

**ELEMENT WASHINGTON DC LLC** 

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# Part 96 MEASUREMENT REPORT Class II Permissive Change

### Applicant Name:

Skylark Wireless, LLC 4011 Garrott St. Houston, TX 77006 USA

### Date of Testing:

05/08/2023 – 08/24/2023 **Test Report Issue Date:** 10/16/2023 **Test Site/Location:** Element Lab., Columbia, MD, USA **Test Report Serial No.:** 1M2308230095-01.2AS22

FCC ID:	2AS22-LUMACH2	
APPLICANT:	Skylark Wireless, LLC	
Annlingtion Trungs	Opplification	
Application Type:		

Model:	LUMACH2
EUT Type:	CBRS Radio Module
FCC Classification:	Category B Citizens Band Radio Service Devices (CBSD)
FCC Rule Part(s):	96
Test Procedure(s):	ANSI C63.26-2015, KDB 940660 D01 v03
Class II Permissive Change:	Please see change document

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

RJ Ortanez Executive Vice President



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# MEASUREMENT REPORT FCC Part 96

Bandwidth Modulation			E	Emission	
		Tx Frequency Range [MHz]	Max. Power [W]	Max. Power [dBm]	Designator
	QPSK	3570.0 - 3680.0	1.334	31.25	35M5G7D
40 MHz	16QAM	3570.0 - 3680.0	1.330	31.24	36M4W7D
	64QAM	3570.0 - 3680.0	1.340	31.27	35M0W7D
	256QAM	3570.0 - 3680.0	1.321	31.21	35M6W7D
	QPSK	3565.0 - 3685.0	1.236	30.92	28M0G7D
30 MHz	16QAM	3565.0 - 3685.0	1.225	30.88	28M1W7D
	64QAM	3565.0 - 3685.0	1.216	30.85	28M1W7D
	256QAM	3565.0 - 3685.0	1.219	30.86	28M3W7D
20 MHz	QPSK	3560.0 - 3690.0	1.242	30.94	18M4G7D
	16QAM	3560.0 - 3690.0	1.225	30.88	18M7W7D
20 1011 12	64QAM	3560.0 - 3690.0	1.227	30.89	18M0W7D
256QAM	256QAM	3560.0 - 3690.0	1.236	30.92	18M3W7D
	QPSK	3555.0 - 3695.0	0.815	29.11	7M91G7D
10 MHz	16QAM	3555.0 - 3695.0	0.818	29.13	7M80W7D
	64QAM	3555.0 - 3695.0	0.818	29.13	7M89W7D
	256QAM	3555.0 - 3695.0	0.815	29.11	7M85W7D

**EUT Overview** 

Note: EIRP levels shown in the table above are measured over the full channel bandwidth.

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# 1.0 INTRODUCTION

### 1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

# 1.2 Element Test Location

These measurement tests were conducted at the Element Laboratory located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

## 1.3 Test Facility / Accreditations

### Measurements were performed at Element Lab located in Columbia, MD 21046, U.S.A.

- Element Washington DC LLC is a OnGo Alliance Approved Test Lab (ATL)
- Element Washington DC LLC is a WInnForum Approved Test Lab
- Element Washington DC LLC is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- Element Washington DC LLC TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).
- Element Washington DC LLC facility is a registered (2451B) test laboratory with the site description on file with ISED.
- Element Washington DC LLC is a Recognized U.S. Certification Assessment Body (CAB # US0110) for ISED Canada as designated by NIST under the U.S. and Canada Mutual Recognition Agreement.

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# 2.0 PRODUCT INFORMATION

# 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Skylark Wireless, LLC CBRS Radio Module FCC ID: 2AS22-LUMACH2**. The test data contained in this report pertains only to the emissions due to the EUT's Band 48 operation in the CBRS bandand covers compliance for the integration of seven modules into a single chassis. Per FCC Part 96, this device is evaluated as a Category B CBSD (CBD).

**Test Device Serial No.:** RF5B000079, RF5B000050, RF5B000001, RF5B000008, RF5B000011, RF5B000083, RF5B000048

## 2.2 Device Capabilities

This device contains the following capabilities:

Band 48

# 2.3 Test Configuration

The EUT was tested per the guidance of ANSI C63.26-2015. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

This device operates with two antenna ports (Channel A and Channel B) which produce two simulatenous, orthogonally polarized transmissions. Seven identical modules are integrated into a host enclosure.

# 2.4 Software and Firmware

Testing was performed on device(s) using software/firmware version 2023.07.01 installed on the EUT.

## 2.5 Antenna Gain

The 14 output ports across the 7 modules integrated in the host unit transmit into 2 orthogonally polarized antennas. The worst case configuration was determined to be the "16 User" case in which beam forming is employed such that the total directional is:

Directional Gain =  $10 * \log(n) - 10 * \log(s) + Antenna Gain$ 

n = number of modules = 7 s = number of spatial streams = 16 Antenna Gain = 13.75dBi

DirectionI Antenna Gain = 10 \* log(7) - 10 \* log(16) + 13.75dBi = 10.16 dBi

# 2.6 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

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# 3.0 DESCRIPTION OF TESTS

### 3.1 Measurement Procedure

The measurement procedures described in the "American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services" (ANSI C63.26-2015) were used in the measurement of the EUT.

Deviation from Measurement Procedure.....None

# 3.2 Radiated Power and Radiated Spurious Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

For radiated power measurements, substitution method is used per the guidance of ANSI C63.26-2015. For emissions below 1GHz, a half-wave dipole is substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

Pd [dBm] = Pg [dBm] - cable loss [dB] + antenna gain [dBd/dBi];

where P<sub>d</sub> is the dipole equivalent power, P<sub>g</sub> is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to P<sub>g [dBm]</sub> – cable loss [dB].

For radiated spurious emissions measurements, the field strength conversion method is used per the formulas in Section 5.2.7 of ANSI C63.26-2015. Field Strength (EIRP) is calculated using the following formulas:

$$\begin{split} E_{[dB\mu V/m]} &= Measured \ amplitude \ level_{[dBm]} + 107 + Cable \ Loss_{[dB]} + Antenna \ Factor_{[dB/m]} \\ & And \\ EIRP_{[dBm]} &= E_{[dB\mu V/m]} + 20logD - 104.8; \ where \ D \ is \ the \ measurement \ distance \ in \ meters. \end{split}$$

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 414788 D01 v01r01.

Radiated power and radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI C63.26-2015.

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# 4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.13
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

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# 5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	MVG	EMC Cable and Switch System	1/12/2023	Annual	1/12/2024	MVG-001
-	ETS	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	ETS-001
-	WL40-1	Licensed Transmitter Cable Set	1/12/2023	Annual	1/12/2024	WL40-1
Agilent	N9030A	50GHz PXA Signal Analyzer	9/9/2022	Annual	9/9/2023	9704-5182
Emco	3115	Horn Antenna (1-18GHz)	8/8/2022	Biennial	8/8/2024	9704-5182
Emco	3116	Horn Antenna (18 - 40GHz)	7/20/2021	Triennial	7/20/2023	9203-2178
Keysight Technologies	N9020A	MXA Signal Analyzer	3/15/2023	Annual	3/15/2024	MY54500644
Keysight Technologies	N9030A	PXA Signal Analyzer (44GHz)	9/6/2022	Annual	9/6/2023	MY54490576
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	8/29/2022	Annual	8/29/2023	100342
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	8/25/2022	Annual	8/25/2023	100348
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	1/13/2023	Annual	1/13/2024	103200
Sunol	JB6	LB6 Antenna	3/2/2023	Biennial	3/2/2025	A082816
Sunol	DRH-118	Horn Antenna (1-18GHz)	2/14/2022	Biennial	2/14/2024	A082816

#### Notes:

- 1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.
- 2. Equipment with a calibration date of "N/A" shown in this list was not used to make direct calibrated measurements.

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# 6.0 SAMPLE CALCULATIONS

## **Emission Designator**

#### **QPSK Modulation**

#### Emission Designator = 8M62G7D

BW = 8.62 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission, telemetry, telecommand

#### **QAM Modulation**

#### Emission Designator = 8M45W7D

BW = 8.45 MHz W = Amplitude/Angle Modulated 7 = Quantized/Digital Info D = Data transmission, telemetry, telecommand

## Spurious Radiated Emission - Band 48

#### Example: Middle Channel Band 48 2<sup>nd</sup> Harmonic (7250 MHz)

The average spectrum analyzer reading at 3 meters with the EUT on the turntable was -81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of -81.0 dBm on the spectrum analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 1564 MHz. So 6.1 dB is added to the signal generator reading of -30.9 dBm yielding -24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm -(-24.80).

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# 7.0 TEST RESULTS

# 7.1 Summary

Company Name:	Skylark Wireless, LLC
FCC ID:	2AS22-LUMACH2
FCC Classification:	Category B Citizens Band Radio Service Devices (CBSD)
Band(s):	Band 48

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
	Conducted Pow er	2.1046(a), 2.1046(c)	NA	PASS	Section 7.2
	Occupied Bandw idth	2.1049(h)	NA	PASS	*
	Peak-Average Ratio	96.41(g)	≤13dB	PASS	Section 7.5
	Conducted Band Edge / Spurious Emissions (CBSD)	2.1051, 96.41(e)(1)(i)	-13 dBm/MHz at frequencies w ithin 0-10 MHz above the upper SAS-assigned channel edge and w ithin 0-10 MHz below the low er SAS-assigned channel edge -25 dBm/MHz at frequencies greater than 10 MHz above and below channel edge -emissions below 3530 MHz or above 3720 MHz shall not exceed -40dBm/MHz	PASS	Sections 7.6, 7.7
ucted	Frequency Stability	2.1055	Fundamental emissions stay within authorized frequency block	PASS	*
Conducted	Category B CBSD Device Additional Requirements (CBSD Protocol)	96.45	Category B CBSDs must be professionally installed. In the 3550-3650MHz band, Category B CBSDs must be authorized consistent with information received from an ESC, as described in 96.15. Category B CBSDs are limited to outdoor operations. When registering with a SAS, Category B CBSDs must tranmist all information required under 96.39 plus the follow ing additonal information: antenna gain, beamw idth, azimuth, dow ntilt angle, and antenna height above ground level.	PASS	
	Equivalent Isotropic Radiated Pow er (EIRP) (Catogory B CBSD)	96.41(b)	47 dBm/10MHz	PASS	Section 7.3
	Pow er Spectral Density (PSD) (Category B CBSD)	96.41(b)	37 dBm/10MHz	PASS	Section 7.4
Radiated	Radiated Spurious Emissions	96.41(e)	-40 dBm/MHz	PASS	Section 7.8

### **Table 7-1 Summary of Test Results**

The test results identifies with an "\*" in the table above were not included in this report because it was determined that the permissive change did not have an impact on these test items.

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#### Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
- 3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
- 4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is EMC Software Tool 1.1 and Chamber Control 1.6.4.

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# 7.2 Conducted Output Power / EIRP Data

#### **Test Overview**

The EUT is set up to transmit at maximum power for Band 48. All power levels are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst-case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.

Measurement equipment was set up with triggering/gating on the spectrum analyzer such that powers were measured only during the on-time of the signal.

#### **Test Procedure Used**

ANSI C63.26-2015 - Section 5.2.4.4.1 ANSI C63.26-2015 - Section 6.4.3.2.3

#### Test Settings

- 1. Span =  $2 \times OBW$  to  $3 \times OBW$
- 2. RBW = 1% to 5% of the OBW
- 3. Number of measurement points in sweep  $\geq 2 \times \text{span} / \text{RBW}$
- 4. Sweep = auto-couple (less than transmission burst duration)
- 5. Detector = RMS (power)
- 6. Trigger was set to enable power measurements only on full power bursts
- 7. Trace was allowed to stabilize
- 8. Spectrum analyzer's "Channel Power" function was used to compute the power by integrating the spectrum across the OBW of the signal

#### Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



Figure 7-1. Test Instrument & Measurement Setup

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# Test Notes

- 1. Conducted power measurements were evaluated using various combinations of modulation and channel bandwidth. Channel bandwidth data is shown in the tables below based only on the channel bandwidths that were supported in this device.
- 2. A scaling factor of 10log(7) was added to obtain the total output summed across all 7 modules.

Bandwidth	Modulation	Frequency [MHz]	Ch. A Conducted Power [dBm]	Ch. B Conducted Power [dBm]	Summed MIMO Conducted Power [dBm]	Summed MIMO Conducted Power [dBm] - All Modules	Ant Gain [dBi]	EIRP [dBm]	EIRP [Watts]
		3570.0	11.27	10.56	13.94	22.39	10.16	32.55	1.799
QPSK	QPSK	3625.0	15.28	17.5	19.54	27.99	10.16	38.15	6.534
	3680.0	13.99	13.48	16.75	25.20	10.16	35.36	3.439	
		3570.0	11.67	10.52	14.14	22.59	10.16	32.75	1.885
N	16-QAM	3625.0	14.99	17.49	19.43	27.88	10.16	38.04	6.366
H		3680.0	13.99	13.43	16.73	25.18	10.16	35.34	3.420
40 MHz		3570.0	11.44	10.53	14.02	22.47	10.16	32.63	1.832
ম	64-QAM	3625.0	15.37	17.52	19.59	28.04	10.16	38.20	6.604
		3680.0	13.88	13.45	16.68	25.13	10.16	35.29	3.382
		3570.0	11.67	10.49	14.13	22.58	10.16	32.74	1.880
	256-QAM	3625.0	15.36	17.46	19.55	28.00	10.16	38.16	6.542
		3680.0	14.01	13.39	16.72	25.17	10.16	35.33	3.414
		3565.0	11.20	10.13	13.71	22.16	10.16	32.32	1.706
	QPSK	3625.0	15.29	17.17	19.34	27.79	10.16	37.95	6.241
		3685.0	14.43	14.66	17.56	26.01	10.16	36.17	4.138
		3565.0	11.20	10.17	13.73	22.18	10.16	32.34	1.713
N	16-QAM	3625.0	15.51	17.13	19.41	27.86	10.16	38.02	6.333
30 MHz		3685.0	14.67	14.64	17.67	26.12	10.16	36.28	4.243
9		3565.0	10.85	10.18	13.54	21.99	10.16	32.15	1.640
e7	64-QAM	3625.0	15.71	17.1	19.47	27.92	10.16	38.08	6.429
		3685.0	14.53	14.68	17.62	26.07	10.16	36.23	4.195
		3565.0	10.68	10.2	13.46	21.91	10.16	32.07	1.610
	256-QAM	3625.0	15.60	17.11	19.43	27.88	10.16	38.04	6.370
		3685.0	14.42	14.67	17.56	26.01	10.16	36.17	4.138
		3560.0	10.28	9.7	13.01	21.46	10.16	31.62	1.452
	QPSK	3625.0	16.05	17.19	19.67	28.12	10.16	38.28	6.728
		3690.0	15.30	14.33	17.85	26.30	10.16	36.46	4.429
		3560.0	10.24	9.71	12.99	21.44	10.16	31.60	1.447
N	16-QAM	3625.0	15.25	17.13	19.30	27.75	10.16	37.91	6.183
20 MHz		3690.0	15.04	14.32	17.71	26.16	10.16	36.32	4.282
50		3560.0	10.54	9.7	13.15	21.60	10.16	31.76	1.500
	64-QAM	3625.0	15.61	17.14	19.45	27.90	10.16	38.06	6.402
		3690.0	14.95	14.33	17.66	26.11	10.16	36.27	4.239
		3560.0	10.66	9.8	13.26	21.71	10.16	31.87	1.539
	256-QAM	3625.0	15.62	17.17	19.47	27.93	10.16	38.09	6.434
		3690.0	15.07	14.33	17.73	26.18	10.16	36.34	4.302
		3555.0	10.48	10.16	13.33	21.78	10.16	31.94	1.565
	QPSK	3625.0	12.22	12.84	15.55	24.00	10.16	34.16	2.608
		3695.0	14.86	15.36	18.13	26.58	10.16	36.74	4.719
		3555.0	10.73	10.2	13.48	21.93	10.16	32.09	1.620
₽	16-QAM	3625.0	12.14	12.82	15.50	23.95	10.16	34.11	2.579
10 MHz		3695.0	15.02	15.38	18.21	26.67	10.16	36.83	4.814
9	64.6444	3555.0	11.08	10.19	13.67	22.12	10.16	32.28	1.690
	64-QAM	3625.0	12.26	12.83	15.56	24.02	10.16	34.18	2.616
		3695.0	14.74	15.38	18.08	26.53	10.16	36.69	4.670
	050 0 0 0	3555.0	11.12	10.20	13.69	22.15	10.16	32.31	1.700
	256-QAM	3625.0	12.42	12.81	15.63	24.08	10.16	34.24	2.655
		3695.0	14.98	15.36	18.18	26.64	10.16	36.80	4.781

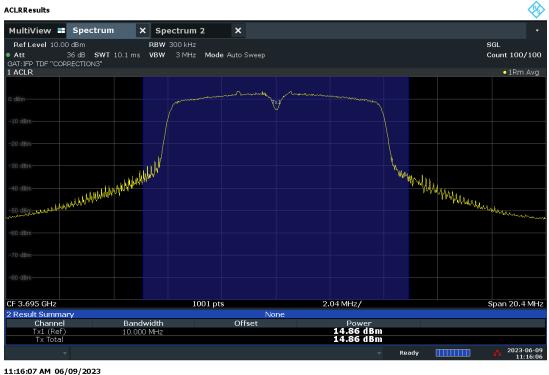
#### **Table 7-2 Conducted Power Measurements**

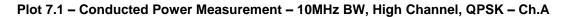
FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change		
Test Report S/N:	Test Dates:	EUT Type:	Page 13 of 124	
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	/24/2023 CBRS Radio Module		
			1/2 0 1/6/2022	

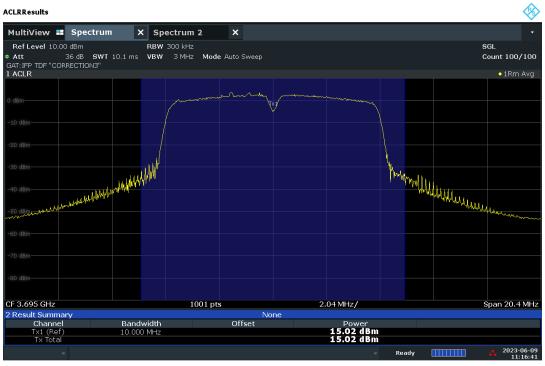


#### **Channel A Conducted Power Measurements**

#### ACLRResults







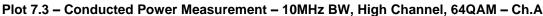
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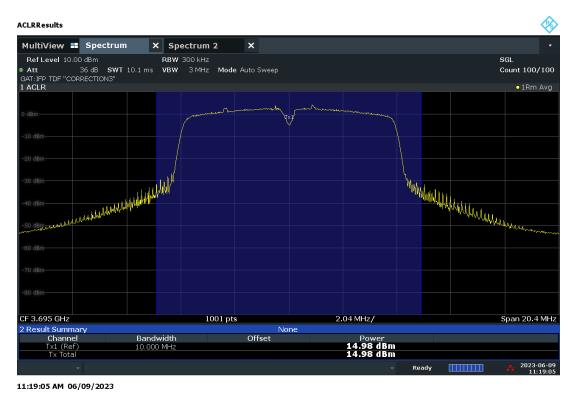
#### Plot 7.2 – Conducted Power Measurement – 10MHz BW, High Channel, 16QAM – Ch.A

FCC ID: 2AS22-LUMACH2		Approved by: Technical Manager		
Test Report S/N:	Test Dates:	EUT Type:	Dogo 14 of 124	
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 14 of 124	
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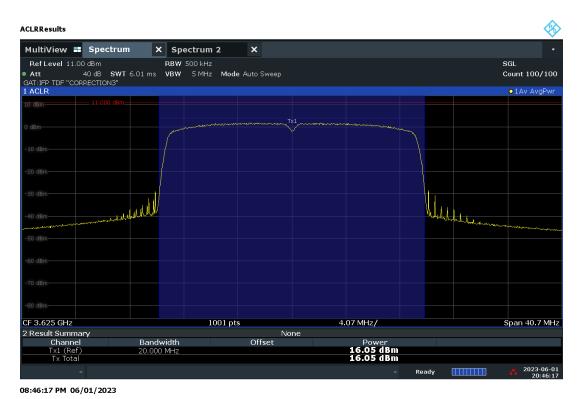


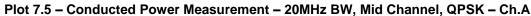


Plot 7.4 – Conducted Power Measurement – 10MHz BW, High Channel, 256QAM – Ch.A

FCC ID: 2AS22-LUMACH2		Approved by: Technical Manager		
Test Report S/N:	Test Dates:	EUT Type:	Page 15 of 124	
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Fage 15 01 124	
			V3.0 1/6/2022	







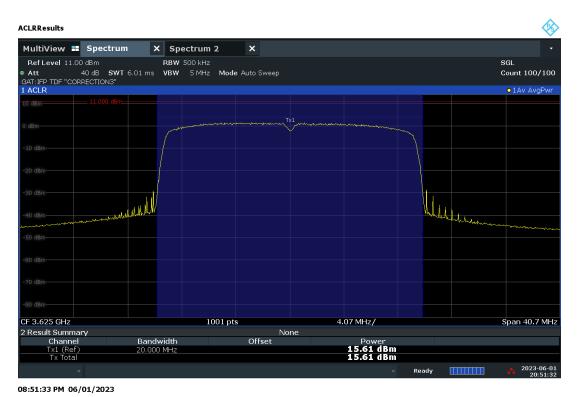


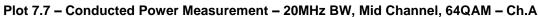
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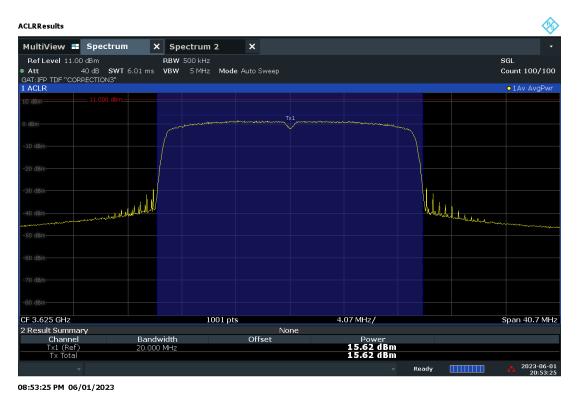
### Plot 7.6 - Conducted Power Measurement - 20MHz BW, Mid Channel, 16QAM - Ch.A

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Page 16 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	
L		·	V3.0 1/6/2022





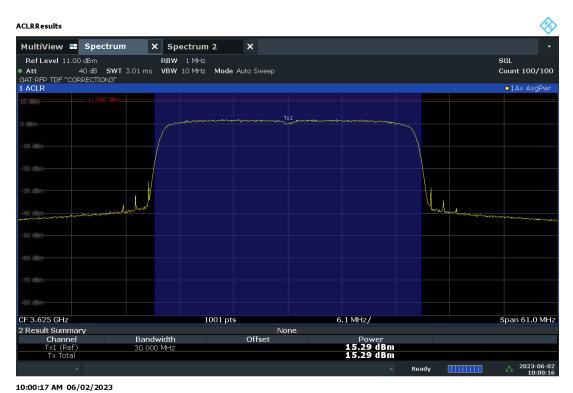




Plot 7.8 – Conducted Power Measurement – 20MHz BW, Mid Channel, 256QAM – Ch.A

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dogo 17 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 17 of 124
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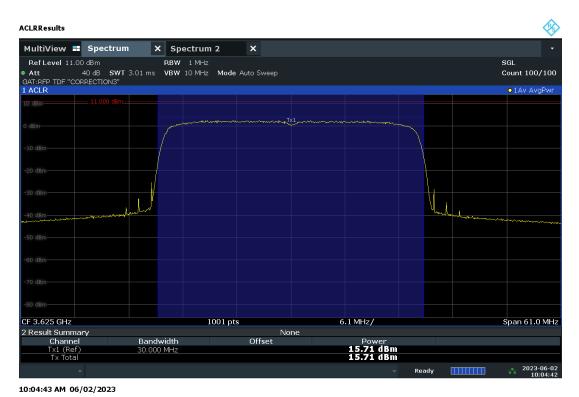


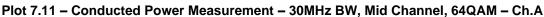


Plot 7.10 - Conducted Power Measurement - 30MHz BW, Mid Channel, 16QAM - Ch.A

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dogo 19 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 18 of 124
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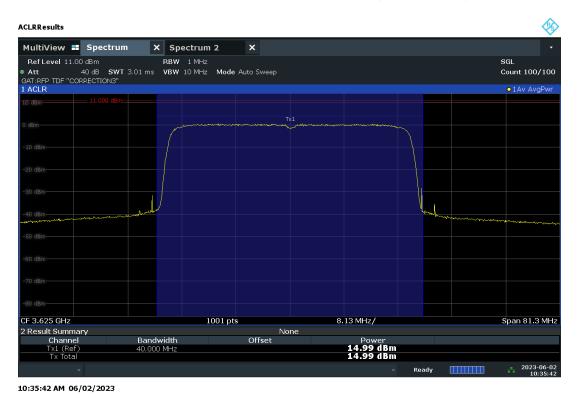
Plot 7.12 - Conducted Power Measurement - 30MHz BW, Mid Channel, 256QAM - Ch.A

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Page 19 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	
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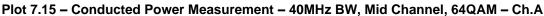


Plot 7.14 - Conducted Power Measurement - 40MHz BW, Mid Channel, 16QAM - Ch.A

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Page 20 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Fage 20 01 124
			V3.0 1/6/2022









Plot 7.16 - Conducted Power Measurement - 40MHz BW, Mid Channel, 256QAM - Ch.A

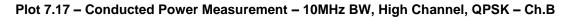
FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dogo 21 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 21 of 124
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#### **Channel B Conducted Power Measurements**

#### ACLRResults





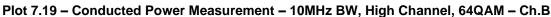


Plot 7.18 – Conducted Power Measurement – 10MHz BW, High Channel, 16QAM – Ch.B

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dogo 22 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 22 of 124
	-		V3.0 1/6/2022





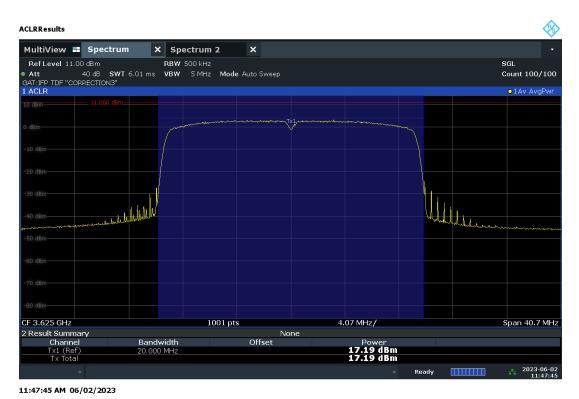




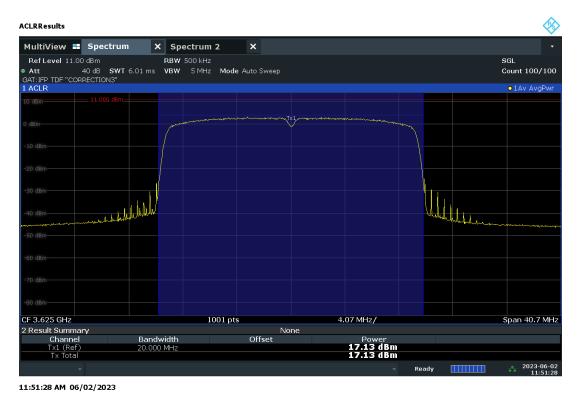
Plot 7.20 - Conducted Power Measurement - 10MHz BW, High Channel, 256QAM - Ch.B

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:	Dega 22 of 124	
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 23 of 124	
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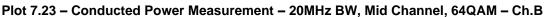


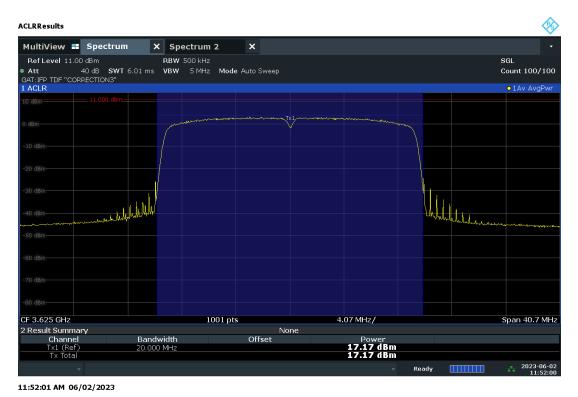
Plot 7.22 - Conducted Power Measurement - 20MHz BW, Mid Channel, 16QAM - Ch.B

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Page 24 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	
	<u>.</u>	·	V3.0 1/6/2022









Plot 7.24 – Conducted Power Measurement – 20MHz BW, Mid Channel, 256QAM – Ch.B

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dogo 25 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 25 of 124
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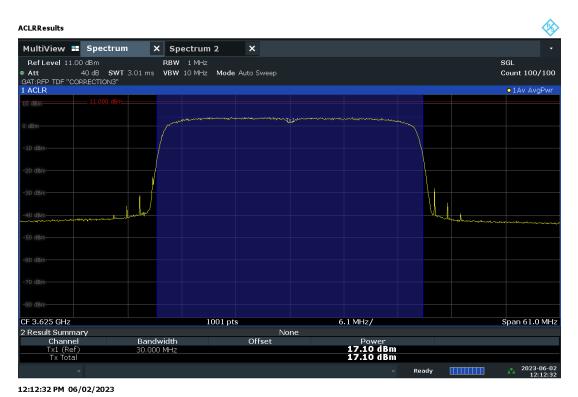


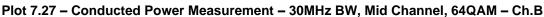


Plot 7.26 – Conducted Power Measurement – 30MHz BW, Mid Channel, 16QAM – Ch.B

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dogo 26 of 124
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Plot 7.28 - Conducted Power Measurement - 30MHz BW, Mid Channel, 256QAM - Ch.B

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Page 27 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Fage 27 01 124
			V3.0 1/6/2022







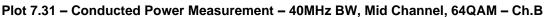


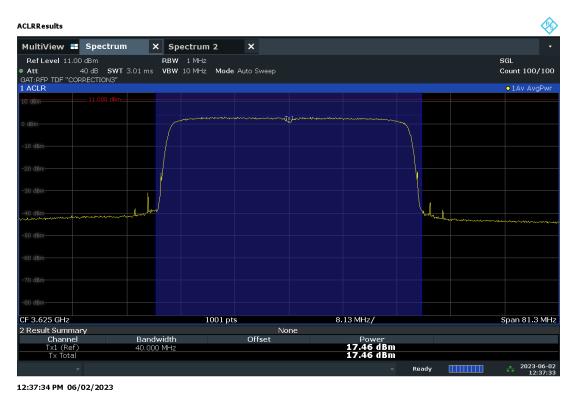
Plot 7.30 - Conducted Power Measurement - 40MHz BW, Mid Channel, 16QAM - Ch.B

FCC ID: 2AS22-LUMACH2		Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:	Page 28 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Fage 20 01 124
			V3.0 1/6/2022









Plot 7.32 - Conducted Power Measurement - 40MHz BW, Mid Channel, 256QAM - Ch.B

FCC ID: 2AS22-LUMACH2		Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:	Page 29 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Fage 29 01 124
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## 7.3 Conducted Power / EIRP per 10MHz Test Overview

The spectrum analyzer was connected to the antenna terminal while the EUT was operating at its maximum power control level, as defined in ANSI C63.26-2015, and at the appropriate frequencies. The EUT transmits with a duty cycle of approximately 71.95%; the spectrum analyzer was gated as to only measure during on periods.

#### The e.i.r.p. per 10MHz for a Category B CBSD must be less than 47dBm/10MHz.

#### **Test Procedure Used**

ANSI C63.26-2015 – Section 5.2.4.4.1 ANSI C63.26-2015 – Section 5.2.4.5 ANSI C63.26-2015 – Section 6.4.3.2.3

#### **Test Settings**

- 1. Span = 2x to 3X the OBW
- 2. RBW = 10MHz
- 3. VBW  $\geq$  3 x RBW
- 4. Set number of sweep points  $\geq 2 \times \text{span} / \text{RBW}$
- 5. Sweep Time = auto couple
- 6. Detector = RMS
- 7. Trace mode = average
- 8. Trigger = Level

#### **Test Setup**

The EUT and measurement equipment were set up as shown in the diagram below.



Figure 7-2. Test Instrument & Measurement Setup

#### Test Notes

A scaling factor of 10log(7) was added to obtain the total output summed across all 7 modules.

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dogo 20 of 124
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Bandwidth	Modulation	Frequency [MHz]	Ch. A Conducted PSD [dBm/10MHz]	Ch. B Conducted PSD [dBm/10MHz]	Summed MIMO Conducted PSD [dBm/10MHz]	Summed MIMO Conducted PSD [dBm/10MHz] - All Modules	Ant Gain [dBi]	EIRP PSD [dBm/10MHz]	EIRP PSD [Watts/10MHz]	EIRP PSD Limit [dBm/10MHz]	Margin [dB]
		3570.0	6.86	5.59	9.28	17.73	10.16	27.89	0.616	47.00	-19.11
	QPSK	3625.0	10.40	12.48	14.57	23.02	10.16	33.18	2.082	47.00	-13.82
		3680.0	9.02	8.54	11.80	20.25	10.16	30.41	1.098	47.00	-16.59
		3570.0	7.15	5.60	9.45	17.91	10.16	28.07	0.640	47.00	-18.93
N	16-QAM	3625.0	9.99	12.68	14.55	23.00	10.16	33.16	2.071	47.00	-13.84
40 MHz		3680.0	9.01	8.47	11.76	20.21	10.16	30.37	1.089	47.00	-16.63
0		3570.0	6.80	5.66	9.28	17.73	10.16	27.89	0.615	47.00	-19.11
4	64-QAM	3625.0	10.39	12.55	14.61	23.06	10.16	33.22	2.101	47.00	-13.78
		3680.0	9.10	8.48	11.81	20.26	10.16	30.42	1.102	47.00	-16.58
		3570.0	7.31	5.65	9.57	18.02	10.16	28.18	0.658	47.00	-18.82
	256-QAM	3625.0	10.48	12.53	14.64	23.09	10.16	33.25	2.112	47.00	-13.75
		3680.0	9.06	8.41	11.76	20.21	10.16	30.37	1.089	47.00	-16.63
		3565.0	7.38	6.23	9.85	18.30	10.16	28.46	0.702	47.00	-18.54
	QPSK	3625.0	11.42	13.24	15.43	23.89	10.16	34.05	2.539	47.00	-12.95
		3685.0	10.49	10.70	13.61	22.06	10.16	32.22	1.666	47.00	-14.78
		3565.0	7.31	6.32	9.85	18.30	10.16	28.46	0.702	47.00	-18.54
N	16-QAM	3625.0	11.65	13.32	15.58	24.03	10.16	34.19	2.622	47.00	-12.81
30 MHz		3685.0	10.77	10.67	13.73	22.18	10.16	32.34	1.715	47.00	-14.66
 0		3565.0	6.98	6.26	9.65	18.10	10.16	28.26	0.669	47.00	-18.74
Ř	64-QAM	3625.0	11.73	13.17	15.52	23.97	10.16	34.13	2.589	47.00	-12.87
		3685.0	10.63	10.74	13.70	22.15	10.16	32.31	1.701	47.00	-14.69
		3565.0	6.76	6.29	9.54	17.99	10.16	28.15	0.654	47.00	-18.85
	256-QAM	3625.0	11.71	13.18	15.52	23.97	10.16	34.13	2.587	47.00	-12.87
		3685.0	10.56	10.71	13.65	22.10	10.16	32.26	1.681	47.00	-14.74
		3560.0	8.57	7.61	11.13	19.58	10.16	29.74	0.941	47.00	-17.26
	QPSK	3625.0	13.97	15.13	17.60	26.05	10.16	36.21	4.178	47.00	-10.79
		3690.0	13.12	12.32	15.75	24.20	10.16	34.36	2.729	47.00	-12.64
		3560.0	8.22	7.61	10.94	19.39	10.16	29.55	0.901	47.00	-17.45
N	16-QAM	3625.0	13.16	15.13	17.27	25.72	10.16	35.88	3.870	47.00	-11.12
20 MHz		3690.0	12.91	12.32	15.64	24.09	10.16	34.25	2.658	47.00	-12.75
0		3560.0	8.56	7.57	11.10	19.55	10.16	29.71	0.936	47.00	-17.29
<b>N</b>	64-QAM	3625.0	13.46	15.07	17.35	25.80	10.16	35.96	3.945	47.00	-11.04
		3690.0	12.83	12.32	15.59	24.04	10.16	34.20	2.633	47.00	-12.80
		3560.0	8.79	7.72	11.30	19.75	10.16	29.91	0.979	47.00	-17.09
	256-QAM	3625.0	13.48	15.15	17.41	25.86	10.16	36.02	3.996	47.00	-10.98
		3690.0	12.92	12.25	15.61	24.06	10.16	34.22	2.642	47.00	-12.78
		3555.0	10.44	10.21	13.34	21.79	10.16	31.95	1.566	47.00	-15.05
	QPSK	3625.0	11.94	12.61	15.30	23.75	10.16	33.91	2.460	47.00	-13.09
		3695.0	14.70	15.20	17.97	26.42	10.16	36.58	4.548	47.00	-10.42
		3555.0	10.57	10.00	13.30	21.76	10.16	31.92	1.554	47.00	-15.08
N	16-QAM	3625.0	11.90	12.62	15.29	23.74	10.16	33.90	2.453	47.00	-13.10
10 MHz		3695.0	14.70	15.20	17.97	26.42	10.16	36.58	4.548	47.00	-10.42
		3555.0	10.83	10.05	13.47	21.92	10.16	32.08	1.614	47.00	-14.92
÷	64-QAM	3625.0	12.00	12.52	15.28	23.73	10.16	33.89	2.449	47.00	-13.11
		3695.0	14.55	15.14	17.87	26.32	10.16	36.48	4.443	47.00	-10.52
		3555.0	10.95	10.02	13.52	21.97	10.16	32.13	1.633	47.00	-14.87
	256-QAM	3625.0	12.28	12.50	15.40	23.85	10.16	34.01	2.519	47.00	-12.99
		3695.0	14.84	15.54	18.21	26.67	10.16	36.83	4.814	47.00	-10.17

Table 7-3 E.I.R.P. Per 10MHz Measurements

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Page 31 of 124
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#### **Channel A Conducted Power / 10MHz Measurement**

#### 

Ref Level 20.00 dBm         • RBW 10 MHz           • Att         36 dB         SWT 1.01 ms         • VBW         40 MHz         Mode Auto Sweep           GAT.IFP TDF "CORRECTIONS"		
SAT-IFP TDF "CORRECTIONS"  I Frequency Sweep  0 dbm  0 dbm  -0 dbm		GL
Image: Productory Sweep       M1         00 dBm       M1	C	ount 100/10
Mi       0 dBm       10 dBm       10 dBm       20 dBm       20 dBm       30 dBm       30 dBm       30 dBm       40 dBm       50 dBm       60 dBm		•1Rm Ave
0 dBm- 1 dBm- 10 dBm- 20 dBm- 20 dBm- 30 dBm- 40 dBm- 50 dB	M1[1]	14.70 dE
dBm	3	.695 749 0 G
10 d8m     10 d8m       20 d8m     10 d8m       30 d8m     10 d8m       50 d8m     10 d8m       60 d8m     10 d8m	the second se	
10 dBm     10 dBm       20 dBm     10 dBm       30 dBm     10 dBm       50 dBm     10 dBm       10 dBm     10 dBm	and the second sec	
		man and a second
		مارس مع ر م
3.695 GHz 1001 pts 3.0	) MHz/ S	Span 30.0 M

11:15:35 AM 06/09/2023





11:17:07 AM 06/09/2023

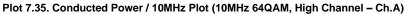
#### Plot 7.34. Conducted Power / 10MHz Plot (10MHz 16QAM, High Channel - Ch.A)

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Page 32 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Faye 32 01 124
			V3.0 1/6/2022



### ¢\$) ACLRResults MultiView 🎫 Spectrum X Spectrum 2 × Ref Level 20.00 dBm • RBW 10 MHz SGL 36 dB SWT 1.01 ms • VBW 40 MHz Mode Auto Sweep Count 100/100 Att GAT: IFP TDF "CORRECTION3" 1 Frequency Sweep o1Rm Avg M1[1] 14.55 dBm Span 30.0 MHz CF 3.695 GHz 1001 pts 3.0 MHz/ Ready 2023-06-09 11:18:08

11:18:08 AM 06/09/2023





11:19:34 AM 06/09/2023

#### Plot 7.36. Conducted Power / 10MHz Plot (10MHz 256QAM, High Channel - Ch.A)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	
Test Report S/N:	Test Dates:	EUT Type:	Dage 22 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 33 of 124
	<u>.</u>		V3.0 1/6/2022



# أ∕♦ ACLRResults MultiView 🎫 Spectrum X Spectrum 2 × Ref Level 26.00 dBm • RBW 10 MHz SGL 40 dB SWT 1.01 ms • VBW 40 MHz Mode Auto Sweep Count 100/100 Att GAT: IFP TDF "CORRECTION3" 1 Frequency Sweep • 1Av AvgPwr 13.97 dBm 7.5 MHz/ CF 3.625 GHz 1001 pts Span 75.0 MHz Ready 2023-06-01

08:48:01 PM 06/01/2023





08:49:26 PM 06/01/2023

#### Plot 7.38. Conducted Power / 10MHz Plot (20MHz 16QAM, Mid Channel - Ch.A)

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dogo 24 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 34 of 124
			V3.0 1/6/2022



### أ∕♦ ACLRResults MultiView 🎫 Spectrum X Spectrum 2 × Ref Level 26.00 dBm • RBW 10 MHz SGL 40 dB SWT 1.01 ms • VBW 40 MHz Mode Auto Sweep Count 100/100 Att GAT: IFP TDF "CORRECTION3" 1 Frequency Sweep • 1Av AvgPwr 13.46 dBm M1 7.5 MHz/ CF 3.625 GHz 1001 pts Span 75.0 MHz Ready 2023-06-01

08:52:07 PM 06/01/2023



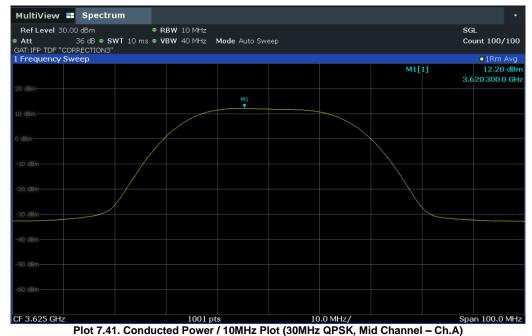


08:52:46 PM 06/01/2023

#### Plot 7.40. Conducted Power / 10MHz Plot (20MHz 256QAM, Mid Channel - Ch.A)

FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Page 35 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Fage 55 01 124
•		·	V3.0 1/6/2022









10:02:25 AM 06/02/2023



FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change		
Test Report S/N:	Test Dates:	EUT Type:	Demo 26 of 124	
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 36 of 124	
		·	V3 0 1/6/2022	

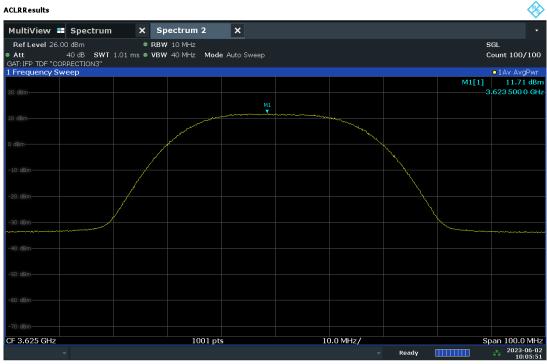


ultiView 🎫 Spectrum	x s	ectrum 2	×					
Ref Level 26.00 dBm		/ 10 MHz						SGL
Att 40 dB SWT 1.0 AT: IFP TDF "CORRECTION3"	01 ms ⊜ <b>VB∀</b>	40 MHz Mod	e Auto Sweep					Count 100/1
Frequency Sweep								o 1 Av AvgP
							M1[1]	
								3.621 000 0 (
			M1					
					and the second s			
					- mark			
		<u></u>						
						$\searrow$		
	1							
J dBm								
I dBm								
3.625 GHz		1001 pt	S	1	0.0 MHz/			Span 100.0 M

10:04:06 AM 06/02/2023

Plot 7.43. Conducted Power / 10MHz Plot (30MHz 64QAM, Mid Channel - Ch.A)

#### ACLRResults



10:05:51 AM 06/02/2023



FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dogo 27 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 37 of 124
,			\/3.0.1/6/2022



ultiView 🎫 Spectrum	X Sp	ectrum 2	×					
RefLevel 26.00 dBm Att 40 dB SWT 1.0		' 10 MHz ' 40 MHz <b>Mod</b>	e Auto Sweep					SGL Count 100/1
T:IFP TDF "CORRECTION3" requency Sweep								o1Av AvgP∖
							M1[1]	10.40 d
								3.6181100
			M1					
	1					~~		
	/							
dBm							<b>\</b>	
dBm-								
3.625 GHz		1001 pt	ts	1	0.0 MHz/			Span 100.0 N
*		1001 0				Ready		2023-06 10:34

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10:34:23 AM 06/02/2023





10:35:17 AM 06/02/2023



FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Page 38 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Fage 30 01 124
			1/2 0 1/6/2022



ultiView	Spectrum	×	Spectrum 2	×				
Ref Level 26 Att	40 dB <b>SWT</b>		RBW 10 MHz VBW 40 MHz Mod	e Auto Sweep				SGL Count 100/1
T: IFP TDF "CI Frequency S	ORRECTION3"							●1Av AvgPv
requeriey a	Weep						M1[1]	
								3.61721000
				M1 V				
			and the second second			n and a second s		
							λ.	
UBIII	manun and a start of the start							
3.625 GHz			1001 pt	s s	10.0 MHz/			Span 100.0 M

10:36:50 AM 06/02/2023

Plot 7.47. Conducted Power / 10MHz Plot (40MHz 64QAM, Mid Channel - Ch.A)

#### ACLRResults



10:37:35 AM 06/02/2023



FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Page 39 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Fage 39 01 124
,			V3 0 1/6/2022



## **Channel B Conducted Power / 10MHz Measurements**

#### ACLRResults



11:36:27 AM 06/02/2023



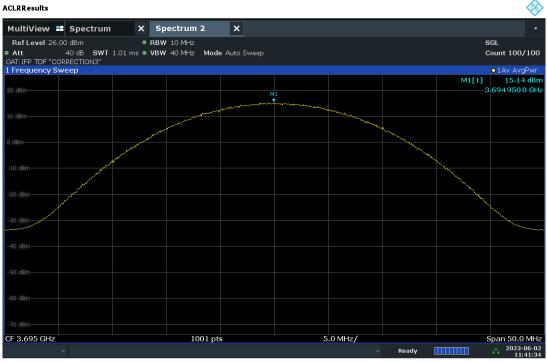


11:40:05 AM 06/02/2023

#### Plot 7.50. Conducted Power / 10MHz Plot (10MHz 16QAM, High Channel - Ch.B)

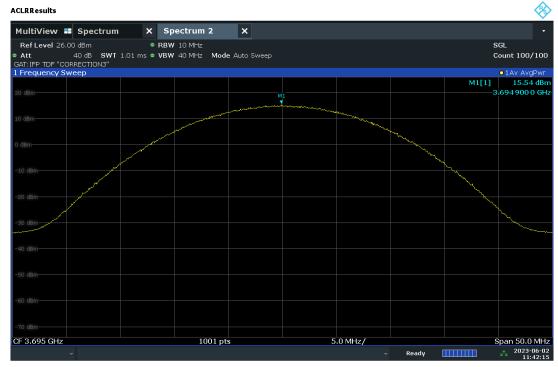
FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Page 40 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Faye 40 01 124
			V3.0 1/6/2022



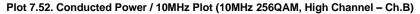


11:41:35 AM 06/02/2023





11:42:15 AM 06/02/2023



FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dago 41 of 104
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 41 of 124
			V3.0 1/6/2022







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ACLRResults



11:49:27 AM 06/02/2023



FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dogo 42 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 42 of 124
	•		V3.0.1/6/2022



MultiView 📰 Spectrum	X Sp	ectrum 2	×					
Ref Level 26.00 dBm		10 MHz						SGL
Att 40 dB SWT 1.0 AT: IFP TDF "CORRECTION3"	01 ms = VBW	40 MHz Mode	e Auto Sweep					Count 100/10
Frequency Sweep								o1Av AvgPw
							M1[1]	
				M1				3.625 075 0 G
					- The second sec			
		and the second s			- market			
						he was a second		
						No.		
	_/							
)	, Carlor and Carlor an					h h		
10 dBm							Ny .	
0 dBm								
3.625 GHz		1001 pt	s	7	.5 MHz/			Span 75.0 M
		roor pe				Ready		2023-06- 11:50:

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11:50:45 AM 06/02/2023

Plot 7.55. Conducted Power / 10MHz Plot (20MHz 64QAM, Mid Channel - Ch.B)

#### ACLRResults



11:52:26 AM 06/02/2023

Plot 7.56. Conducted Power / 10MHz Plot (20MHz 256QAM, Mid Channel - Ch.B)

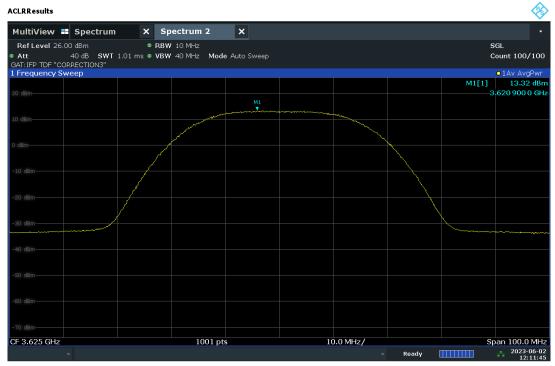
FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Page 43 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Fage 43 01 124
			1/3 0 1/6/2022



IultiView ≡ Spectrum	x s	pectrum 2	×					
		VIOMHZ V40MHzMod	e Auto Sweep					SGL Count 100/10
AT: IFP TDF "CORRECTION3" Frequency Sweep								●1Av AvgPv
							M1[1]	
								3.625 400 0 6
				M1				
					min			
		and the second s						
) dBm								
, 							<u>_</u>	
dBm							1 mm	
3.625 GHz		1001 pt	S		10.0 MHz/			Span 100.0 M
					~	Ready		2023-06- 12:08

12:08:48 PM 06/02/2023





12:11:46 PM 06/02/2023

#### Plot 7.58. Conducted Power / 10MHz Plot (30MHz 16QAM, Mid Channel - Ch.B)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change			
Test Report S/N:	Test Dates:	EUT Type:	Dogo 44 of 124		
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 44 of 124		
			V3.0 1/6/2022		



IultiView 🎫 Spectrum	× sp	ectrum 2	×					
RefLevel 26.00 dBm Att 40 dB SWT 1.01		10 MHz						SGL
Att 40 dB SWT 1.01 IT: IFP TDF "CORRECTION3"	lms = VBW	40 MHz Mod	e Auto Sweep					Count 100/1
requency Sweep								o1Av AvgPv
							M1[1]	
								3.620 800 0 (
					~~~			
					- And			
		y and the second						
) dBm	/					<u> </u>		
) dBm								
3.625 GHz		1001 pt			0.0 MHz/			Span 100.0 M
3.023 GHZ		1001 pt	3	1		Ready	;	2023-06

12:12:15 PM 06/02/2023





12:13:19 PM 06/02/2023

#### Plot 7.60. Conducted Power / 10MHz Plot (30MHz 256QAM, Mid Channel - Ch.B)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change			
Test Report S/N:	Test Dates:	EUT Type:	Page 45 of 124		
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Fage 45 01 124		
			V3.0 1/6/2022		



CLRResults								
4ultiView 🎫 Spectrum	X Sp	ectrum 2	×					•
Ref Level 26.00 dBm           Att         40 dB         SWT 1.1		' 10 MHz ' 40 MHz <b>Mod</b>	e Auto Sweep					SGL Count 100/100
AT: IFP TDF "CORRECTION3"								•1Av AvgPwr
Frequency Sweep							M1[1]	12.48 dBr
0 dBm-								3.6196100 GH
			M1					
			M1 Y					
					- manual of			
	North Contraction					and a second second		
10 dBm	/					l l		
						ľ	Y.	
20 dBm							$\mathbf{h}$	
30 dBm								
60 dBm								
F 3.625 GHz		1001 pt	s	1	0.0 MHz/		S	pan 100.0 M⊦
						Ready		2023-06-0 12:32:5

12:32:50 PM 06/02/2023





12:33:31 PM 06/02/2023

#### Plot 7.62. Conducted Power / 10MHz Plot (40MHz 16QAM, Mid Channel - Ch.B)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change			
Test Report S/N:	Test Dates:	EUT Type:	Dogo 46 of 124		
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 46 of 124		
			V3.0 1/6/2022		



ultiView ≡ Spectrum	x sp	ectrum 2	×					
		/ 10 MHz / 40 MHz Mod	e Auto Sweep					SGL Count 100/1
T:IFP TDF "CORRECTION3" Frequency Sweep								o1Av AvgP∖
							M1[1]	
								3.6165100
			M1					
				·······	- manual and a second			
dBm	<i>,</i>						χ	
dBm								
dBm							- han	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
3.625 GHz			s	1	0.0 MHz/			Span 100.0 N
*		1001 p				Ready		2023-06

12:36:17 PM 06/02/2023

Plot 7.63. Conducted Power / 10MHz Plot (40MHz 64QAM, Mid Channel - Ch.B)

#### ACLRResults



12:37:10 PM 06/02/2023

#### Plot 7.64. Conducted Power / 10MHz Plot (40MHz 256QAM, Mid Channel - Ch.B)

#### Note:

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change			
Test Report S/N:	Test Dates:	EUT Type:	Dogo 47 of 124		
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 47 of 124		
			V3.0 1/6/2022		



Per ANSI C63.26-2015 Section 5.2.5.3 and KDB 662911 v02r01 Section E)2), the power spectral density at Antenna 1 and Antenna 2 were first measured separately as shown in the section above. The measured values were then summed in linear power units then converted back to dBm.

Per ANSI C63.26-2015 Section 6.4.6 and KDB 662911 v02r01 Section F.2.c, since the transmissions are orthognally polarized and with beamforming applies, the directional gain is 18.61dBi.

#### Sample MIMO Calculation:

At 3625 MHz in QPSK, 20MHz BW mode, the average conducted power spectral density was measured to be 13.97 dBm/10MHz for Channel A and 15.13 dBm/10MHz for Channel B.

Antenna 1 + Antenna 2 = MIMO

(13.97 dBm/10MHz + 15.13 dBm/10MHz) = (24.946 mW/10MHz + 32.584 mW/10MHz) = 57.530 mW/10MHz = 17.60 dBm/10MHz

## Sample e.i.r.p Power Spectral Density Calculation:

At 3625 MHz in QPSK, 20MHz BW mode, the average MIMO power density was calculated to be 19.68 dBm with directional gain of 18.61 dBi.

e.i.r.p. Power Spectral Density(dBm) = Power Spectral Density (dBm) + Ant gain (dBi)

17.60 dBm/10MHz + 10.16 dBi = 27.76 dBm/10MHz

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change			
Test Report S/N:	Test Dates:	EUT Type:	Page 48 of 124		
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Faye 40 01 124		
			\/2.0.1/6/2022		



# 7.4 Conducted Power Spectral Density Test Overview

The spectrum analyzer was connected to the antenna terminal while the EUT was operating at its maximum power control level, as defined in ANSI C63.26-2015, and at the appropriate frequencies. The EUT transmits with a duty cycle of approximately 71.95%; the spectrum analyzer was gated as to only measure during on periods.

## The e.i.r.p. power spectral density for a Category B CBSD must be less than 37dBm/MHz.

## **Test Procedure Used**

ANSI C63.26-2015 – Section 5.2.4.4.1 ANSI C63.26-2015 – Section 5.2.4.5 ANSI C63.26-2015 – Section 6.4.3.2.3

## **Test Settings**

- 9. Span = 2x to 3X the OBW
- 10. RBW = 10MHz
- 11. VBW ≥ 3 x RBW
- 12. Set number of sweep points  $\geq$  2 x span / RBW
- 13. Sweep Time = auto couple
- 14. Detector = RMS
- 15. Trace mode = average
- 16. Trigger = Level

### Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



Figure 7-3. Test Instrument & Measurement Setup

## Test Notes

A scaling factor of 10log(7) was added to obtain the total output summed across all 7 modules.

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change			
Test Report S/N:	Test Dates:	EUT Type:	Dage 40 of 104		
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 49 of 124		
			V3.0 1/6/2022		



Bandwidth	Modulation	Frequency [MHz]	Ch. A Conducted PSD [dBm/MHz]	Ch. B Conducted PSD [dBm/MHz]	Summed MIMO Conducted PSD [dBm/MHz]	Summed MIMO Conducted PSD [dBm] - All Modules	Ant Gain [dBi]	EIRP PSD [dBm/MHz]	EIRP PSD [Watts/MHz]	EIRP PSD Limit [dBm/MHz]	Margin [dB]
		3570.0	-2.25	-2.88	0.45	8.90	10.16	19.06	0.081	37.00	-17.94
	QPSK	3625.0	3.13	4.18	6.69	15.14	10.16	25.30	0.339	37.00	-11.70
		3680.0	0.10	-0.51	2.82	11.27	10.16	21.43	0.139	37.00	-15.57
	16-QAM	3570.0	-2.99	-2.75	0.15	8.60	10.16	18.76	0.075	37.00	-18.24
N		3625.0	3.38	4.05	6.74	15.19	10.16	25.35	0.343	37.00	-11.65
40 MHz		3680.0	0.04	-0.54	2.77	11.22	10.16	21.38	0.137	37.00	-15.62
Ū Į		3570.0	-2.56	-2.88	0.29	8.74	10.16	18.90	0.078	37.00	-18.10
4	64-QAM	3625.0	2.67	3.93	6.36	14.81	10.16	24.97	0.314	37.00	-12.03
		3680.0	0.31	-0.49	2.94	11.39	10.16	21.55	0.143	37.00	-15.45
		3570.0	-3.04	-2.70	0.15	8.60	10.16	18.76	0.075	37.00	-18.24
	256-QAM	3625.0	2.61	4.17	6.47	14.92	10.16	25.08	0.322	37.00	-11.92
		3680.0	-0.11	-0.57	2.68	11.13	10.16	21.29	0.135	37.00	-15.71
		3565.0	-1.54	-2.95	0.82	9.27	10.16	19.43	0.088	37.00	-17.57
	QPSK	3625.0	4.47	4.65	7.57	16.02	10.16	26.18	0.415	37.00	-10.82
		3685.0	1.91	2.03	4.98	13.43	10.16	23.59	0.229	37.00	-13.41
		3565.0	-1.02	-2.25	1.42	9.87	10.16	20.03	0.101	37.00	-16.97
N	16-QAM	3625.0	4.64	4.61	7.63	16.09	10.16	26.25	0.421	37.00	-10.75
Ŧ		3685.0	1.98	2.03	5.02	13.47	10.16	23.63	0.231	37.00	-13.37
30 MHz		3565.0	-1.60	-2.21	1.12	9.57	10.16	19.73	0.094	37.00	-17.27
Э	64-QAM	3625.0	4.69	4.62	7.66	16.11	10.16	26.27	0.424	37.00	-10.73
		3685.0	2.02	2.01	5.03	13.48	10.16	23.64	0.231	37.00	-13.36
		3565.0	-1.05	-2.26	1.40	9.85	10.16	20.01	0.100	37.00	-16.99
	256-QAM	3625.0	3.63	4.59	7.15	15.60	10.16	25.76	0.376	37.00	-11.24
		3685.0	2.16	2.01	5.10	13.55	10.16	23.71	0.235	37.00	-13.29
		3560.0	-0.63	-0.42	2.49	10.94	10.16	21.10	0.129	37.00	-15.90
	QPSK	3625.0	6.06	6.83	9.47	17.92	10.16	28.08	0.643	37.00	-8.92
		3690.0	2.99	3.84	6.44	14.90	10.16	25.06	0.320	37.00	-11.94
		3560.0	0.29	-0.43	2.95	11.40	10.16	21.56	0.143	37.00	-15.44
N	16-QAM	3625.0	6.04	6.92	9.52	17.97	10.16	28.13	0.650	37.00	-8.87
20 MHz		3690.0	2.83	3.80	6.35	14.80	10.16	24.96	0.313	37.00	-12.04
2		3560.0	0.24	-0.41	2.94	11.39	10.16	21.55	0.143	37.00	-15.45
5	64-QAM	3625.0	5.71	6.78	9.29	17.74	10.16	27.90	0.617	37.00	-9.10
		3690.0	2.65	3.83	6.29	14.74	10.16	24.90	0.309	37.00	-12.10
		3560.0	0.32	-0.28	3.04	11.49	10.16	21.65	0.146	3.00	18.65
	256-QAM	3625.0	5.98	6.74	9.39	17.84	10.16	28.00	0.630	37.00	-9.00
		3690.0	2.79	3.63	6.24	14.69	10.16	24.85	0.305	37.00	-12.15
		3555.0	5.25	3.86	7.62	16.07	10.16	26.23	0.420	37.00	-10.77
	QPSK	3625.0	6.77	6.70	9.74	18.19	10.16	28.35	0.685	37.00	-8.65
		3695.0	7.95	8.88	11.45	19.90	10.16	30.06	1.014	37.00	-6.94
		3555.0	5.53	3.91	7.81	16.26	10.16	26.42	0.439	37.00	-10.58
N	16-QAM	3625.0	6.58	6.80	9.70	18.15	10.16	28.31	0.677	37.00	-8.69
Ë.		3695.0	7.87	8.90	11.43	19.88	10.16	30.04	1.008	37.00	-6.96
2		3555.0	4.69	4.00	7.37	15.82	10.16	25.98	0.396	37.00	-11.02
1	64-QAM	3625.0	7.15	6.85	10.01	18.46	10.16	28.62	0.728	37.00	-8.38
		3695.0	8.08	8.91	11.53	19.98	10.16	30.14	1.032	37.00	-6.86
		3555.0	4.57	4.06	7.34	15.79	10.16	25.95	0.393	37.00	-11.05
	256-QAM	3625.0	7.41	6.71	10.08	18.53	10.16	28.69	0.740	37.00	-8.31
	100 0.101	3695.0	7.86	8.76	11.35	19.80	10.16	29.96	0.990	37.00	-7.04
						otrol Donoi					

Table 7-4 E.I.R.P. Power Spectral Density Measurements

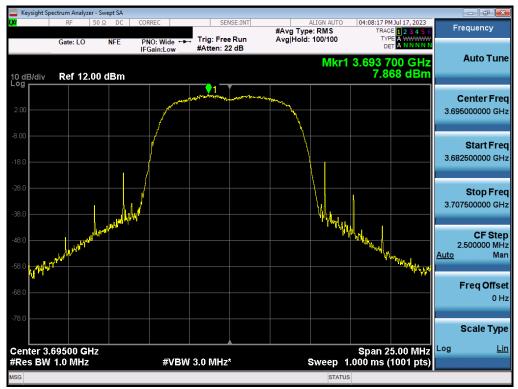
FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change			
Test Report S/N:	Test Dates:	EUT Type:	Dogo 50 of 124		
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## **Channel A Conducted Power Spectral Density**



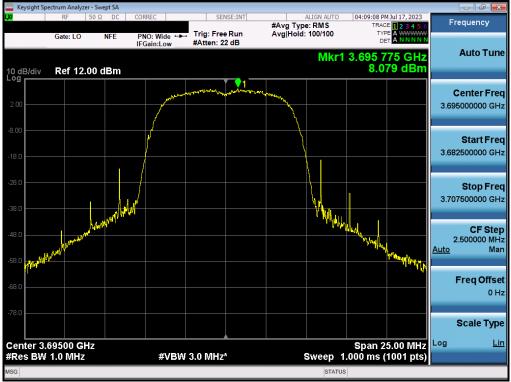
Plot 7.65. Conducted Power Spectral Density Plot (10MHz QPSK, High Channel - Ch.A)



Plot 7.66. Conducted Power Spectral Density Plot (10MHz 16QAM, High Channel - Ch.A)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change			
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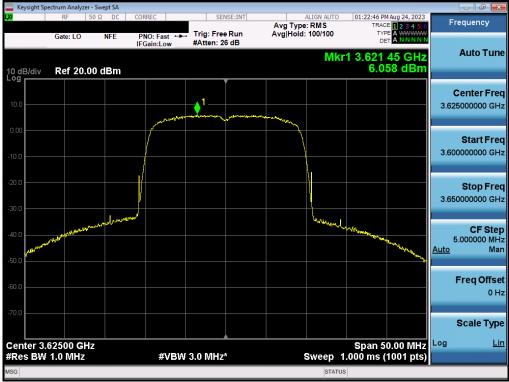
Plot 7.67. Conducted Power Spectral Density Plot (10MHz 64QAM, High Channel - Ch.A)



Plot 7.68. Conducted Power Spectral Density Plot (10MHz 256QAM, High Channel - Ch.A)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	
Test Report S/N:	Test Dates:	EUT Type:	Daga 52 of 124
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Plot 7.69. Conducted Power Spectral Density Plot (20MHz QPSK, Mid Channel - Ch.A)



Plot 7.70. Conducted Power Spectral Density Plot (20MHz 16QAM, Mid Channel - Ch.A)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	
Test Report S/N:	Test Dates:	EUT Type:	Dogo 52 of 124
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Plot 7.71. Conducted Power Spectral Density Plot (20MHz 64QAM, Mid Channel - Ch.A)



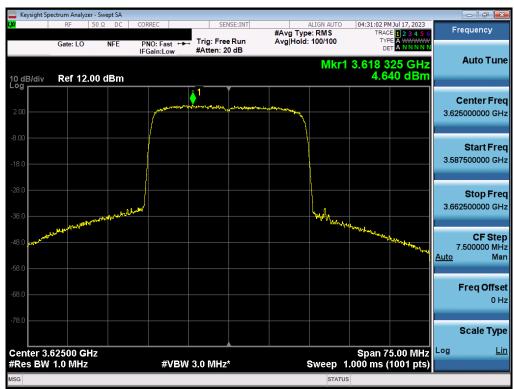
Plot 7.72. Conducted Power Spectral Density Plot (20MHz 256QAM, Mid Channel - Ch.A)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	
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Plot 7.73. Conducted Power Spectral Density Plot (30MHz QPSK, Mid Channel - Ch.A)



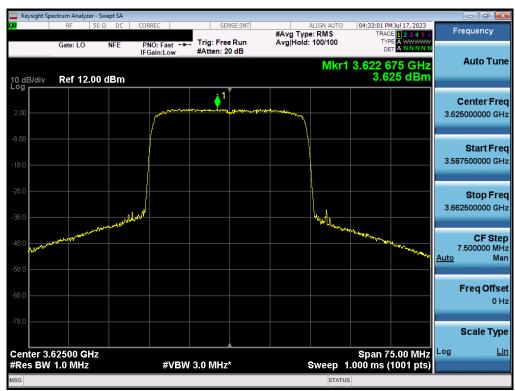
Plot 7.74. Conducted Power Spectral Density Plot (30MHz 16QAM, Mid Channel - Ch.A)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	
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Plot 7.75. Conducted Power Spectral Density Plot (30MHz 64QAM, Mid Channel - Ch.A)



Plot 7.76. Conducted Power Spectral Density Plot (30MHz 256QAM, Mid Channel - Ch.A)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	
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Keysight Spe	ectrum Analyzer						- F
l <mark>XI</mark>	RF 5	50Ω DC	CORREC	SENSE:INT	#Avg Type: RMS	04:45:58 PM Jul 17, 2023 TRACE 1 2 3 4 5 6	Frequency
	Gate: LO	NFE	PNO: Fast ↔→ IFGain:Low	Trig: Free Run #Atten: 20 dB	Avg Hold: 100/100	kr1 3.611 6 GHz 3.126 dBm	Auto Tune
10 dB/div Log	Ref 12.0	0 dBm				3.126 dBm	
2.00			<u>)</u>	an and the second se	minan		Center Freq 3.625000000 GHz
-8.00							Start Freq 3.575000000 GHz
-28.0							<b>Stop Freq</b> 3.675000000 GHz
-48.0	and the second	and the second s			a book water and	warrow warrow with the for some	CF Step 10.000000 MHz <u>Auto</u> Man
-68.0							<b>Freq Offset</b> 0 Hz
-78.0							Scale Type
Center 3.0 #Res BW		z	#VBW	3.0 MHz*	#Sweep 3	Span 100.0 MHz 3.000 ms (1001 pts)	Log <u>Lin</u>
MSG					STATU	s	

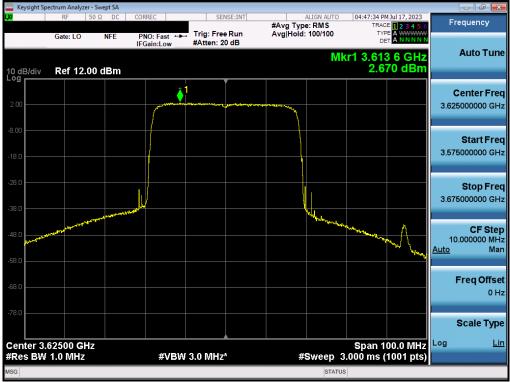
Plot 7.77. Conducted Power Spectral Density Plot (40MHz QPSK, Mid Channel - Ch.A)



Plot 7.78. Conducted Power Spectral Density Plot (40MHz 16QAM, Mid Channel - Ch.A)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	
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Plot 7.79. Conducted Power Spectral Density Plot (40MHz 64QAM, Mid Channel - Ch.A)

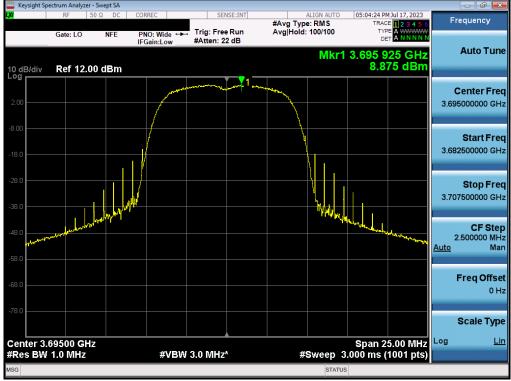


Plot 7.80. Conducted Power Spectral Density Plot (40MHz 256QAM, Mid Channel - Ch.A)

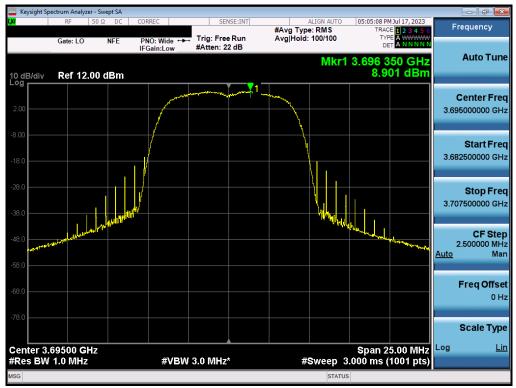
FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	
Test Report S/N:	Test Dates:	EUT Type:	Daga 58 of 124
1M2308230095-01.2AS22	05/08/2023 - 08/24/2023	CBRS Radio Module	Page 58 of 124
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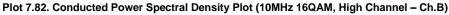


## **Channel B Conducted Power Spectral Density**



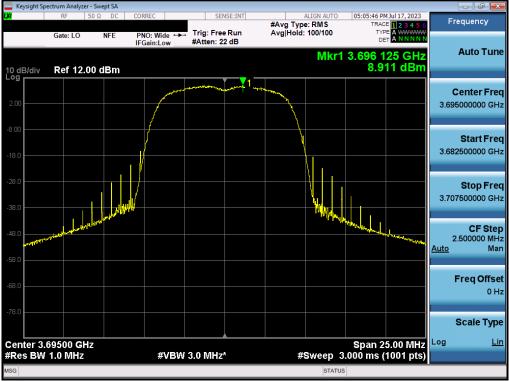
Plot 7.81. Conducted Power Spectral Density Plot (10MHz QPSK, High Channel – Ch.B)



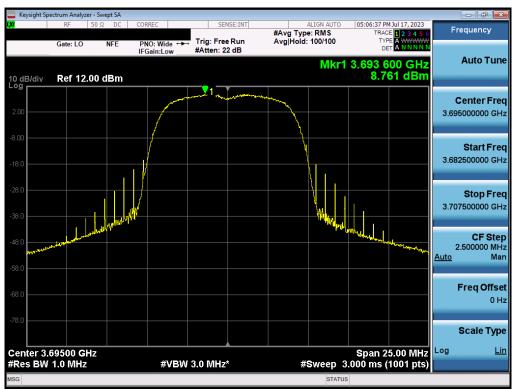


FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Page 59 of 124
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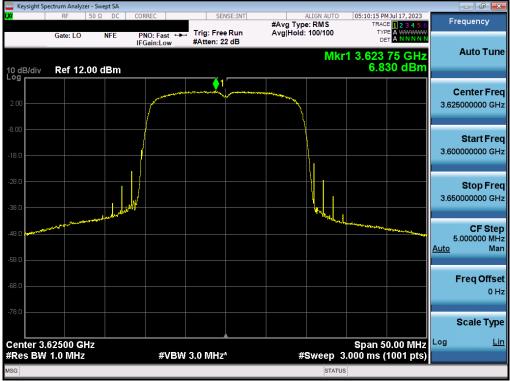
Plot 7.83. Conducted Power Spectral Density Plot (10MHz 64QAM, High Channel - Ch.B)



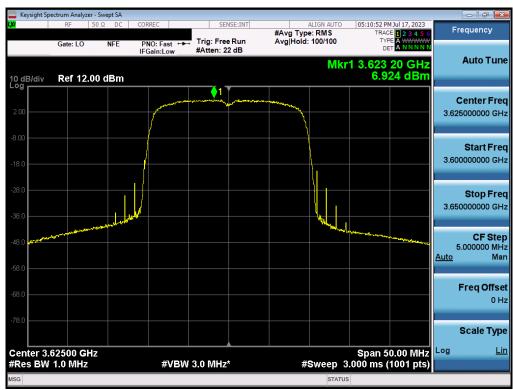
Plot 7.84. Conducted Power Spectral Density Plot (10MHz 256QAM, High Channel - Ch.B)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	
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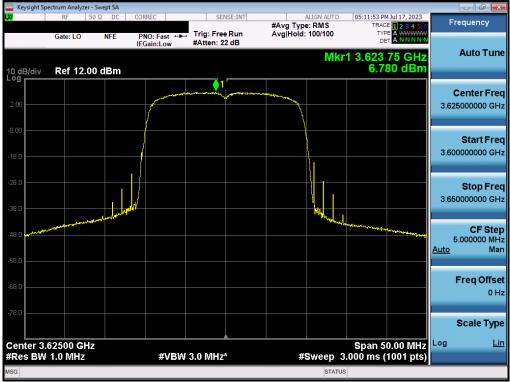
Plot 7.85. Conducted Power Spectral Density Plot (20MHz QPSK, Mid Channel - Ch.B)



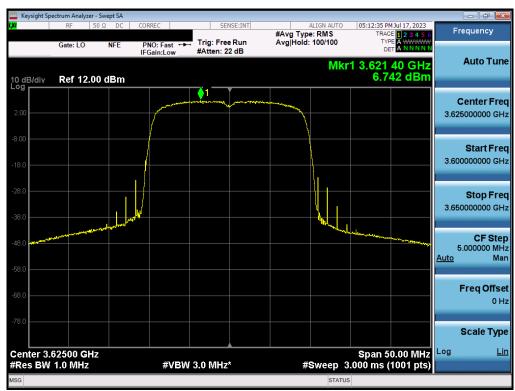
Plot 7.86. Conducted Power Spectral Density Plot (20MHz 16QAM, Mid Channel - Ch.B)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	
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Plot 7.87. Conducted Power Spectral Density Plot (20MHz 64QAM, Mid Channel - Ch.B)



Plot 7.88. Conducted Power Spectral Density Plot (20MHz 256QAM, Mid Channel - Ch.B)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	
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Keysight Spe	ctrum Analyzer						
LXI	RF 5	0Ω DC	CORREC	SENSE:INT	ALIGN AUTO #Avg Type: RMS	05:21:20 PM Jul 17, 2023 TRACE 1 2 3 4 5 6	Frequency
	Gate: LO	NFE	PNO: Fast ↔ IFGain:Low	. Trig: Free Run #Atten: 22 dB	Avg Hold: 100/100	TYPE A WWWW DET A NNNNN	Auto Tune
10 dB/div Log	Ref 12.0	0 dBm		_		4.652 dBm	
			<u> </u>	1	14damana and an		Center Freq
2.00				Ĭ			3.625000000 GHz
-8.00							Start Freq
-18.0							3.587500000 GHz
-28.0							Stop Freq
-38.0			M				3.662500000 GHz
-48.0	-	monormander	AF •		"What and have a second	warmour	CF Step
-40.0						and the second second	7.500000 MHz <u>Auto</u> Man
-58.0							
-68.0							Freq Offset
70.0							U HZ
-78.0							Scale Type
Center 3.6		z					Log <u>Lin</u>
#Res BW	1.0 MHz		#VBW	3.0 MHz*		1.000 ms (1001 pts)	
MSG					STATU	8	

Plot 7.89. Conducted Power Spectral Density Plot (30MHz QPSK, Mid Channel - Ch.B)



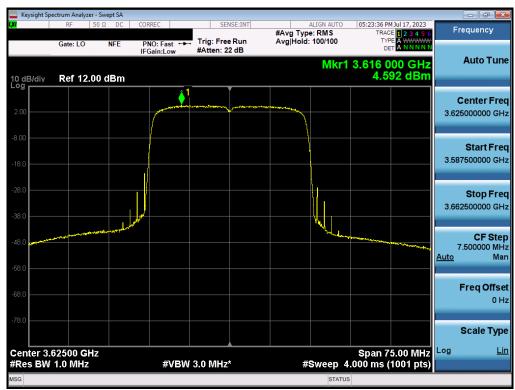
Plot 7.90. Conducted Power Spectral Density Plot (30MHz 16QAM, Mid Channel - Ch.B)

CC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	Approved by: Technical Manager
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Keysight Spe	ectrum Analyze						
LXI	RF	50 Ω DC	CORREC	SENSE:INT	ALIGN AUTO #Avg Type: RMS	05:22:54 PM Jul 17, 2023 TRACE 1 2 3 4 5 6	Frequency
	Gate: LO	NFE	PNO: Fast ↔ IFGain:Low	Trig: Free Run #Atten: 22 dB	Avg Hold: 100/100	DET A NNNNN	A
10 dB/div Log	Ref 12.0	00 dBm			Mkr1	3.619 300 GHz 4.615 dBm	Auto Tune
2.00				<u></u>			Center Fred 3.625000000 GHz
.18.0							Start Fred 3.587500000 GH;
-28.0							<b>Stop Fred</b> 3.662500000 GHz
-48.0		aurana ana dada			<sup>b</sup> huluun	night an	CF Step 7.500000 MH: <u>Auto</u> Mar
68.0							Freq Offse 0 H:
-78.0							Scale Type
Center 3.0 #Res BW		IZ	#VBW	3.0 MHz*	#Sweep 4	Span 75.00 MHz .000 ms (1001 pts)	Log <u>Lir</u>
MSG					STATU		

Plot 7.91. Conducted Power Spectral Density Plot (30MHz 64QAM, Mid Channel - Ch.B)



Plot 7.92. Conducted Power Spectral Density Plot (30MHz 256QAM, Mid Channel - Ch.B)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	Approved by: Technical Manager
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Gate: LO       NFE       PNO: Fast       Trig: Free Run #Atten: 22 dB       Trig: Tree Run #Atten: 22 dB       Tree Run #AvgHold: 100/100       Tree Quency         O dB/div       Ref 12.00 dBm       Center Freq         O dB/div       Ref 12.00 dBm       Center Freq         O dB/div       Ref 12.00 dBm       Center Freq         O dB/div       Center Freq       3.62500000 GHz         Start Freq         Stor Freq <th cols<="" th=""><th>Keysight Spec</th><th>ctrum Analyzer - S</th><th></th><th></th><th></th><th></th><th></th><th></th></th>	<th>Keysight Spec</th> <th>ctrum Analyzer - S</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	Keysight Spec	ctrum Analyzer - S						
Gate: L0       NFE       PNO: Fast the state in	L <mark>XI</mark>	RF 50	Ω DC	CORREC	SENSE:INT	ALIGN AUTO #Avg Type: RMS	05:32:54 PM Jul 17, 2023 TRACE 1 2 3 4 5 6	Frequency	
200 200 200 200 200 200 200 200	10 dB/div					Avg Hold: 100/100		Auto Tune	
180       Start Freq         280       Start Freq         380       Start Freq </td <td>2.00</td> <td></td> <td></td> <td></td> <td>1</td> <td></td> <td></td> <td>Center Freq 3.625000000 GHz</td>	2.00				1			Center Freq 3.625000000 GHz	
Stop Freq 380 480 480 480 480 480 480 480 4	-8.00							Start Freq 3.575000000 GHz	
All of the second secon	-28.0							<b>Stop Freq</b> 3.675000000 GHz	
Res BW 1.0 MHz       #VBW 3.0 MHz*       #Sweep 3.000 ms (1001 pts)       0 Hz	-48.0 -58.0	and the second					-	CF Step 10.000000 MHz <u>Auto</u> Man	
Center 3.62500 GHz Res BW 1.0 MHz #VBW 3.0 MHz* #Sweep 3.000 ms (1001 pts)	-68.0							<b>Freq Offset</b> 0 Hz	
Res BW 1.0 MHz   #VBW 3.0 MHz*   #Sweep 3.000 ms (1001 pts)	-78.0							Scale Type	
				#VBW	3.0 MHz*	#Sweep 3			
314103	MSG					STATU			

Plot 7.93. Conducted Power Spectral Density Plot (40MHz QPSK, Mid Channel - Ch.B)



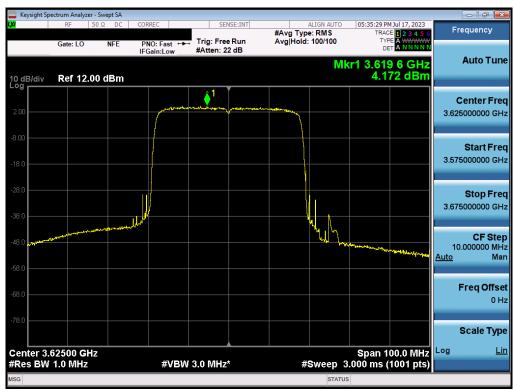
Plot 7.94. Conducted Power Spectral Density Plot (40MHz 16QAM, Mid Channel - Ch.B)

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	Approved by: Technical Manager
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LXI	RF 50 S	2 DC 0									
			CORREC	SENS	SE:INT	#Avg Typ	ALIGN AUTO		1 Jul 17, 2023	Fr	equency
	Gate: LO		PNO: Fast ↔ IFGain:Low	Trig: Free #Atten: 22		Avg Hold:	: 100/100	TYP DE	6 0 GHz 30 dBm		Auto Tune
10 dB/div Log	Ref 12.00	dBm					1	5.5			
2.00				•1	, <b>^₽~~</b> ₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩						<b>Center Freq</b> 5000000 GHz
-8.00										3.57	Start Freq 5000000 GHz
-28.0										3.67	Stop Freq 5000000 GHz
-48.0	and a second and a s	and the second						here and the same of the same	Canal Maril Andrew Provide	10 <u>Auto</u>	<b>CF Step</b> .000000 MHz Man
-58.0										•	Freq Offset 0 Hz
-78.0											Scale Type
Center 3.6 #Res BW 1			#VBW	3.0 MHz*		#	Sweep 3	Span 1 .000 ms (	00.0 MHz 1001 pts)	Log	<u>Lin</u>
MSG							STATUS				

Plot 7.95. Conducted Power Spectral Density Plot (40MHz 64QAM, Mid Channel - Ch.B)



Plot 7.96. Conducted Power Spectral Density Plot (40MHz 256QAM, Mid Channel - Ch.B)

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Note:

Per ANSI C63.26-2015 Section 5.2.5.3 and KDB 662911 v02r01 Section E)2), the power spectral density at Antenna 1 and Antenna 2 were first measured separately as shown in the section above. The measured values were then summed in linear power units then converted back to dBm.

Per ANSI C63.26-2015 Section 6.4.6 and KDB 662911 v02r01 Section F.2.c, since the transmissions are orthognally polarized and with beamforming applies, the directional gain is 18.61dBi.

## Sample MIMO Calculation:

At 3625 MHz in QPSK, 20MHz BW mode, the average conducted power spectral density was measured to be 5.76 dBm for Channel A and 6.83 dBm for Channel B.

Antenna 1 + Antenna 2 = MIMO

(6.06 dBm + 6.83 dBm) = (4.036 mW + 4.819 mW) = 8.855 mW = 9.47 dBm

## Sample e.i.r.p Power Spectral Density Calculation:

At 3625 MHz in QPSK, 20MHz BW mode, the average MIMO power density was calculated to be 9.34 dBm with directional gain of 18.61 dBi.

e.i.r.p. Power Spectral Density(dBm) = Power Spectral Density (dBm) + Ant gain (dBi)

9.47 dBm + 10.16dBi =19.63 dBm

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# 7.5 Peak-Average Ratio

## **Test Overview**

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

## **Test Procedure Used**

ANSI C63.26-2015 - Section 5.2.3.4

### **Test Settings**

- 1. The signal analyzer's CCDF measurement profile is enabled
- 2. Frequency = carrier center frequency
- 3. Measurement BW ≥ OBW or specified reference bandwidth
- 4. The signal analyzer was set to collect one million samples to generate the CCDF curve
- 5. The spectrum analyzer is set to use an internal "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power

#### Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



Figure 7-4. Test Instrument & Measurement Setup

### Test Notes

None.

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PAR							
Bandwidth	Modulation	PAR at 0.1% [dB]	PAR Limit [dB]	Margin [dB]			
	QPSK	8.25	13.0	-4.75			
40 MHz	16QAM	8.3	13.0	-4.7			
40 1011 12	64QAM	8.29	13.0	-4.71			
	256QAM	8.26	13.0	-4.74			
	QPSK	8.23	13.0	-4.77			
30 MHz	16QAM	8.13	13.0	-4.87			
	64QAM	8.01	13.0	-4.99			
	256QAM	8.15	13.0	-4.85			
	QPSK	8.25	13.0	-4.75			
20 MHz	16QAM	8.26	13.0	-4.74			
20 1011 12	64QAM	8.32	13.0	-4.68			
	256QAM	8.34	13.0	-4.66			
	QPSK	8.07	13.0	-4.93			
10 MHz	16QAM	8.09	13.0	-4.91			
	64QAM	8.17	13.0	-4.83			
	256QAM	8.1	13.0	-4.9			

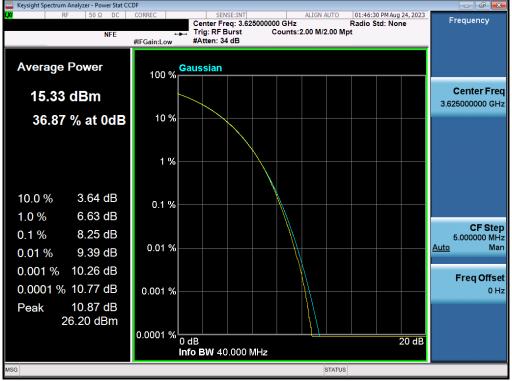
	PAR				
Bandwidth	Modulation	PAR at 0.1% [dB]	PAR Limit [dB]	Margin [dB]	
	QPSK	8.60	13.0	-4.40	
40 MHz	16QAM	8.06	13.0	-4.94	
40 1011 12	64QAM	8.07	13.0	-4.93	
	256QAM	8.09	13.0	-4.91	
	QPSK	8.16	13.0	-4.84	
30 MHz	16QAM	8.01	13.0	-4.99	
	64QAM	8.00	13.0	-5.00	
	256QAM	8.15	13.0	-4.85	
	QPSK	8.06	13.0	-4.94	
20 MHz	16QAM	8.20	13.0	-4.80	
20 1011 12	64QAM	8.06	13.0	-4.94	
	256QAM	8.28	13.0	-4.72	
	QPSK	7.96	13.0	-5.04	
10 MHz	16QAM	7.93	13.0	-5.07	
	64QAM	7.96	13.0	-5.04	
	256QAM	7.96	13.0	-5.04	

Table 7-6 Peak to Average Power Ratio Measurements – Ch.B

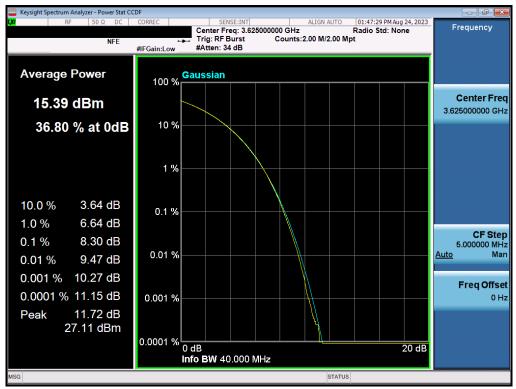
FCC ID: 2AS22-LUMACH2	PART 96 MEASUREMENT REPORT Class II Permissive Change		Approved by: Technical Manager
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## **Channel A Peak to Average Power Ratio Measurements**



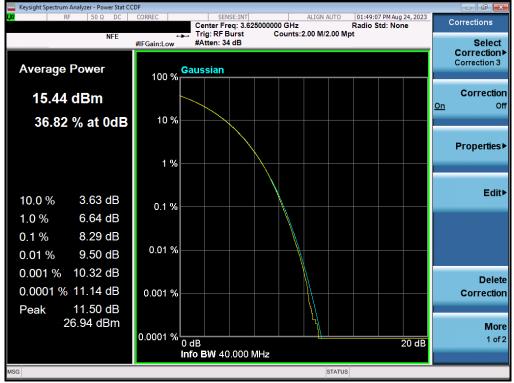
Plot 7.97. Peak to Average Power Ratio Plot (40MHz, QPSK - Mid Channel) - Ch.A



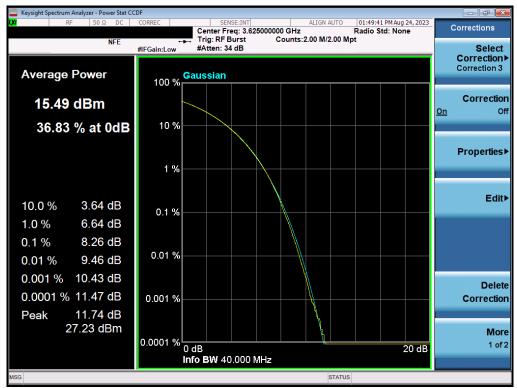
Plot 7.98. Peak to Average Power Ratio Plot (40MHz, 16QAM – Mid Channel) – Ch.A

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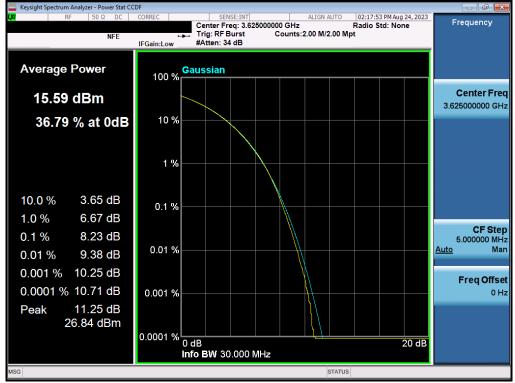
Plot 7.99. Peak to Average Power Ratio Plot (40MHz, 64QAM - Mid Channel) - Ch.A



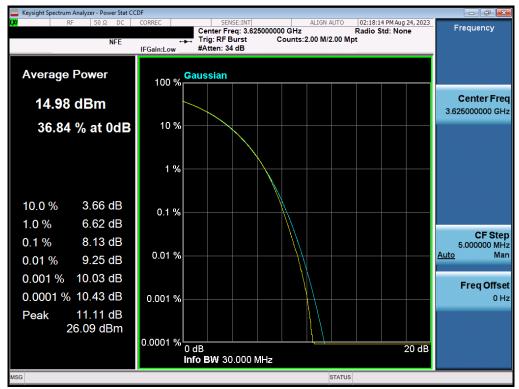
Plot 7.100. Peak to Average Power Ratio Plot (40MHz, 256QAM – Mid Channel) – Ch.A

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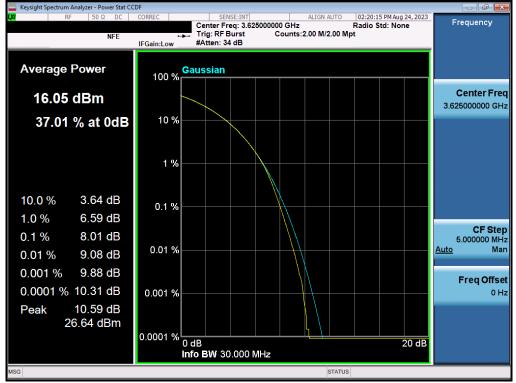
Plot 7.101. Peak to Average Power Ratio Plot (30MHz, QPSK – Mid Channel) – Ch.A



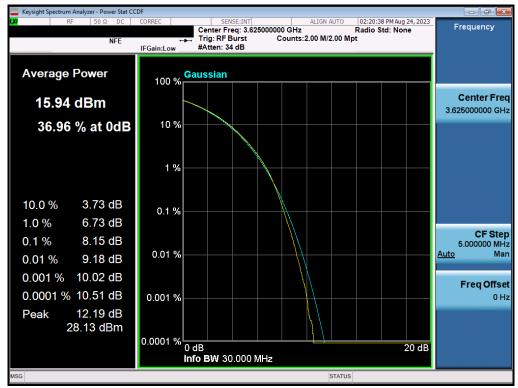
Plot 7.102. Peak to Average Power Ratio Plot (30MHz, 16QAM - Mid Channel) - Ch.A

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	
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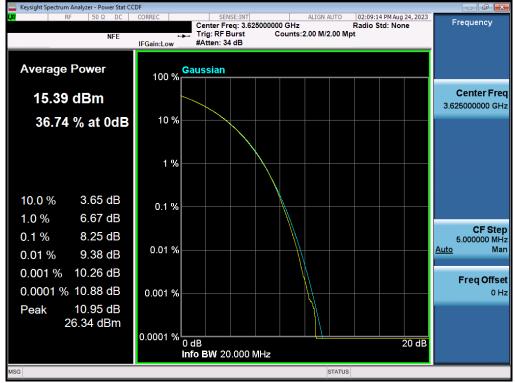
Plot 7.103. Peak to Average Power Ratio Plot (30MHz, 64QAM – Mid Channel) – Ch.A



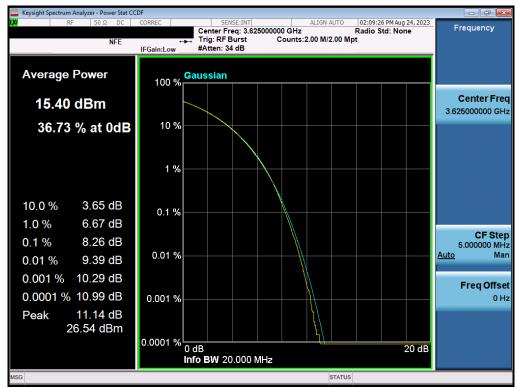
Plot 7.104. Peak to Average Power Ratio Plot (30MHz, 256QAM - Mid Channel) - Ch.A

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	
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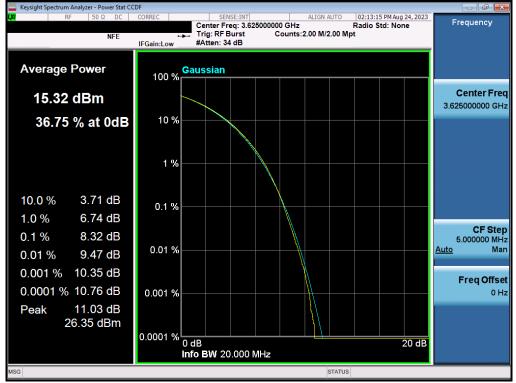
Plot 7.105. Peak to Average Power Ratio Plot (20MHz, QPSK – Mid Channel) – Ch.A



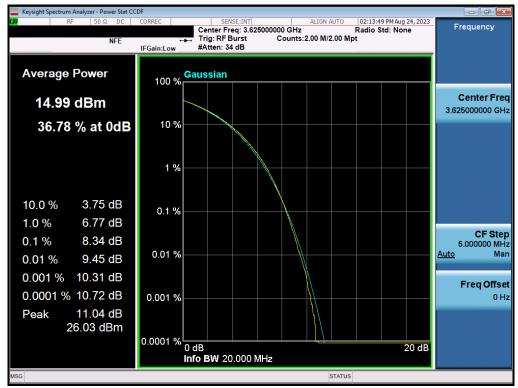
Plot 7.106. Peak to Average Power Ratio Plot (20MHz, 16QAM - Mid Channel) - Ch.A

FCC ID: 2AS22-LUMACH2		PART 96 MEASUREMENT REPORT Class II Permissive Change	
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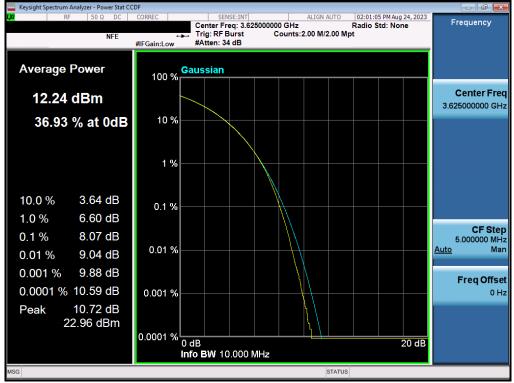
Plot 7.107. Peak to Average Power Ratio Plot (20MHz, 64QAM - Mid Channel) - Ch.A



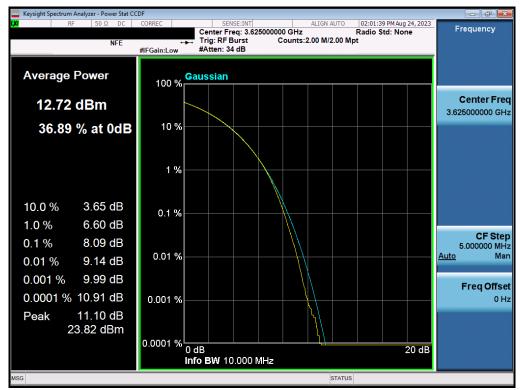
Plot 7.108. Peak to Average Power Ratio Plot (20MHz, 256QAM - Mid Channel) - Ch.A

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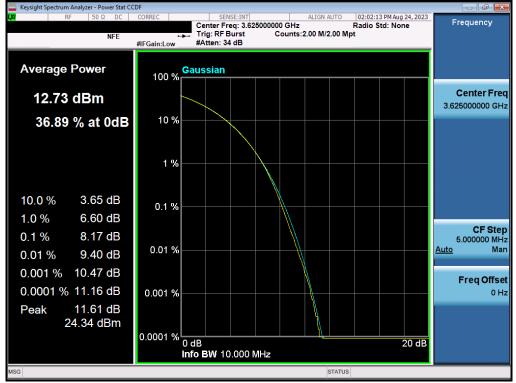
Plot 7.109. Peak to Average Power Ratio Plot (10MHz, QPSK – Mid Channel) – Ch.A



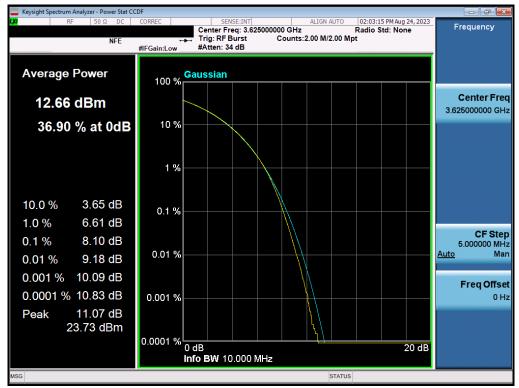
Plot 7.110. Peak to Average Power Ratio Plot (10MHz, 16QAM - Mid Channel) - Ch.A

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Plot 7.111. Peak to Average Power Ratio Plot (10MHz, 64QAM - Mid Channel) - Ch.A



Plot 7.112. Peak to Average Power Ratio Plot (10MHz, 256QAM - Mid Channel) - Ch.A

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