

FCC ISED RF Test Report

Test Report Number	WAP-21122143-LC-FCC-IC-LTE	
FCC ID	KMH-14H074-NA1	
IC	1422A-14H074NA1	
Applicant	Ford Motor Company	
Applicant Address	Building 5, 20300 Rotunda Dr., Dearborn, Michigan, United States 48124	
Product Name	Vehicle Telematics Control Unit	
Model (s)	FB5-TCU-NA	
Family Product/Model	FB5-TCU-ROW	
Date of Receipt	01/04/2022	
Date of Test	01/04/2022 – 01/20/2022	
Report Issue Date	04/25/2022	
Test Standards	47CFR Part 27 RSS-199 Issue 3: Dec 2016 RSS-Gen Issue 5: Mar 2019	
Test Result	PASS	
	Issued by: Vista Compliance Laboratories 1261 Puerta Del Sol, San Clemente, CA 92673 USA www.vista-compliance.com	
 Devin Tai (Test Engineer)		 David Zhang (Technical Manager)
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REVISION HISTORY

Report Number	Version	Description	Issued Date
WAP-21122143-LC-FCC-IC-LTE	01	Initial report	04/15/2022

• Table of CONTENTS

1	TEST SUMMARY	4
2	GENERAL INFORMATION.....	5
2.1	Applicant.....	5
2.2	Product information.....	5
2.3	Test standard and method	7
3	TEST SITE INFORMATION.....	8
4	MODIFICATION OF EUT / DEVIATIONS FROM STANDARDS.....	8
5	TEST CONFIGURATION AND OPERATION	8
5.1	EUT Test Configuration.....	8
5.2	Supporting Equipment	8
6	UNCERTAINTY OF MEASUREMENT	9
7	TEST RESULTS.....	10
7.1	RF Output Power	10
7.2	Peak to Average Ratio	14
7.3	Occupied Bandwidth.....	25
7.4	Band Edge	36
7.5	Conducted spurious emission	44
7.6	Field Strength of Radiated Spurious Emissions.....	49
7.7	Frequency Stability	55
8	EUT AND TEST SETUP PHOTOS.....	57
9	TEST INSTRUMENT LIST	58

1 Test Summary

Test Item	FCC IC Rules	Test Method	Result
Effective (Isotropic) Radiated Power	§ 2.1046, § 27.50, RSS-199 (4.4)	ANSI C63.26: 2015 KDB 971168 D01 Power Meas License Digital Systems v03r01	Pass
Peak to Average Ratio	§ 2.1046, § 27.50, RSS-199 (4.4)	ANSI C63.26: 2015 KDB 971168 D01 Power Meas License Digital Systems v03r01	Pass
Occupied bandwidth	§2.1049 RSS-Gen (6.7)	ANSI C63.26: 2015 KDB 971168 D01 Power Meas License Digital Systems v03r01	Pass
Band Edge	§ 2.1051; § 27.53, RSS-199 (4.5)	ANSI C63.26: 2015 KDB 971168 D01 Power Meas License Digital Systems v03r01	Pass
Conducted Spurious Emission	§ 2.1051; § 27.53 (h), RSS-199 (4.5)	ANSI C63.26: 2015 KDB 971168 D01 Power Meas License Digital Systems v03r01	Pass
Field Strength of Radiated Spurious Emissions	§ 2.1051; § 27.53 (h), RSS-199 (4.5)	ANSI C63.26: 2015 KDB 971168 D01 Power Meas License Digital Systems v03r01	Pass
Frequency Stability	§ 2.1055, § 27.54, RSS-199 (4.3)	ANSI C63.26: 2015 KDB 971168 D01 Power Meas License Digital Systems v03r01	Pass

2 General Information

2.1 Applicant

Applicant	Ford Motor Company
Applicant address	Building 5, 20300 Rotunda Dr., Dearborn, Michigan, United States 48124
Manufacturer	Ford Motor Company
Manufacturer Address	Building 5, 20300 Rotunda Dr., Dearborn, Michigan, United States 48124

2.2 Product information

Product Name	Vehicle Infotainment System
Model Number	FB5-TCU-NA
Family Model Number	FB5-TCU-ROW
Serial Number	ENMHF19050112411, ENMHF19050112546 (Conducted), ENMHF19050112536, ENMHF19050112440 (Radiated)
Frequency Band	BT BDR/EDR: 2402-2480MHz BLE: 2402-2480MHz 802.11b/g/n-20MHz: 2412-2462MHz 802.11n-40MHz: 2422-2452MHz 802.11a/n-20MHz: 5500-5580MHz, 5660-5720, 5725-5825MHz 802.11n-40MHz: 5510-5550MHz, 5630-5710, 5755-5795MHz 802.11ac: 5530, 5690MHz, 5775MHz GPRS/EDGE 850: 824.2- 848.8 MHz GPRS/EDGE 1900: 1850.2- 1909.8 MHz WCDMA Band 2: 1852.4- 1907.6MHz WCDMA Band 4: 1712.4- 1752.6MHz WCDMA Band 5: 826.4- 846.6MHz LTE Band 2: 1850.7-1909.3MHz LTE Band 4: 1710.7-1754.3MHz LTE Band 5: 824.7-848.3MHz LTE Band 7: 2502.5-2567.5MHz LTE Band 12: 699.7-713.5MHz LTE Band 17: 706.5-784.5MHz LTE Band 38: 2572.5-2617.5MHz LTE Band 66: 1710.7-1779.3MHz
Type of modulation	BT BDR/EDR: GFSK, $\pi/4$ DQPSK, 8DPSK BLE: GFSK 802.11b: DSSS (CCK, DQPSK, DBPSK) 802.11g: OFDM-CCK (BPSK, QPSK, 16QAM, 64QAM) 802.11a/n/ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) GPRS/EDGE: GMSK, 8PSK WCDMA: QPSK LTE: QPSK, 16QAM
Equipment Class/Category	DSS, DTS, UNII, PCB
Maximum output power	See test result

Antenna Information	Internal PCB trace antenna Peak Gain: - Antenna1: 3.40 dBi @2.4GHz WiFi/Bluetooth, 8.00 dBi @5GHz WiFi - Antenna2: 3.39 dBi @2.4GHz WiFi/Bluetooth, 6.17 dBi @5GHz WiFi External Antenna Peak Gain: - Antenna3: 9.74 dBi @2.4GHz WiFi/Bluetooth Cellular main and diversity antennas: Peak Gain: 4.32 dBi @ 698-850MHz 5.53 dBi @ 1700-1910MHz 5.91dBi @ 2500-2600MHz For 2.4GHz Wi-Fi, it has total 3 antennas that can transmit simultaneously (Internal antenna 1 &2, and external antenna). For 5GHz Wi-Fi, it has total 2 antennas that can transmit simultaneously (Internal antenna 1 &2). The directional gain is calculated per KDB 662911 D01 Multiple Transmitter Output v02r01, Directional Gain: - 12.59 dBi @2.4GHz - 10.143 dBi @5GHz
Clock Frequencies	N/A
Port/Connectors	CAN bus
Input Power	Vehicle Battery powered: 12VDC
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Hardware version	N/A
Software version	N/A
Simultaneous Transmission	BT/BLE, WLAN and cellular radio can transmit simultaneously
Additional Info	1. FB5-TCU-NA and FB5-TCU-ROW have the same PCB layout. The hardware difference is the population of each RF filters for cellular bands, but the RF paths between FB5-TCU-NA and FB5-TCU-ROW are completely independent for all cellular bands and does not affect other bands. WCDMA and LTE Band 5 are populated in both FB5-TCU-NA and FB5-TCU-ROW. Model FB5-TCU-ROW contains functions that are not operational in U.S. Territories. This report is only applicable for its bands that fall in U.S. operations. 2. FB5-TCU-NA and FB5-TCU-ROW can support following non-US bands but will not be operational in U.S. Territories, - GPRS/EDGE 900 - GPRS/EDGE 1800 - WCDMA Band 1 - WCDMA Band 3 - WCDMA Band 8 - LTE Band 3 - LTE Band 8 - LTE Band 28

2.3 Test standard and method

Test standard	47CFR Part 27 RSS-199 Issue 3: Dec 2016 RSS-Gen Issue 5: Feb 2021
Test method	ANSI C63.26: 2015 KDB 971168 D01 Power Meas License Digital Systems v03r01 KDB 412172 D01 Determining ERP and EIRP v01r01

3 Test Site Information

Lab performing tests	Vista Laboratories, Inc.
Lab Address	1261 Puerta Del Sol, San Clemente, CA 92673 USA
Phone Number	+1 (949) 393-1123
Website	www.vista-compliance.com

Test Condition	Temperature	Humidity	Atmospheric Pressure
RF Testing	23.2°C	57.5%	996 mbar
Radiated Emission Testing	23.2°C	57.5%	996 mbar

4 Modification of EUT / Deviations from Standards

N/A

5 Test Configuration and Operation

5.1 EUT Test Configuration

EUT is powered by external DC power supply for testing purpose. EUT's RF antenna port is connected to spectrum analyzer through RF test cable for measurement. The test software is used to set EUT to different transmission mode in terms of radio mode (WLAN, BLE), test channel, data rate, etc. For Cellular radio, it's controlled by communication tester to change to different mode.

5.2 Supporting Equipment

Description	Manufacturer	Model #	Serial #
AC/DC Adapter	MEAN WELL	GST60A12-P1J	EB74Q81066

6 Uncertainty of Measurement

Test item	Measurement Uncertainty (dB)
RF Output Power (Conducted)	±1.2 dB
Power Spectral Density	±0.9 dB
Unwanted Emission (conducted)	±2.6 dB
Occupied Channel Bandwidth	±5 %
Radiated Emission (9KHz-30MHz)	±3.5 dB
Radiated Emission (30MHz-1GHz)	±4.6 dB
Radiated Emission (1-18GHz)	±4.9 dB
Radiated Emission (18-40GHz)	±3.5 dB

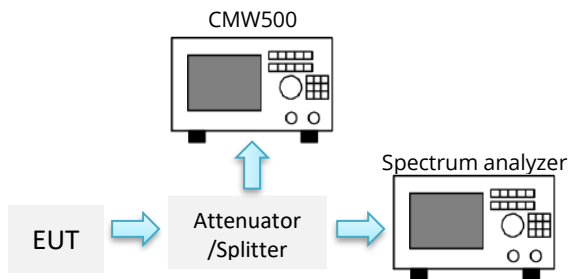
7 Test Results

7.1 RF Output Power

7.1.1 Requirement

§ 27.50(h) / RSS-199(4.4) – EIRP limit: 33 dBm

7.1.2 Test setup



7.1.3 Test Procedure

For Conducted Power:

- The transmitter output port was connected to base station.
- Set EUT at maximum power through base station.
- Select lowest, middle, and highest channels for each band and different test mode.

For ERP/EIRP:

- According with 971168 D01 Power Meas License Digital Systems v03r01
- The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.
- The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.
- The frequency ranges up to tenth harmonic of the fundamental frequency was investigated.
- Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.
- Spurious emissions in dB = $10 \log (\text{TX power in Watts}/0.001)$ – the absolute level
- Spurious attenuation limit in dB = $43 + 10 \log_{10} (\text{power out in Watts})$.

7.1.4 Test Result

Conducted Output Power (dBm)

LTE Band 7				Conducted Power(dBm)					
BW	Modulation	RB size	RB offset	CH 20775	Freq 2502.5	CH 21100	Freq 2535	CH 21425	Freq 2567.5
5MHz	QPSK	1	0	23.01		22.98		22.91	
		1	13	22.71		22.63		22.60	
		1	24	22.46		22.41		22.37	
		12	0	22.25		22.27		22.20	
		12	6	21.88		21.83		21.72	
		12	13	22.37		22.35		22.25	
		25	0	22.08		22.00		21.89	
	16QAM	1	0	22.45		22.39		22.32	
		1	13	23.22		23.19		23.15	
		1	24	22.73		22.70		22.63	
BW	Modulation	RB size	RB offset	20800	2505	21100	2535	21400	2565
10MHz	QPSK	1	0	23.20		23.25		23.10	
		1	25	23.23		23.17		23.10	
		1	49	22.69		22.66		22.62	
		25	0	23.35		23.32		23.25	
		25	13	22.97		22.89		22.86	
		25	25	22.73		22.68		22.64	
		50	0	21.81		21.83		21.76	
	16QAM	1	0	22.61		22.58		22.51	
		1	25	23.28		23.20		23.17	
		1	49	22.44		22.39		22.35	
BW	Modulation	RB size	RB offset	20825	2507.5	21100	2535	21375	2562.5
15MHz	QPSK	1	0	23.06		23.11		22.96	
		1	38	23.19		23.13		23.06	
		1	74	23.33		23.30		23.26	
		36	0	22.77		22.74		22.67	
		36	18	22.96		22.88		22.85	
		36	39	23.40		23.35		23.31	
		75	0	21.70		21.72		21.65	
	16QAM	1	0	23.00		22.97		22.93	
		1	38	22.80		22.77		22.70	
		1	74	23.04		22.96		22.93	
BW	Modulation	RB size	RB offset	20850	2510	21100	2535	21350	2560
20MHz	QPSK	1	0	23.31		23.26		23.22	
		1	50	23.40		23.37		23.30	
		1	99	23.13		23.05		23.02	
		50	0	22.85		22.79		22.72	
		50	25	22.54		22.51		22.47	
		50	50	21.97		21.86		21.94	
		100	0	21.79		21.66		21.75	
	16QAM	1	0	23.06		23.03		22.96	
		1	50	22.80		22.72		22.69	
		1	99	23.38		23.33		23.29	

LTE Band 38				Conducted Power(dBm)					
				CH	Freq	CH	Freq	CH	Freq
BW	Modulation	RB size	RB offset	37775	2572.5	38000	2595	38225	2617.5
5MHz	QPSK	1	0	23.75		23.80		23.65	
			13	23.26		23.20		23.13	
			24	23.31		23.28		23.24	
		12	0	22.82		22.79		22.72	
			6	22.91		22.83		22.80	
			13	23.08		23.03		22.99	
		25	0	21.61		21.63		21.56	
	16QAM	1	0	23.05		22.99		22.92	
			13	22.82		22.79		22.75	
			24	22.45		22.42		22.35	
BW	Modulation	RB size	RB offset	37800	2575	38000	2595	38200	2615
10MHz	QPSK	1	0	23.01		22.93		22.90	
			25	23.32		23.27		23.23	
			49	22.33		22.35		22.28	
		25	0	22.53		22.48		22.37	
			13	22.53		22.51		22.41	
			25	22.04		21.96		21.85	
		50	0	21.65		21.58		21.66	
	16QAM	1	0	23.42		23.47		23.32	
			25	22.41		22.35		22.28	
			49	22.44		22.41		22.37	
BW	Modulation	RB size	RB offset	37825	2577.5	38000	2595	38175	2612.5
15MHz	QPSK	1	0	23.48		23.53		23.38	
			38	23.30		23.24		23.17	
			74	22.62		22.59		22.55	
		36	0	22.54		22.51		22.44	
			18	22.83		22.75		22.72	
			39	22.90		22.85		22.81	
		75	0	21.97		21.99		21.92	
	16QAM	1	0	22.47		22.44		22.37	
			38	23.12		23.04		23.01	
			74	22.91		22.86		22.82	
BW	Modulation	RB size	RB offset	37850	2580	38000	2595	38150	2610
20MHz	QPSK	1	0	23.97		24.02		23.87	
			50	23.07		23.01		22.94	
			99	22.92		22.89		22.85	
		50	0	23.39		23.36		23.29	
			25	23.40		23.32		23.29	
			50	22.56		22.51		22.47	
		100	0	22.10		22.12		22.05	
	16QAM	1	0	23.17		23.11		23.04	
			50	22.73		22.70		22.66	
99			22.80		22.77		22.70		

Radiated power

Band	BW	Channel	Frequency (MHz)	EIRP (dBm)	
				QPSK	16QAM
LTE Band 7	5MHz	20775	2502.5	29.28	28.55
		21100	2535	27.34	27.69
		21425	2567.5	28.00	28.09
	10MHz	20800	2505	28.00	27.45
		21100	2535	27.68	27.68
		21400	2565	28.46	28.17
	15MHz	20825	2507.5	27.16	27.14
		21100	2535	28.02	26.63
		21375	2562.5	27.41	27.04
	20MHz	20850	2510	27.41	26.58
		21100	2535	26.58	27.17
		21350	2560	26.77	28.55

Band	BW	Channel	Frequency (MHz)	EIRP (dBm)	
				QPSK	16QAM
LTE Band 38	5MHz	37775	2572.5	29.55	28.36
		38000	2595	28.79	28.23
		38225	2617.5	28.87	28.04
	10MHz	37800	2575	28.67	27.56
		38000	2595	28.83	27.70
		38200	2615	28.93	27.26
	15MHz	37825	2577.5	27.86	28.11
		38000	2595	28.02	27.85
		38175	2612.5	27.26	28.06
	20MHz	37850	2580	29.42	29.82
		38000	2595	28.69	28.09
		38150	2610	28.76	28.44

7.2 Peak to Average Ratio

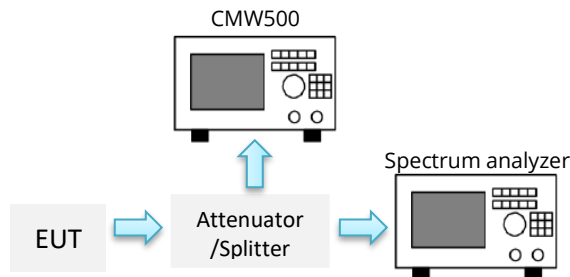
7.2.1 Requirement

§ 2.1046,

RSS-199 (4.4)

The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

7.2.2 Test Setup



7.2.3 Test Procedure

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 5.7.1

- The signal analysers CCDF measurement profile is enabled
- Frequency carrier center frequency
- Measurement BW> Emission bandwidth of signal
- The signal analyzer was set to collect one million samples to generate the CCDF curve
- The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle) the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer is set to use an internal "RF Burst trigger that is synced with an incoming pulse and the measurement interval set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power.
- Record the maximum PAPR level associated with a probability of 0. 1%.

7.2.4 Test Result

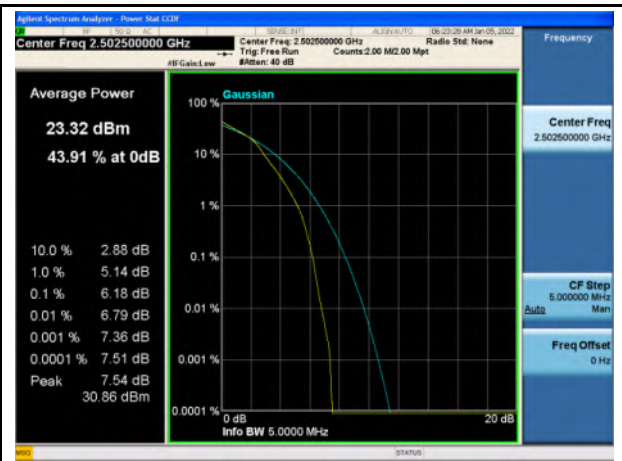
Band	Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	PAR (dB)	Limit (dB)	Result
Band 7	QPSK	5	20775	2502.5	5.39	13	Pass
			21100	2535	5.80	13	Pass
			21425	2567.5	5.26	13	Pass
		10	20800	2505	4.62	13	Pass
			21100	2535	4.65	13	Pass
			21400	2565	4.64	13	Pass
		15	20825	2507.5	5.76	13	Pass
			21100	2535	5.74	13	Pass
			21375	2562.5	5.75	13	Pass
		20	20850	2510	6.46	13	Pass
			21100	2535	6.47	13	Pass
			21350	2560	6.43	13	Pass
	16-QAM	5	20775	2502.5	6.18	13	Pass
			21100	2535	6.25	13	Pass
			21425	2567.5	6.03	13	Pass
		10	20800	2505	6.11	13	Pass
			21100	2535	6.17	13	Pass
			21400	2565	6.12	13	Pass
		15	20825	2507.5	6.83	13	Pass
			21100	2535	6.77	13	Pass
			21375	2562.5	6.85	13	Pass
		20	20850	2510	7.25	13	Pass
			21100	2535	7.20	13	Pass
			21350	2560	7.13	13	Pass

Band	Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	PAR (dB)	Limit (dB)	Result
Band 38	QPSK	5	37775	2572.5	8.77	13	Pass
			38000	2595	9.02	13	Pass
			38225	2617.5	8.36	13	Pass
		10	37800	2575	8.93	13	Pass
			38000	2595	8.38	13	Pass
			38200	2615	8.19	13	Pass
		15	37825	2577.5	9.96	13	Pass
			38000	2595	9.50	13	Pass
			38175	2612.5	9.51	13	Pass
		20	37850	2580	9.82	13	Pass
			38000	2595	10.08	13	Pass
			38150	2610	10.09	13	Pass
	16-QAM	5	37775	2572.5	9.32	13	Pass
			38000	2595	9.23	13	Pass
			38225	2617.5	9.13	13	Pass
		10	37800	2575	9.44	13	Pass
			38000	2595	9.15	13	Pass
			38200	2615	9.29	13	Pass
		15	37825	2577.5	10.94	13	Pass
			38000	2595	10.38	13	Pass
			38175	2612.5	10.00	13	Pass
		20	37850	2580	10.51	13	Pass
			38000	2595	10.75	13	Pass
			38150	2610	10.04	13	Pass

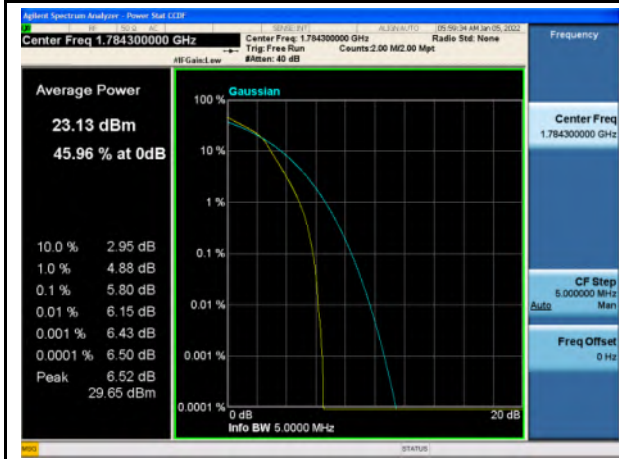
7.2.5 Test Plots



Band 7_QPSK_5M_Low_Full RB Config



Band 7_16-QAM_5M_Low_Full RB Config



Band 7_QPSK_5M_Mid_Full RB Config



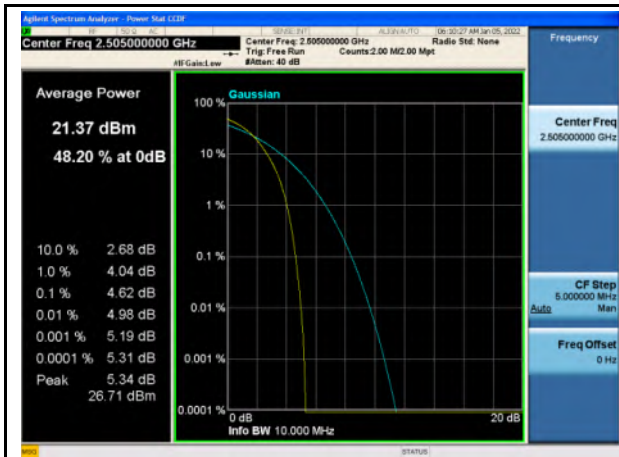
Band 7_16-QAM_5M_Mid_Full RB Config



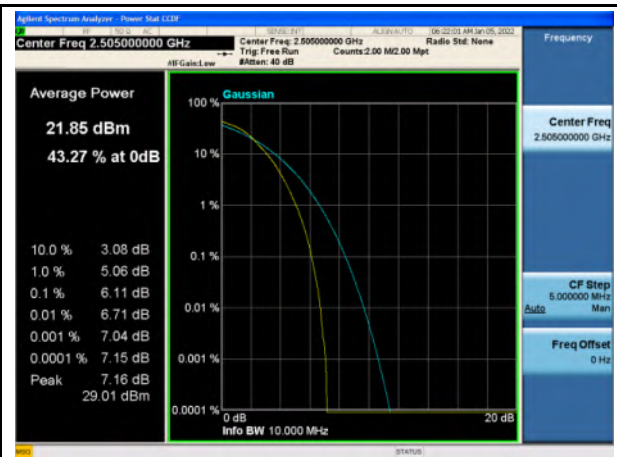
Band 7_QPSK_5M_High_Full RB Config



Band 7_16-QAM_5M_High_Full RB Config



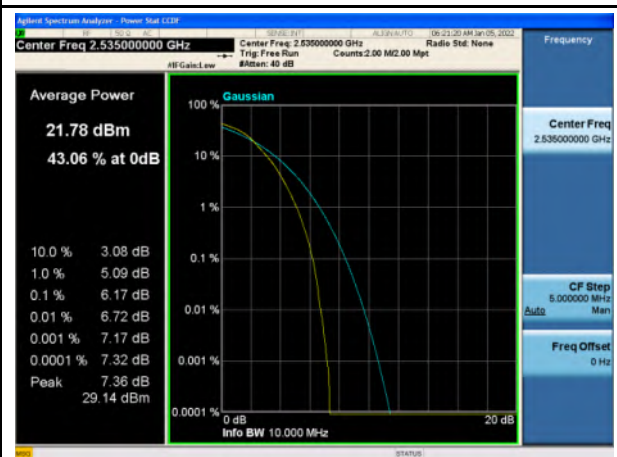
Band 7_QPSK_10M_Low_Full RB Config



Band 7_16-QAM_10M_Low_Full RB Config



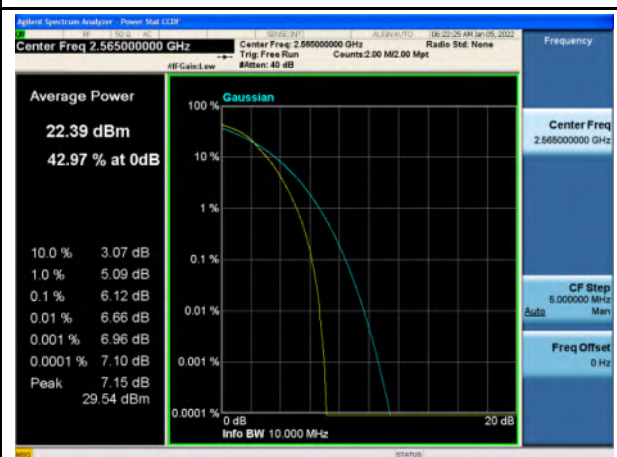
Band 7_QPSK_10M_Mid_Full RB Config



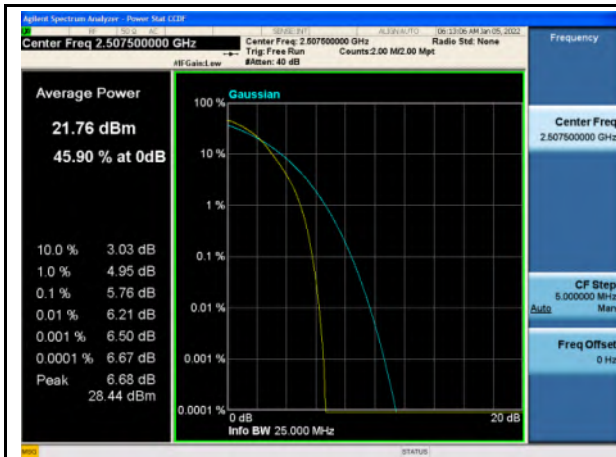
Band 7_16-QAM_10M_Mid_Full RB Config



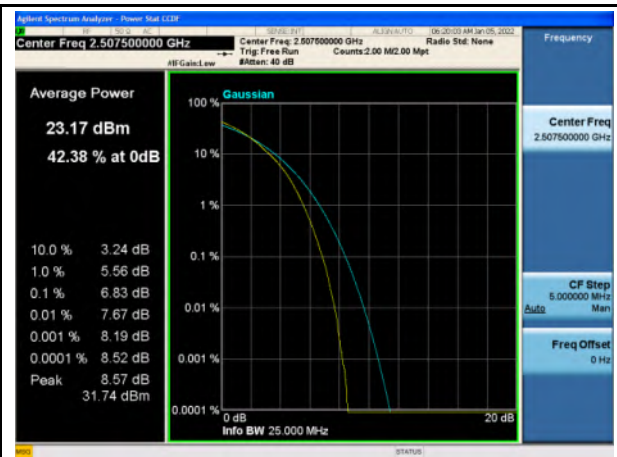
Band 7_QPSK_10M_High_Full RB Config



Band 7_16-QAM_10M_High_Full RB Config



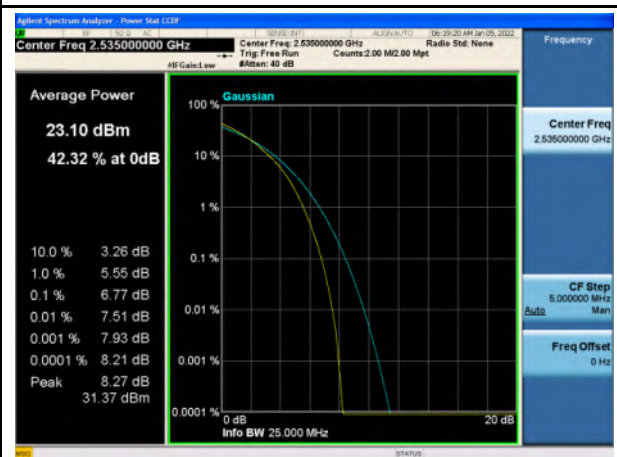
Band 7_QPSK_15M_Low_Full RB Config



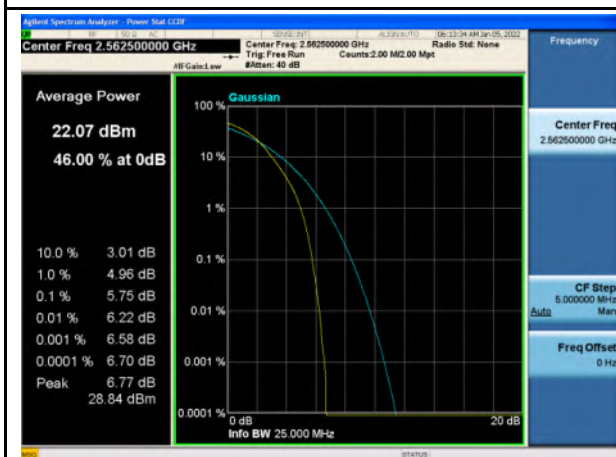
Band 7_16-QAM_15M_Low_Full RB Config



Band 7_QPSK_15M_Mid_Full RB Config



Band 7_16-QAM_15M_Mid_Full RB Config



Band 7_QPSK_15M_High_Full RB Config



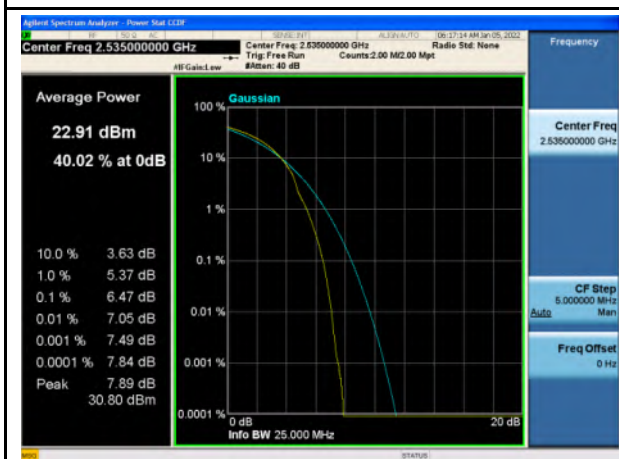
Band 7_16-QAM_15M_High_Full RB Config



Band 7_QPSK_20M_Low_Full RB Config



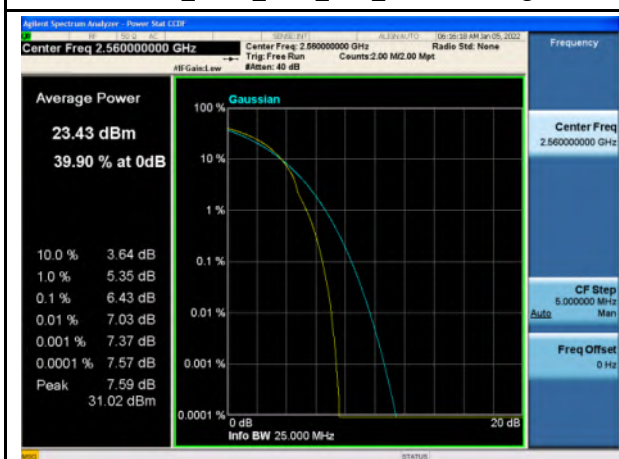
Band 7_16-QAM_20M_Low_Full RB Config



Band 7_QPSK_20M_Mid_Full RB Config



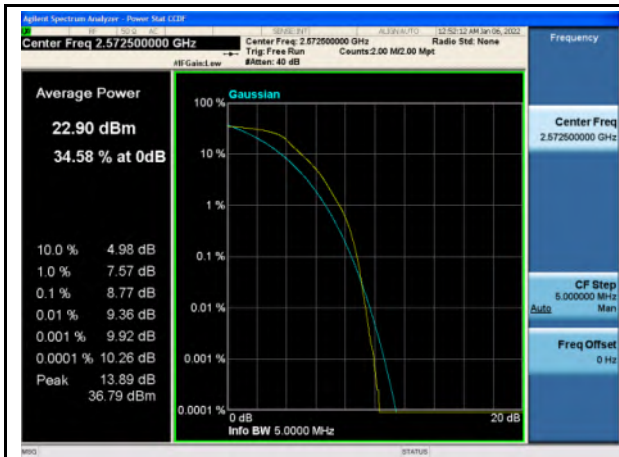
Band 7_16-QAM_20M_Mid_Full RB Config



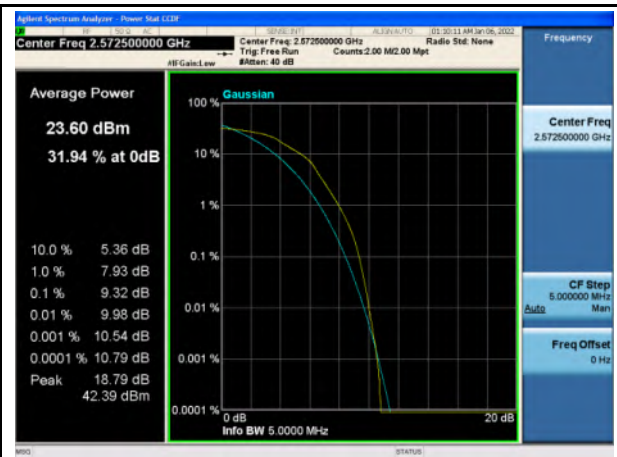
Band 7_QPSK_20M_High_Full RB Config



Band 7_16-QAM_20M_High_Full RB Config



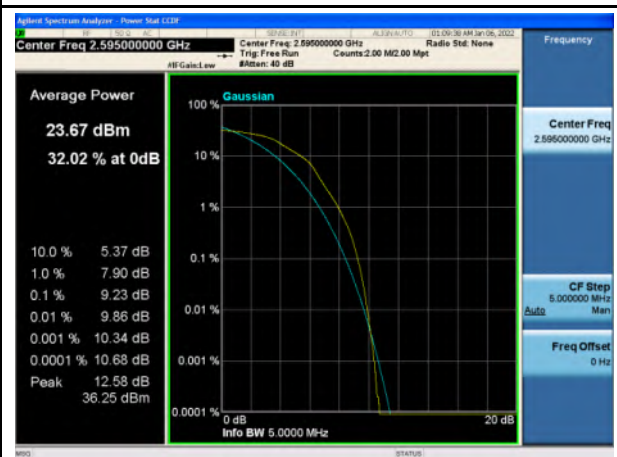
Band 38_QPSK_5M_Low_Full RB Config



Band 38_16-QAM_5M_Low_Full RB Config



Band 38_QPSK_5M_Mid_Full RB Config



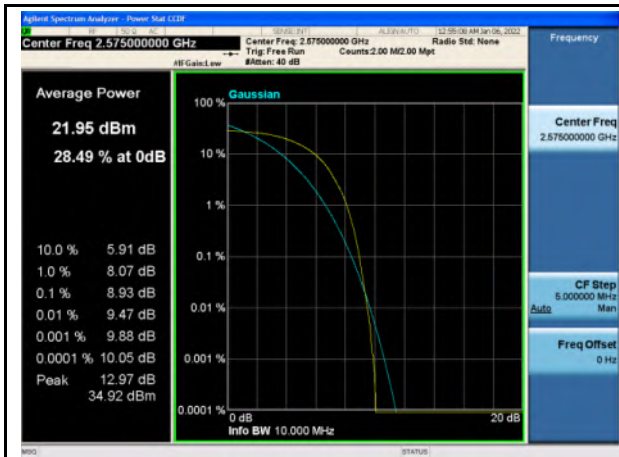
Band 38_16-QAM_5M_Mid_Full RB Config



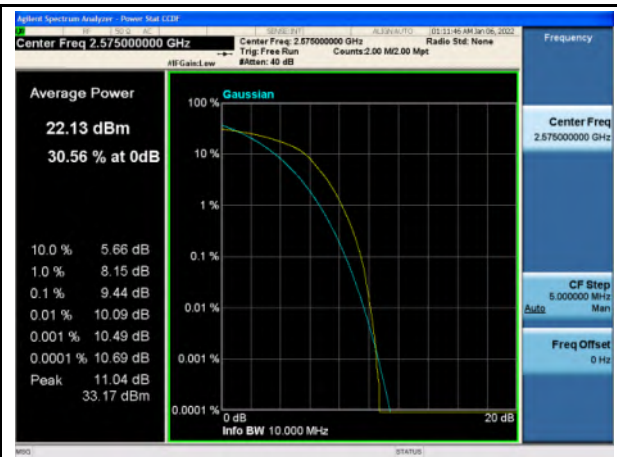
Band 38_QPSK_5M_High_Full RB Config



Band 38_16-QAM_5M_High_Full RB Config



Band 38_QPSK_10M_Low_Full RB Config



Band 38_16-QAM_10M_Low_Full RB Config



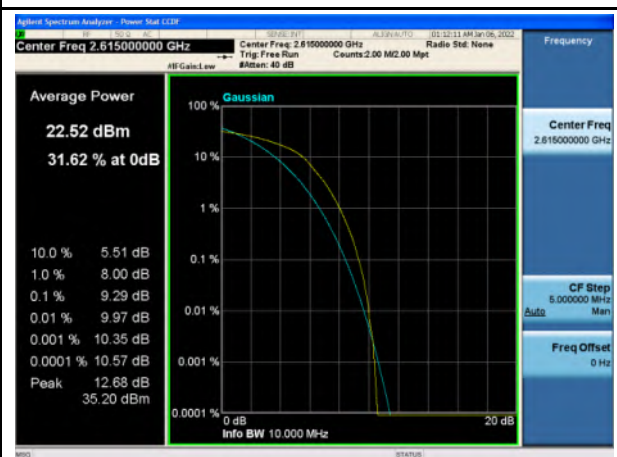
Band 38_QPSK_10M_Mid_Full RB Config



Band 38_16-QAM_10M_Mid_Full RB Config



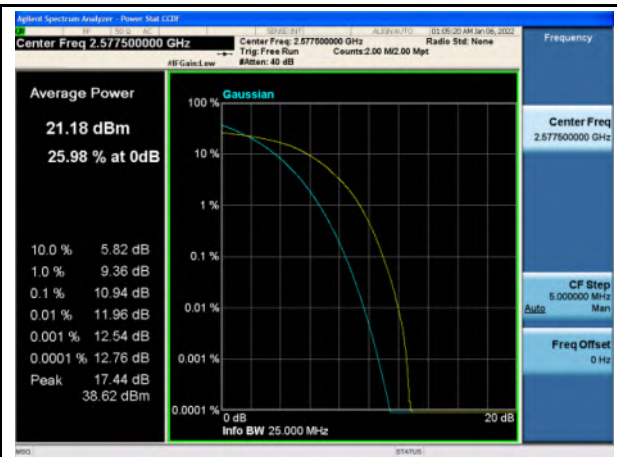
Band 38_QPSK_10M_High_Full RB Config



Band 38_16-QAM_10M_High_Full RB Config



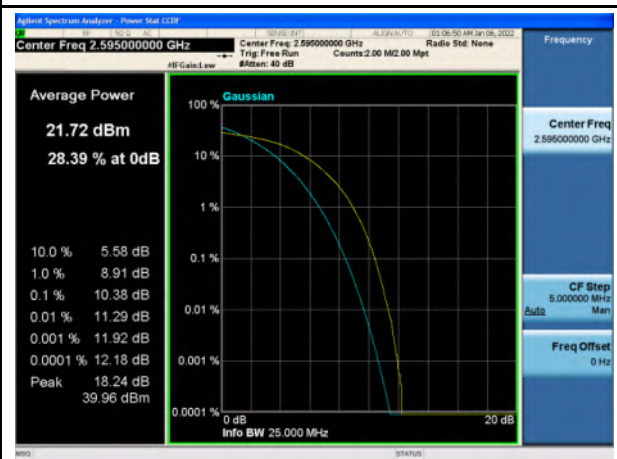
Band 38_QPSK_15M_Low_Full RB Config



Band 38_16-QAM_15M_Low_Full RB Config



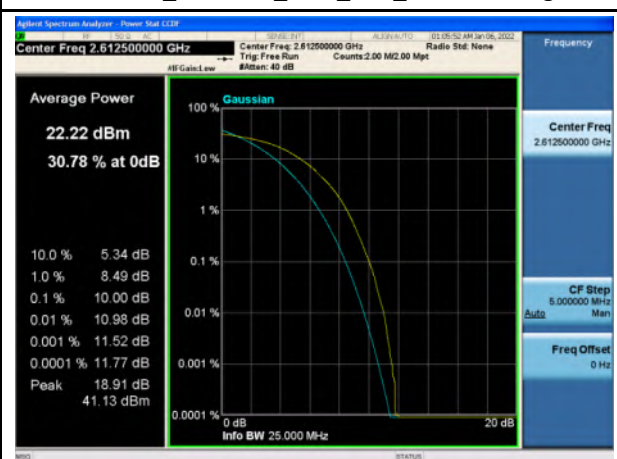
Band 38_QPSK_15M_Mid_Full RB Config



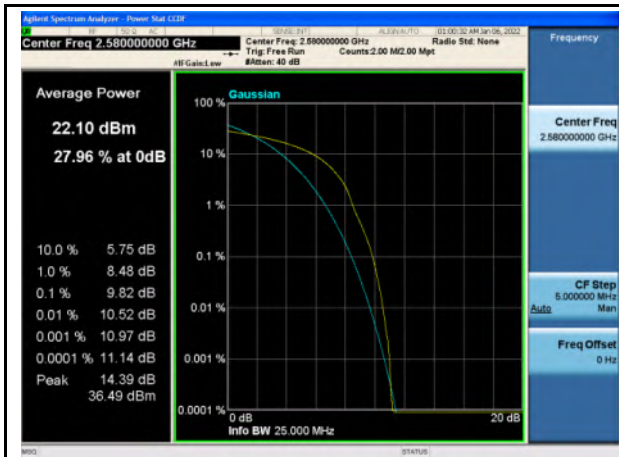
Band 38_16-QAM_15M_Mid_Full RB Config



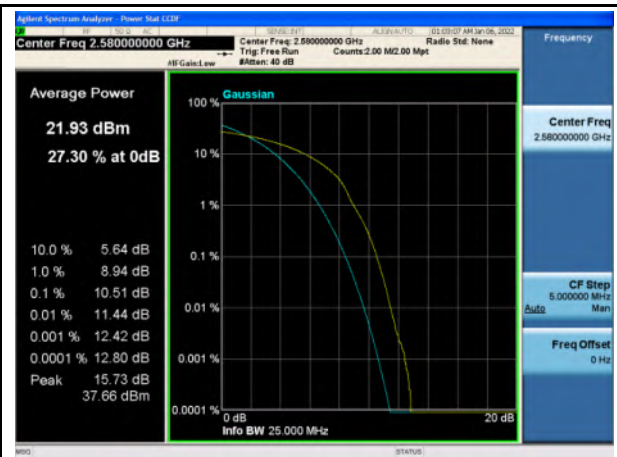
Band 38_QPSK_15M_High_Full RB Config



Band 38_16-QAM_15M_High_Full RB Config



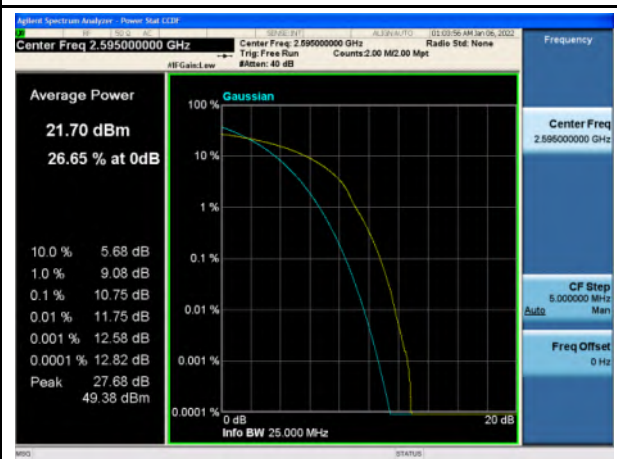
Band 38_QPSK_20M_Low_Full RB Config



Band 38_16-QAM_20M_Low_Full RB Config



Band 38_QPSK_20M_Mid_Full RB Config



Band 38_16-QAM_20M_Mid_Full RB Config



Band 38_QPSK_20M_High_Full RB Config



Band 38_16-QAM_20M_High_Full RB Config

7.3 Occupied Bandwidth

7.3.1 Requirement

§2.1049, RSS-Gen (6.7)

- 99% Occupied Bandwidth(kHz)

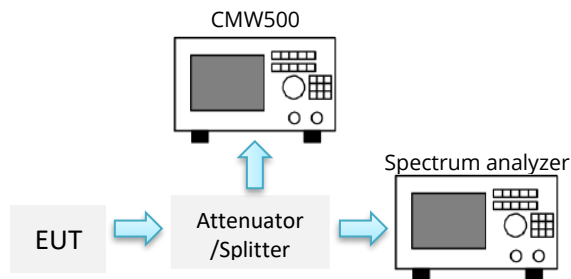
The occupied bandwidth that is the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be Measured.

- 26 dB Bandwidth(kHz)

The 26 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 26 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.

All modes of operation were investigated and the worst-case configuration results are reported in this section

7.3.2 Test Setup



7.3.3 Test Procedure

- The EUT was connected to Spectrum Analyzer and Base Station via power divider.
- Set RBW = 1% to 5% of the actual occupied BW.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Span = large enough to capture all products of the modulation process
- Allow the trace to stabilize.
- Use automatic bandwidth measurement capability on instrument to obtain 99% and -26dB BW.

7.3.4 Test Result

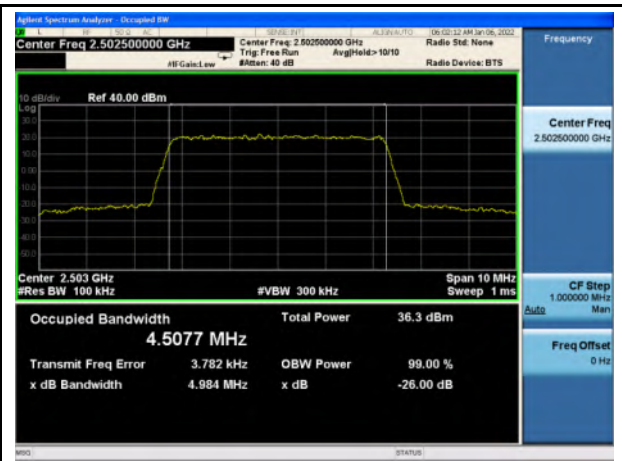
Band	Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	99% Power Bandwidth (kHz)	-26dBc Bandwidth (kHz)
Band 7	QPSK	5	20775	2502.5	4.5153	4.976
			21100	2535	4.5258	4.991
			21425	2567.5	4.5000	4.989
		10	20800	2505	8.9384	9.618
			21100	2535	8.9584	9.669
			21400	2565	8.9440	9.632
		15	20825	2507.5	13.422	14.56
			21100	2535	13.482	14.78
			21375	2562.5	13.450	14.65
		20	20850	2510	17.896	19.20
			21100	2535	17.938	19.37
			21350	2560	17.848	19.33
	16-QAM	5	20775	2502.5	4.5077	4.984
			21100	2535	4.5274	4.995
			21425	2567.5	4.5252	4.990
		10	20800	2505	8.9543	9.672
			21100	2535	8.9487	9.569
			21400	2565	8.9488	9.625
		15	20825	2507.5	13.468	14.64
			21100	2535	13.471	14.68
			21375	2562.5	13.450	14.59
		20	20850	2510	17.890	19.35
			21100	2535	17.898	19.32
			21350	2560	17.856	19.18

Band	Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	99% Power Bandwidth (kHz)	-26dBc Bandwidth (kHz)
Band 38	QPSK	5	37775	2572.5	4.5139	4.938
			38000	2595	4.5023	4.953
			38225	2617.5	4.5028	4.943
		10	37800	2575	8.9482	9.738
			38000	2595	8.9565	9.676
			38200	2615	8.9430	9.507
		15	37825	2577.5	13.434	14.53
			38000	2595	13.463	14.60
			38175	2612.5	13.419	14.62
		20	37850	2580	17.851	19.32
			38000	2595	17.921	19.14
			38150	2610	17.858	19.11
	16-QAM	5	37775	2572.5	4.4935	4.946
			38000	2595	4.5069	4.967
			38225	2617.5	4.5203	4.976
		10	37800	2575	8.9384	9.542
			38000	2595	8.9316	9.611
			38200	2615	8.9445	9.628
		15	37825	2577.5	13.481	14.66
			38000	2595	13.441	14.67
			38175	2612.5	13.486	14.79
		20	37850	2580	17.842	19.29
			38000	2595	17.873	19.19
			38150	2610	17.878	19.20

7.3.5 Test Plots



Band 7_QPSK_5M_Low_Full RB Config



Band 7_16-QAM_5M_Low_Full RB Config



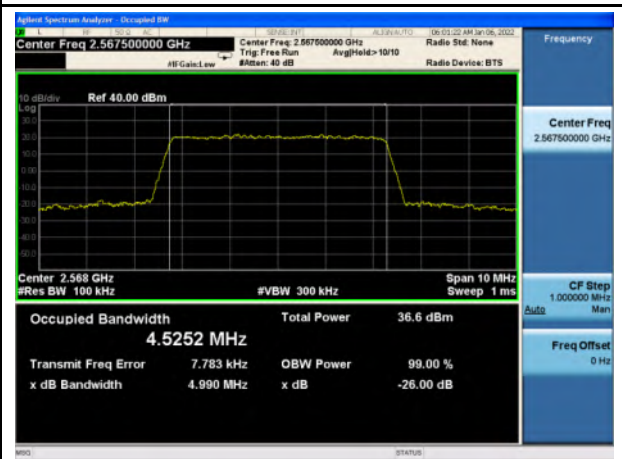
Band 7_QPSK_5M_Mid_Full RB Config



Band 7_16-QAM_5M_Mid_Full RB Config



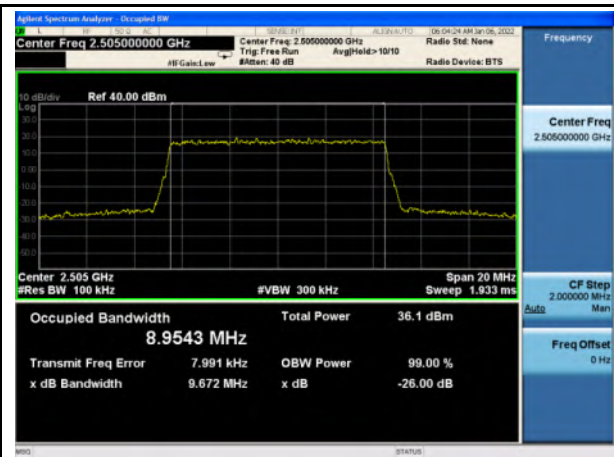
Band 7_QPSK_5M_High_Full RB Config



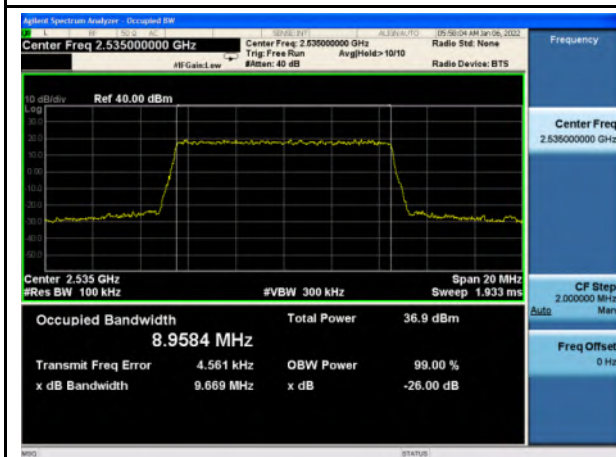
Band 7_16-QAM_5M_High_Full RB Config



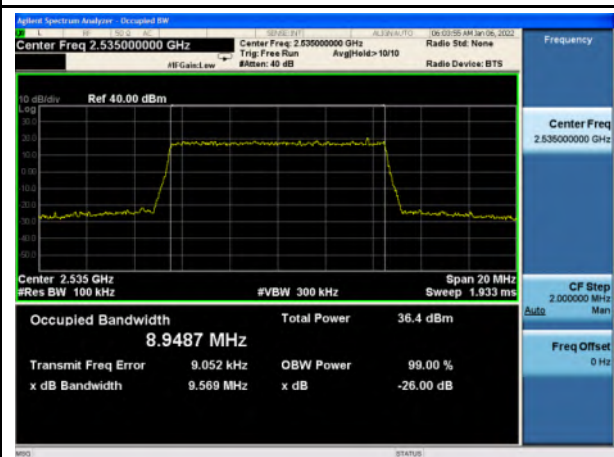
Band 7_QPSK_10M_Low_Full RB Config



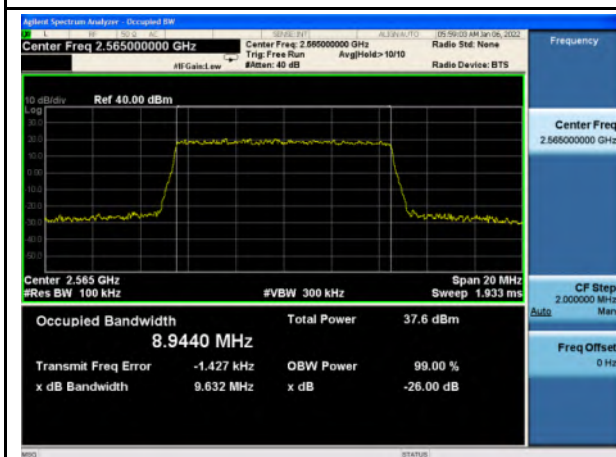
Band 7_16-QAM_10M_Low_Full RB Config



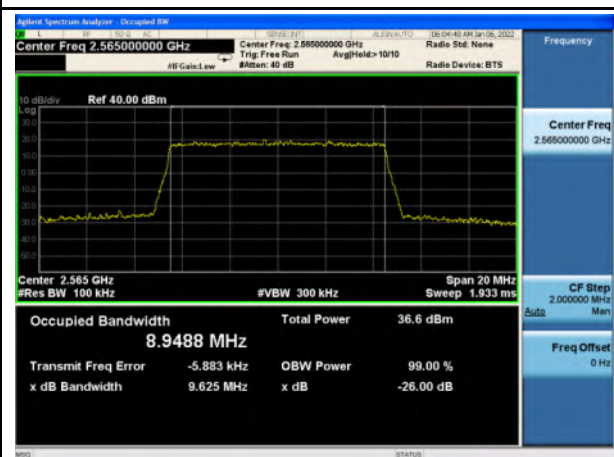
Band 7_QPSK_10M_Mid_Full RB Config



Band 7_16-QAM_10M_Mid_Full RB Config



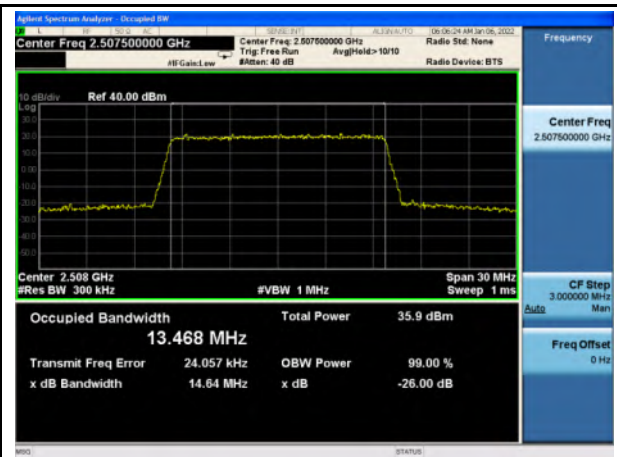
Band 7_QPSK_10M_High_Full RB Config



Band 7_16-QAM_10M_High_Full RB Config



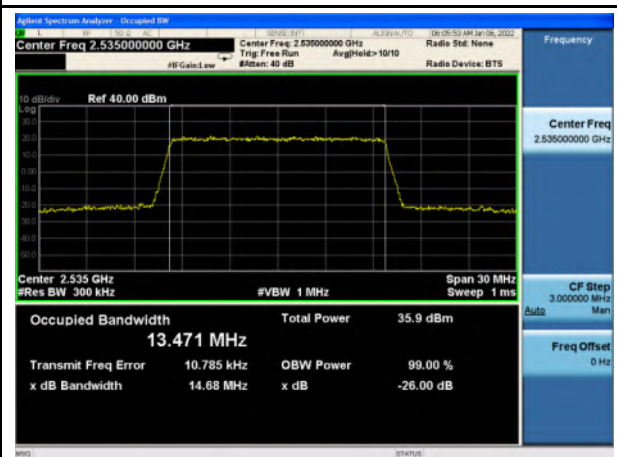
Band 7_QPSK_15M_Low_Full RB Config



Band 7_16-QAM_15M_Low_Full RB Config



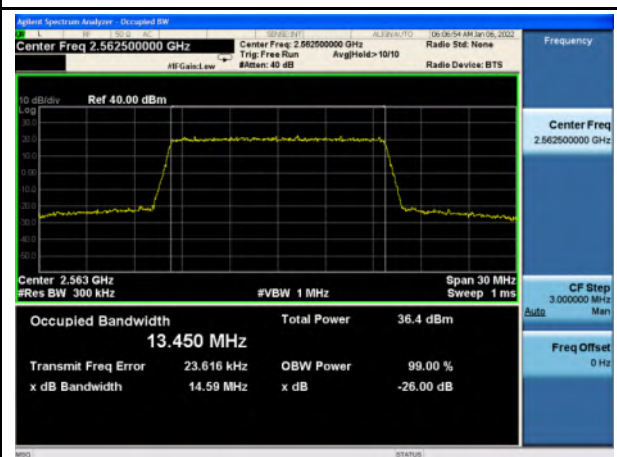
Band 7_QPSK_15M_Mid_Full RB Config



Band 7_16-QAM_15M_Mid_Full RB Config



Band 7_QPSK_15M_High_Full RB Config



Band 7_16-QAM_15M_High_Full RB Config



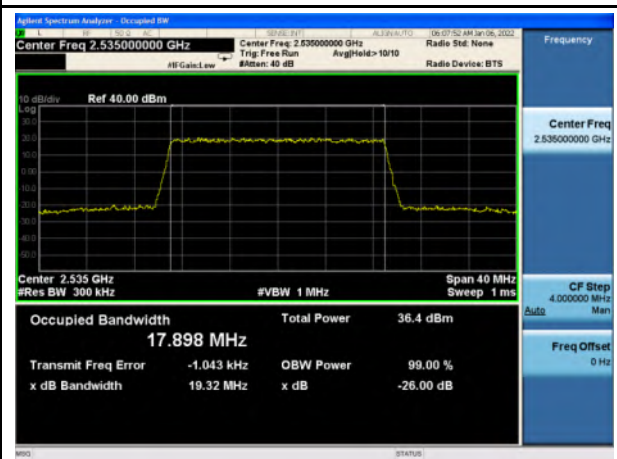
Band 7_QPSK_20M_Low_Full RB Config



Band 7_16-QAM_20M_Low_Full RB Config



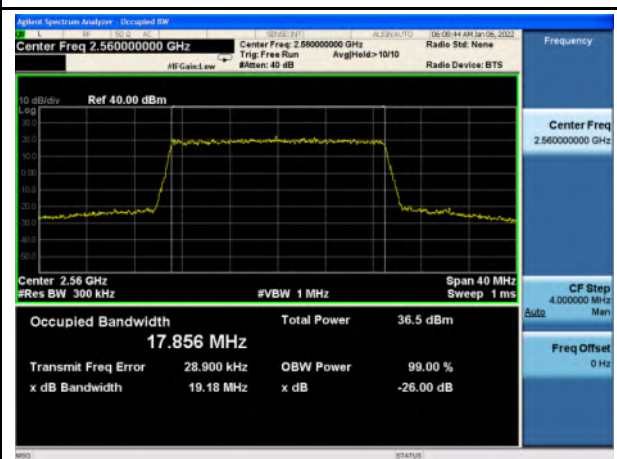
Band 7_QPSK_20M_Mid_Full RB Config



Band 7_16-QAM_20M_Mid_Full RB Config



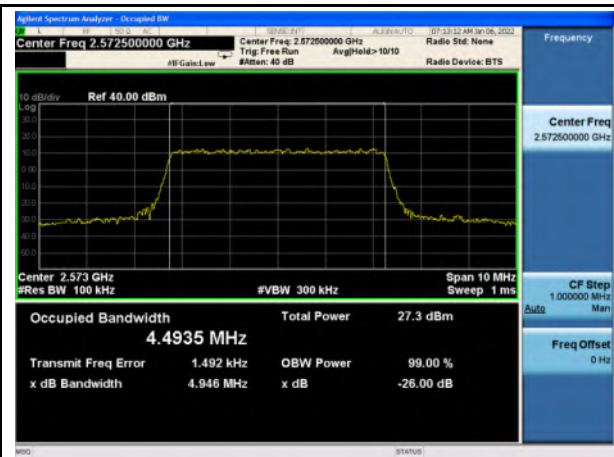
Band 7_QPSK_20M_High_Full RB Config



Band 7_16-QAM_20M_High_Full RB Config



Band 38_QPSK_5M_Low_Full RB Config



Band 38_16-QAM_5M_Low_Full RB Config



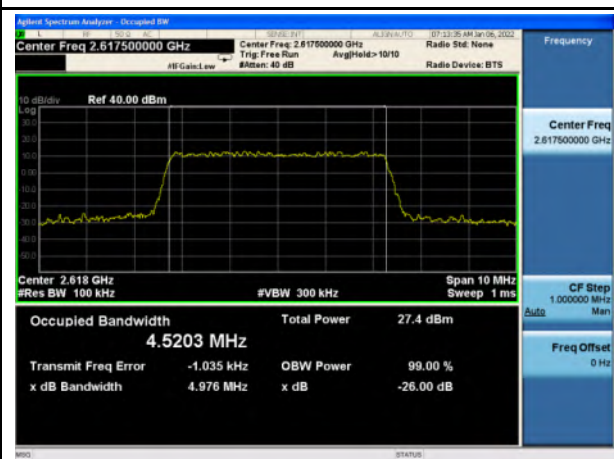
Band 38_QPSK_5M_Mid_Full RB Config



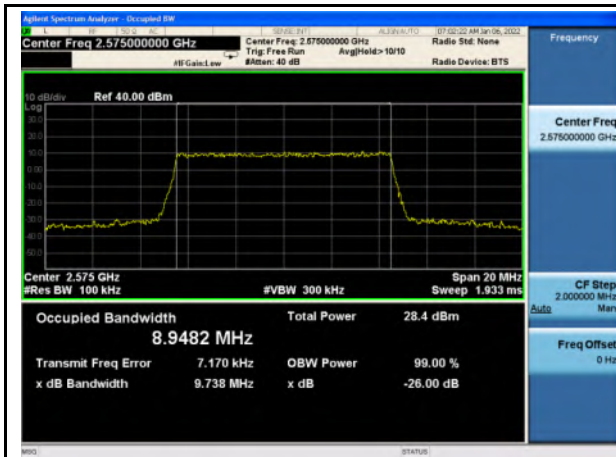
Band 38_16-QAM_5M_Mid_Full RB Config



Band 38_QPSK_5M_High_Full RB Config



Band 38_16-QAM_5M_High_Full RB Config



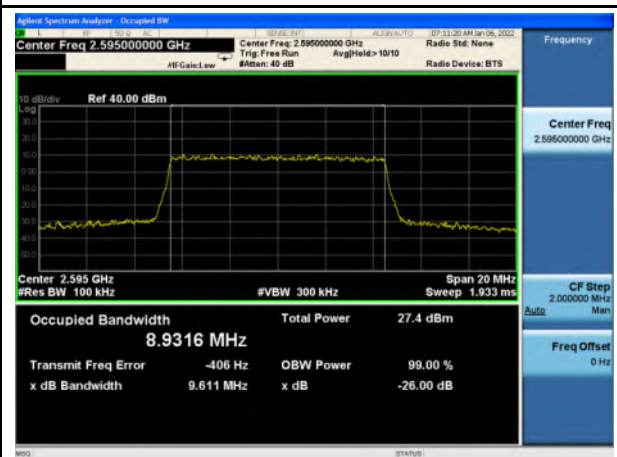
Band 38_QPSK_10M_Low_Full RB Config



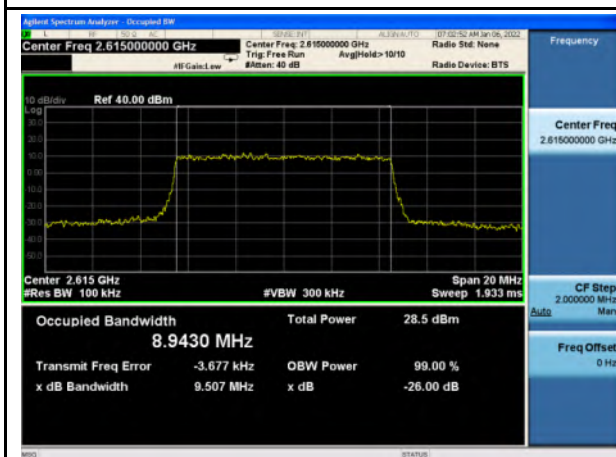
Band 38_16-QAM_10M_Low_Full RB Config



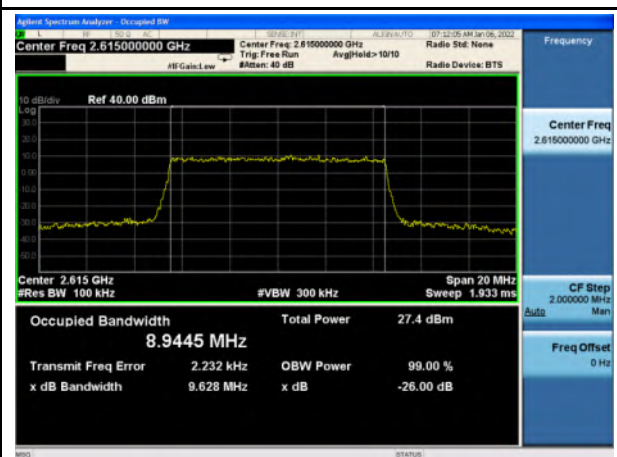
Band 38_QPSK_10M_Mid_Full RB Config



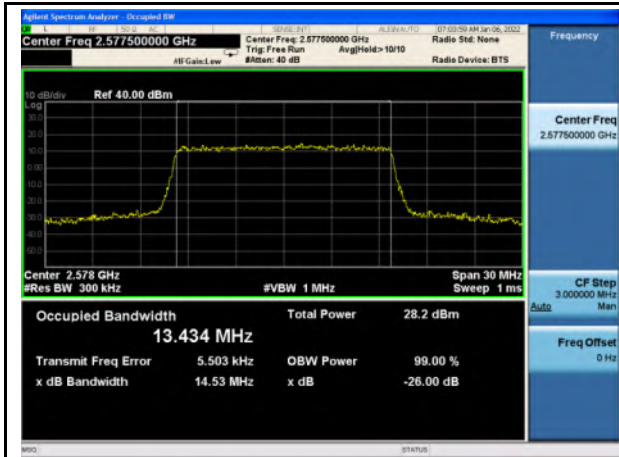
Band 38_16-QAM_10M_Mid_Full RB Config



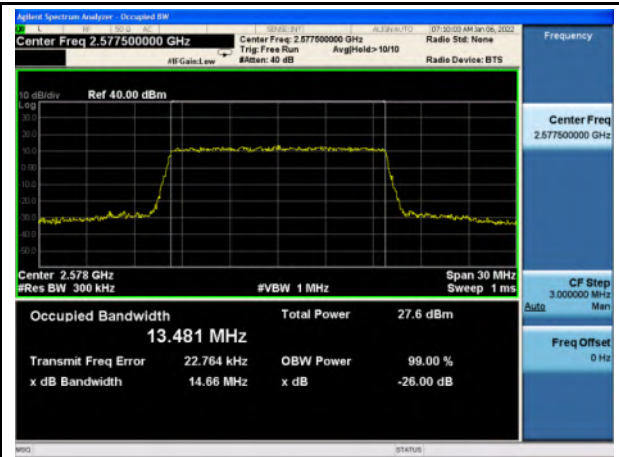
Band 38_QPSK_10M_High_Full RB Config



Band 38_16-QAM_10M_High_Full RB Config



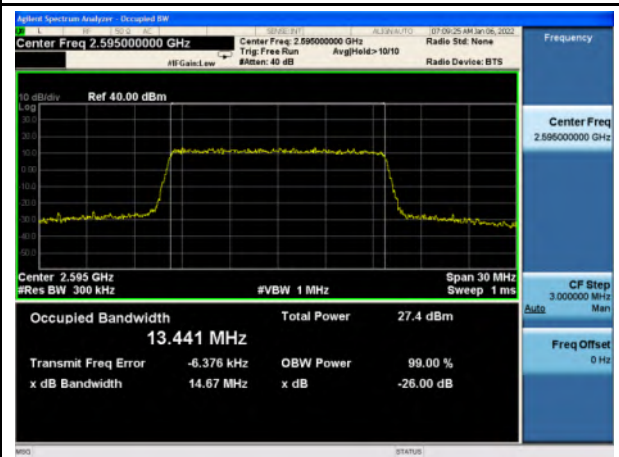
Band 38_QPSK_15M_Low_Full RB Config



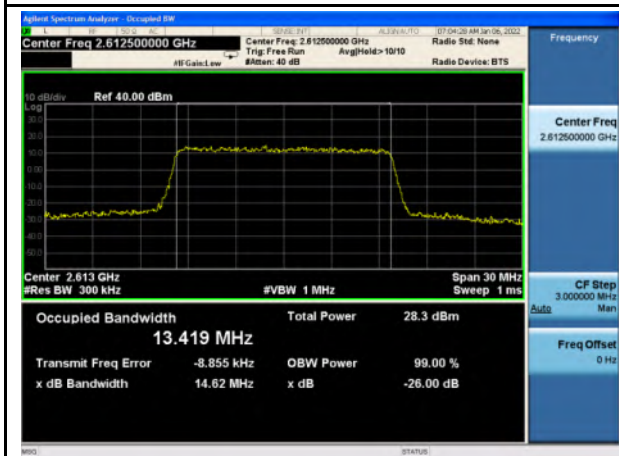
Band 38_16-QAM_15M_Low_Full RB Config



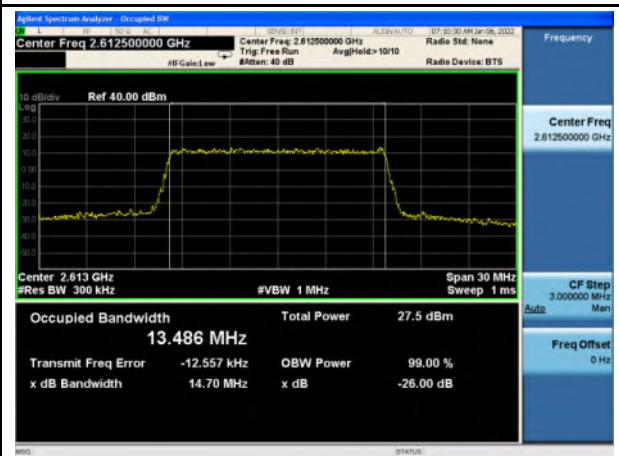
Band 38_QPSK_15M_Mid_Full RB Config



Band 38_16-QAM_15M_Mid_Full RB Config



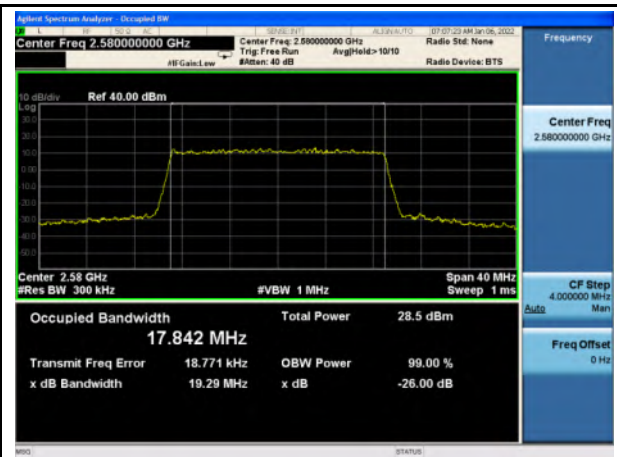
Band 38_QPSK_15M_High_Full RB Config



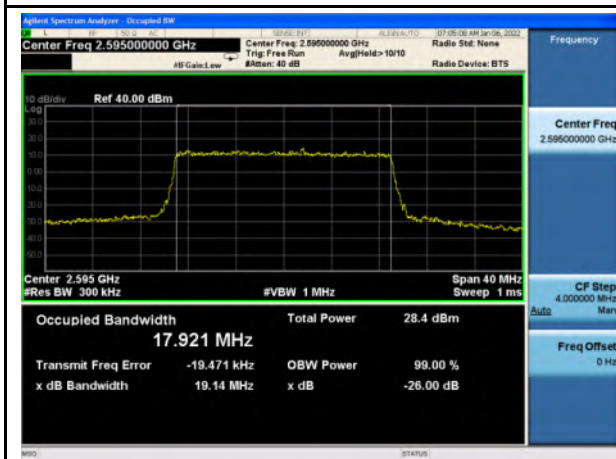
Band 38_16-QAM_15M_High_Full RB Config



Band 38_QPSK_20M_Low_Full RB Config



Band 38_16-QAM_20M_Low_Full RB Config



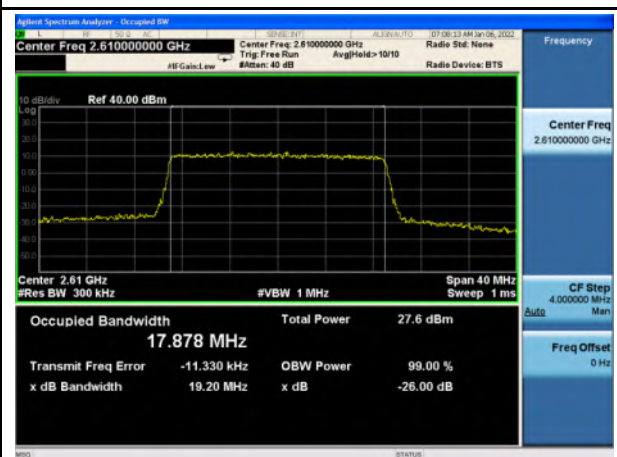
Band 38_QPSK_20M_Mid_Full RB Config



Band 38_16-QAM_20M_Mid_Full RB Config



Band 38_QPSK_20M_High_Full RB Config



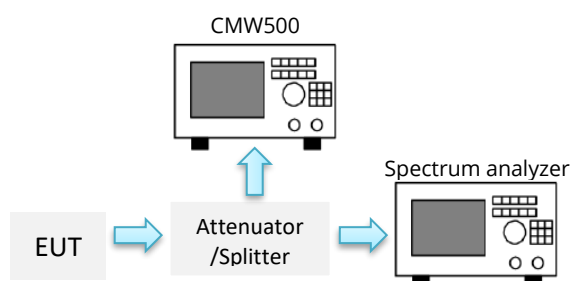
Band 38_16-QAM_20M_High_Full RB Config

7.4 Band Edge

7.4.1 Requirement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power(P) by a factor of at least $43 + 10 \log(P)$ dB.

7.4.2 Test Setup



7.4.3 Test Procedure

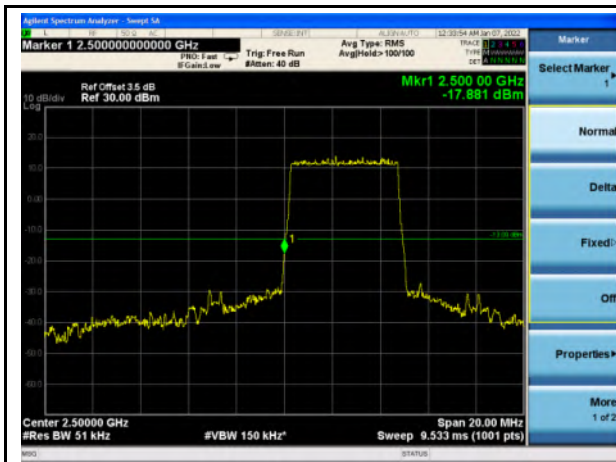
- The EUT was connected to Spectrum Analyzer and Base Station via power divider.
- Set RBW as roughly BW/100.
- Detector = average
- Sweep = auto couple.
- Allow the trace to stabilize.
- Set Marker to edge frequency
- The Band Edges of low and high channels for the highest RF powers were measured

7.4.4 Test Result

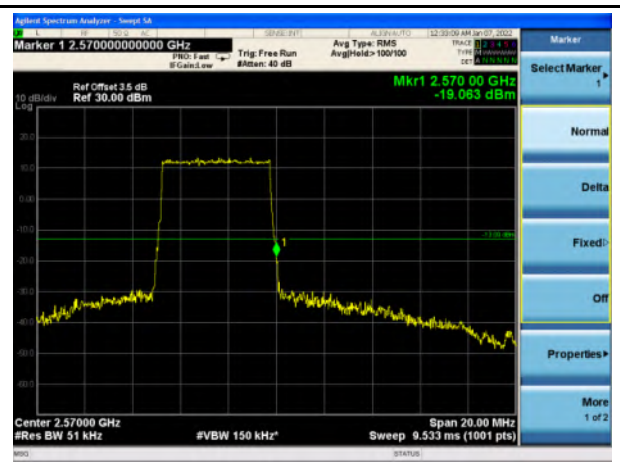
Band	Modulation	Bandwidth	Channel	Frequency (MHz)	Band Edge measured (dBm)	Limit (dBm)	Result
Band 7	QPSK	5	20775	2502.5	-17.881	-13	Pass
			21425	2567.5	-19.063	-13	Pass
		10	20800	2505	-21.225	-13	Pass
			21400	2565	-19.727	-13	Pass
		15	20825	2507.5	-21.473	-13	Pass
			21375	2562.5	-21.159	-13	Pass
		20	20850	2510	-23.118	-13	Pass
			21350	2560	-22.220	-13	Pass
	16-QAM	5	20775	2502.5	-16.772	-13	Pass
			21425	2567.5	-17.189	-13	Pass
		10	20800	2505	-22.714	-13	Pass
			21400	2565	-22.140	-13	Pass
		15	20825	2507.5	-21.411	-13	Pass
			21375	2562.5	-20.536	-13	Pass
		20	20850	2510	-24.831	-13	Pass
			21350	2560	-23.310	-13	Pass

Band	Modulation	Bandwidth	Channel	Frequency (MHz)	Band Edge measured (dBm)	Limit (dBm)	Result
Band 38	QPSK	5	37775	2572.5	-20.549	-13	Pass
			38225	2617.5	-19.764	-13	Pass
		10	37800	2575	-19.533	-13	Pass
			38200	2615	-19.817	-13	Pass
		15	37825	2577.5	-22.002	-13	Pass
			38175	2612.5	-20.283	-13	Pass
		20	37850	2580	-21.294	-13	Pass
			38150	2610	-19.092	-13	Pass
	16-QAM	5	37775	2572.5	-17.935	-13	Pass
			38225	2617.5	-18.149	-13	Pass
		10	37800	2575	-21.929	-13	Pass
			38200	2615	-22.255	-13	Pass
		15	37825	2577.5	-23.330	-13	Pass
			38175	2612.5	-20.810	-13	Pass
		20	37850	2580	-23.043	-13	Pass
			38150	2610	-21.963	-13	Pass

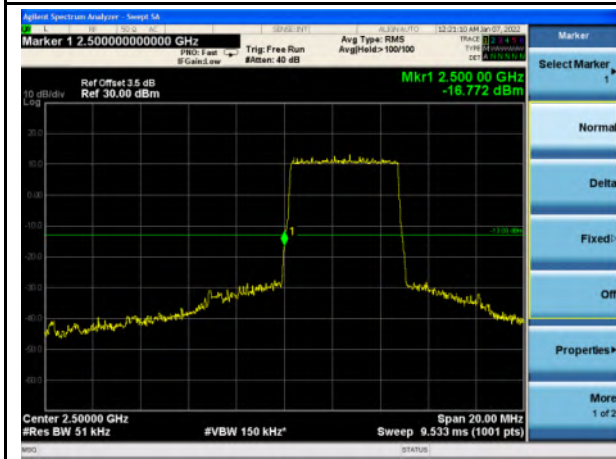
7.4.5 Test Plots



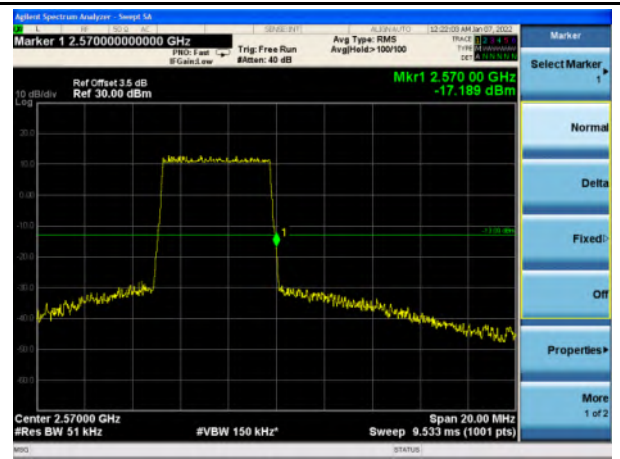
Band 7_QPSK_5M_Low_Full RB Config



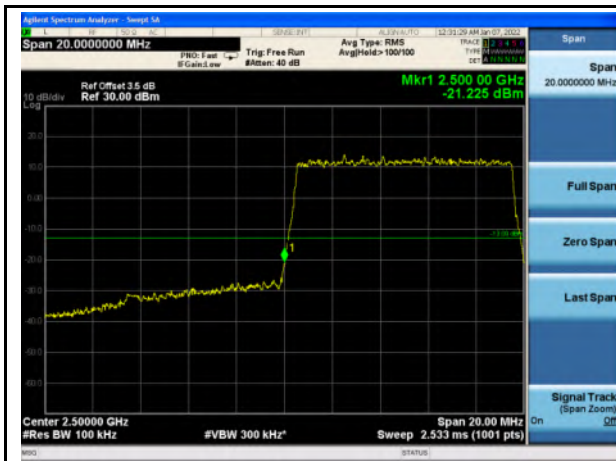
Band 7_QPSK_5M_High_Full RB Config



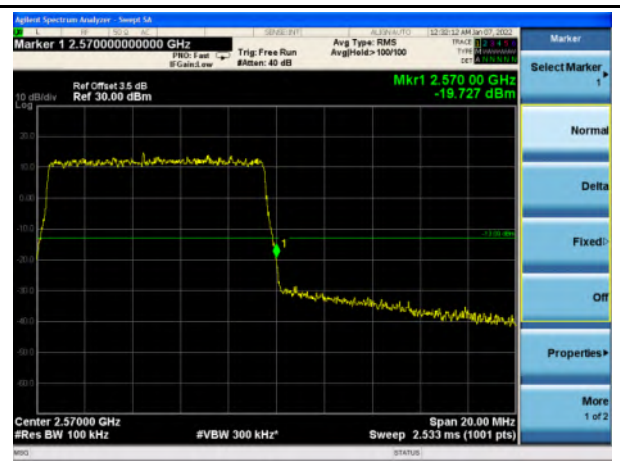
Band 7_16-QAM_5M_Low_Full RB Config



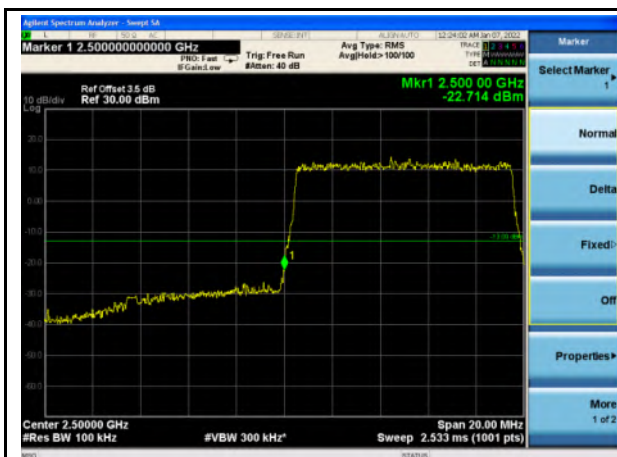
Band 7_16-QAM_5M_High_Full RB Config



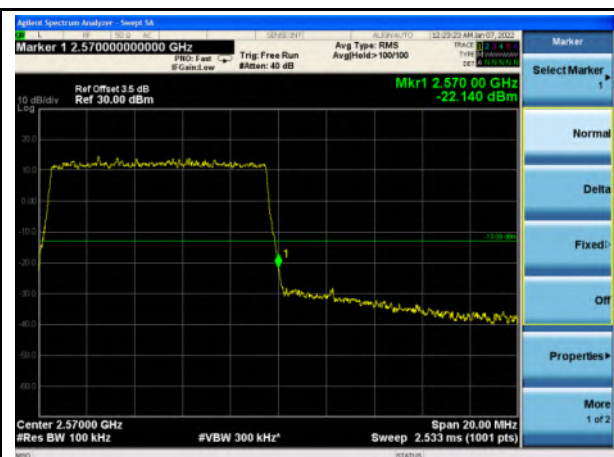
Band 7_QPSK_10M_Low_Full RB Config



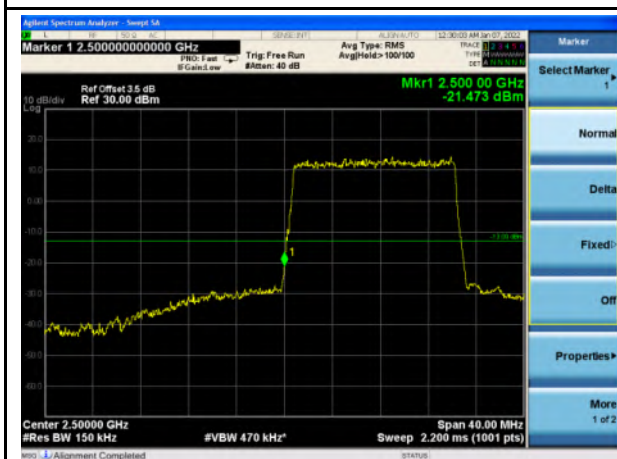
Band 7_QPSK_10M_High_Full RB Config



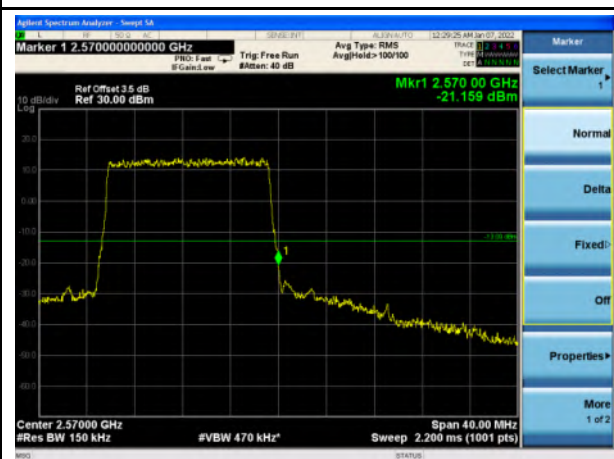
Band 7_16-QAM_10M_Low_Full RB Config



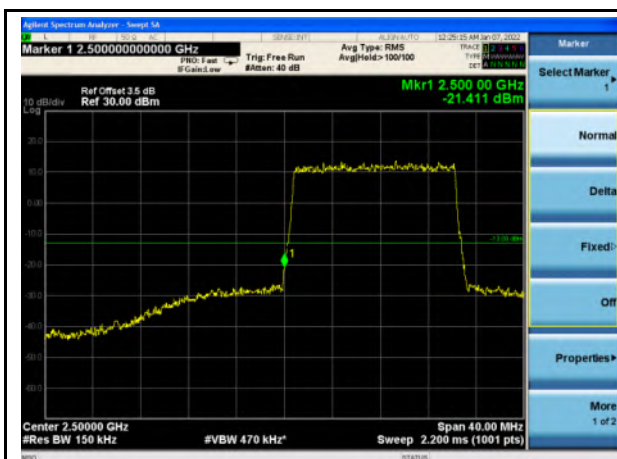
Band 7_16-QAM_10M_High_Full RB Config



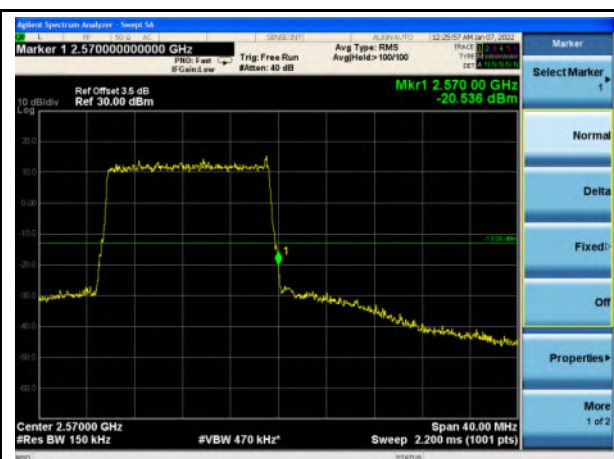
Band 7_QPSK_15M_Low_Full RB Config



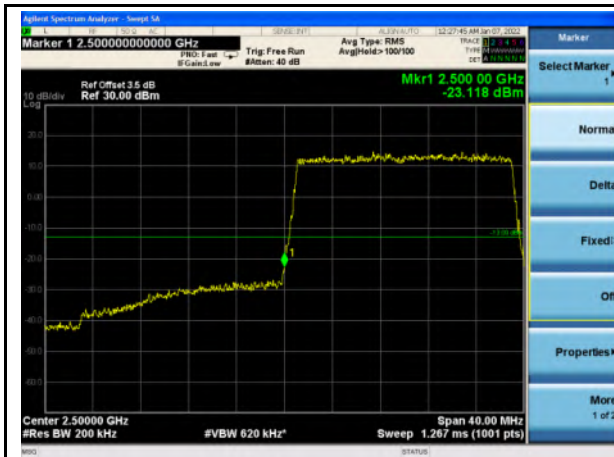
Band_QPSK_15M_High_Full RB Config



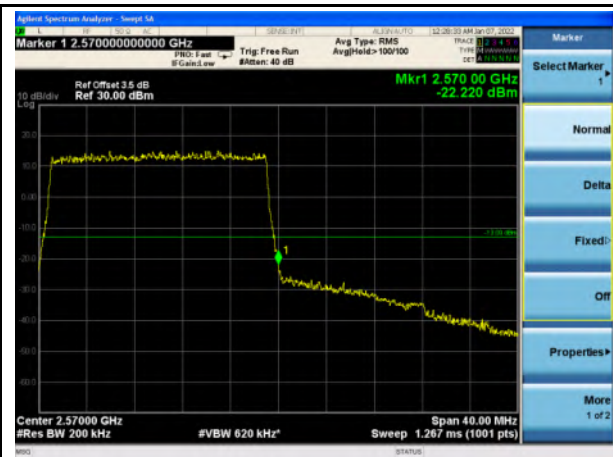
Band 7_16-QAM_15M_Low_Full RB Config



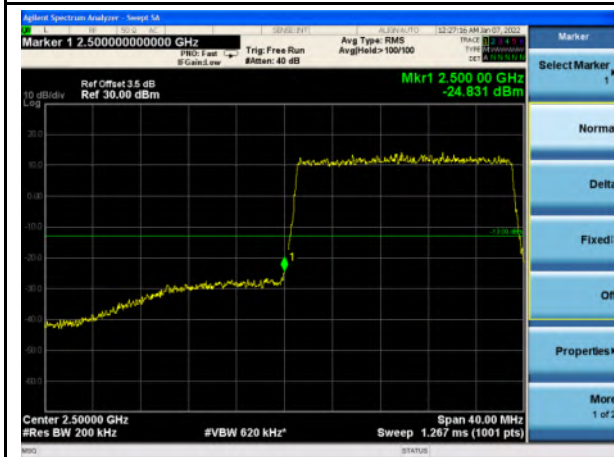
Band 7_16-QAM_15M_High_Full RB Config



Band 7_QPSK_20M_Low_Full RB Config



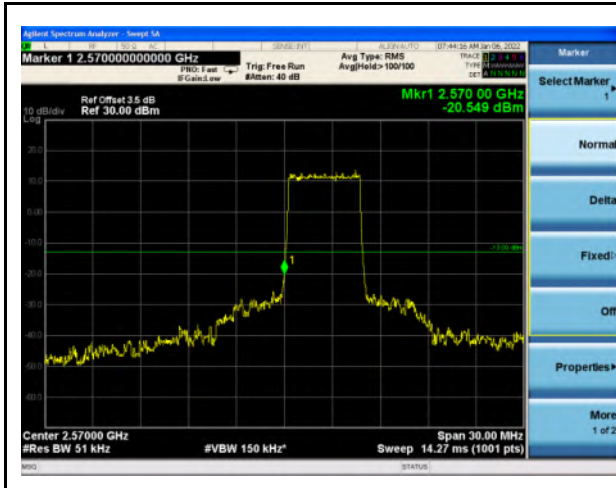
Band 7_QPSK_20M_High_Full RB Config



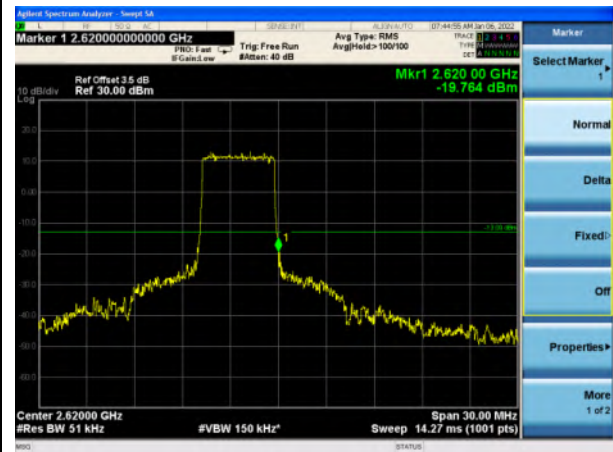
Band 7_16-QAM_20M_Low_Full RB Config



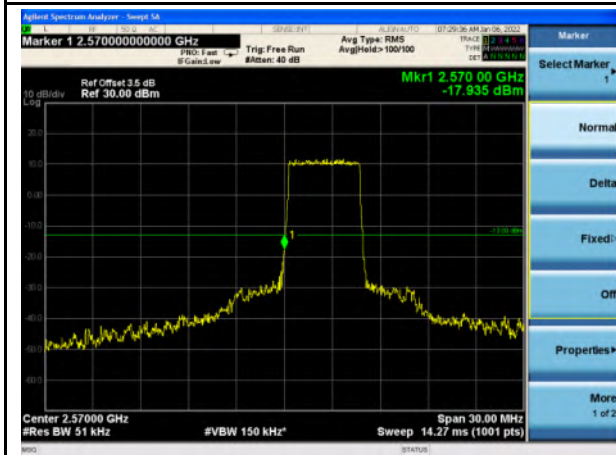
Band 7_16-QAM_20M_High_Full RB Config



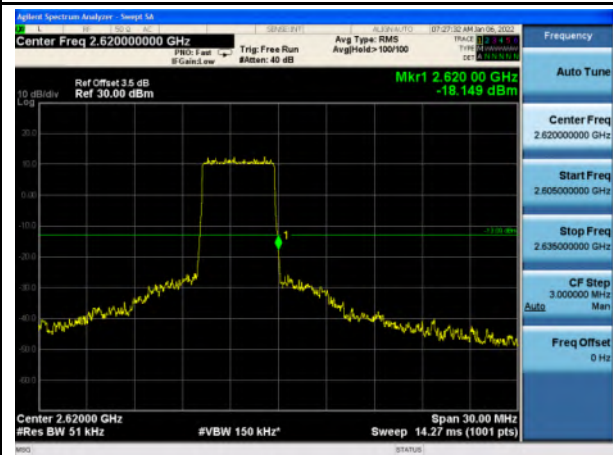
Band 38_QPSK_5M_Low_Full RB Config



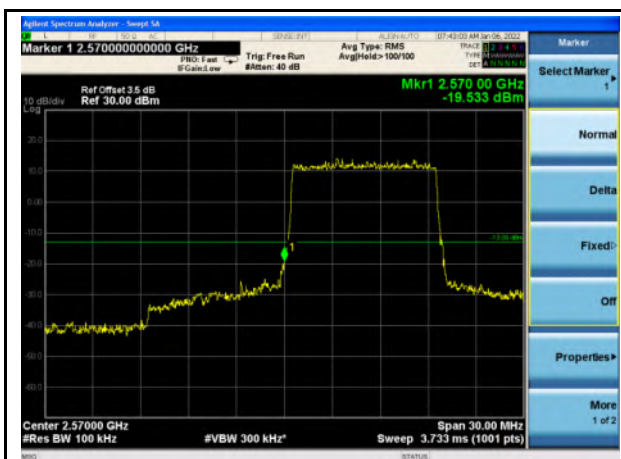
Band 38_QPSK_5M_High_Full RB Config



Band 38_16-QAM_5M_Low_Full RB Config



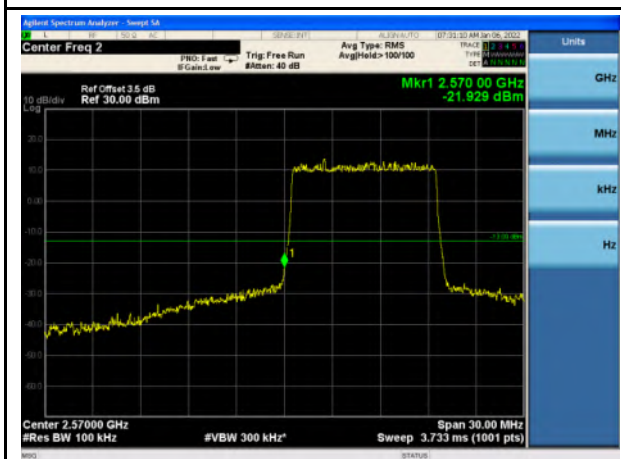
Band 38_16-QAM_5M_High_Full RB Config



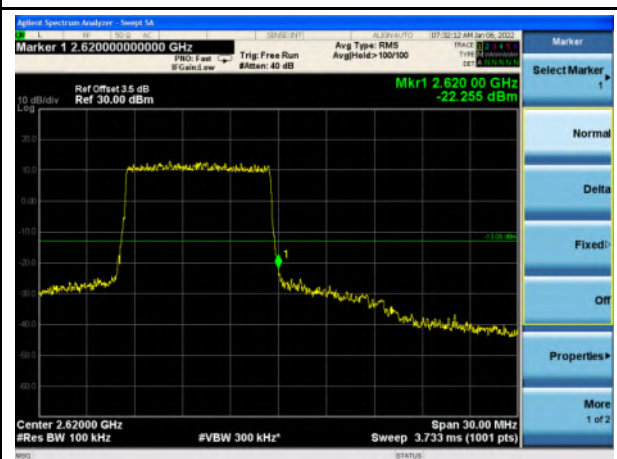
Band 38_QPSK_10M_Low_Full RB Config



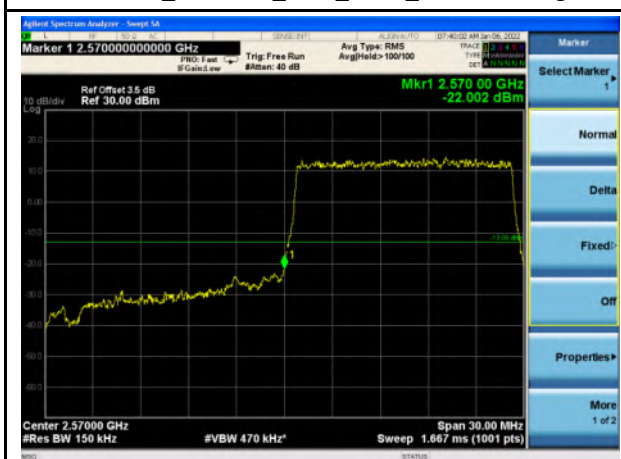
Band 38_QPSK_10M_High_Full RB Config



Band 38_16-QAM_10M_Low_Full RB Config



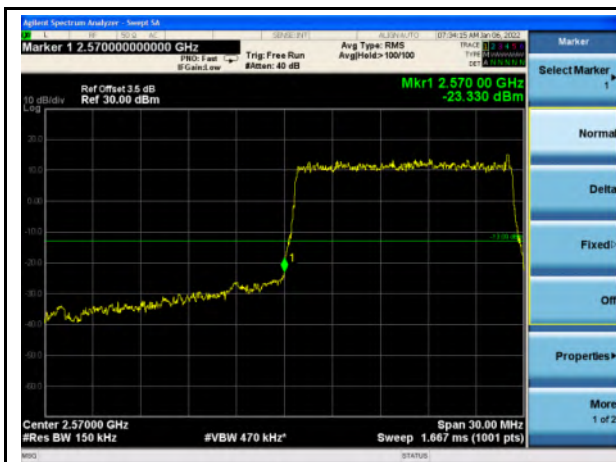
Band 38_16-QAM_10M_High_Full RB Config



Band 38_QPSK_15M_Low_Full RB Config



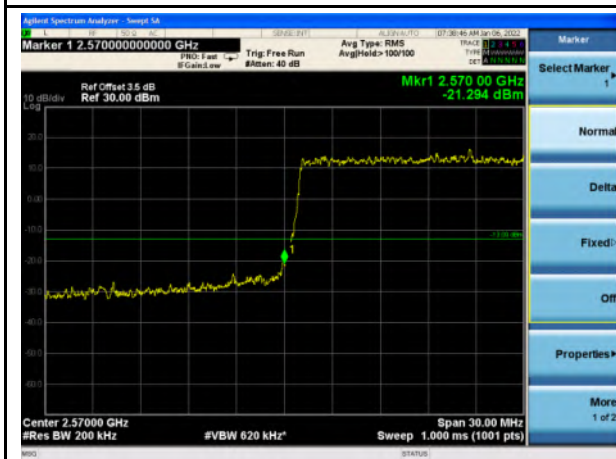
Band 38_QPSK_15M_High_Full RB Config



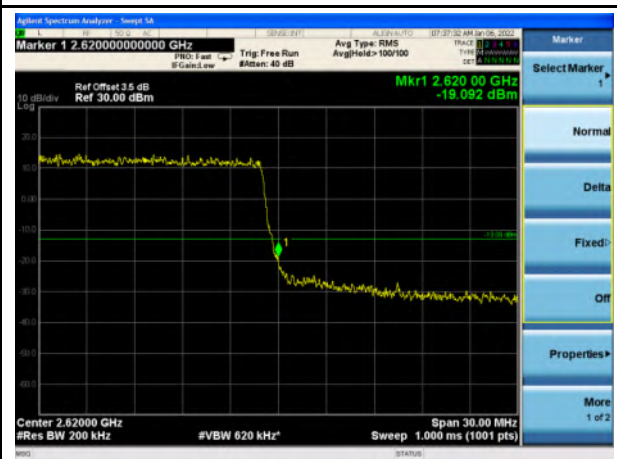
Band 38_16-QAM_15M_Low_Full RB Config



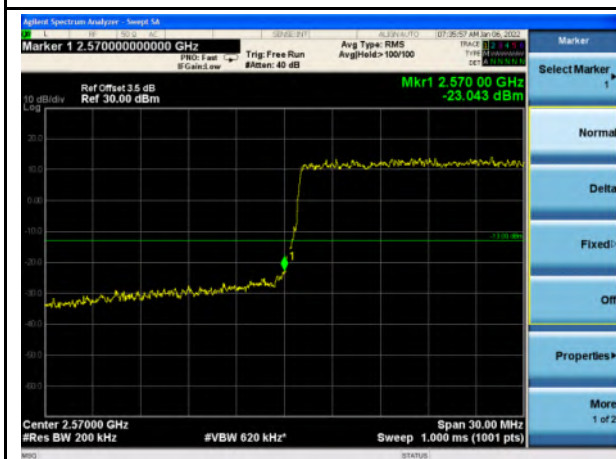
Band 38_16-QAM_15M_High_Full RB Config



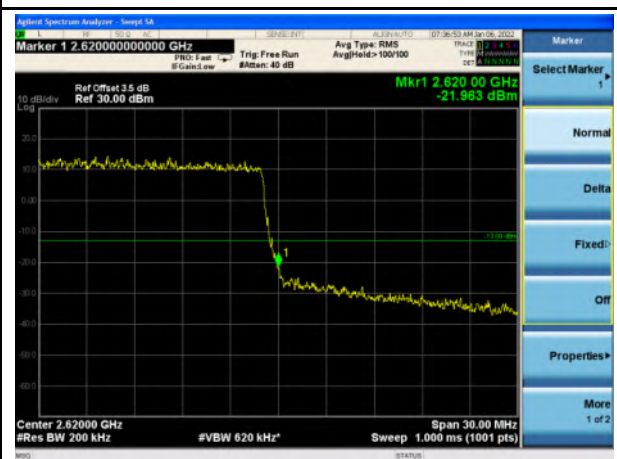
Band 38_QPSK_20M_Low_Full RB Config



Band 38_QPSK_20M_High_Full RB Config



Band 38_16-QAM_20M_Low_Full RB Config



Band 38_16-QAM_20M_High_Full RB Config

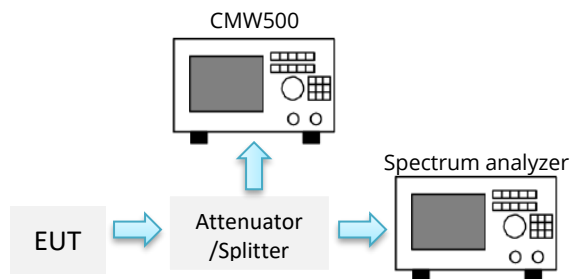
7.5 Conducted spurious emission

7.5.1 Requirement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power(P) by a factor of at least $43 + 10 \log(P)$ dB.

It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10 harmonics.

7.5.2 Test Setup



7.5.3 Test Procedure

- The EUT was connected to Spectrum Analyzer and Base Station via power divider.
- Set RBW = 100KHz and VBW=300KHz for below 1GHz; set RBW=1MHz and VBW=3MHz for above 1GHz.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Use marker peak to search for spurious emission

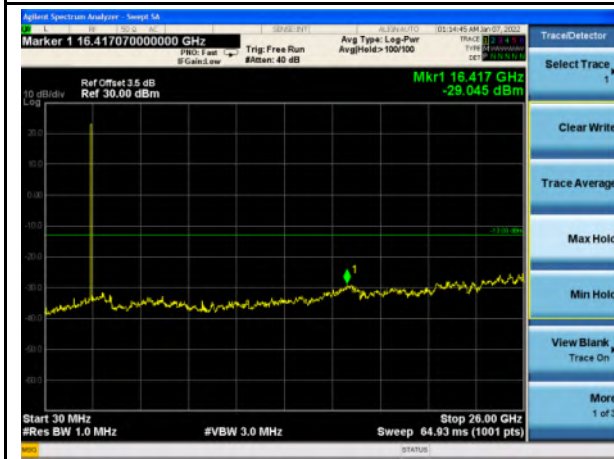
7.5.4 Test Result



Band 7_QPSK_5M_Low - 30MHz~26GHz



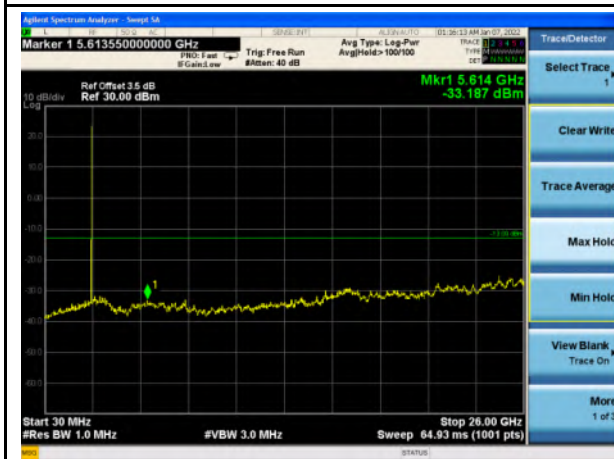
Band 7_QPSK_10M_Low - 30MHz~26GHz



Band 7_QPSK_5M_Mid - 30MHz~26GHz



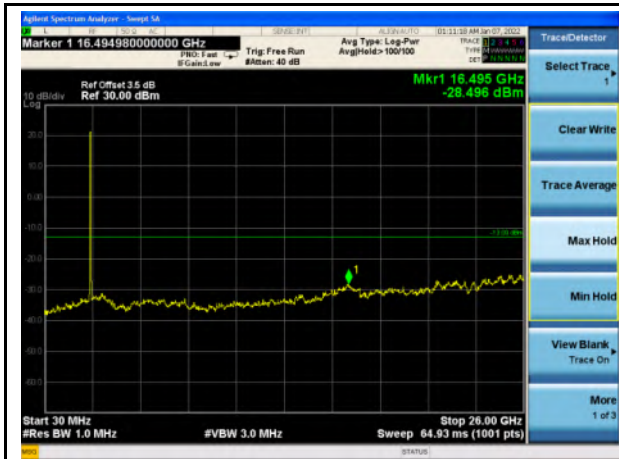
Band 7_QPSK_10M_Mid - 30MHz~26GHz



Band 7_QPSK_5M_High - 30MHz~26GHz



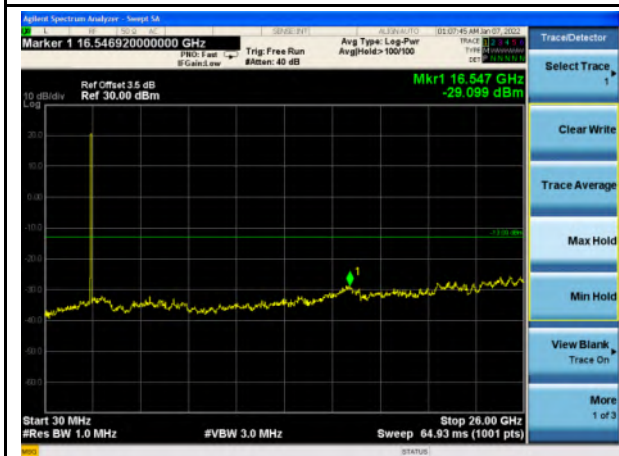
Band 7_QPSK_10M_High - 30MHz~26GHz



Band 7_QPSK_15M_Low - 30MHz~26GHz



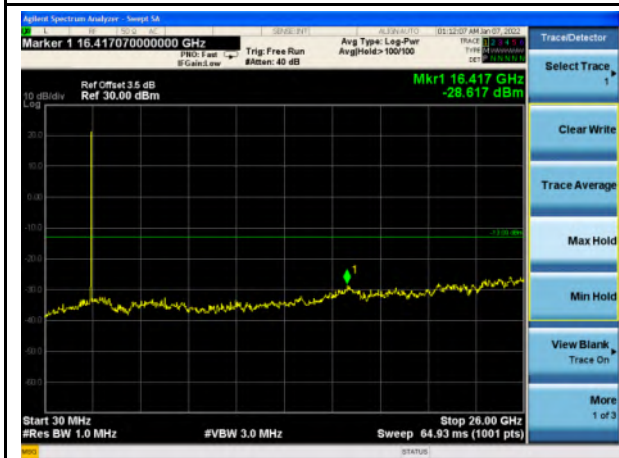
Band 7_QPSK_20M_Low - 30MHz~26GHz



Band 7_QPSK_15M - Mid- 30MHz~26GHz



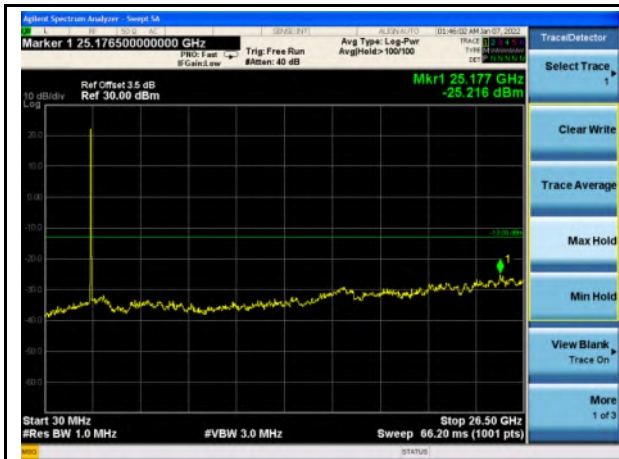
Band 7_QPSK_20M - Mid- 30MHz~26GHz



Band 7_QPSK_15M - High - 30MHz~26GHz



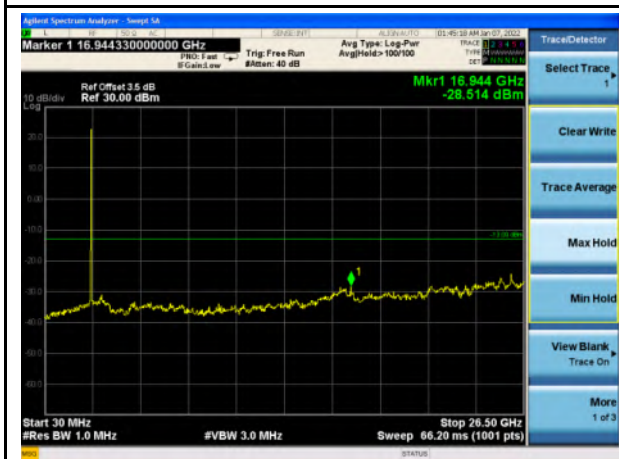
Band 7_QPSK_20M - High - 30MHz~26GHz



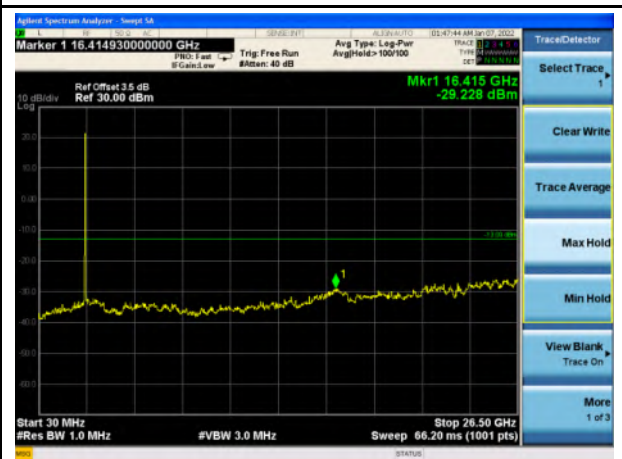
Band 38_QPSK_10M_Low - 30MHz~26.5GHz



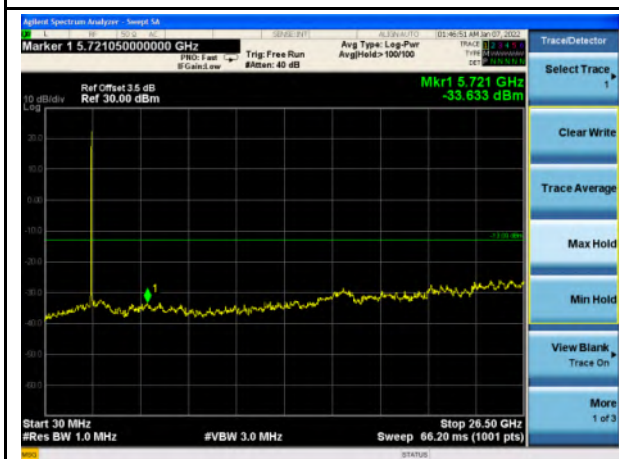
Band 38_QPSK_15M_Low - 30MHz~26.5GHz



Band 38_QPSK_10M - Mid- 30MHz~26.5GHz



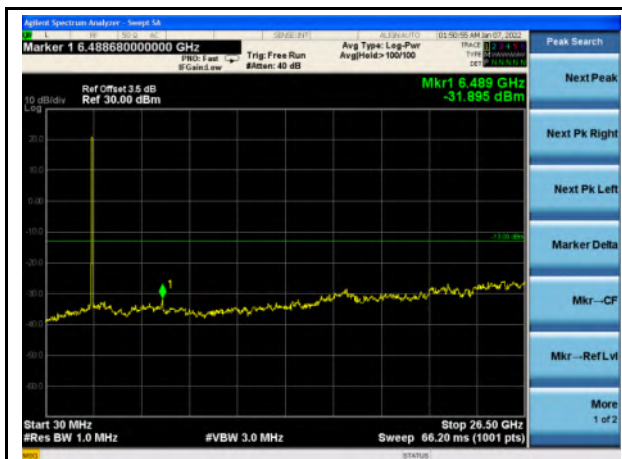
Band 38_QPSK_15M - Mid- 30MHz~26.5GHz



Band 38_QPSK_10M - High - 30MHz~26.5GHz



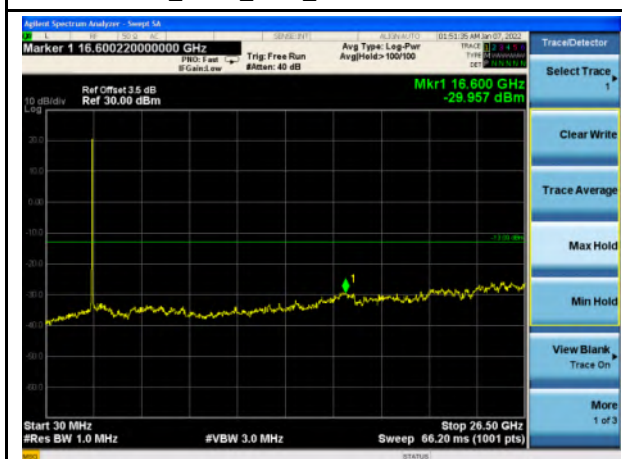
Band 38_QPSK_15M - High - 30MHz~26.5GHz



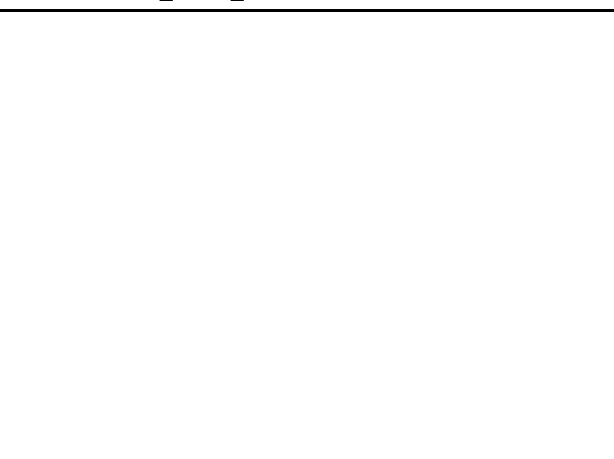
Band 38_QPSK_20M_Low - 30MHz~26.5GHz



Band 38_QPSK_20M - Mid- 30MHz~26.5GHz



Band 38_QPSK_20M - High - 30MHz~26.5GHz



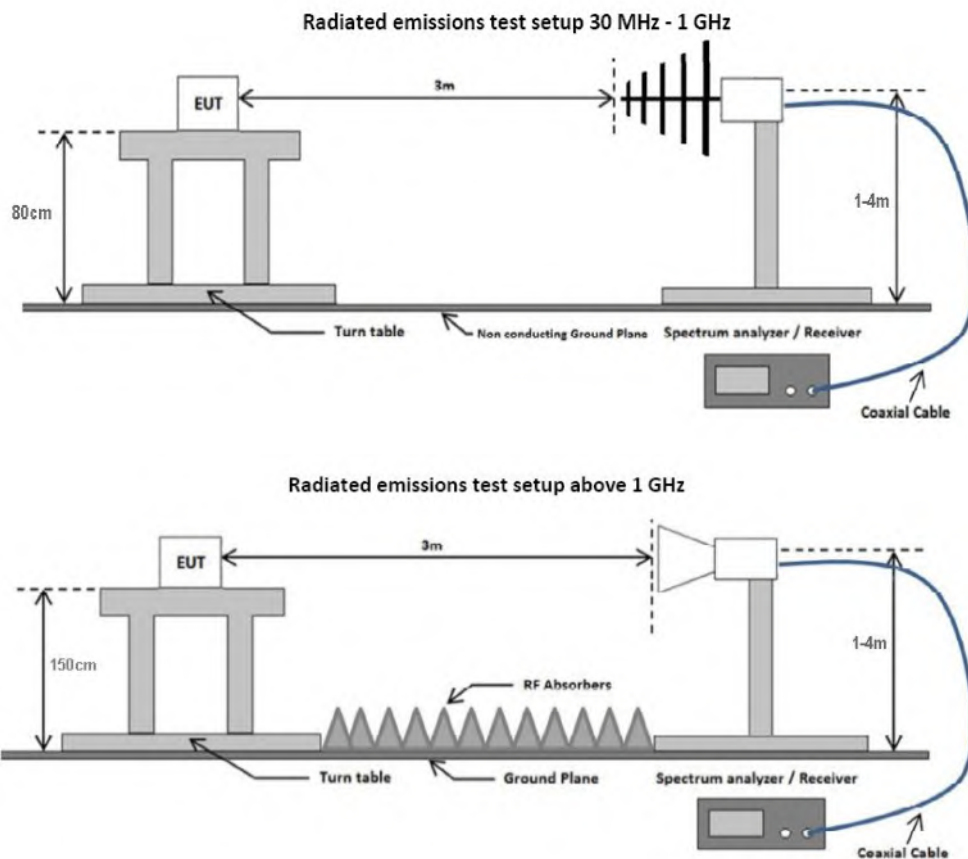
Band 38_16-QAM_20M - High - 1GHz~26.5GHz

7.6 Field Strength of Radiated Spurious Emissions

7.6.1 Requirement

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power(P) by a factor of at least $43 + 10 \log(P)$ dB. The emission limit is equal to -13 dBm.

7.6.2 Test Setup



7.6.3 Test Procedure

ANSI C63.26: 2015 section 5.5

KDB 971168 D01 Power Meas License Digital Systems v03r01 section 7

Boresight antenna mast was used during the scanning to point to EUT to maximize the emission. The process will be repeated in 3 EUT orientations.

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 characterization. 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 polarization (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. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.
4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz – 30MHz.
5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-Peak detection at frequency between 30MHz - 1GHz.
6. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
7. 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.
8. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating 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.
9. Steps 2 - 8 were repeated for the next frequency point, until all selected frequency points were measured

7.6.4 Test Result

LTE Band 7_5M BW												
Low Channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5004.815	-74.85	20.91	-2.02	-55.95	RMS Max	H	243	29	-13	-42.95	Pass
2	7506.623	-76.52	23.67	0.81	-52.03	RMS Max	V	102	180	-13	-39.03	Pass
3	10010.417	-77.45	24.08	0.95	-52.42	RMS Max	V	132	119	-13	-39.42	Pass
Mid channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5070.767	-75.96	21.17	-1.71	-56.5	RMS Max	V	267	54	-13	-43.5	Pass
2	7607.054	-76.53	24.07	0.5	-51.96	RMS Max	H	254	42	-13	-38.96	Pass
3	10139.187	-80.28	24.08	1.21	-54.99	RMS Max	V	241	16	-13	-41.99	Pass
High channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5135.034	-76.15	21.23	-1.54	-56.45	RMS Max	V	136	177	-13	-43.45	Pass
2	7703.248	-77.45	24.18	0.4	-52.87	RMS Max	H	146	90	-13	-39.87	Pass
3	10270.544	-79.9	24.08	1.57	-54.25	RMS Max	V	106	328	-13	-41.25	Pass

LTE Band 7_10M BW												
Low Channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5010.36	-74.94	20.94	-1.98	-55.99	RMS Max	V	159	36	-13	-42.99	Pass
2	7515.71	-76.63	23.71	0.78	-52.14	RMS Max	V	212	161	-13	-39.14	Pass
3	10019.941	-78.19	24.08	0.98	-53.13	RMS Max	H	187	231	-13	-40.13	Pass
Mid channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5070.147	-75.98	21.17	-1.71	-56.52	RMS Max	V	276	158	-13	-43.52	Pass
2	7605.393	-76.54	24.07	0.5	-51.97	RMS Max	V	285	213	-13	-38.97	Pass
3	10140.31	-80.26	24.08	1.21	-54.97	RMS Max	H	205	287	-13	-41.97	Pass
High channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5128.876	-75.87	21.24	-1.56	-56.19	RMS Max	H	219	165	-13	-43.19	Pass
2	7697.203	-77.29	24.18	0.4	-52.71	RMS Max	H	252	131	-13	-39.71	Pass
3	10260.94	-79.96	24.08	1.55	-54.33	RMS Max	V	208	164	-13	-41.33	Pass

Remarks:

1. Level (dBuV) = Raw (dBuV) + Cable loss(dB) + AF (dB).
2. AF(dB) = Antenna Factor (dB) – Preamplifier Gain (dB)
3. Margin = Level (dBuV/m) - Limit value(dBuV/m)

LTE Band 7_15M BW												
Low Channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5014.718	-75.01	20.95	-1.96	-56.01	RMS Max	V	103	196	-13	-43.01	Pass
2	7522.123	-76.88	23.74	0.75	-52.39	RMS Max	H	211	16	-13	-39.39	Pass
3	10029.799	-78.1	24.08	1.01	-53.01	RMS Max	V	128	345	-13	-40.01	Pass
Mid channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5069.302	-76	21.16	-1.71	-56.55	RMS Max	V	275	296	-13	-43.55	Pass
2	7604.577	-76.55	24.07	0.5	-51.98	RMS Max	H	150	132	-13	-38.98	Pass
3	10139.323	-80.28	24.08	1.21	-54.99	RMS Max	V	222	272	-13	-41.99	Pass
High channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5126.266	-75.83	21.25	-1.57	-56.15	RMS Max	H	162	165	-13	-43.15	Pass
2	7686.384	-77.35	24.17	0.42	-52.77	RMS Max	V	252	278	-13	-39.77	Pass
3	10250.007	-79.52	24.08	1.52	-53.92	RMS Max	V	287	268	-13	-40.92	Pass

LTE Band 7_20M BW												
Low Channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5019.817	-74.68	20.97	-1.93	-55.63	RMS Max	V	108	300	-13	-42.63	Pass
2	7531.055	-76.72	23.78	0.72	-52.22	RMS Max	V	138	251	-13	-39.22	Pass
3	10146.597	-80.14	24.08	1.22	-54.84	RMS Max	H	171	259	-13	-41.84	Pass
Mid channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5069.795	-76	21.16	-1.71	-56.54	RMS Max	V	251	18	-13	-43.54	Pass
2	7605.571	-76.54	24.07	0.5	-51.97	RMS Max	H	268	318	-13	-38.97	Pass
3	10139.909	-80.27	24.08	1.21	-54.98	RMS Max	H	180	299	-13	-41.98	Pass
High channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5120.846	-75.79	21.25	-1.58	-56.12	RMS Max	H	224	192	-13	-43.12	Pass
2	7679.274	-76.76	24.16	0.43	-52.18	RMS Max	V	151	154	-13	-39.18	Pass
3	10240.608	-79.58	24.08	1.5	-54	RMS Max	H	233	91	-13	-41	Pass

Remarks:

1. Level (dBuV) = Raw (dBuV) + Cable loss(dB) + AF (dB).
2. AF(dB) = Antenna Factor (dB) - Preamplifier Gain (dB)
3. Margin = Level (dBuV/m) - Limit value(dBuV/m)

LTE Band 38_5M BW												
Low Channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5145.178	-76.86	21.22	-1.51	-57.15	RMS Max	H	210	117	-13	-44.15	Pass
2	7717.776	-77.95	24.19	0.38	-53.38	RMS Max	V	157	279	-13	-40.38	Pass
3	10290.764	-79.88	24.08	1.63	-54.17	RMS Max	V	296	170	-13	-41.17	Pass
Mid channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5190.542	-77.13	21.16	-1.26	-57.23	RMS Max	V	250	294	-13	-44.23	Pass
2	7785.5	-77.1	24.24	0.3	-52.56	RMS Max	H	207	118	-13	-39.56	Pass
3	10380.363	-79.3	24.08	1.85	-53.37	RMS Max	V	221	158	-13	-40.37	Pass
High channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5235.63	-76.35	21.19	-1.04	-56.2	RMS Max	V	164	241	-13	-43.2	Pass
2	7852.508	-76.64	24.24	0.31	-52.09	RMS Max	V	130	253	-13	-39.09	Pass
3	10469.322	-79.26	24.08	2.03	-53.15	RMS Max	H	287	69	-13	-40.15	Pass

Remarks:

1. Level (dBuV) = Raw (dBuV) + Cable loss(dB) + AF (dB).
2. AF(dB) = Antenna Factor (dB) – Preamplifier Gain (dB)
3. Margin = Level (dBuV/m) - Limit value(dBuV/m)

LTE Band 38_10M BW												
Low Channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5150.624	-76.44	21.21	-1.49	-56.71	RMS Max	V	207	170	-13	-43.71	Pass
2	7725.409	-76.94	24.2	0.37	-52.37	RMS Max	H	260	134	-13	-39.37	Pass
3	10300.107	-80.66	24.08	1.66	-54.92	RMS Max	H	243	245	-13	-41.92	Pass
Mid channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5190.036	-77.05	21.16	-1.27	-57.16	RMS Max	H	174	271	-13	-44.16	Pass
2	7785.938	-77.1	24.24	0.3	-52.56	RMS Max	H	151	38	-13	-39.56	Pass
3	10379.367	-79.3	24.08	1.84	-53.38	RMS Max	V	166	73	-13	-40.38	Pass
High channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5230.232	-76.25	21.19	-1.06	-56.13	RMS Max	H	159	93	-13	-43.13	Pass
2	7844.906	-77.22	24.24	0.31	-52.67	RMS Max	H	284	75	-13	-39.67	Pass
3	10460.102	-79.64	24.08	2.01	-53.55	RMS Max	V	121	121	-13	-40.55	Pass

LTE Band 38_15M BW												
Low Channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5155.649	-76.35	21.21	-1.46	-56.6	RMS Max	V	129	360	-13	-43.6	Pass
2	7732.294	-77.17	24.2	0.36	-52.61	RMS Max	H	289	320	-13	-39.61	Pass
3	10310.735	-80.2	24.08	1.68	-54.44	RMS Max	V	144	185	-13	-41.44	Pass
Mid channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5190.662	-77.15	21.16	-1.26	-57.25	RMS Max	V	174	320	-13	-44.25	Pass
2	7785.938	-77.1	24.24	0.3	-52.56	RMS Max	H	193	86	-13	-39.56	Pass
3	10380.963	-79.29	24.08	1.85	-53.36	RMS Max	V	241	295	-13	-40.36	Pass
High channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5225.11	-76.06	21.18	-1.09	-55.97	RMS Max	H	299	315	-13	-42.97	Pass
2	7836.547	-77.68	24.24	0.31	-53.13	RMS Max	V	243	141	-13	-40.13	Pass
3	10450.235	-79.61	24.08	1.99	-53.54	RMS Max	V	294	112	-13	-40.54	Pass

Remarks:

1. Level (dBuV) = Raw (dBuV) + Cable loss(dB) + AF (dB).
2. AF(dB) = Antenna Factor (dB) – Preamplifier Gain (dB)
3. Margin = Level (dBuV/m) - Limit value(dBuV/m)

LTE Band 38_20M BW												
Low Channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5160.713	-77.18	21.2	-1.43	-57.41	RMS Max	V	193	67	-13	-44.41	Pass
2	7740.579	-77.46	24.21	0.35	-52.9	RMS Max	H	272	83	-13	-39.9	Pass
3	10320.947	-80.18	24.08	1.71	-54.39	RMS Max	V	255	154	-13	-41.39	Pass
Mid channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5190.85	-77.17	21.16	-1.26	-57.27	RMS Max	V	108	162	-13	-44.27	Pass
2	7784.624	-77.1	24.24	0.3	-52.56	RMS Max	V	211	295	-13	-39.56	Pass
3	10380.533	-79.3	24.08	1.85	-53.37	RMS Max	H	292	204	-13	-40.37	Pass
High channel												
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Result
1	5220.154	-75.86	21.17	-1.11	-55.8	RMS Max	V	124	110	-13	-42.8	Pass
2	7830.125	-77.71	24.24	0.31	-53.16	RMS Max	H	193	166	-13	-40.16	Pass
3	10440.155	-79.88	24.08	1.97	-53.83	RMS Max	H	298	106	-13	-40.83	Pass

Remarks:

1. Level (dBuV) = Raw (dBuV) + Cable loss(dB) + AF (dB).
2. AF(dB) = Antenna Factor (dB) – Preamplifier Gain (dB)
3. Margin = Level (dBuV/m) - Limit value(dBuV/m)

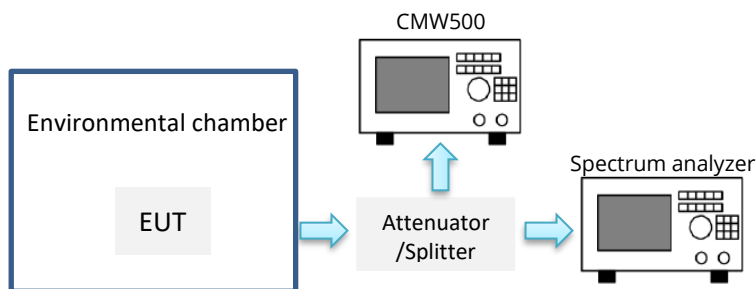
7.7 Frequency Stability

7.7.1 Requirement

§2.1055, § 27.53
RSS-199 (4.3)

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The carrier frequency shall not depart from the reference frequency in excess of $\pm 2.5\text{ppm}$ ($\pm 0.00025\%$) for mobile stations.

7.7.2 Test Setup



7.7.3 Test Procedure

- The testing follows ANSI C63.26 section 5.6.4.
- A communication link was established between EUT and base station.
- The EUT was set up in the thermal chamber and connected with the communication tester.
- With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
- With power OFF, the temperature was raised in 10°C steps up to 50°C . The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.
- The frequency error was monitored and measured by base station under variation of ambient temperature and variation of primary supply voltage.

7.7.4 Test Result

LTE Band 7 - 2535 MHz					
Voltage (Vdc)	Temperature (°C)	Frequency error (Hz)	Frequency error (ppm)	Limit (ppm)	Result
12.0	-30	17	0.006626	2.50	PASS
	-20	16	0.006437		
	-10	10	0.003786		
	0	19	0.007573		
	10	13	0.005301		
	20	17	0.006815		
	30	11	0.004354		
	40	10	0.003975		
	50	16	0.006437		
10.2	20	16	0.006437	2.50	PASS
13.8	20	11	0.004354		

LTE Band 38 - 2595 MHz					
Voltage (Vdc)	Temperature (°C)	Frequency error (Hz)	Frequency error (ppm)	Limit (ppm)	Result
12.0	-30	14	0.014122	2.50	PASS
	-20	5	0.007117		
	-10	13	0.013733		
	0	5	0.007117		
	10	3	0.00517		
	20	13	0.013733		
	30	5	0.007117		
	40	8	0.009063		
	50	7	0.008284		
10.2	20	3	0.00556	2.50	PASS
13.8	20	15	0.01529		

8 EUT and Test Setup Photos

See FCC exhibits

9 Test Instrument List

Equipment	Manufacturer	Model	Instrument Number	Cal. Date	Cal. Due
Semi-Anechoic Chamber	ETS-Lindgren	10M	VL001	10/18/2021	10/18/2022
Shielding Control Room	ETS-Lindgren	Series 81	VL006	N/A	N/A
Spectrum Analyzer	Keysight	N9020A	MY50110074	06/17/2021	06/17/2022
EMC Test Receiver	R&S	ESL6	100230	06/14/2021	06/14/2022
Bi-Log Antenna	ETS-Lindgren	3142E	217921	11/15/2021	11/15/2022
Horn Antenna (1-18GHz)	Electro-Metrics	EM-6961	6292	05/14/2021	05/14/2022
Horn Antenna (18-40GHz)	Com-Power	AH-840	101109	06/24/2021	06/24/2022
Preamplifier	RF Bay, Inc.	LPA-10-20	11180621	07/16/2021	07/16/2022
True RMS Multi-meter	UNI-T	UT181A	C173014829	05/05/2021	05/05/2022
Temp / Humidity / Pressure Meter	PCE Instruments	PCE-THB 40	R062028	05/15/2021	05/15/2022
RF Attenuator	Pasternack	PE7005-3	VL061	07/16/2021	07/16/2022
Preamplifier 100KHz - 40GHz	Aeroflex	33711-392-77150-11	064	07/16/2021	07/16/2022
EM Center Control	ETS-Lindgren	7006-001	160136	N/A	N/A
Turn Table	ETS-Lindgren	2181-3.03	VL002	N/A	N/A
Boresight Antenna Tower	ETS-Lindgren	2171B	VL003	N/A	N/A
Loop Antenna (9k-30MHz)	Com-Power	AL-130	121012	05/16/2021	05/16/2022
RE test cable (below 6GHz)	Vista	RE-6GHz-01	RE-6GHz-01	07/16/2021	07/16/2022
RE test cable (1-18GHz)	PhaseTrack	II-240	RE-18GHz-01	07/16/2021	07/16/2022
RE test cable (>18GHz)	Sucoflex	104	344903/4	07/16/2021	07/16/2022
Pulse limiter	Com-Power	LIT-930A	531727	07/16/2021	07/16/2022
CE test cable #1	FIRST RF	FRF-C-1002-001	CE-6GHz-01	07/16/2021	07/16/2022
CE test cable#2	FIRST RF	FRF-C-1002-001	CE-6GHz-02	07/16/2021	07/16/2022
Vector Signal Generator	Keysight	N5182A	US47080548	06/17/2021	06/17/2022
USB RF Power Sensor	ETS-Lindgren	7002-006	SN 00151268	05/15/2019	05/15/2022
RF Power Amplifier (80-1000MHz)	Ophir	5226FE	1013/1815	N/A	N/A
RF Power Amplifier (700-6000MHz)	Ophir	5293FE	1063/1815	N/A	N/A
Horn Antenna (1-18GHz)	FT-RF	HA-07M18G-NF	180010HA	N/A	N/A
Wideband Communication	R&S	CMW500	147508	05/10/2021	05/10/2022
Temperature/Humidity Chamber	Thermotron	SM-8-8200	40991	09/08/2021	09/08/2022

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