FCC / ISED Test Report

For:
Xirgo Technologies LLC

Model Number:
LX45-NA

Product Description:
IoT GNSS tracking device

FCC ID: GKM-LX45
IC: 10281A-LX45

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

REPORT #: EMC_XIRGG_001_24001_FCC_15_247_BLE_Rev1

DATE: 2024-11-15

A2LA Accredited

IC recognized # 3462B

***CETECOM* Inc.**
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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	IoT GNSS tracking device	LX45-NA

Responsible for the Report:

Date	Section	Name	Signature
2024-11-15	Compliance	Cheng Song (EMC Engineer)	Cheng Song CN = Cheng Song email = cheng.song@cetecom.com C = AD 2024.11.15 14:47:45 -08'00'

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
EMC Engineer:	Cheng Song
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:	Xirgo Technologies LLC.
Manufacturers Address:	1461 Lawrence Dr, Ste 1
City/Zip Code	Thousand Oaks, CA 91320
Country	USA

3 Equipment Under Test (EUT)

3.1 EUT Specifications

<table>
<tr><td>Product Description:</td><td>IoT GNSS tracking device</td></tr>
<tr><td>Model Number:</td><td>LX45-NA</td></tr>
<tr><td>Marketing Name:</td><td>LX41-NA, LT41-NA,
LX42-NA, LT42-NA,
LX43-NA, LT43-NA,
LX44-NA, LT44-NA,
LX45-NA, LT45-NA</td></tr>
<tr><td>HW Version:</td><td>LX45-NA-001</td></tr>
<tr><td>SW Version:</td><td>LX45-NA-001</td></tr>
<tr><td>FCC-ID:</td><td>GKM-LX45</td></tr>
<tr><td>IC:</td><td>10281A-LX45</td></tr>
<tr><td>Radio Information as declared:</td><td><u>Cellular:</u>
• Quectel LPWA BG95-M3
• LTE CAT M1, EGPRS
• LTE: B2, B4, B12, B13, B66 only (other bands will be disabled)
• GSM: 850MHz, 900MHz, 1800MHz, 1900MHz.
<u>Bluetooth:</u>
• Nordic nRF52832 (SoC)
• Bluetooth Low Energy.</td></tr>
<tr><td>Antenna Information as declared:</td><td>
<table>
<tr><td>Bands:</td><td>LTE 2 & GSM 1900</td><td>LTE 4</td><td>LTE 12</td><td>LTE 13</td><td>LTE 66</td><td>GSM 850</td><td>BLE</td></tr>
<tr><td>Max Gain (dBi):</td><td>2.02</td><td>1.21</td><td>-0.79</td><td>-2.98</td><td>2</td><td>-4,5</td><td>0.5</td></tr>
</table>
</td></tr>
<tr><td>Power Supply/ Rated Operating Voltage Range</td><td>Low: 9 VDC, Nom: 12VDC, High: 31VDC</td></tr>
<tr><td>Operating Temperature Range</td><td>Low: -40ºC Norm +25ºC High +85 ºC</td></tr>
<tr><td>Sample Revision</td><td>☐Production ☒ Pre-Production</td></tr>
<tr><td>EUT Dimensions</td><td>68mm x 90mm x 19mm</td></tr>
<tr><td>Weight</td><td>Tracker: 64 grams, Set: 160 grams</td></tr>
<tr><td>EUT Diameter</td><td>☒< 60 cm ☐ Other _____</td></tr>
<tr><td colspan="2">Note: All information provided by the client.</td></tr>
</table>

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	86458 10652 01901	LX45-NA-001	LX45-NA-001	Radiated Emissions
2	86458 10652 01810	LX45-NA-001	LX45-NA-001	Conducted RF

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
1	-	-	-	-

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#2	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. 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 software that is not available to the end user. The internal antenna was connected.

3.5 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	Bluetooth LE	During testing, BLE was configured on the physical layer with LE 1 Mbps and LE 2 Mbps, using the maximum allowable transmit power setting of 8 dBm. The 'Direct Test Mode' in the 'nRF Connect for Desktop' application by Nordic Semiconductor was used to set up the EUT in a mode that enables continuous BLE transmission on a specified channel.

3.6 Justification for 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. 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.

The variant model numbers include LX44-NA, LX43-NA, LX42-NA, LX41-NA, LT44-NA, LT43-NA, LT42-NA, and LT41-NA. For further details regarding the differences between these variant models, please refer to the Similarity Declaration issued by Xirgo Technologies LLC. The LX45-NA model was selected as the worst-case model for testing, based on the initial spot-check verification.

4.1 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)	150 kHz – 30 MHz	2.47 dB	N/A
Radiated emissions	9 kHz – 30 MHz	2.68 dB	2.53 dB
	30 – 100 MHz	4.39 dB	3.85 dB
	100 MHz – 1 GHz	5.65 dB	5.24 dB
	1 – 6 GHz	5.0 dB	4.88 dB
	6 – 18 GHz	4.76 dB	4.58 dB
	18 – 40 GHz	4.65 dB	4.61 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.

4.2 Environmental Conditions During Testing:

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

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

4.3 Dates of Testing:

2024-09-09 – 2024-10-14

4.4 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.

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 1 Note 2

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: The EUT does not draw power from AC public mains; therefore, AC Conducted Emissions testing is not applicable.

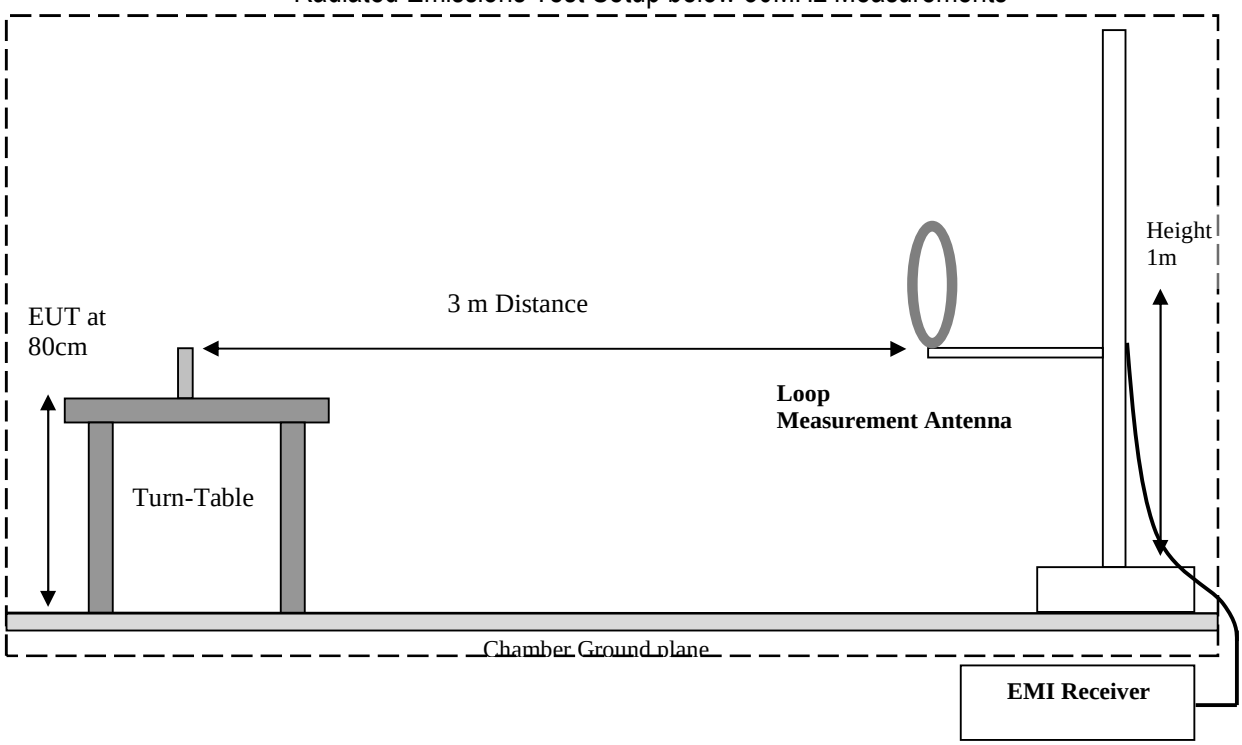
6 Measurement Procedures

6.1 Radiated Measurement

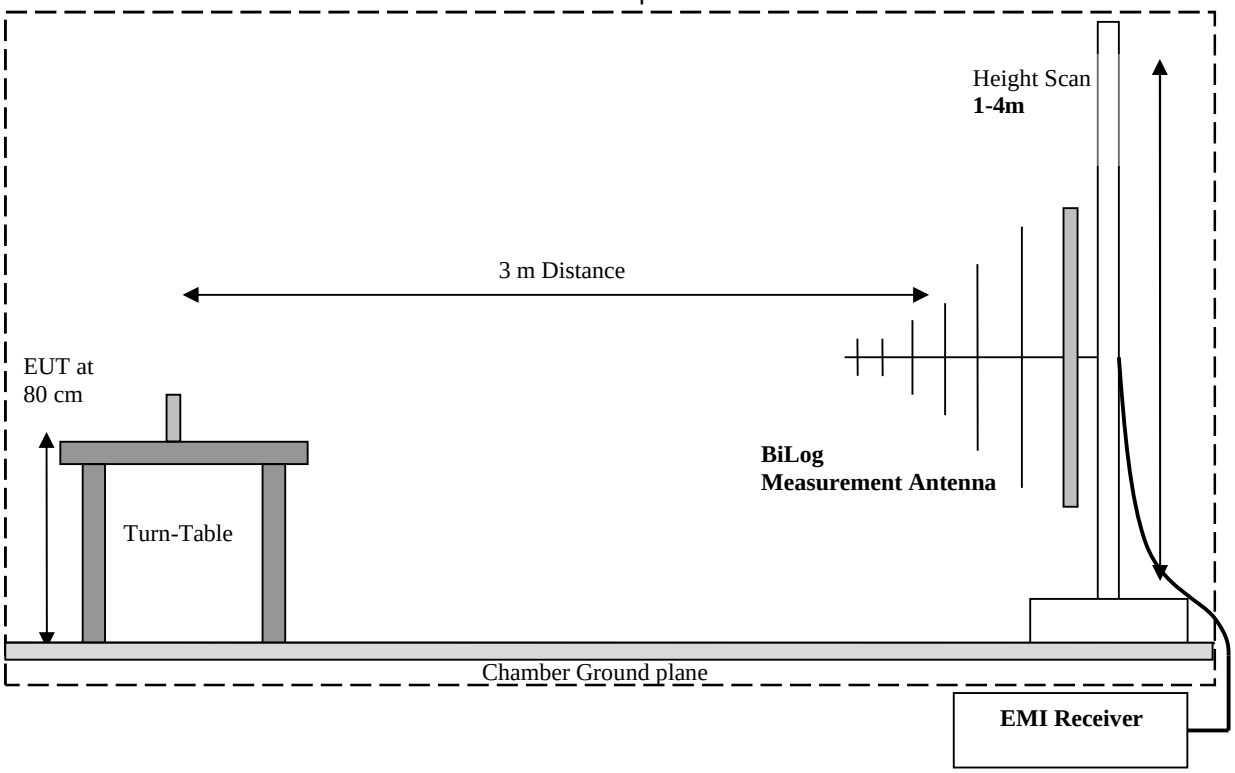
The radiated measurement is performed according to ANSI C63.10 (2013)

- 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.

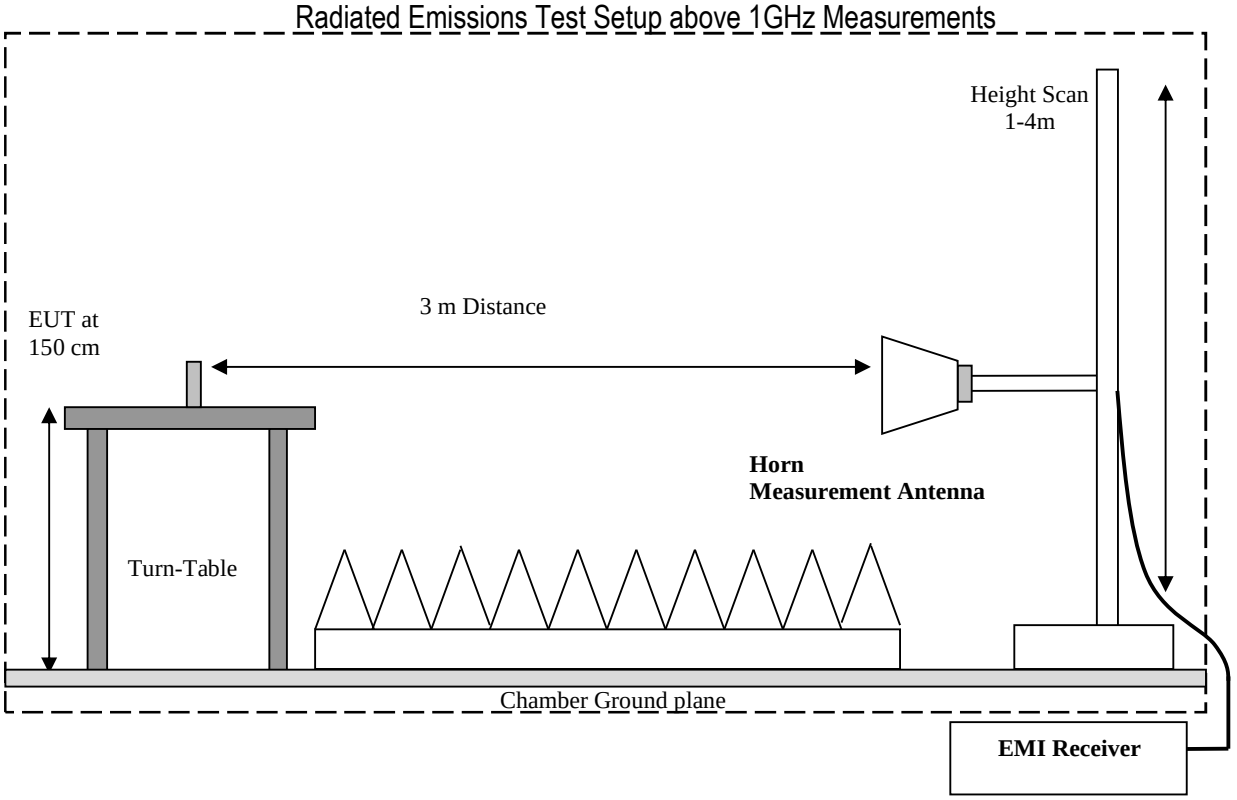
Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



6.1.1 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:

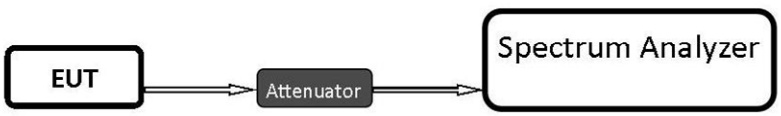
Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

6.2 Power Line Conducted Measurement Procedure

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

6.3 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.

7 Test Result Data

7.1 Maximum Peak Conducted Output Power

7.1.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.11.9

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

7.1.2 Limits:

Maximum Peak Output Power:

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

7.1.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
22° C	1	Op. 1	12 VDC	0.5 dBi

7.1.4 Measurement result:

Test #	Frequency (MHz)	PHY	Maximum Peak Conducted Output Power (dBm)	EIRP (dBm)	Limit (dBm)	Result
1	2402	LE 1M	1.2	1.7	30 (Pk) / 36 (EIRP)	Pass
2	2440	LE 1M	1.3	1.8	30 (Pk) / 36 (EIRP)	Pass
3	2480	LE 1M	1.7	2.2	30 (Pk) / 36 (EIRP)	Pass
4	2402	LE 2M	1.3	1.8	30 (Pk) / 36 (EIRP)	Pass
5	2440	LE 2M	1.3	1.8	30 (Pk) / 36 (EIRP)	Pass
6	2480	LE 2M	1.7	2.2	30 (Pk) / 36 (EIRP)	Pass

7.1.5 Measurement Plots:

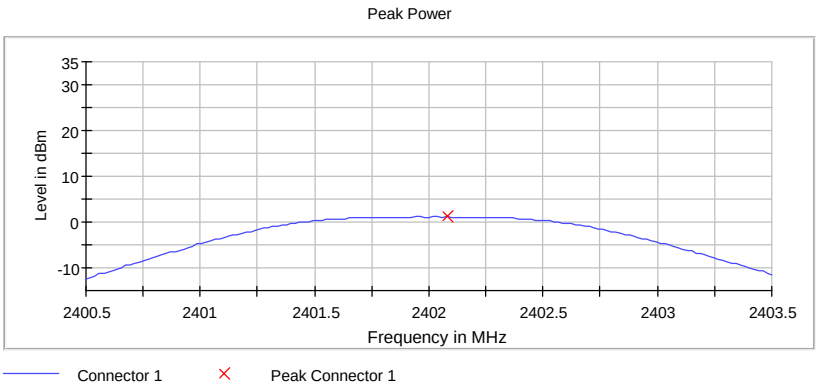
Peak output power (Sweep) (2402 MHz; 10.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.9.1.1

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 1 dB

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2402.000000	**1.2**	**30.0**	**PASS**



Peak Power 1

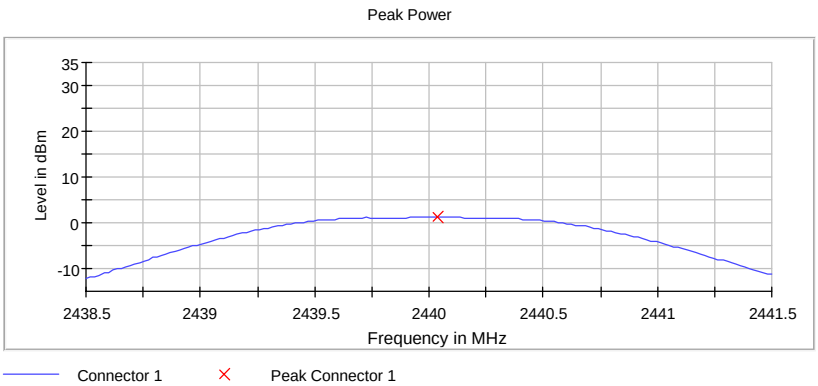
Peak output power (Sweep) (2440 MHz; 10.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.9.1.1

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 1 dB

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2440.000000	**1.3**	**30.0**	**PASS**



Peak Power 1

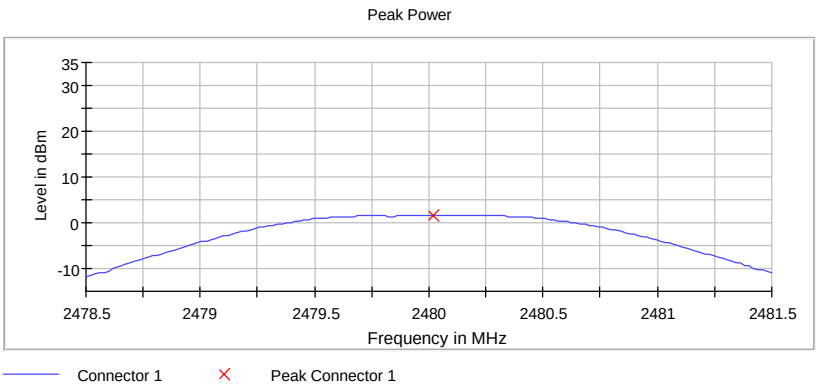
Peak output power (Sweep) (2480 MHz; 10.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.9.1.1

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 1 dB

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2480.000000	**1.7**	**30.0**	**PASS**



Peak Power 1

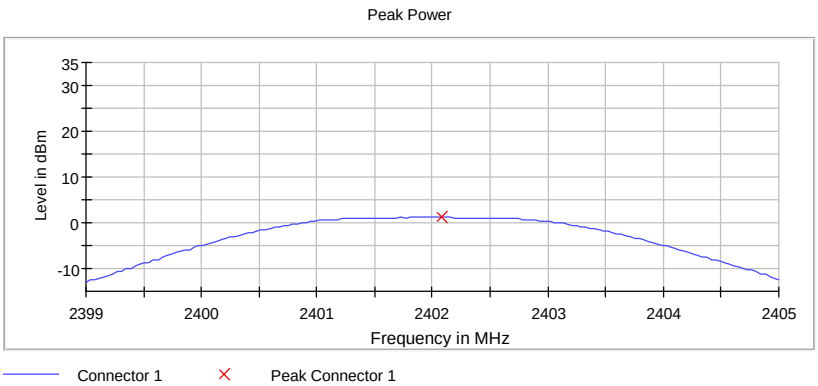
Peak output power (Sweep) (2402 MHz; 10.000 dBm; 2 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.9.1.1

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 1 dB

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2402.000000	**1.3**	**30.0**	**PASS**



Peak Power 1

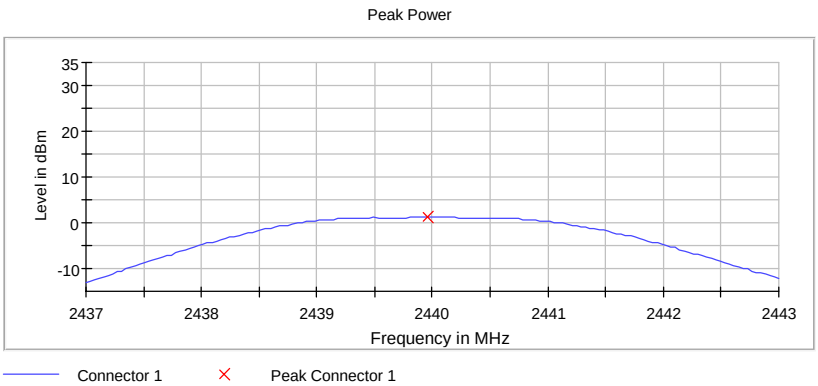
Peak output power (Sweep) (2440 MHz; 10.000 dBm; 2 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.9.1.1

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 1 dB

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2440.000000	**1.3**	**30.0**	**PASS**



Peak Power 1

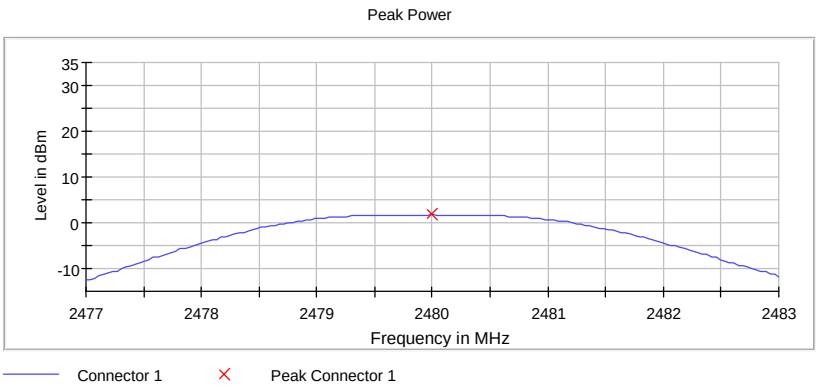
Peak output power (Sweep) (2480 MHz; 10.000 dBm; 2 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.9.1.1

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 1 dB

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2480.000000	**1.7**	**30.0**	**PASS**



Peak Power 1

7.2 Power Spectral Density

7.2.1 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

7.2.2 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.

7.2.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
22° C	1	Op. 1	12 VDC	0.5 dBi

7.2.4 Measurement result:

Test #	Frequency (MHz)	PHY	Maximum Power Spectral Density (dBm/3 kHz)	Limit (dBm/3 kHz)	Result
1	2402	LE 1M	-9.099	8	Pass
2	2440	LE 1M	-8.943	8	Pass
3	2480	LE 1M	-8.601	8	Pass
4	2402	LE 2M	-9.301	8	Pass
5	2440	LE 2M	-9.323	8	Pass
6	2480	LE 2M	-8.944	8	Pass

7.2.5 Measurement Plots:

Peak Power Spectral Density (2402 MHz; 10.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a),(e), KDB 558074 D01 DTS Meas Guidance v05r02 F and ANSI C63.10-2013

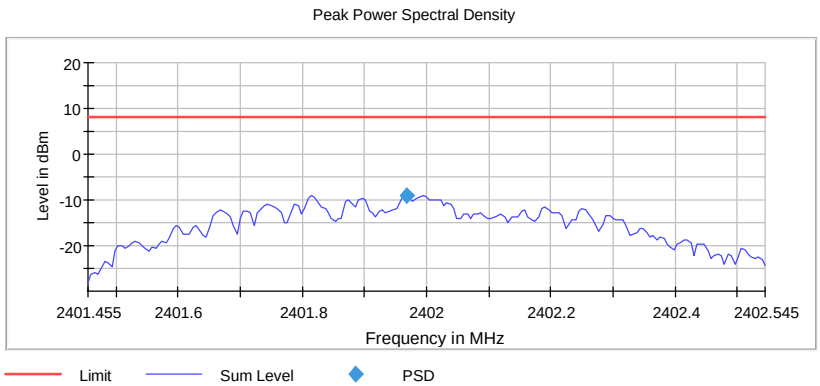
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 1.3 dB

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	2401.967273	-9.099	8.0	PASS

Ports

Port	State
1	used



Peak Power Spectral Density (2440 MHz; 10.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a),(e), KDB 558074 D01 DTS Meas Guidance v05r02 F and ANSI C63.10-2013

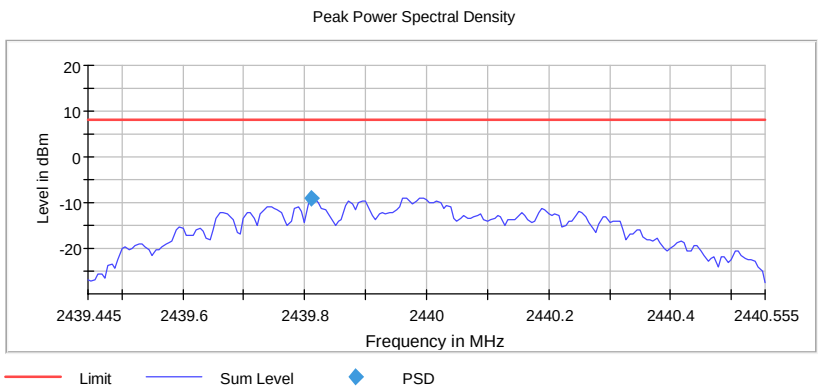
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 1.3 dB

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2440.000000	**2439.811234**	**-8.943**	**8.0**	**PASS**

Ports

Port	State
1	**used**



Peak Power Spectral Density (2480 MHz; 10.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a),(e), KDB 558074 D01 DTS Meas Guidance v05r02 F and ANSI C63.10-2013

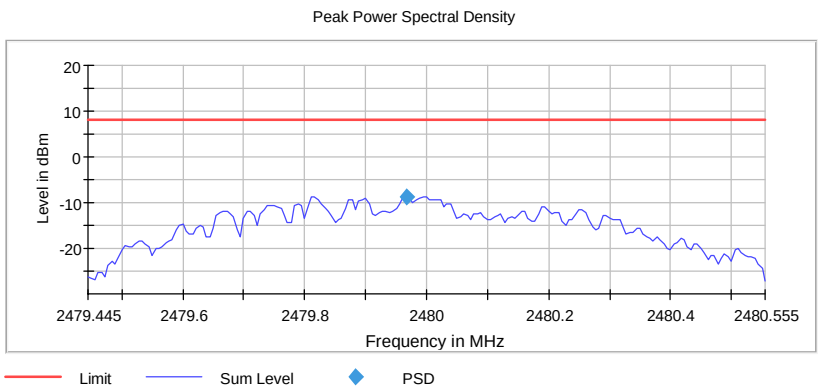
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 1.3 dB

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2480.000000	**2479.966688**	**-8.601**	**8.0**	**PASS**

Ports

Port	State
1	**used**



Peak Power Spectral Density (2402 MHz; 10.000 dBm; 2 MHz)

Test according to FCC title 47 part 15 §15.247(a),(e), KDB 558074 D01 DTS Meas Guidance v05r02 F and ANSI C63.10-2013

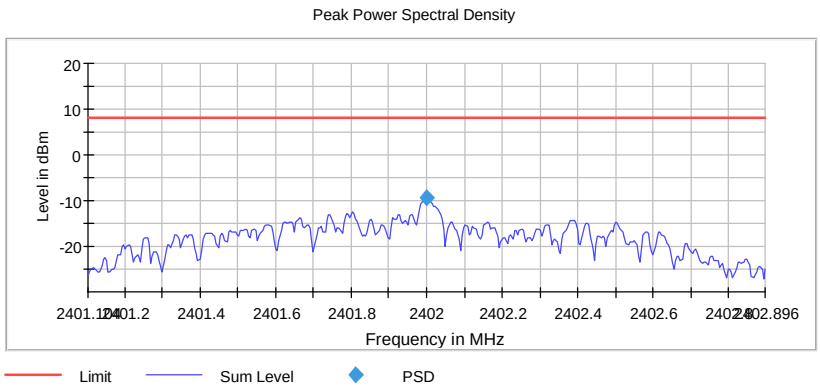
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 1.3 dB

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	**2402.000000**	**-9.301**	**8.0**	**PASS**

Ports

Port	State
1	**used**



Peak Power Spectral Density (2440 MHz; 10.000 dBm; 2 MHz)

Test according to FCC title 47 part 15 §15.247(a),(e), KDB 558074 D01 DTS Meas Guidance v05r02 F and ANSI C63.10-2013

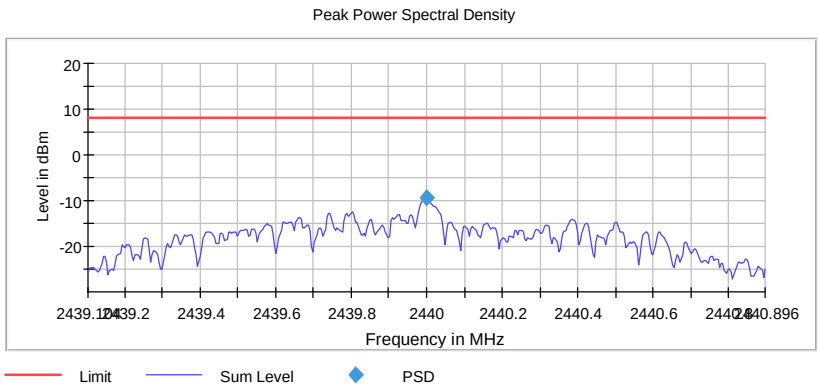
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 1.3 dB

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2440.000000	**2440.000000**	**-9.323**	**8.0**	**PASS**

Ports

Port	State
1	**used**



Peak Power Spectral Density (2480 MHz; 10.000 dBm; 2 MHz)

Test according to FCC title 47 part 15 §15.247(a),(e), KDB 558074 D01 DTS Meas Guidance v05r02 F and ANSI C63.10-2013

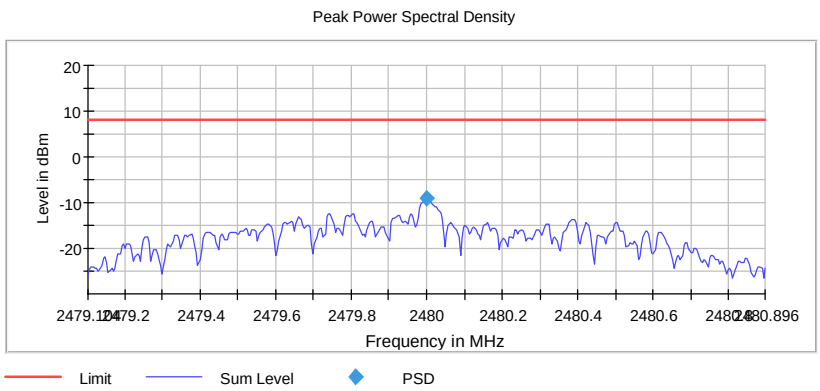
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 1.3 dB

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2480.000000	**2480.000000**	**-8.944**	**8.0**	**PASS**

Ports

Port	State
1	**used**



7.3 Band Edge Compliance

7.3.1 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

7.3.2 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

7.3.3 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			

7.3.4 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
22° C	1 & 2	Op. 1	12 VDC	0.5 dBi

7.3.5 Measurement result:

Test #	EUT Set-up #	PHY	Band Edge	Band Edge Delta (dBc)	Limit (dBc)	Result
1	1	LE 1M	Lower, Non-restricted	26.1	> 20	Pass
2	1	LE 2M	Lower, Non-restricted	46.1	> 20	Pass

Test #	EUT Set-Up #	PHY	Band Edge Radiated (dBµV/m)	Limit (dBµV/m)	Result
3	2	LE 1M	PK: 55.69	PK: 74	Pass
			AVG: 40	AVG: 54	
4	2	LE 2M	PK: 55.77	PK: 74	Pass
			AVG: 39.89	AVG: 54	

7.3.6 Measurement Plots:

Band Edge low (2402 MHz; 10.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(d), KDB 558074 D01 DTS Meas Guidance v05r02 8.7 and ANSI C63.10-2013

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 0.8 dB

Result

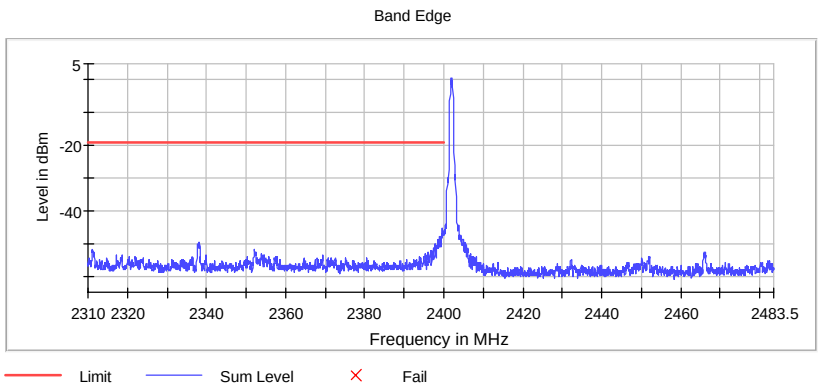
DUT Frequency (MHz)	Result
2402.000000	PASS

Inband Peak

Frequency (MHz)	Level (dBm)
2402.013824	0.8

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.550000	-45.3	26.1	-19.2	PASS
2399.600000	-45.6	26.3	-19.2	PASS
2399.650000	-46.3	27.0	-19.2	PASS
2399.500000	-46.4	27.2	-19.2	PASS
2399.900000	-46.5	27.3	-19.2	PASS
2399.950000	-46.8	27.6	-19.2	PASS
2399.850000	-46.9	27.7	-19.2	PASS
2399.700000	-47.1	27.9	-19.2	PASS
2399.800000	-47.2	28.0	-19.2	PASS
2399.100000	-47.7	28.5	-19.2	PASS
2399.750000	-47.7	28.5	-19.2	PASS
2399.050000	-47.8	28.6	-19.2	PASS
2399.400000	-47.9	28.7	-19.2	PASS
2399.150000	-48.1	28.9	-19.2	PASS
2399.450000	-48.2	29.0	-19.2	PASS



Band Edge low (2402 MHz; 10.000 dBm; 2 MHz)

Test according to FCC title 47 part 15 §15.247(d), KDB 558074 D01 DTS Meas Guidance v05r02 8.7 and ANSI C63.10-2013

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 0.8 dB

Result

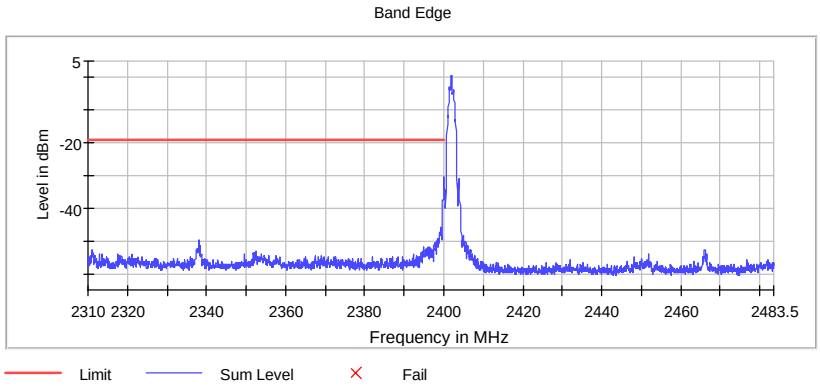
DUT Frequency (MHz)	Result
2402.000000	PASS

Inband Peak

Frequency (MHz)	Level (dBm)
2402.013824	0.8

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.950000	-30.3	11.1	-19.2	PASS
2399.900000	-33.5	14.3	-19.2	PASS
2399.850000	-37.6	18.4	-19.2	PASS
2399.800000	-37.6	18.4	-19.2	PASS
2399.750000	-38.5	19.3	-19.2	PASS
2399.700000	-41.1	21.9	-19.2	PASS
2399.650000	-42.8	23.6	-19.2	PASS
2399.150000	-45.7	26.5	-19.2	PASS
2399.600000	-46.8	27.6	-19.2	PASS
2399.200000	-46.9	27.7	-19.2	PASS
2399.250000	-47.2	28.0	-19.2	PASS
2399.100000	-47.2	28.0	-19.2	PASS
2399.400000	-47.5	28.3	-19.2	PASS
2399.050000	-47.6	28.4	-19.2	PASS
2399.550000	-47.8	28.6	-19.2	PASS

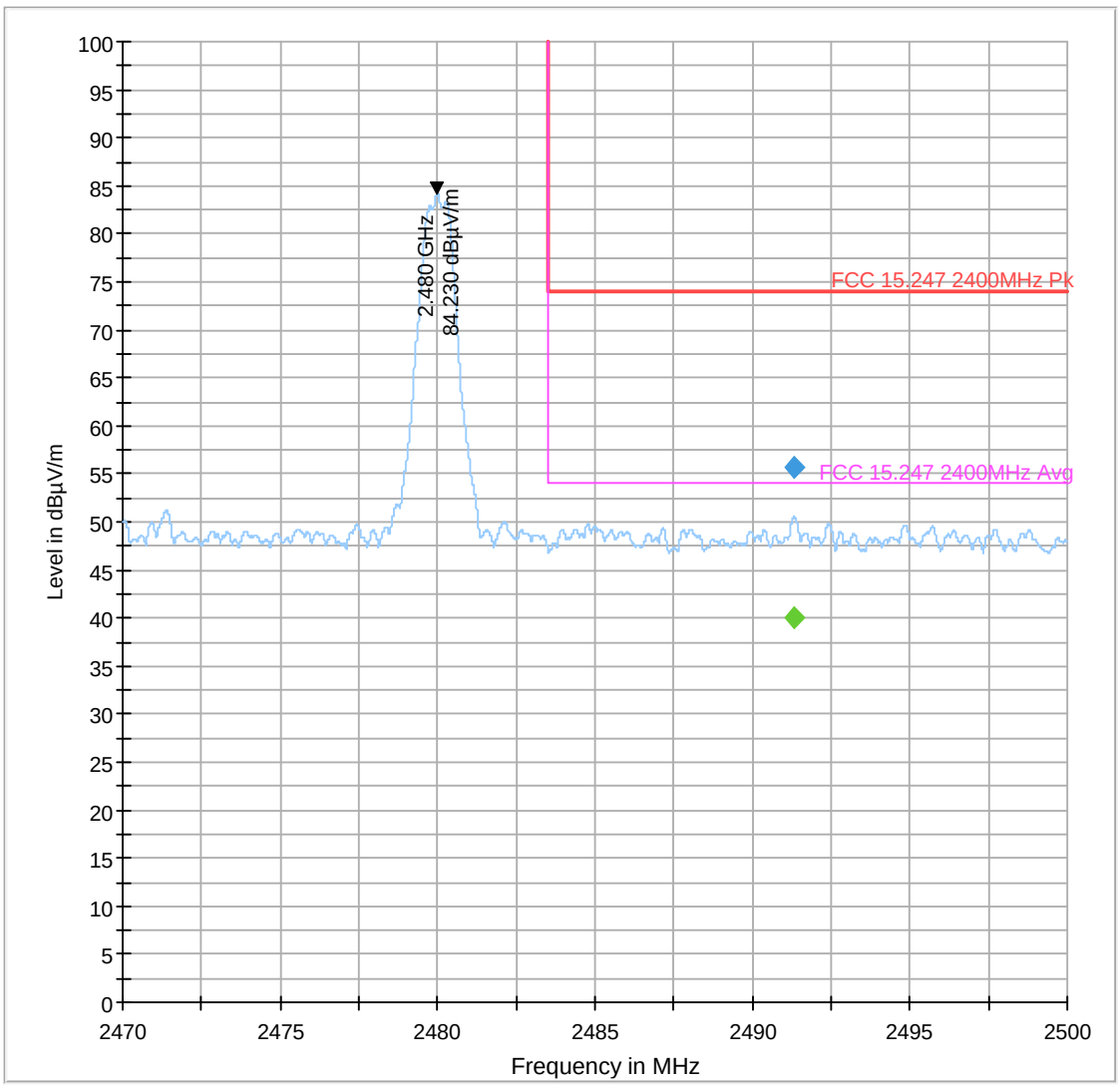


Test # 3

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)	Sig Path (dB)
2491.321	---	40.004	54.00	14.00	500.0	1000.000	292.0	H	6.0	34.1	5.7
2491.321	55.690	---	74.00	18.31	500.0	1000.000	292.0	H	6.0	34.1	5.7

(continuation of the "Final_Result" table from column 17 ...)

Frequency (MHz)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
2491.321	0.0	28.4	5.9	
2491.321	0.0	28.4	21.6	

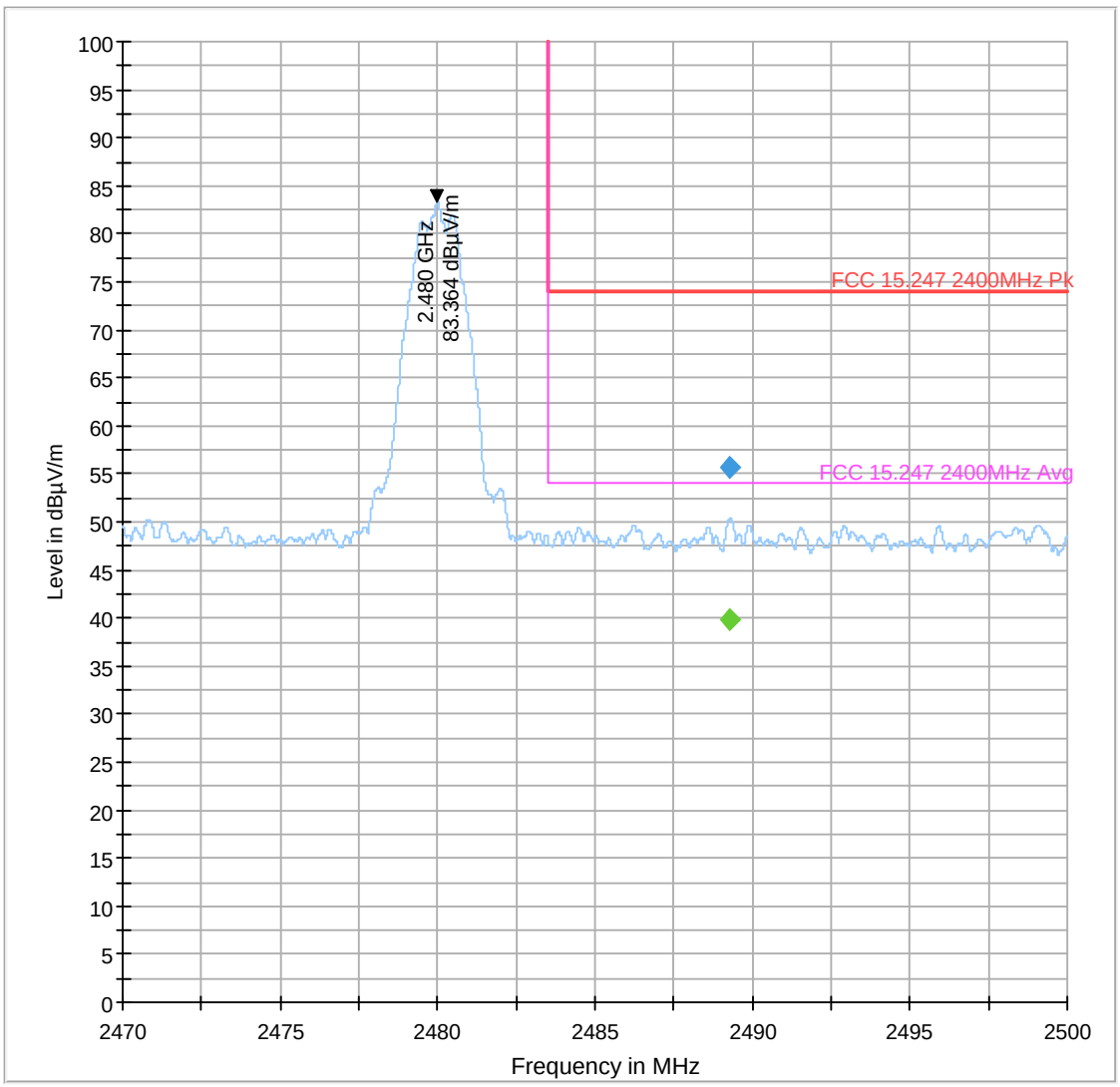


Test # 4

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)	Sig Path (dB)
2489.299	---	39.894	54.00	14.11	500.0	1000.000	100.0	V	57.0	34.0	5.7
2489.299	55.771	---	74.00	18.23	500.0	1000.000	100.0	V	57.0	34.0	5.7

(continuation of the "Final_Result" table from column 17 ...)

Frequency (MHz)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
2489.299	0.0	28.3	5.9	
2489.299	0.0	28.3	21.8	



7.4 Emission Bandwidth 6dB and 99% Occupied Bandwidth

7.4.1 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.

7.4.2 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.

7.4.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
22° C	1	Op. 1	12 VDC

7.4.4 Measurement result:

Test #	Frequency (MHz)	PHY	6dB Emissions Bandwidth (MHz)	Limit (MHz)	Result
1	2402	LE 1M	0.727272	> 0.5	Pass
2	2440	LE 1M	0.740259	> 0.5	Pass
3	2480	LE 1M	0.740259	> 0.5	Pass
4	2402	LE 2M	1.194806	> 0.5	Pass
5	2440	LE 2M	1.194806	> 0.5	Pass
6	2480	LE 2M	1.194806	> 0.5	Pass

Test #	Frequency (MHz)	PHY	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
7	2402	LE 1M	1.050000	NA	-
8	2440	LE 1M	1.050000	NA	-
9	2480	LE 1M	1.055000	NA	-
10	2402	LE 2M	2.050000	NA	-
11	2440	LE 2M	2.050000	NA	-
12	2480	LE 2M	2.050000	NA	-

7.4.5 Measurement Plots:

Minimum Emission Bandwidth 6 dB (2402 MHz; 10.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

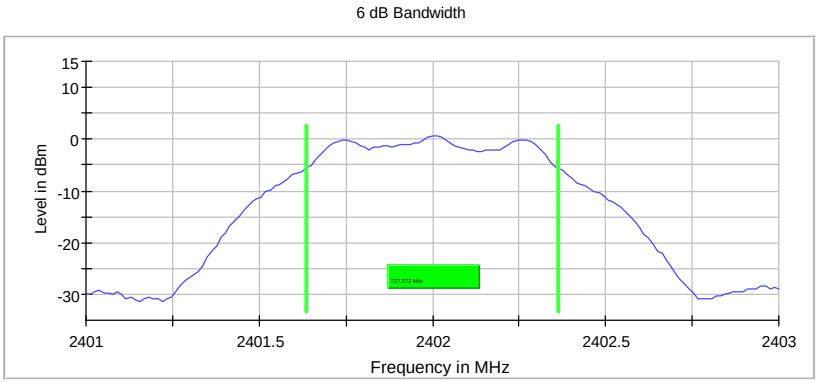
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402.000000	0.727272	0.500000	---	2401.636364	2402.363636

(continuation of the "6 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2402.000000	0.6	PASS



Minimum Emission Bandwidth 6 dB (2440 MHz; 10.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

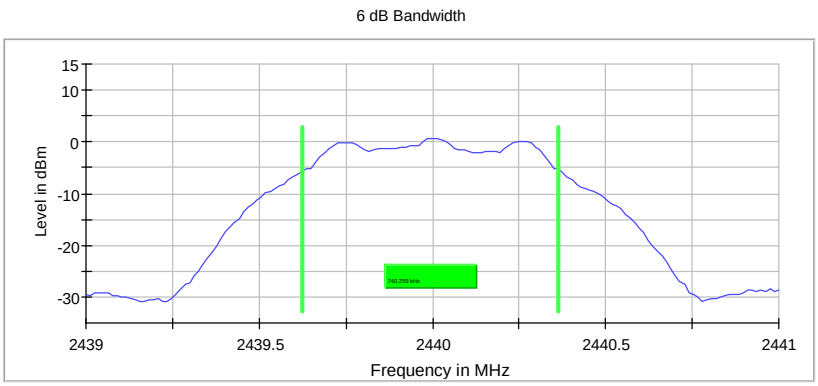
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2440.000000	0.740259	0.500000	---	2439.623377	2440.363636

(continuation of the "6 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2440.000000	0.7	PASS



Minimum Emission Bandwidth 6 dB (2480 MHz; 10.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

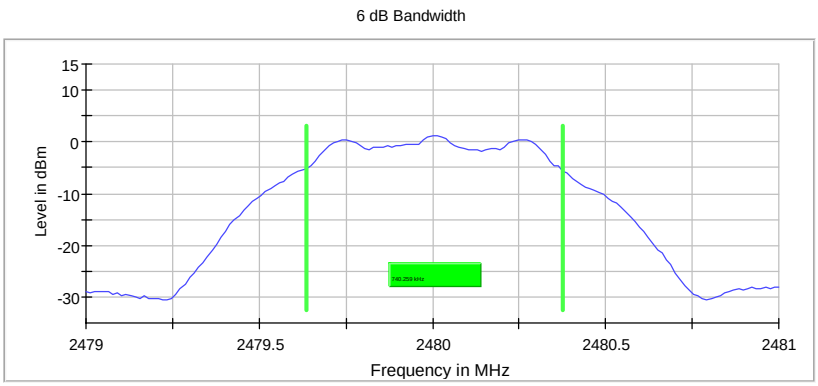
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2480.000000	0.740259	0.500000	---	2479.636364	2480.376623

(continuation of the "6 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2480.000000	1.2	PASS



Minimum Emission Bandwidth 6 dB (2402 MHz; 10.000 dBm; 2 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

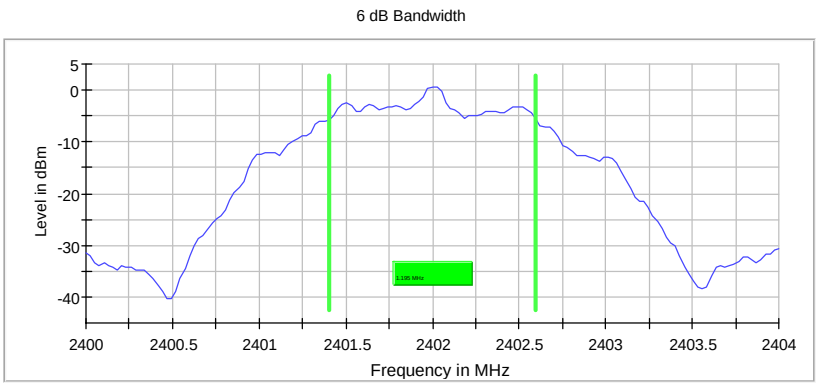
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402.000000	1.194806	0.500000	---	2401.402597	2402.597403

(continuation of the "6 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2402.000000	0.7	PASS



Minimum Emission Bandwidth 6 dB (2440 MHz; 10.000 dBm; 2 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

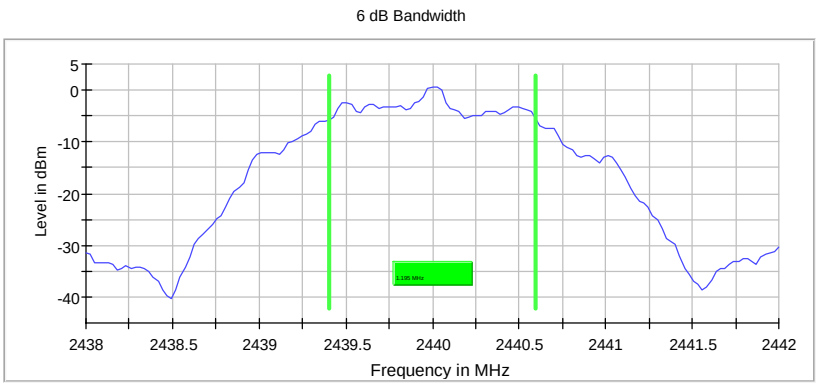
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2440.000000	1.194806	0.500000	---	2439.402597	2440.597403

(continuation of the "6 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2440.000000	0.7	PASS



Minimum Emission Bandwidth 6 dB (2480 MHz; 10.000 dBm; 2 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

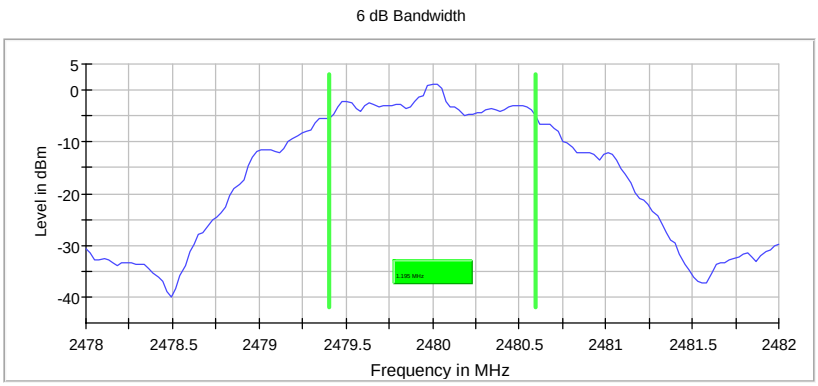
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2480.000000	1.194806	0.500000	---	2479.402597	2480.597403

(continuation of the "6 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2480.000000	1.1	PASS



Occupied Channel Bandwidth 99% (2402 MHz; 10.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

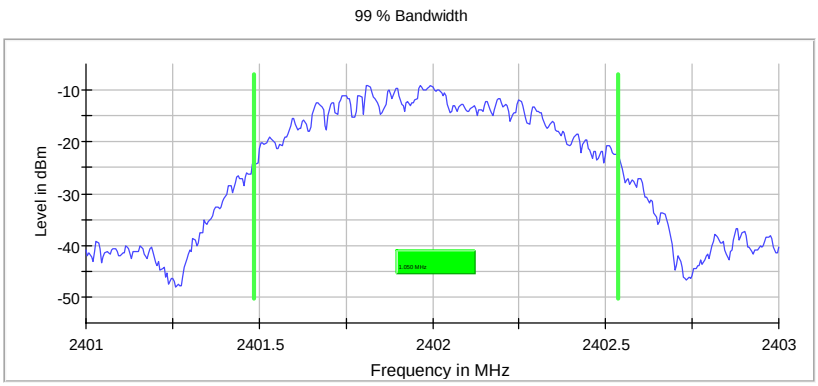
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402.000000	1.050000	---	---	2401.485000	2402.535000

(continuation of the "99 % Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Result
2402.000000	PASS



Occupied Channel Bandwidth 99% (2440 MHz; 10.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

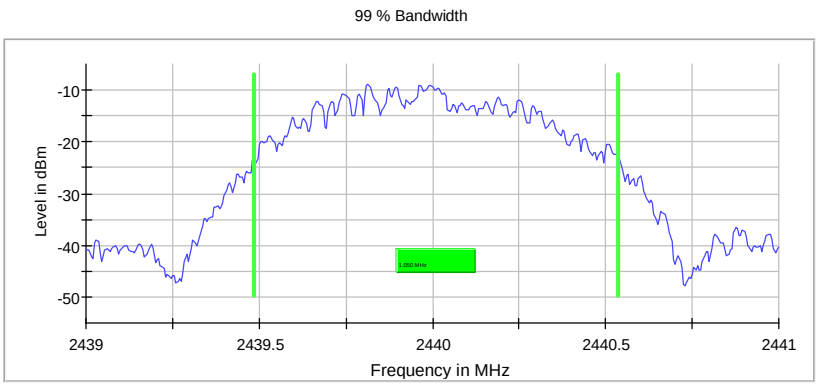
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2440.000000	1.050000	---	---	2439.485000	2440.535000

(continuation of the "99 % Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Result
2440.000000	PASS



Occupied Channel Bandwidth 99% (2480 MHz; 10.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

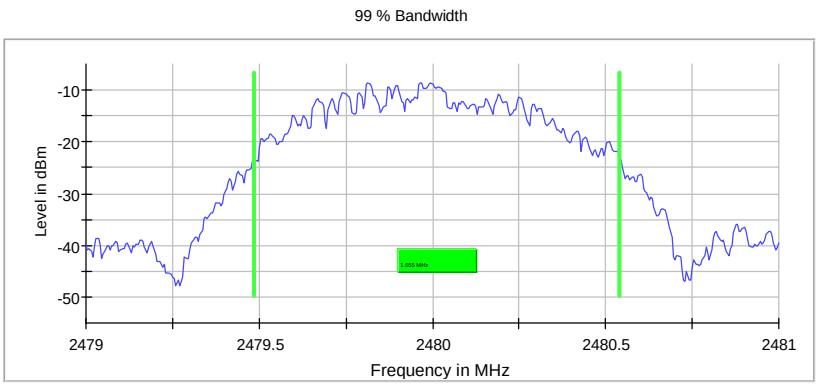
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2480.000000	**1.055000**	**---**	**---**	**2479.485000**	**2480.540000**

(continuation of the "99 % Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Result
2480.000000	**PASS**



Occupied Channel Bandwidth 99% (2402 MHz; 10.000 dBm; 2 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

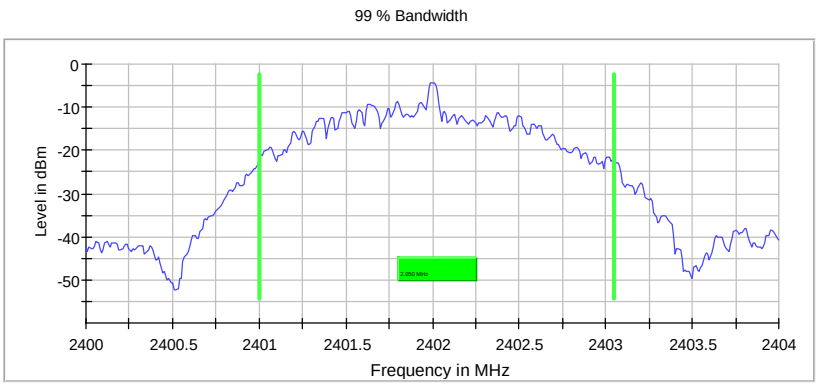
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402.000000	**2.050000**	**---**	**---**	**2401.000000**	**2403.050000**

(continuation of the "99 % Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Result
2402.000000	**PASS**



Occupied Channel Bandwidth 99% (2440 MHz; 10.000 dBm; 2 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

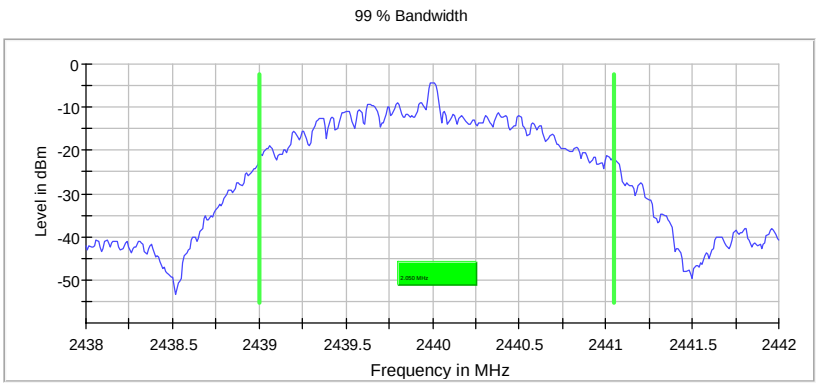
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2440.000000	**2.050000**	**---**	**---**	**2439.000000**	**2441.050000**

(continuation of the "99 % Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Result
2440.000000	**PASS**



Occupied Channel Bandwidth 99% (2480 MHz; 10.000 dBm; 2 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

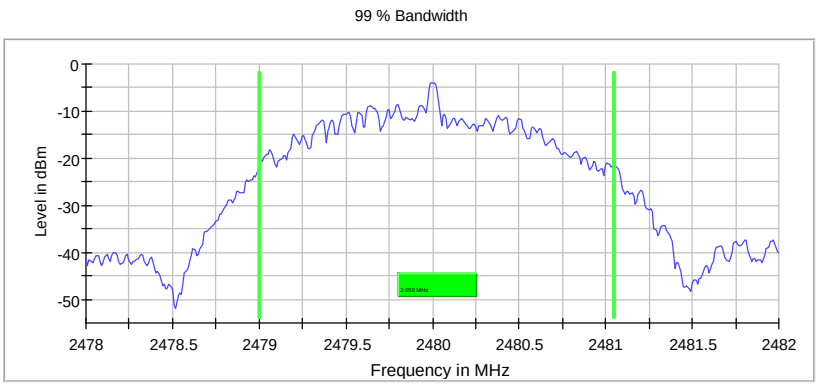
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2480.000000	**2.050000**	**---**	**---**	**2479.000000**	**2481.050000**

(continuation of the "99 % Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Result
2480.000000	**PASS**



7.5 Radiated Transmitter Spurious Emissions and Restricted Bands

7.5.1 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.

7.5.2 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

7.5.3 Test conditions and setup:

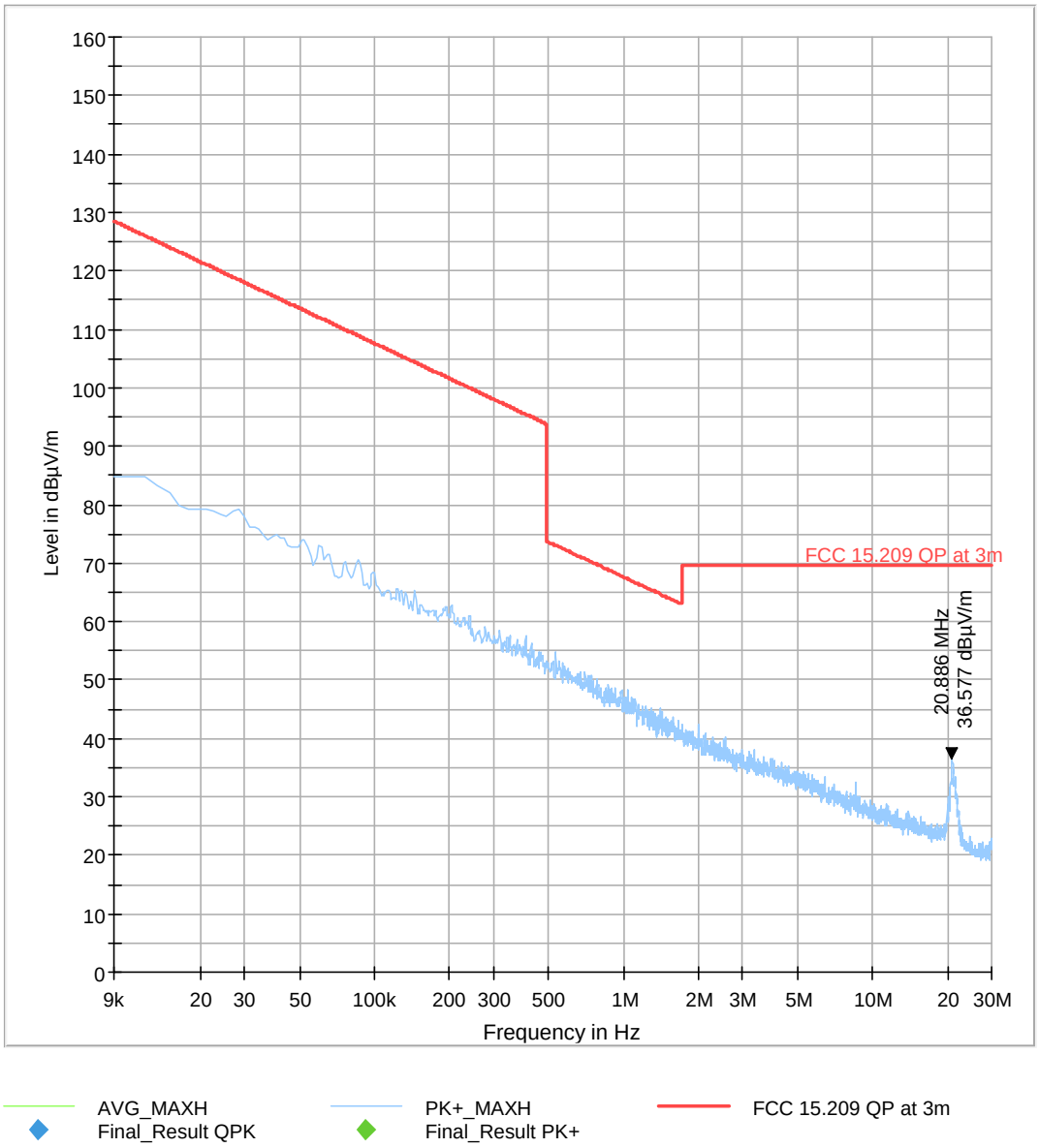
Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
22° C	2	Op. 1	12 VDC

7.5.4 Measurement result:

Plot #	Channel #	Scan Frequency	Limit	Result
1-5	Low	9 kHz – 26 GHz	See section 7.5.2	Pass
6-10	Mid	9 kHz – 26 GHz	See section 7.5.2	Pass
11-15	High	9 kHz – 26 GHz	See section 7.5.2	Pass

7.5.5 Measurement Plots:

Plot # 1

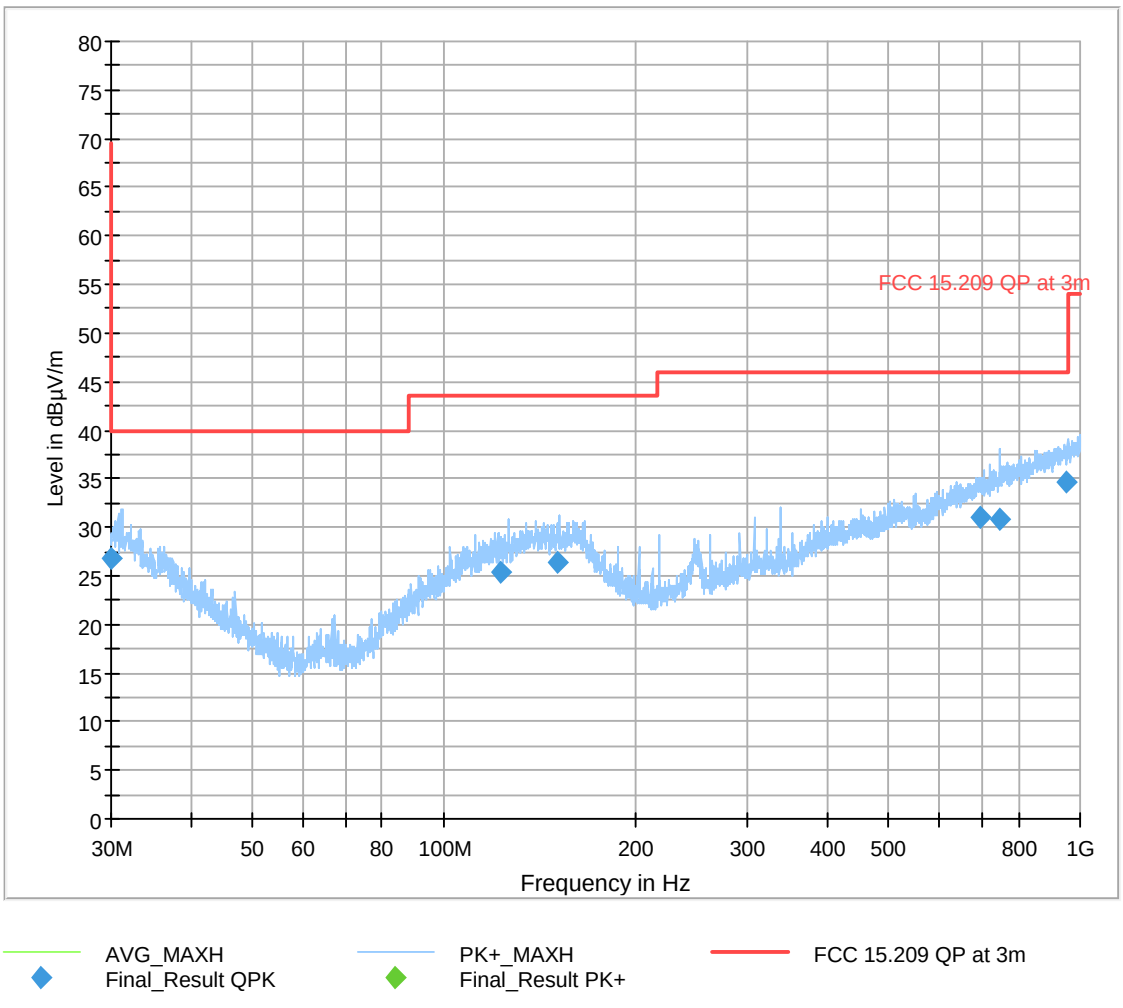


Plot # 2

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)
30.080	26.737	---	40.00	13.26	500.0	120.000	280.0	H	220.0	25.7	0.7
122.758	25.469	---	43.50	18.03	500.0	120.000	117.0	H	206.0	25.2	1.2
151.275	26.456	---	43.50	17.04	500.0	120.000	348.0	H	155.0	26.3	1.4
696.899	31.036	---	46.02	14.98	500.0	120.000	270.0	H	61.0	29.4	2.9
747.382	30.886	---	46.02	15.14	500.0	120.000	107.0	H	101.0	30.4	3.0
954.321	34.613	---	46.02	11.41	500.0	120.000	187.0	H	-2.0	32.7	3.3

(continuation of the "Final_Result" table from column 17 ...)

Frequency (MHz)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
30.080	0.0	25.0	1.1	
122.758	0.0	23.9	0.3	
151.275	0.0	25.0	0.1	
696.899	0.0	26.5	1.6	
747.382	0.0	27.5	0.5	
954.321	0.0	29.5	1.9	

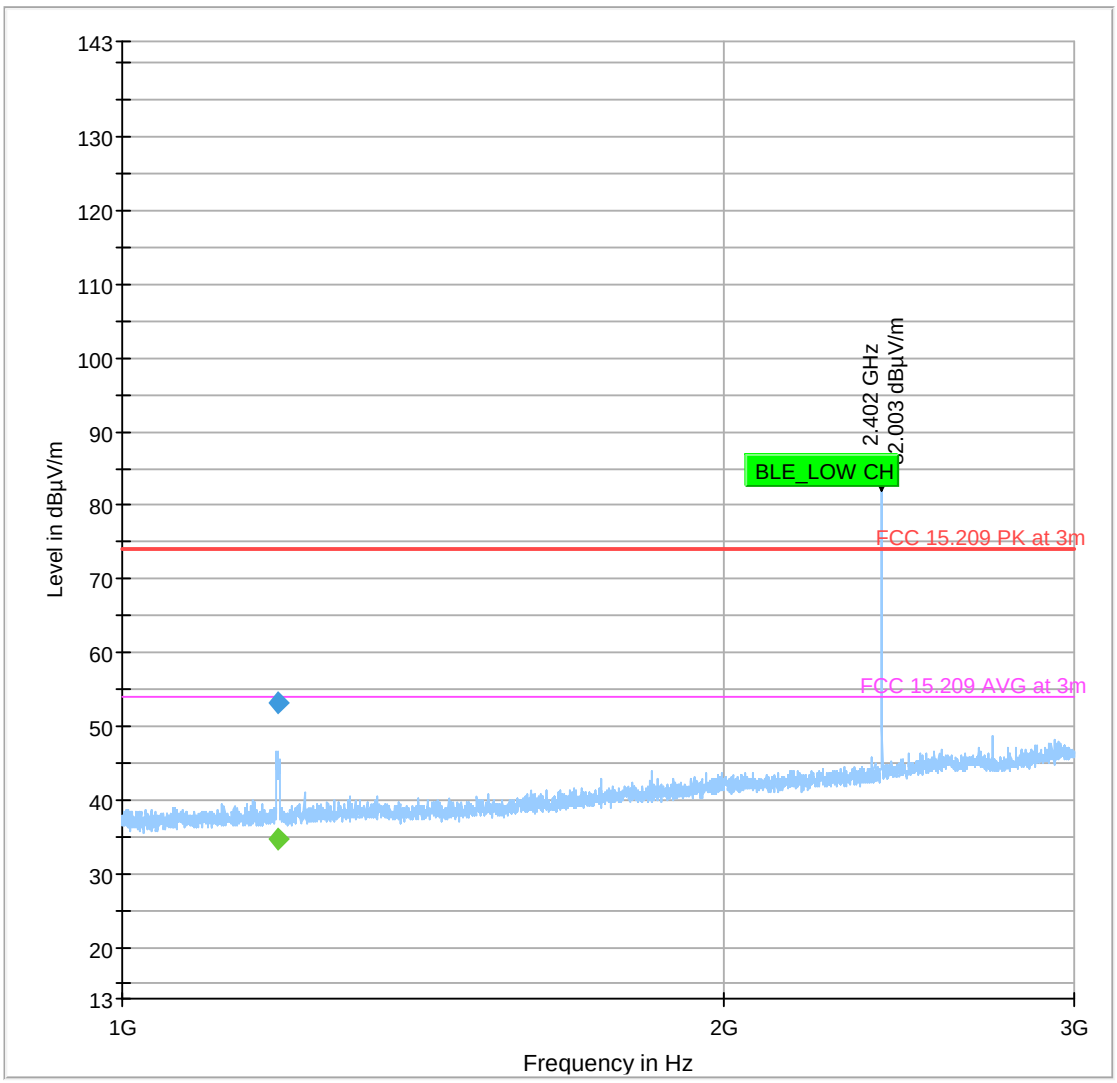


Plot # 3

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)	Sig Path (dB)
1196.309	---	34.797	53.98	19.18	500.0	1000.000	201.0	V	306.0	29.3	4.3
1196.309	53.277	---	73.98	20.70	500.0	1000.000	201.0	V	306.0	29.3	4.3

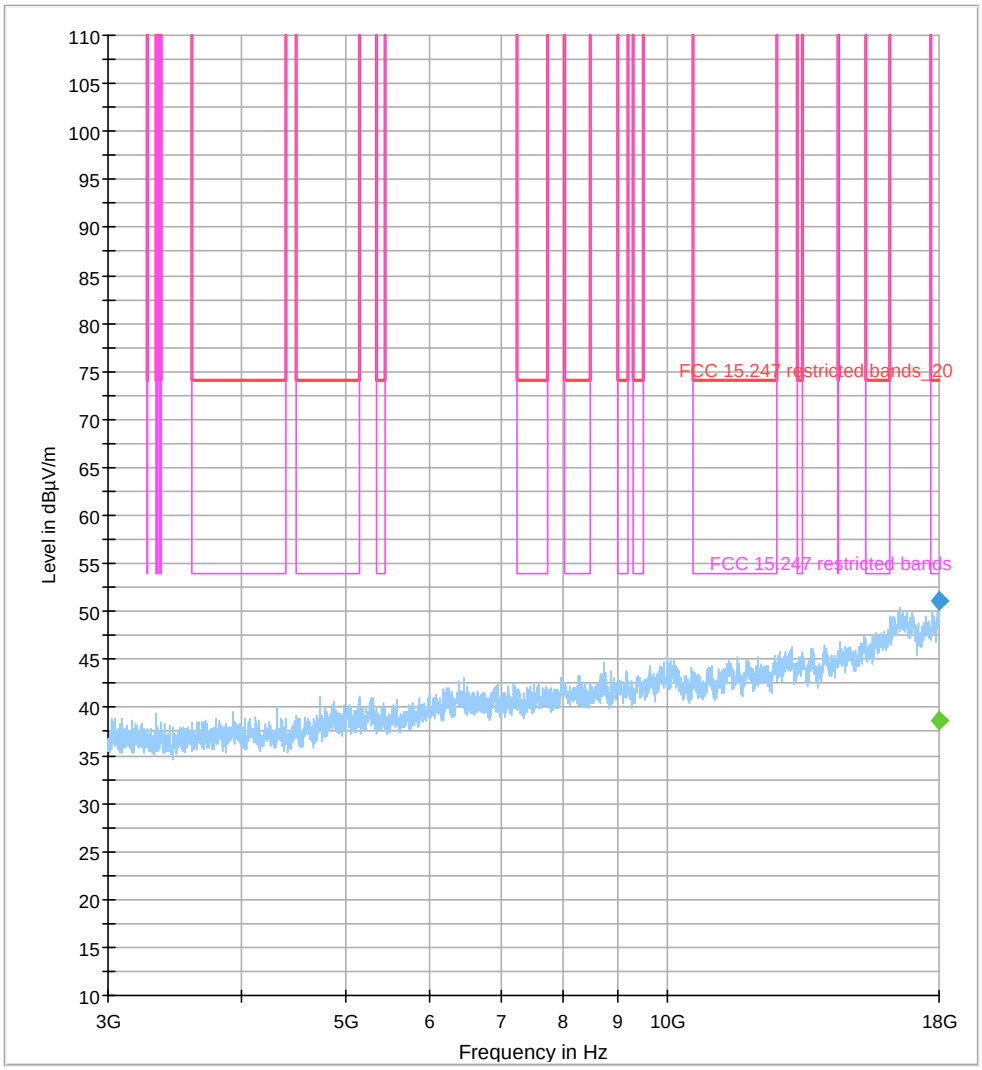
(continuation of the "Final_Result" table from column 17 ...)

Frequency (MHz)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
1196.309	0.0	25.0	5.5	
1196.309	0.0	25.0	24.0	



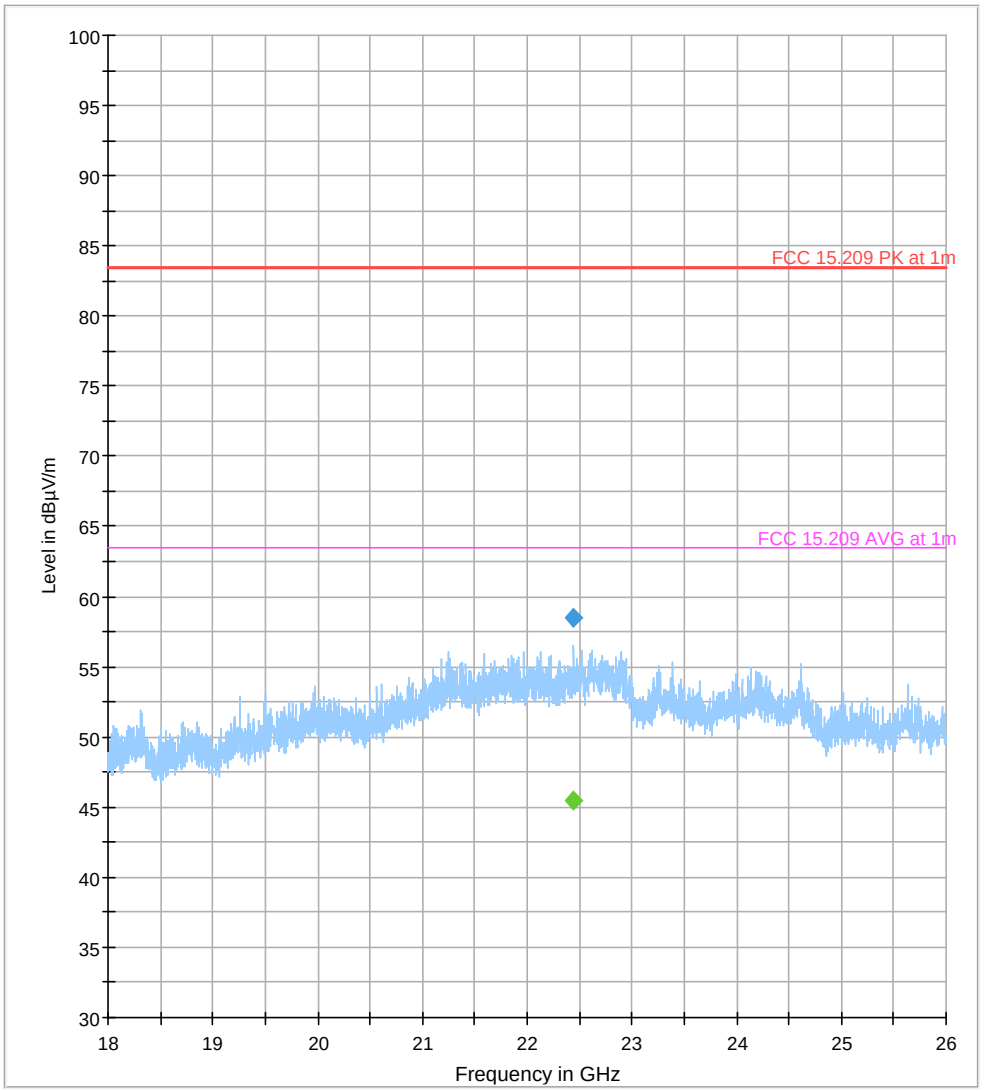
Plot # 4

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)	Comment
17995.000	---	38.66	53.98	15.32	500.0	1000.0	228.0	V	285.0	17.5	
17995.000	51.12	---	73.98	22.86	500.0	1000.0	228.0	V	285.0	17.5	



Plot # 5

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)	Comment
22448.000	---	45.48	63.50	18.02	500.0	1000.0	140.0	H	112.0	19.3	
22448.000	58.54	---	83.50	24.96	500.0	1000.0	140.0	H	112.0	19.3	

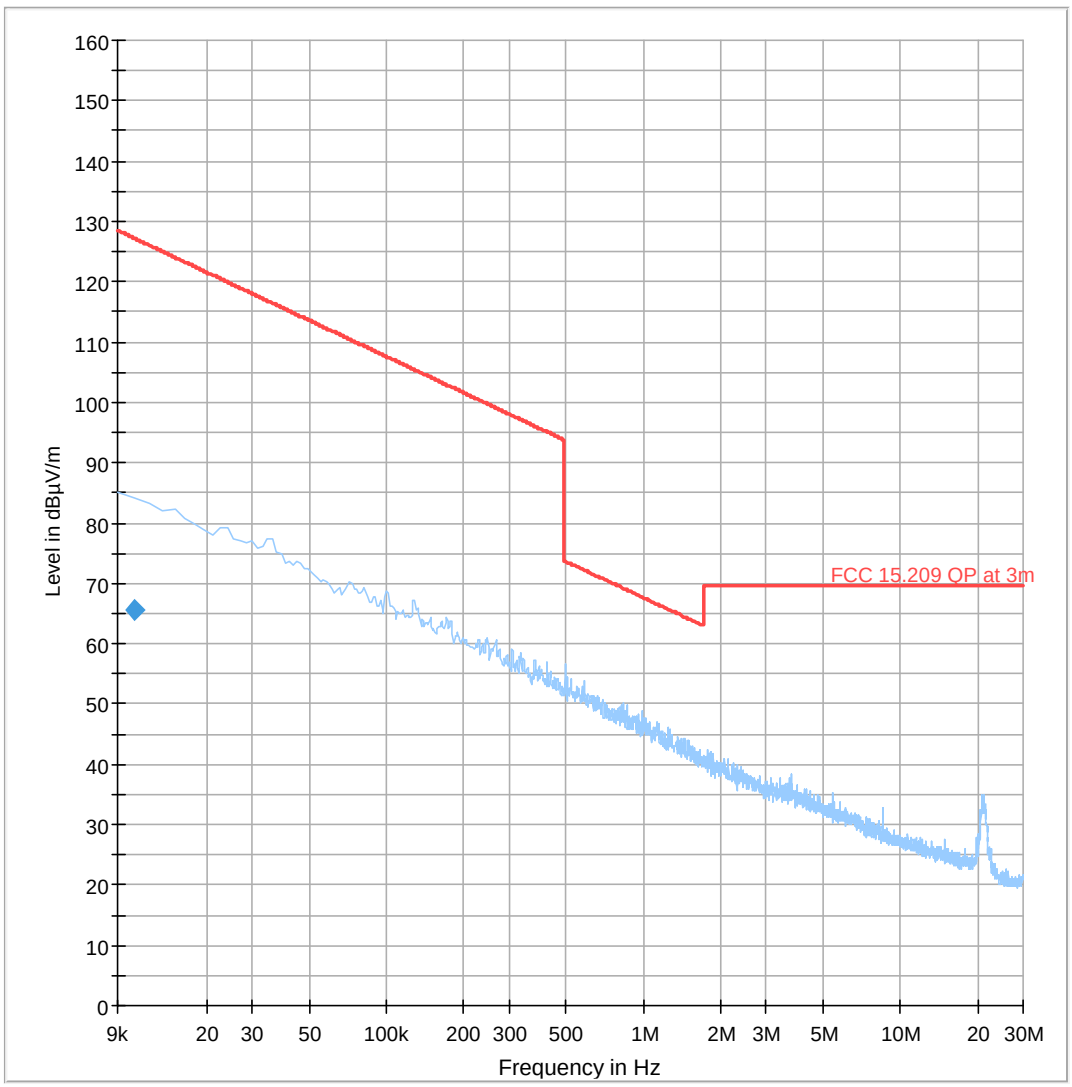


Plot # 6

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)
0.010	65.558	---	127.17	61.61	500.0	0.200	100.0	H	114.0	28.4	0.2

(continuation of the "Final_Result" table from column 17 ...)

Frequency (MHz)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
0.010	0.0	28.2	37.1	

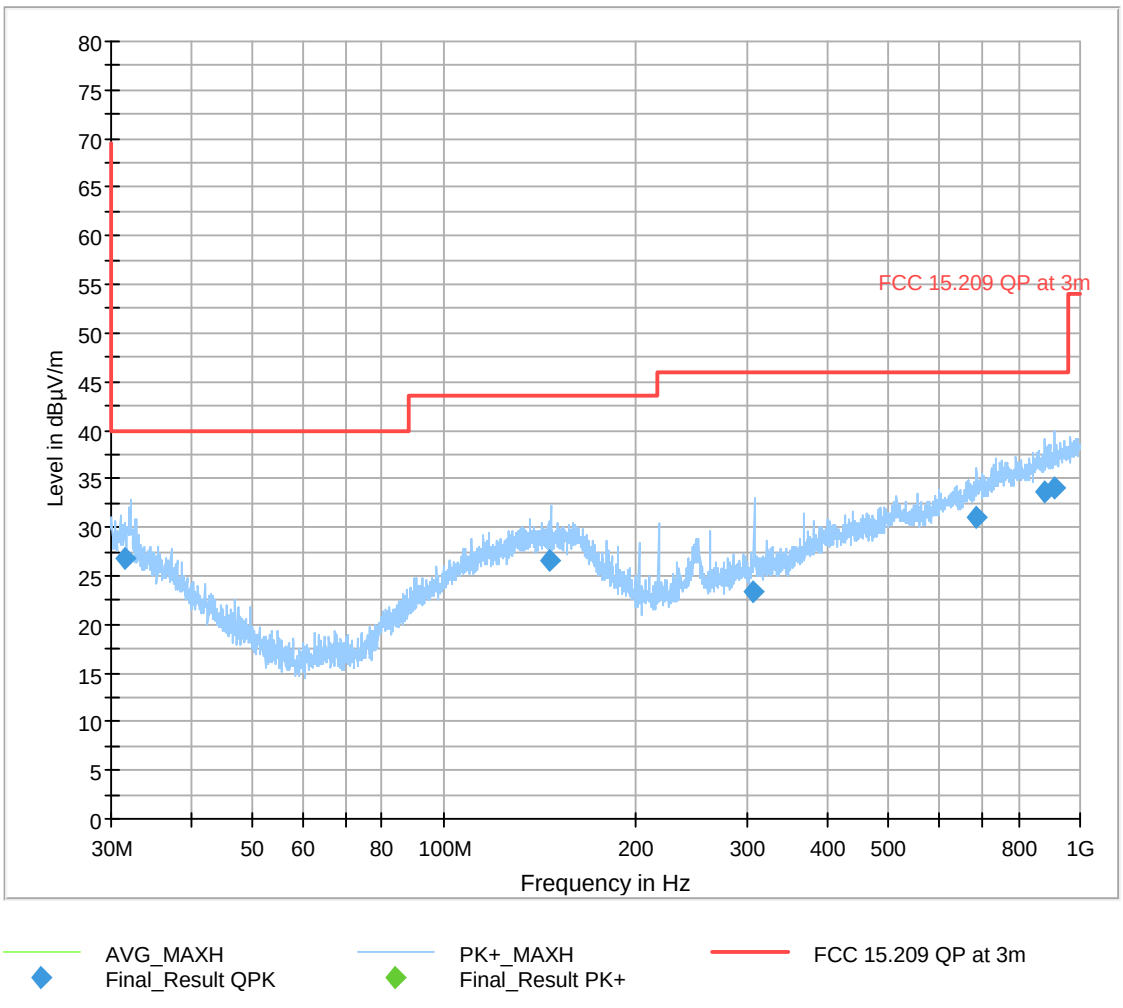


Plot # 7

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)
31.593	26.825	---	40.00	13.18	500.0	120.000	107.0	H	146.0	24.8	0.7
146.859	26.561	---	43.50	16.94	500.0	120.000	383.0	H	99.0	26.5	1.3
305.386	23.459	---	46.02	22.56	500.0	120.000	107.0	V	279.0	22.6	1.9
688.250	31.120	---	46.02	14.90	500.0	120.000	193.0	H	188.0	29.3	2.9
880.655	33.595	---	46.02	12.43	500.0	120.000	117.0	H	62.0	31.9	3.2
910.942	34.079	---	46.02	11.94	500.0	120.000	400.0	H	259.0	32.1	3.2

(continuation of the "Final_Result" table from column 17 ...)

Frequency (MHz)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
31.593	0.0	24.1	2.0	
146.859	0.0	25.2	0.1	
305.386	0.0	20.7	0.9	
688.250	0.0	26.4	1.8	
880.655	0.0	28.8	1.7	
910.942	0.0	28.9	2.0	

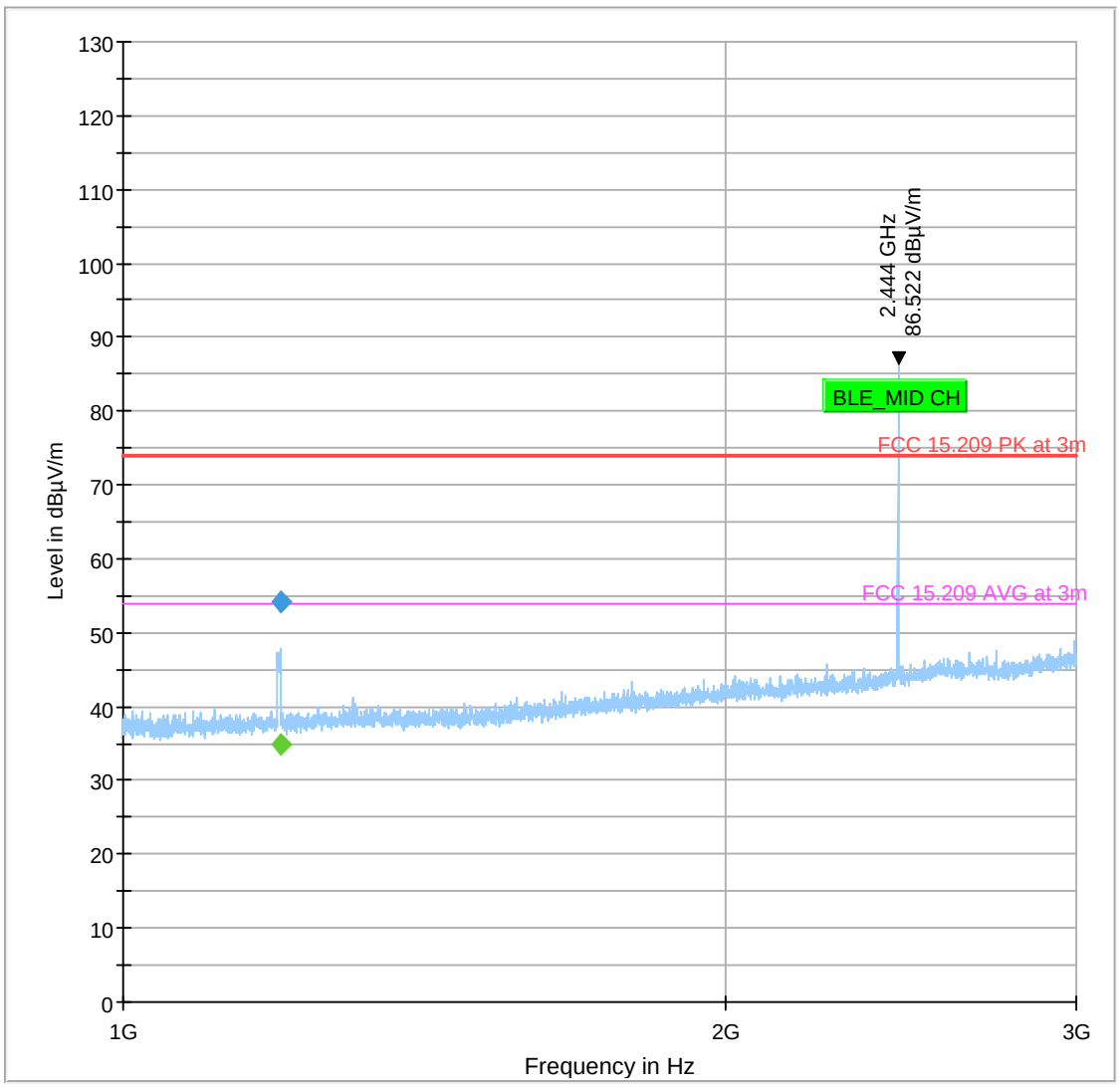


Plot # 8

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)	Sig Path (dB)
1199.714	---	34.809	53.98	19.17	500.0	1000.000	184.0	V	298.0	29.3	4.3
1199.714	54.124	---	73.98	19.86	500.0	1000.000	184.0	V	298.0	29.3	4.3

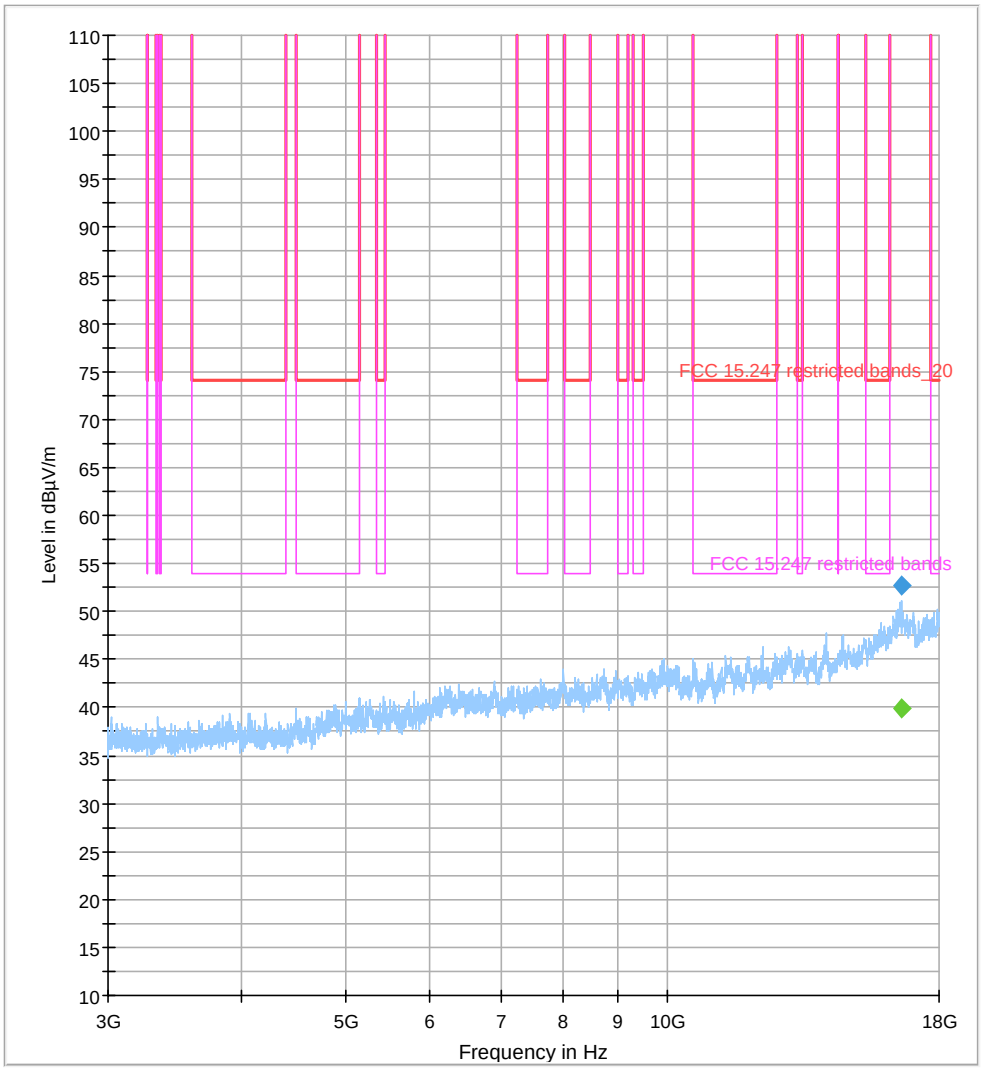
(continuation of the "Final_Result" table from column 17 ...)

Frequency (MHz)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
1199.714	0.0	25.0	5.5	
1199.714	0.0	25.0	24.8	



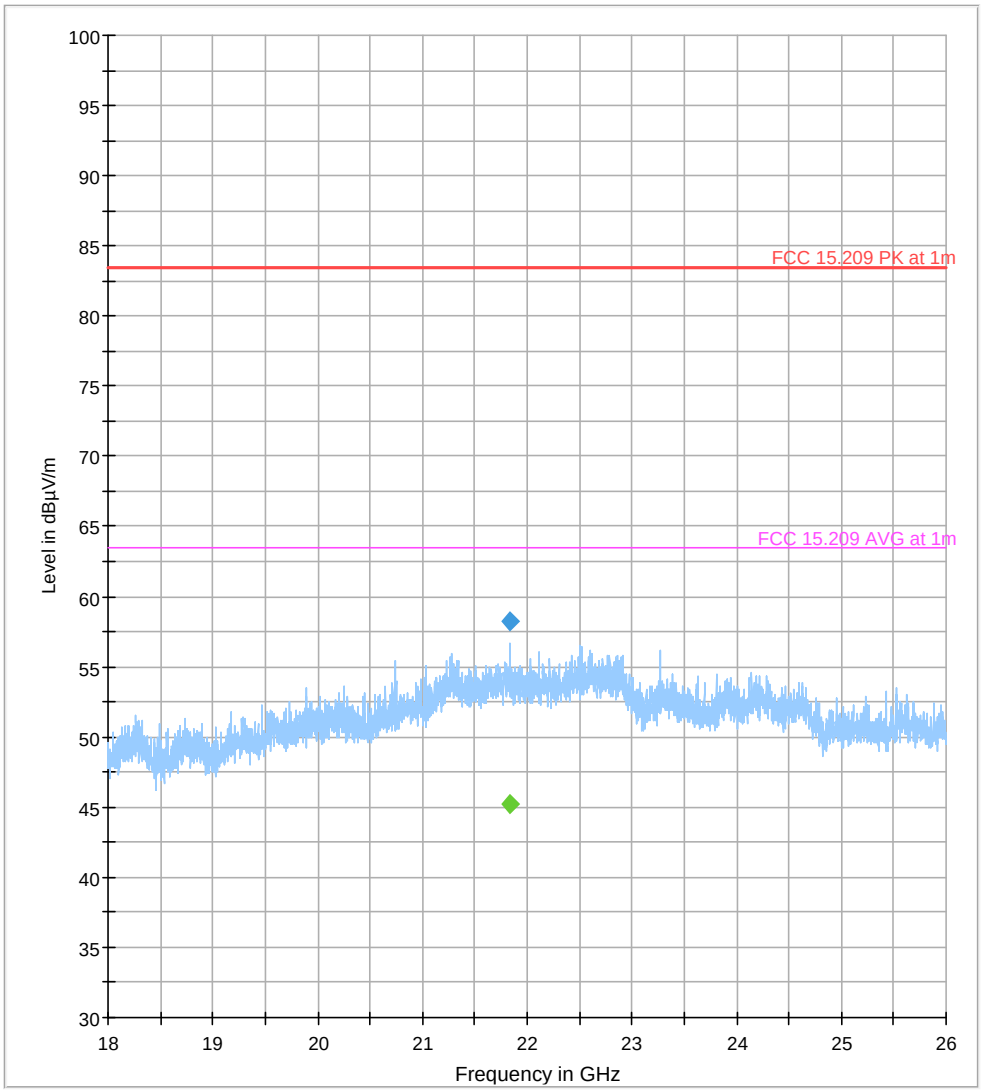
Plot # 9

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)	Comment
16618.750	---	39.81	500.00	460.19	500.0	1000.0	355.0	V	280.0	14.6	
16618.750	52.76	---	520.00	467.24	500.0	1000.0	355.0	V	280.0	14.6	



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)	Comment
21838.750	---	45.24	63.50	18.26	500.0	1000.0	140.0	H	-14.0	18.8	
21838.750	58.26	---	83.50	25.24	500.0	1000.0	140.0	H	-14.0	18.8	

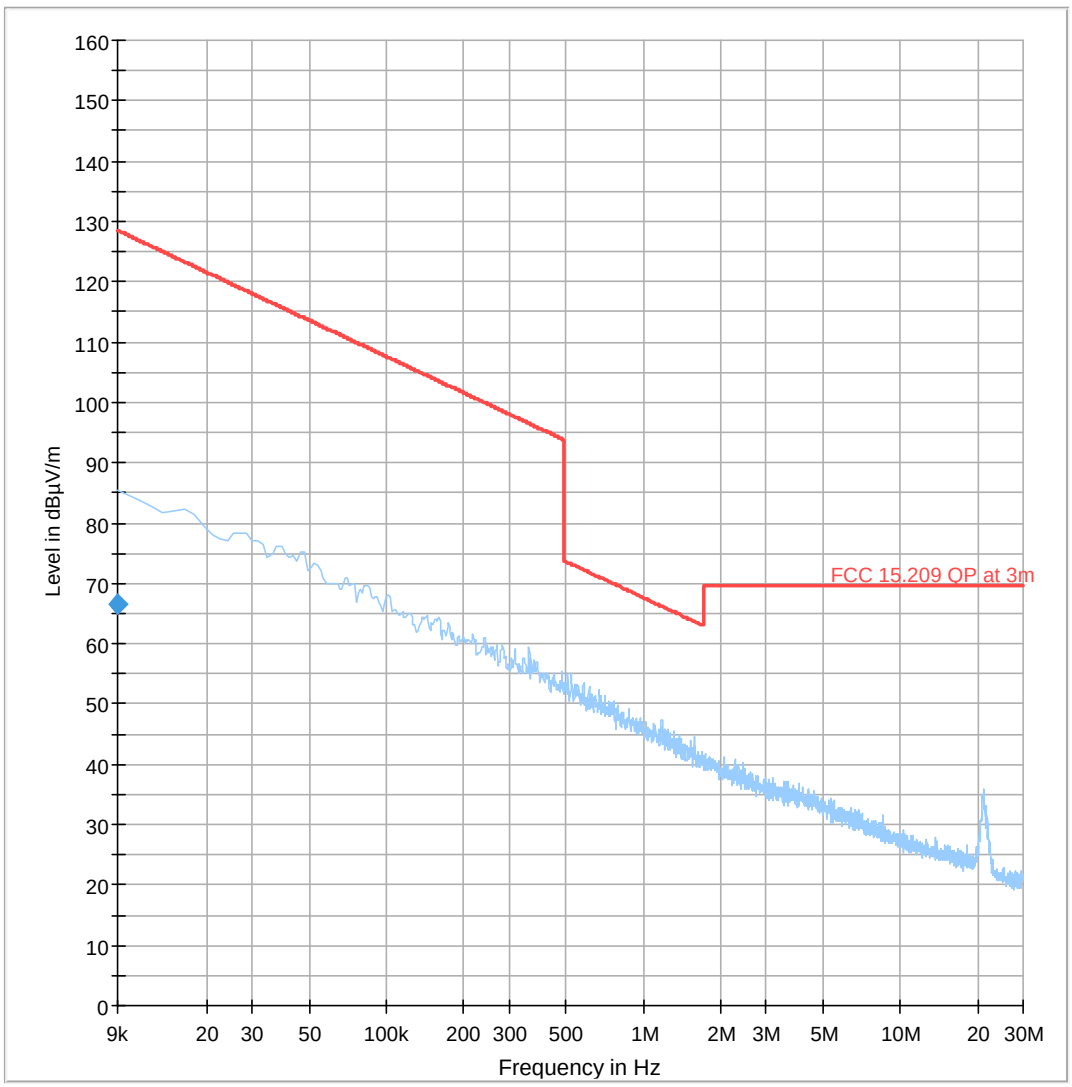


Plot # 11

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)
0.009	66.422	---	128.50	62.08	500.0	0.200	100.0	H	277.0	29.7	0.2

(continuation of the "Final_Result" table from column 17 ...)

Frequency (MHz)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
0.009	0.0	29.5	36.7	

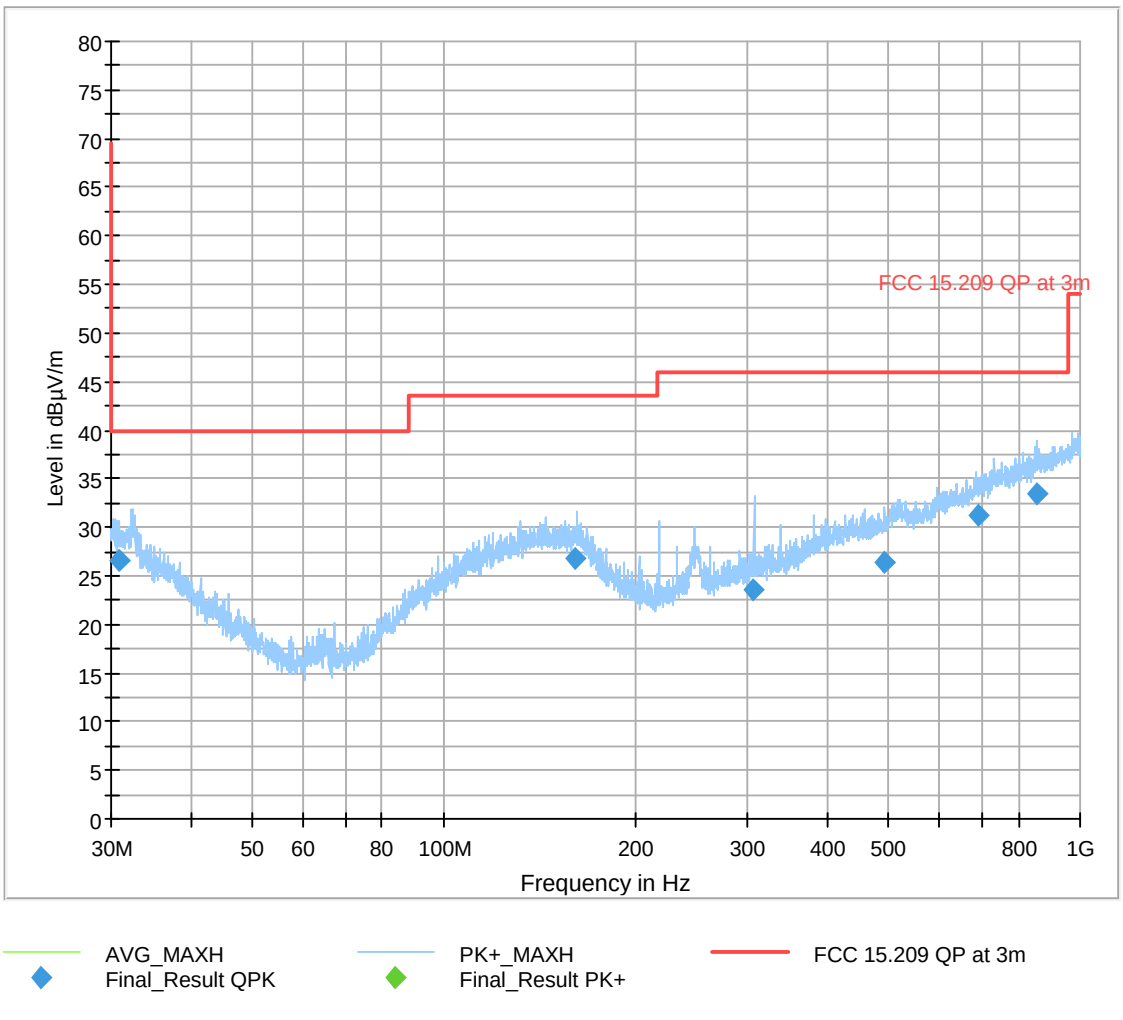


Plot # 12

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)
30.809	26.514	---	40.00	13.49	500.0	120.000	100.0	H	24.0	25.3	0.7
160.899	26.782	---	43.50	16.72	500.0	120.000	358.0	V	68.0	26.3	1.4
306.273	23.519	---	46.02	22.50	500.0	120.000	134.0	V	262.0	22.7	1.9
494.042	26.349	---	46.02	19.67	500.0	120.000	126.0	H	276.0	26.2	2.4
690.156	31.149	---	46.02	14.87	500.0	120.000	126.0	H	313.0	29.3	2.9
858.239	33.450	---	46.02	12.57	500.0	120.000	196.0	H	200.0	31.7	3.1

(continuation of the "Final_Result" table from column 17 ...)

Frequency (MHz)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
30.809	0.0	24.6	1.2	
160.899	0.0	24.9	0.5	
306.273	0.0	20.8	0.8	
494.042	0.0	23.8	0.2	
690.156	0.0	26.5	1.8	
858.239	0.0	28.6	1.7	

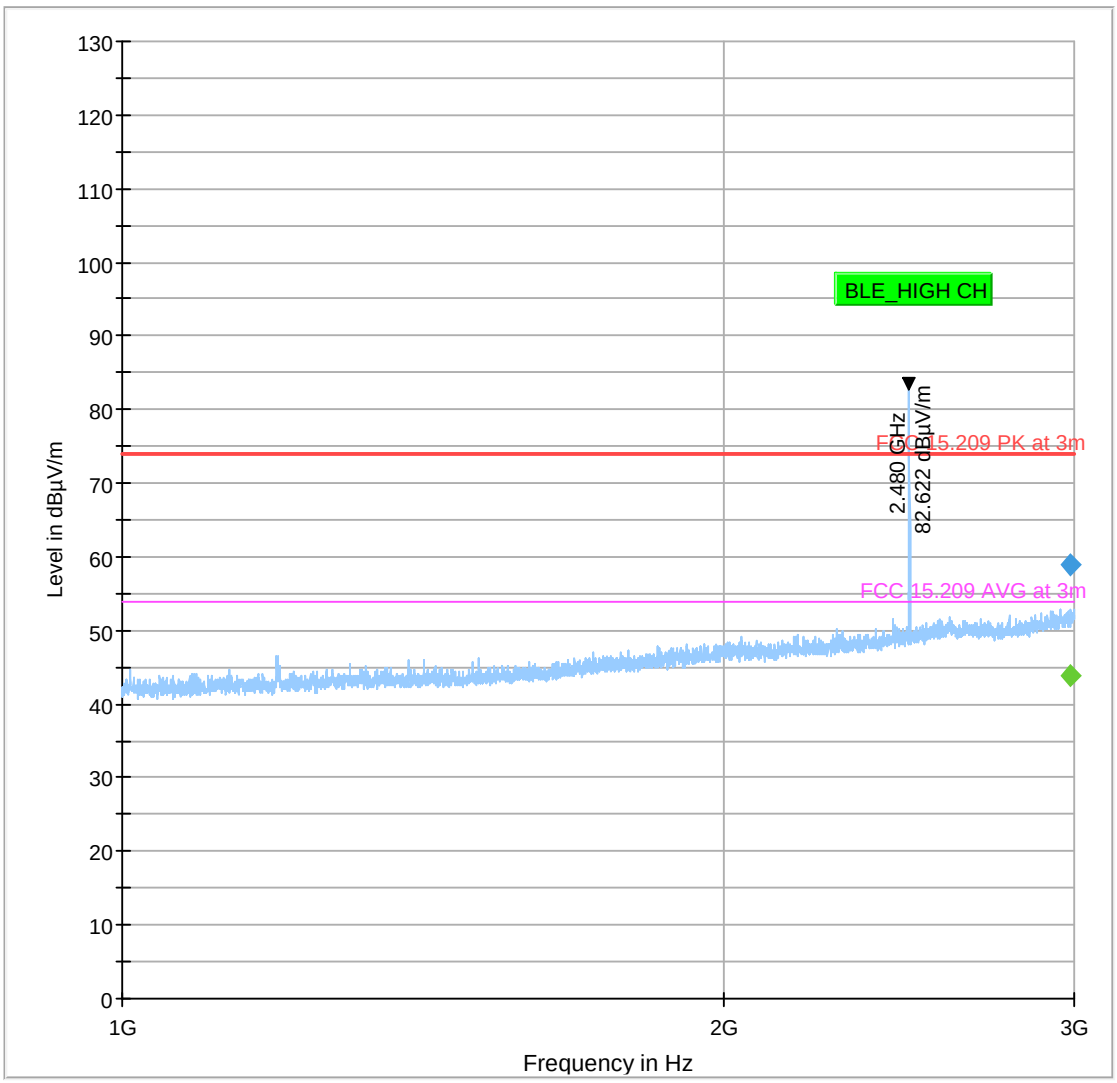


Plot # 13

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)	Sig Path (dB)
2989.814	---	43.806	53.98	10.17	500.0	1000.000	185.0	V	105.0	35.9	6.0
2989.814	58.981	---	73.98	15.00	500.0	1000.000	185.0	V	105.0	35.9	6.0

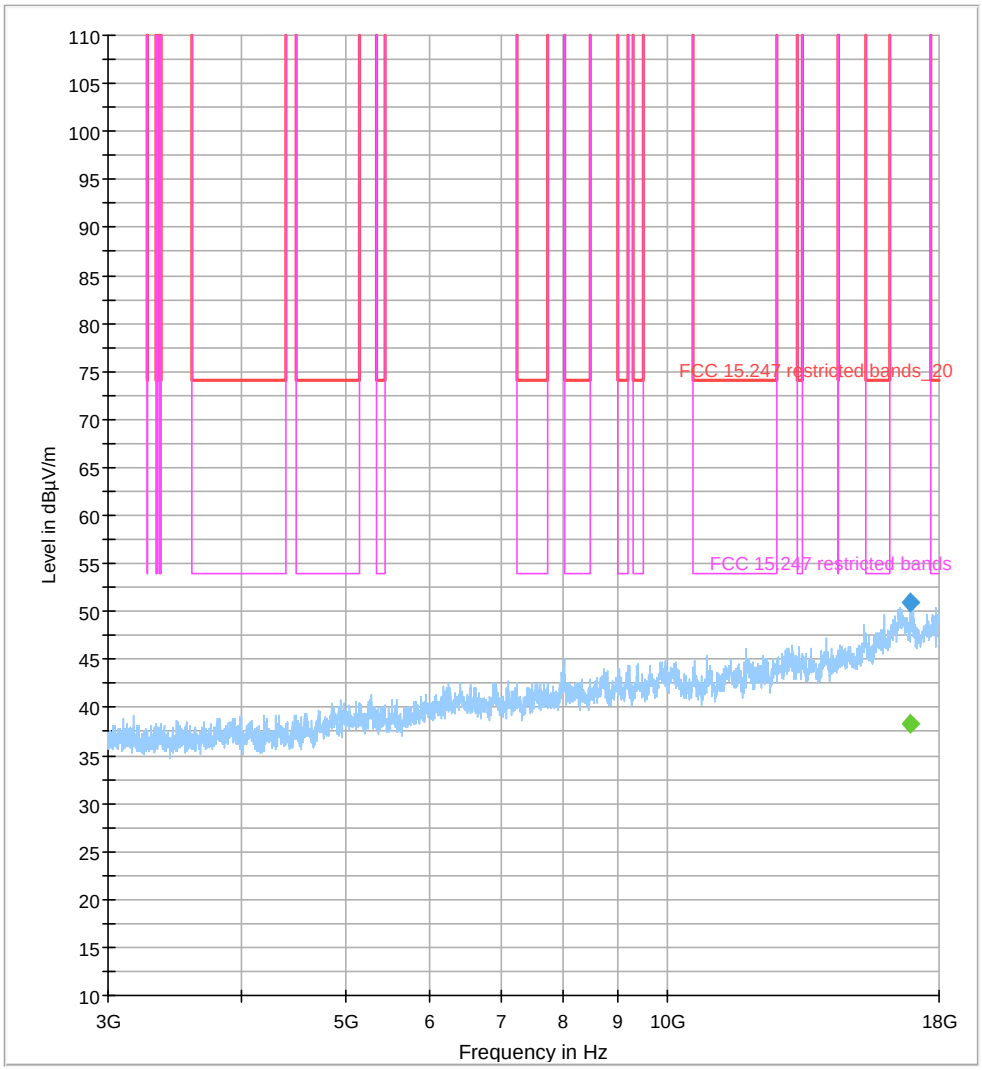
(continuation of the "Final_Result" table from column 17 ...)

Frequency (MHz)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
2989.814	0.0	29.8	7.9	
2989.814	0.0	29.8	23.1	



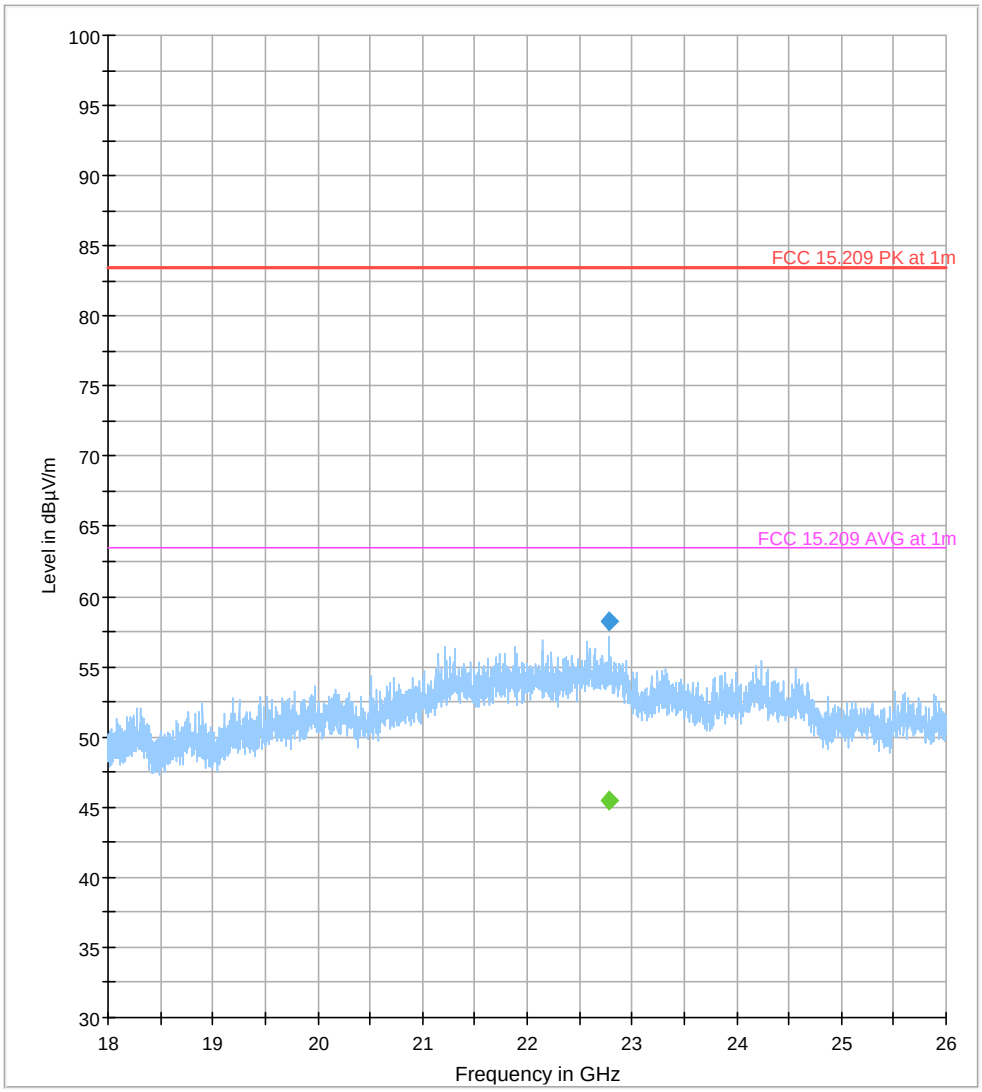
Plot # 14

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)	Comment
16931.750	---	38.37	500.00	461.63	500.0	1000.0	223.0	V	153.0	13.9	
16931.750	50.90	---	520.00	469.10	500.0	1000.0	223.0	V	153.0	13.9	



Plot # 15

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)	Comment
22782.500	---	45.44	63.50	18.06	500.0	1000.0	140.0	H	146.0	19.9	
22782.500	58.20	---	83.50	25.30	500.0	1000.0	140.0	H	146.0	19.9	



8 Test setup photos

Setup photos are included in supporting file name: "EMC_XIRGG_001_24001_FCC_15_247_BLE_Setup_Photos"

9 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
HORN ANTENNA	ETS.LINDGREN	3117	00215984	3 Years	10/26/2023
TEST RECEIVER	R&S	ESW44	103143	3 Years	09/12/2024
DIGITAL THERMOMETER	CONTROL COMPANY	4410,90080-03	230713059	3 Years	10/18/2023
Multimeter	Fluke	115	56090717MV	3 Years	09/26/2023
Software	EMC32	Version 11.40.00	-	-	-

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.

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
ACTIVE LOOP ANTENNA	ETS LINDGREN	6507	00161344	3 Years	08/13/2024
BILOG ANTENNA	A.H. SYSTEMS	BiLA2G	569	3 Years	10/30/2023
HORN ANTENNA	EMCO	3115	00035111	3 Years	10/26/2023
HORN ANTENNA	ETS LINDGREN	3116C-PA	00166821	3 Years	10/26/2023
ESW.EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW44	101715	3 Years	10/24/2023
DIGITAL THERMOMETER	Control Company	4410,90080-03	230712972	3 Years	10/18/2023
Multimeter	Fluke	115	56090717MV	3 Years	09/26/2023
Software	EMC32	Version 10.50.40	-	-	-

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.

10 History

Date	Report Name	Changes to report	Prepared by
2024-11-13	EMC_XIRGG_001_24001_FCC_15_247_BLE	Initial Version	Cheng Song
2024-11-15	EMC_XIRGG_001_24001_FCC_15_247_BLE_Rev1	Updated the calibration record for test equipment in Section 9.	Cheng Song

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