

FCC Test Report

(PART 22)

Report No.: RF161012C04

FCC ID: ZOQVT-400

Test Model: VT-400

Received Date: Oct. 12, 2016

Test Date: Oct. 21, 2016 ~ Oct. 25, 2016

Issued Date: Nov. 03, 2016

Applicant: Verizon Telematics Inc.

Address: 2002 Summit Blvd, Suite 1800

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

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Release Control Record

Issue No.	Description	Date Issued
RF161012C04	Original Release	Nov. 03, 2016

1 Certificate of Conformity

Product: OBD2 LTE/3G/GPS/WIFI/BT tracker

Brand: Verizon Telematics Inc.

Test Model: VT-400

Sample Status: Identical Prototype

Applicant: Verizon Telematics Inc.

Test Date: Oct. 21, 2016 ~ Oct. 25, 2016

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 EMC characteristics under the conditions specified in this report.

Prepared by : Evonne Liu, **Date:** Nov. 03, 2016
Evonne Liu / Specialist

Approved by : Stanley Wu, **Date:** Nov. 03, 2016
Stanley Wu / Assistant Manager

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.
---	Peak to Average Ratio	Pass	Meet the requirement of limit.
2.1055 22.355	Frequency Stability	Pass	Meet the requirement of limit.
2.1049	Occupied Bandwidth	Pass	Meet the requirement of limit.
22.917	Band Edge Measurements	Pass	Meet the requirement of limit.
2.1051 22.917	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 22.917	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -33.04 dB at 2509.50 MHz.

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) (±)
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.44 dB
Radiated Emissions up to 1 GHz	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	Jan. 21, 2016	Jan. 20, 2017
Spectrum Analyzer Agilent	N9010A	MY52220207	Nov. 02, 2015	Nov. 01, 2016
MXG Vector signal generator	N5182B	MY53050430	Oct. 19, 2016	Oct. 18, 2017
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 17, 2015	Dec. 16, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Jan. 07, 2016	Jan. 06, 2017
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Jan. 04, 2016	Jan. 03, 2017
Double Ridge Guide Horn Antenna EMCO	3115	5619	Jan. 04, 2016	Jan. 03, 2017
BILOG Antenna SCHWARZBECK	VULB 9168	9168-153	Jan. 07, 2016	Jan. 06, 2017
Agilent Communications Tester-Wireless	8960 Series 10	MY53201073	Jul. 03, 2015	Jul. 02, 2017
Preamplifier EMCI	EMC 012645	980115	Dec. 21, 2015	Dec. 20, 2016
Preamplifier EMCI	EMC 184045	980116	Dec. 21, 2015	Dec. 20, 2016
Preamplifier EMCI	EMC 330H	980112	Dec. 28, 2015	Dec. 27, 2016
Power Meter Anritsu	ML2495A	1232002	Sep. 08, 2016	Sep. 07, 2017
Power Sensor Anritsu	MA2411B	1207325	Sep. 08, 2016	Sep. 07, 2017
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309222 248780	Aug. 09, 2016	Aug. 08, 2017
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	274092	Aug. 09, 2016	Aug. 08, 2017
RF Coaxial Cable Worken	8D-FB	Cable-CH9-01	Aug. 09, 2016	Aug. 08, 2017
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	MT8820C	6201300640	Aug. 10, 2015	Aug. 09, 2017
Temperature & Humidity Chamber	GTH-120-40-CP-A R	MAA1306-019	Sep. 02, 2016	Sep. 01, 2017
DC Power Supply Topward	33010D	807748	Oct. 27, 2014	Oct. 26, 2016
Digital Multimeter Fluke	87-III	70360742	Jul. 01, 2016	Jun. 30, 2017
Fixed Attenuator Mini-Circuits	BW-N10W5+	N/A	Jul. 08, 2016	Jul. 07, 2017

- 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. The horn antenna and preamplifier (model: EMC 184045) are used only for the measurement of emission frequency above 1 GHz if tested.
 4. The FCC Site Registration No. is 690701.
 5. The IC Site Registration No. is IC7450F-10.

3 General Information

3.1 General Description of EUT

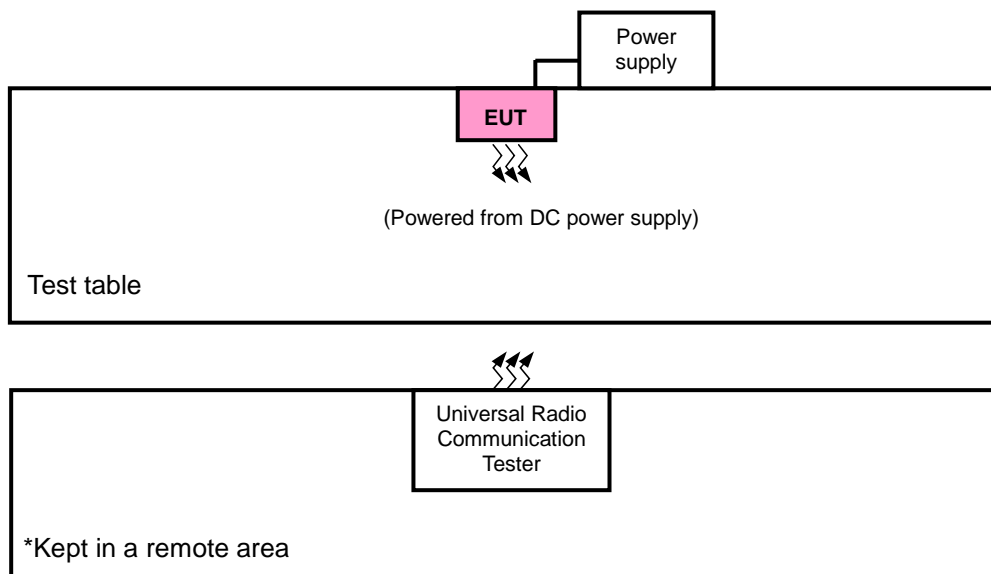
Product	OBD2 LTE/3G/GPS/WIFI/BT tracker	
Brand	Verizon Telematics Inc.	
Test Model	VT-400	
Status of EUT	Identical Prototype	
Power Supply Rating	12Vdc (DC power supply)	
Modulation Type	WCDMA	BPSK
	LTE	QPSK, 16QAM
Frequency Range	WCDMA	826.4 ~ 846.6 MHz
	LTE 5 (Channel Bandwidth: 1.4 MHz)	824.7 ~ 848.3 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	60.39 mW
	LTE 5 (Channel Bandwidth: 1.4 MHz)	115.88 mW
	LTE 5 (Channel Bandwidth: 3 MHz)	117.76 mW
	LTE 5 (Channel Bandwidth: 5 MHz)	119.40 mW
	LTE 5 (Channel Bandwidth: 10 MHz)	121.90 mW
Emission Designator	WCDMA	4M19F9W
	LTE 5 (Channel Bandwidth: 1.4 MHz)	1M09G7D
	LTE 5 (Channel Bandwidth: 3 MHz)	2M70W7D
	LTE 5 (Channel Bandwidth: 5 MHz)	4M50G7D
	LTE 5 (Channel Bandwidth: 10 MHz)	8M97W7D
Antenna Type	Metal monopole Antenna	
Accessory Device	Refer to Note as below	
Data Cable Supplied	Refer to Note as below	

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description, please refer 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.	Power supply	TOP WARD	6603A	725906	N/A

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

Note:

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

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	Z-axis
LTE Band 5	X-plane	Z-axis

WCDMA

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Mode
-	ERP	4132 to 4233	4132, 4182, 4233	WCDMA
-	Frequency Stability	4132 to 4233	4182	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
-	Conducuted Emission	4132 to 4233	4182	WCDMA
-	Radiated Emission	4132 to 4233	4182	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 / 2 RB Offset
		20415 to 20635	20415, 20525, 20635	3 MHz	QPSK, 16QAM	1 RB / 7 RB Offset
		20425 to 20625	20425, 20525, 20625	5 MHz	QPSK, 16QAM	1 RB / 12 RB Offset
		20450 to 20600	20450, 20525, 20600	10 MHz	QPSK, 16QAM	1 RB / 24 RB Offset
-	Frequency Stability	20407 to 20643	20525	1.4 MHz	QPSK	1 RB / 2 RB Offset
		20415 to 20635	20525	3 MHz	QPSK	1 RB / 7 RB Offset
		20425 to 20625	20525	5 MHz	QPSK	1 RB / 12 RB Offset
		20450 to 20600	20525	10 MHz	QPSK	1 RB / 24 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
		20415 to 20635	20643	1.4MHz	QPSK	1 RB / 5 RB Offset
						6 RB / 0 RB Offset
		20425 to 20625	20415	3 MHz	QPSK	1 RB / 0 RB Offset
			20635	3 MHz	QPSK	15 RB / 0 RB Offset
		20450 to 20600	20425	5 MHz	QPSK	1 RB / 14 RB Offset
			20625	5 MHz	QPSK	15 RB / 0 RB Offset
		20407 to 20643	20425	5 MHz	QPSK	1 RB / 0 RB Offset
			20625	5 MHz	QPSK	25 RB / 0 RB Offset
		20415 to 20635	20425	5 MHz	QPSK	1 RB / 24 RB Offset
			20625	5 MHz	QPSK	25 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	6 RB / 0 RB Offset
		20425 to 20625	20425, 20525, 20625	5 MHz	QPSK, 16QAM	15 RB / 0 RB Offset
		20450 to 20600	20450, 20525, 20600	10 MHz	QPSK, 16QAM	25 RB / 0 RB Offset
-	Conducted Emission	20407 to 20643	20525	1.4 MHz	QPSK	50 RB / 0 RB Offset
		20415 to 20635	20525	3 MHz	QPSK	1 RB / 49 RB Offset
		20425 to 20625	20525	5 MHz	QPSK	1 RB / 24 RB Offset
		20450 to 20600	20525	10 MHz	QPSK	50 RB / 0 RB Offset
-	Radiated Emission	20450 to 20600	20525	10 MHz	QPSK	1 RB / 24 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	120 Vac, 60 Hz	Getaz Yang
Frequency Stability	25 deg. C, 65 % RH	120 Vac, 60 Hz	Carlos Chen
Occupied Bandwidth	25 deg. C, 65 % RH	120 Vac, 60 Hz	Carlos Chen
Band Edge	25 deg. C, 65 % RH	120 Vac, 60 Hz	Carlos Chen
Peak to Average Ratio	25 deg. C, 65 % RH	120 Vac, 60 Hz	Carlos Chen
Conducuted Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	Carlos Chen
Radiated Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang

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 v02r02

ANSI/TIA/EIA-603-D 2010

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:

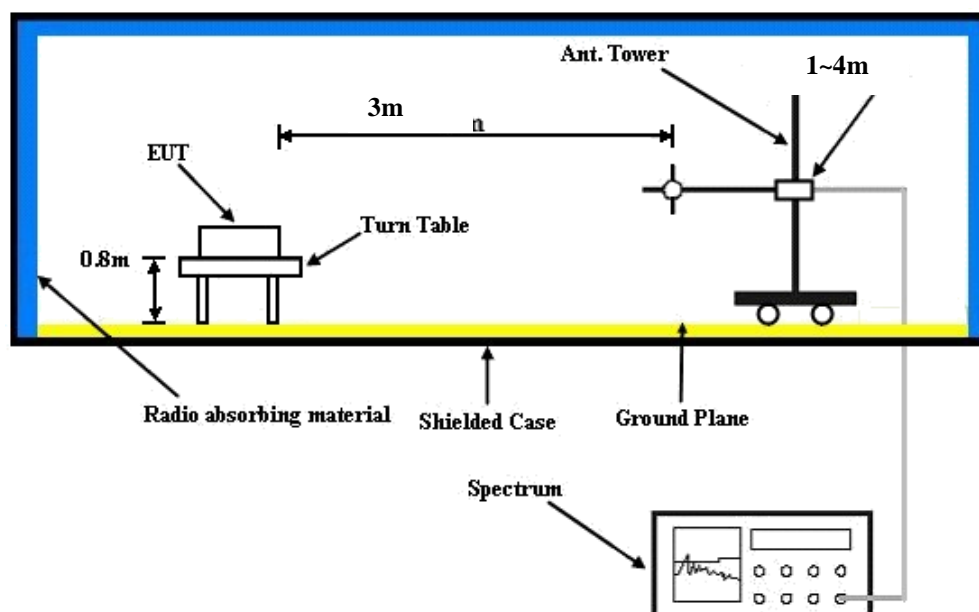
- a. All measurements were done at low, middle and high operational frequency range. RBW and VBW is 1 MHz for GSM, GPRS & EDGE, and 5 MHz for WCDMA and CDMA, and 10 MHz for LTE mode.
- b. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m height 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. $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}$. E.R.P power can be calculated from E.I.R.P power by subtracting the gain of dipole, $E.R.P \text{ power} = E.I.P.R \text{ power} - 2.15 \text{ dBi}$.

Conducted Power Measurement:

The EUT was set up for the maximum power with GSM, GPRS, EDGE, WCDMA, CDMA, 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.

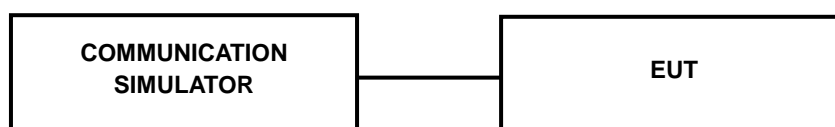
4.1.3 Test Setup

EIRP / ERP Measurement:



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	23.98	23.77	23.92

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 20407	Mid Ch 20525	High Ch 20643		Low Ch 20407	Mid Ch 20525	High Ch 20643	
			824.7 MHz	836.5 MHz	848.3 MHz		824.7 MHz	836.5 MHz	848.3 MHz	
5 / 1.4M	1	0	24.26	24.11	24.46	0	23.10	22.95	23.27	1
	1	2	24.41	24.05	24.31	0	22.93	22.91	23.08	1
	1	5	24.28	23.77	24.32	0	23.01	22.41	23.20	1
	3	0	24.20	23.88	24.45	0	23.08	22.92	23.30	1
	3	1	24.21	23.92	24.42	0	23.24	23.23	23.32	1
	3	3	24.17	23.98	24.45	0	23.15	22.77	23.26	1
	6	0	23.24	22.91	23.45	1	22.16	21.45	22.4	2

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 20415	Mid Ch 20525	High Ch 20635		Low Ch 20415	Mid Ch 20525	High Ch 20635	
			825.5 MHz	836.5 MHz	847.5 MHz		825.5 MHz	836.5 MHz	847.5 MHz	
5 / 3M	1	0	24.12	23.95	24.37	0	23.00	23.01	23.21	1
	1	7	24.05	23.93	24.57	0	22.96	22.74	23.23	1
	1	14	24.10	23.87	24.46	0	22.86	22.86	23.05	1
	8	0	22.98	22.86	23.32	1	22.05	21.90	22.32	2
	8	3	23.10	22.91	23.42	1	22.14	22.01	22.35	2
	8	7	23.01	22.86	23.34	1	22.18	22.08	22.29	2
	15	0	22.96	22.85	23.27	1	21.98	22.06	22.30	2

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 20425	Mid Ch 20525	High Ch 20625		Low Ch 20425	Mid Ch 20525	High Ch 20625	
			826.5 MHz	836.5 MHz	846.5 MHz		826.5 MHz	836.5 MHz	846.5 MHz	
5 / 5M	1	0	23.96	23.76	23.91	0	22.81	22.36	22.75	1
	1	12	24.26	23.83	24.36	0	22.72	22.34	22.95	1
	1	24	24.06	23.67	24.21	0	22.85	22.69	22.96	1
	12	0	22.92	22.85	23.08	1	21.92	21.86	22.02	2
	12	6	22.98	22.86	23.04	1	21.95	21.88	21.93	2
	12	13	22.94	22.77	23.13	1	21.94	21.78	22.15	2
	25	0	23.04	22.87	22.99	1	21.89	21.88	21.94	2

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 20450	Mid Ch 20525	High Ch 20600		Low Ch 20450	Mid Ch 20525	High Ch 20600	
			829.0 MHz	836.5 MHz	844.0 MHz		829.0 MHz	836.5 MHz	844.0 MHz	
5 / 10M	1	0	24.06	24.00	23.89	0	22.69	22.74	22.61	1
	1	24	24.47	24.02	24.32	0	22.67	22.73	22.51	1
	1	49	23.90	23.86	24.33	0	22.31	22.71	22.61	1
	25	0	22.84	22.83	22.74	1	21.99	21.81	21.67	2
	25	12	22.96	22.84	22.89	1	21.87	21.84	21.81	2
	25	25	23.05	22.76	22.99	1	21.93	21.77	21.88	2
	50	0	23.13	22.82	22.92	1	21.89	21.75	21.97	2

ERP Power (dBm)

WCDMA							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (mW)	Polarization (H/V)
Y	4132	826.4	-12.78	32.62	17.69	58.75	H
	4182	836.4	-12.56	32.52	17.81	60.39	
	4233	846.6	-12.99	32.65	17.51	56.36	
	4132	826.4	-18.54	32.76	12.07	16.11	V
	4182	836.4	-18.16	32.39	12.08	16.14	
	4233	846.6	-18.89	32.54	11.50	14.13	

LTE Band 5							
Channel Bandwidth: 1.4 MHz / QPSK							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (mW)	Polarization (H/V)
X	20407	824.7	-9.95	32.62	20.52	112.72	H
	20525	836.5	-9.73	32.52	20.64	115.88	
	20643	848.3	-9.91	32.65	20.59	114.55	
	20407	824.7	-13.38	32.76	17.23	52.84	V
	20525	836.5	-12.91	32.39	17.33	54.08	
	20643	848.3	-13.11	32.54	17.28	53.46	
Channel Bandwidth: 1.4 MHz / 16QAM							
X	20407	824.7	-10.65	32.62	19.82	95.94	H
	20525	836.5	-10.47	32.52	19.90	97.72	
	20643	848.3	-10.72	32.65	19.78	95.06	
	20407	824.7	-14.15	32.76	16.46	44.26	V
	20525	836.5	-13.72	32.39	16.52	44.87	
	20643	848.3	-13.96	32.54	16.43	43.95	

LTE Band 5							
Channel Bandwidth: 3 MHz / QPSK							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (mW)	Polarization (H/V)
X	20415	825.5	-9.87	32.62	20.60	114.82	H
	20525	836.5	-9.66	32.52	20.71	117.76	
	20635	847.5	-9.82	32.65	20.68	116.95	
	20415	825.5	-13.30	32.76	17.31	53.83	V
	20525	836.5	-12.88	32.39	17.36	54.45	
	20635	847.5	-13.05	32.54	17.34	54.20	
Channel Bandwidth: 3 MHz / 16QAM							
X	20415	825.5	-10.58	32.62	19.89	97.50	H
	20525	836.5	-10.41	32.52	19.96	99.08	
	20635	847.5	-10.63	32.65	19.87	97.05	
	20415	825.5	-14.05	32.76	16.56	45.29	V
	20525	836.5	-13.66	32.39	16.58	45.50	
	20635	847.5	-13.84	32.54	16.55	45.19	

LTE Band 5							
Channel Bandwidth: 5 MHz / QPSK							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (mW)	Polarization (H/V)
X	20425	826.5	-9.81	32.62	20.66	116.41	H
	20525	836.5	-9.60	32.52	20.77	119.40	
	20625	846.5	-9.75	32.65	20.75	118.85	
	20425	826.5	-13.24	32.76	17.37	54.58	V
	20525	836.5	-12.81	32.39	17.43	55.34	
	20625	846.5	-13.01	32.54	17.38	54.70	
Channel Bandwidth: 5 MHz / 16QAM							
X	20425	826.5	-10.49	32.62	19.98	99.54	H
	20525	836.5	-10.37	32.52	20.00	100.00	
	20625	846.5	-10.57	32.65	19.93	98.40	
	20425	826.5	-13.79	32.76	16.82	48.08	V
	20525	836.5	-13.30	32.39	16.94	49.43	
	20625	846.5	-13.52	32.54	16.87	48.64	

LTE Band 5							
Channel Bandwidth: 10 MHz / QPSK							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (mW)	Polarization (H/V)
X	20450	829.0	-9.72	32.62	20.75	118.85	H
	20525	836.5	-9.51	32.52	20.86	121.90	
	20600	844.0	-9.70	32.65	20.80	120.23	
	20450	829.0	-13.19	32.76	17.42	55.21	V
	20525	836.5	-12.76	32.39	17.48	55.98	
	20600	844.0	-12.98	32.54	17.41	55.08	
Channel Bandwidth: 10 MHz / 16QAM							
X	20450	829.0	-10.35	32.62	20.12	102.80	H
	20525	836.5	-10.22	32.52	20.15	103.51	
	20600	844.0	-10.41	32.65	20.09	102.09	
	20450	829.0	-13.62	32.76	16.99	50.00	V
	20525	836.5	-13.23	32.39	17.01	50.23	
	20600	844.0	-13.39	32.54	17.00	50.12	

4.2 Frequency Stability Measurement

4.2.1 Limits of Frequency Stability Measurement

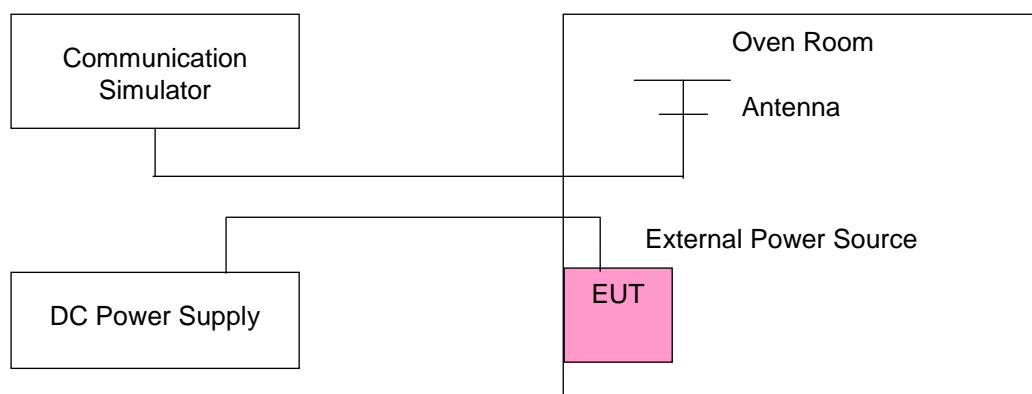
1.5 ppm is for base and fixed station. 2.5 ppm is for mobile station.

4.2.2 Test Procedure

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

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

4.2.3 Test Setup



4.2.4 Test Results

Frequency Error vs. Voltage

Voltage (Volts)	Frequency Error (ppm)					Limit (ppm)
	WCDMA	LTE Band 5				
		1.4 MHz	3 MHz	5 MHz	10 MHz	
12	0.002	0.004	0.002	0.004	0.002	2.5
6	0.004	0.002	0.003	0.002	0.004	2.5
18	0.003	0.003	0.004	0.005	0.002	2.5

Note: The applicant defined the normal working voltage of the battery is from 6 Vdc to 18 Vdc.

Frequency Error vs. Temperature

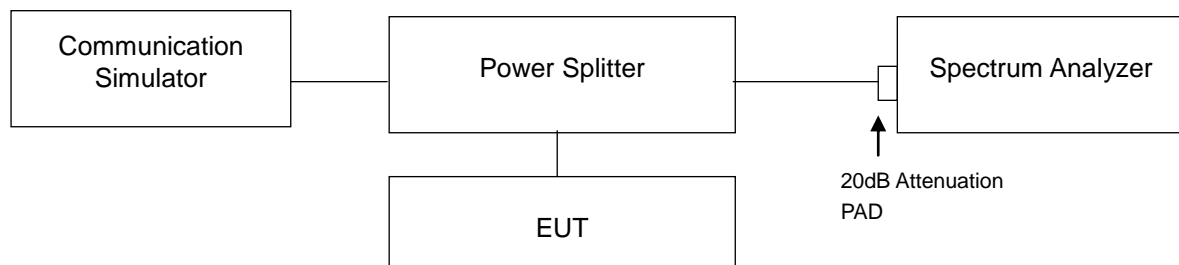
Temp. (°C)	Frequency Error (ppm)					Limit (ppm)
	WCDMA	LTE Band 5				
		1.4 MHz	3 MHz	5 MHz	10 MHz	
-30	0.002	0.002	0.002	0.003	0.004	2.5
-20	0.003	0.004	0.003	0.003	0.004	2.5
-10	0.003	0.003	0.001	0.004	0.002	2.5
0	0.002	0.001	0.004	0.005	0.002	2.5
10	0.003	0.003	0.004	0.002	0.003	2.5
20	-0.002	-0.003	-0.003	-0.002	-0.003	2.5
30	-0.005	-0.002	-0.002	-0.004	-0.005	2.5
40	-0.002	-0.005	-0.003	-0.004	-0.003	2.5
50	-0.004	-0.002	-0.001	-0.001	-0.004	2.5

4.3 Occupied Bandwidth Measurement

4.3.1 Test Procedure

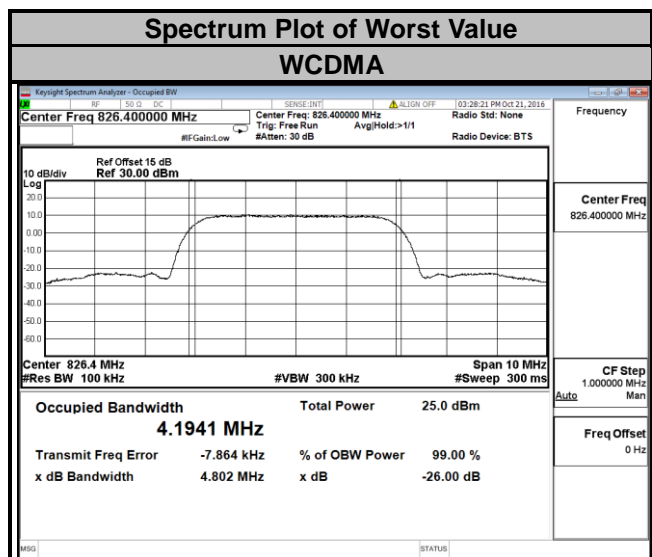
The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function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

4.3.2 Test Setup

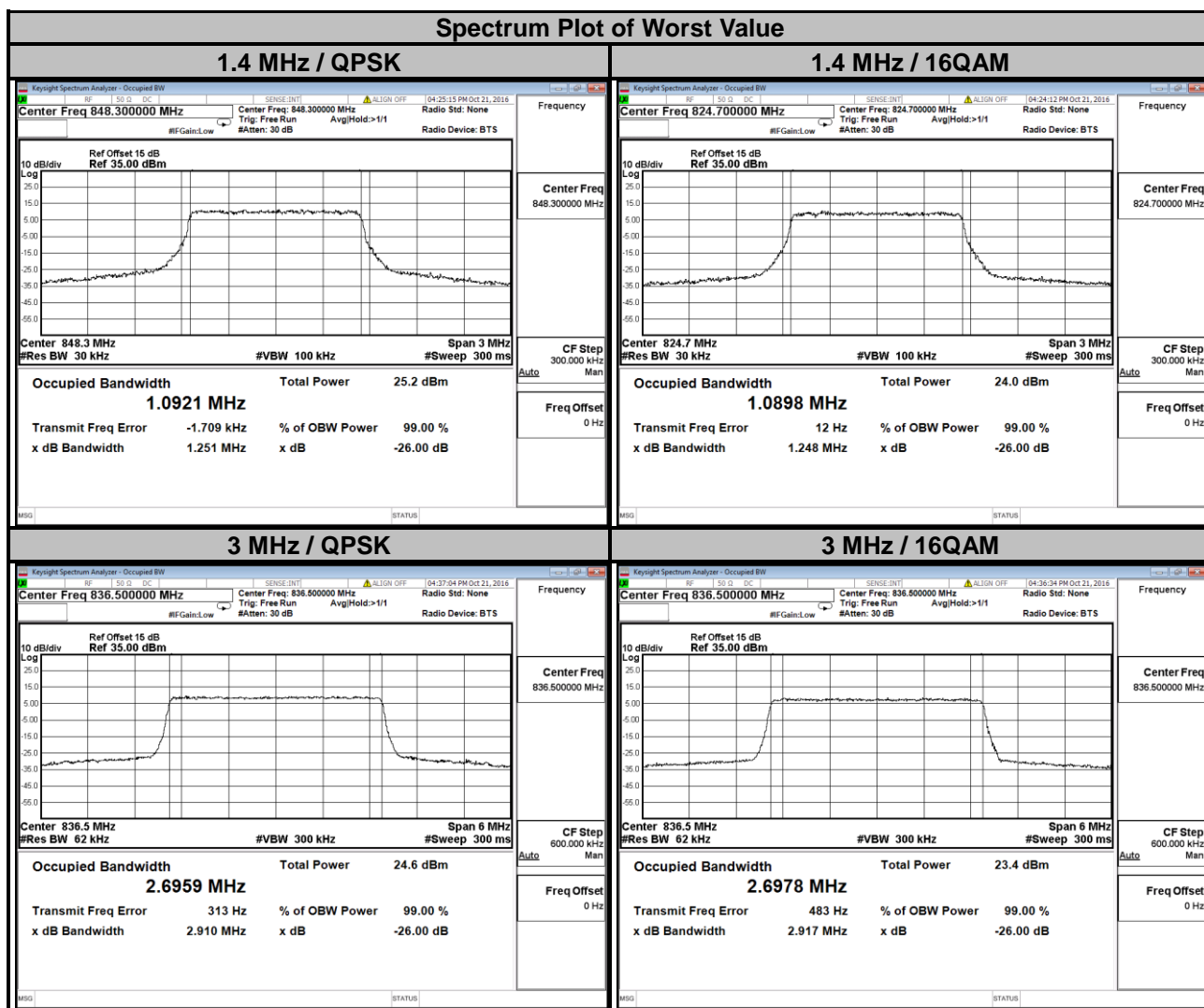


4.3.3 Test Result

Channel	Frequency (MHz)	99 % Occupied Bandwidth (kHz)
		WCDMA
4132	826.4	4.1941
4182	836.4	4.1834
4233	846.6	4.1626



LTE Band 5							
Channel Bandwidth: 1.4 MHz				Channel Bandwidth: 3 MHz			
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	
		QPSK	16QAM			QPSK	16QAM
20407	824.7	1.0882	1.0898	20415	825.5	2.6949	2.6955
20525	836.5	1.0912	1.0883	20525	836.5	2.6959	2.6978
20643	848.3	1.0921	1.0883	20635	847.5	2.6954	2.6973



LTE Band 5

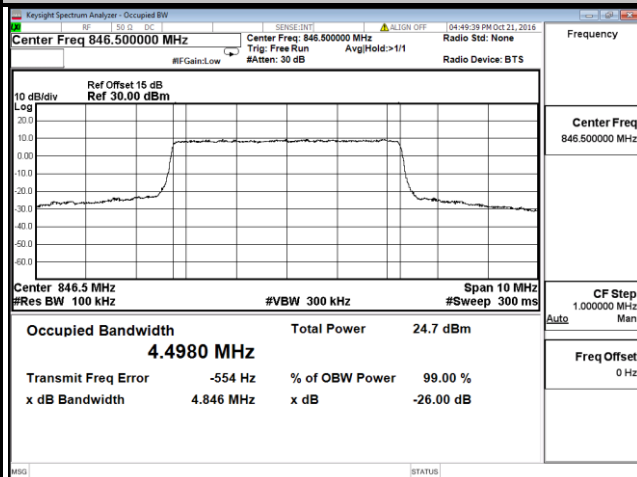
Channel Bandwidth: 5 MHz

Channel Bandwidth: 10 MHz

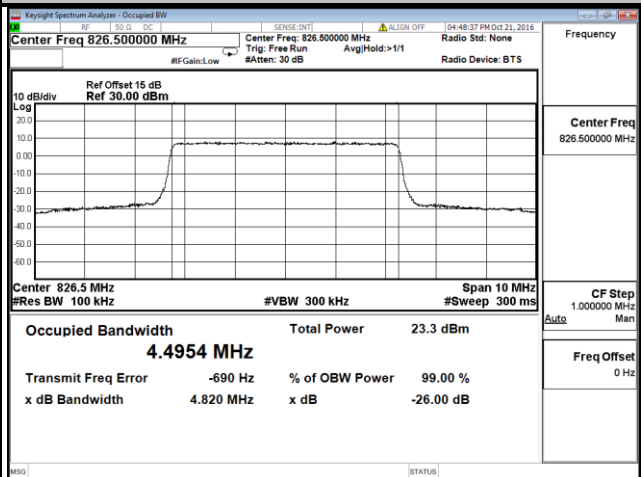
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	
		QPSK	16QAM			QPSK	16QAM
20425	826.5	4.4968	4.4954	20450	829.0	8.9711	8.9707
20525	836.5	4.4957	4.4888	20525	836.5	8.9487	8.9497
20625	846.5	4.4980	4.4908	20600	844.0	8.9741	8.9726

Spectrum Plot of Worst Value

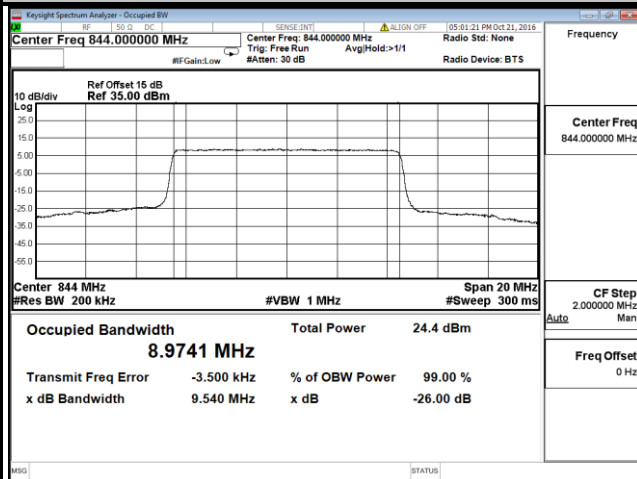
5 MHz / QPSK



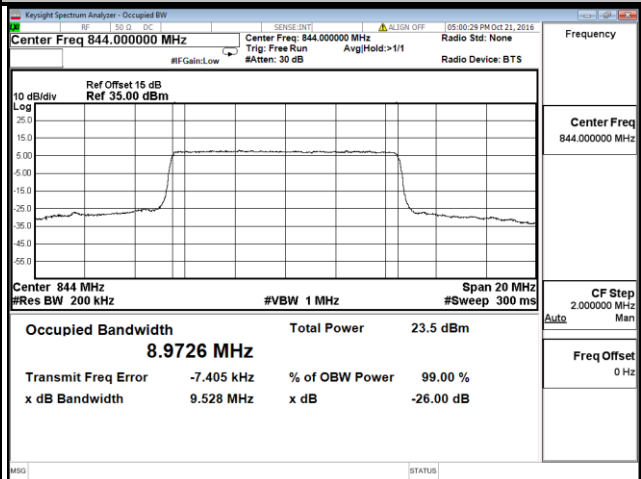
5 MHz / 16QAM



10 MHz / QPSK



10 MHz / 16QAM

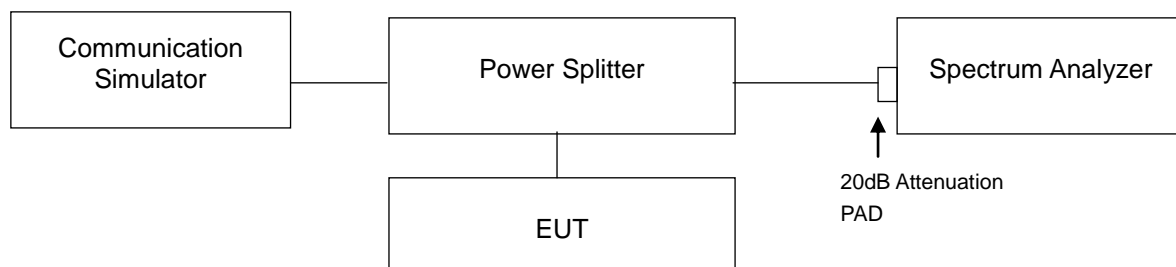


4.4 Band Edge Measurement

4.4.1 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.

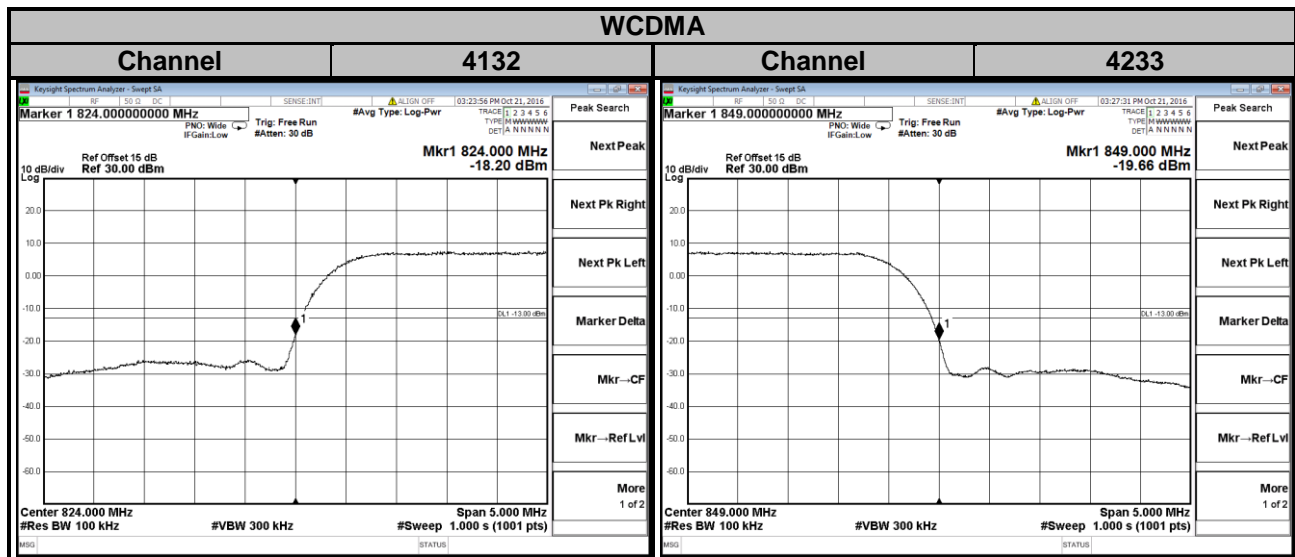
4.4.2 Test Setup

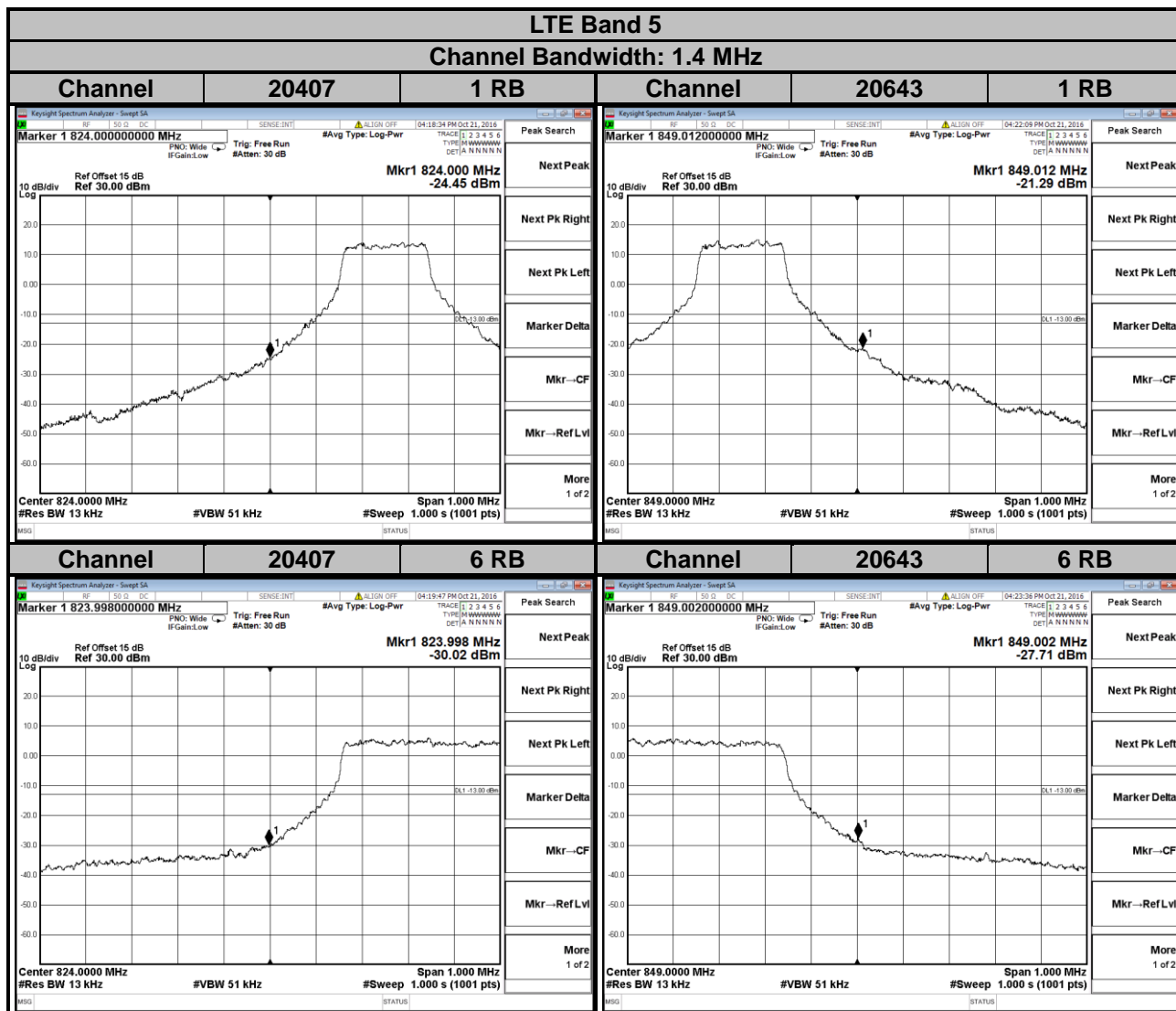


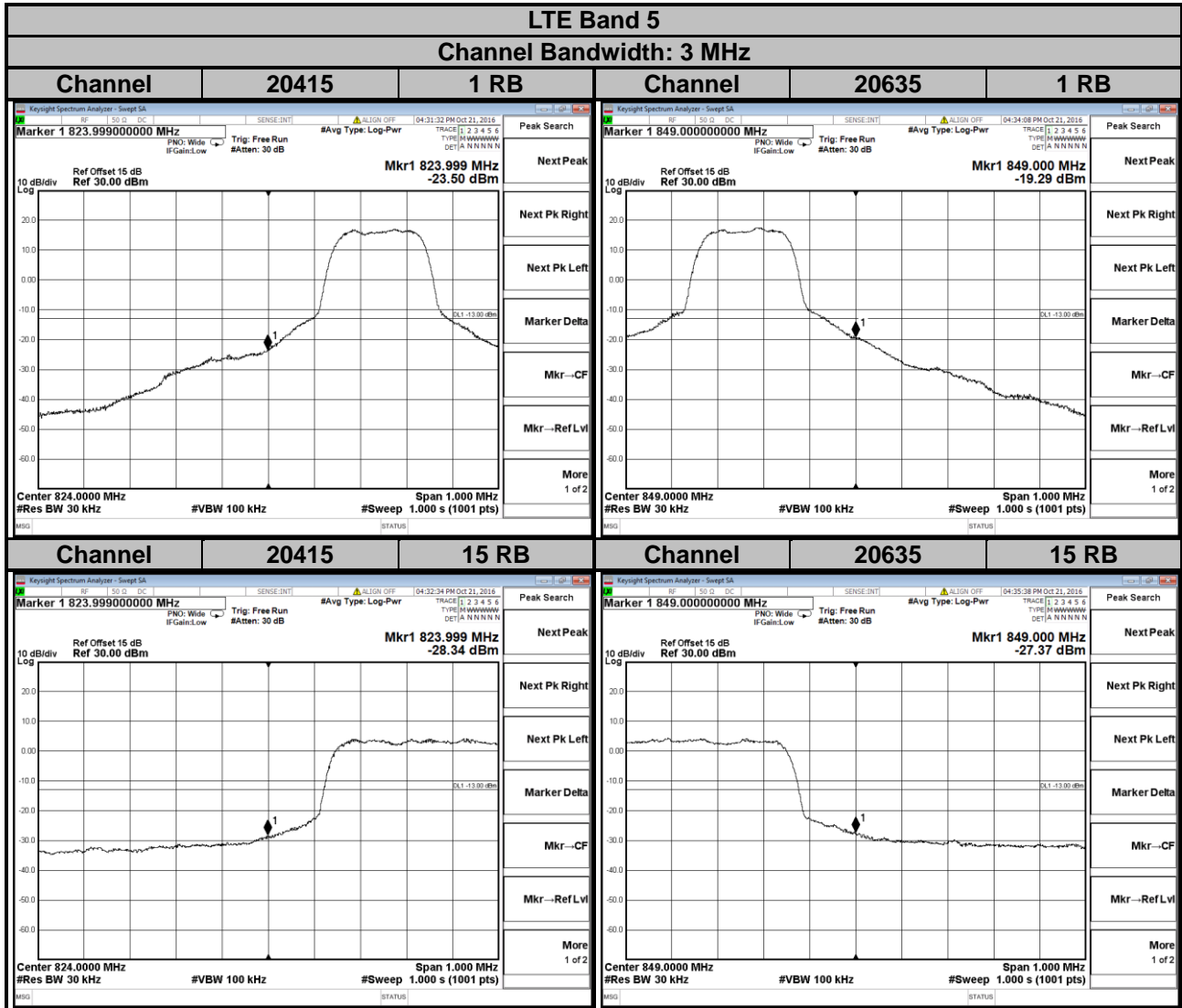
4.4.3 Test Procedures

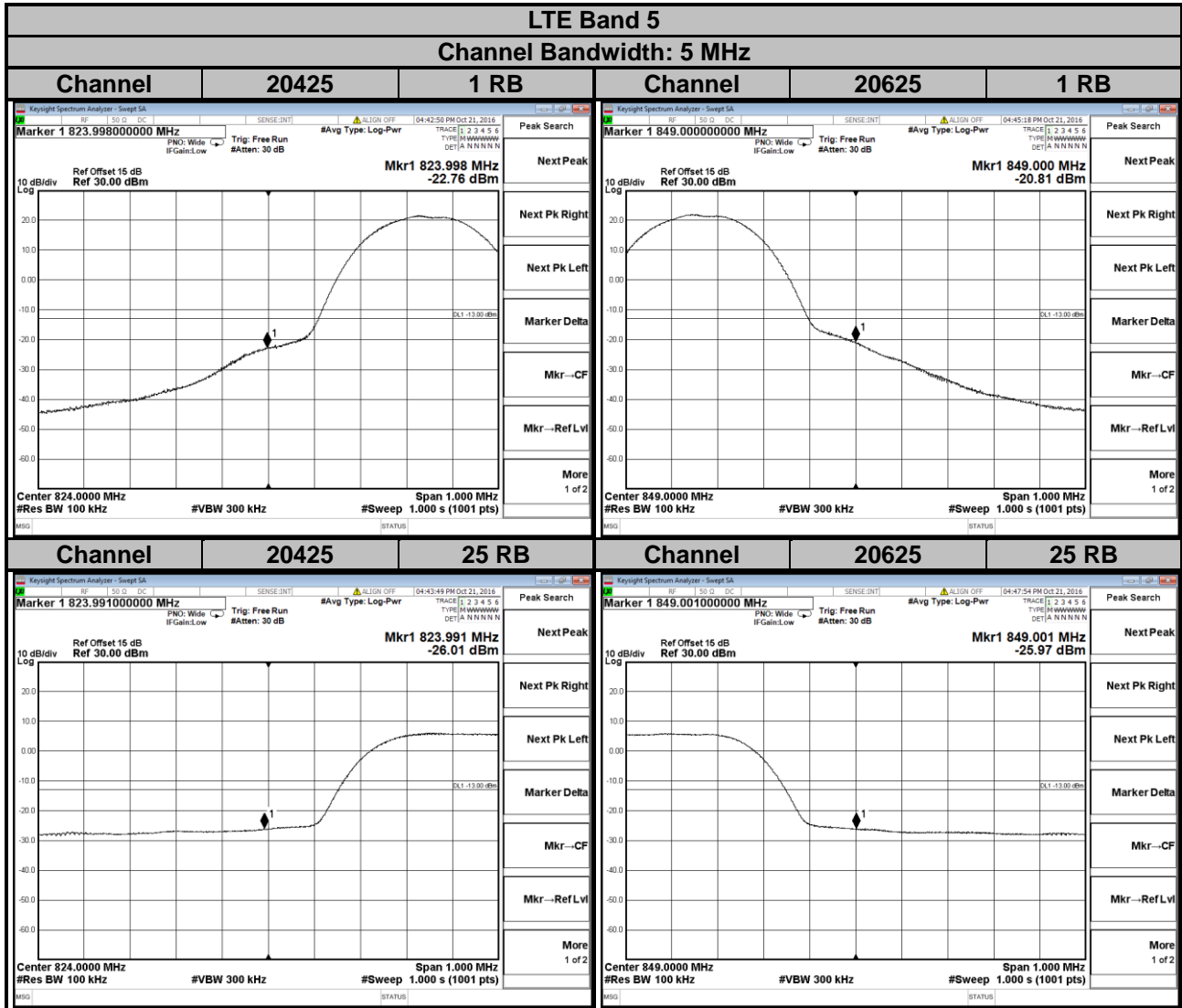
- All measurements were done at low and high operational frequency range.
- The center frequency of spectrum is the band edge frequency and span is 5 MHz. RB of the spectrum is 100 kHz and VB of the spectrum is 300 kHz (WCDMA).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 13 kHz and VB of the spectrum is 51 kHz (LTE Bandwidth 1.4 MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 30 kHz and VB of the spectrum is 100 kHz (LTE Bandwidth 3 MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 100 kHz and VB of the spectrum is 300 kHz (LTE Bandwidth 5 MHz/10 MHz).
- Record the max trace plot into the test report.

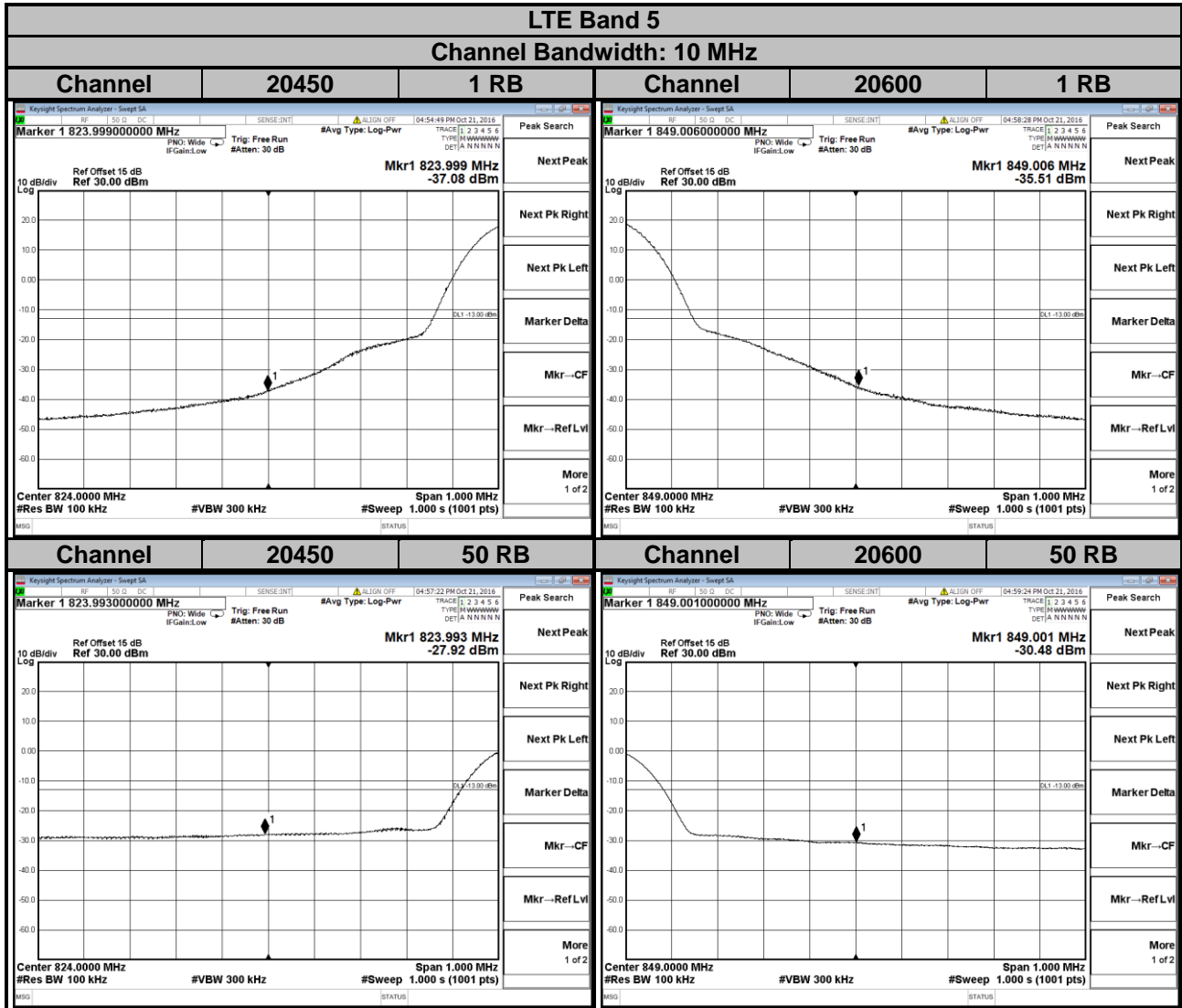
4.4.4 Test Results









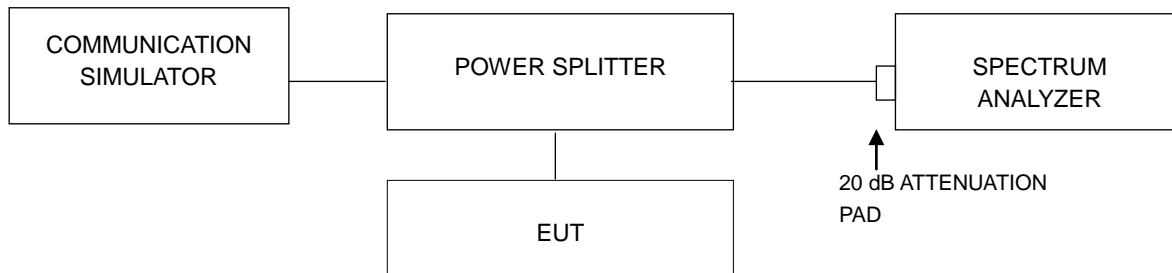


4.5 Peak to Average Ratio

4.5.1 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.

4.5.2 Test Setup

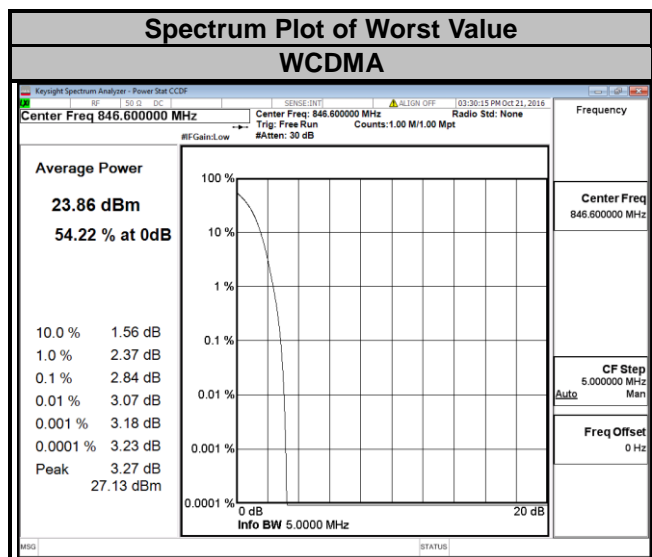


4.5.3 Test Procedures

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

4.5.4 Test Results

Channel	Frequency (MHz)	Peak to Average Ratio (dB)
		WCDMA
4132	826.4	2.69
4182	836.4	2.69
4233	846.6	2.84

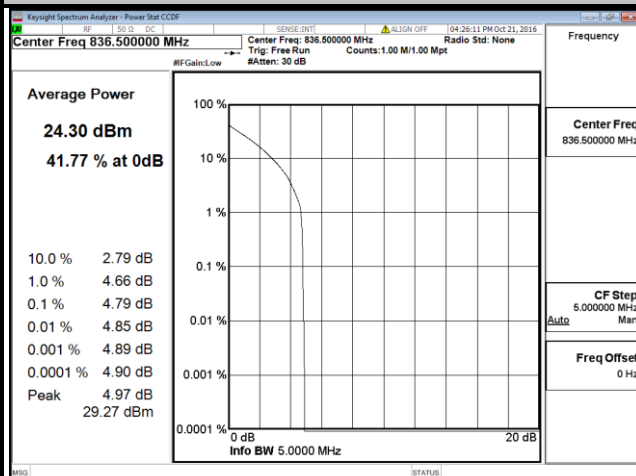


LTE Band 5

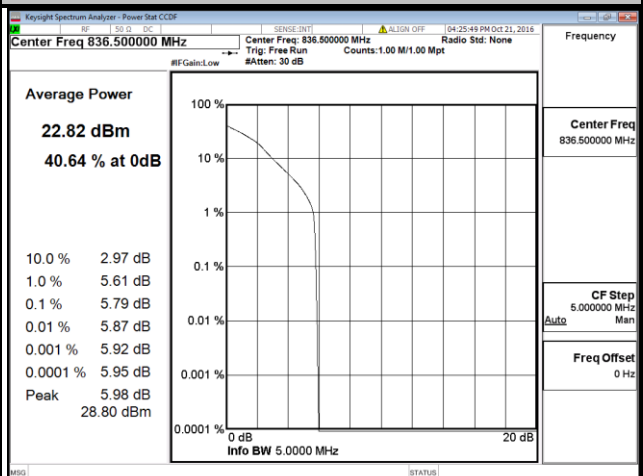
Channel Bandwidth: 1.4 MHz				Channel Bandwidth: 3 MHz			
Channel	Frequency (MHz)	Peak to Average Ratio (dB)		Channel	Frequency (MHz)	Peak to Average Ratio (dB)	
		QPSK	16QAM			QPSK	16QAM
20407	824.7	4.39	5.39	20415	825.5	4.40	5.41
20525	836.5	4.79	5.79	20525	836.5	4.90	5.82
20643	848.3	4.37	5.45	20635	847.5	4.58	5.62

Spectrum Plot of Worst Value

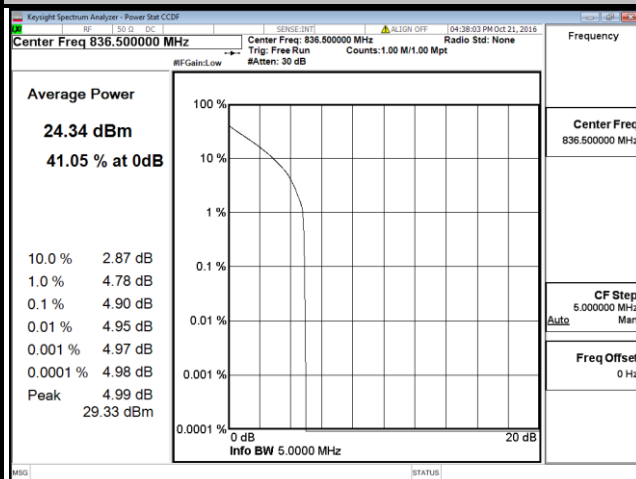
1.4 MHz / QPSK



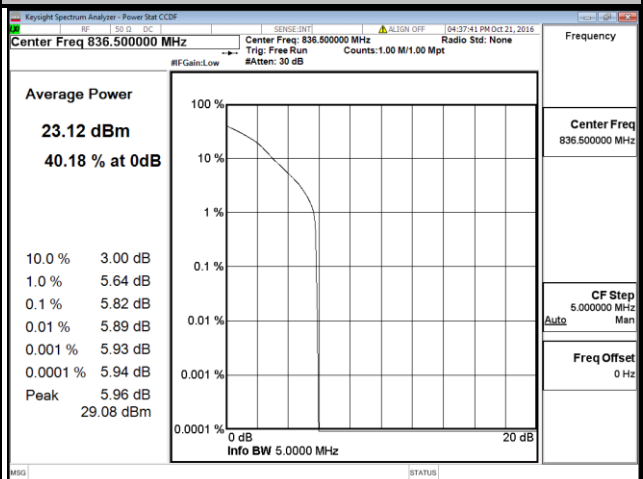
1.4 MHz / 16QAM



3 MHz / QPSK



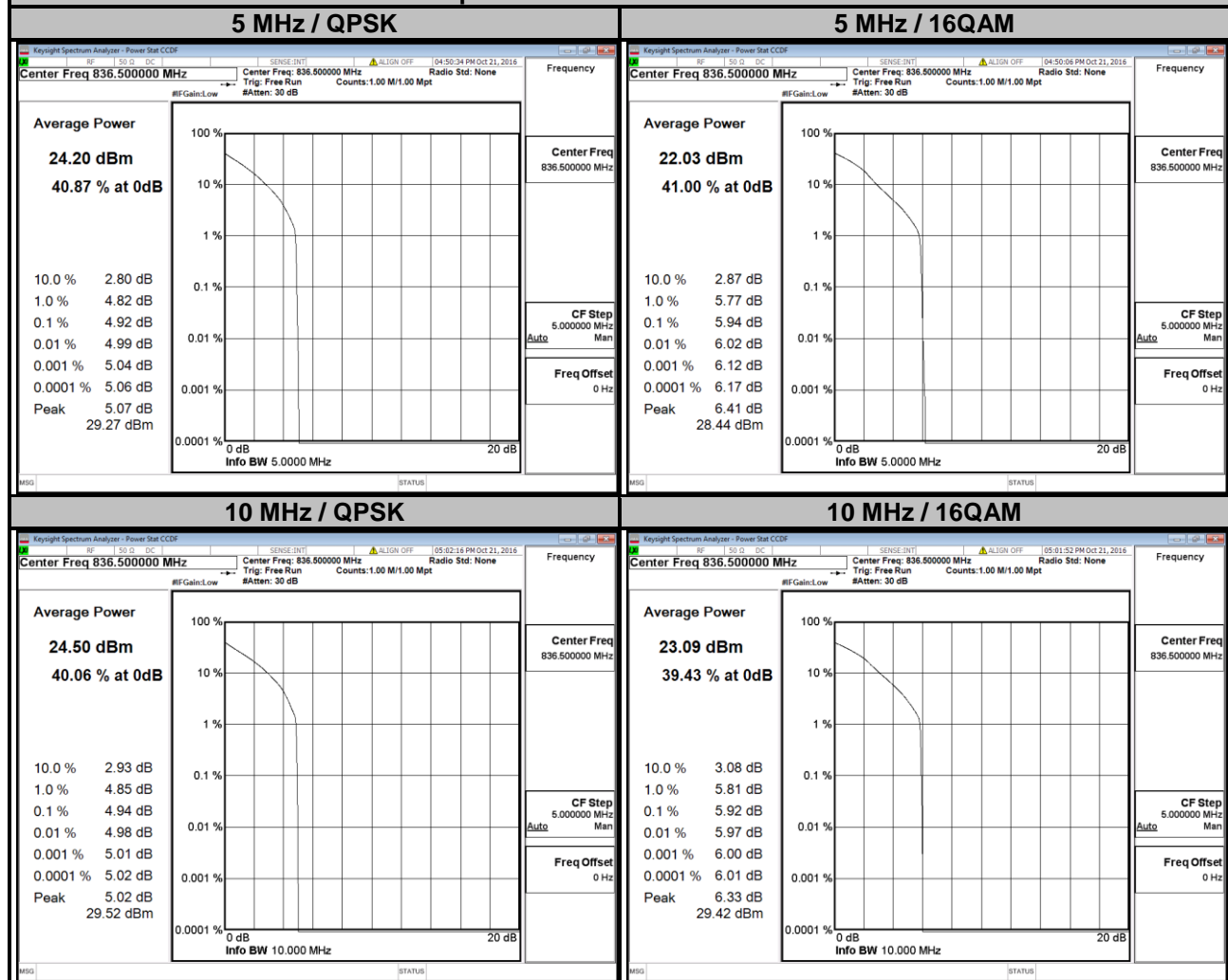
3 MHz / 16QAM



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	4.39	5.43	20450	829.0	4.37	5.38
20525	836.5	4.92	5.94	20525	836.5	4.94	5.92
20625	846.5	4.49	5.55	20600	844.0	4.26	5.24

Spectrum Plot of Worst Value

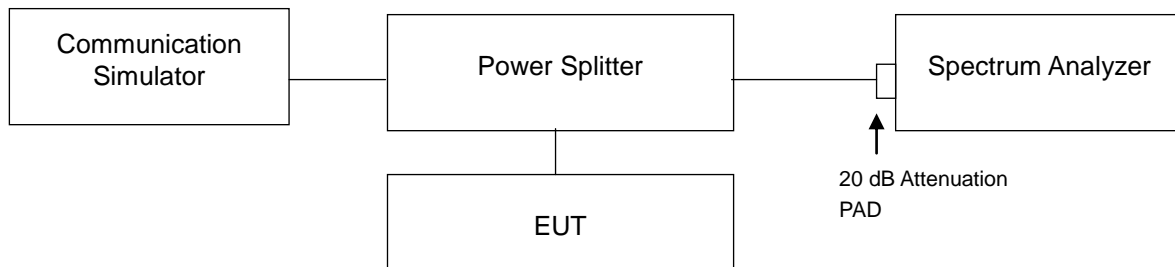


4.6 Conducted Spurious Emissions

4.6.1 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.

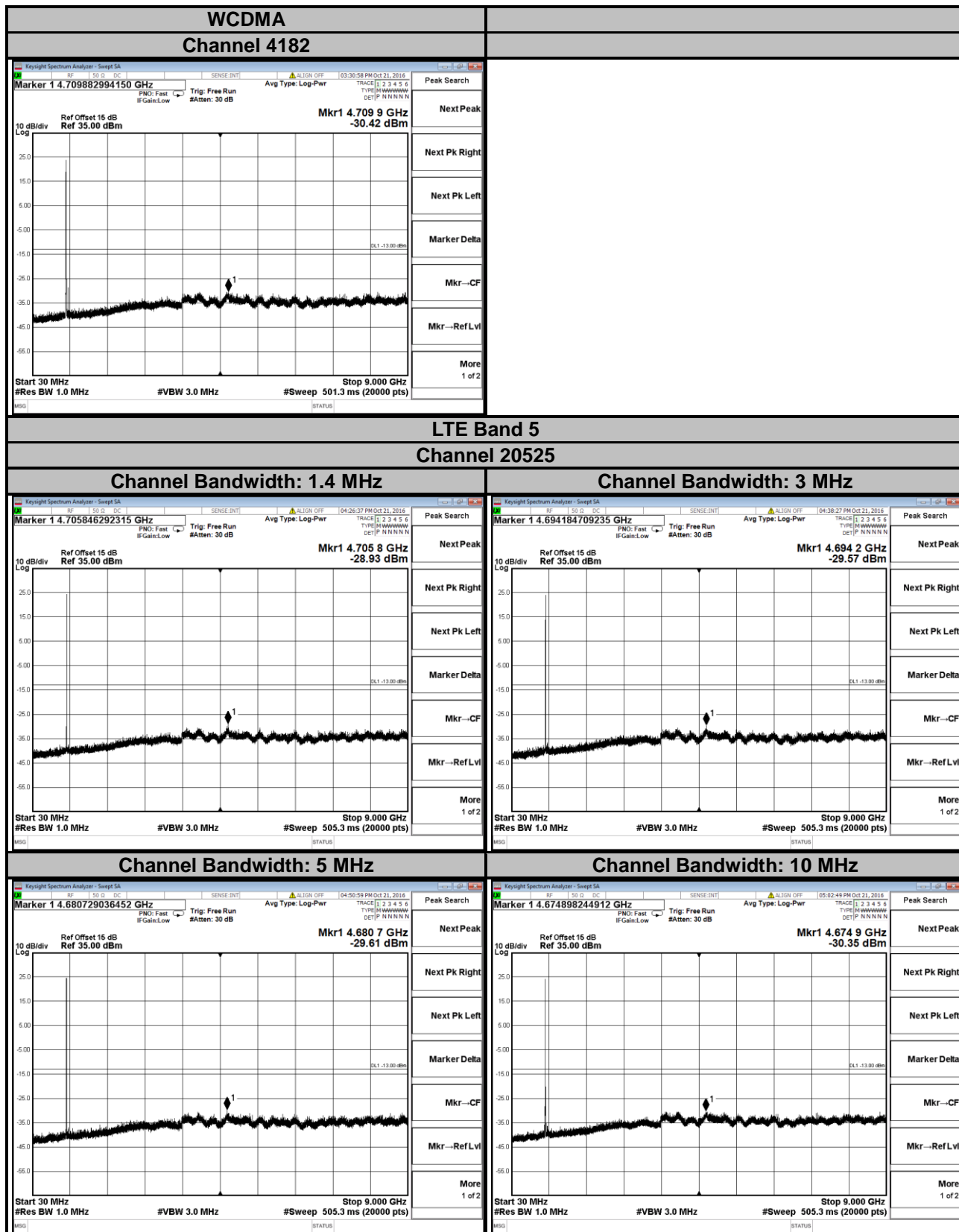
4.6.2 Test Setup



4.6.3 Test Procedure

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

4.6.4 Test Results



4.7 Radiated Emission Measurement

4.7.1 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.

4.7.2 Test Procedure

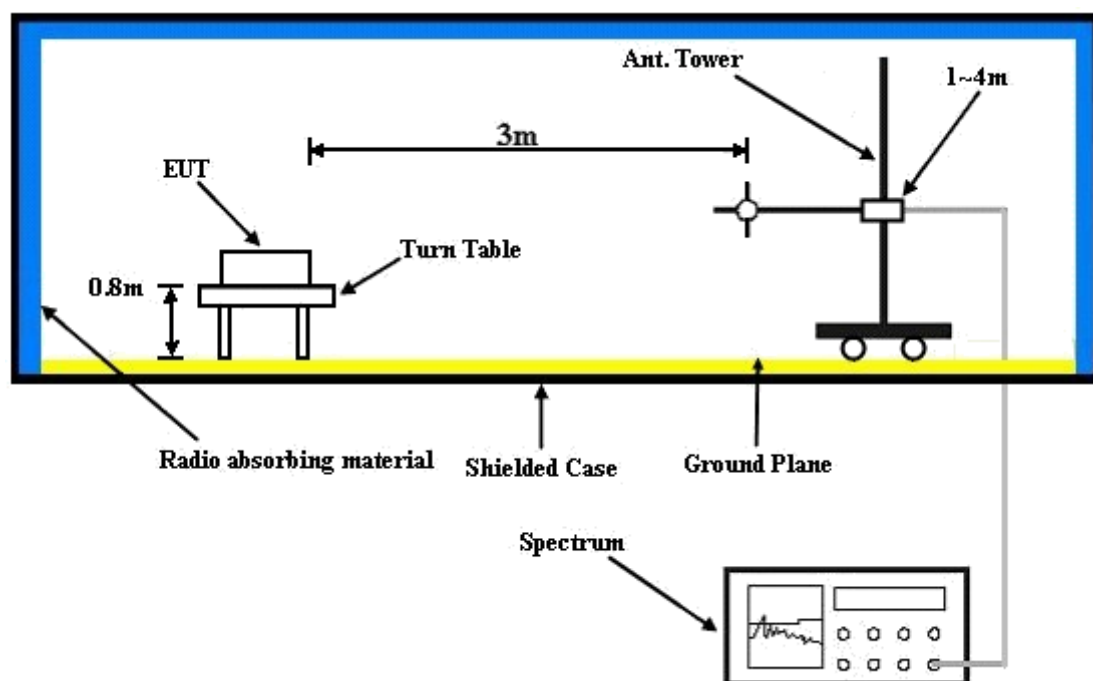
- Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- 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
- $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}.$
- E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, $E.R.P \text{ power} = E.I.R.P \text{ power} - 2.15 \text{ dBi}.$

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

4.7.3 Deviation from Test Standard

No deviation.

4.7.4 Test Setup



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

4.7.5 Test Results

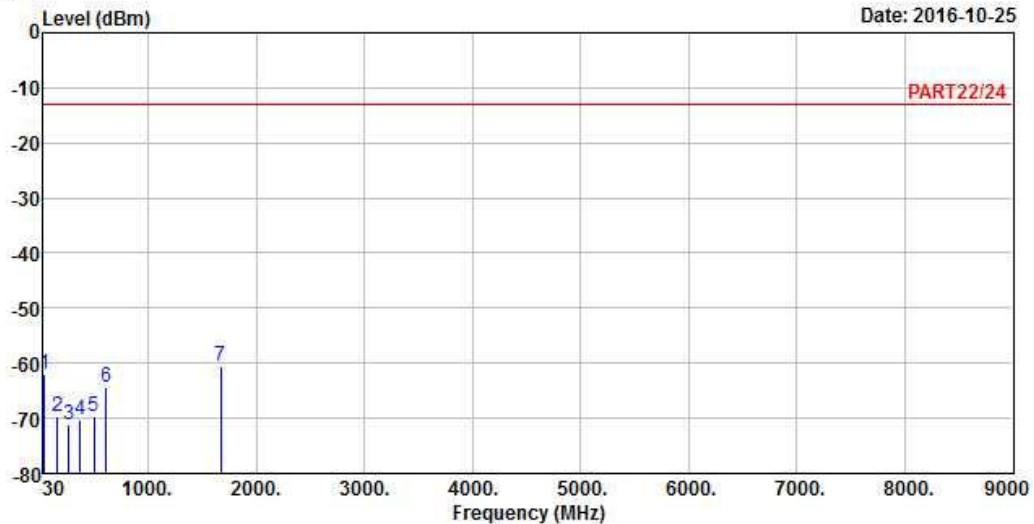
WCDMA:



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 5



Site : 966 Chamber 5
 Condition: PART22/24 HORIZONTAL
 Remak : WCDMA Band V Link
 Tested by: Getaz Yang

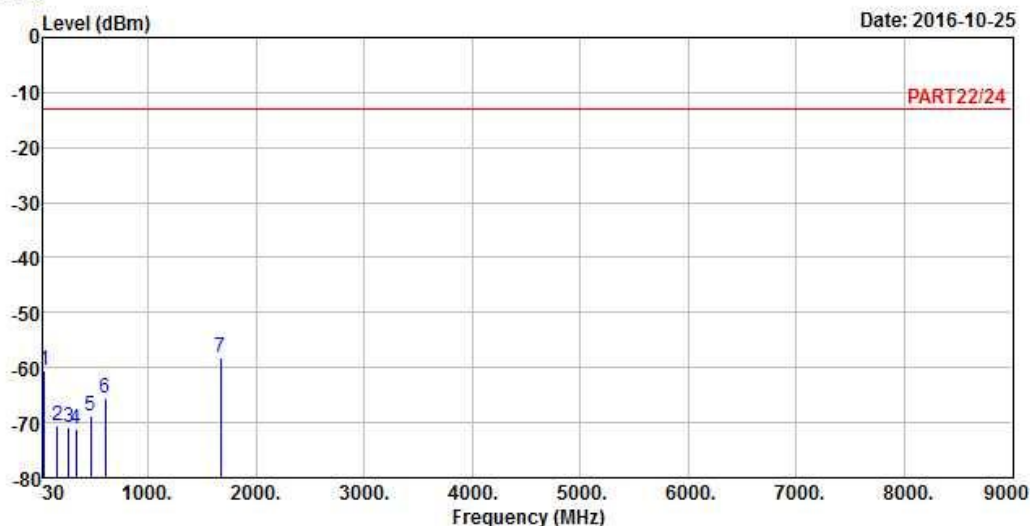
	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	42.61	-62.07	-61.13	-13.00	-49.07	-0.94	Peak
2	162.89	-69.68	-64.63	-13.00	-56.68	-5.05	Peak
3	266.68	-71.23	-64.90	-13.00	-58.23	-6.33	Peak
4	372.41	-70.35	-64.24	-13.00	-57.35	-6.11	Peak
5	498.51	-69.59	-64.94	-13.00	-56.59	-4.65	Peak
6	609.09	-64.48	-63.70	-13.00	-51.48	-0.78	Peak
7 pp	1672.80	-60.61	-45.93	-13.00	-47.61	-14.68	Peak



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 6



Site : 966 Chamber 5

Condition: PART22/24 VERTICAL

Remak : WCDMA Band V Link

Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	42.61	-60.65	-59.71	-13.00	-47.65	-0.94	Peak
2	159.98	-70.68	-65.84	-13.00	-57.68	-4.84	Peak
3	264.74	-70.84	-64.55	-13.00	-57.84	-6.29	Peak
4	336.52	-71.24	-64.79	-13.00	-58.24	-6.45	Peak
5	471.35	-68.81	-63.66	-13.00	-55.81	-5.15	Peak
6	603.27	-65.62	-64.86	-13.00	-52.62	-0.76	Peak
7 pp	1672.80	-58.08	-43.40	-13.00	-45.08	-14.68	Peak

LTE Band 5

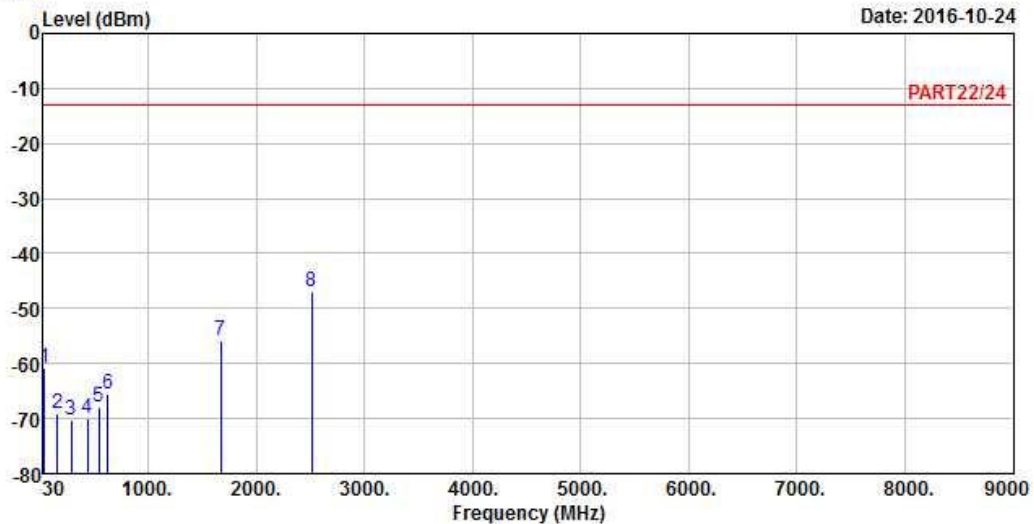
Channel Bandwidth: 10 MHz / QPSK



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 5



Site : 966 Chamber 5
 Condition: PART22/24 HORIZONTAL
 Remak : LTE Band V_QPSK_10M Link
 Tested by: Getaz Yang

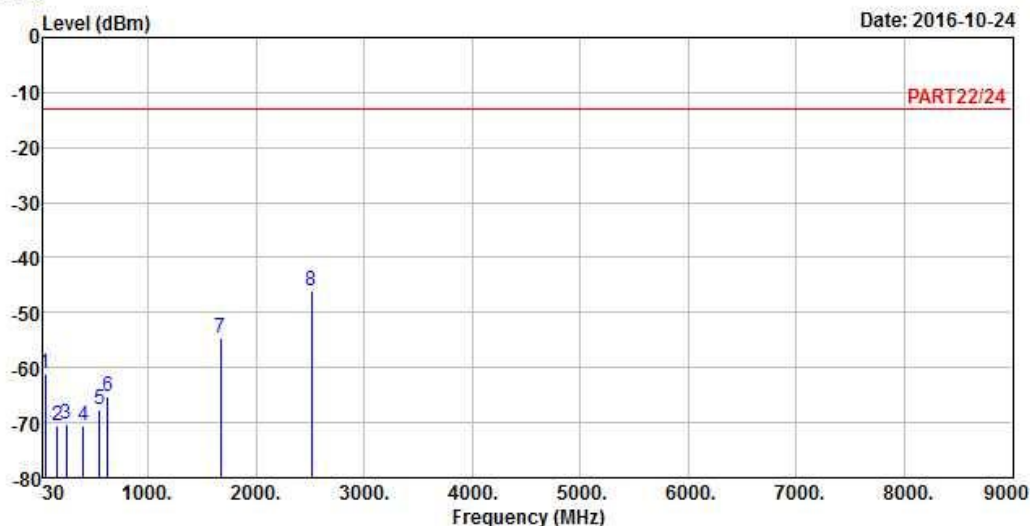
	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	42.61	-60.78	-59.84	-13.00	-47.78	-0.94	Peak
2	159.01	-69.21	-64.09	-13.00	-56.21	-5.12	Peak
3	284.14	-70.17	-63.48	-13.00	-57.17	-6.69	Peak
4	435.46	-69.82	-64.16	-13.00	-56.82	-5.66	Peak
5	544.10	-67.86	-64.80	-13.00	-54.86	-3.06	Peak
6	623.64	-65.66	-64.84	-13.00	-52.66	-0.82	Peak
7	1673.00	-55.70	-41.02	-13.00	-42.70	-14.68	Peak
8 pp	2509.50	-46.89	-35.98	-13.00	-33.89	-10.91	Peak



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 6



Site : 966 Chamber 5
Condition: PART22/24 VERTICAL
Remak : LTE Band V_QPSK_10M Link
Tested by: Getaz Yang

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	43.58	-61.19	-59.72	-13.00	-48.19	-1.47	Peak
2	159.98	-70.64	-65.80	-13.00	-57.64	-4.84	Peak
3	246.31	-70.22	-64.07	-13.00	-57.22	-6.15	Peak
4	402.48	-70.59	-64.66	-13.00	-57.59	-5.93	Peak
5	550.89	-67.56	-64.75	-13.00	-54.56	-2.81	Peak
6	624.61	-65.11	-64.29	-13.00	-52.11	-0.82	Peak
7	1673.00	-54.68	-40.00	-13.00	-41.68	-14.68	Peak
8 pp	2509.50	-46.04	-35.13	-13.00	-33.04	-10.91	Peak

5 Pictures of Test Arrangements

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

Appendix – Information on the Testing Laboratories

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

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

Linko EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565

Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety

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.

--- END ---