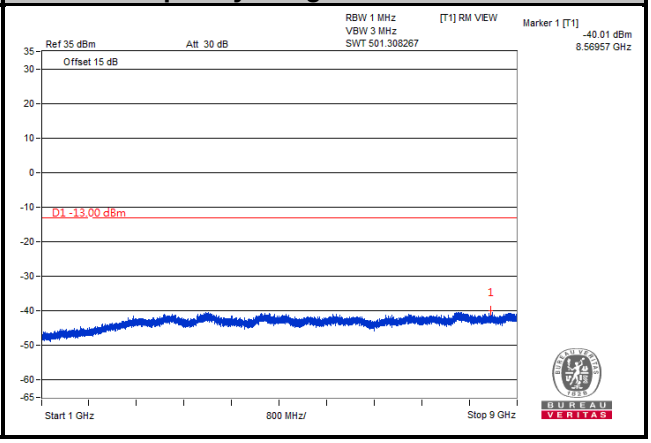
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 5	
Channel Bandwidth: 1.4 MHz	
Channel 20407	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 9 GHz
	
Channel 20525	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 9 GHz
	
Channel 20643	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 9 GHz
	

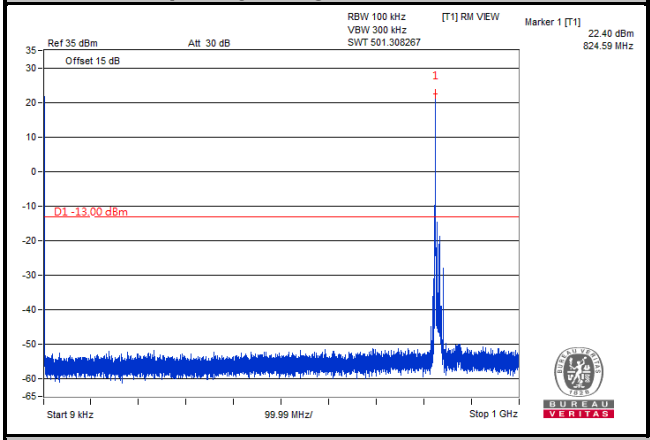
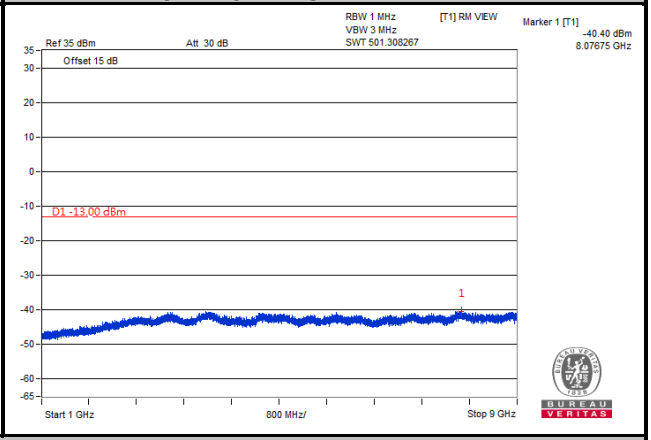
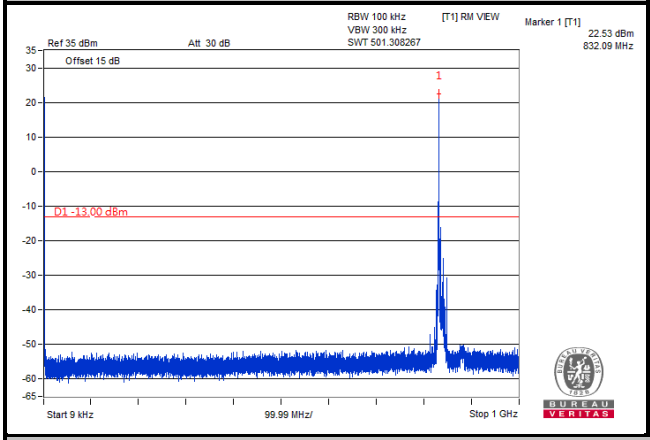
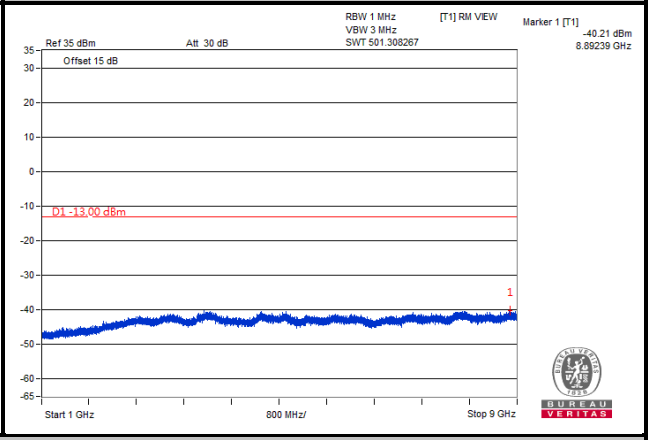
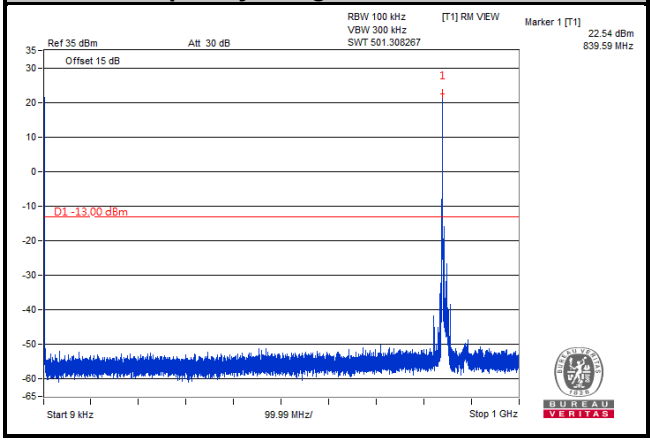
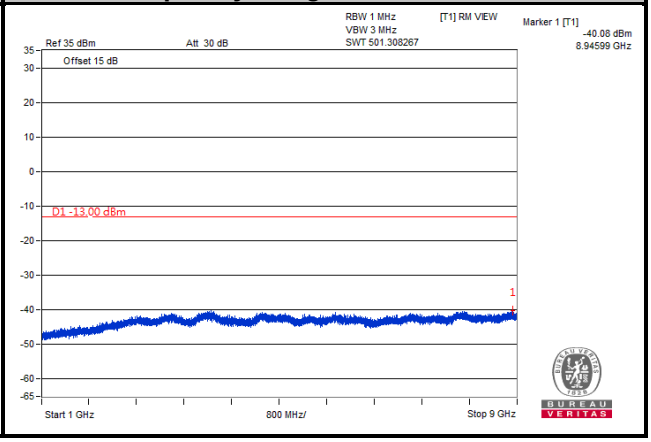
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 5	
Channel Bandwidth: 3 MHz	
Channel 20415	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 9 GHz
	
Channel 20525	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 9 GHz
	
Channel 20635	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 9 GHz
	

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

LTE Band 5	
Channel Bandwidth: 5 MHz	
Channel 20425	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 9 GHz
	
Channel 20525	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 9 GHz
	
Channel 20625	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 9 GHz
	

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

LTE Band 5	
Channel Bandwidth: 10 MHz	
Channel 20450	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 9 GHz
	
Channel 20525	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 9 GHz
	
Channel 20600	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 9 GHz
	

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. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m (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 1 m to 4 m 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. EIRP = Output power level of S.G – TX cable loss + 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, E.R.P power = E.I.R.P power - 2.15 dB.

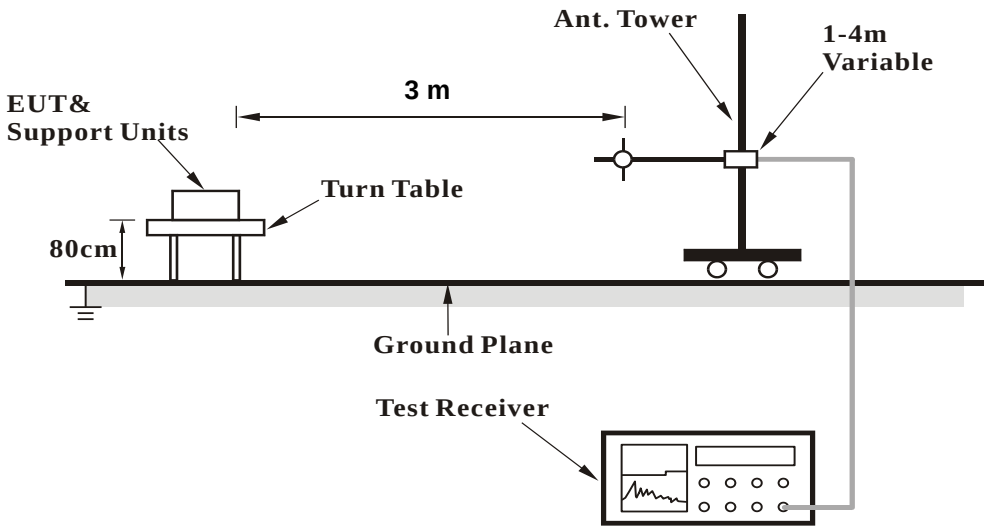
NOTE: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz/3 MHz.
NOTE: The emission levels were against the limit of frequency range 9 kHz ~ 30 MHz:
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

4.8.3 Deviation from Test Standard

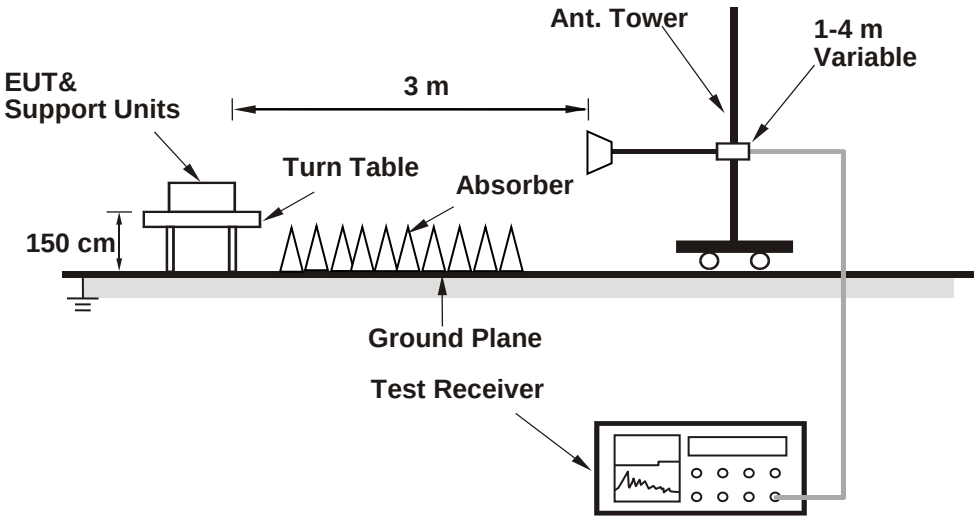
No deviation.

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

WCDMA:

Low Channel

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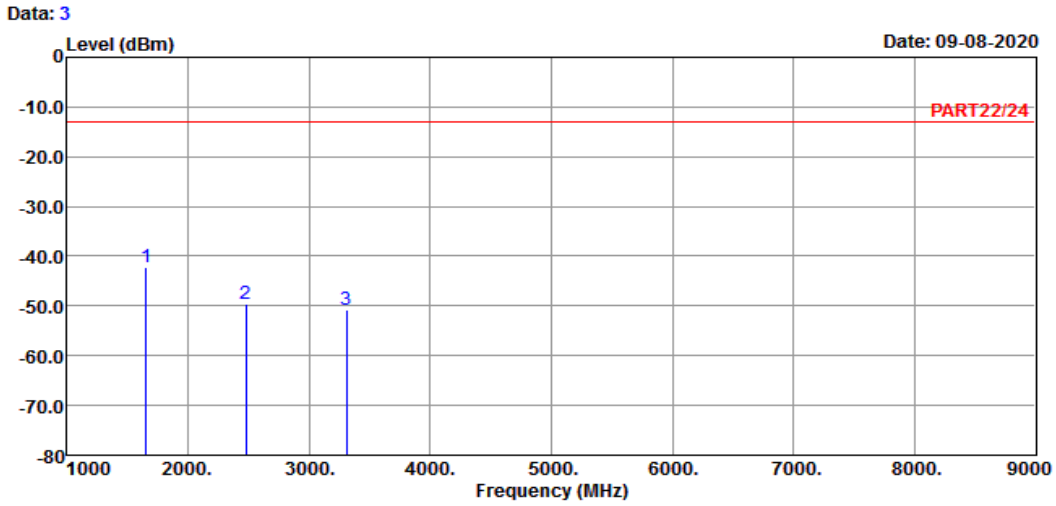
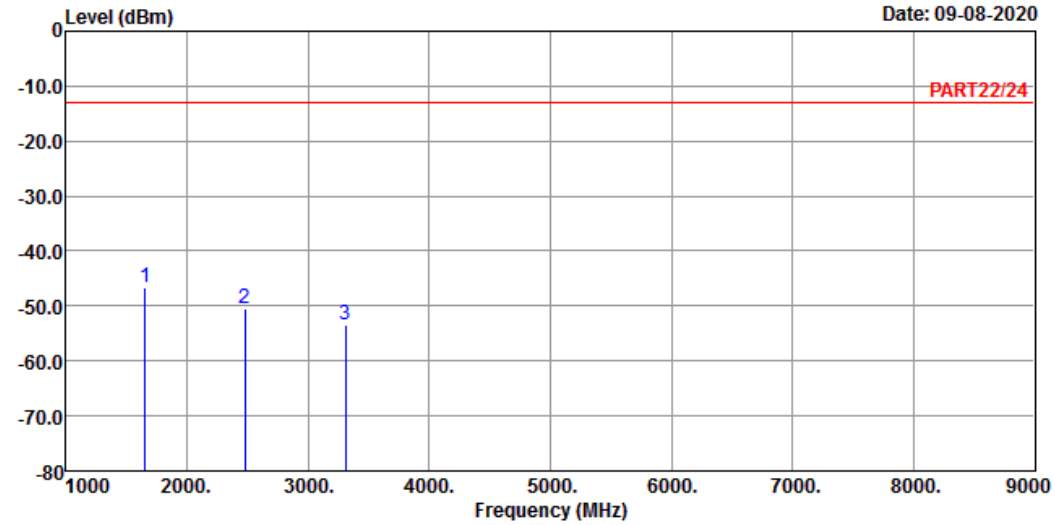


Site : 966 Chamber 5
Condition: PART22/24 HORIZONTAL
Remak : WCDMA B5 Link_L-CH
Tested by: Cyril Chen

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1652.80	-42.25	-28.48	-13.00	-13.77	-29.25	Peak
2	2479.20	-49.47	-39.44	-13.00	-10.03	-36.47	Peak
3	3305.60	-50.87	-41.98	-13.00	-8.89	-37.87	Peak

Data: 4



Site : 966 Chamber 5
Condition: PART22/24 VERTICAL
Remak : WCDMA B5 Link_L-CH
Tested by: Cyril Chen

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1652.80	-46.74	-32.97	-13.00	-13.77	-33.74	Peak
2	2479.20	-50.46	-40.43	-13.00	-10.03	-37.46	Peak
3	3305.60	-53.31	-44.42	-13.00	-8.89	-40.31	Peak

Middle Channel

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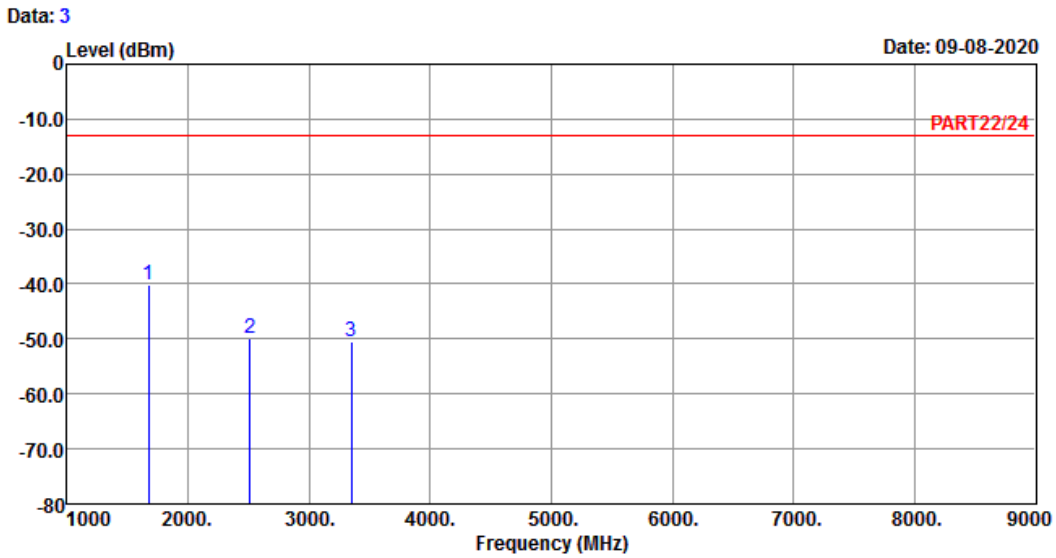
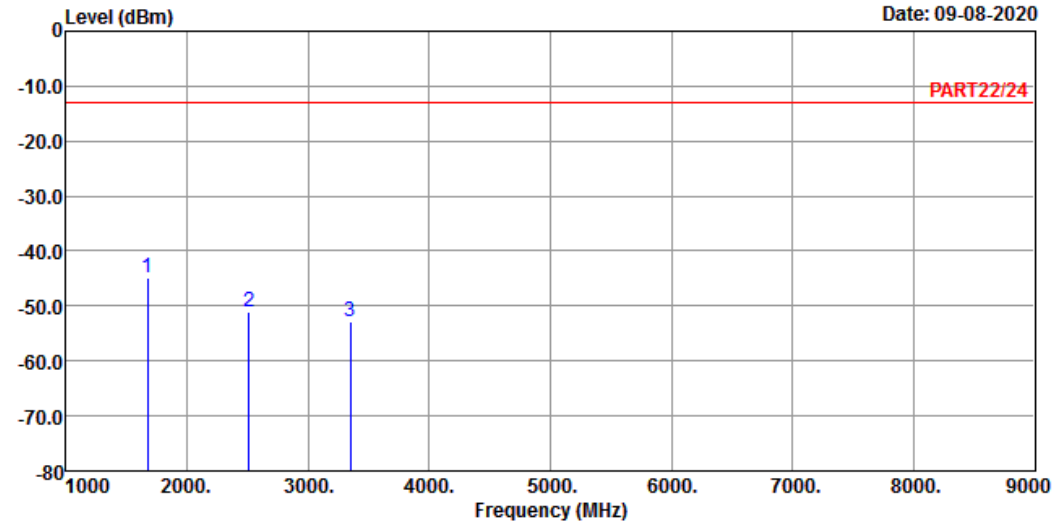


Site : 966 Chamber 5
Condition: PART22/24 HORIZONTAL
Remak : WCDMA B5 Link_M-CH
Tested by: Cyril Chen

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1672.80	-40.19	-26.29	-13.00	-13.90	-27.19	Peak
2	2509.20	-49.96	-39.88	-13.00	-10.08	-36.96	Peak
3	3345.60	-50.56	-41.80	-13.00	-8.76	-37.56	Peak

Data: 4

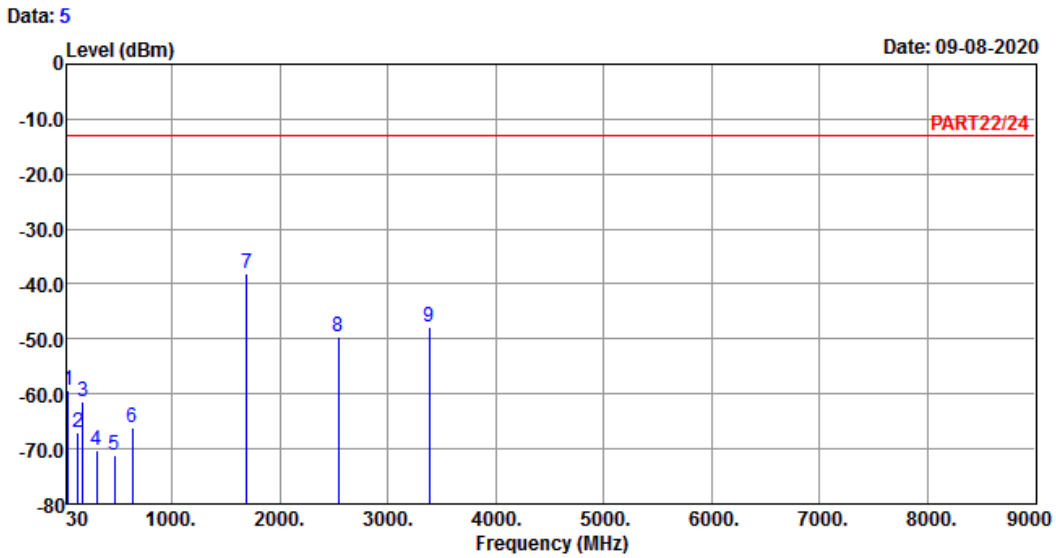


Site : 966 Chamber 5
Condition: PART22/24 VERTICAL
Remak : WCDMA B5 Link_M-CH
Tested by: Cyril Chen

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1672.80	-44.99	-31.09	-13.00	-13.90	-31.99	Peak
2	2509.20	-51.02	-40.94	-13.00	-10.08	-38.02	Peak
3	3345.60	-52.90	-44.14	-13.00	-8.76	-39.90	Peak

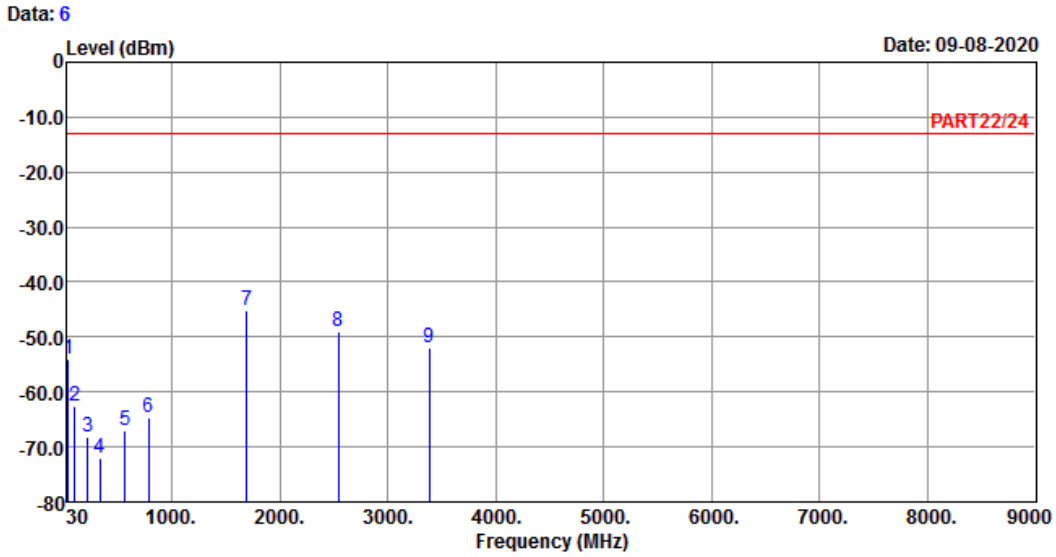
High Channel

Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 Chamber 5
Condition: PART22/24 HORIZONTAL
Remak : WCDMA B5 Link_H-CH
Tested by: Cyril Chen

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	39.70	-59.41	-60.05	-13.00	0.64	-46.41	Peak
2	127.97	-67.01	-58.09	-13.00	-8.92	-54.01	Peak
3	175.50	-61.38	-54.83	-13.00	-6.55	-48.38	Peak
4	301.60	-70.33	-63.35	-13.00	-6.98	-57.33	Peak
5	471.35	-71.02	-65.87	-13.00	-5.15	-58.02	Peak
6	634.31	-66.10	-65.26	-13.00	-0.84	-53.10	Peak
7 pp	1693.20	-38.21	-24.19	-13.00	-14.02	-25.21	Peak
8	2539.80	-49.47	-39.41	-13.00	-10.06	-36.47	Peak
9	3386.40	-47.81	-39.18	-13.00	-8.63	-34.81	Peak

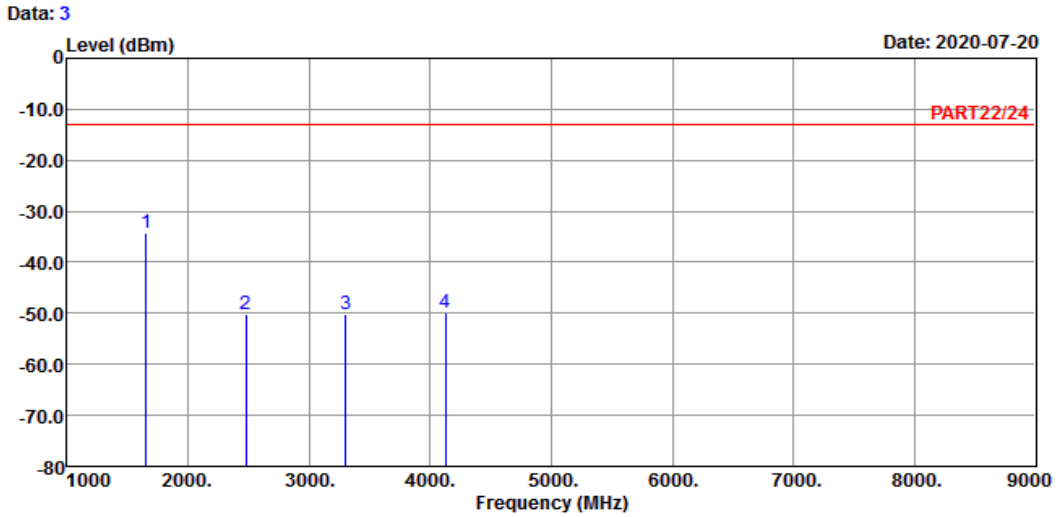


Site : 966 Chamber 5
Condition: PART22/24 VERTICAL
Remak : WCDMA B5 Link_H-CH
Tested by: Cyril Chen

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	36.79	-53.91	-52.92	-13.00	-0.99	-40.91	Peak
2	99.84	-62.60	-52.04	-13.00	-10.56	-49.60	Peak
3	218.18	-68.25	-60.97	-13.00	-7.28	-55.25	Peak
4	333.61	-72.07	-65.58	-13.00	-6.49	-59.07	Peak
5	566.41	-67.15	-64.99	-13.00	-2.16	-54.15	Peak
6	785.63	-64.72	-65.50	-13.00	0.78	-51.72	Peak
7 pp	1693.20	-45.19	-31.17	-13.00	-14.02	-32.19	Peak
8	2539.80	-48.95	-38.89	-13.00	-10.06	-35.95	Peak
9	3386.40	-51.83	-43.20	-13.00	-8.63	-38.83	Peak

LTE Band 5
Channel Bandwidth: 1.4 MHz / QPSK
Low Channel

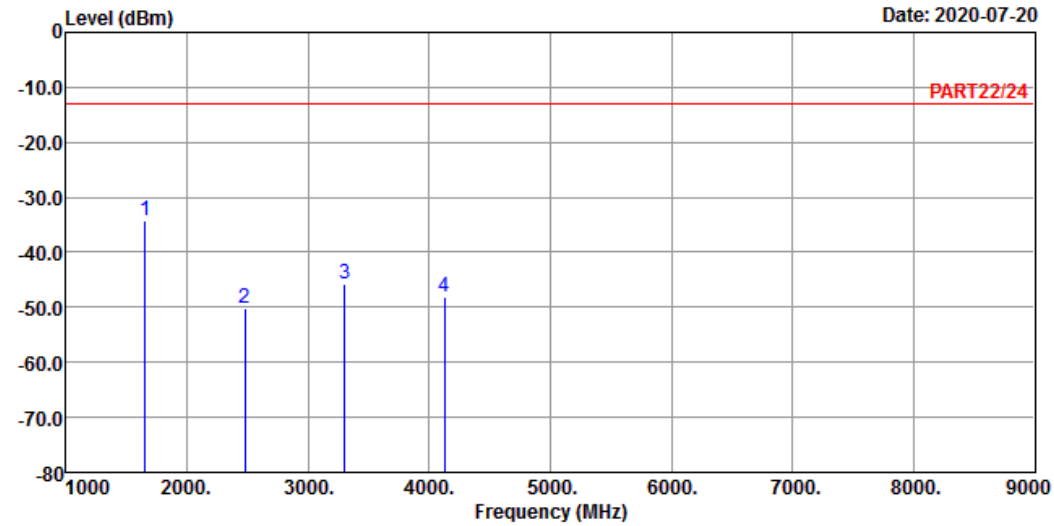
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 Chamber 5
Condition: PART22/24 HORIZONTAL
Remak : LTE Band 5 QPSK_1.4M Link_L-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1649.40	-34.29	-20.55	-13.00	-13.74	-21.29	Peak
2	2474.10	-50.23	-40.21	-13.00	-10.02	-37.23	Peak
3	3298.80	-50.32	-41.46	-13.00	-8.86	-37.32	Peak
4	4123.50	-49.78	-43.67	-13.00	-6.11	-36.78	Peak

Data: 4

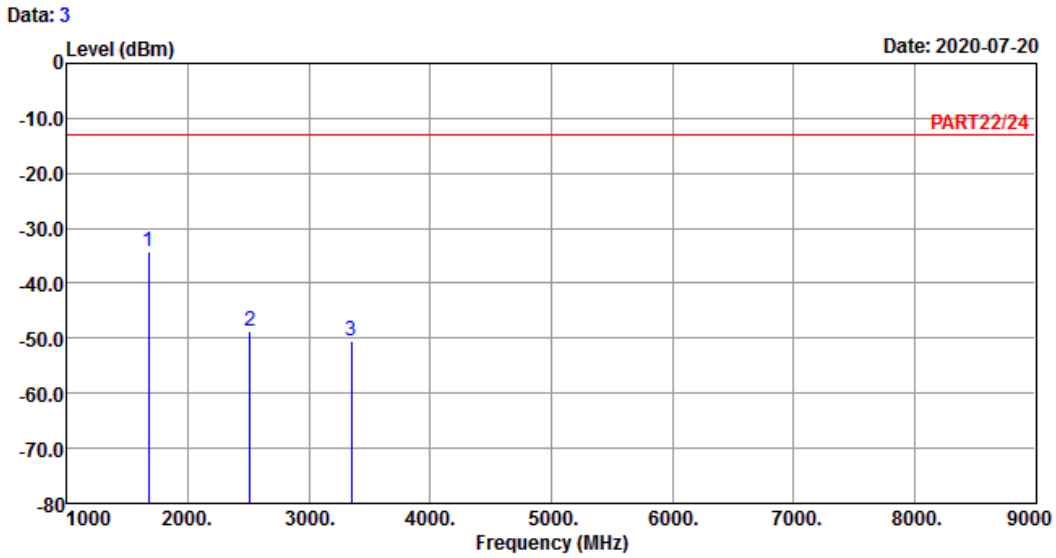


Site : 966 Chamber 5
Condition: PART22/24 VERTICAL
Remak : LTE Band 5 QPSK_1.4M Link_L-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1649.40	-34.27	-20.53	-13.00	-13.74	-21.27	Peak
2	2474.10	-50.25	-40.23	-13.00	-10.02	-37.25	Peak
3	3298.80	-45.76	-36.90	-13.00	-8.86	-32.76	Peak
4	4123.50	-48.26	-42.15	-13.00	-6.11	-35.26	Peak

Middle Channel

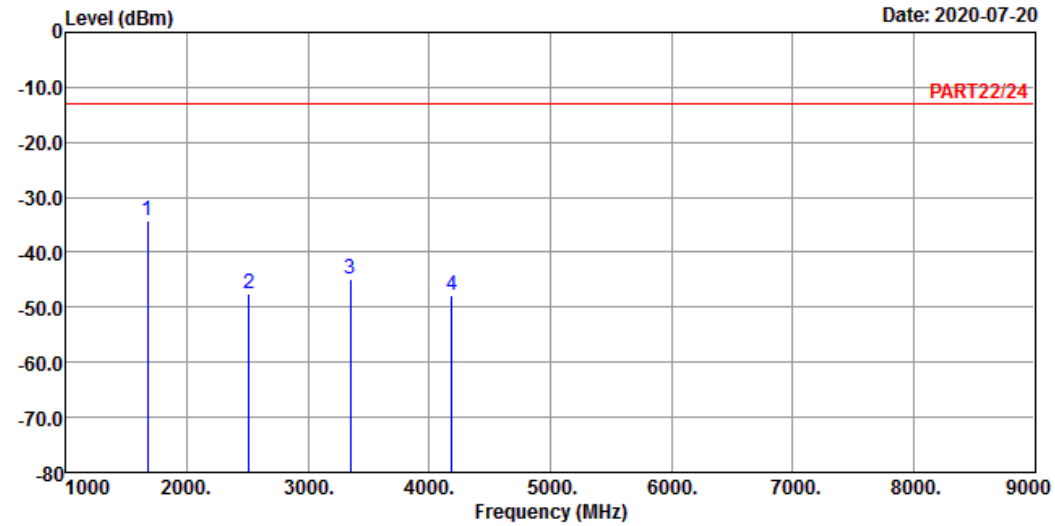
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 Chamber 5
Condition: PART22/24 HORIZONTAL
Remak : LTE Band 5 QPSK_1.4M Link_M-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1673.00	-34.17	-20.27	-13.00	-13.90	-21.17	Peak
2	2509.50	-48.71	-38.63	-13.00	-10.08	-35.71	Peak
3	3346.00	-50.54	-41.78	-13.00	-8.76	-37.54	Peak

Data: 4

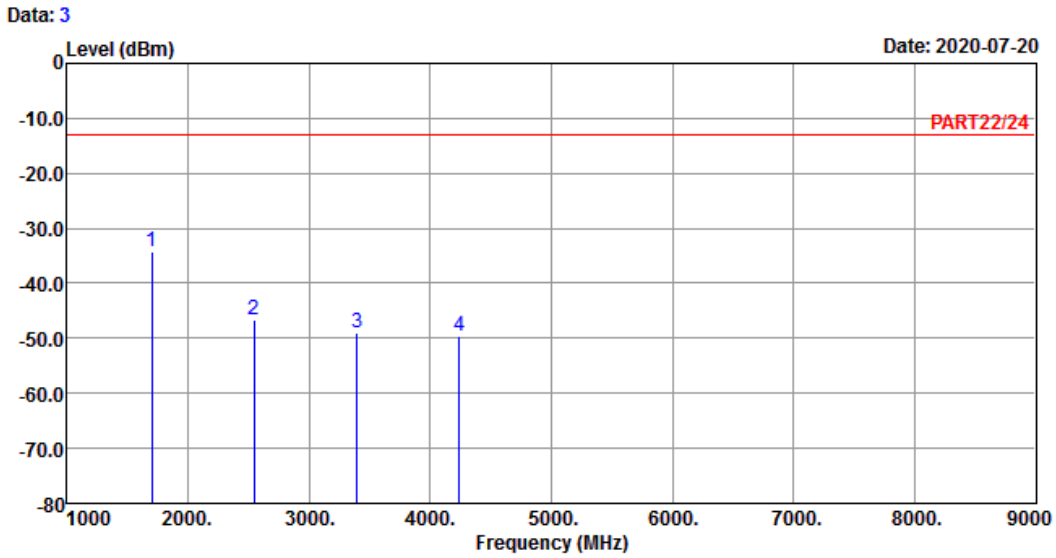


Site : 966 Chamber 5
Condition: PART22/24 VERTICAL
Remak : LTE Band 5 QPSK_1.4M Link_M-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1673.00	-34.18	-20.28	-13.00	-13.90	-21.18	Peak
2	2509.50	-47.61	-37.53	-13.00	-10.08	-34.61	Peak
3	3346.00	-45.00	-36.24	-13.00	-8.76	-32.00	Peak
4	4182.50	-47.78	-42.10	-13.00	-5.68	-34.78	Peak

High Channel

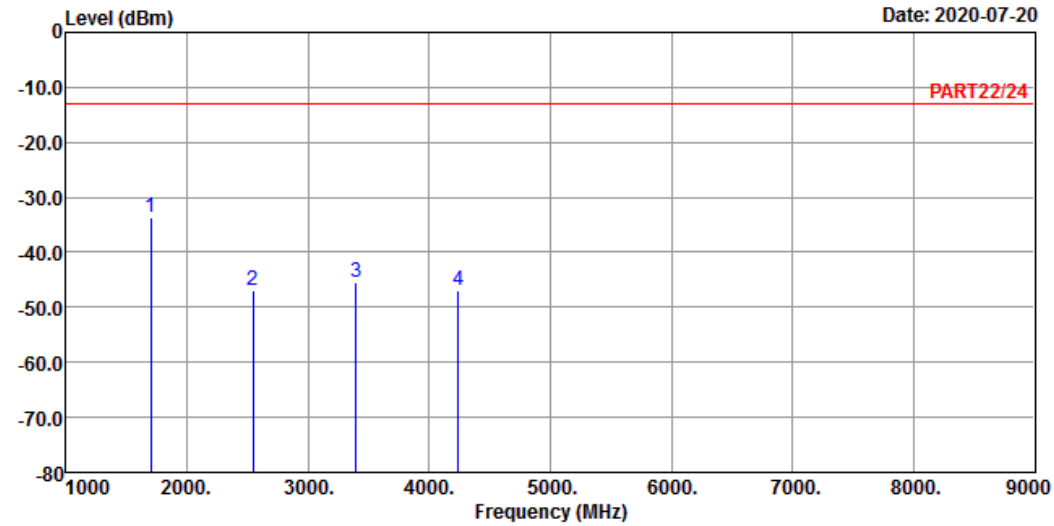
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 Chamber 5
Condition: PART22/24 HORIZONTAL
Remak : LTE Band 5 QPSK_1.4M Link_H-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1696.60	-34.36	-20.34	-13.00	-14.02	-21.36	Peak
2	2544.90	-46.56	-36.50	-13.00	-10.06	-33.56	Peak
3	3393.20	-49.11	-40.51	-13.00	-8.60	-36.11	Peak
4	4241.50	-49.48	-43.93	-13.00	-5.55	-36.48	Peak

Data: 4

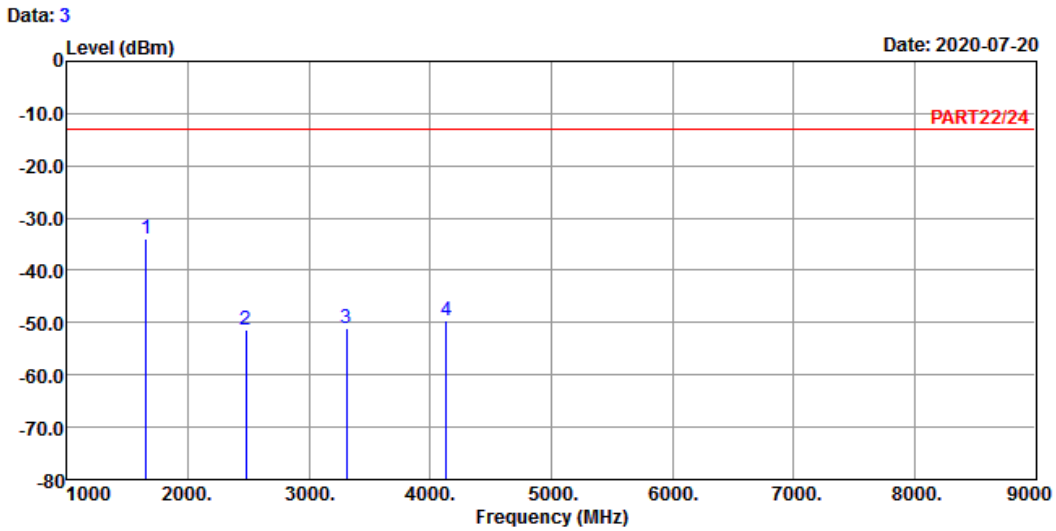


Site : 966 Chamber 5
Condition: PART22/24 VERTICAL
Remak : LTE Band 5 QPSK_1.4M Link_H-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1696.60	-33.51	-19.49	-13.00	-14.02	-20.51	Peak
2	2544.90	-46.94	-36.88	-13.00	-10.06	-33.94	Peak
3	3393.20	-45.34	-36.74	-13.00	-8.60	-32.34	Peak
4	4241.50	-46.79	-41.24	-13.00	-5.55	-33.79	Peak

Channel Bandwidth: 5 MHz / QPSK
Low Channel

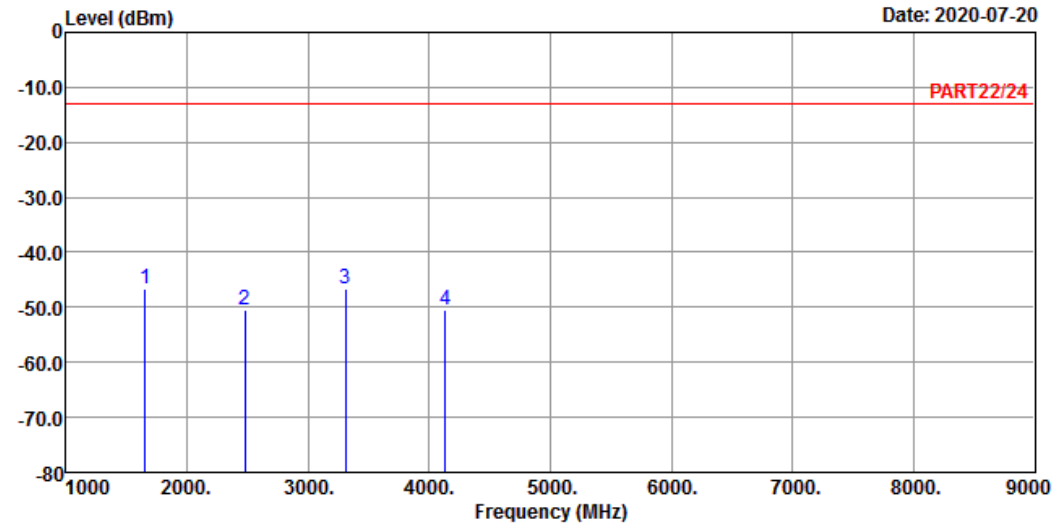
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 Chamber 5
Condition: PART22/24 HORIZONTAL
Remak : LTE Band 5 QPSK_5M Link_L-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1653.00	-33.84	-20.07	-13.00	-13.77	-20.84	Peak
2	2479.50	-51.22	-41.19	-13.00	-10.03	-38.22	Peak
3	3306.00	-51.16	-42.27	-13.00	-8.89	-38.16	Peak
4	4132.50	-49.55	-43.52	-13.00	-6.03	-36.55	Peak

Data: 4

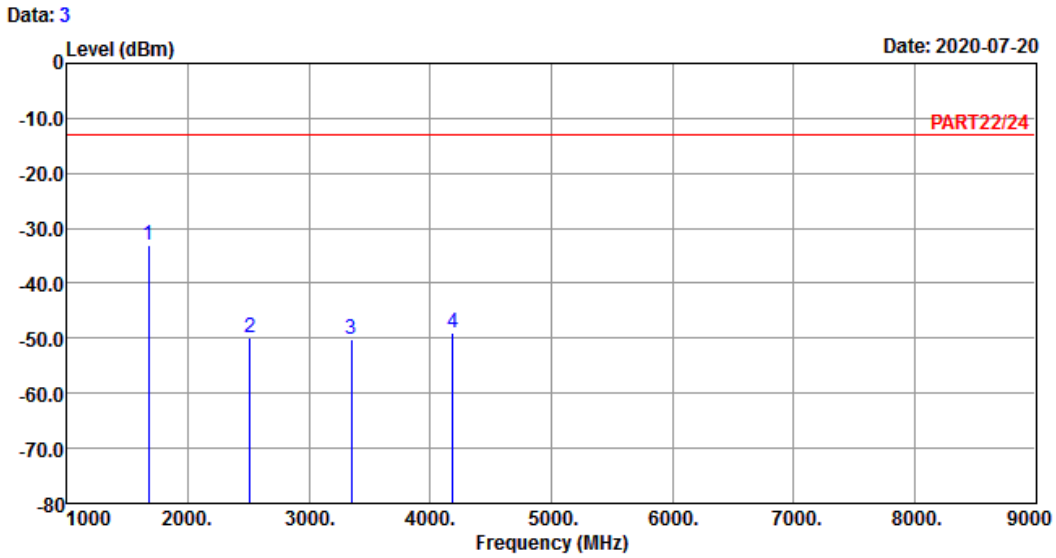


Site : 966 Chamber 5
Condition: PART22/24 VERTICAL
Remak : LTE Band 5 QPSK_5M Link_L-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1653.00	-46.61	-32.84	-13.00	-13.77	-33.61	Peak
2	2479.50	-50.34	-40.31	-13.00	-10.03	-37.34	Peak
3	3306.00	-46.61	-37.72	-13.00	-8.89	-33.61	Peak
4	4132.50	-50.49	-44.46	-13.00	-6.03	-37.49	Peak

Middle Channel

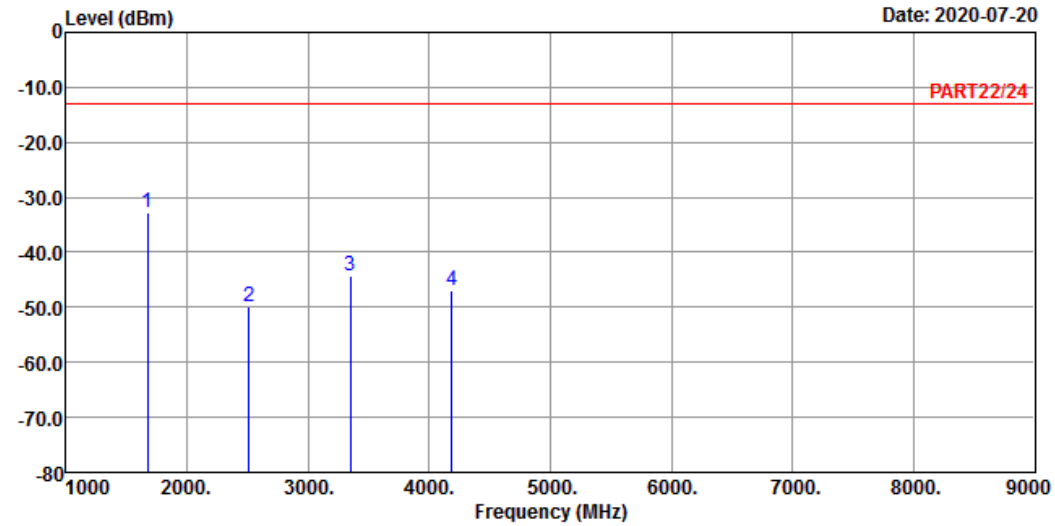
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 Chamber 5
Condition: PART22/24 HORIZONTAL
Remak : LTE Band 5 QPSK_5M Link_M-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1673.00	-33.05	-19.15	-13.00	-13.90	-20.05	Peak
2	2509.50	-49.77	-39.69	-13.00	-10.08	-36.77	Peak
3	3346.00	-50.21	-41.45	-13.00	-8.76	-37.21	Peak
4	4182.50	-48.98	-43.30	-13.00	-5.68	-35.98	Peak

Data: 4

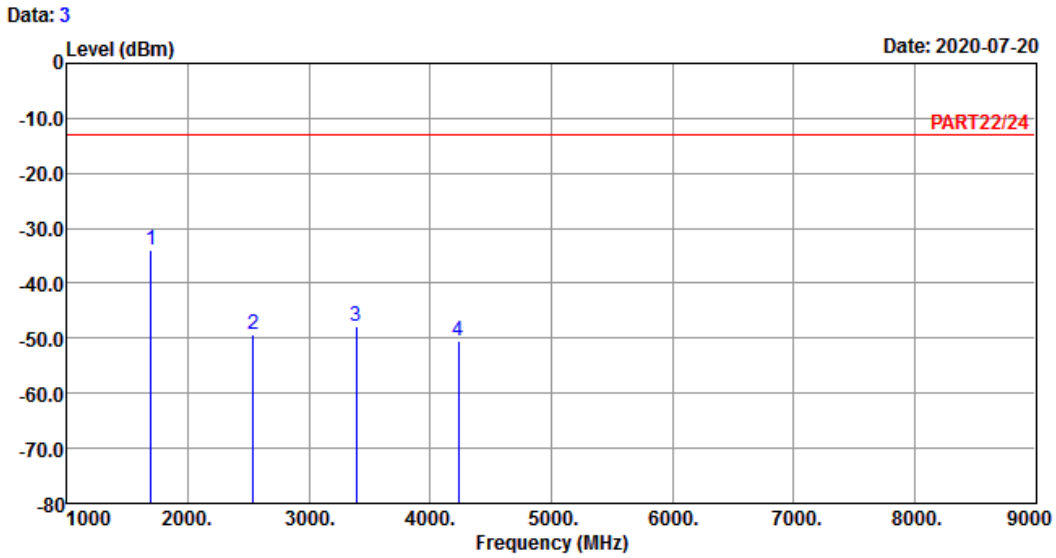


Site : 966 Chamber 5
Condition: PART22/24 VERTICAL
Remak : LTE Band 5 QPSK_5M Link_M-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1673.00	-32.67	-18.77	-13.00	-13.90	-19.67	Peak
2	2509.50	-49.78	-39.70	-13.00	-10.08	-36.78	Peak
3	3346.00	-44.42	-35.66	-13.00	-8.76	-31.42	Peak
4	4182.50	-47.04	-41.36	-13.00	-5.68	-34.04	Peak

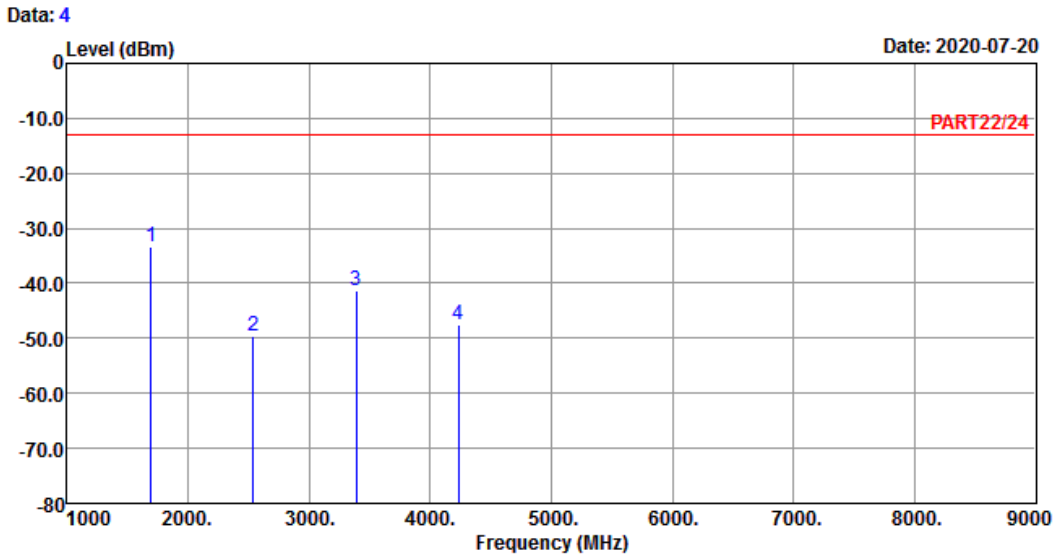
High Channel

Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 Chamber 5
Condition: PART22/24 HORIZONTAL
Remak : LTE Band 5 QPSK_5M Link_H-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1693.00	-34.04	-20.02	-13.00	-14.02	-21.04	Peak
2	2539.50	-49.27	-39.21	-13.00	-10.06	-36.27	Peak
3	3386.00	-47.79	-39.16	-13.00	-8.63	-34.79	Peak
4	4232.50	-50.42	-44.87	-13.00	-5.55	-37.42	Peak

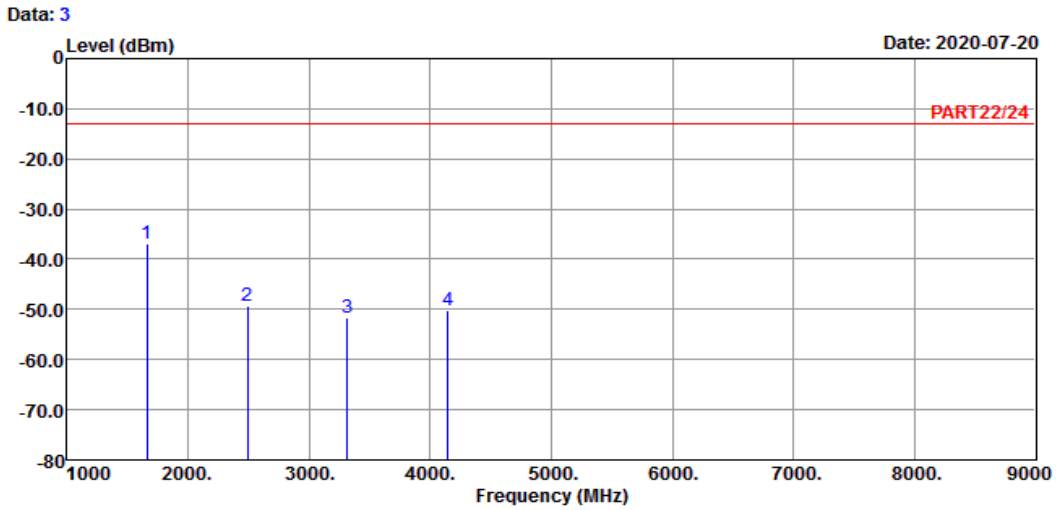


Site : 966 Chamber 5
Condition: PART22/24 VERTICAL
Remak : LTE Band 5 QPSK_5M Link_H-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1693.00	-33.39	-19.37	-13.00	-14.02	-20.39	Peak
2	2539.50	-49.73	-39.67	-13.00	-10.06	-36.73	Peak
3	3386.00	-41.30	-32.67	-13.00	-8.63	-28.30	Peak
4	4232.50	-47.44	-41.89	-13.00	-5.55	-34.44	Peak

Channel Bandwidth: 10 MHz / QPSK
Low Channel

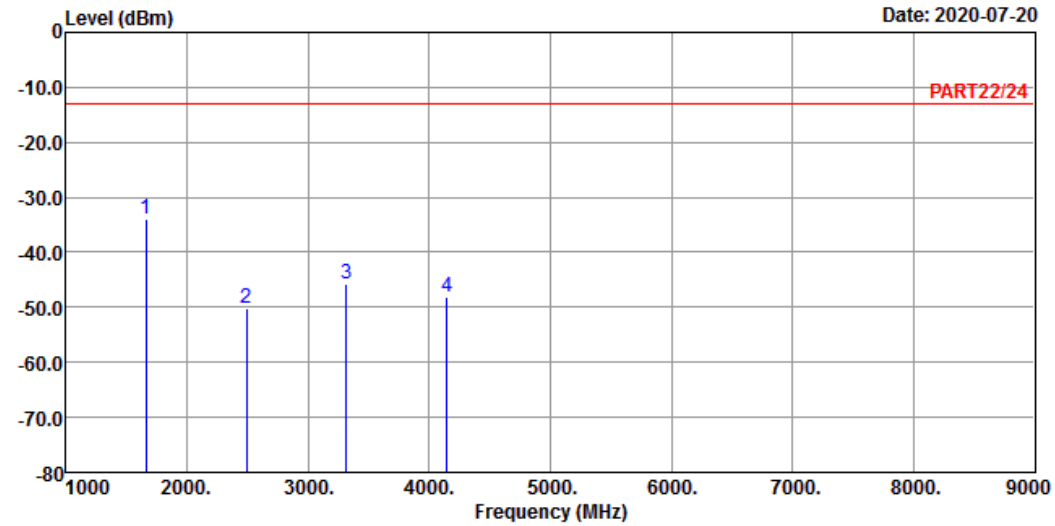
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 Chamber 5
Condition: PART22/24 HORIZONTAL
Remak : LTE Band 5 QPSK_10M Link_L-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1658.00	-36.98	-23.18	-13.00	-13.80	-23.98	Peak
2	2487.00	-49.37	-39.32	-13.00	-10.05	-36.37	Peak
3	3316.00	-51.76	-42.90	-13.00	-8.86	-38.76	Peak
4	4145.00	-50.09	-44.15	-13.00	-5.94	-37.09	Peak

Data: 4

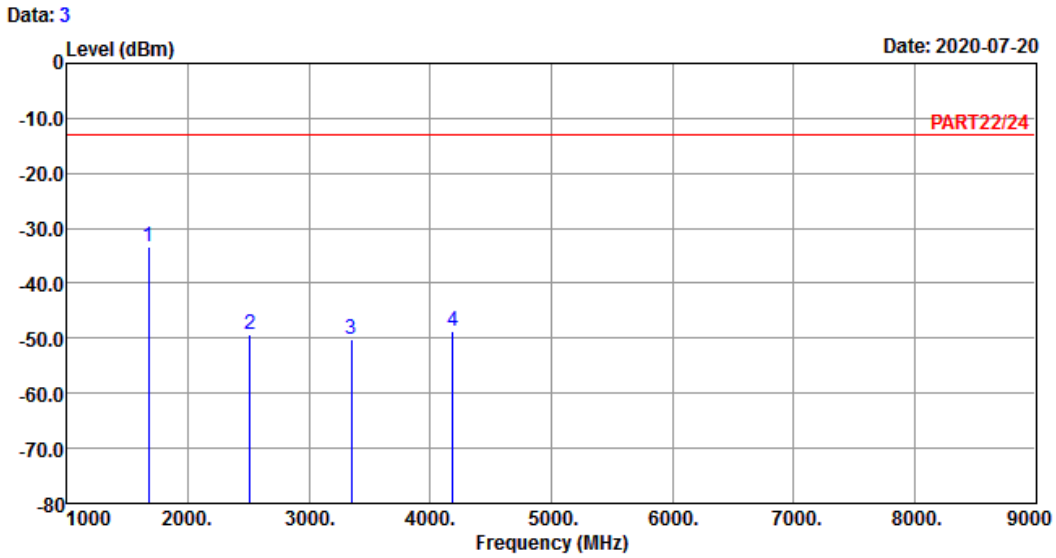


Site : 966 Chamber 5
Condition: PART22/24 VERTICAL
Remak : LTE Band 5 QPSK_10M Link_L-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1658.00	-33.85	-20.05	-13.00	-13.80	-20.85	Peak
2	2487.00	-50.18	-40.13	-13.00	-10.05	-37.18	Peak
3	3316.00	-45.71	-36.85	-13.00	-8.86	-32.71	Peak
4	4145.00	-48.16	-42.22	-13.00	-5.94	-35.16	Peak

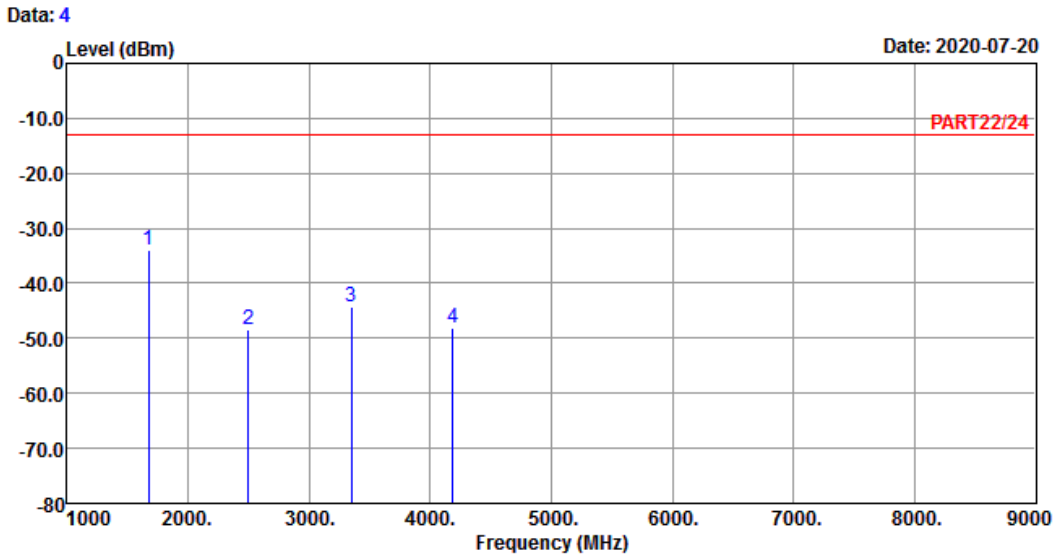
Middle Channel

Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 Chamber 5
Condition: PART22/24 HORIZONTAL
Remak : LTE Band 5 QPSK_10M Link_M-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1673.00	-33.39	-19.49	-13.00	-13.90	-20.39	Peak
2	2509.50	-49.35	-39.27	-13.00	-10.08	-36.35	Peak
3	3346.00	-50.07	-41.31	-13.00	-8.76	-37.07	Peak
4	4182.50	-48.58	-42.90	-13.00	-5.68	-35.58	Peak

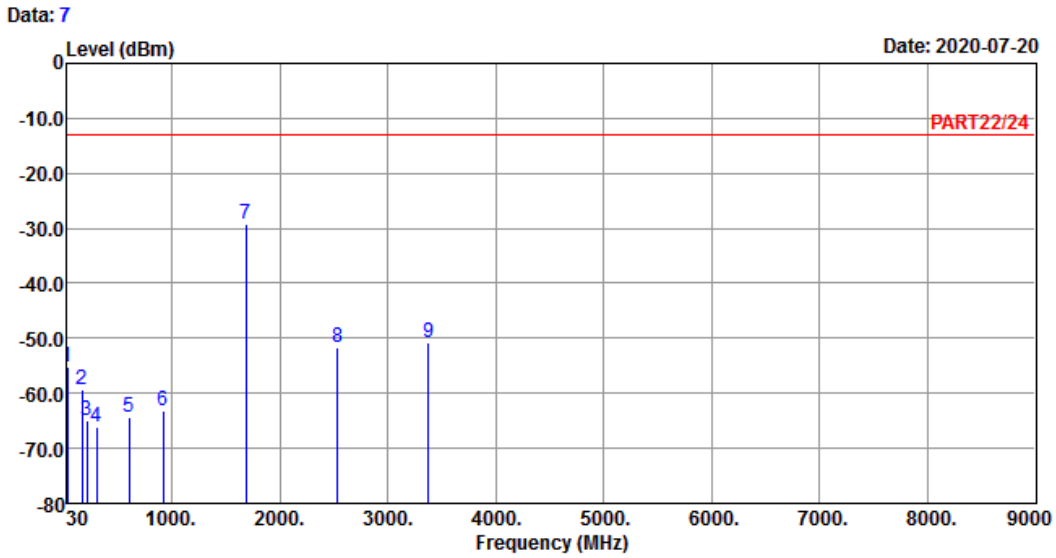


Site : 966 Chamber 5
Condition: PART22/24 VERTICAL
Remak : LTE Band 5 QPSK_10M Link_M-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1673.00	-34.05	-20.15	-13.00	-13.90	-21.05	Peak
2	2496.00	-48.31	-38.25	-13.00	-10.06	-35.31	Peak
3	3346.00	-44.41	-35.65	-13.00	-8.76	-31.41	Peak
4	4182.50	-48.06	-42.38	-13.00	-5.68	-35.06	Peak

High Channel

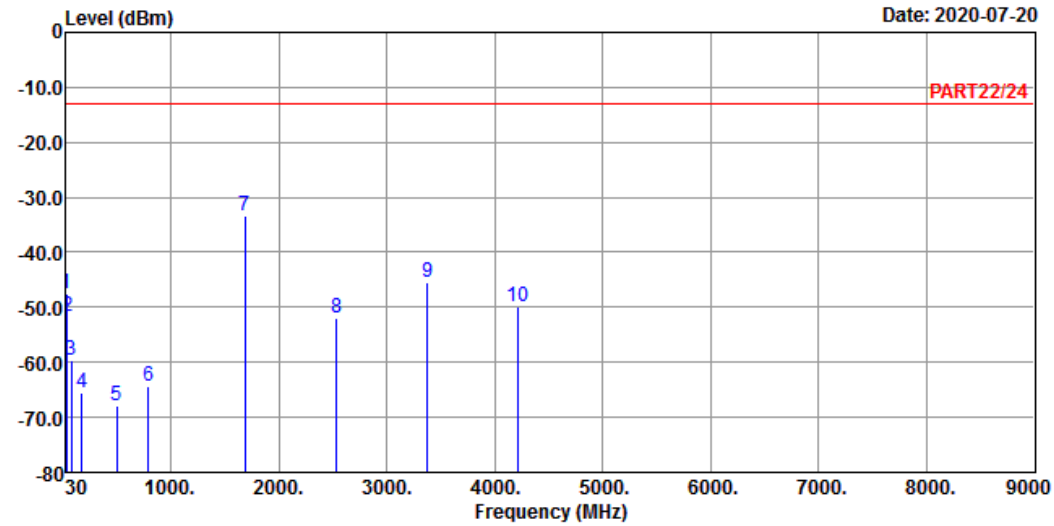
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 Chamber 5
Condition: PART22/24 HORIZONTAL
Remak : LTE Band 5 QPSK_10M Link_H-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 qp	30.00	-55.17	-55.55	-13.00	0.38	-42.17	QP
2	169.68	-59.21	-53.68	-13.00	-5.53	-46.21	QP
3	209.45	-64.99	-57.36	-13.00	-7.63	-51.99	QP
4	303.54	-66.08	-59.13	-13.00	-6.95	-53.08	QP
5	604.24	-64.50	-63.74	-13.00	-0.76	-51.50	QP
6	916.58	-63.18	-64.16	-13.00	0.98	-50.18	QP
7 pp	1688.00	-29.31	-15.32	-13.00	-13.99	-16.31	Peak
8	2532.00	-51.70	-41.63	-13.00	-10.07	-38.70	Peak
9	3376.00	-50.89	-42.22	-13.00	-8.67	-37.89	Peak

Data: 8



Site : 966 Chamber 5
Condition: PART22/24 VERTICAL
Remak : LTE Band 5 QPSK_10M Link_H-CH
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 qp	30.00	-47.60	-47.98	-13.00	0.38	-34.60	QP
2	39.70	-51.55	-52.19	-13.00	0.64	-38.55	QP
3	77.53	-59.73	-49.53	-13.00	-10.20	-46.73	QP
4	172.59	-65.50	-59.46	-13.00	-6.04	-52.50	QP
5	500.45	-67.86	-63.25	-13.00	-4.61	-54.86	QP
6	788.54	-64.40	-65.17	-13.00	0.77	-51.40	QP
7 pp	1688.00	-33.25	-19.26	-13.00	-13.99	-20.25	Peak
8	2532.00	-51.84	-41.77	-13.00	-10.07	-38.84	Peak
9	3376.00	-45.41	-36.74	-13.00	-8.67	-32.41	Peak
10	4220.00	-49.77	-44.20	-13.00	-5.57	-36.77	Peak

5 Pictures of Test Arrangements

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

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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

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Tel: 886-3-3183232
Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

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

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