

# FCC Test Report

## (PART 27)

**Report No.:** RF190516C01-3

**FCC ID:** B94HNQ20PD

**Test Model:** HSN-Q20C

**Received Date:** May 16, 2019

**Test Date:** May 26 ~ Jun. 03, 2019

**Issued Date:** Jun. 26, 2019

**Applicant:** HP Inc.

**Address:** 3390 East Harmony Road, Fort Collins, Colorado 80528, United States

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

**Lab Address:** No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan ( R.O.C )

**Test Location:** No. 19, Hwa Ya 2nd Rd, Wen Hwa Vil, Kwei Shan Dist., Taoyuan City 33383, Taiwan (R.O.C)

**FCC Registration /  
Designation Number:** 788550 / TW0003



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### Release Control Record

Issue No.	Description	Date Issued
RF190516C01-3	Original Release	Jun. 26, 2019

## 1 Certificate of Conformity

**Product:** Notebook Computer

**Brand:** HP

**Test Model:** HSN-Q20C

**Sample Status:** Engineering Sample


**Applicant:** HP Inc.

**Test Date:** May 26 ~ Jun. 03, 2019

**Standards:** FCC Part 27, Subpart C, M

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

**Prepared by :** , **Date:** Jun. 26, 2019  
Gina Liu / Specialist

**Approved by :** , **Date:** Jun. 26, 2019  
Dylan Chiou / Project Engineer

## 2 Summary of Test Results

Applied Standard: FCC Part 27 & Part 2			
FCC Clause	Test Item	Result	Remarks
2.1046 27.50(h)(2)	Equivalent Isotropic Radiated Power	Pass	Meet the requirement of limit.
2.1047	Modulation Characteristics	Pass	Meet the requirement.
2.1055 27.54	Frequency Stability	Pass	Meet the requirement of limit.
2.1049 27.53(m)(6)	Occupied Bandwidth	Pass	Meet the requirement of limit.
--	Peak to Average Ratio	Pass	Meet the requirement of limit.
2.1051 27.53(m)(4)(6)	Out-of-Band Emissions Measurements	Pass	Meet the requirement of limit.
2.1051 27.53(m)(4)(6)	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 27.53(m)(4)(6)	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -22.09 dB at 5012 MHz.

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

### 2.1 Measurement Uncertainty

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

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.04 dB
	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~ 1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

## 2.2 Test Site and Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent	N9038A	MY51210203	Mar. 18, 2019	Mar. 17, 2020
Spectrum Analyzer Agilent	N9010A	MY52220314	Dec. 13, 2018	Dec. 12, 2019
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Apr. 15, 2019	Apr. 14, 2020
HORN Antenna SCHWARZBECK	BBHA 9170	148	Nov. 25, 2018	Nov. 24, 2019
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Nov. 25, 2018	Nov. 24, 2019
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Nov. 23, 2018	Nov. 22, 2019
Double Ridge Guide Horn Antenna EMCO	3115	5619	Nov. 25, 2018	Nov. 24, 2019
BILOG Antenna SCHWARZBECK	VULB 9168	9168-153	Nov. 23, 2018	Nov. 22, 2019
Fixed Attenuator WORKEN	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020
MXG Vector signal generator Agilent	N5182B	MY53050430	Nov. 19, 2018	Nov. 18, 2019
Preamplifier EMCI	EMC 184045	980116	Oct. 12, 2018	Oct. 11, 2019
Preamplifier EMCI	EMC 012645	980115	Oct. 12, 2018	Oct. 11, 2019
Preamplifier EMCI	EMC 330H	980112	Oct. 12, 2018	Oct. 11, 2019
RF Coaxial Cable HUBER+SUHNNER	EMC104-SM-SM-800 0&3000	140811+170717	Oct. 12, 2018	Oct. 11, 2019
RF Coaxial Cable HUBER+SUHNNER	SUCOFLEX 104	EMC104-SM-SM-1 000(140807)	Oct. 12, 2018	Oct. 11, 2019
RF Coaxial Cable WOKEN	8D-FB	Cable-Ch10-01	Oct. 12, 2018	Oct. 11, 2019
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA
Radio Communication Analyzer Anritsu	MT8820C	6201300640	Aug. 16, 2017	Aug. 15, 2019
Temperature & Humidity Chamber	GTH-120-40-CP-AR	MAA1306-019	Sep. 05, 2018	Sep. 04, 2019
DC Power Supply Topward	33010D	807748	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 / 24 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HwaYa Chamber 10.

### 3 General Information

#### 3.1 General Description of EUT

<b>Product</b>	Notebook Computer	
<b>Brand</b>	HP	
<b>Test Model</b>	HSN-Q20C	
<b>Status of EUT</b>	Engineering Sample	
<b>Power Supply Rating</b>	5 or 9 or 12 or 15 or 20 Vdc (Adapter)	
<b>Modulation Type</b>	QPSK, 16QAM	
<b>Frequency Range</b>	LTE Band 7 (Channel Bandwidth: 5 MHz)	2502.5 ~ 2567.5 MHz
	LTE Band 7 (Channel Bandwidth: 10 MHz)	2505 ~ 2565 MHz
	LTE Band 7 (Channel Bandwidth: 15 MHz)	2507.5 ~ 2562.5 MHz
	LTE Band 7 (Channel Bandwidth: 20 MHz)	2510 ~ 2560 MHz
	LTE Band 38 (Channel Bandwidth: 5 MHz)	2572.5 ~ 2617.5 MHz
	LTE Band 38 (Channel Bandwidth: 10 MHz)	2575.0 ~ 2615.0 MHz
	LTE Band 38 (Channel Bandwidth: 15 MHz)	2577.5 ~ 2612.5 MHz
	LTE Band 38 (Channel Bandwidth: 20 MHz)	2580.0 ~ 2610.0 MHz
	LTE Band 41 (Channel Bandwidth: 5 MHz)	2498.5 ~ 2687.5 MHz
	LTE Band 41 (Channel Bandwidth: 10 MHz)	2501.0 ~ 2685.0 MHz
	LTE Band 41 (Channel Bandwidth: 15 MHz)	2503.5 ~ 2682.5 MHz
	LTE Band 41 (Channel Bandwidth: 20 MHz)	2506.0 ~ 2680.0 MHz
<b>Max. EIRP Power</b>	LTE Band 7 (Channel Bandwidth: 5 MHz)	44.06 mW
	LTE Band 7 (Channel Bandwidth: 10 MHz)	46.56 mW
	LTE Band 7 (Channel Bandwidth: 15 MHz)	48.98 mW
	LTE Band 7 (Channel Bandwidth: 20 MHz)	51.52 mW
	LTE Band 38 (Channel Bandwidth: 5 MHz)	28.44 mW
	LTE Band 38 (Channel Bandwidth: 10 MHz)	29.99 mW
	LTE Band 38 (Channel Bandwidth: 15 MHz)	31.77 mW
	LTE Band 38 (Channel Bandwidth: 20 MHz)	33.34 mW
	LTE Band 41 (Channel Bandwidth: 5 MHz)	36.06 mW
	LTE Band 41 (Channel Bandwidth: 10 MHz)	37.84 mW
	LTE Band 41 (Channel Bandwidth: 15 MHz)	40.93 mW
	LTE Band 41 (Channel Bandwidth: 20 MHz)	43.55 mW
<b>Emission Designator</b>	LTE Band 7 (Channel Bandwidth: 5 MHz)	4M50D7W
	LTE Band 7 (Channel Bandwidth: 10 MHz)	9M00G7D
	LTE Band 7 (Channel Bandwidth: 15 MHz)	13M5G7D
	LTE Band 7 (Channel Bandwidth: 20 MHz)	18M0G7D
	LTE Band 38 (Channel Bandwidth: 5 MHz)	4M50D7W
	LTE Band 38 (Channel Bandwidth: 10 MHz)	9M00D7W
	LTE Band 38 (Channel Bandwidth: 15 MHz)	13M5G7D
	LTE Band 38 (Channel Bandwidth: 20 MHz)	18M0D7W
	LTE Band 41 (Channel Bandwidth: 5 MHz)	4M50D7W
	LTE Band 41 (Channel Bandwidth: 10 MHz)	8M99G7D
	LTE Band 41 (Channel Bandwidth: 15 MHz)	13M5D7W
	LTE Band 41 (Channel Bandwidth: 20 MHz)	18M0G7D



<b>Antenna Type</b>	Couple Antenna	
<b>Antenna Gain</b>	LTE Band 7	-4.90 dBi
	LTE Band 38	-5.68 dBi
	LTE Band 41	-4.90 dBi
<b>Accessory Device</b>	Refer to Note as below	
<b>Data Cable Supplied</b>	Refer to Note as below	

Note:

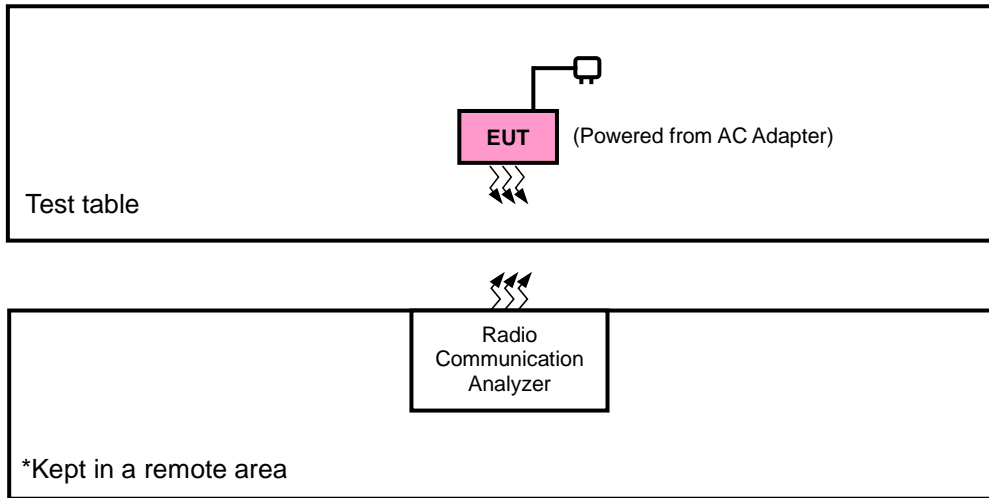
1. The WWAN module (Brand: Fibocom, Model: L850-GL) was installed in the EUT.
2. The EUT contains following accessory devices.

Product	Brand	Model	Description
Adapter	hp	TPN-TA02	I/P: 100-240 Vac, 50-60 Hz, 1.6 A O/P: 5 Vdc, 3 A or 9 Vdc, 3 A or 12 Vdc, 5 A or 15 Vdc, 4.33 A or 20 Vdc, 3.25 A

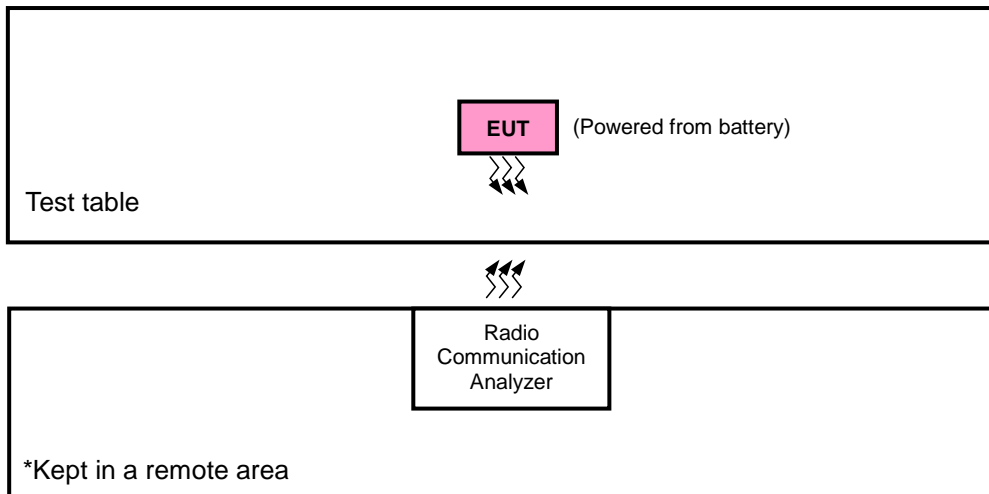
3. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

### 3.2 Configuration of System under Test

#### <Radiated Emission Test>



#### <E.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.

### 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 NB mode, 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	EIRP	Radiated Emission
LTE Band 7	NB mode	Z-axis
LTE Band 38	NB mode	Z-axis
LTE Band 41	NB mode	Z-axis

#### LTE Band 7

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	EIRP	20775 to 21425	20775, 21100, 21425	5 MHz	QPSK, 16QAM	1 RB / 24 RB Offset
		20800 to 21400	20800, 21100, 21400	10 MHz	QPSK, 16QAM	1 RB / 49 RB Offset
		20825 to 21375	20825, 21100, 21375	15 MHz	QPSK, 16QAM	1 RB / 74 RB Offset
		20850 to 21350	20850, 21100 21350	20 MHz	QPSK, 16QAM	1 RB / 99 RB Offset
-	Modulation Characteristics	20850 to 21350	21110	20 MHz	QPSK, 16QAM	100 RB / 0 RB Offset
-	Frequency Stability	20775 to 21425	20775, 21425	5 MHz	QPSK	1 RB / 0 RB Offset
		20800 to 21400	20800, 21400	10 MHz	QPSK	1 RB / 0 RB Offset
		20825 to 21375	20825, 21375	15 MHz	QPSK	1 RB / 0 RB Offset
		20850 to 21350	20850, 21350	20 MHz	QPSK	1 RB / 0 RB Offset
-	Occupied Bandwidth	20775 to 21425	20775, 21100, 21425	5 MHz	QPSK, 16QAM	25 RB / 0 RB Offset
		20800 to 21400	20800, 21100, 21400	10 MHz	QPSK, 16QAM	50 RB / 0 RB Offset
		20825 to 21375	20825, 21100, 21375	15 MHz	QPSK, 16QAM	75 RB / 0 RB Offset
		20850 to 21350	20850, 21100 21350	20 MHz	QPSK, 16QAM	100 RB / 0 RB Offset
-	Peak to Average Ratio	20775 to 21425	20775, 21100, 21425	5 MHz	QPSK, 16QAM	1 RB / 24 RB Offset
		20800 to 21400	20800, 21100, 21400	10 MHz	QPSK, 16QAM	1 RB / 49 RB Offset
		20825 to 21375	20825, 21100, 21375	15 MHz	QPSK, 16QAM	1 RB / 74 RB Offset
		20850 to 21350	20850, 21100 21350	20 MHz	QPSK, 16QAM	1 RB / 99 RB Offset
-	Out-of-Band Emissions	20775 to 21425	20775, 21425	5 MHz	QPSK, 16QAM	25 RB / 0 RB Offset
		20800 to 21400	20800, 21400	10 MHz	QPSK, 16QAM	50 RB / 0 RB Offset
		20825 to 21375	20825, 21375	15 MHz	QPSK, 16QAM	75 RB / 0 RB Offset
		20850 to 21350	20850, 21350	20 MHz	QPSK, 16QAM	100 RB / 0 RB Offset
-	Conducted Emission	20775 to 21425	20775, 21100, 21425	5 MHz	QPSK	1 RB / 24 RB Offset
		20800 to 21400	20800, 21100, 21400	10 MHz	QPSK	1 RB / 49 RB Offset
		20825 to 21375	20825, 21100, 21375	15 MHz	QPSK	1 RB / 74 RB Offset
		20850 to 21350	20850, 21100 21350	20 MHz	QPSK	1 RB / 99 RB Offset
-	Radiated Emission	20775 to 21425	20775, 21100, 21425	5 MHz	QPSK	1 RB / 24 RB Offset
		20850 to 21350	20850, 21100 21350	20 MHz	QPSK	1 RB / 99 RB Offset

**Note:**

1. This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation.
2. For radiated emission above 1 GHz, according to 3GPP 36.521 Section 6.6.3.1.4, choose the lowest, 5 MHz & highest channel bandwidth for final test.

## LTE Band 38

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	EIRP	37775 to 38225	37775, 38000, 38225	5 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		37800 to 38200	37800, 38000, 38200	10 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		37825 to 38175	37825, 38000, 38175	15 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		37850 to 38150	37850, 38000, 38150	20 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
-	Modulation Characteristics	37850 to 38150	38000	20 MHz	QPSK, 16QAM	100 RB / 0 RB Offset
-	Frequency Stability	37775 to 38225	37775, 38225	5 MHz	QPSK	1 RB / 0 RB Offset
		37800 to 38200	37800, 38200	10 MHz	QPSK	1 RB / 0 RB Offset
		37825 to 38175	37825, 38175	15 MHz	QPSK	1 RB / 0 RB Offset
		37850 to 38150	37850, 38150	20 MHz	QPSK	1 RB / 0 RB Offset
-	Occupied Bandwidth	37775 to 38225	37775, 38000, 38225	5 MHz	QPSK, 16QAM	25 RB / 0 RB Offset
		37800 to 38200	37800, 38000, 38200	10 MHz	QPSK, 16QAM	50 RB / 0 RB Offset
		37825 to 38175	37825, 38000, 38175	15 MHz	QPSK, 16QAM	75 RB / 0 RB Offset
		37850 to 38150	37850, 38000, 38150	20 MHz	QPSK, 16QAM	100 RB / 0 RB Offset
-	Peak to Average Ratio	37775 to 38225	37775, 38000, 38225	5 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		37800 to 38200	37800, 38000, 38200	10 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		37825 to 38175	37825, 38000, 38175	15 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		37850 to 38150	37850, 38000, 38150	20 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
-	Out-of-Band Emissions	37775 to 38225	37775, 38225	5 MHz	QPSK, 16QAM	25 RB / 0 RB Offset
		37800 to 38200	37800, 38200	10 MHz	QPSK, 16QAM	50 RB / 0 RB Offset
		37825 to 38175	37825, 38175	15 MHz	QPSK, 16QAM	75 RB / 0 RB Offset
		37850 to 38150	37850, 38150	20 MHz	QPSK, 16QAM	100 RB / 0 RB Offset
-	Conducted Emission	37775 to 38225	37775, 38000, 38225	5 MHz	QPSK	1 RB / 0 RB Offset
		37800 to 38200	37800, 38000, 38200	10 MHz	QPSK	1 RB / 0 RB Offset
		37825 to 38175	37825, 38000, 38175	15 MHz	QPSK	1 RB / 0 RB Offset
		37850 to 38150	37850, 38000, 38150	20 MHz	QPSK	1 RB / 0 RB Offset
-	Radiated Emission	37775 to 38225	37775, 38000, 38225	5 MHz	QPSK	1 RB / 0 RB Offset
		37850 to 38150	37850, 38000, 38150	20 MHz	QPSK	1 RB / 0 RB Offset

### Note:

1. This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation.
2. For radiated emission above 1 GHz, according to 3GPP 36.521 Section 6.6.3.1.4, choose the lowest, 5 MHz & highest channel bandwidth for final test.

## LTE Band 41

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	EIRP	39675 to 41565	39675, 40620, 41565	5 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		39700 to 41540	39700, 40620, 41540	10 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		39725 to 41515	39725, 40620, 41515	15 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		39750 to 41490	39750, 40620, 41490	20 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
-	Modulation Characteristics	39750 to 41490	40620	20 MHz	QPSK, 16QAM	100 RB / 0 RB Offset
-	Frequency Stability	39675 to 41565	39675, 41565	5 MHz	QPSK	1 RB / 0 RB Offset
		39700 to 41540	39700, 41540	10 MHz	QPSK	1 RB / 0 RB Offset
		39725 to 41515	39725, 41515	15 MHz	QPSK	1 RB / 0 RB Offset
		39750 to 41490	39750, 41490	20 MHz	QPSK	1 RB / 0 RB Offset
-	Occupied Bandwidth	39675 to 41565	39675, 40620, 41565	5 MHz	QPSK, 16QAM	25 RB / 0 RB Offset
		39700 to 41540	39700, 40620, 41540	10 MHz	QPSK, 16QAM	50 RB / 0 RB Offset
		39725 to 41515	39725, 40620, 41515	15 MHz	QPSK, 16QAM	75 RB / 0 RB Offset
		39750 to 41490	39750, 40620, 41490	20 MHz	QPSK, 16QAM	100 RB / 0 RB Offset
-	Peak to Average Ratio	39675 to 41565	39675, 40620, 41565	5 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		39700 to 41540	39700, 40620, 41540	10 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		39725 to 41515	39725, 40620, 41515	15 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		39750 to 41490	39750, 40620, 41490	20 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
-	Out-of-Band Emissions	39675 to 41565	39675, 41565	5 MHz	QPSK, 16QAM	25 RB / 0 RB Offset
		39700 to 41540	39700, 41540	10 MHz	QPSK, 16QAM	50 RB / 0 RB Offset
		39725 to 41515	39725, 41515	15 MHz	QPSK, 16QAM	75 RB / 0 RB Offset
		39750 to 41490	39750, 41490	20 MHz	QPSK, 16QAM	100 RB / 0 RB Offset
-	Conducted Emission	39675 to 41565	39675, 40620, 41565	5 MHz	QPSK	1 RB / 0 RB Offset
		39700 to 41540	39700, 40620, 41540	10 MHz	QPSK	1 RB / 0 RB Offset
		39725 to 41515	39725, 40620, 41515	15 MHz	QPSK	1 RB / 0 RB Offset
		39750 to 41490	39750, 40620, 41490	20 MHz	QPSK	1 RB / 0 RB Offset
-	Radiated Emission	39675 to 41565	39675, 40620, 41565	5 MHz	QPSK	1 RB / 0 RB Offset
		39750 to 41490	39750, 40620, 41490	20 MHz	QPSK	1 RB / 0 RB Offset

### Note:

1. This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation.
2. For radiated emission above 1 GHz, according to 3GPP 36.521 Section 6.6.3.1.4, choose the lowest, 5 MHz & highest channel bandwidth for final test.

### Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
EIRP	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
Modulation Characteristics	25 deg. C, 65 % RH	120 Vac, 60 Hz	Gavin Wu
Frequency Stability	25 deg. C, 65 % RH	120 Vac, 60 Hz	Gavin Wu
Occupied Bandwidth	25 deg. C, 65 % RH	120 Vac, 60 Hz	Gavin Wu
Out-of-Band Emissions	25 deg. C, 65 % RH	120 Vac, 60 Hz	Gavin Wu
Peak to Average Ratio	25 deg. C, 65 % RH	120 Vac, 60 Hz	Gavin Wu
Conducted Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	Gavin Wu
Radiated Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang, Tim Chen

### **3.4 EUT Operating Conditions**

The EUT makes a call to the communication simulator. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency

### **3.5 General Description of Applied Standards**

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 v03r01**

**ANSI/TIA/EIA-603-E 2016**

**ANSI 63.26-2015**

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

## 4 Test Types and Results

### 4.1 Output Power Measurement

#### 4.1.1 Limits of Output Power Measurement

The radiated peak output power shall be according to the specific rule Part 27.50(h)(2) that “Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2 watts transmitter output power” and 27.50(i) specific that “Peak transmit power must be measure over any interval of continuous transmission using instrumentation calibration in terms of rms-equivalent voltage.”

#### 4.1.2 Test Procedures

##### **EIRP Measurement:**

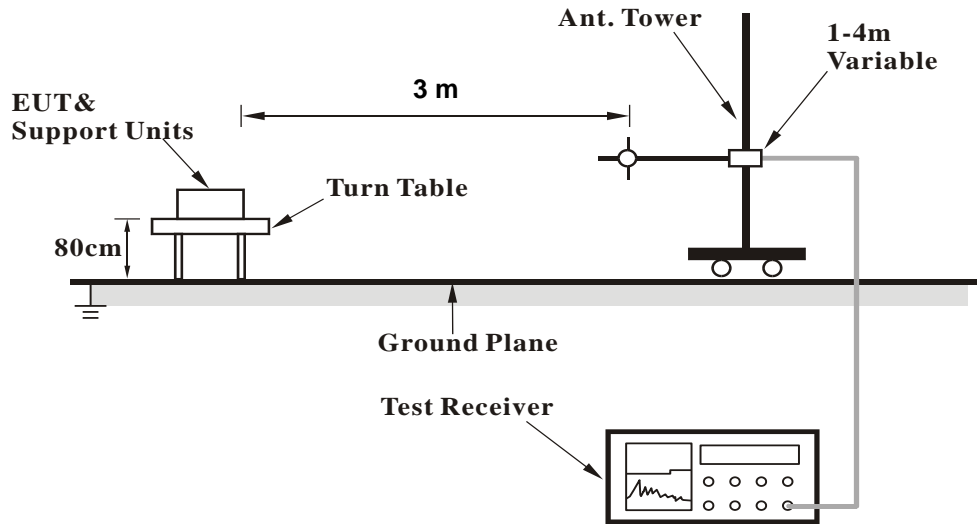
- a. All measurements were done at low, middle and high operational frequency range. RBW and VBW is 10 MHz for LTE mode.
- b. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m (below or equal 1 GHz) and/or 1.5 m (above 1 GHz) height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.
- c. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a tx cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to “Read Value“ of step b. Record the power level of S.G.
- d.  $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}.$

##### **Conducted Power Measurement:**

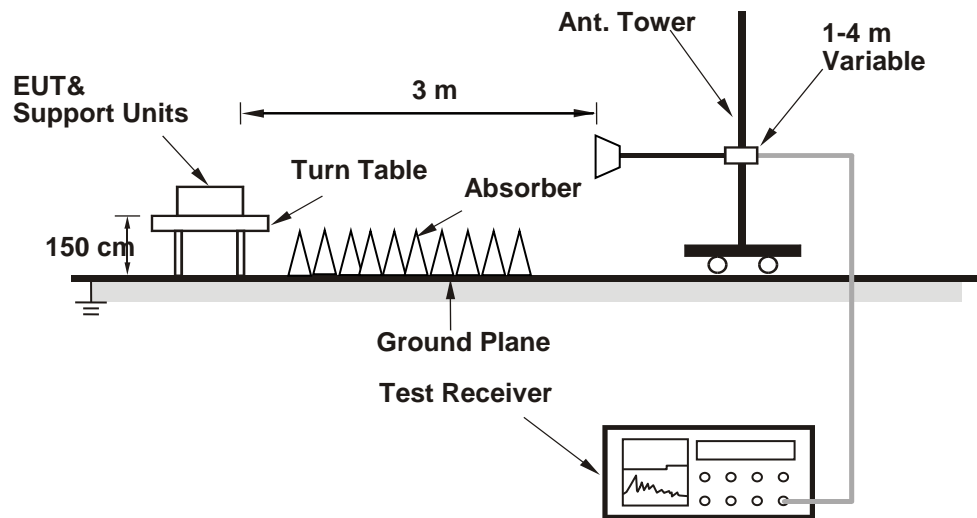
- a. The EUT was set up for the maximum power with LTE link data modulation and link up with simulator.
- b. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

4.1.3 Test Setup

**EIRP / ERP Measurement:**  
**<Radiated Emission below or equal 1 GHz>**



**<Radiated Emission above 1 GHz>**



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

**Conducted Power Measurement:**





#### 4.1.4 Test Results Conducted Output Power (dBm)

LTE Band 7															
BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)	BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		20850	21100	21350				Channel		20825	21100	21375	
		Frequency (MHz)		2510.0	2535.0	2560.0				Frequency (MHz)		2507.5	2535.0	2562.5	
20M	QPSK	1	0	22.54	22.43	22.41	0	15M	QPSK	1	0	22.45	22.38	22.31	0
		1	50	22.53	22.40	22.36	0			1	37	22.50	22.38	22.34	0
		1	99	22.63	22.52	22.50	0			1	74	22.53	22.42	22.40	0
		50	0	21.60	21.39	21.38	1			36	0	21.55	21.34	21.29	1
		50	25	21.58	21.48	21.44	1			36	19	21.51	21.45	21.43	1
		50	50	21.64	21.53	21.50	1			36	39	21.57	21.52	21.42	1
	16QAM	100	0	21.73	21.62	21.59	1		75	0	21.71	21.59	21.51	1	
		1	0	21.44	21.41	21.37	1		16QAM	1	0	21.42	21.39	21.36	1
		1	50	21.52	21.33	21.26	1			1	37	21.50	21.34	21.20	1
		1	99	21.63	21.46	21.43	1			1	74	21.53	21.39	21.30	1
		50	0	20.58	20.33	20.31	2			36	0	20.45	20.27	20.27	2
		50	25	20.54	20.40	20.37	2			36	19	20.57	20.41	20.37	2
		50	50	20.62	20.50	20.50	2			36	39	20.56	20.39	20.40	2
		100	0	20.67	20.54	20.52	2			75	0	20.65	20.42	20.47	2

LTE Band 38															
BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)	BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		37850	38000	38150				Channel		37825	38000	38175	
		Frequency (MHz)		2580	2595	2610				Frequency (MHz)		2577.5	2595	2612.5	
20M	QPSK	1	0	21.92	21.86	21.85	0	15M	QPSK	1	0	21.90	21.84	21.83	0
		1	50	21.87	21.81	21.80	0			1	37	21.85	21.79	21.78	0
		1	99	21.86	21.80	21.79	0			1	74	21.84	21.78	21.77	0
		50	0	20.90	20.83	20.82	1			36	0	20.87	20.81	20.80	1
		50	25	20.88	20.82	20.81	1			36	19	20.86	20.80	20.79	1
		50	50	20.89	20.84	20.83	1			36	39	20.88	20.82	20.81	1
	16QAM	100	0	20.86	20.80	20.79	1		75	0	20.84	20.78	20.77	1	
		1	0	21.18	21.12	21.11	1		16QAM	1	0	21.16	21.10	21.09	1
		1	50	21.17	21.11	21.10	1			1	37	21.15	21.09	21.08	1
		1	99	21.23	21.17	21.16	1			1	74	21.21	21.15	21.14	1
		50	0	19.85	19.79	19.78	2			36	0	19.83	19.77	19.76	2
		50	25	19.92	19.86	19.85	2			36	19	19.90	19.84	19.83	2
		50	50	19.90	19.84	19.83	2			36	39	19.88	19.82	19.81	2
		100	0	19.99	19.93	19.92	2			75	0	19.97	19.91	19.90	2

**LTE Band 41**

BW	MCS Index	RB Size		Low	Mid	Mid	Mid	High	3GPP MPR (dB)	BW	MCS Index	RB Size		Low	Mid	Mid	Mid	High	3GPP MPR (dB)
		Channel	Offset									Channel	Offset						
		Frequency (MHz)										Frequency (MHz)							
20M	QPSK	1	0	22.10	22.33	21.83	21.82	21.76	0	15M	QPSK	1	0	22.06	22.23	21.82	21.75	21.74	0
		1	50	21.88	22.11	21.65	21.60	21.59	0			1	37	21.86	22.03	21.63	21.59	21.53	0
		1	99	21.75	21.97	21.53	21.51	21.50	0			1	74	21.65	21.91	21.49	21.45	21.49	0
		50	0	21.08	21.22	20.85	20.83	20.73	1			36	0	20.99	21.17	20.79	20.75	20.68	1
		50	25	20.92	21.12	20.76	20.61	20.60	1			36	19	20.85	21.05	20.76	20.59	20.52	1
		50	50	20.85	21.05	20.65	20.62	20.58	1			36	39	20.81	21.03	20.55	20.60	20.51	1
		100	0	20.89	21.11	20.72	20.65	20.64	1			75	0	20.81	21.07	20.71	20.65	20.60	1
	16QAM	1	0	21.08	21.32	20.83	20.81	20.68	1		1	0	21.01	21.26	20.79	20.81	20.66	1	
		1	50	20.85	21.11	20.63	20.56	20.57	1		1	37	20.82	21.10	20.57	20.59	20.49	1	
		1	99	20.71	20.97	20.50	20.43	20.48	1		1	74	20.72	20.96	20.44	20.48	20.48	1	
		50	0	20.04	20.16	19.78	19.73	19.64	2		36	0	20.02	20.17	19.80	19.79	19.68	2	
		50	25	19.84	20.08	19.69	19.54	19.52	2		36	19	19.88	20.08	19.72	19.59	19.52	2	
		50	50	19.76	20.01	19.64	19.56	19.55	2		36	39	19.81	20.05	19.62	19.52	19.51	2	
		100	0	19.85	20.02	19.63	19.65	19.56	2		75	0	19.88	20.02	19.66	19.63	19.54	2	
10M	QPSK	1	0	21.98	22.19	21.71	21.74	21.68	0	5M	QPSK	1	0	22.06	22.26	21.72	21.79	21.63	0
		1	24	21.83	21.94	21.58	21.41	21.41	0			1	12	21.82	21.91	21.49	21.43	21.48	0
		1	49	21.66	21.91	21.49	21.37	21.44	0			1	24	21.58	21.94	21.49	21.44	21.32	0
		25	0	20.97	21.14	20.83	20.72	20.60	1			12	0	21.01	21.13	20.80	20.82	20.65	1
		25	12	20.82	20.99	20.74	20.57	20.50	1			12	6	20.75	21.05	20.63	20.41	20.46	1
		25	25	20.69	20.88	20.55	20.51	20.56	1			12	13	20.75	20.96	20.62	20.47	20.49	1
		50	0	20.81	21.01	20.64	20.58	20.54	1			25	0	20.81	20.98	20.63	20.50	20.59	1
	16QAM	1	0	20.94	21.19	20.77	20.74	20.71	1		1	0	21.01	21.21	20.70	20.73	20.59	1	
		1	24	20.78	20.99	20.64	20.44	20.42	1		1	12	20.77	20.93	20.50	20.44	20.44	1	
		1	49	20.56	20.84	20.51	20.33	20.47	1		1	24	20.64	20.94	20.41	20.46	20.32	1	
		25	0	19.97	20.14	19.83	19.76	19.60	2		12	0	20.01	20.17	19.78	19.76	19.71	2	
		25	12	19.83	20.03	19.71	19.50	19.52	2		12	6	19.80	20.03	19.66	19.43	19.42	2	
		25	25	19.72	19.87	19.58	19.53	19.52	2		12	13	19.77	19.95	19.63	19.47	19.43	2	
		50	0	19.72	19.94	19.65	19.52	19.48	2		25	0	19.79	20.01	19.63	19.57	19.58	2	

**EIRP Power (dBm)**

LTE Band 7							
Channel Bandwidth: 5 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
NB	20775	2502.5	-29.71	38.52	8.81	7.60	H
	21100	2535.0	-29.72	38.36	8.64	7.31	
	21425	2567.5	-29.97	38.58	8.61	7.26	
	20775	2502.5	-22.48	38.92	16.44	44.06	V
	21100	2535.0	-22.90	39.26	16.36	43.25	
	21425	2567.5	-23.06	39.22	16.16	41.30	
Channel Bandwidth: 5 MHz / 16QAM							
NB	20775	2502.5	-30.77	38.52	7.75	5.96	H
	21100	2535.0	-30.82	38.36	7.54	5.68	
	21425	2567.5	-31.35	38.58	7.23	5.28	
	20775	2502.5	-23.68	38.92	15.24	33.42	V
	21100	2535.0	-24.07	39.26	15.19	33.04	
	21425	2567.5	-24.10	39.22	15.12	32.51	

Note: EIRP (dBm) = Reading (dBm) + Correction Factor (dB)

LTE Band 7							
Channel Bandwidth: 10 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
NB	20800	2505.0	-29.53	38.65	9.12	8.17	H
	21100	2535.0	-29.46	38.36	8.90	7.76	
	21400	2565.0	-29.66	38.49	8.83	7.64	
	20800	2505.0	-22.16	38.84	16.68	46.56	V
	21100	2535.0	-22.64	39.26	16.62	45.92	
	21400	2565.0	-22.66	39.10	16.44	44.06	
Channel Bandwidth: 10 MHz / 16QAM							
NB	20800	2505.0	-30.67	38.65	7.98	6.28	H
	21100	2535.0	-30.57	38.36	7.79	6.01	
	21400	2565.0	-30.97	38.49	7.52	5.65	
	20800	2505.0	-23.36	38.84	15.48	35.32	V
	21100	2535.0	-23.87	39.26	15.39	34.59	
	21400	2565.0	-23.78	39.10	15.32	34.04	

Note: EIRP (dBm) = Reading (dBm) + Correction Factor (dB)

LTE Band 7							
Channel Bandwidth: 15 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
NB	20825	2507.5	-29.17	38.52	9.35	8.61	H
	21100	2535.0	-29.16	38.36	9.20	8.32	
	21375	2562.5	-29.50	38.58	9.08	8.09	
	20825	2507.5	-22.02	38.92	16.90	48.98	V
	21100	2535.0	-22.41	39.26	16.85	48.42	
	21375	2562.5	-22.51	39.22	16.71	46.88	
Channel Bandwidth: 15 MHz / 16QAM							
NB	20825	2507.5	-30.26	38.52	8.26	6.70	H
	21100	2535.0	-30.26	38.36	8.10	6.46	
	21375	2562.5	-30.76	38.58	7.82	6.05	
	20825	2507.5	-23.24	38.92	15.68	36.98	V
	21100	2535.0	-23.62	39.26	15.64	36.64	
	21375	2562.5	-23.62	39.22	15.60	36.31	

Note: EIRP (dBm) = Reading (dBm) + Correction Factor (dB)

LTE Band 7							
Channel Bandwidth: 20 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
NB	20850	2510.0	-28.93	38.52	9.59	9.10	H
	21100	2535.0	-28.85	38.36	9.51	8.93	
	21350	2560.0	-29.16	38.58	9.42	8.75	
	20850	2510.0	-21.80	38.92	17.12	51.52	V
	21100	2535.0	-22.17	39.26	17.09	51.17	
	21350	2560.0	-22.21	39.22	17.01	50.23	
Channel Bandwidth: 20 MHz / 16QAM							
NB	20850	2510.0	-30.01	38.52	8.51	7.10	H
	21100	2535.0	-29.96	38.36	8.40	6.92	
	21350	2560.0	-30.43	38.58	8.15	6.53	
	20850	2510.0	-22.94	38.92	15.98	39.63	V
	21100	2535.0	-23.30	39.26	15.96	39.45	
	21350	2560.0	-23.39	39.22	15.83	38.28	

Note: EIRP (dBm) = Reading (dBm) + Correction Factor (dB)

LTE Band 38							
Channel Bandwidth: 5 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
NB	37775	2572.5	-29.63	38.99	9.36	8.63	H
	38000	2595.0	-28.61	38.17	9.56	9.04	
	38225	2617.5	-29.23	38.55	9.32	8.55	
	37775	2572.5	-24.77	39.27	14.50	28.18	V
	38000	2595.0	-24.14	38.68	14.54	28.44	
	38225	2617.5	-24.16	38.55	14.39	27.48	
Channel Bandwidth: 5 MHz / 16QAM							
NB	37775	2572.5	-30.68	38.99	8.31	6.78	H
	38000	2595.0	-29.66	38.17	8.51	7.10	
	38225	2617.5	-30.28	38.55	8.27	6.71	
	37775	2572.5	-25.82	39.27	13.45	22.13	V
	38000	2595.0	-25.19	38.68	13.49	22.34	
	38225	2617.5	-25.21	38.55	13.34	21.58	

Note: EIRP (dBm) = Reading (dBm) + Correction Factor (dB)

LTE Band 38							
Channel Bandwidth: 10 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
NB	37800	2575.0	-29.39	38.98	9.59	9.10	H
	38000	2595.0	-28.38	38.17	9.79	9.53	
	38200	2615.0	-28.90	38.45	9.55	9.02	
	37800	2575.0	-24.31	39.04	14.73	29.72	V
	38000	2595.0	-23.91	38.68	14.77	29.99	
	38200	2615.0	-23.98	38.60	14.62	28.97	
Channel Bandwidth: 10 MHz / 16QAM							
NB	37800	2575.0	-30.44	38.98	8.54	7.14	H
	38000	2595.0	-29.43	38.17	8.74	7.48	
	38200	2615.0	-29.95	38.45	8.50	7.08	
	37800	2575.0	-25.36	39.04	13.68	23.33	V
	38000	2595.0	-24.96	38.68	13.72	23.55	
	38200	2615.0	-25.03	38.60	13.57	22.75	

Note: EIRP (dBm) = Reading (dBm) + Correction Factor (dB)

LTE Band 38							
Channel Bandwidth: 15 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
NB	37825	2577.5	-29.25	39.09	9.84	9.64	H
	38000	2595.0	-28.13	38.17	10.04	10.09	
	38175	2612.5	-28.72	38.52	9.80	9.55	
	37825	2577.5	-24.06	39.04	14.98	31.48	V
	38000	2595.0	-23.66	38.68	15.02	31.77	
	38175	2612.5	-23.79	38.66	14.87	30.69	
Channel Bandwidth: 15 MHz / 16QAM							
NB	37825	2577.5	-30.30	39.09	8.79	7.57	H
	38000	2595.0	-29.18	38.17	8.99	7.93	
	38175	2612.5	-29.77	38.52	8.75	7.50	
	37825	2577.5	-25.11	39.04	13.93	24.72	V
	38000	2595.0	-24.71	38.68	13.97	24.95	
	38175	2612.5	-24.84	38.66	13.82	24.10	

Note: EIRP (dBm) = Reading (dBm) + Correction Factor (dB)

LTE Band 38							
Channel Bandwidth: 20 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
NB	37850	2580.0	-29.21	39.26	10.05	10.12	H
	38000	2595.0	-27.92	38.17	10.25	10.59	
	38150	2610.0	-28.70	38.71	10.01	10.02	
	37850	2580.0	-24.14	39.33	15.19	33.04	V
	38000	2595.0	-23.45	38.68	15.23	33.34	
	38150	2610.0	-23.68	38.76	15.08	32.21	
Channel Bandwidth: 20 MHz / 16QAM							
NB	37850	2580.0	-30.23	39.26	9.03	8.00	H
	38000	2595.0	-28.94	38.17	9.23	8.38	
	38150	2610.0	-29.72	38.71	8.99	7.93	
	37850	2580.0	-25.16	39.33	14.17	26.12	V
	38000	2595.0	-24.47	38.68	14.21	26.36	
	38150	2610.0	-24.70	38.76	14.06	25.47	

Note: EIRP (dBm) = Reading (dBm) + Correction Factor (dB)

LTE Band 41							
Channel Bandwidth: 5 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
NB	39675	2498.5	-30.61	38.99	8.38	6.89	H
	40620	2593.0	-29.74	38.17	8.43	6.97	
	41565	2687.5	-30.23	38.55	8.32	6.79	
	39675	2498.5	-23.79	39.27	15.48	35.32	V
	40620	2593.0	-23.11	38.68	15.57	36.06	
	41565	2687.5	-23.09	38.55	15.46	35.16	
Channel Bandwidth: 5 MHz / 16QAM							
NB	39675	2498.5	-31.91	38.99	7.08	5.11	H
	40620	2593.0	-30.72	38.17	7.45	5.56	
	41565	2687.5	-31.57	38.55	6.98	4.99	
	39675	2498.5	-24.73	39.27	14.54	28.44	V
	40620	2593.0	-24.00	38.68	14.68	29.38	
	41565	2687.5	-24.22	38.55	14.33	27.10	

Note: EIRP (dBm) = Reading (dBm) + Correction Factor (dB)

LTE Band 41							
Channel Bandwidth: 10 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
NB	39700	2501.0	-30.27	38.98	8.71	7.43	H
	40620	2593.0	-29.45	38.17	8.72	7.45	
	41540	2685.0	-29.82	38.45	8.63	7.29	
	39700	2501.0	-23.31	39.04	15.73	37.41	V
	40620	2593.0	-22.90	38.68	15.78	37.84	
	41540	2685.0	-22.92	38.60	15.68	36.98	
Channel Bandwidth: 10 MHz / 16QAM							
NB	39700	2501.0	-31.59	38.98	7.39	5.48	H
	40620	2593.0	-30.43	38.17	7.74	5.94	
	41540	2685.0	-31.18	38.45	7.27	5.33	
	39700	2501.0	-24.28	39.04	14.76	29.92	V
	40620	2593.0	-23.77	38.68	14.91	30.97	
	41540	2685.0	-23.95	38.60	14.65	29.17	

Note: EIRP (dBm) = Reading (dBm) + Correction Factor (dB)

LTE Band 41							
Channel Bandwidth: 15 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
NB	39725	2503.5	-30.18	39.09	8.91	7.78	H
	40620	2593.0	-29.22	38.17	8.95	7.85	
	41515	2682.5	-29.68	38.52	8.84	7.66	
	39725	2503.5	-23.06	39.04	15.98	39.63	V
	40620	2593.0	-22.56	38.68	16.12	40.93	
	41515	2682.5	-22.70	38.66	15.96	39.45	
Channel Bandwidth: 15 MHz / 16QAM							
NB	39725	2503.5	-31.48	39.09	7.61	5.77	H
	40620	2593.0	-30.14	38.17	8.03	6.35	
	41515	2682.5	-30.98	38.52	7.54	5.68	
	39725	2503.5	-24.07	39.04	14.97	31.41	V
	40620	2593.0	-23.25	38.68	15.43	34.91	
	41515	2682.5	-23.81	38.66	14.85	30.55	

Note: EIRP (dBm) = Reading (dBm) + Correction Factor (dB)

LTE Band 41							
Channel Bandwidth: 20 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
NB	39750	2506.0	-30.09	39.26	9.17	8.26	H
	40620	2593.0	-28.94	38.17	9.23	8.38	
	41490	2680.0	-29.61	38.71	9.10	8.13	
	39750	2506.0	-23.02	39.33	16.31	42.76	V
	40620	2593.0	-22.29	38.68	16.39	43.55	
	41490	2680.0	-22.51	38.76	16.25	42.17	
Channel Bandwidth: 20 MHz / 16QAM							
NB	39750	2506.0	-31.34	39.26	7.92	6.19	H
	40620	2593.0	-29.93	38.17	8.24	6.67	
	41490	2680.0	-30.86	38.71	7.85	6.10	
	39750	2506.0	-24.11	39.33	15.22	33.27	V
	40620	2593.0	-23.34	38.68	15.34	34.20	
	41490	2680.0	-23.66	38.76	15.10	32.36	

Note: EIRP (dBm) = Reading (dBm) + Correction Factor (dB)



## 4.2 Modulation Characteristics Measurement

### 4.2.1 Limits of Modulation Characteristics

N/A

### 4.2.2 Test Setup



### 4.2.3 Test Procedure

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

### 4.2.4 Test Results



### 4.3 Frequency Stability Measurement

#### 4.3.1 Limits of Frequency Stability Measurement

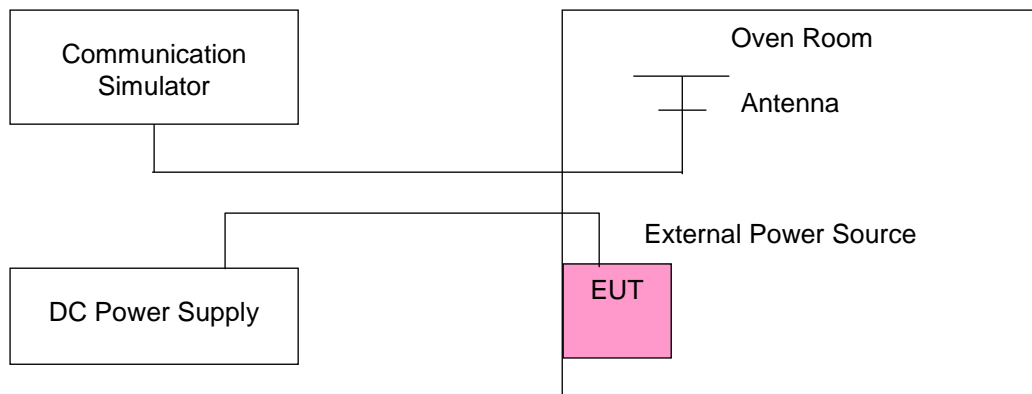
According to the FCC part 2.1055 shall be tested the frequency stability. The rule is defined that "The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block." The test extreme voltage is according to the 2.1055(d)(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment and the extreme temperature rule is comply with specification of EUT  $-30^{\circ}\text{C} \sim 50^{\circ}\text{C}$ .

#### 4.3.2 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  $\pm 0.5^{\circ}\text{C}$  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.

#### 4.3.3 Test Setup



#### 4.3.4 Test Results

##### Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 7			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
120	2502.500002	0.001	2567.500002	0.001
102	2502.500003	0.001	2567.500003	0.001
138	2502.500001	0.000	2567.500004	0.001

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

##### Frequency Error vs. Temperature

Temp. (°C)	LTE Band 7			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2502.500003	0.001	2567.500003	0.001
-20	2502.500001	0.000	2567.500004	0.002
-10	2502.500003	0.001	2567.500003	0.001
0	2502.500003	0.001	2567.500004	0.002
10	2502.499996	-0.001	2567.500002	0.001
20	2502.499998	-0.001	2567.499998	-0.001
30	2502.499999	0.000	2567.499998	-0.001
40	2502.499997	-0.001	2567.499996	-0.001
50	2502.499997	-0.001	2567.499998	-0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 7			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
120	2502.500002	0.001	2567.500004	0.001
102	2502.500003	0.001	2567.500004	0.001
138	2502.500004	0.002	2567.500002	0.001

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 7			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2502.500003	0.001	2567.500003	0.001
-20	2502.500002	0.001	2567.500001	0.000
-10	2502.500001	0.000	2567.500004	0.002
0	2502.500003	0.001	2567.500003	0.001
10	2502.499998	-0.001	2567.500002	0.001
20	2502.499998	-0.001	2567.499998	-0.001
30	2502.499996	-0.002	2567.499996	-0.001
40	2502.499997	-0.001	2567.499997	-0.001
50	2502.499997	-0.001	2567.499997	-0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 7			
	Channel Bandwidth: 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
120	2502.500002	0.001	1.90	2567.500002
102	2502.500001	0.000	1.10	2567.500001
138	2502.500001	0.000	1.70	2567.500002

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 7			
	Channel Bandwidth: 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2502.500003	0.001	2567.500004	0.002
-20	2502.500003	0.001	2567.500002	0.001
-10	2502.500002	0.001	2567.500003	0.001
0	2502.500004	0.002	2567.500002	0.001
10	2502.499998	-0.001	2567.500002	0.001
20	2502.499998	-0.001	2567.499998	-0.001
30	2502.499998	-0.001	2567.499997	-0.001
40	2502.499997	-0.001	2567.499998	-0.001
50	2502.499996	-0.001	2567.499997	-0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 7			
	Channel Bandwidth: 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
120	2502.500003	0.001	2567.500003	0.001
102	2502.500003	0.001	2567.500003	0.001
138	2502.500002	0.001	2567.500002	0.001

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 7			
	Channel Bandwidth: 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2502.500004	0.001	2567.500003	0.001
-20	2502.500001	0.000	2567.500001	0.000
-10	2502.500003	0.001	2567.500003	0.001
0	2502.500001	0.001	2567.500002	0.001
10	2502.499997	-0.001	2567.500003	0.001
20	2502.499998	-0.001	2567.499999	0.000
30	2502.499999	-0.001	2567.499999	0.000
40	2502.499999	-0.001	2567.499996	-0.001
50	2502.499999	-0.001	2567.499999	0.000

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 38			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
120	2572.500003	0.001	2617.500004	0.001
102	2572.500004	0.001	2617.500002	0.001
138	2572.500002	0.001	2617.500001	0.000

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 38			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2572.500003	0.001	2617.500004	0.001
-20	2572.500003	0.001	2617.500004	0.002
-10	2572.500002	0.001	2617.500002	0.001
0	2572.500002	0.001	2617.500001	0.000
10	2572.499996	-0.001	2617.500003	0.001
20	2572.499998	-0.001	2617.499998	-0.001
30	2572.499996	-0.001	2617.499999	-0.001
40	2572.499997	-0.001	2617.499996	-0.001
50	2572.499998	-0.001	2617.499998	-0.001



**Frequency Error vs. Voltage**

Voltage (Volts)	LTE Band 38			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
120	2572.500003	0.001	2617.500004	0.001
102	2572.500003	0.001	2617.500002	0.001
138	2572.500003	0.001	2617.500002	0.001

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

**Frequency Error vs. Temperature**

Temp. (°C)	LTE Band 38			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2572.500002	0.001	2617.500002	0.001
-20	2572.500003	0.001	2617.500002	0.001
-10	2572.500002	0.001	2617.500002	0.001
0	2572.500004	0.002	2617.500002	0.001
10	2572.499997	-0.001	2617.500001	0.000
20	2572.499997	-0.001	2617.499997	-0.001
30	2572.499999	-0.001	2617.499996	-0.001
40	2572.499999	-0.001	2617.499997	-0.001
50	2572.499998	-0.001	2617.499997	-0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 38			
	Channel Bandwidth: 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
120	2572.500004	0.001	2617.500002	0.001
102	2572.500003	0.001	2617.500003	0.001
138	2572.500001	0.001	2617.500002	0.001

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 38			
	Channel Bandwidth: 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2572.500004	0.002	2617.500003	0.001
-20	2572.500001	0.001	2617.500001	0.000
-10	2572.500002	0.001	2617.500003	0.001
0	2572.500004	0.002	2617.500002	0.001
10	2572.499996	-0.001	2617.500002	0.001
20	2572.499999	-0.001	2617.499997	-0.001
30	2572.499999	-0.001	2617.499997	-0.001
40	2572.499997	-0.001	2617.499999	0.000
50	2572.499997	-0.001	2617.499999	-0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 38			
	Channel Bandwidth: 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
120	2572.500001	0.000	2617.500002	0.001
102	2572.500003	0.001	2617.500002	0.001
138	2572.500002	0.001	2617.500001	0.001

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 38			
	Channel Bandwidth: 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2572.500001	0.000	2617.500002	0.001
-20	2572.500002	0.001	2617.500003	0.001
-10	2572.500003	0.001	2617.500002	0.001
0	2572.500003	0.001	2617.500003	0.001
10	2572.499999	-0.001	2617.500004	0.001
20	2572.499997	-0.001	2617.499996	-0.001
30	2572.499998	-0.001	2617.499998	-0.001
40	2572.499997	-0.001	2617.499997	-0.001
50	2572.499997	-0.001	2617.499996	-0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 41			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
120	2498.500002	0.001	2687.500002	0.001
102	2498.500003	0.001	2687.500002	0.001
138	2498.500002	0.001	2687.500002	0.001

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 41			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2498.500004	0.001	2687.500004	0.001
-20	2498.500002	0.001	2687.500004	0.001
-10	2498.500003	0.001	2687.500003	0.001
0	2498.500004	0.001	2687.500003	0.001
10	2498.499996	-0.002	2687.500003	0.001
20	2498.499997	-0.001	2687.499999	-0.001
30	2498.499996	-0.001	2687.499997	-0.001
40	2498.499998	-0.001	2687.499997	-0.001
50	2498.499999	0.000	2687.499998	-0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 41			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
120	2498.500004	0.001	2687.500002	0.001
102	2498.500003	0.001	2687.500004	0.001
138	2498.500004	0.002	2687.500003	0.001

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 41			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2498.500004	0.001	2687.500003	0.001
-20	2498.500003	0.001	2687.500002	0.001
-10	2498.500003	0.001	2687.500004	0.001
0	2498.500002	0.001	2687.500003	0.001
10	2498.499999	-0.001	2687.500004	0.001
20	2498.499998	-0.001	2687.499998	-0.001
30	2498.499996	-0.001	2687.499999	0.000
40	2498.499999	-0.001	2687.499999	0.000
50	2498.499997	-0.001	2687.499998	-0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 41			
	Channel Bandwidth: 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
120	2498.500002	0.001	2687.500003	0.001
102	2498.500003	0.001	2687.500002	0.001
138	2498.500001	0.000	2687.500001	0.001

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 41			
	Channel Bandwidth: 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2498.500002	0.001	2687.500002	0.001
-20	2498.500003	0.001	2687.500003	0.001
-10	2498.500003	0.001	2687.500004	0.001
0	2498.500004	0.002	2687.500004	0.001
10	2498.499996	-0.002	2687.500004	0.001
20	2498.499998	-0.001	2687.499998	-0.001
30	2498.499998	-0.001	2687.499997	-0.001
40	2498.499997	-0.001	2687.499997	-0.001
50	2498.499998	-0.001	2687.499997	-0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 41			
	Channel Bandwidth: 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
120	2498.500003	0.001	2687.500002	0.001
102	2498.500002	0.001	2687.500003	0.001
138	2498.500002	0.001	2687.500002	0.001

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

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 41			
	Channel Bandwidth: 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2498.500003	0.001	2687.500004	0.001
-20	2498.500004	0.002	2687.500003	0.001
-10	2498.500004	0.002	2687.500001	0.000
0	2498.500002	0.001	2687.500001	0.001
10	2498.499999	-0.001	2687.500004	0.001
20	2498.499998	-0.001	2687.499999	-0.001
30	2498.499997	-0.001	2687.499998	-0.001
40	2498.499997	-0.001	2687.499998	-0.001
50	2498.499996	-0.002	2687.499999	0.000

#### 4.4 Occupied Bandwidth Measurement

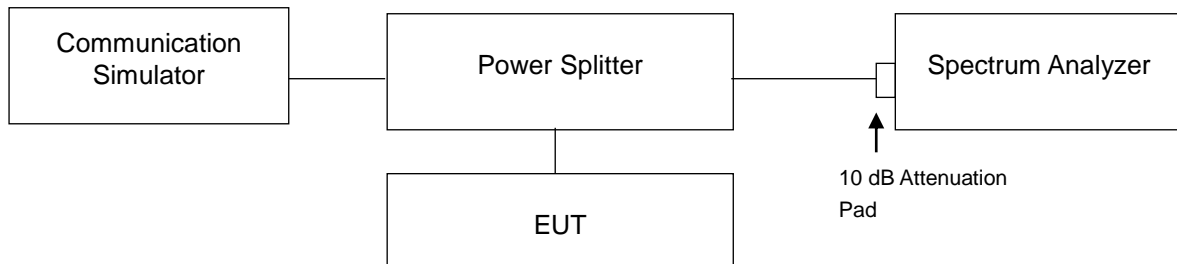
##### 4.4.1 Limits of Occupied Bandwidth Measurement

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.

##### 4.4.2 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.

##### 4.4.3 Test Setup



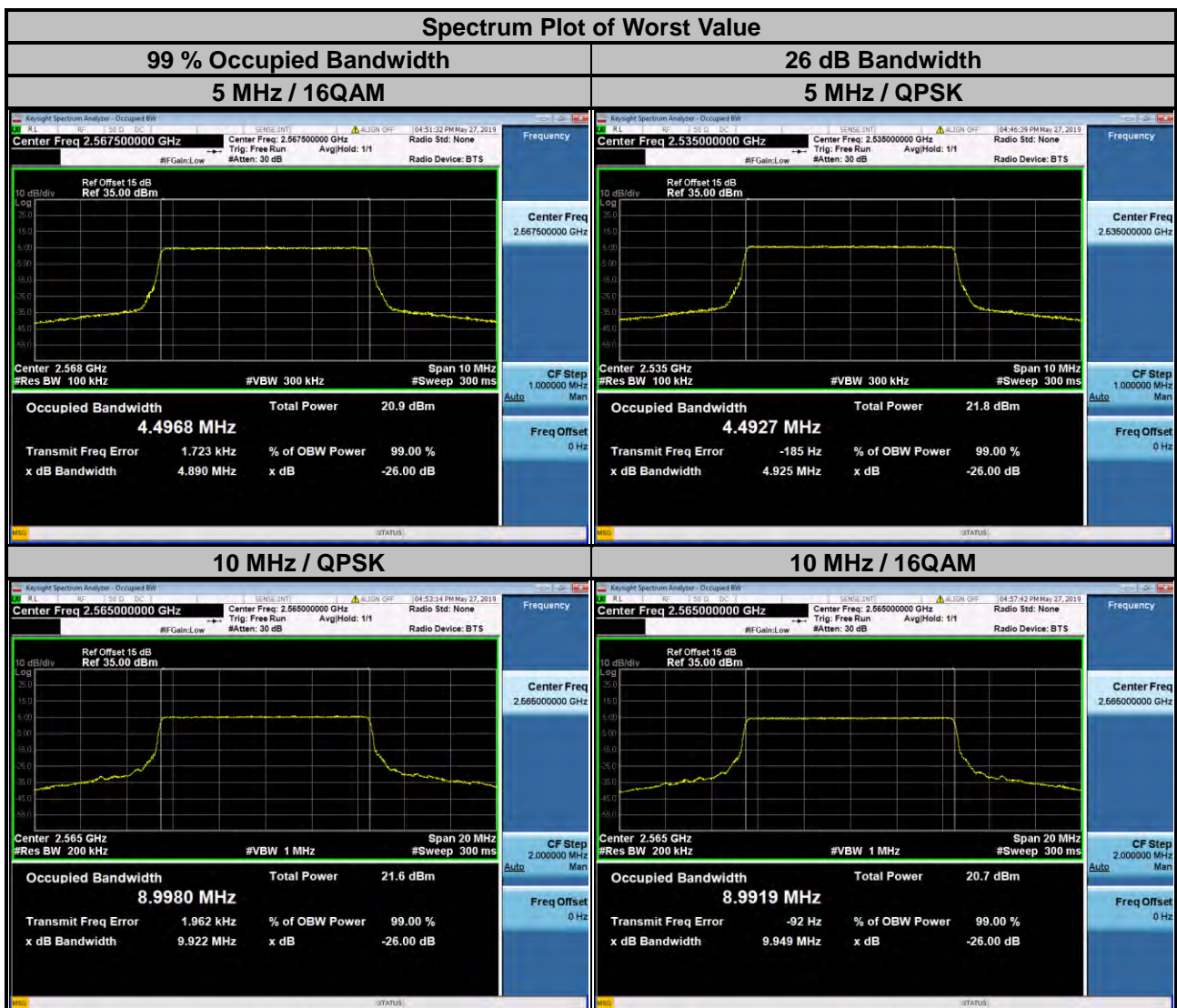


#### 4.4.4 Test Results

LTE Band 7					
Channel Bandwidth: 5 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
20775	2502.5	4.495	4.495	4.861	4.863
21100	2535.0	4.493	4.496	4.925	4.897
21425	2567.5	4.491	4.497	4.872	4.890

Channel Bandwidth: 10 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
20800	2505.0	8.996	8.988	9.912	9.945
21100	2535.0	8.988	8.976	9.871	9.900
21400	2565.0	8.998	8.992	9.922	9.949



LTE Band 7					
Channel Bandwidth: 15 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
20825	2507.5	13.483	13.474	14.380	14.310
21100	2535.0	13.448	13.439	14.320	14.300
21375	2562.5	13.476	13.471	14.420	14.320

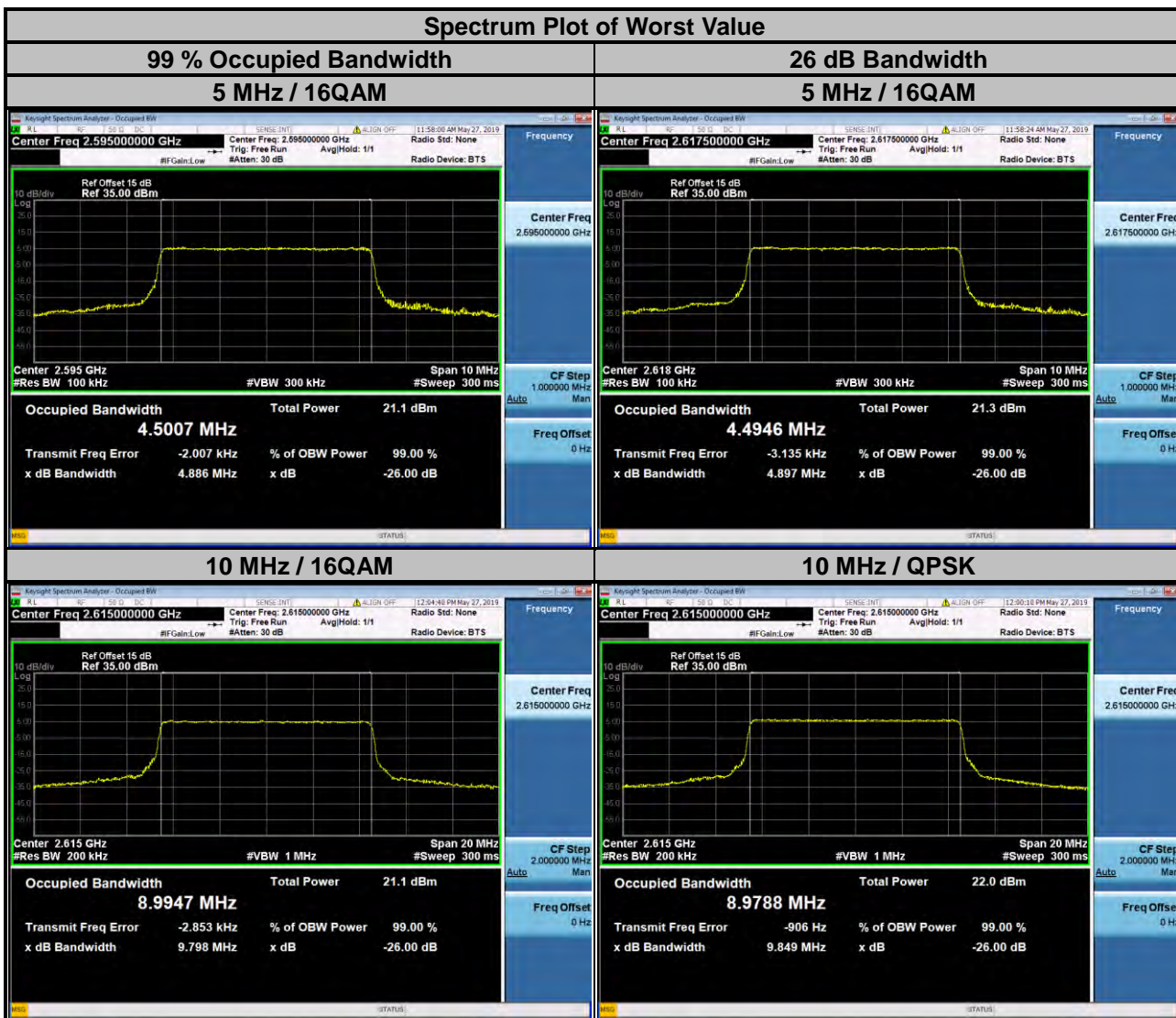
Channel Bandwidth: 20 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
20850	2510.0	18.013	18.007	19.120	19.110
21100	2535.0	17.922	17.926	19.040	19.030
21350	2560.0	17.982	17.999	19.110	19.100



LTE Band 38					
Channel Bandwidth: 5 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
37775	2572.5	4.497	4.494	4.846	4.867
38000	2595.0	4.490	4.501	4.849	4.886
38225	2617.5	4.480	4.495	4.839	4.897

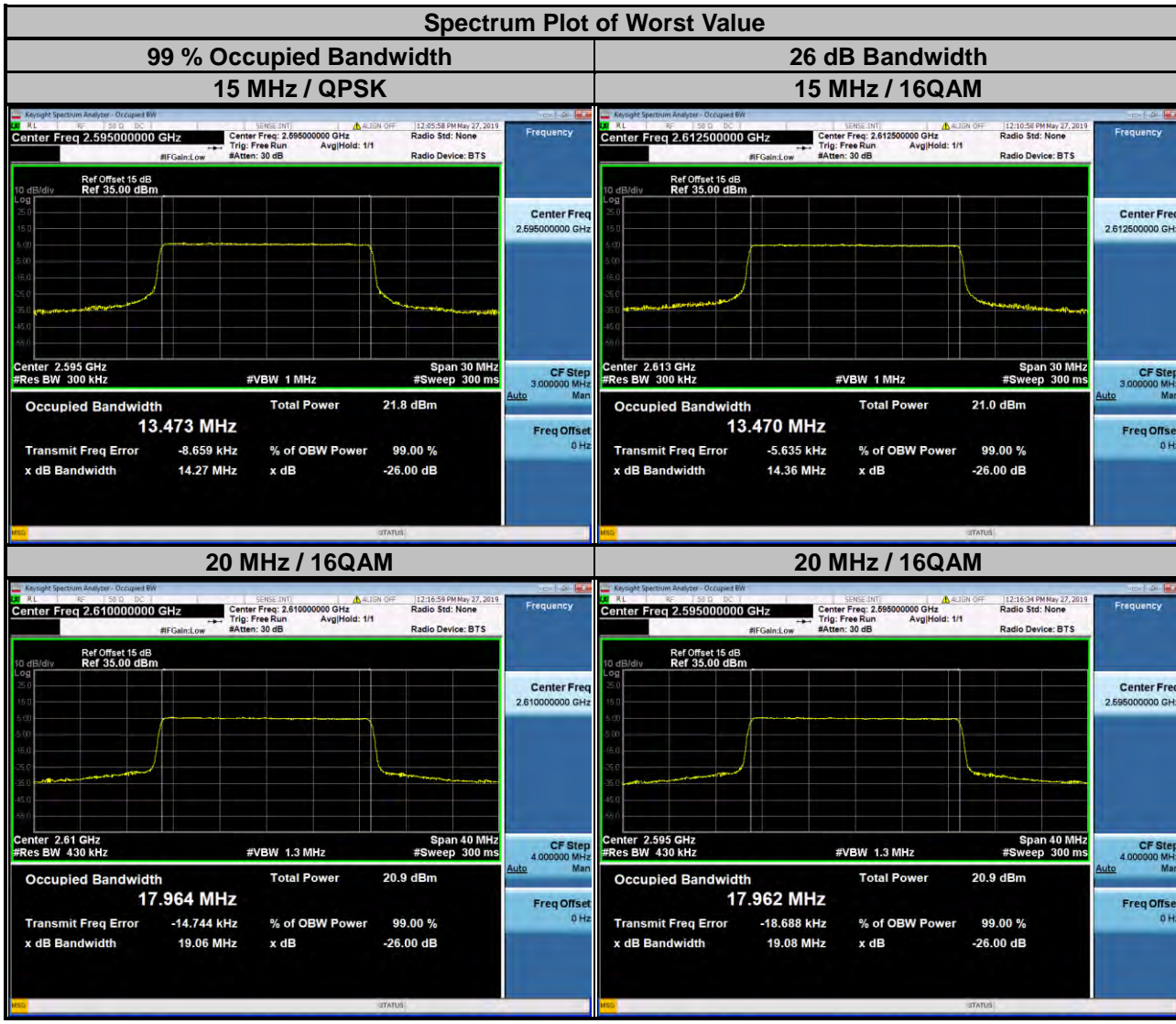
Channel Bandwidth: 10 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
37800	2575.0	8.975	8.987	9.781	9.805
38000	2595.0	8.980	8.981	9.811	9.728
38200	2615.0	8.979	8.995	9.849	9.798



LTE Band 38					
Channel Bandwidth: 15 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
37825	2577.5	13.464	13.467	14.300	14.290
38000	2595.0	13.473	13.463	14.270	14.290
38175	2612.5	13.468	13.470	14.300	14.360

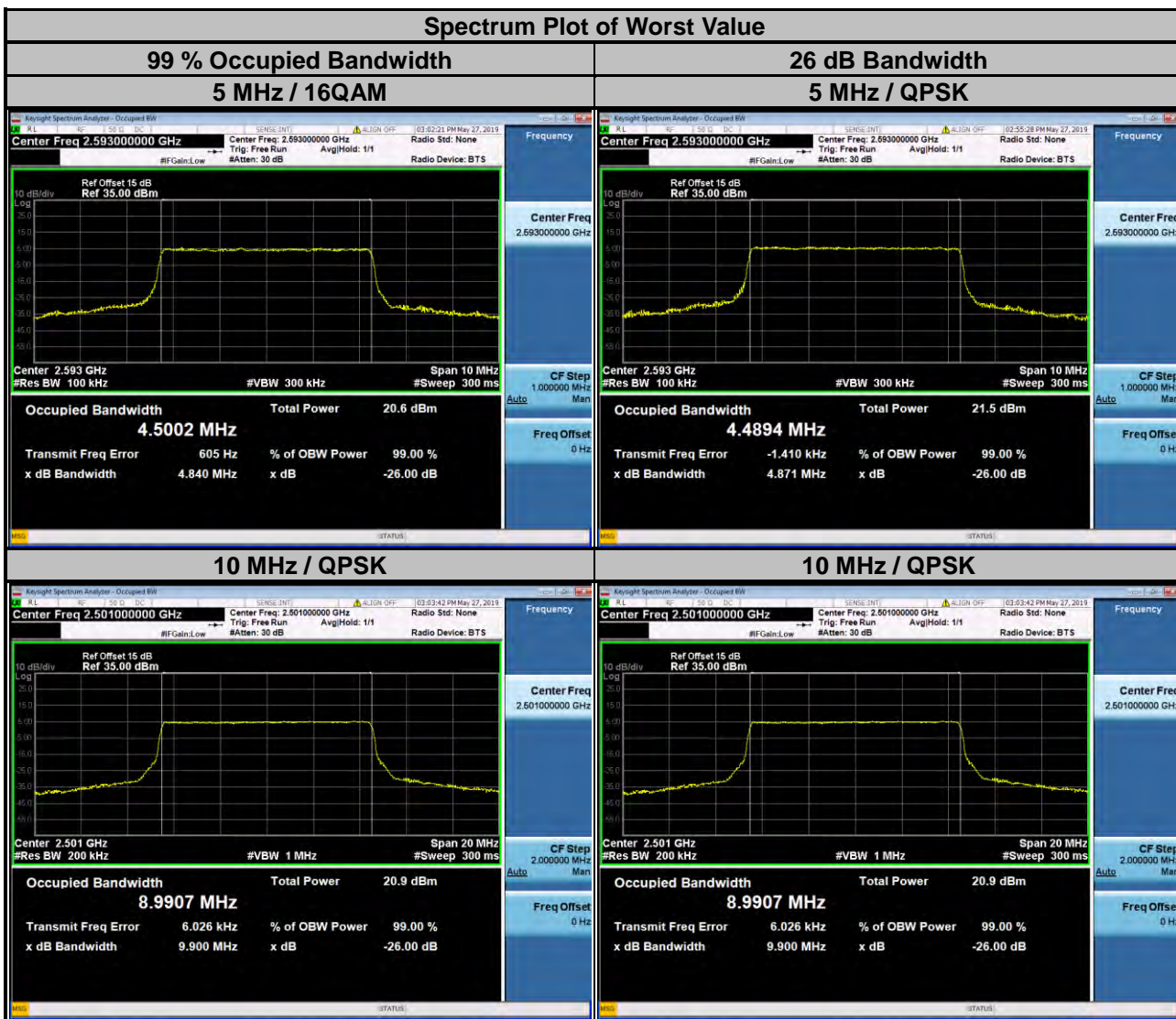
Channel Bandwidth: 20 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
37850	2580.0	17.945	17.950	19.050	19.050
38000	2595.0	17.946	17.962	19.070	19.080
38150	2610.0	17.944	17.964	19.060	19.060



LTE Band 41					
Channel Bandwidth: 5 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
39675	2498.5	4.487	4.493	4.850	4.868
40620	2593.0	4.489	4.500	4.871	4.840
41565	2687.5	4.490	4.492	4.822	4.843

Channel Bandwidth: 10 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
39700	2501.0	8.991	8.983	9.900	9.817
40620	2593.0	8.985	8.981	9.828	9.806
41540	2685.0	8.981	8.983	9.812	9.799



LTE Band 41					
Channel Bandwidth: 15 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
39725	2503.5	13.448	13.453	14.340	14.310
40620	2593.0	13.450	13.460	14.350	14.320
41515	2682.5	13.455	13.454	14.390	14.290

Channel Bandwidth: 20 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
39750	2506.0	17.936	17.947	19.060	19.060
40620	2593.0	17.975	17.946	19.050	19.050
41490	2680.0	17.944	17.930	19.040	19.050

