

TEST REPORT

Report Number: 102886547LEX-001

Project Number: G102886547

Report Issue Date: 3/9/2017

Product Name: XT6372R

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

Radios Under Test: Bluetooth

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

Client:
Xirgo Technologies
188 Camino Ruiz
Camarillo, CA 93012-6700

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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
10	20dB Bandwidth	§ 15.247(a)(1)	RSS-247 5.1(a)	Pass
14	Channel Separation	§ 15.247(a)(1)	RSS-247 5.1(b)	Pass
17	Number of Hopping Channels	§ 15.247(a)(1)(iii)	RSS-247 5.1(e)	Pass
19	Time of Occupancy	§ 15.247(a)(1)(iii)	RSS-247 5.1(c)	Pass
23	Conducted Spurious Emissions	§ 15.247(d)	RSS-247 5.5	Pass
27	Radiated Spurious Emissions (Transmitter)	§ 15.247(d), § 15.209, and § 15.205	RSS-247 5.5	Pass
37	AC Powerline Conducted Emissions	§ 15.107, § 15.207	RSS-Gen (7.2.4)	Pass
40	Antenna Requirement per FCC Part 15.203	§ 15.203	RSS-Gen (7.1.2)	Pass

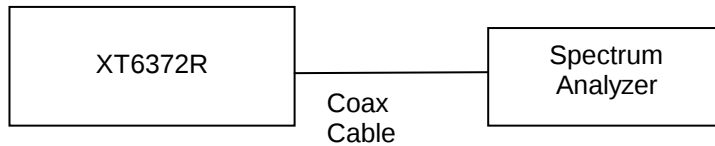
3 Description of Equipment Under Test

Equipment Under Test	
Manufacturer	Xirgo Technologies
Model Number	XT6372R
Serial Number	1
Receive Date	2/21/2017
Test Start Date	2/21/2017
Test End Date	2/31/2017
Device Received Condition	Good
Test Sample Type	Production
Frequency Band	2402 – 2480MHz
Mode(s) of Operation	Bluetooth
Modulation Type	FHSS
Transmission Control	Test Commands
Maximum Output Power	10.643dBm
Test Channels	0, 19, 39
Antenna Type (15.203)	Internal
Operating Voltage	12VDC

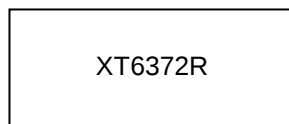
Description of Equipment Under Test
The XT6372R is a vehicle GPS/Cellular tracking device with Bluetooth.

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Transmitting BT Signal on low mid or high channels
2	Receive / idle mode

3.1 System setup including cable interconnection details, support equipment and simplified block diagram**3.2 EUT Block Diagram:**

Conducted Output Measurements



Radiated Measurements

3.3 Cables:

Cables					
Description	Length	Shielding	Ferrites	Connection	
				From	To
DC Power Cable	3ft	None	None	DC Power Supply	Test Sample

3.4 Support Equipment:

No support equipment was used during this evaluation.

4 Peak Output Power

4.1 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.

4.2 Test Procedure

ANSI C63.10: 2013 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. The peak output power was measured using the marker to peak function of the spectrum analyzer.

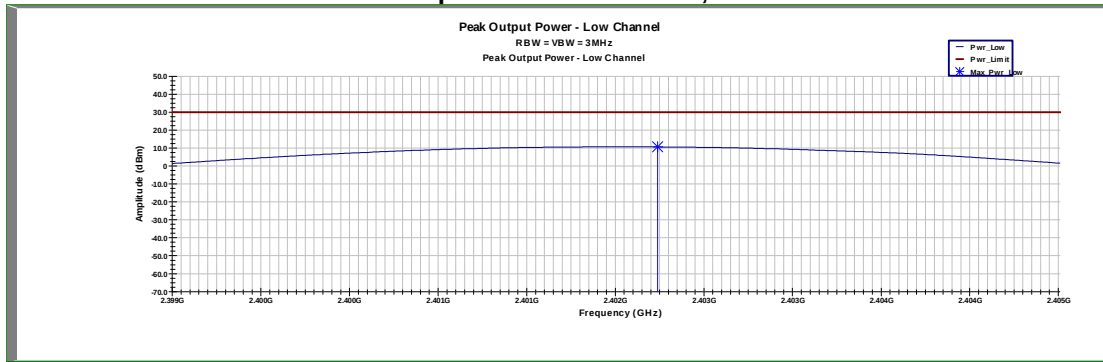
4.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde&Schwarz	ESI26	9/20/2016	9/20/2017
COND3	6026			11/17/2016	11/17/2017

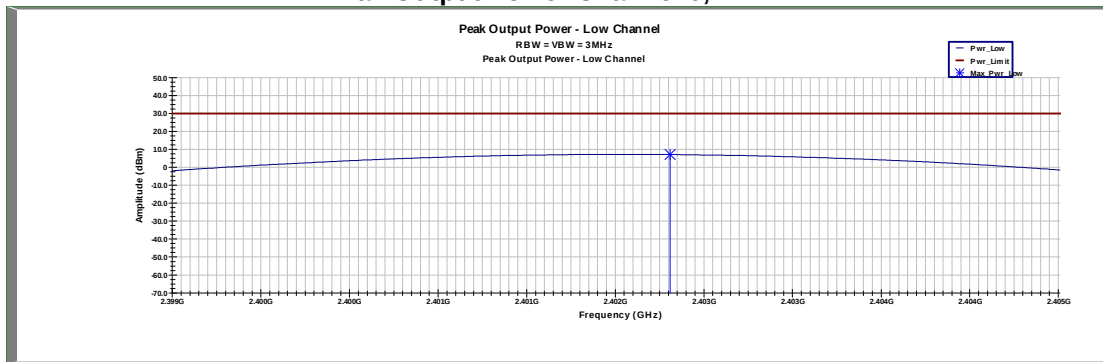
4.4 Results:

Modulation	Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
GFSK	0	2402	10.643	30	Compliant
	39	2441	10.511	30	Compliant
	78	2480	10.535	30	Compliant
EDR2	0	2402	7.096	30	Compliant
	39	2441	6.861	30	Compliant
	78	2480	6.878	30	Compliant
EDR3	0	2402	7.468	30	Compliant
	39	2441	7.343	30	Compliant
	78	2480	7.413	30	Compliant

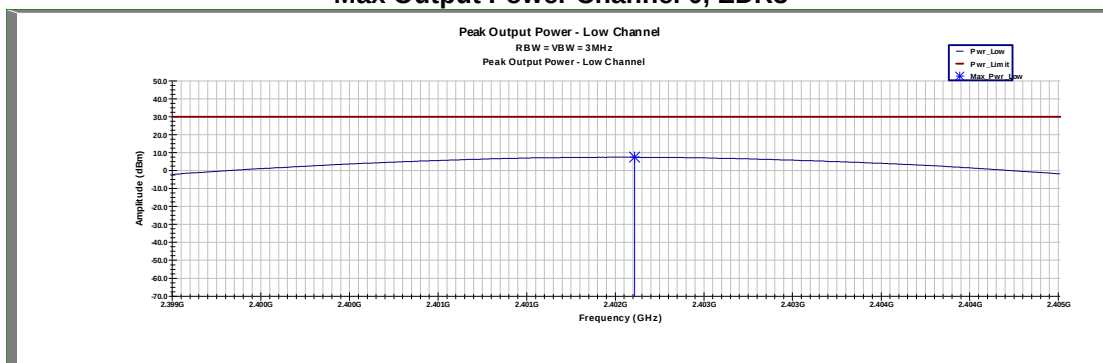
Max Output Power Channel 0, GFSK



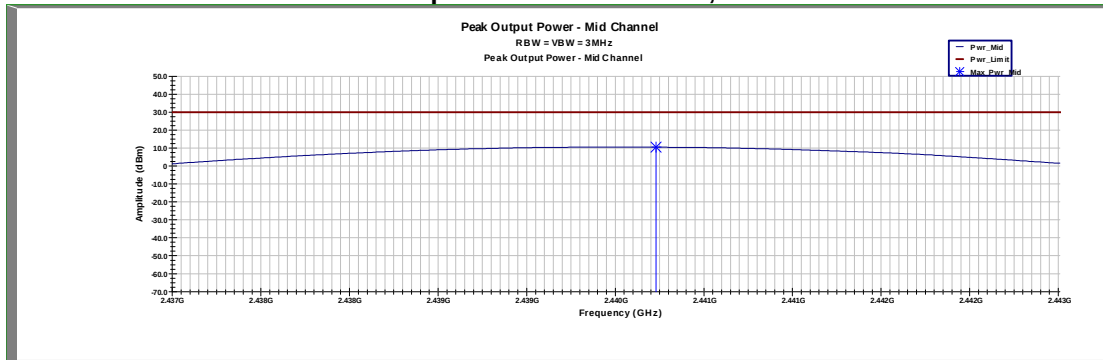
Max Output Power Channel 0, EDR2



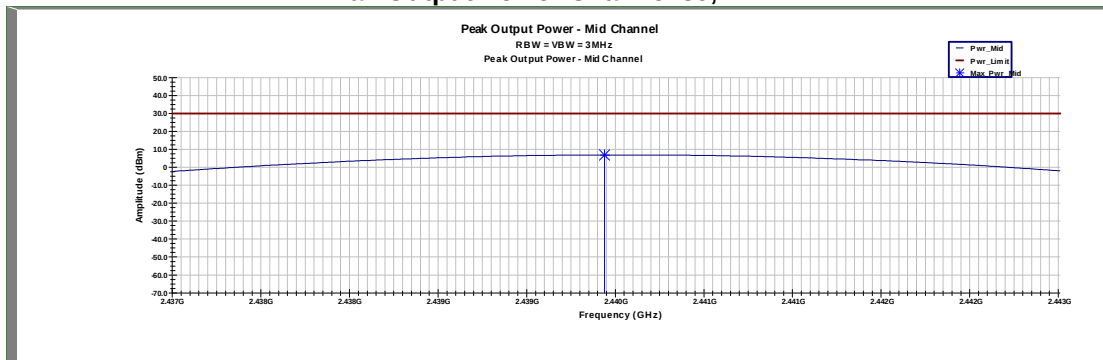
Max Output Power Channel 0, EDR3



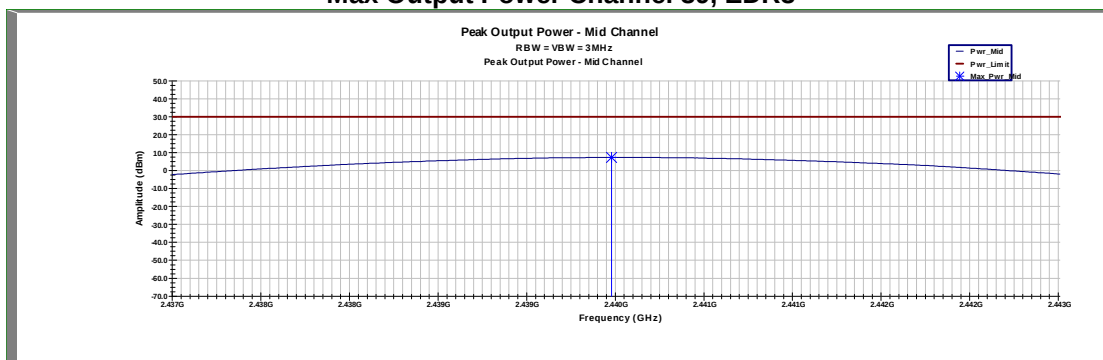
Max Output Power Channel 39, GFSK



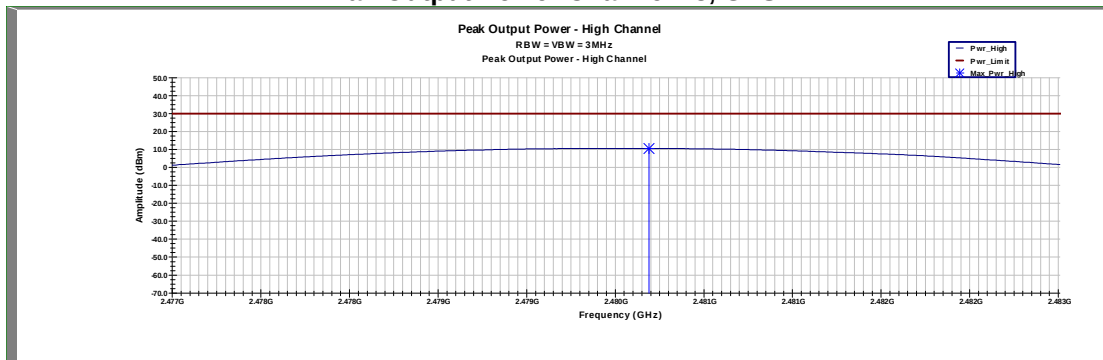
Max Output Power Channel 39, EDR2



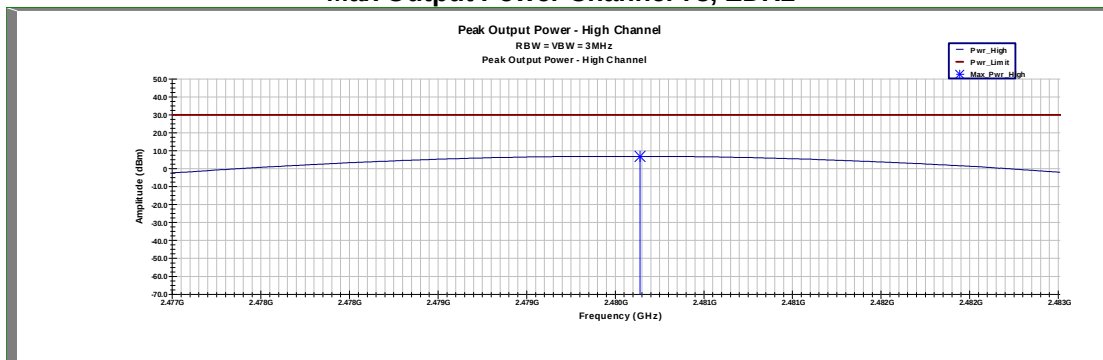
Max Output Power Channel 39, EDR3



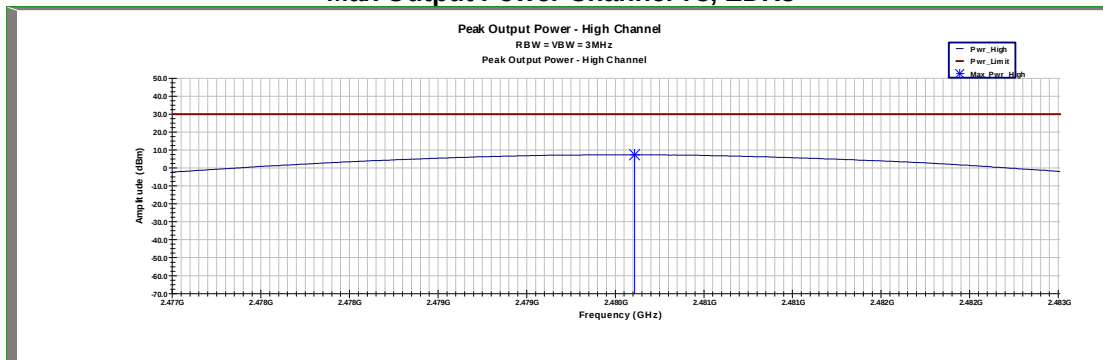
Max Output Power Channel 78, GFSK



Max Output Power Channel 78, EDR2



Max Output Power Channel 78, EDR3



5 20dB Bandwidth

5.1 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.

5.2 Test Procedure

ANSI C63.10: 2013 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

5.3 Test Equipment Used:

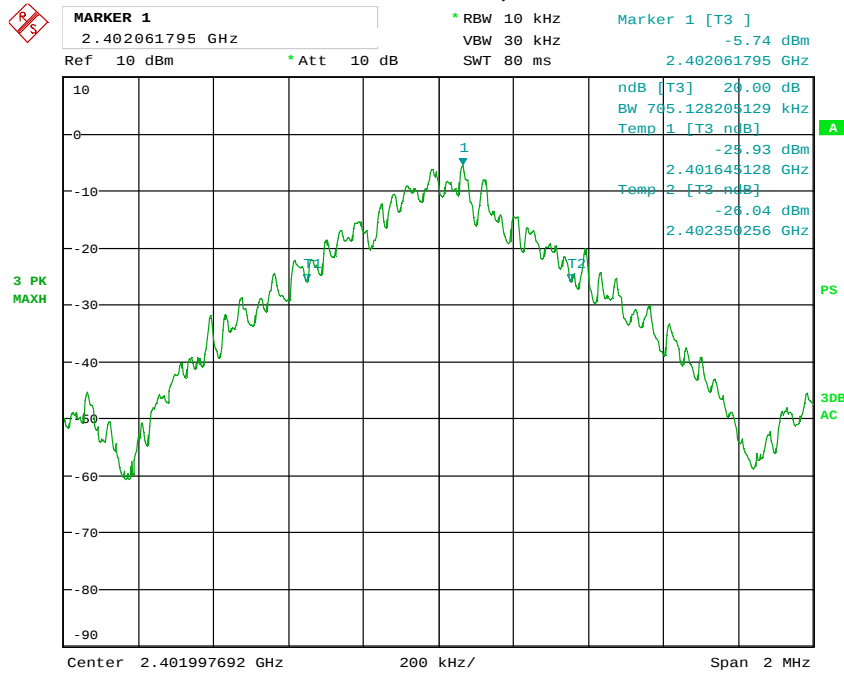
Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1302.6005.40	Rohde&Schwarz	ESU40	9/26/2016	9/26/2017
COND3	6026			11/17/2016	11/17/2017

5.4 Results:

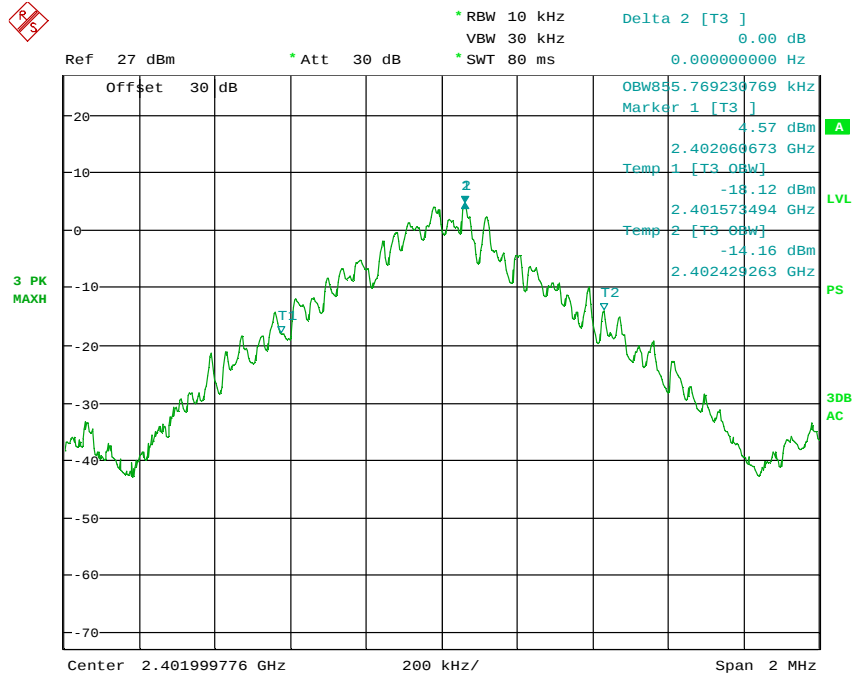
The 20dB bandwidth measurements are shown below. A 99% bandwidth measurement was also performed.

Channel	Frequency (MHz)	20dB Bandwidth	99% Power Bandwidth	Result
GFSK	2402	705.1 kHz	855.8 kHz	Pass
EDR2	2402	1.401 MHz	1.244 MHz	Pass
EDR3	2402	1.355 MHz	1.237 MHz	Pass

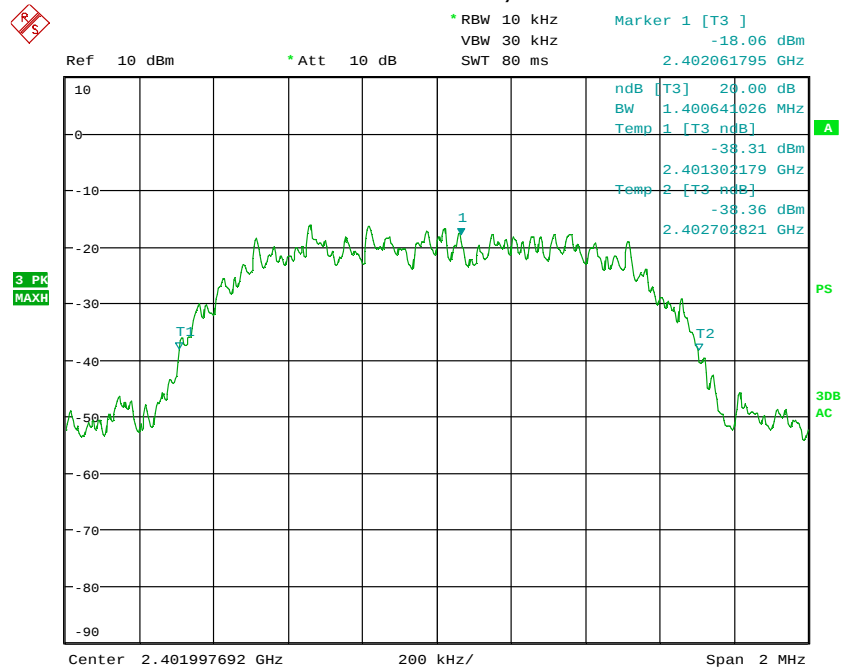
20dB Bandwidth, GFSK



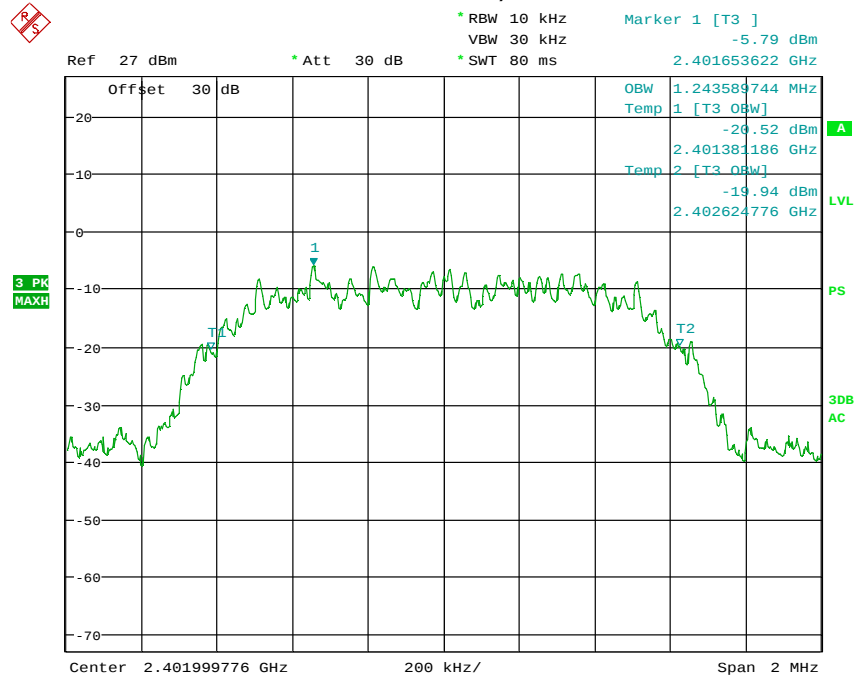
99% Bandwidth, GFSK



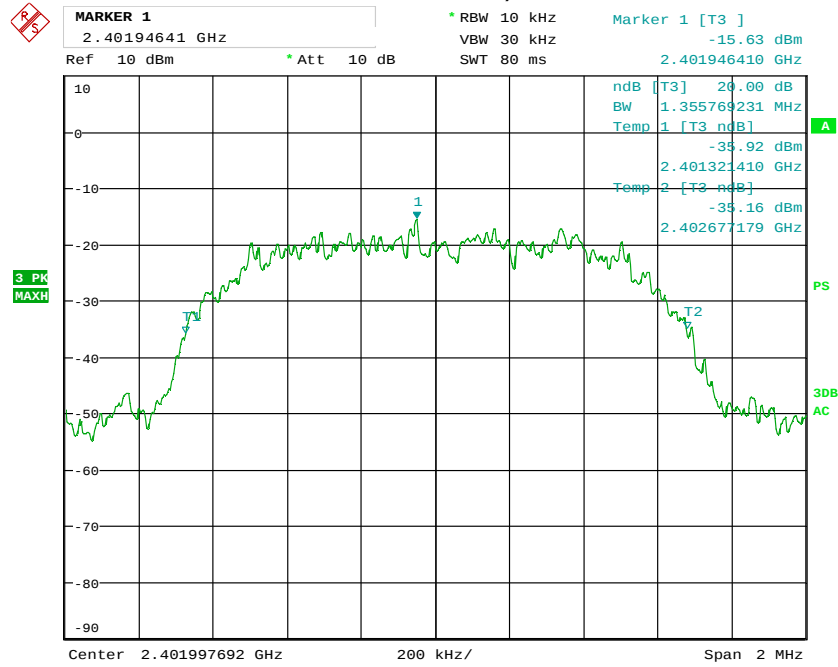
20dB Bandwidth, EDR2



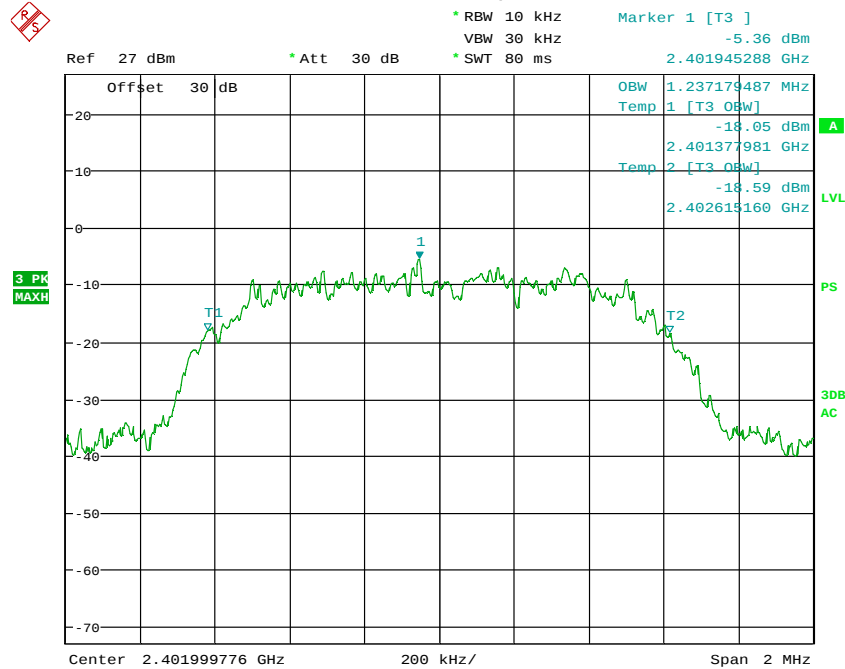
99% Bandwidth, EDR2



20dB Bandwidth, EDR3



99% Bandwidth, EDR3



6 Channel Separation

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 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

6.3 Test Equipment Used:

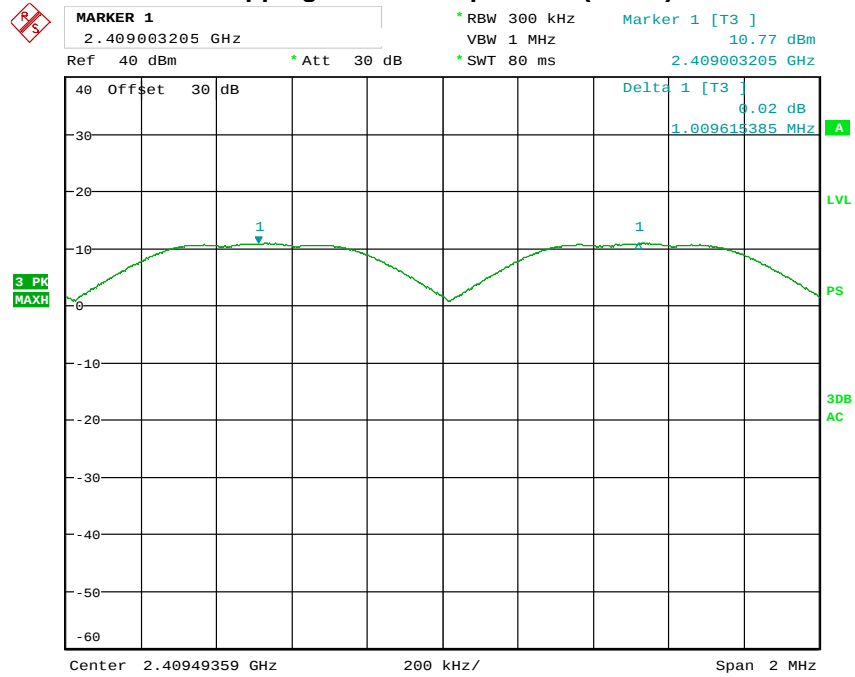
Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1302.6005.40	Rohde&Schwarz	ESU40	9/26/2016	9/26/2017
COND3	6026			11/17/2016	11/17/2017

6.4 Results:

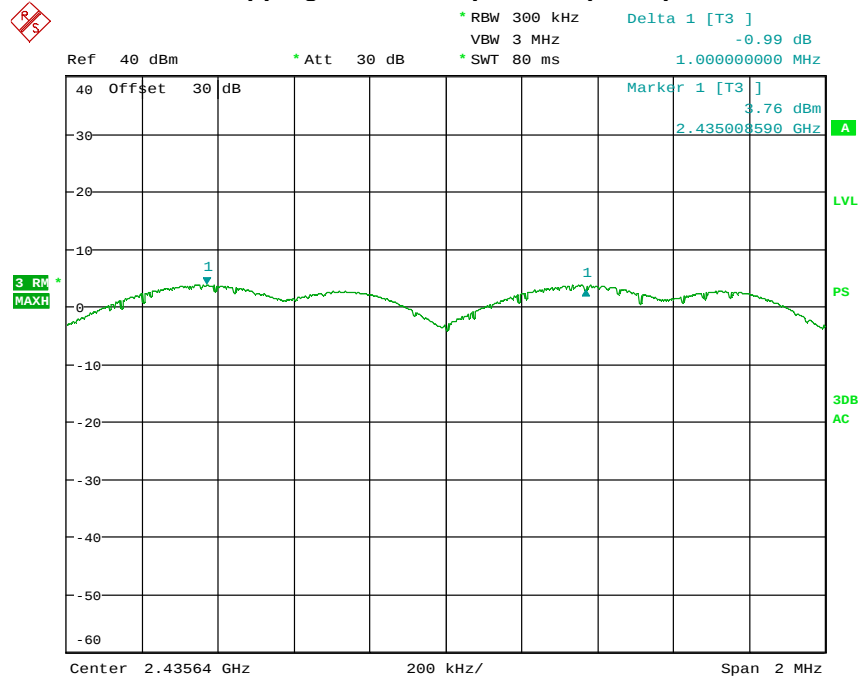
TX Mode	Adjacent Channel Separation (kHz)	Minimum Limit (kHz)*	Pass / Fail
EDR2	1000	25	Pass
EDR3	1000	25	Pass
GFSK	1000	25	Pass

*Limit is derived from 2/3 of the the 20dB bandwidth

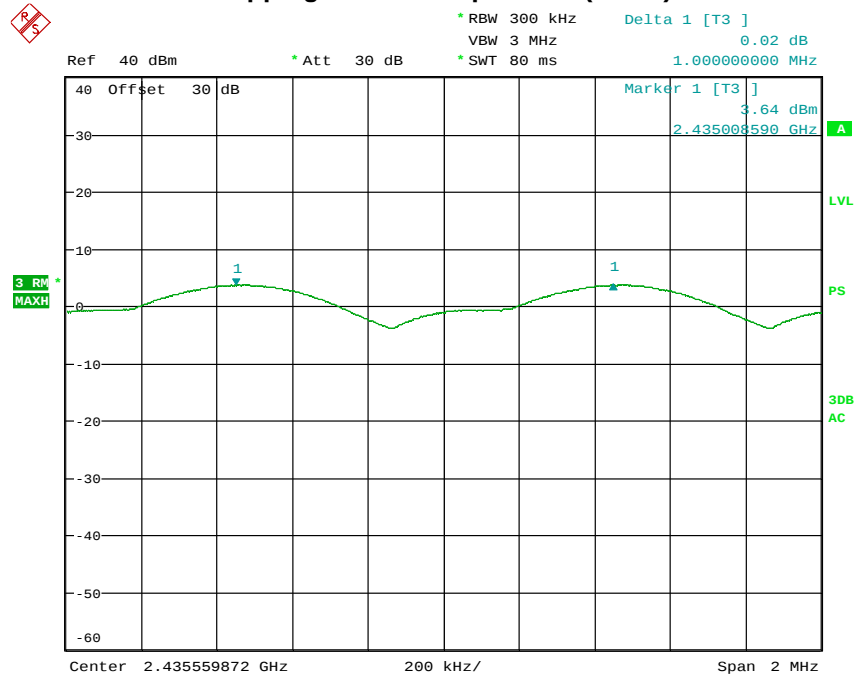
Hopping Channel Separation (GFSK)



Hopping Channel Separation (EDR2)



Hopping Channel Separation (EDR3)



7 Number of Hopping Channels

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

7.2 Test Procedure

ANSI C63.10: 2013 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

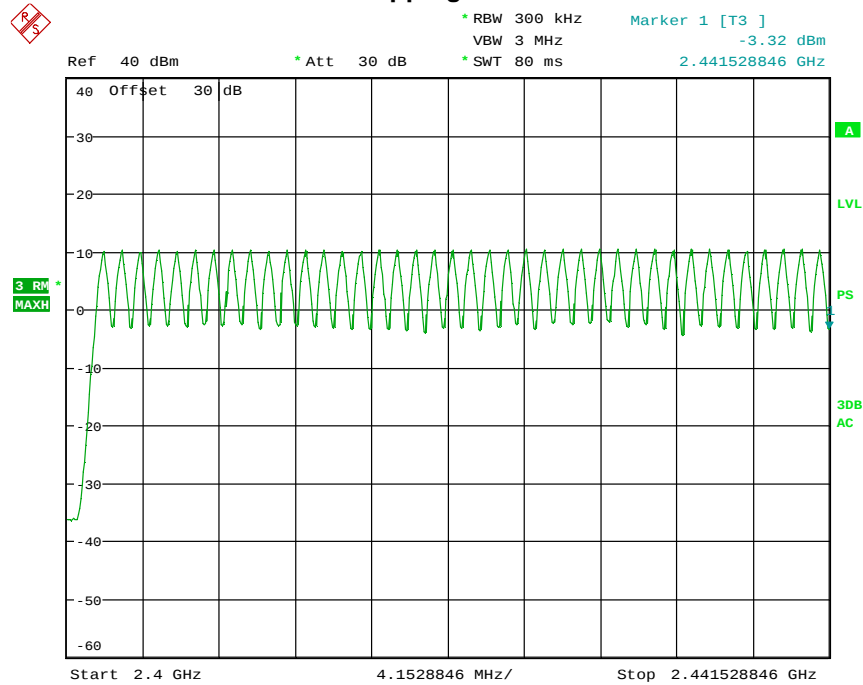
7.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1302.6005.40	Rohde&Schwarz	ESU40	9/26/2016	9/26/2017
COND3	6026			11/17/2016	11/17/2017

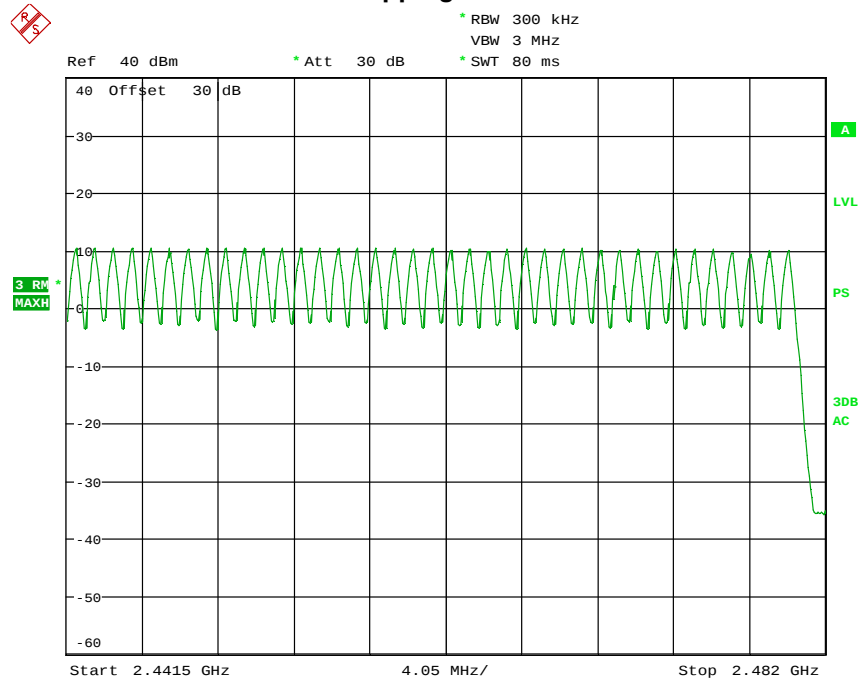
7.4 Results:

The XT6372R used 79 hopping channels as shown in the following plots. The number of hopping channels used was identical for GFSK, EDR2, and EDR3 modes.

Number of Hopping Channels 0 – 39



Number of Hopping Channels 40 – 78



8 Time of Occupancy

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. 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

8.2 Test Procedure

ANSI C63.10: 2013 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

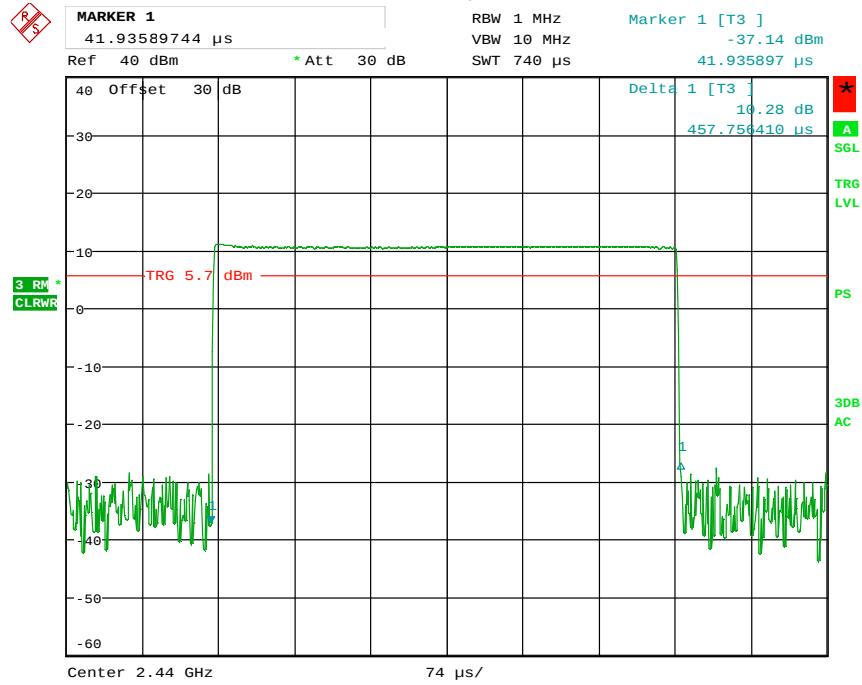
8.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1302.6005.40	Rohde&Schwarz	ESU40	9/26/2016	9/26/2017

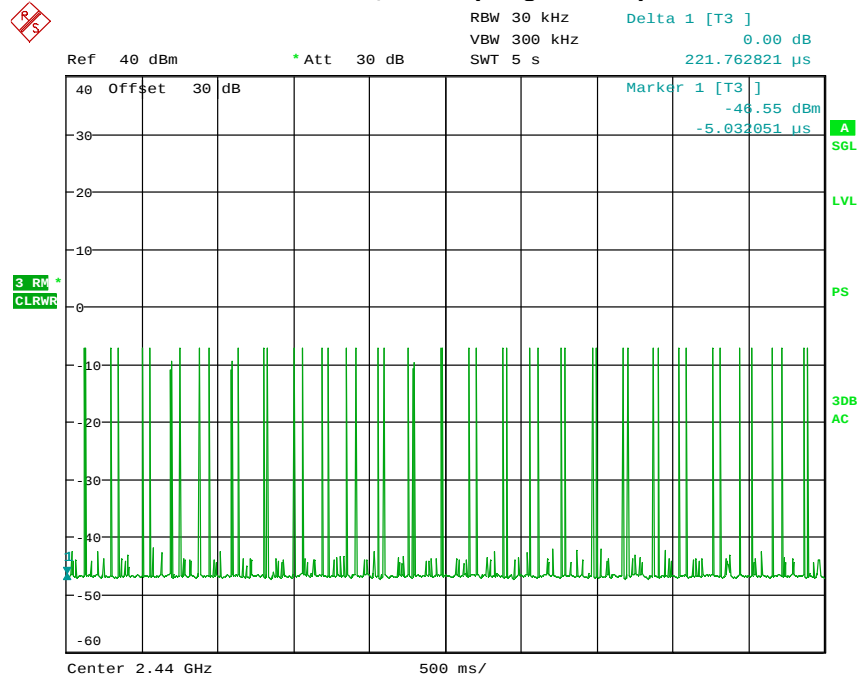
8.4 Results:

Mode	Number of Transmissions in a 31.6sec Frame (79 Hopping Ch x 0.4)	Hop Transmission Time (mS)	Result (mS)	Limit (mS)
GFSK	47 (times in 5sec) * (31.6sec / 5sec) = 297	0.458mS	135.9mS	400
EDR2	50 (times in 5sec) * (31.6sec / 5sec) = 316	0.259mS	81.8mS	400
EDR3	49 (times in 5sec) * (31.6sec / 5sec) = 310	0.222mS	68.2mS	400
Time of occupancy = Hop Transmission Time x Number of Transmissions				

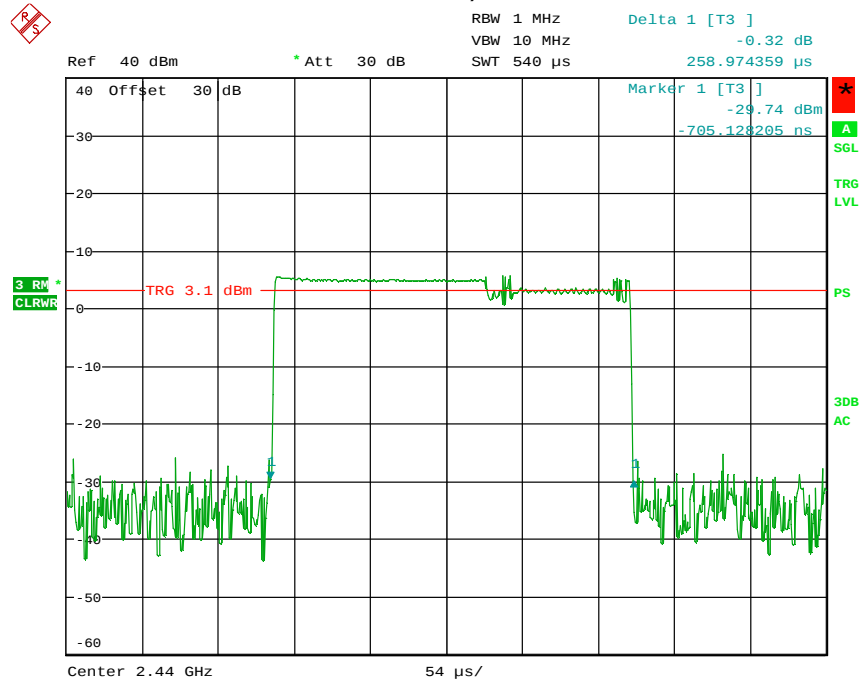
Dwell Time, GFSK



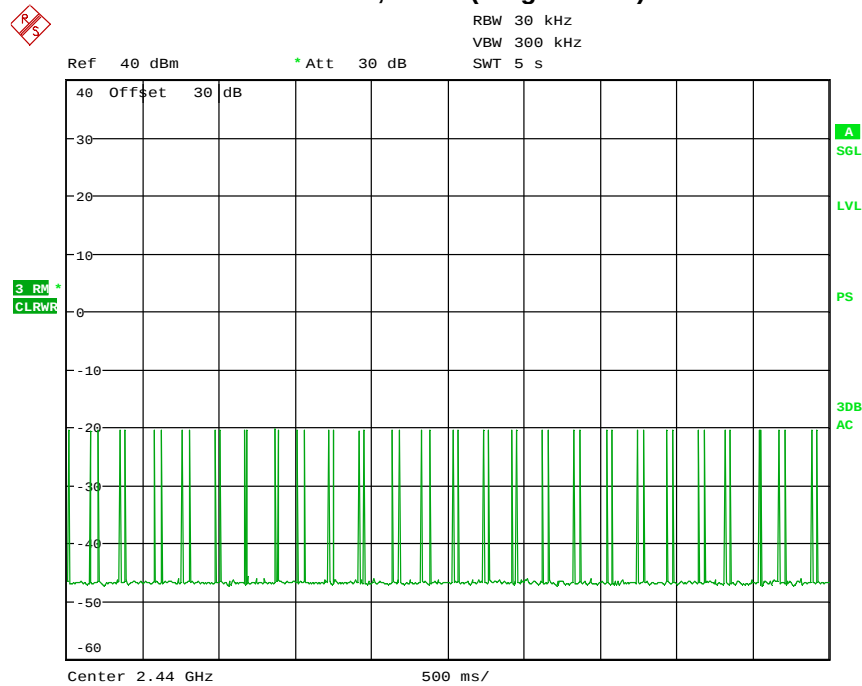
Dwell Time, GFSK (Single Pulse)



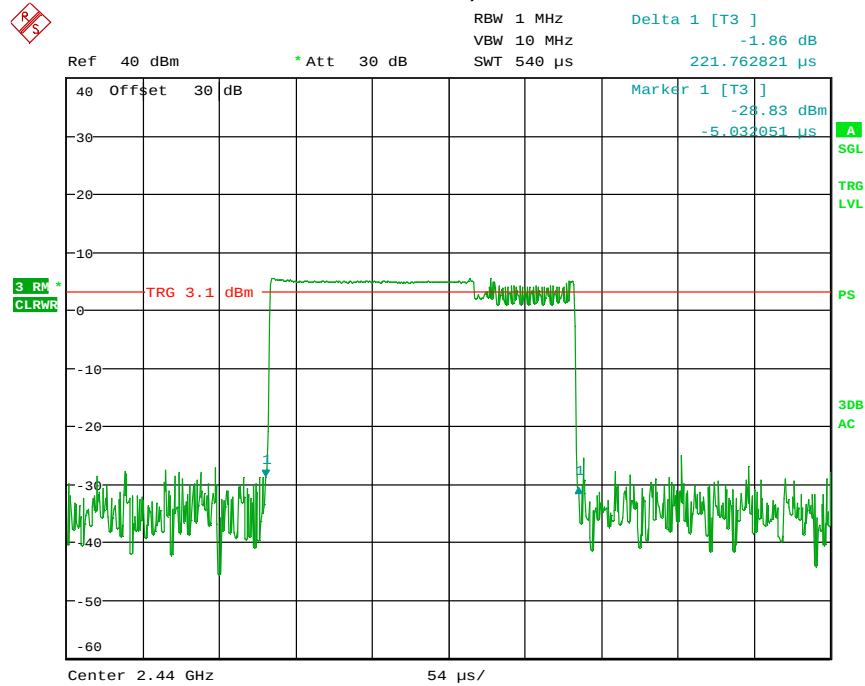
Dwell Time, EDR2



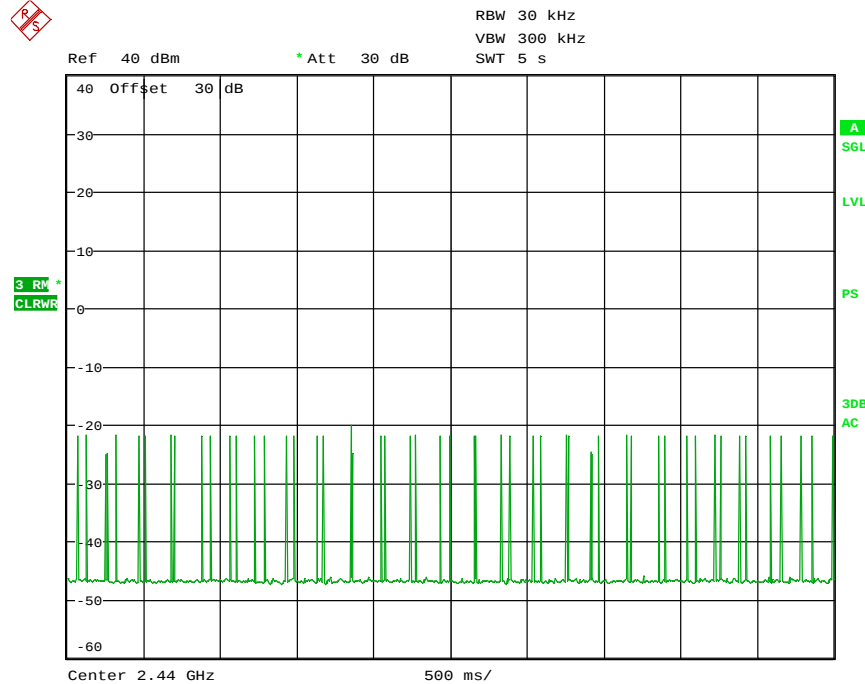
Dwell Time, EDR2 (Single Pulse)



Dwell Time, EDR3



Dwell Time, EDR3 (Single Pulse)



9 Conducted Spurious Emissions

9.1 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.

9.2 Test Procedure

ANSI C63.10: 2013 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

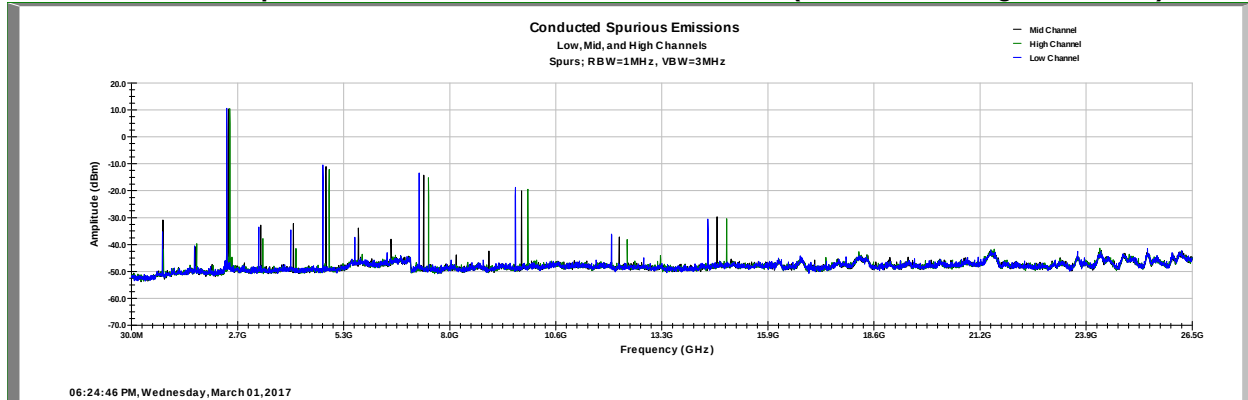
9.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde&Schwarz	ES126	9/20/2016	9/20/2017
COND3	6026			11/17/2016	11/17/2017

9.4 Results:

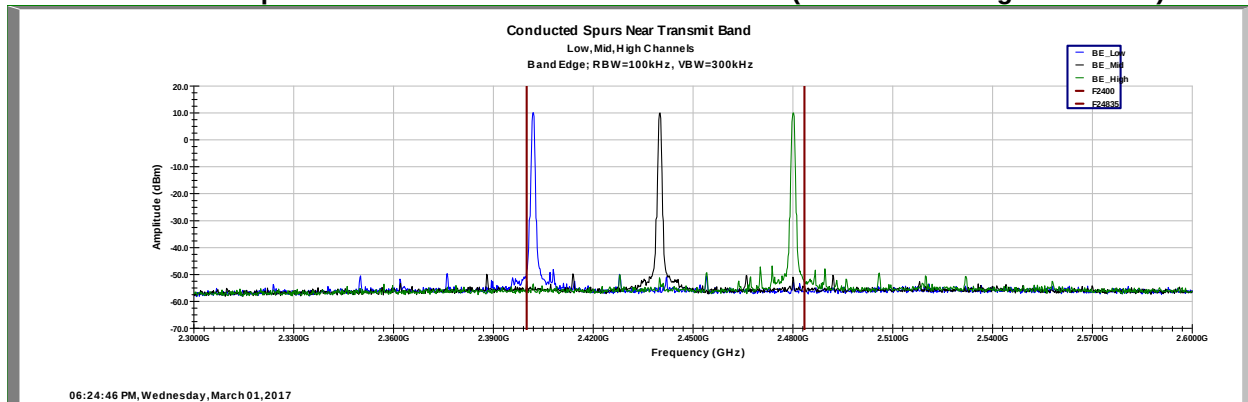
The following plots show that there are no conducted spurious emissions exceeding the 20dB down criteria. Plots are also presented showing the band edge compliance.

Conducted Spurious Emissions at Antenna Port GFSK (Low Mid and High Channels)

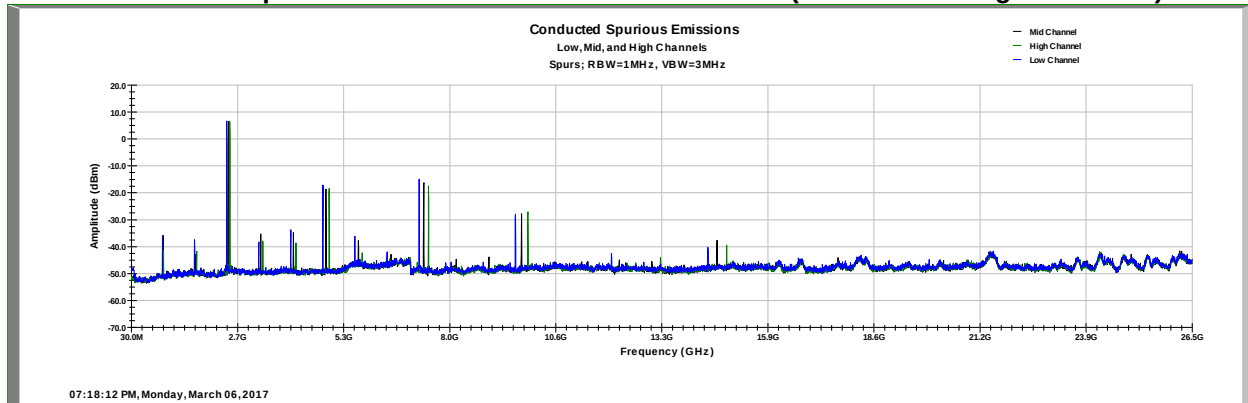


Channel	Frequency (GHz)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	4.804	-10.44	-9.36	1.08	Compliant
	7.206	-13.45	-9.36	4.09	Compliant
Mid	4.880	-11.03	-9.49	1.54	Compliant
	7.320	-14.42	-9.49	4.93	Compliant
High	4.960	-12.11	-9.47	2.65	Compliant
	7.440	-15.23	-9.47	5.77	Compliant

Conducted Spurious Emissions at Antenna Port GFSK (Low Mid and High Channels)

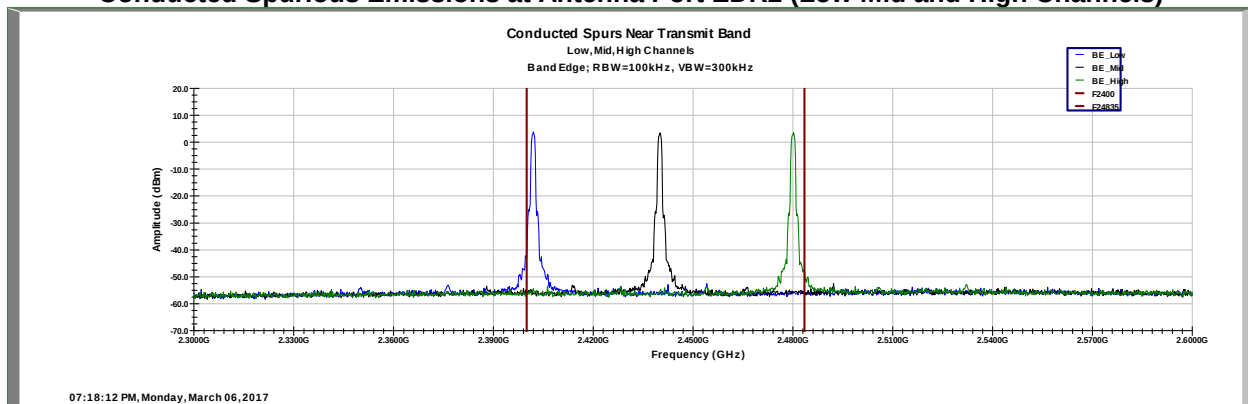


Conducted Spurious Emissions at Antenna Port EDR2 (Low Mid and High Channels)

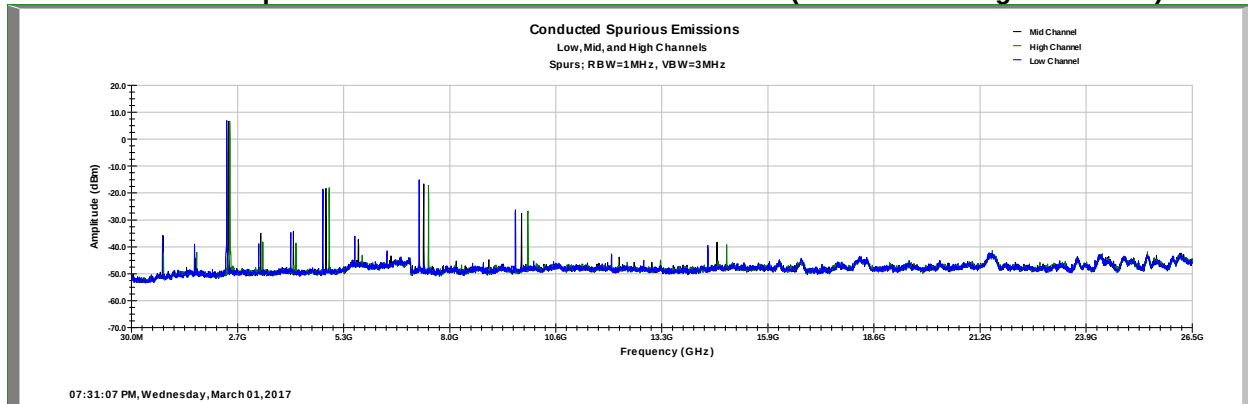


Channel	Frequency (GHz)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	4.804	-17.09	-12.90	4.19	Compliant
	7.206	-14.98	-12.90	2.08	Compliant
Mid	4.880	-18.61	-13.14	5.47	Compliant
	7.320	-16.29	-13.14	3.15	Compliant
High	4.960	-18.48	-13.12	5.36	Compliant
	7.440	-17.41	-13.12	4.29	Compliant

Conducted Spurious Emissions at Antenna Port EDR2 (Low Mid and High Channels)

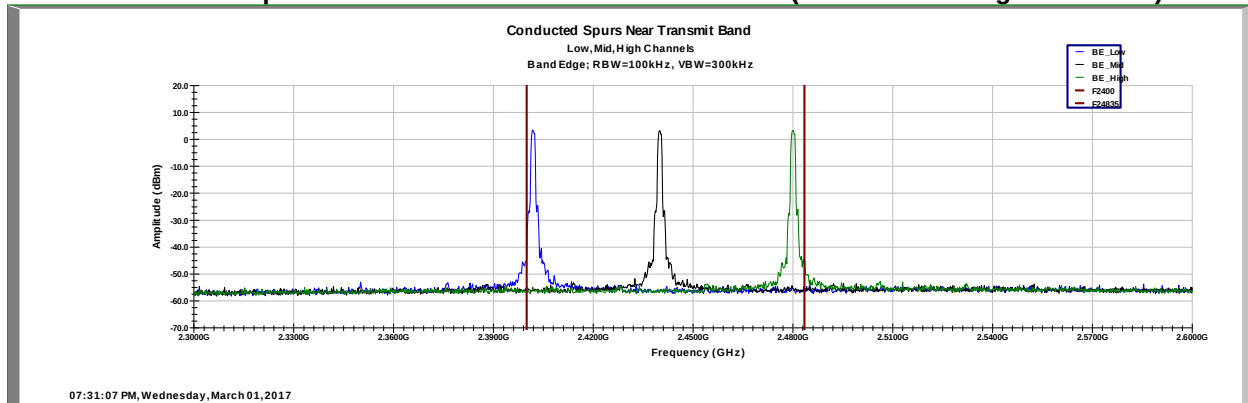


Conducted Spurious Emissions at Antenna Port EDR3 (Low Mid and High Channels)



Channel	Frequency (GHz)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	4.804	-18.55	-12.53	6.02	Compliant
	7.206	-15.04	-12.53	2.51	Compliant
Mid	4.880	-18.32	-12.66	5.66	Compliant
	7.320	-16.61	-12.66	3.95	Compliant
High	4.960	-18.06	-12.59	5.47	Compliant
	7.440	-18.55	-12.59	5.96	Compliant

Conducted Spurious Emissions at Antenna Port EDR3 (Low Mid and High Channels)



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
¹ 0.495–0.505	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 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

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	9/26/2016	9/26/2017
Preamplifier	122005	Rohde&Schwarz	TS-PR18	11/17/2016	11/17/2017
Preamplifier	100050	Rohde&Schwarz	TS-PR26	11/17/2016	11/17/2017
Horn Antenna (18 – 40GHz)	00117798	ETS	3116c	6/6/2016	6/6/2017
Horn Antenna	00156319	ETS	3117	6/3/2016	6/3/2017
Bilog Antenna	2564	Schaffner	CBL6111C	3/23/2016	3/23/2017
High Pass Filter	1	Wainwright	WHKX12- 2533.85-2710- 1800-40SS	11/17/2016	11/17/2017
System Controller	121701-1	Sunol Sciences	SC99V	Time of Use	Time of Use
EMC Software	Version 9.15.02	Rohde&Schwarz	EMC32	Time of Use	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 Results:

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.

Emissions were investigated with the test sample positioned in 3 orthogonal axis and the worst case reported.

Bluetooth, Channel 2402, GFSK**Average**

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4804.000000	38.20	54.00	15.80	1000.000	341.0	H	131.0	7.5
7206.000000	48.99	54.00	5.01	1000.000	366.0	V	274.0	10.4
9607.600000	38.60	54.00	15.40	1000.000	206.0	H	202.0	13.6
12009.400000	37.65	54.00	16.35	1000.000	200.0	H	293.0	17.5
14411.400000	42.45	54.00	11.55	1000.000	311.0	V	131.0	17.0

Max Peak

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4804.000000	45.07	74.00	28.93	1000.000	341.0	H	131.0	7.5
7206.000000	53.58	74.00	20.42	1000.000	366.0	V	274.0	10.4
9607.600000	49.61	74.00	24.39	1000.000	206.0	H	202.0	13.6
12009.400000	50.73	74.00	23.27	1000.000	200.0	H	293.0	17.5
14411.400000	53.11	74.00	20.89	1000.000	311.0	V	131.0	17.0

Bluetooth, Channel 2402, GFSK, Band Edge**Average**

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.000000	41.70	54.00	12.30	1000	294	V	327	37.7

Max Peak

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.000000	52.09	74.00	21.91	1000	294	V	327	37.7

Bluetooth, Channel 2402, EDR2**Average**

Frequency (MHz)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4804.000000	43.14	54.00	10.86	1000.000	100.0	V	329.0	7.5
7206.000000	36.45	54.00	17.55	1000.000	410.0	H	128.0	10.4
9607.600000	34.89	54.00	19.11	1000.000	203.0	H	239.0	13.6

Max Peak

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4804.000000	50.15	74.00	23.85	1000.000	100.0	V	329.0	7.5
7206.000000	46.68	74.00	27.32	1000.000	410.0	H	128.0	10.4
9607.600000	46.89	74.00	27.11	1000.000	203.0	H	239.0	13.6

Bluetooth, Channel 2402, EDR2, Band Edge**Average**

Frequency (MHz)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.000000	42.10	54.00	11.90	1000	238	H	306	37.7

Max Peak

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.000000	52.11	74.00	21.89	1000	238	H	306	37.7

Bluetooth, Channel 2402, EDR3**Average**

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4804.000000	39.47	54.00	14.53	1000.000	198.0	V	256.0	7.5
7206.000000	48.64	54.00	5.36	1000.000	272.0	V	340.0	10.4
9608.000000	37.54	54.00	16.46	1000.000	310.0	V	150.0	13.6

Max Peak

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4804.000000	48.15	74.00	25.85	1000.000	198.0	V	256.0	7.5
7206.000000	56.72	74.00	17.28	1000.000	272.0	V	340.0	10.4
9608.000000	49.30	74.00	24.70	1000.000	310.0	V	150.0	13.6

Bluetooth, Channel 2402, EDR3, Band Edge**Average**

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.000000	42.62	54.00	11.38	1000	100	H	292	37.7

Max Peak

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.000000	57.44	74.00	16.56	1000	100	H	292	37.7

Bluetooth, Channel 2440, GFSK**Average**

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4880.000000	47.37	54.00	6.63	1000.000	308.0	H	278.0	7.4
7320.000000	47.40	54.00	6.60	1000.000	200.0	V	317.0	10.5
9759.600000	39.07	54.00	14.93	1000.000	344.0	H	306.0	13.7
12200.400000	50.61	54.00	3.39	1000.000	100.0	V	276.0	17.2
19519.430000	53.58	54.00	0.42	1000.000	100.0	H	0.0	-27.9

Max Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4880.000000	50.93	74.00	23.07	1000.000	308.0	H	278.0	7.4
7320.000000	52.76	74.00	21.24	1000.000	200.0	V	317.0	10.5
9759.600000	49.92	74.00	24.08	1000.000	344.0	H	306.0	13.7
12200.400000	58.58	74.00	15.42	1000.000	100.0	V	276.0	17.2
19519.430000	64.49	74.00	9.51	1000.000	100.0	H	0.0	-27.9

Bluetooth, Channel 2440, EDR2**Average**

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4804.000000	45.14	54.00	8.86	1000.000	302.0	V	346.0	7.5
7206.000000	44.59	54.00	9.41	1000.000	284.0	V	333.0	10.4
9608.400000	37.62	54.00	16.38	1000.000	342.0	V	146.0	13.6

Max Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4804.000000	51.12	74.00	22.88	1000.000	302.0	V	346.0	7.5
7206.000000	51.19	74.00	22.81	1000.000	284.0	V	333.0	10.4
9608.400000	49.88	74.00	24.12	1000.000	342.0	V	146.0	13.6

Bluetooth, Channel 2440, EDR3**Average**

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4804.000000	45.91	54.00	8.09	1000.000	305.0	V	336.0	7.5
7206.000000	47.45	54.00	6.55	1000.000	270.0	V	339.0	10.4
9608.000000	37.57	54.00	16.43	1000.000	339.0	V	148.0	13.6
12010.400000	38.66	54.00	15.34	1000.000	353.0	V	212.0	17.4
14115.800000	37.69	54.00	16.31	1000.000	200.0	H	160.0	17.6

Max Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4804.000000	52.20	74.00	21.80	1000.000	305.0	V	336.0	7.5
7206.000000	55.46	74.00	18.54	1000.000	270.0	V	339.0	10.4
9608.000000	49.32	74.00	24.68	1000.000	339.0	V	148.0	13.6
12010.400000	50.95	74.00	23.05	1000.000	353.0	V	212.0	17.4
14115.800000	50.54	74.00	23.46	1000.000	200.0	H	160.0	17.6

Bluetooth, Channel 2480, GFSK**Average**

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.000000	53.45	54.00	0.55	1000.000	309.0	H	130.0	7.2
7440.000000	47.55	54.00	6.45	1000.000	410.0	H	134.0	10.9
9920.400000	43.51	54.00	10.49	1000.000	325.0	H	310.0	14.0
12399.400000	40.70	54.00	13.30	1000.000	200.0	V	280.0	16.9
14879.200000	41.88	54.00	12.12	1000.000	211.0	V	261.0	18.2
19840.990000	53.89	54.00	0.11	1000.000	100.0	H	0.0	-27.9

Max Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.000000	55.97	74.00	18.03	1000.000	309.0	H	130.0	7.2
7440.000000	52.83	74.00	21.17	1000.000	410.0	H	134.0	10.9
9920.400000	53.00	74.00	21.00	1000.000	325.0	H	310.0	14.0
12399.400000	51.67	74.00	22.33	1000.000	200.0	V	280.0	16.9
14879.200000	53.05	74.00	20.95	1000.000	211.0	V	261.0	18.2
19840.990000	66.02	74.00	7.98	1000.000	100.0	H	0.0	-27.9

Bluetooth, Channel 2480, GFSK, Band Edge**Average**

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2483.500000	42.95	54.00	11.05	1000	410	H	274	37.8

Max Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2483.500000	53.50	74.00	20.50	1000	410	H	274	37.8

Bluetooth, Channel 2480, EDR2**Average**

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.000000	50.25	54.00	3.75	1000.000	388.0	V	160.0	7.2
7440.000000	48.61	54.00	5.39	1000.000	235.0	V	336.0	10.9
9919.600000	37.11	54.00	16.89	1000.000	360.0	V	144.0	14.0
12399.400000	38.18	54.00	15.82	1000.000	296.0	V	189.0	16.9

Max Peak

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.000000	55.92	74.00	18.08	1000.000	388.0	V	160.0	7.2
7440.000000	53.77	74.00	20.23	1000.000	235.0	V	336.0	10.9
9919.600000	49.46	74.00	24.54	1000.000	360.0	V	144.0	14.0
12399.400000	50.62	74.00	23.38	1000.000	296.0	V	189.0	16.9

Bluetooth, Channel 2480, EDR2, Band Edge**Average**

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2483.500000	44.43	54.00	9.57	1000	315	V	327	37.8

Max Peak

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2483.500000	55.81	74.00	18.19	1000	315	V	327	37.8

Bluetooth, Channel 2480, EDR3**Average**

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4804.000000	45.14	54.00	8.86	1000.000	302.0	V	346.0	7.5
7206.000000	44.59	54.00	9.41	1000.000	284.0	V	333.0	10.4
9608.400000	37.62	54.00	16.38	1000.000	342.0	V	146.0	13.6

Max Peak

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4804.000000	51.12	74.00	22.88	1000.000	302.0	V	346.0	7.5
7206.000000	51.19	74.00	22.81	1000.000	284.0	V	333.0	10.4
9608.400000	49.88	74.00	24.12	1000.000	342.0	V	146.0	13.6

Bluetooth, Channel 2480, EDR3, Band Edge**Average**

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2483.500000	43.13	54.00	10.87	1000	311	V	183	37.8

Max Peak

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2483.500000	53.86	74.00	20.14	1000	311	V	183	37.8

11 AC Powerline Conducted Emissions

11.1 Test Limits

§ 15.107(e): Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

11.2 Test Procedure

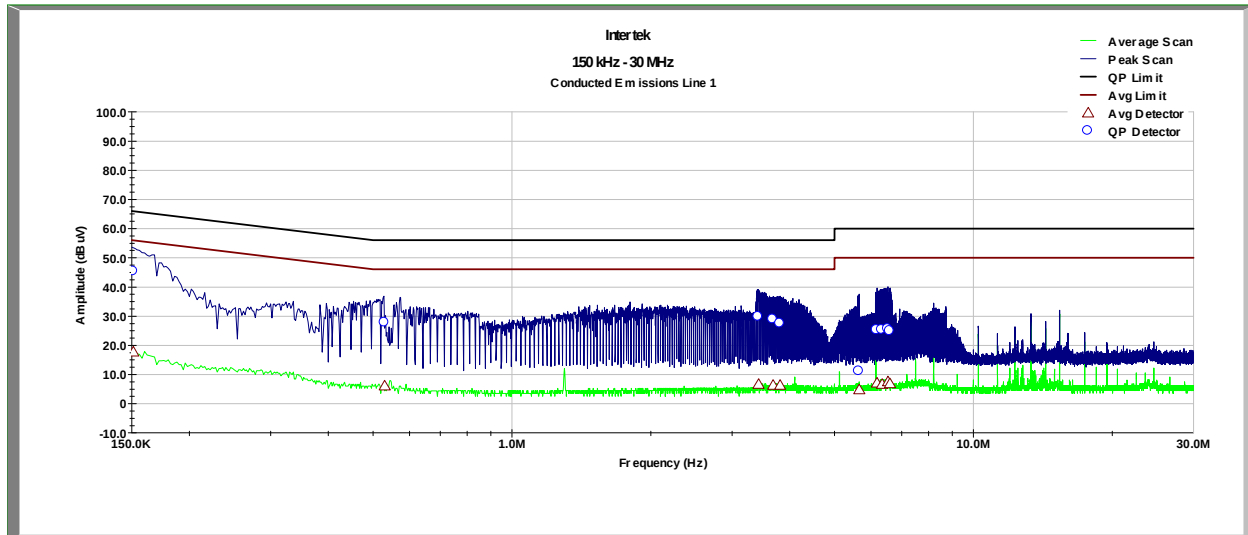
ANSI C63.4: 2014

11.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde&Schwarz	ESI26	9/20/2016	9/20/2017
LISN	3333	Teseq	NNB52	6/3/2016	6/3/2017
COND2	5025			11/17/2016	11/17/2017

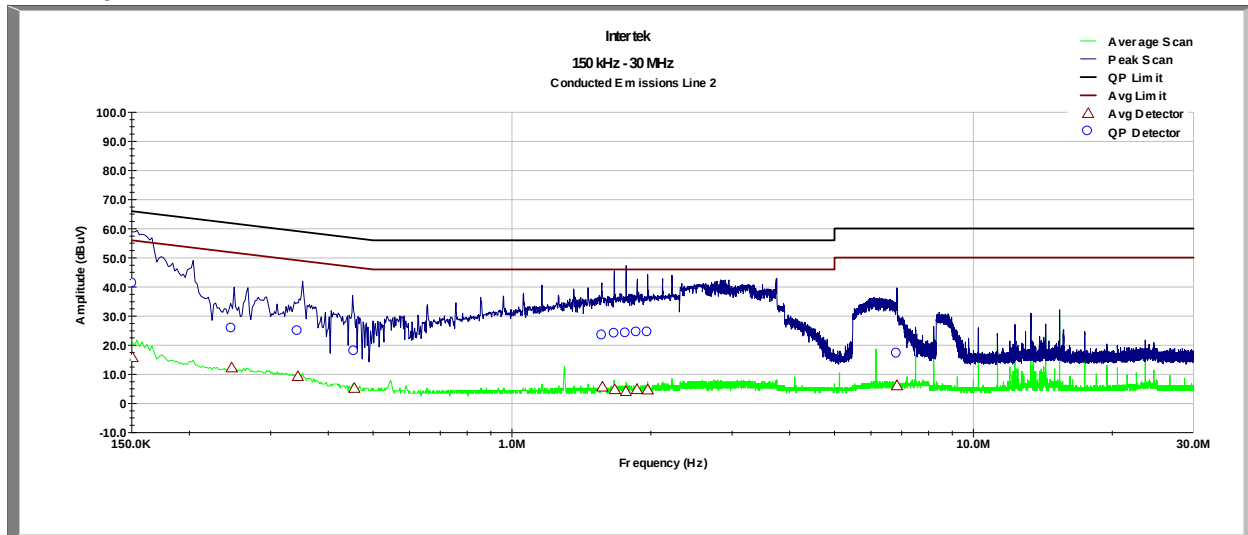
11.4 Results:

Line 1



Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
151.20 KHz	45.277	65.966	20.689	17.774	55.966	38.192
530.20 KHz	27.701	56.000	28.299	6.117	46.000	39.883
3.425 MHz	29.663	56.000	26.337	6.620	46.000	39.380
3.685 MHz	28.813	56.000	27.187	6.279	46.000	39.721
3.815 MHz	27.318	56.000	28.682	6.342	46.000	39.658
5.658 MHz	10.982	60.000	49.018	4.822	50.000	45.178
6.183 MHz	25.137	60.000	34.863	7.102	50.000	42.898
6.342 MHz	25.219	60.000	34.781	6.604	50.000	43.396
6.534 MHz	25.536	60.000	34.464	7.475	50.000	42.525
6.601 MHz	24.809	60.000	35.191	6.831	50.000	43.169

Line 2



Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
150.60 KHz	41.120	65.983	24.862	15.778	55.983	40.205
247.10 KHz	25.687	63.226	37.539	12.240	53.226	40.986
343.70 KHz	24.825	60.466	35.641	9.262	50.466	41.204
455.50 KHz	17.855	57.271	39.417	5.240	47.271	42.031
1.572 MHz	23.256	56.000	32.744	5.616	46.000	40.384
1.671 MHz	23.832	56.000	32.168	4.747	46.000	41.253
1.767 MHz	24.003	56.000	31.997	4.079	46.000	41.921
1.867 MHz	24.381	56.000	31.619	4.823	46.000	41.177
1.969 MHz	24.296	56.000	31.704	4.686	46.000	41.314
6.834 MHz	17.020	60.000	42.980	6.139	50.000	43.861

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 Results:

The sample tested met the antenna requirement. The antenna was a PCB circuit board that was permanently soldered to the main board.

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	3/9/2017	102886547LEX-001	Original Issue