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TEST REPORT

Report Number: 101324699LAX-001
Project Number: G101324699

Report Issue Date: 11/28/2013

Product Name: XS4
Model Number: A9XW
FCCID: UKCA9XW
ICID: 10088A-A9XW

FCC Standards: Title 47 CFR Part 15 Subpart B and C, 15.225
Industry Canada Standards: RSS-210 Issue 8 and ICES-003

Tested by:
Intertek Testing Services NA, Inc.
25791 Commercentre Drive
Lake Forest, CA 92630

Client:
Salto Systems S.L
Pol. Lanbarren, C/ Arkotz 9
20180-OIARTZUN
Spain

Report prepared by

David O'Reilly
Staff Engineer

Report reviewed by

David Chernomordik
Senior Staff Engineer

TABLE OF CONTENTS

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 Drive, Lake Forest, CA 92630. 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.

2 Test Summary

Page	Test Name	FCC Reference	IC Reference	Result
6	20dB Bandwidth	§ 2.1049	RSS-GEN (4.6.1)	Pass
7	In-Band Radiated Spurious Emissions (Transmitter)	§ 15.225(a)(b)(c)	RSS-210 (A2.6)	Pass
9	Out of Band Radiated Spurious Emissions (Transmitter)	§ 15.225(d), § 15.209	RSS-210 (A2.6)	Pass
11	FCC Part 15B Radiated Emissions	§ 15.109	ICES-003	Pass
15	AC Power line Conducted Emissions	§ 15.107, § 15.207	RSS-Gen (7.2.4)	Pass
15	Frequency Stability	§ 15.225(e)	RSS-210 (A2.6)	Pass
17	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	Salto Systems, S.L.
Model Number	A9XW
Serial Number	N/A
FCC Identifier	UKCA9XW
IC Identifier	10088A-A9XW
Receive Date	11/4/2013
Test Start Date	11/4/2013
Test End Date	11/23/2013
Device Received Condition	Good
Test Sample Type	Production
Frequency Band	13.56MHz
Mode(s) of Operation	RFID
Transmission Control	Normal Operation
Antenna Type (15.203)	Internal
Power Supply	Powered by 3 AA dry cell batteries

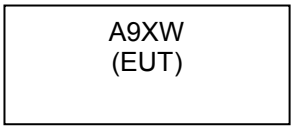
Description of Equipment Under Test
ELECTRONIC PROXIMITY XS4 LOCK A9xxxW SERIES by SALTO SYSTEMS

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Transmitting its normal 13.56MHz signal.

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 20dB Bandwidth

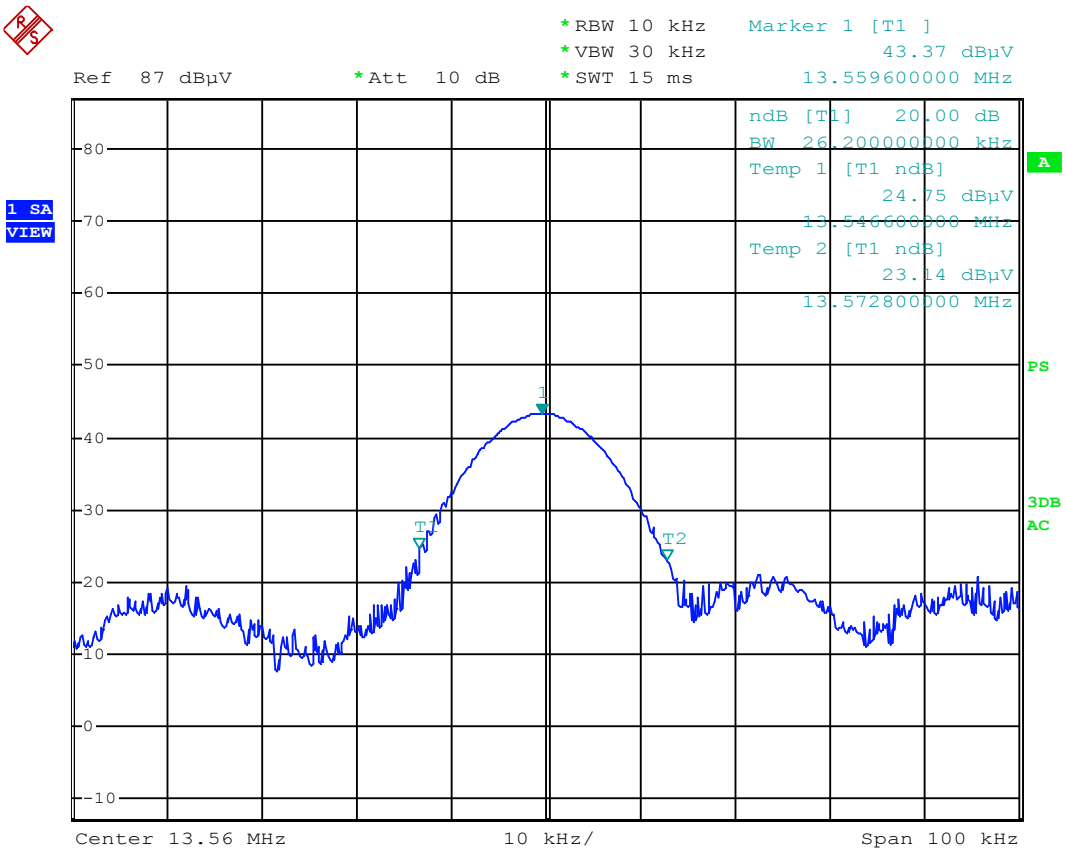
4.1 Test Limits
None

4.2 Test Procedure
The 20dB bandwidth was measured by a spectrum analyzer connected to a receive antenna placed near the test sample while it is transmitting.

4.3 Test Equipment Used:

Description	Asset Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1140	Rohde & Schwarz	ESCI7	2/10/2013	2/10/2014
Active Loop Antenna	590	EMCO	6502	5/14/2013	5/14/2014

4.4 Results:
The 20dB bandwidth was measured to be 26.2kHz as shown below.



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5 In-Band Radiated Spurious Emissions (Transmitter)

5.1 Test Limits

§ 15.225 Operation within the band 13.110-14.010 MHz.

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

5.2 Test Procedure

ANSI C63.10: 2009

5.3 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

5.4 Test Equipment Used:

Description	Asset Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESCI7	9/11/2013	9/11/2014
Active Loop Antenna	590	EMCO	6502	4/19/2013	4/19/2014
Biconnilog Antenna	1174	TESEQ	CBL6112D	2/01/2013	2/01/2014
RF Cable	798	n/a	n/a	7/9/2013	7/9/2014

5.5 Results:

The spurious emissions listed in the following tables are the worst case emissions. Emissions not reported were at or below the measurement noise floor.

Worst Case Spurious Emissions (Radio Transmitting)

A	B	C	D	E	F	G	H	J	K
Freq MHz	**RA QP (dBµV)**	**Antenna (dB)**	**Cable (dB)**	**3m Corr reading dBµV/m**	**30m Corr reading dBµV/m**	**30m Limit dBµV/m**	**Delta (dB)**	**Test Distance meters**	**Results**
13.56	45.52	10.9	0.6	57.02	17.02	84	-66.98	3	Compliant
Calculations:		**E = B + C + D**		**F = E - 40dB**		**H = F - G**	**RBW / QP = 9KHz / QP**		

Notes:

(1) The test sample was evaluated on one orthogonal axis since the product could only be mounted in one orientation.

(2) All measurements were performed with a loop antenna positioned in three orthogonal axis with the level at the highest position being recorded.

(3) Measurements were performed at 3m distance and the level extrapolated to the specified measurement distance of 30m. An inverse linear distance extrapolation factor of 40dB/decade (from part 15.31(f)) was used to facilitate this. Extrapolation Factor = $20\log(30/3)^2$ = 40dB.

(4) All emissions in the frequency bands 13.410-13.553 MHz, 13.567-13.710, 13.110-13.410 MHz and 13.710-14.010 MHz were more than 20dB below the limits.

6 Out of Band Radiated Spurious Emissions (Transmitter)

6.1 Test Limits

6.2 § 15.225 Operation within the band 13.110-14.010 MHz.

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

Part 15.209(a): Field General 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

6.3 Test Procedure

ANSI C63.4: 2009

6.4 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\

6.5 Test Equipment Used:

Description	Asset Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESCI7	9/11/2013	9/11/2014
Active Loop Antenna	590	EMCO	6502	4/19/2013	4/19/2014
Biconnilog Antenna	1147	TESEQ	CBL6112D	2/01/2013	2/01/2014
RF Cable	798	n/a	n/a	7/9/2013	7/9/2014

6.6 Results:

All of the out of band emissions were below the general limits from Part 15.209. The sample was tested from 9kHz – 1GHz excluding the in band 13.110 – 14.010 MHz range. The spurious emissions listed in the following tables are the worst case emissions.

Worst Case Out of Band Spurious Emissions (Radio Transmitting)

A	B	C	D	E	F	G	J	K
Freq. MHz	**RA (dBµV)**	**Ant (dB)**	**Cable (dB)**	**Corr dBµV/m**	**Limit dBµV/m**	**Margin dB/m**	**Dist**	**RBW/ Detector**
25.56	25.56	10.1	0.9	36.56	69.54	-32.98	3	QP / 9KHz
27.12	11.04	9.4	0.9	21.34	69.54	-48.2	3	QP / 9KHz
40.68	20.7	14	0.96	35.66	40	-4.34	3	P / 120KHz
54.24	21.01	8.4	1.27	30.68	40	-9.32	3	P / 120KHz
67.8	23.9	6	1.3	31.2	40	-8.8	3	P / 120KHz
81.36	22.04	7.9	1.4	31.34	40	-8.66	3	P / 120KHz
94.92	25.48	10.4	1.5	37.38	43.52	-6.14	3	QP / 120KHz
108.48	24.91	12.4	1.6	38.91	43.52	-4.61	3	P / 120KHz
122	22.25	12.9	1.75	36.9	43.52	-6.62	3	P / 120KHz
135.6	20.14	12.4	1.76	34.3	43.52	-9.22	3	P / 120KHz
Calculations:	**E = B + C + D**				**G = F - G**			

Notes:

(1) The test sample was evaluated on three orthogonal axes since it was a module and could be used in any orientation.

(2) All measurements below 30MHz were performed with a loop antenna positioned in three orthogonal axis with the level at the highest position being recorded.

(3) All measurements above 30MHz were performed with a bilog antenna maximized from 1-4m in height and in vertical and horizontal polarities.

(4) Measurements were performed at 3m distance.

7 FCC Part 15B Radiated Emissions

7.1 Method

ANSI C63.4: 2009

7.2 Test Location

This test was performed at the Intertek offices located at the following address:

Intertek
25791 Commercentre Drive
Lake Forest, CA. 92630

7.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	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
Active Loop Antenna	3416	ETS	6502	4/19/2013	4/19/2014
System Controller	121701-1	Sunol Sciences	SC99V	Calibration Not Required	Calibration Not Required

7.4 Results and Data:

The sample tested was found to Comply.

Test: Radiated Emissions
Frequency Range: 9KHz to 1000 MHz
Limits: Class B
Measurement Distance: 3 meters
EUT: P023 (Compact Console Unit Host Equipment)
Measurement Uncertainty: 4.2 dB
Temperature: 23.9 ˚C
Relative Humidity: 50.6 %
Power Input: Battery

FCC, pat 15 per 15.209 Horzontal								
Frequency H/V MHz	Quasi Pk FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA dB(uV)	AG dB	AF dB(1/m)	CF dB	DCF dB
30.588 (*)	34.5	40	-5.5	14.4	0	19.2	0.9	0
94.103	26.3	43.5	-17.2	14.4	0	10.4	1.5	0
203.395	30.2	43.5	-13.3	17.3	0	10.7	2.1	0
216.953	28.9	46	-17.1	16.5	0	10.2	2.2	0
230.514	30.3	46	-15.7	16.9	0	11.2	2.3	0
244.246	29.5	46	-16.5	14.7	0	12.5	2.3	0
Detectors/Bandwithds (Det/RBW/VBW)= 120/300kHz								

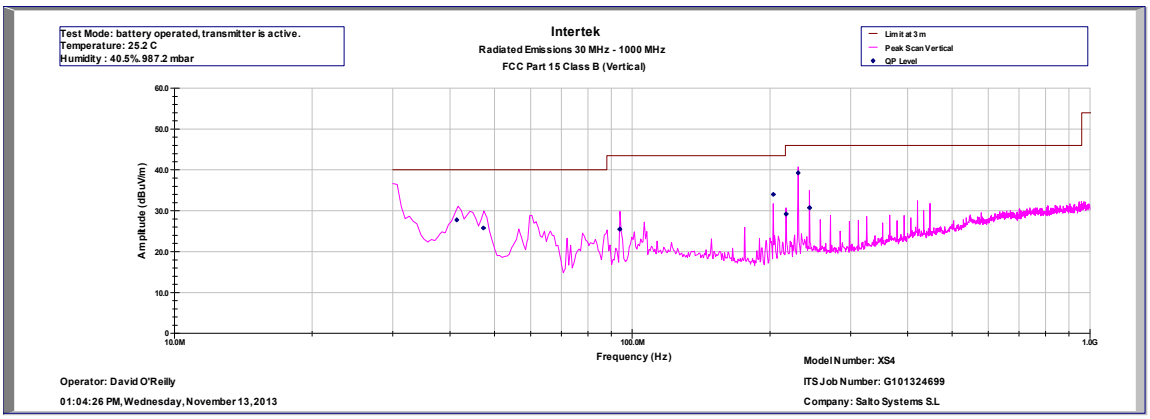
FCC, pat 15 per 15.209 Vertical								
Frequency H/V MHz	Quasi Pk FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA dB(uV)	AG dB	AF dB(1/m)	CF dB	DCF dB
41.36	27.7	40	-12.3	15.5	0	11.2	1	0
203.391	34	43.5	-9.5	20.9	0	11	2.1	0
216.956	29.2	46	-16.8	16.4	0	10.6	2.2	0
230.515	39.2	46	-6.8	25.4	0	11.5	2.3	0
244.072	30.7	46	-15.3	15.8	0	12.6	2.3	0
473.14	25.8	46	-20.2	16.5	0	8.2	1.1	0
Detectors/Bandwithds (Det/RBW/VBW)= 120/300kHz								

Quasi FS – (Final) Quasi Peak Field Strength
RA – Receiver (quasi peak) Amplitude
AG – Preamp Gain
AF – Antenna Factor
CF – Cable Factor
DCF – Distance Correction Factor
Calculation: FS=RA+AF+CF-AG-DCF

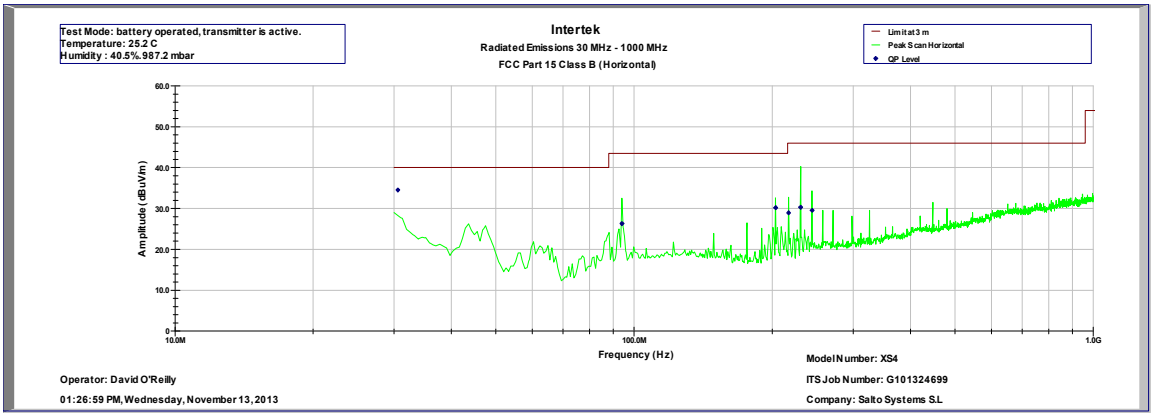
Test Result: (*)The EUT PASSED Radiated Emission test with 5.5 dB margin at 30.558 MHz.

Deviations, Additions, or Exclusions: None

7.5 Plots:

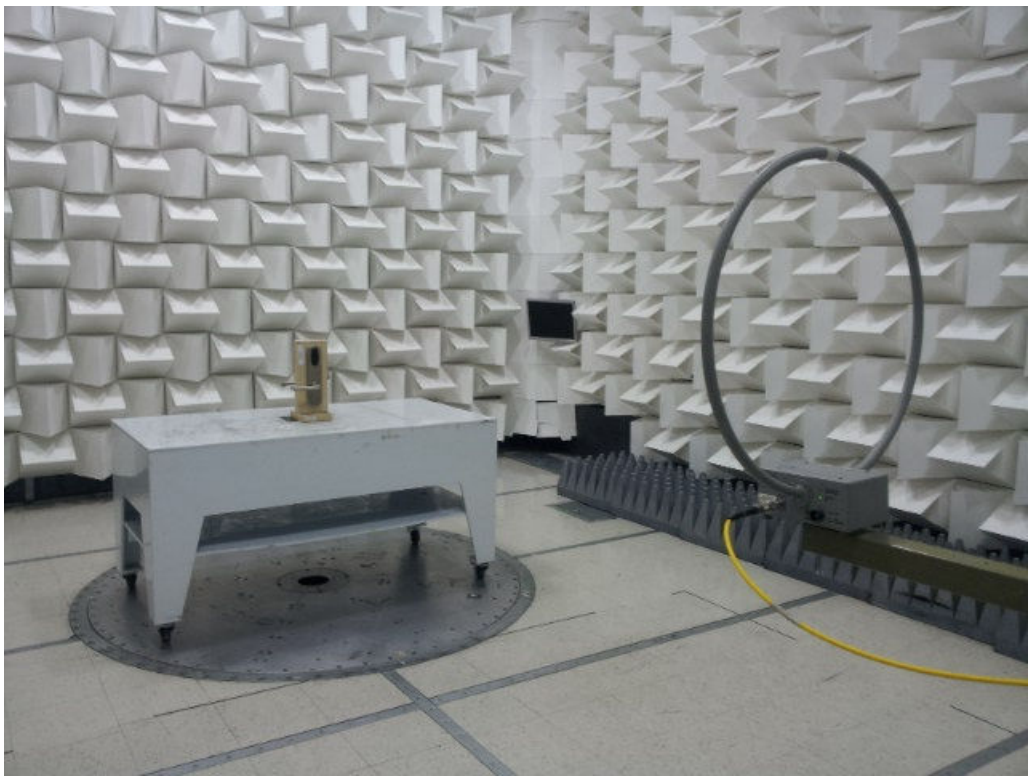


FCC part 15.209 Vertical 30-1000MHz

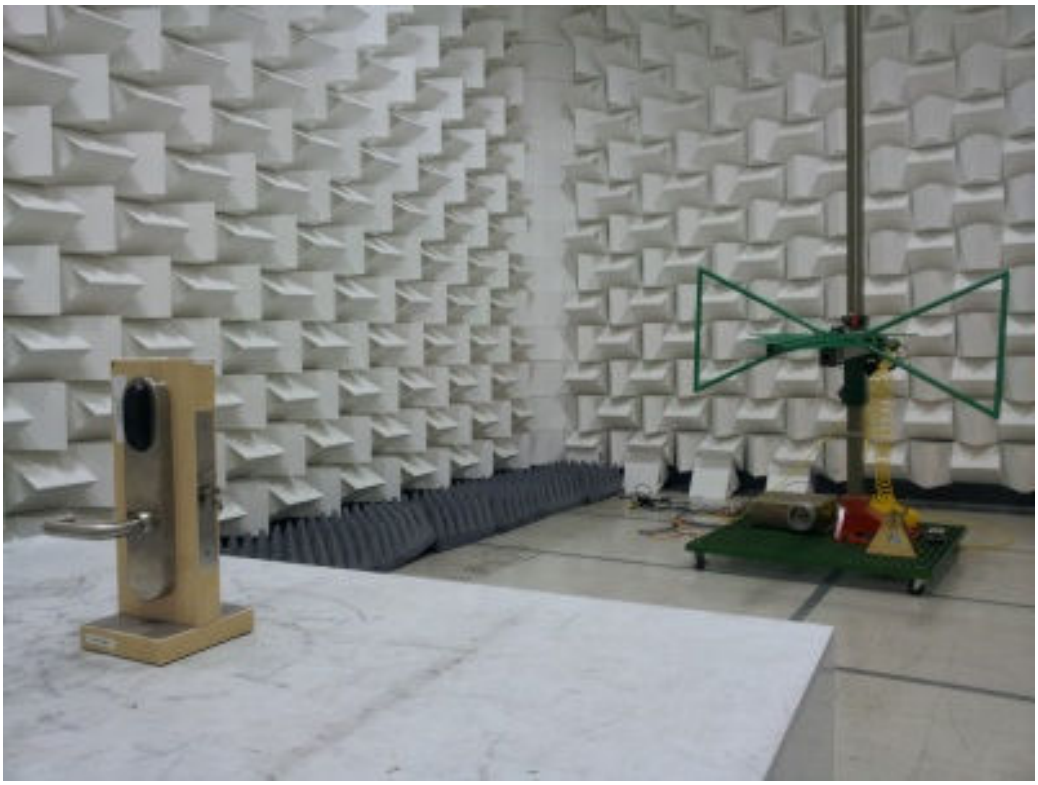


FCC part 15.209 Horizontal 30-1000MHz

7.6 Setup Photos:



9kHz – 30MHz setup



30 MHz – 1000MHz setup

8 AC Power line Conducted Emissions

8.1 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 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.

8.2 Test Procedure

ANSI C63.4: 2009

8.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	9/11/2013	9/11/2014
LISN	3333	Teseq	NNB52	3/11/2013	3/11/2014

8.4 Results:

This test does not apply since the EUT is battery powered, and has no connection to the AC mains.

9 Frequency Stability

9.1 Test Limits

9.2 § 15.225 Operation within the band 13.110-14.010 MHz.

(e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

9.3 Results:

The data below shows that the test sample meets the frequency stability requirements from Part 15.225.

Frequency Stability Test Data

Operating Frequency 13,560,000
Channel: RFID Single Channel
Reference Voltage: 4.5VDC battery operated by 3 AAA cells
Deviation Limit (±): 0.01% of 13.56MHz = 1,356Hz
Notes:

Voltage (%)	Voltage (VDC)	Temp (°C)	Interval Minutes	Frequency (Hz)	Deviation (Hz)	Deviation (%)
3 x AA	4.21	-30°	Startup	13,560,800	800.00	0.006
3 x AA		-30°	2 min	13,560,800	800.00	0.006
3 x AA		-30°	5 min	13,560,800	800.00	0.006
3 x AA		-30°	10 min	13,560,800	800.00	0.006
3 x AA	4.25	-20°	Startup	13,560,400	400.00	0.003
3 x AA		-20°	2 min	13,560,400	400.00	0.003
3 x AA		-20°	5 min	13,560,400	400.00	0.003
3 x AA		-20°	10 min	13,560,400	400.00	0.003
3 x AA	4.32	-10°	Startup	13,560,400	400.00	0.003
3 x AA		-10°	2 min	13,560,400	400.00	0.003
3 x AA		-10°	5 min	13,560,400	400.00	0.003
3 x AA		-10°	10 min	13,560,400	400.00	0.003
3 x AA	4.29	0°	Startup	13,560,400	400.00	0.003
3 x AA		0°	2 min	13,560,400	400.00	0.003
3 x AA		0°	5 min	13,560,400	400.00	0.003
3 x AA		0°	10 min	13,560,400	400.00	0.003
3 x AA	4.27	10°	Startup	13,560,400	400.00	0.003
3 x AA		10°	2 min	13,560,400	400.00	0.003
3 x AA		10°	5 min	13,560,400	400.00	0.003
3 x AA		10°	10 min	13,560,400	400.00	0.003
3 x AA	4.23	20°	Startup	13,560,400	400.00	0.003
3 x AA		20°	2 min	13,560,400	400.00	0.003
3 x AA		20°	5 min	13,560,400	400.00	0.003
3 x AA		20°	10 min	13,560,400	400.00	0.003
3 x AA	4.25	30°	Startup	13,564,000	0.00	0
3 x AA		30°	2 min	13,564,000	0.00	0
3 x AA		30°	5 min	13,564,000	0.00	0
3 x AA		30°	10 min	13,564,000	0.00	0
3 x AA	4.35	40°	Startup	13,564,000	0.00	0
3 x AA		40°	2 min	13,564,000	0.00	0
3 x AA		40°	5 min	13,564,000	0.00	0
3 x AAA		40°	10 min	13,560,000	0.00	0

10 Antenna Requirement per FCC Part 15.203

10.1 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.

10.2 Results:

The sample tested met the antenna requirement. The antenna was a pcb loop antenna permanently attached to the circuit board.

11 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	

12 Revision History

Revision Level	Date	Report Number	Notes
0	11/28/2013	101324716LAX-001	Original Issue