FCC / ISED Test Report

For:
Visteon Corporation

Brand:
Visteon

Marketing Name:
CSCLG

Model Name:
CSCLG

Product Description:
Cell Supervisory Circuit (CSC) is a sensing circuit installed on or adjacent to the cell modules. Their main function is to measure cell voltages and temperatures, as well as perform cell-balancing operations.

FCC ID: NT8-CSCLG
IC: 3043A-CSCLG

Applied Rules and Standards:
47 CFR Part 15.247 (DTS)
RSS-247 Issue 3 (DTS) & RSS-Gen Issue 5

REPORT #: EMC_VISTE_002_23001_FCC15247_DTS_CSCLG_Rev1

DATE: 2024-02-20

A2LA Accredited

IC recognized # 3462B

***CETECOM* Inc.**
411 Dixon Landing Road ◆ Milpitas, CA 95035 ◆ U.S.A.
Phone: + 1 (408) 586 6200 ◆ Fax: + 1 (408) 586 6299 ◆ E-mail: info@cetecom.com ◆ http://www.cetecom.com
CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

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1 Assessment

The following device was evaluated against the applicable criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations and the relevant ISED Canada standard RSS-247.

No deviations were ascertained.

Company Name	Product Description	Model No.
Visteon Corporation	Cell Supervisory Circuit (CSC) is a sensing circuit installed on or adjacent to the cell modules. Their main function is to measure cell voltages and temperatures, as well as perform cell-balancing operations.	CSCLG

Responsible for the Report:

Date	Section	Name	Signature
2024-02-20	Compliance	Guangcheng Huang (Senior EMC Engineer)	

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
EMC Lab Manager:	Issa Ghama
Responsible Project Leader:	Akanksha Baskaran

2.2 Identification of the Client

Applicant's Name:	Visteon Corporation
Street Address:	One Village Center Drive,
City/Zip Code	Van Buren Township, MI, 48111
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as client
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Product Description:	Vehicular device (Wireless Battery Management)
Product Application:	Cell Supervisory Circuit (CSC) is a sensing circuit installed on or adjacent to the cell modules. Their main function is to measure cell voltages and temperatures, as well as perform cell-balancing operations.
Model Name :	CSCLG
HW Version :	VPRE1F-12B684-FF
SW Version :	SWE202-28418-003F00
FCC ID :	NT8-CSCLG
IC :	3043A-CSCLG
Frequency Range / number of channels:	2405 - 2480 MHz / Channels 0-15
Bands/Modes Supported	**Wireless Technologies** Proprietary Protocol: 802.15.4 1 Mbps date rate
Modes of Operation:	Proprietary Protocol: 802.15.4 2400 MHz - 2483.5 MHz ISM Band Modulation: GFSK Nominal Channel Bandwitdth: 5 MHz
Antenna Information as declared:	Peak gain 2.6 dBi Internal Antenna FR4 Antenna Part No : A1001013 CSC
Max. Peak Output Power:	Conducted Power : 8.05dBm
Other Radios included in the device	N/A
Power Supply/ Rated Operating Voltage Range	Min. 12.5 V, Nom . 29.6 V, Max. 36 V powered by the vehicle battery power system
Operating Temperature Range	Low : -40 °C Norm 20 °C High 85 °C
Sample Revision	☐Production ☒ Pre-Production
EUT Dimensions	30 mm x 278 mm x 5 mm
Weight	100 grams
EUT Diameter	☒< 60 cm ☐ Other _____
Note: All information provided by applicant N/A: not available	

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	NA	VPRE1F-12B684-FF	SWE202-28418-003F00	Radiated emissions
2	NA	VPRE1F-12B684-FF	SWE202-28418-003F00	Conducted emissions

NA: not available

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
1	USB cable	NA	NA	NA

NA: not available

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#2 + AE#1	The radio of the EUT was configured to a fixed channel transmission with highest possible duty cycle using software that is not available to the end user. This is setup for the conducted measurement.
2	EUT#1 + AE#1	The radio of the EUT was configured to a fixed channel transmission with highest possible duty cycle using software that is not available to the end user. This is setup for the radiated measurement.

3.5 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	TX continuous	EUT continuously transmitting modulated signal with max. power setting: 12 dBm (according to operational instruction from customer)

3.6 Justification for Worst Case Mode of Operation

During the testing process, the EUT was tested with transmitter sets on low, mid and high channels, and highest possible duty cycle is higher than 98%. For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the performance of the EUT according to the relevant requirements specified in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-247 of ISED Canada.

This test report is to support a request for new equipment authorization under the FCC ID: NT8-CSCLG IC: 3043A-CSCLG

4.1 Test procedures and standards applied

- FCC part 15, Subpart C §15.247
- KDB 558074 D01 15.247 Meas Guidance v05r02
- RSS-247 issue 2 Feb. 2017
- RSS-Gen issue 5 April 2018
- ANSI C63.10:2013

5 Measurement Results Summary

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	NA	NP	Result
FCC §15.247(a)(2) RSS-247 5.2(a) RSS-Gen 6.7	Emission Bandwidth	Nominal	TX	☑	☐	☐	Complies
FCC §15.247(e) RSS-247 5.2(b)	Power Spectral Density	Nominal	TX	☑	☐	☐	Complies
FCC §15.247(b)(3) RSS-247 5.4(d)	Maximum Conducted Output Power and EIRP	Nominal	TX	☑	☐	☐	Complies
FCC §15.247(d) RSS-247 5.5	Band Edge Compliance Unrestricted Band Edges	Nominal	TX	☑	☐	☐	Complies
FCC §15.247; 15.209; 15.205 RSS-Gen 8.9; 8.10	Band Edge Compliance Restricted Band Edges	Nominal	TX	☑	☐	☐	Complies
§15.247(d); §15.209 RSS-Gen 6.13	TX Spurious emissions-Radiated	Nominal	TX	☑	☐	☐	Complies
§15.207(a) RSS Gen 8.8	AC Conducted Emissions	Nominal	TX	☑	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.

6 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=2.

Radiated measurement

Measurement System		EMC 1	EMC 2
Conducted emissions (mains port)		1.12 dB	0.46 dB
Radiated emissions	(< 30 MHz)	3.66 dB	3.88 dB
	(30 MHz – 1GHz)	3.17 dB	3.34 dB
	(1 GHz – 3 GHz)	5.01 dB	4.45 dB
	(>3 GHz)	4.0 dB	4.79 dB

RF conducted measurement ±0.5 dB

According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: http://physics.nist.gov/cuu/Uncertainty/typeb.html. The above calculated uncertainties apply to direct application of the Substitution method. The Substitution method is always used when the EUT comes closer than 3dB to the limit.

6.1 Environmental Conditions During Testing:

The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25°C
- Relative humidity: 40-60%

6.2 Dates of Testing:

2024-01-03 – 2024-01-11

6.3 Decision Rule:

Cetecom advanced follows ILAC G8:2019 chapter 4.2.1 (Simple Acceptance Rule).

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3. The measurement uncertainty is mentioned in this test report, See chapter 9, but is not taken into account – neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong.

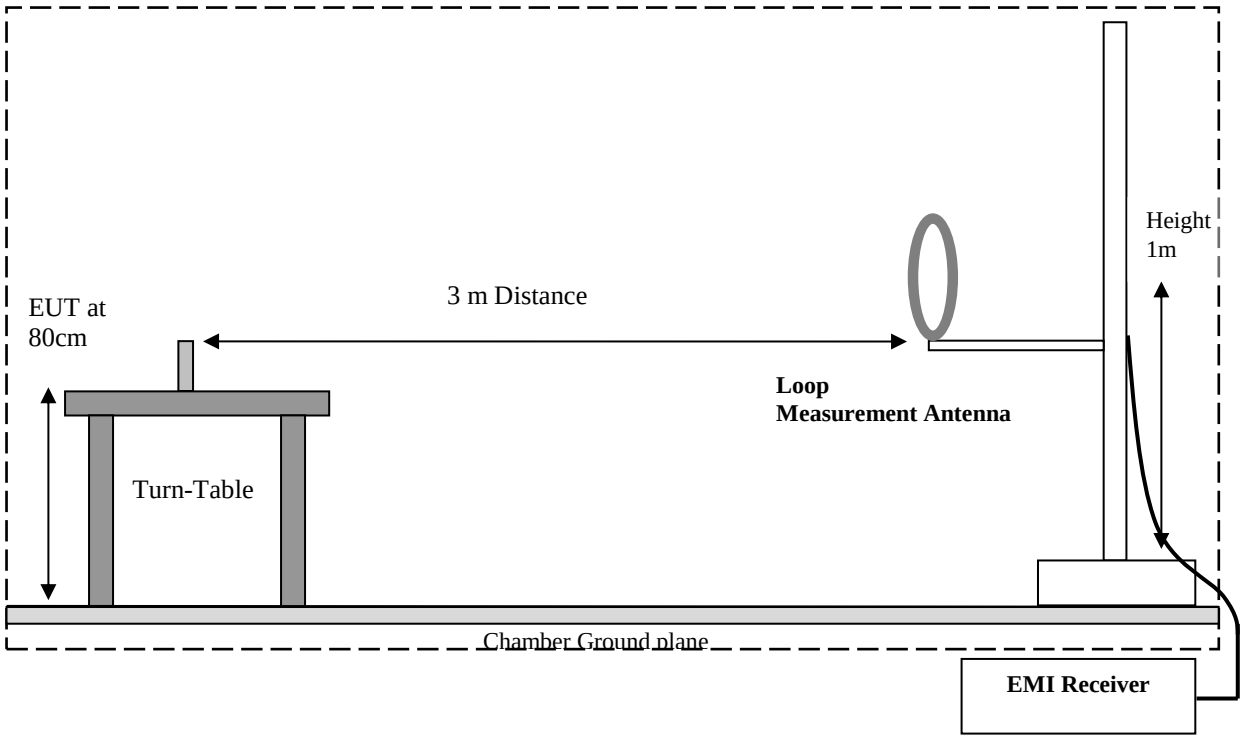
7 Measurement Procedures

7.1 Radiated Measurement

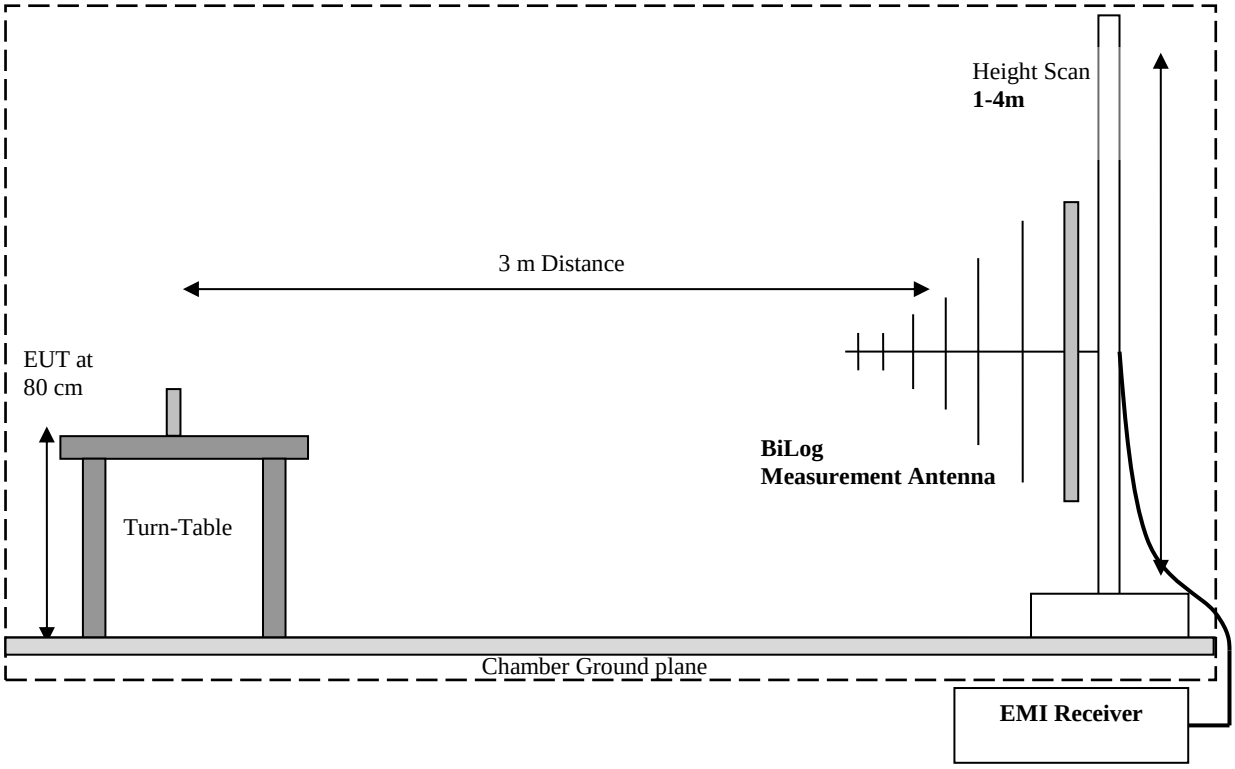
The radiated measurement is performed according to ANSI C63.10 (2013)

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 360° continuous measurement of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The highest six emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.

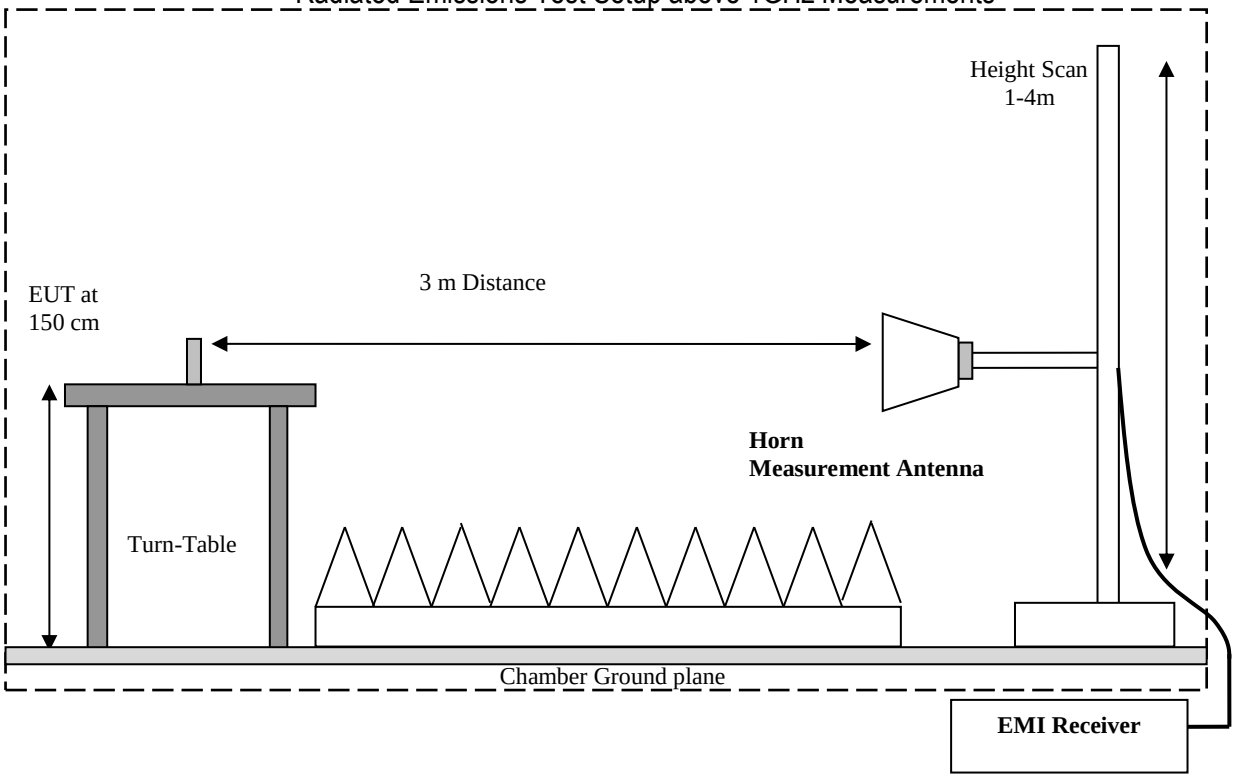
Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



7.1.1 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

FS (dBµV/m) = Measured Value on SA (dBµV) + Cable Loss (dB) + Antenna Factor (dB/m)

Example:

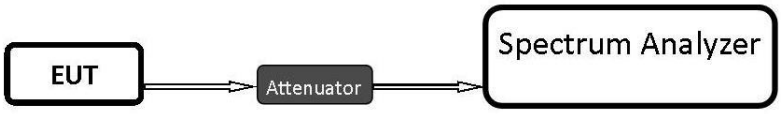
Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

7.2 Power Line Conducted Measurement Procedure

AC Power Line conducted emissions measurements performed according to: ANSI C63.4 (2014)

7.3 RF Conducted Measurement Procedure

Testing procedures are based on 558074 D01 15.247 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 FCC RULES" - April 2, 2019, by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.



- Connect the equipment as shown in the above diagram.
- Adjust the settings of the SA (Rohde-Schwarz Spectrum Analyzer) to connect the EUT at the required mode of test.
- Measurements are to be performed with the EUT set to the low, middle and high channels and for worst case modulation schemes.

8 Test Result Data

8.1 Emission Bandwidth 6dB and 99% Occupied Bandwidth

8.1.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

Spectrum Analyzer settings:

99% Occupied Bandwidth:

- Set frequency = nominal EUT channel center frequency
- Set Span = 1.5 x to 5.0 x OBW
- Set RBW = 1% to 5% of OBW
- Set the video bandwidth (VBW) ≈ 3 x RBW
- Detector = Peak
- Trace mode = Max hold
- Sweep = Auto couple
- Allow the trace to stabilize
- Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth
- If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.

6dB (DTS) Bandwidth:

- Set RBW = 100 kHz
- Set the video bandwidth (VBW) ≥ 3 x RBW
- Detector = Peak
- Trace mode = Max hold
- Sweep = Auto couple
- Allow the trace to stabilize
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

8.1.2 Limits:

FCC §15.247(a)(2) and RSS-247 5.2(a)

- 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.

8.1.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
22 °C	1	TX	nominal

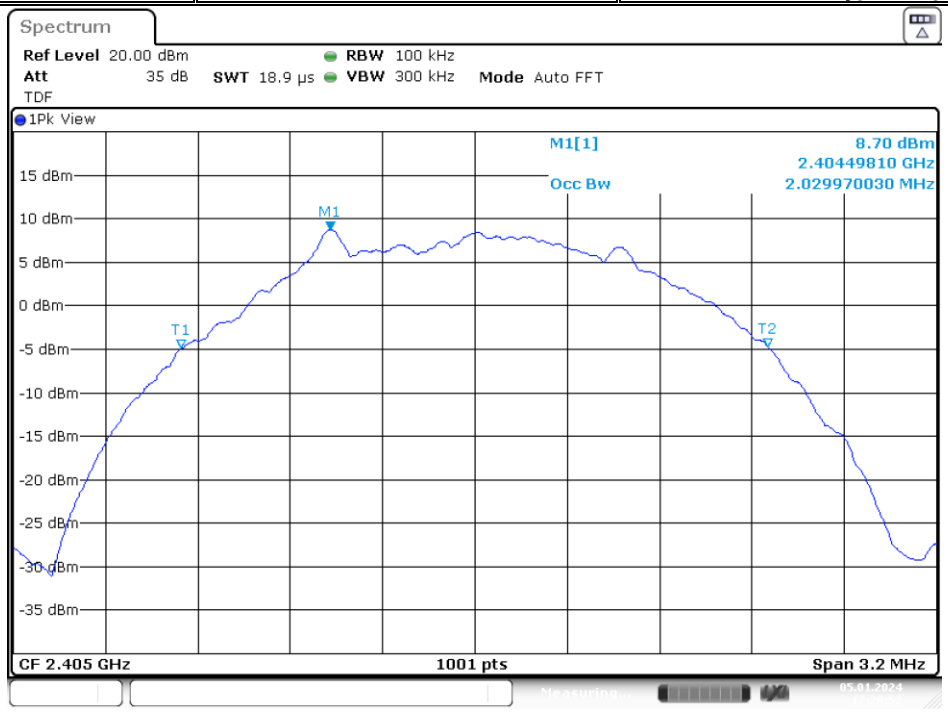
8.1.4 Measurement result:

Plot #	Channel	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
1	0	2.030	-	For info only
2	8	2.033	-	For info only
3	15	2.030	-	For info only

Plot #	Channel	6dB Emissions Bandwidth (MHz)	Limit (MHz)	Result
4	0	1.3676	> 0.5	Pass
5	8	1.3612	> 0.5	Pass
6	15	1.3874	> 0.5	Pass

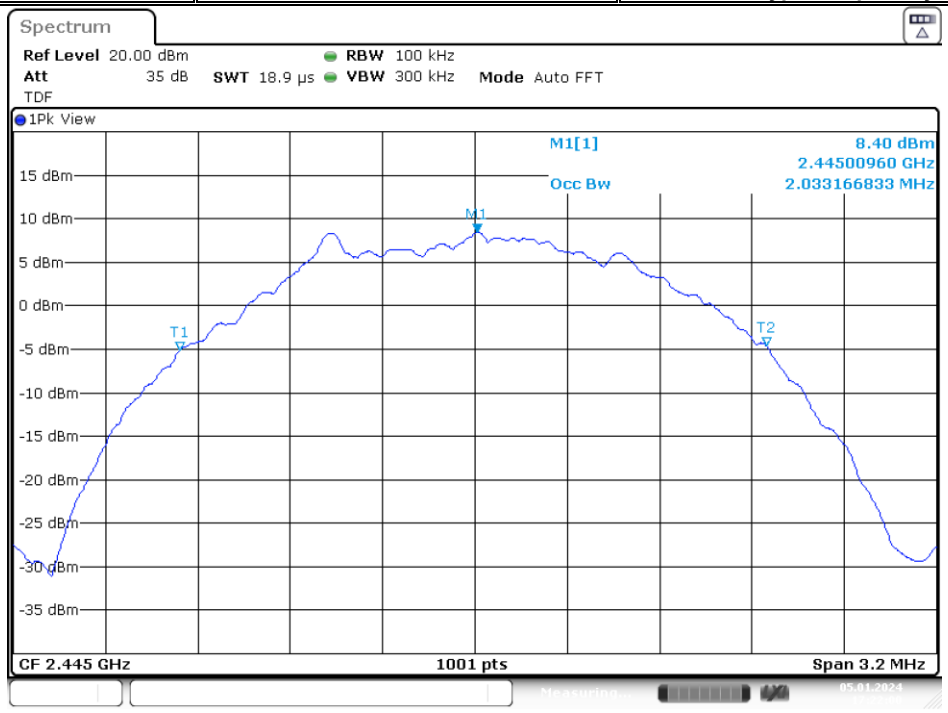
8.1.5 Measurement Plots: 99% OBW

Plot #1	Ch 0	Modulation/Packet Type: Proprietary



Date: 5.JAN.2024 17:20:53

Plot #2	Ch 8	Modulation Type: Proprietary



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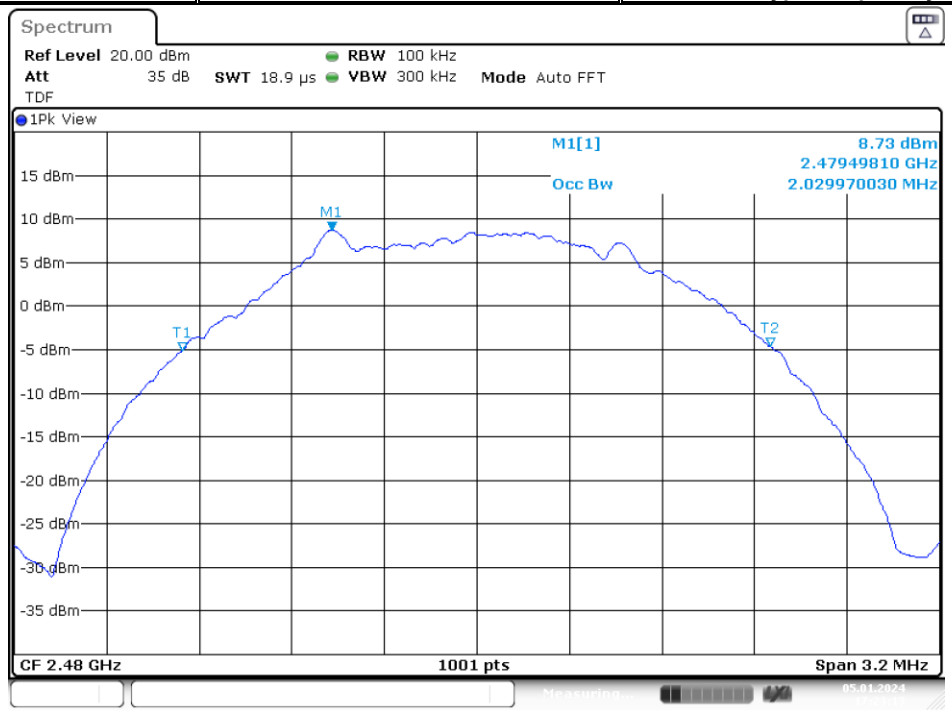
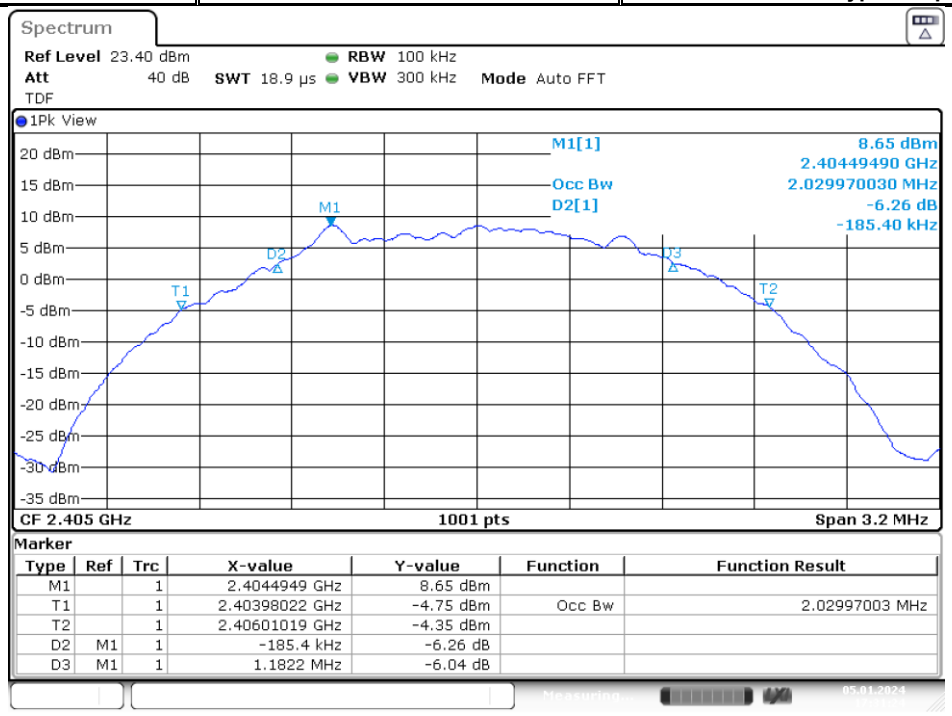
Plot #3	Ch 15	Modulation Type: Proprietary

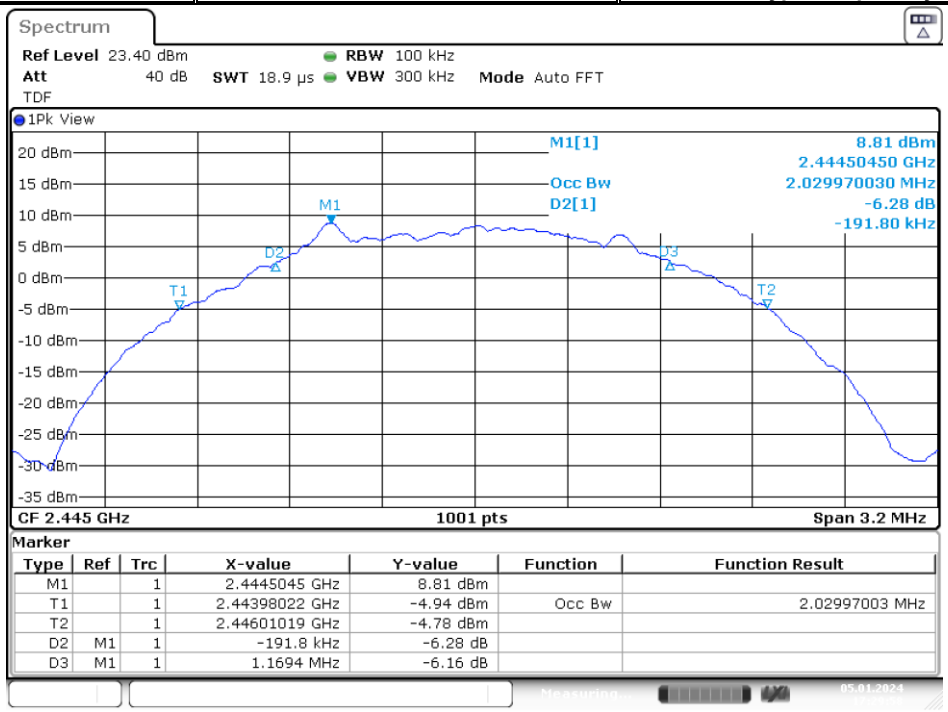


8.1.6 Measurement Plots: 6dB BW

Plot #4	Ch 0	Modulation/Packet Type: Proprietary



Plot #5	Ch 8	Modulation Type: Proprietary



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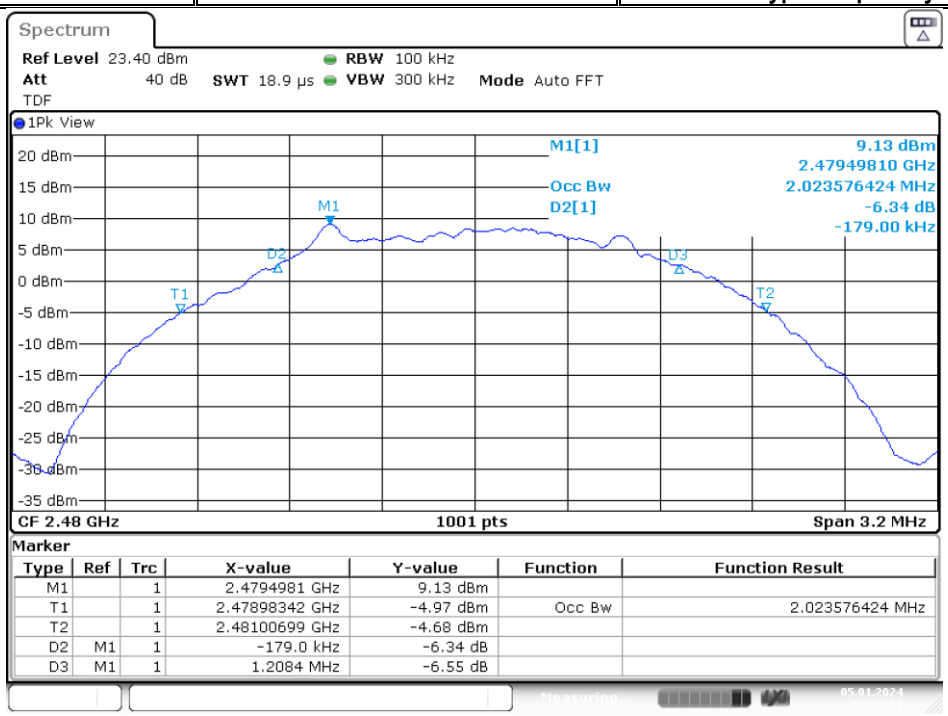
Plot #6	Ch 15	Modulation Type: Proprietary



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8.2 Maximum Peak Conducted Output Power

8.2.1 Measurement according to ANSI C63.10-2013, chap.11

Spectrum Analyzer settings according to mentioned ANSI, sec.11.9.2.2.2 Method AVGSA-1:

8.2.2 Limits:

Maximum Peak Output Power:

- FCC §15.247 (b)(3): 1 W (30 dBm)
- IC RSS-247 5.4(d): 1 W (30 dBm)

8.2.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
22 °C	1	TX	nominal	2.6 dBi *

Note *: information provided by applicant

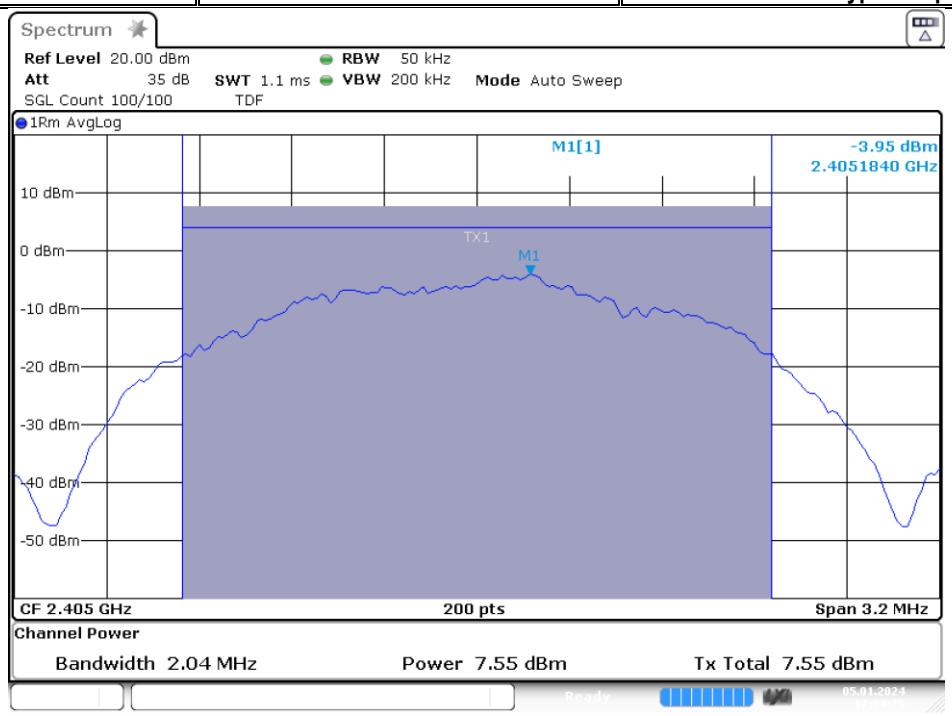
8.2.4 Measurement result:

Plot #	Channel	Maximum Peak Conducted Output Power (dBm)	EIRP (dBm)	Limit (dBm)	Result
7	0	7.55	10.15 *	30 (PK) / 36 (EIRP)	Pass
8	8	7.49	10.09 *	30 (PK) / 36 (EIRP)	Pass
9	15	8.05	10.65 *	30 (PK) / 36 (EIRP)	Pass

Note *: results based on calculation utilizing antenna gain information provided by applicant

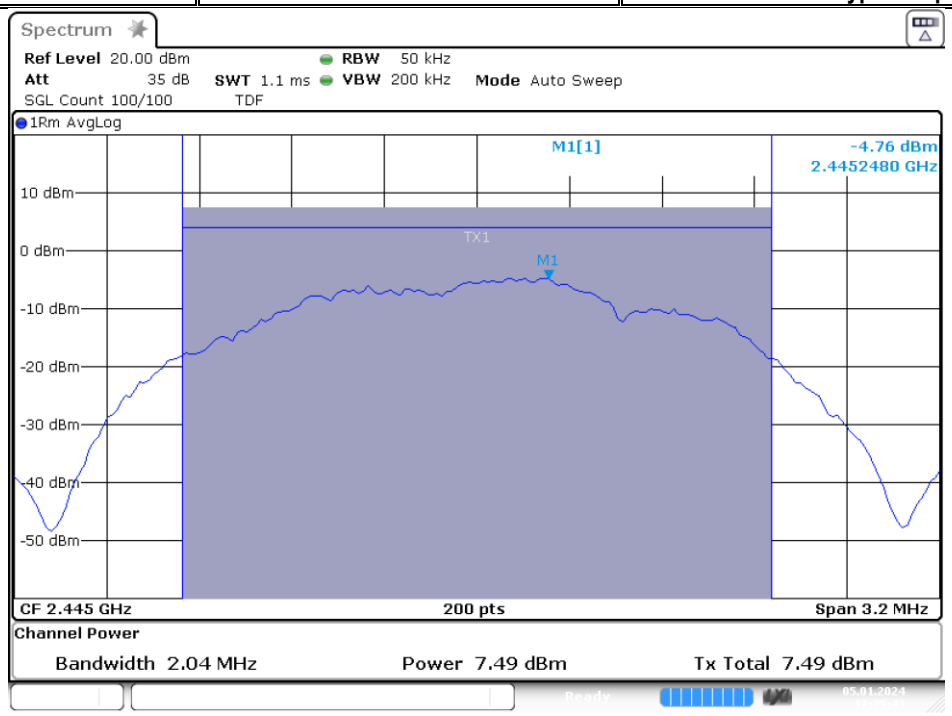
8.2.5 Measurement Plots:

Plot #7	Ch 0	Modulation/Packet Type: Proprietary



Date: 5.JAN.2024 17:34:25

Plot #8	Ch 8	Modulation/Packet Type: Proprietary



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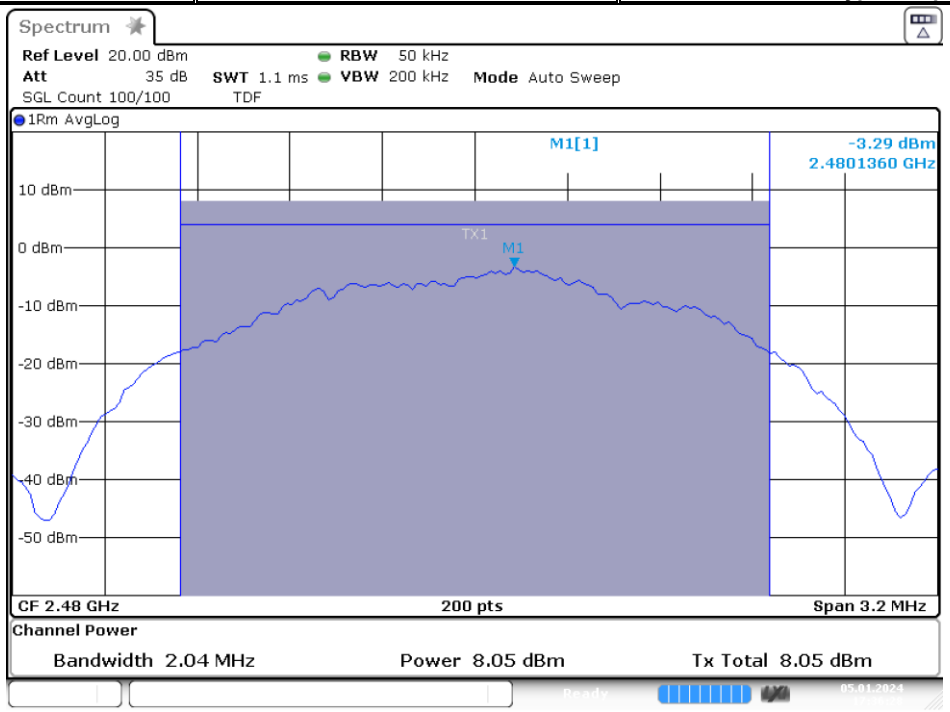
Plot #9	Ch 15	Modulation/Packet Type: Proprietary



8.3 Power Spectral Density

8.3.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

Spectrum Analyzer settings for Peak PSD method:

- Set analyzer center frequency to DTS channel center frequency
- Set the span to 1.5 x DTS bandwidth
- Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz
- Set the VBW ≥ 3 x RBW
- Detector = Peak
- Sweep time = Auto couple
- Trace mode = Max hold
- Allow trace to fully stabilize
- Use the peak marker function to determine the maximum amplitude level within the RBW
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat

8.3.2 Limits:

FCC§15.247(e) & RSS-247 5.2(b)

- For digitally modulated systems, the peak 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.

8.3.3 Test conditions and setup:

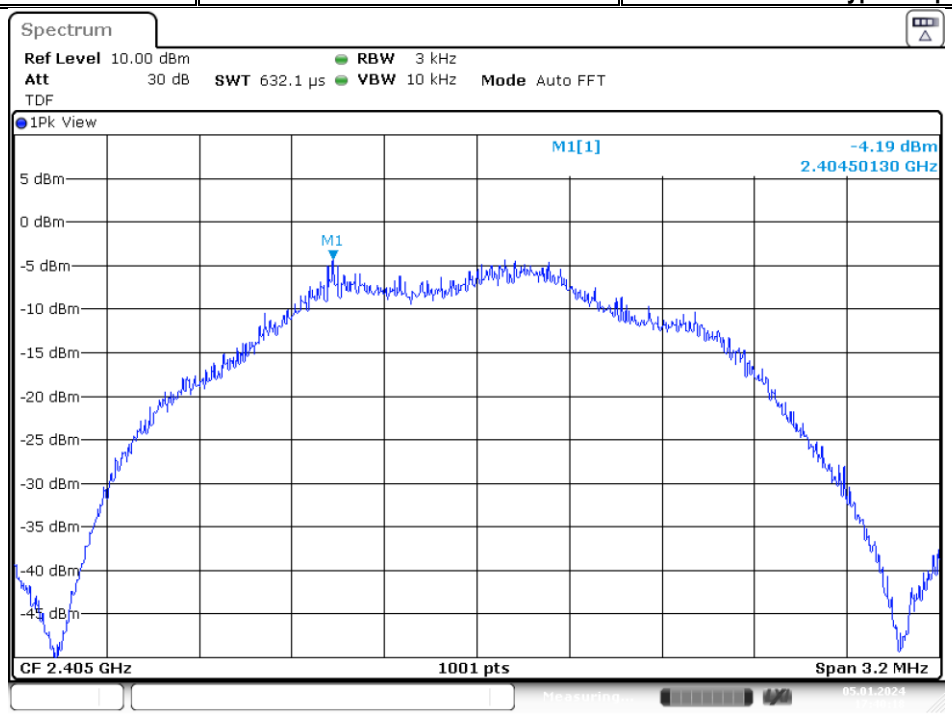
Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
22 °C	1	TX	nominal

8.3.4 Measurement result:

Plot #	Channel	Maximum Power Spectral Density (dBm/3 kHz)	Limit (dBm / 3 kHz)	Result
10	0	-4.19	8	Pass
11	8	-4.33	8	Pass
12	15	-3.74	8	Pass

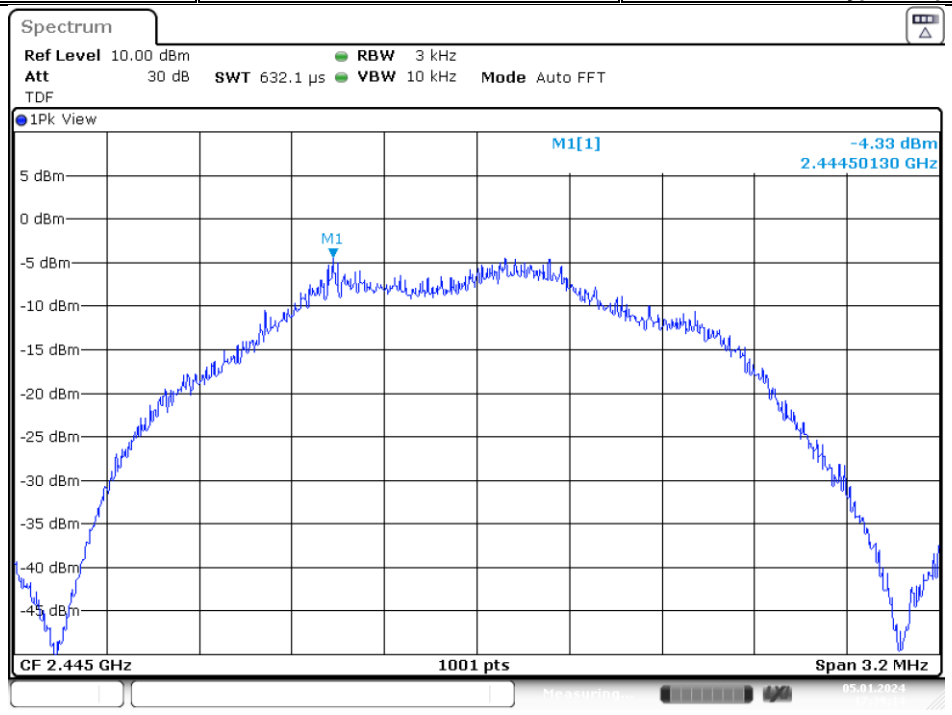
8.3.5 Measurement Plots:

Plot #10	Ch 0	Modulation/Packet Type: Proprietary



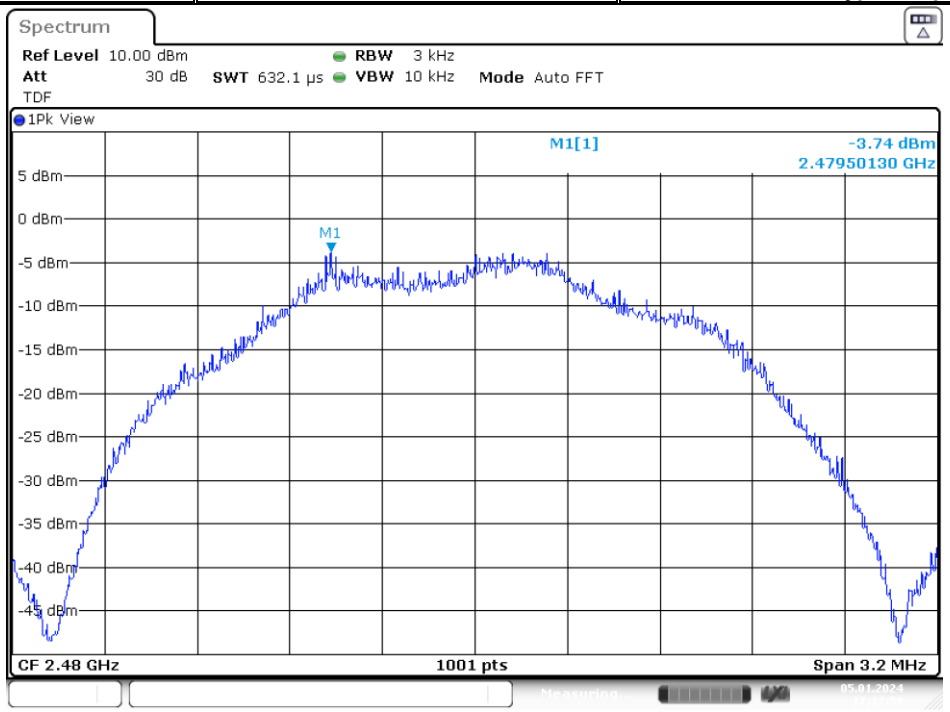
Date: 5.JAN.2024 17:40:18

Plot #11	Ch 8	Modulation/Packet Type: Proprietary



Date: 5.JAN.2024 17:39:14

Plot #12	Ch 15	Modulation/Packet Type: Proprietary



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8.4 Duty cycle

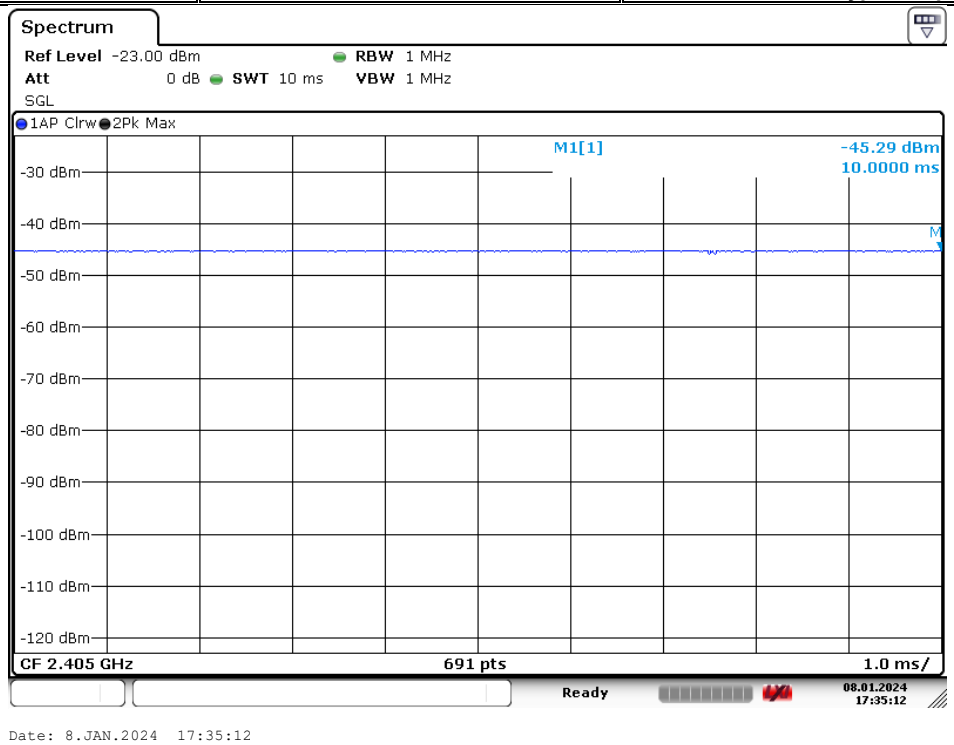
8.4.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

Spectrum Analyzer settings:

- Set the center frequency and of the instrument to the center frequency of the transmission
- Zero span
- Set RBW >=OBW if possible; otherwise, set RBW to the largest available value
- Detector = Peak or average

8.4.2 Measurement result

Plot #13	Ch 0	Modulation/Packet Type: Proprietary



Duty cycle = 100%
Duty cycle correction factor = 10*log(1/1) = 0 dB

8.5 Band Edge Compliance (conducted and radiated)

8.5.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

Spectrum Analyzer settings for band edge:

- Set the center frequency and span to encompass frequency range to be measured
- RBW = 100 kHz
- VBW ≥ 3 x RBW
- Sweep Time: Auto couple
- Detector = Peak
- Trace = Max hold
- Allow trace to fully stabilize
- Use the peak marker function to determine the maximum amplitude level
- Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge

8.5.2 Limits non restricted band:

FCC§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 §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

RSS-247 5.5

- 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 30dB instead of 20dB.

Spectrum Analyzer settings for restricted band:

- Peak measurements are made using a peak detector and RBW=100 kHz

8.5.3 Limits restricted band §15.247/15.209/15.205 and RSS-Gen 8.9/8.10

- *PEAK LIMIT= 74 dBµV/m @3m =-21.23 dBm
- *AVG. LIMIT= 54 dBµV/m @3m =-41.23 dBm
- Start frequency & stop frequency according to frequency range specified in the restricted band table in FCC section 15.205 & RSS-Gen 8.10
- Measurements with a peak detector were used to show compliance to average limits, thus showing compliance to both peak and average limits.

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

8.5.4 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
22 °C	1 (low band edge) 2 (high band edge)	TX	nominal

8.5.5 Measurement result: band edge (conducted and radiated)

Plot #	EUT operating mode	Band Edge	Band Edge Delta (dBc)	Detector	Limit (dBc)	Result
15	TX	Lower, Non-restricted (conducted)	58.55	RMS	min. 30	Pass

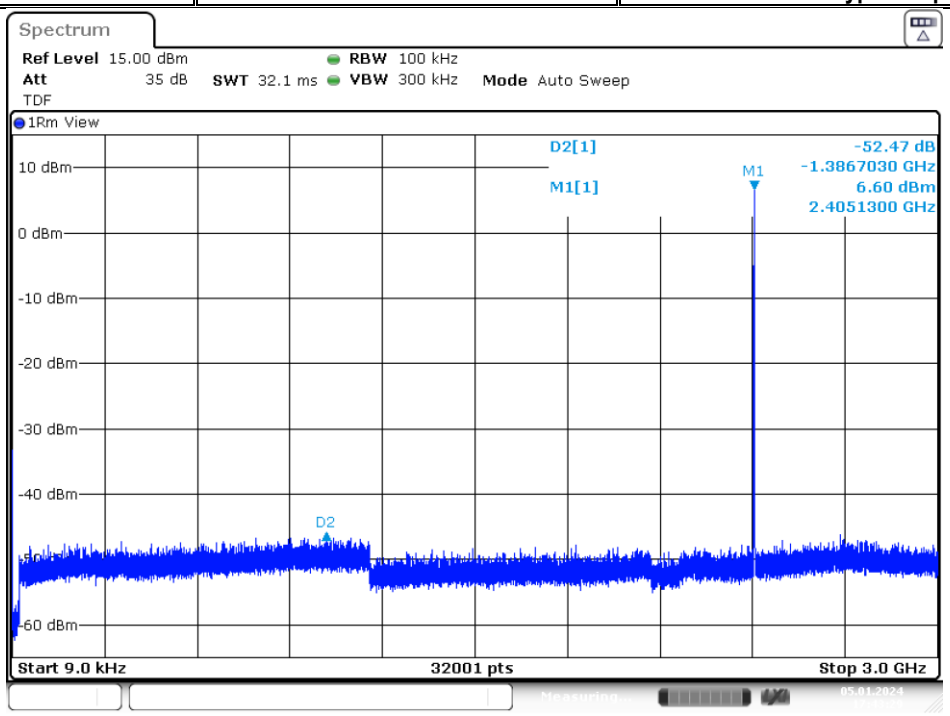
Plot #	EUT operating mode	Band Edge	Band Edge Level (dBµV/m)	Limit (dBµV/m)	Result
34	TX	Upper, Restricted Peak (radiated)	53.92 PK	74 PK	Pass
34	TX	Upper, Restricted AVG (radiated)	41.64 AV	54 AV	Pass

8.5.6 Measurement result: conducted spurious emission

Plot #	EUT operating mode	Frequency range	Measured lowest margin (dBc)	Limit (dBc)	Result
14-23	TX, channel 0	30 MHz – 18 GHz	48.95	min. 30	Pass
24-32	TX, channel 8	9 kHz – 27 GHz	48.82	min. 30	Pass
33-42	TX, channel 15	30 MHz – 18 GHz	48.99	min. 30	Pass

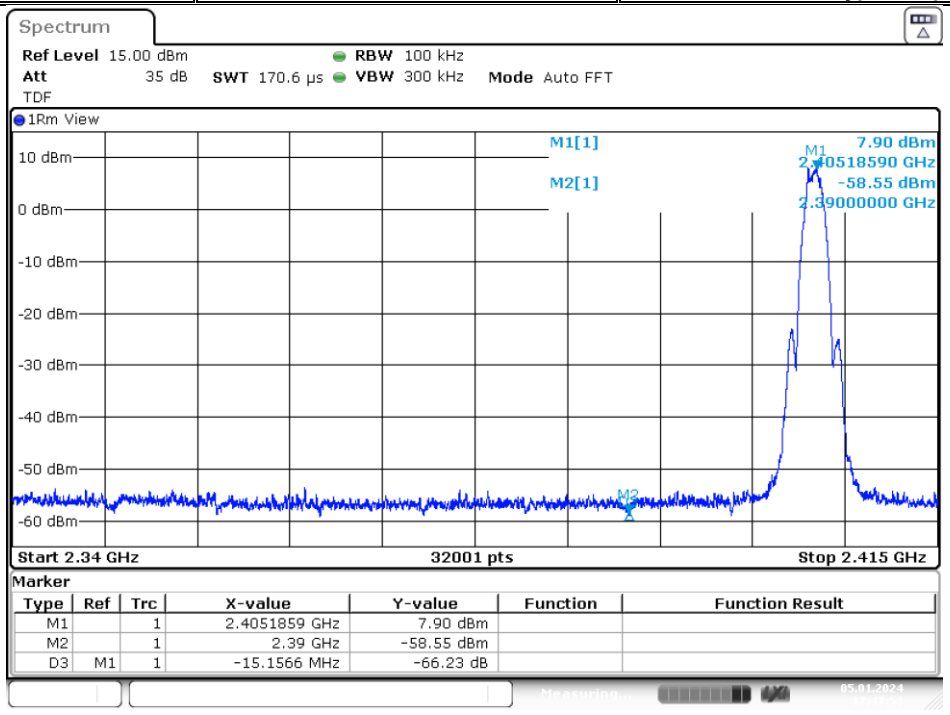
8.5.7 Measurement Plots: channel 0

Plot #14	Ch 0	Modulation/Packet Type: Proprietary



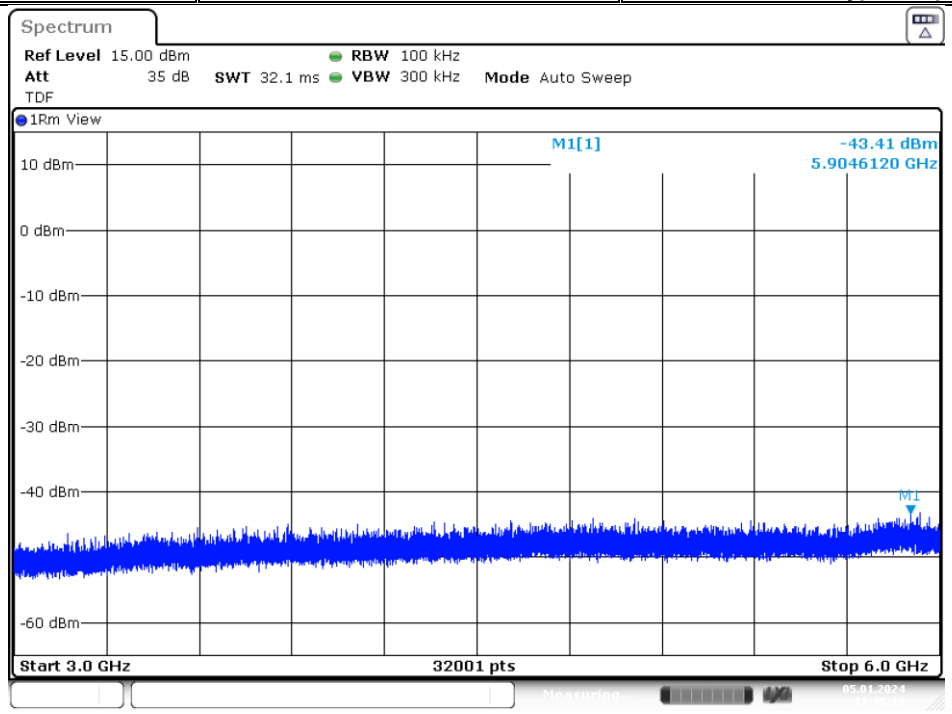
Date: 5.JAN.2024 17:43:29

Plot #15	Ch 0	Modulation/Packet Type: Proprietary



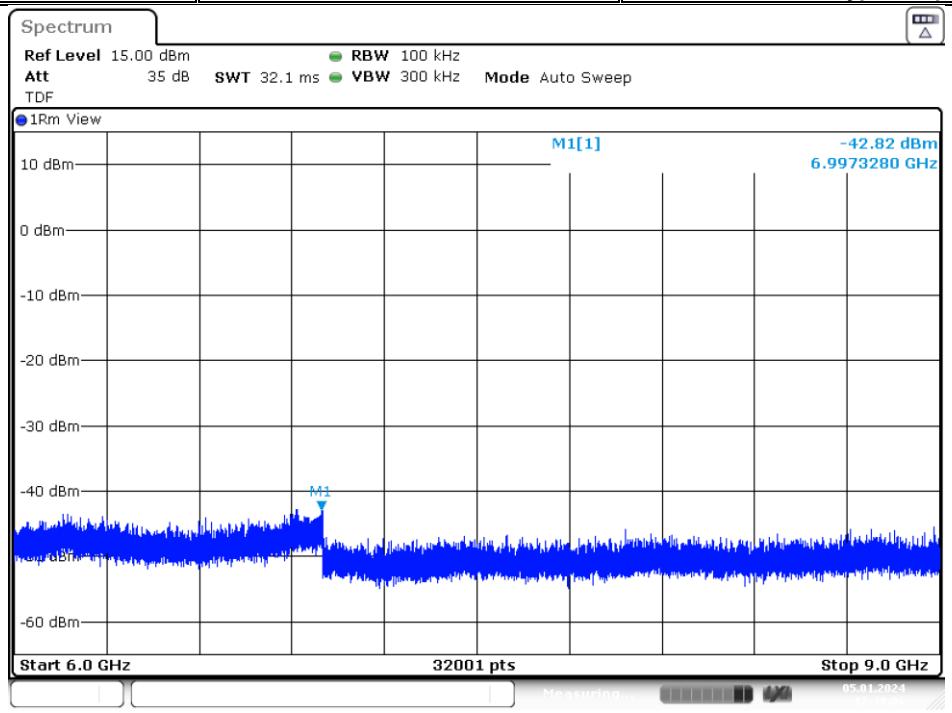
Date: 5.JAN.2024 17:47:53

Plot #16	Ch 0	Modulation/Packet Type: Proprietary



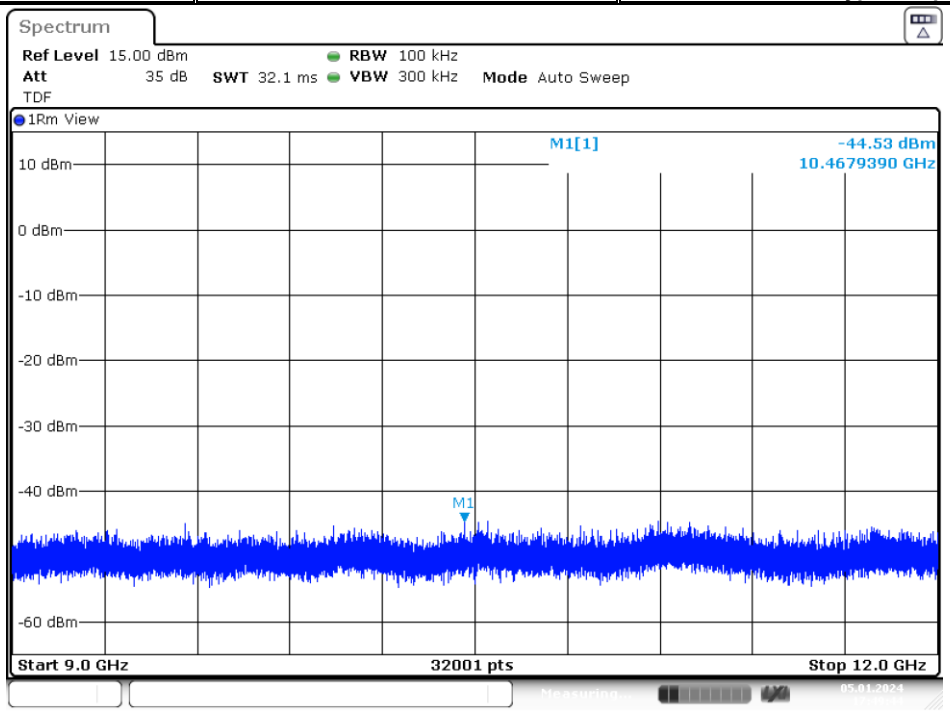
Date: 5.JAN.2024 17:45:30

Plot #17	Ch 0	Modulation/Packet Type: Proprietary



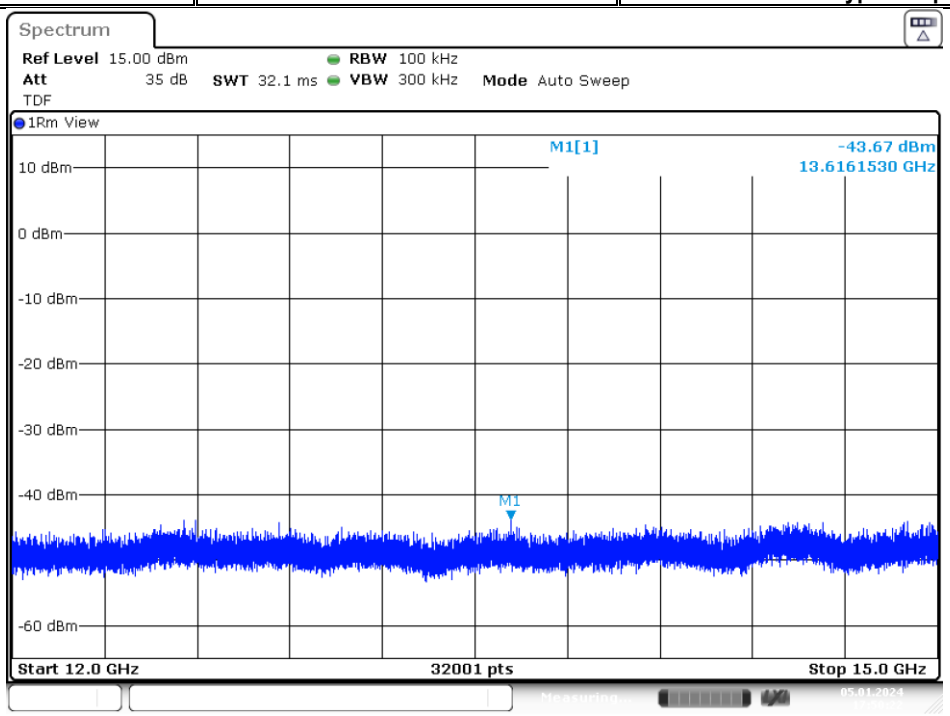
Date: 5.JAN.2024 17:49:06

Plot #18	Ch 0	Modulation/Packet Type: Proprietary



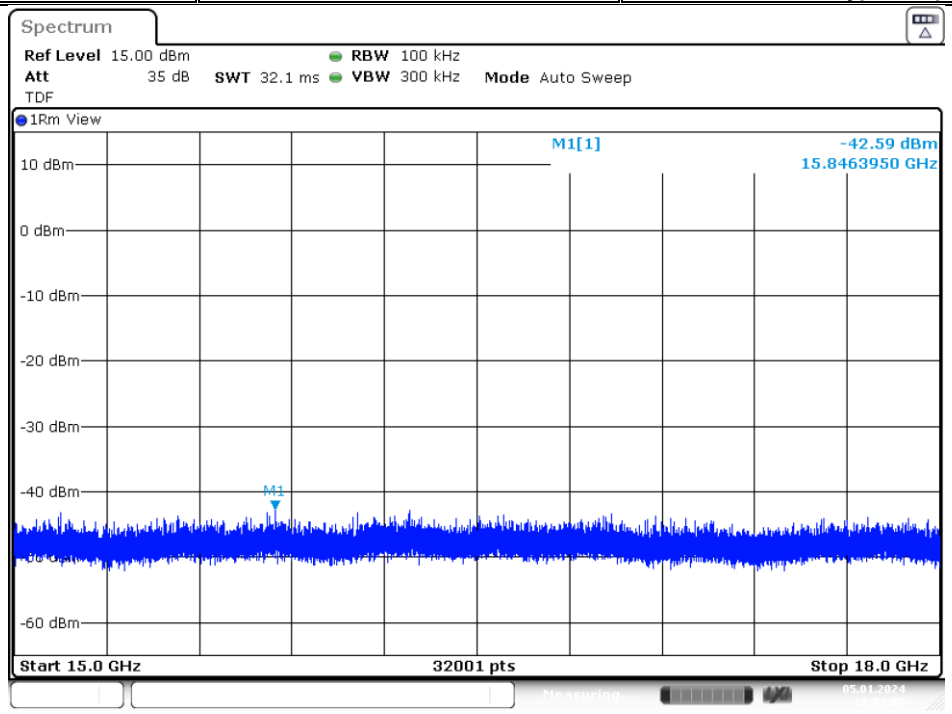
Date: 5.JAN.2024 17:49:45

Plot #19	Ch 0	Modulation/Packet Type: Proprietary



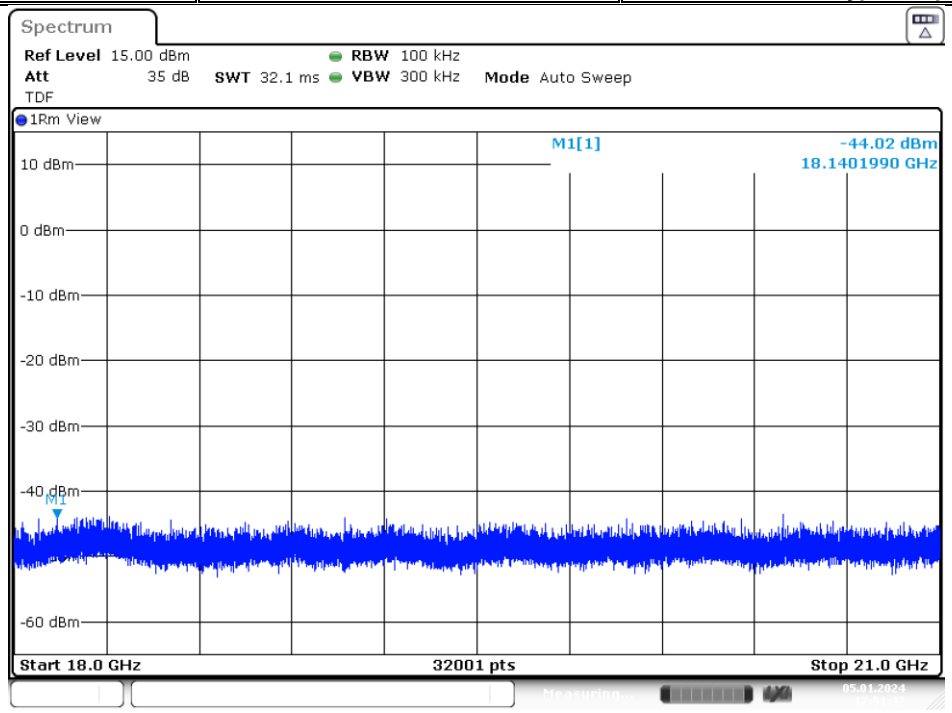
Date: 5.JAN.2024 17:50:23

Plot #20	Ch 0	Modulation/Packet Type: Proprietary



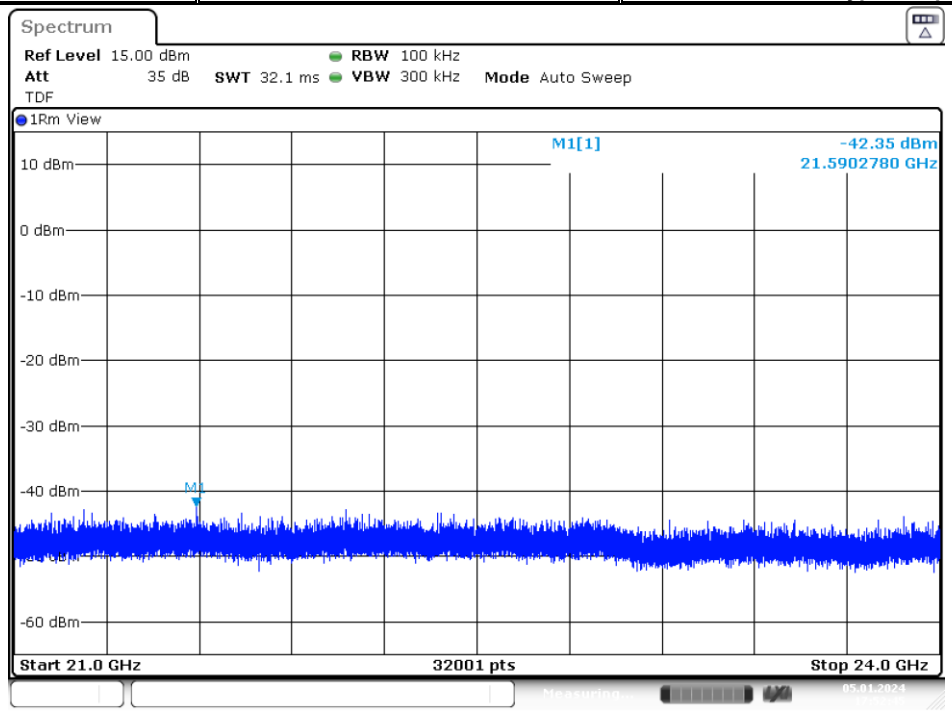
Date: 5.JAN.2024 17:51:07

Plot #21	Ch 0	Modulation/Packet Type: Proprietary



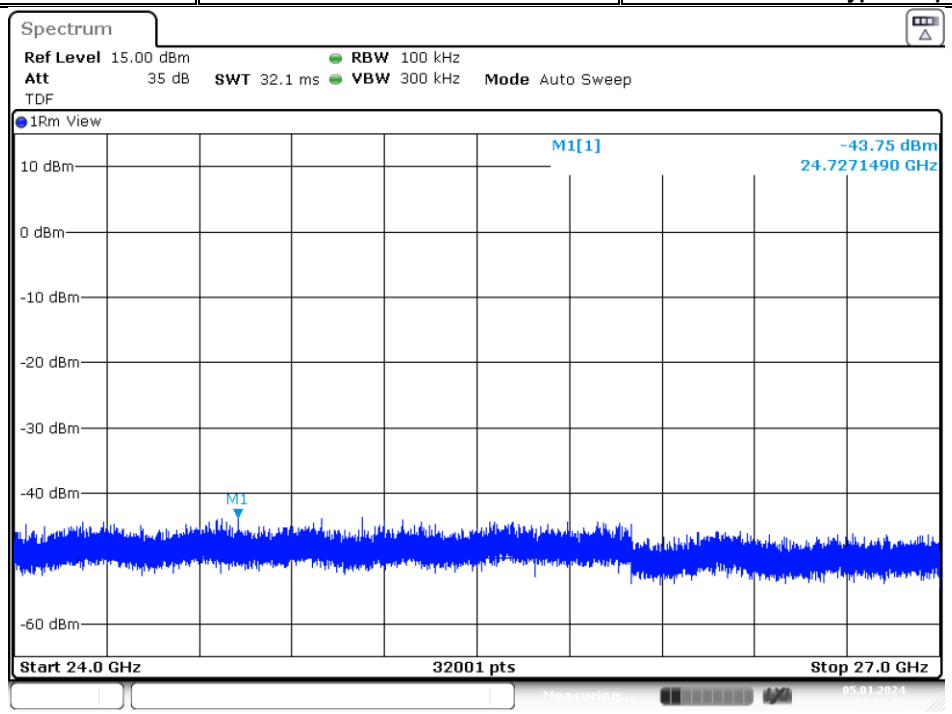
Date: 5.JAN.2024 17:51:48

Plot #22	Ch 0	Modulation/Packet Type: Proprietary



Date: 5.JAN.2024 17:52:45

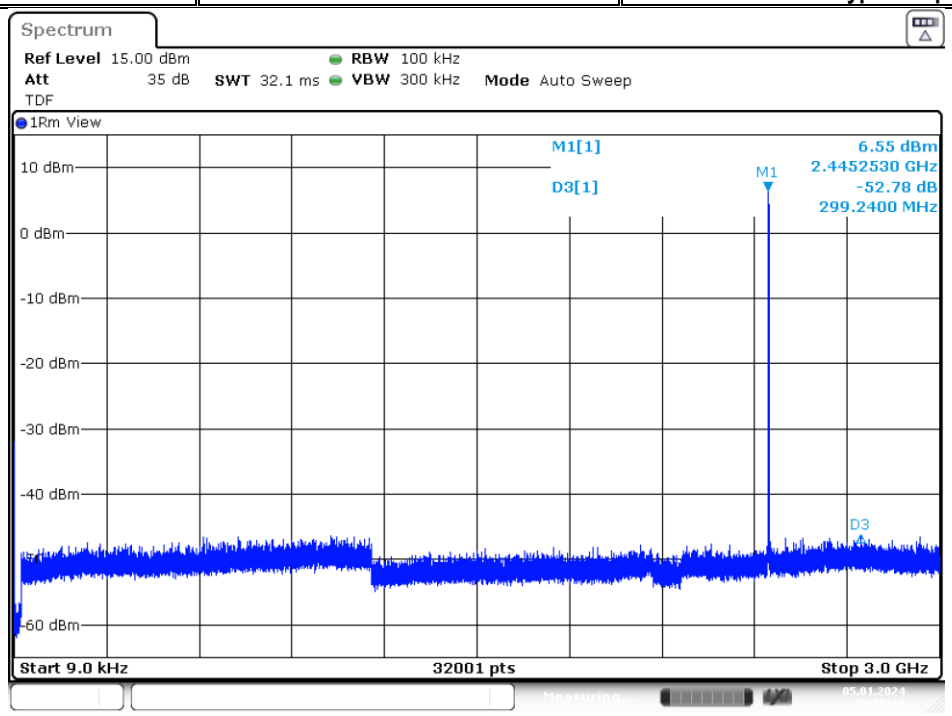
Plot #23	Ch 0	Modulation/Packet Type: Proprietary



Date: 5.JAN.2024 17:53:22

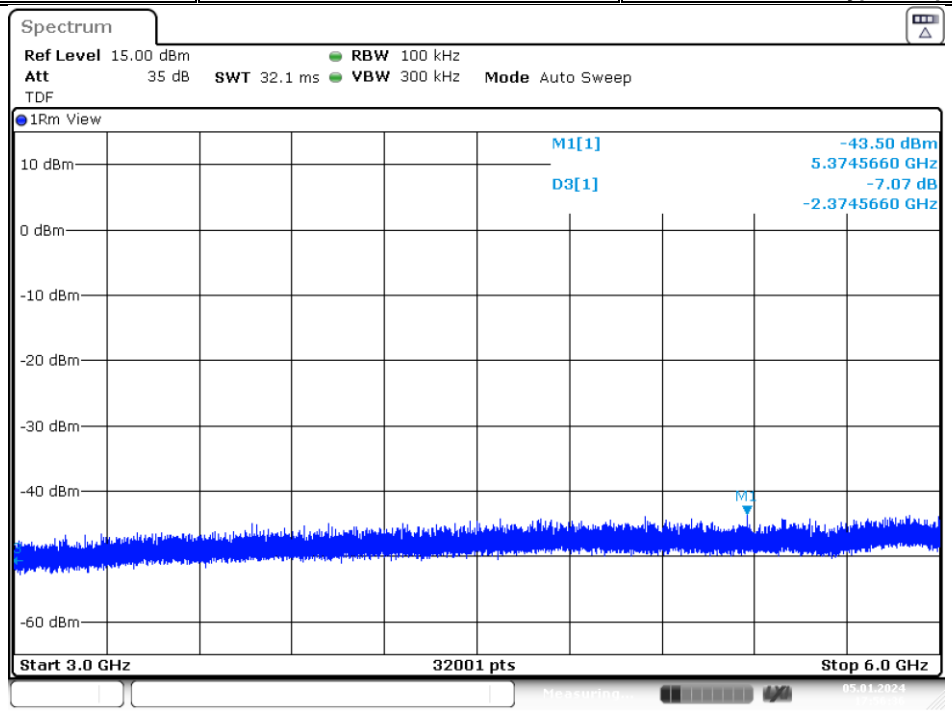
8.5.8 Measurement Plots: channel 8

Plot #24	Ch 8	Modulation/Packet Type: Proprietary



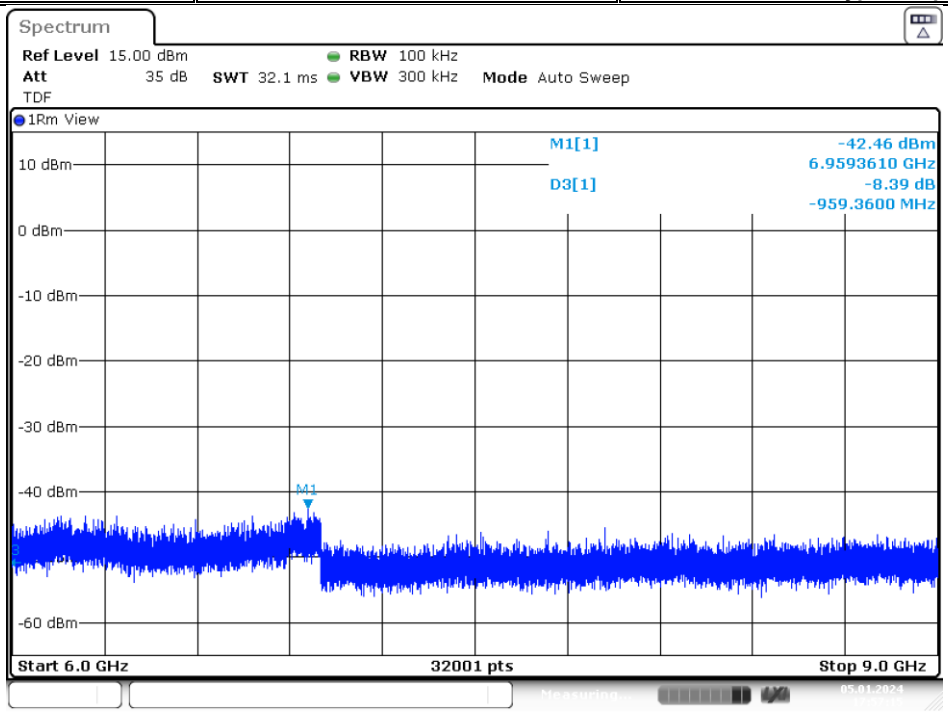
Date: 5.JAN.2024 17:55:15

Plot #25	Ch 8	Modulation/Packet Type: Proprietary



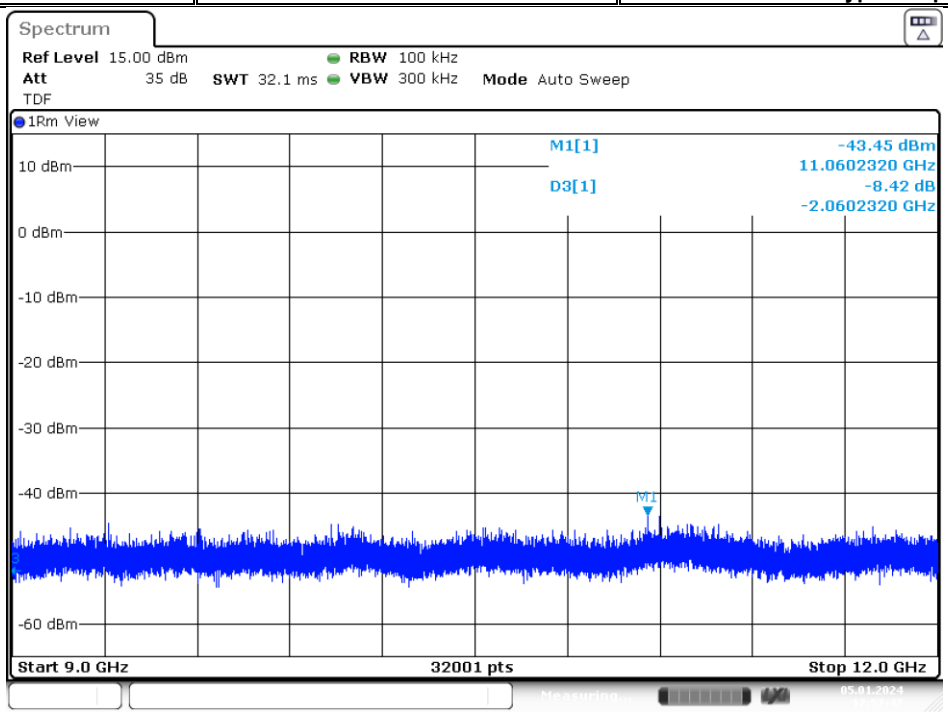
Date: 5.JAN.2024 17:56:36

Plot #26	Ch 8	Modulation/Packet Type: Proprietary



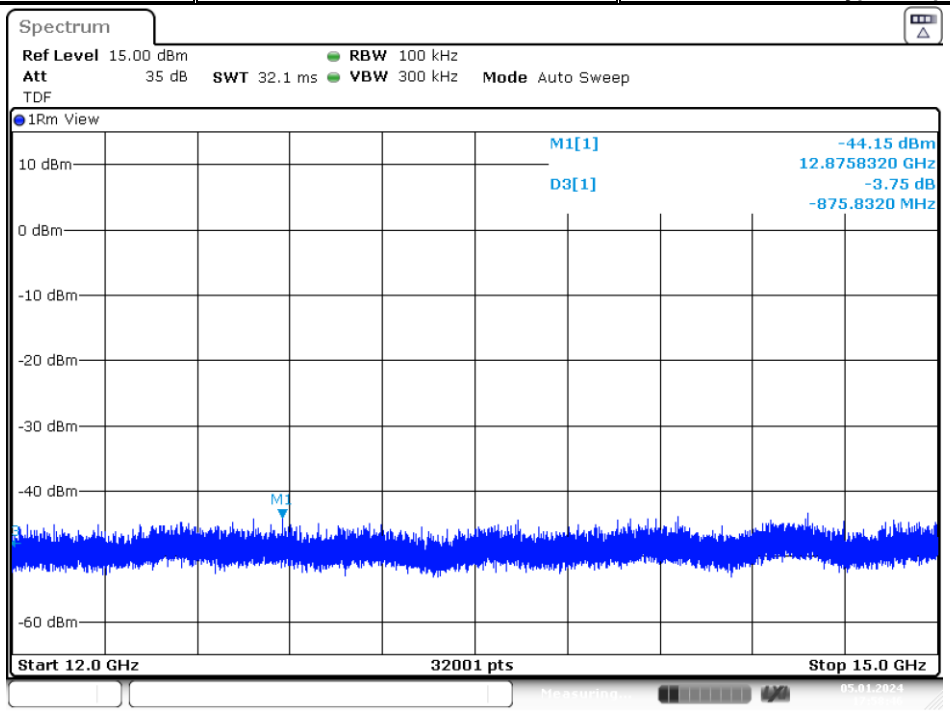
Date: 5.JAN.2024 17:57:15

Plot #27	Ch 8	Modulation/Packet Type: Proprietary



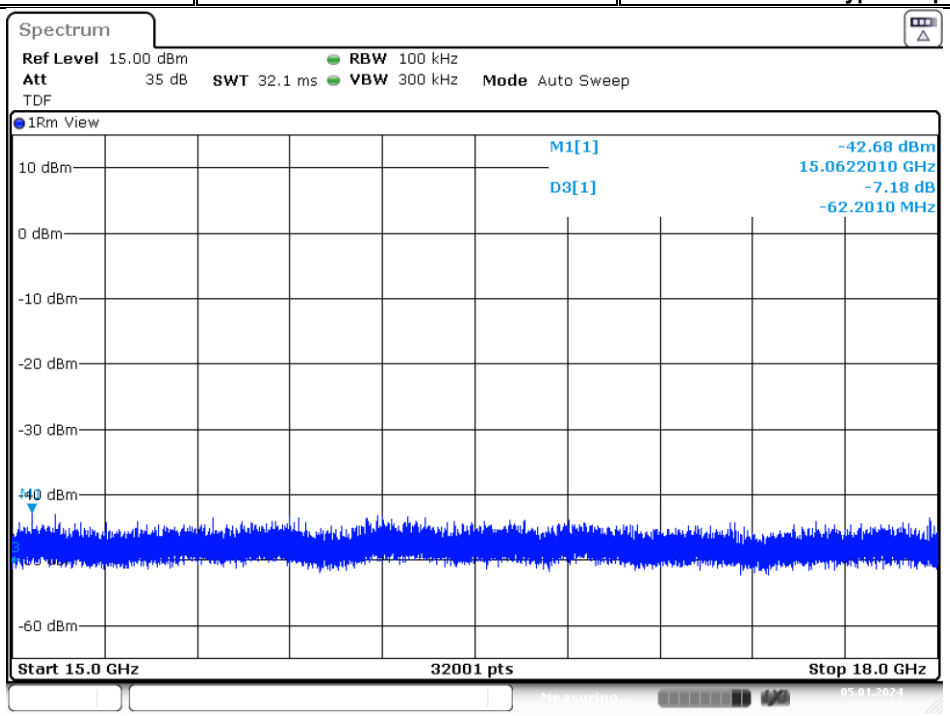
Date: 5.JAN.2024 17:57:47

Plot #28	Ch 8	Modulation/Packet Type: Proprietary



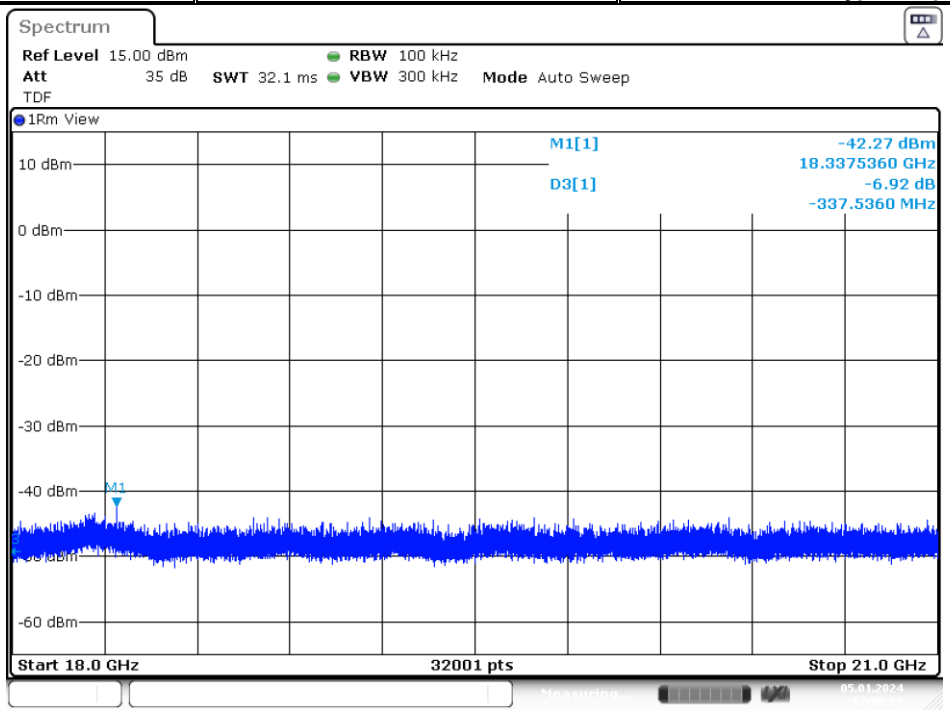
Date: 5.JAN.2024 17:58:46

Plot #29	Ch 8	Modulation/Packet Type: Proprietary



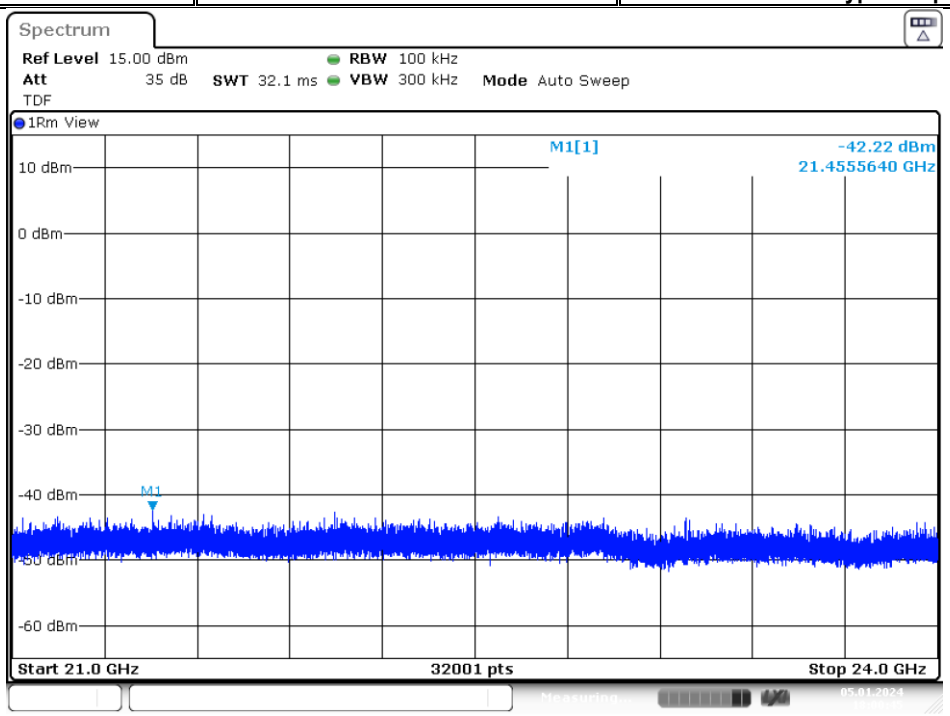
Date: 5.JAN.2024 17:59:18

Plot #30	Ch 8	Modulation/Packet Type: Proprietary



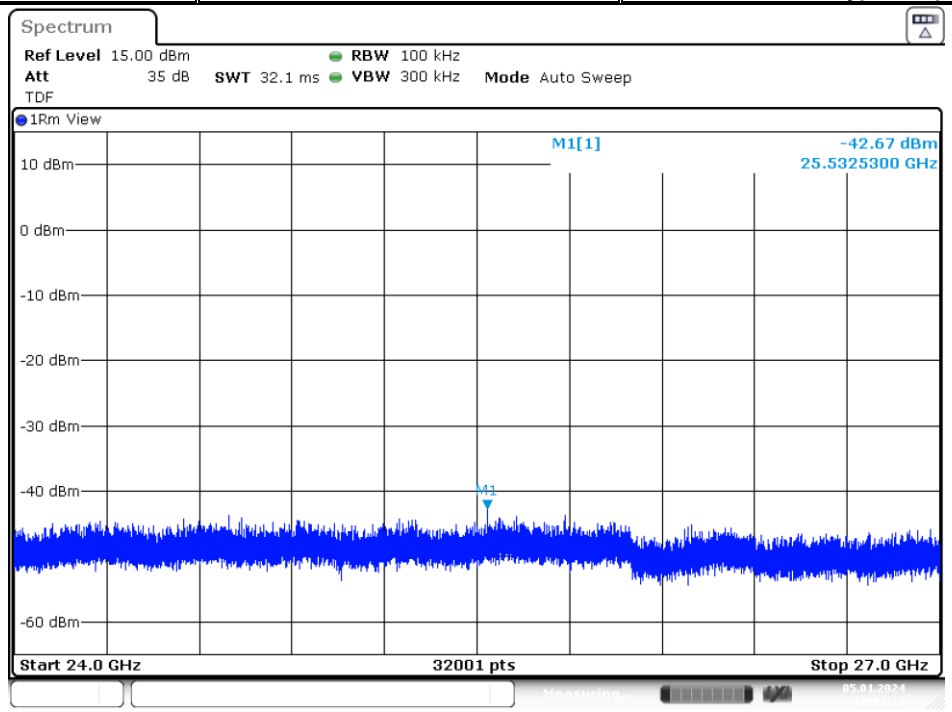
Date: 5.JAN.2024 17:59:59

Plot #31	Ch 8	Modulation/Packet Type: Proprietary



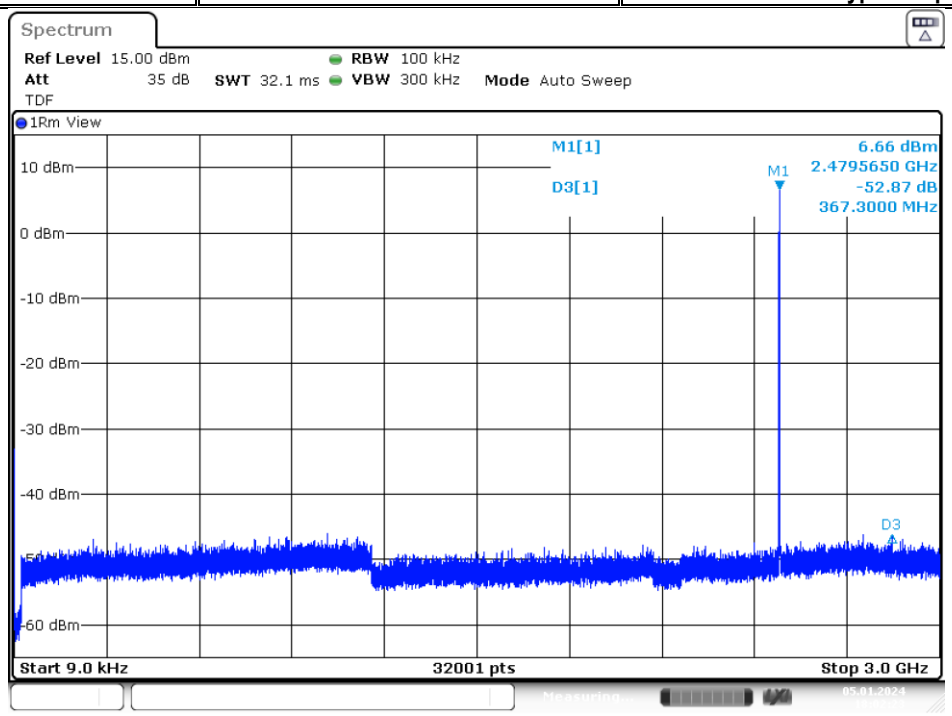
Date: 5.JAN.2024 18:00:44

Plot #32	Ch 8	Modulation/Packet Type: Proprietary



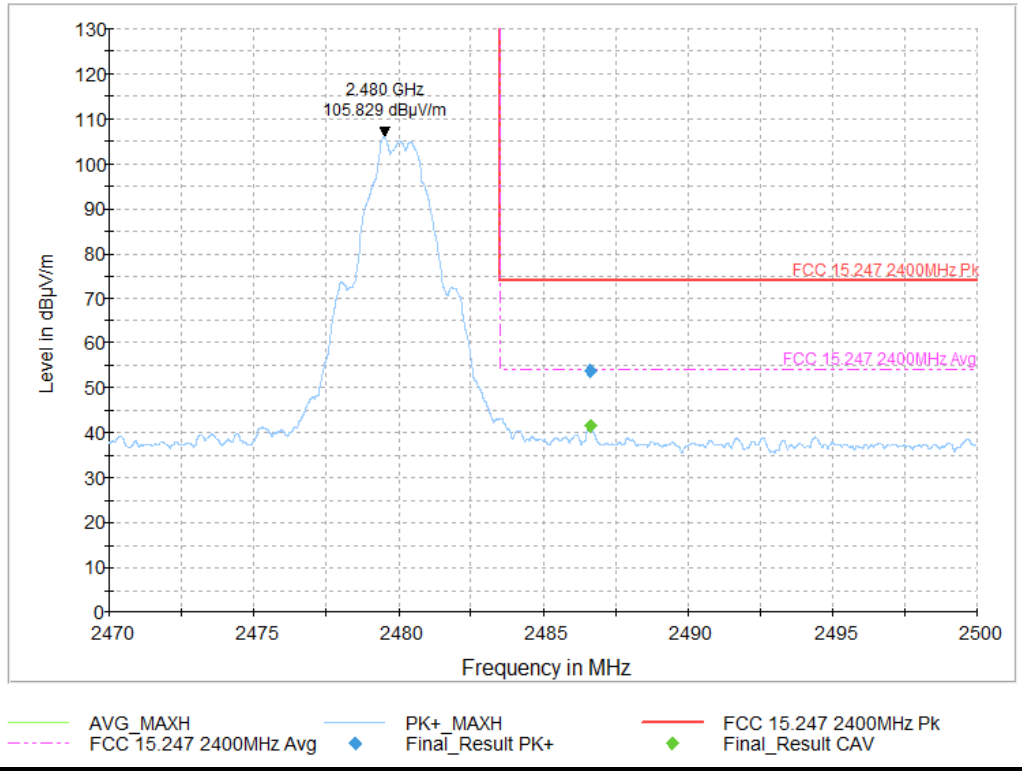
8.5.9 Measurement Plots: channel 15

Plot #33	Ch 15	Modulation/Packet Type: Proprietary



Date: 5.JAN.2024 18:02:23

Plot #34	Ch 15	Modulation/Packet Type: Proprietary

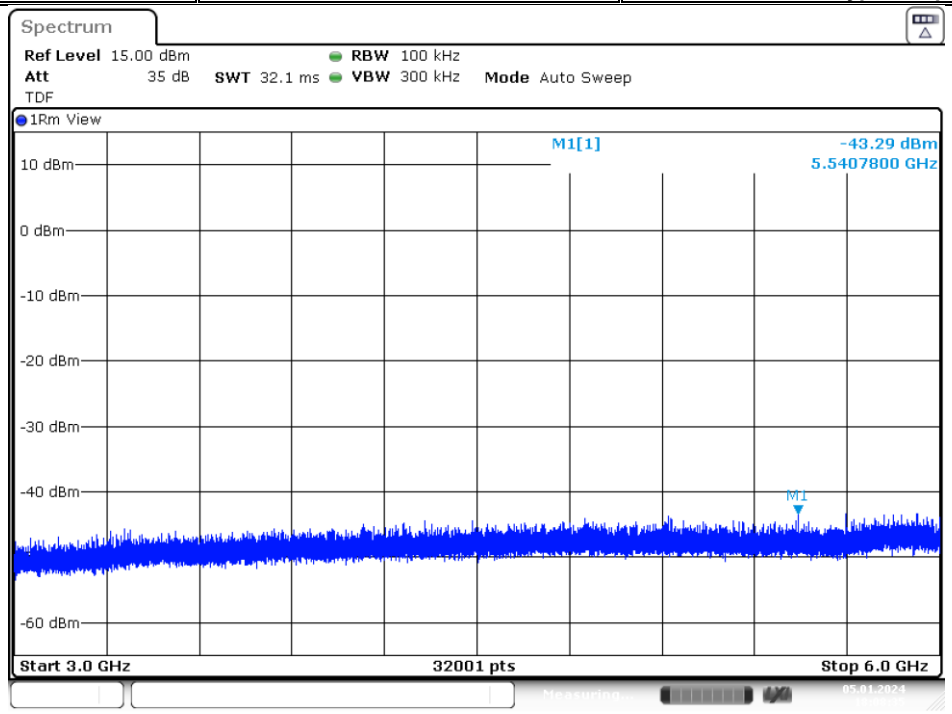


Radiated Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth
2486.637	---	41.64	54.00	12.36	500.0	1000.000	326.0	H	180.0
2486.637	53.92	---	74.00	20.08	500.0	1000.000	326.0	H	180.0

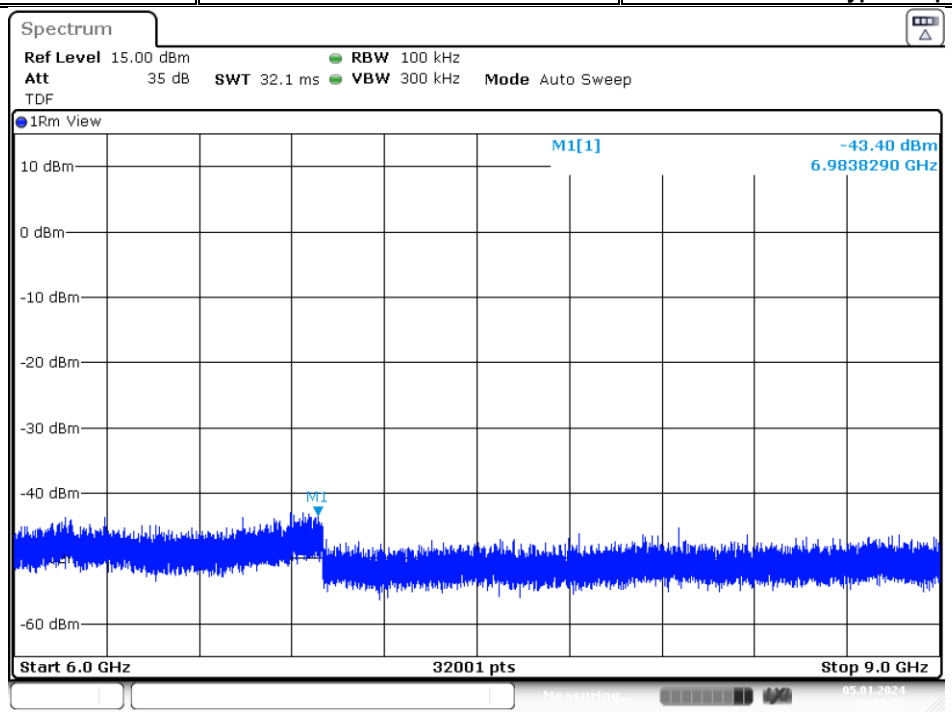
Frequency (MHz)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
2483.500	33.6	5.2	0.0	28.4	8.1
2483.500	33.6	5.2	0.0	28.4	20.4

Plot #35	Ch 15	Modulation/Packet Type: Proprietary



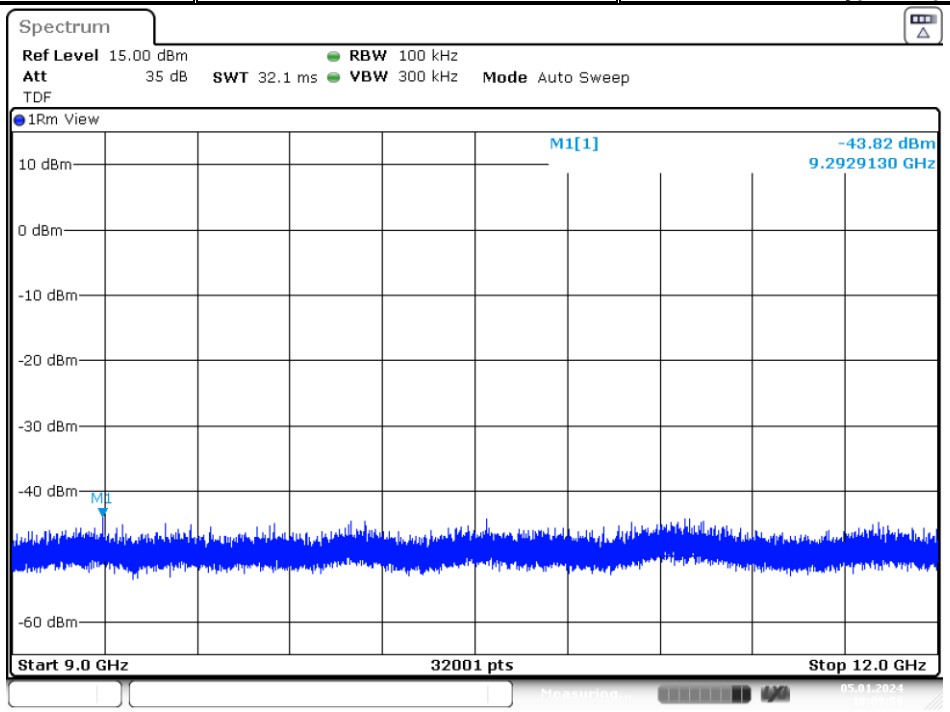
Date: 5.JAN.2024 18:08:35

Plot #36	Ch 15	Modulation/Packet Type: Proprietary



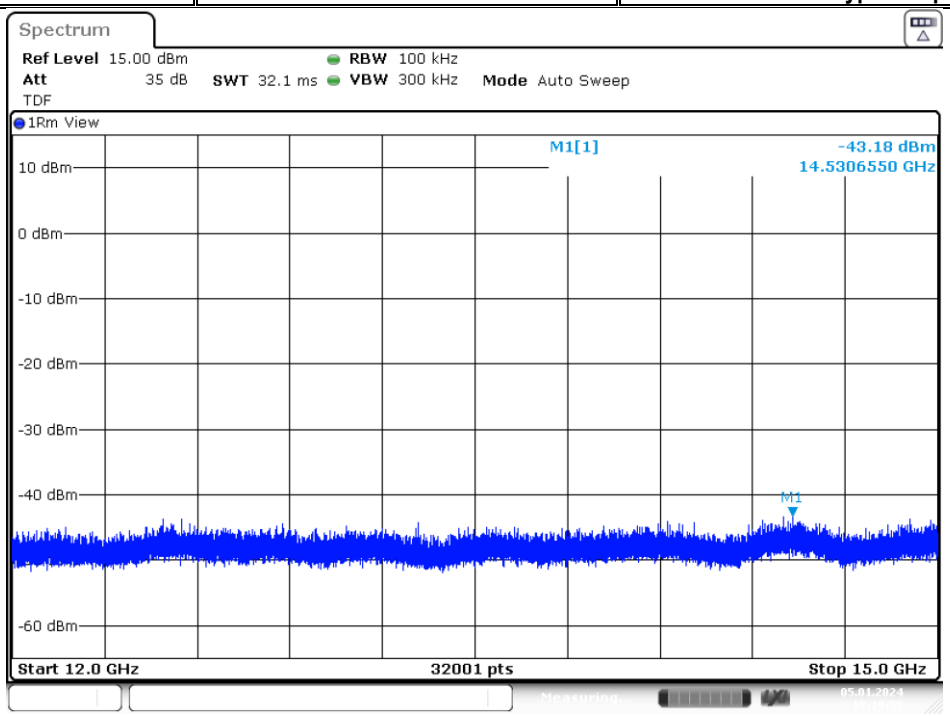
Date: 5.JAN.2024 18:09:23

Plot #37	Ch 15	Modulation/Packet Type: Proprietary



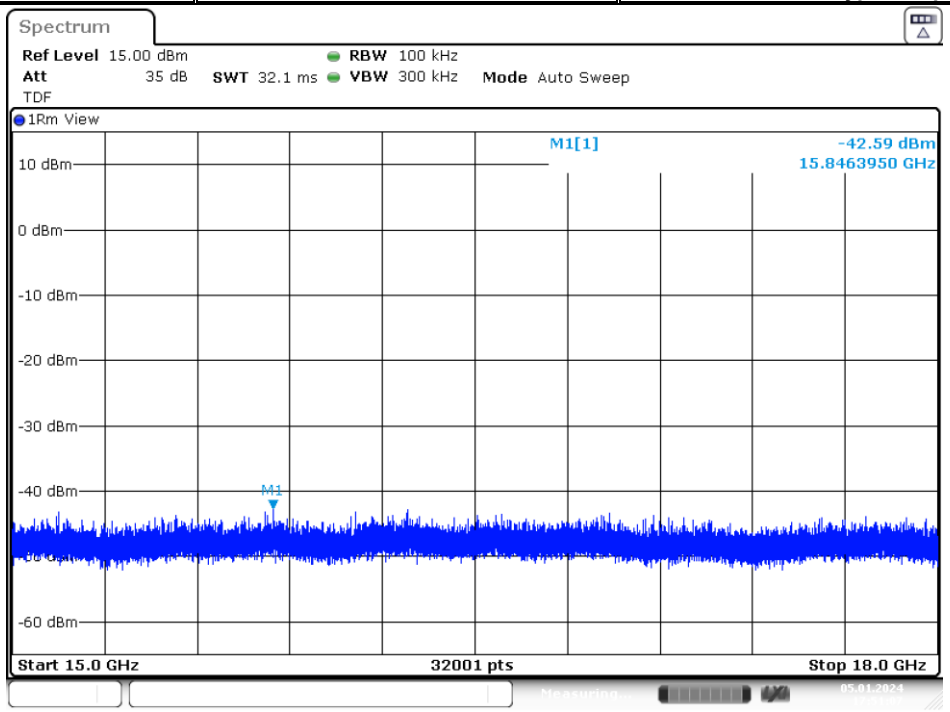
Date: 5.JAN.2024 18:10:00

Plot #38	Ch 15	Modulation/Packet Type: Proprietary



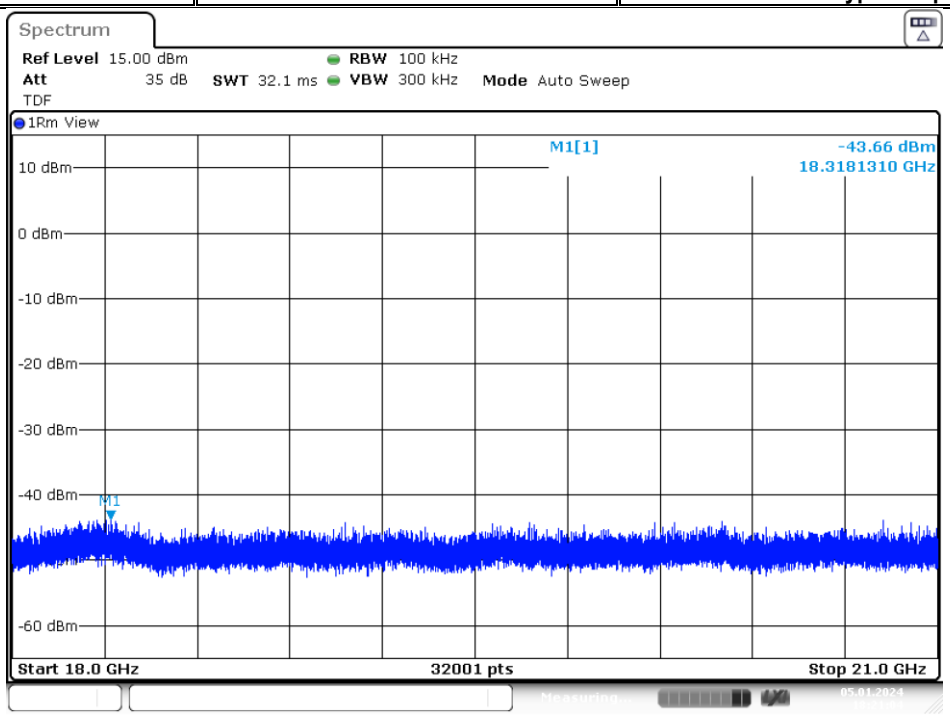
Date: 5.JAN.2024 18:19:58

Plot #39	Ch 15	Modulation/Packet Type: Proprietary



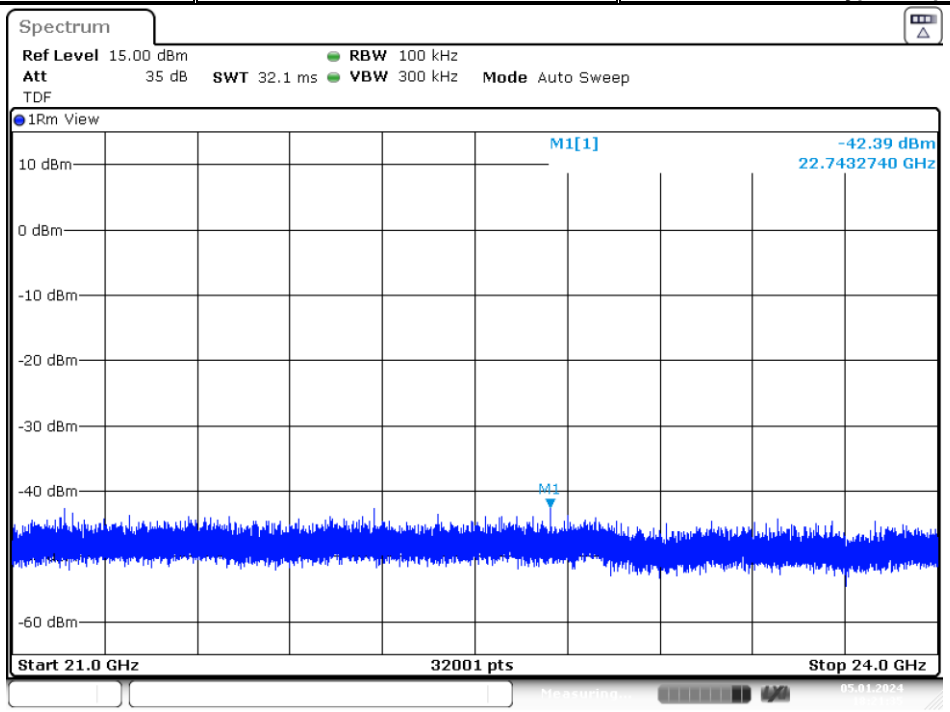
Date: 5.JAN.2024 17:51:07

Plot #40	Ch 15	Modulation/Packet Type: Proprietary



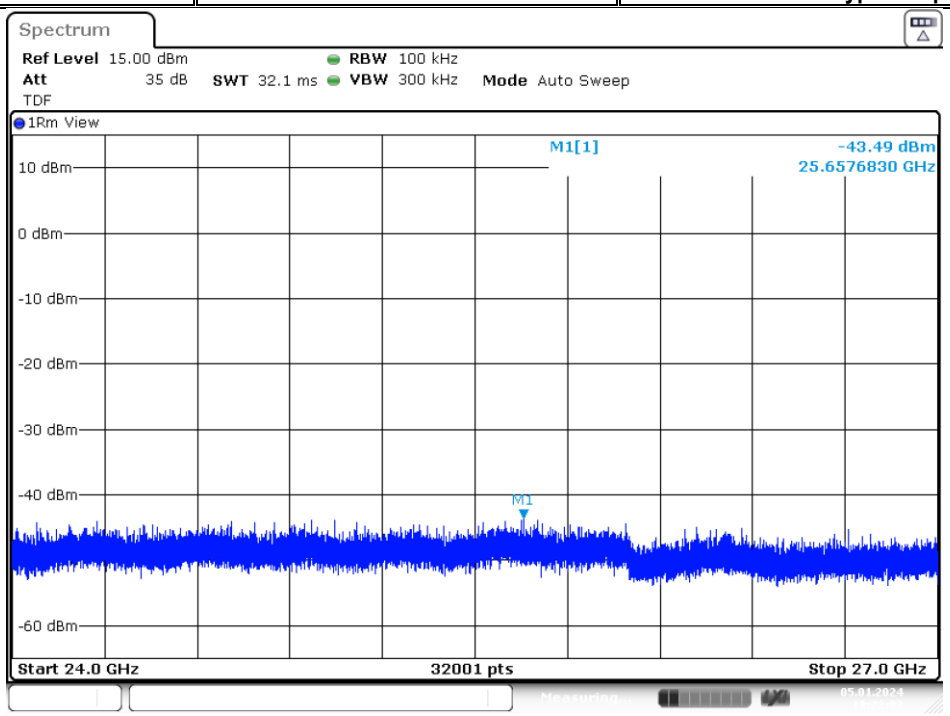
Date: 5.JAN.2024 18:21:05

Plot #41	Ch 15	Modulation/Packet Type: Proprietary



Date: 5.JAN.2024 18:21:35

Plot #42	Ch 15	Modulation/Packet Type: Proprietary



Date: 5.JAN.2024 18:22:03

8.6 Radiated Transmitter Spurious Emissions and Restricted Bands

8.6.1 Measurement according to ANSI C63.10 (2013)

Spectrum Analyzer Settings:

- Frequency = 9 KHz – 30 MHz
- RBW = 9 KHz
- Detector: Peak

- Frequency = 30 MHz – 1 GHz
- Detector = Peak / Quasi-Peak
- RBW= 120 KHz (<1GHz)

- Frequency > 1 GHz
- Detector = Peak / Average
- RBW = 1 MHz

- Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements.
- The highest (or worst-case) data rate shall be recorded for each measurement.
- For testing frequencies below 30 MHz at distance other than the specified in the standard, the limit conversion is calculated by using the FCC materials for the ANSI 63 committee issued on January, 27 1991.

8.6.2 Limits:

FCC §15.247

- 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 §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

FCC §15.209 & RSS-Gen 8.9

- Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency of emission (MHz)	Field strength (µV/m)	Measurement Distance (m)	Field strength @ 3m (dBµV/m)
0.009–0.490	2400/F(kHz) / ---------	300	-
0.490–1.705	24000/F(kHz) / --------	30	-
1.705–30.0	30 / (29.5)	30	-
30–88	100	3	40 dBµV/m
88–216	150	3	43.5 dBµV/m
216–960	200	3	46 dBµV/m
Above 960	500	3	54 dBµV/m

FCC §15.205 & RSS-Gen 8.10

- Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

- Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
  *PEAK LIMIT= 74 dBµV/m
  *AVG. LIMIT= 54 dBµV/m

8.6.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
22 °C	2	TX	nominal

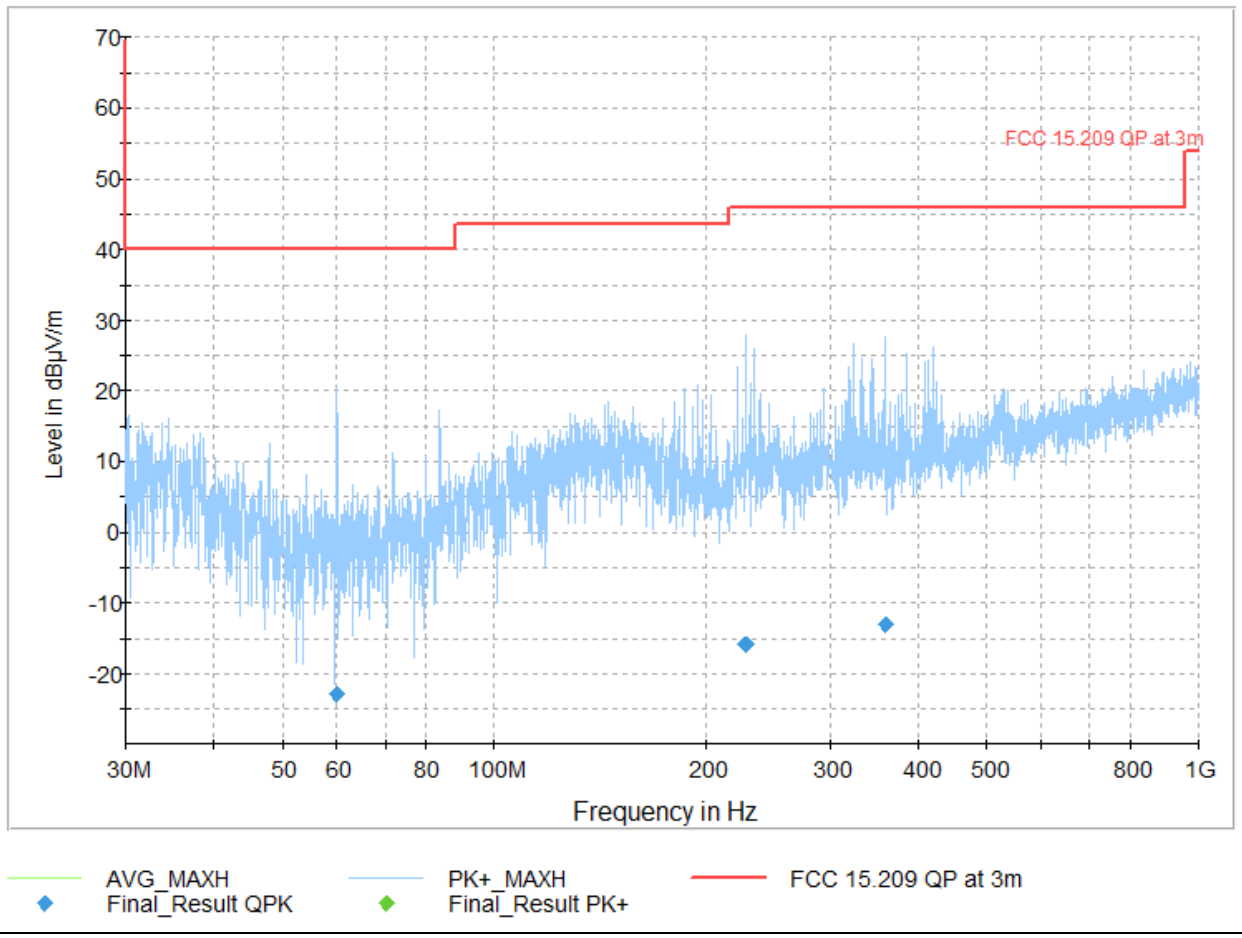
8.6.4 Measurement result:

Plot #	Channel #	Scan Frequency	Emission level with lowest margin to limit	Limit	Result
43-45	Low	30 MHz – 18 GHz	28 dBµV/m	See section 8.6.2	Pass
46-50	Mid	9 kHz – 26 GHz	27 dBµV/m	See section 8.6.2	Pass
51-53	High	30 MHz – 18 GHz	27 dBµV/m	See section 8.6.2	Pass

8.6.5 Measurement Plots: channel 0

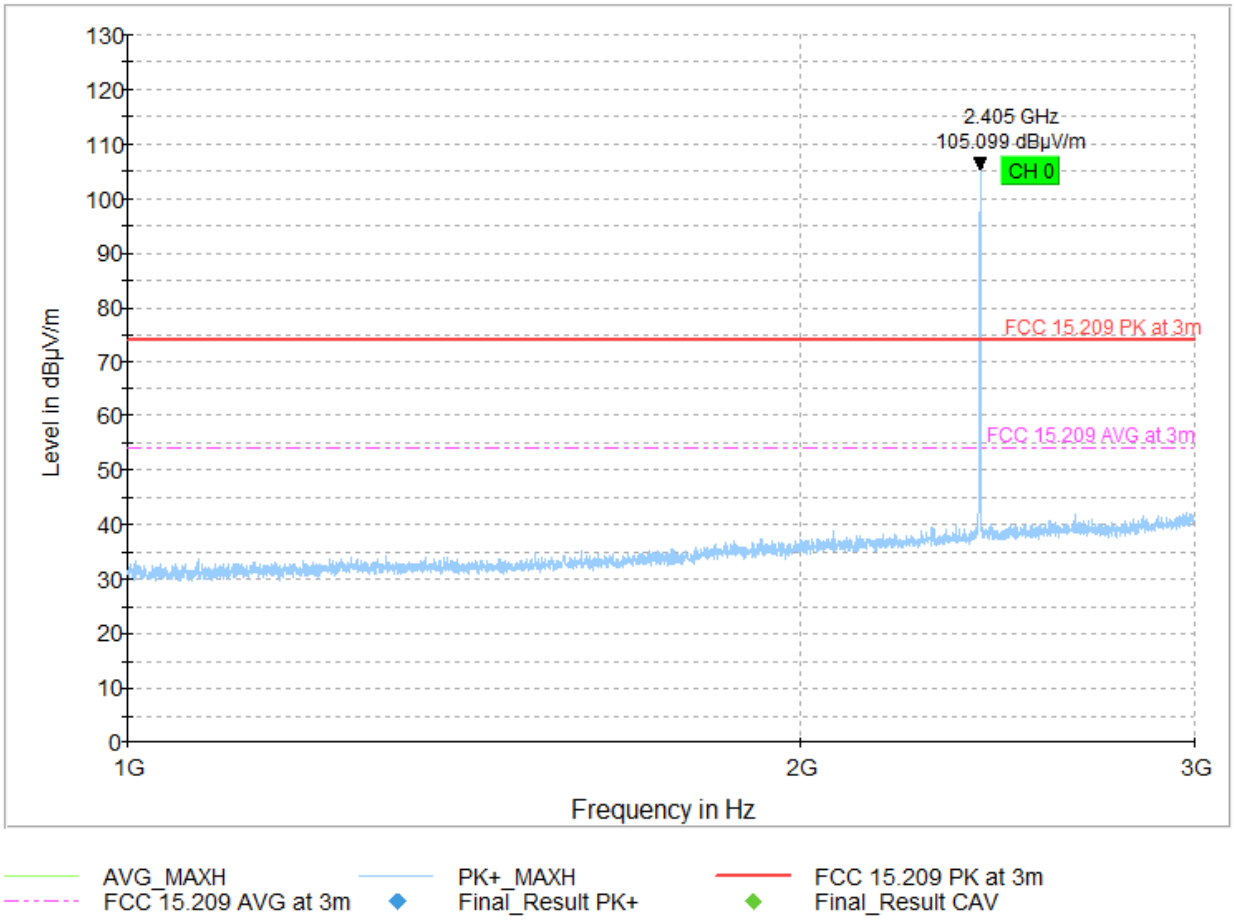
Plot # 43 Radiated Emission

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
59.973	-22.88	40.00	62.88	500.0	120.000	199.0	H	-17.0	-22.9	-35.3	0.0	12.4	0.0
227.977	-15.84	46.02	61.86	500.0	120.000	199.0	V	-16.0	-15.8	-34.3	0.0	18.5	0.0
359.970	-12.96	46.02	58.98	500.0	120.000	203.0	H	-16.0	-13.0	-33.9	0.0	21.0	0.0

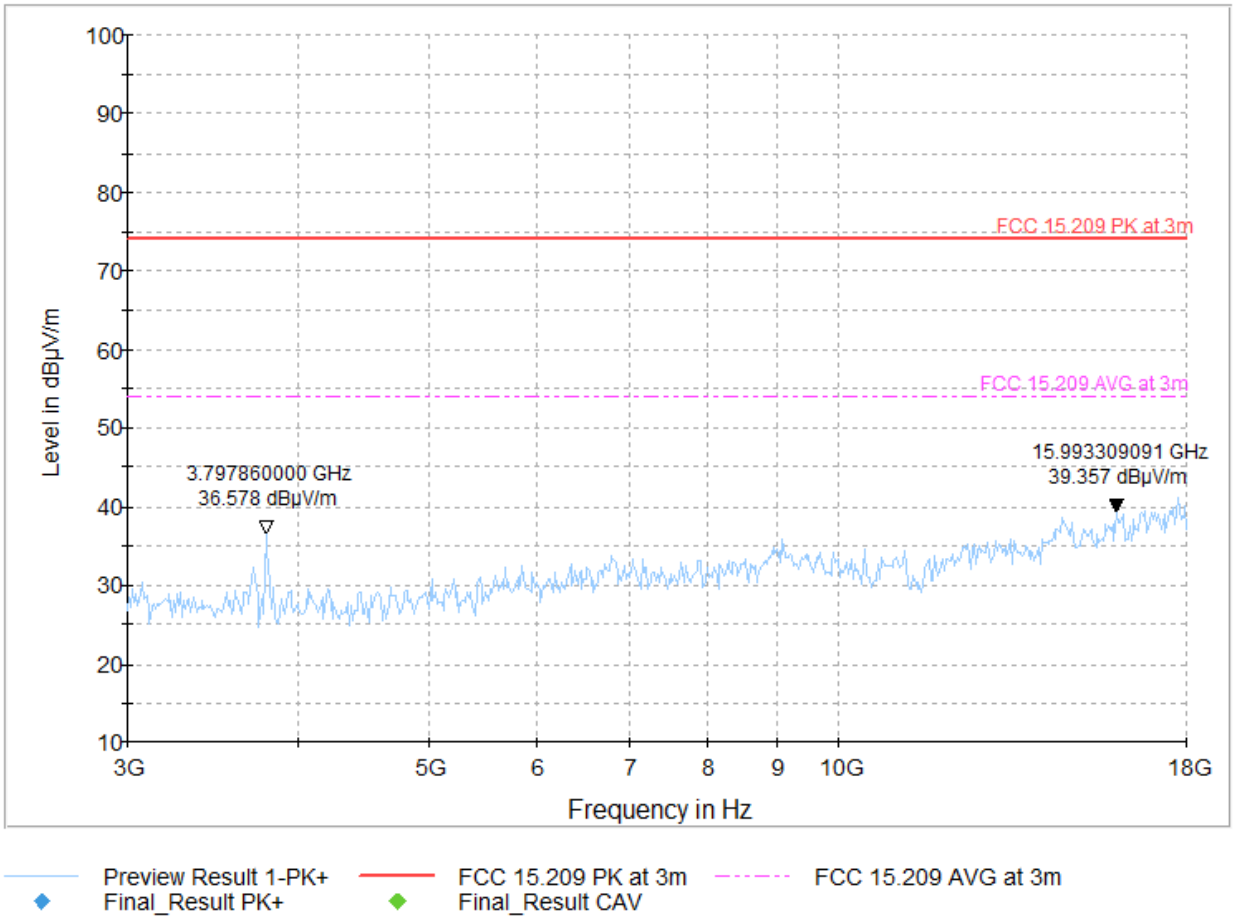


Plot # 44 Radiated Emission

Note: The emission at 2.404 GHz is the wanted emission, which is irrelevant to the limit.



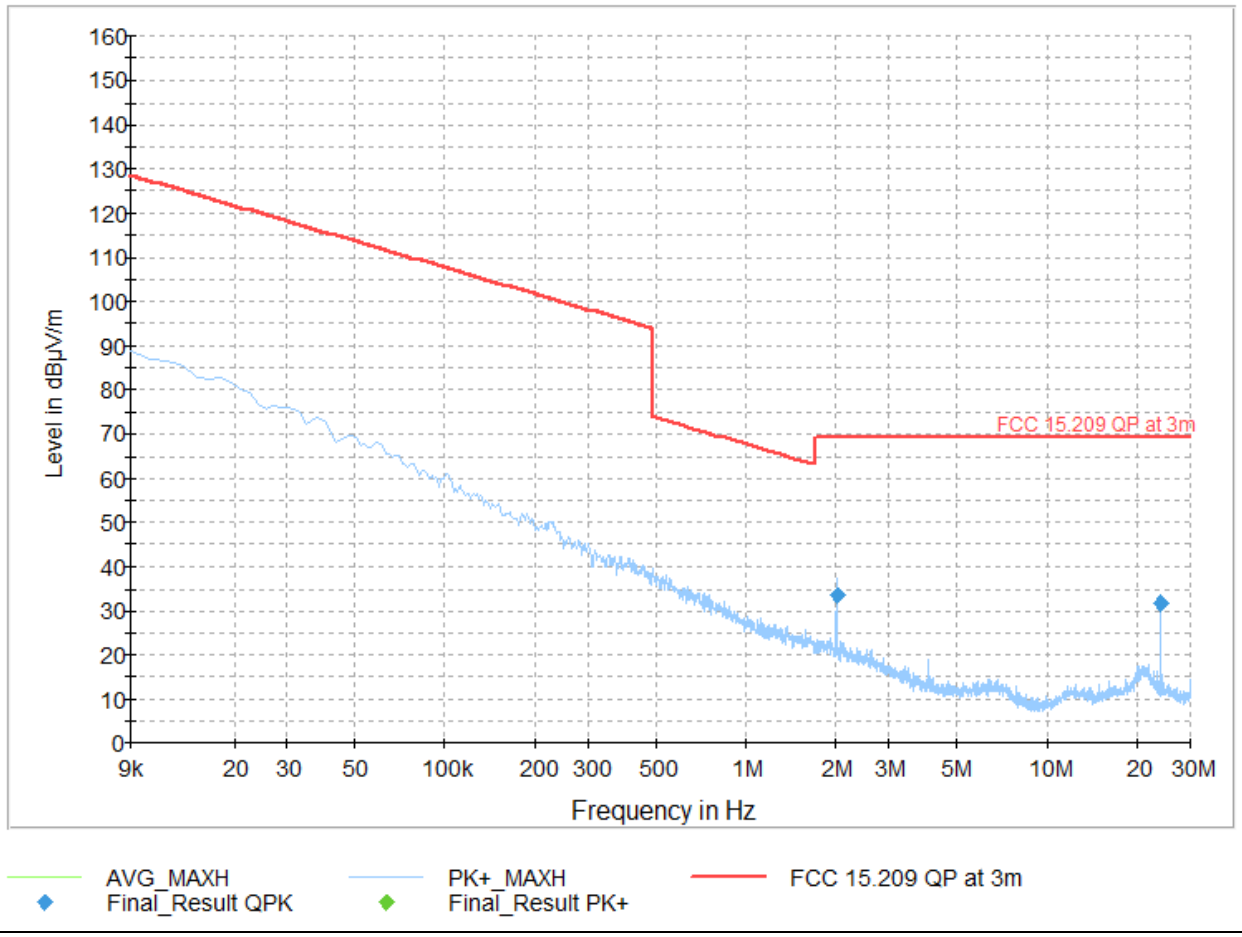
Plot # 45 Radiated Emission



8.6.6 Measurement Plots: channel 8

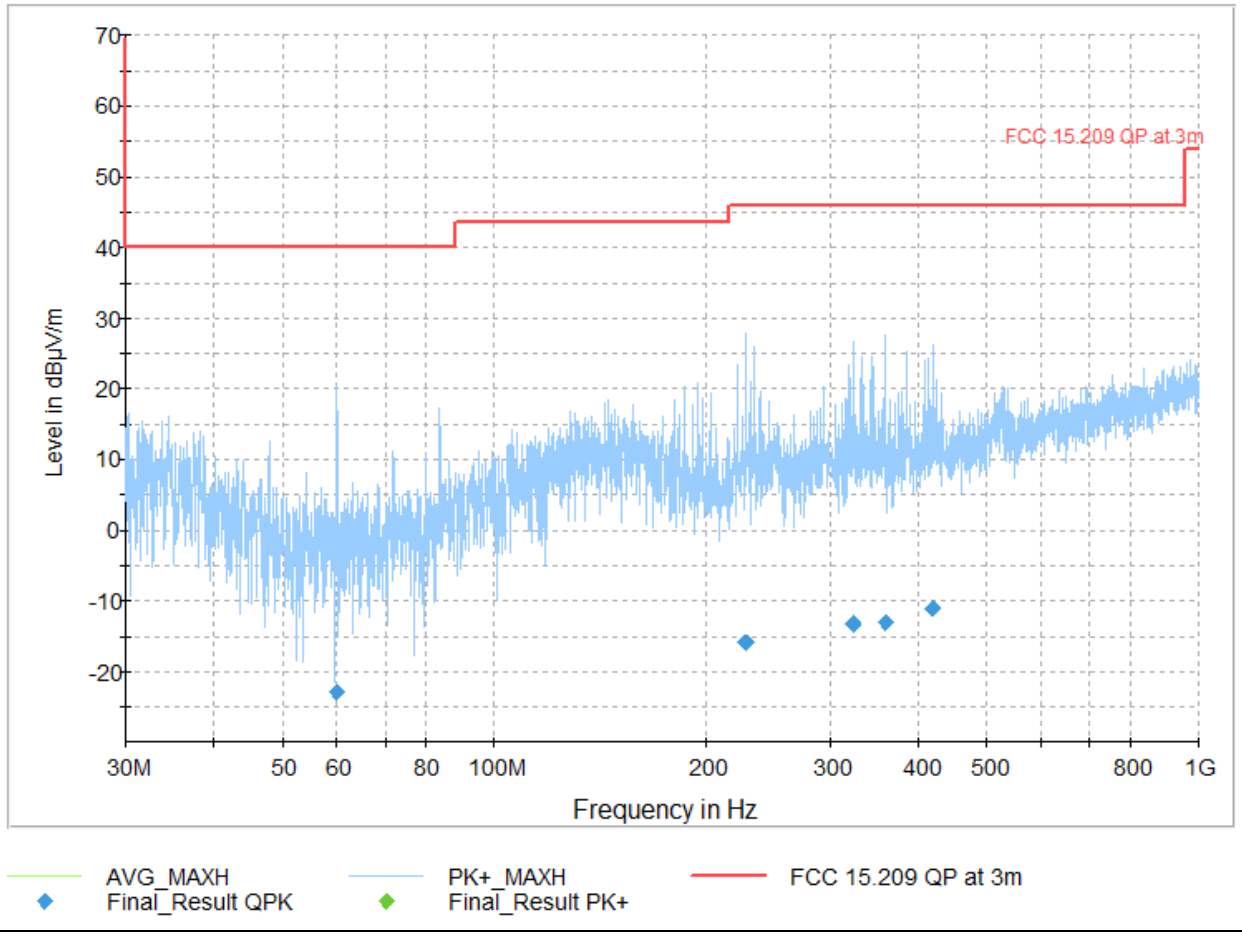
Plot # 46 Radiated Emission

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
2.008	33.64	---	69.50	35.86	500.0	9.000	100.0	V	-1.0	13.6	0.1	-28.2	41.7	20.0
24.000	31.80	---	69.50	37.70	500.0	9.000	100.0	H	338.0	6.0	0.2	-28.0	33.8	25.8



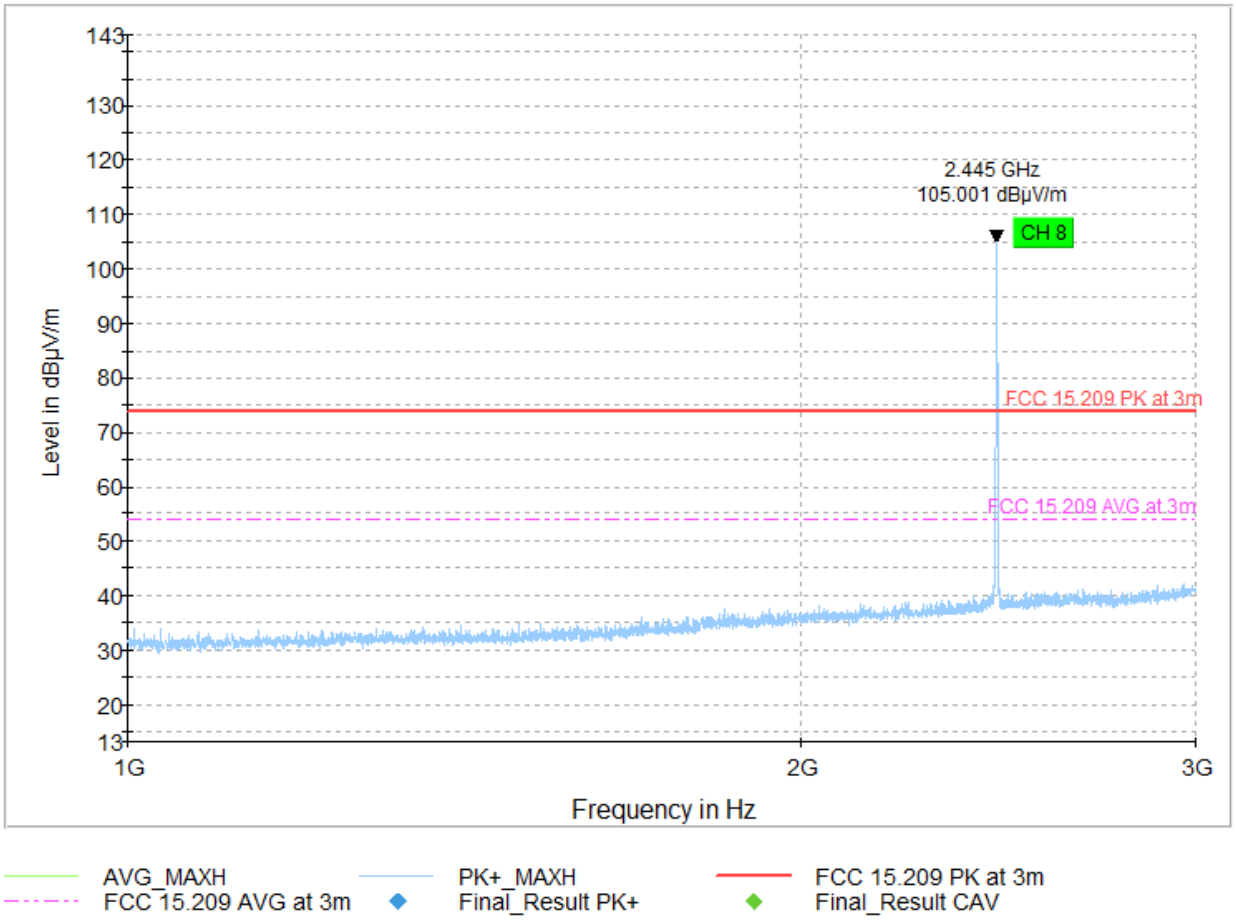
Plot # 47 Radiated Emission

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
59.973	-22.88	---	40.00	62.88	500.0	120.000	198.0	H	-15.0	-22.9	-35.3	0.0	12.4	0.0
227.977	-15.84	---	46.02	61.86	500.0	120.000	199.0	V	-16.0	-15.8	-34.3	0.0	18.5	0.0
323.983	-13.19	---	46.02	59.21	500.0	120.000	201.0	H	-16.0	-13.2	-34.0	0.0	20.8	0.0
359.970	-12.96	---	46.02	58.98	500.0	120.000	200.0	H	-17.0	-13.0	-33.9	0.0	21.0	0.0
419.964	-11.03	---	46.02	57.05	500.0	120.000	203.0	H	-17.0	-11.0	-33.7	0.0	22.7	0.0

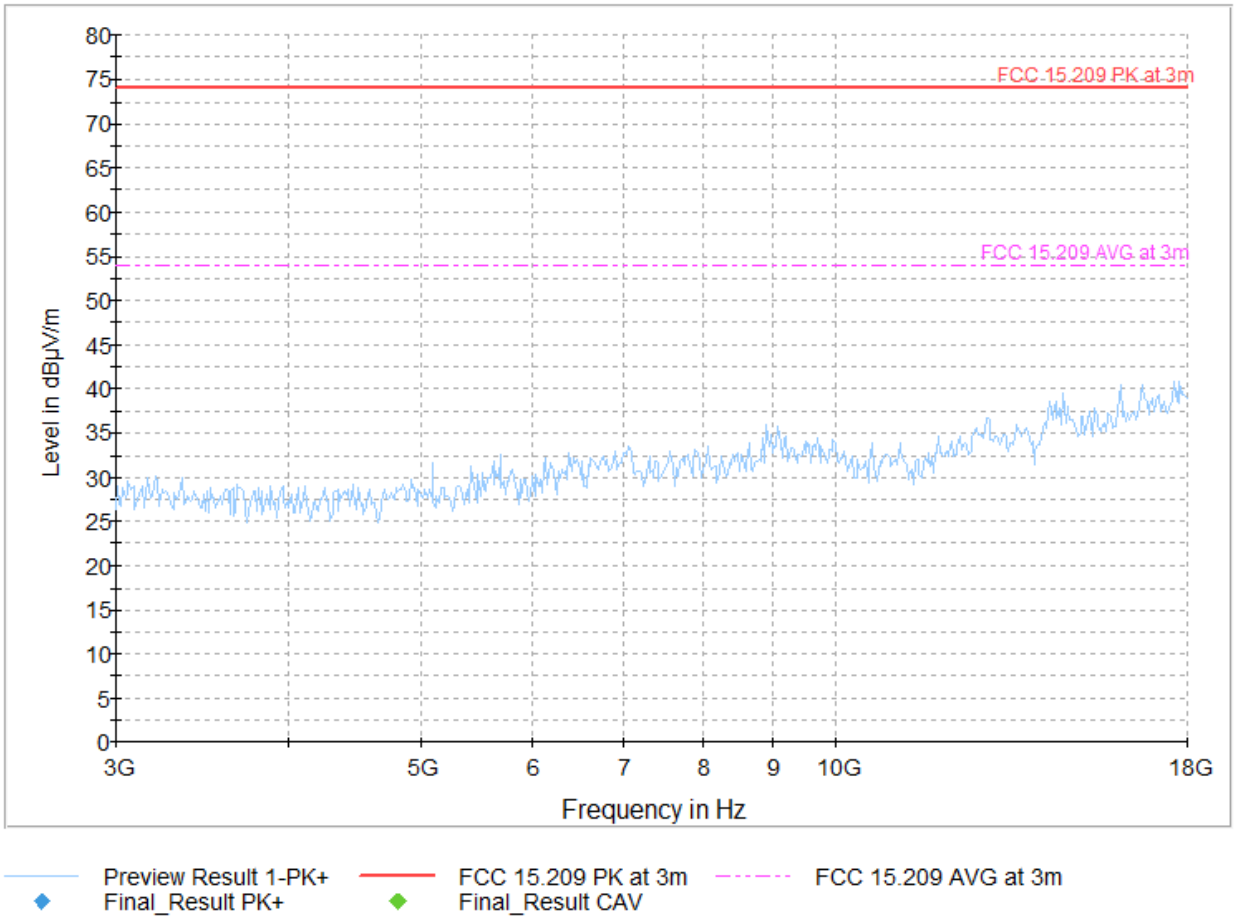


Plot # 48 Radiated Emission

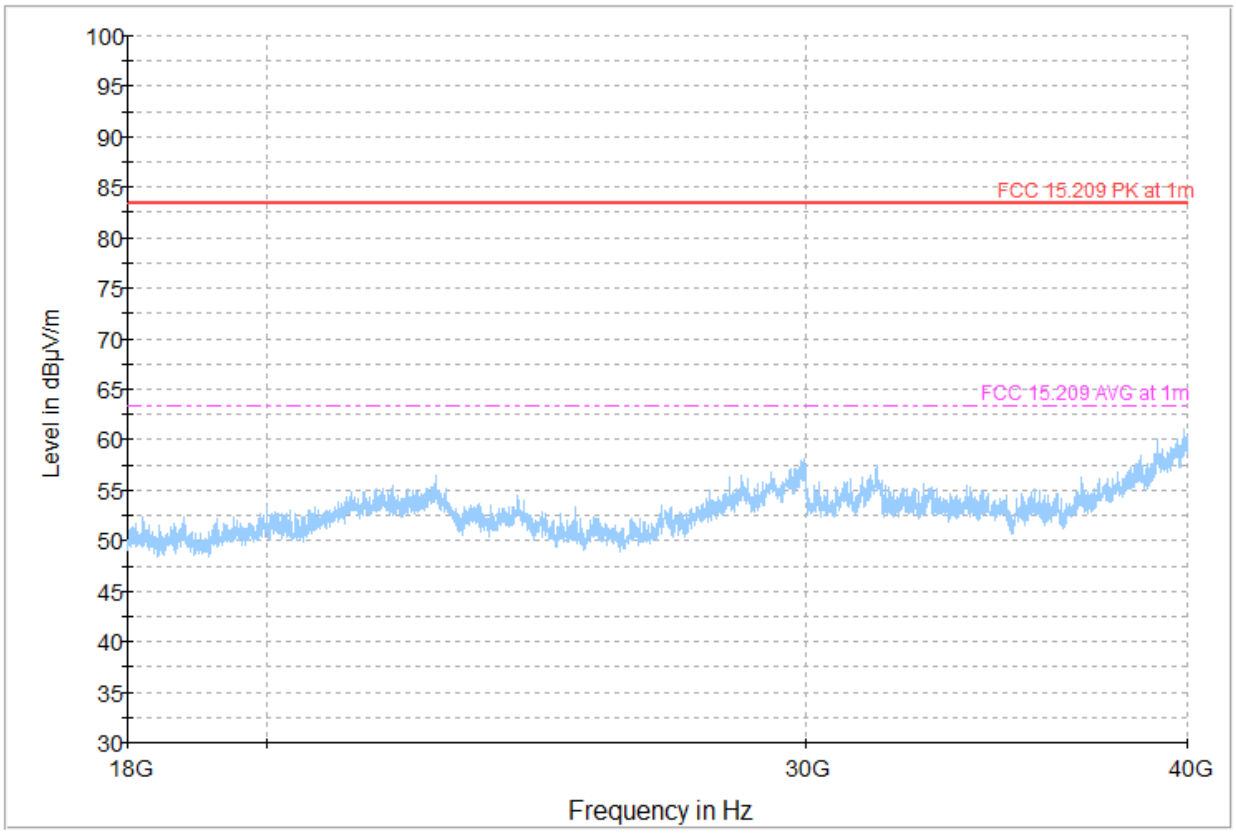
Note: The emission at 2.445 GHz is the wanted emission, which is irrelevant to the limit.



Plot # 49 Radiated Emission



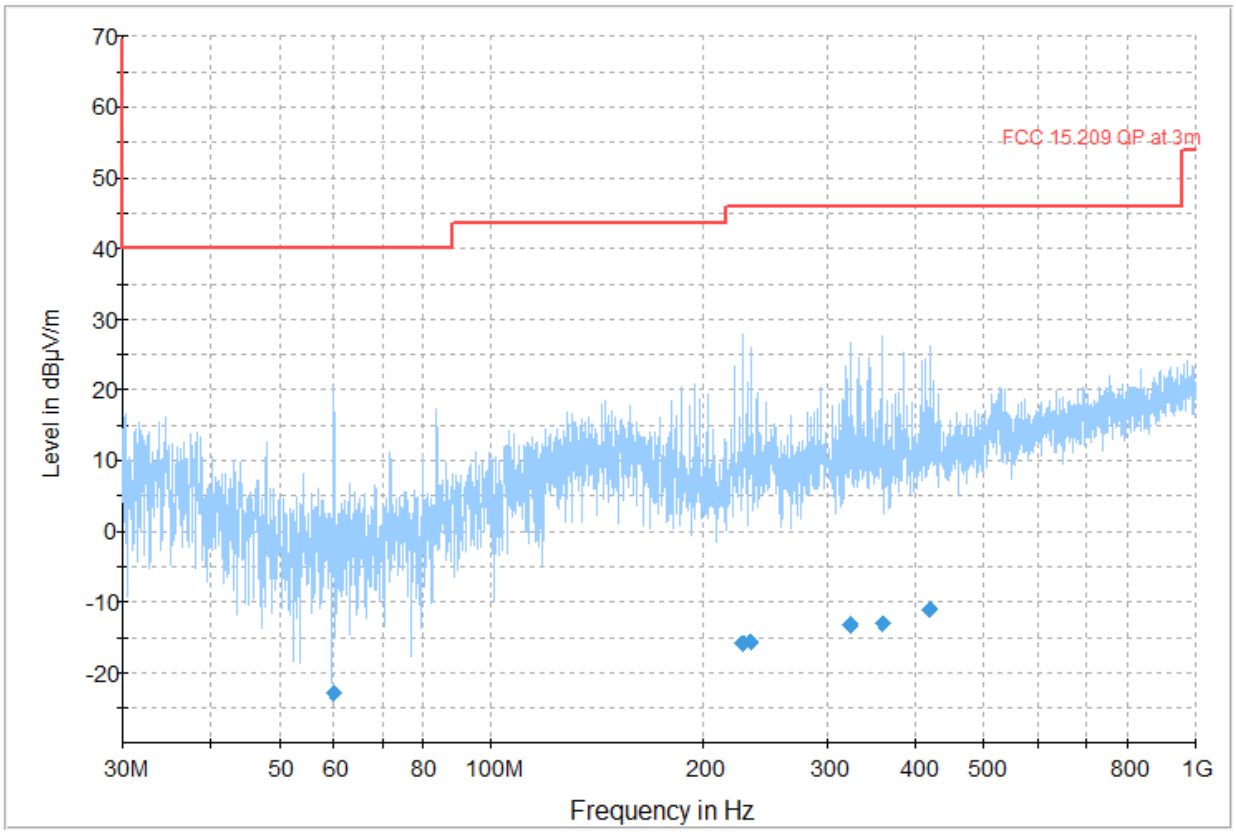
Plot # 50 Radiated Emission



8.6.7 Measurement Plots: channel 15

Plot # 51 Radiated Emission

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
59.973	-22.88	---	40.00	62.88	500.0	120.000	199.0	H	-16.0	-22.9	-35.3	0.0	12.4	0.0
227.977	-15.84	---	46.02	61.86	500.0	120.000	202.0	V	-15.0	-15.8	-34.3	0.0	18.5	0.0
233.967	-15.61	---	46.02	61.63	500.0	120.000	199.0	V	-16.0	-15.6	-34.4	0.0	18.8	0.0
323.983	-13.19	---	46.02	59.21	500.0	120.000	198.0	H	-17.0	-13.2	-34.0	0.0	20.8	0.0
359.970	-12.96	---	46.02	58.98	500.0	120.000	199.0	H	-17.0	-13.0	-33.9	0.0	21.0	0.0
419.964	-11.03	---	46.02	57.05	500.0	120.000	200.0	H	-16.0	-11.0	-33.7	0.0	22.7	0.0



Plot # 52 Radiated Emission

Note: The emission at 2.480 GHz is the wanted emission, which is irrelevant to the limit.

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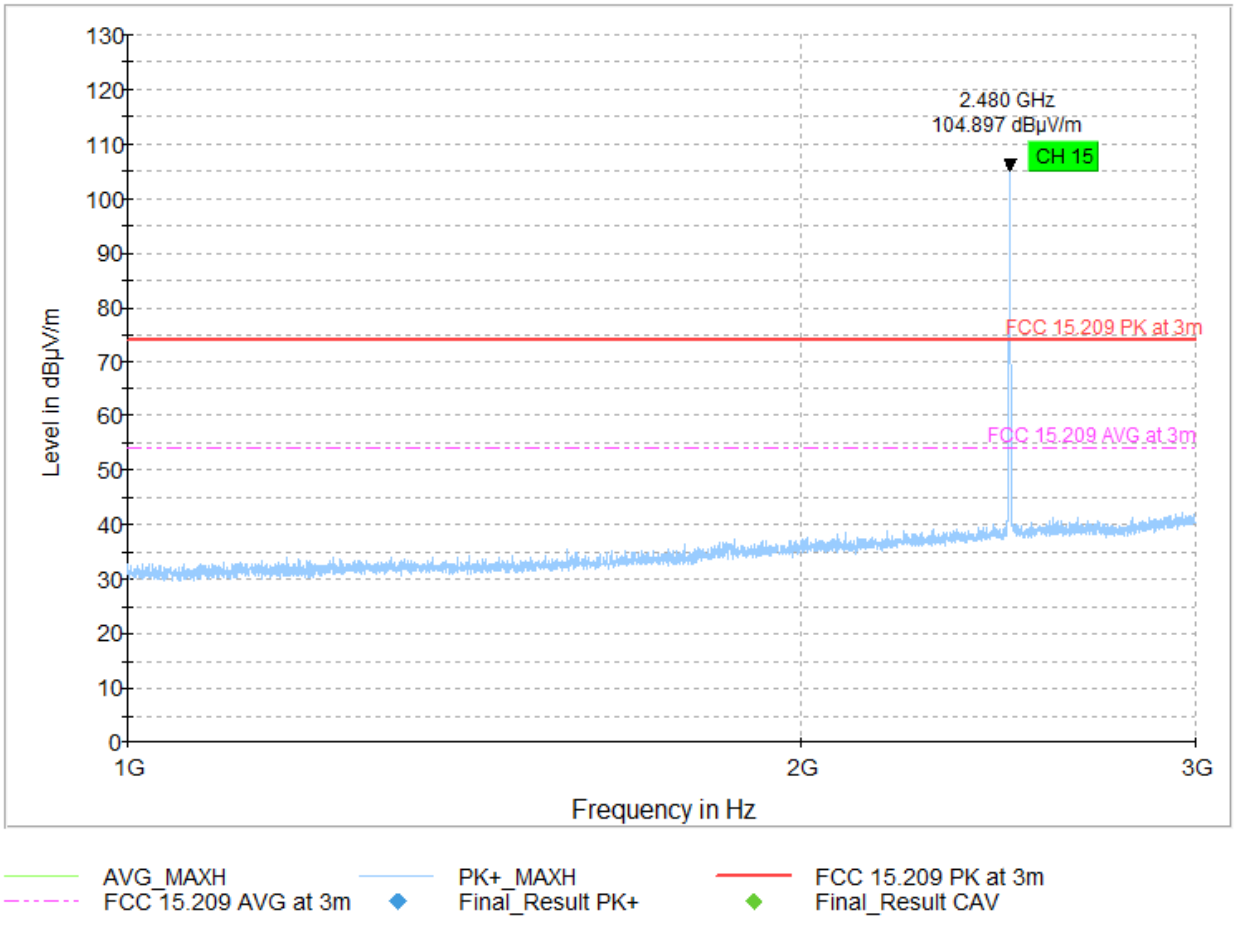
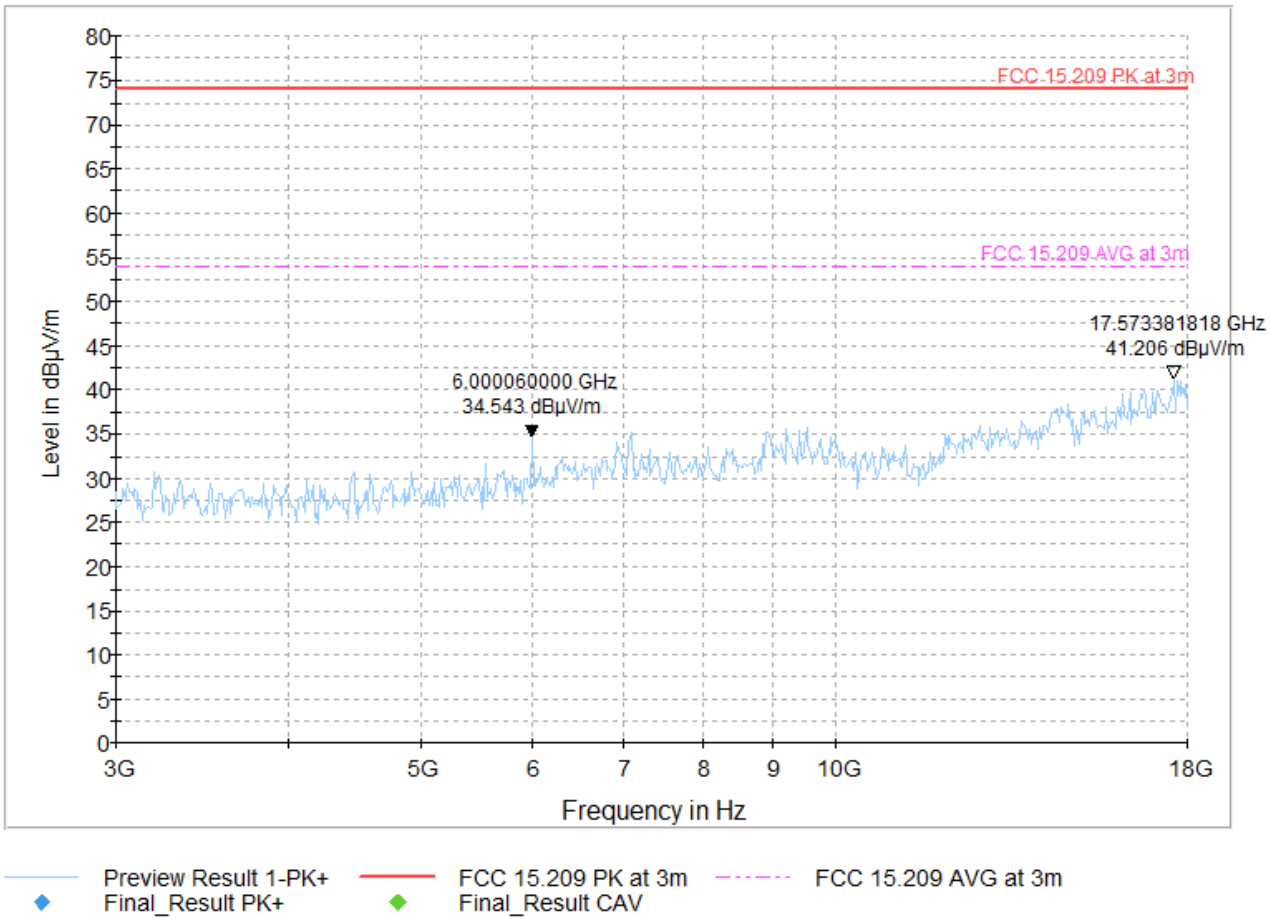


Plot # 53 Radiated Emission



9 Test setup photos

Setup photos are included in supporting file name:
"EMC_VISTE_002_23001_FCC15247_DTS_CSC_LG_Photos.pdf"

10 Test Equipment And Ancillaries Used For Testing

EMC 2

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
Biconlog Antenna	ETS Lindgren	BiLA2G	00063983	3 YEARS	8/14/2023
HORN ANTENNA	EMCO	3115	00035114	3 YEARS	09/13/2023
HORN ANTENNA	ETS LINDGREN	3117-PA	166067	3 YEARS	09/25/2023
HORN ANTENNA	ETS LINDGREN	3116C-PA	00169535	3 YEARS	10/26/2023
DIGITAL THRMOMETER	CONTROL COMPANY	4410,90080-03	230713059	3 YEARS	10/18/2023
Spectrum Analyzer	Rohde & Schwarz	FSU. Spectrum Analyzer	100189	3 YEARS	5/27/2022
PASSIVE LOOP ANTENNA	ETS-LINDGREN	6512	00164698	3 YEARS	6/9/2023
EMI RECEIVER	R&S	ESW44	101715	2 YEARS	10/24/2023
Thermometer	Control Company	4410,90080-03	23071341	2 YEARS	10/18/2023

Note: Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.
Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated "NA" for cal status either do not specifically require calibration or is internally characterized before use.

11 History

Date	Report Name	Changes to report	Prepared by
2024-01-29	EMC_VISTE_002_23001_FCC15247_DTS_CSCLG	Initial version	Guangcheng Huang
2024-02-20	EMC_VISTE_002_23001_FCC15247_DTS_CSCLG_Rev1	Updated Antenna Gain in Section 3.1 and Section 8.2.4	Guangcheng Huang

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