



731 Enterprise Drive
Lexington, KY 40510

Telephone: 859-226-1000
Facsimile: 859-226-1040
www.intertek-etlsemko.com

TEST REPORT

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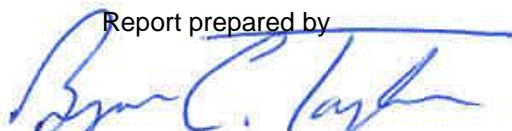
Product Name: iX101T1 Rugged Tablet
Model Number: iX101T1
FCCID: Q2GWWG7550A
ICID: 4596A-WG7550A

Standards: Title 47 CFR Part 15 Subpart C and RSS-210
Issue 8

Radios Under Test: Near Field Communication (NFC)

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

Client:
Xplore Technologies
14000 Summit Dr.
Austin, TX 78728

Report prepared by

Bryan Taylor, Team Leader

Report reviewed by

Jason Centers, Senior Project Engineer



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1 Introduction and Conclusion

The tests indicated in section 2 were performed on the product constructed as described in section 3. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test method, a list of the actual test equipment used, documentation photos, results and raw data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complied with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

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

2 Test Summary

Page	Test 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
10	AC Powerline Conducted Emissions	§ 15.107, § 15.207	RSS-Gen (7.2.4)	Pass
14	Frequency Stability	§ 15.225(e)	RSS-210 (A2.6)	Pass
15	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	Xplore Technologies
Model Number	iX101T1
Serial Number	Test Sample #2
FCC Identifier	Q2GWWG7550A
IC Identifier	4596A-WG7550A
Receive Date	7/18/2013
Test Start Date	7/23/2013
Test End Date	7/24/2013
Device Received Condition	Good
Test Sample Type	Production
Frequency Band	13.56MHz
Mode(s) of Operation	NFC
Transmission Control	Normal Operation
Antenna Type (15.203)	Internal
Power Supply	115VAC/60Hz (Via AC / DC Power Adapter)

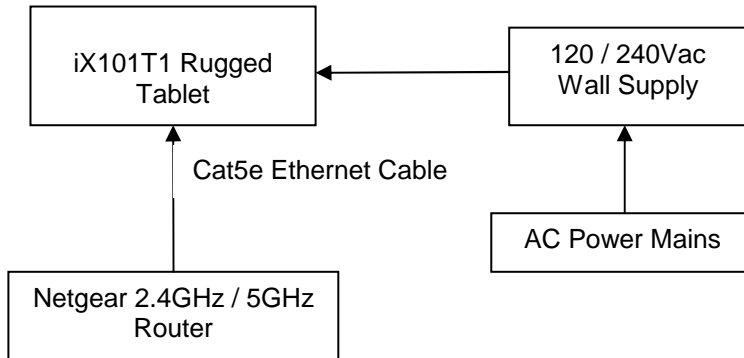
Description of Equipment Under Test
The iX101T1 is a ruggedized tablet PC.

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Transmitting NFC signal at 13.56MHz
2	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
120 / 240Vac Power Cable	1m	No	No	120 / 240Vac Wall Supply	Xplore Tablet
Cat5e Ethernet Cable	1m	No	No	Netgear Ethernet / Wi-Fi Router	Xplore Tablet
HDMI Mini Cable	1m	Yes	No	Xplore Tablet	Unterminated
HDMI Cable	1m	Yes	No	Xplore Tablet	Unterminated
Micro USB Cable	1m	Yes	No	Xplore Tablet	Unterminated
USB Cable	1m	Yes	No	USB Mouse	Xplore Tablet

3.4 Support Equipment:

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Wireless Router	Netgear	WNDR3700v4	311315801CC9

4 20dB Bandwidth

4.1 Test Limits

None

4.2 Test Procedure

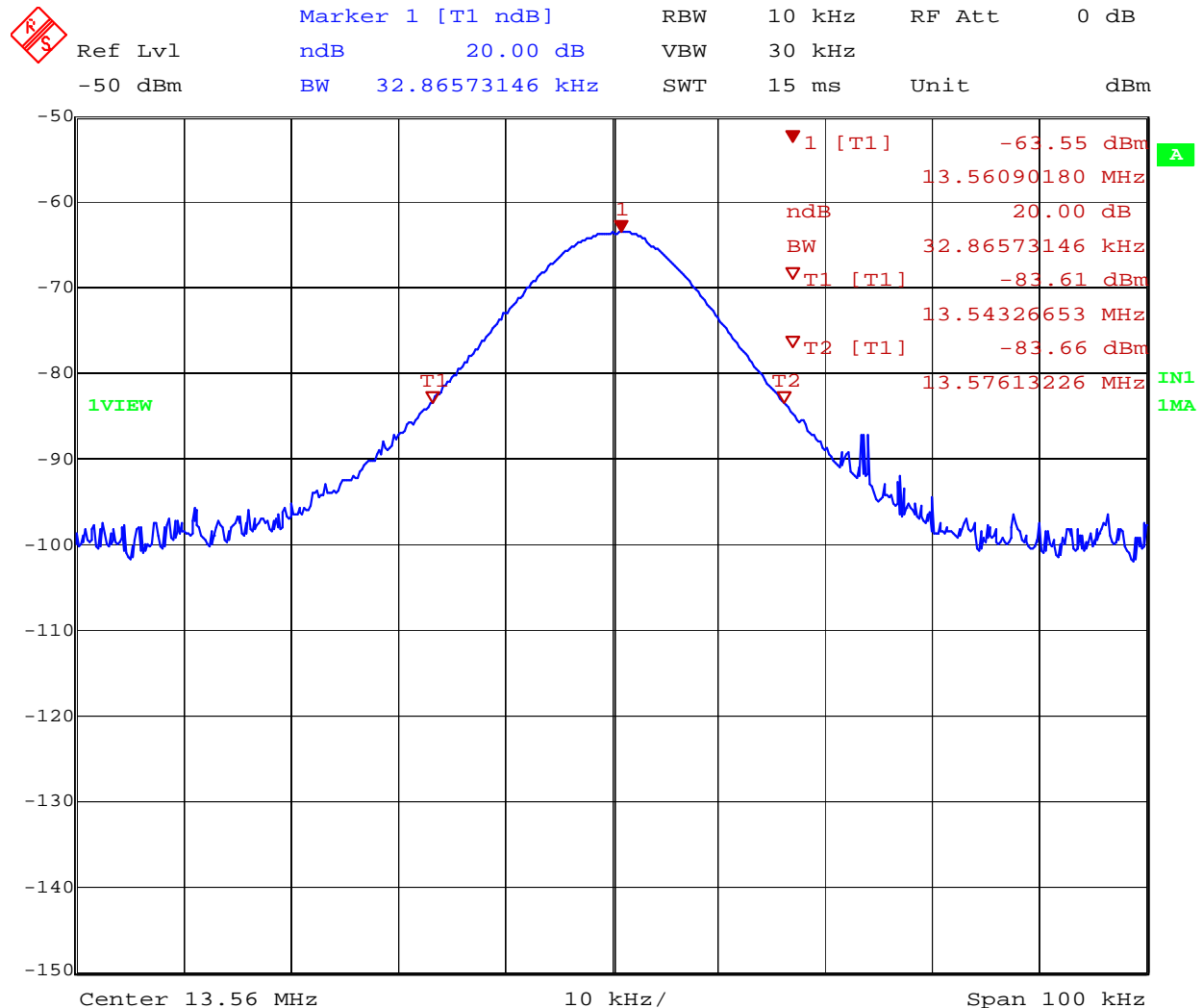
The 20dB bandwidth was measured by a spectrum analyzer connected to a receive antenna placed near the test sample while it is transmitting.

4.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	9/15/2012	9/14/2013

4.4 Results:

The 20dB bandwidth was measured to be 32.86kHz as shown in the plot 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 dB μ V/m

RA = Receiver Amplitude in dB μ V

AF = Antenna Factor in dB

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

Example Calculation:

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

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

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

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

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

5.4 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	9/15/2012	9/14/2013
Preamplifier	SF456200904	Mini-Circuits	ZX60-3018G-S+	9/4/2012	9/4/2013
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

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 (NFC Radio Transmitting)

Radiated Emissions											
Test Engineer: Bryan Taylor		Start Date: 7/23/2013		End Date: 7/23/2013							
Temperature: 23.8C		Humidity: 46.30%		Pressure: 988.4mBar							
Specification: FCC Part 15C				Test Limit: 15.225(a)-(d)							
Notes: NFC Radio Transmitting. In Band Measurements											
A	B	C	D	E	F	G	H	I	J	K	
Frequency	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	3m Corr. Reading. (dBuV/m)	30m Corr Reading (dBuV/m)	30m Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results	
13.137 MHz	2.74	0.54	10.87	14.15	-25.85	40.51	-66.36	9kHz / QPK	3m	Compliant	
13.351 MHz	2.83	0.55	10.87	14.25	-25.75	40.51	-66.26	9kHz / QPK	3m	Compliant	
13.46 MHz	2.83	0.55	10.86	14.24	-25.76	50.47	-76.23	9kHz / QPK	3m	Compliant	
13.56 MHz	33.06	0.55	10.86	44.47	4.47	84	-79.53	9kHz / QPK	3m	Compliant	
13.67 MHz	2.58	0.55	10.85	13.98	-26.02	50.47	-76.49	9kHz / QPK	3m	Compliant	
13.771 MHz	2.5	0.56	10.85	13.91	-26.09	40.51	-66.6	9kHz / QPK	3m	Compliant	
13.991 MHz	2.47	0.56	10.84	13.87	-26.13	40.51	-66.64	9kHz / QPK	3m	Compliant	
Calculations:				E = B + C + D		F = E - 40dB		H = F - G			

Notes:

- (1) The test sample was evaluated on three orthogonal axes since it was a hand held device and could be used in any 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 = $20\log(30/3)^2 = 40\text{dB}$.

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 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

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

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

6.5 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	9/15/2012	9/14/2013
Preamplifier	SF456200904	Mini-Circuits	ZX60-3018G-S+	9/4/2012	9/4/2013
Biconnilog Antenna	00051864	ETS	3142C	12/14/2012	12/14/2013
System Controller	121701-1	Sunol Sciences	SC99V	Time of Use	Time of Use

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 (NFC Radio Transmitting)

Radiated Emissions										
Test Engineer: Bryan Taylor		Start Date: 7/23/2013		End Date: 7/23/2013						
Temperature: 23.8C		Humidity: 46.30%		Pressure: 988.4mBar						
Specification: FCC Part 15C		Test Limit: 15.209 Class B								
Notes: NFC Radio Transmitting, Out of Band Measurements										
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
6.779 MHz	NA	7.15	0.41	11.02	18.58	69.54	-50.96	9kHz / QPK	3m	Compliant
27.12 MHz	NA	33.35	0.74	8.98	43.07	69.54	-26.47	9kHz / QPK	3m	Compliant
54.241 MHz	V	28.04	0.83	8.58	37.45	40	-2.55	120kHz / QPK	3m	Compliant
54.247 MHz	H	18	0.83	8.58	27.41	40	-12.59	120kHz / QPK	3m	Compliant
244.1 MHz	H	25.58	2.07	12.28	39.93	46.02	-6.09	120kHz / QPK	3m	Compliant
650.88 MHz	H	20.41	3.18	20.4	43.99	46.02	-2.03	120kHz / QPK	3m	Compliant
678.01 MHz	H	20.14	3.31	21.32	44.77	46.02	-1.25	120kHz / QPK	3m	Compliant
705.14 MHz	H	15.97	3.35	21.91	41.23	46.02	-4.79	120kHz / QPK	3m	Compliant
Calculations:					F = C + D + E		H = F - G			

Notes:

- (1) The test sample was evaluated on three orthogonal axes since it was a hand held device 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 AC Powerline Conducted Emissions

7.1 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.

7.2 Test Procedure

ANSI C63.4: 2009

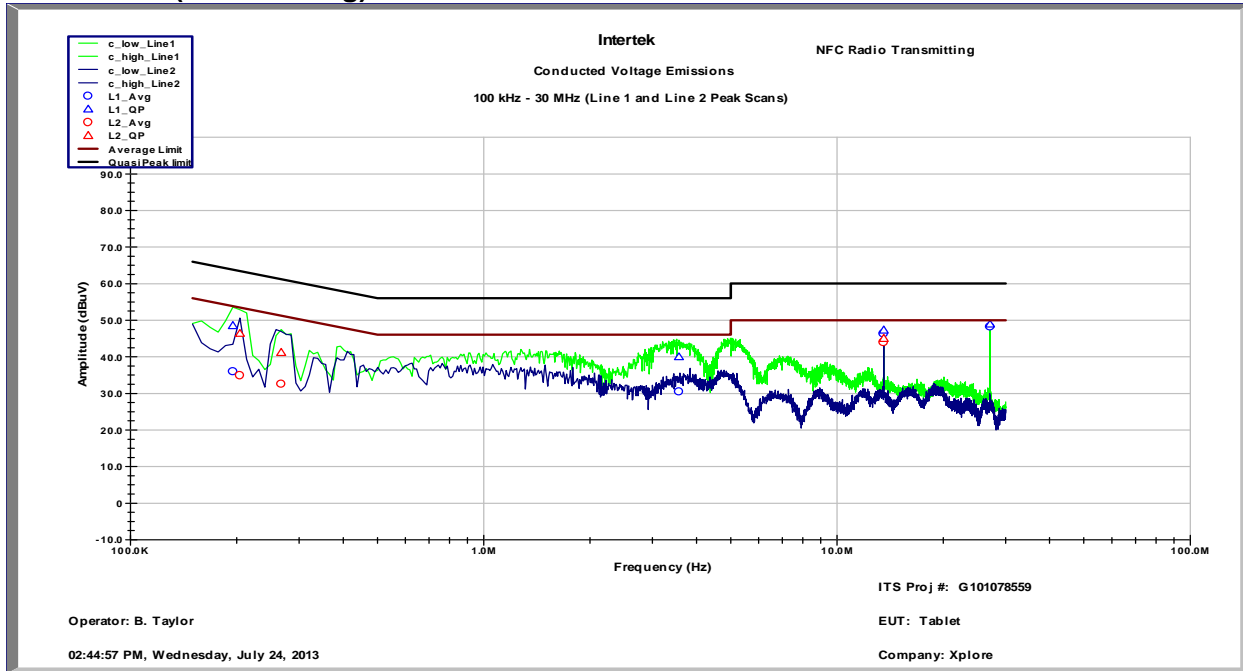
7.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ES126	9/15/2012	9/14/2013
LISN	3333	Teseq	NNB52	3/11/2013	3/11/2014

7.4 Results:

The sample tested was found to Comply.

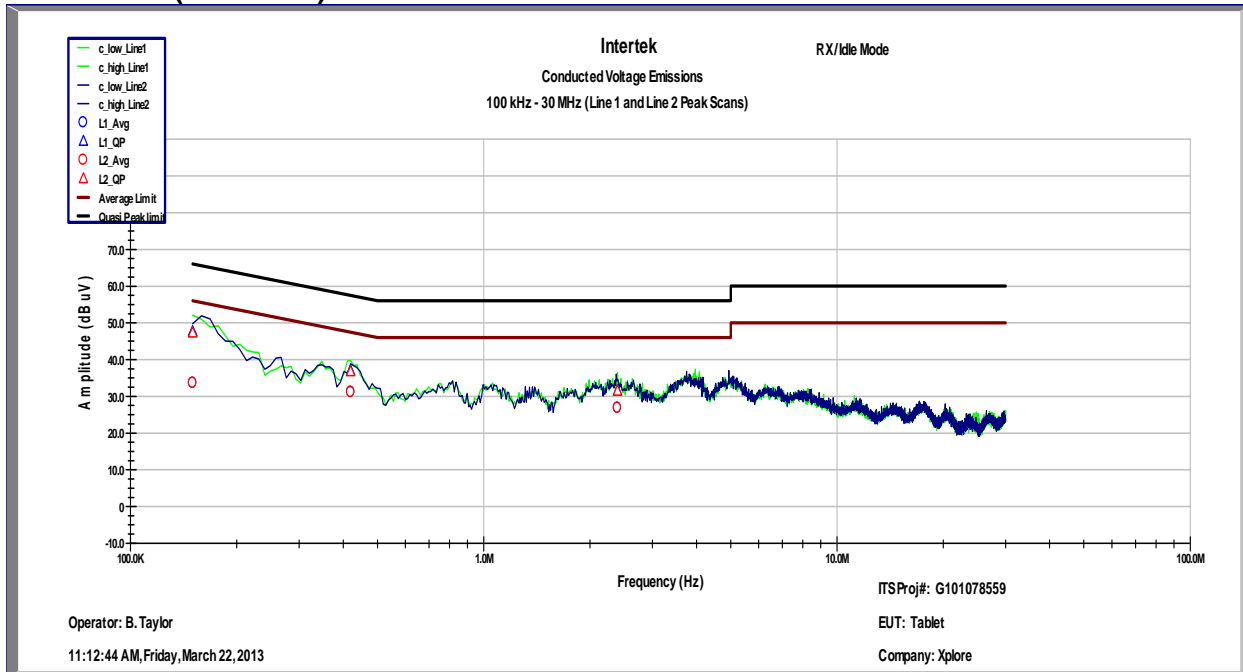
7.5 Data (Transmitting):



Conducted Voltage Emissions on Power Lines								
Test Engineer: Bryan Taylor		Start Date: 7/24/2013		End Date: 7/24/2013				
Temperature: 22.4C		Humidity: 52.10%		Pressure: 990.8mBar				
Specification: FCC Part 15		Test Limit: Class B		RBW: 9kHz				
Notes: NFC Radio 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	195.0 KHz	48.49	63.82	-15.33	35.97	53.82	-17.85	Compliant
Line 1	3.57 MHz	39.97	56	-16.03	30.48	46	-15.52	Compliant
Line 1	13.56 MHz	47.31	60	-12.69	46.31	50	-3.69	Compliant
Line 2	27.12 MHz	48.91	60	-11.09	48.2	50	-1.8	Compliant
Line 2	204.0 KHz	46.36	63.45	-17.09	34.89	53.45	-18.56	Compliant
Line 2	267.0 KHz	41.18	61.21	-20.03	32.55	51.21	-18.66	Compliant
Line 2	13.56 MHz	45.03	60	-14.97	43.95	50	-6.05	Compliant

Deviations, Additions, or Exclusions: None

7.6 Data (Idle Mode):



Conducted Voltage Emissions on Power Lines								
Test Engineer:	Bryan Taylor	Start Date:	3/21/2013	End Date:	3/21/2013			
Temperature:	23.4C	Humidity:	38.20%	Pressure:	987.8mBar			
	FCC Part 15 /							
Specification:	EN55022	Test Limit:	Class B	RBW:	9kHz			
Notes:	Idle Mode							
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	47.66	66	-18.34	33.64	56	-22.36	Compliant
Line 1	420.0 KHz	36.94	57.45	-20.51	31.2	47.45	-16.25	Compliant
Line 1	2.391 MHz	31.47	56	-24.53	26.82	46	-19.18	Compliant
Line 2	150.0 KHz	47.29	66	-18.71	33.57	56	-22.43	Compliant
Line 2	420.0 KHz	36.73	57.45	-20.72	31.1	47.45	-16.35	Compliant
Line 2	2.391 MHz	31.47	56	-24.53	26.85	46	-19.15	Compliant

Deviations, Additions, or Exclusions: None

8 Frequency Stability

8.1 Test Limits

8.2 § 15.225 Operation within the band 13.110-14.010 MHz.

(e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ 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.

8.3 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 Hz			
Channel:		NFC Radio (Single Channel)			
Reference Voltage:		115 VAC			
Deviation Limit (+/-):		0.01 % =		1356 Hz	
Notes:					
Voltage (%)	Voltage (VAC)	Temp (°C)	Frequency (Hz)	Deviation (Hz)	Deviation (%)
100%	115	-30	13560142	142	0.001047
100%	115	-20	13560151	151	0.001114
100%	115	-10	13560187	187	0.001379
100%	115	0	13560195	195	0.001438
100%	115	10	13560112	112	0.000826
100%	115	20	13560115	115	0.000848
100%	115	30	13560126	126	0.000929
100%	115	40	13560124	124	0.000914
100%	115	50	13560108	108	0.000796
100%	115	60	13560111	111	0.000819
115%	132.25	20	13560110	110	0.000811
85%	97.75	20	13560118	118	0.000870

9 Antenna Requirement per FCC Part 15.203**9.1 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.

9.2 Results:

The sample tested met the antenna requirement. The antenna utilized a U.fl connector for connection to the PCB antenna.

10 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	

11 Revision History

Revision Level	Date	Report Number	Notes
0	7/24/2013	101078559LEX-016	Original Issue