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NVLAP LAB CODE: 100275-0

# **Title 47 Code of Federal Regulations Test Report**

Regulation:

FCC Part 2 and 27

Client:

NOKIA SOLUTIONS AND NETWORKS

Product Evaluated:

AirScale MAA 64T64R 192AE n78 200W AEQU

Report Number:

TR-2021-0155-FCC2-27

Date Issued:

January 31, 2022

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## Revisions

Date	Revision	Section	Change
01/31/2022	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.

<b>Equipment Under Test (EUT):</b>	AirScale MAA 64T64R 192AE n78 200W AEQU
<b>Serial Number:</b>	1M214037087
<b>FCC ID:</b>	VBNAEQU-01
<b>Hardware Version:</b>	093263A.101
<b>Software Version:</b>	SBTS22R1
<b>Frequency Range:</b>	3450 – 3550 MHz
<b>GPCL Project Number:</b>	2021-0155
<b>Manufacturer:</b>	NOKIA SOLUTIONS AND NETWORKS OY KARAKAARI 7, FI-02610 ESPOO FINLAND
<b>Test Requirement(s):</b>	Title 47 CFR Parts 2 and 27
<b>Test Standards:</b>	See Section 1.5.1
<b>Measurement Procedure(s):</b>	See Section 1.5.2
<b>Test Date(s):</b>	12/6/2021 - 1/28/2022
<b>Test Performed By:</b>	Nokia Global Product Compliance Laboratory 600-700 Mountain Ave. P.O. Box 636 Murray Hill, NJ 07974-0636
<b>Product Engineer(s):</b>	Jeff Webb
<b>Lead Engineer:</b>	Steve Gordon
<b>Test Engineer (s):</b>	Joe Bordonaro, Jaideep Yadav
<b>Test Results:</b> 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 192AE n78 200W AEQU**, hereinafter referred to as the Equipment Under Test (EUT).

The AEQU is a 5G-NR and LTE-TDD (Long Term Evolution-Time Division Duplex) transceiver that operates in the frequency range of 3450 – 3550 MHz. Only 5G-NR was tested for this Certification.

The AEQU supports 20, 30, and 40 MHz 5G-NR carriers with a maximum total RF power output capacity of up to 200W.

## 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.

## 1.3 EUT Details

### 1.3.1 Specifications

Specification Items	Description
Radio Access Technology	5G-NR
Duplex Mode	Time Division Duplex (TDD)
Modulation Type(s)	QPSK, 16QAM, 64QAM, 256QAM, QPSK/16QAM
Operation Frequency Range	3450 – 3550 MHz
Channel Bandwidth	20, 30, 40 MHz
Number of Tx Ports per Unit	64
MIMO	Yes
Deployment Environment	Outdoor
Supply Voltage	-48.0 VDC

### AEQU AirScale MAA 64T64R 192AE n78 200W Technical datasheet

Specification	Details
Standard	3GPP/FCC, TDD
Band / Frequency range	3450 ~ 3550MHz
Max. supported modulation	256QAM
Number of TX/RX paths	64T / 64R
MIMO streams	16
Instantaneous bandwidth IBW	100MHz
Occupied bandwidth OBW	100MHz
Total average EIRP	77.5 dBm
Max. output power per TRX	3.125 W / TRX (200 W total)
Dimensions	750 x 450 x 242 mm (H x W x D)
Volume	71.7L
Weight	45kg w/o bracket
Supply voltage / Connector type	DC -40.5 V~ -57V, ext. range -36V~-60V/2 pole connector(APPB/C)
Power consumption	699W (75% DL duty cycle, ETSI 24h average load)
Optical ports	2 x SFP28, 10/25GE eCPRI (AOPC IP-seal)
Other interfaces / Connector type	AISG / RS-485, EAC (6 alarms + 1 control) / MDR26 (ASAD), RF Monitor Port/SMA (f+chain), 3 status LEDs
Operational temperature range	-40 °C ... +55 °C
Cooling	Natural convection cooling
Installation options	Pole / Wall, ± 15° mechanical vertical tilt with AMPF
Ingress / Surge protection	IP65/Class II 20KA
Supported RAT	5G

### AirScale High Power MAA benefits

- 5G Adaptive Antenna System for optimized capacity and coverage
- Beamforming capable 64T64R with total 200W output power

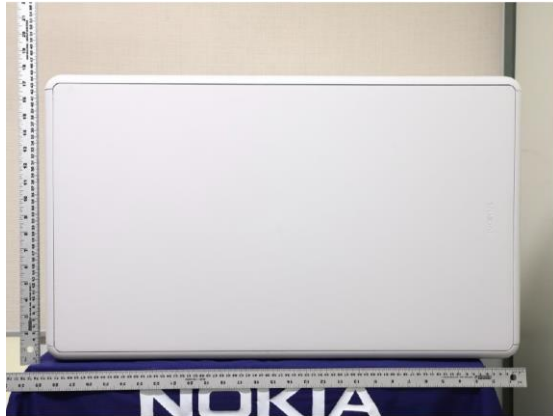


AEQU 476085A

NOKIA

### 1.3.2 Photographs

Front View



Rear View



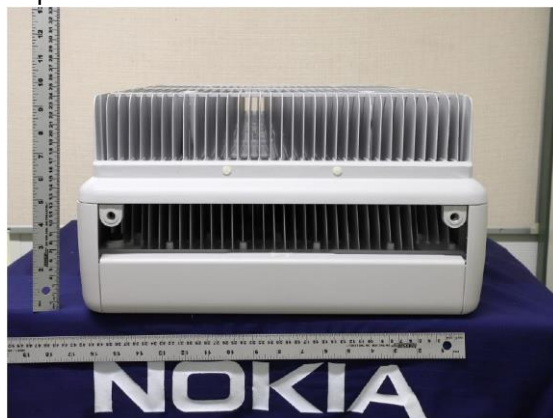
Left View



Right View

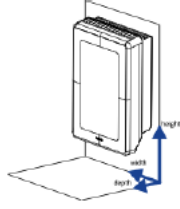


Top View

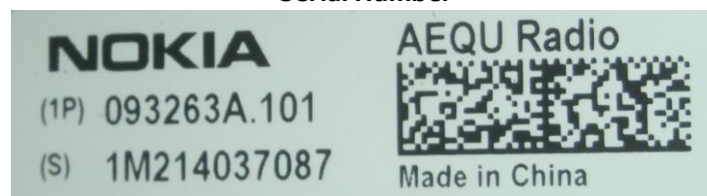


Bottom View



Property	Value	Dimensions orientation
Height	750 mm (29.53 in.)	
Width	450 mm (17.72 in.)	
Depth	242 mm (9.53 in.)	
Weight	45 kg (99.21 lb)	
Volume	81 L	

## Serial Number





## 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	Yes

## 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.
- FCC-IC-FS – GPCL Frequency Stability Measurement Process 6-20-2019.

### 1.5.3 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, 22, <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

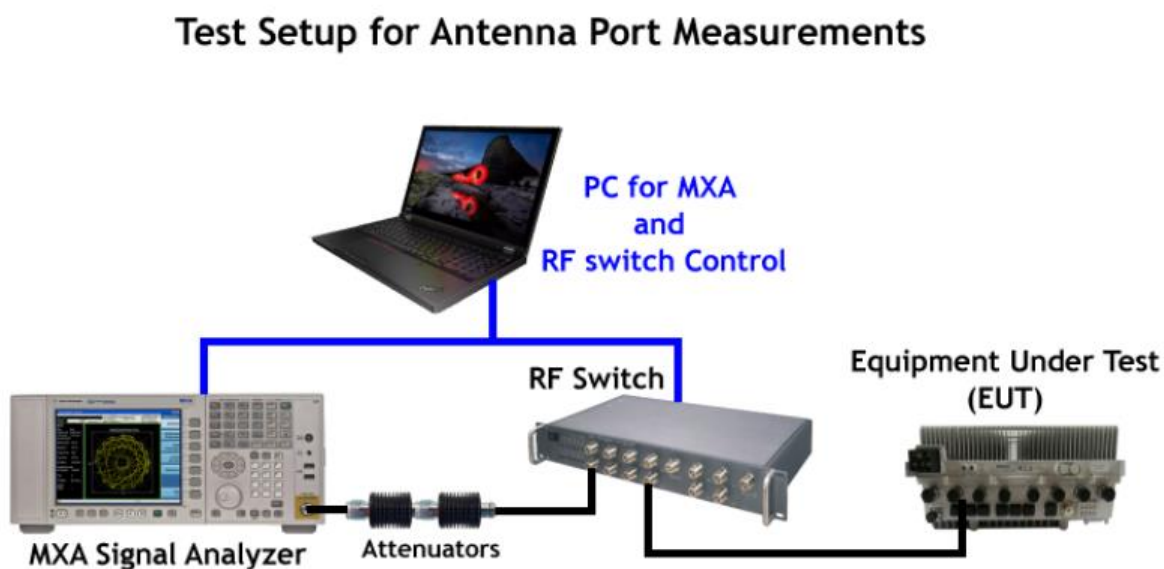
Antenna Port Test	Signal Bandwidth	Frequency Range	Expanded Uncertainty (k=2), Amplitude
Occupied Bandwidth, Edge of Band, Conducted Spurious Emissions	10 Hz 100 Hz 10 kHz to 1 MHz 1MHz	9 kHz to 20 MHz 20 MHz to 1 GHz 1 GHz to 10 GHz 10 GHz to 40 GHz:	1.78 dB
RF Power	10 Hz to 20 MHz	50 MHz to 18 GHz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

## 1.6 Executive Summary

Requirement	Description	Result
47 CFR FCC Parts 2 and 27		
2.1046, 27.53	RF Power Output Peak to Average Power Ratio	COMPLIES
2.1047, 27.53	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, 27.53	Frequency Stability	COMPLIES

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

## 1.7 Test Configuration for all 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 the section above and allowed to warm up and stabilize per KDB 971168 D01 and ANSI C63.26.

Power measurements were made with an MXA Signal Analyzer.

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. All 64 ports were measured, converted to W, and summed to determine total conducted power. Power measurements were made with an MXA Signal Analyzer.

Per FCC 27.50(k)(2), the power of each fixed or base station transmitting in the 3450 - 3550 MHz band is limited to an EIRP of 1640 W/MHz, i.e., 62.15 dBm/MHz EIRP. With 24.5 dBi antenna gain, the total conducted Power Spectral Density limit is 38 dBm/MHz per 64 ports (per polarization). See Summary of PSD Results Table below.

The Average Max RF Power Values are bolded in each configuration.

**Summary of PSD Results**

Channel Bandwidth	Maximum Channel Power (dBm)	Summed Power for 64 Ports	Channel Bandwidth	Maximum Channel Power (dBm)	Summed Power for 64 Ports	Channel Bandwidth
20	32.43	50.05	-13.01	37.04	38	0.96
30	35.36	52.98	-14.77	38.21	38	-0.21
40	35.55	53.17	-16.02	37.15	38	0.85

Manufacturer tolerance:  $\pm 1$  dB

## Tabular Data – Channel RF Power

Channel Power - Signal BW 20MHz (100W)											
Test Model 3.1 Modulation 64QAM Channel Frequency 3460MHz				Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3500MHz				Test Model 3.1a Modulation 256QAM Channel Frequency 3540MHz			
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
0	32.43	32	31.85	0	31.84	32	31.88	0	32.19	32	31.91
1	31.78	33	31.71	1	31.84	33	31.73	1	31.58	33	31.81
2	32.21	34	32.19	2	31.74	34	32.25	2	32.02	34	32.23
3	32.27	35	31.65	3	32.13	35	31.62	3	32.05	35	31.68
4	31.82	36	31.87	4	31.93	36	31.83	4	31.55	36	31.87
5	31.87	37	31.75	5	31.73	37	31.63	5	31.60	37	31.63
6	32.13	38	31.84	6	32.03	38	31.88	6	31.93	38	31.82
7	32.11	39	32.18	7	32.13	39	32.22	7	31.83	39	32.19
8	31.62	40	31.94	8	31.67	40	31.94	8	31.30	40	31.89
9	31.88	41	32.24	9	32.01	41	32.24	9	31.67	41	32.19
10	31.93	42	32.34	10	32.03	42	32.34	10	31.77	42	32.29
11	31.95	43	32.34	11	31.98	43	32.34	11	31.64	43	32.26
12	32.24	44	32.35	12	32.31	44	32.34	12	31.95	44	32.29
13	32.03	45	32.24	13	32.04	45	32.25	13	31.64	45	32.18
14	32.11	46	32.24	14	32.12	46	32.24	14	31.70	46	32.21
15	32.39	47	32.14	15	32.31	47	32.14	15	31.93	47	32.10
16	32.30	48	31.87	16	32.40	48	31.85	16	32.08	48	31.83
17	32.25	49	31.82	17	32.38	49	31.78	17	32.10	49	31.80
18	32.21	50	32.09	18	32.33	50	32.03	18	32.00	50	32.01
19	31.93	51	31.78	19	32.08	51	31.71	19	31.76	51	31.70
20	32.13	52	31.96	20	32.16	52	31.87	20	31.81	52	31.94
21	31.95	53	31.67	21	32.07	53	31.63	21	31.67	53	31.63
22	32.22	54	31.65	22	32.33	54	31.63	22	31.99	54	31.62
23	32.13	55	31.44	23	32.21	55	31.90	23	31.89	55	31.89
24	31.91	56	31.22	24	31.93	56	31.73	24	32.01	56	31.69
25	31.91	57	31.32	25	31.97	57	31.83	25	31.60	57	31.80
26	32.13	58	31.43	26	32.24	58	31.93	26	31.90	58	31.90
27	32.07	59	31.32	27	32.12	59	31.83	27	31.81	59	31.80
28	31.91	60	31.02	28	31.90	60	31.53	28	31.47	60	31.49
29	31.96	61	31.62	29	31.96	61	32.14	29	31.56	61	32.10
30	32.04	62	31.02	30	32.12	62	31.54	30	31.79	62	31.49
31	32.31	63	30.02	31	32.23	63	30.53	31	31.89	63	30.50
Total Power (dBm)		49.99		Total Power (dBm)		50.05		Total Power (dBm)		49.91	
Total Power (W)		99.75		Total Power (W)		101.15		Total Power (W)		97.84	

## Tabular Data – Channel RF Power

Channel Power - Signal BW 30MHz (200W)											
Test Model 3.1 Modulation 64QAM Channel Frequency 3465MHz				Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3500MHz				Test Model 3.1a Modulation 256QAM Channel Frequency 3535MHz			
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
0	35.10	32	34.62	0	<b>35.26</b>	32	34.72	0	35.29	32	34.97
1	34.50	33	34.49	1	34.68	33	34.59	1	34.70	33	34.86
2	34.89	34	34.95	2	35.11	34	35.04	2	35.13	34	35.26
3	35.02	35	34.41	3	35.22	35	34.46	3	35.18	35	34.72
4	34.49	36	34.61	4	34.67	36	34.66	4	34.67	36	34.91
5	34.53	37	33.63	5	34.74	37	33.57	5	34.71	37	33.62
6	34.82	38	34.61	6	35.03	38	34.68	6	35.06	38	34.87
7	34.78	39	34.96	7	34.91	39	35.07	7	34.92	39	35.30
8	34.28	40	34.73	8	34.48	40	34.79	8	34.44	40	34.96
9	34.60	41	35.03	9	34.83	41	35.09	9	34.80	41	35.26
10	34.64	42	<b>35.14</b>	10	34.81	42	35.20	10	34.84	42	<b>35.36</b>
11	34.63	43	35.13	11	34.80	43	35.20	11	34.78	43	<b>35.36</b>
12	34.93	44	35.13	12	35.08	44	35.19	12	35.05	44	<b>35.36</b>
13	34.71	45	35.04	13	34.86	45	35.10	13	34.79	45	35.26
14	34.81	46	35.03	14	34.91	46	35.09	14	34.84	46	35.26
15	35.04	47	34.93	15	35.07	47	34.99	15	35.03	47	35.16
16	35.00	48	34.64	16	35.19	48	34.70	16	35.23	48	34.92
17	34.94	49	34.54	17	35.19	49	34.59	17	35.22	49	34.83
18	34.93	50	34.84	18	35.14	50	34.85	18	35.13	50	35.07
19	34.64	51	34.55	19	34.82	51	34.55	19	34.84	51	34.75
20	34.79	52	34.72	20	34.97	52	34.73	20	34.95	52	35.00
21	34.63	53	34.44	21	34.88	53	34.47	21	34.83	53	34.70
22	34.94	54	34.40	22	35.15	54	34.47	22	35.14	54	34.67
23	34.82	55	34.71	23	35.02	55	34.74	23	35.02	55	34.93
24	34.61	56	34.47	24	34.80	56	34.54	24	35.00	56	34.71
25	34.61	57	34.57	25	34.80	57	34.65	25	34.75	57	34.82
26	34.86	58	34.67	26	35.08	58	34.74	26	35.07	58	34.91
27	34.87	59	34.57	27	34.92	59	34.64	27	34.93	59	34.81
28	34.52	60	34.27	28	34.69	60	34.34	28	34.69	60	34.51
29	34.65	61	34.87	29	34.77	61	34.94	29	34.71	61	35.11
30	34.79	62	34.27	30	34.90	62	34.35	30	34.91	62	34.51
31	35.01	63	33.27	31	35.01	63	33.34	31	35.00	63	33.51
Total Power (dBm)		52.77		Total Power (dBm)		52.88		Total Power (dBm)		52.98	
Total Power (W)		189.24		Total Power (W)		194.3		Total Power (W)		198.52	

## Tabular Data – Channel RF Power

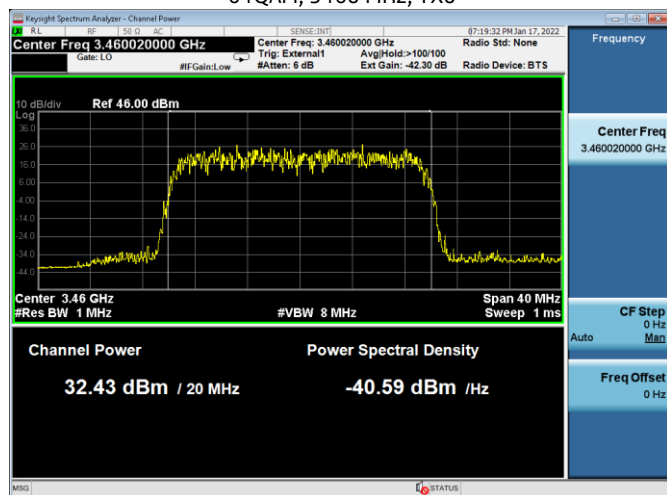
Channel Power - Signal BW 40MHz (200W)											
Test Model 3.1 Modulation 64QAM Channel Frequency 3470MHz				Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3500MHz				Test Model 3.1a Modulation 256QAM Channel Frequency 3530MHz			
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
0	35.31	32	34.83	0	35.10	32	34.60	0	<b>35.55</b>	32	35.09
1	34.65	33	34.72	1	35.10	33	34.49	1	34.94	33	35.00
2	34.93	34	35.17	2	35.00	34	34.92	2	35.34	34	35.40
3	35.17	35	34.59	3	35.09	35	34.33	3	35.42	35	34.87
4	34.63	36	34.81	4	35.20	36	34.54	4	34.90	36	35.05
5	34.69	37	33.82	5	34.99	37	33.49	5	34.94	37	33.85
6	34.98	38	34.80	6	<b>35.30</b>	38	34.56	6	35.28	38	35.00
7	34.84	39	35.18	7	34.72	39	34.95	7	35.14	39	35.41
8	34.41	40	34.94	8	34.31	40	34.69	8	34.67	40	35.13
9	34.79	41	35.23	9	34.69	41	34.99	9	35.05	41	35.43
10	34.79	42	35.33	10	34.65	42	35.09	10	35.08	42	35.53
11	34.79	43	35.33	11	34.65	43	35.09	11	35.03	43	35.53
12	35.09	44	35.33	12	34.95	44	35.09	12	35.29	44	35.53
13	34.79	45	35.23	13	34.64	45	34.99	13	34.99	45	35.43
14	34.94	46	35.23	14	34.76	46	34.98	14	35.09	46	35.43
15	35.28	47	35.13	15	34.90	47	34.89	15	35.30	47	35.34
16	35.08	48	34.84	16	34.95	48	34.58	16	35.44	48	35.07
17	35.13	49	34.74	17	35.05	49	34.48	17	35.46	49	34.99
18	35.13	50	35.09	18	35.02	50	34.78	18	35.38	50	35.25
19	34.78	51	34.76	19	34.67	51	34.45	19	35.09	51	34.94
20	34.97	52	34.90	20	34.83	52	34.61	20	35.19	52	35.17
21	34.81	53	34.63	21	34.73	53	34.35	21	35.07	53	34.84
22	35.09	54	34.58	22	34.98	54	34.33	22	35.36	54	34.82
23	34.98	55	34.90	23	34.86	55	34.63	23	35.26	55	35.09
24	34.86	56	34.66	24	34.76	56	34.43	24	34.99	56	34.85
25	34.74	57	34.77	25	34.62	57	34.53	25	34.99	57	34.96
26	35.02	58	34.87	26	34.96	58	34.63	26	35.35	58	35.06
27	35.01	59	34.77	27	34.84	59	34.53	27	35.20	59	34.96
28	34.62	60	34.47	28	34.50	60	34.22	28	34.91	60	34.66
29	34.80	61	35.07	29	34.62	61	34.82	29	34.96	61	35.26
30	34.97	62	34.48	30	34.80	62	34.22	30	35.18	62	34.66
31	<b>35.43</b>	63	33.47	31	35.11	63	33.22	31	35.32	63	33.66
Total Power (dBm)		52.95		Total Power (dBm)		52.79		Total Power (dBm)		53.17	
Total Power (W)		197.29		Total Power (W)		190.19		Total Power (W)		207.69	

## 2.2 Channel RF Power – Plots

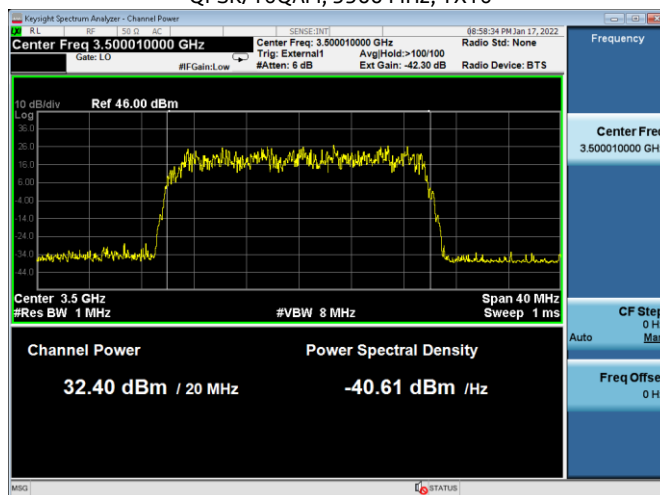
NOTE: Only a sample of the plots are used in this report. The full suite of raw data resides at the MH, New Jersey location.

### 2.2.1 20 MHz BW

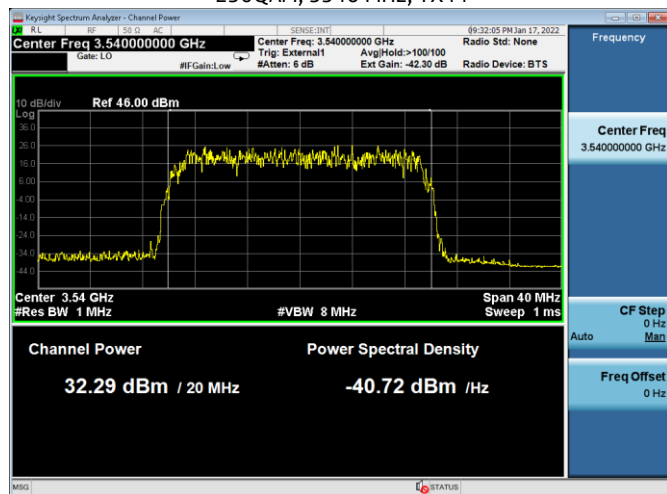
64QAM, 3460 MHz, TX0



QPSK/16QAM, 3500 MHz, TX16



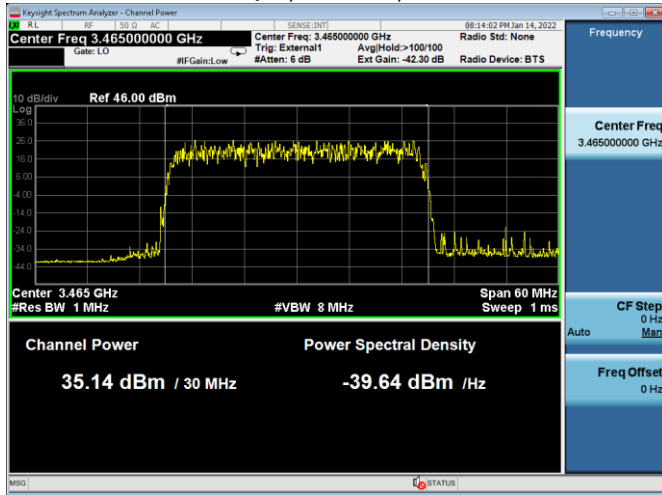
256QAM, 3540 MHz, TX44



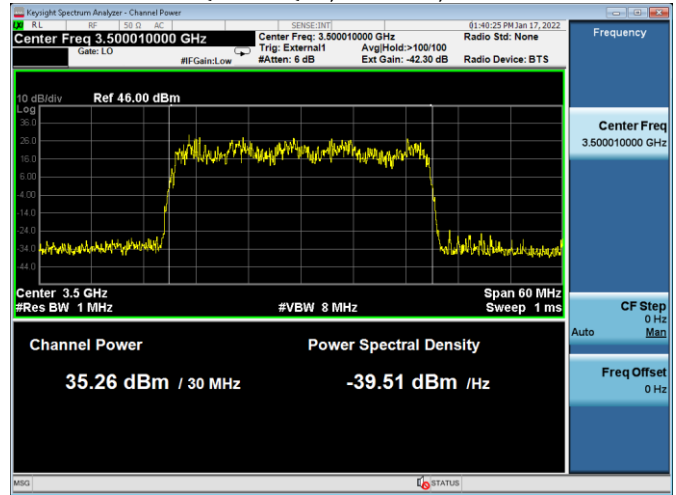


## 2.2.2 30 MHz BW

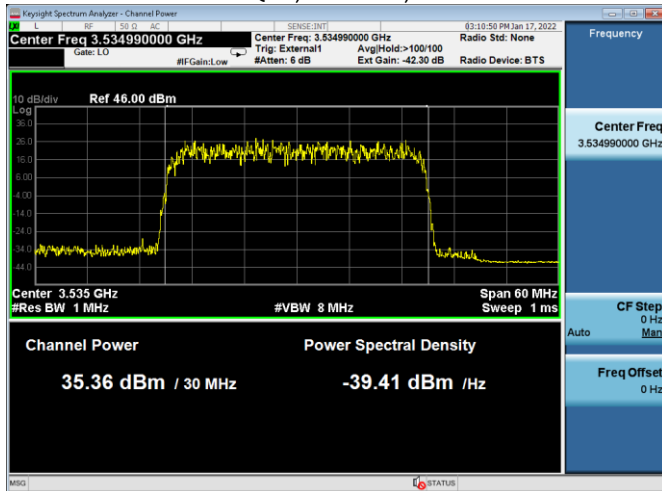
64QAM, 3465 MHz, TX42



QPSK/16QAM, 3500 MHz, TX0

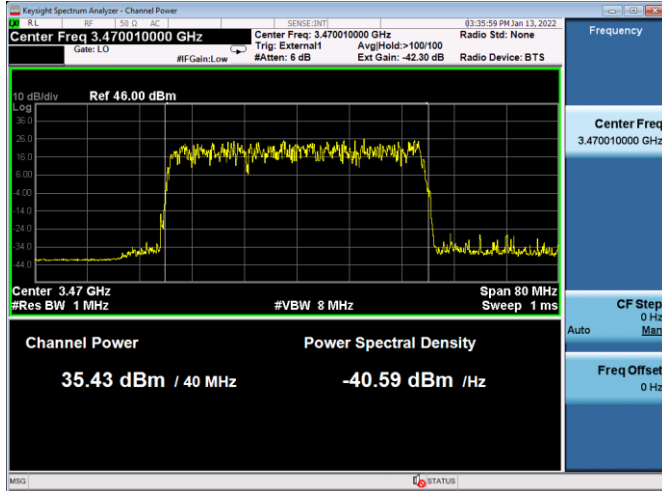


256QAM, 3535 MHz, TX42

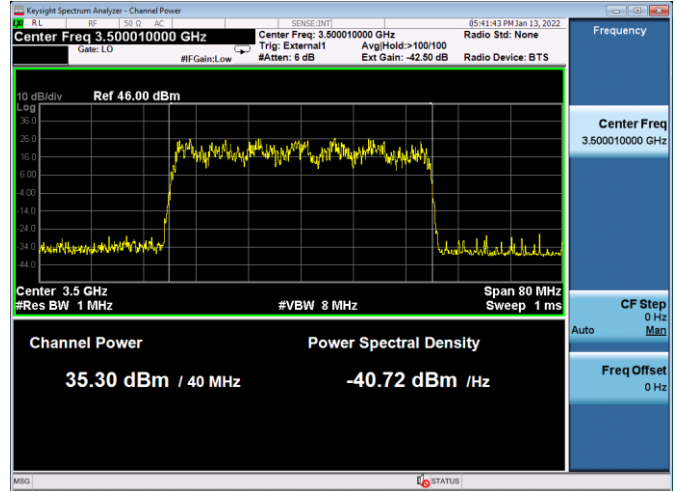


## 2.2.3 40 MHz BW

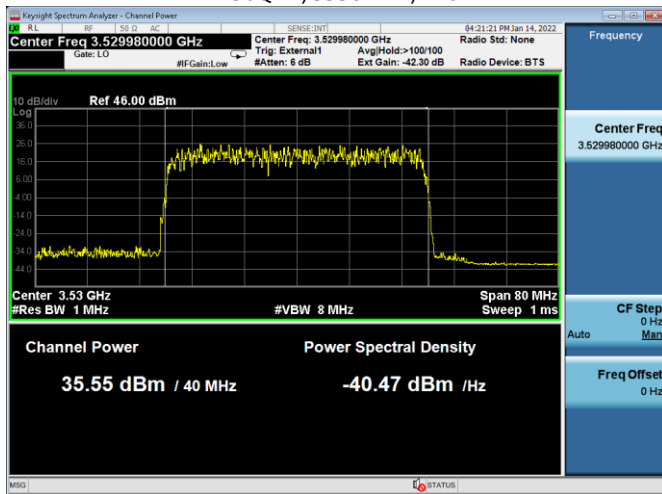
64QAM, 3470 MHz, TX31



QPSK/16QAM, 3500 MHz, TX6



256QAM, 3530 MHz, TX0

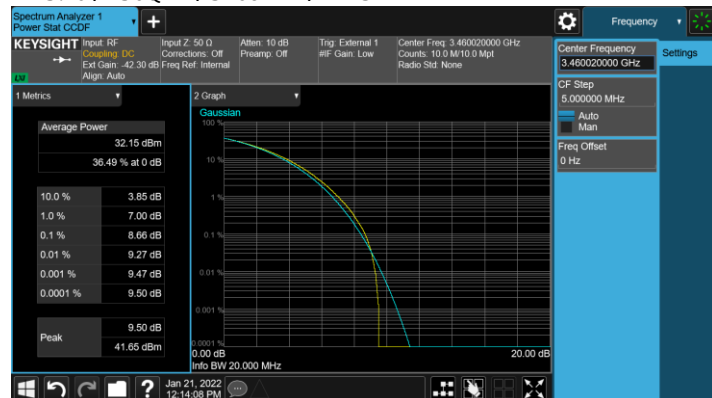


## 2.3 Peak-to-Average Power Ratio (PAPR) – Plots

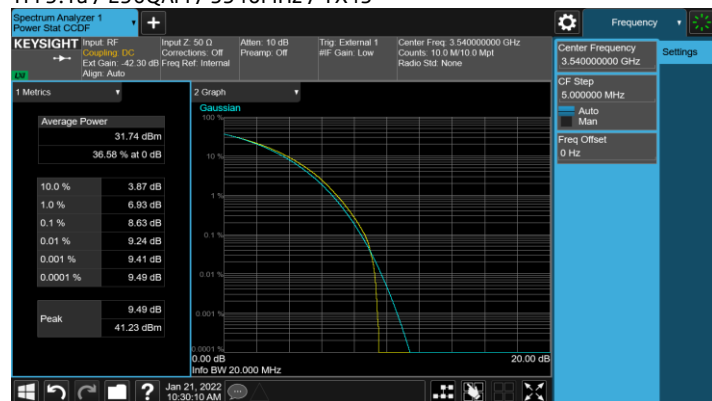
The Peak-to-Average Power Ratio (PAPR) was evaluated per KDB 971168 for Single and Multiple Carriers. The PAPR values of all carriers measured are below 13dB.

### 2.3.1 20 MHz BW

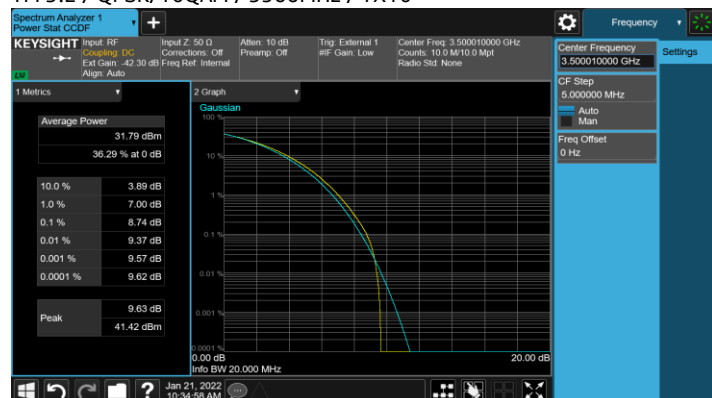
TM 3.1a / 256QAM / 3460MHz / TX15



TM 3.1a / 256QAM / 3540MHz / TX43

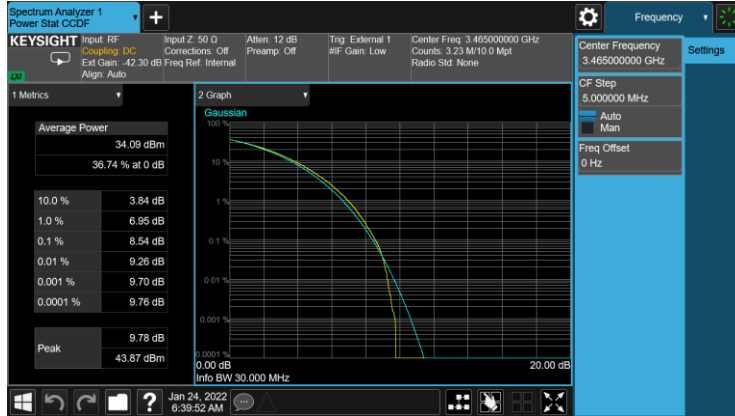


TM 3.2 / QPSK/16QAM / 3500MHz / TX16

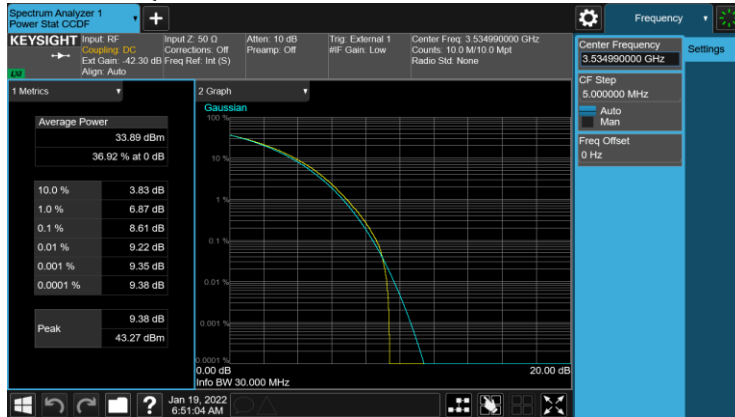


## 2.3.2 30 MHz BW

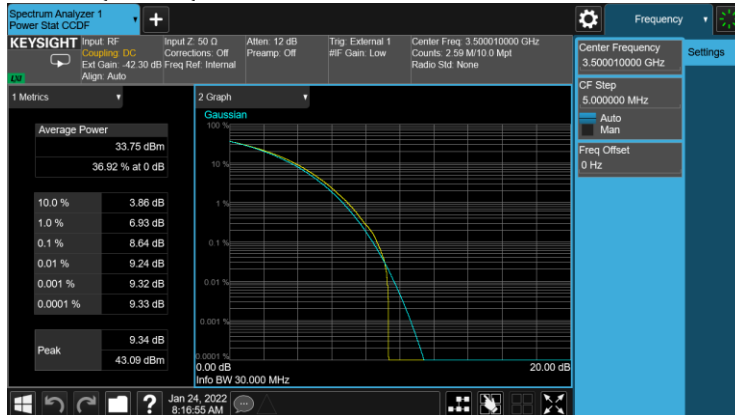
TM 3.1 / 64QAM / 3465MHz / TX42



TM 3.1a / 256QAM / 3535MHz / TX43

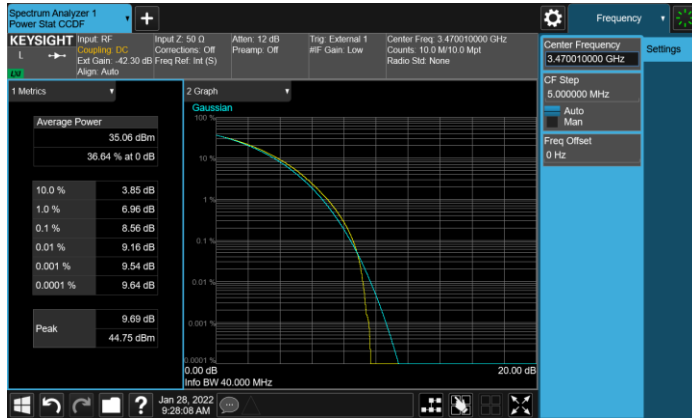


TM 3.2 / QPSK/16QAM / 3500MHz / TX42

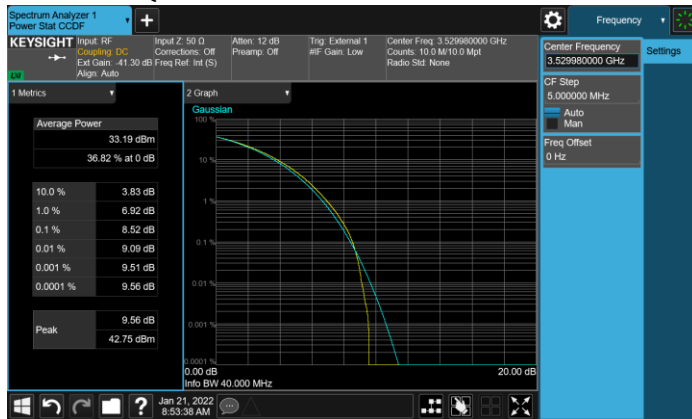


### 2.3.3 40 MHz BW

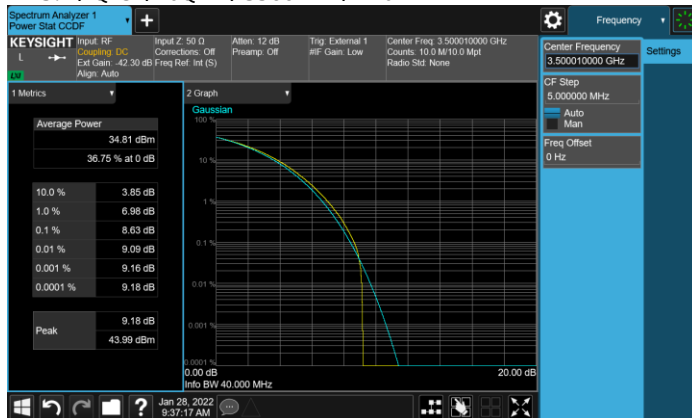
TM 3.1 / 64QAM / 3470MHz / TX31



TM 3.1a / 256QAM / 3530MHz / TX1



TM 3.2 / QPSK/16QAM / 3500MHz / TX6



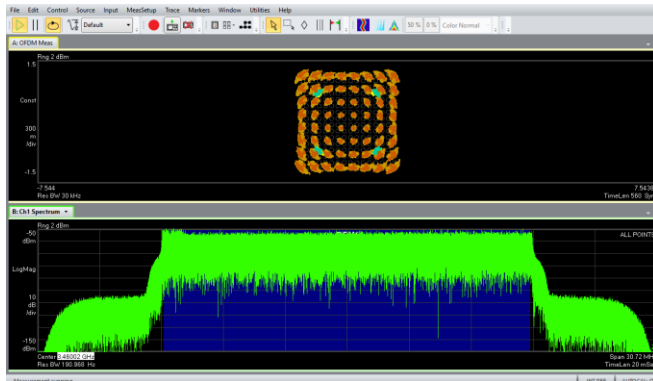
### 3. FCC Section 2.1047 - Modulation Characteristics

#### 3.1 Modulation Characteristics

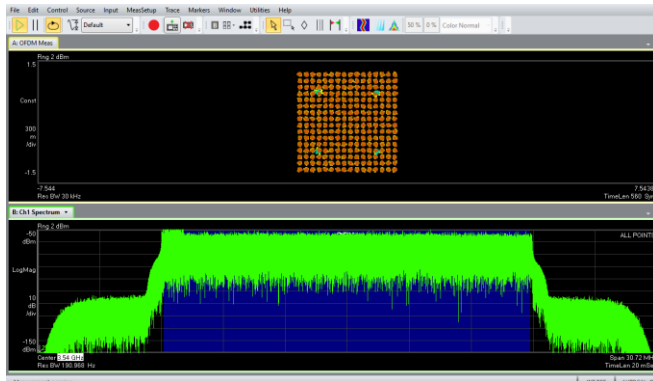
The RF signal at the antenna port was demodulated and verified for correctness of the modulation signal used before each test was performed.

##### 3.1.1 Modulation Characteristics – Plots

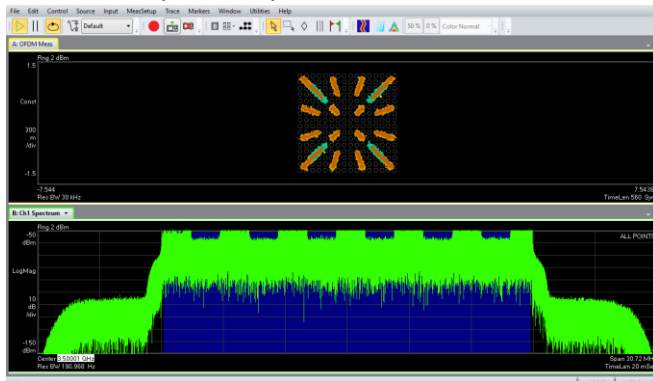
###### Modulation 64QAM



###### Modulation 256QAM



###### Modulation QPSK/16QAM



## 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.

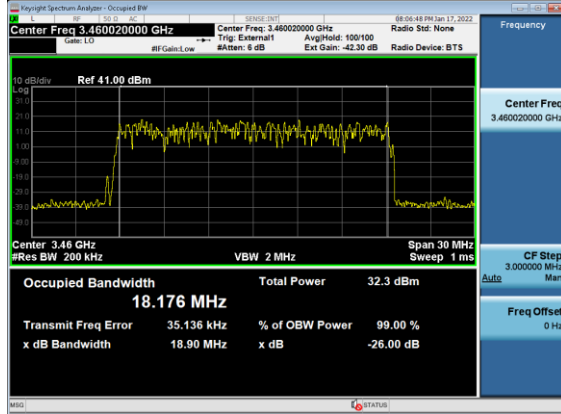
**Tabular Data – Occupied Bandwidth**

Signal BW MHz	Test Model	Modulation	TX Port	Channel Frequency MHz	99% Occupied BW MHz
20	3.1	64QAM	15	3460	18.176
20	3.2	QPSK/16QAM	16	3500	18.185
20	3.1a	256QAM	43	3540	18.076
30	3.1	64QAM	42	3465	27.592
30	3.2	QPSK/16QAM	42	3500	27.958
30	3.1a	256QAM	43	3535	27.989
40	3.1	64QAM	31	3470	37.779
40	3.2	QPSK/16QAM	6	3500	37.712
40	3.1a	256QAM	1	3530	37.790

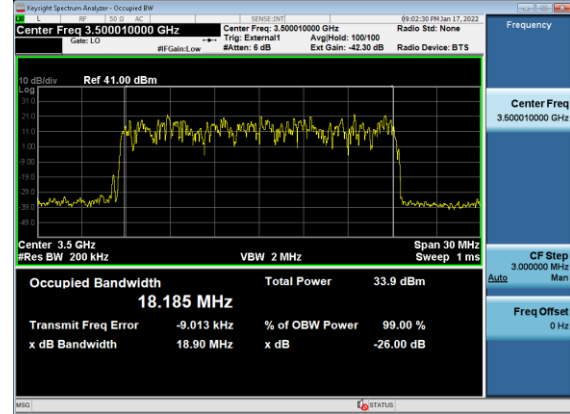
## 4.2 Occupied Bandwidth – Plots

### 4.2.1 20 MHz BW

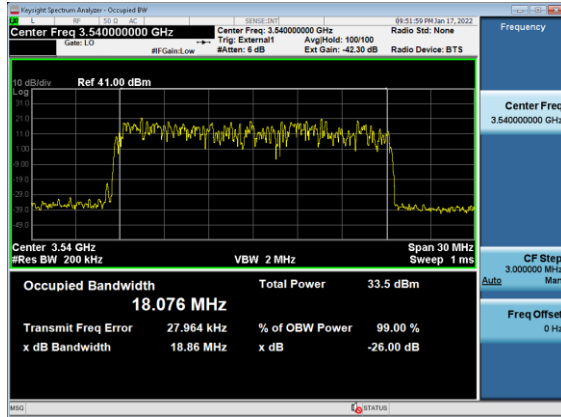
TM 3.1 / 64QAM / 3460MHz / TX15



TM 3.2 / QPSK/16QAM / 3500MHz / TX16



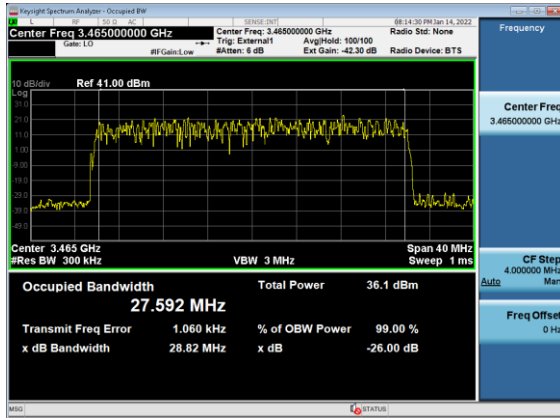
TM 3.1a / 256QAM / 3540MHz / TX43



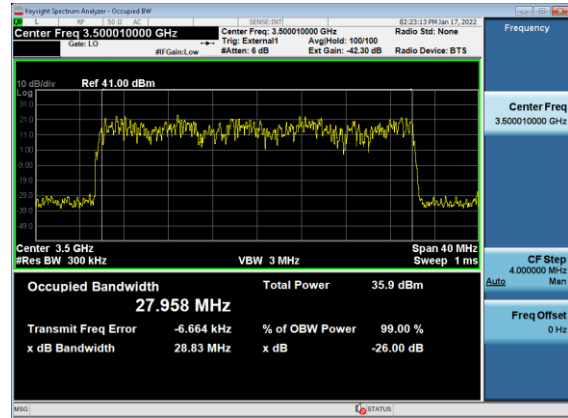


## 4.2.2 30 MHz BW

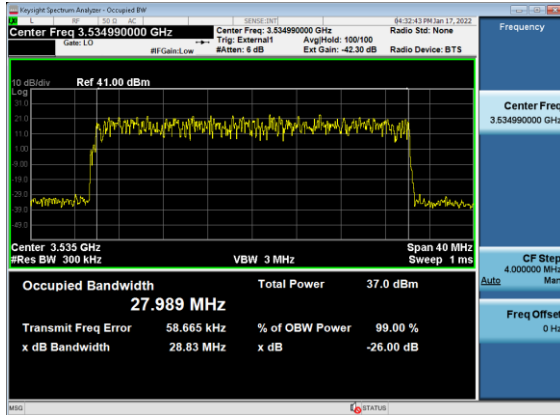
TM 3.1 / 64QAM / 3465MHz / TX42



TM 3.2 / QPSK/16QAM / 3500MHz / TX42

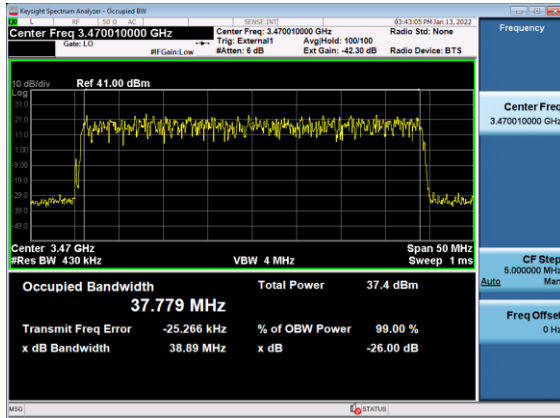


TM 3.1a / 256QAM / 3535MHz / TX43

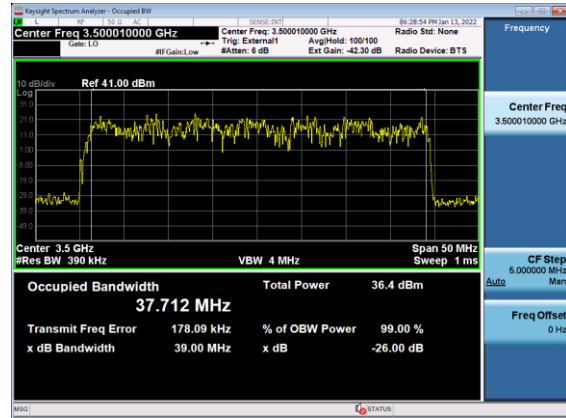


## 4.2.3 40 MHz BW

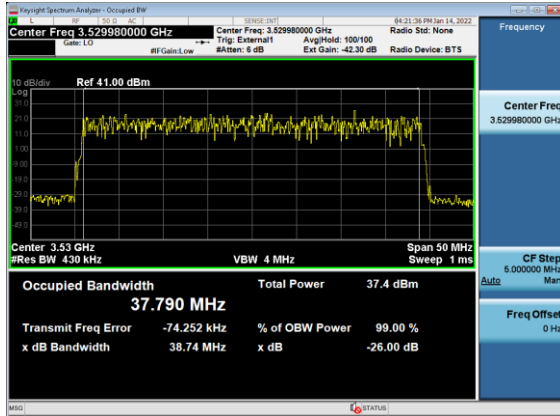
TM 3.1 / 64QAM / 3470MHz / TX31



TM 3.2 / QPSK/16QAM / 3500MHz / TX6



TM 3.1a / 256QAM / 3530MHz / TX1



### 4.3 Edge of band Emissions

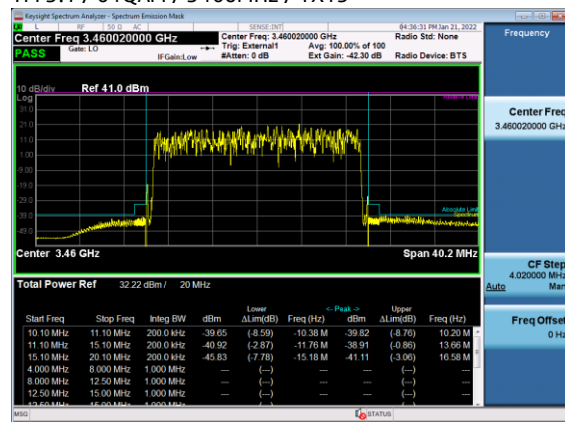
The Edge of Band emissions of the EUT at the TX ports were measured using a Keysight MXA Signal Analyzer. The RF power level was continuously measured using a Keysight MXA Signal Analyzer. The RF output from the TX port to signal analyzer was reduced (to an amplitude usable by the signal analyzer) by using a calibrated attenuator and RF Switch. 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 Keysight MXA Signal Analyzer.

#### 4.3.1 Edge of Band Emissions – Plots

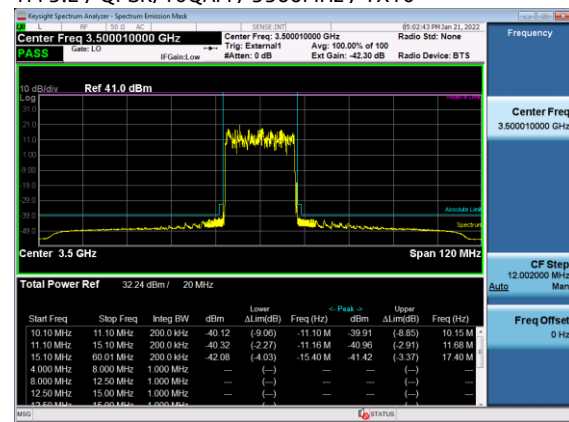
All of the measurements met the requirements of Part 27.53 when measured per Part 2.1049.

##### 4.3.1.1 20 MHz BW OOB E Plots

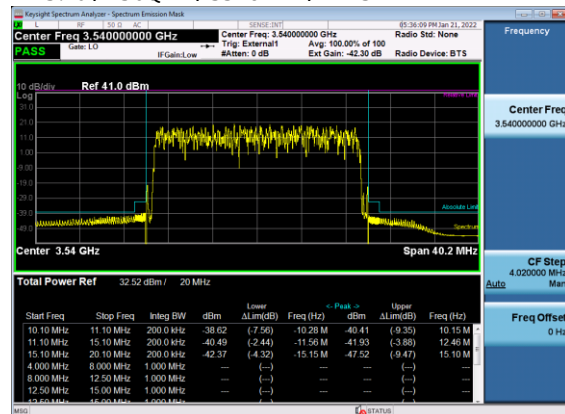
TM 3.1 / 64QAM / 3460MHz / TX15



TM 3.2 / QPSK/16QAM / 3500MHz / TX16

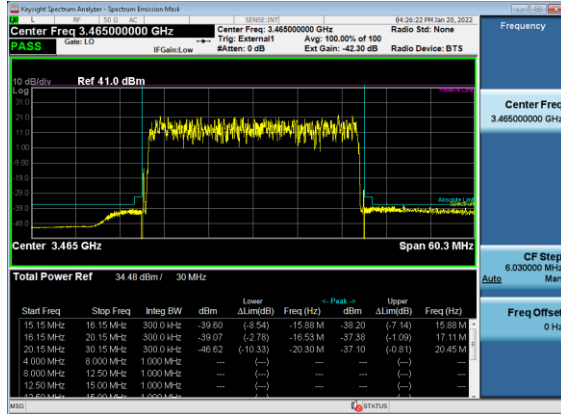


TM 3.1a / 256QAM / 3540MHz / TX43

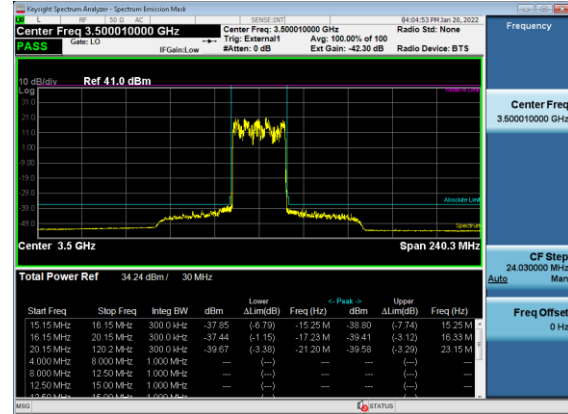


## 4.3.1.2 30 MHz BW OOB E Plots

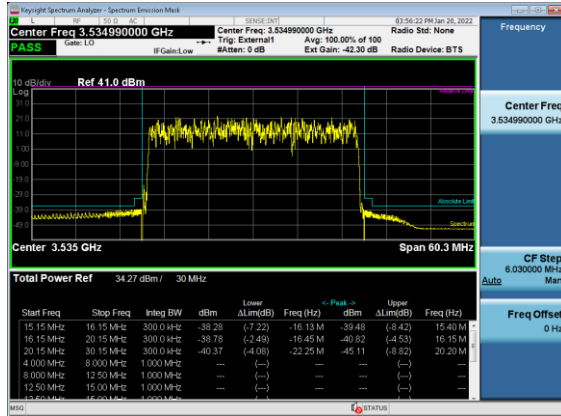
TM 3.1 / 64QAM / 3465MHz / TX42



TM 3.2 / QPSK/16QAM / 3500MHz / TX42

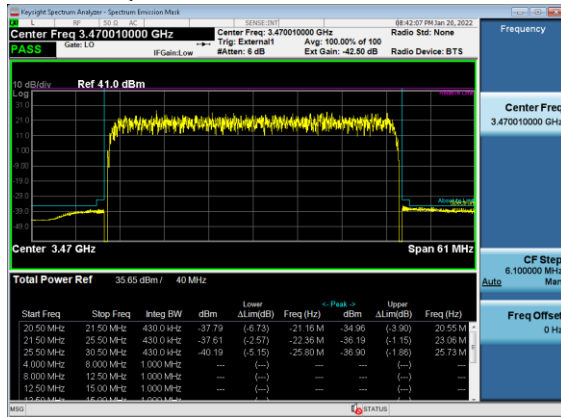


TM 3.1a / 256QAM / 3535MHz / TX43

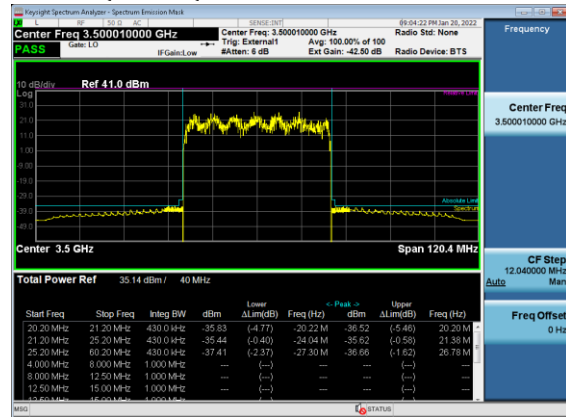


## 4.3.1.3 40 MHz BW OOB E Plots

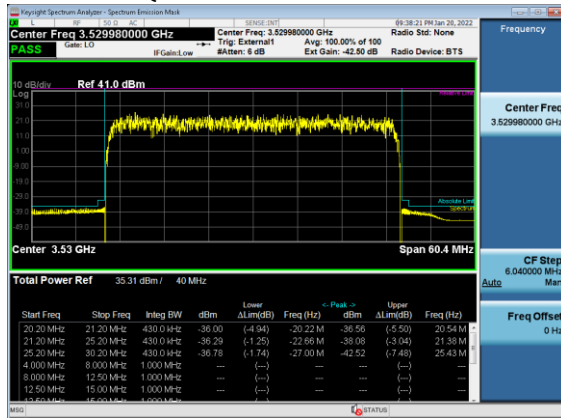
TM 3.1 / 64QAM / 3470MHz / TX31



TM 3.2 / QPSK/16QAM / 3500MHz / TX6



TM 3.1a / 256QAM / 3530MHz / TX1



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

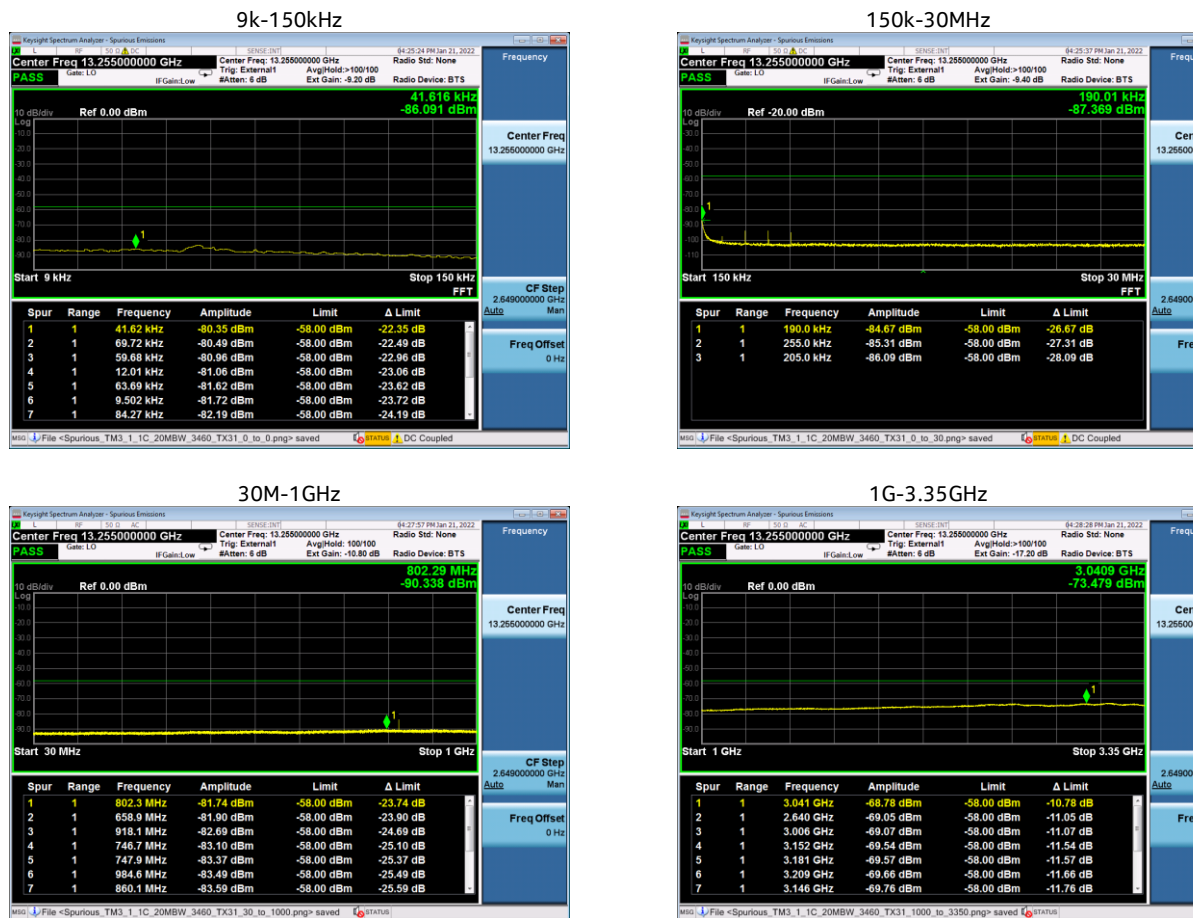
### 5.1 Measurement of Spurious Emissions at Transmit Antenna Port

Spurious Emissions at the transmit-antenna terminals were investigated over the frequency range of 10 MHz 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 36 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 Keysight MXA Signal Analyzer.

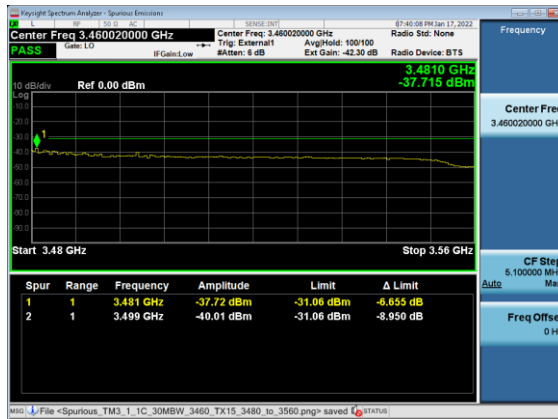
The required emission limitation is specified as appropriate in 27.53. The measured spurious emission levels were plotted for the frequency range as specified in 2.1057. There were no reportable emissions. Data below documents performance up to 36 GHz.

#### 5.1.1 Spurious Emissions at Tx Port - Plots

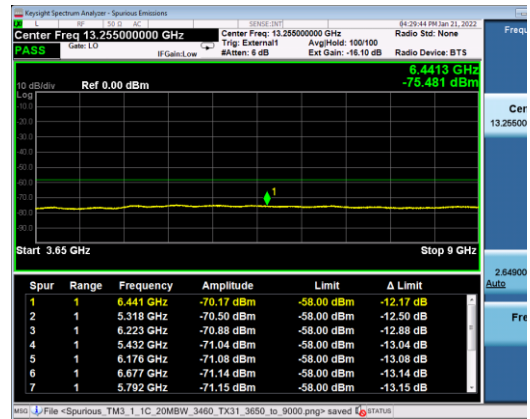
##### 5.1.1.1 20 MHz BW, TM3.1, 64QAM, 3460 MHz, TX15



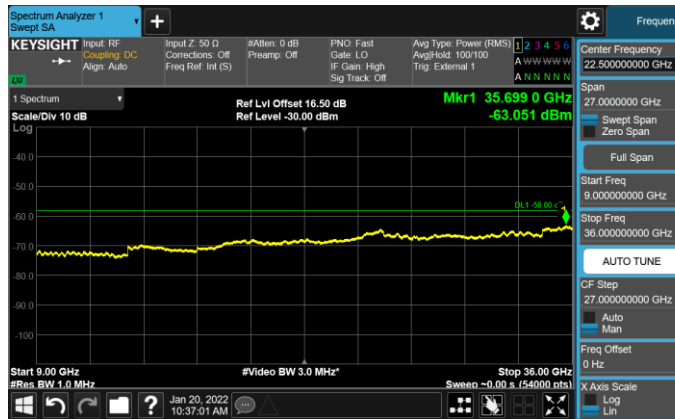
3.48G-3.56GHz



3.65G-9GHz



9G-36GHz

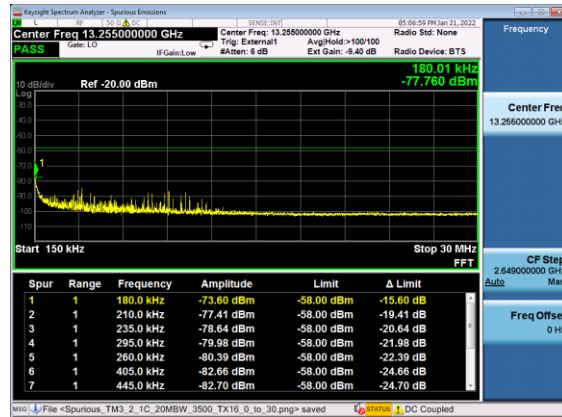


## 5.1.1.2 20 MHz BW, TM3.2, QPSK/16QAM, 3500 MHz, TX16

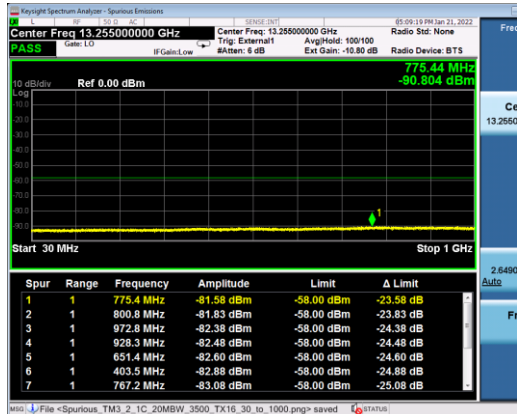
9k-150kHz



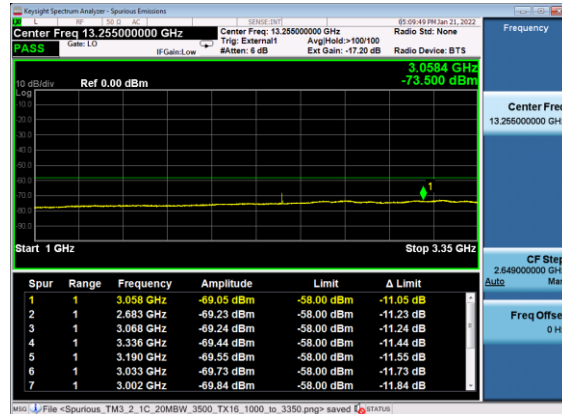
150k-30MHz



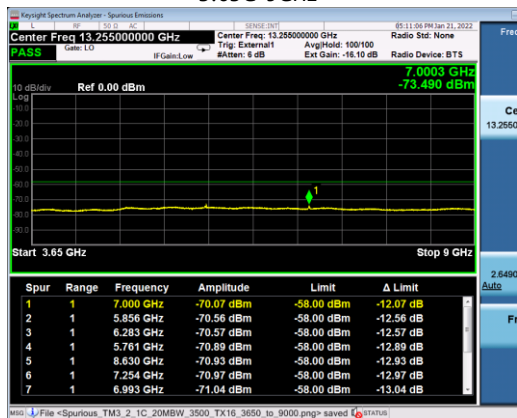
30M-1GHz



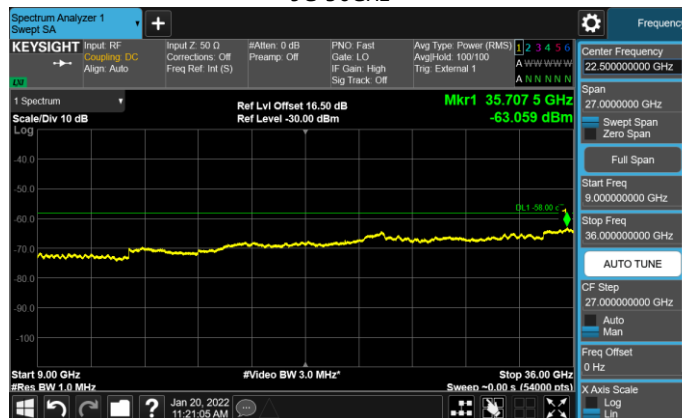
1G-3.35GHz



3.65G-9GHz



9G-36GHz



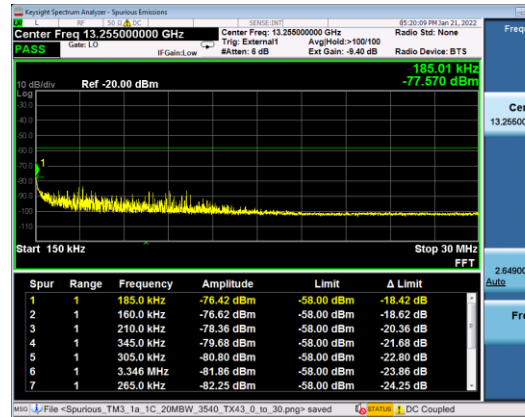


## 5.1.1.3 20 MHz BW, TM3.1a, 256QAM, 3540 MHz, TX43

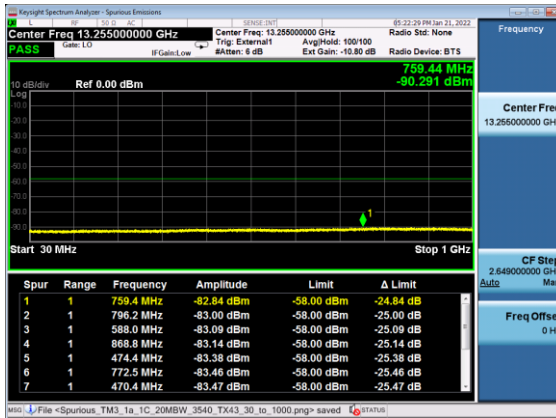
9k-150kHz



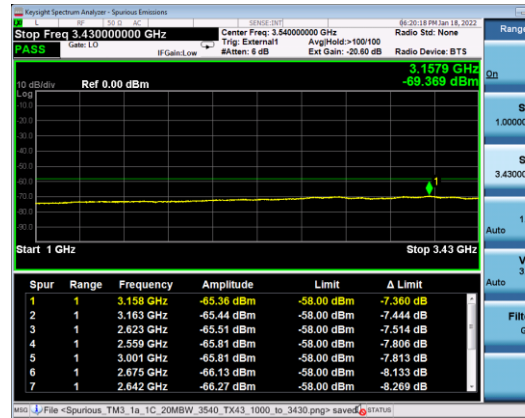
150k-30MHz



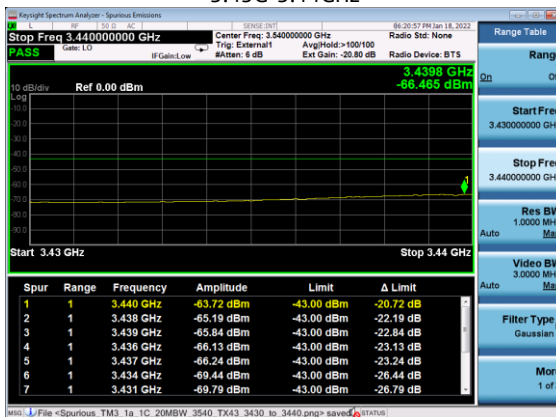
30M-1GHz



1G-3.43GHz



3.43G-3.44GHz



3.44G-3.52GHz

