

**ELECTROMAGNETIC EMISSIONS
COMPLIANCE REPORT**

Applicant: Murata Electronics North America
2200 Lake Park Dr #7604, Smyrna, GA 30080 USA

Manufacturer: Murata Electronics North America
2200 Lake Park Dr #7604, Smyrna, GA 30080 USA

Product Name: Type 1SC

Brand Name: Murata

Model No.: LBAD0XX1SC-DM, LBAD0XX1SC-DMCU

Model Difference: For different market segmentation

Report Number: TERF2304001037E2

FCC ID HSW-TY1SCDM

Issue Date: June 02, 2023

Date of Test: April 26, 2023 ~ May 24, 2023

Date of EUT Received: March 02, 2023

Approved By _____

Jay Lin

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.26-2015 and the energy emitted by the sample EUT comply with FCC rule part 2, 27C.

The results of this report relate only to the sample identified in this report.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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Revision History					
Report Number	Revision	Description	Issue Date	Revised By	Remark
TERF2304001037E2	00	C2PC for adding new test plots of CatM1 B66 & B71	June 02, 2023	Violetta Tang	

Note:

- 1、The remark "" indicates modification of the report upon requests from certification body.
- 2、Variant information of model numbers is provided by the applicant, test results of this report are applicable to the sample EUT(s) received. And are assessed as electrically identical in RF characteristics, therefore, no further assessment required for the variant(s).

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Contents

1	GENERAL PRODUCT INFORMATION	4
2	SYSTEM TEST CONFIGURATION	7
3	SUMMARY OF TEST RESULTS.....	10
4	DESCRIPTION OF TEST MODES	11
5	MEASUREMENT UNCERTAINTY	12
6	MEASUREMENT EQUIPMENT USED.....	13
7	MAXIMUM OUTPUT POWER	14
8	OCCUPIED BANDWIDTH MEASUREMENT	21
9	OUT OF BAND EMISSION AT ANTENNA TERMINALS	33
10	FIELD STRENGTH OF SPURIOUS RADIATION MEASUREMENT	48
11	FREQUENCY STABILITY MEASUREMENT	63
12	PEAK TO AVERAGE RATIO	65

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1 GENERAL PRODUCT INFORMATION

1.1 Product Description

Product Name:	Type 1SC
Brand Name:	Murata
Model No.:	LBAD0XX1SC-DM, LBAD0XX1SC-DMCU
Model Difference:	For different market segmentation
Hardware Version:	ES2
Firmware Version:	RK_03_00_00_00_02751_001
EUT Series No.:	TE_SP_20230403758
Power Supply:	3.6V from DC power supply
Test Software (Name/Version)	Default (Connection Base Station)

1.2 Frequency Range

1.2.1 Cat. M1

Cat-M1 Band 66		
BW (MHz)	Operation Frequency (MHz)	
1.4	1710.7	1779.3
3	1711.5	1778.5
5	1712.5	1777.5
10	1715.0	1775.0
15	1717.5	1772.5
20	1720.0	1770.0
Cat-M1 Band 71		
BW (MHz)	Operation Frequency (MHz)	
5	665.5	695.5
10	688.0	693.0
15	670.5	690.5
20	673.0	688.0

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1.3 Antenna Designation

Antenna Type	Antenna Model No.
Dipole	Ant0
Note: Transmission frequencies in this test report are only available by the above antenna(s).	

Modulation	Frequency (MHz)		Peak Antenna Gain (dBi)
			Ant0
Cat-M1 Band 66	1710	~ 1780	4
Cat-M1 Band 71	663	~ 698	0.4

Note: Antenna information is provided by the applicant.

1.4 Type of Emission & Max ERP/EIRP Power Measurement Result:

1.4.1 Cat. M1

LTE Band	BW	Frequency		Modulation	Conducted Average (dBm)		(W)	99%	Type of Emission
66	1.4	1710.7	1779.3	QPSK	23.36	Conducted	0.217	1.0756	1M08G7D
				16QAM	23.05	Conducted	0.202	1.0751	1M08D7W
66	3	1711.5	1778.5	QPSK	23.23	Conducted	0.210	1.1089	1M11G7D
				16QAM	22.69	Conducted	0.186	1.1107	1M11D7W
66	5	1712.5	1777.5	QPSK	23.44	Conducted	0.221	1.1767	1M18G7D
				16QAM	23.15	Conducted	0.207	1.1595	1M16D7W
66	10	1715.0	1775.0	QPSK	23.47	Conducted	0.222	1.2463	1M25G7D
				16QAM	23.18	Conducted	0.208	1.2589	1M26D7W
66	15	1717.5	1772.5	QPSK	23.47	Conducted	0.222	1.3733	1M37G7D
				16QAM	23.35	Conducted	0.216	1.3705	1M37D7W
66	20	1720.0	1770.0	QPSK	23.45	Conducted	0.221	1.5149	1M51G7D
				16QAM	23.31	Conducted	0.214	1.5229	1M52D7W
LTE Band	BW	Frequency		Modulation	Conducted Average (dBm)		(W)	99%	Type of Emission
71	5	665.5	695.5	QPSK	23.99	Conducted	0.251	1.1577	1M16G7D
				16QAM	23.77	Conducted	0.238	1.1548	1M15D7W
71	10	688.0	693.0	QPSK	23.93	Conducted	0.247	1.2526	1M25G7D
				16QAM	23.85	Conducted	0.243	1.2527	1M25D7W
71	15	670.5	690.5	QPSK	24.17	Conducted	0.261	1.3658	1M37G7D
				16QAM	23.85	Conducted	0.243	1.3593	1M36D7W
71	20	673.0	688.0	QPSK	24.25	Conducted	0.266	1.4989	1M50G7D
				16QAM	23.97	Conducted	0.249	1.4661	1M47D7W

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1.5 Test Methodology of Applied Standards

FCC 47 CFR Part 2, 27C

ANSI C63.26-2015

KDB971168 D01 Power Meas license Digital System v03r01

TS 151 010-1 is used to set, and measure the output power.

1.6 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designation number	IC CAB identifier
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan.	SAC 1	TW0027	TW3702
		SAC 2		
		SAC 3		
		Conduction 1		
		Conducted 1		
		Conducted 2		
		Conducted 3		
		Conducted 4		
		Conducted 5		
		Conducted 6		
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conduction C	TW0028	
		SAC C		
		SAC D		
		SAC G		
		Conducted A		
		Conducted B		
		Conducted C		
		Conducted D		
		Conducted E		
		Conducted F		
Conducted G				

Note: Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.

1.7 Special Accessories

No special accessories were used during testing.

1.8 Equipment Modifications

There was no modifications incorporated into the EUT.

1.9 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m*6m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The EUT (Transmitter) was operated in the continuous transmission mode employed with the simulator of the Base Station that fixates at test default channels to fix the Tx frequency which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Measurement at Antenna Port

The EUT is placed on a table which is 0.8 m above ground plane. A low loss of RF cable was used to connect the antenna port of EUT to measurement equipment.

2.3.2 Radiated Emissions (ERP/EIRP)

The EUT is placed on a turn table, for emission measurements below 1 GHz is 0.8 m above ground plane, for emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both Horizontal and Vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

Note:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

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2.5 Final Amplifier Voltage and Current Information:

2.5.1 Cat M1

Cat-M1 Band 66

Test mode	DC voltage (V)	DC current (mA)
Cat-M1 Band 66_20M QPSK	3.6	215

Cat-M1 Band 71

Test mode	DC voltage (V)	DC current (mA)
Cat-M1 Band 71_20M QPSK	3.6	220

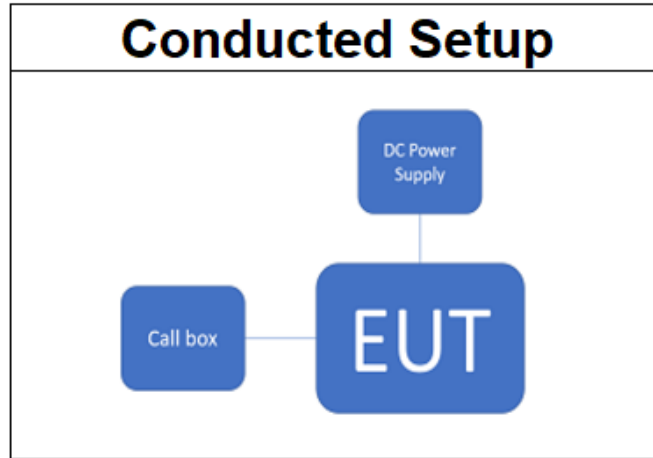
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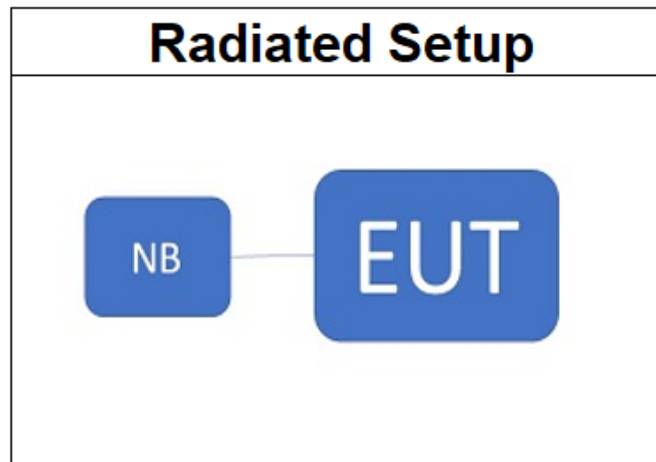
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2.6 Test Configuration

2.6.1 Conducted Emission at the Antenna Port



2.6.2 Radiated Emission



Note: Radio Communication Analyzer is placed in remote side for radiated test.

2.6.3 Equipment used for test

Radiated Emission Test Site: SAC C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
USB CABLE	Quatek	3021003-03	N/A	N.C.R	N.C.R

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3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§2.1046(a)	RF Power Output	Compliant
§27.50(c)(10) §27.50(d)(4)	ERP/ EIRP measurement	Compliant
§2.1049(h)	99% & 26dB Occupied Bandwidth	Compliant
§2.1051 §27.53(g) §27.53(h)	Out of Band Emissions at Antenna Terminals and Band Edge / Emission mask requirements	Compliant
§2.1053 §27.53(g) §27.53(h)	Field Strength of Spurious Radiation	Compliant
§27.50(a)(1)(B)	Peak to Average Ratio	Compliant
§2.1055(a)(1) §27.54	Frequency Stability	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 The Worst Test Modes and Configuration

1. The EUT has been tested under operating condition.
2. The field strength of radiated emission was measured as the EUT positioned in different orthogonal planes (E1/E2/H) based on actual usage of the EUT to pre-scan the emissions for determining the worst case scenario.

4.2 Cat M1

Test Items				Max. Output Power										
Band	Test Channel			Bandwidth (MHz)						Modulation		RB #		
	L	M	H	1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full
66	V	V	V	V	V	V	V	V	V	V	V	V	V	V
71	V	V	V	-	-	V	V	V	V	V	V	V	V	V
Test Items				Frequency Stability										
66	-	V	-				V			V	-	-	-	V
71	-	V	-	-	-		V			V	-	-	-	V

Test Items				26dB and 99% Bandwidth										
Band	Test Channel			Bandwidth (MHz)						Modulation		RB #		
	L	M	H	1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full
66	V	V	V	V	V	V	V	V	V	V	V	-	-	V
71	V	V	V	-	-	V	V	V	V	V	V	-	-	V
Test Items				Peak-to-Average Ratio										
66	V	V	V	V	V	V	V	V	V	V	V	-	-	V
71	V	V	V	-	-	V	V	V	V	V	V	-	-	V

Test Items				Band Edge										
Band	Test Channel			Bandwidth (MHz)						Modulation		RB #		
	L	M	H	1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full
66	V	-	V	V	V	V	V	V	V	V	-	V	V	V
71	V	-	V	-	-	V	V	V	V	V	-	V	V	V
Test Items				Conducted Emission										
66	V	V	V	V	V	V	V	V	V	V	-	V	-	-
71	V	V	V	-	-	V	V	V	V	V	-	V	-	-

Test Items				Radiated Emission										
Band	Test Channel			Bandwidth (MHz)						Modulation		RB #		
	L	M	H	1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full
66	V	V	V	-	-	-	-	V	-	V	-	-	V	-
71	V	V	V						V	-	-	-	V	-

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
RF Power Output	+/- 1 dB
ERP/ EIRP measurement	+/- 2.93 dB
	+/- 2.93 dB
Emission Bandwidth	+/- 1.53 Hz
Out of Band Emissions at Antenna Terminals and Band Edge	+/- 1.68 dB
Peak to Average Ratio	+/- 1 dB
Frequency Stability vs. Temperature	+/- 1.53 Hz
Frequency Stability vs. Voltage	+/- 1.53 Hz
Temperature	+/- 0.7 °C
Humidity	+/- 3 %
DC / AC Power Source	+/- 1 %

Radiated Spurious Emission Measurement Uncertainty		
Polarization: Vertical	+/- 2.8 dB	9kHz~30MHz
	+/- 4.82 dB	30MHz - 1000MHz
	+/- 4.37 dB	1GHz - 18GHz
	+/- 4.21 dB	18GHz - 40GHz
Polarization: Horizontal	+/- 2.8 dB	9kHz~30MHz
	+/- 4.54 dB	30MHz - 1000MHz
	+/- 4.37 dB	1GHz - 18GHz
	+/- 4.21 dB	18GHz - 40GHz

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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6 MEASUREMENT EQUIPMENT USED

6.1 Conducted Measurement

Conducted Emission Test Site: Conducted E					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
DC Power Supply	Gwinstek	SPS-3610	GEV856769	07/28/2022	07/27/2023
Radio Communication Analyser	Anritsu	MT8821C	6262044739	11/29/2022	11/28/2023
Spectrum Analyzer	Keysight	N9010B	MY60240548	01/13/2023	01/12/2024
Temperature Chamber	TERCHY	MHK-120LK	1020582	06/21/2022	06/20/2023
Attenuator	Marvelous	MVE2213-	RF06	11/16/2022	11/15/2023
DC Block	PASTERNAK	PE8210	RF157	11/16/2022	11/15/2023
Coaxial Cables	Woken	00100A1F1 A185C	RF71	11/16/2022	11/15/2023
Coaxial Cables	Woken	00100A1F1 A185C	RF72	11/16/2022	11/15/2023
Coaxial Cables	Woken	00100A1F1 A185C	RF73	11/16/2022	11/15/2023
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R
Splitter	Woken	DOM35LW1 A2	RF255	11/16/2022	11/15/2023

6.2 Radiated Measurement

Radiated Emission Test Site: SAC C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-300	11/11/2022	11/10/2023
Horn Antenna	Schwarzbeck	BBHA9120D	1187	01/12/2023	01/11/2024
3m Site NSA	SGS	966 chamber C	N/A	03/02/2023	03/01/2024
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120200	03/29/2023	03/28/2024
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R
Pre-Amplifier	EMC Instruments	EMC330	980096	11/16/2022	11/15/2023
Pre-Amplifier	EMC Instruments	EMC0011830	980199	11/16/2022	11/15/2023
Pre-Amplifier	EMC Instruments	EMC18405SEE	980881	10/25/2022	10/24/2023
Attenuator	Woken	WATT-218FS-10	RF16	11/16/2022	11/15/2023
Coaxial Cable	Huber Suhner	EMC106-SM-SM- 9100	150704	11/16/2022	11/15/2023
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17388/4	11/16/2022	11/15/2023
Radio Communication Analyser	Anritsu	MT8821C	6262044739	11/29/2022	11/28/2023
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	11/16/2022	11/15/2023

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7 MAXIMUM OUTPUT POWER

7.1 Standard Applicable

A base station simulator was used to establish communication with the EUT. Its parameters were set to transmit the maximum power on the EUT. The measured power in the radio frequency on the transmitter output terminals.

7.2 FCC ERP/EIRP LIMIT

According to FCC §2.1046

FCC 27.50(c)

(9) Control and mobile stations in the 698-746 MHz band are limited to 30 watts ERP.

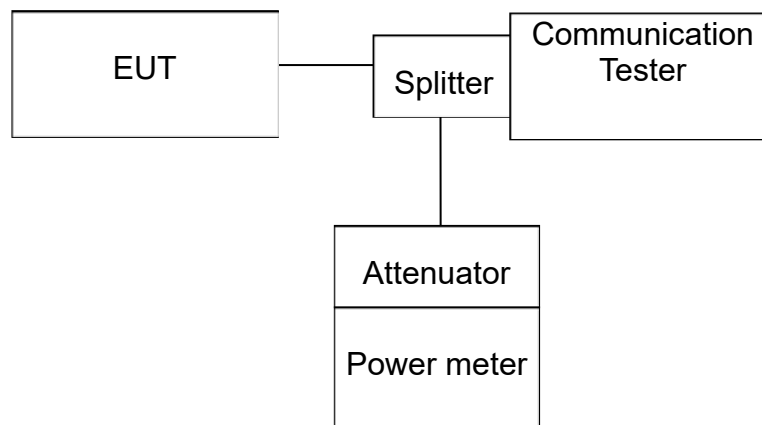
(10) Portable stations (hand-held devices) are limited to 3 watts ERP.

FCC 27.50(d)

(4) Mobile, and portable (hand-held) stations operating in the 1710-1755 MHz, 1695-1710 MHz and 1755-1780 MHz bands are limited to 1W EIRP.

(7) Mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band are limited to 2 watts EIRP.

7.3 Test Set-up



Note: Measurement setup for testing on Antenna connector

7.4 Output Power Measurement Applicable Guidance

The transmitter output was connected to a calibrated attenuator, the other end of which was connected to a power meter. Transmitter output was read off the power meter in dBm. The power output at the transmitter antenna port was determined by adding the value of the attenuator to the power meter reading. TS 151 010-1 is reference to conduct the measurement of output power.

The Procedure of KDB941225 (SAR Measurement Procedures for 3G devices, (WCDMA/HSPA) was used for EUT and Base station setting. RMC 12.2kps is used for this testing, and KDB 971168 D01 Power Meas License Digital System as the supplemental test methodology to adjust the proper setting obtaining the measurement results. All bands conducted average power is obtained from the simulator telecommunication test set.

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7.5 Determining ERP and/or EIRP from conducted RF output power measurements

$$ERP/EIRP = P_{Meas} + GT-LC$$

Where:

ERP/EIRP	= effective or equivalent radiated power, respectively (expressed in the same units as P_{Meas} , typically dBW or dBm);
P_{Meas}	= measured transmitter output power or PSD, in dBm or dBW;
GT	= gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)
LC	= signal attenuation in the connecting cable between the transmitter and antenna, in dB.

For devices utilizing multiple antennas, KDB 662911 provides guidance for determining the effective array transmit antenna gain term to be used in the above equation.

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7.6 Measurement Result

7.6.1 Cat M1

Cat-M1 Band 66_Uplink frequency band : 1710 to 1780 MHz									
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Index	Conducted Average (dBm)	EIRP Limit (dBm)	Allowable gain (dB)
1.4	131979	1710.7	QPSK	1	0	0	22.91	30	7.09
				1	5	0	23.12		6.88
				6	0	0	20.99		9.01
	132322	1745	QPSK	1	0	0	22.89		7.11
				1	5	0	23.16		6.84
				6	0	0	21.04		8.96
	132665	1779.3	QPSK	1	0	0	23.04		6.96
				1	5	0	23.36		6.64
				6	0	0	21.01		8.99
1.4	131979	1710.7	16QAM	1	0	0	22.32	30	7.68
				1	5	0	22.57		7.43
				6	0	0	19.36		10.64
	132322	1745	16QAM	1	0	0	22.41		7.59
				1	5	0	22.73		7.27
				6	0	0	19.13		10.87
	132665	1779.3	16QAM	1	0	0	22.52		7.48
				1	5	0	23.05		6.95
				6	0	0	19.40		10.60
Cat-M1 Band 66_Uplink frequency band : 1710 to 1780 MHz									
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Index	Conducted Average (dBm)	EIRP Limit (dBm)	Allowable gain (dB)
3	131987	1711.5	QPSK	1	0	0	22.85	30	7.15
				1	5	0	23.10		6.90
				6	0	0	20.88		9.12
	132322	1745	QPSK	1	0	0	22.84		7.16
				1	5	0	23.07		6.93
				6	0	0	20.88		9.12
	132657	1778.5	QPSK	1	0	1	22.95		7.05
				1	5	1	23.23		6.77
				6	0	1	20.99		9.01
3	131987	1711.5	16QAM	1	0	0	22.67	30	7.33
				1	5	0	22.59		7.41
				6	0	0	19.46		10.54
	132322	1745	16QAM	1	0	0	22.31		7.69
				1	5	0	22.57		7.43
				6	0	0	19.28		10.72
	132657	1778.5	16QAM	1	0	1	22.59		7.41
				1	5	1	22.69		7.31
				6	0	1	19.36		10.64

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Cat-M1 Band 66_Uplink frequency band : 1710 to 1780 MHz									
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Index	Conducted Average (dBm)	EIRP Limit (dBm)	Allowable gain (dB)
5	131997	1712.5	QPSK	1	0	0	22.61	30	7.39
				1	5	0	22.69		7.31
				6	0	0	21.77		8.23
	132322	1745	QPSK	1	0	0	23.36		6.64
				1	5	0	23.44		6.56
				6	0	0	21.91		8.09
	132647	1777.5	QPSK	1	0	3	22.72		7.28
				1	5	3	22.75		7.25
				6	0	3	21.83		8.17
5	131997	1712.5	16QAM	1	0	0	22.29	30	7.71
				1	5	0	22.25		7.75
				6	0	0	20.37		9.63
	132322	1745	16QAM	1	0	0	22.81		7.19
				1	5	0	23.15		6.85
				6	0	0	19.95		10.05
	132647	1777.5	16QAM	1	0	3	22.36		7.64
				1	5	3	22.32		7.68
				6	0	3	20.26		9.74
Cat-M1 Band 66_Uplink frequency band : 1710 to 1780 MHz									
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Index	Conducted Average (dBm)	EIRP Limit (dBm)	Allowable gain (dB)
10	132022	1715	QPSK	1	0	0	23.32	30	6.68
				1	5	0	22.18		7.82
				6	0	0	21.98		8.02
	132322	1745	QPSK	1	0	0	23.20		6.80
				1	5	0	22.16		7.84
				6	0	0	21.90		8.10
	132622	1775	QPSK	1	0	7	23.37		6.63
				1	5	7	23.47		6.53
				6	0	7	22.09		7.91
10	132022	1715	16QAM	1	0	0	22.85	30	7.15
				1	5	0	21.68		8.32
				6	0	0	20.77		9.23
	132322	1745	16QAM	1	0	0	22.72		7.28
				1	5	0	21.91		8.09
				6	0	0	20.07		9.93
	132622	1775	16QAM	1	0	7	23.18		6.82
				1	5	7	22.93		7.07
				6	0	7	20.64		9.36

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Cat-M1 Band 66_Uplink frequency band : 1710 to 1780 MHz									
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Index	Conducted Average (dBm)	EIRP Limit (dBm)	Allowable gain (dB)
15	132047	1717.5	QPSK	1	0	0	23.33	30	6.67
				1	5	0	23.41		6.59
				6	0	0	22.96		7.04
	132322	1745	QPSK	1	0	0	23.24		6.76
				1	5	0	23.32		6.68
				6	0	0	22.89		7.11
	132597	1772.5	QPSK	1	0	11	23.40		6.60
				1	5	11	23.47		6.53
				6	0	11	23.13		6.87
15	132047	1717.5	16QAM	1	0	0	22.79	30	7.21
				1	5	0	23.08		6.92
				6	0	0	21.47		8.53
	132322	1745	16QAM	1	0	0	22.62		7.38
				1	5	0	22.94		7.06
				6	0	0	21.27		8.73
	132597	1772.5	16QAM	1	0	11	22.88		7.12
				1	5	11	23.35		6.65
				6	0	11	21.87		8.13

Cat-M1 Band 66_Uplink frequency band : 1710 to 1780 MHz									
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Index	Conducted Average (dBm)	EIRP Limit (dBm)	Allowable gain (dB)
20	132072	1720	QPSK	1	0	0	23.34	30	6.66
				1	5	0	23.40		6.60
				6	0	0	22.97		7.03
	132322	1745	QPSK	1	0	0	22.59		7.41
				1	5	0	22.66		7.34
				6	0	0	22.78		7.22
	132572	1770	QPSK	1	0	15	23.35		6.65
				1	5	15	23.45		6.55
				6	0	15	23.08		6.92
20	132072	1720	16QAM	1	0	0	22.95	30	7.05
				1	5	0	22.76		7.24
				6	0	0	21.49		8.51
	132322	1745	16QAM	1	0	0	22.14		7.86
				1	5	0	22.12		7.88
				6	0	0	21.11		8.89
	132572	1770	16QAM	1	0	15	23.08		6.92
				1	5	15	23.31		6.69
				6	0	15	21.79		8.21

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Cat-M1 Band 71_Uplink frequency band : 663 to 698 MHz									
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Index	Conducted Average (dBm)	ERP Limit (dBm)	Allowable gain (dBi)
5	133147	665.5	QPSK	1	0	0	23.95	34.77	10.82
				1	5	0	23.99		10.78
				6	0	0	23.05		11.72
	133297	680.5	QPSK	1	0	0	23.49		11.28
				1	5	0	23.59		11.18
				6	0	0	23.06		11.71
	133447	695.5	QPSK	1	0	3	23.18		11.59
				1	5	3	23.27		11.50
				6	0	3	22.66		12.11
5	133147	665.5	16QAM	1	0	0	23.77	34.77	11.00
				1	5	0	23.65		11.12
				6	0	0	21.82		12.95
	133297	680.5	16QAM	1	0	0	23.27		11.50
				1	5	0	23.37		11.40
				6	0	0	21.48		13.29
	133447	695.5	16QAM	1	0	3	23.08		11.69
				1	5	3	23.12		11.65
				6	0	3	21.41		13.36

Cat-M1 Band 71_Uplink frequency band : 663 to 698 MHz									
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Index	Conducted Average (dBm)	ERP Limit (dBm)	Allowable gain (dBi)
10	133172	668	QPSK	1	0	0	23.86	34.77	10.91
				1	5	0	23.93		10.84
				6	0	0	23.32		11.45
	133297	680.5	QPSK	1	0	0	23.88		10.89
				1	5	0	23.85		10.92
				6	0	0	22.96		11.81
	133422	693	QPSK	1	0	7	23.55		11.22
				1	5	7	23.62		11.15
				6	0	7	22.65		12.12
10	133172	668	16QAM	1	0	0	23.76	34.77	11.01
				1	5	0	23.85		10.92
				6	0	0	22.08		12.69
	133297	680.5	16QAM	1	0	0	23.85		10.92
				1	5	0	23.76		11.01
				6	0	0	22.56		12.21
	133422	693	16QAM	1	0	7	23.42		11.35
				1	5	7	23.55		11.22
				6	0	7	21.56		13.21

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Cat-M1 Band 71_Uplink frequency band : 663 to 698 MHz									
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Index	Conducted Average (dBm)	ERP Limit (dBm)	Allowable gain (dBi)
15	133197	670.5	QPSK	1	0	0	23.93	34.77	10.84
				1	5	0	23.81		10.96
				6	0	0	24.17		10.60
	133297	680.5	QPSK	1	0	0	24.08		10.69
				1	5	0	24.01		10.76
				6	0	0	23.92		10.85
	133397	690.5	QPSK	1	0	11	23.90		10.87
				1	5	11	23.82		10.95
				6	0	11	23.49		11.28
15	133197	670.5	16QAM	1	0	0	23.75	11.02	
				1	5	0	23.77	11.00	
				6	0	0	23.85	10.92	
	133297	680.5	16QAM	1	0	0	23.68	11.09	
				1	5	0	23.59	11.18	
				6	0	0	23.55	11.22	
	133397	690.5	16QAM	1	0	11	23.85	10.92	
				1	5	11	23.82	10.95	
				6	0	11	23.47	11.30	

Cat-M1 Band 71_Uplink frequency band : 663 to 698 MHz									
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Index	Conducted Average (dBm)	ERP Limit (dBm)	Allowable gain (dBi)
20	133222	673	QPSK	1	0	0	24.23	34.77	10.54
				1	5	0	24.25		10.52
				6	0	0	24.10		10.67
	133297	680.5	QPSK	1	0	0	24.01		10.76
				1	5	0	24.04		10.73
				6	0	0	23.94		10.83
	133372	688	QPSK	1	0	15	23.90		10.87
				1	5	15	23.89		10.88
				6	0	15	23.81		10.96
20	133222	673	16QAM	1	0	0	23.83	10.94	
				1	5	0	23.95	10.82	
				6	0	0	23.97	10.80	
	133297	680.5	16QAM	1	0	0	23.59	11.18	
				1	5	0	23.78	10.99	
				6	0	0	23.75	11.02	
	133372	688	16QAM	1	0	15	23.86	10.91	
				1	5	15	23.83	10.94	
				6	0	15	23.56	11.21	

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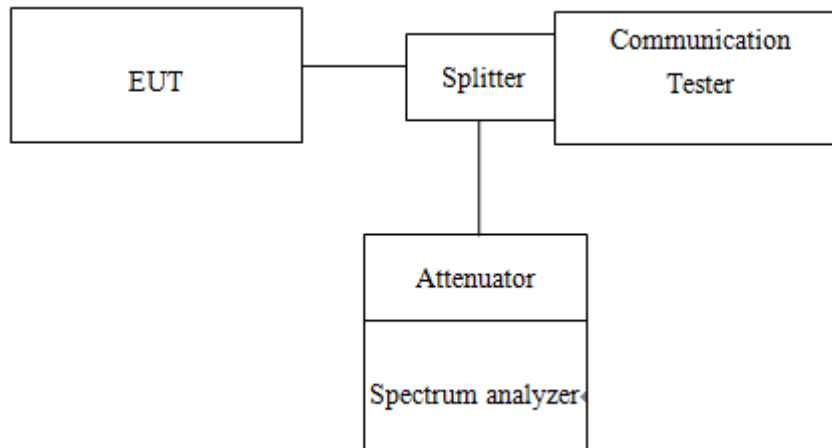
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8 OCCUPIED BANDWIDTH MEASUREMENT

8.1 Standard Applicable

The occupied bandwidth 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.

8.2 Test Set-up



8.3 Measurement Procedure

99% &26dB Bandwidth with detector peak

The EUT's output RF connector was connected with a short cable to the spectrum analyzer, RBW was set to about 1% of emission BW, VBW= 3 times RBW, -26dBc display line was placed on the screen (or 26dB bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace. Then set RBW to 99% bandwidth, RBW= 1%, VBW= 3 RBW, with span > 2 * Signal BW, set % Power = 99%.

99% Bandwidth with detector sample

The EUT's output RF connector was connected with a short cable to the spectrum analyzer, RBW was set to about 1% ~ 5% of emission BW, VBW= 3 times RBW, -20dBc display line was placed on the screen (or 20dB bandwidth). Set RBW to 99% bandwidth, RBW= 1% ~ 5%, VBW= 3 RBW, with span > 2 * Signal BW, set % Power = 99%.

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8.4 Measurement Result

8.4.1 Cat M1

Cat-M1 BAND 66 Channel bandwidth: 1.4MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1710.7	131979	1.0727	1.0751	1.277	1.285
1745.0	132322	1.0743	1.0742	1.279	1.291
1779.3	132665	1.0756	1.0731	1.299	1.265

Cat-M1 BAND 66 Channel bandwidth: 3MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1711.5	131987	1.1019	1.1034	1.329	1.333
1745.0	132322	1.1075	1.1034	1.326	1.345
1778.5	132657	1.1089	1.1107	1.333	1.336

Cat-M1 BAND 66 Channel bandwidth: 5MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1712.5	131997	1.1739	1.1595	1.407	1.401
1745.0	132322	1.1767	1.1552	1.390	1.394
1777.5	132647	1.1715	1.1519	1.412	1.383

Cat-M1 BAND 66 Channel bandwidth: 10MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1715.0	132022	1.2362	1.2576	1.521	1.519
1745.0	132322	1.2371	1.2589	1.541	1.566
1775.0	132622	1.2463	1.2547	1.582	1.533

Cat-M1 BAND 66 Channel bandwidth: 15MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1717.5	132047	1.3161	1.3653	1.530	1.692
1745.0	132322	1.3733	1.3705	1.793	1.720
1772.5	132597	1.3642	1.3615	1.851	2.076

Cat-M1 BAND 66 Channel bandwidth: 20MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1720.0	132072	1.4709	1.4942	1.945	1.899
1745.0	132322	1.5089	1.5229	2.245	2.442
1770.0	132572	1.5149	1.4985	2.324	2.181

Cat-M1 BAND 71 Channel bandwidth: 5MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
665.5	133147	1.1577	1.1472	1.386	1.396
680.5	133297	1.1537	1.1548	1.403	1.392
695.5	133447	1.1556	1.1459	1.392	1.390

Cat-M1 BAND 71 Channel bandwidth: 10MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
688.0	133172	1.2319	1.2297	1.516	1.572
680.5	133297	1.2319	1.2527	1.507	1.598
693.0	133422	1.2526	1.2383	1.635	1.594

Cat-M1 BAND 71 Channel bandwidth: 15MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
670.5	133197	1.3658	1.3593	1.771	1.672
680.5	133297	1.3621	1.3466	1.670	1.659
690.5	133397	1.3656	1.3319	1.643	1.668

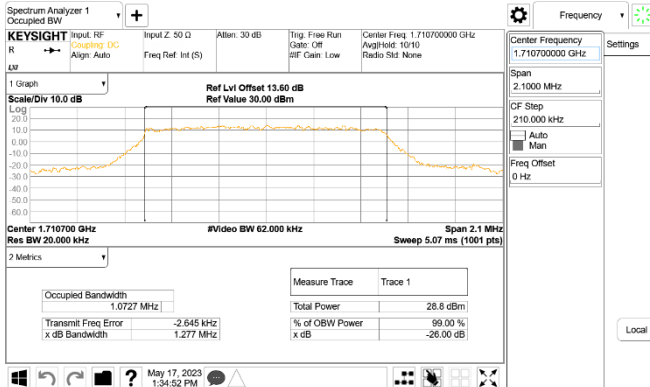
Cat-M1 BAND 71 Channel bandwidth: 20MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
673.0	133222	1.2837	1.4389	1.669	1.867
680.5	133297	1.4989	1.4634	1.960	1.866
688.0	133372	1.4866	1.4661	1.880	1.917

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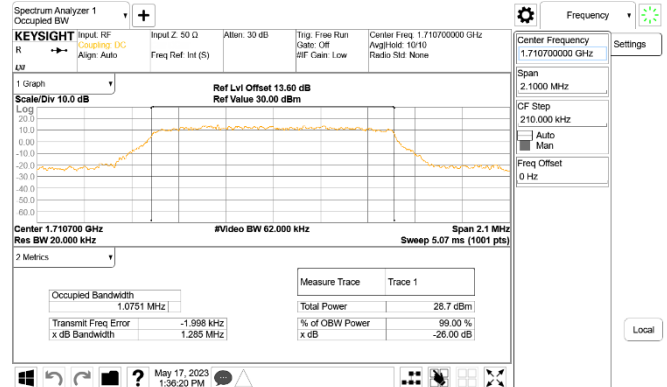
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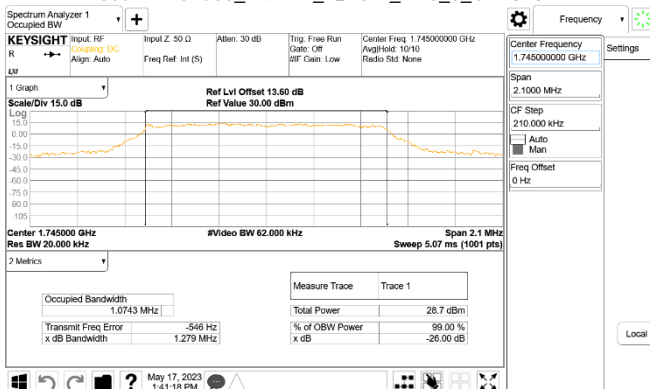
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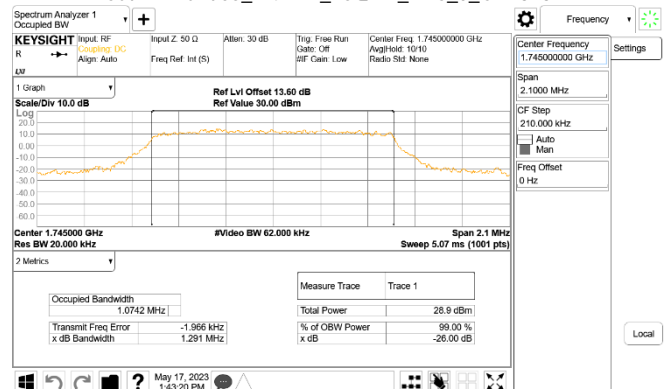
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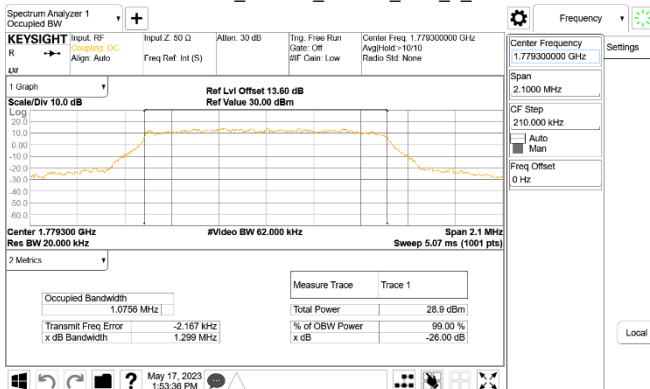
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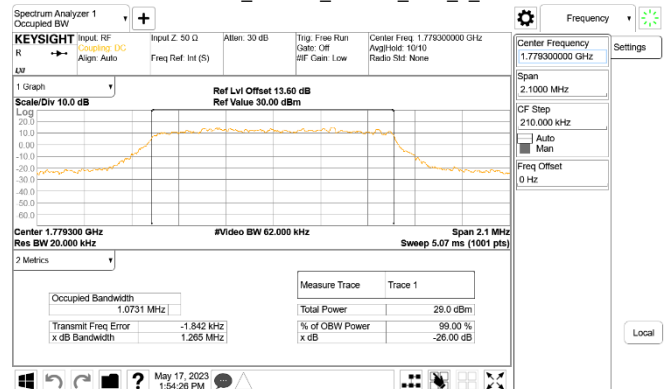
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Cat-M1 Band66_1.4MHz_QPSK_RB6_0_CH132665



Cat-M1 Band66_1.4MHz_16QAM_RB6_0_CH132665

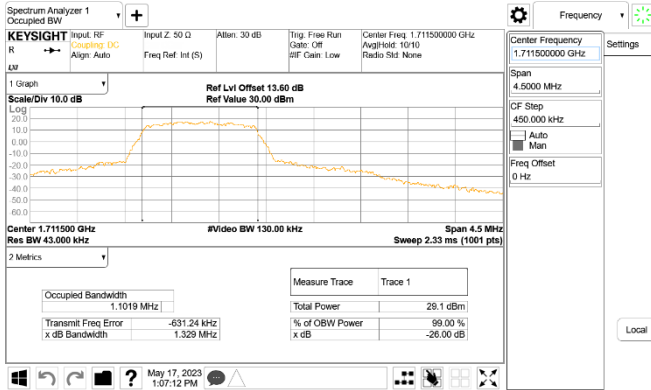


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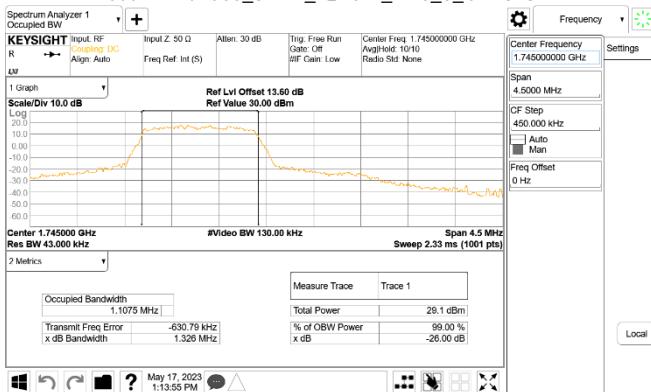
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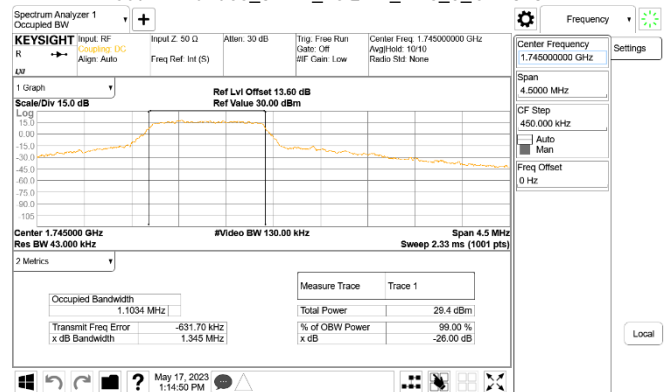
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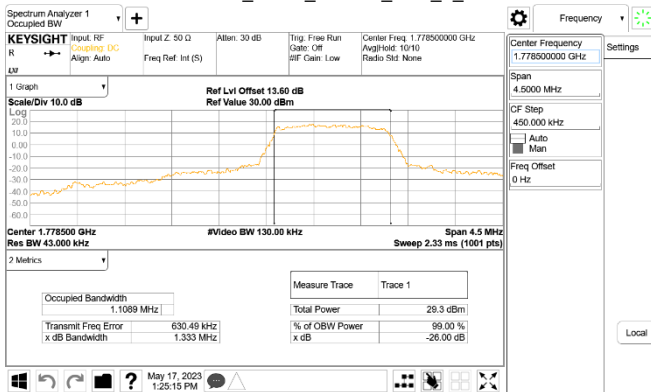
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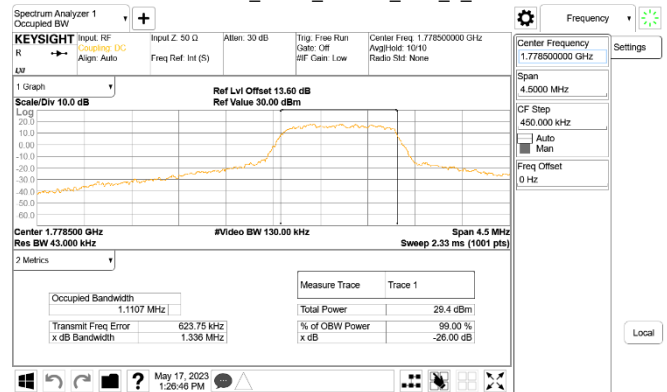
Cat-M1 Band66_3MHz_16QAM_RB6_0_CH132322



Cat-M1 Band66_3MHz_QPSK_RB6_0_CH132657



Cat-M1 Band66_3MHz_16QAM_RB6_0_CH132657

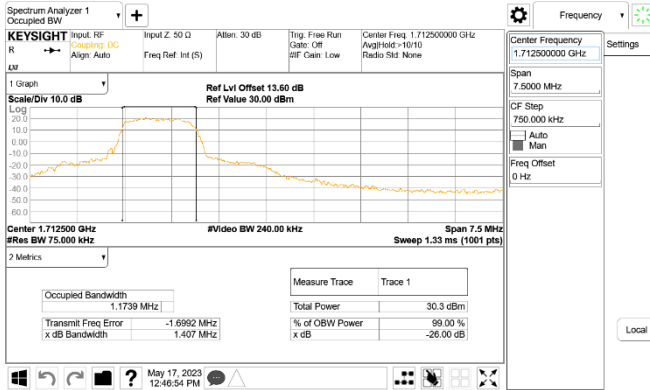


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Cat-M1 Band66_5MHz_QPSK_RB6_0_CH131997



Cat-M1 Band66_5MHz_16QAM_RB6_0_CH131997



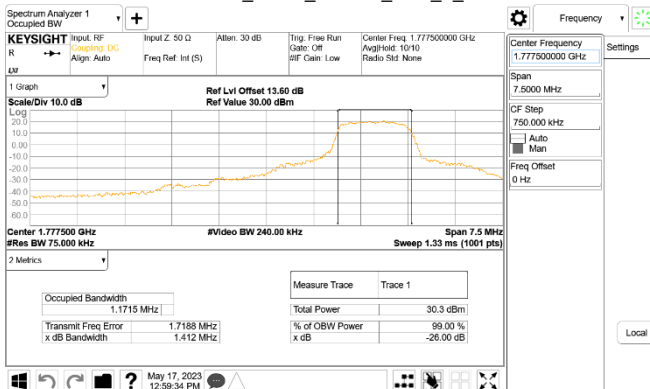
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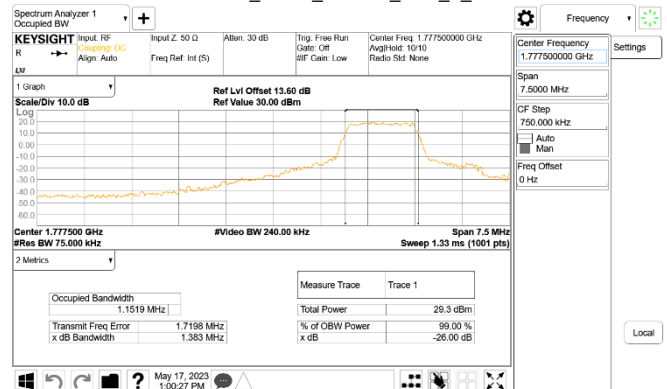
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Cat-M1 Band66_5MHz_16QAM_RB6_0_CH132647

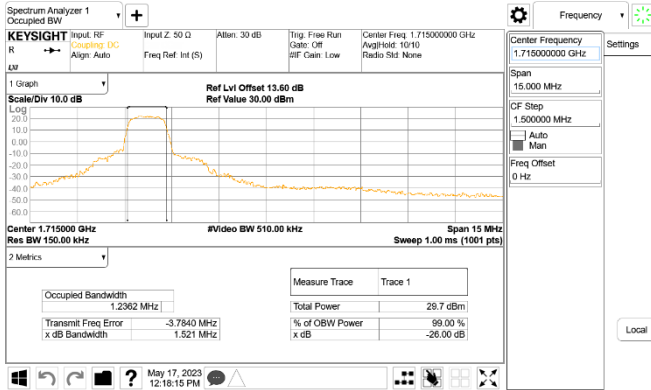


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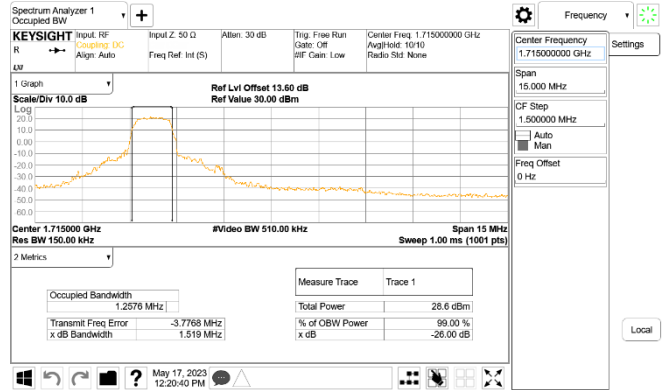
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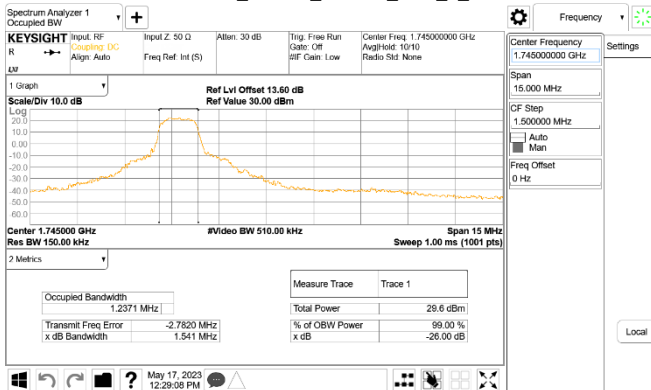
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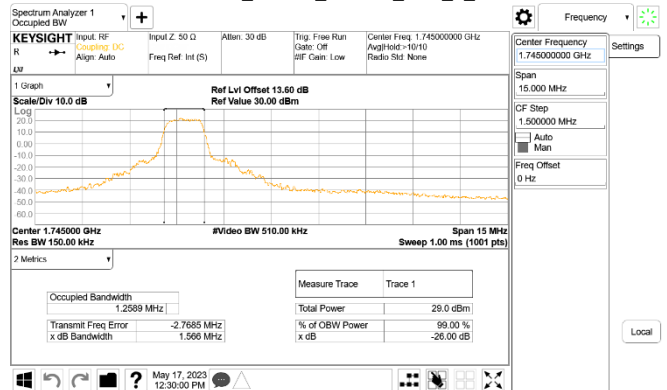
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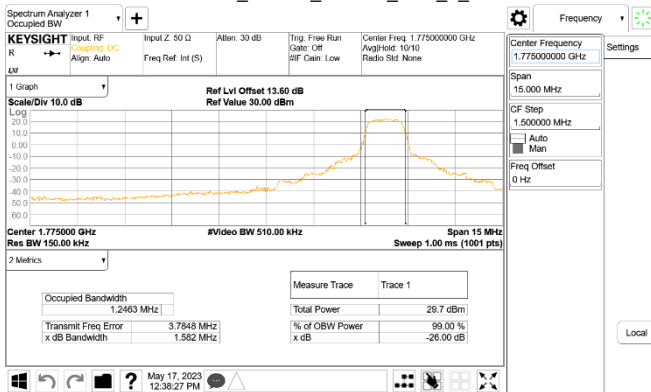
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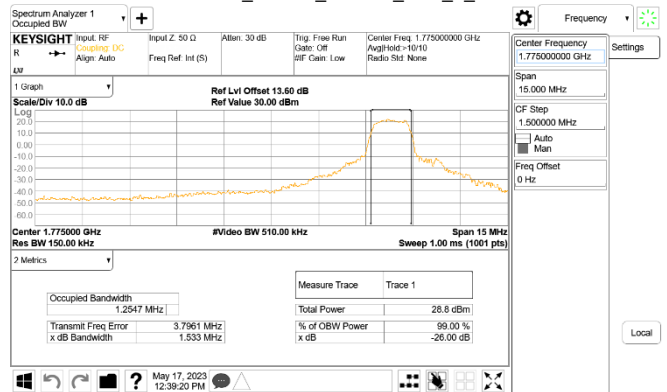
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Cat-M1 Band66_10MHz_16QAM_RB6_0_CH132622

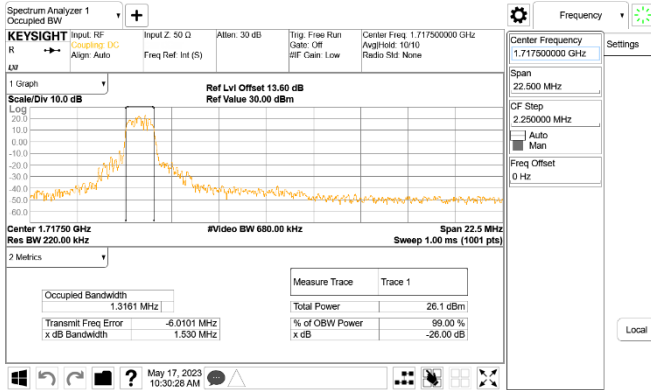


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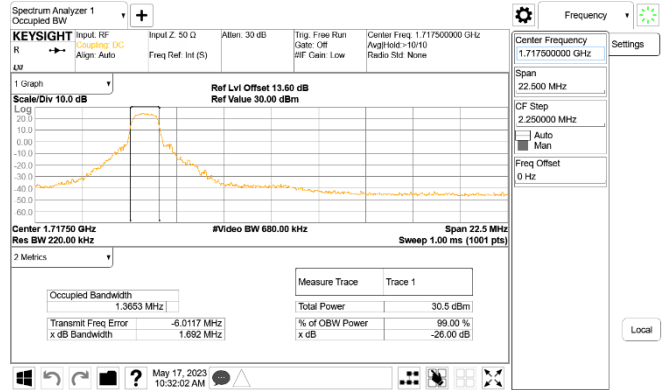
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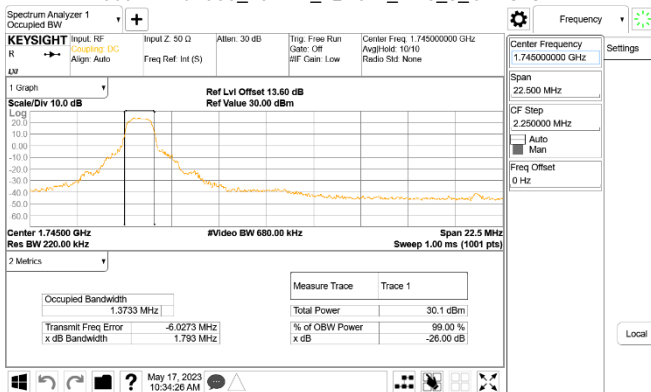
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Cat-M1 Band66_15MHz_16QAM_RB6_0_CH132047



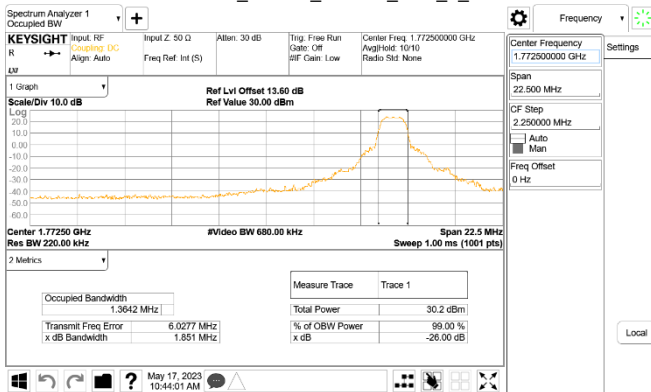
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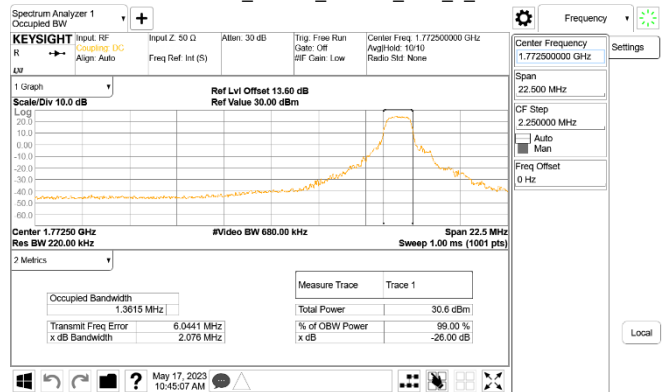
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Cat-M1 Band66_15MHz_QPSK_RB6_0_CH132597



Cat-M1 Band66_15MHz_16QAM_RB6_0_CH132597

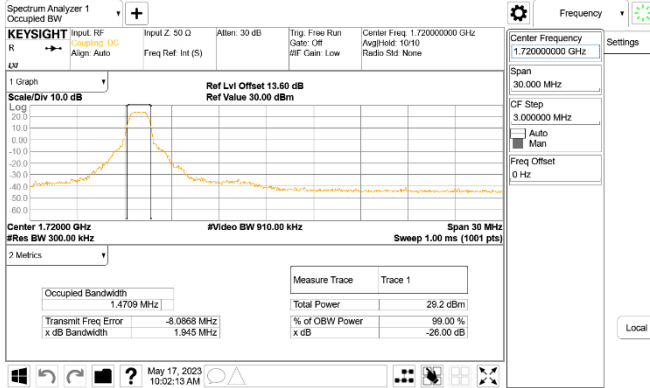


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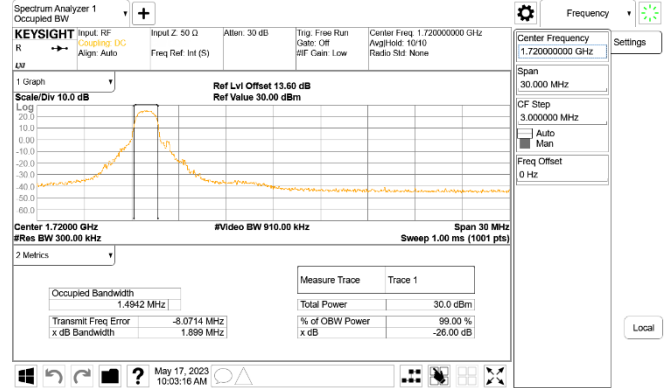
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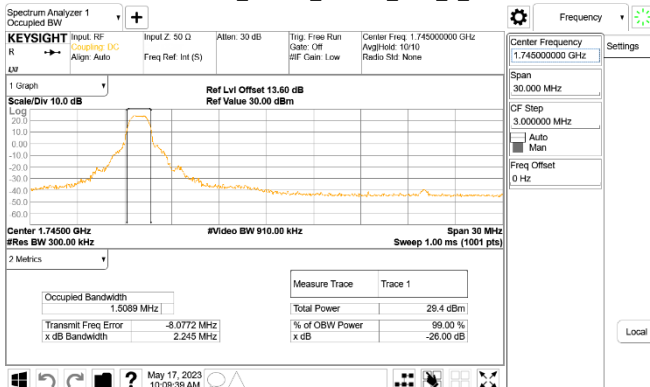
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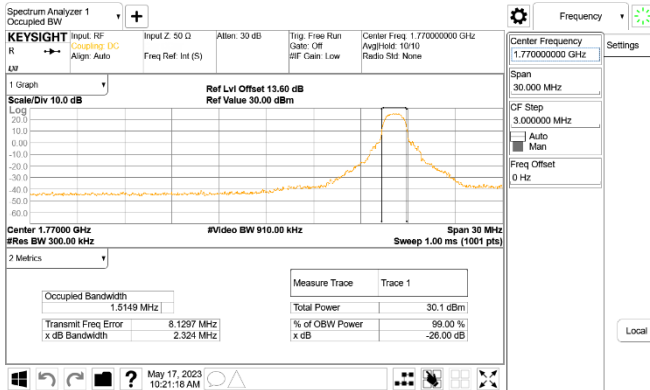
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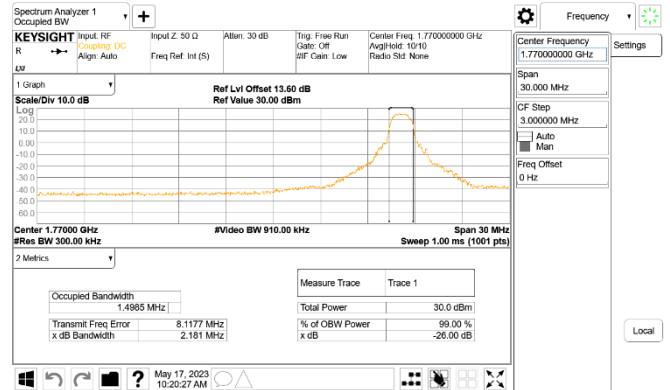
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Cat-M1 Band66_20MHz_QPSK_RB6_0_CH132572



Cat-M1 Band66_20MHz_16QAM_RB6_0_CH132572

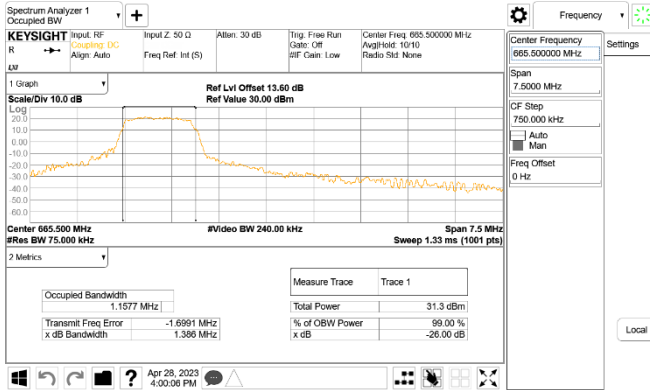


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Cat-M1 Band71_5MHz_QPSK_RB6_0_CH133147



Cat-M1 Band71_5MHz_16QAM_RB6_0_CH133147



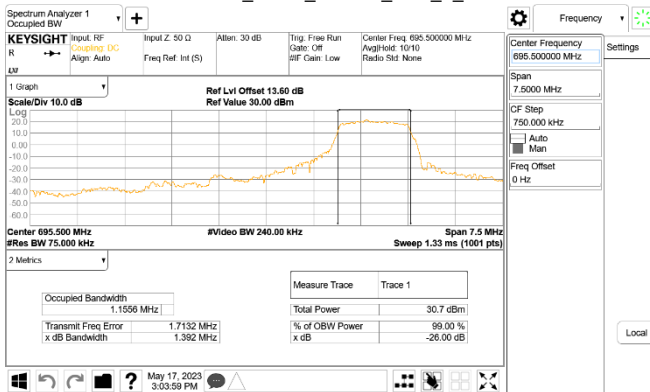
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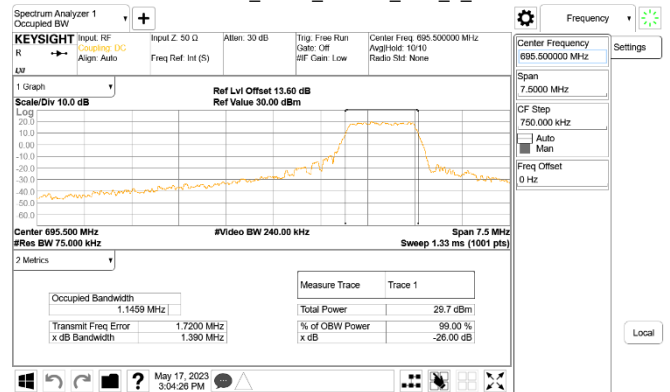
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Cat-M1 Band71_5MHz_QPSK_RB6_0_CH133447



Cat-M1 Band71_5MHz_16QAM_RB6_0_CH133447

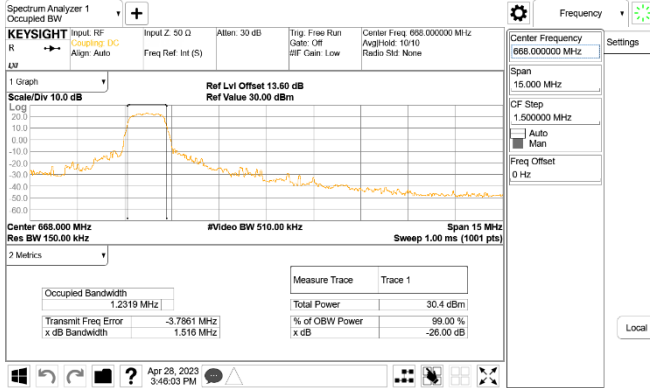


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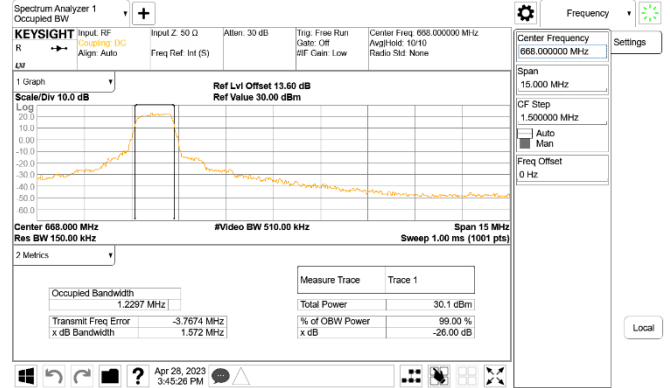
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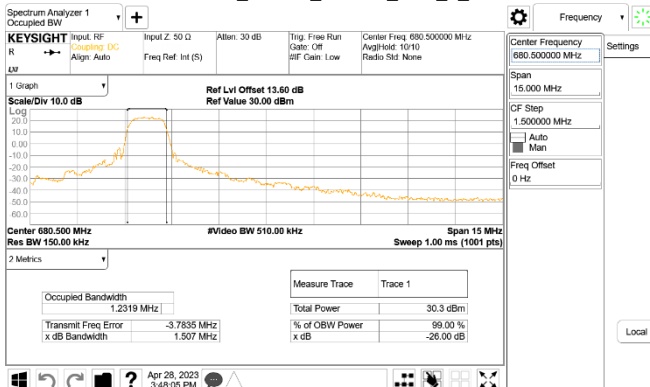
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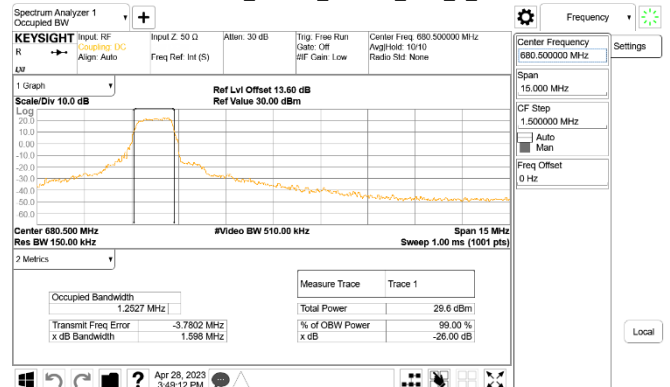
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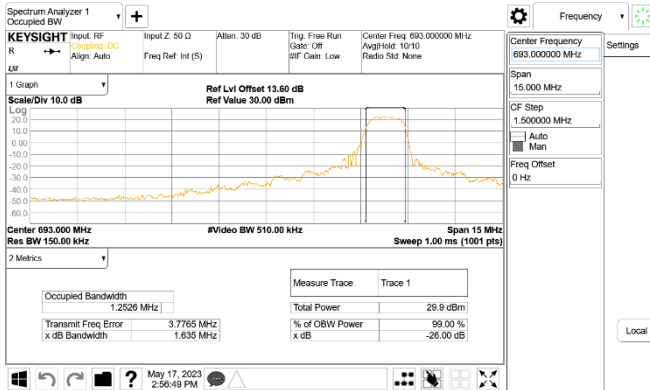
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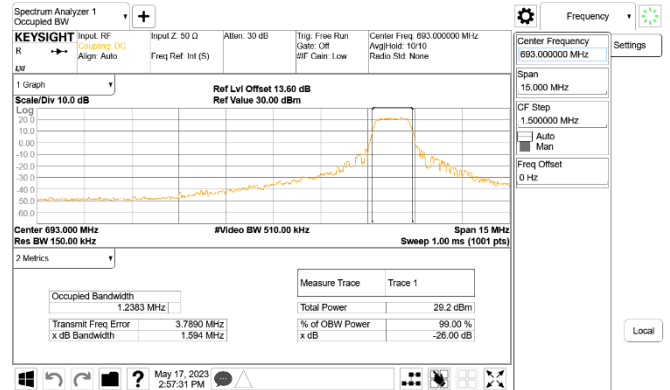
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Cat-M1 Band71_10MHz_QPSK_RB6_0_CH133422



Cat-M1 Band71_10MHz_16QAM_RB6_0_CH133422

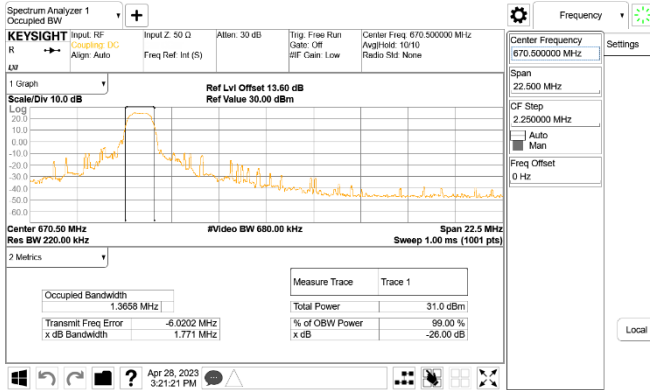


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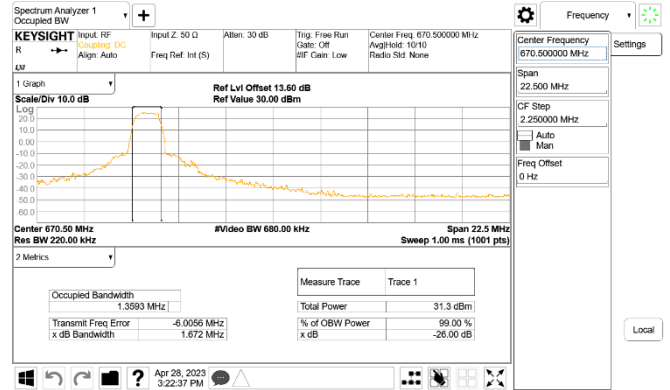
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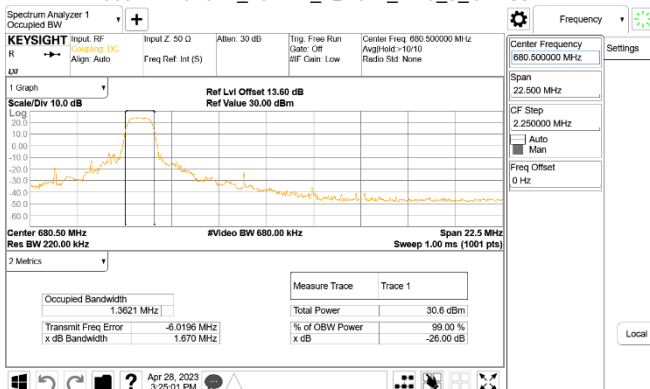
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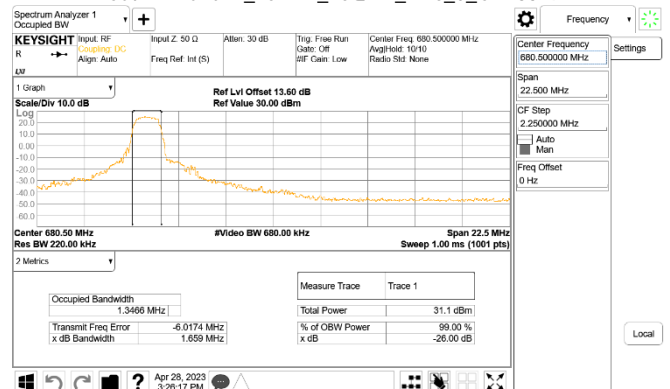
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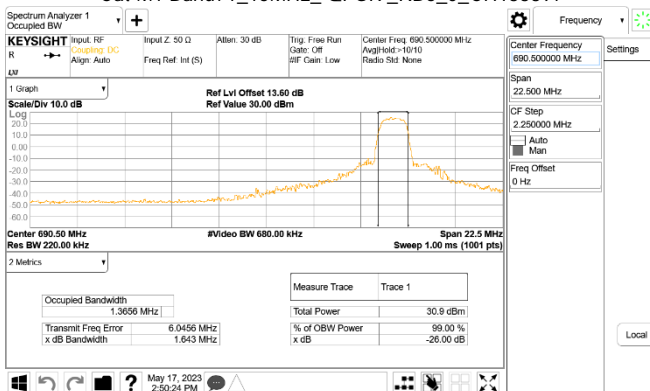
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Cat-M1 Band71_15MHz_16QAM_RB6_0_CH133297



Cat-M1 Band71_15MHz_QPSK_RB6_0_CH133397



Cat-M1 Band71_15MHz_16QAM_RB6_0_CH133397

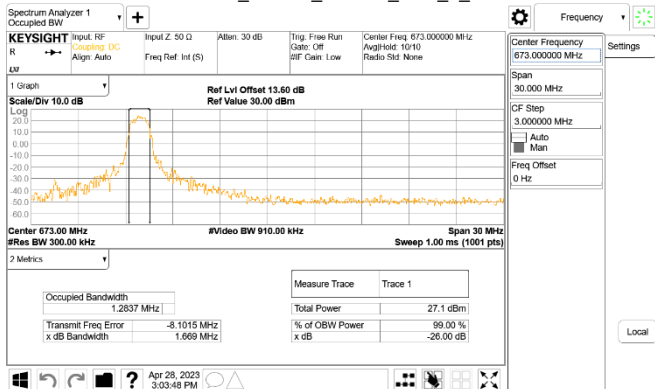


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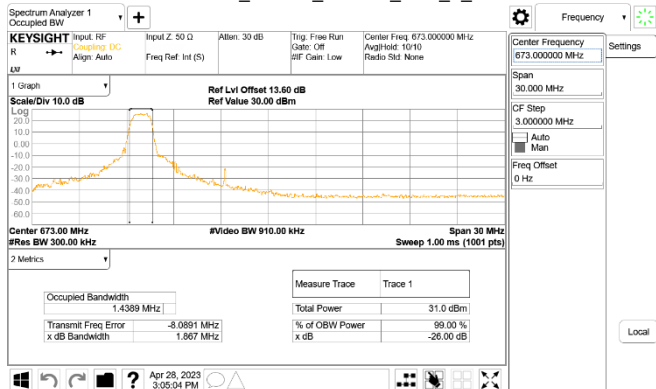
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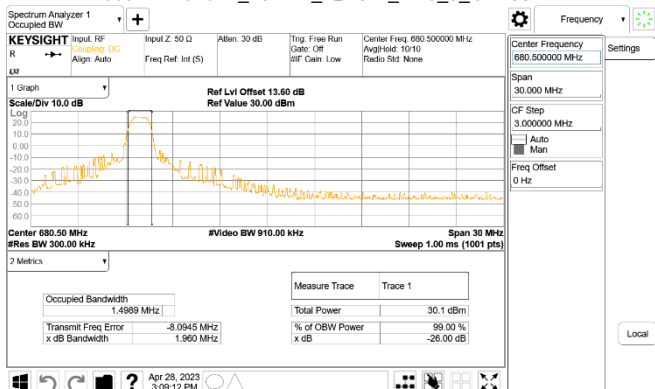
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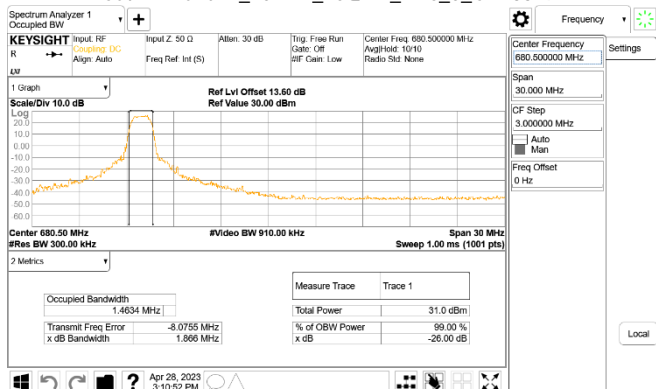
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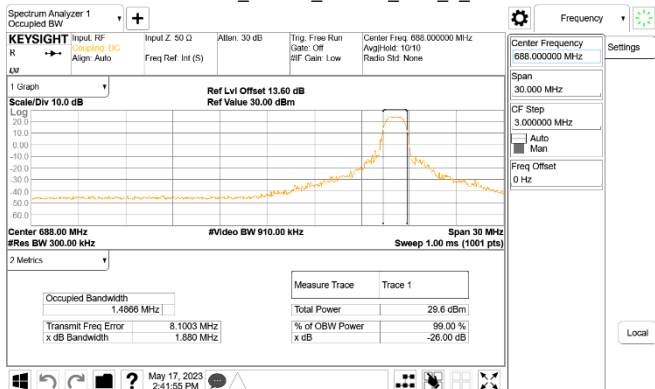
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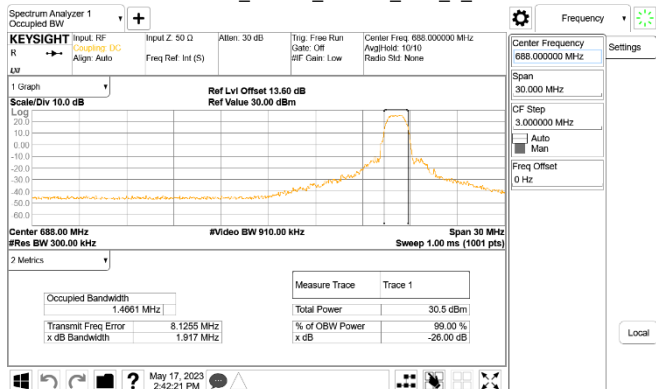
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Cat-M1 Band71_20MHz_QPSK_RB6_0_CH133372



Cat-M1 Band71_20MHz_16QAM_RB6_0_CH133372



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9 OUT OF BAND EMISSION AT ANTENNA TERMINALS

9.1 Standard Applicable

According to FCC §2.1053, **FCC §27.53(h)**

Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

FCC §27.53(g)

Compliance for operations in the 600 MHz, 698-746 MHz, 746-758 MHz and the 776-788 MHz band with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

- (2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB;
- (3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $76 + 10 \log(P)$ dB in a 6.25 kHz band segment, for base and fixed stations;
- (4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $65 + 10 \log(P)$ dB in a 6.25 kHz band segment, for mobile and portable stations;

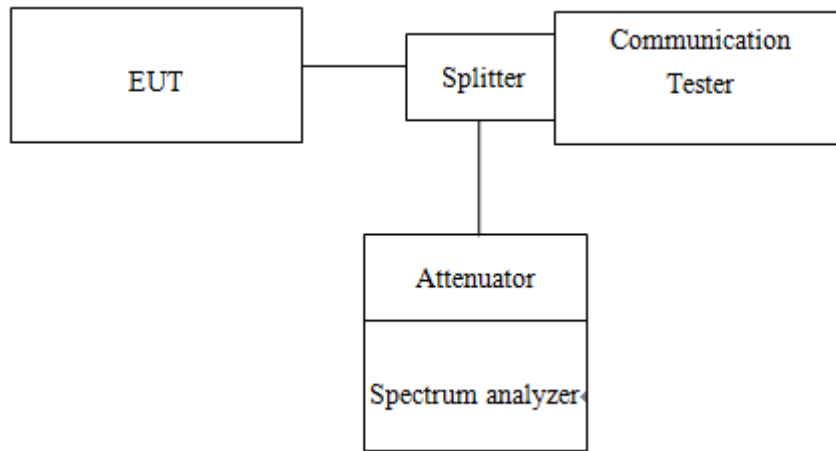
FCC §27.53(h)(1)

(h) *AWS emission limits*—(1) *General protection levels*. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.

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9.2 Test SET-UP



9.3 Measurement Procedure

9.3.1 Conducted Emission

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz, sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.

1. To connect Antenna Port of EUT to Spectrum.
2. Set RBW = 1MHz & VBW = 1MHz on Spectrum.
3. Allow trace to fully stabilize
4. Repeat above procedures until all default test channel measured were complete.

9.3.2 Band Edge

1. To connect Antenna Port of EUT to Spectrum.
2. The band edge of low and high channels for the highest RF powers was measured. Setting RBW \geq 1% EBW.
3. Allow trace to fully stabilize
4. Repeat above procedures until all default test channel measured were complete.

9.4 Band Edge Measurement Result:

Refer to next pages.

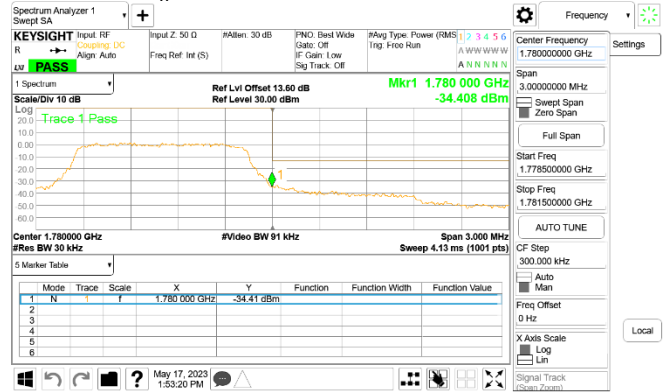
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Band Edge_Band66_1.4MHz_QPSK_RB1_0_CH131979



Band Edge_Band66_1.4MHz_QPSK_RB6_0_CH132665



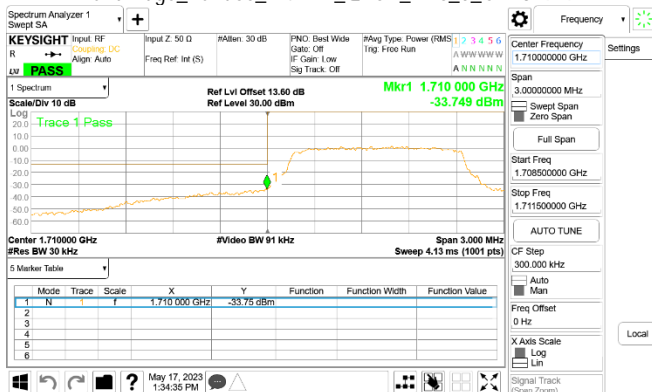
Band Edge_Band66_1.4MHz_QPSK_RB1_5_CH132665



Band Edge_Band66_3MHz_QPSK_RB1_0_CH131987



Band Edge_Band66_1.4MHz_QPSK_RB6_0_CH131979



Band Edge_Band66_3MHz_QPSK_RB1_5_CH132657



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