COMPLIANCE WORLDWIDE INC.
TEST REPORT 124-24

In Accordance with the Requirements of

FCC PART 15.247, SUBPART C

Issued to

Probes Unlimited, Inc.
836 W 8th Street
Lansdale, PA 19446

for the

Wireless Meat Probe
Model TT-MP-23092601
2.4 GHz Bluetooth Low Energy Radio

FCC ID: 2BG32-TTMP1

Report Issued on April 19, 2024

Tested By:

Sean P. Defelice

Sean P. Defelice

Reviewed By:

Larry K. Stillings

Larry K. Stillings

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1. Scope

This test report certifies that the Probes Unlimited Wireless Meat Probe Model TT-MP-23092601, as tested, meets the FCC Part 15, Subpart C 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. Measurement Uncertainty will not be applied to any of the measurement / testing results in this test report to determine pass/fail criteria per the Decision Rule as defined in ISO/IEC Guide 17025-2017 Clause 3.7.

2. Product Details

2.1. Manufacturer: Probes Unlimited Inc
2.2. Model Number: TT-MP-23092601
2.3. Serial Number: 3A8363
2.4. Description: The TT-Wireless Meat Probe is a wireless meat thermometer used to monitor meat cooking process. It transmits temperature readings from multiple sensors through BLE as a beacon. Typically used in barbeque/grills/smokers, the stainless-steel portion is inserted into meat and the transmitted data is used by the BLE receiver to monitor the internal temperature while cooking and control and alert when cooking is done.
2.5. Power Source: 0.8 mAH Li-Ion Battery
2.6. Hardware Revision: Rev 2
2.7. Software Version: V2.3.2
2.8. Modulation Type: Pulsed GFSK
2.9. Operating Frequency: 2402 to 2480 MHz Nominal
2.10. EMC Modifications: None

3. Product Configuration

3.1. Operational Characteristics & Software

Hardware Setup:

After charging the device is configured to transmit on the three advertising channels. The test sample provided was configured to “beacon” approximately every 500 mS.

3.2. EUT Hardware

Manufacturer	Model/Part # / Options	Serial Number	Input Voltage	Freq (Hz)	Description/Function
Probes Unlimited	TT-MP-23092601	3A8363	3	DC	Wireless Meat Probe with BLE Beacon

3.3. EUT Cables/Transducers

Cable Type	Length	Shield	From	To
None				

3.4. Support Equipment

Manufacturer	Model/Part # / Options	Serial Number	Input Voltage	Freq (Hz)	Description/Function
None					

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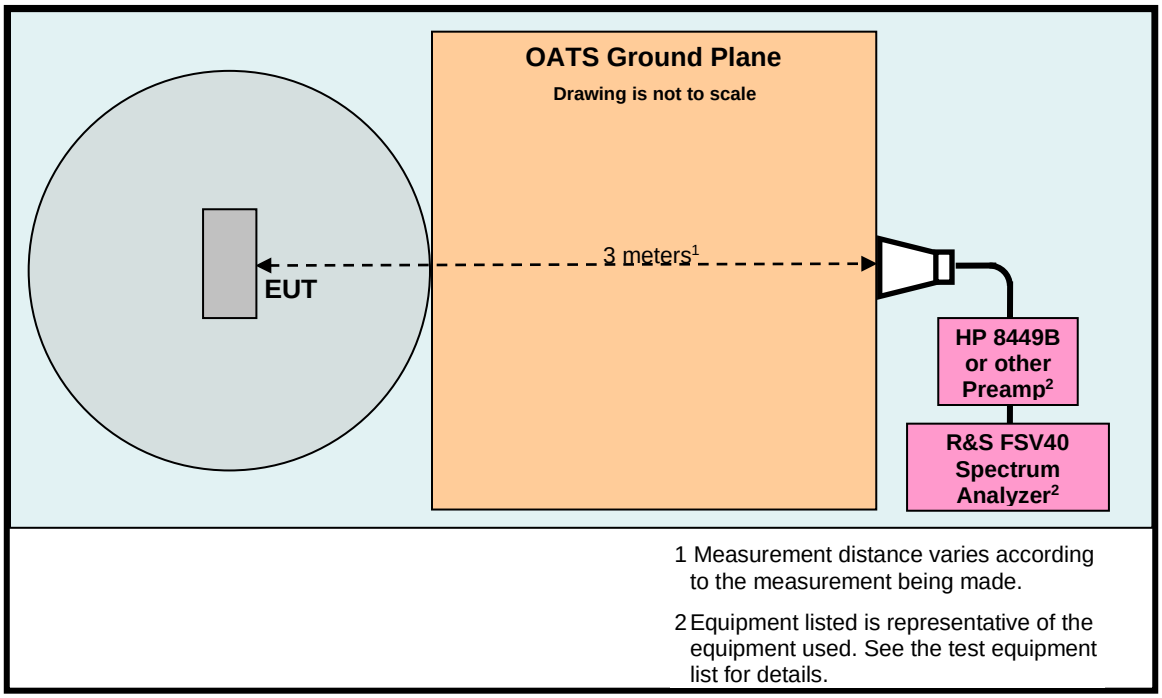
3. Product Configuration (continued)

3.5. Test Setup Diagram



3.6. EUT Orientation Diagram

During all radiated emissions measurement testing, the product was mounted on a polystyrene form to facilitate rotating the device through three orthogonal axes, as required by ANSI C63.10, section 5.10.1, for a handheld or body worn device.

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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	10/26/2024	3 Years
EMI Test Receiver, 10 Hz - 7GHz [1]	Rohde & Schwarz	ESR7	101770	7/23/2024	3 Years
EMI Test Receiver, 9 kHz – 26.5 GHz[1]	Rohde & Schwarz	ESR26	101693	6/26/2024	1 Year
Spectrum Analyzer, 2 Hz to 26.5 GHz[2]	Rohde & Schwarz	FSW26	102057	6/24/2024	3 Years
Spectrum Analyzer, 9 kHz to 40 GHz[3]	Rohde & Schwarz	FSV40	100899	8/12/2024	4 Years
Spectrum Analyzer 10 Hz – 40 GHz[4]	Rohde & Schwarz	FSVR40	100909	9/18/2024	4 Years
Loop Antenna 9 kHz - 30 MHz	EMCO	6512	9309-1139	4/14/2025	3 Years
Biconilog Antenna, 30 MHz - 2 GHz	Sunol Sciences	JB1	A050913	7/1/2024	3 Years
Dbl Ridged Guide Antenna 1- 18 GHz	ETS-Lindgren	3117	00143292	5/11/2025	3 Years
Dbl Ridged Guide Antenna 1- 18 GHz	ETS-Lindgren	3117	00227631	4/21/2025	3 Years
Preamplifier, 1 GHz to 26.5 GHz	Hewlett Packard	8449B	3008A01323	4/3/2025	1 Year
Preamplifier, 1 GHz to 26.5 GHz	Hewlett Packard	8449B H02	3008A00329	4/9/2025	1 Year
2.4 GHz Band Reject Filter	Micro-Tronics	BRM50702	150	2/27/2025	1 Year
Digital Barometer	Control Company	4195	ID236	3/15/2025	1 Year
Barometric Pressure/Humidity & Temp Datalogger	Extech Instruments	SD700	Q590483	4/4/2025	1 Year

[1] ESR7/26 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. Measurement Software

Manufacturer	Software Description	Title or Model #	Rev.	Report Sections
Compliance Worldwide	Test Report Generation Software	Test Report Generator	1.0	7.9. Conducted Emissions

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4. Measurements Parameters

4.3. Measurement & Equipment Setup

Test Dates:	2/26/2024, 2/27/2024, 3/22/2024, 3/25/2024, 4/18/2024, 4/19/2024
Test Engineer:	Sean Defelice
Normal Site Temperature (15 - 35°C):	21.0
Relative Humidity (20 -75%RH):	31
Frequency Range:	30 kHz to 25 GHz
Measurement Distance:	3, 1.5, 1 and 0.3 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 * RBW or IF(BW)
Detector Function:	Peak, QP - 9 kHz to 1 GHz Peak, Avg - Above 1 GHz Unless otherwise specified.

4.4. Measurement Procedures

Test measurements were made in accordance FCC Part 15.247: Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5850 MHz, and 24.0 - 24.25 GHz.

The measurement procedures in this report are in accordance with ANSI C63.10-2013: *American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices*. FCC OET Publication Number KDB 558074 D01 Meas Guidance v05r02, *Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section §15.247 of the rules*, dated April 2, 2019, was also referenced for the test procedures used to generate the data in this report. All references to FCC OET publication number 558074 refer to this version of the publication.

All radiated emissions measurements include correction factors for antenna, cables, preamp and attenuators, if used.

4.5. Measurement Uncertainty

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

RF Frequency (out of band)	± $1x10^{-8}$
Radiated Emission of Transmitter to 100 GHz	± 4.55 dB
Radiated Emission of Receiver	± 4.55 dB
Temperature	± 0.91^{o} C
Humidity	± 5%

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5. Choice of Equipment for Test Suits

5.1 Choice of Model

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

5.2 Presentation

The test samples were 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 EUT, as tested, operates on 40 channels, from channels 0 to 39 in the 2.4 GHz band.

In accordance with ANSI C63.10-2013, section 5.6, and FCC Part 15.31 (m), the choice of operating frequencies selected for the testing detailed in this report are as follows:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
37	2402	9	2422	18	2442	28	2462
0	2404	10	2424	19	2444	29	2464
1	2406	38	2426	20	2446	30	2466
2	2408	11	2428	21	2448	31	2468
3	2410	12	2430	22	2450	32	2470
4	2412	13	2432	23	2452	33	2472
5	2414	14	2434	24	2454	34	2474
6	2416	15	2436	25	2456	35	2476
7	2418	16	2438	26	2458	36	2478
8	2420	17	2440	27	2460	39	2480

5.4 Mode of Operation

Modulation type : GFSK
Pulsed BLE Beacon.

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6. Measurement Summary

Test Requirement	FCC Rule Reference	Test Report Section	Result
Antenna Requirement	15.203	7.1	Compliant
Minimum DTS Bandwidth	15.247 (a) (2)	7.2	Compliant
Maximum Peak Conducted Output Power	15.247 (b) (1)	7.3	Compliant
Operation with directional antenna gains greater than 6 dBi	15.247 (b) (4)	7.4	Compliant
Spurious Radiated Emissions	15.247 (d)	7.5	Compliant
Spurious Radiated Emissions (> GHz) - Harmonic Measurements	15.247 (d)		Compliant
Lower and Upper Band Edges	15.247 (d)	7.6	Compliant
Emissions in Non-restricted Frequency Bands	15.247(e)	7.7	Compliant
Peak Power Spectral Density	15.247(e)	7.8	Compliant
AC Power Line Conducted Emissions	15.207	7.9	N/A
Duty Cycle	15.207	7.10	Compliant

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7. Measurement Data

7.1. Antenna Requirement (15.203)

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.

Results: The EUT utilizes a sleeve/wire antenna which is not user replaceable.

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7. Measurement Data

7.2. Minimum DTS Bandwidth

Requirement: (15.247 (a) (2)
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: This test was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 8.1 Option 1, DTS (6 dB) Channel Bandwidth.

Results: The device under test meets the minimum 500 kHz DTS (6 dB) bandwidth requirement.

Channel	Frequency (MHz)	-6 dB Bandwidth (kHz)	Minimum -6 dB Bandwidth (kHz)	Result
37	2402	671.30	>500	Compliant
38	2426	689.30	>500	Compliant
39	2480	680.30	>500	Compliant

7.2.1. Low Channel – 37, 2402 MHz

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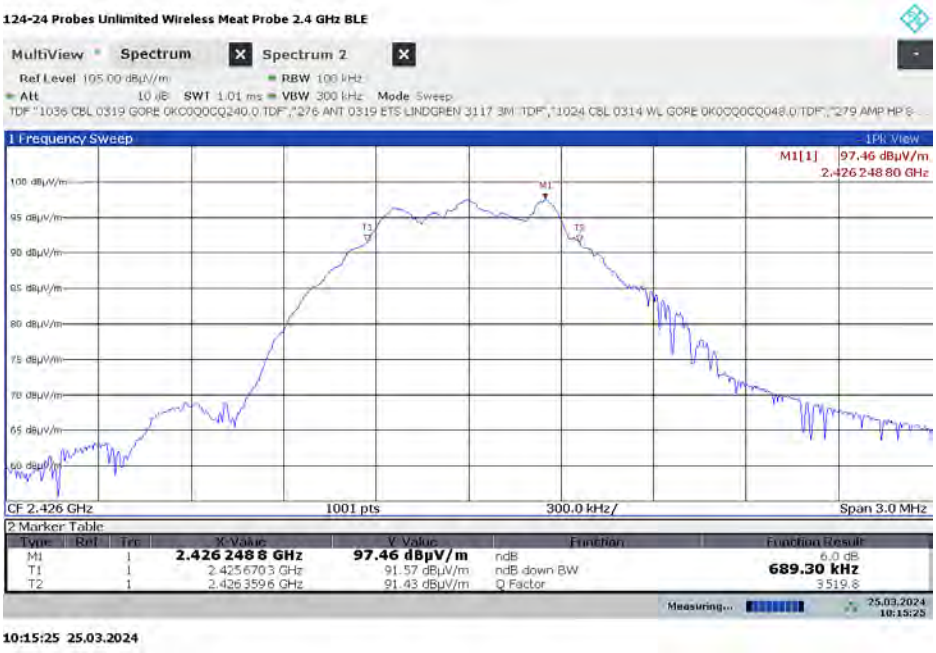
7. Measurement Data

7.2. Minimum DTS Bandwidth (15.247 (a) (2)) (continued)

7.2.2. Middle Channel – 38, 2426 MHz



7.2.3. High Channel – 39, 2480 MHz

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7. Measurement Data (continued)

7.3. Maximum Peak Conducted Output Power 15.247 (b) (3)

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 (+30 dBm).

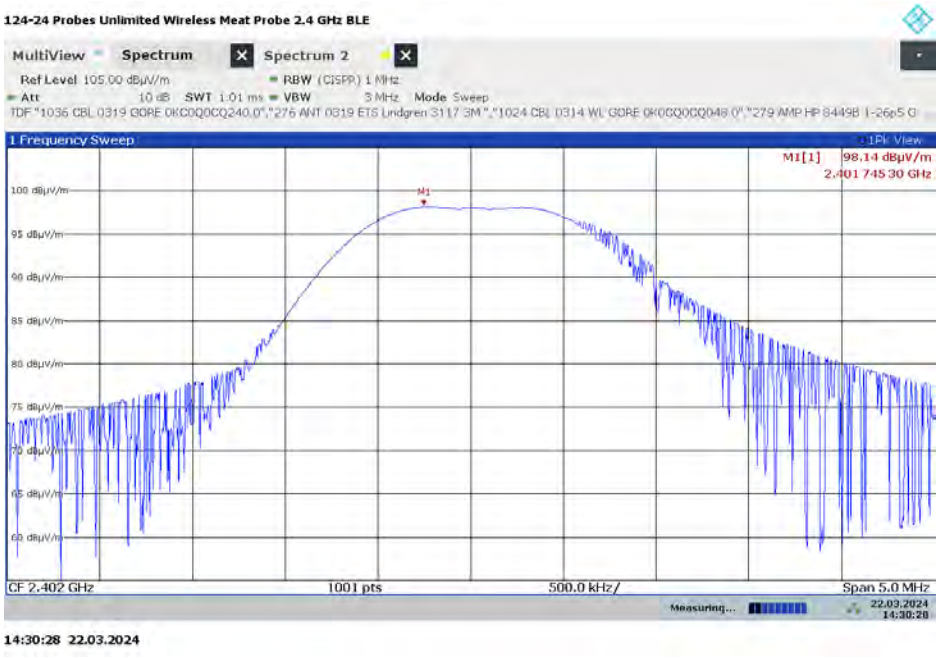
Procedure: This test was performed in accordance with the procedure detailed in FCC OET publication number KDB 558074, Section 9.1.1.

Test Note: A spectrum analyzer resolution bandwidth of 1 MHz and a video bandwidth of 3 MHz were used to meet the requirements of FCC OET publication number 558074, Section 9.1.1 and the measured product DTS bandwidth. Field Strength was converted at 3 meters using 95.2.

Results: The device under test meets the required maximum peak conducted output power level of 1 Watt (30 dBm).

Channel	Frequency	Maximum Peak Radiated Output Power	Maximum Peak Radiated Output Power	Peak Limit	Margin	Result
	(MHz)	(dBµV/m)	(dBm)	(dBm)	(dB)	
37	2402	98.14	2.94	30.00	-27.06	Compliant
38	2426	98.19	2.99	30.00	-27.01	Compliant
39	2480	97.13	1.93	30.00	-28.07	Compliant

7.3.1. Low Channel – 37, 2402 MHz



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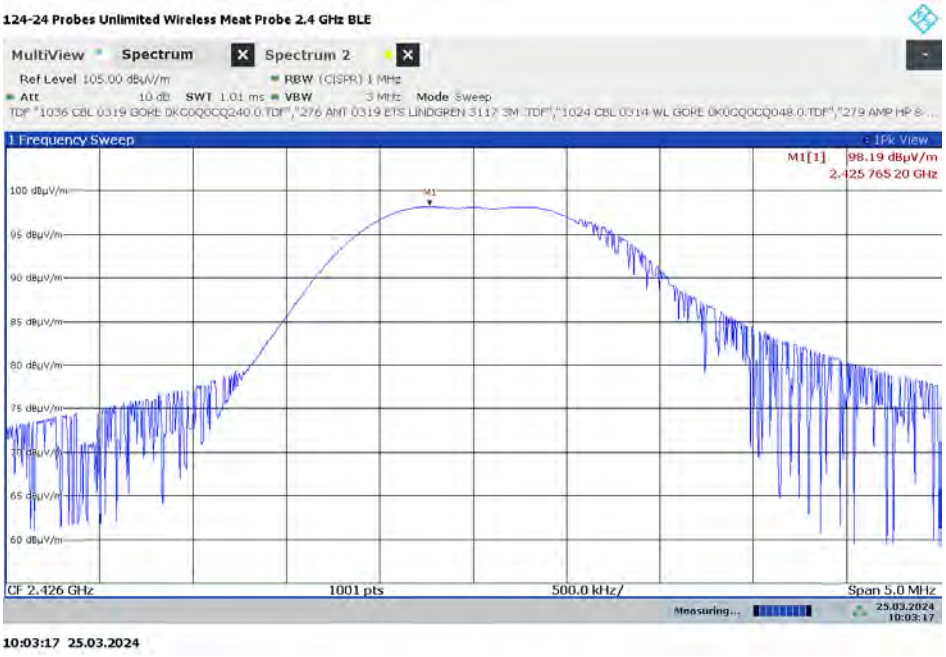
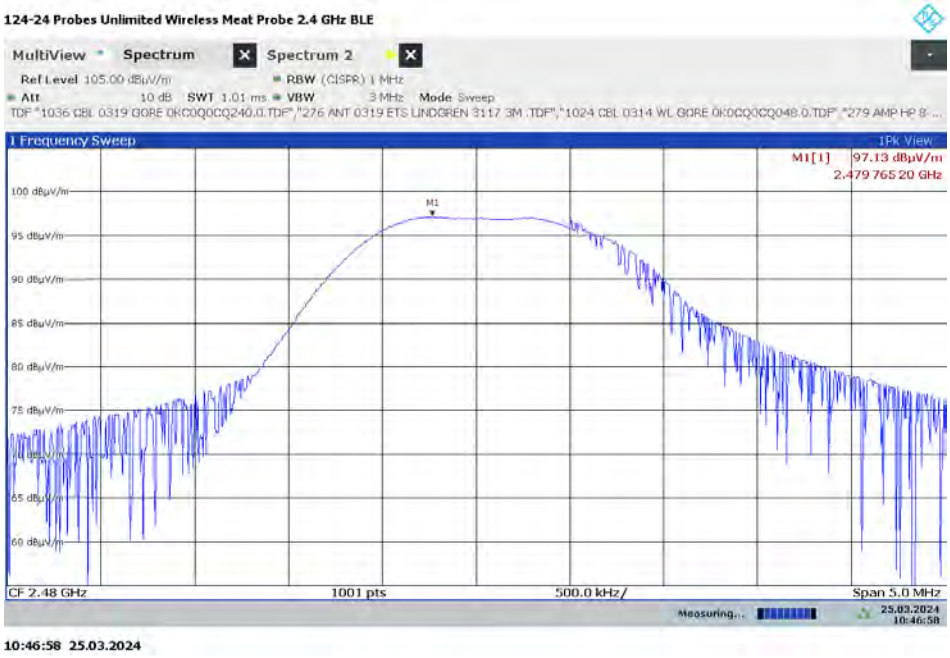
7. Measurement Data

7.3. Maximum Peak Conducted Output Power (continued)

7.3.2. Middle Channel – 38, 2426 MHz



7.3.3. High Channel – 39, 2480 MHz



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7. Measurement Data

7.4. Operation with directional antenna gains greater than 6 dBi (15.247 (b)(4))

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.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Procedure: Not applicable for the device under test.

DUT Status: The EUT uses a sleeve/wire antenna that has 0.0 dBi or less of gain.

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7. Measurement Data (continued)

7.5. Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

7.5.1 Transmitter Spurious Radiated Emissions

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)[1]
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

[1] Measurements in the 9 to 90 kHz, 110 to 490 kHz and above 1000 MHz ranges employ an average detector. Otherwise, a quasi-peak detector is used.

Procedure: This test was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 12.0: Emissions in restricted frequency bands and FCC 47CFR Part 15.209: Radiated Emission Limits; General Requirements.

The test methods used to generate the data in this test report is in accordance with ANSI C63.10:2013, American National Standard for Testing Unlicensed Wireless Devices.

Test Notes: Measurements were made from the lowest oscillator frequency as stated by the manufacturer (26 MHz) to the 10th harmonic of the highest transmitter frequency or 40 GHz, whichever is lower.

Reference FCC Part 15.33(a) and FCC Part 15.33(a)(1).

Each of the test modes documented within the test report were evaluated and the worst case of each of the test modes is detailed in this section. A full set of measurement scans are presented in Appendix A of this test report.

Results: The Emissions from the DUT did not exceed the field strength levels specified in the above table.

Frequency Range	Worst-Case Measured Frequency	Field Strength	FCC Part 15.209 Limit	Margin	Reference	Receive Antenna Polarity
	(MHz)	(dBµV/m)	(dBµV/m)	(dB)	Appendix A	(H/V)
30 kHz - 150 kHz	0.03025	70.71	117.98	-47.27	Y Axis	Parallel
150 kHz - 30 MHz	0.15225	62.72	83.92	-21.20	Z Axis	Gnd Parallel
30 MHz - 1000 MHz	990.51	31.05	46.00	-14.95	Z Axis	V
1000 MHz - 10000 MHz	9741.50	43.31	54.00	-10.69	Z Axis	H
10000 MHz - 18000 MHz	16.793	52.38	54.00	-1.62	Z Axis	H
18000 MHz - 25000 MHz	20.276	40.03	54.00	-13.97	Z Axis	V

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7. Measurement Data (continued)

7.5. Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

7.5.2. Transmitter Spurious Radiated Emissions (Harmonic Meas.) Test Results

Worst case measurements of Harmonics that fall into the restricted bands.

7.5.2.1. 2.4 GHz, BLE

Freq. (MHz)	Field Strength (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)		Antenna Polarity (H/V)	Result
	Peak[1]	Average[1]	Peak	Average	Peak	Average		
4804	43.32	30.81	74.00	54.00	-30.68	-23.19	H	Compliant
4852	43.48	39.96	74.00	54.00	-30.52	-14.04	H	Compliant
4960	42.72	30.83	74.00	54.00	-31.28	-23.17	V	Compliant
7278	44.45	32.61	74.00	54.00	-29.55	-21.39	H	Compliant
7440	43.97	32.48	74.00	54.00	-30.03	-21.52	H	Compliant
12010	52.05	39.70	74.00	54.00	-21.95	-14.30	H	Compliant
12130	52.16	40.16	74.00	54.00	-21.84	-13.84	H	Compliant
12400	51.12	39.44	74.00	54.00	-22.88	-14.56	H	Compliant
19216	54.85	43.10	74.00	54.00	-19.15	-10.90	H	Compliant
19408	55.92	44.02	74.00	54.00	-18.08	-9.98	H	Compliant
19840	55.71	43.60	74.00	54.00	-18.29	-10.40	V	Compliant
22320	55.91	44.44	74.00	54.00	-18.09	-9.56	H	Compliant

[1] All correction factors are stored in the spectrum analyzer and applied to this column entry. Average values are based on a CISPR Average detector.

Freq. (MHz)	Field Strength (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)		Antenna Polarity (H/V)	Result
	Peak[1]	Average[2]	Peak	Average	Peak	Average		
4804	43.32	-6.31	74.00	54.00	-30.68	-60.31	H	Compliant
4852	43.48	-6.15	74.00	54.00	-30.52	-60.15	H	Compliant
4960	42.72	-6.91	74.00	54.00	-31.28	-60.91	V	Compliant
7278	44.45	-5.18	74.00	54.00	-29.55	-59.18	H	Compliant
7440	43.97	-5.66	74.00	54.00	-30.03	-59.66	H	Compliant
12010	52.05	2.42	74.00	54.00	-21.95	-51.58	H	Compliant
12130	52.16	2.53	74.00	54.00	-21.84	-51.47	H	Compliant
12400	51.12	1.49	74.00	54.00	-22.88	-52.51	H	Compliant
19216	54.85	5.22	74.00	54.00	-19.15	-48.78	H	Compliant
19408	55.92	6.29	74.00	54.00	-18.08	-47.71	H	Compliant
19840	55.71	6.08	74.00	54.00	-18.29	-47.92	V	Compliant
22320	55.91	6.28	74.00	54.00	-18.09	-47.72	H	Compliant

[1] All correction factors are stored in the spectrum analyzer and applied to this column entry.

[2] A duty cycle correction factor is applied to the peak measurements due to the short transmission time of 330 µS. 20 * Log (0.330 / 100 mS) = -49.63 dB

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7. Measurement Data (continued)

7.6. Band Edge and Out of Band Measurements

Requirement: 15.247(d) 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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: For the lower band edge, this measurement was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 11: Emissions in non-restricted frequency bands.

For the upper band edge, this measurement was performed as a typical restricted band radiated emissions measurement above 1 GHz. Peak and CISPR average detectors and a 1 MHz resolution and 3 MHz video bandwidth were utilized.

Test Note: The radiated band edge and worst case out of band measurements in this report represent the measurements made with the worst case receive antenna polarity and product orthogonal position. In addition, the DTS bandwidth measurements were taken into consideration for the worst-case examples.

Results: The DUT met the 20 dB requirement at the lower band edge and the Part 15.209 requirements at the upper band edge.

7.6.1. Lower Band Edge

Band Edge Frequency	Lowest Transmitter Frequency	Maximum PSD (100 kHz)	Band Edge Delta to Max PSD (100 kHz)	Minimum Required Delta	Result
(MHz)	(MHz)	(dBµV/m)	(dBµV/m)	(dB)	
2400	2402	98.00	58.36	-20	Compliant

Note: Reference the plot on following page**.**

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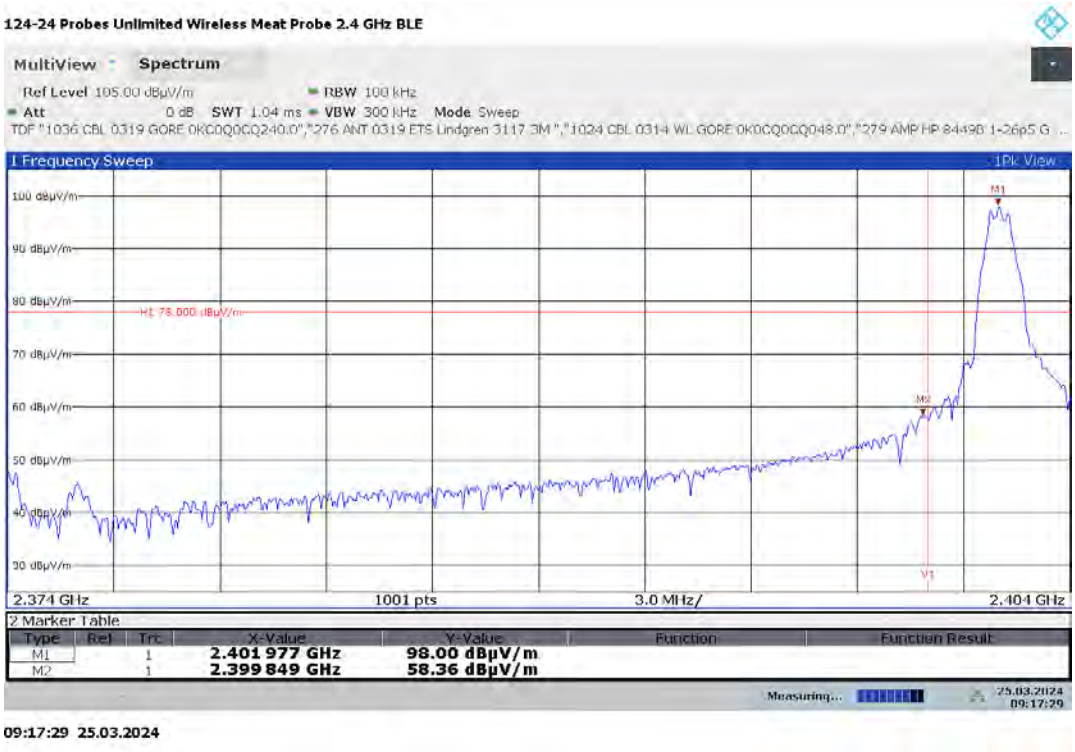
7. Measurement Data (continued)

7.6. Band Edge and Out of Band Measurements (continued)

Lower Band Edge



7.6.2. Upper Band Edge and Worst Case Out of Band

Upper Band Edge

Band Edge Frequency	Field Strength (dBµV/m)		Limit (dBµV/m)		Margin (dB)		Result
(MHz)	Peak	Average	Peak	Average	Peak	Average	
2483.5	71.99	22.36	74	54	-2.01	-31.64	Compliant

Notes: 1. Reference the plot on following page.
2. Worst case out of band is detailed in the upper restricted band measurement.
3. A duty cycle correction factor was applied to the peak value to determine the average value. 20 * log (0.330/100 mS) = -49.63

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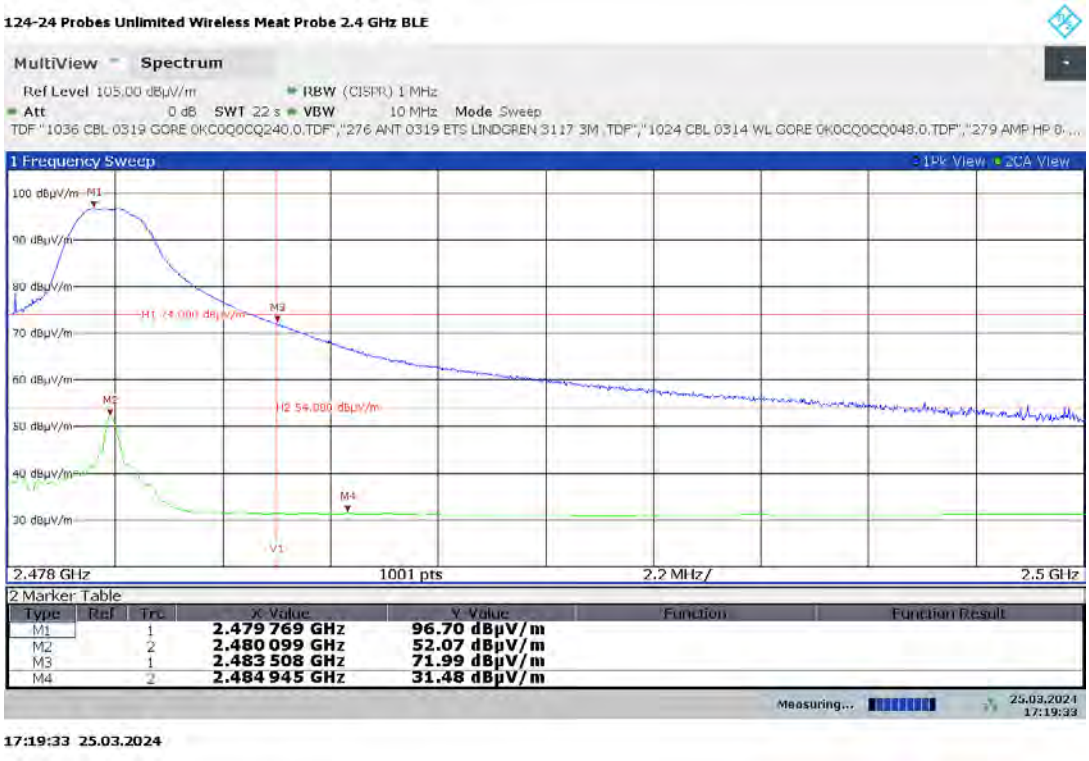
7. Measurement Data (continued)

7.6. Band Edge and Out of Band Measurements (continued)

Upper Band Edge and Worst Case Out of Band



7.6.3. Lower Restricted Band, 2.310 MHz to 2390 MHz

Frequency (MHz)	Field Strength (dBµV/m)		Limit (dBµV/m)		Margin (dB)		Result
	Peak	Average	Peak	Average	Peak	Average	
2390.00	63.05	13.42	74	54	-10.95	-40.58	Compliant

7.6.4. Upper Restricted Band, 2483.5 MHz to 2500 MHz

Frequency (MHz)	Field Strength (dBµV/m)		Limit (dBµV/m)		Margin (dB)		Result
2383.525	72.39	22.76	74	54	-1.61	-31.24	Compliant

Notes: Plots are on the following page. Some ambient in plot of lower restricted band due to new AWS-3 services in the area.

A duty cycle correction factor was applied to the peak value to determine the average value. 20 * log (0.330/100 mS) = -49.63

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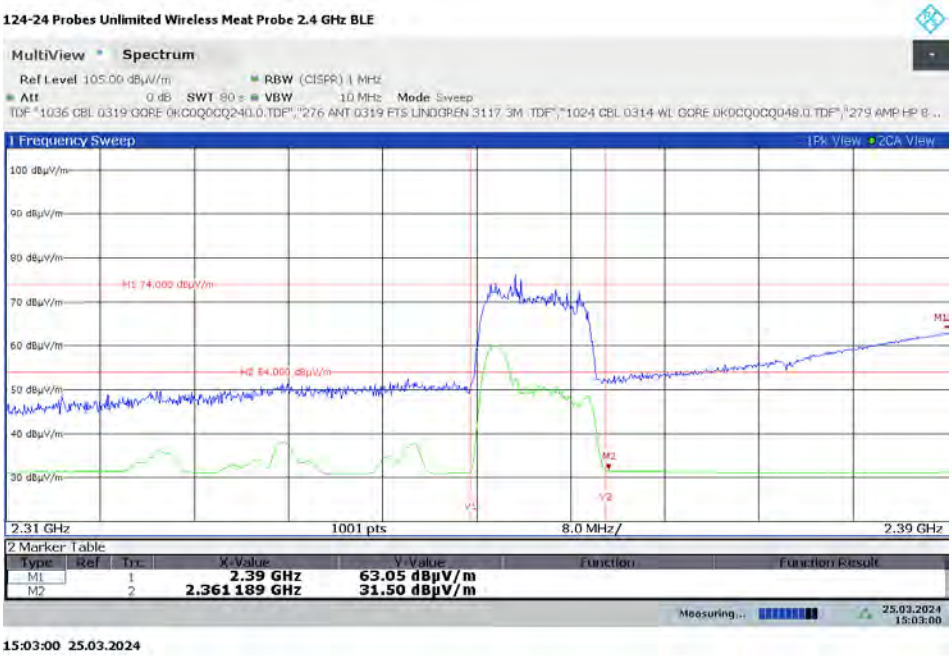
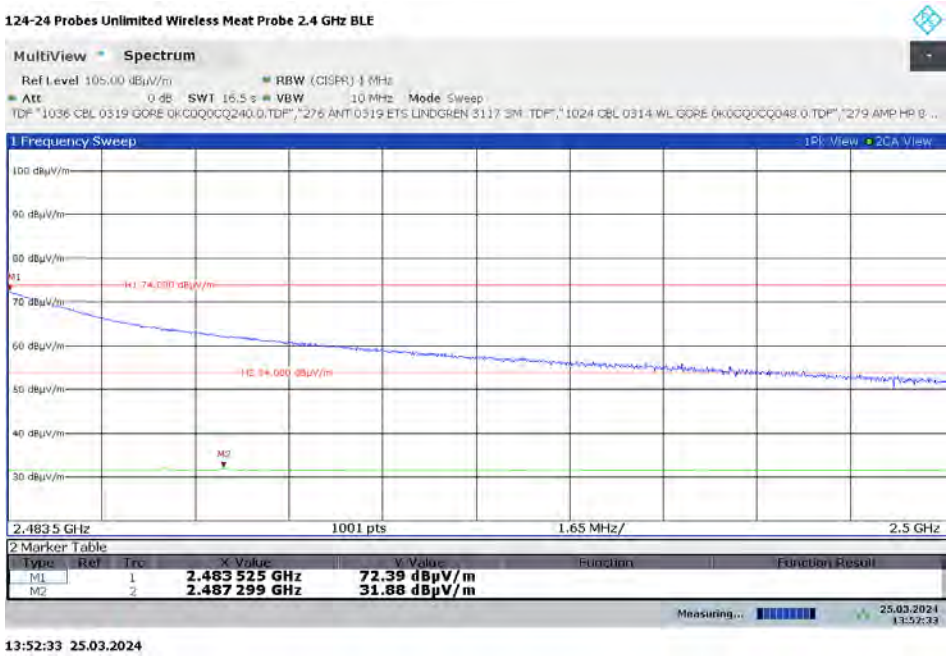
7. Measurement Data (continued)

7.6. Band Edge and Out of Band Measurements (continued)

Lower Restricted Band, 2310 MHz to 2390 MHz



Upper Restricted Band, 2483.5 MHz to 2500 MHz



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7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands

Requirement: 15.247(d) 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.

Test Notes: Peak in-band measurements were taken at the time the DTS (-6 dB) bandwidth measurements were made. These values were used as the reference levels for the following measurements. Refer to section 7.2 of this report for these values.

Results: The DUT met the 20 dB requirement emission level delta requirement in the non restricted frequency bands.

Emissions in Non-restricted Frequency Bands

Maximum PSD (100 kHz) In-Band[1] (dBµV/m)	Worst Case Out-of-Band Frequency (MHz)	Maximum PSD (100 kHz) Out-of-Band (dBµV/m)	Delta to Maximum PSD (dB)	Minimum Required Delta	Result
97.96	16780.63	43.03	-54.93	-20 dB	Compliant

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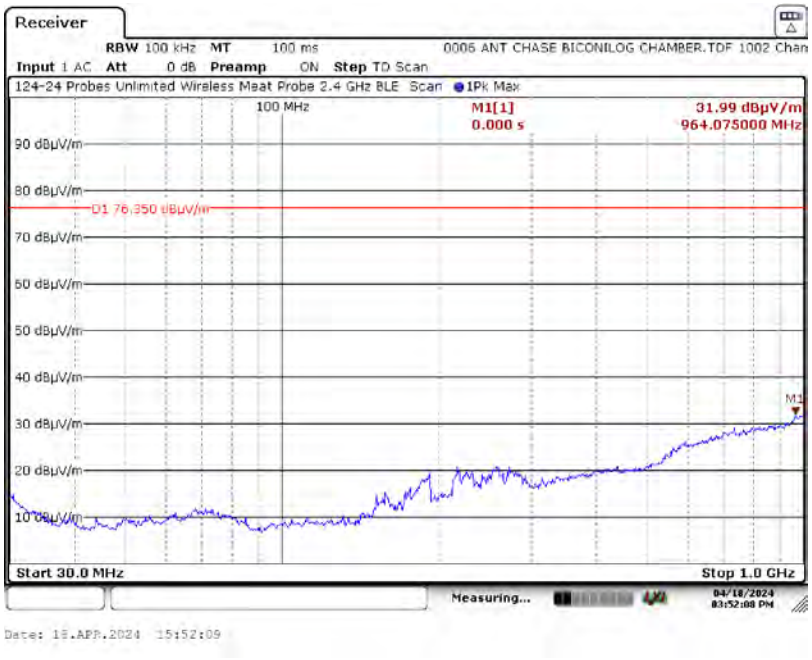
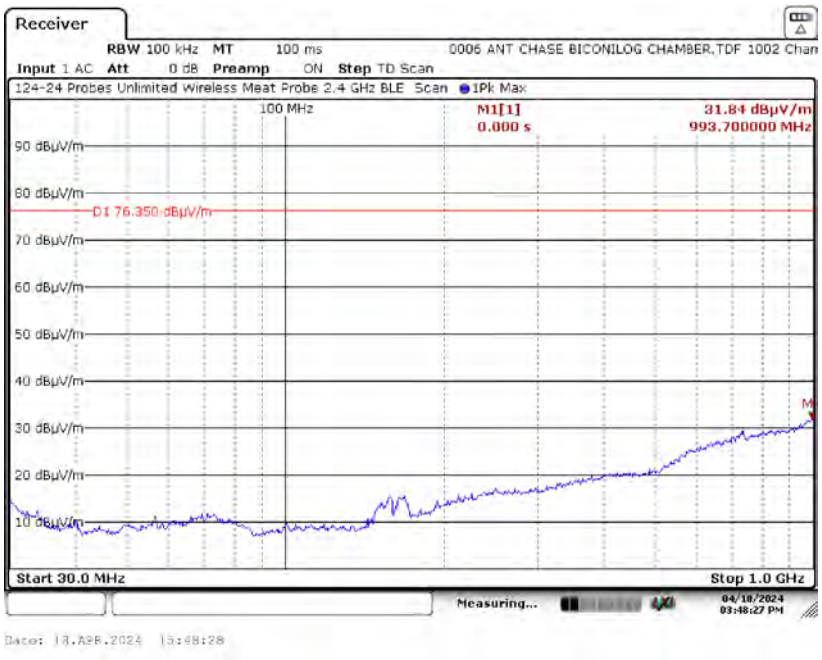
7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.1. 30 MHz to 1 GHz – X Axis Horizontal All Three Channels



7.7.2. 30 MHz to 1 GHz – X Axis Vertical All Three Channels



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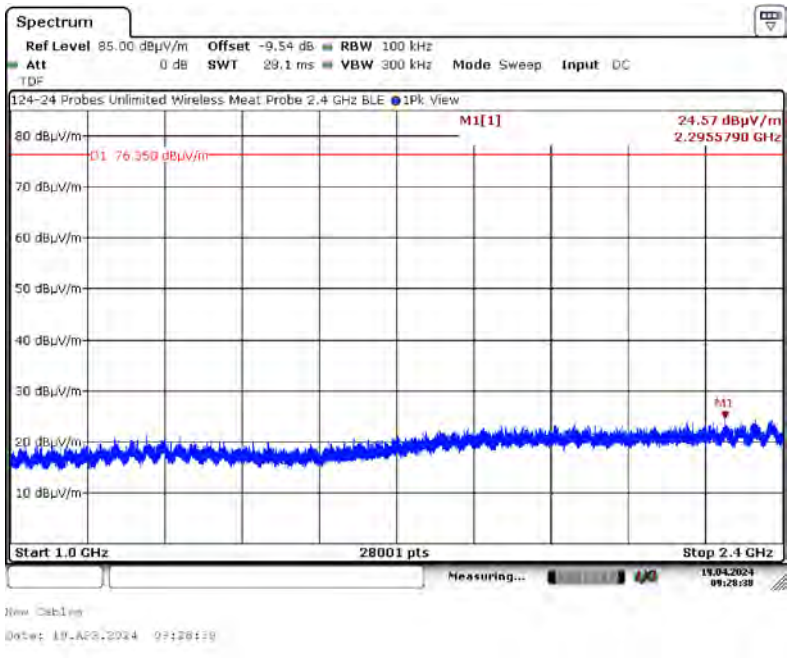
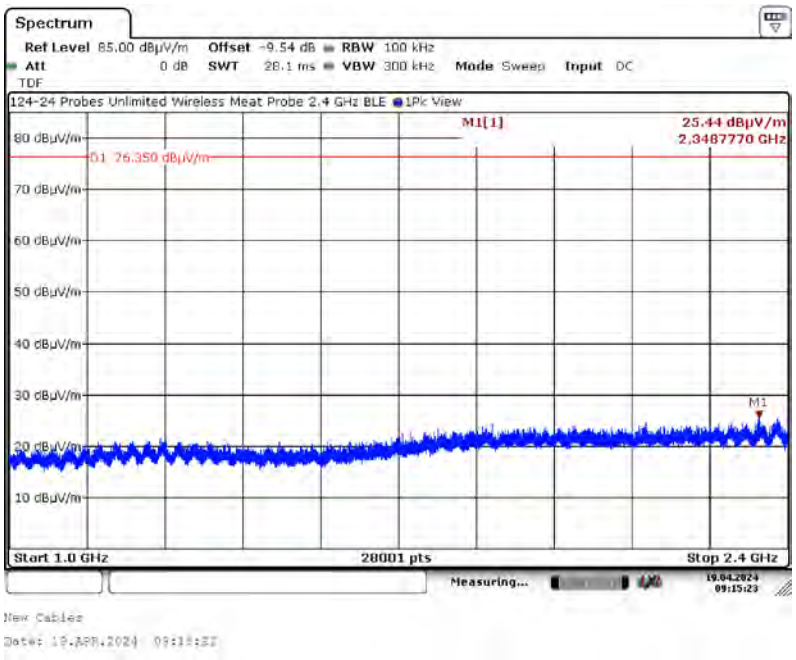
7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.3. 1 GHz to 2.4 GHz – X Axis Horizontal All Three Channels



7.7.4. 1 GHz to 2.4 GHz – X Axis Vertical All Three Channels



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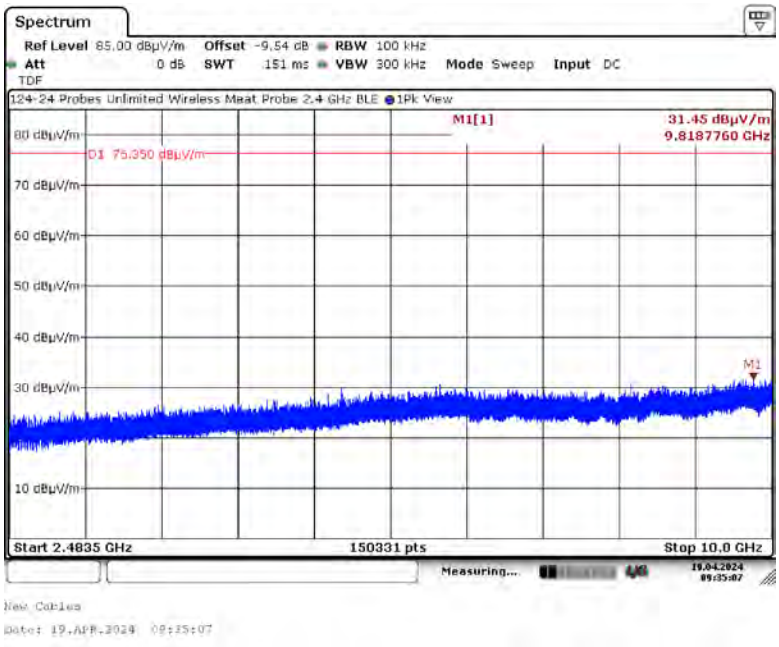
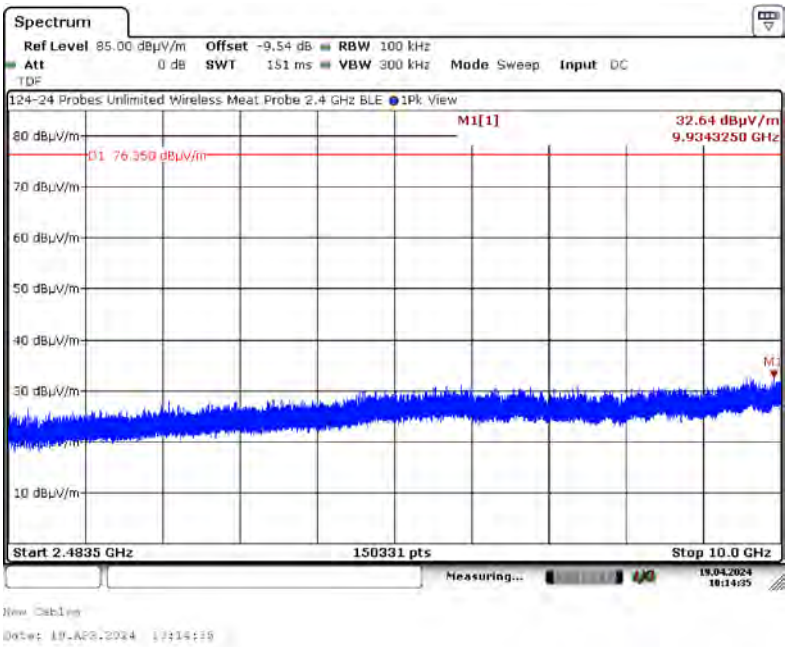
7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.5. 2.4835 GHz to 10 GHz – X Axis Horizontal All Three Channels



7.7.6. 2.4835 GHz to 10 GHz – X Axis Vertical All Three Channels



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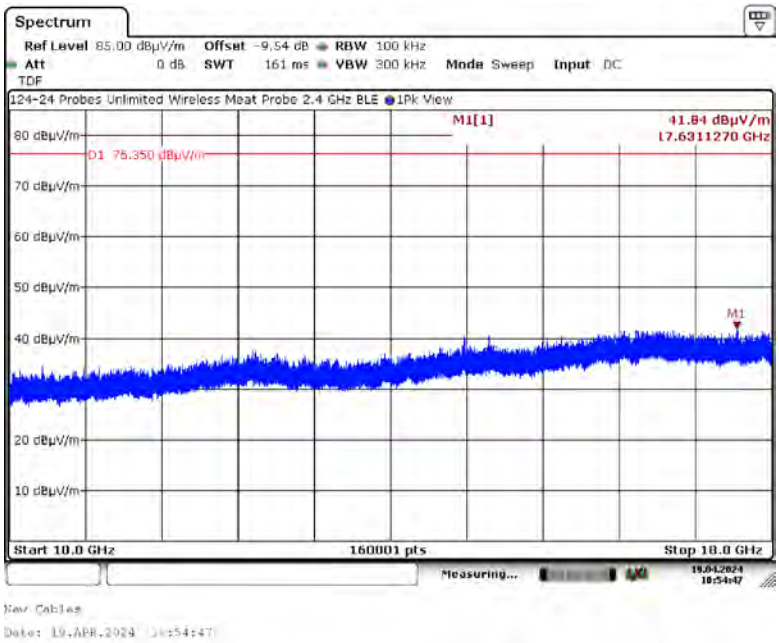
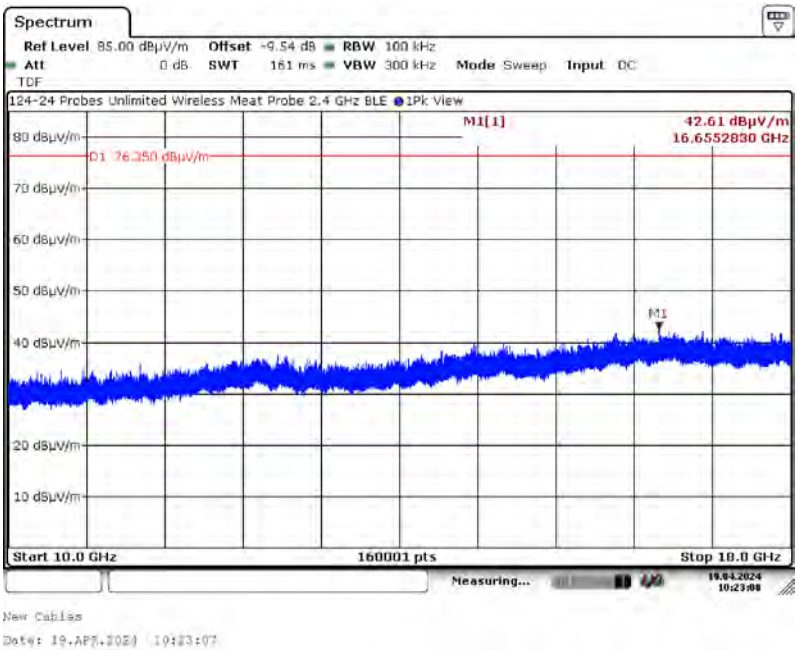
7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.7. 10 GHz to 18 GHz – X Axis Horizontal All Three Channels



7.7.8. 10 GHz to 18 GHz – X Axis Vertical All Three Channels



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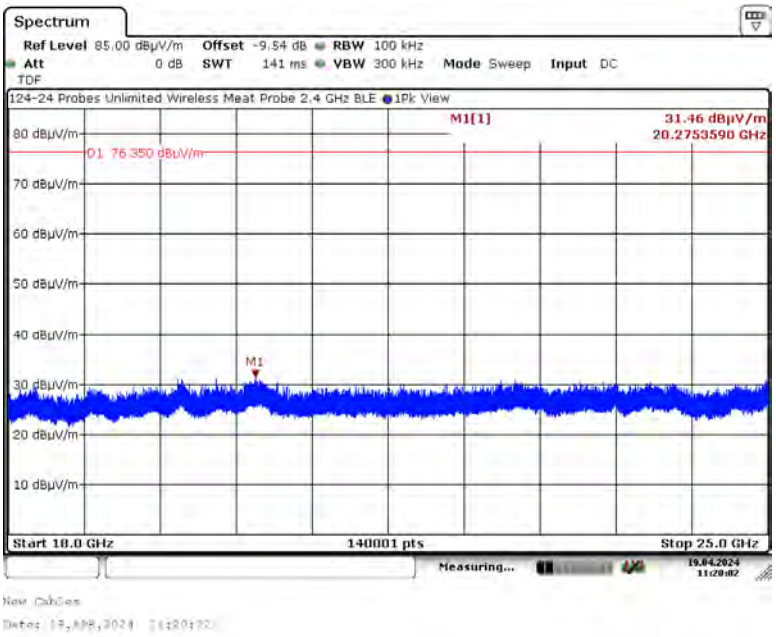
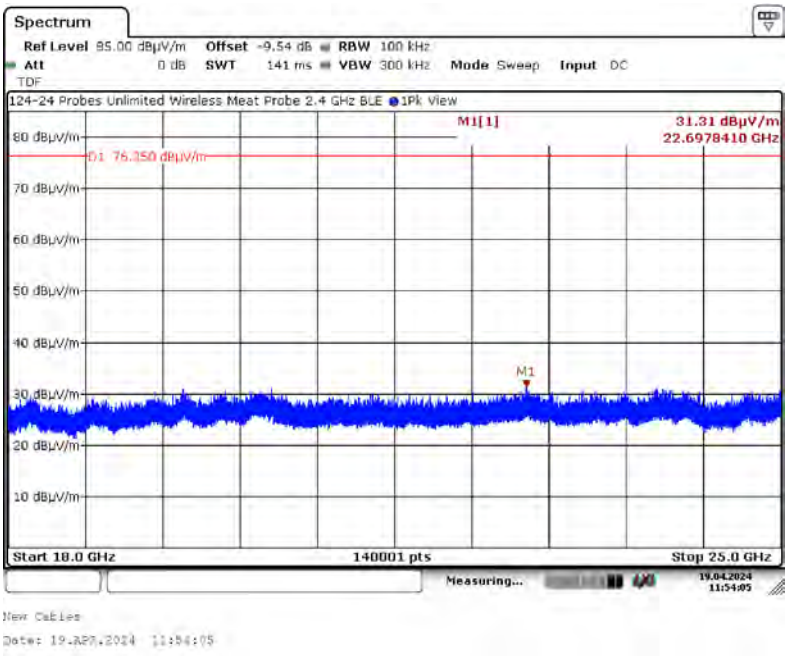
7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.9. 18 GHz to 25 GHz – X Axis Horizontal All Three Channels



7.7.10. 18 GHz to 25 GHz – X Axis Vertical All Three Channels



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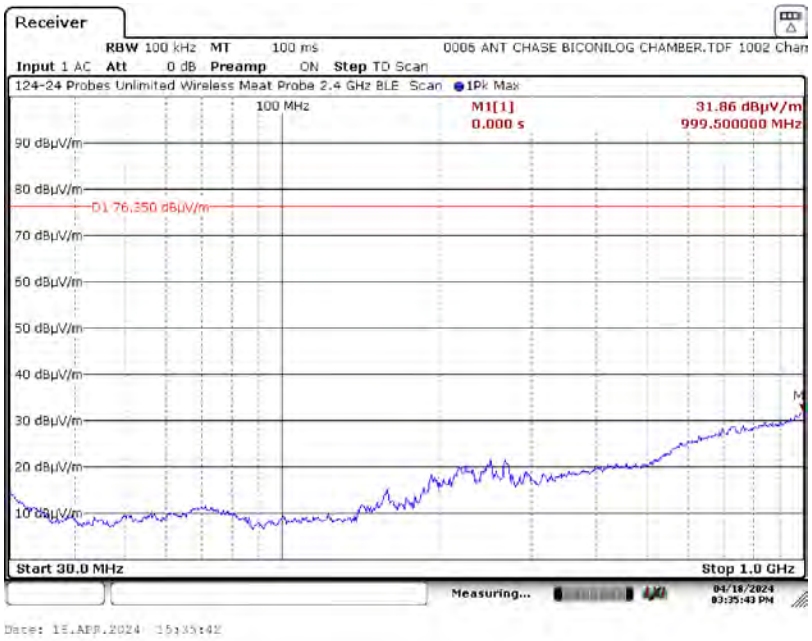
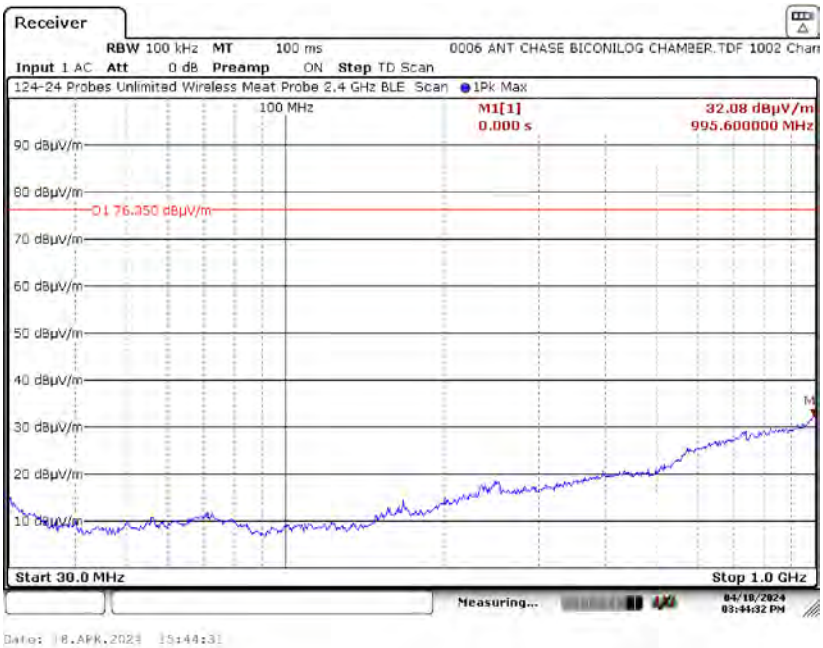
7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.11. 30 MHz to 1 GHz – Y Axis Horizontal All Three Channels



7.7.12. 30 MHz to 1 GHz – Y Axis Vertical All Three Channels



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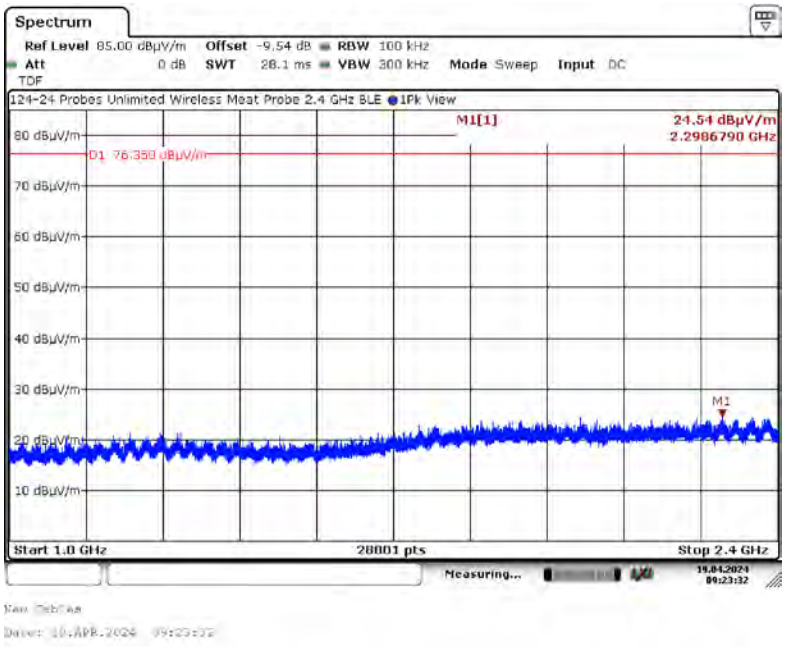
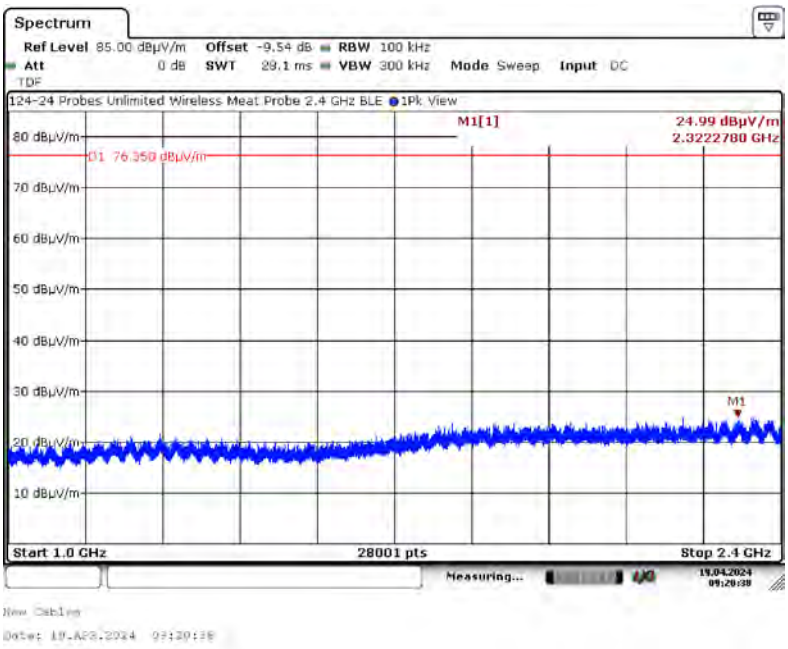
7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.13. 1 GHz to 2.4 GHz – Y Axis Horizontal All Three Channels



7.7.14. 1 GHz to 2.4 GHz – Y Axis Vertical All Three Channels



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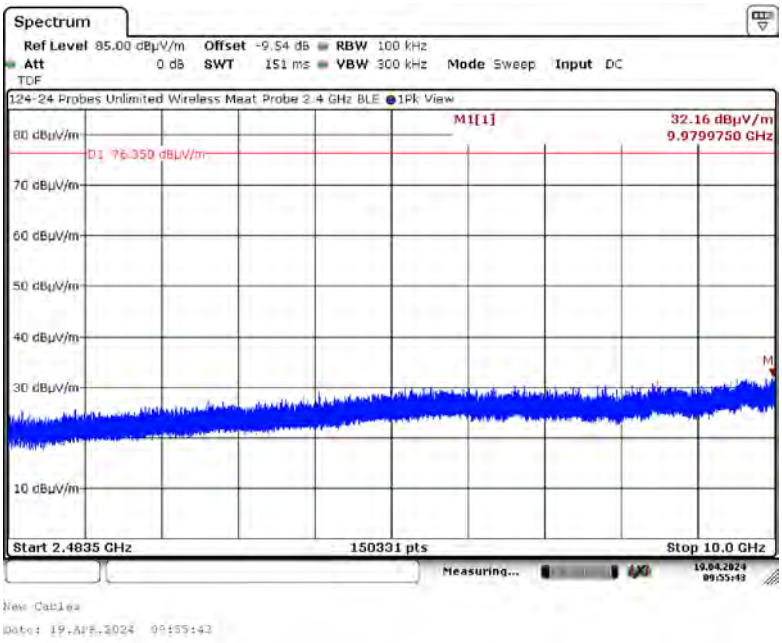
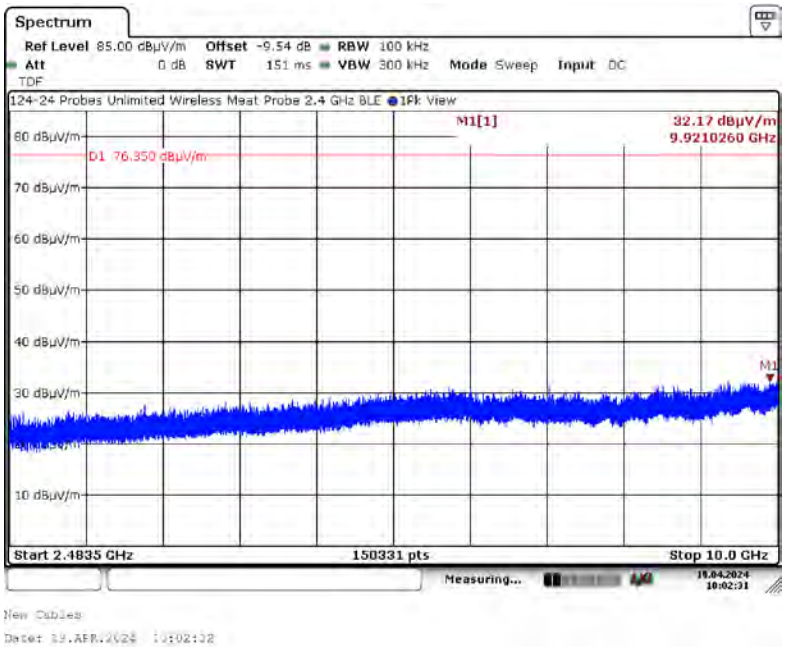
7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.15. 2.4835 GHz to 10 GHz – Y Axis Horizontal All Three Channels



7.7.16. 2.4835 GHz to 10 GHz – Y Axis Vertical All Three Channels



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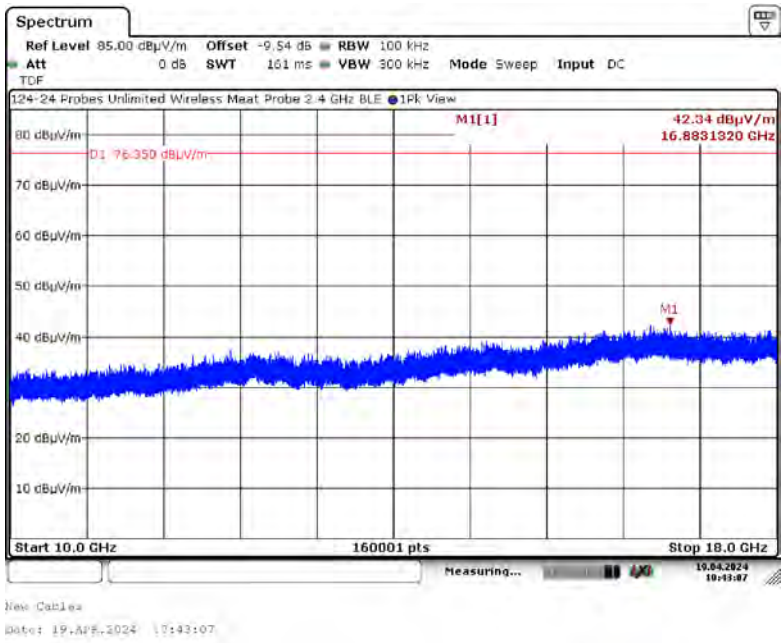
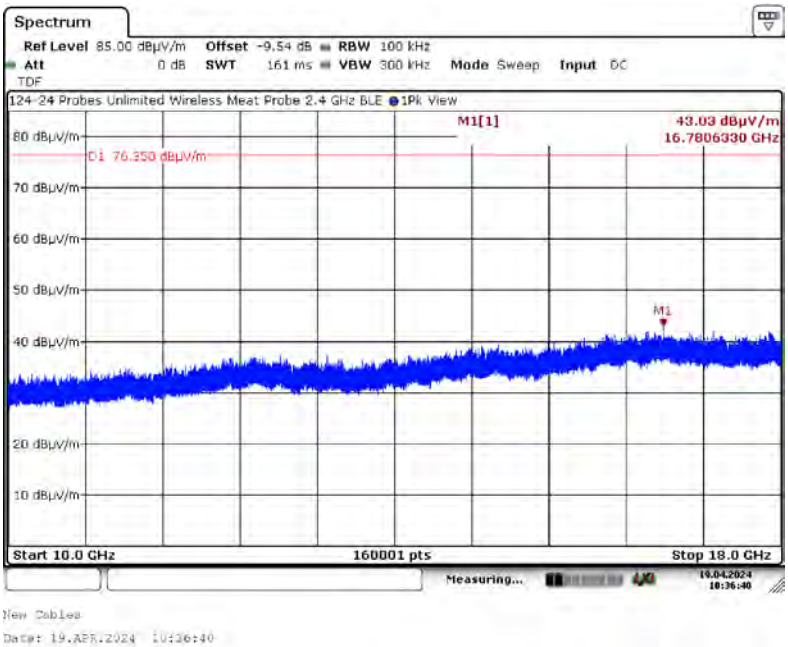
7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.17. 10 GHz to 18 GHz – Y Axis Horizontal All Three Channels



7.7.18. 10 GHz to 18 GHz – Y Axis Vertical All Three Channels



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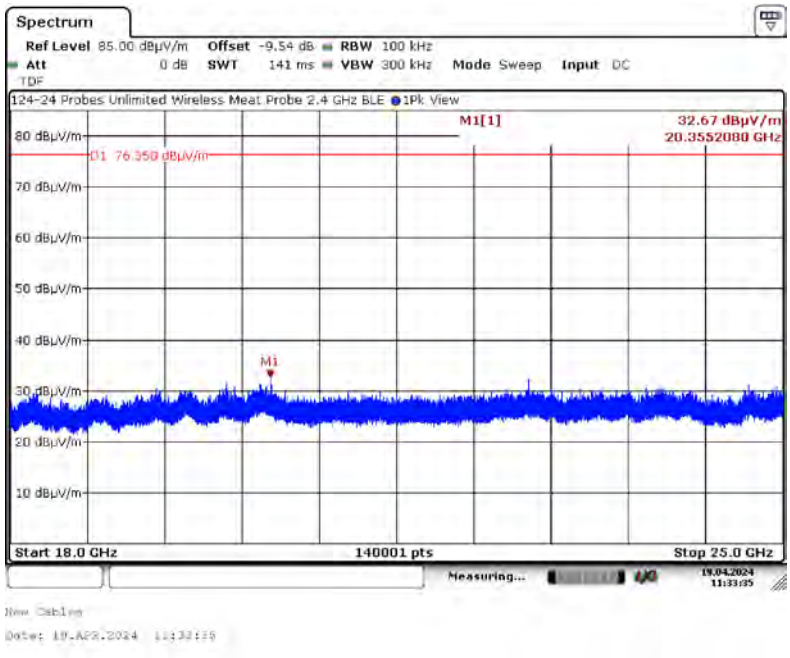
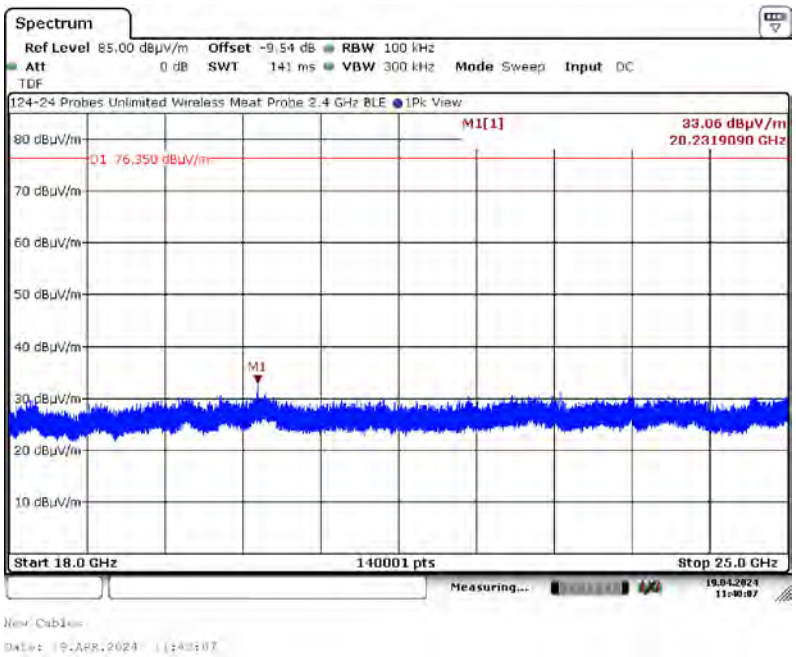
7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.19. 18 GHz to 25 GHz – Y Axis Horizontal All Three Channels



7.7.20. 18 GHz to 25 GHz – Y Axis Vertical All Three Channels



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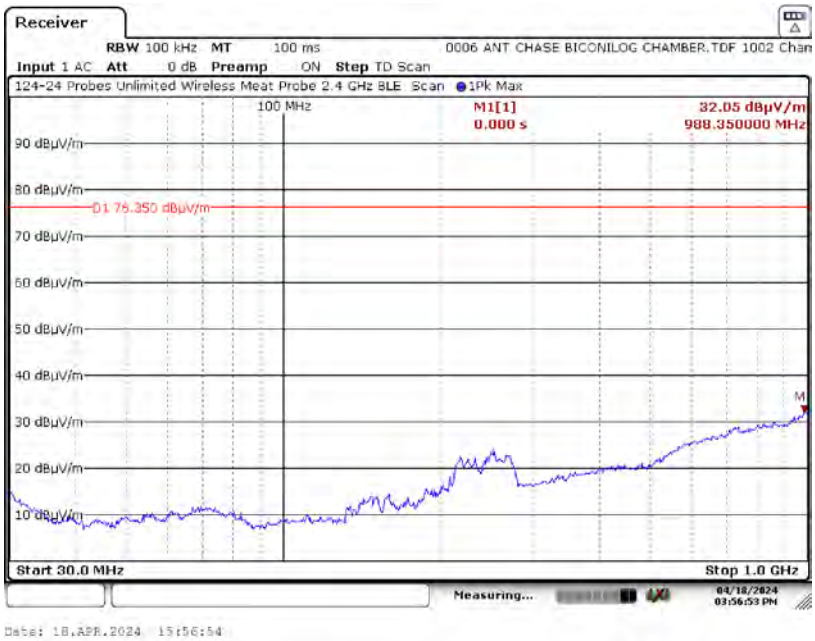
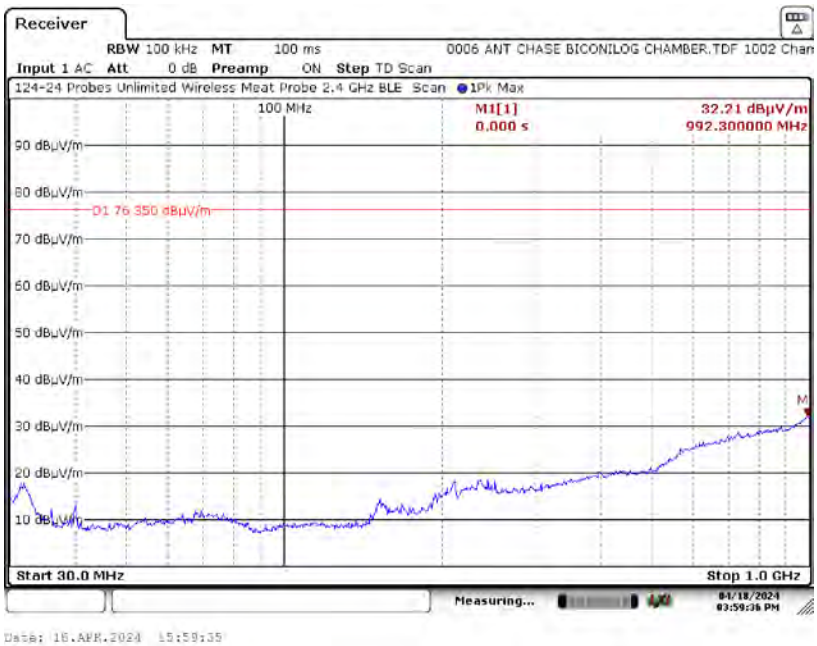
7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.21. 30 MHz to 1 GHz – Z Axis Horizontal All Three Channels



7.7.22. 30 MHz to 1 GHz – Z Axis Vertical All Three Channels



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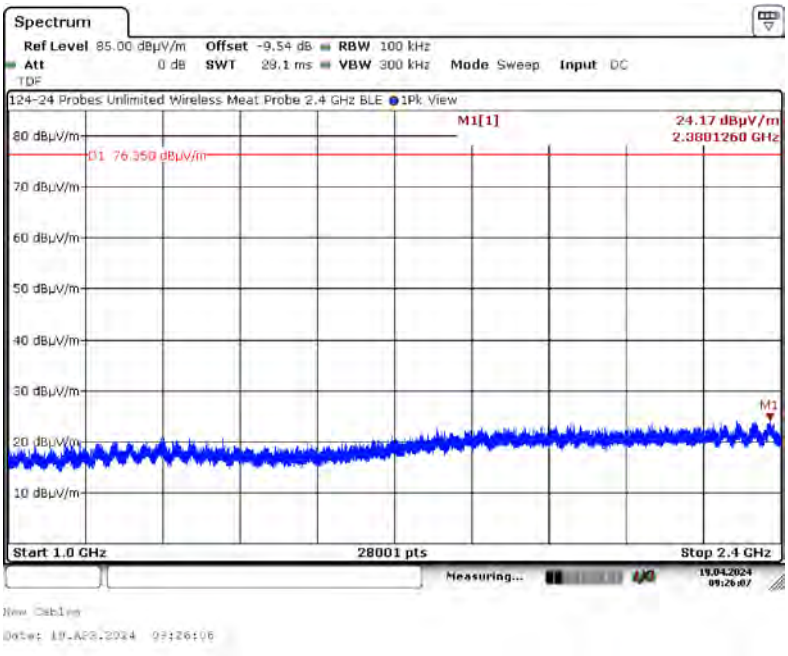
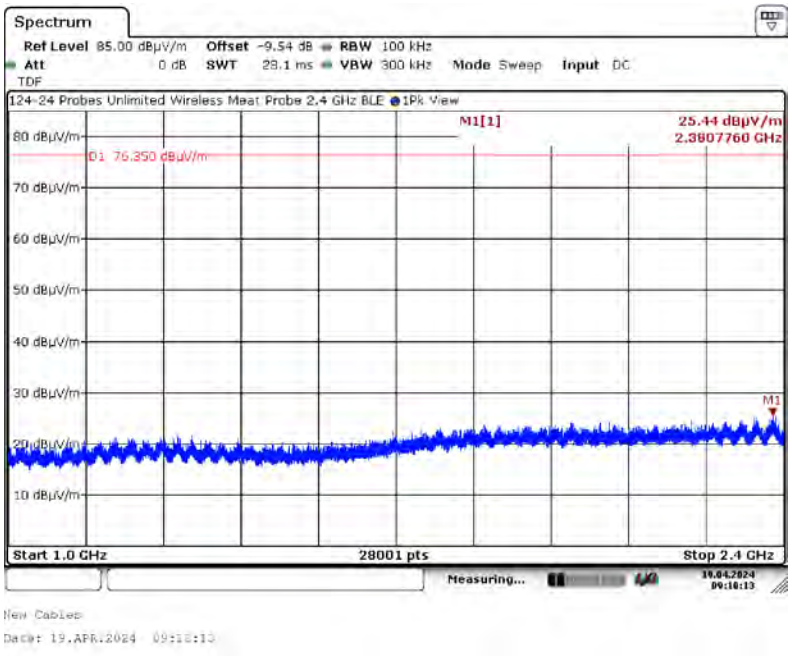
7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.23. 1 GHz to 2.4 GHz – Z Axis Horizontal All Three Channels



7.7.24. 1 GHz to 2.4 GHz – Z Axis Vertical All Three Channels



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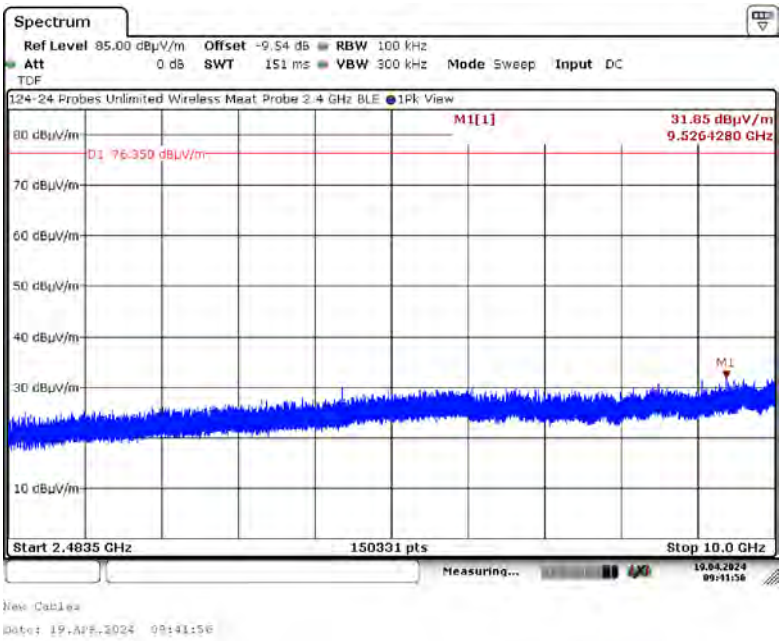
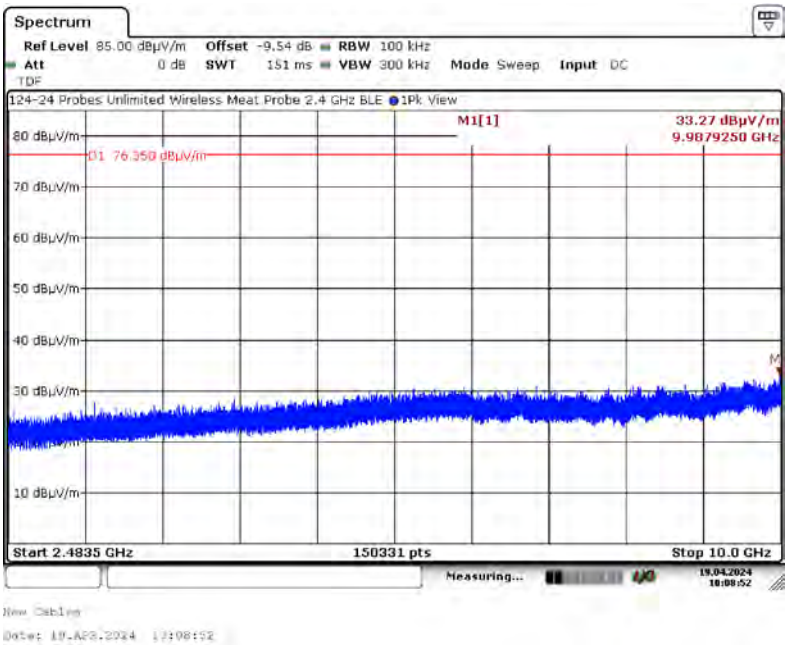
7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.25. 2.4835 GHz to 10 GHz – Z Axis Horizontal All Three Channels



7.7.26. 2.4835 GHz to 10 GHz – Z Axis Vertical All Three Channels



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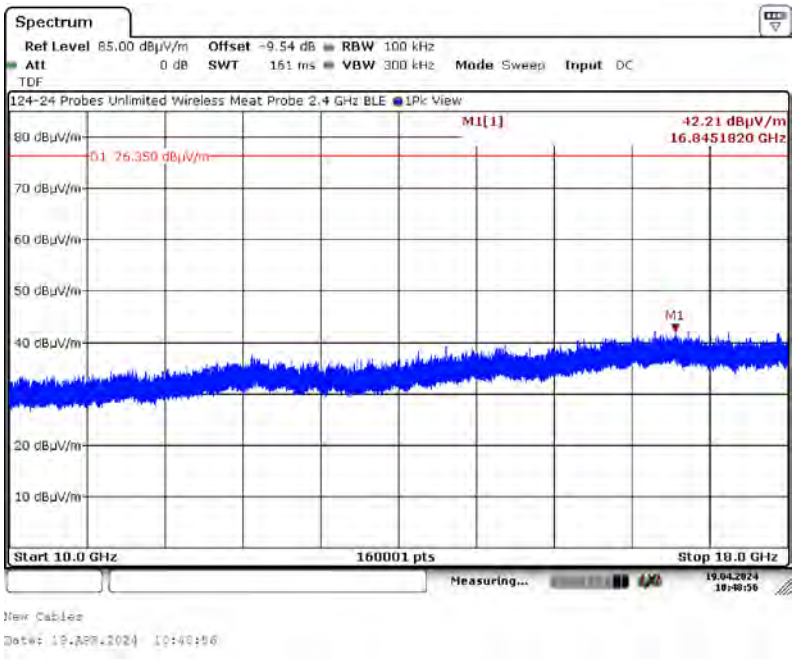
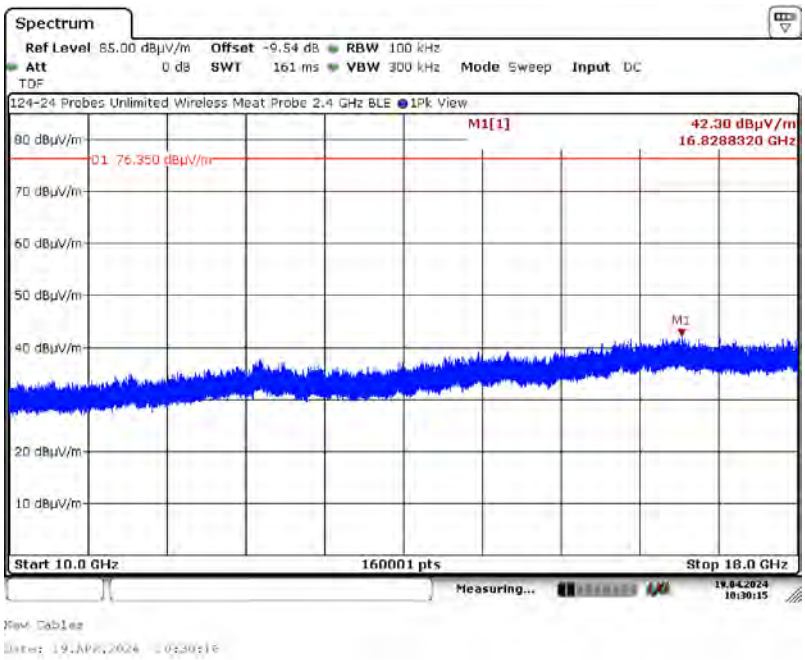
7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.27. 10 GHz to 18 GHz – Z Axis Horizontal All Three Channels



7.7.28. 10 GHz to 18 GHz – Z Axis Vertical All Three Channels



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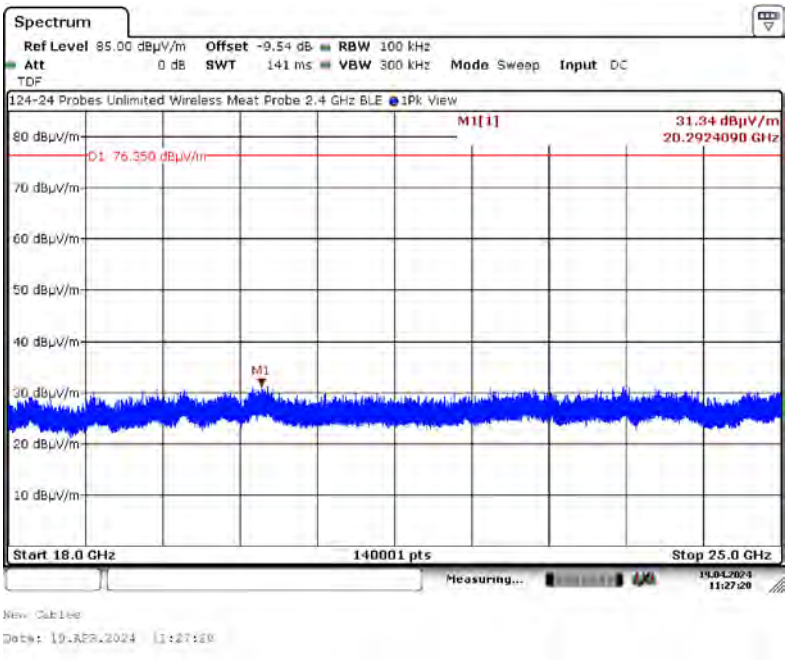
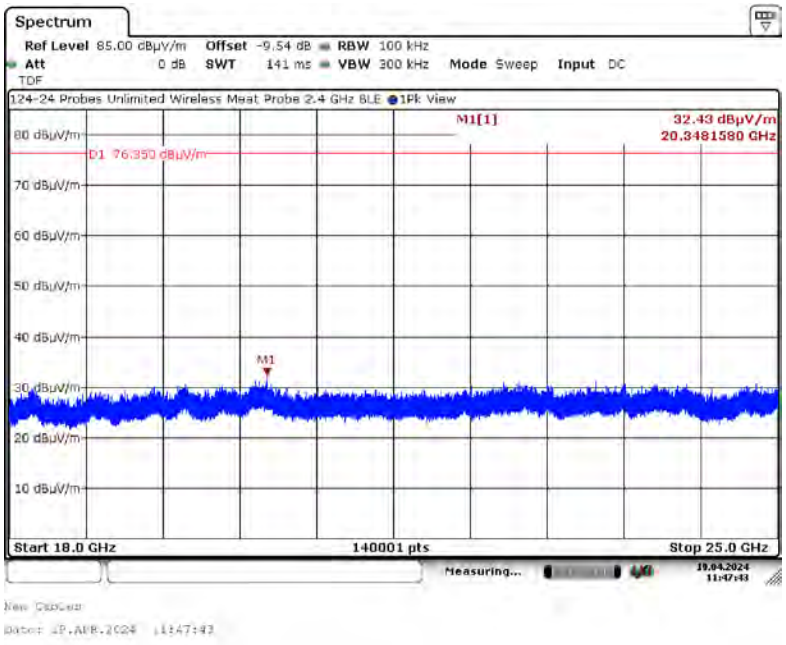
7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.29. 18 GHz to 25 GHz – Z Axis Horizontal All Three Channels



7.7.30. 18 GHz to 25 GHz – Z Axis Vertical All Three Channels



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7. Measurement Data (continued)

7.8. Peak Power Spectral Density (15.247(e))

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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of FCC Part 15.247. The same method of determining the conducted output power shall be used to determine the power spectral density.

Procedure: FCC OET publication number 558074, Section 10.2: Method PKPSD (peak PSD). FCC OET 662911 was referenced to determine the procedure for measuring in-band power spectral density of transmitters with multiple outputs in the same band.

Test Notes: The 8 dBm was converted to a field strength limit at 3 Meters using 95.2

Results: The DUT met the required power spectral density limit at the tested frequencies.

Measurement Results in 2400 MHz to 2483.5 MHz Band

Channel	Frequency	Maximum PSD Frequency	Maximum Power Spectral Density	Limit	Margin	Result
	(MHz)	(MHz)	(dBµV/m)	(dBµV/m)	(dB)	
37	2402	2401.95473	82.02	103.2	-21.18	Compliant
38	2426	2426.17352	82.08	103.2	-21.12	Compliant
39	2480	2480.00097	81.42	103.2	-21.78	Compliant

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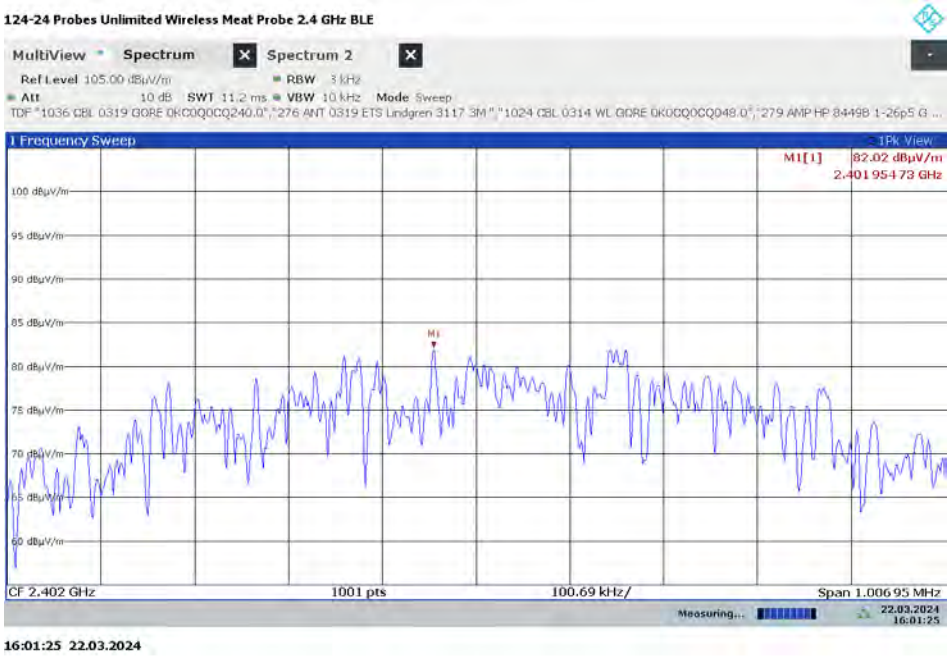
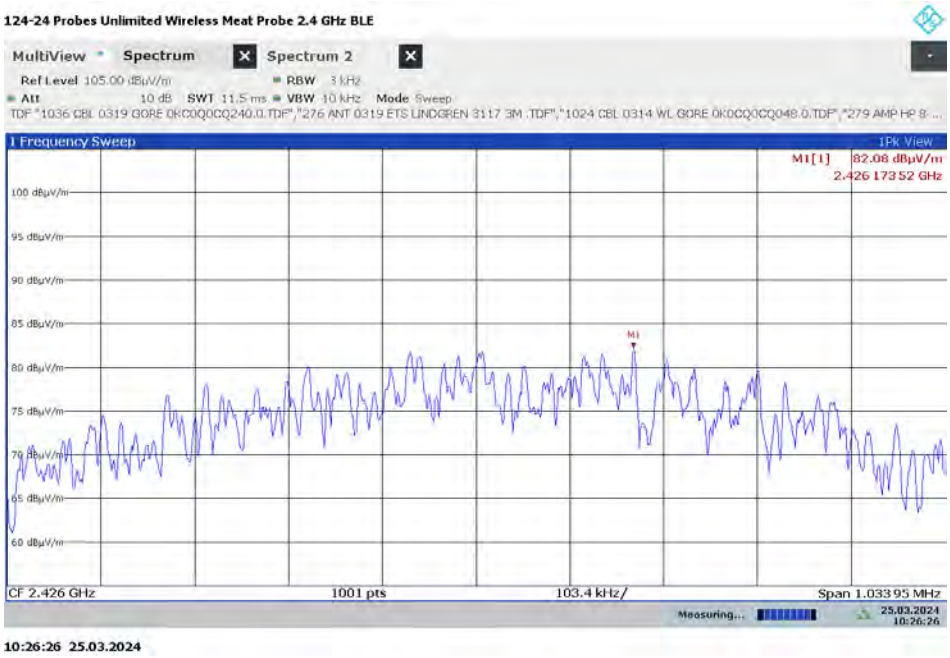
7. Measurement Data (continued)

7.8. Peak Power Spectral Density (15.247(e)) (continued)

7.8.1. Low Channel – 37, 2402 MHz



7.8.2. Middle Channel – 38, 2426 MHz



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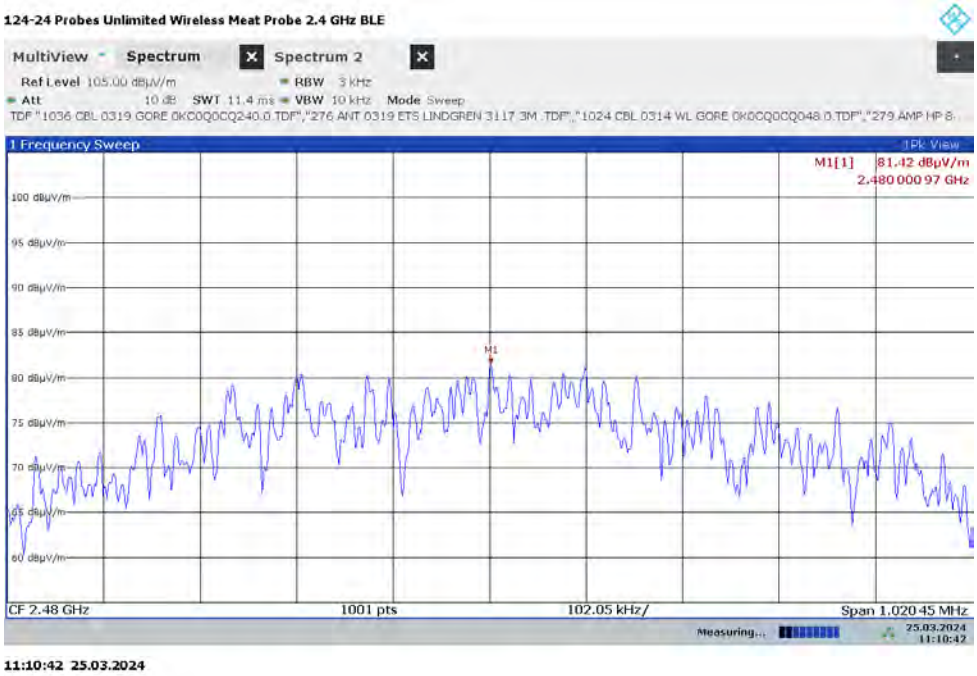
7. Measurement Data

7.8. Peak Power Spectral Density (15.247(e)) (continued)

7.8.3. High Channel – 39, 2480 MHz



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7. Measurement Data (continued)

7.9. Conducted Emissions Test Setup

7.9.1. Regulatory Limit: FCC Part 15, Class B

Frequency Range (MHz)	Limits (dBµV)	
	Quasi-Peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5.0	56	46
5.0 to 30.0	60	50
* Decreases with the logarithm of the frequency.		

7.9.2. Measurement Equipment and Software Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due
LISN	EMCO	3825/2	9109-1860	4/17/2025
EMI Test Receiver	Rohde & Schwarz	ESR7	101156	10/16/2024
Manufacturer	**Software Description**		**Title/Model #**	**Rev.**
Compliance Worldwide	Test Report Generation Software		Test Report Generator	1.0

7.9.3. Measurement & Equipment Setup

Test Date:	N/A
Test Engineer:	N/A
Site Temperature (°C):	N/A
Relative Humidity (%RH):	N/A
Frequency Range:	0.15 MHz to 30 MHz
EMI Receiver IF Bandwidth:	9 kHz
EMI Receiver Avg Bandwidth:	≥ 3 * RBW or IF(BW)
Detector Functions:	Peak, Quasi-Peak. & Average
Measurement Uncertainty	± 3.56 dB

7.9.4. Test Procedure

Test measurements were made in accordance with ANSI C63.4-2009, Standard Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the Range of 9 kHz to 40 GHz.

Sample Calculation: Final Result = Measurement Value + LISN Factor + Cable Loss.

Note: All correction factors are loaded into the measurement instrument prior to testing to determine the final result.

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7. Measurement Data (continued)

7.10. Duty Cycle

Requirement: (FCC OET publication number 558074)
Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%).

Procedure: Duty cycle measurements were made according to the procedure detailed ANSI C63.10-2013, Section 11.6(b)

Results: Duty cycle measurements are listed in the following table. A Peak detector is used for measurements and a DCF applied using a maximum time period of 100 mS. 20 * Log (0.330/100) = -49.63 dB.

Channel	Frequency	Time High	Time per Period	Duty Cycle	
	(MHz)	(mS)	(mS)	(Numeric)	(%)
37	2402	0.330	493.920	0.00067	0.07
38	2426	0.330	506.320	0.00065	0.07
39	2480	0.330	508.320	0.00065	0.06

7.10.1. Low Channel – 37, 2402 MHz – On Time

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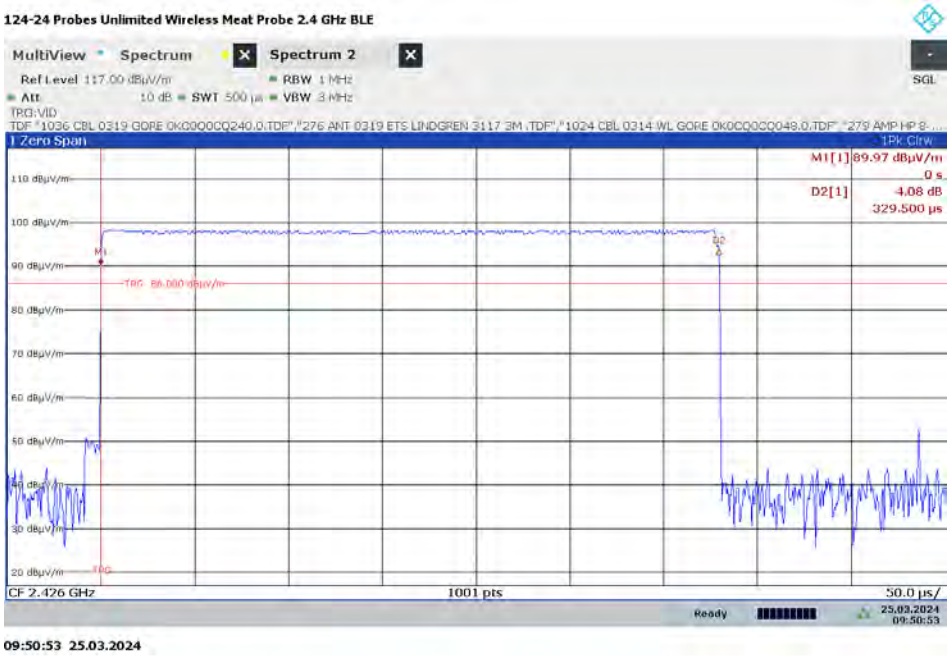
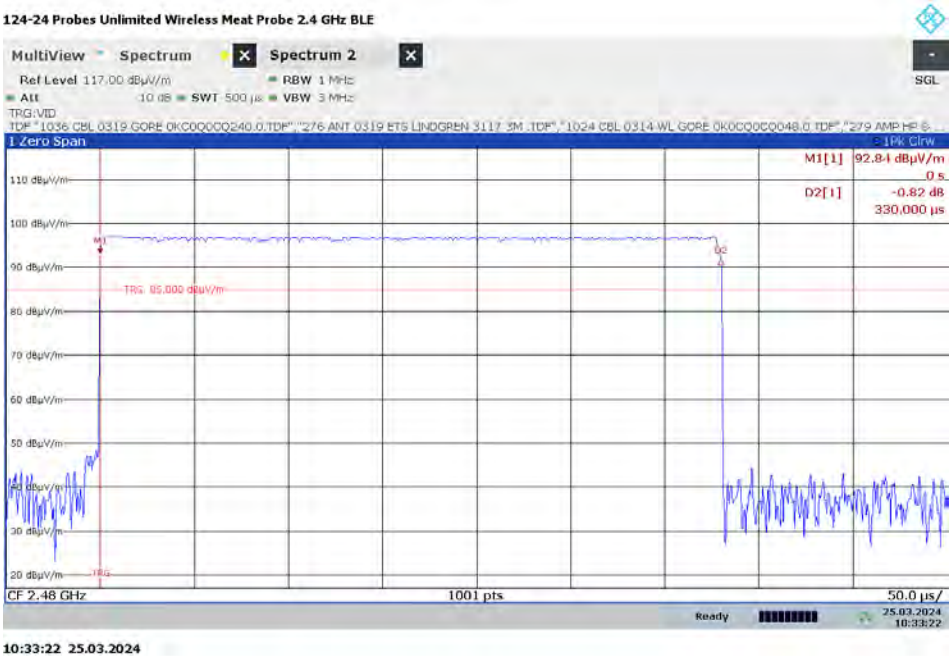
7. Measurement Data (continued)

7.10. Duty Cycle (continued)

7.10.2. Middle Channel – 38, 2426 MHz – On Time



7.10.3. High Channel – 39, 2480 MHz – On Time



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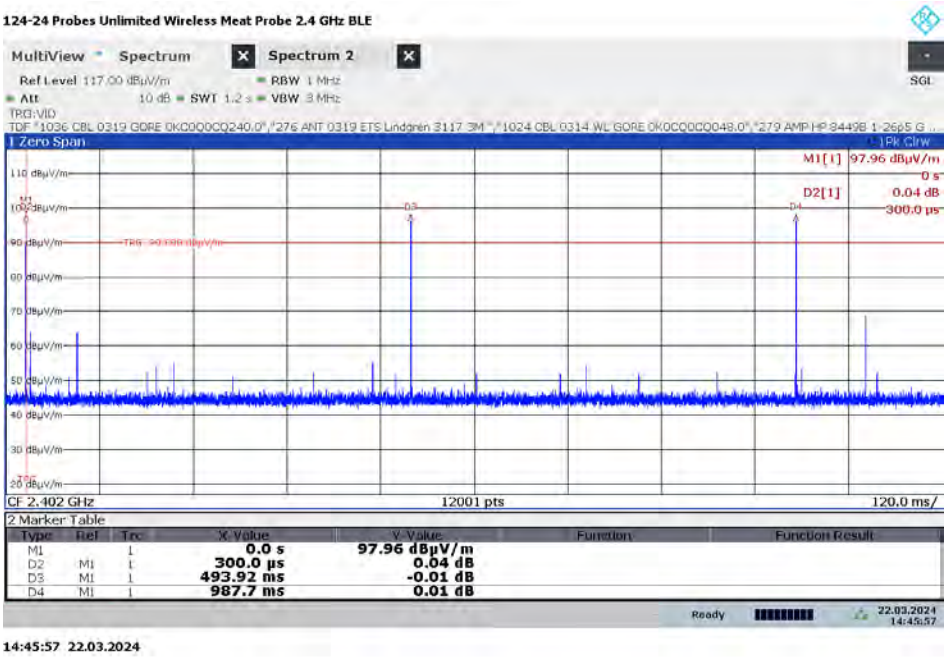
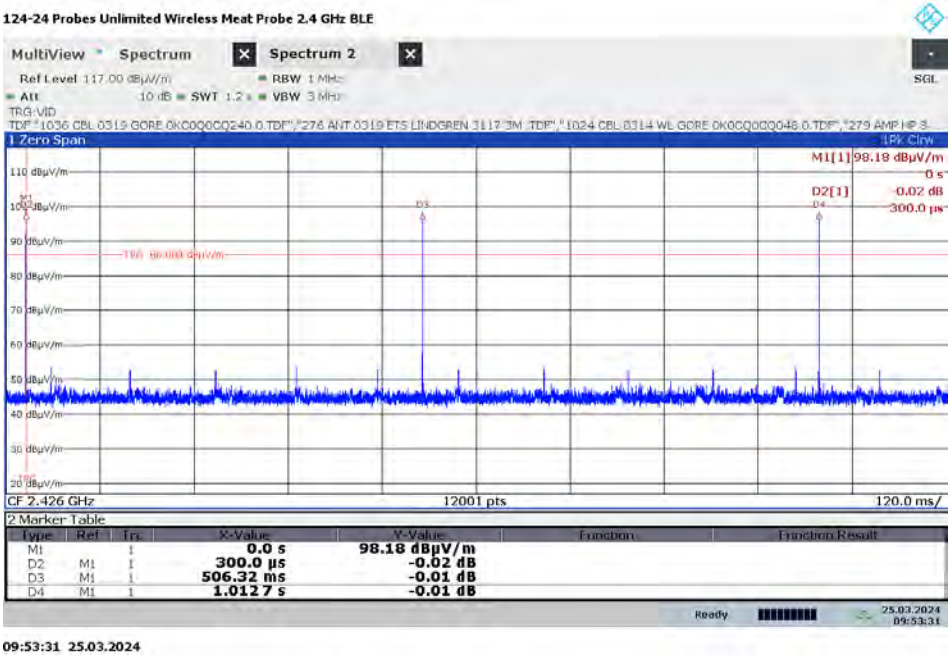
7. Measurement Data

7.10. Duty Cycle (continued)

7.10.4. Low Channel – 37, 2402 MHz Repetition Time



7.10.5. Middle Channel – 38, 2426 MHz – Repetition Time



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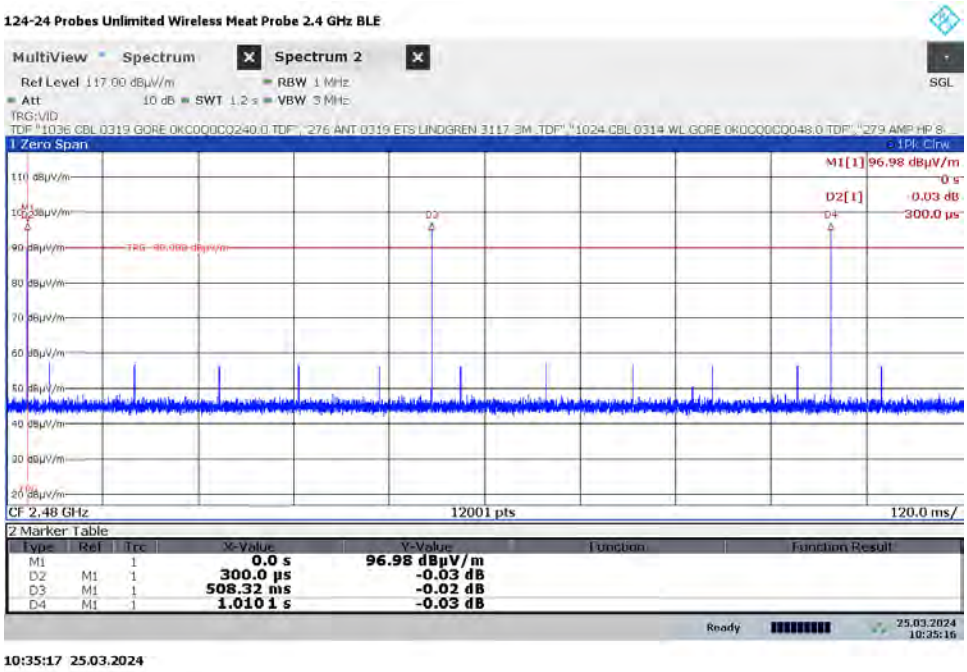
7. Measurement Data

7.10. Duty Cycle (continued)

7.10.6. High Channel – 39, 2480 MHz Repetition Time



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8. Test Setup Photographs

8.1. Spurious Radiated Emissions, 30 kHz to 1 GHz – Front

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8. Test Setup Photographs

8.2. Spurious Radiated Emissions, 30 kHz to 30 MHz – Rear

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8. Test Setup Photographs

8.3. Spurious Radiated Emissions, 30 MHz to 1 GHz – Front

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8. Test Setup Photographs

8.4. Spurious Radiated Emissions, 30 MHz to 1 GHz – Rear

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8. Test Setup Photographs

8.5. Radiated Emissions above 1 GHz – Front

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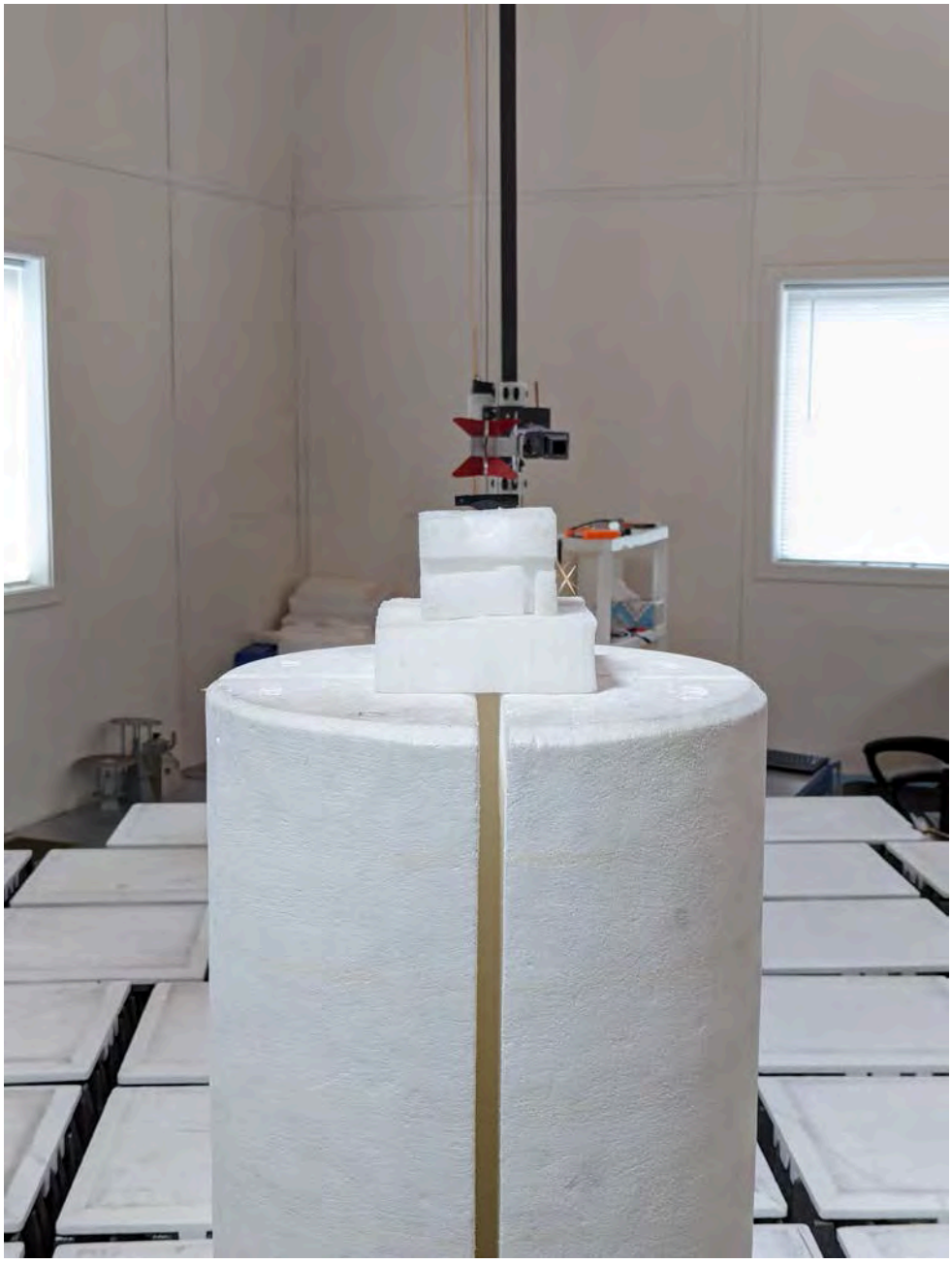
8. Test Setup Photographs

8.6. Radiated Emissions 1 to 18 GHz – Rear



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8. Test Setup Photographs

8.7. Radiated Emissions 18 to 25 GHz – Front

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8. Test Setup Photographs

8.8. Radiated Emissions 18 to 25 GHz – Rear

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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 CISPR 11, AS/NZS CISPR 14-1, AS/NZS CISPR 15, AS/NZS CISPR 32, Chinese-Taipei (Taiwan) BSMI CNS 15936 and Korea (RRA) KS C 9811, KS C 9814-1, KS C 9815, KS C 9832, KS C 9610-6-3 & KS C 9610-6-4.

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 tabletop.

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Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

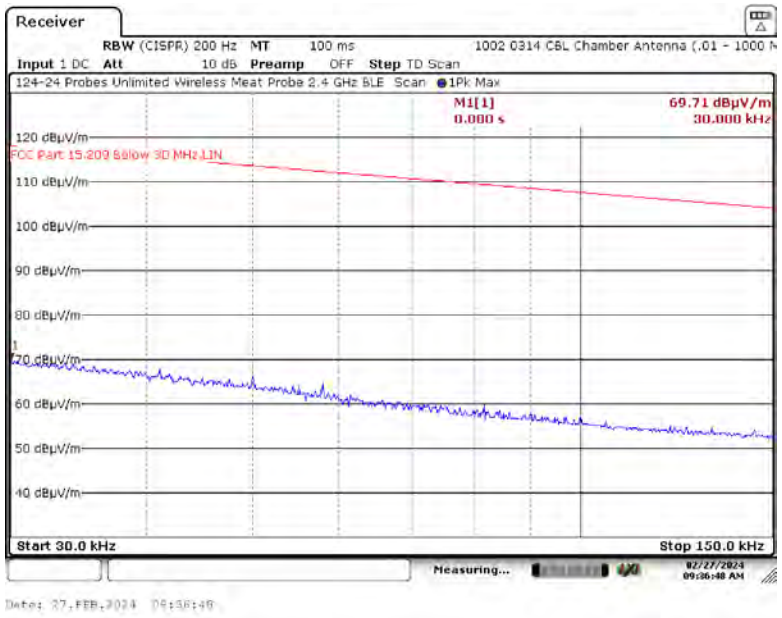
A1. Spurious Radiated Emissions (30 kHz – 150 kHz) Test Results

A1.1. All Three Channels

A1.1.1. Orthogonal Position: X-Axis

A1.1.1.1. Measurement Results: Parallel Antenna

A1.1.1.2. Measurement Results: Perpendicular Antenna



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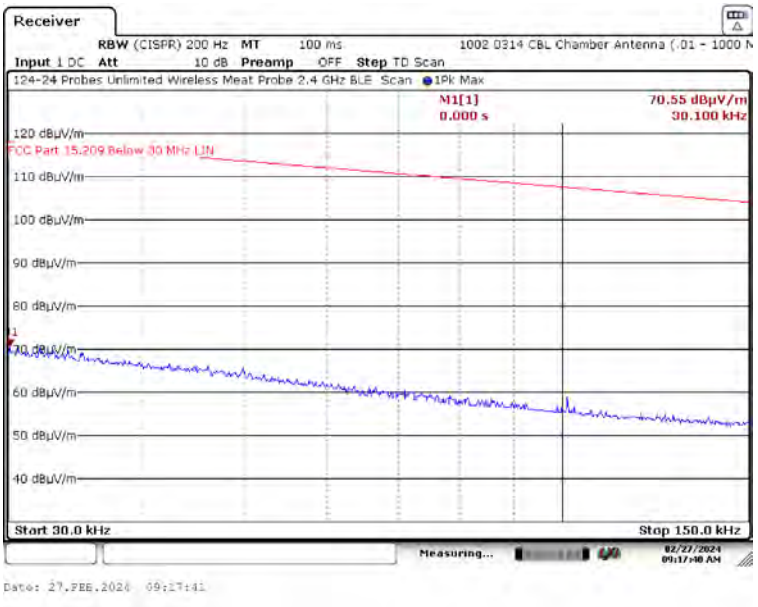
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

A1. Spurious Radiated Emissions (30 kHz – 150 kHz) Test Results

A1.1. All Three Channels

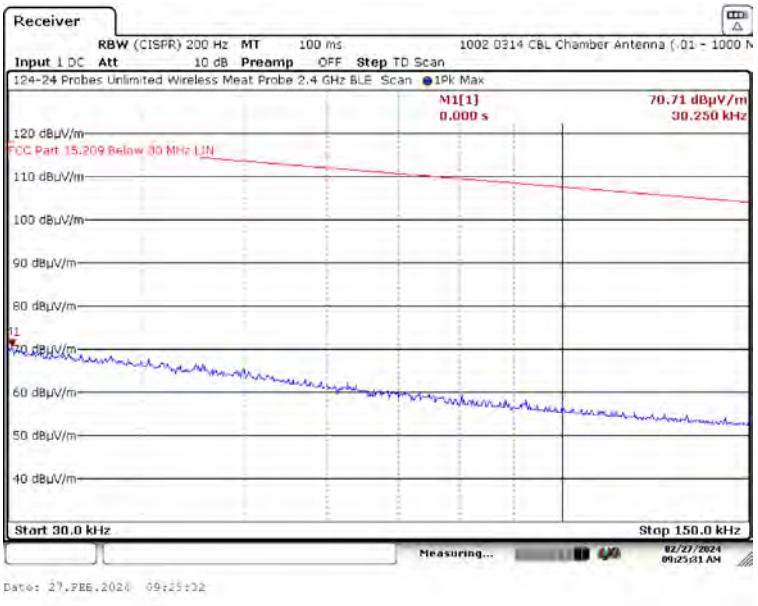
A1.1.1. Orthogonal Position: X-Axis

A1.1.1.3. Measurement Results: Ground Parallel Antenna



A1.1.2. Orthogonal Position: Y-Axis

A1.1.2.1. Measurement Results: Parallel Antenna



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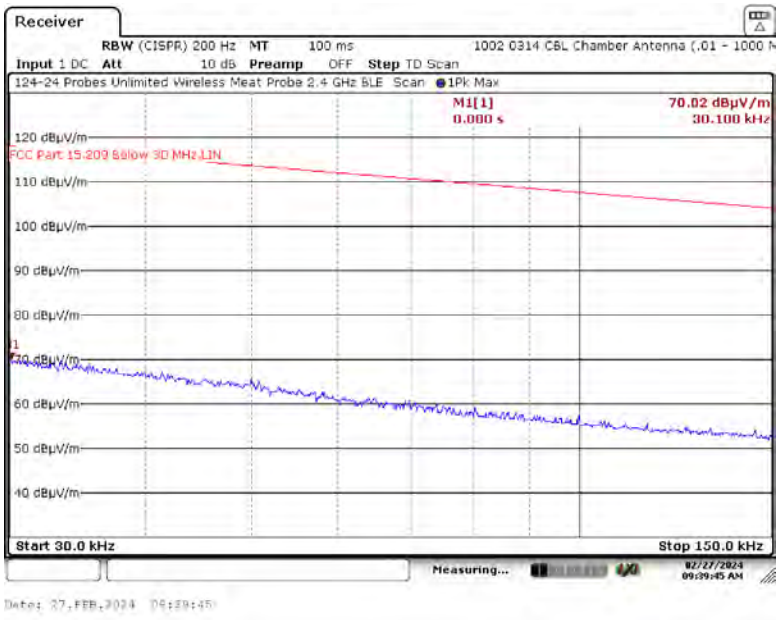
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

A1. Spurious Radiated Emissions (30 kHz – 150 kHz) Test Results

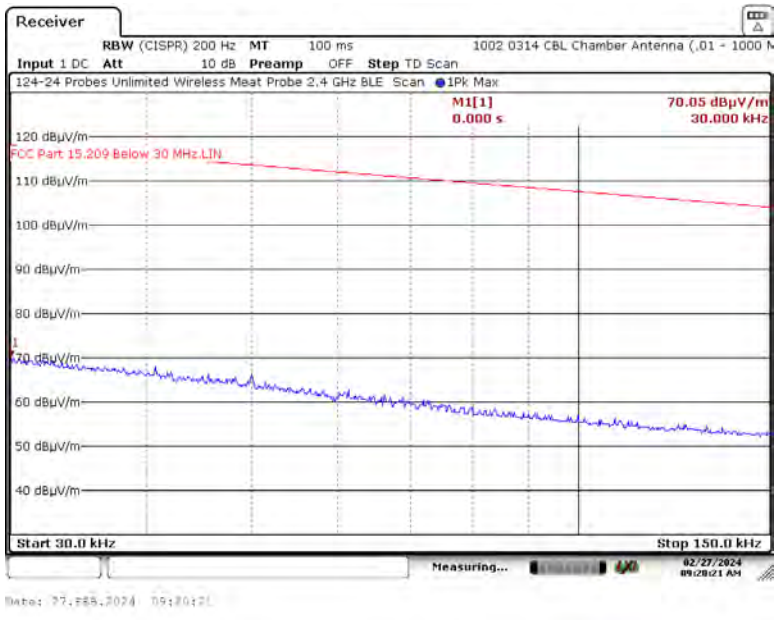
A1.1. All Three Channels

A1.1.2. Orthogonal Position: Y-Axis

A1.1.2.2. Measurement Results: Perpendicular Antenna



A1.1.2.3. Measurement Results: Ground Parallel Antenna



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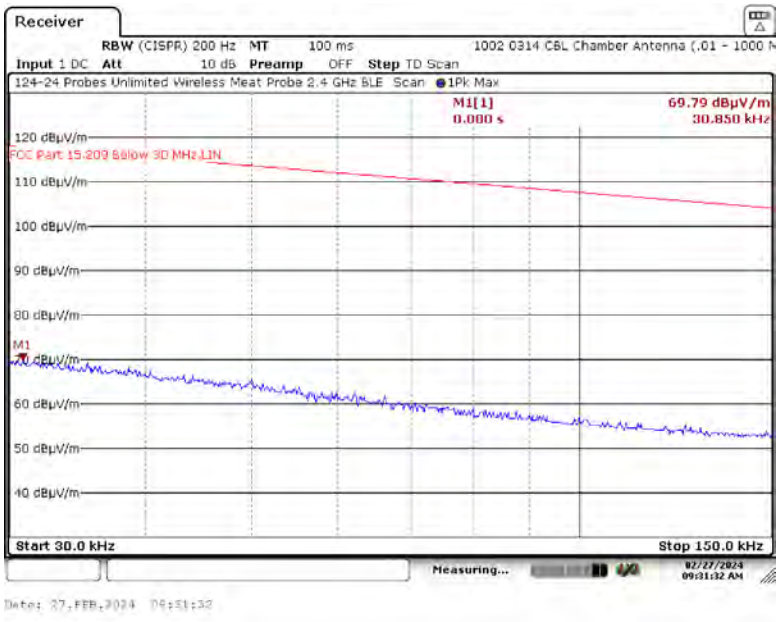
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

A1. Spurious Radiated Emissions (30 kHz – 150 kHz) Test Results

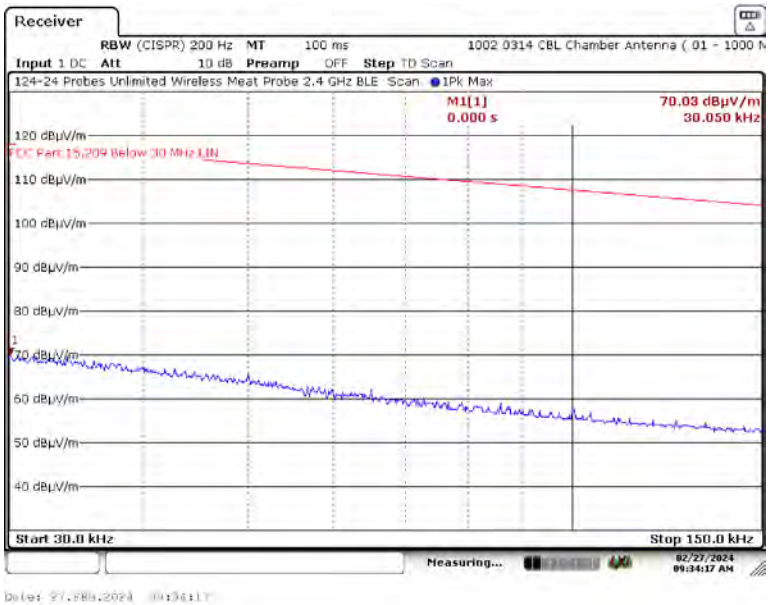
A1.1. All Three Channels

A1.1.3. Orthogonal Position: Z-Axis

A1.1.3.1. Measurement Results: Parallel Antenna



A1.1.3.2. Measurement Results: Perpendicular Antenna



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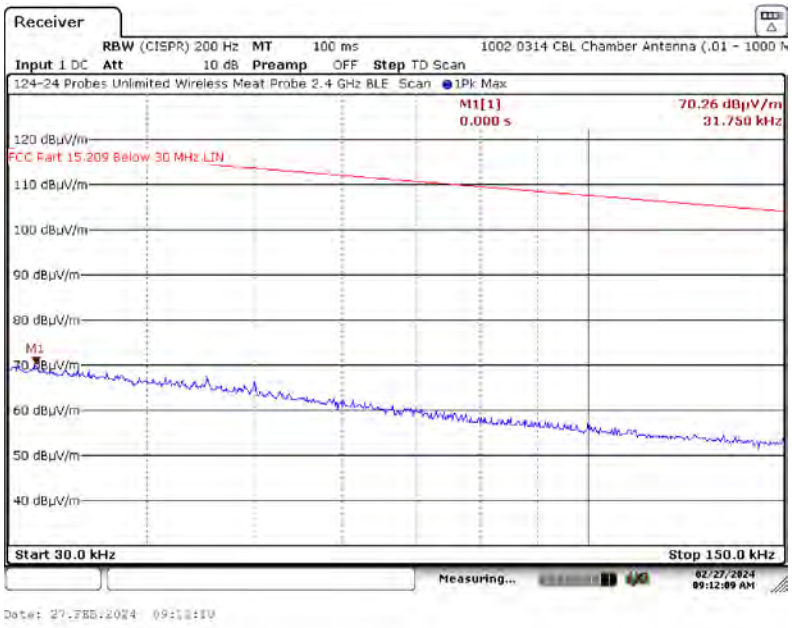
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

A1. Spurious Radiated Emissions (30 kHz – 150 kHz) Test Results

A1.1. All Three Channels

A1.1.3. Orthogonal Position: Z-Axis

A1.1.3.3. Measurement Results: Ground Parallel Antenna



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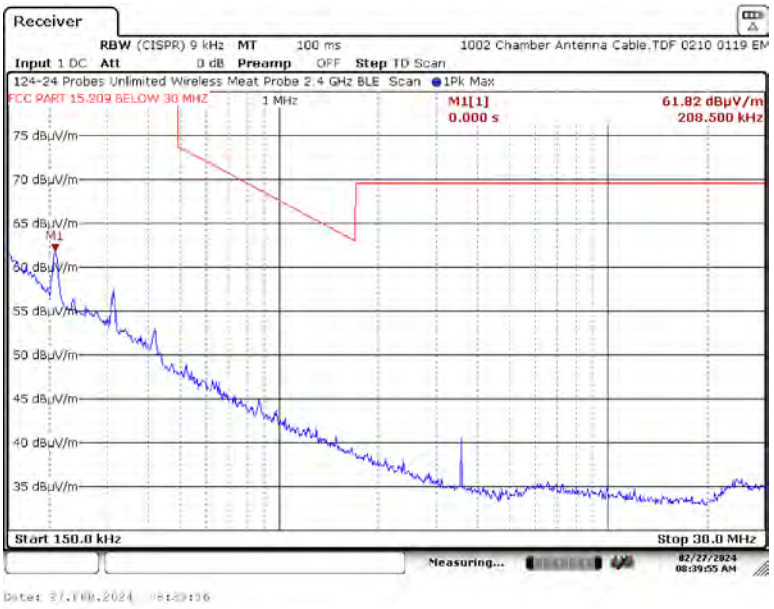
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

A2. Spurious Radiated Emissions (150 kHz – 30 MHz) Test Results

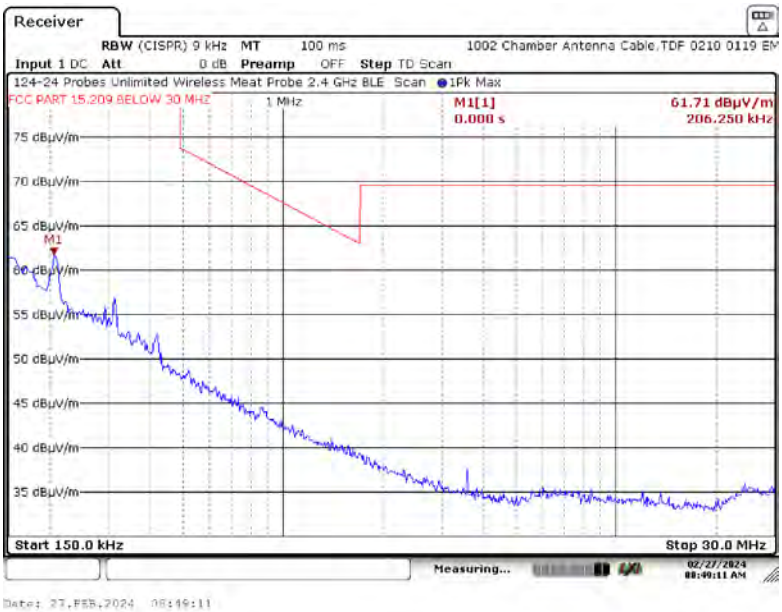
A2.1. All Three Channels

A2.1.1. Orthogonal Position: X-Axis

A2.1.1.1. Measurement Results: Parallel Antenna



A2.1.1.2. Measurement Results: Perpendicular Antenna



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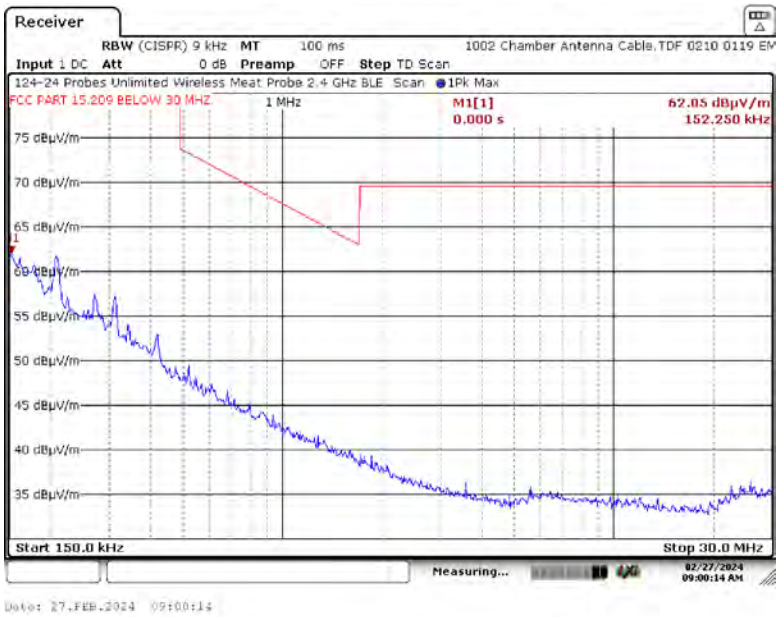
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

A1. Spurious Radiated Emissions (150 kHz – 30 MHz) Test Results

A2.1. All Three Channels

A2.1.1. Orthogonal Position: X-Axis

A2.1.1.3. Measurement Results: Ground Parallel Antenna



A2.1.2. Orthogonal Position: Y-Axis

A2.1.2.1. Measurement Results: Parallel Antenna

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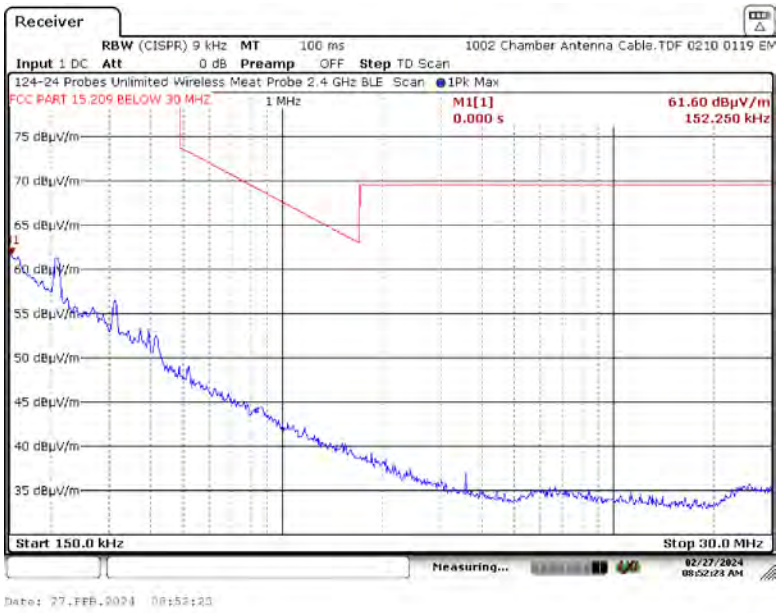
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

A2. Spurious Radiated Emissions (150 kHz – 30 MHz) Test Results

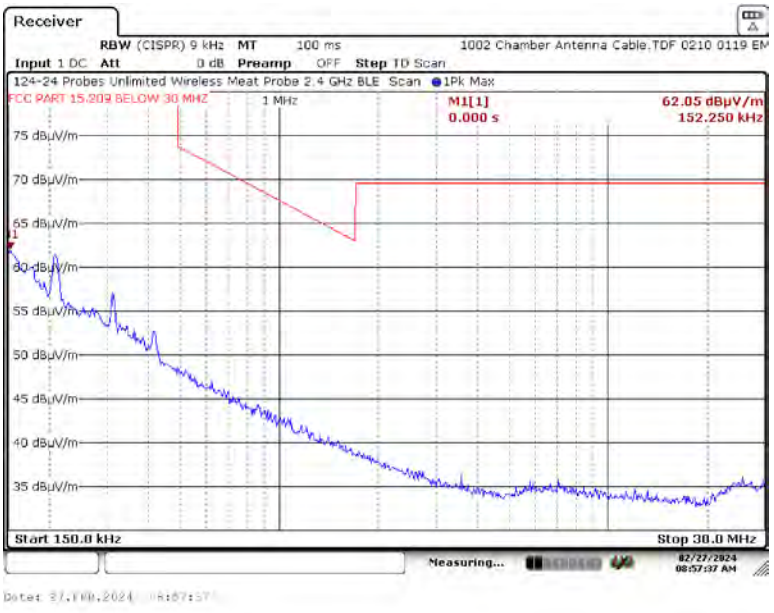
A2.1. All Three Channels

A2.1.2. Orthogonal Position: Y-Axis

A2.1.2.2. Measurement Results: Perpendicular Antenna



A2.1.2.3. Measurement Results: Ground Parallel Antenna



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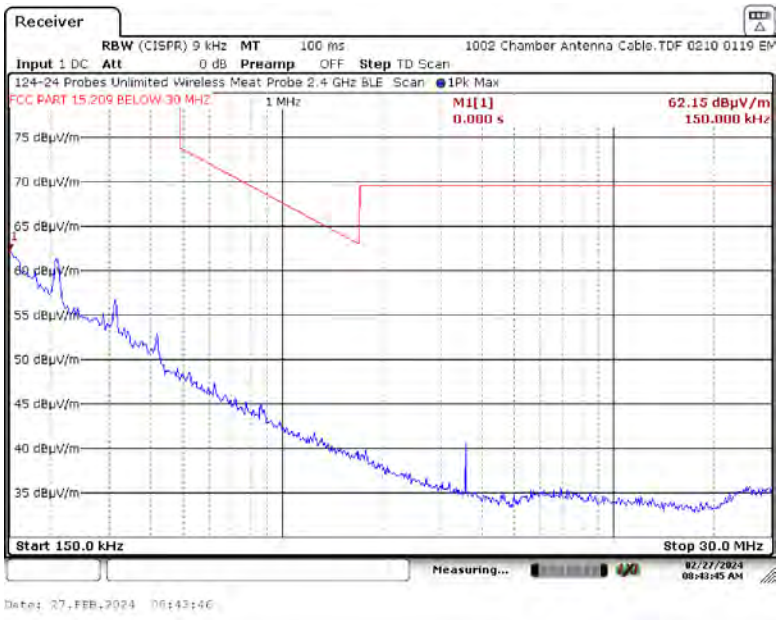
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

A2. Spurious Radiated Emissions (150 kHz – 30 MHz) Test Results

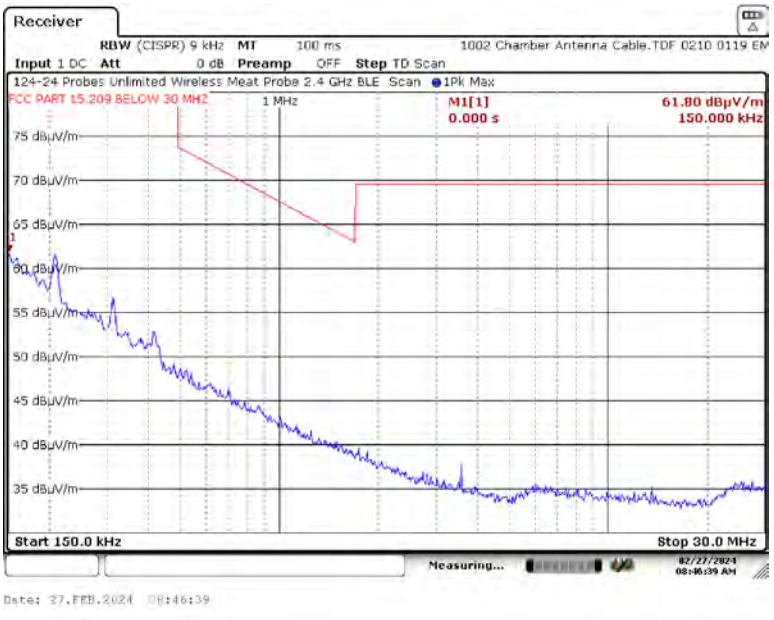
A2.1. All Three Channels

A2.1.3. Orthogonal Position: Z-Axis

A2.1.3.1. Measurement Results: Parallel Antenna



A2.1.3.2. Measurement Results: Perpendicular Antenna



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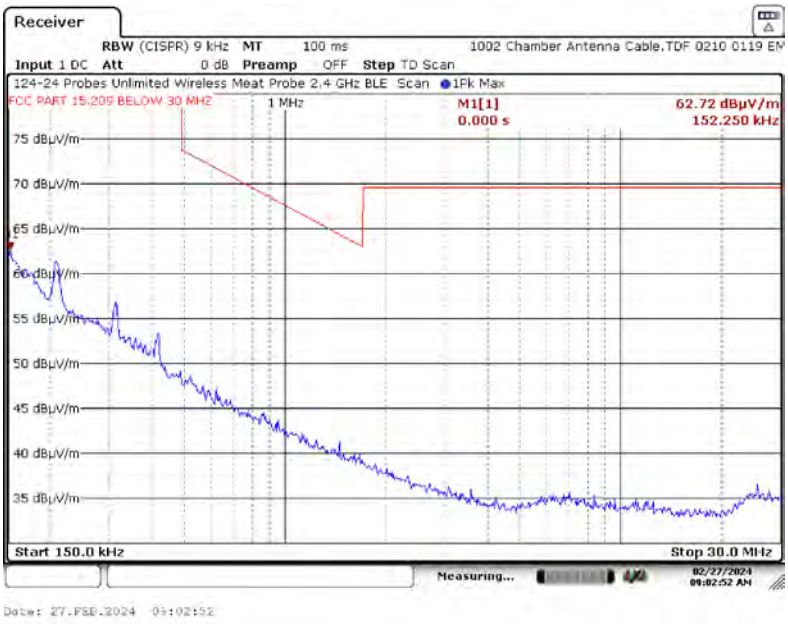
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

A2. Spurious Radiated Emissions (150 kHz – 30 MHz) Test Results

A2.1. All Three Channels

A2.1.3. Orthogonal Position: Z-Axis

A2.1.3.3. Measurement Results: Ground Parallel Antenna



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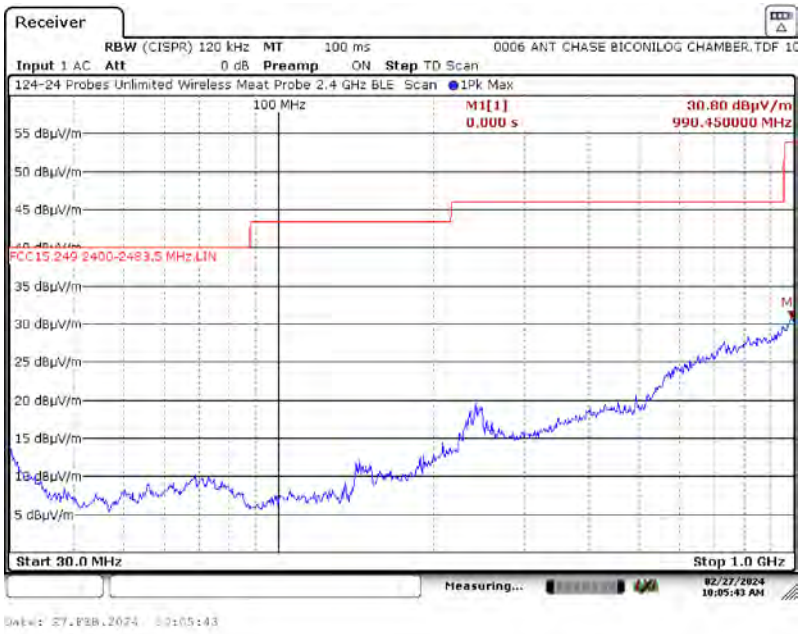
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

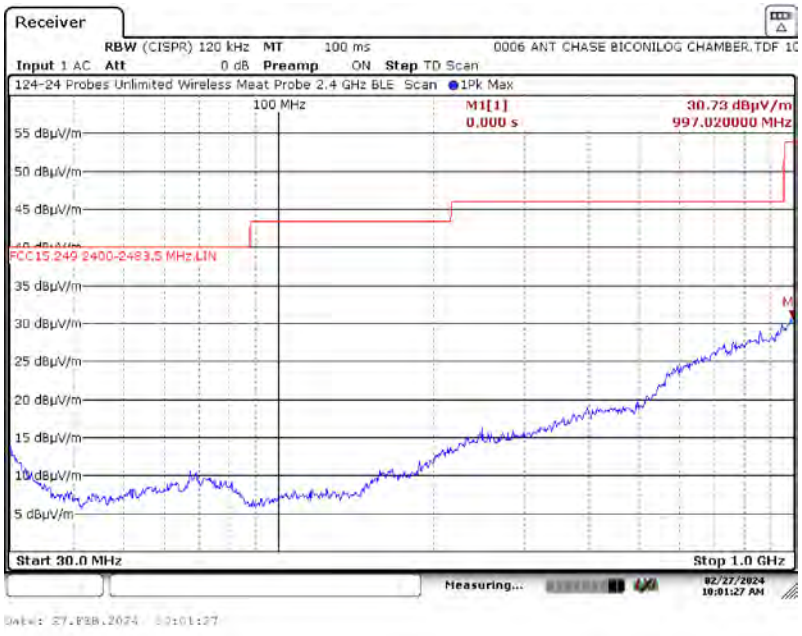
A3. Spurious Radiated Emissions (30 MHz – 1 GHz) Test Results

A3.1. All Three Channels

A3.1.1. Measurement Results: X-Axis, Horizontal Antenna



A3.1.2. Measurement Results: X-Axis, Vertical Antenna



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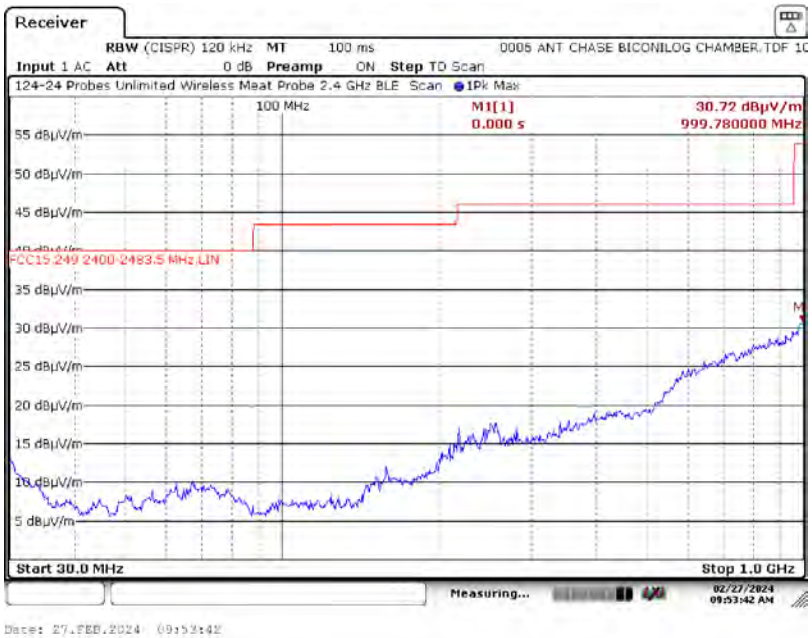
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

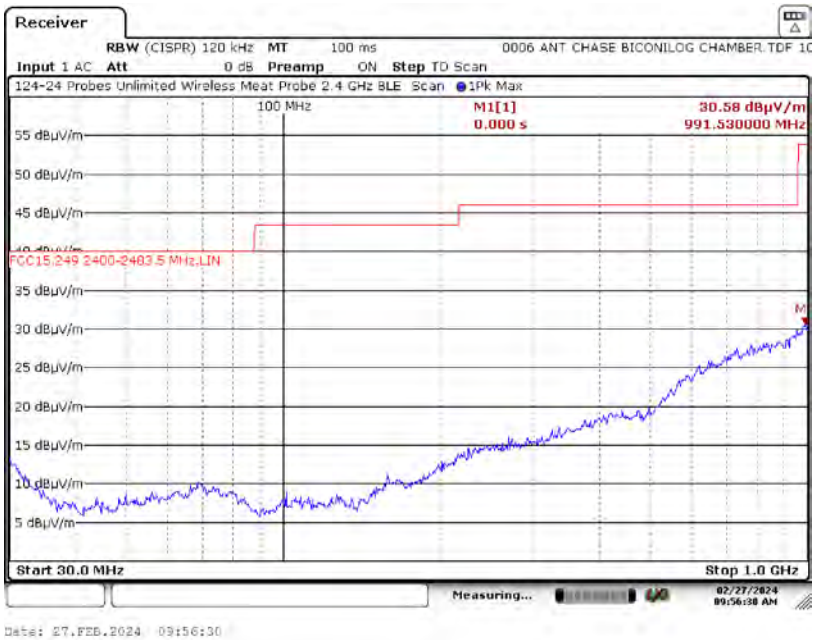
A3. Spurious Radiated Emissions (30 MHz – 1 GHz) Test Results

A3.1. All Three Channels

A3.1.3. Measurement Results: Y-Axis, Horizontal Antenna



A3.1.4. Measurement Results: Y-Axis, Vertical Antenna



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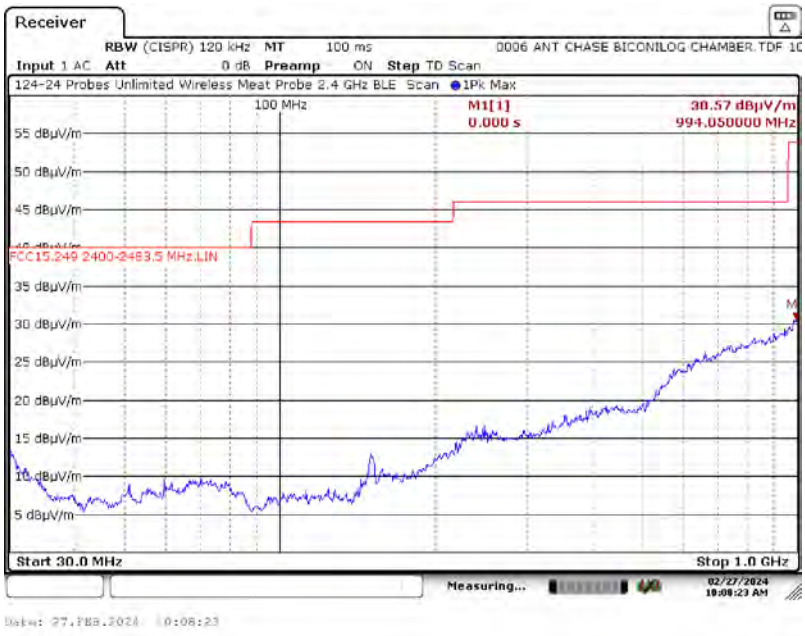
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

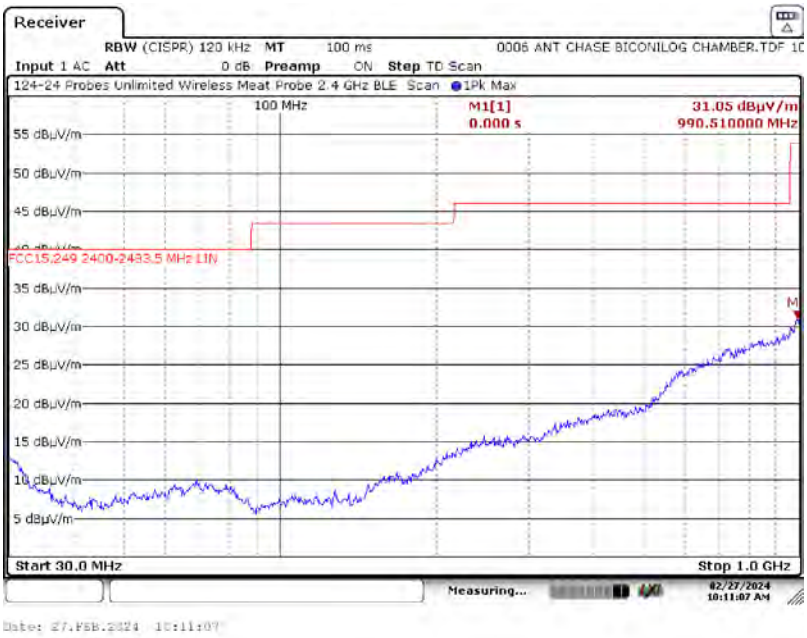
A3. Spurious Radiated Emissions (30 MHz – 1 GHz) Test Results

A3.1. All Three Channels

A3.1.5. Measurement Results: Z-Axis, Horizontal Antenna



A3.1.6. Measurement Results: Z-Axis, Vertical Antenna



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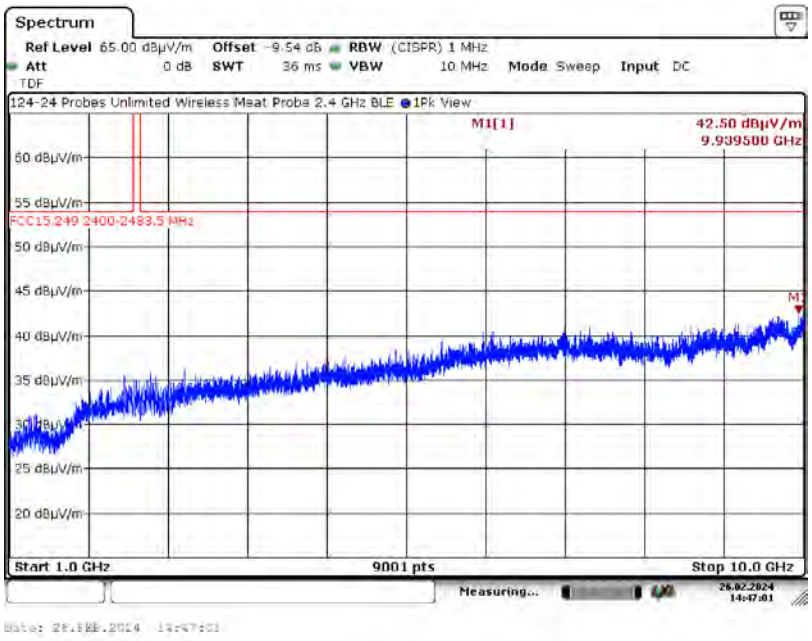
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

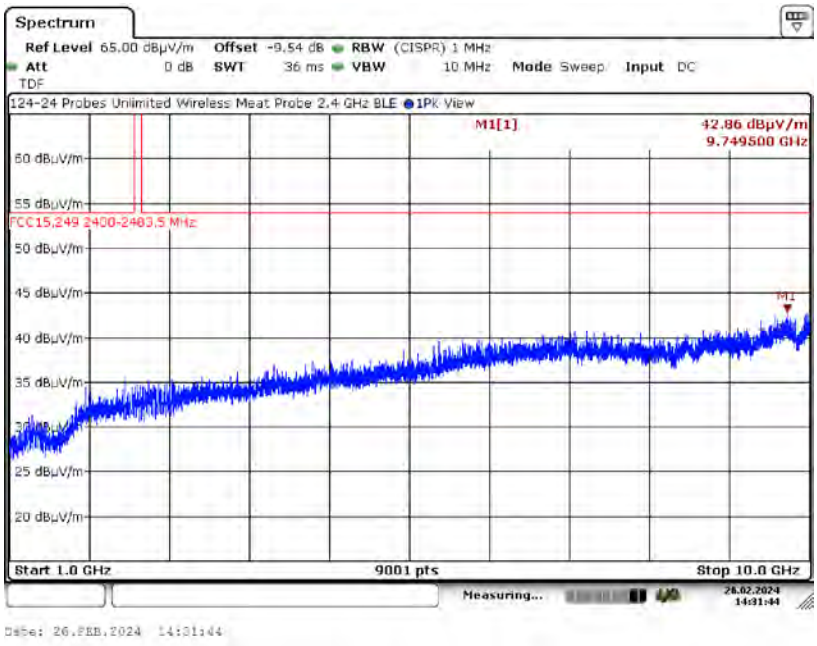
A4. Spurious Radiated Emissions (1 GHz – 10 GHz) Test Results

A4.1. All Three Channels

A4.1.1. Measurement Results: X-Axis, Horizontal Antenna



A4.1.2. Measurement Results: X-Axis, Vertical Antenna



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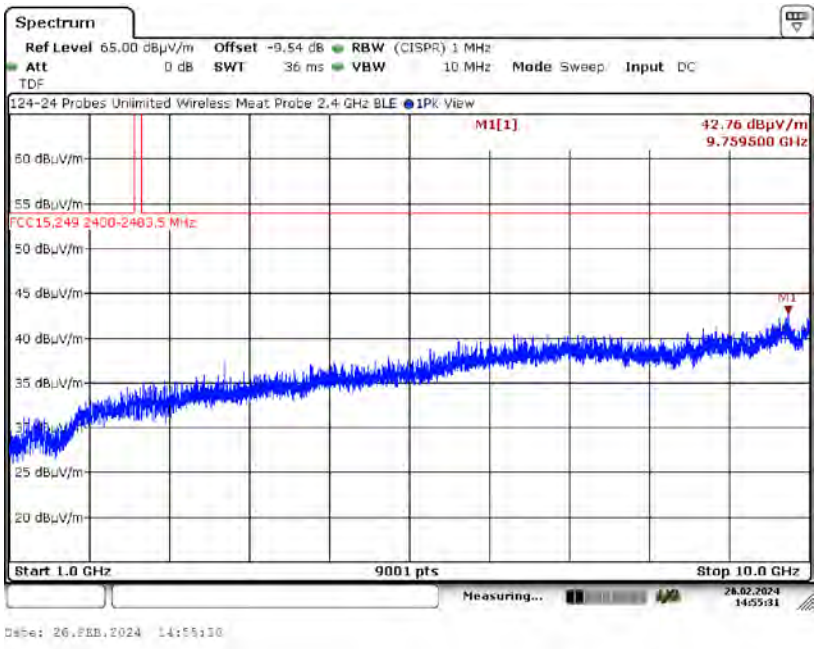
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

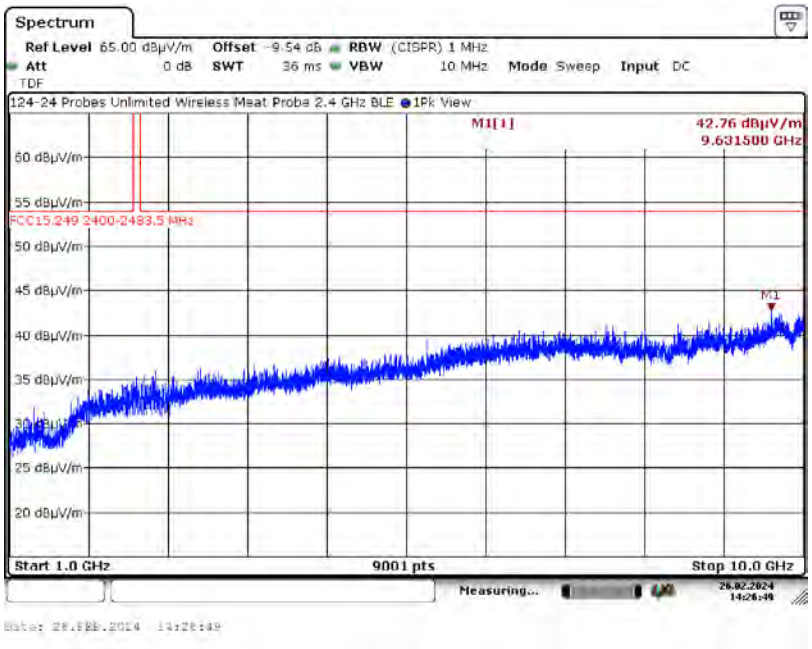
A4. Spurious Radiated Emissions (1 GHz – 10 GHz) Test Results

A4.1. All Three Channels

A4.1.3. Measurement Results: Y-Axis, Horizontal Antenna



A4.1.4. Measurement Results: Y-Axis, Vertical Antenna



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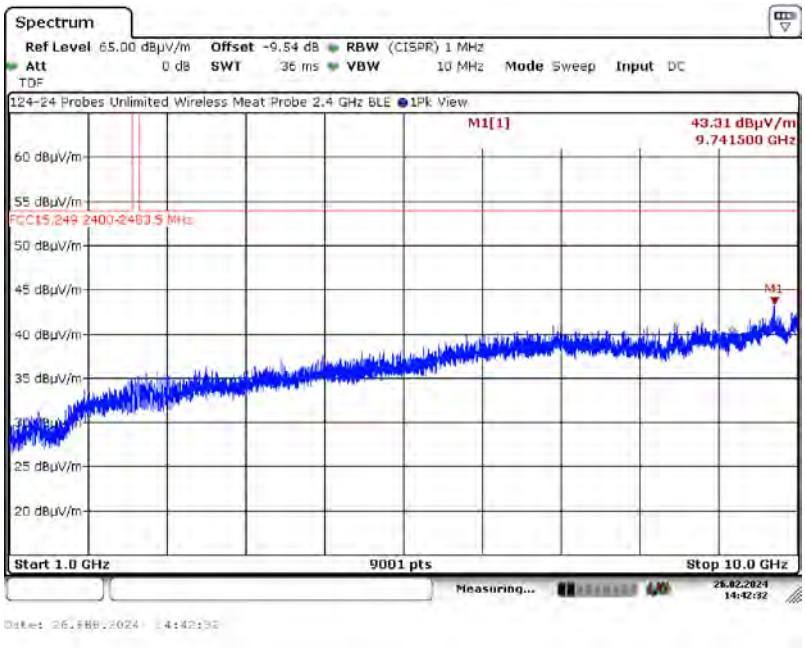
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

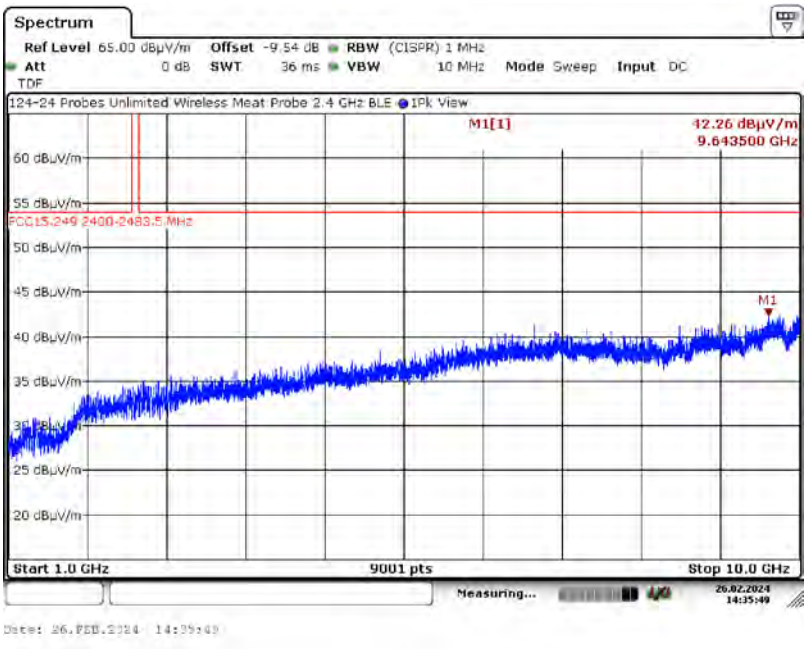
A4. Spurious Radiated Emissions (1 GHz – 10 GHz) Test Results

A4.1. All Three Channels

A4.1.5. Measurement Results: Z-Axis, Horizontal Antenna



A4.1.6. Measurement Results: Z-Axis, Vertical Antenna



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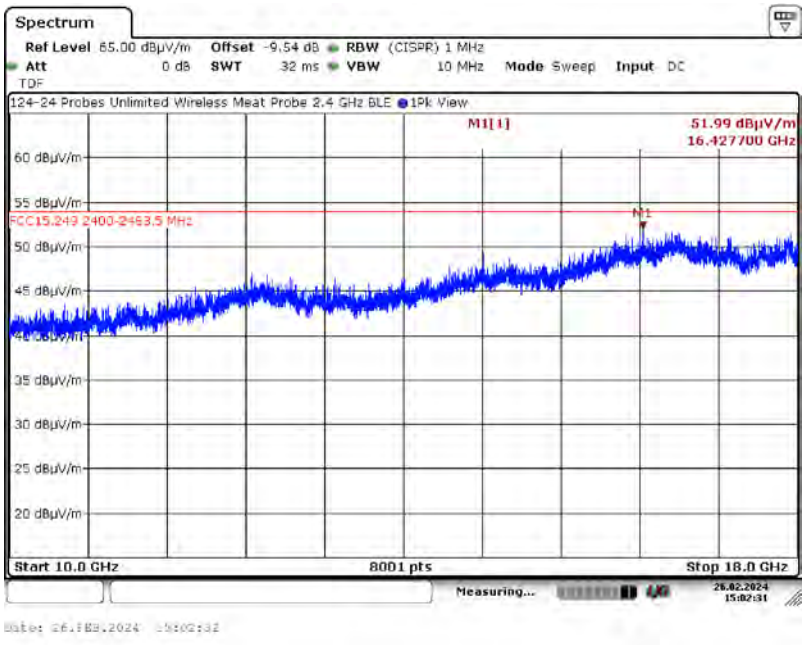
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

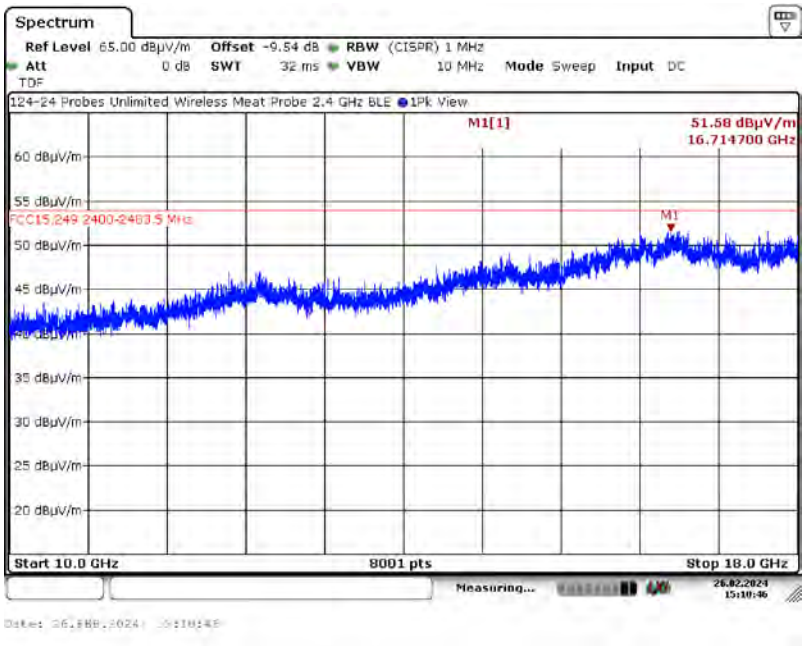
A5. Spurious Radiated Emissions (10 GHz – 18 GHz) Test Results

A5.1. All Three Channels

A5.1.1. Measurement Results: X-Axis, Horizontal Antenna



A5.1.2. Measurement Results: X-Axis, Vertical Antenna



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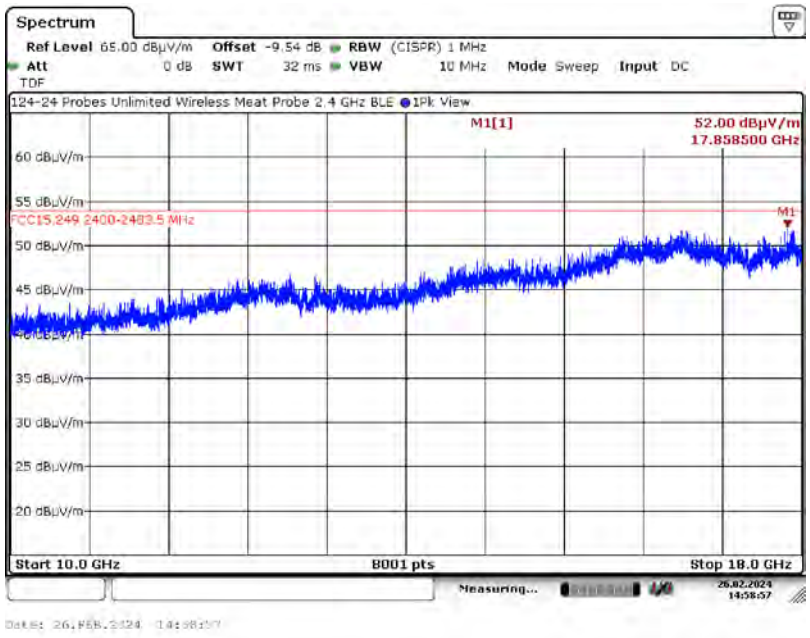
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

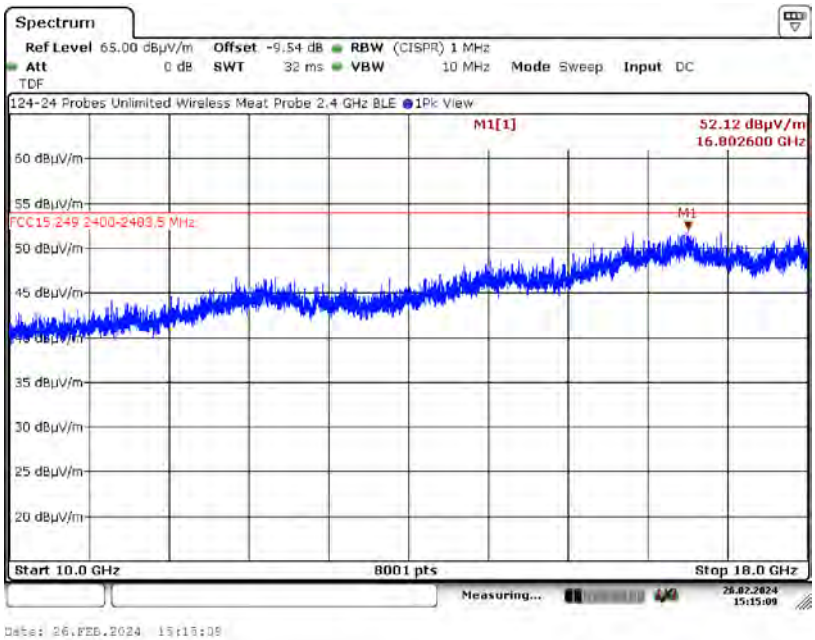
A5. Spurious Radiated Emissions (10 GHz – 18 GHz) Test Results

A5.1. All Three Channels

A5.1.3. Measurement Results: Y-Axis, Horizontal Antenna



A5.1.4. Measurement Results: Y-Axis, Vertical Antenna



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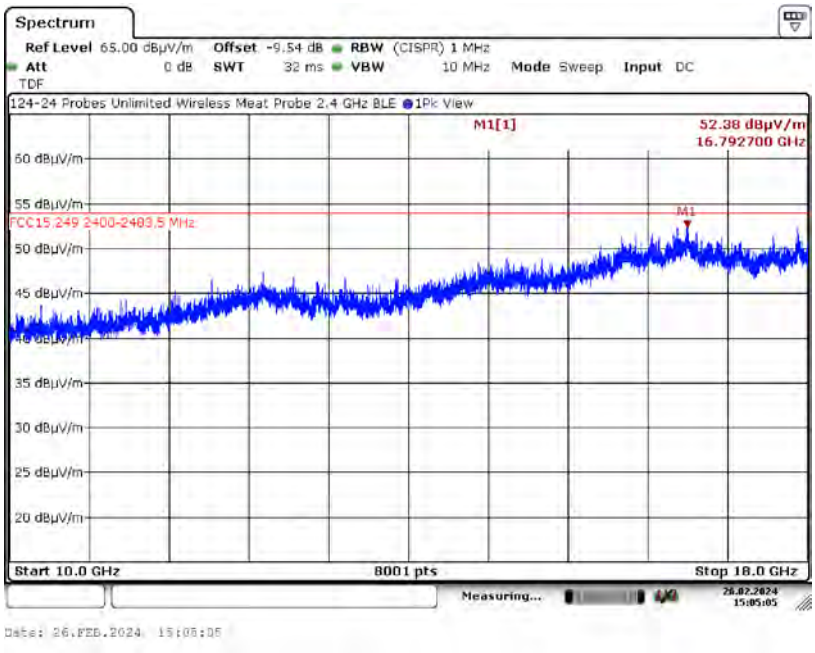
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

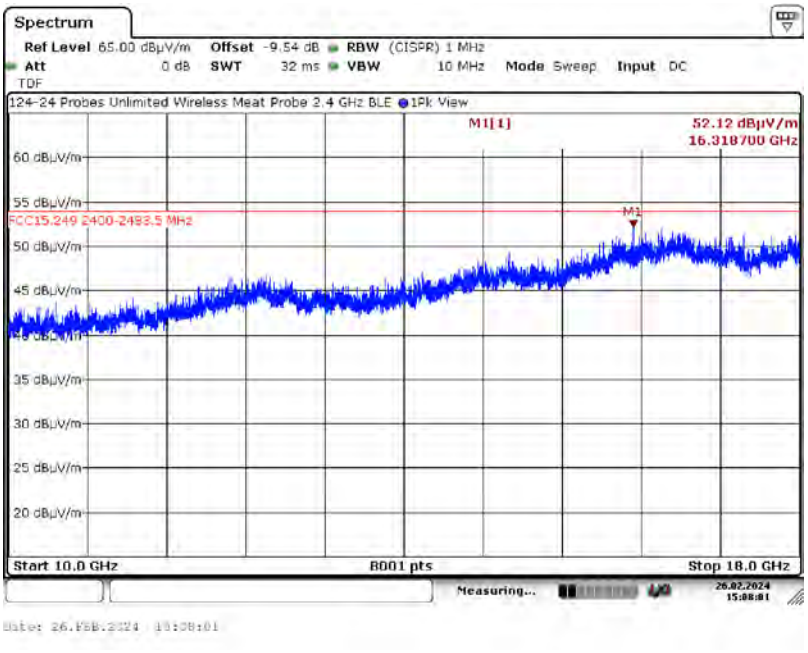
A5. Spurious Radiated Emissions (10 GHz – 18 GHz) Test Results

A5.1. All Three Channels

A5.1.5. Measurement Results: Z-Axis, Horizontal Antenna



A5.1.6. Measurement Results: Z-Axis, Vertical Antenna



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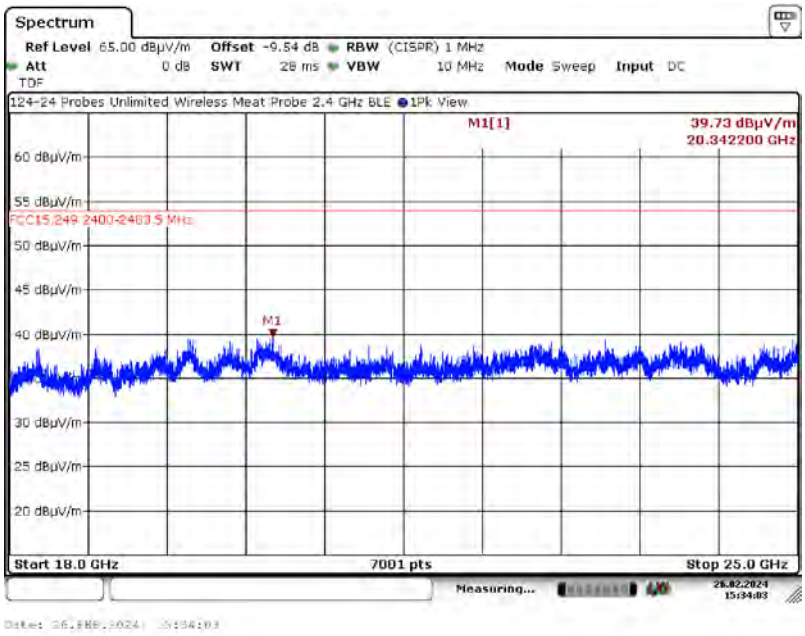
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

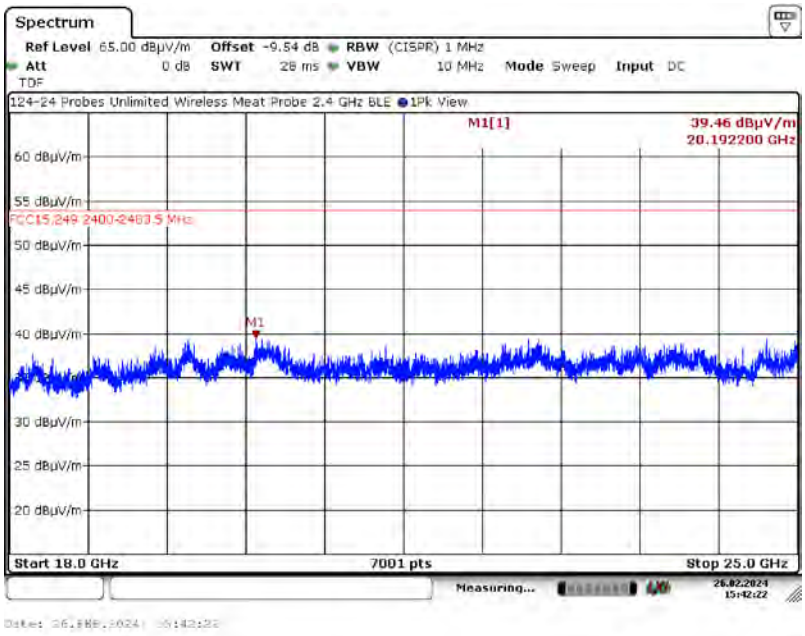
A6. Spurious Radiated Emissions (18 GHz – 25 GHz) Test Results

A6.1. All Three Channels

A6.1.1. Measurement Results: X-Axis, Horizontal Antenna



A6.1.2. Measurement Results: X-Axis, Vertical Antenna



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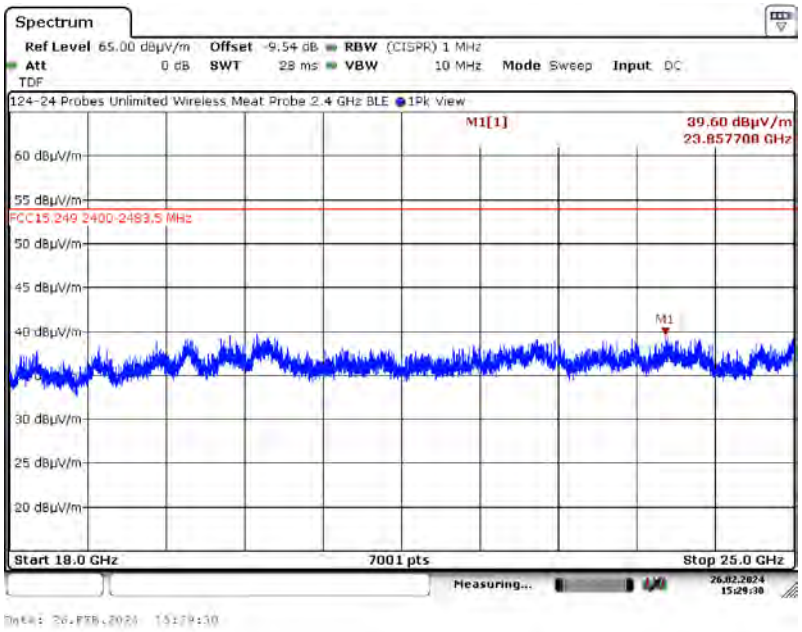
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

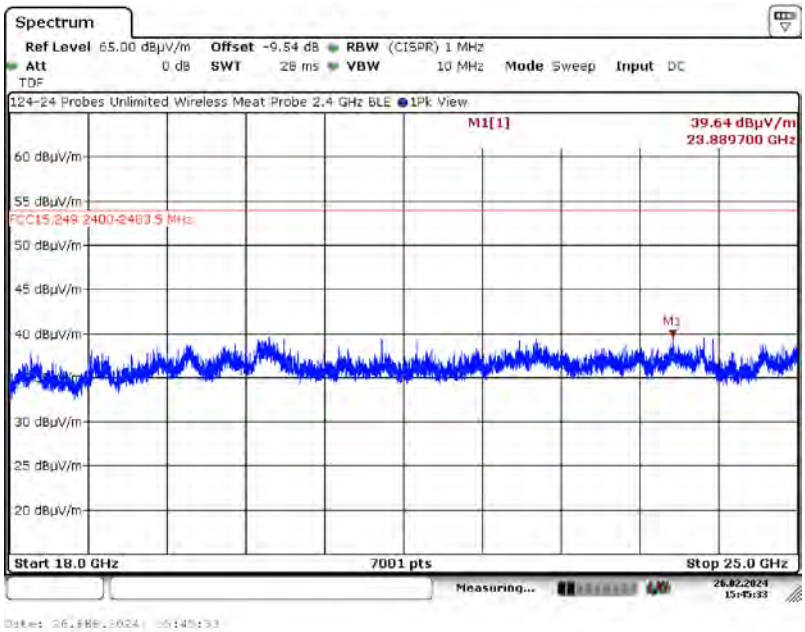
A6. Spurious Radiated Emissions (18 GHz – 25 GHz) Test Results

A6.1. All Three Channels

A6.1.3. Measurement Results: Y-Axis, Horizontal Antenna



A6.1.4. Measurement Results: Y-Axis, Vertical Antenna



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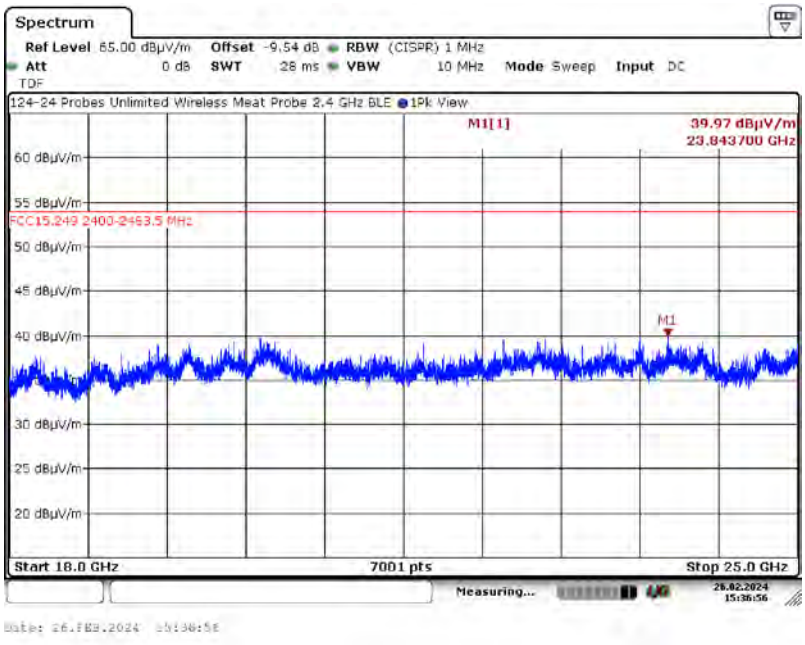
Appendix A - Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

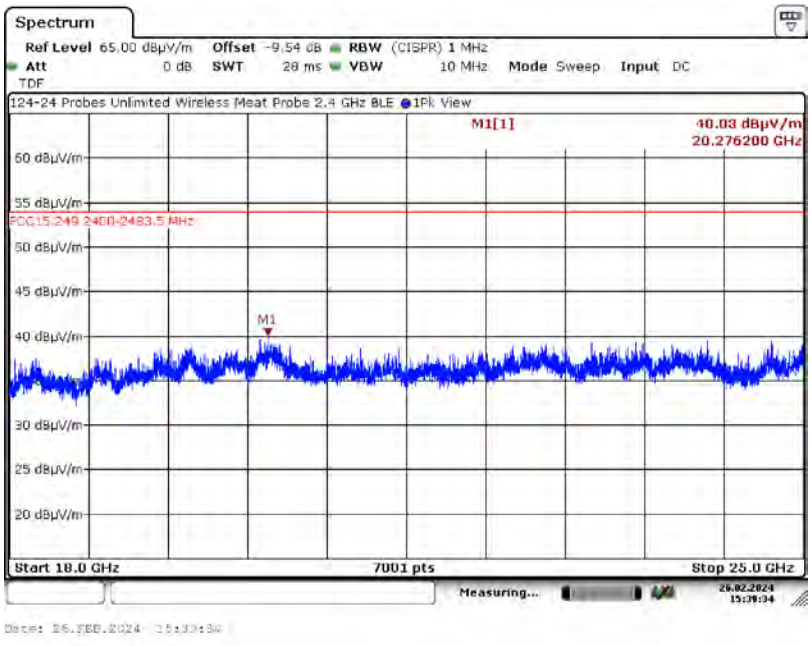
A6. Spurious Radiated Emissions (18 GHz – 25 GHz) Test Results

A6.1. All Three Channels

A6.1.5. Measurement Results: Z-Axis, Horizontal Antenna



A6.1.6. Measurement Results: Z-Axis, Vertical Antenna



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