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TEST REPORT

Report Number:	**101324699LAX-001b**
Project Number:	**G101324699**
Report Issue Date:	**1/10/2014**
Product Name:	**XS4**
Model Number:	**A9XW**
FCCID:	**UKCA9XW**
ICID:	**10088A-A9XW**
FCC Standards:	**Title 47 CFR Part 15:2013 Subpart B and C, 15.247**
Industry Canada Standards:	**RSS-210 Issue 8 and ICES-003 Issue 5**

Tested by:
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Client:
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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-Lake Forest is located at 25791 Commercentre Dr, Lake Forest, Ca. The radiated emission test site is a 3-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 381415. The test site is listed with Industry Canada under site number IC 2042T-1.

2 Test Summary

Page	Test full name	FCC Reference	IC Reference	Result
6	Output Power	§ 15.247(b)(3)	RSS-210 (A8.4)	Pass
11	Occupied Bandwidth	§ 15.247(a)(2)	RSS-210 A8.2(a)	Pass
20	Power Spectral Density	§ 15.247(e)	RSS-210 (A8.2b)	Pass
19	Conducted Spurious Emissions	§ 15.247(d)	RSS-210 (A8.5)	Pass The EUT has a permanently attached internal antenna. It does not contain an antenna port connector. Instead of Antenna Conducted measurements, Radiated measurements were performed.
20	Out-of-Band Radiated Emission (except emissions in Restricted Bands)	15.247(d) A8.5	15.247(d) A8.5	Pass
24	Radiated Spurious Emissions (Transmitter)	§ 15.247(d), § 15.209, and § 15.205	RSS-210 (2.2) (A8.5)	Pass
29	Radiated Emissions (Tx Mode)	§ 15.209	RSS-Gen (6.1)	Pass
32	Conducted Emissions	§ 15.107, § 15.207	RSS-Gen (7.2.4)	EUT is battery operated (exempt)
10	RF Exposure	15.247(i)	RS-102	Pass

3 Description of Equipment Under Test

Equipment Under Test	
Manufacturer	Salto Systems, S.L.
Model Number	A9XW
Serial Number	N/A
Family Series	A9XW
FCC Identifier	UKCA9XW
IC Identifier	10088A-A9XW
Receive Date	11/2/2013
Test Start Date	11/5/2013
Test End Date	11/23/13
Device Received Condition	Good
Test Sample Type	Production sample
Frequency Band	2405MHz – 2480MHz
Mode(s) of Operation	Continuously transmitting a signal
Modulation Type	OQPSK
Number of Hopping Channels	N/A
Transmission Control	Test Firmware
Test Channels	2405, 2445, 2480 MHz
Antenna Type (15.203)	Internal PCB Antenna
Power Supply	Powered by 3 AA dry cells

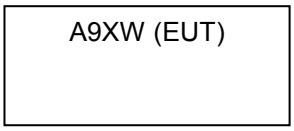
Description of Equipment Under Test
ELECTRONIC PROXIMITY XS4 LOCK by SALTO SYSTEMS

Operating modes of the EUT:

No.	**Descriptions of EUT Exercising**
1	The EUT was setup in the software controlled test mode to continuously transmit a signal at the lowest (2405 MHz), middle (2445 MHz) and highest (2480 MHz) channels.
2	Transmitting its normal 13.56MHz signal for RFID (Covered under separate test report 101324699LAX-001)
3	EUT was controlled by Salto System proprietary test software.

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
n/a	n/a	n/a	n/a	n/a	n/a

3.4 Support Equipment:

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
n/a	n/a	n/a	n/a

4 Peak Conducted Power

4.1 Test Limits

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

§ 15.247(b)(4): The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247). The peak output power was measured using the channel power function of the spectrum analyzer.

4.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	1140	Rohde & Schwarz	ESCI	2/10/2013	2/10/2014

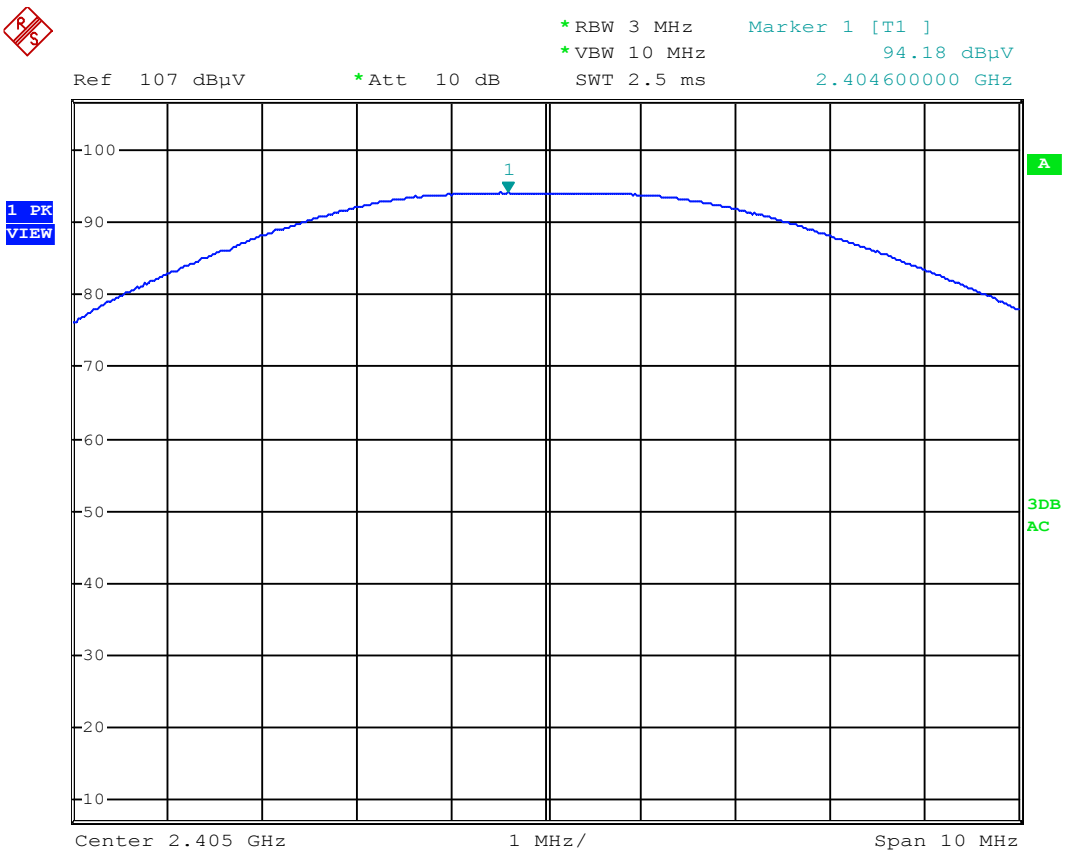
4.4 Results:

The peak output power measurements were all below the 30dBm limit.

Mode	Channel Number	Frequency (MHz)	EIRP Radiated Peak Output Power (dBm)	Transmitter Antenna Gain (dBi)	Conducted Peak Output Power (dBm)	Conducted Peak Output Power (W)	Limit (dBm)	Result
OQPSK	Low	2405	-0.4	+1.7	-2.1	0.00062	30	Pass
OQPSK	Mid	2445	-4.02	+1.7	-5.72	0.00027	30	Pass
OQPSK	High	2480	-6.8	+1.7	-8.5	0.00014	30	Pass

EIRP Radiated Peak Output Power in dBm is calculated as E-field + 20 log(d) – 104.8
E-field = dBµV/m
(d) = distance at 3 meters

Conducted Peak Output Power is calculated as EIRP Radiated Peak Power minus the Antenna Gain of the transmitter.



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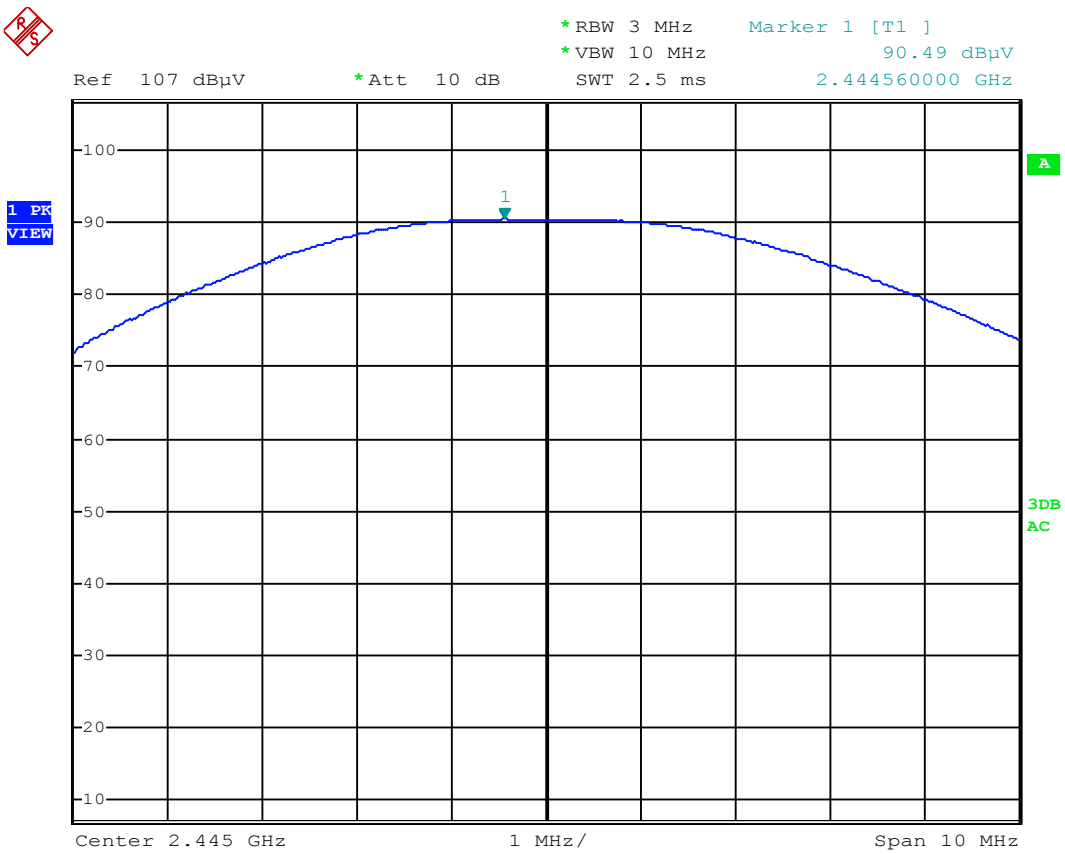
Peak Output Power, Low Channel

Frequency MHz	RA (dBµV)	AG (dB)	CF (dB)	ATT (dB1/m)	AF (dB1/m)	Final Field Strength (dBµV/m)	EIRP dBm	EIRP mW
2405	94.18	43.19	6.04	9.7	28.17	94.9	-0.4	0.91

RA = receiver amplitude
AG = amplifier gain
CF = cable factor
AF = cable factor
Final Field Strength is the same as E-Field

Final Field Strength = RA-AG+CF+AF

EIRP Radiated Peak Output Power in dBm is calculated as E-field + 20 log(d) – 104.8
E-field = dBµV/m
(d) = distance at 3 meters



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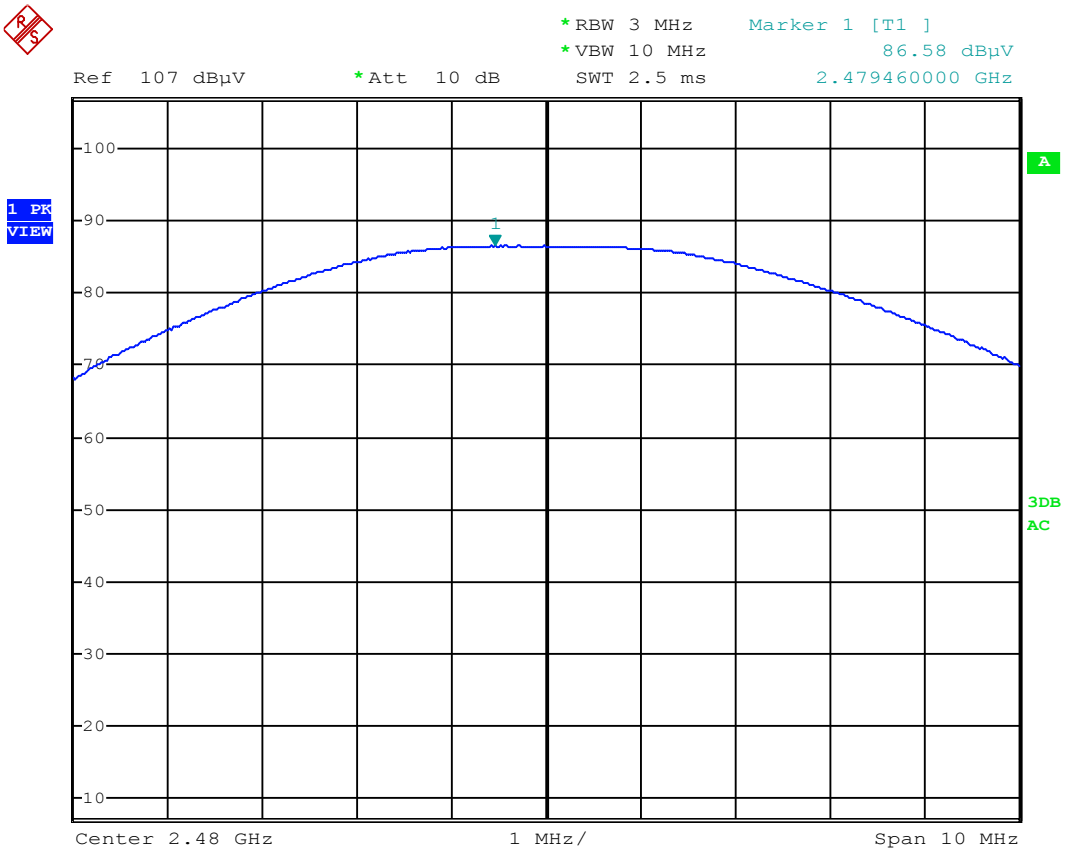
Peak Output Power, Mid Channel

Frequency MHz	RA (dBµV)	AG (dB)	CF (dB)	ATT (dB1/m)	AF (dB1/m)	Final Field Strength (dBµV/m)	EIRP dBm	EIRP mW
2445	90.49	43.16	6.04	9.7	28.17	91.24	-4.02	0.4

RA = receiver amplitude
AG = amplifier gain
CF = cable factor
AF = cable factor
Final Field Strength is the same as E-Field

Final Field Strength = RA-AG+CF+AF

EIRP Radiated Peak Output Power in dBm is calculated as E-field + 20 log(d) – 104.8
E-field = dBµV/m
(d) = distance at 3 meters



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Peak Output Power, High Channel

Frequency MHz	RA (dBµV)	AG (dB)	CF (dB)	ATT (dB1/m)	AF (dB1/m)	Final Field Strength (dBµV/m)	EIRP dBm	EIRP mW
2480	86.58	43.16	6.04	9.7	29.3	88.46	-6.8	0.21

RA = receiver amplitude
AG = amplifier gain
CF = cable factor
AF = cable factor
Final Field Strength is the same as E-Field

Final Field Strength = RA-AG+CF+AF

EIRP Radiated Peak Output Power in dBm is calculated as E-field + 20 log(d) – 104.8
E-field = dBµV/m
(d) = distance at 3 meters

4.5 RF Exposure Evaluations

MPE Evaluation

The EUT is a wireless device used in stationary application, at least 20 cm from any body part of the user or nearby persons.

For the 2.4 GHz radio, the maximum Peak EIRP calculated is -0.4 dBm (0.912 mW); therefore, to comply with RF Exposure requirement, the MPE is calculated.

The Power Density can be cacluated using the formula:

$S = EIRP/ 4\pi D^2$

Where: S is Power Density in W/m^2
D is the distnace from the antenna

It is cosidered that 20 cm is the minimum distance tht user can go closest to the EUT.

At 20cm. $S = 0.0018\ W/m^2$, which is below the MPE limit of $10\ W/m^2$

5 Occupied Bandwidth

5.1 Test Limits

§ 15.247(a)(2): For digital modulation systems, the minimum 6dB bandwidth shall be at least 500kHz.

5.2 Test Procedure

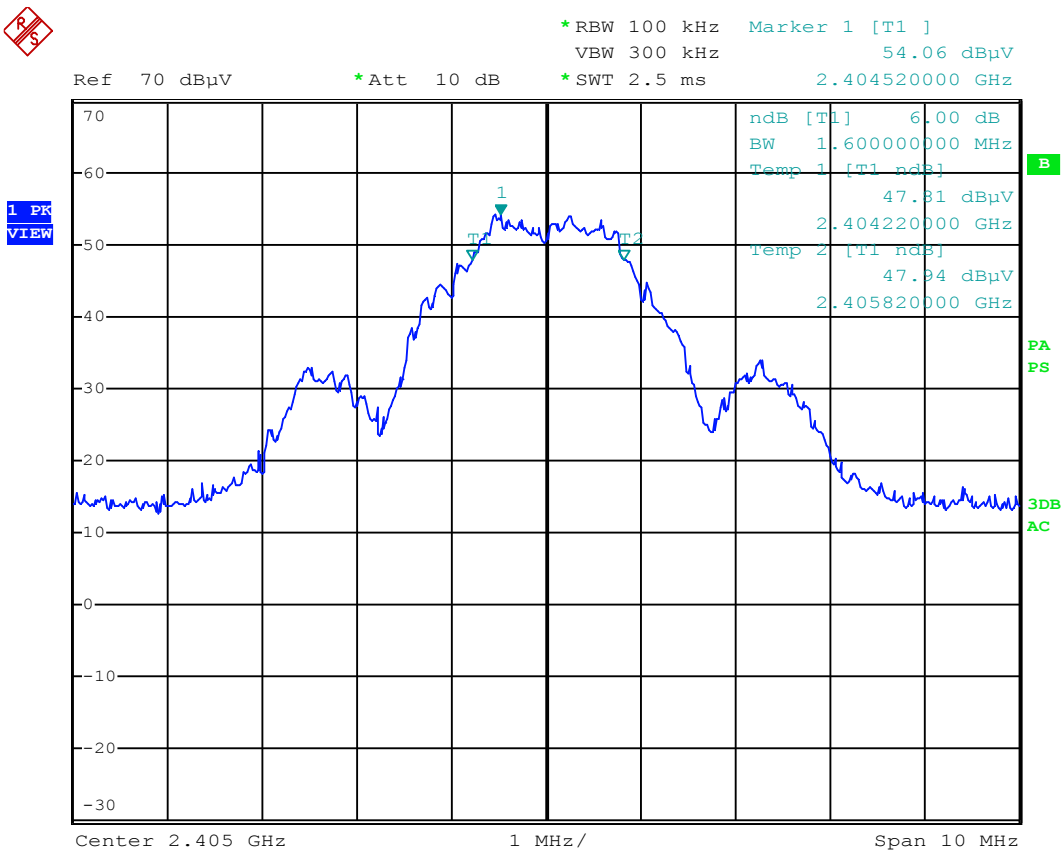
ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

5.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	1140	Rohde & Schwarz	ESCI	2/10/2013	2/10/2014

5.4 Results:

Mode	Channel Number	Frequency (MHz)	6dB Bandwidth	99% Power Bandwidth	Result
OQPSK	Low	2405	1.60MHz	2.94MHz	Pass
OQPSK	Mid	2445	1.62MHz	2.94MHz	Pass
OQPSK	High	2480	1.58MHz	3.52MHz	Pass



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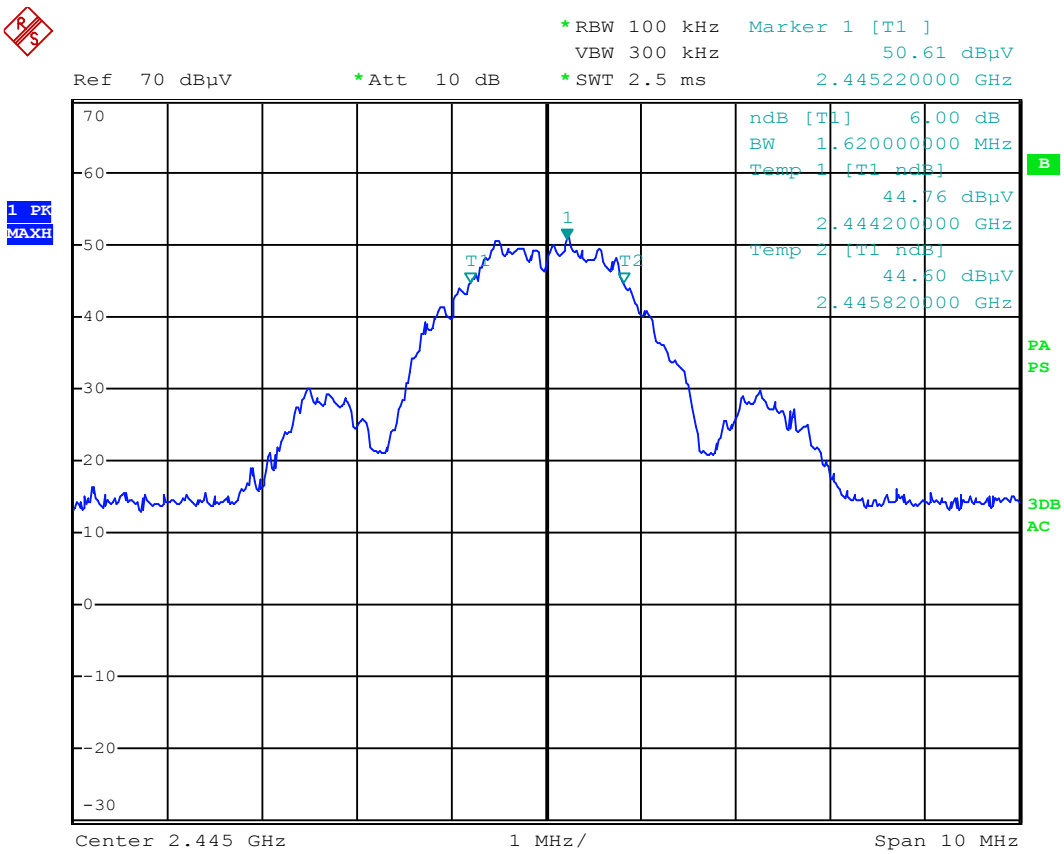
6dB Bandwidth, Low Channel



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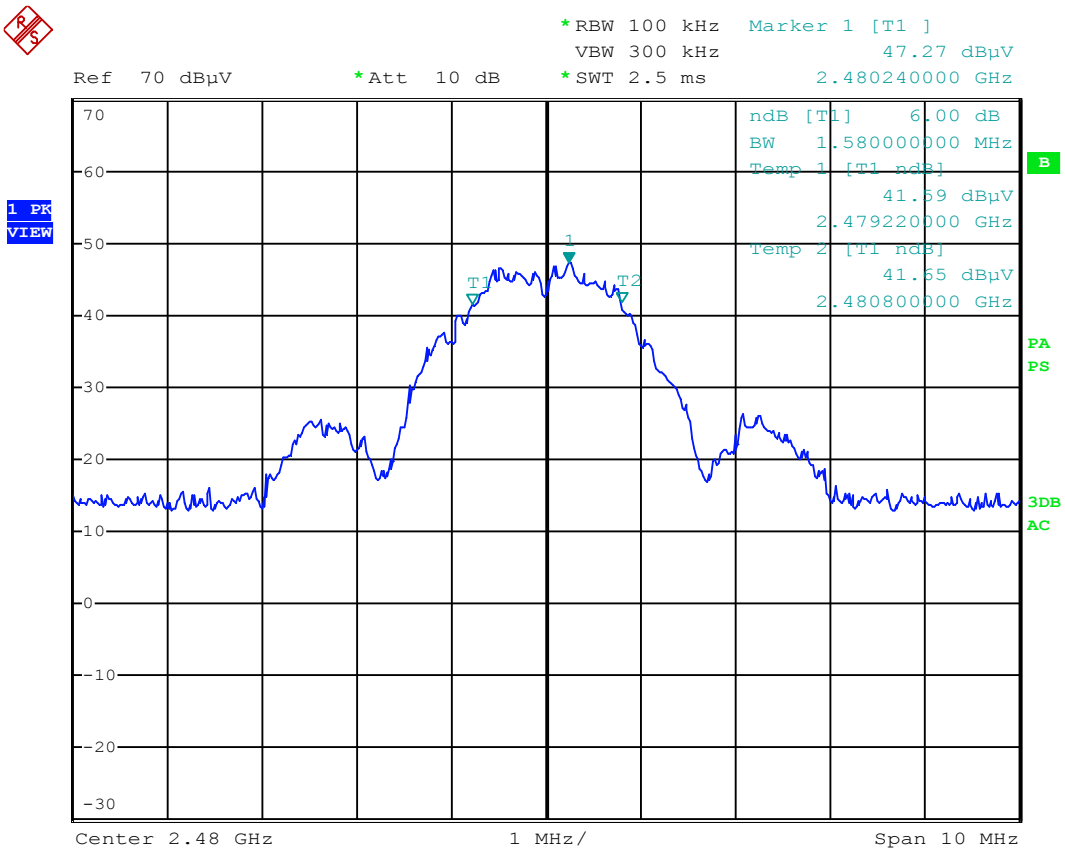
6dB Bandwidth, Middle Channel



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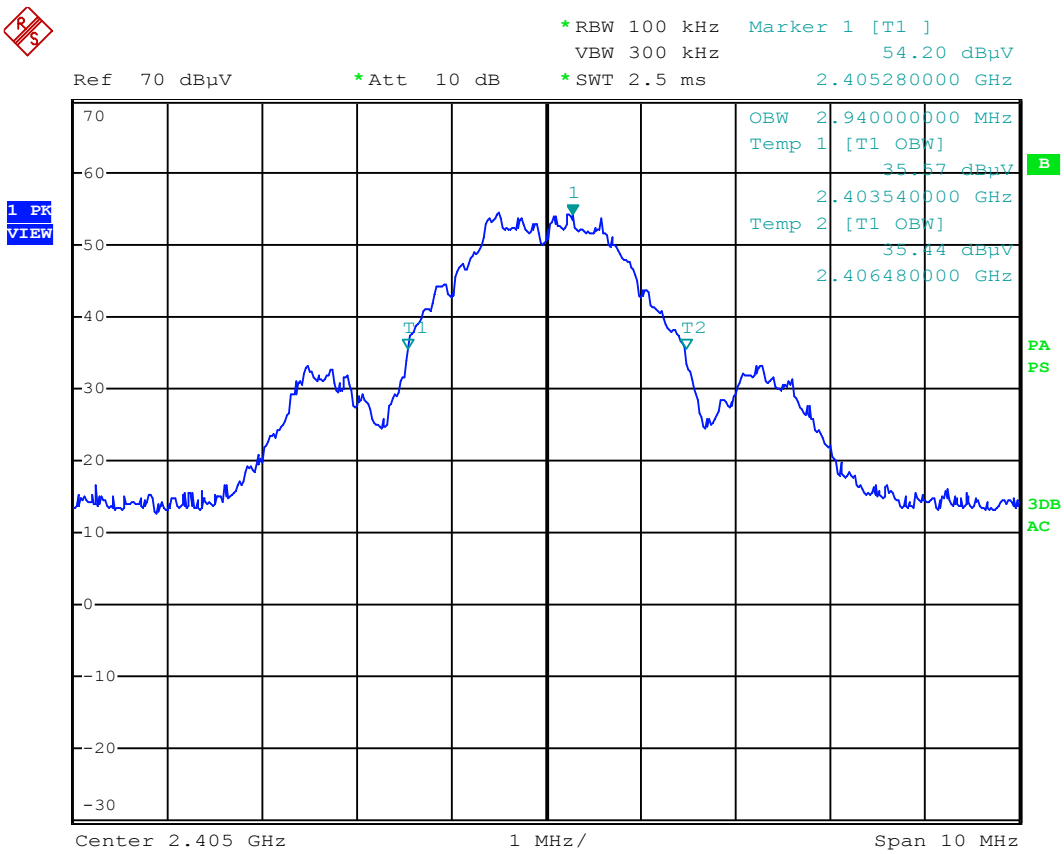
6dB Bandwidth, High Channel



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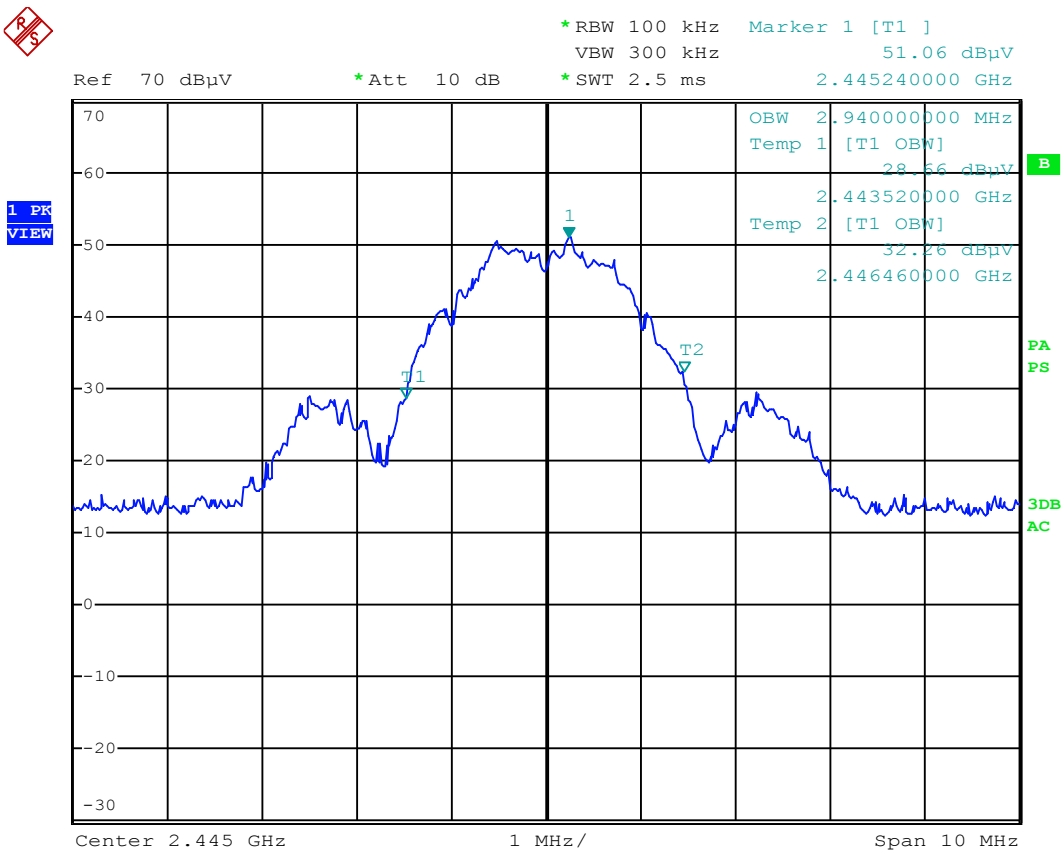
99% Bandwidth, Low Channel



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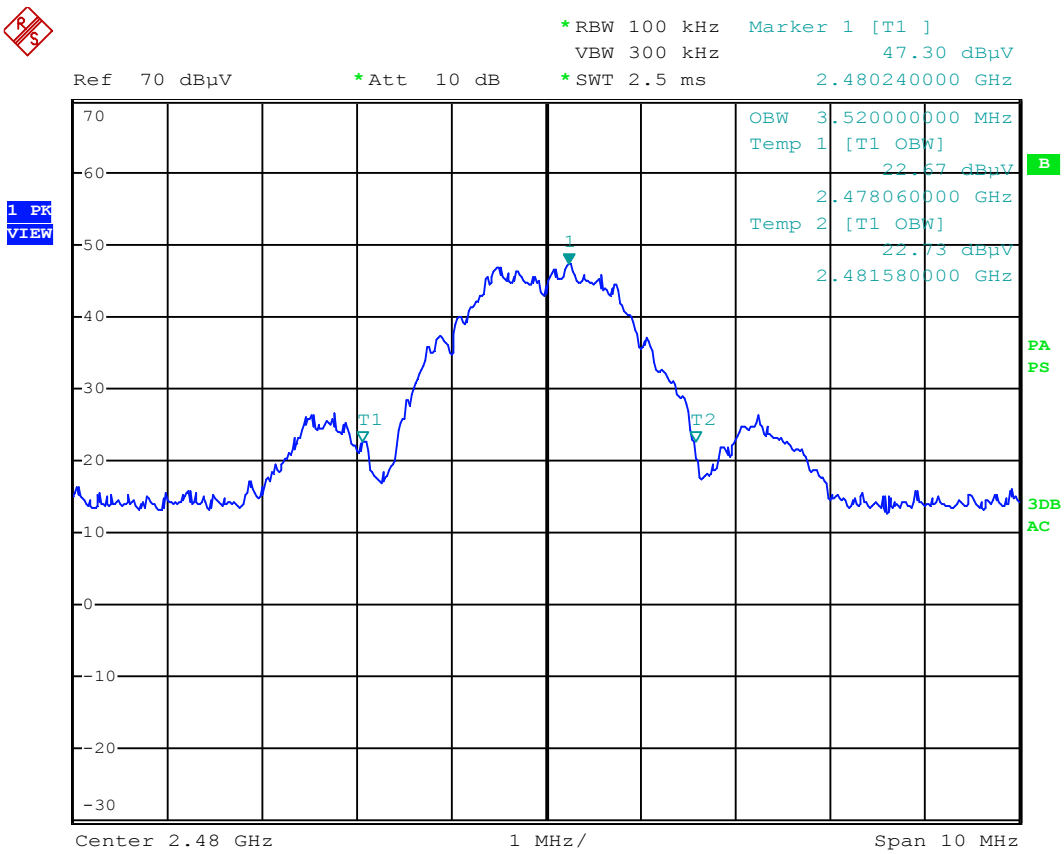
99% Bandwidth, Middle Channel



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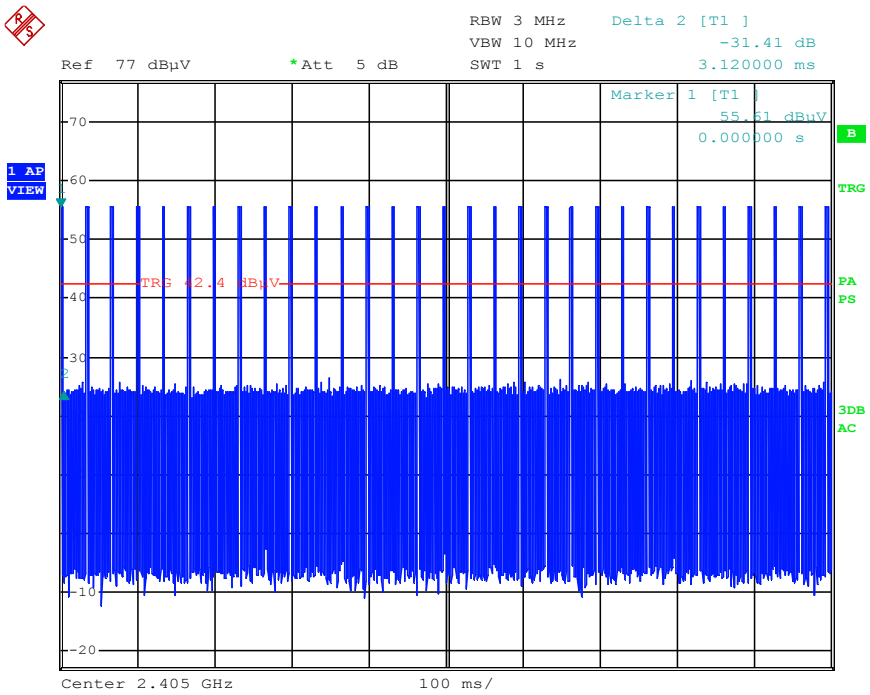
99% Bandwidth, High Channel

6 Duty Cycle Correction Factor



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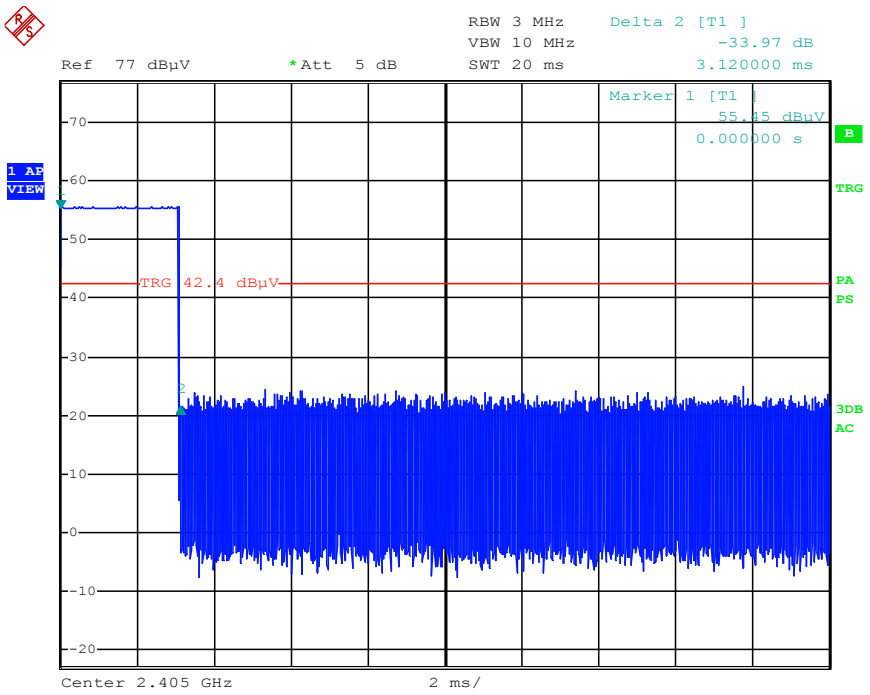

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100mS @ 10ms / div

Time on = 15.6 ms

Duty Cycle Calculation

Sample Calculation:

If $T \leq 0.1$ second, calculate the Duty Cycle correction factor as 20Log(t/T).
If $T > 0.1$ second, calculate the Duty Cycle correction factor as 20Log(t/0.1)

Result:

The duty cycle was calculated by measuring one pulse train in a 100 ms period.

Total ON time = 15.6 ms

Duty Cycle calculation: 20Log (15.6/100) = **-16.13dB**

7 Conducted Spurious Emissions (This test was not performed)

7.1 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.

7.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

7.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	1140	Rohde & Schwarz	ESCI	2/10/2013	2/10/2014

7.4 Results:

The device under test did not have a conducted antenna port, and therefore no conducted plots were taken.

8 Power Spectral Density

8.1 Test Limits

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

8.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

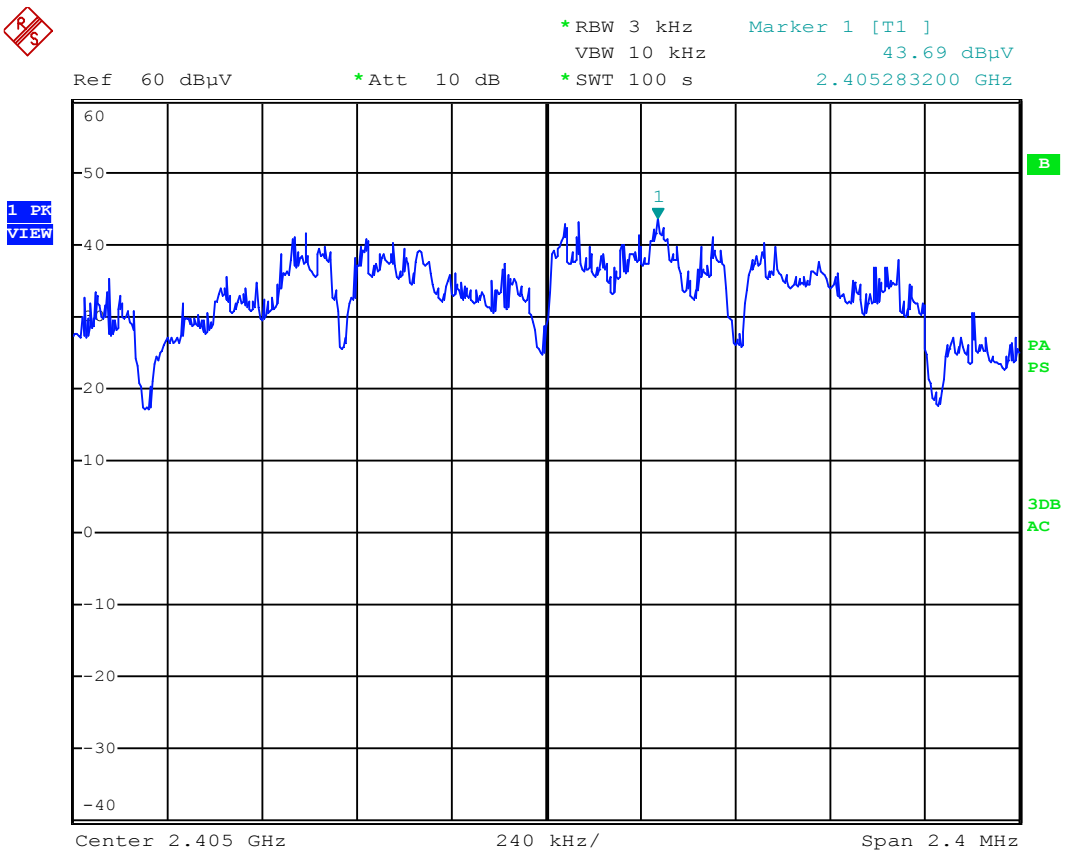
8.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	1140	Rohde & Schwarz	ESCI	2/10/2013	2/10/2014

8.4 Results:

*PSD Option 1 Method

Mode	Channel Number	Frequency (MHz)	PSD in 3kHz BW (dBm)	Limit (dBm)	Result
OQPSK	15	2405	-18.73	8.0	Pass
OQPSK	20	2445	-22.54	8.0	Pass
OQPSK	25	2480	-25.39	8.0	Pass



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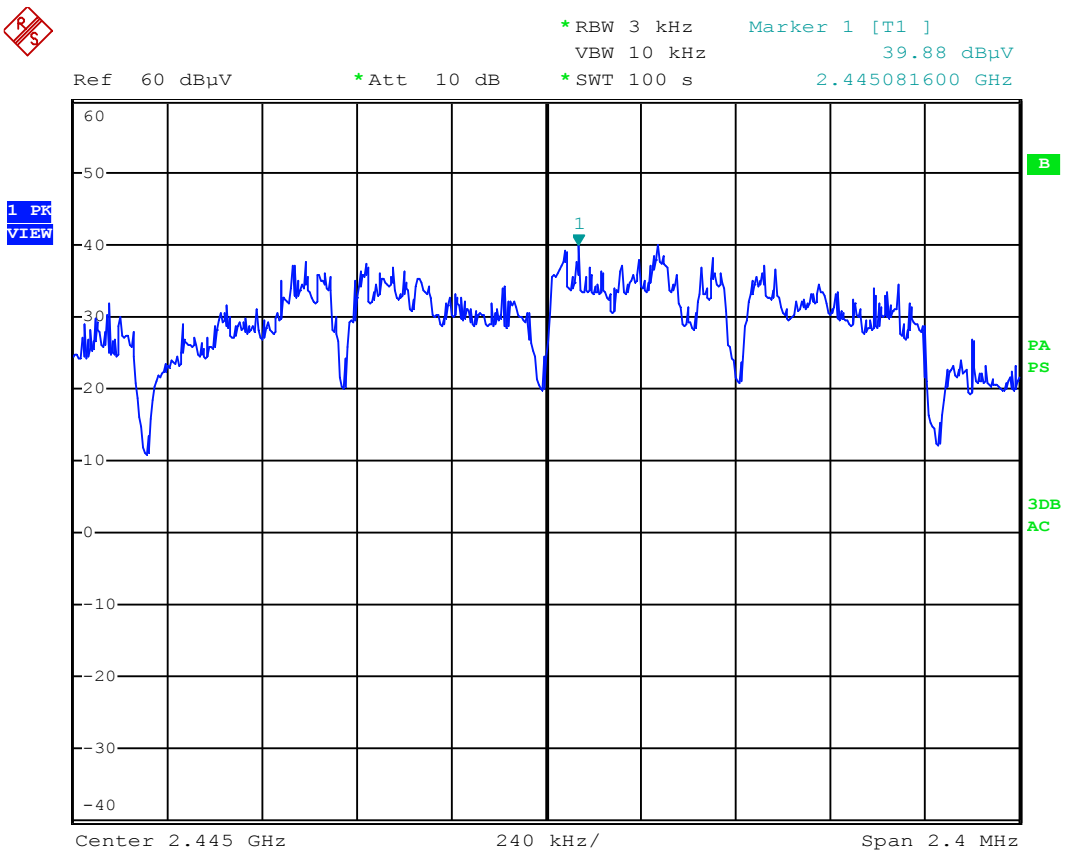
PSD Low Channel

Frequency MHz	RA (dBµV)	AG (dB)	CF (dB)	AF (dB3/m)	Final Field Strength (dBµV/m)	EIRP dBm	EIRP mW
2405	43.69	0	6.04	26.8	76.53	-18.73	0.013397

RA = receiver amplitude
AG = amplifier gain
CF = cable factor
AF = cable factor



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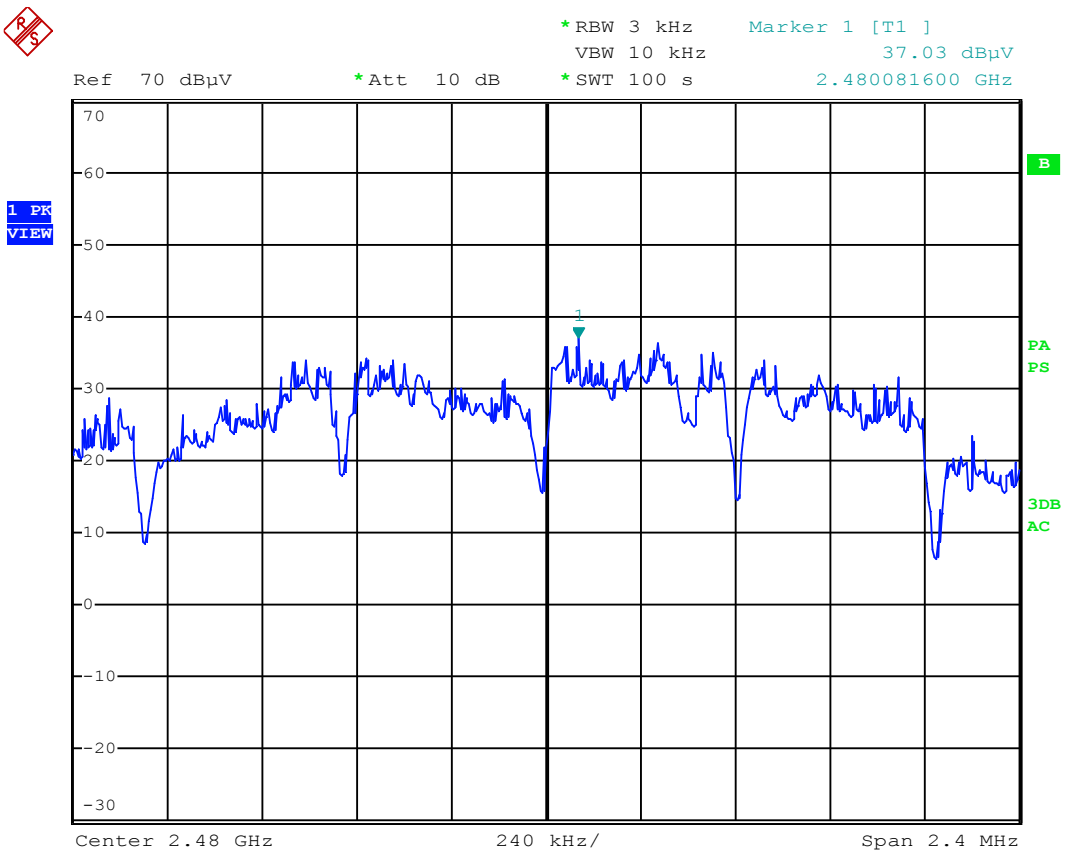
PSD Middle Channel

Frequency MHz	RA (dBµV)	AG (dB)	CF (dB)	AF (dB1/m)	Final Field Strength (dBµV/m)	EIRP dBm	EIRP mW
2445	39.88	0	6.04	26.8	72.72	-22.54	0.005572

RA = receiver amplitude
AG = amplifier gain
CF = cable factor
AF = cable factor



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PSD, High Channel

Frequency MHz	RA (dBµV)	AG (dB)	CF (dB)	AF (dB1/m)	Final Field Strength (dBµV/m)	EIRP dBm	EIRP mW
2480	37.03	0	6.04	26.8	69.87	-25.39	0.002891

RA = Receiver Amplitude
AG = Amplifier Gain
CF = Cable Factor
AF = Antenna Factor

9 Radiated Spurious Emissions (Transmitter)

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. 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

9.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

9.3 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 dBμV/m
RA = Receiver Amplitude in dBμV
AF = Antenna Factor in dB
CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

RA = 19.48 dBμV
AF = 18.52 dB
CF = 0.78 dB

FS = 19.48 + 18.52 + 0.78 = 38.78 dBμV/m
Level in μV/m = Common Antilogarithm [(38.78 dBμV/m)/20] = 86.89 μV/m

9.4 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1140	Rohde & Schwarz	ESCI	2/10/13	2/10/14
Spectrum Analyzer	IN960	Rohde & Schwarz	FSP	4/11/13	4/11/14
Preamplifier	1685147	MD	AMF-60	1/4/13	1/4/14
Preamplifier	583	HP	8449B	4/9/13	4/9/14
Biconnilog Antenna	1174	TESEQ	CBL6112D	2/01/2013	02/01/2014
Horn Antenna	1093	EMCO	3160-09	n/a	VBU 9/24/2013
Horn Antenna	571	AH Systems	**SAS-571**	11/19/2012	11/19/2013
Cable	973	n/a	n/a	10/31/2012	10/31/2013
Cable	1374	AH Systems	n/a	7/18/13	7/18/14

9.5 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 the x any y axis since it is a floor mounted device and is used in only one orientation.

Tx Channel	Spurious Frequency	Corrected Peak dBµV/m	Peak Limit	Peak Margin	Corrected Average dBµV/m	Avg Limit	Avg Margin	Results
Low channel 2405 MHz	4810	58.58	74	-15.42	42.45	54	-11.55	Compliant
	7215	57.63	74	-16.37	41.5	54	-12.5	Compliant
	9620	54.29	74	-19.71	38.16	54	-15.84	Compliant
	12025	59.81	74	-14.19	43.68	54	-10.32	Compliant
	14430	63.61	74	-10.39	47.48	54	-6.52	Compliant
	16835	63.06	74	-10.94	46.83	54	-7.17	Compliant
	19240	65.41	74	-8.59	49.25	54	-4.75	Compliant
	21645	67.72	74	-6.28	43.58	54	-10.42	Compliant
	24050	61.2	74	-12.8	45.07	54	-8.93	Compliant
	26455	64.48	74	-9.52	48.35	54	-5.65	Compliant

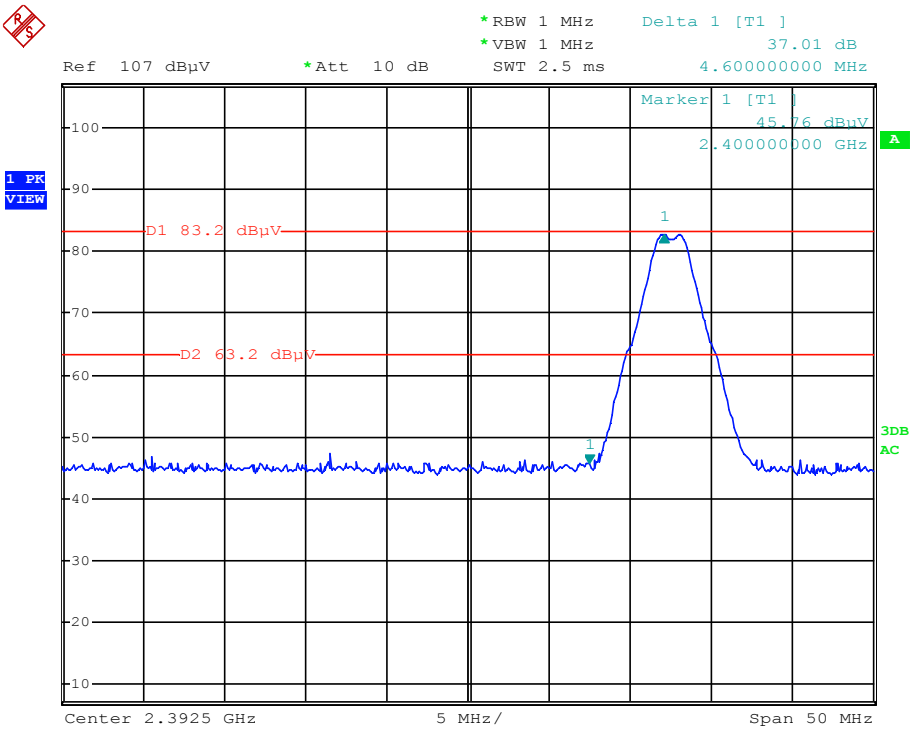
Worst Case Spurious Emissions (OQPSK, Low Channel)

Tx Channel	Spurious Frequency	Corrected Peak dBµV/m	Peak Limit	Peak Margin	Corrected Average dBµV/m	Avg Limit	Avg Margin	Results
Mid channel 2445 MHz	4890	59.06	74	-14.94	25.51	54	-28.49	Compliant
	7335	35.23	74	-38.77	19.1	54	-34.9	Compliant
	9780	42.98	74	-31.02	26.85	54	-27.15	Compliant
	12225	47.23	74	-26.77	31.1	54	-22.9	Compliant
	14670	50.26	74	-23.74	34.13	54	-19.87	Compliant
	17115	47.74	74	-26.26	31.61	54	-22.39	Compliant
	19560	52.09	74	-21.91	35.93	54	-18.07	Compliant
	22005	51.67	74	-22.33	35.54	54	-18.46	Compliant
	24450	61.15	74	-12.85	45.02	54	-8.98	Compliant
	26895	55.98	74	-18.02	39.85	54	-14.15	Compliant

Worst Case Spurious Emissions (OQPSK, Middle Channel)

Tx Channel	Spurious Frequency	Corrected Peak dBµV/m	Peak Limit	Peak Margin	Corrected Average dBµV/m	Avg Limit	Avg Margin	Results
Mid channel 2480 MHz	4960	58.48	74	-15.52	42.35	54	-11.65	Compliant
	7440	62.59	74	-11.41	46.46	54	-7.54	Compliant
	9920	55.53	74	-18.47	39.14	54	-14.86	Compliant
	12400	60.02	74	-13.98	43.89	54	-10.11	Compliant
	14880	62.51	74	-11.49	46.38	54	-7.62	Compliant
	17360	59.87	74	-14.13	43.74	54	-10.26	Compliant
	19840	65.13	74	-8.87	48.97	54	-5.03	Compliant
	22320	67.97	74	-6.03	43.83	54	-10.17	Compliant
	24800	62.45	74	-11.55	46.32	54	-7.68	Compliant
	27280	63.06	74	-10.94	46.93	54	-7.07	Compliant

Worst Case Spurious Emissions (OQPSK, High Channel)



1 MBPS BANDEDGE LOW CH, FH OFF

Date: 13.NOV.2013 21:03:27

Low Band Edge Plot, Low Channel

Frequency MHz	RA (dBµV)	AG (dB)	CF (dB)	AF (dB1/m)	Final Field Strength (dBµV/m)	Average Limit	Margin
2390	45.5	37.87	2.49	29.0	39.12	54	-14.88

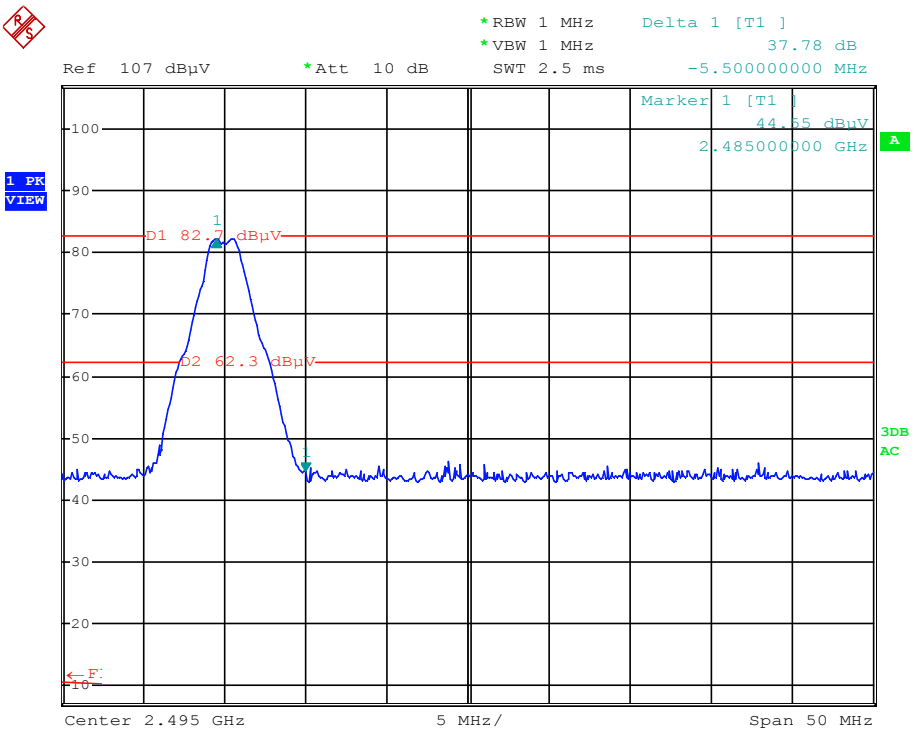
Field Strength = RA-AG+CF+AF

Frequency MHz	RA (dBµV)	AG (dB)	CF (dB)	AF (dB1/m)	Final Field Strength (dBµV/m)	Peak Limit	Margin
2390	45.5	37.87	2.49	29.00	39.12	74	-34.88

Strength = RA-AG+CF+AF

RA = Receiver Amplitude
AG = Amplifier Gain
CF = Cable Factor
AF = Antenna Factor

(Plot)



1 MBPS BANDEDGE LOW CH, FH OFF

Date: 13.NOV.2013 20:34:05

High Band Edge Plot, High Channel

Frequency MHz	RA (dBµV)	AG (dB)	CF (dB)	AF (dB1/m)	Final Field Strength (dBµV/m)	Average Limit	Margin
2483.5	49.4	37.82	2.49	29.01	43.08	54	-10.92

Field Strength = RA-DCF+CF-AG+AF

Frequency MHz	RA (dBµV)	AG (dB)	CF (dB)	AF (dB1/m)	Final Field Strength (dBµV/m)	Peak Limit	Margin
2483.5	49.4	37.82	2.49	29.01	43.08	74	-30.92

Field Strength = RA-AG+CF+AF

RA = Receiver Amplitude
AG = Amplifier Gain
CF = Cable Factor
AF = Antenna Factor

10 Radiated Emissions (Tx Mode)

10.1 Test Limits

§ 15.209:

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

These limits are identical to those in RSS-GEN

10.2 Test Procedure

ANSI C63.4: 2009

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 dBμV/m
RA = Receiver Amplitude in dBμV
AF = Antenna Factor in dB
CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

RA = 19.48 dBμV
AF = 18.52 dB
CF = 0.78 dB

FS = 19.48 + 18.52 + 0.78 = 38.78 dBμV/m
Level in μV/m = Common Antilogarithm [(38.78 dBμV/m)/20] = 86.89 μV/m

10.4 Test Equipment Used:

Description	ID Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1140	Rohde & Schwarz	ESCI7	2/19/13	2/19/14
Spectrum Analyzer	960	Rohde & Schwarz	FSP	4/11/13	4/11/14
Preamplifier	1135	Miteq	AMF-6D	1/4/13	1/4/14
Biconilog Antenna	1147	TESEQ	CBL6112D	2/1/13	2/1/14
Horn Antenna	1093	AH Systems	SAS571	11/19/12	11/19/13
System Controller	121701-1	Sunol Sciences	SC99V	Time of Use	Time of Use

10.5 Results:

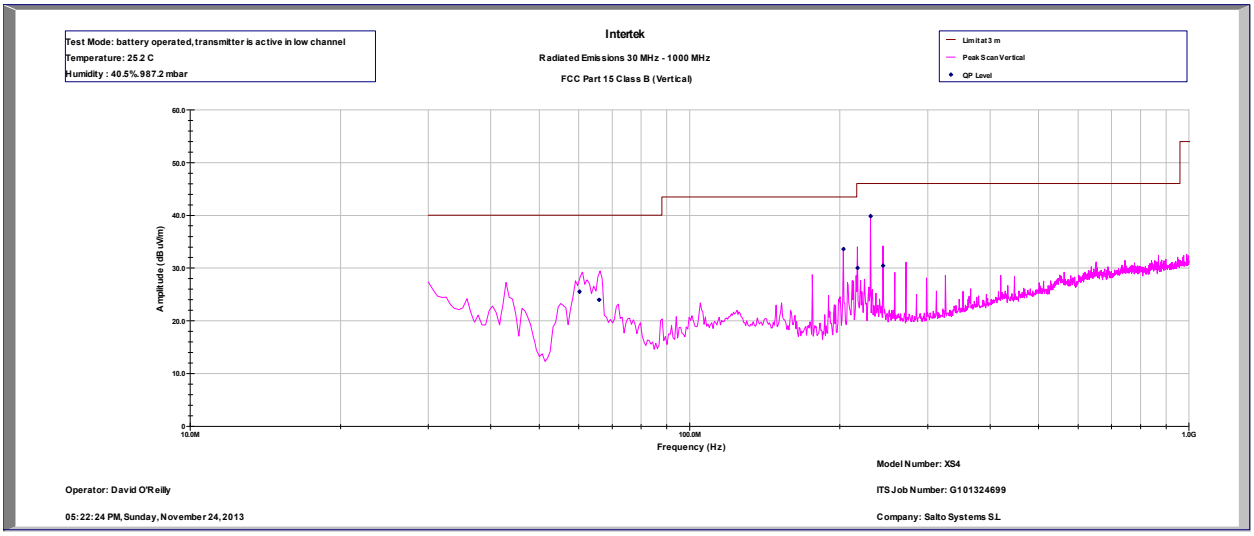
All spurious emissions with the test sample in transmit mode were below the limits specified in Part 15.209 for a class B digital device and RSS-GEN Section 6.1.

10.6 Test Data:

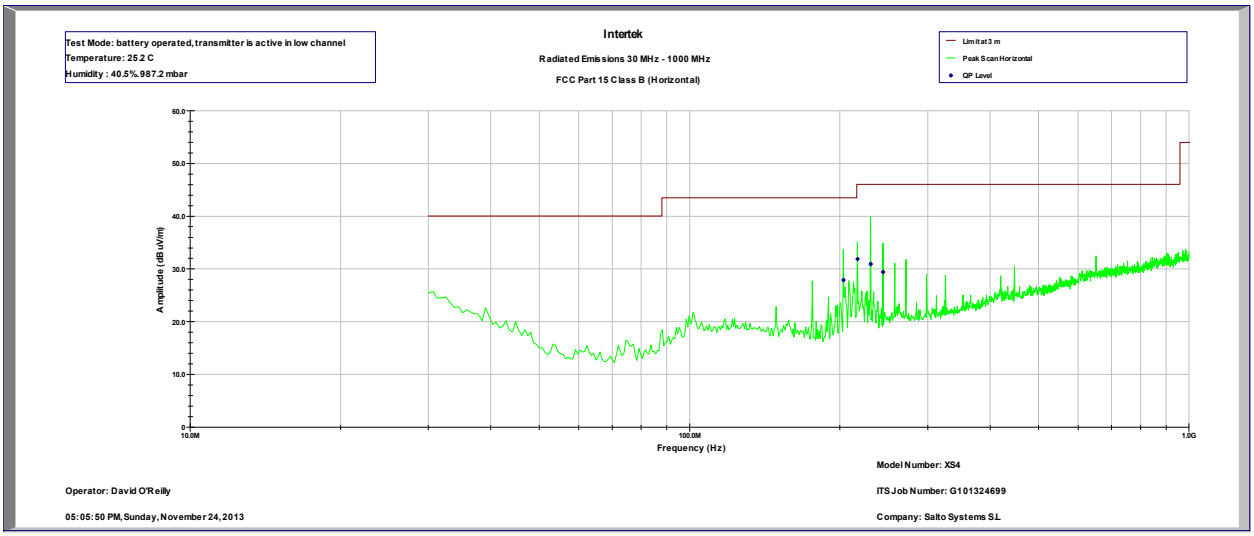
Deviations, Additions, or Exclusions: None

Date:	11/24/2013	**Result: Pass**
Tested by:	David O'Reilly	
Standard:	FCC CFR 47, 15.209	
Test Point:	Anechoic Chamber 3 meters distance	
Operation mode:	Transmit (Tx)	
Note:	Battery operated	

Bilog Prescan:



Vertical Polarity (Tx)



Horizontal Polarity (Tx)

Highest Maximized Emissions in Tx Mode 30MHz – 25GHz (vertical)

Frequency MHz	Quasi Pk FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB(uV)	RA dB(uV)	AG dB(uV)	AF dB(1/m)	CF dB(uV)
41.36	27.7	40	-12.3	15.5	0	11.2	1
47.31	25.8	40	-14.2	16.5	0	8.2	1.1
93.97	25.5	43.5	-18	14.4	0	9.6	1.5
203.39	34	43.5	-9.5	20.9	0	11	2.1
230.52	39.2	46	-6.8	25.4	0	11.5	2.3

Highest Maximized Emissions in Tx Mode 30MHz – 25GHz (horizontal)

Frequency MHz	Quasi Pk FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB(uV)	RA dB(uV)	AG dB(uV)	AF dB(1/m)	CF dB(uV)
30.59	34.5	40	-5.5	14.4	0	19.2	0.9
94.10	26.3	43.5	-17.2	14.4	0	10.4	1.5
203.40	30.2	43.5	-13.3	17.3	0	10.7	2.1
216.95	28.9	46	-17.1	16.5	0	10.2	2.2
230.51	30.3	46	-15.7	16.9	0	11.2	2.3
244.25	29.5	46	-16.5	14.7	0	12.5	2.3

Note: Investigation performed up to 25 GHz. All other emissions not reported are at least 10dB below the limits.

Radiated Emissions (Rx Mode)

10.7 Test Limits

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

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

These limits are identical to those in RSS-GEN

10.8 Test Procedure

ANSI C63.4: 2009

10.9 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 dBμV/m
RA = Receiver Amplitude in dBμV
AF = Antenna Factor in dB
CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

RA = 19.48 dBμV
AF = 18.52 dB
CF = 0.78 dB

FS = 19.48 + 18.52 + 0.78 = 38.78 dBμV/m
Level in μV/m = Common Antilogarithm [(38.78 dBμV/m)/20] = 86.89 μV/m

10.10 Test Equipment Used:

Description	ID Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1140	Rohde & Schwarz	ESCI7	2/19/13	2/19/14
Spectrum Analyzer	960	Rohde & Schwarz	FSP	4/11/13	4/11/14
Preamplifier	1135	Miteq	AMF-6D	1/4/13	1/4/14
Biconnilog Antenna	1147	TESEQ	CBL6112D	2/1/13	2/1/14
Horn Antenna	1093	AH Systems	SAS571	11/19/12	11/19/13
System Controller	121701-1	Sunol Sciences	SC99V	Time of Use	Time of Use

10.11 Results:

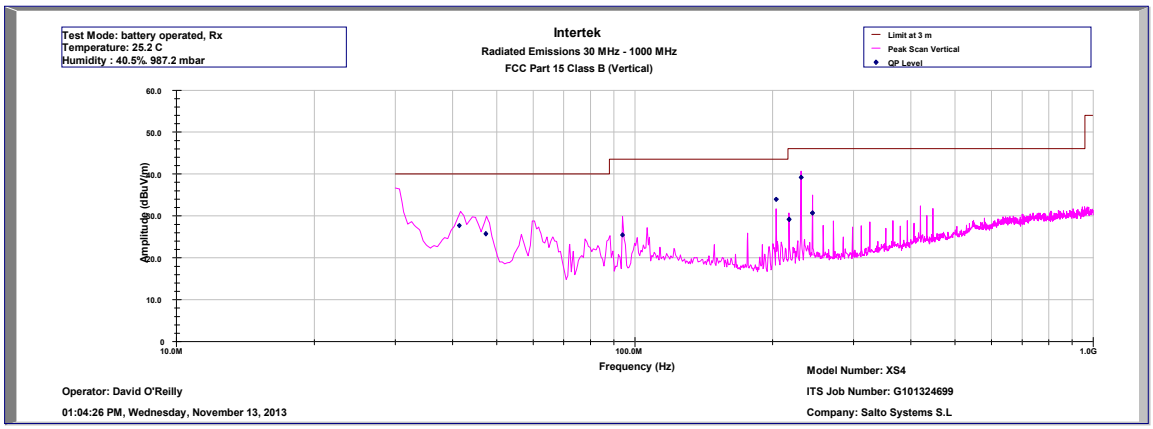
All spurious emissions with the test sample in receive mode were below the limits specified in Part 15.209 for a class B digital device and RSS-GEN Section 6.1.

10.12 Test Data:

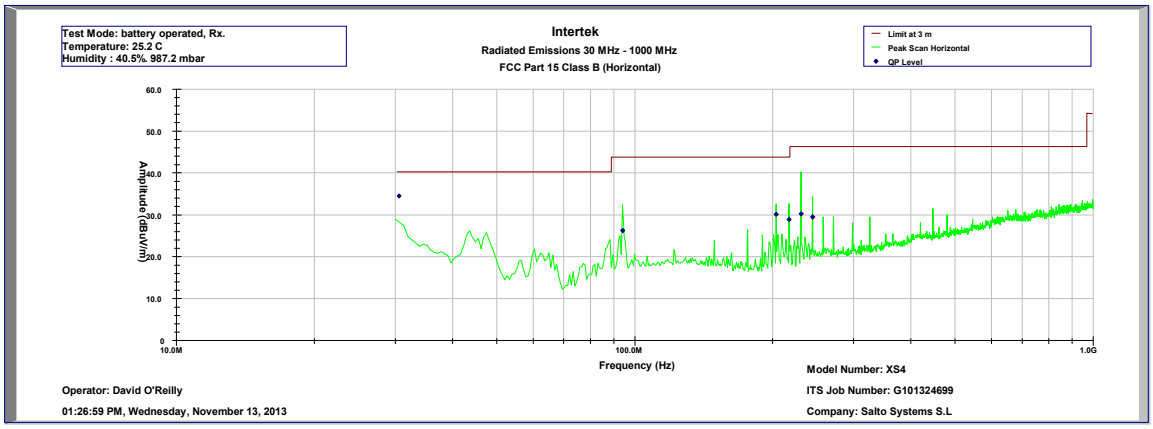
Deviations, Additions, or Exclusions: None

Date:	11/13/2013	**Result:** **Pass**
Tested by:	David O'Reilly	
Standard:	FCC CFR 47, 15.209, Class B	
Test Point:	Anechoic Chamber 3 meters distance	
Operation mode:	Idle mode (Rx)	
Note:	Performed in the EUT in standby / Rx mode	

Bilog Prescan:

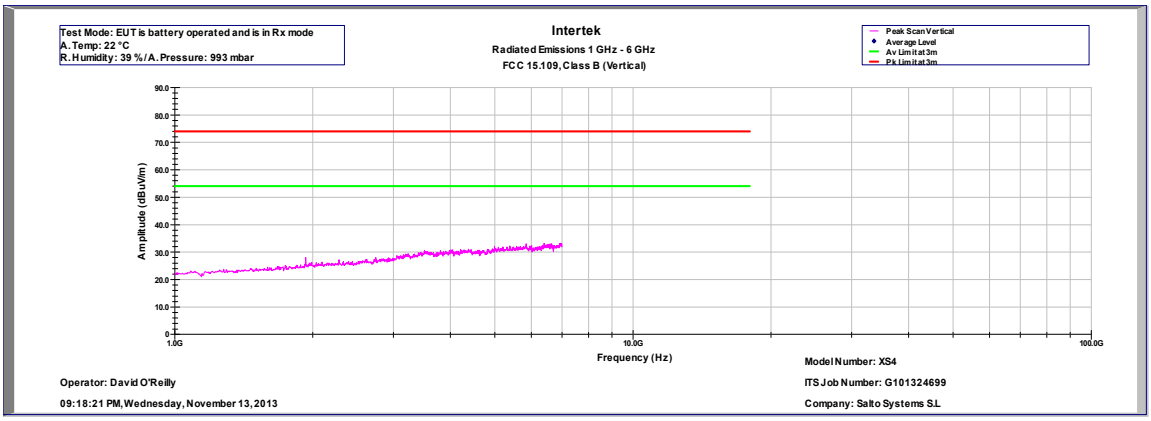


Vertical Polarity (Rx)

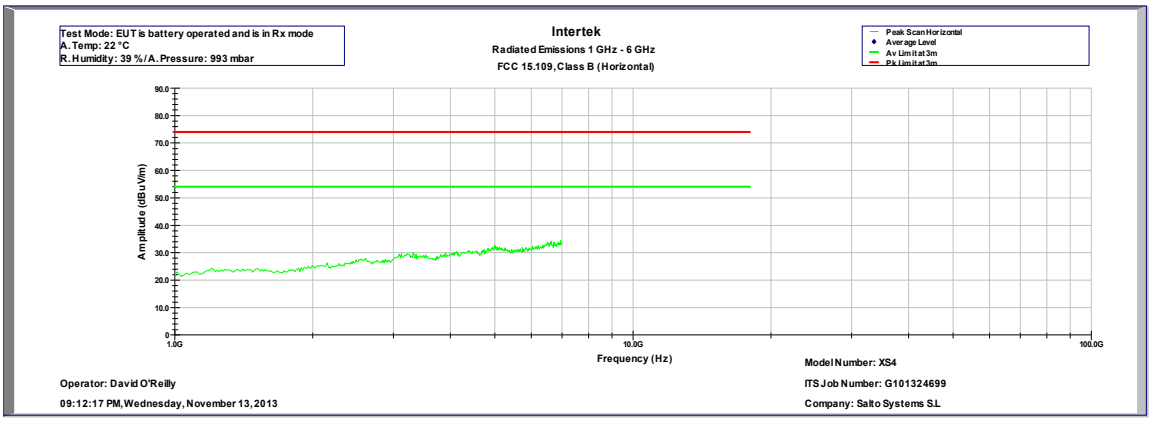


Horizontal Polarity (Rx)

Automated pre-scans between 1GHz - 7GHz.



Vertical Polarity (Rx)



Horizontal Polarity (Rx)

Highest Maximized Emissions in Rx Mode 30MHz – 18GHz (vertical)

Frequency MHz	Quasi Pk FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB(uV)	RA dB(uV)	AG dB(uV)	AF dB(1/m)	CF dB(uV)
41.36	27.7	40	-12.3	15.5	0	11.2	1
47.31	25.8	40	-14.2	16.5	0	8.2	1.1
93.97	25.5	43.5	-18	14.4	0	9.6	1.5
203.39	34	43.5	-9.5	20.9	0	11	2.1
230.52	39.2	46	-6.8	25.4	0	11.5	2.3
244.07	30.7	46	-15.3	15.8	0	12.6	2.3

Highest Maximized Emissions in Rx Mode 30MHz – 18GHz (horizontal)

Frequency MHz	Quasi Pk FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB(uV)	RA dB(uV)	AG dB(uV)	AF dB(1/m)	CF dB(uV)
30.59	34.5	40	-5.5	14.4	0	19.2	0.9
94.10	26.3	43.5	-17.2	14.4	0	10.4	1.5
203.40	30.2	43.5	-13.3	17.3	0	10.7	2.1
216.95	28.9	46	-17.1	16.5	0	10.2	2.2
230.51	30.3	46	-15.7	16.9	0	11.2	2.3
244.25	29.5	46	-16.5	14.7	0	12.5	2.3

Note: Investigation performed up to 18 GHz. All other emissions not reported are at least 10dB below the limits.

11 Conducted Emissions on AC Power Mains Mode (exempt due to battery powered)

11.1 Test Limits

§ 15.207(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 μH/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 (dBμV)	
	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: 2003

11.3 Test Equipment Used:

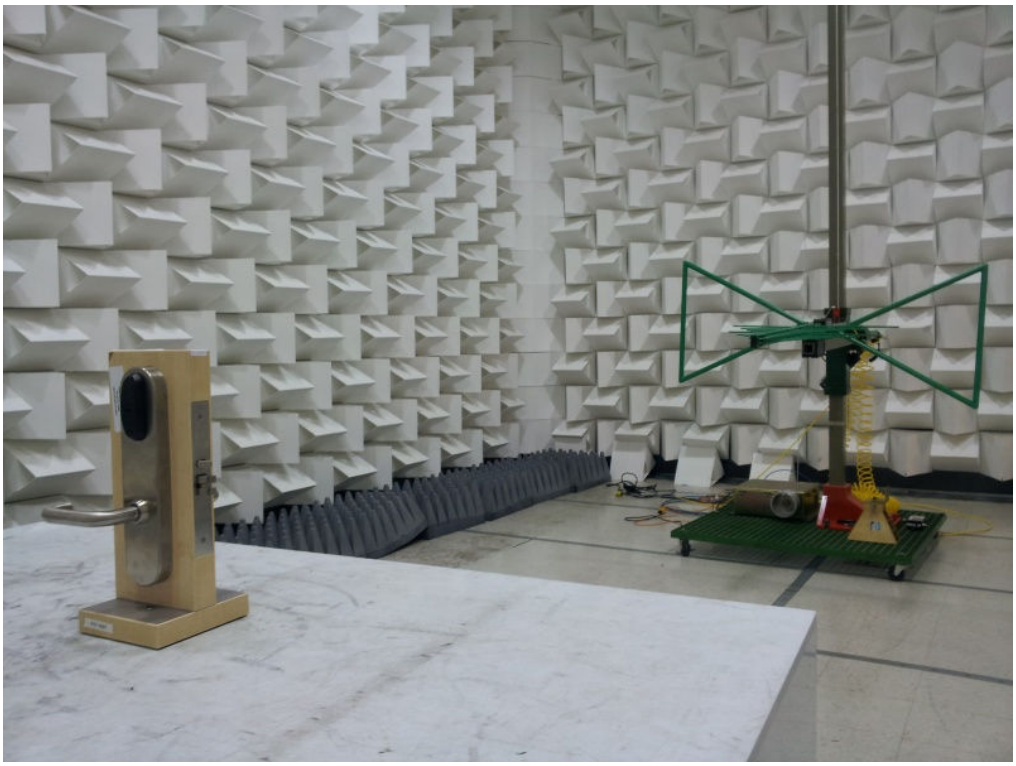
Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1140	Rohde & Schwarz	ESCI7	2/19/13	2/19/14
LISN	546	EMCO	38162	12/17/2012	12/17/2013

11.4 Results:

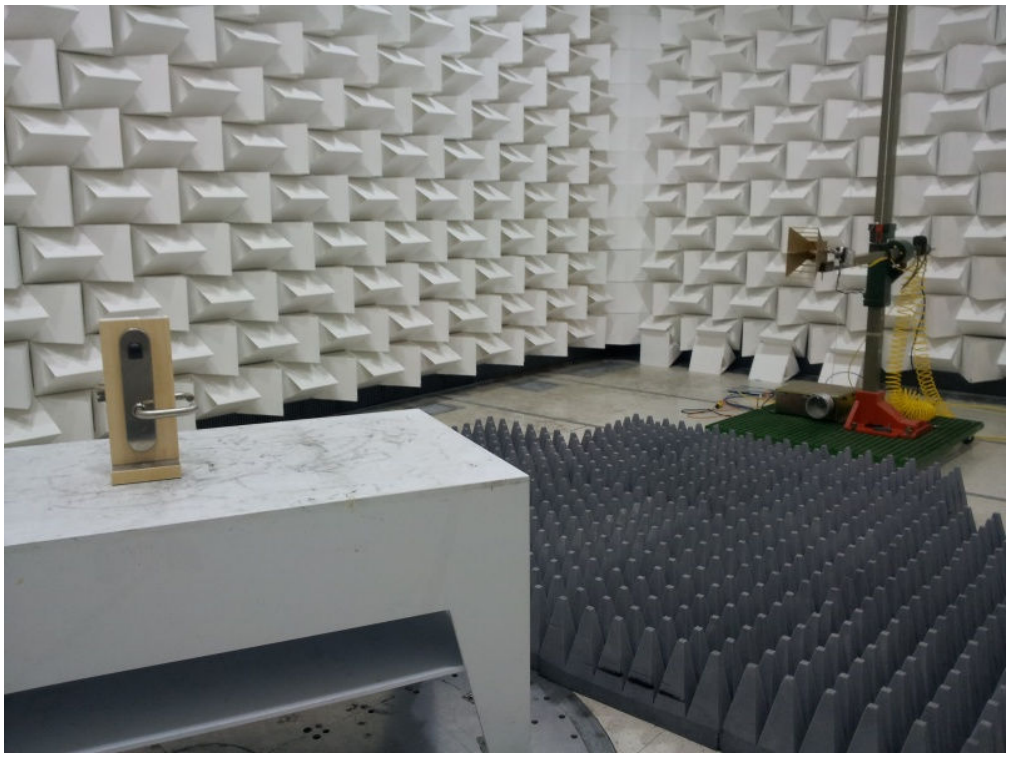
Conducted Emissions was not evaluated due to the product uses battery power only.

Date:		**Result: Exempt**
Tested by:		
Standard:		
Test Point:		
Operation mode:		
Note:		

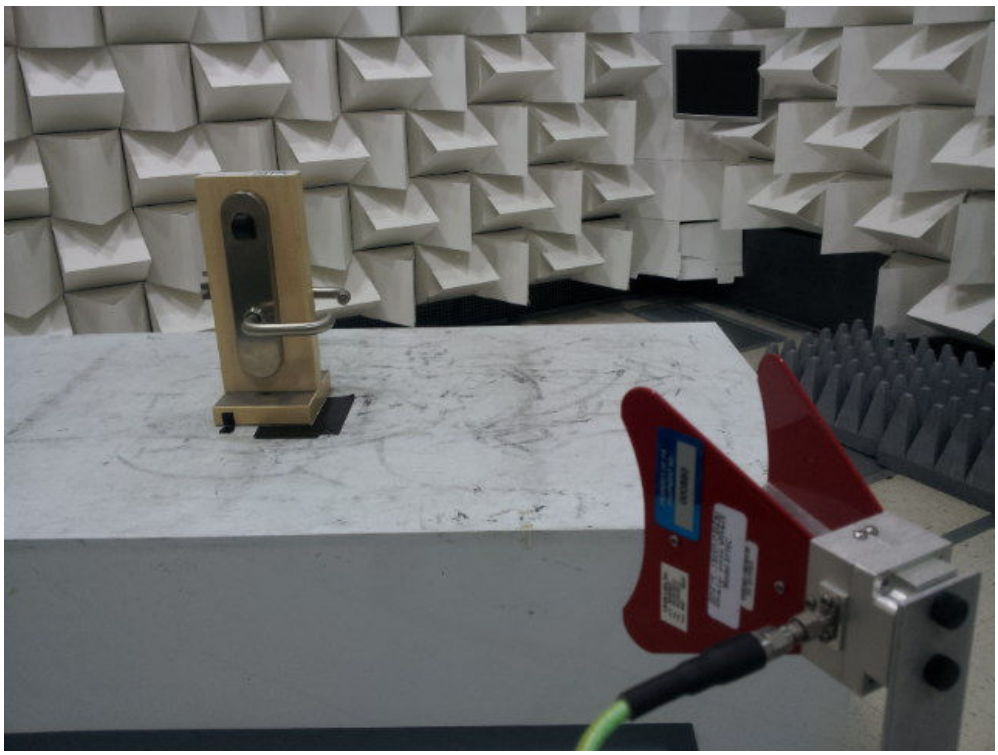
12 Setup Photos



30MHz-1000MHz setup



Above 1000MHz setup



Above 1000MHz setup

13 Antenna Requirement per FCC Part 15.203

13.1 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.

13.2 Results:

The sample tested met the antenna requirement. The EUT utilizes an internal PCB antenna.

14 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	

15 Revision History

Revision Number	Revision Contents	Date	Prepared By	Reviewed By
0	Initial release	1/10/2014		