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Foundation Fitness LLC
TEST REPORT

SCOPE OF WORK
EMC TESTING – DASH L200 BIKE COMPUTER

REPORT NUMBER
104771489LEX-009.3

ISSUE DATE **REVISED DATE**
12/6/2021 8/23/2022

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DOCUMENT CONTROL NUMBER
Non-Specific EMC Report Shell Rev. December 2017

EMC TEST REPORT

(FULL COMPLIANCE)

Report Number: 104771489LEX-009.3
Project Number: G104771489

Report Issue Date: 12/6/2021
Report Revised Date: 8/23/2022

Model(s) Tested: L200

Standards: Title 47 CFR Part 15.247
RSS-247 Issue 2
RSS-Gen Issue 5

Tested by:
Intertek Testing Services NA, Inc.
731 Enterprise Dr.
Lexington, KY 40510
USA

Client:
Foundation Fitness LLC
1220 Main Street
Suite 400
Vancouver, WA 98660
USA

Report prepared by

Brian Lackey, Team Leader

Report reviewed by

James Sudduth, Senior Staff Engineer

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1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
6	Receiver Spurious Emissions (ANSI C63.4: 2014)	Pass
7	Transmitter Spurious Emissions (FCC Part 15.247(d), RSS-247 Issue 2 § 5.5)	Pass
8	Output Power (FCC Part 15.247(b)(3), RSS-247 Issue 2 § 5.4(d))	Pass
9	Occupied Bandwidth (FCC Part 15.247, RSS-247 Issue 2 § 5.2(a))	Pass
10	Power Spectral Density (FCC Part 15.247(e), RSS-247 Issue 2 § 5.2(b))	Pass
11	Conducted Spurious Emissions (FCC Part 15.247(d), RSS-247 Issue 2 § 5.5)	Pass
12	Antenna Requirement (FCC Part 15.203, RSS-Gen Issue 5 § 6.8)	Pass
--	Conducted Emissions on the AC Mains (ANSI C63.4: 2014)	NA[1]

1 The Dash L200 Bike Computer is battery powered when in use and installed on a bicycle. It has no connections to the AC mains.

3 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	Foundation Fitness LLC
Address:	1220 Main Street Suite 400 Vancouver, WA 98660 USA
Contact:	Jim Stemper
Email:	jstemper@stagescycling.com
Manufacturer Information	
Manufacturer Name:	Digital Concepts, Inc.
Manufacturer Address:	3108 Riverport Tech Center Drive Maryland Heights, MO 63043 United States of America
Factory Address:	Digital Concepts de Mexico. S de RL de CV Ponciano Arriaga No. 716 Col. Parque Industrial Los Aztecas Cd. Juarez Chihuahua, Mexico, CP: 32679

4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	Dash L200 Bike Computer
Model Numbers	L200
Serial Number	Test Sample 1
Receive Date	9/1/2021
Test Start Date	9/1/2021
Test End Date	9/21/2021
Device Received Condition	Good
Test Sample Type	Production
Rated Voltage	5VDC
Frequency Band(s)	2400-2483.5MHz
Modulation Type(s)	GFSK
Test Channel(s)	2402MHz, 2440MHz, 2480MHz
Maximum Antenna Gain (dBi)	1.6dBi Taiyo Yuden Model AH316M245001-T Antenna Information was provided by Foundation Fitness LLC and may affect compliance
Description of Equipment Under Test (provided by client)	
The Dash L200 Bike Computer is a 2.7" color display rechargeable bike computer with GPS, Bluetooth (Low Energy), WiFi (approved module), Barometric pressure sensor, piezoelectric buzzer, 16GB of memory, 5 buttons and a plastic mounting interface to connect to handlebars. This computer is built on Linux and is based on the existing M50 bike computer, utilizing all of its existing features.	

4.1 Variant Models:

There were no variant models covered by this evaluation.

5 System Setup and Method

5.1 Method:

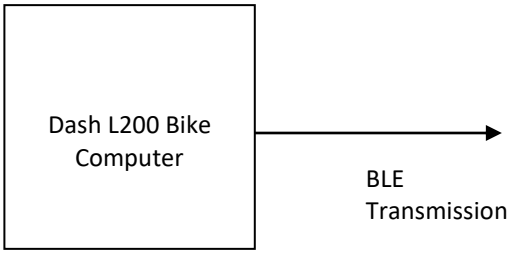
Configuration as required by ANSI C63.4: 2014 and ANSI C63.10:2013

No.	Descriptions of EUT Exercising
1	Transmitting a Bluetooth Low Energy (BLE) signal or low, middle, or high channel
2	Idle, not transmitting. External AC/DC supply used in lieu of battery for testing.

Cables					
Qty	Description	Length (m)	Shielding	Ferrites	Termination
1	USB Charging Cable	2m	Yes	None	Laptop Computer

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Laptop Computer	HP	EliteBook	Not Labeled

5.2 EUT Block Diagram:



6 Receiver Spurious Emissions

6.1 Test Method

Tests are performed in accordance with ANSI C63.4: 2014

TEST SITE: 10m ALSE

Site Designation: 10m Chamber

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	3.9dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.0dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.7dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required.

6.2 Sample 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

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

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

6.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	8131	Rohde & Schwarz	ESW44	1/15/2020	1/22/2022
Bilog Antenna (30MHz-1GHz)	7085	SunAR	JB6	10/5/2021	10/5/2022
Horn Antenna (1-18GHz)	3780	ETS	3117	6/28/2021	6/28/2022
System Controller	4096	ETS Lindgren	2090	Verify at Time of Use	Verify at Time of Use
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
Coaxial Cable	3074			12/21/2020	12/21/2021
Preamplifier	3918	TS-PR18	122005	12/21/2020	12/21/2021
Coaxial Cable	2588			12/21/2020	12/21/2021
Coaxial Cable	2593			12/21/2020	12/21/2021
Coaxial Cable	2592			12/21/2020	12/21/2021
Coaxial Cable	3339			12/21/2020	12/21/2021

6.4 Software Utilized

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

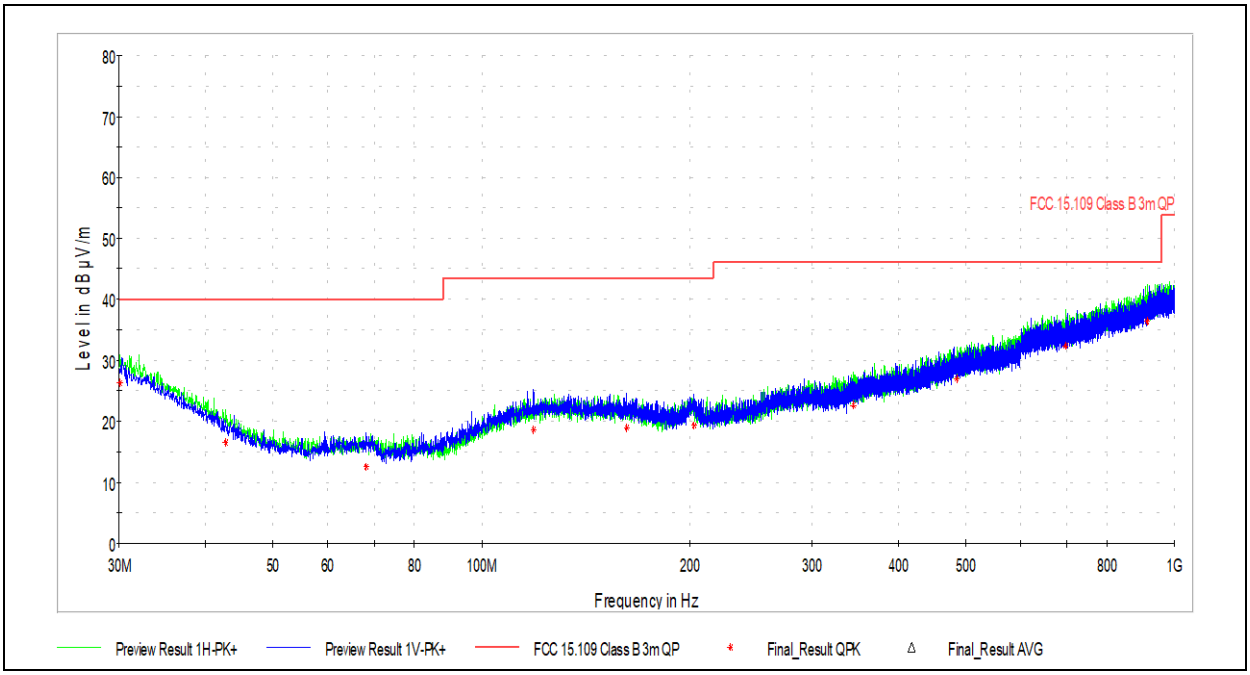
6.5 Test Results

The sample tested was found to be **compliant**.

6.6 Test Conditions

Test Personnel:	Brian Lackey	Test Date:	9/2/2021
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	FCC Part 15.209 / FCC Part 15.109 Class B
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	14.2C
Input Voltage:	Battery Powered	Relative Humidity:	70.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	882.9mbar

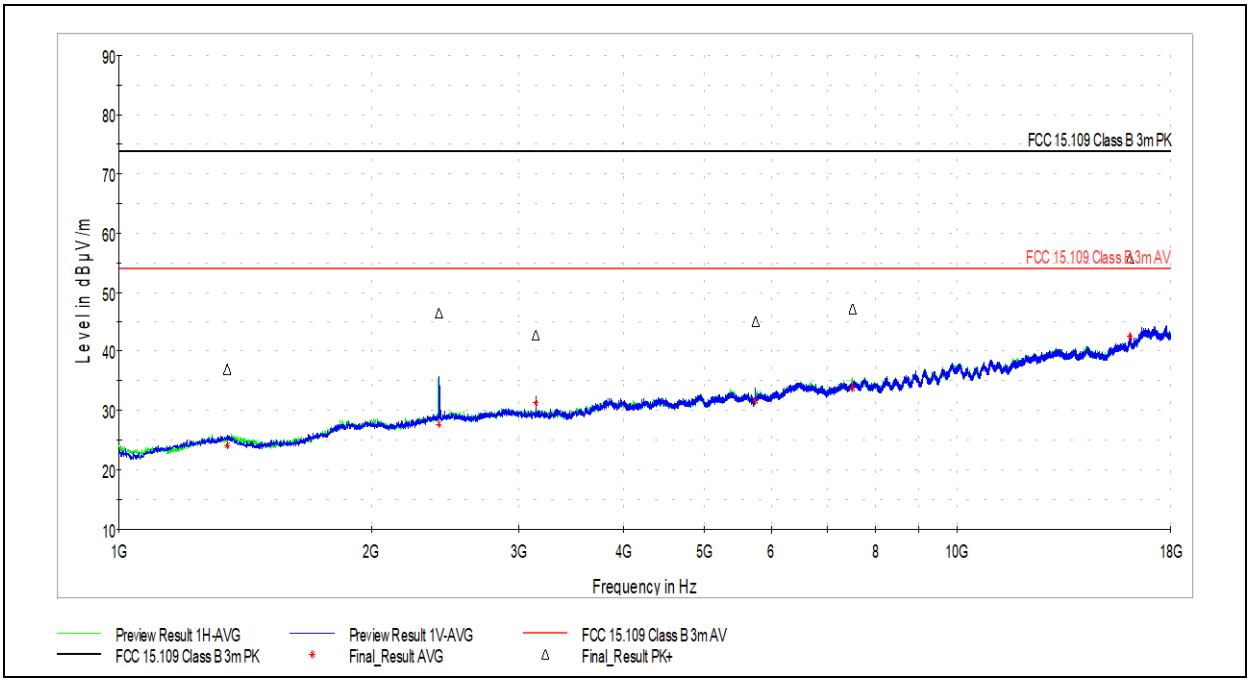
6.7 Test Data: 30MHz – 1GHz



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.107778	26.22	40.00	13.78	120.000	392.0	H	0.0	29
42.717778	16.54	40.00	23.46	120.000	392.0	H	190.0	20
68.207222	12.48	40.00	27.52	120.000	120.0	V	251.0	15
119.024444	18.54	43.52	24.98	120.000	208.0	V	163.0	22
162.135556	19.01	43.52	24.52	120.000	217.0	V	0.0	22
202.660000	19.38	43.52	24.14	120.000	164.0	V	38.0	22
343.687222	22.64	46.02	23.38	120.000	121.0	H	0.0	25
485.415000	26.91	46.02	19.12	120.000	392.0	H	254.0	29
696.282222	32.40	46.02	13.62	120.000	303.0	H	116.0	33
912.161111	36.32	46.02	9.70	120.000	393.0	H	284.0	37

Deviations, Additions, or Exclusions: None

6.8 Test Data: 1GHz – 18GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1345.500000	37.09	73.98	36.89	1000.000	256.0	V	114.0	1
2409.500000	46.43	73.98	27.55	1000.000	331.0	V	220.0	5
3142.500000	42.81	73.98	31.17	1000.000	188.0	H	290.0	6
5749.500000	45.00	73.98	28.98	1000.000	100.0	V	150.0	11
7503.000000	47.23	73.98	26.75	1000.000	230.0	H	322.0	13
16103.000000	55.89	73.98	18.09	1000.000	332.0	H	264.0	25

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1345.500000	24.10	53.98	29.88	1000.000	256.0	V	114.0	1
2409.500000	27.69	53.98	26.29	1000.000	331.0	V	220.0	5
3142.500000	31.36	53.98	22.62	1000.000	188.0	H	290.0	6
5749.500000	31.69	53.98	22.29	1000.000	100.0	V	150.0	11
7503.000000	33.78	53.98	20.20	1000.000	230.0	H	322.0	13
16103.000000	42.55	53.98	11.43	1000.000	332.0	H	264.0	25

Deviations, Additions, or Exclusions: None

7 Transmitter Spurious Emissions

7.1 Test Limits

FCC Part 15.247(d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

RSS-247 Issue 2 § 5.5:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

7.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.12.1 Radiated emission measurements.

7.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	8131	Rohde & Schwarz	ESW44	1/15/2020	1/22/2022
Bilog Antenna (30MHz-1GHz)	7085	SunAR	JB6	10/5/2021	10/5/2022
Horn Antenna (1-18GHz)	3780	ETS	3117	6/28/2021	6/28/2022
System Controller	4096	ETS Lindgren	2090	Verify at Time of Use	Verify at Time of Use
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
Coaxial Cable	3074			12/21/2020	12/21/2021
Preamplifier	3918	TS-PR18	122005	12/21/2020	12/21/2021
Coaxial Cable	2588			12/21/2020	12/21/2021
Coaxial Cable	2593			12/21/2020	12/21/2021
Coaxial Cable	2592			12/21/2020	12/21/2021
Coaxial Cable	3339			12/21/2020	12/21/2021
Magnetic Loop Antenna	2366	ETS	6502	7/30/2021	7/30/2022
Preamplifier (18-40GHz)	3921	Rohde & Schwarz	TS-PR40	12/21/2020	12/21/2021
Horn Antenna (18-40GHz)	3779	ETS	3116c	7/30/2021	7/30/2022

7.4 Software Utilized

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

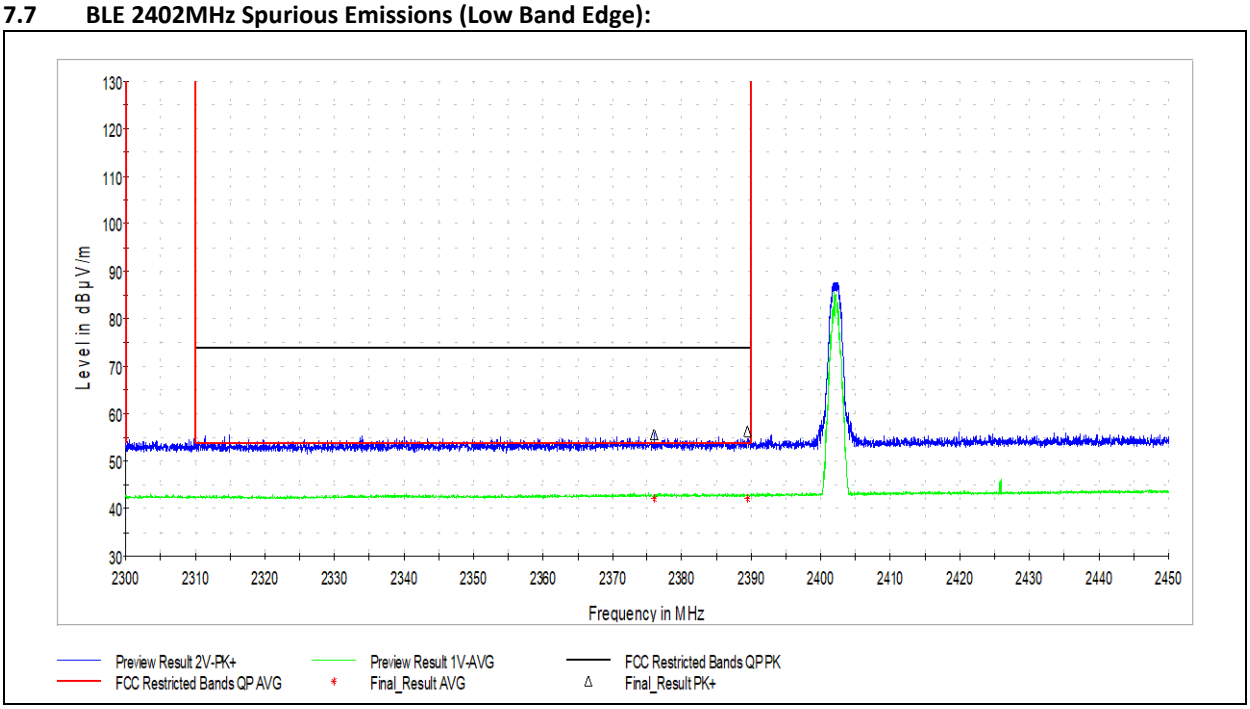
7.5 Test Results

The sample tested was found to be **compliant**. The data presented represents the worst case emissions with the device positioned in three orthogonal positions. All observed emissions outside of the band of operation were attenuated by at least 20dB.

7.6 Test Conditions

Test Personnel:	Bryan Taylor	Test Date:	9/2/2021 – 9/8/2021
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	22.5C
Input Voltage:	Battery	Relative Humidity:	59.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	977.2mbar

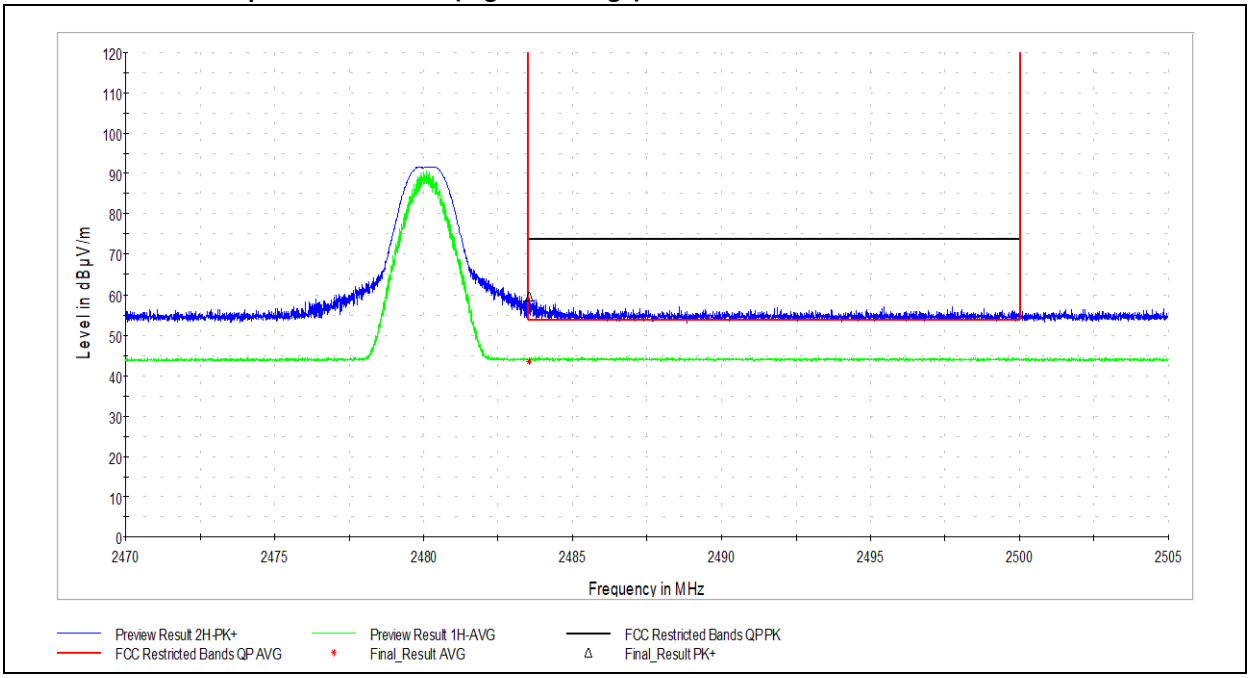
7.7 BLE 2402MHz Spurious Emissions (Low Band Edge):



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2376.038462	55.66	73.98	18.32	1000.000	156.0	V	218.0	39
2389.451923	56.45	73.98	17.53	1000.000	157.0	V	38.0	39

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2376.038462	42.13	53.98	11.85	1000.000	156.0	V	218.0	39
2389.451923	42.16	53.98	11.82	1000.000	157.0	V	38.0	39

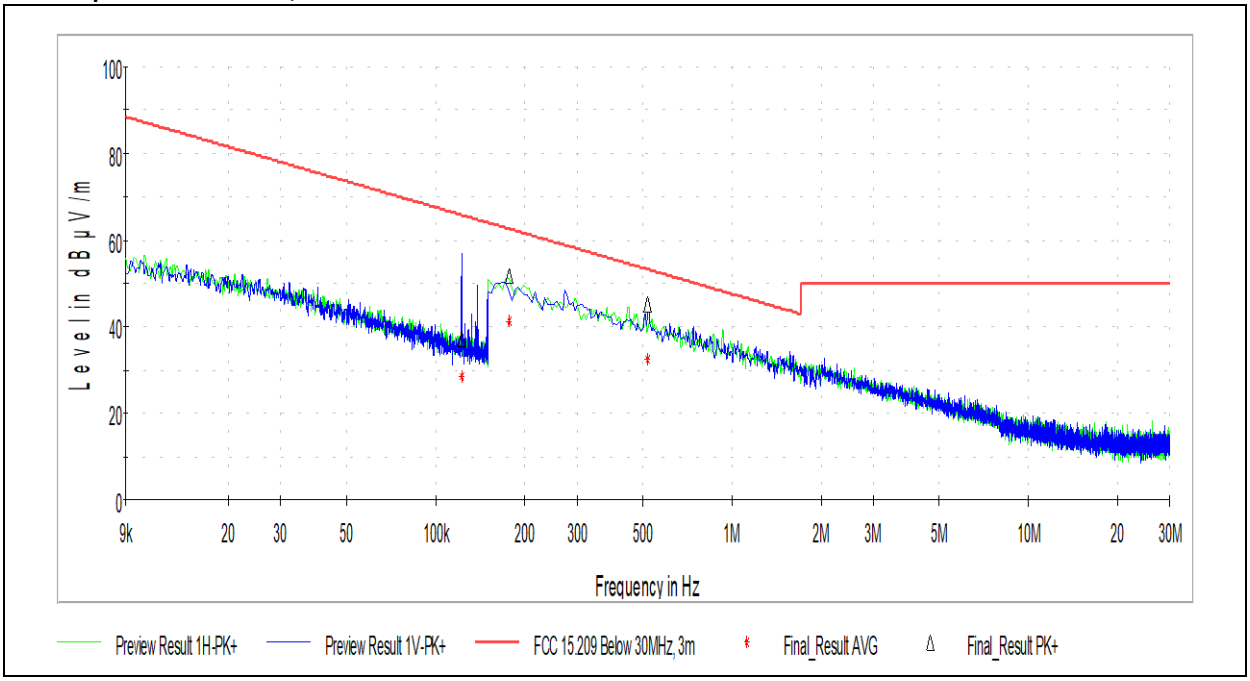
7.8 BLE 2480MHz Spurious Emissions (High Band Edge):



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.542308	59.60	73.98	14.38	1000.000	209.0	H	0.0	39

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.542308	43.40	53.98	10.58	1000.000	209.0	H	0.0	39

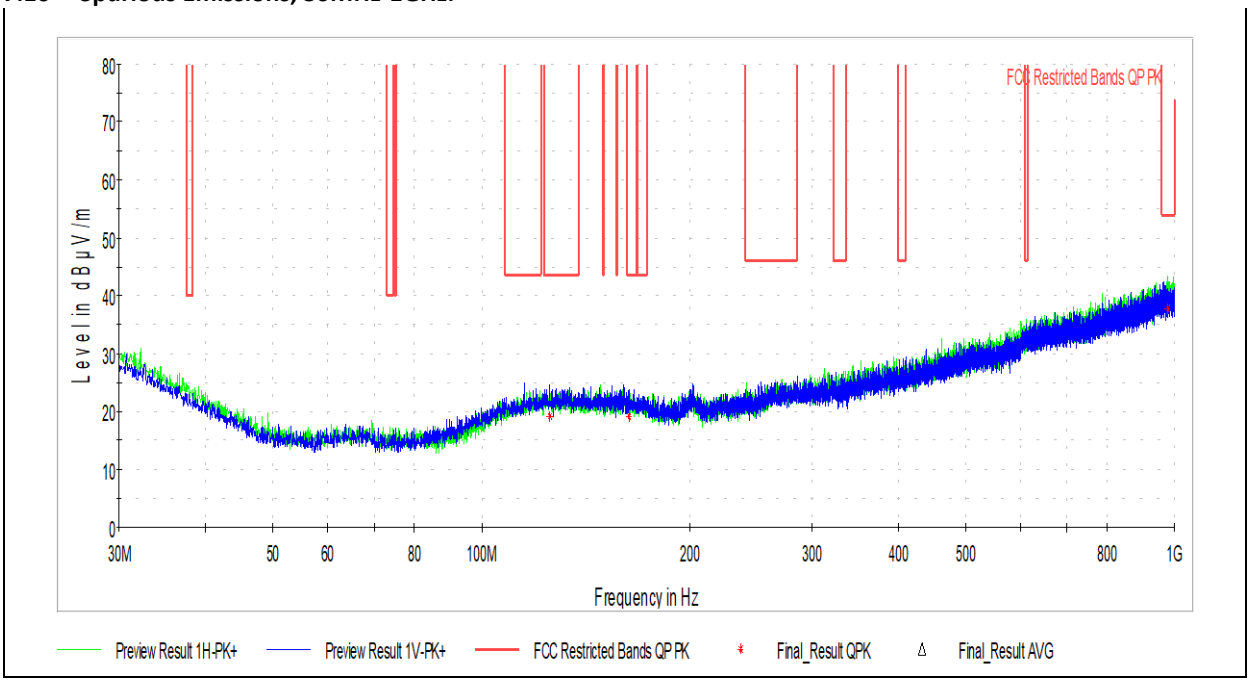
7.9 Spurious Emissions, 9kHz – 30MHz:



Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Azimuth (deg)	Corr. (dB/m)
0.122102	28.38	65.87	37.49	0.200	260.0	12
0.176338	41.25	62.68	21.43	9.000	158.0	12
0.518735	32.39	53.31	20.91	9.000	315.0	12

Note: results shown represent the worst case of three channels under test

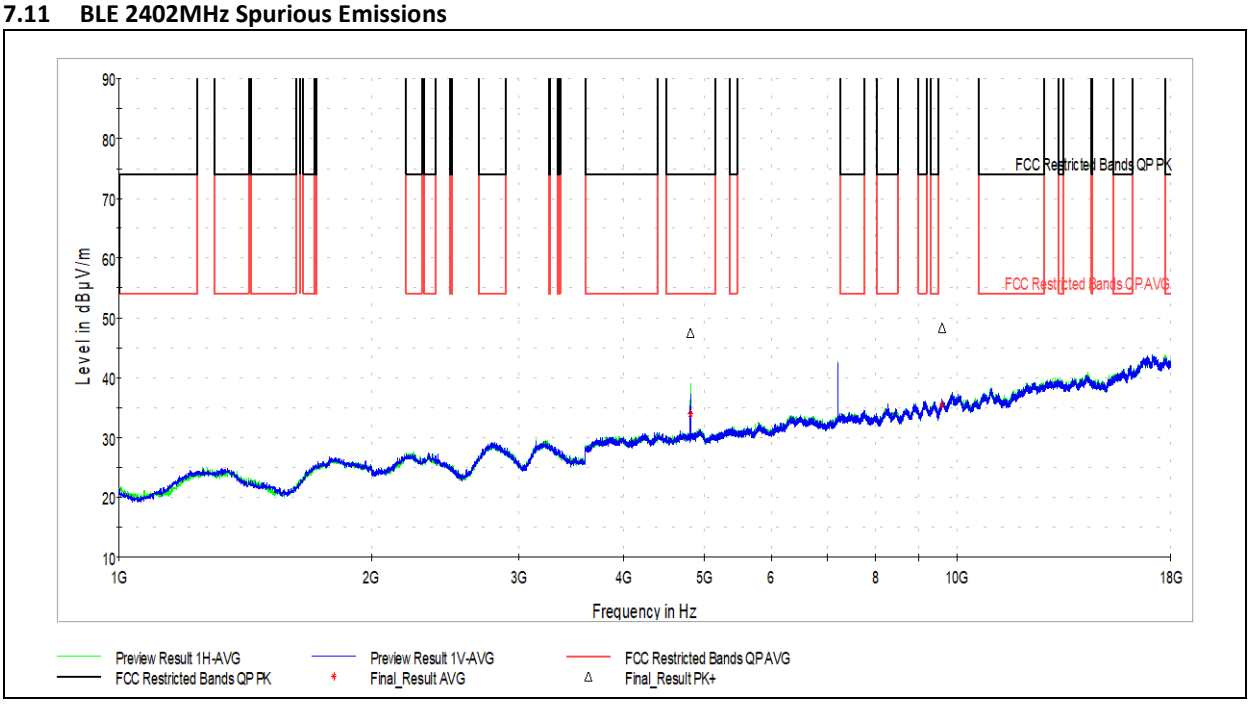
7.10 Spurious Emissions, 30MHz-1GHz:



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
125.437222	19.21	43.52	24.31	120.000	393.0	V	153.0	22
163.321111	19.07	43.52	24.45	120.000	165.0	V	103.0	22
977.905556	37.79	53.98	16.19	120.000	393.0	H	189.0	38

Note: results shown represent the worst case of three channels under test

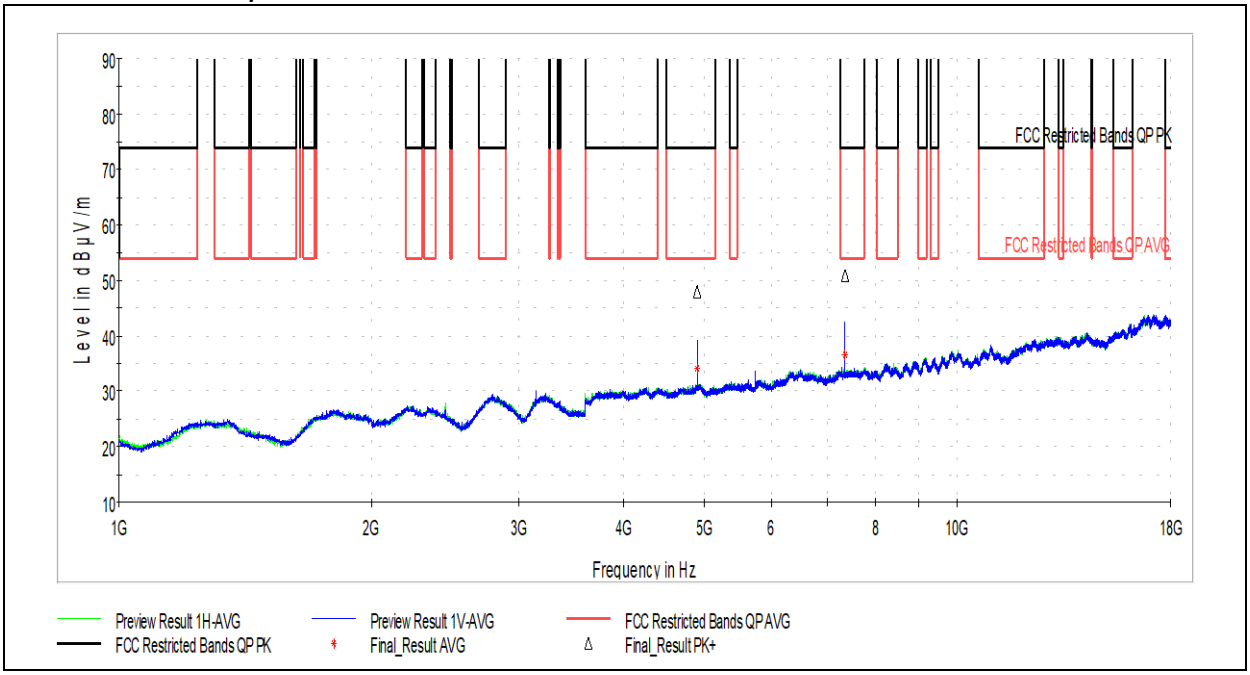
7.11 BLE 2402MHz Spurious Emissions



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4804.000000	47.52	73.98	26.46	1000.000	399.0	H	179.0	9
9604.500000	48.26	-	-	1000.000	228.0	H	225.0	17

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4804.000000	33.86	53.98	20.12	1000.000	399.0	H	179.0	9
9604.500000	35.37	-	-	1000.000	228.0	H	225.0	17

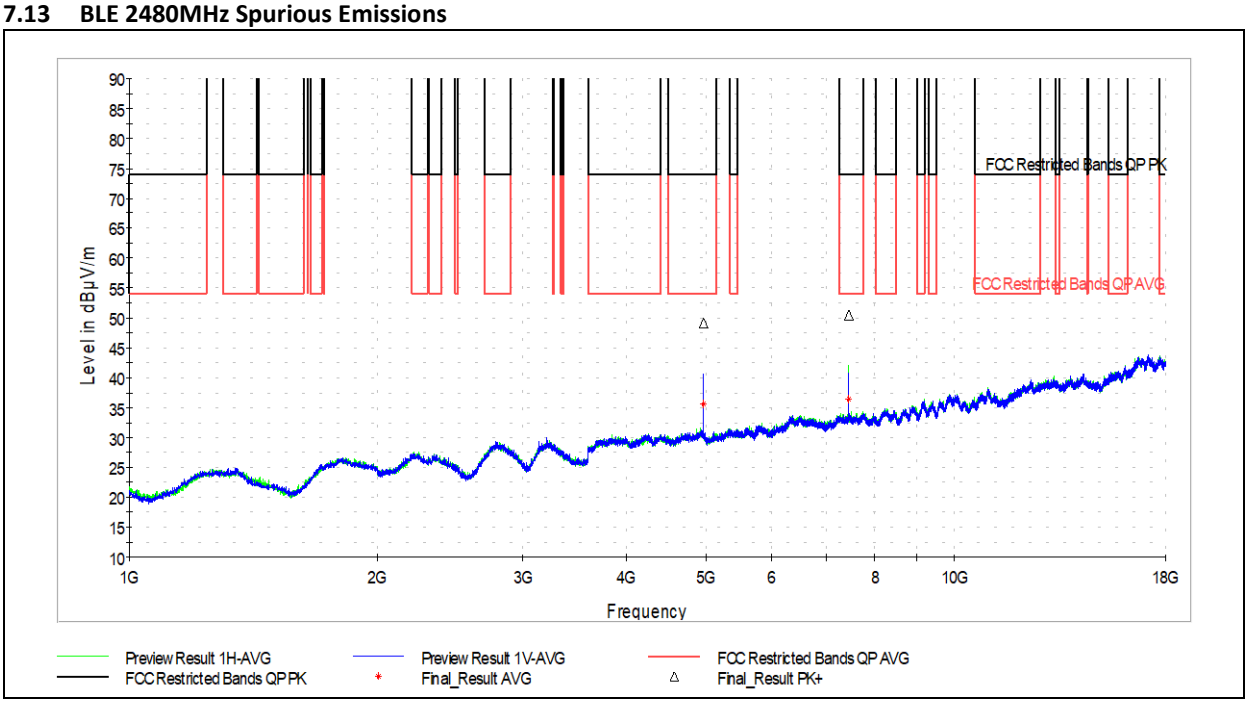
7.12 BLE 2440MHz Spurious Emissions



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4900.000000	48.01	73.98	25.97	1000.000	100.0	H	152.0	10
7350.500000	50.98	73.98	23.00	1000.000	314.0	H	137.0	13

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4900.000000	34.21	53.98	19.77	1000.000	100.0	H	152.0	10
7350.500000	36.58	53.98	17.40	1000.000	314.0	H	137.0	13

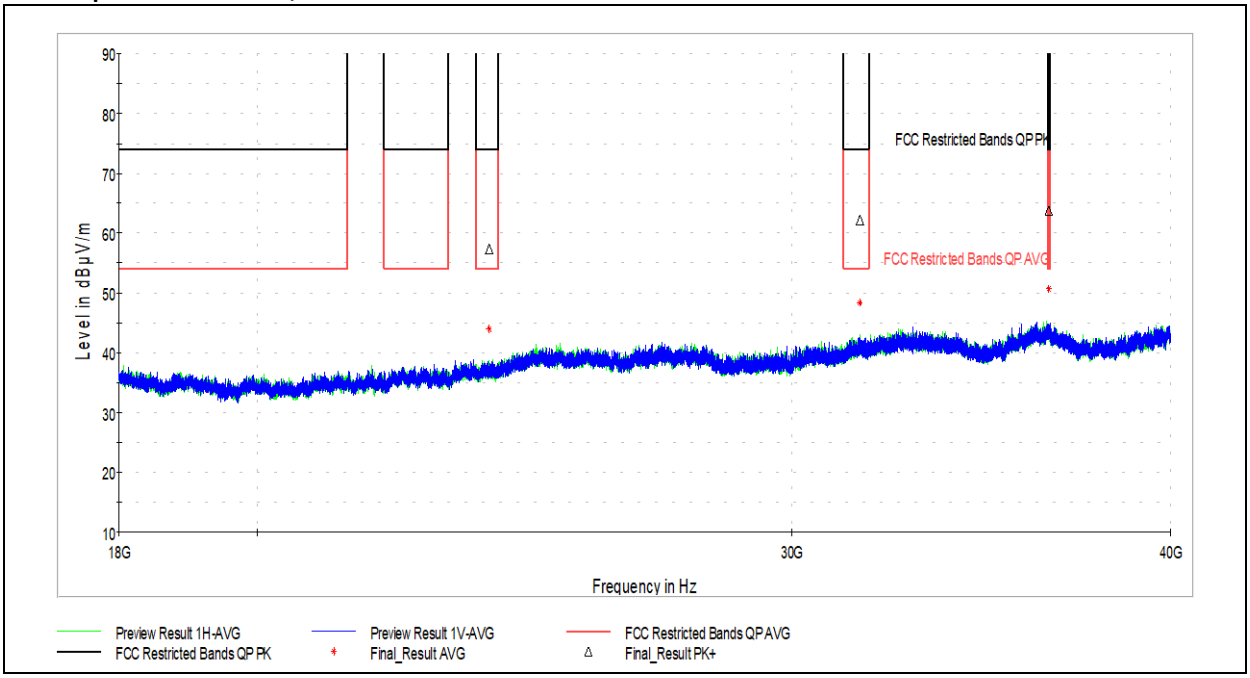
7.13 BLE 2480MHz Spurious Emissions



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4960.000000	49.10	73.98	24.88	1000.000	319.0	V	46.0	10
7440.000000	50.51	73.98	23.47	1000.000	100.0	H	112.0	13

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4960.000000	35.66	53.98	18.32	1000.000	319.0	V	46.0	10
7440.000000	36.48	53.98	17.50	1000.000	100.0	H	112.0	13

7.14 Spurious Emissions, 18GHz-40GHz:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
23836.500000	57.42	73.98	16.56	1000.000	319.0	H	0.0	11
31587.000000	62.19	73.98	11.79	1000.000	305.0	H	153.0	17
36455.500000	63.74	73.98	10.24	1000.000	389.0	V	258.0	19

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
23836.500000	43.93	53.98	10.05	1000.000	319.0	H	0.0	11
31587.000000	48.28	53.98	5.70	1000.000	305.0	H	153.0	17
36455.500000	50.67	53.98	3.31	1000.000	389.0	V	258.0	19

Note: results shown represent the worst case of three channels under test.

8 Output Power

8.1 Test Limits

FCC Part 15.247(b)(3):

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

RSS-247 Issue 2 § 5.4(d):

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

8.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.9.1.1. EIRP measurements were converted to output power based on customer-supplied antenna gain values.

8.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	8181	Rohde & Schwarz	ESW44	11/16/2021	11/16/2022
Horn Antenna	3780	ETS	3117	6/28/2021	6/28/2022
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
Coaxial Cable	3074			1/13/2022	1/13/2023
Coaxial Cable	2588			1/13/2022	1/13/2023
Coaxial Cable	2593			1/13/2022	1/13/2023
Coaxial Cable	2592			1/13/2022	1/13/2023

8.4 Test Results

The device was found to be **compliant**. The peak output power was less than 1W.

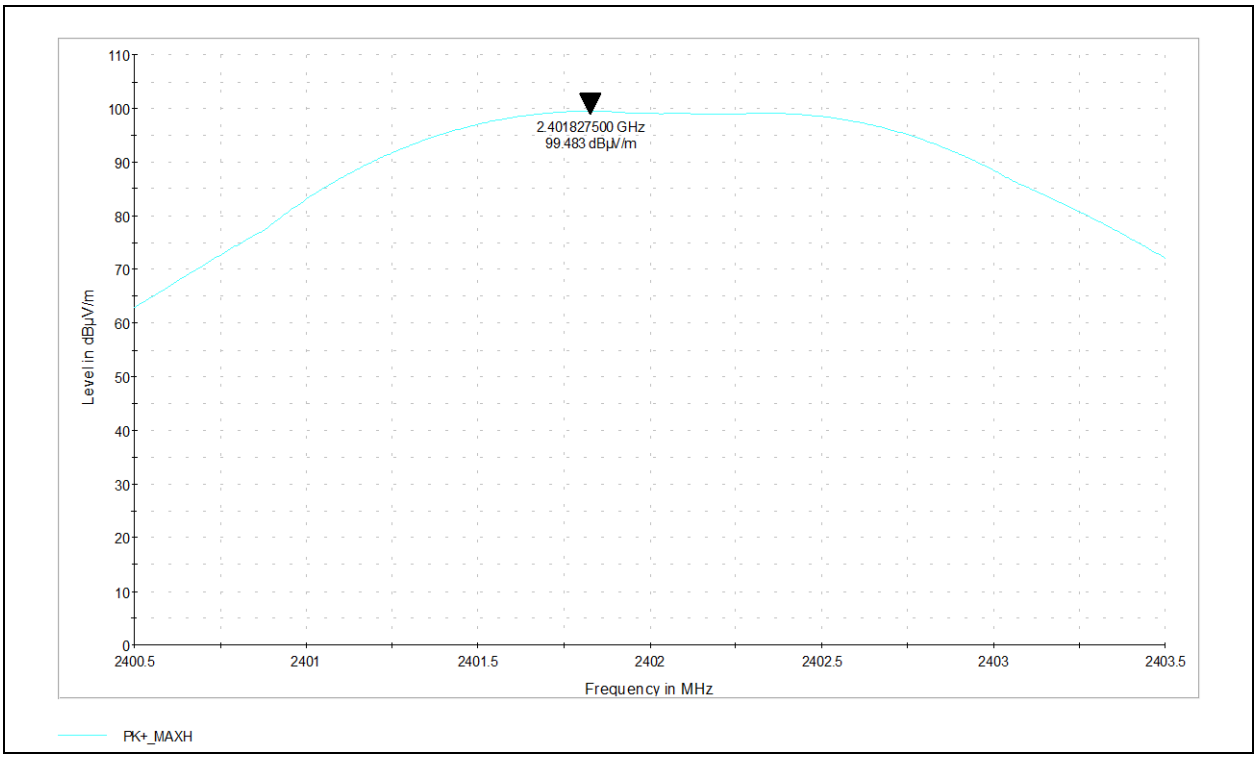
8.5 Test Conditions

Test Personnel:	Bryan Taylor	Test Date:	9/21/2021
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.6C
Input Voltage:	Battery	Relative Humidity:	52.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

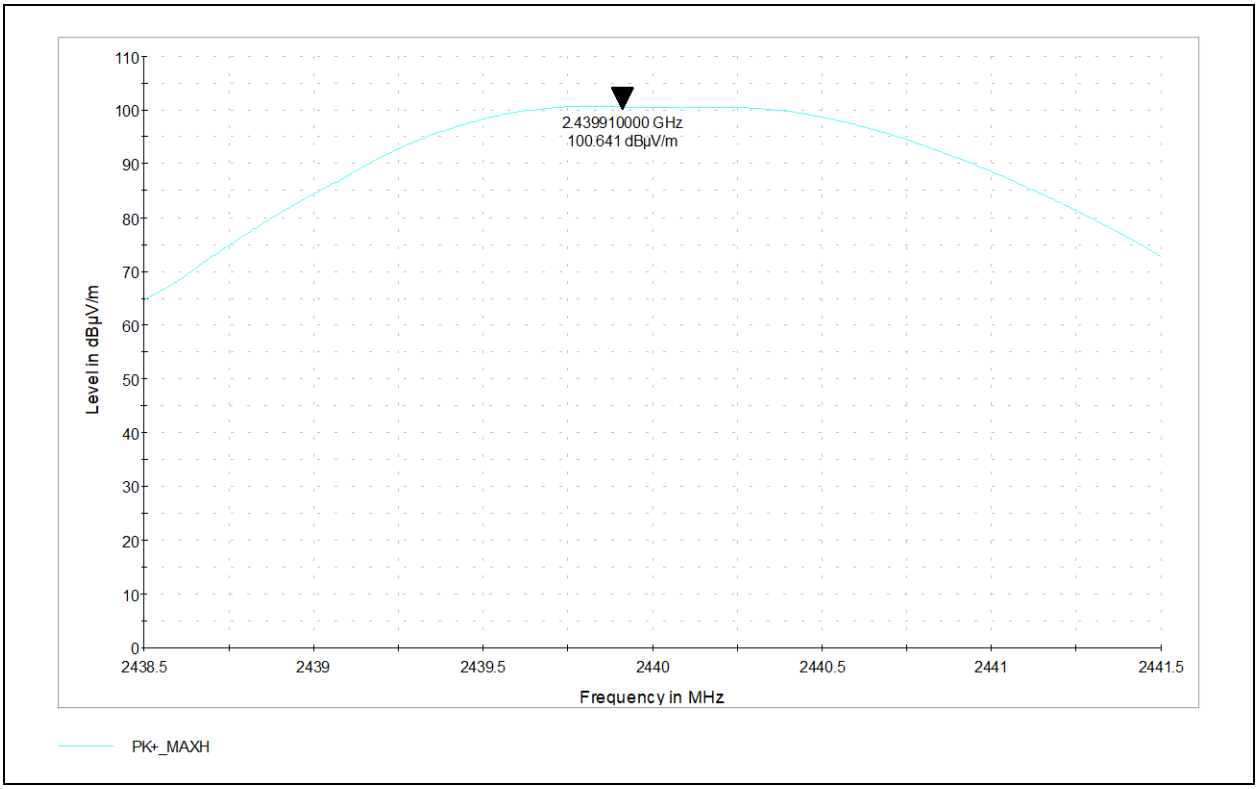
8.6 Test Data

Channel	Frequency (MHz)	Field Strength (dBuV/m)	EIRP (dBm)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
0	2402	99.483	4.283	2.683	30	27.317	PASS
39	2440	100.641	5.110	3.841	30	26.159	PASS
79	2480	100.808	5.608	4.008	30	25.992	PASS

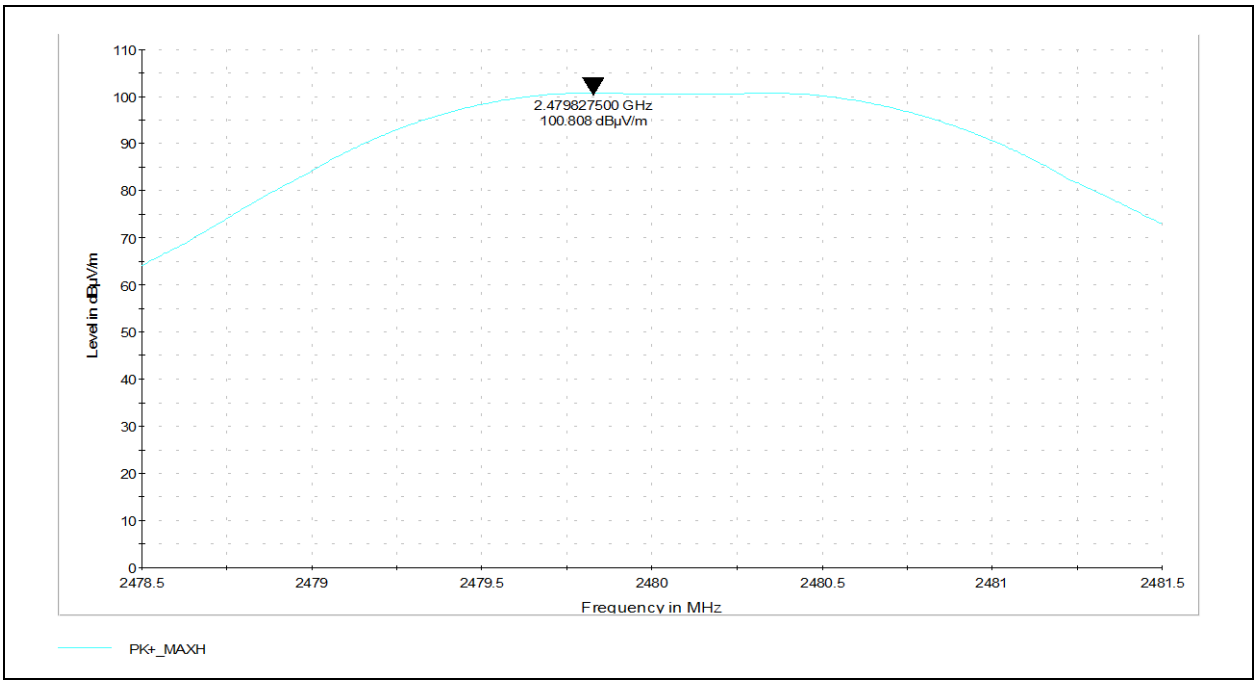
Deviations, Additions, or Exclusions: None



Peak Power, 2402MHz



Peak Power, 2440MHz



Peak Power, 2480MHz

9 Occupied Bandwidth

9.1 Test Limits

FCC Part 15.247(a)(2):

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

RSS-247 Issue 2 § 5.2(a):

The minimum 6 dB bandwidth shall be 500 kHz.

9.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.8.1.

9.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	2327	Rohde & Schwarz	ESI26	10/9/2020	10/9/2021

9.4 Test Results

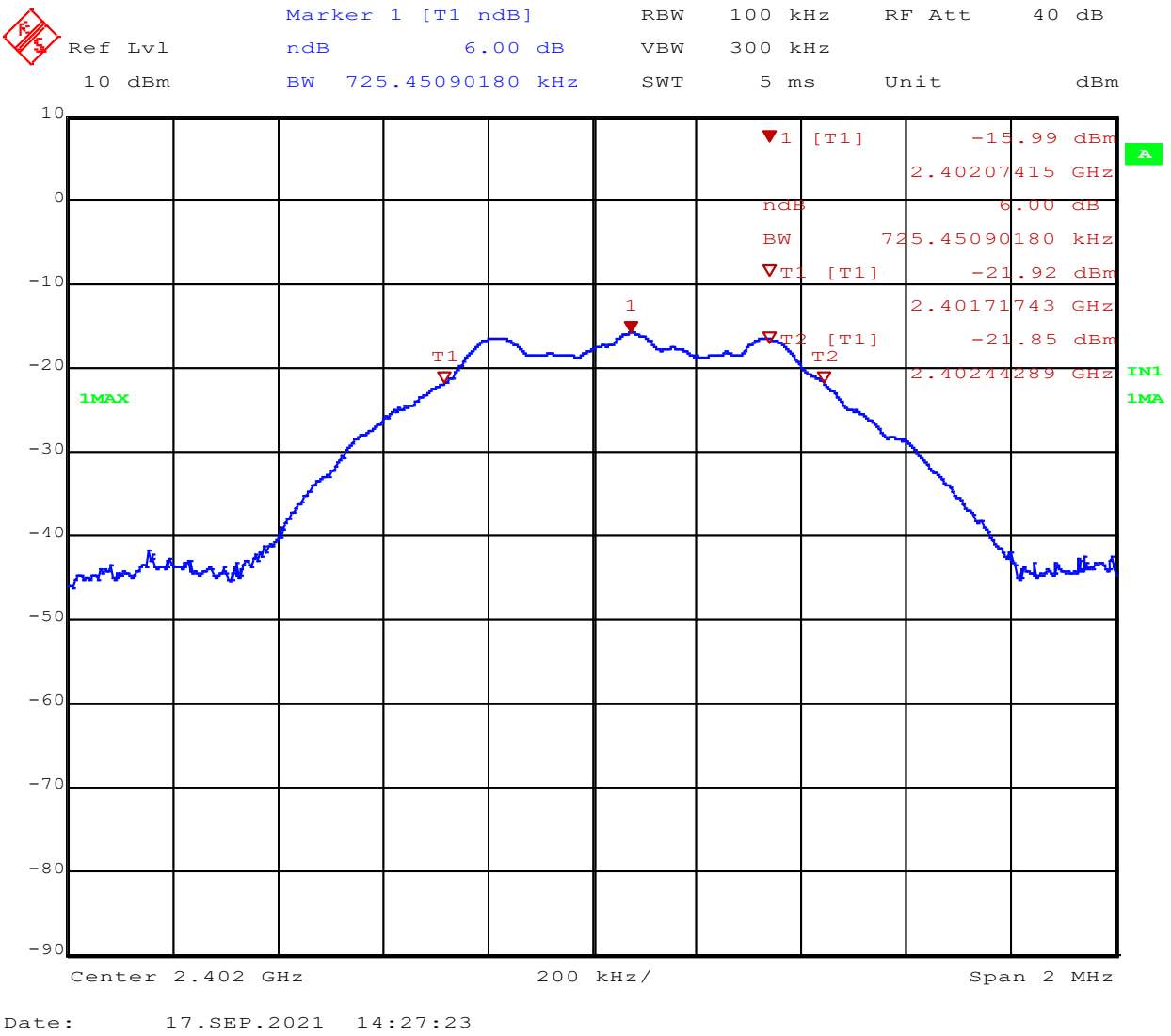
The device was found to be **compliant**. The 6dB bandwidth was at least 500kHz.

9.5 Test Conditions

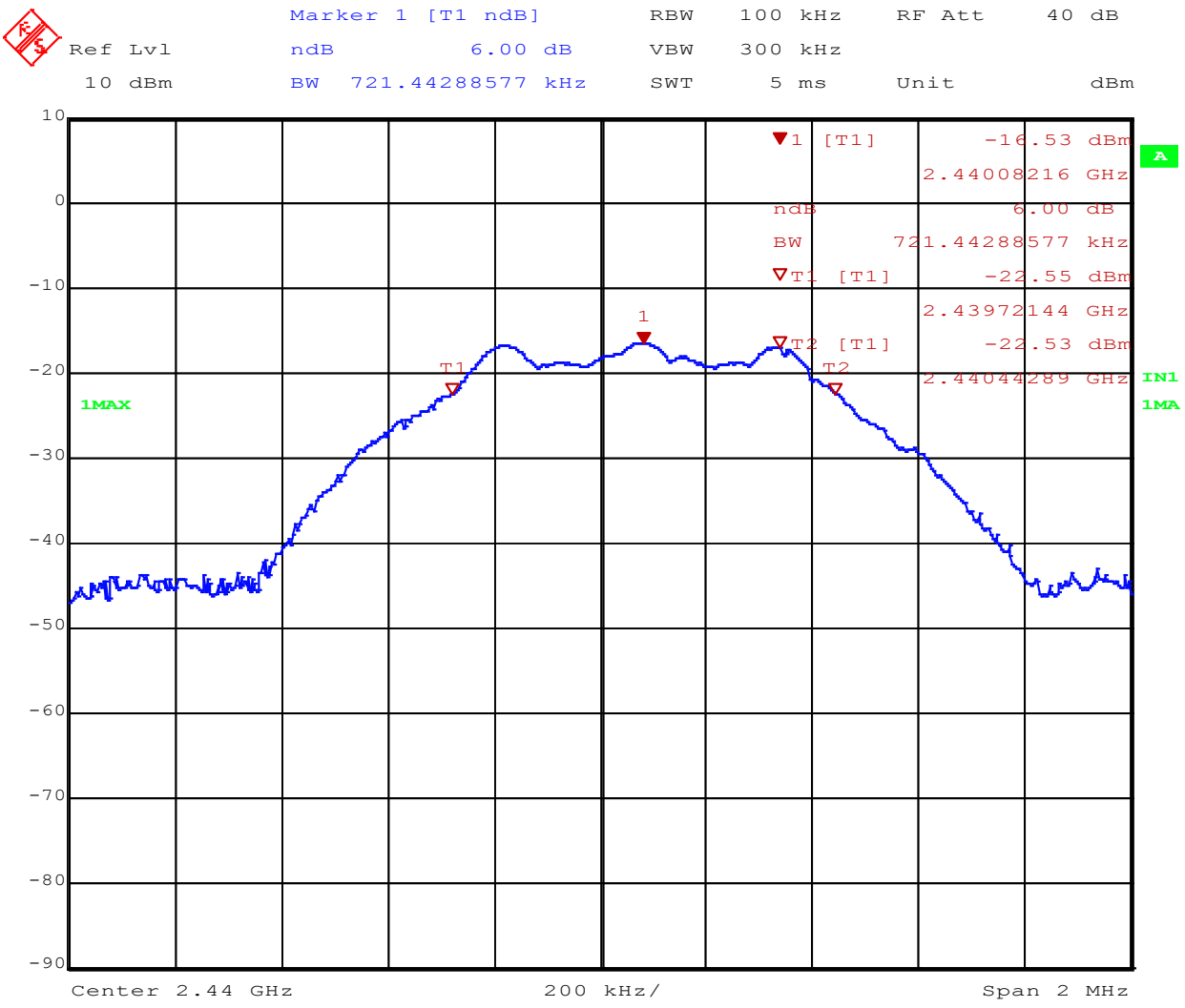
Test Personnel:	Bryan Taylor	Test Date:	9/21/2021
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.6C
Input Voltage:	Battery	Relative Humidity:	52.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

9.6 Test Data

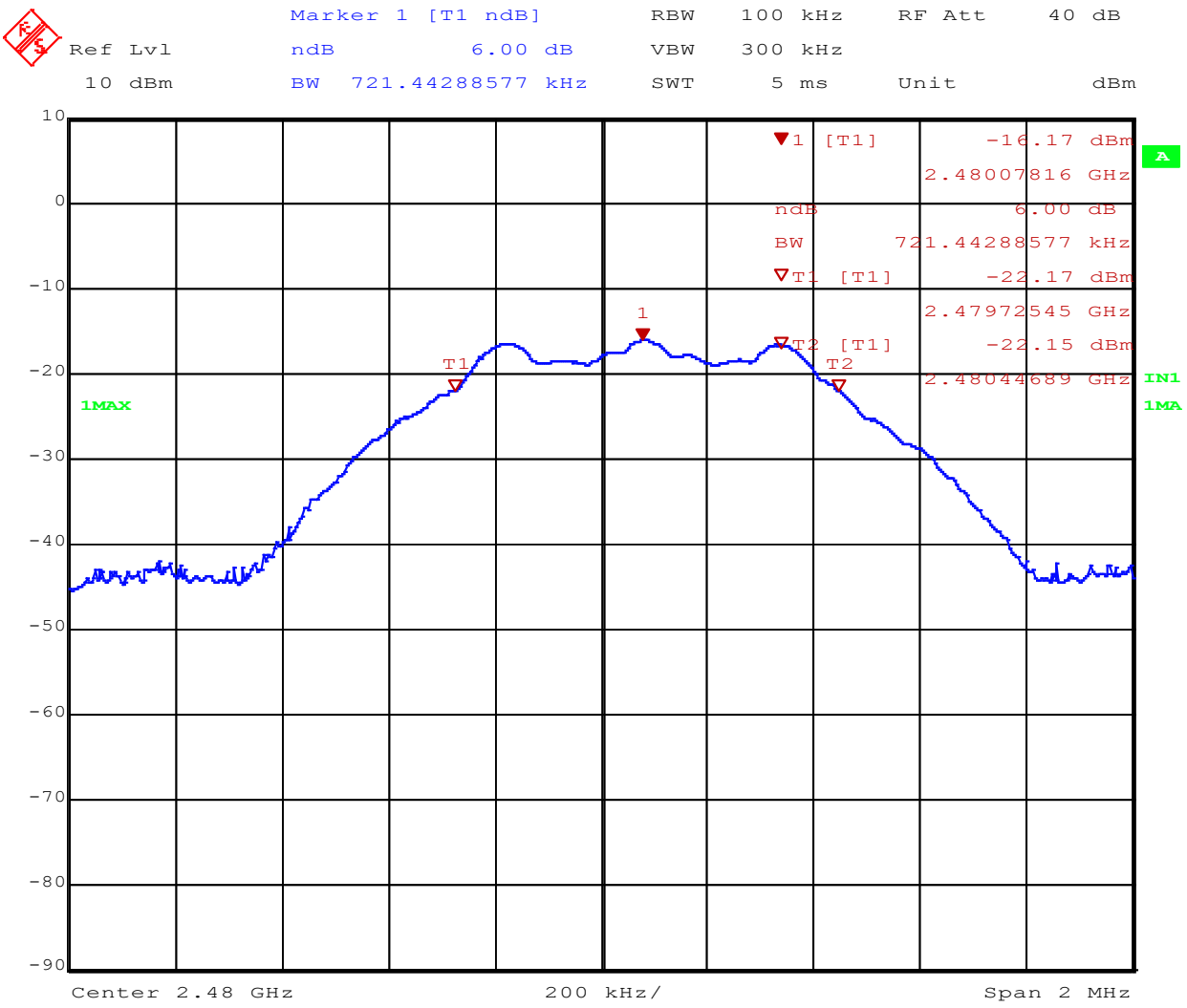
Channel	Frequency (MHz)	DTS BW (kHz)	6dB BW (kHz)	99% BW (kHz)
0	2402	725.4	593.1	1052
39	2440	721.4	597.1	1046
79	2480	721.4	589.1	1052



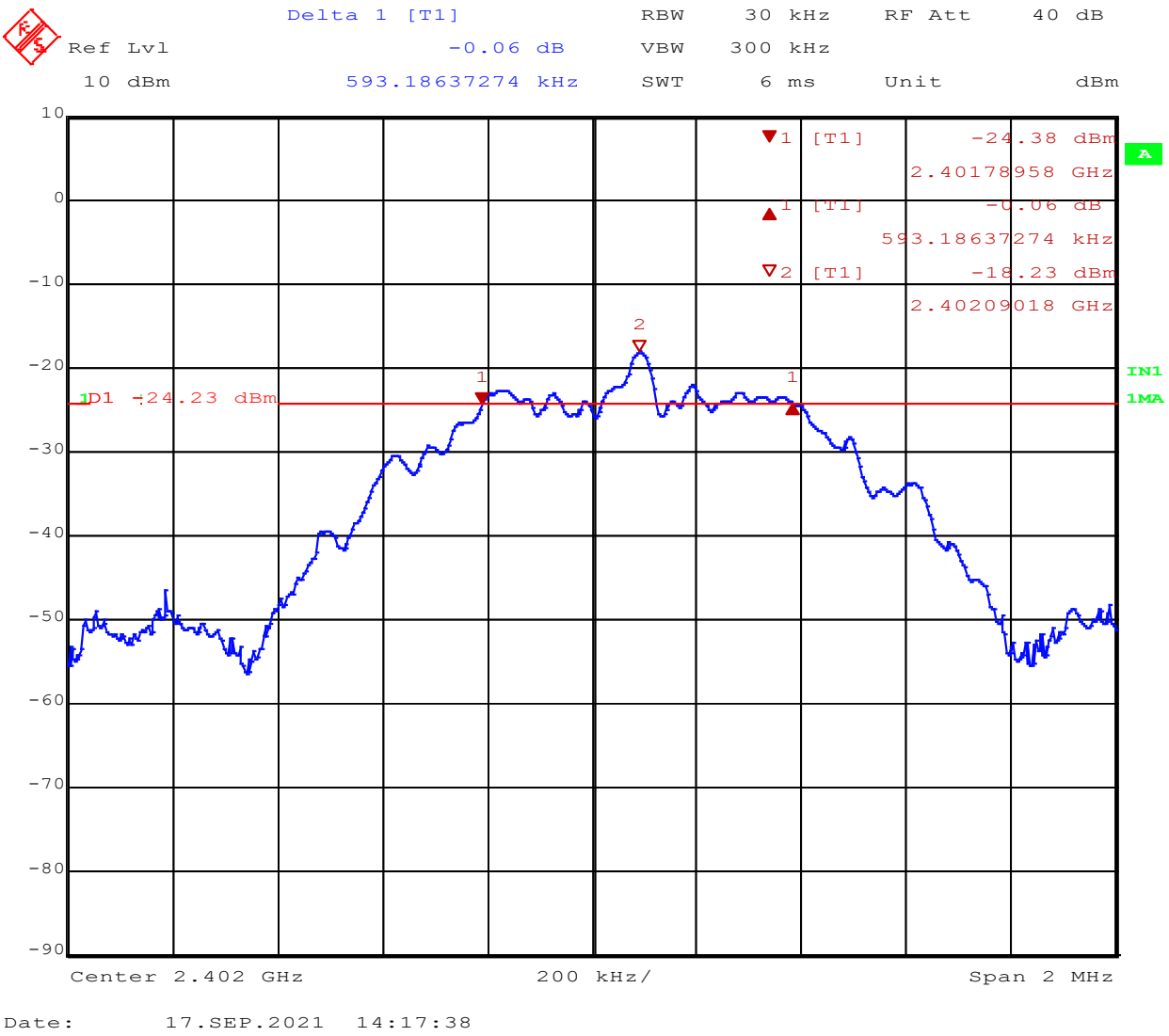
DTS Bandwidth, 2402MHz



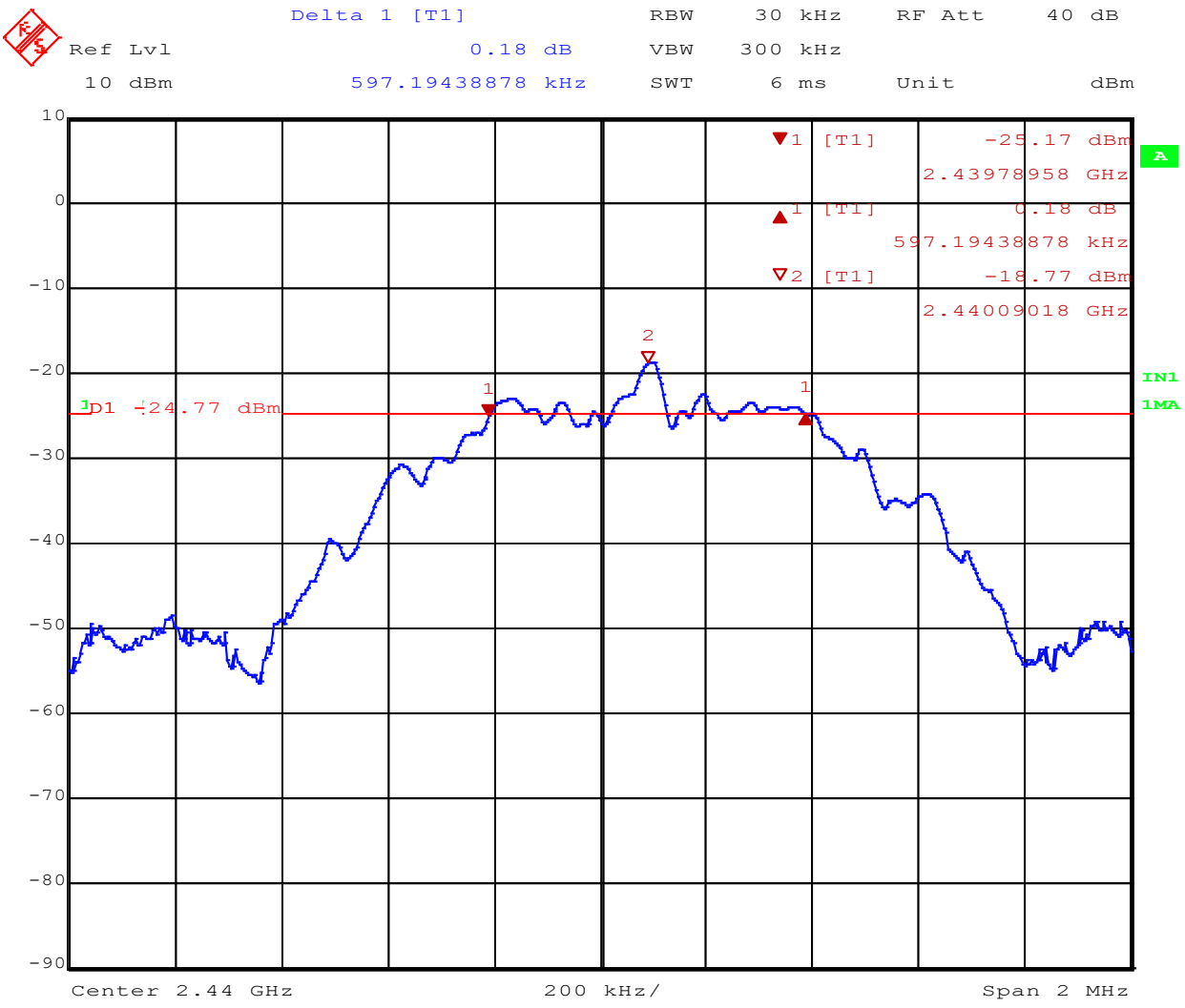
DTS Bandwidth, 2440MHz



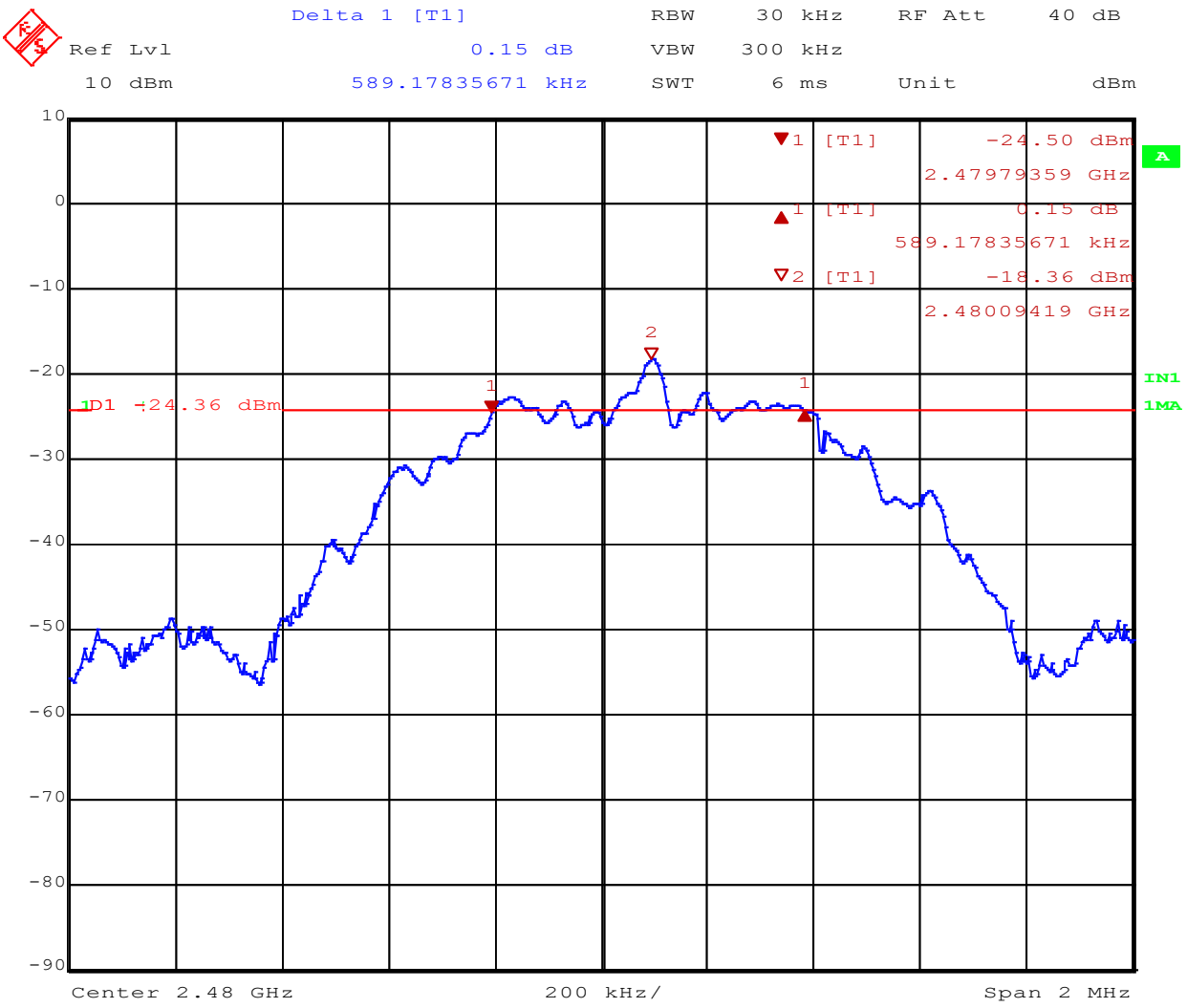
DTS Bandwidth, 2480MHz



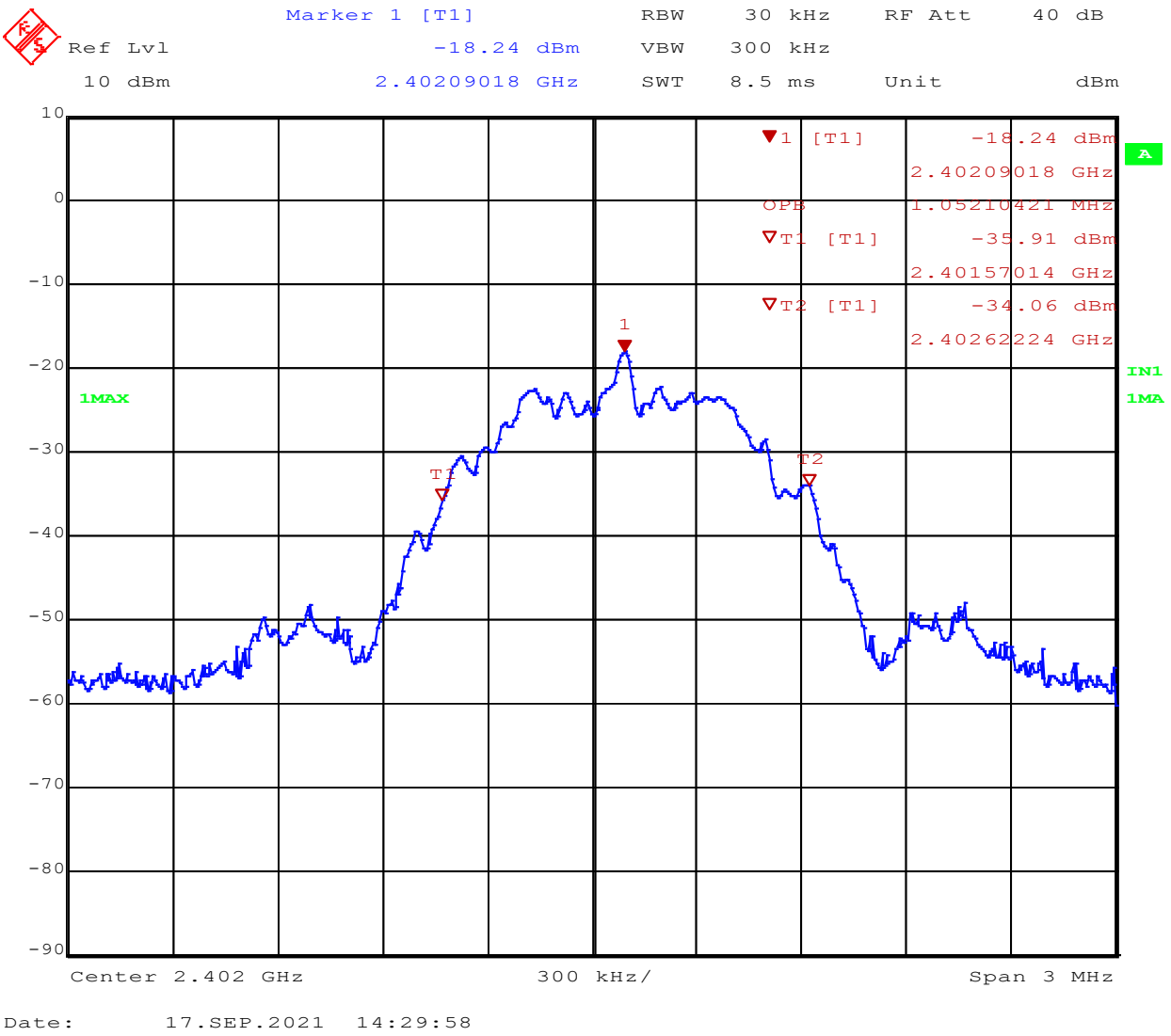
6dB Bandwidth, 2402MHz



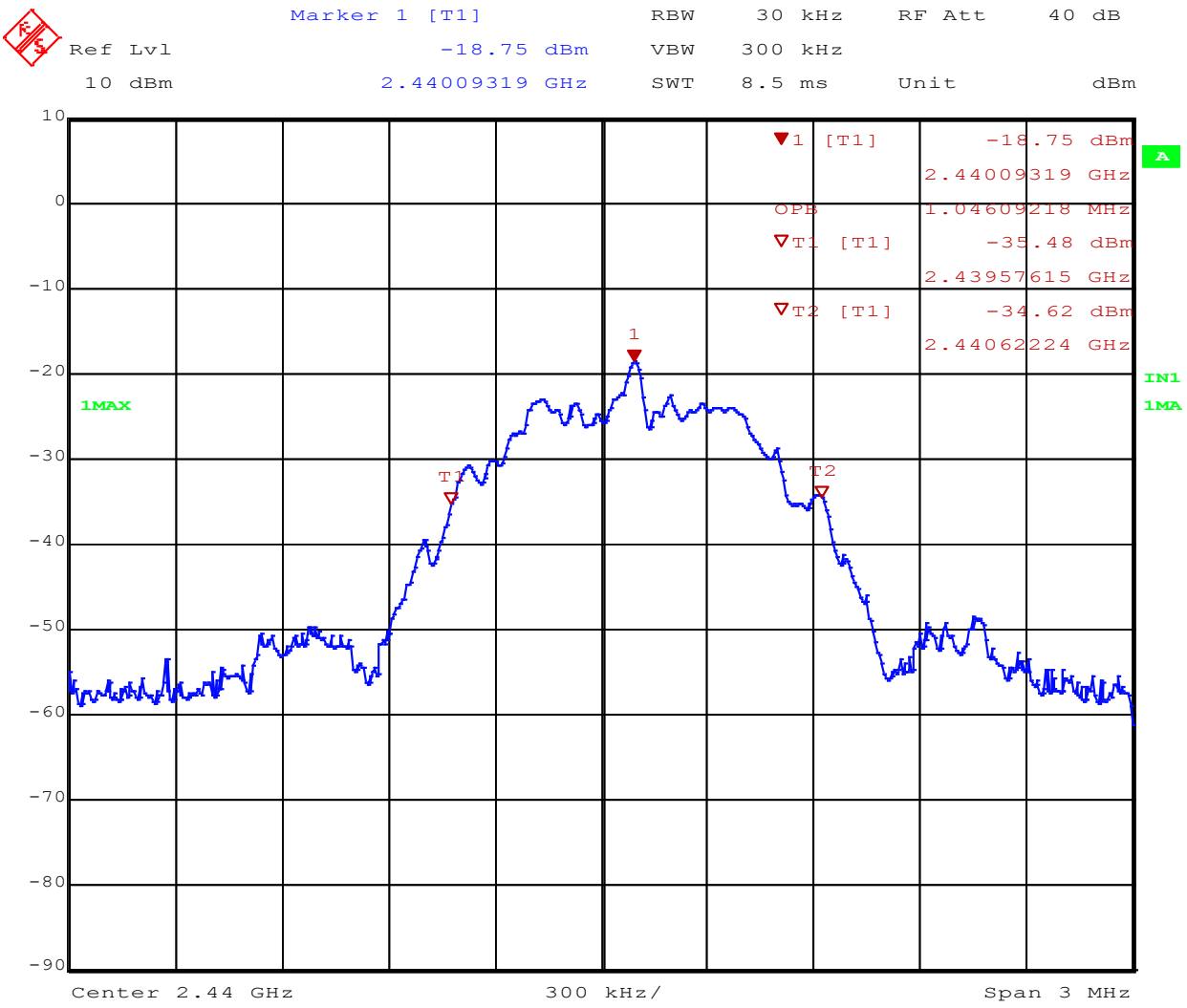
6dB Bandwidth, 2440MHz



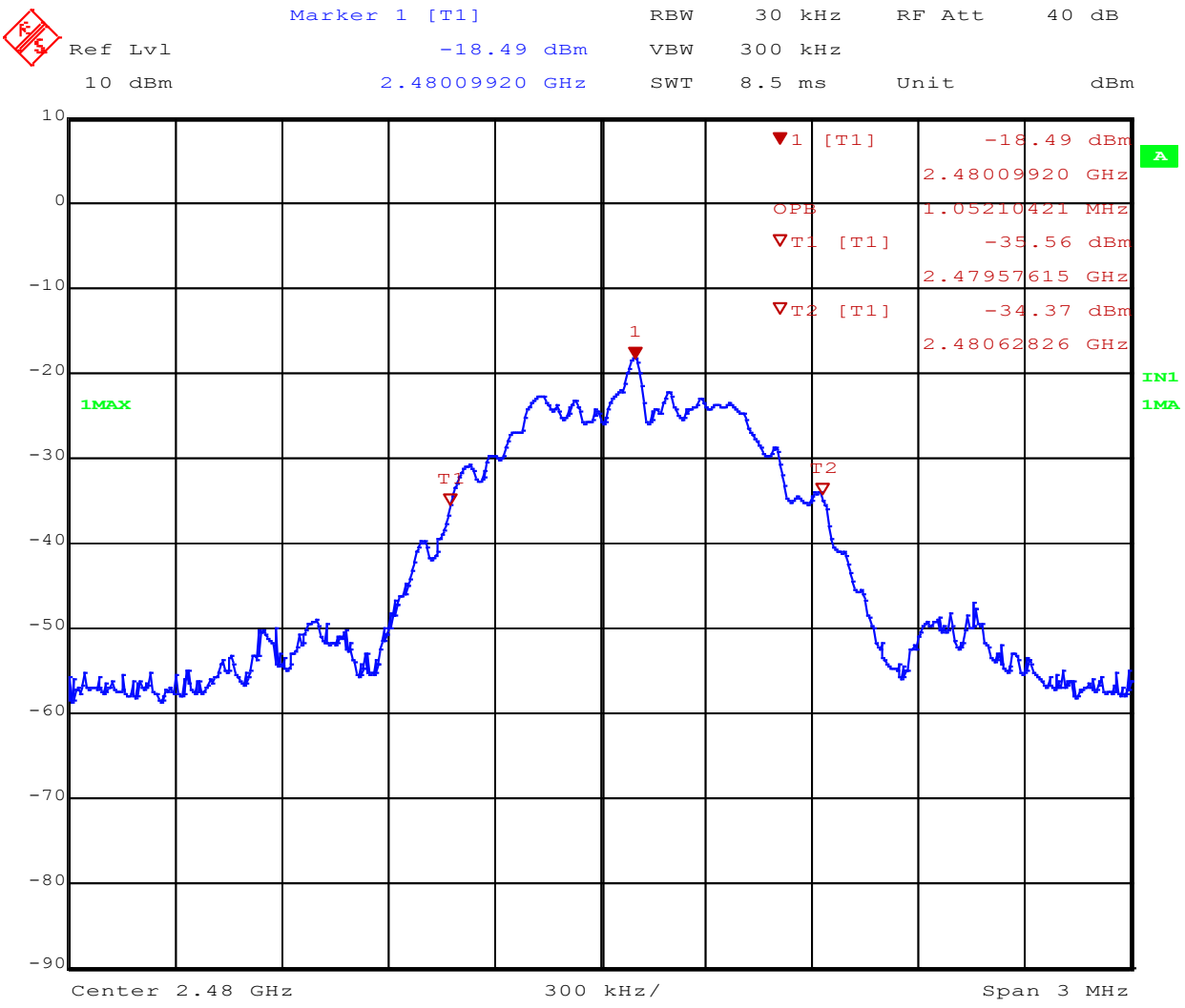
6dB Bandwidth, 2480MHz



99% Bandwidth, 2402MHz



99% Bandwidth, 2440MHz



99% Bandwidth, 2480MHz

10 Power Spectral Density

10.1 Test Limits

FCC Part 15.247(e):

> For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

RSS-247 Issue 2 § 5.2(b):

> The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

10.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.10.2 Method PKPSD (peak PSD). EIRP measurements were converted to conducted PPSD values based on customer-supplied antenna gain.

10.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	8181	Rohde & Schwarz	ESW44	11/16/2021	11/16/2022
Horn Antenna	3780	ETS	3117	6/28/2021	6/28/2022
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
Coaxial Cable	3074			1/13/2022	1/13/2023
Coaxial Cable	2588			1/13/2022	1/13/2023
Coaxial Cable	2593			1/13/2022	1/13/2023
Coaxial Cable	2592			1/13/2022	1/13/2023

10.4 Test Results

The device was found to be **compliant**. The peak power spectral density was less than 8dBm.

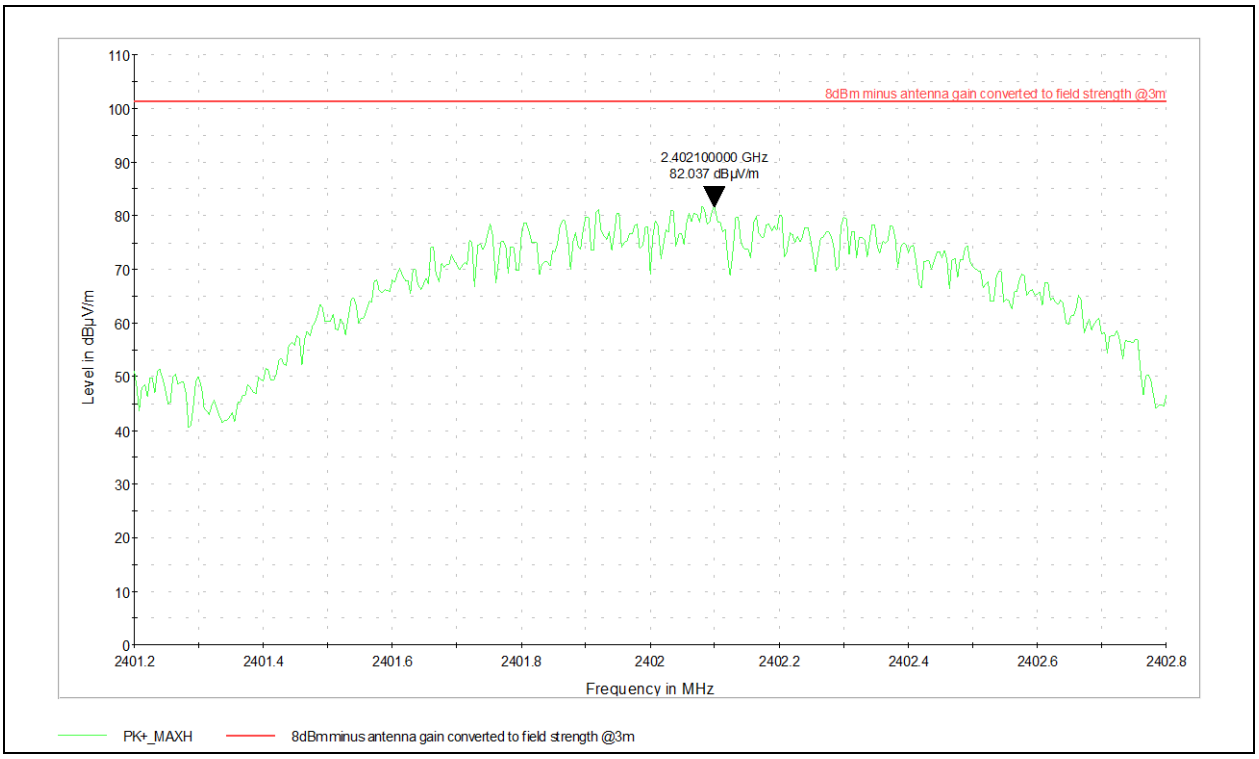
10.5 Test Conditions

Test Personnel:	Bryan Taylor	Test Date:	9/17/2021
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	23.3C
Input Voltage:	Battery	Relative Humidity:	48.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	998mbar

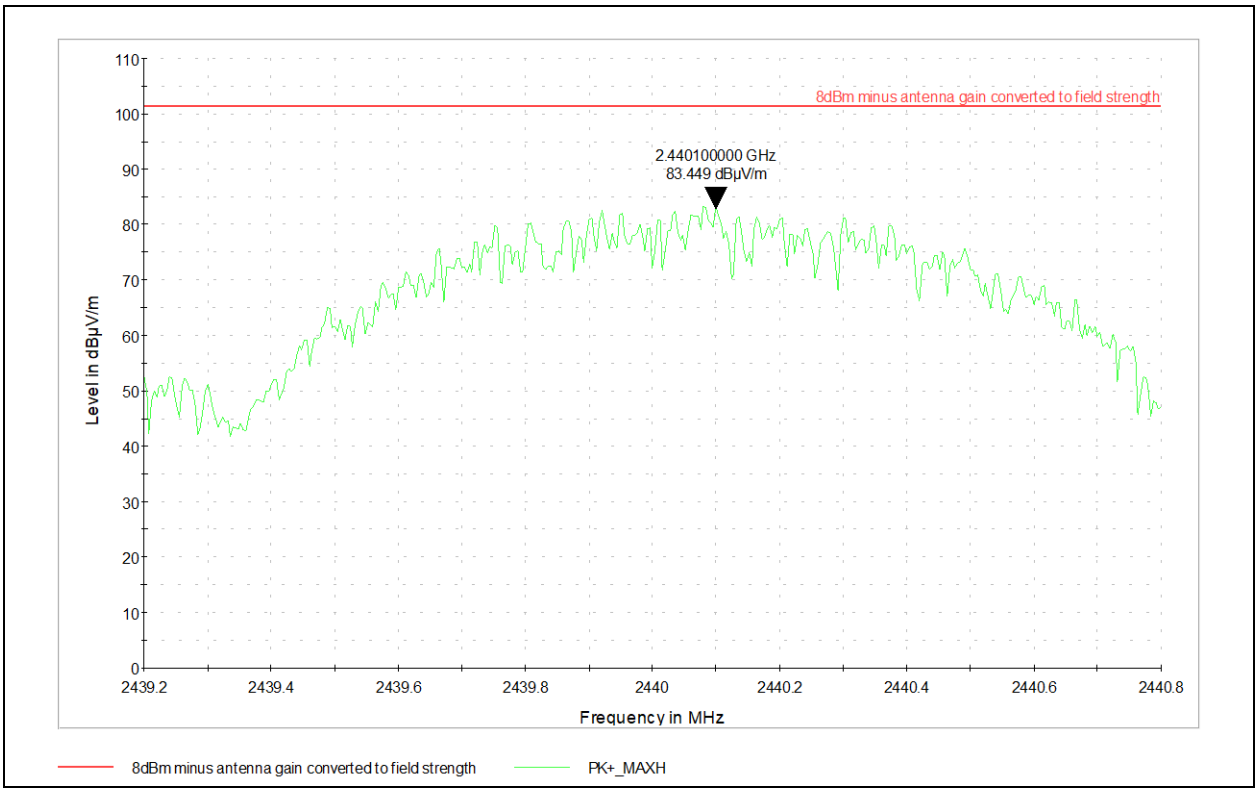
Deviations, Additions, or Exclusions: None.

10.6 Test Data

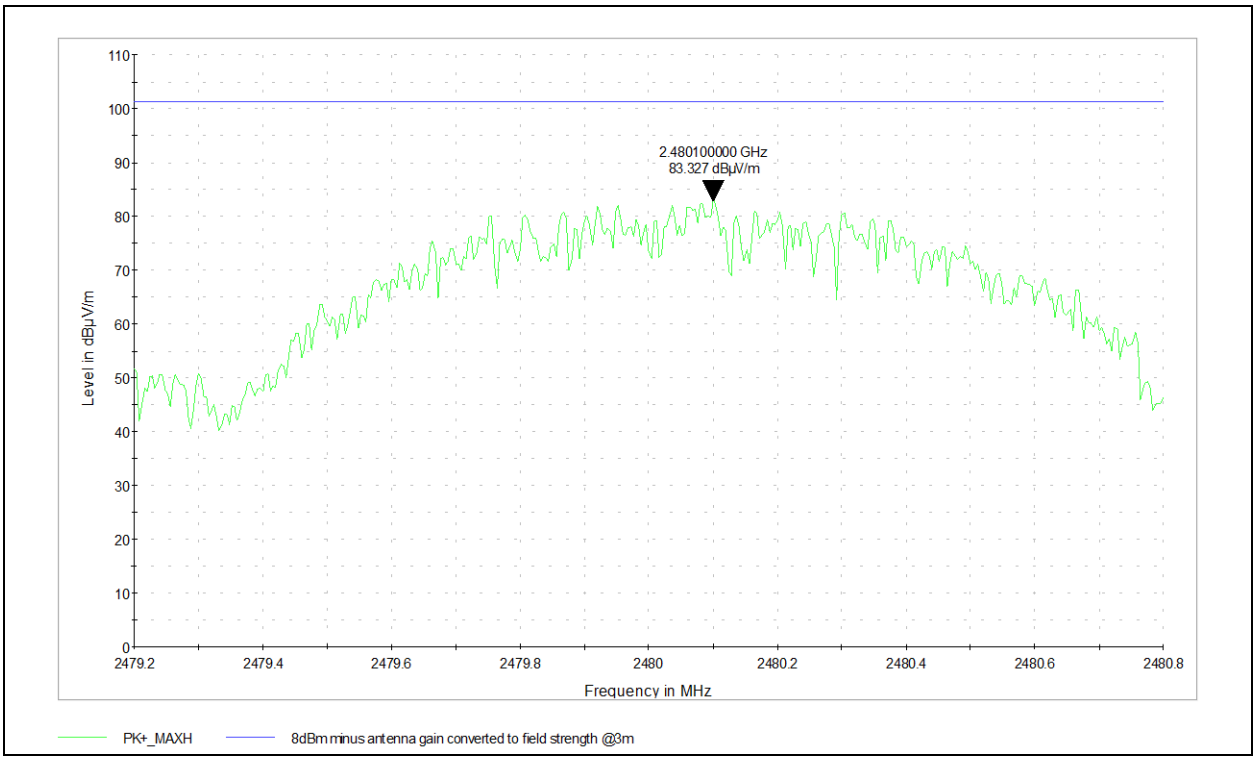
Channel	Frequency (MHz)	Field Strength (dBuV/m)	EIRP (dBm)	PPSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
0	2402	82.037	-13.193	-14.793	8	22.793	PASS
39	2440	83.449	-11.781	-13.381	8	21.381	PASS
79	2480	83.327	-11.903	-13.503	8	21.503	PASS



PPSD, 2402MHz



PPSD, 2440MHz



PPSD, 2480MHz

11 Conducted Spurious Emissions

11.1 Test Limits

FCC Part 15.247(d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

RSS-247 Issue 2 § 5.5:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

11.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.11 Emissions in nonrestricted frequency bands.

11.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	2327	Rohde & Schwarz	ESI26	10/9/2020	10/9/2021

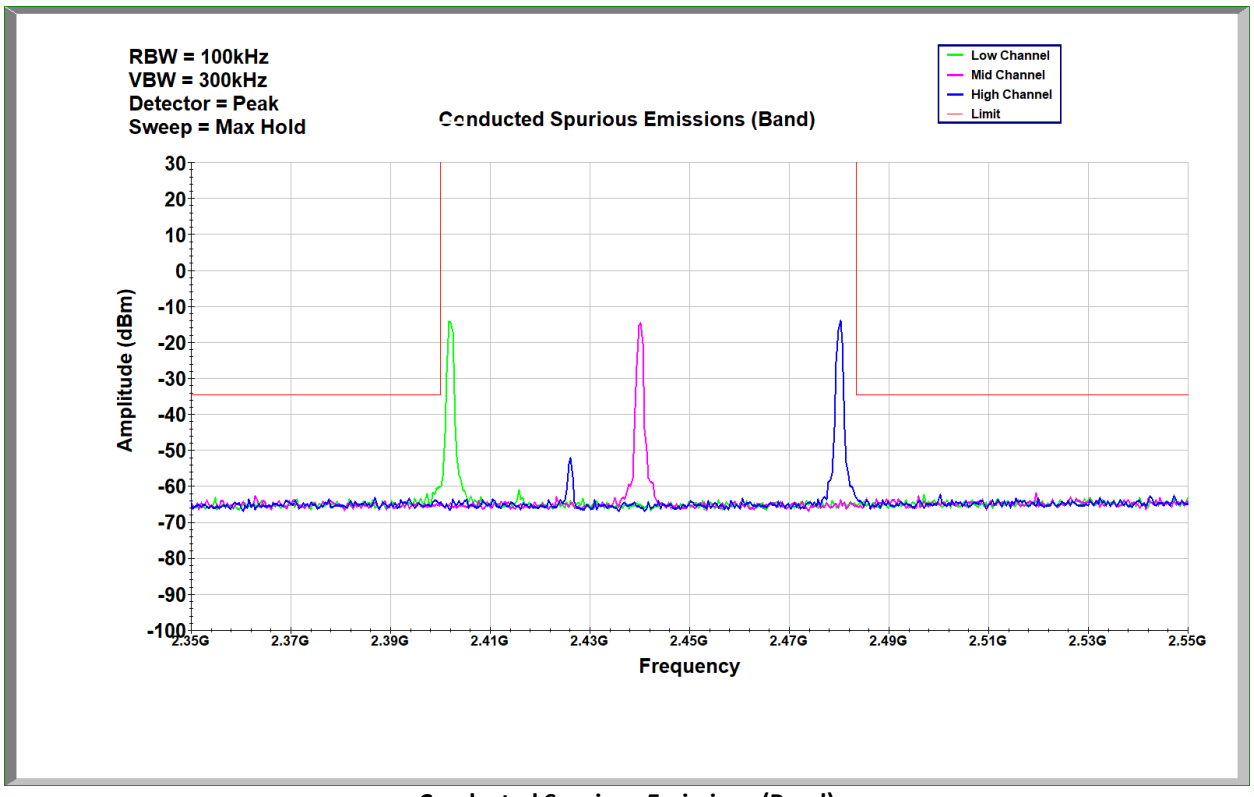
11.4 Test Results

The device was found to be **compliant**. All spurious emissions were found to be attenuated more than 20dB below the level of the fundamental.

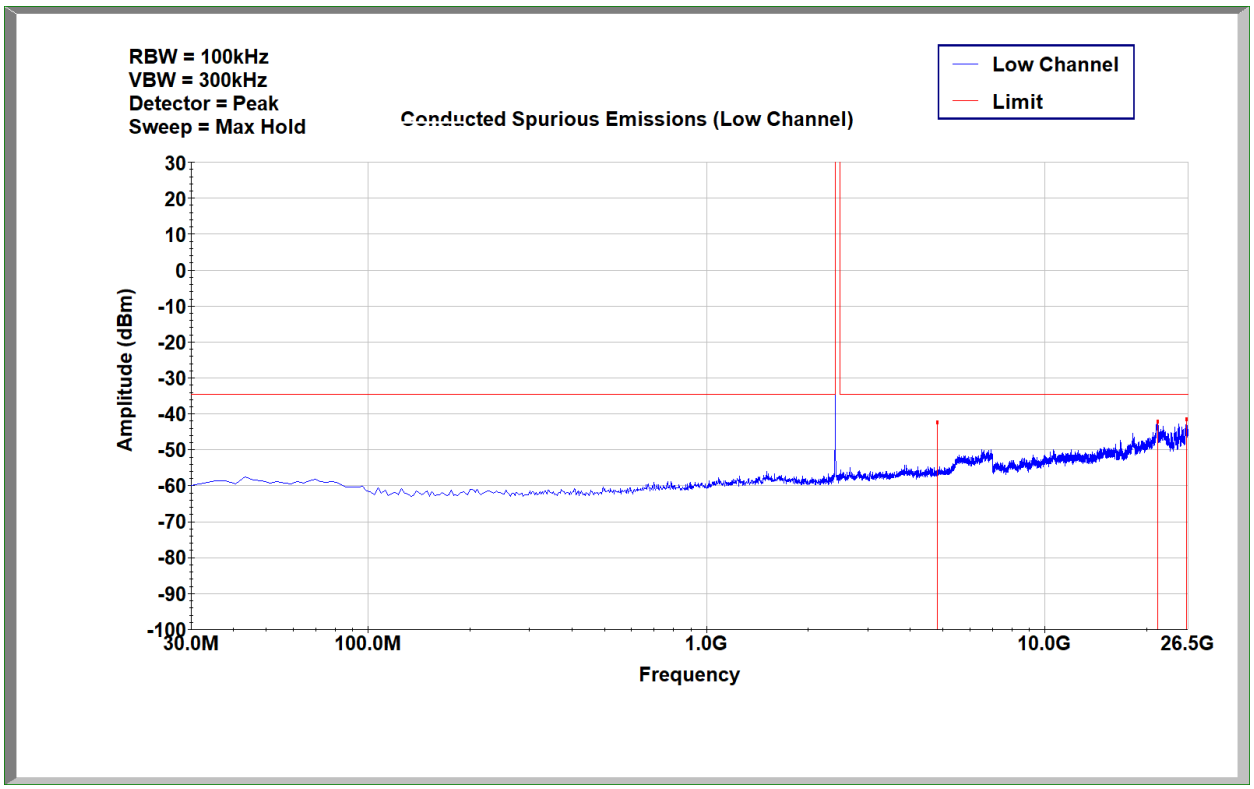
11.5 Test Conditions

Test Personnel:	Bryan Taylor	Test Date:	9/17/2021
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.3C
Input Voltage:	Battery	Relative Humidity:	55.3%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	979.8mbar

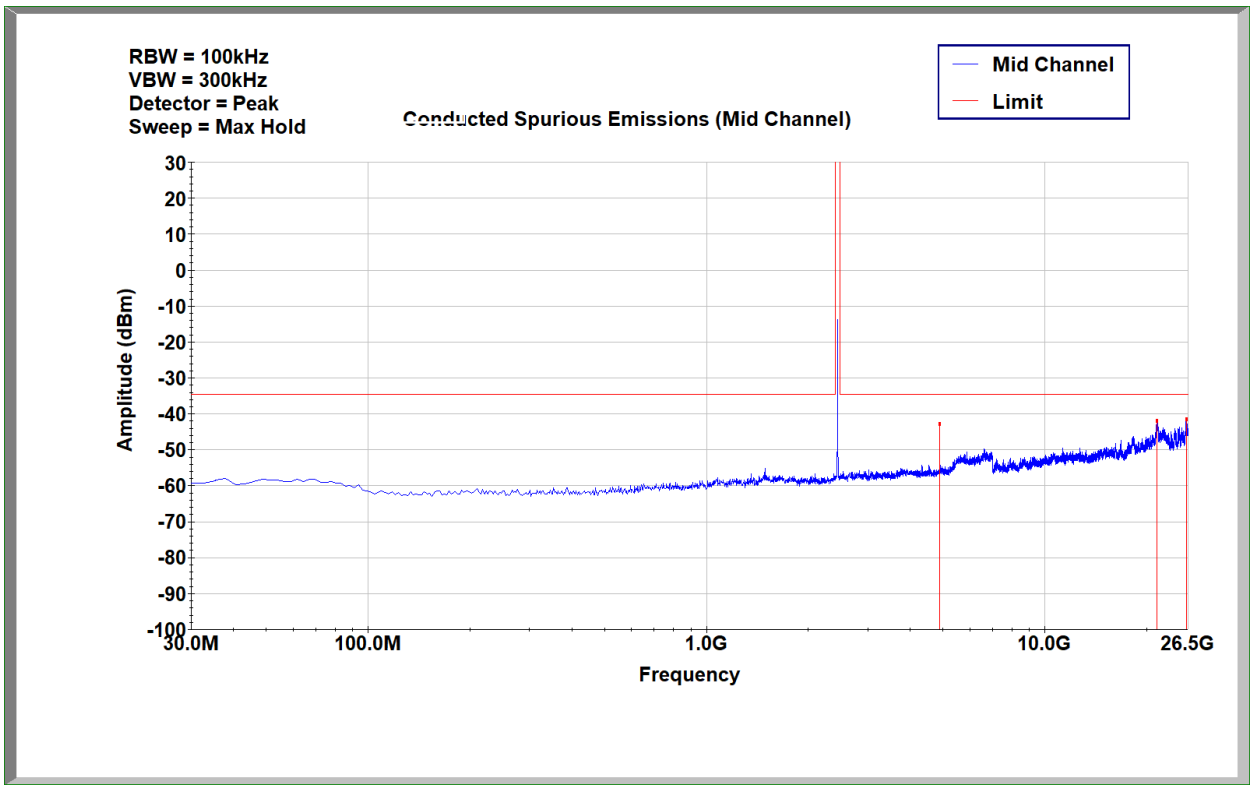
11.6 Test Data



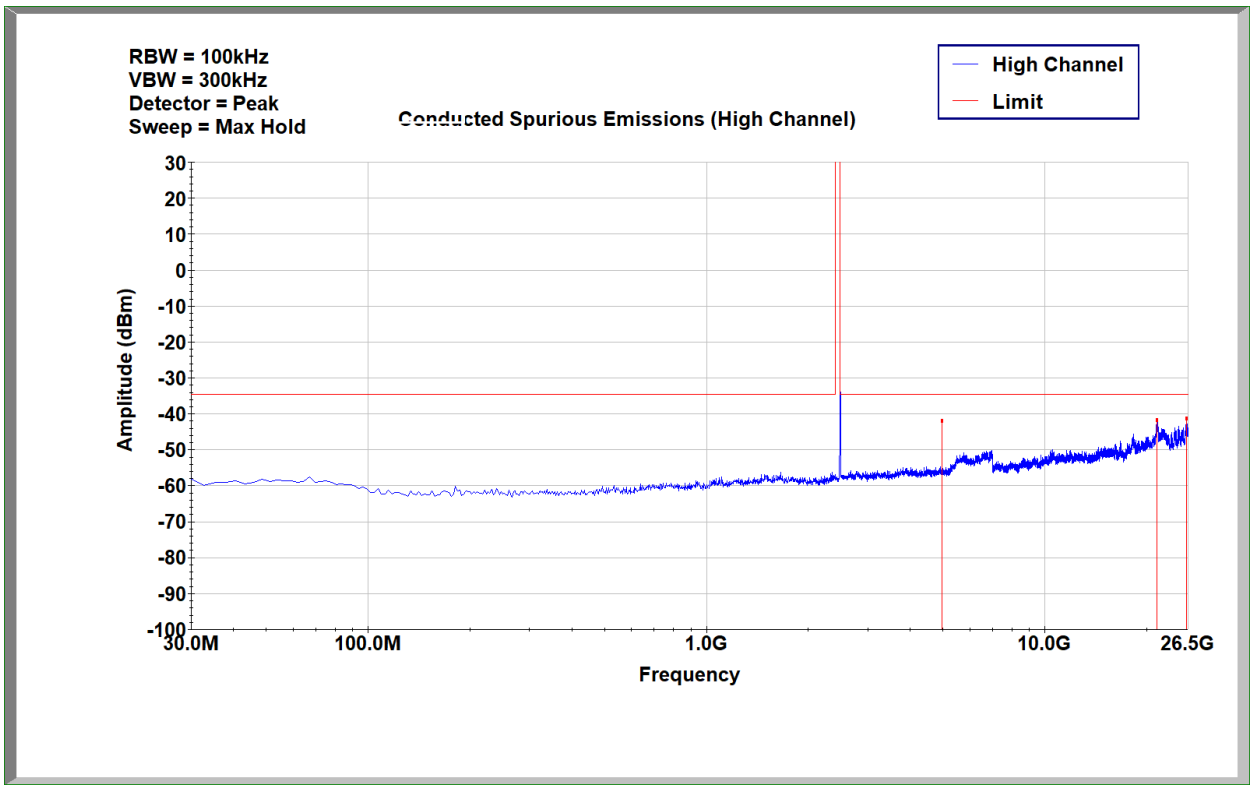
Conducted Spurious Emissions (Band)



2402MHz Conducted Spurious Emissions



2440MHz Conducted Spurious Emissions



2480MHz Conducted Spurious Emissions

12 Antenna Requirement

12.1 Test Limits

FCC Part 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

RSS-Gen Issue 5 § 6.8:

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

12.2 Test Results

The device was found to be **compliant**. The device has an internal, permanently affixed antenna.

13 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	12/6/2021	104771489LEX-009	BCT	BL	Original Issue
1	4/18/2022	104771489LEX-009.1	BL	JTS	Updated output power and PPSD measurements.
2	8/4/2022	104771489LEX-009.2	BL	JTS	Updated contact information.
3	8/23/2022	104771489LEX-009.3	BL	JTS	Updated antenna gain