RF Test Report

Standard(s): FCC Part 15 Subpart 15.247,
RSS-247 Issue 3:2023
Unlicensed Intentional Radiators

Issued To: Elastic Care
95 Apple Creek Boulevard
Markham, Ontario
Canada, L3R 1C7

Product Name: Mobile ECG and multi-sensor medical monitor
Model: Lifepath-C
FCC ID: 2BA2T-LPC1
IC: 30674-LPC1

Report No. ML300116-RF00
Date of Issue: June 5, 2023

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Table of Contents

1. Revision History 3
2. Summary of Test Results 4
   2.1 Test Verdict 4
   2.2 Test Standards 6
   2.3 Test Facility 7
3. General Information 10
   3.1 Client Information 10
   3.2 Device Under Test (DUT) 10
   3.3 Test Setup of DUT 11
   3.4 Modifications for Compliance 11
4. Test Results 12
   4.1 Spurious Radiated Emissions 12
   4.2 Emission Bandwidth 25
   4.3 Maximum Output Power 32
   4.4 Maximum Radiated Output Power 36
   4.5 Antenna Spurious Conducted Emissions 43
   4.6 Power Spectral Density 47
5. Test Setup Photos 52

1. Revision History

Project No. & Revision	Report Date	Initials	Description
ML300116-RF00	June 5, 2023	RA	Initial Release
-	-	-	-

NOTE:

- The latest revision replaces previous revisions.
- This report relates only to the sample(s) identified in this report.

2. Summary of Test Results

2.1 Test Verdict

Unless otherwise stated, the results shown in this test report relate only to the sample(s) tested.

Requirement		Test Type	Result	Remark
FCC	ISED			
15.203	--	Antenna Requirement	Pass	Antenna is an Inventek Systems P/N W24P-U. It connects to the PCB using a U.Fl connector, and is located inside the unit's enclosure. It is not accessible to, or changeable by, the user.
15.205	RSS-GEN (Table 7)	Restricted Bands for Intentional Operation	Pass	---
15.209	RSS-GEN (Tables 5 & 6)	Transmitter Spurious Radiated Emissions & Band Edges	Pass	---
FCC 15.247(a)(2)	RSS-247 5.2(a)	6 dB Emission Bandwidth	Pass	---
---	RSS-GEN 6.7	99% Emission Bandwidth	Pass	---
FCC 15.247(b)(3)	RSS-247 5.4(d)	Maximum Output Power	Pass	---
FCC 15.247(b)(4)	---	Antenna Gain	Pass	Antenna has a max gain of +3.58 dBi.
---	RSS-247 5.4(d)	Max E.I.R.P Output	Pass	---
FCC 15.247(d)	RSS-247 5.5	Antenna Spurious Conducted Emissions	Pass	---
FCC 15.247(e)	RSS-247 5.2(b)	Power Spectral Density	Pass	---
FCC 15.247(i)	RSS-102 (Table 1)	Maximum RF exposure	Pass	---

FCC 15.207	RSS-GEN (Table 4)	Power Line Conducted Emissions	N/A	DUT is powered by a battery which must be detached before being recharged in a separate charger. DUT does not have a means of transmitting while connected to mains power.

N/A = Not Applicable

2.1.1 Test Verdict Notes

The DUT was mounted in three orthogonal axes and worst-case results were obtained with the DUT upright. Worst case results are presented. See the Test Setup Photos for test orientation.

Antenna details were obtained from the client. Max antenna gain is less than 6dBi.

As per FCC 15.203, the antenna connects to the PCB using a U.Fl connector, and is located within the unit's enclosure. It is not accessible or changeable by the user.

For testing, the DUT's output is set to transmit continuously at 100% duty cycle at the maximum output power used during the unit's operation.

The DUT is powered by a battery which must be detached before being recharged in a separate charger. It does not have a means of transmitting while connected to mains power.

2.2 Test Standards

Standard	Description
ANSI C63.4:2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2013	American National Standard for Testing Unlicensed Wireless Devices
CFR 47 FCC 15 Subpart C	Code of Federal Regulations – Radio Frequency Devices, Intentional Radiators
FCC KDB 558074:2019	FCC KDB 558074 Digital Transmission Systems, measurements and procedures
FCC KDB 447498 D01:2015	Rf Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices - General RF Exposure Guidance v06
FCC KDB 447498 D04:2021	RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices - Interim General RF Exposure Guidance v01
ICES-003 Issue 7:2020	Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
RSS-GEN Issue 5:2021	General Requirements and Information for the Certification of Radio Apparatus
RSS-102 Issue 5:2021	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
RSS-210 Issue 10:2019	Licence-Exempt Radio Apparatus: Category I Equipment
RSS-247 Issue 3:2023	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
ISO 17025:2017	General Requirements for the Competence of Testing and Calibration Laboratories

2.3 Test Facility

All tests were performed at Megalab Group Inc., located at 150 Addison Hall Circle, Aurora, ON, L4G 3X8, Canada.
The 10-meter semi-anechoic chamber for radiated emission and radiated immunity is designed to handle weights of up to 10,000lb and has power capability of over 100A. The turntable is capable of supporting test devices or systems either floor standing or table top of up to 4 meters wide and 3m tall. Conducted emissions, unless otherwise specified, are performed on a 2.44m x 2.48m ground plane and using a 2.44m x 2.48m vertical ground plane if applicable.

2.3.1 Accreditations

This report does not indicate any product endorsement by any government, accreditation agency, or Megalab Group Inc. Megalab Group Inc. shall have no liability for any deductions, interpretations or generalizations drawn by the client or others from the issued reports. If any opinions or interpretations are expressed in this report, they are outside Megalab Group Inc.'s scope of accreditation and do not necessarily reflect the opinions of Megalab Group Inc., unless otherwise specified.

A2LA (Certificate #5179.02)
Megalab Group Inc. is accredited to ISO/IEC 17025:2017 by the American Association for Laboratory Accreditation (A2LA) with Testing Certificate #5179.02. The laboratories current scope of accreditation can be found as listed on A2LA's website.

ISED
Megalab Group Inc. is registered with and recognized by Innovation, Science and Economic Development Canada (ISED) as an accredited testing laboratory.
Company Number: 28697

FCC
Megalab Group Inc. is registered with and recognized by the Federal Communications Commission (FCC) as an accredited testing laboratory.
Registration No. 200040

2.3.2 Measurement Uncertainty

As per ISO/IEC 17025 requirements, an evaluation of the measurement uncertainties associated with the emission test results should be included in the test report.

Where relevant, the following measurement uncertainty levels have been estimated for the tests performed on the DUT as specified in CISPR 16-4-2. The measurement uncertainties given below are based on a coverage factor k = 2 which yields approximately a 95% level of confidence for the near-normal distribution typical of most measurement results.

Measurement	Frequency Range	Uncertainty
Conducted Emissions at AC Mains Power Port	150kHz to 30MHz	2.27 dB
Radiated Emissions	30MHz to 1GHz	5.22 dB
	1GHz to 18GHz	4.76 dB

2.3.3 Sample Calculations

Radiated Emissions

Emission Level (dBµV/m) =	Read Level (dBµV)	+	Antenna Factor (dB/m)	+	Cable Loss (dB)	-	Pre-Amp Gain (dB)
=	52.4	+	9.4	+	1.3	-	29.2
=	33.9						

Margin (dB) =	Limit (dBµV/m)	-	Emission Level (dBµV/m)
=	50.0	-	33.9
=	16.1		

2.3.4 Terms, Definitions and Abbreviations

AE	Auxiliary Equipment
DUT	Device Under Test
DTS	Digital Transmission System
EMC	Electro-Magnetic Compatibility
FHSS	Frequency Hopping Spread Spectrum
ISM	Industrial, Scientific and Medical
LISN	Line Impedance Stabilization Network
N/A	Not Applicable
NCR	No Calibration Required
RF	Radio Frequency
RBW	Resolution Bandwidth
VBW	Video Bandwidth

Auxiliary Equipment/Support Equipment
Equipment needed to exercise and/or monitor the operation of the DUT.

Artificial Mains Network
Network that provides a defined impedance to the DUT at radio frequencies, couples the disturbance voltage to the measuring receiver and decouples the test circuit from the supply mains.

Class A Equipment
Equipment suitable for use in all locations other than those allocated in residential environments and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

Class B Equipment
Equipment suitable for use in all locations, including in residential environments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

Device Under Test
Device or system being evaluated for compliance with the requirements of the Test Standards listed in this report.

Electro-Magnetic Compatibility
Ability of equipment or system to function satisfactorily in its EM environment without introducing intolerable electromagnetic disturbances to anything in that environment.

Electromagnetic Disturbance
Any electromagnetic phenomenon which may degrade the performance of a device, equipment or system.

3. General Information

3.1 Client Information

Company	Elastic Care
Address	95 Apple Creek Boulevard Markham, Ontario Canada, L3R 1C7
Contact	Akshay Kalle
Email	akshay.kalle@pathcom.com
Phone	647 274 4620

3.2 Device Under Test (DUT)

3.2.1 DUT Information

DUT Name	Lifepath-C
DUT Model(s)	Lifepath-C
Power Source (AC / DC / Battery)	Lithium Ion battery
Input Voltage (V) or Range	3.7 VDC (Nominal)
Frequency (Hz) or Range	N/A
Mode(s) of Operation	- Continuous Operation - 10.5% Duty Cycle Operation
Connectors Available on DUT	ECG Cable Harness
DUT Dimensions (L x W x H)	36mm x 45.5mm x 30mm (without cable harness)
Transmitter Information	
FCC ID	2BA2T-LPC1
IC	30674-LPC1
Product Name	LifePath-C
Model #	EC-0032-07
Technology Used	BLE
Operating Frequency	2402 – 2480 MHz
Modulation Type	GFSK
Number of Channels	40
Antenna Manufacturer	Inventek Systems
Antenna Model	W24P-U
Antenna Type	PCB
Antenna Gain	+3.58 dBi

Note: Above antenna information is provided by the client.

3.2.2 DUT Description

The DUT is a wearable device used to collect quantitative biometric data such as ECG, Heart Rate, Skin Temperature, Respiration Rate, and Activity data from the thoracic region of adult patients. Data collection and monitoring is done using a mobile application through a BLE connection which operates between 2.402 – 2.480 GHz.

3.3 Test Setup of DUT

3.3.1 Configuration

The DUT was configured with the following parameters

- For all the tests, the DUT was set to transmit continuously with 100% duty cycle
- Output Power: Set "High Power" [7]
- Length of Data: 8
- Packet Payload: Pseudo-Random bit sequence 9
- Channels
    - Low: 2402 MHz (Channel 0)
    - Mid: 2440 MHz (Channel 19),
    - High: 2480 MHz (Channel 39)
- Device is limited to 10.5% duty cycle under normal operation. Maximum output power was measured with the device configured for continuous transmission.

3.3.2 Support Equipment

Device	Manufacturer	Model	S/N
Laptop PC (Disconnected for radiated testing)	Lenovo	T410	R8-7ARBY 10/11

3.4 Modifications for Compliance

No modifications were made to the device under test to achieve compliance with the testing requirements.

4. Test Results

4.1 Spurious Radiated Emissions

Test Date:	April 4, 2023	Initials:	RA
Temperature (°C)	20.8		
Relative Humidity (%)	28.2		
Barometric Pressure (kPa)	98.0		

4.1.1 Limits

Frequency Range (MHz)	Field Strength Limit		Field Strength at 3m (dBµV/m)	Detector Type / Measurement Bandwidth
	µV/m	Distance		
0.009 – 0.150	2400/F(kHz)	300	128.5 – 104.1	Quasi-Peak‡ / 200Hz
0.150 – 0.490	2400/F(kHz)	300	104.1 – 93.8	Quasi-Peak‡ / 9kHz
0.490 – 1.705	24000/F(kHz)	30	73.8 – 63.0	Quasi-Peak / 9kHz
1.705 – 30	30	30	69.5	Quasi-Peak / 9kHz
30 – 88	100	3	40.0	Quasi-Peak / 120kHz
88 – 216	150	3	43.5	Quasi-Peak / 120kHz
216 – 960	200	3	46.0	Quasi-Peak / 120kHz
960 – 1000	500	3	54.0	Quasi-Peak / 120kHz
Above 1000	500	3	54.0	Average / 1MHz
Above 1000	5000	3	74.0	Peak / 1MHz

‡The emission limits below 1GHz shown in the above table are based on measurements employing a CISPR Quasi-Peak detector except for the frequency bands 9-90 kHz and 110-490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector.

4.1.2 Test Procedure

Tested according to ANSI C63.10 Section 6.3.

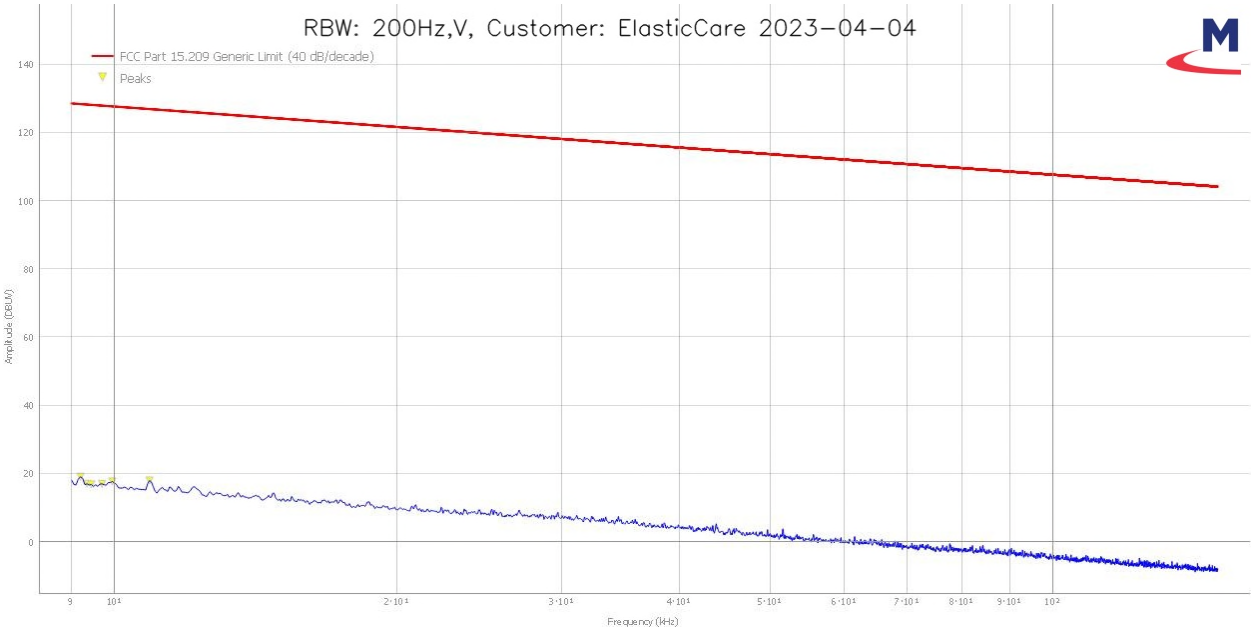
The device under test was setup inside a semi-anechoic chamber with remotely controlled turntable and antenna positioner at a 3m test distance. The DUT was placed on a non-metallic stand 0.8 meters above the ground plane for frequencies below 1GHz and 1.5 meters for frequencies above 1GHz.

To determine the emission characteristics of the DUT, exploratory radiated emission scans were made while rotating the turntable 0° to 360° and using a Peak detector. The results were recorded in graphical form. As per FCC Part 15, Subpart A, Section 15.33, the DUT was scanned to the 10th harmonic of the highest fundamental frequency (a minimum of 24.8 GHz).

For each suspected emission, final measurements of the DUT radiated emissions with the Quasi-Peak, Average or Peak detector, as defined in the limits table above, were made with the turntable azimuth rotated 0° to 360° and antenna height varied from 1m to 4m. The antenna was positioned to receive emissions in the vertical and horizontal polarizations such that the maximum radiated emission levels were detected.

4.1.3 Test Results

Range:	9kHz to 150kHz	**Tx Frequency**	2440MHz
Test Voltage:	Battery	**Antenna Polarization**	N/A

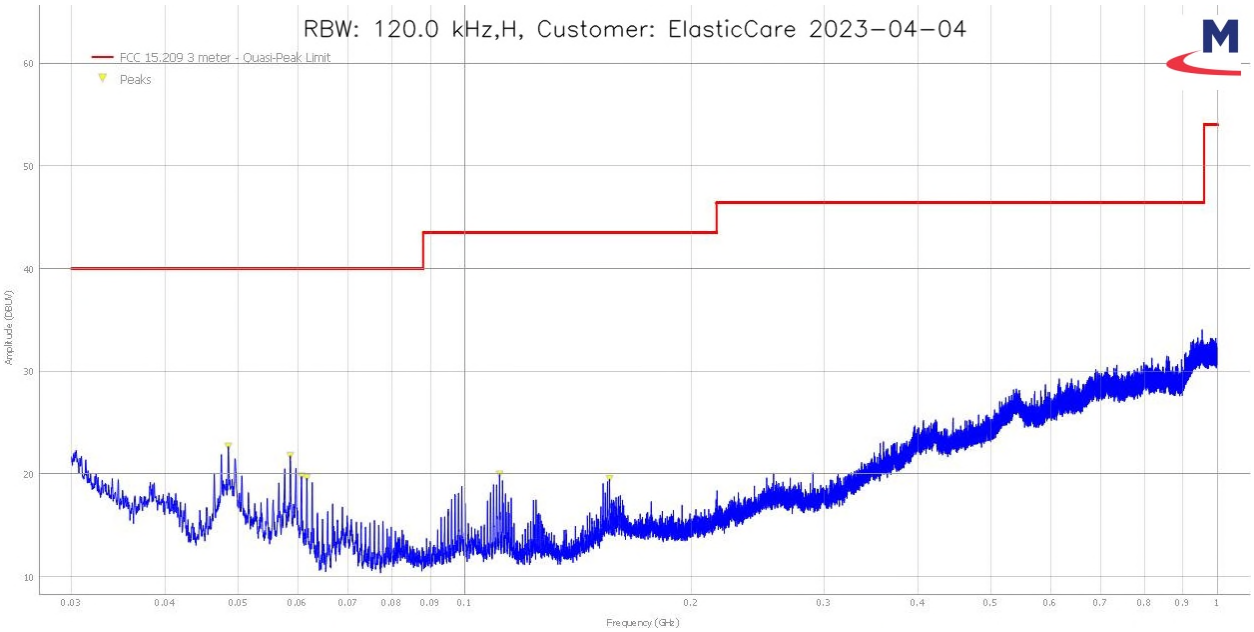


Remark: Peak Emission Plot

Range:	150kHz to 30MHz	**Tx Frequency**	2440MHz
Test Voltage:	Battery	**Antenna Polarization**	N/A

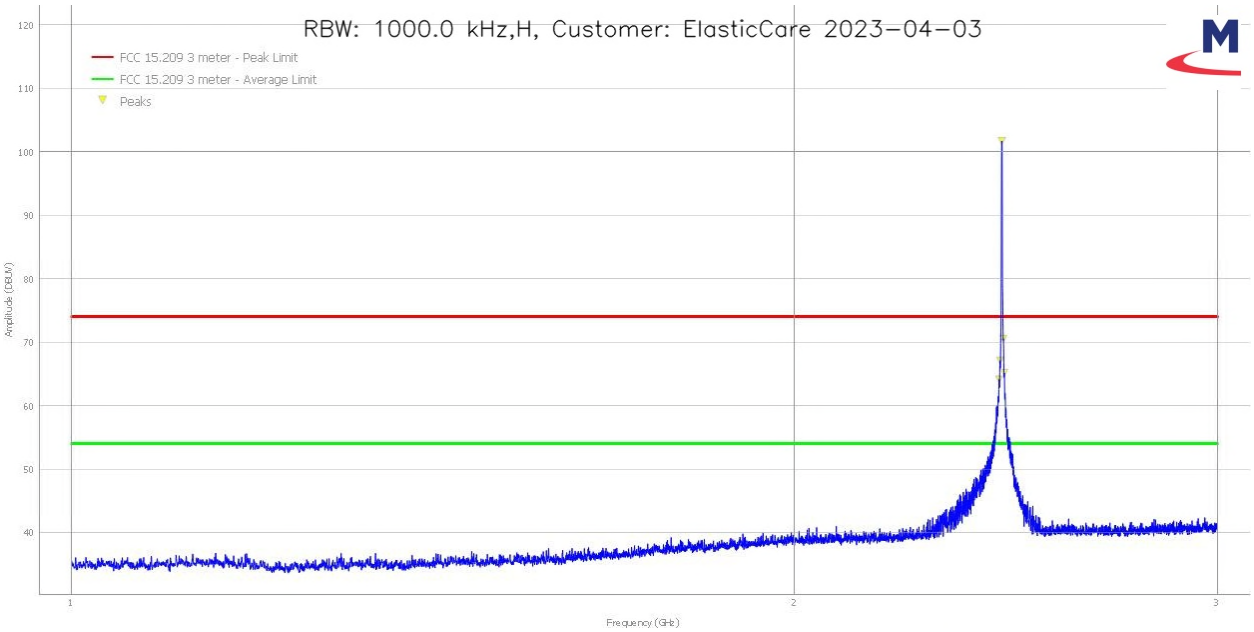
Remark: Peak Emission Plot

Range:	30MHz to 1GHz	**Tx Frequency**	2440MHz
Test Voltage:	Battery	**Antenna Polarization**	Horizontal



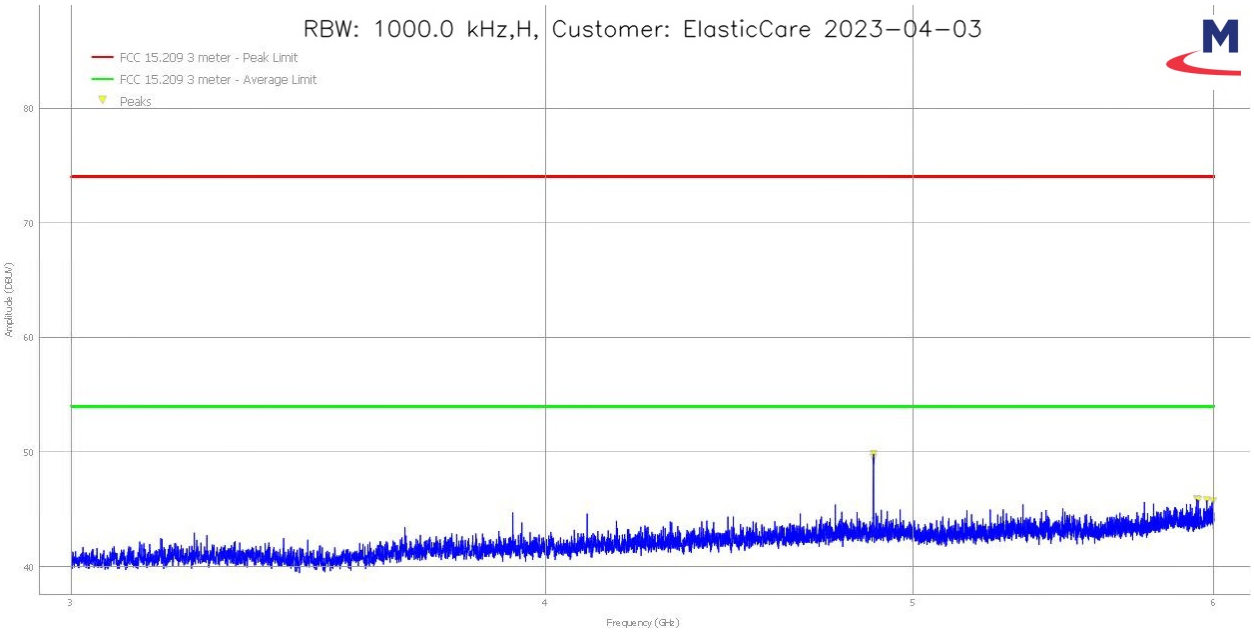
Remark: Peak Emission Plot

Range:	1GHz to 3GHz	**Tx Frequency**	2440MHz
Test Voltage:	Battery	**Antenna Polarization**	Horizontal



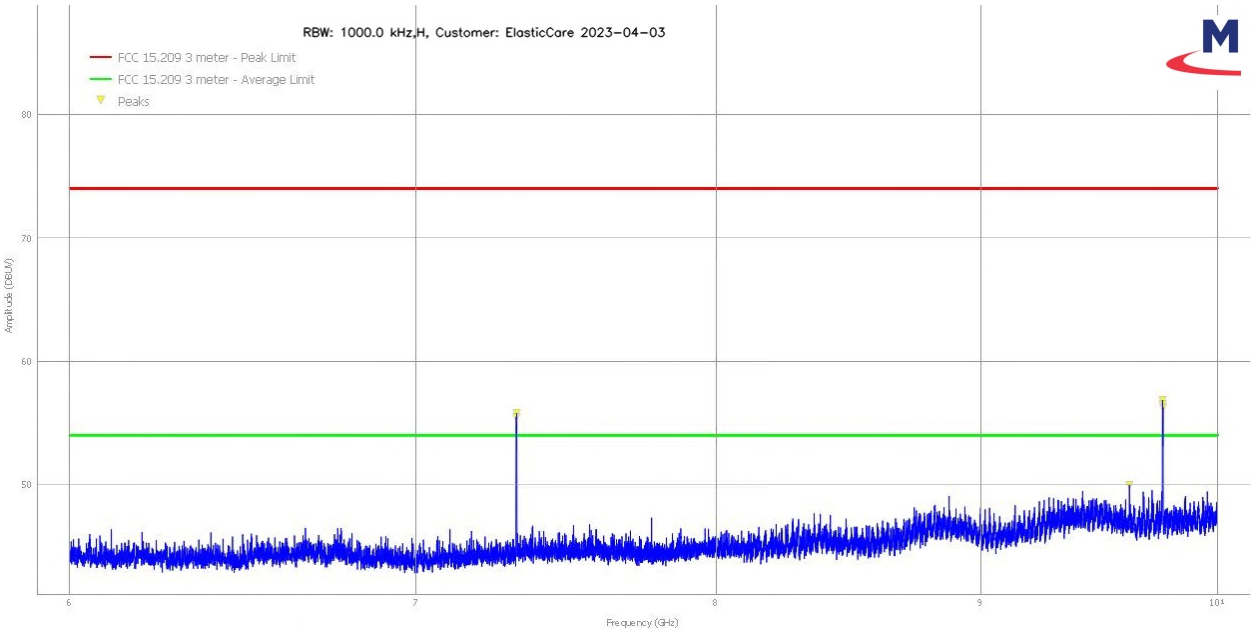
Remarks: Peak Emission Plot
Peak between 2 – 3 GHz is the fundamental emission and not subjected to these limits.

Range:	3GHz to 6GHz	**Tx Frequency**	2440MHz
Test Voltage:	Battery	**Antenna Polarization**	Horizontal



Remark: Peak Emission Plot

Range:	6GHz to 10GHz	**Tx Frequency**	2440MHz
Test Voltage:	Battery	**Antenna Polarization**	Horizontal

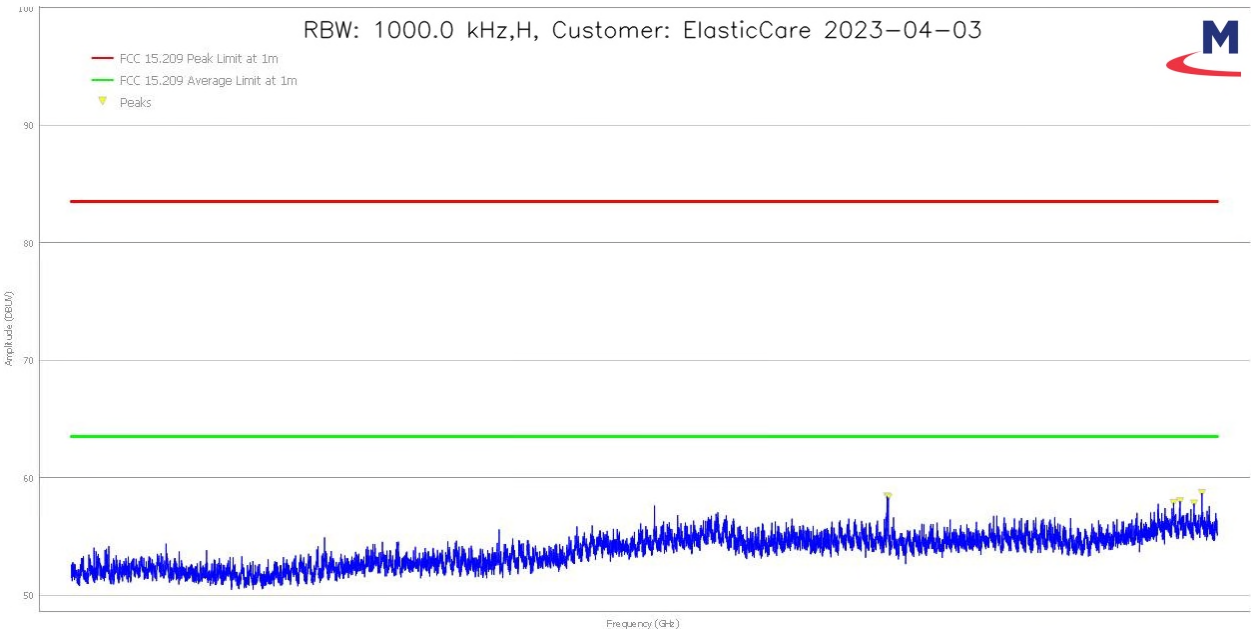


Remark: Peak Emission Plot

Range:	10GHz to 15GHz	Tx Frequency	2440MHz
Test Voltage:	Battery	Antenna Polarization	Horizontal

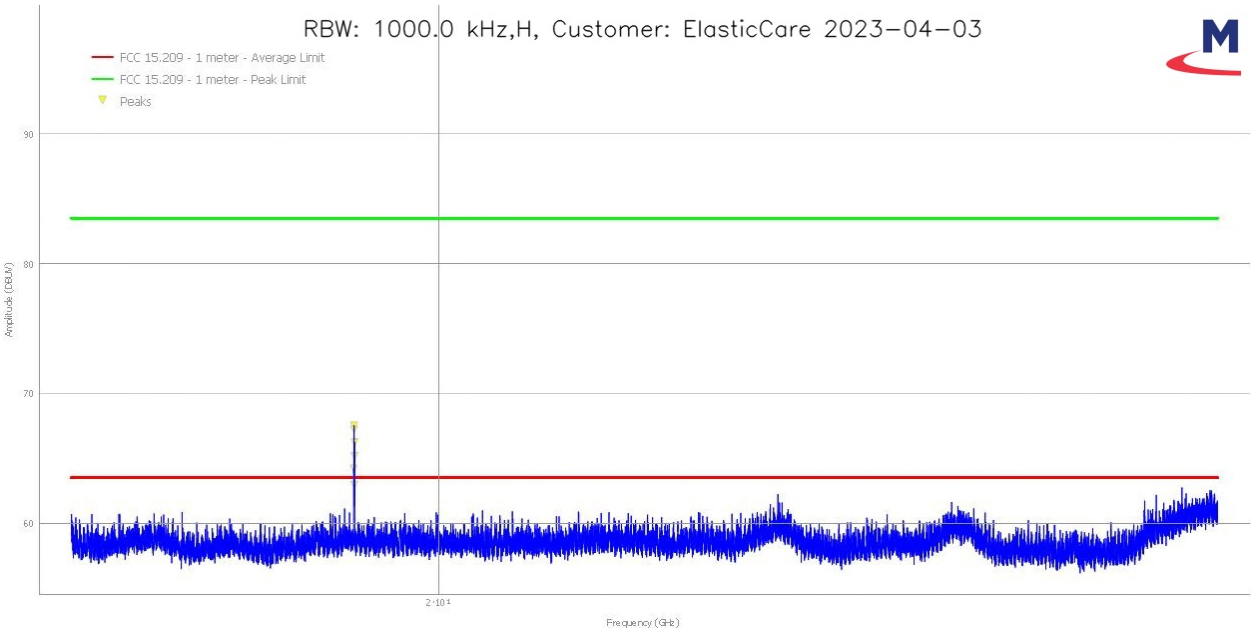
Remark: Peak Emission Plot

Range:	15GHz to 18GHz	Tx Frequency	2440MHz
Test Voltage:	Battery	Antenna Polarization	Horizontal



Remark: Peak Emission Plot

Range:	18GHz to 25GHz	**Tx Frequency**	2440MHz
Test Voltage:	Battery	**Antenna Polarization**	Horizontal

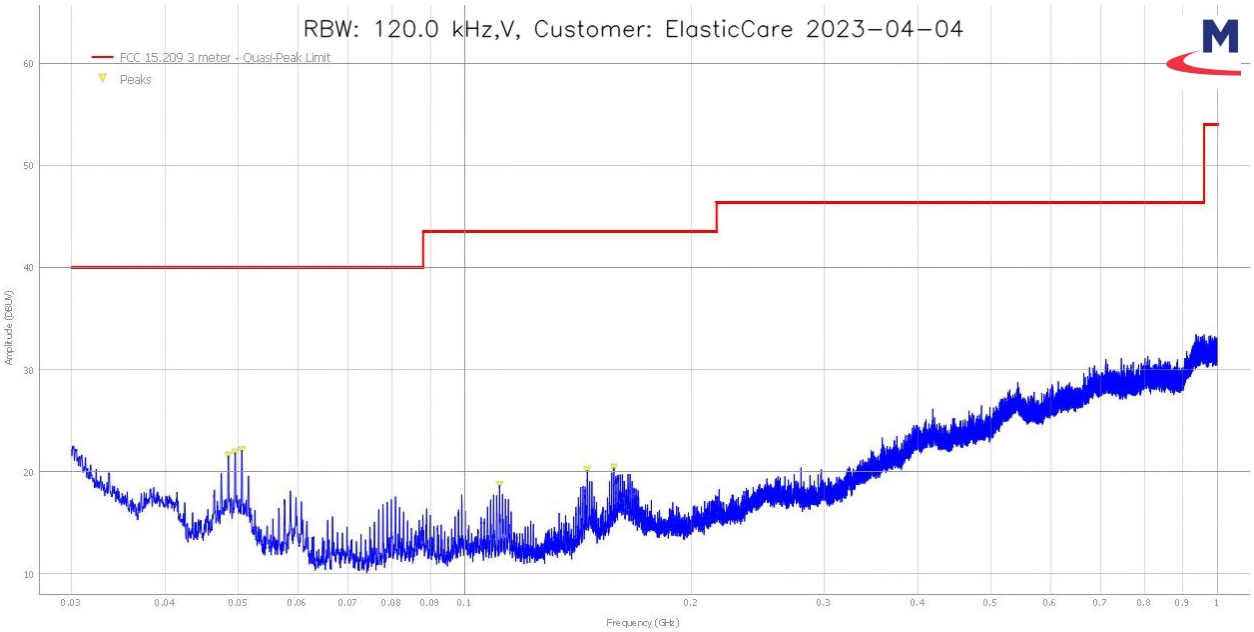


Remark: Peak Emission Plot

Horizontal Antenna Polarization							
Frequency (MHz)	**Detector**	**Reading (dBµV)**	**Correction Factor (dB)**	**Emission Level (dBµV/m)**	**Limit (dBµV/m)**	**Margin (dB)**	**Test Result**
48.48	QP	34.8	-13.8	21.0	40.0	19.0	Pass
4880.50	PEAK	52.9	-1.4	51.5	74.0	22.5	Pass
4880.50	AVG	35.4	-1.4	34.0	54.0	20.1	Pass
9759.00	PEAK	53.8	4.5	58.3	74.0	15.8	Pass
9759.00	AVG	33.6	4.5	38.1	54.0	15.9	Pass
7320.75	PEAK	56.1	1.6	57.8	74.0	16.3	Pass
7320.75	AVG	34.5	1.6	36.1	54.0	17.9	Pass
14638.75	PEAK	46.8	11.1	57.9	83.5	25.6	Pass
14638.75	AVG	30.0	11.1	41.1	63.5	22.4	Pass
17955.75	PEAK	43.0	16.0	59.0	83.5	24.5	Pass
17955.75	AVG	28.1	16.0	44.1	63.5	19.4	Pass
19519.00	PEAK	48.2	19.6	67.8	83.5	15.7	Pass
19519.00	AVG	29.7	19.6	49.3	63.5	14.2	Pass

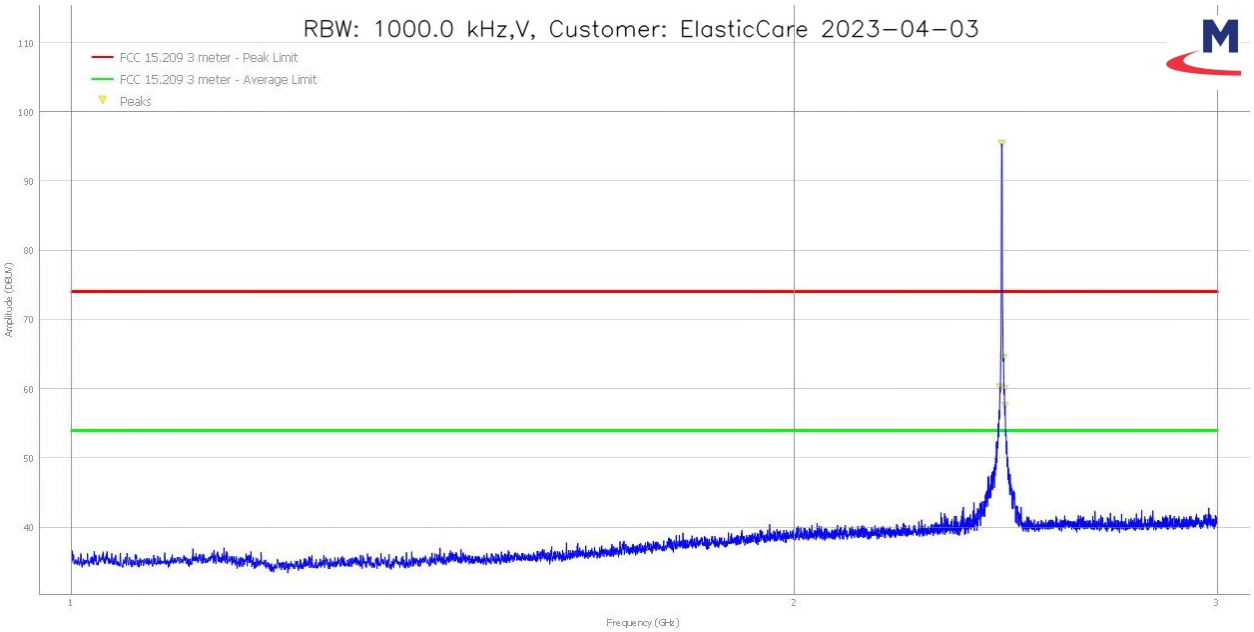
Worst case position: Angle: 69 Deg
Height: 162 cm

Range:	30MHz to 1GHz	**Tx Frequency**	2440MHz
Test Voltage:	Battery	**Antenna Polarization**	Vertical



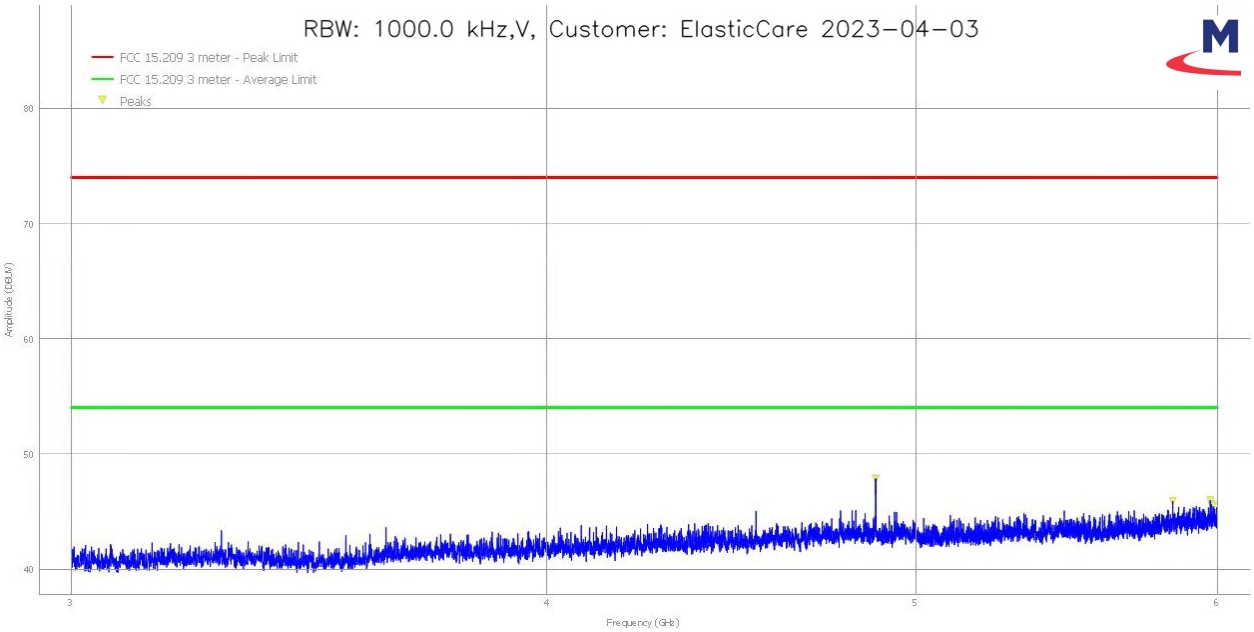
Remark: Peak Emission Plot

Range:	1GHz to 3GHz	**Tx Frequency**	2440MHz
Test Voltage:	Battery	**Antenna Polarization**	Vertical



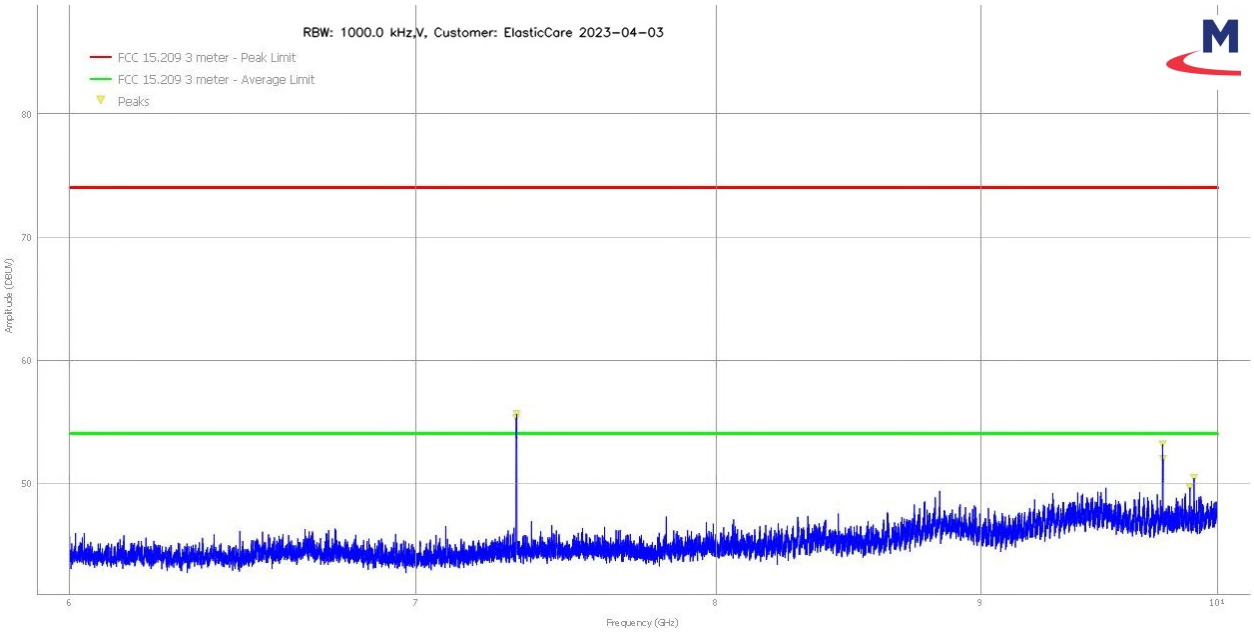
Remarks: Peak Emission Plot
Peak between 2 – 3 GHz is the fundamental emission and not subjected to these limits.

Range:	3GHz to 6GHz	**Tx Frequency**	2440MHz
Test Voltage:	Battery	**Antenna Polarization**	Vertical



Remark: Peak Emission Plot

Range:	6GHz to 10GHz	**Tx Frequency**	2440MHz
Test Voltage:	Battery	**Antenna Polarization**	Vertical

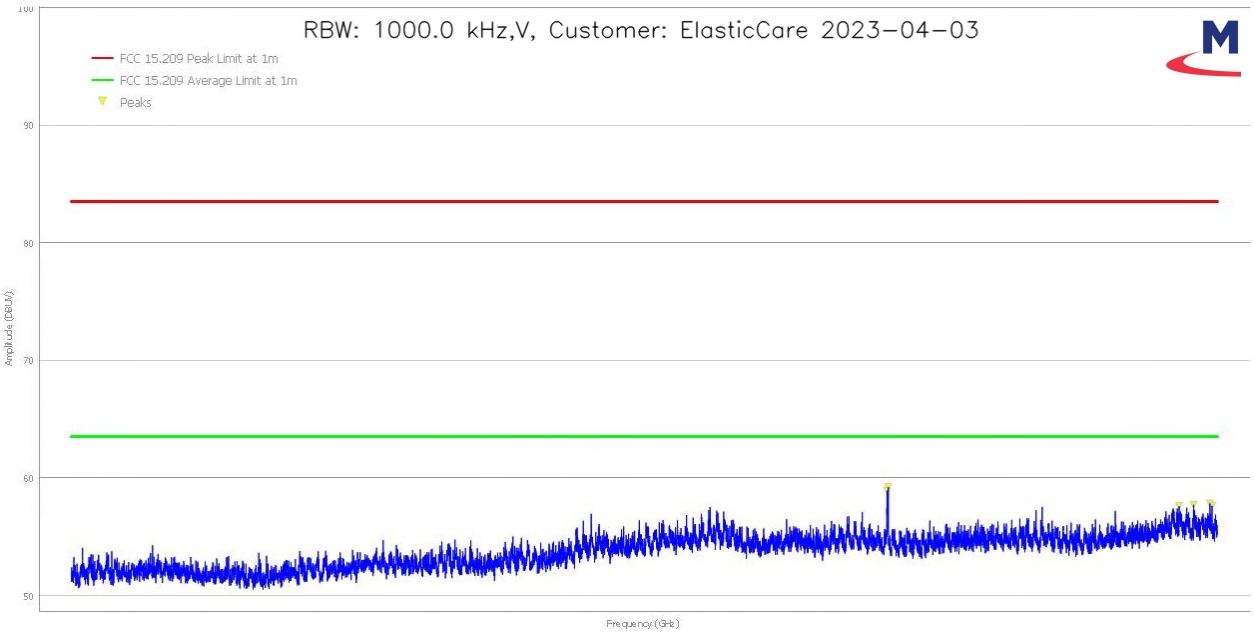


Remark: Peak Emission Plot

Range:	10GHz to 15GHz	**Tx Frequency**	2440MHz
Test Voltage:	Battery	**Antenna Polarization**	Vertical

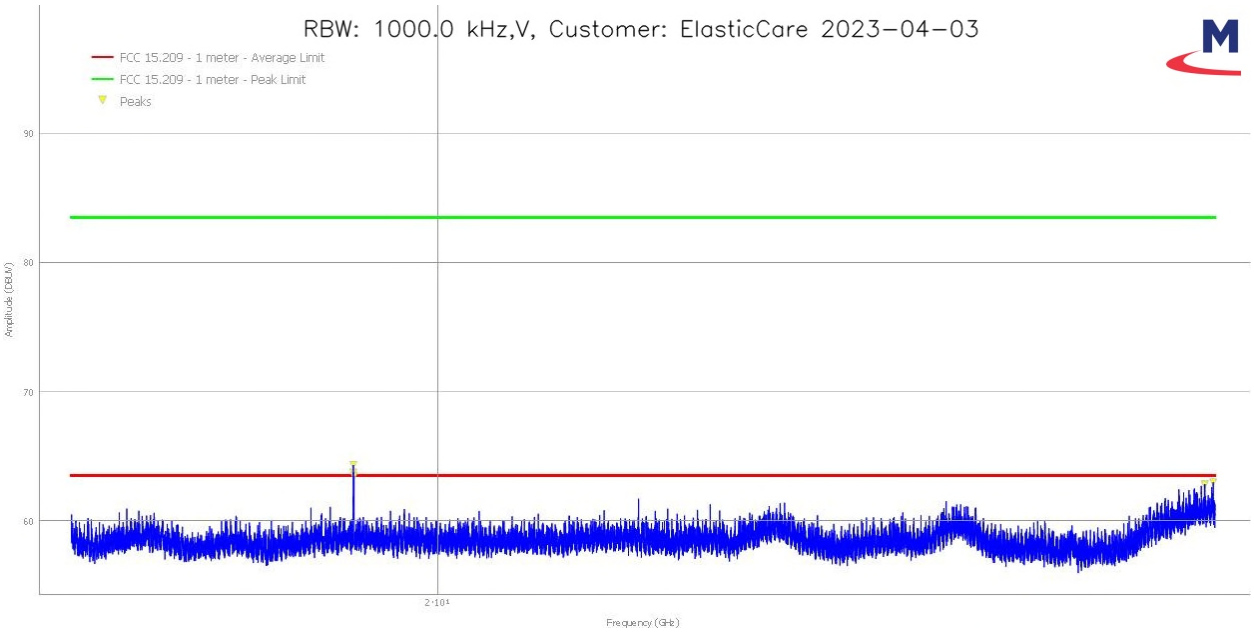
Remark: Peak Emission Plot

Range:	15GHz to 18GHz	**Tx Frequency**	2440MHz
Test Voltage:	Battery	**Antenna Polarization**	Vertical



Remark: Peak Emission Plot

Range:	18GHz to 25GHz	**Tx Frequency**	2440MHz
Test Voltage:	Battery	**Antenna Polarization**	Vertical



Remark: Peak Emission Plot

Vertical Antenna Polarization							
Frequency (MHz)	**Detector**	**Reading (dBµV)**	**Correction Factor (dB)**	**Emission Level (dBµV/m)**	**Limit (dBµV/m)**	**Margin (dB)**	**Test Result**
50.52	PEAK	36.3	-14.2	22.1	40.0	17.9	Pass
4880.50	PEAK	50.5	-1.4	49.1	74.0	24.9	Pass
4880.50	AVG	34.0	-1.4	32.6	54.0	21.4	Pass
7320.75	PEAK	55.7	1.6	57.4	74.0	16.6	Pass
7320.75	AVG	34.5	1.6	36.1	54.0	17.9	Pass
9759.25	PEAK	50.1	4.5	54.6	74.0	19.4	Pass
9759.25	AVG	32.3	4.5	36.8	54.0	17.2	Pass
14638.50	PEAK	50.4	11.1	61.5	83.5	22.0	Pass
14638.50	AVG	31.2	11.1	42.3	63.5	21.2	Pass
17081.75	PEAK	46.4	14.9	61.3	83.5	22.2	Pass
17081.75	AVG	29.3	14.9	44.2	63.5	19.3	Pass
19518.25	PEAK	47.2	19.6	66.8	83.5	16.7	Pass
19518.25	AVG	29.2	19.6	48.8	63.5	14.7	Pass

Worst case position: Angle: 166 Deg
Height: 159 cm

4.1.4 Test Equipment List

Equipment ID	Description	Manufacturer	Model	Calibration Date	Calibration Due
EQ_EMC_58	EMI Receiver	Rohde & Schwarz	ESW 44	Feb 03, 2022	Feb 03, 2024
EQ_EMC_48	Loop Antenna 9kHz – 30MHz	Com-Power	AL-130R	May 4, 2022	May 4, 2024
EQ_EMC_59	BiLog Antenna 30MHz – 1GHz	ETS Lindgren	3142E	Feb 27, 2022	Feb 27, 2024
EQ_EMC_60	Horn Antenna 1GHz – 18GHz	ETS Lindgren	3117	Mar 11, 2022	Mar 11, 2024
EQ_EMC_56	Horn Antenna 18GHz – 25GHz	A.H. Systems	SAS-574	Apr 1, 2022	Apr 1, 2024
EQ_EMC_68	6dB Attenuator	Fairview Microwave	SA3NS-06	NCR	NCR
EQ_EMC_85	RF Cable <1GHz	Times Microwave	LMR-400	NCR	NCR
EQ_EMC_75	RF Cable >1GHz	MegaPhase	EMC2	NCR	NCR
EQ_EMC_89	Preamplifier 9kHz-1GHz	Teseq	LNA 6901	May 12, 2022	May 12, 2024
EQ_EMC_42	Preamplifier 1GHz-18GHz	Com-Power	PAM-118A	Mar 24, 2022	Mar 24, 2024
EQ_EMC_43	Preamplifier 18GHz – 25GHz	Com-Power	PAM-840A	Mar 24, 2022	Mar 24, 2024
EQ_EMC_110	HPF Filter 3GHz – 18GHz	Micro-Tronics	HPM50108	NCR	NCR
EQ_EMC_96	Emissions Software	Megalab Group	EMI V1.0	NCR	NCR

NCR = No Calibration Required

4.2 Emission Bandwidth

Test Date:	April 18, 2023	Initials:	RA
Temperature (°C)	20.1		
Relative Humidity (%)	27.5		
Barometric Pressure (kPa)	96.9		

4.2.1 Limits

The minimum 6 dB bandwidth shall be at least 500 kHz when measured with a 100 kHz RBW and a 300 kHz VBW.

The 99% bandwidth is also measured for informational purposes.

4.2.2 Test Procedure

6 dB bandwidth tested according to ANSI C63.10 Section 6.9.2, FCC KDB 558074 Section 8.1, and RSS-GEN 6.7.

99% occupied bandwidth tested according to ANSI C63.10 Section 6.9.3 and RSS-GEN 6.7

The resolution bandwidth (RBW) was set in the range of 1% to 5% of the actual occupied bandwidth and the video bandwidth (VBW) was set to no smaller than three times the RBW value.

4.2.3 Test Results

The EUT passed.
The minimum 6 dB Bandwidth measured was 664.8 kHz.
The maximum 99% Occupied Bandwidth was 1.03 MHz.

6dB (DTS) Bandwidth				
Frequency (MHz)	**F_{LOW} (MHz)**	**F_{HIGH} (MHz)**	**Occupied Bandwidth (kHz)**	**Test Result**
2402	2401.7018	2402.3666	664.8	Pass
2440	2439.7018	2440.3666	664.8	Pass
2480	2479.7051	2480.3699	664.8	Pass

99% Bandwidth				
Frequency (MHz)	**F_{LOW} (MHz)**	**F_{HIGH} (MHz)**	**Occupied Bandwidth (kHz)**	**Test Result**
2402	2401.53865	2402.55975	1021.101227	Pass
2440	2439.536	2440.56183	1025.830985	Pass
2480	2479.53715	2480.56214	1024.988416	Pass

4.2.4 Plots

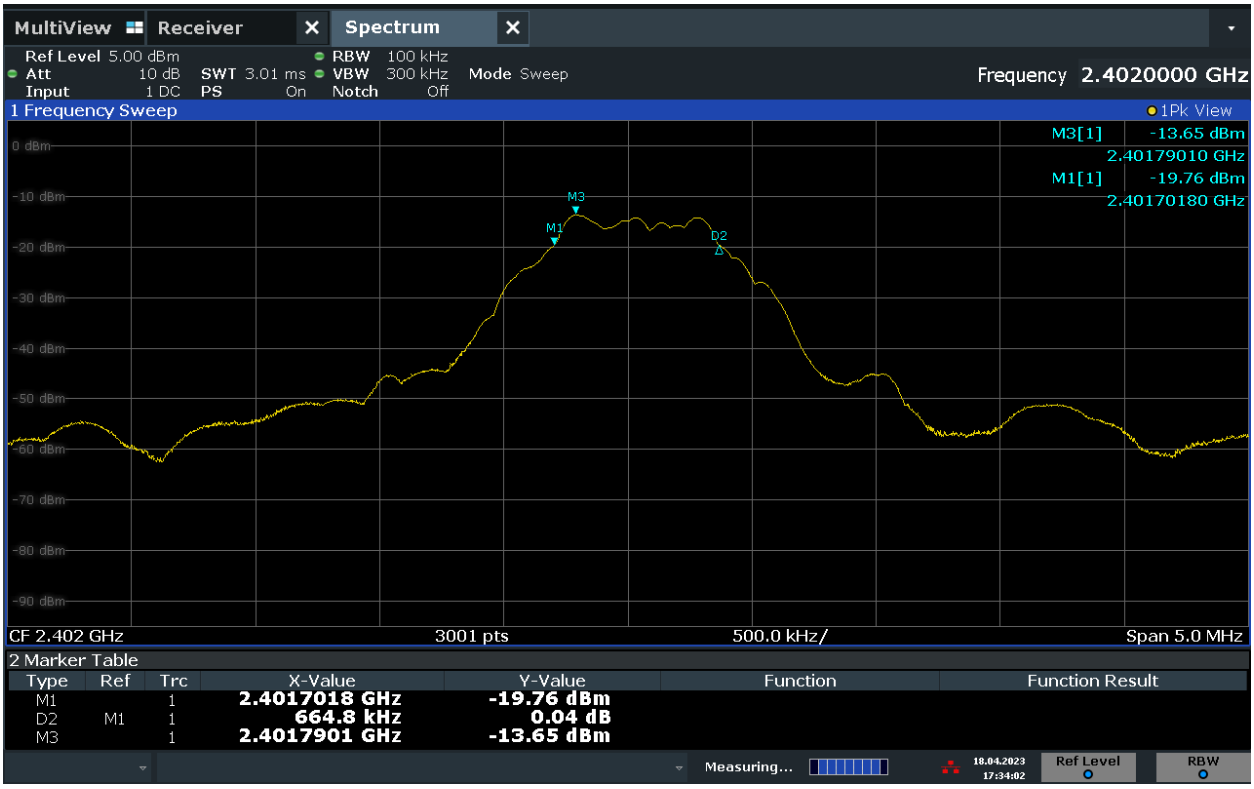


Figure 1 – 6 dB Bandwidth - Low Channel

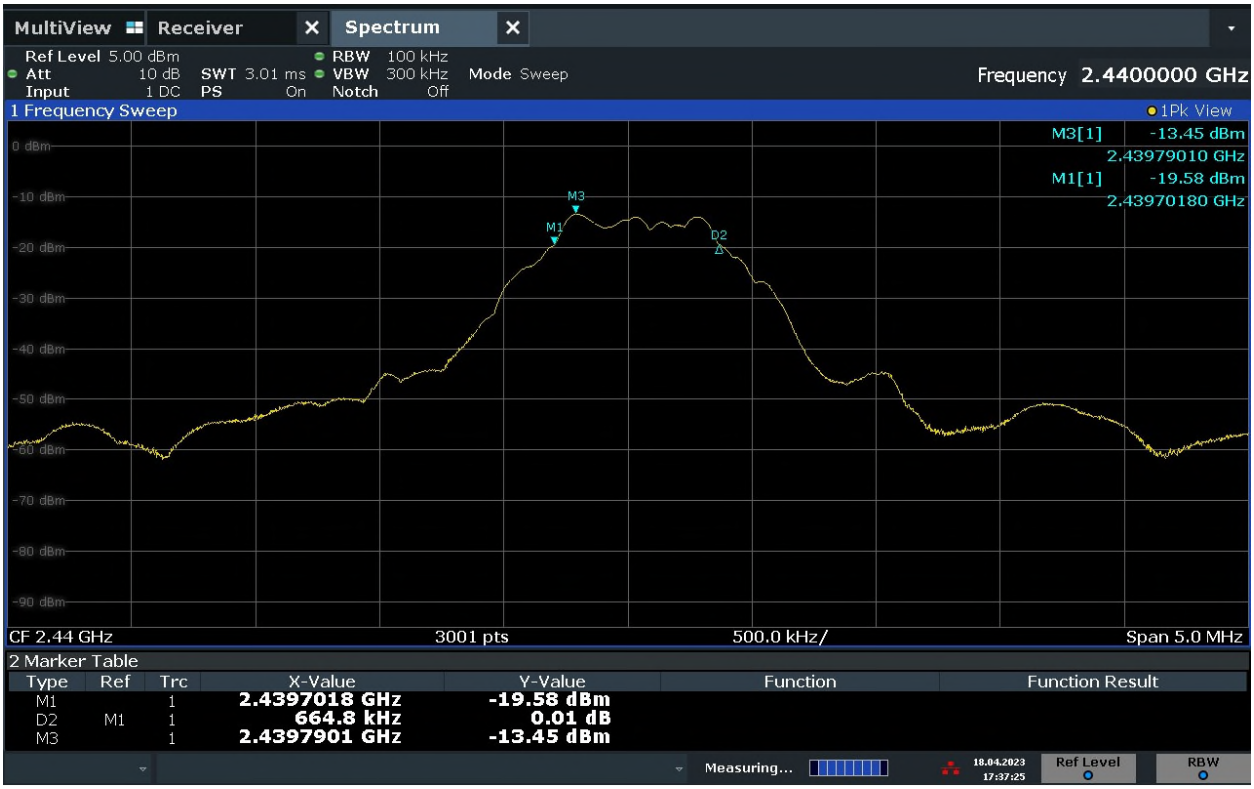


Figure 2 – 6 dB Bandwidth - Mid Channel

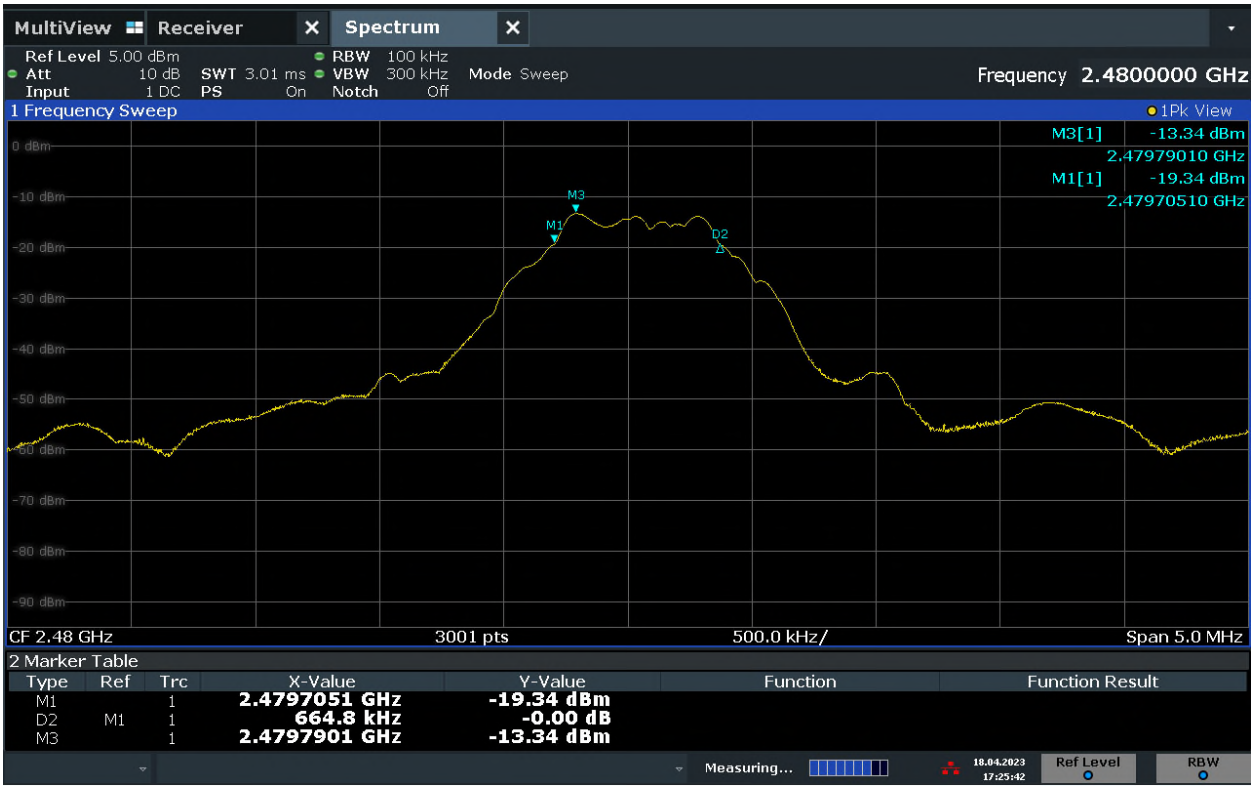


Figure 3 – 6 dB Bandwidth - High Channel

Figure 4 – 99% Bandwidth - Low Channel

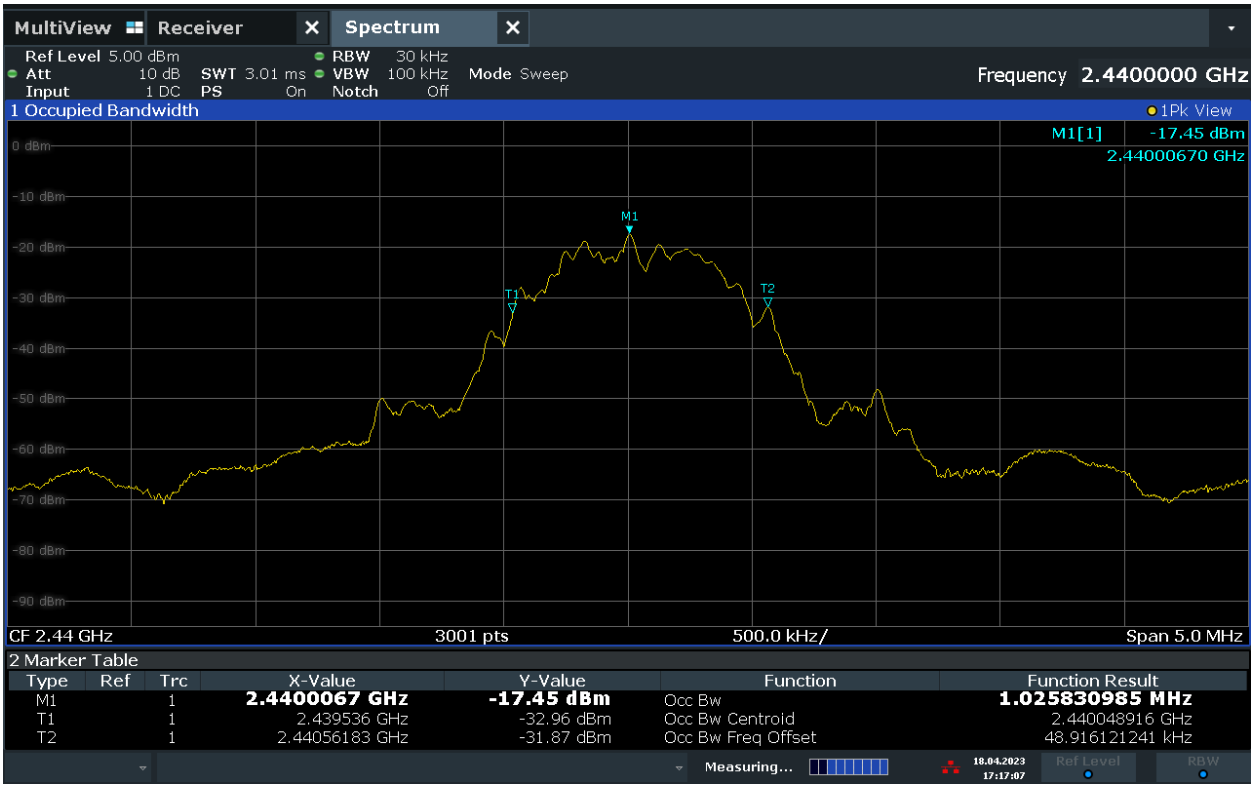


Figure 5 – 99% Bandwidth - Mid Channel

Figure 6 – 99% Bandwidth - High Channel

4.2.5 Test Equipment List

Equipment ID	Description	Manufacturer	Model	Calibration Date	Calibration Due
EQ_EMC_58	EMI Receiver	Rohde & Schwarz	ESW 44	Feb 03, 2022	Feb 03, 2024
EQ_EMC_116	20dB Attenuator	Fairview Microwave	SA18E-20	NCR	NCR

NCR = No Calibration Required

4.3 Maximum Output Power

Test Date:	April 19, 2023	Initials:	RA
Temperature (°C)	18.2		
Relative Humidity (%)	24.4		
Barometric Pressure (kPa)	98.1		

4.3.1 Limits

For systems using digital modulation in the 2400 – 2483.5 MHz band, the peak limit is 1 watt (30 dBm).

4.3.2 Test Procedure

The maximum peak envelope conducted power is tested according to FCC KDB 558074 Section 8.3 and ANSI C63.10 Section 11.9.1, maximum peak conducted output power for DTS devices using an RBW ≥ DTS bandwidth.

4.3.3 Test Results

The EUT passed.

Maximum Conducted Output Power			
Channel	**Frequency (MHz)**	**Peak Power (dBm)**	**Peak Power (mW)**
Low	2402	6.69	4.67
Mid	2440	6.82	4.81
High	2480	6.98	4.99

4.3.4 Conducted Output Power Plots

Note: The external attenuator and cable loss are accounted for as reference offset in the spectrum analyzer.

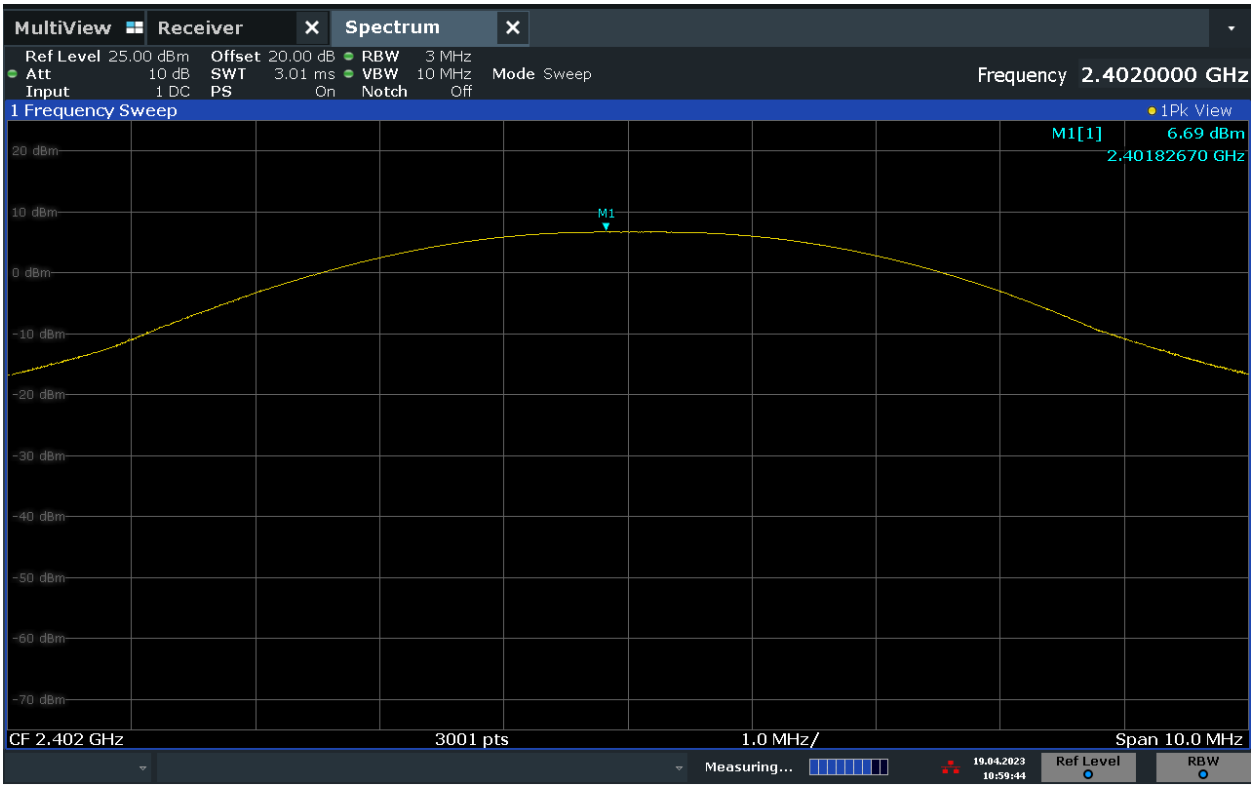


Figure 7 – Maximum Conducted Output Power - Low Channel

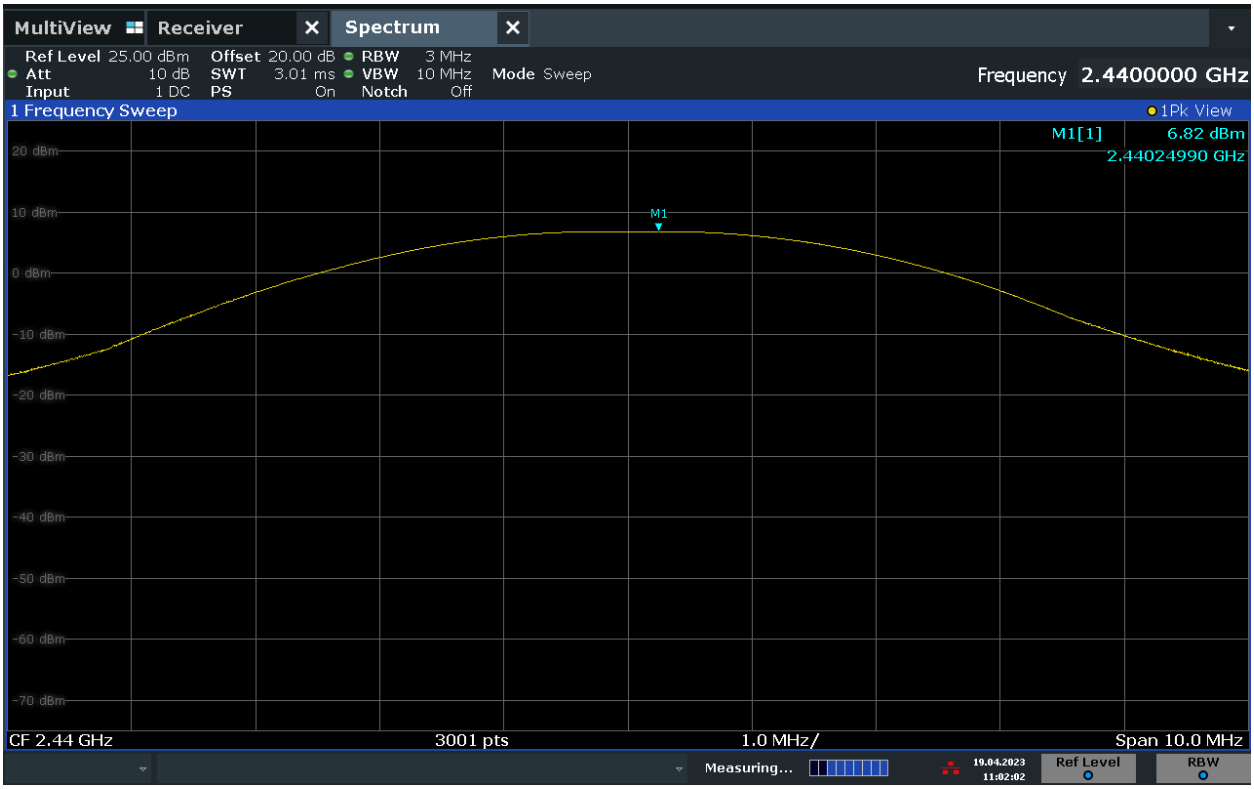


Figure 8 – Maximum Conducted Output Power - Mid Channel

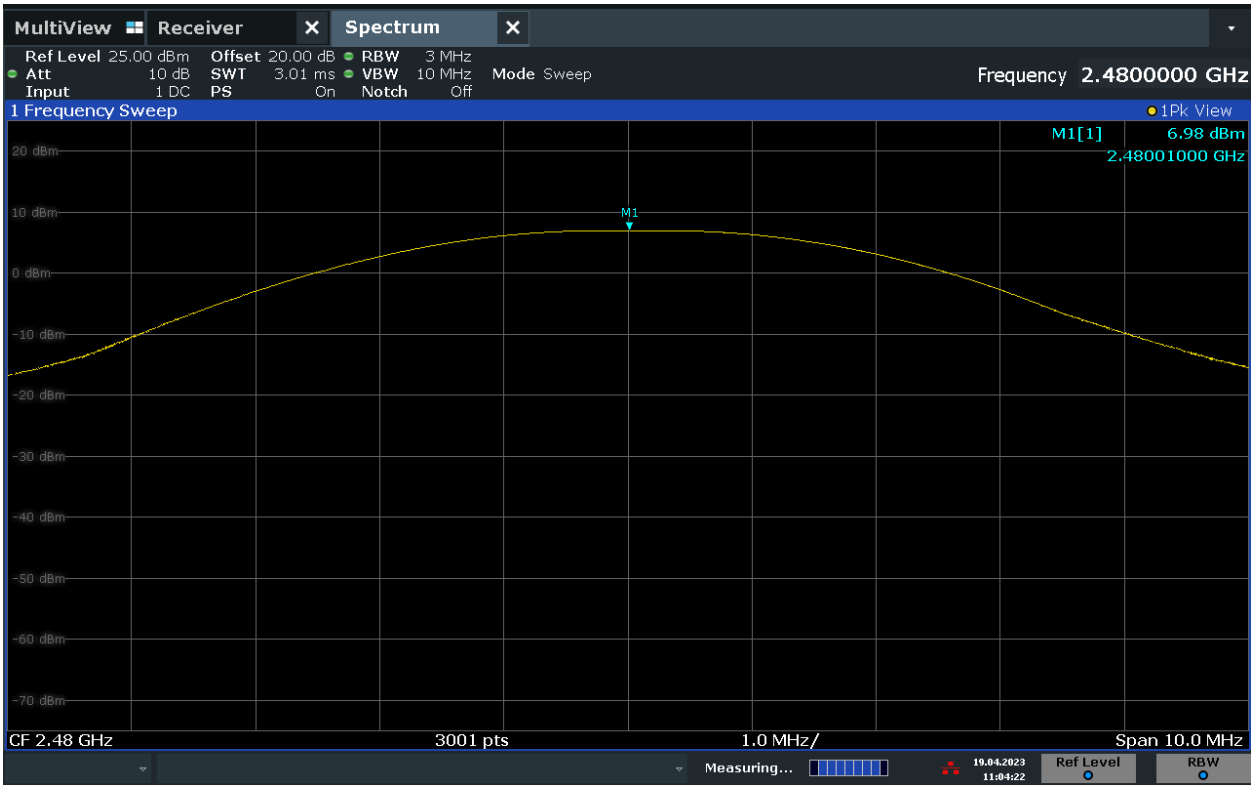


Figure 9 – Maximum Conducted Output Power - High Channel

4.3.5 Test Equipment List

Equipment ID	Description	Manufacturer	Model	Calibration Date	Calibration Due
EQ_EMC_58	EMI Receiver	Rohde & Schwarz	ESW 44	Feb 03, 2022	Feb 03, 2024
EQ_EMC_116	20dB Attenuator	Fairview Microwave	SA18E-20	NCR	NCR

NCR = No Calibration Required

4.4 Maximum Radiated Output Power

Test Date:	April 19, 2023	Initials:	RA
Temperature (°C)	18.2		
Relative Humidity (%)	24.4		
Barometric Pressure (kPa)	98.1		

4.4.1 Limits

For systems using digital modulation in the 2400 – 2483.5 MHz band, the peak limit is 1 watt (30 dBm) + 6 dBi antenna gain.

4.4.2 Test Procedure

The radiated peak emission level is tested according to guidance from FCC KDB 558074 Section 3, and ANSI C63.10 Section 6.3.3, using an RBW ≥ DTS bandwidth.

4.4.3 Test Results

The EUT passed.

Maximum Radiated Output							
Channel	**Polarity**	**Frequency (MHz)**	**Reading (dBµV)**	**Correction Factor (dB)**	**Peak Output Level (dBµV/m)**	**Peak Output Level (dBm)**	**Peak Output Level (mW)**
Low	Horizontal	2402	106.68	-5.60	101.08	5.88	3.87
Low	Vertical	2402	100.32	-5.60	94.72	-0.48	0.90
Mid	Horizontal	2440	107.29	-5.52	101.77	6.57	4.54
Mid	Vertical	2440	101.24	-5.52	95.72	0.52	1.13
High	Horizontal	2480	106.05	-5.44	100.61	5.41	3.48
High	Vertical	2480	99.32	-5.44	93.88	-1.32	0.74

4.4.4 Radiated Output Plots

Note: The measurement factors are not incorporated into these plots. They are added in the *Maximum Radiated Output* table in section *4.4.3 Test Results*.

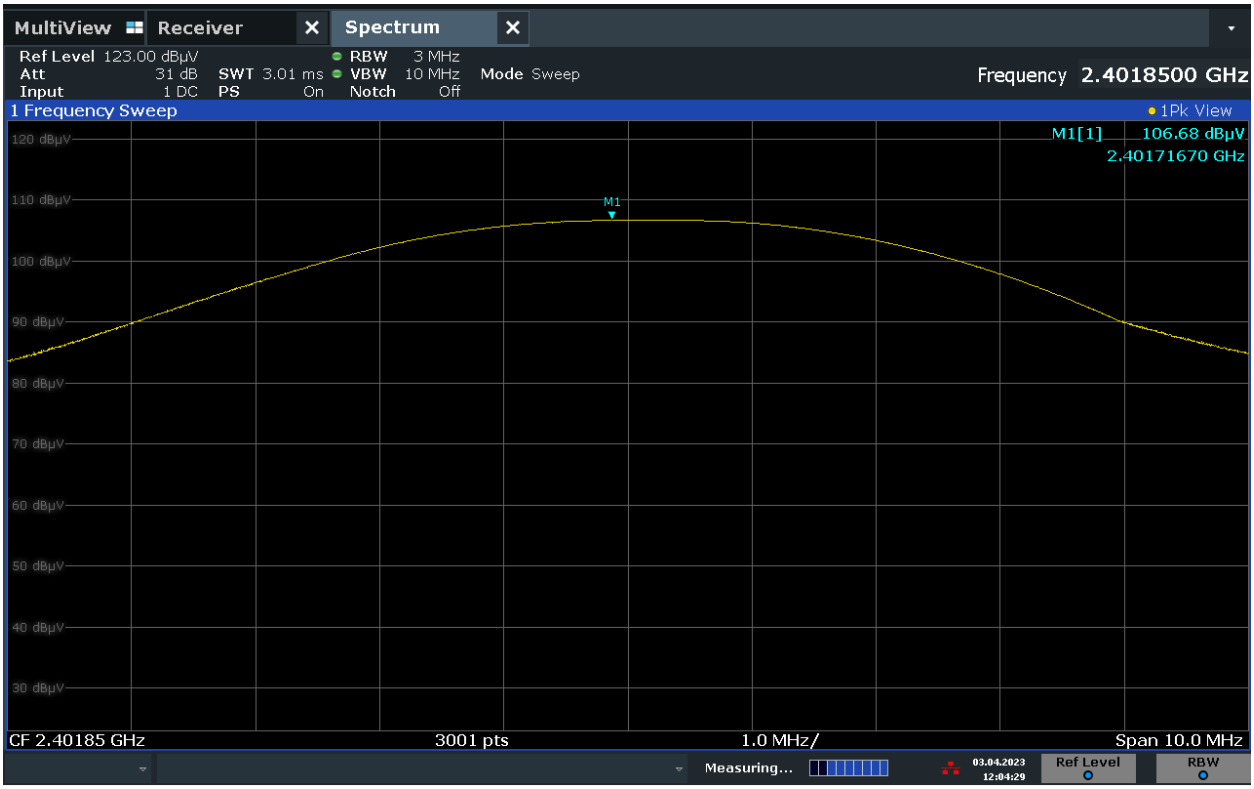


Figure 10 – Maximum Radiated Output Power - Low Channel
Horizontal Antenna Polarity

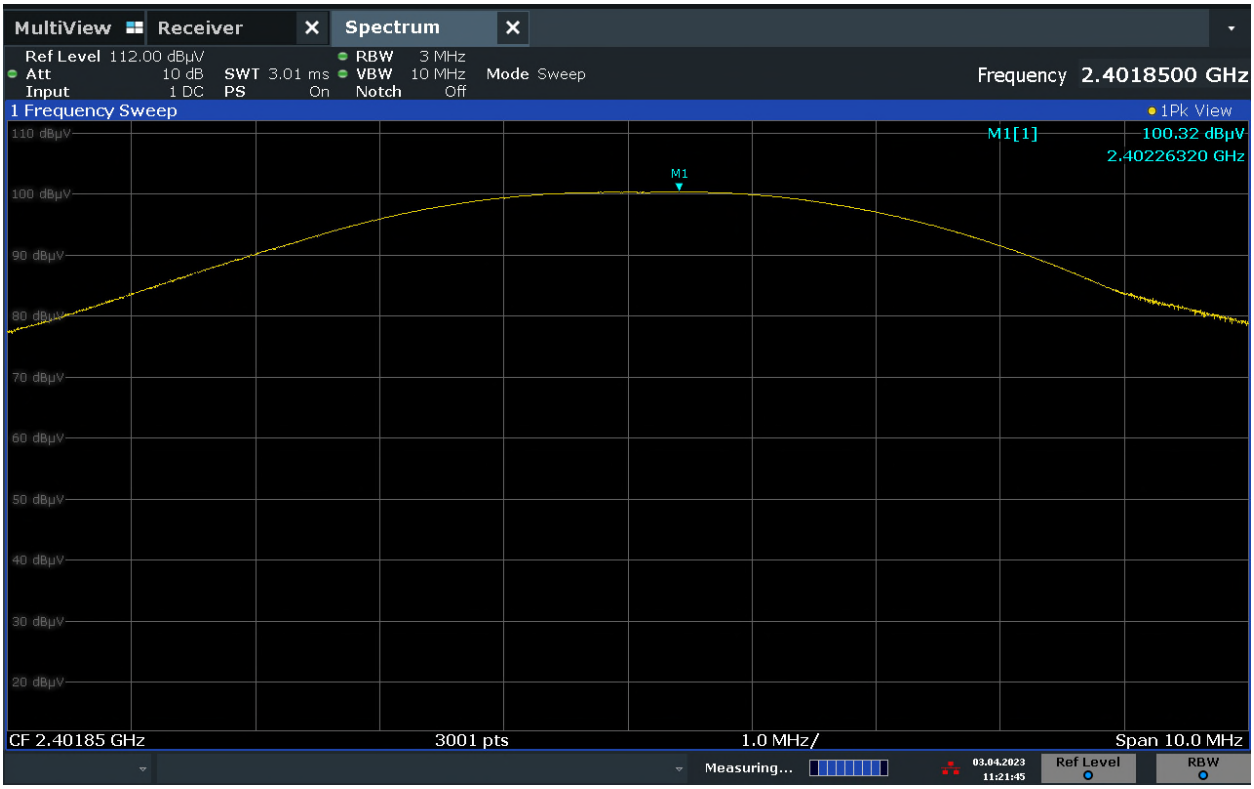


Figure 11 – Maximum Radiated Output Power - Low Channel
Vertical Antenna Polarity

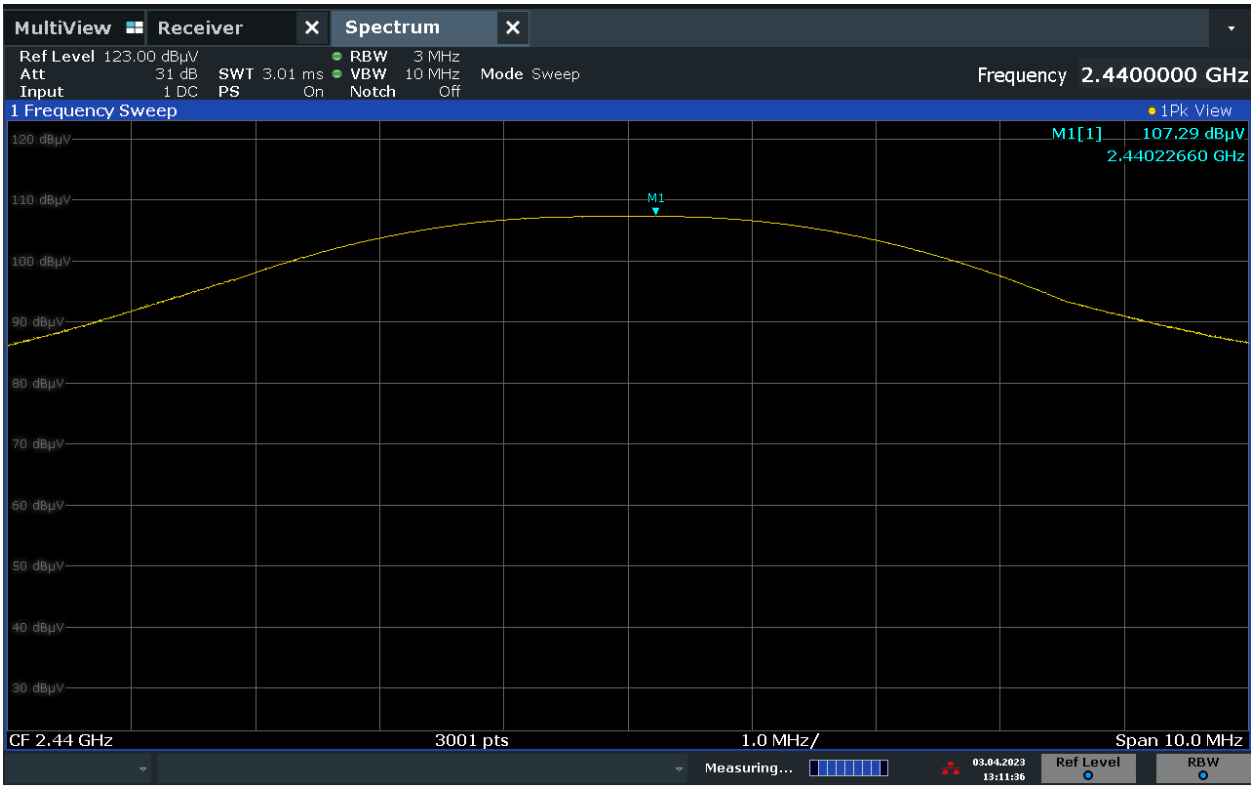


Figure 12 – Maximum Radiated Output Power - Middle Channel
Horizontal Antenna Polarity

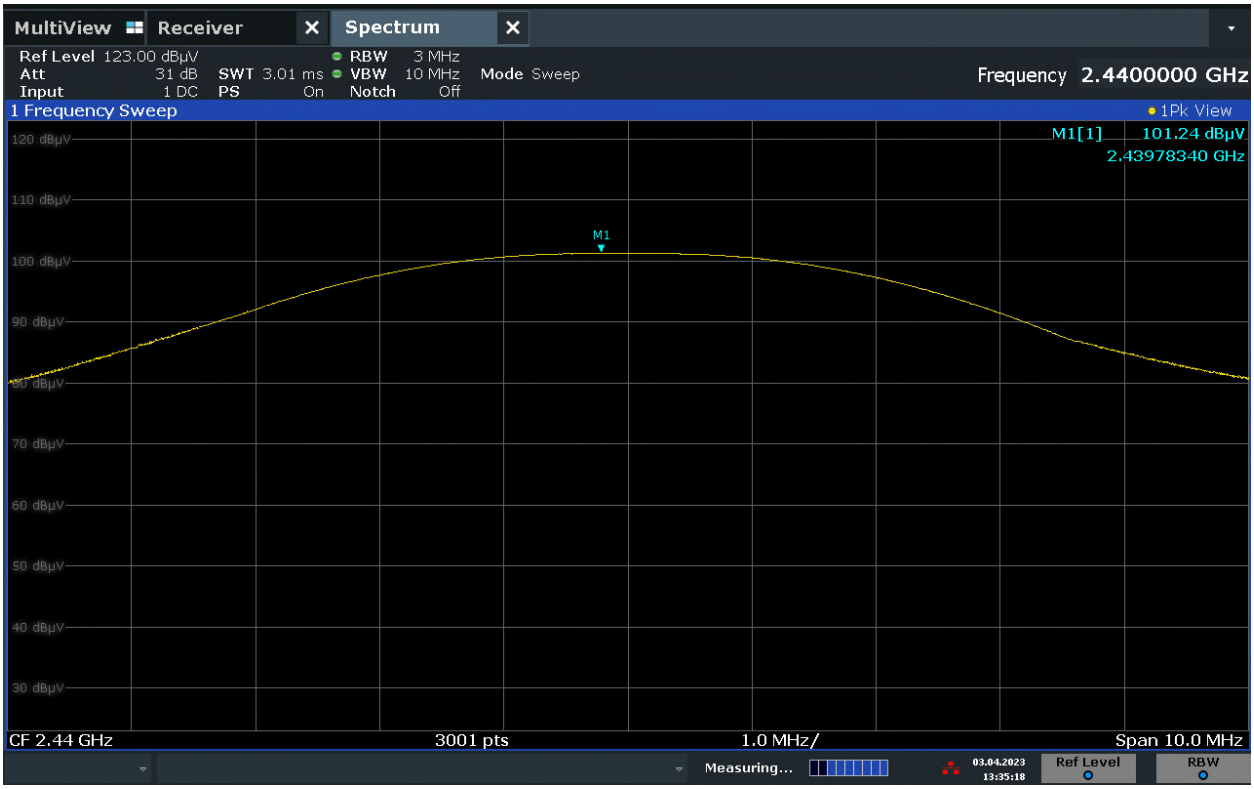


Figure 13 – Maximum Radiated Output Power - Middle Channel
Vertical Antenna Polarity

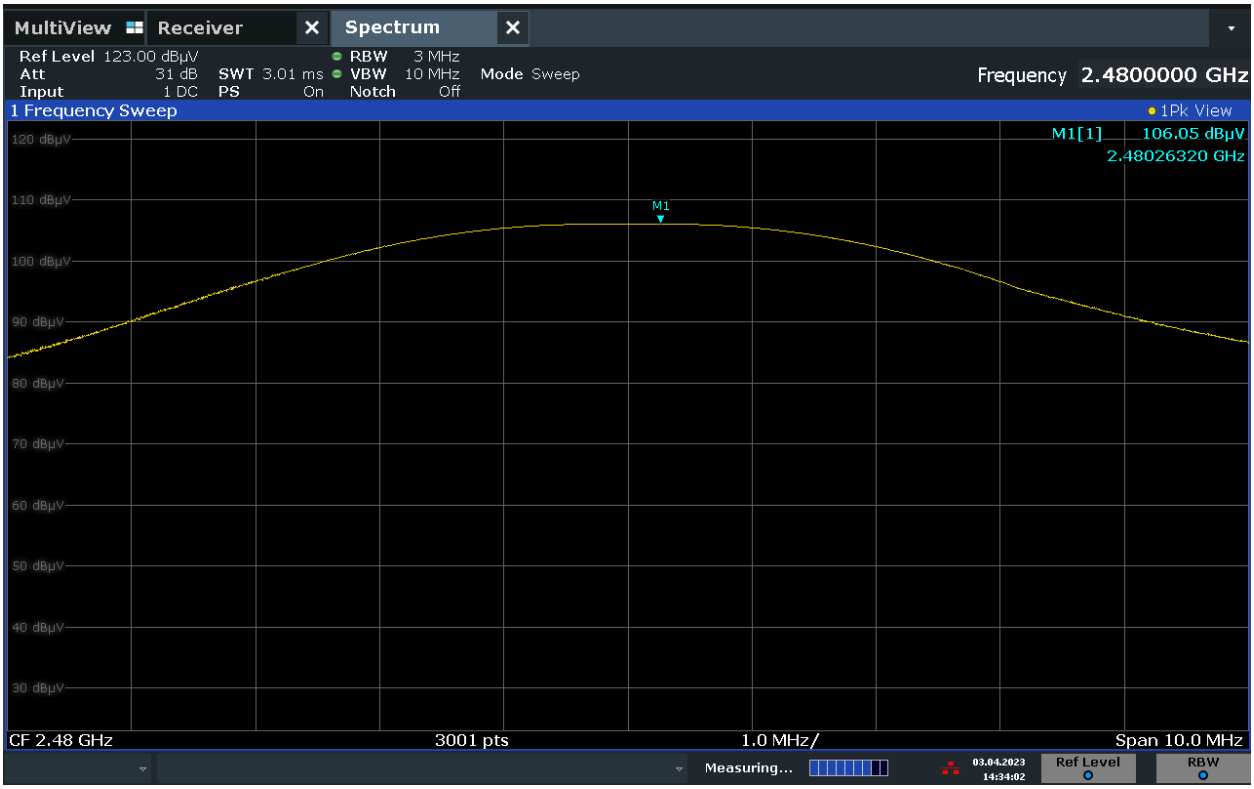


Figure 14 – Maximum Radiated Output Power - High Channel
Horizontal Antenna Polarity

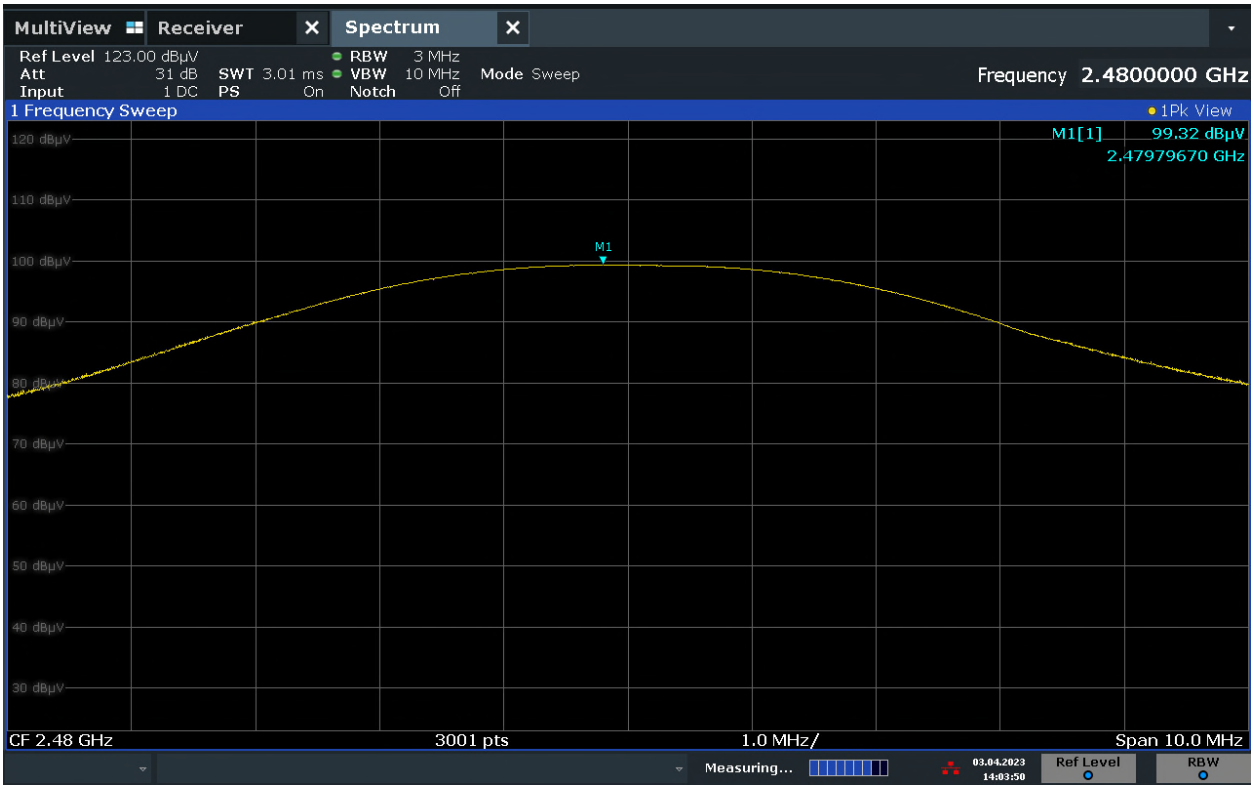


Figure 15 – Maximum Radiated Output Power - High Channel
Vertical Antenna Polarity

4.4.5 Test Equipment List

Equipment ID	Description	Manufacturer	Model	Calibration Date	Calibration Due
EQ_EMC_58	EMI Receiver	Rohde & Schwarz	ESW 44	Feb 03, 2022	Feb 03, 2024
EQ_EMC_60	Horn Antenna	ETS Lindgren	3117	Mar 11, 2022	Mar 11, 2024
EQ_EMC_75	RF Cable >1GHz	MegaPhase	EMC2	NCR	NCR
EQ_EMC_42	Preamplifier 1GHz-18GHz	Com-Power	PAM-118A	Mar 24, 2022	Mar 24, 2024

NCR = No Calibration Required

4.5 Antenna Spurious Conducted Emissions

Test Date:	April 18, 2023	Initials:	RA
Temperature (°C)	20.1		
Relative Humidity (%)	27.5		
Barometric Pressure (kPa)	96.9		

4.5.1 Limits

In any 100 kHz bandwidth outside the frequency band in which the intentional radiator operates, the radio's power must be ≥ 20 dB below the peak power of the fundamental measured with a 100 kHz bandwidth (i.e. 20 dBc).

Emissions are assessed from 9 kHz to the 10th harmonic of the fundamental.

This requirement is applicable at the boundary frequencies of the frequency band (i.e. 2.4 GHz and 2.4835 GHz for the DUT).

4.5.2 Test Procedure

Antenna Spurious Conducted Emissions is tested according to ANSI C63.10 Section 11.11 and FCC KDB 558074 Section 8.

Maximum peak conducted output power procedure is used to determine compliance, with RBW = 100 kHz, and VBW ≥ 3 x RBW. The trace is allowed to fully stabilize, and the peak marker function is used to determine spectral density.

4.5.3 Test Results

The EUT passed.
All antenna spurious conducted emissions outside the 2.4 – 2.4835 GHz band meet the -20 dBc requirement while the DUT is operating in Low, Middle, and High fundamental frequencies.

4.5.4 Plots

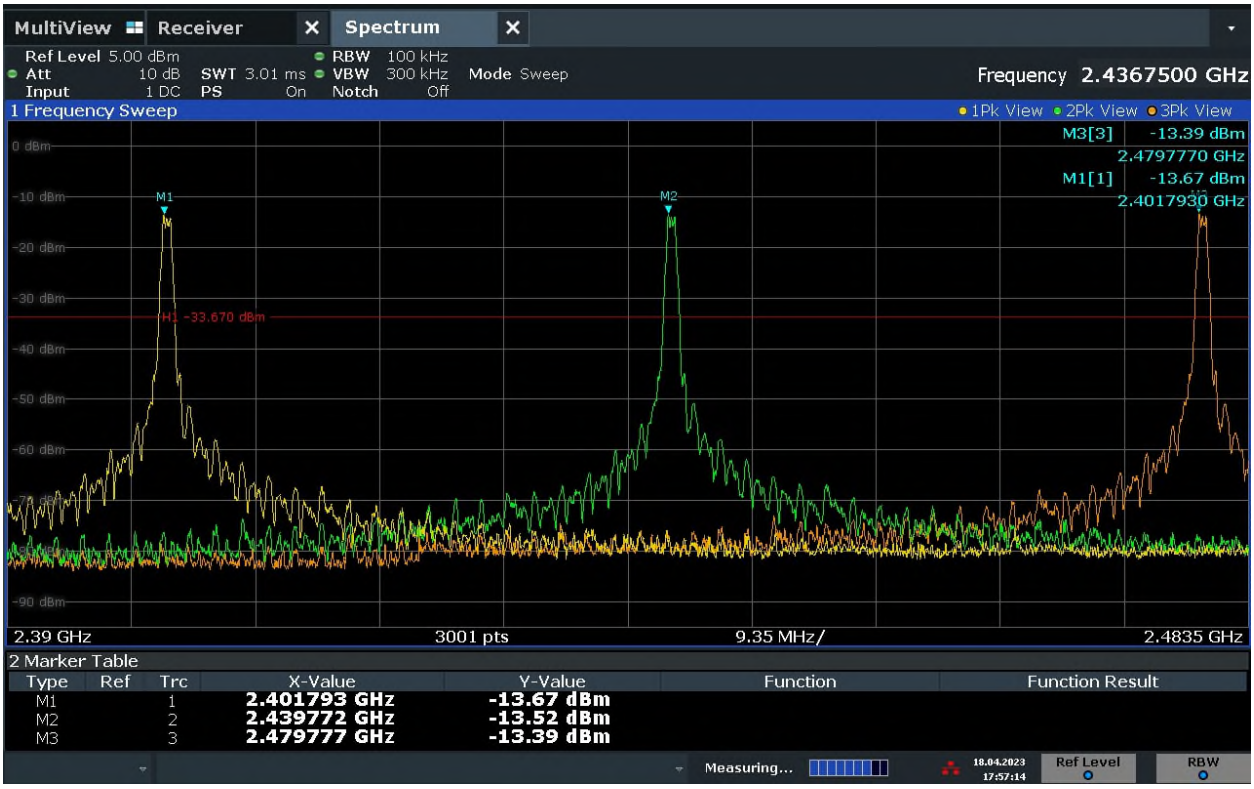


Figure 16 – -20dBc – Peak power of fundamentals operating at
Low, Middle, and High Channels with 100 kHz bandwidth

Reference level of -13.67 dBm used as worst case peak for this test.

-20 dBc line shown at -33.67 dBm.

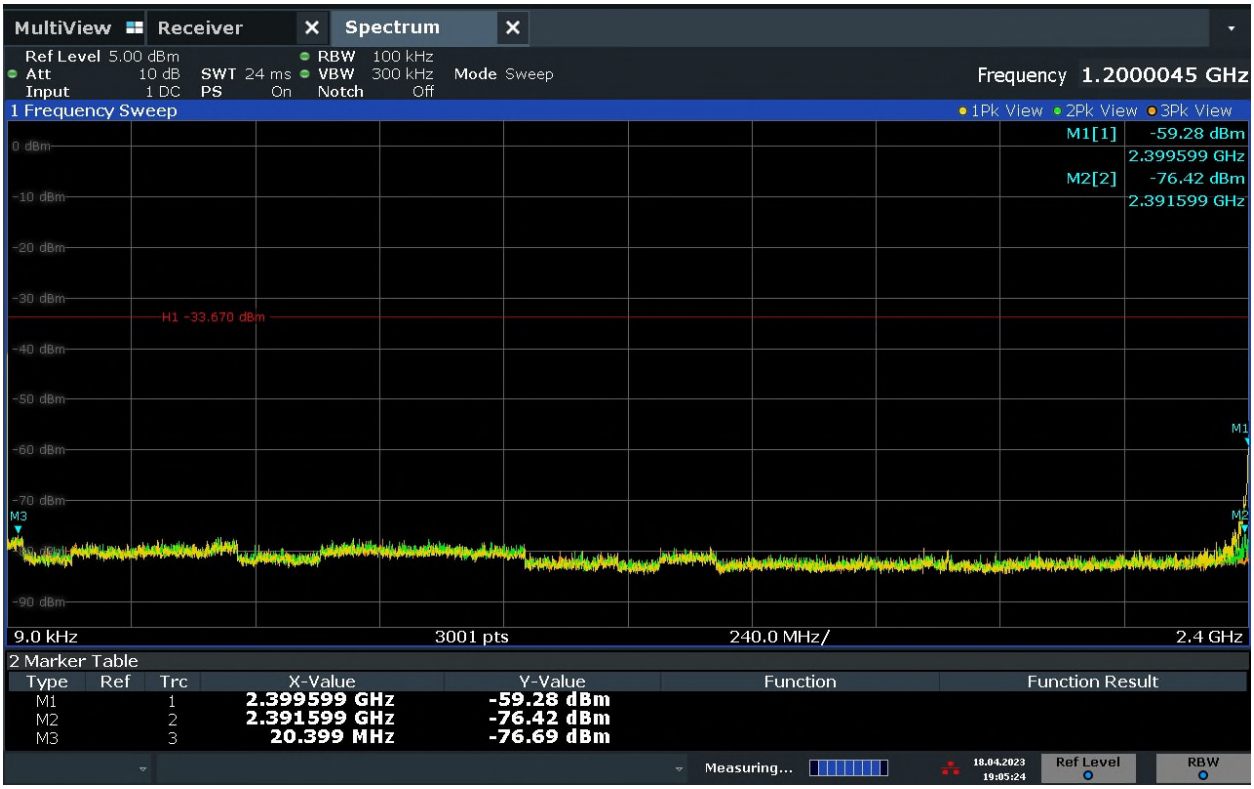


Figure 17 – -20dBc – Emissions outside intentional radiator band, 9 kHz – 2.4 GHz.
Plots with DUT operating at Low, Middle, and High Channels overlaid.
Markers placed at the peak of each plot.

-20 dBc line shown at -33.67 dBm.

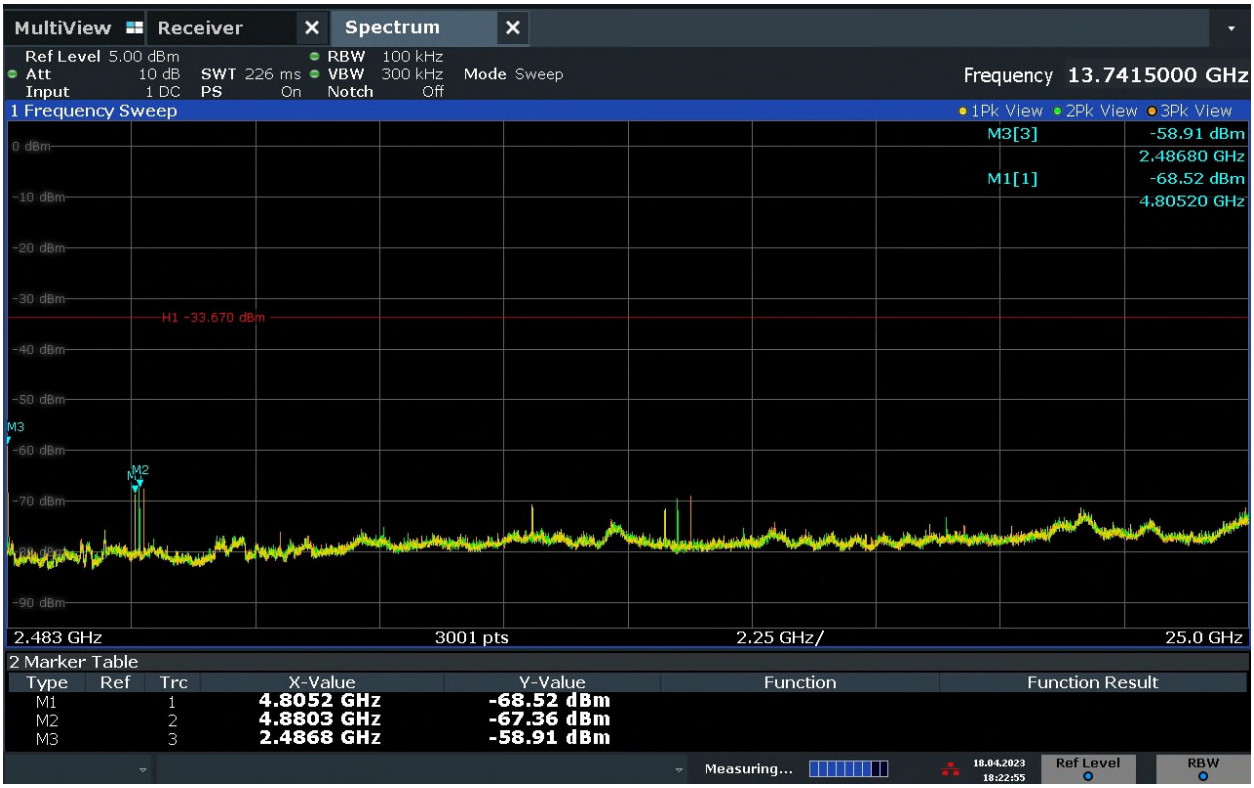


Figure 18 – -20dBc – Emissions outside intentional radiator band, 2.4835GHz – 25 GHz.
Plots with DUT operating at Low, Middle, and High Channels overlaid.
Markers placed at the peak of each plot.

-20 dBc line shown at -33.67 dBm.

4.5.5 Test Equipment List

Equipment ID	Description	Manufacturer	Model	Calibration Date	Calibration Due
EQ_EMC_58	EMI Receiver	Rohde & Schwarz	ESW 44	Feb 03, 2022	Feb 03, 2024
EQ_EMC_116	20dB Attenuator	Fairview Microwave	SA18E-20	NCR	NCR

NCR = No Calibration Required

4.6 Power Spectral Density

Test Date:	April 19, 2023	Initials:	RA
Temperature (°C)	18.2		
Relative Humidity (%)	24.4		
Barometric Pressure (kPa)	98.1		

4.6.1 Limits

The Power Spectral Density (PSD) conducted to the antenna by the intentional radiator must be ≤ 8 dBm in any 3 kHz band during continuous transmission.

4.6.2 Test Procedure

PSD is tested according to ANSI C63.10 Section 11.10 and FCC KDB 558074 Section 8.

Peak PSD procedure is used to determine compliance, with RBW = 3 kHz, and VBW ≥ 3 x RBW. The trace is allowed to fully stabilize, and the peak marker function is used to determine spectral density.

4.6.3 Test Results

The EUT passed.
PSD from the fundamental transmissions does not exceed the 8 dBm limit while the DUT is operating in Low, Middle, and High fundamental frequencies.

4.6.4 Plots

Note: The external attenuator and cable loss are accounted for as reference offset in the spectrum analyzer.

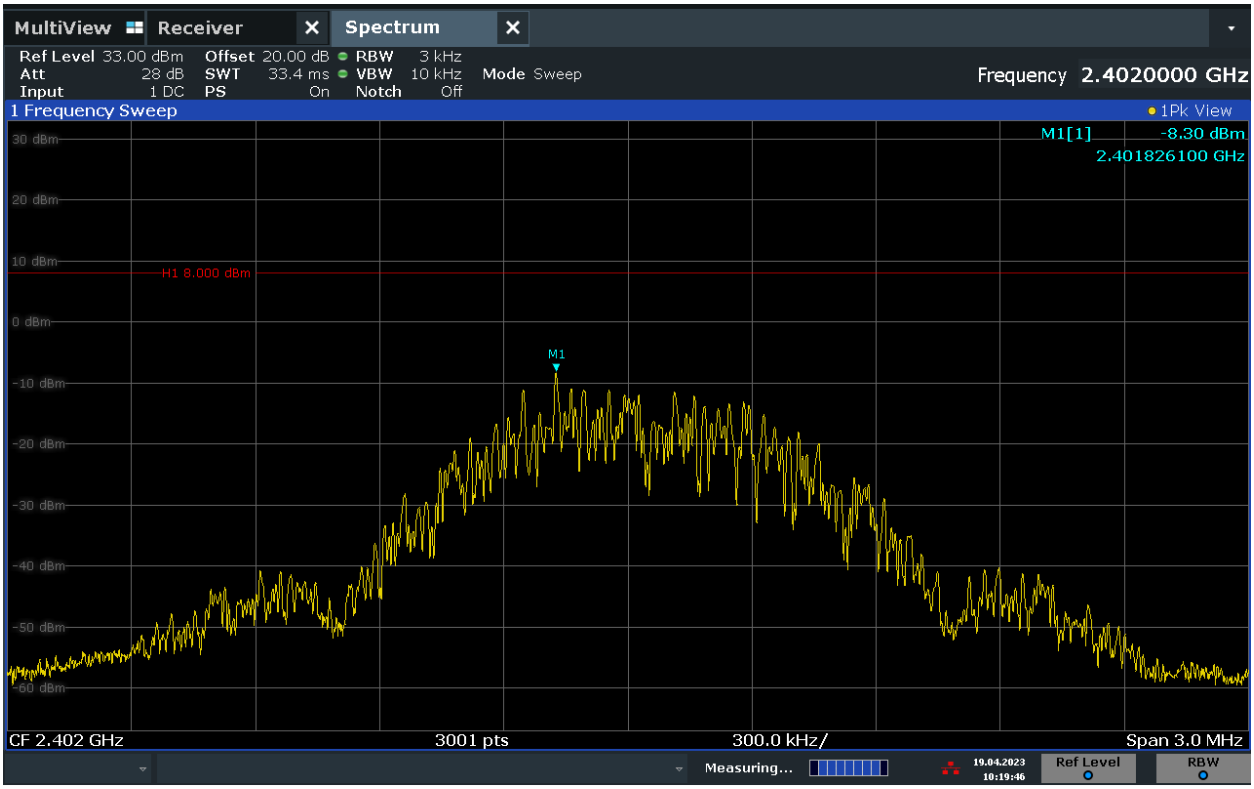


Figure 19 – PSD – Peak power of fundamental operating at Low Channel with 3 kHz bandwidth.

8 dBm limit line is shown.

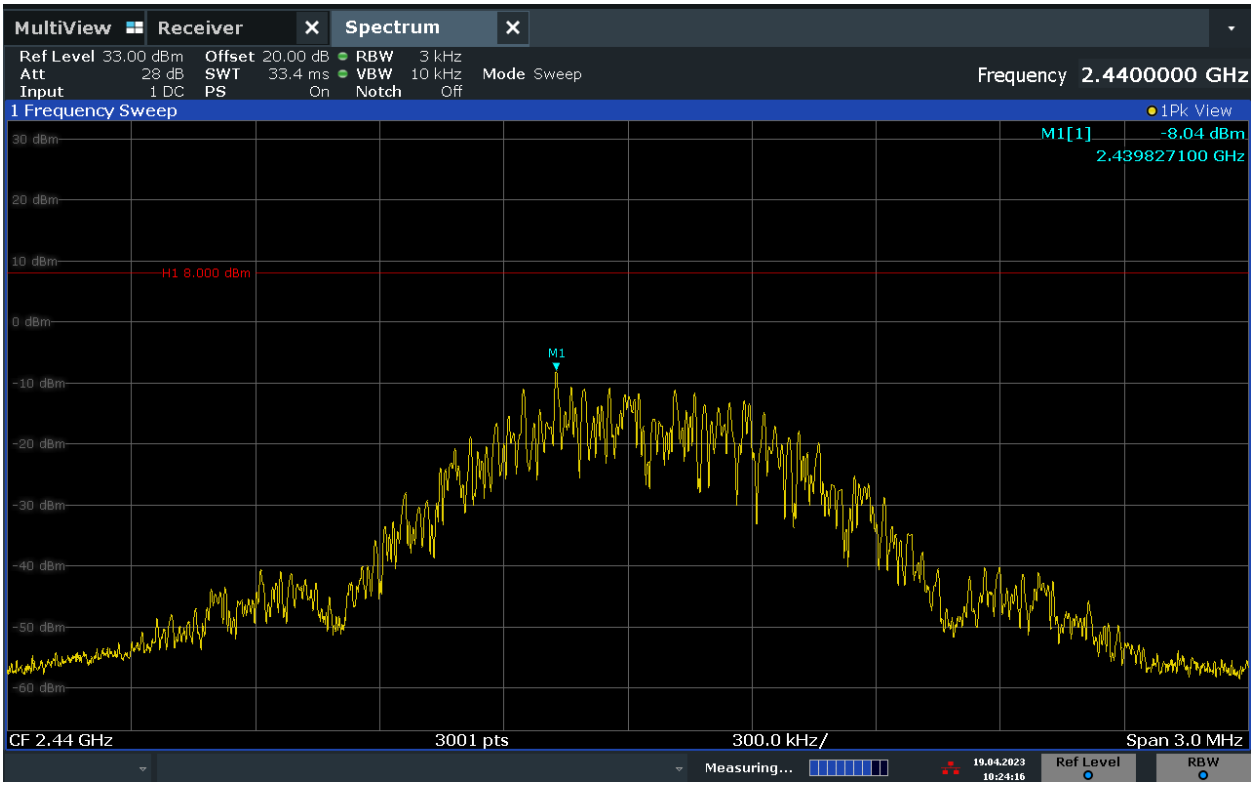


Figure 20 – PSD – Peak power of fundamental operating at Middle Channel with 3 kHz bandwidth.

8 dBm limit line is shown.

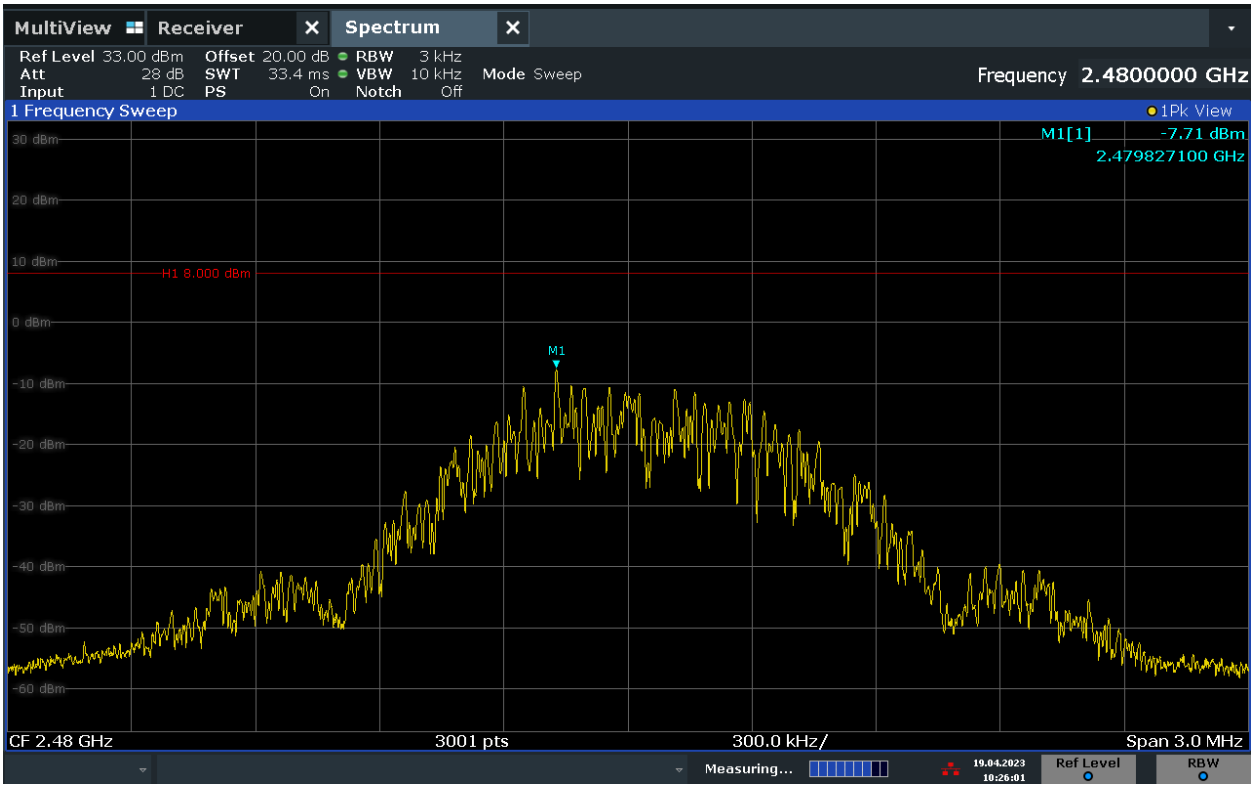


Figure 21 – PSD – Peak power of fundamental operating at
High Channel with 3 kHz bandwidth.

8 dBm limit line is shown.

4.6.5 Test Equipment List

Equipment ID	Description	Manufacturer	Model	Calibration Date	Calibration Due
EQ_EMC_58	EMI Receiver	Rohde & Schwarz	ESW 44	Feb 03, 2022	Feb 03, 2024
EQ_EMC_116	20dB Attenuator	Fairview Microwave	SA18E-20	NCR	NCR

NCR = No Calibration Required

5. Test Setup Photos

Refer to Test Setup Photos file separate from this report

---------- End of Test Report ----------