TEST REPORT

Report Number: 106144856MPK-016
Project Numbers: G106144856
Report Issue Date: May 28, 2025
Report Revision Date: August 18, 2025

Testing performed on the
String Optimizer
Model Number: I36 – 31570050-xxxx

FCC ID: X3R-I36

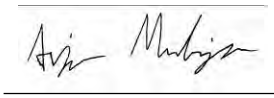
To

FCC Part 15 Subpart C (15.247)
ISED RSS-247 Issue 3

For

Ampt, LLC

Test Performed by:	Test Authorized by:
Intertek	Ampt, LLC
1365 Adams Court	4850 Innovation Drive
Menlo Park, CA 94025 USA	Fort Collins, CO 80525 USA

Prepared by:  **Date:** May 28, 2025
Arjun Mukherjea

Reviewed by:  **Date:** May 28, 2025
Aaron Chang

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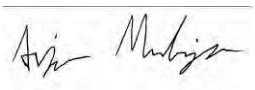
Report No. 105267899MPK-002	
Equipment Under Test:	String Optimizer
Model Number(s):	I36 – 31570050-xxxx
Applicant:	Ampt, LLC
Contact:	Robin Richardson
Address:	Ampt, LLC 4850 Innovation Drive Fort Collins, CO 80525
Country:	USA
Tel. Number:	1 (970) 372-6960
Email:	robin.richardson@ampt.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) ISED RSS-247 Issue 3
Date of Test:	May 8 – 16, 2025; May 28, 2025

We attest to the accuracy of this report:



Arjun Mukherjea
EMC Engineer

Aaron Chang
EMC Team Leader

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1.0 Summary of Tests

TEST	Reference FCC	Reference ISED	RESULTS
RF Output Power	15.247(b)	RSS-247, 5.4.b)	Complies
20-dB Bandwidth	15.247(a)(1)	RSS-247, 5.1.a)	Complies
Channel Separation	15.247(a)(1)	RSS-247, 5.1.b)	Complies
Number of Hopping Channels	15.247(a)(1)	RSS-247, 5.1.d)	Complies
Average Channel Occupancy Time	15.247(a)(1)	RSS-247, 5.1.d)	Complies
Out-of-Band Antenna Conducted Emission	15.247(d)	RSS-247, 5.5	Complies
Transmitter Radiated Emissions	15.247(d), 15.209, 15.205	RSS-GEN	Complies
AC Line Conducted Emissions	15.207	RSS-GEN	Complies
Antenna Requirement	15.203	RSS-GEN	Complies (Internal Antenna)

EUT receive date: May 2, 2025

EUT receive condition: The pre-production version of the EUT was received in good condition with no apparent damage. As declared by the Applicant, it is identical to the production units.

Test start date: May 8, 2025

Test completion date: May 28, 2025

The test results in this report pertain only to the item tested.

2.0 General Description

2.1 Product Description

Ampt, LLC supplied the following description of the EUT:

The Ampt String Optimizers are DC/DC converters that are used to lower the cost and improve performance of new PV systems, upgrade existing systems to produce more energy, enable low-cost DC-coupled solar & storage systems, and provide string-level data for improved O&M.

For more information, see user's manual provided by the manufacturer.

This test report covers only the 2.4GHz FHSS radio.

Information about the 2.4 GHz radio is presented below:

Applicant	Ampt, LLC
Model No.	I36 – 31570050-xxxx
Type of Transmission	Frequency Hopping Spread Spectrum
Rated RF Output	3.57 dBm
Antenna(s) & Gain*	Internal Antenna, Gain: 7.4 dBi
Frequency Range	2410 – 2474.5 MHz
Number of Channel(s)	255 (only 25 used at any given time)
Modulation Type	FSK
Applicant Name & Address	Ampt, LLC 4850 Innovation Drive Fort Collins, CO 80525 USA

*as provided by the client. Intertek takes no responsibility for the accuracy of this information.

2.2 Related Submittal(s) Grants

None.

2.3 Test Methodology

Antenna conducted measurements were performed according to the FCC documents “Guidance for Performing Compliance Measurement on Digital Transmission Systems, Frequency Hopping Spread Spectrum System, and Hybrid System devices Operating under §15.247” (KDB 558074 D01 15.247 Meas Guidance v05r02), RSS-247 Issue 3, ANSI C63.10: 2013 and RSS-GEN Issue 5.

Radiated emissions and AC mains conducted emissions measurements were performed according to the procedures in ANSI C63.10: 2013. Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "Data Sheet" of this report.

All other measurements were made in accordance with the procedures in part 2 of CFR 47.

Following is the channel test plan:

Channels in 2.4 GHz band			
Test Channel		**Frequency, MHz**	**Tested**
Low	0	2410	√
Middle	127	2442	√
High	255	2474.5	√
Hopping Mode		2410 - 2474.5	√

2.4 Test Facility

The test site used to is located at 1365 Adams Court, Menlo Park, California, 94025. This test facility and site measurement data have been fully placed on file with the FCC, IC and A2LA accredited.

3.0 System Test Configuration

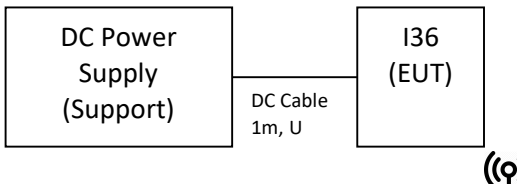
3.1 Support Equipment

Description	Manufacturer	Model Number
DC Power Supply	Tekpower	TP12001X
Laptop	Dell	Latitude 13
Ethernet Switch	TP-Link	TL-WR740N
PoE Injector	STEAMEMO	POE4818D
Control Unit	Ampt, LLC	31570013-00

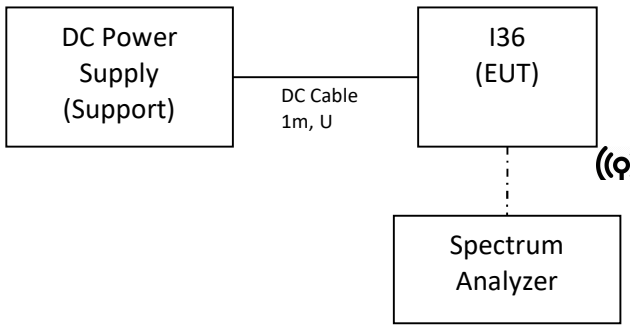
3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	**Manufacturer**	**Model Number**	**Serial Number**
Conducted Unit	Ampt, LLC	I36 – 31570050-xxxx	2824T000511
Radiated Unit	Ampt, LLC	I36 – 31570050-xxxx	2824T000504

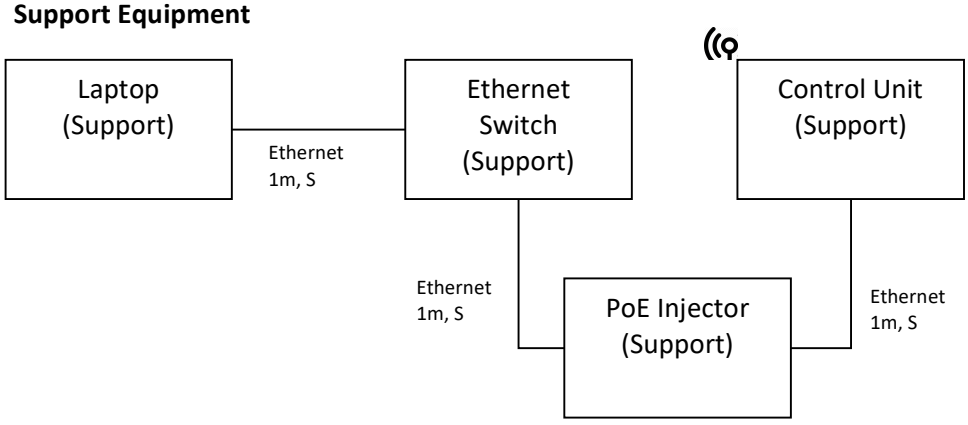
Radiated Unit



Conducted Unit



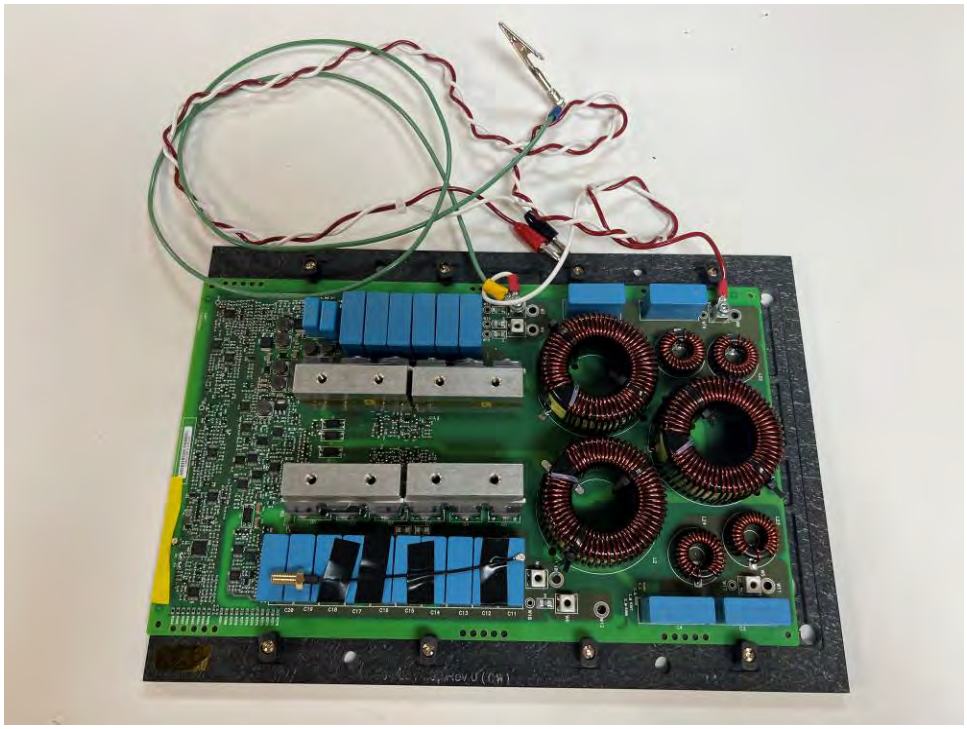
Support Equipment



Antenna was removed and co-axial connector was installed for Conducted Measurements.

S = Shielded **U** = Unshielded	**F** = With Ferrite **m** = Length in Meters

EUT Photos



3.3 Justification

For radiated emission measurements the EUT is placed on a non-conductive table.

3.4 Mode of Operation During Test

During transmitter testing, the transmitter was setup to transmit continuously at maximum RF power on the low channel (2410MHz), middle channel (2442MHz), high channel (2474.5MHz) and with hopping channels enabled.

3.5 Modifications Required for Compliance

Intertek installed no modifications during compliance testing in order to bring the product into compliance.

3.6 Additions, Deviations and Exclusions from Standards

No additions, deviations or exclusions from the standard were made.

3.7 Variant Models:

The following variant models were not tested as part of this evaluation but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

31570051-xxxx, 31570052-xxxx, 31570053-xxxx, 31570054-xxxx, 31570055-xxxx, 31570056-xxxx, 31570057-xxxx, 31570058-xxxx, 31570059-xxxx

4.0 Emissions Measurement Results

4.1 20dB Bandwidth, and 99% Occupied Bandwidth
FCC Rule 15.247(a)(1); RSS-247, 5.1.a);

4.1.1 Procedure

The Procedure described in the FCC Publication 558074 D01 Meas Guidance v05r02 & Section 7.8.7 of ANSI C63.10:2013 for Frequency Hopping Spread Spectrum Systems was used to determine the 20dB bandwidth.

- Span = Approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
- RBW = 1% of the 20 dB bandwidth
- VBW = 3 x RBW
- Sweep = Auto
- Detector function = Peak
- Trace = Max hold

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

For 99% power bandwidth measurement, the bandwidth was determined by using the built-in 99% occupied bandwidth function of the spectrum analyzer.

The antenna port of the EUT was connected to the input of a spectrum analyzer (SA). For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A Peak output reading was taken, a Display line was drawn for 20dB lower than Peak level. The 20dB bandwidth was determined from where the channel output spectrum intersected the display line.

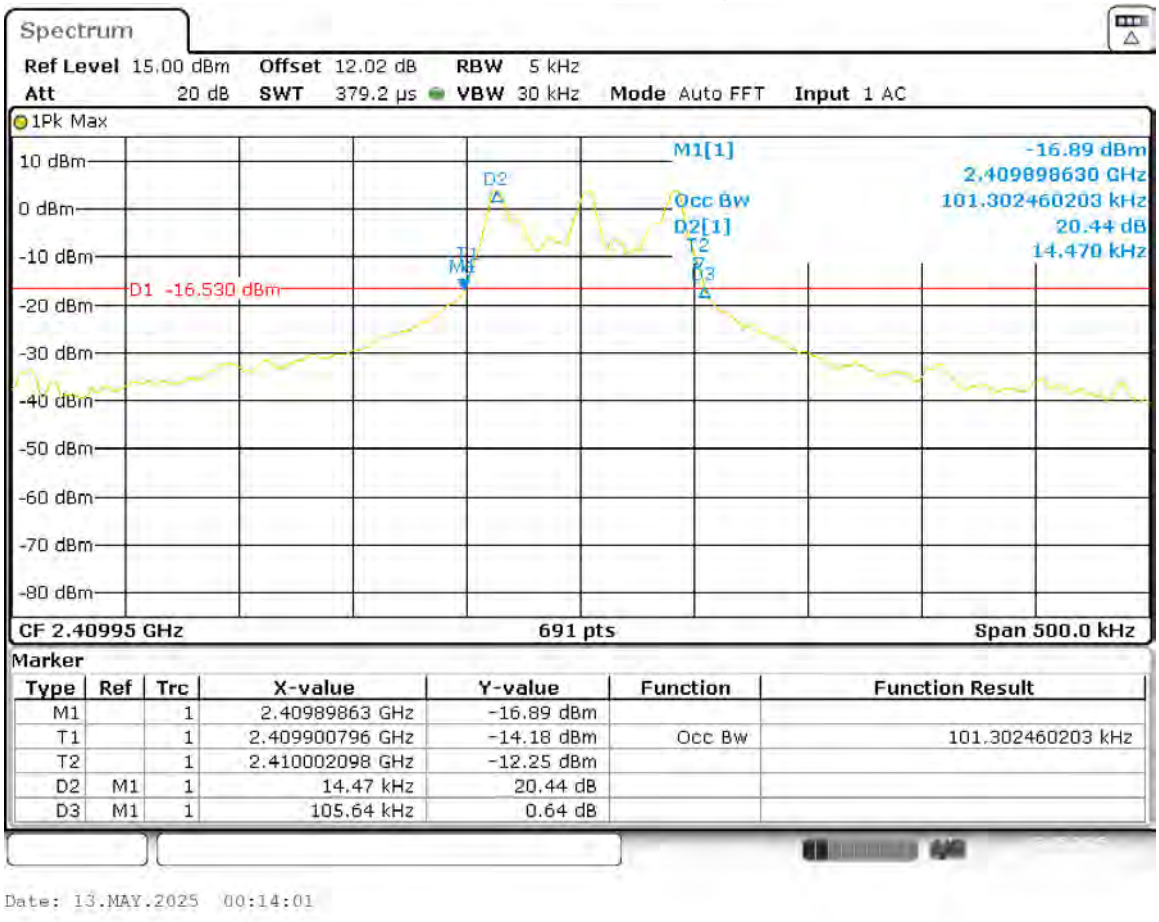
Tested By	Test Date
Arjun Mukherjea	May 12, 2025

4.1.2 Test Result

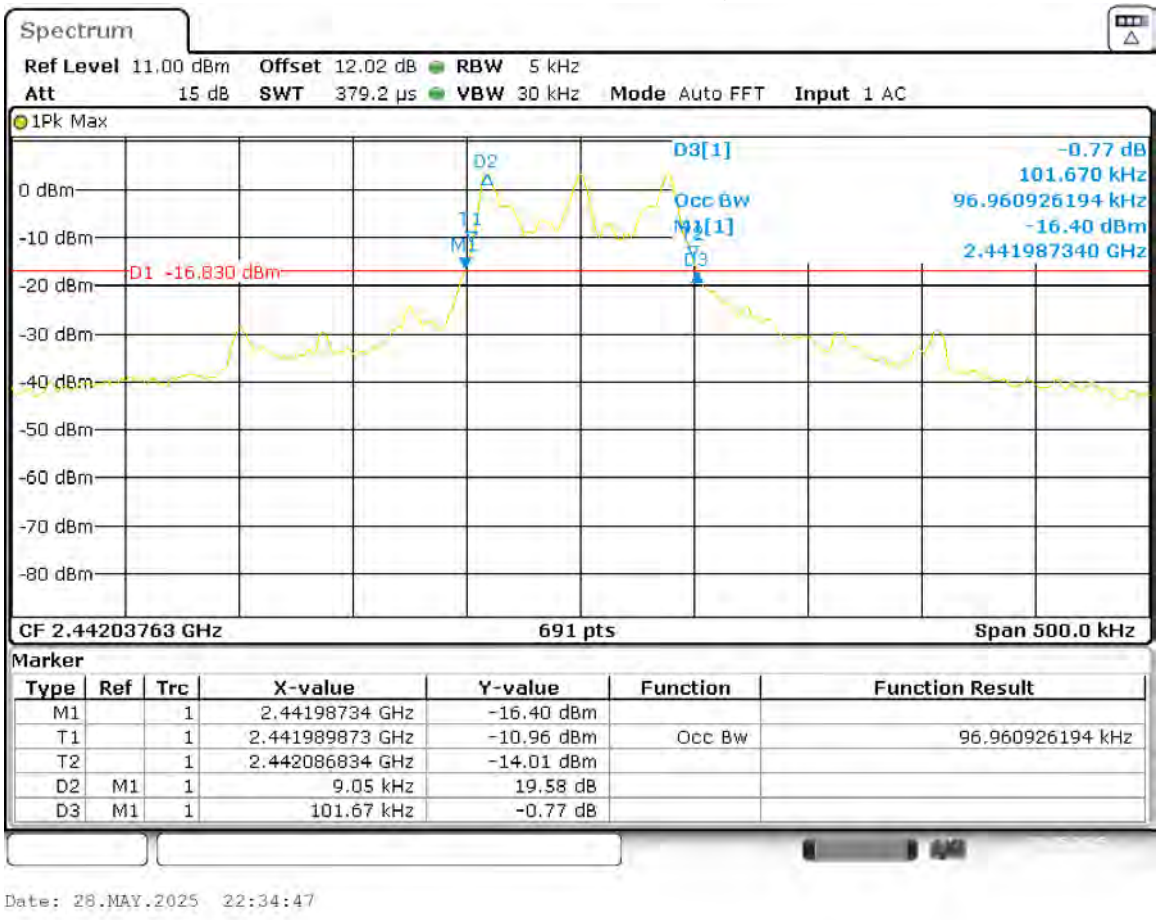
Frequency MHz	20 dB FCC Bandwidth, kHz	99% Bandwidth, kHz	Plot #
2410	105.64	---	1.1
	---	101.302	1.1
2442	101.67	---	1.2
	---	96.961	1.2
2474.5	109.99	---	1.3
	---	102.750	1.3

Results	Complies

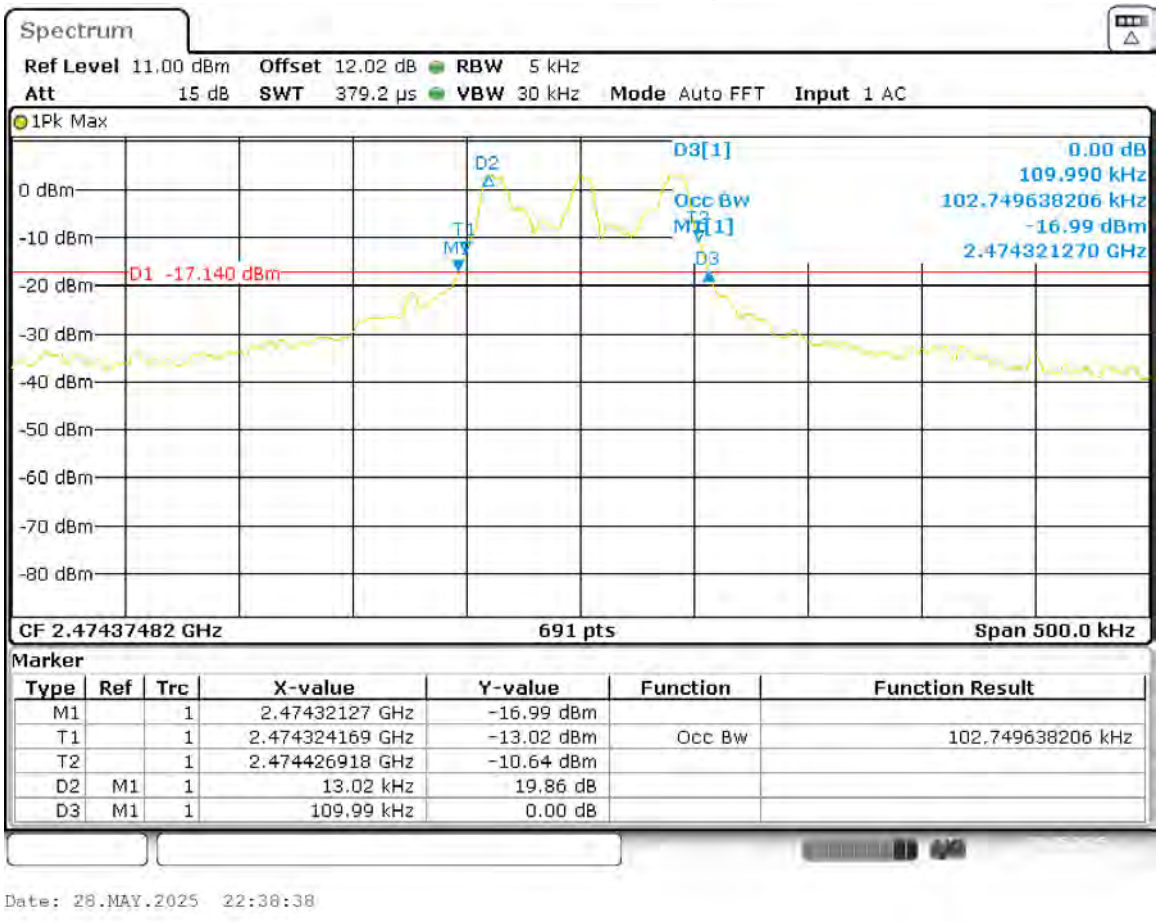
Plot 1.1 – 20dB and 99% Bandwidth, 2410 MHz



Plot 1.2 – 20dB and 99% Bandwidth, 2442 MHz



Plot 1.3 – 20dB and 99% Bandwidth, 2474.5 MHz



4.2 Conducted Output Power at Antenna Terminals
FCC Rule 15.247(b)(1); RSS-247, 5.4.b);

4.2.1 Requirement

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

4.2.2 Procedure

The procedure described in FCC Publication 558074 D01 Meas Guidance v05r02 was used. Specifically, Section 7.8.5 of ANSI C63.10:2013 for Frequency Hopping Spread Spectrum Systems was used to determine the RF Output Power.

- Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
- RBW > the 20 dB bandwidth of the emission being measured
- VBW = 3 x RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold

Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power (see the NOTE above regarding external attenuation and cable loss). The limit is specified in one of the subparagraphs of this Section. Submit this plot.

The antenna port of the EUT was connected to the input of a spectrum analyzer. Power was read directly from the spectrum analyzer and cable loss correction was added to the reading to obtain the power at the antenna terminals.

Tested By	Test Date
Arjun Mukherjea	May 12 & 28, 2025

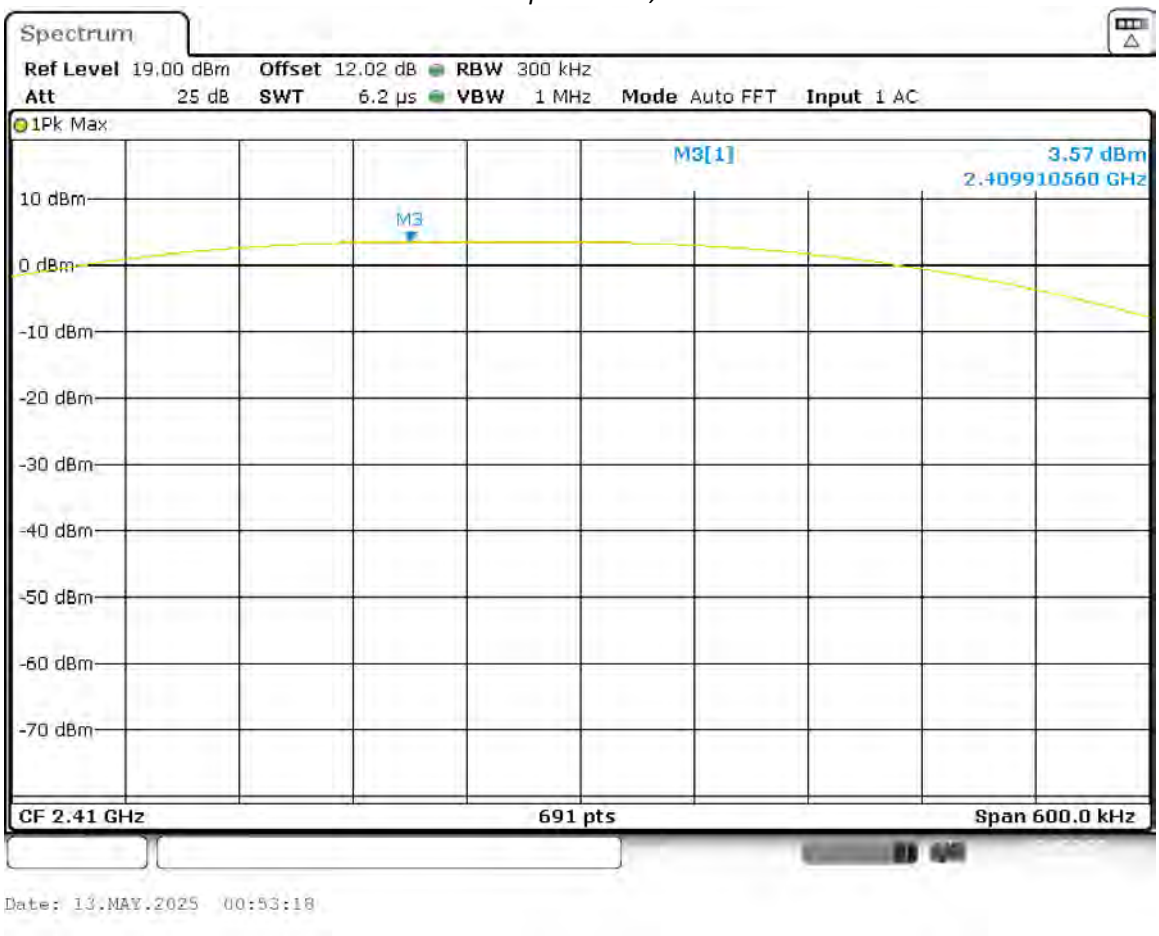
4.2.3 Test Result

Refer to the following plots for the test result:

Frequency MHz	Conducted Peak Power dBm	Conducted Peak Power mW	Plot #
2410	3.57	2.28	2.1
2442	3.42	2.20	2.2
2474.5	3.12	2.05	2.3

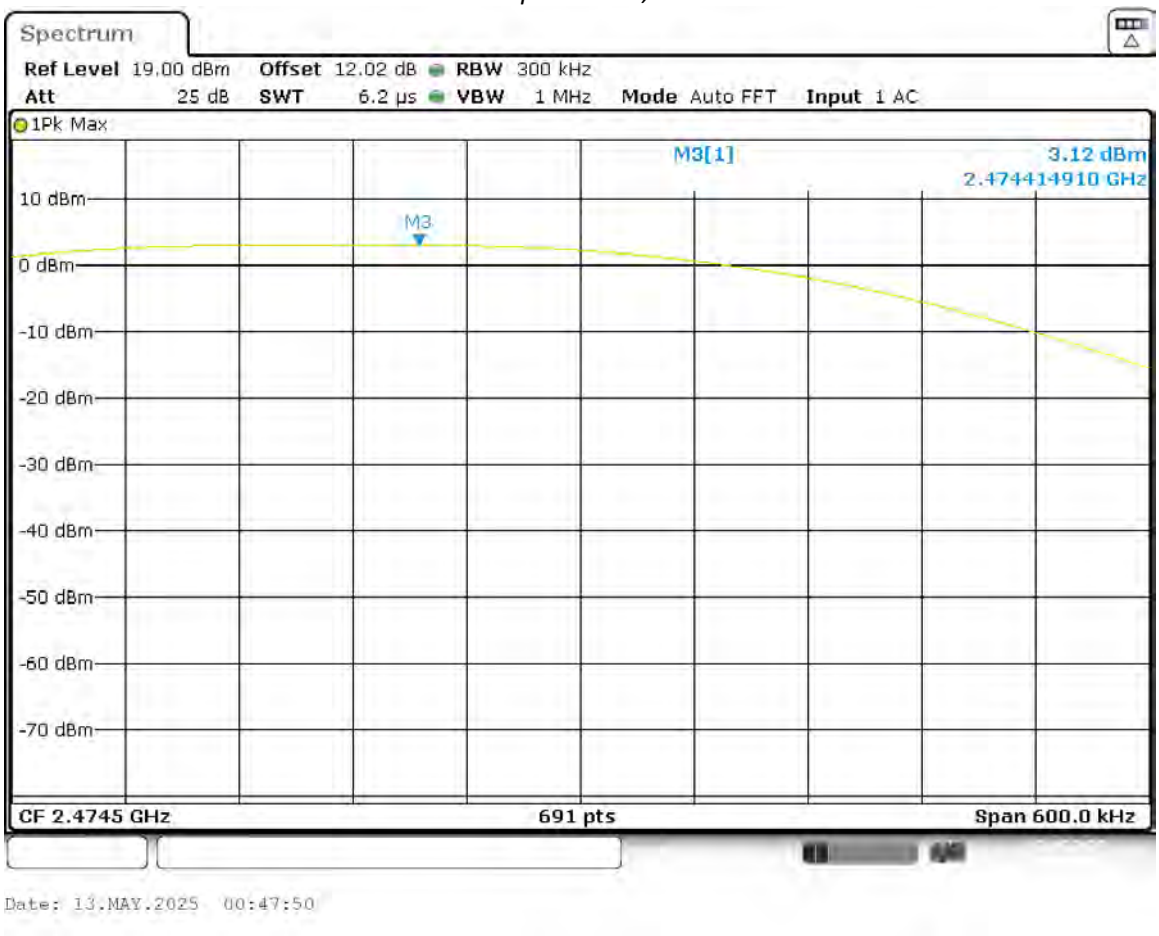
Results	Complies

Plot 2.1– Output Power, 2410 MHz



Plot 2.2 – Output Power, 2442 MHz

Plot 2.3 – Output Power, 2474.5 MHz



4.3 Carrier Frequency Separation
FCC 15.247 (a)(1); RSS-247, 5.1.b);

4.3.1 Requirement

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

4.3.2 Procedure

The procedure described in FCC Publication 558074 D01 Meas Guidance v05r02 was used. Specifically, Section 7.8.2 of ANSI C63.10:2013 for Frequency Hopping Spread Spectrum Systems was used to determine the Carrier Frequency Separation.

- The EUT must have its hopping function enabled
- Span = wide enough to capture the peaks of two adjacent channels
- Resolution (or IF) Bandwidth (RBW) = 1% of the span
- Video (or Average) Bandwidth (VBW) = 3 x RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold

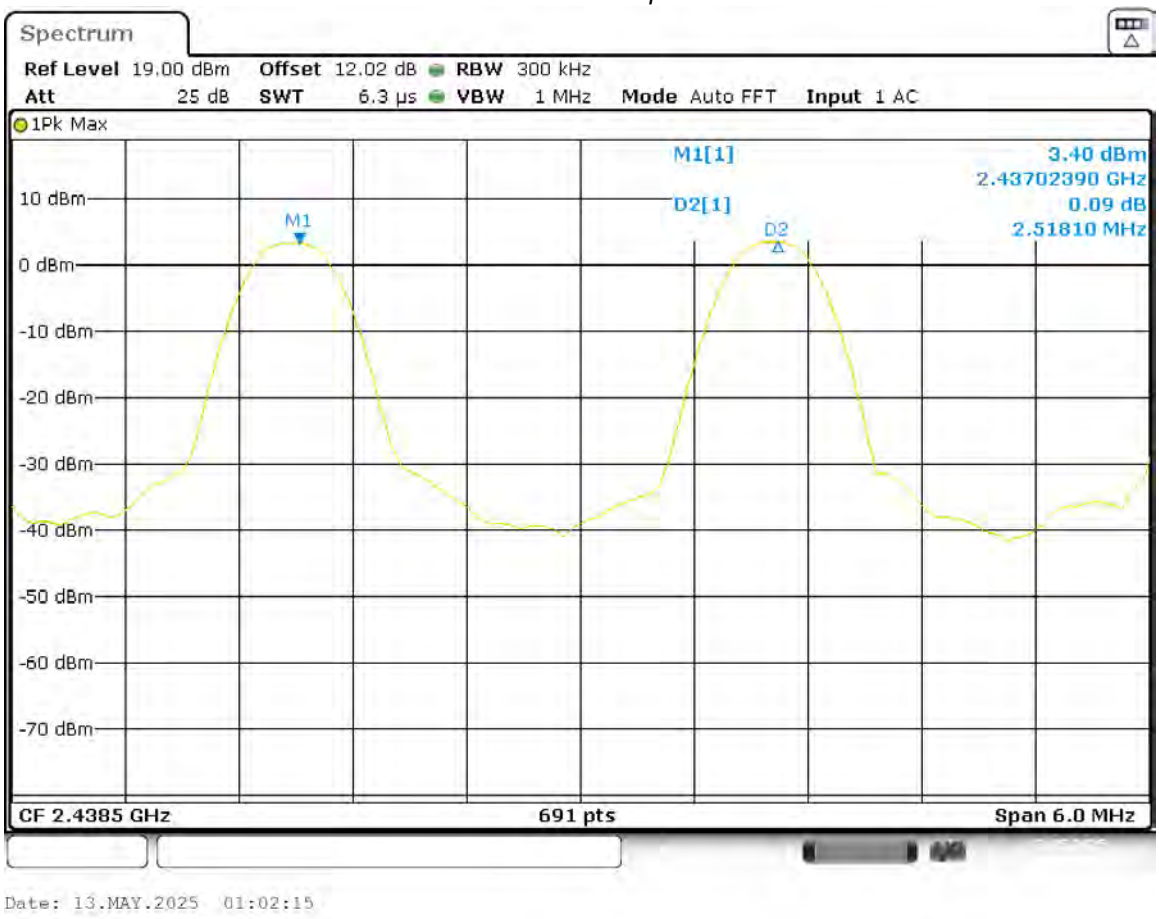
Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

Tested By	Test Date
Arjun Mukherjea	May 12, 2025

4.3.3 Test Result

The highest measured 20dB Bandwidth is 128.80 kHz, therefore the minimum Carrier Frequency Separation shall be greater than two thirds of the 20dB bandwidth; 85.867 kHz. The measured channel separation is 2.51810 MHz. Carrier Frequency Separation meets the minimum requirement. Please refer to spectrum analyzer Plot 3.1 below for the test result.

Plot 3.1– Channel Separation



Results	Complies

4.4 Number of Channels
FCC 15.247 (a)(1)(iii), RSS-247, 5.1.d);

4.4.1 Requirement

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

4.4.2 Procedure

The procedure described in FCC Publication 558074 D01 Meas Guidance v05r02 was used. Specifically, Section 7.8.3 of ANSI C63.10:2013 for Frequency Hopping Spread Spectrum Systems was used to determine the Number of Channels.

- The EUT must have its hopping function enabled.
- Span = the frequency band of operation
- RBW = 1% of the span
- VBW = 3 x RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold

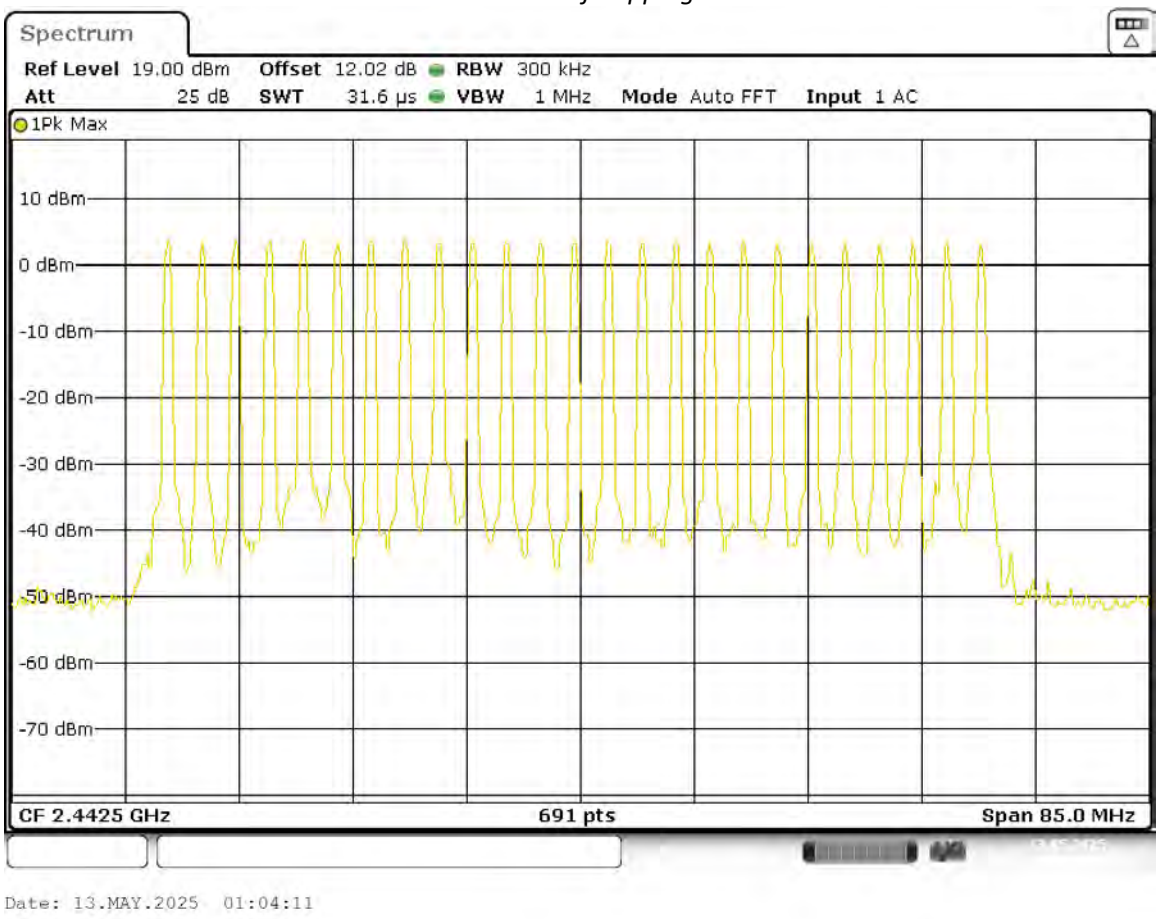
Allow the trace to stabilize. It may prove necessary to break the span up to sections, in order to clearly show all of the hopping frequencies.

With the analyzer set to MAX HOLD, readings were taken once channels were filled in. The channel peaks were recorded and compared to the minimum number of channels required in the regulation.

Tested By	Test Date
Arjun Mukherjea	May 12, 2025

4.4.3 Test Result

Plot 4.1 - Number of hopping channels



Results	Complies, 25 Channels

4.5 Average Channel Occupancy Time
FCC 15.247(a)(1); RSS-247, 5.1.d);

4.5.1 Requirement

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

4.5.2 Procedure

The procedure described in FCC Publication 558074 D01 Meas Guidance v05r02 was used. Specifically, Section 7.8.4 of ANSI C63.10:2013 for Frequency Hopping Spread Spectrum Systems was used to determine the Average Channel Occupancy Time.

- The EUT must have its hopping function enabled.
- Span = zero span, centered on a hopping channel
- RBW = 1 MHz
- VBW = 3 x RBW
- Sweep = as necessary to capture the entire dwell time per hopping channel
- Detector function = peak
- Trace = max hold

If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. An oscilloscope may be used instead of a spectrum analyzer.

The spectrum analyzer center frequency was set to one of the known hopping channels, the SPAN was set to ZERO SPANS, and the TRIGGER was set to VIDEO. The time duration of the transmission so captured was measured with the MARKER DELTA function.

Tested By	Test Date
Arjun Mukherjea	May 12, 2025

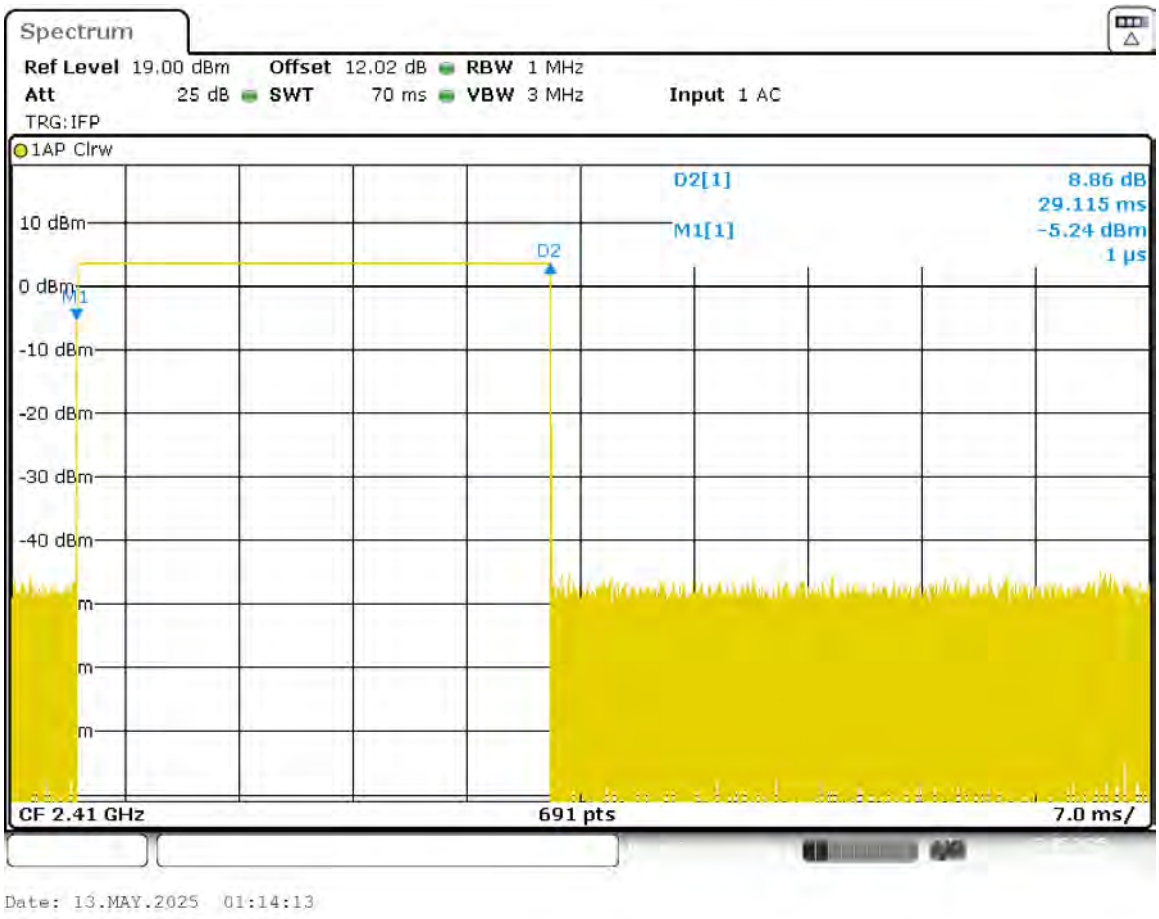
4.5.3 Test Results

Burst On Time (ms)	No. of Burst in 10 seconds	Dwell Time (ms) (Burst Time * No. of Burst * 10)	Dwell Time limit (ms)
29.155	7	204.085	400

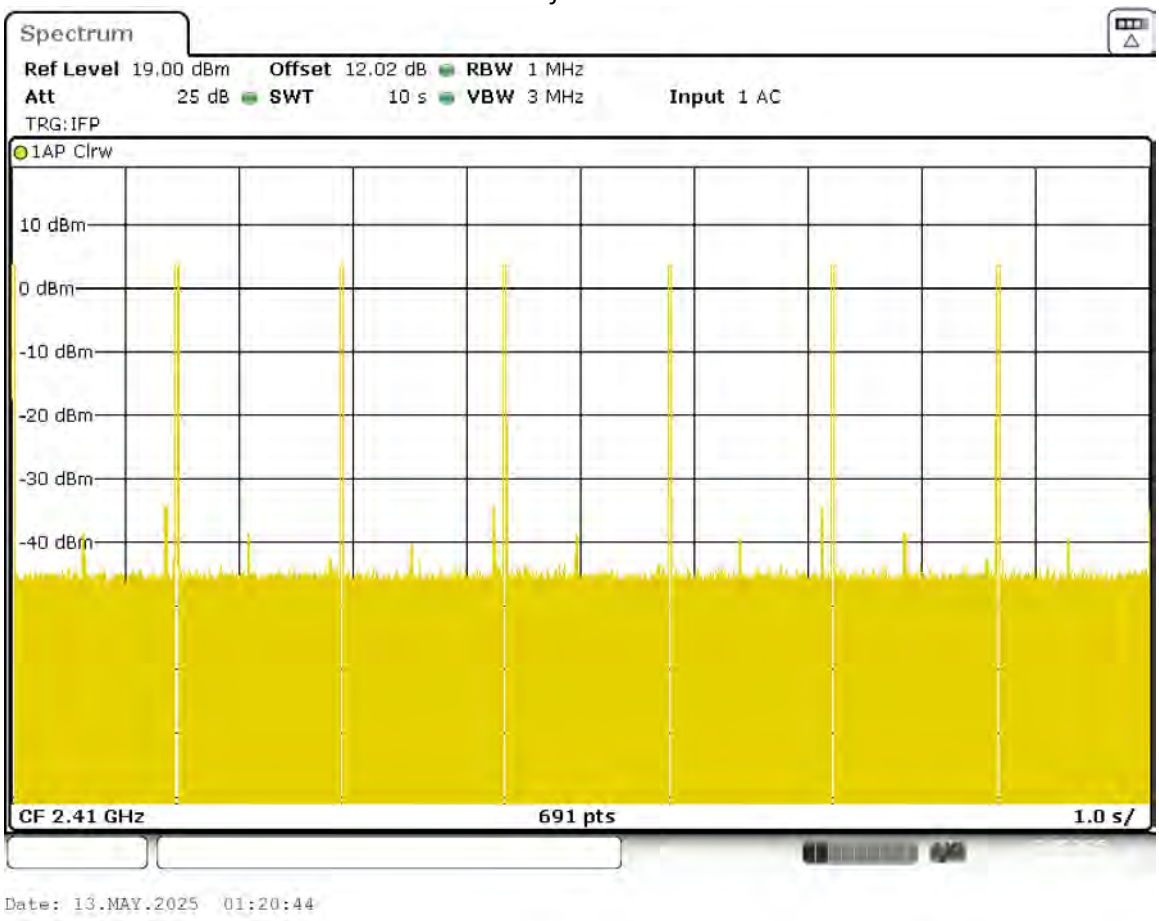
The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of the number of channels (25) multiplied by 0.4 second (10 seconds).

Results	Complies

Burst Time


Spectrum
Ref Level 19.00 dBm Offset 12.02 dB RBW 1 MHz
Att 25 dB SWT 70 ms VBW 3 MHz Input 1 AC
TRG:IFP
1AP Clrw
D2[1] 8.86 dB
29.115 ms
M1[1] -5.24 dBm
1 µs
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
D2
M1
CF 2.41 GHz
691 pts
7.0 ms/
Date: 13.MAY.2025 01:14:13

Number of Bursts in 10 s



4.6 Out-of-Band Conducted Emissions
FCC 15.247(d); RSS-247, 5.5;

4.6.1 Requirement

In any 100 kHz bandwidths outside the EUT pass-band, the RF power shall be at least 20dB (peak) or 30 dB (average) below that of the maximum in-band 100 kHz emissions.

4.6.2 Procedure

The procedure described in FCC Publication 558074 D01 Meas Guidance v05r02 was used. Specifically, Section 7.8.8 of ANSI C63.10:2013 for Frequency Hopping Spread Spectrum Systems was used to determine the Out-of-Band Conducted Emissions.

- Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.
- RBW = 100 kHz
- VBW = 3 x RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold

Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this Section.

A spectrum analyzer was connected to the antenna port of the transmitter. Analyzer Resolution Bandwidth was set to 100 kHz. For each channel investigated, the in-band and out-of-band emission measurements were performed. The out-of-band emissions were measured from 30 MHz to 26 GHz.

Tested By	Test Date
Arjun Mukherjea	May 12-13, 2025

4.6.3 Test Result

Refer to the following plots and out-of-band conducted spurious emissions at the Band-Edge, Table 4.1 & 4.2 for the test results:

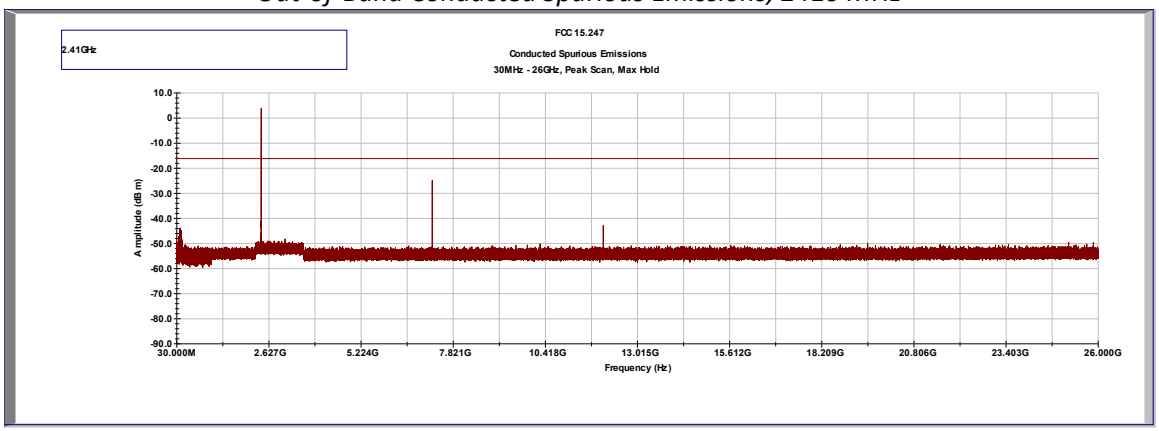
Out-of-Band Conducted Spurious Emissions

Frequency MHz	Description	Results
2410	Scan 30 MHz – 26 GHz	Complies, Greater than 20dB
2442	Scan 30 MHz – 26 GHz	Complies, Greater than 20dB
2474.5	Scan 30 MHz – 26 GHz	Complies, Greater than 20dB

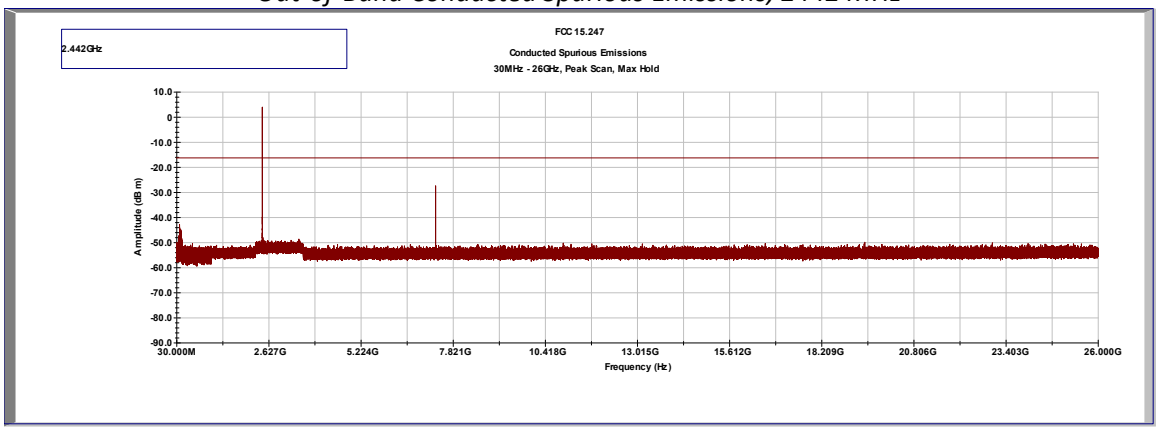
Out-of-Band Conducted Spurious Emissions at the Band-Edge:

Channel	Frequency MHz	Results
0	2410	Complies, Greater than 20dB
Hopping	Low Band Edge	Complies, Greater than 20dB
255	2474.5	Complies, Greater than 20dB
Hopping	High Band Edge	Complies, Greater than 20dB

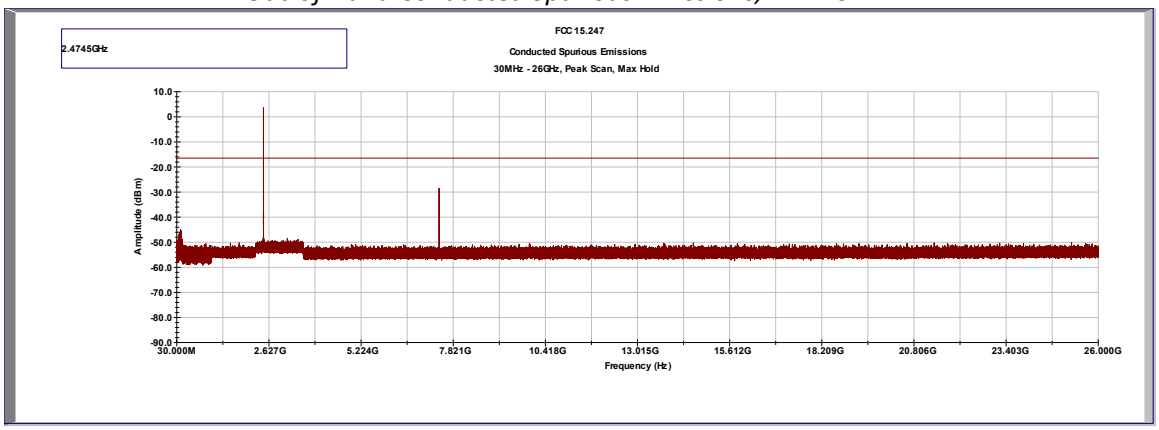
Out-of-Band Conducted Spurious Emissions, 2410 MHz



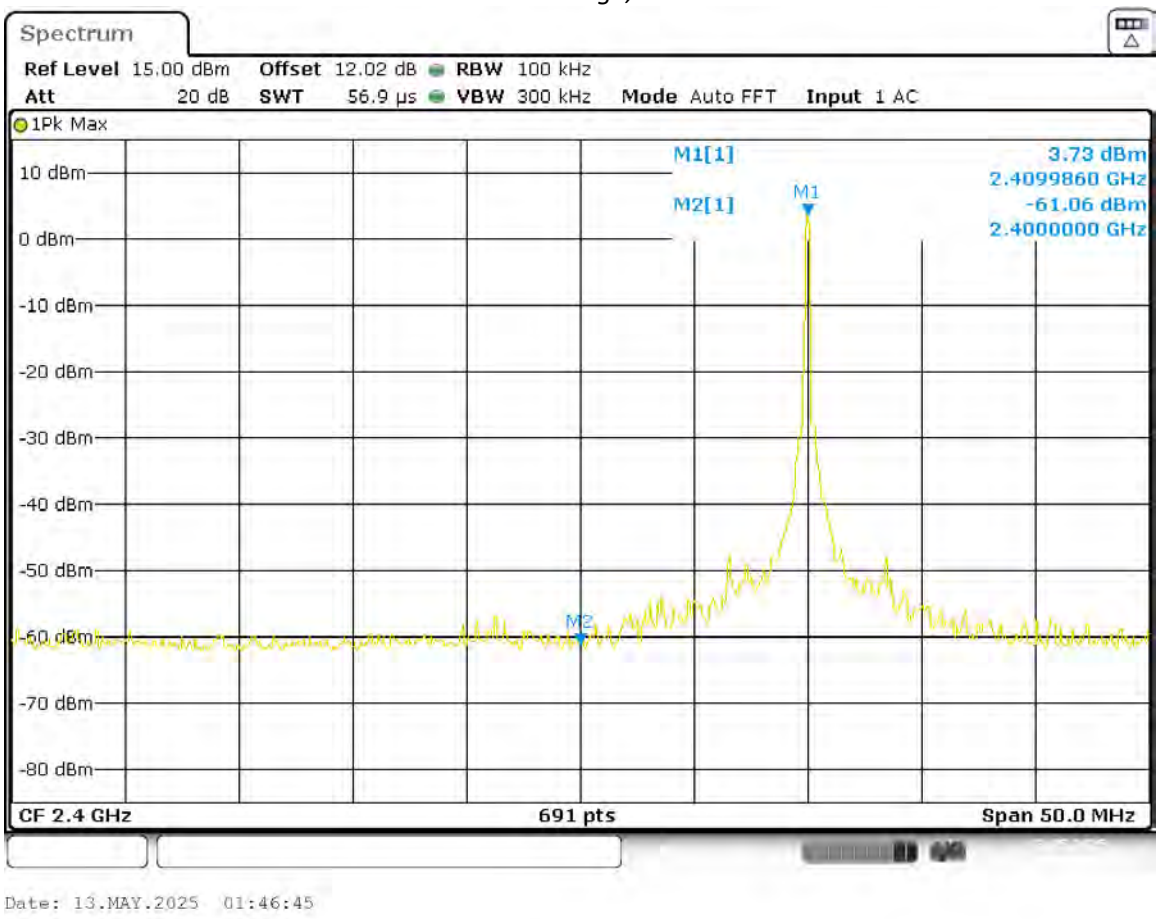
Out-of-Band Conducted Spurious Emissions, 2442 MHz



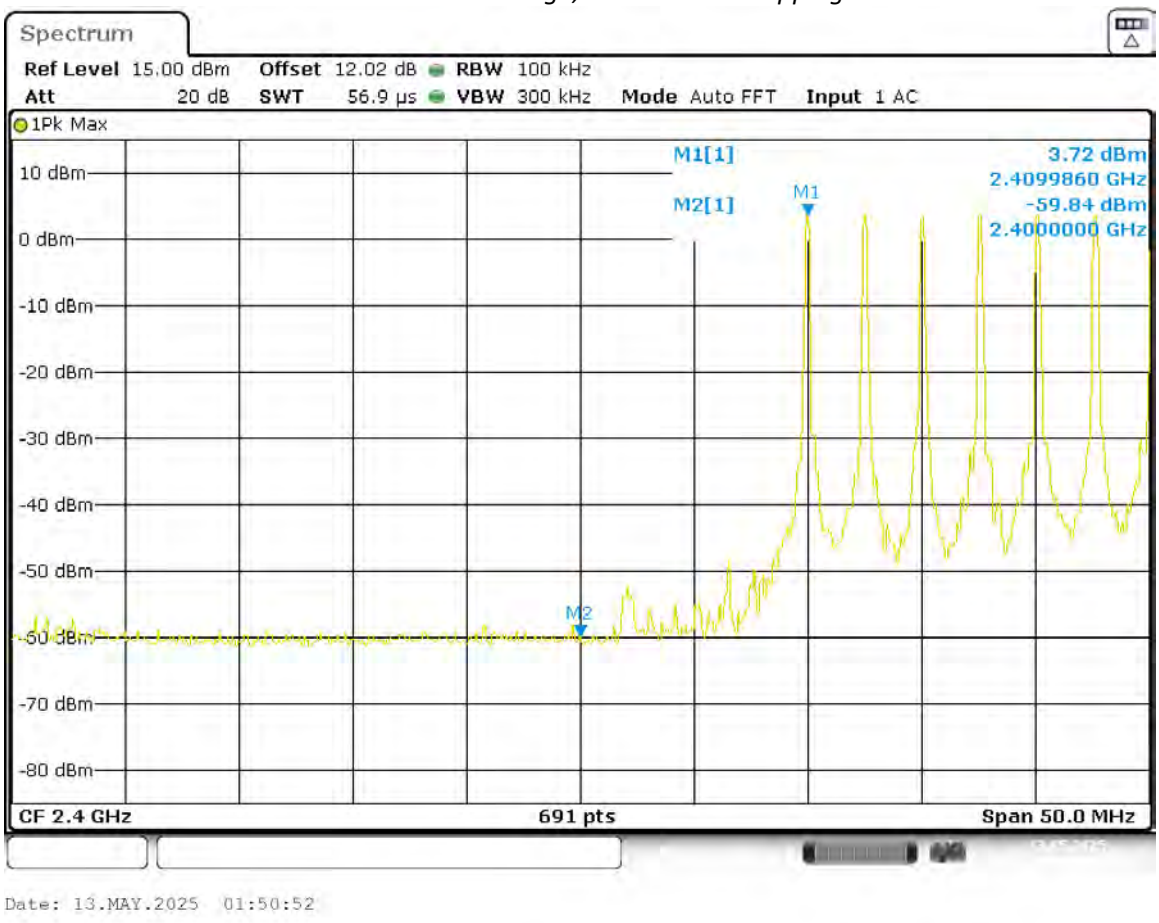
Out-of-Band Conducted Spurious Emissions, 2474.5 MHz



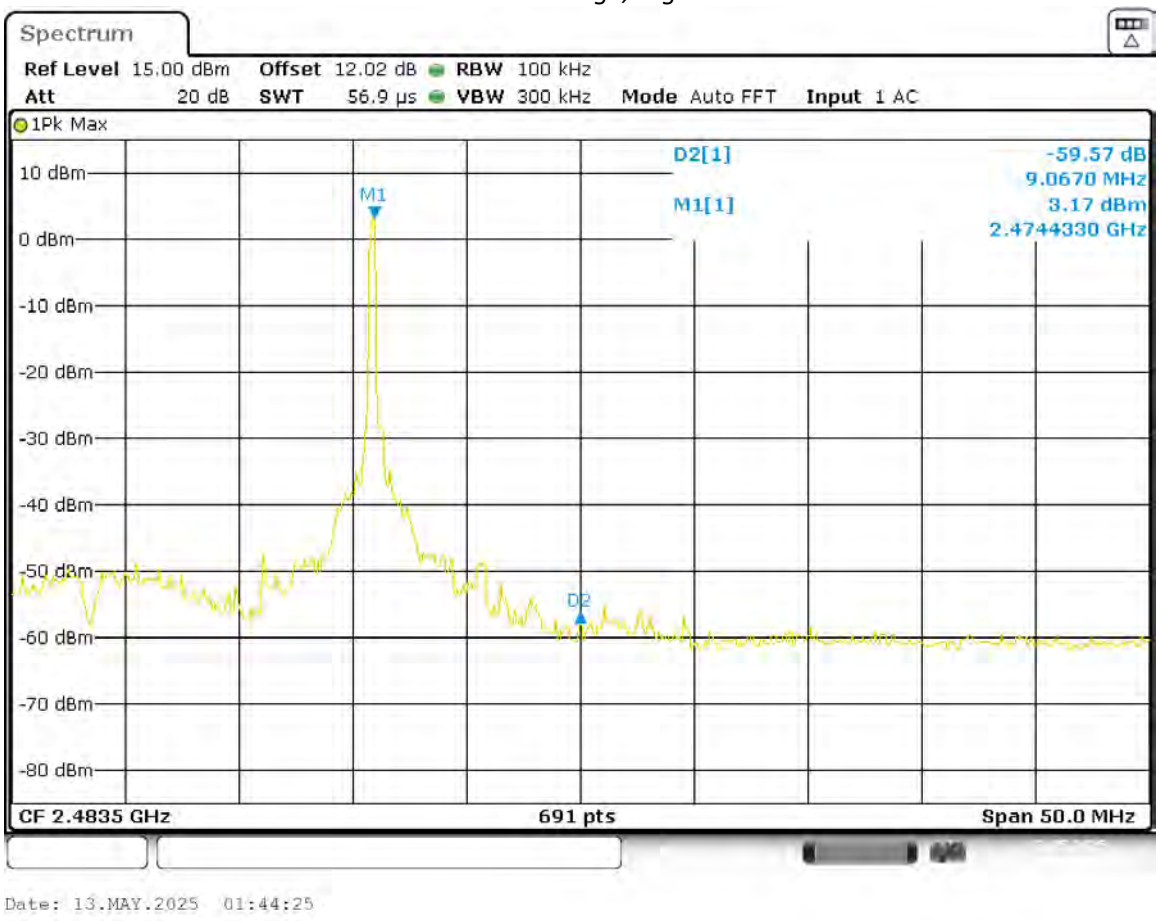
Out-of-Band Conducted Spurious
Conducted Band Edge, Low Channel



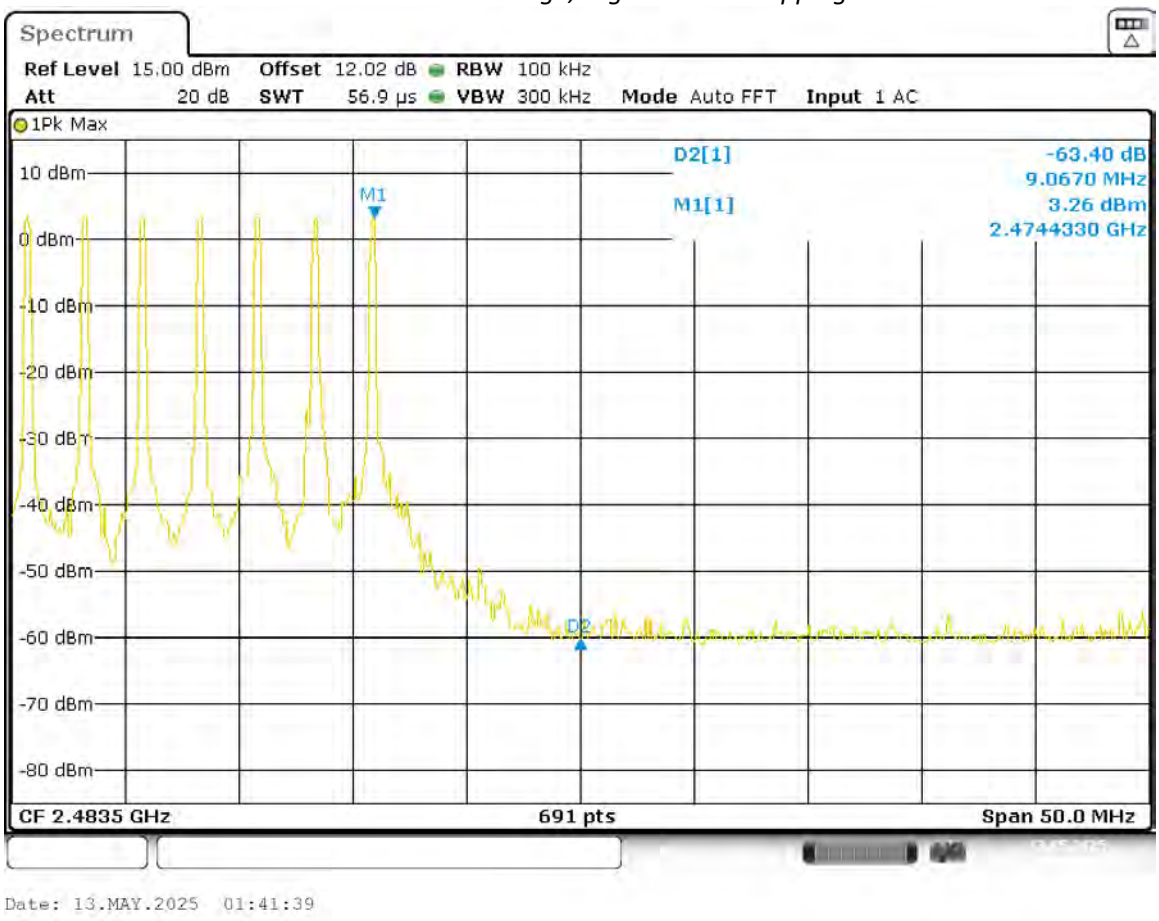
Out-of-Band Conducted Spurious
Conducted Band Edge, Low Channel Hopping



Out-of-Band Conducted Spurious
Conducted Band Edge, High Channel



Out-of-Band Conducted Spurious
Conducted Band Edge, High Channel Hopping



4.7 Transmitter Radiated Emissions
FCC Rule 15.247(d), 15.209, 15.205; RSS-247, 5.5;

4.7.1 Requirement

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)).

For out of band radiated emissions (except for frequencies in restricted bands), in any 100 kHz bandwidths outside the EUT pass-band, the RF power shall be at least 20dB (peak) or 30 dB (average) below that of the maximum in-band 100 kHz emissions.

4.7.2 Procedure

Radiated emission measurements were performed from 9kHz to 25GHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz.

If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at 3 meters for frequencies above 1 GHz and at 10 meters for frequencies below 1 GHz.

Spurious measurements are made with a preamp from 9kHz MHz to 25 GHz.

Measurements may be made with a Peak Detector and compared to QP limits for 9kHz – 1 GHz and Average limits for 1 GHz – 25 GHz.

Correlation measurements were performed below 30MHz between 10m ALSE and Open Field site according to FCC KDB 414788 D01 Radiated Test Site v01r01 section 2. All readings were within the acceptable tolerance.

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels).

4.7.3 Field Strength Calculation

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF – AG; if measurement is performed at a distance other than specified in the rule, a Distance Correction Factor (DCF) shall be added.

Where FS = Field Strength in dB(μV/m)
RA = Receiver Amplitude (including preamplifier) in dB(μV); AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB; AG = Amplifier Gain in dB

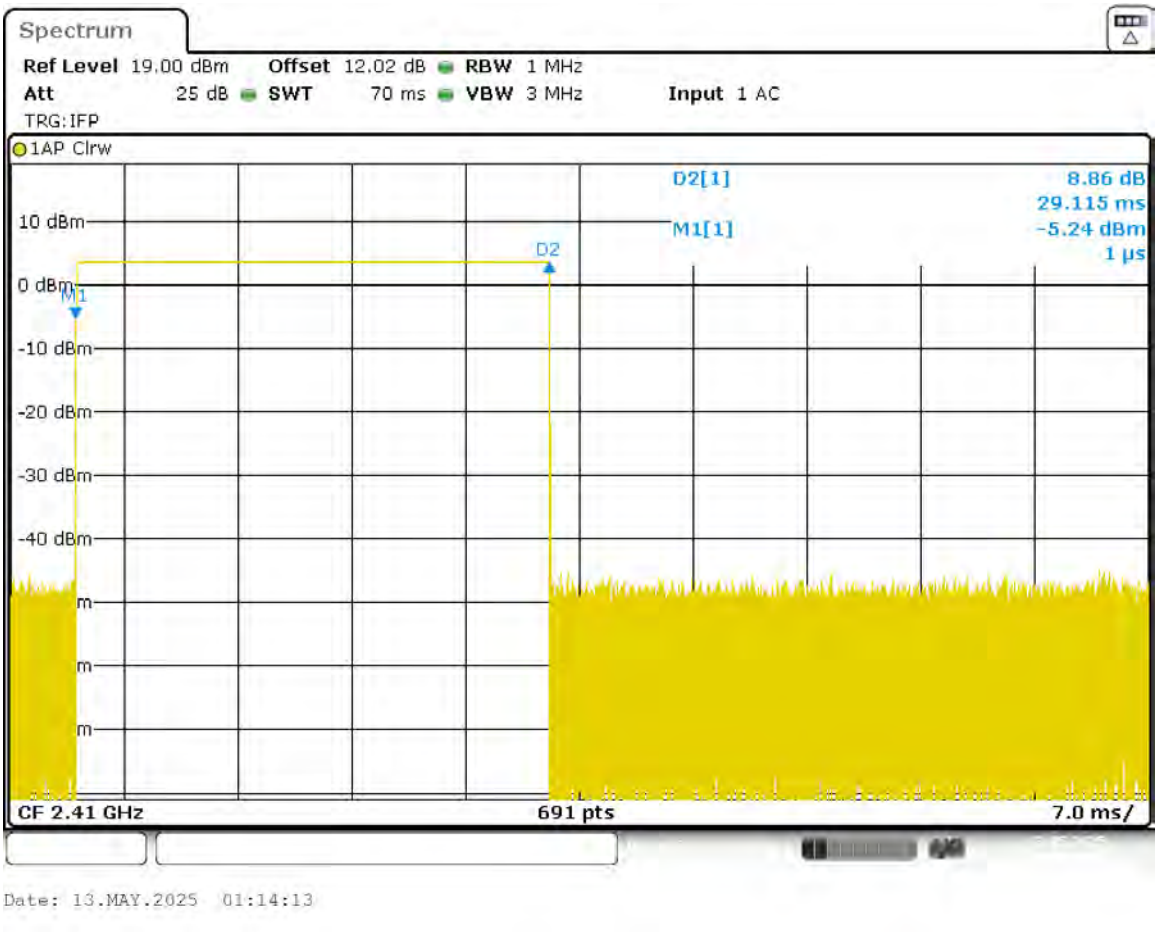
Assume a receiver reading of 52.0 dB(μV) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB(μV/m). This value in dB(μV/m) was converted to its corresponding level in μV/m.
RA = 52.0 dB(μV)
AF = 7.4 dB(1/m)
CF = 1.6 dB
AG = 29.0 dB
FS = 52.0+7.4+1.6-29.0 = 32 dB(μV/m).
Level in μV/m = Common Antilogarithm [(32 dBμV/m)/20] = 39.8 μV/m.

4.7.2.1 Duty Cycle Correction Factor (DCCF)

Per 558074 D01 15.247 Meas Guidance, the use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the unwanted emission limit is subject to an average field strength limit (*e.g.*, within a Government Restricted band) and the conditions specified in Section 15.35(c) can be satisfied. The average radiated field strength is calculated by subtracting the DCCF from the maximum radiated field strength level as determined through measurement. The maximum radiated field strength level represents the worst-case (maximum amplitude) RMS measurement of the emission(s) during continuous transmission (*i.e.*, not including any time intervals during which the transmitter is off or is transmitting at a reduced power level). It is also acceptable to apply the DCCF to a measurement performed with a peak detector instead of the specified RMS power averaging detector. Note that Section 15.35(c) specifies that the DCCF shall represent the worst-case (greatest duty cycle) over any 100 msec transmission period.

Duty Cycle Correction Factor Calculation
Subclause 7.5 of ANSI C63.10 was used to determine the DCCF.

DCCF = 20*log(29.155/100) = -10.71



4.7.4 Antenna-port conducted measurements

Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

4.7.5 General Procedure for conducted measurements in restricted bands

a) Measure the conducted output power (in dBm) using the detector specified for determining quasi-peak, peak, and average conducted output power, respectively.

b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)

c) Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).

d) For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (*e.g.*, Watts, mW).

e) Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:
E = EIRP – 20log D + 104.8+DCF (DCF for Average measurements)
where:
E = electric field strength in dBµV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.
DCF = Duty Cycle Correction Factor
f) Compare the resultant electric field strength level to the applicable limit.
g) Perform radiated spurious emission test

4.7.6 Test Results

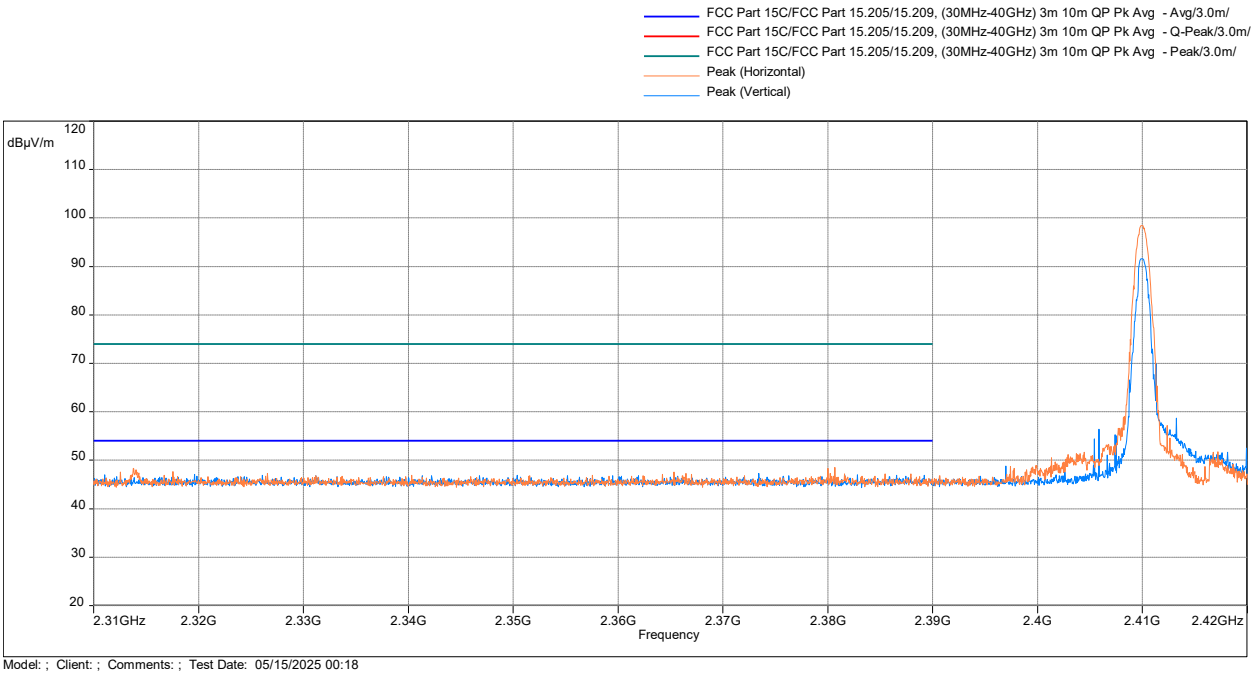
Tested By	Test Date
Arjun Mukherjea	May 8 – 16, 2025

These measurements were performed with antenna in place.

4.7.6 Test Results (Continued)

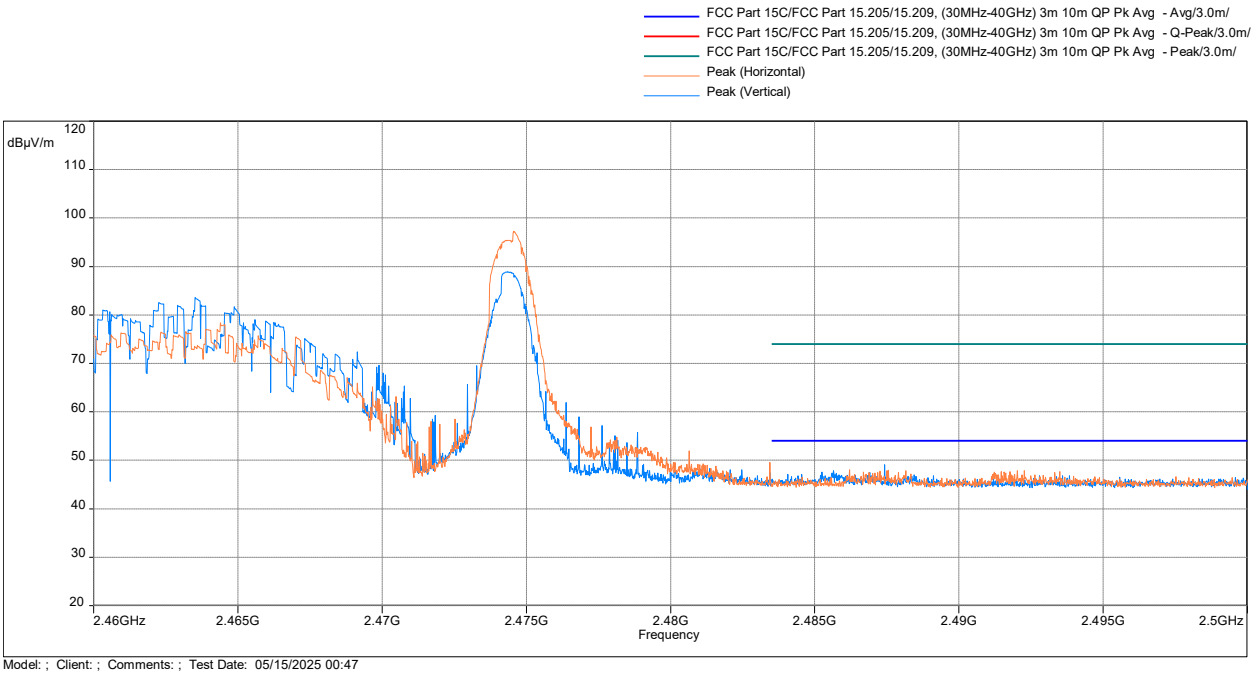
Test Results: 15.209/15.205 Radiated Restricted Band Emissions

Radiated Band Edge at the Restricted Band – Tx @ Low Channel, Peak



Frequency (MHz)	Peak (dBµV/m)	Lim. Avg (dBµV/m)	Peak-Lim (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
2390	46.91	54	-7.09	1.5	312.54	Vertical	4.35

Radiated Band Edge at the Restricted Band – Tx @ High Channel, Peak



Model: ; Client: ; Comments: ; Test Date: 05/15/2025 00:47

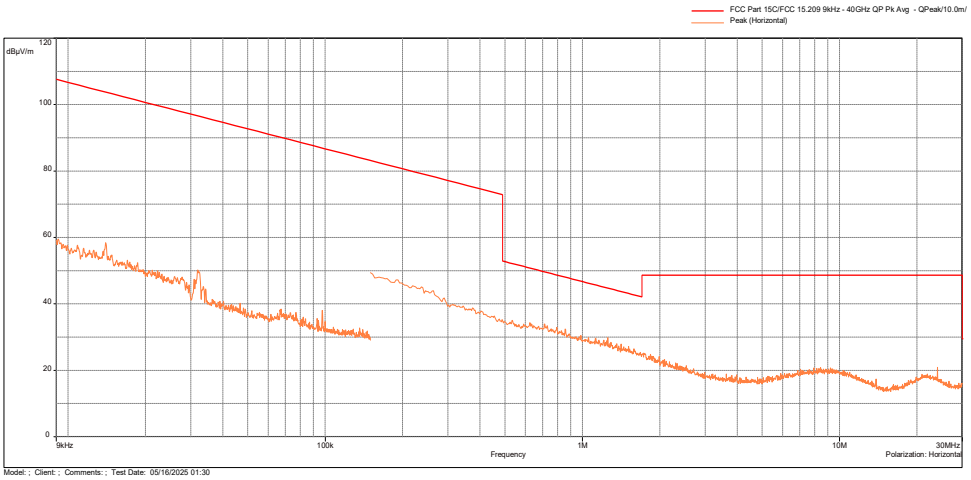
Frequency (MHz)	Peak (dBµV/m)	Lim. Avg (dBµV/m)	Peak-Lim (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
2483.5	47.89	54	-6.11	1.25	226.5	Vertical	4.33

Out-of-Band Radiated Spurious Emissions

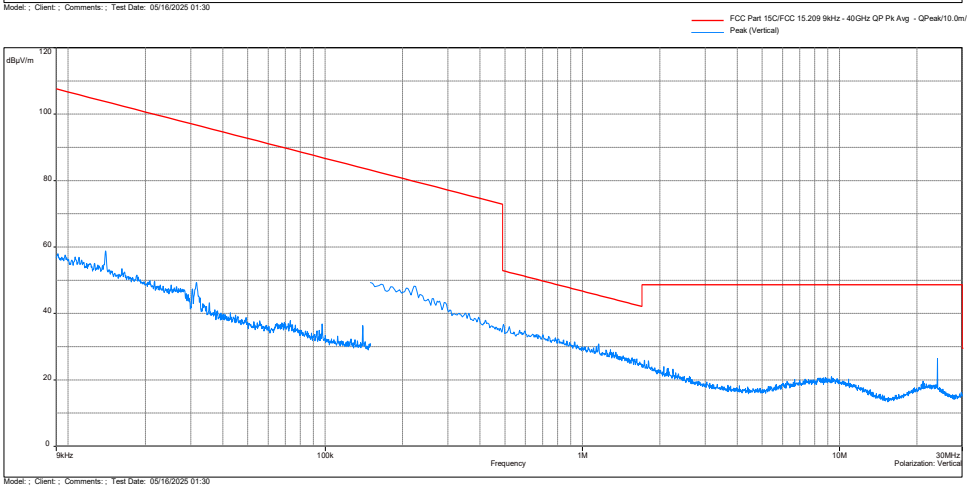
Test Results: 15.209 Radiated Spurious Emissions

Radiated Spurious Emissions 9 kHz to 30 MHz, Peak Scan vs QP Limit

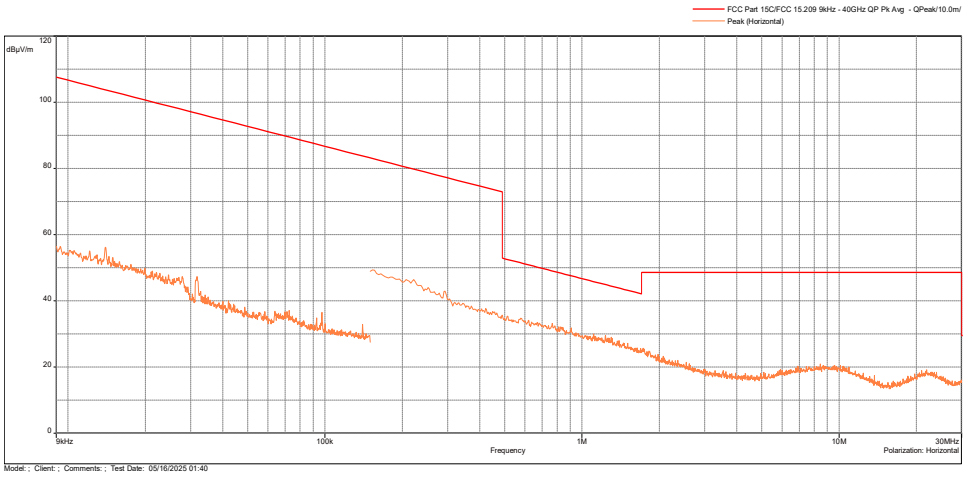
Antenna Position - Coaxial



Antenna Position - Coplanar

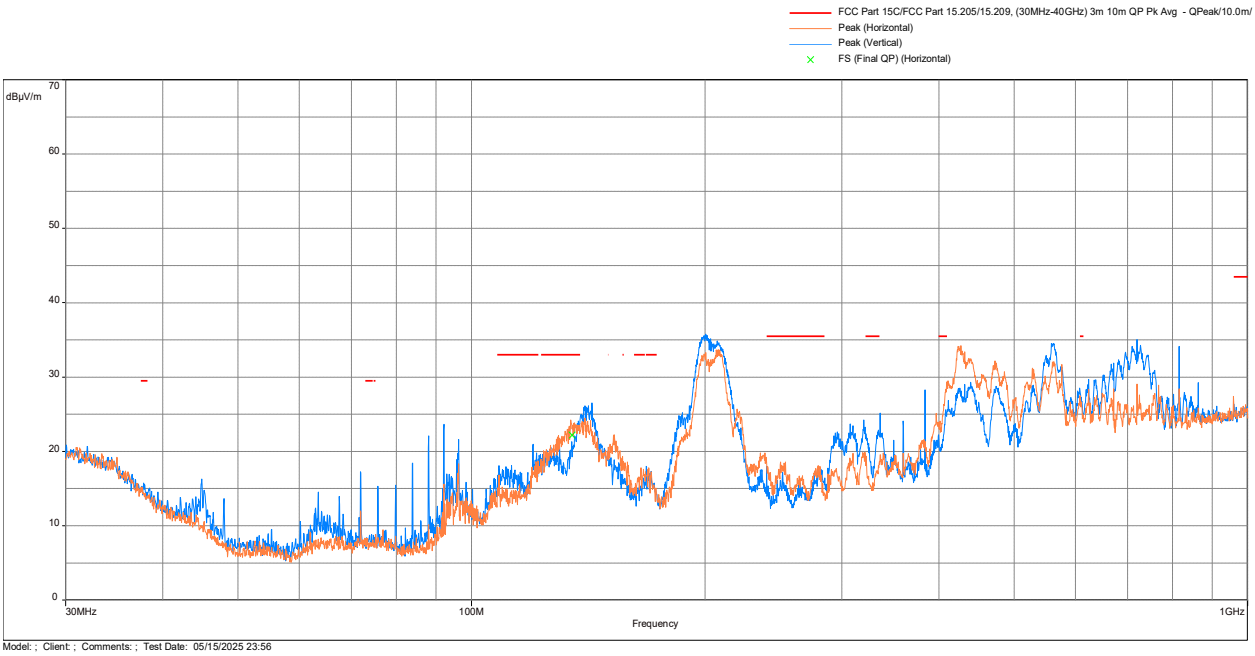


Antenna Position - Horizontal

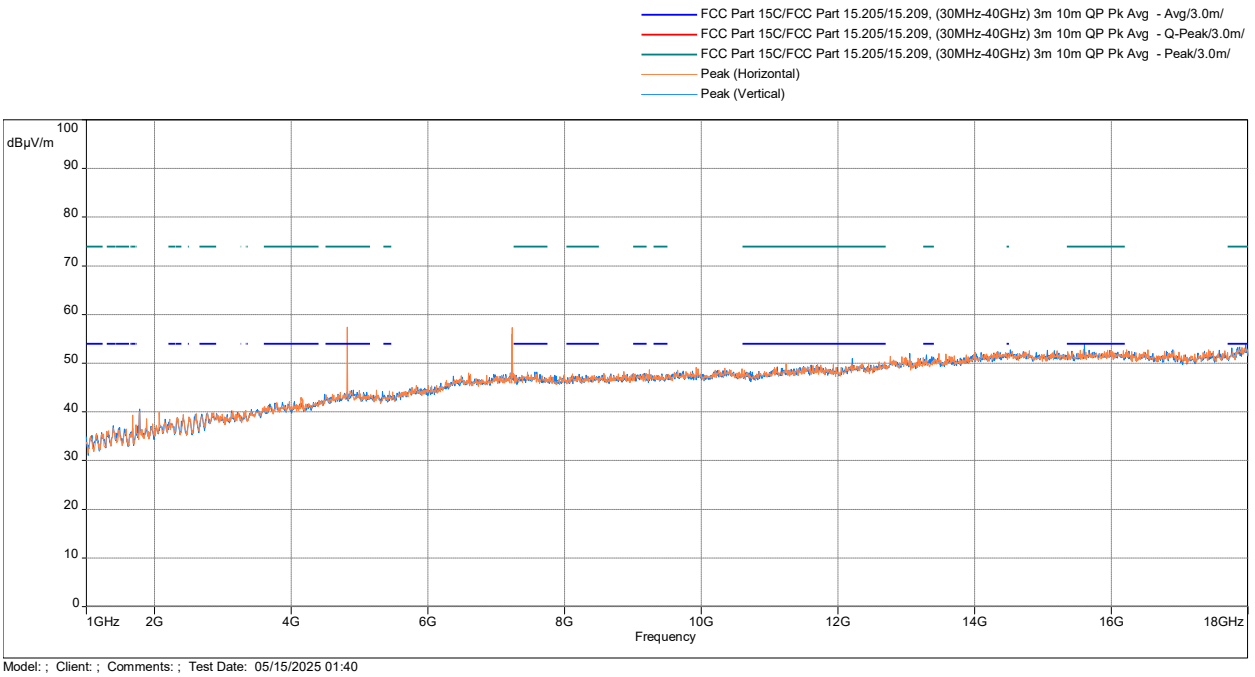


Test Results: Test Results: 15.209 Radiated Spurious Emissions, Tx at 2410 MHz

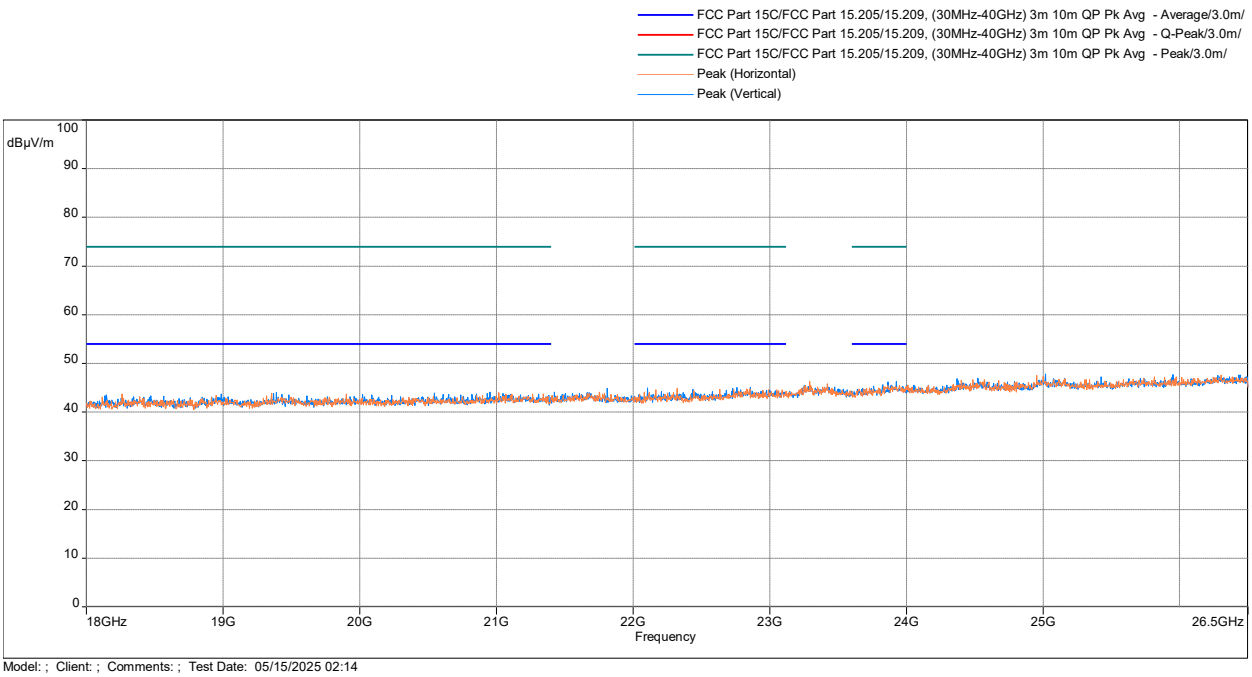
Out-of-Band Radiated Spurious Emissions - 30 MHz to 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Peak Limit



Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Peak & Avg Limit



Frequency (MHz)	QP@10m (dBµV/m)	Limit@10m (dB(uV/m))	Margin (dB)	Height (m)	Azimuth (deg)	Polarity	Correction (dB)
134.7236	22.18	33	-10.82	192.75	3.33	Horizontal	34.88

Note: Correction = AF + CF – Preamp

Frequency (MHz)	Peak@3m (dBµV/m)	Duty Cycle Correction Factor	Final Field Strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Height (m)	Azimuth (deg)	Polarity	Detection	Correction (dB)
4819.9	57.38	0	57.38	74	-16.62	2	147.9	H	Pk	1.41
4819.9	57.38	-10.71	46.67	54	-7.33	2	147.9	H	Avg	1.41
7458.867	48.21	0	48.21	74	-25.79	2	78.78	H	Pk	5.68
7458.867	48.21	-10.71	37.5	54	-16.5	2	78.78	H	Avg	5.68
15605.27	54.01	0	54.01	74	-19.99	1.25	157.35	V	Pk	5.42
15605.27	54.01	-10.71	43.3	54	-10.7	1.25	157.35	V	Avg	5.42
17967.13	53.82	0	53.82	74	-20.18	2	153.42	V	Pk	5.4
17967.13	53.82	-10.71	43.11	54	-10.89	2	153.42	V	Avg	5.4

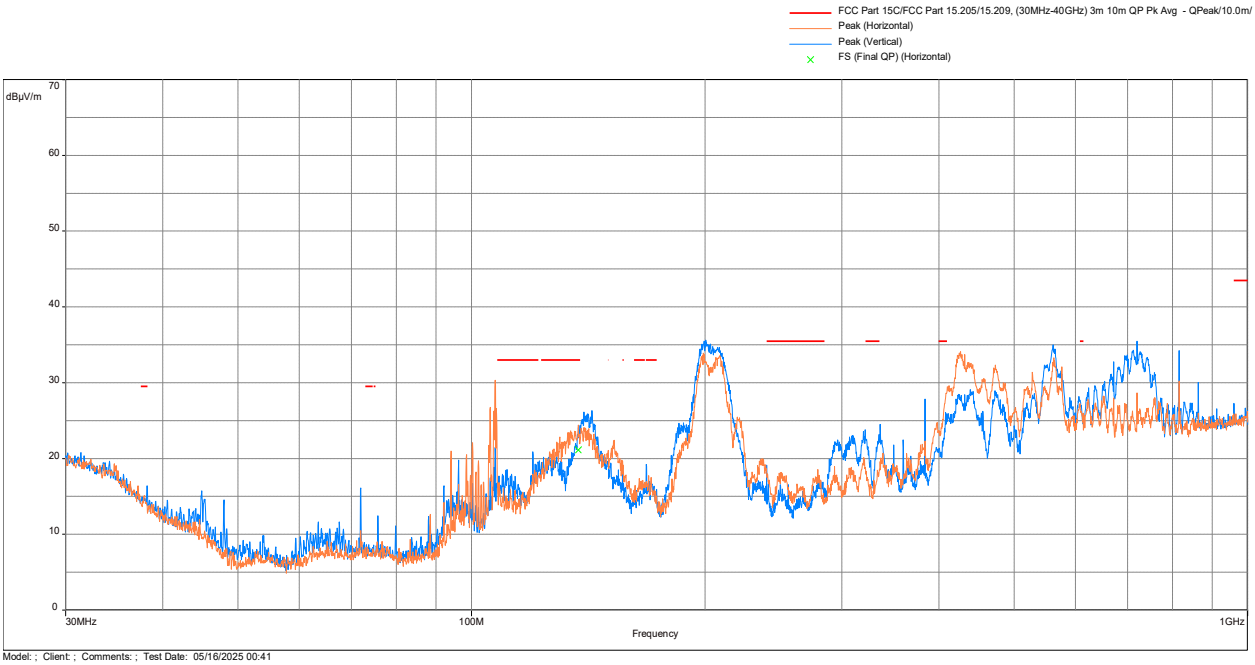
Note: Correction = AF + CF - Preamp

Results	Complies

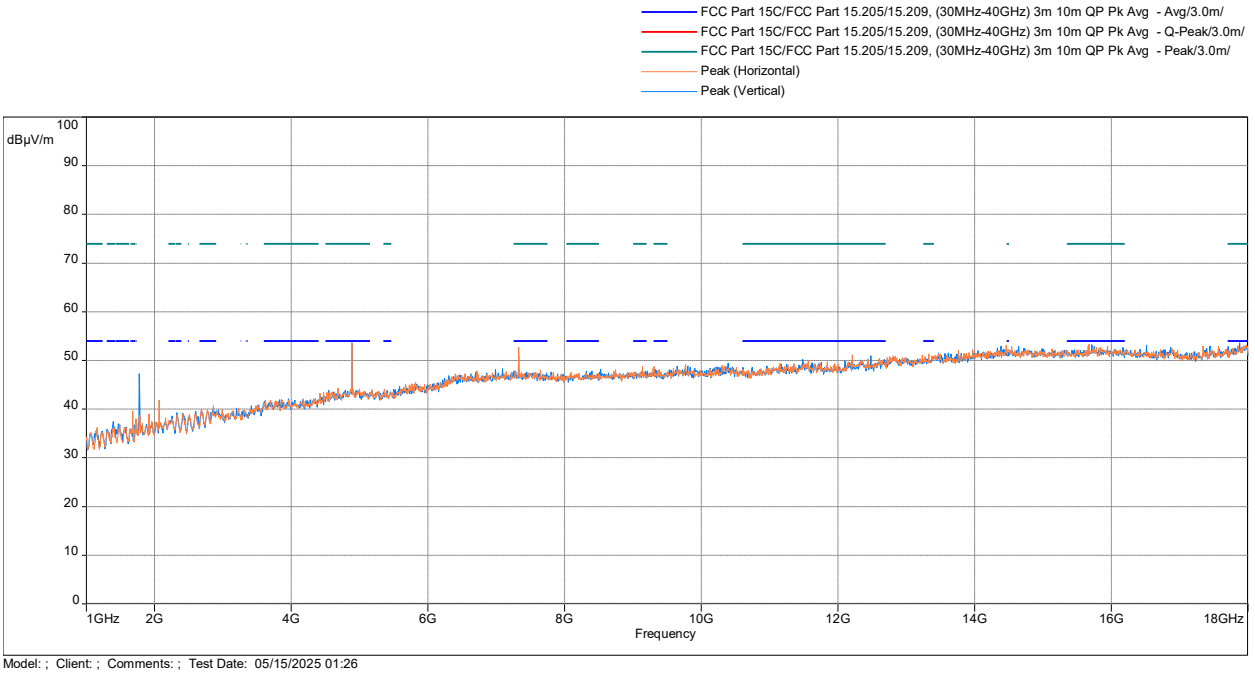
Note: Radiated emission measurements were performed up to from 9kHz to 26GHz.

Test Results: Test Results: 15.209 Radiated Spurious Emissions, Tx at 2442MHz

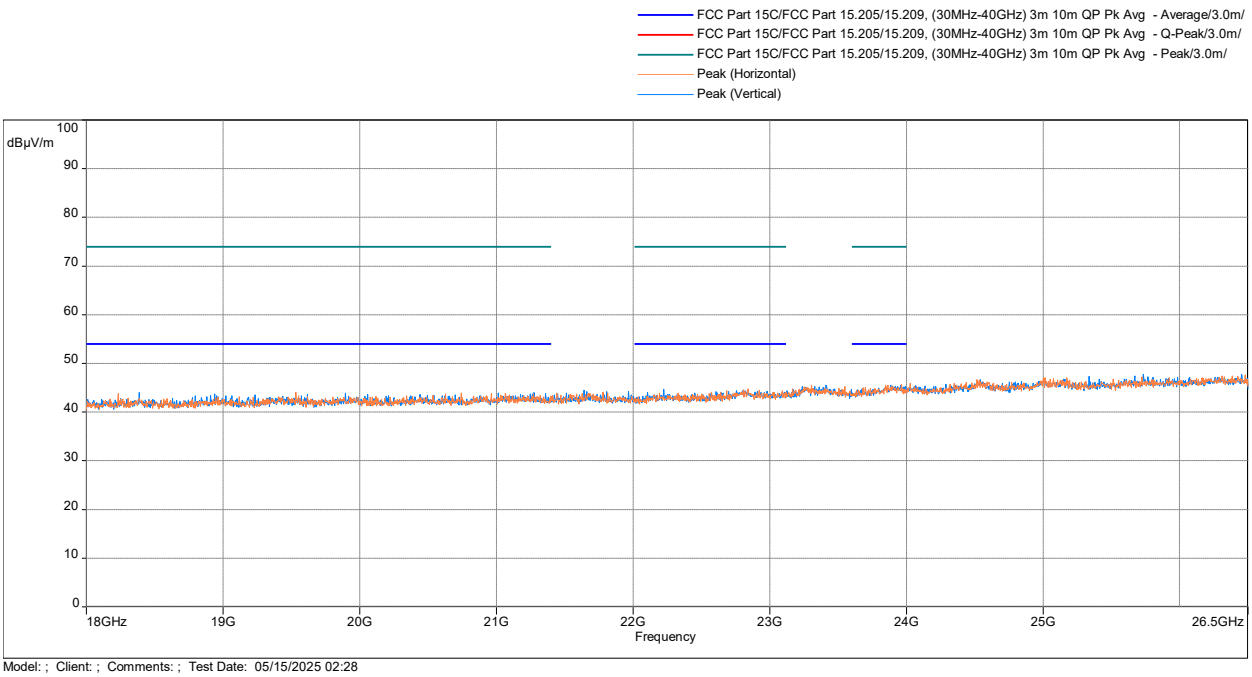
Out-of-Band Radiated Spurious Emissions - 30 MHz to 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Peak Limit



Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Peak & Avg Limit



Frequency (MHz)	QP@10m (dBµV/m)	Limit@10m (dB(uV/m))	Margin (dB)	Height (m)	Azimuth (deg)	Polarity	Correction (dB)
137.2692	21.12	33	-11.88	177.25	1.94	Horizontal	33.96

Note: Correction = AF + CF – Preamp

Frequency (MHz)	Peak@3m (dBµV/m)	Duty Cycle Correction Factor	Final Field Strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Height (m)	Azimuth (deg)	Polarity	Detection	Correction (dB)
4883.933	53.65	0	53.65	74	-20.35	1.5	97.68	V	Pk	1.56
4883.933	53.65	-10.71	42.94	54	-11.06	1.5	97.68	V	Avg	1.56
7326.267	52.71	0	52.71	74	-21.29	1.5	134.52	H	Pk	5.79
7326.267	52.71	-10.71	42	54	-12	1.5	134.52	H	Avg	5.79
15672.13	53.33	0	53.33	74	-20.67	1.25	58.89	H	Pk	5.58
15672.13	53.33	-10.71	42.62	54	-11.38	1.25	58.89	H	Avg	5.58
17879.87	53.58	0	53.58	74	-20.42	1.5	117.57	V	Pk	5.37
17879.87	53.58	-10.71	42.87	54	-11.13	1.5	117.57	V	Avg	5.37

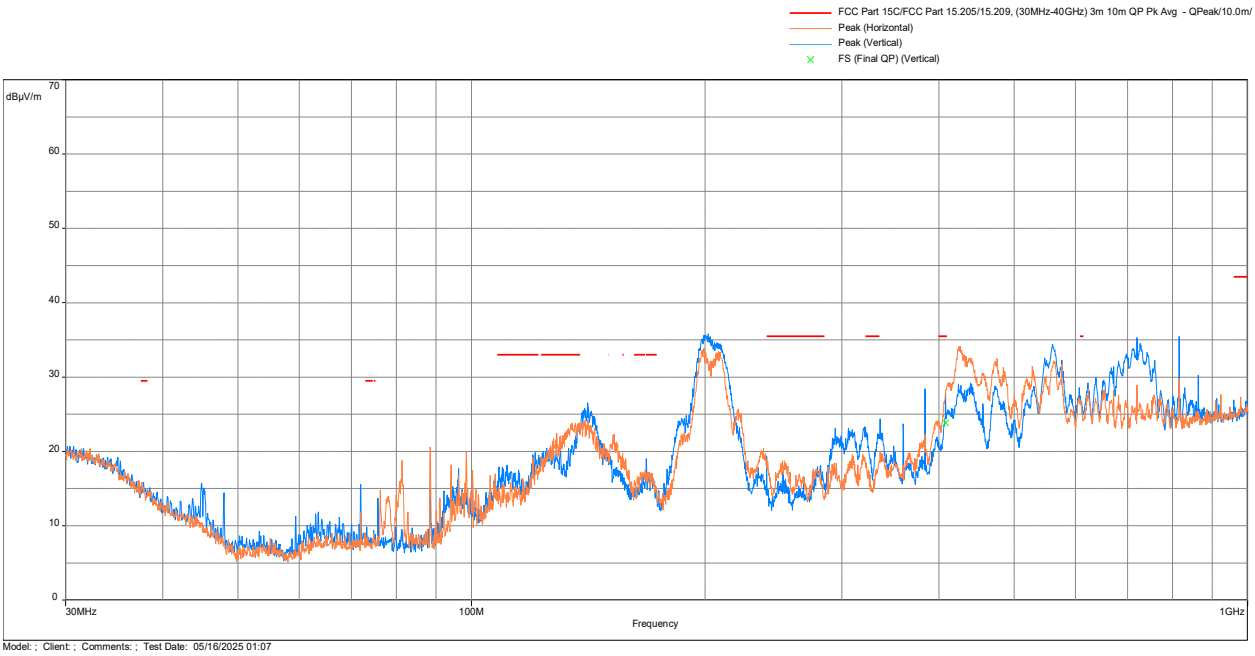
Note: Correction = AF + CF – Preamp

Results	Complies

Note: Radiated emission measurements were performed up to from 9kHz to 26GHz.

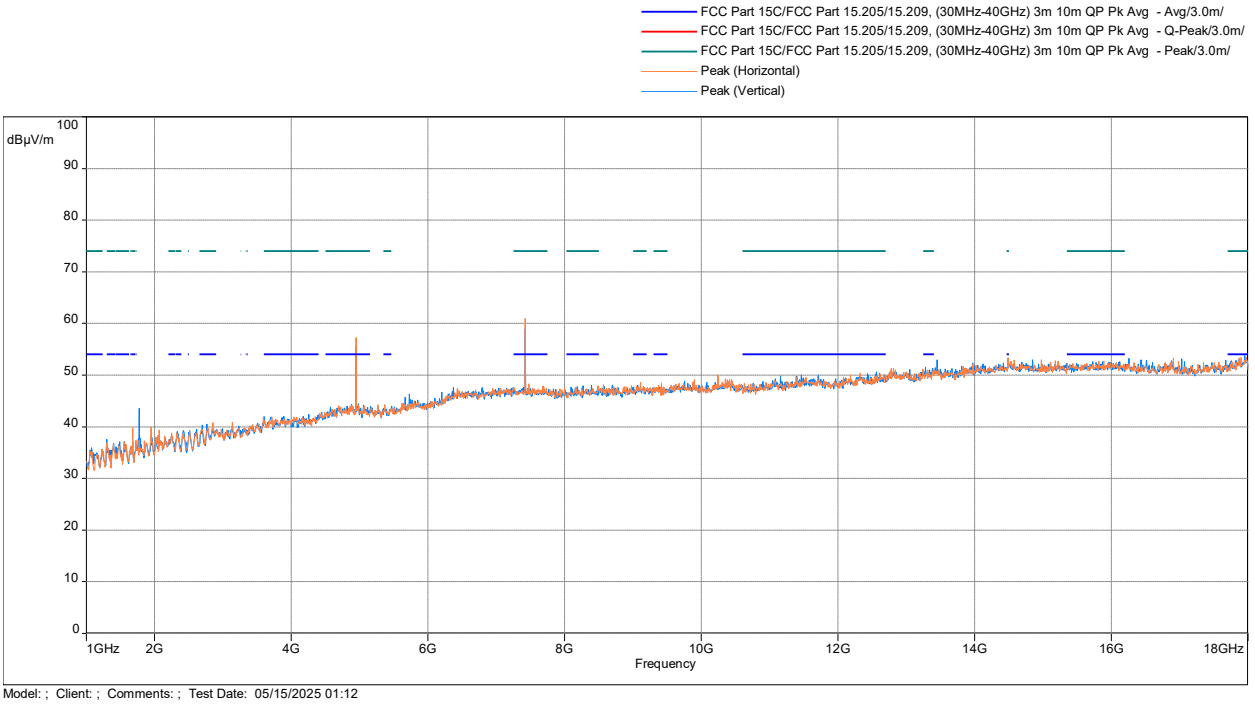
Test Results: Test Results: 15.209 Radiated Spurious Emissions, Tx at 2474.5MHz

Out-of-Band Radiated Spurious Emissions - 30 MHz to 1000 MHz



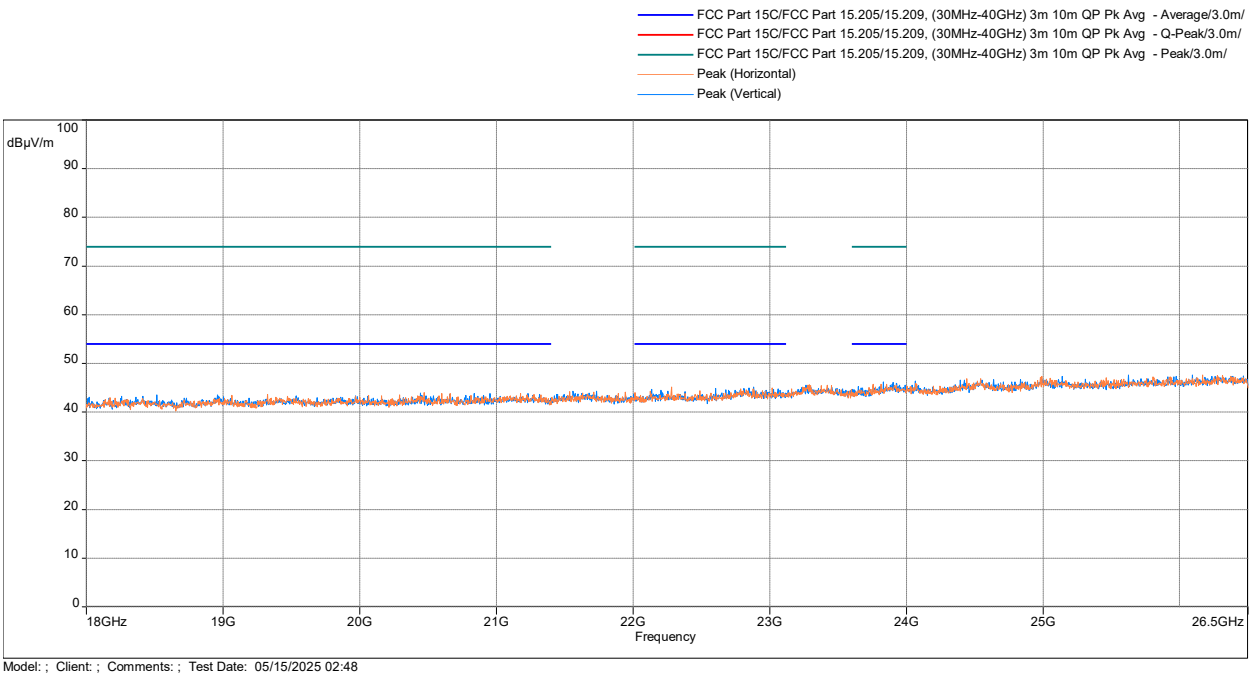
Model: ; Client: ; Comments: ; Test Date: 05/16/2025 01:07

Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Peak Limit



Model: ; Client: ; Comments: ; Test Date: 05/15/2025 01:12

Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Peak & Avg Limit



Frequency (MHz)	QP@10m (dBµV/m)	Limit@10m (dB(uV/m))	Margin (dB)	Height (m)	Azimuth (deg)	Polarity	Correction (dB)
407.9899	23.85	35.5	-11.65	0	1	Vertical	33.42

Note: Correction = AF + CF – Preamp

Frequency (MHz)	Peak@3m (dBµV/m)	Duty Cycle Correction Factor	Final Field Strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Height (m)	Azimuth (deg)	Polarity	Detection	Correction (dB)
4948.533	57.23	0	57.23	74	-16.77	2	270.78	H	Pk	1.64
4948.533	57.23	-10.71	46.52	54	-7.48	2	270.78	H	Avg	1.64
4948.533	55.46	0	55.46	74	-18.54	2	265.26	V	Pk	1.64
4948.533	55.46	-10.71	44.75	54	-9.25	2	265.26	V	Avg	1.64
7423.167	58.98	0	58.98	74	-15.02	1.5	294.6	V	Pk	5.73
7423.167	58.98	-10.71	48.27	54	-5.73	1.5	294.6	V	Avg	5.73
7423.167	60.91	0	60.91	74	-13.09	2	142.98	H	Pk	5.73
7423.167	60.91	-10.71	50.2	54	-3.8	2	142.98	H	Avg	5.73
14489.5	53.34	0	53.34	74	-20.66	2	352.79	H	Pk	5.71
14489.5	53.34	-10.71	42.63	54	-11.37	2	352.79	H	Avg	5.71
17954.1	53.73	0	53.73	74	-20.27	1.25	73.86	V	Pk	5.4
17954.1	53.73	-10.71	43.02	54	-10.98	1.25	73.86	V	Avg	5.4

Note: Correction = AF + CF – Preamp

Results	Complies

Note: The EUT was tested in all three orientations. The worst case data presented.

4.8 AC Line Conducted Emission
FCC: 15.207; RSS-GEN;

4.8.1 Requirement

Frequency Band MHz	Class B Limit dB(µV)		Class A Limit dB(µV)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15-0.50	66 to 56 *	56 to 46 *	79	66
0.50-5.00	56	46	73	60
5.00-30.00	60	50	73	60

*Note: *Decreases linearly with the logarithm of the frequency. At the transition frequency the lower limit applies.*

4.8.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.10-2013.

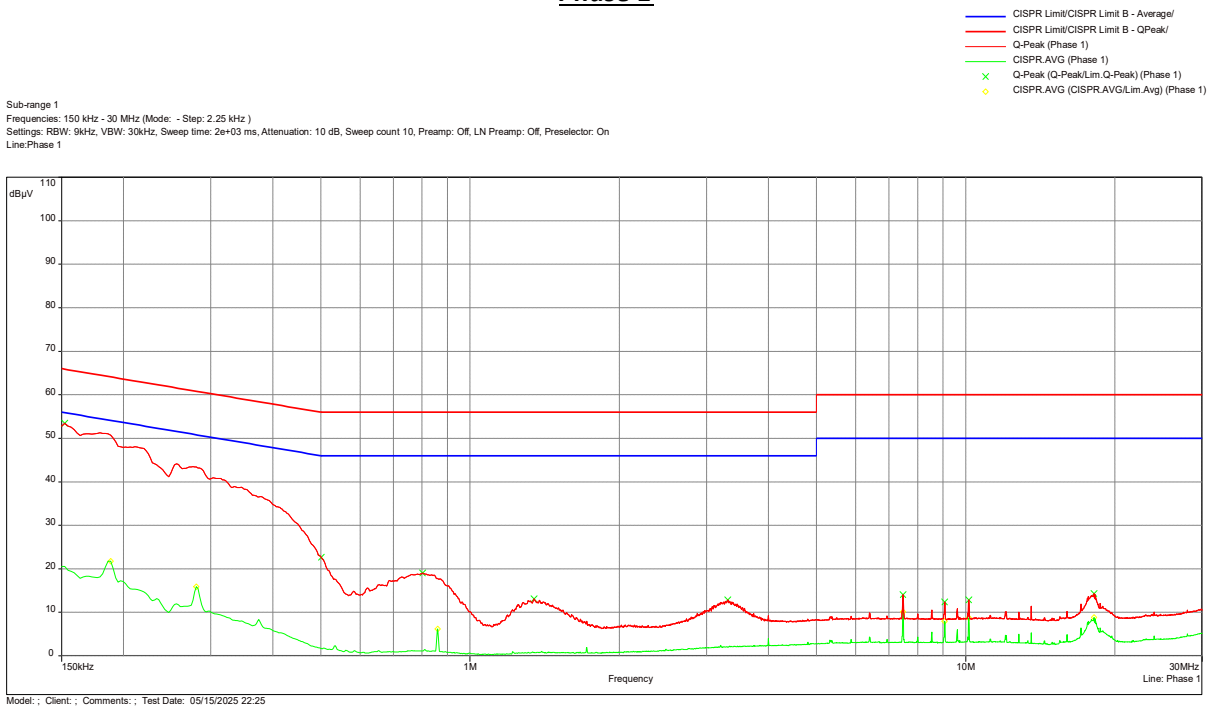
Tested By / Supervised By	Test Date	Results
Arjun Mukherjea	May 15, 2025	Complies

4.8.3 Test Result

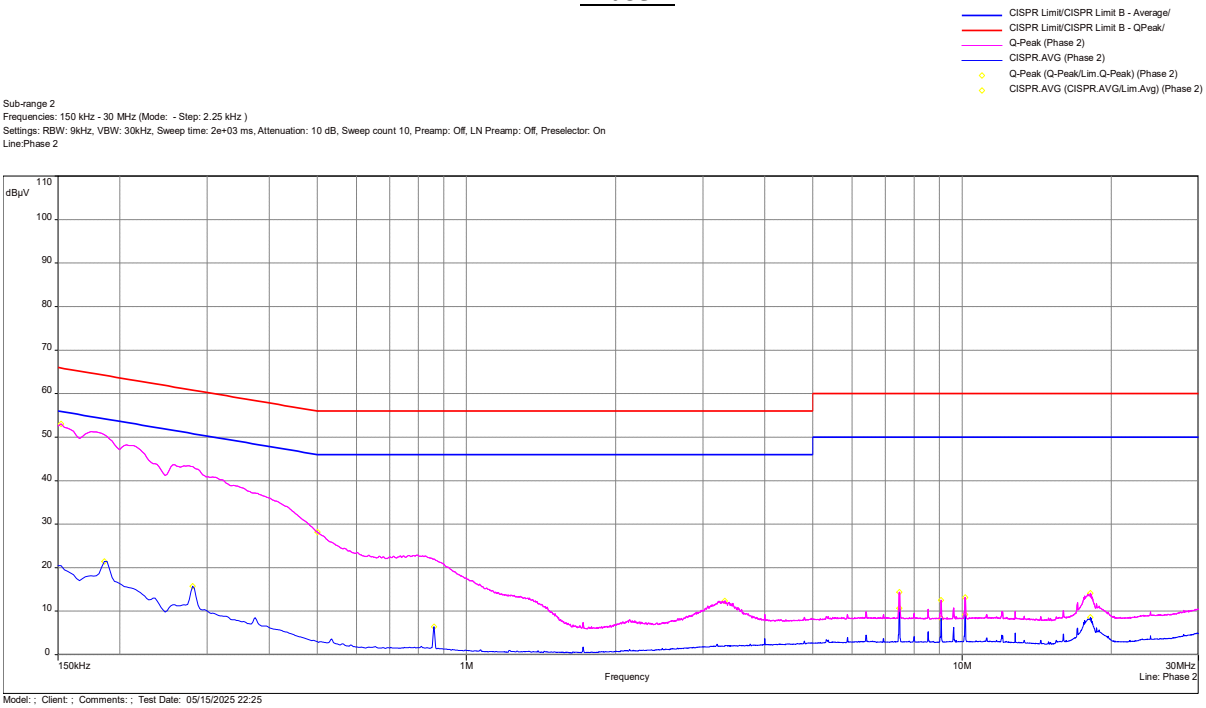
15.207: Conducted Emissions 120VAC 60Hz

Tx @ 2410MHz

Phase 1



Phase 2



4.8.3 Test Results (Continued)

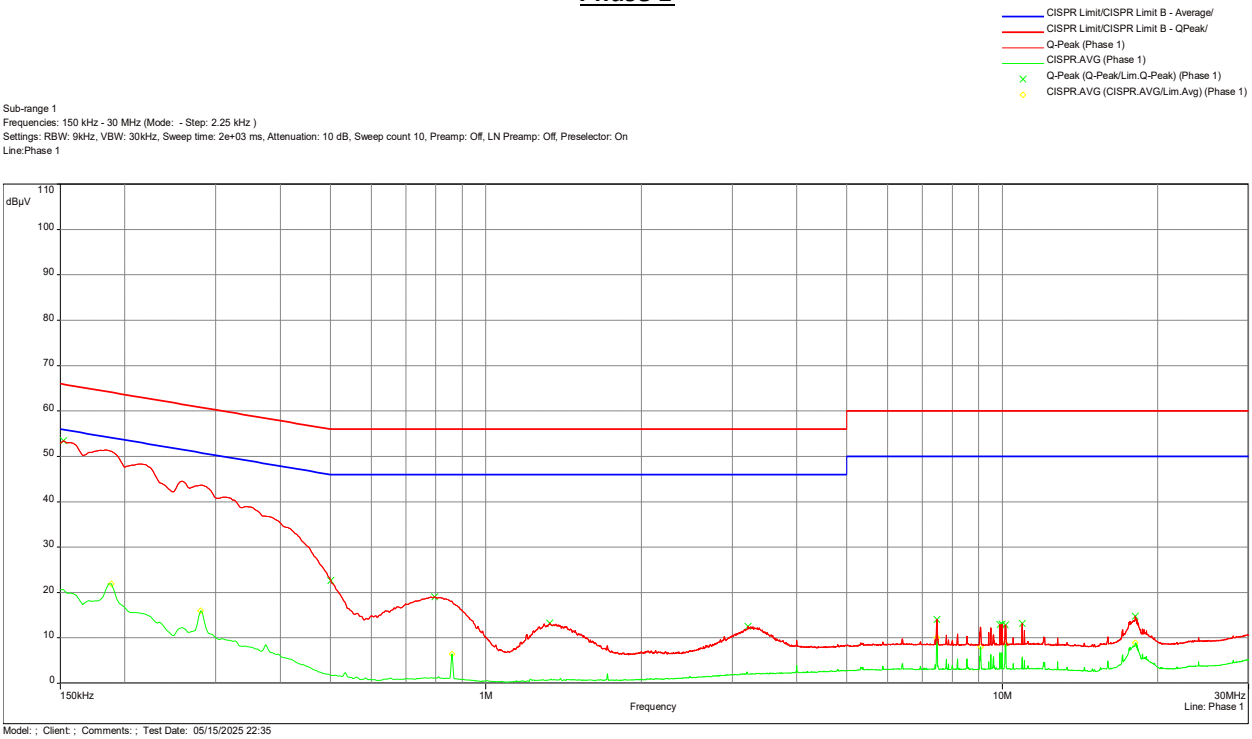
Frequency (MHz)	Q-Peak (dBµV)	Limit Q-Peak (dBµV)	Margin Q-Peak (dB)	Line	Correction (dB)
0.15225	53.44	65.88	-12.44	Phase 1	11.27
0.15225	53.06	65.88	-12.82	Phase 2	11.16
0.501	22.63	56	-33.37	Phase 1	10.86
0.501	28.14	56	-27.86	Phase 2	10.74
0.8025	18.99	56	-37.01	Phase 1	10.84
1.347	13.06	56	-42.94	Phase 1	10.83
3.3135	12.85	56	-43.15	Phase 1	10.91
3.3225	12.34	56	-43.66	Phase 2	10.81
7.47375	14.01	60	-45.99	Phase 1	11.04
7.476	14.36	60	-45.64	Phase 2	10.89
9.069	12.54	60	-47.46	Phase 2	10.9
9.07575	12.36	60	-47.64	Phase 1	11.06
10.1445	12.87	60	-47.13	Phase 1	11.1
10.1445	13.18	60	-46.82	Phase 2	10.92
18.168	14.31	60	-45.69	Phase 1	11.12
18.168	14.12	60	-45.88	Phase 2	10.89

Frequency (MHz)	CISPR AVG (dBµV)	Limit Avg (dBµV)	Margin Avg (dB)	Line	Correction (dB)
0.186	21.45	54.21	-32.76	Phase 2	11.02
0.18825	21.76	54.11	-32.36	Phase 1	11.12
0.2805	15.92	50.8	-34.88	Phase 1	10.94
0.2805	15.76	50.8	-35.04	Phase 2	10.84
0.861	6.22	46	-39.78	Phase 1	10.83
0.861	6.44	46	-39.56	Phase 2	10.73
7.476	10.66	50	-39.34	Phase 2	10.89
7.4805	10.12	50	-39.88	Phase 1	11.04
9.069	8.37	50	-41.63	Phase 2	10.9
9.07575	7.97	50	-42.03	Phase 1	11.06
10.1445	8.75	50	-41.25	Phase 1	11.1
10.1445	9.22	50	-40.78	Phase 2	10.92
18.168	8.84	50	-41.16	Phase 1	11.12
18.17025	8.63	50	-41.37	Phase 2	10.89

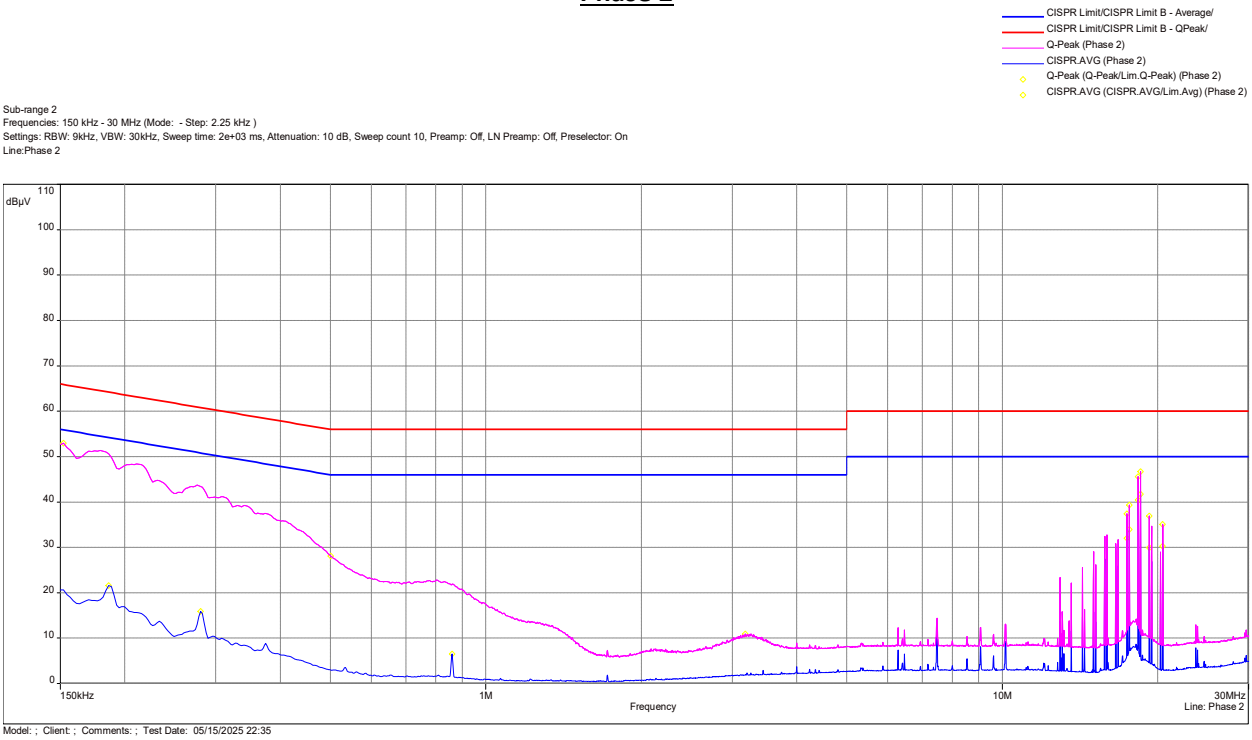
Results	**Complies** by 12.44 dB

Tx @ 2442MHz

Phase 1



Phase 2



4.8.3 Test Results (Continued)

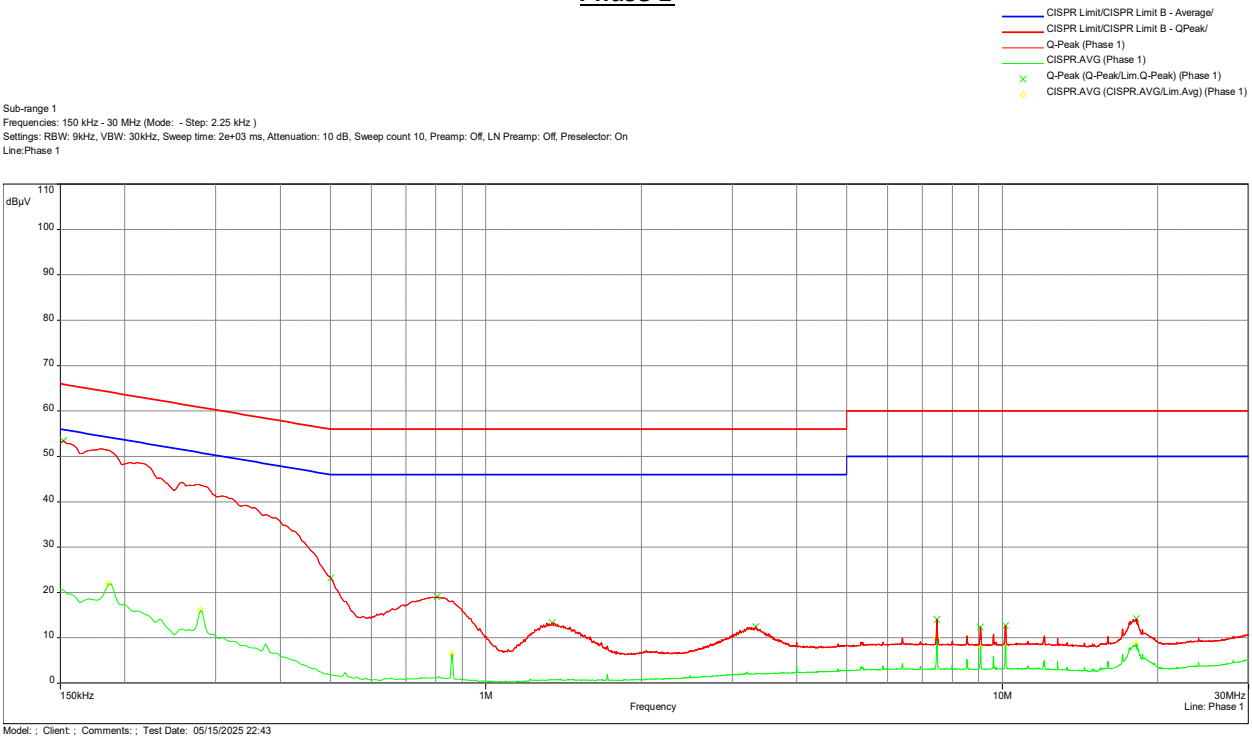
Frequency (MHz)	Q-Peak (dBµV)	Limit Q-Peak (dBµV)	Margin Q-Peak (dB)	Line	Correction (dB)
0.15225	53.41	65.88	-12.46	Phase 1	11.27
0.15225	52.94	65.88	-12.93	Phase 2	11.16
0.501	28.12	56	-27.88	Phase 2	10.74
0.501	22.59	56	-33.41	Phase 1	10.86
0.79575	19.02	56	-36.98	Phase 1	10.84
1.329	13.21	56	-42.79	Phase 1	10.83
3.18075	10.93	56	-45.07	Phase 2	10.81
3.22125	12.56	56	-43.44	Phase 1	10.91
7.476	14.04	60	-45.96	Phase 1	11.04
9.89475	12.89	60	-47.11	Phase 1	11.08
9.99375	13	60	-47	Phase 1	11.08
10.14675	12.86	60	-47.14	Phase 1	11.1
10.92975	13.19	60	-46.81	Phase 1	11.17
17.44575	37.4	60	-22.6	Phase 2	10.89
17.62125	39.35	60	-20.65	Phase 2	10.89
18.09375	14.8	60	-45.2	Phase 1	11.12
18.33675	45.55	60	-14.45	Phase 2	10.89
18.519	46.73	60	-13.27	Phase 2	10.89
19.2705	36.9	60	-23.1	Phase 2	10.9
20.45625	35.1	60	-24.9	Phase 2	10.92

Frequency (MHz)	CISPR AVG (dBµV)	Limit Avg (dBµV)	Margin Avg (dB)	Line	Correction (dB)
0.186	21.59	54.21	-32.63	Phase 2	11.02
0.18825	21.93	54.11	-32.18	Phase 1	11.12
0.2805	15.93	50.8	-34.87	Phase 2	10.84
0.2805	16.01	50.8	-34.79	Phase 1	10.94
0.861	6.4	46	-39.6	Phase 1	10.83
0.861	6.51	46	-39.49	Phase 2	10.73
7.476	10.05	50	-39.95	Phase 1	11.04
9.078	8.01	50	-41.99	Phase 1	11.06
10.14675	8.7	50	-41.3	Phase 1	11.1
17.44575	32.01	50	-17.99	Phase 2	10.89
17.62125	33.92	50	-16.08	Phase 2	10.89
18.09375	8.9	50	-41.1	Phase 1	11.12
18.33675	40.43	50	-9.57	Phase 2	10.89
18.519	41.7	50	-8.3	Phase 2	10.89
19.2705	29.92	50	-20.08	Phase 2	10.9
20.45625	30.22	50	-19.78	Phase 2	10.92

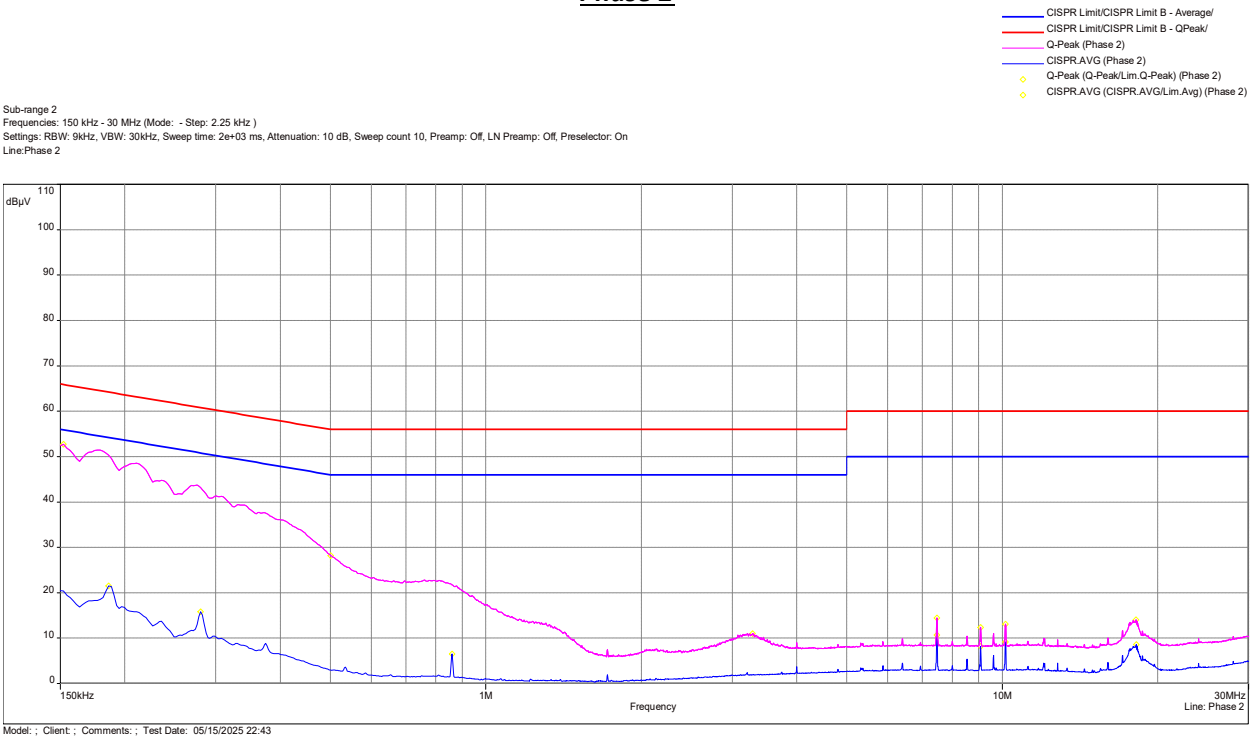
Results	**Complies** by 8.3 dB

Tx @ 2474.5MHz

Phase 1



Phase 2



4.8.3 Test Results (Continued)

Frequency (MHz)	Q-Peak (dBµV)	Limit Q-Peak (dBµV)	Margin Q-Peak (dB)	Line	Correction (dB)
0.15225	53.46	65.88	-12.42	Phase 1	11.27
0.15225	52.74	65.88	-13.14	Phase 2	11.16
0.501	23.16	56	-32.84	Phase 1	10.86
0.501	28.21	56	-27.79	Phase 2	10.74
0.80475	18.99	56	-37.01	Phase 1	10.84
1.34475	13.29	56	-42.71	Phase 1	10.83
3.28425	11.01	56	-44.99	Phase 2	10.81
3.3315	12.46	56	-43.54	Phase 1	10.91
7.47825	14.01	60	-45.99	Phase 1	11.04
7.47825	14.44	60	-45.56	Phase 2	10.89
9.07125	12.33	60	-47.67	Phase 1	11.06
9.08025	12.39	60	-47.61	Phase 2	10.9
10.14675	12.72	60	-47.28	Phase 1	11.1
10.149	13.05	60	-46.95	Phase 2	10.92
18.16125	14.06	60	-45.94	Phase 2	10.89
18.17475	14.19	60	-45.81	Phase 1	11.12

Frequency (MHz)	CISPR AVG (dBµV)	Limit Avg (dBµV)	Margin Avg (dB)	Line	Correction (dB)
0.186	21.9	54.21	-32.31	Phase 1	11.12
0.186	21.5	54.21	-32.72	Phase 2	11.02
0.2805	16.11	50.8	-34.69	Phase 1	10.94
0.2805	15.78	50.8	-35.02	Phase 2	10.84
0.861	6.45	46	-39.55	Phase 1	10.83
0.861	6.53	46	-39.47	Phase 2	10.73
7.47825	10.71	50	-39.29	Phase 2	10.89
7.47825	10.06	50	-39.94	Phase 1	11.04
9.07125	8.09	50	-41.91	Phase 1	11.06
9.08025	8.16	50	-41.84	Phase 2	10.9
10.149	8.51	50	-41.49	Phase 1	11.1
10.149	9.13	50	-40.87	Phase 2	10.92
18.159	8.75	50	-41.25	Phase 1	11.12
18.177	8.56	50	-41.44	Phase 2	10.89
0.186	21.9	54.21	-32.31	Phase 1	11.12
0.186	21.5	54.21	-32.72	Phase 2	11.02
0.2805	16.11	50.8	-34.69	Phase 1	10.94
0.2805	15.78	50.8	-35.02	Phase 2	10.84
0.861	6.45	46	-39.55	Phase 1	10.83
0.861	6.53	46	-39.47	Phase 2	10.73

Results	**Complies** by 12.42 dB

5.0 List of Test Equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

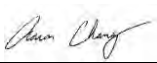
Equipment	Manufacturer	Model/Type	Asset #	Cal Int	Cal Due
EMI Test Receiver	Rohde & Schwarz	ESU40	00961	12	04/08/2026
EMI Test Receiver	Rohde & Schwarz	ESR	01607	12	10/22/2025
9kHz-30MHz Loop Antenna	ETS Lindgren	6512	01573	12	12/02/2025
30MHz-2GHz Bi-Log	SunAR RF Motion	JB1	01577	12	02/21/2026
1-18GHz Horn Antenna	RF Spin	DRH18-E	02114	12	10/02/2025
18-40GHz Horn Antenna	RF Spin	DRH0844	02115	12	10/03/2025
9kHz-1GHz Pre-amplifier	Sonoma Instrument	310N	01713	12	02/17/2026
1-18GHz Preamplifier	EMC Instruments	EMC118A45SE	02113	12	10/02/2025
18-40GHz Preamplifier	EMC Instruments	EMC184045SE	02112	12	10/02/2025
Notch filter	MICRO-TRONICS	BRM50702-01	02062	12	02/18/2026
9kHz-30MHz LISN	COM-POWER	LI-220C	ITS 01907	12	04/10/2026
10m Semi-Anechoic	Panashield	10m Chamber	ITS 00984	#	#

= Calibration not required.

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version
Tile	Quantum Change	3.4.K.22
BAT-EMC	Nexio	3.20.0.23

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewers Initials	Date	Change
0 / G106144856	AM	AC	May 28, 2025	Original Document
1 / G106144856	AM 	AC 	August 18, 2025	Updated RSS-247 Issue, Antenna Gain, Test Setup Photos

END OF REPORT