NOKIA Bell Labs

Global Product Compliance Laboratory
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TESTING
NVLAP LAB CODE: 100275-0

Title 47 Code of Federal Regulations Test Report

Regulation:
Title 47 CFR FCC Part 96

Client:
NOKIA SOLUTIONS AND NETWORKS, OY

Product Evaluated:
AWHQU AirScale Micro 4T4R n48 40W CBRS 20W

Report Number:
TR-2023-0004-FCC96

Date Issued:
April 19, 2023

Table of Contents

Revisions

Date	Revision	Section	Change
4/19/2023	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):	AWHQU AirScale Micro 4T4R n48 40W CBRS 20W
Serial Number:	Refer to Section 1.3.2
FCC ID:	2AD8UAWHQU01
Hardware Version:	476212A.X21
Software Version:	SBTS23R3
Frequency Range:	3550-3700 MHz
GPCL Project Number:	2023-0004
Manufacturer:	NOKIA SOLUTIONS AND NETWORKS, OY KARAKAARI 7, FI-02610 ESPOO FINLAND
Applicant:	NOKIA SOLUTIONS AND NETWORKS, OY 3201 Olympus Blvd Dallas, Texas 75019 Lee Klindenborg
Test Requirement(s):	Title 47 CFR Part96
Test Standards:	• Title 47 CFR Parts 2 and 96 • KDB 940660 D01 Certification And Test Procedures For Citizens Broadband Radio Service Devices Authorized Under Part 96, v03, Oct 29, 2020 • 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):	• 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):	1/31/2023 – 4/12/2023
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):	Jaideep Yadav, Mike Soli, Chris Polanco, Hussain Saifnijat, Joe Bordonaro
Test Results: The EUT, *as tested* 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 **AWHQU AirScale Micro 4T4R n48 40W CBRS 20W**, hereinafter referred to as the Equipment Under Test (EUT).

1.2 Purpose and Scope

This document is to provide the testing data required for qualifying the EUT in compliance with FCC Part 96 measured in accordance with the procedures set out in Section 2.1033 (c) (14) of the Rules.

The AWHQU is an LTE-TDD (Long Term Evolution-Time Division Duplex) and 5G-NR transceiver which operates in Band 48 Citizens Broadband Radio Service (CBRS) spectrum (3550-3700 MHz).

It supports the external antennas with a minimum gain of 4 dBi and a maximum gain of 18dBi for the following operating modes:

LTE:
Single Carrier 10 and 20 MHz

5G-NR:
Single Carrier 10, 20, 30, 40, 80 (40+40) MHz

LTE and 5G-NR Multi Carrier Operation up to 2 carriers, any combinations of approved bandwidths.

1.3 EUT Details

1.3.1 Specifications

Specification Items	Description
Product Type	AWHQU AirScale Micro 4T4R n48 40W CBRS 20W
Radio Type	Intentional Transceiver
CBSD Category	Category B CBSD Device
Power Type	DC: -48V
Modulation	QPSK, 16QAM, 64QAM and 256QAM
Operating Frequency Range	CBRS (Tx/Rx: 3550-3700 MHz)
Channel Bandwidth	LTE: 10, 20, 10+10 MHz 5G-NG: 10, 20,10+10, 30, 40, 80 (40+40) MHz Multi Carrier Operation up to 2 carriers, any combinations of approved bandwidths.
Max Conducted Power (Rated)	Up to 4x5W (37.0 dBm)
Antenna Gain	Between 4 & 18 dBi Max
Operating Mode	4T4R

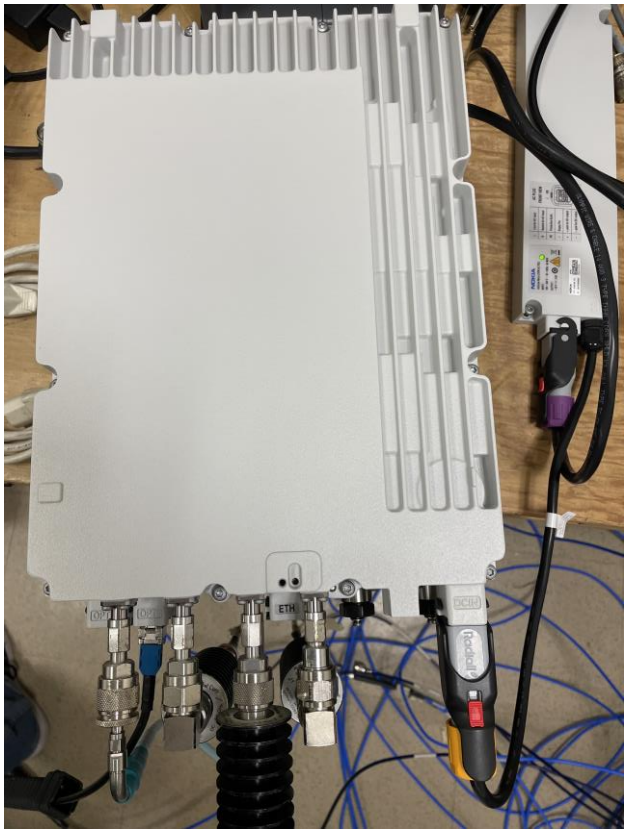
1.3.2 Supported Antenna

Antenna Vendor	Model	Gain	Minimum Gain evaluated	Conducted Power Adjustment (dBm)
REF Antenna	N/A	4.0	4.0	0
JMA	CX14OMI236-1C	5.0	4.0	-1.0
JMA	CX16OMI236-1C	5.0	4.0	-1.0
JMA	CX16OMI224-1H	6.1	4.0	-2.1
JMA	CX16OMI218-1P	5.3	4.0	-1.3
JMA	DX10FRO260-00 or 06	14.8	4.0	-10.8
JMA	DX12FRO260-20 or 26	15.5	4.0	-11.5
Amphenol	C2U3MT360X06Fxys0	6.6	4.0	-2.6
Amphenol	2C2U3MT360X06Fxys0	5.3	4.0	-1.3
Amphenol	4U4MT360X06Fxys0	5.7	4.0	-1.7
Amphenol	2C4U3MT360X06Fwxys0	5.9	4.0	-1.9
Amphenol	2U3MX065X06Fxys0	11.6	4.0	-7.6
Amphenol	4U4MX065X06Fxys0	11.3	4.0	-7.3
Amphenol	2C4U3MX065X06Fwxys0	8.9	4.0	-4.9
Kathrein	84010555 / 84010556	7.0	4.0	-3.0
Kathrein	84010557 / 84010558	5.8	4.0	-1.8
Kathrein	84010603 / 84010604	6.5	4.0	-2.5
Kathrein	84010564	11.0	4.0	-7.0
CommScope	VVSSP-360S-F	4.9	4.0	-0.9
CommScope	NNVVSSP-360S-FM 5.7	5.7	4.0	-1.7
CommScope	VVSSP-65S-R1BV2 (Panel)	10.4	4.0	-6.4
Alpha Wireless	AW3023-T0-N	18.0	4.0	-14.0
Alpha Wireless	AW3499	6.5	4.0	-2.5
Nokia	AAQA	12.0	4.0	-8.0
Nokia	FA2QD	6.0	4.0	-2.0

1.3.3 Photographs

Frequency Stability & RE Unit

Radio Test Unit



1.4 Test Requirements

Each required measurement is listed below:

47 CFR FCC Sections	Description of Tests	Test Required
2.1046, 96.41 (b) 96.41(g)	RF Power Output (b) Power Limits, EIRP, PSD (g) Peak-to-Average Power Ratio	Yes
2.1047, 96.41(a)	Modulation Characteristics	Yes
2.1049, 96.41(e)(2)(3)	(a) Occupied Bandwidth (b) Out-of-Band Emissions	Yes
2.1051, 96.41(e)	Spurious Emissions at Antenna Terminals	Yes
2.1053, 96.41(e)(2)(3)	Field Strength of Spurious Radiation	Yes
2.1055, 96.41(e)(2)(3)	Measurement of 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 96.
- KDB 940660 D01 Certification And Test Procedures For Citizens Broadband Radio Service Devices Authorized Under Part 96, v03, Oct 29, 2020
- 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, (*e.g.*, ANSI C63.4, CISPR 11, 14, 22, *etc.*, using ESHS 30,	Conducted Emissions	0.009 - 30	±3.5 dB
	Radiated Emissions (AR-6 Semi-Anechoic Chamber)	30 MHz – 200MHz H 30 MHz – 200 MHz V 200 MHz – 1000 MHz H 200 MHz – 1000 MHz V 1 GHz - 18 GHz	±5.1 dB ±5.1 dB ±4.7 dB ±4.7 dB ±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

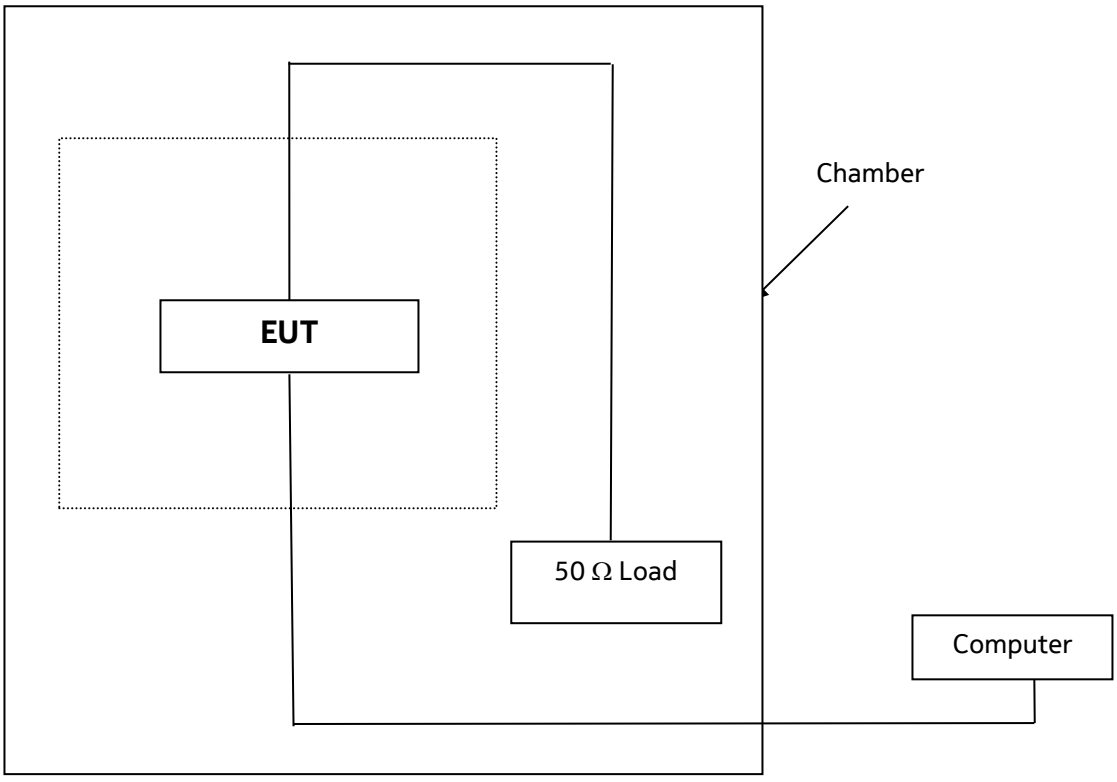
Requirement 47 CFR FCC Parts 2 and 96	Description of Tests	Result
2.1046, 96.41 (b) 96.41(g)	RF Power Output (b) Power Limits, EIRP, PSD (g) Peak-to-Average Power Ratio	COMPLIES
2.1047, 96.41(a)	Modulation Characteristics	COMPLIES
2.1049, 96.41(e)(2)(3)	(a) Occupied Bandwidth (b) Out-of-Band Emissions	COMPLIES
2.1051, 96.41(e)	Spurious Emissions at Antenna Terminals	COMPLIES
2.1053, 96.41(e)	Field Strength of Spurious Radiation	COMPLIES
2.1055	Measurement of Frequency Stability	COMPLIES

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

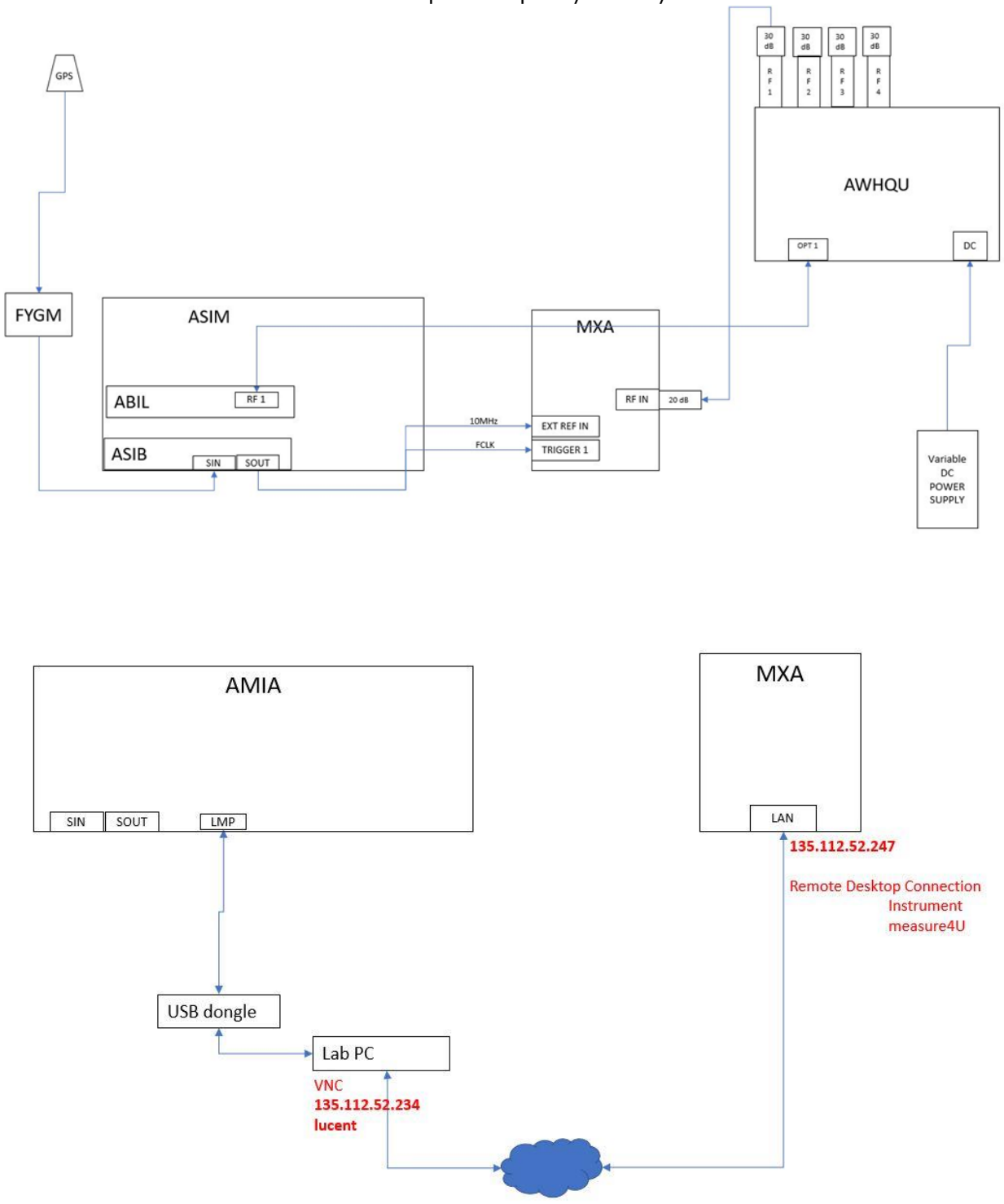
1.8 Test Configurations

Test Setup for all Antenna Port Measurements

Test Setup for Radiated Measurement



Test Setup for Frequency Stability



2. FCC Section 2.1046 - RF Power Output and Power Spectral Density

2.1 RF Power Output

2.1.1 Limits

The FCC Part 96.41 requirement for Category B CBSD is that the Output Power of the EUT shall not exceed 47 dBm/10MHz EIRP.

2.1.2 Results

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.

The maximum RF conducted output power and EIRP for each configuration/operation mode using the minimum and maximum antenna gain are tabulated below and the results are all below FCC Part 96.41 maximum EIRP limit for Category B CBSD. Additional antenna types used with the product require conducted power to be reduced below maximum demonstrated for 4 dBi gain antenna by the difference in gain of that antenna minus 4 dBi. The results have demonstrated the compliance with FCC RF EIRP power output requirement.

Maximum Effective Isotropic Radiated Power (EIRP) per 10MHz Compliance

Technology	Signal BW (MHz)	Set Power Level (dBm)	TM	Modulation	Channel Frequency (MHz)	4 Port Max Total Power (dBm)/ BW	Max Total Power Adjusted (dBm/10MHz)	Antenna Gain (dBi)	Total Product EIRP (dBm/10MHz)	EIRP Compliance
5G-NR	10	21.7	3.2	QPSK/16QAM	3625	27.67	27.67	18	45.67	Pass
5G-NR	10	35.5	3.2	QPSK/16QAM	3625	41.35	41.35	4	45.35	Pass
5G-NR	20	24.57	3.1a	256QAM	3690	30.51	27.50	18	45.50	Pass
5G-NR	20	37	3.1	64QAM	3560.001	43.09	40.08	4	44.08	Pass
5G-NR	30	26.7	3.2	QPSK/16QAM	3624.99	32.58	27.81	18	45.81	Pass
5G-NR	30	37	3.2	QPSK/16QAM	3624.99	42.96	38.19	4	42.19	Pass
5G-NR	40	27.4	3.2	QPSK/16QAM	3624.99	33.29	27.27	18	45.27	Pass
5G-NR	40	37	3.1	64QAM	3570	43.08	37.06	4	41.06	Pass
5G-NR	10+10	24.6	3.2	QPSK/16QAM	3555+3564.96	30.35	27.34	18	45.34	Pass
5G-NR	10+10	37	1.1	QPSK	3655+3695	42.97	39.96	4	43.96	Pass
5G-NR	40+40	31	3.2	QPSK/16QAM	3570+3679.995	37.26	28.23	18	46.23	Pass
5G-NR	40+40	37	3.2	QPSK/16QAM	3570+3609.96	42.86	33.83	4	37.83	Pass
LTE	10	21.73	3.1	64QAM	3555	27.93	27.93	18	45.93	Pass
LTE	10	35.5	3.2	QPSK/16QAM	3625	42.75	42.75	4	46.75	Pass
LTE	20	24.57	3.1	64QAM	3560	30.59	27.58	18	45.58	Pass
LTE	20	37	3.1a	256QAM	3690	42.8	39.79	4	43.79	Pass
LTE	10+10	24.59	3.1a	256QAM	3685+3695	31.88	28.87	18	**46.87**	Pass
LTE	10+10	37	3.1a	256QAM	3685+3695	43.04	40.03	4	44.03	Pass

The conducted RF output power results measured for all configurations and operation modes supported are presented in the following sections.

Total Maximum Effective Isotropic Radiated Power (EIRP) per BW

Technology	Signal BW (MHz)	Set Power Level (dBm)	TM	Modulation	Channel Frequency (MHz)	4 Port Max Total Power (dBm)/ BW	Antenna Gain (dBi)	Total Max EIRP (dBm/BW)
5G-NR	10	21.7	3.2	QPSK/16QAM	3625	27.67	18	45.67
5G-NR	20	24.57	3.1a	256QAM	3690	30.51	18	48.51
5G-NR	30	26.7	3.2	QPSK/16QAM	3624.99	32.58	18	50.58
5G-NR	40	27.4	3.2	QPSK/16QAM	3624.99	33.29	18	51.29
5G-NR	10+10	24.6	3.2	QPSK/16QAM	3555+3564.96	30.35	18	48.35
5G-NR	40+40	31	3.2	QPSK/16QAM	3570+3679.995	37.26	18	55.36
LTE	10	35.5	3.2	QPSK/16QAM	3625	42.75	4	46.75
LTE	20	24.57	3.1	64QAM	3560	30.59	18	48.59
LTE	10+10	24.59	3.1a	256QAM	3685+3695	31.88	18	49.88

2.1.2.1 5G-NR, 10 MHz

Table 2.1 RF Power Output Results – 21.7dBm

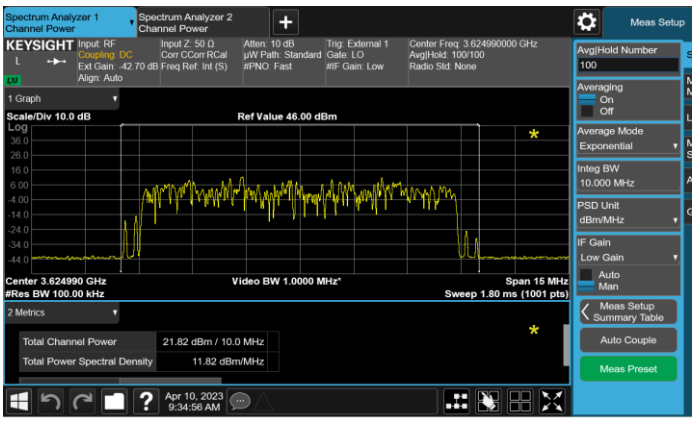
Channel Power - Signal BW 10MHz 5G-NR					
Test Model 3.1 Modulation 64 QAM Channel Frequency 35551MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3625MHz		Test Model 3.1a Modulation 256QAM Channel Frequency 3695MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	21.07	1	21.55	1	21.29
2	21.56	2	**21.82**	2	21.35
3	21.22	3	21.58	3	21.48
4	21.67	4	21.65	4	21.69
Total Power (dBm)	27.41	Total Power (dBm)	27.67	Total Power (dBm)	27.48
Total Power (W)	0.55	Total Power (W)	0.59	Total Power (W)	0.56

Table 2.2 RF Power Output Results – 35.5dBm

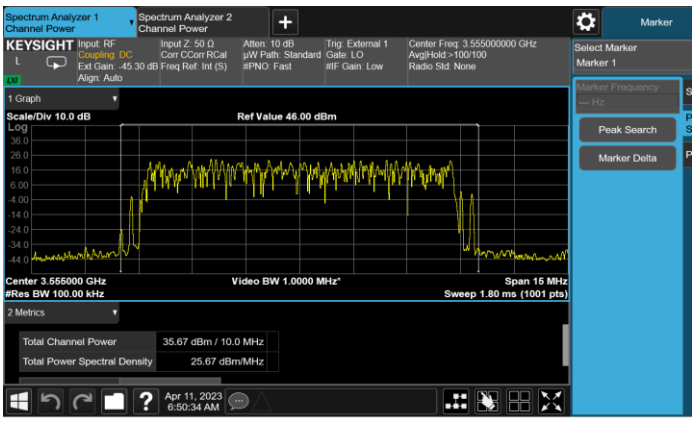
Channel Power - Signal BW 10MHz 5G-NR					
Test Model 3.1 Modulation 64 QAM Channel Frequency 35551MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3625MHz		Test Model 3.1a Modulation 256QAM Channel Frequency 3695MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	34.98	1	35.24	1	35.09
2	35.46	2	35.54	2	35.21
3	34.94	3	35.07	3	35.17
4	**35.67**	4	35.45	4	35.56
Total Power (dBm)	41.29	Total Power (dBm)	41.35	Total Power (dBm)	41.28
Total Power (W)	13.47	Total Power (W)	13.64	Total Power (W)	13.43

Maximum RF Conducted Output Power Plots

21.7dBm



35.5dBm



2.1.2.2 5G-NR, 20 MHz

Table 2.3 RF Power Output Results - 24.57dBm

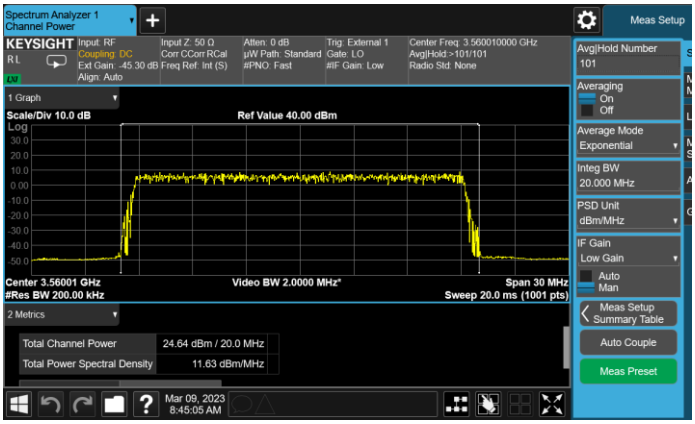
Channel Power - Signal BW 20MHz 5G-NR					
Test Model 3.1 Modulation 64 QAM Channel Frequency 3560.01MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3624.99MHz		Test Model 3.1a Modulation 256QAM Channel Frequency 3690MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	24.26	1	24.35	1	24.42
2	24.59	2	24.61	2	24.57
3	24.25	3	24.25	3	24.43
4	**24.64**	4	24.48	4	24.55
Total Power (dBm)	30.46	Total Power (dBm)	30.45	Total Power (dBm)	30.51
Total Power (W)	1.11	Total Power (W)	1.11	Total Power (W)	1.13

Table 2.4 RF Power Output Results - 37dBm

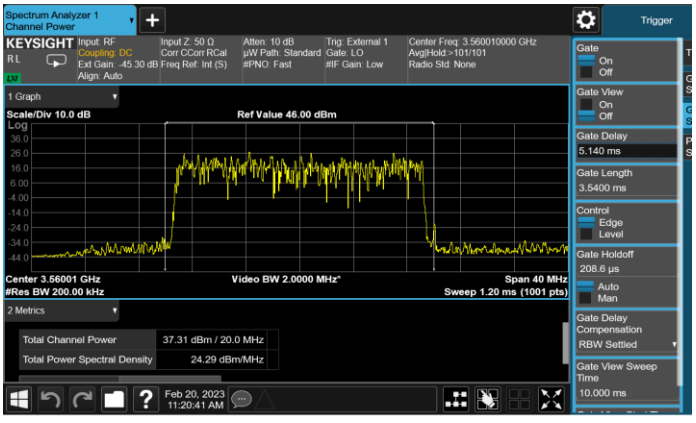
Channel Power - Signal BW 20MHz 5G-NR					
Test Model 3.1 Modulation 64 QAM Channel Frequency 3560.001MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3624.99MHz		Test Model 3.1a Modulation 256QAM Channel Frequency 3690MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	36.82	1	36.42	1	36.85
2	37.15	2	36.74	2	37.03
3	37.00	3	36.43	3	36.99
4	**37.31**	4	36.69	4	37.07
Total Power (dBm)	43.09	Total Power (dBm)	42.59	Total Power (dBm)	43.01
Total Power (W)	20.39	Total Power (W)	18.17	Total Power (W)	19.98

Maximum RF Conducted Output Power Plots

24.57dBm



37dBm



2.1.2.3 5G-NR, 30 MHz

Table 2.5 RF Power Output Results – 26.7dBm

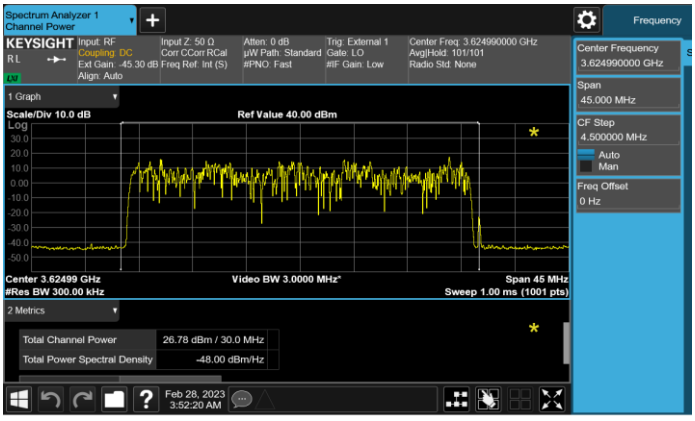
Channel Power - Signal BW 30MHz 5G-NR					
Test Model 3.1 Modulation 64 QAM Channel Frequency 3565.005MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3624.99MHz		Test Model 1.1 Modulation QPSK Channel Frequency 3684.99MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	26.39	1	26.45	1	26.41
2	26.69	2	26.71	2	26.57
3	26.30	3	26.27	3	26.39
4	26.77	4	**26.78**	4	26.62
Total Power (dBm)	32.56	Total Power (dBm)	32.58	Total Power (dBm)	32.52
Total Power (W)	1.80	Total Power (W)	1.81	Total Power (W)	1.79

Table 2.6 RF Power Output Results - 37dBm

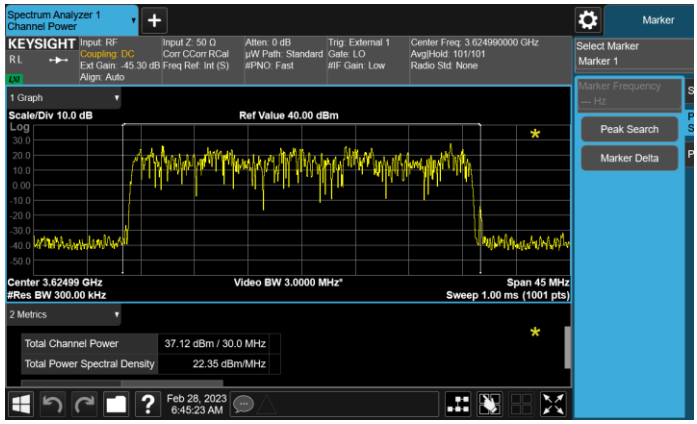
Channel Power - Signal BW 30MHz 5G-NR					
Test Model 3.1 Modulation 64 QAM Channel Frequency 3565.005MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3624.99MHz		Test Model 3.1a Modulation 256QAM Channel Frequency 3684.99MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	36.70	1	36.80	1	36.76
2	37.05	2	37.07	2	36.94
3	36.84	3	36.74	3	36.79
4	37.09	4	**37.12**	4	36.94
Total Power (dBm)	42.94	Total Power (dBm)	42.96	Total Power (dBm)	42.88
Total Power (W)	19.69	Total Power (W)	19.75	Total Power (W)	19.40

Maximum RF Conducted Output Power Plots

26.7dBm



37dBm



2.1.2.4 5G-NR, 40 MHz

Table 2.7 RF Power Output Results –27.4dBm

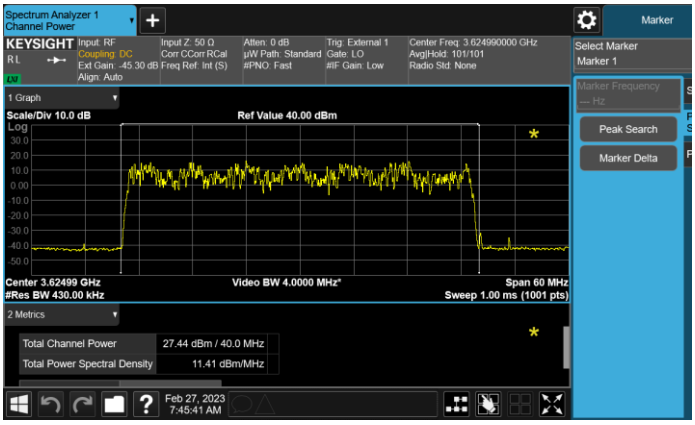
Channel Power - Signal BW 40MHz 5G-NR					
Test Model 3.1 Modulation 64 QAM Channel Frequency 3570MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3624.99MHz		Test Model 3.1a Modulation 256QAM Channel Frequency 3679.995MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	27.03	1	27.11	1	27.20
2	27.35	2	27.37	2	27.34
3	26.97	3	27.14	3	27.06
4	27.42	4	**27.44**	4	27.42
Total Power (dBm)	33.22	Total Power (dBm)	33.29	Total Power (dBm)	33.28
Total Power (W)	2.10	Total Power (W)	2.13	Total Power (W)	2.13

Table 2.8 RF Power Output Results - 37dBm

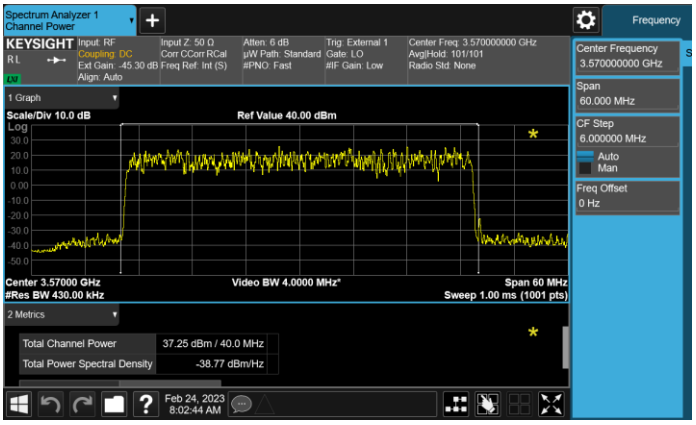
Channel Power - Signal BW 40MHz 5G-NR					
Test Model 3.1 Modulation 64 QAM Channel Frequency 3570MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3624.99MHz		Test Model 1.1 Modulation QPSK Channel Frequency 3679.99MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	36.82	1	36.61	1	36.80
2	37.18	2	36.86	2	36.99
3	36.99	3	36.67	3	36.82
4	**37.25**	4	36.90	4	37.01
Total Power (dBm)	43.08	Total Power (dBm)	42.78	Total Power (dBm)	42.93
Total Power (W)	20.34	Total Power (W)	18.98	Total Power (W)	19.62

Maximum RF Conducted Output Power Plots

27.4dBm



37dBm



2.1.2.5 5G-NR, 10+10 MHz

Table 2.9 RF Power Output Results – 24.6dBm

Channel Power - Signal BW 10+10 MHz 5G-NR			
Test Model 1.1 Modulation QPSK Channel Frequency 3655+3694.995MHz * Non-Contiguous		Test Model 3.2 Modulation QPSK+16QAM Channel Frequency 3555+3564.96MHz	
TX Port	(dBm)	TX Port	(dBm)
1	23.99	1	24.02
2	24.26	2	24.50
3	24.14	3	24.14
4	24.55	4	**24.62**
Total Power (dBm)	30.26	Total Power (dBm)	30.35
Total Power (W)	1.06	Total Power (W)	1.08

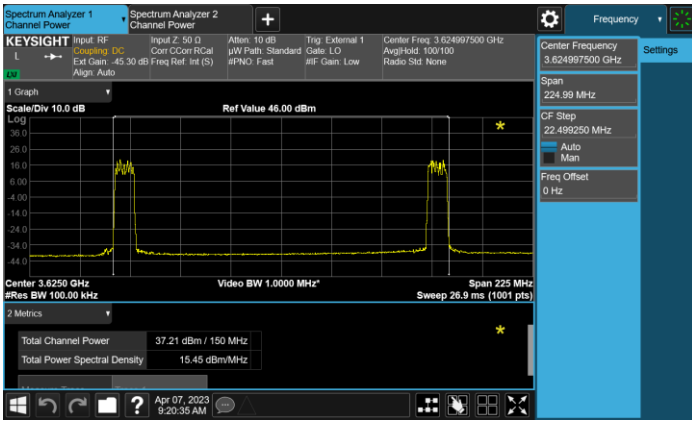
Table 2.10 RF Power Output Results - 37dBm

Channel Power - Signal BW 10+10 MHz 5G-NR			
Test Model 1.1 Modulation QPSK Channel Frequency 3655+3695MHz * Non-Contiguous		Test Model 3.2 Modulation QPSK+16QAM Channel Frequency 3555+3564.96MHz	
TX Port	(dBm)	TX Port	(dBm)
1	36.70	1	36.25
2	37.00	2	36.77
3	36.87	3	36.36
4	**37.21**	4	36.82
Total Power (dBm)	42.97	Total Power (dBm)	42.58
Total Power (W)	19.81	Total Power (W)	18.10

Maximum RF Conducted Output Power Plots

24.6dBm

37dBm



2.1.2.6 5G-NR, 40+40 MHz

Table 2.11 RF Power Output Results – 31dBm

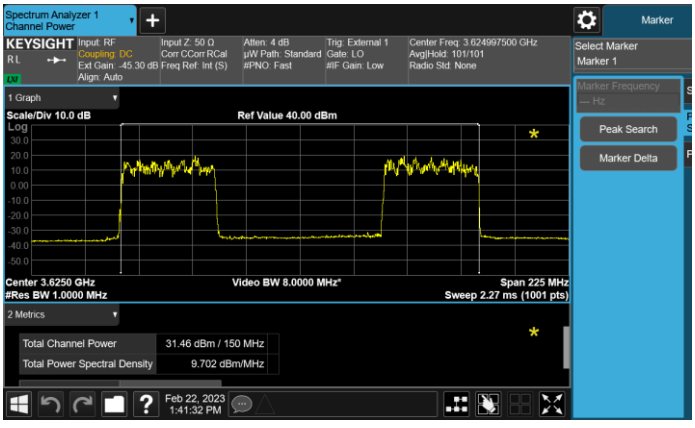
Channel Power - Signal BW 40+40 MHz 5G-NR							
Test Model 3.2 Modulation QPSK+16QAM Channel Frequency 3570+3679.995MHz * Non-Contiguous		Test Model 3.2 Modulation QPSK+16QAM Channel Frequency 3570+3609.96MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3604.995 + 3644.955MHz		Test Model 3.1a Modulation 256QAM Channel Frequency 3639.99 + 3679.95MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	31.12	1	30.78	1	30.92	1	30.99
2	31.35	2	31.09	2	31.17	2	30.83
3	31.02	3	30.71	3	30.87	3	31.17
4	**31.46**	4	31.15	4	31.23	4	31.24
Total Power (dBm)	37.26	Total Power (dBm)	36.96	Total Power (dBm)	37.07	Total Power (dBm)	37.08
Total Power (W)	5.32	Total Power (W)	4.96	Total Power (W)	5.09	Total Power (W)	5.11

Table 2.12 RF Power Output Results - 37dBm

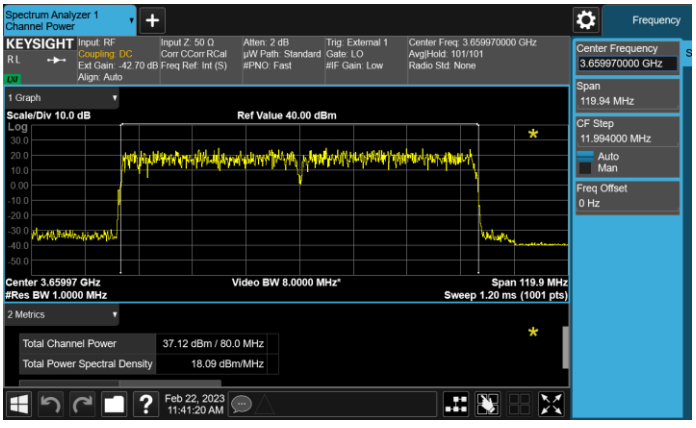
Channel Power - Signal BW 40+40 MHz 5G-NR							
Test Model 1.1 Modulation QPSK Channel Frequency 3570+3679.995MHz * Non-Contiguous		Test Model 3.2 Modulation QPSK+16QAM Channel Frequency 3570+3609.96MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3604.995 + 3644.955MHz		Test Model 3.1a Modulation 256QAM Channel Frequency 3639.99 + 3679.95MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	36.50	1	36.66	1	36.71	1	36.66
2	36.76	2	36.97	2	36.97	2	**37.12**
3	36.58	3	36.73	3	36.78	3	36.59
4	36.80	4	37.00	4	36.89	4	36.91
Total Power (dBm)	42.68	Total Power (dBm)	42.86	Total Power (dBm)	42.86	Total Power (dBm)	42.85
Total Power (W)	18.55	Total Power (W)	19.33	Total Power (W)	19.32	Total Power (W)	19.26

Maximum RF Conducted Output Power Plots

31dBm



37dBm



2.1.2.7 LTE, 10 MHz

Table 2.13 RF Power Output Results – 21.73dBm

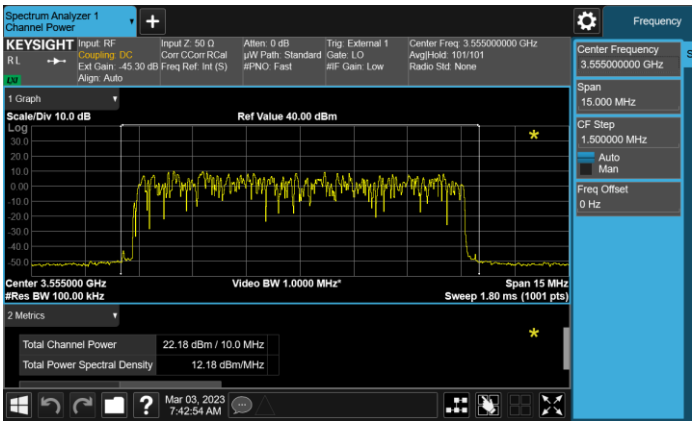
Channel Power - Signal BW 10MHz LTE					
Test Model 3.1 Modulation 64 QAM Channel Frequency 3555MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3625MHz		Test Model 3.1a Modulation 256QAM Channel Frequency 3695MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	21.69	1	21.54	1	21.43
2	22.06	2	21.73	2	21.90
3	21.67	3	21.39	3	21.59
4	**22.18**	4	21.48	4	21.76
Total Power (dBm)	27.93	Total Power (dBm)	27.56	Total Power (dBm)	27.69
Total Power (W)	0.62	Total Power (W)	0.57	Total Power (W)	0.59

Table 2.14 RF Power Output Results – 35.5dBm

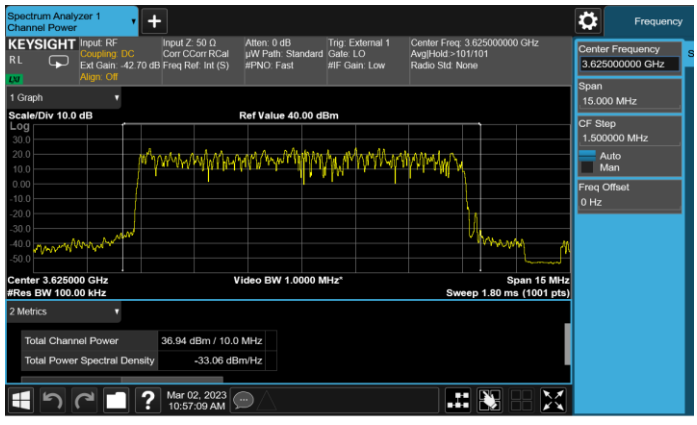
Channel Power - Signal BW 10MHz LTE					
Test Model 3.1 Modulation 64 QAM Channel Frequency 3555MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3625MHz		Test Model 3.1a Modulation 256QAM Channel Frequency 3695MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	35.08	1	36.68	1	35.12
2	35.42	2	**36.94**	2	35.27
3	34.98	3	36.68	3	35.28
4	35.57	4	36.60	4	35.43
Total Power (dBm)	41.29	Total Power (dBm)	42.75	Total Power (dBm)	41.30
Total Power (W)	13.46	Total Power (W)	18.83	Total Power (W)	13.48

Maximum RF Conducted Output Power Plots

21.73dBm



35.5dBm



2.1.2.8 LTE, 20 MHz

Table 2.15 RF Power Output Results – 24.57dBm

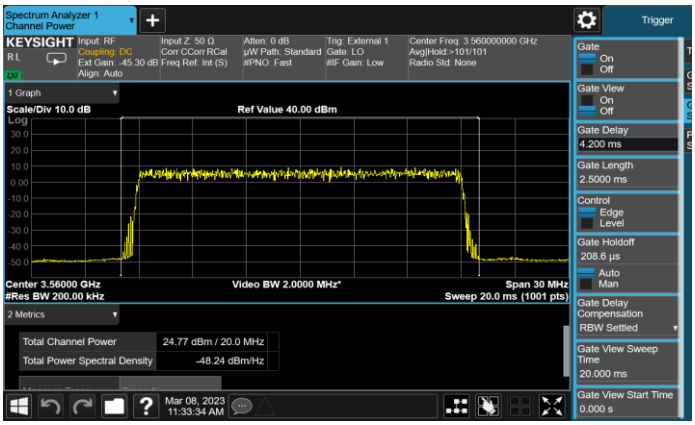
Channel Power - Signal BW 20MHz LTE					
Test Model 3.1 Modulation 64 QAM Channel Frequency 3560MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3625MHz		Test Model 3.1a Modulation 256QAM Channel Frequency 3690MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	24.37	1	24.39	1	24.43
2	24.71	2	24.64	2	24.57
3	24.43	3	24.31	3	24.55
4	**24.77**	4	24.49	4	24.57
Total Power (dBm)	30.59	Total Power (dBm)	30.48	Total Power (dBm)	30.55
Total Power (W)	1.15	Total Power (W)	1.12	Total Power (W)	1.14

Table 2.16 RF Power Output Results – 37dBm

Channel Power - Signal BW 20MHz LTE					
Test Model 3.1 Modulation 64 QAM Channel Frequency 3560MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3625MHz		Test Model 3.1a Modulation 256QAM Channel Frequency 3690MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	36.36	1	36.26	1	36.71
2	36.73	2	36.71	2	36.83
3	36.43	3	36.31	3	36.69
4	36.81	4	36.54	4	**36.89**
Total Power (dBm)	42.61	Total Power (dBm)	42.48	Total Power (dBm)	42.80
Total Power (W)	18.23	Total Power (W)	17.70	Total Power (W)	19.06

Maximum RF Conducted Output Power Plots

24.57dBm



37dBm

2.1.2.9 LTE, 10+10 MHz

Table 2.17 RF Power Output Results – 24.59dBm

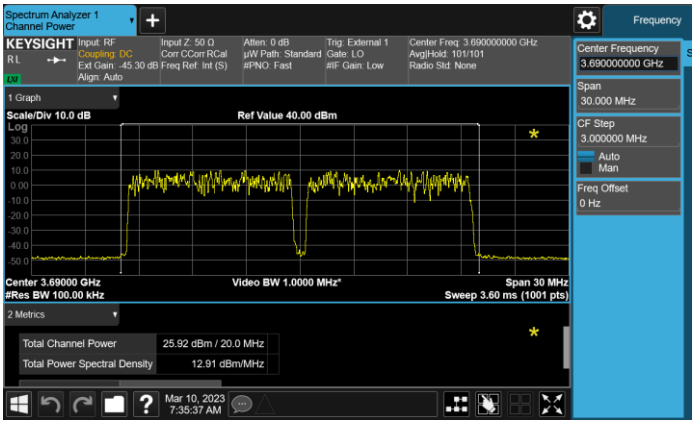
Channel Power - Signal BW 10+10 MHz LTE							
Test Model 1.1 Modulation QPSK Channel Frequency 3655+3695MHz * Non-Contiguous		Test Model 3.2 Modulation QPSK+16QAM Channel Frequency 3555+3565MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3620 + 3630MHz		Test Model 3.1a Modulation 256QAM Channel Frequency 3685 + 3695MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	24.32	1	24.16	1	24.61	1	25.79
2	24.56	2	24.55	2	24.85	2	25.90
3	24.62	3	24.46	3	24.53	3	25.83
4	24.07	4	24.59	4	24.75	4	**25.92**
Total Power (dBm)	30.42	Total Power (dBm)	30.46	Total Power (dBm)	30.71	Total Power (dBm)	31.88
Total Power (W)	1.10	Total Power (W)	1.11	Total Power (W)	1.18	Total Power (W)	1.54

Table 2.18 RF Power Output Results – 37dBm

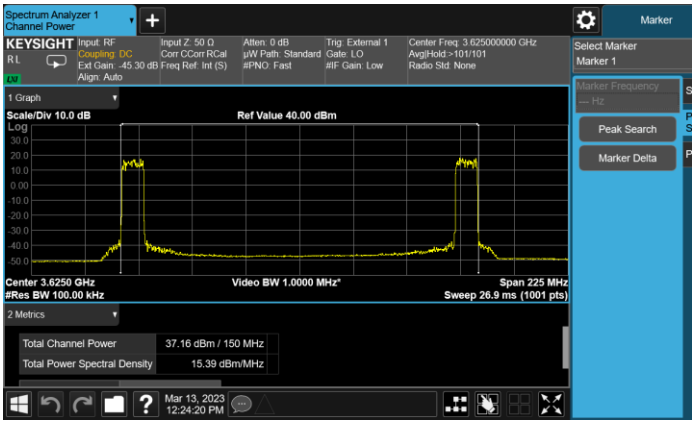
Channel Power - Signal BW 10+10 MHz LTE							
Test Model 1.1 Modulation QPSK Channel Frequency 3555+3695MHz * Non-Contiguous		Test Model 3.2 Modulation QPSK+16QAM Channel Frequency 3555+3565MHz		Test Model 3.2 Modulation QPSK/16QAM Channel Frequency 3620 + 3630MHz		Test Model 3.1a Modulation 256QAM Channel Frequency 3685 + 3695MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
1	36.82	1	36.76	1	36.75	1	36.96
2	37.07	2	37.07	2	36.99	2	37.10
3	36.83	3	36.79	3	36.74	3	36.91
4	**37.16**	4	37.13	4	36.88	4	37.12
Total Power (dBm)	42.99	Total Power (dBm)	42.96	Total Power (dBm)	42.86	Total Power (dBm)	43.04
Total Power (W)	19.92	Total Power (W)	19.78	Total Power (W)	19.33	Total Power (W)	20.16

Maximum RF Conducted Output Power Plots

24.59dBm



37dBm



2.2 Power Spectral Density

2.2.1 Limits

The FCC Part 96.41 requirement for Category B CBSD is that the Power Spectral Density (PSD) of the EUT shall not exceed 37 dBm/MHz.

2.2.2 Results

The peak average PSD of the EUT was measured per ANSI C63.26 methods and procedures and with the PSD Measurement feature of the MXA Analyzer. The PSD was measured when the product was set to each power setting for the bandwidths being measured at the antenna transmitting terminals. The signal bandwidths, modulations and transmit channels identified in Table below were evaluated. The measured power spectral density level was documented in the table below.

The Maximum Average PSD Values are bolded in each Table.

Table 2.19 LTE Power Spectral Density Results

Technology	Signal BW (MHz)	Power Level (dBm)	TM	Modulation	Channel Frequency (MHz)	TX	Peak PSD (1Port) dBm/1MHz	Peak PSD (4Port) dBm/1MHz	Antenna Gain	Total PSD dBm/1MHz	PSD Compliance
LTE	10	21.73	1.1	QPSK	3555	4	12.77	18.79	18	36.79	Pass
LTE	10	21.73	1.1	QPSK	3625	2	12.90	18.92	18	36.92	Pass
LTE	10	21.73	1.1	QPSK	3695	2	12.83	18.85	18	36.85	Pass
LTE	10	35.5	1.1	QPSK	3555	4	26.92	32.94	4	36.94	Pass
LTE	10	35.5	1.1	QPSK	3625	2	26.88	32.90	4	36.90	Pass
LTE	10	35.5	1.1	QPSK	3695	4	26.78	32.80	4	36.80	Pass
LTE	20	24.57	1.1	QPSK	3560	4	12.97	18.99	18	**36.99**	Pass
LTE	20	24.57	1.1	QPSK	3625	2	12.97	18.99	18	**36.99**	Pass
LTE	20	24.57	1.1	QPSK	3690	2	12.94	18.96	18	36.96	Pass
LTE	20	37	1.1	QPSK	3560	4	25.06	31.08	4	35.08	Pass
LTE	20	37	1.1	QPSK	3625	2	25.31	31.33	4	35.33	Pass
LTE	20	37	1.1	QPSK	3690	4	25.40	31.42	4	35.42	Pass
LTE	10+10	24.59	1.1	QPSK	3555+3565	4	12.88	18.90	18	36.90	Pass
LTE	10+10	24.59	1.1	QPSK	3620+3630	4	12.88	18.90	18	36.90	Pass
LTE	10+10	24.59	1.1	QPSK	3655+3695	4	12.25	18.27	18	36.27	Pass
LTE	10+10	24.59	1.1	QPSK	3685+3695	4	12.92	18.94	18	36.94	Pass
LTE	10+10	37	1.1	QPSK	3555+3565	4	25.45	31.47	4	35.47	Pass
LTE	10+10	37	1.1	QPSK	3555+3695	4	23.87	29.89	4	33.89	Pass
LTE	10+10	37	1.1	QPSK	3620+3630	2	25.08	31.10	4	35.10	Pass
LTE	10+10	37	1.1	QPSK	3685+3695	4	24.94	30.96	4	34.96	Pass

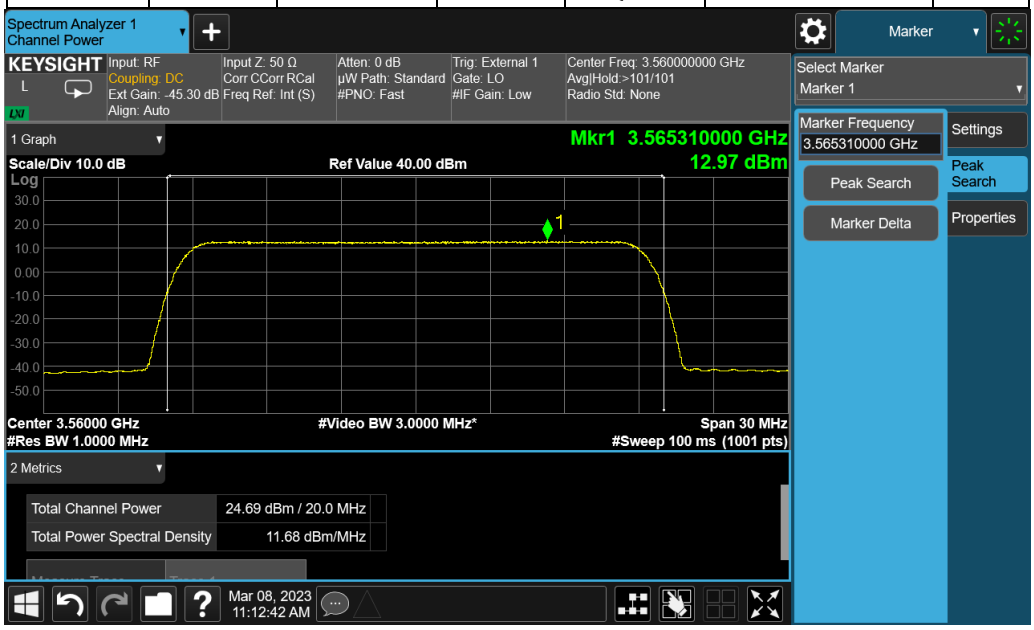
Table 2.20 5G-NR Power Spectral Density Results

Technology	Signal BW (MHz)	Power Level (dBm)	TM	Modulation	Channel Frequency (MHz)	TX	Peak PSD (1Port) dBm/1MHz	Peak PSD (4Port) dBm/1MHz	Antenna Gain	Total PSD dBm/1MHz	PSD Compliance
5G-NR	10	21.7	1.1	QPSK	3555	4	12.89	18.91	18	36.91	Pass
5G-NR	10	21.7	1.1	QPSK	3625	2	12.74	18.76	18	36.76	Pass
5G-NR	10	21.7	1.1	QPSK	3695	4	12.79	18.81	18	36.81	Pass
5G-NR	10	35.5	1.1	QPSK	3555	4	26.90	32.92	4	36.92	Pass
5G-NR	10	35.5	1.1	QPSK	3625	2	26.89	32.91	4	36.91	Pass
5G-NR	10	35.5	1.1	QPSK	3695	4	26.58	32.60	4	36.60	Pass
5G-NR	20	24.57	1.1	QPSK	3560.01	4	12.68	18.70	18	36.70	Pass
5G-NR	20	24.57	1.1	QPSK	3624.99	2	12.65	18.67	18	36.67	Pass
5G-NR	20	24.57	1.1	QPSK	3690	2	12.72	18.74	18	36.74	Pass
5G-NR	20	37	1.1	QPSK	3560.001	4	25.78	31.80	4	35.80	Pass
5G-NR	20	37	1.1	QPSK	3624.99	2	25.48	31.50	4	35.50	Pass
5G-NR	20	37	1.1	QPSK	3690	4	25.08	31.10	4	35.10	Pass
5G-NR	30	26.7	1.1	QPSK	3565.005	4	12.79	18.81	18	36.81	Pass
5G-NR	30	26.7	1.1	QPSK	3624.99	4	12.86	18.88	18	36.88	Pass
5G-NR	30	26.7	1.1	QPSK	3684.99	4	12.91	18.93	18	36.93	Pass
5G-NR	30	37	1.1	QPSK	3565.005	4	23.19	29.21	4	33.21	Pass
5G-NR	30	37	1.1	QPSK	3624.99	4	23.24	29.26	4	33.26	Pass
5G-NR	30	37	1.1	QPSK	3684.99	4	23.47	29.49	4	33.49	Pass
5G-NR	40	27.4	1.1	QPSK	3570	4	12.38	18.40	18	36.40	Pass
5G-NR	40	27.4	1.1	QPSK	3624.99	4	12.86	18.88	18	36.88	Pass
5G-NR	40	27.4	1.1	QPSK	3679.995	4	12.95	18.97	18	**36.97**	Pass
5G-NR	40	37	1.1	QPSK	3570	4	21.80	27.82	4	31.82	Pass
5G-NR	40	37	1.1	QPSK	3624.99	4	21.97	27.99	4	31.99	Pass
5G-NR	40	37	1.1	QPSK	3679.99	4	22.57	28.59	4	32.59	Pass
5G-NR	10+10	24.6	1.1	QPSK	3555+3564.96	4	12.94	18.96	18	36.96	Pass
5G-NR	10+10	24.6	1.1	QPSK	3555+3694.995	4	12.91	18.93	18	36.93	Pass
5G-NR	10+10	37	1.1	QPSK	3555+3564.96	4	24.99	31.01	4	35.01	Pass
5G-NR	10+10	37	1.1	QPSK	3555+3695	4	25.37	31.39	4	35.39	Pass
5G-NR	40+40	31	1.1	QPSK	3570+3679.995	4	12.25	18.27	18	36.27	Pass
5G-NR	40+40	31	1.1	QPSK	3570+3609.96	4	12.49	18.51	18	36.51	Pass
5G-NR	40+40	31	1.1	QPSK	3604.995 + 3644.955	4	12.89	18.91	18	36.91	Pass
5G-NR	40+40	31	1.1	QPSK	3639.99+3679.95	4	12.84	18.86	18	36.86	Pass
5G-NR	40+40	37	1.1	QPSK	3570+3679.995	4	18.34	24.36	4	28.36	Pass
5G-NR	40+40	37	1.1	QPSK	3570+3609.96	4	18.82	24.84	4	28.84	Pass
5G-NR	40+40	37	1.1	QPSK	3604.995+3644.955	2	18.74	24.76	4	28.76	Pass
5G-NR	40+40	37	1.1	QPSK	3639.99+3679.95	4	18.57	24.59	4	28.59	Pass

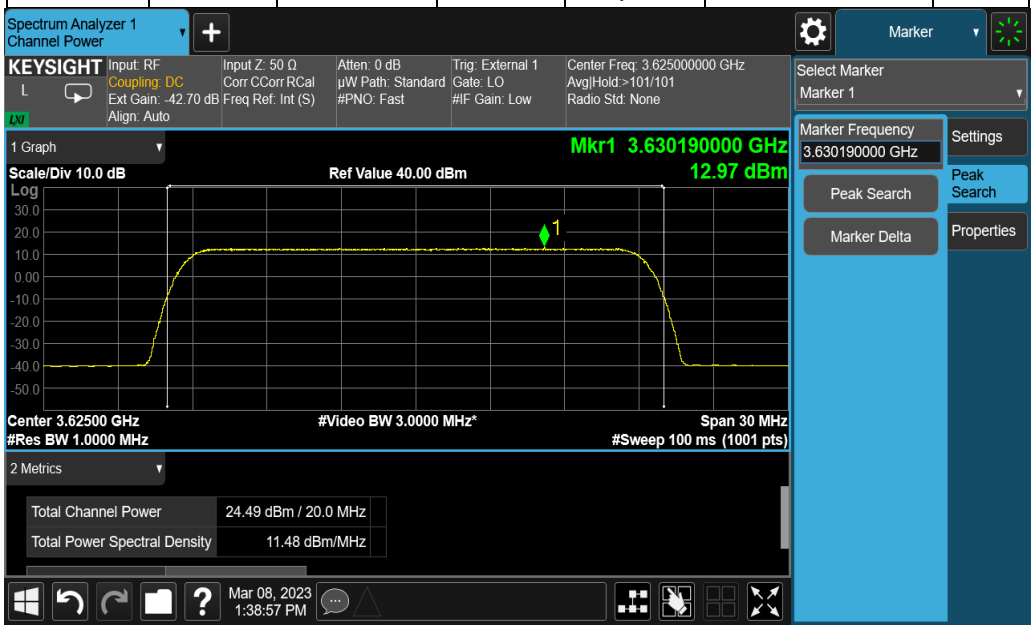
2.2.3 Maximum Conducted PSD Plots

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.

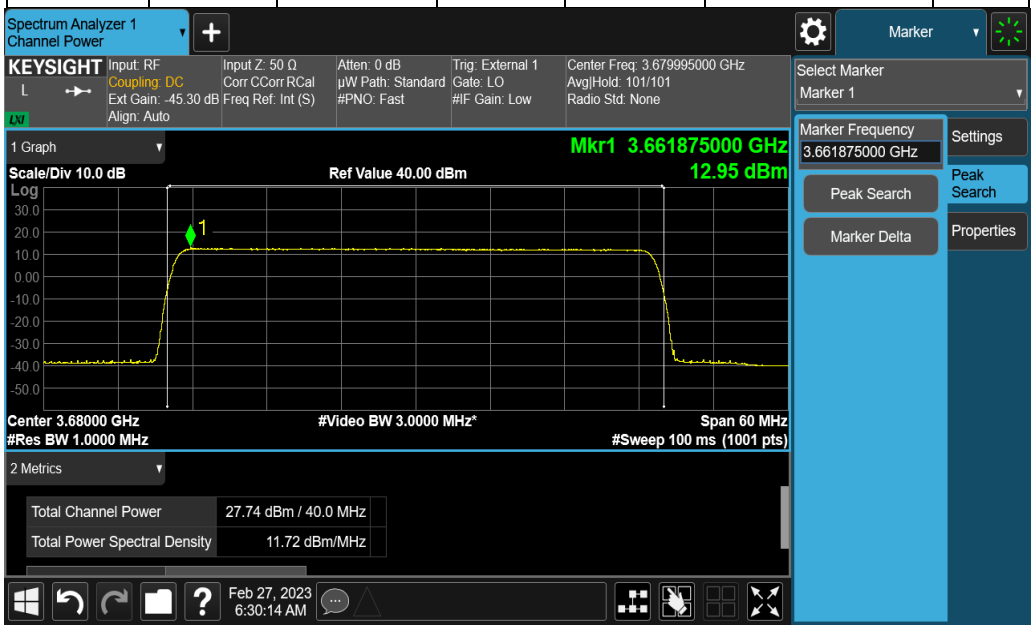
Technology	Signal BW (MHz)	Power Level (dBm)	TM	Modulation	Channel Frequency (MHz)	TX
LTE	20	24.57	1.1	QPSK	3560	4



Technology	Signal BW (MHz)	Power Level (dBm)	TM	Modulation	Channel Frequency (MHz)	TX
LTE	20	24.57	1.1	QPSK	3625	2



Technology	Signal BW (MHz)	Power Level (dBm)	TM	Modulation	Channel Frequency (MHz)	TX
5G-NR	40	27.4	1.1	QPSK	3679.995	4



2.3 Peak-to-Average Power Ratio (PAPR)

The Peak-to-Average Power Ratio (PAPR) of the EUT was measured per KDB 971168 D01 using the Power Complementary Cumulative Distribution Function (CCDF) feature of the MXA Analyzer. The PAPR measurements are tabulated in Table 2.16.

The FCC requirement for PAPR is that the transmitter's peak-to-average power ratio (PAPR) shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission. The maximum PAPR value for each measured configuration is given in Table 2.16.

2.3.1 Peak-to-Average Power Ratio Result

The maximum Peak-to-Average Power Ratio (PAPR) of the EUT measured at its antenna transmitting terminals was measured to be 8.11dB maximum, which is in full compliance with the requirement to not exceed 13 dB as specified by the FCC. The representative data sets exact values are listed in Table 2.16 below.

Table 2.21 Peak to Average Power Ratio

Technology	Signal BW (MHz)	Power Level (dBm)	TM	Modulation	Channel Frequency (MHz)	TX	PAR at 0.1% Limit - 13 dB
5G-NR	10	35.5	3.1	64QAM	3555	4	8.17
5G-NR	10	35.5	3.2	QPSK/16QAM	3625	2	8.48
5G-NR	10	35.5	3.1a	256QAM	3695	4	8.53
5G-NR	20	37	3.1	64QAM	3560.01	4	8.15
5G-NR	20	37	3.2	QPSK/16QAM	3624.99	2	8.18
5G-NR	20	37	3.1a	256QAM	3690	4	8.38
5G-NR	30	37	3.1	64QAM	3565.005	4	8.42
5G-NR	30	37	3.2	QPSK/16QAM	3624.99	4	8.43
5G-NR	30	37	3.1a	256QAM	3684.99	4	8.41
5G-NR	40	37	3.1	64QAM	3570	4	8.39
5G-NR	40	37	3.2	QPSK/16QAM	3624.99	4	8.34
5G-NR	40	37	3.1a	256QAM	3679.995	4	8.43
5G-NR	10+10	37	3.2	QPSK/16QAM	3555+3564.96	4	8.82
5G-NR	10+10	37	3.2	QPSK/16QAM	3555+3695	4	8.46 / 8.43
5G-NR	40+40	37	1.1	QPSK	3570+3679.995	4	8.66 / 8.56
5G-NR	40+40	37	3.2	QPSK/16QAM	3570+3609.96	4	8.58
5G-NR	40+40	37	3.2	QPSK/16QAM	3604.995+3644.955	2	8.51
5G-NR	40+40	37	3.1a	256QAM	3639.99+3679.95	4	**9.24**
LTE	10	35.5	3.1	64QAM	3555	4	8.28
LTE	10	35.5	3.2	QPSK/16QAM	3625	2	7.77
LTE	10	35.5	3.1a	256QAM	3695	4	8.45
LTE	20	37	3.1	64QAM	3560	4	7.70
LTE	20	37	3.2	QPSK/16QAM	3625	2	7.80
LTE	20	37	3.1a	256QAM	3690	4	7.80
LTE	10+10	37	3.2	QPSK/16QAM	3555+3565	4	7.80
LTE	10+10	37	1.1	QPSK	3555+3695	4	7.95
LTE	10+10	37	3.2	QPSK/16QAM	3620+3630	2	7.86
LTE	10+10	37	3.1a	256QAM	3685+3695	4	8.31 / 8.22

2.3.2 Peak-to-Average Power Ratio Plot

NOTE: Only the worst-case plot is used in this report. The full suite of raw data resides at the MH, New Jersey location.

3. FCC Section 2.1047 - Modulation Characteristics

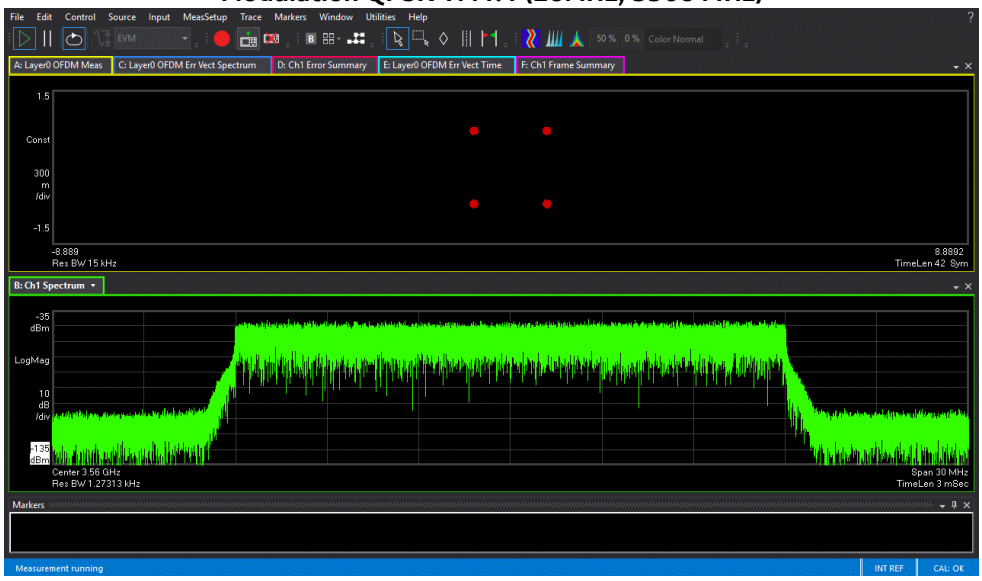
3.1 Modulation Characteristics

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

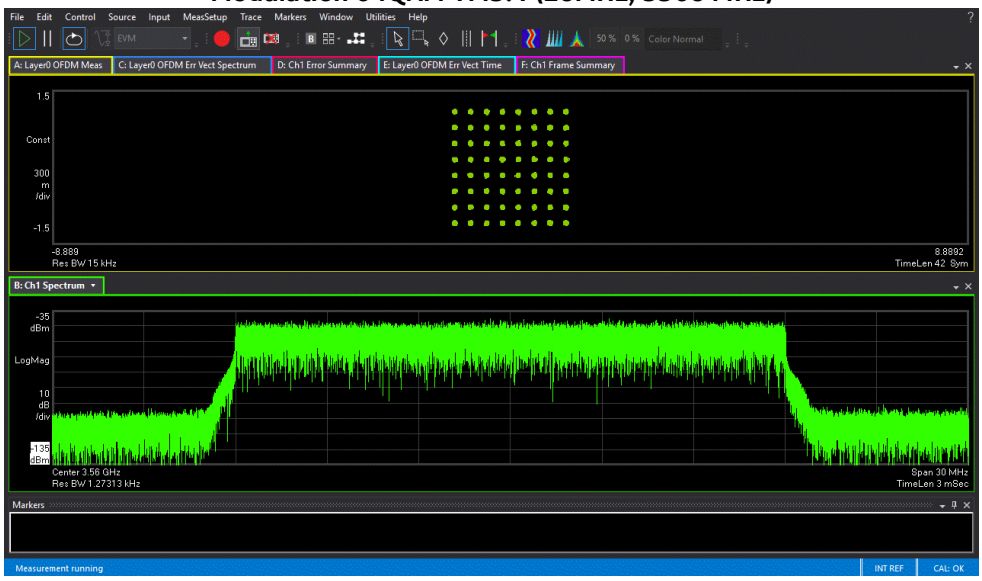
3.1.1 Modulation Characteristics – Plots

LTE

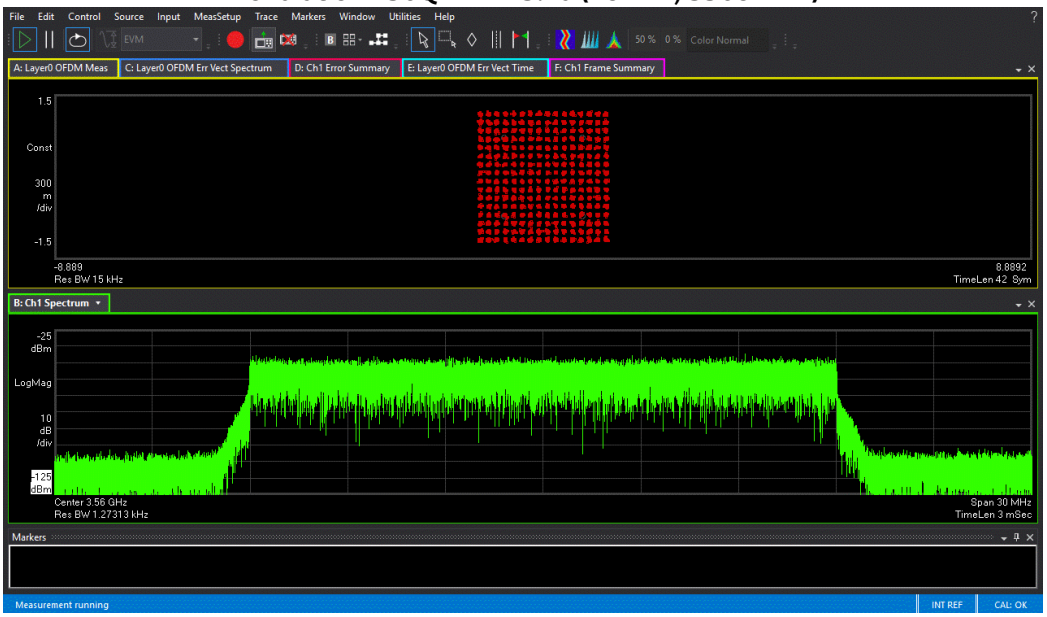
Modulation QPSK TM1.1 (20MHz, 3560 MHz)



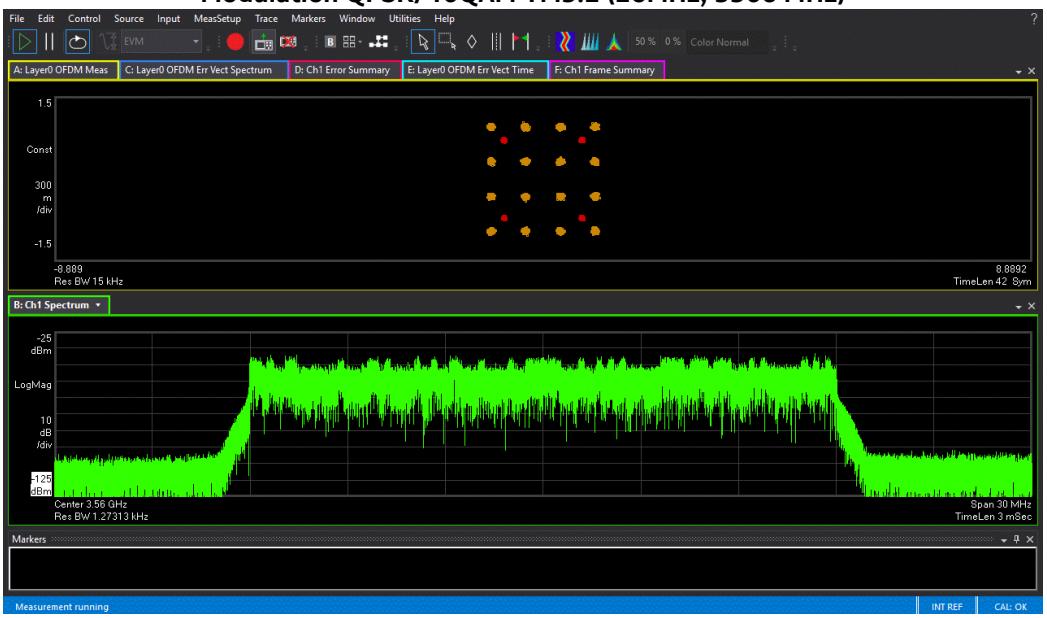
Modulation 64QAM TM3.1 (20MHz, 3560 MHz)



Modulation 256QAM TM3.1a (20MHz, 3560 MHz)

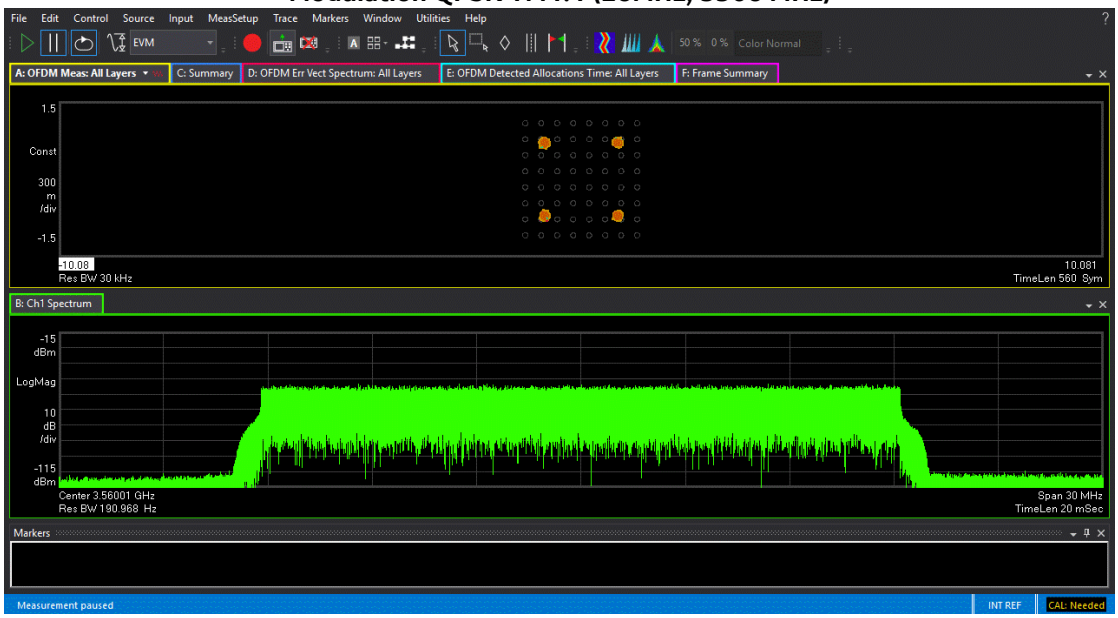


Modulation QPSK/16QAM TM3.2 (20MHz, 3560 MHz)

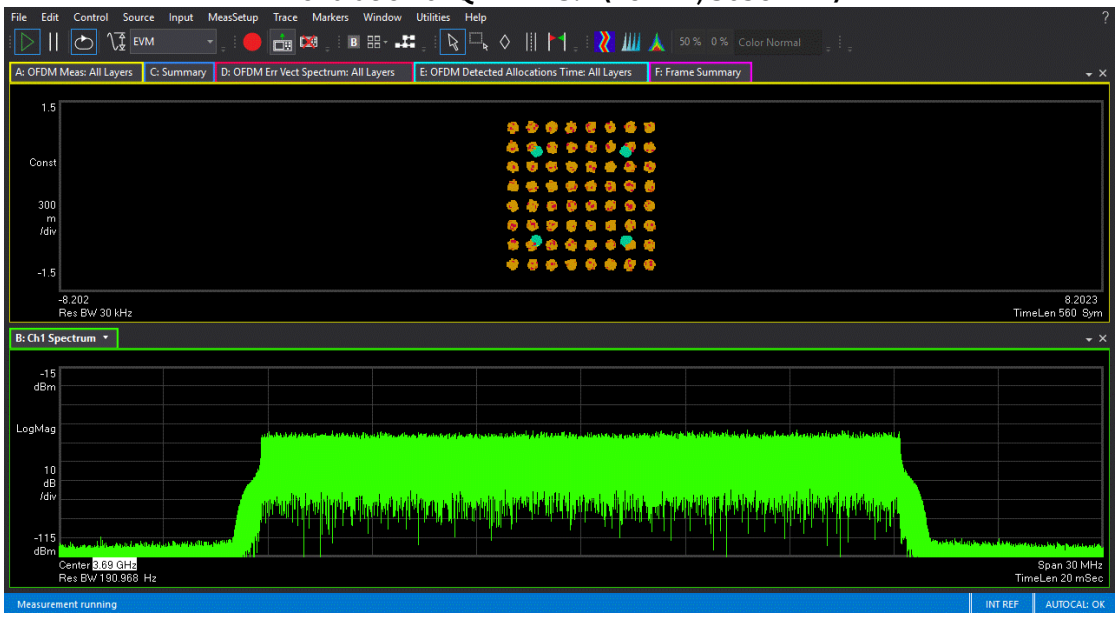


5G-NR

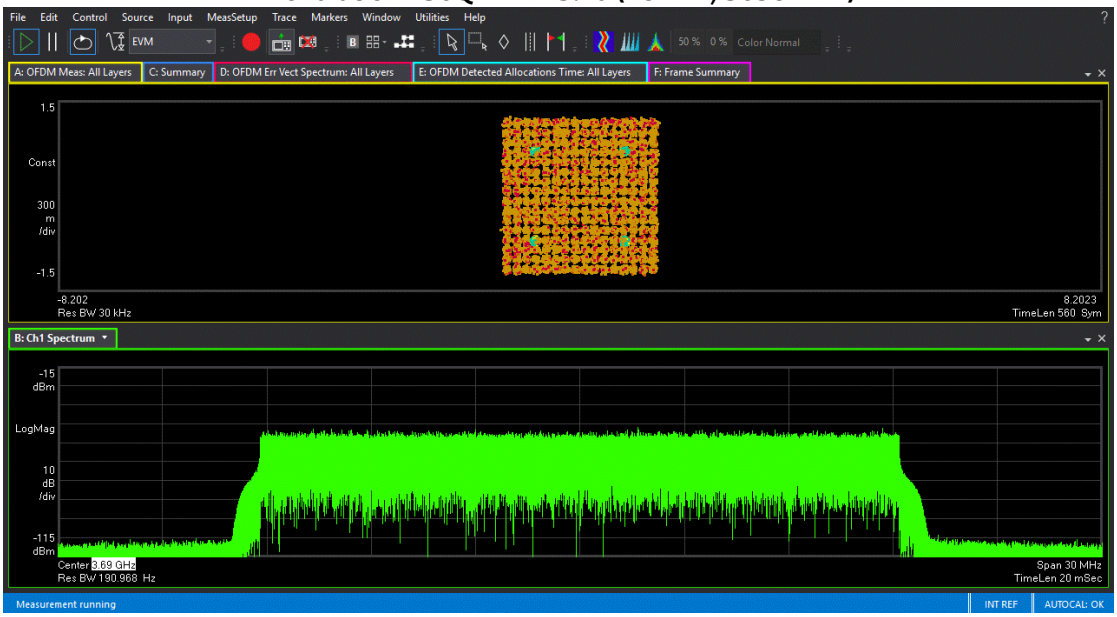
Modulation QPSK TM1.1 (20MHz, 3560 MHz)



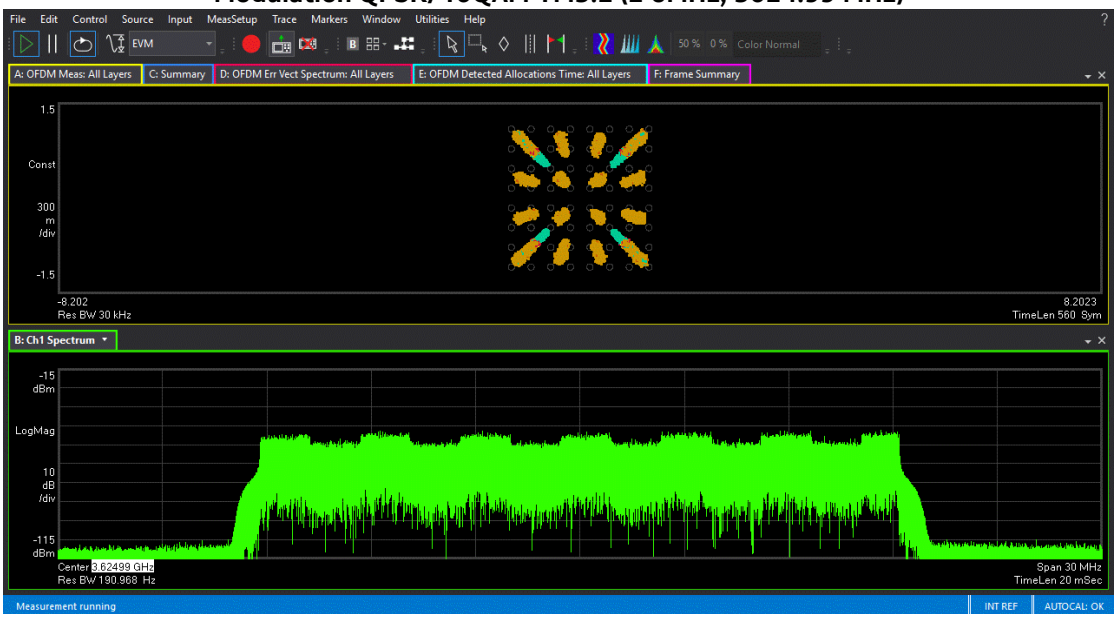
Modulation 64QAM TM3.1 (20MHz, 3690 MHz)



Modulation 256QAM TM3.1a (20MHz, 3690 MHz)



Modulation QPSK/16QAM TM3.2 (2 0MHz, 3624.99 MHz)



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.

Part 96.41e(3) specified that the fundamental emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

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

4.1.1 Occupied Bandwidth – Result

4.1.1.1 99% Occupied Bandwidth Result

99% Occupied Bandwidth

Technology	Signal BW (MHz)	Power Level (dBm)	TM	Modulation	Channel Frequency (MHz)	TX	99% Occupied BW (MHz)
5G-NR	10	35.5	3.1	64QAM	3555	4	8.4631
5G-NR	10	35.5	3.2	QPSK/16QAM	3625	2	**8.5537**
5G-NR	10	35.5	3.1a	256QAM	3695	4	8.5362
5G-NR	20	37	3.1	64QAM	3560.01	4	17.945
5G-NR	20	37	3.2	QPSK/16QAM	3624.99	2	**18.207**
5G-NR	20	37	3.1a	256QAM	3690	4	18.124
5G-NR	30	37	3.1	64QAM	3565.005	4	**27.882**
5G-NR	30	37	3.2	QPSK/16QAM	3624.99	4	27.878
5G-NR	30	37	3.1a	256QAM	3684.99	4	27.542
5G-NR	40	37	3.1	64QAM	3570	4	37.672
5G-NR	40	37	3.2	QPSK/16QAM	3624.99	4	**37.781**
5G-NR	40	37	1.1	QPSK	3679.995	4	37.710
5G-NR	10+10	37	3.2	QPSK/16QAM	3555+3564.96	4	**18.218**
5G-NR	10+10	37	3.2	QPSK/16QAM	3555+3695	4	8.5538+8.4964
5G-NR	40+40	37	1.1	QPSK	3570+3679.995	4	37.756 + 37.682
5G-NR	40+40	37	3.2	QPSK/16QAM	3570+3609.96	4	**77.795**
5G-NR	40+40	37	3.2	QPSK/16QAM	3604.995+3644.955	2	77.759
5G-NR	40+40	37	3.1a	256QAM	3639.99+3679.95	4	77.591
LTE	10	35.5	3.1	64QAM	3555	4	8.8014
LTE	10	35.5	3.2	QPSK/16QAM	3625	2	8.8325
LTE	10	35.5	3.1a	256QAM	3695	4	**8.869**
LTE	20	37	3.1	64QAM	3560	4	17.560
LTE	20	37	3.2	QPSK/16QAM	3625	2	**17.713**
LTE	20	37	3.1a	256QAM	3690	4	17.692
LTE	10+10	37	3.2	QPSK/16QAM	3555+3565	4	18.850
LTE	10+10	37	3.2	QPSK/16QAM	3620+3630	2	18.848
LTE	10+10	37	3.1a	256QAM	3685+3695	4	**18.911**

4.1.1.2 26 dB Emission Bandwidth Result

26dB Emission Bandwidth

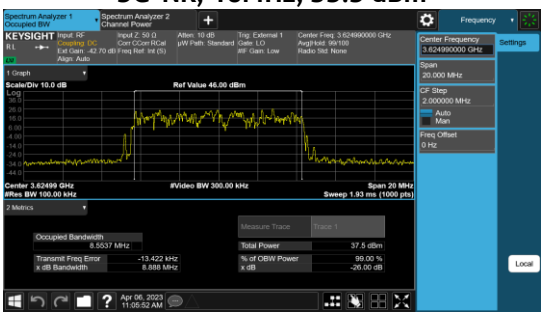
Technology	Signal BW (MHz)	Power Level (dBm)	TM	Modulation	Channel Frequency (MHz)	TX	26dBm BW (MHz)
5G-NR	10	35.5	3.1	64QAM	3555	4	8.971
5G-NR	10	35.5	3.2	QPSK/16QAM	3625	2	8.888
5G-NR	10	35.5	3.1a	256QAM	3695	4	**9.059**
5G-NR	20	37	3.1	64QAM	3560.01	4	18.75
5G-NR	20	37	3.2	QPSK/16QAM	3624.99	2	18.72
5G-NR	20	37	3.1a	256QAM	3690	4	**18.78**
5G-NR	30	37	3.1	64QAM	3565.005	4	**28.63**
5G-NR	30	37	3.2	QPSK/16QAM	3624.99	4	28.45
5G-NR	30	37	3.1a	256QAM	3684.99	4	28.6
5G-NR	40	37	3.1	64QAM	3570	4	39.28
5G-NR	40	37	3.2	QPSK/16QAM	3624.99	4	39.00
5G-NR	40	37	1.1	QPSK	3679.995	4	**39.33**
5G-NR	10+10	37	3.2	QPSK/16QAM	3555+3564.96	4	**18.91**
5G-NR	10+10	37	3.2	QPSK/16QAM	3555+3695	4	8.889+8.893
5G-NR	40+40	37	1.1	QPSK	3570+3679.995	4	38.89 + 38.77
5G-NR	40+40	37	3.2	QPSK/16QAM	3570+3609.96	4	79.93
5G-NR	40+40	37	3.2	QPSK/16QAM	3604.995+3644.955	2	**79.98**
5G-NR	40+40	37	3.1a	256QAM	3639.99+3679.95	4	79.67
LTE	10	35.5	3.1	64QAM	3555	4	**9.227**
LTE	10	35.5	3.2	QPSK/16QAM	3625	2	9.198
LTE	10	35.5	3.1a	256QAM	3695	4	9.153
LTE	20	37	3.1	64QAM	3560	4	**18.67**
LTE	20	37	3.2	QPSK/16QAM	3625	2	18.58
LTE	20	37	3.1a	256QAM	3690	4	18.56
LTE	10+10	37	3.2	QPSK/16QAM	3555+3565	4	19.20
LTE	10+10	37	3.2	QPSK/16QAM	3620+3630	2	19.20
LTE	10+10	37	3.1a	256QAM	3685+3695	4	**19.22**

4.1.2 Occupied Bandwidth – Plots

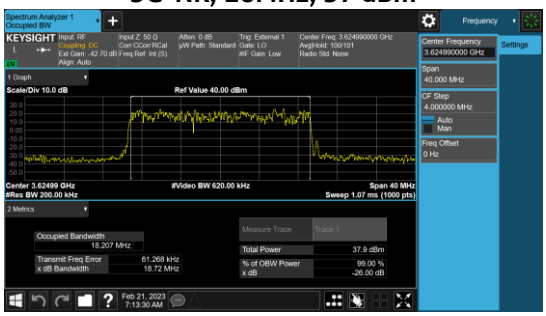
NOTE: Only the plots which give the widest bandwidth for each configuration evaluated are used in this report. The full suite of raw data resides at the MH, New Jersey location.

4.1.2.1 99% Occupied Bandwidth Plots, 5G-NR

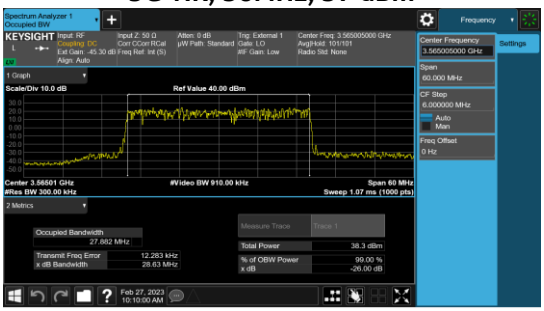
5G-NR, 10MHz, 35.5 dBm



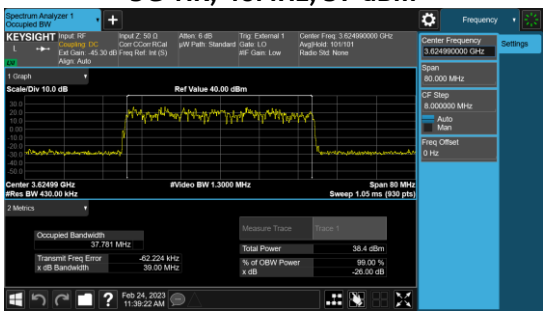
5G-NR, 20MHz, 37 dBm



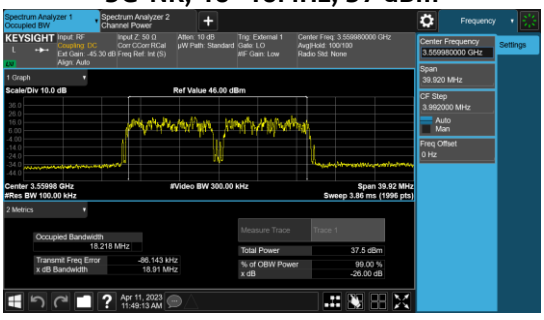
5G-NR, 30MHz, 37 dBm



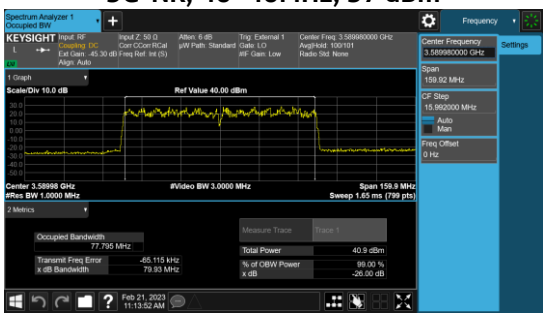
5G-NR, 40MHz, 37 dBm



5G-NR, 10+10MHz, 37 dBm

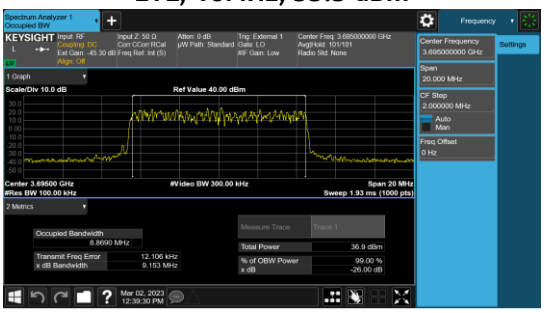


5G-NR, 40+40MHz, 37 dBm

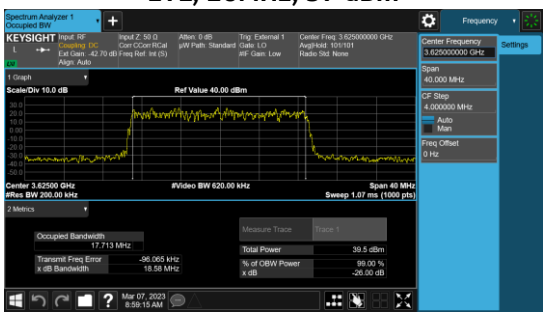


4.1.2.2 99% Occupied Bandwidth Plots, LTE

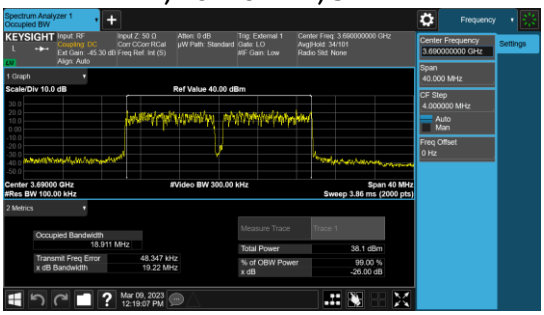
LTE, 10MHz, 35.5 dBm



LTE, 20MHz, 37 dBm

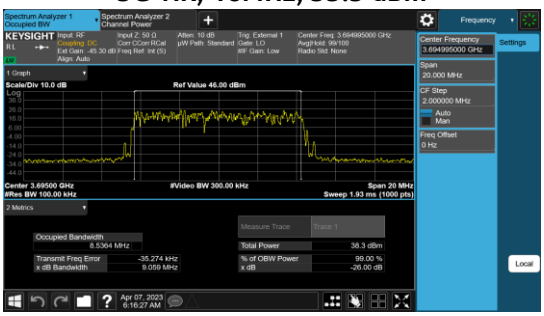


LTE, 10+10 MHz, 37 dBm

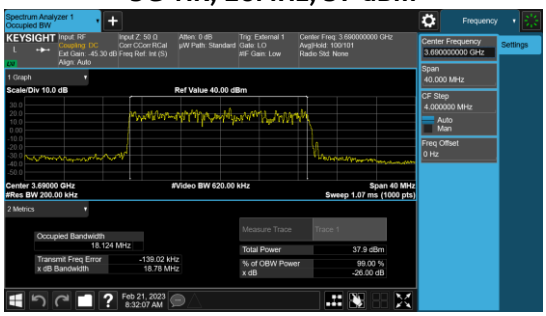


4.1.2.3 26 dB Emission Bandwidth Plots, 5G-NR

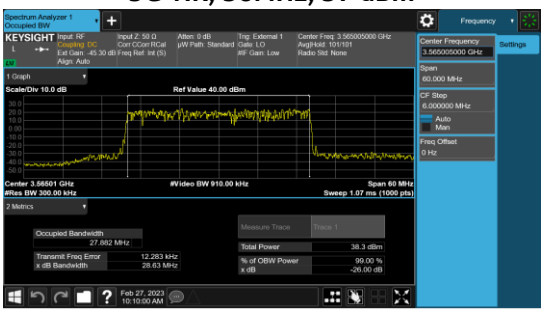
5G-NR, 10MHz, 35.5 dBm



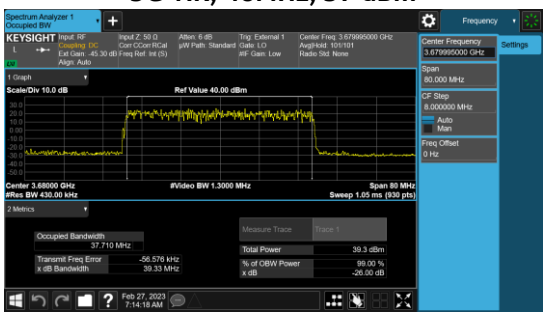
5G-NR, 20MHz, 37 dBm



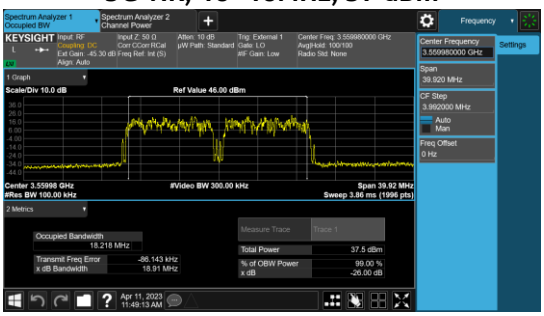
5G-NR, 30MHz, 37 dBm



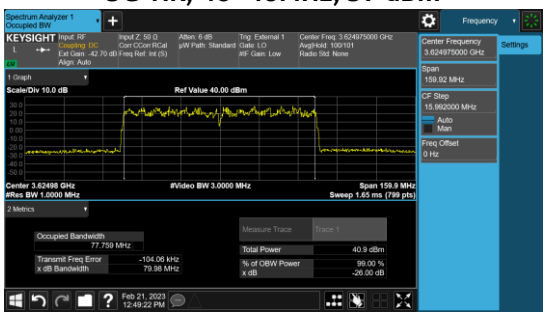
5G-NR, 40MHz, 37 dBm



5G-NR, 10+10MHz, 37 dBm

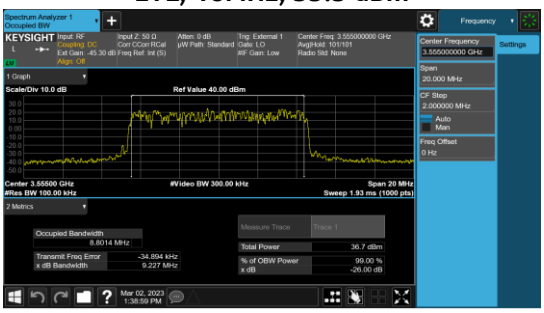


5G-NR, 40+40MHz, 37 dBm

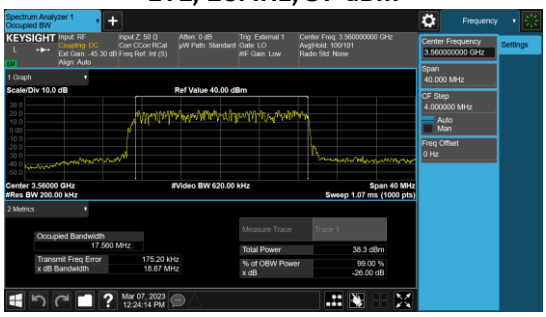


4.1.2.4 26 dB Emission Bandwidth Plots, LTE

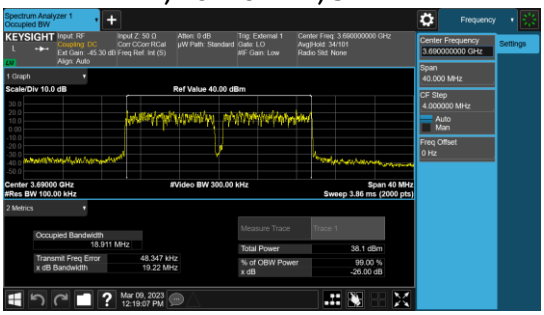
LTE, 10MHz, 35.5 dBm



LTE, 20MHz, 37 dBm



LTE, 10+10 MHz, 37 dBm



4.2 Edge of band Emissions

47CFR 96.41 (e)(1) (i) (2) and KDB 940660 D01 Section 3.2 (b)(6) specified that the limits for the emissions outside the fundamental are as follows.

- within 0 MHz to 10 MHz above and below the assigned channel $\leqslant$ −13 dBm/MHz,
- greater than 10 MHz above and below the assigned channel $\leqslant$ −25 dBm/MHz,
- any emission below 3530 MHz and above 3720 MHz $\leqslant$ −40 dBm/MHz.

47CFR 96.41 (e)(3) and KDB 940660 D01 Section 3.2 (b)(6) specified stated that (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's authorized frequency channel, a resolution bandwidth of no less than one percent of the fundamental emission bandwidth may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full reference bandwidth (*i.e.,* 1 MHz or 1 percent of emission bandwidth, as specified). The fundamental emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. (ii) When measuring unwanted emissions to demonstrate compliance with the limits, the CBSD and End User Device nominal carrier frequency/channel shall be adjusted as close to the licensee's authorized frequency block edges, both upper and lower, as the design permits. (iii) Compliance with emission limits shall be demonstrated using either average (RMS)-detected or peak-detected power measurement techniques.

KDB 940660 D01 Section 3.2 (b)(6) specified that measurements must be performed for low, mid, and high channels. It is acceptable to apply the procedures in Section 5.7 of ANSI C63.26-2015. When antenna-port conducted measurements are performed to demonstrate compliance to the applicable unwanted emission limits (Section 2.1051), a separate radiated measurement is required to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation (Section 2.1053). The Section 96.41(e) limits generally also apply to radiated unwanted 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 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.

OOBE mask limit was created using the following sample calculation:
Limits:

Within 0-1MHz: -13dBm/1%EBW
Within 1-10MHz: -13dBm/MHz
Within >10: -25dBm/MHz

For 10MHz Carriers with 4 ports, the limits at one port:

Within 0-1MHz: -13dBm/1%EBW=> -19dBm/100kHz
Within 1-10MHz: -13dBm/MHz => -29dBm/100kHz
Within >10: -25dBm/MHz => -41dBm/100kHz