

BLUETOOTH TEST REPORT

Report Number: 103264009LEX-004b
Project Number: G103264009

Report Issue Date: 12/18/2017

Product Name: Wireless Print Server
Model Number: LEX-M07-001

Standards: Title 47 CFR Part 15 Subpart C
RSS-247 Issue 2

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

Client:
Lexmark International, Inc.
740 W New Circle Road, F61/004-2
Lexington, KY 40511

Report prepared by



Bryan Taylor, Team Leader

Report reviewed by



Brian Lackey, Project Engineer

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1 Introduction and Conclusion

The tests indicated in section 2 were performed on the product constructed as described in section 3. 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 complied with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

The INTERTEK-Lexington is located at 731 Enterprise Drive, Lexington Kentucky, 40510. The radiated emission test site is a 10-meter semi-anechoic chamber. The chamber meets the characteristics of CISPR 16-1 and ANSI C63.4. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters. The test site is listed with the FCC under registration number 485103. The test site is listed with Industry Canada under site number IC 2042M-1.

2 Test Summary

Page	Test full name	FCC Reference	IC Reference	Result
6	Peak Output Power	§ 15.247(b)(1)	RSS-247 § 5.4(b)	Pass
7	20dB Bandwidth	§ 15.247(a)(1)	RSS-247 § 5.2(a)	Pass
23	Channel Separation	§ 15.247(a)(1)	RSS-247 § 5.1(b)	Pass
27	Number of Hopping Channels	§ 15.247(a)(1)(iii)	RSS-247 § 5.1(d)	Pass
29	Time of Occupancy	§ 15.247(a)(1)(iii)	RSS-247 § 5.1(d)	Pass
34	Radiated Spurious Emissions (Transmitter)	§ 15.247(d), § 15.209, and § 15.205	RSS-247 § 5.5	Pass
55	Radiated Spurious Emissions (Receiver)	§ 15.109	RSS-Gen § 7.1.2	Pass
-	AC Mains Conducted Emissions	§ 15.107, § 15.207	RSS-Gen § 8.8	Pass
59	Antenna Requirement per FCC Part 15.203	§ 15.203	RSS-Gen § 8.3	Pass

3 Description of Equipment Under Test

Equipment Under Test	
Manufacturer	Lexmark International, Inc.
Model Number	LEX-M07-001
Serial Number	Test Sample 3
Receive Date	10/9/2017
Test Start Date	10/24/2017
Test End Date	12/15/2017
Device Received Condition	Good
Test Sample Type	Production
Frequency Band	2402 – 2480MHz
Mode(s) of Operation	Bluetooth (GFSK, Pi/4-DQPSK, 8DPSK)
Modulation Type	FHSS
Transmission Control	Test Commands
Maximum Output Power	6.63dBm
Test Channels	0, 39, 79
Antenna Type (15.203)	Internal
Operating Voltage	5V via USB
Antenna Gain	2402MHz: -0.7dBi 2440MHz: 0.2dBi 2480MHz: 0.3dBi

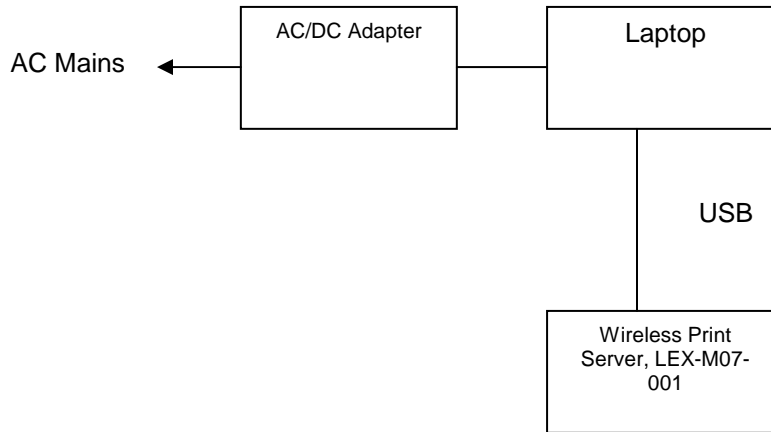
Description of Equipment Under Test
The LEX-M07-001 is a 2.4GHz/5GHz dual band Wi-Fi module supporting 802.11b/g/a/n/ac standards. WiFi function supports 2x2 MU-MIMO. Module hardware also supports Bluetooth 4.2/Bluetooth Low Energy.

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Bluetooth transmitting on low, mid, and high channels
2	Normal hopping mode.
3	Receive / idle mode

4 System setup including cable interconnection details, support equipment and simplified block diagram

4.1 EUT Block Diagram:



4.2 Cables:

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

4.3 Support Equipment:

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Laptop	HP	ProBook 455 G4	5CD7212NG5

5 Peak Output Power

5.1 Test Limits

§ 15.247(b): The maximum peak conducted output power of the intentional radiator shall not exceed the following:

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

5.2 Test Procedure

ANSI C63.10: 2013. The peak output power was measured using the marker to peak function of the spectrum analyzer.

5.3 Test Equipment Used

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1302.6005.40	Rohde & Schwarz	ESU40	10/12/2017	10/12/2018
Horn Antenna	154521	ETS	3117	6/1/2017	6/1/2018
System Controller	121701-1	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use

5.4 Test Results

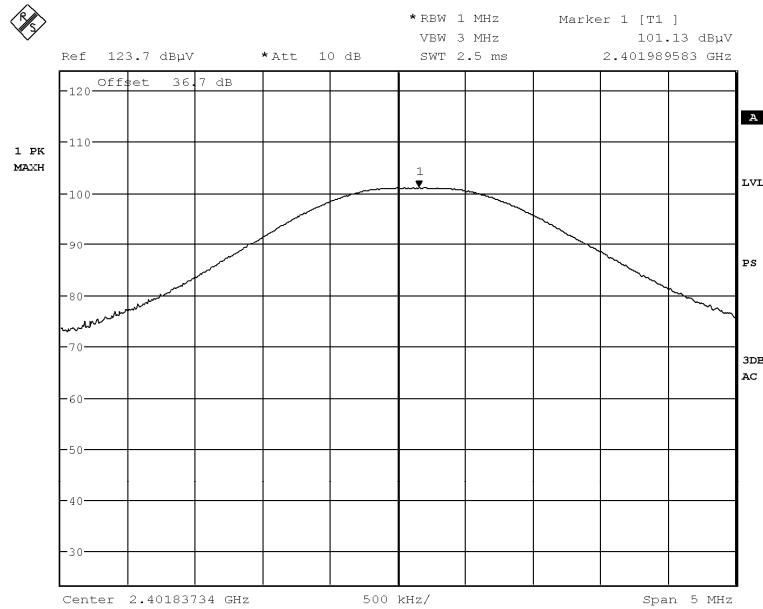
The device was found to be **compliant**. The peak output power was less than the limit. Note that the sample did not have an antenna connector so the measurements were performed via radiated methods and the field strength converted from dBuV/m to dBm per the guidance in ANSI C63.10: 2013.

5.5 Test Conditions

Test Personnel:	<u>Bryan Taylor</u>	Test Date:	<u>11/29/2017</u>
Supervising/Reviewing Engineer:		Limit Applied:	<u>30dBm (1 Watt)</u>
(Where Applicable) Product Standard:	<u>NA</u>	Ambient Temperature:	<u>22.4C</u>
Input Voltage:	<u>FCC Part 15C, RSS-247</u>	Relative Humidity:	<u>44.9%</u>
Pretest Verification w/ Ambient Signals or BB Source:	<u>DC Powered via USB</u>		
	<u>Yes</u>		

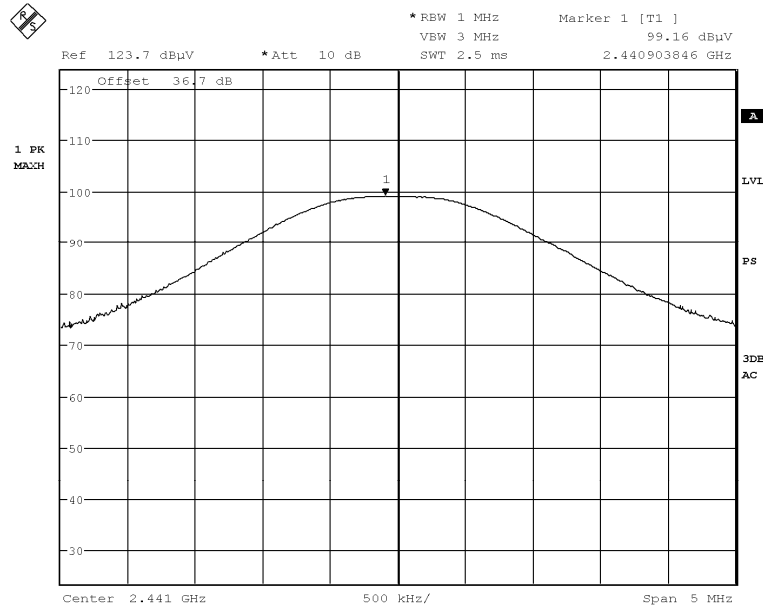
5.6 Test Data

Mode	Freq. (MHz)	Field Strength (dBuV/m)	EIRP (dBm)	Antenna Gain (dBi)	Cond. Output Power (dBm)	Limit (dBm)	Margin (dB)	Result
BDR	2402	101.13	5.93	-0.7	6.63	30	23.37	Pass
BDR	2441	99.16	3.96	0.2	3.76	30	26.24	Pass
BDR	2480	98.28	3.08	0.3	2.78	30	27.22	Pass
EDR2	2402	98.98	3.78	-0.7	4.48	30	25.52	Pass
EDR2	2441	98.68	3.48	0.2	3.28	30	26.72	Pass
EDR2	2480	97.54	2.34	0.3	2.04	30	27.96	Pass
EDR3	2402	97.79	2.59	-0.7	3.29	30	26.71	Pass
EDR3	2441	98.04	2.84	0.2	2.64	30	27.36	Pass
EDR3	2480	98.43	3.23	0.3	2.93	30	27.07	Pass



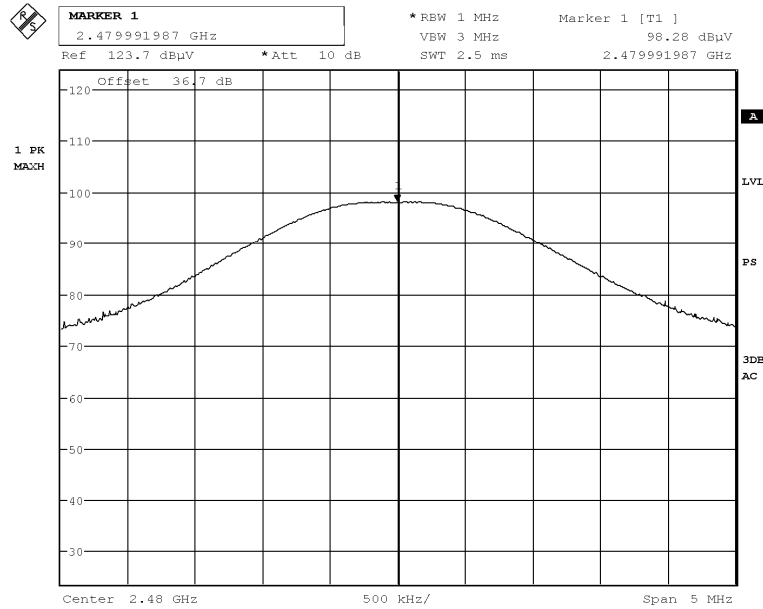
Date: 29.NOV.2017 11:59:30

BT BDR Channel 0: Max Field Strength



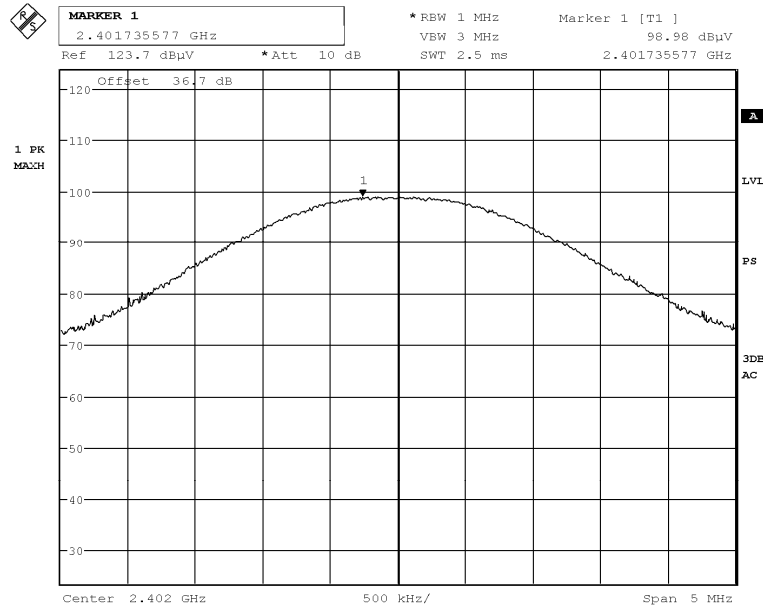
Date: 29.NOV.2017 12:03:59

BT BDR Channel 39: Max Field Strength



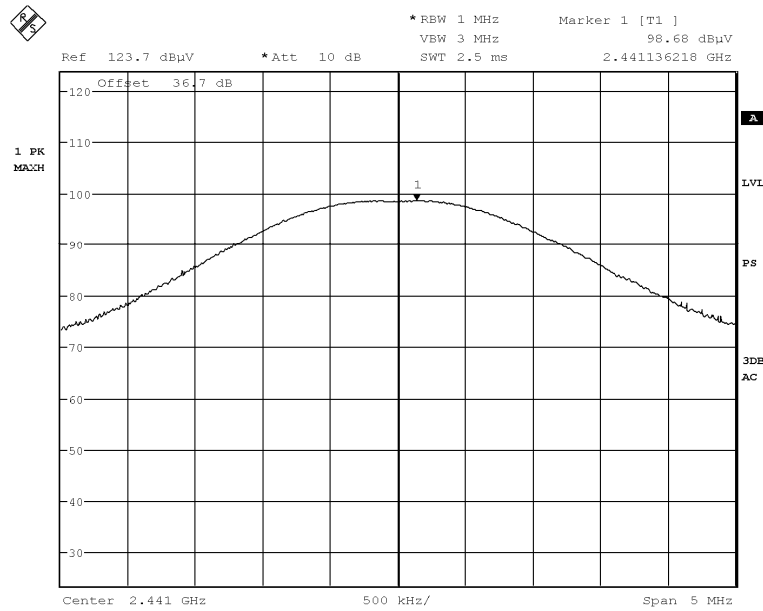
Date: 29.NOV.2017 12:07:49

BT BDR Channel 78: Max Field Strength



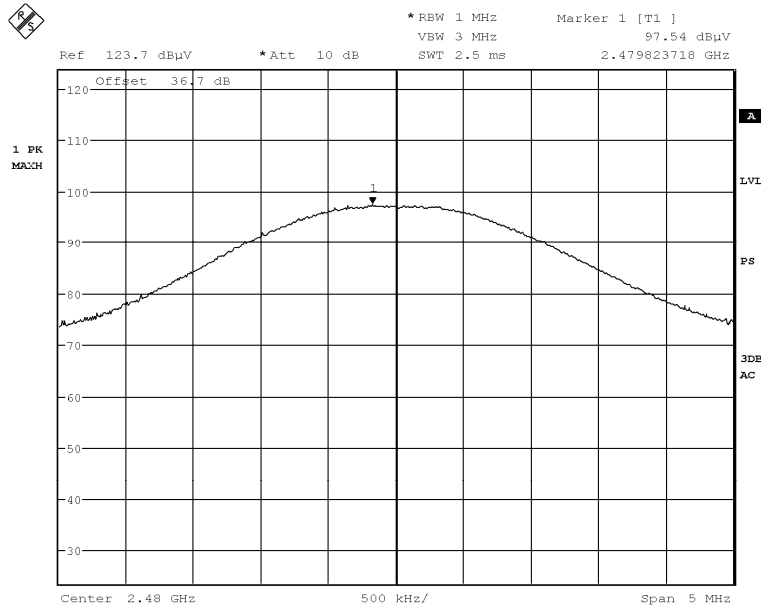
Date: 29.NOV.2017 12:10:24

BT EDR2 Channel 0: Max Field Strength



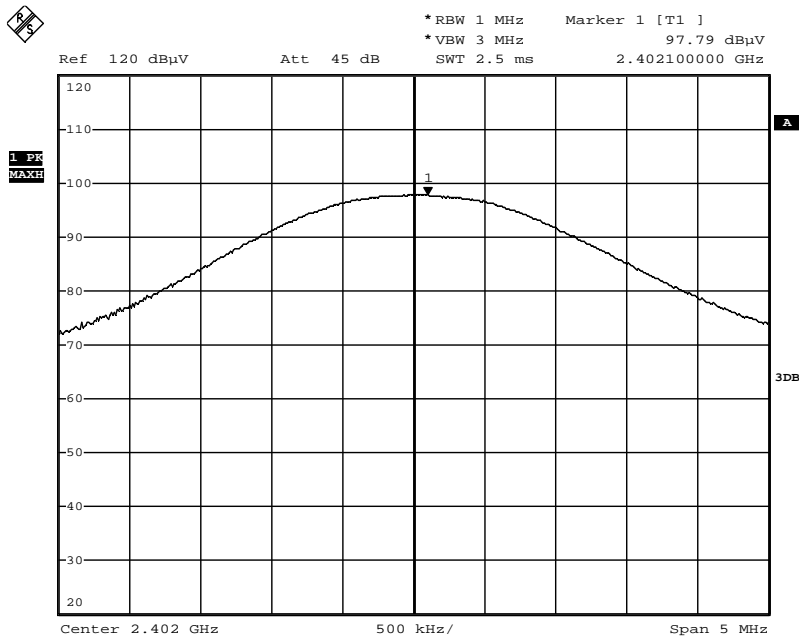
Date: 29.NOV.2017 12:13:21

BT EDR2 Channel 39: Max Field Strength



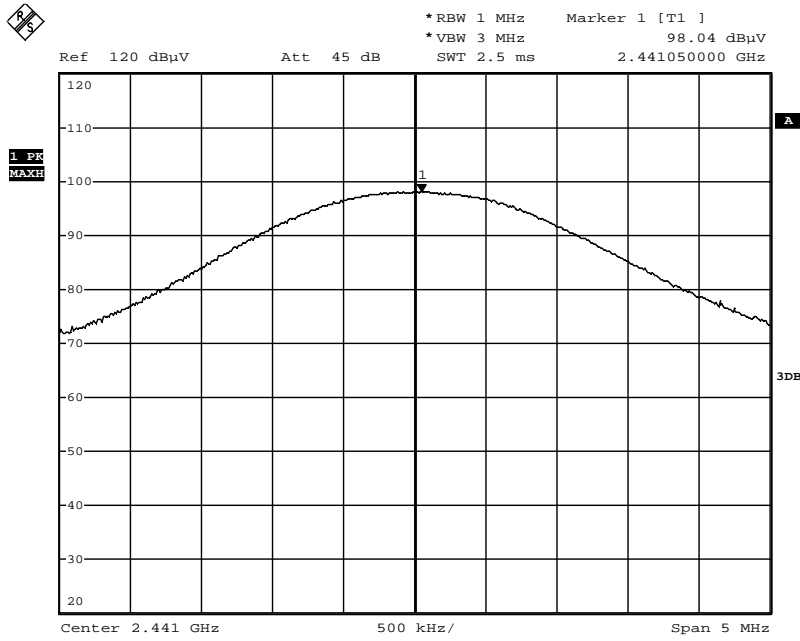
Date: 29.NOV.2017 12:23:13

BT EDR2 Channel 78: Max Field Strength



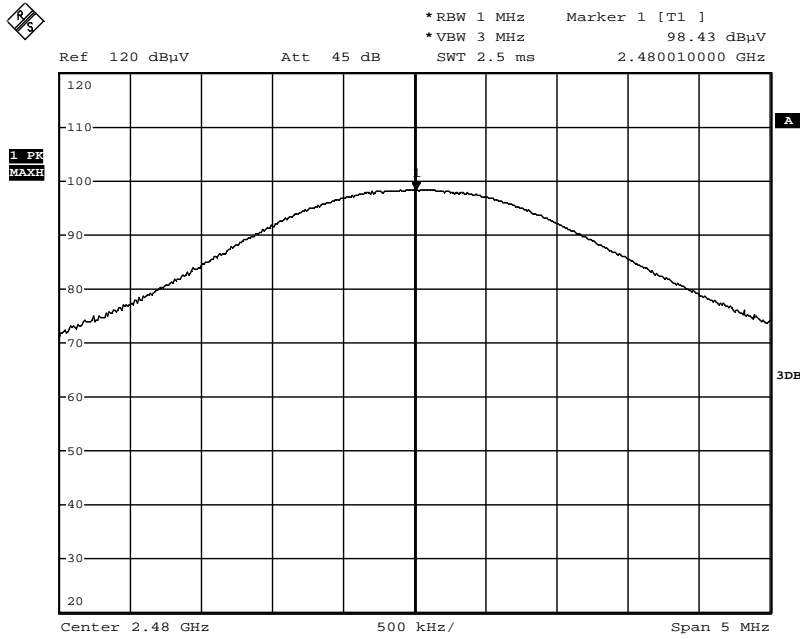
Date: 12.DEC.2017 10:50:14

BT EDR3 Channel 0: Max Field Strength



Date: 12.DEC.2017 10:52:17

BT EDR3 Channel 39: Max Field Strength



Date: 12.DEC.2017 10:53:29

BT EDR3 Channel 78: Max Field Strength

6 20dB Bandwidth

6.1 Test Limits

§ 15.247(a): Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

6.2 Test Procedure

ANSI C63.10: 2013.

6.3 Test Equipment Used

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1302.6005.40	Rohde & Schwarz	ESU40	10/12/2017	10/12/2018
Horn Antenna	154521	ETS	3117	6/1/2017	6/1/2018
System Controller	121701-1	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use

6.4 Test Results

The 20dB bandwidth measurements are shown below. A 99% bandwidth measurement was also performed.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
0 BDR	2402	769.6kHz	857.7kHz
39 BDR	2440	705.4kHz	813.6kHz
78 BDR	2480	721.4kHz	969.9kHz
0 EDR2	2402	1.038MHz	1.102MHz
39 EDR2	2440	1.038MHz	1.094MHz
78 EDR2	2480	1.046MHz	1.098MHz
0 EDR3	2402	1.222MHz	1.178MHz
19 EDR3	2440	1.190MHz	1.230MHz
78 EDR3	2480	1.186MHz	1.603MHz

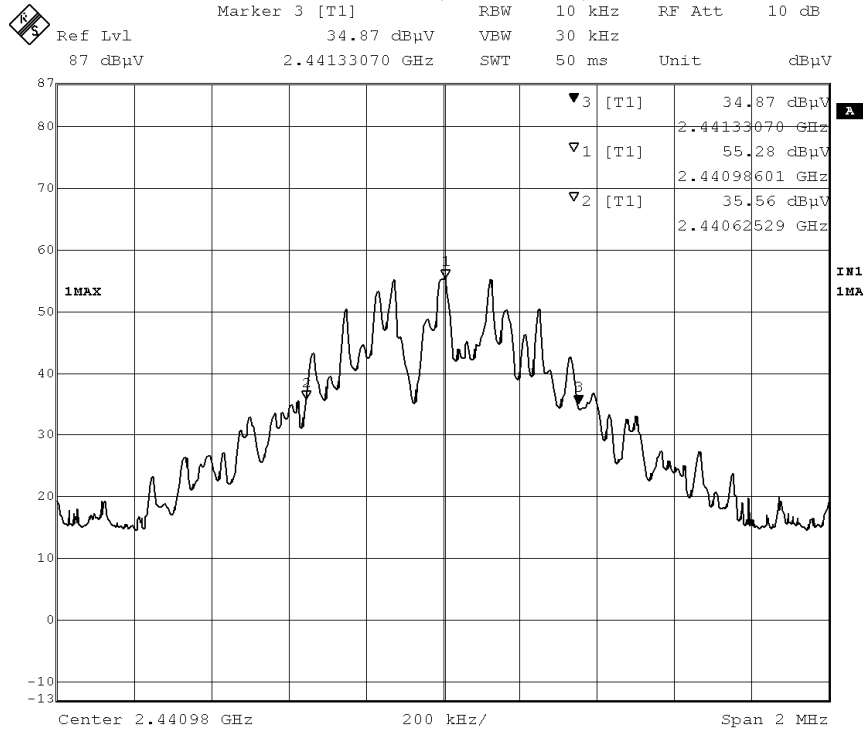
6.5 Test Conditions

Test Personnel: Brian Daffin
 Supervising/Reviewing Engineer:
 (Where Applicable) NA
 Input Voltage: USB

Test Date: 10/30/2017
 Ambient Temperature: 23.4C
 Relative Humidity: 37.2%
 Atmospheric Pressure: 991.2mbar

6.6 Test Data

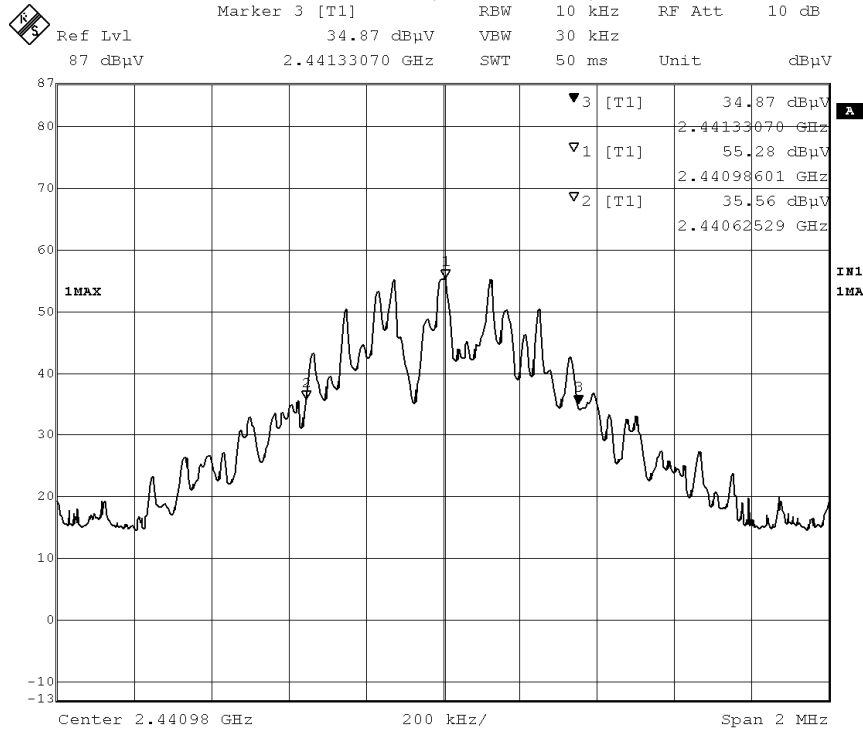
20dB Bandwidth, Channel 0, BDR



Date: 30.OCT.2017 14:39:19

Ch 0, 20dB Down
705.41 kHz

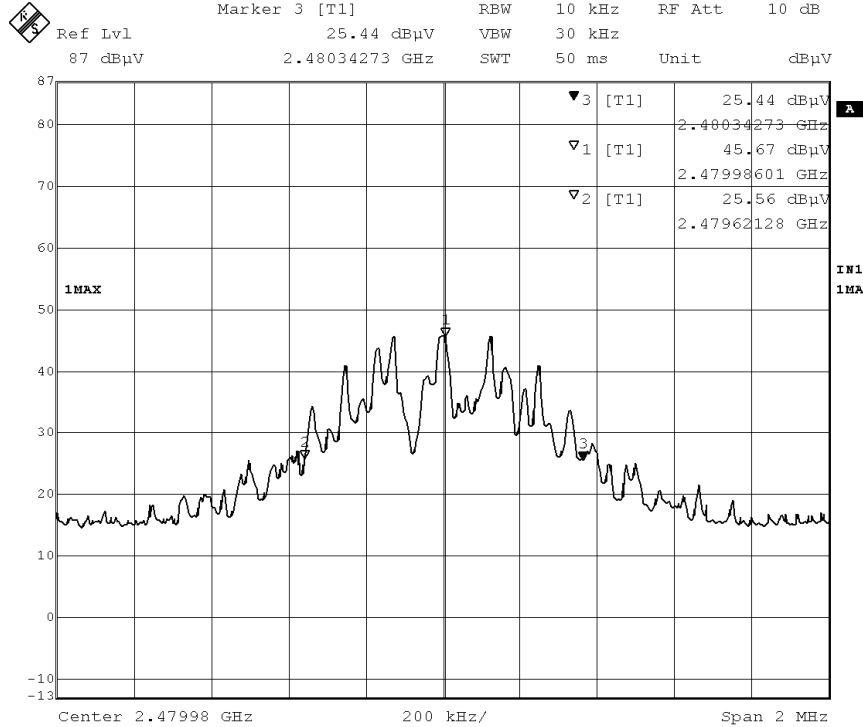
20dB Bandwidth, Channel 19, BDR



Date: 30.OCT.2017 14:39:19

Ch 39, 20dB Down
705.41 kHz

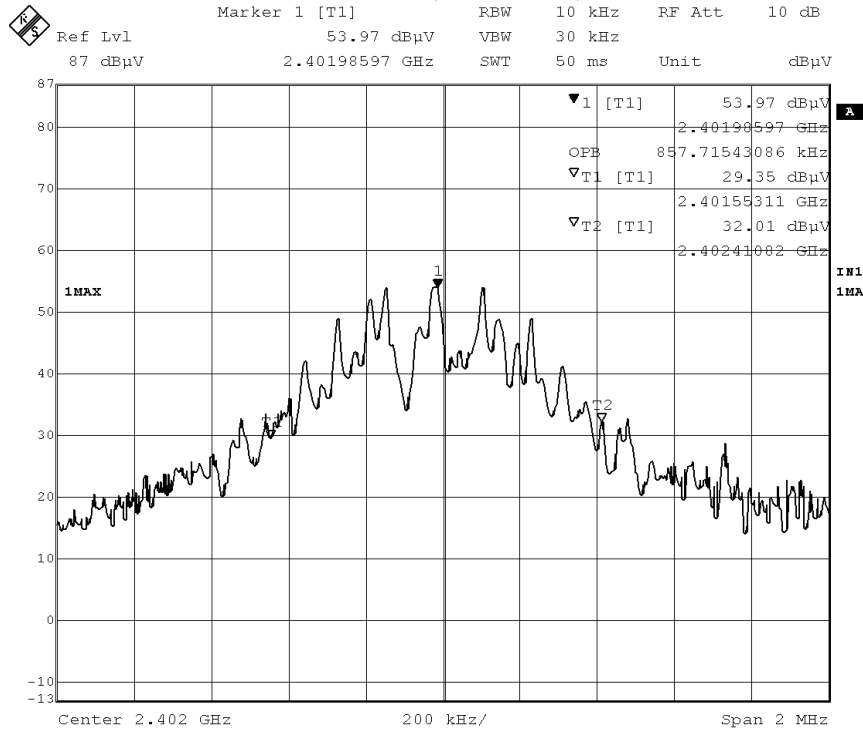
20dB Bandwidth, Channel 78, BDR



Date: 30.OCT.2017 14:55:23

Ch 78, 20dB Down
721.45 kHz


99% Bandwidth, Channel 0, BDR

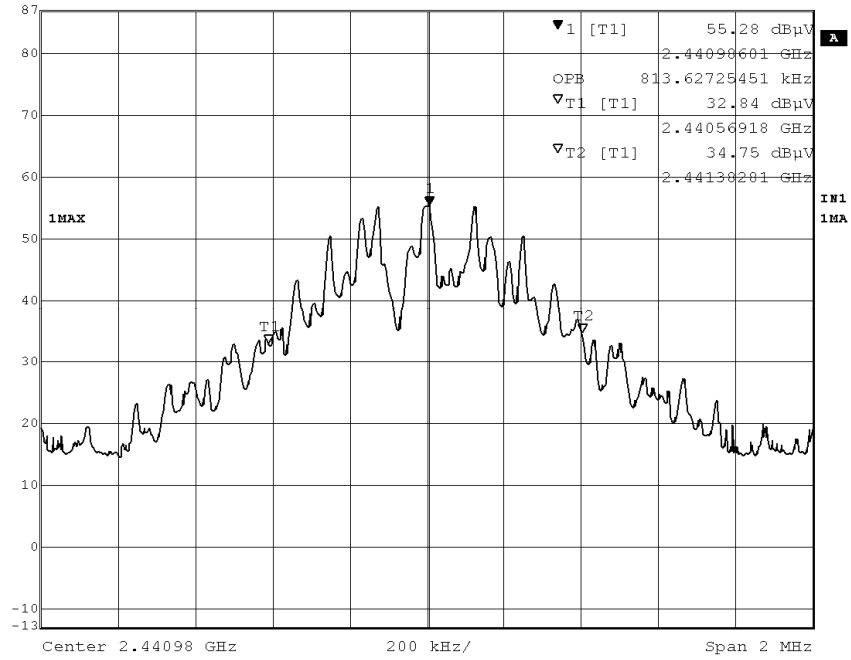


Date: 30.OCT.2017 14:20:07

Ch 0, 99% Power
857.7 kHz

99% Bandwidth, Channel 39, BDR


	Ref Lvl	Marker 1 [T1]	RBW	10 kHz	RF Att	10 dB
	87 dBμV	55.28 dBμV	VBW	30 kHz		
		2.44098601 GHz	SWT	50 ms	Unit	dBμV

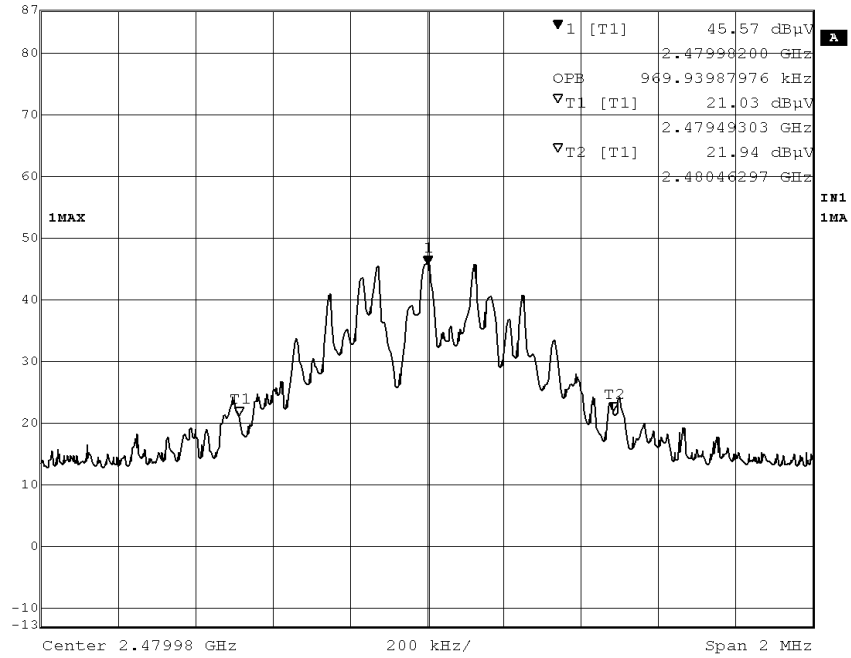


Date: 30.OCT.2017 14:40:58

Ch 39, 99% Power
813.627 kHz

99% Bandwidth, Channel 78, BDR


	Ref Lvl	Marker 1 [T1]	RBW	10 kHz	RF Att	10 dB
	87 dBμV	45.57 dBμV	VBW	30 kHz		
		2.47998200 GHz	SWT	50 ms	Unit	dBμV

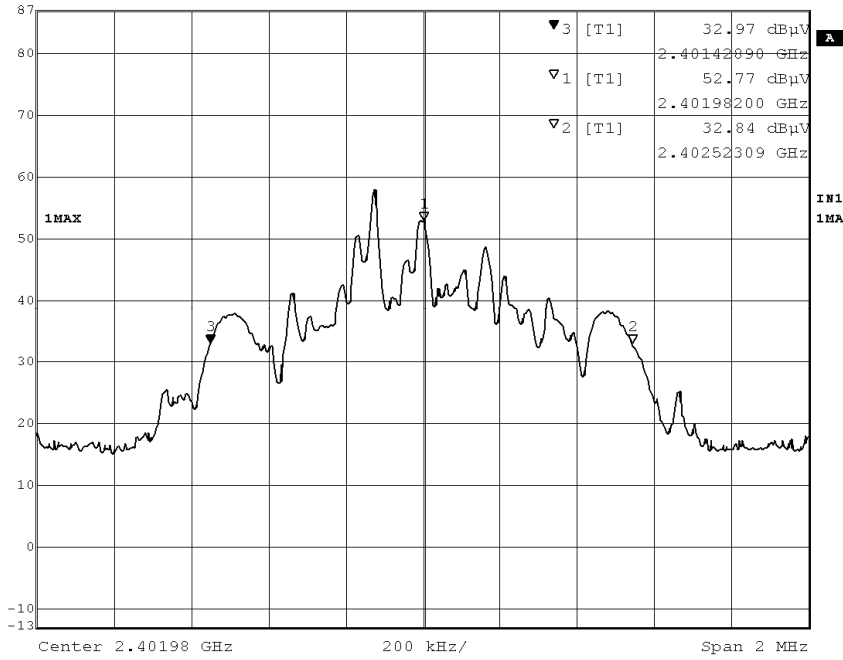


Date: 30.OCT.2017 14:50:45

Ch 78, 99% Power
969.94 kHz

20dB Bandwidth, Channel 0, EDR 2



 Ref Lvl 87 dBμV
 Marker 3 [T1] 32.97 dBμV 2.40142890 GHz
 RBW 10 kHz RF Att 10 dB
 VBW 30 kHz
 SWT 50 ms Unit dBμV

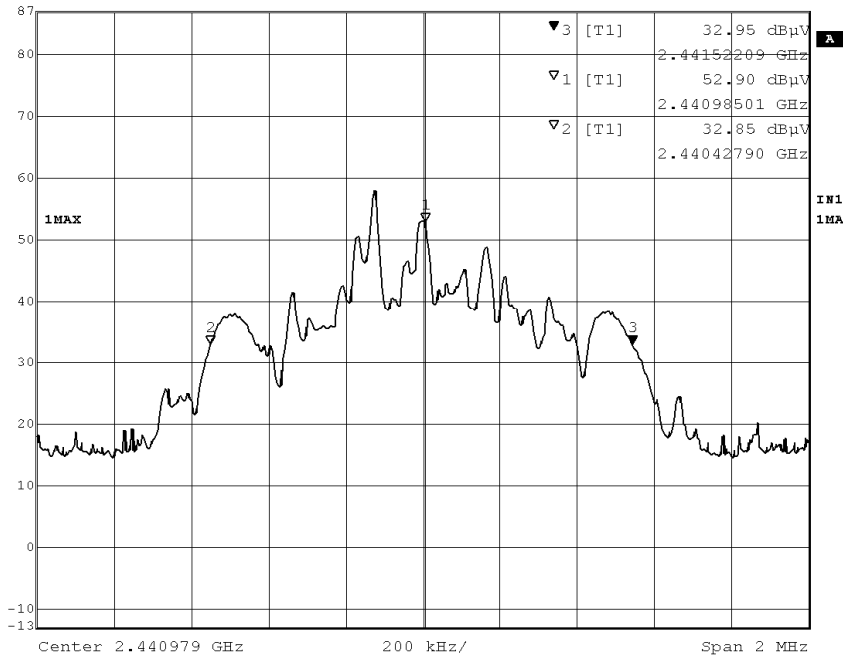


Date: 30.OCT.2017 15:17:40

Ch 0, 20dB Down
1.102 MHz

20dB Bandwidth, Channel 39, EDR 2


 Ref Lvl 87 dBμV
 Marker 3 [T1] 32.95 dBμV 2.44152209 GHz
 RBW 10 kHz RF Att 10 dB
 VBW 30 kHz
 SWT 50 ms Unit dBμV

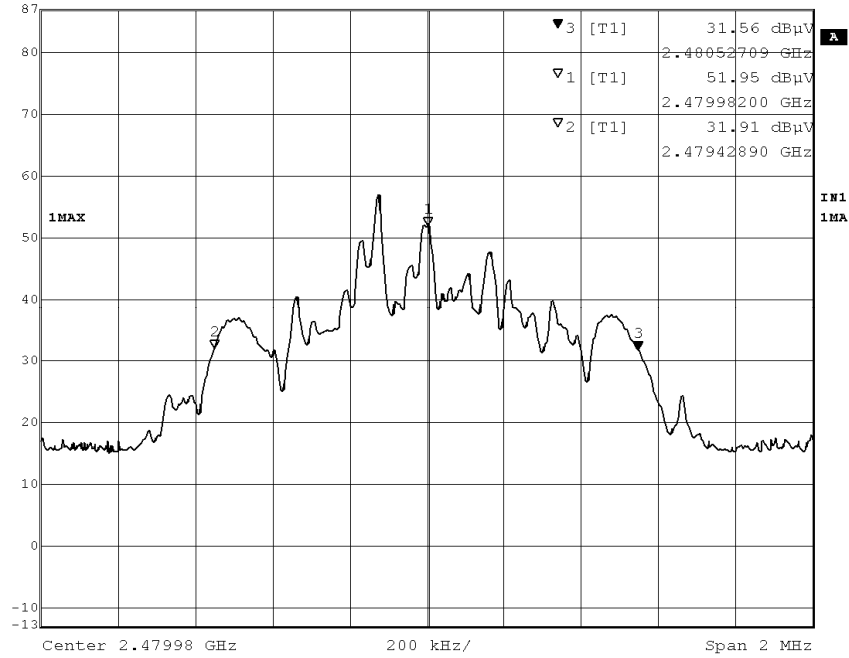


Date: 30.OCT.2017 15:31:21

Ch 39, 20dB Down
1.094 MHz

20dB Bandwidth, Channel 78, EDR 2

Marker 3 [T1] RBW 10 kHz RF Att 10 dB
 Ref Lvl 31.56 dBµV VBW 30 kHz
 87 dBµV 2.48052709 GHz SWT 50 ms Unit dBµV

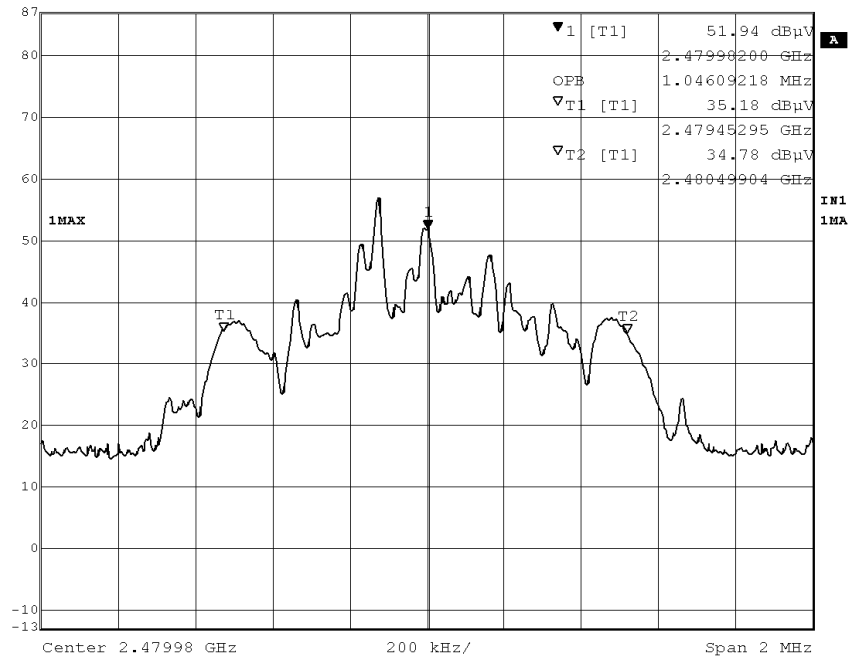


Date: 30.OCT.2017 15:48:31

Ch 78, 20dB Down
 1.098 MHz

99% Bandwidth, Channel 0, EDR 2


Marker 1 [T1] RBW 10 kHz RF Att 10 dB
 Ref Lvl 51.94 dBµV VBW 30 kHz
 87 dBµV 2.47998200 GHz SWT 50 ms Unit dBµV

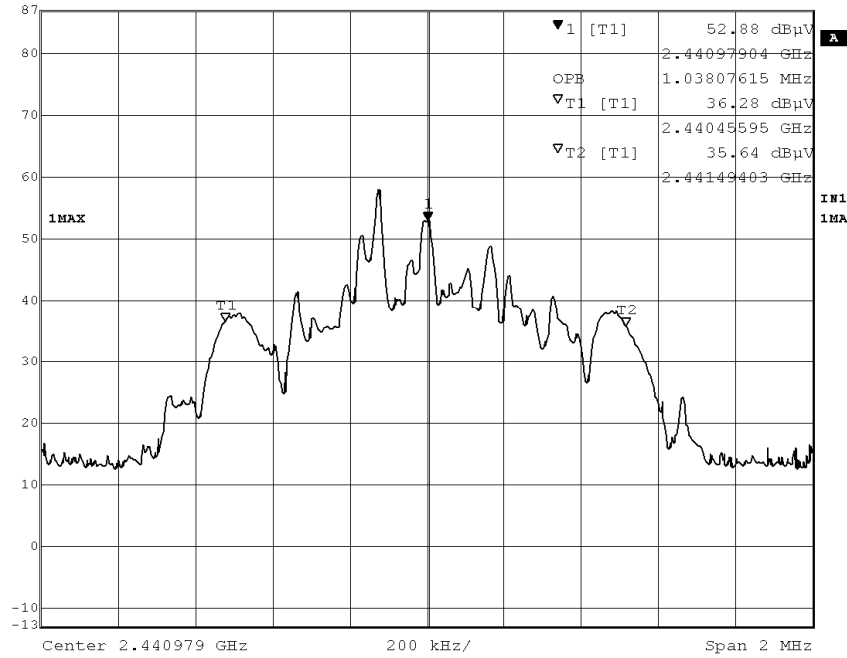


Date: 30.OCT.2017 15:43:07

Ch 0, 99% Power
 1.046 MHz

99% Bandwidth, Channel 39, EDR 2



 Ref Lvl 87 dBμV
 Marker 1 [T1] 52.88 dBμV
 2.44097904 GHz
 RBW 10 kHz
 VBW 30 kHz
 RF Att 10 dB
 Unit dBμV
 SWT 50 ms

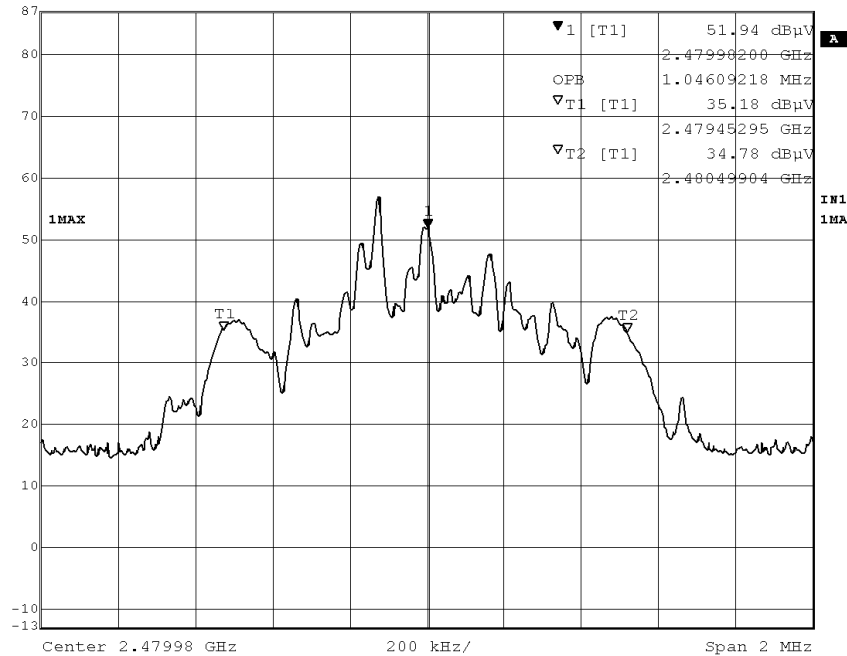


Date: 30.OCT.2017 15:25:31

Ch 39, 99% Power
1.038 MHz

99% Bandwidth, Channel 78, EDR 2


 Ref Lvl 87 dBμV
 Marker 1 [T1] 51.94 dBμV
 2.47998200 GHz
 RBW 10 kHz
 VBW 30 kHz
 RF Att 10 dB
 Unit dBμV
 SWT 50 ms

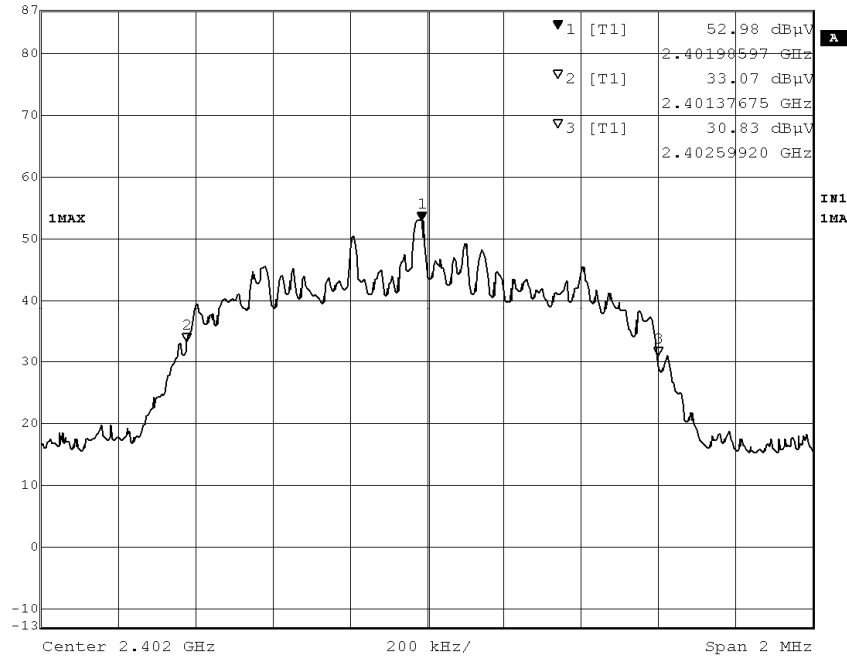


Date: 30.OCT.2017 15:43:07

Ch 78, 99% Power
1.046 MHz

20dB Bandwidth, Channel 0, EDR 3

Ref Lvl 87 dBμV
Marker 1 [T1] 52.98 dBμV
2.40198597 GHz
RBW 10 kHz
VBW 30 kHz
RF Att 10 dB
SWT 50 ms
Unit dBμV

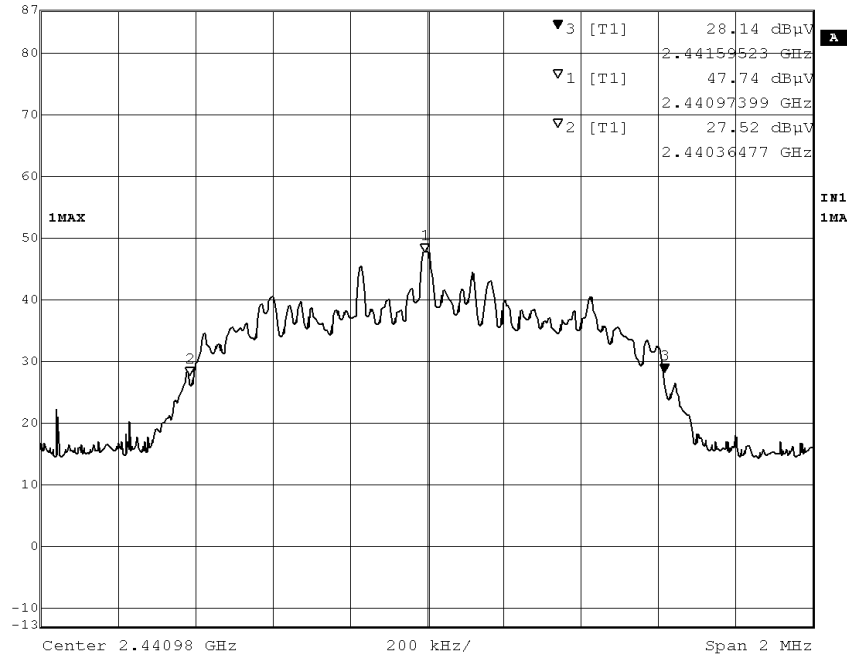


Date: 30.OCT.2017 15:56:36

Ch 0, 20dB Down
1.222 MHz

20dB Bandwidth, Channel 39, EDR 3


Ref Lvl 87 dBμV
Marker 3 [T1] 28.14 dBμV
2.44159523 GHz
RBW 10 kHz
VBW 30 kHz
RF Att 10 dB
SWT 50 ms
Unit dBμV

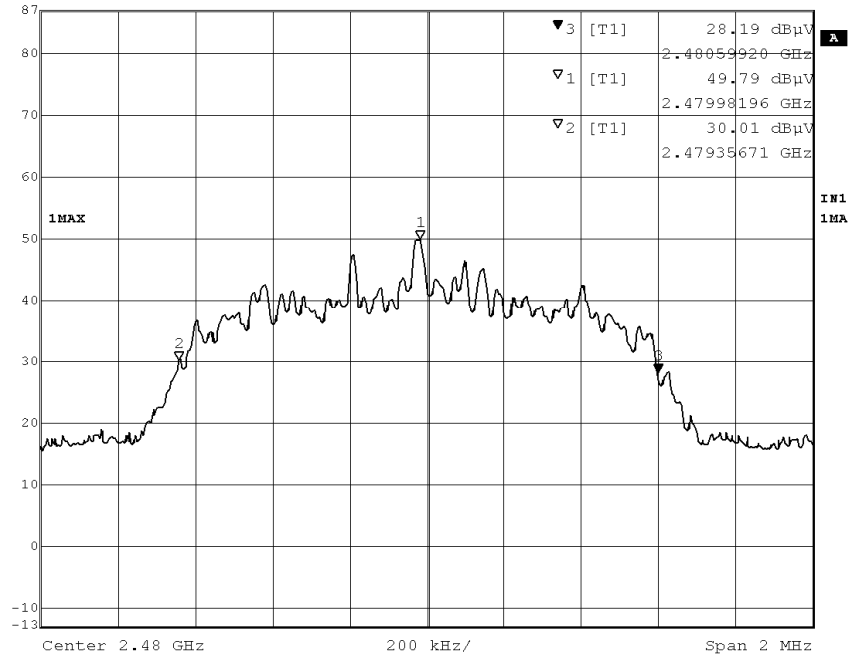


Date: 30.OCT.2017 16:01:21

Ch 39, 20dB Down
1.230 MHz

20dB Bandwidth, Channel 78, EDR 3



 Ref Lvl 87 dBμV
 Marker 3 [T1] 28.19 dBμV
 RBW 10 kHz
 RF Att 10 dB
 VBW 30 kHz
 Unit dBμV
 2.48059920 GHz
 SWT 50 ms

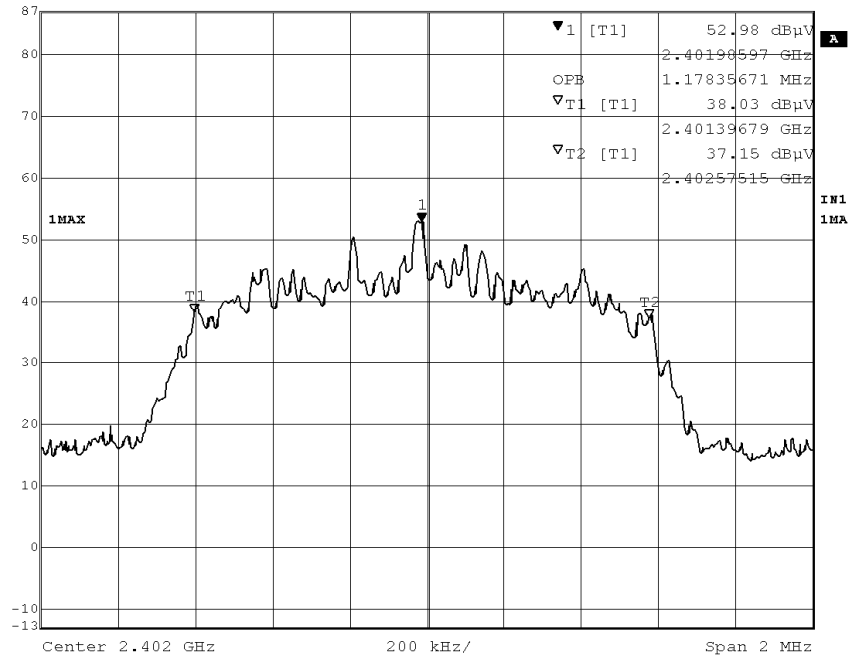


Date: 30.OCT.2017 16:19:41

Ch 78, 20dB Down
1.603 MHz

99% Bandwidth, Channel 0, EDR 3

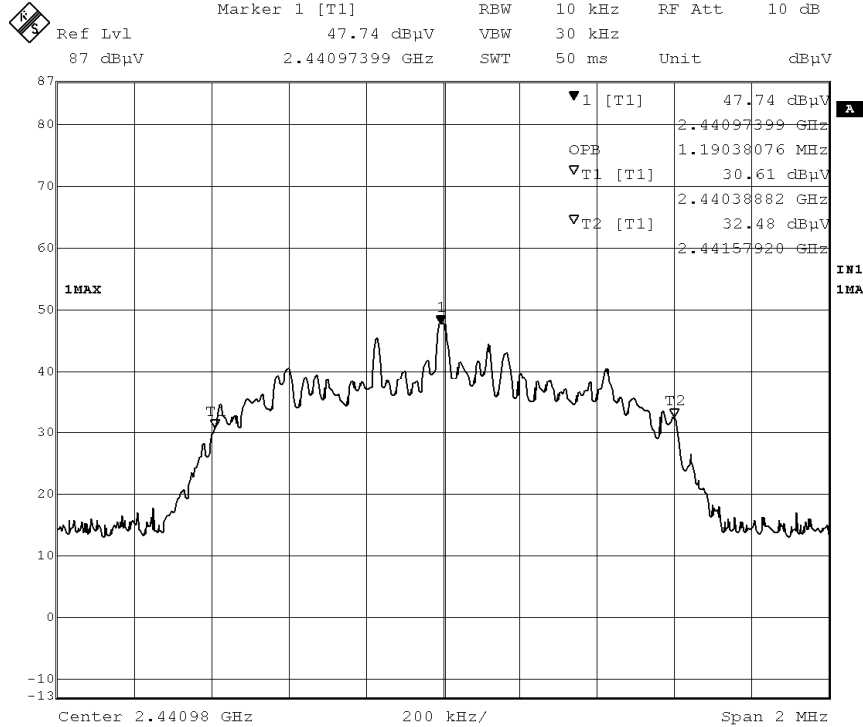

 Ref Lvl 87 dBμV
 Marker 1 [T1] 52.98 dBμV
 RBW 10 kHz
 RF Att 10 dB
 VBW 30 kHz
 Unit dBμV
 2.40198597 GHz
 SWT 50 ms



Date: 30.OCT.2017 15:54:12

Ch 0, 99% Power
1.178 MHz

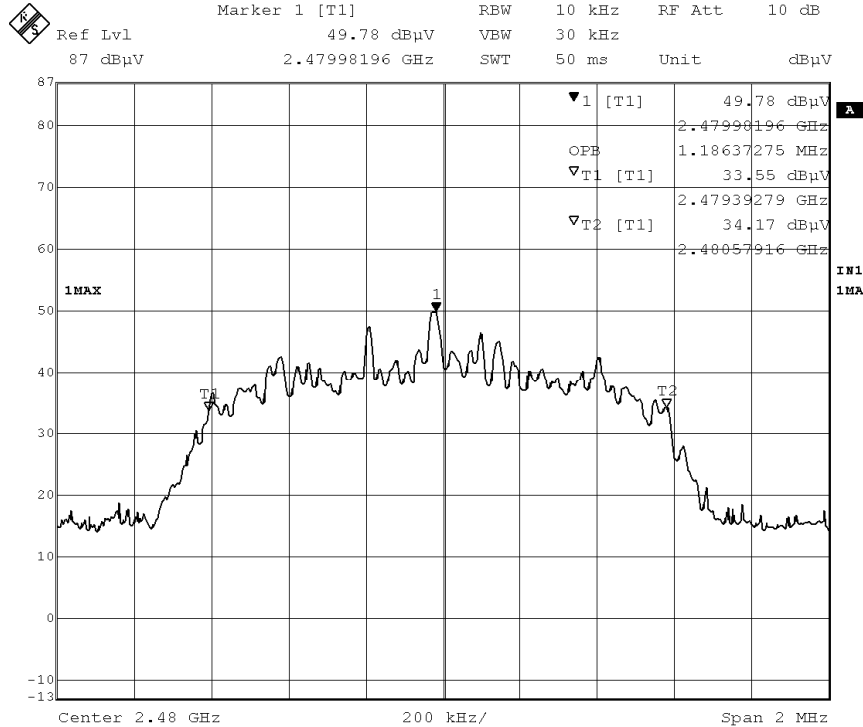
99% Bandwidth, Channel 39, EDR 3



Date: 30.OCT.2017 15:58:43

Ch 39, 99% Power
1.19 MHz

99% Bandwidth, Channel 78, EDR 3



Date: 30.OCT.2017 16:04:23

Ch 78, 99% Power
1.186 MHz

7 Channel Separation

7.1 Test Limits

§ 15.247(a): Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

7.2 Test Procedure

ANSI C63.10: 2013.

7.3 Test Equipment Used

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ES126	9/20/2017	9/20/2018

7.4 Test Results

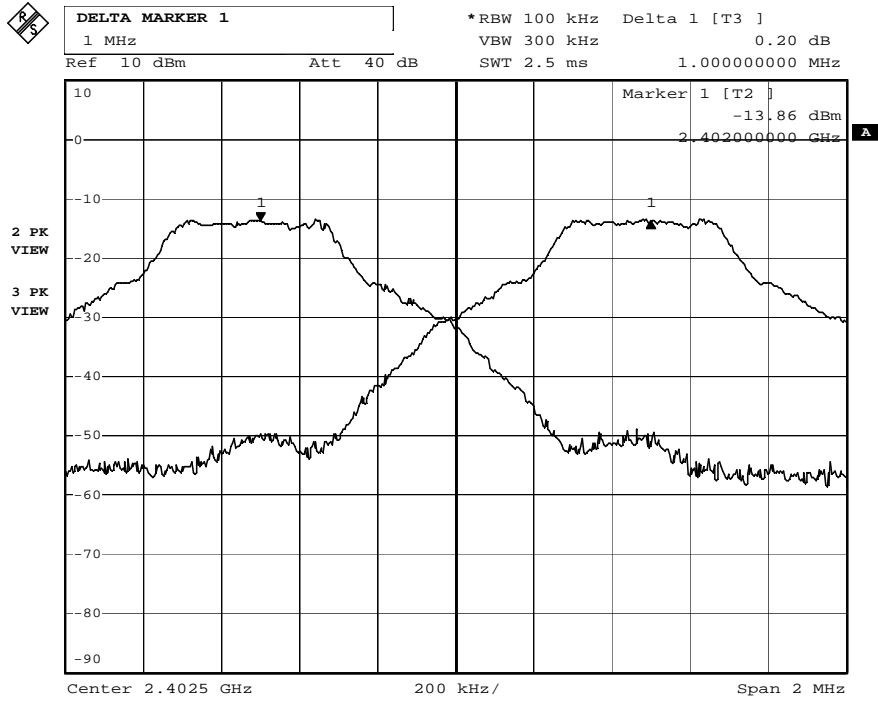
The device was found to be **compliant**. The channel separation was greater than the minimum limit.

7.5 Test Conditions

Test Personnel: <u>Bryan Taylor</u>	Test Date: <u>12/15/2017</u>
Supervising/Reviewing Engineer: _____	
(Where Applicable) Input Voltage: <u>NA</u>	Ambient Temperature: <u>22.1C</u>
<u>DC Powered via USB</u>	Relative Humidity: <u>35.2%</u>
	Atmospheric Pressure: <u>992.0mbar</u>

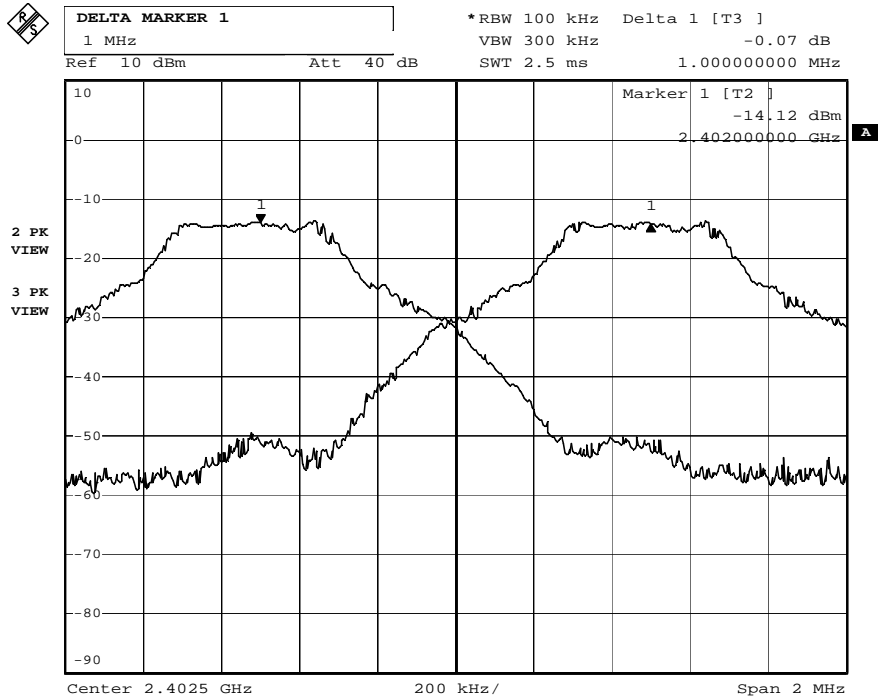
7.6 Test Data

The channel separation for all hopping modes was 1MHz.



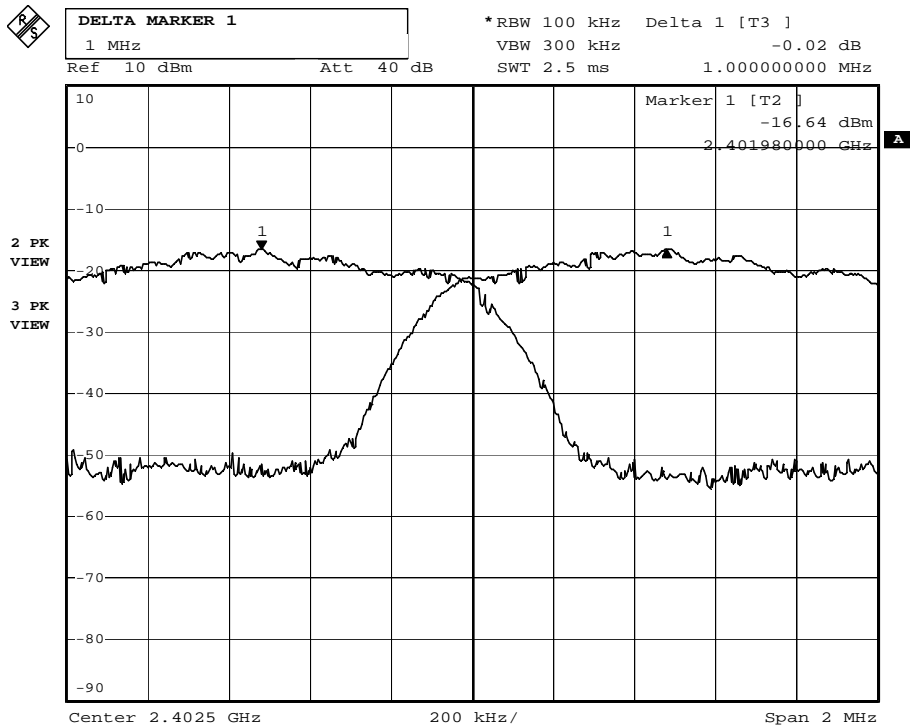
Date: 15.DEC.2017 10:22:55

Hopping Channel Separation (Ch. 1 and Ch. 2 BDR)



Date: 15.DEC.2017 10:25:33

Hopping Channel Separation (Ch. 1 and Ch. 2 EDR2)



Date: 15.DEC.2017 10:33:57

Hopping Channel Separation (Ch. 1 and Ch. 2 EDR3)

8 Number of Hopping Channels

8.1 Test Limits

§ 15.247(a): Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1)(iii) Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

8.2 Test Procedure

ANSI C63.10: 2013.

8.3 Test Equipment Used

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	9/20/2017	9/20/2018

8.4 Test Results

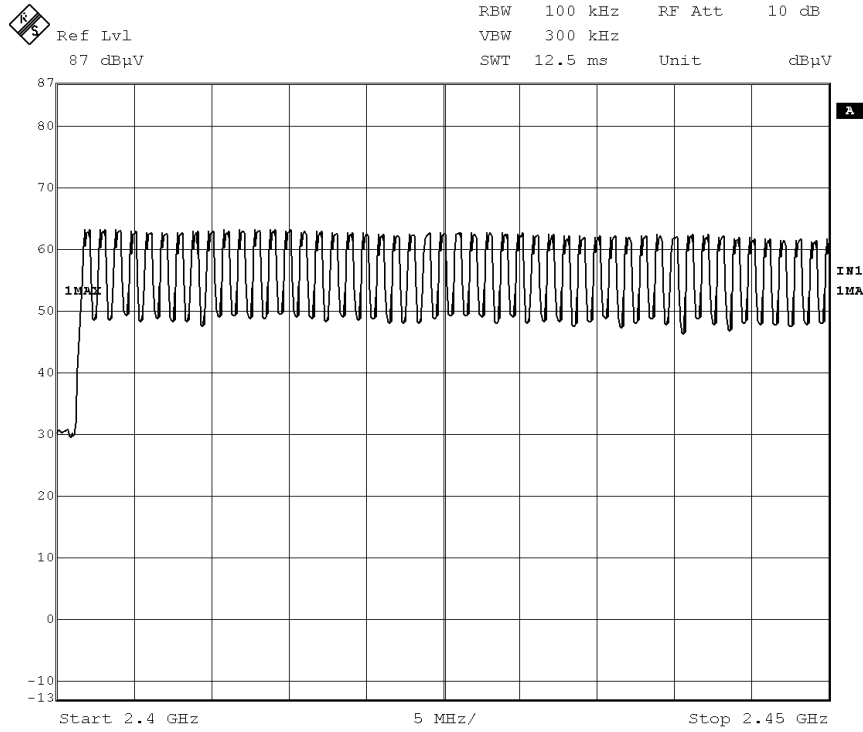
The device was found to be **compliant**. The Wireless Print Server used a total of 79 hopping channels as shown in the following plots.

8.5 Test Conditions

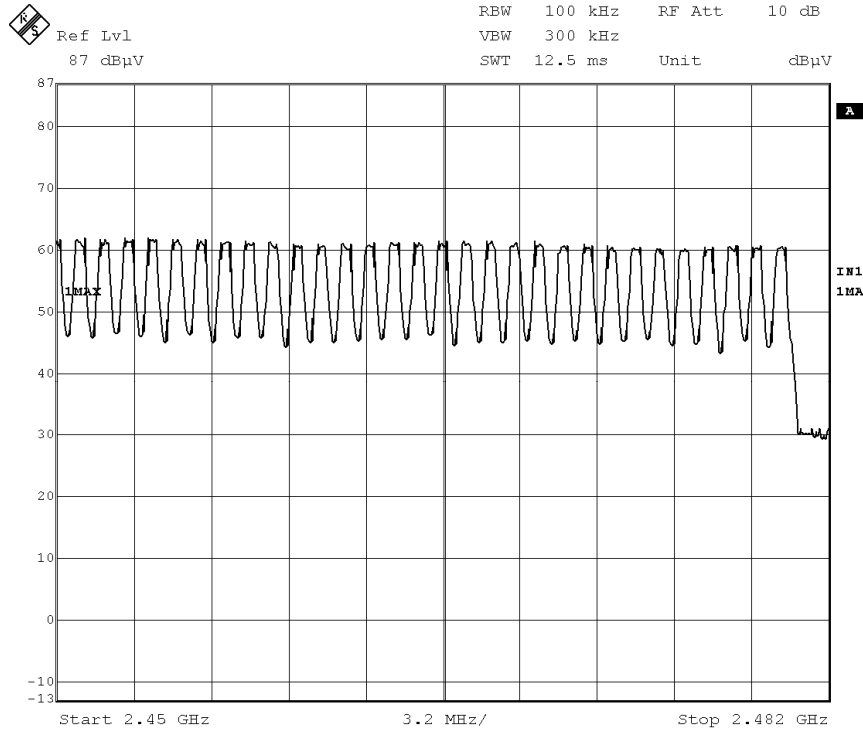
Test Personnel: Brian Daffin
 Supervising/Reviewing Engineer:
 (Where Applicable) NA
 Input Voltage: DC powered via USB

Test Date: 10/30/2017
 Ambient Temperature: 21.2C
 Relative Humidity: 29.7%
 Atmospheric Pressure: 985.4mbar

8.6 Test Data



48 channels



31 channels

Number of Hopping Channels (Normal Operation) = 48 + 31 = 79

9 Time of Occupancy

9.1 Test Limits

§ 15.247(a): Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

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

9.2 Test Procedure

ANSI C63.10: 2013.

9.3 Test Equipment Used

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	9/20/2017	9/20/2018

9.4 Test Results

The device was found to be **compliant**. The time of occupancy was less than the limit.

The time domain was adjusted on the spectrum analyzer so that the dwell time of one single pulse could be measured. It was then adjusted so that the number of pulses in 1/10th of the required observation period could be counted. The total dwell time in the required observation period was calculated by multiplying the burst “on time” by the number of bursts counted in 1/10th of the observation period, and then multiplying by 10.

9.5 Test Conditions

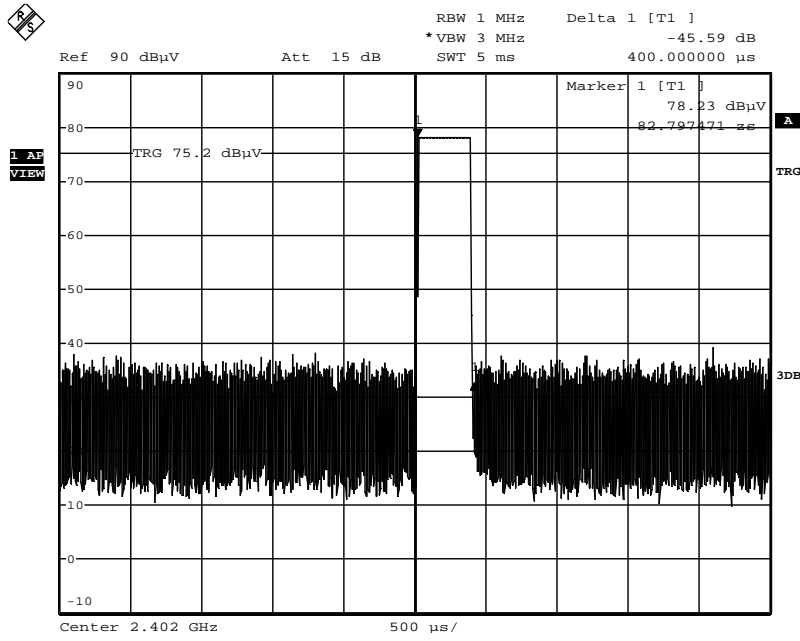
Test Personnel: Bryan Taylor
 Supervising/Reviewing Engineer:
 (Where Applicable) NA
 Input Voltage: DC via USB

Test Date: 12/12/2017

 Ambient Temperature: 22.4C
 Relative Humidity: 30.34%
 Atmospheric Pressure: 987.4mbar

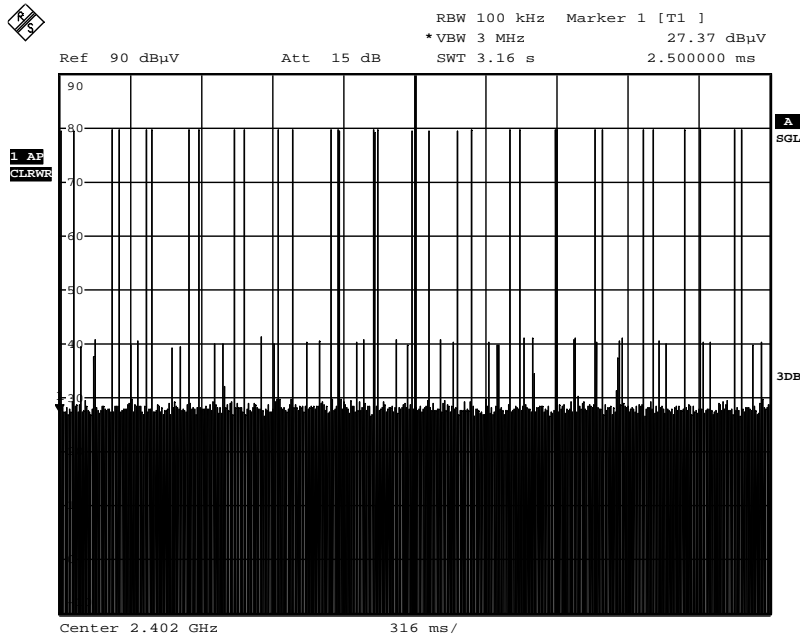
9.6 Test Data

Mode	Number of Channels	Observation Period (mS) (0.4s x No. of Ch)	Burst On Time (ms) (Single)	No. of Burst in 1/10th Period	Multiplier	Dwell Time (ms)	Limit (ms)
BDR	79	31.6	0.400	30	10	120mS	400mS
EDR2	79	31.6	1.650	16	10	264mS	400mS
EDR3	79	31.6	2.92	12	10	350.4mS	400mS



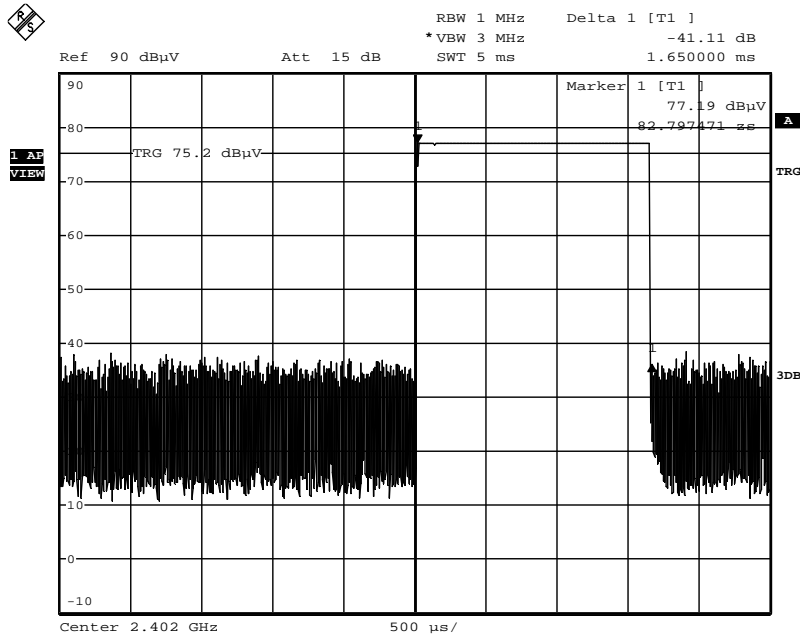
Date: 12.DEC.2017 11:33:59

Single Pulse, BDR



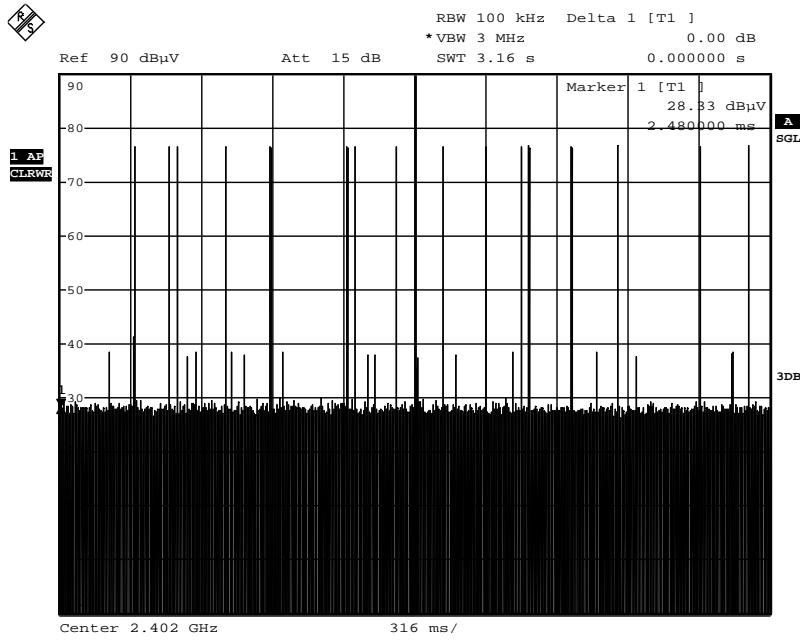
Date: 12.DEC.2017 11:30:17

Bursts in 3.16 Seconds, BDR



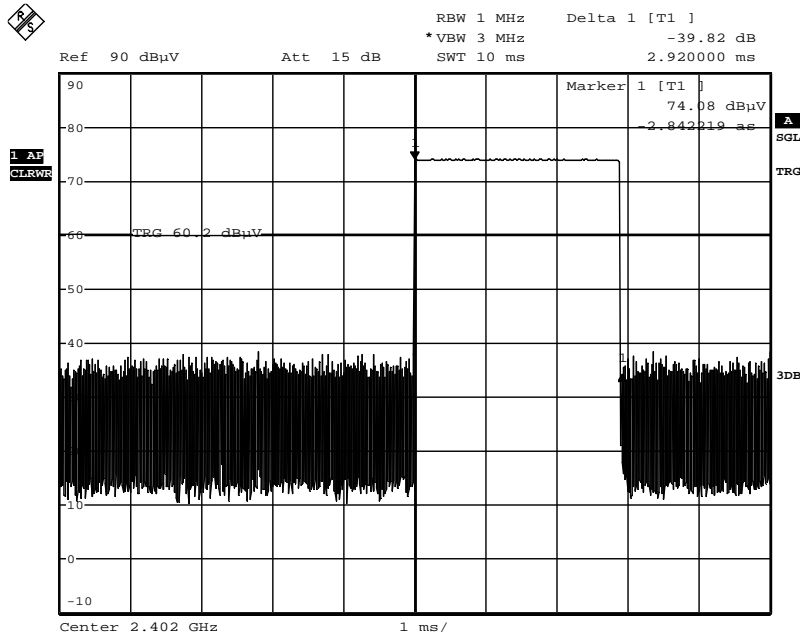
Date: 12.DEC.2017 11:38:16

Single Pulse, EDR2



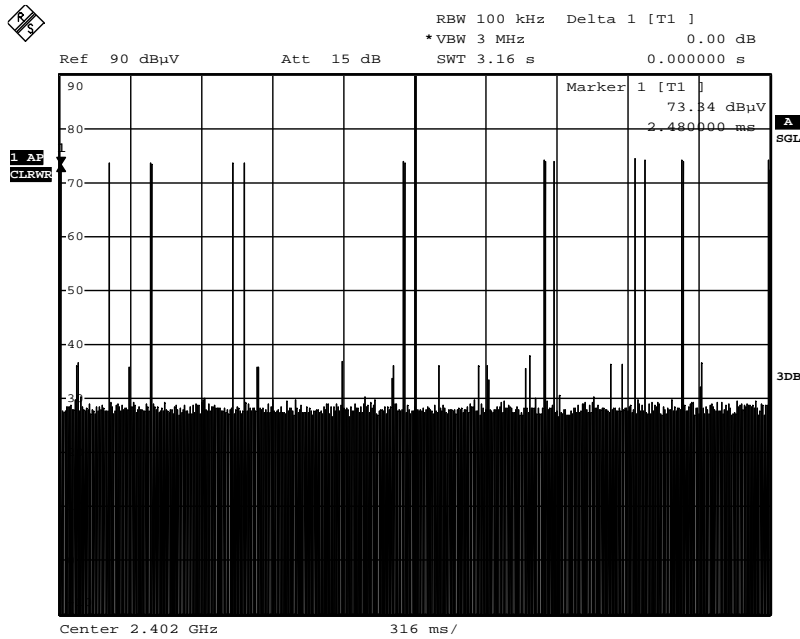
Date: 12.DEC.2017 11:39:38

Bursts in 3.16 Seconds, EDR2



Date: 12.DEC.2017 11:50:09

Single Pulse, EDR3



Date: 12.DEC.2017 11:47:40

Bursts in 3.16 Seconds, EDR3

10 Radiated Spurious Emissions (Transmitter)

10.1 Test Limits

§ 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)).

Part 15.205(a): Restricted Bands of Operations

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
10.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	(2)
13.36–13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

² Above 38.6

Part 15.209(a): Field Strength Limits for Restricted Bands of Operation

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2,400 / F (kHz)	300
0.490 - 1.705	24,000 / F (kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

10.2 Test Procedure

ANSI C63.10: 2013.

10.3 Example of Field Strength Calculation Method

The measured field strength was calculated by summing the readings taken from the spectrum analyzer with the appropriate correction factors associated with the antenna losses and cable losses. The calculation formula and sample calculations are listed below:

Formula:

$$FS = RA + AF + CF$$

FS = Field Strength in dB μ V/m

RA = Receiver Amplitude in dB μ V

AF = Antenna Factor in dB

CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

$$RA = 19.48 \text{ dB}\mu\text{V}$$

$$AF = 18.52 \text{ dB}$$

$$CF = 0.78 \text{ dB}$$

$$FS = 19.48 + 18.52 + 0.78 = 38.78 \text{ dB}\mu\text{V/m}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(38.78 \text{ dB}\mu\text{V/m})/20] = 86.89 \mu\text{V/m}$$

10.4 Test Equipment Used

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1302.6005.40	Rohde & Schwarz	ESU40	10/12/2017	10/12/2018
Preamplifier	122005	Rohde&Schwarz	TS-PR18	11/17/2016	11/17/2017
Biconnilog Antenna	9610-1102	ETS	3142	2/25/2016	2/25/2018
Horn Antenna	154521	ETS	3117	11/14/2016	11/14/2017
System Controller	121701-1	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
3m Cable Antenna→Preamp	3074			11/17/2016	11/17/2017
3m Cable Preamp→Chamber	2588			11/17/2016	11/17/2017
3m Cable Chamber→Control Room	2593			11/17/2016	11/17/2017
3m Cable Control Room→Receiver	2592			11/17/2016	11/17/2017
10m Cable Antenna→Preamp	3339			11/17/2016	11/17/2017
10m Cable Preamp→Chamber	3172			11/17/2016	11/17/2017
10m Cable Chamber→Control Room	2590			11/17/2016	11/17/2017
10m Cable Control Room→Receiver	2589			11/17/2016	11/17/2017

10.5 Test Results

The device was found to be **compliant**. All spurious emissions were attenuated by at least 20dB below the level of the fundamental as required by Part 15.247(d). Additionally, all emissions falling within restricted bands of operation and at the band edges were found to be below the limit specified in Part 15.209(a). The spurious emissions listed in the following table are the worst case emissions. Plots are also presented showing compliance with the restricted bands immediately adjacent to the transmit band.

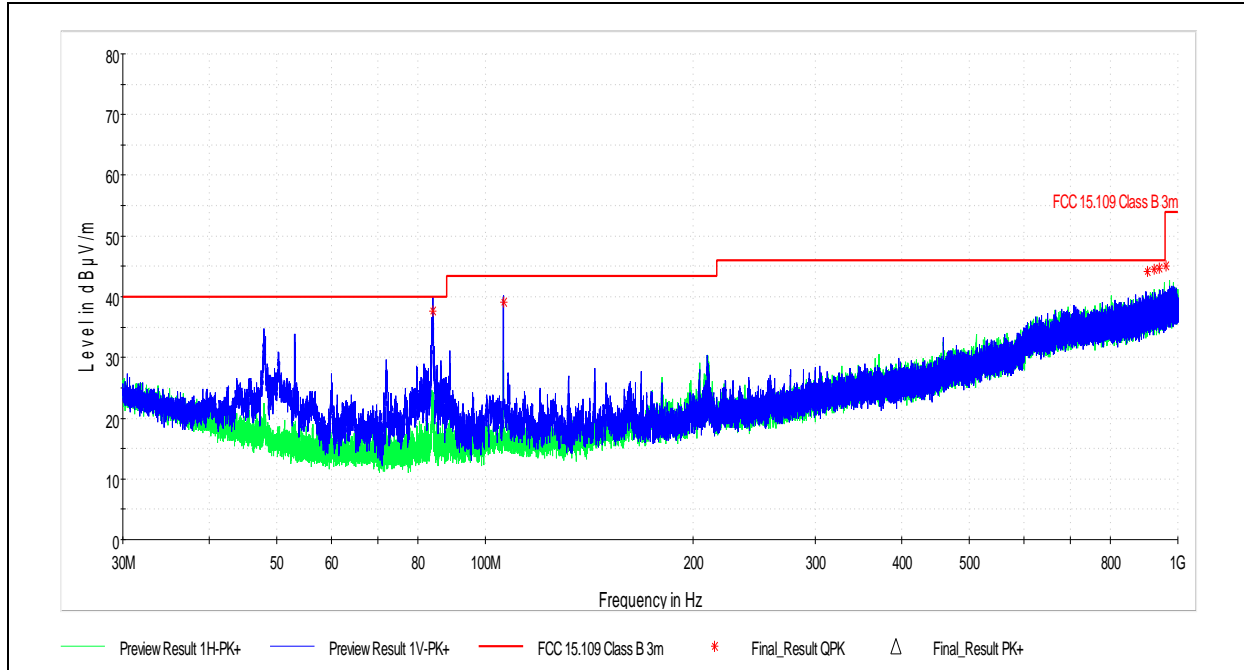
10.6 Test Conditions

Test Personnel:	<u>Bryan Taylor</u>	Test Date:	<u>10/24/2017 – 10/25/2017</u>
Supervising/Reviewing Engineer:			<u>20dB down from fundamental (non-restricted bands)</u>
(Where Applicable)	<u>NA</u>	Limit Applied:	<u>15.209 (restricted bands)</u>
Product Standard:	<u>FCC Part 15C, RSS-247</u>	Ambient Temperature:	<u>22.4C</u>
Input Voltage:	<u>DC Powered via USB</u>	Relative Humidity:	<u>44.9%</u>
Pretest Verification w/ Ambient Signals or BB Source:	<u>Yes</u>	Atmospheric Pressure:	<u>995.6mbar</u>

10.7 Test Data

The worst case test data is shown below. Note that emissions were investigated with the test sample in its worst operating position across 3 orthogonal axes.

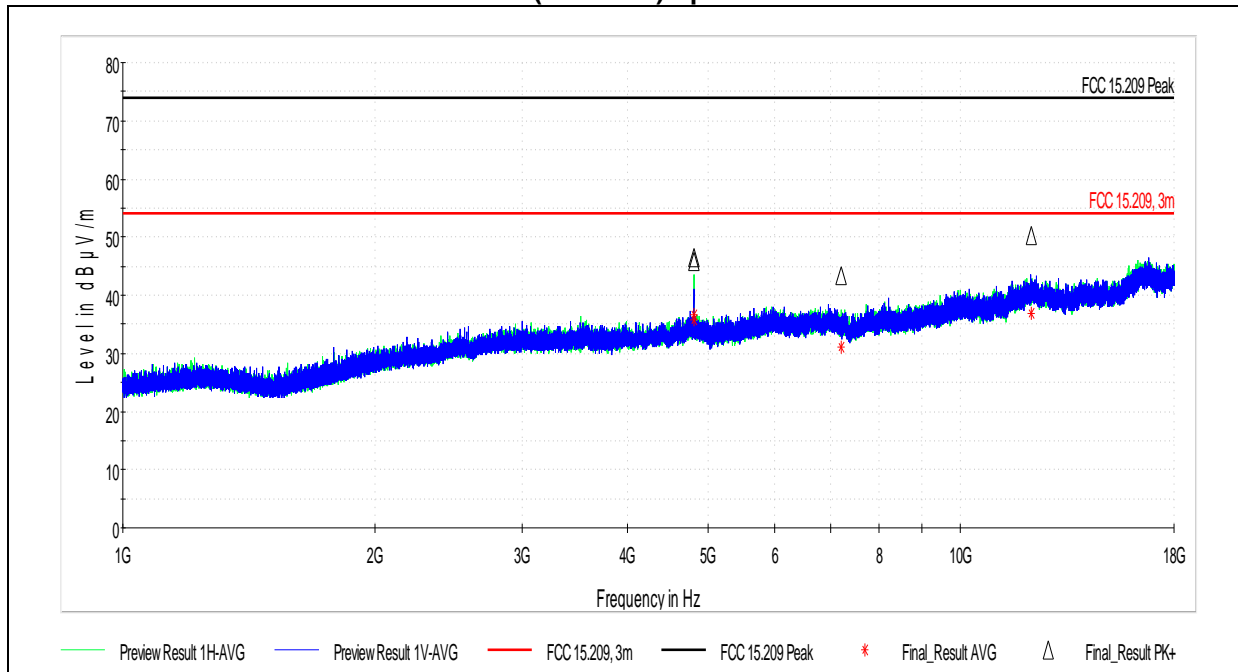
**Bluetooth 30MHz – 1GHz Data
(Worst case is shown and is representative of all channels)**



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
83.965000	37.67	40.00	2.33	120.000	104.6	V	7.0	16.1
106.320000	39.08	43.52	4.44	120.000	109.7	V	0.0	16.8
903.460000	44.15	46.02	1.87	120.000	248.3	V	165.0	35.8
924.780000	44.46	46.02	1.56	120.000	329.8	H	218.0	36.0
939.660000	44.76	46.02	1.26	120.000	331.7	H	184.0	36.0
960.920000	45.00	54.00	9.00	120.000	405.0	H	72.0	36.2

BDR Channel 0 (2402MHz) Spurious Emissions



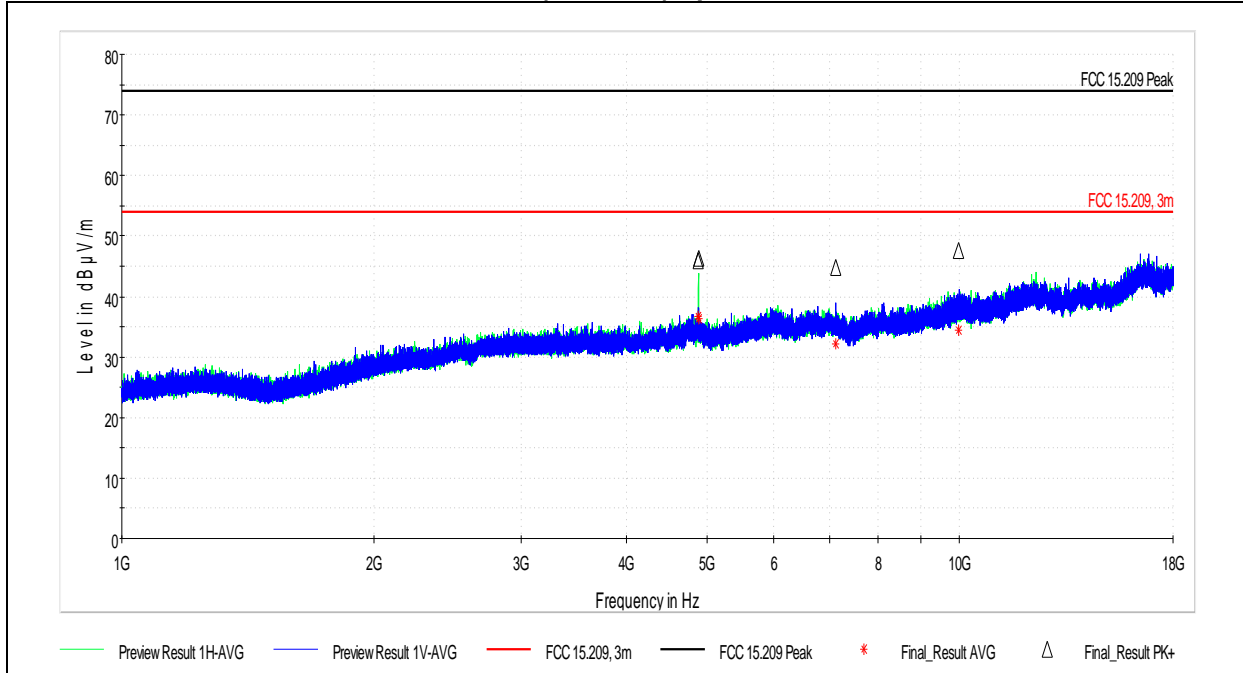
Final_Result_PK+

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4803.642000	46.48	74.00	27.52	1000.000	168.0	V	0.0	7.5
4803.958500	45.91	74.00	28.09	1000.000	166.0	V	0.0	7.5
7210.173000	43.31	74.00	30.69	1000.000	179.0	H	50.0	10.4
12145.357500	50.27	74.00	23.73	1000.000	150.0	H	12.0	17.2

Final_Result_AVG

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4803.642000	35.83	54.00	18.17	1000.000	168.0	V	0.0	7.5
4803.958500	36.71	54.00	17.29	1000.000	166.0	V	0.0	7.5
7210.173000	31.08	54.00	22.92	1000.000	179.0	H	50.0	10.4
12145.357500	36.85	54.00	17.15	1000.000	150.0	H	12.0	17.2

BDR Channel 39 (2440MHz) Spurious Emissions



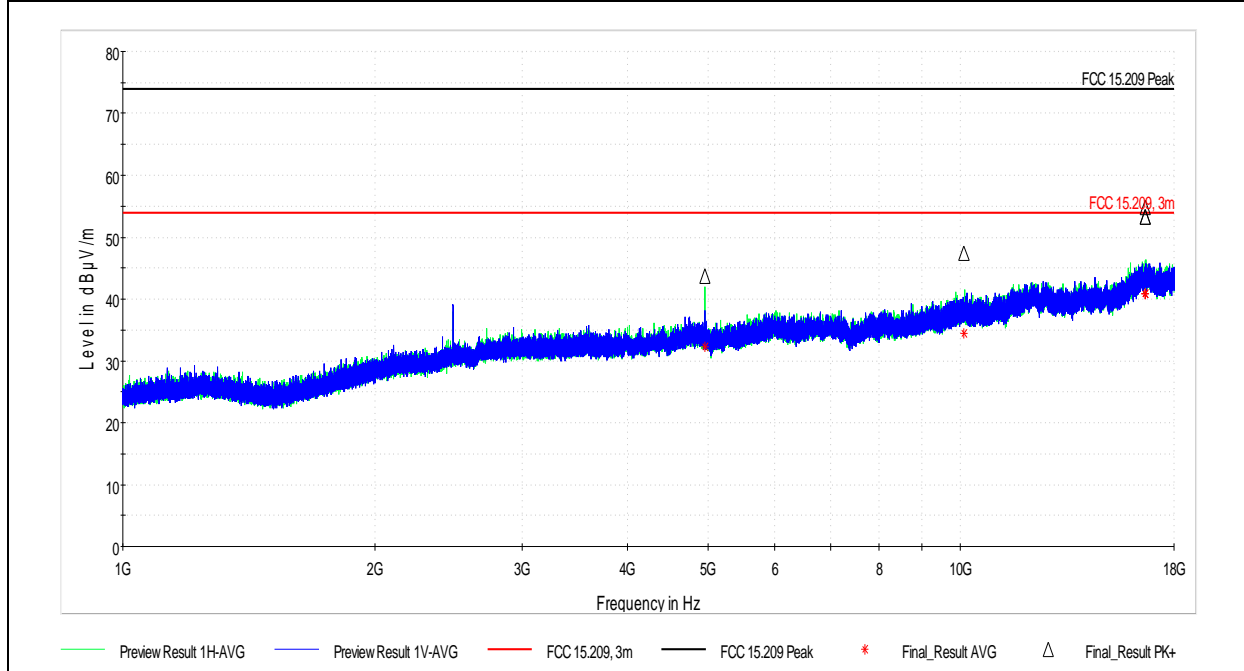
Final_Result_PK+

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4881.870000	45.94	74.00	28.06	1000.000	200.0	V	0.0	7.4
4882.116000	46.26	74.00	27.74	1000.000	200.0	V	0.0	7.4
7118.356000	44.84	74.00	29.16	1000.000	162.0	V	22.0	10.2
9988.687000	47.70	74.00	26.30	1000.000	166.0	V	24.0	14.2

Final_Result_AVG

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4881.870000	36.80	54.00	17.20	1000.000	200.0	V	0.0	7.4
4882.116000	36.41	54.00	17.59	1000.000	200.0	V	0.0	7.4
7118.356000	32.23	54.00	21.77	1000.000	162.0	V	22.0	10.2
9988.687000	34.44	54.00	19.56	1000.000	166.0	V	24.0	14.2

BDR Channel 79 (2480MHz) Spurious Emissions



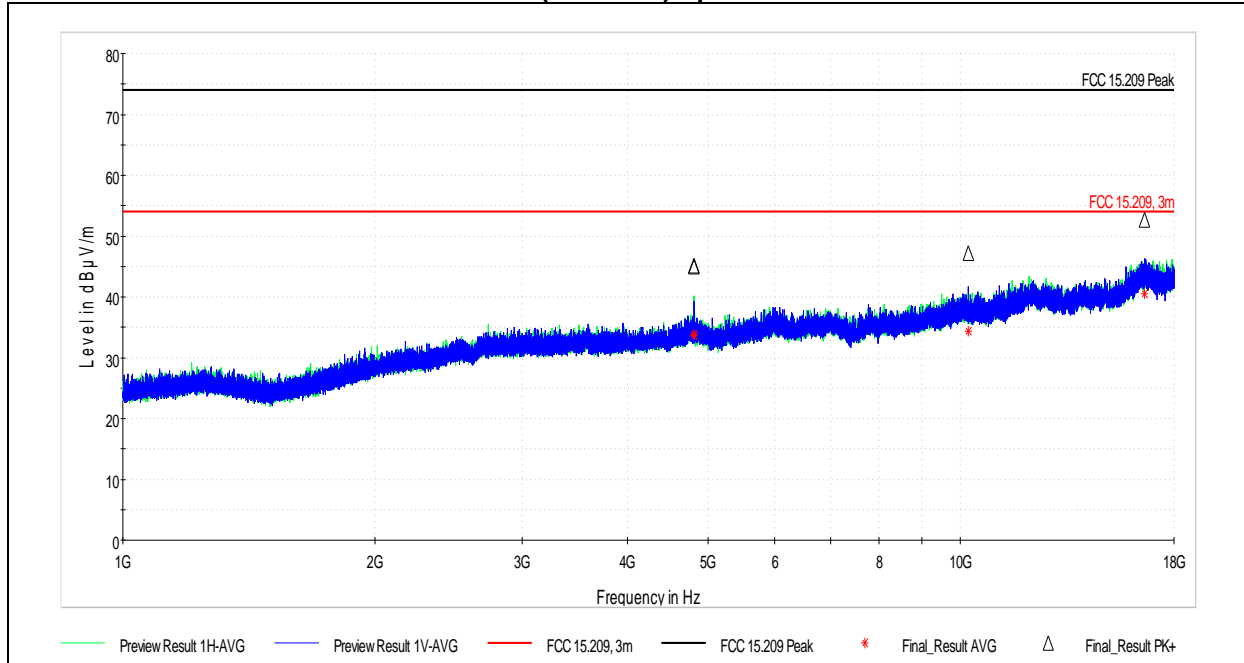
Final Result PK+

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4959.626500	43.64	74.00	30.36	1000.000	200.0	V	23.0	7.2
10107.316000	47.47	74.00	26.53	1000.000	162.0	V	36.0	14.5
16633.275500	54.75	74.00	19.25	1000.000	144.0	V	50.0	21.6
16634.759000	53.30	74.00	20.70	1000.000	271.0	H	9.0	21.6
16641.197000	53.29	74.00	20.71	1000.000	200.0	H	0.0	21.6

Final Result AVG

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4959.626500	32.26	54.00	21.74	1000.000	200.0	V	23.0	7.2
10107.316000	34.48	54.00	19.52	1000.000	162.0	V	36.0	14.5
16633.275500	40.88	54.00	13.12	1000.000	144.0	V	50.0	21.6
16634.759000	40.85	54.00	13.15	1000.000	271.0	H	9.0	21.6
16641.197000	40.85	54.00	13.15	1000.000	200.0	H	0.0	21.6

EDR2 Channel 0 (2402MHz) Spurious Emissions



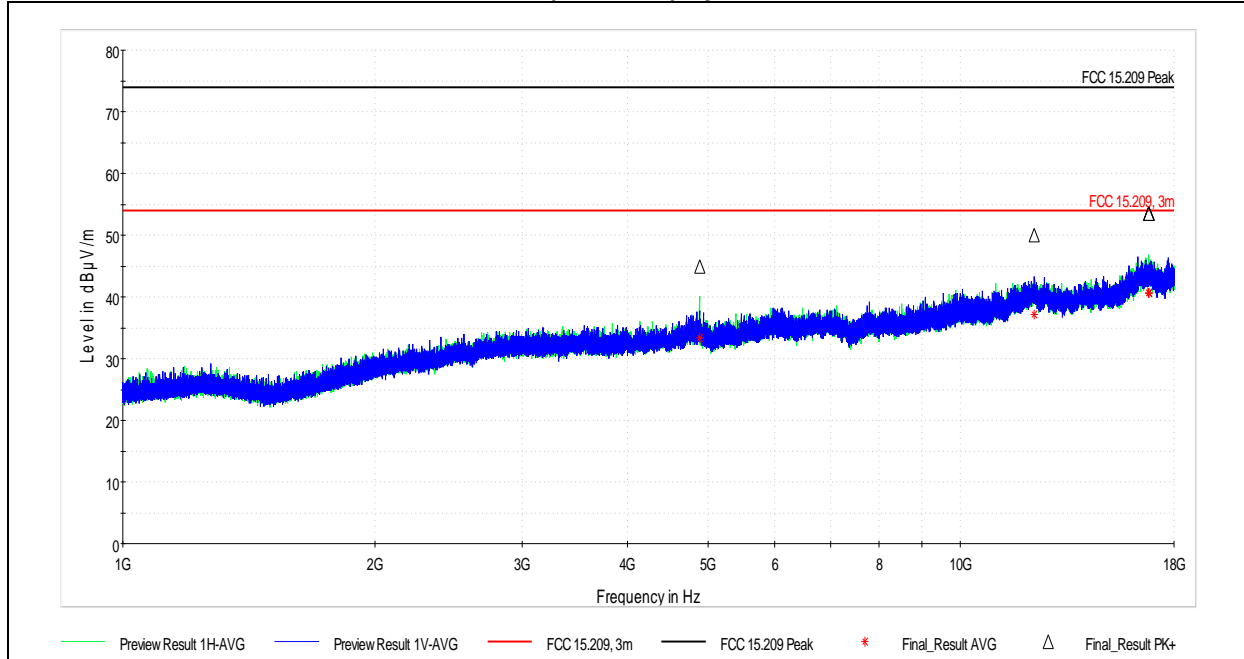
Final_Result_PK+

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4803.920500	45.06	74.00	28.94	1000.000	155.0	V	0.0	7.5
4803.941000	44.92	74.00	29.08	1000.000	156.0	V	0.0	7.5
10226.432000	47.12	74.00	26.88	1000.000	200.0	H	22.0	14.5
16596.738500	52.73	74.00	21.27	1000.000	188.0	H	26.0	21.4

Final_Result_AVG

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4803.920500	33.66	54.00	20.34	1000.000	155.0	V	0.0	7.5
4803.941000	33.78	54.00	20.22	1000.000	156.0	V	0.0	7.5
10226.432000	34.32	54.00	19.68	1000.000	200.0	H	22.0	14.5
16596.738500	40.43	54.00	13.57	1000.000	188.0	H	26.0	21.4

EDR2 Channel 39 (2440MHz) Spurious Emissions



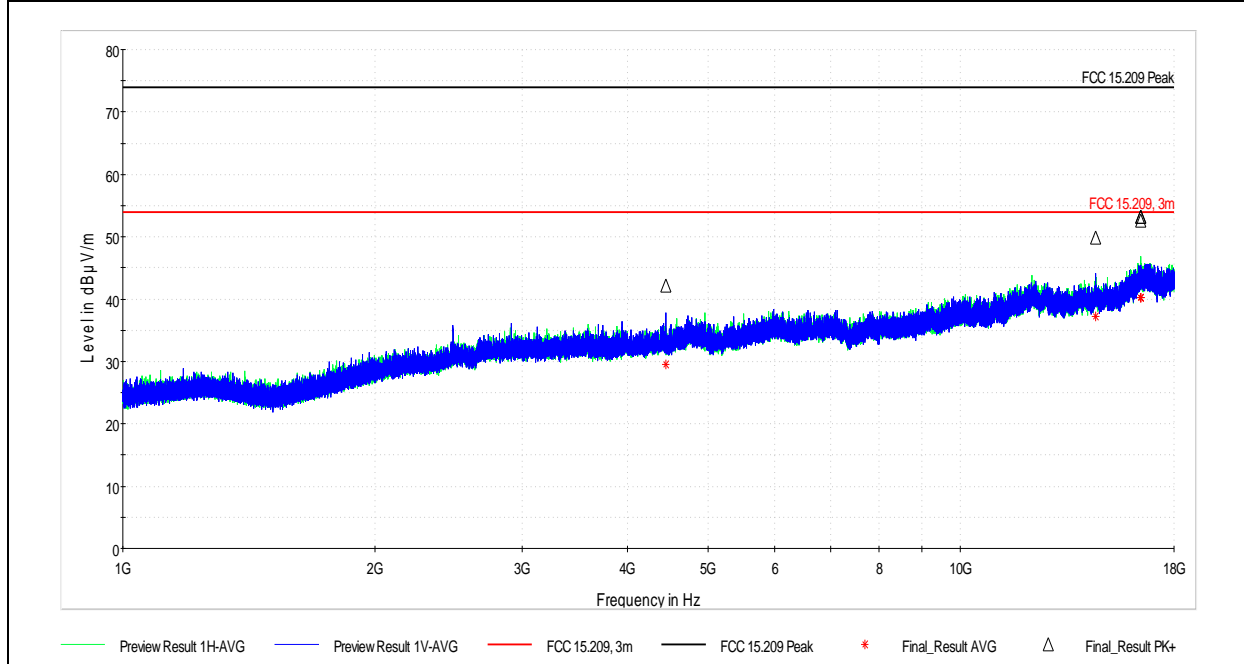
Final_Result_PK+

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4882.061500	44.99	74.00	29.01	1000.000	200.0	V	-10.0	7.4
12263.854000	49.94	74.00	24.06	1000.000	177.0	V	34.0	17.2
16786.098500	53.56	74.00	20.44	1000.000	200.0	V	50.0	21.5
16789.824500	53.50	74.00	20.50	1000.000	170.0	H	98.0	21.5
16798.380500	53.50	74.00	20.50	1000.000	189.0	H	50.0	21.5

Final_Result_AVG

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4882.061500	33.32	54.00	20.68	1000.000	200.0	V	-10.0	7.4
12263.854000	37.07	54.00	16.93	1000.000	177.0	V	34.0	17.2
16786.098500	40.64	54.00	13.36	1000.000	200.0	V	50.0	21.5
16789.824500	40.62	54.00	13.38	1000.000	170.0	H	98.0	21.5
16798.380500	40.68	54.00	13.32	1000.000	189.0	H	50.0	21.5

EDR2 Channel 79 (2480MHz) Spurious Emissions



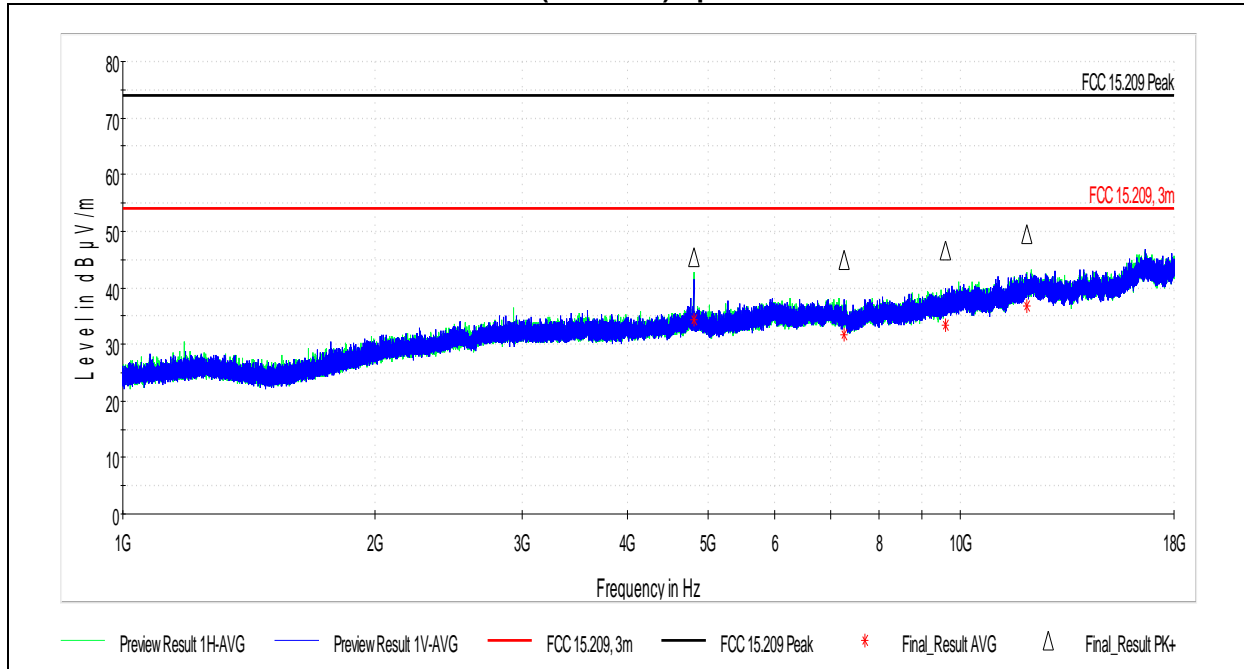
Final_Result_PK+

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4450.751500	42.16	74.00	31.84	1000.000	131.0	V	50.0	7.2
14519.940000	49.84	74.00	24.16	1000.000	136.0	H	50.0	17.4
16419.858500	53.17	74.00	20.83	1000.000	200.0	V	50.0	21.0
16421.721500	53.13	74.00	20.87	1000.000	165.0	H	50.0	21.0
16426.394000	52.55	74.00	21.45	1000.000	175.0	H	153.0	21.0

Final_Result_AVG

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4450.751500	29.53	54.00	24.47	1000.000	131.0	V	50.0	7.2
14519.940000	37.18	54.00	16.82	1000.000	136.0	H	50.0	17.4
16419.858500	40.16	54.00	13.84	1000.000	200.0	V	50.0	21.0
16421.721500	40.20	54.00	13.80	1000.000	165.0	H	50.0	21.0
16426.394000	40.20	54.00	13.80	1000.000	175.0	H	153.0	21.0

EDR3 Channel 0 (2402MHz) Spurious Emissions



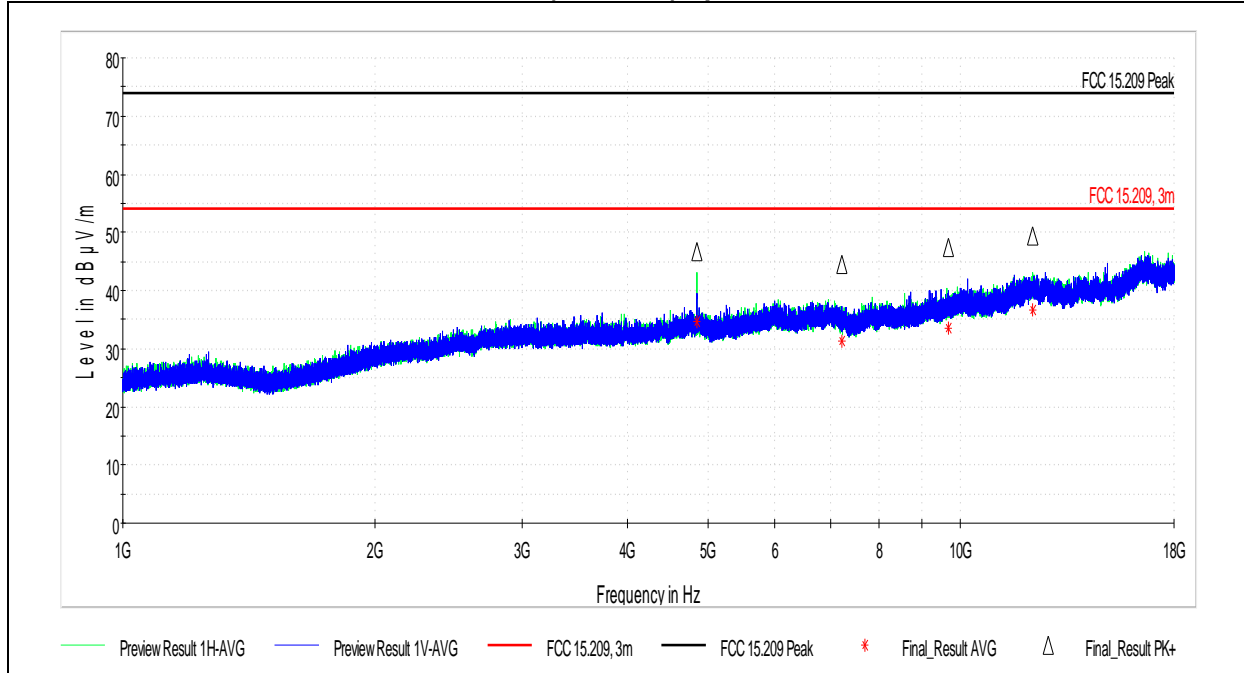
Final Result PK+

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4803.927000	45.47	74.00	28.53	1000.000	166.0	V	10.0	7.5
7268.508500	44.93	74.00	29.07	1000.000	148.0	V	50.0	10.4
9592.259500	46.61	74.00	27.39	1000.000	128.0	V	50.0	13.5
12011.301979	49.40	74.00	24.60	1000.000	165.0	H	50.0	17.4

Final Result AVG

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4803.927000	34.28	54.00	19.72	1000.000	166.0	V	10.0	7.5
7268.508500	31.73	54.00	22.27	1000.000	148.0	V	50.0	10.4
9592.259500	33.49	54.00	20.51	1000.000	128.0	V	50.0	13.5
12011.301979	36.84	54.00	17.16	1000.000	165.0	H	50.0	17.4

EDR3 Channel 39 (2440MHz) Spurious Emissions



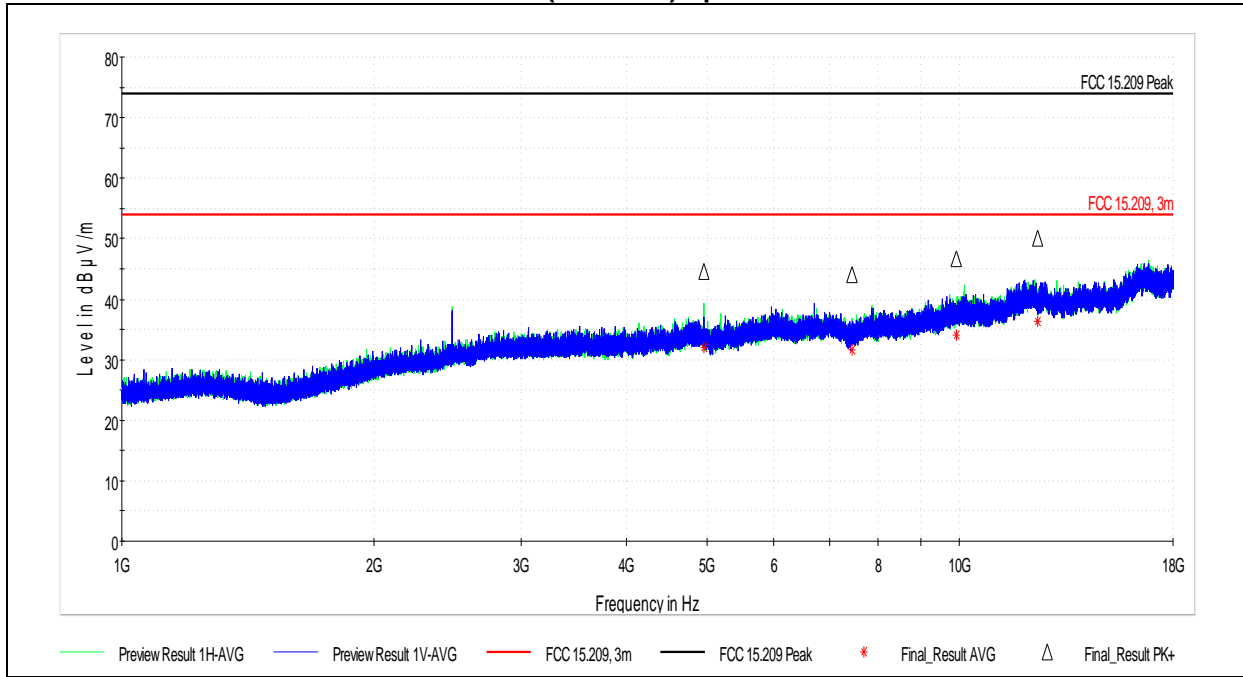
Final_Result_PK+

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4844.286500	46.79	74.00	27.21	1000.000	200.0	V	0.0	7.4
7225.932500	44.58	74.00	29.42	1000.000	159.0	V	50.0	10.4
9689.029000	47.40	74.00	26.60	1000.000	145.0	V	50.0	13.6
12210.530500	49.29	74.00	24.71	1000.000	170.0	H	27.0	17.2

Final_Result_AVG

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4844.286500	34.69	54.00	19.31	1000.000	200.0	V	0.0	7.4
7225.932500	31.39	54.00	22.61	1000.000	159.0	V	50.0	10.4
9689.029000	33.63	54.00	20.37	1000.000	145.0	V	50.0	13.6
12210.530500	36.61	54.00	17.39	1000.000	170.0	H	27.0	17.2

EDR3 Channel 79 (2480MHz) Spurious Emissions



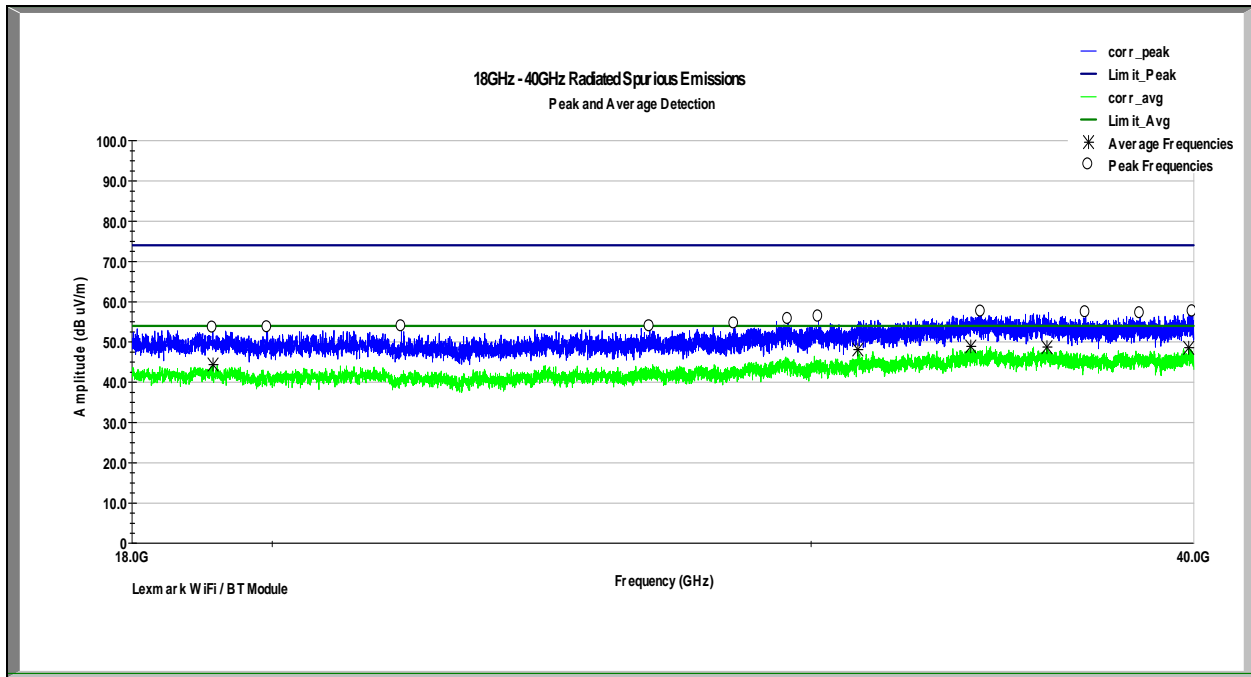
Final_Result_PK+

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4959.997000	44.57	74.00	29.43	1000.000	200.0	V	23.0	7.2
7446.099000	44.04	74.00	29.96	1000.000	145.0	H	0.0	10.9
9919.149500	46.69	74.00	27.31	1000.000	158.0	V	50.0	14.0
12402.883500	50.05	74.00	23.95	1000.000	176.0	V	50.0	16.9

Final_Result_AVG

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4959.997000	31.94	54.00	22.06	1000.000	200.0	V	23.0	7.2
7446.099000	31.66	54.00	22.34	1000.000	145.0	H	0.0	10.9
9919.149500	34.01	54.00	19.99	1000.000	158.0	V	50.0	14.0
12402.883500	36.28	54.00	17.72	1000.000	176.0	V	50.0	16.9

Bluetooth 18 – 40GHz Data
(Worst case is shown and is representative of all channels)



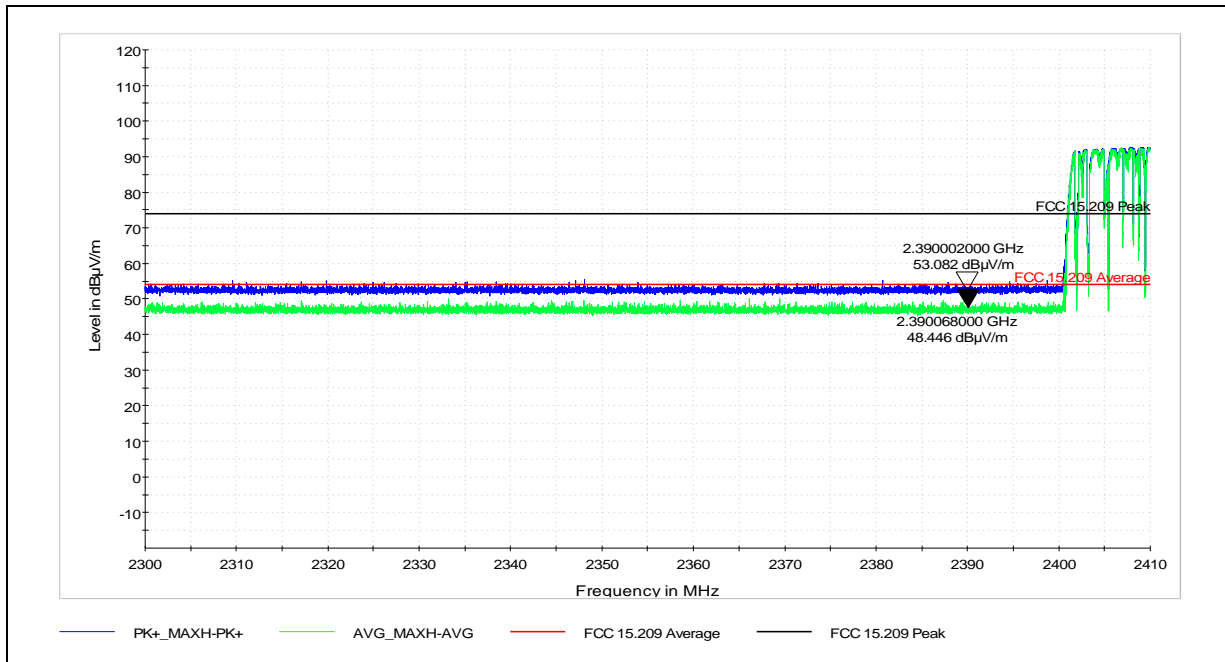
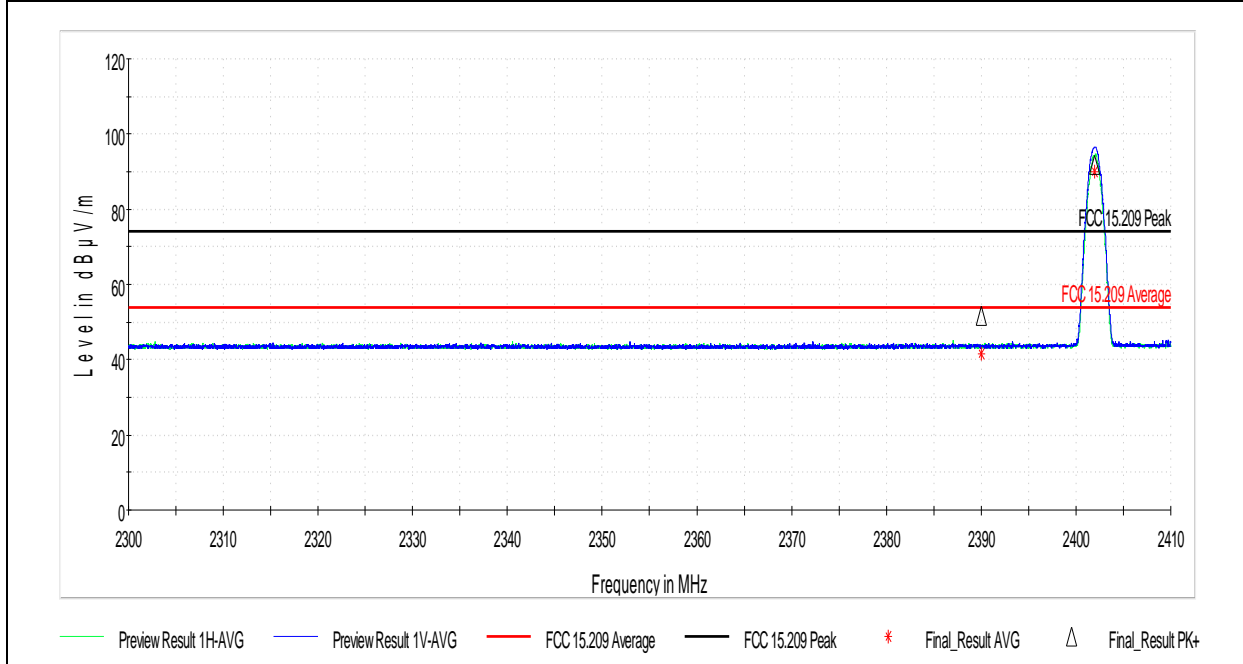
Scan_Result_PK+

Frequency (GHz)	Peak (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
19.129 GHz	53.44	74.00	20.56
19.932 GHz	53.53	74.00	20.47
22.044 GHz	53.82	74.00	20.18
26.571 GHz	53.79	74.00	20.21
28.316 GHz	54.45	74.00	19.55
29.484 GHz	55.61	74.00	18.39
30.166 GHz	56.20	74.00	17.80
34.089 GHz	57.42	74.00	16.58
36.880 GHz	57.24	74.00	16.76
38.420 GHz	57.04	74.00	16.96
39.971 GHz	57.47	74.00	16.53

Scan_Result_AVG

Frequency (GHz)	Average (dBuV/m)	Limit (dBuV/m)	Average Margin (dB)
19.131 GHz	44.40	54.00	29.60
31.070 GHz	48.09	54.00	25.91
33.825 GHz	48.89	54.00	25.11
35.820 GHz	48.71	54.00	25.29
39.853 GHz	48.55	54.00	25.45

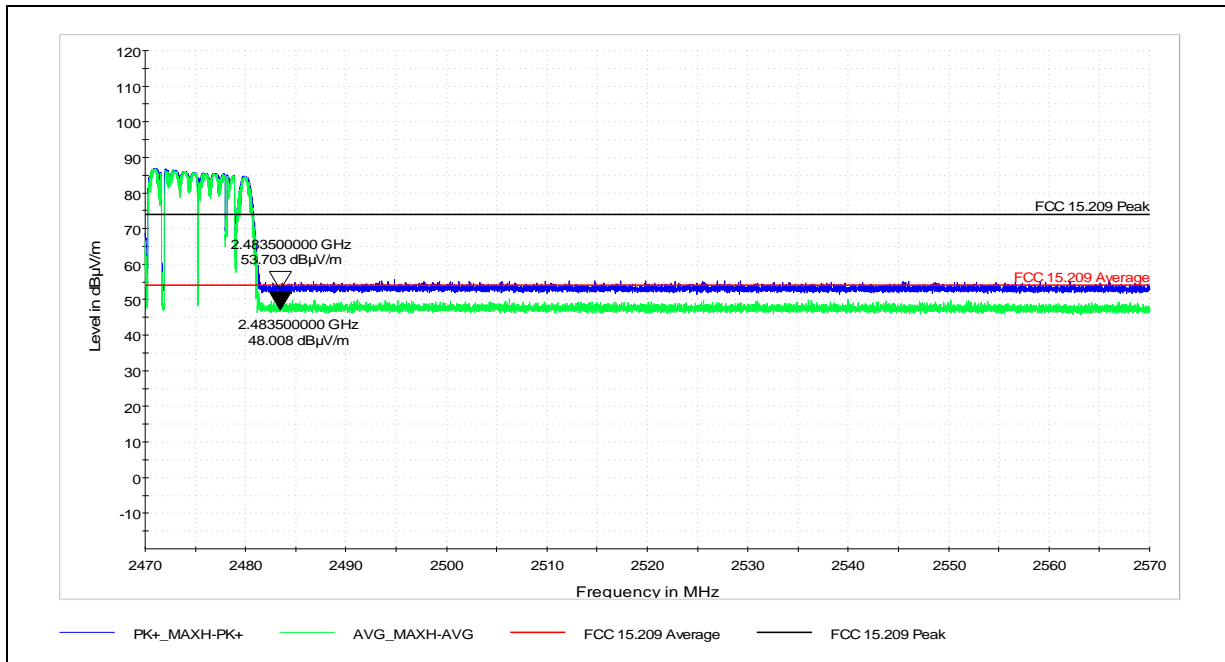
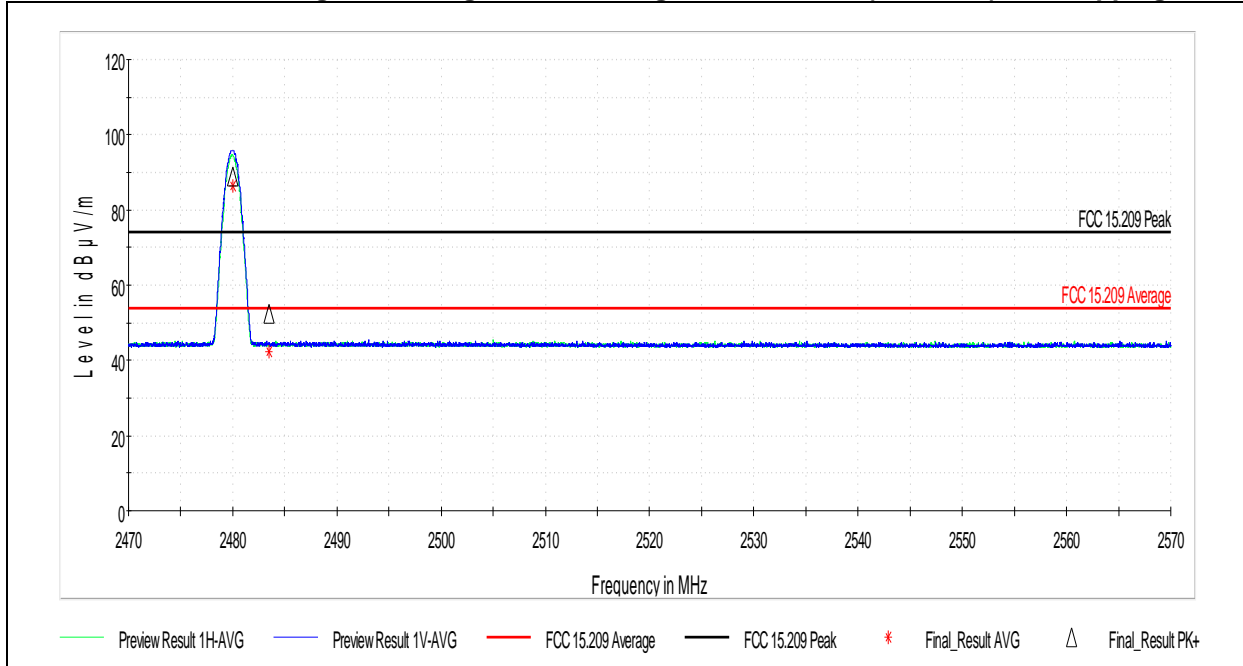
Bluetooth BDR Low Band Edge, Transmitting on Channel 0 (2402MHz) and Hopping



Final_Result

Frequency (MHz)	Average (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.000000	---	51.86	74.00	22.14	1000.000	410.0	H	210.0	37.7
2390.000000	41.65	---	54.00	12.35	1000.000	410.0	H	210.0	37.7
2401.970000	---	91.88	Fund	Fund	1000.000	100.0	V	274.0	37.8
2401.970000	90.08	---	Fund	Fund	1000.000	100.0	V	274.0	37.8

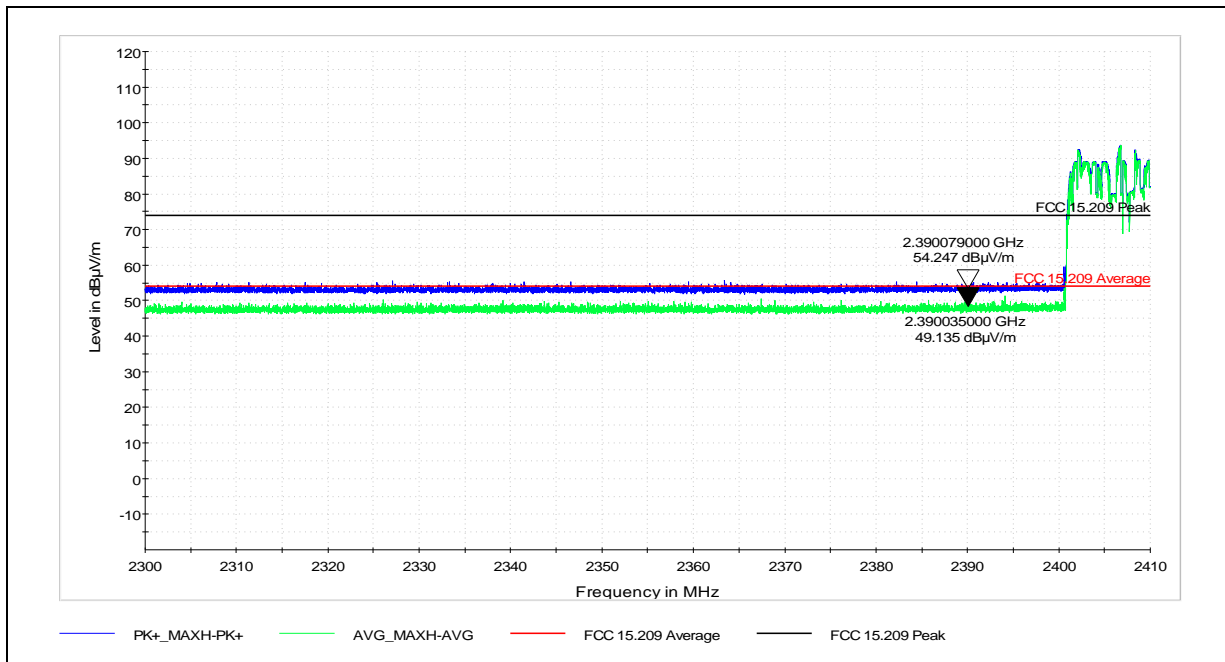
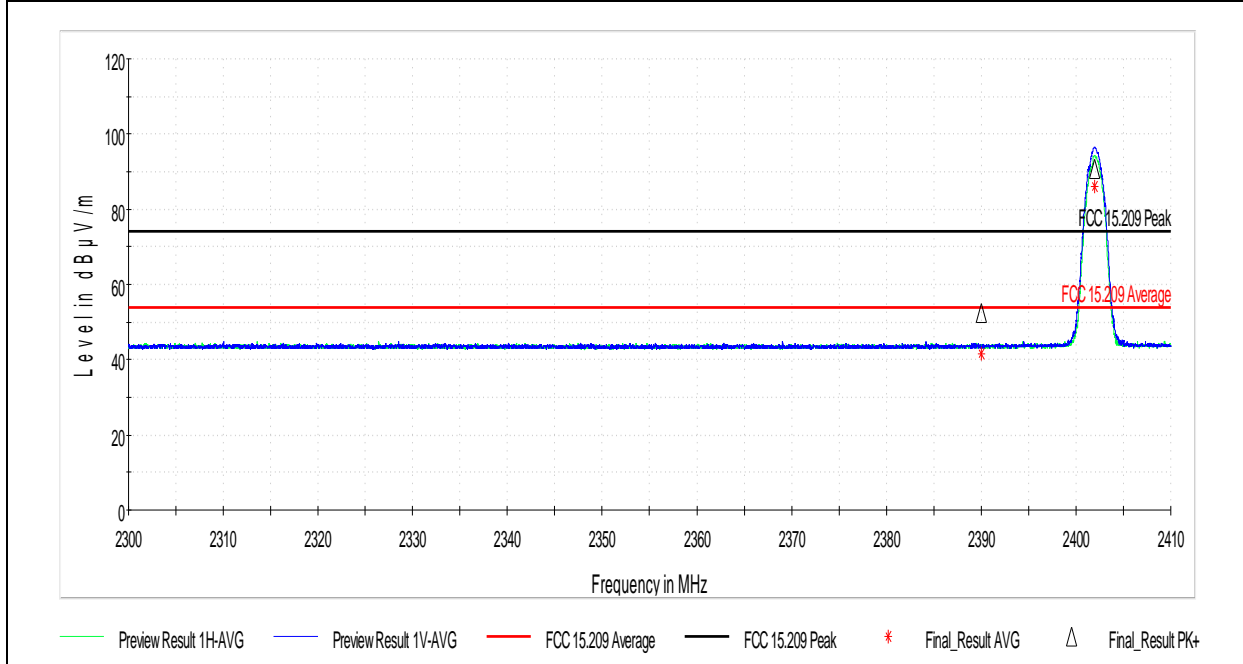
Bluetooth BDR High Band Edge, Transmitting on Channel 79 (2480MHz) and Hopping



Final_Result

Frequency (MHz)	Average (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2479.990000	---	88.81	Fund	Fund	1000.000	268.0	V	174.0	37.8
2479.990000	86.41	---	Fund	Fund	1000.000	268.0	V	174.0	37.8
2483.500000	---	52.27	74.00	21.73	1000.000	240.0	V	271.0	37.8
2483.500000	42.29	---	54.00	11.71	1000.000	240.0	V	271.0	37.8

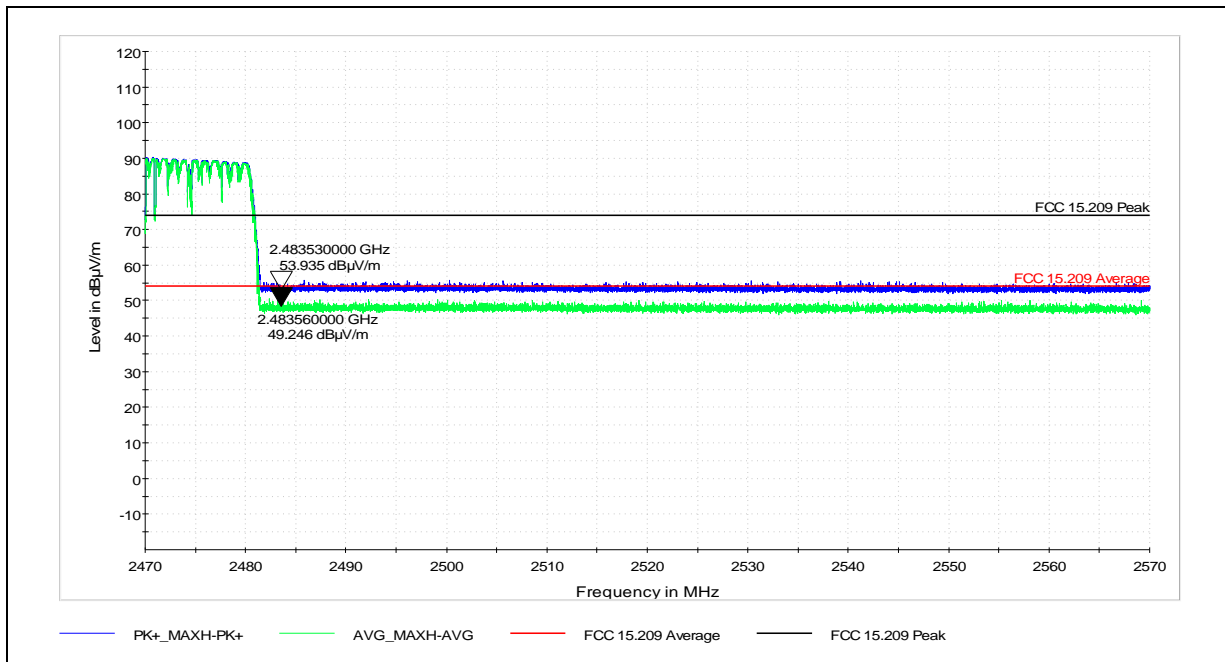
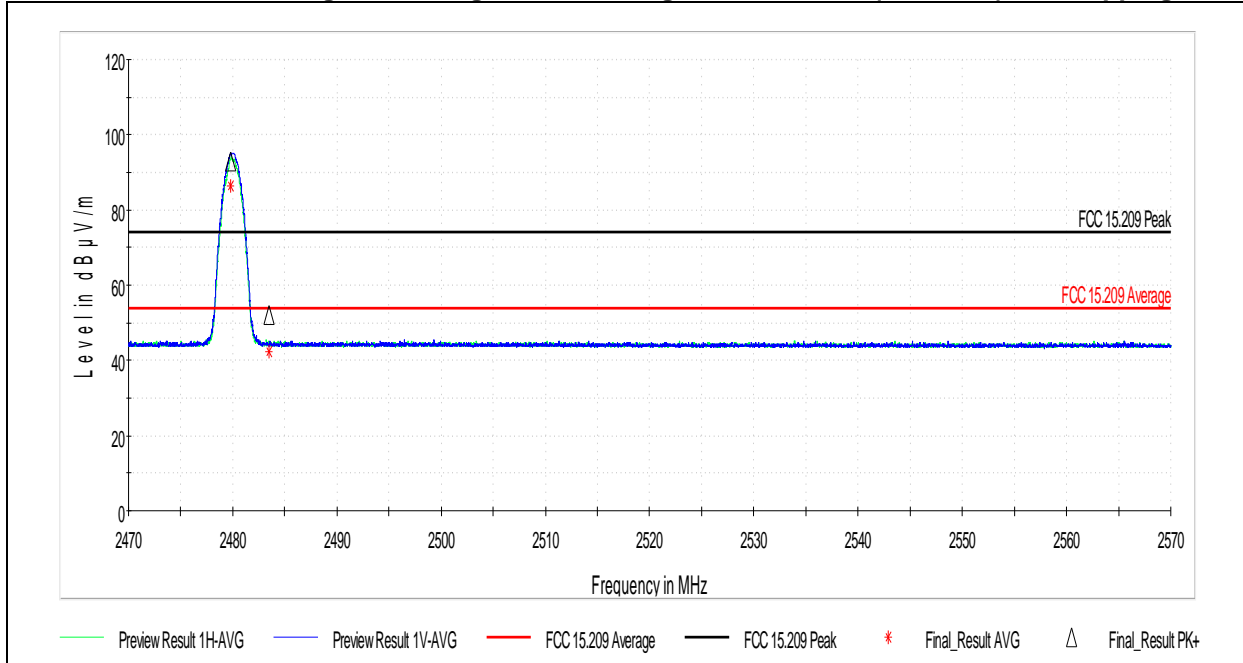
Bluetooth EDR2 Low Band Edge, Transmitting on Channel 0 (2402MHz) and Hopping



Final_Result

Frequency (MHz)	Average (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.000000	---	52.35	74.00	21.65	1000.000	331.0	H	334.0	37.7
2390.000000	41.47	---	54.00	12.53	1000.000	331.0	H	334.0	37.7
2401.981000	---	90.90	Fund	Fund	1000.000	204.0	V	172.0	37.8
2401.981000	86.01	---	Fund	Fund	1000.000	204.0	V	172.0	37.8

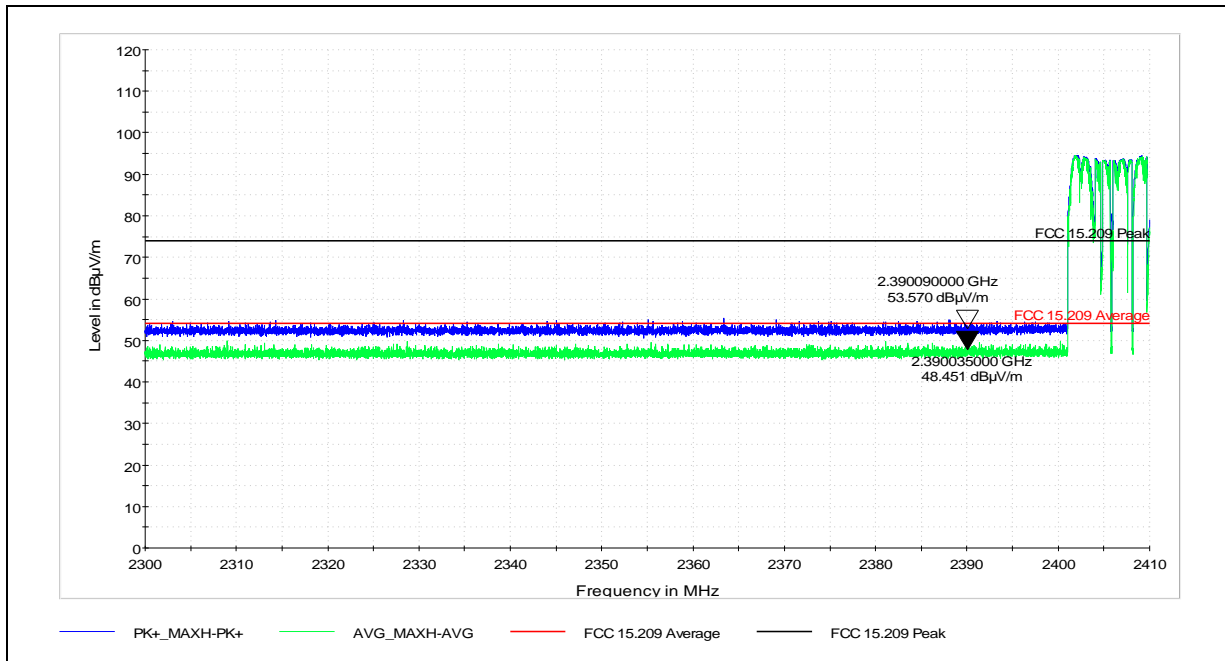
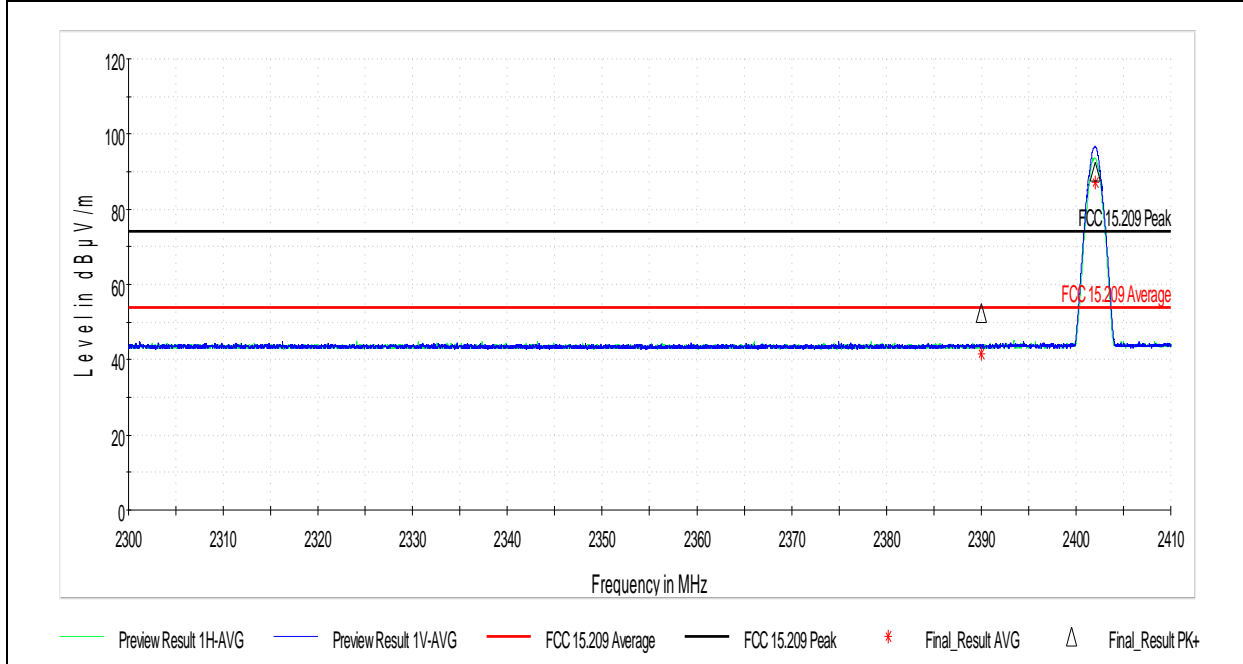
Bluetooth EDR2 High Band Edge, Transmitting on Channel 79 (2480MHz) and Hopping



Final Result

Frequency (MHz)	Average (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2479.790000	---	92.88	Fund	Fund	1000.000	269.0	V	165.0	37.8
2479.790000	86.43	---	Fund	Fund	1000.000	269.0	V	165.0	37.8
2483.500000	---	51.90	74.00	22.10	1000.000	246.0	V	143.0	37.8
2483.500000	42.28	---	54.00	11.72	1000.000	246.0	V	143.0	37.8

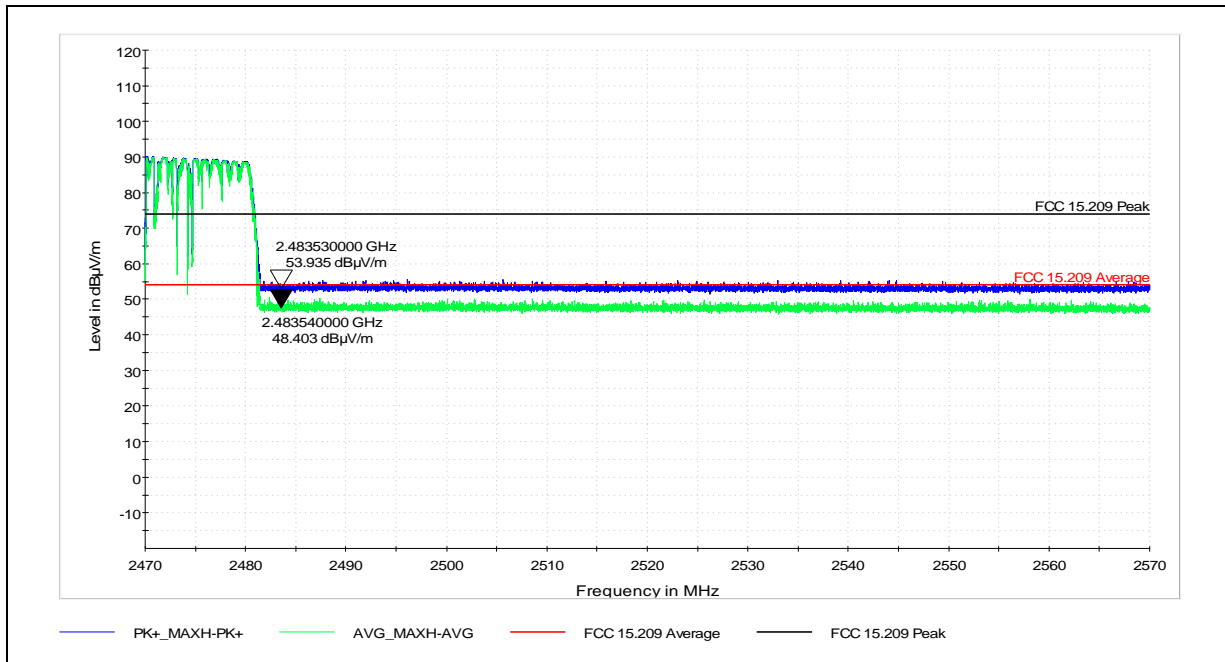
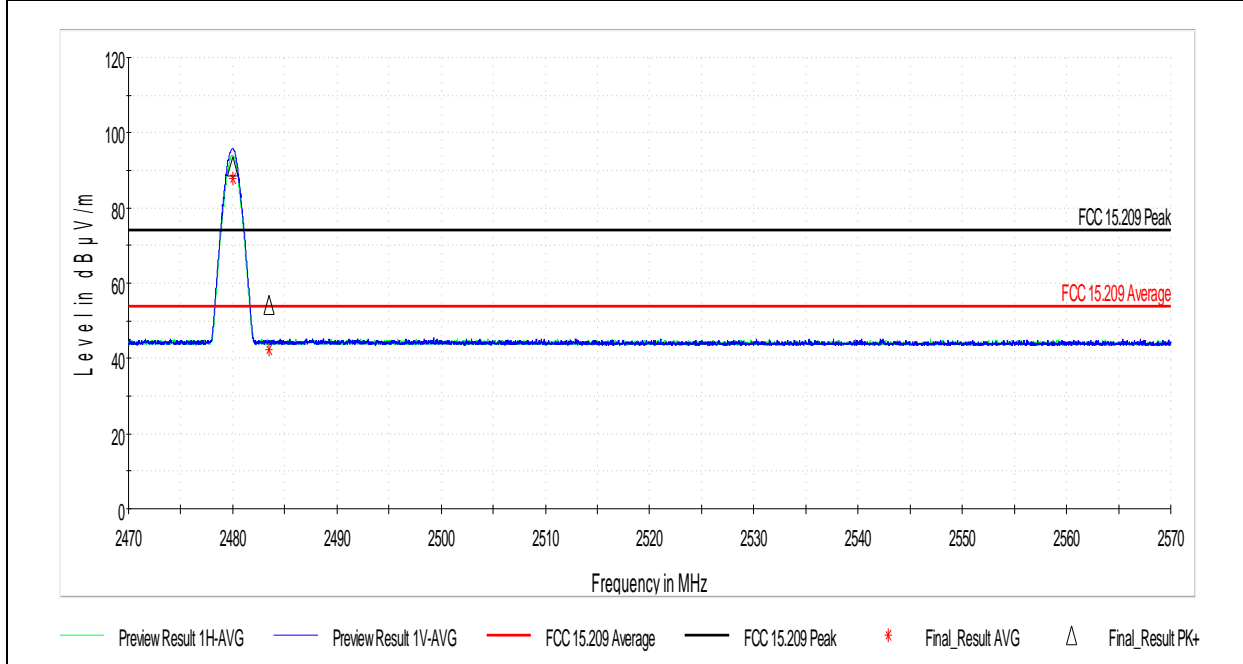
Bluetooth EDR3 Low Band Edge, Transmitting on Channel 0 (2402MHz) and Hopping



Final Result

Frequency (MHz)	Average (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.000000	---	52.24	74.00	21.76	1000.000	243.0	V	0.0	37.7
2390.000000	41.49	---	54.00	12.51	1000.000	243.0	V	0.0	37.7
2402.014000	---	89.98	Fund	Fund	1000.000	205.0	V	171.0	37.8
2402.014000	87.11	---	Fund	Fund	1000.000	205.0	V	171.0	37.8

Bluetooth EDR3 High Band Edge, Transmitting on Channel 79 (2480MHz) and Hopping



Final_Result

Frequency (MHz)	Average (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2480.020000	---	91.07	Fund	Fund	1000.000	410.0	H	341.0	37.8
2480.020000	87.84	---	Fund	Fund	1000.000	410.0	H	341.0	37.8
2483.500000	---	54.14	74.00	19.86	1000.000	215.0	V	334.0	37.8
2483.500000	42.16	---	54.00	11.84	1000.000	215.0	V	334.0	37.8

11 Radiated Spurious Emissions (Receiver)

11.1 Test Limits

§ 15.109: Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission (MHz)	Field strength (microvolts/meter)	Field strength (dBuV/m)
30–88	100	40
88–216	150	43.5
216–960	200	46
Above 960	500	54

These limits are identical to those in RSS-GEN

11.2 Test Procedure

ANSI C63.4: 2014

11.3 Example of Field Strength Calculation Method

The measured field strength was calculated by summing the readings taken from the spectrum analyzer with the appropriate correction factors associated with the antenna losses and cable losses. The calculation formula and sample calculations are listed below:

Formula:

$$FS = RA + AF + CF$$

FS = Field Strength in dB μ V/m

RA = Receiver Amplitude in dB μ V

AF = Antenna Factor in dB

CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

$$RA = 19.48 \text{ dB}\mu\text{V}$$

$$AF = 18.52 \text{ dB}$$

$$CF = 0.78 \text{ dB}$$

$$FS = 19.48 + 18.52 + 0.78 = 38.78 \text{ dB}\mu\text{V/m}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(38.78 \text{ dB}\mu\text{V/m})/20] = 86.89 \mu\text{V/m}$$

11.4 Test Equipment Used

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1302.6005.40	Rohde & Schwarz	ESU40	10/12/2017	10/12/2018
Preamplifier	122005	Rohde&Schwarz	TS-PR18	11/17/2016	11/17/2017
Biconnilog Antenna	9610-1102	ETS	3142	2/25/2016	2/25/2018
Horn Antenna	154521	ETS	3117	11/14/2016	11/14/2017
System Controller	121701-1	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
3m Cable Antenna→Preamp	3074			11/17/2016	11/17/2017
3m Cable Preamp→Chamber	2588			11/17/2016	11/17/2017
3m Cable Chamber→Control Room	2593			11/17/2016	11/17/2017
3m Cable Control Room→Receiver	2592			11/17/2016	11/17/2017
10m Cable Antenna→Preamp	3339			11/17/2016	11/17/2017
10m Cable Preamp→Chamber	3172			11/17/2016	11/17/2017
10m Cable Chamber→Control Room	2590			11/17/2016	11/17/2017
10m Cable Control Room→Receiver	2589			11/17/2016	11/17/2017

11.5 Test Results

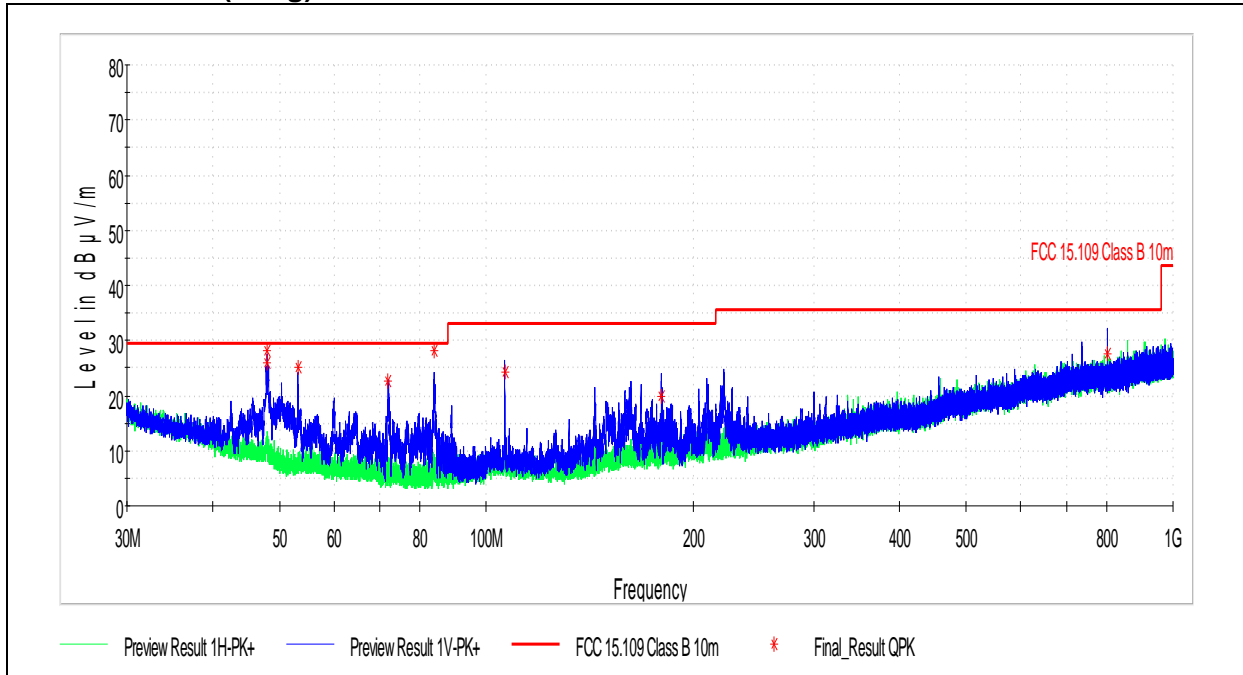
All spurious emissions with the test sample in receive mode were below the limits specified in Part 15.109 for a class B digital device and RSS-GEN Section 6.1. All peak detected emissions were at least 15dB below the limit.

11.6 Test Conditions

Test Personnel: Bryan Taylor
 Supervising/Reviewing Engineer:
 (Where Applicable) NA
 Product Standard: FCC Part 15C, RSS-247
 Input Voltage: DC Powered via USB
 Pretest Verification w/ Ambient Signals or BB Source: Yes

Test Date: 10/24/2017
 Limit Applied: Class B
 Ambient Temperature: 22.4C
 Relative Humidity: 44.9%
 Atmospheric Pressure: 995.6mbar

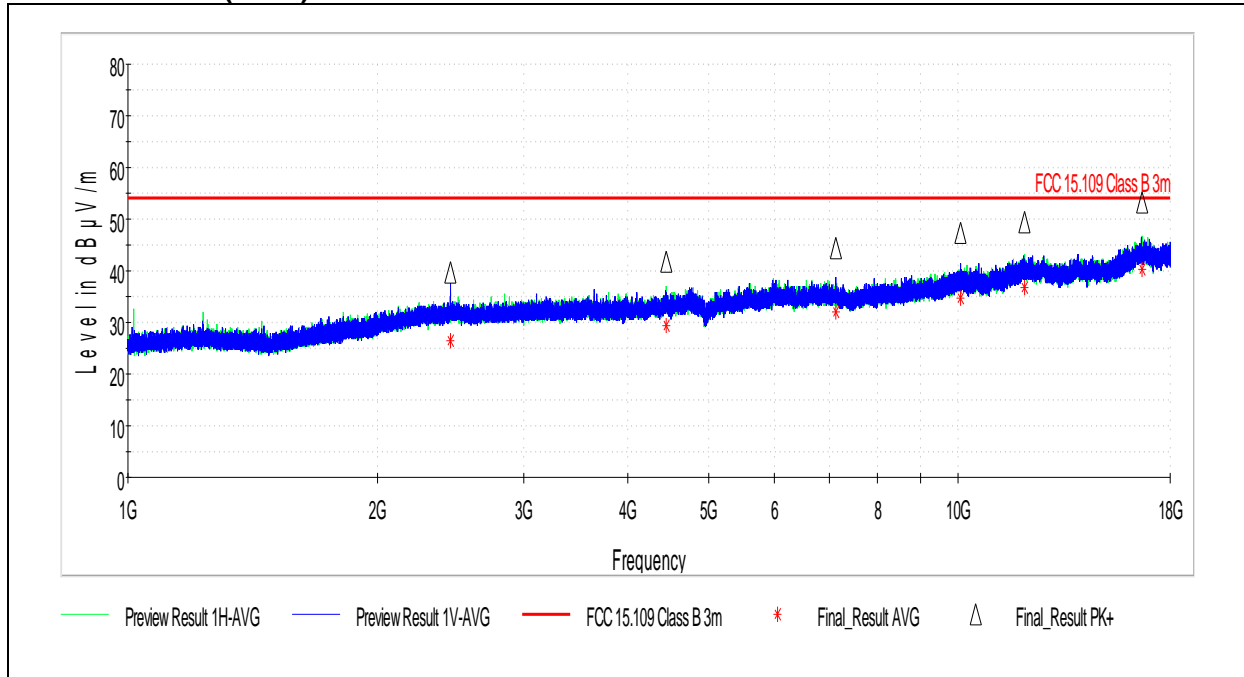
11.7 Test Data (Bilog)



Final Results

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
48.001600	28.26	29.55	1.29	120.000	343.8	V	0.0	-10.8
48.012300	26.03	29.55	3.52	120.000	337.0	V	94.0	-10.8
53.193700	25.01	29.55	4.54	120.000	100.5	V	244.0	-11.8
71.986100	22.64	29.55	6.91	120.000	181.9	V	0.0	-13.0
83.989200	28.16	29.55	1.39	120.000	139.4	V	0.0	-13.1
106.533600	24.34	33.10	8.76	120.000	99.6	V	0.0	-11.9
179.994000	19.99	33.10	13.11	120.000	104.9	V	60.0	-9.1
801.822000	27.71	35.55	7.84	120.000	110.2	V	274.0	6.5

11.8 Test Data (Horn)



Final_Result_PK+

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2447.233000	39.66	74.00	34.34	1000.000	166.0	V	50.0	3.9
4450.298000	41.86	74.00	32.14	1000.000	200.0	V	50.0	7.2
7122.561500	44.46	74.00	29.54	1000.000	177.0	V	19.0	10.2
10067.851000	47.45	74.00	26.55	1000.000	165.0	V	20.0	14.4
12028.892500	49.42	74.00	24.58	1000.000	135.0	V	50.0	17.4
16650.824000	53.21	74.00	20.79	1000.000	200.0	H	50.0	21.5

Final_Result_AVG

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2447.233000	26.48	54.00	27.52	1000.000	166.0	V	50.0	3.9
4450.298000	29.32	54.00	24.68	1000.000	200.0	V	50.0	7.2
7122.561500	32.02	54.00	21.98	1000.000	177.0	V	19.0	10.2
10067.851000	34.56	54.00	19.44	1000.000	165.0	V	20.0	14.4
12028.892500	36.89	54.00	17.11	1000.000	135.0	V	50.0	17.4
16650.824000	40.36	54.00	13.64	1000.000	200.0	H	50.0	21.5

12 Antenna Requirement per FCC Part 15.203

12.1 Test Limits

§ 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, or §15.221. 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.

12.2 Test Results

The sample tested met the antenna requirement. The antenna used was internal to the sample and permanently attached to the PCB.

12.3 Test Conditions

Test Personnel: Brian Lackey
Supervising/Reviewing
Engineer:
(Where Applicable) NA
Input Voltage: USB

Test Date: 10/27/2017
Ambient Temperature: 22.6C
Relative Humidity: 41.1%
Atmospheric Pressure: 990.8mbar

13 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements.

The measurement uncertainty figures were calculated and correspond to a coverage factor of $k = 2$, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Measurement uncertainty Table

Parameter	Uncertainty	Notes
Radiated emissions, 30 to 1000 MHz	+3.9dB	
Radiated emissions, 1 to 18 GHz	+4.2dB	
Radiated emissions, 18 to 40 GHz	+4.3dB	
Power Port Conducted emissions, 150kHz to 30 MHz	±2.8dB	

14 Revision History

Revision Level	Date	Report Number	Notes
0	12/18/2017	103264009LEX-004b	Original Issue