FCC / ISED Test Report

For:
Xirgo Technologies LLC

Model Name:
XT1040S6

Product Description:
Wireless Door Sensor

FCC ID: GKM-XT1040S6
IC: 10281A-XT1040S6

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

REPORT #: EMC_XIRGO_193_23001_FCC_15_247

DATE: 2023-09-29

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: contact@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.
Xirgo Technologies LLC	Wireless Door Sensor	XT1040S6

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2023-09-29	Compliance	Arndt Stoecker (Director of Regulatory Services)	Arndt Stoecker Digitally signed by: Arndt Stoecker DN: CN = Arndt Stoecker email = arndt.stoecker@cetecom.com C = US O = CETECOM Inc Date: 2023.09.29 10:53:48 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
2023-09-29	Compliance	Cheng Song (EMC Engineer)	cheng.song@cetecom.com Digitally signed by: cheng.song@cetecom.com DN: CN = cheng.song@cetecom.com Date: 2023.09.29 10:31:52 -07'00'

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
Director of Regulatory Services:	Arndt Stoecker
Responsible Project Leader:	Akanksha Baskaran

2.2 Identification of the Client

Applicant's Name:	Xirgo Technologies, LLC.
Street Address:	1461 Lawrence Dr, Ste 1
City/Zip Code	Thousand Oaks, CA 91320
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:	Wireless Door Sensor
Model Name :	XT1040S6
HW Version :	XT1040S6-001
SW Version :	XT1040S6-01
FCC ID :	GKM-XT1040S6
IC :	10281A-XT1040S6
Frequency Range / number of channels:	Nominal band: 2400 MHz – 2483.5 MHz; Center to center: 2402 MHz (ch 0) – 2480 MHz (ch 39), 40 channels
Radio Information:	**Bluetooth Low Energy (BLE):** • **Module:** Silicon Labs EFR32BG22 • **Modulation:** Bluetooth 5.3, GFSK
Antenna Information as declared:	Trace Antenna, Max Gain 3dBi
Max. Peak Output Power:	7.34dBm Conducted Power
Other Radios included in the device	NA
Power Supply/ Rated Operating Voltage Range	2 L91 Replaceable Lithium AA: 2.7V to 3.6VDC
Operating Temperature Range	Low : -40 ºC to ºC High +60 ºC
Sample Revision	☐Production ☒ Pre-Production
EUT Dimensions	55 mm x 145mm x 25.4mm
EUT Diameter	☒< 60 cm ☐ Other _____

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	110823000002	XT1040S6-001	XT1040S6-01	Radiated Emissions Conducted RF

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
1	N/A	N/A	N/A	N/A

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#1	The radio of the EUT was configured to a fixed channel transmission with highest possible duty cycle, using a software which is not applicable for end users. The measurement equipment was connected to the 50 ohm RF port of the EUT.
2	EUT#1	The radio of the EUT was configured to a fixed channel transmission with highest possible duty cycle, using a software which is not applicable for end users. The internal antenna was connected.

3.5 Mode of Operation

Operating Mode #	Comments
Op. 1	During the testing process, the EUT was tested with transmitter sets on low, mid and high channels, and highest possible duty cycle. 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. The EUT has the BLE PHY 2Mbps feature disabled.

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.

5 Measurement Results Summary

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	NA	NP	Result
§15.247(a)(1) RSS-247 5.2(a)	Emission Bandwidth	Nominal	Op. 1	■	☐	☐	Complies
§15.247(e) RSS-247 5.2(b)	Power Spectral Density	Nominal	Op. 1	■	☐	☐	Complies
§15.247(b)(1) RSS-247 5.4(d)	Maximum Conducted Output Power and EIRP	Nominal	Op. 1	■	☐	☐	Complies
§15.247(d) RSS-247 5.5	Band edge compliance Unrestricted Band Edges	Nominal	Op. 1	■	☐	☐	Complies
§15.247; 15.209; 15.205 RSS-Gen 8.9; 8.10	Band edge compliance Restricted Band Edges	Nominal	Op. 1	■	☐	☐	Complies
§15.247(d); §15.209 RSS-Gen 6.13	TX Spurious emissions-Radiated	Nominal	Op. 1	■	☐	☐	Complies
§15.207(a) RSS Gen 8.8	AC Conducted Emissions	Nominal		☐	■	☐	Note 2

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: EUT does not draw power from public mains.

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:

2023-09-20 – 2023-09-26

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.

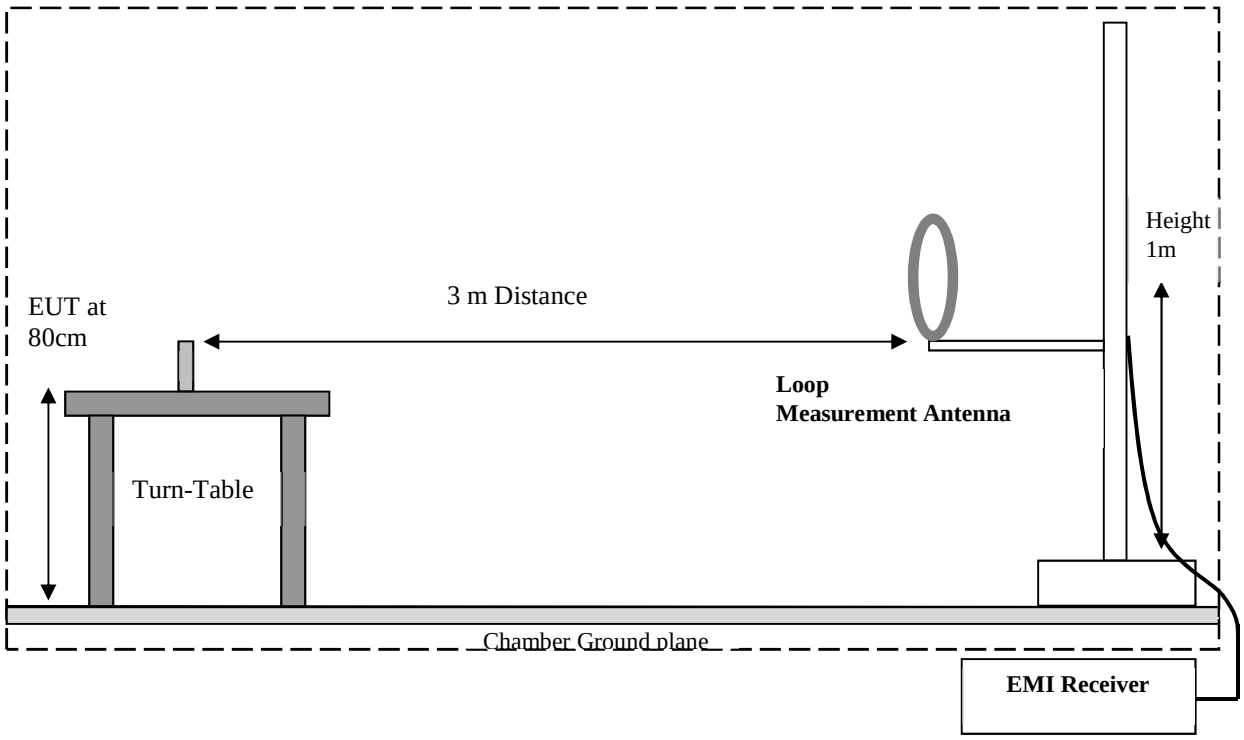
7 Measurement Procedures

7.1 Radiated Measurement

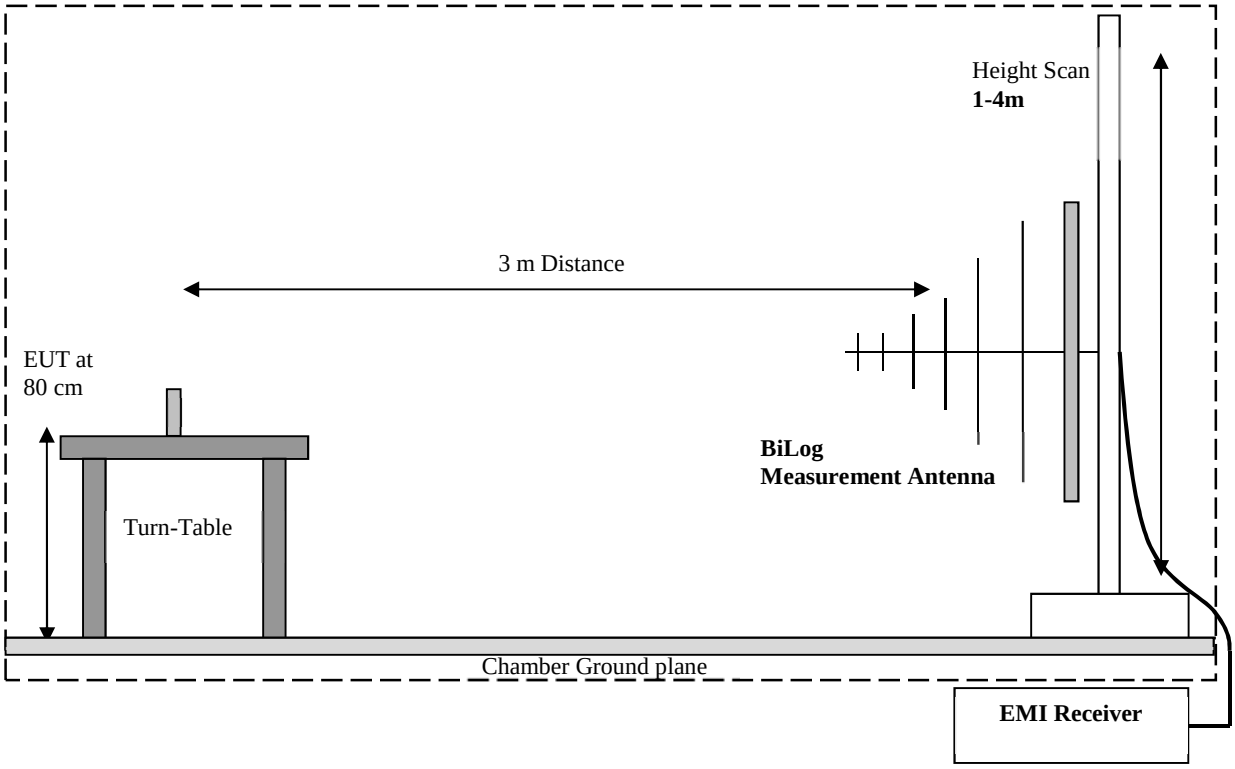
The radiated measurement is performed according to ANSI C63.10 (2013)

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions 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 10 highest 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 up 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.

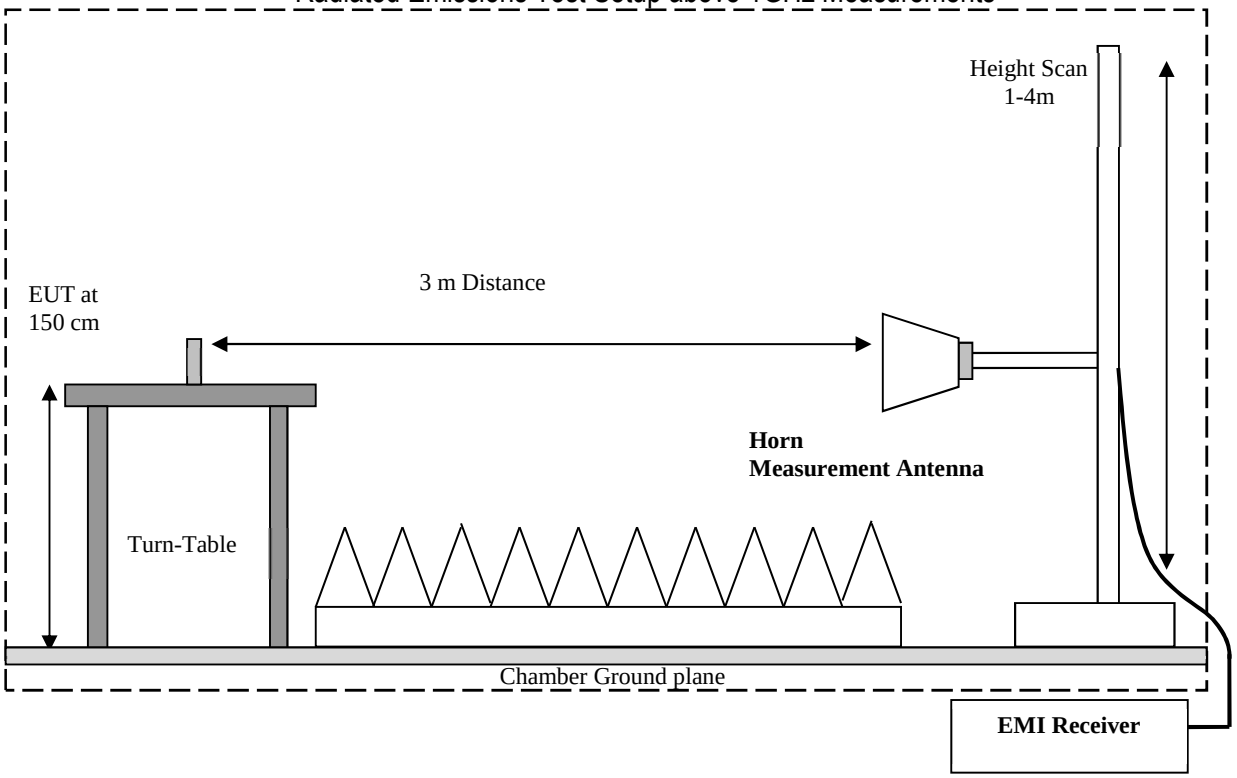
Radiated Emissions Test Setup below 30MHz Measurements



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:

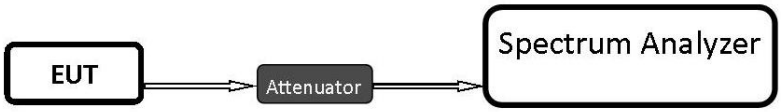
Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

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 Maximum Peak Conducted Output Power

8.1.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

Spectrum Analyzer settings:

- RBW ≥ DTS bandwidth
- VBW ≥ 3 x RBW
- Span ≥ 3 x RBW
- Sweep = Auto couple
- Detector function = Peak
- Trace = Max hold
- Use peak marker function to determine the peak amplitude level

8.1.2 Limits:

Maximum Peak Output Power:

- FCC §15.247 (b)(1): 1 W
- IC RSS-247: 1 W

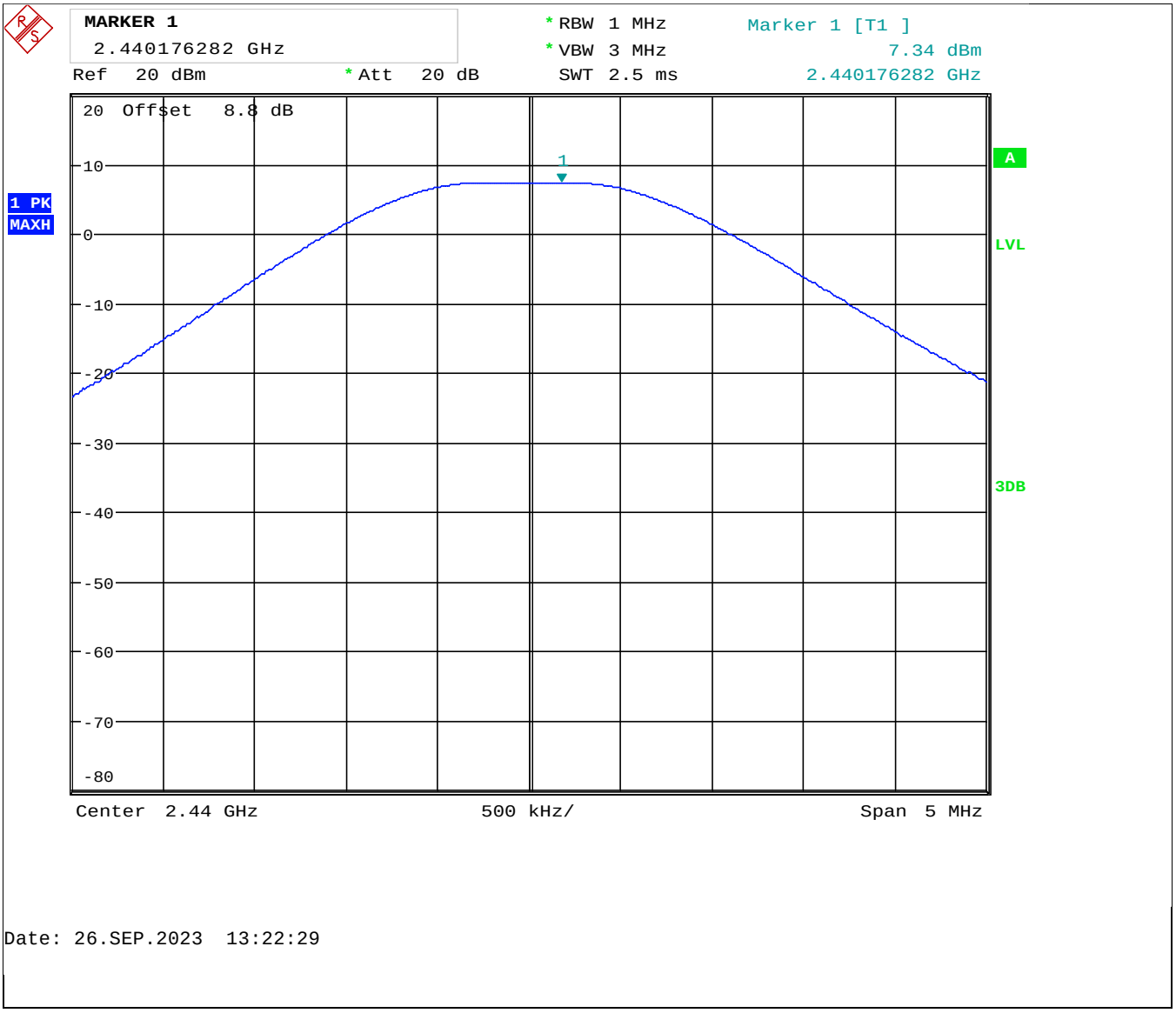
8.1.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
22° C	1	Op. 1	Battery	3 dBi

8.1.4 Measurement result:

Plot #	PHY	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)	EIRP (dBm)	Limit (dBm)	Result
1	LE 1M	2402	6.67	9.67	30 (Pk) / 36 (EIRP)	Pass
2	LE 1M	2440	7.34	10.34	30 (Pk) / 36 (EIRP)	Pass
3	LE 1M	2480	6.43	9.43	30 (Pk) / 36 (EIRP)	Pass

8.1.5 Measurement Plots:



8.2 Power Spectral Density

8.2.1 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

8.2.2 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.

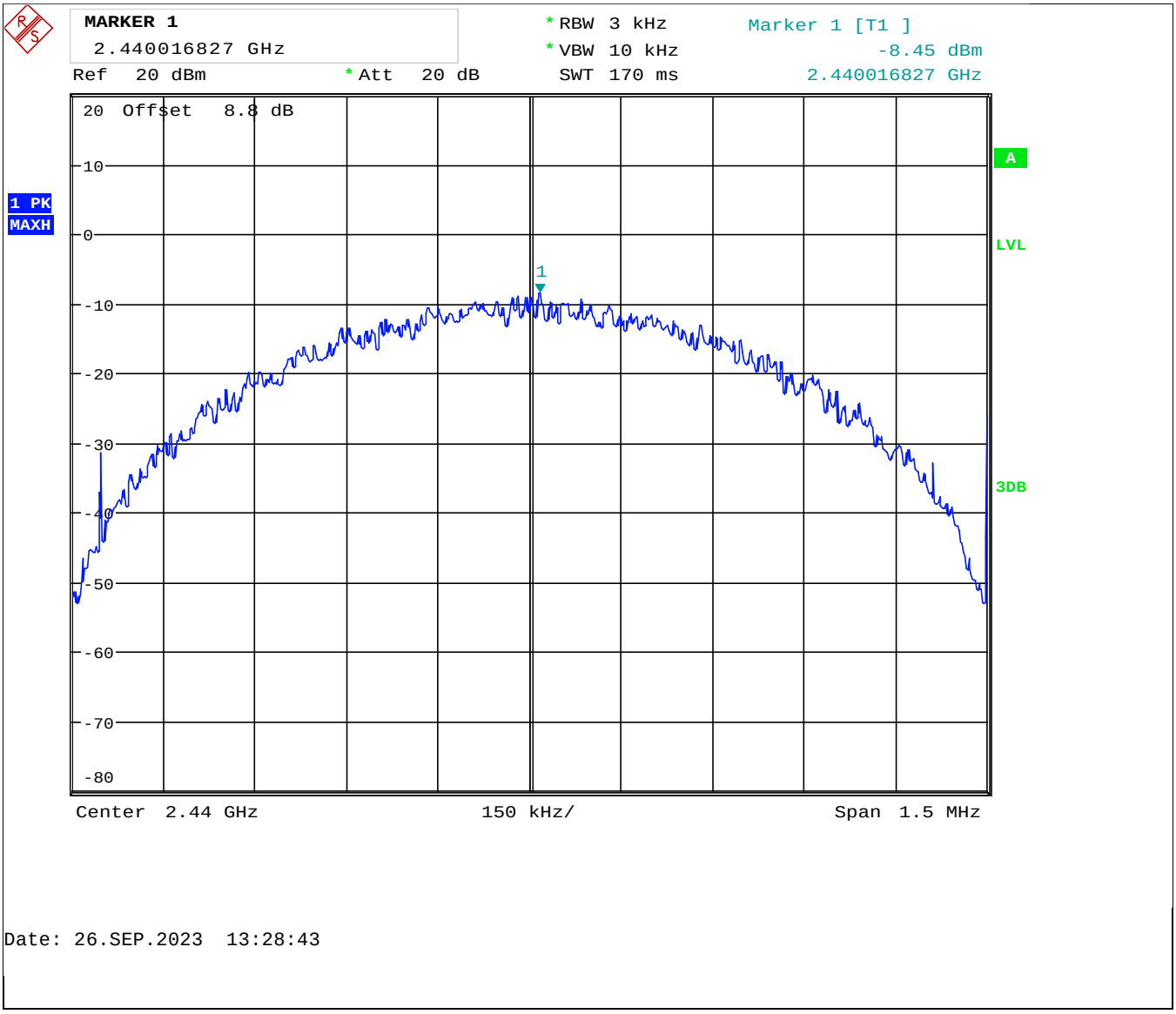
8.2.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
22° C	1	Op. 1	Battery	3 dBi

8.2.4 Measurement result:

Plot #	Frequency (MHz)	PHY	Maximum Power Spectral Density (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Result
1	2402	LE 1M	-9.13	8	Pass
2	2440	LE 1M	-8.45	8	Pass
3	2480	LE 1M	-9.33	8	Pass

8.2.5 Measurement Plots:



8.3 Duty cycle

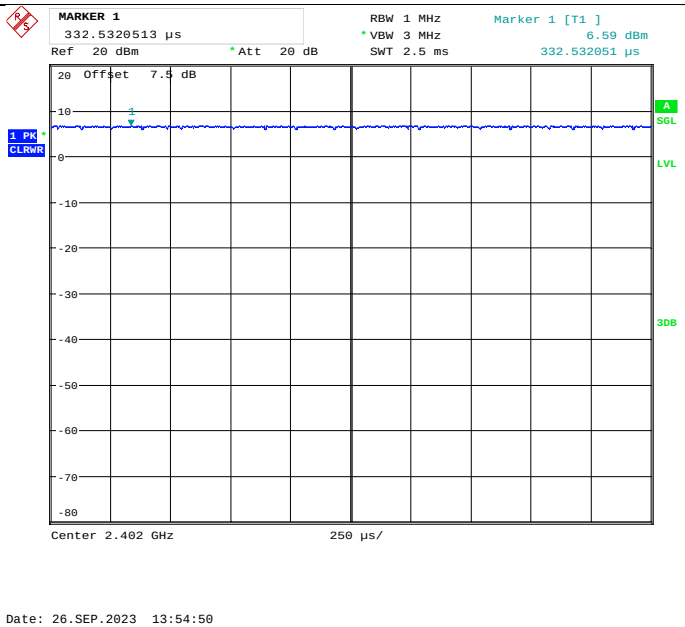
8.3.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

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

8.3.2 Measurement result

LE 1M



Note: The EUT operates at a 100% duty cycle using the Direct Test Mode firmware, exclusively for compliance testing. In contrast, regular production units are set to a maximum 20% duty cycle for BTLE 1Mbps.
For Radiated Spurious Emissions testing, a correction factor for the duty cycle will be used to convert the MaxPeak measurement outcome to the Average result.

Duty cycle = 20%
Duty cycle correction factor = 20*log(1/0.2) = 13.98 dBuV/m

8.4 Band Edge Compliance

8.4.1 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

8.4.2 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)).

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- 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=1 MHz

8.4.3 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			

8.4.4 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
22° C	1 & 2	Op. 1	Battery	3 dBi

8.4.5 Measurement result:

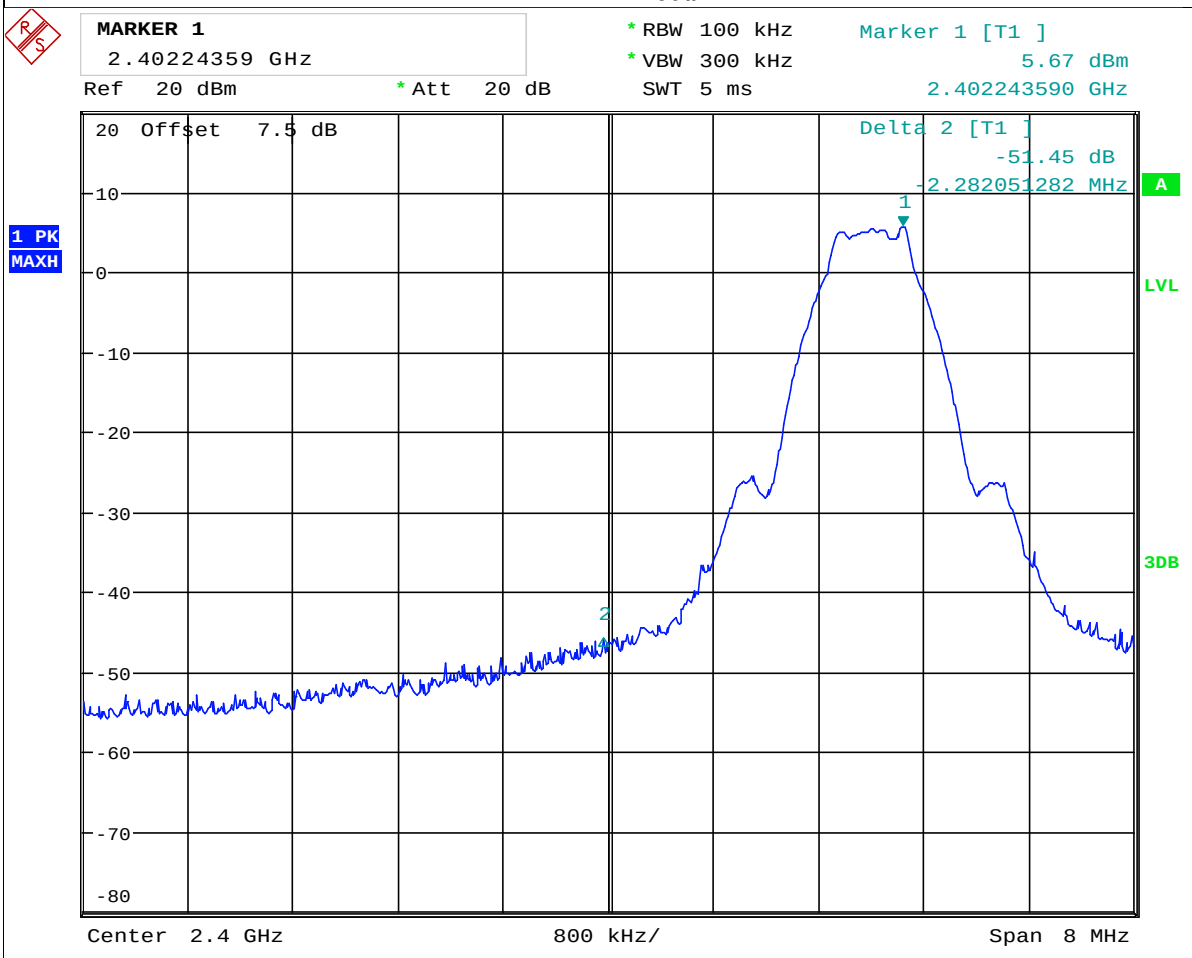
Plot #	EUT Set-Up #	PHY	Band Edge	Band Edge Delta (dBc)	Limit (dBc)	Result
1	1	LE 1M	Lower, Non-restricted	-51.45	< -20	Pass

Plot #	EUT Set-Up #	PHY	Measured Peak Value (dBµV/m)	Limit (dBµV/m)	Result
2	2	LE 1M	PK: 47.29	PK: 74	Pass
			AVG: 34.12	AVG:54	

Note: Radiated testing setup refer section 7.1

8.4.6 Measurement Plots:

Plot # 1



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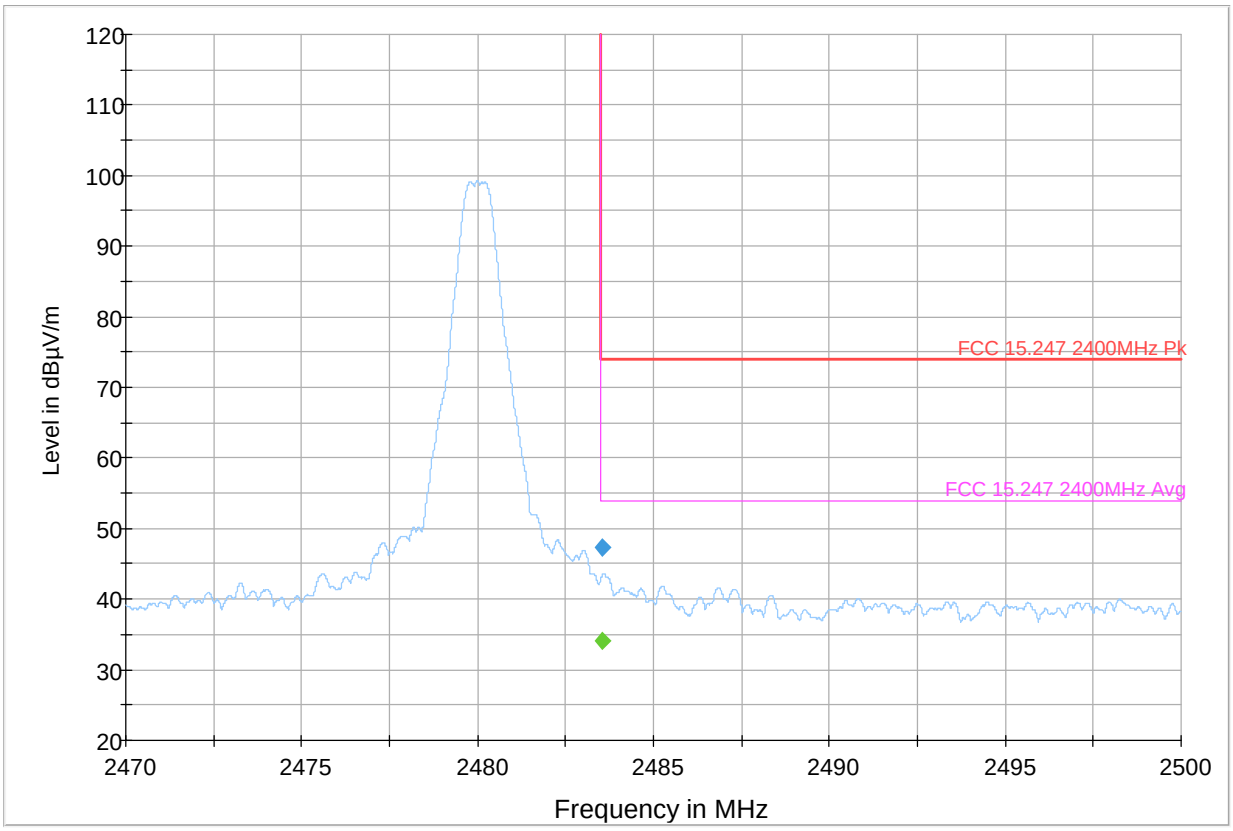
Plot # 2

Frequency	MaxPeak (dBµV/m	CAverage	Limit (dBµV/m	Margin	Meas.	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m	Sig Pat	Preamp	Trd Corr.	Raw Rec
2483.541	---	34.12	54.00	19.88	500.0	1000.000	344.0	H	130.0	6.0	-	0.0	28.5	28.2
2483.541	47.29	---	74.00	26.71	500.0	1000.000	344.0	H	130.0	6.0	-	0.0	28.5	41.3



8.5 Emission Bandwidth 6dB and 99% Occupied Bandwidth

8.5.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

Spectrum Analyzer settings:

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.

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.

8.5.2 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.

8.5.3 Test conditions and setup:

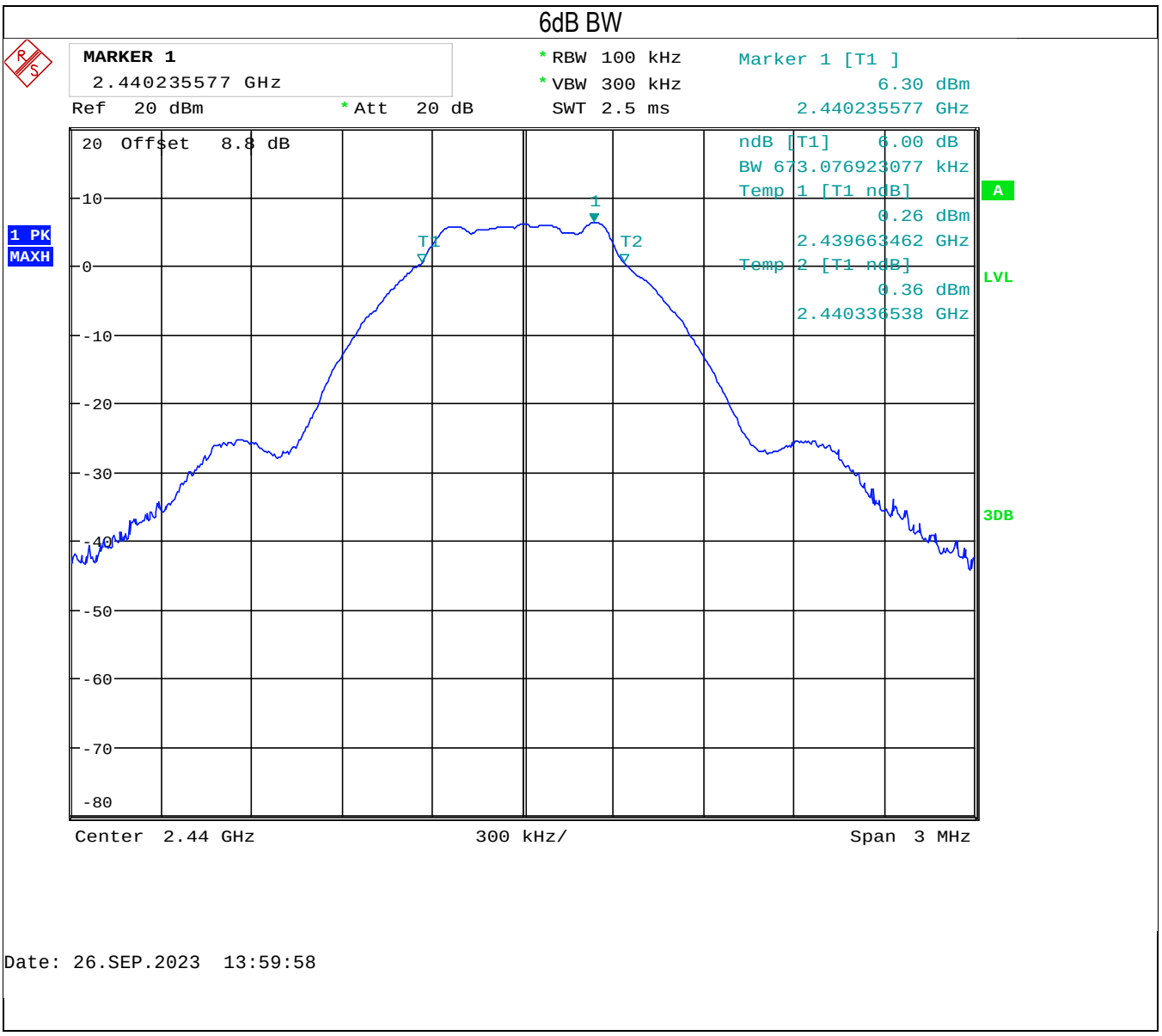
Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
22° C	1	Op. 1	Battery

8.5.4 Measurement result:

Plot #	Frequency (MHz)	PHY	6dB Emissions Bandwidth (MHz)	Limit (MHz)	Result
1	2402	LE 1M	0.673	> 0.5	Pass
2	2440	LE 1M	0.673	> 0.5	Pass
3	2480	LE 1M	0.673	> 0.5	Pass

Plot #	Frequency (MHz)	PHY	99% Occupied Bandwidth (MHz)	Result
4	2402	LE 1M	1.024	Pass
5	2440	LE 1M	1.024	Pass
6	2480	LE 1M	1.024	Pass

8.5.5 Measurement Plots:



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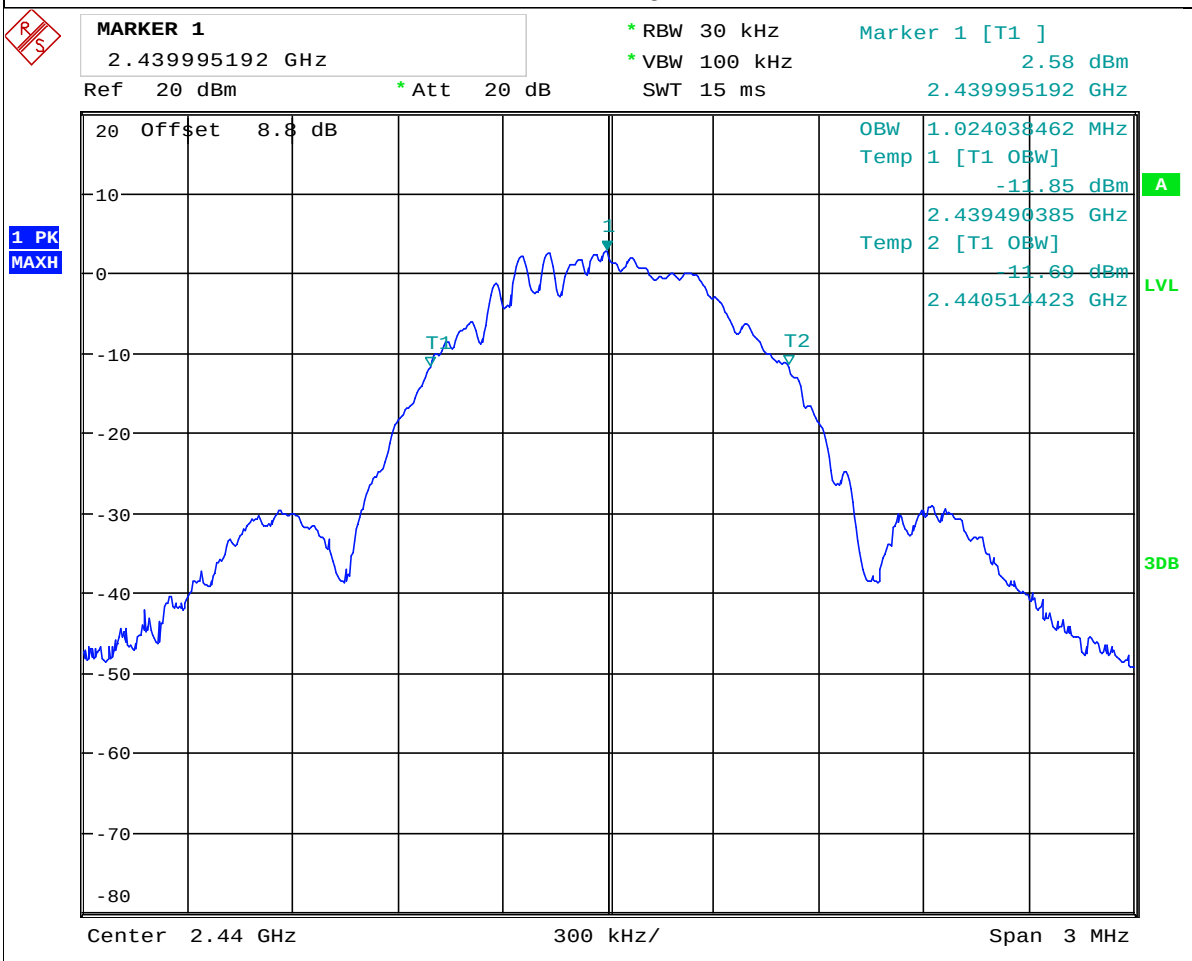

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8.6 Radiated Transmitter Spurious Emissions and Restricted Bands

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	Op. 1	Battery

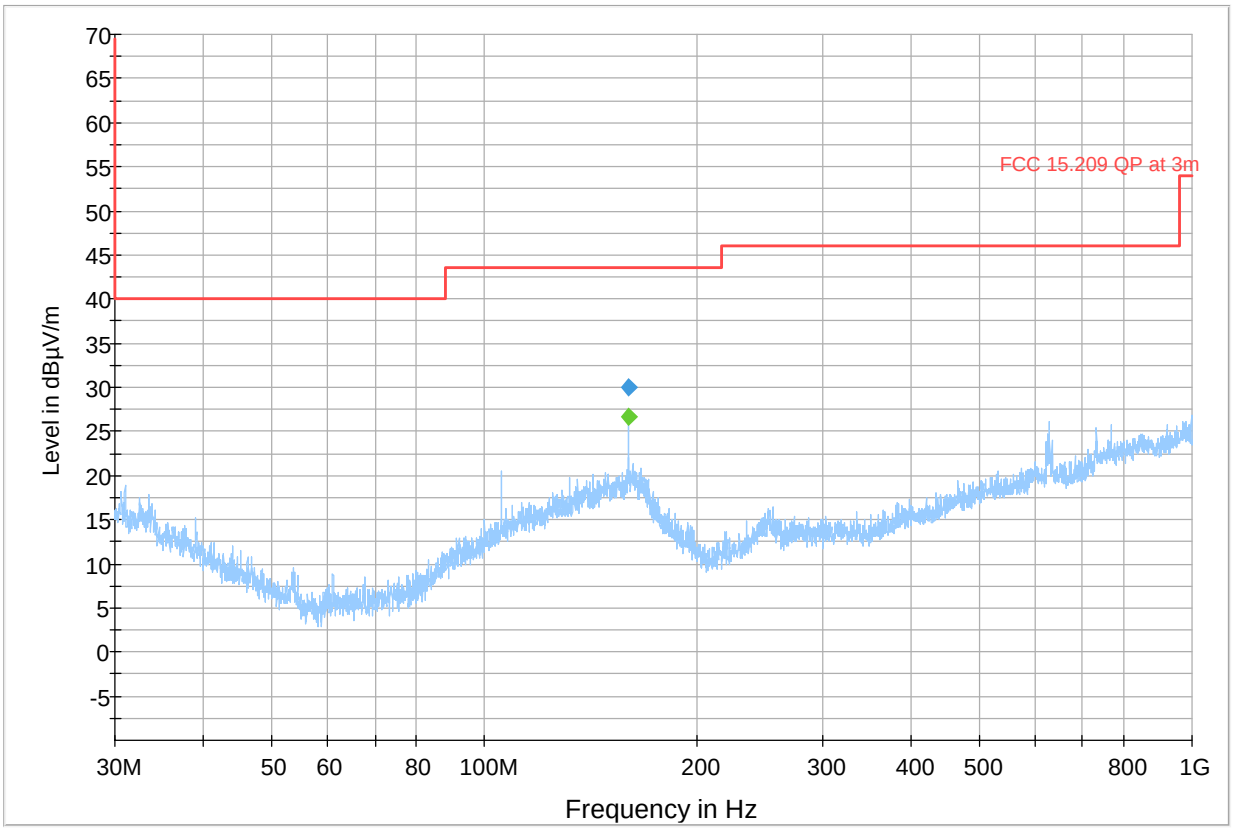
8.6.4 Measurement result:

Plot #	Channel #	PHY	Scan Frequency	Limit	Result
1-3	Low	LE 1M	30 MHz – 18 GHz	See section 8.6.2	Pass
4-8	Mid	LE 1M	9 kHz – 26 GHz	See section 8.6.2	Pass
9-11	High	LE 1M	30 MHz – 18 GHz	See section 8.6.2	Pass

8.6.5 Measurement Plots:

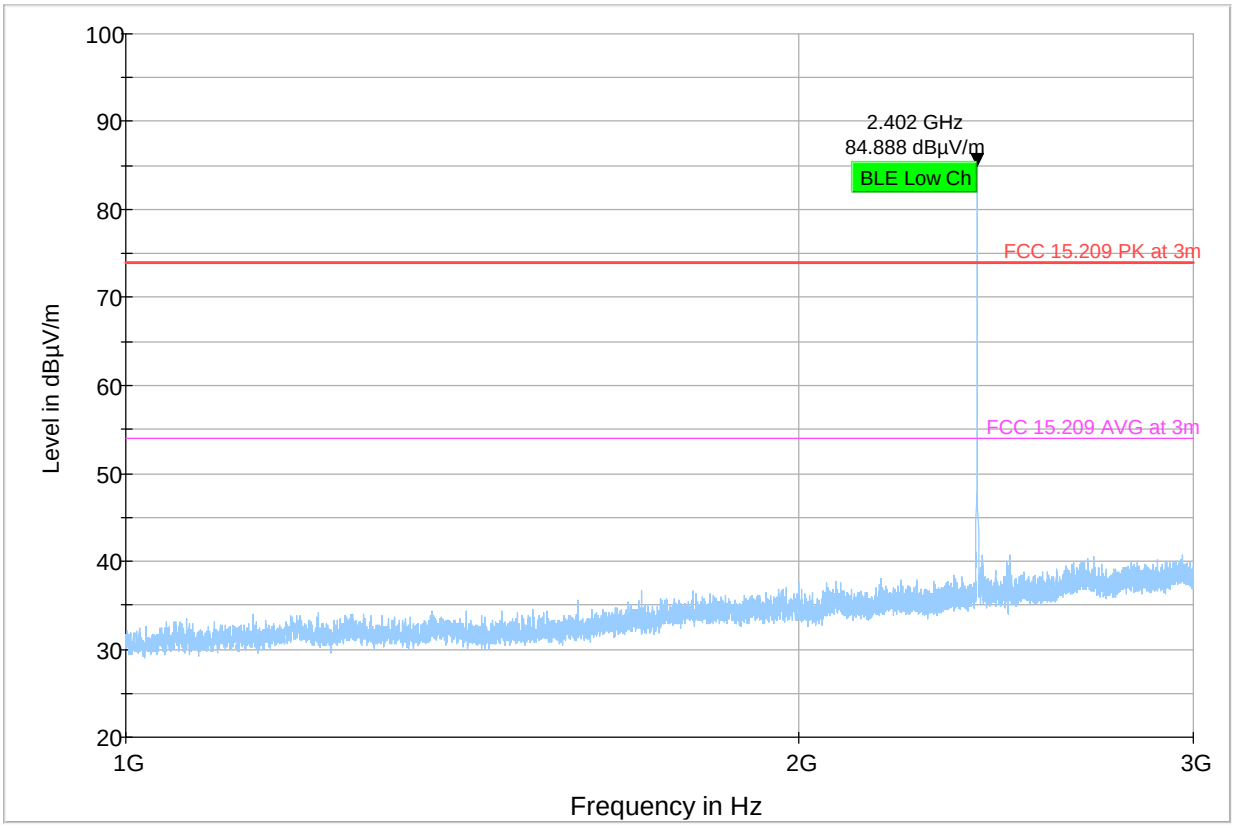
Plot # 1

Frequency	MaxPeak	QuasiPeak	Limit (dBµV/m	Margin	Meas.	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m	Sig Pat	Preamp	Trd Corr.	Raw Rec
159.980	---	26.73	---	---	500.0	120.000	100.0	V	29.0	-9.2	-	0.0	25.5	35.9
159.980	29.92	---	43.50	13.58	500.0	120.000	100.0	V	29.0	-9.2	-	0.0	25.5	39.1



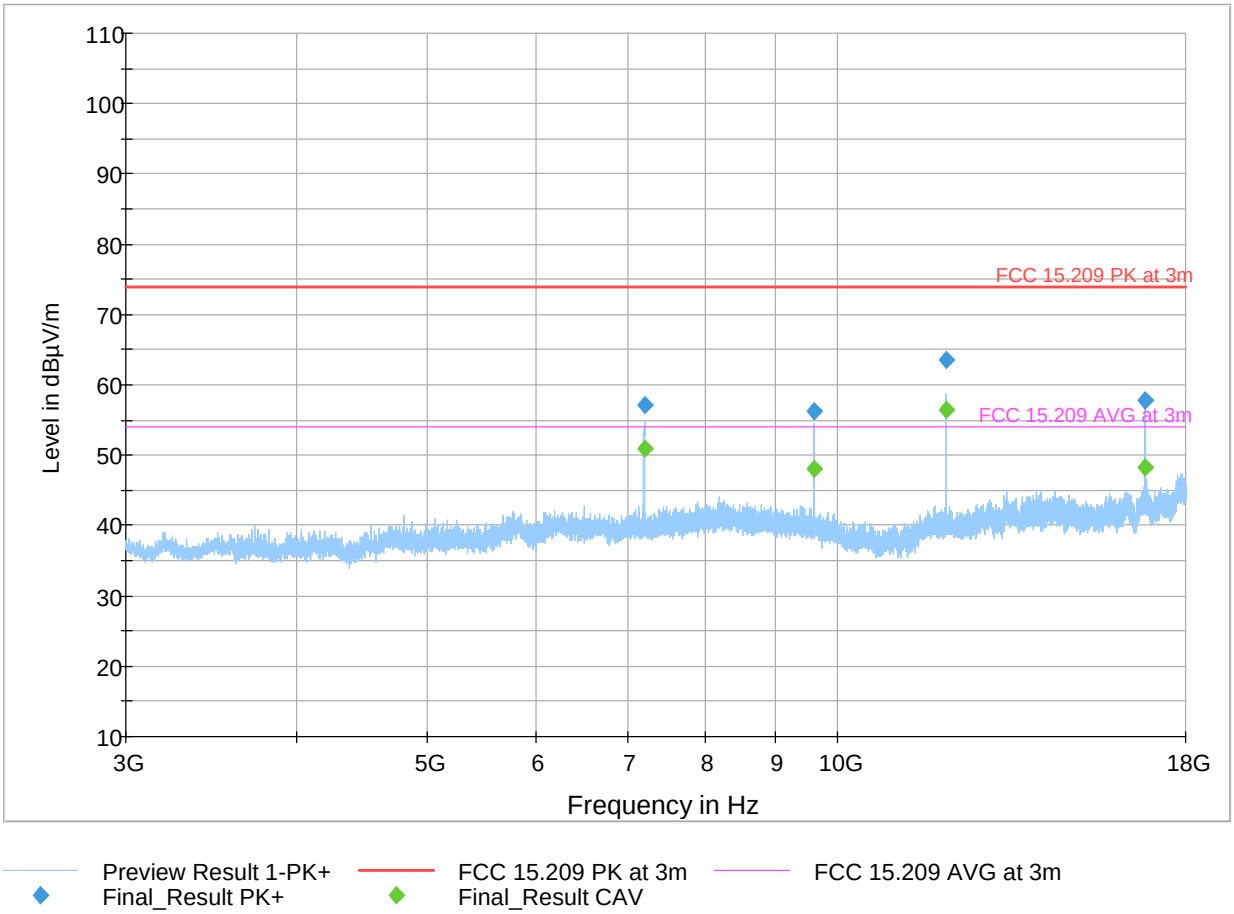
Plot # 2

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
---	---	---	---	---	---	---	---		---	---



Plot # 3

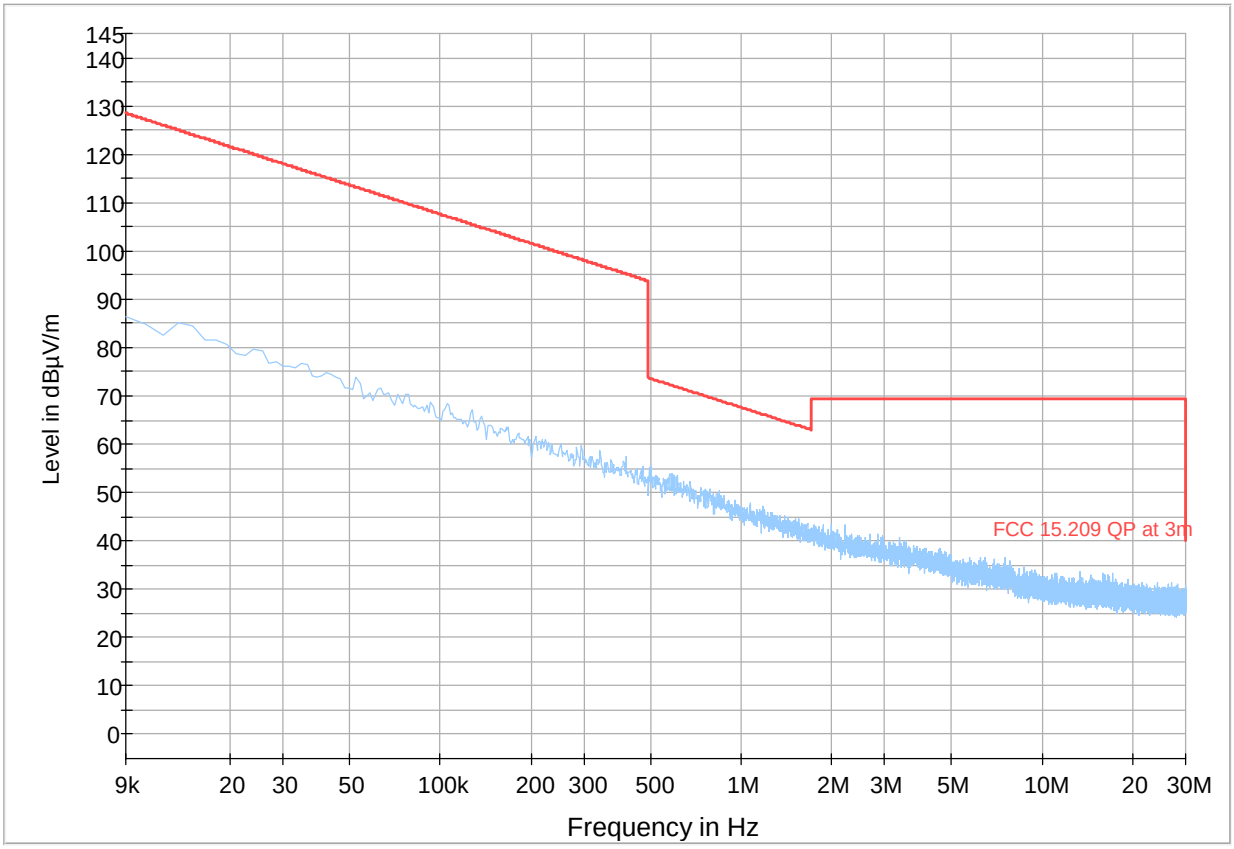
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7205.500	57.231	---	73.98	16.75	500.0	1000.000	315.0	V	136.0	0.8
7205.500	---	50.877	53.98	3.10	500.0	1000.000	315.0	V	136.0	0.8
9609.000	56.315	---	73.98	17.66	500.0	1000.000	275.0	H	177.0	1.8
9609.000	---	48.008	53.98	5.97	500.0	1000.000	275.0	H	177.0	1.8
12009.000	---	56.470	53.98	-2.49	500.0	1000.000	271.0	H	41.0	1.6
12009.000	63.506	---	73.98	10.47	500.0	1000.000	271.0	H	41.0	1.6
16813.000	---	48.311	53.98	5.67	500.0	1000.000	231.0	H	139.0	8.5
16813.000	57.821	---	73.98	16.16	500.0	1000.000	231.0	H	139.0	8.5



Note 1: For the frequency of 12009 MHz, the average result can be calculated by deducting the duty cycle factor of 13.98dBuV/m from the peak result of 63.506dBuV/m, yielding 49.526dBuV/m. This result remains below the average limit of 53.98dBuV/m.
Note 2: Refer to section 8.3.2 for the calculation of the duty cycle correction factor.

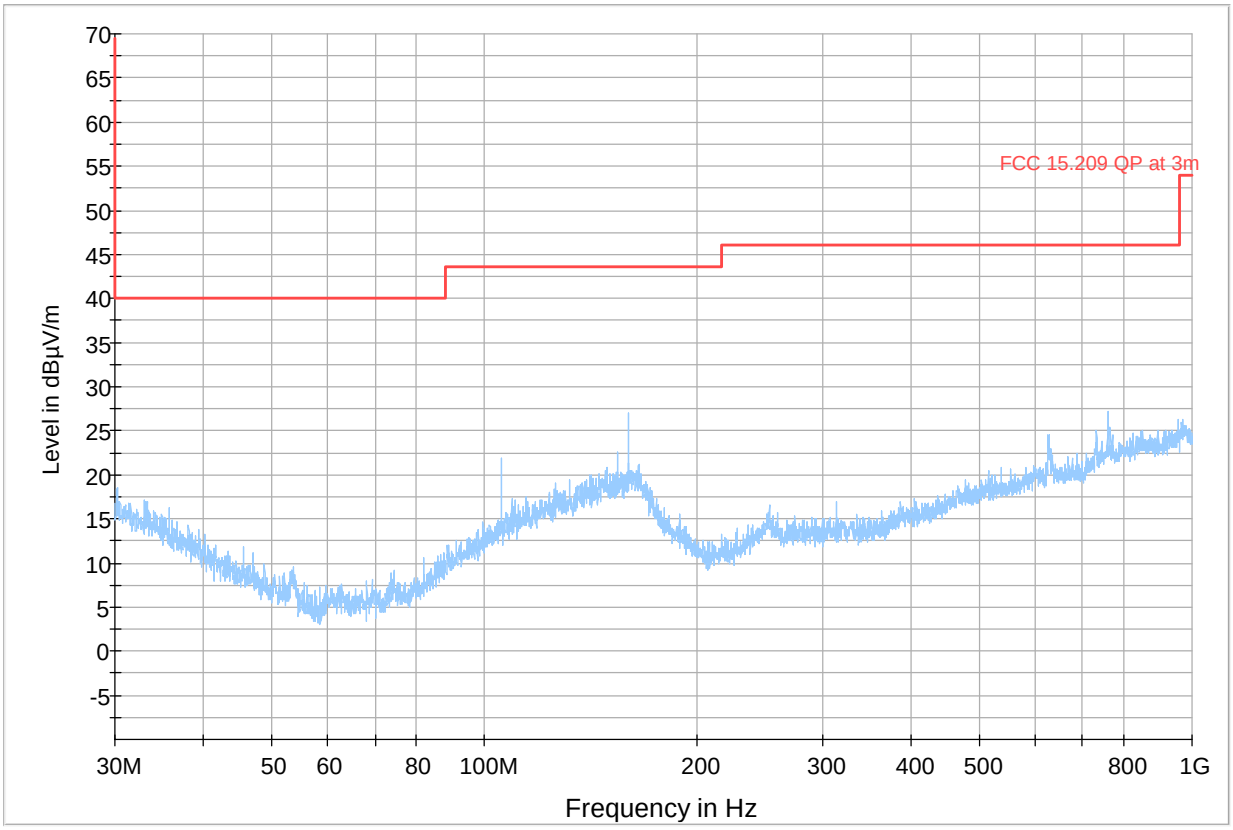
Plot # 4

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
---	---	---	---	---	---	---		---	---



Plot # 5

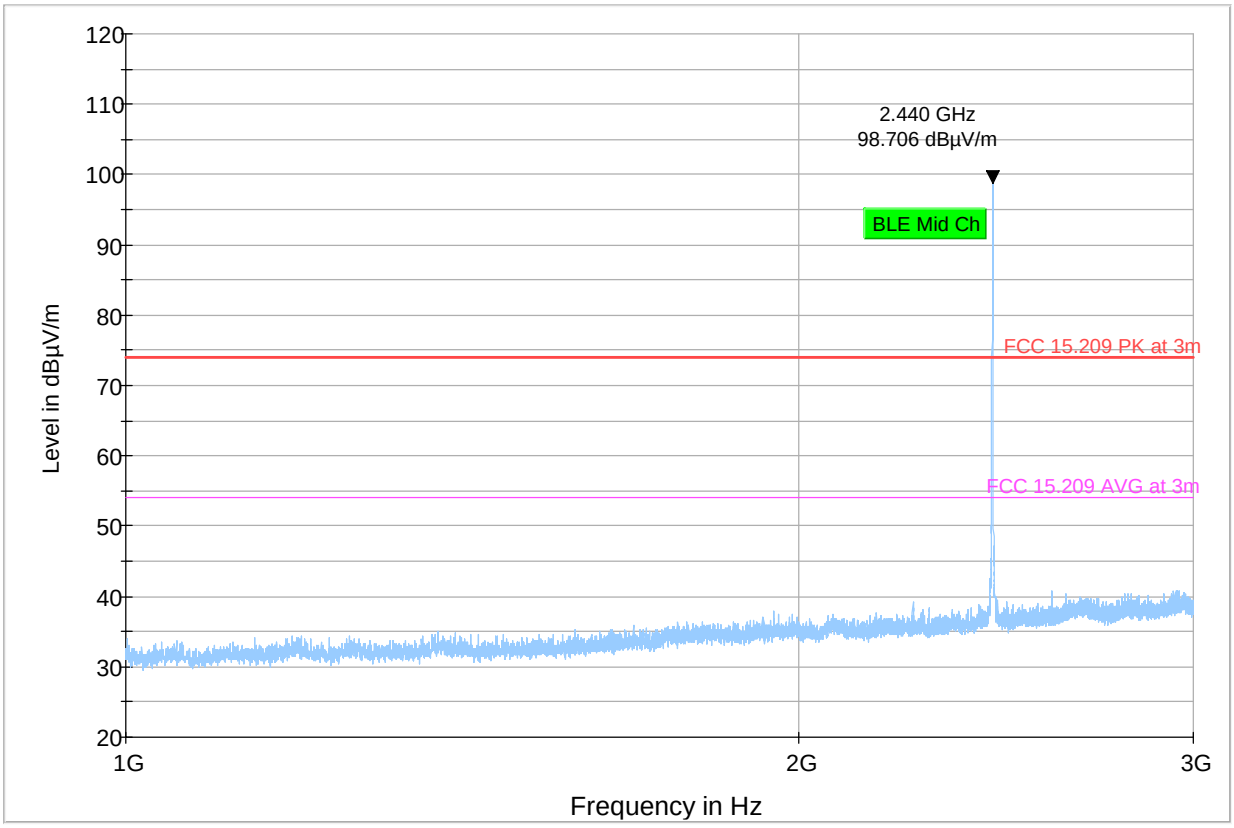
Frequency	MaxPeak	QuasiPeak	Limit (dBµV/m	Margin	Meas.	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m	Sig Pat	Preamp	Trd Corr.	Raw Rec
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---



AVG_MAXH
Final_Result PK+
PK+_MAXH
Final_Result QPK
FCC 15.209 QP at 3m

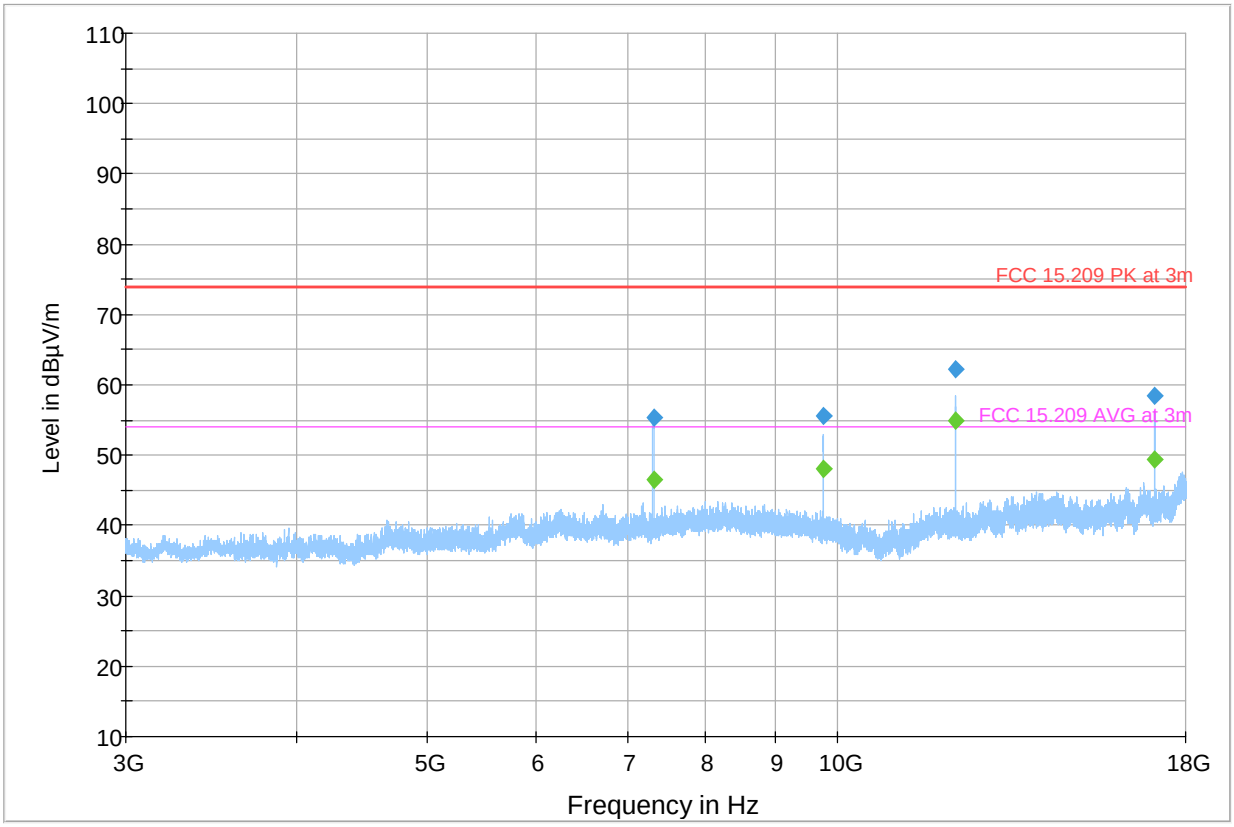
Plot # 6

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
---	---	---	---	---	---	---	---		---	---



Plot # 7

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7321.000	---	46.585	53.98	7.39	500.0	1000.000	150.0	V	268.0	0.7
7321.000	55.426	---	73.98	18.55	500.0	1000.000	150.0	V	268.0	0.7
9759.500	55.509	---	73.98	18.47	500.0	1000.000	289.0	H	13.0	1.3
9759.500	---	47.988	53.98	5.99	500.0	1000.000	289.0	H	13.0	1.3
12199.000	---	54.909	53.98	-0.93	500.0	1000.000	249.0	H	187.0	1.5
12199.000	62.110	---	73.98	11.87	500.0	1000.000	249.0	H	187.0	1.5
17079.000	58.381	---	73.98	15.60	500.0	1000.000	253.0	H	60.0	7.5
17079.000	---	49.392	53.98	4.59	500.0	1000.000	253.0	H	60.0	7.5

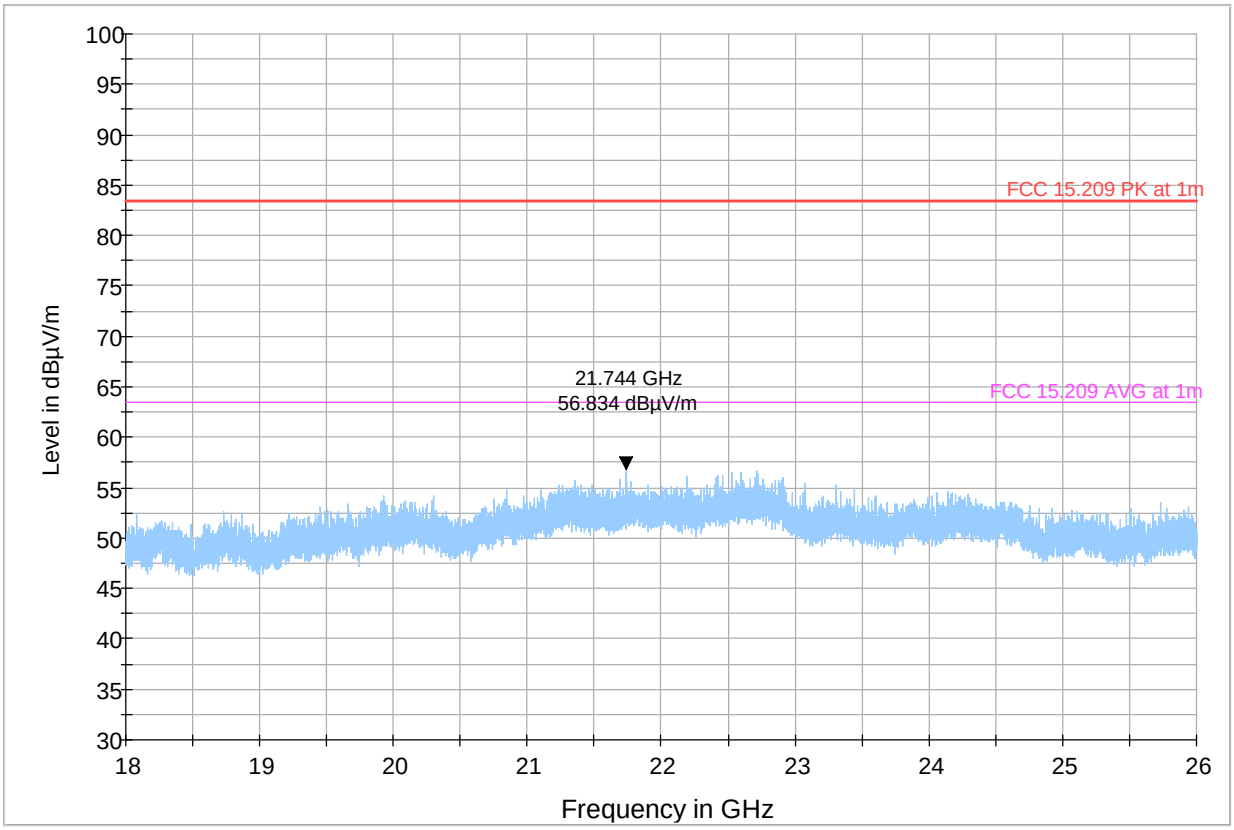


Note 1: For the frequency of 12199 MHz, the average result can be calculated by deducting the duty cycle factor of 13.98dBuV/m from the peak result of 62.110dBuV/m, yielding 48.13dBuV/m. This result remains below the average limit of 53.98dBuV/m.

Note 2: Refer to section 8.3.2 for the calculation of the duty cycle correction factor.

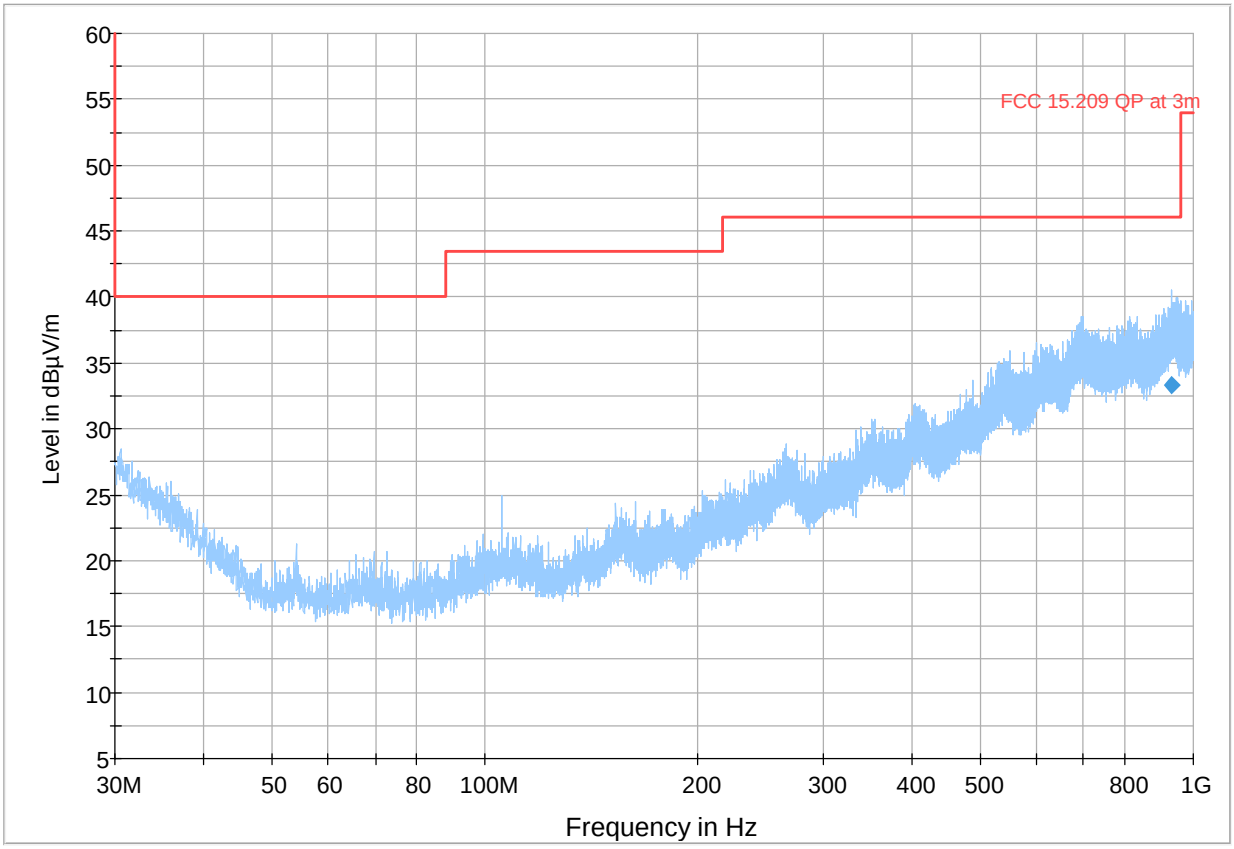
Plot # 8

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
---	---	---	---	---	---	---	---		---	---



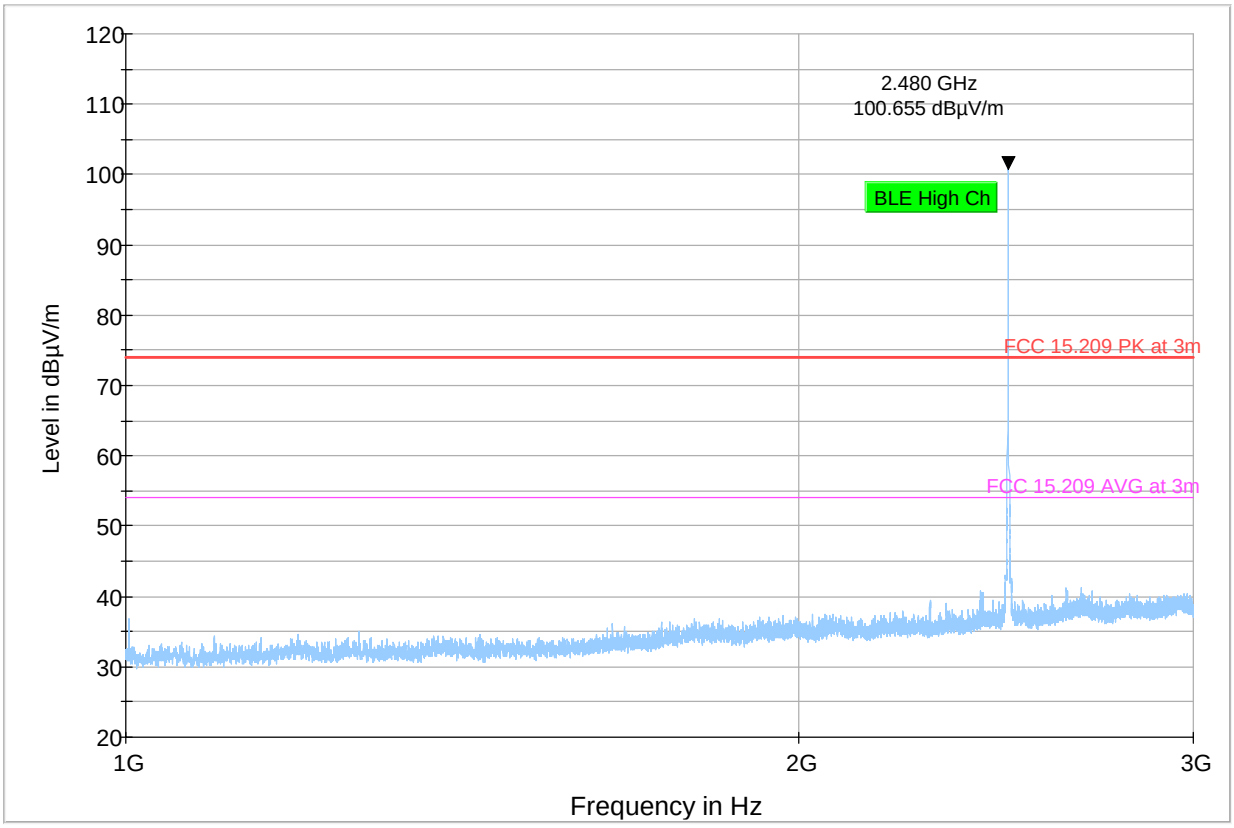
Plot # 9

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
932.326	33.300	46.02	12.72	500.0	120.000	262.0	H	54.0	33.6



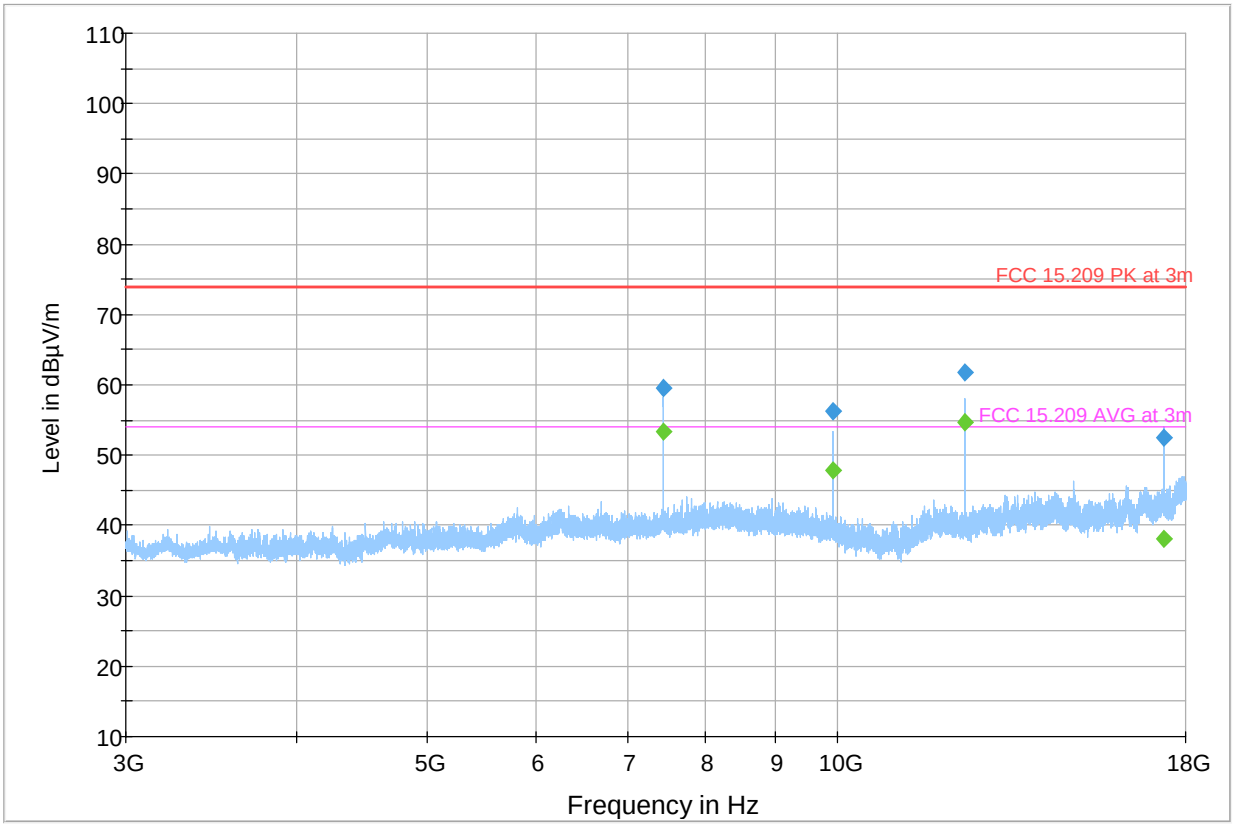
Plot # 10

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
---	---	---	---	---	---	---	---		---	---



Plot # 11

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7439.500	---	53.293	53.98	0.69	500.0	1000.000	315.0	V	276.0	1.0
7439.500	59.551	---	73.98	14.43	500.0	1000.000	315.0	V	276.0	1.0
9919.000	56.168	---	73.98	17.81	500.0	1000.000	271.0	H	12.0	1.2
9919.000	---	47.723	53.98	6.26	500.0	1000.000	271.0	H	12.0	1.2
12399.000	61.873	---	73.98	12.11	500.0	1000.000	243.0	H	186.0	1.9
12399.000	---	54.789	53.98	-0.81	500.0	1000.000	243.0	H	186.0	1.9
17359.000	---	38.018	53.98	15.96	500.0	1000.000	230.0	V	338.0	8.5
17359.000	52.380	---	73.98	21.60	500.0	1000.000	230.0	V	338.0	8.5



Note 1: For the frequency of 12399 MHz, the average result can be calculated by deducting the duty cycle factor of 13.98dBuV/m from the peak result of 61.873dBuV/m, yielding 47.893dBuV/m. This result remains below the average limit of 53.98dBuV/m.
Note 2: Refer to section 8.3.2 for the calculation of the duty cycle correction factor.

9 Test setup photos

Setup photos are included in supporting file name: "EMC_XIRGO_193_23001_FCC_Setup_Photos"

10 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
ACTIVE LOOP ANTENNA	ETS LINDGREN	6507	00161344	3 YEARS	10/30/2020
BILOG ANTENNA	ETS.LINDGREN	3142E	00166067	3 YEARS	10/21/2021
HORN ANTENNA	EMCO	3115	00035111	3 YEARS	09/30/2021
HORN ANTENNA	ETS.LINDGREN	3117	00215984	3 YEARS	01/31/2021
HORN ANTENNA	ETS.LINDGREN	3116	00070497	3 YEARS	11/23/2020
TEST RECEIVER	R&S	ESU40	100251	3 YEARS	09/13/2021
DIGITAL THRMOMETER	CONTROL COMPANY	36934-164	181230565	3 YEARS	10/20/2021
Spectrum Analyzer	Rohde & Schwarz	FSU. Spectrum Analyzer	200302	3 YEARS	9/13/2021

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 "N/A" for cal status either do not specifically require calibration or is internally characterized before use.

11 History

Date	Template Revision	Changes to report	Prepared by
2023-09-27	EMC_XIRGO_193_23001_FCC_15_247	Initial Version	Cheng Song

<<< The End >>>