Test Report

Report Number: 105013322MPK-001
Project Number: G105013322
Issue Date: April 11, 2022
Revision Date: July 14, 2022

Testing performed on
Merlin™ 2 PCS
Model Number: MER3700BLE

FCC ID: RIA-MER3700BLE
IC ID: 8454A-MER3700BLE

to

FCC Part 15 Subpart C (15.247)
ISED RSS-247 Issue 2

For

Abbott Laboratories

Test Performed by:	**Test Authorized by:**
Intertek	Abbott Laboratories
1365 Adams Court	15900 Valley View Court
Menlo Park, CA 94025 USA	Sylmar, CA 91342 USA

Prepared by: _____ **Date:** April 11, 2022
Aaron Chang

Reviewed by: _____ **Date:** April 11, 2022
Minh Ly

Report No. 105013322MPK-001	
Equipment Under Test:	Merlin™ 2 PCS
Model Number:	MER3700BLE
Applicant:	Abbott Laboratories
Contact:	Himabindu Gandra
Address:	Abbott Laboratories 15900 Valley View Court Sylmar, CA 91342
Country:	USA
Tel. Number:	(818) 493-2012
Email:	Himabindu.gandra@abbott.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) ISED RSS-247 Issue 2
Date of Test:	May 7, 2021 & April 1 – 7, 2022

We attest to the accuracy of this report:

Aaron Chang
EMC Project Enginner

Minh Ly
EMC Team Lead

TABLE OF CONTENTS

1.0 Summary of Tests

Test	Reference FCC	Reference Industry Canada	Result
RF Output Power	15.247(b)(3)	RSS-247, 5.4.d)	Complies
6 dB Bandwidth	15.247(a)(2)	RSS-247, 5.2.a)	Complies
Power Density	15.247(e)	RSS-247, 5.2.b)	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-247, 5.5	Complies
AC Line Conducted Emission	15.207	RSS-GEN	Complies
Antenna Requirement	15.203	RSS-GEN	Complies (Internal Antenna)

EUT receive date: May 7, 2021

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 7, 2021

Test completion date: April 07, 2022

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

2.0 General Information

2.1 Product Description

Abbott Laboratories supplied the following description of the EUT:

Merlin™ 2 PCS Model MER3700BLE (Hardware) and Model MER3400 (Software) is a portable, dedicated programming system designed to interrogate, program, display data, and test implantable devices and leads. Merlin™ 2 PCS Model MER3700BLE and Model MER3400 programmer system is defined to be the programmer, all attached accessories, cables, and the telemetry interface to support implantable devices.

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

This test report covers only the 2.4GHz BLE radio.

Information about the BLE radio is presented below:

Applicant	Abbott Laboratories
Model No.	MER3700BLE
FCC Identifier	RIA-MER3700BLE
IC Identifier	8454A-MER3700BLE
Type of transmission	Digital Transmission System (DTS)
Rated RF Output	9.33 dBm
Antenna(s) & Gain	Internal Antenna, Gain: +5.03 dBi
Frequency Range	2402 – 2480 MHz
Type of modulation/data rate	GFSK/1Mbit/s
Number of Channel(s)	40
Applicant Name & Address	Abbott Laboratories 15900 Valley View Court Sylmar, CA 91342 USA

2.2 Related Submittal(s) Grants

None.

2.3 Test Facility

The test site used to collect the radiated data is site 1 (10-m semi-anechoic chamber). This test facility and site measurement data have been fully placed on file with the FCC, IC and A2LA accredited.

2.4 Test Methodology

Antenna conducted measurements were performed according to the FCC documents "Guidance for Performing Compliance Measurement on Digital Transmission Systems (DTS) Operating under §15.247" (KDB 558074 D01 DTS Meas Guidance v05r02), and RSS-247 Issue 2, 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.

2.5 Measurement Uncertainty

Compliance with the limits was based on the results of the measurements and doesn't take into account the measurement uncertainty.

Estimated Measurement Uncertainty

Measurement	Expanded Uncertainty (k=2)		
	0.15 MHz – 1 GHz	1 GHz – 2.5 GHz	> 2.5 GHz
RF Power and Power Density – antenna conducted	-	0.7 dB	-
Unwanted emissions – antenna conducted	1.1 dB	1.3 dB	1.9 dB
Bandwidth – antenna conducted	-	30 Hz	-

Measurement	Expanded Uncertainty (k=2)			
	0.15 MHz – 30MHz	30 – 200 MHz	200 MHz – 1 GHz	1 GHz – 18 GHz
Radiated emissions	-	4.7	4.6	5.1 dB
AC mains conducted emissions	2.1 dB	-	-	-

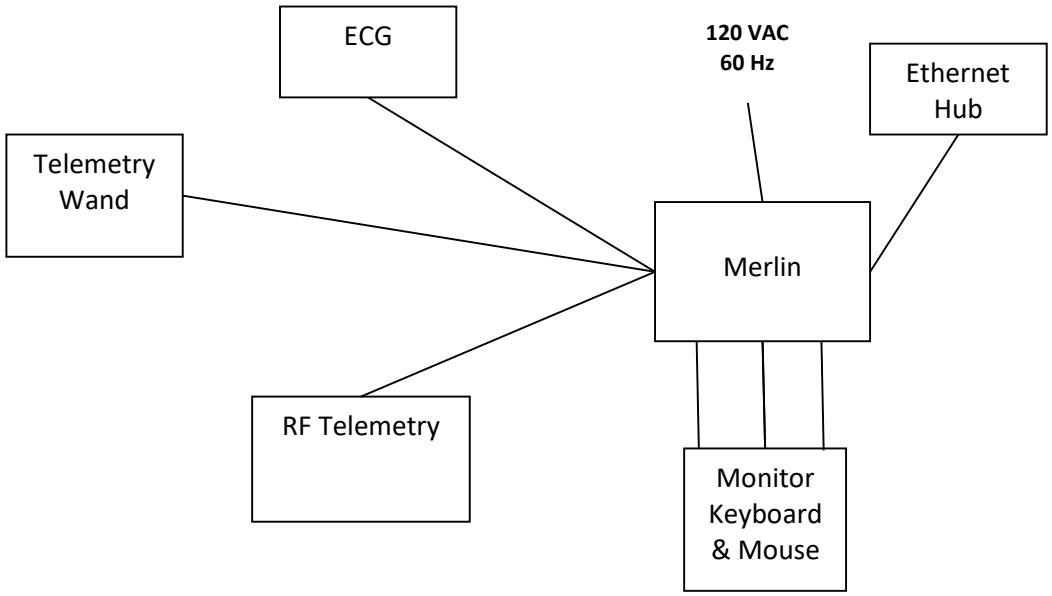
3.0 System Test Configuration

3.1 Support Equipment

Support Equipment		
Description	**Manufacturer**	**Model**
Monitor	HP	E273i
Keyboard	Dell	KB4021
Mouse	HP	M-U0031-O
USB Drives x 4	Generic	NA
Ethernet Hub	Netgear	GS105NA

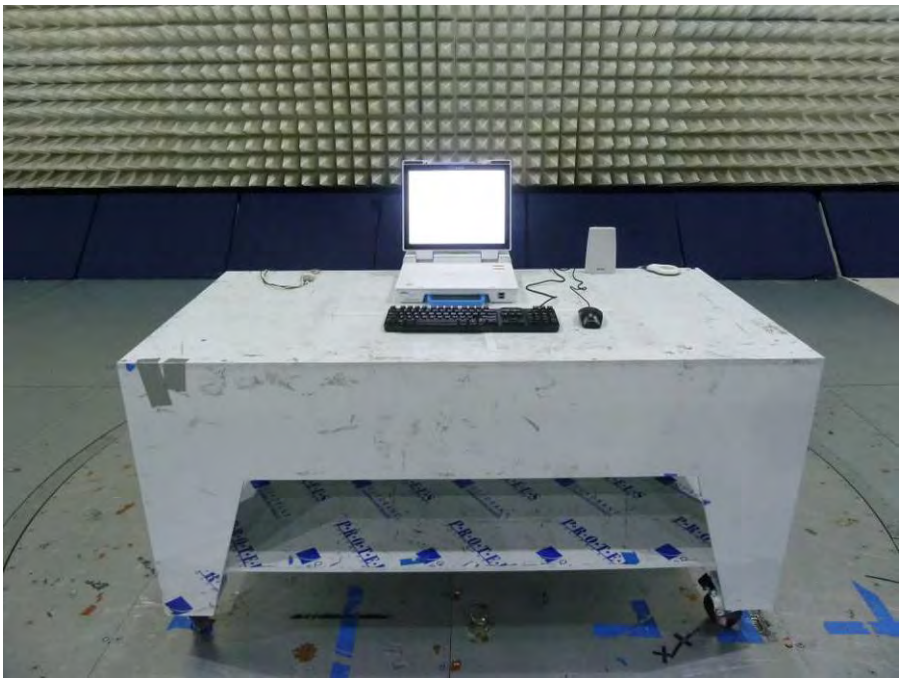
3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	**Manufacturer**	**Model**	**Serial Number**
Merlin™ 2 PCS	Abbott Laboratories	MER3700BLE	124000250
RF Telemetry	Abbott Laboratories	Model 3638	010893
RF Wand	Abbott Laboratories	Model 3630	Not Marked
ECG	Abbott Laboratories	Model 3625	0332530619
Gallant HF Implantable Device	Abbott Laboratories	CDHFA500Q	8009662



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. The EUT was configured to continuously transmit. Different orientation of the EUT were tested and only the worse-case emissions were reported.

The BLE radio was tested being installed in the Host Device model number: MER3700.

The BLE radio device does not simultaneously transmit with other Host Device transmitters (NFC & inductive).

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was provided by Abbott Laboratories.

3.5 Mode of Operation during Test

During the transmitter tests, the transmitter was setup to transmit maximum communication and RF power levels.

EUT was placed into transmit mode at the lowest (2402MHz) middle (2440MHz), and highest (2480MHz) channels.

3.6 Modifications Required for Compliance

No modifications were made by the manufacturer or Intertek to the EUT in order to bring the EUT into compliance.

3.7 Additions, Deviations and Exclusions from Standards

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

4.0 Measurement Results

4.1 6-dB Bandwidth and 99% Occupied Bandwidth
FCC Rule: 15.247(a)(2); RSS-247, 5.2.a) and RSS-GEN;

4.1.1 Requirement

The minimum 6-dB bandwidth shall be at least 500 kHz

4.1.2 Procedure

A spectrum analyzer was connected to the antenna port of the transmitter.

For FCC 6dB Channel Bandwidth the Procedure described in the FCC Publication KDB 558074 D01 Meas Guidance v05r02 was used to determine the DTS occupied bandwidth. Section 11.8.1 Option 1 of ANSI 63.10 was used.

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. 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.

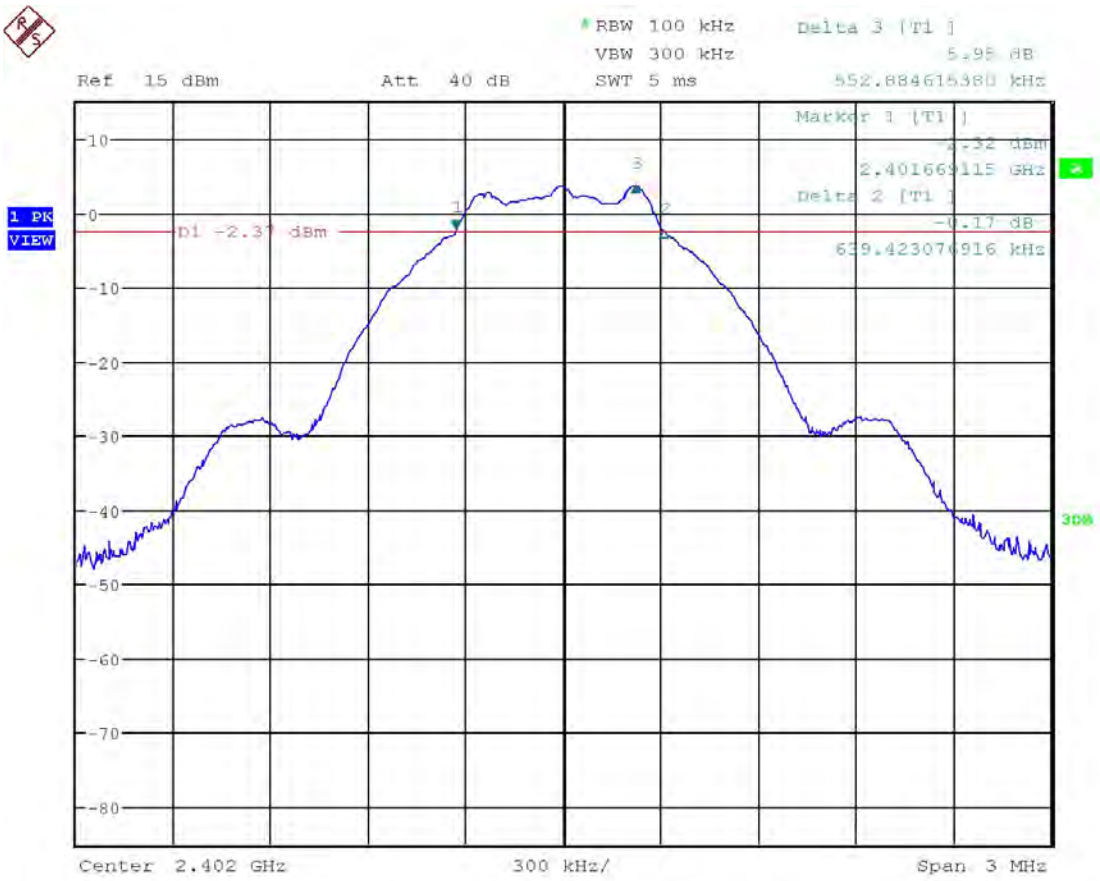
For 99% power bandwidth measurement, the bandwidth was determined by using the built-in 99% occupied bandwidth function of the spectrum analyzer. The resolution bandwidth is set to 1% of the selected span as is without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

4.1.3 Test Result

Frequency (MHz)	6-dB bandwidth FCC 15.247 & RSS-GEN, kHz	Occupied bandwidth, RSS-GEN, MHz	Plot
2402	639.423	--	1.1
	--	1.026	1.4
2440	653.846	--	1.2
	--	1.032	1.5
2480	649.038	--	1.3
	--	1.029	1.6

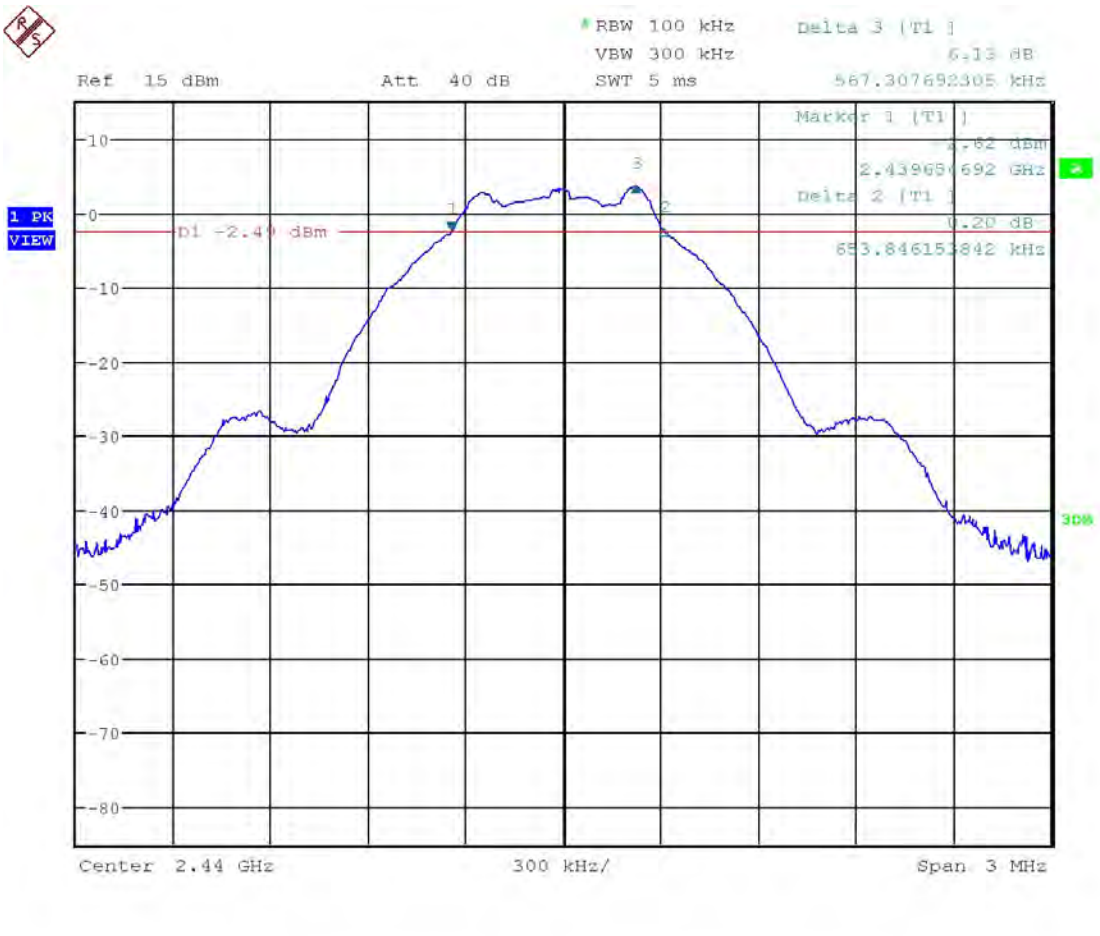
Tested By	Test Date	Results
Aaron Chang	April 07, 2022	Complies

Plot 1. 1

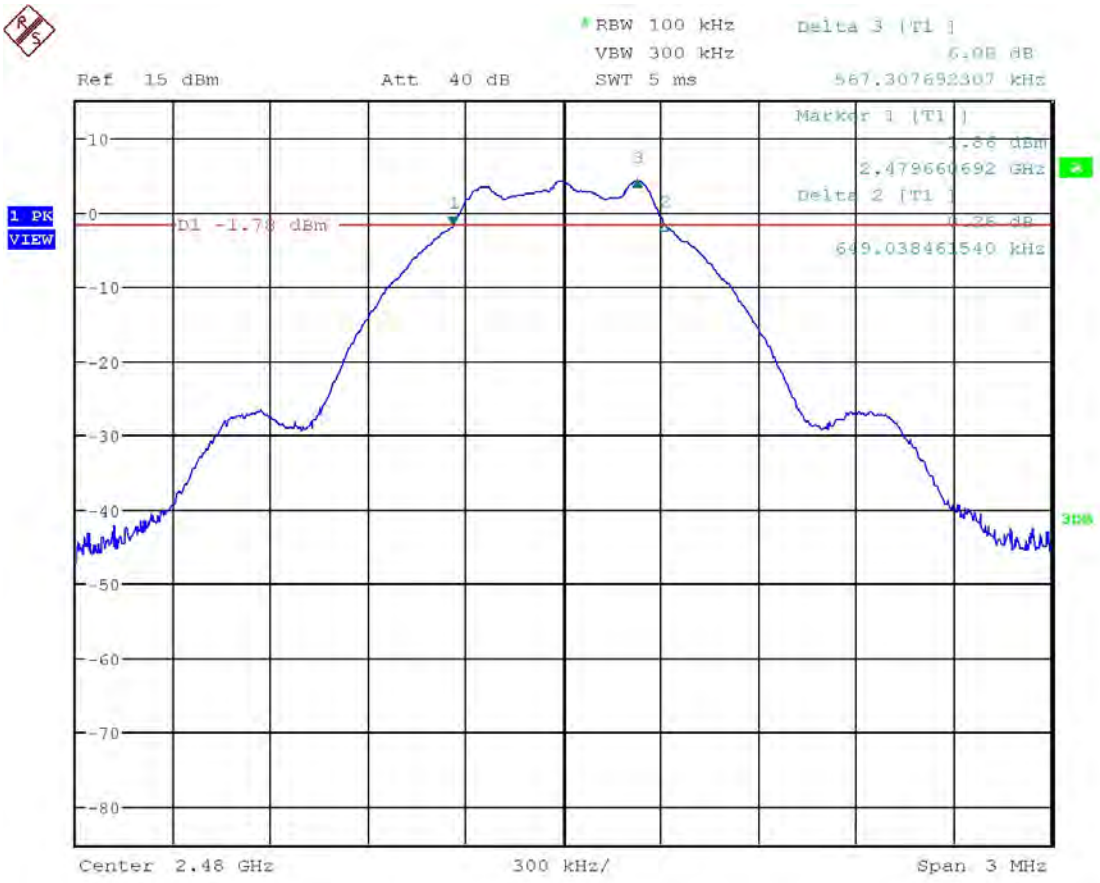


Date: 7.APR.2022 23:11:07

Plot 1. 2

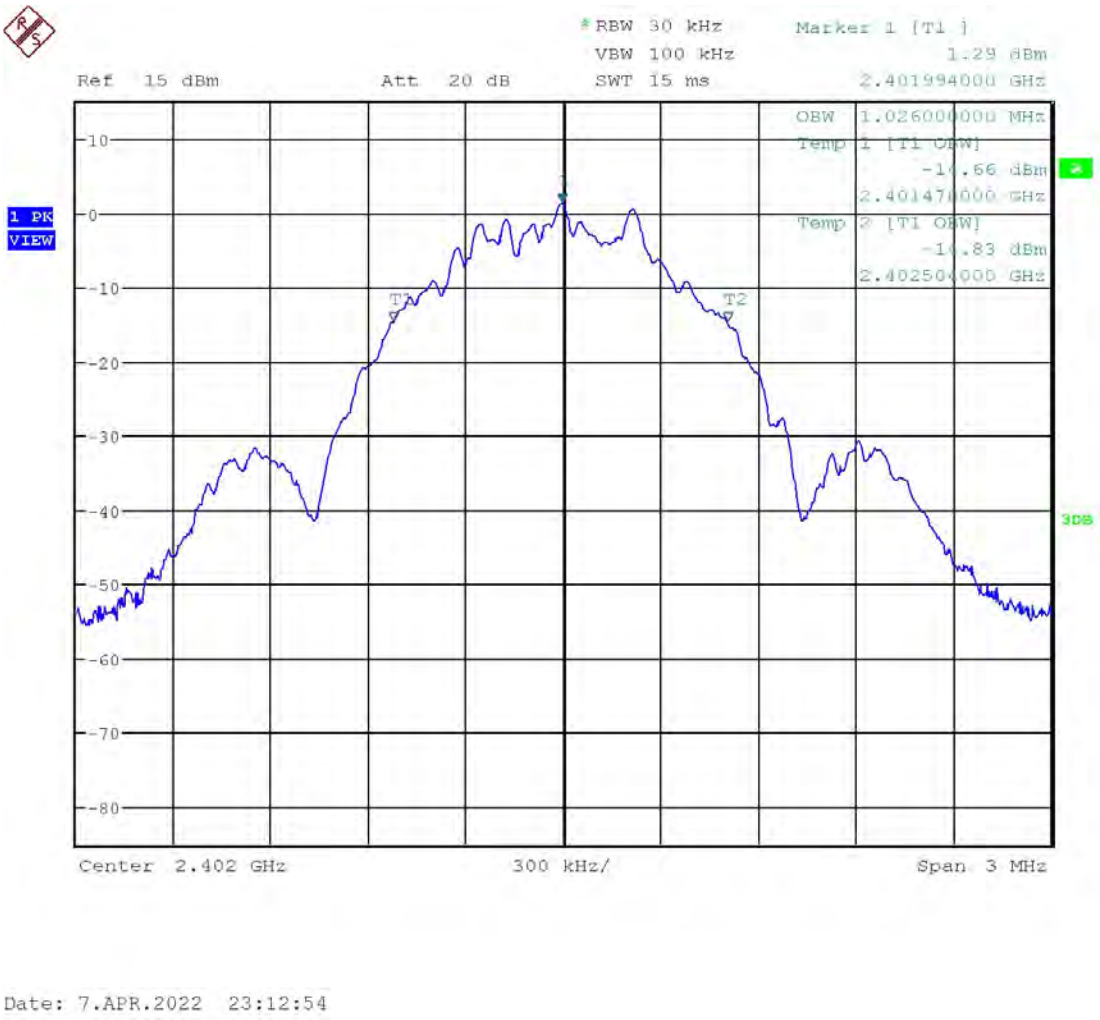

RBW 100 kHz
VBW 300 kHz
SWT 5 ms
Delta 3 [T1]
6.13 dB
567.307692305 kHz
Ref 15 dBm
Att 40 dB
Marker 1 [T1]
Delta 2 [T1]
0.20 dB
1 PK
VIEW
D1 -2.40 dBm
Center 2.44 GHz
300 kHz/
Span 3 MHz
Date: 7.APR.2022 23:09:32

Plot 1. 3

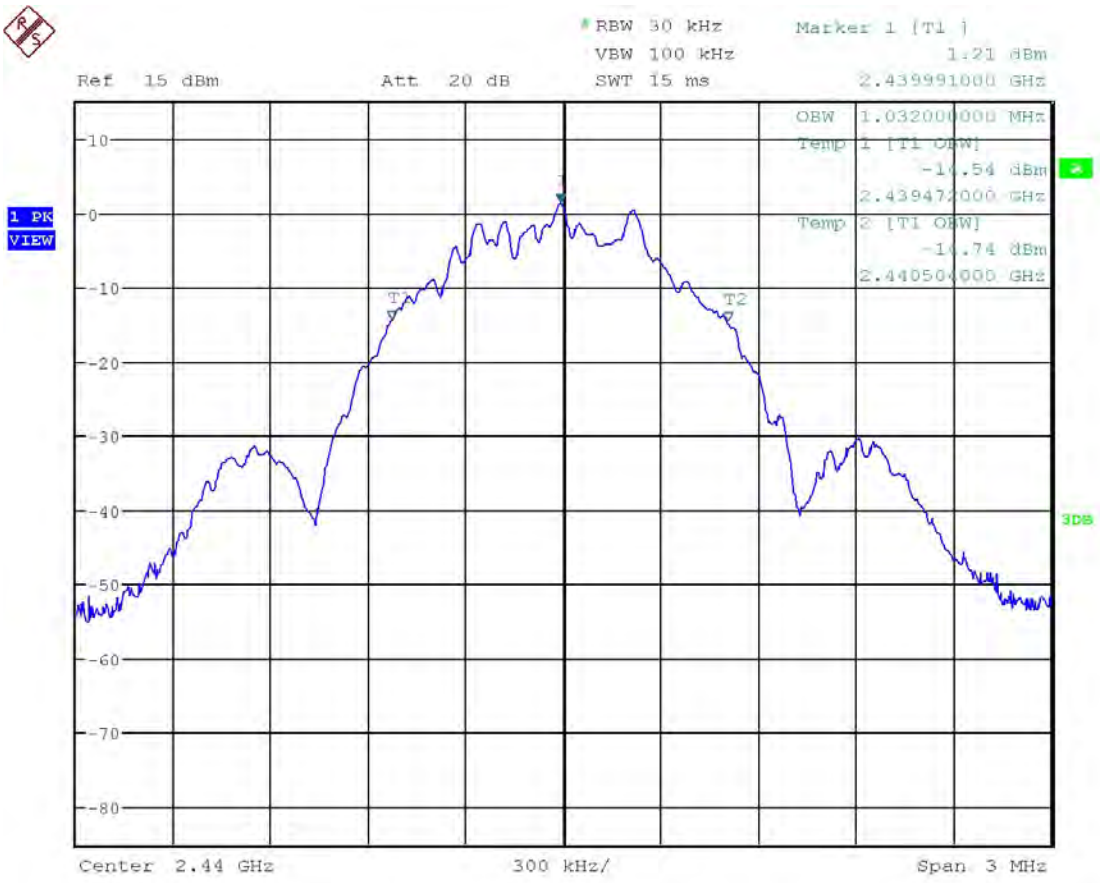


Date: 7.APR.2022 23:07:18

Plot 1. 4

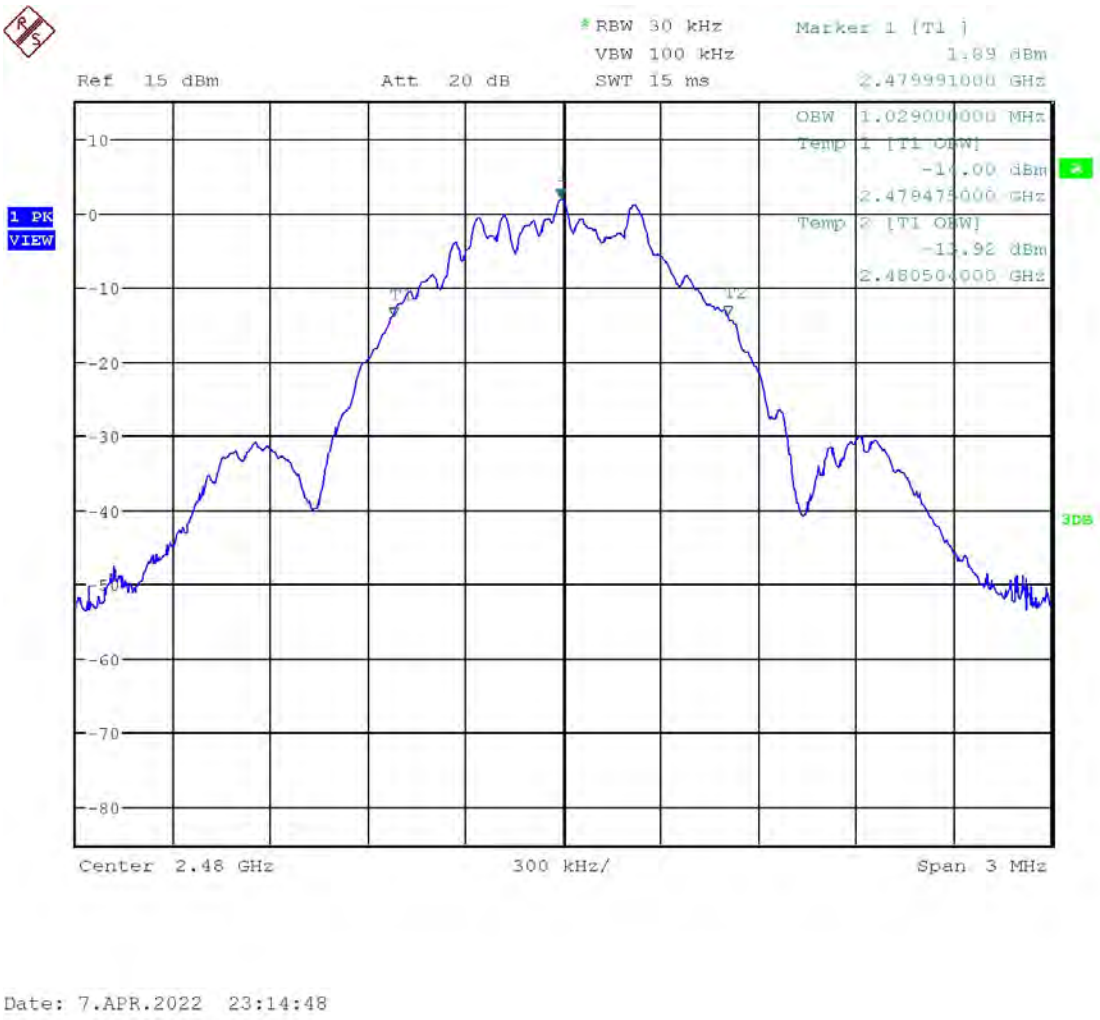

RBW 30 kHz
VBW 100 kHz
SWT 15 ms
Marker 1 [T1]
1.29 dBm
2.401994000 GHz
Ref 15 dBm
Att 20 dB
OBW 1.026000000 MHz
Temp 1 [T1 OBW]
-14.66 dBm
2.401470000 GHz
Temp 2 [T1 OBW]
-14.83 dBm
2.402504000 GHz
1 PK
VIEW
T1
T2
3DB
Center 2.402 GHz
300 kHz/
Span 3 MHz
Date: 7.APR.2022 23:12:54

Plot 1.5



Date: 7.APR.2022 23:13:45

Plot 1.6



Results	Complies

4.2 Maximum Peak Conducted Output Power at Antenna Terminals
FCC Rule: 15.247(b)(3); RSS-247, 5.4.d);

4.2.1 Requirement

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt or 30 dBm.
For antennas with gains greater than 6 dBi, transmitter output level must be decreased appropriately, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2.2 Procedure

The procedure described in FCC Publication KDB 558074 D01 Meas Guidance v05r02 was used. Specifically, section 11.9.1.1 RBW ≥ DTS bandwidth in ANSI 63.10.

1. Set the RBW ≥ DTS Bandwidth
2. Set the VBW ≥ 3 x RBW
3. Set the span ≥ 3 x RBW
4. Detector = Peak
5. Sweep time = Auto couple
6. Trace mode = Max Hold
7. Allow trace to fully stabilize
8. Use peak marker function to determine the peak amplitude level.

A spectrum analyzer was connected to the antenna port of the transmitter.

4.2.3 Test Result

Refer to the following plots 2.1 – 2.3 for the test details.

Frequency	Conducted Power (peak)		Plot
MHz	dBm	mW	
2402	8.36	6.855	2.1
2442	8.36	6.855	2.2
2480	9.33	8.570	2.3

Tested By	Test Date	Results
Ken Roque	April 1, 2022	Complies

Plot 2. 1


RBW 3 MHz
VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
8.36 dBm
2.401935897 GHz
Ref 15 dBm
Att 40 dB
Offset 2.5 dB
1 PK
VIEW
LVL
3DB
Center 2.402 GHz
1 MHz/
Span 10 MHz
Date: 1.APR.2022 11:26:54

Plot 2. 2


RBW 3 MHz
VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
8.36 dBm
2.439871795 GHz
Ref 15 dBm
Att 40 dB
Offset 2.5 dB
1 PK
VIEW
LVL
3DB
Center 2.44 GHz
1 MHz/
Span 10 MHz
Date: 1.APR.2022 11:25:34

Plot 2. 3

Results	Complies

4.3 Maximum Power Spectral Density
FCC: 15.247 (e); RSS-247, 5.2.b);

4.3.1 Requirement

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna should not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.3.2 Procedure

A spectrum analyzer was connected to the antenna port of the transmitter.

The procedure described in FCC Publication KDB 558074 D01 Meas Guidance v05r02, specifically section 11.10.2 Method PKPSD (peak PSD) of ANSI 63.10.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the *DTS bandwidth*.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

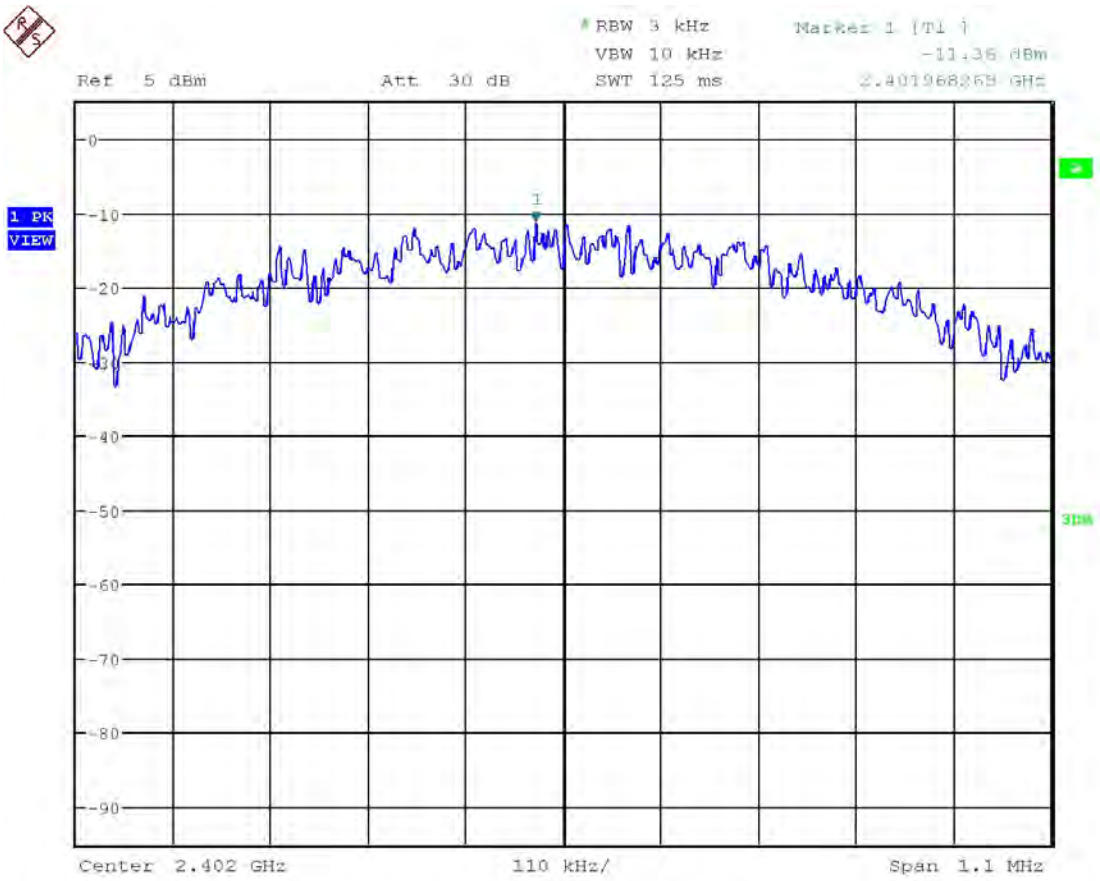
4.3.3 Test Result

Refer to the following plots for the test result

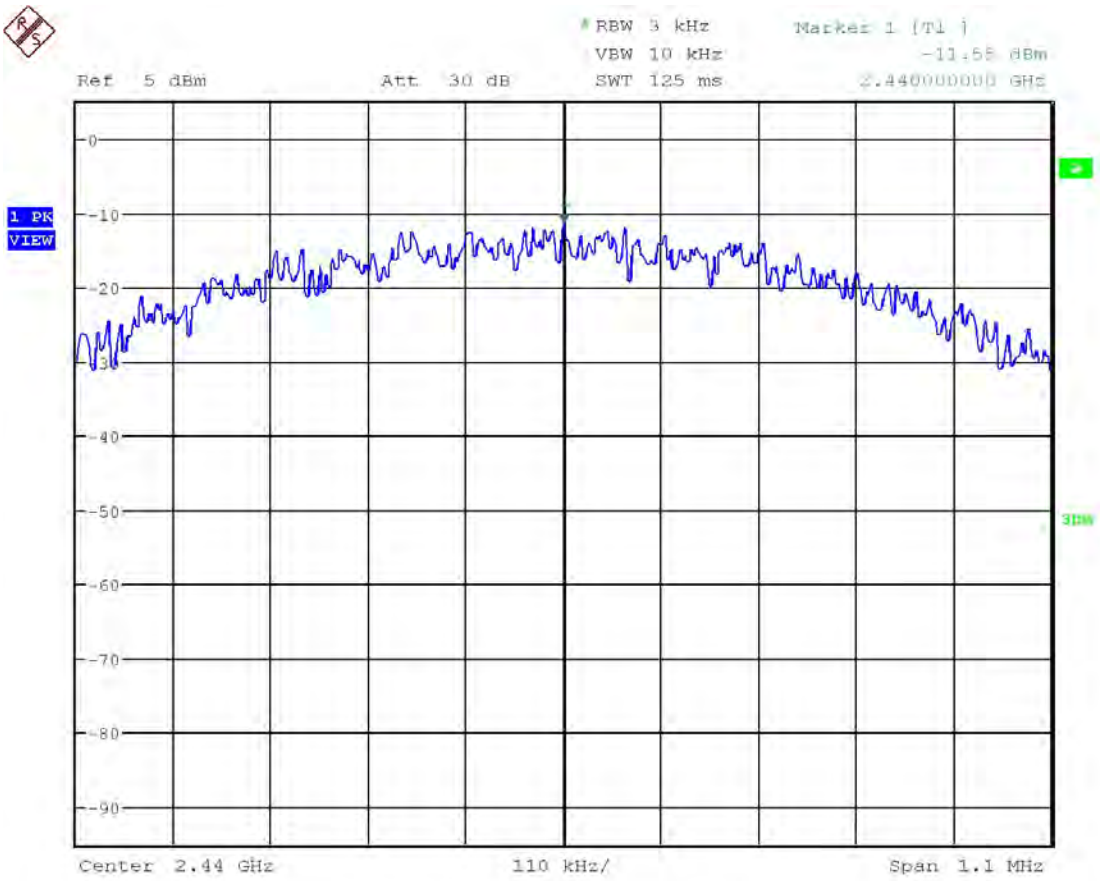
Frequency, MHz	Maximum Power Spectral Density, dBm	Maximum Power Spectral Density Limit, dBm	Margin, dB	Plot
2402	-11.36	8.0	-19.36	3.1
2440	-11.55	8.0	-19.55	3.2
2480	-11.08	8.0	-19.08	3.3

Tested By	Test Date	Results
Aaron Chang	April 11, 2022	Complies

Plot 3. 1

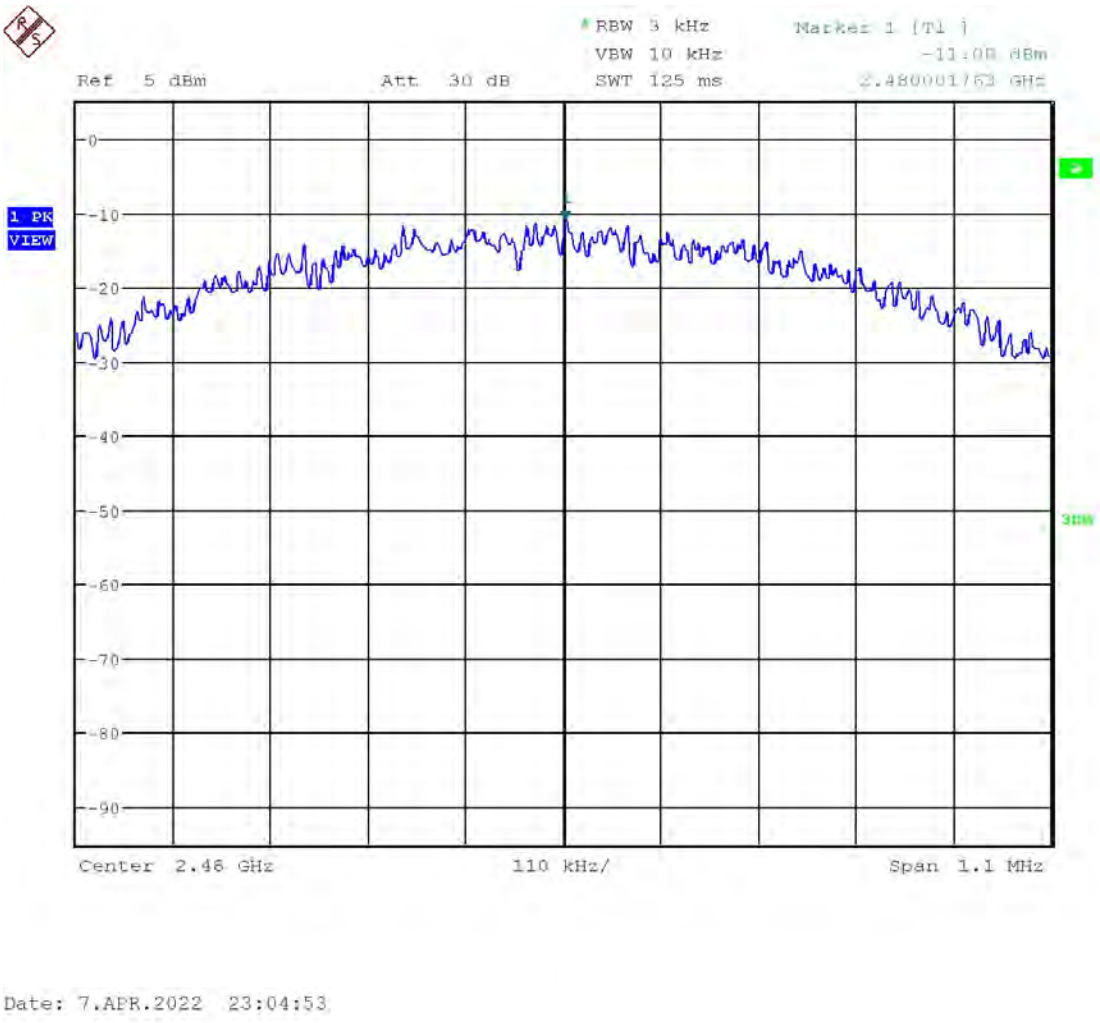

RBW 3 kHz
VBW 10 kHz
SWT 125 ms
Marker 1 [T1]
-11.36 dBm
2.401968269 GHz
Ref 5 dBm
Att 30 dB
1 PK
VIEW
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.402 GHz
110 kHz/
Span 1.1 MHz
Date: 7.APR.2022 23:03:05

Plot 3. 2



Date: 7.APR.2022 23:04:05

Plot 3. 3



Results	Complies

4.4 Out of Band Antenna Conducted Emission
FCC: 15.247(d); RSS-247, 5.5;

4.4.1 Requirement

In any 100 kHz bandwidth outside the EUT pass-band, the RF power shall be below the maximum in-band 100 kHz emissions by at least 20 dB (if peak power of in-band emission is measured) or 30 dB (if average power of in-band emission is measured).

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)

4.4.2 Procedure

The procedure described in FCC Publication KDB 558074 D01 Meas Guidance v05r02, specifically section 11.11 DTS Emissions in non-restricted frequency bands of ANSI 63.10.

A spectrum analyzer was connected to the antenna port of the transmitter.

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 3 x RBW.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

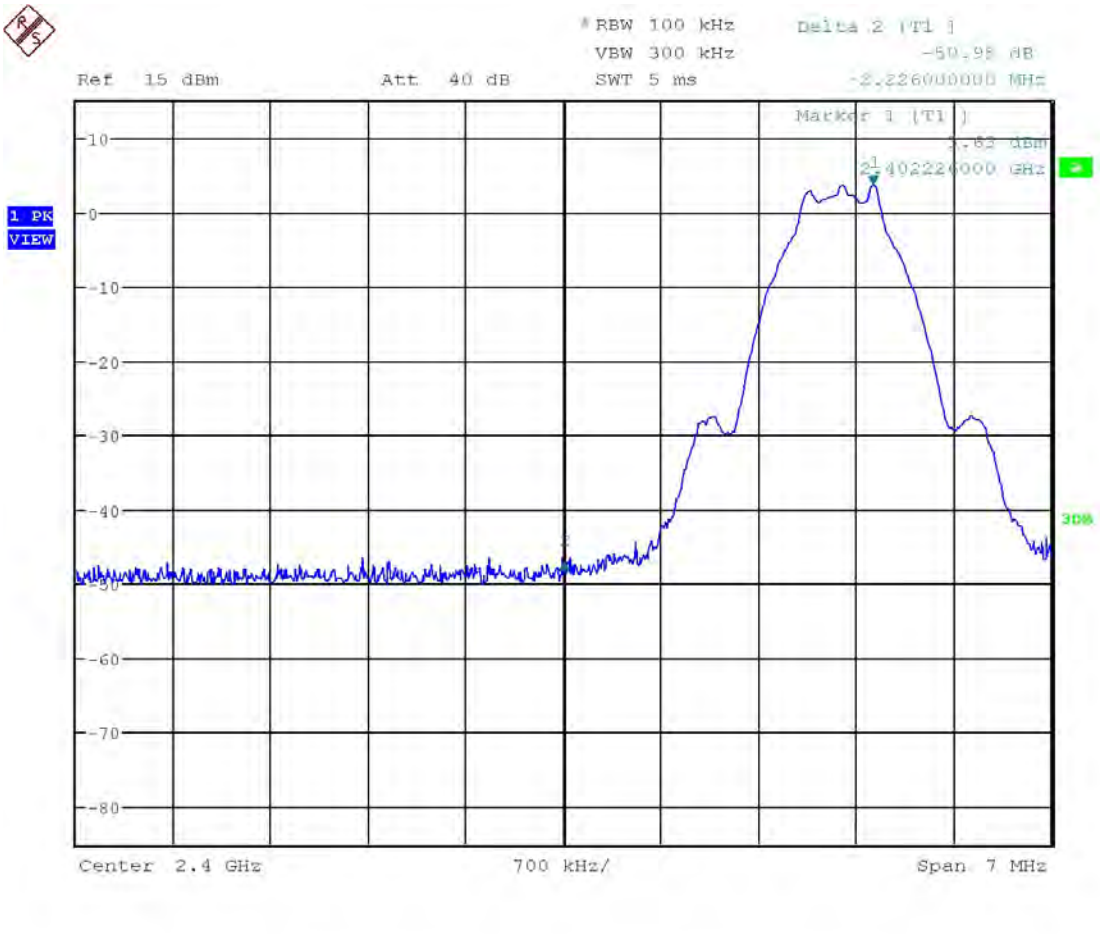
The unwanted emissions were measured from 30 MHz to 25 GHz. Plots below are corrected for cable loss and then compared to the limits.

4.4.3 Test Result

Refer to the following plots 4.1 – 4.5 for unwanted conducted emissions. The plot shows -20dB attenuation limit line.

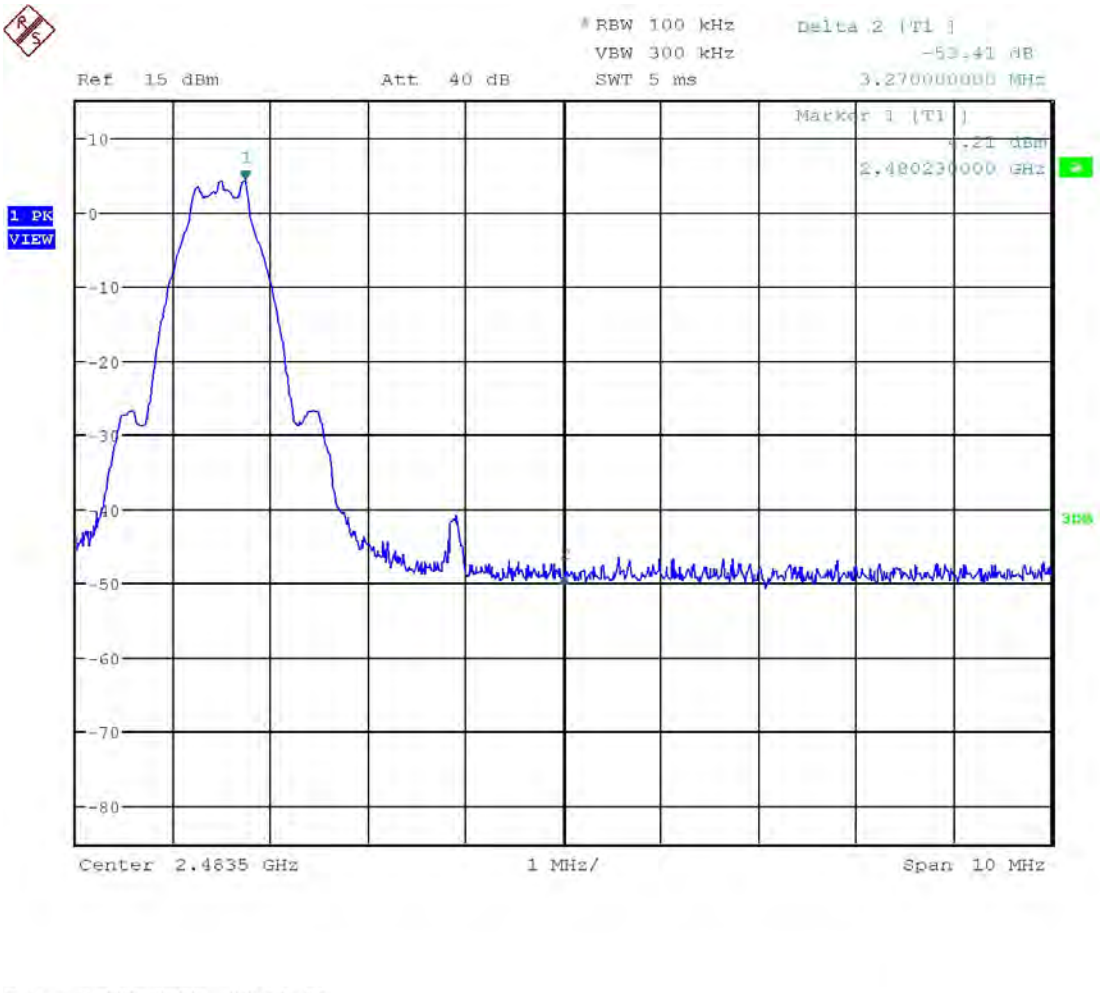
Tested By	Test Date	Results
Aaron Chang	April 11, 2022	Complies

Tx @ Low Channel, 2402 MHz Band Edge
Plot 4.1



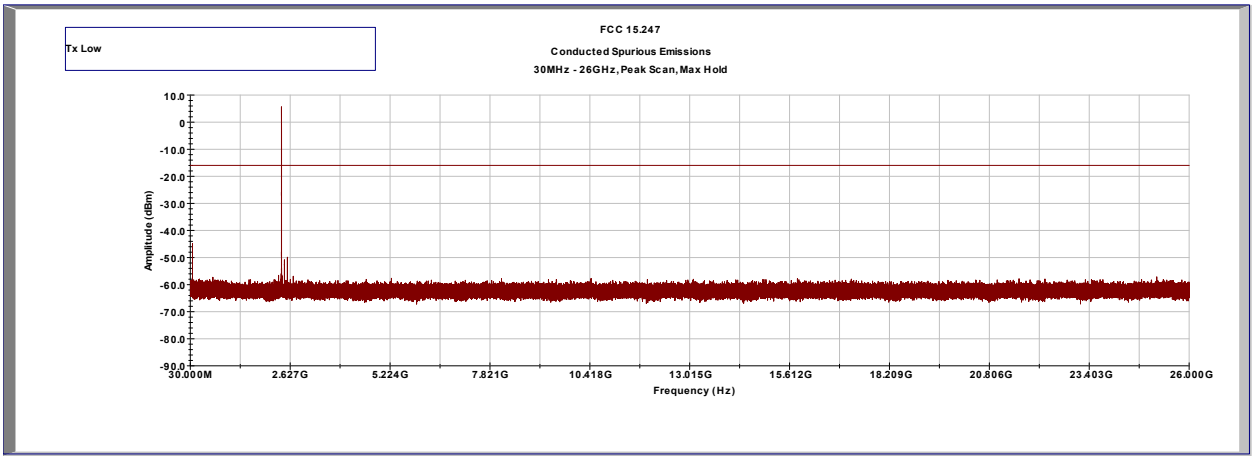
Date: 7.APR.2022 23:18:08

Tx @ High Channel, 2480 MHz Band Edge
Plot 4.2

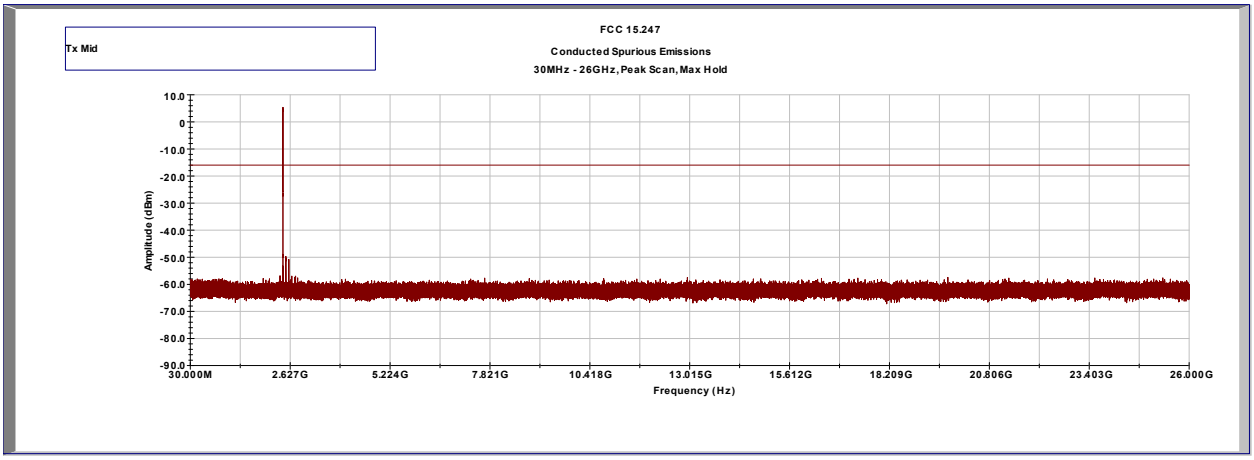


Results	Complies

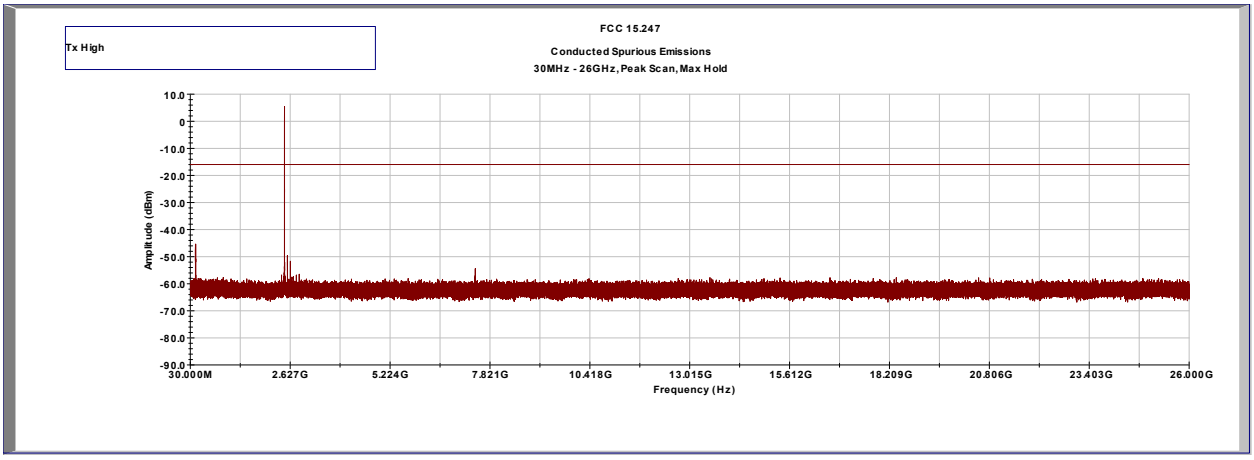
Tx @ Low Channel, 2402 MHz
30MHz -26GHz Conducted Spurious
Plot 4.3



Tx @ Mid Channel, 2440 MHz
30MHz -26GHz Conducted Spurious
Plot 4.4



Tx @ High Channel, 2480 MHz
30MHz -26GHz Conducted Spurious
Plot 4.5



Results	**Complies**

4.5 Transmitter Radiated Emissions
FCC Rules: 15.247(d), 15.209, 15.205; RSS-247, 5.5;

4.5.1 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.

4.5.2 Procedure

Radiated emission measurements were performed from 9 kHz to 26.5 GHz according to the procedure described in ANSI C63.10: 2013. Spectrum Analyzer Resolution Bandwidth is 200Hz or greater for frequencies 9kHz to 30MHz, 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz. Above 1000 MHz Peak and Average measurements were performed.

The EUT is placed on a plastic turntable that is 80 cm in height for below 1000MHz and 1.5m in height for above 1GHz. 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.

Measurements made from 1 GHz to 18GHz had a 2.4-2.5GHz notch filter in place. A preamp was used from 9kHz to 26.5GHz.

All measurements were made with a Peak Detector and compared to QP limits for 30MHz – 1GHz and Average limits for 1GHz – 26.5GHz.

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.

4.5.3 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.

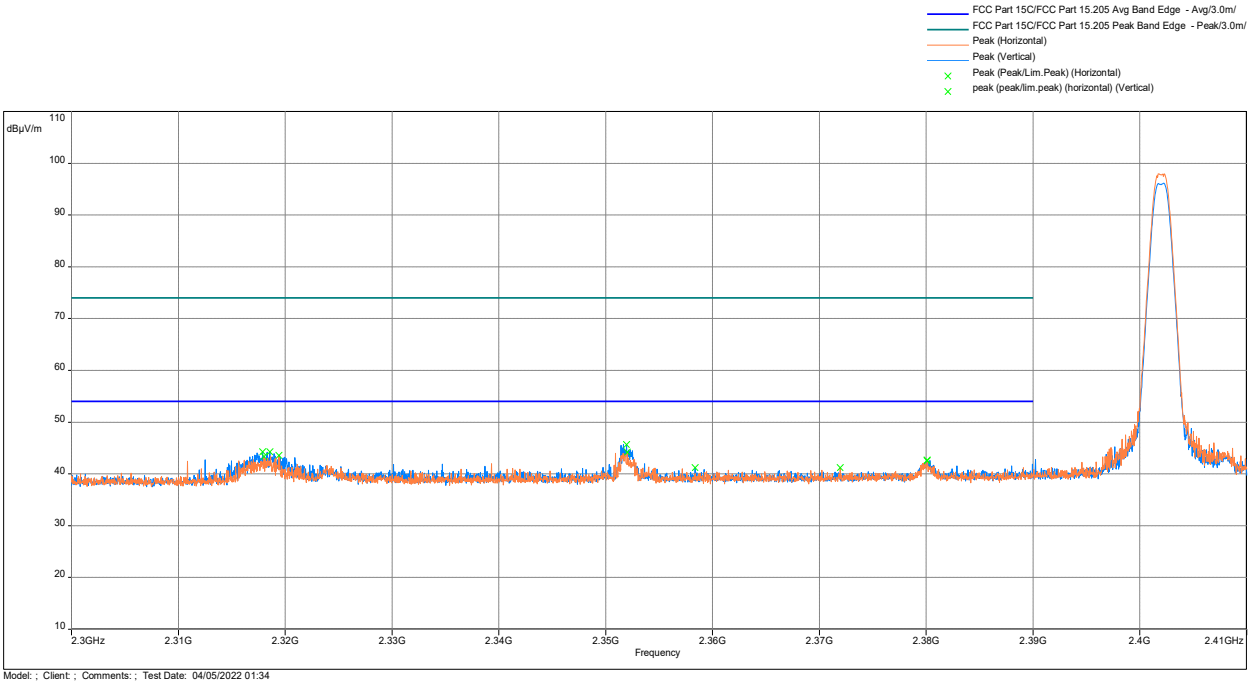
4.5.4 Test Results

All testing in this section were performed by radiated measurements.

Tested By	Test Date	Results
Aaron Chang	April 3 – 5, 2022	Complies

Test Results: 15.209/15.205 Radiated Restricted Band Emissions

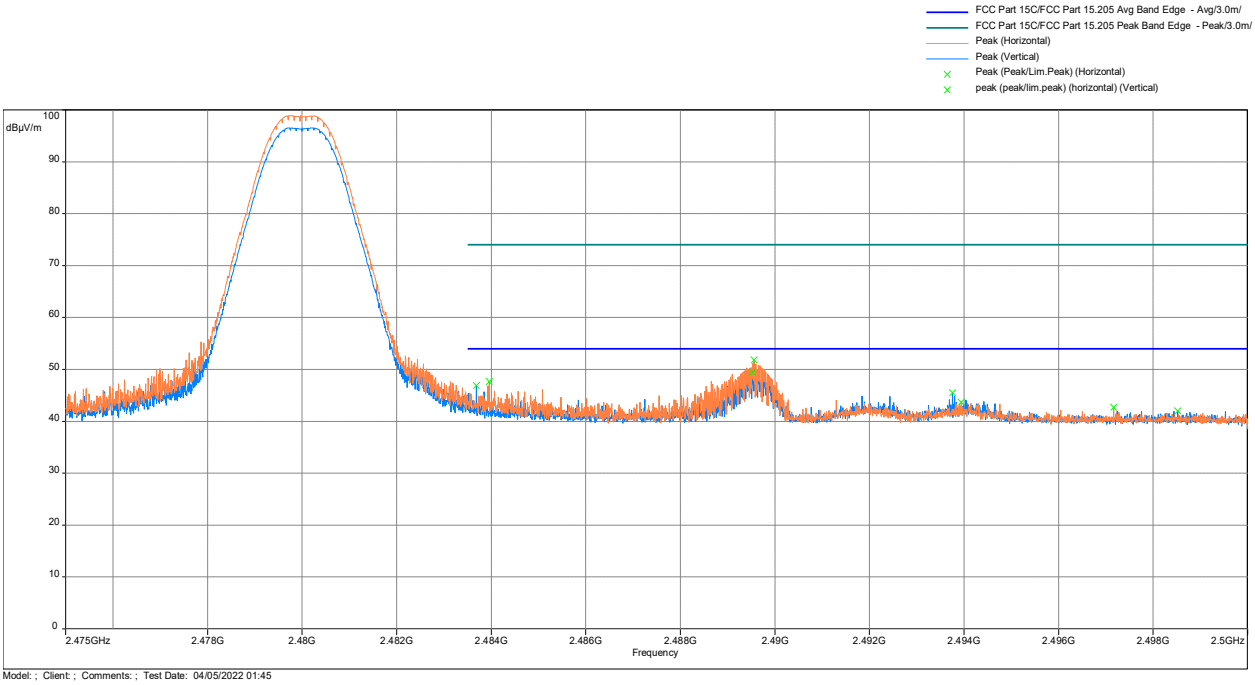
Out-of-Band Radiated spurious emissions at the Band-edge
2310–2390 MHz, Peak Scan with Peak Limit and Average Limit



Freq. MHz	Peak@3m dB(uV/m)	Ave Limit dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
2351.942	45.63	54	-8.37	2.99	129.5	Vertical	-12.34
2390	41.9	54	-12.1	1.00	30.5	Vertical	-11.93

Note: Correction = AF + CF + DCF – Preamp

Out-of-Band Radiated spurious emissions at the Band-edge
2483.5–2500 MHz, Peak Scan with Peak Limit and Average Limit



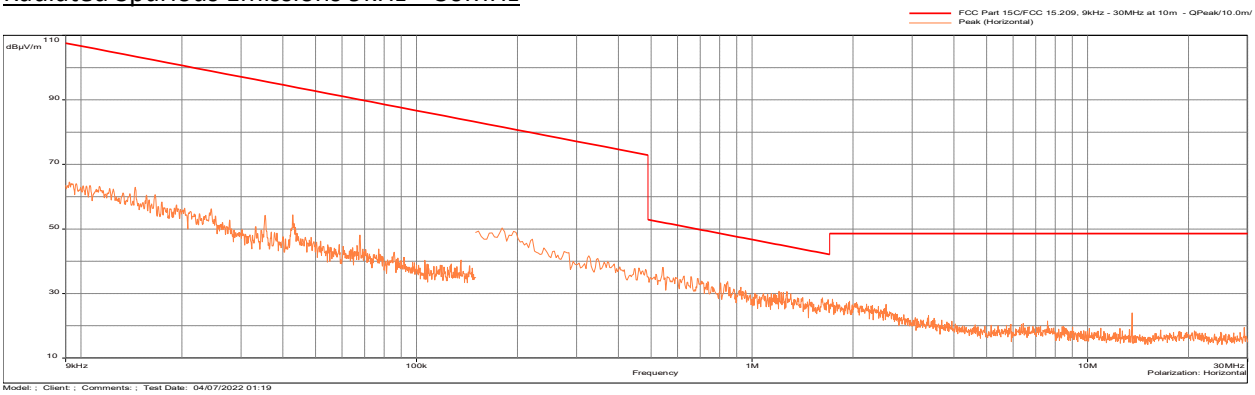
Freq. MHz	Peak@3m dB(uV/m)	Ave Limit dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
2483.5	45.09	54	-8.91	1.00	243.5	Vertical	-10.86
2489.563	51.81	54	-2.19	2.01	209.0	Horizontal	-10.86

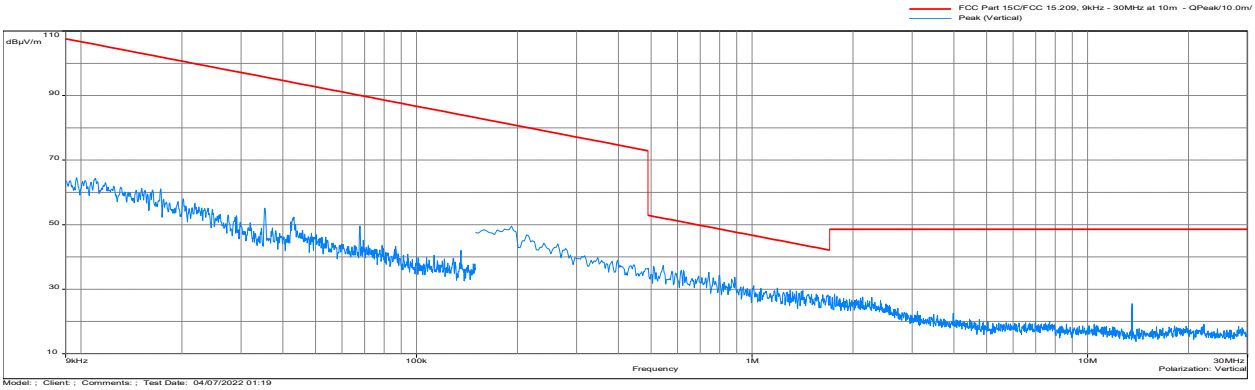
Note: Correction = AF + CF + DCF – Preamp

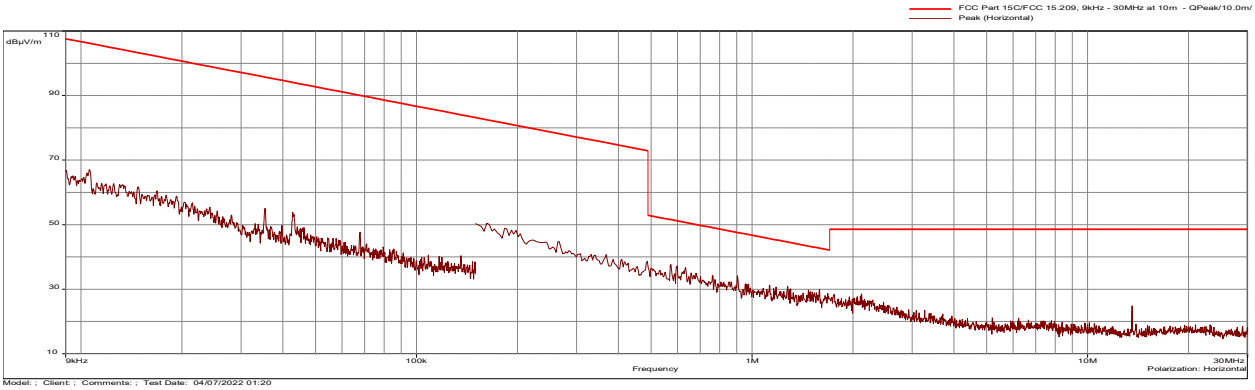
Out-of-Band Radiated Spurious Emissions

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2402MHz

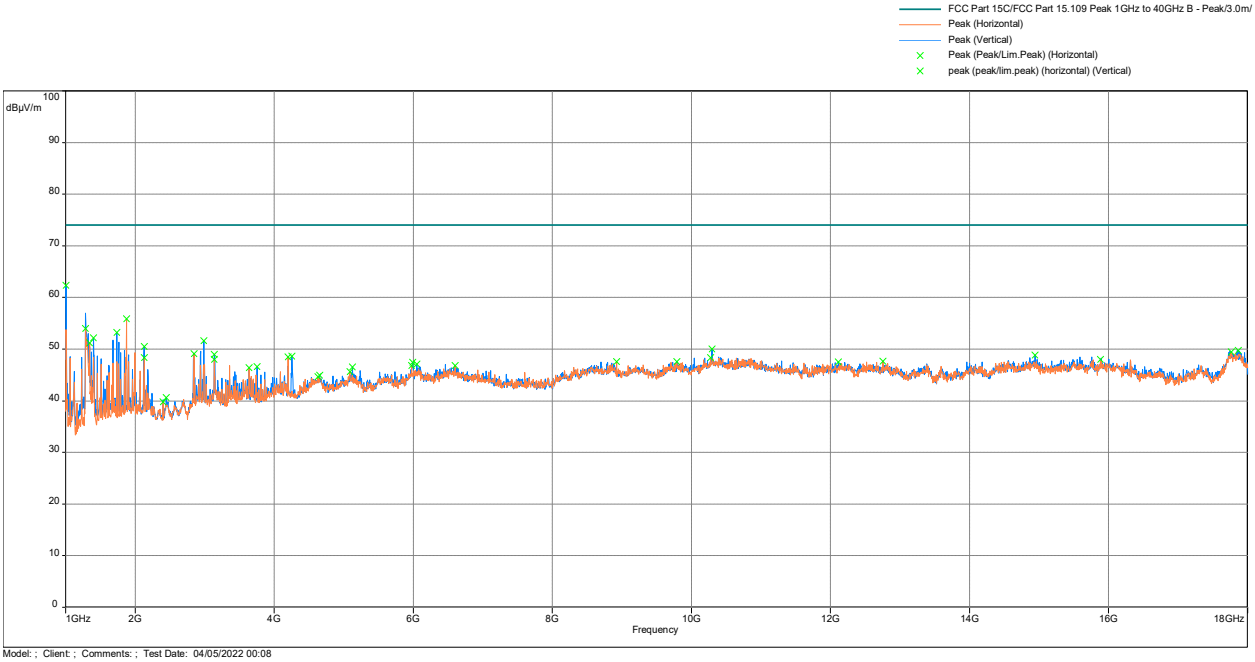
Radiated Spurious Emissions 9kHz – 30MHz



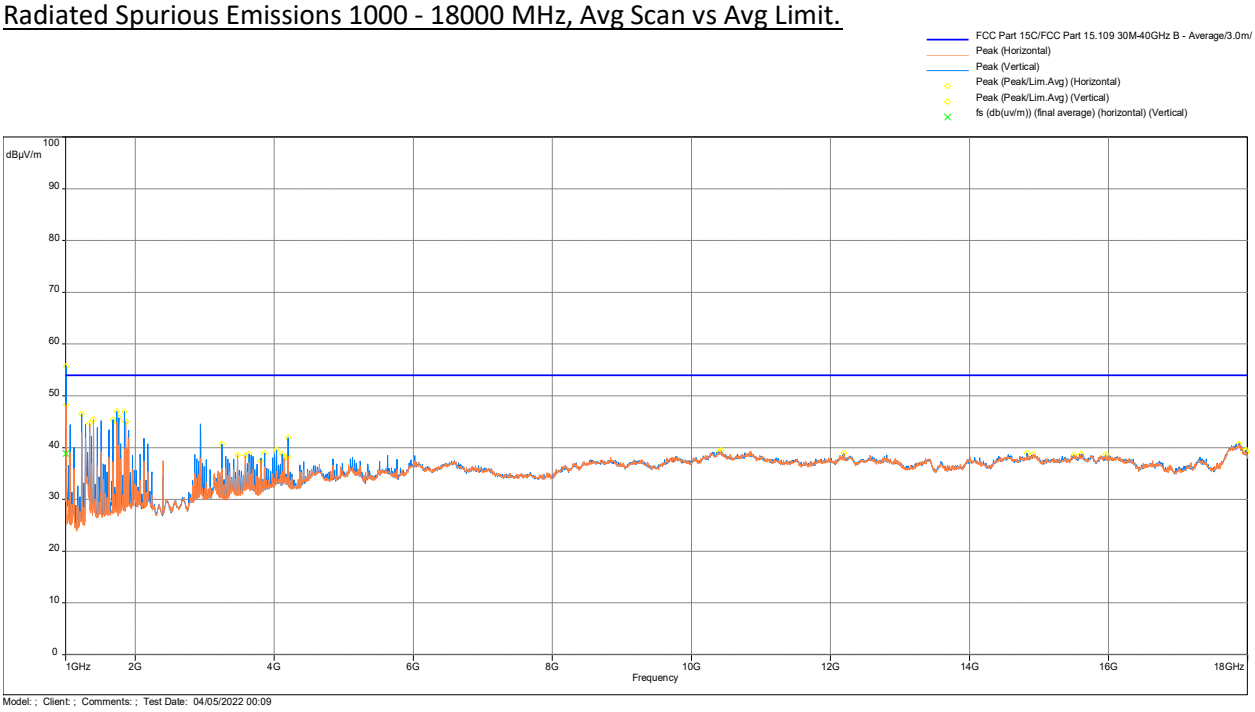




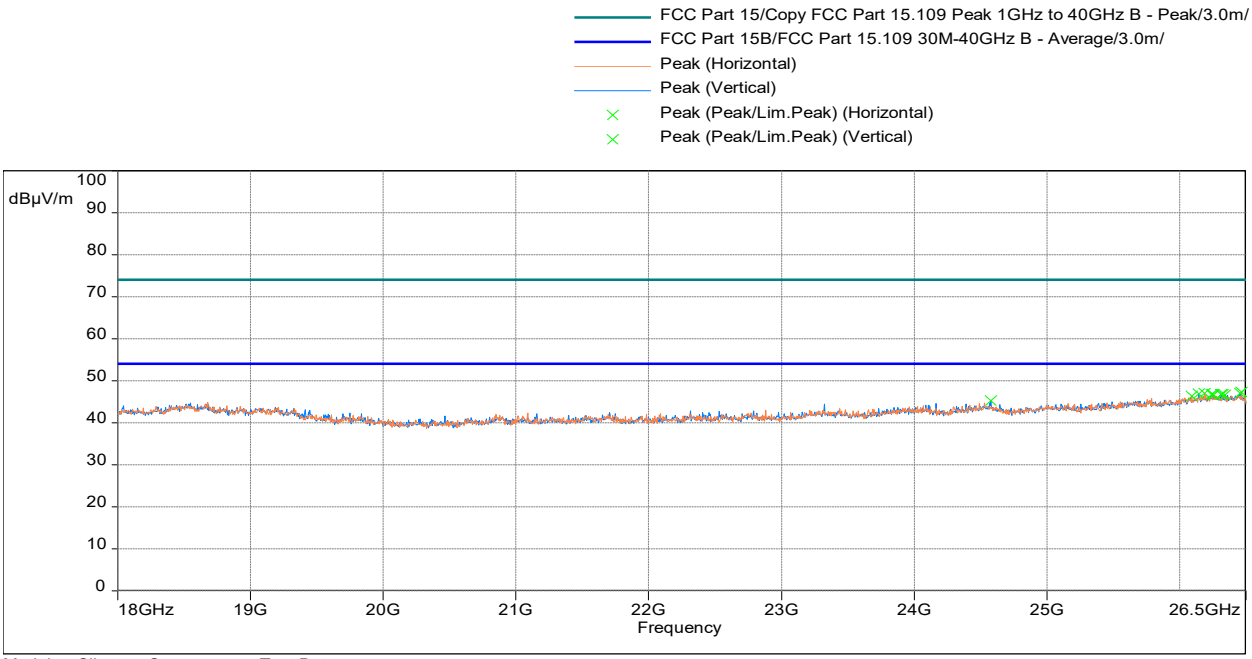
Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Peak Limit.



Radiated Spurious Emissions 1000 - 18000 MHz, Avg Scan vs Avg Limit.



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



Model: ; Client: ; Comments: ; Test Date:

Frequency (MHz)	Q-Peak @10m (dBµV/m)	Lim. Q-Peak @10m (dBµV/m)	Margin (dB)	Angle (°)	Height (m)	Comment	Correction (dB)
30.226	22.36	29.5	-7.14	1.96	128	Horizontal	-5.94
40.799	27.61	29.5	-1.89	2	338	Vertical	-13.56
55.964	29.1	29.5	-0.4	4	268.25	Vertical	-19.53
68.574	21.55	29.5	-7.95	2.97	56.75	Horizontal	-18.32
69.479	21.75	29.5	-7.75	2.97	56.75	Horizontal	-18.22
72.680	24.33	29.5	-5.17	4	197.5	Vertical	-18.14
73.424	25.42	29.5	-4.08	2	57.5	Vertical	-18.18
85.678	28.31	29.5	-1.19	2	101.5	Vertical	-18.91
85.678	25.29	29.5	-4.21	4	66.75	Horizontal	-18.91
111.545	30.87	33	-2.13	2	154	Vertical	-13.35
124.219	27.05	33	-5.95	1	173	Vertical	-11.85
127.032	27.53	33	-5.47	1	233.75	Vertical	-11.83
167.126	30.64	33	-2.36	4	85.25	Horizontal	-13.93
167.190	31.2	33	-1.8	2	197.75	Vertical	-13.93
167.546	31.58	33	-1.42	4	85.25	Horizontal	-13.93
168.516	27.51	33	-5.49	2.97	84	Horizontal	-13.97
223.741	30.3	35.5	-5.2	4	0	Horizontal	-14.36
224.808	30.98	35.5	-4.52	1	355.25	Vertical	-14.33
251.871	33.61	35.5	-1.89	4	199.25	Horizontal	-13.57
252.130	30.02	35.5	-5.48	2.97	197.25	Horizontal	-13.57
336.003	32.55	35.5	-2.95	1	181.75	Vertical	-10.6
448.038	30.54	35.5	-4.96	1.96	171	Horizontal	-7.3
504.007	33.86	35.5	-1.64	3	110.25	Vertical	-6.09
504.039	29.92	35.5	-5.58	4	242.75	Horizontal	-6.09
515.162	30.27	35.5	-5.23	2	188.25	Vertical	-6.1
515.291	30.18	35.5	-5.32	1.96	2.5	Horizontal	-6.11
516.714	29.69	35.5	-5.81	1.96	2.5	Horizontal	-6.18
518.686	29.53	35.5	-5.97	1.96	355	Horizontal	-6.17
559.394	29.82	35.5	-5.68	3	181.75	Vertical	-5.45
562.271	30.74	35.5	-4.76	3	172	Vertical	-5.33
572.747	30.37	35.5	-5.13	1.96	0	Horizontal	-5
615.880	32.17	35.5	-3.33	0.99	163.25	Horizontal	-4.69
616.009	34.8	35.5	-0.7	2	197.75	Vertical	-4.69
671.946	33.94	35.5	-1.56	2	0.25	Vertical	-3.41
839.950	30.1	35.5	-5.4	2.97	197.25	Horizontal	-0.67
840.015	31.5	35.5	-4	3	0	Vertical	-0.67
896.016	30.34	35.5	-5.16	4	268.25	Vertical	0.36
896.081	31.36	35.5	-4.14	0.99	303	Horizontal	0.36

Note: Correction = AF + CF - Preamp

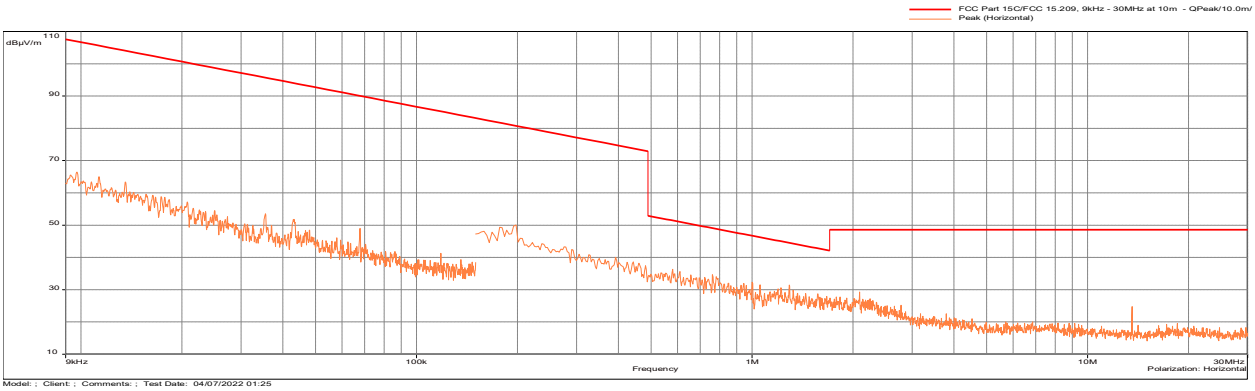
Frequency (MHz)	Peak @3m (dBµV/m)	Lim. Peak @3m (dBµV/m)	Margin dB)	Angle (°)	Height (m)	Comment	Correction (dB)
1008.000	62.34	74	-11.66	209.5	4.00	Vertical	-16.85

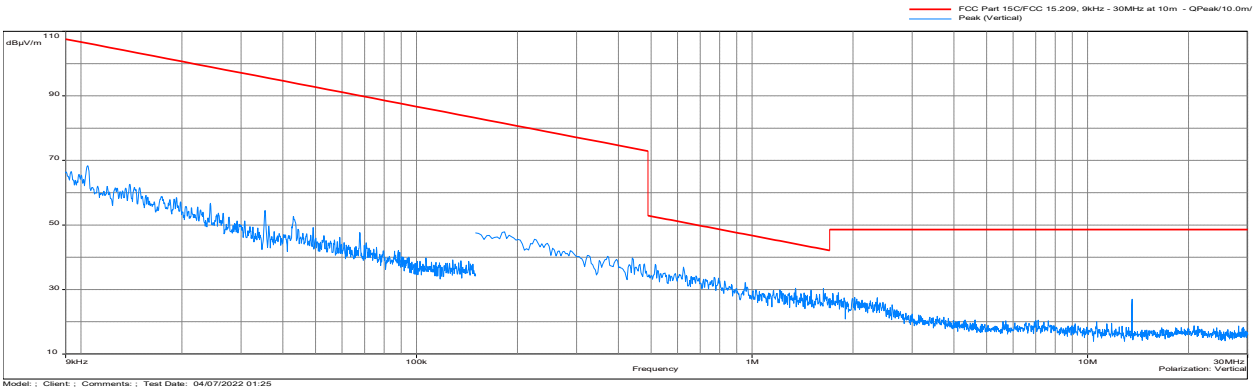
Frequency (MHz)	Avg @3m (dBµV/m)	Lim. Avg @3m (dBµV/m)	Margin dB)	Angle (°)	Height (m)	Comment	Correction (dB)
1008.000	38.86	54	-15.14	273	1.02	Vertical	-16.85

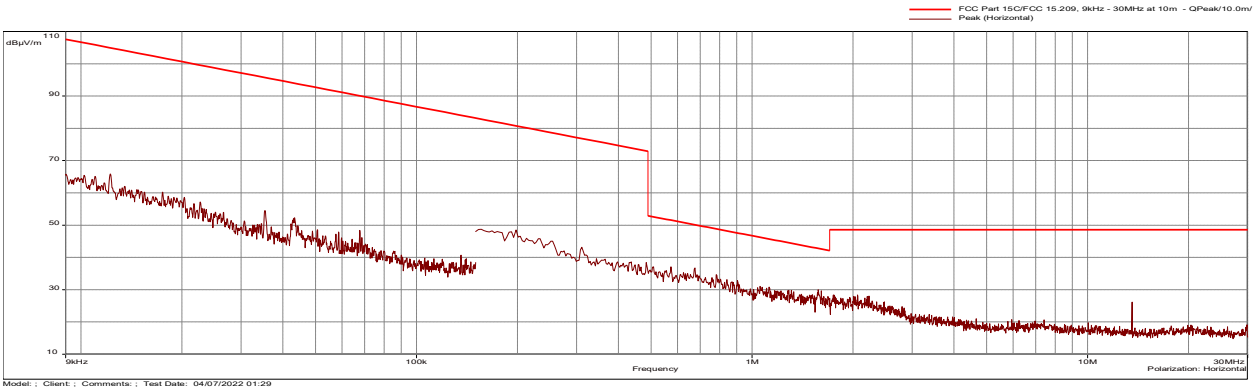
Results	Complies

Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440 MHz

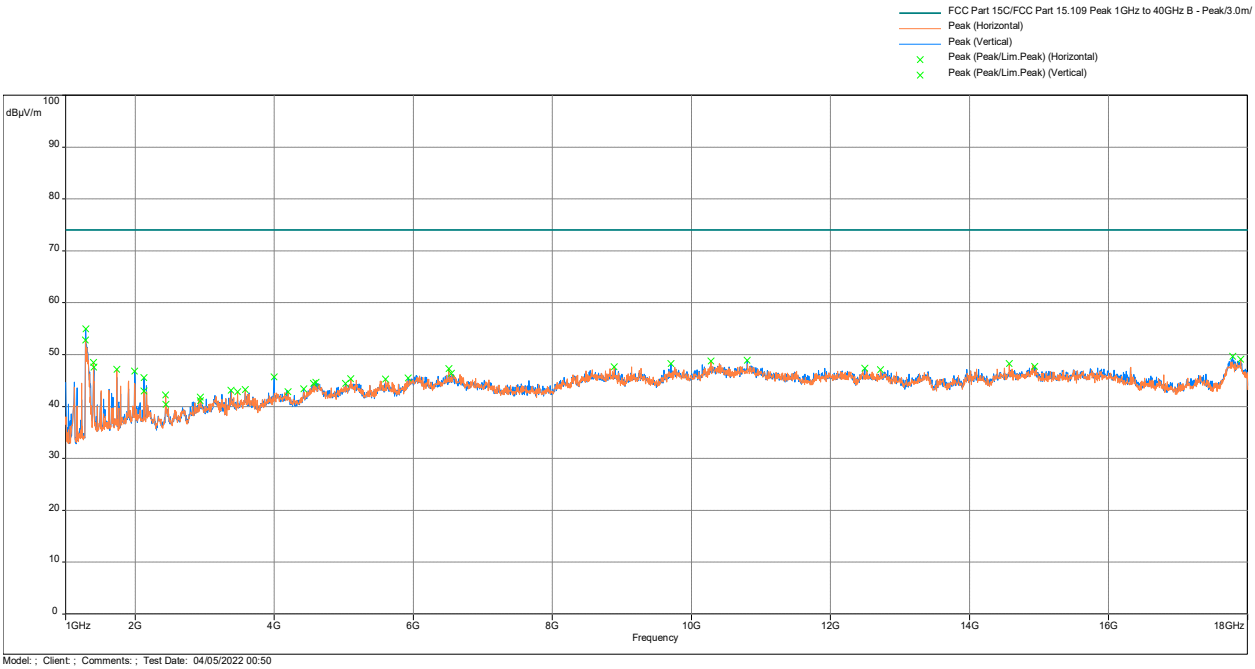
Radiated Spurious Emissions 9kHz – 30MHz





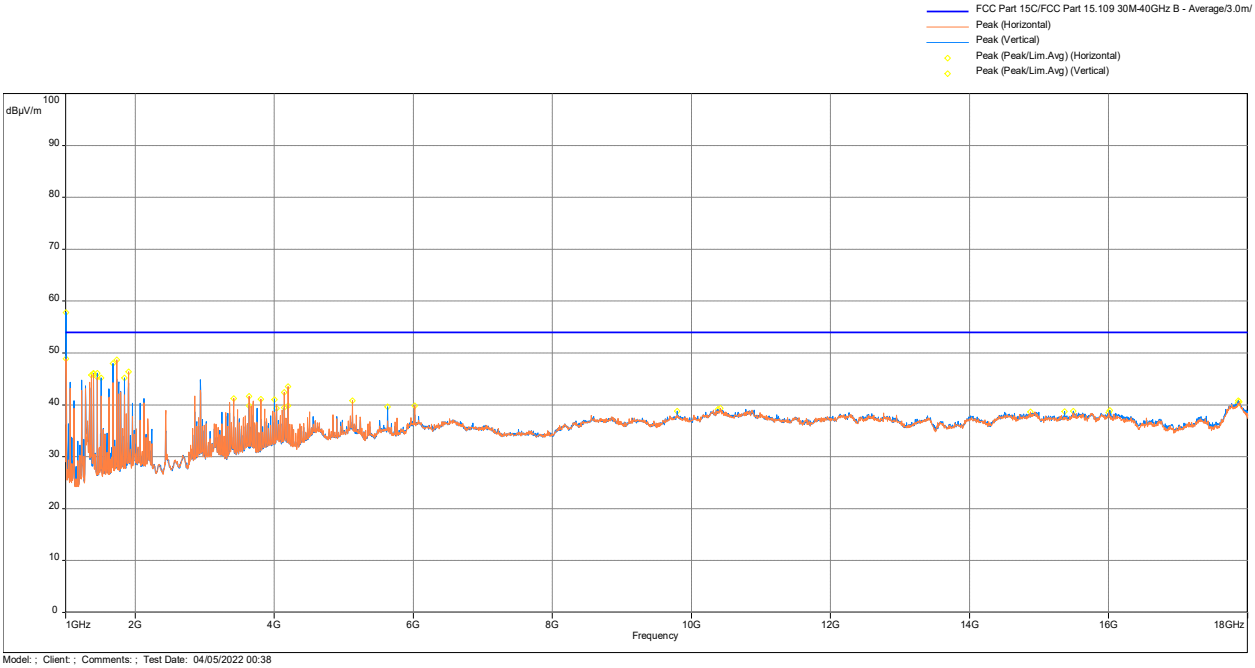


Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Peak Limit.



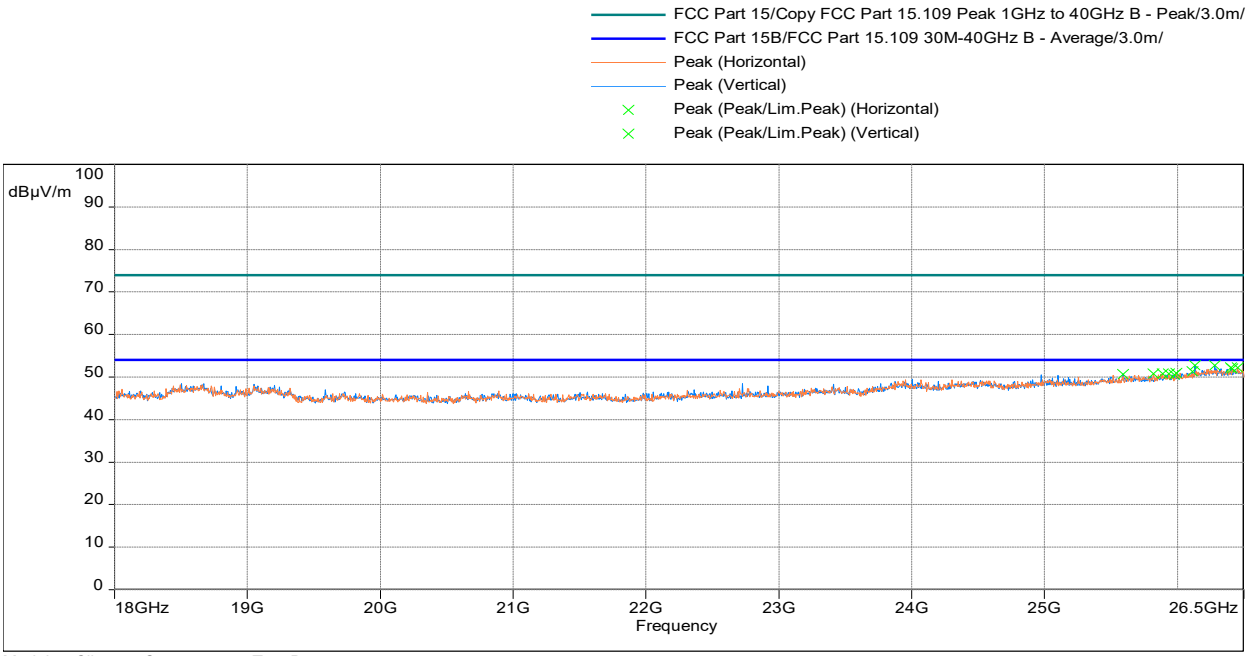
Model: ; Client: ; Comments: ; Test Date: 04/05/2022 00:50

Radiated Spurious Emissions 1000 - 18000 MHz, Avg Scan vs Avg Limit.



Model: ; Client: ; Comments: ; Test Date: 04/05/2022 00:38

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



Model: ; Client: ; Comments: ; Test Date:

Frequency (MHz)	Q-Peak @10m (dBµV/m)	Lim. Q-Peak @10m (dBµV/m)	Margin dB)	Angle (°)	Height (m)	Comment	Correction (dB)
32.619	20.87	29.5	-8.63	4	22.5	Horizontal	-7.47
39.732	26.39	29.5	-3.11	2.01	251.5	Vertical	-12.75
40.347	24.71	29.5	-4.79	3	101	Vertical	-13.2
41.349	27.83	29.5	-1.67	1	338	Vertical	-13.96
68.800	21.28	29.5	-8.22	3	58.75	Horizontal	-18.3
69.026	21.42	29.5	-8.08	3	84.75	Horizontal	-18.27
71.031	26.37	29.5	-3.13	2.01	145.75	Vertical	-18.16
72.130	24.84	29.5	-4.66	2.01	101.5	Vertical	-18.15
74.297	24.43	29.5	-5.07	2.01	321.25	Vertical	-18.22
85.646	25.2	29.5	-4.3	4	57.25	Horizontal	-18.91
111.577	28.2	33	-4.8	4	268.5	Horizontal	-13.34
124.219	27.15	33	-5.85	1	197.25	Vertical	-11.85
127.291	27.89	33	-5.11	1	259.5	Vertical	-11.83
128.099	29.46	33	-3.54	1	197.25	Vertical	-11.82
167.158	30.73	33	-2.27	3	66.75	Horizontal	-13.93
167.223	29.97	33	-3.03	1	259.5	Vertical	-13.93
168.290	31.63	33	-1.37	1	259.5	Vertical	-13.95
181.061	27.35	33	-5.65	1	206.25	Vertical	-14.43
223.806	33.52	35.5	-1.98	1	328.5	Vertical	-14.36
224.808	30.62	35.5	-4.88	4	352.75	Horizontal	-14.33
251.968	29.55	35.5	-5.95	2	171.5	Horizontal	-13.57
279.646	32.91	35.5	-2.59	3	58.75	Horizontal	-11.61
336.035	33.18	35.5	-2.32	1	197.25	Vertical	-10.6
504.007	32.75	35.5	-2.75	3	135.5	Vertical	-6.09
515.065	29.62	35.5	-5.88	2.01	190.5	Vertical	-6.09
515.259	30.29	35.5	-5.21	2	0	Horizontal	-6.11
515.679	30.56	35.5	-4.94	2.01	190.5	Vertical	-6.15
558.682	30.05	35.5	-5.45	3	180	Vertical	-5.45
559.976	34.02	35.5	-1.48	3	0	Vertical	-5.44
560.234	31.24	35.5	-4.26	2	319.5	Horizontal	-5.42
562.013	30.81	35.5	-4.69	3	188.75	Vertical	-5.33
616.009	34.05	35.5	-1.45	1	200	Horizontal	-4.69
672.043	33.92	35.5	-1.58	2.01	359.75	Vertical	-3.4
783.981	30.5	35.5	-5	1	322.25	Horizontal	-1.35
784.078	31.01	35.5	-4.49	1	0.5	Vertical	-1.35
840.144	30.38	35.5	-5.12	2.01	207.75	Vertical	-0.67
895.951	30.59	35.5	-4.91	1	200	Horizontal	0.36
895.984	31.2	35.5	-4.3	2.01	128.5	Vertical	0.36

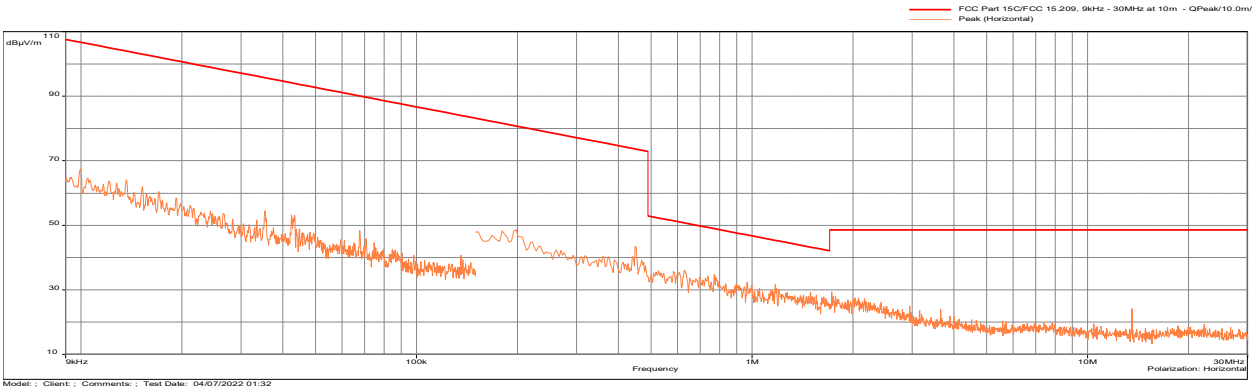
Note: Correction = AF + CF - Preamp

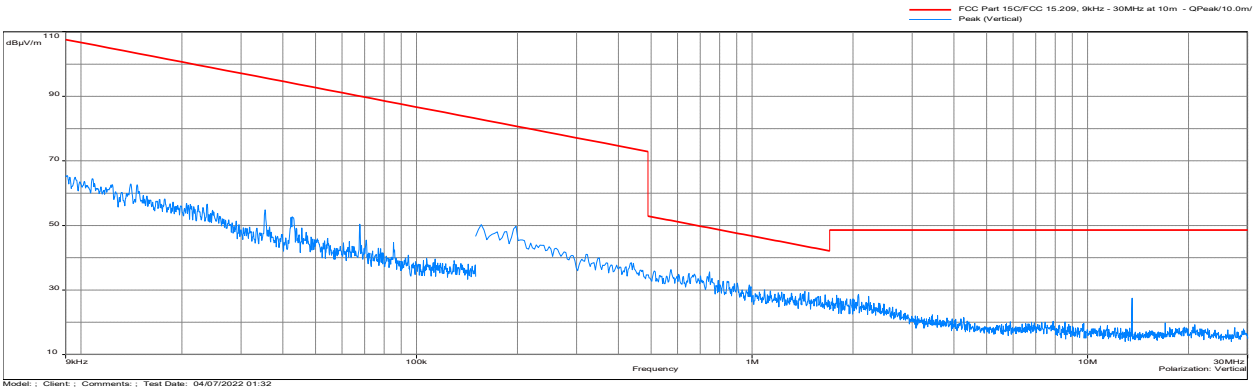
Frequency (MHz)	Avg @3m (dBµV/m)	Lim. Avg @3m (dBµV/m)	Margin dB)	Angle (°)	Height (m)	Comment	Correction (dB)
1007.998	37.66	54	-16.34	1.02	271	Vertical	-16.85

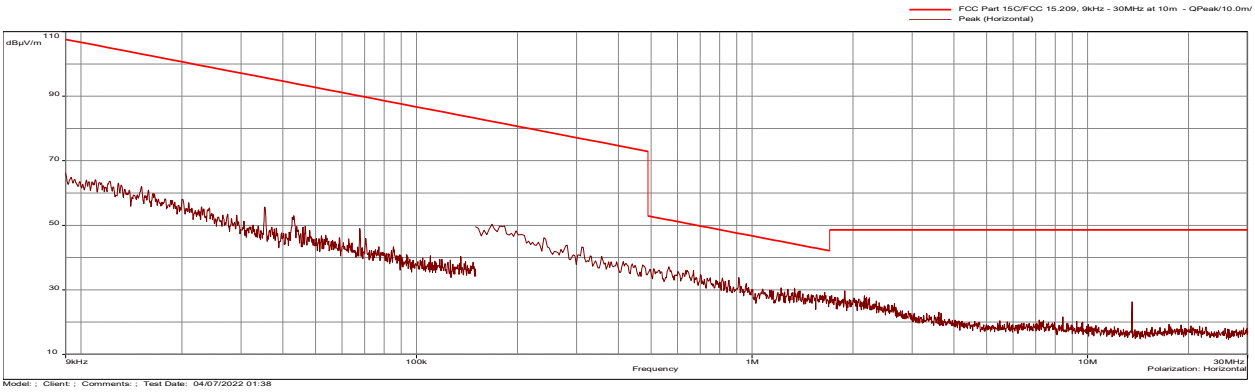
Results	Complies

Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2480MHz

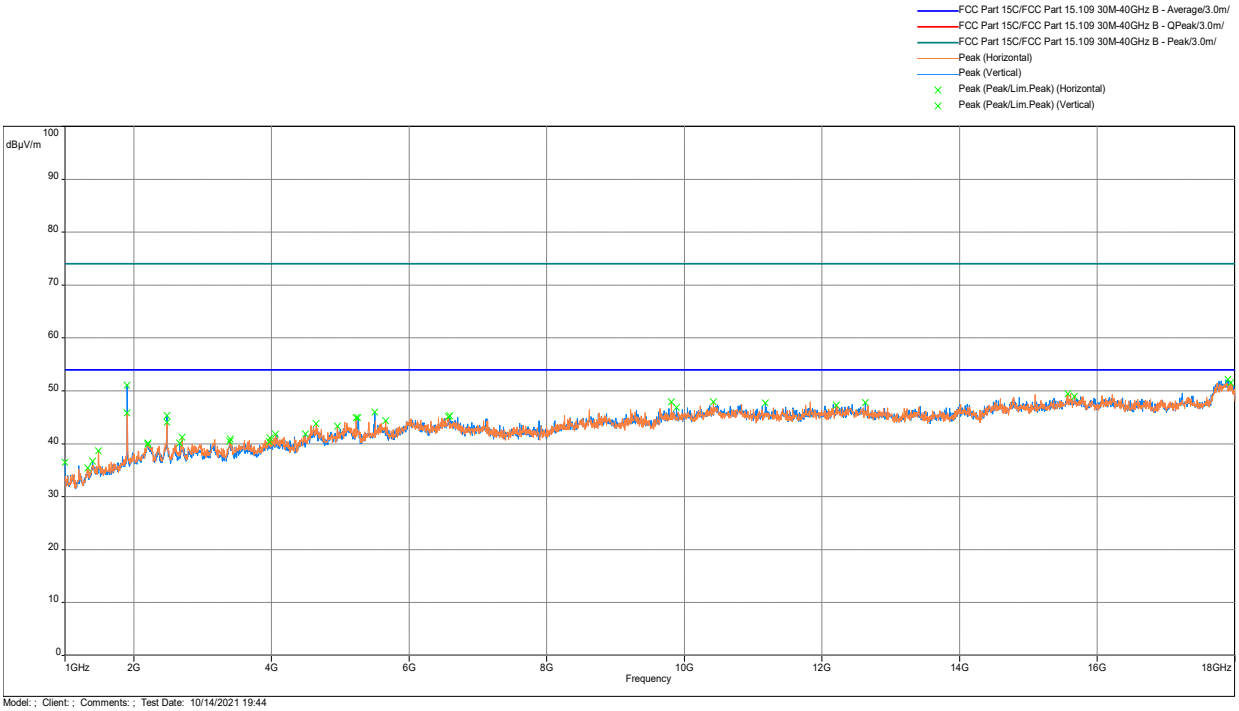
Radiated Spurious Emissions 9kHz – 30MHz





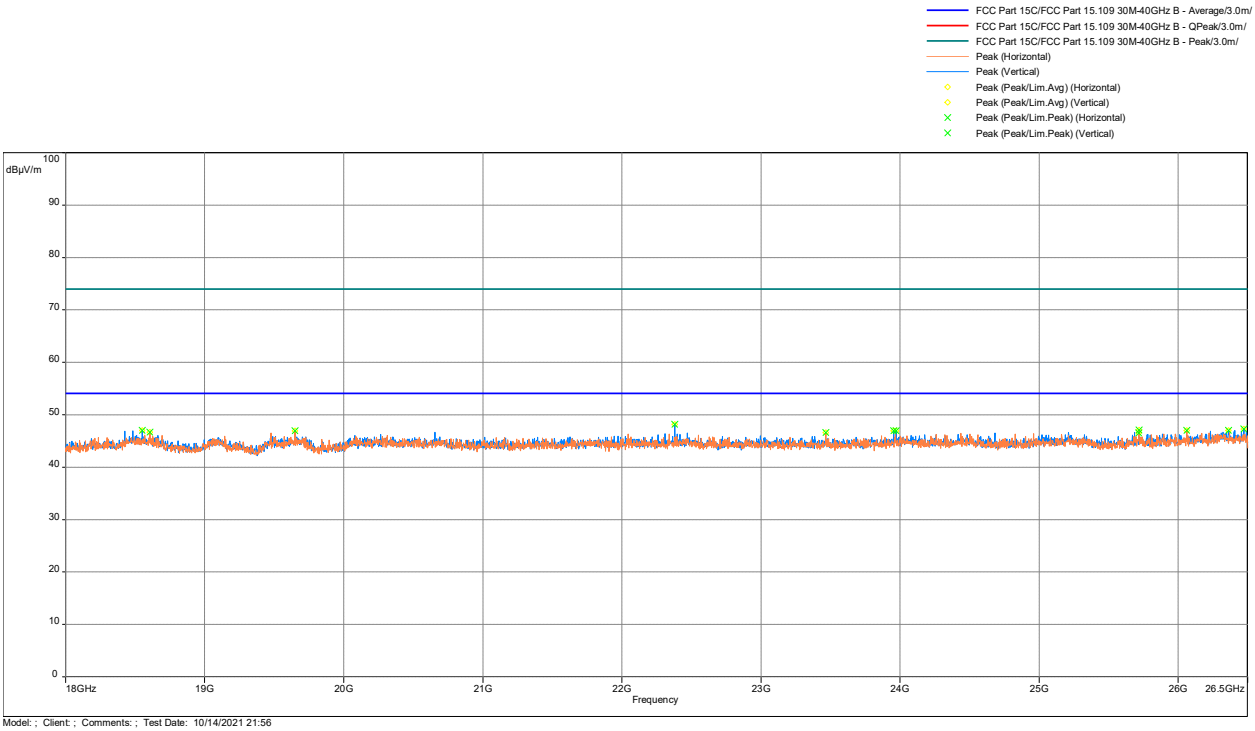


Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Peak Limit.



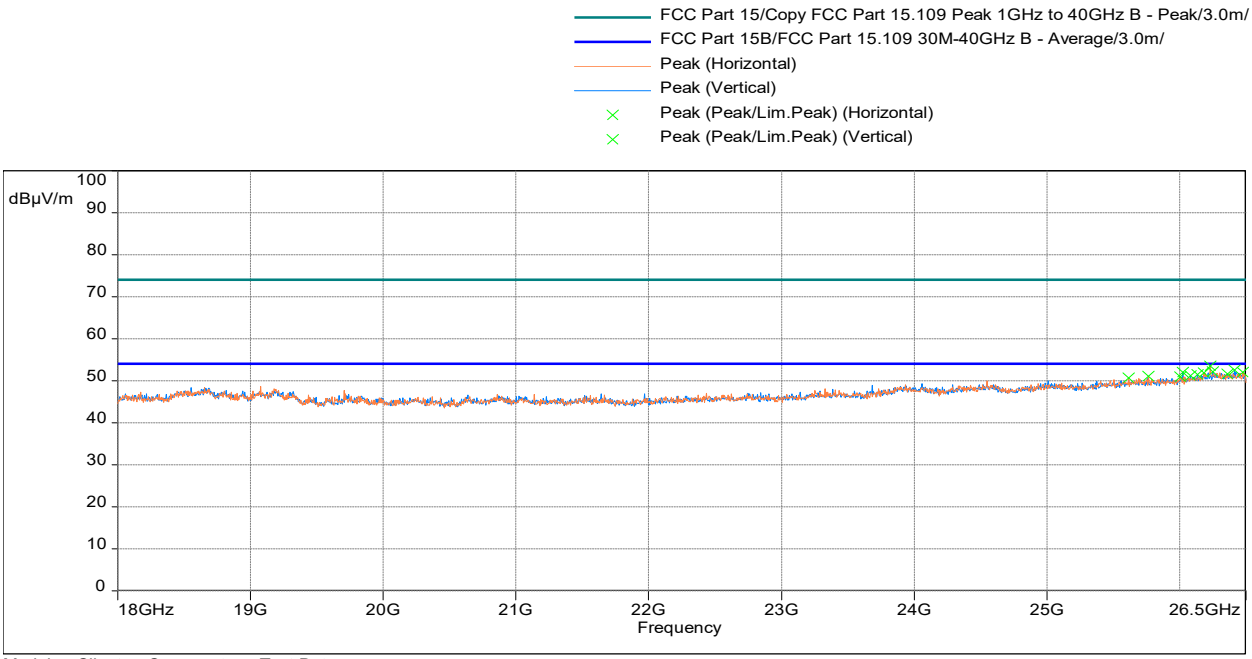
Model: ; Client: ; Comments: ; Test Date: 10/14/2021 19:44

Radiated Spurious Emissions 1000 - 18000 MHz, Avg Scan vs Avg Limit.



Model: ; Client: ; Comments: ; Test Date: 10/14/2021 21:56

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



Model: ; Client: ; Comments: ; Test Date:

Frequency (MHz)	Q-Peak @10m (dBµV/m)	Lim. Q-Peak @10m (dBµV/m)	Margin dB)	Angle (°)	Height (m)	Comment	Correction (dB)
30.259	21.21	29.5	-8.29	4	320.25	Horizontal	-5.96
40.799	28.61	29.5	-0.89	4	182.5	Vertical	-13.56
68.768	20.94	29.5	-8.56	3	58.75	Horizontal	-18.3
70.029	21.46	29.5	-8.04	3	74.5	Horizontal	-18.17
72.163	25.11	29.5	-4.39	4	102.5	Vertical	-18.15
73.424	28.84	29.5	-0.66	2.01	83.5	Vertical	-18.18
74.846	25.64	29.5	-3.86	2.01	260	Vertical	-18.22
75.396	23.86	29.5	-5.64	0.99	241.5	Vertical	-18.25
76.463	25.76	29.5	-3.74	0.99	302.5	Vertical	-18.35
85.646	23.61	29.5	-5.89	2.01	93.5	Vertical	-18.91
85.678	25.35	29.5	-4.15	4	56.75	Horizontal	-18.91
112.579	27.68	33	-5.32	4	277.25	Horizontal	-13.13
120.016	27.11	33	-5.89	0.99	277	Vertical	-12.09
126.127	27.73	33	-5.27	0.99	241.5	Vertical	-11.84
127.032	28.89	33	-4.11	0.99	250.5	Vertical	-11.83
128.390	27.51	33	-5.49	0.99	197.5	Vertical	-11.82
129.263	27.61	33	-5.39	0.99	250.5	Vertical	-11.82
130.880	27.5	33	-5.5	0.99	197.5	Vertical	-11.89
167.190	31.57	33	-1.43	0.99	250.5	Vertical	-13.93
167.190	31.51	33	-1.49	4	84	Horizontal	-13.93
168.548	30.54	33	-2.46	4	84	Horizontal	-13.98
224.226	30.96	35.5	-4.54	4	353	Horizontal	-14.34
224.808	32.01	35.5	-3.49	0.99	181	Vertical	-14.33
224.938	30.12	35.5	-5.38	0.99	181	Vertical	-14.33
336.035	33.72	35.5	-1.78	0.99	197.5	Vertical	-10.6
448.038	29.9	35.5	-5.6	0.99	31.25	Vertical	-7.3
448.038	29.56	35.5	-5.94	2	162.75	Horizontal	-7.3
504.039	31.52	35.5	-3.98	3	110.5	Vertical	-6.09
515.485	30.41	35.5	-5.09	2.01	189.75	Vertical	-6.13
515.550	31.09	35.5	-4.41	2	359.75	Horizontal	-6.14
560.073	34.99	35.5	-0.51	3	249.75	Vertical	-5.44
562.304	32.04	35.5	-3.46	3	180.25	Vertical	-5.33
672.011	33.3	35.5	-2.2	2.01	0	Vertical	-3.4
727.980	35.05	35.5	-0.45	4	0	Vertical	-2.58
784.013	30.13	35.5	-5.37	2.01	223.5	Vertical	-1.35
840.015	29.68	35.5	-5.82	2.01	198.5	Vertical	-0.67
895.919	31.04	35.5	-4.46	2.01	251.25	Vertical	0.35
895.984	31.14	35.5	-4.36	0.99	191.25	Horizontal	0.36

Note: Correction = AF + CF - Preamp

Frequency (MHz)	Peak @3m (dBµV/m)	Lim. Peak @3m (dBµV/m)	Margin dB)	Angle (°)	Height (m)	Comment	Correction (dB)
1400.067	48.49	74	-25.51	2.01	208	Horizontal	-14.84

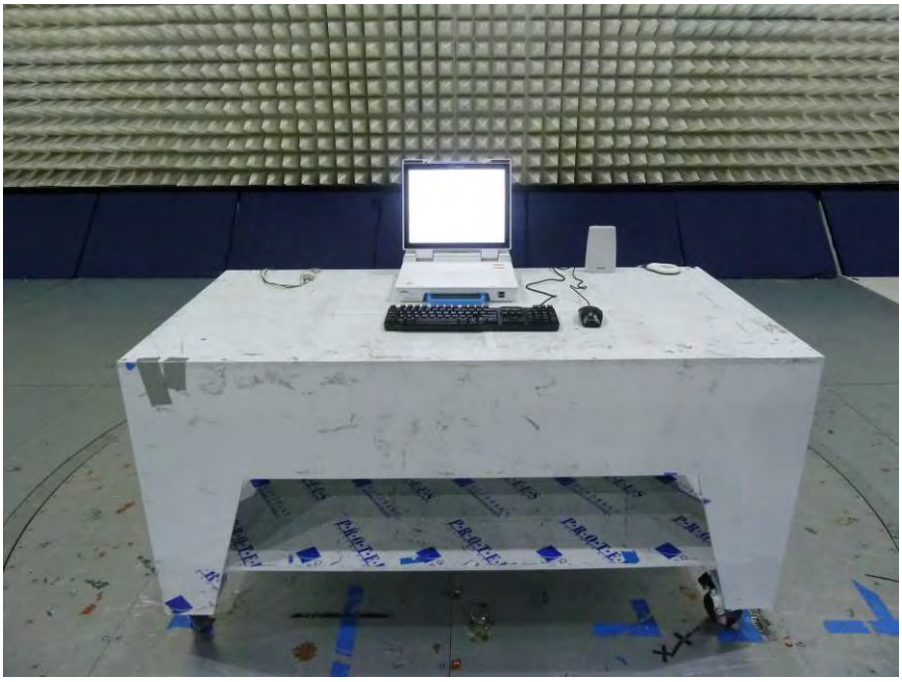
Frequency (MHz)	Avg @3m (dBµV/m)	Lim. Avg @3m (dBµV/m)	Margin dB)	Angle (°)	Height (m)	Comment	Correction (dB)
1400.067	45.18	54	-8.82	2.01	187	Horizontal	-14.84

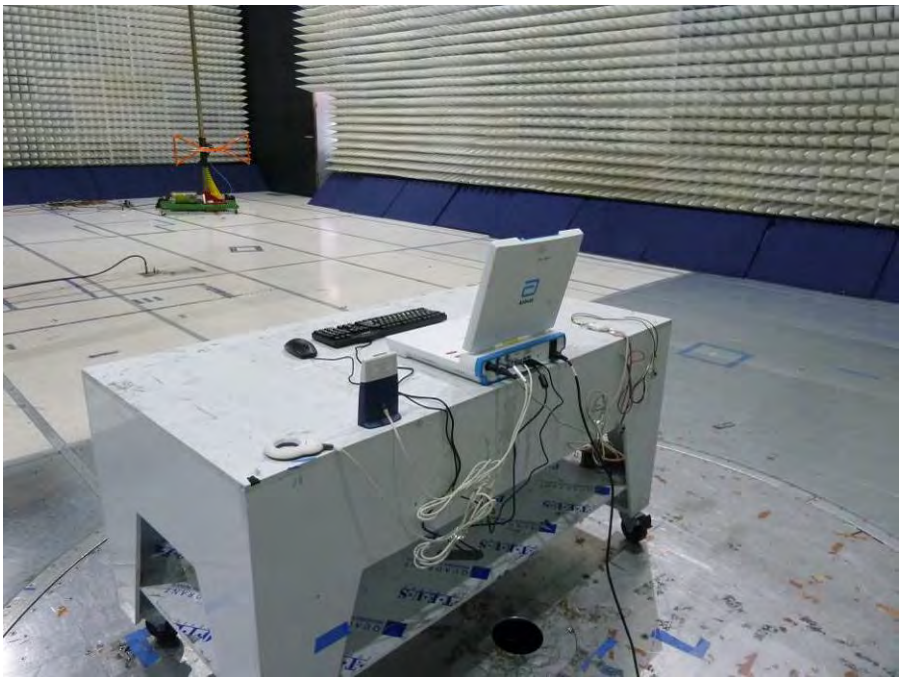
Results	Complies

.

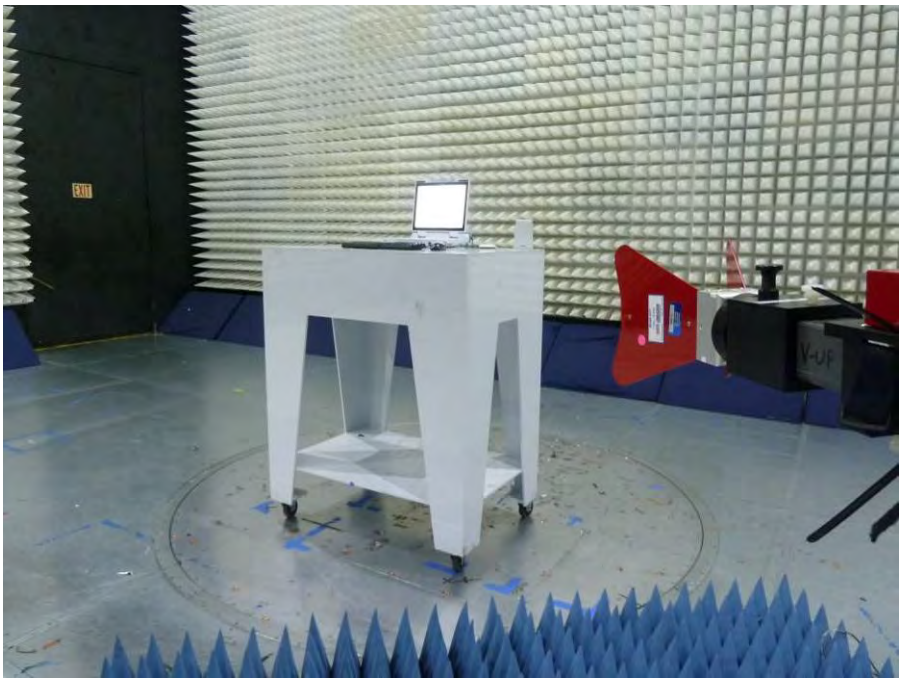
4.5.5 Test Setup Configuration

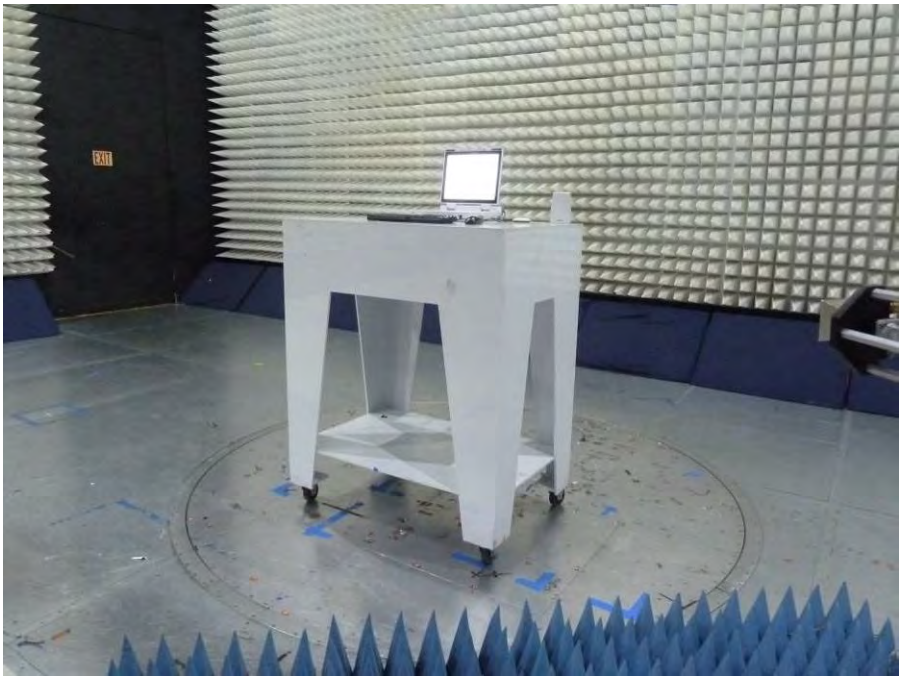
The following photographs show the testing configurations used.





4.5.5 Test Setup Configuration (Continued)





4.5.5 Test Setup Configuration (Continued)

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

4.6.1 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.*

4.6.2 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.

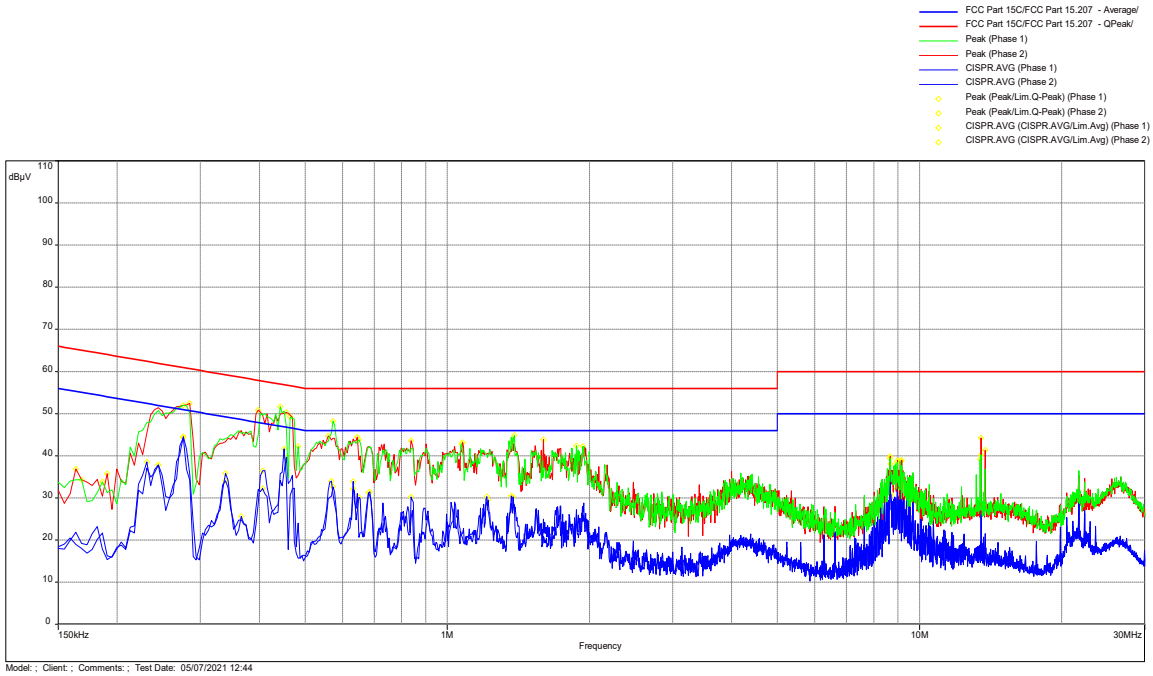
Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

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

Tested By	Test Date	Results
Anderson Soungpanya	May 07, 2021	Complies

4.6.3 Test Result

15.207: Conducted Emissions 120VAC 60Hz



4.6.3 Test Results (Continued)

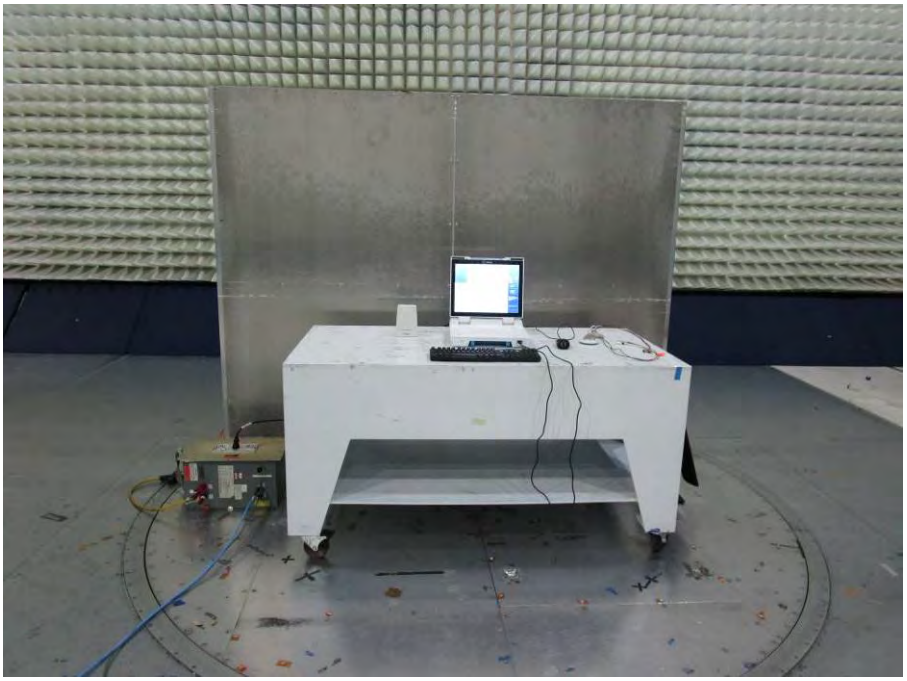
Frequency (MHz)	Peak (dBµV)	Lim.Q-Peak (dBµV)	Margin (dB)	Line	Correction (dB)
0.164	36.87	65.28	-28.41	Phase 2	10.99
0.168	34.32	65.06	-30.74	Phase 1	10.99
0.186	33.83	64.21	-30.38	Phase 1	10.98
0.191	35.76	64.01	-28.26	Phase 2	10.97
0.276	51.98	60.94	-8.95	Phase 1	10.98
0.285	52.42	60.67	-8.25	Phase 2	10.97
0.398	50.86	57.91	-7.05	Phase 2	10.98
0.443	51.66	57.01	-5.36	Phase 1	10.99
0.456	50.29	56.77	-6.48	Phase 2	10.99
0.465	49.22	56.60	-7.38	Phase 1	10.99
0.483	42.20	56.29	-14.09	Phase 1	10.99
0.560	44.67	56.00	-11.33	Phase 2	11.01
0.573	48.25	56.00	-7.75	Phase 1	11.00
0.645	44.45	56.00	-11.55	Phase 2	11.02
0.650	43.79	56.00	-12.21	Phase 1	11.02
0.839	43.55	56.00	-12.45	Phase 2	11.02
1.073	42.88	56.00	-13.12	Phase 1	11.01
1.077	43.17	56.00	-12.83	Phase 2	11.01
1.374	43.38	56.00	-12.62	Phase 2	11.02
1.388	44.88	56.00	-11.12	Phase 1	11.02
1.599	43.80	56.00	-12.20	Phase 2	11.02
1.878	42.38	56.00	-13.62	Phase 1	11.02
1.937	42.26	56.00	-13.74	Phase 1	11.02
8.660	39.41	60.00	-20.59	Phase 1	11.22
8.664	39.82	60.00	-20.18	Phase 2	11.22
8.687	38.09	60.00	-21.91	Phase 1	11.22
8.975	38.45	60.00	-21.55	Phase 1	11.21
8.979	38.89	60.00	-21.11	Phase 2	11.21
9.096	38.76	60.00	-21.24	Phase 1	11.21
9.132	38.69	60.00	-21.31	Phase 2	11.22
9.173	38.92	60.00	-21.08	Phase 2	11.22
13.439	39.15	60.00	-20.85	Phase 1	11.24
13.493	40.22	60.00	-19.78	Phase 1	11.24
13.511	44.18	60.00	-15.82	Phase 2	11.24
13.776	41.32	60.00	-18.68	Phase 2	11.24

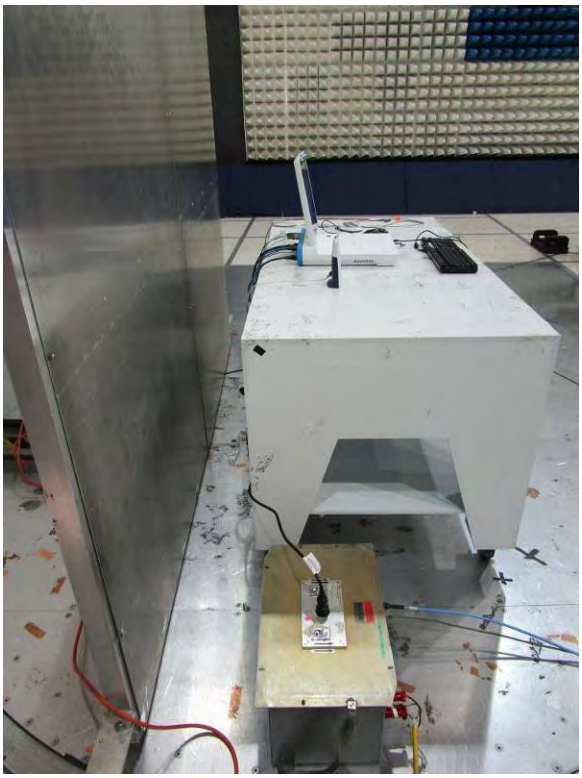
Frequency (MHz)	Peak (dBµV)	Lim. Avg (dBµV)	Margin (dB)	Line	Correction (dB)
0.231	38.52	52.41	-13.89	Phase 1	10.98
0.245	37.83	51.94	-14.11	Phase 1	10.98
0.245	37.81	51.94	-14.13	Phase 2	10.98
0.276	44.26	50.94	-6.67	Phase 1	10.98
0.276	44.50	50.94	-6.43	Phase 2	10.98
0.339	35.84	49.23	-13.38	Phase 1	10.98
0.339	34.06	49.23	-15.17	Phase 2	10.98
0.366	25.61	48.59	-22.98	Phase 2	10.98
0.407	36.50	47.72	-11.22	Phase 1	10.99
0.407	32.22	47.72	-15.50	Phase 2	10.99
0.452	41.63	46.85	-5.21	Phase 1	10.99
0.456	39.58	46.77	-7.18	Phase 2	10.99
0.569	33.95	46.00	-12.05	Phase 1	11.00
0.573	32.65	46.00	-13.35	Phase 2	11.00
0.632	33.89	46.00	-12.11	Phase 2	11.02
0.632	32.12	46.00	-13.88	Phase 1	11.02
0.650	30.11	46.00	-15.89	Phase 1	11.02
0.681	31.15	46.00	-14.85	Phase 1	11.03
0.686	31.44	46.00	-14.56	Phase 2	11.03
0.839	30.26	46.00	-15.74	Phase 2	11.02
1.212	30.32	46.00	-15.68	Phase 1	11.01
1.221	29.48	46.00	-16.52	Phase 2	11.01
1.365	30.48	46.00	-15.52	Phase 1	11.02
1.379	30.22	46.00	-15.78	Phase 2	11.02
8.435	30.46	50.00	-19.54	Phase 1	11.23
8.660	36.10	50.00	-13.90	Phase 2	11.22
8.664	35.84	50.00	-14.16	Phase 1	11.22
8.687	30.59	50.00	-19.41	Phase 1	11.22
8.696	30.84	50.00	-19.16	Phase 2	11.22
8.975	32.14	50.00	-17.86	Phase 2	11.21
8.979	32.34	50.00	-17.66	Phase 1	11.21
9.092	31.69	50.00	-18.31	Phase 1	11.21
9.092	31.80	50.00	-18.20	Phase 2	11.21
9.132	32.41	50.00	-17.59	Phase 2	11.22
9.132	32.32	50.00	-17.68	Phase 1	11.22
9.677	31.01	50.00	-18.99	Phase 2	11.23

Results	**Complies** by 5.36 dB

4.6.4 Test Setup Photographs

The following photographs show the testing configurations used.





5.0 List of Test Equipment

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

Equipment	Manufacturer	Model/Type	Asset #	Cal Int	Cal Due
EMI Receiver	Rohde and Schwarz	ESU40	ITS 00961	12	03/010/23
Horn Antenna	ETS Lindgren	3117PA	ITS 01365	12	04/20/22
Pyramidal Horn Antenna	EMCO	3160-09	ITS 00571	#	#
Bilog Antenna 30-1000MHz	SunAR	JB1	ITS 01577	12	02/10/23
Pre-Amplifier	Sonoma Instrument	310N	ITS 00942	12	04/19/22
Passive Loop Antenna	EMCO	6512	ITS 001598	12	06/21/22
LISN	Fischer Custom Communication CUSTOM COMM	FCC-LISN-50-50-M-H	ITS 00551	12	11/16/21
RF Cable	Mega Phase	TM40-K1K1-59	ITS 01655	12	01/11/23
RF Cable	Mega Phase	TM40-K1K1-19	ITS 01155	12	04/28/22
Notch Filter	MICRO-TRONICS	BRM50702	ITS 01166	12	06/29/22
RF Cable	Mega Phase	EMC1-K1K1-236	ITS 01484	12	06/29/22
10m Semi-anechoic chamber	Panashield	10m Chamber	ITS 00984	36	07/29/23

Calibration not required.

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
BAT-EMC	Nexio	3.20.0.14	ESU and ESR Intertek Emissions Template
Tile	Quantum Change	3.4.K.22	Conducted Spurious_30M-26GHz
RS Commander	Rohde Schwarz	1.6.4	Not Applicable (Screen grabber)

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewers Initials	Date	Change
1.0 / G105013322	AC	ML	April 11, 2022	Original document
1.1 / G105013322	AC	ML	July 14, 2022	Modified model name

END OF REPORT