COMPLIANCE WORLDWIDE INC.
TEST REPORT 288-20R1

In Accordance with the Requirements of

FCC PART 15.247, SUBPART C
Innovation, Science and Economic Development Canada
RSS-247, Issue 2

Issued to

Philips Medical Systems
3000 Minuteman Drive
Andover, MA 01810
978-659-2800

for the

MX40 CTS Radio

Model
FCC ID: PQC-MX40SH2C4
IC: 3549B- MX40SH2C4

Report Issued on April 7, 2021
Revision R1 Issued on May 16, 2022

Tested by

Brian F. Breault

Reviewed by

Larry K. Stillings

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1. Scope

This test report certifies that the Philips Medical Systems MX40 2.4 GHz CTS Radio, as tested, meets the FCC Part 15, Subpart C and Industry Canada RSS 247, Issue 2 requirements. The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated, and a retest may be required. Revision R1 corrects the antenna gain in Section 7.5 and updates the report for using pulsed emissions and duty cycle calculation in sections 7.8 and 7.11.

2. Product Details

2.1. Manufacturer:	Philips Medical Systems
2.2. Model Number:	Model 865351/MX40-2C4
2.3 Serial Number:	US156Z7318 (conducted), US156Z7319 (radiated)
2.4 Description of EUT:	Wireless ECG/SpO2 patient monitor
2.5 Power Source:	3 AA batteries
2.6 Hardware Revision:	B.01.02
2.7 Software Revision:	C.01.54
2.8 Firmware Revision:	A.06.40
2.9. Modulation Type:	Smart Hopping, GFSK
2.10. Operating Freq.:	2400 MHz to 2483.5 MHz
2.11. EMC Modifications:	None

3. Product Configuration

3.1. Operational Characteristics & Software

The MX40 transmits to the Philips Clinical Network located outside the field of test. Patient information will be displayed on an IntelliVue Information Center also located outside the field of test.

3.2. Operating Instructions

The MX40 will be in normal monitoring mode transmitting patient data and waveforms to a frequency corresponding wireless access point where the patient data will be transferred through the IntelliVue Telemetry infrastructure and displayed on the IntelliVue Information Center display. Patient waveforms and data are also displayed on the MX40 display for local monitoring.

For Radiated Emissions testing, fan out the ECG leads and connect them to a termination plate. Extend the SpO2 transducer across the table opposite the ECG leads. The SpO2 transducer will be connected to an SpO2 simulator. Ensure the SpO2 function is set to continuous:

Select "**PATIENT WINDOW**" for the bed being monitored on the PIIC display. From the menu button choices across the bottom of the display, select "**Telemetry Setup**". A window will open and in the "**SpO2 Equipped Devices Only**" section, select the "**Enable SpO2**" checkbox. Below that checkbox, under "**SpO2 Mode**" click the dropdown menu and select "**Continuous**". Below that, ensure the "**Pleth**", "**Pulse**" and "**SpO2 Alarm**" boxes are also checked. For all other tests, the ECG leads will be connected to an ECG simulator.

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3. Product Configuration (continued)

3.2. Operating Instructions (continued)

Channel Selection:

1. Press Alt + F11 – A list of menu items and a "Login to access Windows Desktop Access" window will appear. Enter the username: PhilipsBD[1] (case sensitive) and password: <<Removed>>. The Taskbar should appear at the bottom of the screen.
2. Click the Start button at the left side of Taskbar and select Internet Explorer from the list.
3. Either use the Internet Explorer dropdown or manually enter the Access Point Controller address: 172.31.225.8[1]. The System Access Configuration screen should appear.
4. Click on the access point controller in the list on the left side of the window to expand the list and then click on the access point. The 2.4 GHz Smart Hopping AP Configuration should be available on the right side of the window.
5. At the bottom of the window, select the "click here to access advanced channel configuration options. The channel selection check boxes should appear. Click on the corresponding box to the channel you wish to select. If the channel is selected, click to deselect. Once complete, click save. The access point will reset to the selected channels.

3.3. EUT Hardware

Block Diag. #	Manufacturer	Model/Part # / Options	Serial Number/ Other	Input Voltage Range (V)	Input Freq. Range (Hz)	Description/Function
1a	Philips	865351/MX40-2C4/ C01, C03, J46, M02, S02	US156Z7318	3.7 - 4.5	DC	2.4 GHz CTS Patient Worn telemetry transceiver
1b	Philips	865351/MX40-2C4/ C01 C03 J46 M02 S02	US156Z7319 `	3.7 - 4.5	DC	2.4 GHz CTS Patient Worn telemetry transceiver

3.4. EUT Cables/Transducers

Diagram Block Letter	Manufacturer	Model/Part #	Length (m)	Shield Y/N	Description/Function
A	PHILIPS	989803171871	0.9	Y	ECG 6 LEAD /SPO2 LEAD SET
B	PHILIPS	M11191A	2.5	N	SPO_2 TRANSDUCER

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3. Product Configuration

3.5. Support Equipment

Diagram Block #	Manufacturer	Model/Part # / Options	Input Voltage Range	Input Freq. Range (Hz)	Description/Function
2	Cisco	WS-C2960+24PC-S V02	100-240	50-60	Power Over LAN Ethernet Switch S/N FOC2137Y584
3	Philips	453564195161/ ITS3171A	100-240	50-60	Access Point Controller (2.4 GHz) S/N SG71509672
4	Philips	989803171221	48	DC	2.4 GHz CTS Access Point S/N US51736275
5	Philips	453564195161	100-240	50-60	Philips IntelliVue Information Center S/N 2UA8081BX0
6	AXM	AXM2418	12	DC	24" Monitor JTA2017010045
7	Pronk Tech	OxiTest Ox-2	1.5	DC	SpO2 simulator S/N OX5497
8	Biotek	LionHeart2	9	DC	ECG simulator S/N 158997

3.6. Support Equipment Cables / Transducers

Diagram Block #	Manufacturer	Model/Part #	Length (m)	Shield Y/N	Description/Function
D	N/A	N/A	Various	N	Cat 5 UTP LAN cable

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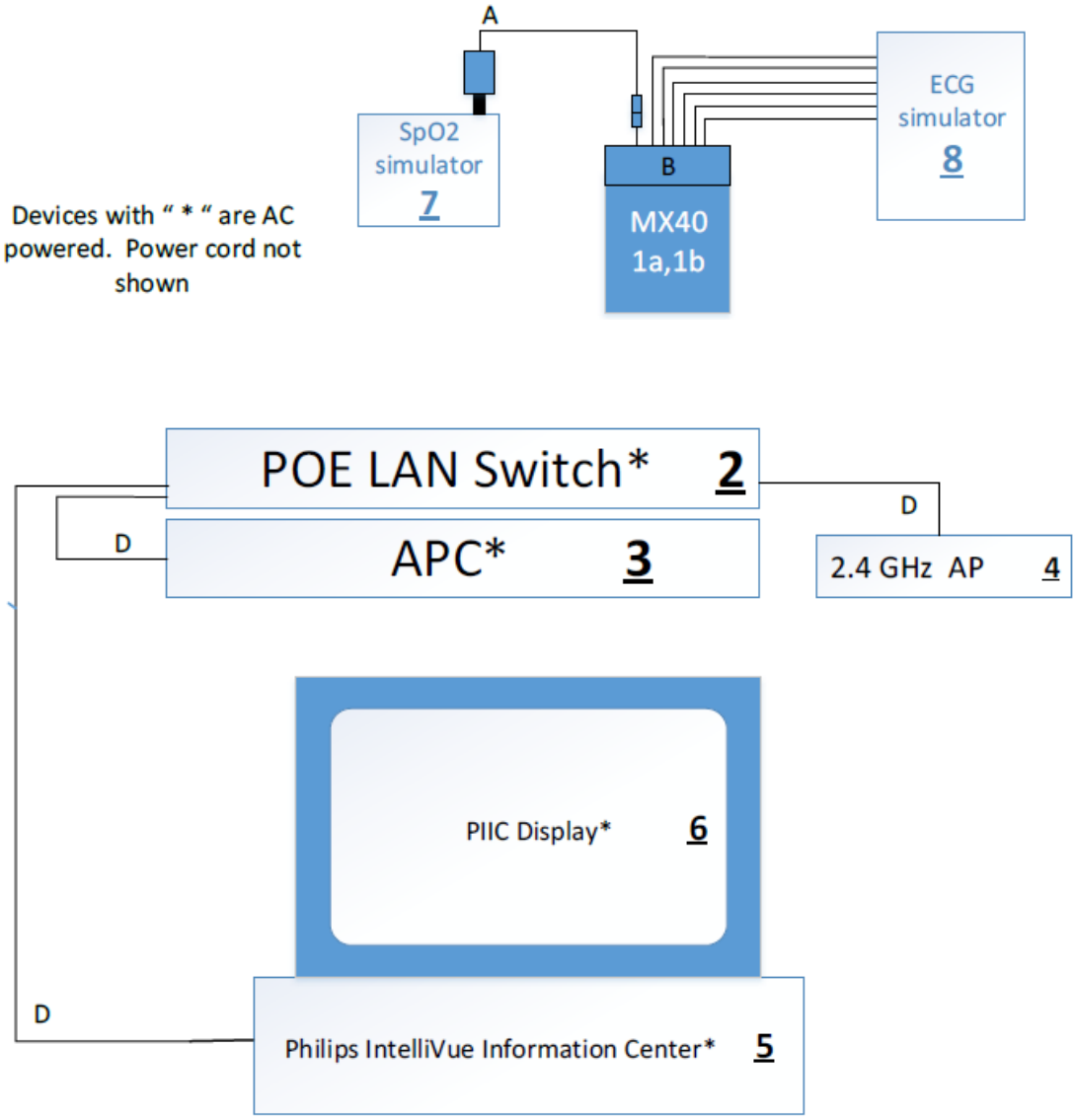
3. Product Configuration (continued)

3.7. Block Diagram



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4. Measurements Parameters

4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due	Interval
EMI Test Receiver, 9kHz - 7GHz [1]	Rohde & Schwarz	ESR7	101156	10/16/2022	2 Years
EMI Test Receiver, 10 Hz - 7GHz [1]	Rohde & Schwarz	ESR7	101770	7/17/2022	2 Years
Spectrum Analyzer, 2 Hz to 26.5 GHz[2]	Rohde & Schwarz	FSW26	102057	9/13/2021	3 Years
Spectrum Analyzer, 9 kHz to 40 GHz[3]	Rohde & Schwarz	FSV40	100899	8/12/2022	2 Years
Spectrum Analyzer 10 Hz – 40 GHz4	Rohde & Schwarz	FSVR40	100909	9/18/2022	2 Years
Loop Antenna 9 kHz - 30 MHz	EMCO	6512	9309-1139	1/28/2022	3 Years
Biconilog Antenna, 30 MHz - 2 GHz	Sunol Sciences	JB1	A050913	6/5/2021	2 Years
Dbl Ridged Guide Antenna 1- 18 GHz	ETS-Lindgren	3117	00143292	3/21/2022	2 Years
Horn Antenna, 18 to 40 GHz	Com-Power	AH-840	101032	9/28/2021	3 Years
Preamplifier, 1 GHz to 26.5 GHz	Hewlett Packard	8449B	3008A01323	9/11/2021	3 Years
Power Splitter/Combiner, to 4.2 GHz	RF Bay, Inc.	4195	14110124	6/16/2021	1 Year
Power Splitter/Combiner, 1-26.5 GHz	Mini Circuits	ZC2PD-01263-S+	961225	4/1/2022	1 Year
Digital Barometer	Control Company	4195	ID236	4/30/2021	3 Years
Digital Multimeter with Temp Probe	Fluke	187	80350579	9/18/2021	1 Year
Temperature Chamber	Associated Environmental	SD-308	10782	CNR	N/A

[1] ESR7 Firmware revision: V3.48 SP3, Date installed: 09/30/2020 Previous V3.48 SP2, installed 07/23/2020.
[2] FSW26 Firmware revision: V4.71 SP1, Date installed: 11/16/2020 Previous V4.61, installed 08/11/2020.
[3] FSV40 Firmware revision: V2.30 SP4, Date installed: 05/04/2016 Previous V2.30 SP1, installed 10/22/2014.
[4] FSVR40 Firmware revision: V2.23 SP1, Date installed: 08/19/2016 Previous V2.23, installed 10/22/2014.

4.2. Software Used to Perform Test

Manufacturer	Software Description	Title or Model #	Rev.	Report Sections
Compliance Worldwide	Test Report Generation Software	Test Report Generator	1.0	Not required for the equipment under test

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4. Measurements Parameters

4.3. Measurement & Equipment Setup

Test Dates:	11/4/2020 - 11/20/2020, 4/7/2021
Test Engineers:	Brian Breault, Sean Defelice
Normal Site Temperature (15 - 35°C):	21.2
Relative Humidity (20 -75%RH):	35
Frequency Range:	10 kHz to 25 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	200 Hz - 9 kHz to 150 kHz 9 kHz - 150 kHz to 30 MHz 120 kHz - 30 MHz to 1 GHz 1 MHz - Above 1 GHz
EMI Receiver Average Bandwidth:	≥3 x RBW (IFBw)
Detector Function:	Peak, Quasi-Peak & average

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4. Measurements Parameters

4.4. Measurement Procedure

Testing was performed in accordance with the requirements detailed in FCC Part 15.247 and ISED RSS-247, Issue 2 using ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and ISED RSS-GEN, Issue 5 Amendment 1 (March 2019) and Amendment 2 (February 2021).

In addition, FCC KDB 558074, D01: 15.247 Measurement Guidance v05r02, April 2, 2019 are referenced for the testing and requirements detailed in this report.

The device under test can utilize 48 channels. In accordance with ANSI C63.10, section 5.6, three channel frequencies were selected for measurement:

Channel 0	2401.056 MHz (Low)
Channel 24	2442.520 MHz (Middle)
Channel 47	2482.252 MHz (High)

During all radiated mode measurement testing, the MX40 was mounted on a polystyrene form to facilitate rotating the device through three orthogonal axes as required by ANSI C63.10-2013, section 5.10.1, for a handheld or body worn device. The three axes were defined as follows:

X-Axis Horizontal with the top of the MX40 facing to the left. The front of MX40 was facing the antenna at 0º turntable azimuth.

Y-Axis Vertical with the top of MX40 facing up. The front of the MX40 was facing the antenna at 0º turntable azimuth.

Z-Axis The front of the MX40 was facing up. The bottom of the MX40 was facing the antenna at 0º turntable azimuth.

X-Axis

Y-Axis

Z-Axis

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4. Measurements Parameters

4.5. Measurement Uncertainty

The following uncertainties are expressed for an expansion/coverage factor of K=2.

RF Frequency	$\pm$ 1x10^{-8}
Radiated Emission of Transmitter	$\pm$ 4.55 dB
Radiated Emission of Receiver	$\pm$ 4.55 dB
Temperature	$\pm$ 0.91^{o} C
Humidity	$\pm$ 5%

5. Choice of Equipment for Test Suits

5.1 Choice of Model

This test report is based on the test sample supplied by the manufacturer and is reported by the manufacturer to be equivalent to the production units.

5.2 Presentation

This test sample was tested complete with all required ancillary equipment. Refer to Section 3 of this report for product equipment configuration.

5.3 Choice of Operating Frequencies

The Philips MX40 IntelliVue Patient Worn Monitor, as tested, utilizes 48 channels. Refer to Section 4.3 for the selected test frequencies.

5.4 Modes of Operation

The Philips MX40 IntelliVue Patient Worn Monitor has a single mode of operation which is determined by the system software.

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6. Measurement Summary

Test Requirement	FCC Rule Reference	ISED Rule Reference	Test Report Section	Result
Antenna Requirement	15.203	RSS-GEN 6.8	7.1	Compliant
Minimum 6 dB Bandwidth	15.247 (a) (2)	RSS-247 5.2 (a)	7.2	Compliant
Bandwidth of Momentary Signals (99% Bandwidth)	N/A	RSS-GEN 6.7	7.3	Compliant
Maximum Peak Conducted Output Power	15.247 (b) (1)	RSS-247 5.4 (d)	7.4	Compliant
Operation with directional antenna gains greater than 6 dBi	15.247 (b) (4)	RSS-247 5.4 (d)	7.5	N/A
Spurious Radiated Emissions	15.247 (d)	RSS-GEN 6.13	7.6	Compliant
Emissions in Non-Restricted Frequency Bands	15.247 (d)	RSS-247 5.5	7.7	Compliant
Harmonic Emissions in the Restricted Bands of Operation	15.247 (d)	RSS-GEN 8.10	7.8	Compliant
Band Edge and Restricted Band Measurements	15.247 (d)	RSS-247 5.5	7.9	Compliant
Peak Power Spectral Density	15.247(e)	RSS-247 5.2 (b)	7.10	Compliant
Duty Cycle Correction Factor	15.35(c)	RSS-GEN 8.2	7.11	Compliant

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7. Measurement Data

7.1. Antenna Requirement (15.203, RSS-GEN 6.8)

Requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section.

Status: The MX40 utilizes internal, inaccessible antennas. The housing of the device under test is completely sealed.

7.2. Minimum 6 dB Bandwidth (15.247 (a) (2), RSS-247 5.2(a))

Requirement: Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

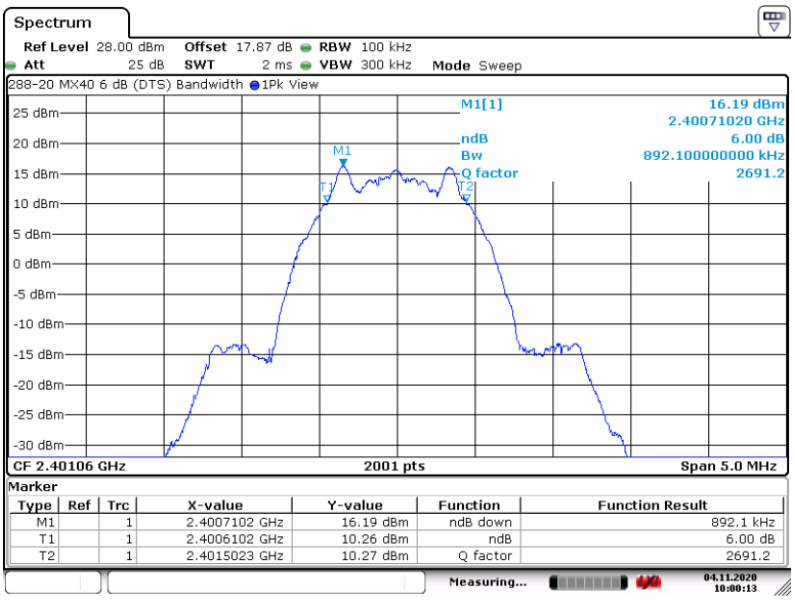
Procedure: Performed in accordance with FCC 558074 D01 DTS Measurement Guidance, v05r02, April 2, 2019, §8.2: DTS bandwidth.

Conclusion: The device under test meets the minimum 500 kHz 6 dB bandwidth requirement.

Measurement Results - Minimum 6 dB Bandwidth

Channel	Frequency (MHz)	-6 dB Bandwidth (kHz)	Min. -6 dB Bandwidth (kHz)	Result
Low	2401.060	892.1	>500	Compliant
Middle	2442.520	867.1	>500	Compliant
High	2482.252	869.6	>500	Compliant

7.2.1. -6 dB Bandwidth, Low Channel 0



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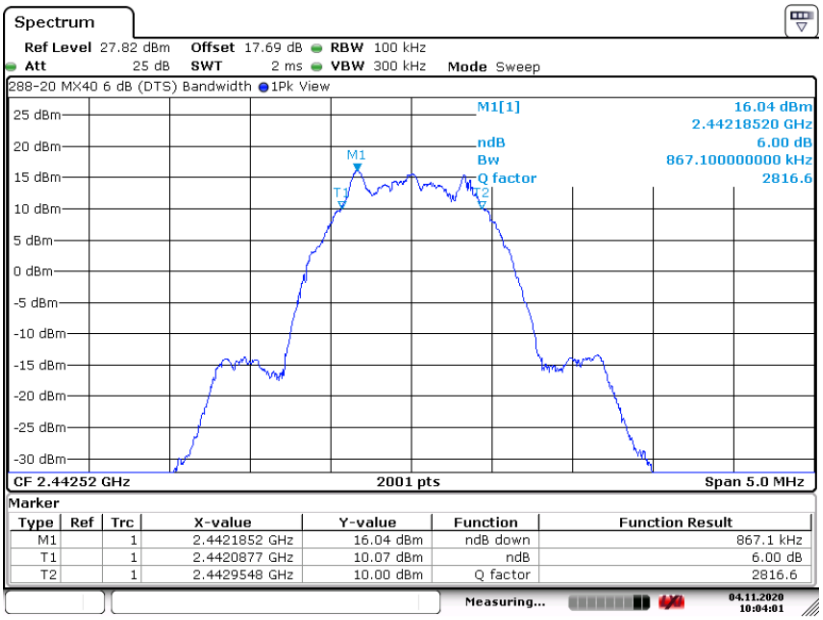
7. Measurement Data

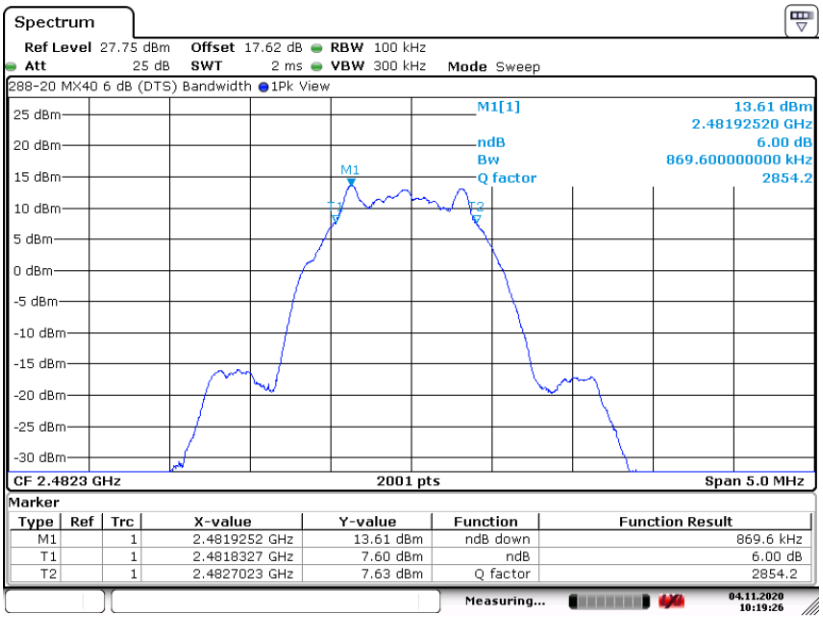
7.2. Minimum 6 dB Bandwidth (15.247 (a) (2), RSS-247 5.2 (a)) (continued)

7.2.2. -6 dB Bandwidth, Middle Channel 24



Date: 4.NOV.2020 10:04:01

7.2.3. -6 dB Bandwidth, High Channel 47



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7. Measurement Data (continued)

7.3. Bandwidth of Momentary Signals RSS-GEN 6.7

Requirement: When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.
The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

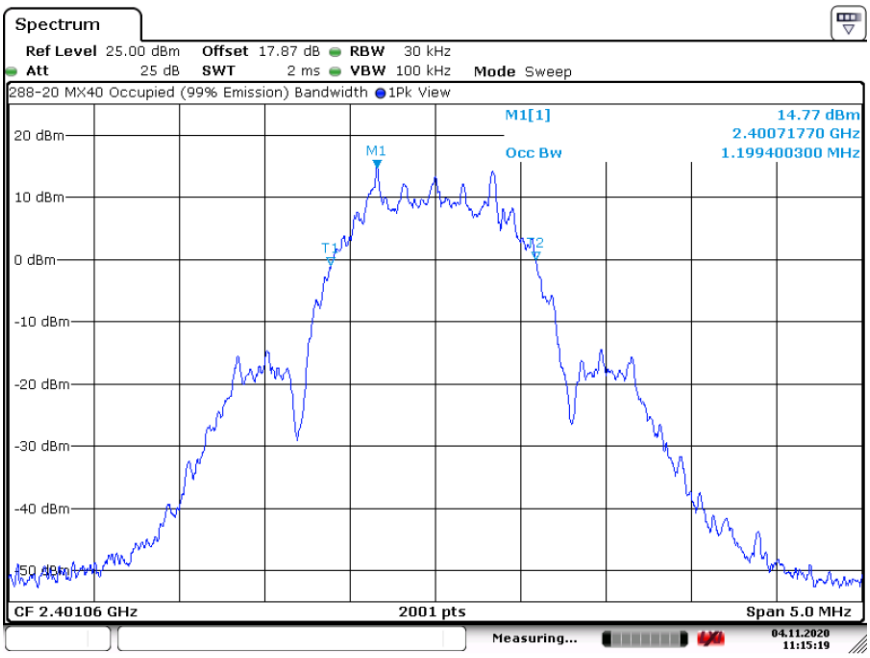
Procedure: This test was performed utilizing the automated 99% bandwidth function of the spectrum analyzer.

Conclusion: Compliant, for informational purposes.

Measurement Results - 99% Bandwidth

Channel	Channel Frequency (MHz)	99% Power Bandwidth (MHz)
Low	2401.060	1.1994
Middle	2442.520	1.1919
High	2482.252	1.1969

7.3.1. 99% Bandwidth, Low Channel 0



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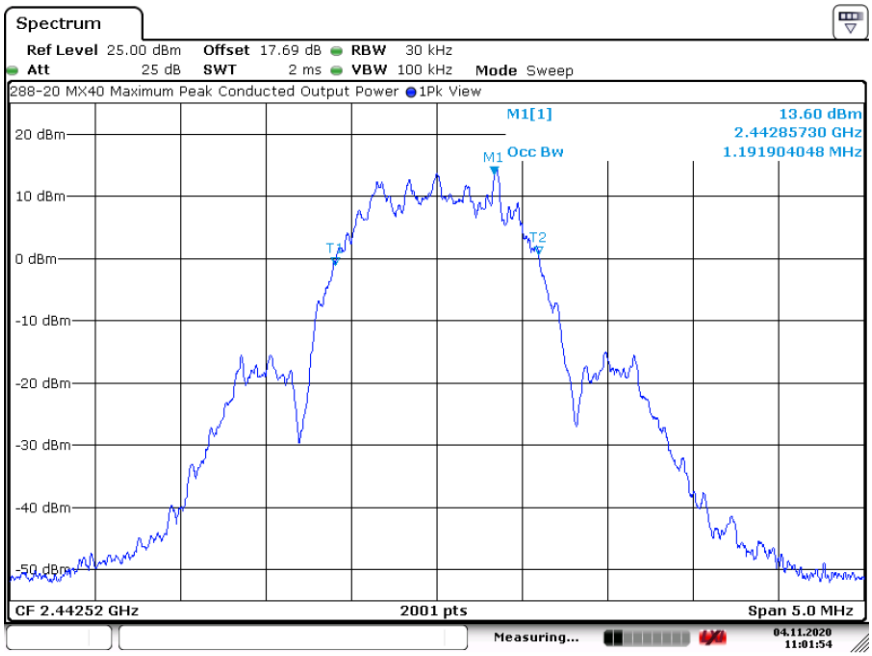
7. Measurement Data (continued)

7.3. Bandwidth of Momentary Signals (RSS-GEN 6.7) Continued

7.3.2. 99% Bandwidth, Middle Channel 24



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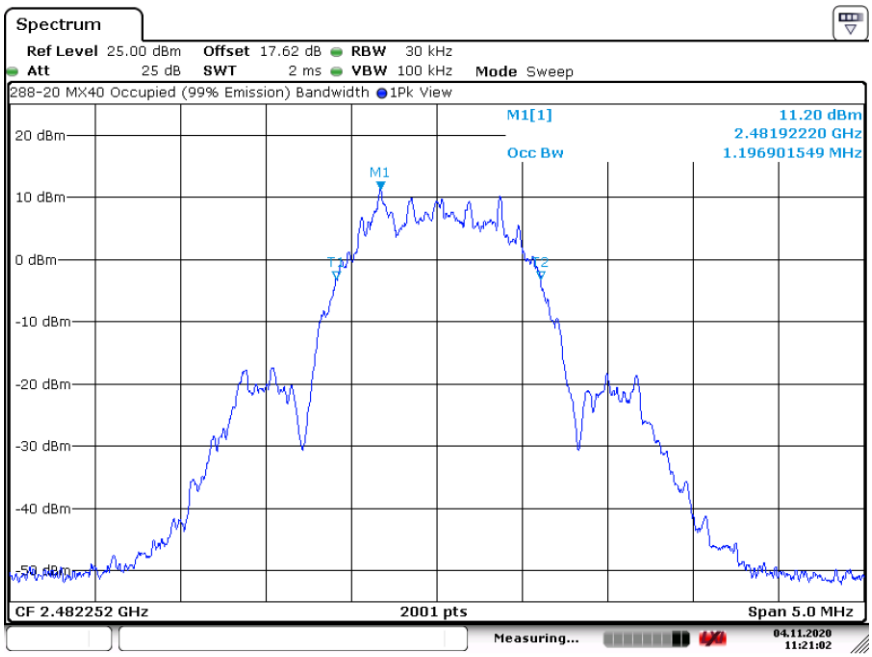
7.3.3. 99% Bandwidth, High Channel 47



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7. Measurement Data (continued)

7.4. Maximum Peak Conducted Output Power (15.247 (b) (1), RSS-247 5.4 (d))

Requirement: The maximum peak conducted output power of the intentional radiator shall not exceed the following: For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

Procedure: FCC 558074 D01 DTS Measurement Guidance, v05r02, April 2, 2019, Section 8.3.1: Maximum peak conducted output power, RBW ≥ DTS bandwidth, was referenced for the maximum peak conducted output power measurements detailed in this section of this report.

Test Notes: The maximum peak conducted output power measurements were performed as conducted mode measurements. All insertion loss factors are included in the test measurements and factored as amplitude offset values.

EIRP Measurement Results

Frequency	Measured Peak Output Power		Output Power Limit	Result
(MHz)	(dBm)	(mW)	(mW)	
2401.060	16.86	48.53	1000.0	Compliant
2442.520	16.57	45.39	1000.0	Compliant
2482.252	14.20	26.30	1000.0	Compliant

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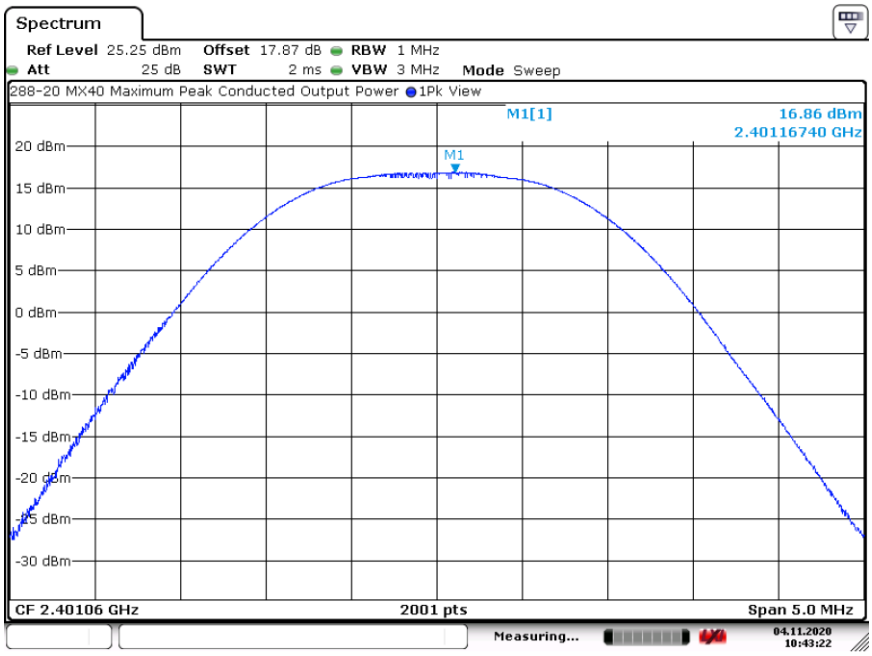
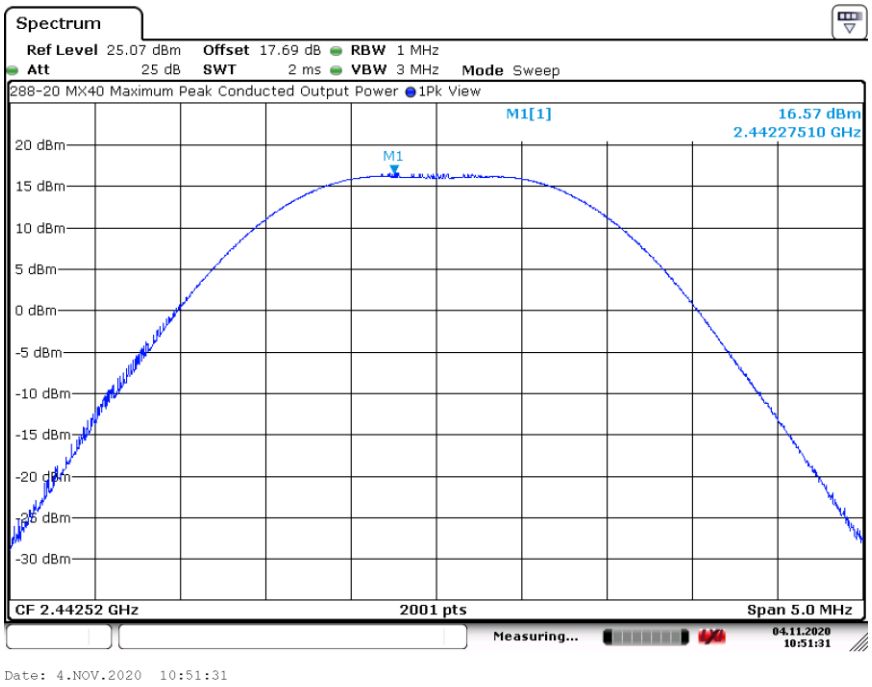
7. Measurement Data (continued)

7.4. Maximum Peak Conducted Output Power (15.247 (b) (3), RSS-247 5.4 (d)) (cont.)

7.4.1. Maximum Peak Field Strength, Low Channel 0



7.4.2. Maximum Peak Field Strength, Middle Channel 24



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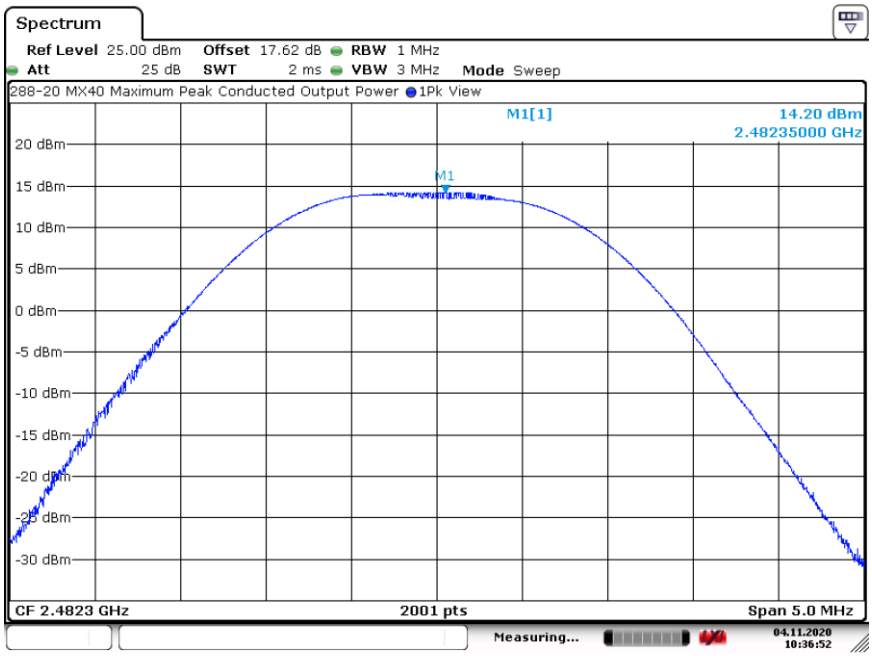
7. Measurement Data (continued)

7.4. Maximum Peak Conducted Output Power (15.247 (b) (3), RSS-247 5.4 (d)) (cont.)

7.4.3. Maximum Peak Field Strength, High Channel 47



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7. Measurement Data (continued)

7.5. Operation with directional antenna gains greater than 6 dBi (15.247 (b)(4), RSS-GEN 6.8)

Requirement: If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of FCC Part 15.247, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400 – 2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Conclusion: Based on the antenna manufacturer's specifications, the antenna used with the DUT has a gain of -3.00 dBi Omni-directional pattern. Therefore Part 15.247, section (b)(4)) does not apply.

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7. Measurement Data (continued)

7.6. Transmitter Spurious Radiated Emissions (30 kHz to 30 GHz)

Requirement: (15.209) The Emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency Range (MHz)	Distance (Meters)	Limit (dBµV/m)
0.009 to 0.490	3	128.5 to 93.8
0.490 to 1.705	3	73.8 to 63.0
1.705 to 30	3	69.5
30 to 88	3	40.0
88 to 216	3	43.5
216 to 960	3	46.0
>960	3	54.0

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

Procedure: This test was performed in accordance with the procedure detailed in ANSI C63.10:2013, section 6.3: Radiated emissions testing—general requirements and FCC 47 CFR Part 15.209: Radiated Emission Limits; General Requirements.

Test measurements were made in accordance with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

Test Note: The measurements were performed with the device in three orthogonal positions in accordance with ANSI C63.10-2013, sections 5.10.1. Reference section 4.3 of this report for additional information.

Conclusion: The Emissions from the DUT did not exceed the FCC Part 15,209 field strength levels specified in the above table. Reference Appendix A for the transmitter spurious emission data.

Worst Case Measurements

Range	Frequency	Peak Field Strength	FCC 15.209 Limit	Margin	Result	Appendix A Reference
(MHz)	(MHz)	(dBµV/m)	(dBµV/m)	(dB)		
0.03 to 0.15	0.0303	69.56	117.960	-48.40	Compliant	A1.3.9
0.15 to 30.0	0.1725	64.05	82.840	-18.79	Compliant	A2.1.8
30 to 1000	953.58	39.85	46.000	-6.15	Compliant	A3.1.3
1000 to 2400	2296.28	42.35	54.000	-11.65	Compliant	A4.2.3
2483.5 to 10000	11960.27	44.95	54.000	-9.05	Compliant	A5.1.1
10000 to 18000	17024.46	44.91	54.000	-9.09	Compliant	A6.1.5
18000 to 25000	24162.67	47.11	54.000	-6.89	Compliant	A7.1.1

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7. Measurement Data (continued)

7.7. Emissions in Non-Restricted Frequency Bands (15.247(d), RSS-247 5.5)

Requirement: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Procedure: The procedure detailed in FCC 558074 D01 DTS Measurement Guidance, v05r02, April 2, 2019, Section 8.5: DTS Emissions in non-restricted frequency bands was used to perform the following measurements.

Test Notes: Reference Section 7.2, Screen Capture 7.2.3 for the in-band reference used to set the -20 dB limit for the measurements taken in this section. The Channel 26 100 kHz measurement level of 82.13 dBµV/m was used as the reference for the out of band measurements.

Reference Appendix B for the emissions in non-restricted frequency bands screen captures.

Worst Case Measurements

Range	Frequency	Peak Power	W/C In-Band -20 dB	Margin	Result	Appendix B Reference
(MHz)	(MHz)	(dBm)	(dBm)	(dB)		
30 to 2400	2399.925	-14.96	16.19	-31.15	Compliant	1.1
2483.5 to 12000	2484.325	-51.38	16.19	-67.57	Compliant	3.2
12000 to 20000	19769.266	-53.03	16.19	-69.22	Compliant	2.3
20000 to 25000	20205.93	-53.96	16.19	-70.15	Compliant	2.4

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7. Measurement Data (continued)

7.8. Harmonic Emissions in the Restricted Bands of Operation (15.247 (d), RSS-GEN 8.10)

Measurement Results – Worst Case Harmonic Emissions

Freq. (MHz)	Field Strength (dBµV/m)	Duty Cycle Correction	Field Strength (dBµV/m)	Limit (dBµV/m)		Margin (dBµV/m)		Antenna Polarity	Result
	Peak		Average	Peak	Average	Peak	Average	(H/V)	
4802.120	54.59	-18.82	35.77	74.00	54.00	-19.41	-18.23	H	Compliant
4885.040	54.40	-18.82	35.58	74.00	54.00	-19.60	-18.42	H	Compliant
4964.504	53.42	-18.82	34.60	74.00	54.00	-20.58	-19.40	V	Compliant
7327.560	52.19	-18.82	33.37	74.00	54.00	-21.81	-20.63	H	Compliant
7446.756	52.51	-18.82	33.69	74.00	54.00	-21.49	-20.31	V	Compliant
12005.300	59.62	-18.82	40.80	74.00	54.00	-14.38	-13.20	H	Compliant
12212.600	60.27	-18.82	41.45	74.00	54.00	-13.73	-12.55	V	Compliant
12411.260	59.72	-18.82	40.90	74.00	54.00	-14.28	-13.10	V	Compliant
19208.480	60.28	-18.82	41.46	74.00	54.00	-13.72	-12.54	V	Compliant
19540.160	60.68	-18.82	41.86	74.00	54.00	-13.32	-12.14	H	Compliant
19858.016	61.43	-18.82	42.61	74.00	54.00	-12.57	-11.39	H	Compliant
22340.268	61.87	-18.82	43.05	74.00	54.00	-12.13	-10.95	H	Compliant

Note: A Duty Cycle correction value for each fundamental frequencies tested in Section 7.11 of this report was used to determine the average value for pulsed emissions for the device.

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7. Measurement Data (continued)

7.9. Band Edge and Restricted Band Measurements (15.247 (d), RSS-247 5.5)

Requirement: Lower Band Edge

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. Attenuation below the general limits specified in Section 15.209(a) is not required.

Upper Band Edge

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

Procedures: Lower Band Edge - ANSI C63.10:2013, section 6.10.4: Authorized-band band-edge measurements (-20 dB delta relative method).

Upper Band Edge – ANSI C63.10:2013, section 6.10.5: Restricted-band edge, marker delta method measurement. The EUT uppermost frequency falls within two standard bandwidths of the band edge.

Conclusion: The device under test meets the band edge requirements

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7. Measurement Data (continued)

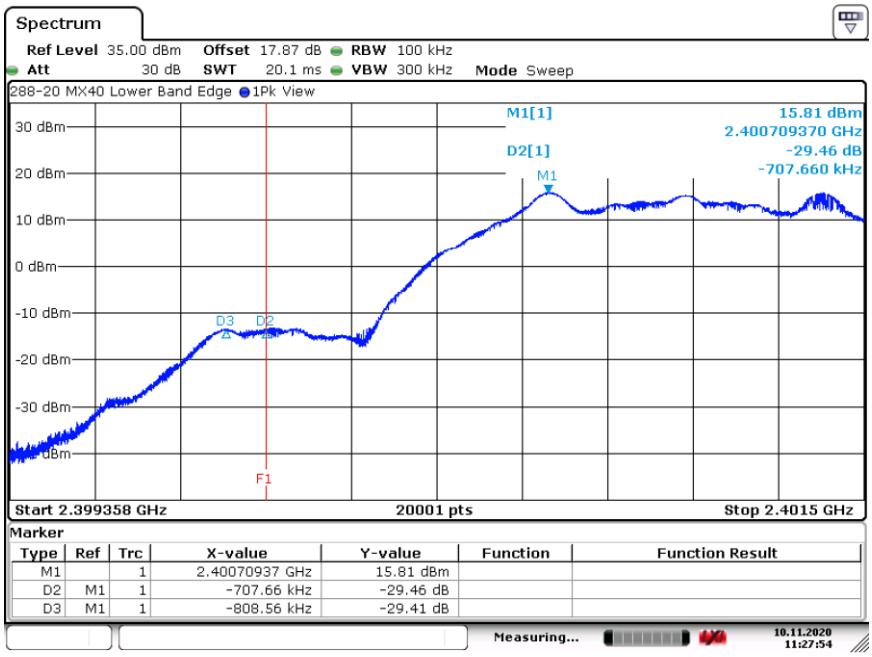
7.9. Band Edge and Restricted Band Measurements (15.247 (d), RSS-247 5.5)

7.9.1. Lower Band Edge

Measurement Results

Lowest Channel (MHz)	In-Band Peak Measurement (dBm)		Band Edge Frequency (MHz)	Band Edge Measurement (dBm)		Required Offset (dB)	Actual Offset (dB)	Result
	Peak	Average		Peak	Average			
2401.060	15.81	---	2400	-29.46	---	>20	45.27	Compliant

7.9.1.1. Lower Band Edge



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7. Measurement Data (continued)

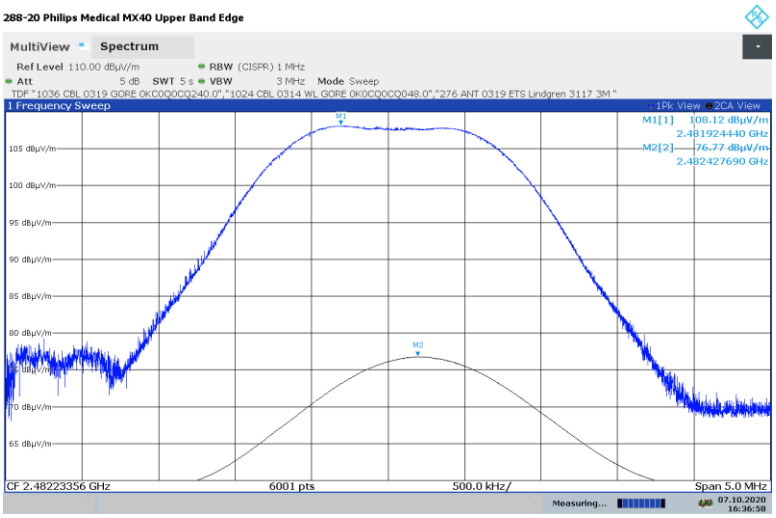
7.9. Band Edge and Restricted Band Measurements (15.247 (d), RSS-247 5.5)

7.9.2. Upper Band Edge

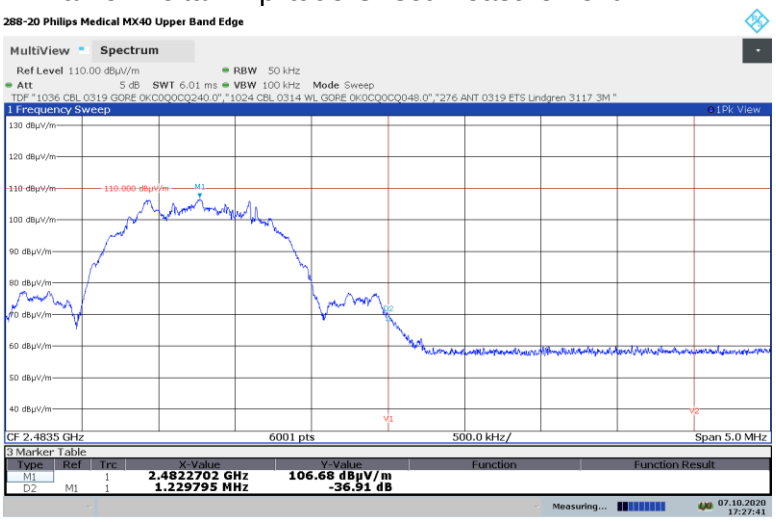
Measurement Results

Highest Channel Frequency (MHz)	Maximum Field Strength (dBµV/m)		50 kHz RBW Marker Delta Amplitude Offset (dB)	Band Edge Field Strength (dBµV/m)		FCC Part 15.209 Limit (dBµV/m)		Margin (dB)		Result
	Peak	Average		Peak	Average	Peak	Average	Peak	Average	
(A)	(B)	(C)	(D)	(E) (B+D)	(F) (C+D)	(G)	(H)	(E-G)	(F-H)	
2482.252	108.12	76.77	-36.91	71.21	39.86	74	54	-2.79	-14.14	Compliant

7.9.2.1. In-Band Field Strength Measurement of the Fundamental Emission



7.9.2.2. Marker-Delta Amplitude Offset Measurement



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7. Measurement Data (continued)

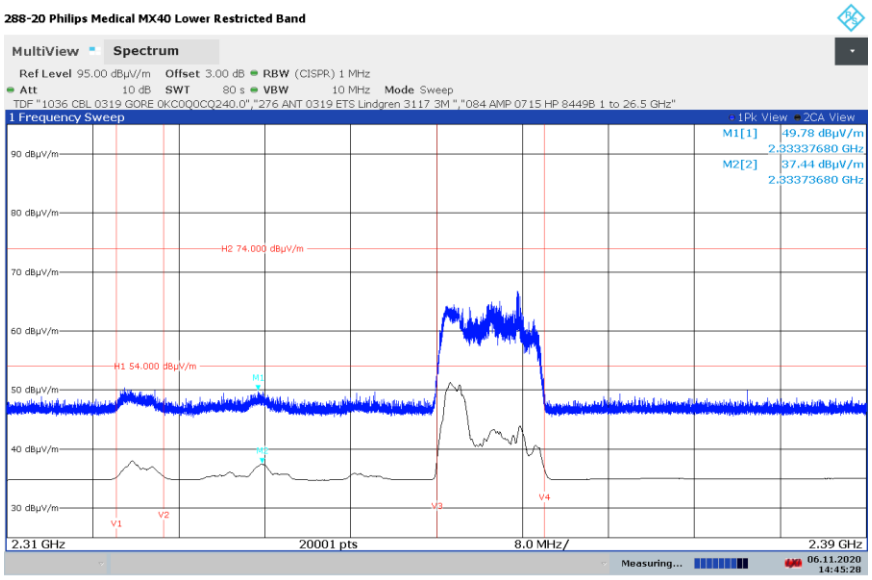
7.9. Band Edge and Restricted Band Measurements (15.247 (d), RSS-247 5.5)

7.9.3. Lower Restricted Band

Measurement Results

Frequency (MHz)	Field Strength (dBµV/m)		FCC Part 15.209 Limit (dBµV/m)		Margin (dB)		Result
	Peak	Average	Peak	Average	Peak	Average	
2333.3737	49.78	37.44	74.00	54.00	-24.22	-16.56	Compliant

7.9.3.1. Lower Restricted Band



Note about the non-EUT transmissions in this band:

The emissions enclosed in the first pair of vertical markers was due to a transmission in the Wireless Communications Service (WCS) B Block (2310 MHz to 2315 MHz). The emission enclosed in the second pair of vertical markers was due to a transmission in the WCS A and B Blocks (2350 MHz to 2360 MHz). A real-time observation of the Lower Restricted Band confirmed that there were no emissions contributed by the EUT in either of these WCS Blocks during the absence of the ambient signals. However, due to the measurement time requirements of the CISPR average detector, this could not be realized on the spectrum analyzer for display purposes. Markers 1 and 2 represent the peak and CISPR average values of the worst-case emission contributed by the EUT.

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7. Measurement Data (continued)

7.9. Band Edge and Restricted Band Measurements (15.247 (d), RSS-247 5.5)

7.9.4. Upper Restricted Band

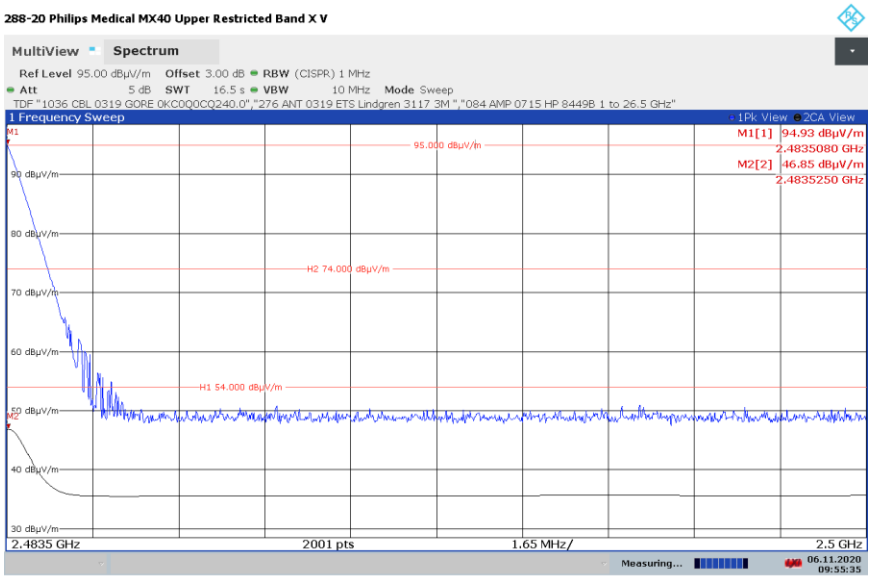
Measurement Results

Frequency[1] (MHz)	Maximum Field Strength (dBµV/m)		50 kHz RBW Marker Delta Amplitude Offset (dB)	Band Edge Field Strength (dBµV/m)[2]		FCC Part 15.209 Limit (dBµV/m)		Margin (dB)[2]		Result
	Peak	Average		Peak	Average	Peak	Average	Peak	Average	
(A)	(B)	(C)	(D)	(E) (B+D)	(F) (F = C)	(G)	(H)	(E-G)	(F-H)	
2483.5012	94.93	46.85	-36.91	58.02	46.85	74	54	-15.98	-7.15	Compliant

[1] Measured frequency falls within two standard bandwidths of the restricted band edge (ANSI C63.10-2013, Section 6.10.6.1).

[2] CISPR average field strength met the 54 dBµV/m field strength limit without correction.

7.9.4.1. Upper Restricted Band



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7. Measurement Data (continued)

7.10. Peak Power Spectral Density (15.247(e), RSS-247 5.2 (b))

Requirement: For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Procedure: This measurement was performed in accordance with FCC OET 558074 D01 DTS Measurement Guidance, v05r02, dated April 9, 2019, section 8.4: Method PKPSD (peak PSD).

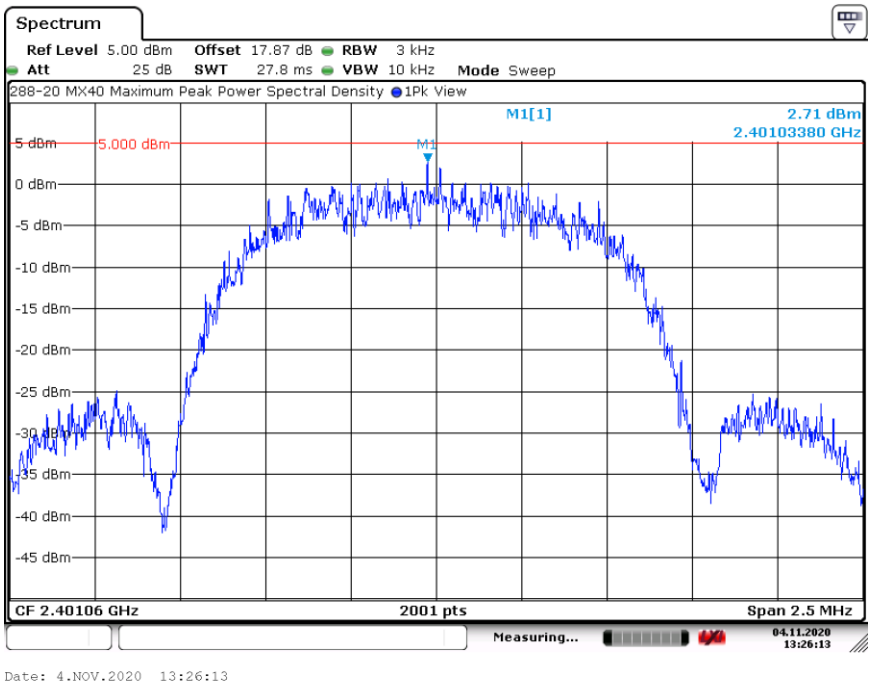
Test Notes: Conducted mode measurements were taken for this section of the report.

Conclusion: The DUT meets the Part 15.247(e) power spectral density requirement.

Measurement Results – Power Spectral Density

Channel Frequency	Measured Frequency	Peak Power Spectral Density	Output Power Limit	Margin	Result
(MHz)	(MHz)	(dBm)	(dBm)	(dB)	
2401.060	2401.0338	2.71	8.0	-5.3	Compliant
2442.520	2442.5425	2.48	8.0	-5.5	Compliant
2482.252	2482.2860	1.04	8.0	-7.0	Compliant

7.10.1. Peak Power Spectral Density, Low Channel 0



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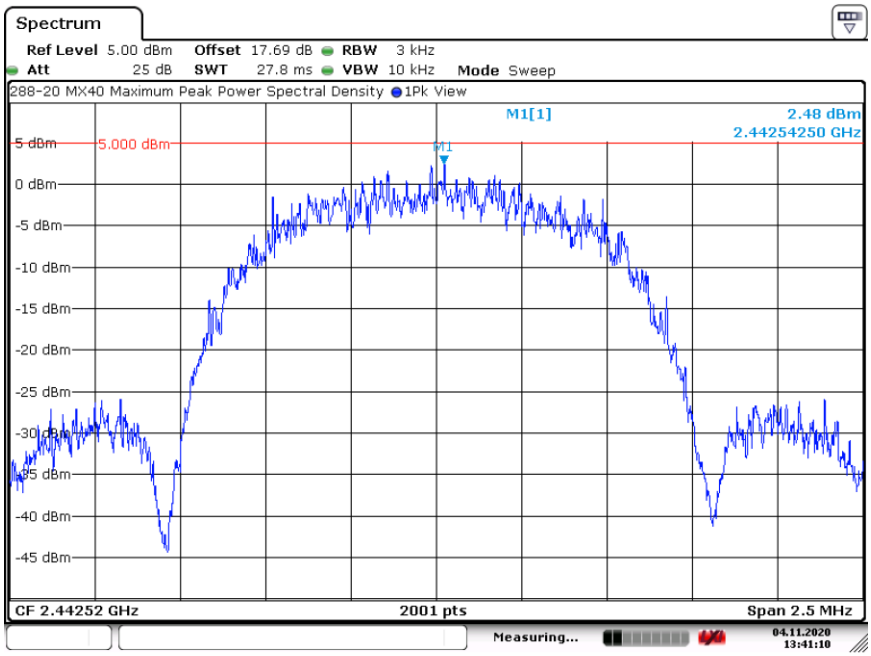
7. Measurement Data (continued)

7.10. Peak Power Spectral Density (15.247(e), RSS-247 5.2 (b)) (continued)

7.10.2. Peak Power Spectral Density, Middle Channel 24



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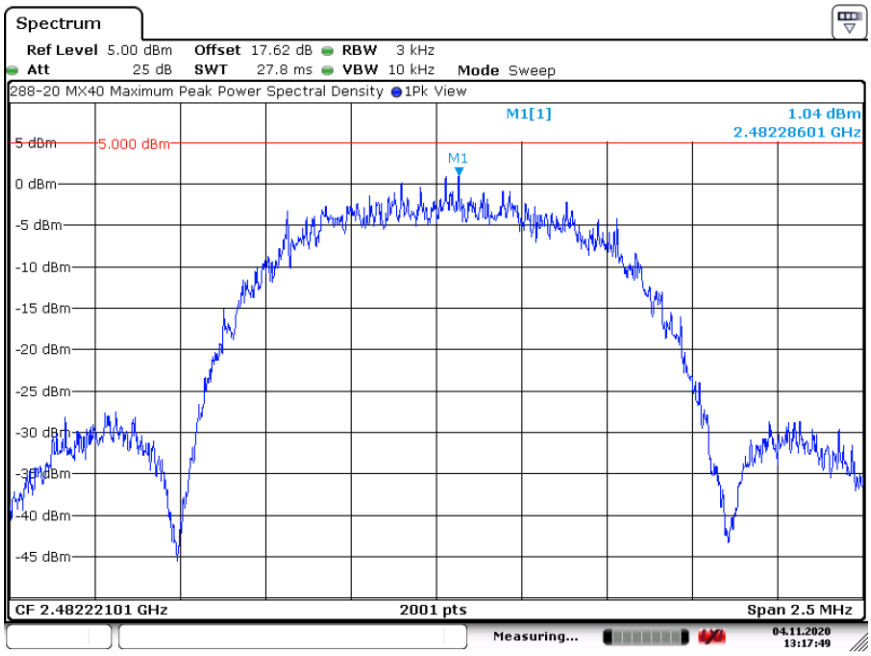
7.10.3. Peak Power Spectral Density, High Channel 47



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7. Measurement Data (continued)

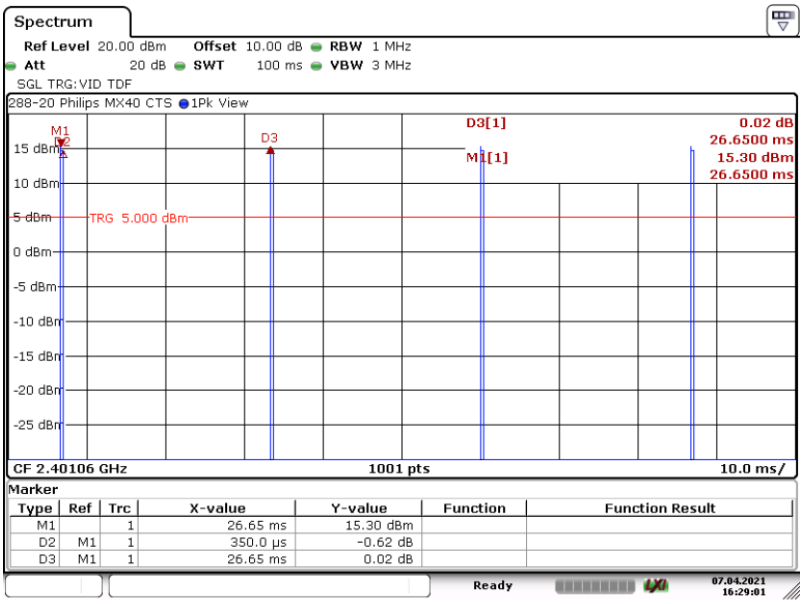
7.11. Duty Cycle Correction Factor (FCC Part 15.35(c), RSS-GEN 8.2)

Requirement: When the field strength or envelope power is not constant or it is in pulses, and an average detector is specified to be used, the value of field strength or power shall be determined by averaging over one complete pulse train during which the field strength or power is at its maximum value, including blanking intervals within the pulse train, provided that the pulse train does not exceed 0.1 seconds. In cases where the pulse train exceeds 0.1 seconds, the average value of field strength or output power shall be determined during a 0.1 seconds interval during which the field strength or power is at its maximum value..

Procedure: The duty cycle correction was determined using the information provided in ANSI C63.10-2013, Section 7.5: Procedure for determining the average value of pulsed emissions. Note: This is the maximum duty cycle allowed by the operational software/firmware for the device.

Channel Frequency	Time On	Time per Period	Duty Cycle (DC)		Maximum Peak Conducted Power	Duty Cycle Correction (10 log(DC))	Corrected Conducted Power	
	T_{on}	$T_{on} + T_{off}$						
(MHz)	(mS)	(mS)	$T_{on}/(T_{on} + T_{off})$	(%)	(dBm)	dB	dBm	mW
2401.060	0.350	26.65	0.01313	1.3	16.86	-18.82	-1.9563	0.6373
2442.520	0.350	26.65	0.01313	1.3	16.57	-18.82	-2.2463	0.5962
2482.252	0.350	26.65	0.01313	1.3	14.20	-18.82	-4.6163	0.3454

7.11.1. T_{on} and $T_{on} + T_{off}$, Lowest Channel, 0



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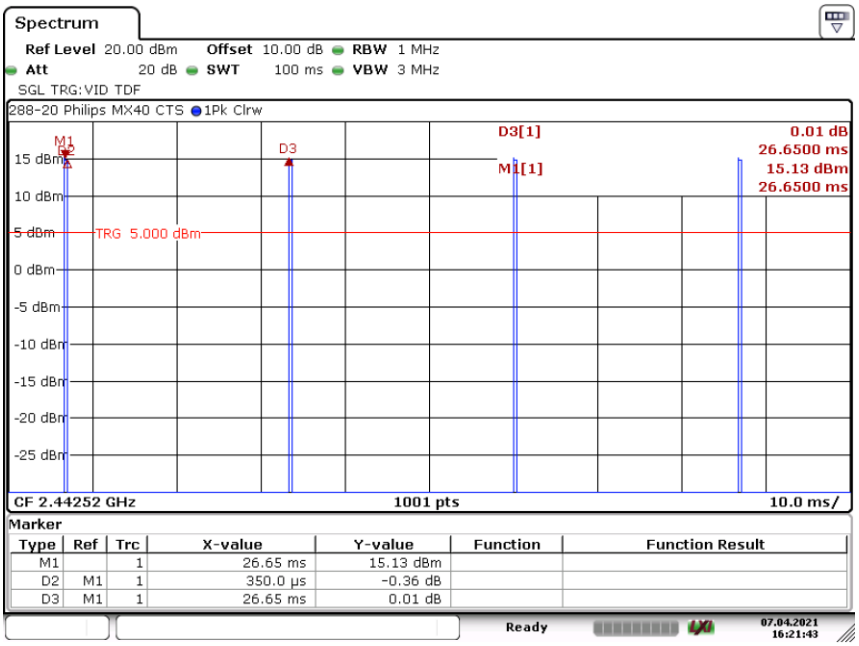
7. Measurement Data (continued)

7.11. Duty Cycle Correction Factor (FCC Part 15.35(c), RSS-GEN 8.2)

7.11.2. T_{on} and T_{on} + T_{off}, Middle Channel, 24



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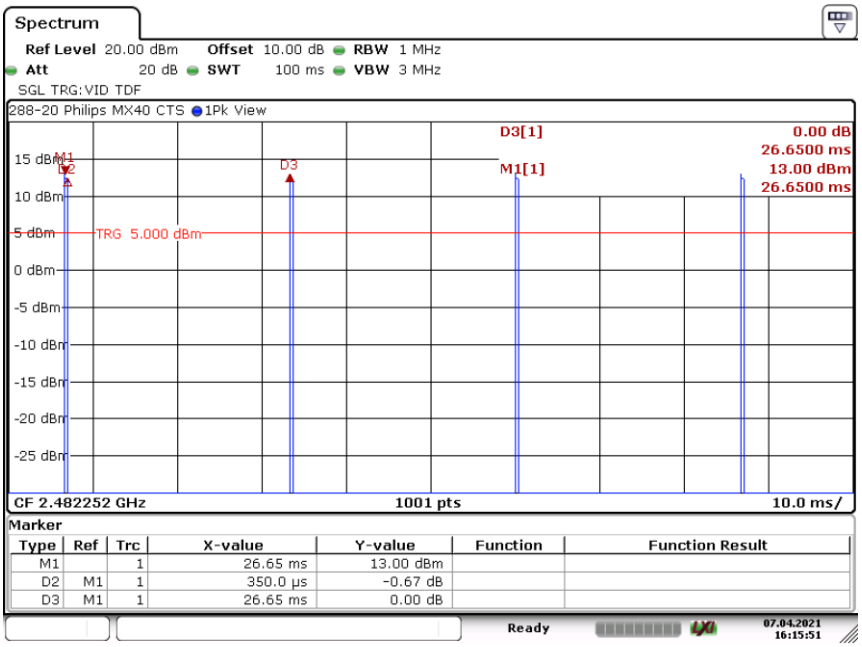
7.11.3. T_{on} and T_{on} + T_{off}, Upper Channel, 47



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8. Test Setup Images

8.1. Radiated Emissions – Front View 30 kHz to 1 GHz

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8. Test Setup Images

8.2. Radiated Emissions – Rear View Below 30 MHz

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8. Test Setup Images

8.3. Radiated Emissions – Rear View 30 MHz to 1 GHz

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8. Test Setup Images

8.4. Microwave Emissions – Front View Above 1 GHz

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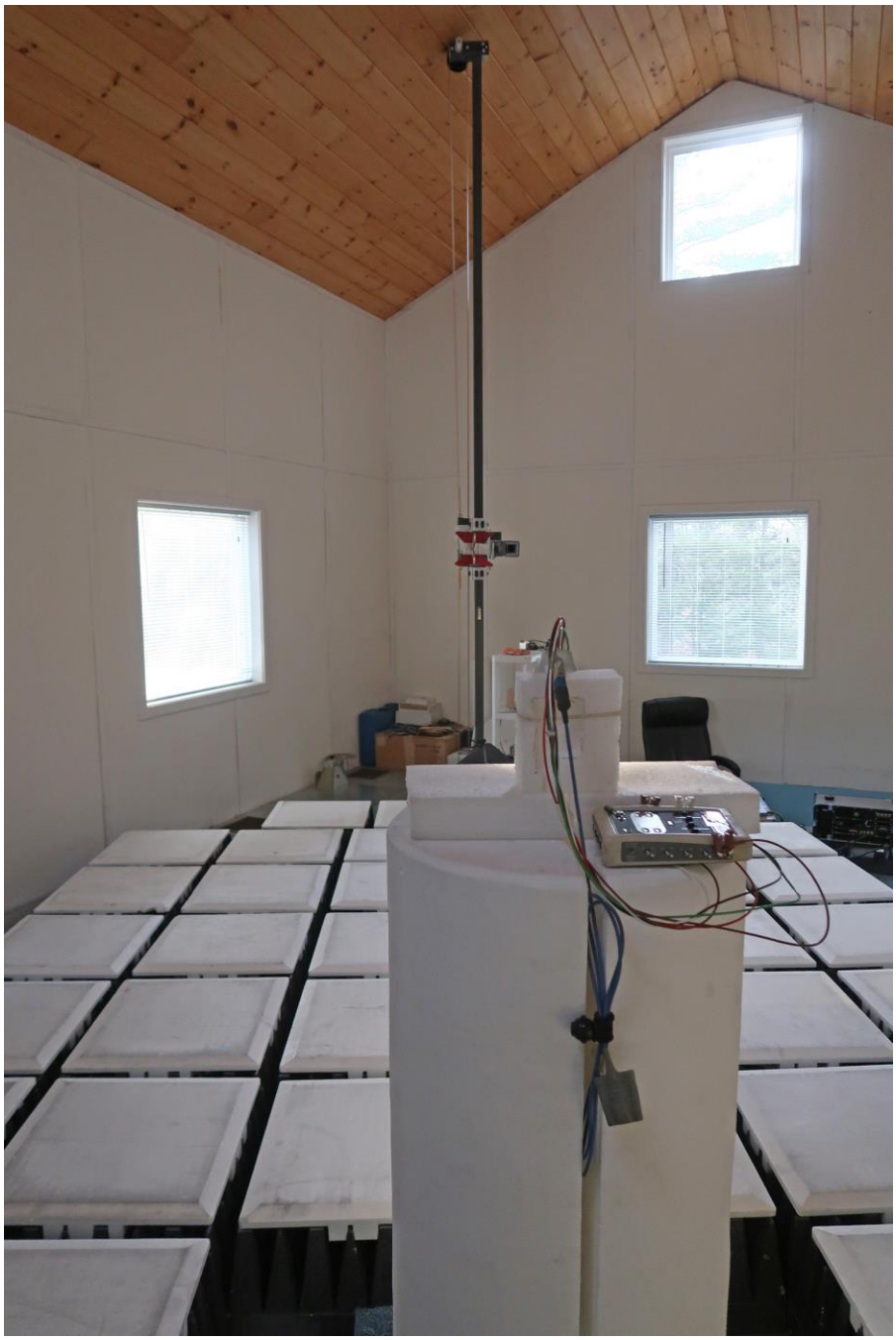
8. Test Setup Images

8.5. Microwave Emissions – Rear View 1GHz to 18 GHz



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8. Test Setup Images

8.6. Microwave Emissions – Rear View Above 18 GHz

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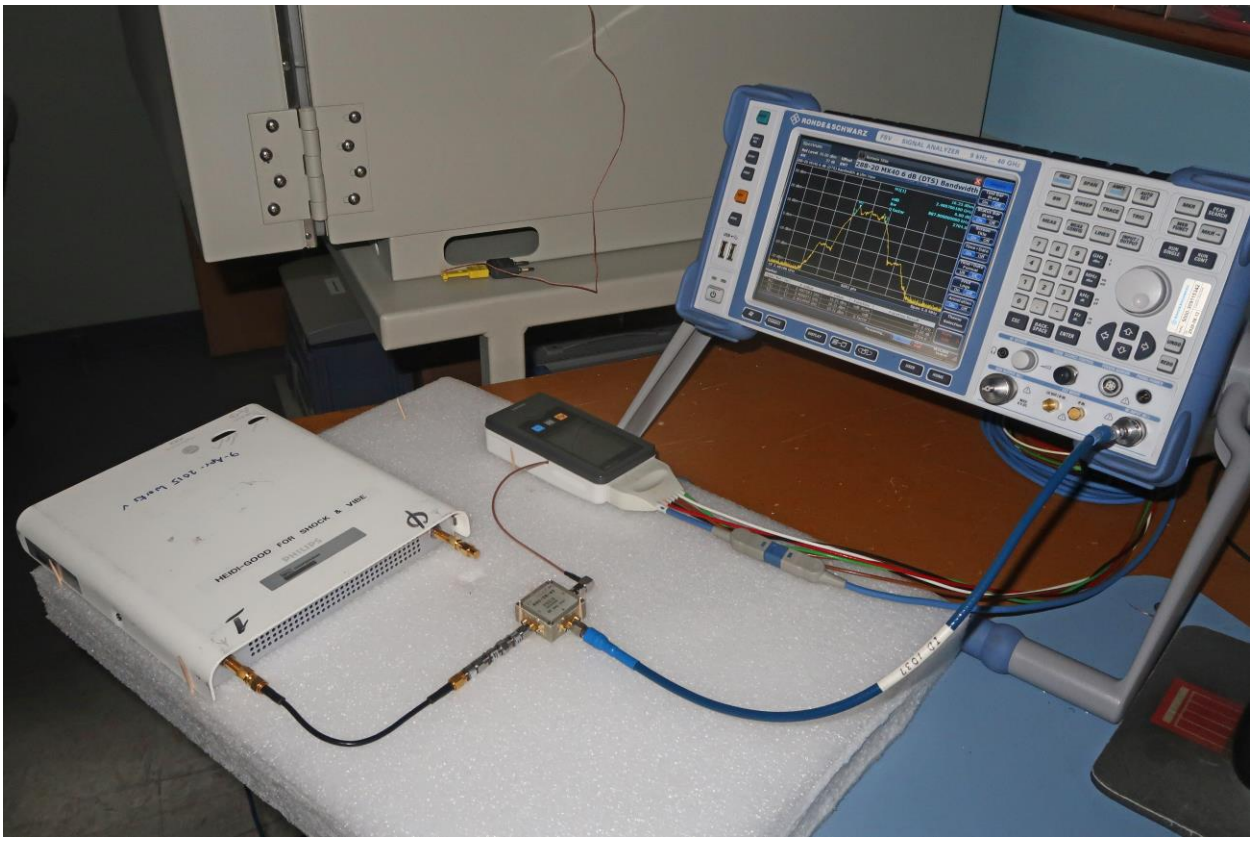
8. Test Setup Images

8.7. Conducted Mode Measurements



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9. Test Site Description

Compliance Worldwide is located at 357 Main Street in Sandown, New Hampshire. The test sites at Compliance Worldwide are used for conducted and radiated emissions testing in accordance with the Federal Communications Commission (FCC) and Industry Canada standards. Through our American Association for Laboratory Accreditation (A2LA) ISO Guide 17025 Accreditation our test sites are designated with the FCC (designation number **US1091**), Industry Canada (file number **IC 3023A-1)** and VCCI (Member number 3168) under registration number A-0274.

Compliance Worldwide is also designated as a Phase 1 CAB under APEC-MRA (US0132) for Australia/New Zealand AS/NZS CISPR 22, Chinese-Taipei (Taiwan) BSMI CNS 13438 and Korea (RRA) KN 11, KN 13, KN 14-1, KN 22, KN 32, KN 61000-6-3, KN 61000-6-4.

The radiated emissions test site is a 3 and 10 meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

The conducted emissions site is part of a 16' x 20' x 12' ferrite tile chamber and uses one of the walls for the vertical ground plane. A second conducted emissions site is also located in the basement of the OATS site with a 2.3 x 2.5 meter ground plane and a 2.4 x 2.4 meter vertical wall.

The radiated emissions test site for measurements above 1GHz is a 3 Meter open area test site (OATS) with a 3.6 by 3.6 meter anechoic absorber floor patch to achieve a quasi-free space measurement environment per ANSI C63.4/C63.10 and CISPR 16-1-4 standards.

The sites are designed to test products or systems 1.5 meters W x 1.5 meters L x 2.0 meters H, floor standing or table top.

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