

FCC Test Report

(PART 27)

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FCC ID: 2AFZZ-RT3161

Test Model: 2015161

Received Date: Mar. 16, 2016

Test Date: Mar. 21, 2016 ~ Mar. 30, 2016

Issued Date: Apr. 22, 2016

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Release Control Record

Issue No.	Description	Date Issued
RF160316C04-8	Original Release	Apr. 22, 2016

1 Certificate of Conformity

Product: Mobile phone

Brand: MI

Test Model: 2015161

Sample Status: Identical Prototype

Applicant: Xiaomi Communications Co., Ltd.

Test Date: Mar. 21, 2016 ~ Mar. 30, 2016

Standards: FCC Part 27, Subpart C, L

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:** Apr. 22, 2016
Evonne Liu / Specialist

Approved by : Stanley Wu, **Date:** Apr. 22, 2016
Stanley Wu / Assistant Manager

2 Summary of Test Results

Applied Standard: FCC Part 27 & Part 2 (LTE 4)			
FCC Clause	Test Item	Result	Remarks
2.1046 27.50(d)(4)	Maximum Peak Output Power	Pass	Meet the requirement of limit.
2.1055 27.54	Frequency Stability	Pass	Meet the requirement of limit.
2.1049 27.53(h)	Occupied Bandwidth	Pass	Meet the requirement of limit.
27.50(d)(5)	Peak to Average Ratio	Pass	Meet the requirement of limit.
27.53(h)	Band Edge Measurements	Pass	Meet the requirement of limit.
2.1051 27.53(h)	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 27.53(h)	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -34.39 dB at 5197.50 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	2.0153 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	May 19, 2015	May 18, 2016
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 17, 2015	Dec. 16, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Jan. 07, 2016	Jan. 06, 2017
BILOG Antenna SCHWARZBECK	VULB 9168	9168-153	Jan. 07, 2016	Jan. 06, 2017
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Jan. 04, 2016	Jan. 03, 2017
HORN Antenna ETS-Lindgren	3117	00143293	Jan. 19, 2016	Jan. 18, 2017
Bluetooth Tester	CBT	100980	Apr. 27, 2015	Apr. 26, 2017
Loop Antenna	EM-6879	269	Jul. 31, 2015	Jul. 30, 2016
Agilent Communications Tester-Wireless	8960 Series 10	MY53201073	Jul. 03, 2015	Jul. 02, 2017
Preamplifier Agilent	310N	187226	Jun. 29, 2015	Jun. 28, 2016
Preamplifier Agilent	83017A	MY39501357	Jun. 29, 2015	Jun. 28, 2016
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170243	Jan. 20, 2016	Jan. 19, 2017
Power Meter Anritsu	ML2495A	1232002	Sep. 21, 2015	Sep. 20, 2016
Power Sensor Anritsu	MA2411B	1207325	Sep. 21, 2015	Sep. 20, 2016
RF signal cable ETS-LINDGREN	5D-FB	Cable-CH1-01(R FC-SMS-100-SM S-120+RFC-SMS -100-SMS-400)	Jun. 27, 2015	Jun. 26, 2016
RF signal cable ETS-LINDGREN	8D-FB	Cable-CH1-02(R FC-SMS-100-SM S-24)	Jun. 27, 2015	Jun. 26, 2016
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	Jul. 03, 2015	Jul. 02, 2017
Radio Communication Analyzer Anritsu	MT8820C	6201240432	Jul. 06, 2015	Jul. 05, 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 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 FCC Site Registration No. is 149147.
5. The IC Site Registration No. is IC7450I-1.

3 General Information

3.1 General Description of EUT

Product	Mobile phone	
Brand	MI	
Test Model	2015161	
Status of EUT	Identical Prototype	
Power Supply Rating	5.0 Vdc (adapter or host equipment) 3.85 Vdc (Li-ion battery)	
Modulation Type	LTE	QPSK, 16QAM
Frequency Range	LTE Band 4 (Channel Bandwidth: 1.4 MHz)	1710.7 ~ 1754.3 MHz
	LTE Band 4 (Channel Bandwidth: 3 MHz)	1711.5 ~ 1753.5 MHz
	LTE Band 4 (Channel Bandwidth: 5 MHz)	1712.5 ~ 1752.5 MHz
	LTE Band 4 (Channel Bandwidth: 10 MHz)	1715.0 ~ 1750.0 MHz
	LTE Band 4 (Channel Bandwidth: 15 MHz)	1717.5 ~ 1747.5 MHz
	LTE Band 4 (Channel Bandwidth: 20 MHz)	1720.0 ~ 1745.0 MHz
Emission Designator	LTE Band 4 (Channel Bandwidth: 1.4 MHz)	1M09G7D
	LTE Band 4 (Channel Bandwidth: 3 MHz)	2M70W7D
	LTE Band 4 (Channel Bandwidth: 5 MHz)	4M49G7D
	LTE Band 4 (Channel Bandwidth: 10 MHz)	8M96W7D
	LTE Band 4 (Channel Bandwidth: 15 MHz)	13M4G7D
	LTE Band 4 (Channel Bandwidth: 20 MHz)	17M9G7D
Max. EIRP Power	LTE Band 4 (Channel Bandwidth: 1.4 MHz)	132.13mW
	LTE Band 4 (Channel Bandwidth: 3 MHz)	136.77mW
	LTE Band 4 (Channel Bandwidth: 5 MHz)	155.78mW
	LTE Band 4 (Channel Bandwidth: 10 MHz)	144.11mW
	LTE Band 4 (Channel Bandwidth: 15 MHz)	151.95mW
	LTE Band 4 (Channel Bandwidth: 20 MHz)	155.13mW
Antenna Type	LDS Antenna	
Accessory Device	Refer to Note as below	
Data Cable Supplied	Refer to Note as below	

Note:

1. The EUT contains following accessory devices.

Product	Brand	Model	Description
Adapter	MI	MDY-08-EF	I/P: 100-240Vac, 50/60Hz, 500mA O/P: 5Vdc, 2A
Battery	MI	BM46	3.85Vdc, 4000mAh

USB Cable	MI	N/A	1.15m shielded cable w/o core
eMMC 1 (=ROM 1)	N/A	N/A	16G
eMMC 2 (=ROM 2)	N/A	N/A	32G

2. There're 2 configurations for the EUT listed as below.

Main sample: EUT + eMMC 1 (16G)

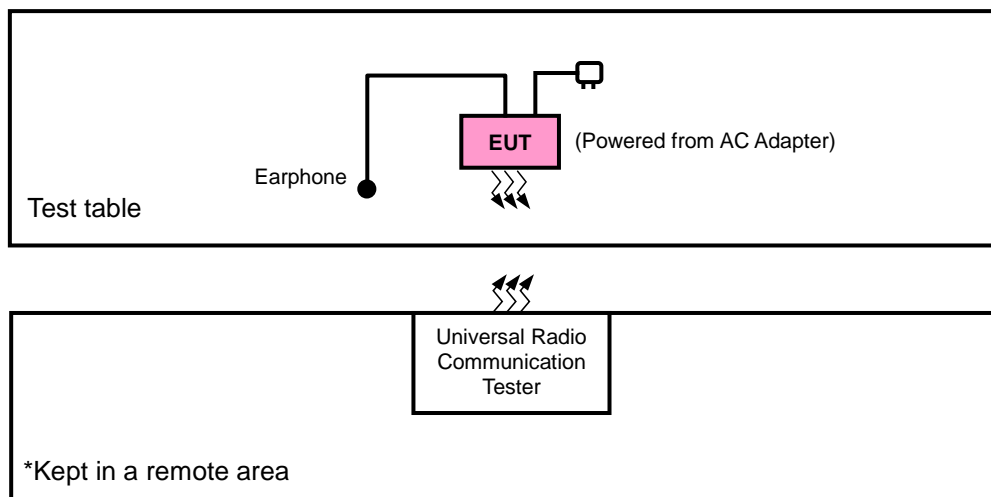
2nd sample: EUT + eMMC 1 (32G)

✧ Only the worst case data was presented in the report.

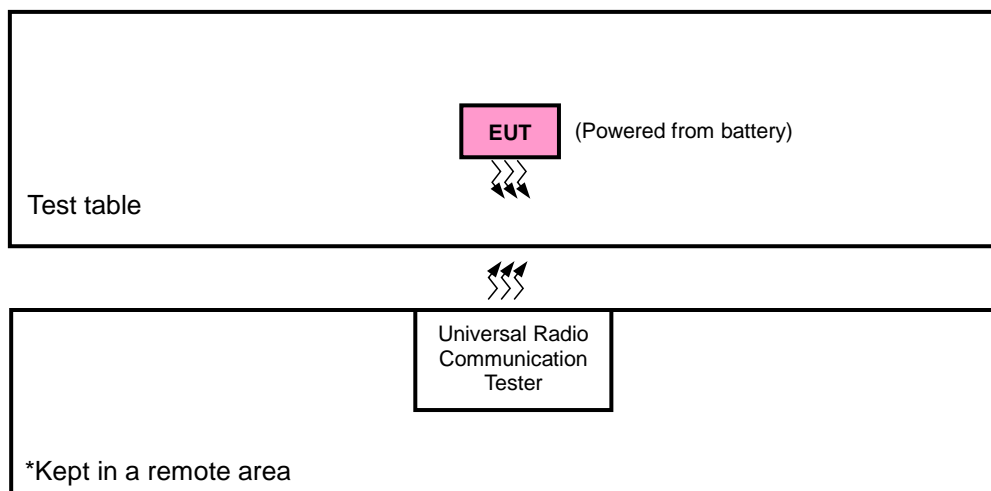
3. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Configuration of System under Test

<Radiated Emission Test>



<E.R.P. / E.I.R.P. Test>



3.2.1 Description of Support Units

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

tests.

No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Earphone	N/A	N/A	N/A	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:

EUT Configuration Mode	Radiated Emission
A	Main Sample
B	2 nd Sample

Band	EIRP	Radiated Emission
LTE Band 4	Y-plane (Mode A, B)	Y-axis (Mode A, B)

LTE Band 4

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
A	EIRP	19957 to 20393	19957, 20175, 20393	1.4 MHz	QPSK, 16QAM	1 RB / 5 RB Offset
		19965 to 20385	19965, 20175, 20385	3 MHz	QPSK, 16QAM	1 RB / 14 RB Offset
		19975 to 20375	19975, 20175, 20375	5 MHz	QPSK, 16QAM	1 RB / 24 RB Offset
		20000 to 20350	20000, 20175, 20350	10 MHz	QPSK, 16QAM	1 RB / 49 RB Offset
		20025 to 20325	20025, 20175, 20325	15 MHz	QPSK, 16QAM	1 RB / 74 RB Offset
		20050 to 20300	20050, 20175, 20300	20 MHz	QPSK, 16QAM	1 RB / 99 RB Offset
	Frequency Stability	19957 to 20393	20175	1.4 MHz	QPSK	1 RB / 5 RB Offset
		19965 to 20385	20175	3 MHz	QPSK	1 RB / 14 RB Offset
		19975 to 20375	20175	5 MHz	QPSK	1 RB / 24 RB Offset
		20000 to 20350	20175	10 MHz	QPSK	1 RB / 49 RB Offset
		20025 to 20325	20175	15 MHz	QPSK	1 RB / 74 RB Offset
		20050 to 20300	20175	20 MHz	QPSK	1 RB / 99 RB Offset
	Occupied Bandwidth	19957 to 20393	19957, 20175, 20393	1.4 MHz	QPSK, 16QAM	6 RB / 0 RB Offset
		19965 to 20385	19965, 20175, 20385	3 MHz	QPSK, 16QAM	15 RB / 0 RB Offset
		19975 to 20375	19975, 20175, 20375	5 MHz	QPSK, 16QAM	25 RB / 0 RB Offset
		20000 to 20350	20000, 20175, 20350	10 MHz	QPSK, 16QAM	50 RB / 0 RB Offset
		20025 to 20325	20025, 20175, 20325	15 MHz	QPSK, 16QAM	75 RB / 0 RB Offset
		20050 to 20300	20050, 20175, 20300	20 MHz	QPSK, 16QAM	100 RB / 0 RB Offset
	Peak to Average Ratio	19957 to 20393	19957, 20175, 20393	1.4 MHz	QPSK, 16QAM	1 RB / 2 RB Offset
		19965 to 20385	19965, 20175, 20385	3 MHz	QPSK, 16QAM	1 RB / 7 RB Offset



		19975 to 20375	19975, 20175, 20375	5 MHz	QPSK, 16QAM	12 RB / 0 RB Offset
		20000 to 20350	20000, 20175, 20350	10 MHz	QPSK, 16QAM	1 RB / 24 RB Offset
		20025 to 20325	20025, 20175, 20325	15 MHz	QPSK, 16QAM	36 RB / 0 RB Offset
		20050 to 20300	20050, 20175, 20300	20 MHz	QPSK, 16QAM	50 RB / 0 RB Offset

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
A	Band Edge	19957 to 20393	19957	1.4 MHz	QPSK	1 RB / 0 RB Offset
						6 RB / 0 RB Offset
			20393	1.4 MHz	QPSK	1 RB / 5 RB Offset
						6 RB / 0 RB Offset
		19965 to 20385	19965	3 MHz	QPSK	1 RB / 0 RB Offset
						15 RB / 0 RB Offset
			20385	3 MHz	QPSK	1 RB / 14 RB Offset
						15 RB / 0 RB Offset
		19975 to 20375	19975	5 MHz	QPSK	1 RB / 0 RB Offset
						25 RB / 0 RB Offset
			20375	5 MHz	QPSK	1 RB / 24 RB Offset
						25 RB / 0 RB Offset
		20000 to 20350	20000	10 MHz	QPSK	1 RB / 0 RB Offset
						50 RB / 0 RB Offset
			20350	10 MHz	QPSK	1 RB / 49 RB Offset
						50 RB / 0 RB Offset
		20025 to 20325	20025	15 MHz	QPSK	1 RB / 0 RB Offset
						75 RB / 0 RB Offset
			20325	15 MHz	QPSK	1 RB / 74 RB Offset
						75 RB / 0 RB Offset
		20050 to 20300	20050	20 MHz	QPSK	1 RB / 0 RB Offset
						100 RB / 0 RB Offset
	Conducted Emission	19957 to 20393	20175	1.4 MHz	QPSK	1 RB / 2 RB Offset
		19965 to 20385	20175	3 MHz	QPSK	1 RB / 7 RB Offset
		19975 to 20375	20175	5 MHz	QPSK	12 RB / 0 RB Offset
		20000 to 20350	20175	10 MHz	QPSK	50 RB / 0 RB Offset
		20025 to 20325	20175	15 MHz	QPSK	36 RB / 0 RB Offset
		20050 to 20300	20175	20 MHz	QPSK	50 RB / 0 RB Offset
B	EIRP	20050 to 20300	20050, 20175, 20300	20 MHz	QPSK, 16QAM	1 RB / 99 RB Offset
	Radiated Emission	20050 to 20300	20175	20 MHz	QPSK	1 RB / 99 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 / EIRP	25 deg. C, 65 % RH	3.85 Vdc	Karl Lee
Frequency Stability	25 deg. C, 65 % RH	3.85 Vdc	Taylor Liu
Occupied Bandwidth	25 deg. C, 65 % RH	3.85 Vdc	Taylor Liu
Band Edge	25 deg. C, 65 % RH	3.85 Vdc	Taylor Liu
Peak to Average Ratio	25 deg. C, 65 % RH	3.85 Vdc	Taylor Liu
Conducuted Emission	25 deg. C, 65 % RH	3.85 Vdc	Taylor Liu
Radiated Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	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 27

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

Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP.

4.1.2 Test Procedures

EIRP / ERP Measurement:

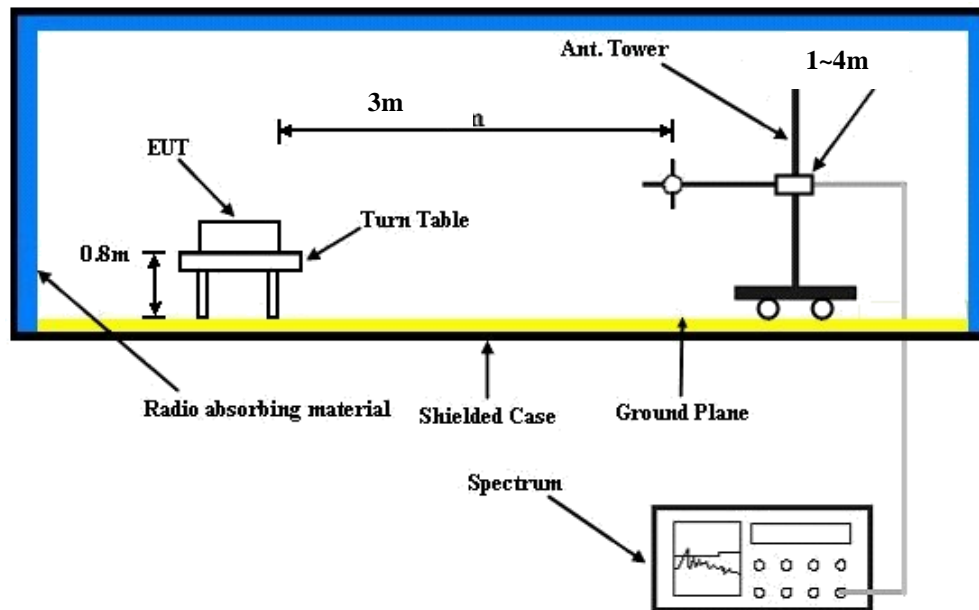
- a. All measurements were done at low, middle and high operational frequency range. RBW and VBW is 5 MHz for WCDMA and 10 MHz for LTE mode.
- b. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m height of Turn Table, rotated the table around 360 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 form 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:

- a. The EUT was set up for the maximum power with LTE link data modulation and link up with simulator.
- b. 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 / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 19957	Mid Ch 20175	High Ch 20393		Low Ch 19957	Mid Ch 20175	High Ch 20393	
			1710.7 MHz	1732.5 MHz	1754.3 MHz		1710.7 MHz	1732.5 MHz	1754.3 MHz	
4 / 1.4M	1	0	22.14	22.26	22.42	0	21.15	21.30	21.46	1
	1	2	22.75	22.87	22.97	0	21.74	21.91	22.00	1
	1	5	22.23	22.30	22.42	0	21.26	21.36	21.46	1
	3	0	21.73	21.84	22.03	0	20.68	20.84	21.14	1
	3	1	21.64	21.78	21.98	0	20.56	20.80	20.95	1
	3	3	21.54	21.64	21.82	0	20.55	20.61	20.73	1
	6	0	21.69	21.91	22.07	1	20.65	20.91	21.07	2

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 19965	Mid Ch 20175	High Ch 20385		Low Ch 19965	Mid Ch 20175	High Ch 20385	
			1711.5 MHz	1732.5 MHz	1753.5 MHz		1711.5 MHz	1732.5 MHz	1753.5 MHz	
4 / 3M	1	0	22.23	22.30	22.44	0	21.30	21.36	21.49	1
	1	7	22.82	22.91	22.98	0	21.90	21.98	22.05	1
	1	14	22.15	22.35	22.58	0	21.22	21.41	21.60	1
	8	0	21.34	21.40	21.64	1	20.35	20.43	20.68	2
	8	3	21.22	21.36	21.53	1	20.20	20.39	20.56	2
	8	7	21.16	21.25	21.45	1	20.14	20.26	20.43	2
	15	0	21.30	21.47	21.62	1	20.31	20.56	20.65	2

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 19975	Mid Ch 20175	High Ch 20375		Low CH 19975	Mid CH 20175	High CH 20375	
			1712.5 MHz	1732.5 MHz	1752.5 MHz		1712.5 MHz	1732.5 MHz	1752.5 MHz	
4 / 5M	1	0	22.34	22.40	22.54	0	21.33	21.42	21.57	1
	1	12	22.91	22.99	23.06	0	21.98	22.04	22.10	1
	1	24	22.31	22.46	22.61	0	21.27	21.48	21.72	1
	12	0	21.46	21.56	21.72	1	20.41	20.50	20.79	2
	12	6	21.41	21.51	21.65	1	20.36	20.47	20.61	2
	12	13	21.35	21.41	21.58	1	20.28	20.32	20.50	2
	25	0	21.54	21.62	21.71	1	20.36	20.57	20.66	2

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 20000	Mid Ch 20175	High Ch 20350		Low Ch 20000	Mid Ch 20175	High Ch 20350	
			1715.0 MHz	1732.5 MHz	1750.0 MHz		1715.0 MHz	1732.5 MHz	1750.0 MHz	
4 / 10M	1	0	22.42	22.48	22.60	0	21.42	21.53	21.63	1
	1	24	22.86	23.01	23.09	0	21.94	22.08	22.14	1
	1	49	22.42	22.52	22.58	0	21.49	21.57	21.67	1
	25	0	21.59	21.66	21.85	1	20.58	20.66	20.92	2
	25	12	21.52	21.63	21.77	1	20.47	20.63	20.77	2
	25	25	21.47	21.53	21.71	1	20.41	20.51	20.70	2
	50	0	21.64	21.73	21.82	1	20.55	20.72	20.82	2

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 20025	Mid Ch 20175	High Ch 20325		Low Ch 20025	Mid Ch 20175	High Ch 20325	
			1717.5 MHz	1732.5 MHz	1747.5 MHz		1717.5 MHz	1732.5 MHz	1747.5 MHz	
4 / 15M	1	0	22.51	22.57	22.69	0	21.50	21.61	21.71	1
	1	37	23.05	23.09	23.15	0	22.07	22.13	22.19	1
	1	74	22.49	22.62	22.77	0	21.52	21.65	21.81	1
	36	0	21.73	21.80	21.95	1	20.70	20.79	20.97	2
	36	19	21.66	21.77	21.86	1	20.62	20.76	20.85	2
	36	39	21.63	21.69	21.77	1	20.57	20.64	20.74	2
	75	0	21.74	21.84	21.91	1	20.73	20.84	20.91	2

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 20050	Mid Ch 20175	High Ch 20300		Low Ch 20050	Mid Ch 20175	High Ch 20300	
			1720.0 MHz	1732.5 MHz	1745.0 MHz		1720.0 MHz	1732.5 MHz	1745.0 MHz	
4 / 20M	1	0	22.59	22.65	22.74	0	21.58	21.65	21.76	1
	1	50	23.07	23.14	23.19	0	22.04	22.18	22.24	1
	1	99	22.60	22.68	22.81	0	21.54	21.70	21.83	1
	50	0	21.85	21.91	22.03	1	20.84	20.89	21.05	2
	50	25	21.81	21.89	21.96	1	20.75	20.87	20.96	2
	50	50	21.77	21.82	21.93	1	20.72	20.78	20.86	2
	100	0	21.87	21.95	22.04	1	20.84	20.93	20.98	2

Mode A
EIRP Power (dBm)

LTE Band 4							
Channel Bandwidth: 1.4 MHz / QPSK							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
Y	19957	1710.7	-21.38	42.49	21.11	128.97	H
	20175	1732.5	-21.21	42.33	21.12	129.33	
	20393	1754.3	-20.89	42.10	21.21	132.13	
	19957	1710.7	-25.25	42.99	17.74	59.43	V
	20175	1732.5	-25.65	42.74	17.09	51.17	
	20393	1754.3	-25.17	42.21	17.04	50.58	
Channel Bandwidth: 1.4 MHz / 16QAM							
Y	19957	1710.7	-22.31	42.49	20.18	104.11	H
	20175	1732.5	-21.87	42.33	20.46	111.10	
	20393	1754.3	-21.75	42.10	20.35	108.39	
	19957	1710.7	-26.21	42.99	16.78	47.64	V
	20175	1732.5	-25.86	42.74	16.88	48.75	
	20393	1754.3	-26.10	42.21	16.11	40.83	

LTE Band 4							
Channel Bandwidth: 3 MHz / QPSK							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
Y	19965	1711.5	-21.22	42.49	21.27	133.81	H
	20175	1732.5	-21.31	42.33	21.02	126.39	
	20385	1753.5	-20.74	42.10	21.36	136.77	
	19965	1711.5	-25.54	42.99	17.45	55.59	V
	20175	1732.5	-25.38	42.74	17.36	54.45	
	20385	1753.5	-25.21	42.21	17.00	50.12	
Channel Bandwidth: 3 MHz / 16QAM							
Y	19965	1711.5	-22.38	42.49	20.11	102.45	H
	20175	1732.5	-21.89	42.33	20.44	110.59	
	20385	1753.5	-21.36	42.10	20.74	118.58	
	19965	1711.5	-26.38	42.99	16.61	45.81	V
	20175	1732.5	-25.97	42.74	16.77	47.53	
	20385	1753.5	-26.07	42.21	16.14	41.11	

LTE Band 4							
Channel Bandwidth: 5 MHz / QPSK							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
Y	19975	1712.5	-20.56	42.49	21.93	155.78	H
	20175	1732.5	-20.87	42.33	21.46	139.86	
	20375	1752.5	-21.08	42.10	21.02	126.47	
	19975	1712.5	-25.33	42.99	17.66	58.34	V
	20175	1732.5	-25.51	42.74	17.23	52.84	
	20375	1752.5	-24.75	42.21	17.46	55.72	
Channel Bandwidth: 5 MHz / 16QAM							
Y	19975	1712.5	-21.71	42.49	20.78	119.54	H
	20175	1732.5	-21.85	42.33	20.48	111.61	
	20375	1752.5	-21.93	42.10	20.17	103.99	
	19975	1712.5	-26.18	42.99	16.81	47.97	V
	20175	1732.5	-25.94	42.74	16.80	47.86	
	20375	1752.5	-26.08	42.21	16.13	41.02	

LTE Band 4							
Channel Bandwidth: 10 MHz / QPSK							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
Y	20000	1715.0	-21.18	42.49	21.31	135.05	H
	20175	1732.5	-20.74	42.33	21.59	144.11	
	20350	1750.0	-20.59	42.10	21.51	141.58	
	20000	1715.0	-25.15	42.99	17.84	60.81	V
	20175	1732.5	-25.38	42.74	17.36	54.45	
	20350	1750.0	-24.82	42.21	17.39	54.83	
Channel Bandwidth: 10 MHz / 16QAM							
Y	20000	1715.0	-21.90	42.49	20.59	114.42	H
	20175	1732.5	-21.36	42.33	20.97	124.94	
	20350	1750.0	-21.75	42.10	20.35	108.39	
	20000	1715.0	-26.28	42.99	16.71	46.88	V
	20175	1732.5	-25.95	42.74	16.79	47.75	
	20350	1750.0	-25.28	42.21	16.93	49.32	

LTE Band 4							
Channel Bandwidth: 15 MHz / QPSK							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
Y	20025	1717.5	-21.38	42.49	21.11	128.97	H
	20175	1732.5	-20.51	42.33	21.82	151.95	
	20325	1747.5	-20.42	42.10	21.68	147.23	
	20025	1717.5	-25.08	42.99	17.91	61.80	V
	20175	1732.5	-25.15	42.74	17.59	57.41	
	20325	1747.5	-24.62	42.21	17.59	57.41	
Channel Bandwidth: 15 MHz / 16QAM							
Y	20025	1717.5	-21.85	42.49	20.64	115.74	H
	20175	1732.5	-21.95	42.33	20.38	109.07	
	20325	1747.5	-21.74	42.10	20.36	108.64	
	20025	1717.5	-26.59	42.99	16.40	43.65	V
	20175	1732.5	-26.71	42.74	16.03	40.09	
	20325	1747.5	-25.89	42.21	16.32	42.85	

LTE Band 4							
Channel Bandwidth: 20 MHz / QPSK							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
Y	20050	1720.0	-21.17	42.49	21.32	135.36	H
	20175	1732.5	-20.42	42.33	21.91	155.13	
	20300	1745.0	-20.37	42.10	21.73	148.94	
	20050	1720.0	-25.02	42.99	17.97	62.66	V
	20175	1732.5	-25.09	42.74	17.65	58.21	
	20300	1745.0	-24.37	42.21	17.84	60.81	
Channel Bandwidth: 20 MHz / 16QAM							
Y	20050	1720.0	-21.85	42.49	20.64	115.74	H
	20175	1732.5	-21.76	42.33	20.57	113.95	
	20300	1745.0	-21.69	42.10	20.41	109.90	
	20050	1720.0	-26.25	42.99	16.74	47.21	V
	20175	1732.5	-25.87	42.74	16.87	48.64	
	20300	1745.0	-25.39	42.21	16.82	48.08	

Mode B

LTE Band 4							
Channel Bandwidth: 20 MHz / QPSK							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
Y	20050	1720.0	-21.55	42.49	20.94	124.02	H
	20175	1732.5	-21.36	42.33	20.97	124.94	
	20300	1745.0	-20.97	42.10	21.13	129.72	
	20050	1720.0	-25.81	42.99	17.18	52.24	V
	20175	1732.5	-25.72	42.74	17.02	50.35	
	20300	1745.0	-25.36	42.21	16.85	48.42	
Channel Bandwidth: 20 MHz / 16QAM							
Y	20050	1720.0	-22.65	42.49	19.84	96.27	H
	20175	1732.5	-22.74	42.33	19.59	90.93	
	20300	1745.0	-22.59	42.10	19.51	89.33	
	20050	1720.0	-27.05	42.99	15.94	39.26	V
	20175	1732.5	-26.87	42.74	15.87	38.64	
	20300	1745.0	-26.92	42.21	15.29	33.81	

4.2 Frequency Stability Measurement

4.2.1 Limits of Frequency Stability Measurement

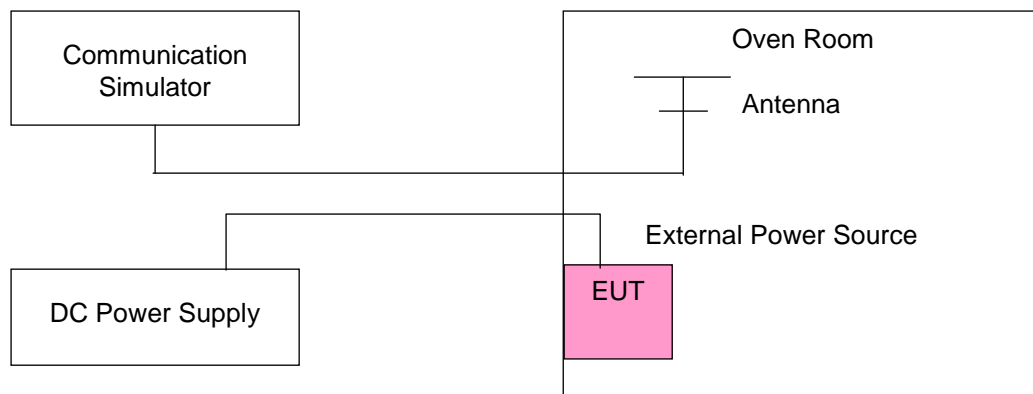
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

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)
	LTE Band 4						
	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
3.85	0.001	0.002	0.002	0.001	0.000	0.000	2.5
3.7	0.001	0.000	0.002	0.002	0.002	0.002	2.5
4.35	0.001	0.000	0.001	0.002	0.002	0.001	2.5

NOTE: The applicant defined the normal working voltage of the battery is from 3.7 Vdc to 4.35 Vdc.

Frequency Error vs. Temperature

Temp. (°C)	Frequency Error (ppm)						Limit (ppm)
	LTE Band 4						
	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
-30	0.001	-0.002	-0.001	-0.002	0.001	0.002	2.5
-20	0.001	0.000	0.000	-0.001	0.002	0.000	2.5
-10	0.001	0.002	0.002	0.002	0.001	0.001	2.5
0	0.002	0.001	0.000	0.001	0.002	0.001	2.5
10	0.002	0.002	0.002	0.001	-0.001	0.002	2.5
20	-0.001	0.001	0.001	0.002	-0.001	-0.001	2.5
30	0.000	0.002	0.000	-0.001	0.000	-0.001	2.5
40	-0.002	-0.002	-0.002	-0.001	-0.001	0.000	2.5
50	-0.002	-0.002	-0.002	-0.001	-0.001	-0.002	2.5

4.3 Occupied Bandwidth Measurement

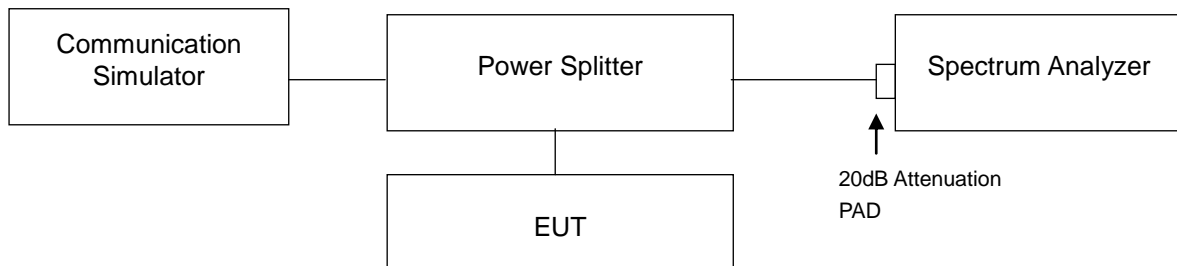
4.3.1 Limits of Occupied Bandwidth Measurement

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

4.3.2 Test Procedure

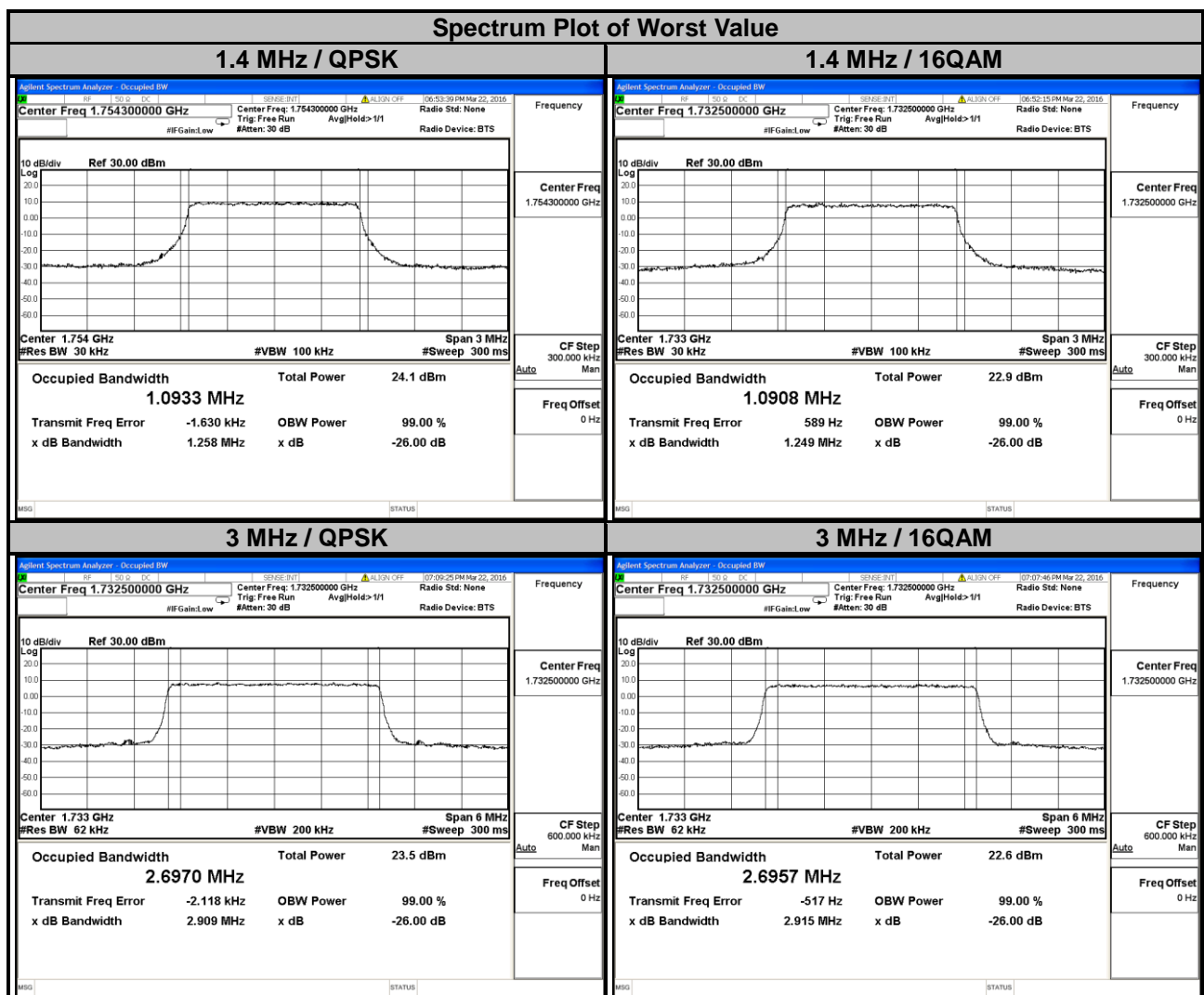
- The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.
- Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

4.3.3 Test Setup



4.3.4 Test Result

LTE Band 4							
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
19957	1710.7	1.0903	1.0898	19965	1711.5	2.6953	2.6943
20175	1732.5	1.0916	1.0908	20175	1732.5	2.6970	2.6957
20393	1754.3	1.0933	1.0899	20385	1753.5	2.6950	2.6957



LTE Band 4

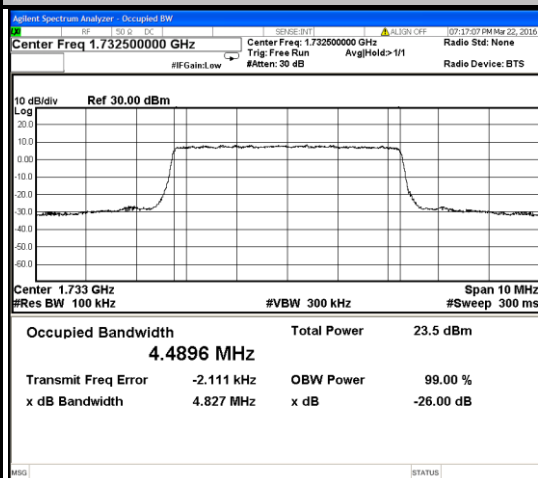
Channel Bandwidth: 5 MHz

Channel Bandwidth: 10 MHz

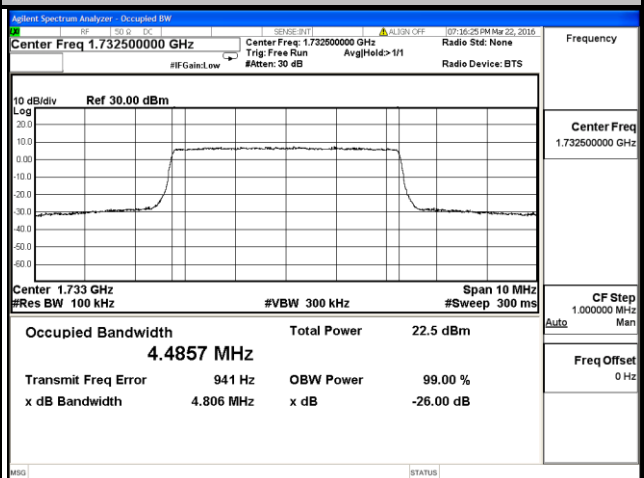
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	
		QPSK	16QAM			QPSK	16QAM
19975	1712.5	4.4859	4.4849	20000	1715.0	8.9570	8.9544
20175	1732.5	4.4896	4.4857	20175	1732.5	8.9550	8.9482
20375	1752.5	4.4882	4.4842	20350	1750.0	8.9470	8.9524

Spectrum Plot of Worst Value

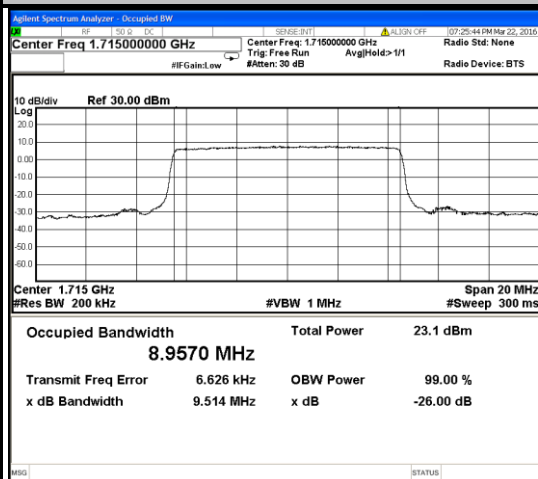
5 MHz / QPSK



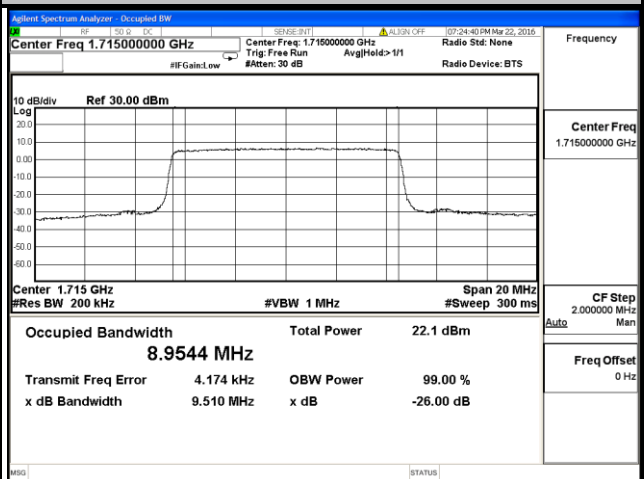
5 MHz / 16QAM



10 MHz / QPSK



10 MHz / 16QAM



LTE BAND 4

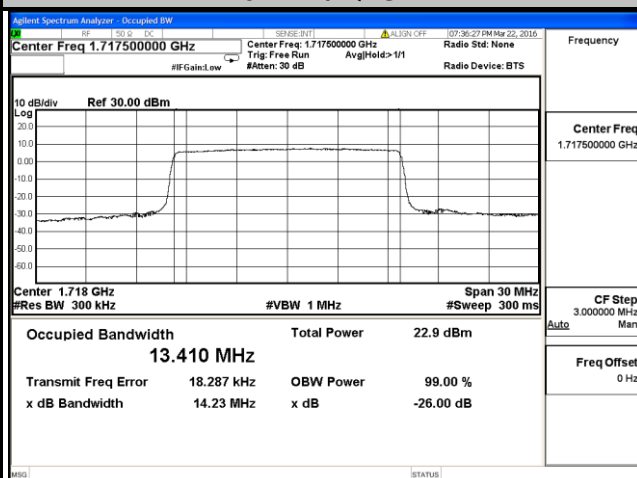
Channel Bandwidth: 15 MHz

Channel Bandwidth: 20 MHz

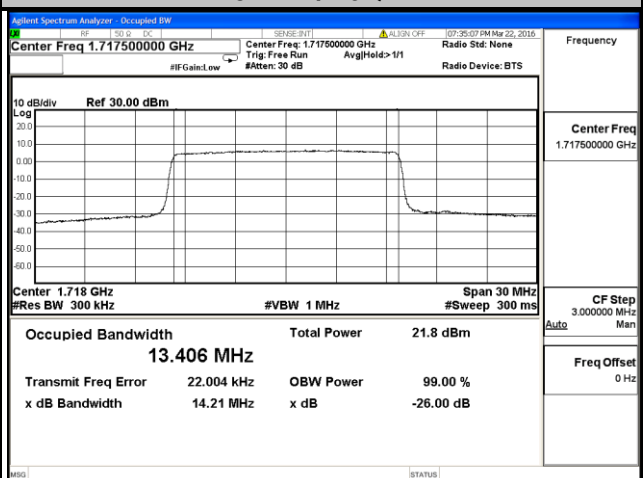
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	
		QPSK	16QAM			QPSK	16QAM
20025	1717.5	13.410	13.406	20050	1720.0	17.885	17.901
20175	1732.5	13.402	13.398	20175	1732.5	17.864	17.882
20325	1747.5	13.408	13.403	20300	1745.0	17.899	17.913

Spectrum Plot of Worst Value

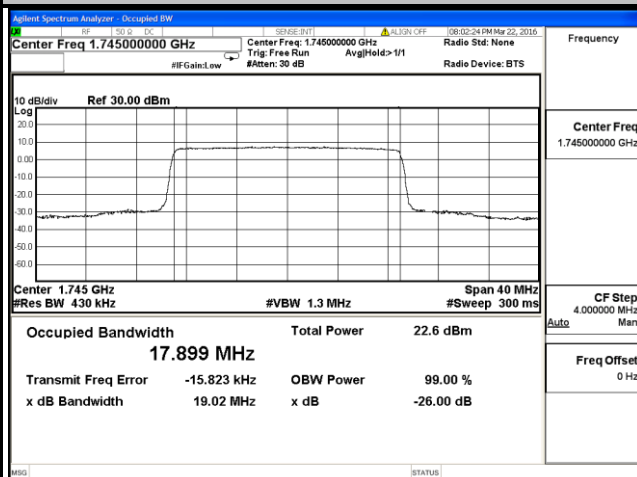
15 MHz / QPSK



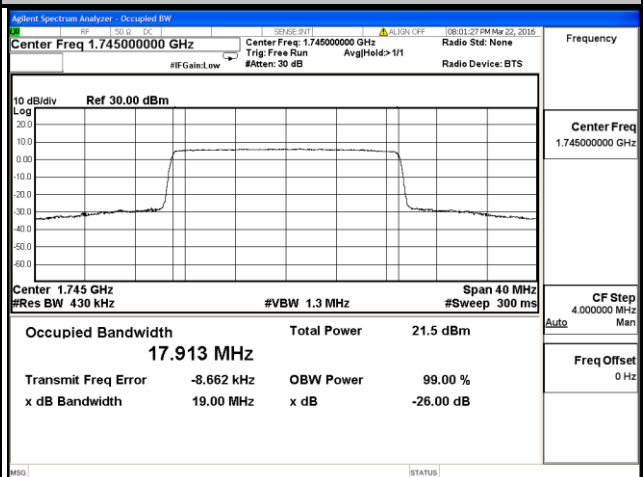
15 MHz / 16QAM



20 MHz / QPSK



20 MHz / 16QAM

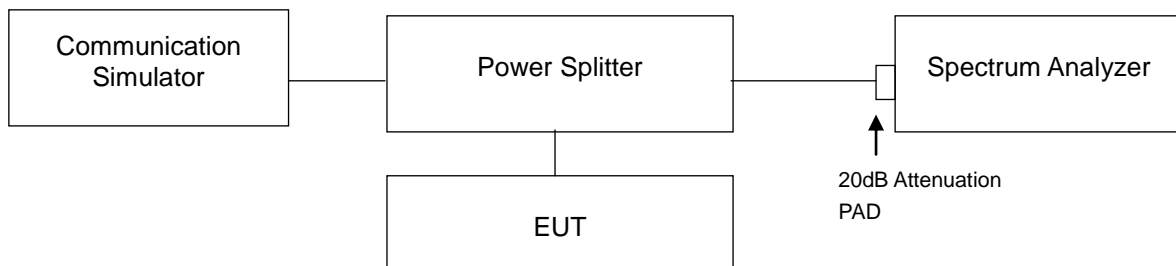


4.4 Band Edge Measurement

4.4.1 Limits of Band Edge Measurement

For operations in the 1710–1755 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.

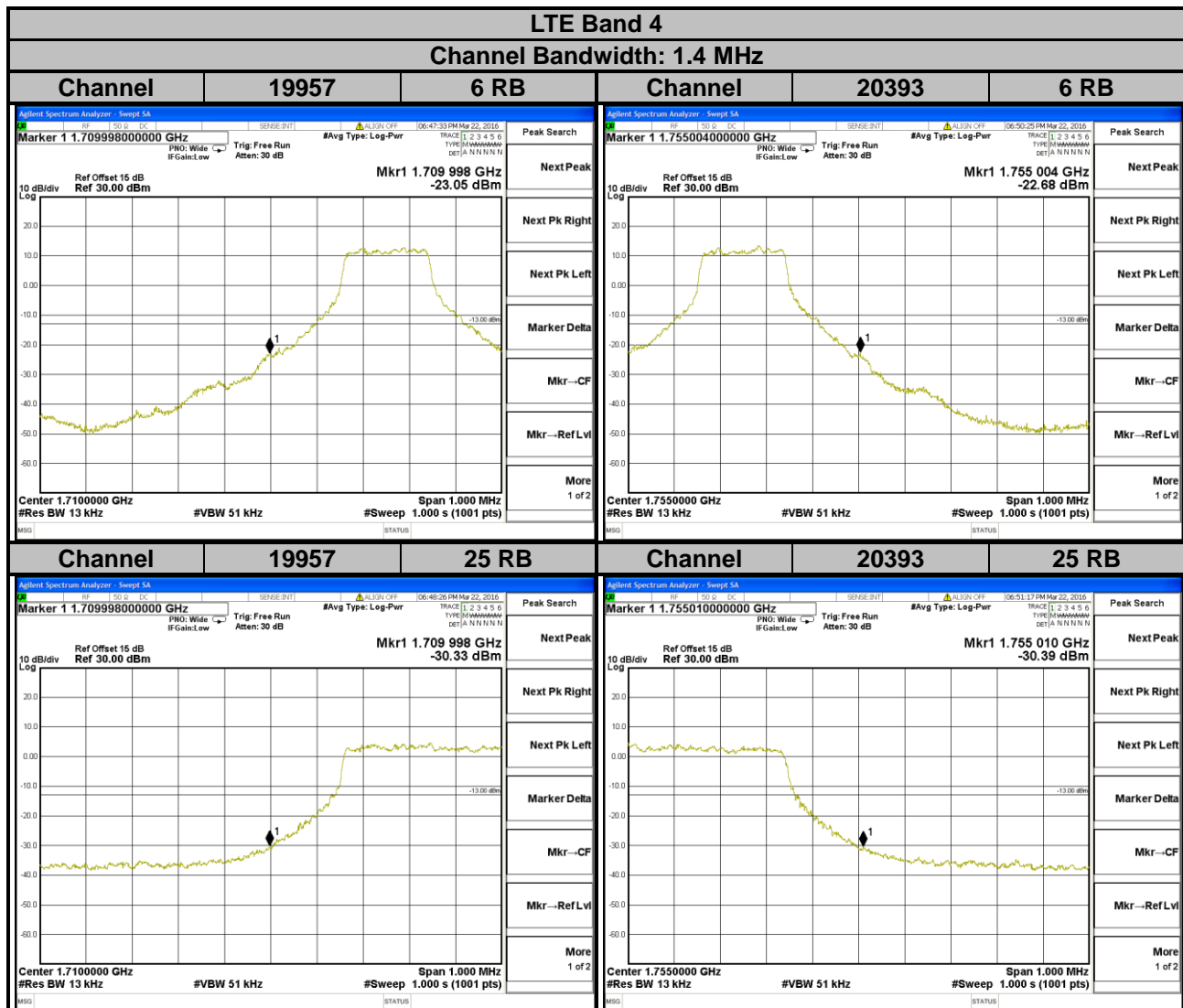
4.4.2 Test Setup



4.4.3 Test Procedures

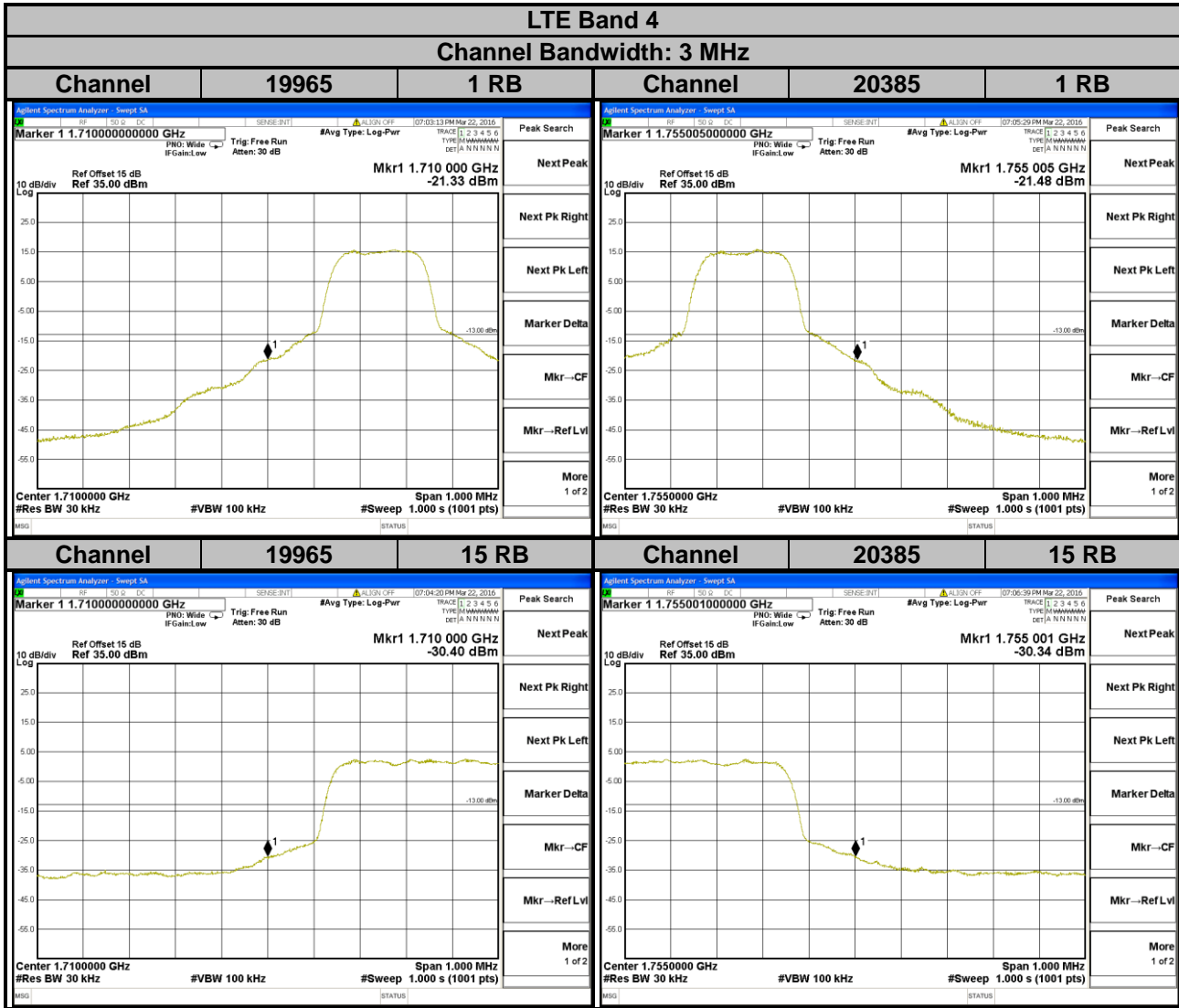
- All measurements were done at low and high operational frequency range.
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 13 kHz and VB of the spectrum is 51 kHz (LTE Bandwidth 1.4 MHz).
- The center frequency of spectrum is the band edge frequency 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).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 150 kHz and VB of the spectrum is 470 kHz (LTE Bandwidth 15 MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 180 kHz and VB of the spectrum is 560 kHz (LTE Bandwidth 20 MHz).
- Record the max trace plot into the test report.

4.4.4 Test Results



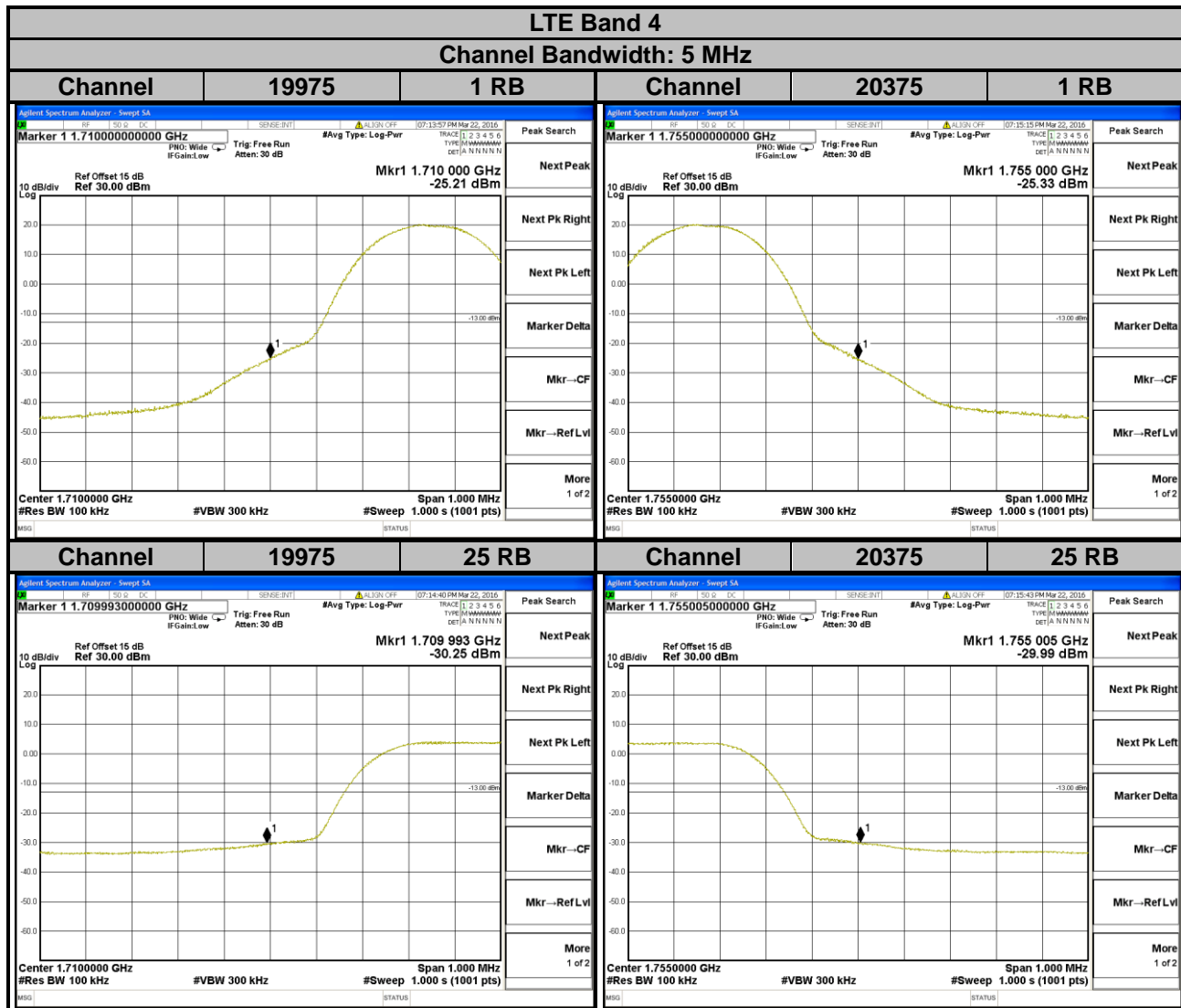


A D T



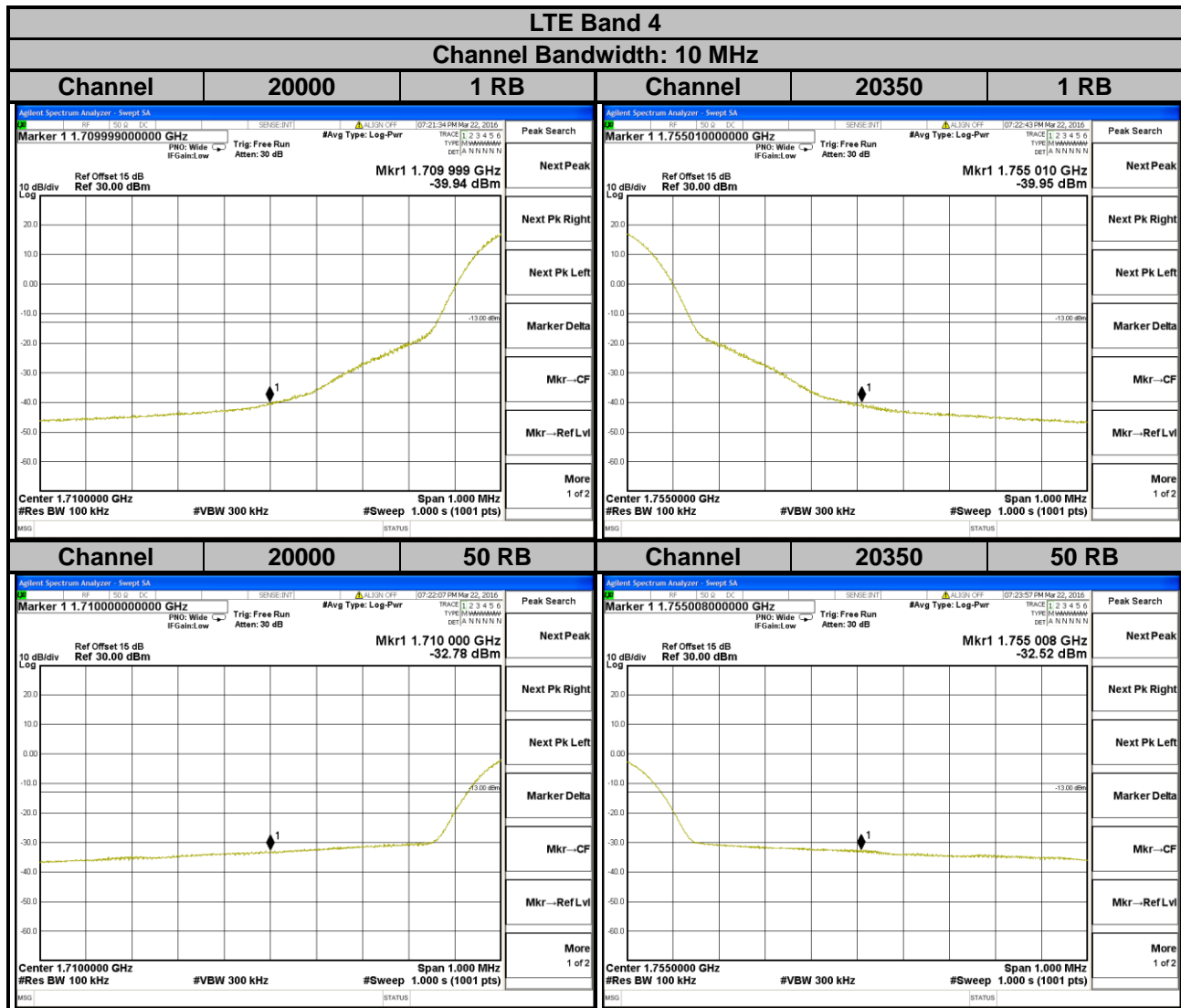


A D T



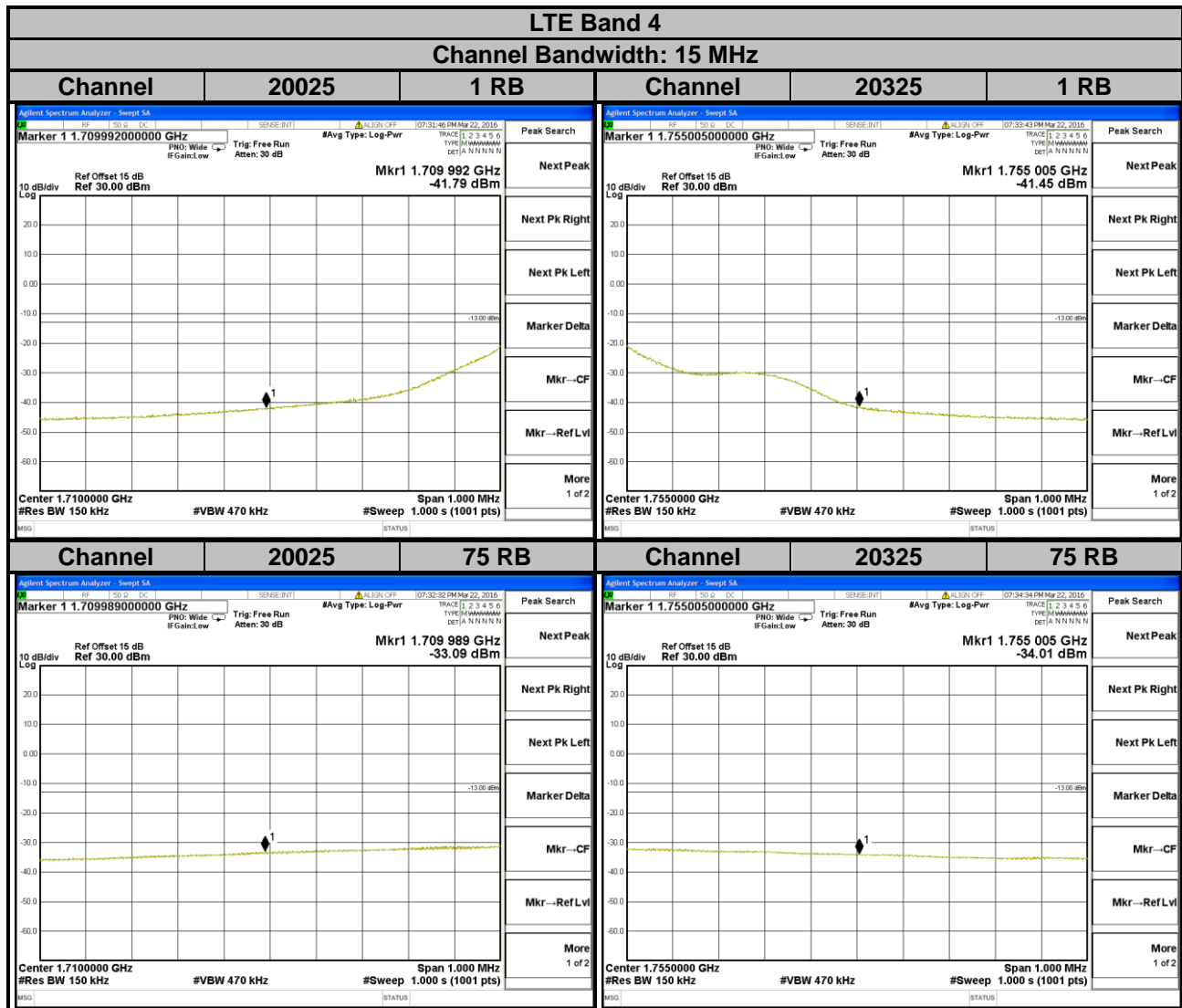


A D T



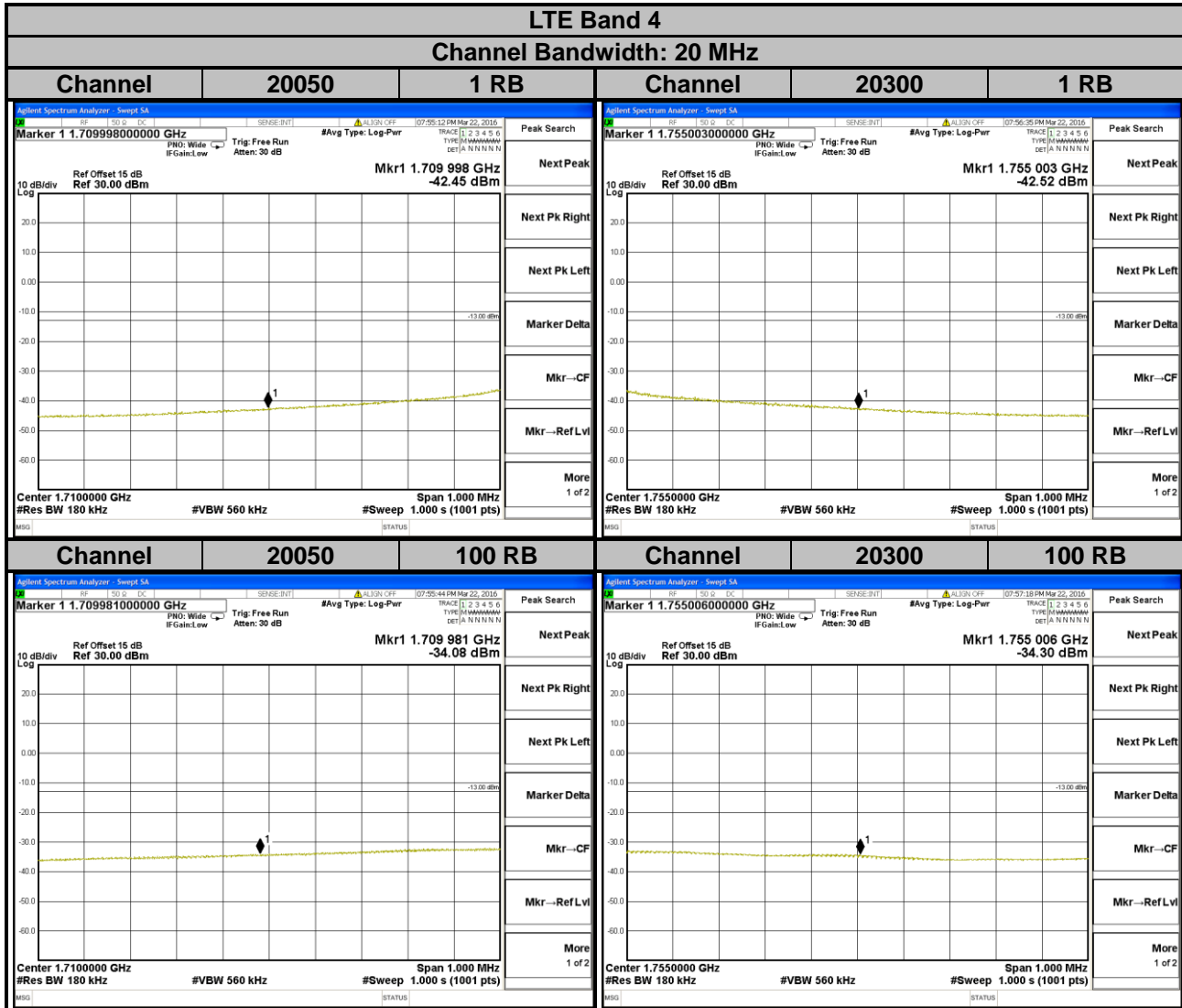


A D T





A D T

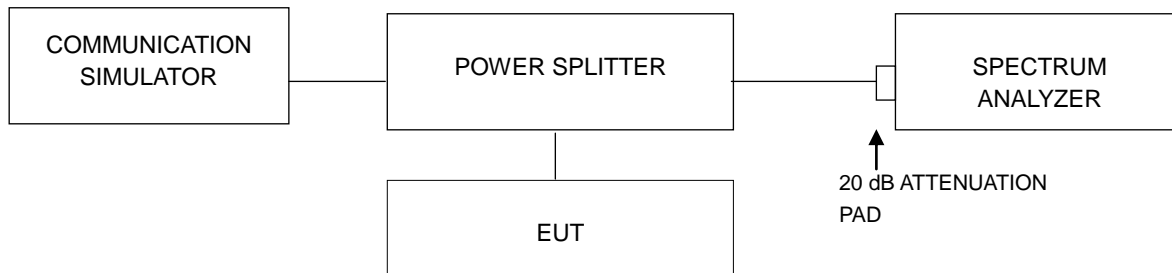


4.5 Peak to Average Ratio

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

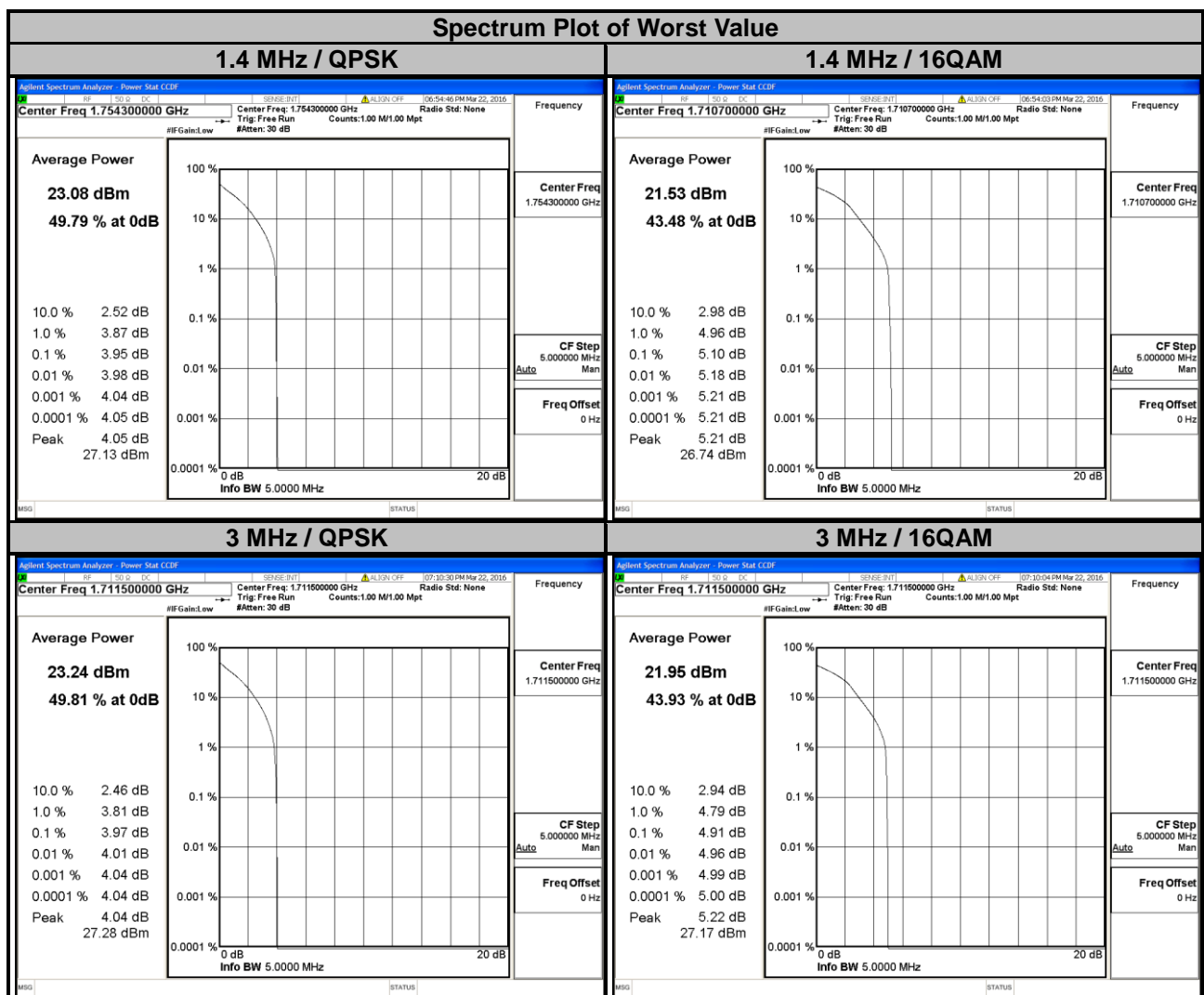


4.5.3 Test Procedures

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

LTE Band 4							
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
19957	1710.7	3.85	5.10	19965	1711.5	3.97	4.91
20175	1732.5	3.61	4.64	20175	1732.5	3.45	4.58
20393	1754.3	3.95	4.88	20385	1753.5	3.87	4.79



LTE Band 4

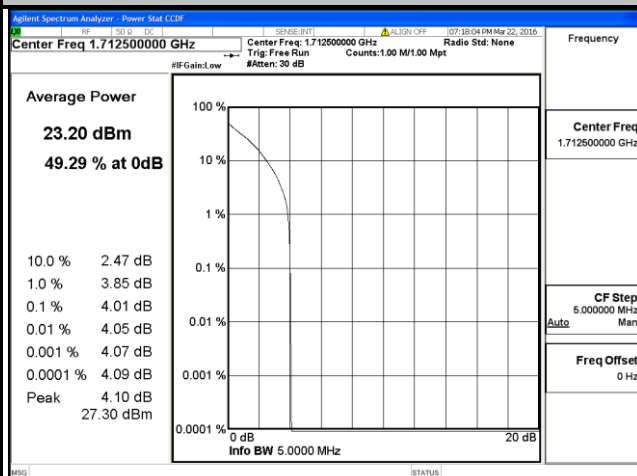
Channel Bandwidth: 5 MHz

Channel Bandwidth: 10 MHz

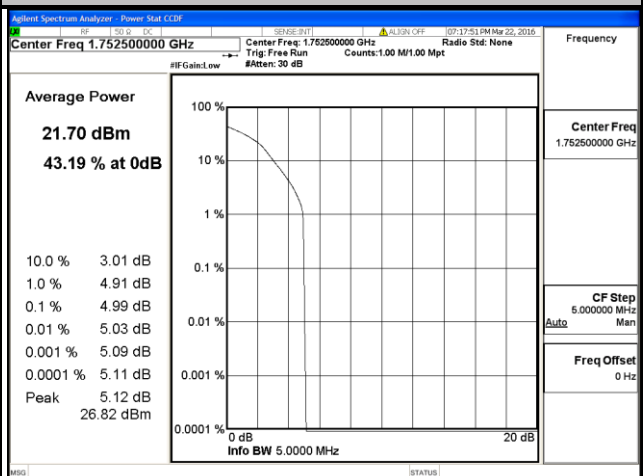
Channel	Frequency (MHz)	Peak to Average Ratio (dB)		Channel	Frequency (MHz)	Peak to Average Ratio (dB)	
		QPSK	16QAM			QPSK	16QAM
19975	1712.5	4.01	4.98	20000	1715.0	3.98	5.04
20175	1732.5	3.41	4.49	20175	1732.5	3.33	4.36
20375	1752.5	3.90	4.99	20350	1750.0	3.97	5.03

Spectrum Plot of Worst Value

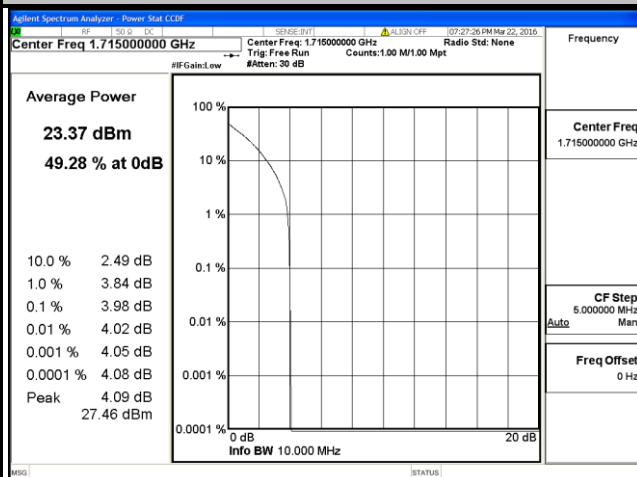
5 MHz / QPSK



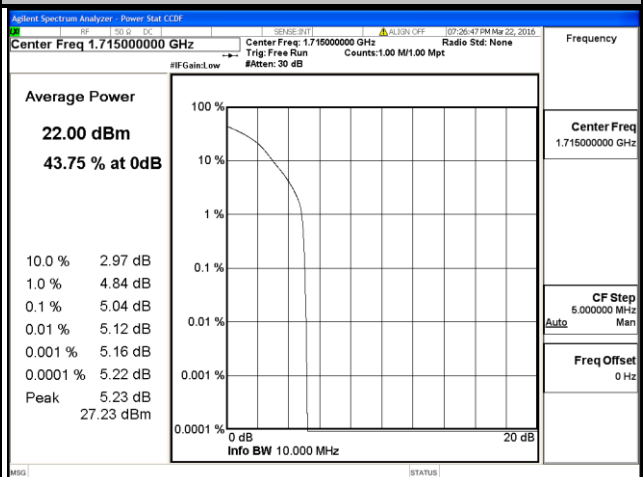
5 MHz / 16QAM



10 MHz / QPSK



10 MHz / 16QAM



LTE Band 4

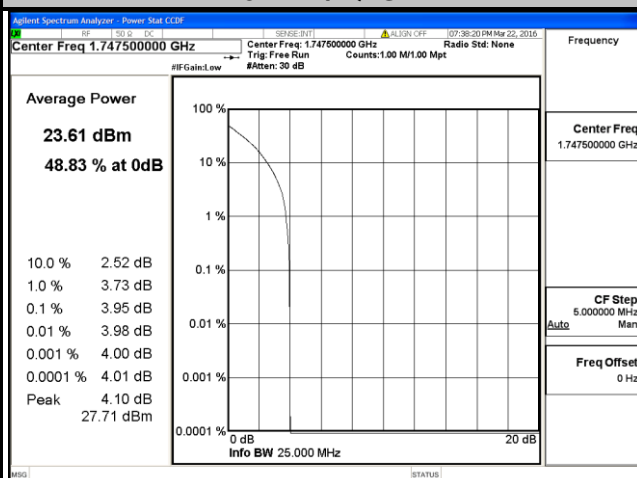
Channel Bandwidth: 15 MHz

Channel Bandwidth: 20 MHz

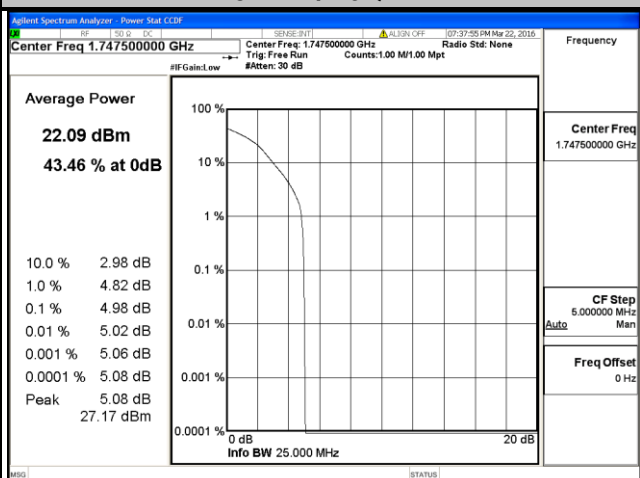
Channel	Frequency (MHz)	Peak to Average Ratio (dB)		Channel	Frequency (MHz)	Peak to Average Ratio (dB)	
		QPSK	16QAM			QPSK	16QAM
20025	1717.5	3.92	5.05	20050	1720.0	3.82	4.99
20175	1732.5	3.06	4.16	20175	1732.5	2.97	4.20
20325	1747.5	3.95	4.98	20300	1745.0	3.88	4.94

Spectrum Plot of Worst Value

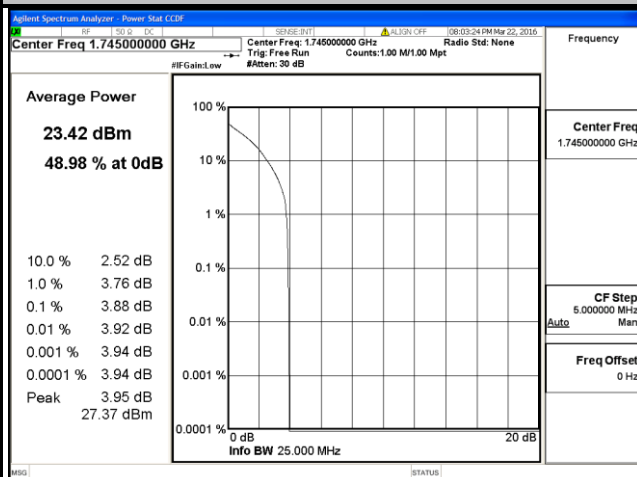
15 MHz / QPSK



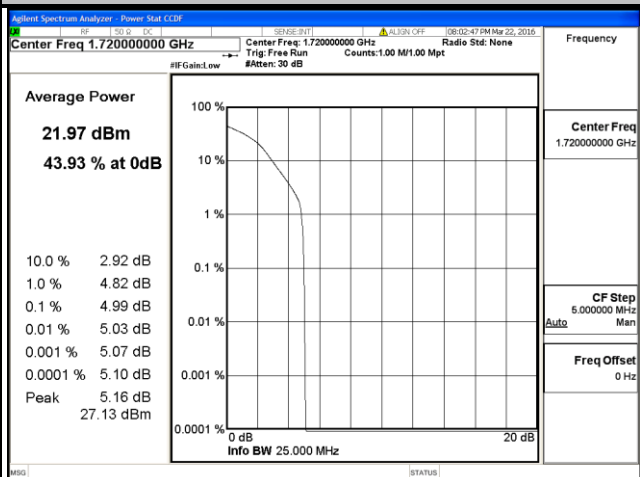
15 MHz / 16QAM



20 MHz / QPSK



20 MHz / 16QAM

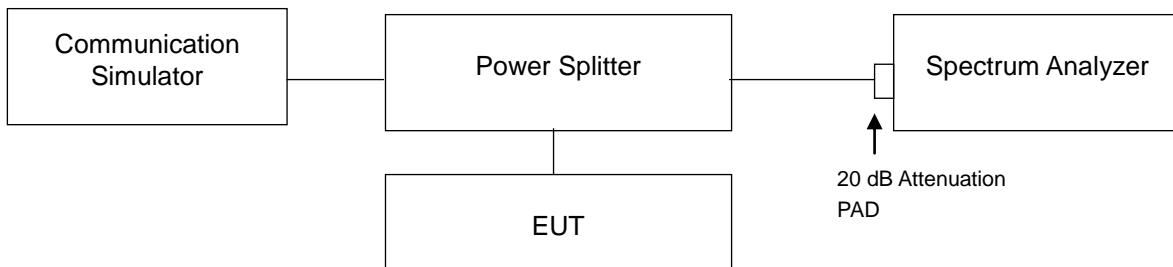


4.6 Conducted Spurious Emissions

4.6.1 Limits of Conducted Spurious Emissions Measurement

The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB. The limit of emission is equal to -13 dBm.

4.6.2 Test Setup

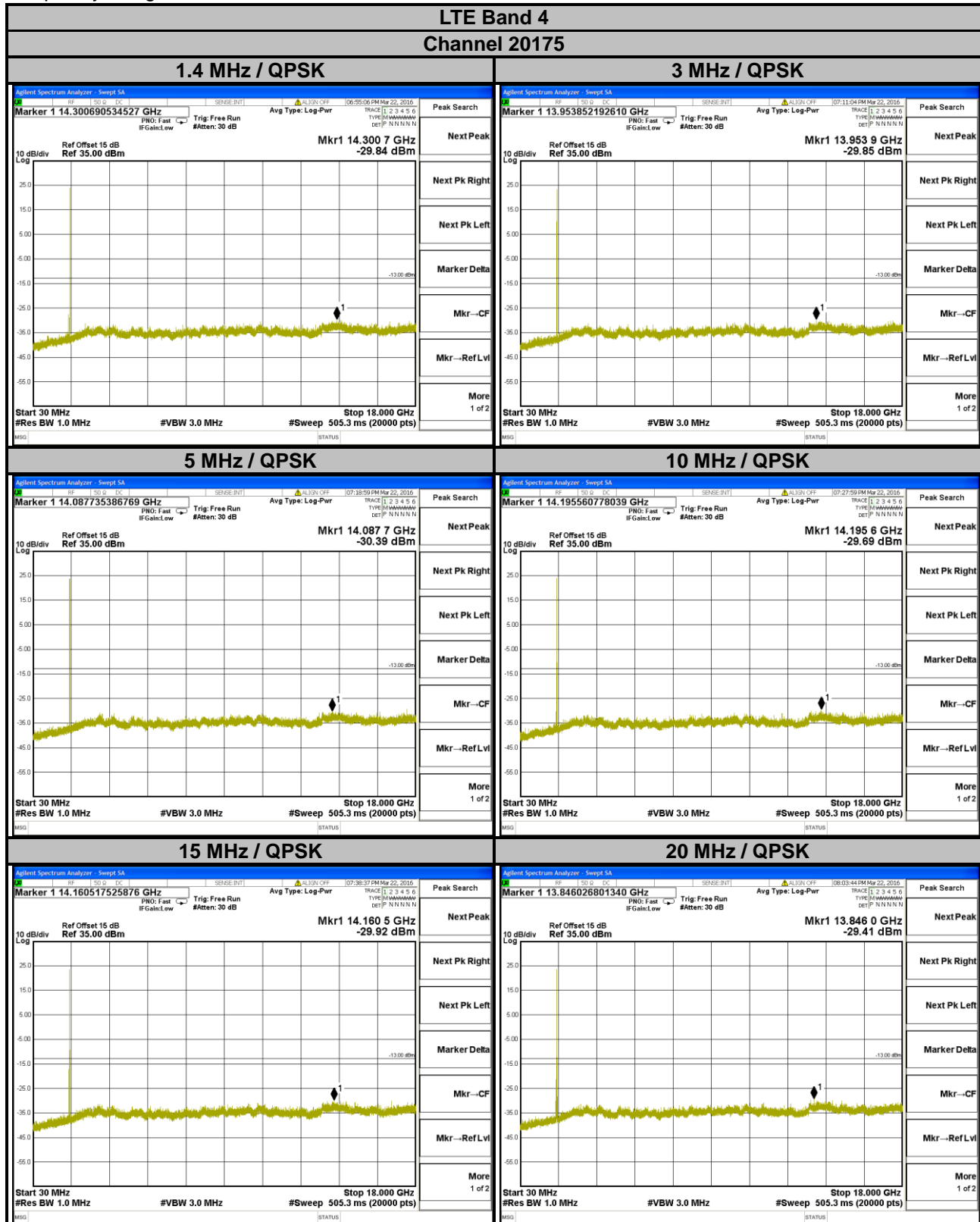


4.6.3 Test Procedure

- 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 30 MHz to 18 GHz for LTE Band 4. 10 dB attenuation pad is connected with spectrum. RBW=1 MHz and VBW=3 MHz are used for conducted emission measurement.

4.6.4 Test Results

Frequency Range: 30 MHz ~ 18 GHz



4.7 Radiated Emission Measurement

4.7.1 Limits of Radiated Emission Measurement

The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB. The limit of emission is equal to -13 dBm.

4.7.2 Test Procedure

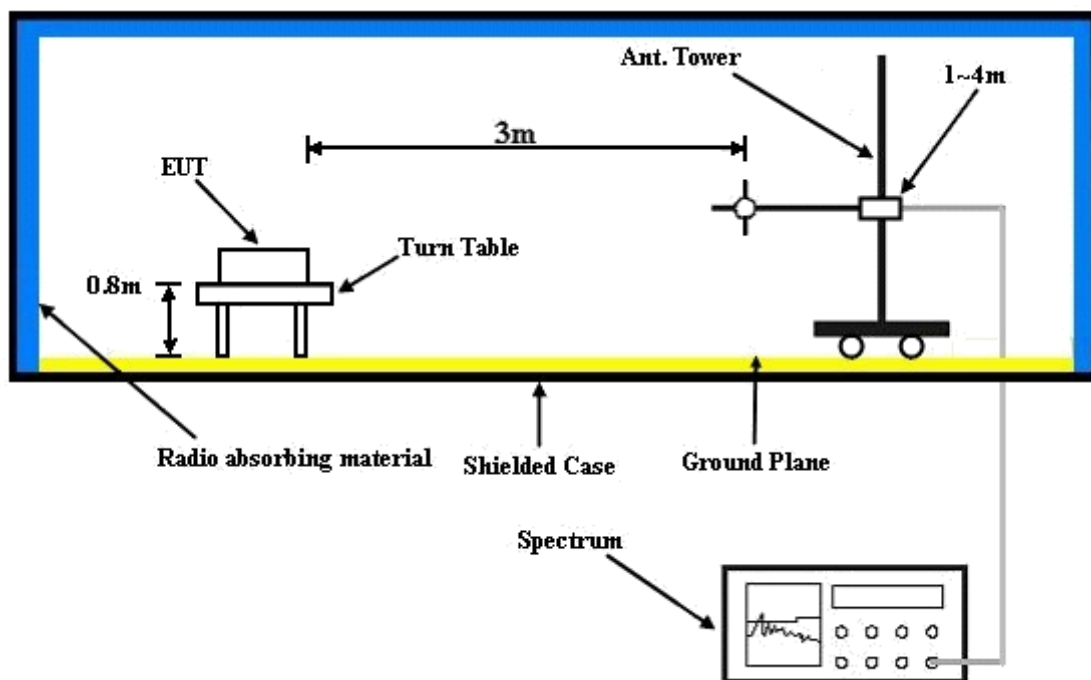
- Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 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, $E.R.P \text{ power} = E.I.P.R \text{ power} - 2.15 \text{ dBi}.$

NOTE: The resolution bandwidth of spectrum analyzer is 1 MHz and the video bandwidth is 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

LTE Band 4

Channel Bandwidth: 20 MHz / QPSK

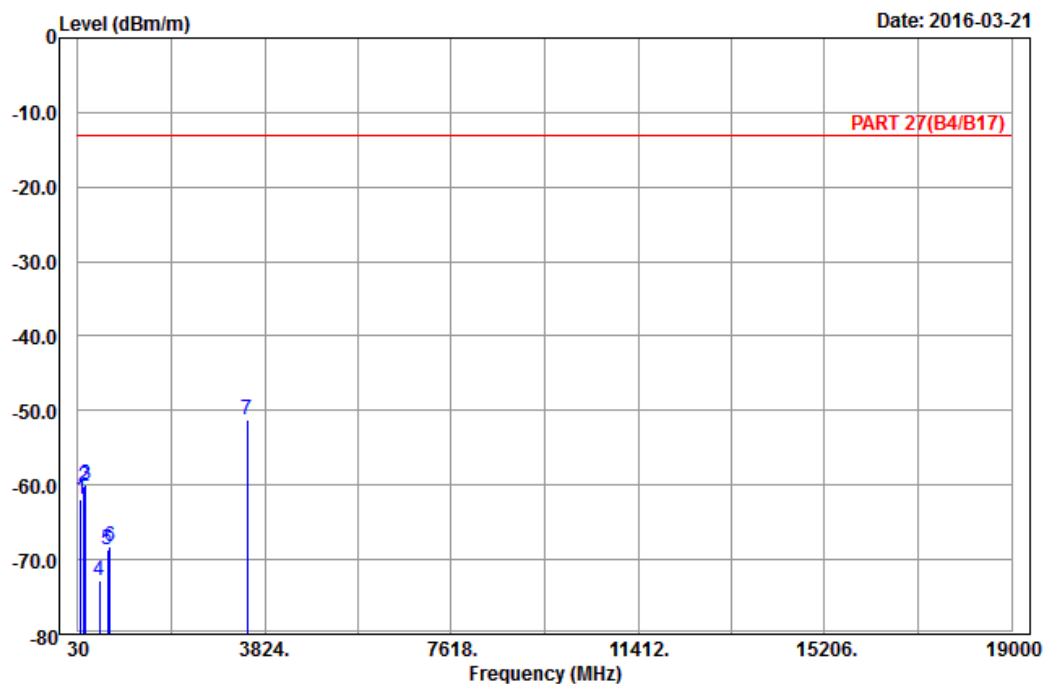
Mode A



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 13



Site : 966 chamber 1

Condition: PART 27(B4/B17) 3m Horizontal

Remark : LTE_Band 4_Link_CH20175

Tested by: Karl Lee

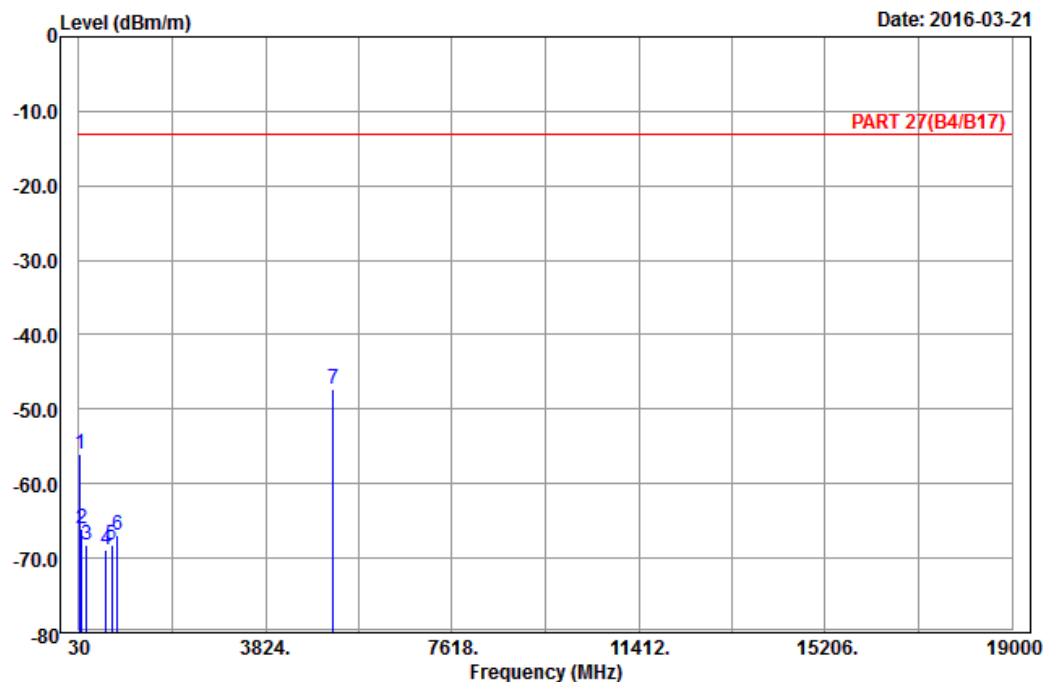
		Read	Limit	Over			
	Freq	Level	Level	Line	Limit	Factor	Remark
	MHz	dBm/m	dBm	dBm/m	dB	dB/m	
1	94.80	-61.94	-51.54	-13.00	-48.94	-10.40	Peak
2	146.64	-60.23	-52.37	-13.00	-47.23	-7.86	Peak
3	189.84	-60.04	-54.31	-13.00	-47.04	-5.73	Peak
4	466.60	-72.71	-68.39	-13.00	-59.71	-4.32	Peak
5	638.80	-68.61	-68.60	-13.00	-55.61	-0.01	Peak
6	673.80	-68.19	-67.94	-13.00	-55.19	-0.25	Peak
7 pp	3465.00	-51.29	-65.63	-13.00	-38.29	14.34	Peak



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 14



Site : 966 chamber 1
Condition: PART 27(B4/B17) 3m Vertical
Remark : LTE_Band 4_Link_CH20175
Tested by: Karl Lee

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm/m	dBm	dBm/m	dB	dB/m	
1	47.01	-55.93	-42.82	-13.00	-42.93	-13.11	Peak
2	89.13	-66.03	-55.25	-13.00	-53.03	-10.78	Peak
3	190.92	-68.31	-62.53	-13.00	-55.31	-5.78	Peak
4	582.80	-68.98	-68.68	-13.00	-55.98	-0.30	Peak
5	691.30	-68.14	-67.80	-13.00	-55.14	-0.34	Peak
6	808.20	-67.02	-68.94	-13.00	-54.02	1.92	Peak
7 pp	5197.50	-47.39	-67.51	-13.00	-34.39	20.12	Peak

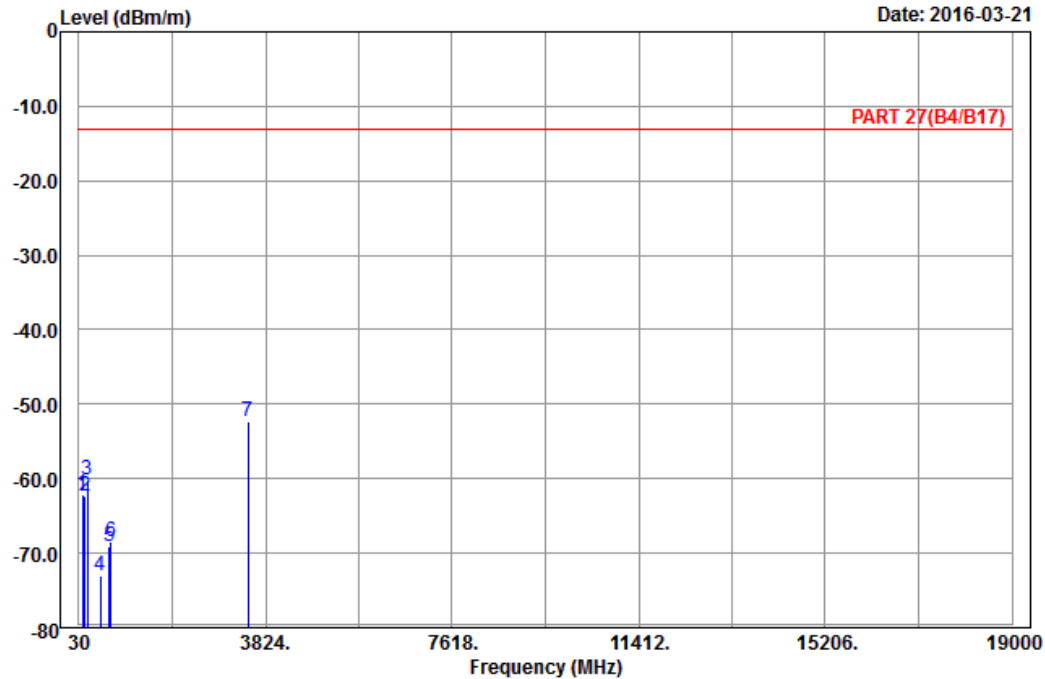
Mode B



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 13



Site : 966 chamber 1
Condition: PART 27(B4/B17) 3m Horizontal
Remark : LTE_Band 4_Link_CH20175
Tested by: Karl Lee

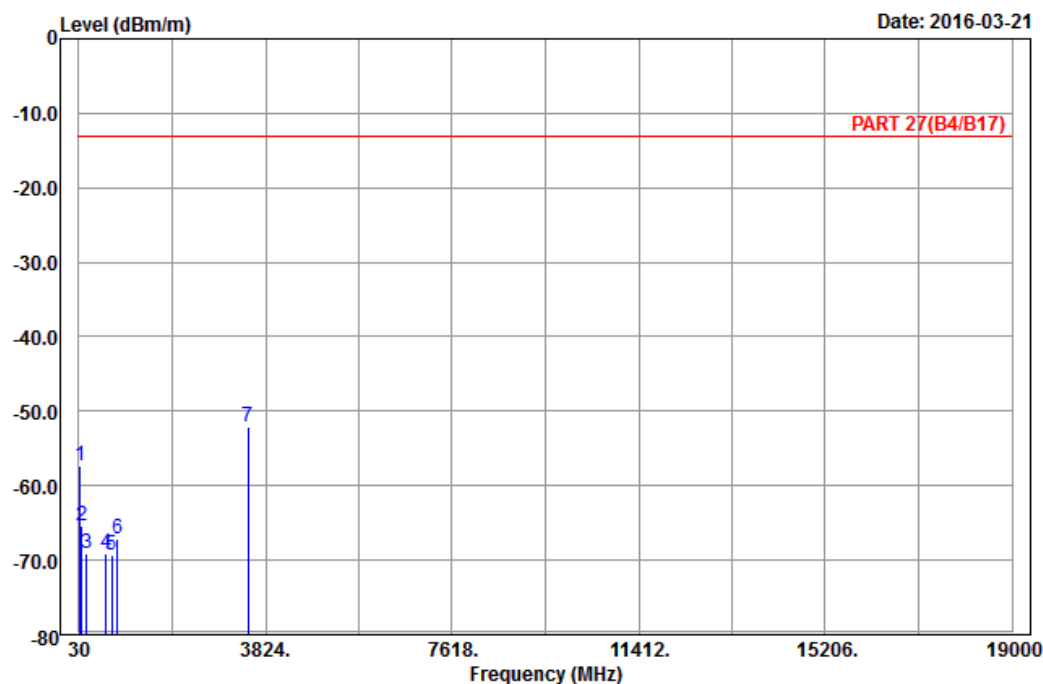
			Read	Limit	Over		
	Freq	Level	Level	Line	Limit	Factor	Remark
	MHz	dBm/m	dBm	dBm/m	dB	dB/m	
1	98.31	-62.20	-51.97	-13.00	-49.20	-10.23	Peak
2	150.42	-62.29	-54.34	-13.00	-49.29	-7.95	Peak
3	195.51	-60.22	-54.22	-13.00	-47.22	-6.00	Peak
4	474.30	-73.04	-68.50	-13.00	-60.04	-4.54	Peak
5	646.50	-69.06	-68.96	-13.00	-56.06	-0.10	Peak
6	684.30	-68.45	-68.15	-13.00	-55.45	-0.30	Peak
7 pp	3465.00	-52.22	-66.56	-13.00	-39.22	14.34	Peak



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 14



Site : 966 chamber 1
Condition: PART 27(B4/B17) 3m Vertical
Remark : LTE_Band 4_Link_CH20175
Tested by: Karl Lee

			Read	Limit	Over		
	Freq	Level	Level	Line	Limit	Factor	Remark
	MHz	dBm/m	dBm	dBm/m	dB	dB/m	
1	48.63	-57.42	-43.99	-13.00	-44.42	-13.43	Peak
2	91.02	-65.38	-54.76	-13.00	-52.38	-10.62	Peak
3	194.16	-69.13	-63.22	-13.00	-56.13	-5.91	Peak
4	585.60	-69.00	-68.82	-13.00	-56.00	-0.18	Peak
5	694.10	-69.29	-68.94	-13.00	-56.29	-0.35	Peak
6	813.10	-67.22	-69.09	-13.00	-54.22	1.87	Peak
7 pp	3465.00	-52.14	-66.48	-13.00	-39.14	14.34	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.

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Fax: 886-2-26051924

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Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

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