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Title 47 Code of Federal Regulations Test Report

Regulation:
FCC Part 2 and 27

Client:
NOKIA SOLUTIONS AND NETWORKS

Product Evaluated:
AirScale MAA 64T64R B41 320W AEHC (AEHC)

Report Number:
TR-2021-0154-FCC2-27

Date Issued:
January 14, 2022

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Revisions

Date	Revision	Section	Change
01/14/2022	0		Initial Release


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1. System Information and Requirements

Report copies and other information not contained in this report are held by either the product engineer or in an identified file at the Global Product Compliance Laboratory in Murray-Hill, NJ.

Equipment Under Test (EUT):	AirScale MAA 64T64R B41 320W AEHC (AEHC)
Serial Number:	L1203206454
FCC ID:	VBNAEHC-01
Hardware Version:	475124B.101
Software Version:	STBS22R1
Frequency Range:	2496-2690 MHz
GPCL Project Number:	2021-00154
Applicant	Nokia Solutions and Networks Steve Mitchell 3201 Olympus Blvd Dallas, TX 75019
Test Requirement(s):	Title 47 CFR Parts 2 and 27
Test Standards:	<ul style="list-style-type: none"> Title 47 CFR Parts 2 and 27 KDB 971168 D01 Power Measurement License Digital Systems v03r01 April 9, 2018. KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013 ANSI C63.26 (2015) ANSI C63.4 (2014)
Measurement Procedure(s):	<ul style="list-style-type: none"> FCC-IC-OB - GPCL Power Measurement, Occupied Bandwidth & Modulation Test Procedure 6-20-2019 FCC-IC-SE - GPCL Spurious Emissions Test Procedure 6-20-2019
Test Date(s):	12/15/2021 - 1/12/2022
Test Performed By:	Nokia Global Product Compliance Laboratory 600-700 Mountain Ave. P.O. Box 636 Murray Hill, NJ 07974-0636 Test Site Number: US5302
Product Engineer(s):	Ron Remy
Lead Engineer:	Steve Gordon
Test Engineer (s):	Nilesh Patel
Test Results: The EUT, <i>as tested</i> met the above listed Test Requirements. The decision rule employed is binary (Pass/Fail) based on the measured values without accounting for Measurement Uncertainty or any Guard Band. The measured values obtained during testing were compared to a value given in the referenced regulation or normative standard. Report copies and other information not contained in this report are held by either the product engineer or in an identified file at the Global Product Compliance Laboratory in New Providence, NJ.	

1.1 Introduction

This Conformity test report applies to the AirScale MAA 64T64R B41 320W AEHC (AEHC), hereinafter referred to as the Equipment Under Test (EUT).

1.2 Purpose and Scope

The purpose of this document is to provide the testing data required for qualifying the EUT in compliance with FCC Parts 2 and 27 measured in accordance with the procedures set out in Section 2.1033 (c) (14) of the Rules.

This report covers the Class II Permissive change to add new 30MHz BW at 120 W (50.79 dBm) conducted power and 5G/LTE multicarrier configurations (3.2/1.5 W per port conducted power) with contiguous bandwidth up to 190 MHz to the existing grant. The following multicarrier configurations were considered for test:

Config#	OBW	NR	NR	LTE	LTE	Note
1	180	100	40	20	20	Previously tested - 4cc carriers at 180 MHz BW.
2	160	100	20	20	20	No Testing required. Covered by 5cc (50NR+50NR+20LTE+20LTE_20LTE and 100NR+60NR)
3	160	80	40	20	20	No Testing required. Covered by 5cc (50NR+50NR+20LTE+20LTE_20LTE and 100NR+60NR)
4	190	100	50	20	20	Class 2. OBW is 190 MHz. Highest previously certified is 180 MHz.
5	140	80	20	20	20	No Testing required. Covered by 5cc (50NR+50NR+20LTE+20LTE_20LTE and 100NR+60NR)
6	170	30	100	20	20	Class 2. New BW 30MHZ Carrier

Based on the new 30 MHz Bandwidth and the maximum contiguous spectrum of 190 MHz, configurations #4 and #6 were chosen for test. The AEHC product is certified under FCC ID: VBNAEHC-01.

No Frequency Stability testing was considered necessary for this test program since there were no changes to the basic frequency determining and stabilizing circuitry (including clock and data rates).

1.3 EUT Details

1.3.1 Specifications

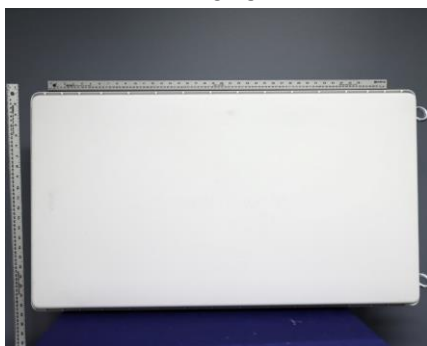
Radio Characteristics	
Max RF Output Power	320 W (5 W per TRX)
TX / RX	64T64R
Band / Frequency Range	n41: 2496 - 2690 MHz
Instantaneous bandwidth (IBW)	194 MHz
Occupied bandwidth (OBW)	190 MHz
Carrier bandwidth	20, 40, 50, 60, 70, 80, 100 MHz
Operating mode	64TRX Digital Beamforming
Other Characteristics	
External Interfaces	4 * SFP28 for eCPRI 10/25, DC -48 V, AISG-ES-RAE 2.0, ext. alarms MDR-26
Installation Options	Pole / Wall with mechanical adjustment
Antenna Characteristics	
Antenna configurations	physical: 12, 8, 2 (192 AE) logical: 4, 8, 2
Minimum beamwidth	horizontal: 15° (boresight) vertical: 6° (boresight)
Beamsteering angle	horizontal: ±45° vertical: ±6°
Maximum antenna gain	≥25.5 dBi

1.3.2 Photographs

Serial Number



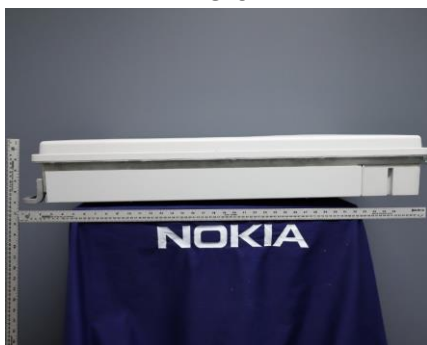
Front



Rear



Left



Right



Top



Bottom



1.4 Test Requirements

Each required measurement is listed below:

47 CFR FCC Sections	Description of Tests	Test Required
2.1046, 27.53	RF Power Output	Yes
2.1047, 27.53	Modulation Characteristics	Yes
2.1049, 27.53	(a) Occupied Bandwidth (b) Out-of-Band Emissions	Yes
2.1051, 27.53	Spurious Emissions at Antenna Terminals	Yes
2.1053, 27.53	Field Strength of Spurious Radiation	Yes
2.1055, 27.53	Frequency Stability	No*

* No Frequency Stability testing was considered necessary for this test program since there were no changes to the basic frequency determining and stabilizing circuitry (including clock and data rates.)

1.5 Test Standards & Measurement Procedures

1.5.1 Test Standards

- Title 47 Code of Federal Regulations, Federal Communications Commission Part 2.
- Title 47 Code of Federal Regulations, Federal Communications Commission Part 27.
- KDB 971168 D01 Power Measurement License Digital Systems v03r01 April 9, 2018.
- KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013
- ANSI C63.26-2015, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
- ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

1.5.2 Measurement Procedures

- FCC-IC-OB - GPCL Power Measurement, Occupied Bandwidth & Modulation Test Procedure 6-20-2019
- FCC-IC-SE - GPCL Spurious Emissions Test Procedure 6-20-2019

1.6 MEASUREMENT UNCERTAINTY

The results of the calculations to estimate uncertainties for the several test methods and standards are shown in the Table below. These are the worst-case values.

Worst-Case Estimated Measurement Uncertainties

Standard, Method or Procedure	Condition	Frequency MHz	Expanded Uncertainty (k=2)
a. Classical Emissions, (<i>e.g.</i> , ANSI C63.4, CISPR 11, 14, 32, <i>etc.</i> , using ESHS 30,	Conducted Emissions	0.009 - 30	±3.5 dB
	Radiated Emissions (AR-6 Semi-Anechoic Chamber)	30 MHz – 200MHz H	±5.1 dB
		30 MHz – 200 MHz V	±5.1 dB
		200 MHz – 1000 MHz H	±4.7 dB
		200 MHz – 1000 MHz V	±4.7 dB
		1 GHz - 18 GHz	±3.3 dB

Antenna Port Test	Signal Bandwidth	Frequency Range	Expanded Uncertainty (k=2), Amplitude
Occupied Bandwidth, Edge of Band, Conducted Spurious Emissions	10 Hz 100 Hz 10 kHz to 1 MHz 1MHz	9 kHz to 20 MHz 20 MHz to 1 GHz 1 GHz to 10 GHz 10 GHz to 40 GHz:	1.78 dB
RF Power	10 Hz to 20 MHz	50 MHz to 18 GHz	0.5 dB

1.7 Executive Summary

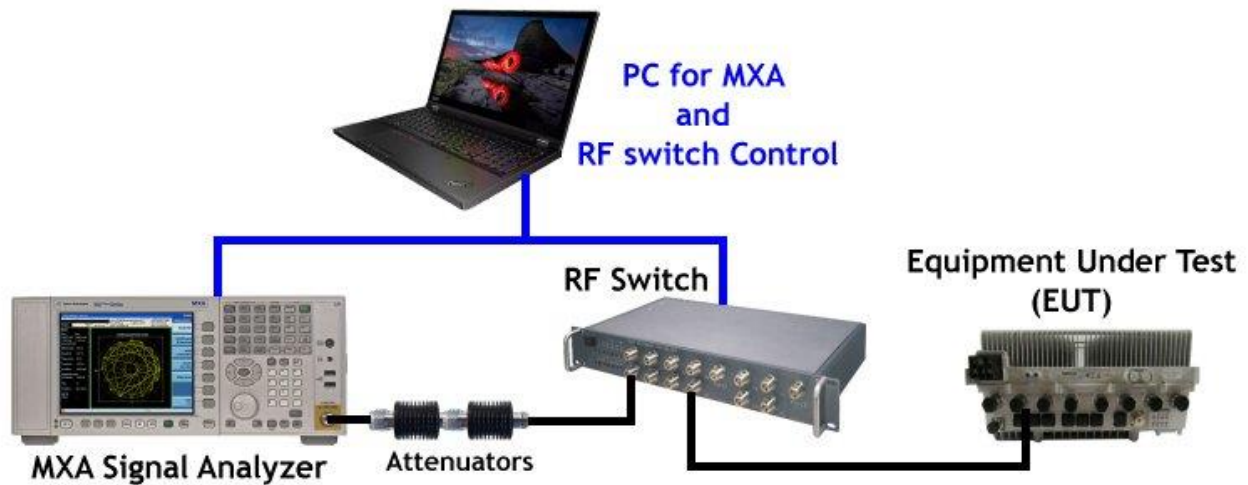
Requirement	Description	Result
47 CFR FCC Parts 2 and 27		
2.1046, 27.50	RF Power Output Peak to Average Power Ratio	COMPLIES
2.1047	Modulation Characteristics	COMPLIES
2.1049, 27.53	(a) Occupied Bandwidth (b) Edge of Band Emissions	COMPLIES
2.1051, 27.53	Spurious Emissions at Antenna Terminals	COMPLIES
2.1053, 27.53	Field Strength of Spurious Radiation	COMPLIES
2.1055, 27.54	Frequency Stability	NT*

* No Frequency Stability testing was considered necessary for this test program since there were no changes to the basic frequency determining and stabilizing circuitry (including clock and data rates.)

1. **COMPLIES** - Passed all applicable tests.
2. **N/A** – Not Applicable.
3. **NT** – Not Tested.

1.8 Test Configurations

Test Setup for Antenna Port Measurements



2. FCC Section 2.1046 - RF Power Output

2.1 RF Power Output

This test is a measurement of the total RF power level transmitted at the antenna-transmitting terminal. The product was configured for test as shown in section above and allowed to warm up and stabilize per KDB 971168 D01 and ANSI C63.26. The product has 64 ports divided into 8 segments. One segment of 8 ports was measured and is representative of the remaining segments. The results of one segment are then converted to watts, summed, and converted back to dBm to represent all 64 ports. Power measurements were made with an MXA Signal Analyzer. The measured results are tabulated below with maximum value bolded in each case.

2.1.1 1C Data

Tabular Data – Channel RF Power (1-Carrier)

Channel Power - Signal BW 30MHz					
Test Model 3.1 Modulation 64QAM Channel Frequency 2511MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 2593MHz		Test Model 3.1a Modulation 256QAM Channel Frequency 2675MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	31.971	1	32.016	1	31.924
2	32.480	2	32.558	2	32.766
3	31.948	3	31.917	3	32.190
4	32.188	4	32.160	4	32.397
5	31.537	5	31.842	5	32.062
6	31.830	6	31.803	6	32.075
7	31.843	7	31.815	7	32.032
8	31.825	8	31.809	8	32.105
Total Power (dBm)	50.02	Total Power (dBm)	50.06	Total Power (dBm)	50.26
Total Power (W)	100.52	Total Power (W)	101.36	Total Power (W)	106.25

Manufacturer tolerance: +/- 2 dB

2.1.2 4C Data

Tabular Data – Channel RF Power (4-Carrier)

Channel Power - Signal BW 30+100+20+20 MHz			
Test Model 1.1			
Modulation QPSK			
Channel Frequency 2511+ 2576 + 2660 + 2680 MHz			
TX Port	(dBm)		Total Power (dBm) / Port
1	33.442	33.444	36.453
2	33.981	33.979	36.990
3	33.647	33.644	36.656
4	33.651	33.644	36.658
5	33.446	33.436	36.451
6	33.547	33.537	36.552
7	33.452	33.439	36.456
8	33.547	33.534	36.551
Total Power (dBm)			54.66
Total Power (W)			292.48

Manufacturer tolerance: +/- 2 dB

Channel Power - Signal BW 50+100+20+20 MHz			
Test Model 1.1			
Modulation QPSK			
Channel Frequency 2521+ 2506 + 2660 + 2680 MHz			
TX Port	(dBm)		Total Power (dBm) / Port
1	35.262	31.632	36.826
2	35.535	32.175	37.182
3	35.250	31.727	36.847
4	35.389	31.840	36.978
5	34.891	33.037	37.072
6	34.900	33.079	37.095
7	34.899	33.059	37.086
8	34.821	33.106	37.058
Total Power (dBm)			55.08
Total Power (W)			322.21

Manufacturer tolerance: +/- 2 dB

2.2 Channel RF Power – Plots

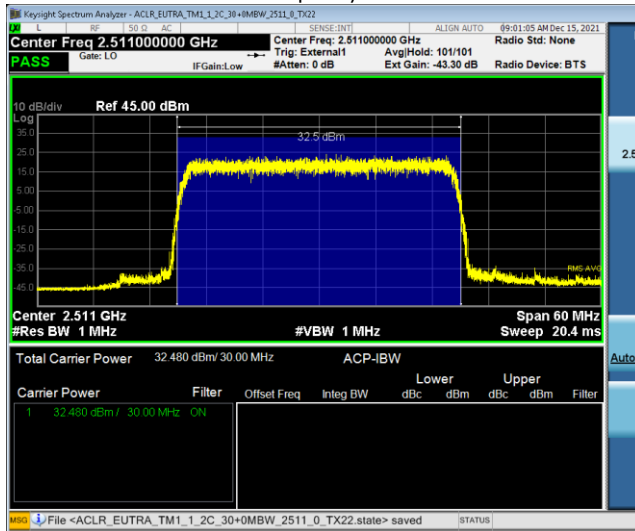
NOTE: Only the maximum value results in each case are used in this report. The full suite of raw data resides at the MH, New Jersey location.

2.2.1 1C Plots

Channel RF Power 1-Carrier, 30MHz BW

Test Model 3.1
Modulation 64QAM

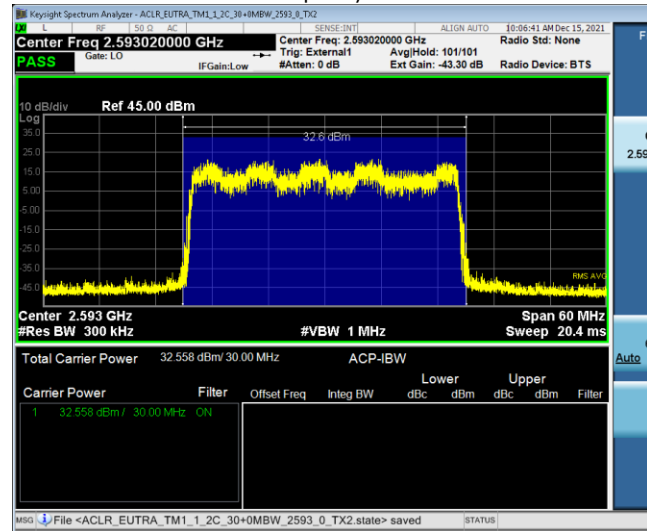
Channel Frequency 2511MHz



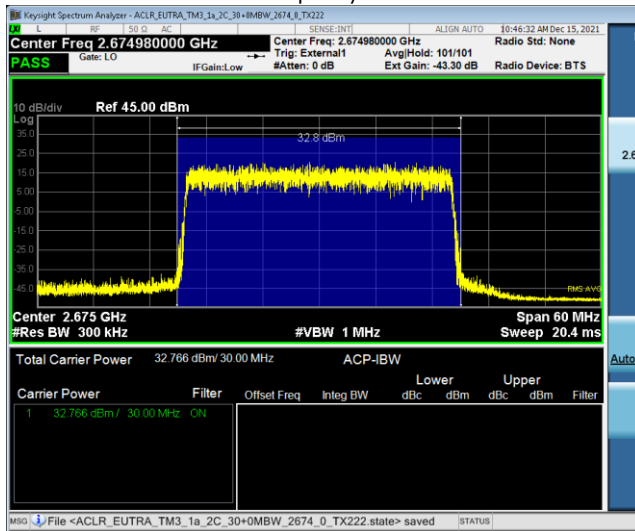
Test Model 3.2

Modulation QPSK/16QAM

Channel Frequency 2593MHz



Test Model 3.1a
Modulation 256QAM
Channel Frequency 2675MHz



2.2.2 4C Plots

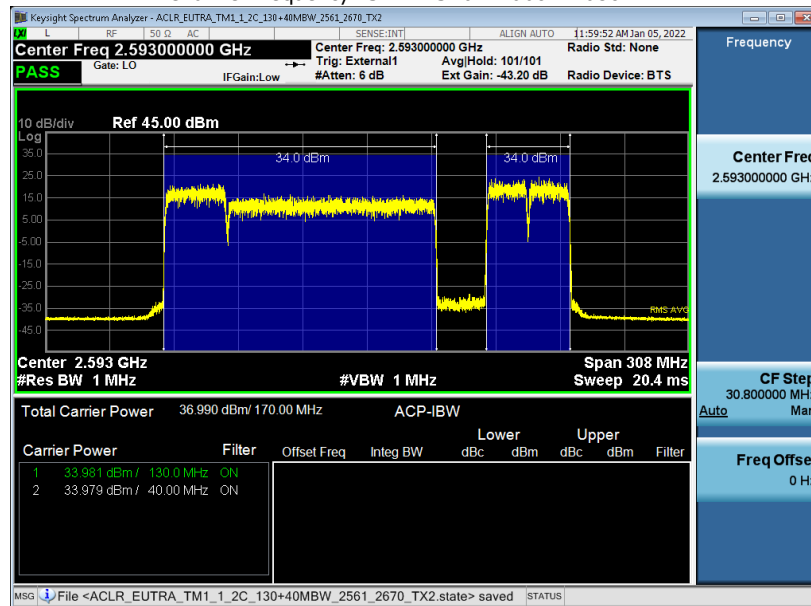
Channel RF Power 4-Carrier

Signal BW 30+100+20+20 MHz

Test Model 1.1

Modulation QPSK

Channel Frequency 2511 + 2576 + 2660 + 2680 MHz

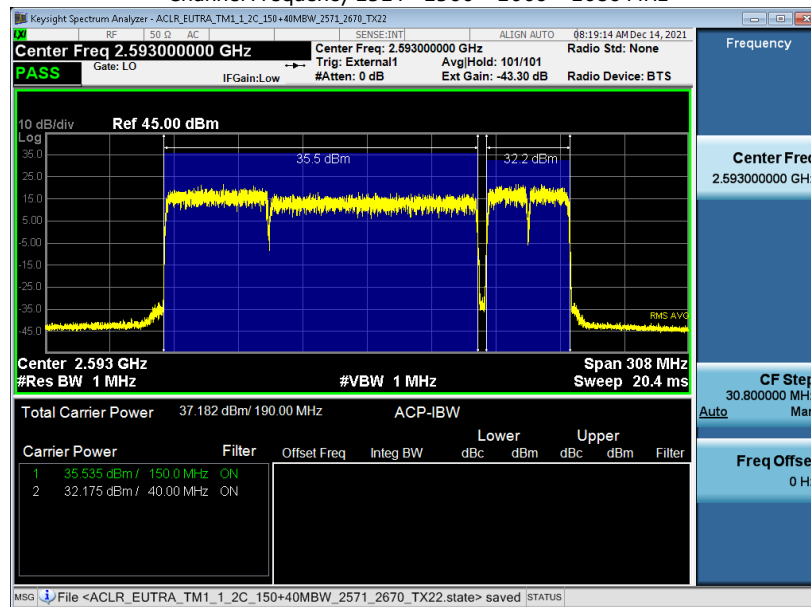


Signal BW 50+100+20+20 MHz

Test Model 1.1

Modulation QPSK

Channel Frequency 2521 + 2506 + 2660 + 2680 MHz



2.3 Peak-to-Average Power Ratio (PAPR)

The Peak-to-Average Power Ratio (PAPR) was evaluated per KDB 971168. The PAPR values of all carriers measured are below 13dB.

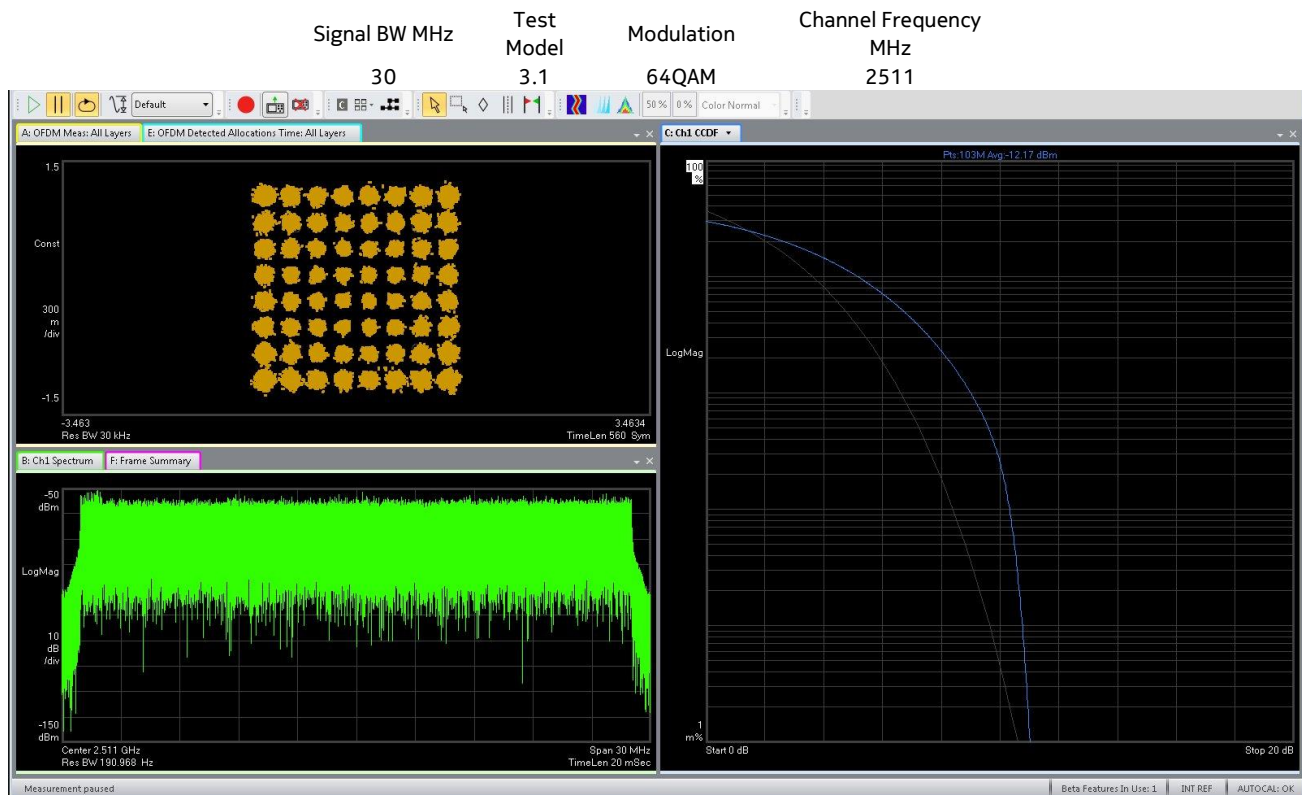
NOTE: Only a sample of the plots are used in this report. The full suite of raw data resides at the MH, New Jersey location.

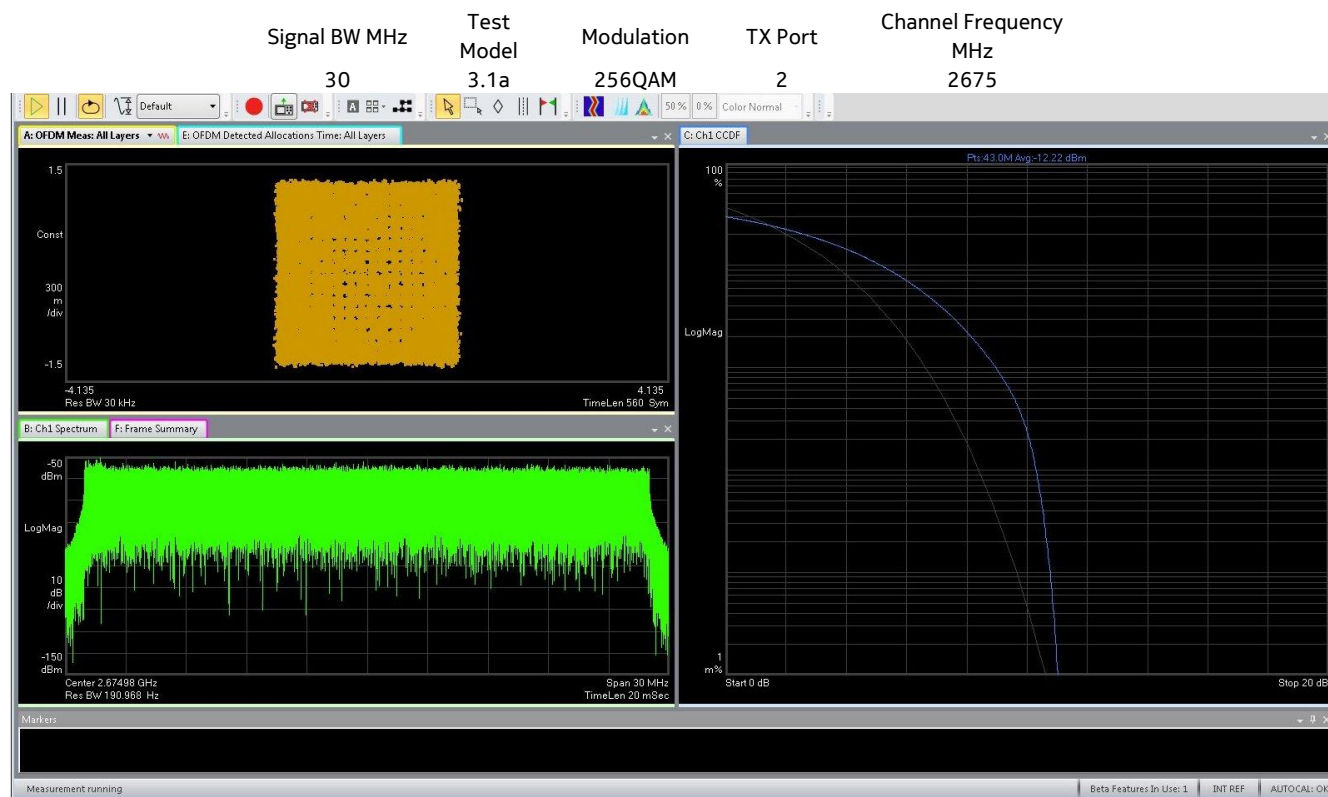
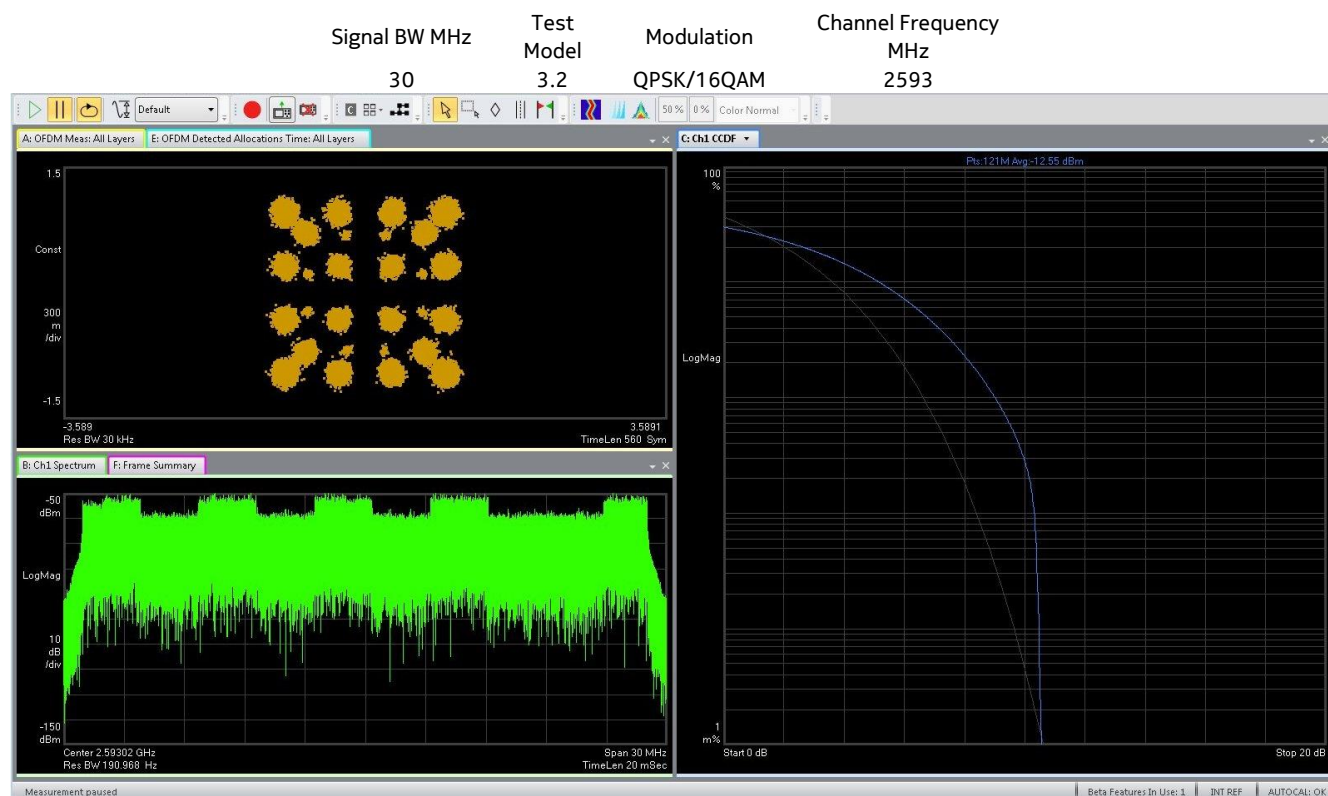
2.3.1 Peak-to-Average Power Ratio Data

Tabular Data – PAPR

# of Carriers	Signal BW MHz	Test Model	Modulation	TX Port	Channel Frequency MHz	PAR at 0.1% Limit - 13 dB
1	30	3.1	64QAM	2	2511	12.17
1	30	3.2	QPSK/16QAM	2	2593	12.55
1	30	3.1a	256QAM	2	2675	12.22

2.3.2 Peak-to-Average Power Ratio – Plots



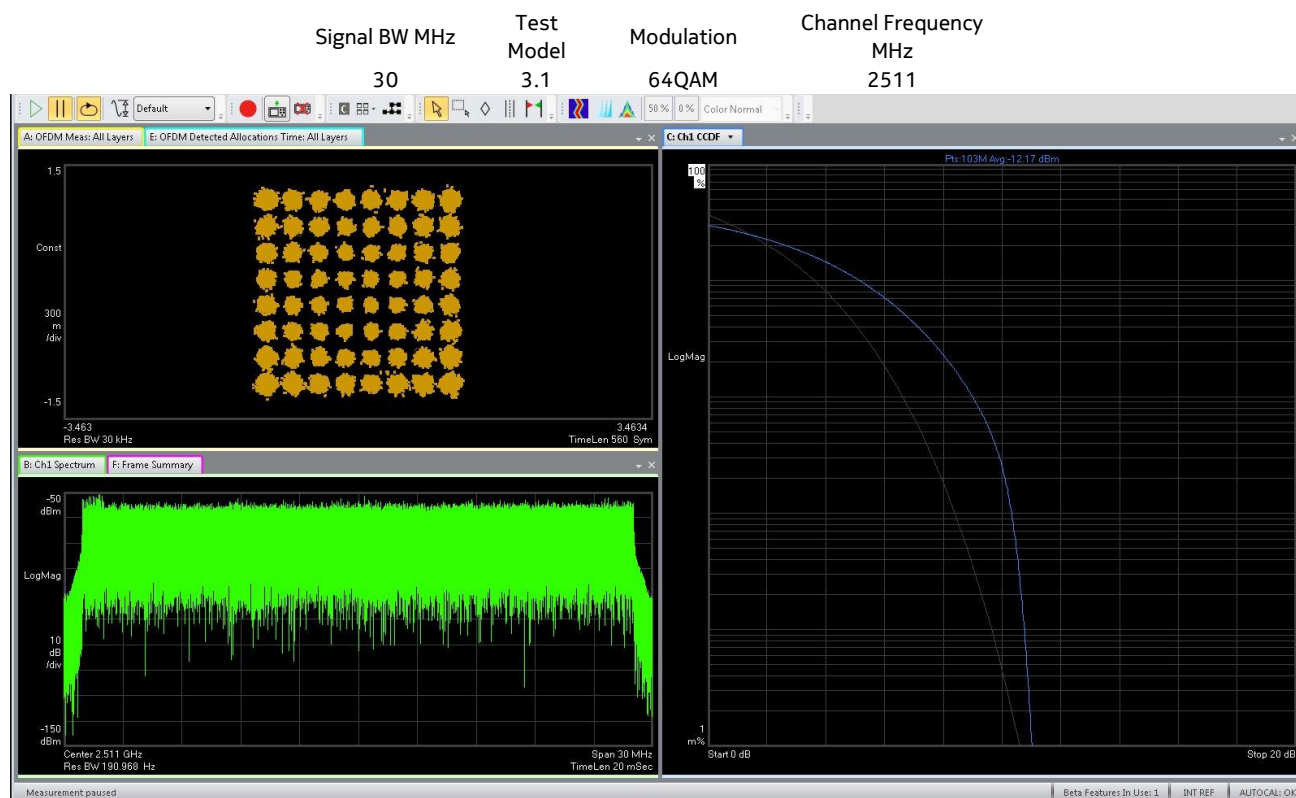


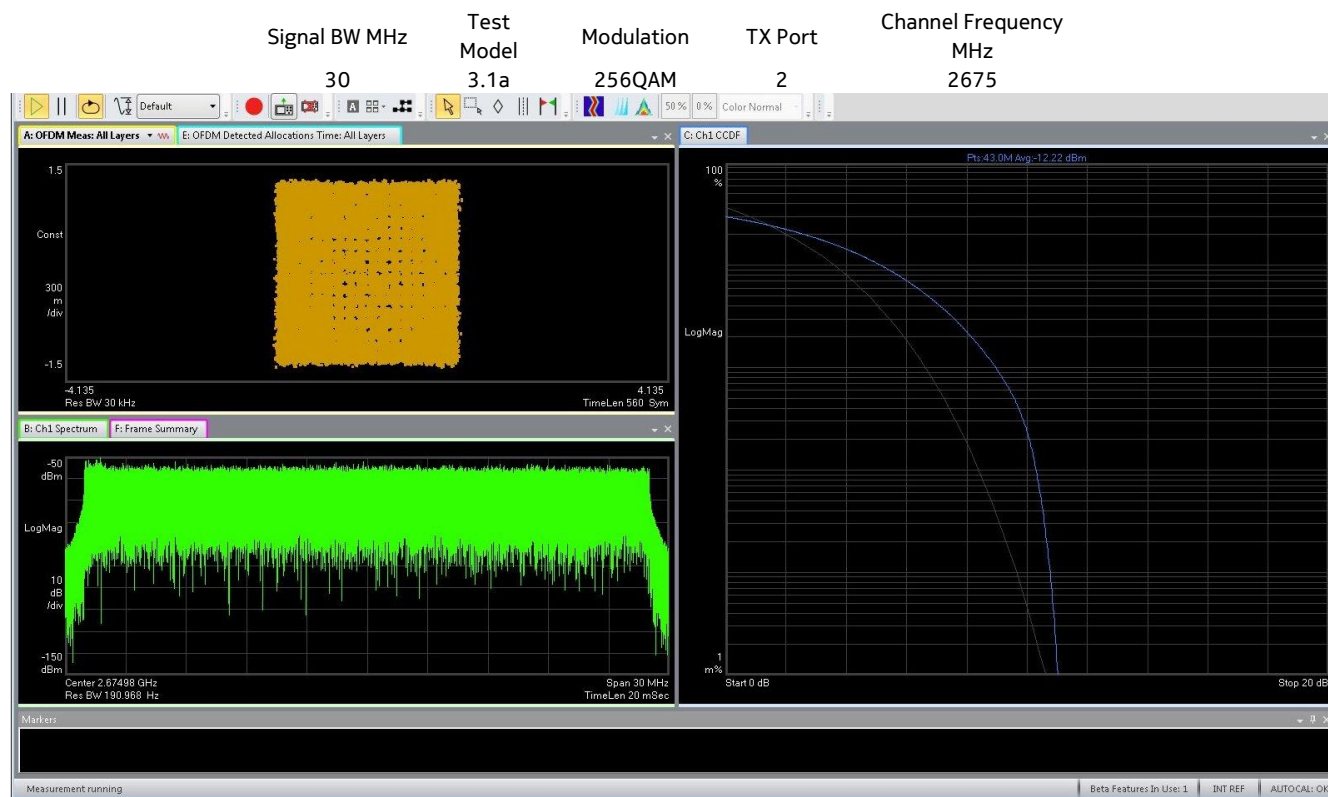
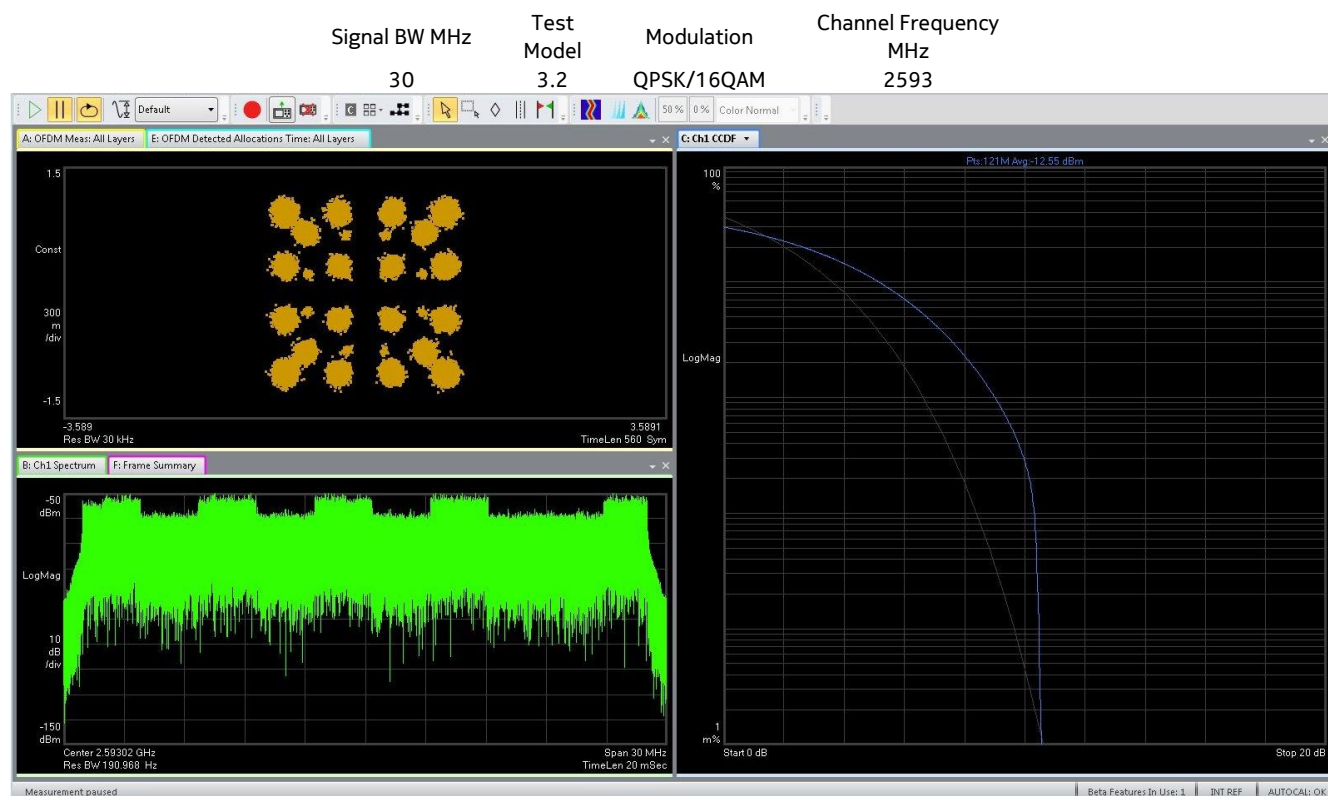
3. FCC Section 2.1047 - Modulation Characteristics

3.1 Modulation Characteristics

The RF signal at the antenna port was demodulated and verified for correctness of the modulation signal used before each test was performed.

3.1.1 Modulation Characteristics





4. FCC Section 2.1049 – Occupied Bandwidth/Edge of Band Emissions

4.1 Occupied Bandwidth

In 47CFR 2.1049 the FCC requires:

“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 as applicable.”

This required measurement is the 99% Occupied Bandwidth, also called the designated signal bandwidth and needs to be within the parameters of the products specified emissions designator. During these measurements it is customary to evaluate the Edge of Band emissions at block/band edges.

The transmitted signal occupied bandwidth was measured using a Keysight MXA Signal Analyzer. All emissions were within the parameters as required.

Tabular Data – Occupied Bandwidth

# of Carriers	Signal BW MHz	Test Model	Modulation	TX Port	Channel Frequency MHz	99% Occupied BW MHz
1	30	3.1	64QAM	2	2511	27.729
1	30	3.2	QPSK/16QAM	2	2593	27.656
1	30	3.1a	256QAM	2	2675	27.731
4	30+100+20+20	1.1	QPSK	2	2561+2670	127.19+38.039
4	50+100+20+20	1.1	QPSK	2	2571+2670	147.15+38.535

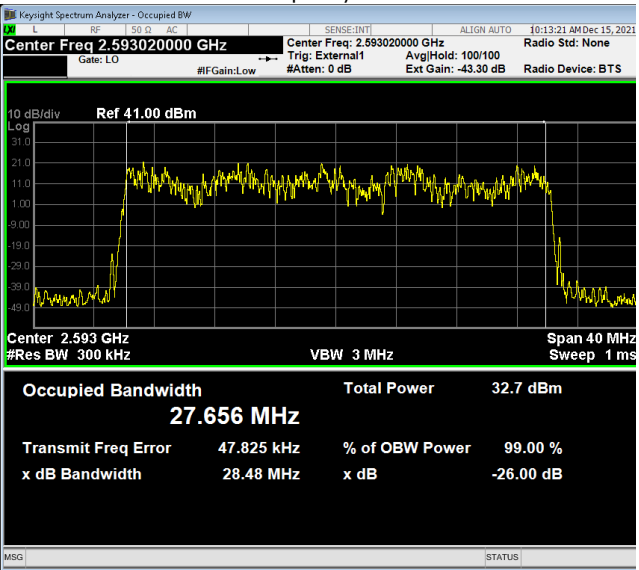
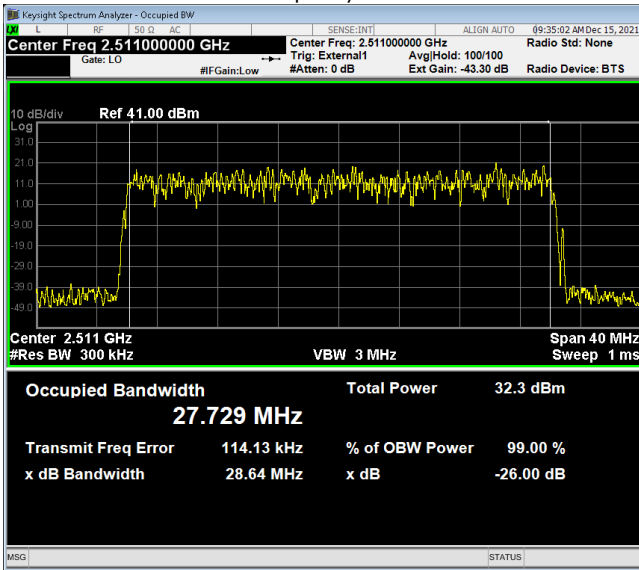
4.1.1 Occupied Bandwidth - Plots

4.1.1.1 1C Plots

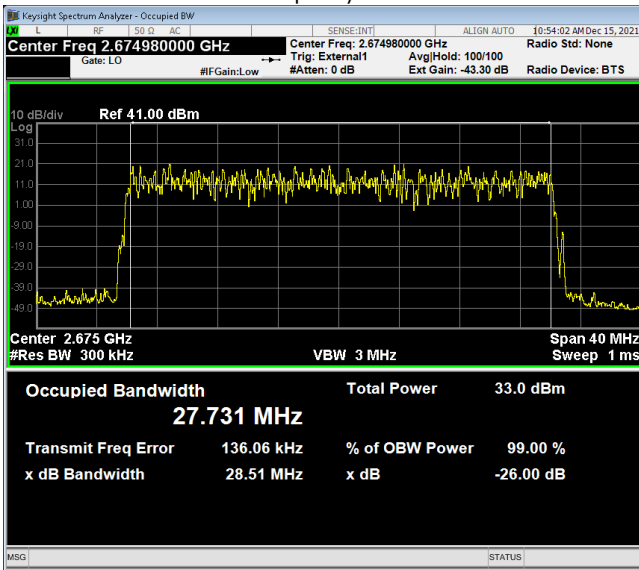
OBW 1-Carrier, 30MHz BW

Test Model 3.1
Modulation 64QAM
Channel Frequency 2511MHz

Test Model 3.2
Modulation QPSK/16QAM
Channel Frequency 2593MHz



Test Model 3.1a
Modulation 256QAM
Channel Frequency 2675MHz



4.1.1.2 4C Plots

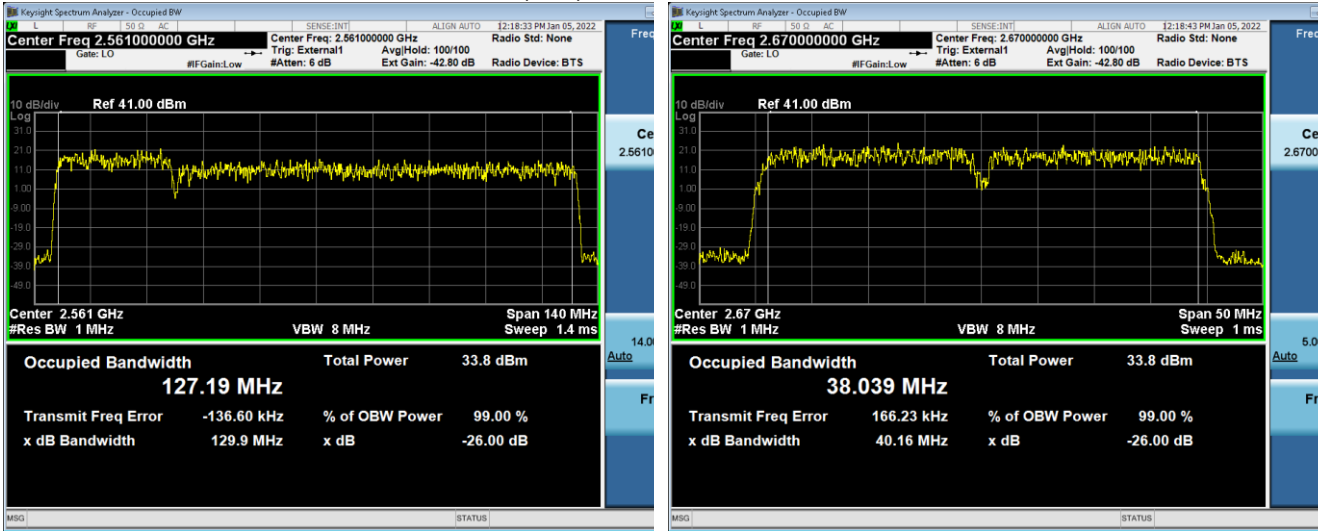
OBW 4-Carrier

Signal BW 30+100+20+20 MHz

Test Model 1.1

Modulation QPSK

Channel Frequency 2511 + 2576 + 2660 + 2680 MHz

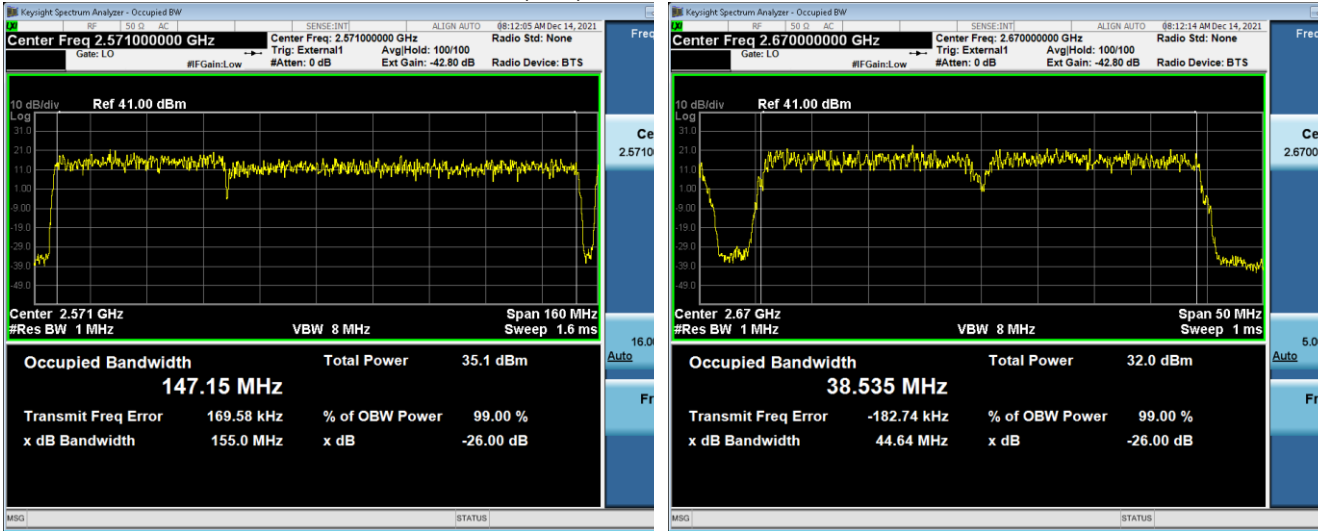


Signal BW 50+100+20+20 MHz

Test Model 1.1

Modulation QPSK

Channel Frequency 2521 + 2506 + 2660 + 2680 MHz



4.2 Edge of band Emissions

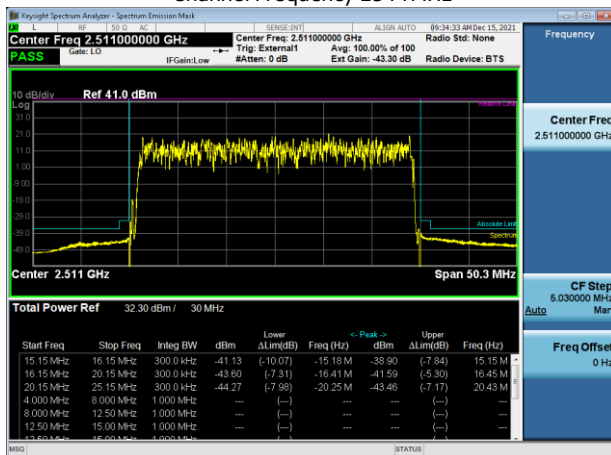
The Edge of Band emissions of the EUT at the external antenna connector (EAC) were measured using a Keysight MXA Signal Analyzer. The RF power level was continuously measured using a RF broadband power meter. The RF output from the EAC port to signal analyzer was reduced (to an amplitude usable by the signal analyzer) by using a calibrated attenuator and test coupler. The path attenuation was offset on the display and the signal for the carrier was adjusted to the corrected RF power level for the resolution bandwidth used for the transmit signal. All mask values were adjusted based upon the designated signal bandwidth and measurement bandwidths. The Top of Mask corresponds to the set rated power level as confirmed by the RF power meter.

The required emission limitation for the edge of band is specified as appropriate in 27.53. The measured spurious emission levels were plotted for one port with the limit line (-13 dBm) adjusted for 64 ports where $10\log(64) = 18\text{dBm}$, the limit is 31dBm/MHz.

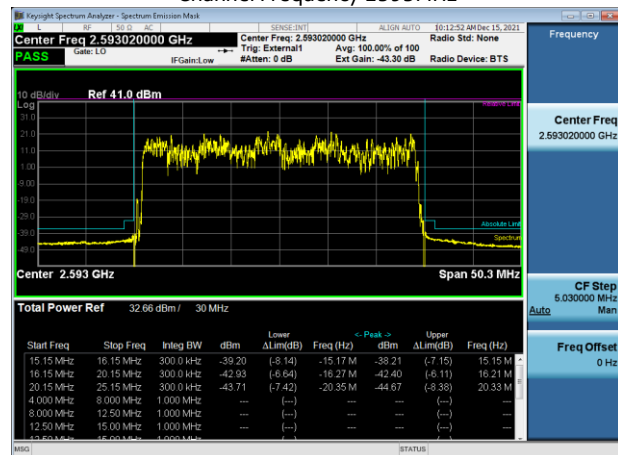
4.2.1 1C Plots

OOBE 1-Carrier, 30MHz BW

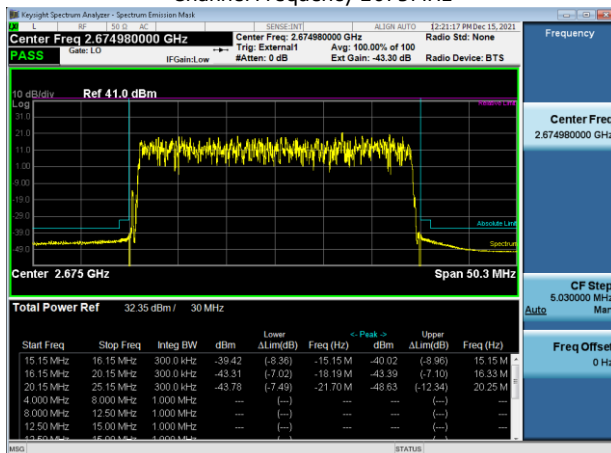
Test Model 3.1
Modulation 64QAM
Channel Frequency 2511MHz



Test Model 3.2
Modulation QPSK/16QAM
Channel Frequency 2593MHz



Test Model 3.1a
Modulation 256QAM
Channel Frequency 2675MHz



4.2.2 4C Plots

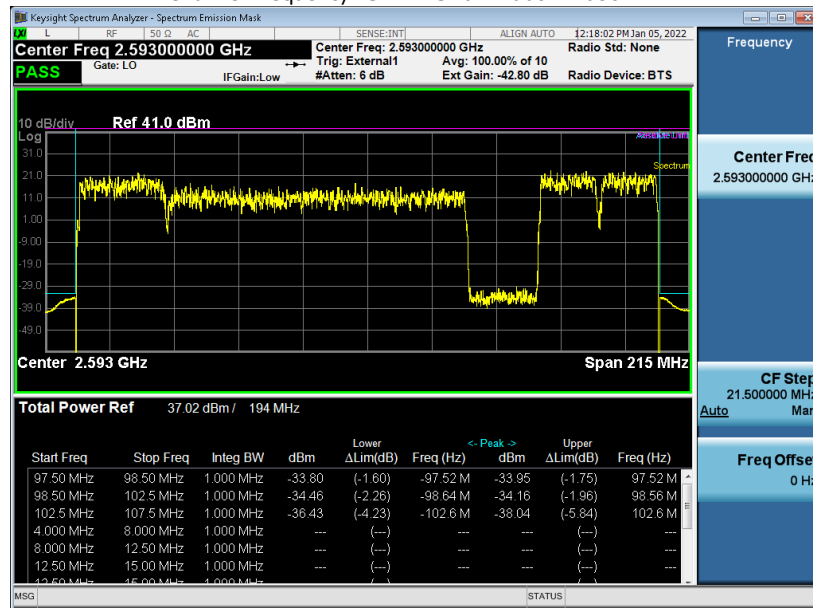
OOBE 4-Carrier

Signal BW 30+100+20+20 MHz

Test Model 1.1

Modulation QPSK

Channel Frequency 2511 + 2576 + 2660 + 2680 MHz

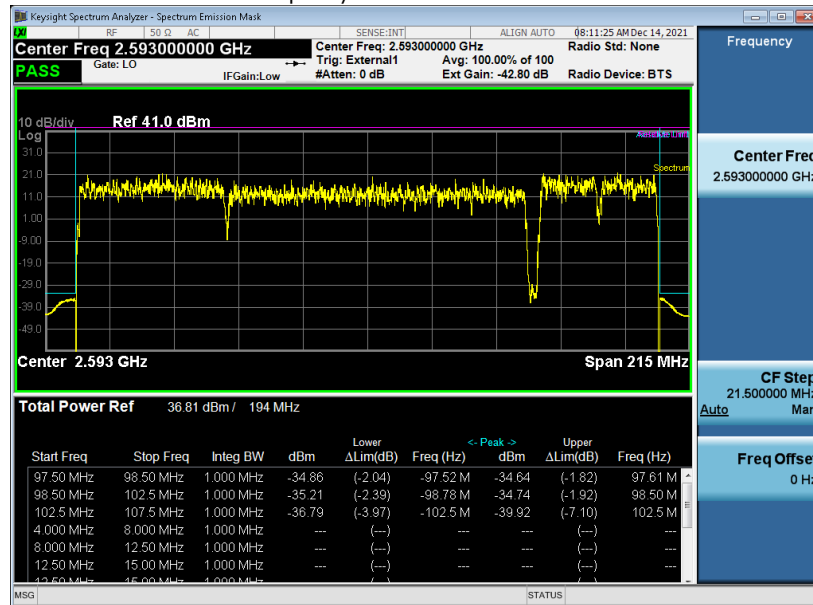


Signal BW 50+100+20+20 MHz

Test Model 1.1

Modulation QPSK

Channel Frequency 2521 + 2506 + 2660 + 2680 MHz



5. FCC Section 2.1051 - Spurious Emissions at Transmit Antenna Port

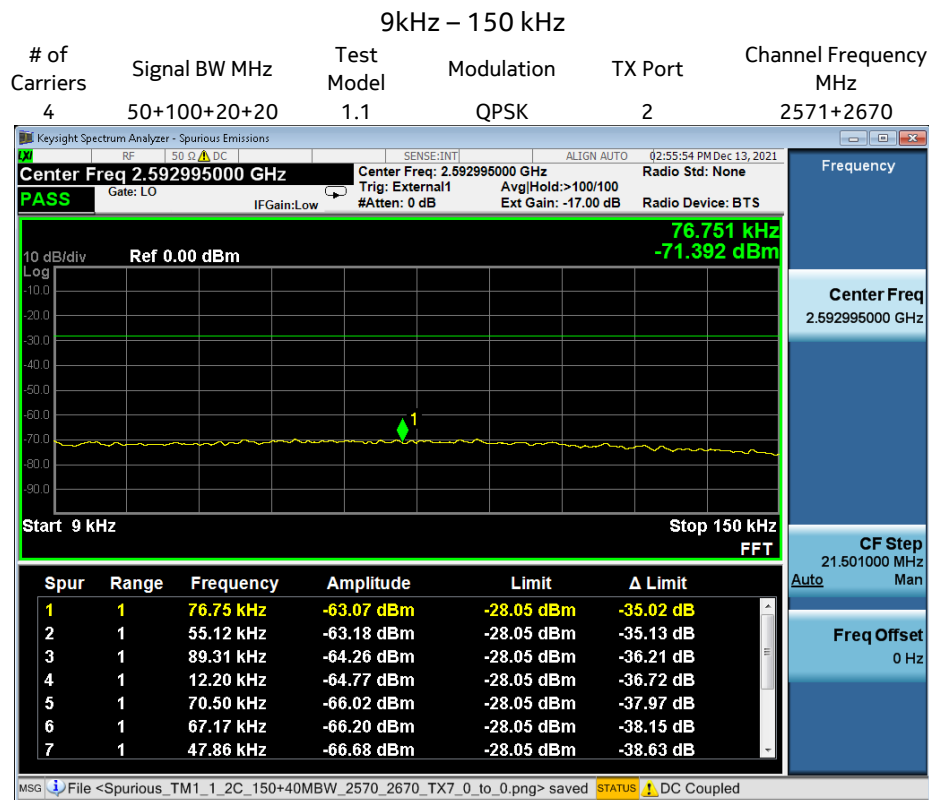
5.1 Measurement of Spurious Emissions at Transmit Antenna Port

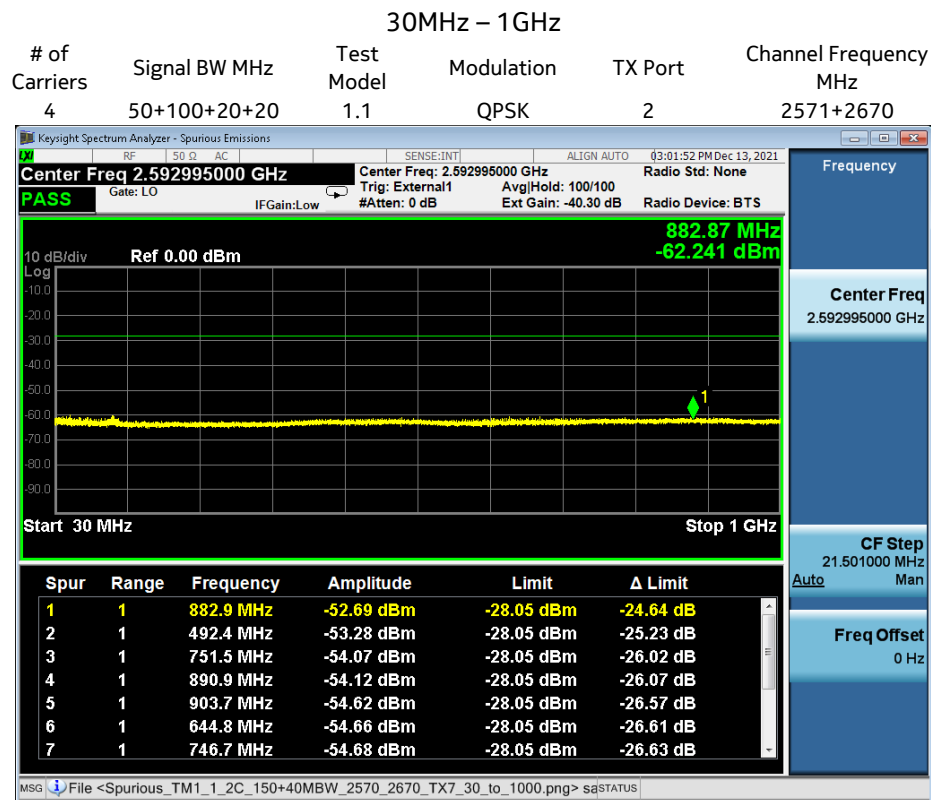
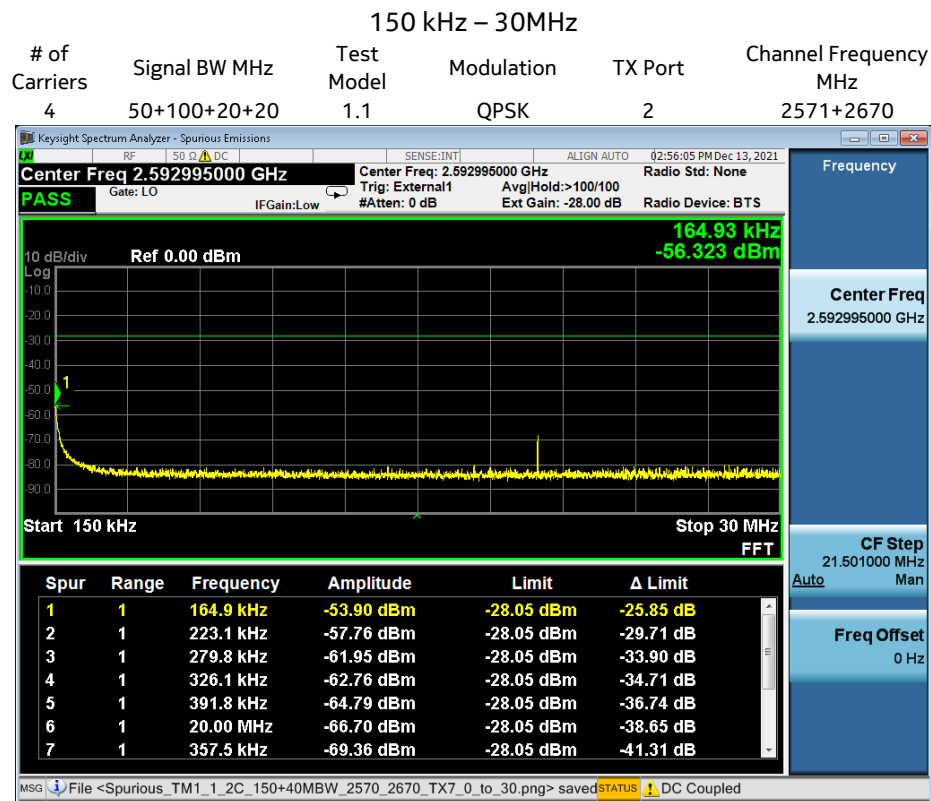
Spurious Emissions at the transmit-antenna terminals were investigated over the frequency range of 9 kHz to beyond the 10th harmonic of the specific transmit band. Carrier Bandwidth is exempt. For this band of operation, the measurements were performed up to 27 GHz. Measurements were made using a Keysight MXA Signal Analyzer. The RF output from the transmitter was reduced (to an amplitude usable by the receivers) using calibrated attenuators. The RF power level was continuously monitored via a coupled RF Power Meter.

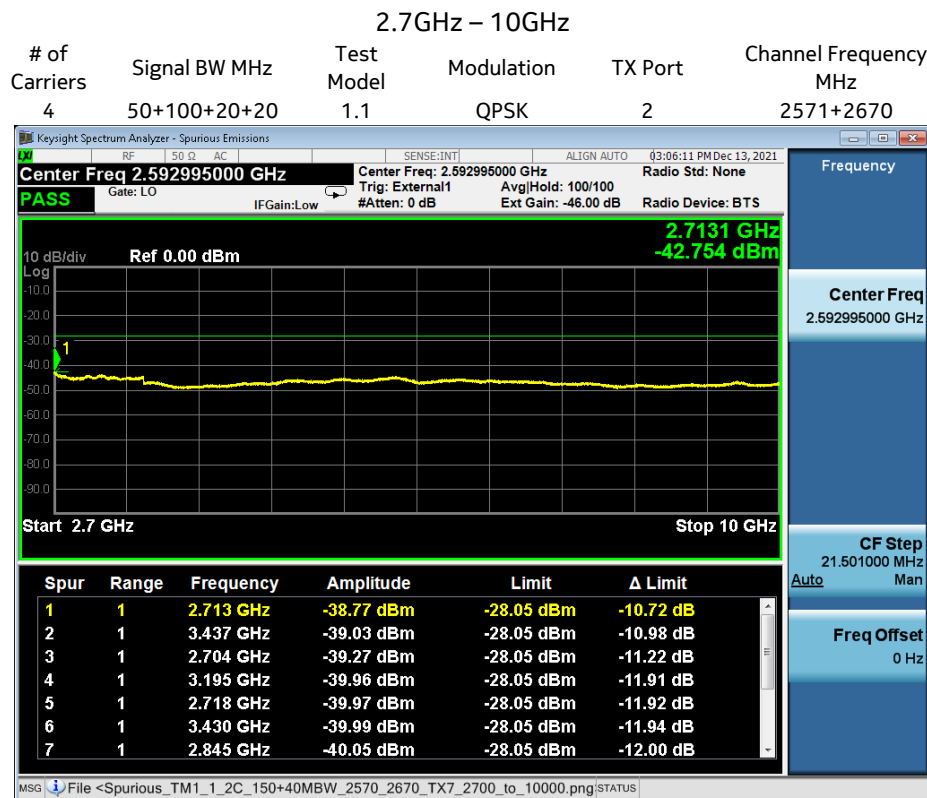
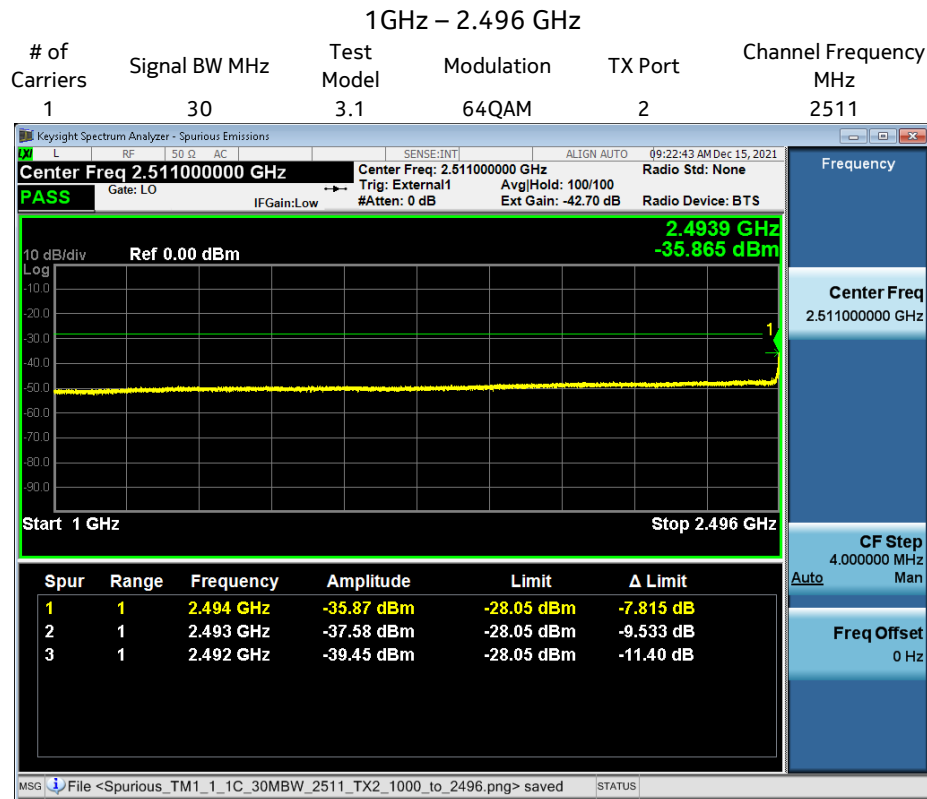
The required emission limitation is specified as appropriate in 27.53. The measured spurious emission levels were plotted for the frequency range as specified in 2.1057. For 64 ports where $10\log(64) = 18\text{dBm}$, the limit is -31dBm/MHz . Data below documents performance up to 27 GHz.

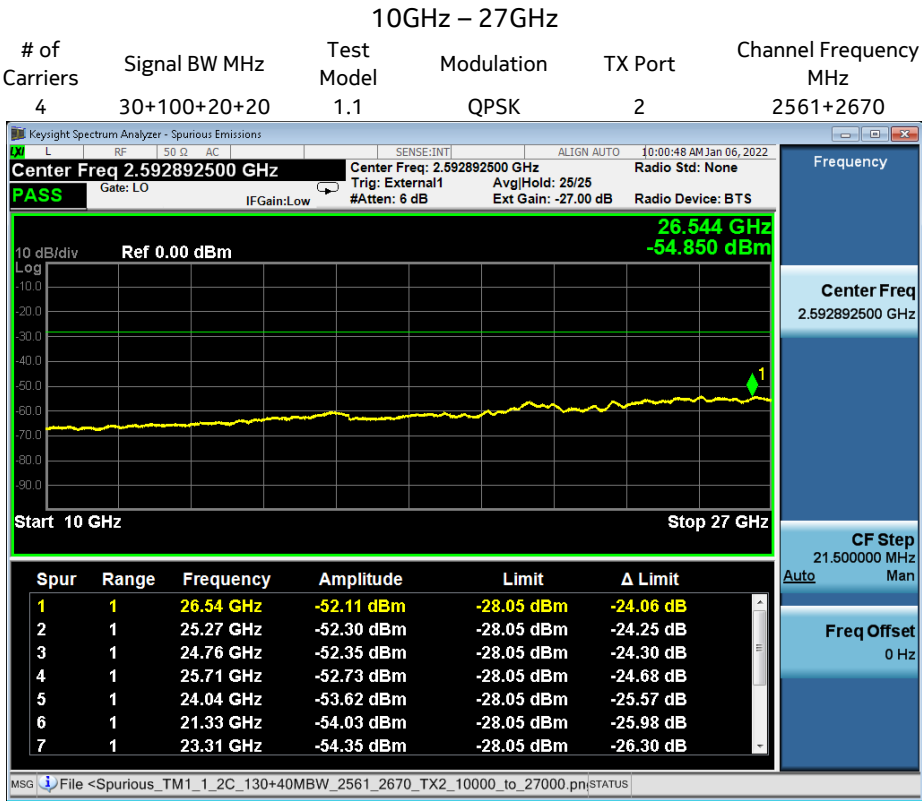
The Spurious Emission plots below show an incorrect limit of -28.05 dBm . However, all plots show enough margin to pass the correct limit of -31 dBm .

NOTES: Only the emissions plots which give the minimum emission margin in each frequency range were used in this report. The full suite of raw data resides at the MH, New Jersey location.









6. FCC Section 2.1053 - Field strength of spurious radiation

6.1 Section 2.1053 Field Strength of Spurious Emissions

Field strength measurements of radiated spurious emissions were made in an FCC registered 3m Semi-Anechoic Chamber which is maintained by Nokia Bell Labs in Murray Hill, New Jersey. A complete description and full measurement data for the site is on file with the Commission (Site Registration Number: 515091).

The spectrum from 30 MHz to beyond the tenth harmonic of the carrier, 26.5 GHz, was searched for spurious radiation. Measurements were made using both horizontally and vertically polarized broadband antennas. Per FCC regulations, the comparison of out of band spurious emissions directly to the limit is appropriately made using the substitution method. However, when the emissions are more than 20 dB below the specification limit, the use of field strength measurements for compliance determination is acceptable and those emissions are considered not reportable (Section 2.1053 and the FCC Interpretive database for 2.1053). For this case the evaluation of acceptable radiated field strength is as follows.

6.2 Field Strength of Spurious Emissions - Limits

Sections 2.1053 and 27.53 contain the requirements for the levels of spurious radiation as a function of the level of the unmodulated carrier. The reference level for the unmodulated carrier is calculated as the field produced by an ideal dipole excited by the transmitter output power according to the following relation taken from Reference Data for Radio Engineers, page 676, 4th edition, IT&T Corp.

$$E = [(30 \cdot P)^{1/2}] / R$$

$$20 \log (E \cdot 10^6) - (43 + 10 \log P) = 82.23 \text{ dB}\mu\text{V/meter}$$

Where:

E = Field Intensity in Volts/meter

P = Transmitted Power in Watts

R = Measurement distance in meters = 3 m

The Part 27 Limit is 82.23 dB μ V/m at 3m and 91.77 dB μ V/m at 1m

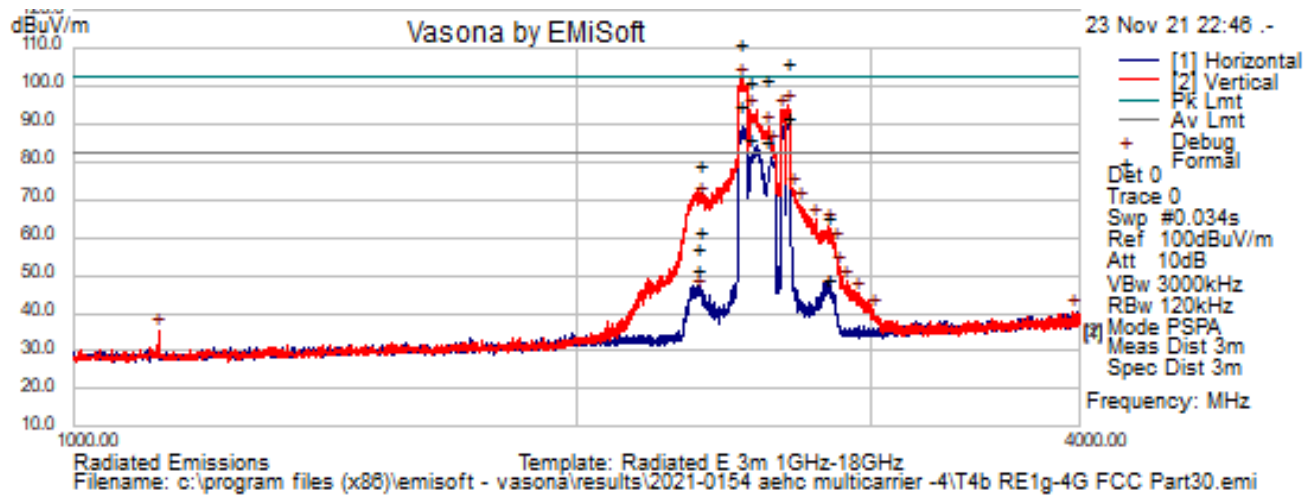
The Part 27 non-report level is 62.23 dB μ V/m at 3m.

The calculated emission levels were found by:

$$\text{Measured level (dB}\mu\text{V)} + \text{Cable Loss(dB)} + \text{Antenna Factor(dB)} = \text{Field Strength (dB}\mu\text{V/m)}$$

RESULTS:

For compliance with 47CFR Parts 2 and 27, the field strength of any spurious radiation, measured at 3m, is required to be less than 82.23 dB μ V/meter (82.23 @ 3m). Emissions equal to or less than 62.23 dB μ V/meter at 3m are not reportable and may be verified using field strength measurements and broadband antennas. See reportable emissions below in bold.



Test Information

Results Title	Radiated E 3m 1GHz-18GHz
File Name	T4b RE1g-4G FCC Part30.emi
Test Laboratory	MH-AR9, 38%RH, 21C, 995hPa.
Test Engineer	MJS
Test Software	Vasona by EMiSoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	AEHC - 5G Multicarrier Class II with 30 MHz - FCC. 5G 2CC 100M + 50M, LTE 2CC 20M +20M, Tx-2.521G, 2.596G, 2.660G, 2.680G. TM1.1 Power per port 35 Watts. SN-L1203206454, PN-475124B.101.
Configuration	AR9 Powered by -48Vdc, ESI26G-E908, Horn antenna E518, PA-E447, 6dB Pad E1130, RE 1GHz - 4GHz FCC Part 27. Cable set-E1503 + E1504. Internal Attenuation 10dB Preview RBW 120k; Formal RBW 1M
Date	2021-11-23 22:46:18

Formal Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
2511.849038	111.41	9.92	-10.31	111.02	PeakMax	V	273	1	102.23	8.79	Fail	TX Exempt
2679.028517	105.91	10.08	-9.81	106.18	PeakMax	V	255	349	102.23	3.95	Fail	TX Exempt
2543.998938	101.60	9.95	-10.21	101.35	PeakMax	V	157	5	102.23	-0.88	Pass	TX Exempt
2604.280	102.01	10.01	-10.03	102.00	PeakMax	V	213	1	102.23	-0.23	Pass	TX Exempt
2371.829	80.03	9.79	-10.57	79.25	PeakMax	V	134	5	102.23	-22.98	Pass	
2363.623	58.17	9.78	-10.59	57.36	PeakMax	H	201	42	102.23	-44.87	Pass	
2830.388	64.34	10.22	-9.39	65.18	PeakMax	H	164	58	102.23	-37.05	Pass	
2511.849038	95.01	9.92	-10.31	94.62	AvgMax	V	273	1	82.23	12.39	Fail	TX Exempt
2679.028517	91.68	10.08	-9.81	91.95	AvgMax	V	255	349	82.23	9.72	Fail	TX Exempt
2543.998938	86.35	9.95	-10.21	86.09	AvgMax	V	157	5	82.23	3.86	Fail	TX Exempt
2604.280	85.48	10.01	-10.03	85.46	AvgMax	V	213	1	82.23	3.23	Fail	TX Exempt
2371.829	62.76	9.79	-10.57	61.98	AvgMax	V	134	5	82.23	-20.25	Pass	
2363.623	52.13	9.78	-10.59	51.32	AvgMax	H	201	42	82.23	-30.91	Pass	
2830.388	48.06	10.22	-9.39	48.90	AvgMax	H	164	58	82.23	-33.33	Pass	

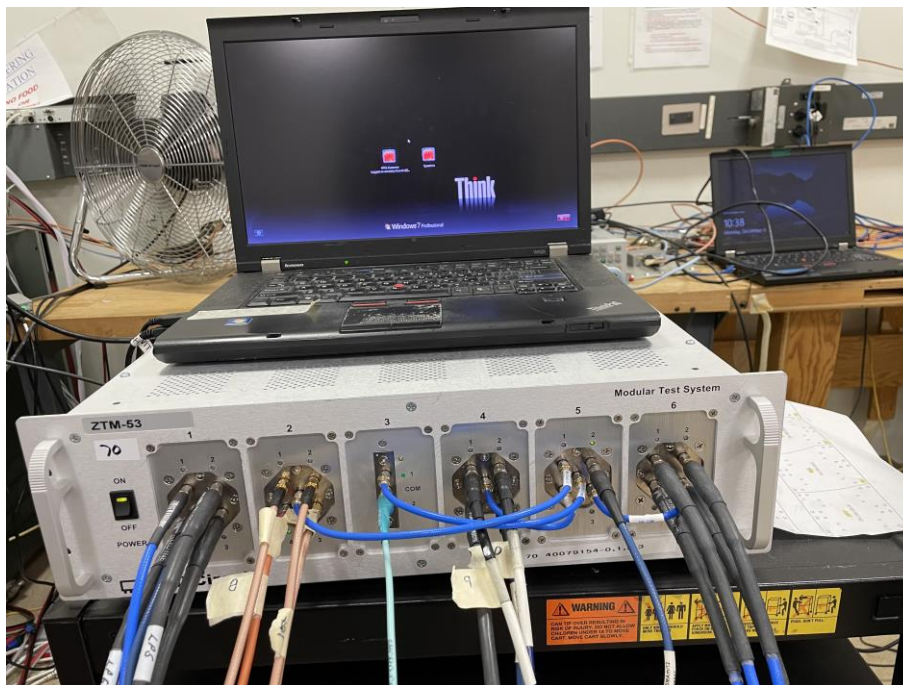
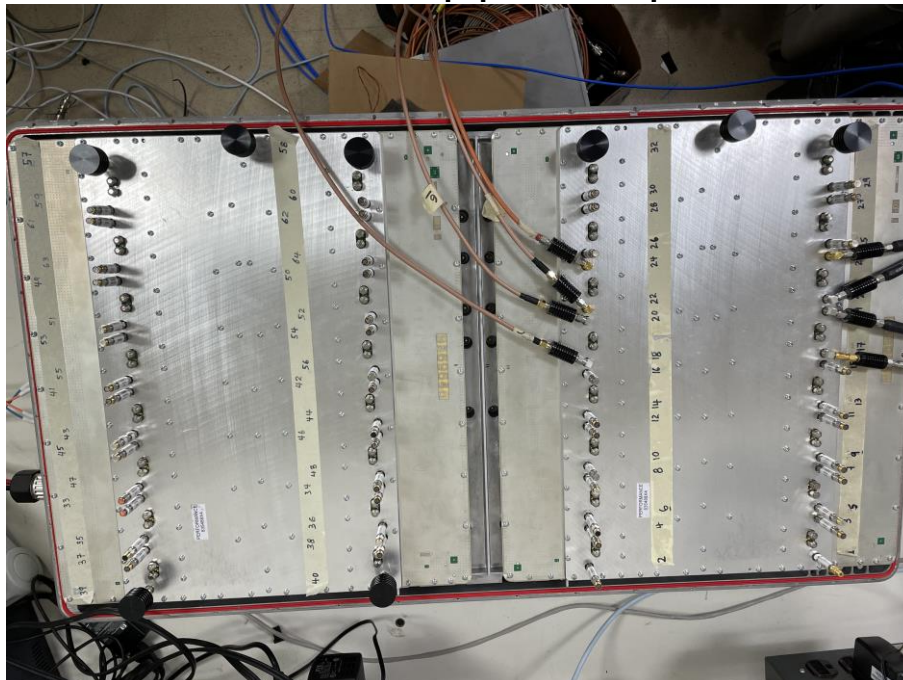
Preview Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
2511.849038	102.16	9.92	-10.31	101.77	Debug	V	150	0	82.23	19.54	Fail	
2679.028517	94.34	10.08	-9.81	94.61	Debug	V	150	350	82.23	12.38	Fail	
2651.701102	93.67	10.06	-9.89	93.84	Debug	V	150	350	82.23	11.61	Fail	
2543.998938	94.04	9.95	-10.21	93.78	Debug	V	150	0	82.23	11.55	Fail	
2604.280	89.07	10.01	-10.03	89.06	Debug	V	150	0	82.23	6.83	Fail	
2621.158697	84.09	10.03	-9.98	84.13	Debug	V	150	350	82.23	1.90	Fail	
2692.692224	72.32	10.10	-9.77	72.65	Debug	V	150	0	82.23	-9.58	Pass	
2723.234629	68.40	10.13	-9.69	68.84	Debug	V	150	0	82.23	-13.39	Pass	
2779.496954	63.96	10.18	-9.53	64.61	Debug	V	150	0	82.23	-17.62	Pass	
2829.329299	62.35	10.22	-9.39	63.18	Debug	V	150	0	82.23	-19.05	Pass	
2854.245471	57.56	10.25	-9.32	58.48	Debug	V	150	0	82.23	-23.75	Pass	
2872.731663	51.17	10.26	-9.27	52.15	Debug	V	150	0	82.23	-30.08	Pass	
2900.862826	47.09	10.29	-9.20	48.18	Debug	V	150	0	82.23	-34.05	Pass	
2940.246453	44.02	10.32	-9.09	45.25	Debug	V	150	0	82.23	-36.98	Pass	
3011.77998	39.45	10.38	-8.90	40.93	Debug	V	150	0	82.23	-41.30	Pass	
3964.892966	34.96	11.26	-5.65	40.57	Debug	V	150	135	82.23	-41.66	Pass	
1124.580862	42.91	8.56	-15.86	35.61	Debug	V	150	180	82.23	-46.62	Pass	
2371.829	71.10	9.79	-10.57	70.32	Debug	V	143	350	82.23	-11.91	Pass	
2363.623	46.78	9.78	-10.59	45.98	Debug	H	143	350	82.23	-36.25	Pass	
2830.388	44.84	10.22	-9.39	45.68	Debug	H	143	350	82.23	-36.55	Pass	

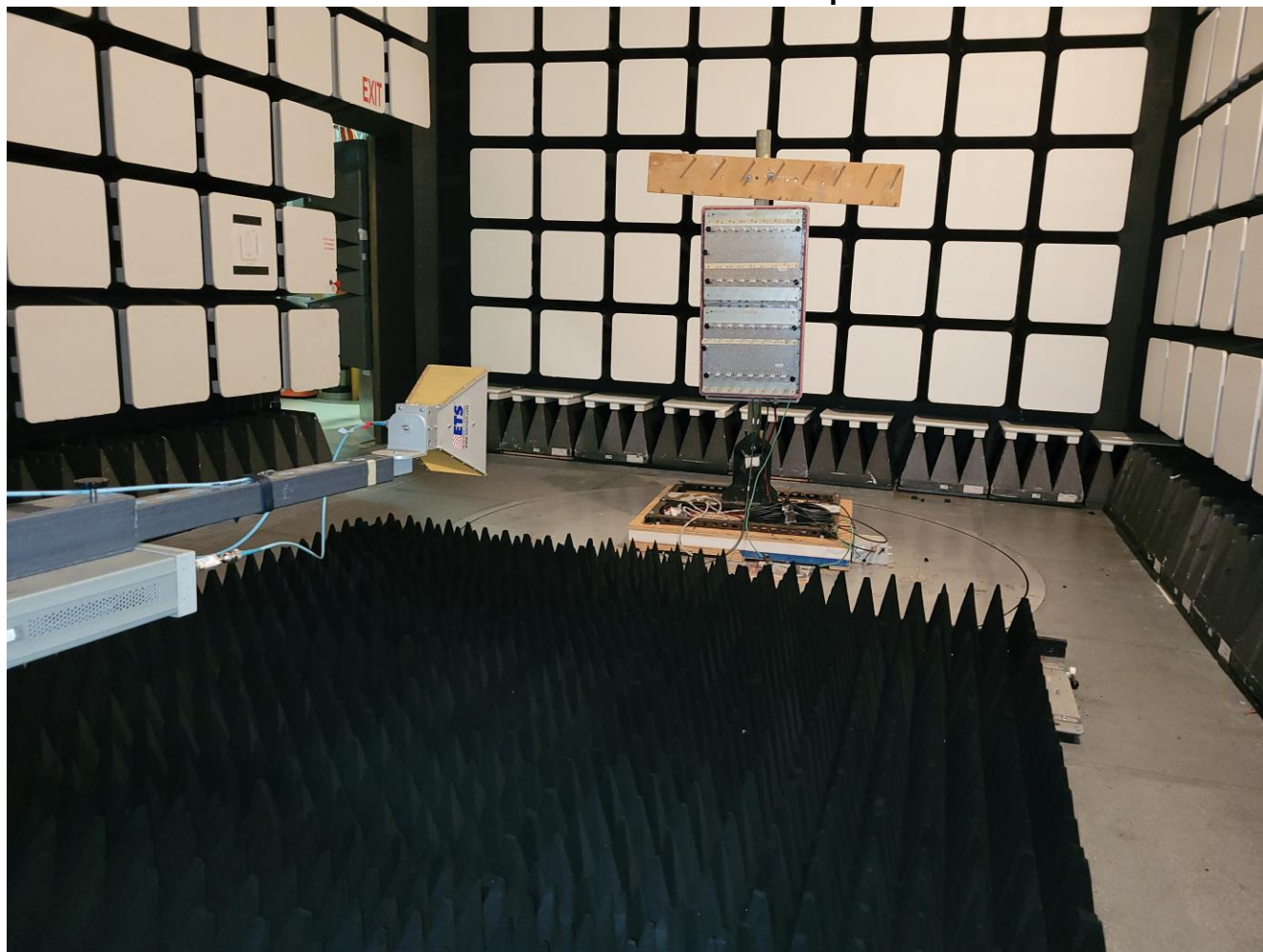
Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

Photographs

Radio Test Equipment Setup



Radiated Emission Test Setup



Test Equipment

Radio Test Equipment List

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due
E1217	KeySight Technologies	EMI Receiver	MXE EMI Receiver 26.5GHz	N9038A	MY54130087	2021-05-11	2023-05-11
E896	Agilent Technologies	Network Analyzer	10 MHz - 40 GHz	N5230C	MY49000897	2021-03-03	2023-03-03
E1534	Traceable	Data Logger	Barometric Humidity Temp Data Logger	6529	200648430	2020-10-21	2022-10-21
E1212	RLC Electronics	Filter, High Pass	10 - 30 GHz, 2W, 5dB	F-19414	1444002	CNR-V	CNR-V
E1022	Weinschel	Attenuator	10dB DC-18GHz 25W	46-10-34-LIM	BN3118	CNR-V	CNR-V
E1023	Weinschel	Attenuator	20 dB DC-18 GHz 25W	46-20-34	BJ4772	CNR-V	CNR-V
E1344	Macom	Attenuator	3 dB, DC - 4 GHz, 2W	2082-6171-03	N/A	CNR-V	CNR-V
E1155	Weinschel	Attenuator	10dB 25W 0.05- 26GHz	74-10-12	1068	CNR-V	CNR-V
E1154	Weinschel	Attenuator	30dB 25W 0.05GHz-26GHz	74-30-12	1065	CNR-V	CNR-V
E1250	Weinschel	Attenuator	3dB Attenuator 100W	24-3-43	BB9072	CNR-V	CNR-V
E1251	Aeroflex	Attenuator	30dB 150W DC-18GHz Attenuator	66-30-33	BV1667	CNR-V	CNR-V

CNR-V: Calibration Not Required, Must Be Verified

Tests were performed between 12/15/2021 - 1/12/2022.

Radiated Emission Test Equipment

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due
E1119	Extech	Data Logger	Pressure Humidity Temp data logger	SD700	Q668960	2021-01-11	2023-01-11
E518	EMCO	Horn Antenna	Double Ridged Horn 1-18 Ghz	3115	6431	2021-02-16	2023-02-16
E447	Hewlett Packard	Pre-Amplifier	Preamplifier 1-26.5 GHz	8449B	3008A01384	2020-08-31	2022-08-31
E1503	Micro-Coax	Cable	1-18GHz, N(m)+N(m), 300 inch	UFA210B-0-3000-500500	234419-001	CNR-V	CNR-V
E1504	Micro-Coax	Cable	1-18GHz, N(m)+N(m), 36 inch	UFA210B-0-0360-500500	234418-001	CNR-V	CNR-V
E908	Rohde & Schwarz	Test Receiver	EMI (20Hz to 40 GHz)-150 +30dBm	ESIB40	100100	2020-04-17	2022-04-17
E1384	Rohde & Schwarz	Spectrum Analyzer	2 Hz to 85 GHz (with R&S®FSW-B90G option: 2 Hz to 90 GHz)	FSW85	101537	2020-08-25	2022-08-25
E1130	Weinschel	Attenuator	6dB	2/6	CD2545	2021-05-10	2023-05-10

Test Date: 11/23/2021

7. NVLAP Certificate of Accreditation

<p>United States Department of Commerce National Institute of Standards and Technology</p> <p>NVLAP[®] </p> <hr/> <p>Certificate of Accreditation to ISO/IEC 17025:2017</p> <hr/>	
<p>NVLAP LAB CODE: 100275-0</p>	
<p>Nokia, Global Product Compliance Lab Murray Hill, NJ</p>	
<p><i>is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:</i></p>	
<p>Electromagnetic Compatibility & Telecommunications</p>	
<p><i>This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).</i></p>	
<p>2021-09-24 through 2022-09-30 Effective Dates</p>	<div><p>For the National Voluntary Laboratory Accreditation Program</p></div>