

**ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT**

OF

**Applicant:** Rombit NV  
Meir 30, 2000 Antwerpen, Belgium

**Product Name:** Integrated personal safety and site security device

**Brand Name:** Romware

**Model No.:** Romware One

**Model Difference:** N/A

**Report Number:** E2/2020/30003-01

**FCC ID** 2AVTBRW01U1

**FCC Rule Part:** 2, 24E & 27C

**Issue Date:** Mar. 11, 2021

**Date of Test:** Dec. 15, 2020 ~ Mar. 03, 2021

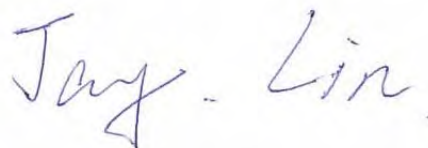
**Date of EUT Received:** Dec. 15, 2020

**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 tested as described in this report is in compliance with conducted and radiated emission limits.

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

Approved By: \_\_\_\_\_



Jay Lin / Asst. Supervisor



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## Revision History

Report Number	Revision	Description	Issue Date	Remark
E2/2020/30003	Rev.00	Original.	Jun. 24, 2020	Revised By: Karen Huang
E2/2020/30003-01	Rev.01	Add Cat M1 Band 13	Mar. 11, 2021	Revised By: Violetta Tang

**Note:**

1、Disclaimer

Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

2、Measurement results in the original test report E2/2020/30003 are fully leveraged in this test report with new evaluation on Cat M1 Band 13 test to demonstrate compliance.

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## 1 GENERAL PRODUCT INFORMATION

### 1.1 Product Description

Product Name:	Integrated personal safety and site security device	
Brand Name:	Romware	
Model No.:	Romware One	
Model difference:	N/A	
Hardware Version:	N/A	
Software Version:	N/A	
USB Cable:	Model No.: 2P-2.54PH-2, Supplier: Feng King Co. Ltd.	
Power Supply:	3.7Vdc from Rechargeable Li-polymer Battery or 5Vdc from USB Port	
	Battery:	Model No.: A-037-000550SAD, Supplier: Axiss Technology Corp.

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## 1.2 Frequency Range

### 1.2.1 Cat. M1

Cat M1 Band	BW (MHz)	Operation Frequency (MHz)	
2	1.4	1850.7	- 1909.3
	3	1851.5	- 1908.5
	5	1852.5	- 1907.5
	10	1855.0	- 1905.0
	15	1857.5	- 1902.5
	20	1860.0	- 1900.0
4	1.4	1710.7	- 1754.3
	3	1711.5	- 1753.5
	5	1712.5	- 1752.5
	10	1715.0	- 1750.0
	15	1717.5	- 1747.5
	20	1720.0	- 1745.0
12	1.4	699.7	- 715.3
	3	700.5	- 714.5
	5	701.5	- 713.5
	10	704.0	- 711.0
13	5	779.5	- 784.5
	10	782	

## 1.3 Antenna Designation

Vendor	Type	Main / Aux	Antenna Part No.	Modulation	Frequency (MHz)		Peak Antenna Gain (dBi)
Aristotle Enterprises Inc.	PIFA	Main	RFA-LTE-AP901-4-G-30	Cat M1 Band 2	1850	~ 1910	-1.56
				Cat M1 Band 4	1710	~ 1755	-1.56
				Cat M1 Band 12	699	~ 716	-0.33
				Cat M1 Band 13	779	~ 785	-0.33

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

### 1.4.1 Cat. M1

M1 Band	BW	Modulation	ERP / EIRP (dBm)		(W)	Type of Emission
			ERP	EIRP		
2	1.4	QPSK	19.06	EIRP	0.081	1M10G7D
		16QAM	18.10	EIRP	0.065	923KD7W
2	3	QPSK	19.08	EIRP	0.081	1M15G7D
		16QAM	18.04	EIRP	0.064	979KD7W
2	5	QPSK	19.07	EIRP	0.081	1M18G7D
		16QAM	19.10	EIRP	<b>0.081</b>	1M05D7W
2	10	QPSK	19.08	EIRP	0.081	1M33G7D
		16QAM	19.09	EIRP	0.081	1M20D7W
2	15	QPSK	19.10	EIRP	0.081	1M58G7D
		16QAM	19.09	EIRP	0.081	1M37D7W
2	20	QPSK	19.20	EIRP	<b>0.083</b>	1M72G7D
		16QAM	19.08	EIRP	0.081	1M64D7W
M1 Band	BW	Modulation	ERP / EIRP (dBm)		(W)	Type of Emission
4	1.4	QPSK	19.02	EIRP	0.080	1M10G7D
		16QAM	18.09	EIRP	0.064	932KD7W
4	3	QPSK	19.05	EIRP	0.080	1M15G7D
		16QAM	18.05	EIRP	0.064	980KD7W
4	5	QPSK	19.04	EIRP	0.080	1M18G7D
		16QAM	19.06	EIRP	0.081	1M04D7W
4	10	QPSK	19.08	EIRP	0.081	1M34G7D
		16QAM	19.09	EIRP	<b>0.081</b>	1M19D7W
4	15	QPSK	19.08	EIRP	0.081	1M51G7D
		16QAM	19.07	EIRP	0.081	1M38D7W
4	20	QPSK	19.25	EIRP	<b>0.084</b>	1M72G7D
		16QAM	19.09	EIRP	<b>0.081</b>	1M56D7W

M1 Band	BW	Modulation	ERP / EIRP (dBm)		(W)	Type of Emission
			ERP	EIRP		
12	1.4	QPSK	17.78	ERP	0.060	1M10G7D
		16QAM	16.79	ERP	0.048	929KD7W
12	3	QPSK	17.80	ERP	0.060	1M16G7D
		16QAM	16.77	ERP	0.048	988KD7W
12	5	QPSK	17.78	ERP	0.060	1M18G7D
		16QAM	16.80	ERP	0.048	1M04D7W
12	10	QPSK	18.25	ERP	<b>0.067</b>	1M34G7D
		16QAM	17.77	ERP	<b>0.060</b>	1M19D7W

M1 Band	BW	Modulation	ERP / EIRP (dBm)		(W)	Type of Emission
			ERP	EIRP		
13	5	QPSK	17.75	ERP	0.060	1M20G7D
		16QAM	16.73	ERP	0.047	1M03D7W
13	10	QPSK	18.16	ERP	<b>0.065</b>	1M41G7D
		16QAM	17.63	ERP	<b>0.058</b>	1M18D7W

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## 1.5 Test Methodology of Applied Standards

FCC 47 CFR Part 2, 24E, 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

SGS Taiwan Ltd. Central RF Lab (TAF code 3702)

No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803

FCC Designation number: TW0027

## 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\*9m\*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 according to the requirements in Section 8 and 13.

### 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. Following shows an offset computation in physical test.

	RF cable loss (dB)	Attenuation factor(dB)	offset(dB)
Low Band (Below 1GHz)	3.6	10	13.6
Low Band (Below 1GHz for Band 13)	4.47	10	14.47
High Band (Above 1 GHz)	3.8	10	13.8

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## 2.5 Final Amplifier Voltage and Current Information:

### 2.5.1 Cat M1

#### M1 Band 2

Test mode	DC voltage (V)	DC current (mA)
M1 Band 2_1.4M QPSK	3.7	153
M1 Band 2_1.4M 16QAM	3.7	118
M1 Band 2_3M QPSK	3.7	109
M1 Band 2_3M 16QAM	3.7	112
M1 Band 2_5M QPSK	3.7	107
M1 Band 2_5M 16QAM	3.7	120
M1 Band 2_10M QPSK	3.7	127
M1 Band 2_10M 16QAM	3.7	154
M1 Band 2_15M QPSK	3.7	117
M1 Band 2_15M 16QAM	3.7	146
M1 Band 2_20M QPSK	3.7	138
M1 Band 2_20M 16QAM	3.7	125

#### M1 Band 4

Test mode	DC voltage (V)	DC current (mA)
M1 Band 4_1.4M QPSK	3.7	121
M1 Band 4_1.4M 16QAM	3.7	135
M1 Band 4_3M QPSK	3.7	150
M1 Band 4_3M 16QAM	3.7	130
M1 Band 4_5M QPSK	3.7	145
M1 Band 4_5M 16QAM	3.7	127
M1 Band 4_10M QPSK	3.7	144
M1 Band 4_10M 16QAM	3.7	123
M1 Band 4_15M QPSK	3.7	142
M1 Band 4_15M 16QAM	3.7	139
M1 Band 4_20M QPSK	3.7	153
M1 Band 4_20M 16QAM	3.7	152

#### M1 Band 12

Test mode	DC voltage (V)	DC current (mA)
M1 Band 5_1.4M QPSK	3.7	153
M1 Band 5_1.4M 16QAM	3.7	138
M1 Band 5_3M QPSK	3.7	118
M1 Band 5_3M 16QAM	3.7	124
M1 Band 5_5M QPSK	3.7	117
M1 Band 5_5M 16QAM	3.7	121
M1 Band 5_10M QPSK	3.7	135
M1 Band 5_10M 16QAM	3.7	114

#### M1 Band 13

Test mode	DC voltage (V)	DC current (mA)
M1 Band 13_5M QPSK	3.7	207
M1 Band 13_5M 16QAM	3.7	212
M1 Band 13_10M QPSK	3.7	198
M1 Band 13_10M 16QAM	3.7	205

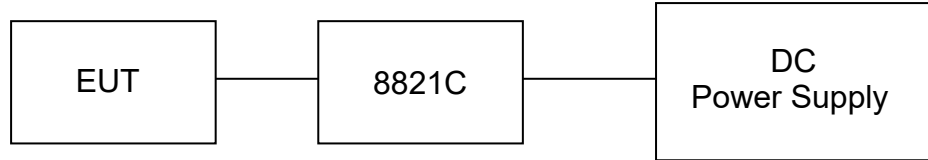
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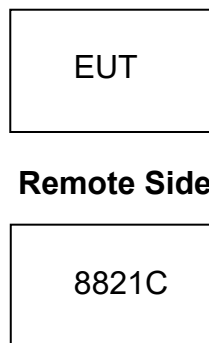
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## 2.6 Configuration of Tested System

**Fig. 2-1 Configuration of Tested System (Fixed Channel-Conducted)**



**Fig. 2-2 Configuration of Tested System (Fixed Channel-Radiated)**



**Table 2-1 Equipment Used in**

Item	Equipment	Mfr/Brand	Model / Type No.	Series No.	Data Cable	Power Cord
1.	Radio Communication Analyzer	Anritsu	MT8821C	6261786084	N/A	N/A
2.	DC Power Supply	Agilent	E3640A	MY53140006	N/A	N/A
3.	DC Power Supply	Agilent	E3640A	MY40000811	N/A	N/A

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### 3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§2.1046(a)	RF Power Output	Compliant
§24.232(c) §27.50(c)(10) §27.50(d)(4)	ERP/ EIRP measurement	Compliant
§2.1049(h)	99% & 26dB Occupied Bandwidth	Compliant
§2.1051 §24.238(a) §27.53(g) §27.53(h)	Out of Band Emissions at Antenna Terminals and Band Edge / Emission mask requirements	Compliant
§2.1053 §24.238(a) §27.53(g) §27.53(h)	Field Strength of Spurious Radiation	Compliant
§24.232(d) §27.50((B)	Peak to Average Ratio	Compliant
§2.1055(a)(1) §24.235 §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. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, X(E1)Y(E2)Z(H) axis and antenna ports. The worst case was found as listed below. Following channel(s) was (were) selected for the final test as listed below:

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**4.2 Cat M1  
M1 Band 2**

TEST ITEM	AVAILABLE CHANNEL	TESTED CHANNEL	CHANNEL BANDWIDTH	MODULATION	MODE
EIRP	18607 to 19193	18607, 18900, 19193	1.4MHz	QPSK, 16QAM	1 RB/ 0,5 RB Offest
	18615 to 19185	18615, 18900, 19185	3MHz	QPSK, 16QAM	1 RB/ 0,14 RB Offest
	18625 to 19175	18625, 18900, 19175	5MHz	QPSK, 16QAM	1 RB/ 0,24 RB Offest
	18650 to 19150	18650, 18900, 19150	10MHz	QPSK, 16QAM	1 RB/ 0,49 RB Offest
	18675 to 19125	18675, 18900, 19125	15MHz	QPSK, 16QAM	1 RB/ 0,74 RB Offest
	18700 to 19100	18700, 18900, 19100	20MHz	QPSK, 16QAM	1 RB/ 0,99 RB Offest
FREQUENCY STABILITY	18650 to 19150	18900	10MHz	QPSK	Full RB
OCCUPIED BANDWIDTH	18607 to 19193	18607, 18900, 19193	1.4MHz	QPSK, 16QAM	Full RB
	18615 to 19185	18615, 18900, 19185	3MHz	QPSK, 16QAM	Full RB
	18625 to 19175	18625, 18900, 19175	5MHz	QPSK, 16QAM	Full RB
	18650 to 19150	18650, 18900, 19150	10MHz	QPSK, 16QAM	Full RB
	18675 to 19125	18675, 18900, 19125	15MHz	QPSK, 16QAM	Full RB
	18700 to 19100	18700, 18900, 19100	20MHz	QPSK, 16QAM	Full RB
PEAK TO AVERAGE RATIO	18607 to 19193	18607, 18900, 19193	1.4MHz	QPSK	Full RB
	18615 to 19185	18615, 18900, 19185	3MHz	QPSK	Full RB
	18625 to 19175	18625, 18900, 19175	5MHz	QPSK	Full RB
	18650 to 19150	18650, 18900, 19150	10MHz	QPSK	Full RB
	18675 to 19125	18675, 18900, 19125	15MHz	QPSK	Full RB
	18700 to 19100	18700, 18900, 19100	20MHz	QPSK	Full RB
BAND EDGE	18607 to 19193	18607, 19193	1.4MHz	QPSK	1 RB/ 0,5 RB Offes Full RB
	18615 to 19185	18615, 19185	3MHz	QPSK	1 RB/ 0,14 RB Offest Full RB
	18625 to 19175	18625, 19175	5MHz	QPSK	1 RB/ 0,24 RB Offest Full RB
	18650 to 19150	18650, 19150	10MHz	QPSK	1 RB/ 0,49 RB Offest Full RB
	18675 to 19125	18675, 19125	15MHz	QPSK	1 RB/ 0,74 RB Offest Full RB
	18700 to 19100	18700, 19100	20MHz	QPSK	1 RB/ 0,99 RB Offest Full RB
CONDCUDED EMISSION	18607 to 19193	18607, 18900, 19193	1.4MHz	QPSK	1 RB, 0 RB Offest
	18615 to 19185	18615, 18900, 19185	3MHz	QPSK	1 RB, 0 RB Offest
	18625 to 19175	18625, 18900, 19175	5MHz	QPSK	1 RB, 0 RB Offest
	18650 to 19150	18650, 18900, 19150	10MHz	QPSK	1 RB, 0 RB Offest
	18675 to 19125	18675, 18900, 19125	15MHz	QPSK	1 RB, 0 RB Offest
	18700 to 19100	18700, 18900, 19100	20MHz	QPSK	1 RB, 0 RB Offest
RADIATED EMISSION	18625 to 19175	18625, 18900, 19175	5MHz	QPSK	3 RB, 3 RB Offest

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**M1 Band 4**

TEST ITEM	AVAILABLE CHANNEL	TESTED CHANNEL	CHANNEL BANDWIDTH	MODULATION	MODE
EIRP	19957 to 19393	19957, 20175, 19393	1.4MHz	QPSK, 16QAM	1 RB/ 0,5 RB Offest
	19965 to 22385	19965, 20175, 22385	3MHz	QPSK, 16QAM	1 RB/ 0,14 RB Offest
	19975 to 20375	19975, 20175, 20375	5MHz	QPSK, 16QAM	1 RB/ 0,24 RB Offest
	20000 to 20350	20000, 20175, 20350	10MHz	QPSK, 16QAM	1 RB/ 0,49 RB Offest
	20025 to 20325	20025, 20175, 20325	15MHz	QPSK, 16QAM	1 RB/ 0,74 RB Offest
	20050 to 20300	20050, 20175, 20300	20MHz	QPSK, 16QAM	1 RB/ 0,99 RB Offest
FREQUENCY STABILITY	20000 to 20350	20175	10MHz	QPSK	Full RB
OCCUPIED BANDWIDTH	19957 to 19393	19957, 20175, 19393	1.4MHz	QPSK, 16QAM	Full RB
	19965 to 22385	19965, 20175, 22385	3MHz	QPSK, 16QAM	Full RB
	19975 to 20375	19975, 20175, 20375	5MHz	QPSK, 16QAM	Full RB
	20000 to 20350	20000, 20175, 20350	10MHz	QPSK, 16QAM	Full RB
	20025 to 20325	20025, 20175, 20325	15MHz	QPSK, 16QAM	Full RB
	20050 to 20300	20050, 20175, 20300	20MHz	QPSK, 16QAM	Full RB
PEAK TO AVERAGE RATIO	19957 to 19393	19957, 20175, 19393	1.4MHz	QPSK	Full RB
	19965 to 22385	19965, 20175, 22385	3MHz	QPSK	Full RB
	19975 to 20375	19975, 20175, 20375	5MHz	QPSK	Full RB
	20000 to 20350	20000, 20175, 20350	10MHz	QPSK	Full RB
	20025 to 20325	20025, 20175, 20325	15MHz	QPSK	Full RB
	20050 to 20300	20050, 20175, 20300	20MHz	QPSK	Full RB
BAND EDGE	19957 to 19393	19957, 19393	1.4MHz	QPSK	1 RB/ 0,5 RB Offes Full RB
	19965 to 22385	19965, 22385	3MHz	QPSK	1 RB/ 0,14 RB Offest Full RB
	19975 to 20375	19975, 20375	5MHz	QPSK	1 RB/ 0,24 RB Offest Full RB
	20000 to 20350	20000, 20350	10MHz	QPSK	1 RB/ 0,49 RB Offest Full RB
	20025 to 20325	20025, 20325	15MHz	QPSK	1 RB/ 0,74 RB Offest Full RB
	20050 to 20300	20050, 20300	20MHz	QPSK	1 RB/ 0,99 RB Offest Full RB
CONDCUDED EMISSION	19957 to 19393	19957, 20175, 19393	1.4MHz	QPSK	1 RB, 0 RB Offest
	19965 to 22385	19965, 20175, 22385	3MHz	QPSK	1 RB, 0 RB Offest
	19975 to 20375	19975, 20175, 20375	5MHz	QPSK	1 RB, 0 RB Offest
	20000 to 20350	20000, 20175, 20350	10MHz	QPSK	1 RB, 0 RB Offest
	20025 to 20325	20025, 20175, 20325	15MHz	QPSK	1 RB, 0 RB Offest
	20050 to 20300	20050, 20175, 20300	20MHz	QPSK	1 RB, 0 RB Offest
RADIATED EMIS-SION	19975 to 20375	19975, 20175, 20375	5MHz	16QAM	1 RB, 5 RB Offest

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M1 Band 12

TEST ITEM	AVAILABLE CHANNEL	TESTED CHANNEL	CHANNEL BANDWIDTH	MODULATION	MODE
ERP	23017 to 23173	23017, 23095, 23173	1.4MHz	QPSK, 16QAM	1 RB/ 0,5 RB Offest
	23025 to 23165	23025, 23095, 23165	3MHz	QPSK, 16QAM	1 RB/ 0,14 RB Offest
	23035 to 23155	23035, 23095, 23155	5MHz	QPSK, 16QAM	1 RB/ 0,24 RB Offest
	23060 to 23130	23060, 23095, 23130	10MHz	QPSK, 16QAM	1 RB/ 0,49 RB Offest
FREQUENCY STABILITY	23060 to 23130	23095	10MHz	QPSK	Full RB
OCCUPIED BANDWIDTH	23017 to 23173	23017, 23095, 23173	1.4MHz	QPSK, 16QAM	Full RB
	23025 to 23165	23025, 23095, 23165	3MHz	QPSK, 16QAM	Full RB
	23035 to 23155	23035, 23095, 23155	5MHz	QPSK, 16QAM	Full RB
	23060 to 23130	23060, 23095, 23130	10MHz	QPSK, 16QAM	Full RB
PEAK TO AVERAGE RATIO	23017 to 23173	23017, 23095, 23173	1.4MHz	QPSK	Full RB
	23025 to 23165	23025, 23095, 23165	3MHz	QPSK	Full RB
	23035 to 23155	23035, 23095, 23155	5MHz	QPSK	Full RB
	23060 to 23130	23060, 23095, 23130	10MHz	QPSK	Full RB
BAND EDGE	23017 to 23173	23017, 23095, 23173	1.4MHz	QPSK	1 RB/ 0,5 RB Offes Full RB
	23025 to 23165	23025, 23095, 23165	3MHz	QPSK	1 RB/ 0,14 RB Offest Full RB
	23035 to 23155	23035, 23095, 23155	5MHz	QPSK	1 RB/ 0,24 RB Offest Full RB
	23060 to 23130	23060, 23095, 23130	10MHz	QPSK	1 RB/ 0,49 RB Offest Full RB
CONDUCTED EMISSION	23017 to 23173	23017, 23095, 23173	1.4MHz	QPSK	1 RB, 0 RB Offest
	23025 to 23165	23025, 23095, 23165	3MHz	QPSK	1 RB, 0 RB Offest
	23035 to 23155	23035, 23095, 23155	5MHz	QPSK	1 RB, 0 RB Offest
	23060 to 23130	23060, 23095, 23130	10MHz	QPSK	1 RB, 0 RB Offest
RADIATED EMISSION	23035 to 23155	23035, 23095, 23155	5MHz	16QAM	1 RB, 2 RB Offest

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**M1 Band 13**

TEST ITEM	AVAILABLE CHANNEL	TESTED CHANNEL	CHANNEL BANDWIDTH	MODULATION	MODE
ERP	23205 to 23255	23205, 23230, 23255	5MHz	QPSK, 16QAM	1 RB/ 0,24 RB Offest
	23230	23230	10MHz	QPSK, 16QAM	1 RB/ 0,49 RB Offest
FREQUENCY STABILITY	23230	23230	10MHz	QPSK	Full RB
OCCUPIED BANDWIDTH	23205 to 23255	23205, 23230, 23255	5MHz	QPSK, 16QAM	Full RB
	23230	23230	10MHz	QPSK, 16QAM	Full RB
PEAK TO AVERAGE RATIO	23205 to 23255	23205, 23230, 23255	5MHz	QPSK	Full RB
	23230	23230	10MHz	QPSK	Full RB
BAND EDGE	23205 to 23255	23205, 23255	5MHz	QPSK	1 RB/ 0,24 RB Offest Full RB
	23230	23230	10MHz	QPSK	1 RB/ 0,49 RB Offest Full RB
CONDCUDED EMISSION	23205 to 23255	23205, 23230, 23255	5MHz	QPSK	1 RB, 0 RB Offest
	23230	23230	10MHz	QPSK	1 RB, 0 RB Offest
RADIATED EMIS- SION	23230	23230	10MHz	QPSK	1 RB/ 0 RB Offest

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## 5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
RF Power Output	+/- 1.10 dB
ERP/ EIRP measurement	Vertical Polarization = +/- 4.74dB Horizontal Polarization = +/- 4.62dB
99% Occupied Bandwidth	+/- 5.19 Hz
Out of Band Emissions at Antenna Terminals and Band Edge	+/- 0.70 dB
Peak to Average Ratio	+/- 0.70 dB
Frequency Stability vs. Temperature	+/- 5.19 Hz
Frequency Stability vs. Voltage	+/- 5.19 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%

### Radiated Spurious Emission:

Measurement uncertainty (Polarization : <b>Vertical</b> )	9kHz – 30MHz: +/- 2.87 dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : <b>Horizontal</b> )	9kHz – 30MHz: +/- 2.87 dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

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 MAXMUM OUTPUT POWER

### 6.1 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.

### 6.2 FCC ERP/EIRP LIMIT

According to FCC §2.1046

#### FCC 24.232(c)

Mobile and portable stations are limited to 2 W EIRP.

#### FCC 27.50 (b)

(9) Control stations and mobile stations transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 30 watts ERP.

(10) Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

#### FCC 27.50(c)

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

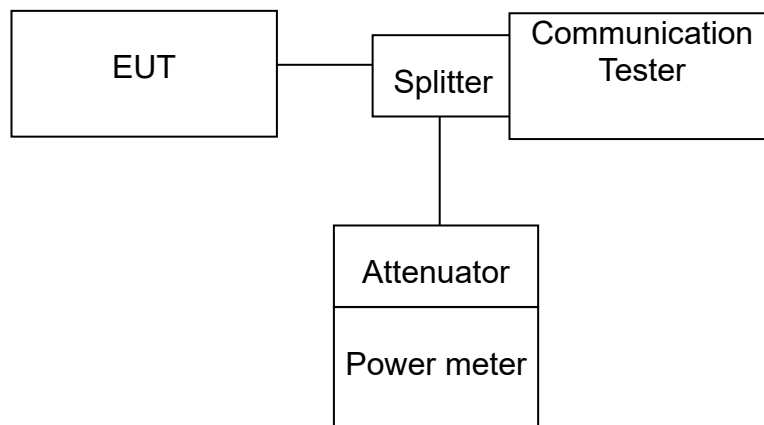
(10) Portable stations (hand-held devices) are limited to 3 watts ERP.

#### 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.

### 6.3 Test Set-up



**Note:** Measurement setup for testing on Antenna connector

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#### 6.4 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.

#### 6.5 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<sub>Meas</sub>, typically dBW or dBm);
- P<sub>Meas</sub> = 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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## 6.6 Measurement Equipment Used

Conducted Emission (measured at antenna port) Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
DC Block	PASTERNAK	PE8210	RF32	11/20/2019	11/19/2020
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	07/15/2019	07/14/2020
DC Power Supply	Agilent	E3640A	MY53140006	05/31/2019	05/30/2020
Splitter	Woken	DOM35LW1A2	RF36	11/20/2019	11/19/2020
Attenuator	Marvelous	MVE2213-10	RF31	11/20/2019	11/19/2020
Radio Communication Analyzer	Anritsu	MT8821C	6261786084	01/18/2020	01/17/2021

### Add Cat M1 Band 13

Conducted Emission (measured at antenna port) Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Radio Communication Analyzer	Anritsu	MT8821C	6261786084	01/18/2020	01/17/2021
Radio Communication Analyzer	Anritsu	MT8821C	6261786084	12/22/2020	12/21/2021
DC Power Supply	Agilent	E3640A	MY40000811	12/23/2019	12/22/2020
Splitter	RF-LAMBAD	RFLT2W1G18G	11-JSPF412-017	01/02/2020	01/01/2021

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## 6.7 Measurement Result

### 6.7.1 Cat M1

Antenna gain (dBi) -1.56

M1 Band 2_Uplink frequency band : 1850 to 1910 MHz									
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Limit (dBm)	Margin (dB)
1.4	18607	1850.7	QPSK	1	0	20.50	18.94	33	-14.06
				1	5	20.56	19.00	33	-14
				3	2	19.59	18.03	33	-14.97
				6	0	18.59	17.03	33	-15.97
	18900	1880	QPSK	1	0	20.59	19.03	33	-13.97
				1	5	20.54	18.98	33	-14.02
				3	2	19.59	18.03	33	-14.97
				6	0	18.64	17.08	33	-15.92
	19193	1909.3	QPSK	1	0	20.62	<b>19.06</b>	33	-13.94
				1	5	20.48	18.92	33	-14.08
				3	2	19.62	18.06	33	-14.94
				6	0	18.66	17.10	33	-15.9
	18607	1850.7	16QAM	1	0	19.52	17.96	33	-15.04
				1	5	19.55	17.99	33	-15.01
				3	2	18.54	16.98	33	-16.02
				5	0	18.54	16.98	33	-16.02
	18900	1880	16QAM	1	0	19.56	18.00	33	-15
				1	5	19.66	<b>18.10</b>	33	-14.9
				3	2	18.58	17.02	33	-15.98
				5	0	18.57	17.01	33	-15.99
	19193	1909.3	16QAM	1	0	19.59	18.03	33	-14.97
				1	5	19.65	18.09	33	-14.91
				3	2	18.61	17.05	33	-15.95
				5	0	18.52	16.96	33	-16.04

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Antenna gain (dBi) -1.56

M1 Band 2\_Uplink frequency band : 1850 to 1910 MHz

BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Limit (dBm)	Margin (dB)
3	18615	1851.5	QPSK	1	0	20.62	19.06	33	-13.94
				1	5	20.51	18.95	33	-14.05
				3	2	19.53	17.97	33	-15.03
				6	0	18.66	17.10	33	-15.9
	18900	1880	QPSK	1	0	20.54	18.98	33	-14.02
				1	5	20.55	18.99	33	-14.01
				3	2	19.58	18.02	33	-14.98
				6	0	18.66	17.10	33	-15.9
	19185	1908.5	QPSK	1	0	20.54	18.98	33	-14.02
				1	5	20.64	19.08	33	-13.92
				3	2	19.54	17.98	33	-15.02
				6	0	18.51	16.95	33	-16.05
	18615	1851.5	16QAM	1	0	19.52	17.96	33	-15.04
				1	5	19.54	17.98	33	-15.02
				3	2	18.50	16.94	33	-16.06
				5	0	18.54	16.98	33	-16.02
	18900	1880	16QAM	1	0	19.60	18.04	33	-14.96
				1	5	19.49	17.93	33	-15.07
				3	2	18.65	17.09	33	-15.91
				5	0	18.52	16.96	33	-16.04
	19185	1908.5	16QAM	1	0	19.52	17.96	33	-15.04
				1	5	19.53	17.97	33	-15.03
				3	2	18.53	16.97	33	-16.03
				5	0	18.48	16.92	33	-16.08

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Antenna gain (dBi) -1.56

M1 Band 2\_Uplink frequency band : 1850 to 1910 MHz

BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Limit (dBm)	Margin (dB)
5	18625	1852.5	QPSK	1	0	20.61	19.05	33	-13.95
				1	5	20.62	19.06	33	-13.94
				3	2	19.49	17.93	33	-15.07
				6	0	19.54	17.98	33	-15.02
	18900	1880	QPSK	1	0	20.48	18.92	33	-14.08
				1	5	20.63	<b>19.07</b>	33	-13.93
				3	2	19.51	17.95	33	-15.05
				6	0	19.59	18.03	33	-14.97
	19175	1907.5	QPSK	1	0	20.56	19.00	33	-14
				1	5	20.59	19.03	33	-13.97
				3	2	19.53	17.97	33	-15.03
				6	0	19.59	18.03	33	-14.97
	18625	1852.5	16QAM	1	0	20.66	<b>19.10</b>	33	-13.9
				1	5	20.60	19.04	33	-13.96
				3	2	19.53	17.97	33	-15.03
				5	0	18.53	16.97	33	-16.03
	18900	1880	16QAM	1	0	20.50	18.94	33	-14.06
				1	5	20.54	18.98	33	-14.02
				3	2	19.57	18.01	33	-14.99
				5	0	18.54	16.98	33	-16.02
	19175	1907.5	16QAM	1	0	20.47	18.91	33	-14.09
				1	5	20.51	18.95	33	-14.05
				3	2	19.65	18.09	33	-14.91
				5	0	18.54	16.98	33	-16.02

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Antenna gain (dBi) -1.56

M1 Band 2\_Uplink frequency band : 1850 to 1910 MHz

BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Limit (dBm)	Margin (dB)
10	18650	1855	QPSK	1	0	20.60	19.04	33	-13.96
				1	5	20.48	18.92	33	-14.08
				3	2	20.53	18.97	33	-14.03
				6	0	19.61	18.05	33	-14.95
	18900	1880	QPSK	1	0	20.61	19.05	33	-13.95
				1	5	20.50	18.94	33	-14.06
				3	2	20.61	19.05	33	-13.95
				6	0	19.56	18.00	33	-15
	19150	1905	QPSK	1	0	20.64	19.08	33	-13.92
				1	5	20.62	19.06	33	-13.94
				3	2	20.63	19.07	33	-13.93
				6	0	19.54	17.98	33	-15.02
	18650	1855	16QAM	1	0	20.62	19.06	33	-13.94
				1	5	20.50	18.94	33	-14.06
				3	2	20.61	19.05	33	-13.95
				5	0	19.49	17.93	33	-15.07
	18900	1880	16QAM	1	0	20.53	18.97	33	-14.03
				1	5	20.52	18.96	33	-14.04
				3	2	20.56	19.00	33	-14
				5	0	19.61	18.05	33	-14.95
	19150	1905	16QAM	1	0	20.65	19.09	33	-13.91
				1	5	20.62	19.06	33	-13.94
				3	2	20.59	19.03	33	-13.97
				5	0	19.59	18.03	33	-14.97

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Antenna gain (dBi) -1.56

M1 Band 2\_Uplink frequency band : 1850 to 1910 MHz

BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Limit (dBm)	Margin (dB)
15	18675	1857.5	QPSK	1	0	20.66	19.10	33	-13.9
				1	5	20.66	19.10	33	-13.9
				3	2	20.65	19.09	33	-13.91
				6	0	20.55	18.99	33	-14.01
	18900	1880	QPSK	1	0	20.57	19.01	33	-13.99
				1	5	20.49	18.93	33	-14.07
				3	2	20.66	19.10	33	-13.9
				6	0	20.48	18.92	33	-14.08
	19125	1902.5	QPSK	1	0	20.51	18.95	33	-14.05
				1	5	20.55	18.99	33	-14.01
				3	2	20.51	18.95	33	-14.05
				6	0	20.53	18.97	33	-14.03
	18675	1857.5	16QAM	1	0	20.65	19.09	33	-13.91
				1	5	20.55	18.99	33	-14.01
				3	2	20.47	18.91	33	-14.09
				5	0	20.50	18.94	33	-14.06
	18900	1880	16QAM	1	0	20.53	18.97	33	-14.03
				1	5	20.63	19.07	33	-13.93
				3	2	20.59	19.03	33	-13.97
				5	0	20.52	18.96	33	-14.04
	19125	1902.5	16QAM	1	0	20.56	19.00	33	-14
				1	5	20.53	18.97	33	-14.03
				3	2	20.53	18.97	33	-14.03
				5	0	20.50	18.94	33	-14.06

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Antenna gain (dBi) -1.56

M1 Band 2\_Uplink frequency band : 1850 to 1910 MHz

BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Limit (dBm)	Margin (dB)
20	18700	1860	QPSK	1	0	20.67	19.11	33	-13.89
				1	5	20.66	19.10	33	-13.9
				3	2	20.52	18.96	33	-14.04
				6	0	20.50	18.94	33	-14.06
	18900	1880	QPSK	1	0	20.71	19.15	33	-13.85
				1	5	20.62	19.06	33	-13.94
				3	2	20.63	19.07	33	-13.93
				6	0	20.64	19.08	33	-13.92
	19100	1900	QPSK	1	0	20.76	19.20	33	-13.8
				1	5	20.52	18.96	33	-14.04
				3	2	20.52	18.96	33	-14.04
				6	0	20.64	19.08	33	-13.92
	18700	1860	16QAM	1	0	20.52	18.96	33	-14.04
				1	5	20.62	19.06	33	-13.94
				3	2	20.62	19.06	33	-13.94
				5	0	20.58	19.02	33	-13.98
	18900	1880	16QAM	1	0	20.57	19.01	33	-13.99
				1	5	20.49	18.93	33	-14.07
				3	2	20.64	19.08	33	-13.92
				5	0	20.62	19.06	33	-13.94
19100	1900	16QAM	1	0	20.49	18.93	33	-14.07	
			1	5	20.56	19.00	33	-14	
			3	2	20.47	18.91	33	-14.09	
			5	0	20.49	18.93	33	-14.07	

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Antenna gain (dBi) -1.56

M1 Band 4_Uplink frequency band : 1710 to 1755 MHz									
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Limit (dBm)	Margin (dB)
1.4	19957	1710.7	QPSK	1	0	20.57	19.01	30	-10.99
				1	5	20.50	18.94	30	-11.06
				3	2	19.52	17.96	30	-12.04
				6	0	18.46	16.90	30	-13.1
	20175	1732.5	QPSK	1	0	20.54	18.98	30	-11.02
				1	5	20.51	18.95	30	-11.05
				3	2	19.52	17.96	30	-12.04
				6	0	18.64	17.08	30	-12.92
	20393	1754.3	QPSK	1	0	20.58	<b>19.02</b>	30	-10.98
				1	5	20.51	18.95	30	-11.05
				3	2	19.64	18.08	30	-11.92
				6	0	18.49	16.93	30	-13.07
	19957	1710.7	16QAM	1	0	19.61	18.05	30	-11.95
				1	5	19.64	18.08	30	-11.92
				3	2	18.52	16.96	30	-13.04
				5	0	18.47	16.91	30	-13.09
	20175	1732.5	16QAM	1	0	19.57	18.01	30	-11.99
				1	5	19.65	<b>18.09</b>	30	-11.91
				3	2	18.56	17.00	30	-13
				5	0	18.54	16.98	30	-13.02
	20393	1754.3	16QAM	1	0	19.49	17.93	30	-12.07
				1	5	19.57	18.01	30	-11.99
				3	2	18.52	16.96	30	-13.04
				5	0	18.50	16.94	30	-13.06

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Antenna gain (dBi) -1.56

M1 Band 4_Uplink frequency band : 1710 to 1755 MHz									
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Limit (dBm)	Margin (dB)
3	19965	1711.5	QPSK	1	0	20.59	19.03	30	-10.97
				1	5	20.61	<b>19.05</b>	30	-10.95
				3	2	19.48	17.92	30	-12.08
				6	0	18.64	17.08	30	-12.92
	20175	1732.5	QPSK	1	0	20.49	18.93	30	-11.07
				1	5	20.61	<b>19.05</b>	30	-10.95
				3	2	19.64	18.08	30	-11.92
				6	0	18.52	16.96	30	-13.04
	20385	1753.5	QPSK	1	0	20.47	18.91	30	-11.09
				1	5	20.47	18.91	30	-11.09
				3	2	19.48	17.92	30	-12.08
				6	0	18.53	16.97	30	-13.03
	19965	1711.5	16QAM	1	0	19.53	17.97	30	-12.03
				1	5	19.57	18.01	30	-11.99
				3	2	18.47	16.91	30	-13.09
				5	0	18.63	17.07	30	-12.93
	20175	1732.5	16QAM	1	0	19.58	18.02	30	-11.98
				1	5	19.50	17.94	30	-12.06
				3	2	18.63	17.07	30	-12.93
				5	0	18.65	17.09	30	-12.91
	20385	1753.5	16QAM	1	0	19.61	<b>18.05</b>	30	-11.95
				1	5	19.58	18.02	30	-11.98
				3	2	18.58	17.02	30	-12.98
				5	0	18.61	17.05	30	-12.95

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Antenna gain (dBi) -1.56

**M1 Band 4\_Uplink frequency band : 1710 to 1755 MHz**

BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Limit (dBm)	Margin (dB)
5	19975	1712.5	QPSK	1	0	20.46	18.90	30	-11.1
				1	5	20.60	<b>19.04</b>	30	-10.96
				3	2	19.61	18.05	30	-11.95
				6	0	19.51	17.95	30	-12.05
	20175	1732.5	QPSK	1	0	20.58	19.02	30	-10.98
				1	5	20.47	18.91	30	-11.09
				3	2	19.59	18.03	30	-11.97
				6	0	19.53	17.97	30	-12.03
	20375	1752.5	QPSK	1	0	20.57	19.01	30	-10.99
				1	5	20.50	18.94	30	-11.06
				3	2	19.56	18.00	30	-12
				6	0	19.47	17.91	30	-12.09
	19975	1712.5	16QAM	1	0	20.58	19.02	30	-10.98
				1	5	20.53	18.97	30	-11.03
				3	2	19.46	17.90	30	-12.1
				5	0	18.53	16.97	30	-13.03
	20175	1732.5	16QAM	1	0	20.62	<b>19.06</b>	30	-10.94
				1	5	20.50	18.94	30	-11.06
				3	2	19.49	17.93	30	-12.07
				5	0	18.58	17.02	30	-12.98
	20375	1752.5	16QAM	1	0	20.62	<b>19.06</b>	30	-10.94
				1	5	20.60	19.04	30	-10.96
				3	2	19.49	17.93	30	-12.07
				5	0	18.60	17.04	30	-12.96

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Antenna gain (dBi) -1.56

**M1 Band 4\_Uplink frequency band : 1710 to 1755 MHz**

BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Limit (dBm)	Margin (dB)
10	20000	1715	QPSK	1	0	20.50	18.94	30	-11.06
				1	5	20.47	18.91	30	-11.09
				3	2	20.57	19.01	30	-10.99
				6	0	19.54	17.98	30	-12.02
	20175	1732.5	QPSK	1	0	20.47	18.91	30	-11.09
				1	5	20.59	19.03	30	-10.97
				3	2	20.64	<b>19.08</b>	30	-10.92
				6	0	19.65	18.09	30	-11.91
	20375	1750	QPSK	1	0	20.51	18.95	30	-11.05
				1	5	20.55	18.99	30	-11.01
				3	2	20.51	18.95	30	-11.05
				6	0	19.47	17.91	30	-12.09
	20000	1715	16QAM	1	0	20.60	19.04	30	-10.96
				1	5	20.65	<b>19.09</b>	30	-10.91
				3	2	20.61	19.05	30	-10.95
				5	0	19.65	18.09	30	-11.91
	20175	1732.5	16QAM	1	0	20.65	<b>19.09</b>	30	-10.91
				1	5	20.58	19.02	30	-10.98
				3	2	20.59	19.03	30	-10.97
				5	0	19.58	18.02	30	-11.98
	20375	1750	16QAM	1	0	20.52	18.96	30	-11.04
				1	5	20.65	<b>19.09</b>	30	-10.91
				3	2	20.47	18.91	30	-11.09
				5	0	19.51	17.95	30	-12.05

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Antenna gain (dBi) -1.56

M1 Band 4\_Uplink frequency band : 1710 to 1755 MHz

BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Limit (dBm)	Margin (dB)
15	20025	1717.5	QPSK	1	0	20.61	19.05	30	-10.95
				1	5	20.60	19.04	30	-10.96
				3	2	20.60	19.04	30	-10.96
				6	0	20.56	19.00	30	-11
	20175	1732.5	QPSK	1	0	20.55	18.99	30	-11.01
				1	5	20.53	18.97	30	-11.03
				3	2	20.64	<b>19.08</b>	30	-10.92
				6	0	20.52	18.96	30	-11.04
	20325	1747.5	QPSK	1	0	20.62	19.06	30	-10.94
				1	5	20.54	18.98	30	-11.02
				3	2	20.58	19.02	30	-10.98
				6	0	20.47	18.91	30	-11.09
	20025	1717.5	16QAM	1	0	20.48	18.92	30	-11.08
				1	5	20.58	19.02	30	-10.98
				3	2	20.56	19.00	30	-11
				5	0	20.59	19.03	30	-10.97
	20175	1732.5	16QAM	1	0	20.57	19.01	30	-10.99
				1	5	20.63	<b>19.07</b>	30	-10.93
				3	2	20.47	18.91	30	-11.09
				5	0	20.61	19.05	30	-10.95
	20325	1747.5	16QAM	1	0	20.61	19.05	30	-10.95
				1	5	20.55	18.99	30	-11.01
				3	2	20.52	18.96	30	-11.04
				5	0	20.58	19.02	30	-10.98

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Antenna gain (dBi) -1.56

M1 Band 4_Uplink frequency band : 1710 to 1755 MHz									
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducte d Average (dBm)	EIRP Average (dBm)	EIRP Limit (dBm)	Margin (dB)
20	20050	1720	QPSK	1	0	20.66	19.10	30	-10.9
				1	5	20.62	19.06	30	-10.94
				3	2	20.59	19.03	30	-10.97
				6	0	20.57	19.01	30	-10.99
	20175	1732.5	QPSK	1	0	20.81	<b>19.25</b>	30	-10.75
				1	5	20.56	19.00	30	-11
				3	2	20.48	18.92	30	-11.08
				6	0	20.47	18.91	30	-11.09
	20300	1745	QPSK	1	0	20.56	19.00	30	-11
				1	5	20.50	18.94	30	-11.06
				3	2	20.49	18.93	30	-11.07
				6	0	20.64	19.08	30	-10.92
	20050	1720	16QAM	1	0	20.56	19.00	30	-11
				1	5	20.65	<b>19.09</b>	30	-10.91
				3	2	20.54	18.98	30	-11.02
				5	0	20.60	19.04	30	-10.96
	20175	1732.5	16QAM	1	0	20.51	18.95	30	-11.05
				1	5	20.51	18.95	30	-11.05
				3	2	20.51	18.95	30	-11.05
				5	0	20.55	18.99	30	-11.01
20300	1745	16QAM	1	0	20.59	19.03	30	-10.97	
			1	5	20.56	19.00	30	-11	
			3	2	20.62	19.06	30	-10.94	
			5	0	20.58	19.02	30	-10.98	

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Antenna gain (dBi)		-0.33								
M1 Band 12_Uplink frequency band : 699 to 716 MHz										
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducted Average (dBm)	ERP Average (dBm)	EIRP Average (dBm)	ERP Limit (dBm)	Margin (dB)
1.4	23017	699.7	QPSK	1	0	20.26	17.78	<b>19.93</b>	34.77	-16.99
				1	5	20.10	17.62	19.77	34.77	-17.15
				3	2	19.17	16.69	18.84	34.77	-18.08
				6	0	18.12	15.64	17.79	34.77	-19.13
	23095	707.5	QPSK	1	0	20.15	17.67	19.82	34.77	-17.10
				1	5	20.25	17.77	19.92	34.77	-17.00
				3	2	19.11	16.63	18.78	34.77	-18.14
				6	0	18.19	15.71	17.86	34.77	-19.06
	23173	715.5	QPSK	1	0	20.12	17.64	19.79	34.77	-17.13
				1	5	20.23	17.75	19.90	34.77	-17.02
				3	2	19.24	16.76	18.91	34.77	-18.01
				6	0	18.20	15.72	17.87	34.77	-19.05
	23017	699.7	16QAM	1	0	19.22	16.74	18.89	34.77	-18.03
				1	5	19.17	16.69	18.84	34.77	-18.08
				3	2	18.28	15.80	17.95	34.77	-18.97
				5	0	18.25	15.77	17.92	34.77	-19.00
	23095	707.5	16QAM	1	0	19.22	16.74	18.89	34.77	-18.03
				1	5	19.12	16.64	18.79	34.77	-18.13
				3	2	18.28	15.80	17.95	34.77	-18.97
				5	0	18.12	15.64	17.79	34.77	-19.13
	23173	715.5	16QAM	1	0	19.27	16.79	<b>18.94</b>	34.77	-17.98
				1	5	19.11	16.63	18.78	34.77	-18.14
				3	2	18.21	15.73	17.88	34.77	-19.04
				5	0	18.20	15.72	17.87	34.77	-19.05

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Antenna gain (dBi)		-0.33								
M1 Band 12_Uplink frequency band : 699 to 716 MHz										
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducted Average (dBm)	ERP Average (dBm)	EIRP Average (dBm)	ERP Limit (dBm)	Margin (dB)
3	23025	700.5	QPSK	1	0	20.25	17.77	19.92	34.77	-17.00
				1	5	20.16	17.68	19.83	34.77	-17.09
				3	2	19.14	16.66	18.81	34.77	-18.11
				6	0	18.28	15.80	17.95	34.77	-18.97
	23095	707.5	QPSK	1	0	20.12	17.64	19.79	34.77	-17.13
				1	5	20.17	17.69	19.84	34.77	-17.08
				3	2	19.10	16.62	18.77	34.77	-18.15
				6	0	18.23	15.75	17.90	34.77	-19.02
	23165	714.5	QPSK	1	0	20.28	17.80	<b>19.95</b>	34.77	-16.97
				1	5	20.22	17.74	19.89	34.77	-17.03
				3	2	19.19	16.71	18.86	34.77	-18.06
				6	0	18.10	15.62	17.77	34.77	-19.15
	23025	700.5	16QAM	1	0	19.25	16.77	<b>18.92</b>	34.77	-18.00
				1	5	19.12	16.64	18.79	34.77	-18.13
				3	2	18.09	15.61	17.76	34.77	-19.16
				5	0	18.10	15.62	17.77	34.77	-19.15
	23095	707.5	16QAM	1	0	19.12	16.64	18.79	34.77	-18.13
				1	5	19.10	16.62	18.77	34.77	-18.15
				3	2	18.18	15.70	17.85	34.77	-19.07
				5	0	18.28	15.80	17.95	34.77	-18.97
	23165	714.5	16QAM	1	0	19.09	16.61	18.76	34.77	-18.16
				1	5	19.25	16.77	<b>18.92</b>	34.77	-18.00
				3	2	18.14	15.66	17.81	34.77	-19.11
				5	0	18.12	15.64	17.79	34.77	-19.13

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Antenna gain (dBi)		-0.33								
M1 Band 12_Uplink frequency band : 699 to 716 MHz										
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducted Average (dBm)	ERP Average (dBm)	EIRP Average (dBm)	ERP Limit (dBm)	Margin (dB)
5	23035	701.5	QPSK	1	0	20.25	17.77	19.92	34.77	-17.00
				1	5	20.18	17.70	19.85	34.77	-17.07
				3	2	19.19	16.71	18.86	34.77	-18.06
				6	0	19.19	16.71	18.86	34.77	-18.06
	23095	707.5	QPSK	1	0	20.26	17.78	<b>19.93</b>	34.77	-16.99
				1	5	20.16	17.68	19.83	34.77	-17.09
				3	2	19.21	16.73	18.88	34.77	-18.04
				6	0	19.22	16.74	18.89	34.77	-18.03
	23155	713.5	QPSK	1	0	20.22	17.74	19.89	34.77	-17.03
				1	5	20.17	17.69	19.84	34.77	-17.08
				3	2	19.10	16.62	18.77	34.77	-18.15
				6	0	19.18	16.70	18.85	34.77	-18.07
	23035	701.5	16QAM	1	0	19.28	16.80	<b>18.95</b>	34.77	-17.97
				1	5	19.18	16.70	18.85	34.77	-18.07
				3	2	19.17	16.69	18.84	34.77	-18.08
				5	0	18.12	15.64	17.79	34.77	-19.13
	23095	707.5	16QAM	1	0	19.25	16.77	18.92	34.77	-18.00
				1	5	19.09	16.61	18.76	34.77	-18.16
				3	2	19.11	16.63	18.78	34.77	-18.14
				5	0	18.13	15.65	17.80	34.77	-19.12
	23155	713.5	16QAM	1	0	19.18	16.70	18.85	34.77	-18.07
				1	5	19.17	16.69	18.84	34.77	-18.08
				3	2	19.16	16.68	18.83	34.77	-18.09
				5	0	18.10	15.62	17.77	34.77	-19.15

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Antenna gain (dBi)		-0.33								
M1 Band 12_Uplink frequency band : 699 to 716 MHz										
BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB Size	RB Offset	Conducted Average (dBm)	ERP Average (dBm)	EIRP Average (dBm)	ERP Limit (dBm)	Margin (dB)
10	23060	704	QPSK	1	0	20.73	18.25	<b>20.40</b>	34.77	-16.52
				1	5	20.17	17.69	19.84	34.77	-17.08
				3	2	20.16	17.68	19.83	34.77	-17.09
				6	0	19.20	16.72	18.87	34.77	-18.05
	23095	707.5	QPSK	1	0	20.49	18.01	20.16	34.77	-16.76
				1	5	20.24	17.76	19.91	34.77	-17.01
				3	2	20.11	17.63	19.78	34.77	-17.14
				6	0	19.20	16.72	18.87	34.77	-18.05
	23130	711	QPSK	1	0	20.29	17.81	19.96	34.77	-16.96
				1	5	20.19	17.71	19.86	34.77	-17.06
				3	2	20.26	17.78	19.93	34.77	-16.99
				6	0	19.12	16.64	18.79	34.77	-18.13
	23060	704	16QAM	1	0	20.18	17.70	19.85	34.77	-17.07
				1	5	20.11	17.63	19.78	34.77	-17.14
				3	2	20.24	17.76	19.91	34.77	-17.01
				5	0	19.28	16.80	18.95	34.77	-17.97
	23095	707.5	16QAM	1	0	20.25	17.77	<b>19.92</b>	34.77	-17.00
				1	5	20.24	17.76	19.91	34.77	-17.01
				3	2	20.13	17.65	19.80	34.77	-17.12
				5	0	19.20	16.72	18.87	34.77	-18.05
	23130	711	16QAM	1	0	20.16	17.68	19.83	34.77	-17.09
				1	5	20.10	17.62	19.77	34.77	-17.15
				3	2	20.09	17.61	19.76	34.77	-17.16
				5	0	19.20	16.72	18.87	34.77	-18.05

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Antenna gain (dBi) -0.33

M1 Band 13\_Uplink frequency band : 777 to 787 MHz

BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB allocation	RB Start	Index	Conducted Average (dBm)	ERP Average (dBm)	EIRP Average (dBm)	ERP Limit (dBm)	Margin (dB)
5	23205	779.5	QPSK	1	0	0	20.21	17.73	19.88	34.77	-17.04
				1	5	0	20.14	17.66	19.81	34.77	-17.11
				6	0	0	19.04	16.56	18.71	34.77	-18.21
	23230	782	QPSK	1	0	0	20.23	17.75	<b>19.90</b>	34.77	-17.02
				1	5	0	20.17	17.69	19.84	34.77	-17.08
				6	0	0	19.05	16.57	18.72	34.77	-18.20
	23255	784.5	QPSK	1	0	0	20.17	17.69	19.84	34.77	-17.08
				1	5	0	20.11	17.63	19.78	34.77	-17.14
				6	0	0	19.02	16.54	18.69	34.77	-18.23
	23205	779.5	16QAM	1	0	0	19.14	16.66	18.81	34.77	-18.11
				1	5	0	19.11	16.63	18.78	34.77	-18.14
				5	0	0	18.23	15.75	17.90	34.77	-19.02
	23230	782	16QAM	1	0	0	19.21	16.73	<b>18.88</b>	34.77	-18.04
				1	5	0	19.14	16.66	18.81	34.77	-18.11
				5	0	0	18.34	15.86	18.01	34.77	-18.91
	23255	784.5	16QAM	1	0	0	19.11	16.63	18.78	34.77	-18.14
				1	5	0	19.08	16.60	18.75	34.77	-18.17
				5	0	0	18.16	15.68	17.83	34.77	-19.09

Antenna gain (dBi) -0.33

M1 Band 13\_Uplink frequency band : 777 to 787 MHz

BW (MHz)	UL Channel	Frequency (MHz)	Modulation	RB allocation	RB Start	Index	Conducted Average (dBm)	ERP Average (dBm)	EIRP Average (dBm)	ERP Limit (dBm)	Margin (dB)
10	23230	782	QPSK	1	0	0	20.64	18.16	<b>20.31</b>	34.77	-16.61
				1	5	0	20.21	17.73	19.88	34.77	-17.04
				6	0	0	19.09	16.61	18.76	34.77	-18.16
	23230	782	16QAM	1	0	0	20.11	17.63	<b>19.78</b>	34.77	-17.14
				1	5	0	20.04	17.56	19.71	34.77	-17.21
				5	0	0	18.62	16.14	18.29	34.77	-18.63

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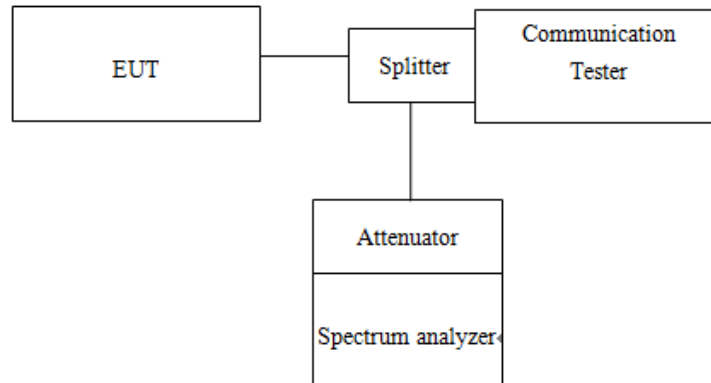
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## 7 OCCUPIED BANDWIDTH MEASUREMENT

### 7.1 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.

### 7.2 Test Set-up



### 7.3 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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#### 7.4 Measurement Equipment Used

Conducted Emission (measured at antenna port) Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
DC Block	PASTERNAK	PE8210	RF32	11/20/2019	11/19/2020
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	07/15/2019	07/14/2020
DC Power Supply	Agilent	E3640A	MY53140006	05/31/2019	05/30/2020
Splitter	Woken	DOM35LW1A2	RF36	11/20/2019	11/19/2020
Attenuator	Marvelous	MVE2213-10	RF31	11/20/2019	11/19/2020
Radio Communication Analyzer	Anritsu	MT8821C	6261786084	01/18/2020	01/17/2021

#### Add Cat M1 Band 13

Conducted Emission (measured at antenna port) Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54200716	04/01/2020	03/31/2021
Radio Communication Analyzer	Anritsu	MT8821C	6261786084	01/18/2020	01/17/2021
DC Power Supply	Agilent	E3640A	MY40000811	12/23/2019	12/22/2020
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2020	01/01/2021
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2020	01/01/2021
Splitter	RF-LAMBAD	RFLT2W1G18G	11-JSPF412-017	01/02/2020	01/01/2021

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## 7.5 Measurement Result

### 7.5.1 Cat M1

M1 BAND 2 Channel bandwidth: 1.4MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1850.7	18607	1.0999	<b>0.9323</b>	1.262	1.114
1880.0	18900	<b>1.1026</b>	0.9254	1.255	1.119
1909.3	19193	1.0986	0.9291	<b>1.281</b>	<b>1.128</b>

M1 BAND 2 Channel bandwidth: 3MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1851.5	18615	1.1447	0.9770	1.365	1.215
1880.0	18900	<b>1.1513</b>	0.9748	<b>1.367</b>	1.196
1908.5	19185	1.1355	<b>0.9791</b>	1.348	<b>1.218</b>

M1 BAND 2 Channel bandwidth: 5MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1852.5	18625	1.1743	1.0408	1.509	1.299
1880.0	18900	<b>1.1781</b>	1.0458	1.421	1.277
1907.5	19175	1.1745	<b>1.0484</b>	<b>1.536</b>	<b>1.331</b>

M1 BAND 2 Channel bandwidth: 10MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1855.0	18650	1.3152	<b>1.1984</b>	1.694	<b>1.718</b>
1880.0	18900	1.3179	1.1928	1.595	1.551
1905.0	19150	<b>1.3265</b>	1.1944	<b>1.763</b>	1.678

M1 BAND 2 Channel bandwidth: 15MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1857.5	18675	1.541	1.368	<b>2.772</b>	1.990
1880.0	18900	1.517	<b>1.373</b>	2.329	<b>2.317</b>
1902.5	19125	<b>1.585</b>	1.371	2.499	2.042

M1 BAND 2 Channel bandwidth: 20MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1860.0	18700	1.684	<b>1.639</b>	<b>2.818</b>	<b>3.125</b>
1880.0	18900	<b>1.717</b>	1.576	2.550	3.014
1900.0	19100	1.688	1.538	2.473	2.642

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M1 BAND 4 Channel bandwidth: 1.4MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1710.7	19957	<b>1.1007</b>	0.9218	<b>1.298</b>	1.121
1732.5	20175	1.0966	0.9298	1.283	1.126
1754.3	20393	1.0916	<b>0.9325</b>	1.276	<b>1.129</b>

M1 BAND 4 Channel bandwidth: 3MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1711.5	19965	1.1385	0.9754	1.359	<b>1.230</b>
1732.5	20175	1.1474	<b>0.9803</b>	1.332	1.186
1753.5	20385	<b>1.1541</b>	0.97148	<b>1.364</b>	1.166

M1 BAND 4 Channel bandwidth: 5MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1712.5	19957	<b>1.1827</b>	1.0435	<b>1.468</b>	<b>1.305</b>
1732.5	20175	1.1780	<b>1.0440</b>	1.444	1.294
1752.5	20375	1.1739	1.0408	1.460	1.301

M1 BAND 4 Channel bandwidth: 10MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1715.0	20000	1.3073	<b>1.1938</b>	1.879	1.542
1732.5	20175	<b>1.3393</b>	1.1661	<b>1.957</b>	1.515
1750.0	20350	1.3241	1.1917	1.904	<b>1.622</b>

M1 BAND 4 Channel bandwidth: 15MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1717.5	20025	1.509	1.362	2.558	2.122
1732.5	20175	1.502	1.372	1.979	<b>2.194</b>
1747.5	20325	<b>1.511</b>	<b>1.376</b>	<b>2.560</b>	2.137

M1 BAND 4 Channel bandwidth: 20MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
1720.0	20050	<b>1.719</b>	1.542	2.709	2.823
1732.5	20175	1.666	1.540	<b>2.746</b>	<b>3.241</b>
1745.0	20300	1.692	<b>1.563</b>	2.423	2.753

M1 BAND 12 Channel bandwidth: 1.4MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
699.7	23017	1.0976	<b>0.9292</b>	1.288	<b>1.179</b>
707.5	23095	<b>1.0995</b>	0.9258	1.287	1.122
715.3	23173	1.0944	0.9284	<b>1.319</b>	1.111

M1 BAND 12 Channel bandwidth: 3MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
700.5	23025	1.1470	<b>0.9883</b>	1.362	<b>1.244</b>
707.5	23095	<b>1.1560</b>	0.9809	<b>1.368</b>	1.233
714.5	23165	1.1472	0.9786	1.367	1.239

M1 BAND 12 Channel bandwidth: 5MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
701.5	23035	1.1763	<b>1.0431</b>	1.448	1.290
707.5	23095	<b>1.1800</b>	1.0343	1.430	<b>1.354</b>
713.5	23155	1.1715	1.0166	<b>1.503</b>	1.269

M1 BAND 12 Channel bandwidth: 10MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
704.0	23060	<b>1.3366</b>	<b>1.1899</b>	1.966	<b>1.645</b>
707.5	23095	1.3228	1.1680	<b>1.982</b>	1.475
711.0	23130	1.3313	1.1754	1.923	1.505

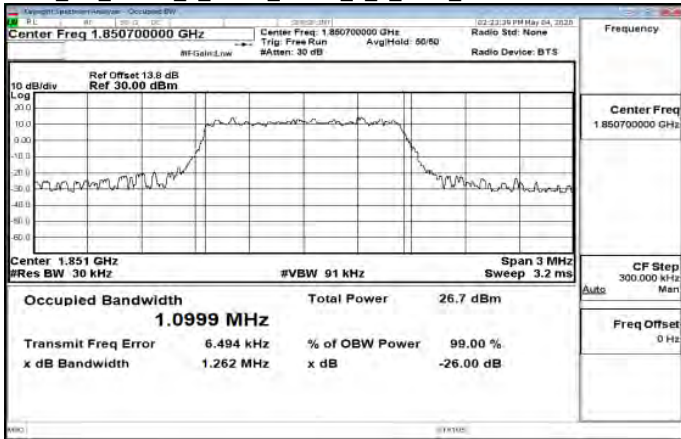
M1 BAND 13 Channel bandwidth: 5MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
779.5	23205	1.1920	1.0264	1.566	1.284
782.0	23230	1.1970	1.0314	1.584	<b>1.320</b>
784.5	23255	<b>1.1975</b>	<b>1.0341</b>	<b>1.602</b>	1.292

M1 BAND 13 Channel bandwidth: 10MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
782.0	23230	<b>1.408</b>	<b>1.182</b>	<b>2.227</b>	<b>1.547</b>

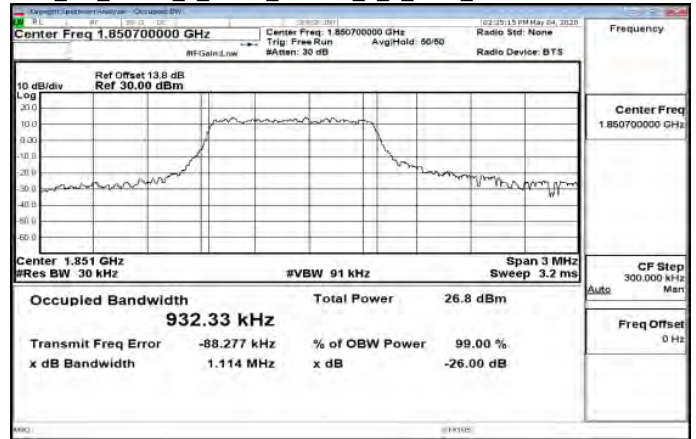
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Cat\_M1\_Band2\_1\_4MHz\_QPSK\_6\_0\_Main\_LowCH18607-1850.7



Cat\_M1\_Band2\_1\_4MHz\_16QAM\_5\_0\_Main\_LowCH18607-1850.7



Cat\_M1\_Band2\_1\_4MHz\_QPSK\_6\_0\_Main\_MidCH18900-1880



Cat\_M1\_Band2\_1\_4MHz\_16QAM\_5\_0\_Main\_MidCH18900-1880



Cat\_M1\_Band2\_1\_4MHz\_QPSK\_6\_0\_Main\_HighCH19193-1909.3



Cat\_M1\_Band2\_1\_4MHz\_16QAM\_5\_0\_Main\_HighCH19193-1909.3



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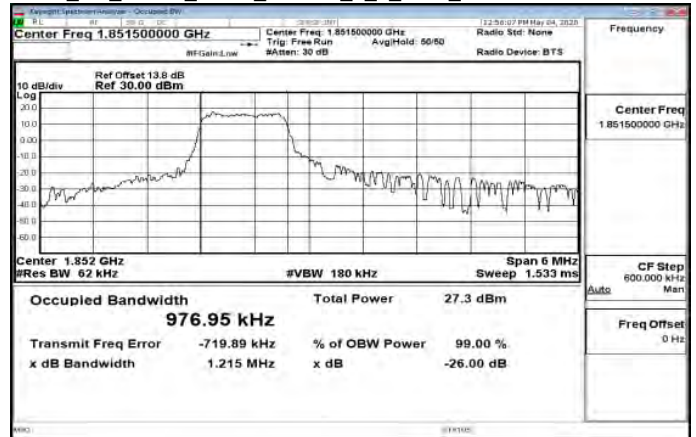
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Cat\_M1\_Band2\_3MHz\_QPSK\_6\_0\_Main\_LowCH18615-1851.5



Cat\_M1\_Band2\_3MHz\_16QAM\_5\_0\_Main\_LowCH18615-1851.5



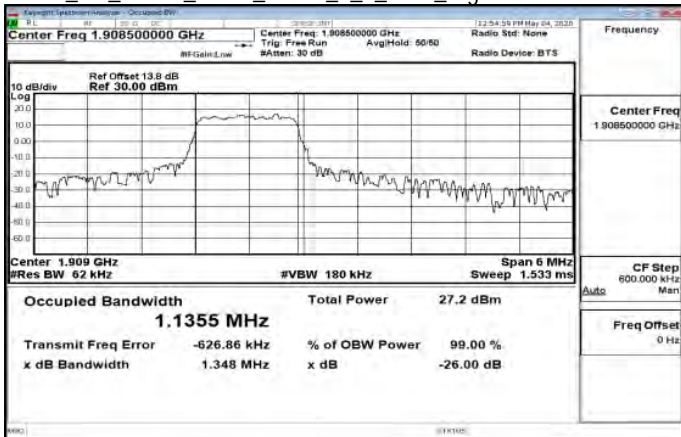
Cat\_M1\_Band2\_3MHz\_QPSK\_6\_0\_Main\_MidCH18900-1880



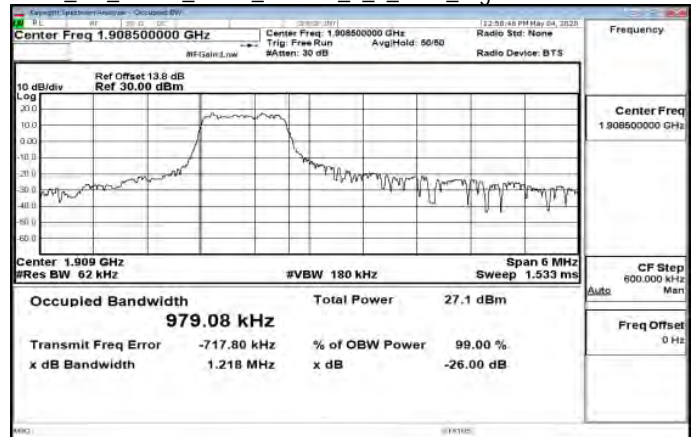
Cat\_M1\_Band2\_3MHz\_16QAM\_5\_0\_Main\_MidCH18900-1880



Cat\_M1\_Band2\_3MHz\_QPSK\_6\_0\_Main\_HighCH19185-1908.5



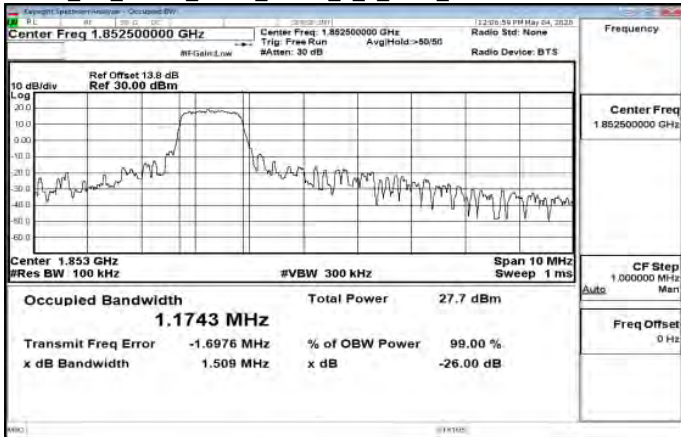
Cat\_M1\_Band2\_3MHz\_16QAM\_5\_0\_Main\_HighCH19185-1908.5



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Cat\_M1\_Band2\_5MHz\_QPSK\_6\_0\_Main\_LowCH18625-1852.5



Cat\_M1\_Band2\_5MHz\_16QAM\_5\_0\_Main\_LowCH18625-1852.5



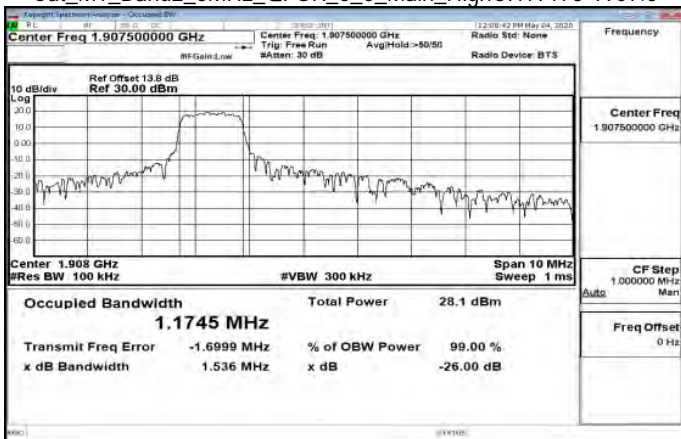
Cat\_M1\_Band2\_5MHz\_QPSK\_6\_0\_Main\_MidCH18900-1880



Cat\_M1\_Band2\_5MHz\_16QAM\_5\_0\_Main\_MidCH18900-1880



Cat\_M1\_Band2\_5MHz\_QPSK\_6\_0\_Main\_HighCH19175-1907.5



Cat\_M1\_Band2\_5MHz\_16QAM\_5\_0\_Main\_HighCH19175-1907.5

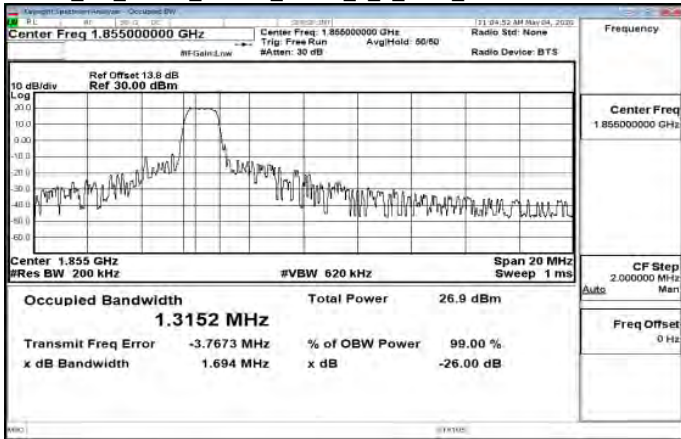


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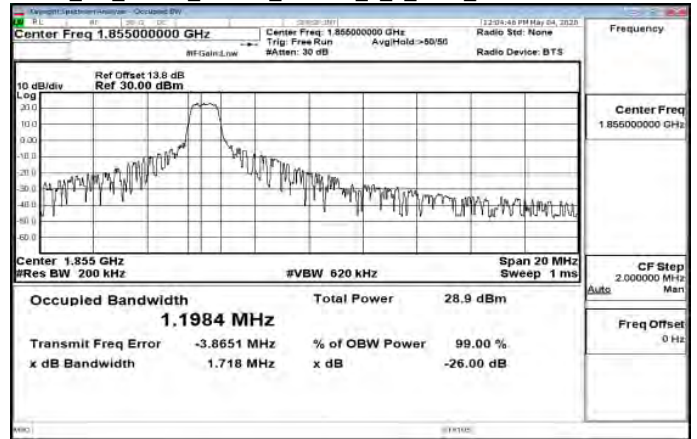
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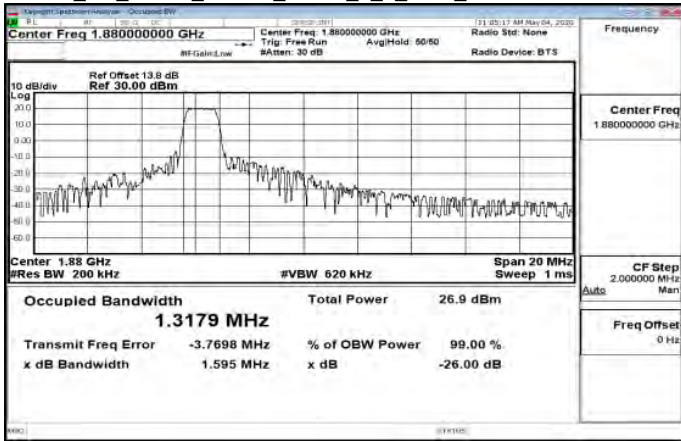
Cat\_M1\_Band2\_10MHz\_QPSK\_6\_0\_Main\_LowCH18650-1855



Cat\_M1\_Band2\_10MHz\_16QAM\_5\_0\_Main\_LowCH18650-1855



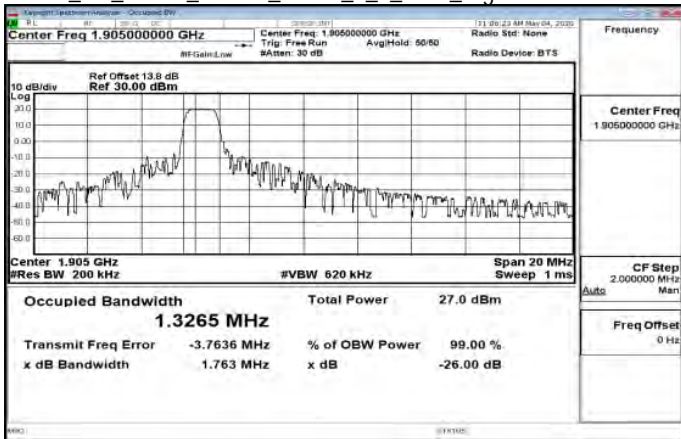
Cat\_M1\_Band2\_10MHz\_QPSK\_6\_0\_Main\_MidCH18900-1880



Cat\_M1\_Band2\_10MHz\_16QAM\_5\_0\_Main\_MidCH18900-1880



Cat\_M1\_Band2\_10MHz\_QPSK\_6\_0\_Main\_HighCH19150-1905



Cat\_M1\_Band2\_10MHz\_16QAM\_5\_0\_Main\_HighCH19150-1905



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Cat\_M1\_Band2\_15MHz\_QPSK\_6\_0\_Main\_LowCH18675-1857.5



Cat\_M1\_Band2\_15MHz\_16QAM\_5\_0\_Main\_LowCH18675-1857.5



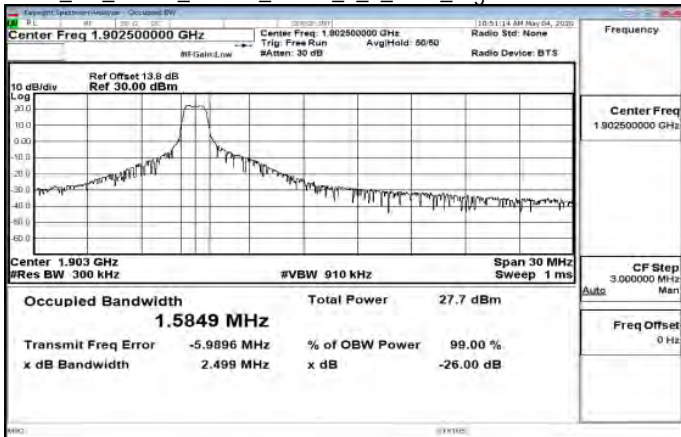
Cat\_M1\_Band2\_15MHz\_QPSK\_6\_0\_Main\_MidCH18900-1880



Cat\_M1\_Band2\_15MHz\_16QAM\_5\_0\_Main\_MidCH18900-1880



Cat\_M1\_Band2\_15MHz\_QPSK\_6\_0\_Main\_HighCH19125-1902.5



Cat\_M1\_Band2\_15MHz\_16QAM\_5\_0\_Main\_HighCH19125-1902.5

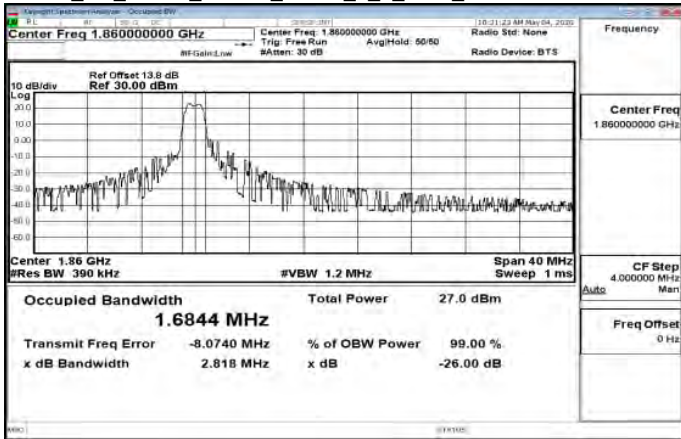


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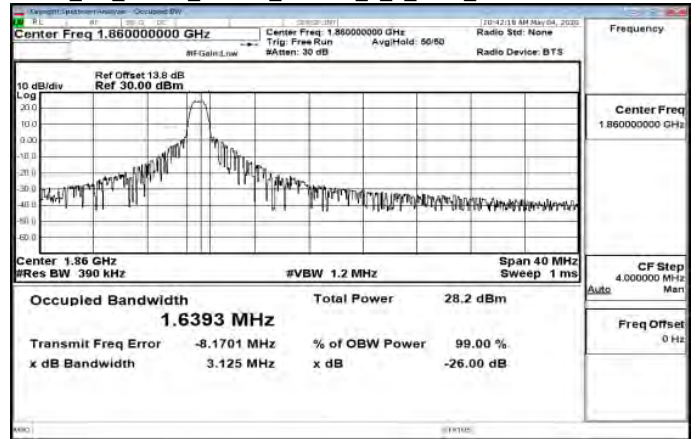
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Cat\_M1\_Band2\_20MHz\_QPSK\_6\_0\_Main\_LowCH18700-1860



Cat\_M1\_Band2\_20MHz\_16QAM\_5\_0\_Main\_LowCH18700-1860



Cat\_M1\_Band2\_20MHz\_QPSK\_6\_0\_Main\_MidCH18900-1880



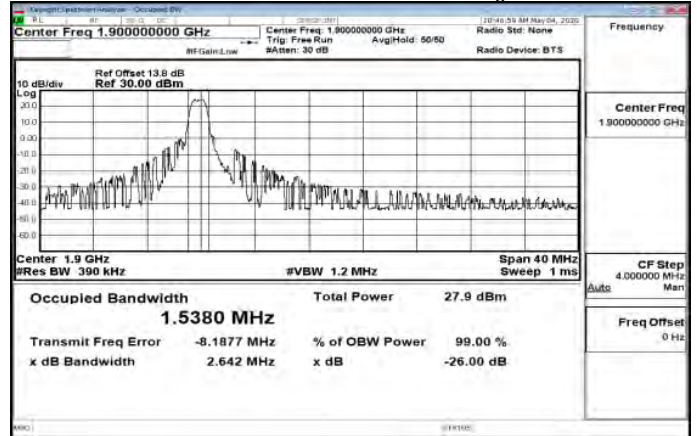
Cat\_M1\_Band2\_20MHz\_16QAM\_5\_0\_Main\_MidCH18900-1880



Cat\_M1\_Band2\_20MHz\_QPSK\_6\_0\_Main\_HighCH19100-1900



Cat\_M1\_Band2\_20MHz\_16QAM\_5\_0\_Main\_HighCH19100-1900

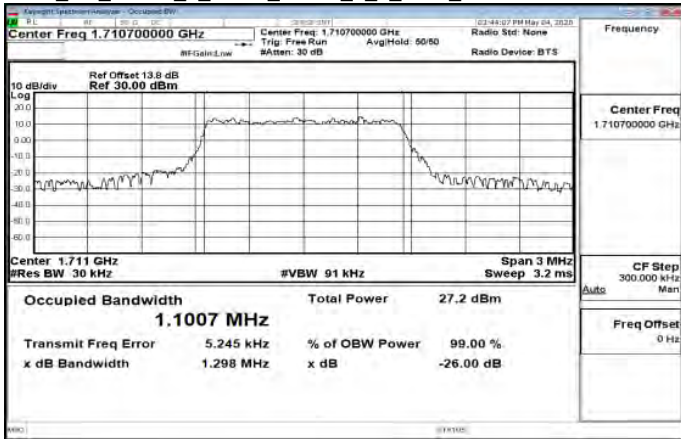


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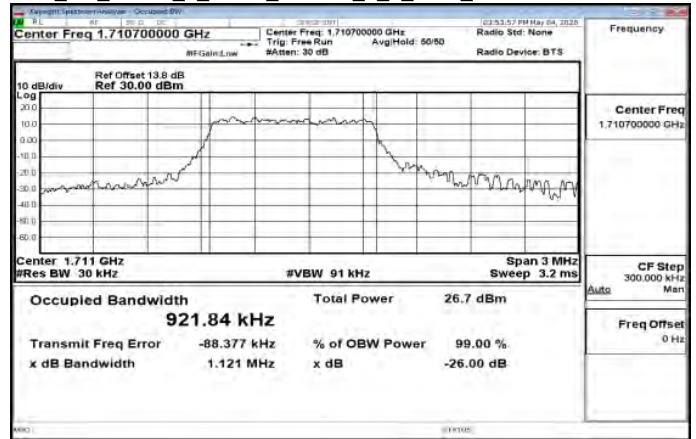
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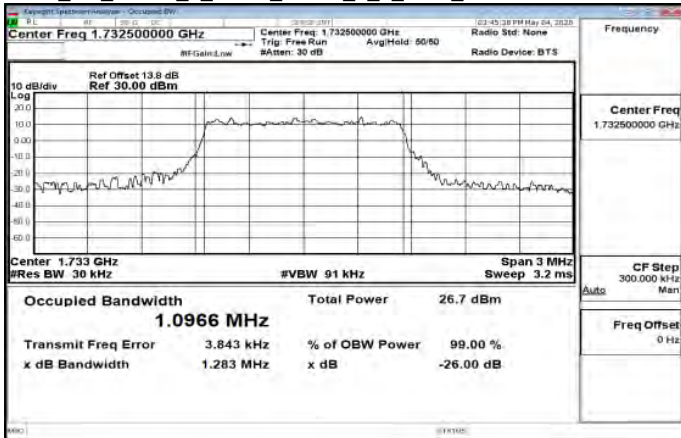
Cat\_M1\_Band4\_1\_4MHz\_QPSK\_6\_0\_Main\_LowCH19957-1710.7



Cat\_M1\_Band4\_1\_4MHz\_16QAM\_5\_0\_Main\_LowCH19957-1710.7



Cat\_M1\_Band4\_1\_4MHz\_QPSK\_6\_0\_Main\_MidCH20175-1732.5



Cat\_M1\_Band4\_1\_4MHz\_16QAM\_5\_0\_Main\_MidCH20175-1732.5



Cat\_M1\_Band4\_1\_4MHz\_QPSK\_6\_0\_Main\_HighCH20393-1754.3



Cat\_M1\_Band4\_1\_4MHz\_16QAM\_5\_0\_Main\_HighCH20393-1754.3



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Cat\_M1\_Band4\_3MHz\_QPSK\_6\_0\_Main\_LowCH19965-1711.5



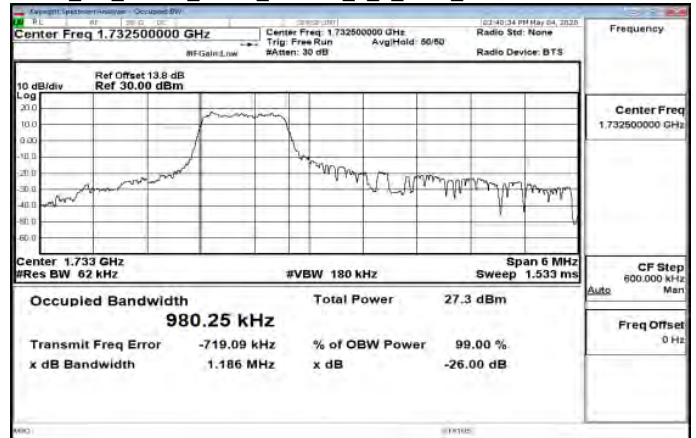
Cat\_M1\_Band4\_3MHz\_16QAM\_5\_0\_Main\_LowCH19965-1711.5



Cat\_M1\_Band4\_3MHz\_QPSK\_6\_0\_Main\_MidCH20175-1732.5



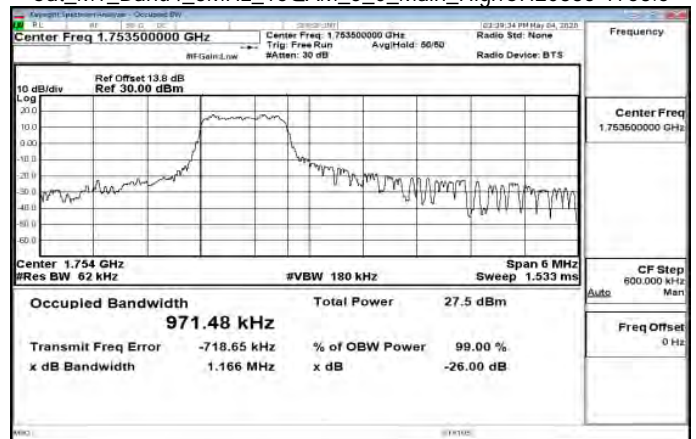
Cat\_M1\_Band4\_3MHz\_16QAM\_5\_0\_Main\_MidCH20175-1732.5



Cat\_M1\_Band4\_3MHz\_QPSK\_6\_0\_Main\_HighCH20385-1753.5



Cat\_M1\_Band4\_3MHz\_16QAM\_5\_0\_Main\_HighCH20385-1753.5



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Cat\_M1\_Band4\_5MHz\_QPSK\_6\_0\_Main\_LowCH19975-1712.5



Cat\_M1\_Band4\_5MHz\_16QAM\_5\_0\_Main\_LowCH19975-1712.5



Cat\_M1\_Band4\_5MHz\_QPSK\_6\_0\_Main\_MidCH20175-1732.5



Cat\_M1\_Band4\_5MHz\_16QAM\_5\_0\_Main\_MidCH20175-1732.5



Cat\_M1\_Band4\_5MHz\_QPSK\_6\_0\_Main\_HighCH20375-1752.5



Cat\_M1\_Band4\_5MHz\_16QAM\_5\_0\_Main\_HighCH20375-1752.5

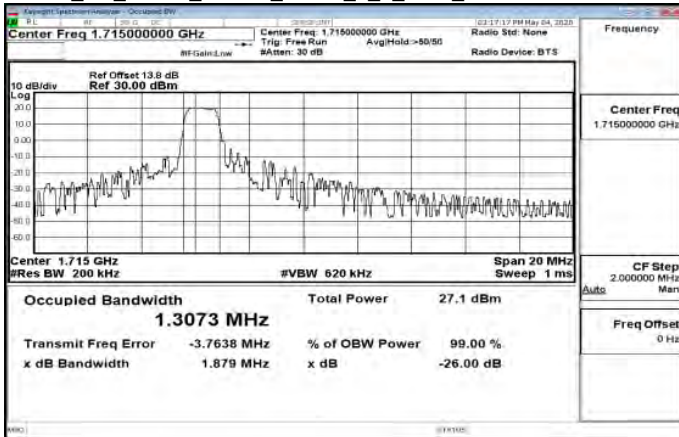


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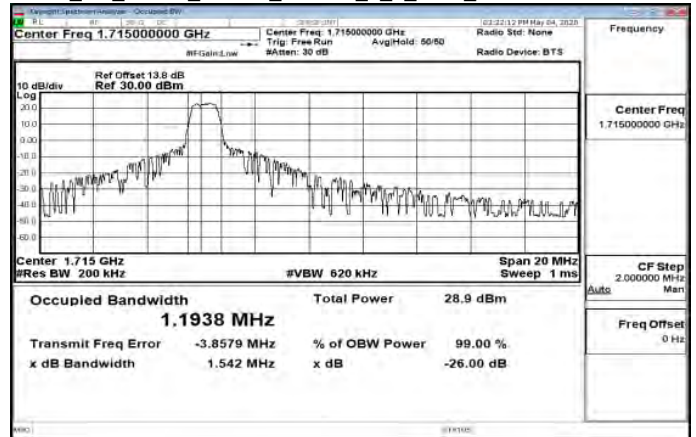
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Cat\_M1\_Band4\_10MHz\_QPSK\_6\_0\_Main\_LowCH20000-1715



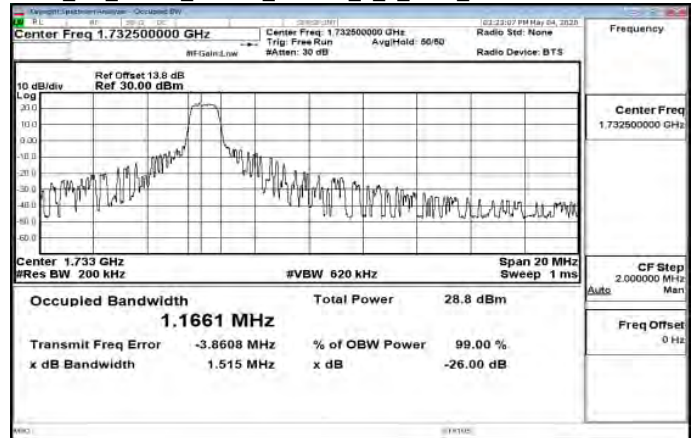
Cat\_M1\_Band4\_10MHz\_16QAM\_5\_0\_Main\_LowCH20000-1715



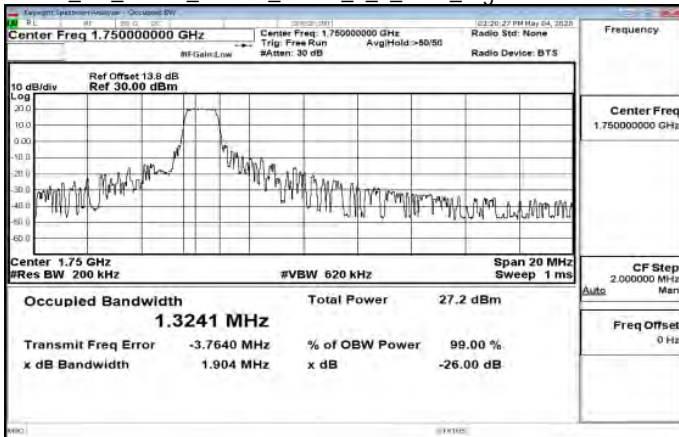
Cat\_M1\_Band4\_10MHz\_QPSK\_6\_0\_Main\_MidCH20175-1732.5



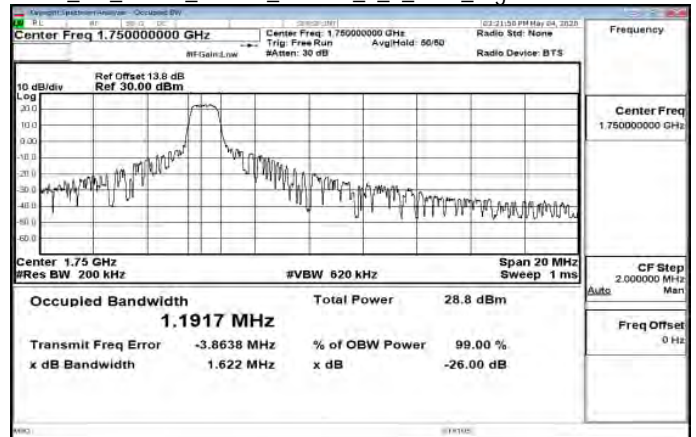
Cat\_M1\_Band4\_10MHz\_16QAM\_5\_0\_Main\_MidCH20175-1732.5



Cat\_M1\_Band4\_10MHz\_QPSK\_6\_0\_Main\_HighCH20350-1750



Cat\_M1\_Band4\_10MHz\_16QAM\_5\_0\_Main\_HighCH20350-1750

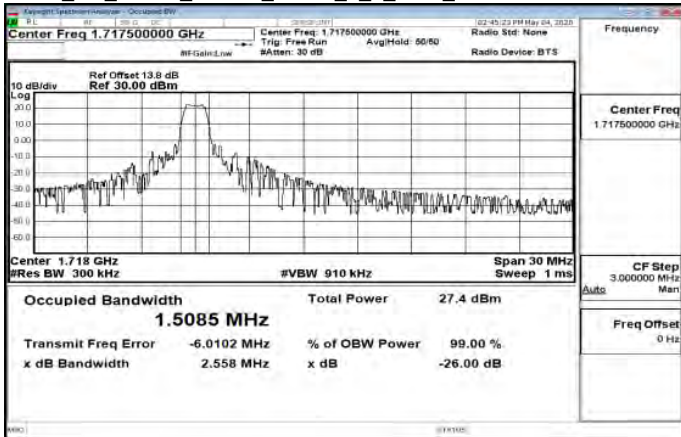


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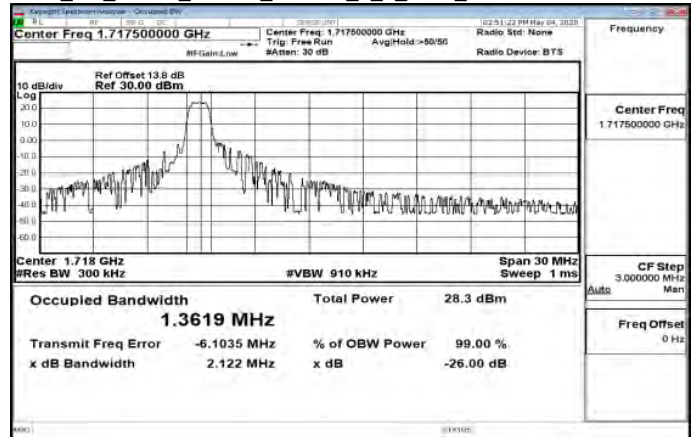
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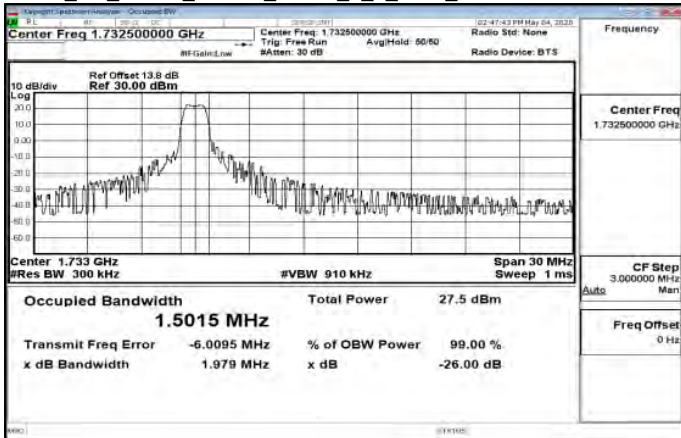
Cat\_M1\_Band4\_15MHz\_QPSK\_6\_0\_Main\_LowCH20025-1717.5



Cat\_M1\_Band4\_15MHz\_16QAM\_5\_0\_Main\_LowCH20025-1717.5



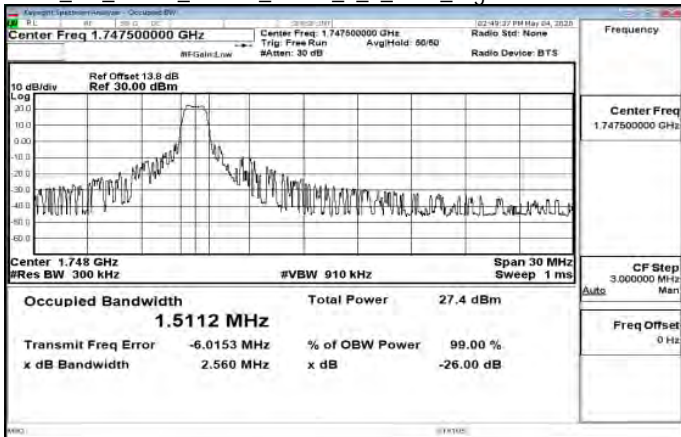
Cat\_M1\_Band4\_15MHz\_QPSK\_6\_0\_Main\_MidCH20175-1732.5



Cat\_M1\_Band4\_15MHz\_16QAM\_5\_0\_Main\_MidCH20175-1732.5



Cat\_M1\_Band4\_15MHz\_QPSK\_6\_0\_Main\_HighCH20325-1747.5



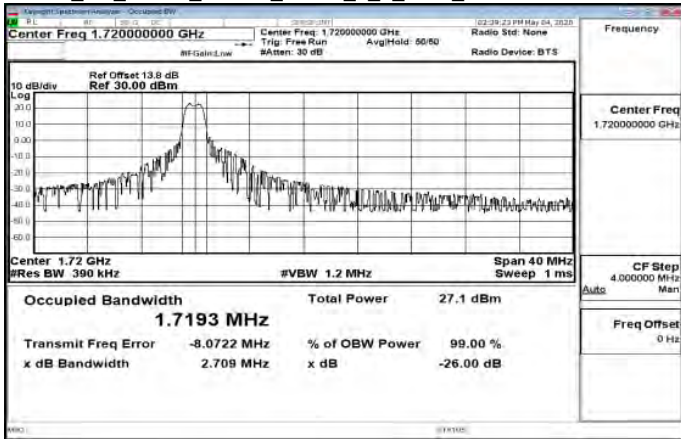
Cat\_M1\_Band4\_15MHz\_16QAM\_5\_0\_Main\_HighCH20325-1747.5



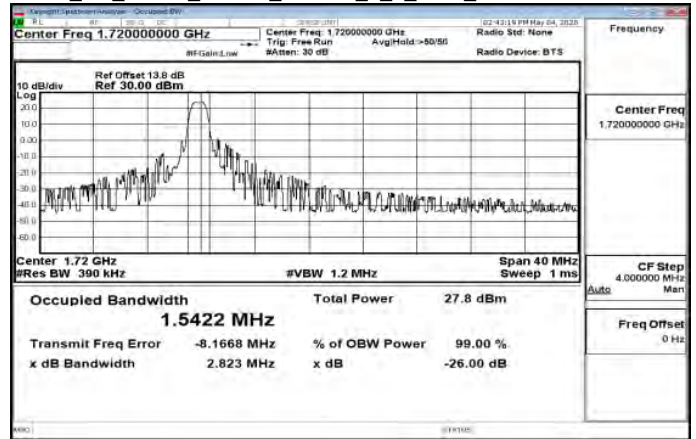
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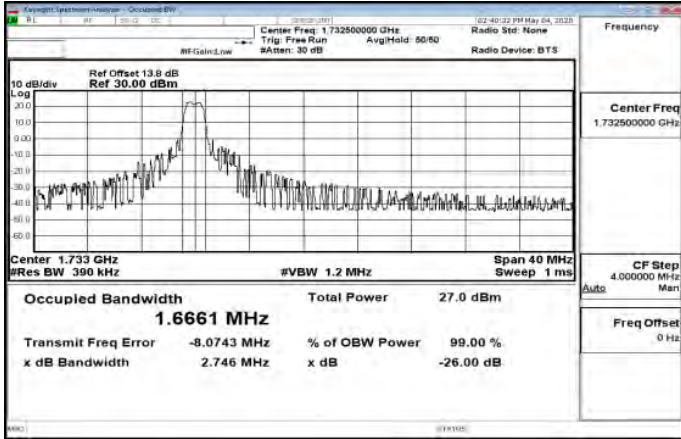
Cat\_M1\_Band4\_20MHz\_QPSK\_6\_0\_Main\_LowCH20050-1720



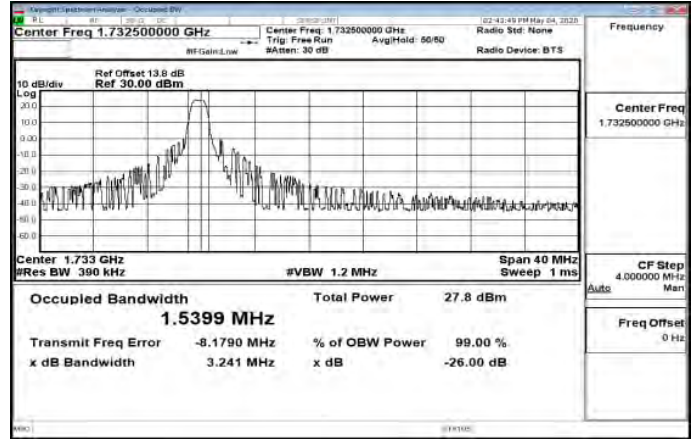
Cat\_M1\_Band4\_20MHz\_16QAM\_5\_0\_Main\_LowCH20050-1720



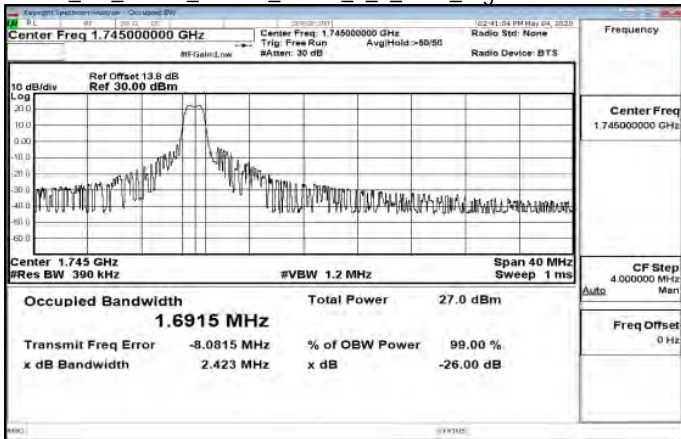
Cat\_M1\_Band4\_20MHz\_QPSK\_6\_0\_Main\_MidCH20175-1732.5



Cat\_M1\_Band4\_20MHz\_16QAM\_5\_0\_Main\_MidCH20175-1732.5



Cat\_M1\_Band4\_20MHz\_QPSK\_6\_0\_Main\_HighCH20300-1745



Cat\_M1\_Band4\_20MHz\_16QAM\_5\_0\_Main\_HighCH20300-1745



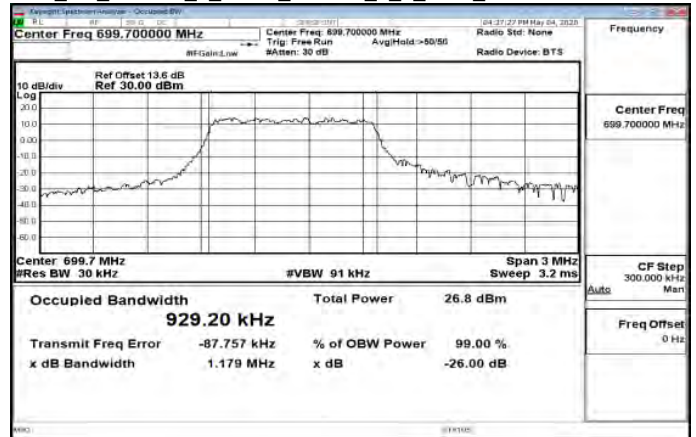
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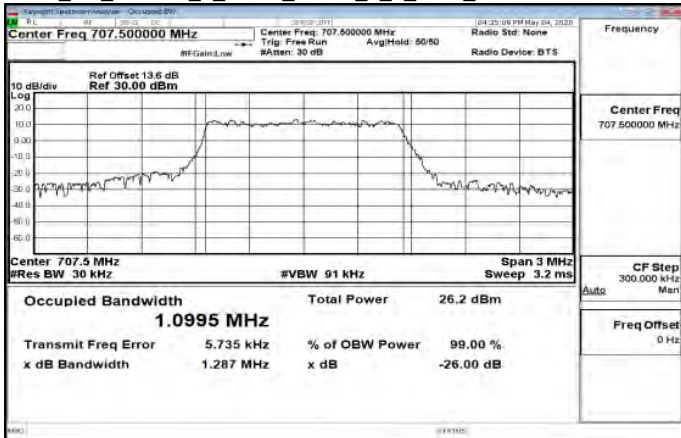
Cat\_M1\_Band12\_1\_4MHz\_QPSK\_6\_0\_Main\_LowCH23017-699.7



Cat\_M1\_Band12\_1\_4MHz\_16QAM\_5\_0\_Main\_LowCH23017-699.7



Cat\_M1\_Band12\_1\_4MHz\_QPSK\_6\_0\_Main\_MidCH23095-707.5



Cat\_M1\_Band12\_1\_4MHz\_16QAM\_5\_0\_Main\_MidCH23095-707.5



Cat\_M1\_Band12\_1\_4MHz\_QPSK\_6\_0\_Main\_HighCH23173-715.3



Cat\_M1\_Band12\_1\_4MHz\_16QAM\_5\_0\_Main\_HighCH23173-715.3



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Cat\_M1\_Band12\_3MHz\_QPSK\_6\_0\_Main\_LowCH23025-700.5



Cat\_M1\_Band12\_3MHz\_16QAM\_5\_0\_Main\_LowCH23025-700.5



Cat\_M1\_Band12\_3MHz\_QPSK\_6\_0\_Main\_MidCH23095-707.5



Cat\_M1\_Band12\_3MHz\_16QAM\_5\_0\_Main\_MidCH23095-707.5



Cat\_M1\_Band12\_3MHz\_QPSK\_6\_0\_Main\_HighCH23165-714.5



Cat\_M1\_Band12\_3MHz\_16QAM\_5\_0\_Main\_HighCH23165-714.5



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Cat\_M1\_Band12\_5MHz\_QPSK\_6\_0\_Main\_LowCH23035-701.5



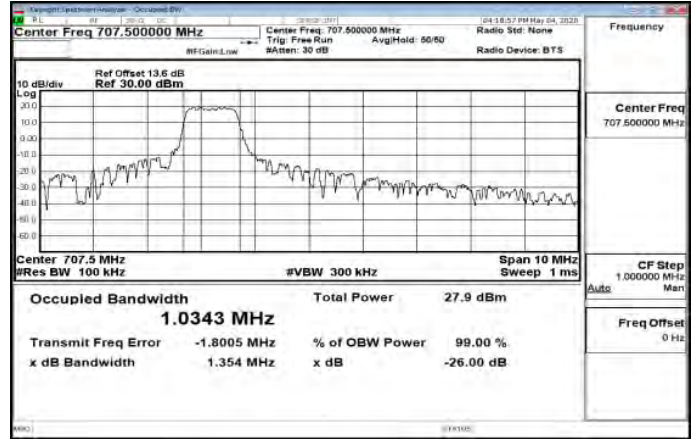
Cat\_M1\_Band12\_5MHz\_16QAM\_5\_0\_Main\_LowCH23035-701.5



Cat\_M1\_Band12\_5MHz\_QPSK\_6\_0\_Main\_MidCH23095-707.5



Cat\_M1\_Band12\_5MHz\_16QAM\_5\_0\_Main\_MidCH23095-707.5



Cat\_M1\_Band12\_5MHz\_QPSK\_6\_0\_Main\_HighCH23155-713.5



Cat\_M1\_Band12\_5MHz\_16QAM\_5\_0\_Main\_HighCH23155-713.5

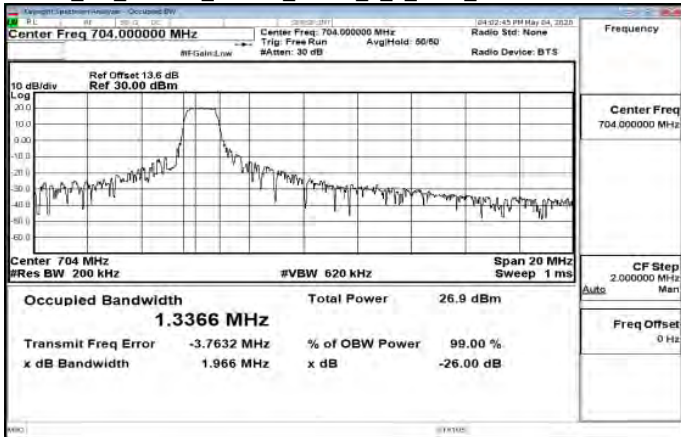


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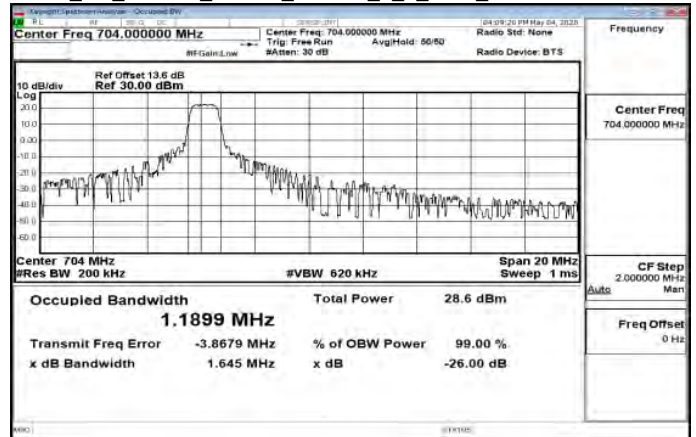
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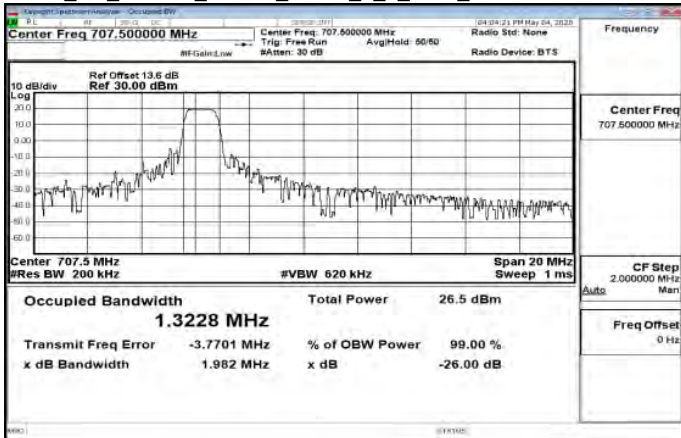
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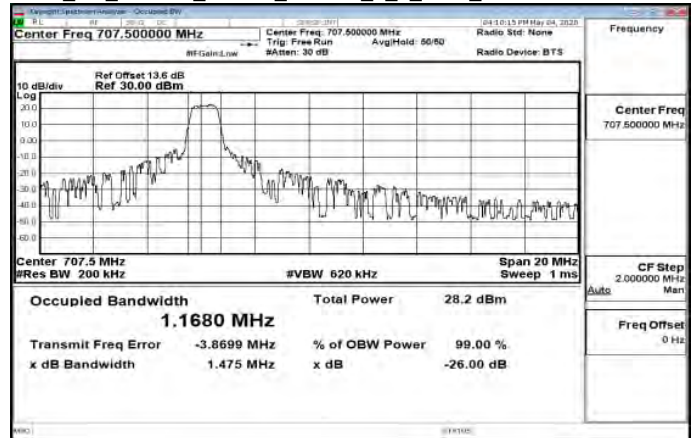
Cat\_M1\_Band12\_10MHz\_16QAM\_5\_0\_Main\_LowCH23060-704



Cat\_M1\_Band12\_10MHz\_QPSK\_6\_0\_Main\_MidCH23095-707.5



Cat\_M1\_Band12\_10MHz\_16QAM\_5\_0\_Main\_MidCH23095-707.5



Cat\_M1\_Band12\_10MHz\_QPSK\_6\_0\_Main\_HighCH23130-711



Cat\_M1\_Band12\_10MHz\_16QAM\_5\_0\_Main\_HighCH23130-711

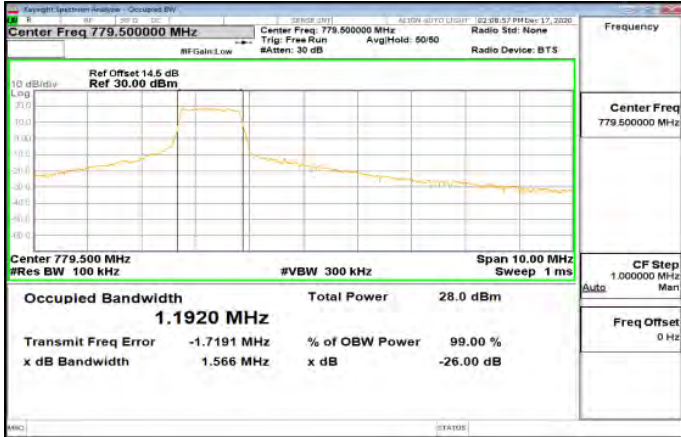


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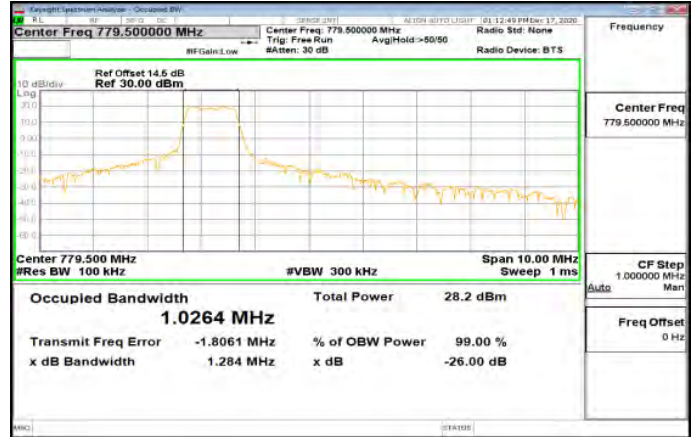
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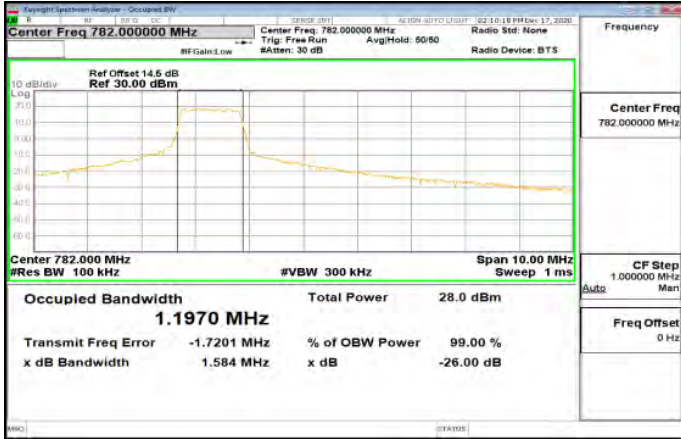
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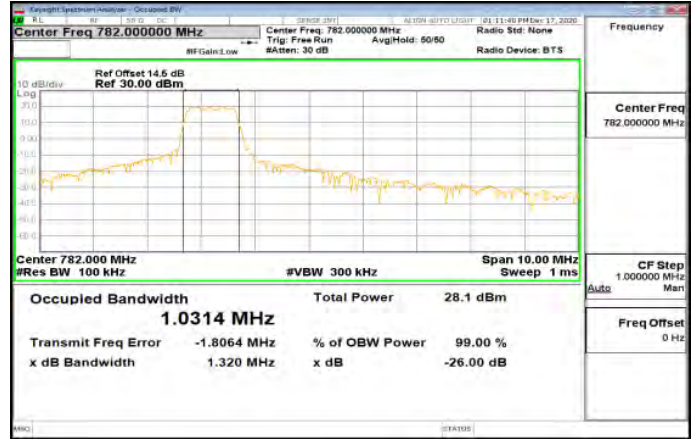
Cat\_M1\_Band13\_5MHz\_index\_0\_16QAM\_5\_0\_Main\_LowCH23205-779.5



Cat\_M1\_Band13\_5MHz\_index\_0\_QPSK\_6\_0\_Main\_MidCH23230-782



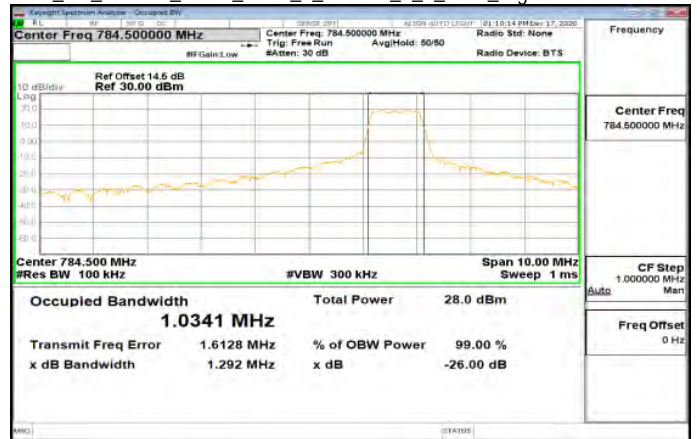
Cat\_M1\_Band13\_5MHz\_index\_0\_16QAM\_5\_0\_Main\_MidCH23230-782



Cat\_M1\_Band13\_5MHz\_index\_3\_QPSK\_6\_0\_Main\_HighCH23255-784.5



Cat\_M1\_Band13\_5MHz\_index\_3\_16QAM\_5\_0\_Main\_HighCH23255-784.5

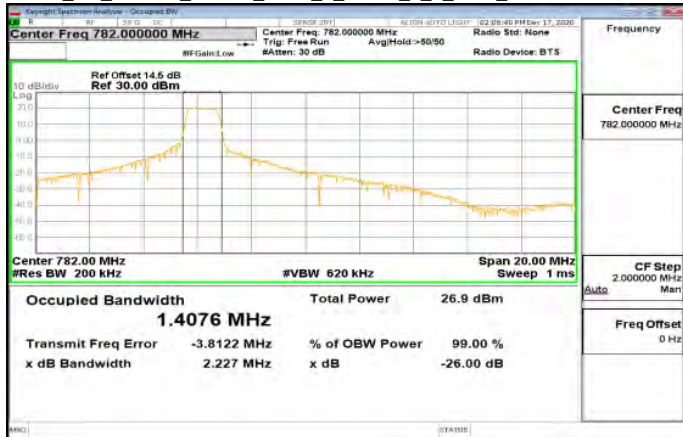


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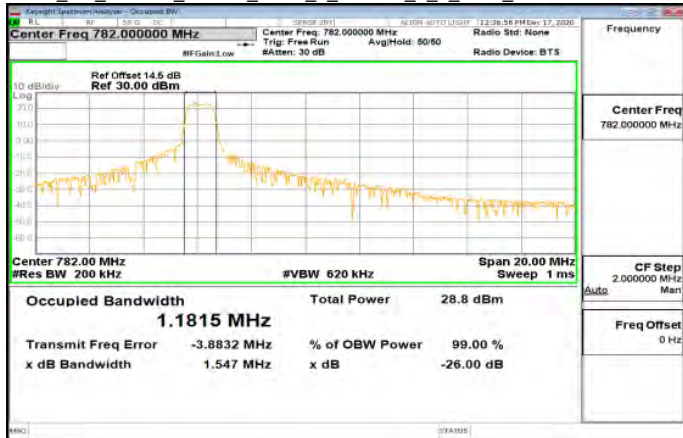
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Cat\_M1\_Band13\_10MHz\_index\_0\_QPSK\_6\_0\_Main\_MidCH23230-782



Cat\_M1\_Band13\_10MHz\_index\_0\_16QAM\_5\_0\_Main\_MidCH23230-782



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## 8 OUT OF BAND EMISSION AT ANTENNA TERMINALS

### 8.1 Standard Applicable

#### FCC §22.917(a), §24.238(a), §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(c) for B13

For operations in the 746–758 MHz band and the 776–788 MHz band, the power of any emission outside the licensee’s frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(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 (-13dBm)

(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;

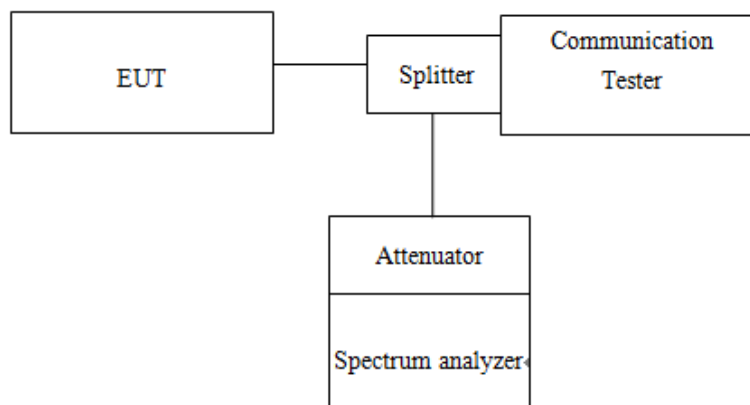
#### FCC §27.53(c) (5) & FCC §27.53(g) for B12, 13

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.

#### FCC §27.53(h)(3) for B4

Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee’s frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

### 8.2 Test SET-UP



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### 8.3 Measurement Procedure

#### 8.3.1 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.

#### 8.3.2 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.

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#### 8.4 Measurement Equipment Used

Conducted Emission (measured at antenna port) Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
DC Block	PASTERNAK	PE8210	RF32	11/20/2019	11/19/2020
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	07/15/2019	07/14/2020
DC Power Supply	Agilent	E3640A	MY53140006	05/31/2019	05/30/2020
Splitter	Woken	DOM35LW1A2	RF36	11/20/2019	11/19/2020
Attenuator	Marvelous	MVE2213-10	RF31	11/20/2019	11/19/2020
Radio Communication Analyzer	Anritsu	MT8821C	6261786084	01/18/2020	01/17/2021

#### Add Cat M1 Band 13

Conducted Emission (measured at antenna port) Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54200716	04/01/2020	03/31/2021
Radio Communication Analyzer	Anritsu	MT8821C	6261786084	01/18/2020	01/17/2021
DC Power Supply	Agilent	E3640A	MY40000811	12/23/2019	12/22/2020
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2020	01/01/2021
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2020	01/01/2021
Splitter	RF-LAMBAD	RFLT2W1G18G	11-JSPF412-017	01/02/2020	01/01/2021

#### 8.5 Measurement Result:

Refer to next pages.

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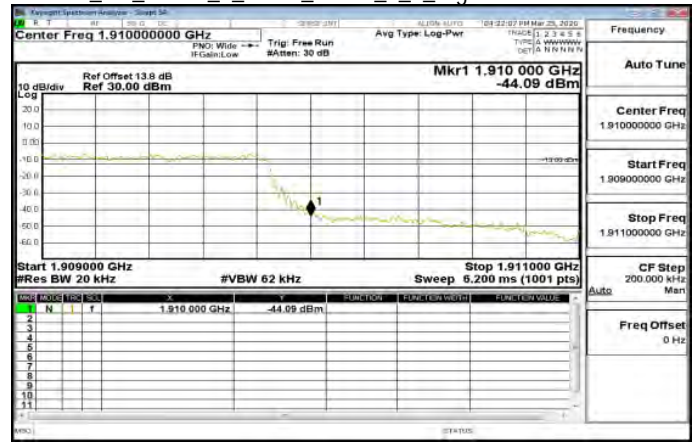
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### 8.5.1 Bandedge

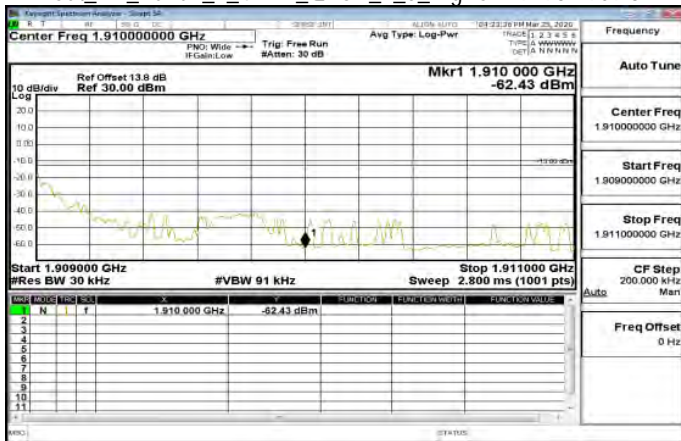
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Cat\_M1\_Band2\_1\_4MHz\_QPSK\_6\_0\_HighCH19193-1909.3



Cat\_M1\_Band2\_1\_4MHz\_QPSK\_1\_0\_HighCH19193-1909.3



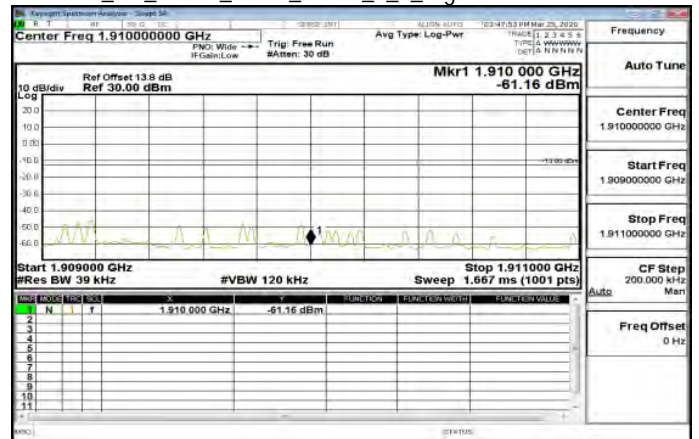
Cat\_M1\_Band2\_3MHz\_QPSK\_1\_0\_LowCH18615-1851.5



Cat\_M1\_Band2\_1\_4MHz\_QPSK\_6\_0\_LowCH18607-1850.7



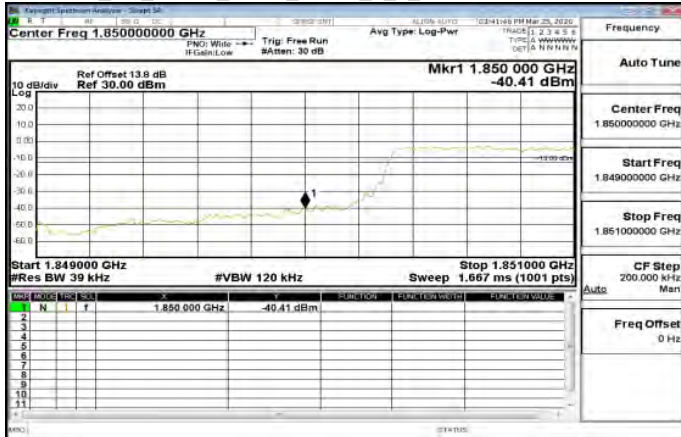
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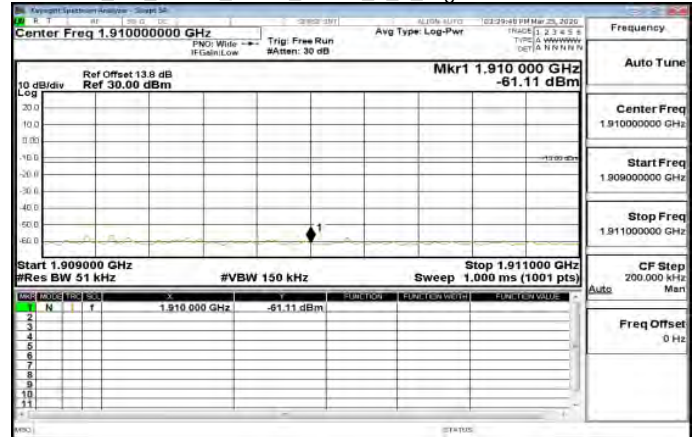
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Cat\_M1\_Band2\_3MHz\_QPSK\_6\_0\_LowCH18615-1851.5



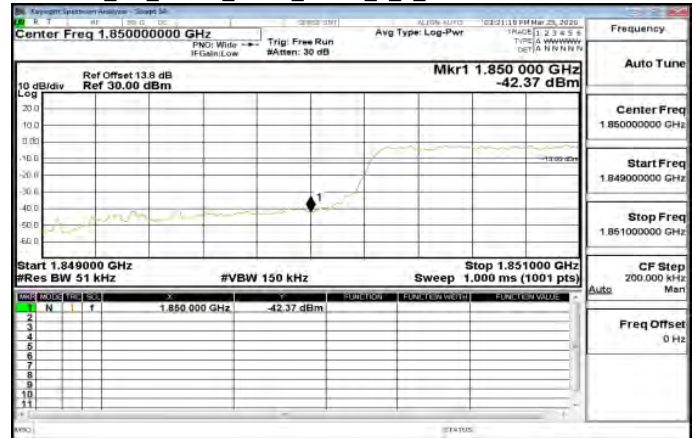
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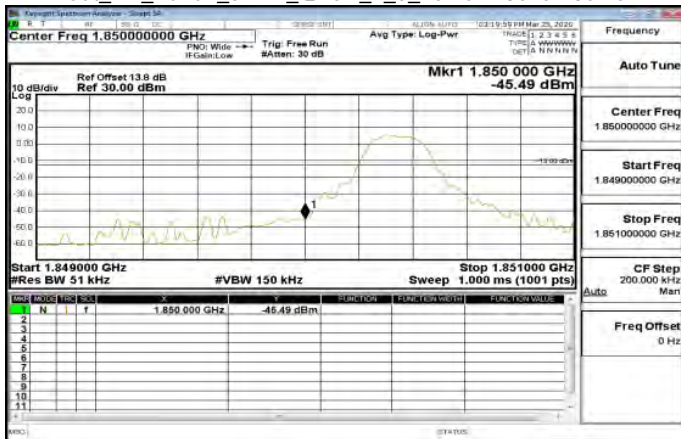
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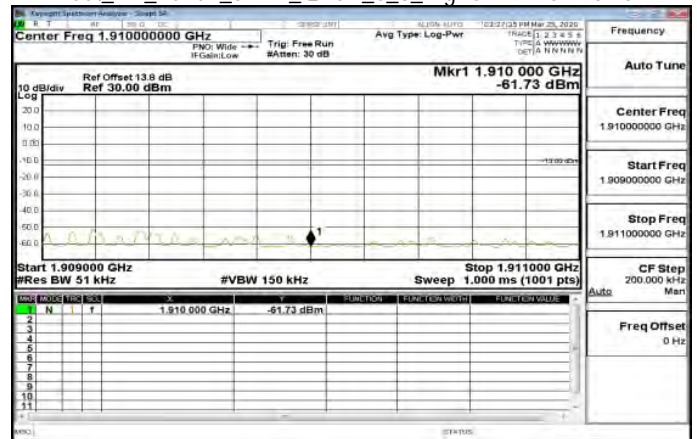
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Cat\_M1\_Band2\_5MHz\_QPSK\_6\_0\_HighCH19175-1907.5

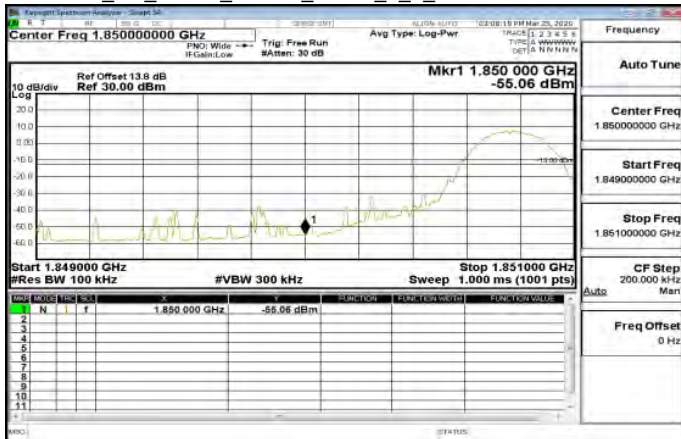


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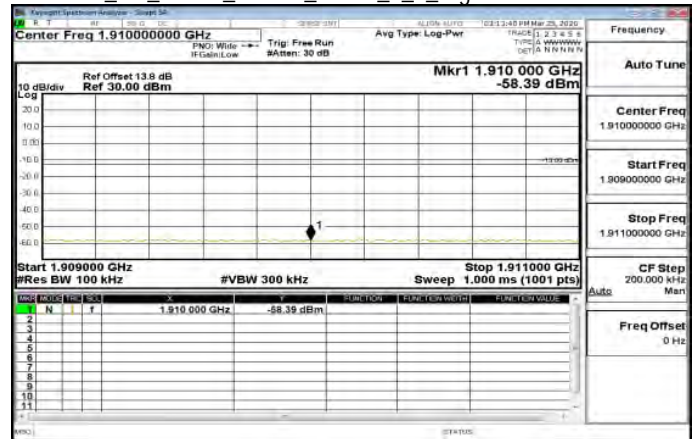
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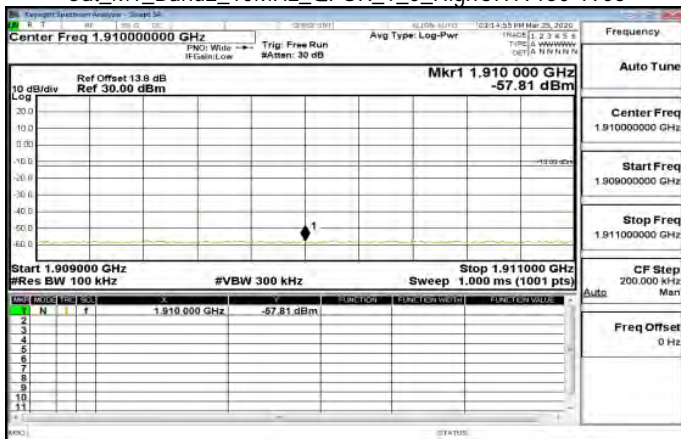
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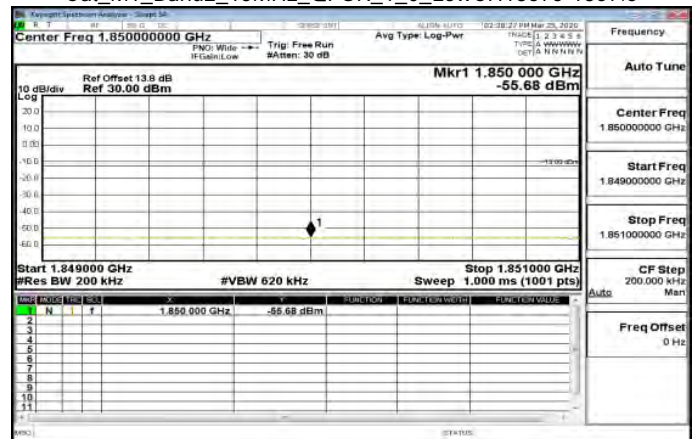
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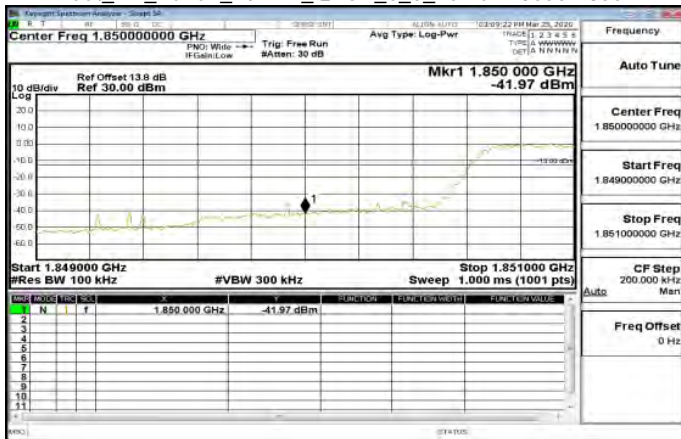
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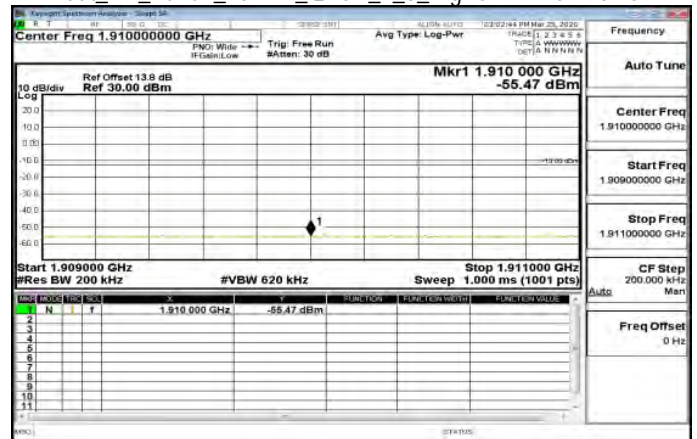
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Cat\_M1\_Band2\_10MHz\_QPSK\_6\_0\_LowCH18650-1855



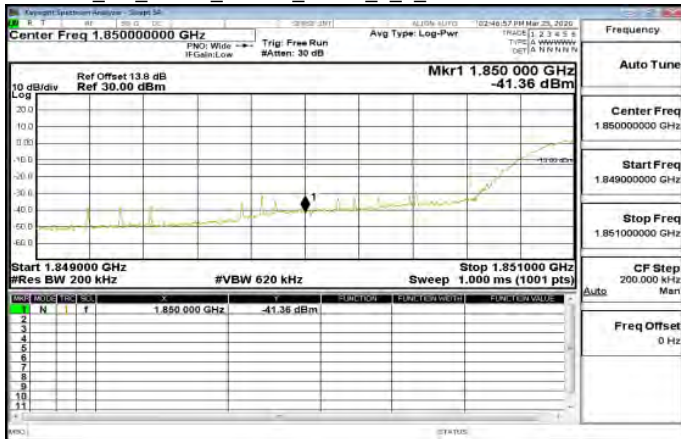
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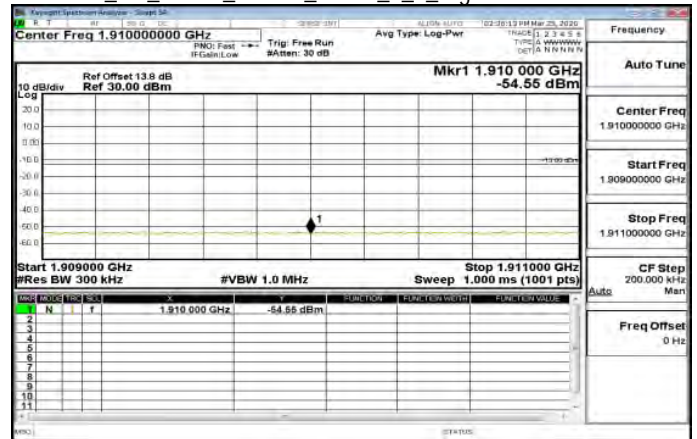
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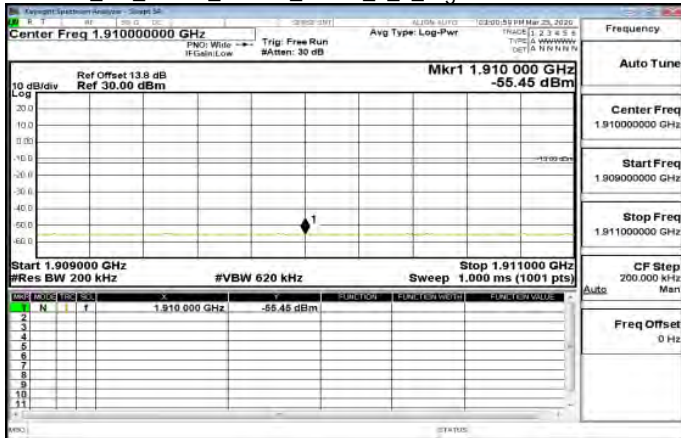
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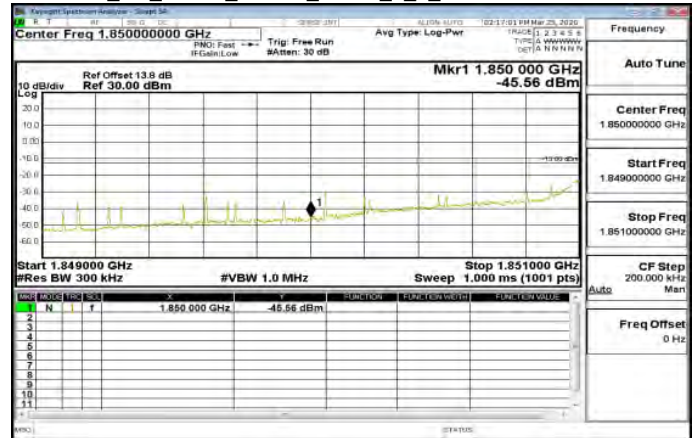
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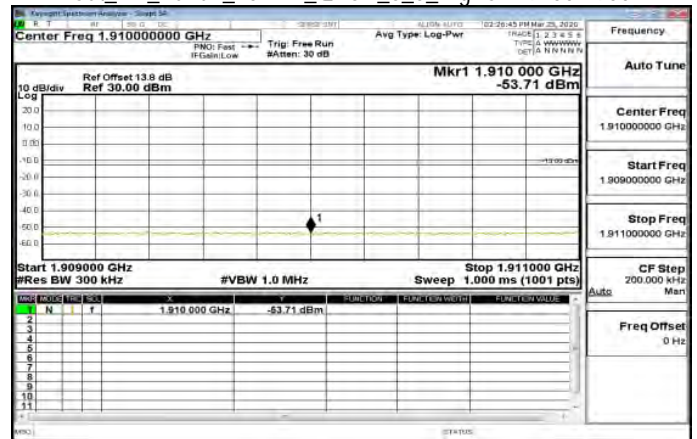
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Cat\_M1\_Band2\_20MHz\_QPSK\_1\_0\_LowCH18700-1860



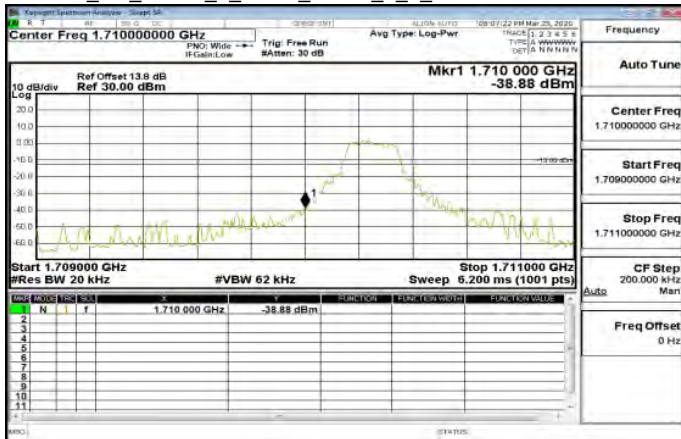
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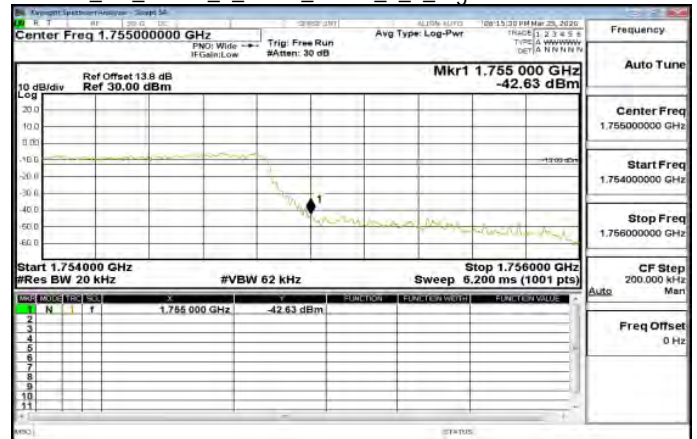
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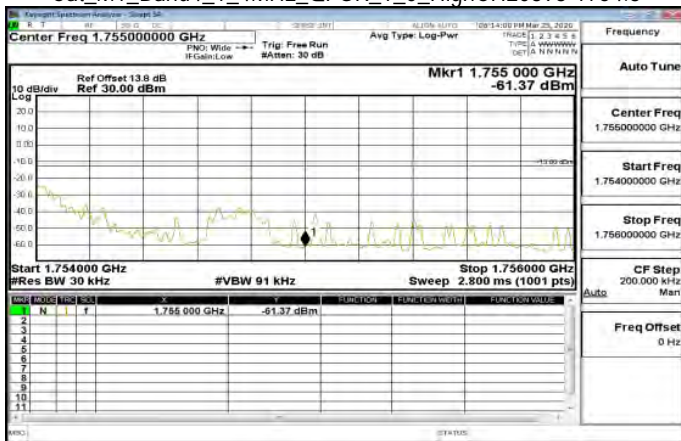
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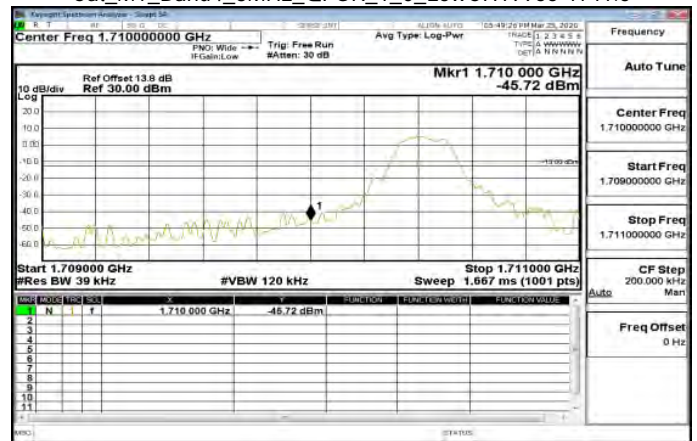
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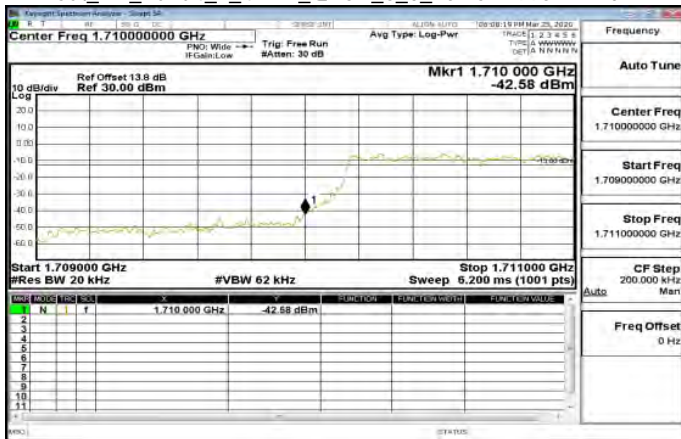
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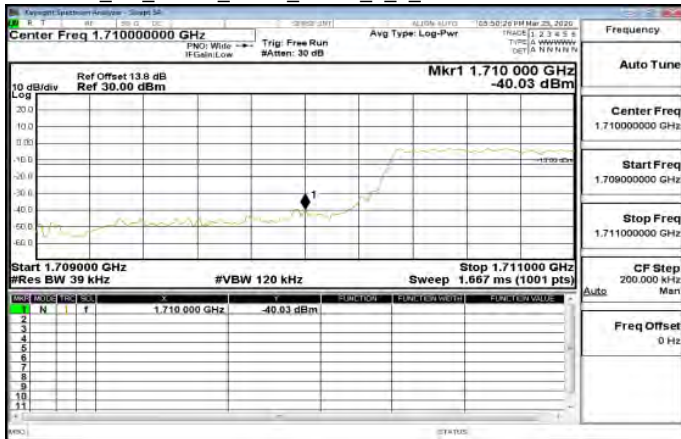
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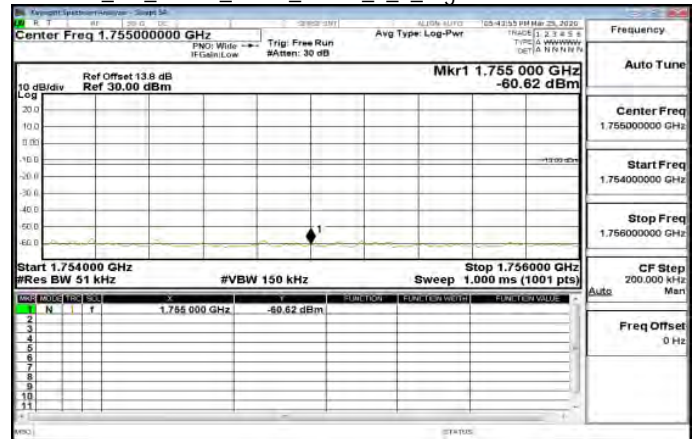
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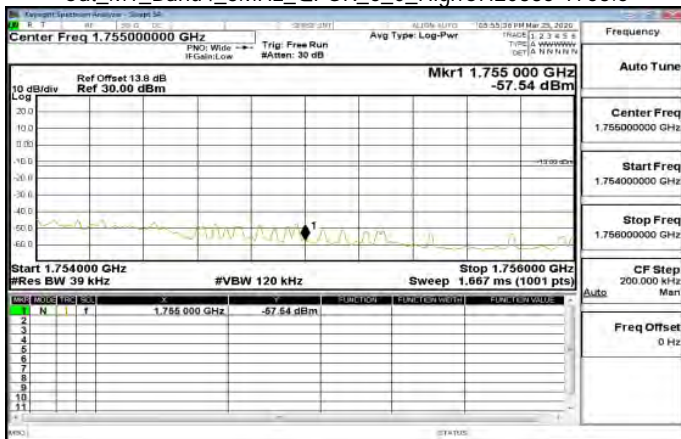
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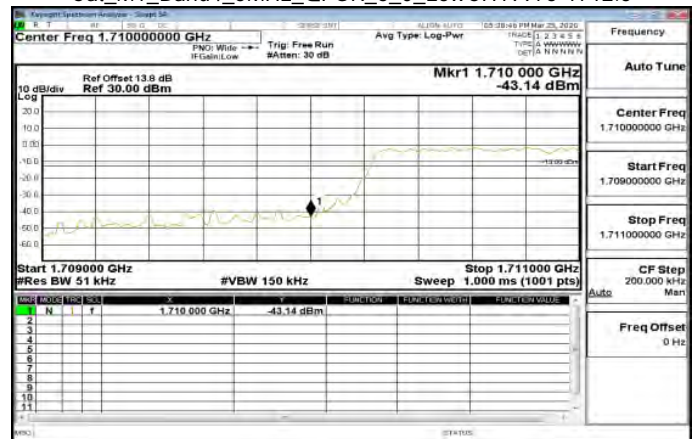
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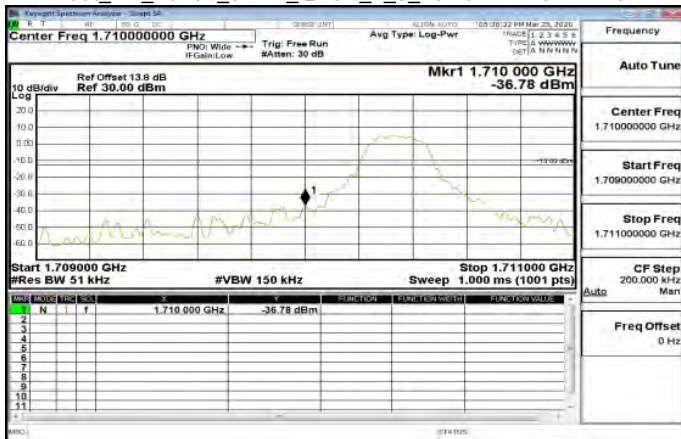
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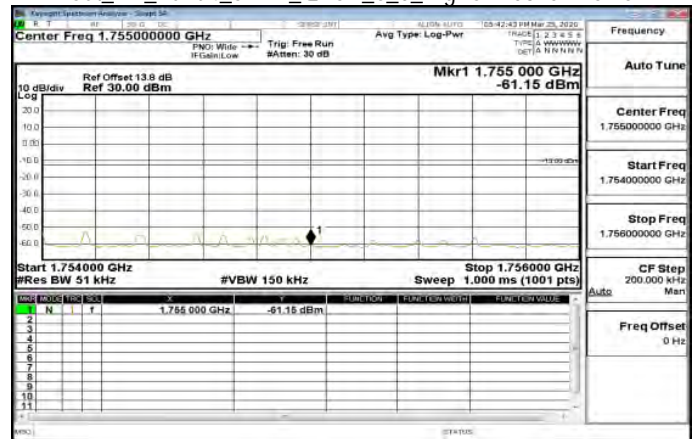
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Cat\_M1\_Band4\_5MHz\_QPSK\_6\_0\_HighCH20375-1752.5



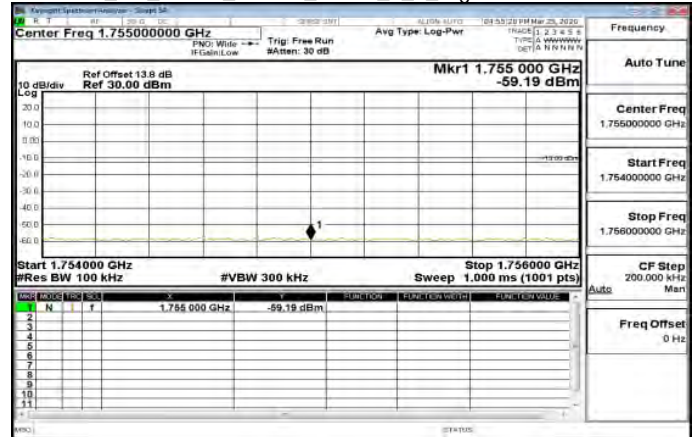
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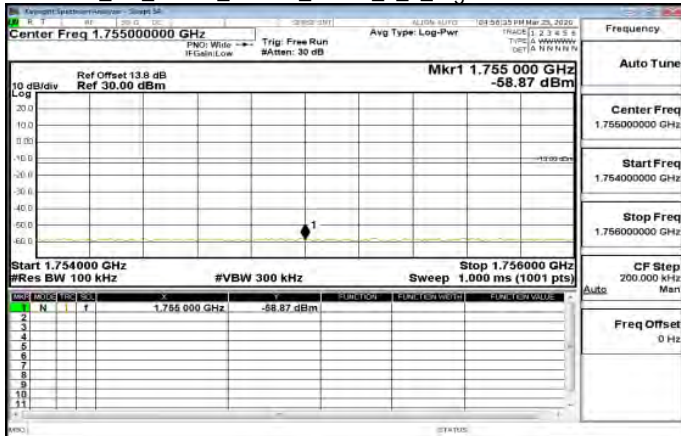
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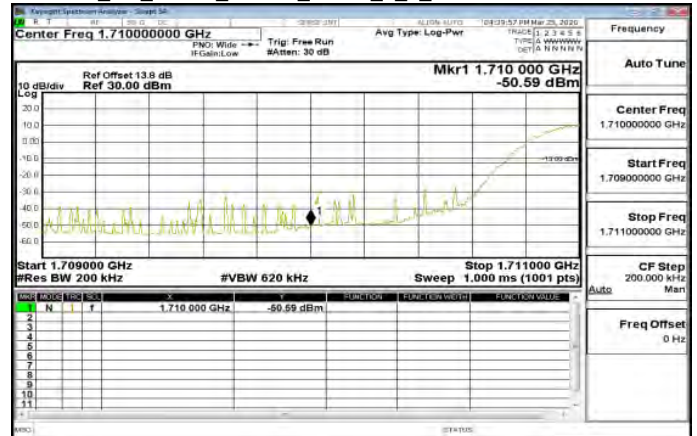
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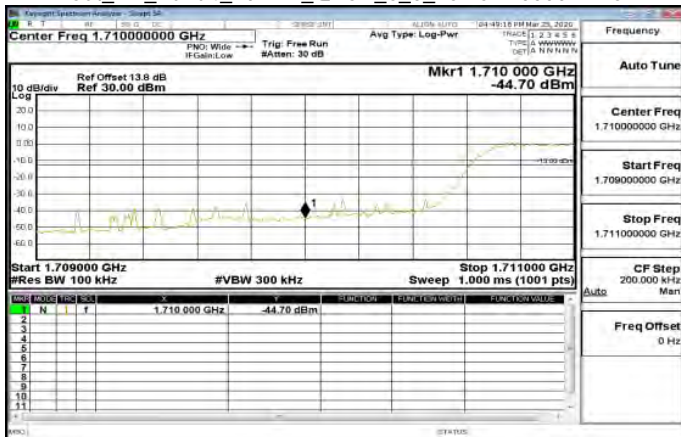
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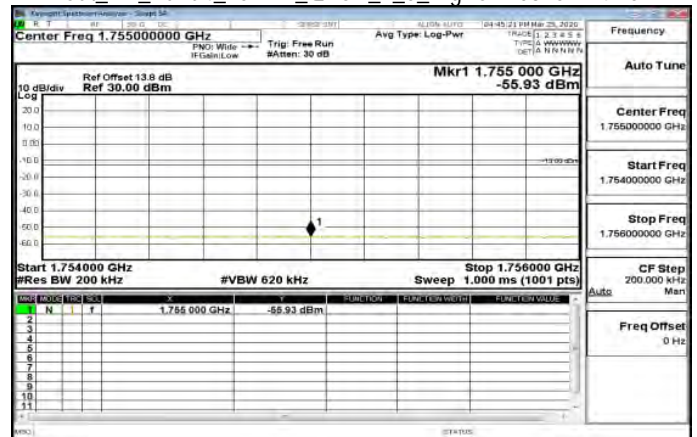
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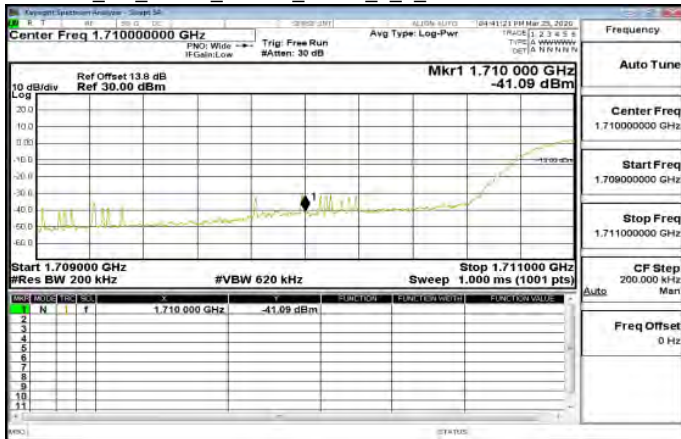
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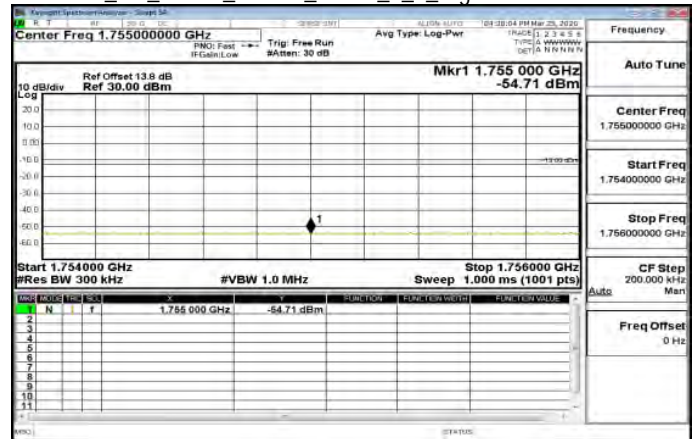
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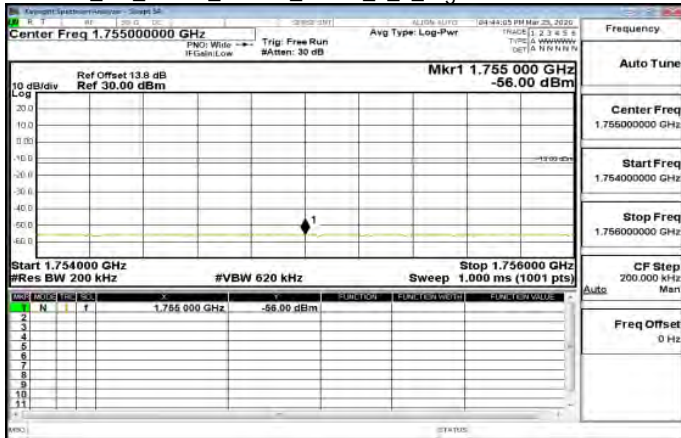
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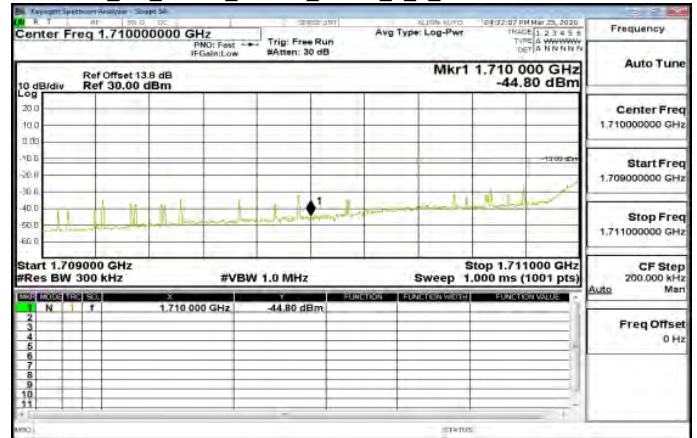
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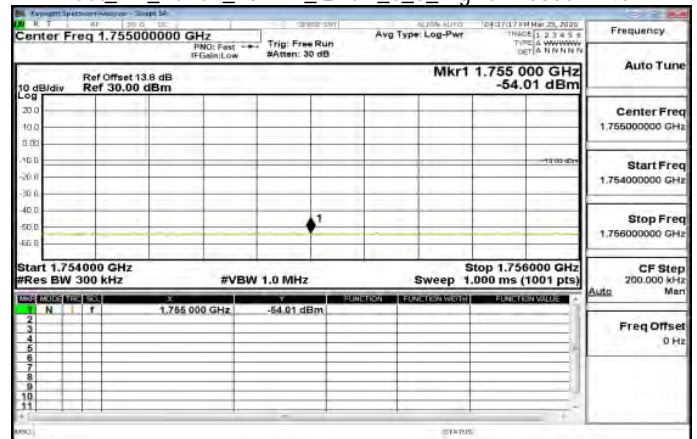
Cat\_M1\_Band4\_20MHz\_QPSK\_6\_0\_LowCH20050-1720



Cat\_M1\_Band4\_20MHz\_QPSK\_1\_0\_LowCH20050-1720



Cat\_M1\_Band4\_20MHz\_QPSK\_6\_0\_HighCH20300-1745



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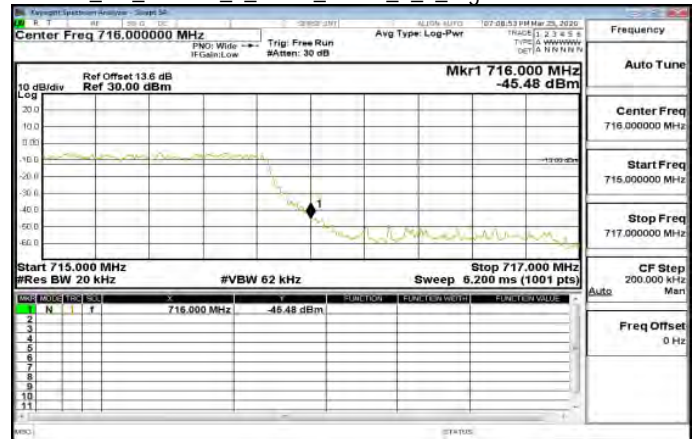
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Cat\_M1\_Band12\_1\_4MHz\_QPSK\_1\_0\_LowCH23017-699.7



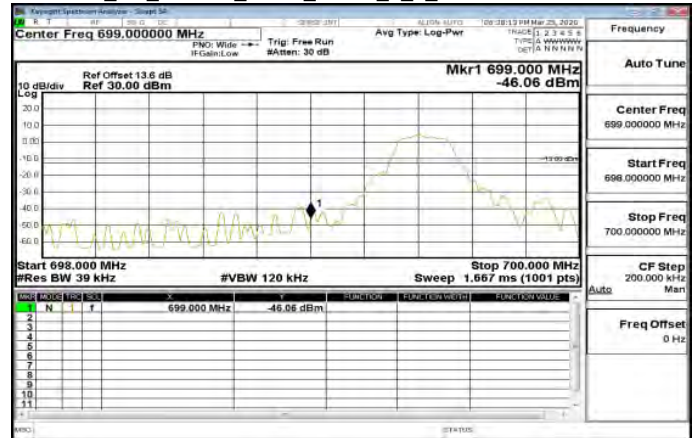
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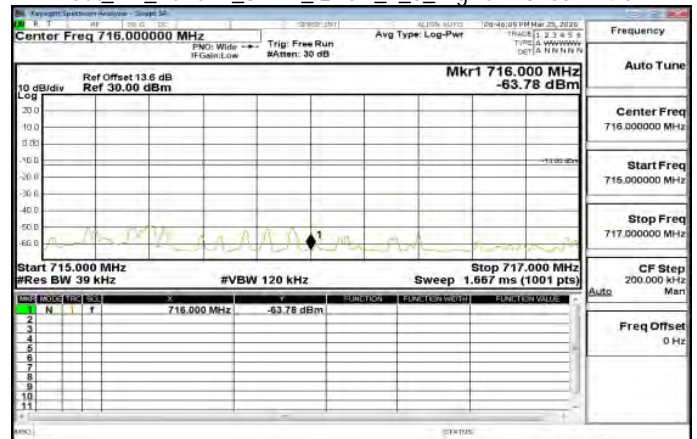
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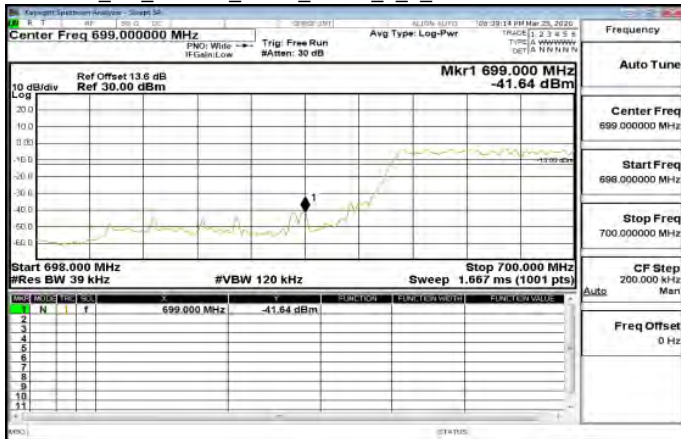
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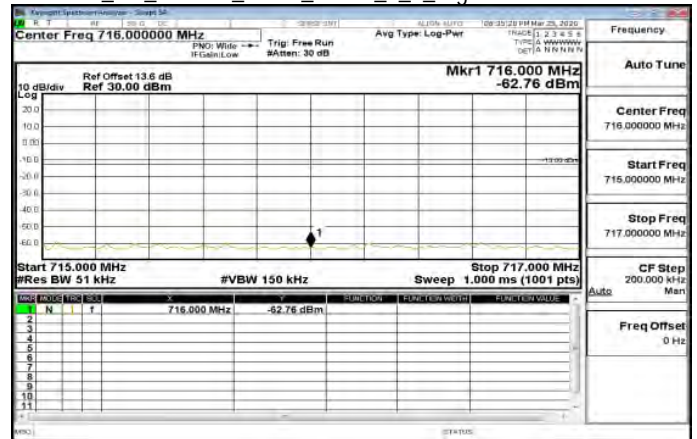
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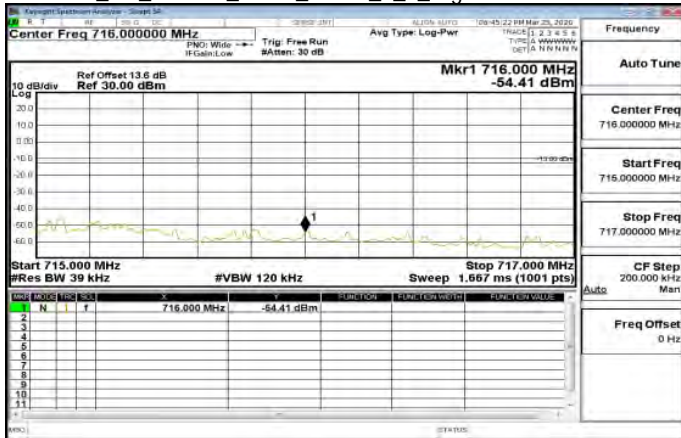
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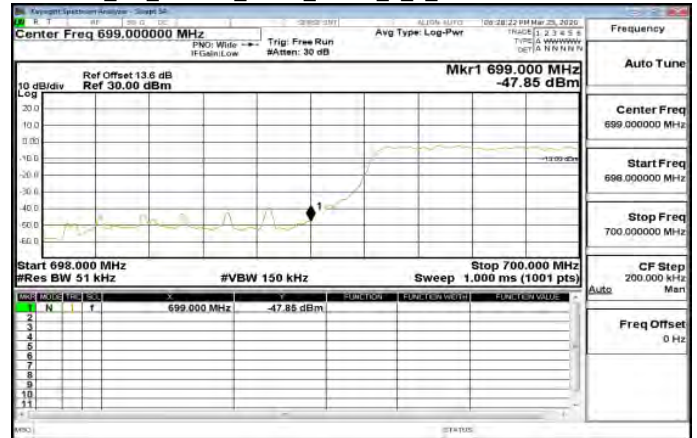
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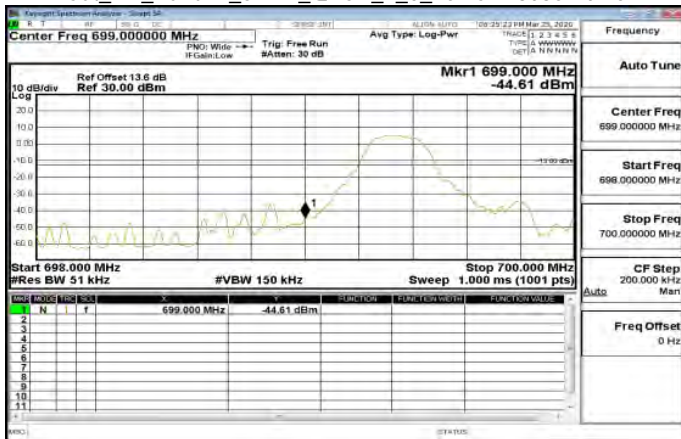
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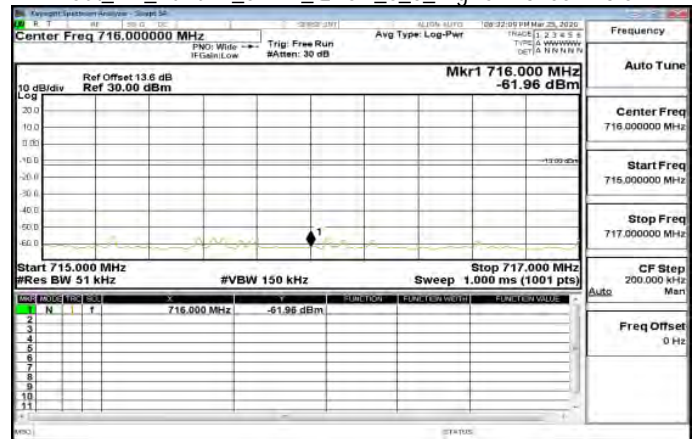
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Cat\_M1\_Band12\_5MHz\_QPSK\_6\_0\_HighCH23155-713.5

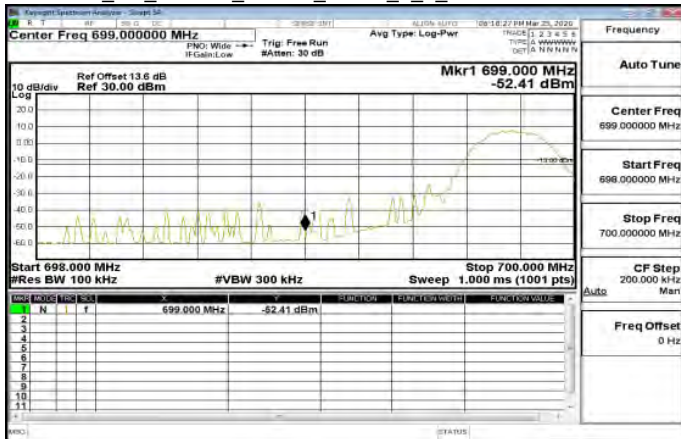


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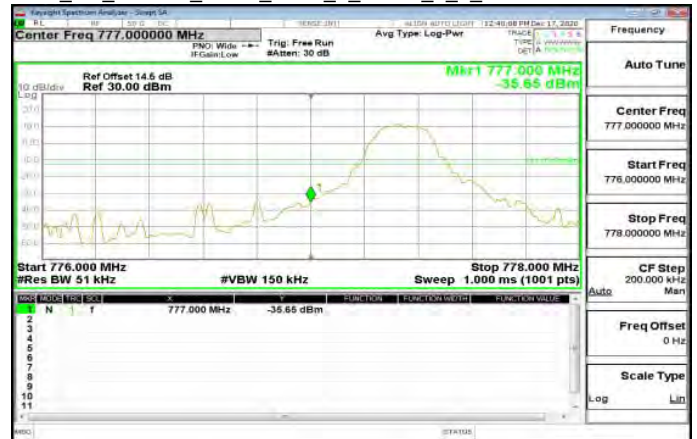
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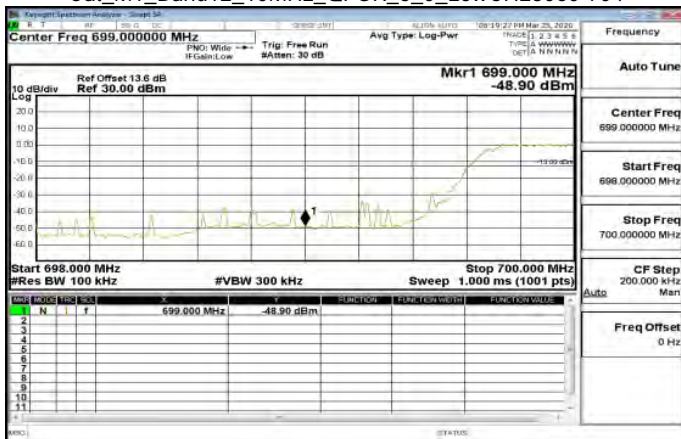
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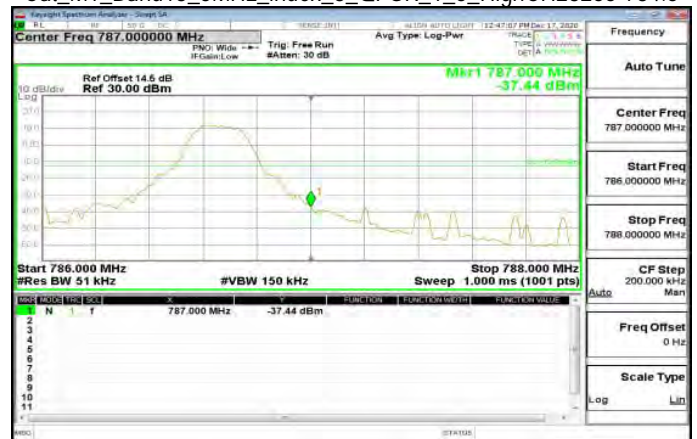
Cat\_M1\_Band13\_5MHz\_index\_0\_QPSK\_1\_0\_LowCH23205-779.5



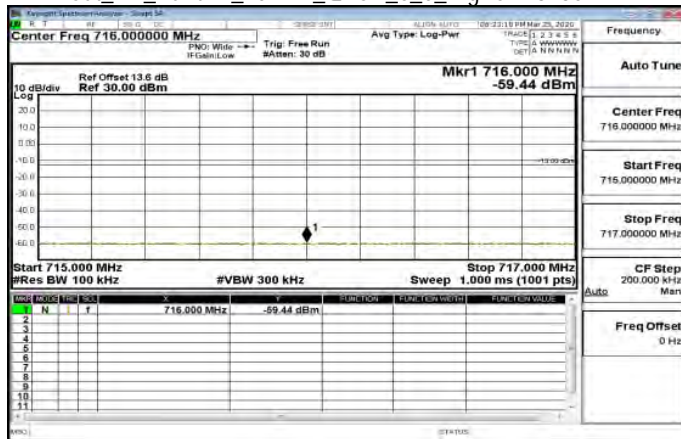
Cat\_M1\_Band12\_10MHz\_QPSK\_6\_0\_LowCH23060-704



Cat\_M1\_Band13\_5MHz\_index\_3\_QPSK\_1\_5\_HighCH23255-784.5



Cat\_M1\_Band12\_10MHz\_QPSK\_6\_0\_HighCH23130-711



Cat\_M1\_Band13\_5MHz\_index\_0\_QPSK\_6\_0\_LowCH23205-779.5



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Cat\_M1\_Band13\_5MHz\_index\_3\_QPSK\_6\_0\_HighCH23255-784.5



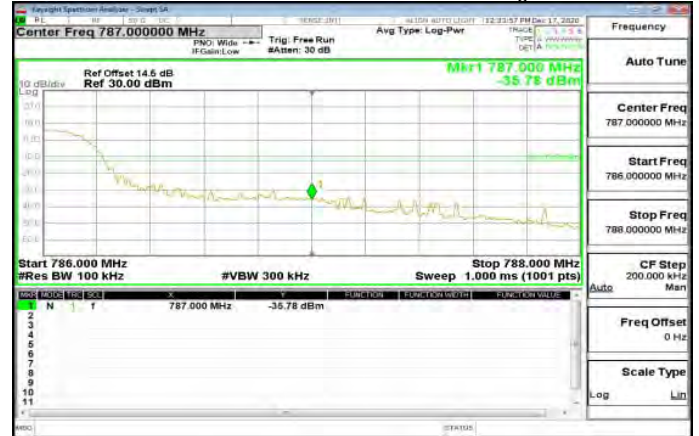
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Cat\_M1\_Band13\_10MHz\_index\_0\_QPSK\_1\_0\_LowCH23230-782



Cat\_M1\_Band13\_10MHz\_index\_7\_QPSK\_6\_0\_HighCH23230-782



Cat\_M1\_Band13\_10MHz\_index\_7\_QPSK\_1\_5\_HighCH23230-782



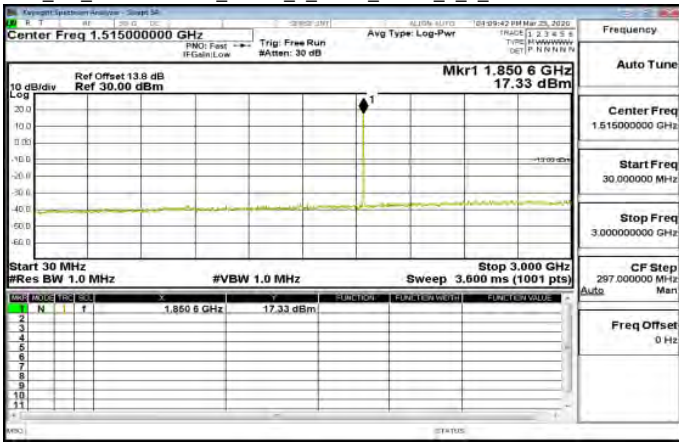
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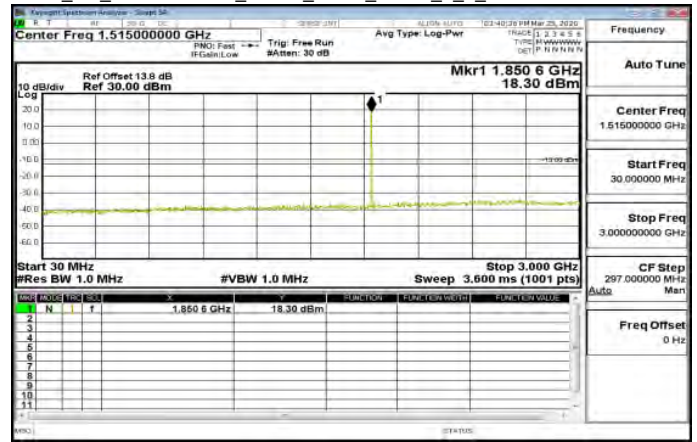
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### 8.5.2 Spurious Emission

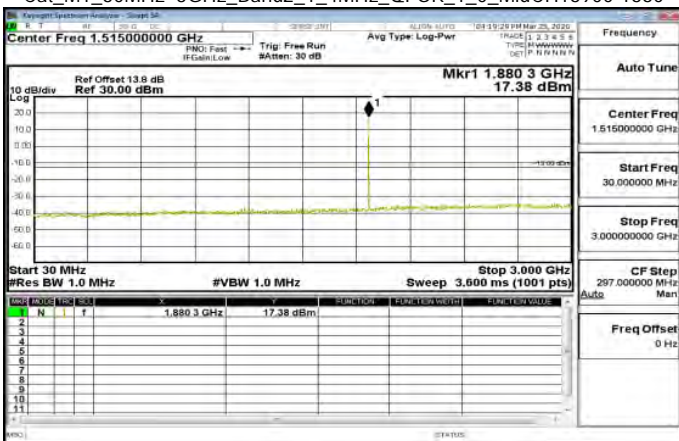
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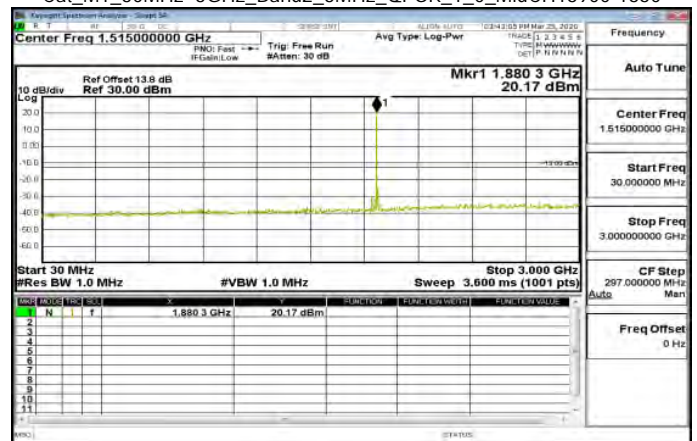
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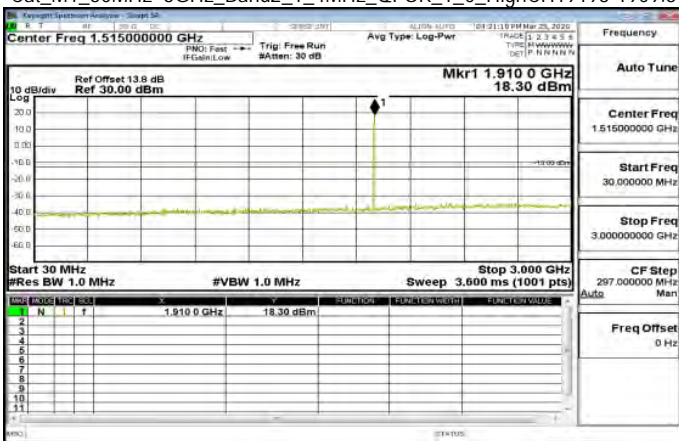
Cat\_M1\_30MHz-3GHz\_Band2\_1\_4MHz\_QPSK\_1\_0\_MidCH18900-1880



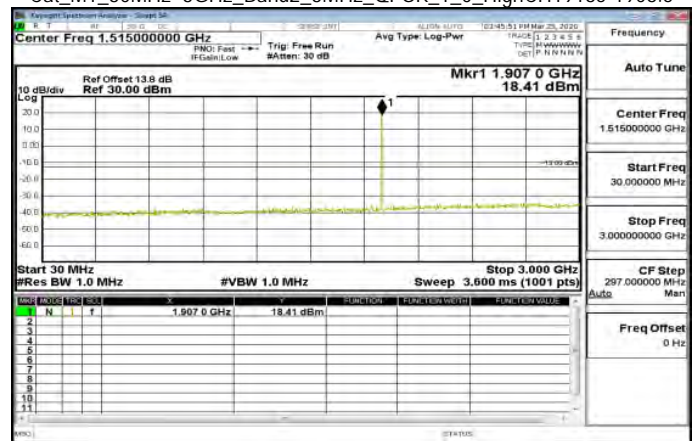
Cat\_M1\_30MHz-3GHz\_Band2\_3MHz\_QPSK\_1\_0\_MidCH18900-1880



Cat\_M1\_30MHz-3GHz\_Band2\_1\_4MHz\_QPSK\_1\_0\_HighCH19193-1909.3



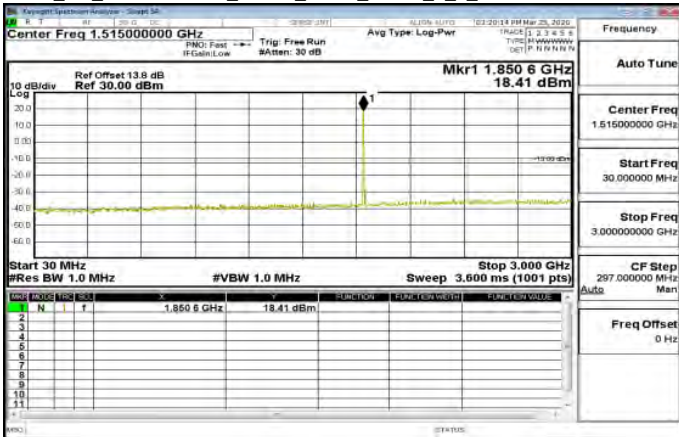
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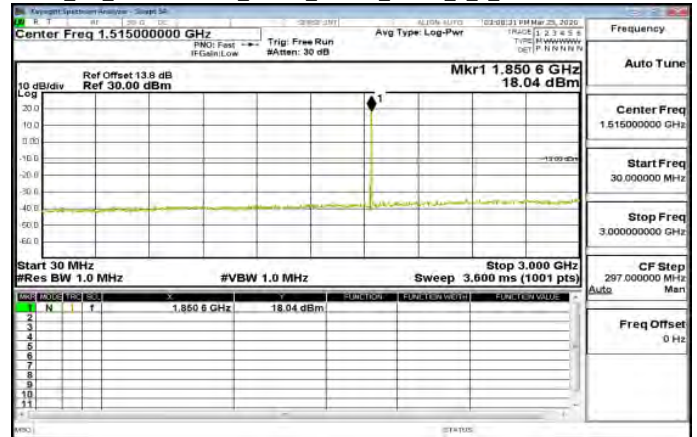
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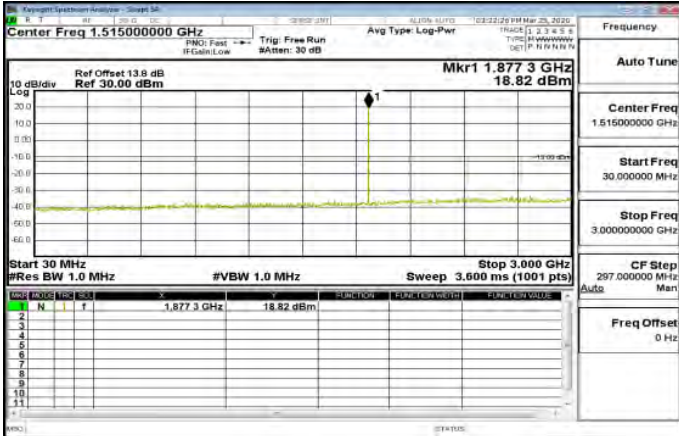
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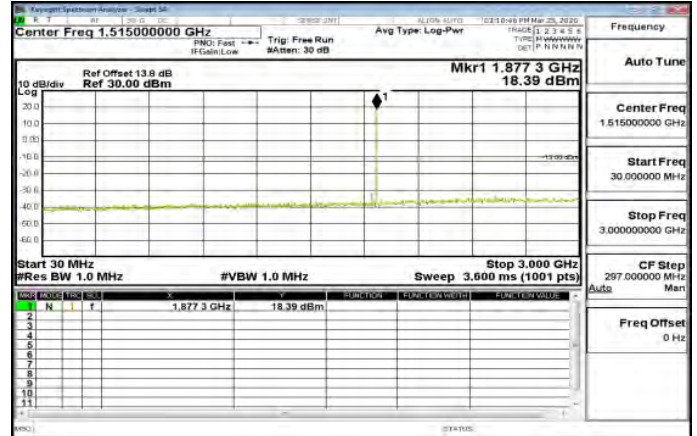
Cat\_M1\_30MHz-3GHz\_Band2\_10MHz\_QPSK\_1\_0\_LowCH18650-1855



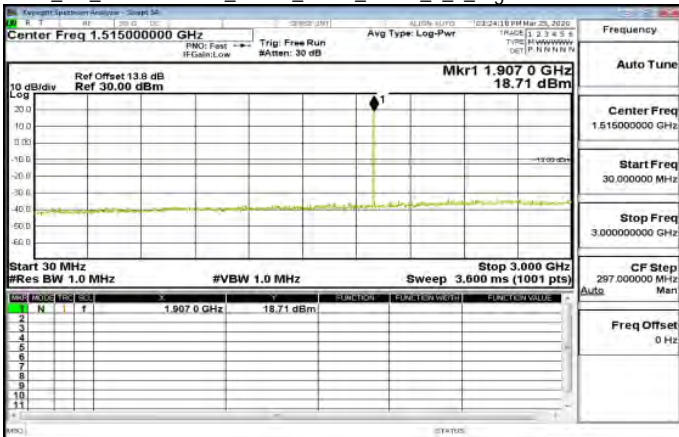
Cat\_M1\_30MHz-3GHz\_Band2\_5MHz\_QPSK\_1\_0\_MidCH18900-1880



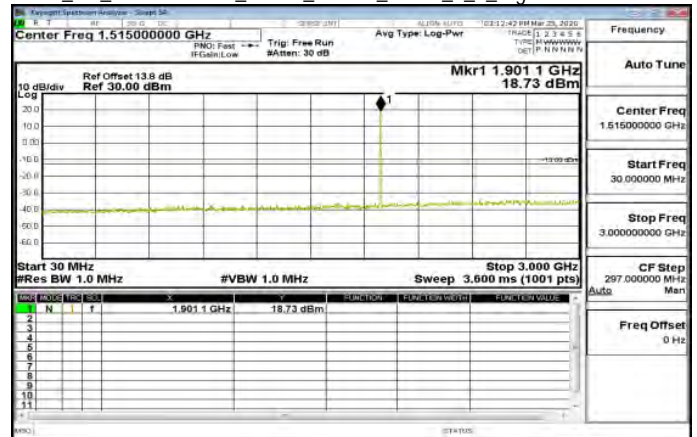
Cat\_M1\_30MHz-3GHz\_Band2\_10MHz\_QPSK\_1\_0\_MidCH18900-1880



Cat\_M1\_30MHz-3GHz\_Band2\_5MHz\_QPSK\_1\_0\_HighCH19175-1907.5



Cat\_M1\_30MHz-3GHz\_Band2\_10MHz\_QPSK\_1\_0\_HighCH19150-1905



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