

FCC Test Report

(PART 22)

Report No.: RF170810C05A

FCC ID: 2ANKMFS040U

Test Model: FS040U

Received Date: Aug. 11, 2017

Test Date: Aug. 16, 2017 ~ Aug. 20, 2017

Issued Date: Aug. 31, 2017

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Testing Laboratory
2021

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Release Control Record

Issue No.	Description	Date Issued
RF170810C05A	Original Release	Aug. 31, 2017

1 Certificate of Conformity

Product: LTE USB Modem

Brand: +F

Test Model: FS040U

Sample Status: Identical Prototype

Applicant: Shanghai Tricheer Technology Co., Ltd.

Test Date: Aug. 16, 2017 ~ Aug. 20, 2017

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:** Aug. 31, 2017
Evonne Liu / Specialist

Approved by : David Huang, **Date:** Aug. 31, 2017
David Huang / 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.
---	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 -35.33 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	Expended 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	Jul. 05, 2017	Jul. 04, 2018
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 13, 2016	Dec. 12, 2017
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Dec. 16, 2016	Dec. 15, 2017
HORN Antenna ETS-Lindgren	3117	00143293	Dec. 29, 2016	Dec. 28, 2017
Double Ridge Guide Horn Antenna EMCO	3115	5619	Dec. 27, 2016	Dec. 26, 2017
BILOG Antenna SCHWARZBECK	VULB 9168	9168-153	Dec. 13, 2016	Dec. 12, 2017
Communications Tester-Wireless Agilent	8960 Series 10	MY53201073	Jun. 28, 2017	Jun. 27, 2019
Preamplifier Agilent	310N	187226	Jun. 23, 2017	Jun. 22, 2018
Preamplifier Agilent	83017A	MY39501357	Jun. 23, 2017	Jun. 22, 2018
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 ETS-LINDGREN	5D-FB	Cable-CH1-01(R FC-SMS-100-SM S-120+RFC-SMS -100-SMS-400)	Jun. 23, 2017	Jun. 22, 2018
RF signal cable ETS-LINDGREN	8D-FB	Cable-CH1-02(R FC-SMS-100-SM S-24)	Jun. 23, 2017	Jun. 22, 2018
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
Radio Communication Analyzer Anritsu	MT8820C	6201525832	Sep. 23, 2016	Sep. 22, 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 IC Site Registration No. is IC7450I-1.

3 General Information

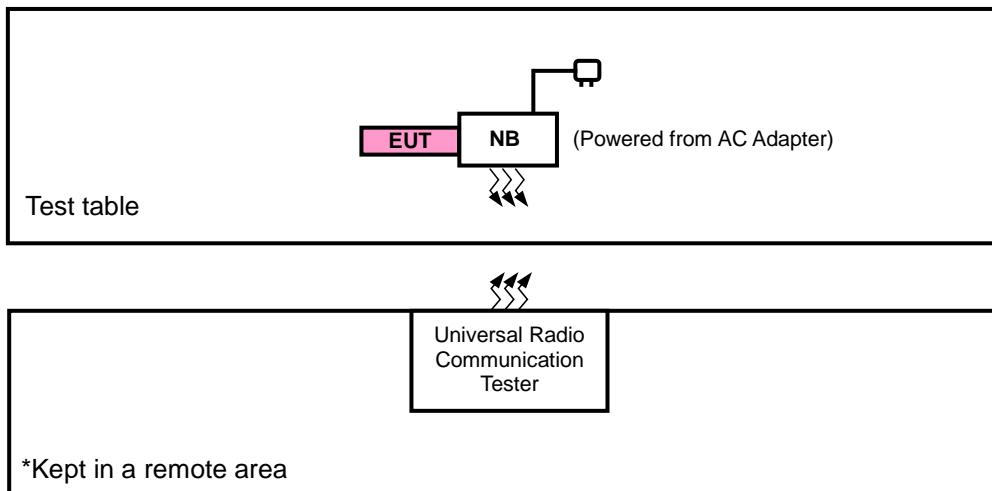
3.1 General Description of EUT

Product	LTE USB Modem	
Brand	+F	
Test Model	FS040U	
Status of EUT	Identical Prototype	
Power Supply Rating	5.0 Vdc (host equipment)	
Modulation Type	LTE	QPSK, 16QAM
Frequency Range	LTE 26 (Channel Bandwidth: 1.4 MHz)	824.7 ~ 848.3 MHz
	LTE 26 (Channel Bandwidth: 3 MHz)	825.5 ~ 847.5 MHz
	LTE 26 (Channel Bandwidth: 5 MHz)	826.5 ~ 846.5 MHz
	LTE 26 (Channel Bandwidth: 10 MHz)	829 ~ 844 MHz
	LTE 26 (Channel Bandwidth: 15 MHz)	831.5 ~ 841.5 MHz
Max. ERP Power	LTE 26 (Channel Bandwidth: 1.4 MHz)	77.62 mW
	LTE 26 (Channel Bandwidth: 3 MHz)	77.98 mW
	LTE 26 (Channel Bandwidth: 5 MHz)	76.00 mW
	LTE 26 (Channel Bandwidth: 10 MHz)	74.10 mW
	LTE 26 (Channel Bandwidth: 15 MHz)	80.32 mW
Emission Designator	LTE 26 (Channel Bandwidth: 1.4 MHz)	1M09G7D
	LTE 26 (Channel Bandwidth: 3 MHz)	2M70G7D
	LTE 26 (Channel Bandwidth: 5 MHz)	4M49W7D
	LTE 26 (Channel Bandwidth: 10 MHz)	8M95G7D
	LTE 26 (Channel Bandwidth: 15 MHz)	13M4G7D
Antenna Type	Fixed Internal 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



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.	Universal Radio Communication Tester	R&S	CMU200	123295	N/A
2.	NB	N/A	N/A	N/A	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).
2. Items 1 acted as communication partners to transfer data.

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
LTE Band 26	X-plane	X-axis

LTE Band 26

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	ERP	26797 to 27033	26797, 26915, 27033	1.4 MHz	QPSK, 16QAM	1 RB / 5 RB Offset
		26805 to 27025	26805, 26915, 27025	3 MHz	QPSK, 16QAM	1 RB / 14 RB Offset
		26815 to 27015	26815, 26915, 27015	5 MHz	QPSK, 16QAM	1 RB / 24 RB Offset
		26840 to 26990	26840, 26915, 26990	10 MHz	QPSK, 16QAM	1 RB / 49 RB Offset
		26865 to 26965	26865, 26915, 26965	15 MHz	QPSK, 16QAM	1 RB / 49 RB Offset
-	Frequency Stability	26797 to 27033	26797, 27033	1.4 MHz	QPSK	1 RB / 5 RB Offset
		26805 to 27025	26805, 27025	3 MHz	QPSK	1 RB / 14 RB Offset
		26815 to 27015	26815, 27015	5 MHz	QPSK	1 RB / 24 RB Offset
		26840 to 26990	26840, 26990	10 MHz	QPSK	1 RB / 49 RB Offset
		26865 to 26965	26865, 26965	15 MHz	QPSK	1 RB / 49 RB Offset
-	Occupied Bandwidth	26797 to 27033	26797, 26915, 27033	1.4 MHz	QPSK, 16QAM	6 RB / 0 RB Offset
		26805 to 27025	26805, 26915, 27025	3 MHz	QPSK, 16QAM	15 RB / 0 RB Offset
		26815 to 27015	26815, 26915, 27015	5 MHz	QPSK, 16QAM	25 RB / 0 RB Offset
		26840 to 26990	26840, 26915, 26990	10 MHz	QPSK, 16QAM	50 RB / 0 RB Offset
		26865 to 26965	26865, 26915, 26965	15 MHz	QPSK, 16QAM	75 RB / 0 RB Offset
-	Band Edge	26797 to 27033	26797	1.4 MHz	QPSK	1 RB / 0 RB Offset
			27033	1.4 MHz	QPSK	6 RB / 0 RB Offset
		26805 to 27025	26805	3 MHz	QPSK	1 RB / 5 RB Offset
			27025	3 MHz	QPSK	6 RB / 0 RB Offset
		26815 to 27015	26815	5 MHz	QPSK	1 RB / 0 RB Offset
			27015	5 MHz	QPSK	25 RB / 0 RB Offset
		26840 to 26990	26840	10 MHz	QPSK	1 RB / 14 RB Offset
			26990	10 MHz	QPSK	15 RB / 0 RB Offset
		26865 to 26965	26865	15 MHz	QPSK	1 RB / 24 RB Offset
			26965	15 MHz	QPSK	25 RB / 0 RB Offset

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	Peak to Average Ratio	26797 to 27033	26797, 26915, 27033	1.4 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		26805 to 27025	26805, 26915, 27025	3 MHz	QPSK, 16QAM	15 RB / 0 RB Offset
		26815 to 27015	26815, 26915, 27015	5 MHz	QPSK, 16QAM	25 RB / 0 RB Offset
		26840 to 26990	26840, 26915, 26990	10 MHz	QPSK, 16QAM	50 RB / 0 RB Offset
		26865 to 26965	26865, 26915, 26965	15 MHz	QPSK, 16QAM	75 RB / 0 RB Offset
-	Conducted Emission	26797 to 27033	26797, 26915, 27033	1.4 MHz	QPSK	1 RB / 0 RB Offset
		26805 to 27025	26805, 26915, 27025	3 MHz	QPSK	15 RB / 0 RB Offset
		26815 to 27015	26815, 26915, 27015	5 MHz	QPSK	25 RB / 0 RB Offset
		26840 to 26990	26840, 26915, 26990	10 MHz	QPSK	1 RB / 0 RB Offset
		26865 to 26965	26865, 26915, 26965	15 MHz	QPSK	25 RB / 0 RB Offset
-	Radiated Emission	26865 to 26965	26865, 26915, 26965	15 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	4.5 Vdc	Carlos Chen
Frequency Stability	25 deg. C, 65 % RH	4.5 Vdc	Carlos Chen
Occupied Bandwidth	25 deg. C, 65 % RH	4.5 Vdc	Carlos Chen
Band Edge	25 deg. C, 65 % RH	4.5 Vdc	Carlos Chen
Peak to Average Ratio	25 deg. C, 65 % RH	4.5 Vdc	Carlos Chen
Conducted Emission	25 deg. C, 65 % RH	4.5 Vdc	Carlos Chen
Radiated Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	Charles Hsiao

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:

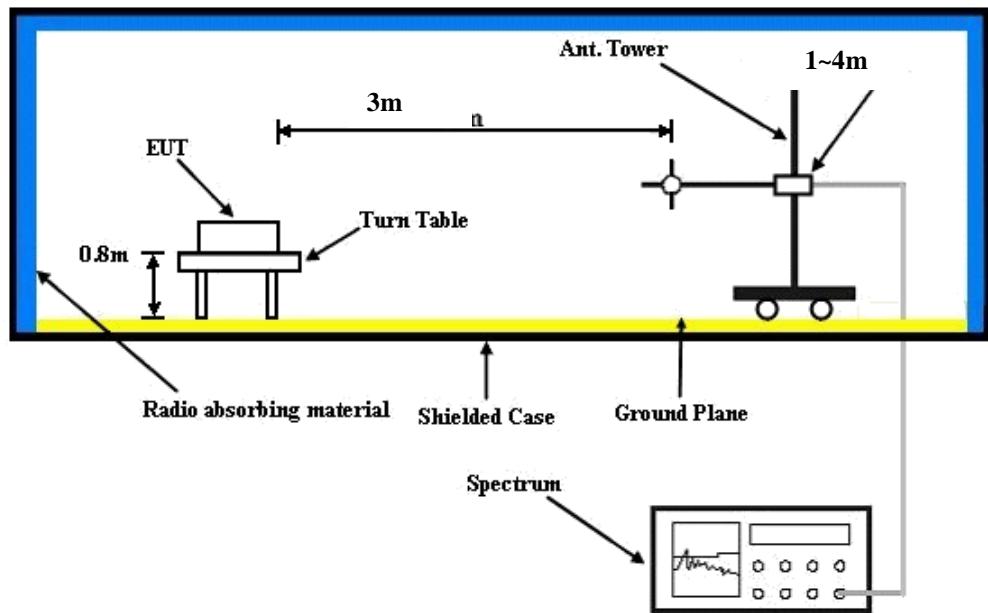
- a. All measurements were done at low, middle and high operational frequency range. RBW and VBW is 1 MHz for GSM, GPRS & EDGE, and 5 MHz for WCDMA and CDMA, and 10 MHz for LTE mode.
- b. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m height 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 form E.I.R.P power by subtracting the gain of dipole, E.R.P power = E.I.P.R power - 2.15 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.

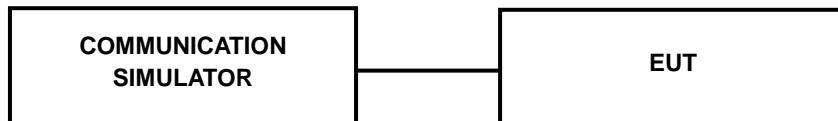
4.1.3 Test Setup

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 / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 26797	Mid Ch 26915	High Ch 27033		Low Ch 26797	Mid Ch 26915	High Ch 27033	
			824.7 MHz	836.5 MHz	848.3 MHz		824.7 MHz	836.5 MHz	848.3 MHz	
26 / 1.4M	1	0	20.80	20.85	20.82	0	19.61	19.66	19.63	1
	1	2	21.08	21.13	21.10	0	19.68	19.73	19.70	1
	1	5	20.94	20.99	20.96	0	19.57	19.62	19.59	1
	3	0	20.78	20.83	20.80	0	19.60	19.65	19.62	1
	3	1	21.06	21.11	21.08	0	19.67	19.72	19.69	1
	3	3	20.92	20.97	20.94	0	19.56	19.61	19.58	1
	6	0	19.94	19.99	19.96	1	18.94	18.99	18.96	2

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 26805	Mid Ch 26915	High Ch 27025		Low Ch 26805	Mid Ch 26915	High Ch 27025	
			825.5 MHz	836.5 MHz	847.5 MHz		825.5 MHz	836.5 MHz	847.5 MHz	
26 / 3M	1	0	20.84	20.89	20.86	0	19.65	19.70	19.67	1
	1	7	21.12	21.17	21.14	0	19.72	19.77	19.74	1
	1	14	20.98	21.03	21.00	0	19.61	19.66	19.63	1
	8	0	19.99	20.04	20.01	1	18.89	18.94	18.91	2
	8	3	20.04	20.09	20.06	1	18.98	19.03	19.00	2
	8	7	19.96	20.01	19.98	1	18.97	19.02	18.99	2
	15	0	19.98	20.03	20.00	1	18.98	19.03	19.00	2

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 26815	Mid Ch 26915	High Ch 27015		Low Ch 26815	Mid Ch 26915	High Ch 27015	
			826.5 MHz	836.5 MHz	846.5 MHz		826.5 MHz	836.5 MHz	846.5 MHz	
26 / 5M	1	0	20.87	20.92	20.89	0	19.68	19.73	19.70	1
	1	12	21.15	21.20	21.17	0	19.75	19.80	19.77	1
	1	24	21.01	21.06	21.03	0	19.64	19.69	19.66	1
	12	0	20.02	20.07	20.04	1	18.92	18.97	18.94	2
	12	6	20.07	20.12	20.09	1	19.01	19.06	19.03	2
	12	13	19.99	20.04	20.01	1	19.00	19.05	19.02	2
	25	0	20.01	20.06	20.03	1	19.01	19.06	19.03	2

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 26840	Mid Ch 26915	High Ch 26990		Low Ch 26840	Mid Ch 26915	High Ch 26990	
			829.0 MHz	836.5 MHz	844.0 MHz		829.0 MHz	836.5 MHz	844.0 MHz	
26 / 10M	1	0	20.90	20.95	20.92	0	19.71	19.76	19.73	1
	1	24	21.18	21.23	21.20	0	19.78	19.83	19.80	1
	1	49	21.04	21.09	21.06	0	19.67	19.72	19.69	1
	25	0	20.05	20.10	20.07	1	18.95	19.00	18.97	2
	25	12	20.10	20.15	20.12	1	19.04	19.09	19.06	2
	25	25	20.02	20.07	20.04	1	19.03	19.08	19.05	2
	50	0	20.04	20.09	20.06	1	19.04	19.09	19.06	2

Band / BW	RB Size	RB Offset	QPSK			3GPP MPR (dB)	16QAM			3GPP MPR (dB)
			Low Ch 26865	Mid Ch 26915	High Ch 26965		Low Ch 26865	Mid Ch 26915	High Ch 26965	
			831.5 MHz	836.5 MHz	841.5 MHz		831.5 MHz	836.5 MHz	841.5 MHz	
26 / 15M	1	0	20.93	20.98	20.95	0	19.74	19.79	19.76	1
	1	37	21.21	21.26	21.23	0	19.81	19.86	19.83	1
	1	74	21.07	21.12	21.09	0	19.70	19.75	19.72	1
	36	0	20.08	20.13	20.10	1	18.98	19.03	19.00	2
	36	19	20.13	20.18	20.15	1	19.07	19.12	19.09	2
	36	39	20.05	20.10	20.07	1	19.06	19.11	19.08	2
	75	0	20.07	20.12	20.09	1	19.07	19.12	19.09	2

ERP Power (dBm)

LTE Band 26							
Channel Bandwidth: 1.4 MHz / QPSK							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (mW)	Polarization (H/V)
X	26797	824.7	-10.23	31.208	18.83	76.35	H
	26915	836.5	-10.25	31.3	18.90	77.62	
	27033	848.3	-10.24	31.222	18.83	76.42	
	26797	824.7	-15.36	31.504	13.99	25.08	V
	26915	836.5	-15.42	31.117	13.55	22.63	
	27033	848.3	-15.81	31.922	13.96	24.90	
Channel Bandwidth: 1.4 MHz / 16QAM							
X	26797	824.7	-11.36	31.208	17.70	58.86	H
	26915	836.5	-11.26	31.3	17.89	61.52	
	27033	848.3	-11.48	31.222	17.59	57.44	
	26797	824.7	-16.85	31.504	12.50	17.80	V
	26915	836.5	-16.78	31.117	12.19	16.55	
	27033	848.3	-16.91	31.922	12.86	19.33	

LTE Band 26							
Channel Bandwidth: 3 MHz / QPSK							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (mW)	Polarization (H/V)
X	26805	825.5	-10.25	31.208	18.81	76.00	H
	26915	836.5	-10.23	31.3	18.92	77.98	
	27025	847.5	-10.54	31.222	18.53	71.32	
	26805	825.5	-15.36	31.504	13.99	25.08	V
	26915	836.5	-15.15	31.117	13.82	24.11	
	27025	847.5	-15.84	31.922	13.93	24.73	
Channel Bandwidth: 3 MHz / 16QAM							
X	26805	825.5	-11.69	31.208	17.37	54.55	H
	26915	836.5	-11.23	31.3	17.92	62.00	
	27025	847.5	-11.72	31.222	17.35	54.35	
	26805	825.5	-16.36	31.504	12.99	19.93	V
	26915	836.5	-16.91	31.117	12.06	16.06	
	27025	847.5	-16.87	31.922	12.90	19.51	

LTE Band 26								
Channel Bandwidth: 5 MHz / QPSK								
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (mW)	Polarization (H/V)	
X	26815	826.5	-10.25	31.208	18.81	76.00	H	
	26915	836.5	-10.36	31.3	18.79	75.68		
	27015	846.5	-10.59	31.222	18.48	70.50		
	26815	826.5	-15.42	31.504	13.93	24.74	V	
	26919	836.5	-15.69	31.117	13.28	21.27		
	27015	846.5	-15.89	31.922	13.88	24.45		
Channel Bandwidth: 5 MHz / 16QAM								
X	26815	826.5	-11.69	31.208	17.37	54.55	H	
	26915	836.5	-11.46	31.3	17.69	58.75		
	27015	846.5	-11.29	31.222	17.78	60.01		
	26815	826.5	-16.38	31.504	12.97	19.83	V	
	26919	836.5	-16.79	31.117	12.18	16.51		
	27015	846.5	-16.84	31.922	12.93	19.64		
LTE Band 26								
Channel Bandwidth: 10 MHz / QPSK								
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (mW)	Polarization (H/V)	
X	26840	829.0	-10.36	31.208	18.70	74.10	H	
	26915	836.5	-10.49	31.3	18.66	73.45		
	26990	844.0	-10.47	31.222	18.60	72.48		
	26840	829.0	-15.99	31.504	13.37	21.72	V	
	26919	836.5	-15.48	31.117	13.49	22.32		
	26990	844.0	-16.23	31.922	13.54	22.60		
Channel Bandwidth: 10 MHz / 16QAM								
X	26840	829.0	-11.66	31.208	17.40	54.93	H	
	26915	836.5	-11.94	31.3	17.21	52.60		
	26990	844.0	-11.67	31.222	17.40	54.98		
	26840	829.0	-16.85	31.504	12.50	17.80	V	
	26919	836.5	-16.91	31.117	12.06	16.06		
	26990	844.0	-16.89	31.922	12.88	19.42		

LTE Band 26							
Channel Bandwidth: 15 MHz / QPSK							
Plane	Channel	Frequency (MHz)	LVL (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (mW)	Polarization (H/V)
X	26865	831.5	-10.01	31.208	19.05	80.32	H
	26915	836.5	-10.75	31.3	18.40	69.18	
	26965	841.5	-10.49	31.222	18.58	72.14	
	26865	831.5	-15.48	31.504	13.87	24.40	V
	26915	836.5	-15.76	31.117	13.21	20.93	
	26965	841.5	-15.98	31.922	13.79	23.94	
Channel Bandwidth: 15 MHz / 16QAM							
X	26865	831.5	-11.04	31.208	18.02	63.42	H
	26915	836.5	-11.20	31.3	17.95	62.37	
	26965	841.5	-11.58	31.222	17.49	56.13	
	26865	831.5	-16.36	31.504	12.99	19.93	V
	26915	836.5	-16.85	31.117	12.12	16.28	
	26965	841.5	-16.99	31.922	12.78	18.98	

4.2 Frequency Stability Measurement

4.2.1 Limits of Frequency Stability Measurement

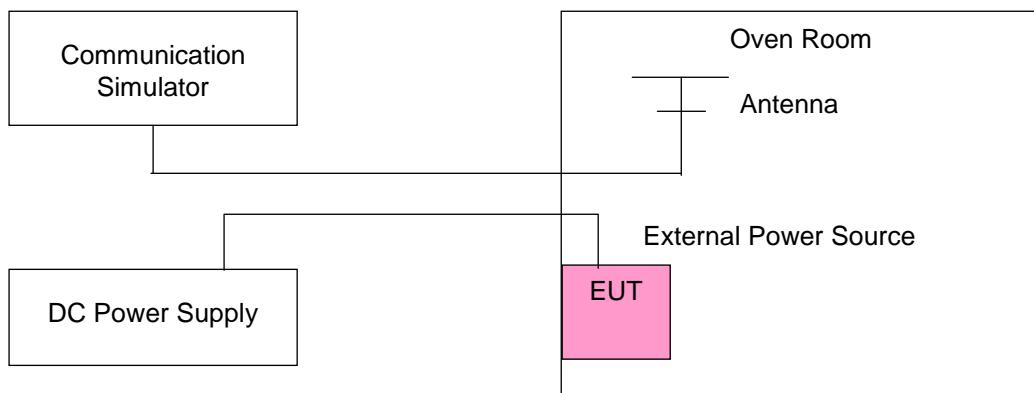
1.5 ppm is for base and fixed station. 2.5 ppm is for mobile station.

4.2.2 Test Procedure

- 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 $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

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

4.2.3 Test Setup



4.2.4 Test Results

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 26				Limit (ppm)	
	Channel Bandwidth: 1.4 MHz					
	Low Channel		High Channel			
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)		
5.0	824.700004	0.004	848.300001	0.002	2.5	
4.5	824.700004	0.005	848.300002	0.002	2.5	
5.5	824.700002	0.003	848.300001	0.002	2.5	

Note: The applicant defined the normal working voltage of the battery is from 4.5 Vdc to 5.5 Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 26				Limit (ppm)	
	Channel Bandwidth: 1.4 MHz					
	Low Channel		High Channel			
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)		
-20	824.700004	0.005	848.300002	0.003	2.5	
-10	824.700002	0.002	848.300004	0.004	2.5	
0	824.700004	0.005	848.300001	0.001	2.5	
10	824.700002	0.003	848.300001	0.001	2.5	
20	824.699999	-0.002	848.299998	-0.002	2.5	
30	824.699997	-0.004	848.299998	-0.002	2.5	
40	824.699997	-0.004	848.299998	-0.003	2.5	
50	824.699998	-0.003	848.299998	-0.002	2.5	
55	824.699997	-0.003	848.299996	-0.004	2.5	

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 26				Limit (ppm)	
	Channel Bandwidth: 3 MHz					
	Low Channel		High Channel			
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)		
5.0	825.500003	0.004	847.500000	0.000	2.5	
4.5	825.500004	0.005	847.500000	0.000	2.5	
5.5	825.500002	0.002	847.500000	0.000	2.5	

Note: The applicant defined the normal working voltage of the battery is from 4.5 Vdc to 5.5 Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 26				Limit (ppm)	
	Channel Bandwidth: 3 MHz					
	Low Channel		High Channel			
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)		
-20	825.500002	0.002	847.500003	0.003	2.5	
-10	825.500002	0.003	847.500004	0.004	2.5	
0	825.500002	0.003	847.500002	0.002	2.5	
10	825.500003	0.003	847.500004	0.004	2.5	
20	825.499997	-0.004	847.499997	-0.004	2.5	
30	825.499999	-0.002	847.499997	-0.004	2.5	
40	825.499998	-0.002	847.499998	-0.003	2.5	
50	825.499996	-0.004	847.499997	-0.003	2.5	
55	825.499998	-0.003	847.499998	-0.003	2.5	

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 26				Limit (ppm)	
	Channel Bandwidth: 5 MHz					
	Low Channel		High Channel			
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)		
5.0	826.500000	0.000	846.500002	0.003	2.5	
4.5	826.500000	0.000	846.500004	0.004	2.5	
5.5	826.500000	0.000	846.500002	0.002	2.5	

Note: The applicant defined the normal working voltage of the battery is from 4.5 Vdc to 5.5 Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 26				Limit (ppm)	
	Channel Bandwidth: 5 MHz					
	Low Channel		High Channel			
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)		
-20	826.500001	0.001	846.500002	0.002	2.5	
-10	826.500001	0.001	846.500002	0.002	2.5	
0	826.500003	0.003	846.500001	0.001	2.5	
10	826.500001	0.001	846.500002	0.002	2.5	
20	826.499997	-0.004	846.499998	-0.002	2.5	
30	826.499999	-0.002	846.499997	-0.004	2.5	
40	826.499998	-0.002	846.499998	-0.003	2.5	
50	826.499998	-0.002	846.499997	-0.004	2.5	
55	826.499998	-0.003	846.499999	-0.002	2.5	

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 26				Limit (ppm)	
	Channel Bandwidth: 10 MHz					
	Low Channel		High Channel			
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)		
5.0	829.000004	0.005	844.000003	0.004	2.5	
4.5	829.000002	0.002	844.000002	0.003	2.5	
5.5	829.000003	0.004	844.000003	0.003	2.5	

Note: The applicant defined the normal working voltage of the battery is from 4.5 Vdc to 5.5 Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 26				Limit (ppm)	
	Channel Bandwidth: 10 MHz					
	Low Channel		High Channel			
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)		
-20	829.000001	0.002	844.000001	0.001	2.5	
-10	829.000002	0.002	844.000001	0.002	2.5	
0	829.000003	0.003	844.000002	0.002	2.5	
10	829.000002	0.003	844.000004	0.004	2.5	
20	828.999996	-0.004	843.999998	-0.003	2.5	
30	828.999998	-0.003	843.999999	-0.002	2.5	
40	828.999997	-0.004	843.999996	-0.005	2.5	
50	828.999996	-0.005	843.999996	-0.005	2.5	
55	828.999998	-0.002	843.999998	-0.002	2.5	

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 26				Limit (ppm)	
	Channel Bandwidth: 15 MHz					
	Low Channel		High Channel			
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)		
5.0	831.500002	0.003	841.500003	0.003	2.5	
4.5	831.500003	0.003	841.500002	0.002	2.5	
5.5	831.500002	0.002	841.500003	0.004	2.5	

Note: The applicant defined the normal working voltage of the battery is from 4.5 Vdc to 5.5 Vdc.

Frequency Error vs. Temperature

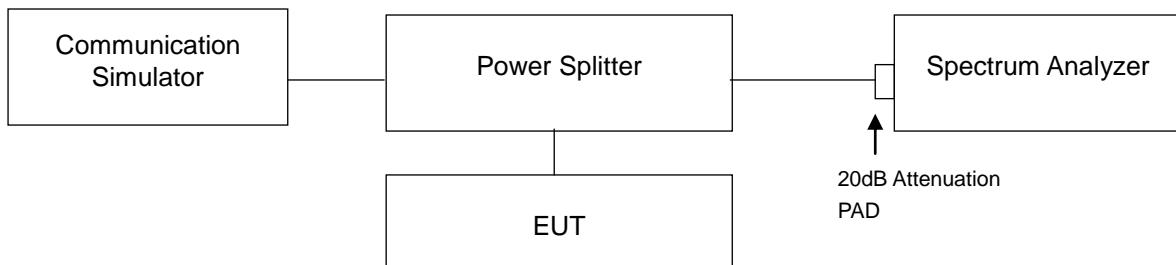
Temp. (°C)	LTE Band 26				Limit (ppm)	
	Channel Bandwidth: 15 MHz					
	Low Channel		High Channel			
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)		
-20	831.500002	0.002	841.500003	0.003	2.5	
-10	831.500001	0.002	841.500002	0.002	2.5	
0	831.500002	0.002	841.500004	0.004	2.5	
10	831.500004	0.005	841.500002	0.002	2.5	
20	831.499997	-0.004	841.499998	-0.002	2.5	
30	831.499998	-0.002	841.499998	-0.002	2.5	
40	831.499999	-0.002	841.499998	-0.003	2.5	
50	831.499998	-0.002	841.499998	-0.002	2.5	
55	831.499997	-0.004	841.499999	-0.002	2.5	

4.3 Occupied Bandwidth Measurement

4.3.1 Test Procedure

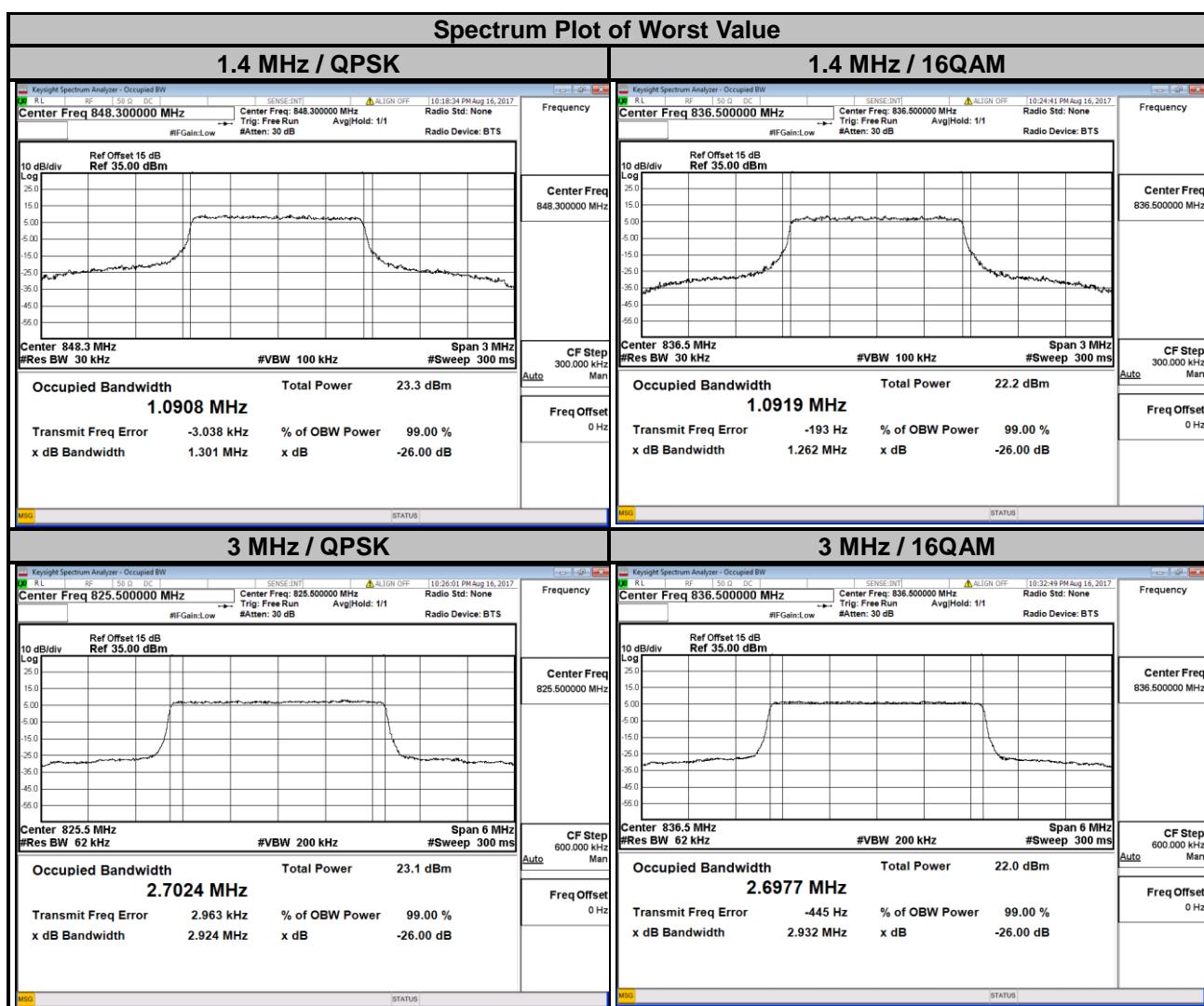
The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function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

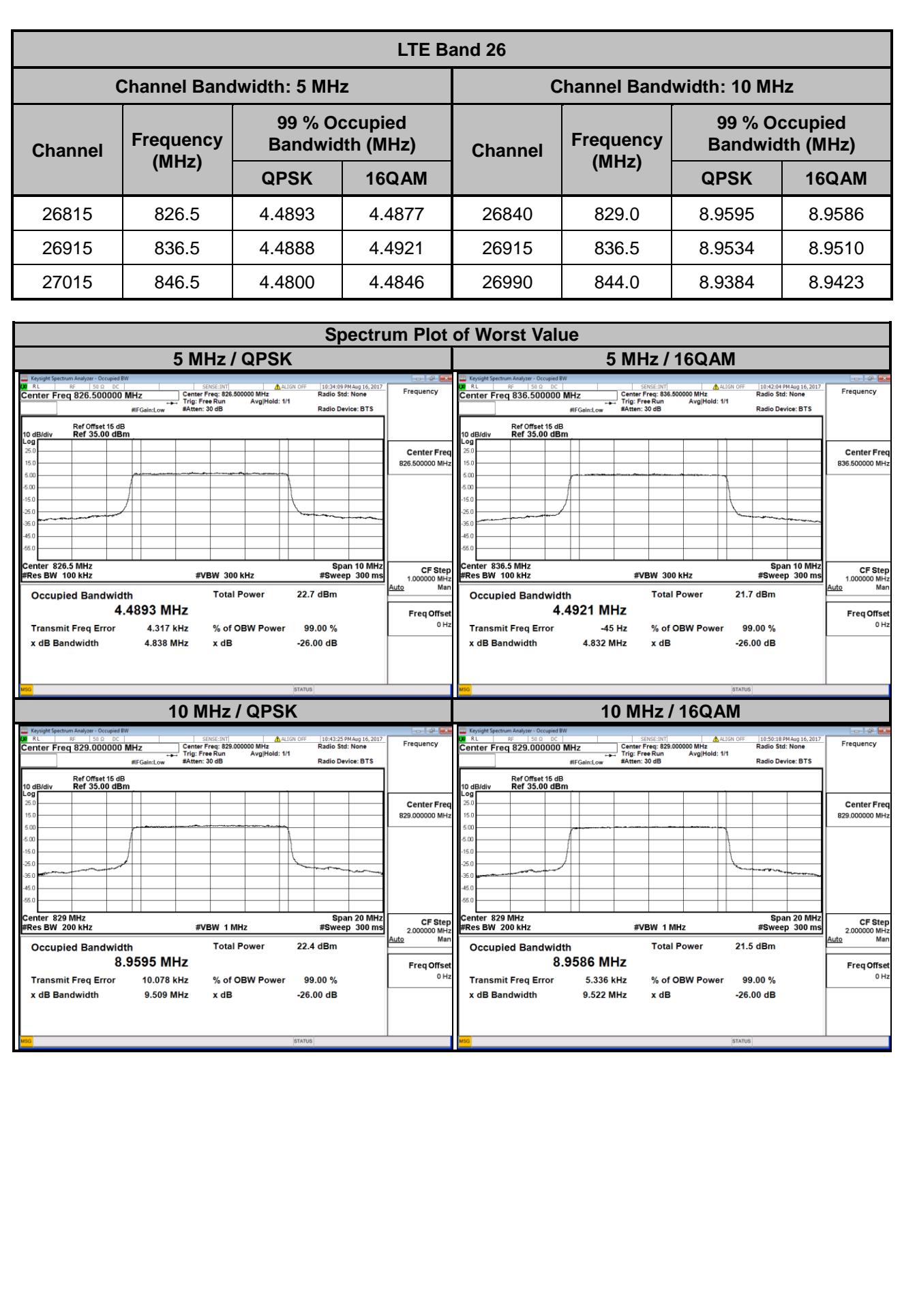
4.3.2 Test Setup



4.3.3 Test Result

LTE Band 26							
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
26797	824.7	1.0877	1.0902	26805	825.5	2.7024	2.6975
26915	836.5	1.0890	1.0919	26915	836.5	2.7001	2.6977
27033	848.3	1.0908	1.0903	27025	847.5	2.7021	2.6969





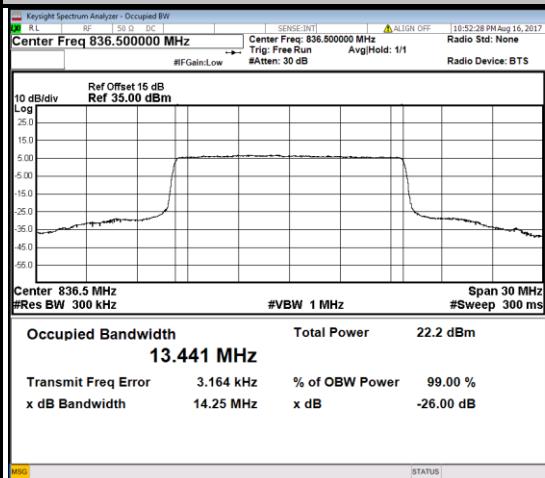
LTE Band 26

Channel Bandwidth: 15 MHz

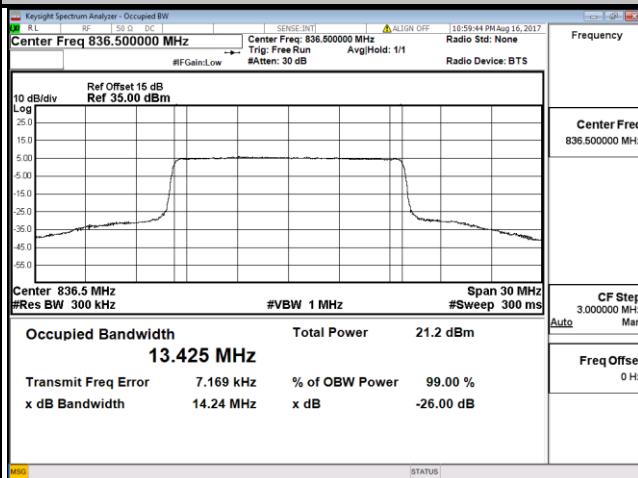
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	
		QPSK	16QAM
26865	831.5	13.4260	13.4160
26915	836.5	13.4410	13.4250
26965	841.5	13.4340	13.4220

Spectrum Plot of Worst Value

15 MHz / QPSK



15 MHz / 16QAM

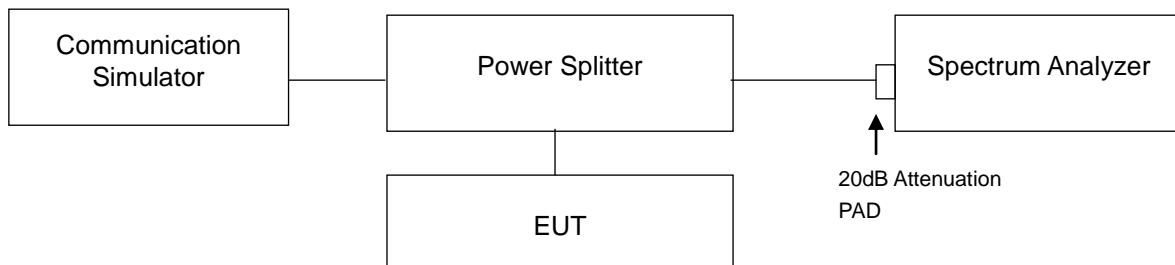


4.4 Band Edge Measurement

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.

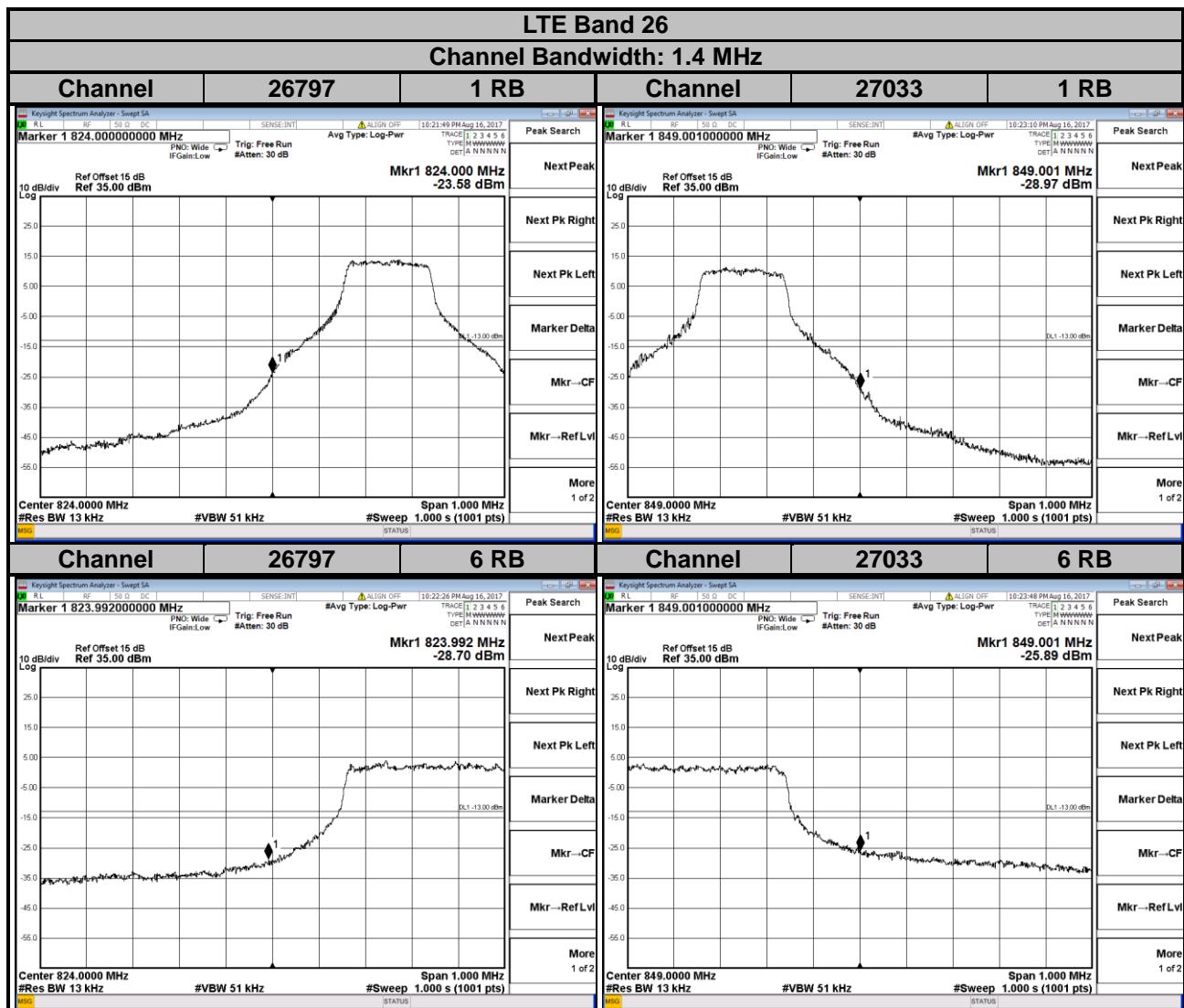
4.4.2 Test Setup

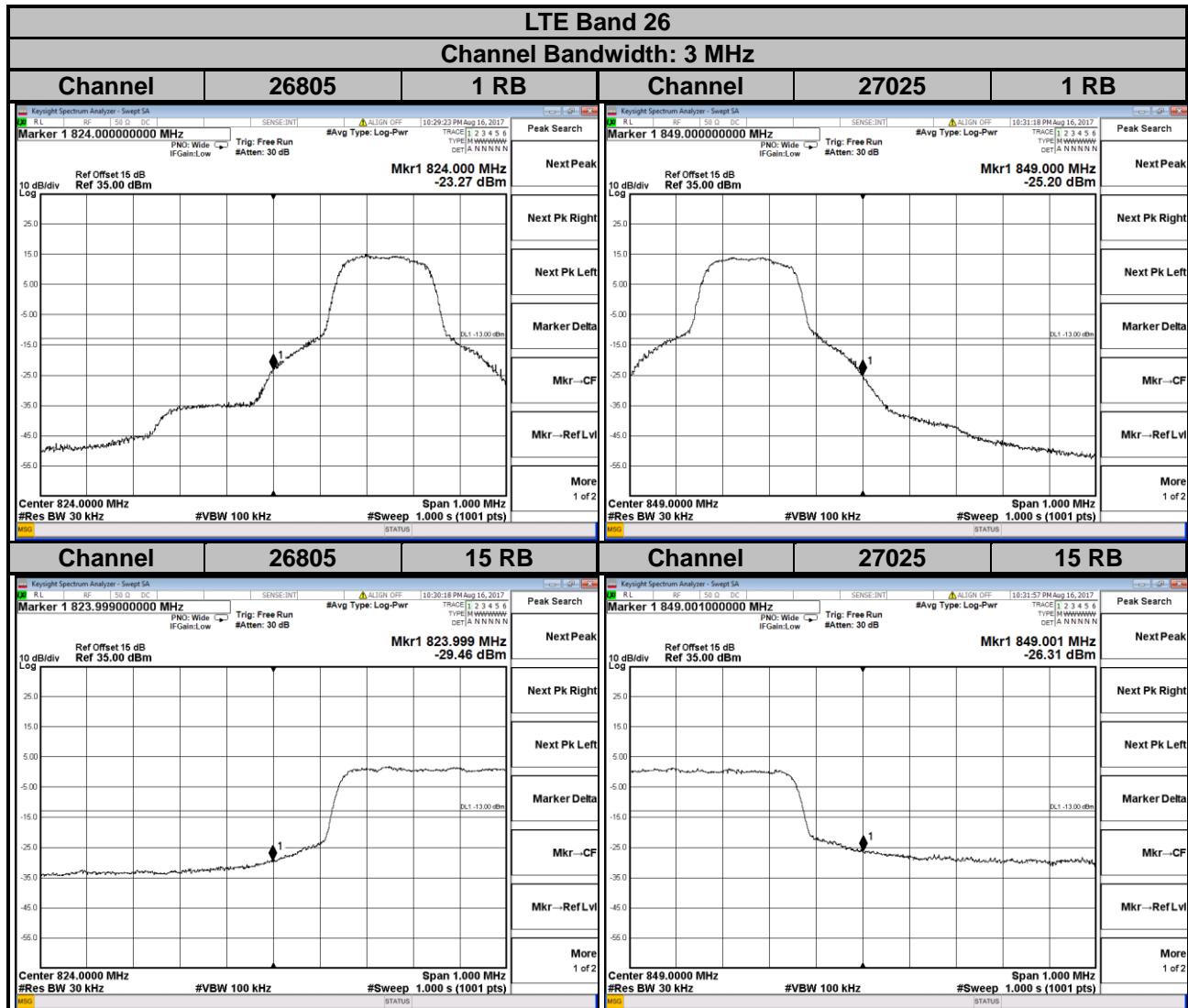


4.4.3 Test Procedures

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

4.4.4 Test Results





LTE Band 26

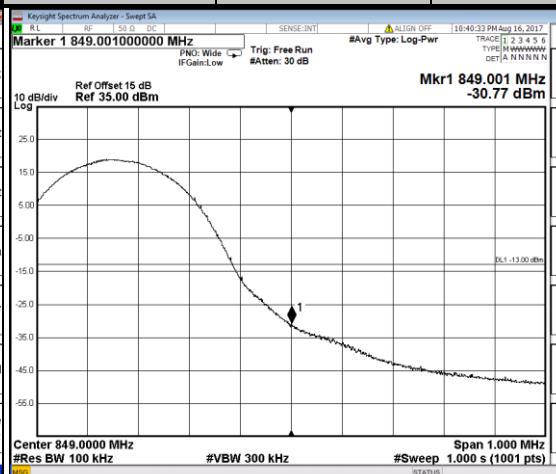
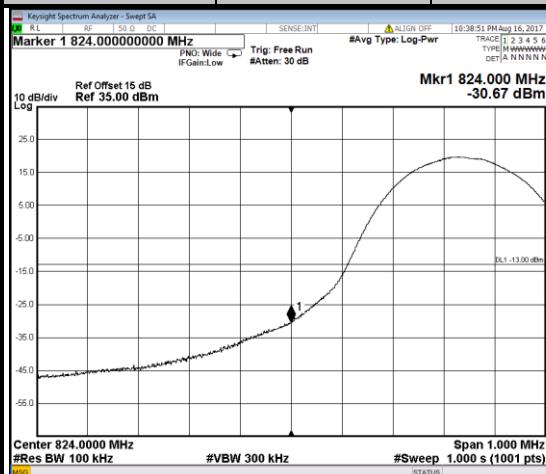
Channel Bandwidth: 5 MHz

Channel 26815

1 RB

Channel 27015

1 RB

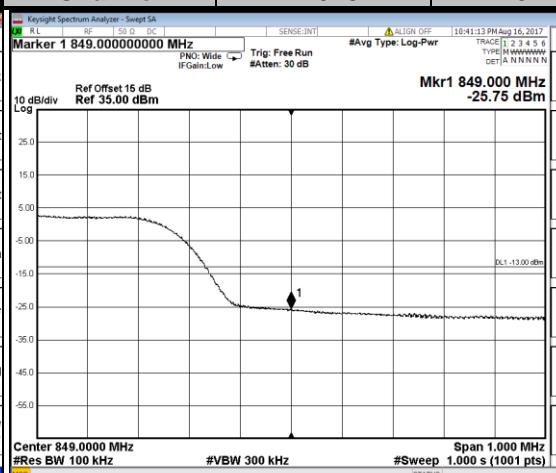
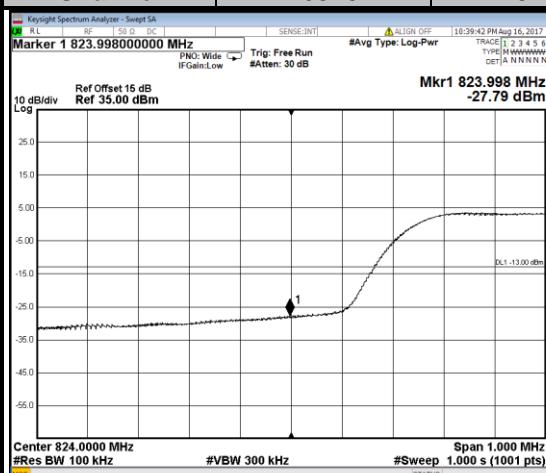


Channel 26815

25 RB

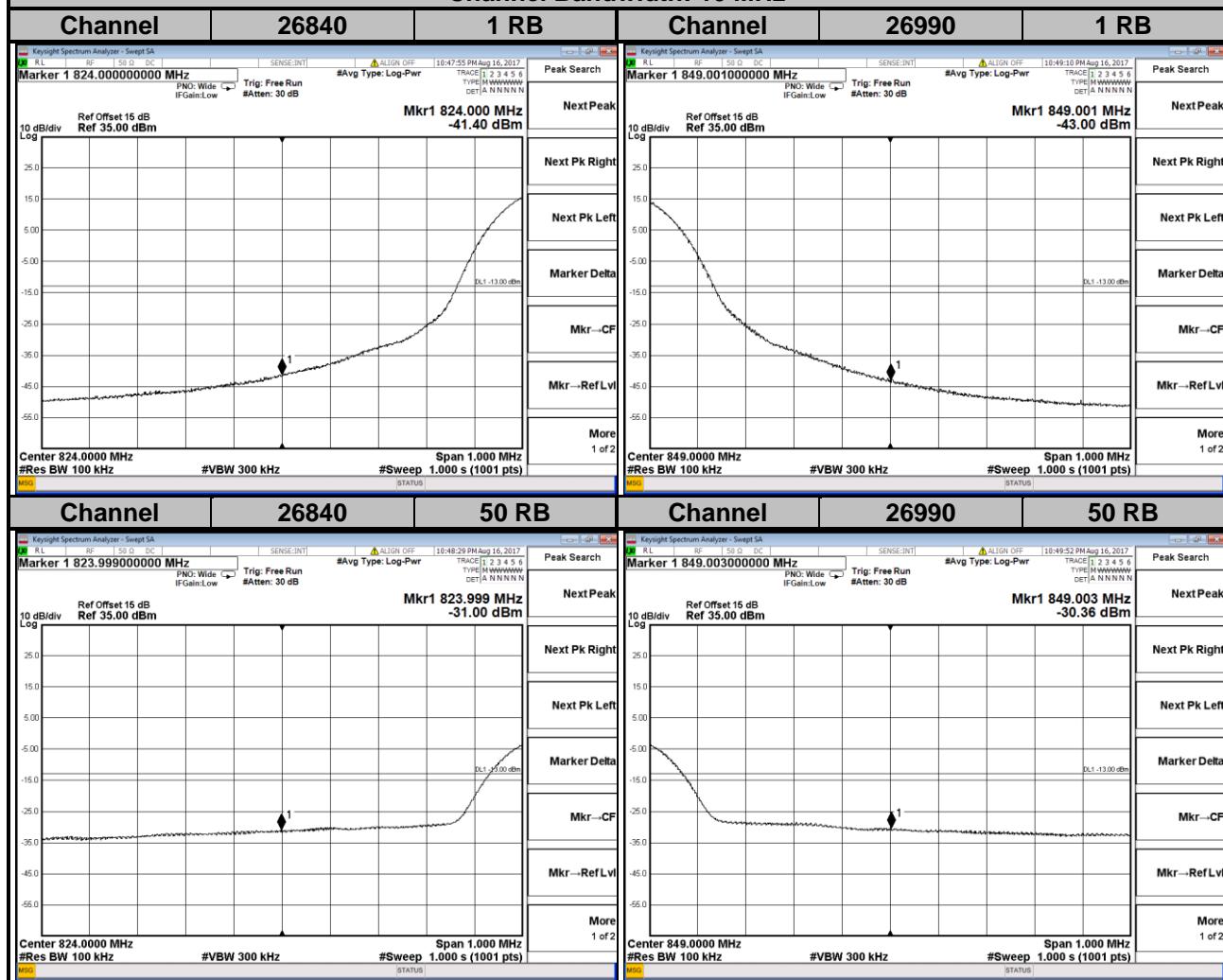
Channel 27015

25 RB



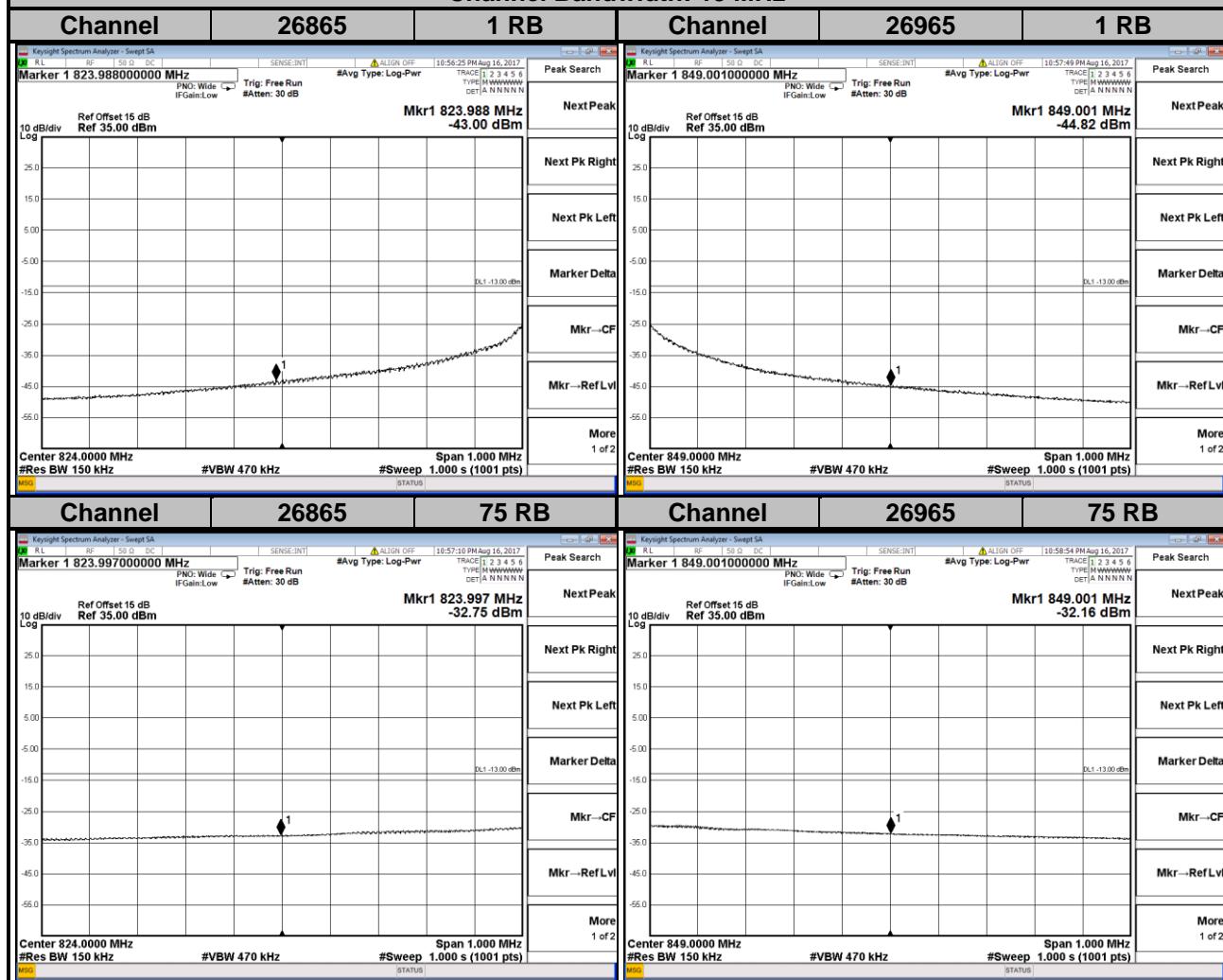
LTE Band 26

Channel Bandwidth: 10 MHz



LTE Band 26

Channel Bandwidth: 15 MHz

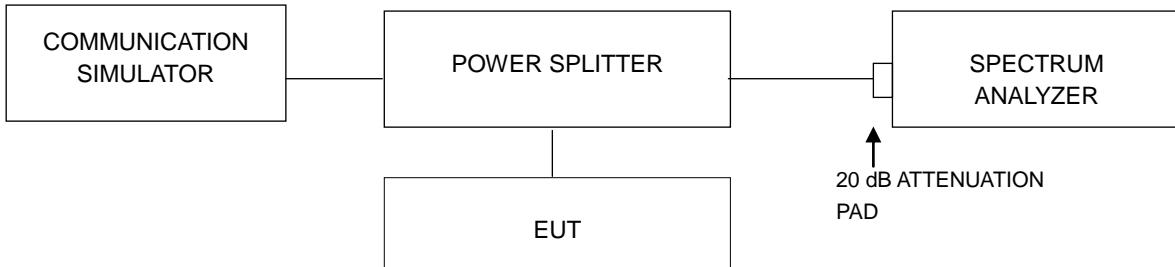


4.5 Peak to Average Ratio

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

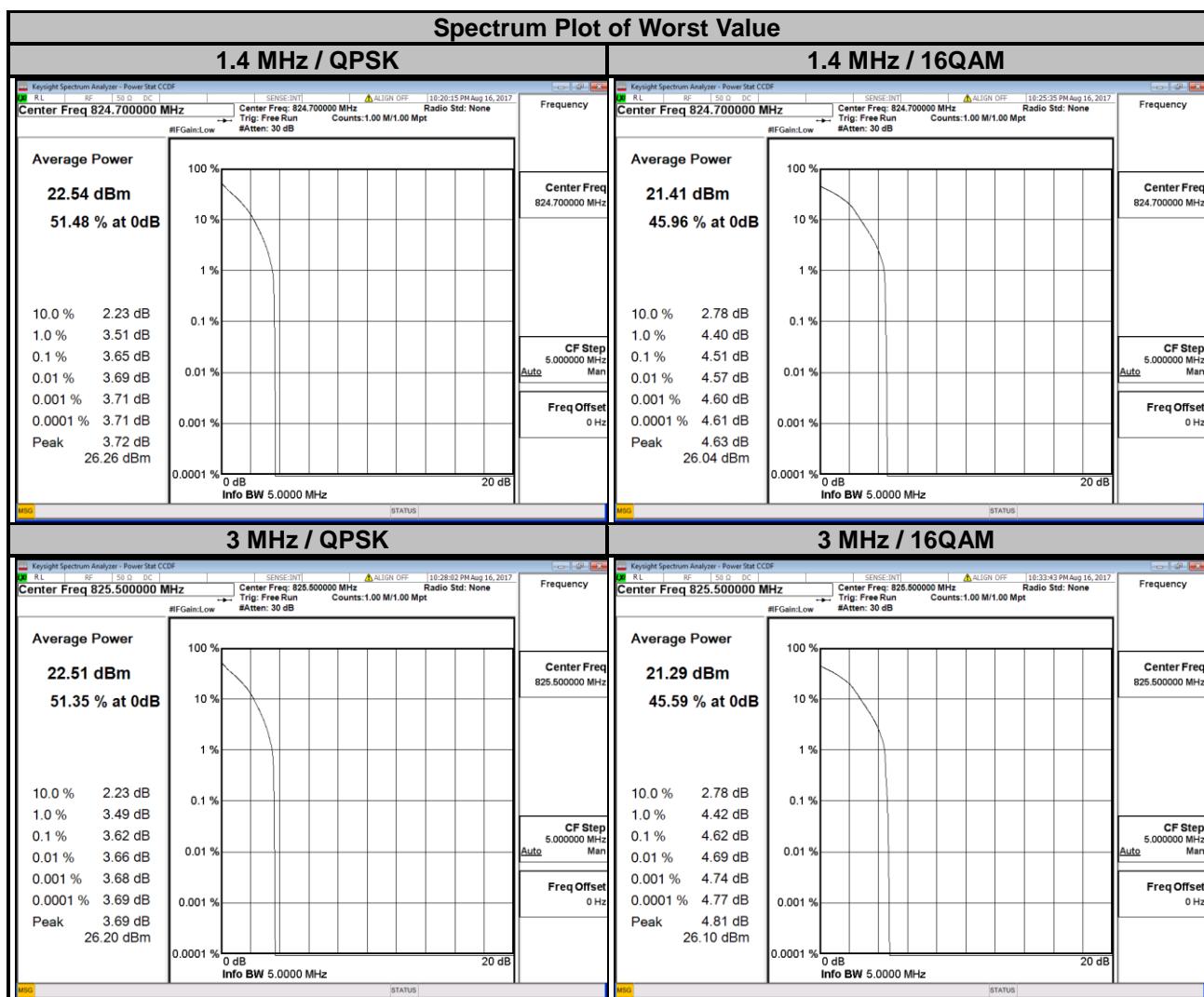


4.5.3 Test Procedures

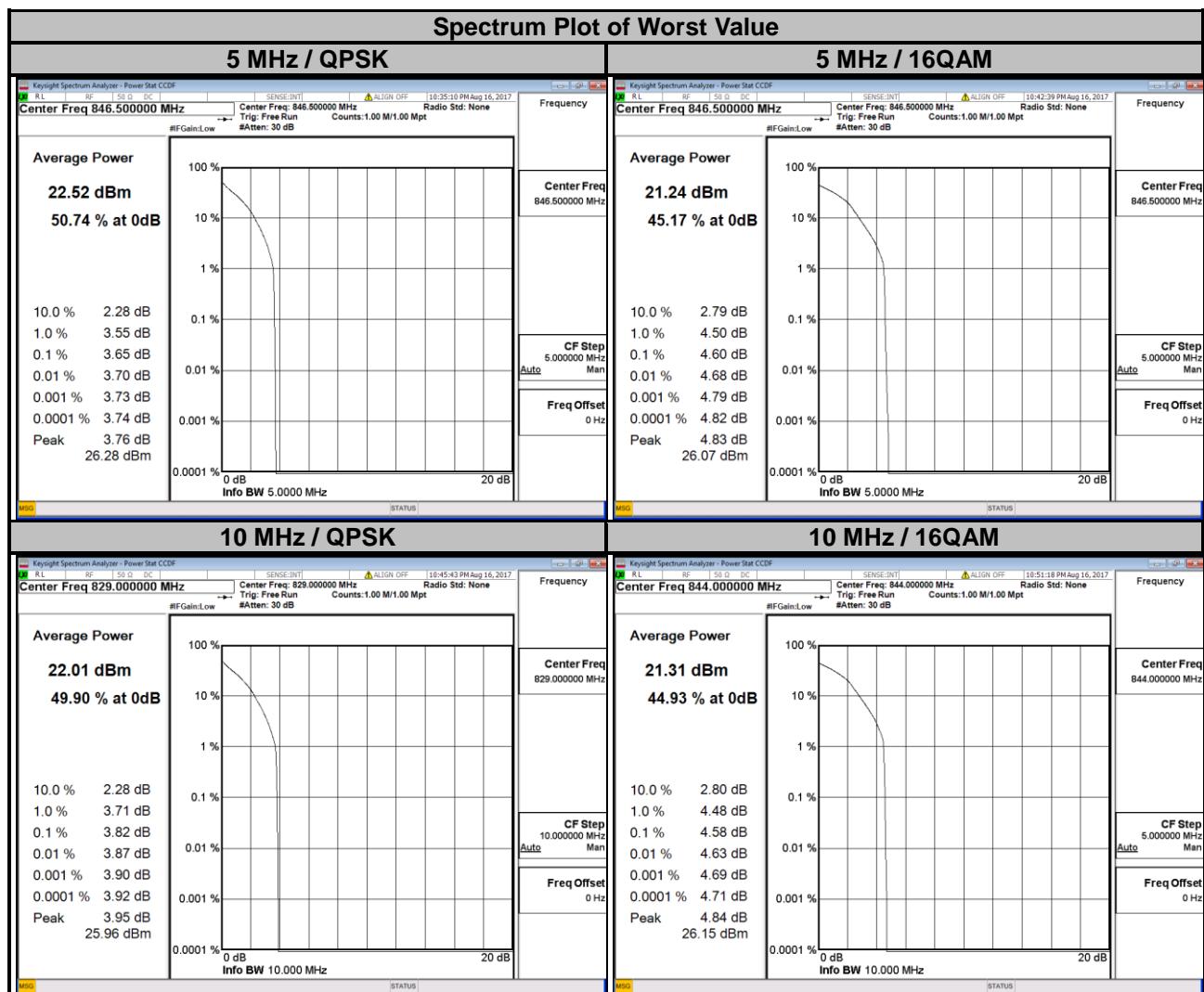
1. Set resolution/measurement bandwidth \geq signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Record the maximum PAPR level associated with a probability of 0.1 %.

4.5.4 Test Results

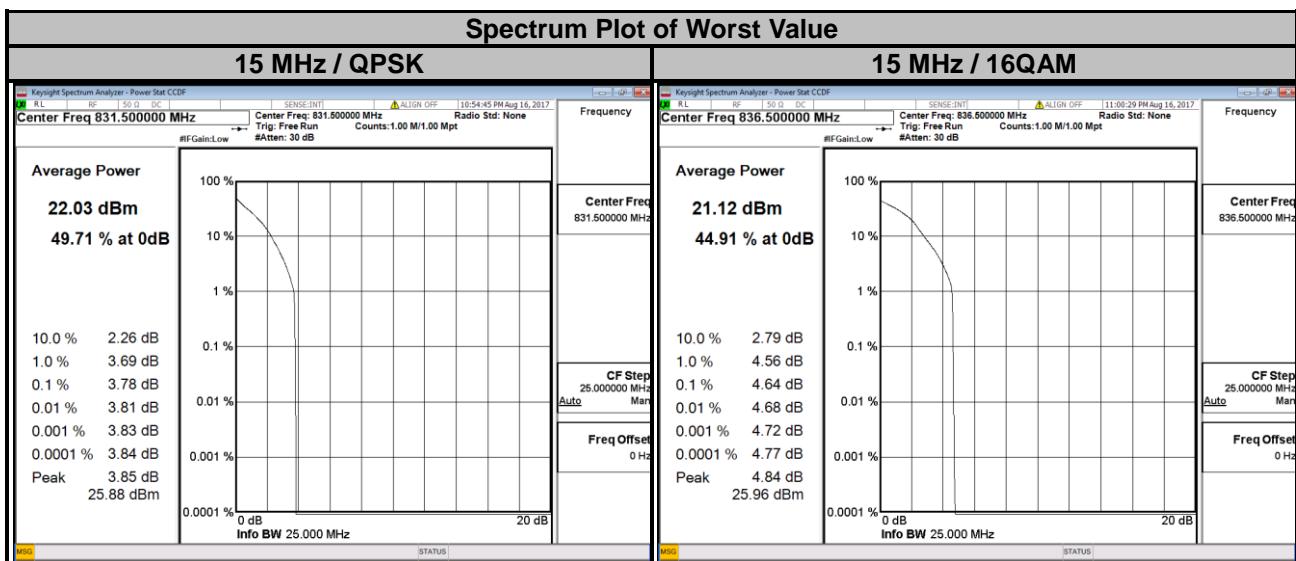
LTE Band 26							
Channel Bandwidth: 1.4 MHz				Channel Bandwidth: 3 MHz			
Channel	Frequency (MHz)	Peak to Average Ratio (dB)		Channel	Frequency (MHz)	Peak to Average Ratio (dB)	
		QPSK	16QAM			QPSK	16QAM
26797	824.7	3.65	4.51	26805	825.5	3.62	4.62
26915	836.5	3.65	4.48	26915	836.5	3.59	4.46
27033	848.3	2.96	3.89	27025	847.5	3.16	4.24



LTE Band 26							
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
26815	826.5	3.63	4.58	26840	829.0	3.82	4.53
26915	836.5	3.60	4.54	26915	836.5	3.67	4.41
27015	846.5	3.65	4.60	26990	844.0	3.77	4.58



LTE Band 26			
Channel Bandwidth: 15 MHz			
Channel	Frequency (MHz)	Peak to Average Ratio (dB)	
		QPSK	16QAM
26865	831.5	3.78	4.46
26915	836.5	3.73	4.64
26965	841.5	3.59	4.34

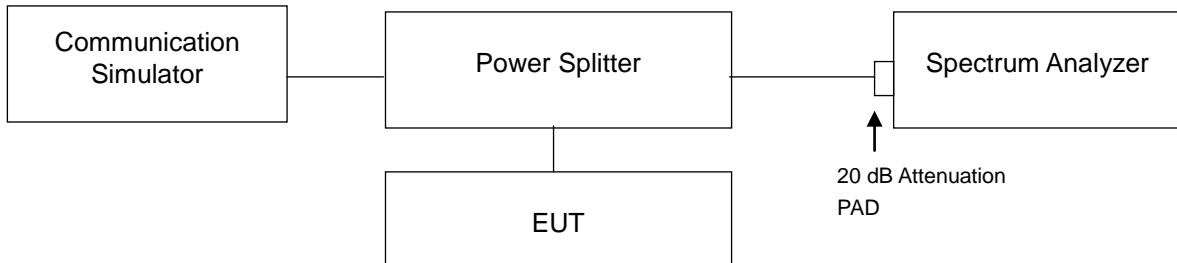


4.6 Conducted Spurious Emissions

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.

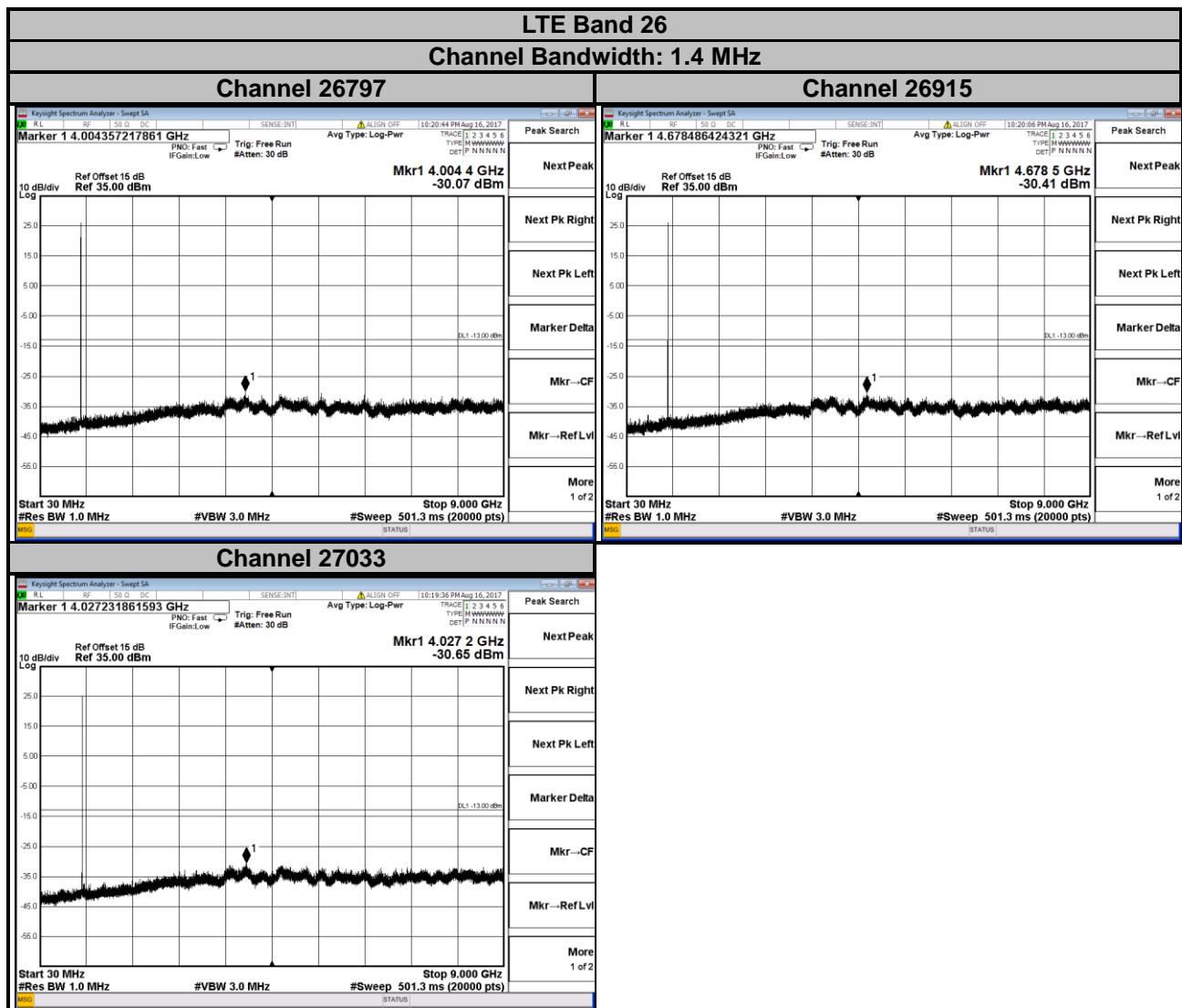
4.6.2 Test Setup

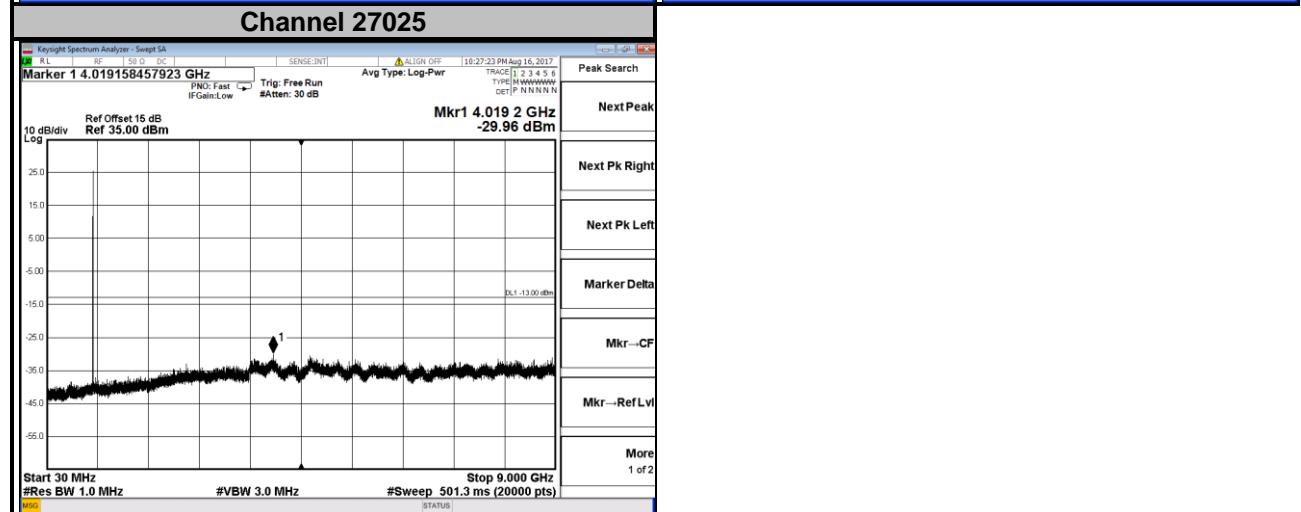
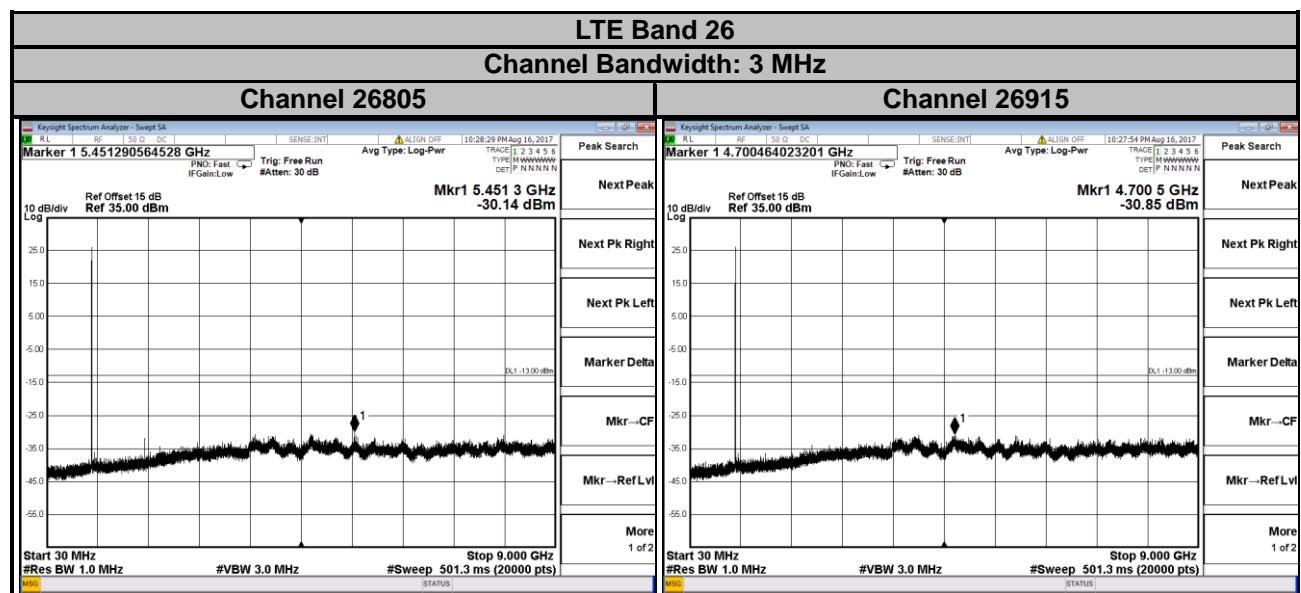


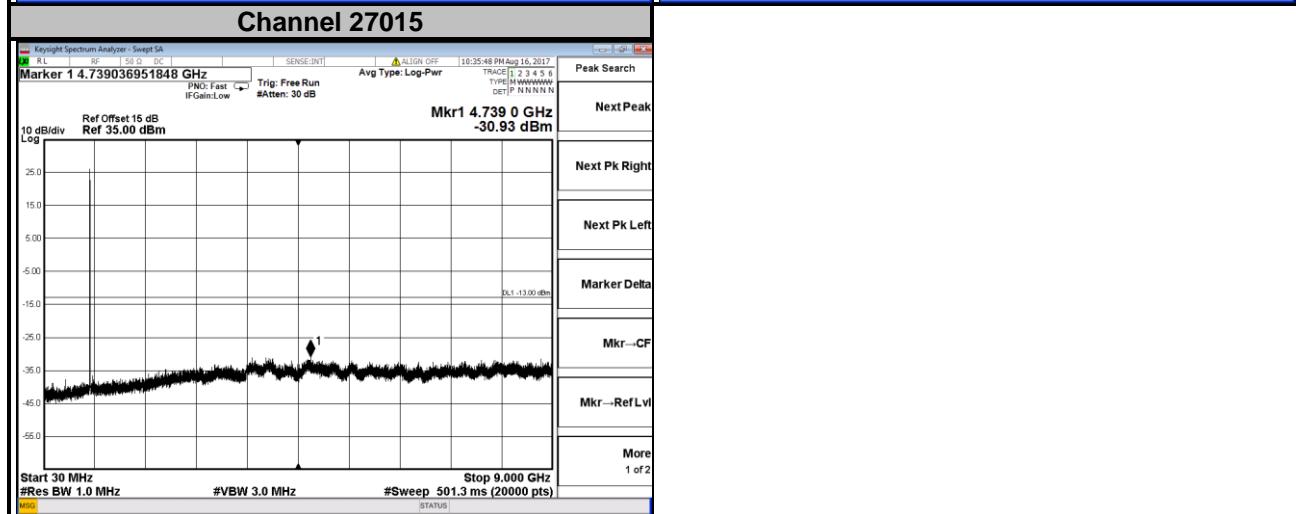
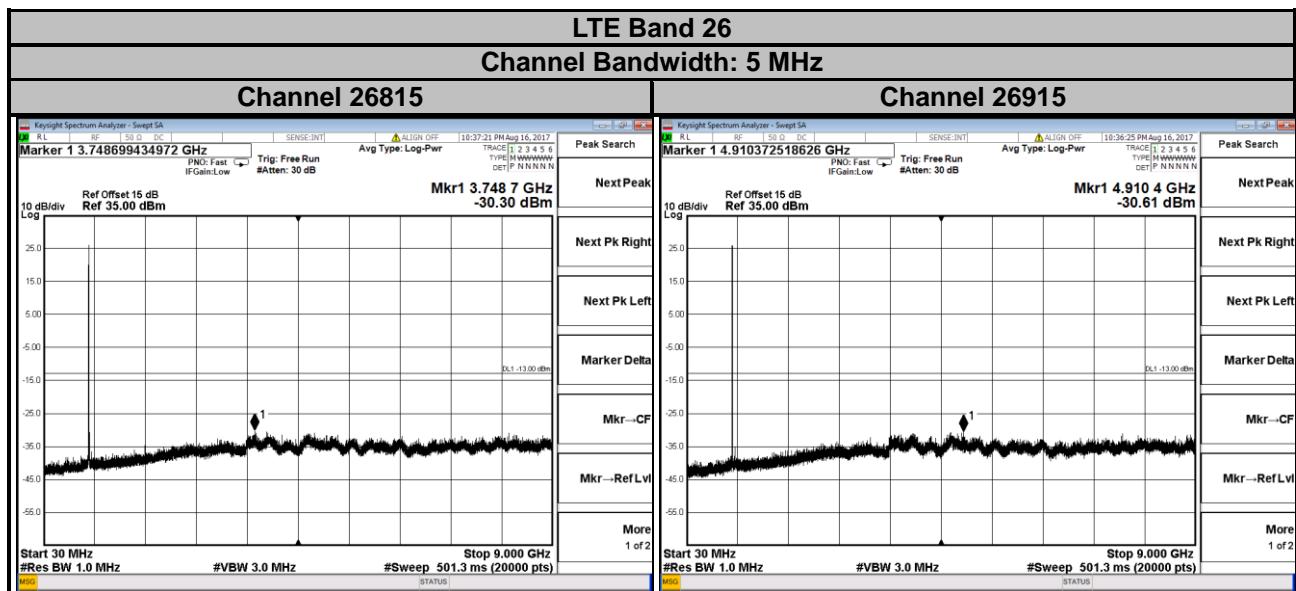
4.6.3 Test Procedure

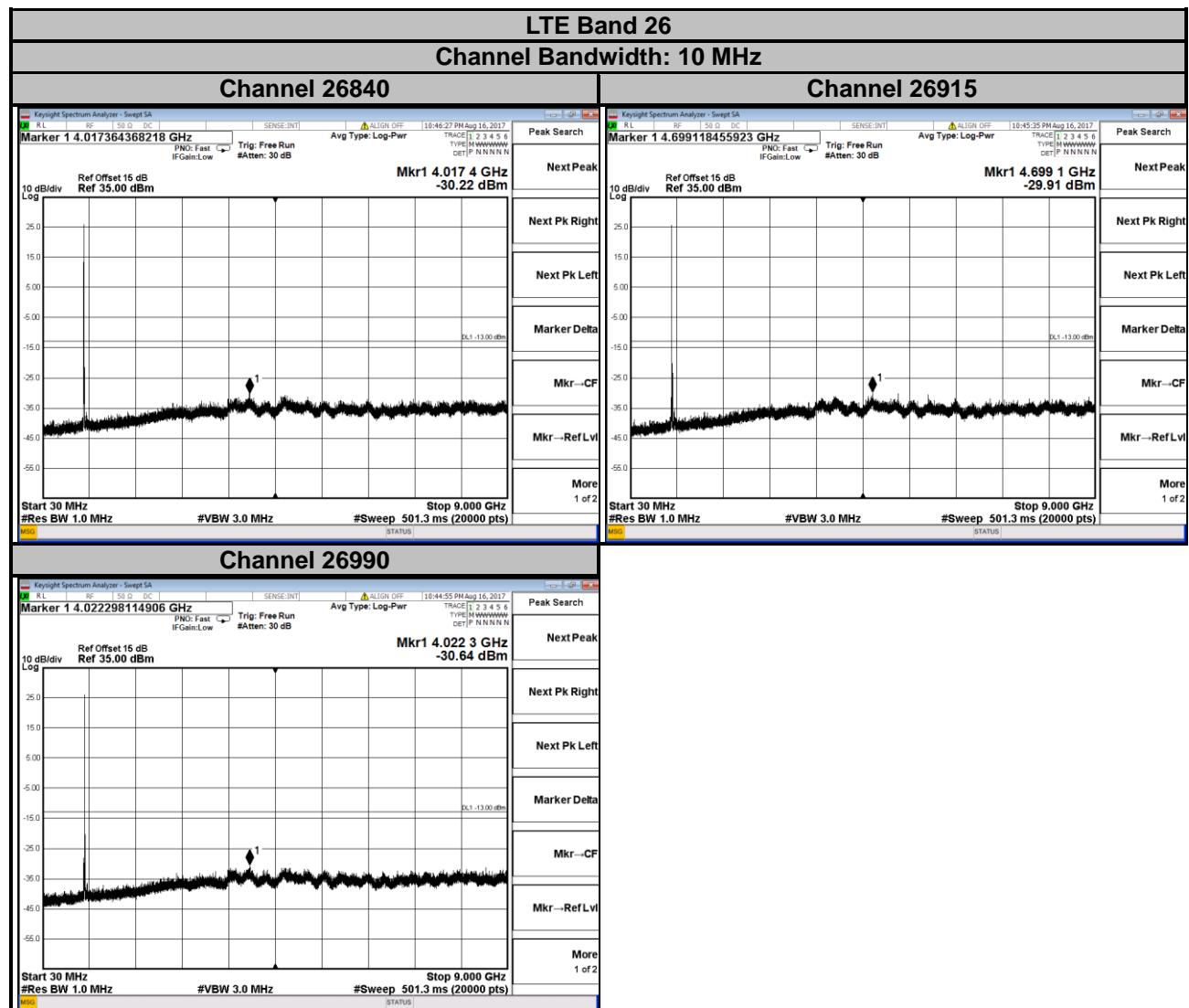
- The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
- Measuring frequency range is from 9 kHz to 9 GHz. 20 dB attenuation pad is connected with spectrum. RBW=1 MHz and VBW=3 MHz is used for conducted emission measurement.

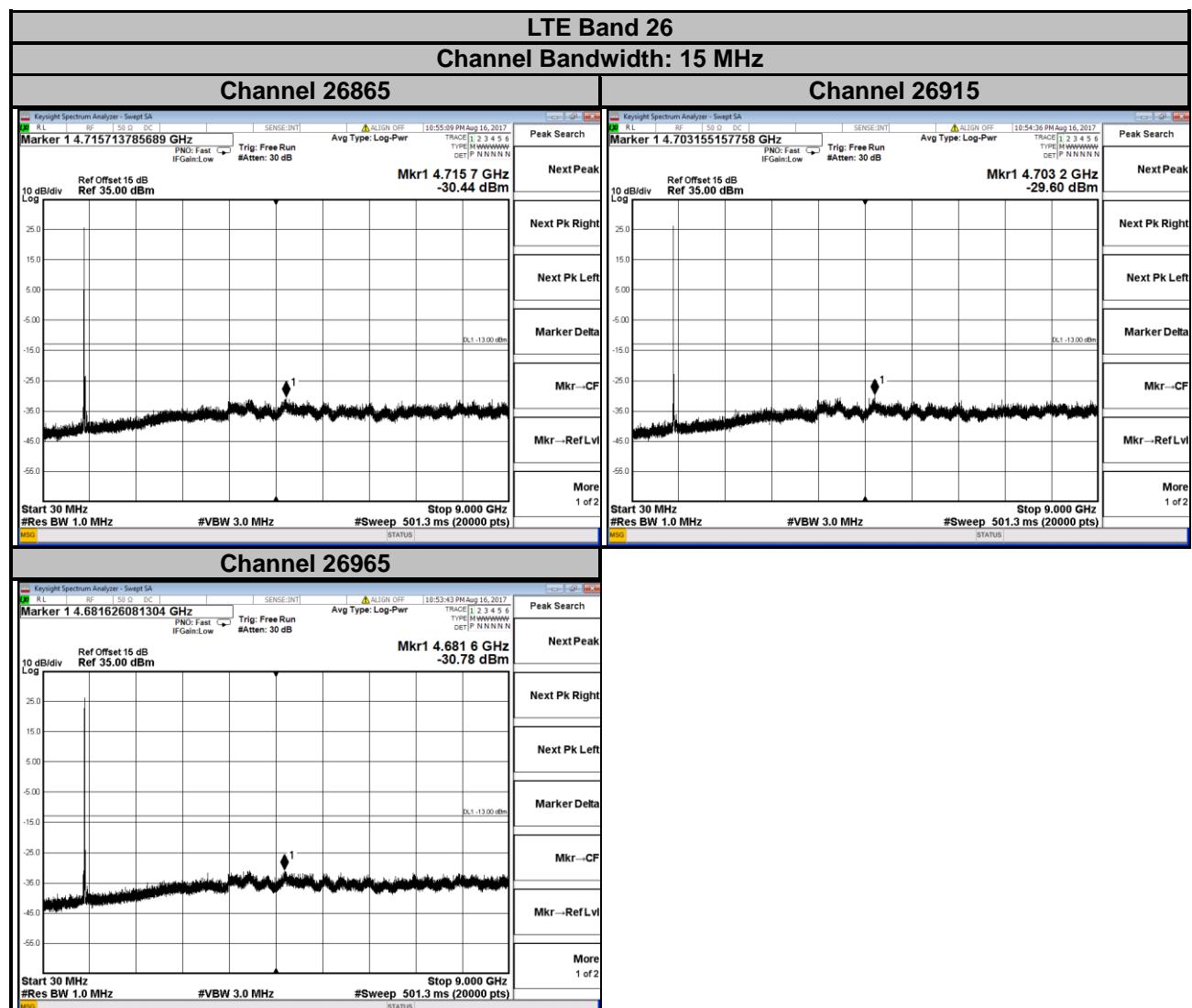
4.6.4 Test Results











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

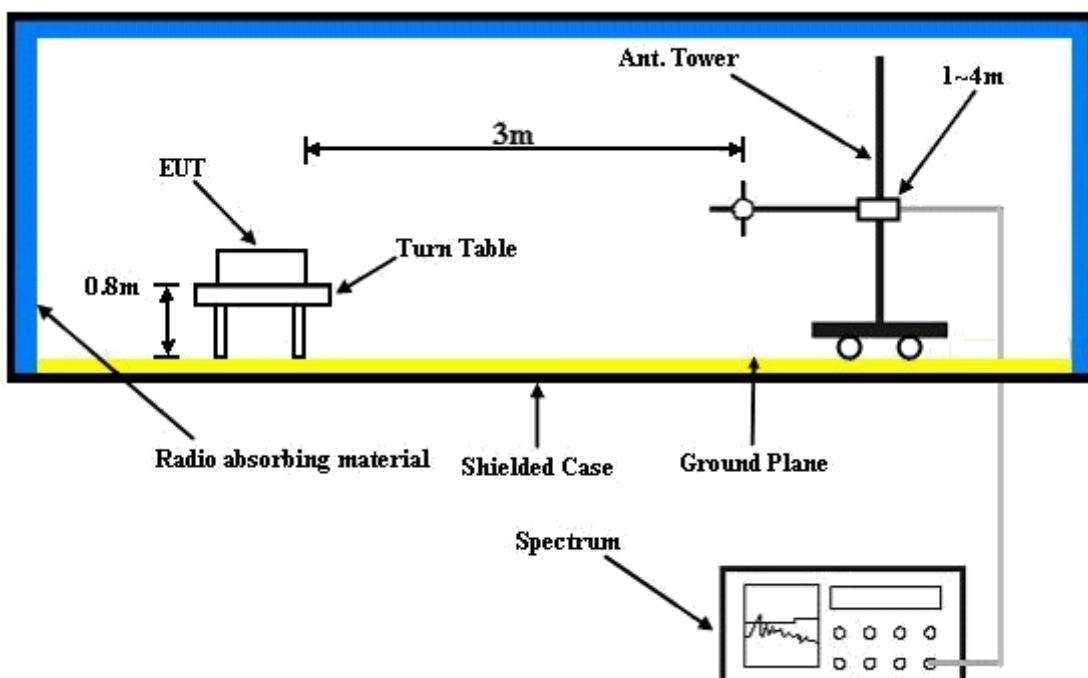
- a. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.
- 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 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

LTE Band 26

Channel Bandwidth: 15 MHz / QPSK

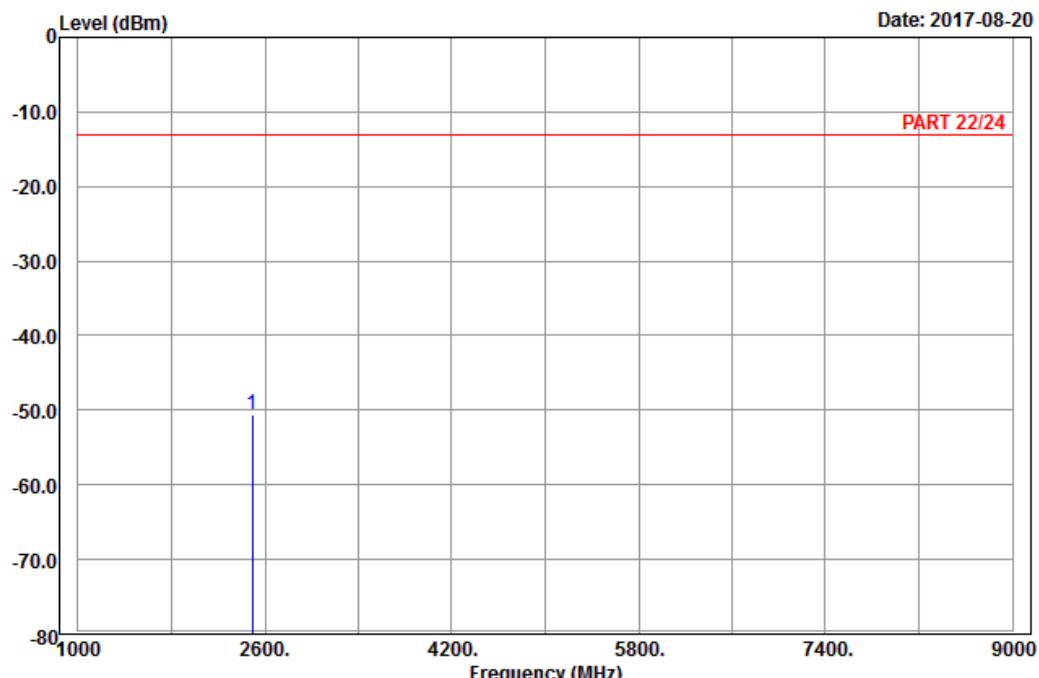
Low Channel



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A D T

Data: 5



Site : 966 chamber 1
 Condition: PART 22/24 Horizontal
 Remark : LTE_Band 26_Link_CH26865
 Tested by: Charles Hsiao

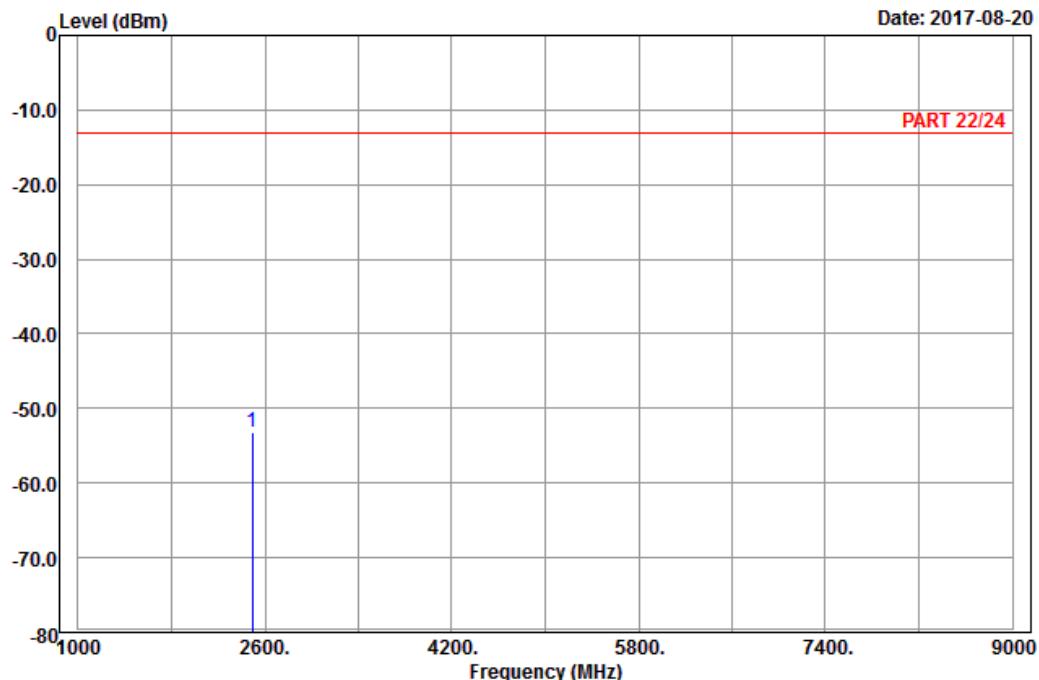
Freq	Read	Limit	Over	Remark		
	Level	Level	Line			
MHz	dBm	dBm	dBm	dB		
1 pp	2494.50	-50.58	-61.62	-13.00	-37.58	11.04 Peak



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A D T

Data: 6



Site : 966 chamber 1
 Condition: PART 22/24 Vertical
 Remark : LTE_Band_26_Link_CH26865
 Tested by: Charles Hsiao

		Read	Limit	Over		
Freq	Level	Level	Line	Limit	Factor	Remark
MHz	dBm	dBm	dBm	dB	dB	
1 pp	2494.50	-53.28	-64.32	-13.00	-40.28	11.04 Peak

Frequency (MHz)	ERP(dBm)	Limit(dBm)	Over Limit (dB)	SPA. Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)	Result
2494.5	-50.58	-13	-37.58	-59.35	-50.01	4.57	6.15	H	Pass
2494.5	-53.28	-13	-40.28	-62.14	-52.71	4.57	6.15	V	Pass

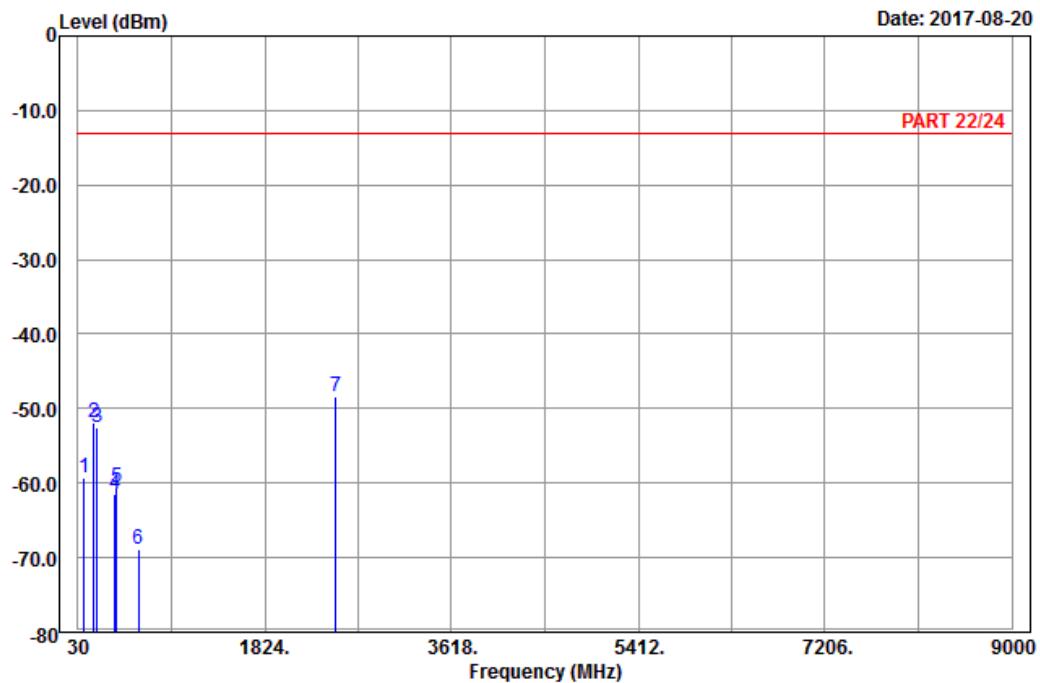
Middle Channel



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A D T

Data: 9



Site : 966 chamber 1

Condition: PART 22/24 Horizontal

Remark : LTE_Band 26_Link_CH26915

Tested by: Charles Hsiao

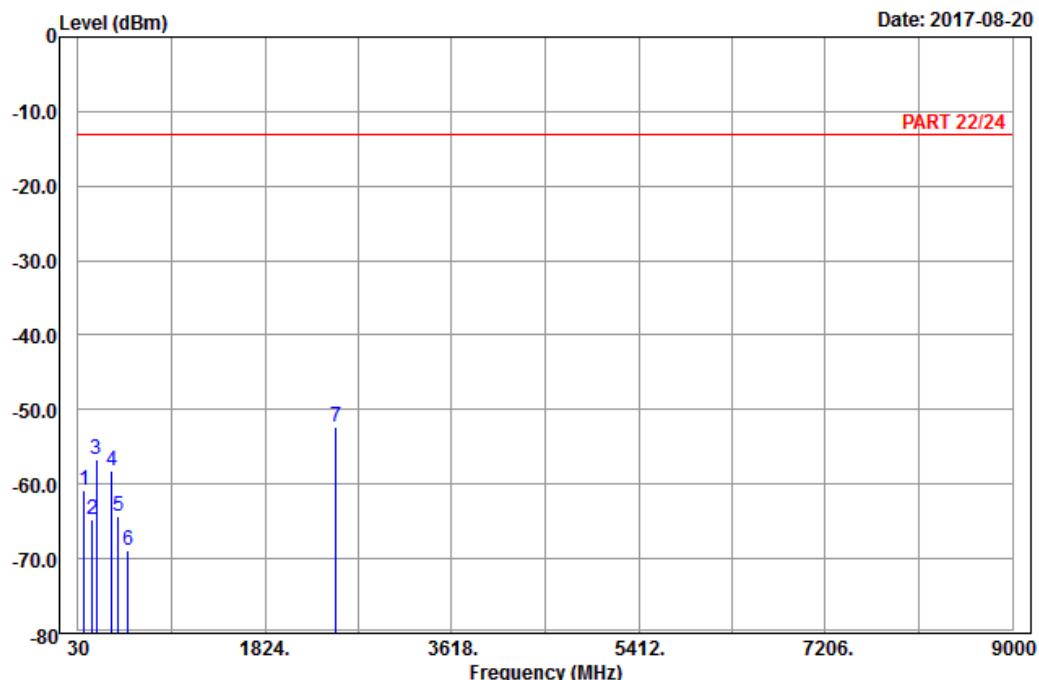
	Freq	Read Level	Limit Level	Over Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	91.83	-59.34	-48.78	-13.00	-46.34	-10.56	Peak
2	180.93	-51.89	-46.30	-13.00	-38.89	-5.59	Peak
3	211.44	-52.58	-46.55	-13.00	-39.58	-6.03	Peak
4	388.20	-61.53	-58.17	-13.00	-48.53	-3.36	Peak
5	398.70	-60.66	-57.87	-13.00	-47.66	-2.79	Peak
6	608.70	-68.85	-69.18	-13.00	-55.85	0.33	Peak
7 pp	2509.50	-48.33	-59.61	-13.00	-35.33	11.28	Peak



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A D T

Data: 10



Site : 966 chamber 1

Condition: PART 22/24 Vertical

Remark : LTE_Band_26_Link_CH26915

Tested by: Charles Hsiao

	Read Freq	Limit Level	Over Line	Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	
1	90.75	-60.82	-50.20	-13.00	-47.82	-10.62 Peak
2	166.89	-64.67	-57.68	-13.00	-51.67	-6.99 Peak
3	204.15	-56.73	-50.61	-13.00	-43.73	-6.12 Peak
4	352.50	-58.24	-52.97	-13.00	-45.24	-5.27 Peak
5	414.10	-64.33	-61.27	-13.00	-51.33	-3.06 Peak
6	507.90	-68.97	-64.26	-13.00	-55.97	-4.71 Peak
7 pp	2509.50	-52.32	-63.60	-13.00	-39.32	11.28 Peak

Frequency (MHz)	ERP(dBm)	Limit(dBm)	Over Limit (dB)	SPA. Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)	Result
2509.5	-48.33	-13	-35.33	-57.46	-47.76	4.57	6.15	H	Pass
2509.5	-52.32	-13	-39.32	-61.46	-51.75	4.57	6.15	V	Pass

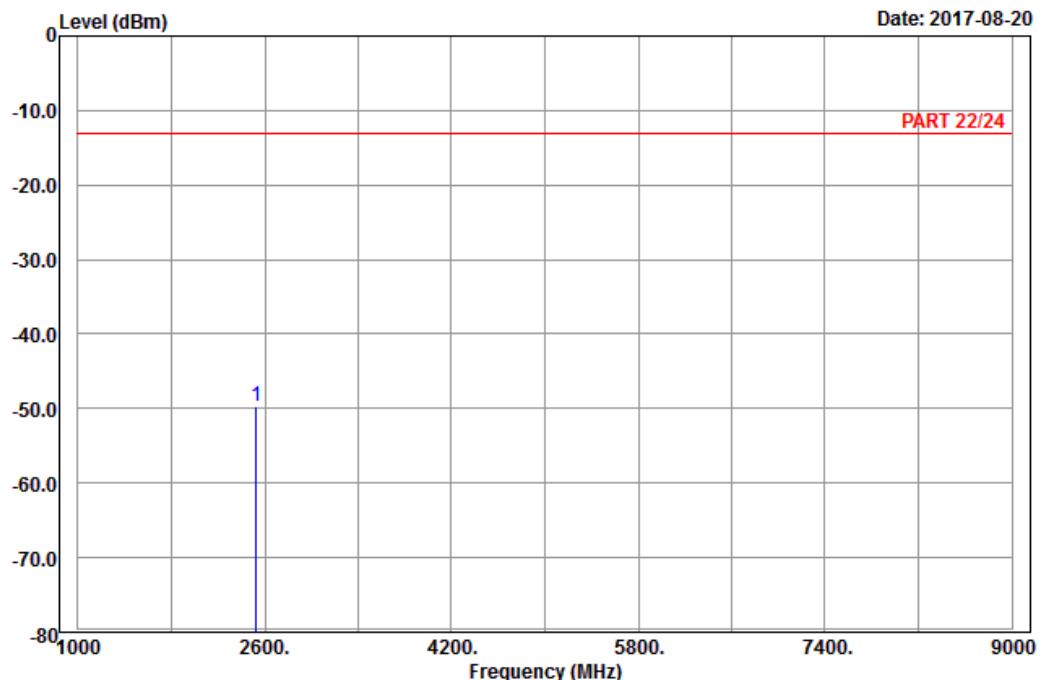
High Channel



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A D T

Data: 5



Site : 966 chamber 1
 Condition: PART 22/24 Horizontal
 Remark : LTE_Band 26_Link_CH26965
 Tested by: Charles Hsiao

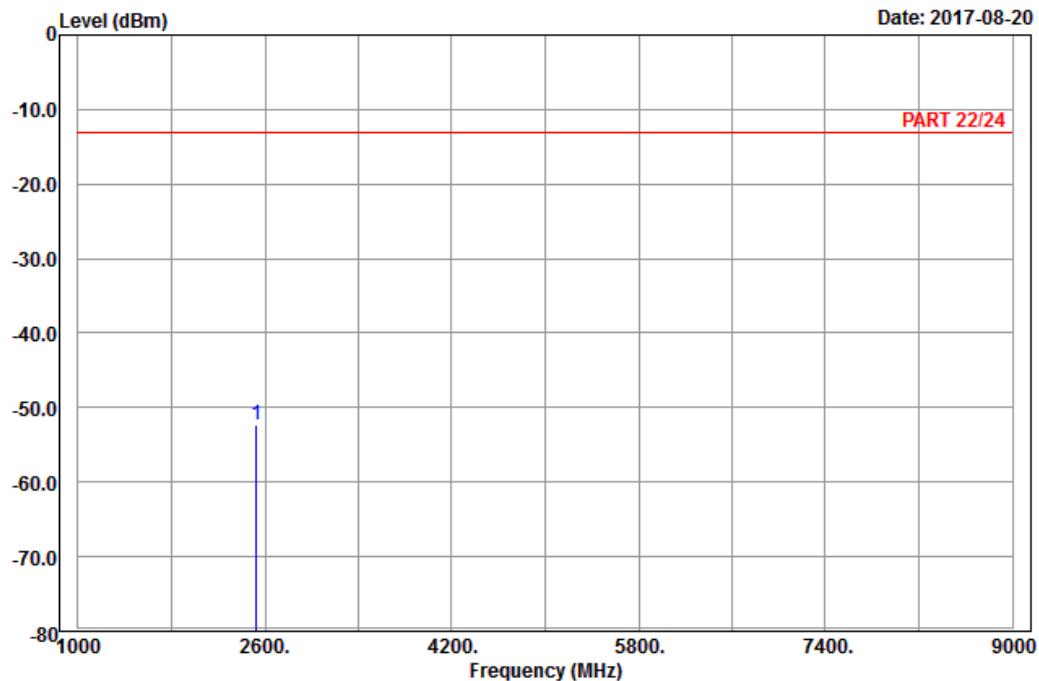
	Read	Limit	Over		
Freq	Level	Level	Line	Limit Factor	Remark
MHz	dBm	dBm	dBm	dB	dB
1 pp	2524.50	-49.80	-61.18	-13.00	-36.80
					11.38 Peak



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A D T

Data: 6



Site : 966 chamber 1
 Condition: PART 22/24 Vertical
 Remark : LTE_Band_26_Link_CH26965
 Tested by: Charles Hsiao

Freq	Read Level	Limit Level	Over Line	Limit Factor	Remark
MHz	dBm	dBm	dBm	dB	
1 pp	2524.50	-52.35	-63.73	-13.00	-39.35 11.38 Peak

Frequency (MHz)	ERP(dBm)	Limit(dBm)	Over Limit (dB)	SPA. Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)	Result
2524.5	-49.80	-13	-36.80	-59.03	-49.23	4.57	6.15	H	Pass
2524.5	-52.35	-13	-39.35	-61.63	-51.78	4.57	6.15	V	Pass

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 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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Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety

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Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

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