Class II Permissive Change
TEST REPORT

Report Number: 104395865MPK-010
Project Number: G104395865
January 06, 2021

Testing performed on
Beta Mask
Model: BETA MK 4

FCC ID: 2AWYY-BETA

to

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

For

Sana Health, Inc

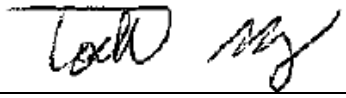
Test Performed by:	**Test Authorized by:**
Intertek	Sana Health, Inc
1365 Adams Court	130 Miners Drive, Suite 101
Menlo Park, CA 94025 USA	Lafayette, CO 80026 USA

Prepared by: _____ **Date:** January 06, 2021
Todd Moy

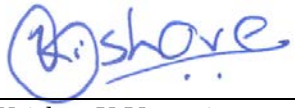
Reviewed by: _____ **Date:** January 06, 2021
Krishna K Vemuri

Report No. 104395865MPK-010	
Equipment Under Test:	Beta Mask
Trade Name:	Sana Health, Inc
Model Number:	BETA MK 4
Applicant:	Sana Health, Inc
Contact:	Sam Pai
Address:	130 Miners Drive, Suite 101 Lafayette, CO 80026
Country:	USA
Tel. Number:	(303)862-1474
Email:	Sam@sana.io
Applicable Regulation:	FCC Part 15 Subpart C (15.247) Industry Canada RSS-247 Issue 2
Date of Test:	December 22, 2020 - January 4, 2021

We attest to the accuracy of this report:



Todd Moy
Project Engineer



Krishna K Vemuri
EMC Manager

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
Transmitter Radiated Emissions	15.247(d), 15.209, 15.205	RSS-247, 5.5	Complies
AC Line Conducted Emission	15.207	RSS-GEN	Not Applicable[1]
Antenna Requirement	15.203	RSS-GEN	Complies (Internal Antenna)

[1]The EUT is battery operated under normal operation. According to manufacture, the BLE is turned off during charging mode.

EUT receive date: December 22, 2020

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: December 22, 2020

Test completion date: January 04, 2021

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

2.0 General Information

2.1 Product Description

Sana Health, Inc supplied the following description of the EUT:

The BETA MK 4 is an audio-visual stimulation mask.

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

Information about the Bluetooth (BLE) radio is presented below:

For more information, refer to the following product specification, declared by the manufacturer.

Information about the 2.4 GHz radio is presented below:

Applicant	Sana Health, Inc
Model No.	BETA MK 4
FCC Identifier	2AWYY-BETA
Type of transmission	Digital Transmission System (DTS)
Antenna(s) & Gain	Internal Antenna, Gain: +0.5 dBi peak
Frequency Range	2402 – 2480 MHz
Type of modulation	GFSK
Number of Channel(s)	40, Channel 0-39
Applicant Name & Address	Sana Health, Inc 130 Miners Drive, Suite 101 Lafayette, CO 80026 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

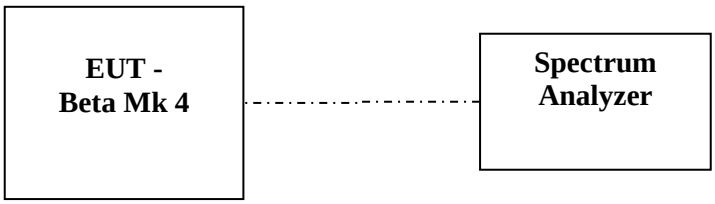
3.1 Support Equipment

Support Equipment			
Description	**Manufacturer**	**Model Number**	**Serial Number**
Earphone	Xiaomi	HSEJ03JY	Not listed

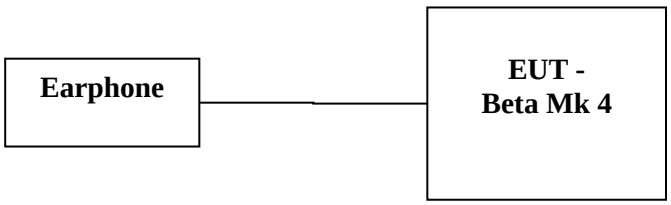
3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	**Manufacturer**	**Model Number**	**Serial Number**
Beta mask – Conducted Unit	Sara Health, Inc	BETA MK 4	E0:90:66:10:8C:39
Beta mask – Radiated Unit	Sara Health, Inc	BETA MK 4	E8:30:C5:9C:3D:3D

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

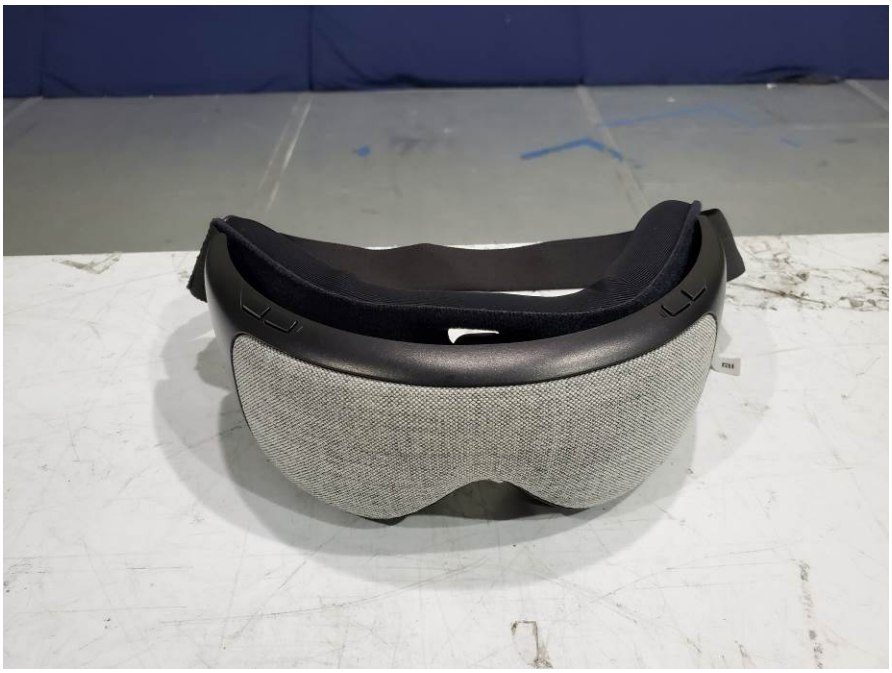


Radiated Measurements



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. The EUT is attached to peripherals and they are connected and operational (as typical as possible). During testing, all cables are manipulated to produce worst-case emissions.

The EUT is battery operated under normal operation. According to manufacture, the BLE is turned off during charging mode.

The lowest clock frequency that used by the device is 32.768 kHz. Radiated Emission is investigated from 9kHz up to 25GHz.

The client has removed a ground path from the antenna as advised by his antenna manufacturer. No other changes to the unit. Hence, power and radiated spurious emissions with antenna were performed for Class II permissive change.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was provided by Sana Health, Inc

3.5 Mode of Operation during Test

During transmitter testing, the transmitter was setup to transmit at maximum RF power on low, middle and high channel.

3.5 Modifications Required for Compliance

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

3.6 Additions, Deviations and Exclusions from Standards

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

3.7 Additions, Deviations and Exclusions from Standards

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

4.0 Measurement Results

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

4.1.1 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.

4.1.2 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.

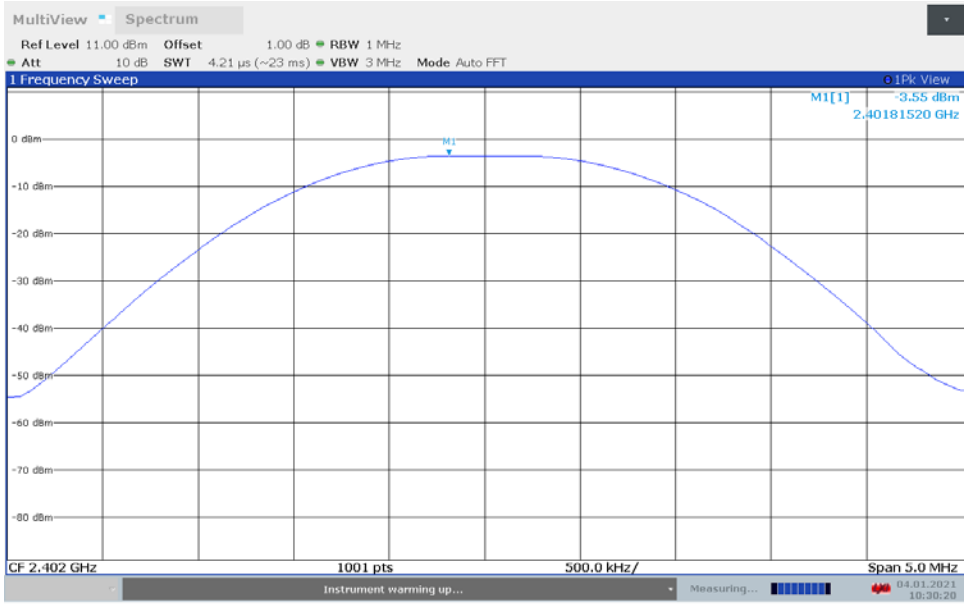
4.1.3 Test Result

Refer to the following plots 1.1 – 1.3 for the test details.

Frequency, MHz	Conducted Power (peak), dBm	Conducted Power (peak), mW	Plot
2402	-3.55	0.442	2.1
2440	-4.92	0.322	2.2
2480	-6.29	0.235	2.3

Date of Test:	January 4, 2021
Results	**Complies**

Plot 1. 1



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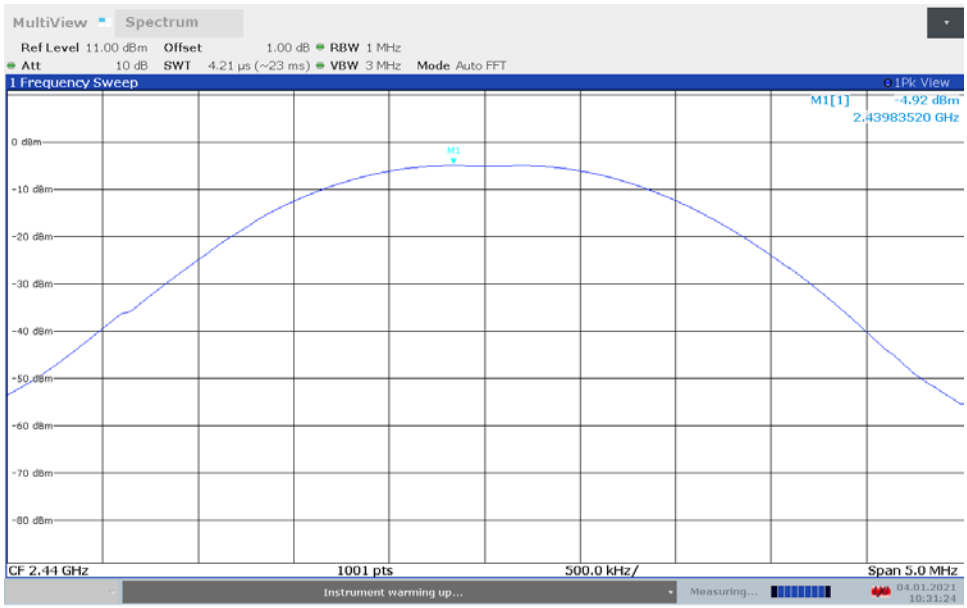
Plot 1. 2



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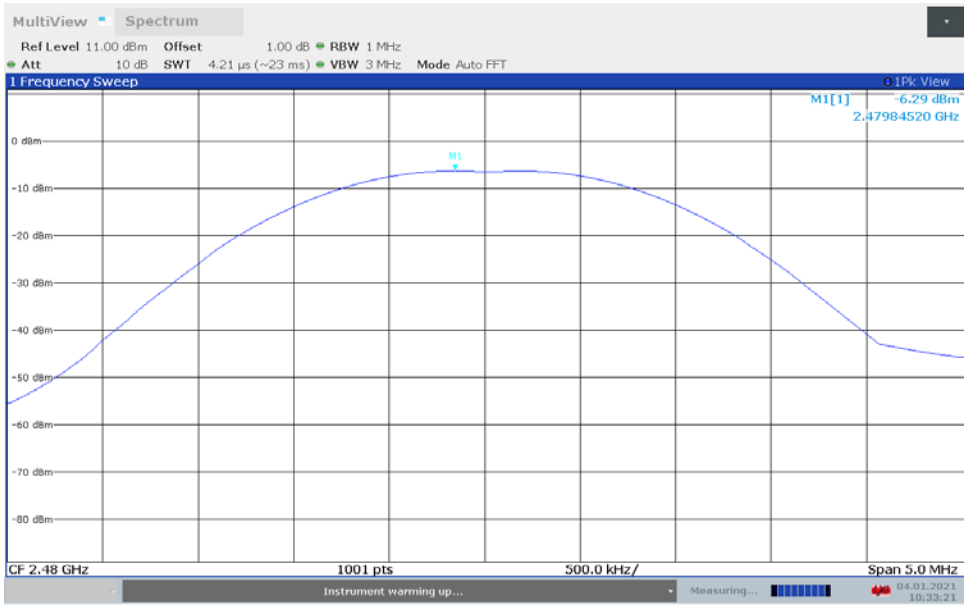
Plot 1. 3



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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 25 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 30MHz to 26GHz.

All measurements were made with a Peak Detector and compared to QP limits for 30MHz – 1GHz and Average limits for 1GHz – 26GHz.

Radiated measurements were performed on the X, Y and Z orientation of the EUT. Data is presented with the worst-case configuration (the configuration which resulted in the highest emission levels).

EUT was tested with Internal Antenna. Measurements for Radiated Band Edge were performed at the lowest and highest channels.

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 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.

4.5.5 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).

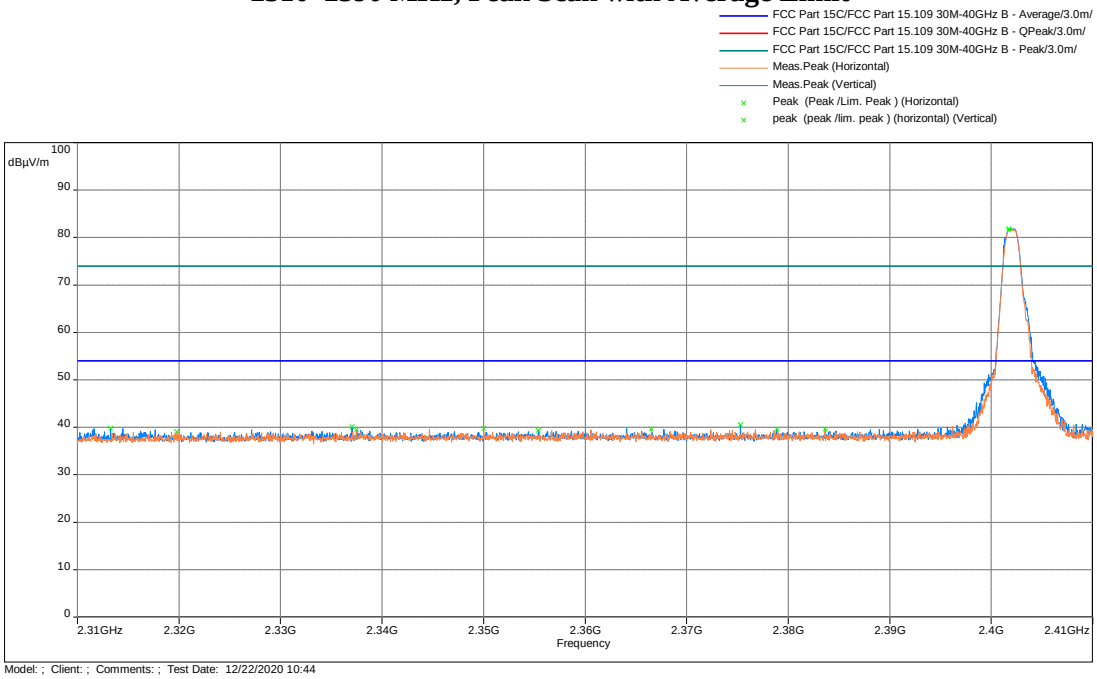
e) Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:
E = EIRP – 20log D + 104.8+DCF (DCF for Average measurements)
where:
E = electric field strength in dBμV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance 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

4.5.4 Test Results

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

Date of Test:	December 22, 2020
Results	**Complies**

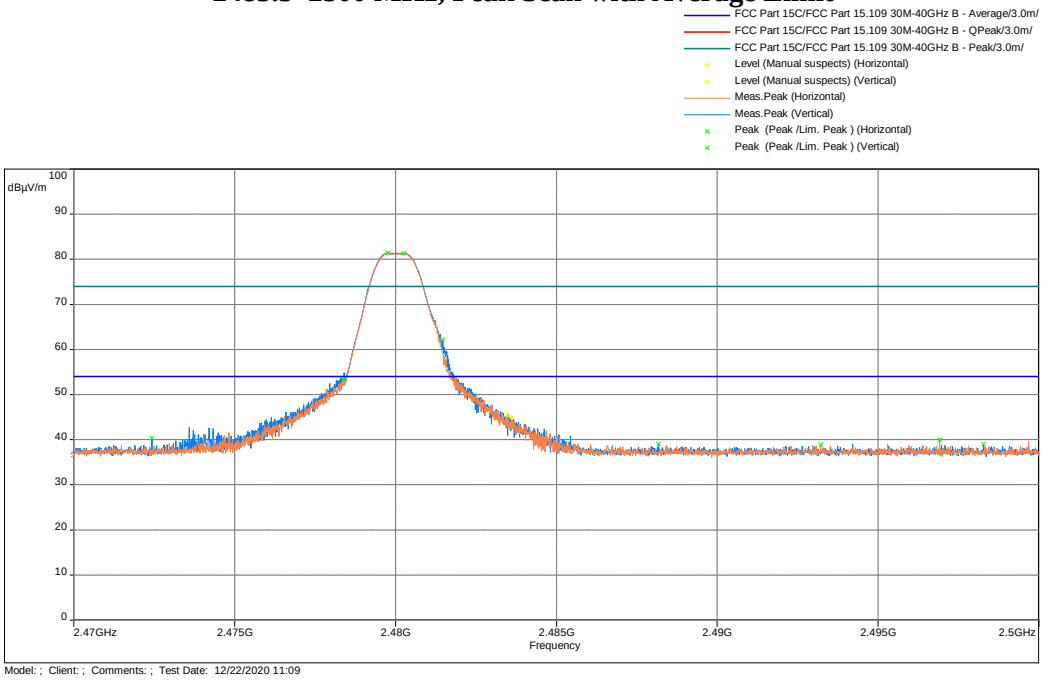
Out-of-Band Radiated spurious emissions at the Band-edge @3m distance
2310–2390 MHz, Peak Scan with Average Limit



Frequency (MHz)	Peak FS@3m (dBµV/m)	Ave Limit@3m (dBµV/m)	Margin (dB)	Angle (°)	Height (m)	Polarity	Raw (dBuV)	Correction (dB)
2390.0	38.3	54	-15.7	158.5	3.24	Horizontal	51.5	-13.2
2390.0	39.1	54	-14.9	271	1.26	Vertical	52.3	-13.2

Note: FS@3m = RA + Correction
Correction = AF + CF – Preamp

Out-of-Band Radiated spurious emissions at the Band-edge @3m distance
2483.5–2500 MHz, Peak Scan with Average Limit

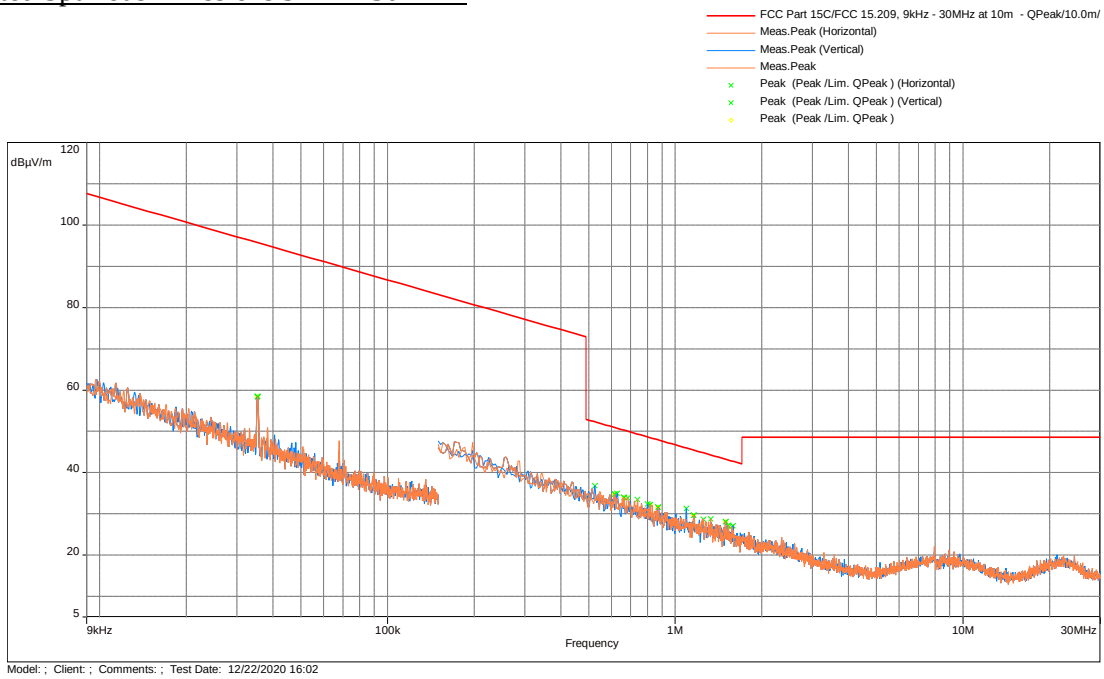


Frequency (MHz)	Peak FS@3m (dBµV/m)	Ave Limit@3m (dBµV/m)	Margin (dB)	Angle (°)	Height (m)	Polarity	Raw (dBuV)	Correction (dB)
2483.5	44.9	54	-9.1	167.25	3.24	Horizontal	58.0	-13.1
2483.5	45.6	54	-8.4	200	1.26	Vertical	58.7	-13.1

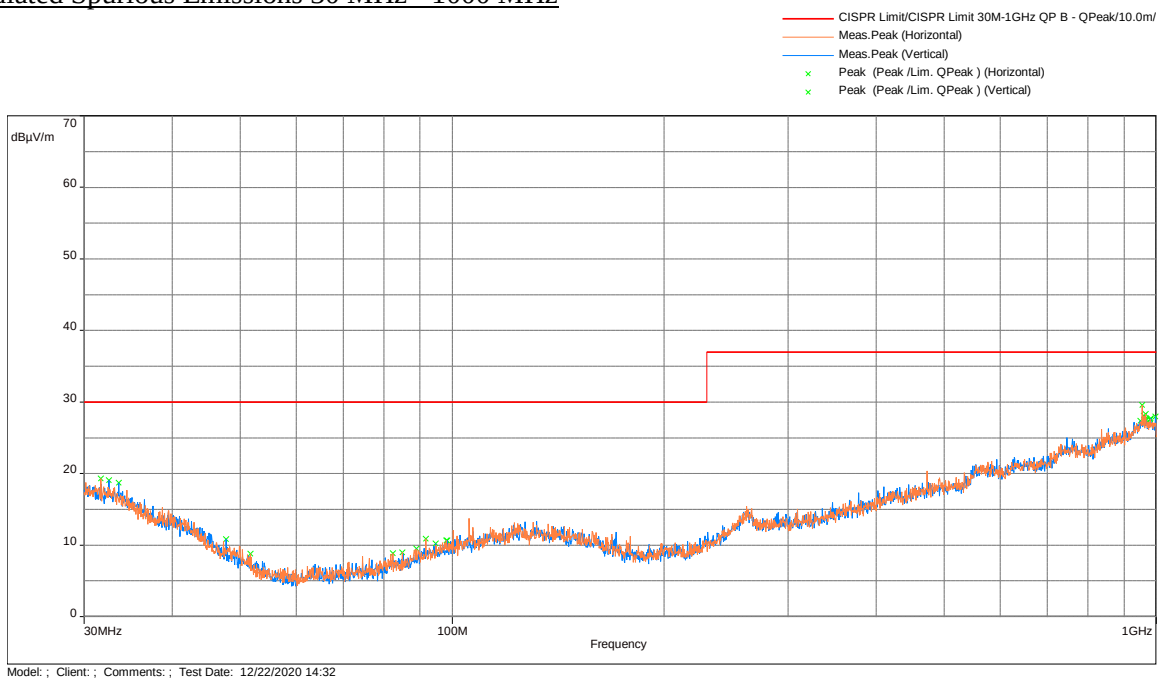
Note: FS@3m = RA + Correction
Correction = AF + CF – Preamp

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

Radiated Spurious Emissions 9kHz - 30 MHz



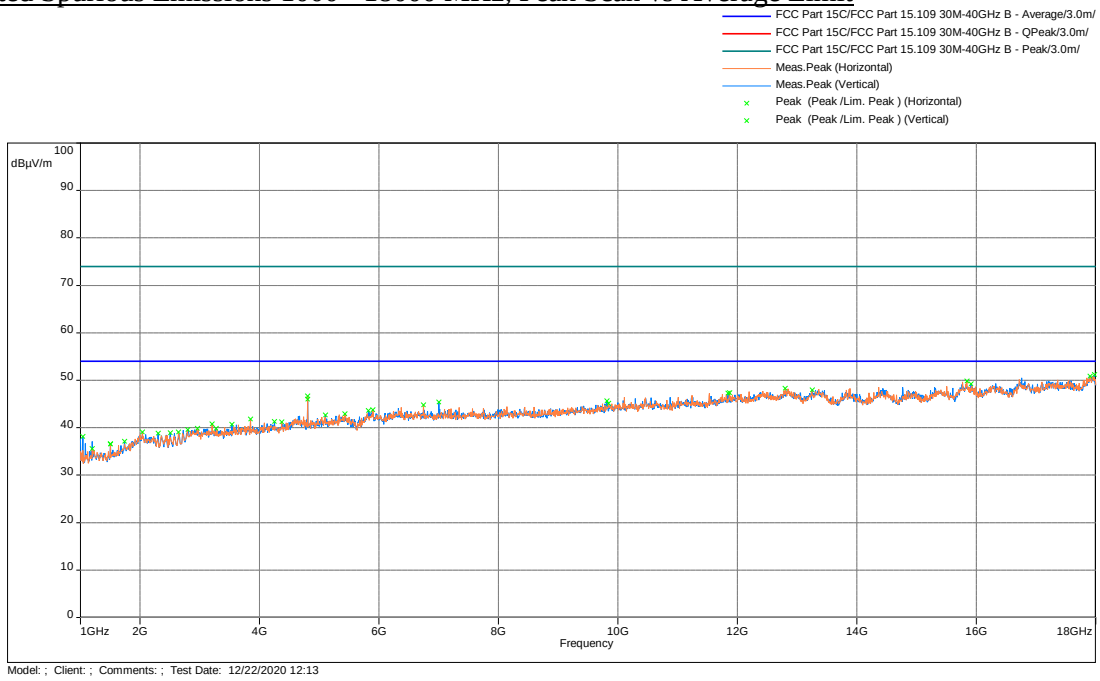
Radiated Spurious Emissions 30 MHz - 1000 MHz



Frequency (MHz)	QP FS@10m (dBµV/m)	Limit@10m (dBµV/m)	Margin (dB)	Angle (°)	Height (m)	Polarity	Raw (dBuV)	Correction (dB)
31.681	19.3	30	-10.7	148	1	Horizontal	29.1	-9.8
32.554	19.0	30	-11.0	111.25	3.02	Vertical	29.2	-10.1
98.126	10.6	30	-19.4	32	2.98	Horizontal	27.9	-17.3
98.320	10.6	30	-19.4	259	4	Vertical	27.9	-17.3
980.729	27.6	37	-9.4	98	1.02	Vertical	26.0	1.6
980.762	27.6	37	-9.4	269.5	3.98	Horizontal	26.0	1.6

Note: FS@10m = RA + Correction
Correction = AF + CF – Preamp

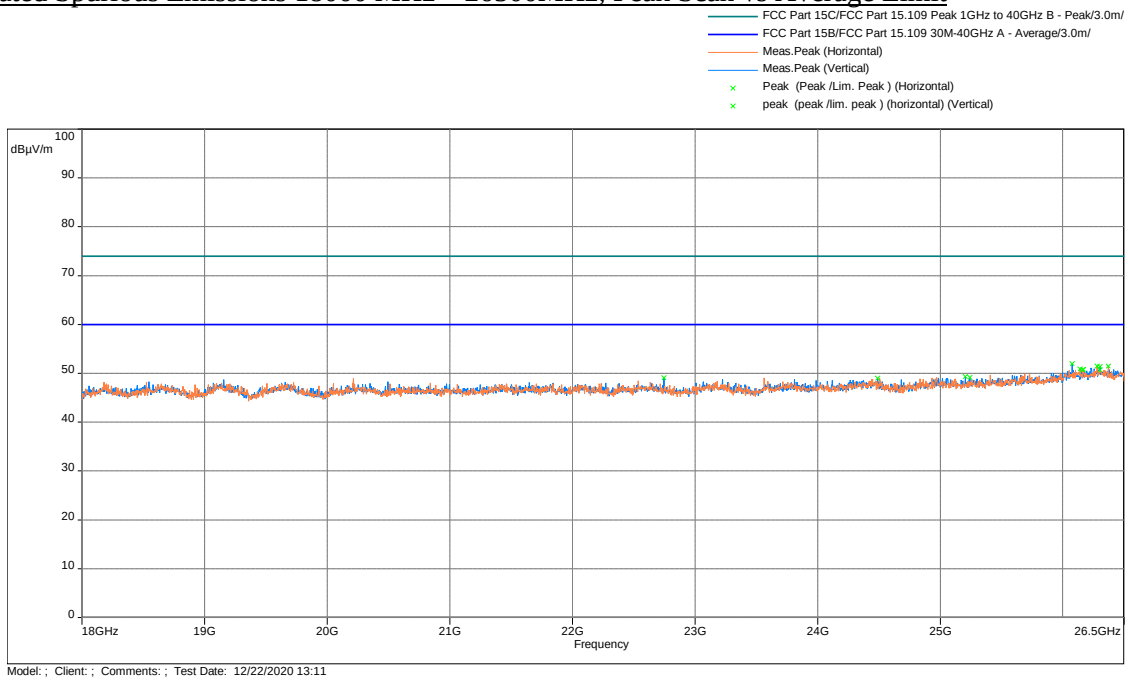
Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Average Limit



Frequency (MHz)	Peak@3m (dBµV/m)	Ave Limit@3m (dBµV/m)	Margin (dB)	Angle (°)	Height (m)	Polarity	Raw (dBuV)	Correction (dB)
5821.767	43.6	54	-10.4	46.75	3.23	Vertical	49.4	-5.8
5893.167	43.8	54	-10.2	0	1.27	Horizontal	49.5	-5.7

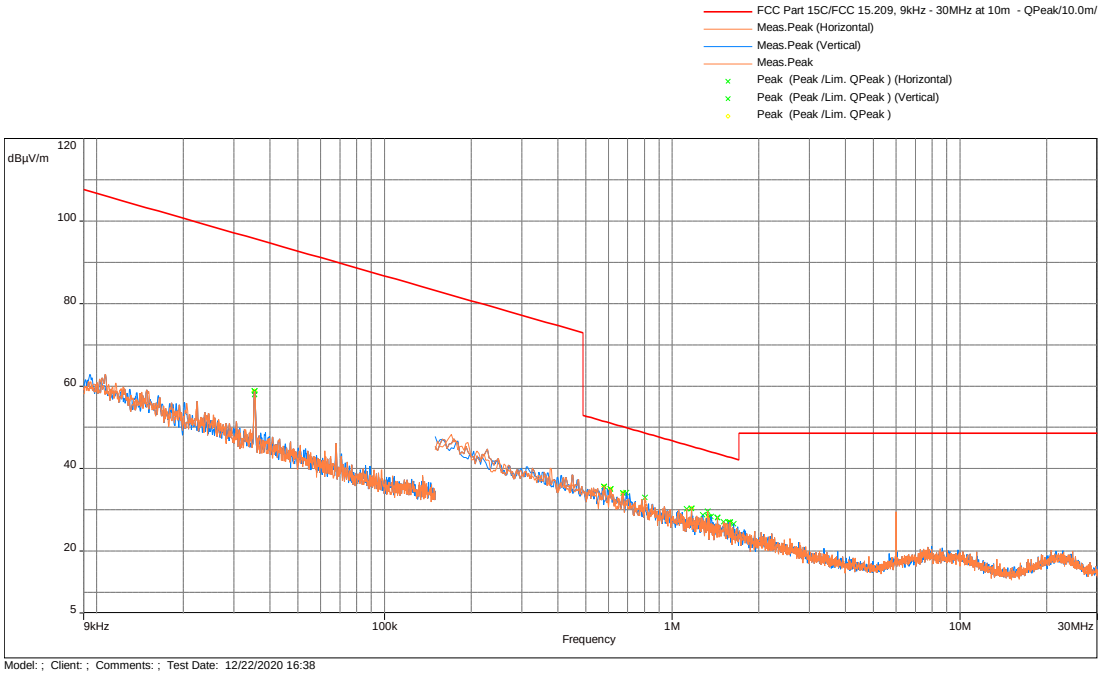
Note: FS@3m = RA + Correction
Correction = AF + CF - Preamp

Radiated Spurious Emissions 18000 MHz – 26500MHz, Peak Scan vs Average Limit

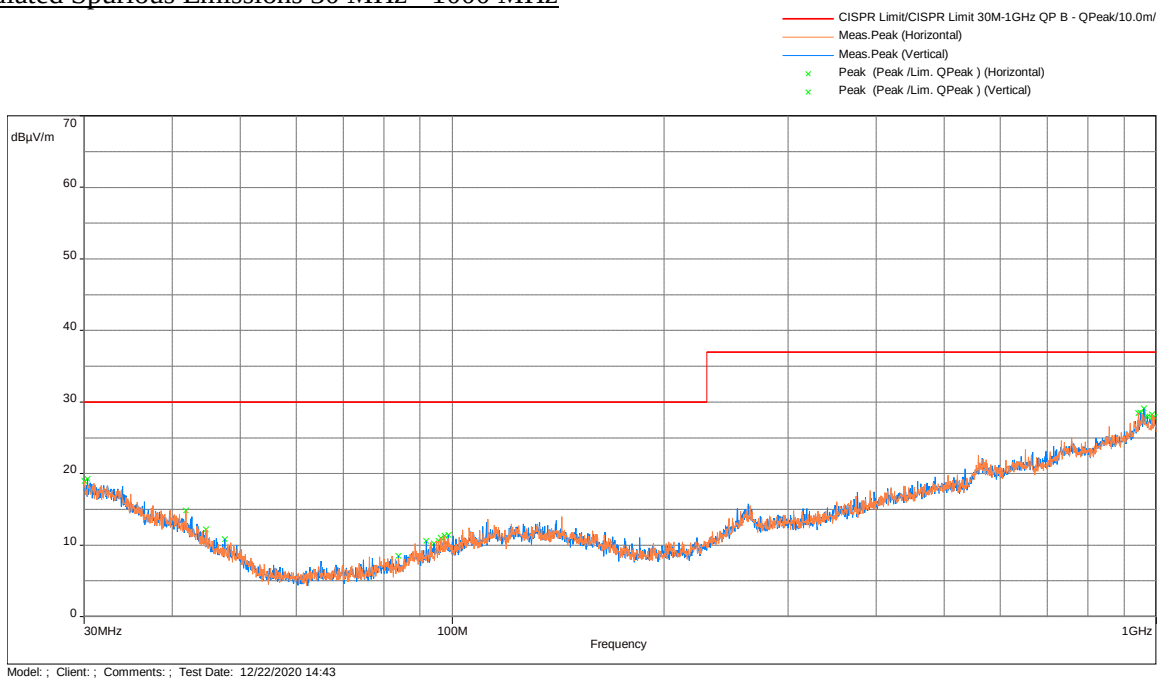


Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440MHz

Radiated Spurious Emissions 9kHz - 30 MHz



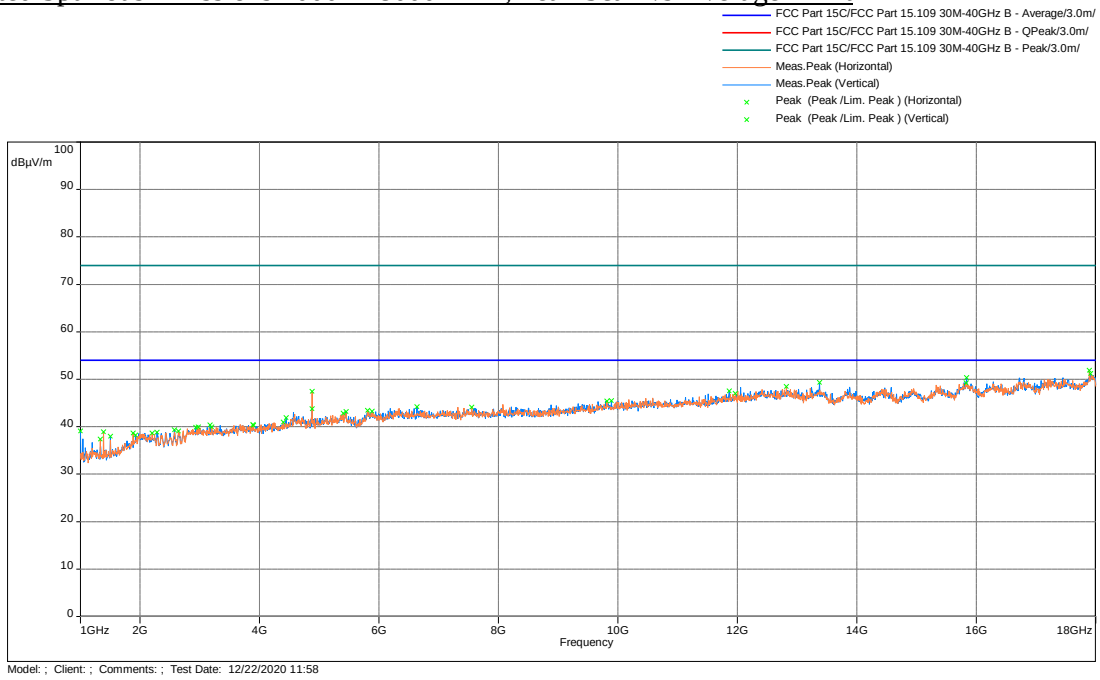
Radiated Spurious Emissions 30 MHz - 1000 MHz



Frequency (MHz)	QP FS@10m (dBµV/m)	Limit@10m (dBµV/m)	Margin (dB)	Angle (°)	Height (m)	Polarity	Raw (dBuV)	Correction (dB)
30.065	19.0	30	-11.1	172	3.98	Horizontal	27.7	-8.8
30.356	19.3	30	-10.7	259.5	1.02	Vertical	28.3	-9.0
94.149	10.2	30	-19.8	172.75	1.02	Vertical	28.0	-17.8
95.604	10.6	30	-19.4	191.25	1.98	Horizontal	28.2	-17.6
984.771	27.8	37	-9.2	247	1.02	Vertical	26.2	1.6
986.388	28.3	37	-8.7	327.5	2.98	Horizontal	26.6	1.6

Note: FS@10m = RA + Correction
Correction = AF + CF – Preamp

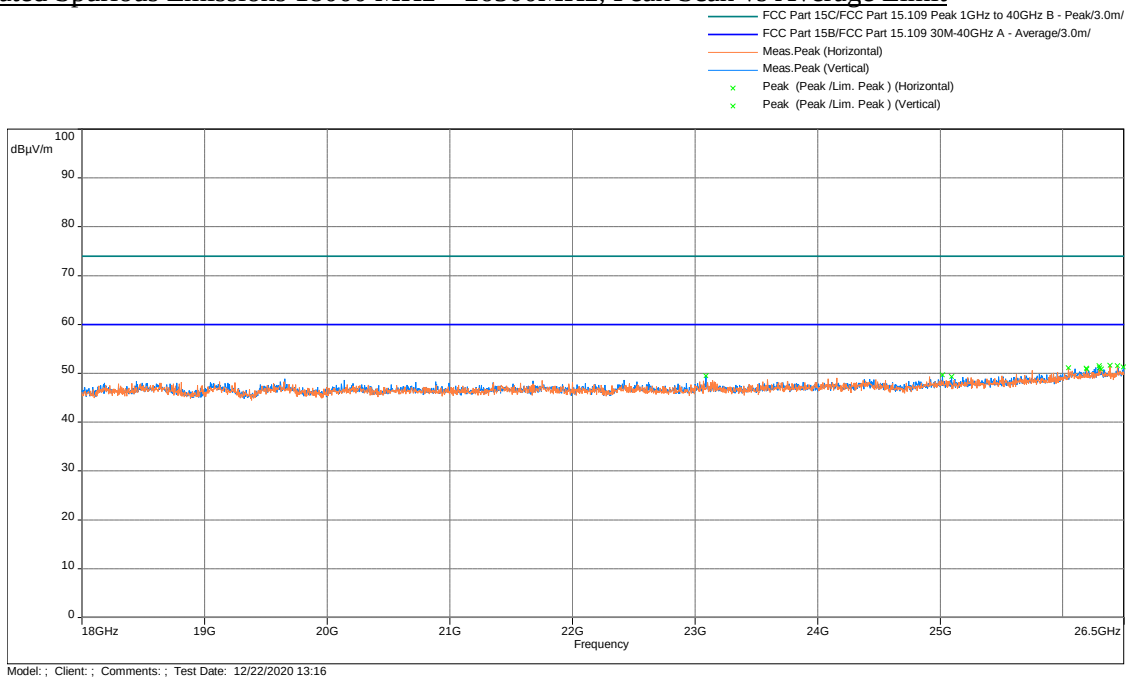
Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Average Limit



Frequency (MHz)	Peak@3m (dBµV/m)	Ave Limit@3m (dBµV/m)	Margin (dB)	Angle (°)	Height (m)	Polarity	Raw (dBuV)	Correction (dB)
4879.967	43.8	54	-10.2	190.75	2.23	Vertical	52.1	-8.3
4879.967	47.5	54	-6.5	0	2.27	Horizontal	55.8	-8.3

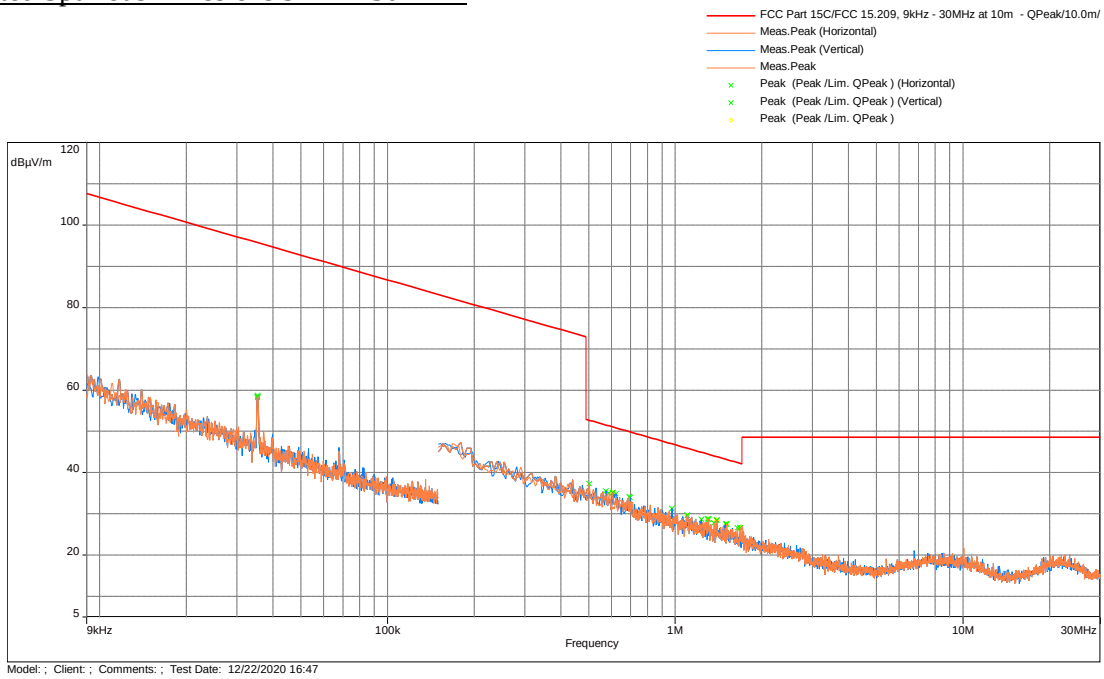
Note: FS@3m = RA + Correction
Correction = AF + CF - Preamp

Radiated Spurious Emissions 18000 MHz – 26500MHz, Peak Scan vs Average Limit

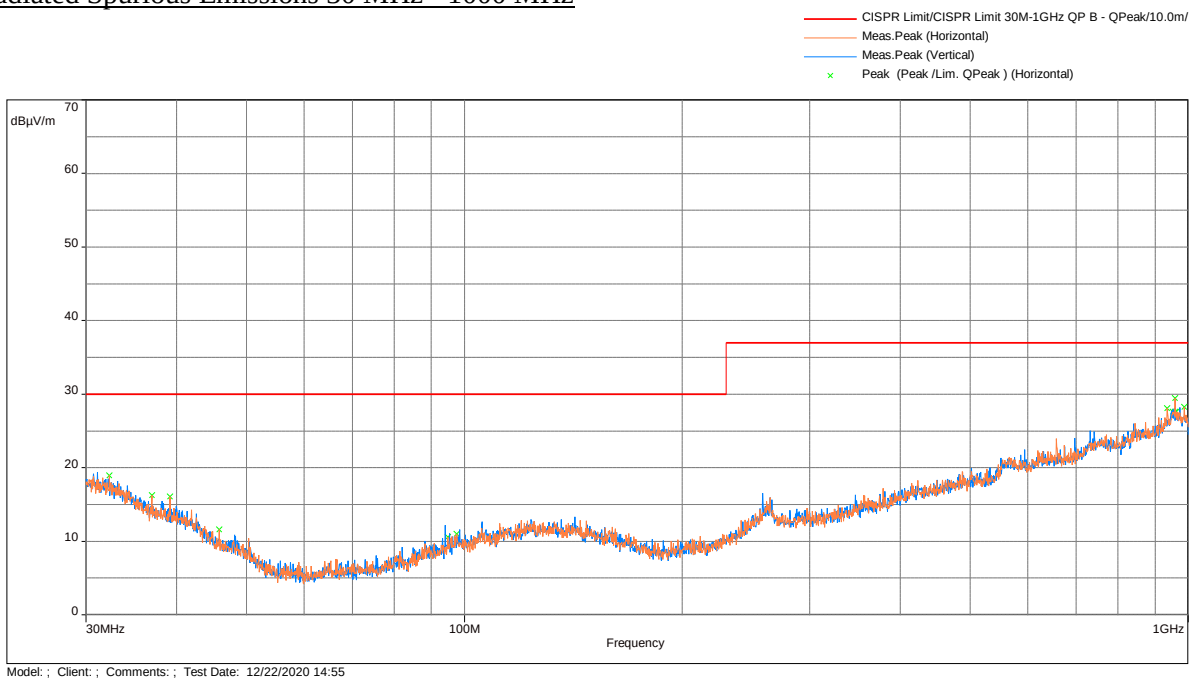


Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2480MHz

Radiated Spurious Emissions 9kHz - 30 MHz



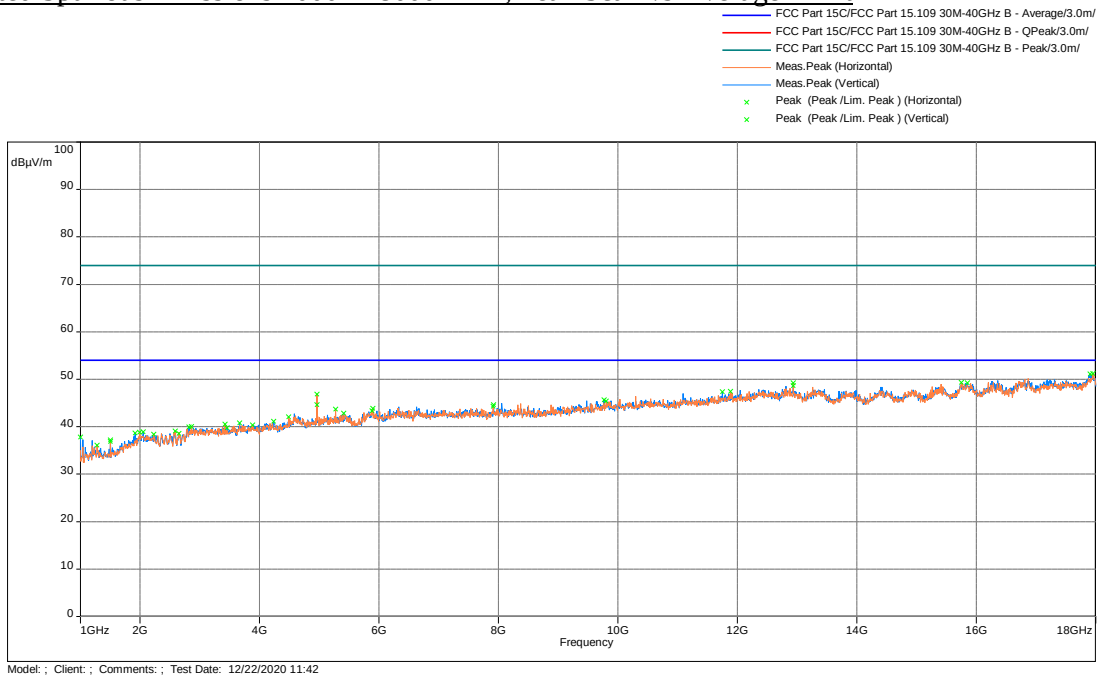
Radiated Spurious Emissions 30 MHz - 1000 MHz



Frequency (MHz)	QP FS@10m (dBµV/m)	Limit@10m (dBµV/m)	Margin (dB)	Angle (°)	Height (m)	Polarity	Raw (dBuV)	Correction (dB)
32.231	18.5	30	-11.5	284	3.02	Vertical	28.5	-10.0
32.328	19.0	30	-11.1	329.5	3.98	Horizontal	29.0	-10.0
258.403	16.6	37	-20.4	157	2.02	Vertical	29.4	-12.8
264.449	16.0	37	-21.1	185.5	1.98	Horizontal	28.3	-12.3
956.932	28.2	37	-8.8	36.5	2.02	Vertical	26.2	2.0
958.646	29.4	37	-7.6	279	2.98	Horizontal	27.5	2.0

Note: FS@10m = RA + Correction
Correction = AF + CF – Preamp

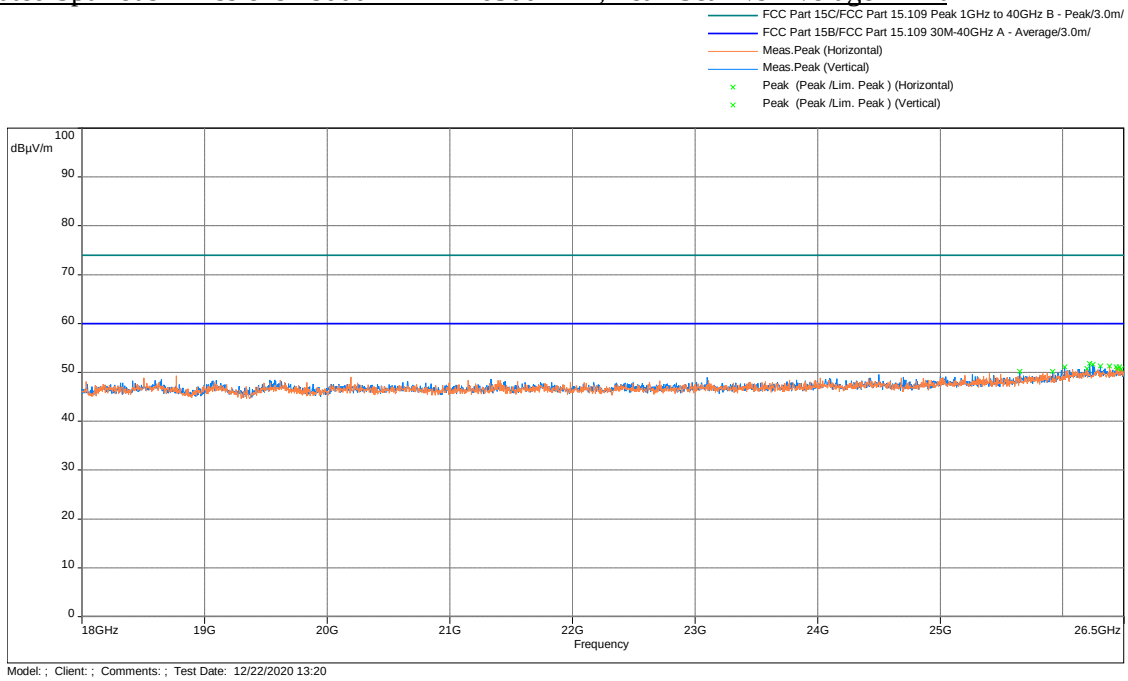
Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Average Limit



Frequency (MHz)	Peak@3m (dBµV/m)	Ave Limit@3m (dBµV/m)	Margin (dB)	Angle (°)	Height (m)	Polarity	Raw (dBuV)	Correction (dB)
4959.867	46.8	54	-7.2	0	1.27	Horizontal	55.0	-8.2
4959.867	44.7	54	-9.4	151.75	3.23	Vertical	52.8	-8.2

Note: FS@3m = RA + Correction
Correction = AF + CF - Preamp

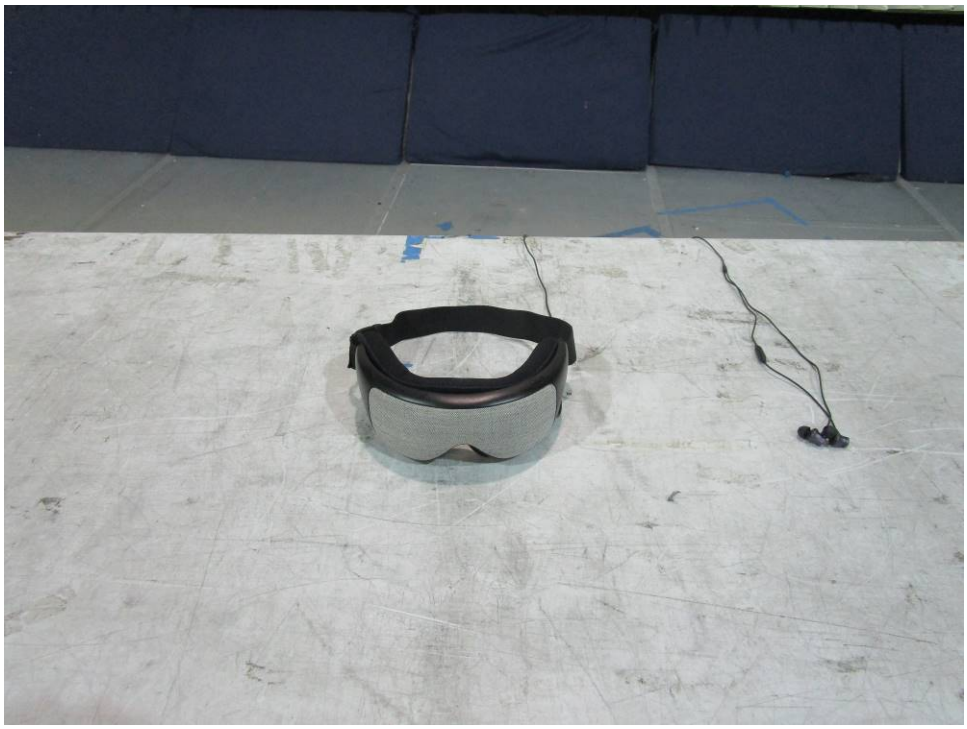
Radiated Spurious Emissions 18000 MHz – 26500MHz, Peak Scan vs Average Limit

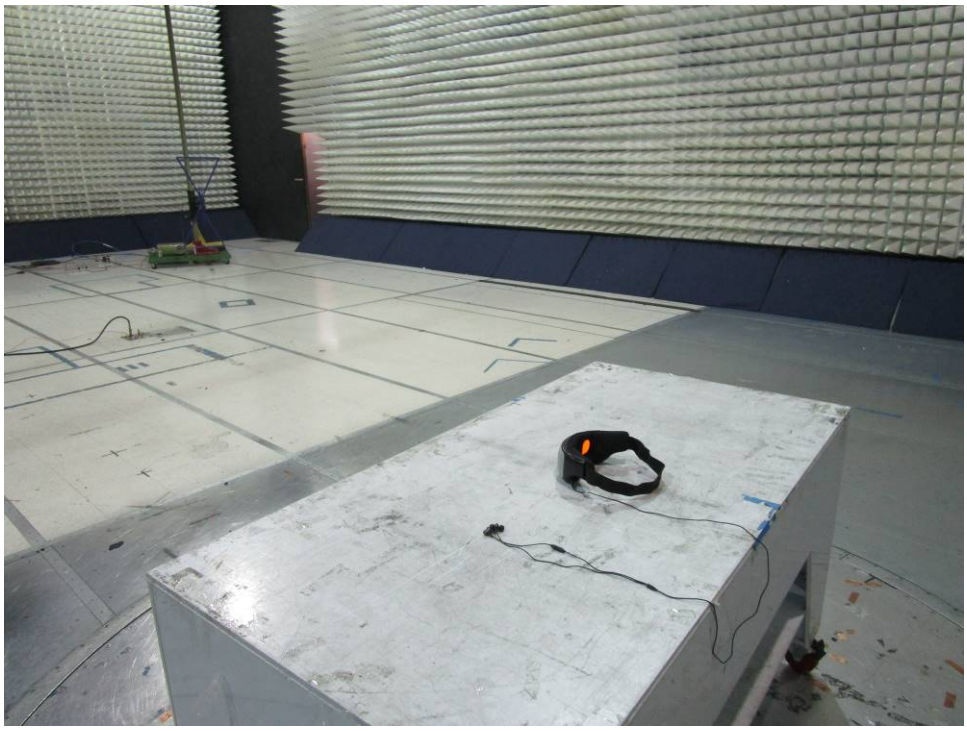


Result:	**Complies** by 6.5 dB

4.5.5 Test setup photographs

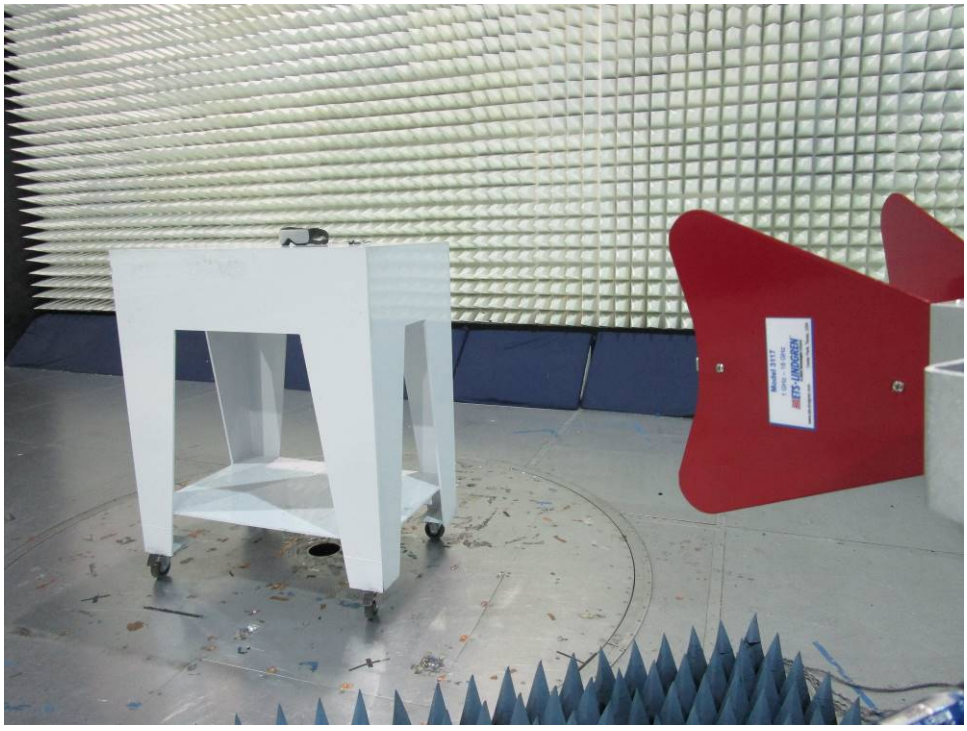
The following photographs show the testing configurations used.



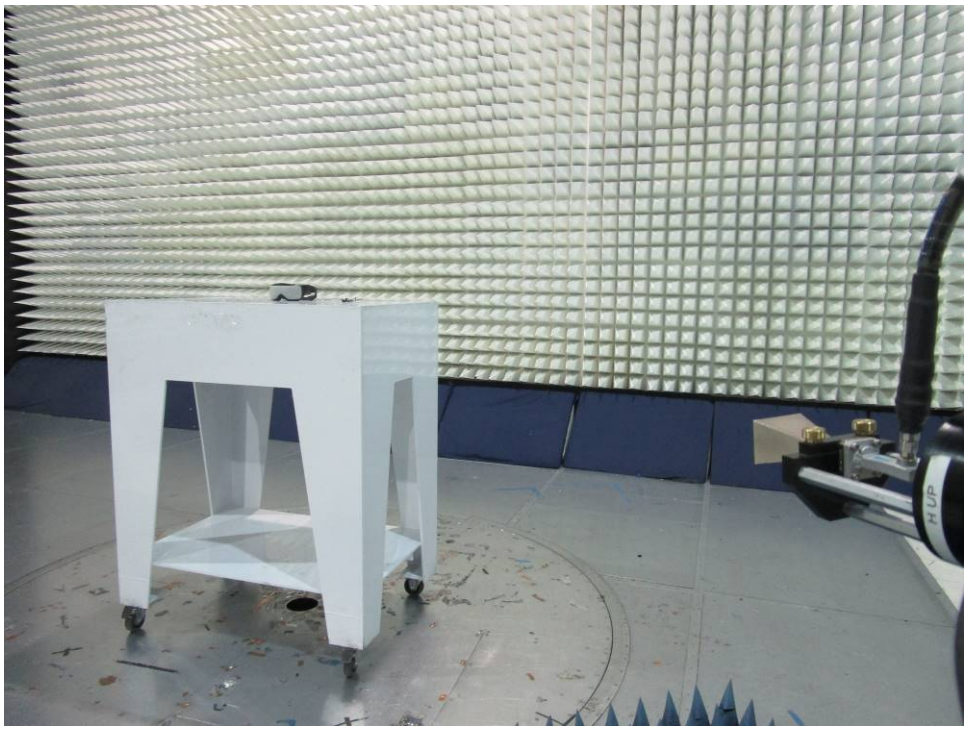


4.5.5 Test Setup Photographs (Continued)

4.5.5 Test Setup Photographs (Continued)



4.5.5 Test Setup Photographs (Continued)



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
Spectrum Analyzer	Rohde and Schwarz	FSW	ITS 01818	12	07/09/21
EMI Receiver	Rohde & Schwarz	ESU40	ITS 00961	12	03/09/21
BI-Log Antenna	Teseq	CBL 6111D	ITS 01505	12	03/11/21
Preamp	Sonoma Preamp	310N	ITS 01714	12	11/13/21
Active Horn Antenna	ETS Lindgren	3117PA	ITS 01636	12	02/24/21
Pyramidal Horn Antenna	EMCO	3160-09	ITS 00571	#	#
Pre-Amplifier	Miteq	TTA1840-35-S-M	ITS 01393	12	03/02/21
Notch Filter	Micro-Tronics	BRM50702	ITS 01166	12	06/11/21
RE Cable	TRU Corporation	TRU CORE 300	ITS 01462	12	09/01/21
RE Cable	TRU Corporation	TRU CORE 300	ITS 01465	12	09/01/21
RE Cable	TRU Corporation	TRU CORE 300	ITS 01470	12	09/01/21
RF Cable	TRU Corporation	TRU CORE 300	ITS 01342	12	09/01/21
RF Cable	Mega Phase	TM40-K1K1-59	ITS 01655	12	10/05/21
10m chamber	Panashield	10m Semi-Anechoic	ITS 00984	36	09/11/21
Passive Loop Antenna	EMCO	6512	ITS 001598	12	11/03/21
Preamp	Sonoma Preamp	310N	ITS 00942	12	04/14/21

No Calibration required

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
BAT-EMC	Nexio	3.19.1.19	Sana Health December 22, 2020.bpp
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 / G104395865	TM	KV	January 06, 2021	Original document