FCC Test Report

(PART 22)

Report No.:	RF181205C09-3
FCC ID:	2AP3D-CT001
Test Model:	CT001
Received Date:	Dec. 05, 2018
Test Date:	Feb. 19, 2019 ~ Feb. 26, 2019
Issued Date:	Mar. 08, 2019
Applicant:	Spotify USA, Inc.
Address:	45 West 18th Street, New York, NY 10011, USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C)
Test Location (1):	No. 19, Hwa Ya 2nd Rd, Wen Hwa Vil, Kwei Shan Dist., Taoyuan City 33383, Taiwan (R.O.C)
Test Location (2):	B2F., No.215, Sec. 3, Beixin Rd., Xindian Dist., New Taipei City 231, Taiwan, R.O.C
FCC Registration / Designation Number:	427177 / TW0011

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Release Control Record

Issue No.	Description	Date Issued
RF181205C09-3	Original Release	Mar. 08, 2019

1 Certificate of Conformity

Product:	Music Streaming Device
Brand:	Spotify
Test Model:	CT001
Sample Status:	Engineering Sample
Applicant:	Spotify USA, Inc.
Test Date:	Feb. 19, 2019 ~ Feb. 26, 2019
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 : _____ , **Date:** Mar. 08, 2019

Ivonne Wu / Supervisor

Approved by : _____ , **Date:** Mar. 08, 2019

Dylan Chiou / 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.
---	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 -27.35 dB at 32.43 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**	**Expended Uncertainty (k=2) (±)**
Radiated Emissions up to 1 GHz	30 MHz ~ 200 MHz	2.0153 dB
	200 MHz ~ 1000 MHz	2.0224 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	1.0121 dB
	18 GHz ~ 40 GHz	1.1508 dB

2.2 Test Site and Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent Technologies	N9038A	MY52260177	Aug. 20, 2018	Aug. 19, 2019
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	100115	Jan. 21, 2019	Jan. 20, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSW26	102023	Oct. 11, 2018	Oct. 10, 2019
BILOG Antenna SCHWARZBECK	VULB9168	9168-616	Nov. 27, 2018	Nov. 26, 2019
HORN Antenna ETS-Lindgren	3117	00143293	Nov. 25, 2018	Nov. 24, 2019
HORN Antenna SCHWARZBECK	BBHA9170	9170-480	Nov. 25, 2018	Nov. 24, 2019
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-969	Nov. 25, 2018	Nov. 24, 2019
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 16, 2018	Apr. 15, 2019
MXG Vector signal generator Agilent	N5182B	MY53050430	Nov. 19, 2018	Nov. 18, 2019
Preamplifier Agilent	310N	187226	Jun. 19, 2018	Jun. 18, 2019
Preamplifier Agilent	83017A	MY39501357	Jun. 19, 2018	Jun. 18, 2019
RF signal cable ETS-LINDGREN	5D-FB	Cable-CH1-01(RFC-SMS-100-SMS-120+RFC-SMS-100-SMS-400)	Jun. 19, 2018	Jun. 18, 2019
RF signal cable ETS-LINDGREN	8D-FB	Cable-CH1-02(RFC-SMS-100-SMS-24)	Jun. 19, 2018	Jun. 18, 2019
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Software BV ADT	E3 8.130425b	NA	NA	NA
Antenna Tower MF	NA	NA	NA	NA
Turn Table MF	NA	NA	NA	NA
Antenna Tower &Turn Table Controller MF	MF-7802	NA	NA	NA
Communications Tester-Wireless Agilent	8960 Series 10	MY53201073	Jun. 28, 2017	Jun. 27, 2019
Radio Communication Analyzer Anritsu	MT8820C	6201300640	Aug. 16, 2017	Aug. 15, 2019
Temperature & Humidity Chamber	GTH-120-40-CP-AR	MAA1306-019	Sep. 05, 2018	Sep. 04, 2019
True RMS Clamp Meter Fluke	325	31130711WS	May 22, 2018	May 21, 2019
Power Supply Agilent	66319D	MY43005576	Oct. 19, 2018	Oct. 18, 2019

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 HsinTien Chamber 1.
3. The horn antenna and preamplifier (model: 83017A) are used only for the measurement of emission frequency above 1 GHz if tested.
4. The IC Site Registration No. is 7450I-1.

3 General Information

3.1 General Description of EUT

Product	Music Streaming Device	
Brand	Spotify	
Test Model	CT001	
Status of EUT	Engineering Sample	
Power Supply Rating	2.4 Vdc (battery) 5.0 Vdc (host equipment)	
Modulation Type	WCDMA	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	130.62 mW
	LTE 5 (Channel Bandwidth: 1.4 MHz)	103.56 mW
	LTE 5 (Channel Bandwidth: 3 MHz)	104.52 mW
	LTE 5 (Channel Bandwidth: 5 MHz)	105.49 mW
	LTE 5 (Channel Bandwidth: 10 MHz)	106.46 mW
Emission Designator	WCDMA	4M16F9W
	LTE 5 (Channel Bandwidth: 1.4 MHz)	1M09D7W
	LTE 5 (Channel Bandwidth: 3 MHz)	2M70G7D
	LTE 5 (Channel Bandwidth: 5 MHz)	4M50D7W
	LTE 5 (Channel Bandwidth: 10 MHz)	8M97D7W
Antenna Type	PIFA Antenna with -0.5 dBi gain (Main) / -10.9 dBi (Aux.)	
Accessory Device	Refer to Note as below	
Data Cable Supplied	Refer to Note as below	

Note:

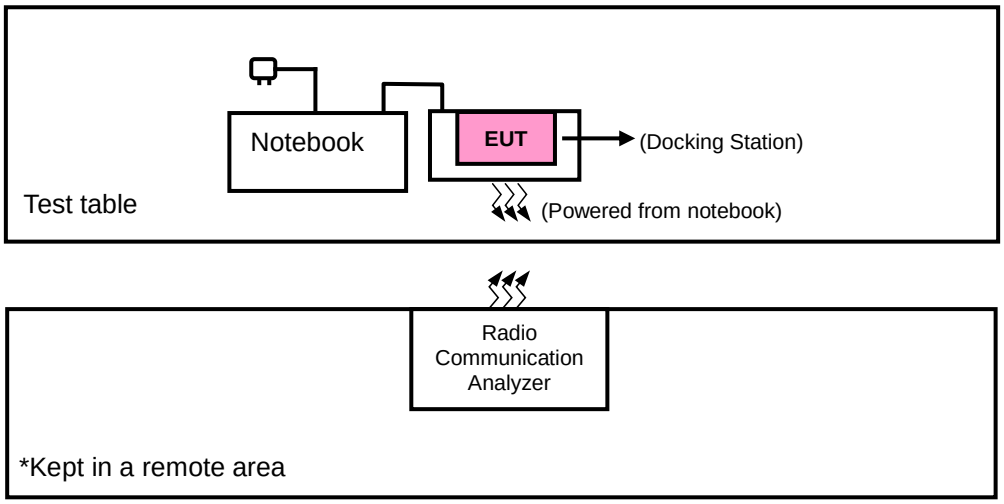
1. The EUT contains following accessory devices.

Product	Brand	Model	Description
12V to 5V car power supply	KYOHAYA	KC-D53	18W
Battery	Varta	V500HT	1.2 Vdc, 500 mAh
LCD Panel	AUO	H140QVT01.0	--
eMMC (=ROM)	Samsung	KMFE60012M-B214	16Gbyte
RAM	Samsung	KMFE60012M-B214	8Gbit LPDDR3
CPU	Qualcomm	MSM8909-4-504NSP	--
Docking station	In house design	N/A	P/N: 22222

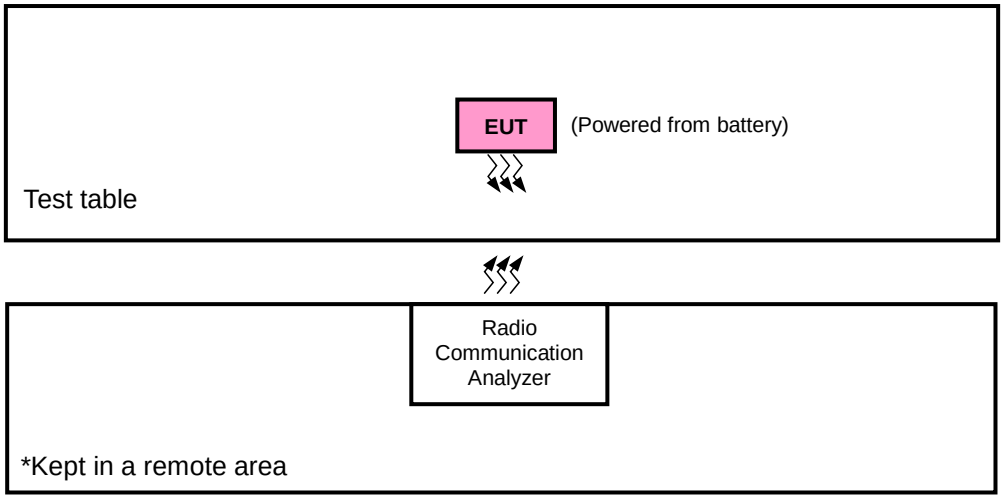
2. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

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.	Adapter	HTC	TC U250	100980	N/A
2.	Notebook	DELL	Inspiron 14R	8LRKKW1	N/A

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

Note:

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

3.3 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis, and antenna ports.
The worst case was found when positioned as the table below. Following channel(s) was (were) selected for the final test as listed below:

Band	ERP	Radiated Emission
WCDMA	X-plane	X-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	10 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
-	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: This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
ERP	25 deg. C, 65 % RH	5 Vdc	Harry Hsueh
Modulation Characteristics	25 deg. C, 65 % RH	5 Vdc	Gavin Wu
Frequency Stability	25 deg. C, 65 % RH	5 Vdc	Gavin Wu
Occupied Bandwidth	25 deg. C, 65 % RH	5 Vdc	Gavin Wu
Band Edge	25 deg. C, 65 % RH	5 Vdc	Gavin Wu
Peak to Average Ratio	25 deg. C, 65 % RH	5 Vdc	Gavin Wu
Conducted Emission	25 deg. C, 65 % RH	5 Vdc	Gavin Wu
Radiated Emission	25 deg. C, 65 % RH	5 Vdc	Harry Hsueh / Karl Lee

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

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

FCC 47 CFR Part 2
FCC 47 CFR Part 22
KDB 971168 D01 Power Meas License Digital Systems v03r01
ANSI/TIA/EIA-603-E 2016
ANSI 63.26-2015

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

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:

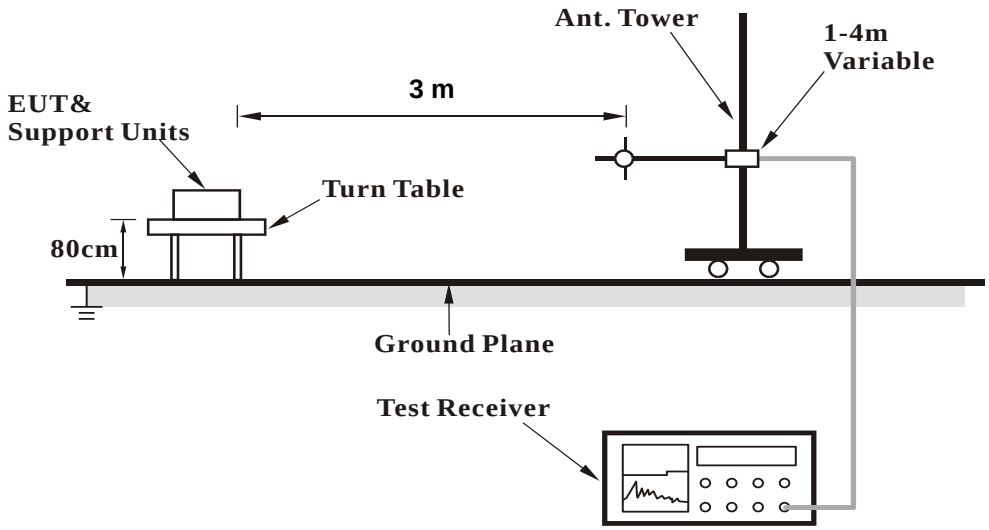
a. All measurements were done at low, middle and high operational frequency range. RBW and VBW is 5 MHz for WCDMA and 10 MHz for LTE mode.
b. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m (below or equal 1 GHz) and/or 1.5 m (above 1 GHz) height 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:

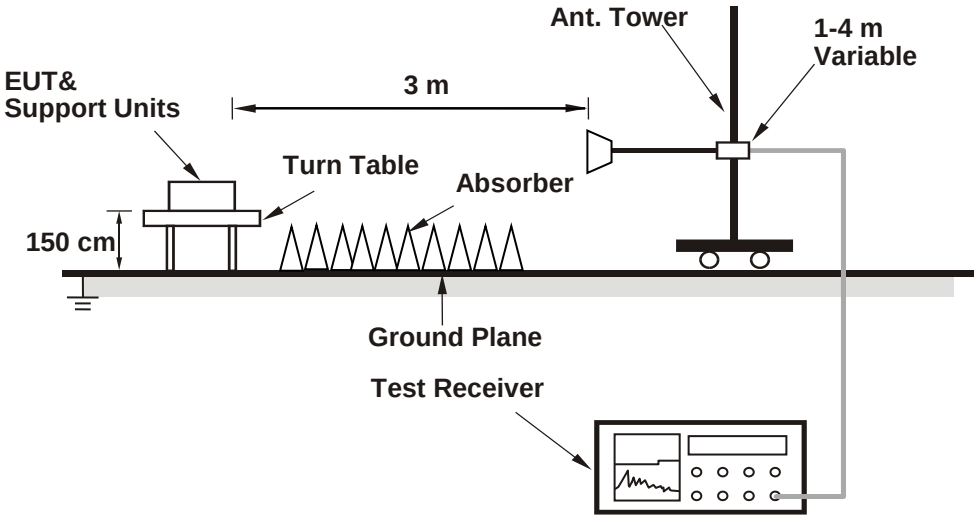
The EUT was set up for the maximum power with WCDMA and LTE link data modulation and link up with simulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

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	23.56	22.89	23.81
HSDPA Subtest-1	22.45	21.64	22.71
HSDPA Subtest-2	21.36	20.62	21.67
HSDPA Subtest-3	21.25	20.52	21.52
HSDPA Subtest-4	21.14	20.20	21.30
HSUPA Subtest-1	22.47	21.73	22.51
HSUPA Subtest-2	19.90	19.14	19.92
HSUPA Subtest-3	21.57	20.85	21.61
HSUPA Subtest-4	19.90	19.15	19.94
HSUPA Subtest-5	21.98	21.24	22.03

LTE Band 5

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)	BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		20450	20525	20600				Channel		20425	20525	20625	
		Frequency (MHz)		829.0	836.5	844.0				Frequency (MHz)		826.5	836.5	846.5	
10M	QPSK	1	0	22.75	22.81	22.83	0	5M	QPSK	1	0	22.71	22.76	22.80	0
		1	24	22.64	22.69	22.72	0			1	12	22.59	22.60	22.65	0
		1	49	22.38	22.60	22.45	0			1	24	22.31	22.49	22.41	0
		25	0	21.59	21.66	21.72	1			12	0	21.58	21.58	21.62	1
		25	12	21.37	21.48	21.53	1			12	6	21.41	21.43	21.38	1
		25	25	21.31	21.35	21.38	1			12	13	21.31	21.28	21.36	1
		50	0	21.59	21.65	21.64	1			25	0	21.50	21.62	21.61	1
	16QAM	1	0	21.69	21.79	21.74	1		16QAM	1	0	21.67	21.69	21.73	1
		1	24	21.55	21.63	21.66	1			1	12	21.51	21.56	21.62	1
		1	49	21.30	21.53	21.44	1			1	24	21.29	21.45	21.39	1
		25	0	20.54	20.44	20.50	2			12	0	20.44	20.50	20.43	2
		25	12	20.28	20.40	20.44	2			12	6	20.36	20.41	20.29	2
		25	25	20.28	20.31	20.37	2			12	13	20.22	20.21	20.29	2
		50	0	20.57	20.58	20.62	2			25	0	20.48	20.54	20.54	2
BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)	BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		20415	20525	20635				Channel		20407	20525	20643	
		Frequency (MHz)		825.5	836.5	847.5				Frequency (MHz)		824.7	836.5	848.3	
3M	QPSK	1	0	22.62	22.68	22.69	0	1.4M	QPSK	1	0	22.53	22.64	22.69	0
		1	7	22.58	22.52	22.59	0			1	2	22.47	22.47	22.55	0
		1	14	22.31	22.42	22.35	0			1	5	22.37	22.32	22.42	0
		8	0	21.53	21.58	21.57	1			3	0	21.46	21.43	21.49	0
		8	3	21.36	21.39	21.38	1			3	1	21.26	21.30	21.31	0
		8	7	21.27	21.31	21.36	1			3	3	21.21	21.18	21.20	0
		15	0	21.47	21.47	21.53	1			6	0	21.42	21.46	21.43	1
	16QAM	1	0	21.57	21.62	21.62	1		16QAM	1	0	21.51	21.57	21.64	1
		1	7	21.49	21.47	21.57	1			1	2	21.44	21.41	21.53	1
		1	14	21.30	21.34	21.33	1			1	5	21.31	21.31	21.33	1
		8	0	20.46	20.53	20.35	2			3	0	20.36	20.25	20.42	1
		8	3	20.35	20.34	20.37	2			3	1	20.18	20.21	20.30	1
		8	7	20.24	20.25	20.30	2			3	3	20.12	20.09	20.11	1
		15	0	20.40	20.46	20.48	2			6	0	20.28	20.30	20.33	2

ERP Power (dBm)

WCDMA							
Plane	**Channel**	**Frequency (MHz)**	**Reading (dBm)**	**Correction Factor (dB)**	**ERP (dBm)**	**ERP (mW)**	**Polarization (H/V)**
X	4132	826.4	-8.29	31.208	20.77	119.34	H
	4182	836.4	-7.99	31.3	21.16	130.62	
	4233	846.6	-8.00	31.222	21.07	128.00	
	4132	826.4	-13.56	31.504	15.79	37.97	V
	4182	836.4	-12.82	31.117	16.15	41.18	
	4233	846.6	-13.65	31.922	16.12	40.94	

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	-9.15	31.208	19.91	97.90	H
	20525	836.5	-9.10	31.3	20.05	101.16	
	20643	848.3	-8.92	31.222	20.15	103.56	
	20407	824.7	-14.45	31.504	14.90	30.93	V
	20525	836.5	-13.91	31.117	15.06	32.04	
	20643	848.3	-14.65	31.922	15.12	32.52	
Channel Bandwidth: 1.4 MHz / 16QAM							
X	20407	824.7	-10.16	31.208	18.90	77.59	H
	20525	836.5	-10.11	31.3	19.04	80.17	
	20643	848.3	-9.93	31.222	19.14	82.07	
	20407	824.7	-15.46	31.504	13.89	24.51	V
	20525	836.5	-14.92	31.117	14.05	25.39	
	20643	848.3	-15.65	31.922	14.12	25.83	

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	-9.11	31.208	19.95	98.81	H
	20525	836.5	-9.07	31.3	20.08	101.86	
	20635	847.5	-8.88	31.222	20.19	104.52	
	20415	825.5	-14.42	31.504	14.93	31.15	V
	20525	836.5	-13.87	31.117	15.10	32.34	
	20635	847.5	-14.61	31.922	15.16	32.82	
Channel Bandwidth: 3 MHz / 16QAM							
X	20415	825.5	-10.12	31.208	18.94	78.31	H
	20525	836.5	-10.07	31.3	19.08	80.91	
	20635	847.5	-9.88	31.222	19.19	83.02	
	20415	825.5	-15.42	31.504	13.93	24.74	V
	20525	836.5	-14.88	31.117	14.09	25.63	
	20635	847.5	-15.62	31.922	14.15	26.01	

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	-9.08	31.208	19.98	99.49	H
	20525	836.5	-9.03	31.3	20.12	102.80	
	20625	846.5	-8.84	31.222	20.23	105.49	
	20425	826.5	-14.38	31.504	14.97	31.43	V
	20525	836.5	-13.83	31.117	15.14	32.64	
	20625	846.5	-14.57	31.922	15.20	33.13	
Channel Bandwidth: 5 MHz / 16QAM							
X	20425	826.5	-10.09	31.208	18.97	78.85	H
	20525	836.5	-10.04	31.3	19.11	81.47	
	20625	846.5	-9.85	31.222	19.22	83.60	
	20425	826.5	-15.39	31.504	13.96	24.91	V
	20525	836.5	-14.84	31.117	14.13	25.86	
	20625	846.5	-15.58	31.922	14.19	26.25	

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	-9.04	31.208	20.02	100.42	H
	20525	836.5	-8.99	31.3	20.16	103.75	
	20600	844.0	-8.80	31.222	20.27	106.46	
	20450	829.0	-14.34	31.504	15.01	31.72	V
	20525	836.5	-13.80	31.117	15.17	32.86	
	20600	844.0	-14.54	31.922	15.23	33.36	
Channel Bandwidth: 10 MHz / 16QAM							
X	20450	829.0	-10.05	31.208	19.01	79.58	H
	20525	836.5	-9.99	31.3	19.16	82.41	
	20600	844.0	-9.81	31.222	19.26	84.37	
	20450	829.0	-15.35	31.504	14.00	25.14	V
	20525	836.5	-14.81	31.117	14.16	26.04	
	20600	844.0	-15.54	31.922	14.23	26.50	

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

4.2 Modulation Characteristics Measurement

4.2.1 Limits of Modulation Characteristics

N/A

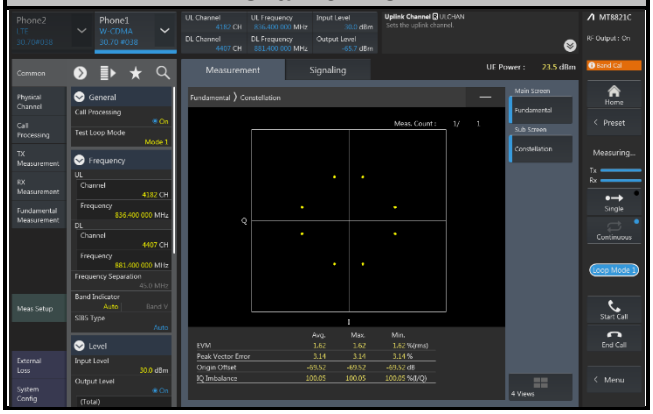
4.2.2 Test Setup

4.2.3 Test Procedure

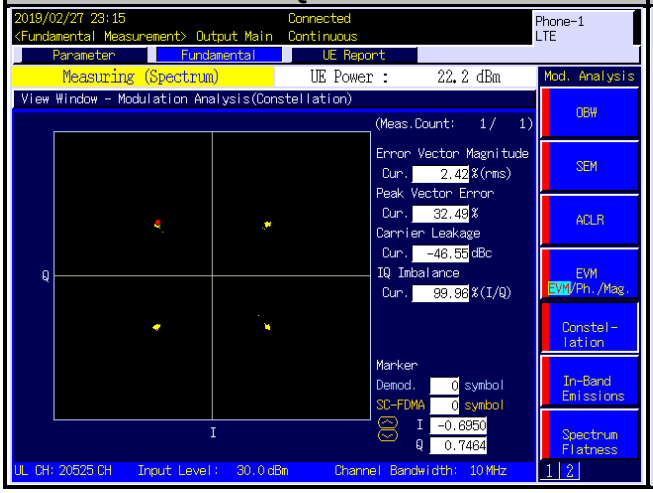
Connect the EUT to Communication Simulator via the antenna connector. The frequency band is set as EUT supported Modulation and Channels, the EUT output is matched with 50 ohm load, the waveform quality and constellation of the EUT was tested.

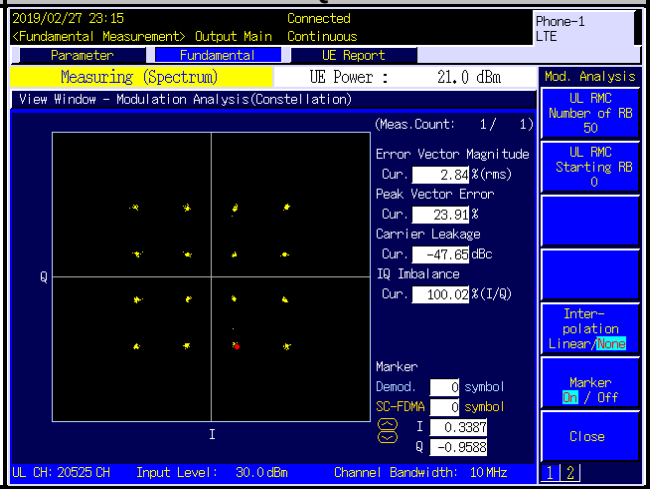
4.2.4 Test Results

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

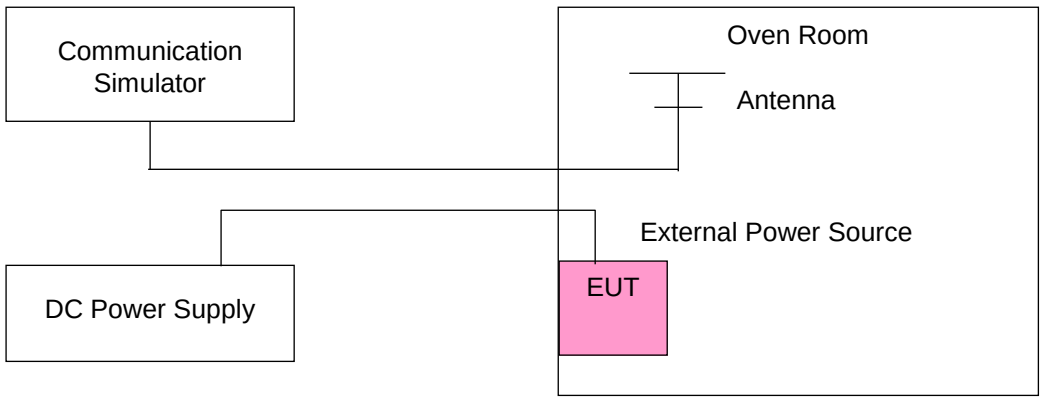
1.5 ppm is for base and fixed station. 2.5 ppm is for mobile station.

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 DC 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)	
4.25	826.400001	0.001	846.600001	0.001	2.5
5	826.400003	0.003	846.600002	0.003	2.5
5.75	826.400004	0.005	846.600002	0.002	2.5

Note: The applicant defined the normal working voltage of the battery is from 4.25 Vdc to 5.75 Vdc.

Frequency Error vs. Temperature

Temp. (℃)	WCDMA				Limit (ppm)
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
-30	826.400002	0.002	846.600001	0.001	2.5
-20	826.400001	0.002	846.600002	0.002	2.5
-10	826.400002	0.003	846.600004	0.004	2.5
0	826.400003	0.004	846.600002	0.003	2.5
10	826.400003	0.003	846.600003	0.004	2.5
20	826.399998	-0.002	846.599998	-0.003	2.5
30	826.399997	-0.004	846.599999	-0.001	2.5
40	826.399997	-0.004	846.599997	-0.003	2.5
50	826.399997	-0.004	846.599997	-0.004	2.5
55	826.399999	-0.001	846.599996	-0.004	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)	
4.25	824.700002	0.002	848.300004	0.005	2.5
5	824.700004	0.004	848.300003	0.003	2.5
5.75	824.700003	0.003	848.300002	0.002	2.5

Note: The applicant defined the normal working voltage of the battery is from 4.25 Vdc to 5.75 Vdc.

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	824.700002	0.002	848.300003	0.004	2.5
-20	824.700001	0.002	848.300004	0.004	2.5
-10	824.700003	0.004	848.300004	0.004	2.5
0	824.700003	0.003	848.300003	0.003	2.5
10	824.700004	0.005	848.300004	0.004	2.5
20	824.699997	-0.003	848.299997	-0.004	2.5
30	824.699997	-0.004	848.299997	-0.003	2.5
40	824.699997	-0.004	848.299996	-0.004	2.5
50	824.699996	-0.005	848.299996	-0.005	2.5
55	824.699997	-0.004	848.299998	-0.002	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)	
4.25	825.500004	0.004	847.500002	0.002	2.5
5	825.500004	0.004	847.500004	0.005	2.5
5.75	825.500002	0.002	847.500001	0.001	2.5

Note: The applicant defined the normal working voltage of the battery is from 4.25 Vdc to 5.75 Vdc.

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	825.500002	0.002	847.500004	0.004	2.5
-20	825.500002	0.002	847.500002	0.003	2.5
-10	825.500004	0.005	847.500001	0.001	2.5
0	825.500002	0.003	847.500003	0.004	2.5
10	825.500002	0.002	847.500001	0.001	2.5
20	825.499998	-0.003	847.499999	-0.002	2.5
30	825.499998	-0.003	847.499998	-0.002	2.5
40	825.499999	-0.001	847.499998	-0.002	2.5
50	825.499996	-0.004	847.499997	-0.004	2.5
55	825.499999	-0.002	847.499998	-0.002	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)	
4.25	826.500002	0.002	846.500002	0.002	2.5
5	826.500003	0.003	846.500004	0.005	2.5
5.75	826.500003	0.004	846.500003	0.003	2.5

Note: The applicant defined the normal working voltage of the battery is from 4.25 Vdc to 5.75 Vdc.

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	826.500003	0.003	846.500002	0.002	2.5
-20	826.500001	0.001	846.500002	0.002	2.5
-10	826.500003	0.004	846.500002	0.002	2.5
0	826.500004	0.005	846.500003	0.003	2.5
10	826.500002	0.002	846.500003	0.003	2.5
20	826.499998	-0.003	846.499997	-0.004	2.5
30	826.499999	-0.001	846.499999	-0.001	2.5
40	826.499999	-0.001	846.499997	-0.004	2.5
50	826.499997	-0.004	846.499998	-0.003	2.5
55	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)	
4.25	829.000003	0.003	844.000003	0.003	2.5
5	829.000004	0.004	844.000003	0.003	2.5
5.75	829.000003	0.003	844.000004	0.005	2.5

Note: The applicant defined the normal working voltage of the battery is from 4.25 Vdc to 5.75 Vdc.

Frequency Error vs. Temperature

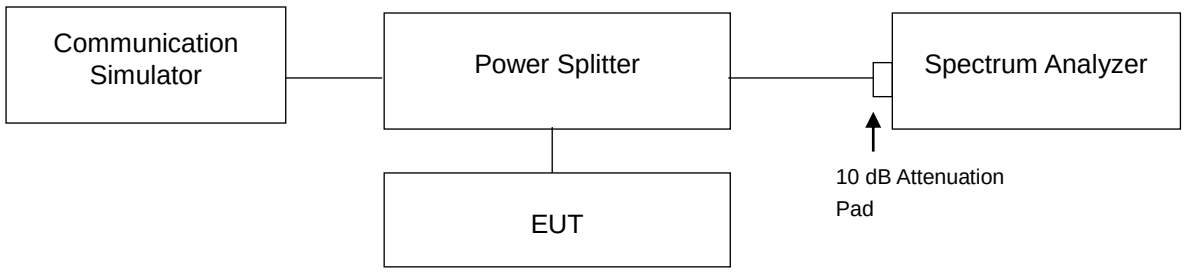
Temp. (℃)	LTE Band 5				Limit (ppm)
	Channel Bandwidth: 10 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
-30	829.000002	0.002	844.000002	0.002	2.5
-20	829.000002	0.003	844.000002	0.002	2.5
-10	829.000001	0.001	844.000004	0.005	2.5
0	829.000004	0.004	844.000004	0.004	2.5
10	829.000001	0.002	844.000002	0.002	2.5
20	828.999997	-0.003	843.999997	-0.003	2.5
30	828.999997	-0.004	843.999996	-0.004	2.5
40	828.999996	-0.005	843.999998	-0.002	2.5
50	828.999997	-0.003	843.999998	-0.002	2.5
55	828.999997	-0.004	843.999998	-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.

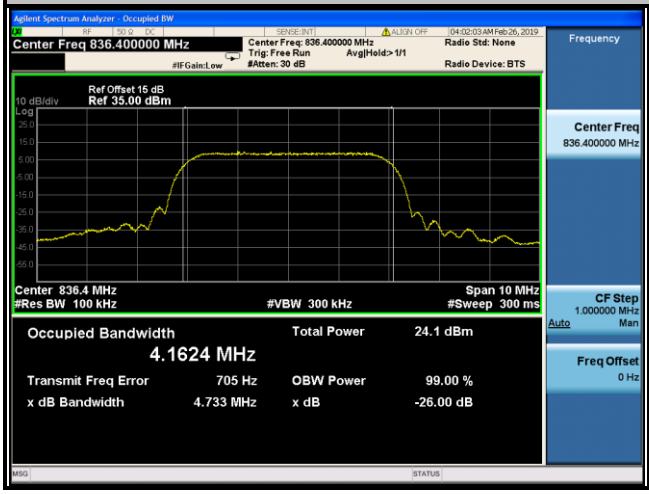
4.4.2 Test Setup

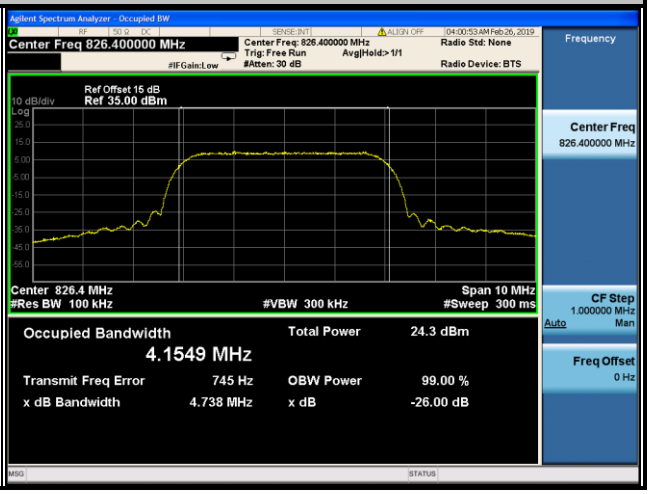


4.4.3 Test Result

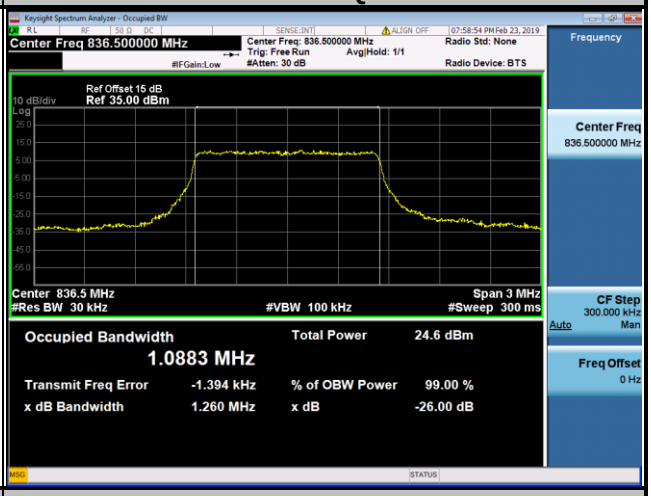
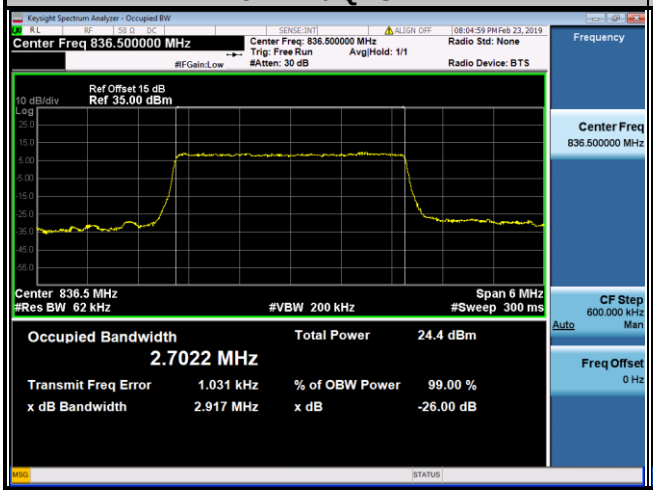
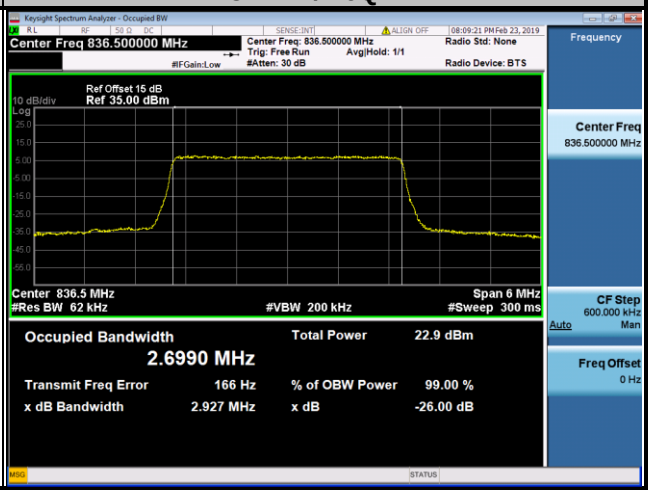
WCDMA			
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
4132	826.4	4.1549	4.738
4182	836.4	4.1624	4.733
4233	846.6	4.1554	4.729

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

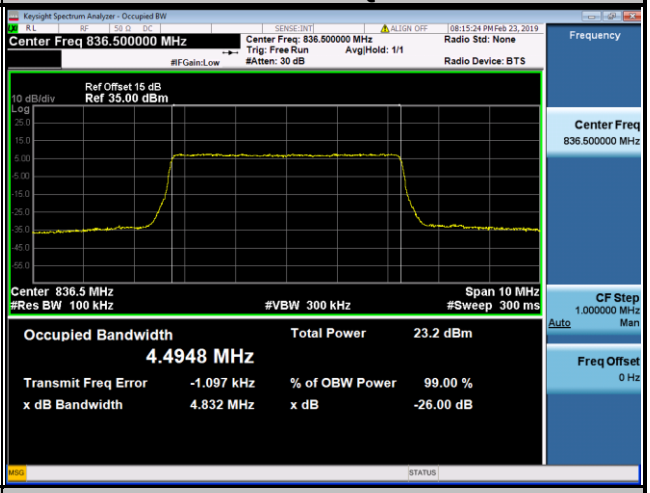




LTE Band 5					
Channel Bandwidth: 1.4 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
20407	824.7	1.0880	1.0873	1.251	1.247
20525	836.5	1.0883	1.0907	1.260	1.249
20643	848.3	1.0880	1.0892	1.256	1.237
Channel Bandwidth: 3 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
20415	825.5	2.7006	2.6979	2.917	2.918
20525	836.5	2.7022	2.6990	2.917	2.927
20635	847.5	2.7012	2.6984	2.917	2.923

Spectrum Plot of Worst Value	
99 % Occupied Bandwidth	26 dB Bandwidth
1.4 MHz / 16QAM	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	4.4934	4.4919	4.828	4.824
20525	836.5	4.4950	4.4948	4.821	4.832
20625	846.5	4.4926	4.4960	4.826	4.829
Channel Bandwidth: 10 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
20450	829.0	8.9651	8.9647	9.510	9.534
20525	836.5	8.9670	8.9700	9.527	9.533
20600	844.0	8.9602	8.9573	9.535	9.521

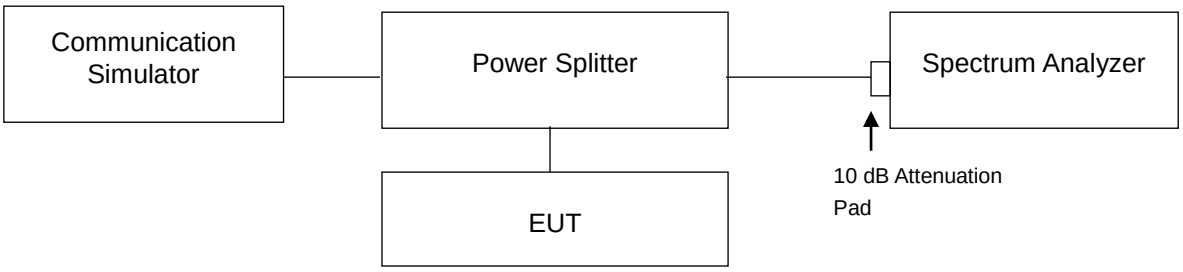
Spectrum Plot of Worst Value	
99 % Occupied Bandwidth	26 dB Bandwidth
5 MHz / 16QAM	5 MHz / 16QAM
	
10 MHz / 16QAM	10 MHz / QPSK
	

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

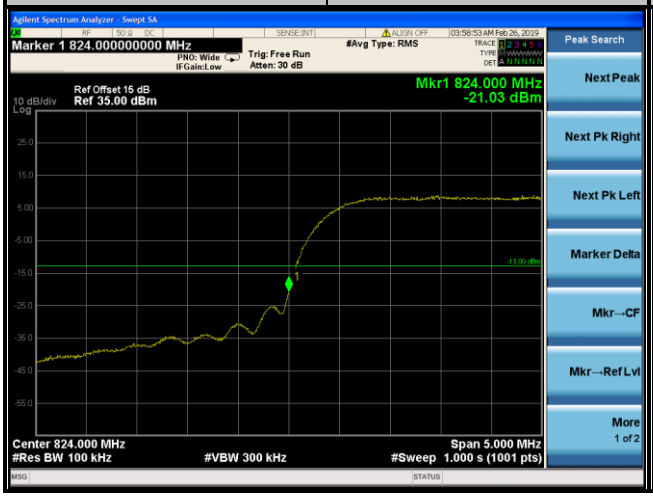


4.5.3 Test Procedures

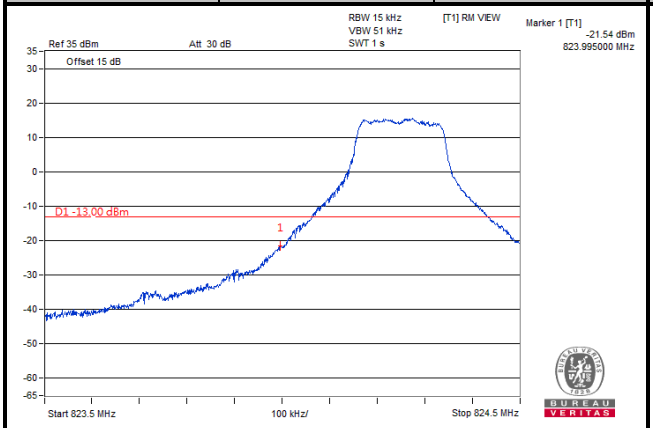
a. All measurements were done at low and high operational frequency range.
b. The center frequency of spectrum is the band edge frequency and span is 5 MHz. RB of the spectrum is 100 kHz and VB of the spectrum is 300 kHz (WCDMA).
c. The center frequency of spectrum is the band edge frequency and span 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 62 kHz and VB of the spectrum is 200 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.

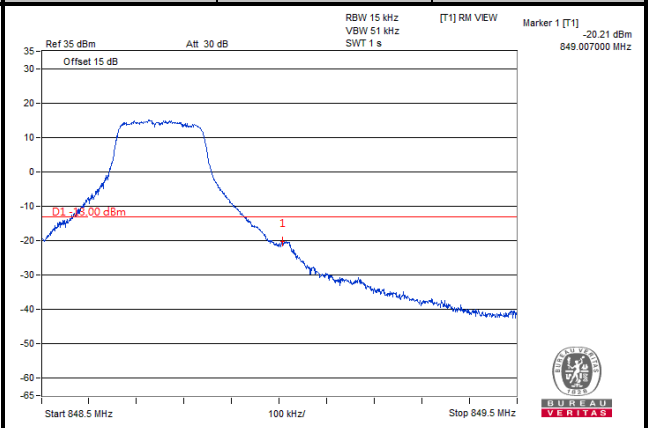
4.5.4 Test Results

WCDMA			
Channel	4132	Channel	4233

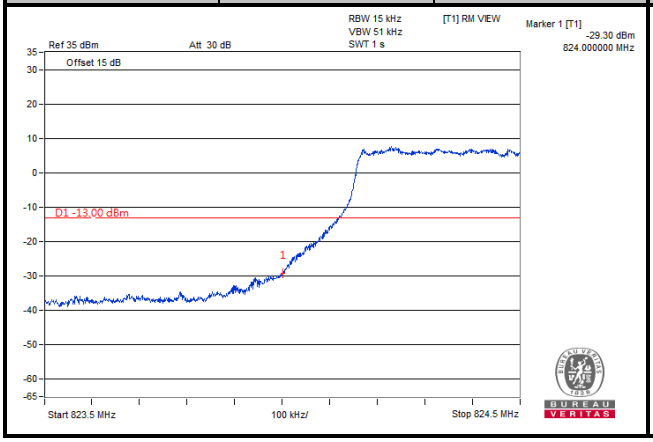


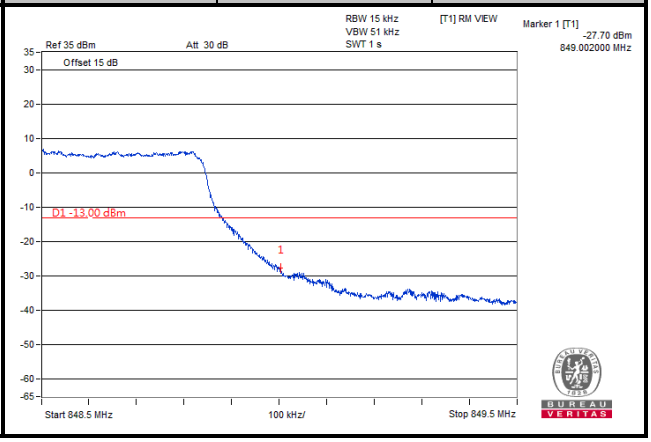
LTE Band 5					
Channel Bandwidth: 1.4 MHz					
Channel	20407	1 RB	Channel	20643	1 RB

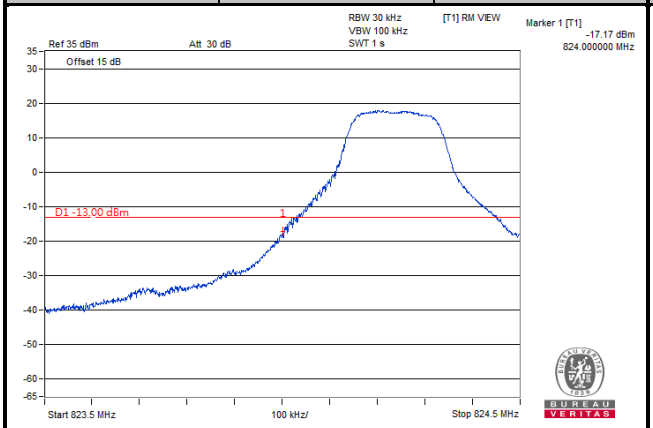
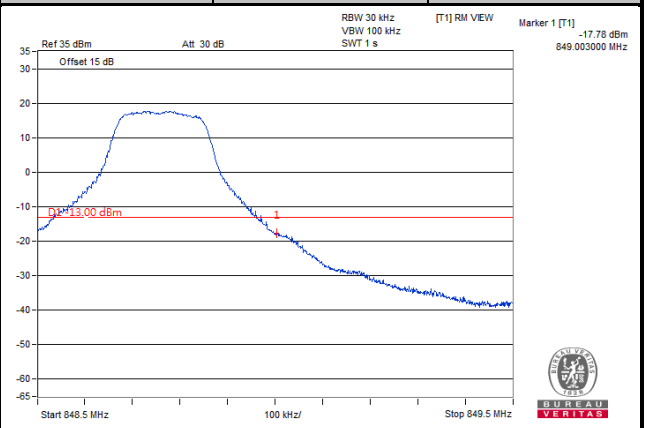
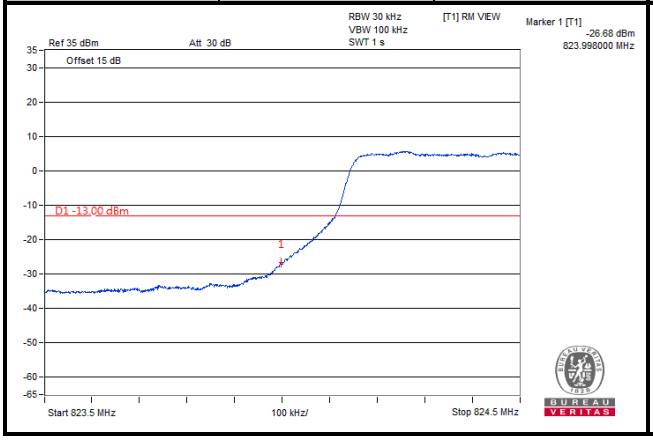
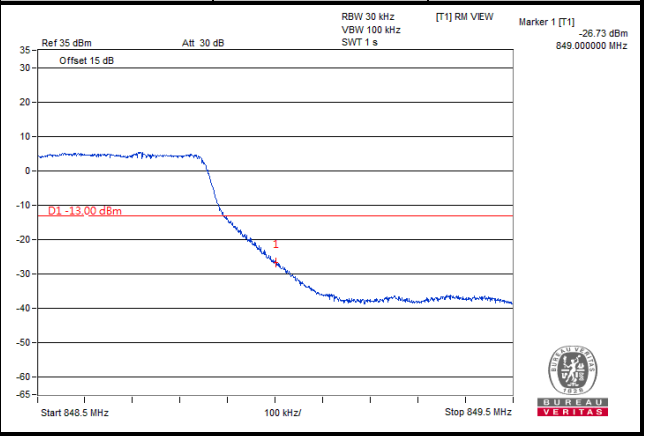


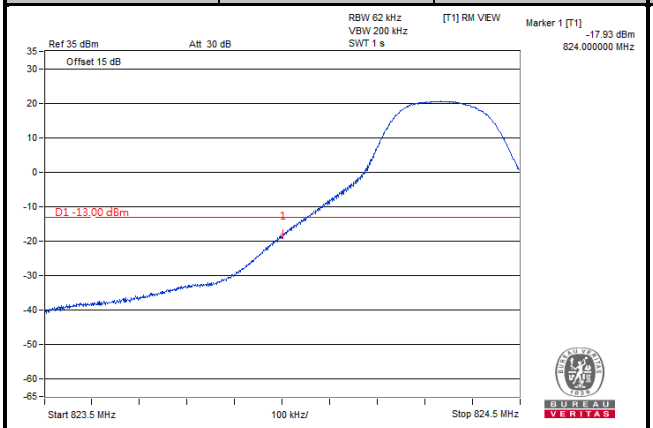
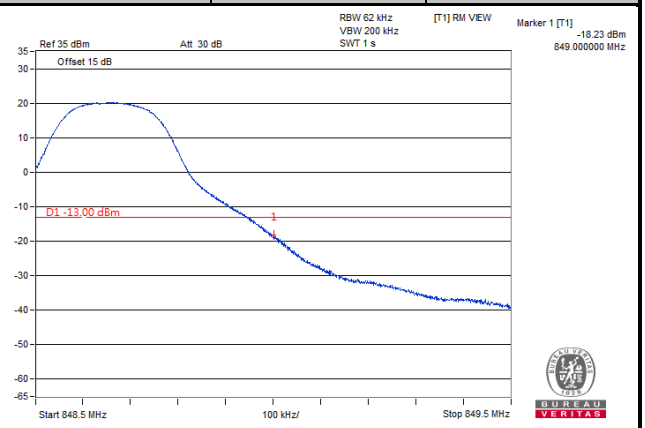
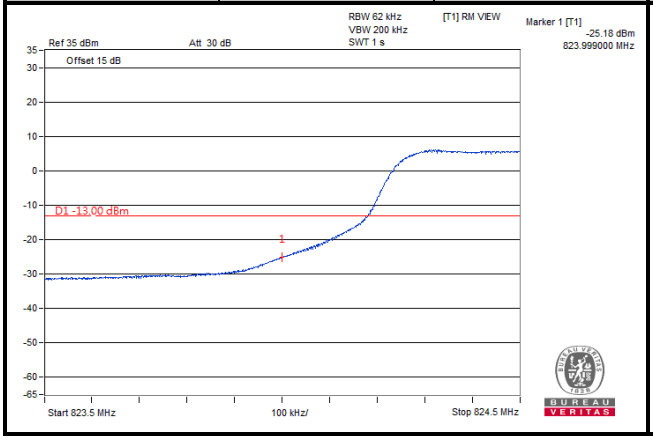
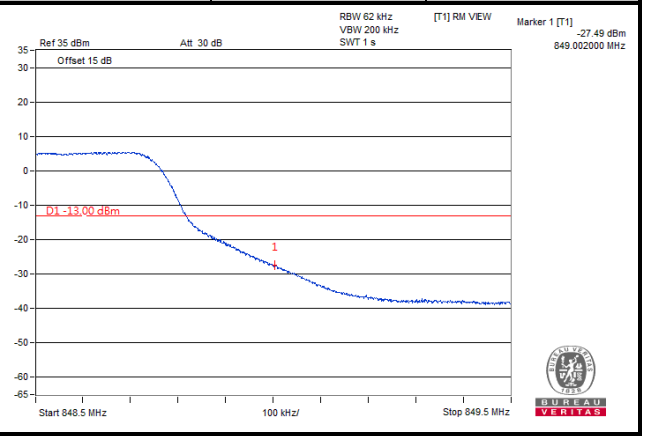


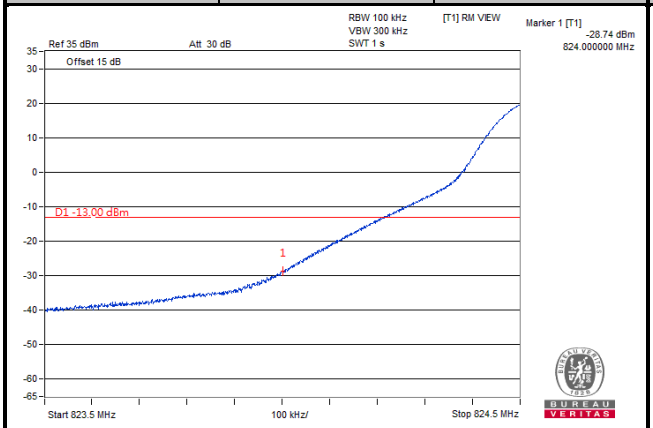
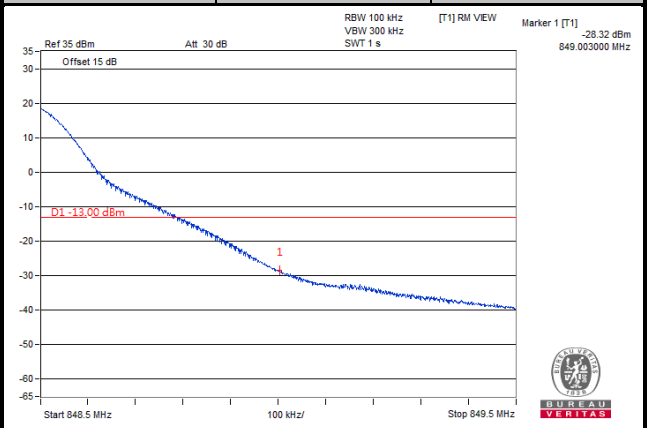
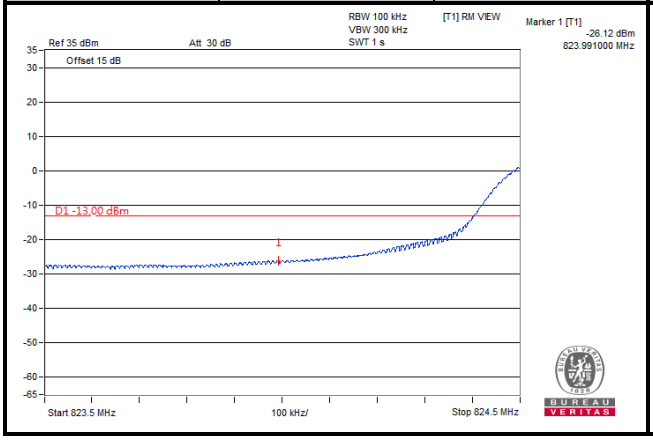
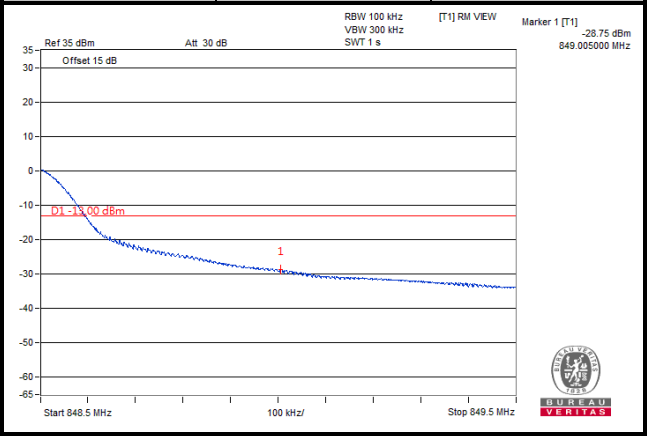
Channel	20407	6 RB	Channel	20643	6 RB





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
					

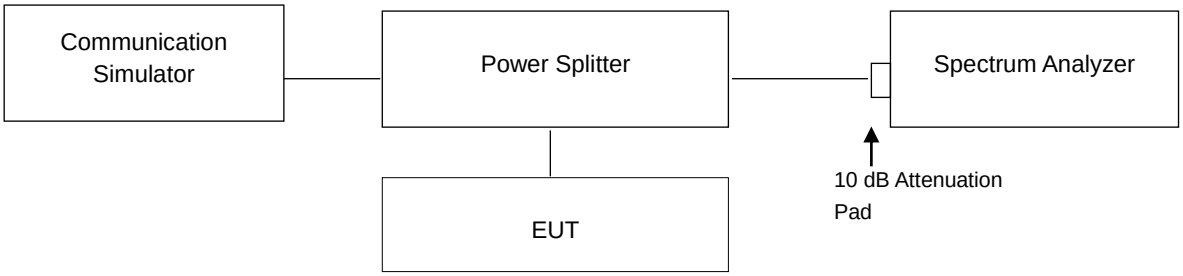
LTE Band 5					
Channel Bandwidth: 10 MHz					
Channel	20450	1 RB	Channel	20600	1 RB
					
Channel	20450	50 RB	Channel	20600	50 RB
					

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



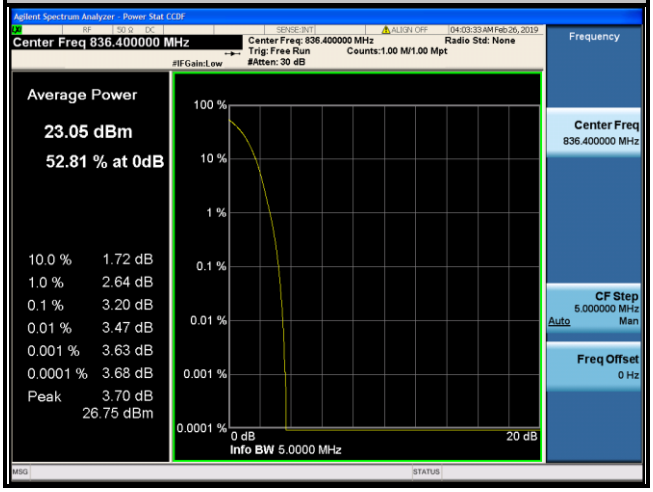
4.6.3 Test Procedures

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 %.

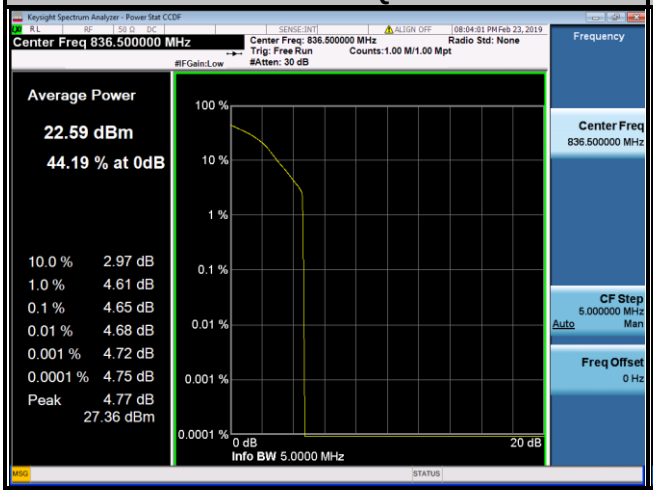
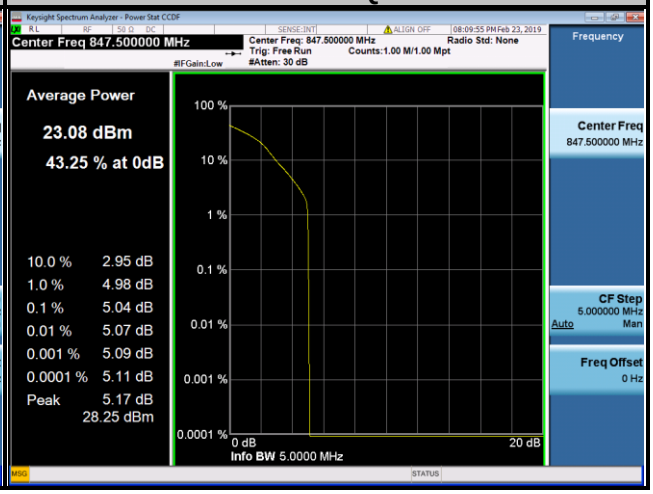
4.6.4 Test Results

Channel	Frequency (MHz)	Peak to Average Ratio (dB)
		WCDMA
4132	826.4	2.96
4182	836.4	3.20
4233	846.6	3.06

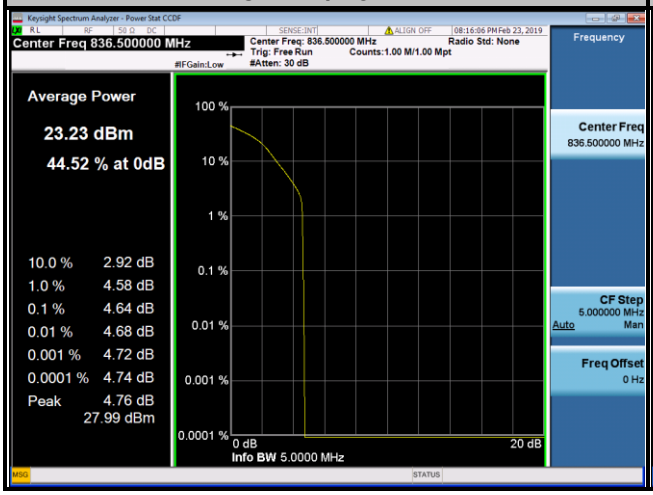
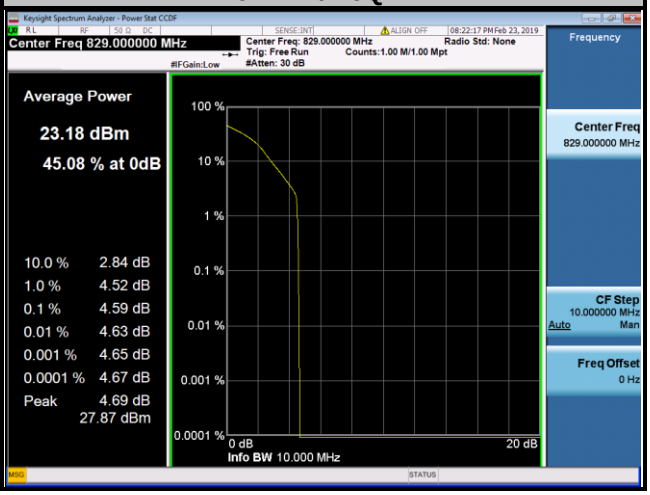
Spectrum Plot of Worst Value
WCDMA



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	3.55	4.17	20415	825.5	3.59	4.53
20525	836.5	3.44	4.65	20525	836.5	3.68	4.78
20643	848.3	3.63	4.53	20635	847.5	4.31	5.04

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	4.00	4.17	20450	829.0	3.82	4.59
20525	836.5	3.94	4.64	20525	836.5	4.22	4.12
20625	846.5	4.19	4.21	20600	844.0	3.56	4.35

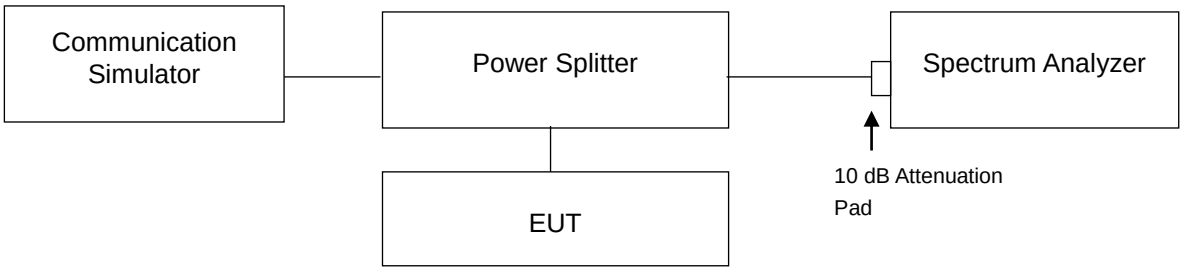
Spectrum Plot of Worst Value	
5 MHz / 16AM	10 MHz / 16QAM
	

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.

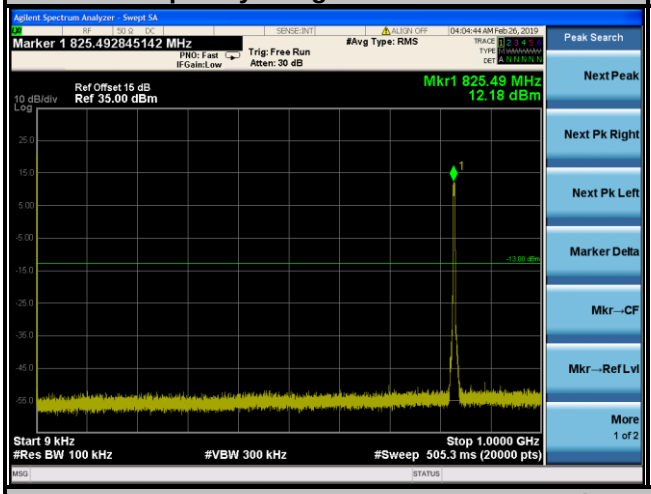
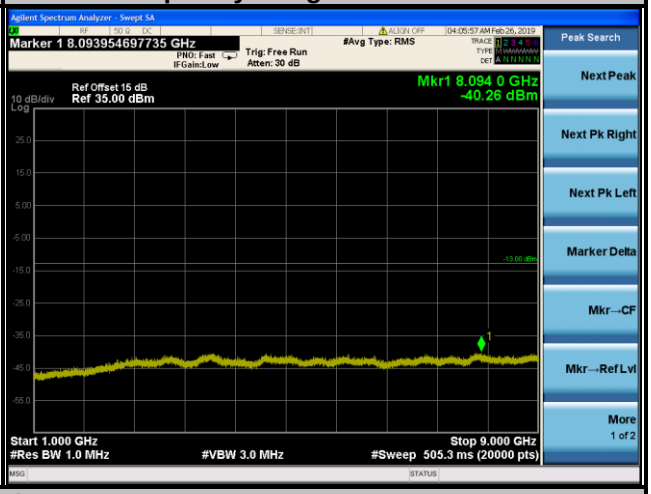
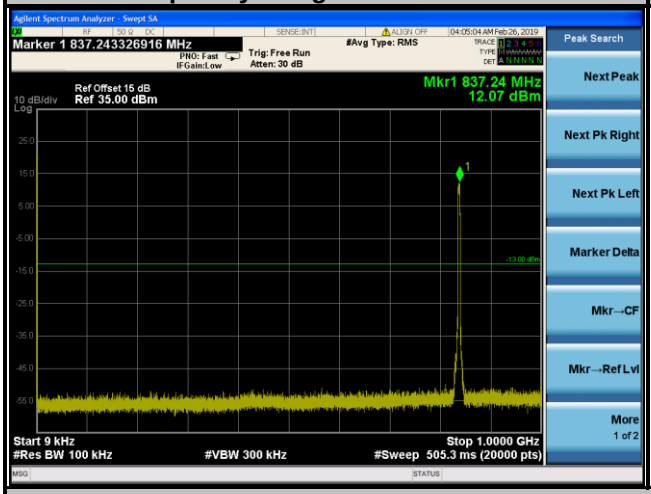
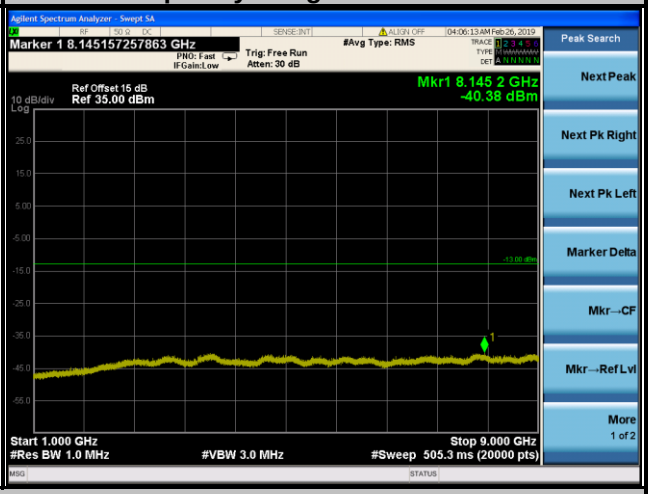
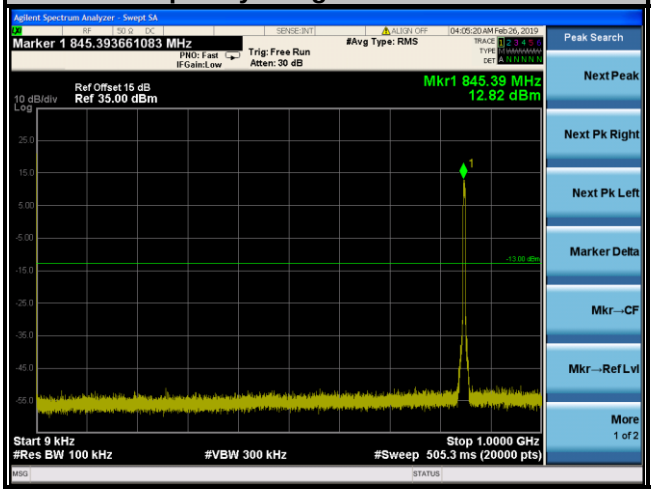
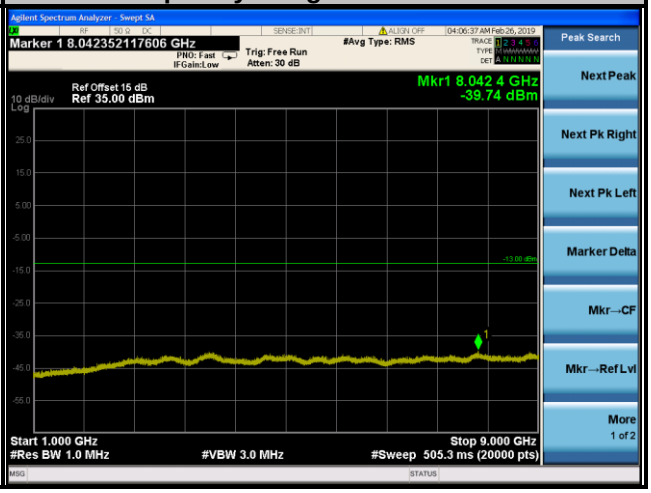
4.7.2 Test Setup



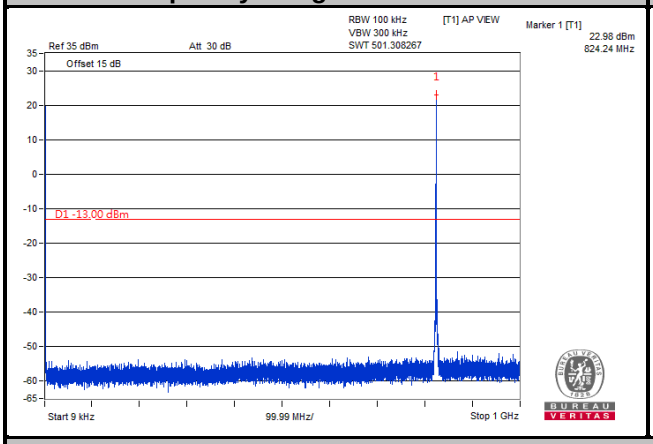
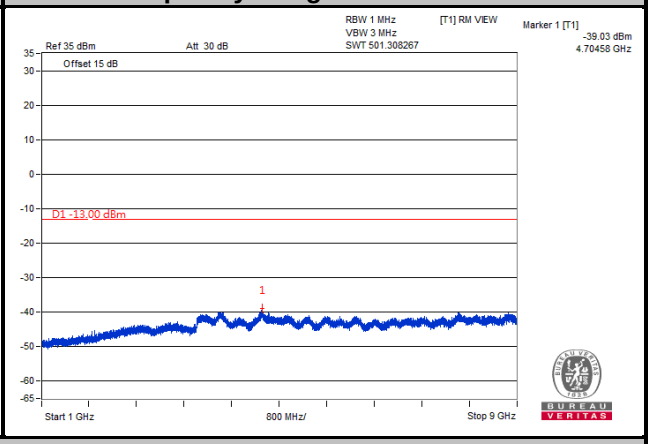
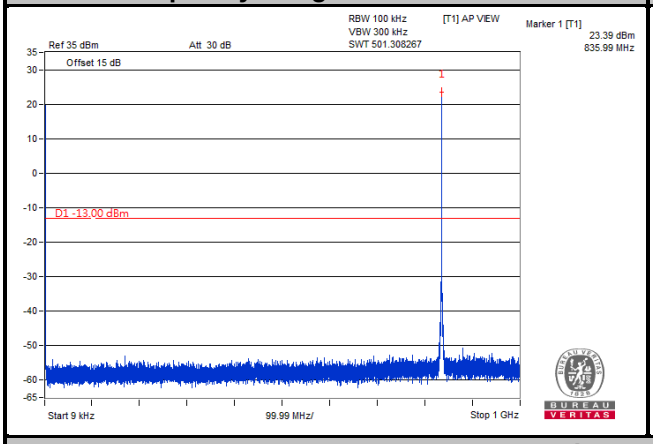
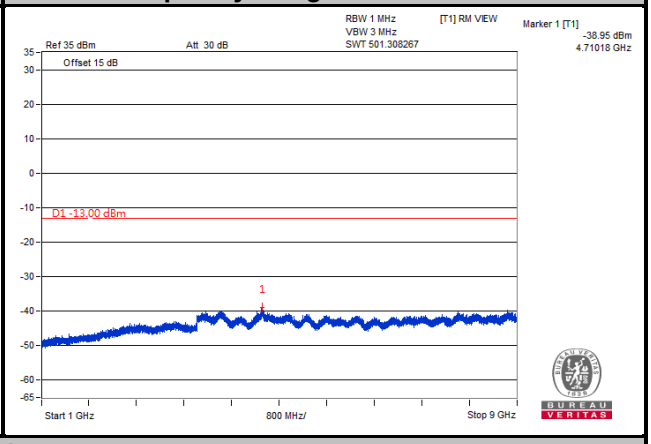
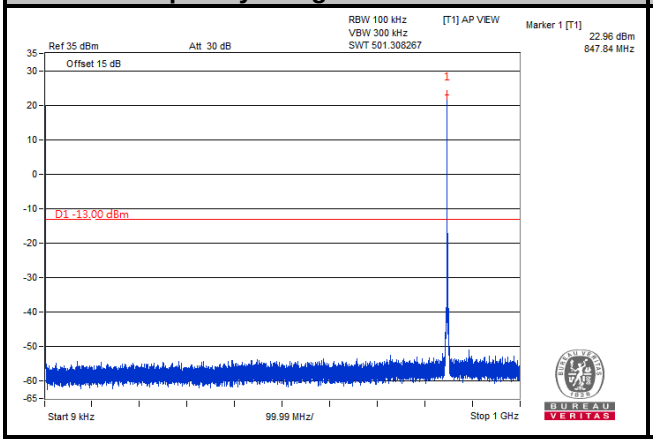
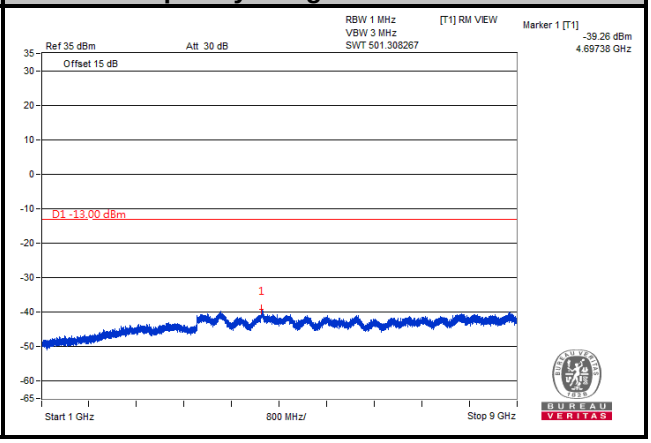
4.7.3 Test Procedure

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.

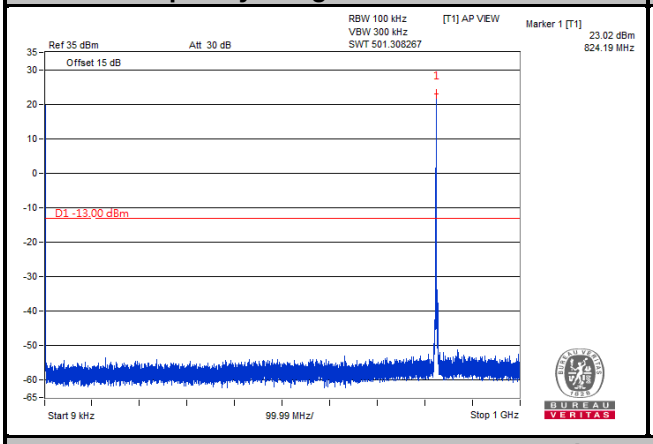
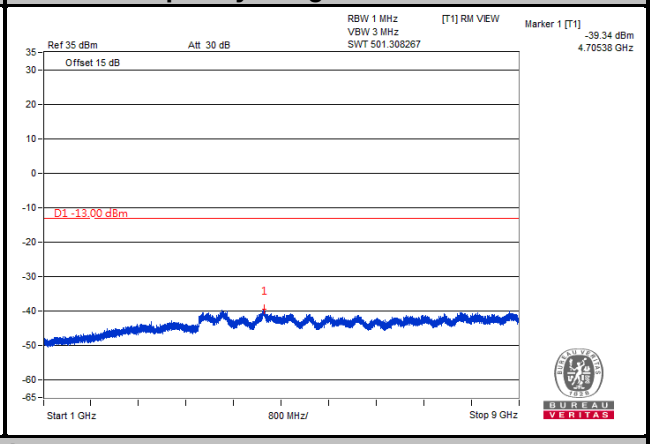
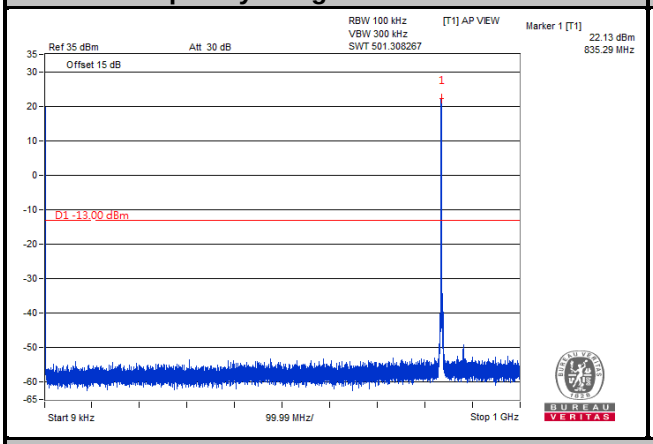
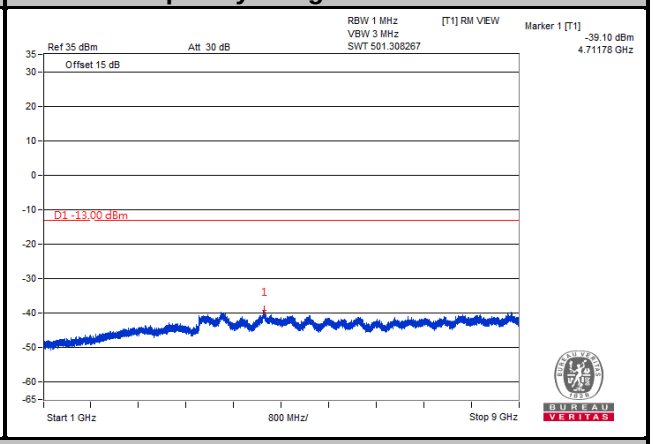
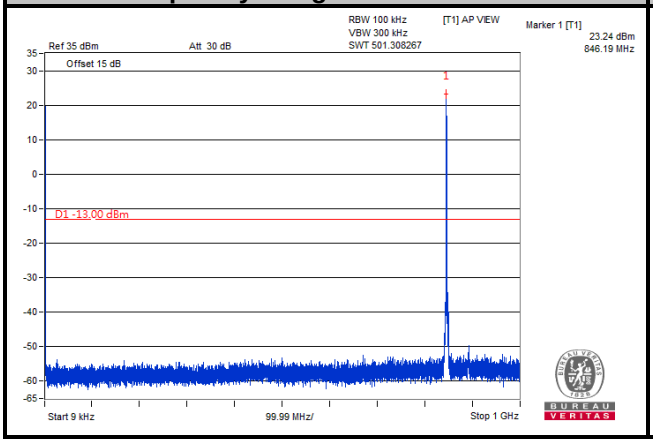
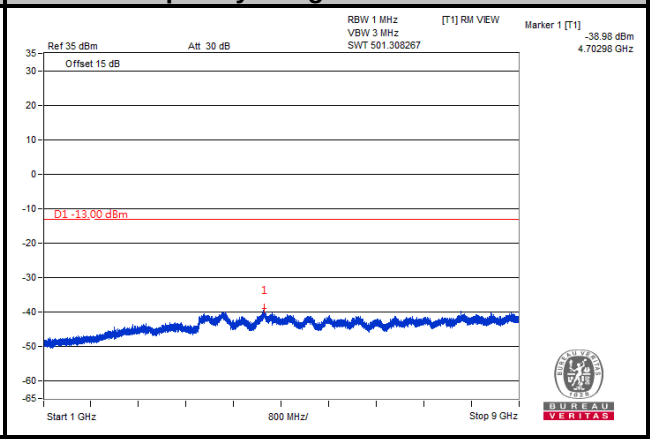
4.7.4 Test Results

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
	

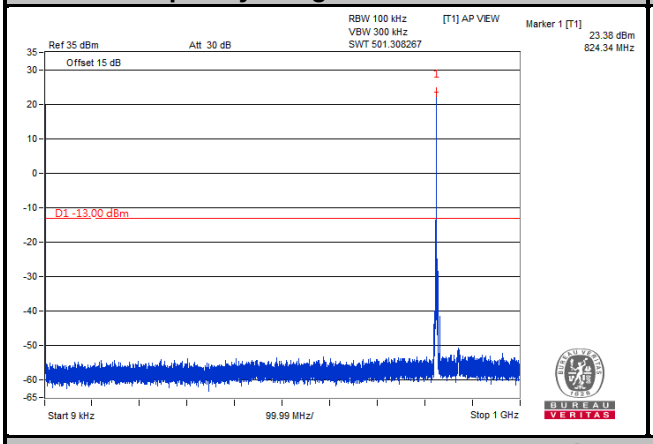
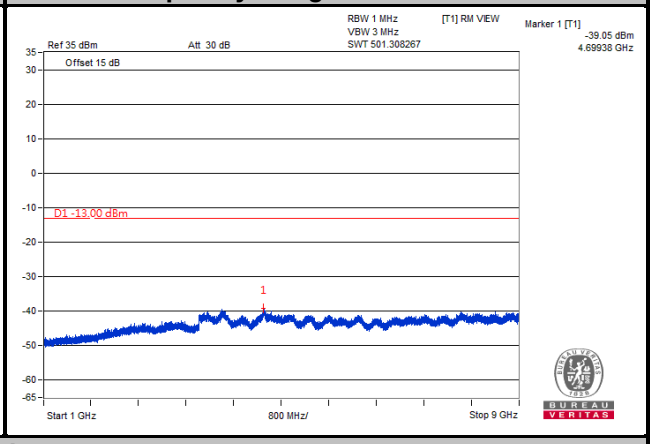
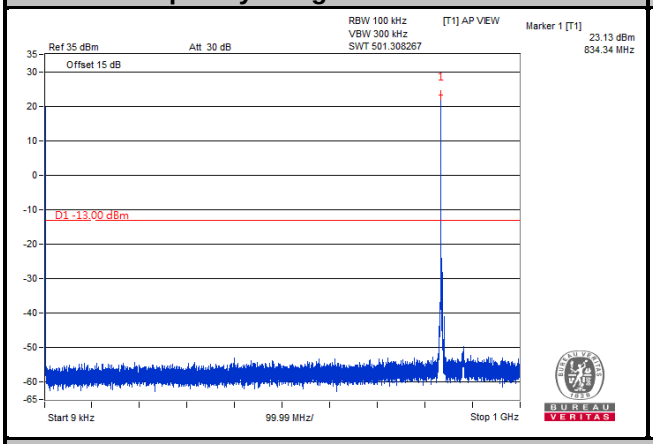
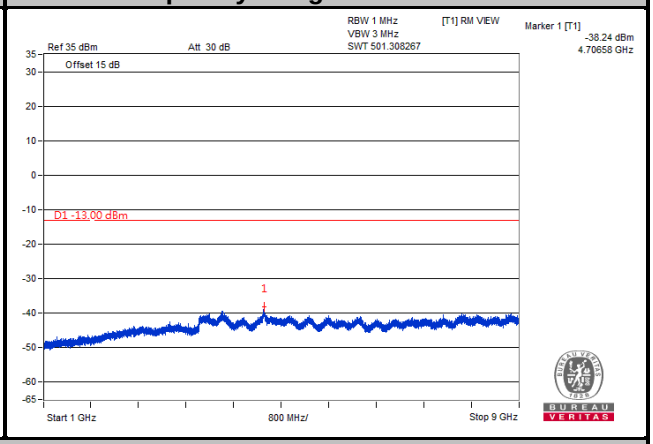
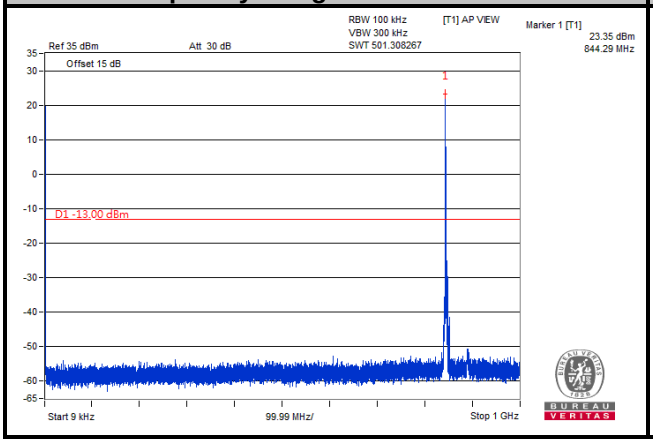
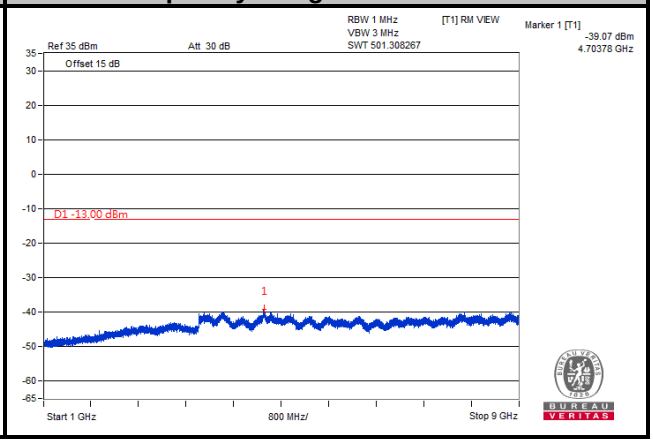
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

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
	

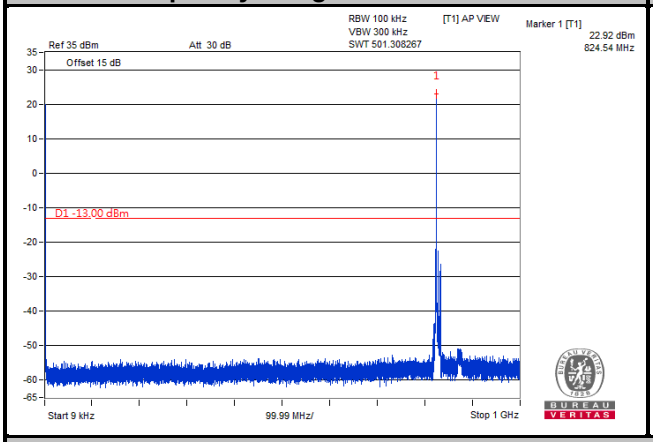
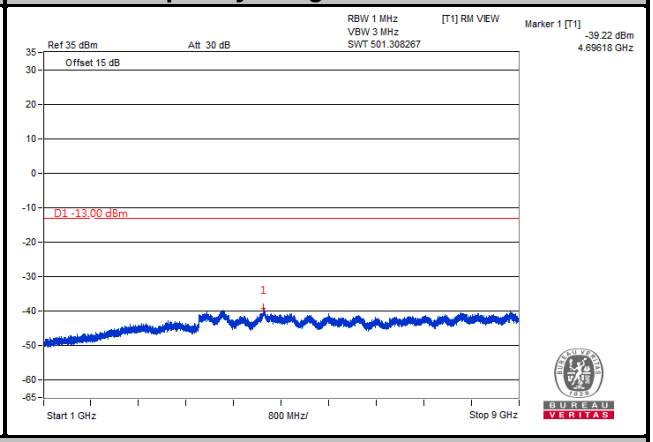
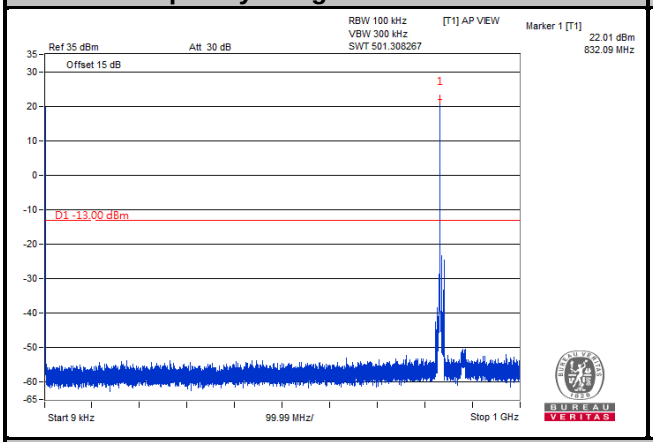
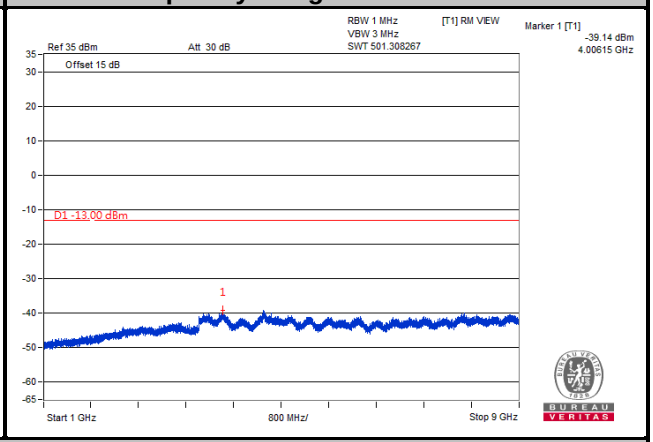
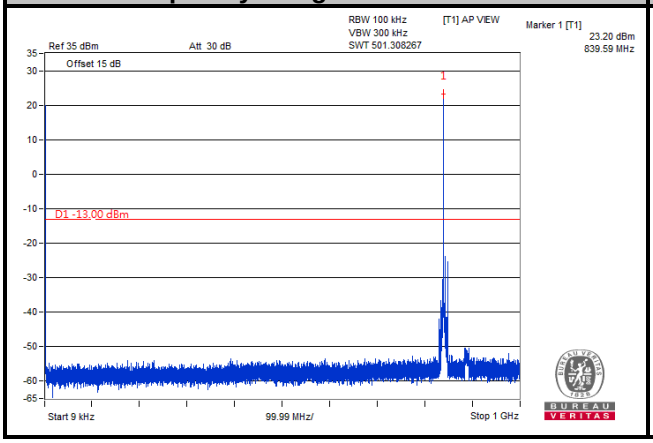
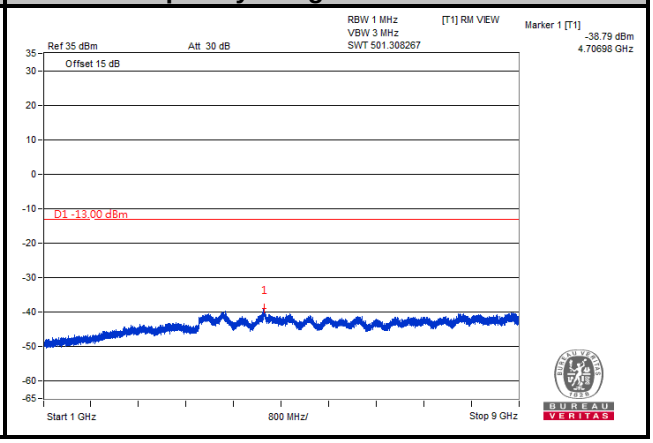
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

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.

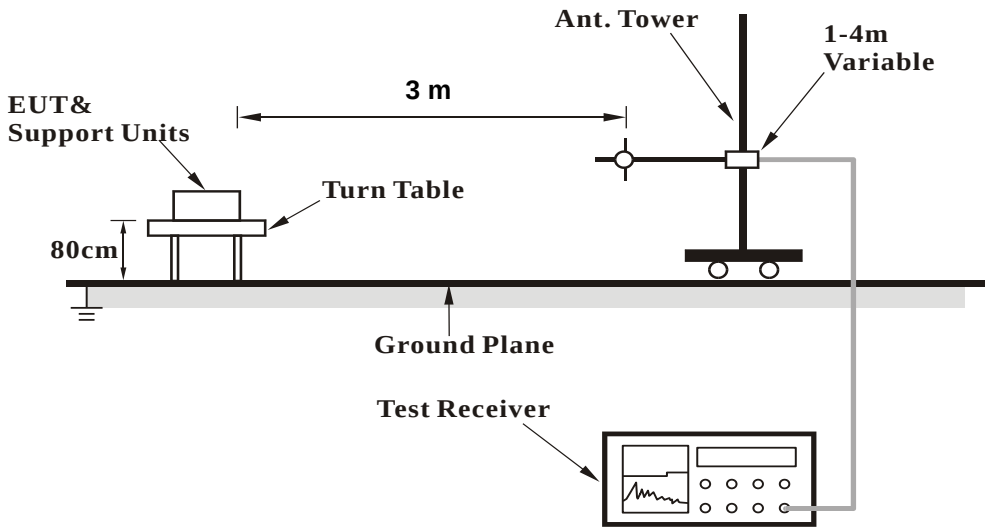
NOTE: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz/3 MHz.

4.8.3 Deviation from Test Standard

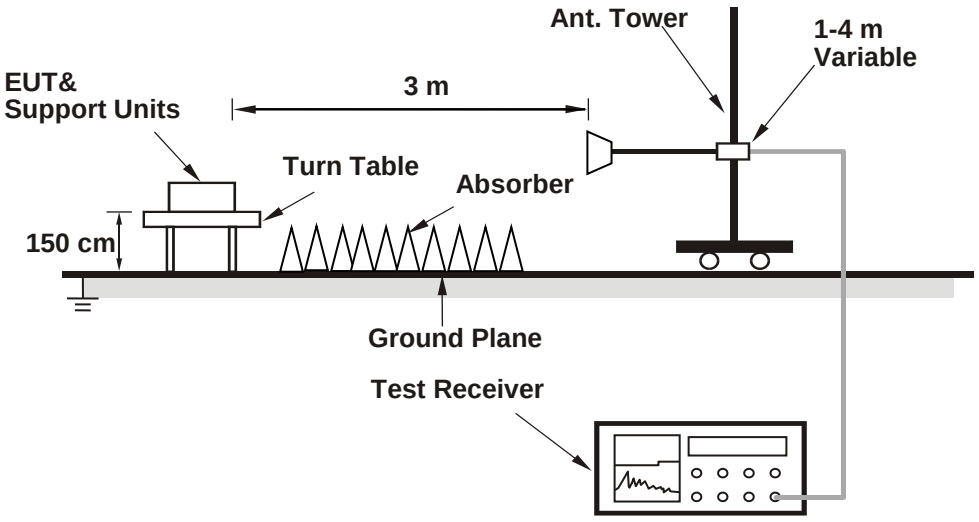
No deviation.

4.8.4 Test Setup

<Radiated Emission below or equal 1 GHz>



<Radiated Emission above 1 GHz>



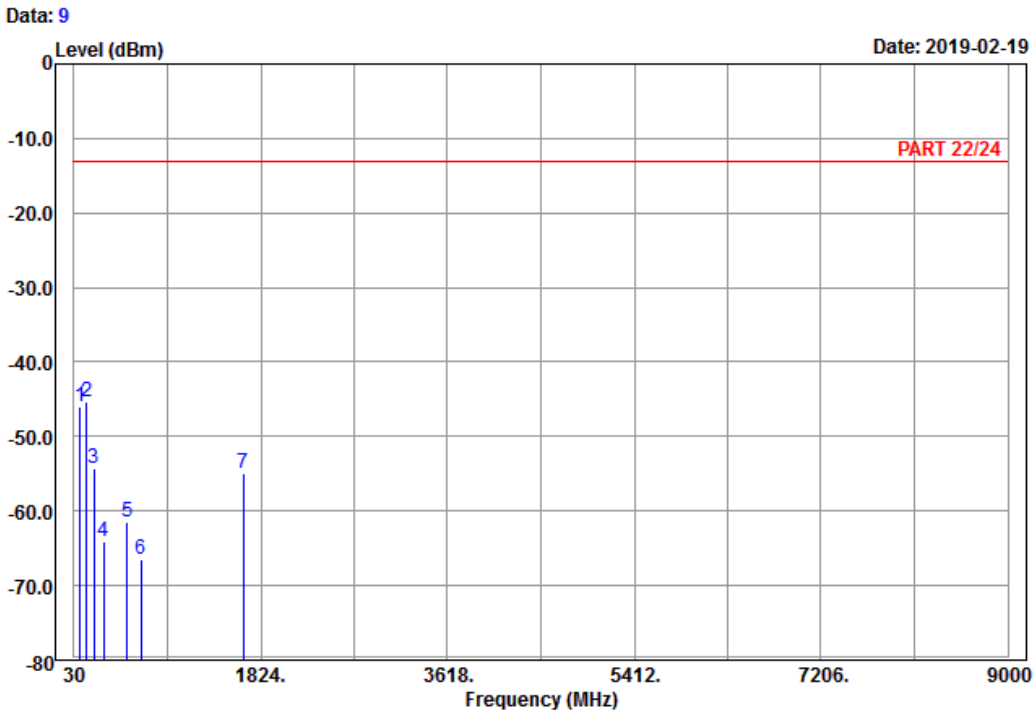
For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.8.5 Test Results

WCDMA:

Low Channel

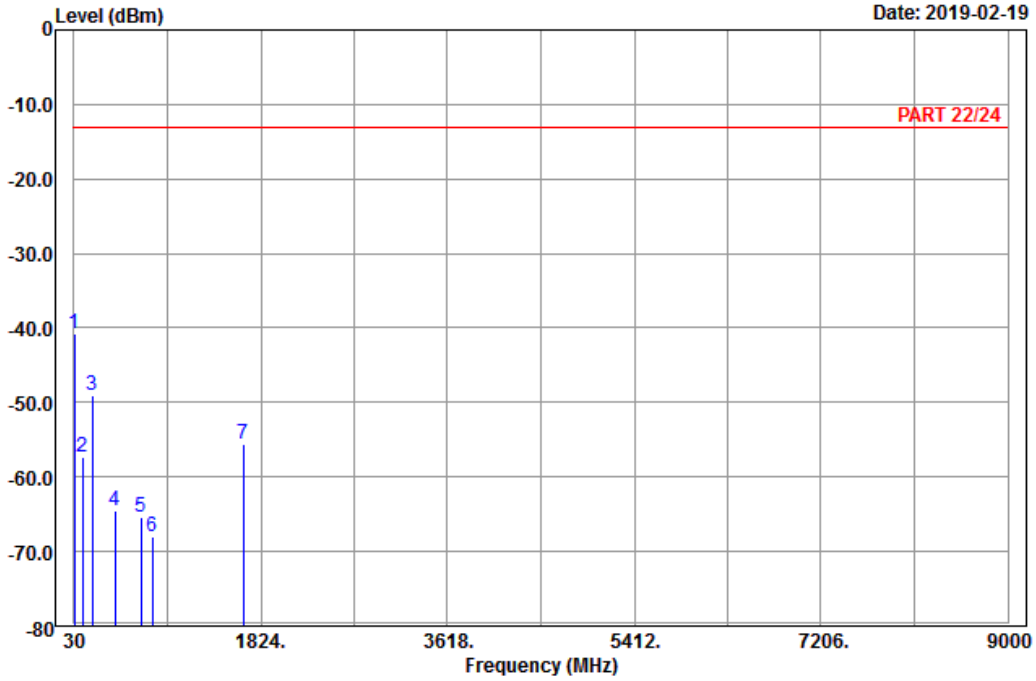
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 chamber 1
Condition: PART 22/24 Horizontal
Remark : Band V_Link_CH4132
Tested by: Charles Hsiao

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	87.24	-46.09	-35.09	-13.00	-33.09	-11.00	Peak
2 pp	151.23	-45.28	-37.36	-13.00	-32.28	-7.92	Peak
3	219.00	-54.20	-48.28	-13.00	-41.20	-5.92	Peak
4	318.20	-64.17	-58.42	-13.00	-51.17	-5.75	Peak
5	538.00	-61.49	-58.98	-13.00	-48.49	-2.51	Peak
6	671.00	-66.59	-66.35	-13.00	-53.59	-0.24	Peak
7	1652.80	-54.98	-62.71	-13.00	-41.98	7.73	Peak

Data: 10

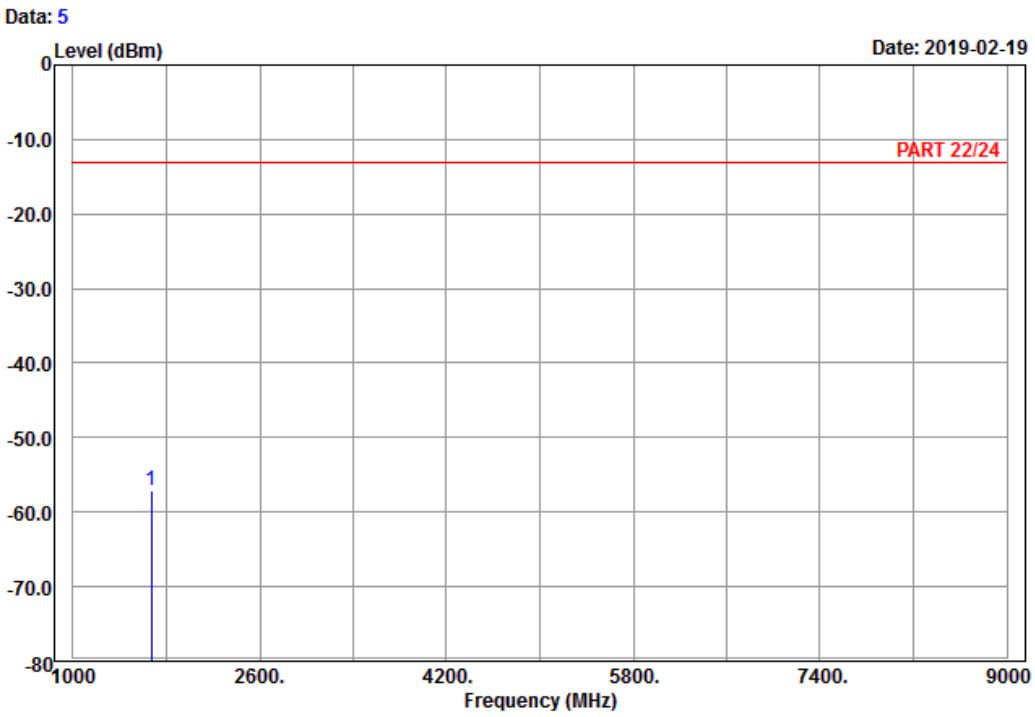


Site : 966 chamber 1
Condition: PART 22/24 Vertical
Remark : Band V_Link_CH4132
Tested by: Charles Hsiao

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	32.97	-40.73	-29.86	-13.00	-27.73	-10.87	Peak
2	110.73	-57.39	-48.51	-13.00	-44.39	-8.88	Peak
3	203.07	-48.94	-42.80	-13.00	-35.94	-6.14	Peak
4	422.50	-64.42	-61.17	-13.00	-51.42	-3.25	Peak
5	675.20	-65.49	-65.23	-13.00	-52.49	-0.26	Peak
6	785.10	-67.93	-68.92	-13.00	-54.93	0.99	Peak
7	1652.80	-55.65	-63.38	-13.00	-42.65	7.73	Peak

Middle Channel

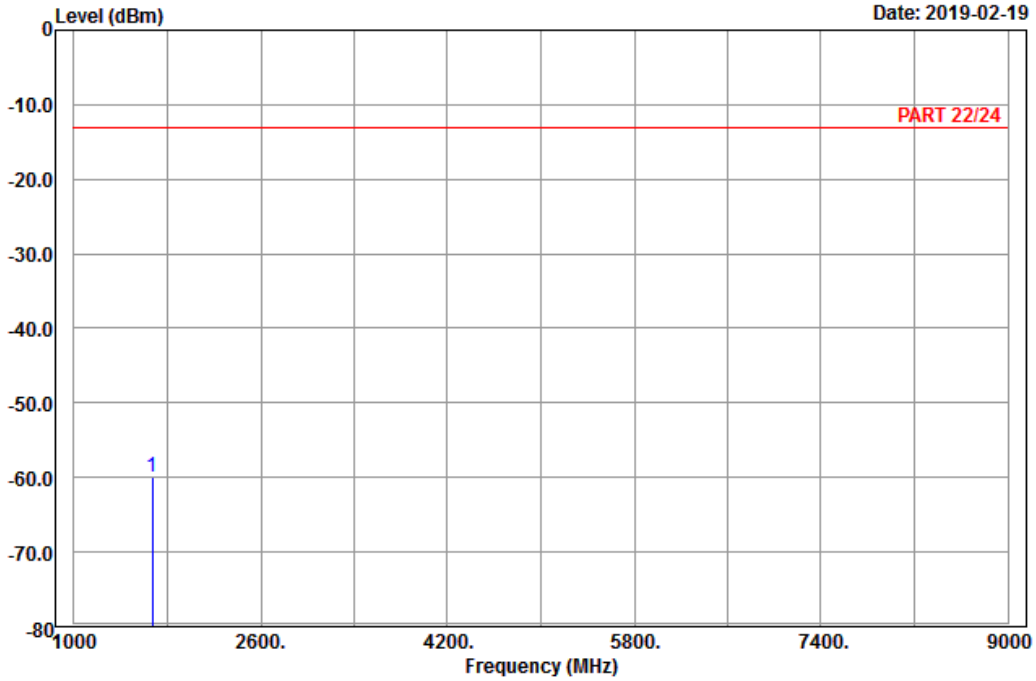
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 chamber 1
Condition: PART 22/24 Horizontal
Remark : Band V_Link_CH4182
Tested by: Charles Hsiao

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1672.80	-57.07	-64.98	-13.00	-44.07	7.91	Peak

Data: 6

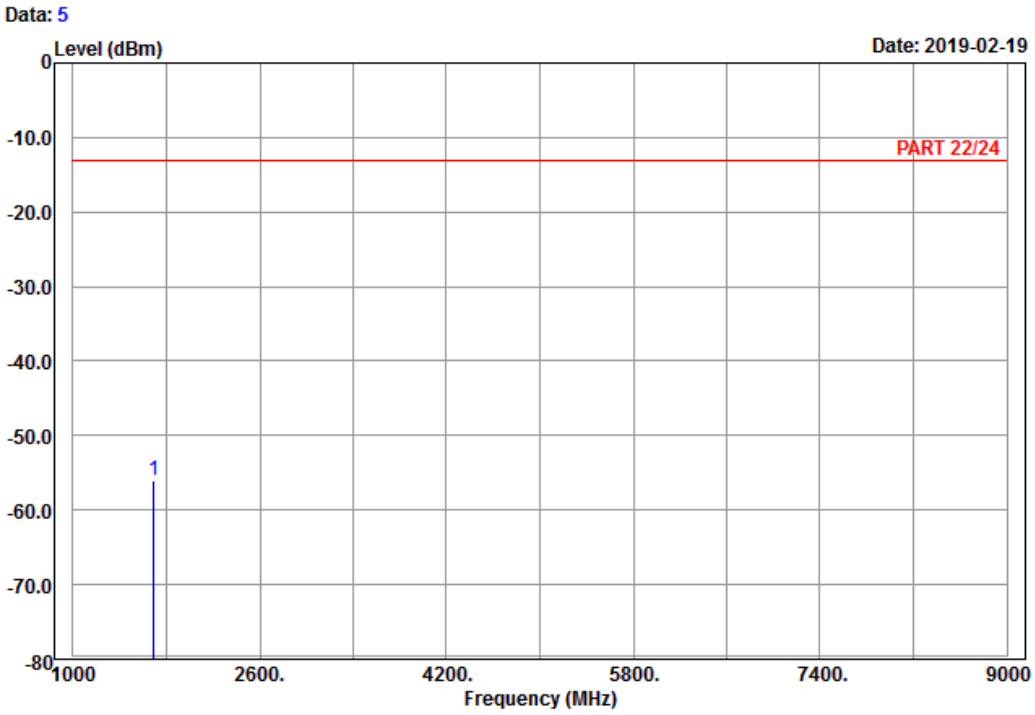


Site : 966 chamber 1
Condition: PART 22/24 Vertical
Remark : Band V_Link_CH4182
Tested by: Charles Hsiao

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1672.80	-59.87	-67.78	-13.00	-46.87	7.91	Peak

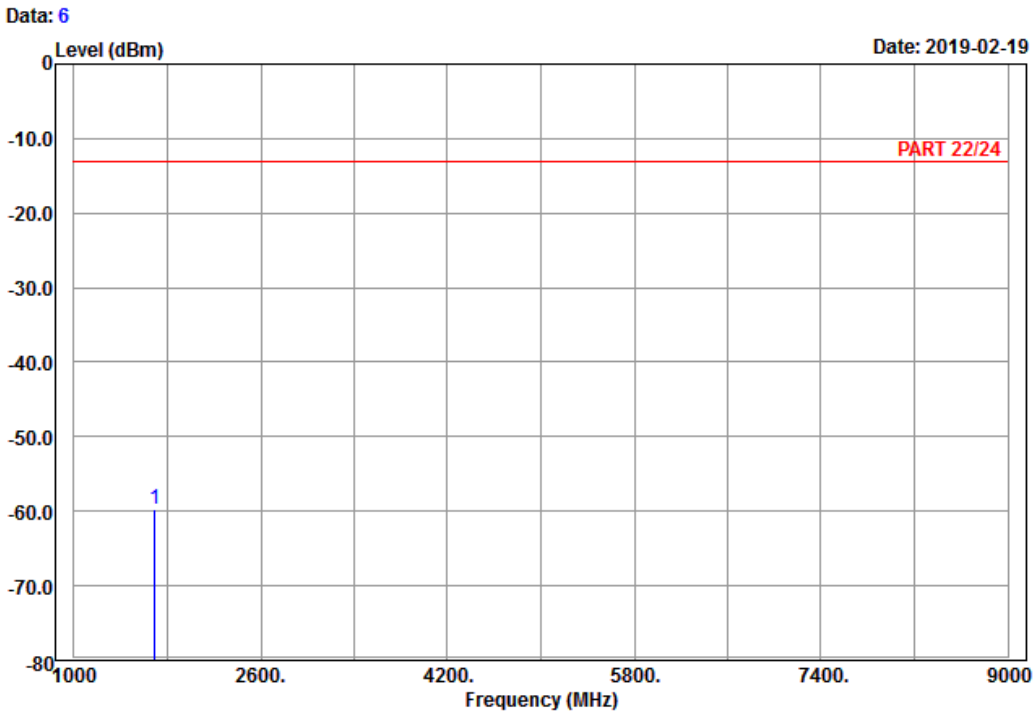
High Channel

Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 chamber 1
Condition: PART 22/24 Horizontal
Remark : Band V_Link_CH4233
Tested by: Charles Hsiao

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1693.20	-55.92	-64.06	-13.00	-42.92	8.14	Peak

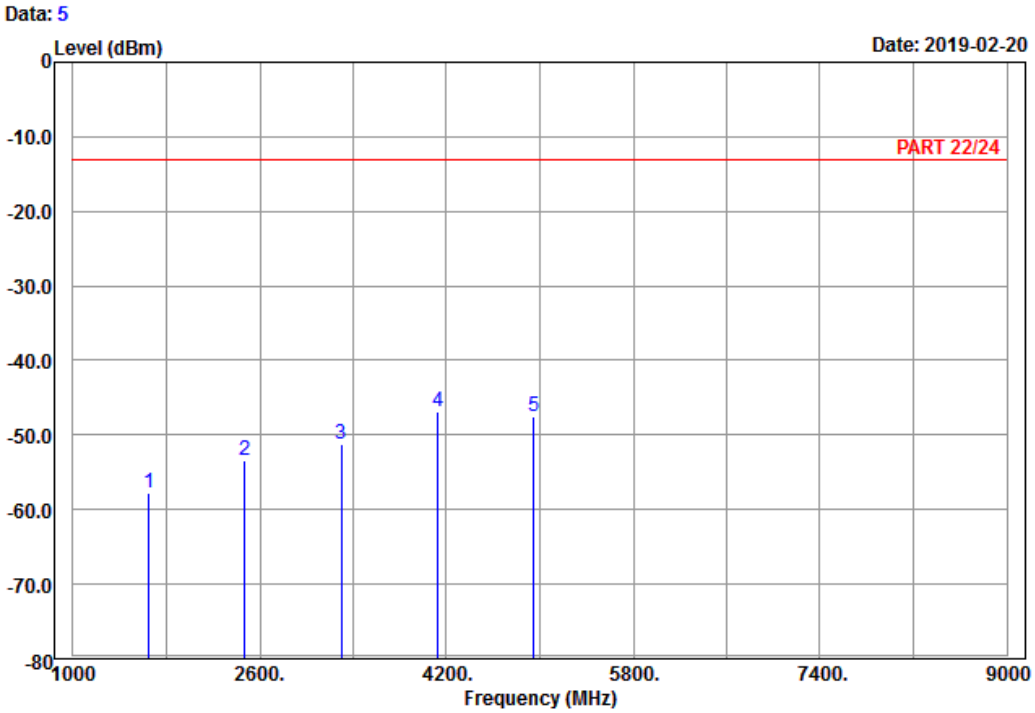


Site : 966 chamber 1
Condition: PART 22/24 Vertical
Remark : Band V_Link_CH4233
Tested by: Charles Hsiao

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	1693.20	-59.65	-67.79	-13.00	-46.65	8.14	Peak

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

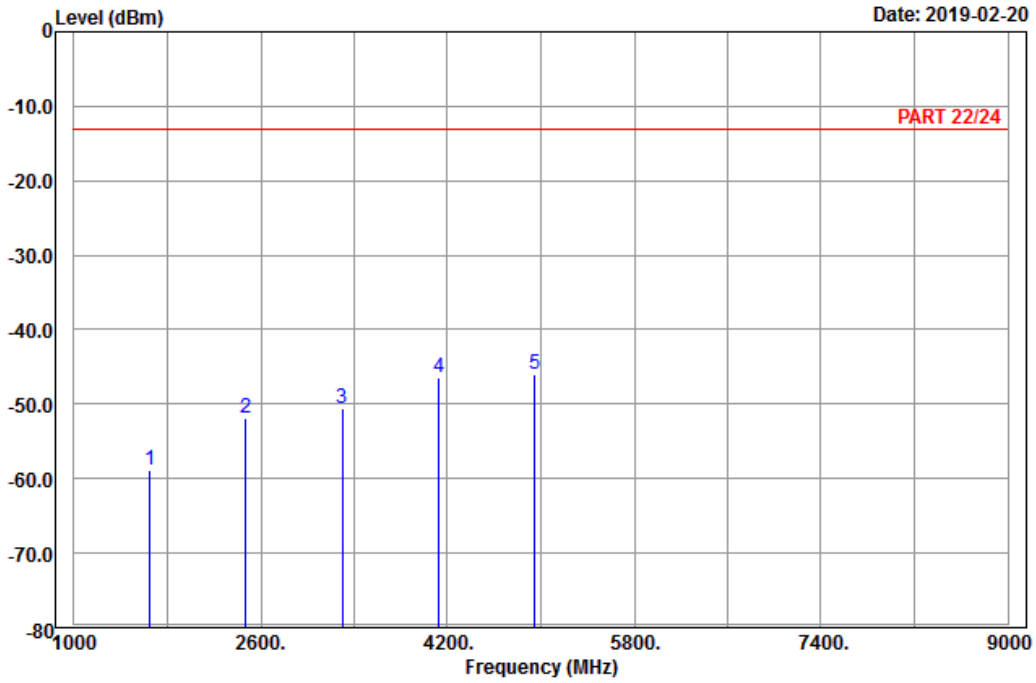
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 chamber 1
Condition: PART 22/24 Horizontal
Remark : LTE_Band 5_Link_CH20407
Tested by: Harry Hsueh

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	1649.40	-57.66	-65.39	-13.00	-44.66	7.73	Peak
2	2474.10	-53.50	-64.53	-13.00	-40.50	11.03	Peak
3	3298.80	-51.31	-65.61	-13.00	-38.31	14.30	Peak
4 pp	4123.50	-46.81	-63.83	-13.00	-33.81	17.02	Peak
5	4948.20	-47.56	-66.95	-13.00	-34.56	19.39	Peak

Data: 6

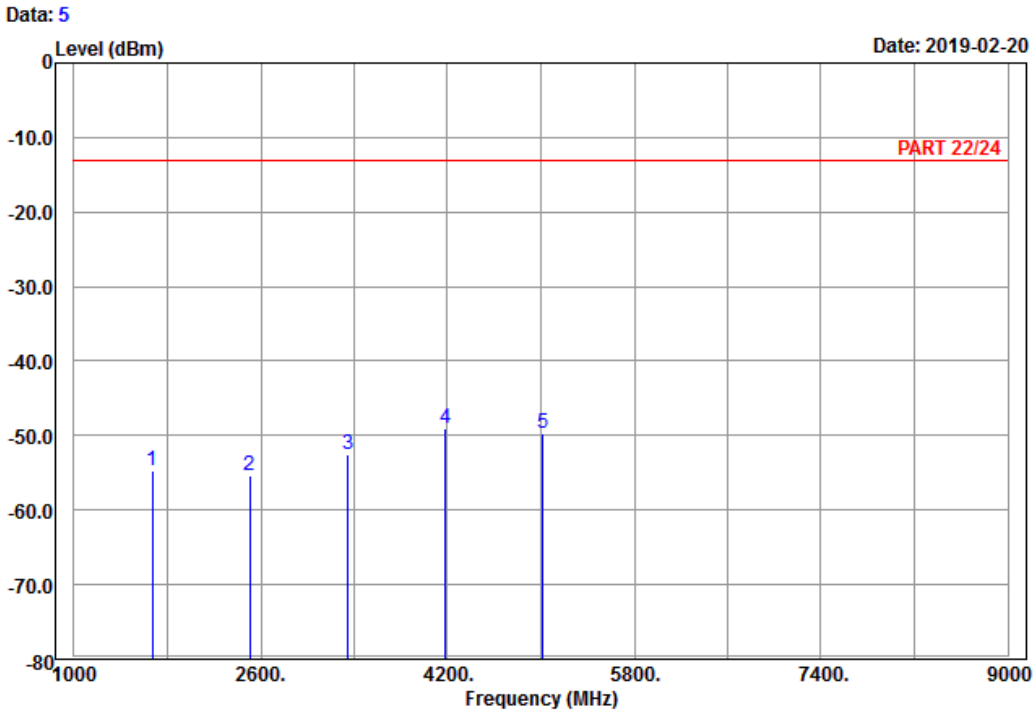


Site : 966 chamber 1
Condition: PART 22/24 Vertical
Remark : LTE_Band 5_Link_CH20407
Tested by: Harry Hsueh

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	1649.40	-58.77	-66.50	-13.00	-45.77	7.73	Peak
2	2474.10	-51.90	-62.93	-13.00	-38.90	11.03	Peak
3	3298.80	-50.60	-64.90	-13.00	-37.60	14.30	Peak
4	4123.50	-46.36	-63.38	-13.00	-33.36	17.02	Peak
5 pp	4948.20	-45.98	-65.37	-13.00	-32.98	19.39	Peak

Middle Channel

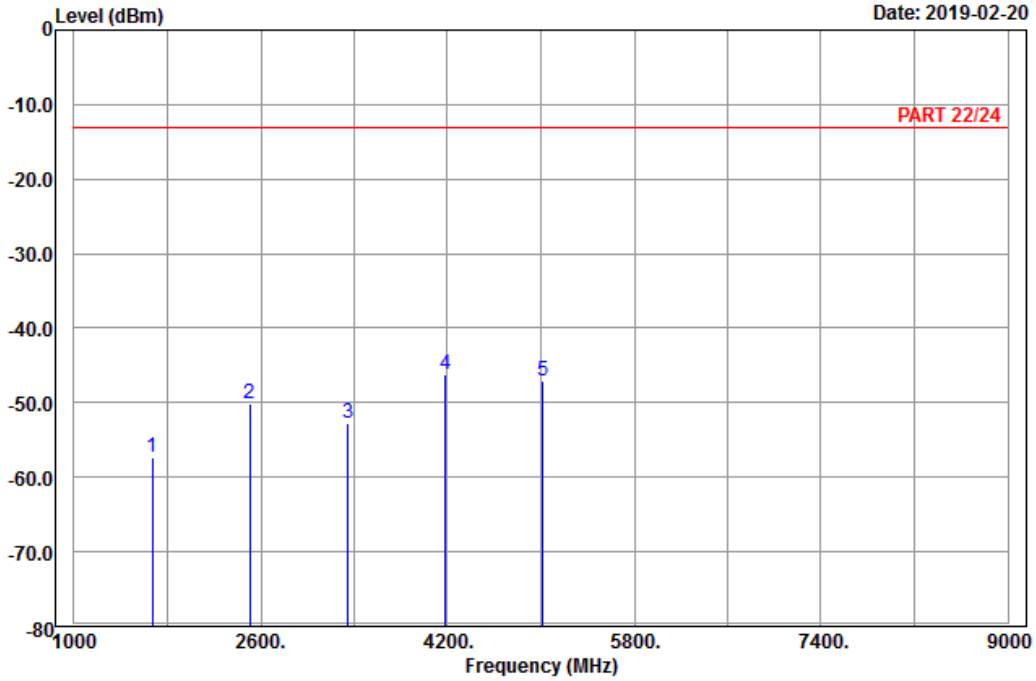
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 chamber 1
Condition: PART 22/24 Horizontal
Remark : LTE_Band 5_Link_CH20525
Tested by: Harry Hsueh

		Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
		MHz	dBm	dBm	dBm	dB	dB	
1		1673.00	-54.77	-62.68	-13.00	-41.77	7.91	Peak
2		2509.50	-55.34	-66.62	-13.00	-42.34	11.28	Peak
3		3346.00	-52.48	-66.93	-13.00	-39.48	14.45	Peak
4	pp	4182.50	-49.00	-66.13	-13.00	-36.00	17.13	Peak
5		5019.00	-49.71	-68.79	-13.00	-36.71	19.08	Peak

Data: 6

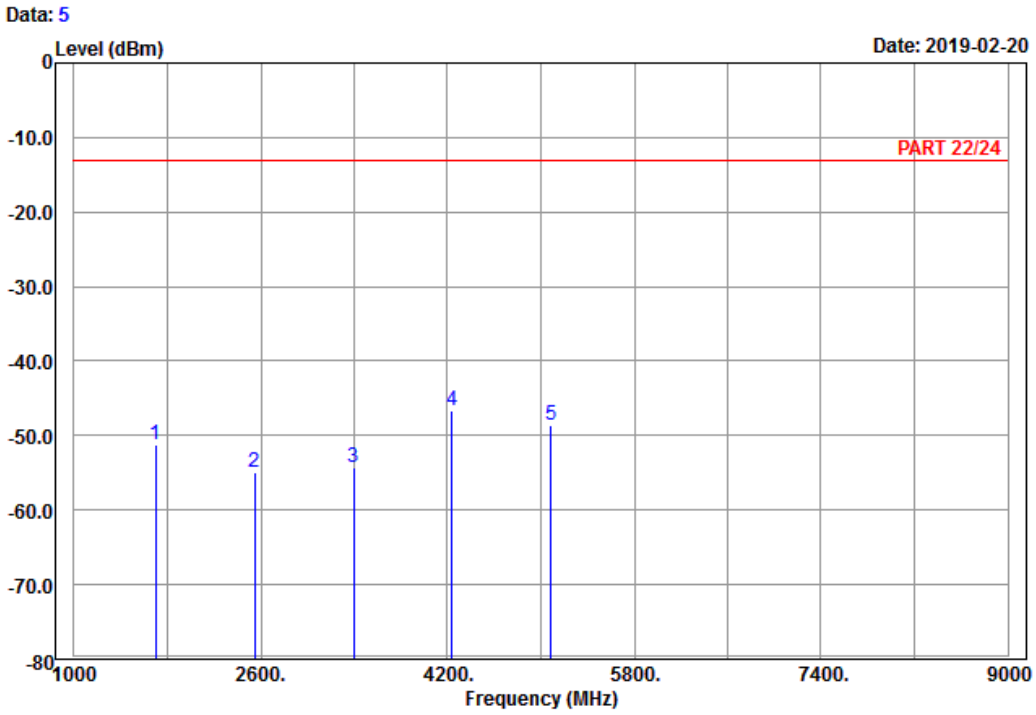


Site : 966 chamber 1
Condition: PART 22/24 Vertical
Remark : LTE_Band 5_Link_CH20525
Tested by: Harry Hsueh

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	1673.00	-57.33	-65.24	-13.00	-44.33	7.91	Peak
2	2509.50	-50.04	-61.32	-13.00	-37.04	11.28	Peak
3	3346.00	-52.70	-67.15	-13.00	-39.70	14.45	Peak
4 pp	4182.50	-46.19	-63.32	-13.00	-33.19	17.13	Peak
5	5019.00	-47.13	-66.21	-13.00	-34.13	19.08	Peak

High Channel

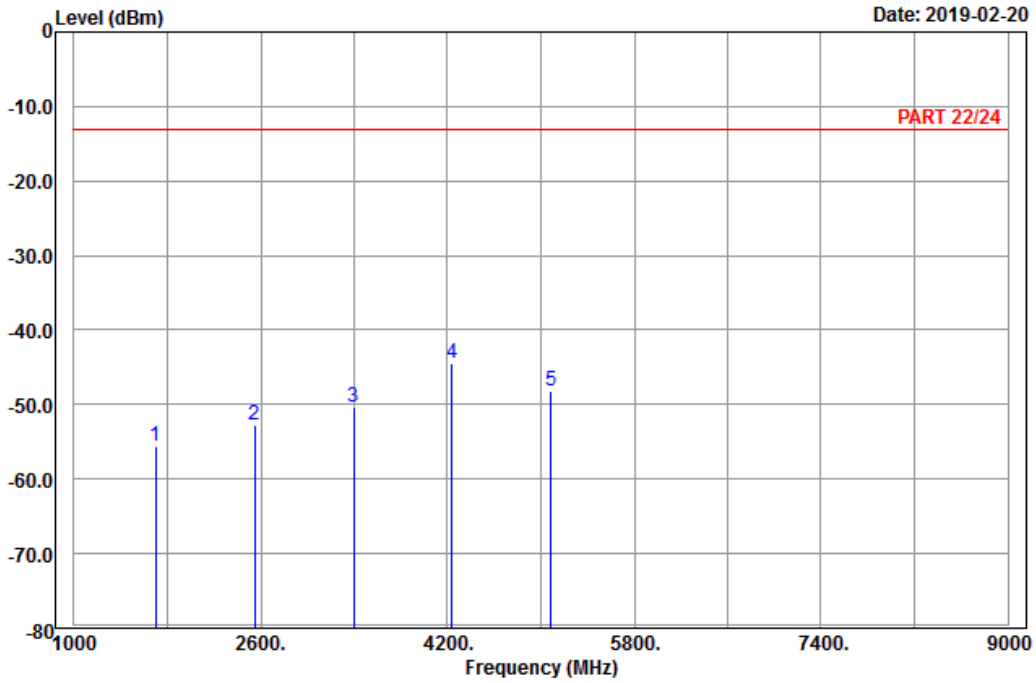
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 chamber 1
Condition: PART 22/24 Horizontal
Remark : LTE_Band 5_Link_CH20643
Tested by: Harry Hsueh

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	1696.60	-51.15	-59.29	-13.00	-38.15	8.14	Peak
2	2544.90	-55.01	-66.48	-13.00	-42.01	11.47	Peak
3	3393.20	-54.31	-68.71	-13.00	-41.31	14.40	Peak
4 pp	4241.50	-46.58	-63.94	-13.00	-33.58	17.36	Peak
5	5089.80	-48.54	-68.04	-13.00	-35.54	19.50	Peak

Data: 6

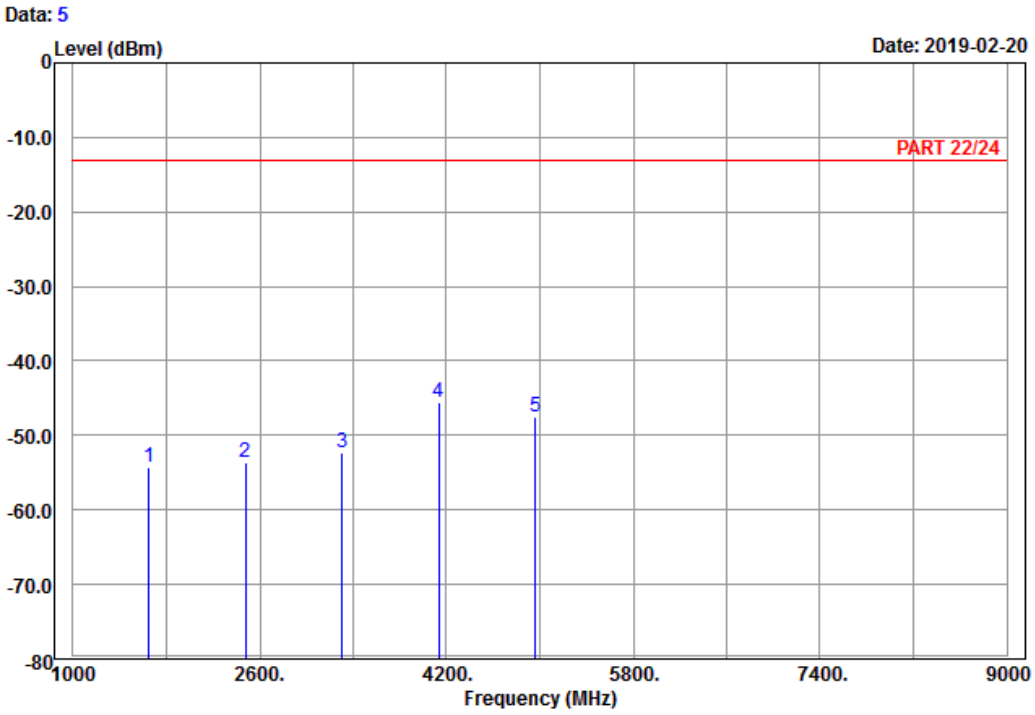


Site : 966 chamber 1
Condition: PART 22/24 Vertical
Remark : LTE_Band 5_Link_CH20643
Tested by: Harry Hsueh

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	1696.60	-55.58	-63.72	-13.00	-42.58	8.14	Peak
2	2544.90	-52.66	-64.13	-13.00	-39.66	11.47	Peak
3	3393.20	-50.42	-64.82	-13.00	-37.42	14.40	Peak
4 pp	4241.50	-44.36	-61.72	-13.00	-31.36	17.36	Peak
5	5089.80	-48.24	-67.74	-13.00	-35.24	19.50	Peak

Channel Bandwidth: 5 MHz / QPSK
Low Channel

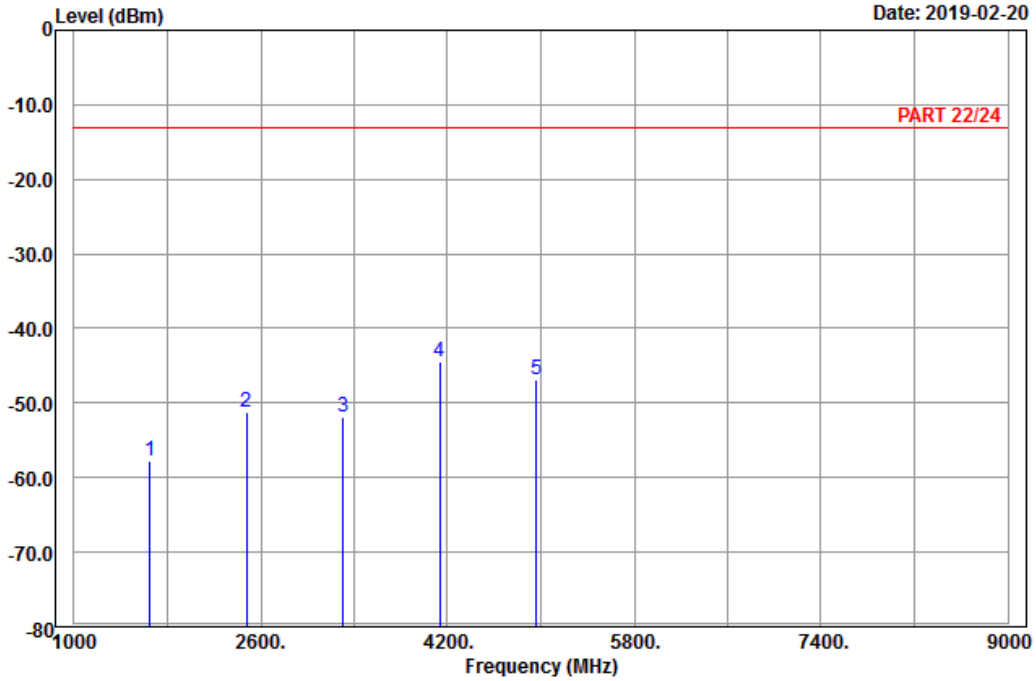
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 chamber 1
Condition: PART 22/24 Horizontal
Remark : LTE_Band 5_Link_CH20425
Tested by: Harry Hsueh

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	1653.00	-54.33	-62.06	-13.00	-41.33	7.73	Peak
2	2479.50	-53.57	-64.60	-13.00	-40.57	11.03	Peak
3	3306.00	-52.42	-66.72	-13.00	-39.42	14.30	Peak
4 pp	4132.50	-45.58	-62.60	-13.00	-32.58	17.02	Peak
5	4959.00	-47.56	-66.99	-13.00	-34.56	19.43	Peak

Data: 6

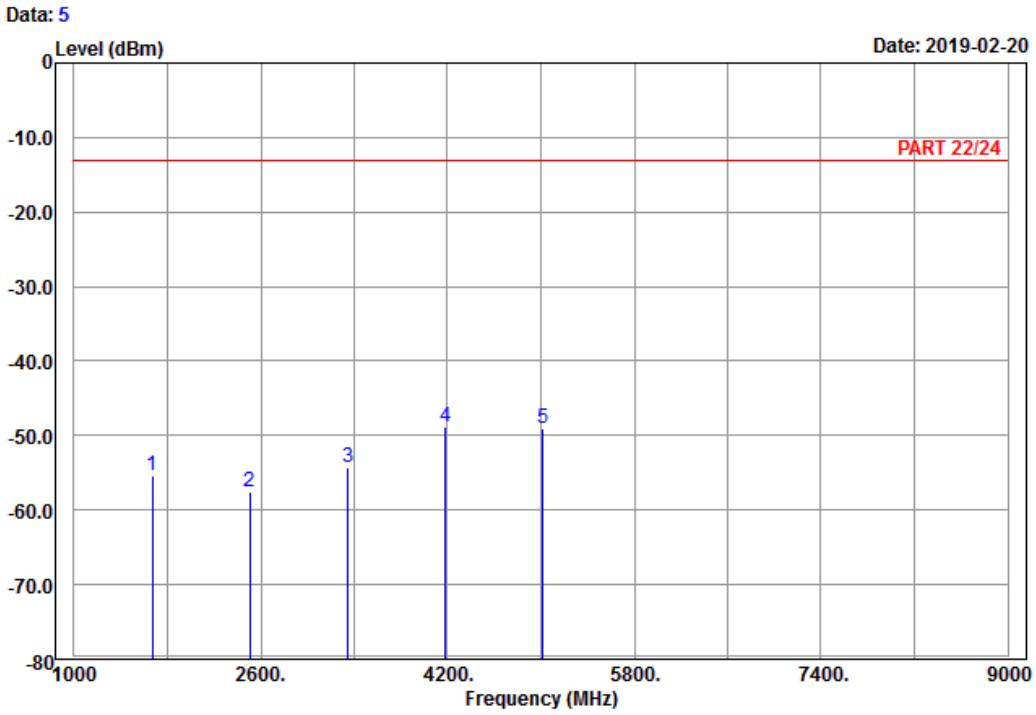


Site : 966 chamber 1
Condition: PART 22/24 Vertical
Remark : LTE_Band 5_Link_CH20425
Tested by: Harry Hsueh

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	1653.00	-57.86	-65.59	-13.00	-44.86	7.73	Peak
2	2479.50	-51.31	-62.34	-13.00	-38.31	11.03	Peak
3	3306.00	-51.86	-66.16	-13.00	-38.86	14.30	Peak
4 pp	4132.50	-44.51	-61.53	-13.00	-31.51	17.02	Peak
5	4959.00	-46.80	-66.23	-13.00	-33.80	19.43	Peak

Middle Channel

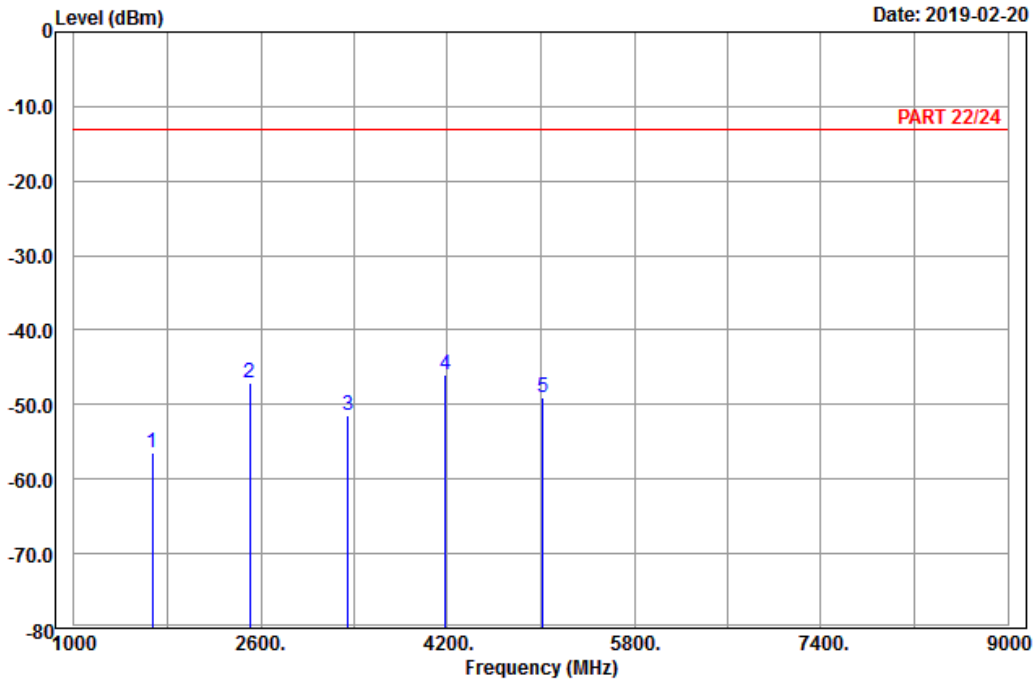
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 chamber 1
Condition: PART 22/24 Horizontal
Remark : LTE_Band 5_Link_CH20525
Tested by: Harry Hsueh

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	1673.00	-55.34	-63.25	-13.00	-42.34	7.91	Peak
2	2509.50	-57.49	-68.77	-13.00	-44.49	11.28	Peak
3	3346.00	-54.21	-68.66	-13.00	-41.21	14.45	Peak
4 pp	4182.50	-48.81	-65.94	-13.00	-35.81	17.13	Peak
5	5019.00	-49.10	-68.18	-13.00	-36.10	19.08	Peak

Data: 6

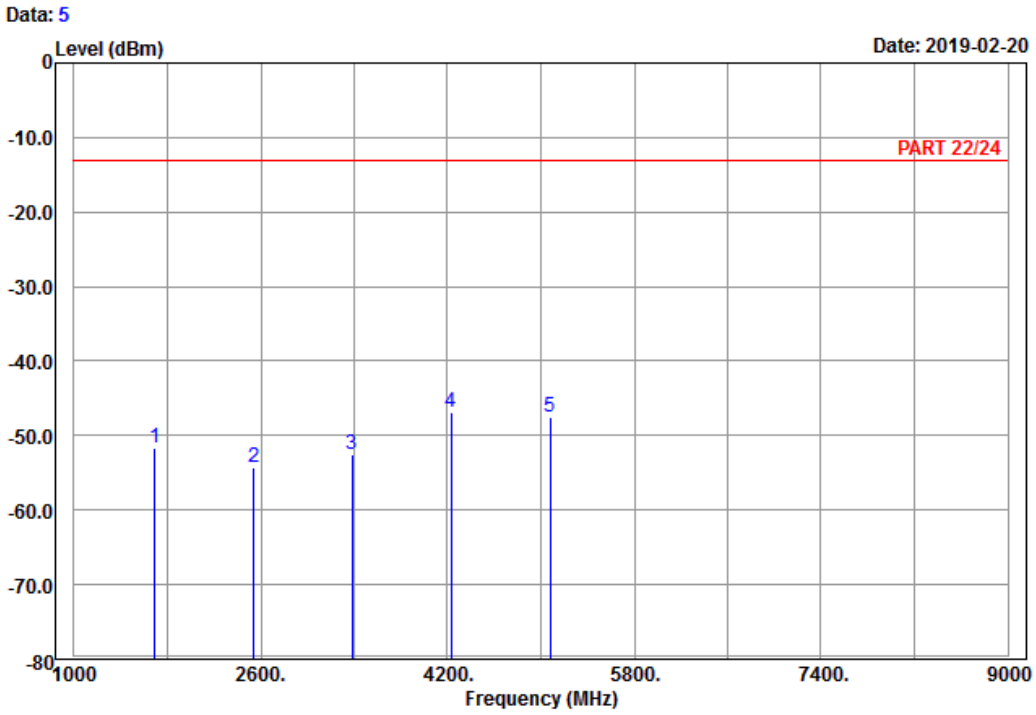


Site : 966 chamber 1
Condition: PART 22/24 Vertical
Remark : LTE_Band 5_Link_CH20525
Tested by: Harry Hsueh

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	1673.00	-56.55	-64.46	-13.00	-43.55	7.91	Peak
2	2509.50	-47.10	-58.38	-13.00	-34.10	11.28	Peak
3	3346.00	-51.36	-65.81	-13.00	-38.36	14.45	Peak
4 pp	4182.50	-46.00	-63.13	-13.00	-33.00	17.13	Peak
5	5019.00	-48.94	-68.02	-13.00	-35.94	19.08	Peak

High Channel

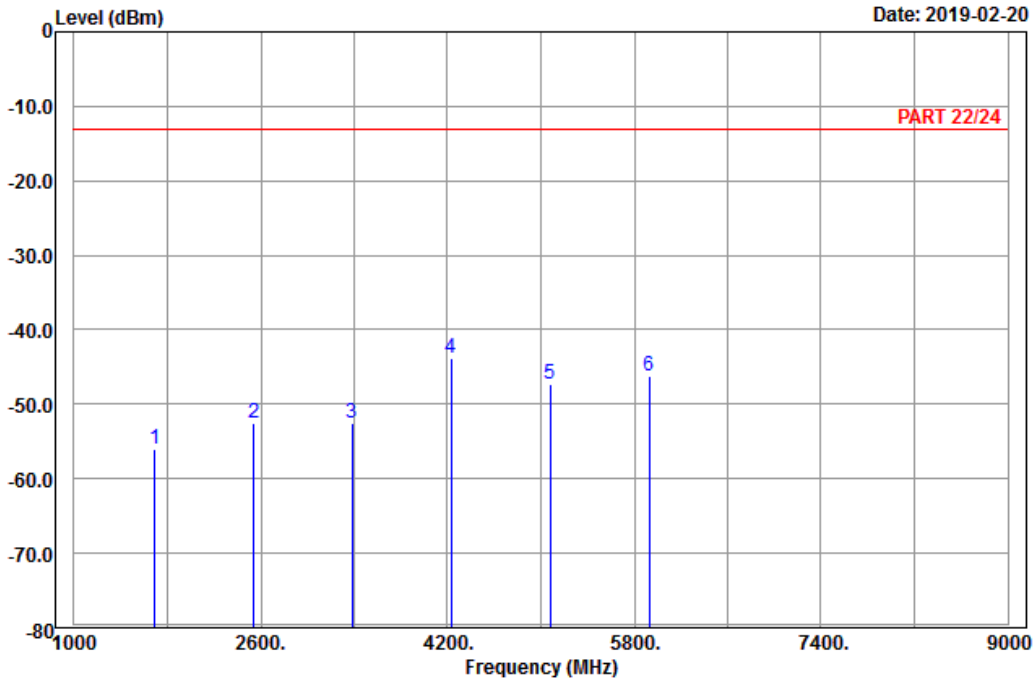
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 chamber 1
Condition: PART 22/24 Horizontal
Remark : LTE_Band 5_Link_CH20625
Tested by: Harry Hsueh

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	1693.00	-51.66	-59.68	-13.00	-38.66	8.02	Peak
2	2539.50	-54.33	-65.80	-13.00	-41.33	11.47	Peak
3	3386.00	-52.46	-66.86	-13.00	-39.46	14.40	Peak
4 pp	4232.50	-46.95	-64.31	-13.00	-33.95	17.36	Peak
5	5079.00	-47.60	-67.10	-13.00	-34.60	19.50	Peak

Data: 6

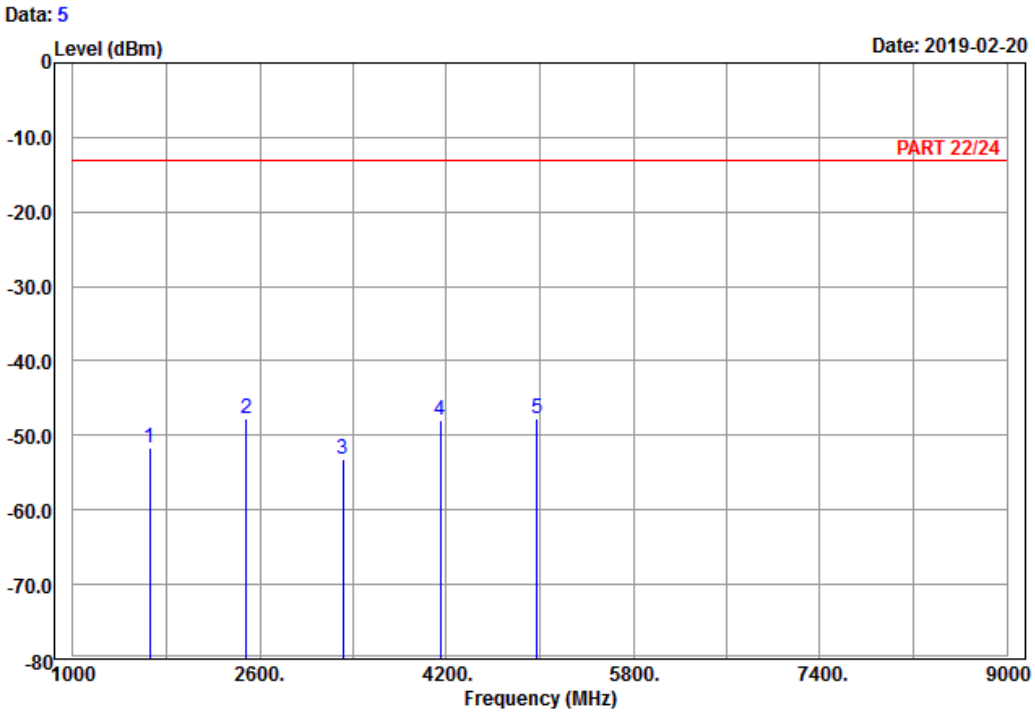


Site : 966 chamber 1
Condition: PART 22/24 Vertical
Remark : LTE_Band 5_Link_CH20625
Tested by: Harry Hsueh

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	1693.00	-56.10	-64.12	-13.00	-43.10	8.02	Peak
2	2539.50	-52.49	-63.96	-13.00	-39.49	11.47	Peak
3	3386.00	-52.63	-67.03	-13.00	-39.63	14.40	Peak
4 pp	4232.50	-43.81	-61.17	-13.00	-30.81	17.36	Peak
5	5079.00	-47.30	-66.80	-13.00	-34.30	19.50	Peak
6	5925.50	-46.28	-67.23	-13.00	-33.28	20.95	Peak

Channel Bandwidth: 10 MHz / QPSK
Low Channel

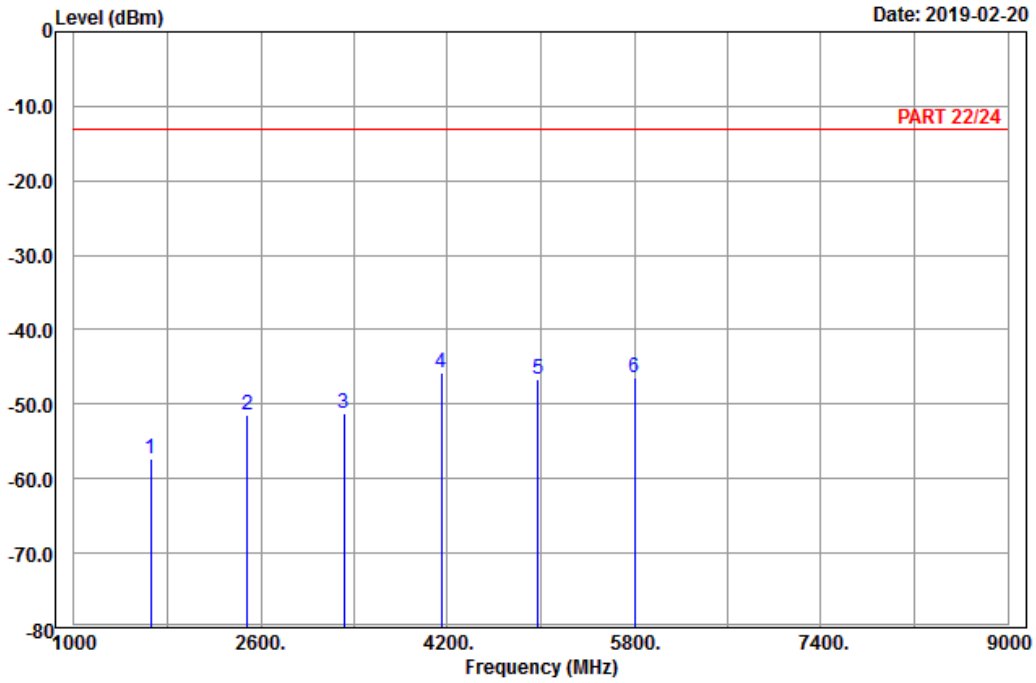
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 chamber 1
Condition: PART 22/24 Horizontal
Remark : LTE_Band 5_Link_CH20450
Tested by: Karl Lee

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	1658.00	-51.76	-59.67	-13.00	-38.76	7.91	Peak
2 pp	2487.00	-47.77	-58.81	-13.00	-34.77	11.04	Peak
3	3316.00	-53.11	-67.49	-13.00	-40.11	14.38	Peak
4	4145.00	-48.00	-65.06	-13.00	-35.00	17.06	Peak
5	4974.00	-47.80	-67.27	-13.00	-34.80	19.47	Peak

Data: 6



Site : 966 chamber 1
Condition: PART 22/24 Vertical
Remark : LTE_Band 5_Link_CH20450
Tested by: Karl Lee

		Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
		MHz	dBm	dBm	dBm	dB	dB	
1		1658.00	-57.23	-65.14	-13.00	-44.23	7.91	Peak
2		2487.00	-51.34	-62.38	-13.00	-38.34	11.04	Peak
3		3316.00	-51.20	-65.58	-13.00	-38.20	14.38	Peak
4	pp	4145.00	-45.81	-62.87	-13.00	-32.81	17.06	Peak
5		4974.00	-46.62	-66.09	-13.00	-33.62	19.47	Peak
6		5803.00	-46.53	-67.12	-13.00	-33.53	20.59	Peak

Middle Channel

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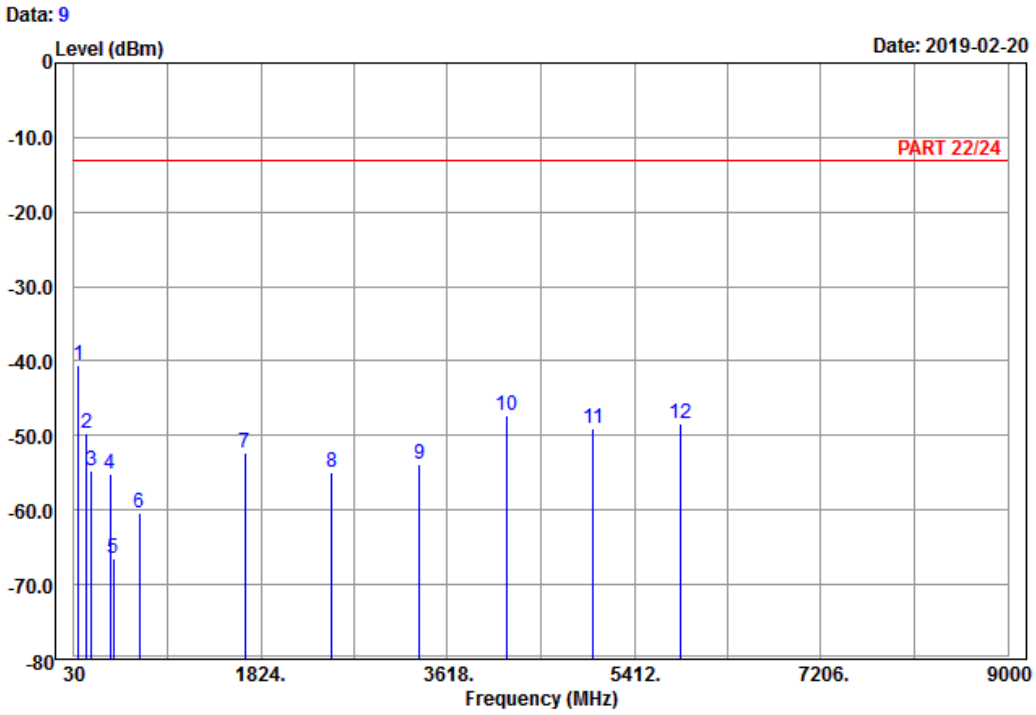
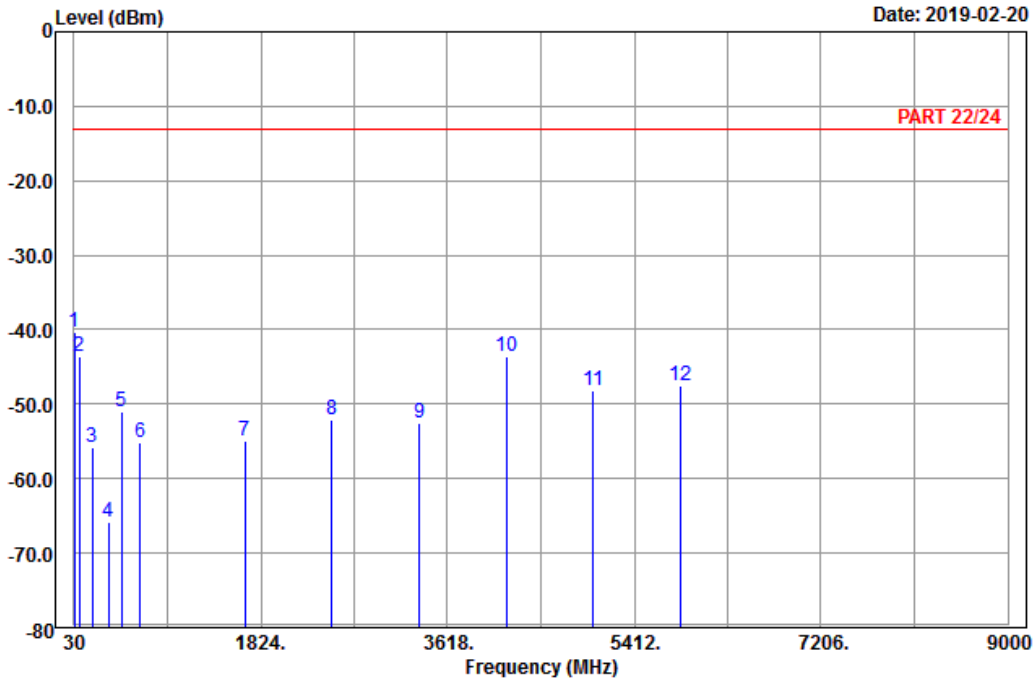


Site : 966 chamber 1
Condition: PART 22/24 Horizontal
Remark : LTE_Band 5_Link_CH20525
Tested by: Karl Lee

		Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
		MHz	dBm	dBm	dBm	dB	dB	
1	pp	76.44	-40.58	-28.48	-13.00	-27.58	-12.10	Peak
2		153.12	-49.74	-41.88	-13.00	-36.74	-7.86	Peak
3		198.48	-54.61	-48.47	-13.00	-41.61	-6.14	Peak
4		375.60	-55.13	-51.10	-13.00	-42.13	-4.03	Peak
5		405.00	-66.39	-63.52	-13.00	-53.39	-2.87	Peak
6		659.80	-60.33	-60.15	-13.00	-47.33	-0.18	Peak
7		1673.00	-52.30	-60.21	-13.00	-39.30	7.91	Peak
8		2509.50	-54.86	-66.14	-13.00	-41.86	11.28	Peak
9		3346.00	-53.86	-68.31	-13.00	-40.86	14.45	Peak
10		4182.50	-47.40	-64.53	-13.00	-34.40	17.13	Peak
11		5019.00	-48.94	-68.02	-13.00	-35.94	19.08	Peak
12		5855.50	-48.29	-69.07	-13.00	-35.29	20.78	Peak

Data: 10

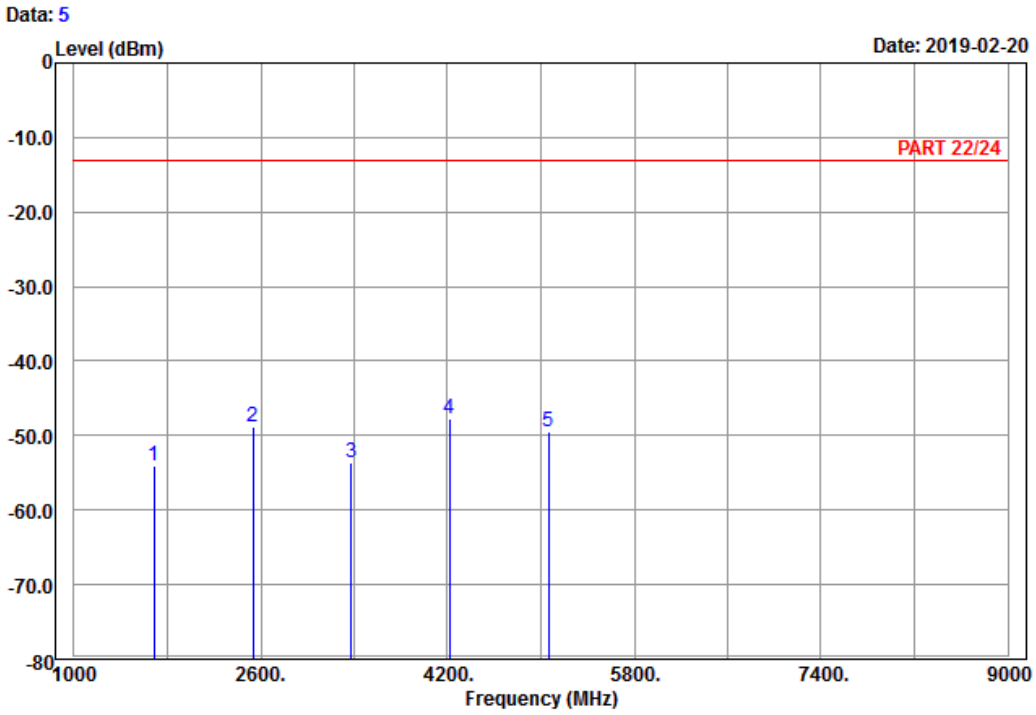


Site : 966 chamber 1
Condition: PART 22/24 Vertical
Remark : LTE_Band 5_Link_CH20525
Tested by: Karl Lee

		Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
		MHz	dBm	dBm	dBm	dB	dB	
1	pp	32.43	-40.35	-29.48	-13.00	-27.35	-10.87	Peak
2		83.19	-43.51	-32.07	-13.00	-30.51	-11.44	Peak
3		204.15	-55.75	-49.63	-13.00	-42.75	-6.12	Peak
4		365.10	-65.75	-61.15	-13.00	-52.75	-4.60	Peak
5		485.50	-50.97	-46.10	-13.00	-37.97	-4.87	Peak
6		666.80	-55.20	-54.99	-13.00	-42.20	-0.21	Peak
7		1673.00	-54.87	-62.78	-13.00	-41.87	7.91	Peak
8		2509.50	-52.01	-63.29	-13.00	-39.01	11.28	Peak
9		3346.00	-52.60	-67.05	-13.00	-39.60	14.45	Peak
10		4182.50	-43.61	-60.74	-13.00	-30.61	17.13	Peak
11		5019.00	-48.13	-67.21	-13.00	-35.13	19.08	Peak
12		5855.50	-47.51	-68.29	-13.00	-34.51	20.78	Peak

High Channel

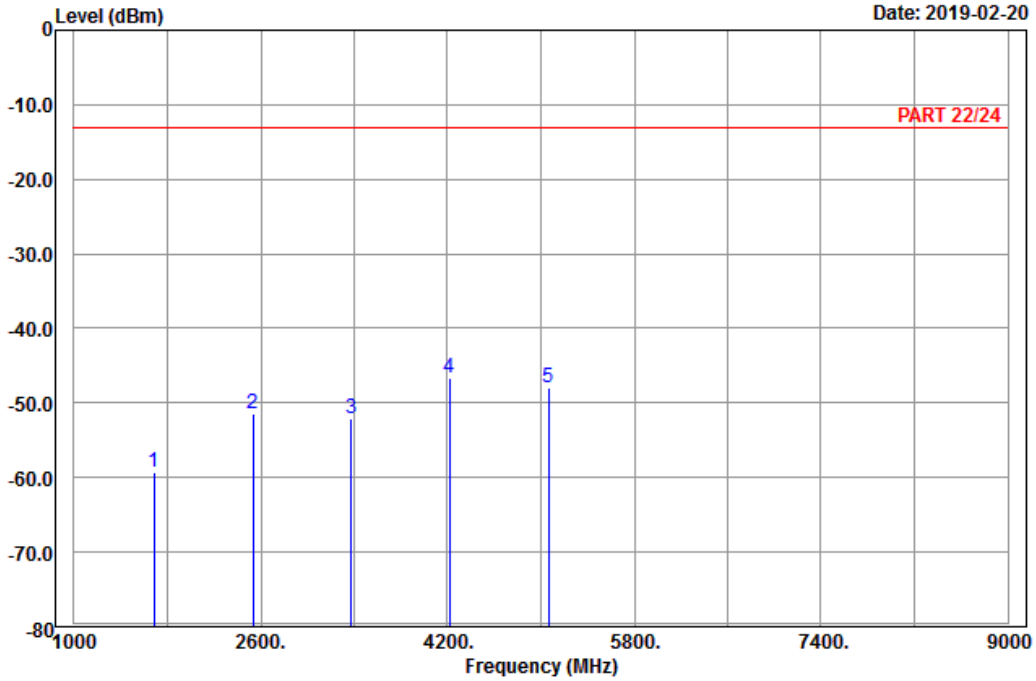
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 chamber 1
Condition: PART 22/24 Horizontal
Remark : LTE_Band 5_Link_CH20600
Tested by: Karl Lee

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	1688.00	-54.06	-62.08	-13.00	-41.06	8.02	Peak
2	2532.00	-48.93	-60.31	-13.00	-35.93	11.38	Peak
3	3376.00	-53.63	-68.05	-13.00	-40.63	14.42	Peak
4 pp	4220.00	-47.83	-65.11	-13.00	-34.83	17.28	Peak
5	5064.00	-49.54	-68.93	-13.00	-36.54	19.39	Peak

Data: 6



Site : 966 chamber 1
Condition: PART 22/24 Vertical
Remark : LTE_Band 5_Link_CH20600
Tested by: Karl Lee

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	1688.00	-59.32	-67.34	-13.00	-46.32	8.02	Peak
2	2532.00	-51.37	-62.75	-13.00	-38.37	11.38	Peak
3	3376.00	-52.11	-66.53	-13.00	-39.11	14.42	Peak
4 pp	4220.00	-46.63	-63.91	-13.00	-33.63	17.28	Peak
5	5064.00	-47.89	-67.28	-13.00	-34.89	19.39	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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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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