FCC / ISED Test Report

For:
Lennox Industries Inc.

Model Name:
Lennox L40

Product Description:
Thermostat to control residential HVAC system

FCC ID: 2A6F9-L4024A
ISED: 28687-L4024A

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

REPORT #: EMC_LENNX_014_24001_15_247_BTLE_DTS_Rev1

DATE: 2025-01-22

A2LA Accredited

IC recognized # 3462B

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TABLE OF CONTENTS

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.
Lennox Industries Inc.	Thermostat to control residential HVAC system	Lennox L40

Responsible for the Report:

Date	Section	Name	Signature
2025-01-22	Compliance	Art Thammanavarat (Senior EMC Engineer)	Art Thammanavarat Digitally signed by: Art Thammanavarat DN: CN = Art Thammanavarat email = art.thammanavarat@cetecom.com C = AD Date: 2025.01.22 16:04:03 -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 Lab Manager:	Alvin, Ilarina
Responsible Project Leader:	Shane Hao

2.2 Identification of the Client

Applicant's Name:	Lennox Industries Inc.
Street Address:	PO Box 799900
City/Zip Code	Dallas TX 75379
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:	Thermostat to control residential HVAC system
Model Name:	Lennox L40 Yosemite
HW Version:	A
SW Version:	04.33.0167
FCC-ID:	2A6F9-L4024A
ISED:	28687-L4024A
Frequency Range / number of channels:	Nominal band: 2400 MHz – 2483.5 MHz Center to center: 2402 MHz (ch 0) – 2480 MHz (ch 79), 80 channels
Bands/Modes Supported	**Bluetooth Modules** **Model Name**: Murata - Type 1YN - Wi-Fi and Bluetooth Combo **Model Number:** LBEE5KL1YN-814 **FCC:** VPYLB1DX **ISED**: 772C-LB1DX **Wireless Technologies** **Bluetooth LE**
Modes of Operation:	BLE - GATT
Max. declared antenna gain	Name: Pulse Electronics Description: FPC 2.4G Antenna Part Number: W3921B0100 Location: Internal Antenna Peak Gain: • 2400-2500GHz: 1.0 dBi
Max. Peak Output Power:	Conducted Peak Power 9.6 dBm
Other Radios included in the device	Wi-Fi 2.4GHz
Power Supply/ Rated Operating Voltage Range	120Vac to 24Vac
Operating Temperature Range	Low: -20 ºC - ºC High 70 ºC
Sample Revision	☐Production ☒ Pre-Production
EUT Dimensions	96.5mm x 96.5mm x 24mm
Weight	250 grams
EUT Diameter	☒< 60 cm ☐ Other _____
Note: The information of the EUT specifications in the table above is provided by the client.	

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	EQ1-001	A	04.33.0167	Radiated and AC Conducted Emissions

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number	Comments
1	Laptop	P135G	Dell	12243628947	Support laptop provided by Cetecom to exercise device.

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#1+AE#1	The radio of the EUT was configured to a fixed channel transmission with dynamic 100% duty cycle using Windows command prompt to configure the EUT. The measurement instrument was connected to the 50 ohm RF port of the EUT.

3.5 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 of 100%. For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

4 Subject of Investigation

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

This test report is to support a request for new equipment authorization under the FCC ID: 2A6F9-L4024AIC ID: 28687- L4024A

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.

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	BTLE	■	☐	☐	Complies
§15.247(e) RSS-247 5.2(b)	Power Spectral Density	Nominal	BTLE	■	☐	☐	Complies
§15.247(b)(1) RSS-247 5.4(d)	Maximum Conducted Output Power and EIRP	Nominal	BTLE	■	☐	☐	Complies
§15.247(d) RSS-247 5.5	Band edge compliance Unrestricted Band Edges	Nominal	BTLE	■	☐	☐	Complies
§15.247; 15.209; 15.205 RSS-Gen 8.9; 8.10	Band edge compliance Restricted Band Edges	Nominal	BTLE	■	☐	☐	Complies
§15.247(d); §15.209 RSS-Gen 6.13	TX Radiated Spurious Emissions	Nominal	BTLE	■	☐	☐	Complies
§15.207(a) RSS Gen 8.8	AC Conducted Emissions	Nominal	BTLE	■	☐	☐	Complies

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

6 Measurement Uncertainty

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

Radiated measurement

Measurement System		EMC Lab 1	EMC Lab 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.

6.1 Environmental Conditions During Testing:

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

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

6.2 Dates of Testing:

2024-09-16 – 2024-09-25

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.

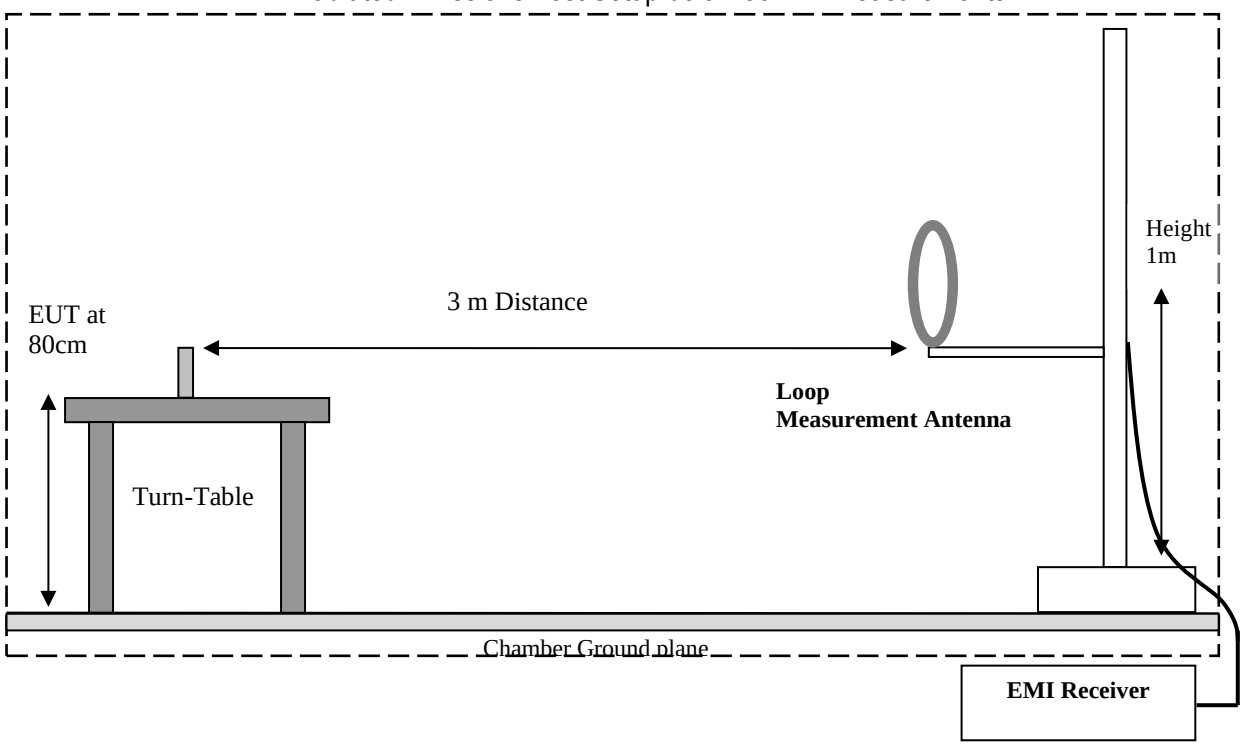
7 Measurement Procedures

7.1 Radiated Measurement

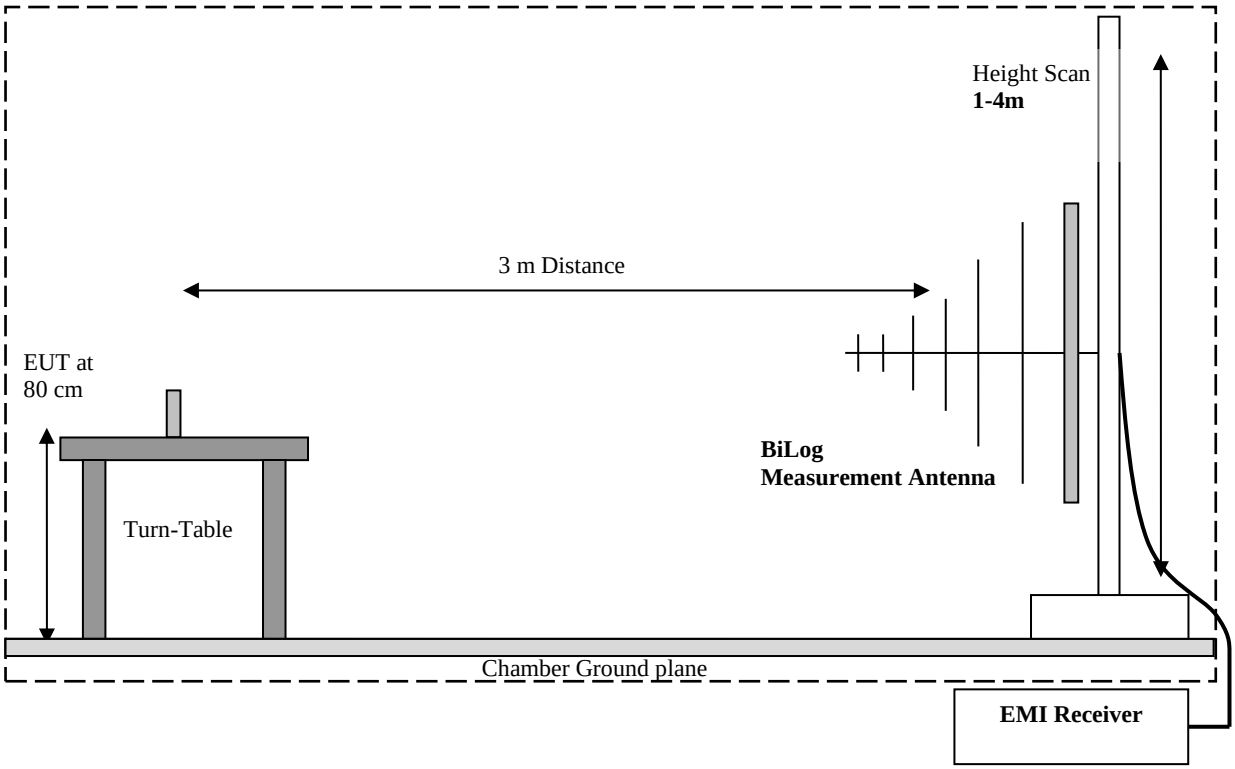
The radiated measurement is performed according to ANSI C63.10 (2013)

- 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.

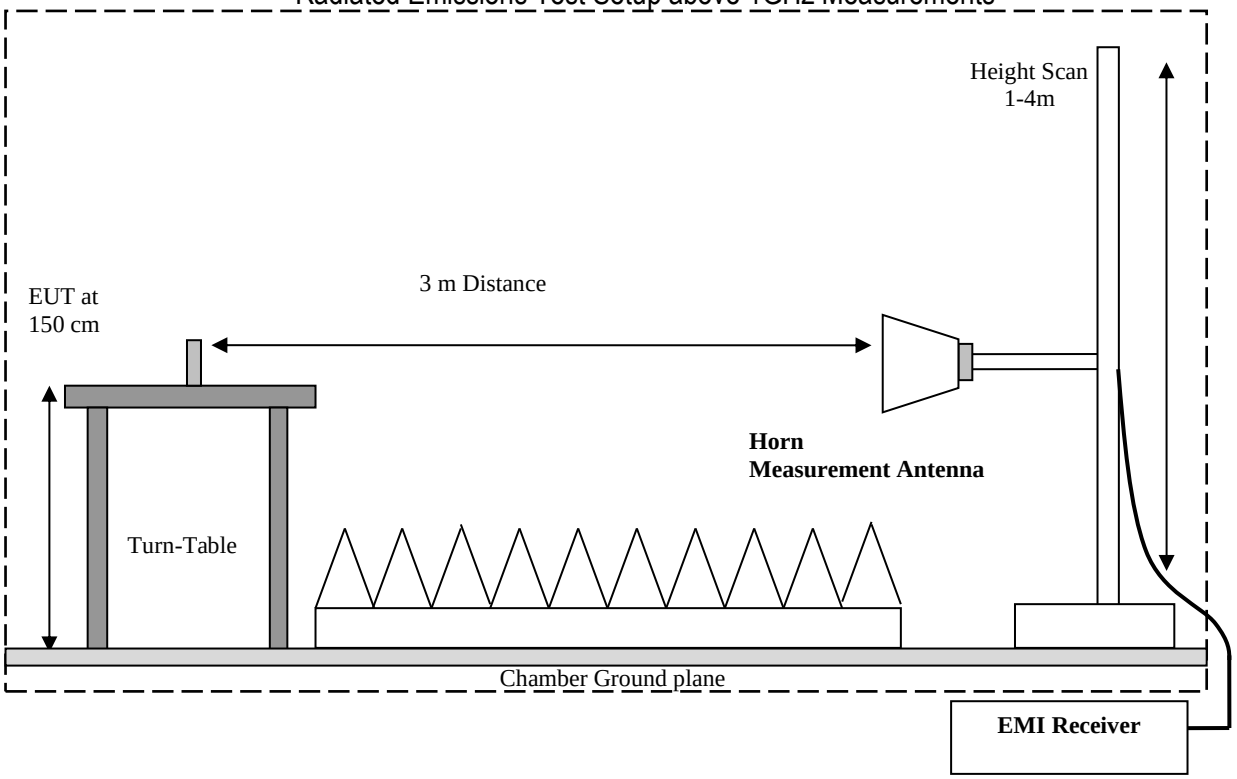
Radiated Emissions Test Setup below 30MHz Measurements



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:

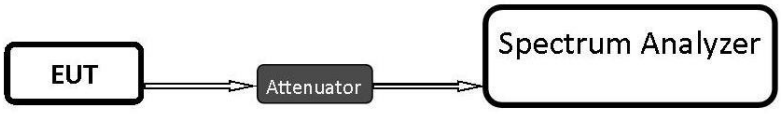
Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

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 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

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
22.8° C	1	BTLE	24Vac	1 dBi

8.1.4 Measurement result:

Plot #	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)	EIRP (dBm)	Limit (dBm)	Result
1	2402	9.50	10.50	30 (Pk) / 36 (EIRP)	Pass
2	2441	9.40	10.40	30 (Pk) / 36 (EIRP)	Pass
3	2480	9.60	10.60	30 (Pk) / 36 (EIRP)	Pass

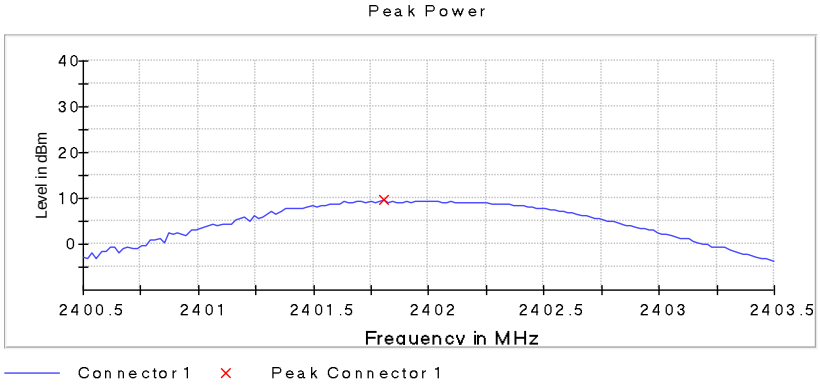
8.1.5 Measurement Plots:

Plot #1

Low channel / 2402 MHz	Modulation/Packet Type: BTLE

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2402.000000	9.5	30.0	PASS

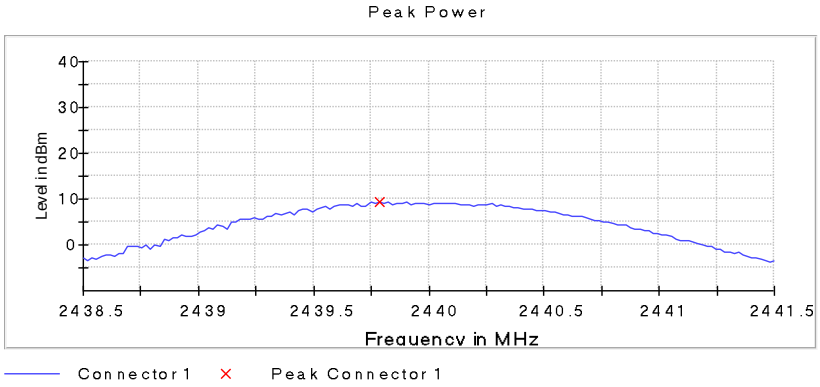


Plot #2

Mid channel 2441 MHz	Modulation/Packet Type: BTLE

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2440.000000	9.4	30.0	PASS

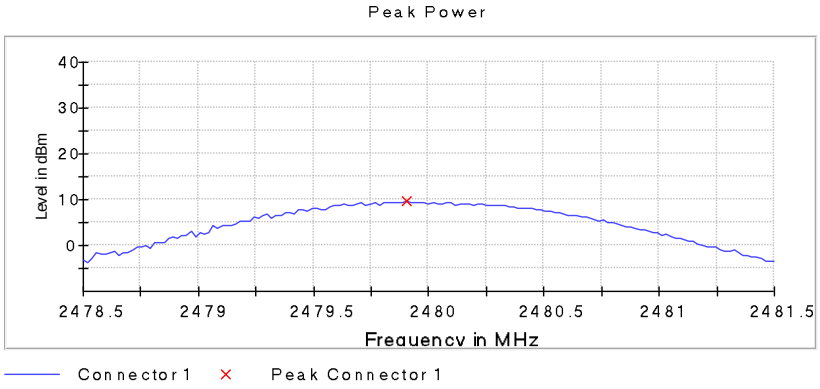


Plot #3

High channel 2480 MHz | **Modulation/Packet Type: BTLE**

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2480.000000	9.6	30.0	PASS



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
22.8° C	1	BTLE	24Vac	1 dBi

8.2.4 Measurement result:

Plot #	Frequency (MHz)	Maximum Power Spectral Density (dBm/3 kHz)	Limit (dBm / 3 kHz)	Result
1	2402	2.58	8	Pass
2	2441	2.17	8	Pass
3	2480	2.27	8	Pass

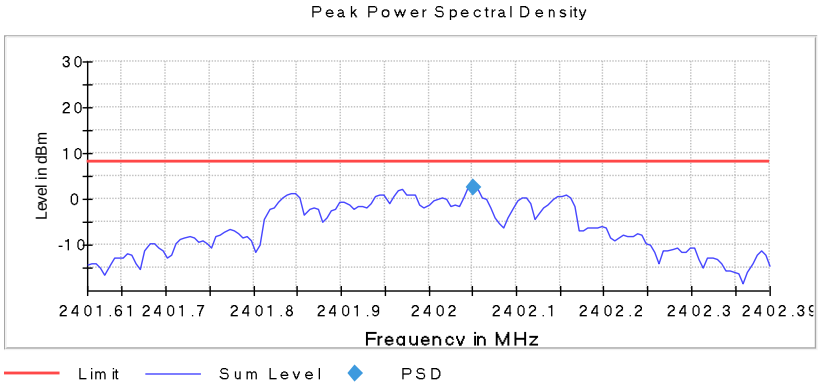
8.2.5 Measurement Plots:

Plot #1

Low channel / 2402 MHz	Modulation/Packet Type: BTLE

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	2402.050599	2.578	8.0	PASS

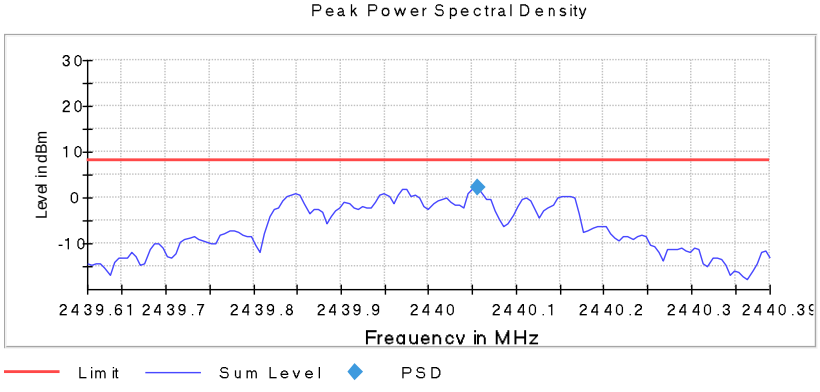


Plot #2

Mid channel 2441 MHz	Modulation/Packet Type: BTLE

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2440.000000	2440.055659	2.167	8.0	PASS

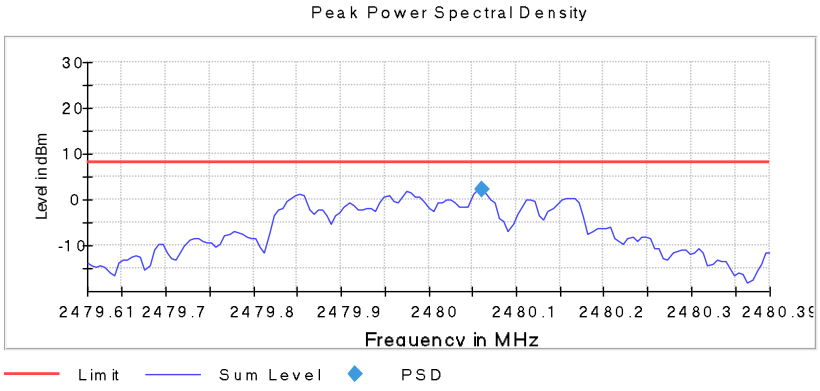


Plot #3

High channel 2480 MHz	Modulation/Packet Type: BTLE

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2480.000000	2480.060718	2.274	8.0	PASS



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

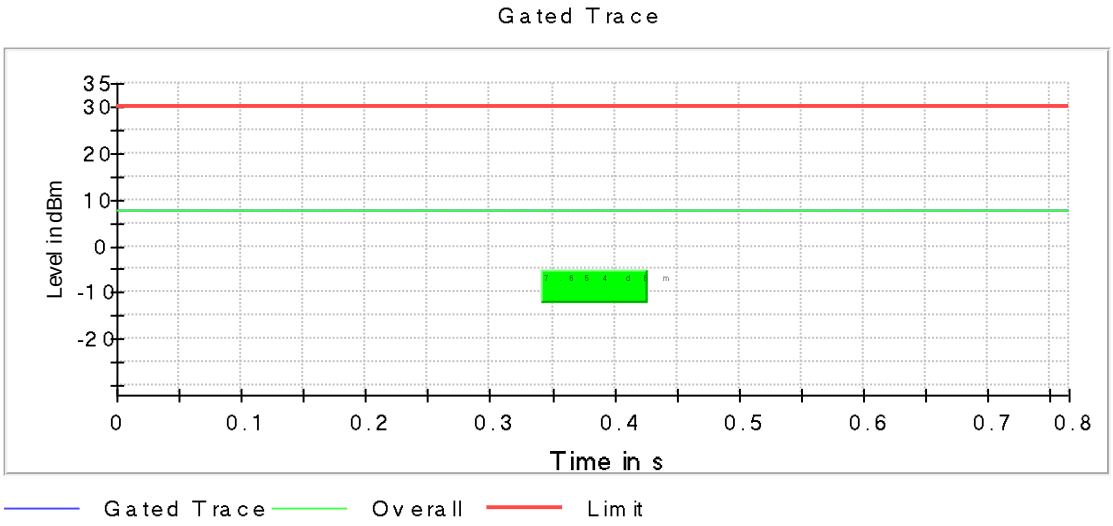
8.3.2 Measurement result

Duty cycle measurement

Mid channel / 2437 MHz	Modulation/Packet Type: 802.11b

Result

DUT Frequency (MHz)	Gated RMS (dBm)	Limit Max (dBm)	Gated EIRP (dBm)	DutyCycle (%)	Result
2440.000000	7.7	30.0	8.7	77.039	PASS



Duty cycle = 77.039%
Duty cycle correction factor = 10*log(1/0.77) = 1.14 dB

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)).

RSS-247 5/5

- In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30dB instead of 20dB.

Spectrum Analyzer settings for restricted band:

- Peak measurements are made using a peak detector and RBW=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
22.8° C	1	BTLE	24Vac	1 dBi

8.4.5 Measurement result:

Plot #	EUT operating mode	Band Edge	Band Edge Delta (dBm)	Limit (dBm)	Result
1	BTLE	Lower, non-restricted	-46.7	-10.6	Pass

Plot #	EUT operating mode	Band Edge	Measured Value (dBµV/m)	Limit (dBµV/m)	Result
2	BTLE	Upper Restricted Peak	55.58	74	Pass
		Upper Restricted AVG	40.01	54	Pass

8.4.6 Measurement Plots:

Plot #1

Low channel / 2402 MHz | **Modulation/Packet Type: BTLE**

Result

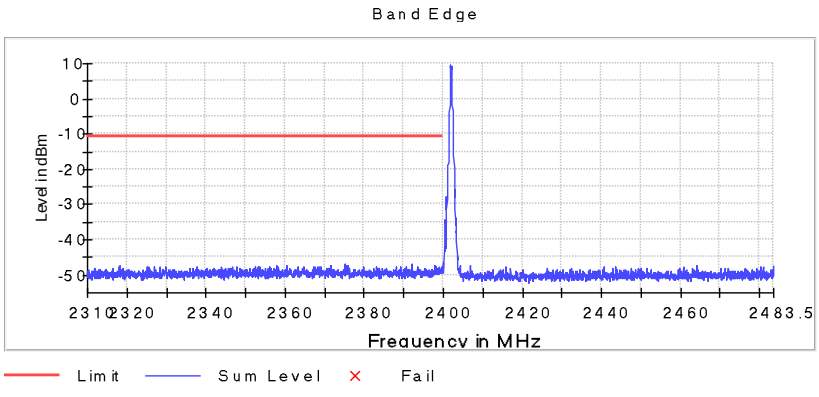
DUT Frequency (MHz)	Result
2402.000000	PASS

Inband Peak

Frequency (MHz)	Level (dBm)
2401.817353	9.4

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2375.100000	-46.7	36.1	-10.6	PASS
2392.050000	-46.8	36.2	-10.6	PASS
2376.050000	-47.1	36.5	-10.6	PASS
2358.000000	-47.1	36.5	-10.6	PASS
2392.100000	-47.2	36.6	-10.6	PASS
2318.100000	-47.3	36.7	-10.6	PASS
2397.900000	-47.3	36.7	-10.6	PASS
2358.050000	-47.4	36.8	-10.6	PASS
2375.400000	-47.4	36.8	-10.6	PASS
2376.000000	-47.4	36.8	-10.6	PASS
2371.550000	-47.4	36.8	-10.6	PASS
2360.350000	-47.5	36.9	-10.6	PASS
2363.350000	-47.5	36.9	-10.6	PASS
2367.750000	-47.5	36.9	-10.6	PASS
2399.500000	-47.5	36.9	-10.6	PASS

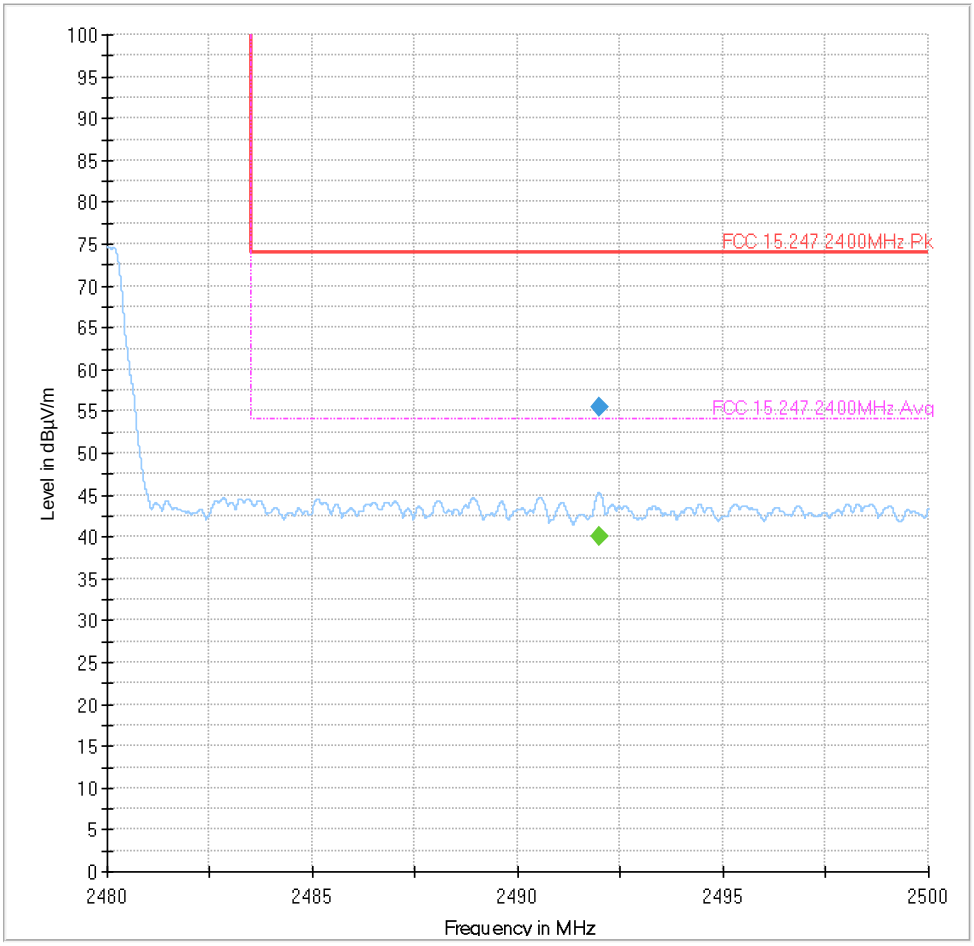


Plot #2

High channel 2480 MHz Peak | **Modulation/Packet Type: BTLE**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path	Trd Corr.	Raw Rec
2491.973	---	40.011	54.00	13.99	500.0	1000.000	333.0	H	270.0	34.1	5.7	28.4	5.9
2491.973	55.578	---	74.00	18.42	500.0	1000.000	333.0	H	270.0	34.1	5.7	28.4	21.5



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	Antenna Gain
22.8° C	1	BTLE	24Vac	1 dBi

8.5.4 Measurement result:

Plot #	Frequency (MHz)	6dB Emissions Bandwidth (MHz)	Limit (MHz)	Result
1	2402	0.52	> 0.5	Pass
2	2441	0.52	> 0.5	Pass
3	2480	0.52	> 0.5	Pass

Plot #	Frequency (MHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
4	2402	0.92	> 0.5	Pass
5	2441	0.92	> 0.5	Pass
6	2480	0.92	> 0.5	Pass

8.5.5 Measurement Plots:

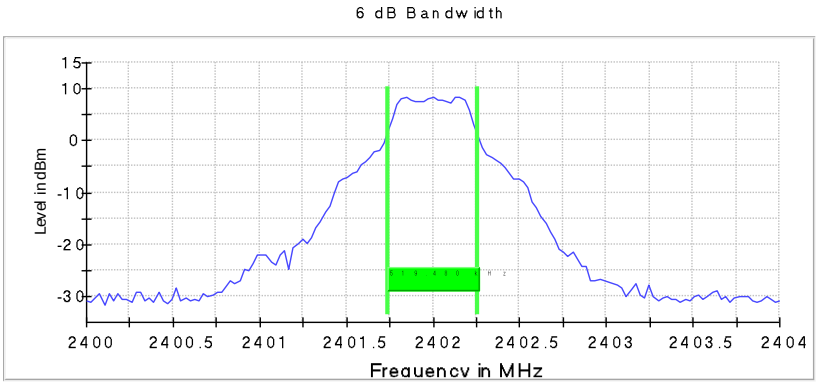
Plot #1

2402 MHz	Mode: BTLE

6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402.000000	0.519480	0.500000	---	2401.740260	2402.259740

(



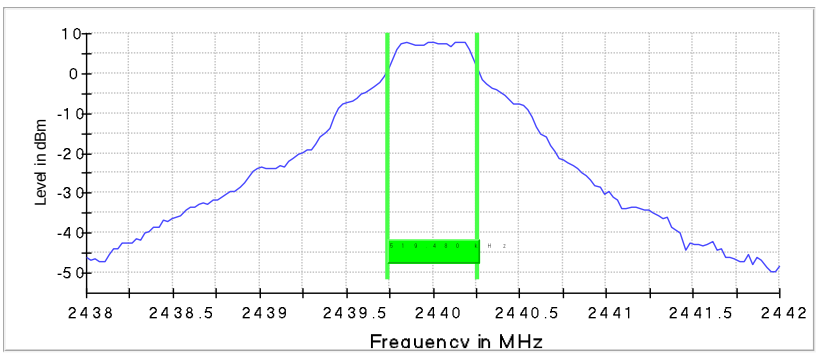
Plot #2

2440 MHz	Mode: BTLE

6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2440.000000	0.519480	0.500000	---	2439.740260	2440.259740

(

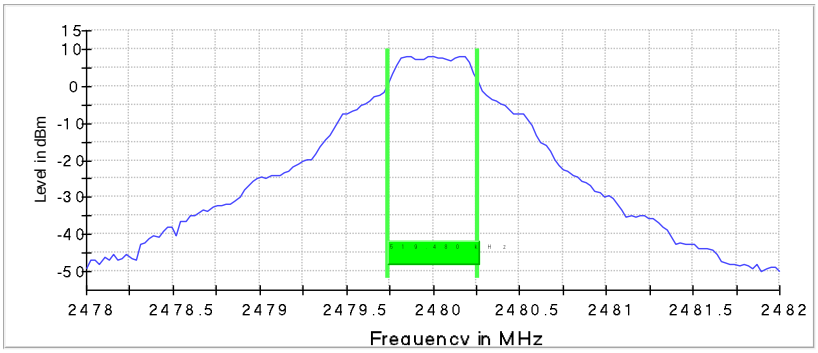


Plot #3

2480 MHz	Mode: BTLE

6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2480.000000	0.519480	0.500000	---	2479.740260	2480.259740

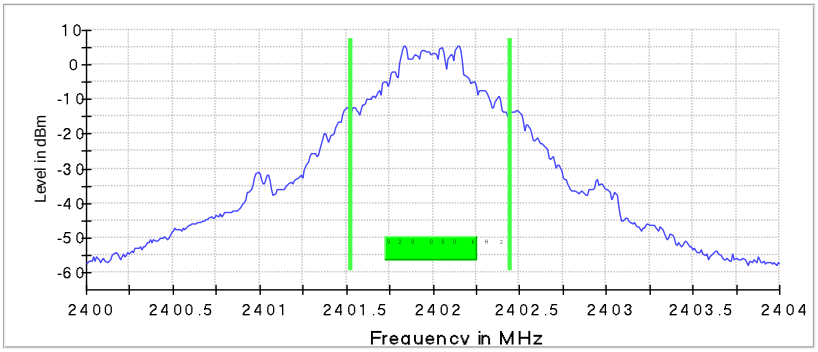


Plot #4

2402 MHz	Mode: BTLE

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402.000000	0.920000	---	---	2401.530000	2402.450000



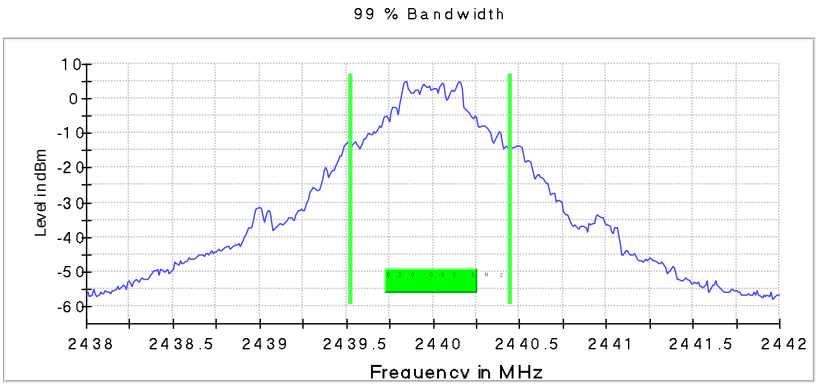
Plot #5

2440 MHz	Mode: BTLE

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2440.000000	0.920000	---	---	2439.530000	2440.450000

(

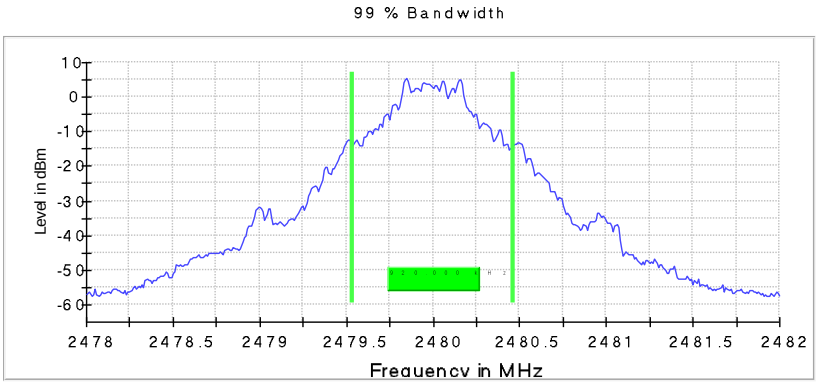


Plot #6

2480 MHz	Mode: BTLE

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2480.000000	0.920000	---	---	2479.540000	2480.460000



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	Antenna Gain
22.8° C	1	BTLE	24Vac	1 dBi

8.6.4 Measurement result:

Plot #	Channel #	Scan Frequency	Limit	Result
1-5	Low	9 kHz – 26 GHz	See section 8.6.2	Pass
6-10	Mid	9 kHz – 26 GHz	See section 8.6.2	Pass
11-15	High	9 kHz – 26 GHz	See section 8.6.2	Pass

8.6.5 Measurement Plots:

Plot # 1 Radiated Emissions: 9 KHz – 30 MHz

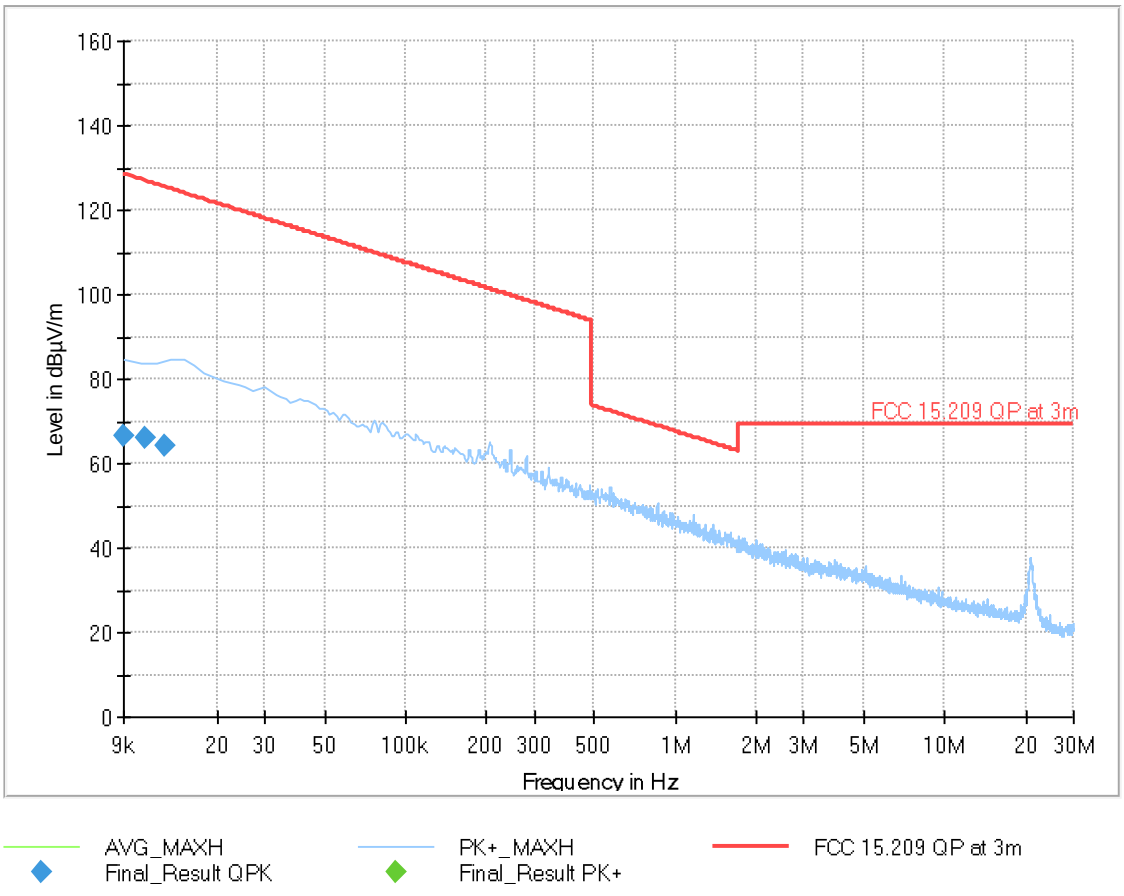
Tx Frequency: 2402 MHz	GFSK (PHY: 1M)

Final Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Sig Path (dB)
0.009	66.461	---	128.50	62.04	500.0	0.200	100.0	V	271.0	29.7	0.2
0.011	65.869	---	126.89	61.02	500.0	0.200	100.0	V	350.0	28.3	0.2
0.013	64.412	---	125.47	61.06	500.0	0.200	100.0	H	324.0	27.2	0.2

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

Frequency (MHz)	Preamp	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
0.009	0.0	29.5	36.8	
0.011	0.0	28.1	37.6	
0.013	0.0	27.0	37.2	



Plot # 2 Radiated Emissions: 30 – 1000MHz

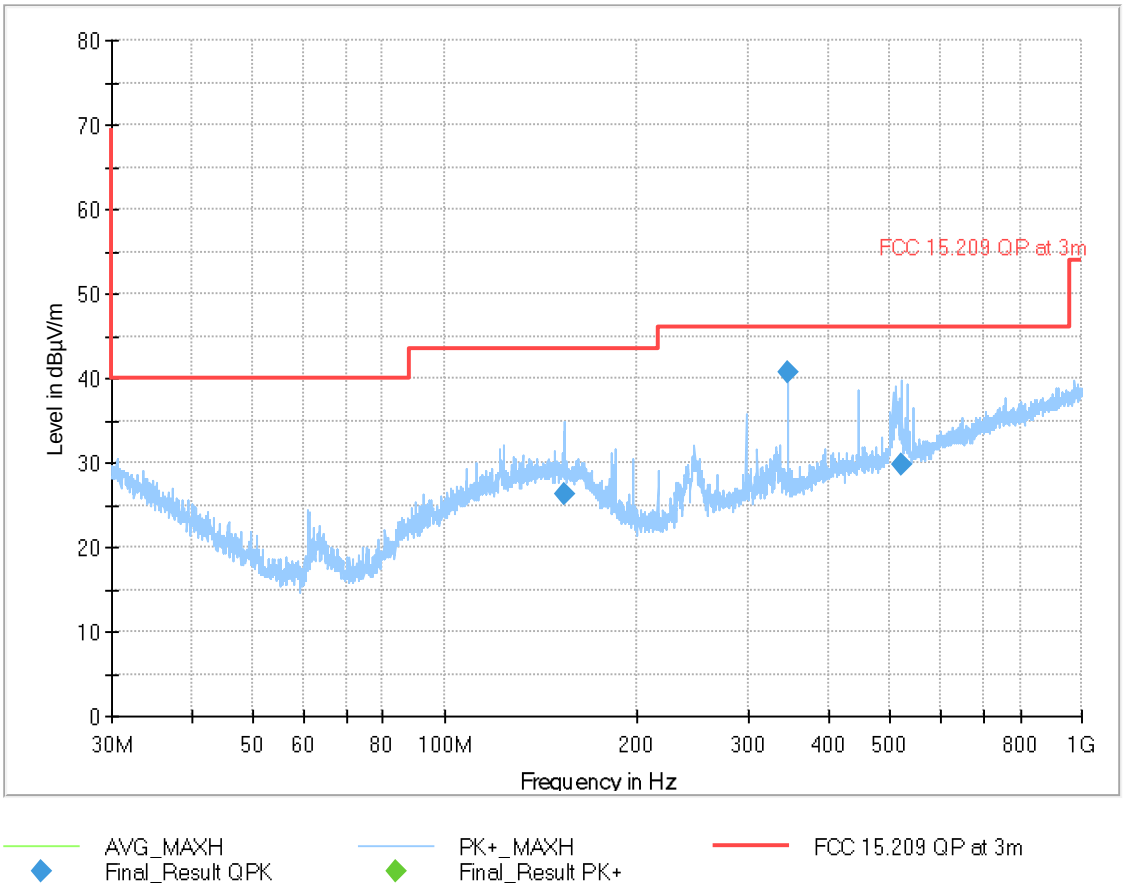
Tx Frequency: 2402 MHz | **GFSK (PHY: 1M)**

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Sig Path (dB)
154.284	26.184	---	43.50	17.32	500.0	120.000	169.0	H	255.0	26.1	1.4
346.503	40.812	---	46.02	5.21	500.0	120.000	100.0	H	220.0	22.9	2.0
522.494	29.782	---	46.02	16.24	500.0	120.000	237.0	V	207.0	26.7	2.5

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

Frequency (MHz)	Preamp	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
154.284	0.0	24.7	0.1	
346.503	0.0	20.9	18.0	
522.494	0.0	24.2	3.1	



Plot # 3 Radiated Emissions: 1 – 3 GHz

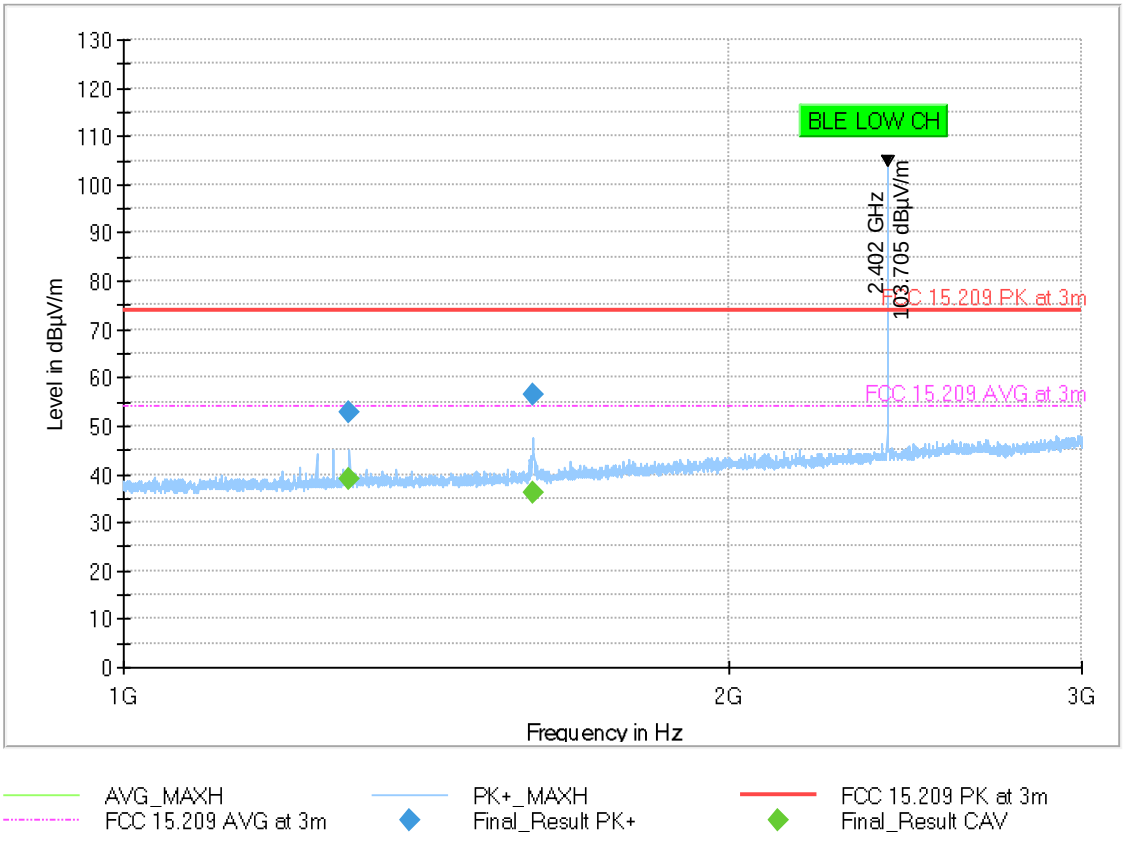
Tx Frequency: 2402 MHz | **GFSK (PHY: 1M)**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Sig Path (dB)
1295.971	---	38.944	53.98	15.04	500.0	1000.000	100.0	H	218.0	29.7	4.5
1295.971	52.702	---	73.98	21.28	500.0	1000.000	100.0	H	218.0	29.7	4.5
1599.363	---	36.061	53.98	17.92	500.0	1000.000	370.0	H	167.0	30.2	4.8
1599.363	56.301	---	73.98	17.68	500.0	1000.000	370.0	H	167.0	30.2	4.8

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

Frequency (MHz)	Preamp	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
1295.971	0.0	25.2	9.2	
1295.971	0.0	25.2	23.0	
1599.363	0.0	25.4	5.8	
1599.363	0.0	25.4	26.1	



Plot # 4 Radiated Emissions: 3 - 18 GHz

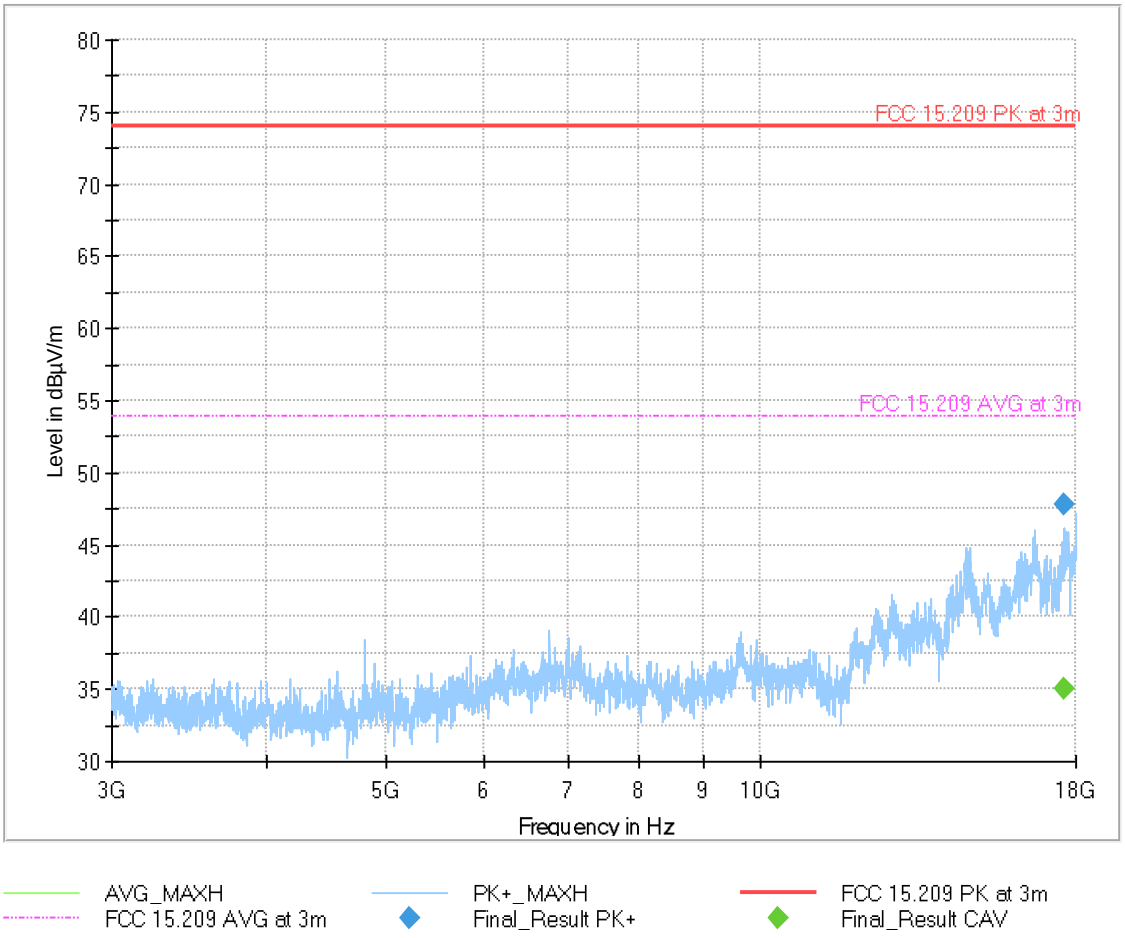
Tx Frequency: 2402 MHz | **GFSK (PHY: 1M)**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Sig Path (dB)
17612.500	---	35.021	53.98	18.96	500.0	1000.000	357.0	H	217.0	14.7	16.1
17612.500	47.794	---	73.98	26.19	500.0	1000.000	357.0	H	217.0	14.7	16.1

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

Frequency (MHz)	Preamp	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
17612.500	-42.8	41.4	20.3	
17612.500	-42.8	41.4	33.1	



Plot # 5 Radiated Emissions: 18 - 26GHz

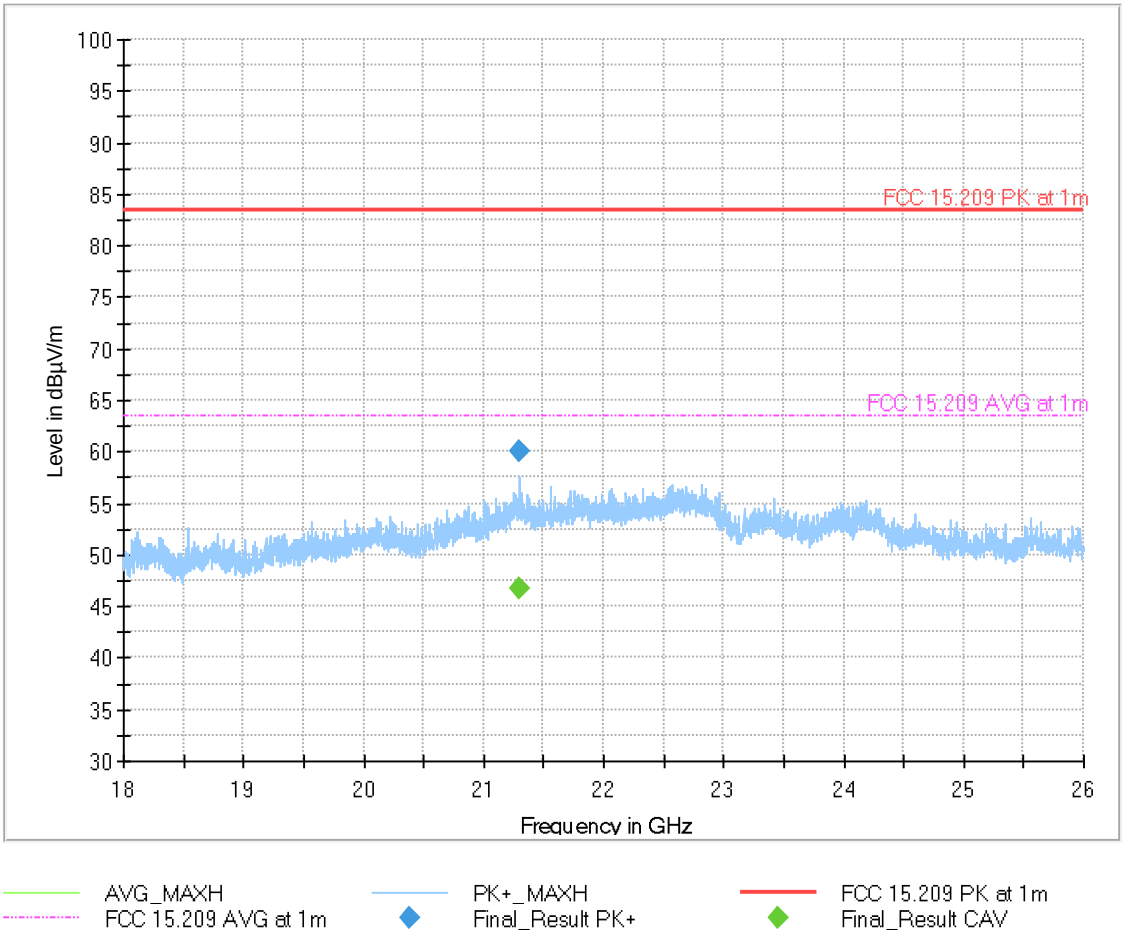
Tx Frequency: 2402 MHz | **GFSK (PHY: 1M)**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Sig Path (dB)
21293.500	---	46.803	63.50	16.70	500.0	1000.000	100.0	V	310.0	18.5	9.3
21293.500	60.062	---	83.50	23.44	500.0	1000.000	100.0	V	310.0	18.5	9.3

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

Frequency (MHz)	Preamp	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
21293.500	0.0	9.3	28.3	
21293.500	0.0	9.3	41.5	



Plot # 6 Radiated Emissions: 9 KHz – 30 MHz

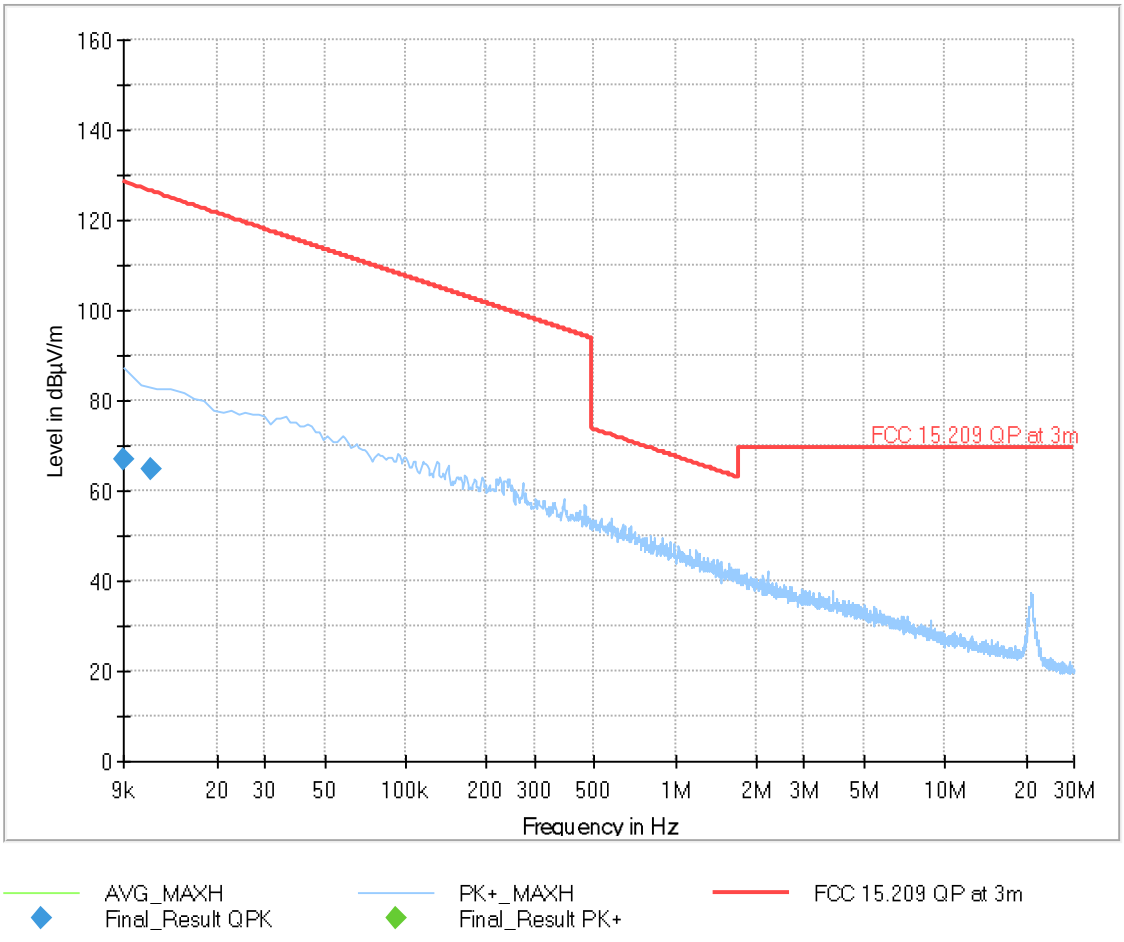
Tx Frequency: 2440 MHz | **GFSK (PHY: 1M)**

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Sig Path (dB)
0.009	67.147	---	128.50	61.35	500.0	0.200	100.0	H	0.0	29.7	0.2
0.011	64.978	---	126.52	61.54	500.0	0.200	100.0	V	129.0	28.0	0.2

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

Frequency (MHz)	Preamp	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
0.009	0.0	29.5	37.4	
0.011	0.0	27.8	37.0	



Plot # 7 Radiated Emissions: 30 – 1000MHz

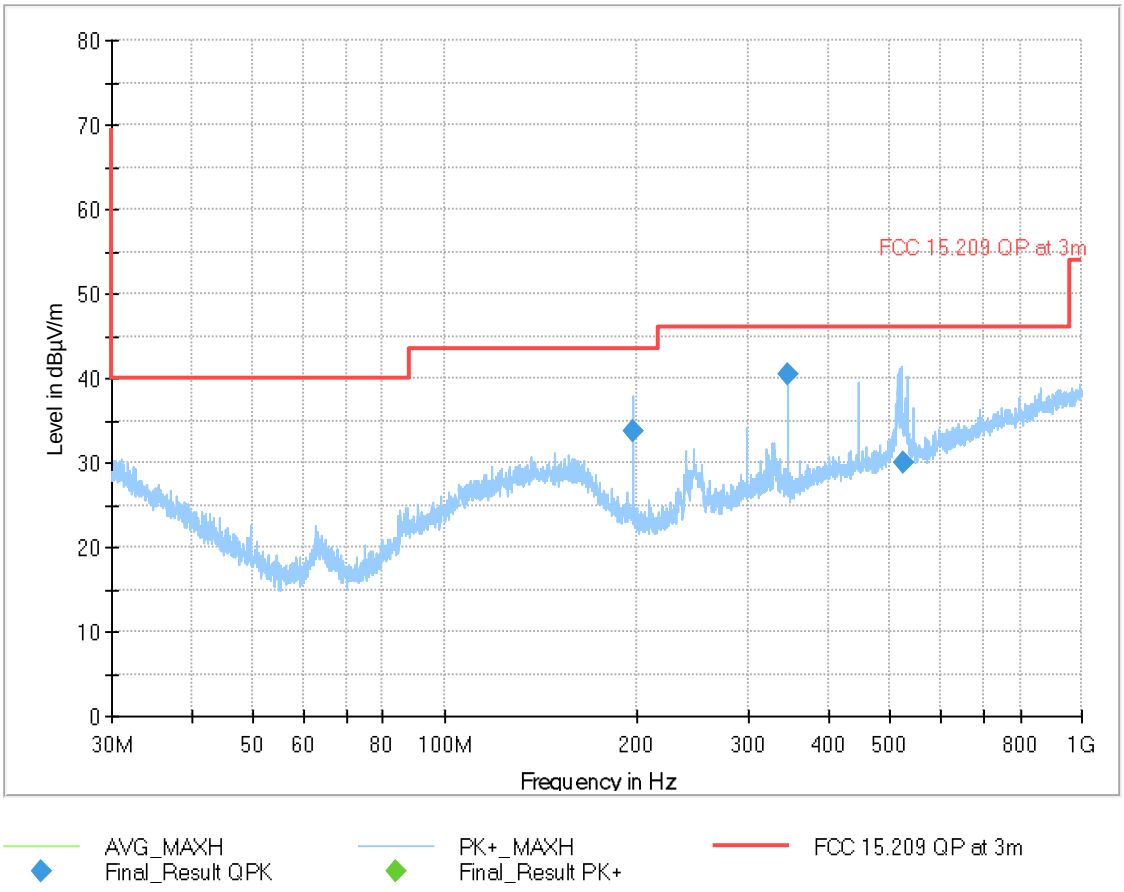
Tx Frequency: 2440 MHz | **GFSK (PHY: 1M)**

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Sig Path (dB)
198.001	33.829	---	43.50	9.67	500.0	120.000	173.0	H	106.0	19.5	1.5
346.503	40.507	---	46.02	5.51	500.0	120.000	100.0	H	233.0	22.9	2.0
523.946	30.051	---	46.02	15.97	500.0	120.000	243.0	V	227.0	26.6	2.5

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

Frequency (MHz)	Preamp	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
198.001	0.0	18.0	14.3	
346.503	0.0	20.9	17.6	
523.946	0.0	24.2	3.4	



Plot # 8 Radiated Emissions: 1 – 3 GHz

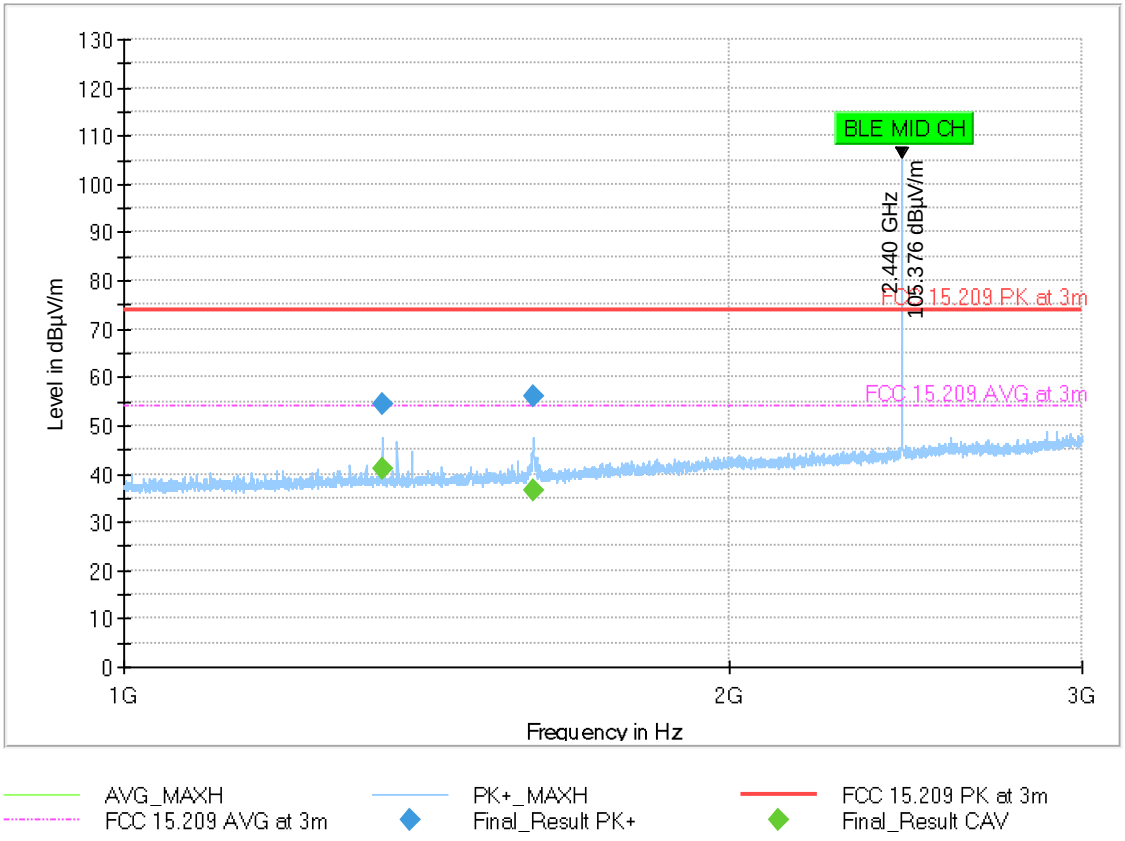
Tx Frequency: 2440 MHz | **GFSK (PHY: 1M)**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Sig Path (dB)
1344.051	54.240	---	73.98	19.74	500.0	1000.000	167.0	H	178.0	29.8	4.6
1344.051	---	40.898	53.98	13.08	500.0	1000.000	167.0	H	178.0	29.8	4.6
1598.443	56.265	---	73.98	17.71	500.0	1000.000	134.0	V	350.0	30.3	4.8
1598.443	---	36.534	53.98	17.45	500.0	1000.000	134.0	V	350.0	30.3	4.8

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

Frequency (MHz)	Preamp	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
1344.051	0.0	25.2	24.4	
1344.051	0.0	25.2	11.1	
1598.443	0.0	25.5	25.9	
1598.443	0.0	25.5	6.2	



Plot # 9 Radiated Emissions: 3 - 18 GHz

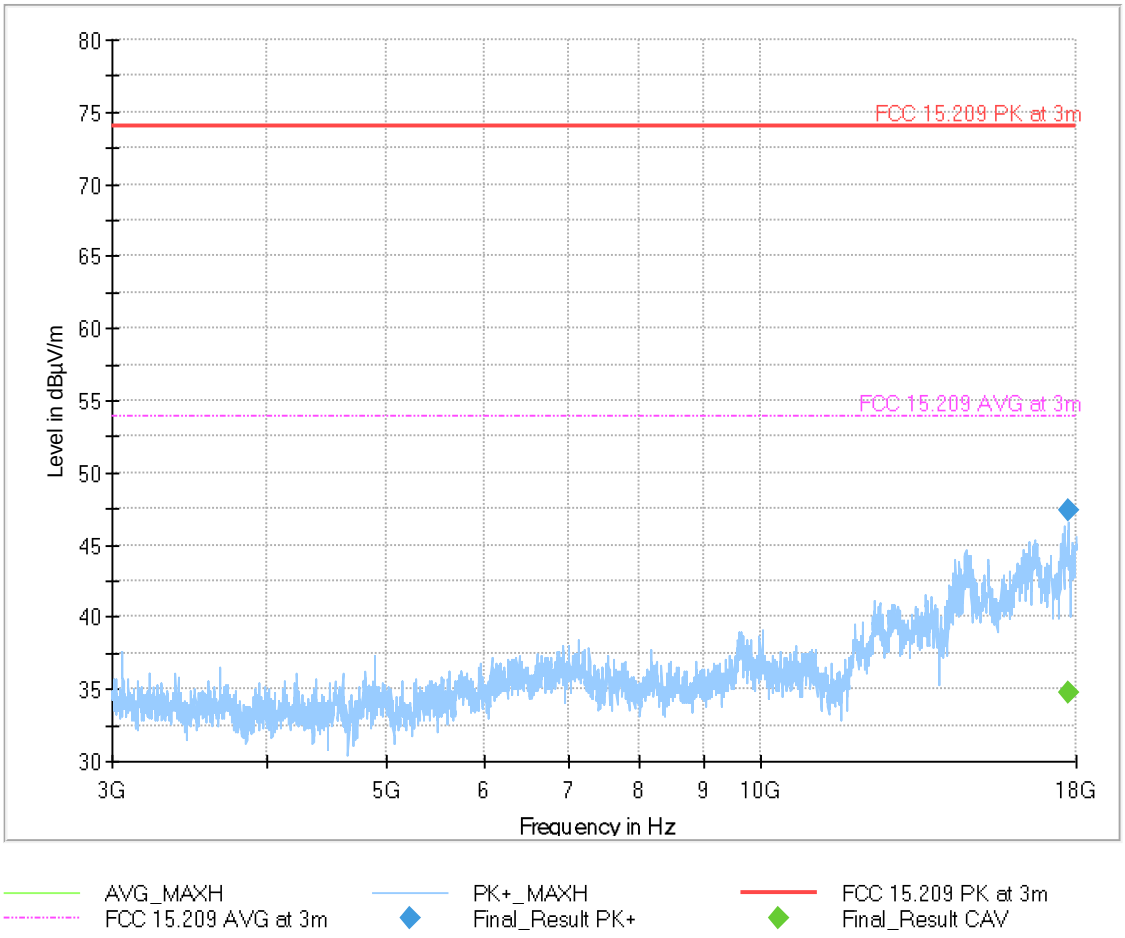
Tx Frequency: 2440 MHz | **GFSK (PHY: 1M)**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Sig Path (dB)
17723.500	---	34.780	53.98	19.20	500.0	1000.000	100.0	V	272.0	15.0	16.2
17723.500	47.386	---	73.98	26.59	500.0	1000.000	100.0	V	272.0	15.0	16.2

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

Frequency (MHz)	Preamp	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
17723.500	-42.7	41.5	19.8	
17723.500	-42.7	41.5	32.4	



Plot # 10 Radiated Emissions: 18 - 26GHz

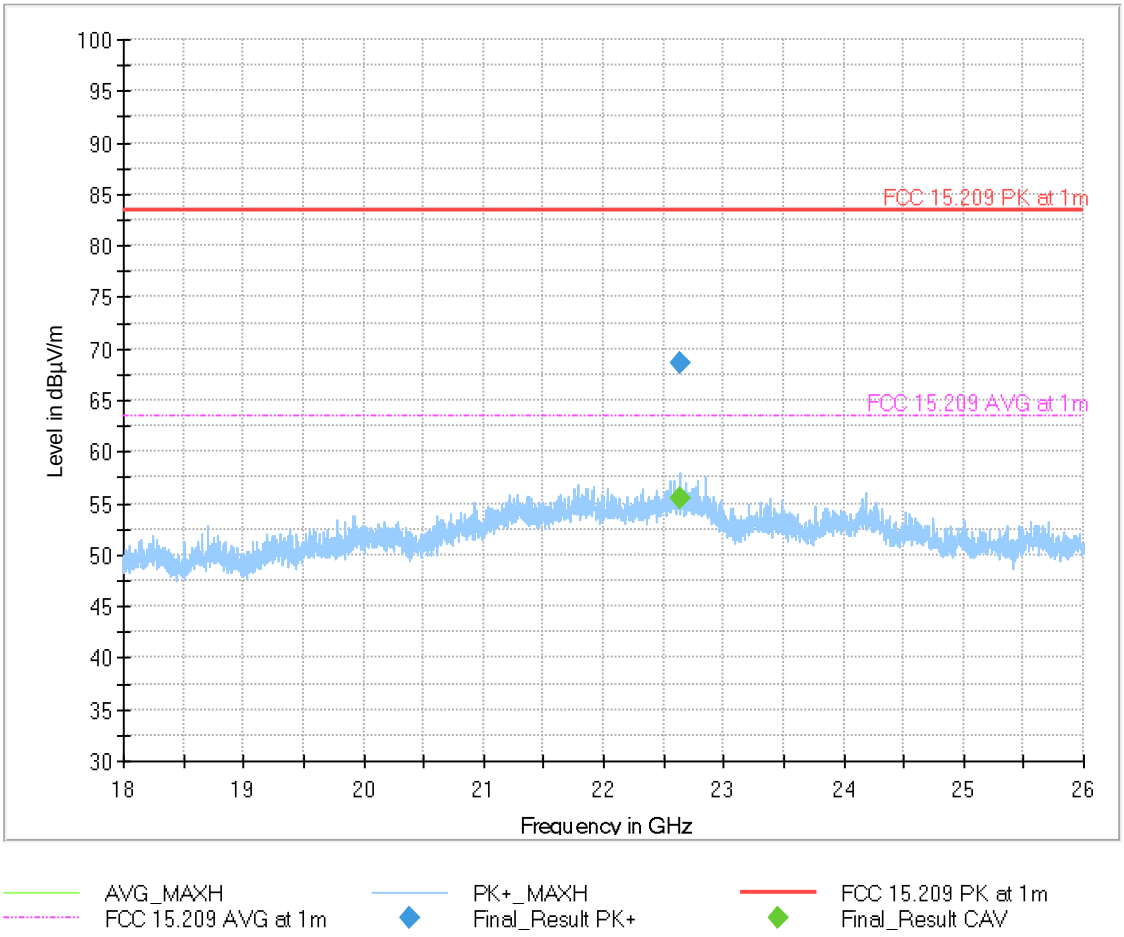
Tx Frequency: 2440 MHz | **GFSK (PHY: 1M)**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Sig Path (dB)
22636.750	---	55.523	63.50	7.98	500.0	1000.000	100.0	V	262.0	20.3	9.8
22636.750	68.525	---	83.50	14.98	500.0	1000.000	100.0	V	262.0	20.3	9.8

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

Frequency (MHz)	Preamp	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
22636.750	0.0	10.5	35.2	
22636.750	0.0	10.5	48.2	



Plot # 11 Radiated Emissions: 9 KHz – 30 MHz

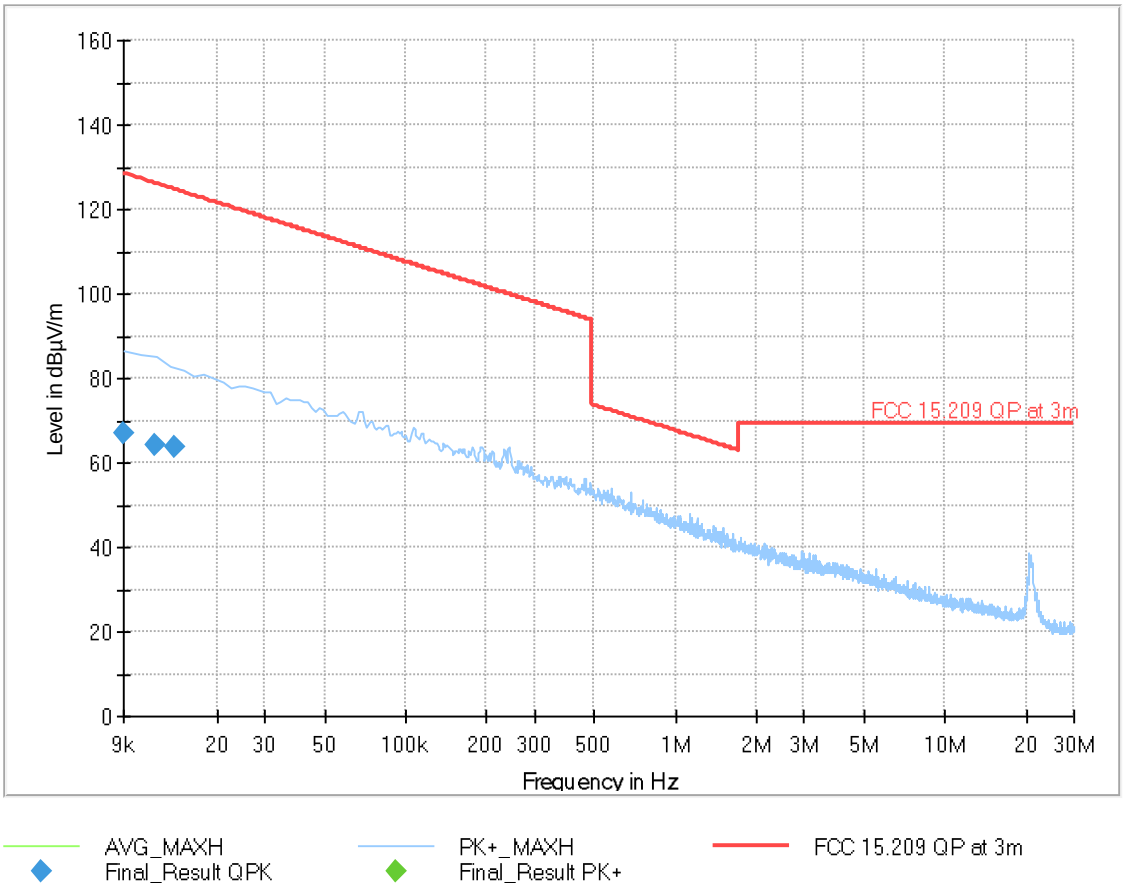
Tx Frequency: 2480 MHz | **GFSK (PHY: 1M)**

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Sig Path (dB)
0.009	66.977	---	128.50	61.52	500.0	0.200	100.0	H	129.0	29.7	0.2
0.012	64.158	---	126.22	62.07	500.0	0.200	100.0	H	147.0	27.8	0.2
0.014	63.919	---	124.69	60.77	500.0	0.200	100.0	V	312.0	26.6	0.2

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

Frequency (MHz)	Preamp	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
0.009	0.0	29.5	37.3	
0.012	0.0	27.6	36.4	
0.014	0.0	26.4	37.4	



Plot # 12 Radiated Emissions: 30 – 1000MHz

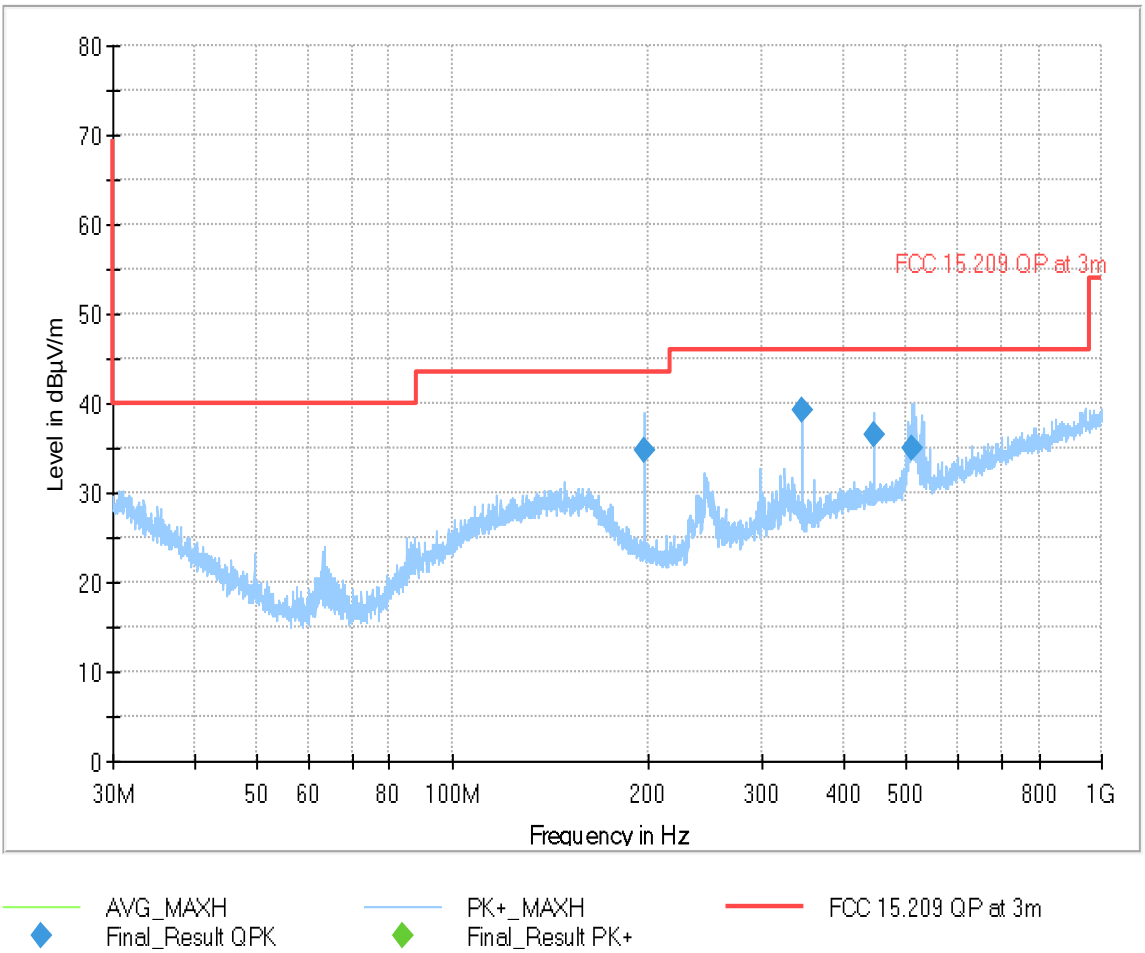
Tx Frequency: 2480 MHz | **GFSK (PHY: 1M)**

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Sig Path (dB)
198.002	34.653	---	43.50	8.85	500.0	120.000	150.0	H	114.0	19.5	1.5
346.506	39.253	---	46.02	6.77	500.0	120.000	100.0	H	240.0	22.9	2.0
445.509	36.506	---	46.02	9.51	500.0	120.000	177.0	H	327.0	25.5	2.3
509.798	35.097	---	46.02	10.92	500.0	120.000	100.0	V	227.0	26.6	2.5

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

Frequency (MHz)	Preamp	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
198.002	0.0	18.0	15.1	
346.506	0.0	20.9	16.4	
445.509	0.0	23.2	11.1	
509.798	0.0	24.1	8.5	



Plot # 13 Radiated Emissions: 1 – 3 GHz

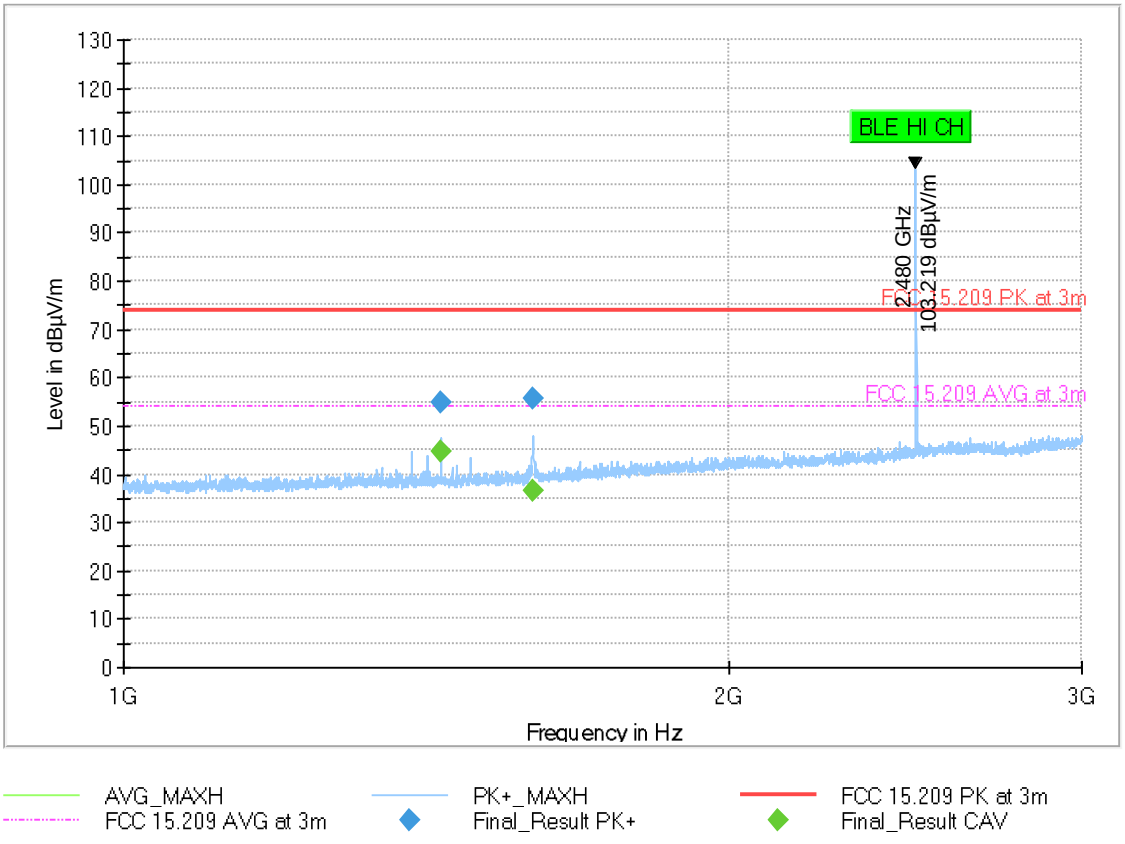
Tx Frequency: 2480 MHz | **GFSK (PHY: 1M)**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Sig Path (dB)
1439.967	54.876	---	73.98	19.10	500.0	1000.000	168.0	H	183.0	29.8	4.5
1439.967	---	44.706	53.98	9.27	500.0	1000.000	168.0	H	183.0	29.8	4.5
1599.043	55.849	---	73.98	18.13	500.0	1000.000	158.0	V	-20.0	30.3	4.8
1599.043	---	36.543	53.98	17.44	500.0	1000.000	158.0	V	-20.0	30.3	4.8

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

Frequency (MHz)	Preamp	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
1439.967	0.0	25.2	25.1	
1439.967	0.0	25.2	14.9	
1599.043	0.0	25.5	25.5	
1599.043	0.0	25.5	6.2	



Plot # 14 Radiated Emissions: 3 - 18 GHz

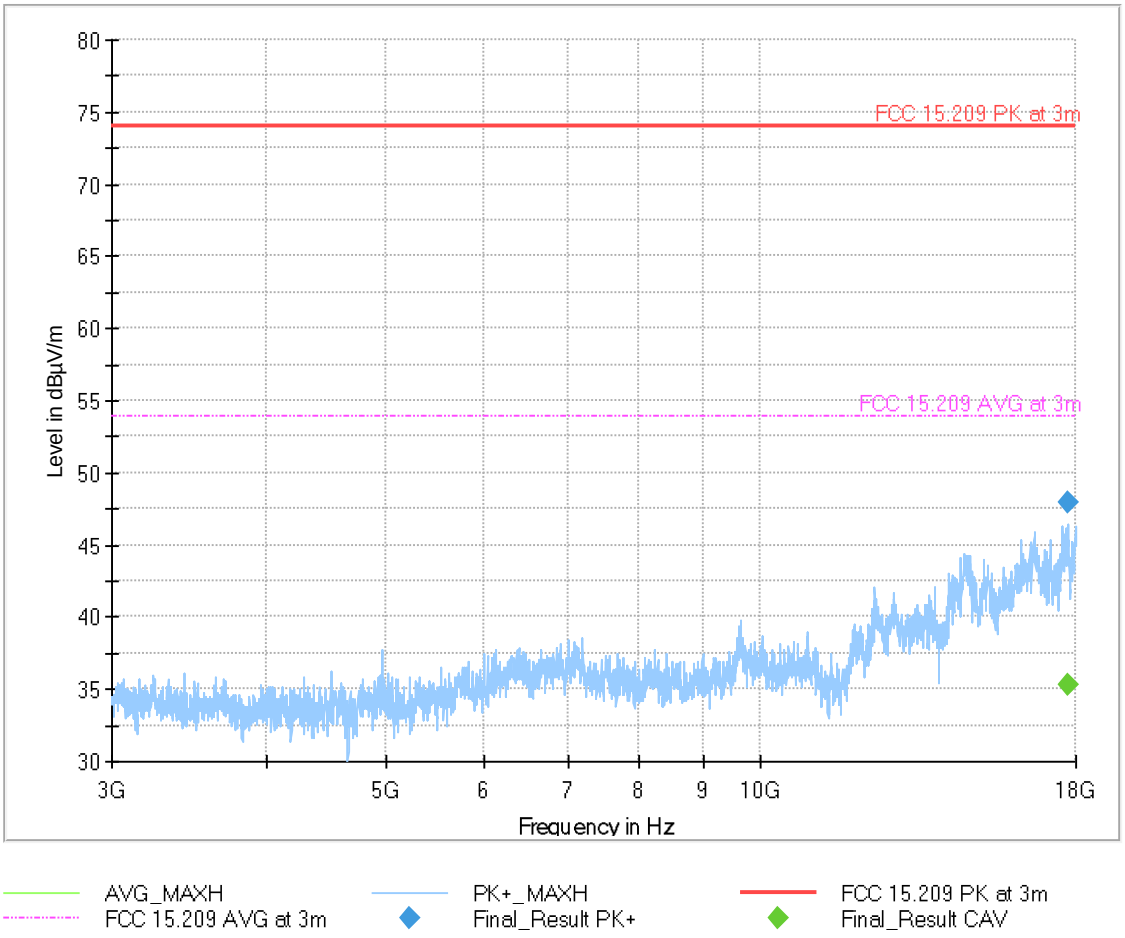
Tx Frequency: 2480 MHz | **GFSK (PHY: 1M)**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Sig Path (dB)
17725.250	---	35.356	53.98	18.62	500.0	1000.000	400.0	V	168.0	15.0	16.2
17725.250	47.976	---	73.98	26.00	500.0	1000.000	400.0	V	168.0	15.0	16.2

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

Frequency (MHz)	Preamp	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
17725.250	-42.7	41.5	20.4	
17725.250	-42.7	41.5	33.0	



Plot # 15 Radiated Emissions: 18 - 26GHz

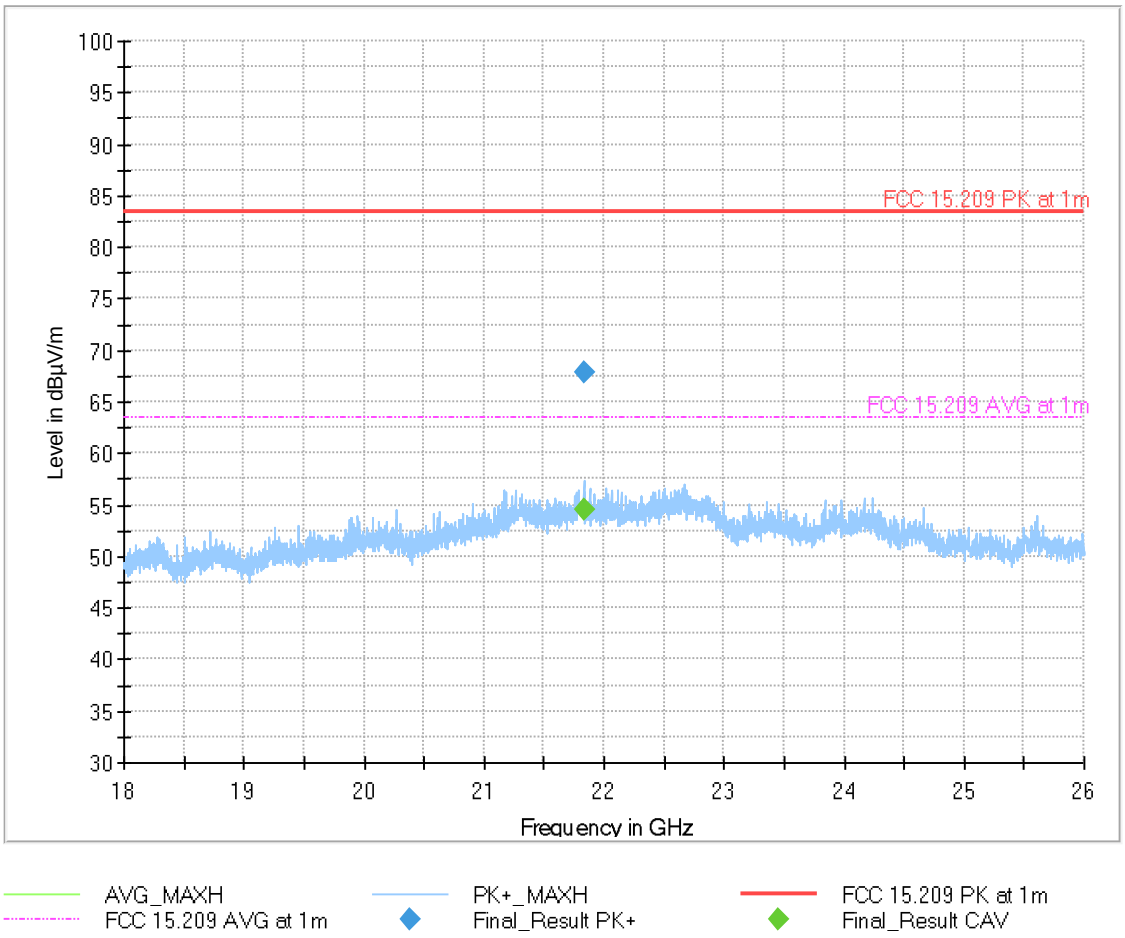
Tx Frequency: 2480 MHz | **GFSK (PHY: 1M)**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Sig Path (dB)
21829.250	---	54.532	63.50	8.97	500.0	1000.000	100.0	V	150.0	19.3	9.6
21829.250	67.935	---	83.50	15.56	500.0	1000.000	100.0	V	150.0	19.3	9.6

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

Frequency (MHz)	Preamp	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
21829.250	0.0	9.7	35.2	
21829.250	0.0	9.7	48.6	



8.7 AC Power Line Conducted Emissions

8.7.1 Measurement according to ANSI C63.4

Analyzer Settings:

- RBW = 9 KHz (CISPR Bandwidth)
- Detector: Peak / Average for Pre-scan
- Quasi-Peak/Average for Final Measurements

8.7.2 Limits: §15.207 & RSS-Gen 8.8

FCC §15.207(a) & RSS-Gen 8.8

- Except as shown in paragraphs (b) and (c) of this section of the CFR, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table (1), as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

8.7.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
22.8° C	1	BTLE	24Vac	1 dBi

8.7.4 Measurement Result:

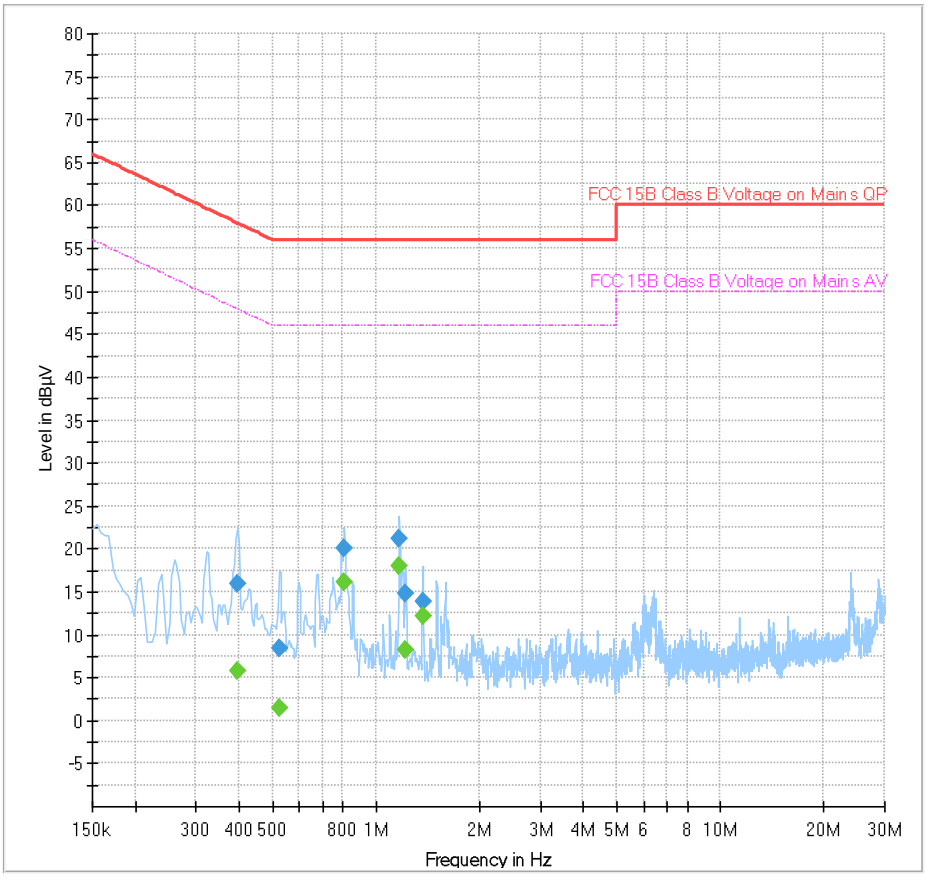
Plot #	Port	EUT Set-Up #:	EUT operating mode	Scan Frequency	Limit	Result
1	AC Mains	1	BT LE continuous fixed channel	150 kHz – 30 MHz	See section 8.7.2	Pass

8.7.5 Measurement Plots:

Plot # 1 Conducted Emission 150kHz – 30MHz Mid Ch

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.396	15.86	---	57.94	42.08	500.0	9.0	N	GND	10.0
0.396	---	5.78	47.94	42.16	500.0	9.0	N	GND	10.0
0.523	8.36	---	56.00	47.64	500.0	9.0	L1	GND	9.9
0.523	---	1.50	46.00	44.50	500.0	9.0	L1	GND	9.9
0.808	20.12	---	56.00	35.88	500.0	9.0	L1	GND	9.9
0.808	---	16.11	46.00	29.89	500.0	9.0	L1	GND	9.9
1.168	---	17.94	46.00	28.06	500.0	9.0	L1	GND	9.9
1.168	21.22	---	56.00	34.78	500.0	9.0	L1	GND	9.9
1.217	14.79	---	56.00	41.21	500.0	9.0	N	GND	9.9
1.217	---	8.31	46.00	37.69	500.0	9.0	N	GND	9.9
1.370	---	12.09	46.00	33.91	500.0	9.0	L1	GND	9.9
1.370	13.95	---	56.00	42.05	500.0	9.0	L1	GND	9.9



9 Test setup photos

Setup photos are included in supporting file name: "EMC_LENNX_014_24001_15_247_Setup_Photos.pdf"

10 Test Equipment And Ancillaries Used For Testing

EMC1 emission

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
TEST RECEIVER	R&S	ESW44	103143	2 Years	09/12/2024
DIGITAL THERMOMETER	CONTROL COMPANY	4410,90080-03	230713059	3 Years	10/18/2023
PULSE LIMITER	R&S	ESH3-Z2	102473	3 Years	11/02/2023
LISN	FCC	FCC-LISN-50-25-2-08	08014	2 Years	10/06/2023
Multimeter	Fluke	115	56090717MV	3 Years	09/26/2023
Software	EMC32	Version 11.40.00	-	-	-

EMC2 emission

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	3117-PA	00167061	3 Years	9/25/2023
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
Signal Analyzer	R&S	FSV40	101022	3 Years	09/25/2023
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.

11 History

Date	Report Name	Changes to report	Prepared by
2024-10-01	EMC_LENNX_014_24001_FCC_15_247_BTLE_DTS	Initial Version	Art Thammanavarat
2025-01-22	EMC_LENNX_014_24001_FCC_15_247_BTLE_DTS_Rev1	**Report Revised** 1. Updated FCC ID and ISED	Art Thammanavarat

<<< The End >>>