

FHSS TEST REPORT

Report Number: G101112064LEX-002.2
Project Number: G101112064

Report Issue Date: 1/2/2014

Product Name: Machinery Health Analyzer
Model Number: CSI 2140
FCCID: NL5-CSI2410M1
ICID: 3434A-CSI2140M1

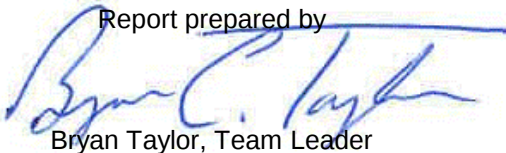
Standards: FCC Part 15C and RSS-210 Issue 8

Radios Under Test: Bluetooth

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

Client:
Computational systems Inc.
835 Innovation Drive
Knoxville, TN 37932

Report prepared by



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Report reviewed by



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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 facility 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 radiated 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)	RSS210 (A8.4)	Pass
12	20dB Bandwidth	§ 15.247(a)(1)	RSS210 (A8.1)	Pass
18	Channel Separation	§ 15.247(a)(1)	RSS210 (A8.1)	Pass
21	Number of Hopping Channels	§ 15.247(a)(1)(iii)	RSS210(A8.1)	Pass
25	Time of Occupancy	§ 15.247(a)(1)(iii)	RSS210 (A8.1)	Pass
29	Conducted Spurious Emissions	§ 15.247(d)	RSS210 (A8.5)	Pass
38	Radiated Spurious Emissions (Transmitter)	§ 15.247(d), § 15.209, and § 15.205	RSS-210 (A8.5)	Pass
46	AC Powerline Conducted Emissions	§ 15.107, § 15.207	RSS-Gen (7.2.4)	Pass
49	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	Computational systems Inc.
Model Number	CSI 2140
Serial Number	BETA 001020
FCC Identifier	NL5-CSI2410M1
Industry Canada Identifier	3434A-CSI2140M1
Receive Date	10/31/2013
Test Start Date	11/18/2013
Test End Date	11/20/2013
Device Received Condition	Good
Test Sample Type	Production
Frequency Range	2402 – 2480MHz
Modulation Type	GFSK (1Mbps), pi/4 DPSK (2Mbps), 8DPSK (3Mbps)
Transmission Control	Test Commands
Maximum Output Power	1.69dBm
Test Channels	2402MHz, 2441MHz, and 2480MHz
Antenna Type (15.203)	Internal
Operating Voltage	115VAC/60Hz (Via AC / DC Power Adapter)

Description of Equipment Under Test

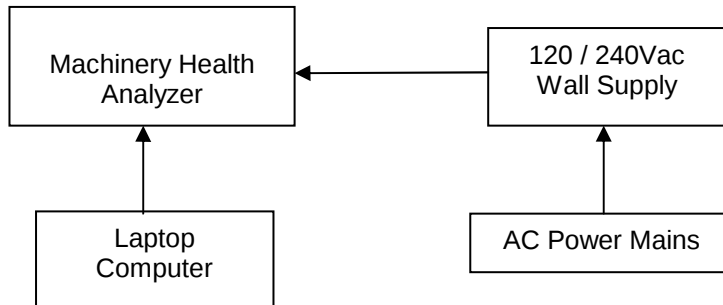
The CSI 2140 is a ruggedized machinery health analyzer.

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Transmitting a FHSS signal with the hopping enabled.
2	Transmitting continuously on a single channel.
3	Receive / idle mode.

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

3.2 EUT Block Diagram:



3.3 Cables:

Cables					
Description	Length	Shielding	Ferrites	Connection	
				From	To
DC Power Cable	5ft	None	None	DC Power Adapter	DC Power Input
AC Power Cable	5ft	None	None	AC Power Source	DC Power Adapter
Ethernet Cable	50ft	None	None	Ethernet Port	Laptop Computer

3.4 Support Equipment:

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Laptop Computer	HP	EliteBook 8470p	None

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:

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

4.2 Test Procedure

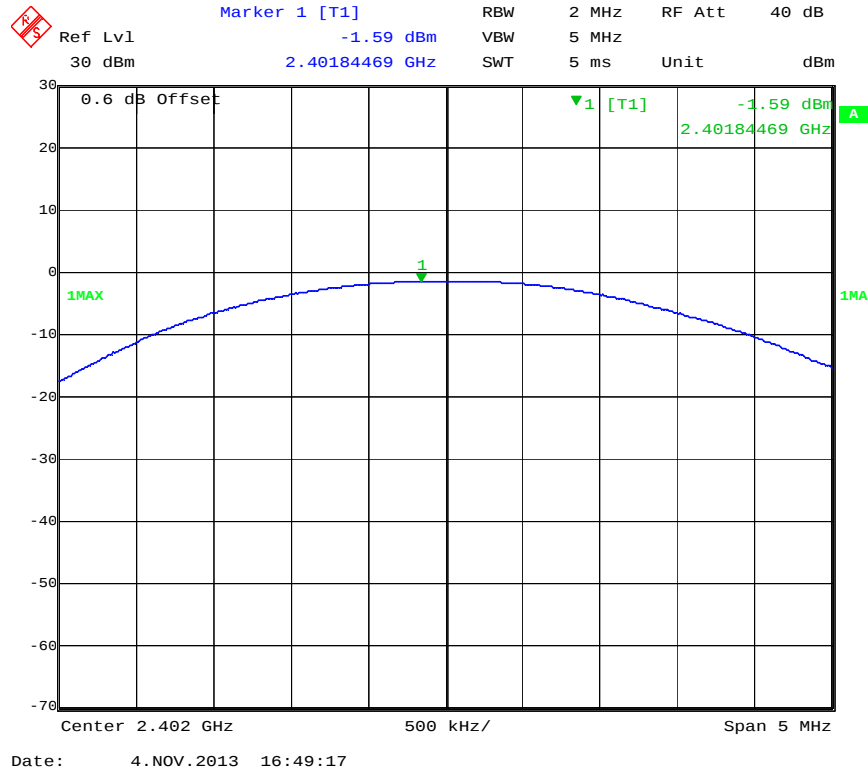
ANSI C63.10: 2009 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. The peak output power was measured using the marker to peak function of the spectrum analyzer.

4.3 Test Equipment Used:

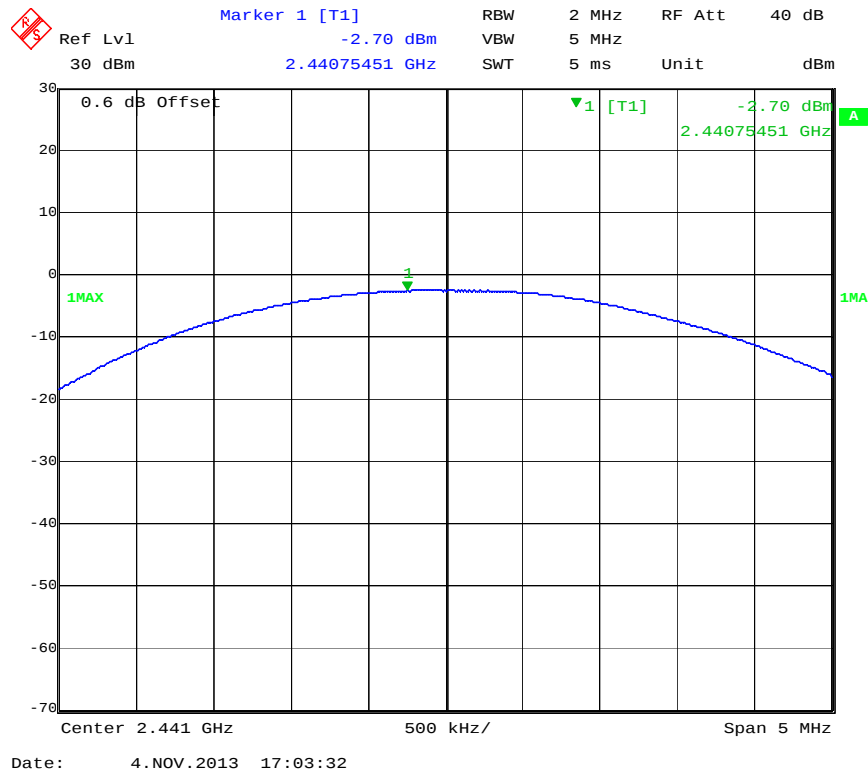
Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	3720	Rohde&Schwarz	FSEK30	9/10/2013	9/10/2014

4.4 Results:

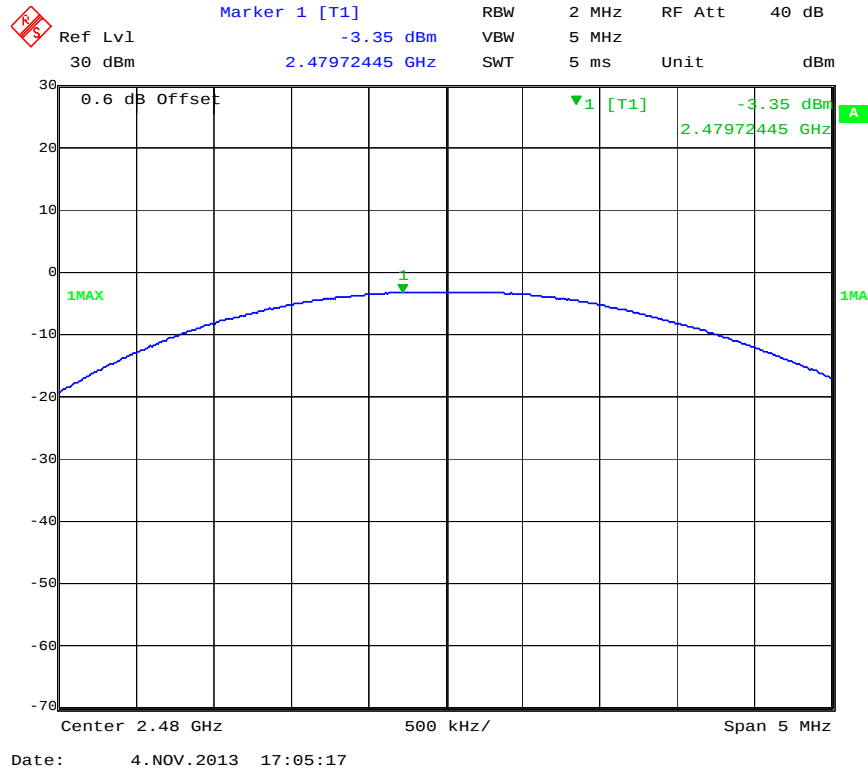
Channel	Frequency (MHz)	Data Rate	Output Power (dBm)	Limit (dBm)	Pass / Fail
Low	2402	1Mbps	-1.59dBm	30dBm	Pass
Mid	2441	1Mbps	-2.70dBm	30dBm	Pass
High	2480	1Mbps	-3.35dBm	30dBm	Pass
Low	2402	2Mbps	1.56dBm	30dBm	Pass
Mid	2441	2Mbps	0.48dBm	30dBm	Pass
High	2480	2Mbps	0.16dBm	30dBm	Pass
Low	2402	3Mbps	1.69dBm	30dBm	Pass
Mid	2441	3Mbps	0.6dBm	30dBm	Pass
High	2480	3Mbps	0.23dBm	30dBm	Pass



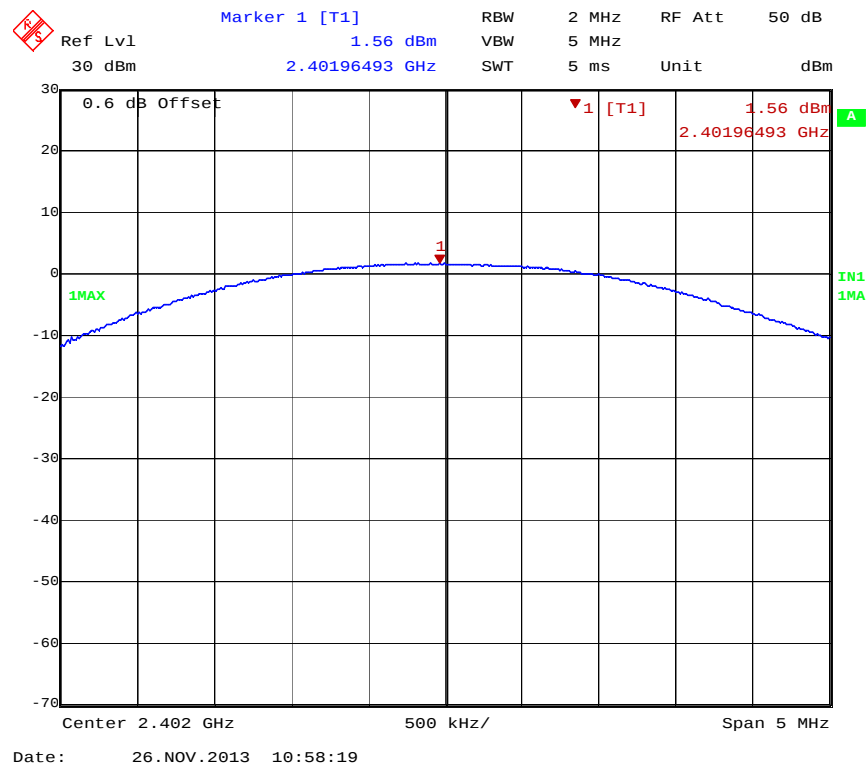
Peak Output Power Low Channel (1Mbps)



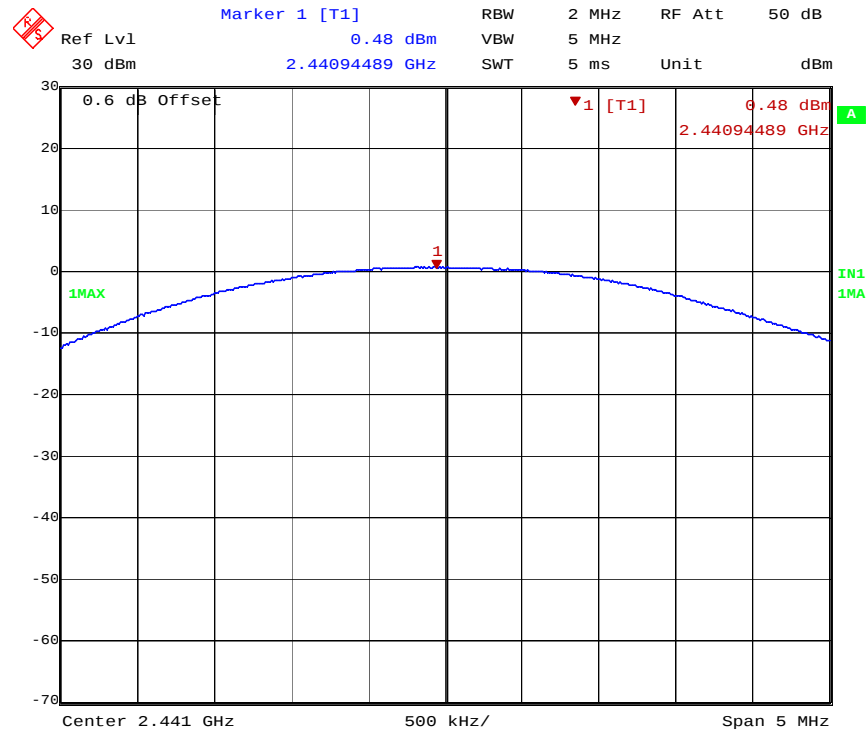
Peak Output Power Middle Channel (1Mbps)



Peak Output Power High Channel (1Mbps)

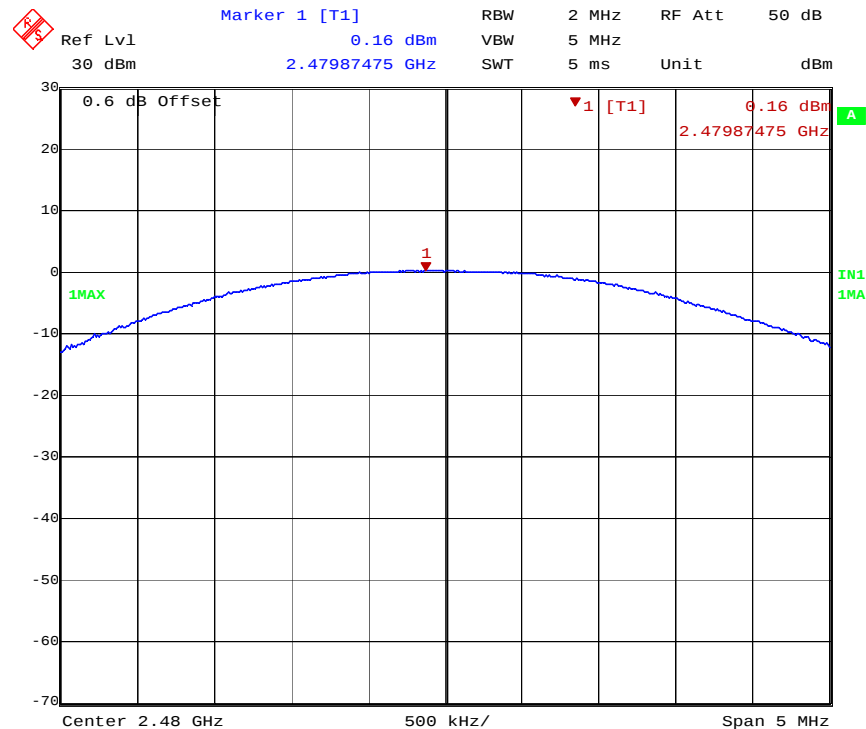


Peak Output Power Low Channel (2Mbps)



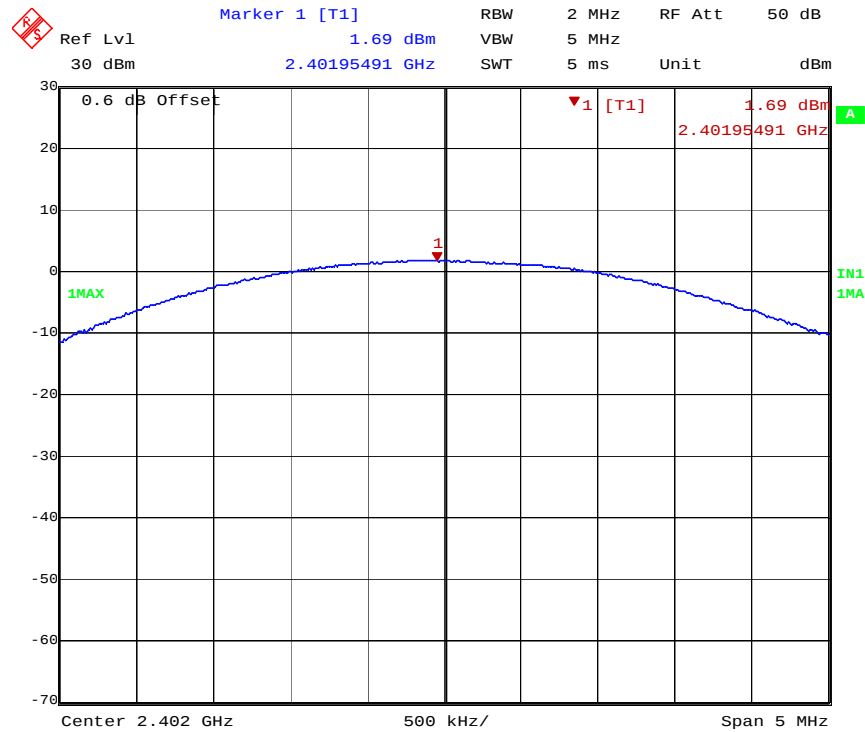
Date: 26.NOV.2013 10:56:14

Peak Output Power Middle Channel (2Mbps)



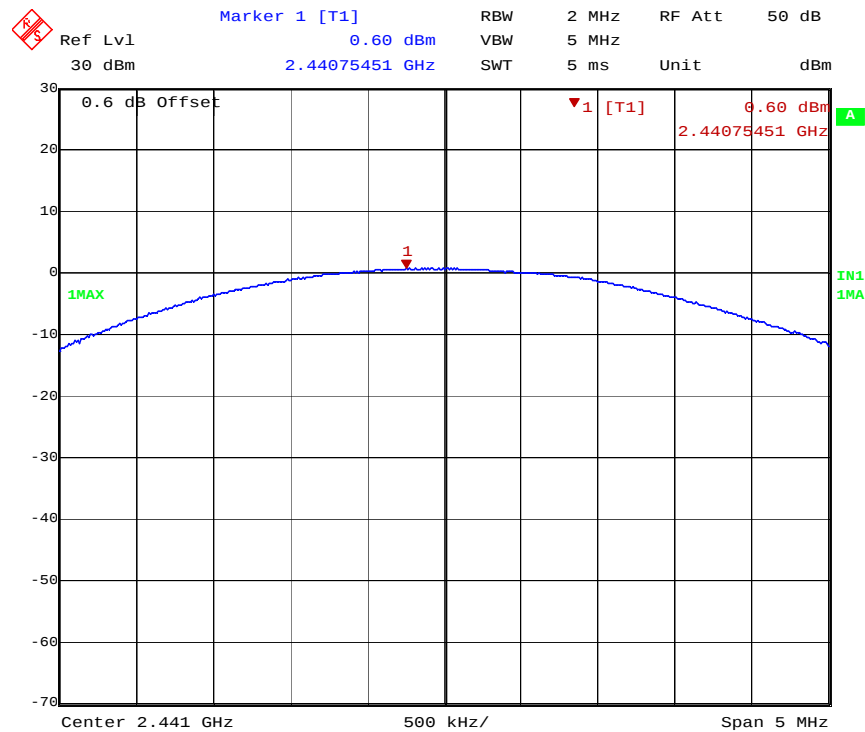
Date: 26.NOV.2013 11:01:14

Peak Output Power High Channel (2Mbps)



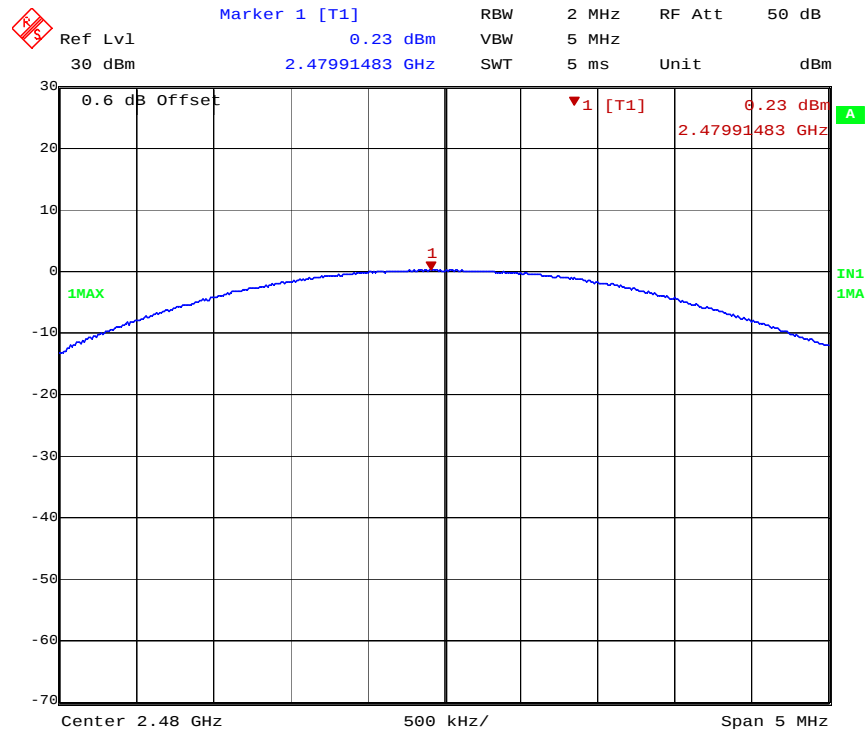
Date: 26.NOV.2013 11:11:58

Peak Output Power Low Channel (3Mbps)



Date: 26.NOV.2013 11:05:47

Peak Output Power Middle Channel (3Mbps)



Date: 26.NOV.2013 11:04:26

Peak Output Power High Channel (3Mbps)

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.

(i) For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz

5.2 Test Procedure

ANSI C63.10: 2009 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

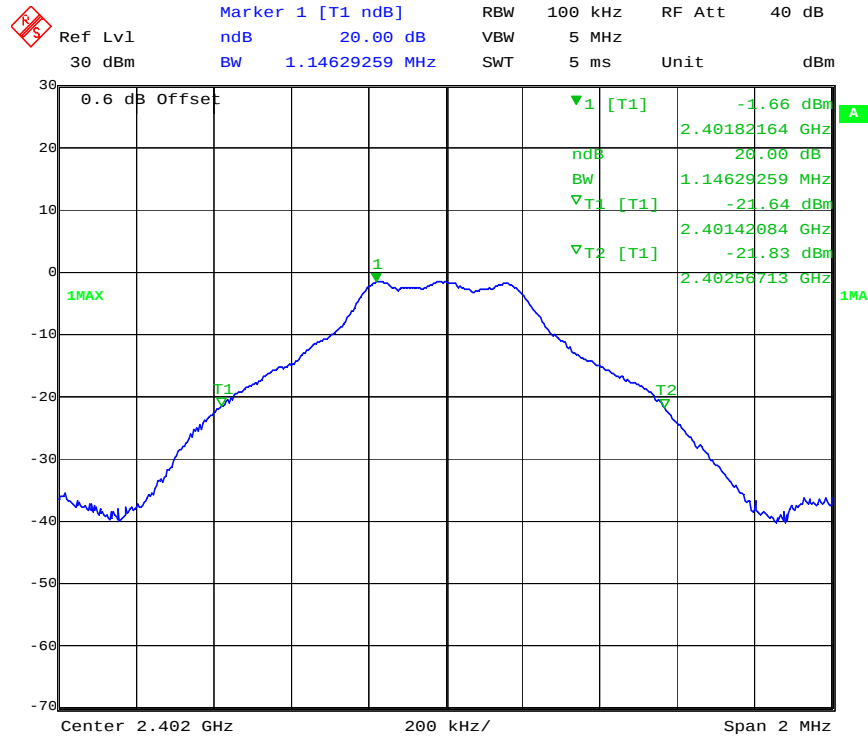
5.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	3720	Rohde&Schwarz	FSEK30	9/10/2013	9/10/2014

5.4 Results:

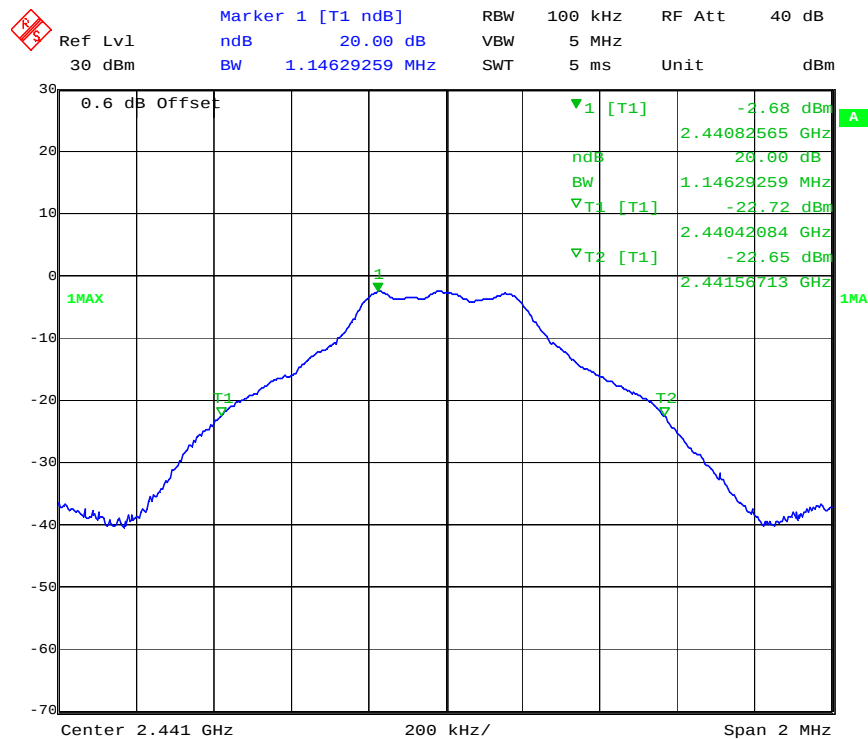
The 20dB bandwidth measurements are shown below. The 20dB bandwidth is also used as the 99% bandwidth.

Channel	Data Rate	Frequency (MHz)	20dB Bandwidth (MHz)
Low	1Mbps	2402	1.14MHz
Mid	1Mbps	2441	1.14MHz
High	1Mbps	2480	1.14MHz
Low	2Mbps	2402	1.4MHz
Mid	2Mbps	2441	1.39MHz
High	2Mbps	2480	1.39MHz
Low	3Mbps	2402	1.38MHz
Mid	3Mbps	2441	1.38MHz
High	3Mbps	2480	1.38MHz



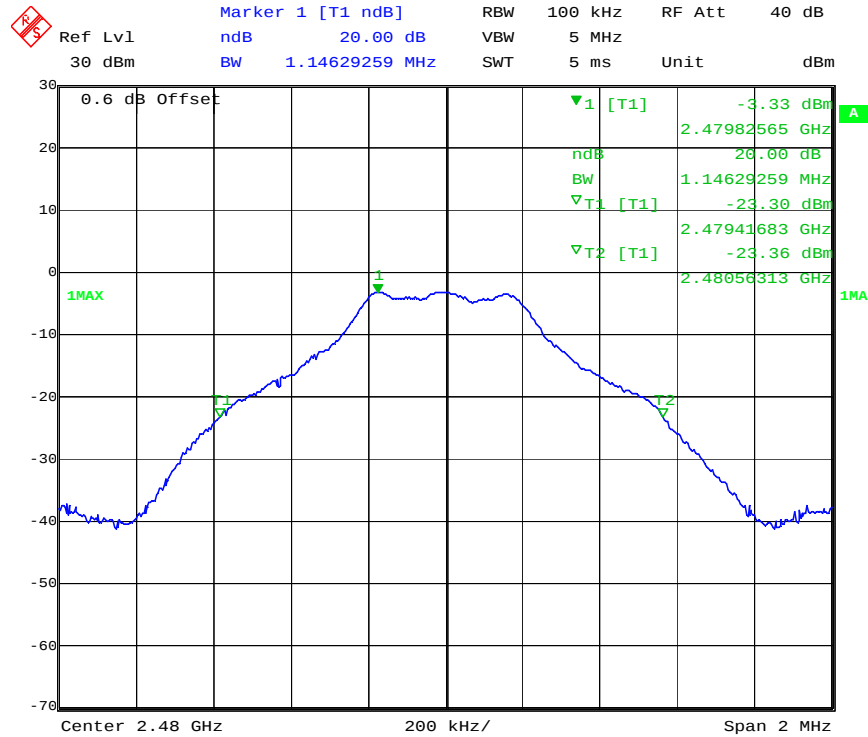
Date: 4.NOV.2013 17:13:34

20dB Bandwidth Low Channel (1Mbps)



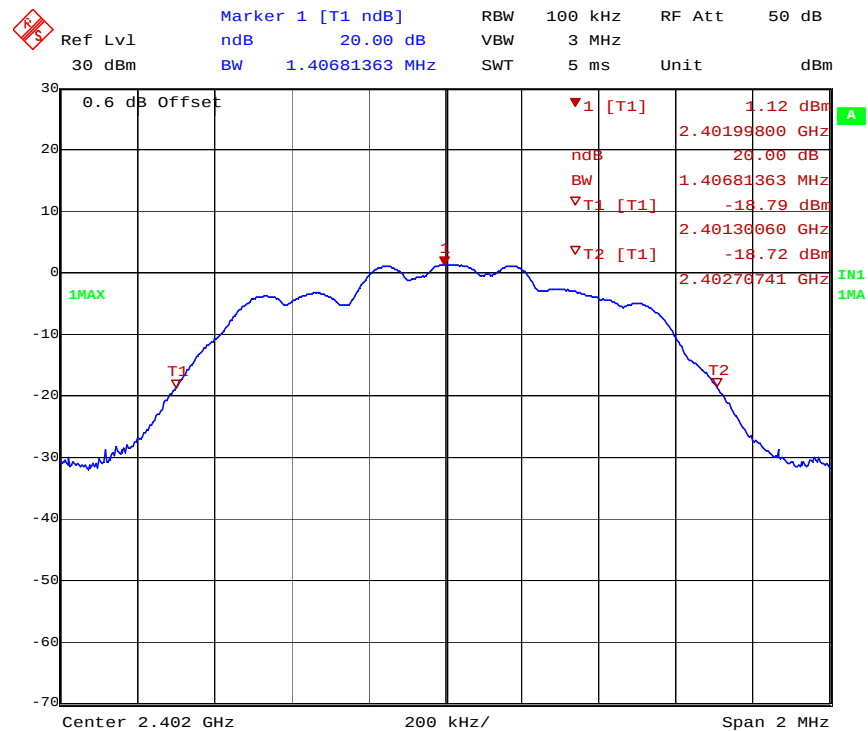
Date: 4.NOV.2013 17:12:37

20dB Bandwidth Mid Channel (1Mbps)



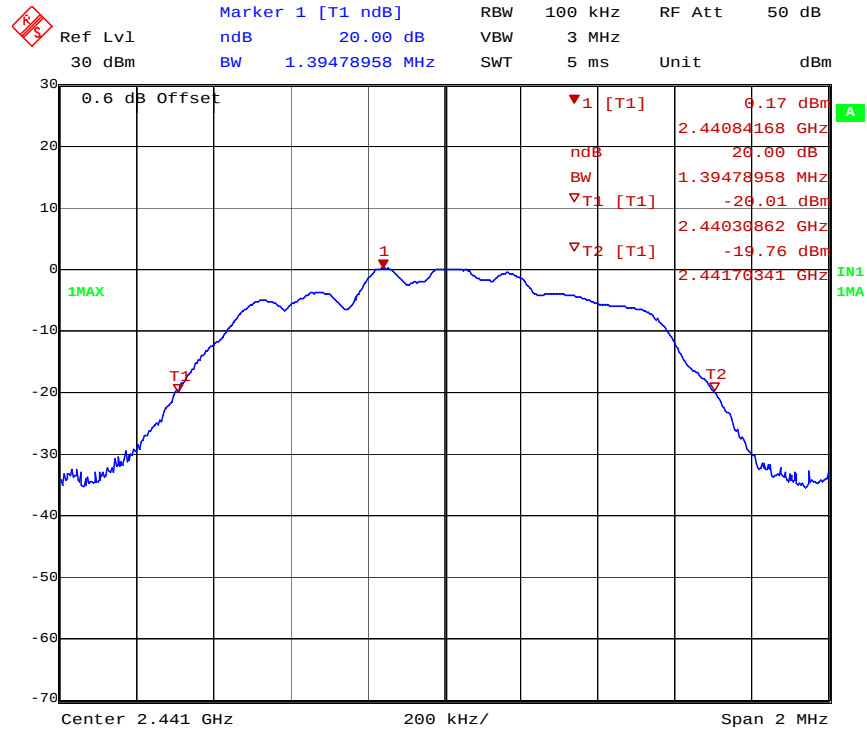
Date: 4.NOV.2013 17:11:20

20dB Bandwidth High Channel (1Mbps)



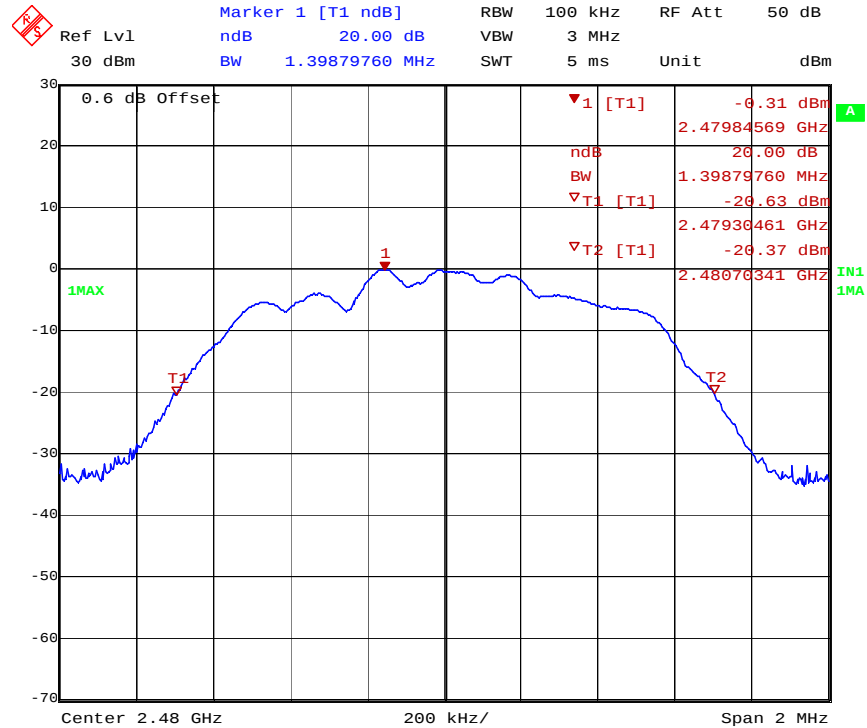
Date: 26.NOV.2013 11:40:59

20dB Bandwidth Low Channel (2Mbps)



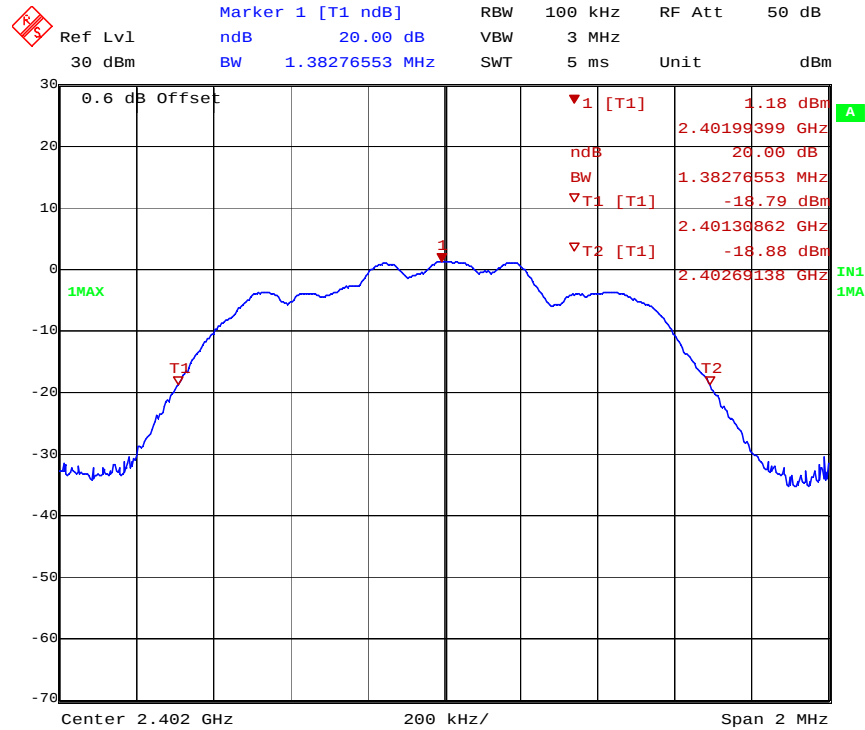
Date: 26.NOV.2013 11:43:53

20dB Bandwidth Mid Channel (2Mbps)



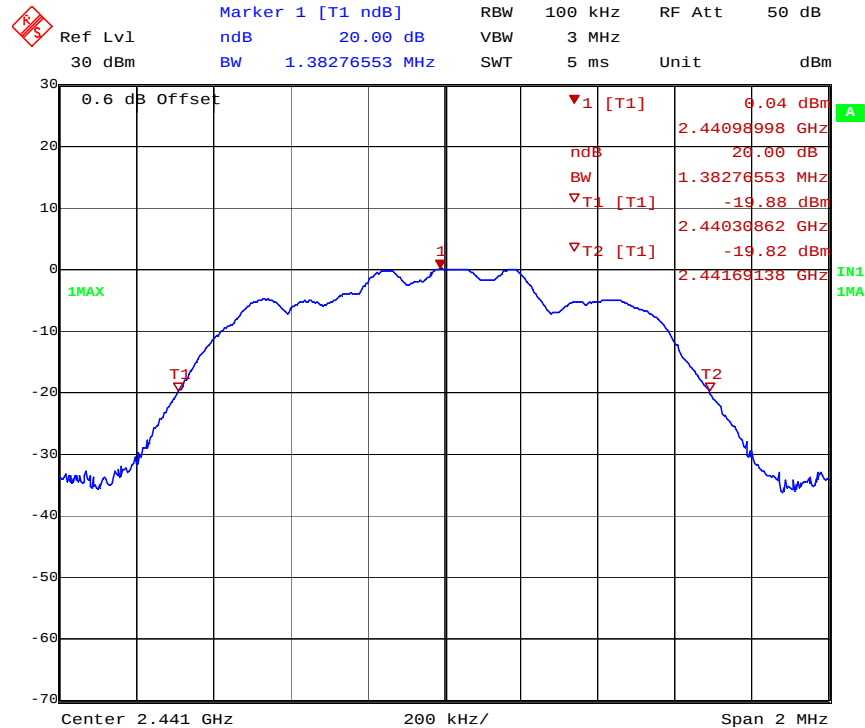
Date: 26.NOV.2013 11:45:20

20dB Bandwidth High Channel (2Mbps)



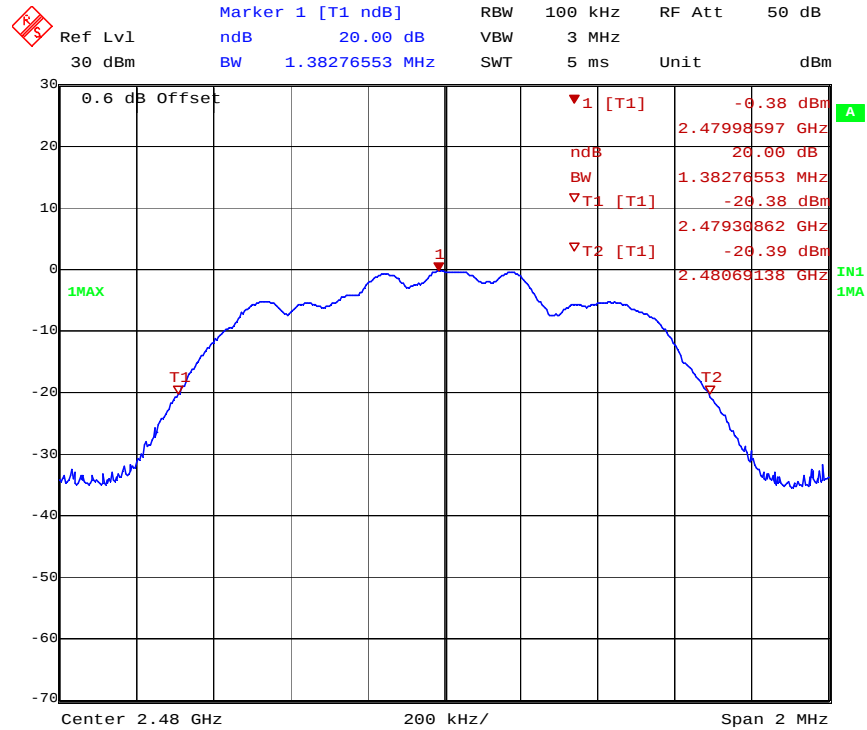
Date: 26.NOV.2013 11:47:03

20dB Bandwidth Low Channel (3Mbps)



Date: 26.NOV.2013 11:48:42

20dB Bandwidth Mid Channel (3Mbps)



Date: 26.NOV.2013 11:50:07

20dB Bandwidth High Channel (3Mbps)

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) (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

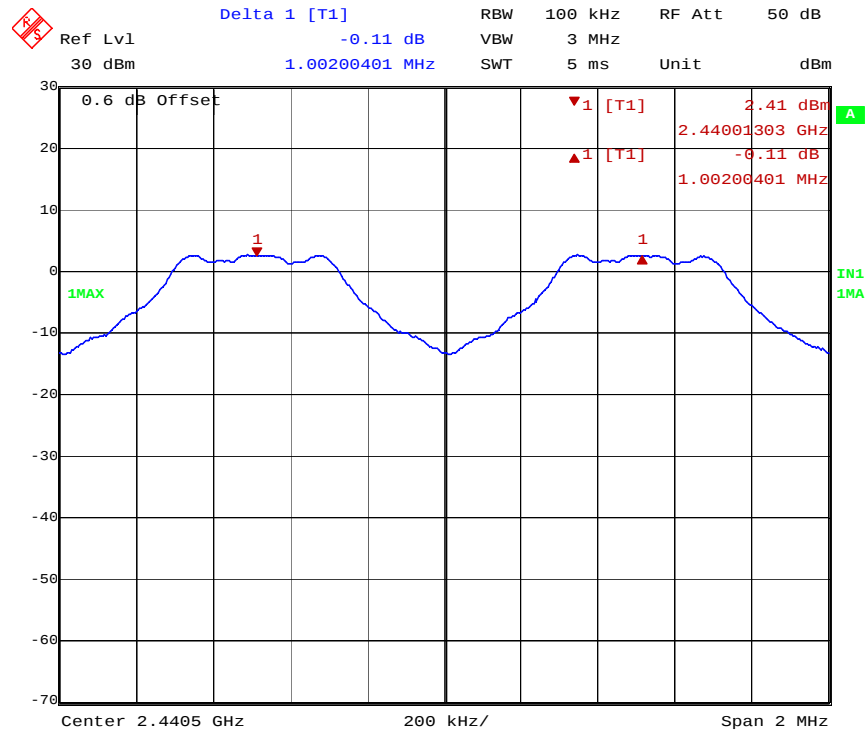
ANSI C63.10: 2009 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

6.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	3720	Rohde&Schwarz	FSEK30	9/10/2013	9/10/2014

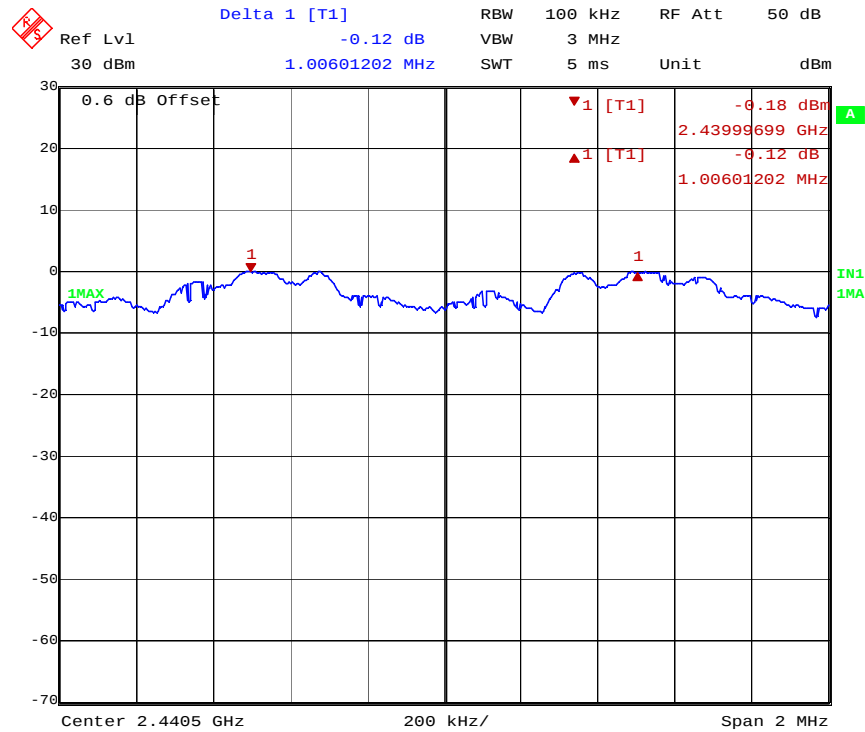
6.4 Results:

The plot below shows that the carrier frequency separation is 1MHz.



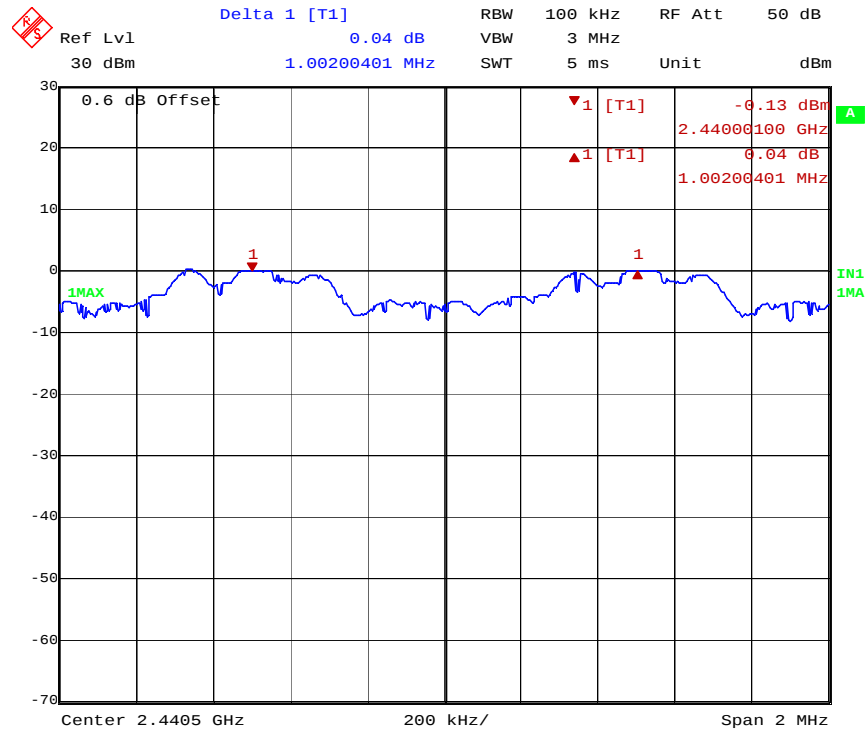
Date: 26.NOV.2013 13:43:28

Carrier Frequency Separation (1Mbps)



Date: 26.NOV.2013 13:51:45

Carrier Frequency Separation (2Mbps)



Date: 26.NOV.2013 13:59:41

Carrier Frequency Separation (3Mbps)

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) (i) For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

7.2 Test Procedure

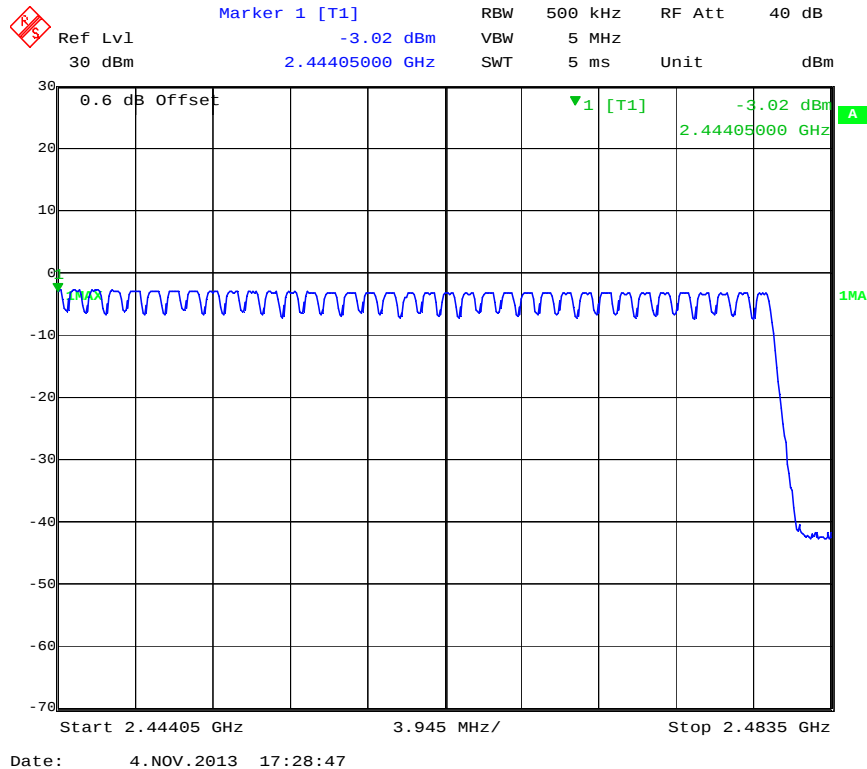
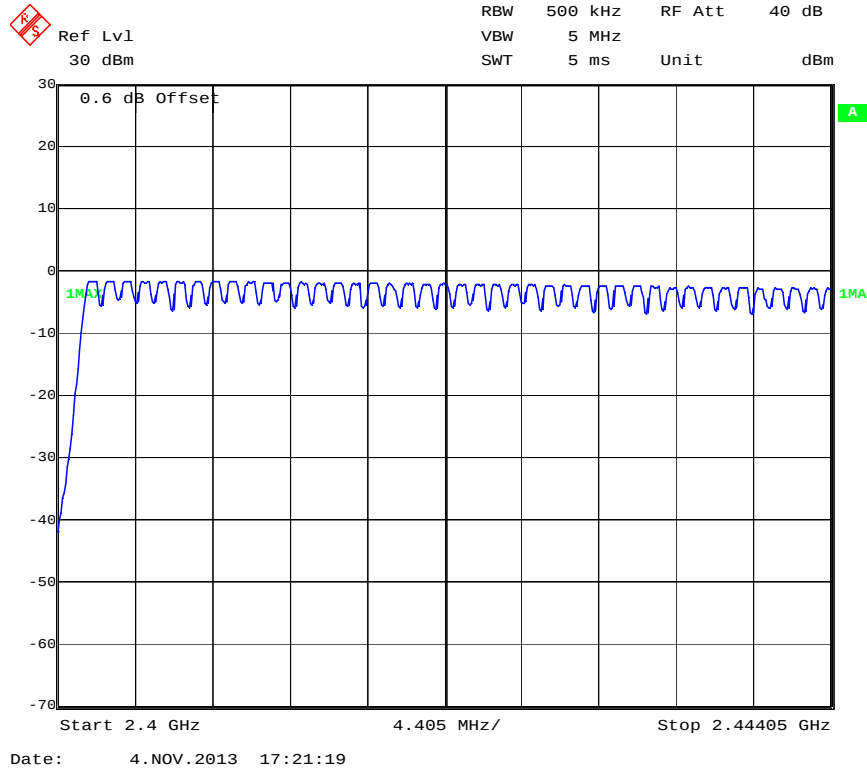
ANSI C63.10: 2009 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

7.3 Test Equipment Used:

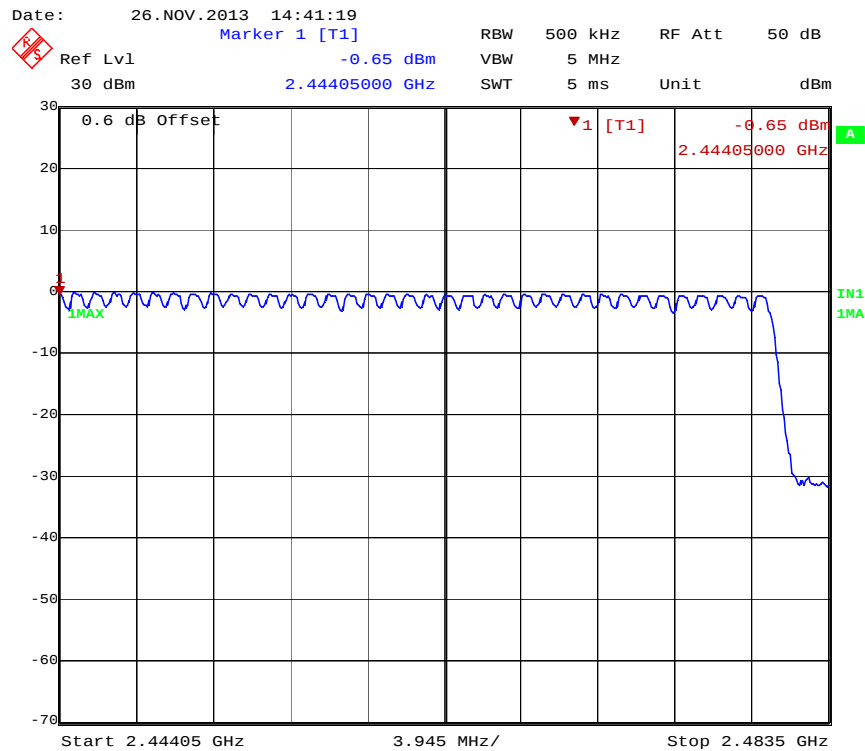
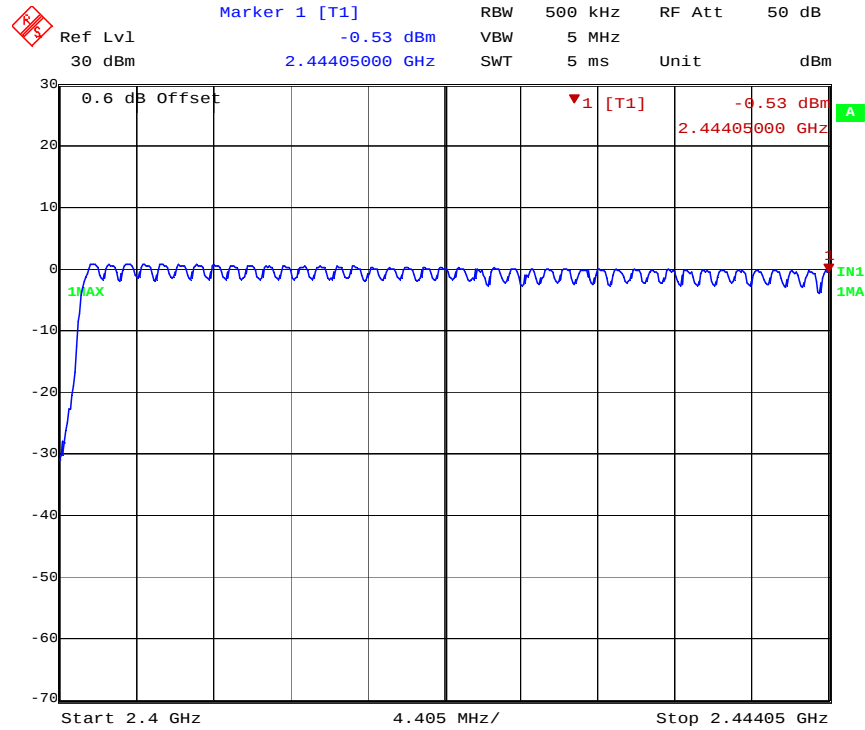
Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	3720	Rohde&Schwarz	FSEK30	9/10/2013	9/10/2014

7.4 Results:

The plot below shows that there are 79 hopping frequencies channels being used.

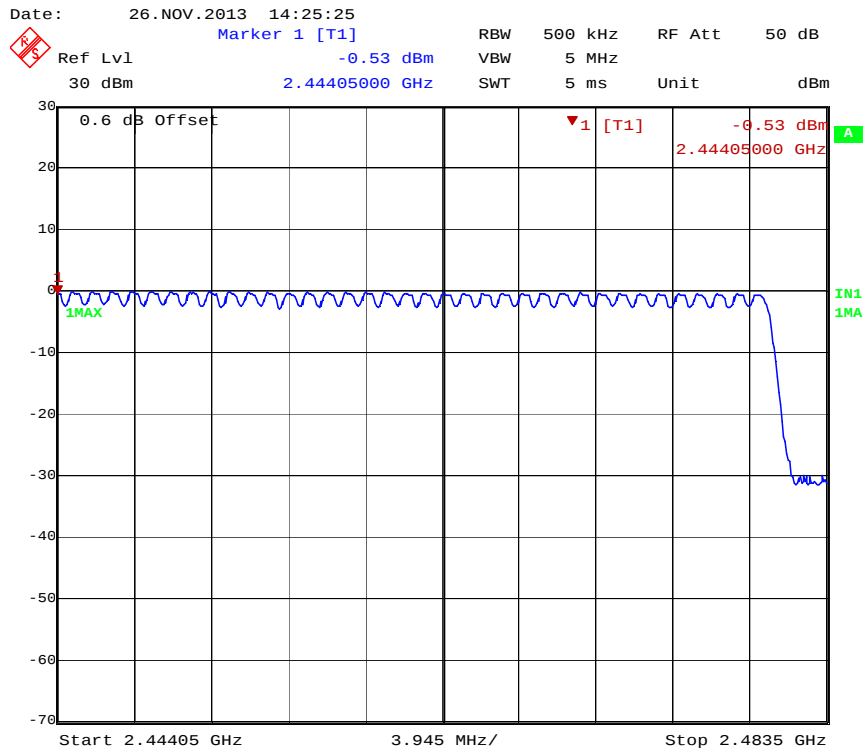
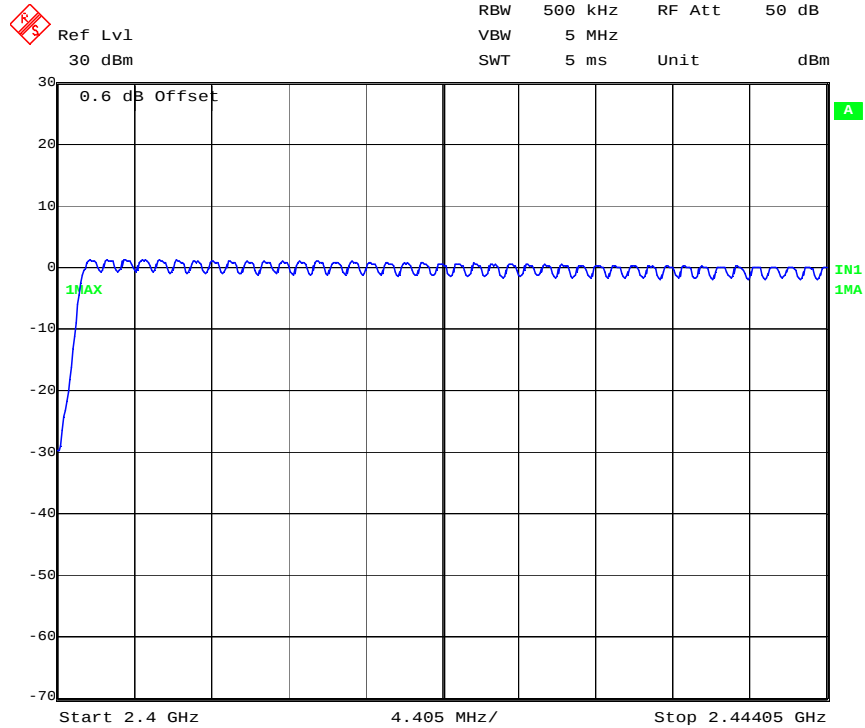


Number of Hopping Frequencies (1Mbps)



Date: 26.NOV.2013 14:35:18

Number of Hopping Frequencies (2Mbps)



Number of Hopping Frequencies (3Mbps)

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: 2009 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
Spectrum Analyzer	3720	Rohde&Schwarz	FSEK30	9/10/2013	9/10/2014

8.4 Results:

The total "on" time over the measurement period is less than the 400mS limit.

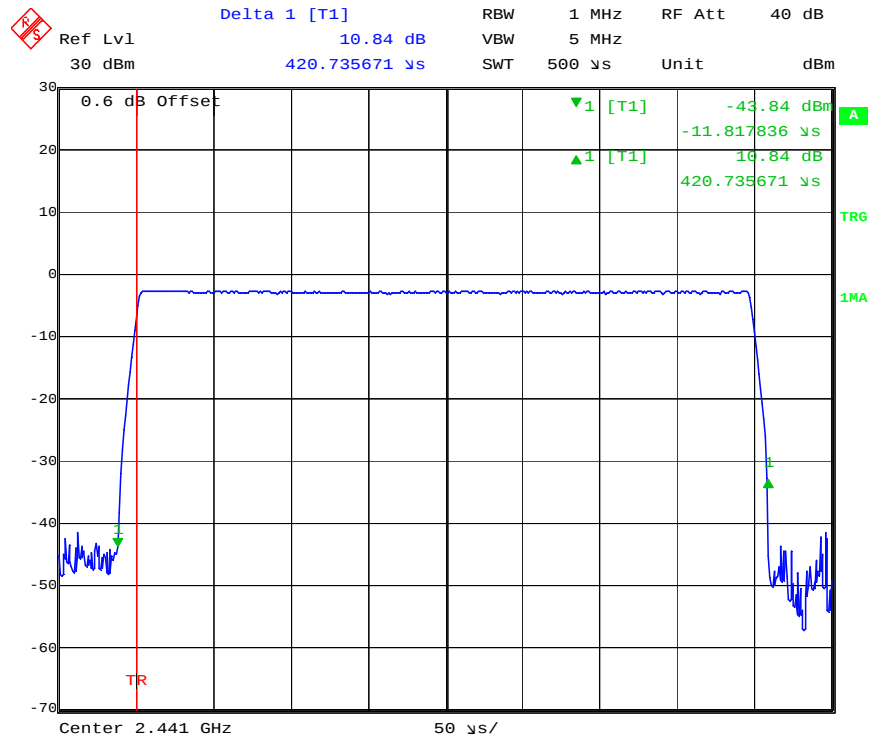
Measurement Period Calculation

Number of Hopping Channels Used = 79
 Measurement Period = $0.4 \times N$
 Measurement Period = 0.4×79
 Measurement Period = 31.6 seconds

Time of Occupancy Calculation¹

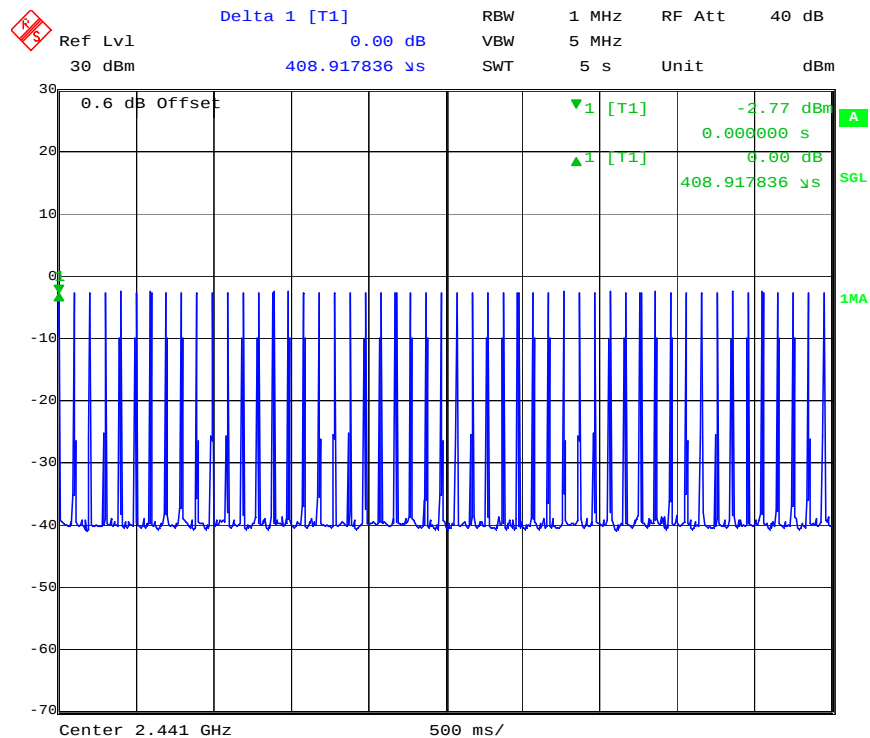
Mode	Number of Transmissions in a 31.6sec Frame (79 Hopping Ch x 0.4)	Transmission Single Pulse On Time (mS)	Result (mS)	Limit (mS)
1Mbps	$51 (\text{times in 5sec}) * (31.6\text{sec} / 5\text{sec}) = 322.32$	0.420	135.37	400
2Mbps	$103(\text{times in 5sec}) * (31.6\text{sec} / 5\text{sec}) = 650.96$	0.328	213.5	400
3Mbps	$103(\text{times in 5sec}) * (31.6\text{sec} / 5\text{sec}) = 650.96$	0.287	186.8	400

¹ Time of occupancy = Transmission Single Pulse On Time x Number of Transmissions in a 31.6 Second Frame



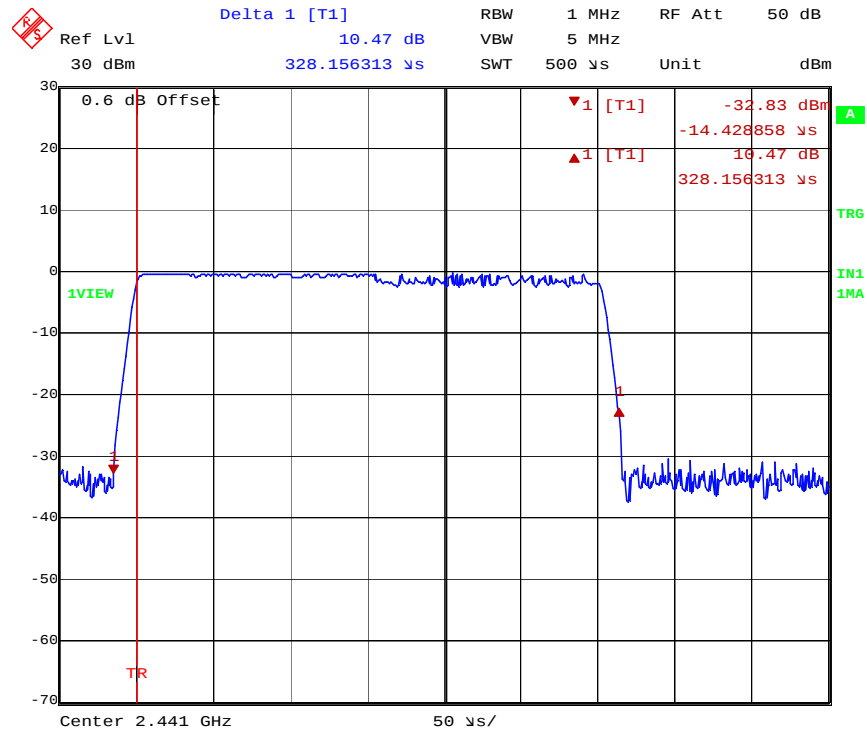
Date: 4.NOV.2013 17:33:48

Channel Occupancy Time (1Mbps)



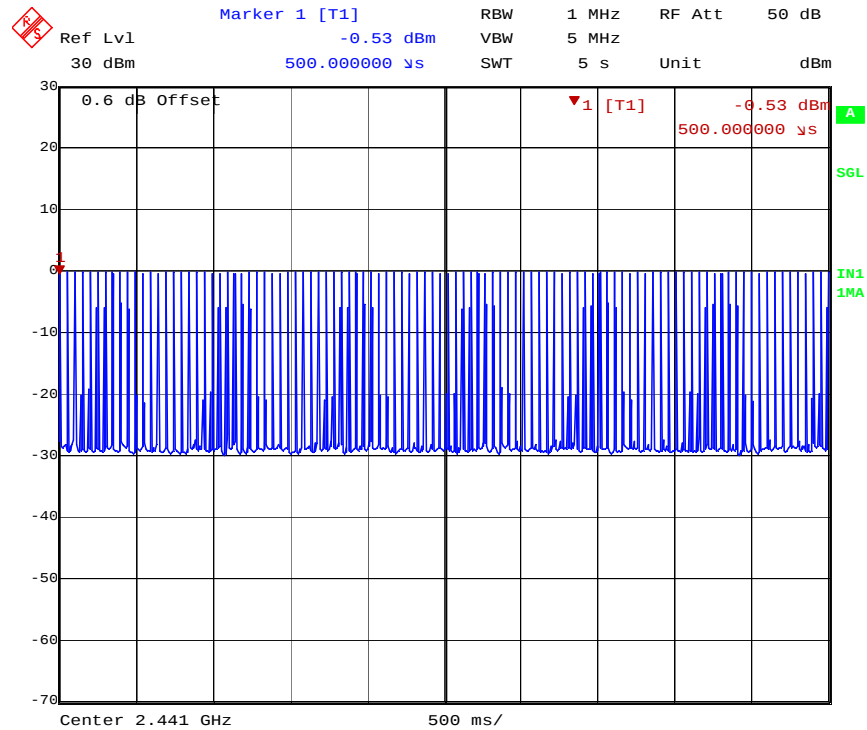
Date: 4.NOV.2013 17:36:26

Number of Transmissions in 5 Seconds (1Mbps)



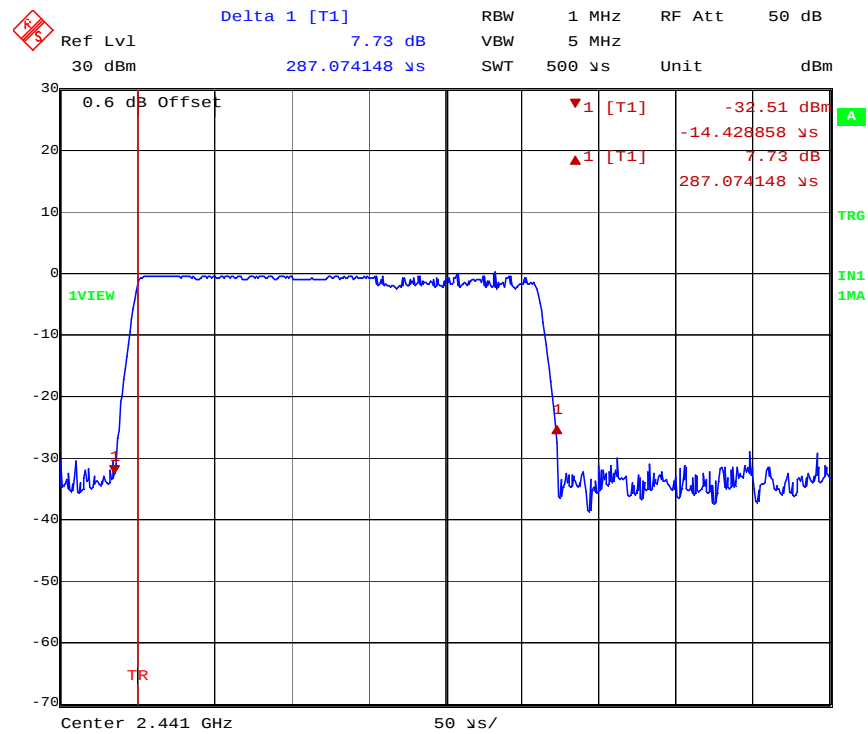
Date: 26.NOV.2013 14:52:41

Channel Occupancy Time (2Mbps)



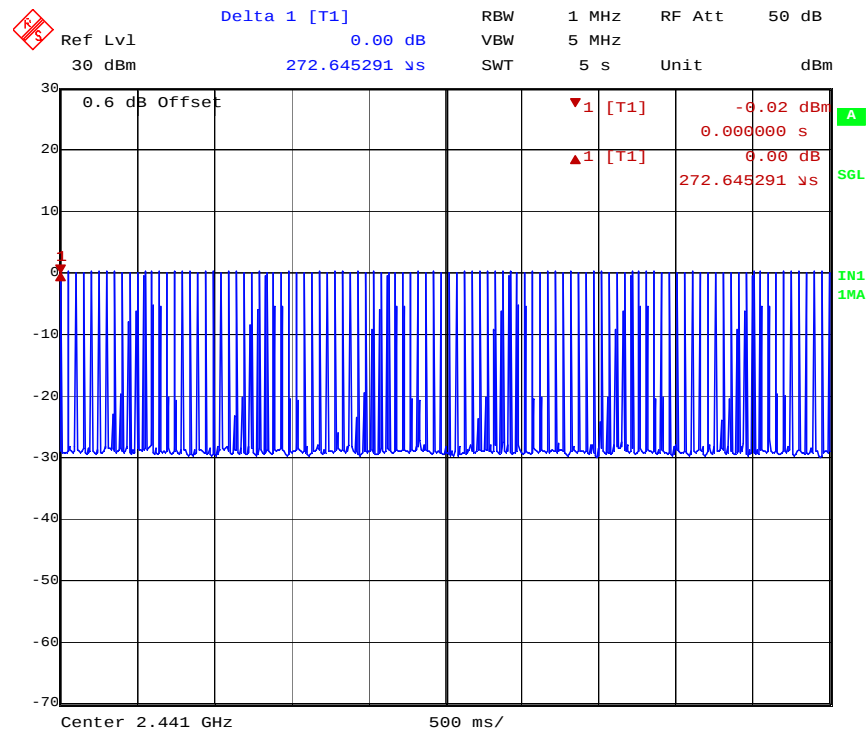
Date: 26.NOV.2013 14:48:51

Number of Transmissions in 5 Seconds (2Mbps)



Date: 26.NOV.2013 14:58:32

Channel Occupancy Time (3Mbps)



Date: 26.NOV.2013 15:01:18

Number of Transmissions in 5 Seconds (3Mbps)

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

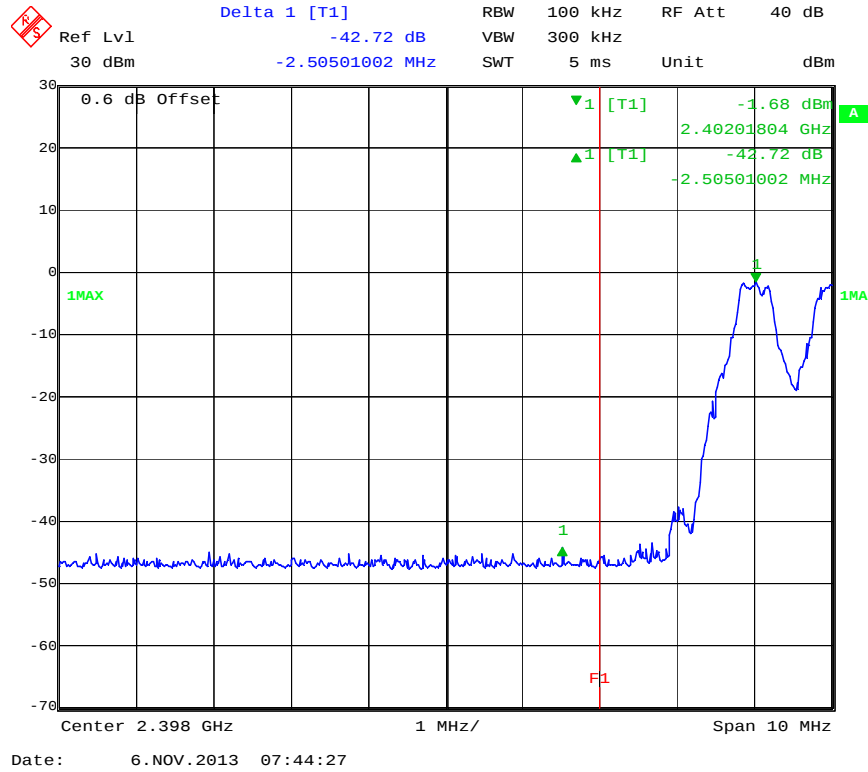
ANSI C63.10: 2009 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

9.3 Test Equipment Used:

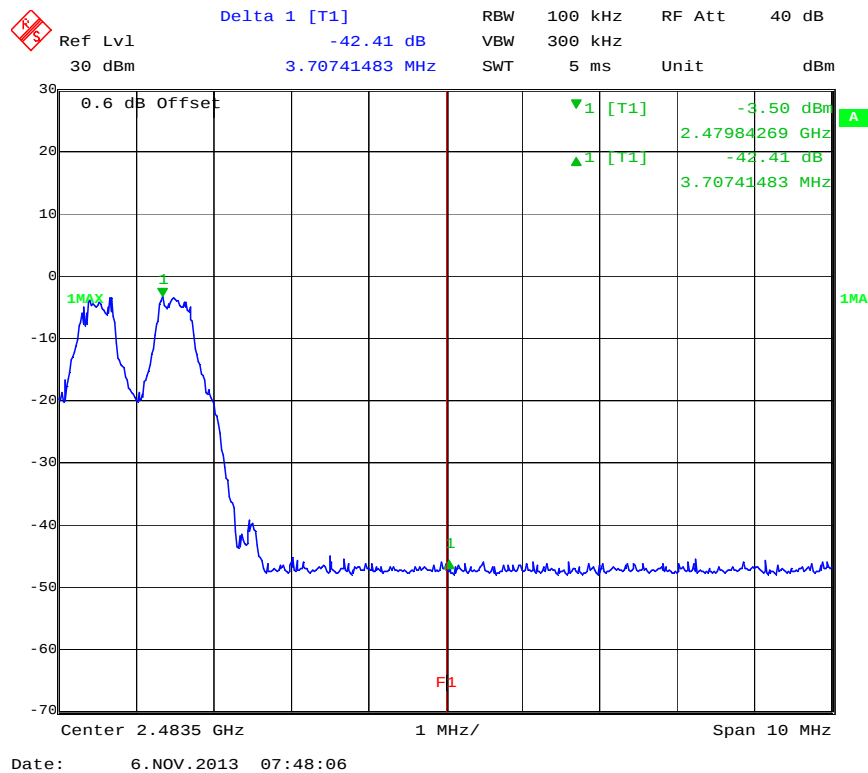
Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	3720	Rohde&Schwarz	FSEK30	9/10/2013	9/10/2014

9.4 Results:

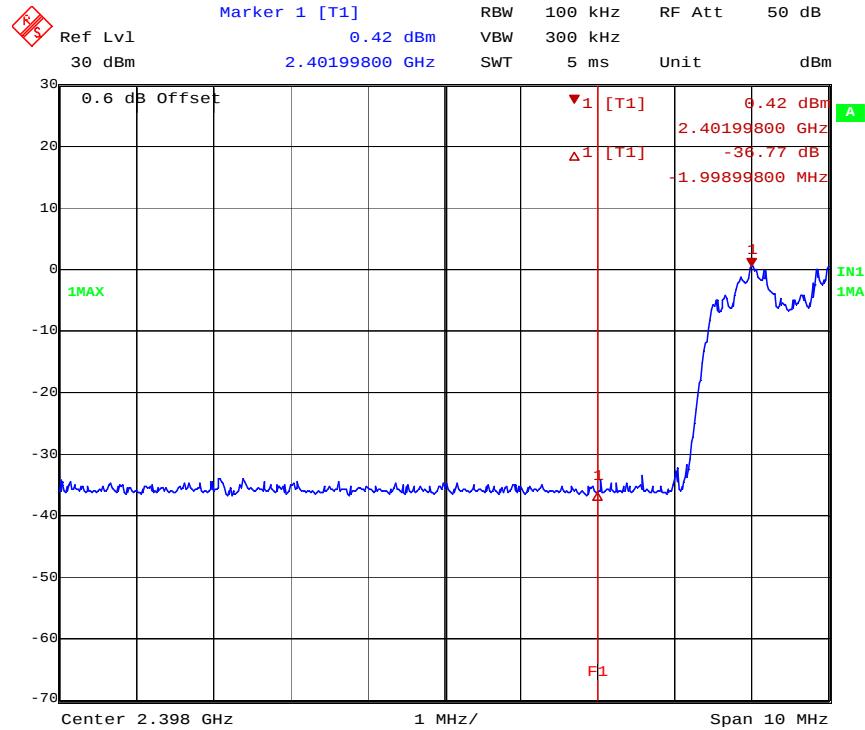
The following plots show that there are no conducted spurious emissions exceeding the 20dB down criteria. Plots are also presented showing the band edge compliance with the band edge centered on the analyzer display.



Conducted Band Edge Low Channel (1Mbps)

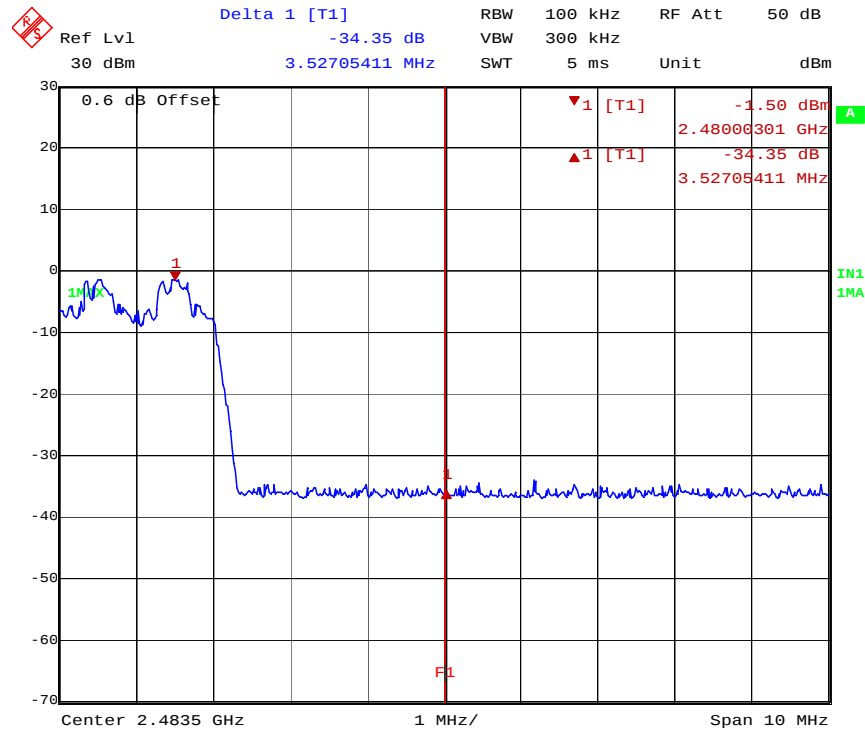


Conducted Band Edge High Channel (1Mbps)



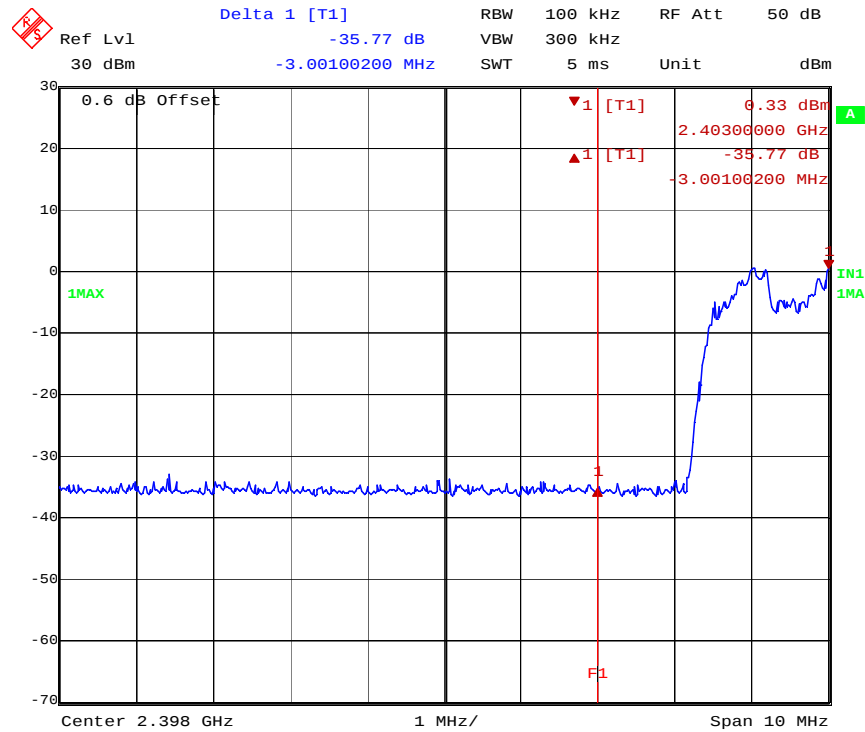
Date: 26.NOV.2013 15:19:45

Conducted Band Edge Low Channel (2Mbps)



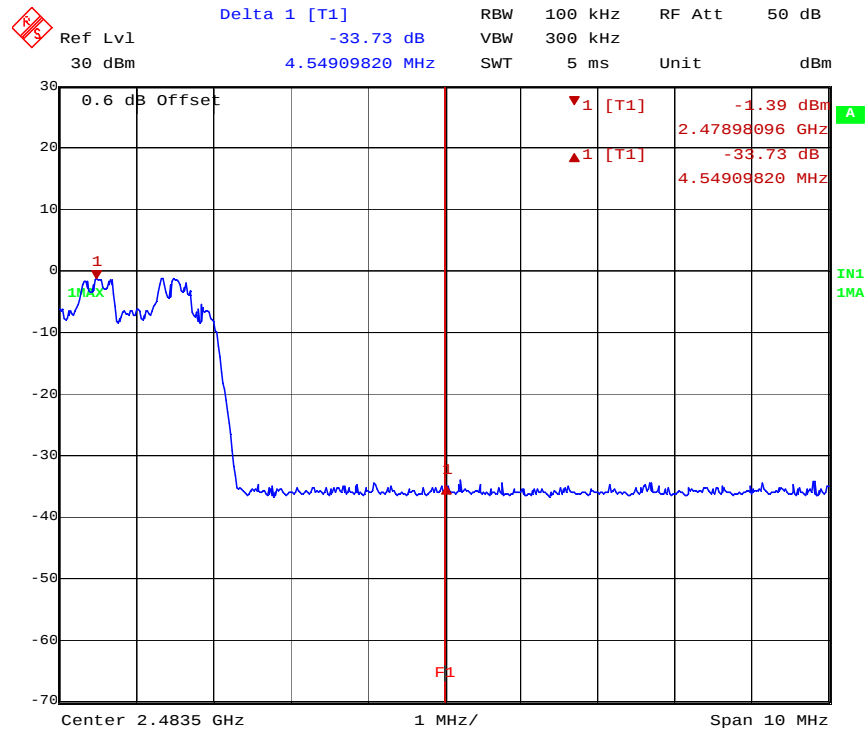
Date: 26.NOV.2013 15:24:09

Conducted Band Edge High Channel (2Mbps)



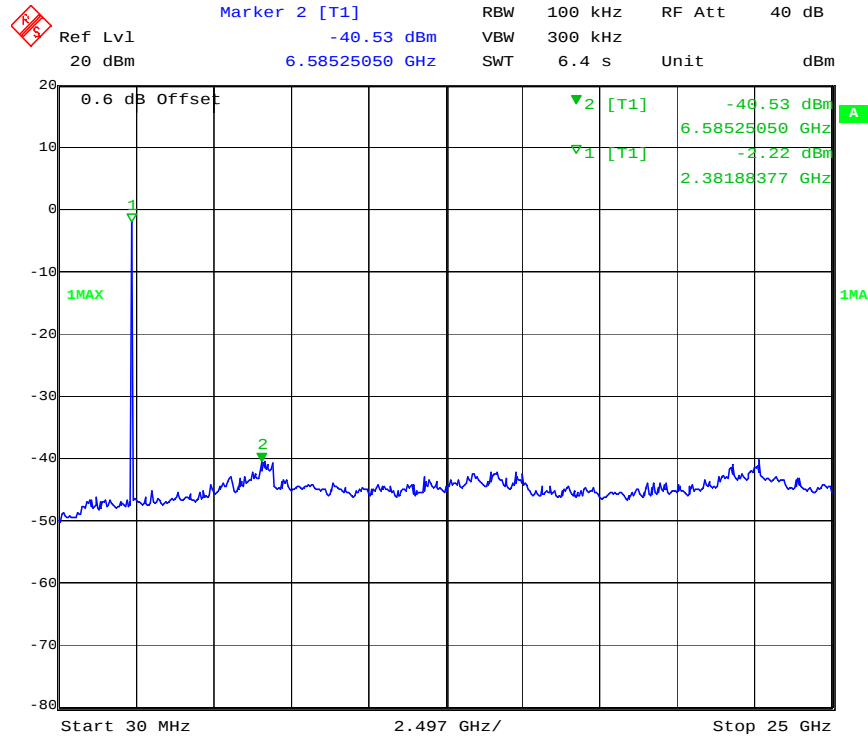
Date: 26.NOV.2013 15:13:29

Conducted Band Edge Low Channel (3Mbps)



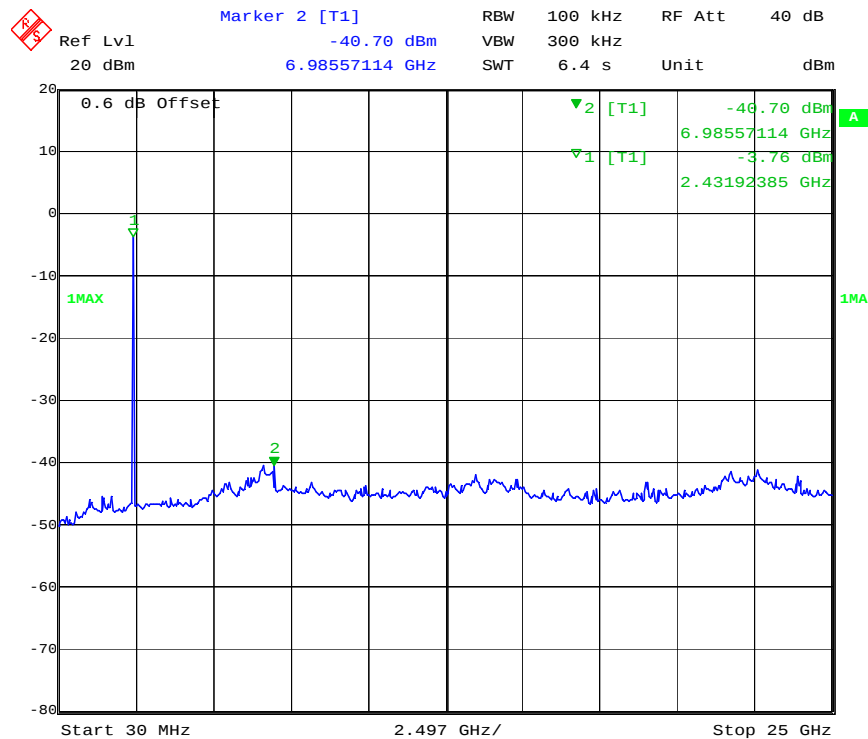
Date: 26.NOV.2013 15:33:06

Conducted Band Edge High Channel (3Mbps)



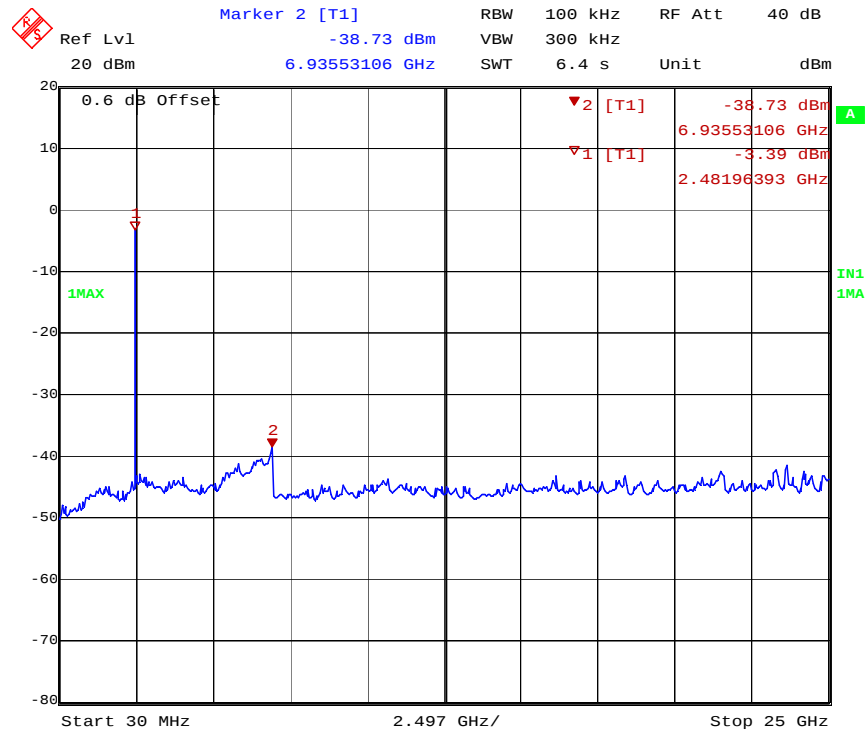
Date: 6.NOV.2013 07:54:06

Conducted Spurious Emissions (Low Channel, 1Mbps)



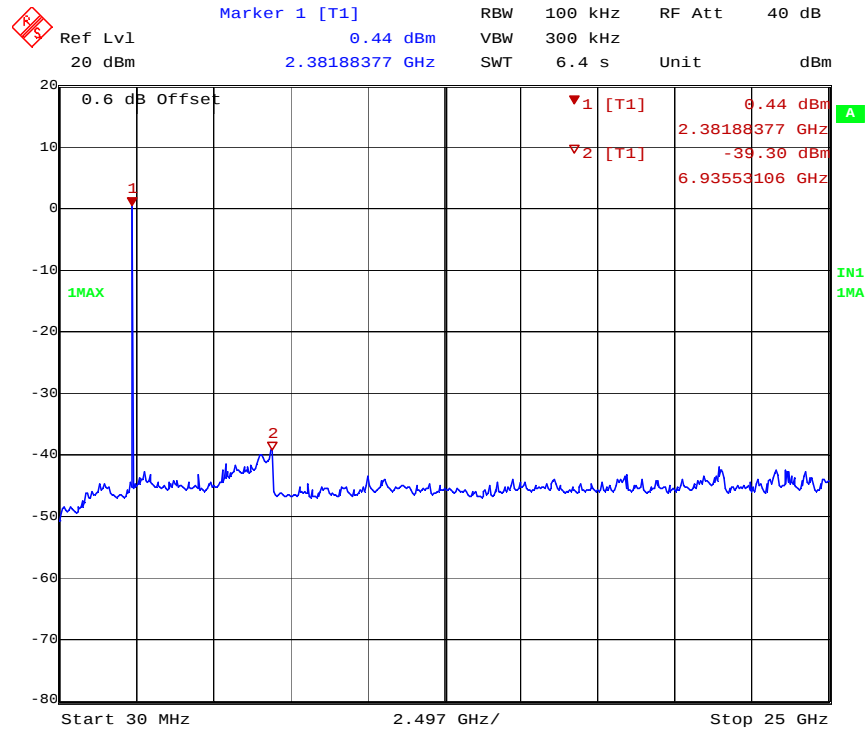
Date: 6.NOV.2013 07:58:44

Conducted Spurious Emissions (Mid Channel, 1Mbps)



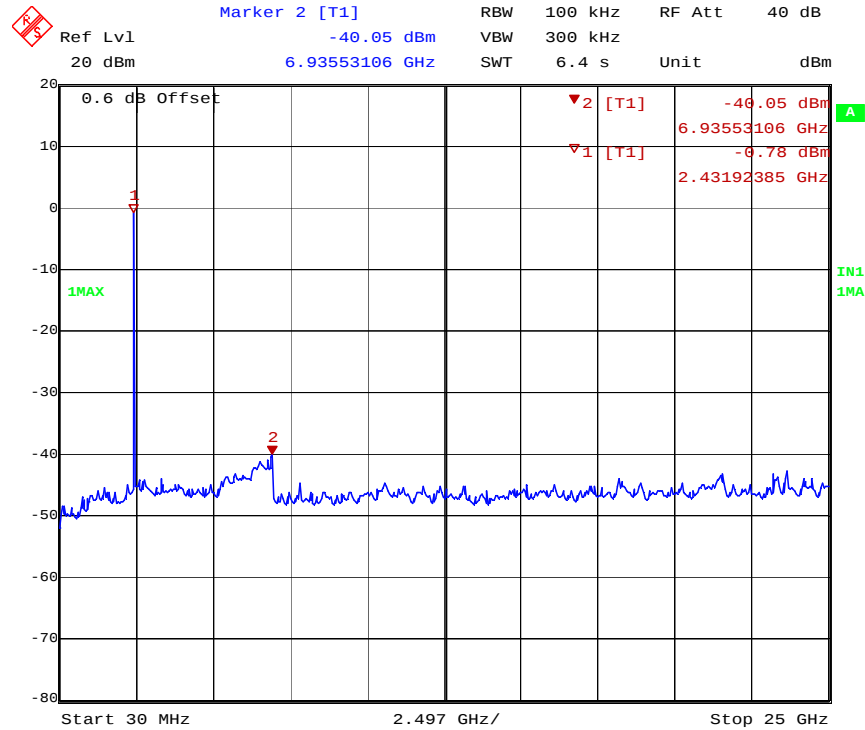
Date: 26.NOV.2013 15:46:59

Conducted Spurious Emissions (High Channel, 1Mbps)



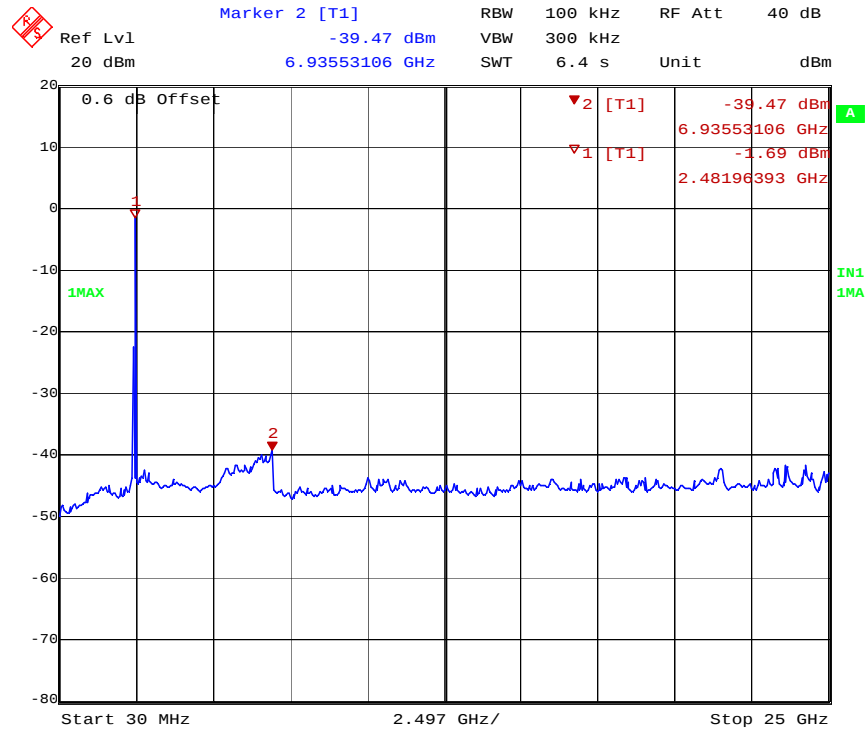
Date: 26.NOV.2013 15:54:45

Conducted Spurious Emissions (Low Channel, 2Mbps)



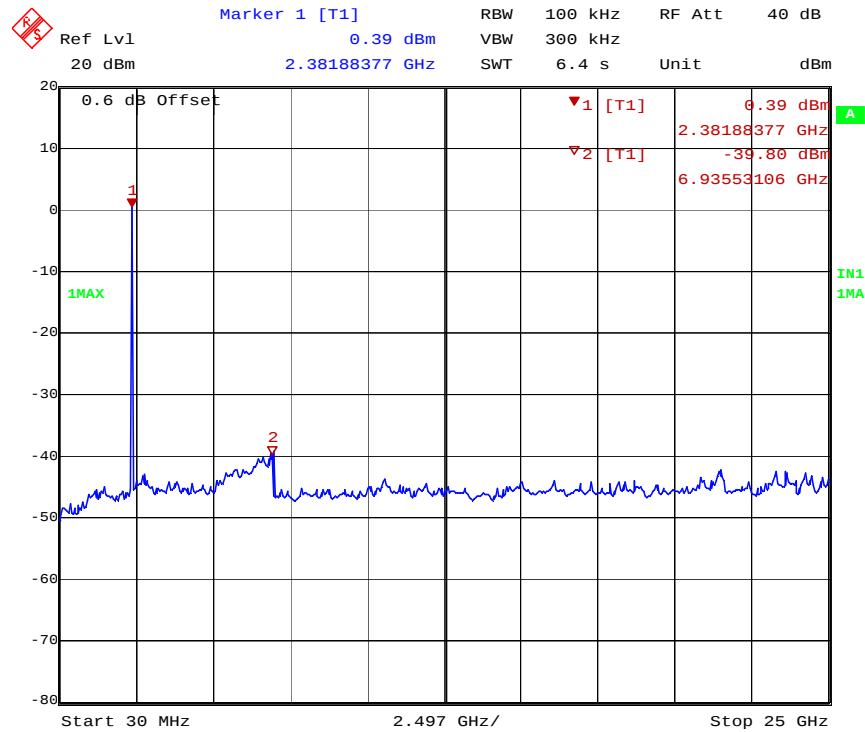
Date: 26.NOV.2013 15:56:19

Conducted Spurious Emissions (Mid Channel, 2Mbps)



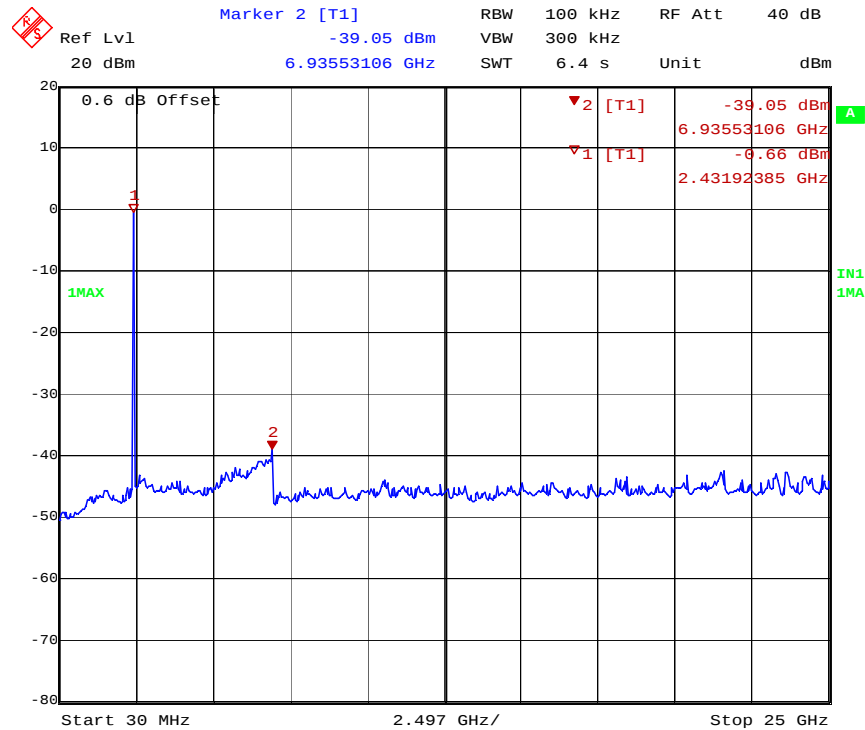
Date: 26.NOV.2013 16:05:26

Conducted Spurious Emissions (High Channel, 2Mbps)



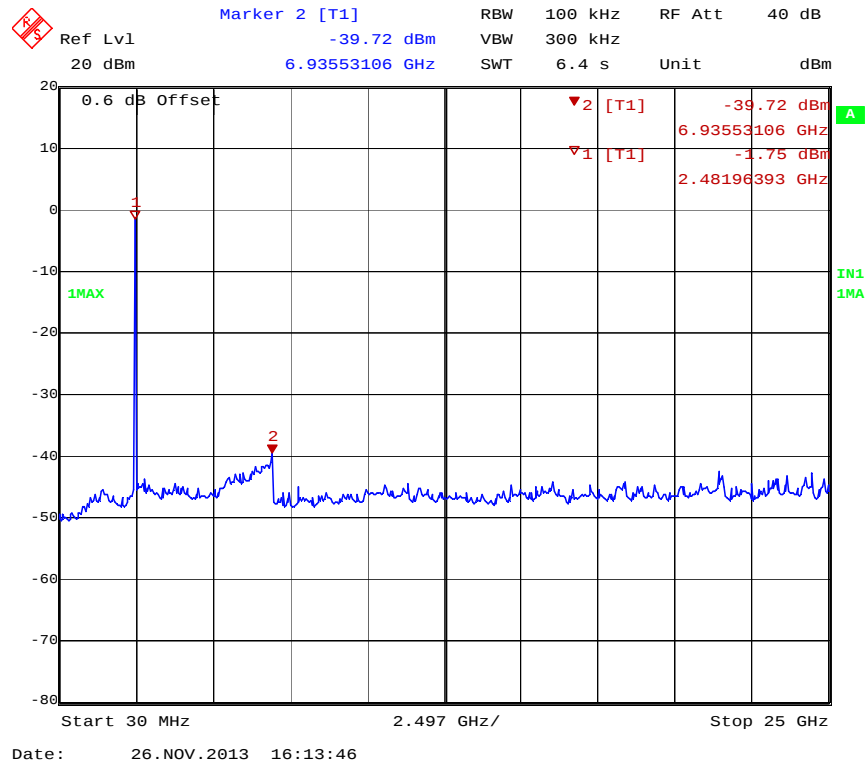
Date: 26.NOV.2013 16:09:41

Conducted Spurious Emissions (Low Channel, 3Mbps)



Date: 26.NOV.2013 16:12:15

Conducted Spurious Emissions (Mid Channel, 3Mbps)



Conducted Spurious Emissions (High Channel, 3Mbps)

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: 2009 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 dB μ V

AF = 18.52 dB

CF = 0.78 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	9/11/2013	9/11/2014
Preamplifier	987410	Miteq	AFS44-00102000-30-10P-44	9/11/2013	9/11/2014
Preamplifier	SF456200904	Mini-Circuits	ZX60-3018G-S+	9/11/2013	9/11/2014
Biconnilog Antenna	00051864	ETS	3142C	12/14/2012	12/14/2013
Horn Antenna	00156319	ETS	3117	4/24/2013	4/24/2014
Horn Antenna	00117798	ETS	3116C	4/24/2013	4/24/2014
System Controller	121701-1	Sunol Sciences	SC99V	Calibration Not Required	Calibration Not Required
High Pass Filter	3986-01 DC0408	Microwave Circuits, Inc.	H3G020G2	Calibrate at Time Of Use	Calibrate at Time Of Use
Band Reject filter	155	Micro-Tronics	BRM50702	Calibrate at Time Of Use	Calibrate at Time Of Use

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 tables are the worst case emissions. Emissions not reported were at or below the measurement noise floor. The test sample was evaluated on three orthogonal axes since it was a hand held device and could be used in any orientation. No significant emissions below 1GHz were found in any of the restricted bands.

Worst Case Spurious Measurements (GFSK, Low Channel)

Radiated Emissions										
Test Engineer:	Bryan Taylor	Start Date:	11/8/2013	End Date:	11/8/2013					
Temperature:	23.9C	Humidity:	52.10%	Pressure:	989.7mBar					
Specification:	FCC Part 15C	Test Limit:	Class B							
Notes:	Emissions Above 1GHz Falling in Restricted Bands. BT, Low Channel.									
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.804 GHz	V	42.29	-31.121	34.7	45.869	74	-28.131	1MHz / Pk	3m	Compliant
7.206 GHz	V	32.37	-26.759	35.935	41.546	74	-32.454	1MHz / Pk	3m	Compliant
9.608 GHz	V	28.99	-22.524	37.273	43.739	74	-30.261	1MHz / Pk	3m	Compliant
12.01 GHz	V	29.76	-22.691	39.592	46.661	74	-27.339	1MHz / Pk	3m	Compliant
4.804 GHz	V	32.54	-31.121	34.7	36.119	54	-17.861	1MHz / Avg	3m	Compliant
7.206 GHz	V	22.38	-26.759	35.935	31.556	54	-22.424	1MHz / Avg	3m	Compliant
9.608 GHz	V	20.01	-22.524	37.273	34.759	54	-19.221	1MHz / Avg	3m	Compliant
12.01 GHz	V	20.26	-22.691	39.592	37.161	54	-16.819	1MHz / Avg	3m	Compliant
4.8042 GHz	H	39.85	-31.121	34.7	43.429	74	-30.571	1MHz / Pk	3m	Compliant
7.206 GHz	H	31.42	-26.759	35.935	40.596	74	-33.404	1MHz / Pk	3m	Compliant
9.608 GHz	H	29.5	-22.524	37.273	44.249	74	-29.751	1MHz / Pk	3m	Compliant
12.01 GHz	H	29.63	-22.691	39.592	46.531	74	-27.469	1MHz / Pk	3m	Compliant
4.8042 GHz	H	32.56	-31.121	34.7	36.139	54	-17.841	1MHz / Avg	3m	Compliant
7.206 GHz	H	21.52	-26.759	35.935	30.696	54	-23.284	1MHz / Avg	3m	Compliant
9.608 GHz	H	19.29	-22.524	37.273	34.039	54	-19.941	1MHz / Avg	3m	Compliant
12.01 GHz	H	19.57	-22.691	39.592	36.471	54	-17.509	1MHz / Avg	3m	Compliant
Restricted Band Edge Measurements Below										
2.39 GHz	V	11.55	10.584	32.944	55.078	74	-18.922	1MHz / Pk	3m	Compliant
2.39 GHz	V	2.24	10.584	32.944	45.768	54	-8.232	1MHz / Avg	3m	Compliant
2.39 GHz	H	12.08	10.584	32.944	55.608	74	-18.392	1MHz / Pk	3m	Compliant
2.39 GHz	H	2.24	10.584	32.944	45.768	54	-8.232	1MHz / Avg	3m	Compliant

Worst Case Spurious Measurements (GFSK, Middle Channel)

Radiated Emissions										
Test Engineer:	Bryan Taylor	Start Date:	11/8/2013	End Date:	11/8/2013					
Temperature:	23.9C	Humidity:	52.10%	Pressure:	989.7mBar					
Specification:	FCC Part 15C	Test Limit:	Class B							
Notes:	Emissions Above 1GHz Falling in Restricted Bands. BT, Middle Channel.									
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.882 GHz	V	43.21	-31.109	34.7	46.801	74	-27.199	1MHz / Pk	3m	Compliant
7.323 GHz	V	25.87	-26.514	35.9	35.256	74	-38.744	1MHz / Pk	3m	Compliant
9.764 GHz	V	23.75	-22.528	37.522	38.744	74	-35.256	1MHz / Pk	3m	Compliant
12.205 GHz	V	29.12	-22.561	39.436	45.995	74	-28.005	1MHz / Pk	3m	Compliant
4.882 GHz	V	33.57	-31.109	34.7	37.161	54	-16.819	1MHz / Avg	3m	Compliant
7.323 GHz	V	22.21	-26.514	35.9	31.596	54	-22.384	1MHz / Avg	3m	Compliant
9.764 GHz	V	19.62	-22.528	37.522	34.614	54	-19.366	1MHz / Avg	3m	Compliant
12.205 GHz	V	19.69	-22.561	39.436	36.565	54	-17.415	1MHz / Avg	3m	Compliant
4.8817 GHz	H	45.6	-31.109	34.7	49.191	74	-24.809	1MHz / Pk	3m	Compliant
7.323 GHz	H	33.75	-26.514	35.9	43.136	74	-30.864	1MHz / Pk	3m	Compliant
9.764 GHz	H	30.14	-22.528	37.522	45.134	74	-28.866	1MHz / Pk	3m	Compliant
12.205 GHz	H	30.65	-22.561	39.436	47.525	74	-26.475	1MHz / Pk	3m	Compliant
4.8817 GHz	H	31.8	-31.109	34.7	35.391	54	-18.589	1MHz / Avg	3m	Compliant
7.323 GHz	H	23.29	-26.514	35.9	32.676	54	-21.304	1MHz / Avg	3m	Compliant
9.764 GHz	H	20.23	-22.528	37.522	35.224	54	-18.756	1MHz / Avg	3m	Compliant
12.205 GHz	H	20.21	-22.561	39.436	37.085	54	-16.895	1MHz / Avg	3m	Compliant
Calculations:					F = C + D + E		H = F - G			

Worst Case Spurious Measurements (GFSK, High Channel)

Radiated Emissions										
Test Engineer:	Bryan Taylor	Start Date:	11/8/2013	End Date:	11/8/2013					
Temperature:	23.9C	Humidity:	52.10%	Pressure:	989.7mBar					
Specification:	FCC Part 15C	Test Limit:	Class B							
Notes:	Emissions Above 1GHz Falling in Restricted Bands. BT, High Channel.									
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.96 GHz	V	42.42	-31.085	34.7	46.035	74	-27.965	1MHz / Pk	3m	Compliant
7.44 GHz	V	30.27	-26.387	35.9	39.783	74	-34.217	1MHz / Pk	3m	Compliant
9.92 GHz	V	27.51	-22.51	37.772	42.772	74	-31.228	1MHz / Pk	3m	Compliant
12.4 GHz	V	29.24	-22.309	39.34	46.271	74	-27.729	1MHz / Pk	3m	Compliant
4.96 GHz	V	31.29	-31.085	34.7	34.905	54	-19.075	1MHz / Avg	3m	Compliant
7.44 GHz	V	21.28	-26.387	35.9	30.793	54	-23.187	1MHz / Avg	3m	Compliant
9.92 GHz	V	18.88	-22.51	37.772	34.142	54	-19.838	1MHz / Avg	3m	Compliant
12.4 GHz	V	18.94	-22.309	39.34	35.971	54	-18.009	1MHz / Avg	3m	Compliant
4.96 GHz	H	49.22	-31.085	34.7	52.835	74	-21.165	1MHz / Pk	3m	Compliant
7.44 GHz	H	31.02	-26.387	35.9	40.533	74	-33.467	1MHz / Pk	3m	Compliant
9.92 GHz	H	28.74	-22.51	37.772	44.002	74	-29.998	1MHz / Pk	3m	Compliant
12.4 GHz	H	28.38	-22.309	39.34	45.411	74	-28.589	1MHz / Pk	3m	Compliant
4.96 GHz	H	37.41	-31.085	34.7	41.025	54	-12.955	1MHz / Avg	3m	Compliant
7.44 GHz	H	21.08	-26.387	35.9	30.593	54	-23.387	1MHz / Avg	3m	Compliant
9.92 GHz	H	18.86	-22.51	37.772	34.122	54	-19.858	1MHz / Avg	3m	Compliant
12.4 GHz	H	19	-22.309	39.34	36.031	54	-17.949	1MHz / Avg	3m	Compliant
Restricted Band Edge Measurements Below										
2.4835 GHz	V	13.75	10.794	32.907	57.45	74	-16.55	1MHz / Pk	3m	Compliant
2.4835 GHz	V	2.55	10.794	32.907	46.25	54	-7.75	1MHz / Avg	3m	Compliant
2.4835 GHz	H	11.42	10.794	32.907	55.12	74	-18.88	1MHz / Pk	3m	Compliant
2.4835 GHz	H	2.55	10.794	32.907	46.25	54	-7.75	1MHz / Avg	3m	Compliant
Calculations:					F = C + D + E		H = F - G			

Worst Case Spurious Measurements (Pi/4 DPSK, Low Channel)

Radiated Emissions										
Test Engineer:	Bryan Taylor		Start Date:	11/26/2013		End Date:	11/26/2013			
Temperature:	23.9C		Humidity:	52.10%		Pressure:	989.7mBar			
Specification:	FCC Part 15C		Test Limit:	Class B		Mod:	Pi/4DPSK			
Notes:	Emissions Above 1GHz Falling in Restricted Bands. BT, Low Channel.									
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.804 GHz	V	33.33	-23.998	34.7	44.032	74	-29.968	1MHz / Pk	3m	Compliant
7.206 GHz	V	31.17	-22.5	35.935	44.605	74	-29.395	1MHz / Pk	3m	Compliant
9.608 GHz	V	30.4	-20.096	37.273	47.577	74	-26.423	1MHz / Pk	3m	Compliant
12.01 GHz	V	28.89	-20.197	39.592	48.285	74	-25.715	1MHz / Pk	3m	Compliant
4.804 GHz	V	22.5	-23.998	34.7	33.202	54	-20.798	1MHz / Avg	3m	Compliant
7.206 GHz	V	21.23	-22.5	35.935	34.665	54	-19.335	1MHz / Avg	3m	Compliant
9.608 GHz	V	19.94	-20.096	37.273	37.117	54	-16.883	1MHz / Avg	3m	Compliant
12.01 GHz	V	19.05	-20.197	39.592	38.445	54	-15.555	1MHz / Avg	3m	Compliant
4.804 GHz	H	32.77	-23.998	34.7	43.472	74	-30.528	1MHz / Pk	3m	Compliant
7.206 GHz	H	30.32	-22.5	35.935	43.755	74	-30.245	1MHz / Pk	3m	Compliant
9.608 GHz	H	29.18	-20.096	37.273	46.356	74	-27.644	1MHz / Pk	3m	Compliant
12.01 GHz	H	27.91	-20.197	39.592	47.305	74	-26.695	1MHz / Pk	3m	Compliant
4.804 GHz	H	22.24	-23.998	34.7	32.942	54	-21.058	1MHz / Avg	3m	Compliant
7.206 GHz	H	21.21	-22.5	35.935	34.645	54	-19.355	1MHz / Avg	3m	Compliant
9.608 GHz	H	19.94	-20.096	37.273	37.116	54	-16.884	1MHz / Avg	3m	Compliant
12.01 GHz	H	19.05	-20.197	39.592	38.445	54	-15.555	1MHz / Avg	3m	Compliant
Restricted Band Edge Measurements Below										
2.39 GHz	V	23.13	4.673	32.944	60.747	74	-13.253	1MHz / Pk	3m	Compliant
2.39 GHz	V	13.11	4.673	32.944	50.727	54	-3.273	1MHz / Avg	3m	Compliant
2.39 GHz	H	20.9	4.673	32.944	58.517	74	-15.483	1MHz / Pk	3m	Compliant
2.39 GHz	H	13.1	4.673	32.944	50.717	54	-3.283	1MHz / Avg	3m	Compliant
Calculations:		F = C + D + E H = F - G								

Worst Case Spurious Measurements (Pi/4 DPSK, Mid Channel)

Radiated Emissions										
Test Engineer:	Bryan Taylor		Start Date:	11/26/2013		End Date:	11/26/2013			
Temperature:	23.9C		Humidity:	52.10%		Pressure:	989.7mBar			
Specification:	FCC Part 15C		Test Limit:	Class B		Mod:	Pi/4DPSK			
Notes:	Emissions Above 1GHz Falling in Restricted Bands. BT, Middle Channel.									
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.882 GHz	V	30.96	-23.787	34.7	41.873	74	-32.127	1MHz / Pk	3m	Compliant
7.323 GHz	V	30.88	-22.469	35.9	44.311	74	-29.689	1MHz / Pk	3m	Compliant
9.764 GHz	V	30.07	-21.074	37.522	46.518	74	-27.482	1MHz / Pk	3m	Compliant
12.205 GHz	V	27.97	-19.932	39.436	47.474	74	-26.526	1MHz / Pk	3m	Compliant
4.882 GHz	V	21.74	-23.787	34.7	32.653	54	-21.327	1MHz / Avg	3m	Compliant
7.323 GHz	V	20.97	-22.469	35.9	34.401	54	-19.579	1MHz / Avg	3m	Compliant
9.764 GHz	V	20.05	-21.074	37.522	36.498	54	-17.482	1MHz / Avg	3m	Compliant
12.205 GHz	V	19.45	-19.932	39.436	38.954	54	-15.026	1MHz / Avg	3m	Compliant
4.8772 GHz	H	34.91	-23.745	34.7	45.865	74	-28.135	1MHz / Pk	3m	Compliant
7.323 GHz	H	29.4	-22.469	35.9	42.831	74	-31.169	1MHz / Pk	3m	Compliant
9.764 GHz	H	29.25	-21.074	37.522	45.698	74	-28.302	1MHz / Pk	3m	Compliant
12.205 GHz	H	29.29	-19.931	39.436	48.795	74	-25.205	1MHz / Pk	3m	Compliant
4.8772 GHz	H	21.78	-23.745	34.7	32.735	54	-21.245	1MHz / Avg	3m	Compliant
7.323 GHz	H	20.92	-22.469	35.9	34.351	54	-19.629	1MHz / Avg	3m	Compliant
9.764 GHz	H	19.97	-21.074	37.522	36.418	54	-17.562	1MHz / Avg	3m	Compliant
12.205 GHz	H	19.39	-19.931	39.436	38.895	54	-15.085	1MHz / Avg	3m	Compliant
Calculations:			F = C + D + E			H = F - G				

Worst Case Spurious Measurements (Pi/4 DPSK, High Channel)

Radiated Emissions										
Test Engineer:	Bryan Taylor		Start Date:	11/26/2013		End Date:	11/26/2013			
Temperature:	23.9C		Humidity:	52.10%		Pressure:	989.7mBar			
Specification:	FCC Part 15C		Test Limit:	Class B		Mod:	Pi/4DPSK			
Notes:	Emissions Above 1GHz Falling in Restricted Bands. BT, High Channel.									
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.9599 GHz	V	31.04	-23.7	34.7	42.04	74	-31.96	1MHz / Pk	3m	Compliant
7.44 GHz	V	31.36	-22.466	35.9	44.794	74	-29.206	1MHz / Pk	3m	Compliant
9.92 GHz	V	29.02	-20.716	37.772	46.076	74	-27.924	1MHz / Pk	3m	Compliant
12.4 GHz	V	29.19	-19.613	39.34	48.917	74	-25.083	1MHz / Pk	3m	Compliant
4.9599 GHz	V	22.02	-23.7	34.7	33.02	54	-20.98	1MHz / Avg	3m	Compliant
7.44 GHz	V	21.03	-22.466	35.9	34.464	54	-19.536	1MHz / Avg	3m	Compliant
9.92 GHz	V	19.76	-20.716	37.772	36.816	54	-17.184	1MHz / Avg	3m	Compliant
12.4 GHz	V	19.36	-19.613	39.34	39.087	54	-14.913	1MHz / Avg	3m	Compliant
4.96 GHz	H	32.5	-23.7	34.7	43.5	74	-30.5	1MHz / Pk	3m	Compliant
7.44 GHz	H	29.84	-22.466	35.9	43.274	74	-30.726	1MHz / Pk	3m	Compliant
9.92 GHz	H	30.05	-20.716	37.772	47.106	74	-26.894	1MHz / Pk	3m	Compliant
12.4 GHz	H	29.09	-19.613	39.34	48.817	74	-25.183	1MHz / Pk	3m	Compliant
4.96 GHz	H	21.46	-23.7	34.7	32.46	54	-21.54	1MHz / Avg	3m	Compliant
7.44 GHz	H	21.07	-22.466	35.9	34.504	54	-19.496	1MHz / Avg	3m	Compliant
9.92 GHz	H	19.82	-20.716	37.772	36.876	54	-17.124	1MHz / Avg	3m	Compliant
12.4 GHz	H	19.43	-19.613	39.34	39.157	54	-14.843	1MHz / Avg	3m	Compliant
Restricted Band Edge Measurements Below										
2.4835 GHz	V	23.53	4.773	32.907	61.21	74	-12.79	1MHz / Pk	3m	Compliant
2.4835 GHz	V	13.81	4.773	32.907	51.49	54	-2.51	1MHz / Avg	3m	Compliant
2.4835 GHz	H	22.75	4.773	32.907	60.43	74	-13.57	1MHz / Pk	3m	Compliant
2.4835 GHz	H	13.79	4.773	32.907	51.47	54	-2.53	1MHz / Avg	3m	Compliant
Calculations:				F = C + D + E			H = F - G			

Worst Case Spurious Measurements (8DPSK, Low Channel)

Radiated Emissions										
Test Engineer:	Bryan Taylor	Start Date:	11/27/2013	End Date:	11/27/2013					
Temperature:	23.9C	Humidity:	52.10%	Pressure:	989.7mBar					
Specification:	FCC Part 15C	Test Limit:	Class B	Mod:	8DPSK					
Notes:	Emissions Above 1GHz Falling in Restricted Bands. BT, Low Channel.									
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.804 GHz	V	32.39	-23.998	34.7	43.092	74	-30.908	1MHz / Pk	3m	Compliant
7.206 GHz	V	32.1	-22.5	35.935	45.535	74	-28.465	1MHz / Pk	3m	Compliant
9.608 GHz	V	30.45	-20.096	37.273	47.627	74	-26.373	1MHz / Pk	3m	Compliant
12.01 GHz	V	28.63	-20.197	39.592	48.025	74	-25.975	1MHz / Pk	3m	Compliant
4.804 GHz	V	22.42	-23.998	34.7	33.122	54	-20.858	1MHz / Avg	3m	Compliant
7.206 GHz	V	21.17	-22.5	35.935	34.605	54	-19.375	1MHz / Avg	3m	Compliant
9.608 GHz	V	19.92	-20.096	37.273	37.097	54	-16.883	1MHz / Avg	3m	Compliant
12.01 GHz	V	19.03	-20.197	39.592	38.425	54	-15.555	1MHz / Avg	3m	Compliant
4.804 GHz	H	30.96	-23.998	34.7	41.662	74	-32.338	1MHz / Pk	3m	Compliant
7.206 GHz	H	30.97	-22.5	35.935	44.405	74	-29.595	1MHz / Pk	3m	Compliant
9.608 GHz	H	30.05	-20.096	37.273	47.226	74	-26.774	1MHz / Pk	3m	Compliant
12.01 GHz	H	27.91	-20.197	39.592	47.305	74	-26.695	1MHz / Pk	3m	Compliant
4.804 GHz	H	22.19	-23.998	34.7	32.892	54	-21.088	1MHz / Avg	3m	Compliant
7.206 GHz	H	21.18	-22.5	35.935	34.615	54	-19.365	1MHz / Avg	3m	Compliant
9.608 GHz	H	19.93	-20.096	37.273	37.106	54	-16.874	1MHz / Avg	3m	Compliant
12.01 GHz	H	19.03	-20.197	39.592	38.425	54	-15.555	1MHz / Avg	3m	Compliant
Restricted Band Edge Measurements Below										
2.39 GHz	V	23.43	4.673	32.944	61.047	74	-12.953	1MHz / Pk	3m	Compliant
2.39 GHz	V	13.11	4.673	32.944	50.727	54	-3.273	1MHz / Avg	3m	Compliant
2.39 GHz	H	21.8	4.673	32.944	59.417	74	-14.583	1MHz / Pk	3m	Compliant
2.39 GHz	H	13.11	4.673	32.944	50.727	54	-3.273	1MHz / Avg	3m	Compliant
Calculations:					F = C + D + E		H = F - G			

Worst Case Spurious Measurements (8DPSK, Mid Channel)

Radiated Emissions										
Test Engineer:	Bryan Taylor	Start Date:	11/27/2013	End Date:	11/27/2013					
Temperature:	23.9C	Humidity:	52.10%	Pressure:	989.7mBar					
Specification:	FCC Part 15C	Test Limit:	Class B	Mod:	8DPSK					
Notes:	Emissions Above 1GHz Falling in Restricted Bands. BT, Middle Channel.									
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.882 GHz	V	31.58	-23.787	34.7	42.493	74	-31.507	1MHz / Pk	3m	Compliant
7.323 GHz	V	30.79	-22.469	35.9	44.221	74	-29.779	1MHz / Pk	3m	Compliant
9.764 GHz	V	30.02	-21.074	37.522	46.468	74	-27.532	1MHz / Pk	3m	Compliant
12.205 GHz	V	29.55	-19.932	39.436	49.054	74	-24.946	1MHz / Pk	3m	Compliant
4.882 GHz	V	22.07	-23.787	34.7	32.983	54	-20.997	1MHz / Avg	3m	Compliant
7.323 GHz	V	20.9	-22.469	35.9	34.331	54	-19.649	1MHz / Avg	3m	Compliant
9.764 GHz	V	20.06	-21.074	37.522	36.508	54	-17.472	1MHz / Avg	3m	Compliant
12.205 GHz	V	19.47	-19.932	39.436	38.974	54	-15.006	1MHz / Avg	3m	Compliant
4.882 GHz	H	31.21	-23.787	34.7	42.123	74	-31.877	1MHz / Pk	3m	Compliant
7.323 GHz	H	29.57	-22.469	35.9	43.001	74	-30.999	1MHz / Pk	3m	Compliant
9.764 GHz	H	30.82	-21.074	37.522	47.268	74	-26.732	1MHz / Pk	3m	Compliant
12.205 GHz	H	30.1	-19.932	39.436	49.604	74	-24.396	1MHz / Pk	3m	Compliant
4.882 GHz	H	21.69	-23.787	34.7	32.603	54	-21.377	1MHz / Avg	3m	Compliant
7.323 GHz	H	20.95	-22.469	35.9	34.381	54	-19.599	1MHz / Avg	3m	Compliant
9.764 GHz	H	20.02	-21.074	37.522	36.468	54	-17.512	1MHz / Avg	3m	Compliant
12.205 GHz	H	19.44	-19.932	39.436	38.944	54	-15.036	1MHz / Avg	3m	Compliant
Calculations:					F = C + D + E		H = F - G			

Worst Case Spurious Measurements (8DPSK, High Channel)

Radiated Emissions										
Test Engineer:	Bryan Taylor	Start Date:	11/27/2013	End Date:	11/27/2013					
Temperature:	23.9C	Humidity:	52.10%	Pressure:	989.7mBar					
Specification:	FCC Part 15C	Test Limit:	Class B	Mod:	8DPSK					
Notes:	Emissions Above 1GHz Falling in Restricted Bands. BT, High Channel.									
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
4.96 GHz	V	31.46	-23.7	34.7	42.46	74	-31.54	1MHz / Pk	3m	Compliant
7.44 GHz	V	32.31	-22.466	35.9	45.744	74	-28.256	1MHz / Pk	3m	Compliant
9.92 GHz	V	28.44	-20.716	37.772	45.496	74	-28.504	1MHz / Pk	3m	Compliant
12.4 GHz	V	27.51	-19.613	39.34	47.237	74	-26.763	1MHz / Pk	3m	Compliant
4.96 GHz	V	21.82	-23.7	34.7	32.82	54	-21.18	1MHz / Avg	3m	Compliant
7.44 GHz	V	21.04	-22.466	35.9	34.474	54	-19.526	1MHz / Avg	3m	Compliant
9.92 GHz	V	19.79	-20.716	37.772	36.846	54	-17.154	1MHz / Avg	3m	Compliant
12.4 GHz	V	19.39	-19.613	39.34	39.117	54	-14.883	1MHz / Avg	3m	Compliant
4.96 GHz	H	31.22	-23.7	34.7	42.22	74	-31.78	1MHz / Pk	3m	Compliant
7.44 GHz	H	30.62	-22.466	35.9	44.054	74	-29.946	1MHz / Pk	3m	Compliant
9.92 GHz	H	29.67	-20.716	37.772	46.726	74	-27.274	1MHz / Pk	3m	Compliant
12.4 GHz	H	28.66	-19.613	39.34	48.387	74	-25.613	1MHz / Pk	3m	Compliant
4.96 GHz	H	21.6	-23.7	34.7	32.6	54	-21.4	1MHz / Avg	3m	Compliant
7.44 GHz	H	21.04	-22.466	35.9	34.474	54	-19.526	1MHz / Avg	3m	Compliant
9.92 GHz	H	19.79	-20.716	37.772	36.846	54	-17.154	1MHz / Avg	3m	Compliant
12.4 GHz	H	19.39	-19.613	39.34	39.117	54	-14.883	1MHz / Avg	3m	Compliant
Restricted Band Edge Measurements Below										
2.4835 GHz	V	23.04	4.773	32.907	60.72	74	-13.28	1MHz / Pk	3m	Compliant
2.4835 GHz	V	13.81	4.773	32.907	51.49	54	-2.51	1MHz / Avg	3m	Compliant
2.4835 GHz	H	23.6	4.773	32.907	61.28	74	-12.72	1MHz / Pk	3m	Compliant
2.4835 GHz	H	13.79	4.773	32.907	51.47	54	-2.53	1MHz / Avg	3m	Compliant
Calculations:					F = C + D + E		H = F - G			

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: 2009

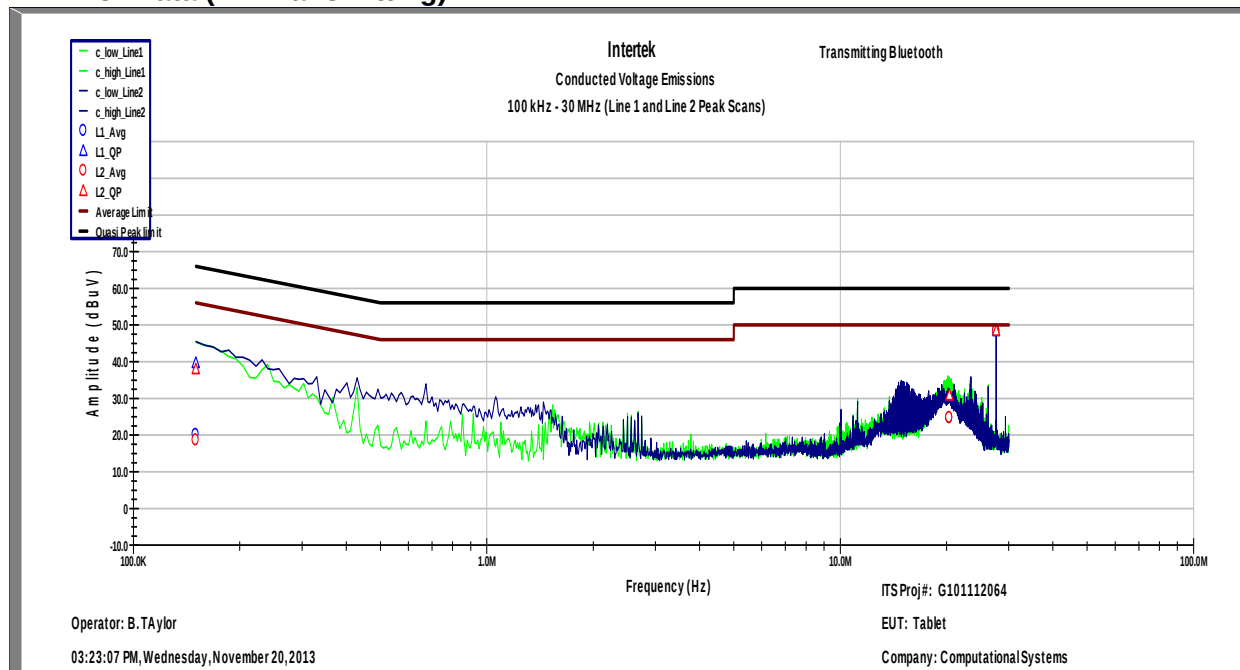
11.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ES126	9/11/2013	9/11/2014
LISN	3333	Teseq	NNB52	3/11/2013	3/11/2014

11.4 Results:

The sample tested was found to Comply.

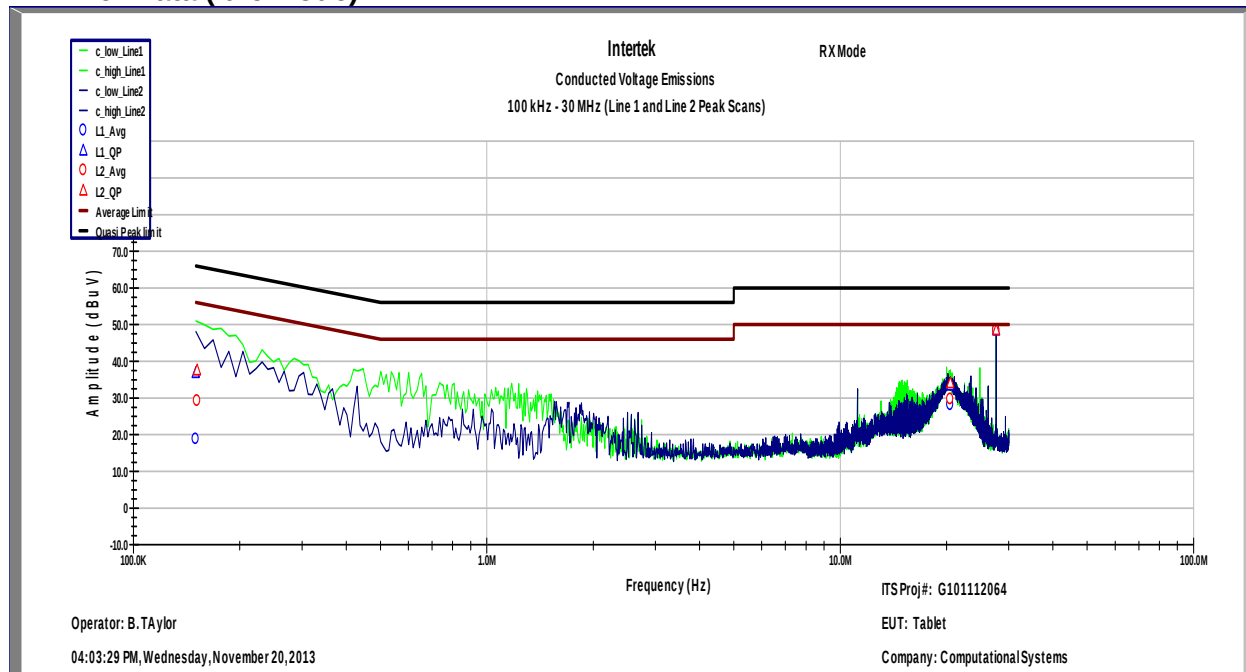
11.5 Data (BT Transmitting):



Conducted Voltage Emissions on Power Lines								
Test Engineer:	Bryan Taylor		Start Date:	11/20/2013		End Date:	11/20/2013	
Temperature:	23.6C		Humidity:	45.20%		Pressure:	988.9mBar	
Specification:	FCC Part 15C		Test Limit:	Class B		RBW:	9kHz	
Notes:	Bluetooth Transmitting							
Line	Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Delta (dB)	Average (dBuV)	Average Limit (dBuV)	Average Delta (dB)	Results
Line 1	150.0 KHz	39.58	66	-26.42	20.17	56	-35.83	Compliant
Line 1	20.364 MHz	30.58	60	-29.42	24.59	50	-25.41	Compliant
Line 1	27.636 MHz	48.33	60	-11.67	48.28	50	-1.72	Compliant
Line 2	150.0 KHz	37.9	66	-28.1	18.58	56	-37.42	Compliant
Line 2	20.364 MHz	30.77	60	-29.23	24.67	50	-25.33	Compliant
Line 2	27.636 MHz	48.4	60	-11.6	48.33	50	-1.67	Compliant

Deviations, Additions, or Exclusions: None

11.6 Data (Idle Mode):



Conducted Voltage Emissions on Power Lines								
Test Engineer:	Bryan Taylor	Start Date:		11/20/2013	End Date:		11/20/2013	
Temperature:	23.6C	Humidity:		45.20%	Pressure:		988.9mBAR	
Specification:	FCC Part 15C	Test Limit:		Class B	RBW:		9kHz	
Notes:	RX							
Line	Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Delta (dB)	Average (dBuV)	Average Limit (dBuV)	Average Delta (dB)	Results
Line 1	150.0 KHz	36.81	66	-29.19	18.76	56	-37.24	Compliant
Line 1	20.49 MHz	33.45	60	-26.55	28.09	50	-21.91	Compliant
Line 1	27.636 MHz	48.41	60	-11.59	48.34	50	-1.66	Compliant
Line 2	151.3 KHz	37.5	65.93	-28.43	29.13	55.93	-26.8	Compliant
Line 2	20.49 MHz	34.03	60	-25.97	29.56	50	-20.44	Compliant
Line 2	27.636 MHz	48.51	60	-11.49	48.45	50	-1.55	Compliant

Deviations, Additions, or Exclusions: None

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 used was permanently attached and integral to the PCB.

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
1	12/1/2013	G101112064LEX-002	Original Issue
2	1/2/2014	G101112064LEX-002.2	The FCCID and ICID were swapped.