RF TEST REPORT

SIEMIC
GLOBAL TESTING & CERTIFICATIONS
YOUR CHOICE FOR- TCB FCB CB NB CAB RCB

Report No.: FCC_RF_SL17021501-SPC-003_B25
Supersede Report No.:

Applicant	**SpiderCloud Wireless, Inc.**
Product Name	**SpiderCloud Radio Node**
Model No.	**SCRN-250-0402-2L**
Test Standard	**47CFR Part27**
Test Method	**TIA-603-D: 2010**
FCC ID	**Y478818C24**
Date of test	**04/13/2015 - 05/03/2015** **10/26/2015 - 11/02/2015** **02/16/2017**
Issue Date	**02/23/2017**
Test Result	**Pass** **Fail**
Equipment complied with the specification	**[x]**
Equipment did not comply with the specification	**[ ]**

Gary Chou	Chen Ge
Gary Chou	**Chen Ge**
Test Engineer	**Engineer Reviewer**

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Test result presented in this test report is applicable to the tested sample only

Issued By:
SIEMIC Laboratories
775 Montague Expressway, Milpitas, 95035 CA

ilac-MRA
A2LA ACCREDITED
TESTING CERT # 2742-01

Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC , RF/Wireless , Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless , Telecom
Taiwan	BSMI , NCC , NIST	EMC, RF, Telecom , Safety
Hong Kong	OFTA , NIST	RF/Wireless ,Telecom
Australia	NATA, NIST	EMC, RF, Telecom , Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF , Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC , RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom , Safety
Israel	MOC, NIST	EMC, RF, Telecom, Safety

Accreditations for Product Certifications

Country	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC , RF , Telecom
Canada	IC FCB , NIST	EMC , RF , Telecom
Singapore	iDA, NIST	EMC , RF , Telecom
EU	NB	EMC & R&TTE Directive
Japan	MIC (RCB 208)	RF , Telecom
HongKong	OFTA (US002)	RF , Telecom

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1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC_RF_SL17021501-SPC-003_B25	None	Original	02/23/2017

2 Executive Summary

The purpose of this test program was to demonstrate compliance of following product

Company: SpiderCloud Wireless, Inc.
Product: SpiderCloud Radio Node
Model: SCRN-250-0402-2L

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page.

3 Customer information

Applicant Name	SpiderCloud Wireless
Applicant Address	475 Sycamore Dr, Milpitas, CA, 95035, USA
Manufacturer Name	Flextronics International USA, Inc
Manufacturer Address	927 Gibraltar Dr., Bldg. 6, Milpitas, CA, 95035, USA

4 Test site information

Lab performing tests	SIEMIC Laboratories
Lab Address	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	881796
IC Test Site No.	4842D-2
VCCI Test Site No.	A0133

5 Modification

Index	Item	Description	Note
-	-	-	-

6 EUT Information

6.1 EUT Description

Product Name	SpiderCloud Radio Node
Model No.	SCRN-250-0402-2L
Trade Name	SpiderCloud
Serial No.	15202C61066
Input Power	48VDC
Power Adapter Manu/Model	N/A
Power Adapter SN	-
Hardware version	-
Software version	-
Date of EUT received	10/20/2015
Equipment Class/ Category	PCB, TNB
Operating Frequencies	LTE: TX (1930 MHz to 1995 MHz), LTE: RX (1850 MHz to 1915 MHz)
Port/Connectors	N/A
Remark	NONE

6.2 Radio Description

Item	LTE
Operating Band /Radio Type	LTE Band 25
Bandwidth	5MHz, 10MHz, 15MHz, 20MHz
Modulation	QPSK/16QAM/64QAM
Antenna Type	Internal Omni-directional antenna
Antenna Gain	2 dBi
Frequency TX(MHz)	TX: 1930 MHz to 1995 MHz RX: 1850 MHz to 1915 MHz

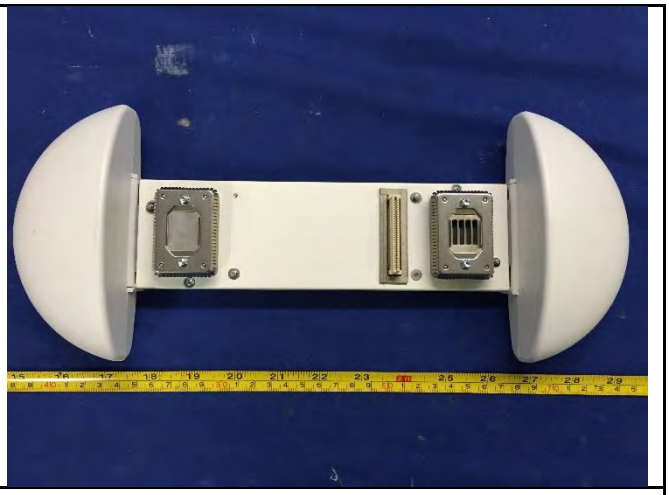
6.3 EUT test modes/configuration Description

Test mode

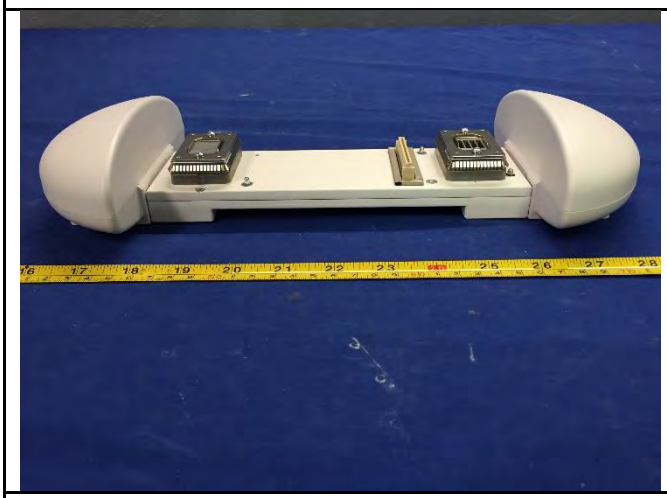
Final Test Mode		Note
Final_test_mode_1	Continuous transmission, 5MHz, QPSK, Low CH	LTE
Final_test_mode_2	Continuous transmission, 5MHz, QPSK, Mid CH	LTE
Final_test_mode_3	Continuous transmission, 5MHz, QPSK, High CH	LTE
Final_test_mode_4	Continuous transmission, 5MHz, 64QAM, Low CH	LTE
Final_test_mode_5	Continuous transmission, 5MHz, 64QAM, Mid CH	LTE
Final_test_mode_5	Continuous transmission, 5MHz, 64QAM, High CH	LTE
Final_test_mode_7	Continuous transmission, 10MHz, QPSK, Low CH	LTE
Final_test_mode_8	Continuous transmission, 10MHz, QPSK, Mid CH	LTE
Final_test_mode_9	Continuous transmission, 10MHz, QPSK, High CH	LTE
Final_test_mode_10	Continuous transmission, 10MHz, 64QAM, Low CH	LTE
Final_test_mode_11	Continuous transmission, 10MHz, 64QAM, Mid CH	LTE
Final_test_mode_12	Continuous transmission, 10MHz, 64QAM, High CH	LTE
Final_test_mode_13	Continuous transmission, 15MHz, QPSK, Low CH	LTE
Final_test_mode_14	Continuous transmission, 15MHz, QPSK, Mid CH	LTE
Final_test_mode_15	Continuous transmission, 15MHz, QPSK, High CH	LTE
Final_test_mode_16	Continuous transmission, 15MHz, 64QAM, Low CH	LTE
Final_test_mode_17	Continuous transmission, 15MHz, 64QAM, Mid CH	LTE
Final_test_mode_18	Continuous transmission, 15MHz, 64QAM, High CH	LTE
Final_test_mode_19	Continuous transmission, 20MHz, QPSK, Low CH	LTE
Final_test_mode_20	Continuous transmission, 20MHz, QPSK, Mid CH	LTE
Final_test_mode_21	Continuous transmission, 20MHz, QPSK, High CH	LTE
Final_test_mode_22	Continuous transmission, 20MHz, 64QAM, Low CH	LTE
Final_test_mode_23	Continuous transmission, 20MHz, 64QAM, Mid CH	LTE
Final_test_mode_24	Continuous transmission, 20MHz, 64QAM, High CH	LTE
Remark: LTE Band 25 is evaluated.		

6.4 EUT Photos - External

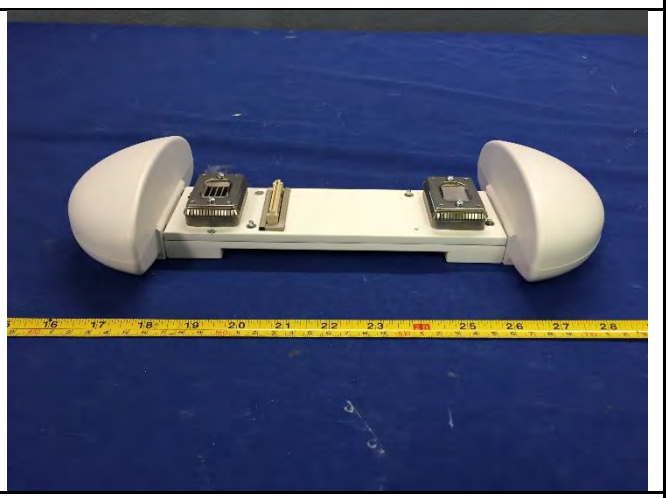
Top View



Bottom View



Front View

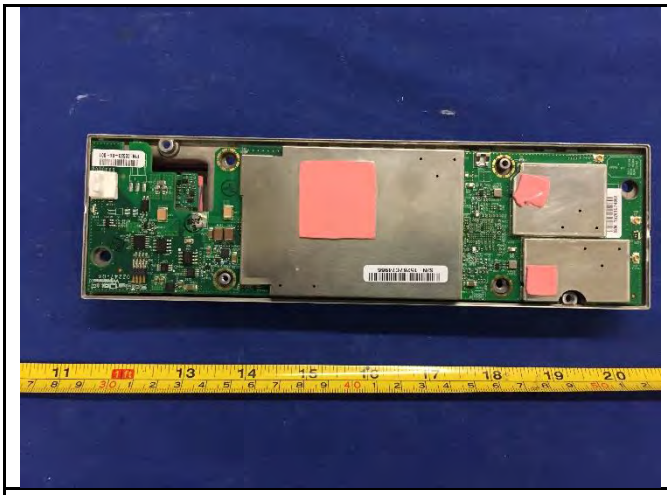
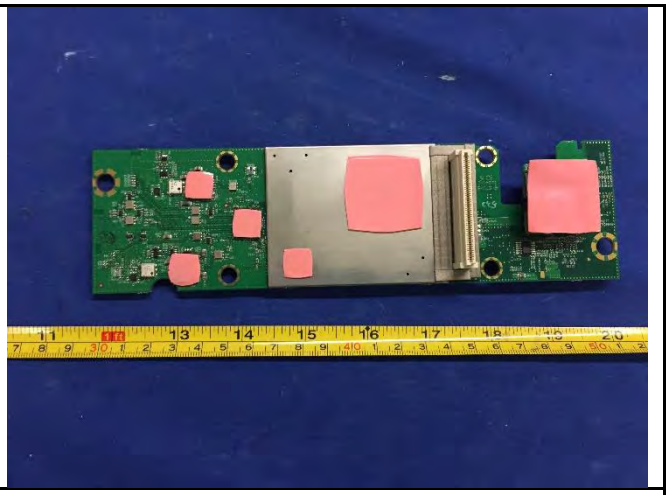
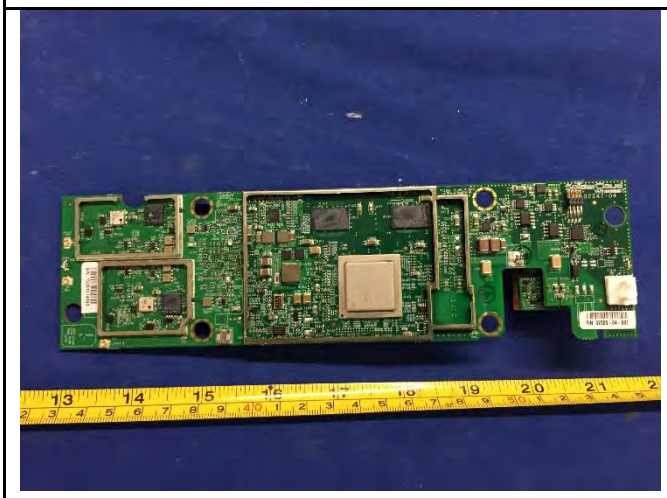
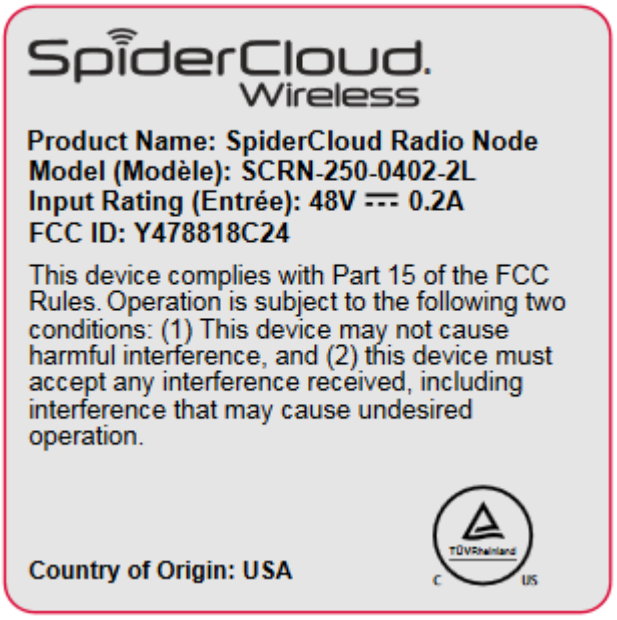


Rear View

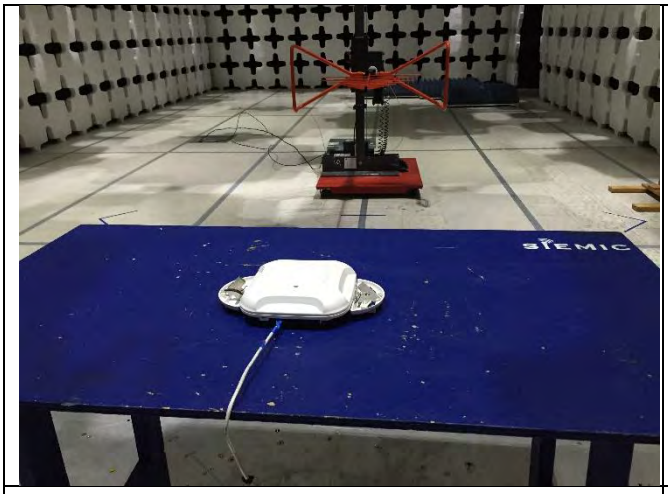
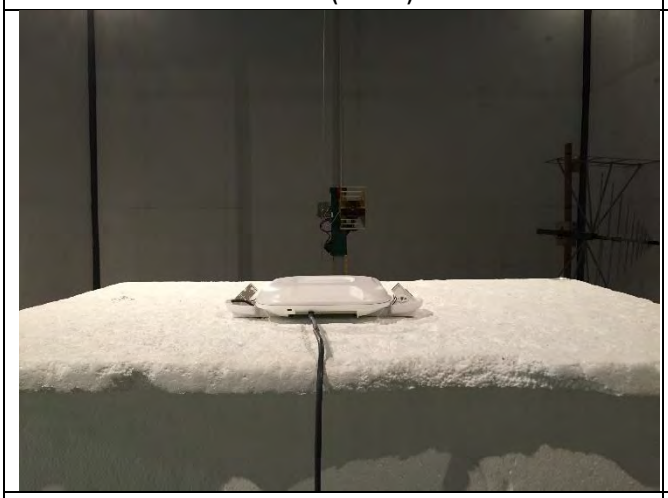
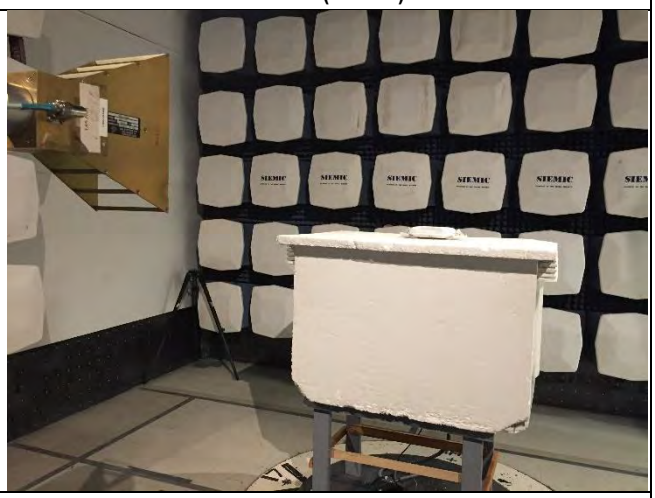
Left Side View

Right Side View

6.5 EUT Photos - Internal

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Main PCB - Top View</td><td>Main PCB - Bottom View</td></tr>
<tr><td>  </td><td> 
</td></tr>
<tr><td>Main PCB without shielding</td><td>EUT Label</td></tr>
</table>

6.6 EUT Test Setup Photos

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Radiated Emissions (<1GHz) – Front View</td><td>Radiated Emissions (<1GHz) – Rear View</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Radiated Emissions (>1GHz) – Front View</td><td>Radiated Emissions (>1GHz) – Rear View</td></tr>
</table>

Note: The spurious emission in different EUT orientation was investigated, including the EUT standing up position and the laying down position. The EUT orientation shown in above setup photo is the worst case position.

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	PoE Adatper	POE36U-1AT-R	P90212324A1	Phihong	-
2	Service Node	SCSN-9000	14193C26505	SpiderCloud	-
3	Access Point	AIR-CAP3702I-A-K9	FTX1848RA30	Cisco	-

7.2 Test Software Description

Test Item	Software	Description
RF testing	ePerview	Enable EUT continuous TX mode and change to different channel

8 Test Summary

Test Item	Test standard		Test Method/Procedure		Pass / Fail
E.R.P/ E.I.R.P	FCC	47CFR27.50	FCC	TIA-603-D: 2010	☒ Pass ☐ N/A
Occupied Bandwidth	FCC	47CFR27.53	FCC	TIA-603-D: 2010	☒ Pass ☐ N/A
Peak-Average Ratio	FCC	47CFR27.50	FCC	TIA-603-D: 2010	☒ Pass ☐ N/A
Spurious and harmonic Emission at antenna port	FCC	47CFR2.1051, 47CFR27.53	FCC	TIA-603-D: 2010	☒ Pass ☐ N/A
Band Edge	FCC	47CFR2.1053, 47CFR27.53	FCC	TIA-603-D: 2010	☒ Pass ☐ N/A
Radiated spurious and harmonic emission	FCC	47CFR2.1053, 47CFR27.53	FCC	TIA-603-D: 2010	☒ Pass ☐ N/A
Frequency stability	FCC	47CFR2.1053, 47CFR27.53	FCC	TIA-603-D: 2010	☒ Pass ☐ N/A
Remark	1. All measurement uncertainties do not take into consideration for all presented test results. 2. The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual.				

9 Measurement Uncertainty

9.1 Conducted Emissions

The test is to measure the conducted emissions to the mains port of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the LISN
- Uncertainty of cables
- Uncertainty due to the mismatches
- Etc, see the below table for details

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
LISN Insertion Loss	0.40	Normal	2	1	0.20
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch LISN - Receiver	0.25	U-Shape	1.414	1	0.1768033
LISN Impedance	2.5	Triangular	2.449	1	1.0208248
Combined Standard Uncertainty					1.928133
Expanded Uncertainty (K=2)					**3.856266**

The total derived measurement uncertainty is +/- 3.86 dB.

9.2 Radiated Emissions (30MHz to 1GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- NSA Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
Antenna Factor	0.65	Normal	2	1	0.325
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
NSA Calibration	4.0	U-Shape	1.414	1	2.8288543
Combined Standard Uncertainty					3.0059131
Expanded Uncertainty (K=2)					**6.0118262**

The total derived measurement uncertainty is +/- 6.00 dB.

9.3 Radiated Emissions (1GHz to 40GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:
- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- VSWR Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.0692840
Cable Insertion Loss	0.21	Normal	2	1	0.1050000
Filter Insertion Loss	0.25	Normal	2	1	0.1250000
Antenna Factor	0.65	Normal	2	1	0.3250000
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.8660508
PRF Response	1.5	Rectangular	1.732	1	0.8660508
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
VSWR Calibration	2.0	U-Shape	1.414	1	1.4144272
Combined Standard Uncertainty					4.2363
Expanded Uncertainty (K=2)					**8.4726**

The total derived measurement uncertainty is +/- 8.47 dB.

9.4 RF conducted measurement

The test is to measure the RF output power from the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the Reference Level Uncertainty
- Uncertainty of variable attenuators
- Uncertainty of cables
- Uncertainty due to the mismatches

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Reference Level	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Attenuator	0.25	Normal	2	1	0.125
Mismatch	0.25	U-Shape	1.414	1	0.1768033
Combined Standard Uncertainty					0.476087
Expanded Uncertainty (K=2)					**0.952174**

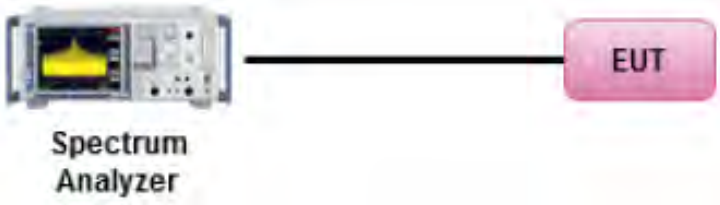
The total derived measurement uncertainty is +/- 0.95 dB.

10 Measurements, Examination and Derived Results

10.1 RF Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR27.50	-	The maximum effective radiated power (ERP) of fixed and base station must not exceed 1000 Watts.	☒

Test Setup				
Test Procedure	- EUT was set for low, mid, high channel with modulated mode and highest RF output power. - The spectrum analyzer was connected to the antenna terminal.			
Test Date	04/14/2015 – 05/03/2015 10/26/2015 - 11/02/2015 02/16/2017	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	22°C 48% 1008mbar
Remark	For LTE mode, EUT is using 2x2 MIMO, which has 2 transmit antennas. They are correlated to each other. The directional gain is calculated per the formula at below, Directional gain dBi = Gmax + 10 Log10 N The max gain of single antenna is 2 dBi. So the directional gain = 5 dBi			
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes ☐ N/A

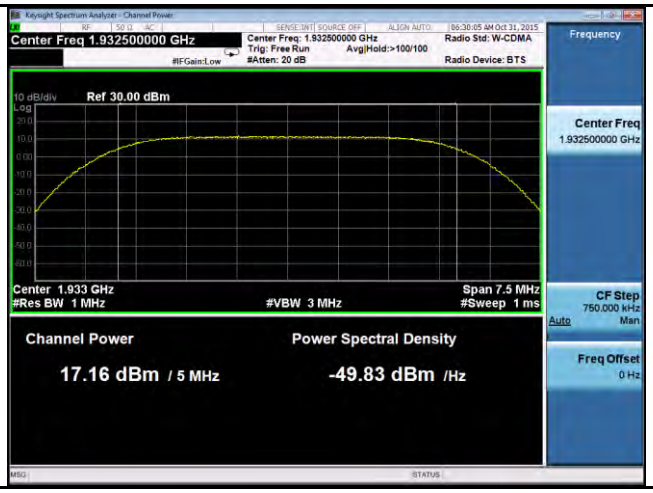
Test Plot ☒ Yes (See below) ☐ N/A

Test Data for LTE Band 25:

Type	Channel	Frequency (MHz)	Measured PW –Port 1(dBm)	Measured PW –Port 2(dBm)	Combined Power (dBm)	Antenna Gain (dBi)	E.I.R.P (dBm)
5MHz BW, QPSK	Low	1932.5	17.15	17.16	20.17	5	25.17
	Mid	1960	17.39	17.41	20.41	5	25.41
	High	1992.5	17.48	17.53	20.51	5	25.51
5MHz BW, 64QAM	Low	1932.5	17.04	17.01	20.04	5	25.04
	Mid	1960	17.24	17.16	20.21	5	25.21
	High	1992.5	17.85	17.54	20.70	5	25.70
10MHz BW, QPSK	Low	1935	17.03	17.04	20.05	5	25.05
	Mid	1960	17.11	17.10	20.12	5	25.12
	High	1985	17.29	17.28	20.30	5	25.30
10MHz BW, 64QAM	Low	1935	17.14	17.15	20.16	5	25.16
	Mid	1960	17.28	17.32	20.31	5	25.31
	High	1985	17.22	17.18	20.21	5	25.21
15MHz BW, QPSK	Low	1937.5	17.22	17.19	20.22	5	25.22
	Mid	1960	17.29	17.29	20.30	5	25.30
	High	1982.5	17.33	17.33	20.34	5	25.34
15MHz BW, 64QAM	Low	1937.5	17.30	17.28	20.30	5	25.30
	Mid	1960	17.14	17.13	20.15	5	25.15
	High	1982.5	17.14	17.13	20.15	5	25.15
20MHz BW, QPSK	Low	1940	17.07	17.10	20.10	5	25.10
	Mid	1960	17.27	17.25	20.27	5	25.27
	High	1980	16.97	17.00	20.00	5	25.00
20MHz BW, 64QAM	Low	1940	17.13	17.12	20.14	5	25.14
	Mid	1960	17.14	17.19	20.18	5	25.18
	High	1980	17.21	17.20	20.22	5	25.22

Test Plots for Band 25-QPSK-5MHz

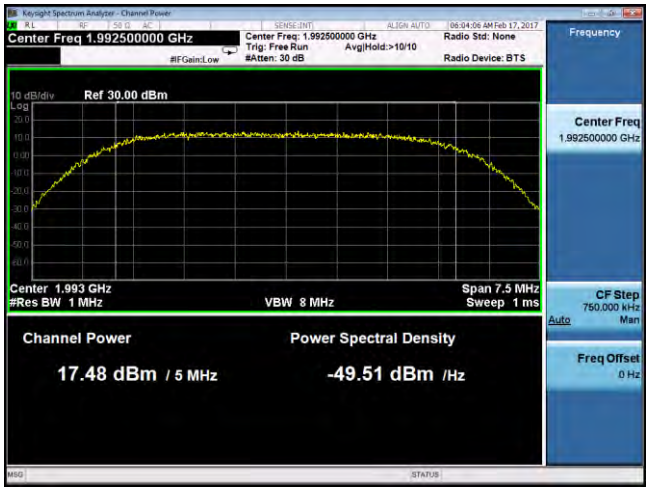
PWR-Band25-QPSK-5M BW-Low CH-Port1



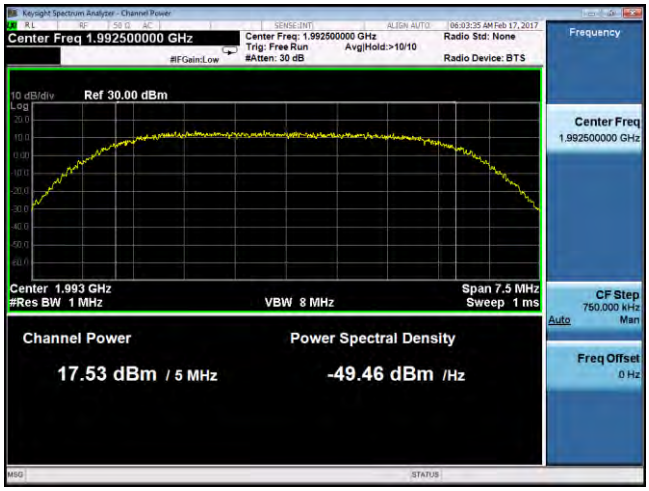
PWR- Band25-QPSK-5M BW-Low CH-Port2

PWR- Band25-QPSK-5M BW-Mid CH-Port1

PWR- Band25-QPSK-5M BW-Mid CH-Port2



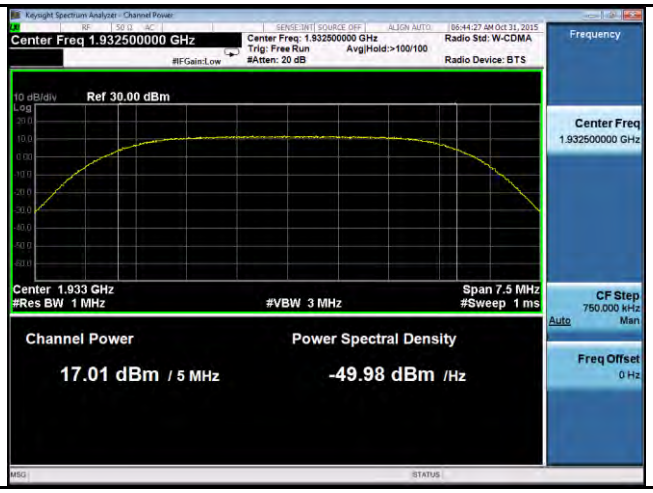
PWR- Band25-QPSK-5M BW-High CH-Port1



PWR- Band25-QPSK-5M BW-High CH-Port2

Test Plots for Band 25-64QAM-5MHz

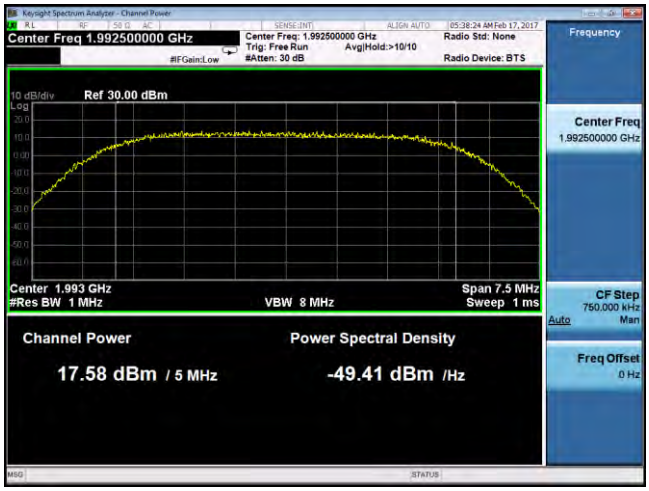
PWR-Band25-64QAM-5M BW-Low CH-Port1



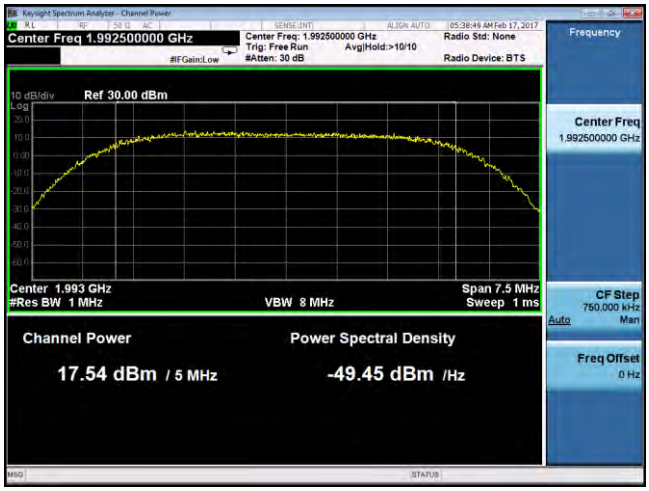
PWR- Band25-64QAM-5M BW-Low CH-Port2

PWR- Band25-64QAM-5M BW-Mid CH-Port1

PWR- Band25-64QAM-5M BW-Mid CH-Port2



PWR- Band25-64QAM-5M BW-High CH-Port1

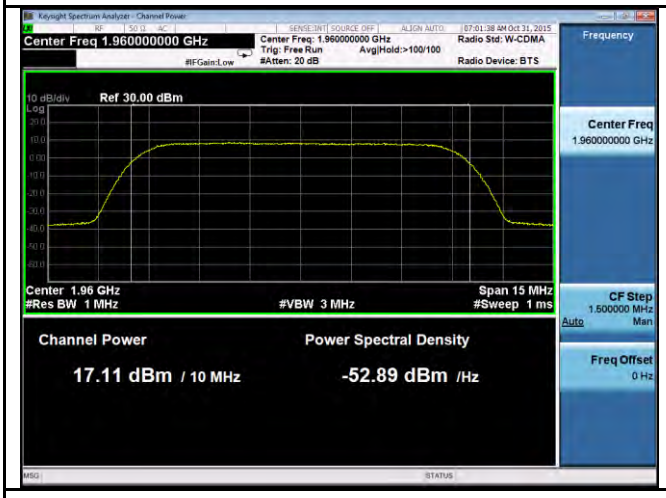


PWR- Band25-64QAM-5M BW-High CH-Port2

Test Plots for Band 25-QPSK-10MHz

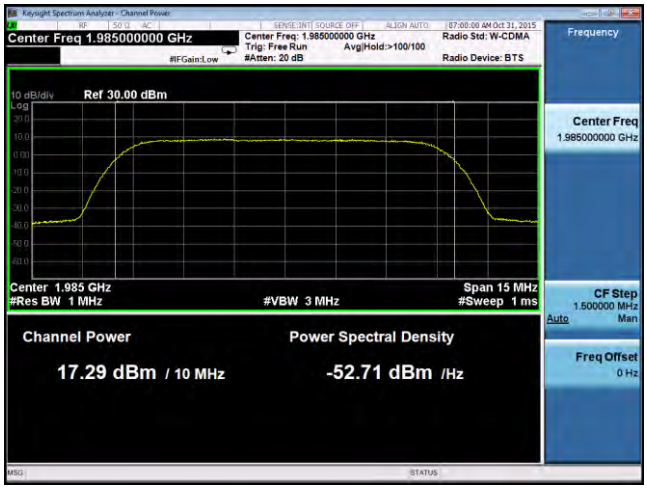
PWR-Band25-QPSK-10M BW-Low CH-Port1

PWR- Band25-QPSK-10M BW-Low CH-Port2

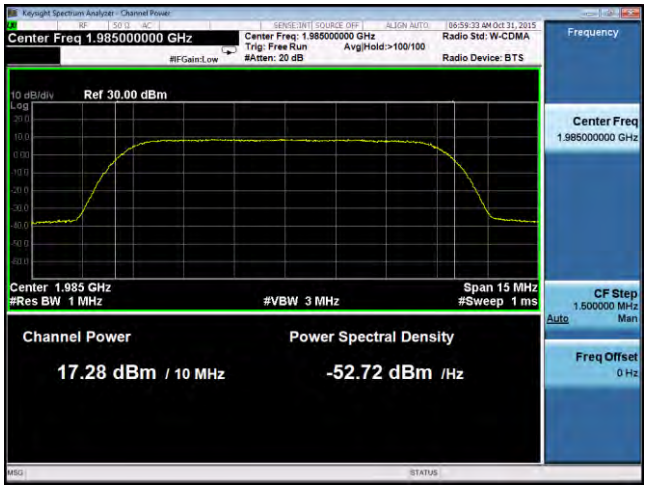


PWR- Band25-QPSK-10M BW-Mid CH-Port1

PWR- Band25-QPSK-10M BW-Mid CH-Port2



PWR- Band25-QPSK-10M BW-High CH-Port1

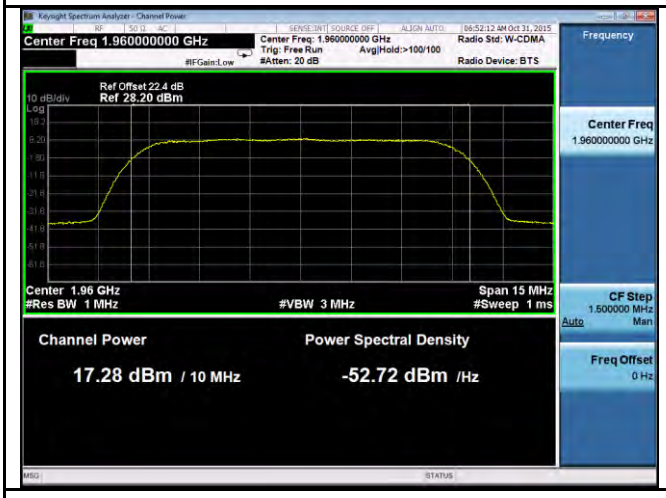


PWR- Band25-QPSK-10M BW-High CH-Port2

Test Plots for Band 25-64QAM-10MHz

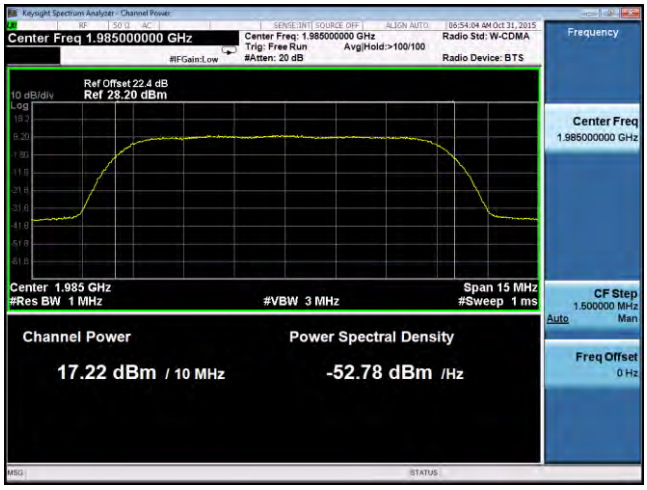
PWR- Band25-64QAM-10M BW-Low CH-Port1

PWR- Band25-64QAM-10M BW-Low CH-Port2

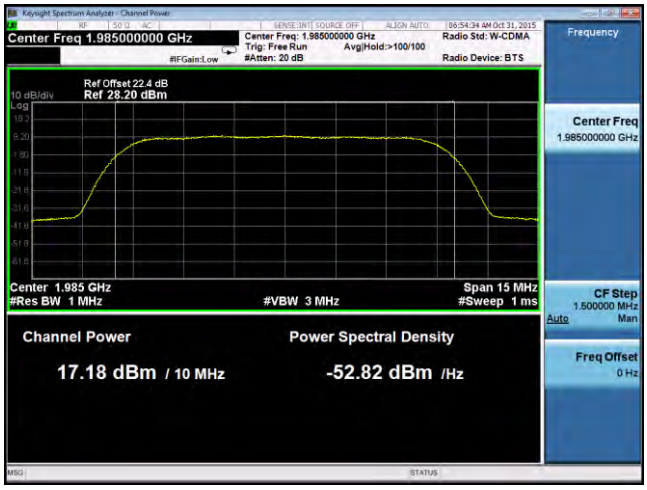


PWR- Band25-64QAM-10M BW-Mid CH-Port1

PWR- Band25-64QAM-10M BW-Mid CH-Port2



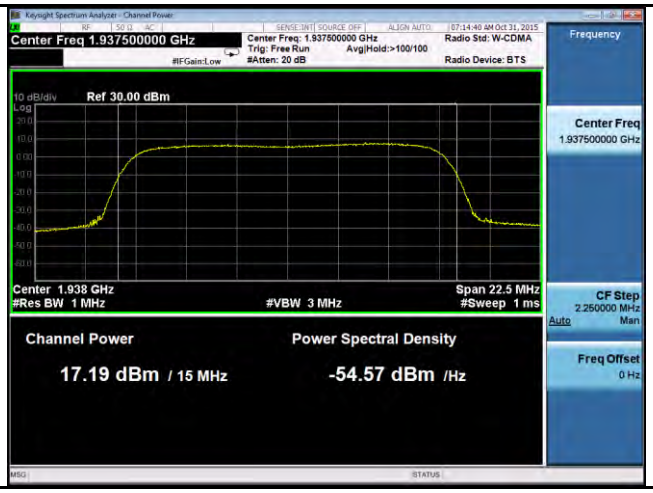
PWR- Band25-64QAM-10M BW-High CH-Port1



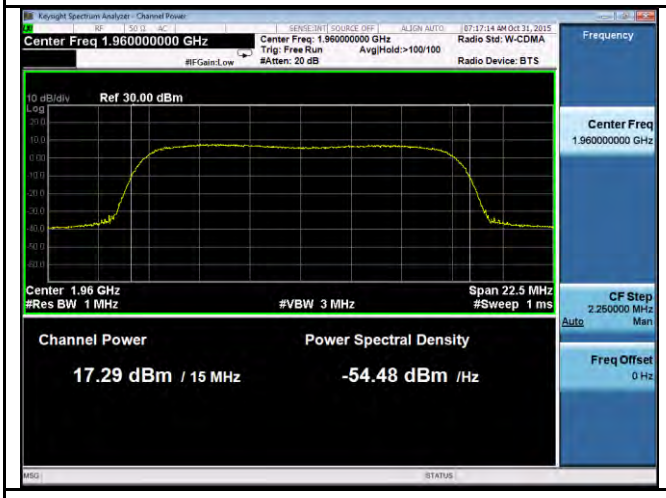
PWR- Band25-64QAM-10M BW-High CH-Port2

Test Plots for Band 25-QPSK-15MHz

PWR-Band25-QPSK-15M BW-Low CH-Port1

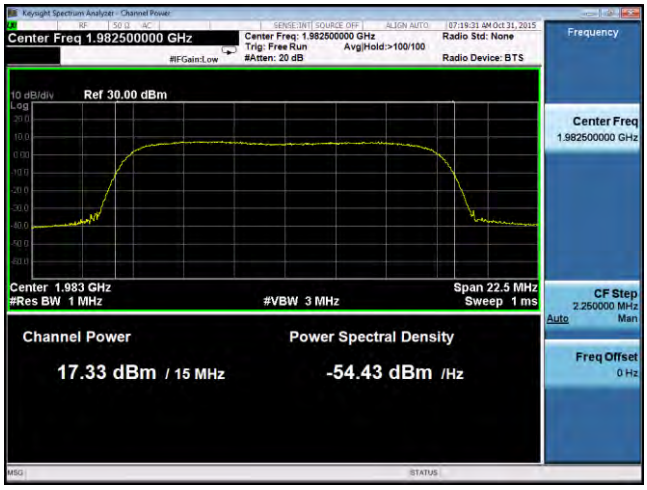


PWR- Band25-QPSK-15M BW-Low CH-Port2

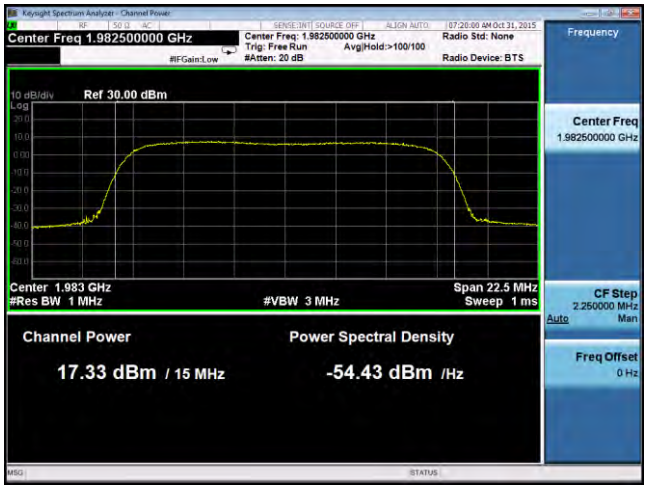


PWR- Band25-QPSK-15M BW-Mid CH-Port1

PWR- Band25-QPSK-15M BW-Mid CH-Port2



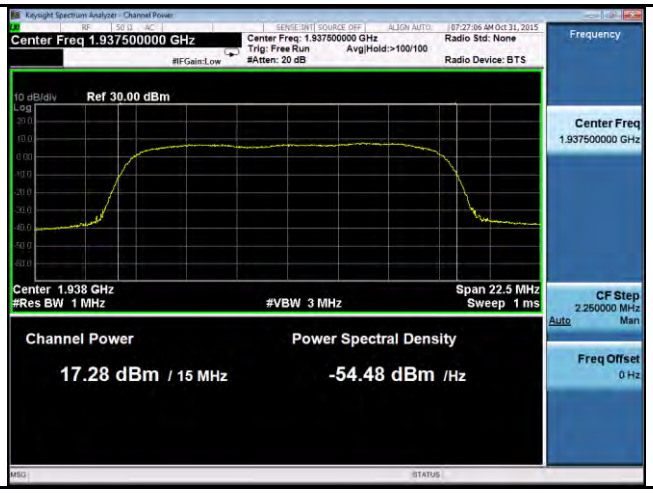
PWR- Band25-QPSK-15M BW-High CH-Port1



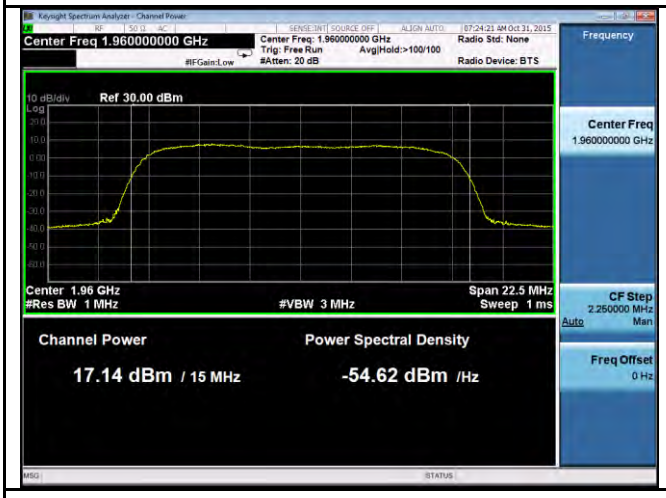
PWR- Band25-QPSK-15M BW-High CH-Port2

Test Plots for Band 25-64QAM-15MHz

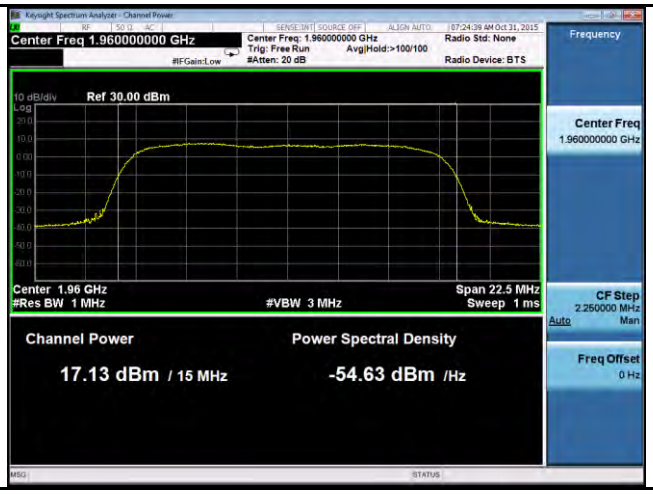
PWR- Band25-64QAM-15M BW-Low CH-Port1



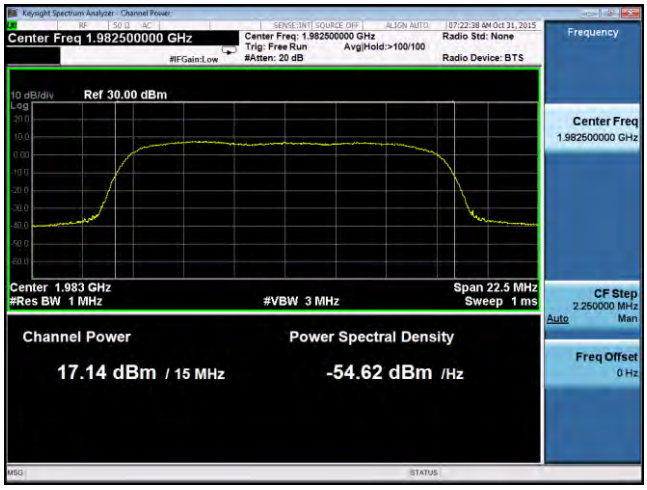
PWR- Band25-64QAM-15M BW-Low CH-Port2



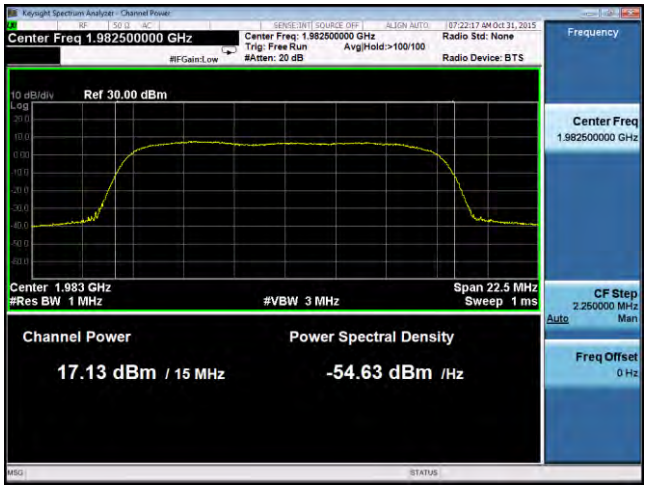
PWR- Band25-64QAM-15M BW-Mid CH-Port1



PWR- Band25-64QAM-15M BW-Mid CH-Port2



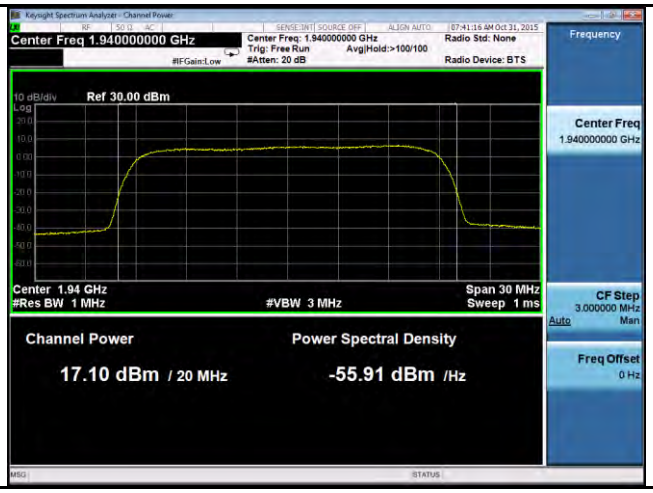
PWR- Band25-64QAM-15M BW-High CH-Port1



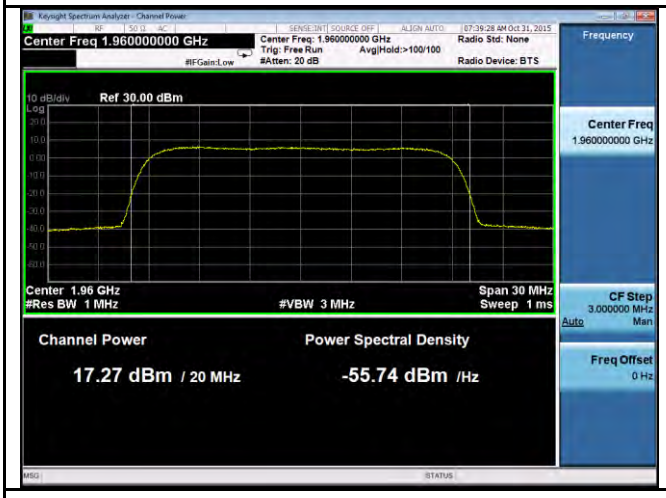
PWR- Band25-64QAM-15M BW-High CH-Port2

Test Plots for Band 25-QPSK-20MHz

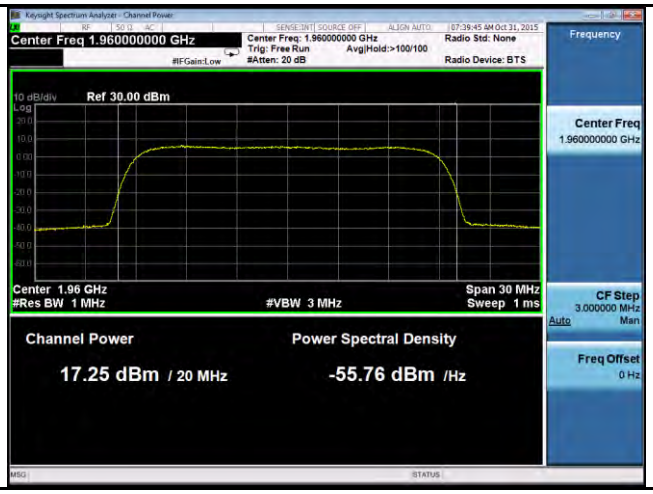
PWR-Band25-QPSK-20M BW-Low CH-Port1



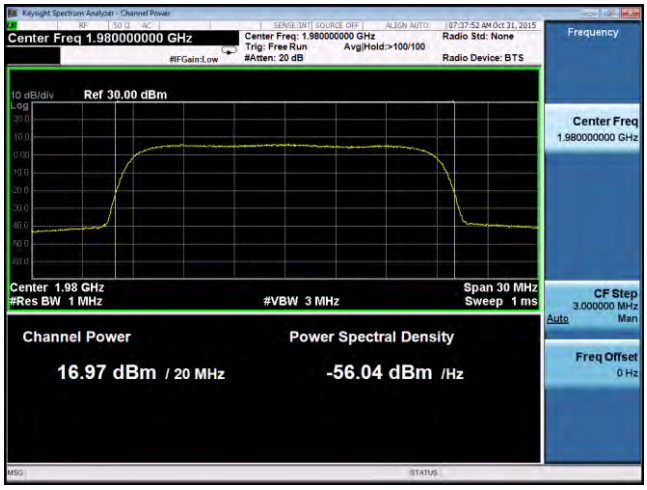
PWR-Band25-QPSK-20M BW-Low CH-Port2



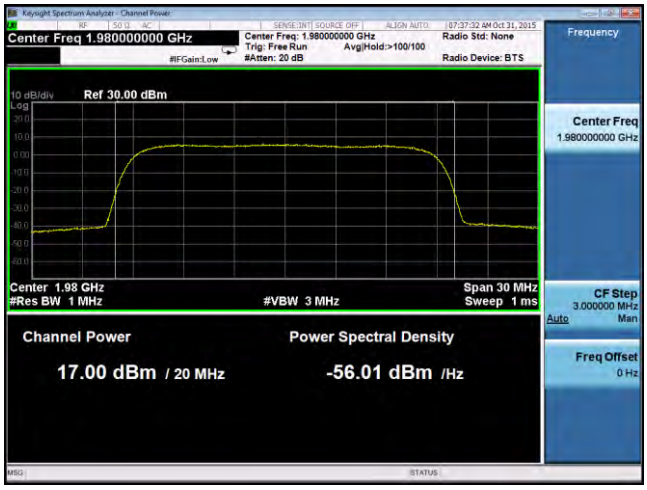
PWR-Band25-QPSK-20M BW-Mid CH-Port1



PWR-Band25-QPSK-20M BW-Mid CH-Port2



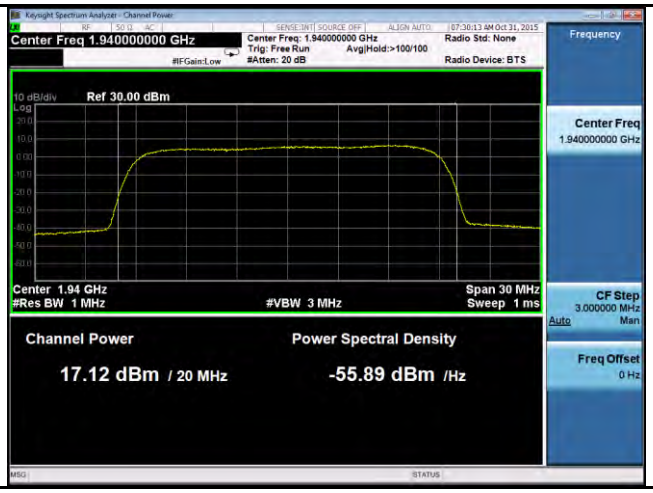
PWR-Band25-QPSK-20M BW-High CH-Port1



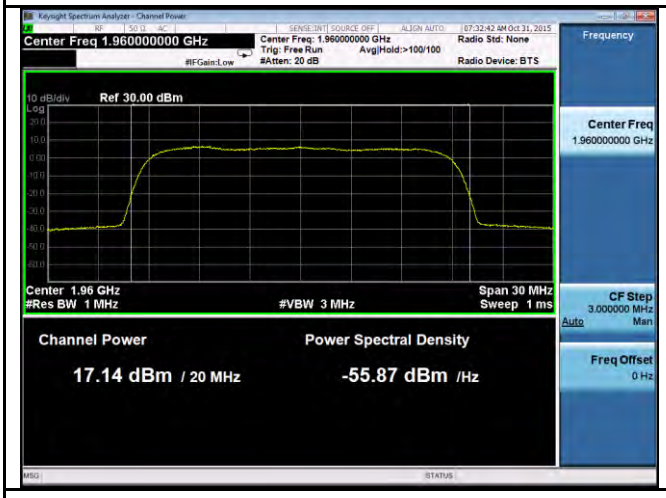
PWR-Band25-QPSK-20M BW-High CH-Port2

Test Plots for Band 25-64QAM-20MHz

PWR-Band25-64QAM-20M BW-Low CH-Port1

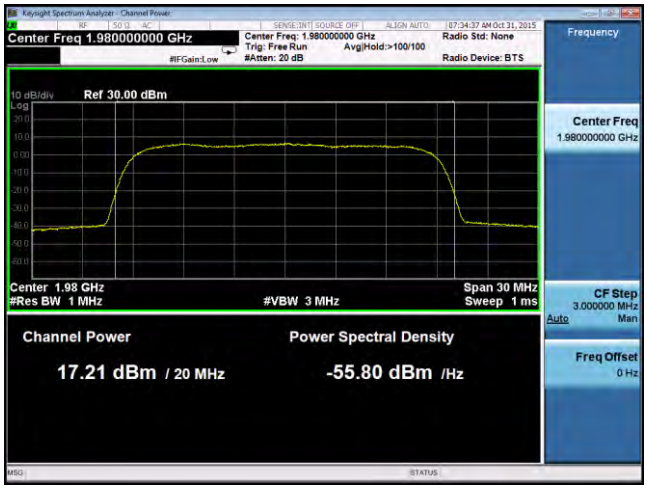


PWR-Band25-64QAM-20M BW-Low CH-Port2

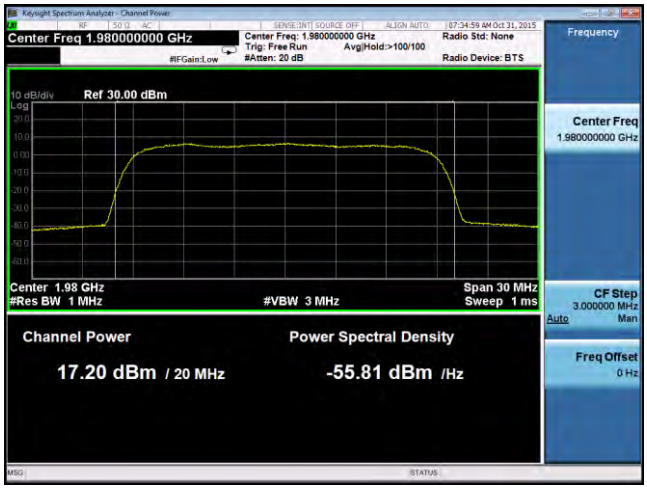


PWR-Band25-64QAM-20M BW-Mid CH-Port1

PWR-Band25-64QAM-20M BW-Mid CH-Port2



PWR-Band25-64QAM-20M BW-High CH-Port1

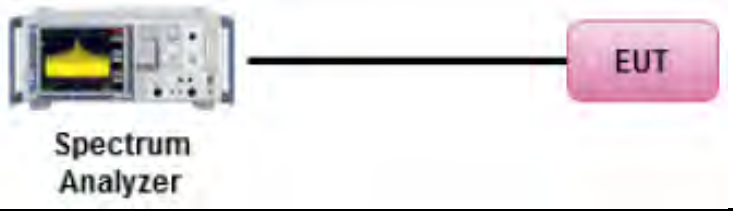


PWR-Band25-64QAM-20M BW-High CH-Port2

10.2 Peak-Average Ratio

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR27.50	(b)	The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.	☒

Test Setup				
Test Procedure	- EUT was set for low, mid, high channel with modulated mode and highest RF output power. - The spectrum analyzer was connected to the antenna terminal.			
Test Date	04/30/2015 – 05/03/2015 10/26/2015 – 11/02/2015 02/22/2017	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	23°C 48% 1008mbar
Remark	NONE			
Result	☒ Pass ☐ Fail			

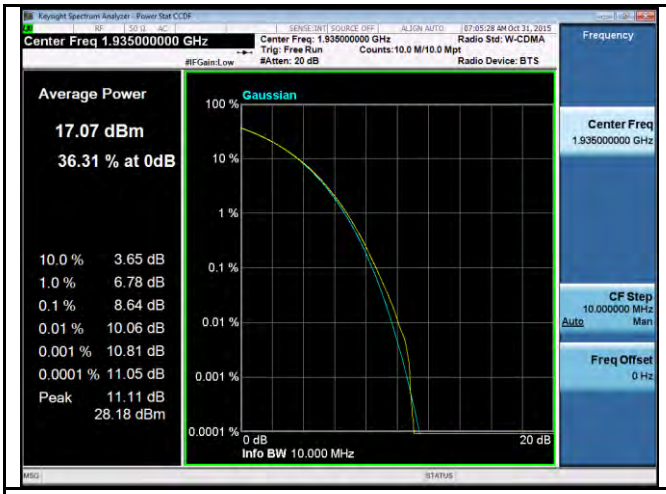
Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

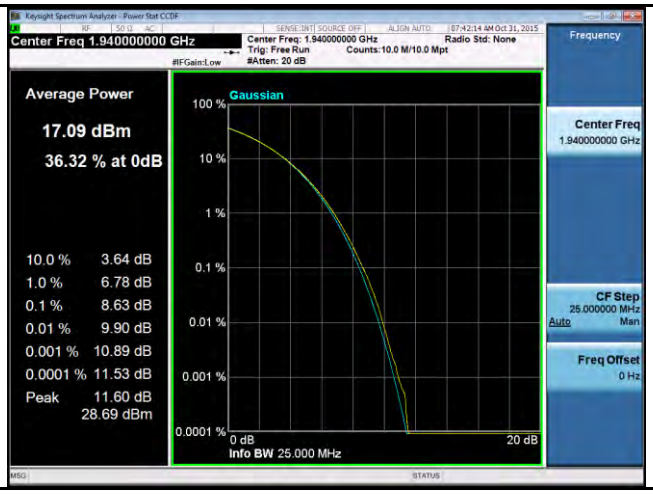
Test Data for LTE Band 25 (QPSK is the worst case)

Type	Channel	Frequency (MHz)	Peak-Average Ratio (dB)	Peak-Average Ratio (dB)
5MHz BW, QPSK	Low	1932.5	9.79	13
	Mid	1960.0	9.79	13
	High	1992.5	9.80	13
10MHz BW, QPSK	Low	1935.0	10.06	13
	Mid	1960.0	10.06	13
	High	1985.0	10.05	13
15MHz BW, QPSK	Low	1937.5	9.90	13
	Mid	1960.0	9.93	13
	High	1982.5	9.92	13
20MHz BW, QPSK	Low	1940.0	9.90	13
	Mid	1960.0	9.89	13
	High	1980.0	9.84	13

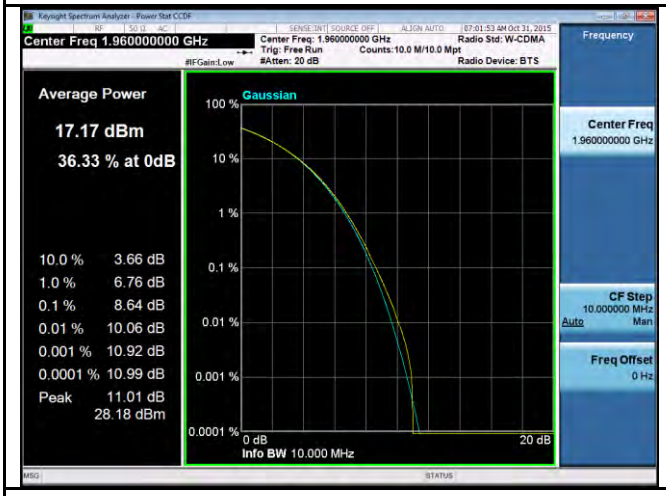
Test Plots for Band 25:



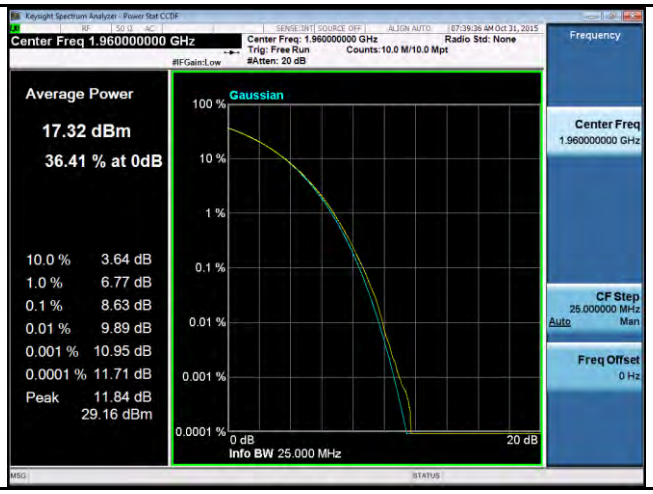
PK-AV-Ratio-Band25-QPSK-10M BW-Low



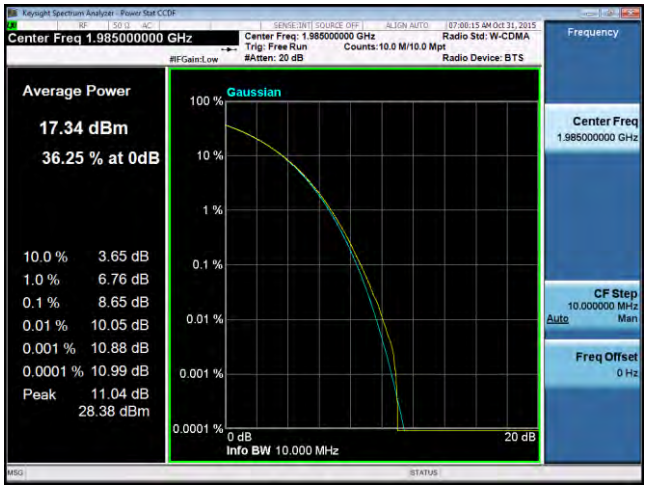
PK-AV-Ratio- Band25-QPSK-20M BW-Low



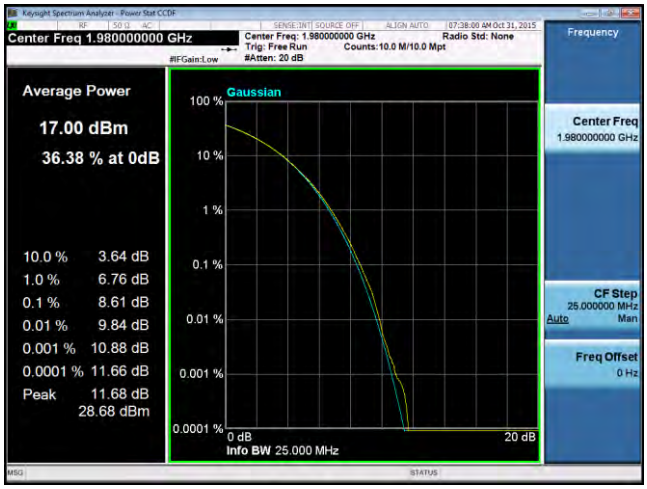
PK-AV-Ratio- Band25-QPSK-10M BW-Mid



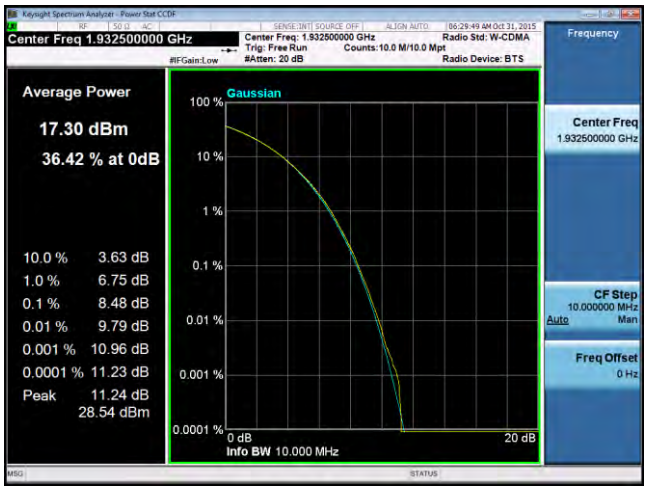
PK-AV-Ratio- Band25-QPSK-20M BW-Mid



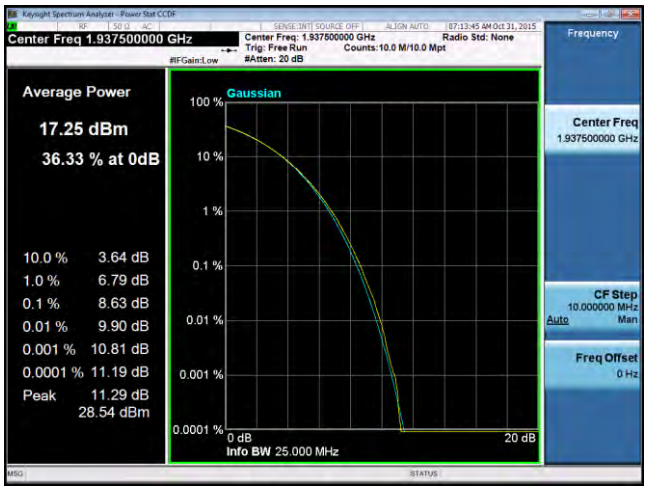
PK-AV-Ratio- Band25-QPSK-10M BW-High



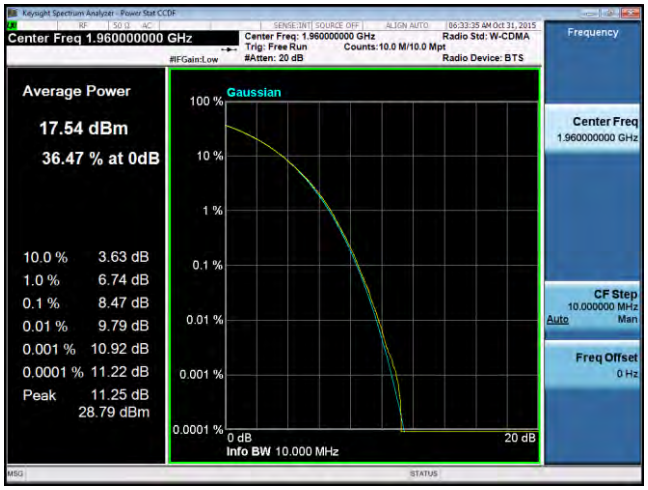
PK-AV-Ratio- Band25-QPSK-20M BW-High



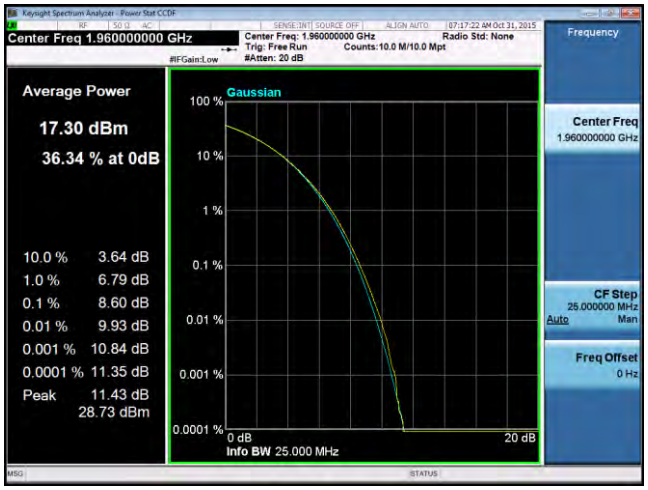
PK-AV-Ratio- Band25-QPSK-5M BW-Low



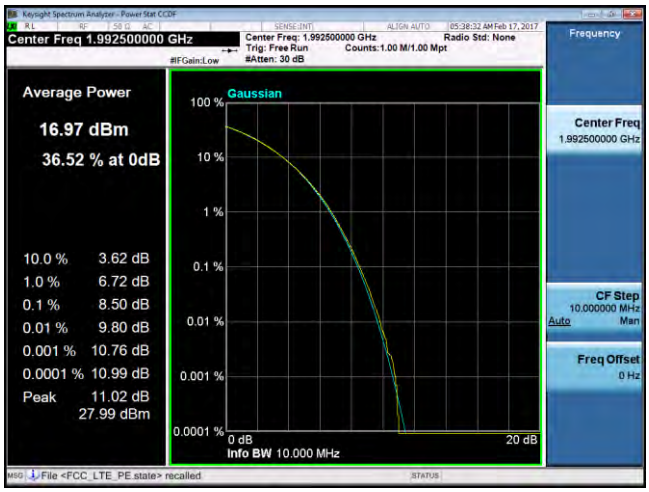
PK-AV-Ratio- Band25-QPSK-15M BW-Low



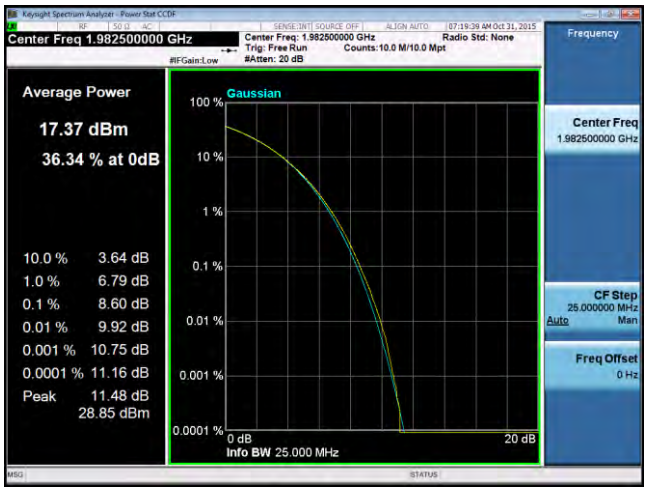
PK-AV-Ratio- Band25-QPSK-5M BW-Mid



PK-AV-Ratio- Band25-QPSK-15M BW-Mid



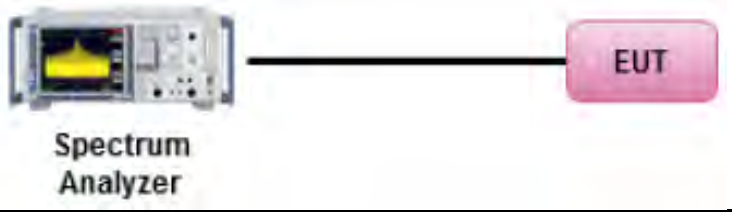
PK-AV-Ratio- Band25-QPSK-5M BW-High



PK-AV-Ratio- Band25-QPSK-15M BW-High

10.3 Occupied Bandwidth

Requirement(s):

Spec	Requirement	Applicable
47 CFR §2.1049	The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions of § 2.1049 (a) through (i)	☒
Test Setup		
Procedure	99% Occupied bandwidth measurement procedure - Allow the trace to stabilize. - Use the spectrum analyzer built-in measurement function to determine the 26 dB bandwidth 99% OBW. o Set RBW = 1% -5% of Emission Bandwidth o Set VBW = approximately 3 x RBW o Detector = Peak o Trace mode = max hold o Sweep = auto couple - Capture the plot. Repeat above steps for different test channel and other modulation type.	

Test Date	04/30/2015 – 05/03/2015 10/26/2015 – 11/02/2015 02/22/2017	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	23°C 48% 1008mbar
Remark	NONE			
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes ☐ N/A

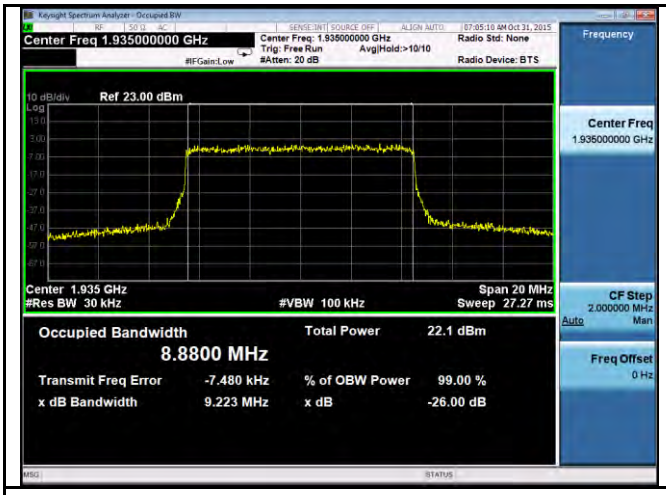
Test Plot ☒ Yes (See below) ☐ N/A

Test Data

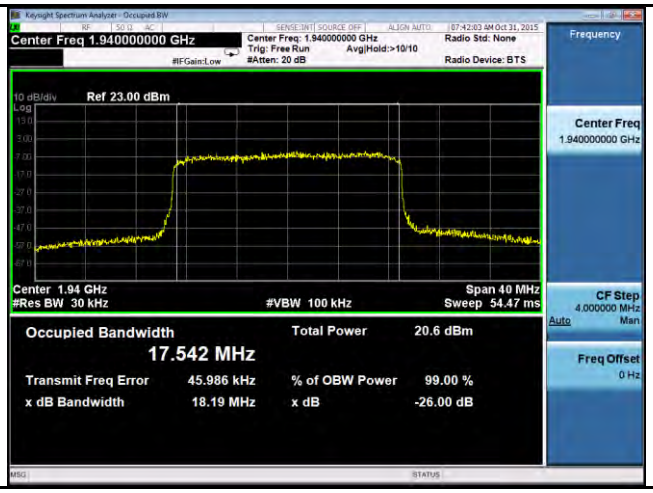
99% Bandwidth measurement result for LTE Band 25:

Type	Channel	Channel Frequency (MHz)	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
5MHz BW, QPSK	Low	1932.5	4.41	4.63
	Mid	1960.0	4.42	4.67
	High	1992.5	4.41	4.69
5MHz BW, 64QAM	Low	1932.5	4.41	4.63
	Mid	1960.0	4.40	4.63
	High	1992.5	4.41	4.67
10MHz BW, QPSK	Low	1935.0	8.88	9.22
	Mid	1960.0	8.85	9.24
	High	1985.0	8.85	9.22
10MHz BW, 64QAM	Low	1935.0	8.88	9.22
	Mid	1960.0	8.86	9.18
	High	1985.0	8.86	9.21
15MHz BW, QPSK	Low	1937.5	13.27	13.77
	Mid	1960.0	13.27	13.88
	High	1982.5	13.26	13.70
15MHz BW, 64QAM	Low	1937.5	13.26	13.82
	Mid	1960.0	13.27	13.72
	High	1982.5	13.28	13.88
20MHz BW, QPSK	Low	1940.0	17.54	18.19
	Mid	1960.0	17.59	18.19
	High	1980.0	17.57	18.18
20MHz BW, 64QAM	Low	1940.0	17.59	18.14
	Mid	1960.0	17.49	18.14
	High	1980.0	17.46	18.15

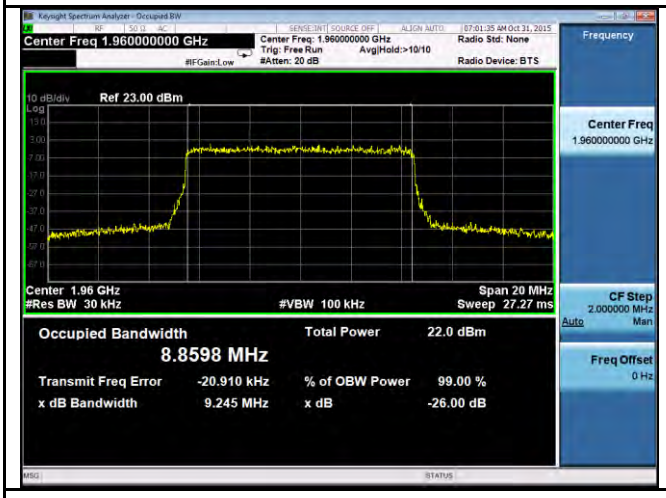
Test Plots for LTE Band25 QPSK



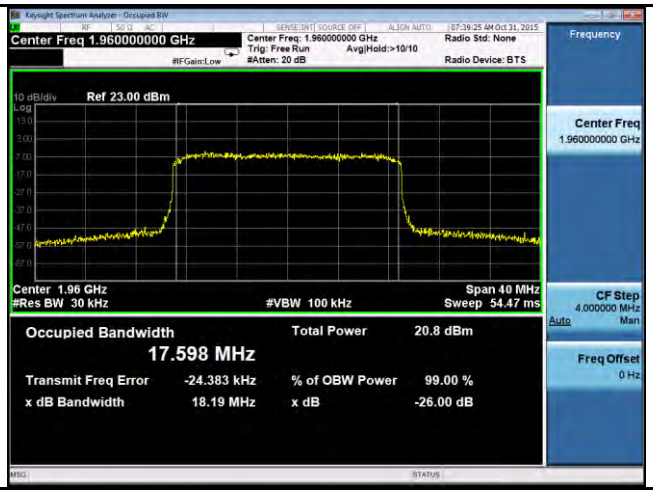
OBW- Band25-10M BW-Low



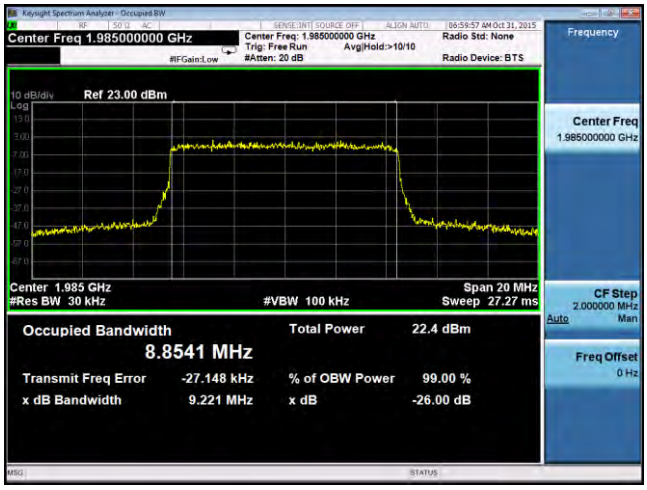
OBW- Band25-20M BW-Low



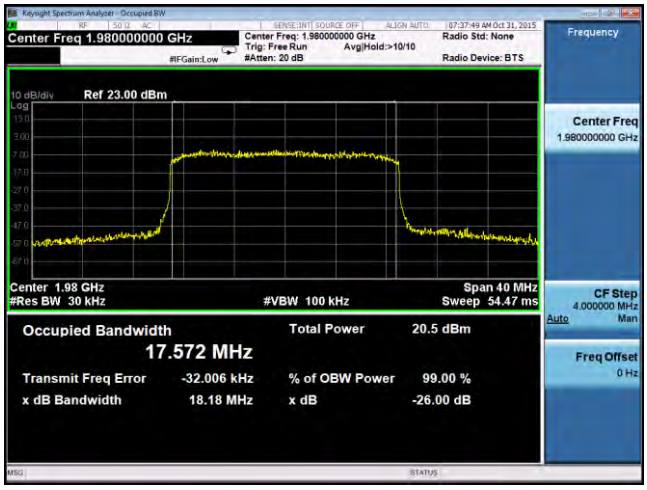
OBW- Band25-10M BW-Mid



OBW- Band25-20M BW-Mid



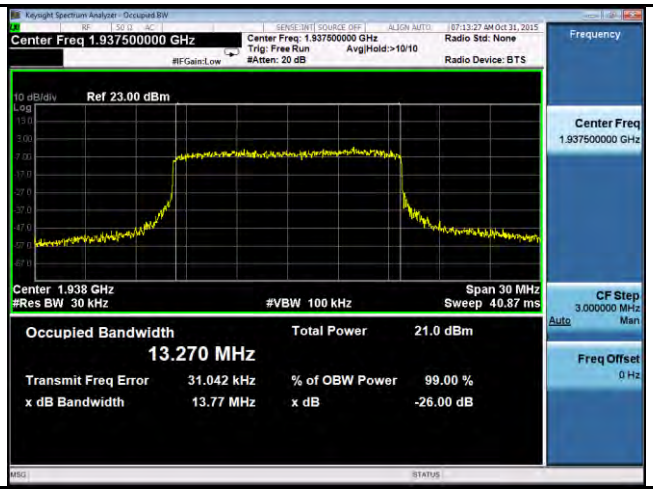
OBW- Band25-10M BW-High



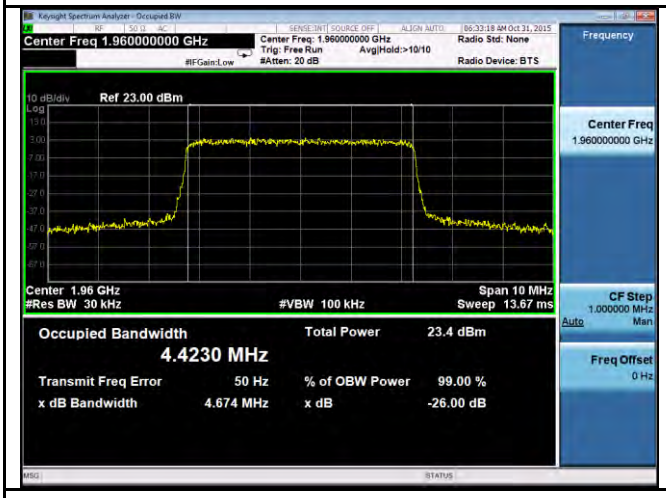
OBW- Band25-20M BW-High

Test Plots for LTE Band25 QPSK

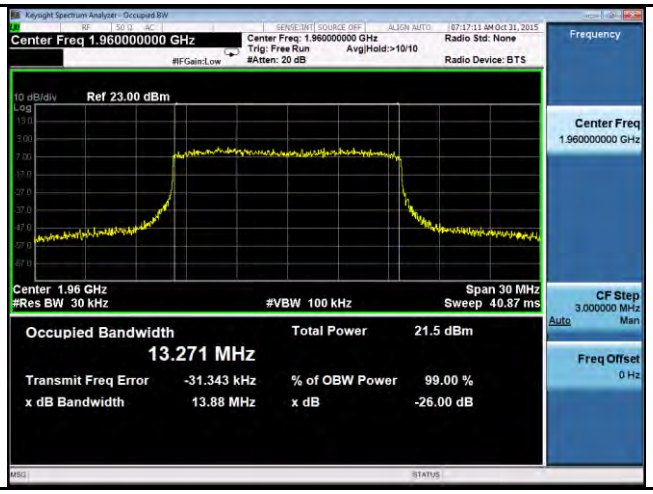
OBW- Band25-5M BW-Low



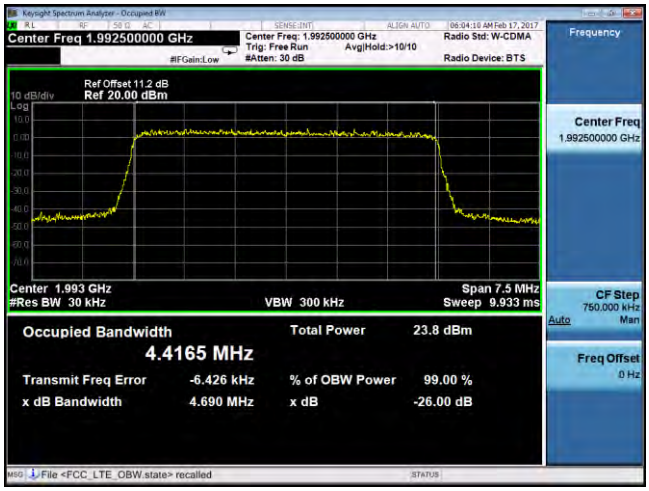
OBW- Band25-15M BW-Low



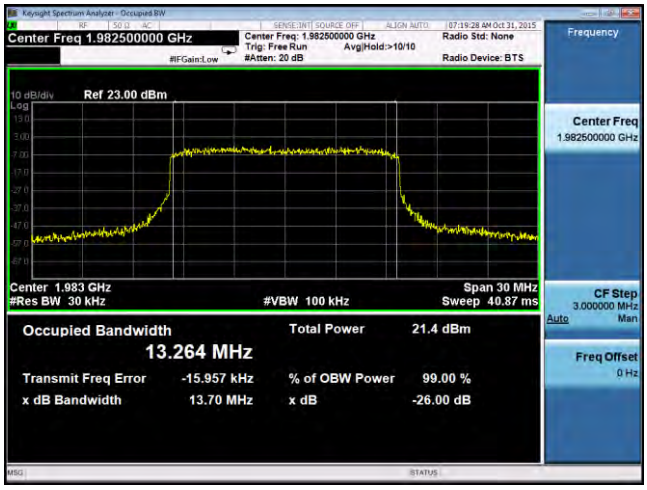
OBW- Band25-5M BW-Mid



OBW- Band25-15M BW-Mid



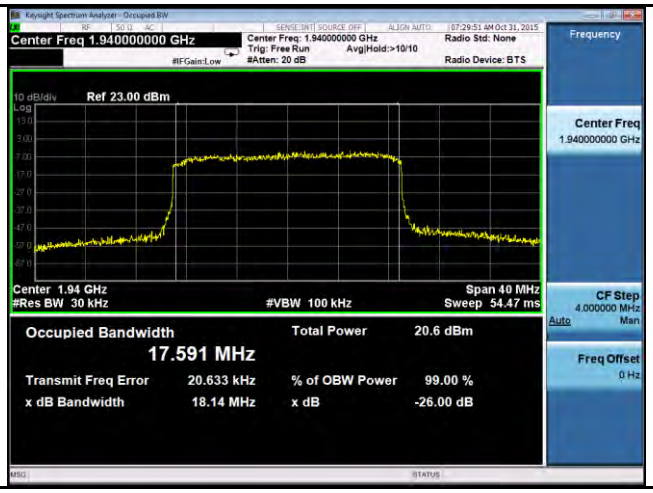
OBW- Band25-5M BW-High



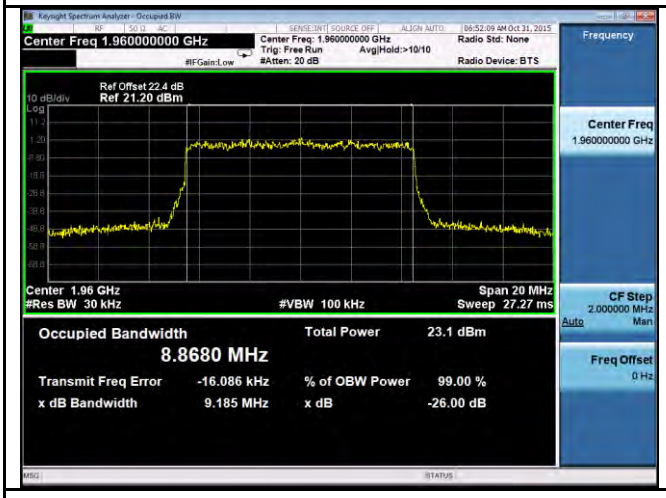
OBW- Band25-15M BW-High

Test Plots for LTE Band25 64QAM

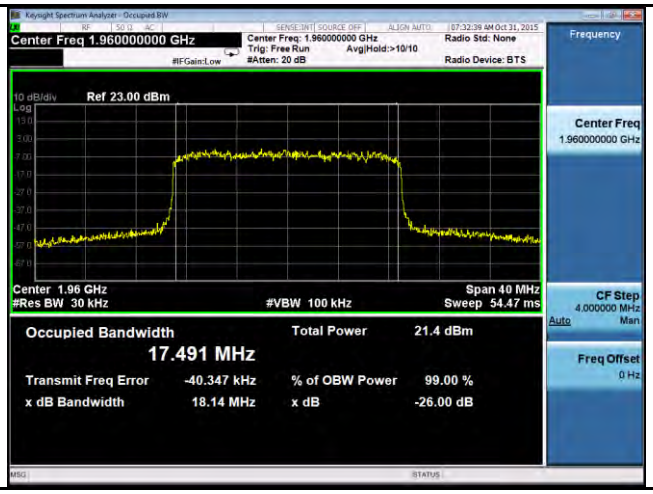
OBW- Band25 -10M BW-Low



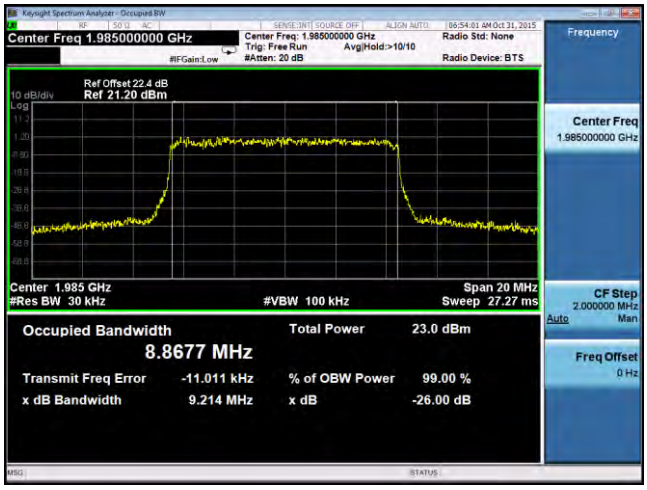
OBW- Band25 -20M BW-Low



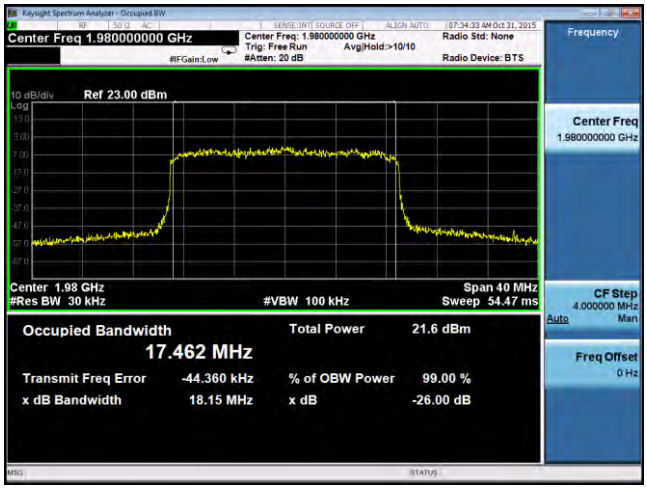
OBW- Band25 -10M BW-Mid



OBW- Band25-20M BW-Mid

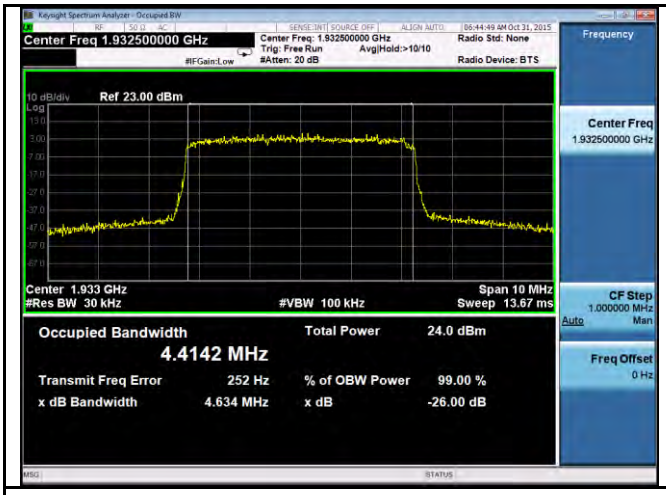


OBW- Band25 -10M BW-High

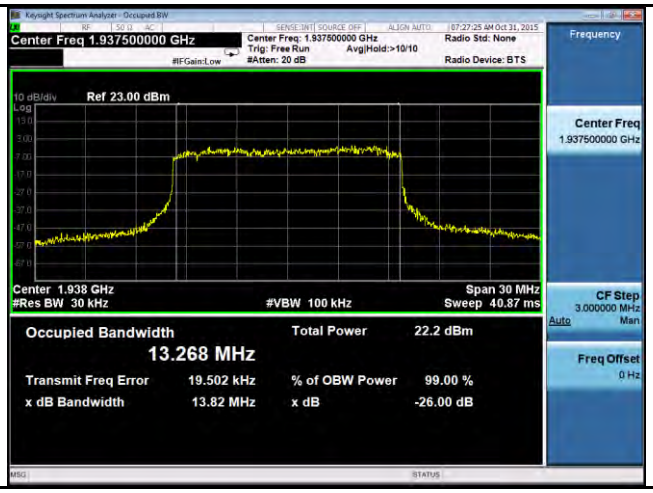


OBW- Band25-20M BW-High

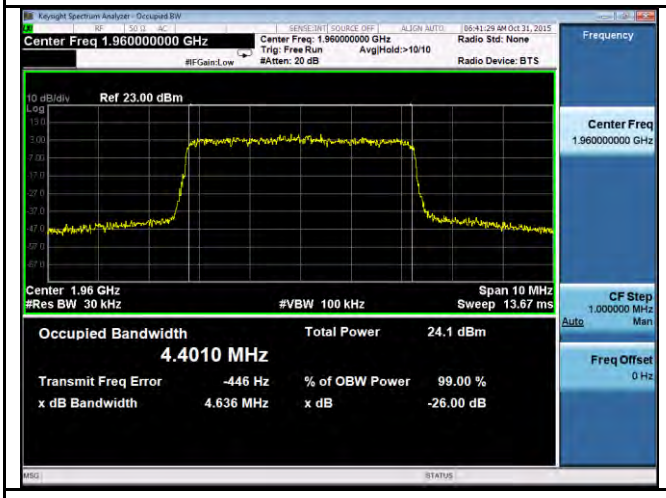
Test Plots for LTE Band25 64QAM



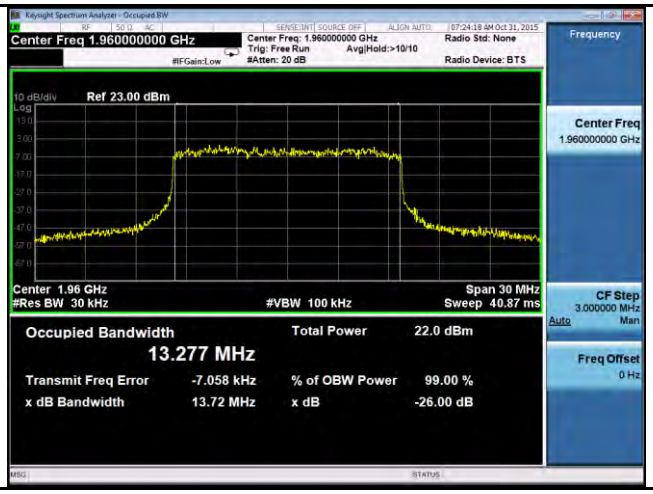
OBW- Band25-5M BW-Low



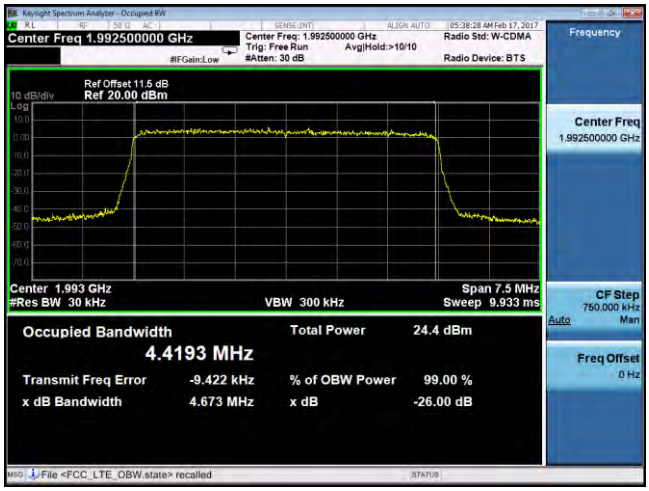
OBW- Band25-15M BW-Low



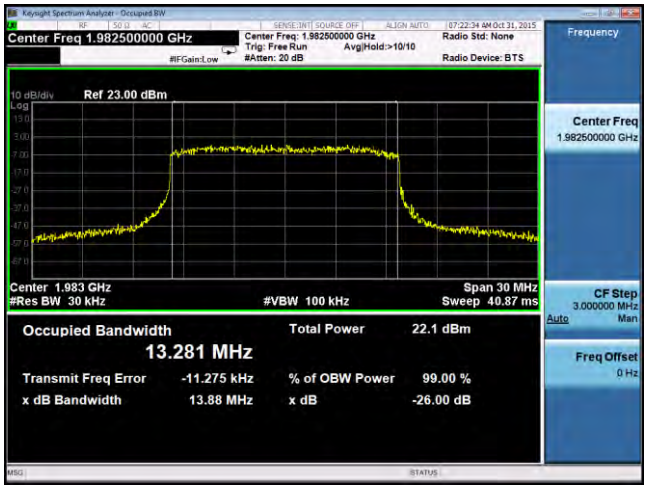
OBW- Band25-5M BW-Mid



OBW- Band25-15M BW-Mid



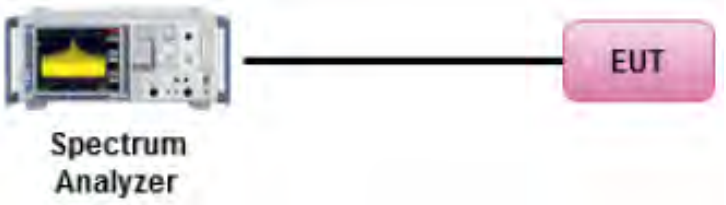
OBW- Band25-5M BW-High



OBW-Band25-15M BW-High

10.4 Band Edge

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR27.53	-	Out of band emissions. 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.	☒
Test Setup			
Test Procedure	1. EUT was set for low , mid, high channel with modulated mode and highest RF output power. 2. The spectrum analyzer was connected to the antenna terminal. 3. A RBW of 1% greater than the 26 dB emission bandwidth should be used for band edge measurement or if narrower RBW is used, a correct factor calculated with formula 10*log (EBW/BW_{meas}) will be added to the result.		
Test Date	04/30/2015 - 05/03/2015 10/26/2015 – 11/02/2015	Environmental condition	Temperature 22°C Relative Humidity 48% Atmospheric Pressure 1008mbar
Remark	The EUT was scanned up to 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. Limit calculation: Emission limit = PdBm – [43+ 10 log (PW)] = 10log(1000 x PW) - 43 - 10log(PW) = 30 dBm - 43 = -13 dBm		
Result	☒ Pass ☐ Fail		

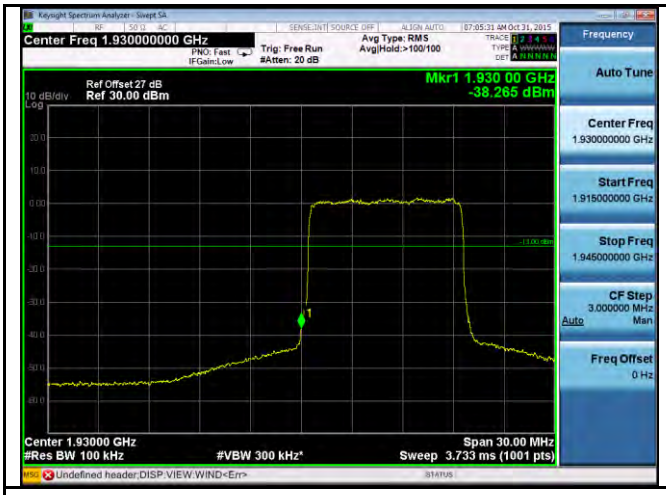
Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

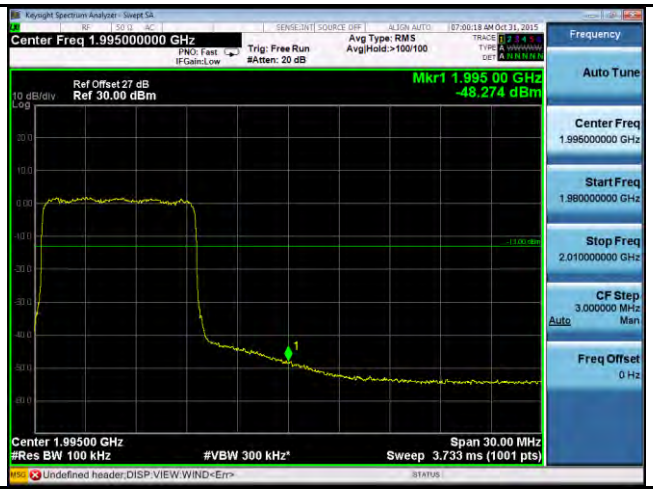
Band Edge Measurement Data for LTE Band 25

Type	Channel	Channel Frequency (MHz)	Measurement Band Edge (dBm)	Limit (dBm)
5MHz BW, QPSK	Low	1932.5	-38.28	-13
	High	1992.5	-38.03	-13
5MHz BW, 64QAM	Low	1932.5	-38.28	-13
	High	1992.5	-36.88	-13
10MHz BW, QPSK	Low	1935	-38.26	-13
	High	1985	-48.27	-13
10MHz BW, 64QAM	Low	1935	-37.53	-13
	High	1985	-47.39	-13
15MHz BW, QPSK	Low	1937.5	-39.98	-13
	High	1982.5	-47.55	-13
15MHz BW, 64QAM	Low	1937.5	-36.06	-13
	High	1982.5	-47.72	-13
20MHz BW, QPSK	Low	1940	-46.08	-13
	High	1980	-48.38	-13
20MHz BW, 64QAM	Low	1940	-45.63	-13
	High	1980	-47.90	-13

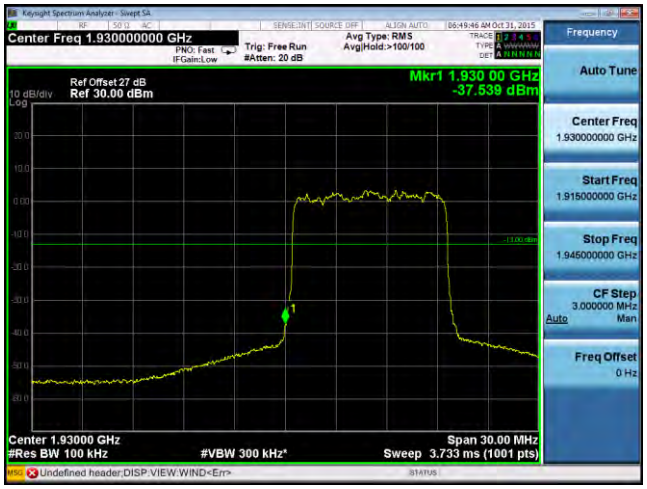
Test Plots for Band 25:



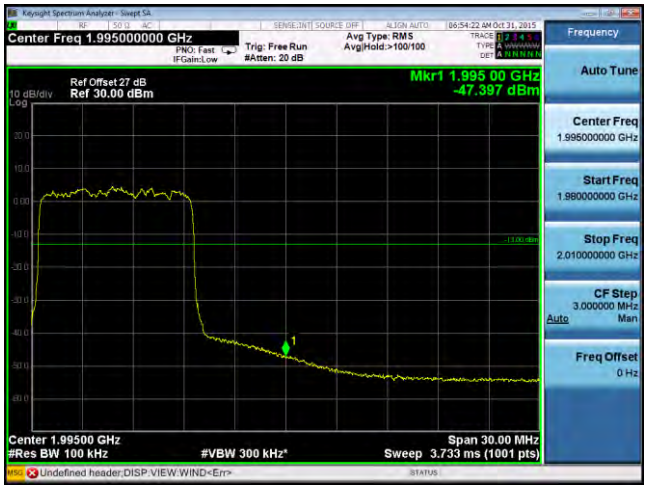
BandEdge-LTE-Band25-10MHz-QPSK-Low



BandEdge-LTE-Band25-10MHz-QPSK-High



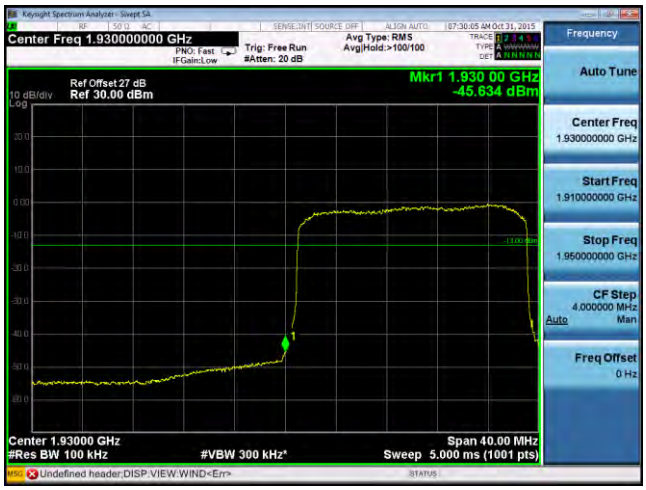
BandEdge-LTE- Band25-10MHz-64QAM-Low



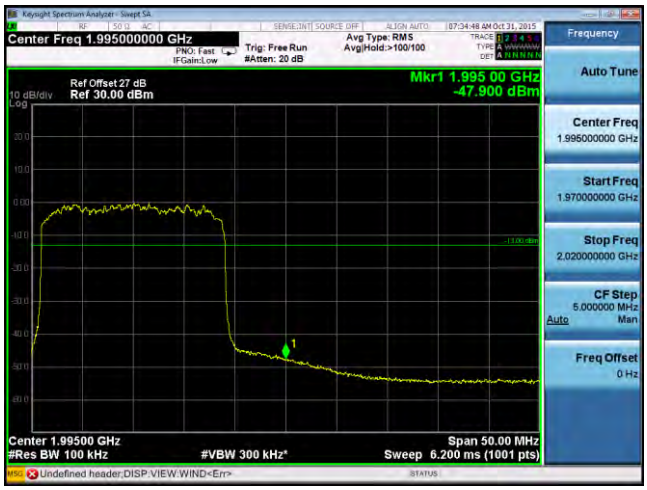
BandEdge-LTE- Band25-10MHz-64QAM-High

BandEdge-LTE- Band25-20MHz-QPSK-Low

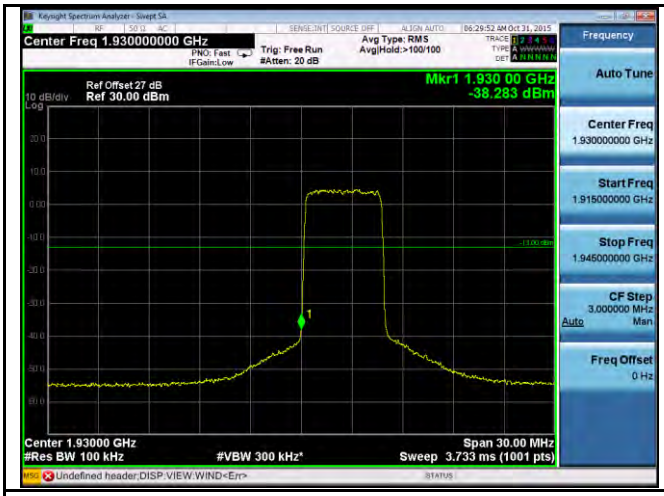
BandEdge-LTE- Band25-20MHz-QPSK-High



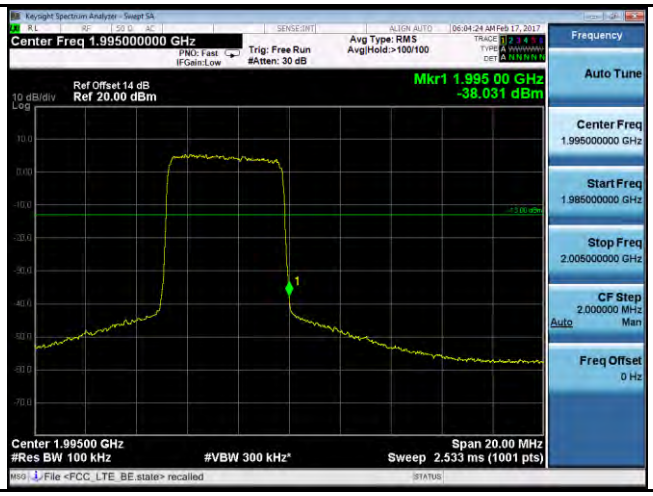
BandEdge-LTE- Band25-20MHz-64QAM-Low



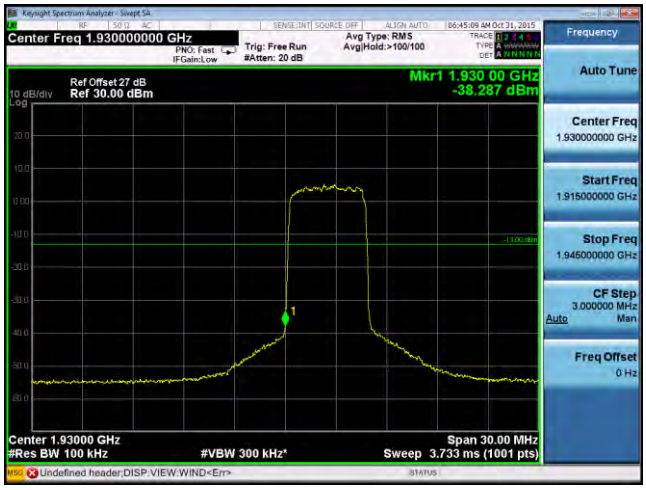
BandEdge-LTE- Band25-20MHz-64QAM-High



BandEdge-LTE- Band25-5MHz-QPSK-Low



BandEdge-LTE- Band25-5MHz -QPSK-High



BandEdge-LTE- Band25-5MHz -64QAM-Low

BandEdge-LTE- Band25-5MHz -64QAM-High

BandEdge-LTE- Band25-15MHz-QPSK-Low

BandEdge-LTE- Band25-15MHz -QPSK-High

BandEdge-LTE- Band25-15MHz -64QAM-Low

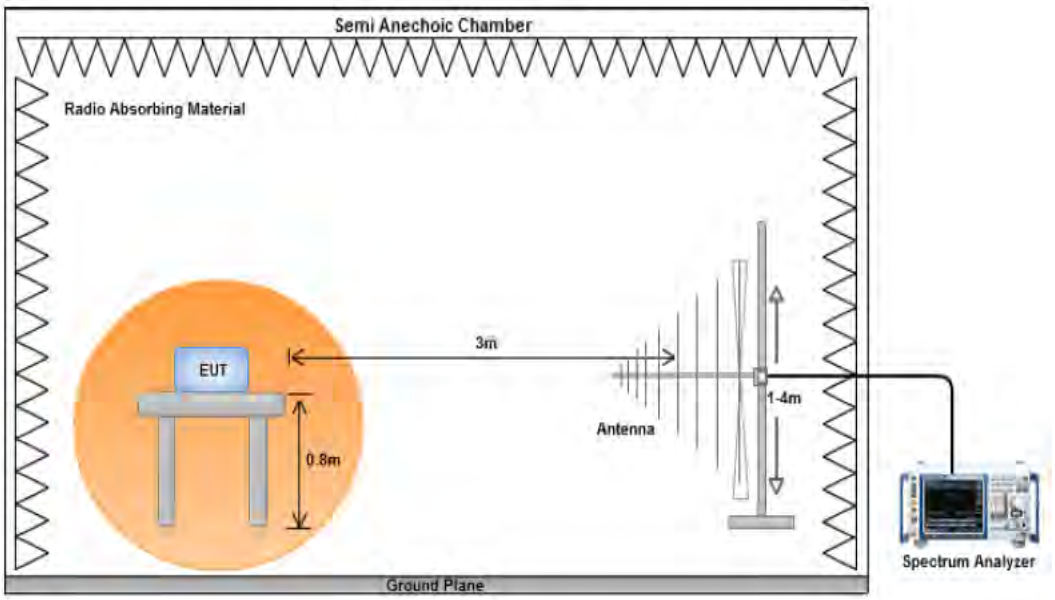
BandEdge-LTE- Band25-15MHz -64QAM-High

10.5 Radiated Spurious Emission below 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR27.53	-	Out of band emissions. 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.	☒

Test Setup



Test Procedure

Substitution method:

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter.
4. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained.
5. Steps 4 were repeated for the next frequency point, until all selected frequency points were measured.

Test Date	04/30/2015 10/26/2015 – 11/02/2015	Environmental condition	Temperature 23°C Relative Humidity 48% Atmospheric Pressure 1008mbar

Remark

The EUT was scanned up to 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.

Limit calculation:
Emission limit = PdBm – [43+ 10 log (PW)] = 10log(1000 x PW) - 43 - 10log(PW) = 30 dBm - 43 = -13 dBm
All different modulation and bandwidth configuration has been verified and only the test data of worst case with QPSK modulation and greatest bandwidth was presented in this report.

Result ☒ Pass ☐ Fail

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Radiated Emission Test Results for LTE Band 25

Test specification	below 1GHz		Result	Pass
Environmental Conditions:	Temp (°C):	24		
	Humidity (%)	39		
	Atmospheric (mbar):	1012		
Mains Power:	48VDC			
Tested by:	Chen Ge			
Test Date:	10/26/2015 – 11/02/2015			
Remarks:	LTE Band25-Mid CH-20MHz BW, QPSK			

Frequency MHz	SG Level dBm	Cable Loss dB	Antenna Gain dBd	Substituted Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
750.05	-46.23	4.88	0	-51.11	RMS Max	H	109	27	-13	-38.11	Pass
454.18	-48.19	3.69	0	-51.88	RMS Max	V	178	29	-13	-38.88	Pass
456.81	-48.84	3.68	0	-52.52	RMS Max	V	100	228	-13	-39.52	Pass
444.73	-50.38	3.66	0	-54.04	RMS Max	V	170	302	-13	-41.04	Pass
448.66	-51.86	3.68	0	-55.54	RMS Max	V	196	269	-13	-42.54	Pass
463.42	-51.86	3.72	0	-55.58	RMS Max	V	154	260	-13	-42.58	Pass

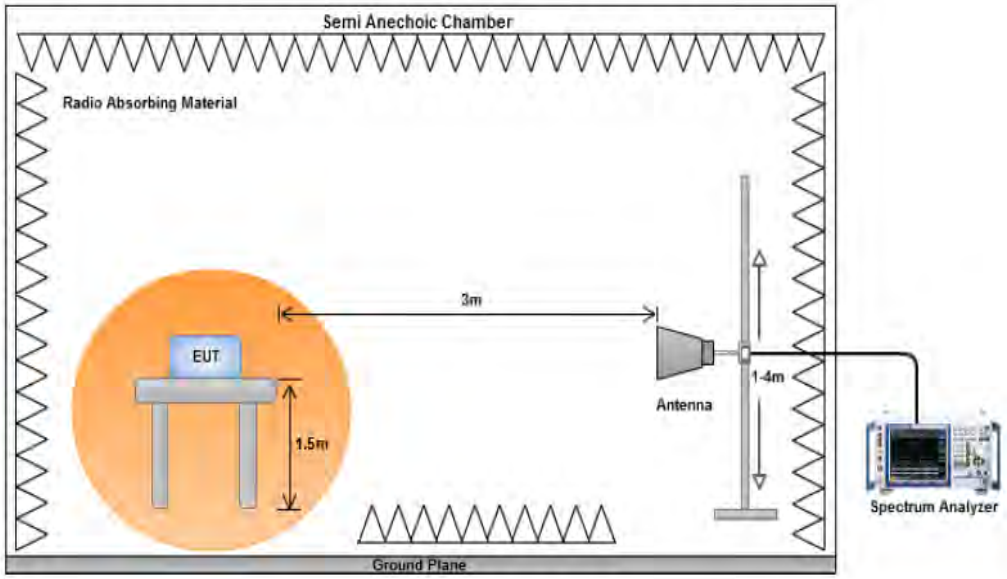
Note: Dipole antenna was used for substitution method.

10.6 Radiated Spurious Emissions above 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR27.53	-	Out of band emissions. 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.	☒

Test Setup



Test Procedure

Substitution method:

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter.
4. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained.
5. Steps 4 were repeated for the next frequency point, until all selected frequency points were measured.

Test Date	04/30/2015 – 05/03/2015 10/26/2015 – 11/02/2015	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	23°C 48% 1008mbar

Remark

The EUT was scanned up to 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.
Limit calculation:
Emission limit = PdBm – [43+ 10 log (PW)] = 10log(1000 x PW) - 43 - 10log(PW) = 30 dBm - 43 = -13 dBm

All different modulation and bandwidth configuration has been verified and only the test data of worst case with QPSK modulation and greatest bandwidth was presented in this report.

Result ☒ Pass ☐ Fail

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Radiated Emission Test Results (Above 1GHz)

LTE Band 25 Low Channel, 20MHz BW, QPSK

Frequency MHz	SG Level dBm	Cable Loss dB	Antenna Gain dBd	Substituted Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
3863.68	-52.02	17.51	15.51	-54.02	Average Max	V	108	57	-13	-41.02	Pass
7743.91	-48.54	20.44	12.39	-56.59	Average Max	V	100	283	-13	-43.59	Pass
2395.48	-53.64	16.53	14.27	-55.9	Average Max	V	166	216	-13	-42.9	Pass

LTE band 25 Mid Channel, 20MHz BW, QPSK

Frequency MHz	SG Level dBm	Cable Loss dB	Antenna Gain dBd	Substituted Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
5292.43	-52.9	18.21	12.63	-58.48	Average Max	H	126	133	-13	-45.48	Pass
3896.89	-51.79	17.54	15.57	-53.76	Average Max	V	108	220	-13	-40.76	Pass
7814.57	-48.12	20.45	12.43	-56.14	Average Max	V	118	324	-13	-43.14	Pass

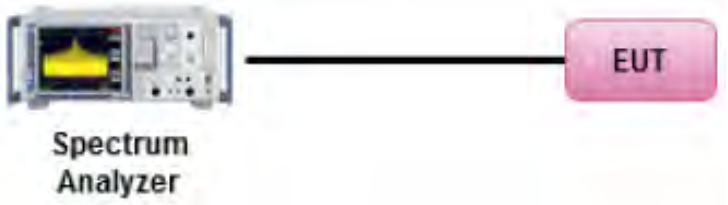
LTE band 25 High Channel, 20MHz BW, QPSK

Frequency MHz	SG Level dBm	Cable Loss dB	Antenna Gain dBd	Substituted Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
5291.34	-52.89	18.21	12.63	-58.47	Average Max	H	189	0	-13	-45.47	Pass
7916.86	-42.82	20.46	12.49	-50.79	Average Max	V	125	317	-13	-37.79	Pass
3962.08	-40.16	17.58	15.69	-42.05	Average Max	V	102	323	-13	-29.05	Pass
2398.59	-53.39	16.54	14.27	-55.66	Average Max	H	100	103	-13	-42.66	Pass

10.7 Frequency Stability

Requirement(s):

Spec	Item	Requirement	Applicable
47 CFR 2.1055, 47 CFR	-	The frequency stability of the transmitter shall be maintained within ±0.0001 percent (±1 ppm) of the center frequency over a temperature variation of −30 °Celsius to +50 °Celsius at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of 20 °Celsius.	☒
47 CFR 2.1055, 47 CFR 27.54	-	The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.	☒

Test Setup				
Test Procedure	The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference). 1. The equipment is turned on in a "standby" condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter. 2. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half hour is provided to allow stabilization of the equipment at each temperature level.			
Test Date	04/30/2015 10/26/2015 – 11/02/2015	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	23°C 48% 1008mbar
Remark	NONE			
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test Data for LTE Band 25:

Voltage (%)	Power (VDC)	Temp. (°)	Frequency (KHz)	Frequency Error (Hz)	Deviation (ppm)
100%	48	20 (ref)	1960000.016	0	0.000
100%		0	1960000.022	6	0.003
100%		10	1960000.023	7	0.004
100%		30	1960000.018	2	0.001
100%		40	1960000.026	10	0.005
115%	55.2	20	1960000.026	10	0.005
85%	40.8	20	1960000.025	9	0.005

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Radiated Emissions						
EMI Test Receiver	ESIB 40	100179	06/03/2016	1 Year	06/03/2017	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	08/15/2016	1 Year	08/15/2017	☑
Horn Antenna (1-18GHz)	3115	10SL0059	08/25/2016	1 Year	08/25/2017	☑
Horn Antenna (18-40 GHz)	AH-840	101013	08/28/2016	1 Year	08/28/2017	☑
Pre-Amplifier	LPA-6-30	11140711	03/19/2016	1 Year	03/19/2017	☑
Microwave Preamplifier (18-40 GHz)	PA-840	181251	02/19/2016	1 Year	02/19/2017	☑
3 Meters SAC	3M	N/A	08/08/2016	1 Year	08/08/2017	☑
10 Meters SAC	10M	N/A	09/05/2016	1 Year	09/05/2017	☑
RF Conducted Measurement						
Spectrum Analyzer	N9010A	MY51440112	08/20/2016	1 Year	08/20/2017	☑
EMI Test Receiver	ESIB 40	100179	06/03/2016	1 Year	06/03/2017	☑
Agilent Signal Generator	MXG N5182A	MY47071065	04/06/2016	1 Year	04/06/2017	☑

Annex B. SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		A1, A2, A3, A4, B1, B2, B3, B4, C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		**Radio & Telecommunications Terminal Equipment:** EN45001 – EN ISO/IEC 17025
		Electromagnetic Compatibility: EN45001 – EN ISO/IEC 17025
Singapore iDA CB(Certification Body)		Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
HongKong OFCA		**(Phase II)** OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		**Radio:** Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII

Japan Recognized Certification Body Designation		**Radio** : A1. Terminal equipment for purpose of calling **Telecom** : B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law
Korea CAB Accreditation		**EMI:** KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI**EMS:** KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EMS KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS
		Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68
		Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		R-3083: Radiation 3 meter site C-3421: Main Ports Conducted Interference Measurement T-1597: Telecommunication Ports Conducted Interference Measuremet
Australia CAB Regocnition		**EMC:** AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		Radiocommunications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771
		Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06 AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016,AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2