

TEST REPORT

CERTIFICATE OF CONFORMITY

Standard: 47 CFR FCC Part 22
47 CFR FCC Part 24
47 CFR FCC Part 27
47 CFR FCC Part 2

Report No.: RFBDWM-WTW-P24050507-2

FCC ID: 2AUWW-HALOWA2

Product: Halo Collar 4

Brand: Halo

Model No.: Halo 4

Received Date: 2024/5/26

Test Date: 2024/7/2 ~ 2024/7/26

Issued Date: 2024/8/20

Applicant: Protecct Animals with Satellites, LLC

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2024/8/20

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Prepared by : Vera Huang / Specialist



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Release Control Record

Issue No.	Description	Date Issued
RFBDWM-WTW-P24050507-2	Original Release	2024/8/20

1 Certificate

Product: Halo Collar 4

Brand: Halo

Test Model: Halo 4

Sample Status: Engineering sample

Applicant: Protecct Animals with Satellites, LLC

Test Date: 2024/7/2 ~ 2024/7/26

Standard: 47 CFR FCC Part 22
47 CFR FCC Part 24
47 CFR FCC Part 27
47 CFR FCC Part 2

Measurement ANSI/TIA/EIA-603-E 2016

procedure: ANSI C63.26-2015

KDB 971168 D01 Power Meas License Digital Systems v03r01

KDB 971168 D02 Misc Rev Approv License Devices v02r02

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

2 Summary of Test Results

47 CFR FCC Part 22 47 CFR FCC Part 24 47 CFR FCC Part 27 47 CFR FCC Part 2			
Standard / Clause	Test Item	Result	Remark
FCC 47 CFR Part 2.1046 FCC 47 CFR Part 22.913 (a) FCC 47 CFR Part 24.232 (c) FCC 47 CFR Part 27.50(d) FCC 47 CFR Part 27.50(c) FCC 47 CFR Part 27.50(b)	Effective Radiated Power and Equivalent Isotropically Radiated Power	Pass	Meet the requirement of limit.
FCC 47 CFR Part 2.1047	Modulation Characteristics	Pass	Meet the requirement of limit.
FCC 47 CFR Part 22.913 (d) FCC 47 CFR Part 24.232 (d) FCC 47 CFR Part 27.50(d)	Peak to Average Ratio	Pass	Meet the requirement of limit.
FCC 47 CFR Part 2.1049	Bandwidth	Pass	Meet the requirement of limit.
FCC 47 CFR Part 2.1051 FCC 47 CFR Part 22.917 FCC 47 CFR Part 24.238 FCC 47 CFR Part 27.53(h) FCC 47 CFR Part 27.53(g) FCC 47 CFR Part 27.53(c)(f)	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
FCC 47 CFR Part 2.1053 FCC 47 CFR Part 22.917 FCC 47 CFR Part 24.238 FCC 47 CFR Part 27.53(h) FCC 47 CFR Part 27.53(g) FCC 47 CFR Part 27.53(c)(f)	Radiated Spurious Emissions below 1GHz	Pass	Minimum passing margin is -44.10 dB at 450.98 MHz

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Standard / Clause	Test Item	Result	Remark
FCC 47 CFR Part 2.1053 FCC 47 CFR Part 22.917 FCC 47 CFR Part 24.238 FCC 47 CFR Part 27.53(h) FCC 47 CFR Part 27.53(g) FCC 47 CFR Part 27.53(c)(f)	Radiated Spurious Emissions above 1GHz	Pass	Minimum passing margin is -15.90 dB at 1569.00 MHz
FCC 47 CFR Part 2.1055 FCC 47 CFR Part 22.355 FCC 47 CFR Part 24.235 FCC 47 CFR Part 27.54	Frequency Stability	Pass	Meet the requirement of limit.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Specification	Expanded Uncertainty (k=2) (±)
Radiated Spurious Emissions below 1GHz	9 kHz ~ 30 MHz	3 dB
	30 MHz ~ 1 GHz	2.93 dB
Radiated Spurious Emissions above 1GHz	1 GHz ~ 18 GHz	1.76 dB
	18 GHz ~ 40 GHz	1.77 dB

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

2.2 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Halo Collar 4
Brand	Halo
Test Model	Halo 4
Status of EUT	Engineering sample
Power Supply Rating	5 Vdc from adapter

Note:

1. The following modules can be configured in the EUT.

Item	Brand	Model	Specification
WWAN module	Quectel	BG770A-GL	Cat-M1
BT + WiFi module	Silicon labs	RS9116W	b/g/n+BT LE
BT module	Nordic	NRF52840	BT LE

2. EUT Overview

Band / Bandwidth	TX Frequency Range (MHz)	Max. EIRP Power		Emission Designator	
		QPSK	16QAM	QPSK	16QAM
Cat-M1 Band 2 (Channel Bandwidth 1.4MHz)	1850.7-1909.3	23.281mW (13.67dBm)	25.061mW (13.99dBm)	1M08G7D	1M07D7W
Cat-M1 Band 2 (Channel Bandwidth 3MHz)	1851.5-1908.5	23.014mW (13.62dBm)	25.177mW (14.01dBm)	1M08G7D	1M07D7W
Cat-M1 Band 2 (Channel Bandwidth 5MHz)	1852.5-1907.5	23.174mW (13.65dBm)	25.293mW (14.03dBm)	1M07G7D	1M08D7W
Cat-M1 Band 2 (Channel Bandwidth 10MHz)	1855.0-1905.0	23.335mW (13.68dBm)	25.293mW (14.03dBm)	1M07G7D	1M08D7W
Cat-M1 Band 2 (Channel Bandwidth 15MHz)	1857.5-1902.5	23.335mW (13.68dBm)	25.177mW (14.01dBm)	1M07G7D	1M07D7W
Cat-M1 Band 2 (Channel Bandwidth 20MHz)	1860.0-1900.0	23.281mW (13.67dBm)	25.235mW (14.02dBm)	1M07G7D	1M07D7W
Cat-M1 Band 4 (Channel Bandwidth 1.4MHz)	1710.7-1754.3	19.011mW (12.79dBm)	19.907mW (12.99dBm)	1M07G7D	1M07D7W
Cat-M1 Band 4 (Channel Bandwidth 3MHz)	1711.5-1753.5	19.187mW (12.83dBm)	19.953mW (13.00dBm)	1M07G7D	1M07D7W
Cat-M1 Band 4 (Channel Bandwidth 5MHz)	1712.5-1752.5	19.143mW (12.82dBm)	19.861mW (12.98dBm)	1M08G7D	1M08D7W
Cat-M1 Band 4 (Channel Bandwidth 10MHz)	1715.0-1750.0	19.187mW (12.83dBm)	19.679mW (12.94dBm)	1M07G7D	1M07D7W
Cat-M1 Band 4 (Channel Bandwidth 15MHz)	1717.5-1747.5	19.187mW (12.83dBm)	19.953mW (13.00dBm)	1M08G7D	1M07D7W
Cat-M1 Band 4 (Channel Bandwidth 20MHz)	1720.0-1745.0	18.967mW (12.78dBm)	19.999mW (13.01dBm)	1M07G7D	1M08D7W

Band / Bandwidth	TX Frequency Range (MHz)	Max. ERP Power		Emission Designator	
		QPSK	16QAM	QPSK	16QAM
Cat-M1 Band 5 (Channel Bandwidth 1.4MHz)	824.7-848.3	16.866mW (12.27dBm)	18.281mW (12.62dBm)	1M07G7D	1M07D7W
Cat-M1 Band 5 (Channel Bandwidth 3MHz)	825.5-847.5	16.558mW (12.19dBm)	17.947mW (12.54dBm)	1M07G7D	1M07D7W
Cat-M1 Band 5 (Channel Bandwidth 5MHz)	826.5-846.5	16.827mW (12.26dBm)	18.239mW (12.61dBm)	1M07G7D	1M07D7W
Cat-M1 Band 5 (Channel Bandwidth 10MHz)	829.0-844.0	16.482mW (12.17dBm)	18.155mW (12.59dBm)	1M07G7D	1M07D7W
Cat-M1 Band 12 (Channel Bandwidth 1.4MHz)	699.7-715.3	43.853mW (16.42dBm)	39.355mW (15.95dBm)	1M07G7D	1M07D7W
Cat-M1 Band 12 (Channel Bandwidth 3MHz)	700.5-714.5	43.853mW (16.42dBm)	39.446mW (15.96dBm)	1M07G7D	1M07D7W
Cat-M1 Band 12 (Channel Bandwidth 5MHz)	701.5-713.5	43.853mW (16.42dBm)	39.355mW (15.95dBm)	1M07G7D	1M07D7W
Cat-M1 Band 12 (Channel Bandwidth 10MHz)	704.0-711.0	43.752mW (16.41dBm)	38.905mW (15.90dBm)	1M07G7D	1M07D7W
Cat-M1 Band 13 (Channel Bandwidth 5MHz)	779.5-784.5	30.061mW (14.78dBm)	32.810mW (15.16dBm)	1M07G7D	1M08D7W
Cat-M1 Band 13 (Channel Bandwidth 10MHz)	782.0	30.130mW (14.79dBm)	32.810mW (15.16dBm)	1M07G7D	1M07D7W

3. The EUT uses following accessories.

Charging dock	Brand	VSO
	Model	N-841-079-05000002
Type C cable	Brand	VSO
	Model	N801-000-00025635
	Signal Line	1.2M with shielding

4. WWAN, WLAN, BT function cannot transmission at the same time.

5. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Antenna Description of EUT

1. The antenna information is listed as below.

RF Chain No.	Frequency Band	Antenna Net Gain (dBi)	Antenna Type	Connector Type
LTE0	Cat-M1 Band 2	-8.5	PCB	pogo pin
LTE1	Cat-M1 Band 4	-7.6	PCB	pogo pin
LTE2	Cat-M1 Band 5	-8.8	PCB	pogo pin
LTE3	Cat-M1 Band 12	-5.2	PCB	pogo pin
LTE4	Cat-M1 Band 13	-4.6	PCB	pogo pin

* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

3.3 Test Mode Applicability and Tested Channel Detail

Pre-Scan:	EUT can be used in the following ways: X-axis/ Y-axis/ Z-axis. Pre-scan these ways and find the worst case as a representative test condition.
Worst Case:	Y-axis

For Cat-M1 Band 2

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
EIRP	18607 (1850.70 MHz) 18900 (1880.00 MHz) 19193 (1909.30 MHz)	1.4 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	18615 (1851.50 MHz) 18900 (1880.00 MHz) 19185 (1908.50 MHz)	3 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	18625 (1852.50 MHz) 18900 (1880.00 MHz) 19175 (1907.50 MHz)	5 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	18650 (1855.00 MHz) 18900 (1880.00 MHz) 19150 (1905.00 MHz)	10 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	18675 (1857.50 MHz) 18900 (1880.00 MHz) 19125 (1902.50 MHz)	15 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	18700 (1860.00 MHz) 18900 (1880.00 MHz) 19100 (1900.00 MHz)	20 MHz	QPSK / 16QAM	1 RB Half RB Full RB
Modulation Characteristics	18900 (1880.00 MHz)	20 MHz	QPSK / 16QAM	Full RB

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
Peak to Average Ratio	18607 (1850.70 MHz) 18900 (1880.00 MHz) 19193 (1909.30 MHz)	1.4 MHz	QPSK / 16QAM	1 RB
	18615 (1851.50 MHz) 18900 (1880.00 MHz) 19185 (1908.50 MHz)	3 MHz	QPSK / 16QAM	1 RB
	18625 (1852.50 MHz) 18900 (1880.00 MHz) 19175 (1907.50 MHz)	5 MHz	QPSK / 16QAM	1 RB
	18650 (1855.00 MHz) 18900 (1880.00 MHz) 19150 (1905.00 MHz)	10 MHz	QPSK / 16QAM	1 RB
	18675 (1857.50 MHz) 18900 (1880.00 MHz) 19125 (1902.50 MHz)	15 MHz	QPSK / 16QAM	1 RB
	18700 (1860.00 MHz) 18900 (1880.00 MHz) 19100 (1900.00 MHz)	20 MHz	QPSK / 16QAM	1 RB
Occupied Bandwidth	18607 (1850.70 MHz) 18900 (1880.00 MHz) 19193 (1909.30 MHz)	1.4 MHz	QPSK / 16QAM	Full RB
	18615 (1851.50 MHz) 18900 (1880.00 MHz) 19185 (1908.50 MHz)	3 MHz	QPSK / 16QAM	Full RB
	18625 (1852.50 MHz) 18900 (1880.00 MHz) 19175 (1907.50 MHz)	5 MHz	QPSK / 16QAM	Full RB
	18650 (1855.00 MHz) 18900 (1880.00 MHz) 19150 (1905.00 MHz)	10 MHz	QPSK / 16QAM	Full RB
	18675 (1857.50 MHz) 18900 (1880.00 MHz) 19125 (1902.50 MHz)	15 MHz	QPSK / 16QAM	Full RB
	18700 (1860.00 MHz) 18900 (1880.00 MHz) 19100 (1900.00 MHz)	20 MHz	QPSK / 16QAM	Full RB

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
Conducted Emission	18607 (1850.70 MHz) 18900 (1880.00 MHz) 19193 (1909.30 MHz)	1.4 MHz	16QAM	1 RB Full RB
	18615 (1851.50 MHz) 18900 (1880.00 MHz) 19185 (1908.50 MHz)	3 MHz	16QAM	1 RB Full RB
	18625 (1852.50 MHz) 18900 (1880.00 MHz) 19175 (1907.50 MHz)	5 MHz	16QAM	1 RB Full RB
	18650 (1855.00 MHz) 18900 (1880.00 MHz) 19150 (1905.00 MHz)	10 MHz	16QAM	1 RB Full RB
	18675 (1857.50 MHz) 18900 (1880.00 MHz) 19125 (1902.50 MHz)	15 MHz	16QAM	1 RB Full RB
	18700 (1860.00 MHz) 18900 (1880.00 MHz) 19100 (1900.00 MHz)	20 MHz	16QAM	1 RB Full RB
Radiated Spurious Emissions below 1GHz	19193 (1909.30 MHz)	1.4 MHz	16QAM	1 RB
Radiated Spurious Emissions above 1GHz	18607 (1850.70 MHz) 18900 (1880.00 MHz) 19193 (1909.30 MHz)	1.4 MHz	16QAM	1 RB
	18625 (1852.50 MHz) 18900 (1880.00 MHz) 19175 (1907.50 MHz)	5 MHz	16QAM	1 RB
	18700 (1860.00 MHz) 18900 (1880.00 MHz) 19100 (1900.00 MHz)	20 MHz	16QAM	1 RB
Frequency Stability	18607 (1850.70 MHz) 19193 (1909.30 MHz)	1.4 MHz	16QAM	Full RB
	18615 (1851.50 MHz) 19185 (1908.50 MHz)	3 MHz	16QAM	Full RB
	18625 (1852.50 MHz) 19175 (1907.50 MHz)	5 MHz	16QAM	Full RB
	18650 (1855.00 MHz) 19150 (1905.00 MHz)	10 MHz	16QAM	Full RB
	18675 (1857.50 MHz) 19125 (1902.50 MHz)	15 MHz	16QAM	Full RB
	18700 (1860.00 MHz) 19100 (1900.00 MHz)	20 MHz	16QAM	Full RB

For Cat-M1 Band 4

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
EIRP	19957 (1710.70 MHz) 20175 (1732.50 MHz) 20393 (1754.30 MHz)	1.4 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	19965 (1711.50 MHz) 20175 (1732.50 MHz) 20385 (1753.50 MHz)	3 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	19975 (1712.50 MHz) 20175 (1732.50 MHz) 20375 (1752.50 MHz)	5 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	20000 (1715.00 MHz) 20175 (1732.50 MHz) 20350 (1750.00 MHz)	10 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	20025 (1717.50 MHz) 20175 (1732.50 MHz) 20325 (1747.50 MHz)	15 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	20050 (1720.00 MHz) 20175 (1732.50 MHz) 20300 (1745.00 MHz)	20 MHz	QPSK / 16QAM	1 RB Half RB Full RB
Modulation Characteristics	20175 (1732.50 MHz)	20 MHz	QPSK / 16QAM	Full RB
Peak to Average Ratio	19957 (1710.70 MHz) 20175 (1732.50 MHz) 20393 (1754.30 MHz)	1.4 MHz	QPSK / 16QAM	1 RB
	19965 (1711.50 MHz) 20175 (1732.50 MHz) 20385 (1753.50 MHz)	3 MHz	QPSK / 16QAM	1 RB
	19975 (1712.50 MHz) 20175 (1732.50 MHz) 20375 (1752.50 MHz)	5 MHz	QPSK / 16QAM	1 RB
	20000 (1715.00 MHz) 20175 (1732.50 MHz) 20350 (1750.00 MHz)	10 MHz	QPSK / 16QAM	1 RB
	20025 (1717.50 MHz) 20175 (1732.50 MHz) 20325 (1747.50 MHz)	15 MHz	QPSK / 16QAM	1 RB
	20050 (1720.00 MHz) 20175 (1732.50 MHz) 20300 (1745.00 MHz)	20 MHz	QPSK / 16QAM	1 RB

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
Occupied Bandwidth	19957 (1710.70 MHz) 20175 (1732.50 MHz) 20393 (1754.30 MHz)	1.4 MHz	QPSK / 16QAM	Full RB
	19965 (1711.50 MHz) 20175 (1732.50 MHz) 20385 (1753.50 MHz)	3 MHz	QPSK / 16QAM	Full RB
	19975 (1712.50 MHz) 20175 (1732.50 MHz) 20375 (1752.50 MHz)	5 MHz	QPSK / 16QAM	Full RB
	20000 (1715.00 MHz) 20175 (1732.50 MHz) 20350 (1750.00 MHz)	10 MHz	QPSK / 16QAM	Full RB
	20025 (1717.50 MHz) 20175 (1732.50 MHz) 20325 (1747.50 MHz)	15 MHz	QPSK / 16QAM	Full RB
	20050 (1720.00 MHz) 20175 (1732.50 MHz) 20300 (1745.00 MHz)	20 MHz	QPSK / 16QAM	Full RB
Conducted Emission	19957 (1710.70 MHz) 20175 (1732.50 MHz) 20393 (1754.30 MHz)	1.4 MHz	16QAM	1 RB Full RB
	19965 (1711.50 MHz) 20175 (1732.50 MHz) 20385 (1753.50 MHz)	3 MHz	16QAM	1 RB Full RB
	19975 (1712.50 MHz) 20175 (1732.50 MHz) 20375 (1752.50 MHz)	5 MHz	16QAM	1 RB Full RB
	20000 (1715.00 MHz) 20175 (1732.50 MHz) 20350 (1750.00 MHz)	10 MHz	16QAM	1 RB Full RB
	20025 (1717.50 MHz) 20175 (1732.50 MHz) 20325 (1747.50 MHz)	15 MHz	16QAM	1 RB Full RB
	20050 (1720.00 MHz) 20175 (1732.50 MHz) 20300 (1745.00 MHz)	20 MHz	16QAM	1 RB Full RB
Radiated Spurious Emissions below 1GHz	20300 (1745.00 MHz)	20 MHz	16QAM	1 RB
Radiated Spurious Emissions above 1GHz	19957 (1710.70 MHz) 20175 (1732.50 MHz) 20393 (1754.30 MHz)	1.4 MHz	16QAM	1 RB
	19975 (1712.50 MHz) 20175 (1732.50 MHz) 20375 (1752.50 MHz)	5 MHz	16QAM	1 RB
	20050 (1720.00 MHz) 20175 (1732.50 MHz) 20300 (1745.00 MHz)	20 MHz	16QAM	1 RB

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
Frequency Stability	19957 (1710.70 MHz) 20393 (1754.30 MHz)	1.4 MHz	16QAM	Full RB
	19965 (1711.50 MHz) 20385 (1753.50 MHz)	3 MHz	16QAM	Full RB
	19975 (1712.50 MHz) 20375 (1752.50 MHz)	5 MHz	16QAM	Full RB
	20000 (1715.00 MHz) 20350 (1750.00 MHz)	10 MHz	16QAM	Full RB
	20025 (1717.50 MHz) 20325 (1747.50 MHz)	15 MHz	16QAM	Full RB
	20050 (1720.00 MHz) 20300 (1745.00 MHz)	20 MHz	16QAM	Full RB

For Cat-M1 Band 5

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
ERP	20407 (824.70 MHz) 20525 (836.50 MHz) 20643 (848.30 MHz)	1.4 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	20415 (825.50 MHz) 20525 (836.50 MHz) 20635 (847.50 MHz)	3 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	20425 (826.50 MHz) 20525 (836.50 MHz) 20625 (846.50 MHz)	5 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	20450 (829.00 MHz) 20525 (836.50 MHz) 20600 (844.00 MHz)	10 MHz	QPSK / 16QAM	1 RB Half RB Full RB
Modulation Characteristics	20525 (836.50 MHz)	10 MHz	QPSK / 16QAM	Full RB
Peak to Average Ratio	20407 (824.70 MHz) 20525 (836.50 MHz) 20643 (848.30 MHz)	1.4 MHz	QPSK / 16QAM	1 RB
	20415 (825.50 MHz) 20525 (836.50 MHz) 20635 (847.50 MHz)	3 MHz	QPSK / 16QAM	1 RB
	20425 (826.50 MHz) 20525 (836.50 MHz) 20625 (846.50 MHz)	5 MHz	QPSK / 16QAM	1 RB
	20450 (829.00 MHz) 20525 (836.50 MHz) 20600 (844.00 MHz)	10 MHz	QPSK / 16QAM	1 RB
Occupied Bandwidth	20407 (824.70 MHz) 20525 (836.50 MHz) 20643 (848.30 MHz)	1.4 MHz	QPSK / 16QAM	Full RB
	20415 (825.50 MHz) 20525 (836.50 MHz) 20635 (847.50 MHz)	3 MHz	QPSK / 16QAM	Full RB
	20425 (826.50 MHz) 20525 (836.50 MHz) 20625 (846.50 MHz)	5 MHz	QPSK / 16QAM	Full RB
	20450 (829.00 MHz) 20525 (836.50 MHz) 20600 (844.00 MHz)	10 MHz	QPSK / 16QAM	Full RB
Conducted Emission	20407 (824.70 MHz) 20525 (836.50 MHz) 20643 (848.30 MHz)	1.4 MHz	16QAM	1 RB Full RB
	20415 (825.50 MHz) 20525 (836.50 MHz) 20635 (847.50 MHz)	3 MHz	16QAM	1 RB Full RB
	20425 (826.50 MHz) 20525 (836.50 MHz) 20625 (846.50 MHz)	5 MHz	16QAM	1 RB Full RB
	20450 (829.00 MHz) 20525 (836.50 MHz) 20600 (844.00 MHz)	10 MHz	16QAM	1 RB Full RB

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
Radiated Spurious Emissions below 1GHz	20525 (836.50 MHz)	10 MHz	16QAM	1 RB
Radiated Spurious Emissions above 1GHz	20407 (824.70 MHz) 20525 (836.50 MHz) 20643 (848.30 MHz)	1.4 MHz	16QAM	1 RB
	20425 (826.50 MHz) 20525 (836.50 MHz) 20625 (846.50 MHz)	5 MHz	16QAM	1 RB
	20450 (829.00 MHz) 20525 (836.50 MHz) 20600 (844.00 MHz)	10 MHz	16QAM	1 RB
	20407 (824.70 MHz) 20643 (848.30 MHz)	1.4 MHz	16QAM	Full RB
	20415 (825.50 MHz) 20635 (847.50 MHz)	3 MHz	16QAM	Full RB
	20425 (826.50 MHz) 20625 (846.50 MHz)	5 MHz	16QAM	Full RB
Frequency Stability	20450 (829.00 MHz) 20600 (844.00 MHz)	10 MHz	16QAM	Full RB

For Cat-M1 Band 12

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
ERP	23017 (699.70 MHz) 23095 (707.50 MHz) 23173 (715.30 MHz)	1.4 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	23025 (700.50 MHz) 23095 (707.50 MHz) 23165 (714.50 MHz)	3 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	23035 (701.50 MHz) 23095 (707.50 MHz) 23155 (713.50 MHz)	5 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	23060 (704.00 MHz) 23095 (707.50 MHz) 23130 (711.00 MHz)	10 MHz	QPSK / 16QAM	1 RB Half RB Full RB
Modulation Characteristics	23095 (707.50 MHz)	10 MHz	QPSK / 16QAM	Full RB
Peak to Average Ratio	23017 (699.70 MHz) 23095 (707.50 MHz) 23173 (715.30 MHz)	1.4 MHz	QPSK / 16QAM	1 RB
	23025 (700.50 MHz) 23095 (707.50 MHz) 23165 (714.50 MHz)	3 MHz	QPSK / 16QAM	1 RB
	23035 (701.50 MHz) 23095 (707.50 MHz) 23155 (713.50 MHz)	5 MHz	QPSK / 16QAM	1 RB
	23060 (704.00 MHz) 23095 (707.50 MHz) 23130 (711.00 MHz)	10 MHz	QPSK / 16QAM	1 RB
Occupied Bandwidth	23017 (699.70 MHz) 23095 (707.50 MHz) 23173 (715.30 MHz)	1.4 MHz	QPSK / 16QAM	Full RB
	23025 (700.50 MHz) 23095 (707.50 MHz) 23165 (714.50 MHz)	3 MHz	QPSK / 16QAM	Full RB
	23035 (701.50 MHz) 23095 (707.50 MHz) 23155 (713.50 MHz)	5 MHz	QPSK / 16QAM	Full RB
	23060 (704.00 MHz) 23095 (707.50 MHz) 23130 (711.00 MHz)	10 MHz	QPSK / 16QAM	Full RB
Conducted Emission	23017 (699.70 MHz) 23095 (707.50 MHz) 23173 (715.30 MHz)	1.4 MHz	QPSK	1 RB Full RB
	23025 (700.50 MHz) 23095 (707.50 MHz) 23165 (714.50 MHz)	3 MHz	QPSK	1 RB Full RB
	23035 (701.50 MHz) 23095 (707.50 MHz) 23155 (713.50 MHz)	5 MHz	QPSK	1 RB Full RB
	23060 (704.00 MHz) 23095 (707.50 MHz) 23130 (711.00 MHz)	10 MHz	QPSK	1 RB Full RB

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
Radiated Spurious Emissions below 1GHz	23095 (707.50 MHz)	5 MHz	QPSK	1 RB
Radiated Spurious Emissions above 1GHz	23017 (699.70 MHz) 23095 (707.50 MHz) 23173 (715.30 MHz)	1.4 MHz	QPSK	1 RB
	23035 (701.50 MHz) 23095 (707.50 MHz) 23155 (713.50 MHz)	5 MHz	QPSK	1 RB
	23060 (704.00 MHz) 23095 (707.50 MHz) 23130 (711.00 MHz)	10 MHz	QPSK	1 RB
Frequency Stability	23017 (699.70 MHz) 23173 (715.30 MHz)	1.4 MHz	QPSK	Full RB
	23025 (700.50 MHz) 23165 (714.50 MHz)	3 MHz	QPSK	Full RB
	23035 (701.50 MHz) 23155 (713.50 MHz)	5 MHz	QPSK	Full RB
	23060 (704.00 MHz) 23130 (711.00 MHz)	10 MHz	QPSK	Full RB

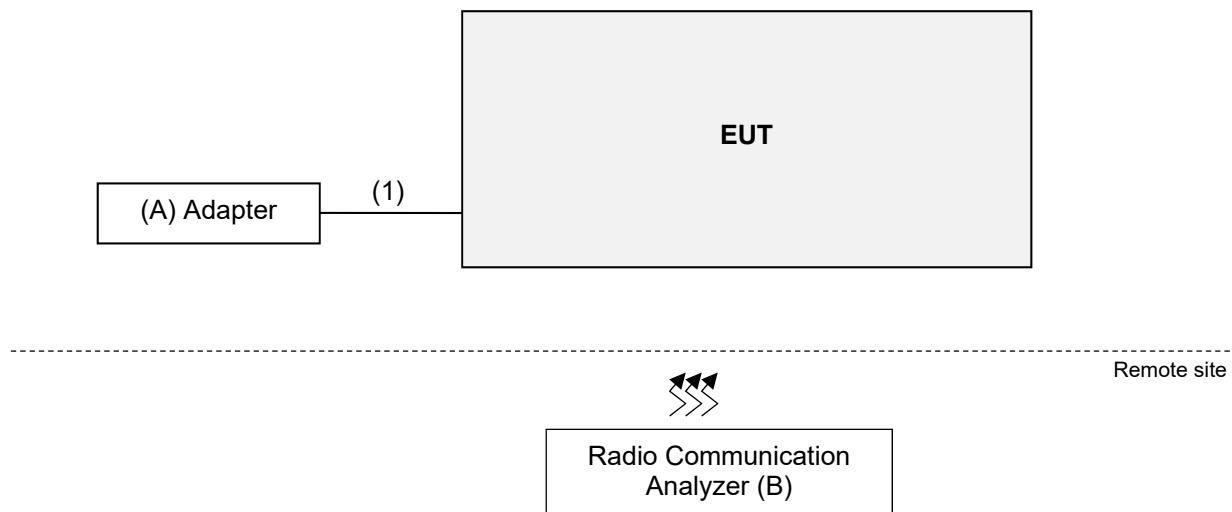
For Cat-M1 Band 13

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
ERP	23205 (779.50 MHz) 23230 (782.00 MHz) 23255 (784.50 MHz)	5 MHz	QPSK / 16QAM	1 RB Half RB Full RB
	23230 (782.00 MHz)	10 MHz	QPSK / 16QAM	1 RB Half RB Full RB
Modulation Characteristics	23230 (782.00 MHz)	10 MHz	QPSK / 16QAM	Full RB
Peak to Average Ratio	23205 (779.50 MHz) 23230 (782.00 MHz) 23255 (784.50 MHz)	5 MHz	QPSK / 16QAM	1 RB
	23230 (782.00 MHz)	10 MHz	QPSK / 16QAM	1 RB
Occupied Bandwidth	23205 (779.50 MHz) 23230 (782.00 MHz) 23255 (784.50 MHz)	5 MHz	QPSK / 16QAM	Full RB
	23230 (782.00 MHz)	10 MHz	QPSK / 16QAM	Full RB
Conducted Emission	23205 (779.50 MHz) 23230 (782.00 MHz) 23255 (784.50 MHz)	5 MHz	16QAM	1 RB Full RB
	23230 (782.00 MHz)	10 MHz	16QAM	1 RB Full RB
Radiated Spurious Emissions below 1GHz	23255 (784.50 MHz)	5 MHz	16QAM	1 RB
Radiated Spurious Emissions above 1GHz	23205 (779.50 MHz) 23230 (782.00 MHz) 23255 (784.50 MHz)	5 MHz	16QAM	1 RB
	23230 (782.00 MHz)	10 MHz	16QAM	1 RB
Frequency Stability	23205 (779.50 MHz) 23255 (784.50 MHz)	5 MHz	16QAM	Full RB
	23230 (782.00 MHz)	10 MHz	16QAM	Full RB

3.4 Test Program Used and Operation Descriptions

There is no need to controlling software during the test, and the EUT can be paired with the Radio Communication Analyzer to test the connection when it is powered on.

3.5 Connection Diagram of EUT and Peripheral Devices



3.6 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Adapter	Apple	A1720	FNT912201EHL9J911	N/A	Provided by Lab
B.	Radio Communication Analyzer	Anritsu	MT8821C	6201462755	N/A	Provided by Lab

No.	Cable Descriptions	Qty.	Length (m)	Shielded (Yes/ No)	Cores (Qty.)	Remark
1.	Type C Cable	1	1.2	Yes	0	Accessory of the EUT (for RF Setup)

4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.1 Effective Radiated Power and Equivalent Isotropically Radiated Power

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
N9030B - PXA Signal Analyzer KEYSIGHT	N9030B	MY57140488	2024/3/6	2025/3/5
Radio Communication Analyzer Anritsu	MT8821C	6201462755	2024/3/13	2025/3/12
Software BV	ADT_RF Test Software V6.6.5.4	N/A	N/A	N/A

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2024/7/22

4.2 Modulation Characteristics

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
N9030B - PXA Signal Analyzer KEYSIGHT	N9030B	MY57140938	2024/3/20	2025/3/19
Radio Communication Analyzer Anritsu	MT8821C	6201462755	2024/3/13	2025/3/12
Software BV	ADT_RF Test Software V6.6.5.4	N/A	N/A	N/A

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2024/7/19

4.3 Peak to Average Ratio

Refer to section 4.2 to get information of the instruments.

4.4 Bandwidth

Refer to section 4.2 to get information of the instruments.

4.5 Conducted Spurious Emissions

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
N9030B - PXA Signal Analyzer KEYSIGHT	N9030B	MY57140938	2024/3/20	2025/3/19
Radio Communication Analyzer Anritsu	MT8821C	6201462755	2024/3/13	2025/3/12
Software BV	ADT_RF Test Software V6.6.5.4	N/A	N/A	N/A

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2024/7/19 ~ 2024/7/26

4.6 Radiated Spurious Emissions below 1GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower Max-Full	MFT-151SS-0.5T	N/A	N/A	N/A
Bi_Log Antenna Schwarzbeck	VULB 9168	9168-1213	2023/10/13	2024/10/12
EMI Test Receiver R&S	ESR3	102782	2023/12/7	2024/12/6
Loop Antenna Electro-Metrics	EM-6879	269	2023/9/23	2024/9/22
Loop Antenna TESEQ	HLA 6121	45745	2023/8/8	2024/8/7
MXA Signal Analyzer Keysight	N9020B	MY60110513	2023/12/22	2024/12/21
Preamplifier EMCI	EMC330N	980782	2024/1/15	2025/1/14
	EMC001340	980201	2023/9/27	2024/9/26
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-500	201233	2024/1/15	2025/1/14
	EMCCFD400-NM-NM-3000	201235	2024/1/15	2025/1/14
	EMCCFD400-NM-NM-9000	201236(with PAD)	2024/1/15	2025/1/14
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	N/A	N/A	N/A
Turn Table Max-Full	MF-7802BS	N/A	N/A	N/A
Turn Table Controller Max-Full	MF-7802BS	MF780208674	N/A	N/A

Notes:

1. The test was performed in WM - 966 chamber 8.
2. Tested Date: 2024/7/10

4.7 Radiated Spurious Emissions above 1GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower Max-Full	MFT-151SS-0.5T	N/A	N/A	N/A
EMI Test Receiver R&S	ESR3	102782	2023/12/7	2024/12/6
Horn Antenna RFSPIN	DRH18-E	210103A18E	2023/11/12	2024/11/11
Horn Antenna Schwarzbeck	BBHA 9170	9170-1049	2023/11/12	2024/11/11
MXA Signal Analyzer Keysight	N9020B	MY60110513	2023/12/22	2024/12/21
Preamplifier EMCI	EMC118A45SE	980808	2023/12/28	2024/12/27
	EMC184045SE	980788	2024/1/15	2025/1/14
RF Coaxial Cable EMCI	EMC101G-KM-KM-2000	201254	2024/1/15	2025/1/14
	EMC101G-KM-KM-3000	201258	2024/1/15	2025/1/14
	EMC101G-KM-KM-5000	201261	2024/1/15	2025/1/14
	EMC104-SM-SM-1000	210102	2024/1/15	2025/1/14
	EMC104-SM-SM-3000	201231	2024/1/15	2025/1/14
	EMC104-SM-SM-9000	201243	2024/1/15	2025/1/14
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	N/A	N/A	N/A
Turn Table Max-Full	MF-7802BS	N/A	N/A	N/A
Turn Table Controller Max-Full	MF-7802BS	MF780208674	N/A	N/A

Notes:

1. The test was performed in WM - 966 chamber 8.
2. Tested Date: 2024/7/2 ~ 2024/7/3

4.8 Frequency Stability

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
3-channel DC power supply JIN YIH Technology	ODP3033	ODP30332128138	N/A	N/A
Digital Multimeter Fluke	87-III	70360742	2024/7/5	2025/7/4
Software BV	ADT_RF Test Software V6.6.5.4	N/A	N/A	N/A
Spectrum Analyzer R&S	FSV40	100980	2024/5/6	2025/5/5
Temperature & Humidity Chamber TERCHY	HRM-120RF	931022	2023/12/19	2024/12/18
Radio Communication Analyzer Anritsu	MT8821C	6201462755	2024/3/13	2025/3/12

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2024/7/19

5 Limits of Test Items

5.1 Effective Radiated Power and Equivalent Isotropically Radiated Power

For Cat-M1 Band 2:

Mobile and portable stations are limited to 2 watts EIRP.

For Cat-M1 Band 4:

Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

For Cat-M1 Band 5:

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

For Cat-M1 Band 12:

Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

For Cat-M1 Band 13:

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.

5.2 Modulation Characteristics

A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

5.3 Peak to Average Ratio

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB.

5.4 Bandwidth

According to FCC 47 CFR part 2.1049, the occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission.

5.5 Conducted Spurious Emissions

For Cat-M1 Band 2, Cat-M1 Band 5:

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. The emission limit equal to -13 dBm.

For Cat-M1 Band 4:

According to FCC 47 CFR part 27.53(h), for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log(P)$ dB. 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.

For Cat-M1 Band 12:

According to FCC 47 CFR part 27.53(g), for operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a 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, by at least $43 + 10 \log(P)$ dB. Compliance 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.

For Cat-M1 Band 13:

According to FCC 47 CFR part 27.53(c)(2), for 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. Compliance 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.

According to FCC 47 CFR part 27.53(c)(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.

For operations in the 775-788 MHz, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz (EIRP). The limit of emissions is equal to -40 dBm.

5.6 Radiated Spurious Emissions below 1GHz

For Cat-M1 Band 2, Cat-M1 Band 5:

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. The emission limit equal to -13 dBm.

For Cat-M1 Band 4:

According to FCC 47 CFR part 27.53(h), for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log(P)$ dB. The limit of emission is equal to -13 dBm.

For Cat-M1 Band 12:

According to FCC 47 CFR part 27.53(g), for operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a 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, by at least $43 + 10 \log(P)$ dB. The limit of emissions is equal to -13 dBm.

For Cat-M1 Band 13:

According to FCC 47 CFR part 27.53(c)(2), for 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. The limit of emissions is equal to -13 dBm.

For operations in the 775-788 MHz, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz (EIRP). The limit of emissions is equal to -40 dBm.

5.7 Radiated Spurious Emissions above 1GHz

For Cat-M1 Band 2, Cat-M1 Band 5:

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. The emission limit equal to -13 dBm.

For Cat-M1 Band 4:

According to FCC 47 CFR part 27.53(h), for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log(P)$ dB. The limit of emission is equal to -13 dBm.

For Cat-M1 Band 12:

According to FCC 47 CFR part 27.53(g), for operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a 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, by at least $43 + 10 \log(P)$ dB. The limit of emissions is equal to -13 dBm.

For Cat-M1 Band 13:

According to FCC 47 CFR part 27.53(c)(2), for 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. The limit of emissions is equal to -13 dBm.

For operations in the 775-788 MHz, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz (EIRP). The limit of emissions is equal to -40 dBm.

5.8 Frequency Stability

For Cat-M1 Band 5:

1.5 ppm is for base and fixed station. 2.5 ppm is for mobile station.

For Cat-M1 Band 2, Cat-M1 Band 4, Cat-M1 Band 12, Cat-M1 Band 13:

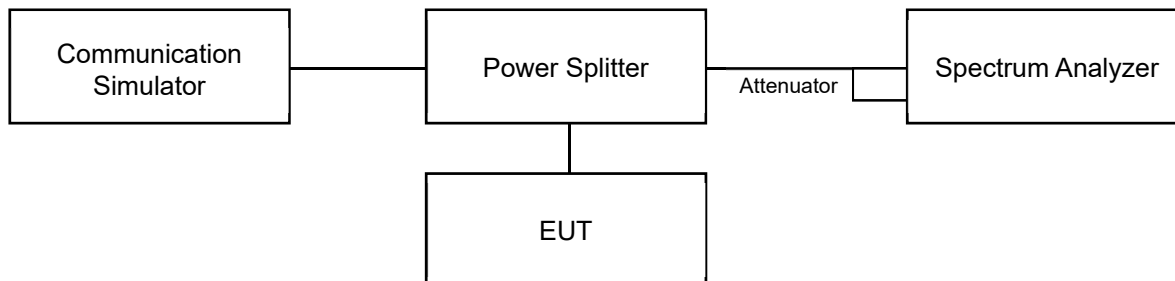
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation (authorized frequency block).

6 Test Arrangements

6.1 Effective Radiated Power and Equivalent Isotropically Radiated Power

6.1.1 Test Setup

Conducted Power Measurement:



6.1.2 Test Procedure

Conducted Power Measurement:

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology. The average (rms) power measurement was performed on emulator and power value was measured from power function on emulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

Maximum EIRP / ERP

The relevant equation for determining the maximum ERP or EIRP from the measured RF output power is given in Equation as follows:

$$\text{EIRP} = P_{\text{Meas}} + G_T$$

$$\text{ERP} = P_{\text{Meas}} + G_T - 2.15$$

where

ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively

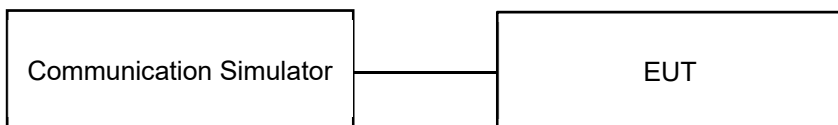
(expressed in the same units as P_{Meas} , e.g., dBm or dBW)

P_{Meas} measured transmitter output power or PSD, in dBm or dBW

G_T gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

6.2 Modulation Characteristics

6.2.1 Test Setup

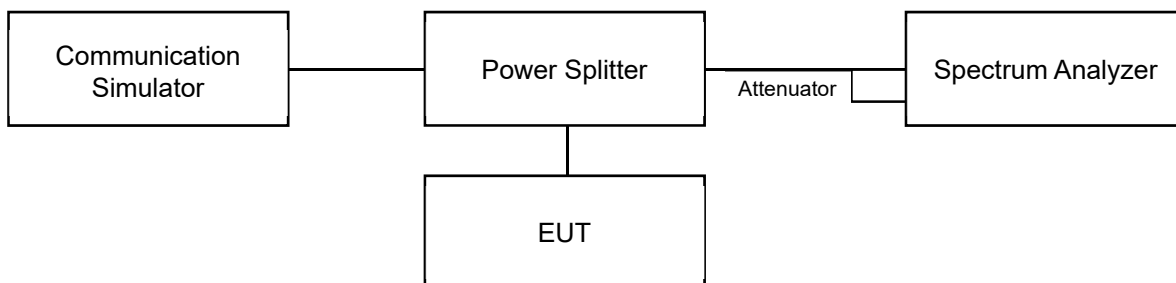


6.2.2 Test Procedure

Connect the EUT to Communication Simulator via the antenna connector, the frequency band is set as EUT supported Modulation and Channels, the EUT output is matched with 50 ohm load, the waveform quality and constellation of the EUT was tested.

6.3 Peak to Average Ratio

6.3.1 Test Setup

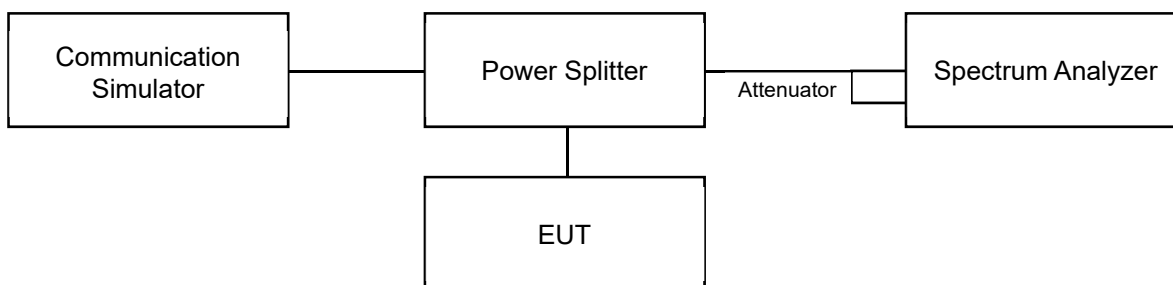


6.3.2 Test Procedure

- Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth;
- Set the number of counts to a value that stabilizes the measured CCDF curve;
- Record the maximum PAPR level associated with a probability of 0.1%.

6.4 Bandwidth

6.4.1 Test Setup



6.4.2 Test Procedure

For the 26 dBc bandwidth measurement method, please refer to section 5.4.3 of ANSI C63.26.

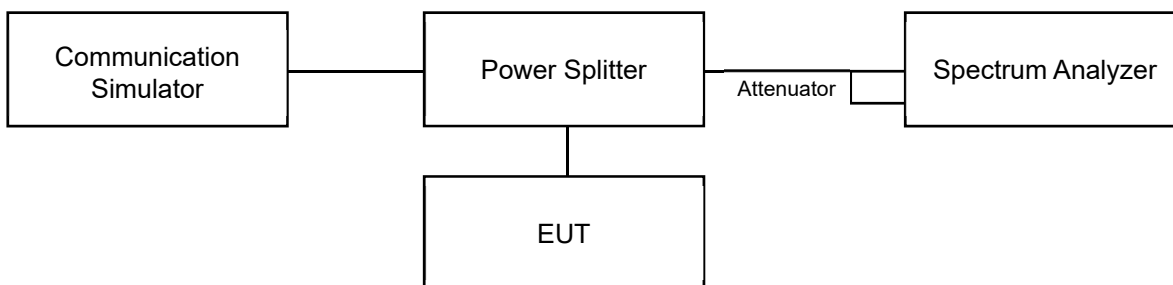
- The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
- The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set $\geq 3 \times$ RBW.
- Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target “-X dB” requirement, i.e., if the requirement calls for measuring the -26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
- Set spectrum analyzer detection mode to peak, and the trace mode to max hold.
- Determine the following reference values: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
- Determine the “-X dB amplitude” as equal to (Reference Value - X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.
- Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “-X dB amplitude” determined in step f). If a marker is below this “-X dB amplitude” value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers.
- The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

For the occupied bandwidth measurement method, please refer to section 5.4.4 of ANSI C63.26.

- a. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
- b. The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set $\geq 3 \times$ RBW.
- c. Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- d. The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target “-X dB” requirement, i.e., if the requirement calls for measuring the -26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
- e. Set spectrum analyzer detection mode to peak, and the trace mode to max hold.
- f. Determine the reference value by either of the following:
 - g. 1) Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
 - h. 2) Set the EUT to transmit an unmodulated carrier. Set the spectrum analyzer marker to the level of the carrier.
- i. Determine the “-X dB amplitude” as equal to (Reference Value - X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.
- j. If the reference value was determined using an unmodulated carrier, turn the EUT modulation on, then either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise the trace from step f) shall be used for step i).
- k. Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “-X dB amplitude” determined in step f). If a marker is below this “-X dB amplitude” value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers. The spectral envelope can cross the “-X dB amplitude” at multiple points. The lowest or highest frequency shall be selected as the frequencies that are the farthest away from the center frequency at which the spectral envelope crosses the “-X dB amplitude.”
- l. The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

6.5 Conducted Spurious Emissions

6.5.1 Test Setup



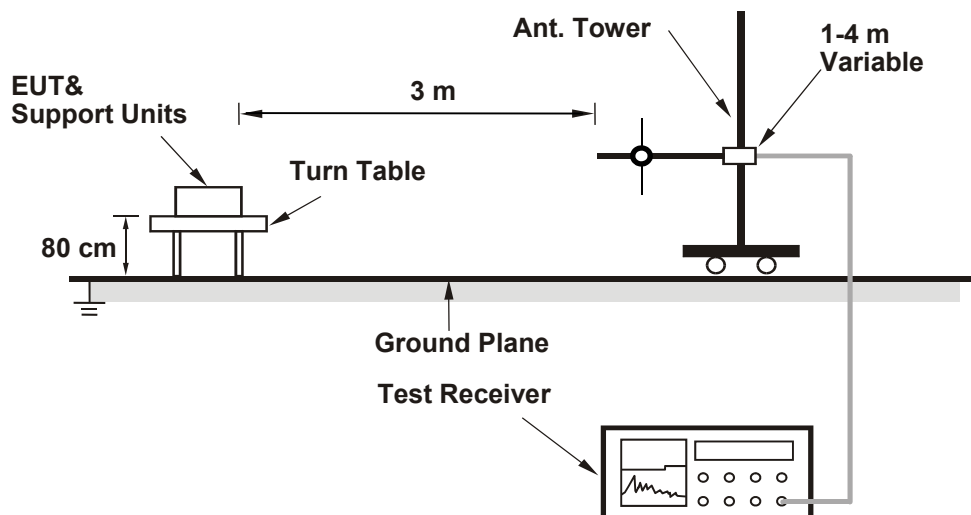
6.5.2 Test Procedure

- Measurement refer to ANSI C63.26 section 5.7.
- All measurements were done at 3 channels: low, middle and high operational frequency range.
- Measuring frequency range is from 9 kHz up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. 20 dB attenuation pad is connected with spectrum.
- The fundamental frequency above 1 GHz, the spectrum set RBW = 1 MHz, VBW = 3 MHz, Detector = Average.
- The fundamental frequency below 1 GHz, the spectrum set RBW $\geq$ 100 kHz, VBW $\geq$ 3 x RBW, Detector = Average.
- Measuring frequency band edge, narrow RBW (no less than 1% of the OBW) is used for conducted emission measurement.

6.6 Radiated Spurious Emissions below 1GHz

6.6.1 Test Setup

For radiated emission 30 MHz to 1 GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.6.2 Test Procedure

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology.

- In the semi-anechoic chamber, EUT placed on the 0.8 m (below or equal 1 GHz) height of turn table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.
- Following C63.26 section 5.5 and 5.2.7
- $EIRP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance (in the far field region) in m.
- $ERP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8 - 2.15$; where D is the measurement distance (in the far field region) in m.

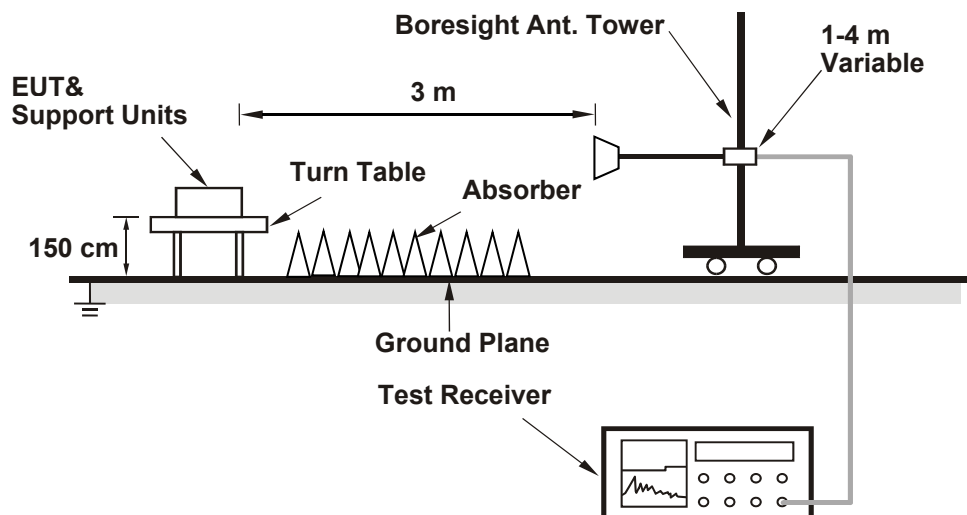
Note:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz/3 MHz. Set detector=average
- The emission levels were against the limit of frequency range 9 kHz ~ 30 MHz:
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

6.7 Radiated Spurious Emissions above 1GHz

6.7.1 Test Setup

For radiated emission above 1 GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.7.2 Test Procedure

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology.

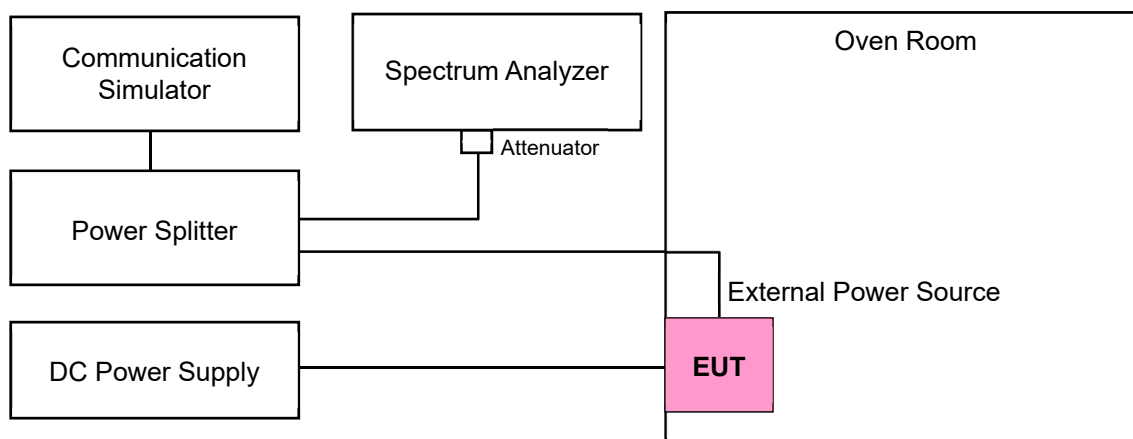
- In the semi-anechoic chamber, EUT placed on the 1.5 m height of turn table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.
- Following C63.26 section 5.5 and 5.2.7
- $EIRP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance (in the far field region) in m.
- $ERP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8 - 2.15$; where D is the measurement distance (in the far field region) in m.

Note:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz/3 MHz. Set detector=average

6.8 Frequency Stability

6.8.1 Test Setup



6.8.2 Test Procedure

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology.

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

Note: The frequency error was recorded frequency error from the communication simulator.

7 Test Results of Test Item

7.1 Effective Radiated Power and Equivalent Isotropically Radiated Power

Input Power:	5 Vdc	Environmental Conditions:	22°C, 65% RH	Tested By:	Willy Cheng
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7.1.1 Cat-M1 Band 2

Conducted Output Power (dBm)

Cat-M1 Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18700	18900	19100
		Frequency (MHz)		1860	1880	1900
20M	QPSK	1	0	21.96	21.95	22.04
		1	50	22.17	21.97	21.95
		1	99	21.91	21.93	22.07
		50	0	20.69	20.75	20.97
		50	25	20.80	20.85	20.88
		50	50	20.78	20.82	20.68
		100	0	20.20	20.19	19.97
20M	16QAM	1	0	22.52	22.27	22.45
		1	50	22.31	22.38	22.31
		1	99	22.46	22.31	22.43
		50	0	20.36	20.40	20.30
		50	25	20.53	20.30	20.42
		50	50	20.57	20.35	20.58
		100	0	19.02	19.15	18.98

Cat-M1 Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18675	18900	19125
		Frequency (MHz)		1857.5	1880	1902.5
15M	QPSK	1	0	21.88	22.17	21.96
		1	37	21.97	22.12	22.15
		1	74	21.94	22.18	21.99
		36	0	20.81	20.94	20.79
		36	19	20.73	20.76	20.83
		36	39	20.72	20.82	20.83
		75	0	20.14	20.16	20.13
15M	16QAM	1	0	22.36	22.24	22.51
		1	37	22.27	22.32	22.31
		1	74	22.25	22.31	22.48
		36	0	20.39	20.44	20.50
		36	19	20.36	20.39	20.38
		36	39	20.43	20.53	20.54
		75	0	18.93	19.12	18.94

Cat-M1 Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18650	18900	19150
		Frequency (MHz)		1855	1880	1905
10M	QPSK	1	0	22.16	22.12	22.10
		1	24	21.88	22.05	22.15
		1	49	21.97	22.05	22.18
		25	0	20.72	20.77	20.75
		25	12	20.70	20.97	20.91
		25	25	20.81	20.77	20.98
		50	0	20.14	20.15	20.27
10M	16QAM	1	0	22.34	22.39	22.53
		1	24	22.44	22.42	22.41
		1	49	22.35	22.29	22.53
		25	0	20.50	20.39	20.38
		25	12	20.35	20.50	20.29
		25	25	20.50	20.43	20.44
		50	0	19.19	19.15	19.00

Cat-M1 Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18625	18900	19175
		Frequency (MHz)		1852.5	1880	1907.5
5M	QPSK	1	0	22.00	22.15	22.06
		1	12	21.95	22.05	21.95
		1	24	21.97	22.14	22.14
		12	0	20.84	20.74	20.87
		12	6	20.78	20.91	20.86
		12	13	20.98	20.98	20.77
		25	0	20.16	20.16	20.18
5M	16QAM	1	0	22.38	22.28	22.47
		1	12	22.26	22.53	22.53
		1	24	22.26	22.40	22.27
		12	0	20.49	20.40	20.52
		12	6	20.42	20.46	20.50
		12	13	20.55	20.45	20.29
		25	0	18.94	19.02	19.22

Cat-M1 Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18615	18900	19185
		Frequency (MHz)		1851.5	1880	1908.5
3M	QPSK	1	0	22.08	21.92	22.12
		1	7	21.91	21.96	22.07
		1	14	21.90	22.12	22.02
		8	0	20.71	20.78	20.89
		8	3	20.96	20.90	20.96
		8	7	20.88	20.88	20.86
		15	0	20.19	20.01	20.00
3M	16QAM	1	0	22.51	22.50	22.30
		1	7	22.39	22.42	22.30
		1	14	22.25	22.38	22.33
		8	0	20.45	20.49	20.32
		8	3	20.40	20.55	20.37
		8	7	20.35	20.57	20.57
		15	0	19.17	19.08	18.96

Cat-M1 Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18607	18900	19193
		Frequency (MHz)		1850.7	1880	1909.3
1.4M	QPSK	1	0	21.90	22.00	22.02
		1	2	21.91	22.17	22.09
		1	5	22.11	22.16	22.16
		3	0	20.92	20.97	20.86
		3	1	20.85	20.94	20.78
		3	3	20.85	20.77	20.74
		6	0	20.08	19.97	20.02
1.4M	16QAM	1	0	22.32	22.49	22.42
		1	2	22.24	22.41	22.40
		1	5	22.44	22.30	22.41
		3	0	20.48	20.54	20.42
		3	1	20.58	20.56	20.39
		3	3	20.47	20.56	20.49
		6	0	18.99	19.18	19.18

EIRP Power (dBm)

Cat-M1 Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18700	18900	19100
		Frequency (MHz)		1860	1880	1900
20M	QPSK	1	0	13.46	13.45	13.54
		1	50	13.67	13.47	13.45
		1	99	13.41	13.43	13.57
		50	0	12.19	12.25	12.47
		50	25	12.30	12.35	12.38
		50	50	12.28	12.32	12.18
		100	0	11.70	11.69	11.47
20M	16QAM	1	0	14.02	13.77	13.95
		1	50	13.81	13.88	13.81
		1	99	13.96	13.81	13.93
		50	0	11.86	11.90	11.80
		50	25	12.03	11.80	11.92
		50	50	12.07	11.85	12.08
		100	0	10.52	10.65	10.48

*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

Cat-M1 Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18675	18900	19125
		Frequency (MHz)		1857.5	1880	1902.5
15M	QPSK	1	0	13.38	13.67	13.46
		1	37	13.47	13.62	13.65
		1	74	13.44	13.68	13.49
		36	0	12.31	12.44	12.29
		36	19	12.23	12.26	12.33
		36	39	12.22	12.32	12.33
		75	0	11.64	11.66	11.63
15M	16QAM	1	0	13.86	13.74	14.01
		1	37	13.77	13.82	13.81
		1	74	13.75	13.81	13.98
		36	0	11.89	11.94	12.00
		36	19	11.86	11.89	11.88
		36	39	11.93	12.03	12.04
		75	0	10.43	10.62	10.44

*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

Cat-M1 Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18650	18900	19150
		Frequency (MHz)		1855	1880	1905
10M	QPSK	1	0	13.66	13.62	13.60
		1	24	13.38	13.55	13.65
		1	49	13.47	13.55	13.68
		25	0	12.22	12.27	12.25
		25	12	12.20	12.47	12.41
		25	25	12.31	12.27	12.48
		50	0	11.64	11.65	11.77
10M	16QAM	1	0	13.84	13.89	14.03
		1	24	13.94	13.92	13.91
		1	49	13.85	13.79	14.03
		25	0	12.00	11.89	11.88
		25	12	11.85	12.00	11.79
		25	25	12.00	11.93	11.94
		50	0	10.69	10.65	10.50

*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

Cat-M1 Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18625	18900	19175
		Frequency (MHz)		1852.5	1880	1907.5
5M	QPSK	1	0	13.50	13.65	13.56
		1	12	13.45	13.55	13.45
		1	24	13.47	13.64	13.64
		12	0	12.34	12.24	12.37
		12	6	12.28	12.41	12.36
		12	13	12.48	12.48	12.27
		25	0	11.66	11.66	11.68
5M	16QAM	1	0	13.88	13.78	13.97
		1	12	13.76	14.03	14.03
		1	24	13.76	13.90	13.77
		12	0	11.99	11.90	12.02
		12	6	11.92	11.96	12.00
		12	13	12.05	11.95	11.79
		25	0	10.44	10.52	10.72

*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

Cat-M1 Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18615	18900	19185
		Frequency (MHz)		1851.5	1880	1908.5
3M	QPSK	1	0	13.58	13.42	13.62
		1	7	13.41	13.46	13.57
		1	14	13.40	13.62	13.52
		8	0	12.21	12.28	12.39
		8	3	12.46	12.40	12.46
		8	7	12.38	12.38	12.36
		15	0	11.69	11.51	11.50
3M	16QAM	1	0	14.01	14.00	13.80
		1	7	13.89	13.92	13.80
		1	14	13.75	13.88	13.83
		8	0	11.95	11.99	11.82
		8	3	11.90	12.05	11.87
		8	7	11.85	12.07	12.07
		15	0	10.67	10.58	10.46

*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

Cat-M1 Band 2						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		18607	18900	19193
		Frequency (MHz)		1850.7	1880	1909.3
1.4M	QPSK	1	0	13.40	13.50	13.52
		1	2	13.41	13.67	13.59
		1	5	13.61	13.66	13.66
		3	0	12.42	12.47	12.36
		3	1	12.35	12.44	12.28
		3	3	12.35	12.27	12.24
		6	0	11.58	11.47	11.52
1.4M	16QAM	1	0	13.82	13.99	13.92
		1	2	13.74	13.91	13.90
		1	5	13.94	13.80	13.91
		3	0	11.98	12.04	11.92
		3	1	12.08	12.06	11.89
		3	3	11.97	12.06	11.99
		6	0	10.49	10.68	10.68

*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

7.1.2 Cat-M1 Band 4

Conducted Output Power (dBm)

Cat-M1 Band 4						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20050	20175	20300
		Frequency (MHz)		1720	1732.5	1745
20M	QPSK	1	0	20.38	20.14	20.17
		1	50	20.30	20.32	20.23
		1	99	20.28	20.27	20.19
		50	0	19.28	19.19	19.31
		50	25	19.05	19.08	19.07
		50	50	19.25	19.11	19.10
		100	0	18.50	18.54	18.55
20M	16QAM	1	0	20.52	20.35	20.51
		1	50	20.32	20.47	20.61
		1	99	20.50	20.48	20.42
		50	0	18.48	18.25	18.37
		50	25	18.31	18.51	18.50
		50	50	18.26	18.43	18.48
		100	0	16.92	17.09	16.92

Cat-M1 Band 4						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20025	20175	20325
		Frequency (MHz)		1717.5	1732.5	1747.5
15M	QPSK	1	0	20.36	20.30	20.13
		1	37	20.13	20.43	20.31
		1	74	20.17	20.16	20.42
		36	0	19.21	19.19	19.31
		36	19	19.17	19.06	19.21
		36	39	19.30	19.12	19.31
		75	0	18.52	18.63	18.47
15M	16QAM	1	0	20.47	20.54	20.60
		1	37	20.52	20.52	20.54
		1	74	20.52	20.30	20.51
		36	0	18.31	18.42	18.35
		36	19	18.42	18.54	18.50
		36	39	18.29	18.35	18.29
		75	0	16.88	16.88	16.87

Cat-M1 Band 4						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20000	20175	20350
		Frequency (MHz)		1715	1732.5	1750
10M	QPSK	1	0	20.14	20.33	20.19
		1	24	20.38	20.40	20.28
		1	49	20.27	20.26	20.43
		25	0	19.21	19.10	19.21
		25	12	19.12	19.18	19.33
		25	25	19.17	19.19	19.13
		50	0	18.77	18.68	18.54
10M	16QAM	1	0	20.45	20.48	20.49
		1	24	20.35	20.36	20.54
		1	49	20.52	20.42	20.50
		25	0	18.49	18.48	18.45
		25	12	18.26	18.43	18.25
		25	25	18.53	18.34	18.51
		50	0	16.99	16.88	16.96

Cat-M1 Band 4						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		19975	20175	20375
		Frequency (MHz)		1712.5	1732.5	1752.5
5M	QPSK	1	0	20.42	20.20	20.36
		1	12	20.41	20.32	20.36
		1	24	20.14	20.38	20.27
		12	0	19.08	19.31	19.07
		12	6	19.33	19.06	19.07
		12	13	19.26	19.31	19.27
		25	0	18.59	18.56	18.62
5M	16QAM	1	0	20.30	20.45	20.31
		1	12	20.38	20.42	20.58
		1	24	20.47	20.31	20.38
		12	0	18.28	18.44	18.32
		12	6	18.48	18.54	18.53
		12	13	18.24	18.52	18.49
		25	0	16.91	16.86	17.13

Cat-M1 Band 4						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		19965	20175	20385
		Frequency (MHz)		1711.5	1732.5	1753.5
3M	QPSK	1	0	20.43	20.16	20.38
		1	7	20.34	20.27	20.26
		1	14	20.30	20.32	20.33
		8	0	19.29	19.05	19.35
		8	3	19.25	19.33	19.13
		8	7	19.30	19.27	19.12
		15	0	18.58	18.51	18.52
3M	16QAM	1	0	20.42	20.55	20.46
		1	7	20.43	20.60	20.41
		1	14	20.47	20.52	20.44
		8	0	18.51	18.41	18.41
		8	3	18.47	18.54	18.28
		8	7	18.45	18.47	18.52
		15	0	17.03	16.85	17.01

Cat-M1 Band 4						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		19957	20175	20393
		Frequency (MHz)		1710.7	1732.5	1754.3
1.4M	QPSK	1	0	20.15	20.24	20.33
		1	2	20.22	20.39	20.39
		1	5	20.24	20.27	20.16
		3	0	19.16	19.22	19.08
		3	1	19.23	19.06	19.13
		3	3	19.18	19.20	19.35
		6	0	18.50	18.64	18.70
1.4M	16QAM	1	0	20.49	20.46	20.43
		1	2	20.48	20.59	20.52
		1	5	20.45	20.46	20.34
		3	0	18.35	18.25	18.51
		3	1	18.30	18.47	18.29
		3	3	18.41	18.52	18.30
		6	0	17.14	16.87	16.91

EIRP Power (dBm)

Cat-M1 Band 4						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20050	20175	20300
		Frequency (MHz)		1720	1732.5	1745
20M	QPSK	1	0	12.78	12.54	12.57
		1	50	12.70	12.72	12.63
		1	99	12.68	12.67	12.59
		50	0	11.68	11.59	11.71
		50	25	11.45	11.48	11.47
		50	50	11.65	11.51	11.50
		100	0	10.90	10.94	10.95
20M	16QAM	1	0	12.92	12.75	12.91
		1	50	12.72	12.87	13.01
		1	99	12.90	12.88	12.82
		50	0	10.88	10.65	10.77
		50	25	10.71	10.91	10.90
		50	50	10.66	10.83	10.88
		100	0	9.32	9.49	9.32

*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

Cat-M1 Band 4						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20025	20175	20325
		Frequency (MHz)		1717.5	1732.5	1747.5
15M	QPSK	1	0	12.76	12.70	12.53
		1	37	12.53	12.83	12.71
		1	74	12.57	12.56	12.82
		36	0	11.61	11.59	11.71
		36	19	11.57	11.46	11.61
		36	39	11.70	11.52	11.71
		75	0	10.92	11.03	10.87
15M	16QAM	1	0	12.87	12.94	13.00
		1	37	12.92	12.92	12.94
		1	74	12.92	12.70	12.91
		36	0	10.71	10.82	10.75
		36	19	10.82	10.94	10.90
		36	39	10.69	10.75	10.69
		75	0	9.28	9.28	9.27

*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

Cat-M1 Band 4						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20000	20175	20350
		Frequency (MHz)		1715	1732.5	1750
10M	QPSK	1	0	12.54	12.73	12.59
		1	24	12.78	12.80	12.68
		1	49	12.67	12.66	12.83
		25	0	11.61	11.50	11.61
		25	12	11.52	11.58	11.73
		25	25	11.57	11.59	11.53
		50	0	11.17	11.08	10.94
10M	16QAM	1	0	12.85	12.88	12.89
		1	24	12.75	12.76	12.94
		1	49	12.92	12.82	12.90
		25	0	10.89	10.88	10.85
		25	12	10.66	10.83	10.65
		25	25	10.93	10.74	10.91
		50	0	9.39	9.28	9.36

*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

Cat-M1 Band 4						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		19975	20175	20375
		Frequency (MHz)		1712.5	1732.5	1752.5
5M	QPSK	1	0	12.82	12.60	12.76
		1	12	12.81	12.72	12.76
		1	24	12.54	12.78	12.67
		12	0	11.48	11.71	11.47
		12	6	11.73	11.46	11.47
		12	13	11.66	11.71	11.67
		25	0	10.99	10.96	11.02
5M	16QAM	1	0	12.70	12.85	12.71
		1	12	12.78	12.82	12.98
		1	24	12.87	12.71	12.78
		12	0	10.68	10.84	10.72
		12	6	10.88	10.94	10.93
		12	13	10.64	10.92	10.89
		25	0	9.31	9.26	9.53

*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

Cat-M1 Band 4						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		19965	20175	20385
		Frequency (MHz)		1711.5	1732.5	1753.5
3M	QPSK	1	0	12.83	12.56	12.78
		1	7	12.74	12.67	12.66
		1	14	12.70	12.72	12.73
		8	0	11.69	11.45	11.75
		8	3	11.65	11.73	11.53
		8	7	11.70	11.67	11.52
		15	0	10.98	10.91	10.92
3M	16QAM	1	0	12.82	12.95	12.86
		1	7	12.83	13.00	12.81
		1	14	12.87	12.92	12.84
		8	0	10.91	10.81	10.81
		8	3	10.87	10.94	10.68
		8	7	10.85	10.87	10.92
		15	0	9.43	9.25	9.41

*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

Cat-M1 Band 4						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		19957	20175	20393
		Frequency (MHz)		1710.7	1732.5	1754.3
1.4M	QPSK	1	0	12.55	12.64	12.73
		1	2	12.62	12.79	12.79
		1	5	12.64	12.67	12.56
		3	0	11.56	11.62	11.48
		3	1	11.63	11.46	11.53
		3	3	11.58	11.60	11.75
		6	0	10.90	11.04	11.10
1.4M	16QAM	1	0	12.89	12.86	12.83
		1	2	12.88	12.99	12.92
		1	5	12.85	12.86	12.74
		3	0	10.75	10.65	10.91
		3	1	10.70	10.87	10.69
		3	3	10.81	10.92	10.70
		6	0	9.54	9.27	9.31

*EIRP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi)

7.1.3 Cat-M1 Band 5

Conducted Output Power (dBm)

Cat-M1 Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20450	20525	20600
		Frequency (MHz)		829	836.5	844
10M	QPSK	1	0	22.98	23.12	22.98
		1	24	23.02	23.01	23.08
		1	49	23.11	22.98	23.06
		25	0	22.13	21.97	22.25
		25	12	22.18	22.16	22.03
		25	25	22.07	22.21	22.22
		50	0	22.24	22.07	22.32
10M	16QAM	1	0	23.33	23.48	23.54
		1	24	23.31	23.39	23.37
		1	49	23.33	23.42	23.50
		25	0	22.45	22.50	22.56
		25	12	22.31	22.48	22.29
		25	25	22.57	22.56	22.42
		50	0	20.93	21.05	20.92

Cat-M1 Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20425	20525	20625
		Frequency (MHz)		826.5	836.5	846.5
5M	QPSK	1	0	22.96	23.07	23.10
		1	12	23.04	22.99	23.21
		1	24	23.06	22.99	22.98
		12	0	22.10	21.99	22.27
		12	6	22.03	21.98	22.16
		12	13	22.05	22.17	22.05
		25	0	22.13	22.27	22.05
5M	16QAM	1	0	23.46	23.47	23.36
		1	12	23.56	23.30	23.41
		1	24	23.56	23.27	23.54
		12	0	22.43	22.30	22.49
		12	6	22.53	22.54	22.57
		12	13	22.53	22.41	22.36
		25	0	20.90	20.93	21.06

Cat-M1 Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20415	20525	20635
		Frequency (MHz)		825.5	836.5	847.5
3M	QPSK	1	0	23.08	23.14	23.09
		1	7	23.00	23.01	23.14
		1	14	22.99	23.09	23.02
		8	0	22.09	21.99	22.20
		8	3	22.23	22.19	22.09
		8	7	22.08	22.22	21.97
		15	0	22.29	22.07	22.33
3M	16QAM	1	0	23.37	23.49	23.28
		1	7	23.33	23.29	23.48
		1	14	23.32	23.33	23.30
		8	0	22.59	22.36	22.40
		8	3	22.51	22.56	22.58
		8	7	22.38	22.48	22.50
		15	0	20.82	20.98	20.90

Cat-M1 Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20407	20525	20643
		Frequency (MHz)		824.7	836.5	848.3
1.4M	QPSK	1	0	23.21	22.94	23.12
		1	2	22.98	23.02	23.21
		1	5	23.00	23.22	23.08
		3	0	22.08	22.17	22.23
		3	1	22.14	22.03	22.00
		3	3	22.27	22.23	22.25
		6	0	22.05	22.32	22.22
1.4M	16QAM	1	0	23.55	23.57	23.27
		1	2	23.37	23.56	23.34
		1	5	23.55	23.28	23.30
		3	0	22.30	22.46	22.59
		3	1	22.57	22.38	22.34
		3	3	22.37	22.40	22.58
		6	0	20.96	21.05	20.96

ERP Power (dBm)

Cat-M1 Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20450	20525	20600
		Frequency (MHz)		829	836.5	844
10M	QPSK	1	0	12.03	12.17	12.03
		1	24	12.07	12.06	12.13
		1	49	12.16	12.03	12.11
		25	0	11.18	11.02	11.30
		25	12	11.23	11.21	11.08
		25	25	11.12	11.26	11.27
		50	0	11.29	11.12	11.37
10M	16QAM	1	0	12.38	12.53	12.59
		1	24	12.36	12.44	12.42
		1	49	12.38	12.47	12.55
		25	0	11.50	11.55	11.61
		25	12	11.36	11.53	11.34
		25	25	11.62	11.61	11.47
		50	0	9.98	10.10	9.97

*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

Cat-M1 Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20425	20525	20625
		Frequency (MHz)		826.5	836.5	846.5
5M	QPSK	1	0	12.01	12.12	12.15
		1	12	12.09	12.04	12.26
		1	24	12.11	12.04	12.03
		12	0	11.15	11.04	11.32
		12	6	11.08	11.03	11.21
		12	13	11.10	11.22	11.10
		25	0	11.18	11.32	11.10
5M	16QAM	1	0	12.51	12.52	12.41
		1	12	12.61	12.35	12.46
		1	24	12.61	12.32	12.59
		12	0	11.48	11.35	11.54
		12	6	11.58	11.59	11.62
		12	13	11.58	11.46	11.41
		25	0	9.95	9.98	10.11

*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

Cat-M1 Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20415	20525	20635
		Frequency (MHz)		825.5	836.5	847.5
3M	QPSK	1	0	12.13	12.19	12.14
		1	7	12.05	12.06	12.19
		1	14	12.04	12.14	12.07
		8	0	11.14	11.04	11.25
		8	3	11.28	11.24	11.14
		8	7	11.13	11.27	11.02
		15	0	11.34	11.12	11.38
3M	16QAM	1	0	12.42	12.54	12.33
		1	7	12.38	12.34	12.53
		1	14	12.37	12.38	12.35
		8	0	11.64	11.41	11.45
		8	3	11.56	11.61	11.63
		8	7	11.43	11.53	11.55
		15	0	9.87	10.03	9.95

*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

Cat-M1 Band 5						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		20407	20525	20643
		Frequency (MHz)		824.7	836.5	848.3
1.4M	QPSK	1	0	12.26	11.99	12.17
		1	2	12.03	12.07	12.26
		1	5	12.05	12.27	12.13
		3	0	11.13	11.22	11.28
		3	1	11.19	11.08	11.05
		3	3	11.32	11.28	11.30
		6	0	11.10	11.37	11.27
1.4M	16QAM	1	0	12.60	12.62	12.32
		1	2	12.42	12.61	12.39
		1	5	12.60	12.33	12.35
		3	0	11.35	11.51	11.64
		3	1	11.62	11.43	11.39
		3	3	11.42	11.45	11.63
		6	0	10.01	10.10	10.01

*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

7.1.4 Cat-M1 Band 12

Conducted Output Power (dBm)

Cat-M1 Band 12						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		23060	23095	23130
		Frequency (MHz)		704	707.5	711
10M	QPSK	1	0	23.45	23.51	23.32
		1	24	23.59	23.59	23.53
		1	49	23.34	23.44	23.49
		25	0	23.76	23.53	23.56
		25	12	23.51	23.74	23.59
		25	25	23.49	23.67	23.76
		50	0	21.97	21.82	21.89
10M	16QAM	1	0	23.16	23.25	23.01
		1	24	23.03	23.20	23.04
		1	49	23.14	23.19	23.21
		25	0	23.02	22.97	23.02
		25	12	22.98	23.08	22.95
		25	25	22.94	23.10	23.11
		50	0	20.80	20.77	20.75

Cat-M1 Band 12						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		23035	23095	23155
		Frequency (MHz)		701.5	707.5	713.5
5M	QPSK	1	0	23.43	23.50	23.59
		1	12	23.36	23.51	23.51
		1	24	23.49	23.44	23.40
		12	0	23.59	23.52	23.53
		12	6	23.76	23.67	23.67
		12	13	23.62	23.77	23.68
		25	0	21.79	22.05	21.79
5M	16QAM	1	0	23.01	23.21	23.22
		1	12	23.03	23.27	23.26
		1	24	23.12	23.07	23.30
		12	0	22.98	23.02	23.14
		12	6	22.99	22.95	22.93
		12	13	22.94	23.11	22.95
		25	0	20.74	20.71	20.76

Cat-M1 Band 12						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		23025	23095	23165
		Frequency (MHz)		700.5	707.5	714.5
3M	QPSK	1	0	23.52	23.36	23.32
		1	7	23.58	23.35	23.43
		1	14	23.44	23.56	23.44
		8	0	23.77	23.69	23.63
		8	3	23.74	23.72	23.68
		8	7	23.50	23.77	23.63
		15	0	21.86	22.06	22.01
3M	16QAM	1	0	23.31	23.30	23.08
		1	7	23.24	23.06	23.05
		1	14	23.17	23.30	23.06
		8	0	23.04	23.00	22.98
		8	3	23.10	22.96	22.89
		8	7	22.93	23.13	22.88
		15	0	20.68	20.61	20.80

Cat-M1 Band 12						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		23017	23095	23173
		Frequency (MHz)		699.7	707.5	715.3
1.4M	QPSK	1	0	23.62	23.61	23.35
		1	2	23.34	23.45	23.48
		1	5	23.45	23.39	23.53
		3	0	23.65	23.74	23.56
		3	1	23.58	23.77	23.50
		3	3	23.68	23.75	23.75
		6	0	21.81	21.81	21.83
1.4M	16QAM	1	0	23.05	23.19	23.01
		1	2	23.30	23.25	23.08
		1	5	23.24	23.06	23.06
		3	0	23.04	23.14	23.02
		3	1	22.88	22.92	22.90
		3	3	23.16	23.15	23.14
		6	0	20.65	20.73	20.64

ERP Power (dBm)

Cat-M1 Band 12						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		23060	23095	23130
		Frequency (MHz)		704	707.5	711
10M	QPSK	1	0	16.10	16.16	15.97
		1	24	16.24	16.24	16.18
		1	49	15.99	16.09	16.14
		25	0	16.41	16.18	16.21
		25	12	16.16	16.39	16.24
		25	25	16.14	16.32	16.41
		50	0	14.62	14.47	14.54
10M	16QAM	1	0	15.81	15.90	15.66
		1	24	15.68	15.85	15.69
		1	49	15.79	15.84	15.86
		25	0	15.67	15.62	15.67
		25	12	15.63	15.73	15.60
		25	25	15.59	15.75	15.76
		50	0	13.45	13.42	13.40

*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

Cat-M1 Band 12						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		23035	23095	23155
		Frequency (MHz)		701.5	707.5	713.5
5M	QPSK	1	0	16.08	16.15	16.24
		1	12	16.01	16.16	16.16
		1	24	16.14	16.09	16.05
		12	0	16.24	16.17	16.18
		12	6	16.41	16.32	16.32
		12	13	16.27	16.42	16.33
		25	0	14.44	14.70	14.44
5M	16QAM	1	0	15.66	15.86	15.87
		1	12	15.68	15.92	15.91
		1	24	15.77	15.72	15.95
		12	0	15.63	15.67	15.79
		12	6	15.64	15.60	15.58
		12	13	15.59	15.76	15.60
		25	0	13.39	13.36	13.41

*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

Cat-M1 Band 12						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		23025	23095	23165
		Frequency (MHz)		700.5	707.5	714.5
3M	QPSK	1	0	16.17	16.01	15.97
		1	7	16.23	16.00	16.08
		1	14	16.09	16.21	16.09
		8	0	16.42	16.34	16.28
		8	3	16.39	16.37	16.33
		8	7	16.15	16.42	16.28
		15	0	14.51	14.71	14.66
3M	16QAM	1	0	15.96	15.95	15.73
		1	7	15.89	15.71	15.70
		1	14	15.82	15.95	15.71
		8	0	15.69	15.65	15.63
		8	3	15.75	15.61	15.54
		8	7	15.58	15.78	15.53
		15	0	13.33	13.26	13.45

*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

Cat-M1 Band 12						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		23017	23095	23173
		Frequency (MHz)		699.7	707.5	715.3
1.4M	QPSK	1	0	16.27	16.26	16.00
		1	2	15.99	16.10	16.13
		1	5	16.10	16.04	16.18
		3	0	16.30	16.39	16.21
		3	1	16.23	16.42	16.15
		3	3	16.33	16.40	16.40
		6	0	14.46	14.46	14.48
1.4M	16QAM	1	0	15.70	15.84	15.66
		1	2	15.95	15.90	15.73
		1	5	15.89	15.71	15.71
		3	0	15.69	15.79	15.67
		3	1	15.53	15.57	15.55
		3	3	15.81	15.80	15.79
		6	0	13.30	13.38	13.29

*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

7.1.5 Cat-M1 Band 13

Conducted Output Power (dBm)

Cat-M1 Band 13				
BW	MCS Index	RB Size	RB Offset	Mid
		Channel		23230
		Frequency (MHz)		782
10M	QPSK	1	0	21.12
		1	24	20.96
		1	49	21.02
		25	0	21.36
		25	12	21.54
		25	25	21.41
		50	0	20.82
10M	16QAM	1	0	21.45
		1	24	21.54
		1	49	21.63
		25	0	21.91
		25	12	21.81
		25	25	21.75
		50	0	19.41

Cat-M1 Band 13						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		23205	23230	23255
		Frequency (MHz)		779.5	782	784.5
5M	QPSK	1	0	21.04	21.17	21.25
		1	12	21.24	21.24	21.22
		1	24	20.99	21.22	21.23
		12	0	21.35	21.30	21.39
		12	6	21.44	21.37	21.35
		12	13	21.53	21.25	21.41
		25	0	20.71	20.78	20.73
5M	16QAM	1	0	21.55	21.57	21.63
		1	12	21.67	21.48	21.56
		1	24	21.60	21.68	21.61
		12	0	21.66	21.84	21.78
		12	6	21.79	21.91	21.88
		12	13	21.74	21.64	21.87
		25	0	19.33	19.50	19.29

ERP Power (dBm)

Cat-M1 Band 13				
BW	MCS Index	RB Size	RB Offset	Mid
		Channel		23230
		Frequency (MHz)		782
10M	QPSK	1	0	14.37
		1	24	14.21
		1	49	14.27
		25	0	14.61
		25	12	14.79
		25	25	14.66
		50	0	14.07
10M	16QAM	1	0	14.70
		1	24	14.79
		1	49	14.88
		25	0	15.16
		25	12	15.06
		25	25	15.00
		50	0	12.66

*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

Cat-M1 Band 13						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		23205	23230	23255
		Frequency (MHz)		779.5	782	784.5
5M	QPSK	1	0	14.29	14.42	14.50
		1	12	14.49	14.49	14.47
		1	24	14.24	14.47	14.48
		12	0	14.60	14.55	14.64
		12	6	14.69	14.62	14.60
		12	13	14.78	14.50	14.66
		25	0	13.96	14.03	13.98
5M	16QAM	1	0	14.80	14.82	14.88
		1	12	14.92	14.73	14.81
		1	24	14.85	14.93	14.86
		12	0	14.91	15.09	15.03
		12	6	15.04	15.16	15.13
		12	13	14.99	14.89	15.12
		25	0	12.58	12.75	12.54

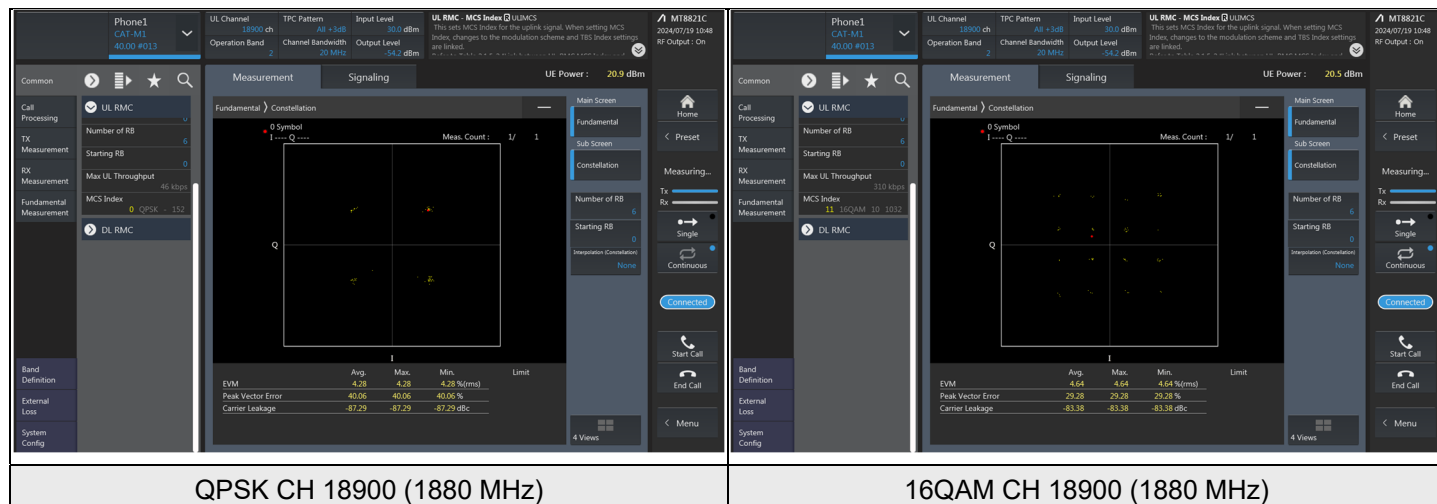
*ERP (dBm) = Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15

7.2 Modulation Characteristics

Input Power:	5 Vdc	Environmental Conditions:	22°C, 68% RH	Tested By:	Noah Chang
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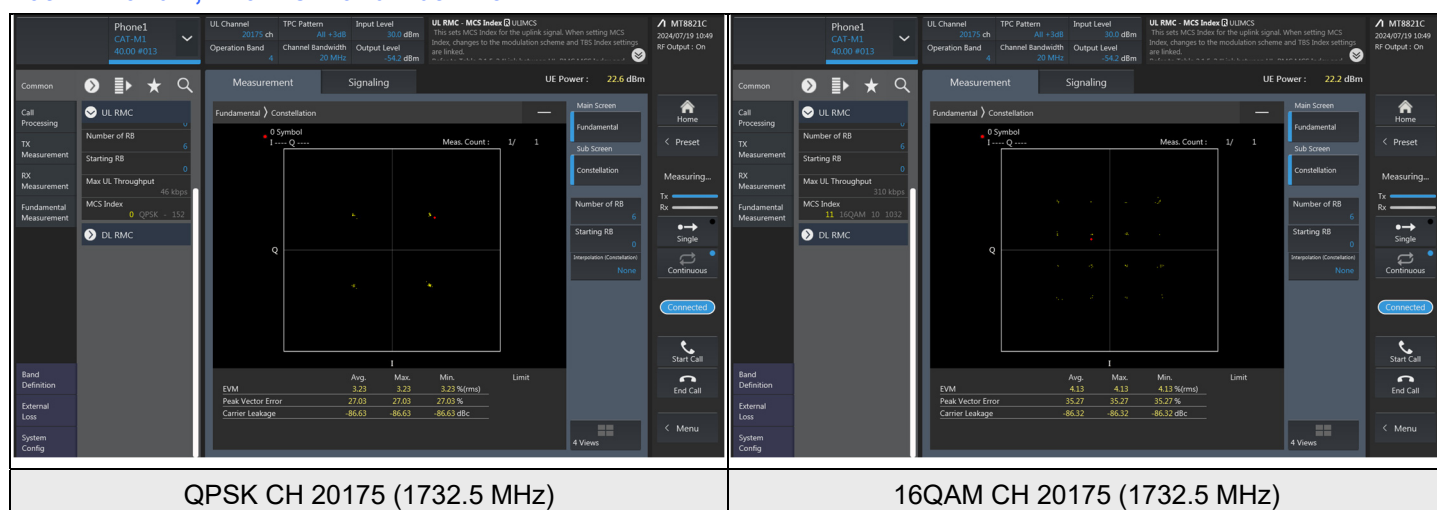
7.2.1 Cat-M1 Band 2

Cat-M1 Band 2, Channel Bandwidth: 20 MHz



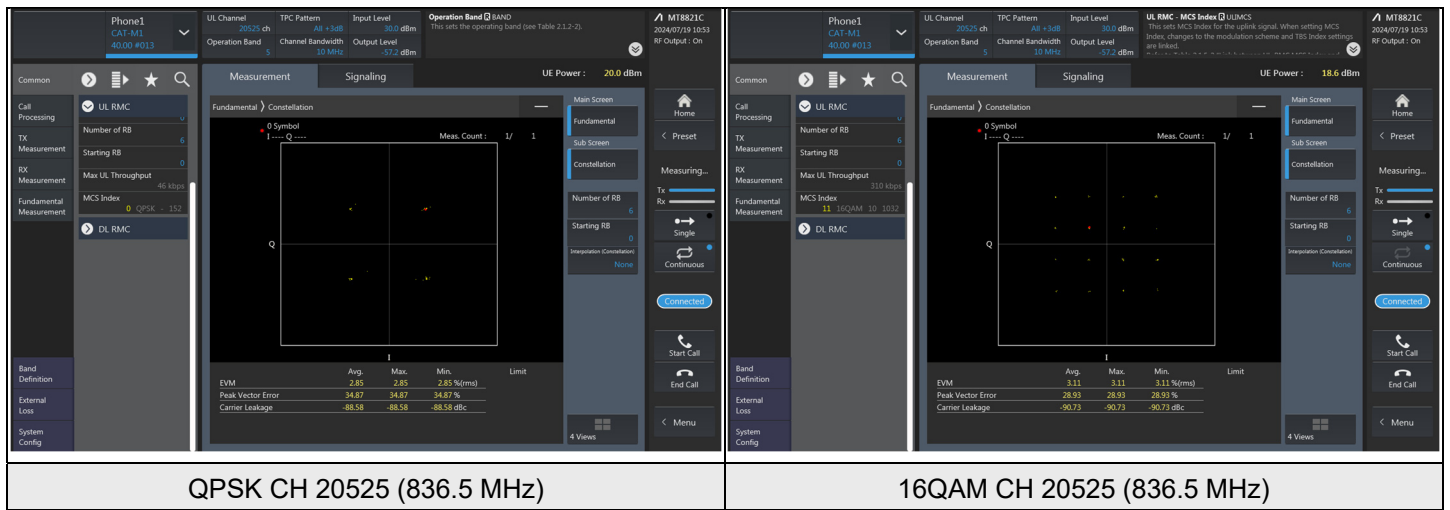
7.2.2 Cat-M1 Band 4

Cat-M1 Band 4, Channel Bandwidth: 20 MHz



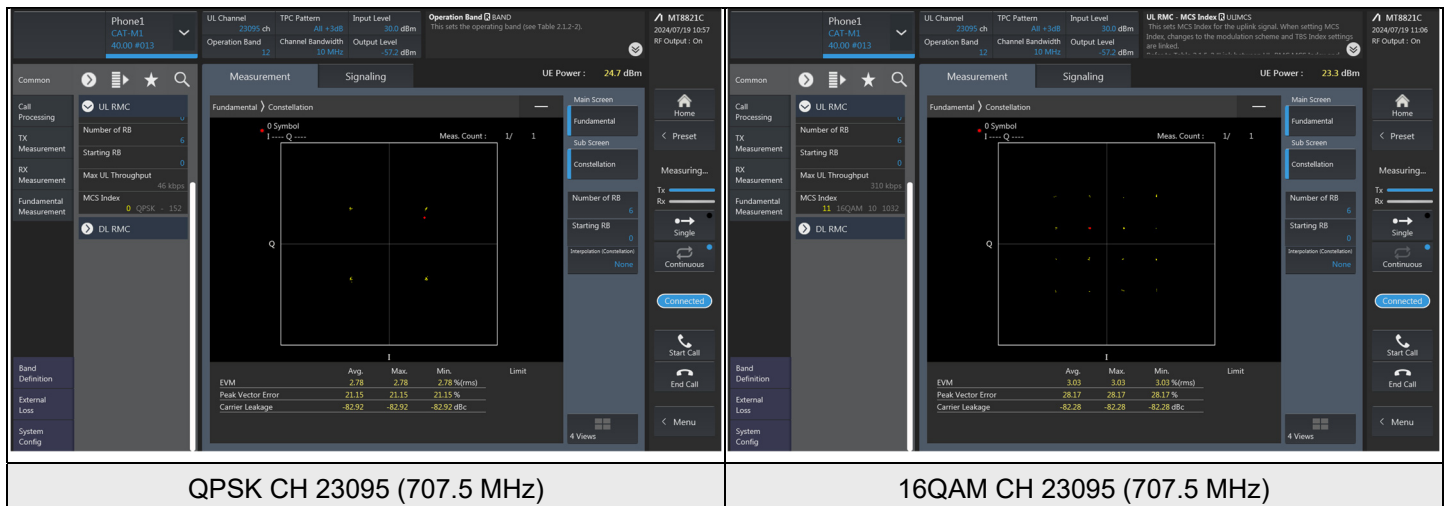
7.2.3 Cat-M1 Band 5

Cat-M1 Band 5, Channel Bandwidth: 10 MHz



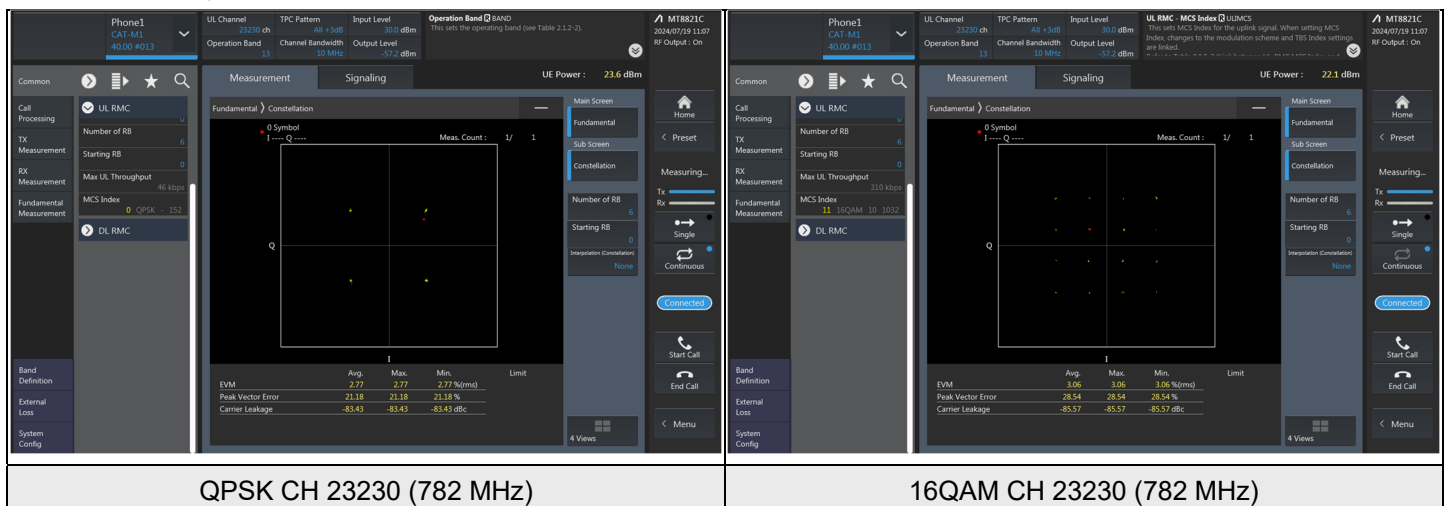
7.2.4 Cat-M1 Band 12

Cat-M1 Band 12, Channel Bandwidth: 10 MHz



7.2.5 Cat-M1 Band 13

Cat-M1 Band 13, Channel Bandwidth: 10 MHz



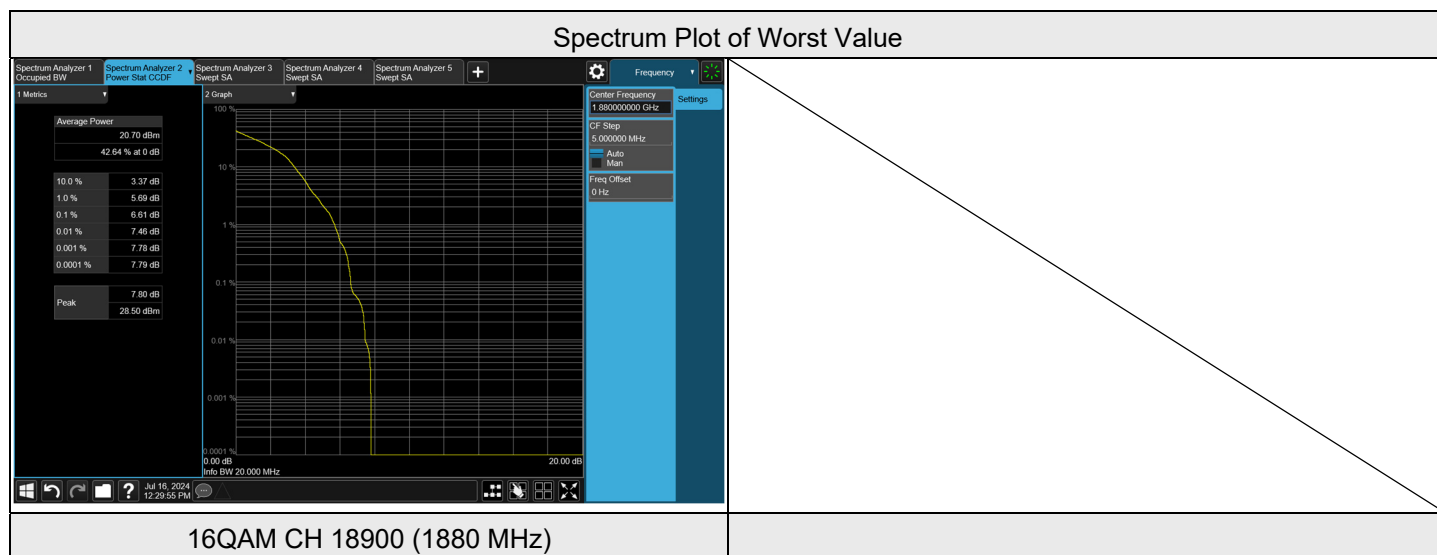
7.3 Peak to Average Ratio

Input Power:	5 Vdc	Environmental Conditions:	22°C, 68% RH	Tested By:	Noah Chang
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7.3.1 Cat-M1 Band 2

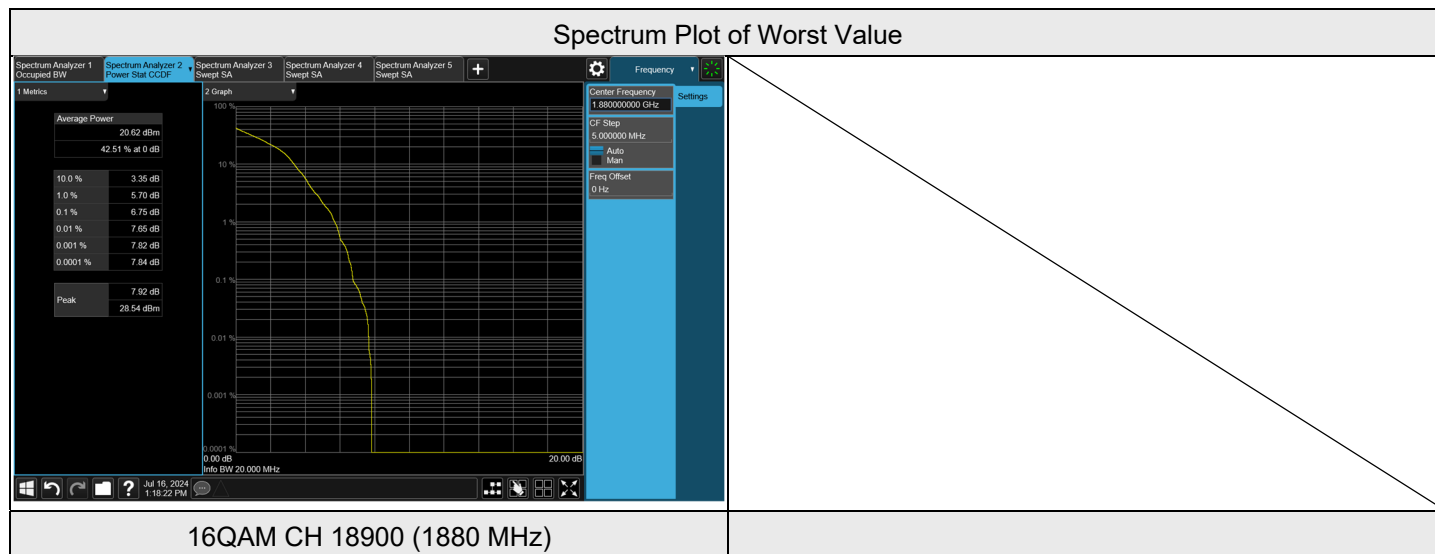
Cat-M1 Band 2, Channel Bandwidth: 1.4 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	18607	1850.7	5.06	13	PASS
QPSK	18900	1880	5.17	13	PASS
QPSK	19193	1909.3	4.90	13	PASS
16QAM	18607	1850.7	6.26	13	PASS
16QAM	18900	1880	6.61	13	PASS
16QAM	19193	1909.3	6.05	13	PASS



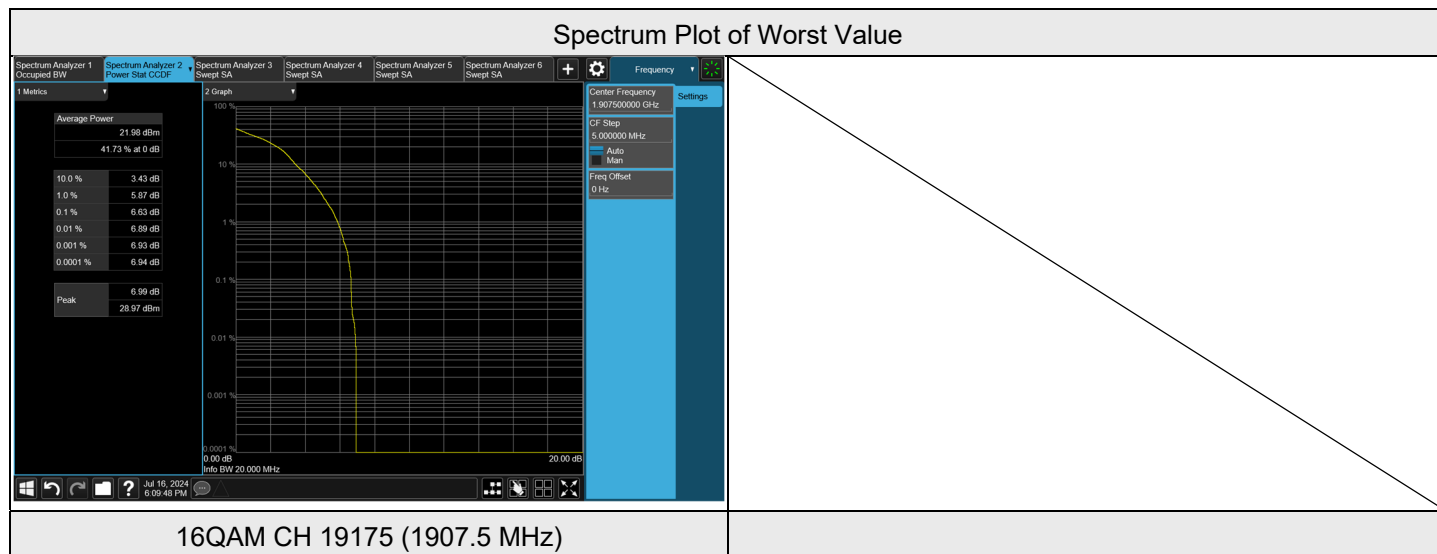
Cat-M1 Band 2, Channel Bandwidth: 3 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	18615	1851.5	5.55	13	PASS
QPSK	18900	1880	5.71	13	PASS
QPSK	19185	1908.5	5.41	13	PASS
16QAM	18615	1851.5	6.53	13	PASS
16QAM	18900	1880	6.75	13	PASS
16QAM	19185	1908.5	6.44	13	PASS

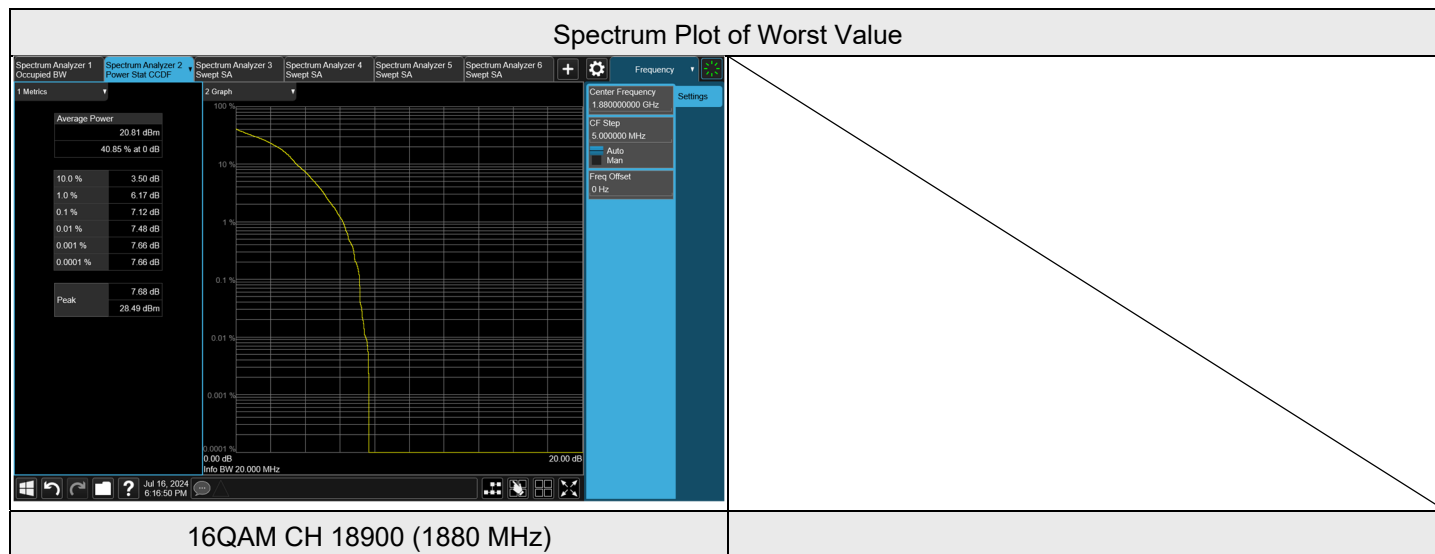


Cat-M1 Band 2, Channel Bandwidth: 5 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	18625	1852.5	5.36	13	PASS
QPSK	18900	1880	5.84	13	PASS
QPSK	19175	1907.5	5.48	13	PASS
16QAM	18625	1852.5	5.51	13	PASS
16QAM	18900	1880	5.91	13	PASS
16QAM	19175	1907.5	6.63	13	PASS

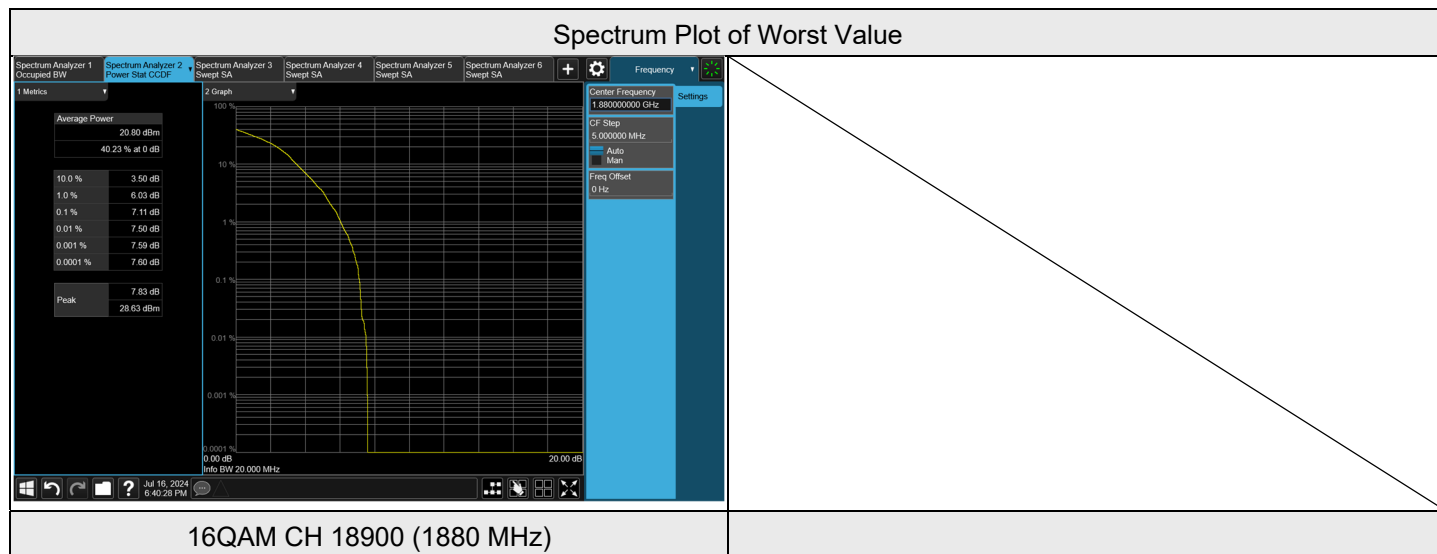


Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	18650	1855	5.47	13	PASS
QPSK	18900	1880	5.78	13	PASS
QPSK	19150	1905	5.46	13	PASS
16QAM	18650	1855	6.49	13	PASS
16QAM	18900	1880	7.12	13	PASS
16QAM	19150	1905	6.69	13	PASS

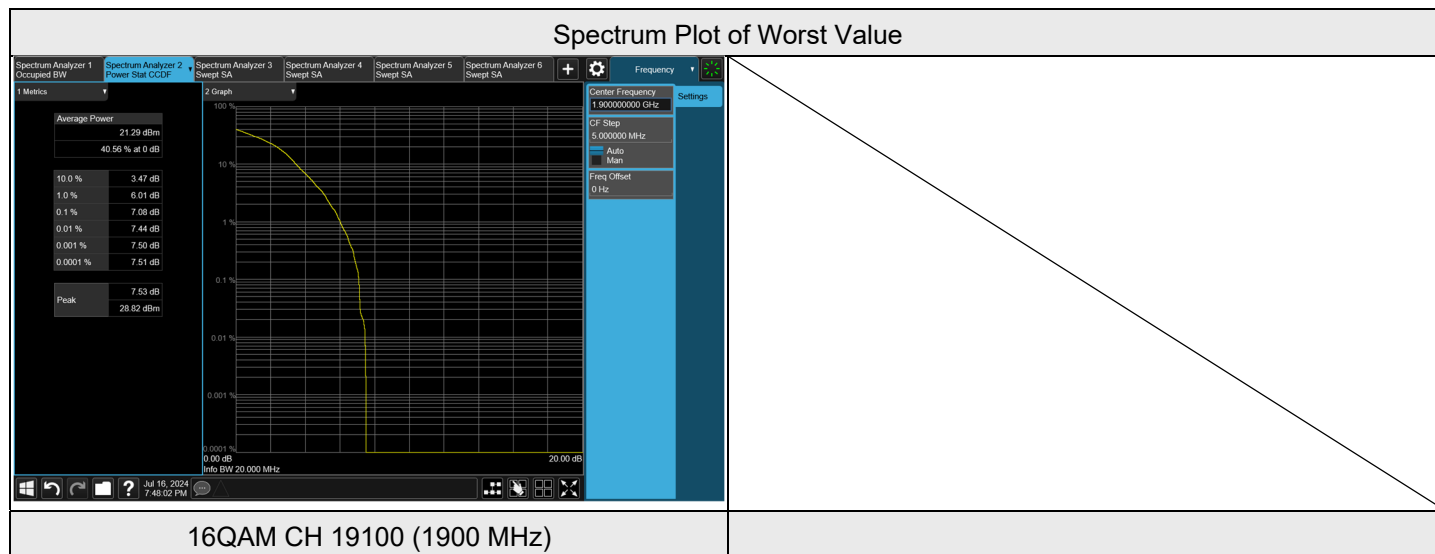


Cat-M1 Band 2, Channel Bandwidth: 15 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	18675	1857.5	5.40	13	PASS
QPSK	18900	1880	5.83	13	PASS
QPSK	19125	1902.5	5.53	13	PASS
16QAM	18675	1857.5	6.70	13	PASS
16QAM	18900	1880	7.11	13	PASS
16QAM	19125	1902.5	6.91	13	PASS



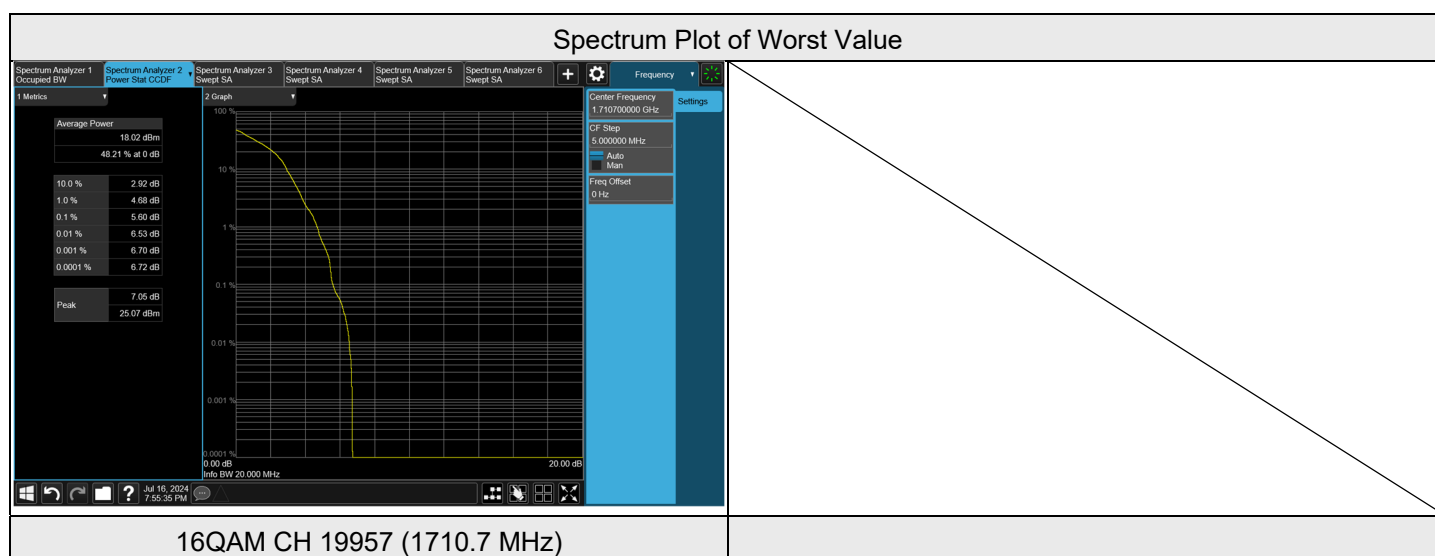
Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	18700	1860	5.33	13	PASS
QPSK	18900	1880	5.75	13	PASS
QPSK	19100	1900	5.46	13	PASS
16QAM	18700	1860	6.60	13	PASS
16QAM	18900	1880	7.04	13	PASS
16QAM	19100	1900	7.08	13	PASS



7.3.2 Cat-M1 Band 4

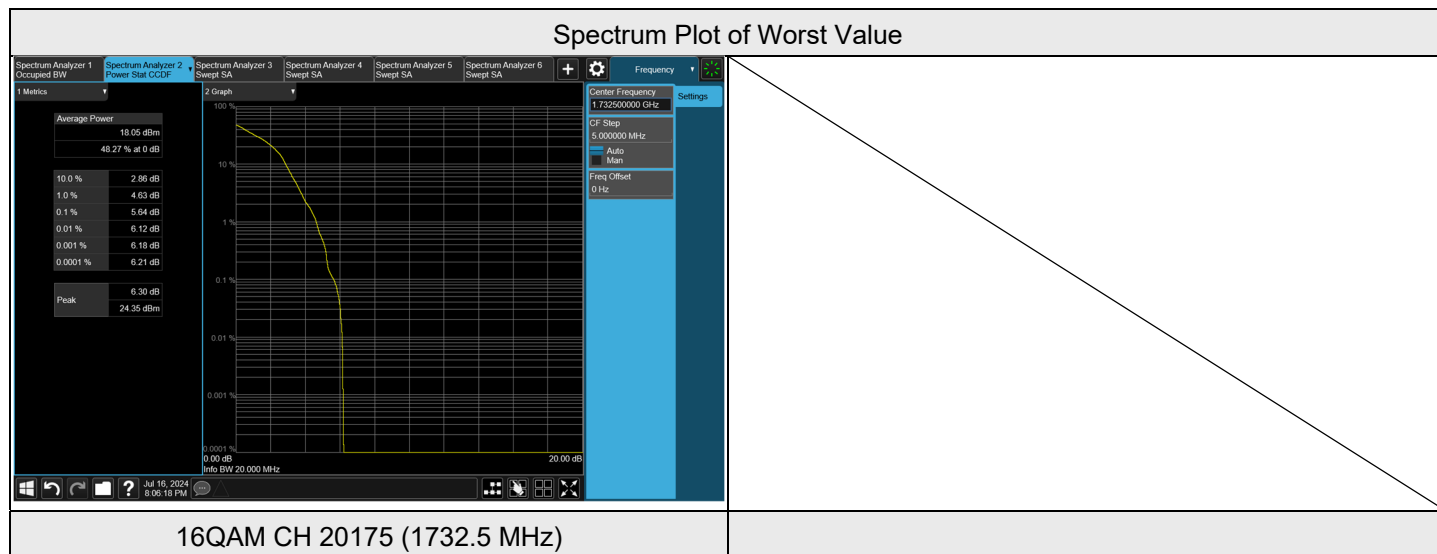
Cat-M1 Band 4, Channel Bandwidth: 1.4 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	19957	1710.7	3.87	13	PASS
QPSK	20175	1732.5	3.89	13	PASS
QPSK	20393	1754.3	3.71	13	PASS
16QAM	19957	1710.7	5.60	13	PASS
16QAM	20175	1732.5	5.53	13	PASS
16QAM	20393	1754.3	4.87	13	PASS



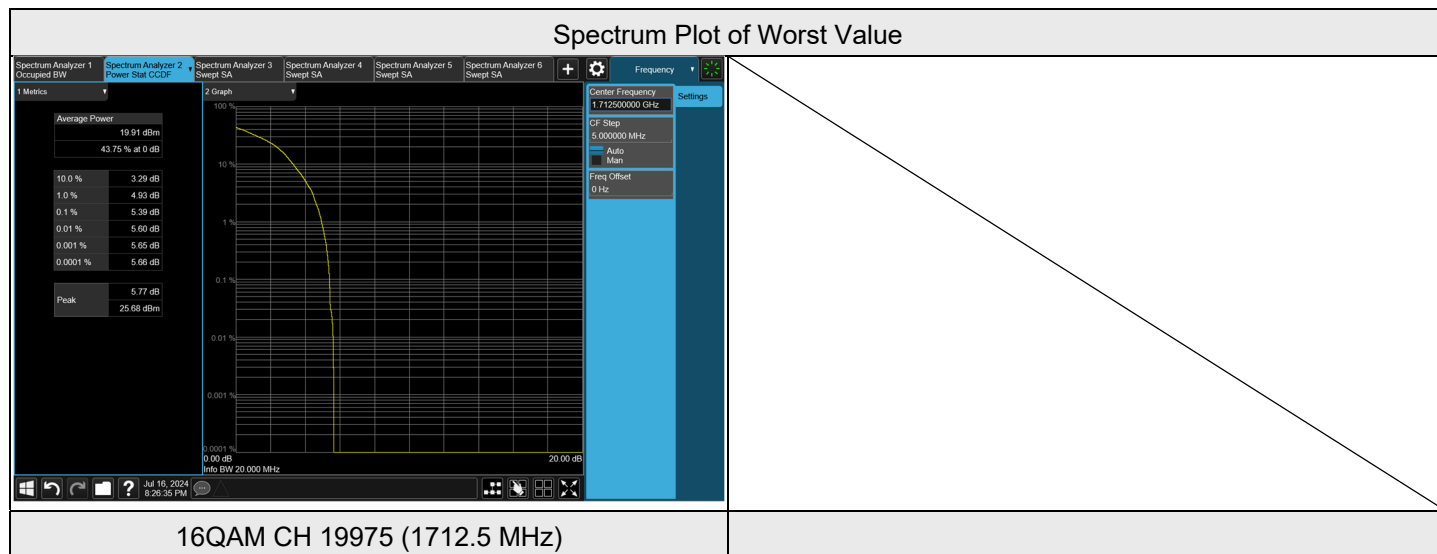
Cat-M1 Band 4, Channel Bandwidth: 3 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	19965	1711.5	4.22	13	PASS
QPSK	20175	1732.5	4.09	13	PASS
QPSK	20385	1753.5	3.23	13	PASS
16QAM	19965	1711.5	5.45	13	PASS
16QAM	20175	1732.5	5.64	13	PASS
16QAM	20385	1753.5	4.69	13	PASS



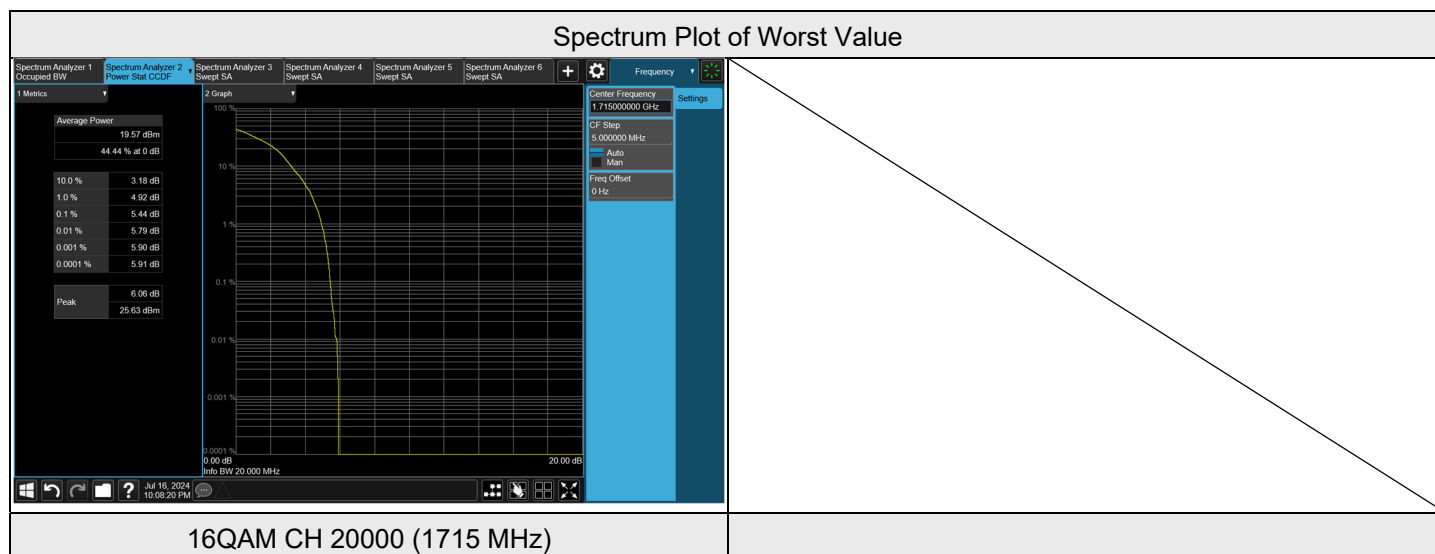
Cat-M1 Band 4, Channel Bandwidth: 5 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	19975	1712.5	4.10	13	PASS
QPSK	20175	1732.5	3.94	13	PASS
QPSK	20375	1752.5	3.92	13	PASS
16QAM	19975	1712.5	5.39	13	PASS
16QAM	20175	1732.5	4.08	13	PASS
16QAM	20375	1752.5	5.15	13	PASS



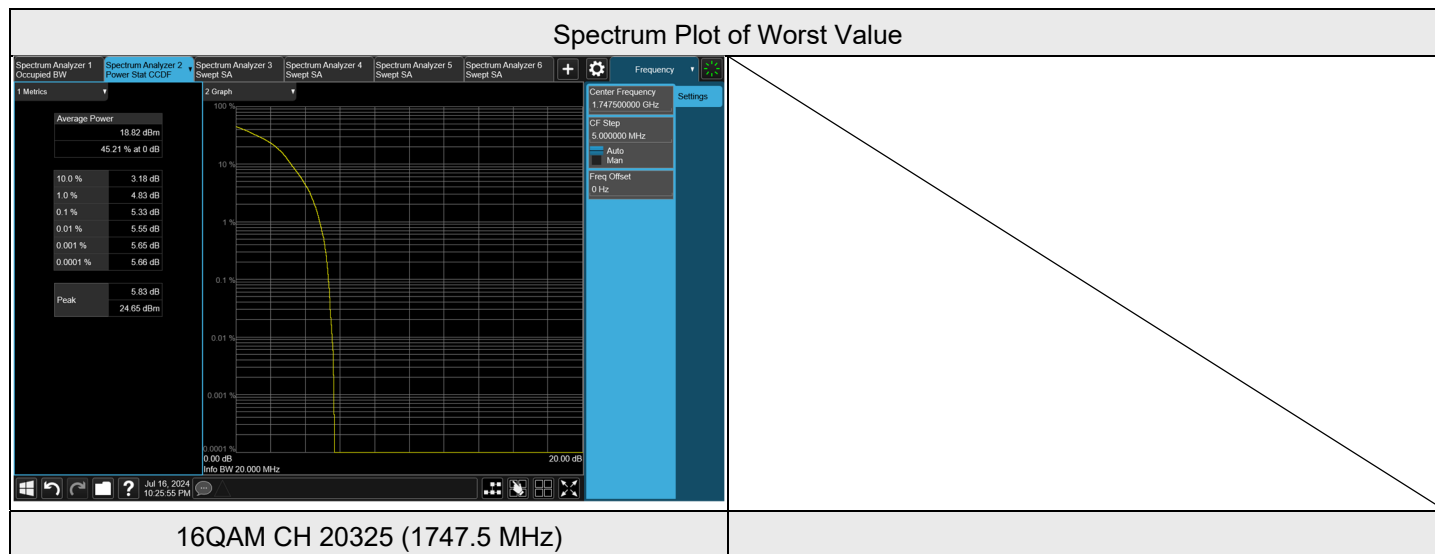
Cat-M1 Band 4, Channel Bandwidth: 10 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	20000	1715	4.12	13	PASS
QPSK	20175	1732.5	3.94	13	PASS
QPSK	20350	1750	4.03	13	PASS
16QAM	20000	1715	5.44	13	PASS
16QAM	20175	1732.5	5.38	13	PASS
16QAM	20350	1750	5.24	13	PASS



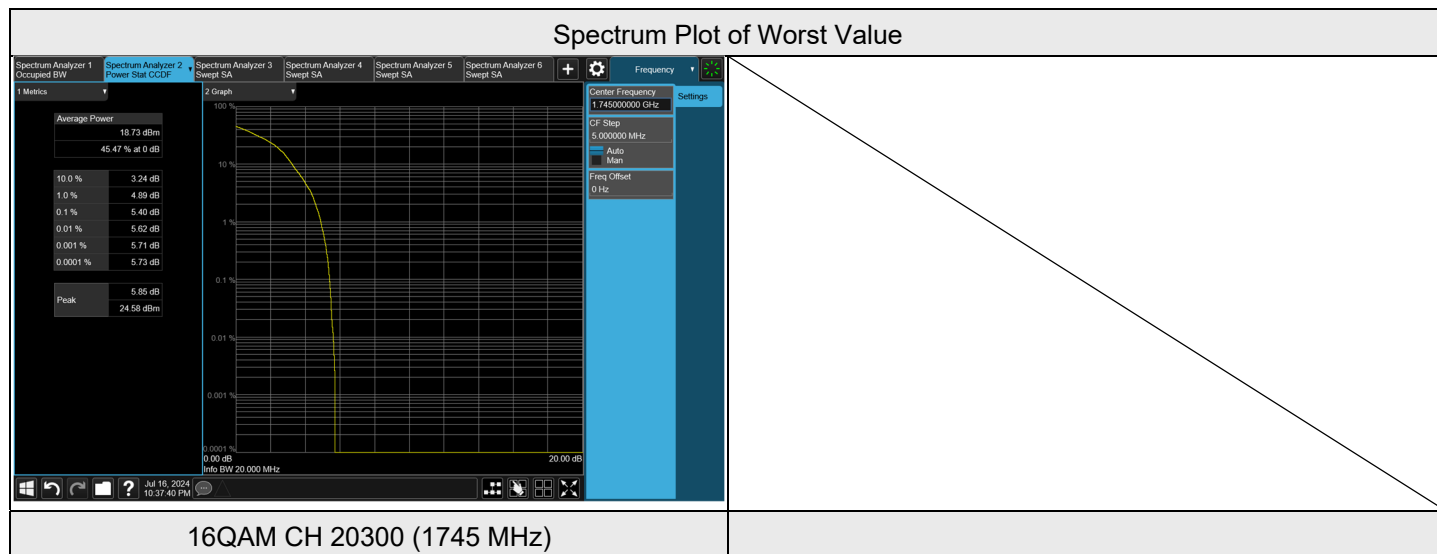
Cat-M1 Band 4, Channel Bandwidth: 15 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	20025	1717.5	4.14	13	PASS
QPSK	20175	1732.5	4.10	13	PASS
QPSK	20325	1747.5	3.88	13	PASS
16QAM	20025	1717.5	5.19	13	PASS
16QAM	20175	1732.5	5.05	13	PASS
16QAM	20325	1747.5	5.33	13	PASS



Cat-M1 Band 4, Channel Bandwidth: 20 MHz

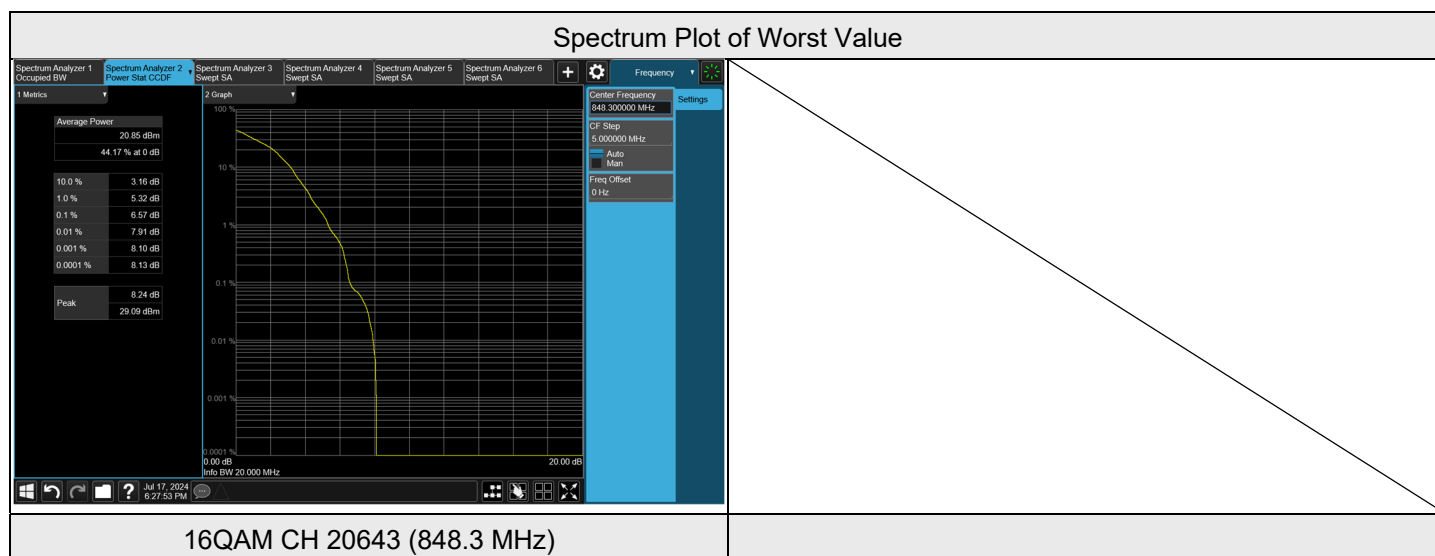
Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	20050	1720	3.95	13	PASS
QPSK	20175	1732.5	4.08	13	PASS
QPSK	20300	1745	4.00	13	PASS
16QAM	20050	1720	5.27	13	PASS
16QAM	20175	1732.5	5.31	13	PASS
16QAM	20300	1745	5.40	13	PASS



7.3.3 Cat-M1 Band 5

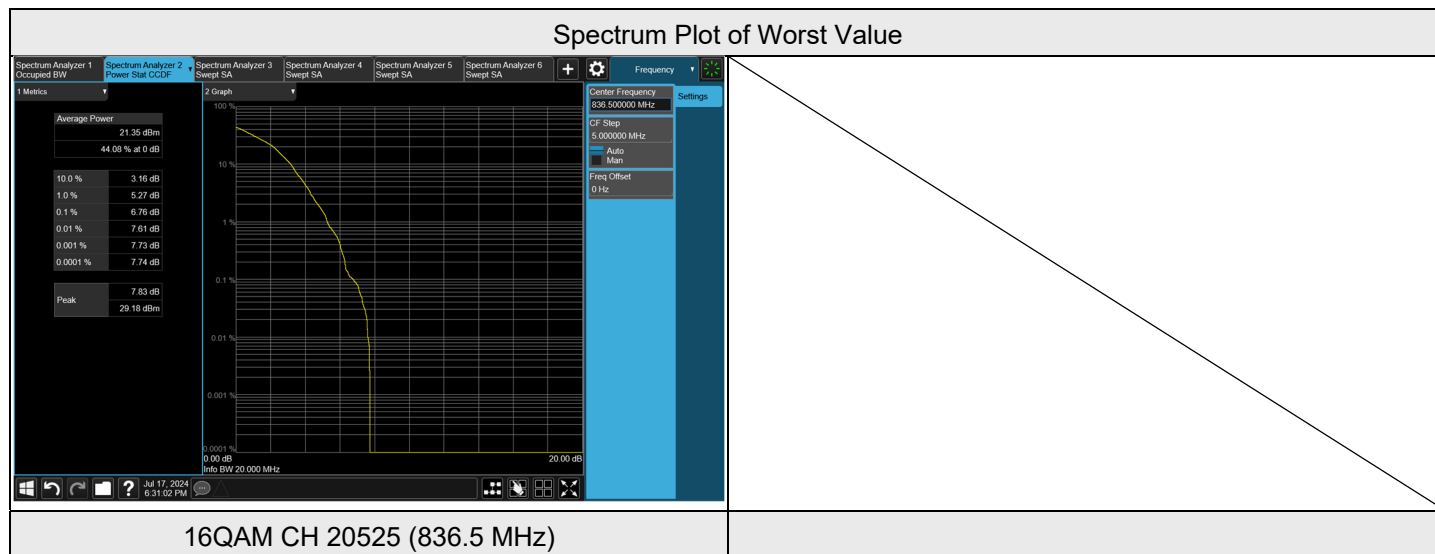
Cat-M1 Band 5, Channel Bandwidth: 1.4 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	20407	824.7	5.13	13	PASS
QPSK	20525	836.5	5.32	13	PASS
QPSK	20643	848.3	5.28	13	PASS
16QAM	20407	824.7	6.33	13	PASS
16QAM	20525	836.5	6.38	13	PASS
16QAM	20643	848.3	6.57	13	PASS



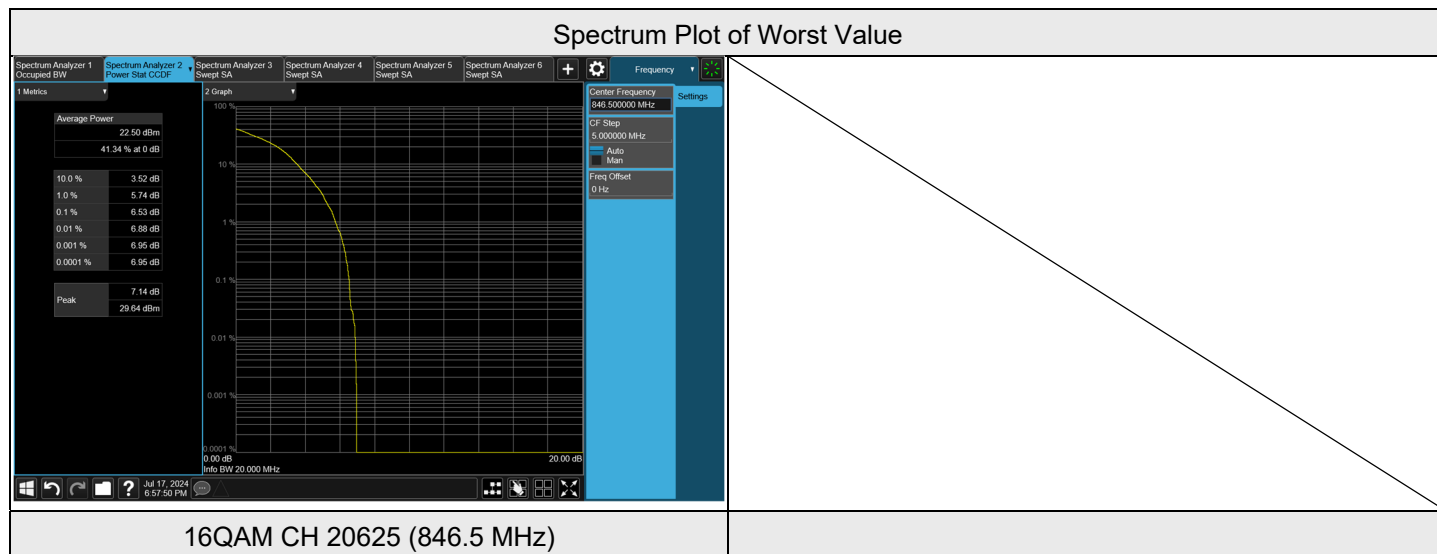
Cat-M1 Band 5, Channel Bandwidth: 3 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	20415	825.5	5.57	13	PASS
QPSK	20525	836.5	5.07	13	PASS
QPSK	20635	847.5	5.16	13	PASS
16QAM	20415	825.5	6.57	13	PASS
16QAM	20525	836.5	6.76	13	PASS
16QAM	20635	847.5	6.61	13	PASS



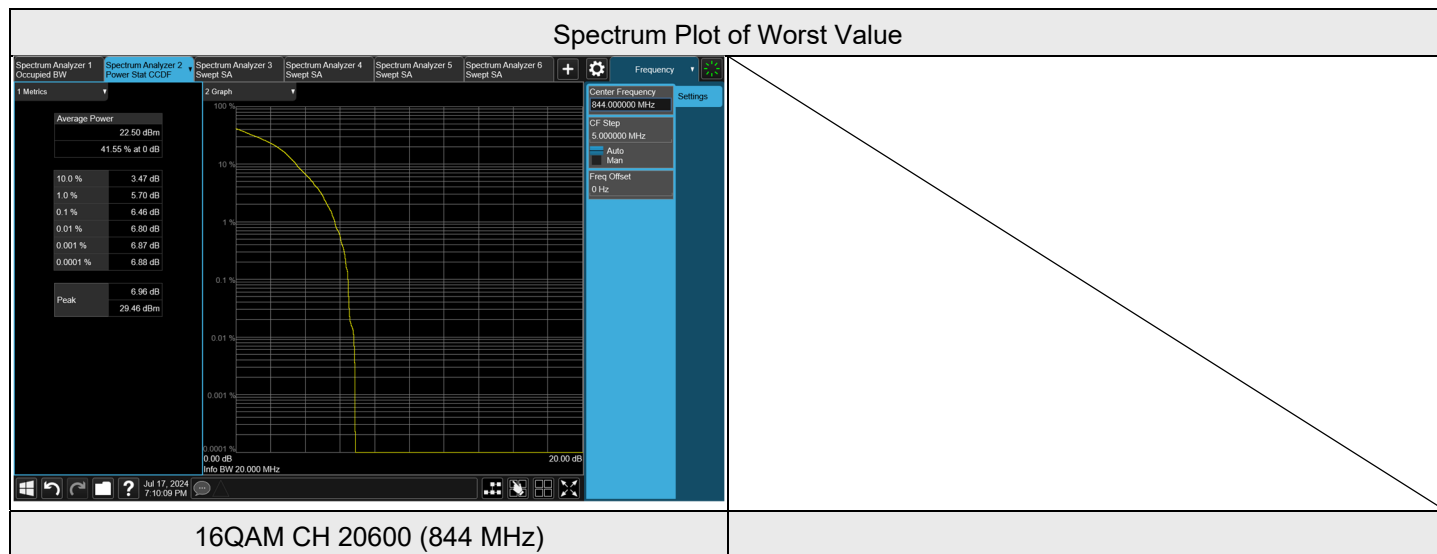
Cat-M1 Band 5, Channel Bandwidth: 5 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	20425	826.5	5.73	13	PASS
QPSK	20525	836.5	5.46	13	PASS
QPSK	20625	846.5	5.77	13	PASS
16QAM	20425	826.5	6.39	13	PASS
16QAM	20525	836.5	6.28	13	PASS
16QAM	20625	846.5	6.53	13	PASS



Cat-M1 Band 5, Channel Bandwidth: 10 MHz

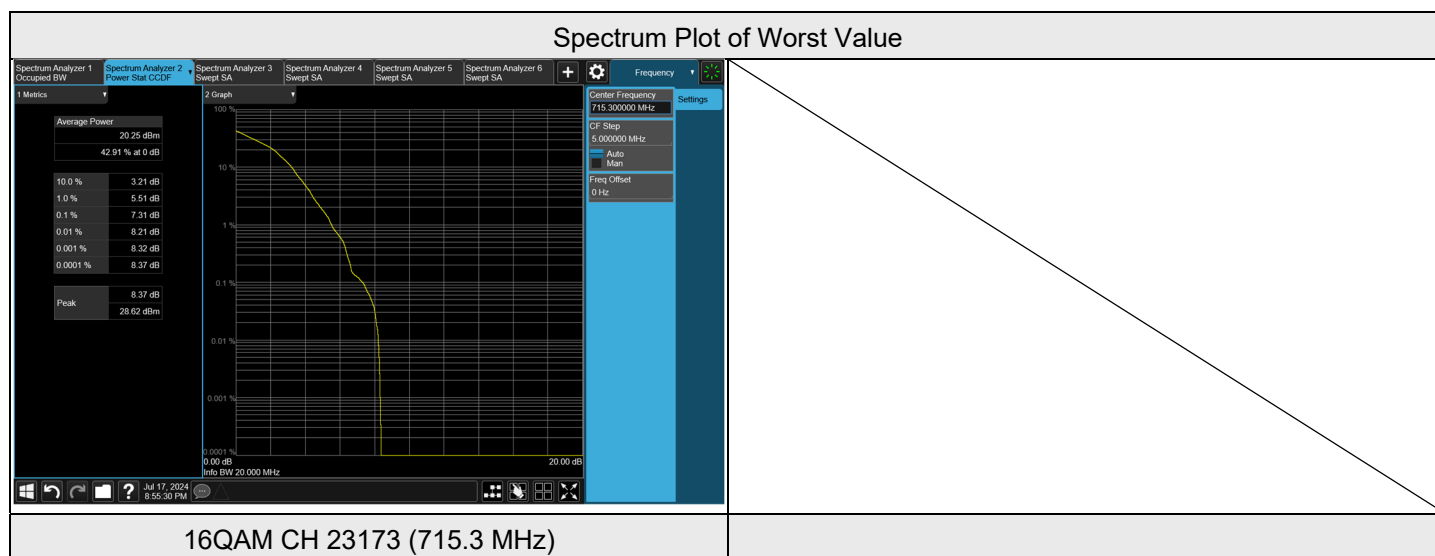
Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	20450	829	5.72	13	PASS
QPSK	20525	836.5	5.58	13	PASS
QPSK	20600	844	5.58	13	PASS
16QAM	20450	829	6.17	13	PASS
16QAM	20525	836.5	6.43	13	PASS
16QAM	20600	844	6.46	13	PASS



7.3.4 Cat-M1 Band 12

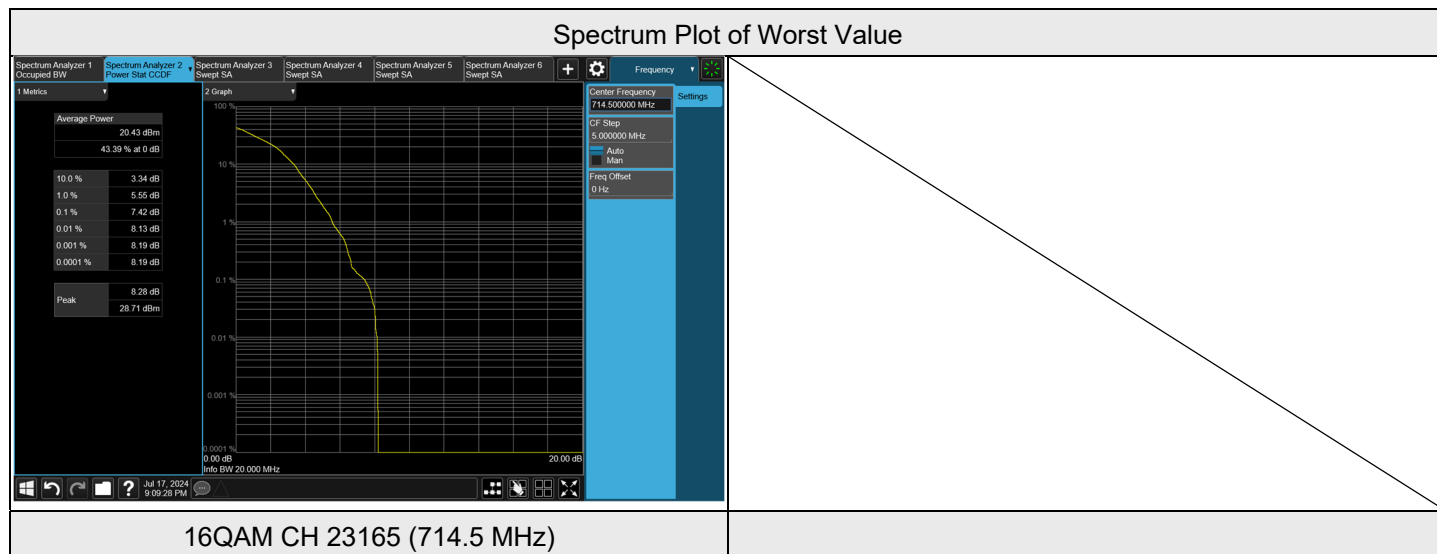
Cat-M1 Band 12, Channel Bandwidth: 1.4 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	23017	699.7	4.46	13	PASS
QPSK	23095	707.5	4.80	13	PASS
QPSK	23173	715.3	5.42	13	PASS
16QAM	23017	699.7	6.27	13	PASS
16QAM	23095	707.5	6.63	13	PASS
16QAM	23173	715.3	7.31	13	PASS



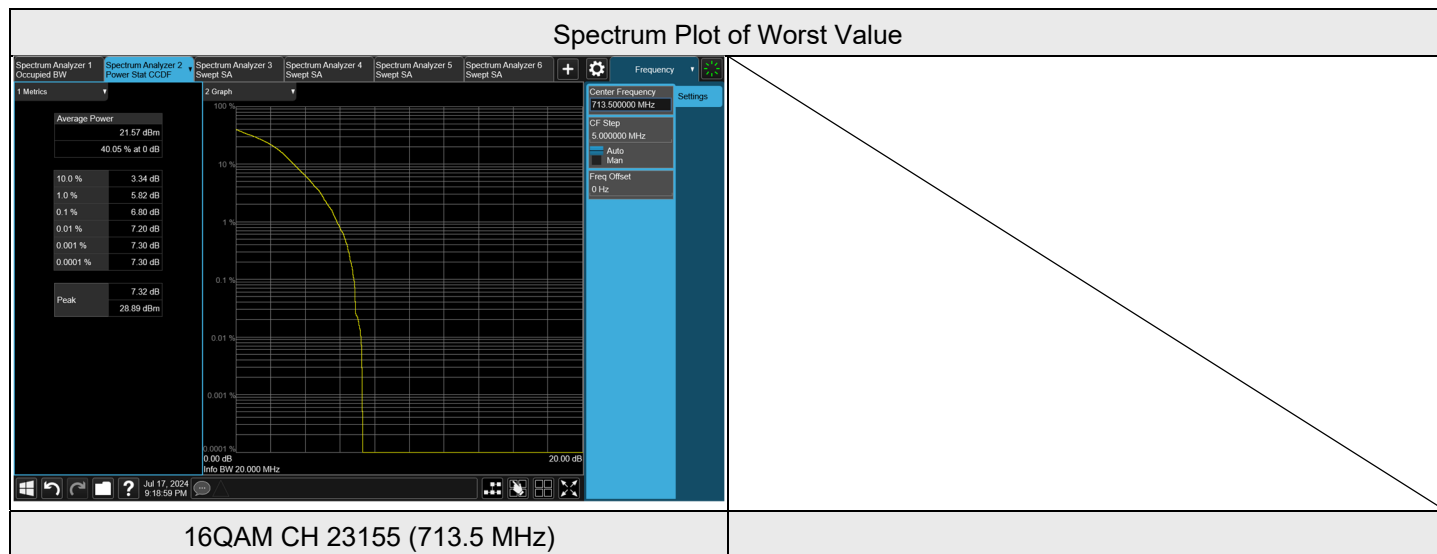
Cat-M1 Band 12, Channel Bandwidth: 3 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	23025	700.5	4.74	13	PASS
QPSK	23095	707.5	4.88	13	PASS
QPSK	23165	714.5	5.43	13	PASS
16QAM	23025	700.5	6.46	13	PASS
16QAM	23095	707.5	6.92	13	PASS
16QAM	23165	714.5	7.42	13	PASS



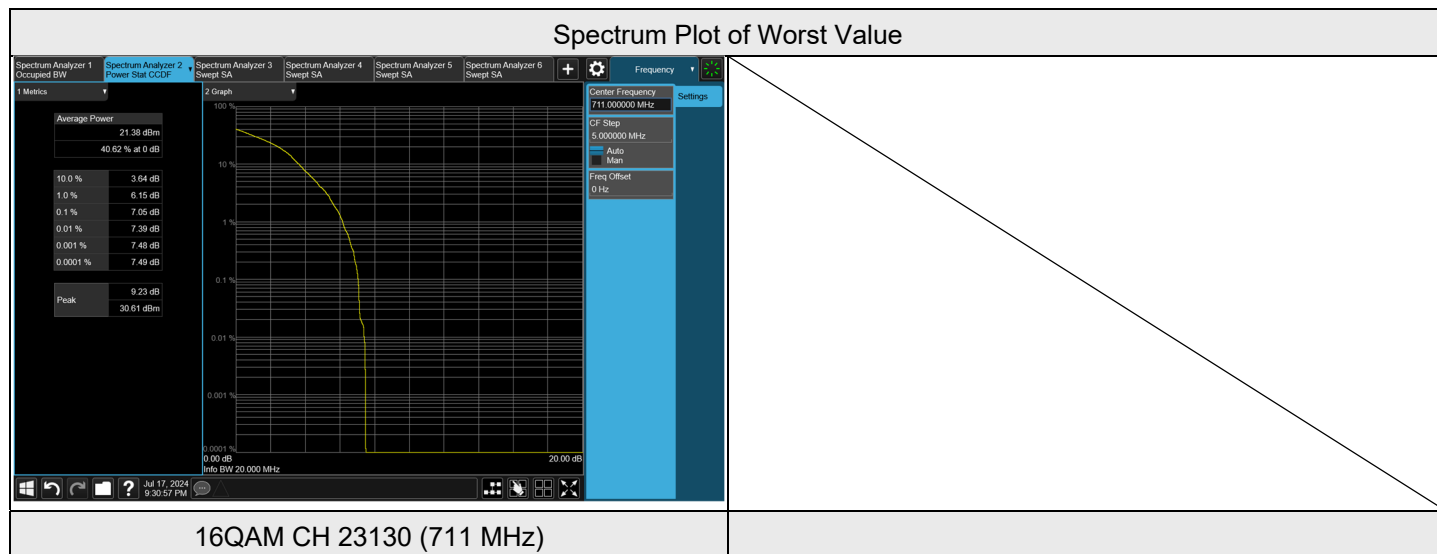
Cat-M1 Band 12, Channel Bandwidth: 5 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	23035	701.5	4.84	13	PASS
QPSK	23095	707.5	5.21	13	PASS
QPSK	23155	713.5	5.66	13	PASS
16QAM	23035	701.5	6.18	13	PASS
16QAM	23095	707.5	6.38	13	PASS
16QAM	23155	713.5	6.80	13	PASS



Cat-M1 Band 12, Channel Bandwidth: 10 MHz

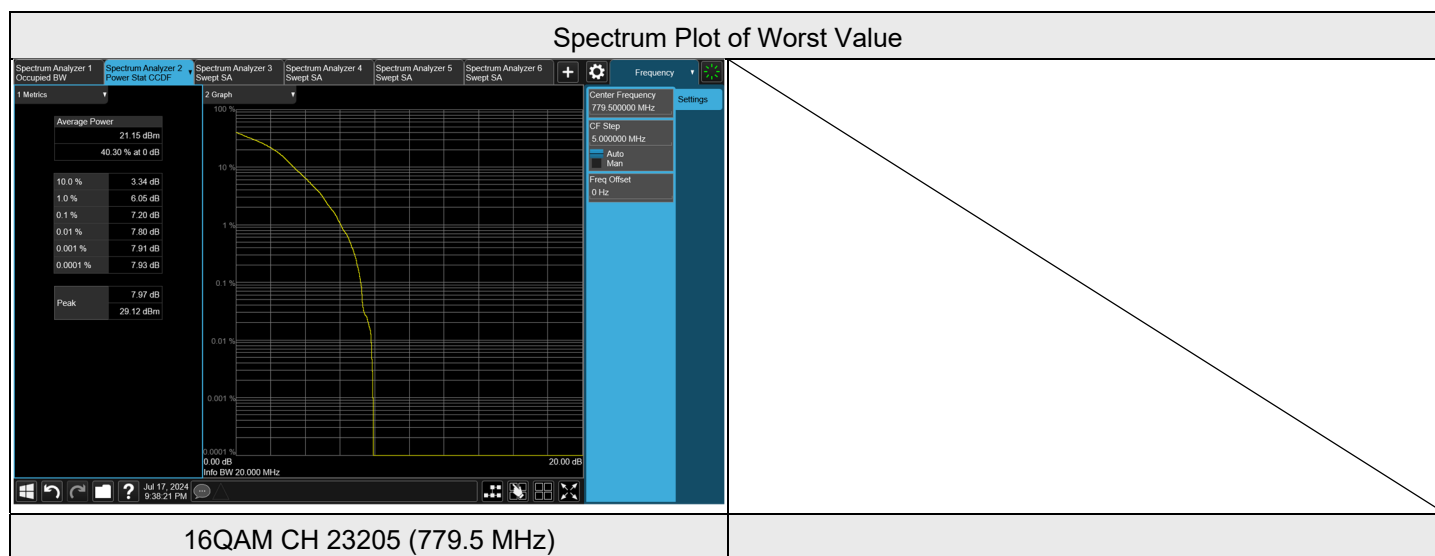
Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	23060	704	5.08	13	PASS
QPSK	23095	707.5	5.17	13	PASS
QPSK	23130	711	5.29	13	PASS
16QAM	23060	704	6.16	13	PASS
16QAM	23095	707.5	6.62	13	PASS
16QAM	23130	711	7.05	13	PASS



7.3.5 Cat-M1 Band 13

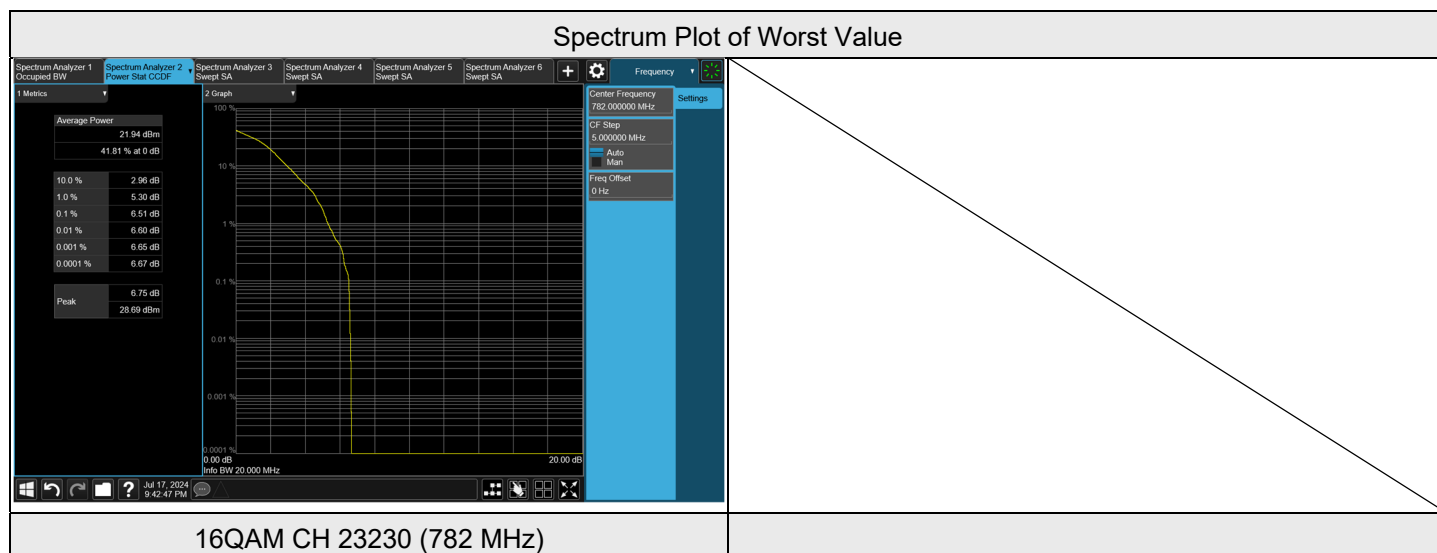
Cat-M1 Band 13, Channel Bandwidth: 5 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	23205	779.5	6.19	13	PASS
QPSK	23230	782	6.17	13	PASS
QPSK	23255	784.5	6.21	13	PASS
16QAM	23205	779.5	7.20	13	PASS
16QAM	23230	782	7.09	13	PASS
16QAM	23255	784.5	6.98	13	PASS



Cat-M1 Band 13, Channel Bandwidth: 10 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	23230	782	6.14	13	PASS
16QAM	23230	782	6.51	13	PASS



7.4 Bandwidth

Input Power:	5 Vdc	Environmental Conditions:	22°C, 68% RH	Tested By:	Noah Chang
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7.4.1 Cat-M1 Band 2

Cat-M1 Band 2, Channel Bandwidth: 1.4 MHz

Modulation	Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
QPSK	18607	1850.7	1.0726	1.264
QPSK	18900	1880	1.0779	1.251
QPSK	19193	1909.3	1.0752	1.260
16QAM	18607	1850.7	1.0725	1.263
16QAM	18900	1880	1.0731	1.255
16QAM	19193	1909.3	1.0718	1.252

