NVLAP Lab Code 200087-0

Test Report For Grant of Certification Application

Model: RFID Programmer
13.56 MHz

RFID Device Transmitter

FCC ID: WPZ-RFIDPRG1
IC: 7945A-RFIDPRG1

FOR

Digital Ally

9705 Loiret Blvd
Lenexa, KS 66219

Test Report Number: 141006
IC Test Site Registration: 3041A-1

Authorized Signatory: Scot D Rogers
Scot D. Rogers

NVLAP Lab Code 200087-0

ROGERS LABS, INC.
4405 West 259th Terrace
Louisburg, KS 66053
Phone / Fax (913) 837-3214

Engineering Test Report for Grant of Certification Application

FOR

CFR 47, PART 15C - Intentional Radiators
CFR 47 Paragraph 15.225 and Industry Canada RSS-310
License Exempt Intentional Radiator

For

Digital Ally

9705 Loiret Blvd
Lenexa, KS 66219

Model: RFID Programmer

Low Power Transmitter
Frequency Range 13.56 MHz
FCC ID#: WPZ-RFIDPRG1
IC: 7945A-RFIDPRG1

Test Date: October 6, 2014

Certifying Engineer: Scot D Rogers
Scot D. Rogers
Rogers Labs, Inc.
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Revisions

Revision 1 Issued November 5, 2014

Forward

The following information is submitted for consideration in obtaining Grant of Certification for low power intentional radiator per CFR 47 Paragraph 15.225, and Industry Canada RSS-310 issue 3, operation at 13.56 MHz as Near Field Communications Device.

Name of Applicant: Digital Ally FRN: 0018 03 1203
9705 Loiret Blvd
Lenexa, KS 66219
Model: RFID Programmer
FCC ID: WPZ-RFIDPRG1 Industry Canada ID IC: 7945A-RFIDPRG1

Frequency Range: 13.56 MHz
Operating power: maximum average power 30.3 dBµV/m @ 30 meters, 99 percent occupied bandwidth 1.0 MHz

Opinion / Interpretation of Results

Tests Performed	Margin (dB)	Results
Emissions as per CFR 47 paragraphs 2 and 15.205	-18.7	Complies
Emissions as per CFR 47 paragraphs 2 and 15.207	-4.5	Complies
Emissions as per CFR 47 paragraphs 2 and 15.209	-18.1	Complies
Harmonic Emissions per CFR 47 15.225	-13.1	Complies

Equipment Tested

Equipment	Model	FCC I.D.
EUT	RFID Programmer	WPZ-RFIDPRG1
Laptop Computer	studio XPS (PP35L)	921LBN1
USB Printer	Dell 0N5819	5D1SL61

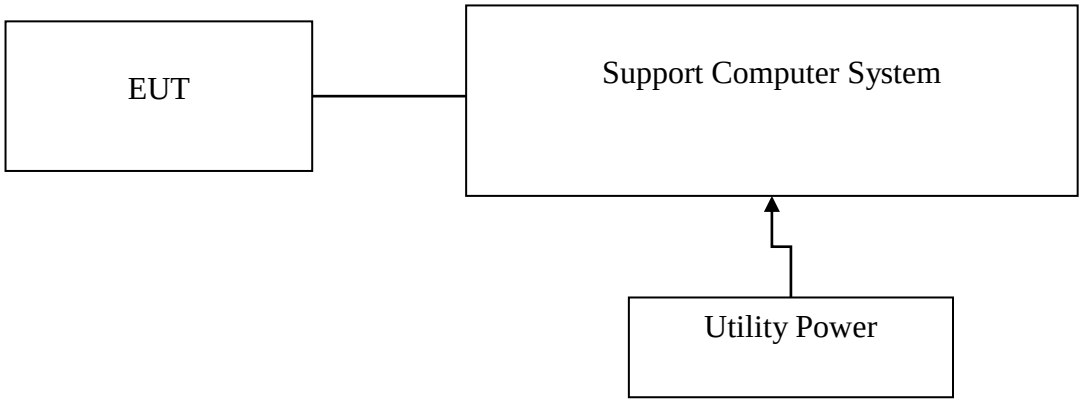
Test results in this report relate only to the items tested.

Antenna/Type
Permanently Attached PCB trace antenna

Equipment Function and Configuration

The EUT is a mobile RFID Tag programmer incorporating a 13.56 MHz transmitter. The transmitter system provides user ability to programmer compatible RFID tag. The design utilizes permanently attached PCB antenna. For testing purposes, the RFID Programmer was interfaced with the computer for control. This configuration provided operational control of the EUT. The RFID Programmer offers single port for power and communications through compliant USB equipment only and offers no other interface ports. For testing purposes, the RFID Programmer received powered from the support computer system and was configured to transmit in available mode. The antenna system complies with requirements for unique antenna connection port.

Equipment Configuration



Application for Certification

(1) Manufacturer: Digital Ally
9705 Loiret Blvd
Lenexa, KS 66219

(2) Identification: Model: RFID Programmer

FCC I.D.: WPZ-RFIDPRG1 IC: 7945A-RFIDPRG1

(3) Instruction Book:

Refer to Exhibit for Instruction Manual.

(4) Description of Circuit Functions:

Refer to Exhibit of Operational Description.

(5) Block Diagram with Frequencies:

Refer to Exhibit of Operational Description.

(6) Report of Measurements:

Report of measurements follows in this Report.

(7) Photographs: Construction, Component Placement, etc.:

Refer to Exhibit for photographs of equipment.

(8) List of Peripheral Equipment Necessary for operation. The equipment operates from direct current power received from external USB support equipment. The EUT provides interface port for connection with compliant USB equipment. During testing, the EUT was connected to the external support computer system.

(9) Transition Provisions of CFR47 15.37 are not requested

(10) Not Applicable. The unit is not a scanning receiver.

(11) Not Applicable. The EUT does not operate in the 59 – 64 GHz frequency band.

(12) The equipment is not software defined and this section is not applicable.

Applicable Standards & Test Procedures

In accordance with the Federal Communications Commission and Code of Federal Regulations CFR 47, dated October 1, 2013, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057, applicable parts of paragraph 15, Part 15C paragraph 15.225 and Industry Canada RSS-310, the following information is submitted. Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in the ANSI C63.10-2009 Document.

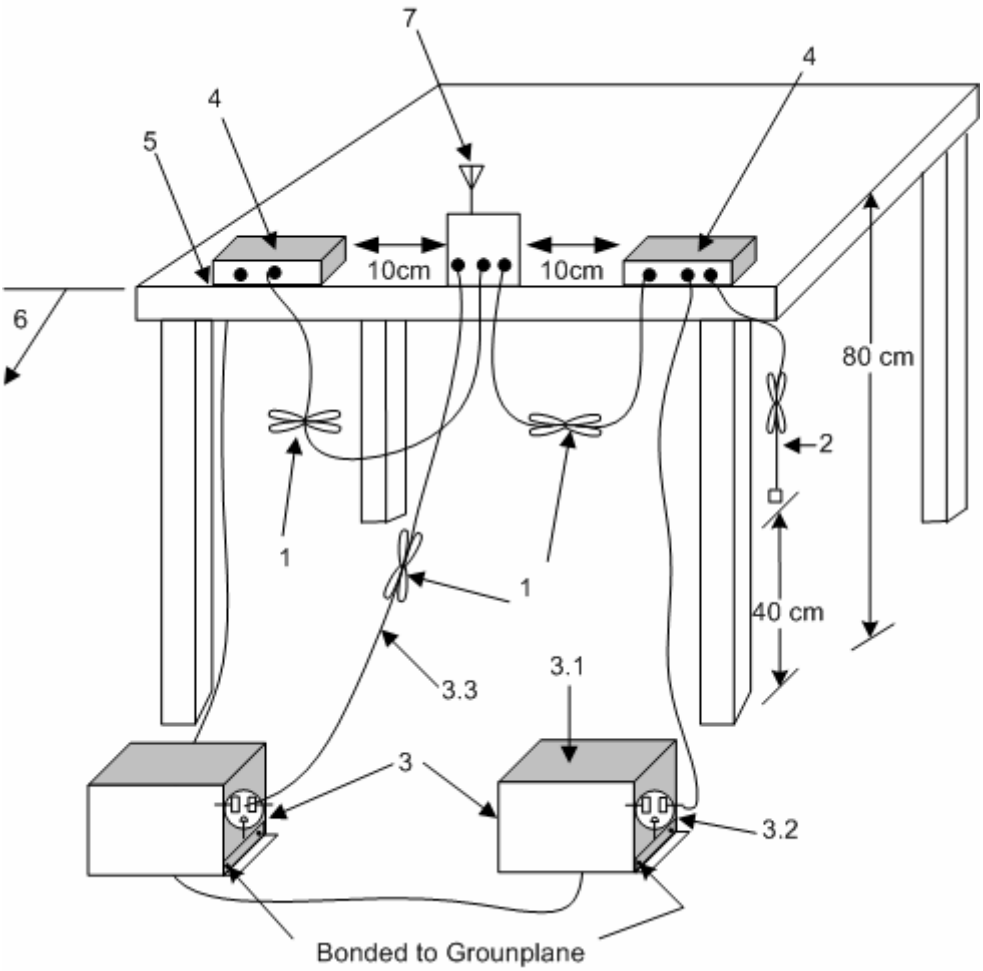
Equipment Testing Procedures

AC Line Conducted Emission Test Procedure

Testing for the AC line-conducted emissions was performed as defined in ANSI C63.10-2009. The test setup, including the EUT, was arranged in the test configurations as presented during testing. The test configuration was placed on a 1 x 1.5-meter wooden bench, 0.8 meters high located in a screen room. The power lines of the system were isolated from the power source using a standard LISN with a 50-µHy choke. EMI was coupled to the spectrum analyzer through a 0.1 µF capacitor internal to the LISN. The LISN was positioned on the floor beneath the wooden bench supporting the EUT. The power lines and cables were draped over the back edge of the table. Refer to diagram 1 showing typical test arrangement and photographs in exhibits for EUT placement used during testing.

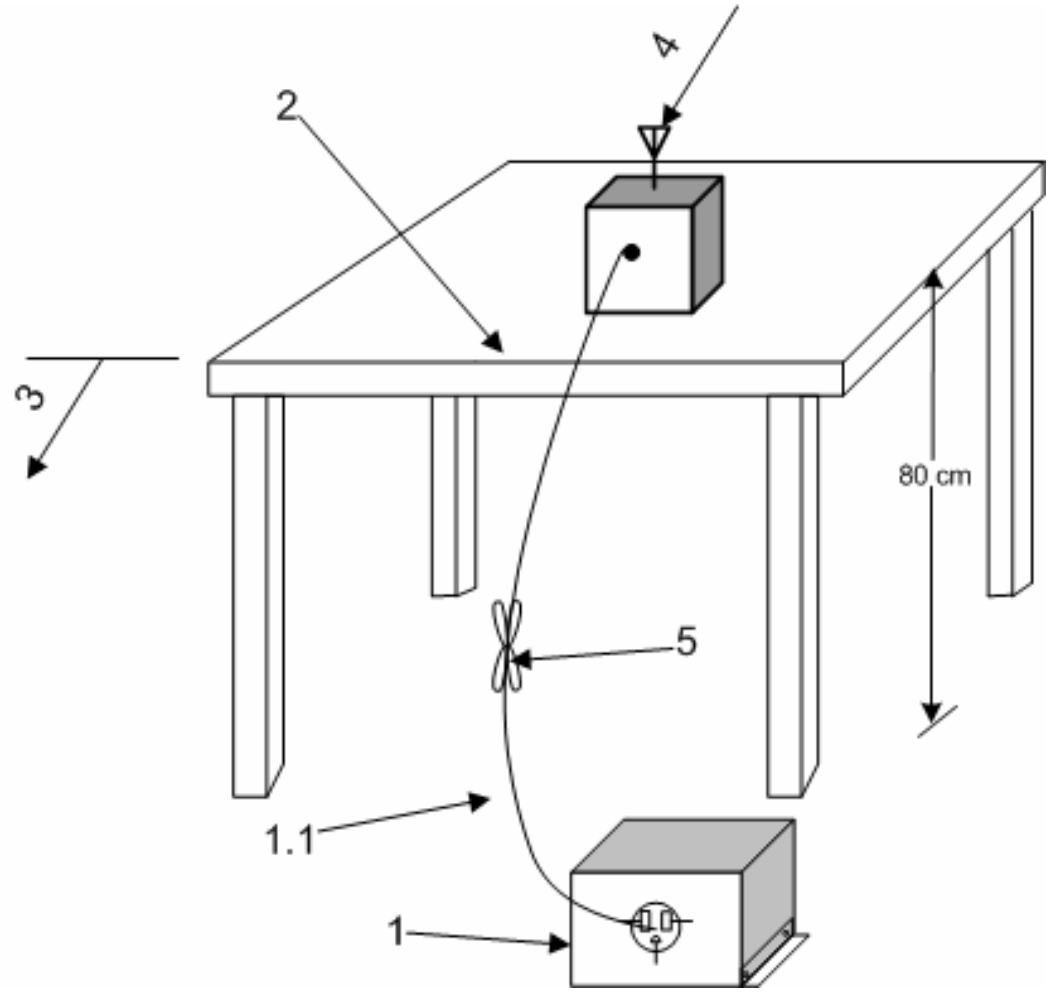
Radiated Emission Test Procedure

The EUT was placed on a rotating 1 x 1.5-meter wooden platform, 0.8 meters above the ground plane at a distance of 3 meters from the FSM antenna. Radiated emissions testing were performed as required in CFR47 paragraph 15C, RSS-310 and as specified in sections 6 and 7 of ANSI C63.10-2009. EMI energy was maximized by equipment placement, raising and lowering the FSM antenna, changing the antenna polarization, and by rotating the turntable. Each emission was maximized before data was taken using a spectrum analyzer. The frequency spectrum from 9 kHz to 25,000 MHz was searched for during preliminary investigation. Refer to diagrams 2 and 3 showing typical test arrangement and photographs in the test setup exhibits for specific EUT placement during testing.



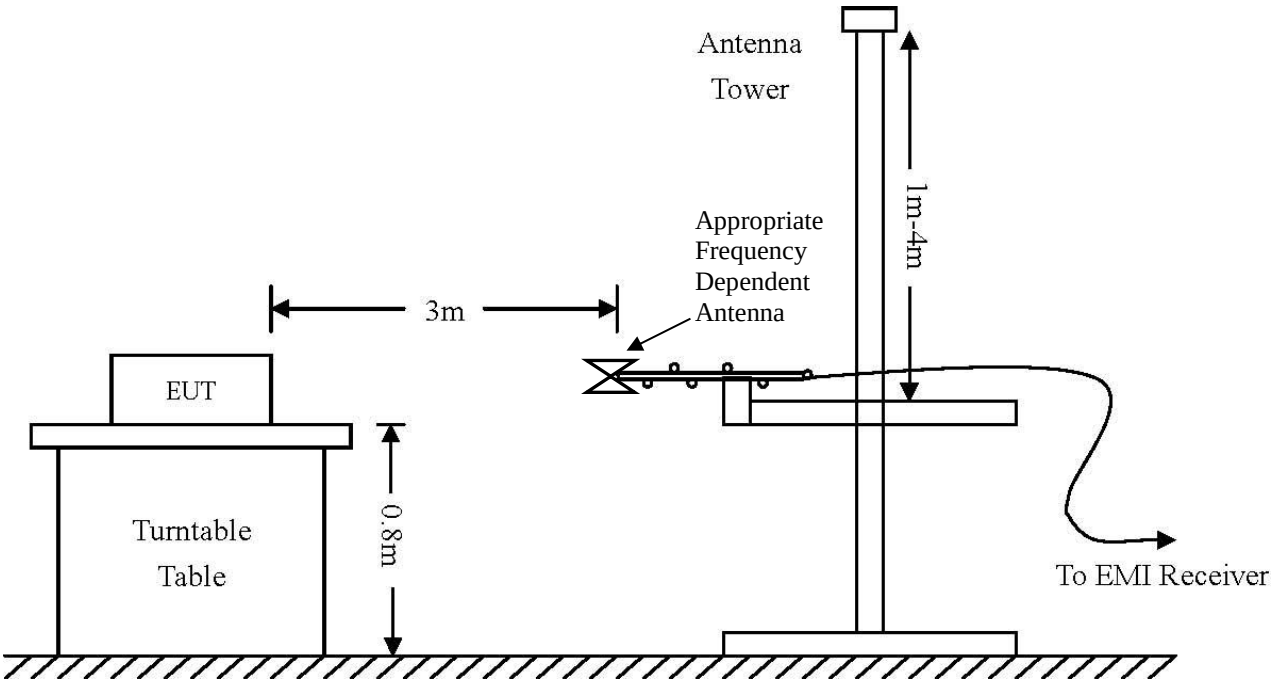
1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long see (see 6.2.3.1).
2. I/O cables that are not connected to an accessory shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m (see 6.2.2).
3. EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω loads. LISN can be placed on top of, or immediately beneath, reference ground plane (see 6.2.2 and 6.2.3).
   3.1 All other equipment powered from additional LISN(s).
   3.2 Multiple-outlet strip can be used for multiple power cords of non-EUT equipment.
   3.3 LISN at least 80 cm from nearest part of EUT chassis
4. Non-EUT components of EUT system being tested
5. Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop (see 6.2.3.1).
6. Edge of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane (see 6.2.2 for options).
7. Antenna may be integral or detachable. If detachable, the antenna shall be attached for this test.

Diagram 1 Test arrangement for AC Line Conducted emissions



1. A LISN is optional for radiated measurements between 30 MHz to 1000 MHz, but not allowed for measurements below 30 MHz and above 1000 MHz (See 6.4.3, 6.5.1, and 6.6.3). If used, connect EUT to one LISN. Unused LISN measuring port connectors shall be terminated in 50Ω. LISN can be placed on top of, or immediately beneath, reference ground plane (see 6.2.2 and 6.2.3.1).
   1.1 LISN spaced at least 80 cm from nearest part of EUT chassis.
2. The EUT shall be placed in the center of the table to the extent possible (See 6.2.3.1 and 6.3.4).
3. A vertical conducting plane, if used for conducted tests per 6.2.2, shall be removed for radiated emission tests.
4. Antenna may be integral or detachable, depending on the EUT.
5. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long.

Diagram 2 Test arrangement for radiated emissions of tabletop equipment



Frequency: 9 kHz-30 MHz	Frequency: 30 MHz- 1 GHZ	Frequency: Above 1 GHz
Loop Antenna	Broadband Biconilog	Horn
RBW = 9 kHz	RBW = 120 kHz	RBW = 1 MHz
VBW = 30 kHz	VBW = 500 kHz	VBW = 3 MHz
Sweep time = Auto	Sweep time = Auto	Sweep time = Auto
Detector = PK, QP	Detector = PK, QP	Detector = PK, AV

Diagram 3 Test arrangement for radiated emissions tested on Open Area Test Site (OATS)

List of Test Equipment

A Rohde and Schwarz ESU40 and/or Hewlett Packard 8591EM was used as the measuring device for the emissions testing of frequencies below 1 GHz. A Rohde and Schwarz ESU40 and/or Hewlett Packard 8562A Spectrum Analyzer was used as the measuring device for testing the emissions at frequencies above 1 GHz. The analyzer settings used are described in the following table. Refer to the appendix for a complete list of test equipment.

AC Line Conducted Emissions (0.150 -30 MHz)		
RBW	AVG. BW	Detector Function
9 kHz	30 kHz	Peak / Quasi Peak
Emissions (30-1000 MHz)		
RBW	AVG. BW	Detector Function
120 kHz	300 kHz	Peak / Quasi Peak
Emissions (Above 1000 MHz)		
RBW	Video BW	Detector Function
100 kHz	100 kHz	Peak
1 MHz	1 MHz	Peak / Average

Equipment	Manufacturer	Model (SN)	Band	Cal Date	Due
☒ LISN	Comp. Design	FCC-LISN-2-MOD.CD (126)	.15-30MHz	10/14	10/15
☒ Cable	Time Microwave	750HF290-750 (L10M)	9kHz-40 GHz	10/14	10/15
☒ Cable	Belden	RG-58 (L1-CAT3-11509)	9kHz-30 MHz	10/14	10/15
☒ Cable	Belden	RG-58 (L2-CAT3-11509)	9kHz-30 MHz	10/14	10/15
☐ Antenna	ARA	BCD-235-B (169)	20-350MHz	10/14	10/15
☐ Antenna	EMCO	3147 (40582)	200-1000MHz	10/14	10/15
☒ Antenna	Com Power	AH-118 (10110)	1-18 GHz	10/14	10/15
☒ Antenna	Com Power	AH-840 (101046)	18-40 GHz	5/14	5/15
☒ Antenna	EMCO	6509 (9502-1374)	.001-30 MHz	10/14	10/15
☒ Antenna	Sunol	JB-6 (A100709)	30-1000 MHz	10/14	10/15
☒ Antenna	Standard	FXRY638A (621786)	10-18 GHz	5/14	5/15
☐ Antenna	EMCO	3143 (9607-1277)	20-1200 MHz	5/14	5/15
☐ Analyzer	HP	8591EM (3628A00871)	9kHz-1.8GHz	5/14	5/15
☐ Analyzer	HP	8562A (3051A05950)	9kHz-110GHz	5/14	5/15
☒ Analyzer	Rohde & Schwarz	ESU40 (100108)	20Hz-40GHz	5/14	5/15
☒ Amplifier	Com-Power	PA-010 (171003)	100Hz-30MHz	10/14	10/15
☒ Amplifier	Com-Power	CPPA-102 (01254)	1-1000 MHz	10/14	10/15
☒ Amplifier	Com-Power	PAM-118A (551014)	0.5-18 GHz	10/14	10/15

Units of Measurements

Conducted EMI Data is in dBµV; dB referenced to one microvolt

Radiated EMI Data is in dBµV/m; dB/m referenced to one microvolt per meter

Sample Calculation:

RFS = Radiated Field Strength, FSM = Field Strength Measured

A.F. = Receive antenna factor, Gain = amplification gains and/or cable losses

RFS (dBµV/m @ 3m) = FSM (dBµV) + A.F. (dB) - Gain (dB)

Environmental Conditions

Ambient Temperature	21.5° C
Relative Humidity	43%
Atmospheric Pressure	1008.2 mb

Test Site Locations

Conducted EMI The AC power line conducted emissions testing performed in a shielded screen room located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS

Radiated EMI The radiated emissions tests were performed at the 3 meters, Open Area Test Site (OATS) located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS

Site Registration Refer to Annex for Site Registration Letters

NVLAP Accreditation Lab code 200087-0

Statement of Modifications and Deviations

No modifications to the EUT were required for the unit to demonstrate compliance with the CFR47 Part 15C emissions standards. There were no deviations or modifications to the specifications.

Intentional Radiators

As per CFR47, Subpart C, paragraph 15.225 and RSS-310 the following information is submitted.

Antenna Requirements

The EUT utilizes permanently attached trace on printed circuit board antenna inside the enclosure and offers no provision for antenna replacement. The antenna connection point complies with the unique antenna connection requirements. The requirements of 15.203 are fulfilled; there are no deviations or exceptions to the specification.

Restricted Bands of Operation

Spurious emissions falling in the restricted frequency bands of operation were measured at the OATS. The EUT utilizes frequency, determining circuitry, which generates harmonics falling in the restricted bands. Emissions were investigated at the OATS, using appropriate antennas or pyramidal horns, amplification stages, and spectrum analyzer. Peak and average amplitudes of frequencies above 1000 MHz were compared to the required limits with worst-case data presented below. Test procedures of ANSI C63.10-2009 paragraph 6 were used during testing. No other significant emission was observed which fell into the restricted bands of operation. Computed emission values take into account the received and measured radiated field strength, receive antenna correction factor, amplifier gain stage, and test system cable losses.

Table 1 Radiated Emissions in Restricted Bands Data (Battery)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
108.5	31.3	N/A	24.8	29.8	N/A	24.5	43.5
122.0	22.1	N/A	15.9	16.2	N/A	10.8	43.5
135.6	19.9	N/A	14.7	14.0	N/A	9.8	43.5

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequency range below 1000 MHz. Peak and Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Summary of Results for Radiated Emissions in Restricted Bands

The EUT demonstrated compliance with the radiated emissions requirements of CFR 47 Part 15C Intentional Radiators. The EUT demonstrated a worst-case minimum margin of -18.7 dB below the radiated emissions requirements in restricted frequency bands. Peak, Quasi-peak, and average amplitudes were checked for compliance with the regulations. Worst-case emissions are reported with other emissions found in the restricted frequency bands at least 20 dB below the requirements.

AC Line Conducted Emissions Procedure

The EUT was arranged in a typical equipment configuration and placed on a 1 x 1.5-meter wooden bench 80 cm above the conducting ground plane, floor of a screen room. The bench was positioned 40 cm away from the wall of the screen room. The device only operates from direct current power supplied from compliant USB interface equipment. Therefore, AC line conducted emissions testing were performed on the AC adapter of the computer supporting the USB interface. The LISN was positioned on the floor of the screen room 80-cm from the rear of the EUT. The manufacturer supplied AC power cord for the computer supporting the transmitter EUT was connected to the LISN. A second LISN was positioned on the floor of the screen room 80-cm from the rear of the supporting equipment of the EUT. All power cords except the CPU were then powered from the second LISN. EMI was coupled to the spectrum analyzer through a 0.1 μF capacitor, internal to the LISN. Power line conducted emissions testing were carried out individually for each current carrying conductor of the EUT. The excess length of lead between the system and the LISN receptacle was folded back and forth to form a bundle not exceeding 40 cm in length. The screen room, conducting ground plane, analyzer, and LISN were bonded together to the protective earth ground. Preliminary testing was performed to identify the frequency of each radio frequency emission displaying the highest amplitude. The cables were repositioned to obtain maximum amplitude of measured EMI level. Once the maximum emission configuration was identified, plots were made of the EMI from 0.15 MHz to 30 MHz then the data was recorded with maximum conducted emissions levels. Refer to figures one and two for plots of the AC Power Line conducted emissions of the computer systems supporting the EUT.

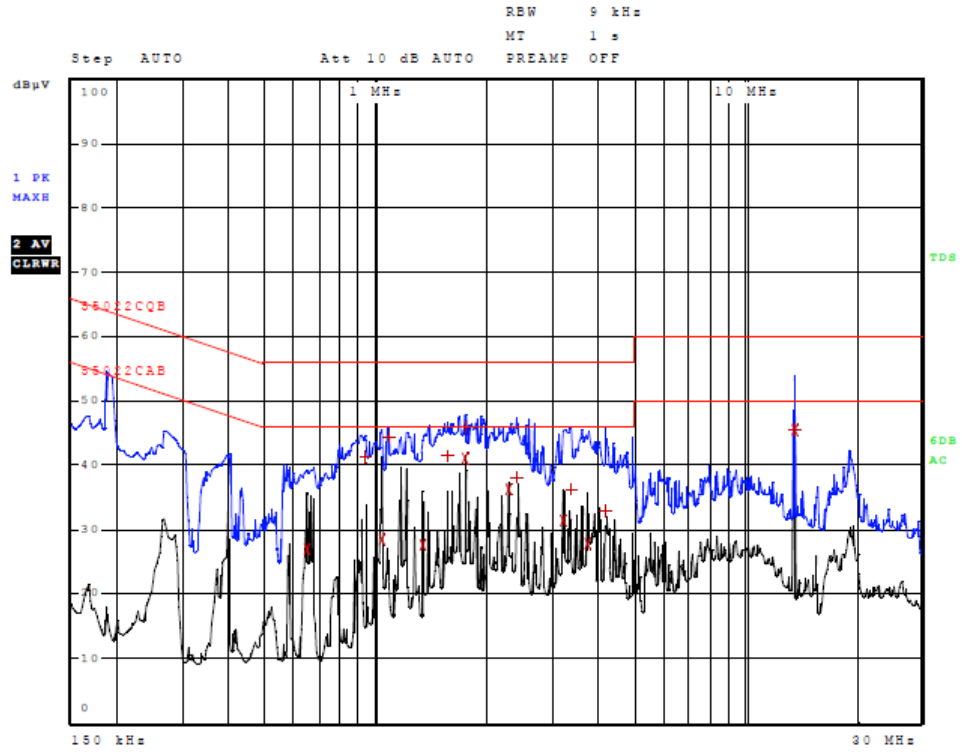


Figure 1 AC Line Conducted Emissions Line 1

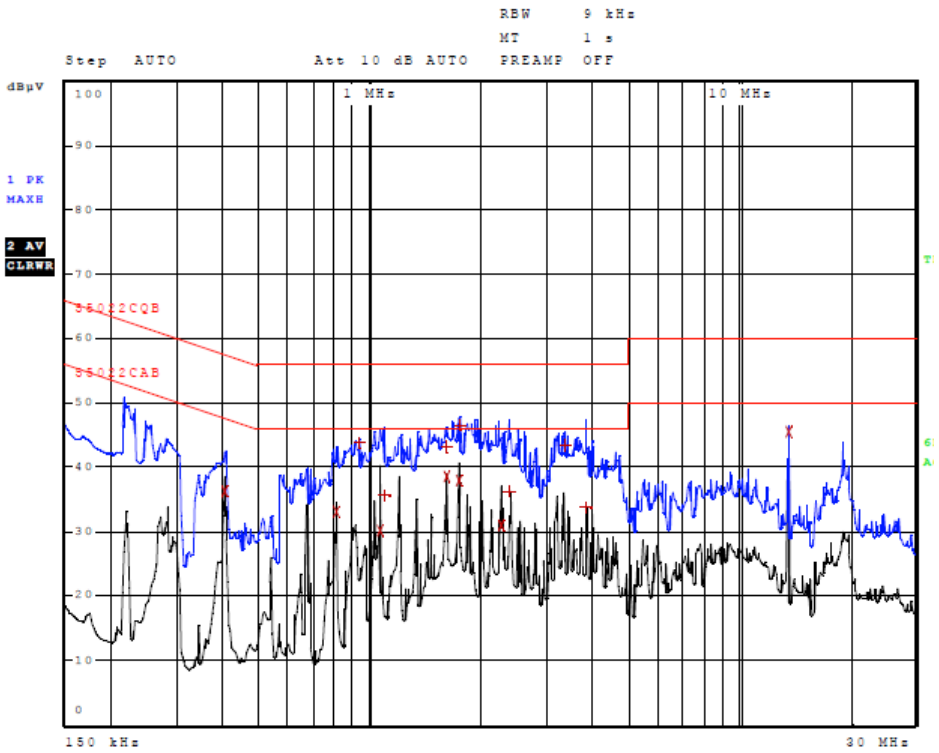


Figure 2 AC Line Conducted Emissions Line 2

Table 2 AC Line Conducted Emissions Data (Highest Emissions) Line L1

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
2	646.000000000 kHz	27.04	Average	-18.96
1	938.000000000 kHz	41.32	Quasi Peak	-14.68
2	1.034000000 MHz	28.53	Average	-17.47
1	1.078000000 MHz	44.40	Quasi Peak	-11.60
2	1.342000000 MHz	27.72	Average	-18.28
1	1.554000000 MHz	41.39	Quasi Peak	-14.61
1	1.746000000 MHz	45.99	Quasi Peak	-10.01
2	1.746000000 MHz	41.16	Average	-4.84
2	2.282000000 MHz	36.28	Average	-9.72
1	2.406000000 MHz	38.16	Quasi Peak	-17.84
2	3.218000000 MHz	31.37	Average	-14.63
1	3.386000000 MHz	36.25	Quasi Peak	-19.75
2	3.750000000 MHz	27.85	Average	-18.15
1	4.186000000 MHz	32.91	Quasi Peak	-23.09
1	13.560000000 MHz	45.58	Quasi Peak	-14.42
2	13.560000000 MHz	45.41	Average	-4.59

Other emissions present had amplitudes at least 20 dB below the limit.

Table 3 AC Line Conducted Emissions Data (Highest Emissions) Line L2

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
2	402.000000000 kHz	36.28	Average	-11.53
2	806.000000000 kHz	33.17	Average	-12.83
1	938.000000000 kHz	43.86	Quasi Peak	-12.14
2	1.062000000 MHz	30.24	Average	-15.76
1	1.086000000 MHz	35.55	Quasi Peak	-20.45
1	1.606000000 MHz	43.21	Quasi Peak	-12.79
2	1.610000000 MHz	38.65	Average	-7.35
2	1.742000000 MHz	37.95	Average	-8.05
1	1.750000000 MHz	46.55	Quasi Peak	-9.45
2	2.274000000 MHz	31.02	Average	-14.98
1	2.394000000 MHz	36.29	Quasi Peak	-19.71
1	3.366000000 MHz	43.37	Quasi Peak	-12.63
1	3.834000000 MHz	33.82	Quasi Peak	-22.18
2	13.560000000 MHz	45.44	Average	-4.56

Other emissions present had amplitudes at least 20 dB below the limit.

Summary of Results for AC Line Conducted Emissions

The EUT demonstrated compliance to the conducted emissions requirements of CFR47 Part 15C equipment. The EUT supporting system demonstrated minimum margin of -4.5 dB below the limit. Measurements were taken using the peak, quasi peak, and average, measurement function for each emissions amplitude and were below the limits stated in the specification. Other emissions were present with recorded data representing worst-case amplitudes.

General Radiated Emissions Procedure

The EUT was arranged in a typical equipment configuration and operated through all modes during testing. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM. Radiated emissions measurements were performed to identify the frequencies, which produced the highest emissions. Each radiated emission was then maximized at the OATS location before final radiated emissions measurements were performed. Final data was taken with the EUT located at the OATS at a distance of 3 meters between the EUT and the receiving antenna. The frequency spectrum from 9 kHz to 25,000 MHz was searched for general radiated emissions. Measured emission levels were maximized by EUT placement on the table, rotating the turntable through 360 degrees, varying the antenna height between 1 and 4 meters above the ground plane and changing antenna position between horizontal and vertical polarization. Antennas used were Loop from 9 kHz to 30 MHz, Broadband Biconical from 30 to 200 MHz, Biconilog from 30 to 1000 MHz, Log Periodic from 200 MHz to 1 GHz and or Double Ridge or pyramidal horns and mixers above 1 GHz, notch filters, and appropriate amplifiers and external mixers were utilized.

Table 4 General Radiated Emissions from EUT Data (Highest Emissions)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
96.0	29.0	N/A	24.0	30.5	N/A	25.0	43.5
120.0	28.1	N/A	23.0	30.9	N/A	25.4	43.5
121.2	24.9	N/A	20.2	29.2	N/A	23.9	43.5
212.0	26.9	N/A	21.4	24.1	N/A	19.3	43.5
212.2	28.1	N/A	21.7	23.9	N/A	19.1	43.5
250.4	27.1	N/A	21.5	24.6	N/A	19.5	46.0
256.5	27.6	N/A	22.5	23.0	N/A	18.1	46.0
270.0	25.5	N/A	20.0	22.1	N/A	17.0	46.0
274.3	24.3	N/A	19.2	21.8	N/A	16.5	46.0
293.5	26.1	N/A	20.7	20.0	N/A	13.8	46.0
294.0	25.3	N/A	20.5	20.1	N/A	14.2	46.0
1005.1	20.0	N/A	14.5	20.2	N/A	14.7	54.0

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequency range below 1000 MHz. Peak and Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Summary of Results for General Radiated Emissions

The EUT demonstrated compliance with the radiated emissions requirements of 47CFR Part 15C paragraph 15.209 Intentional Radiators. The EUT demonstrated a minimum margin of -18.1 dB below the requirements. Other emissions were present with amplitudes at least 20 dB below the Limits.

Operation in the Band 13.110 - 14.010 MHz Band

The transmitter output power; harmonic and general emissions were measured on an open area test site at 3 and 10 meters. Test procedures of ANSI C63.10-2009 paragraph 6 were used during testing. The EUT was placed on a wooden turntable 0.8 meters above the ground plane and at a distance of 3 and 10 meters from the FSM antenna. The peak and quasi-peak amplitude of frequencies below 1000 MHz were measured using a spectrum analyzer. Plots were taken of transmitter performance for reference in this and other documentation. Refer to figure five showing the operation in the frequency band. The amplitude of each radiated emission was measured on the OATS at a distance of 3 and/or 10 meters from the FSM antenna (OATS testing was performed on sample 1 representative of production equipment with integral antenna). The measured amplitude was then corrected for comparison with the limits. Measurements taken at 3 meters of the fundamental and emissions below 30 MHz were corrected using the square of an inverse linear distance extrapolation factor (40 dB/decade) as provided in the standards and requirements. The amplitude of each radiated emission was maximized by varying the FSM antenna height, polarization, and by rotating the turntable. A Loop antenna was used for measuring emissions from 0.009 to 30 MHz, Biconilog Antenna for 30 to 1000 MHz, Double-Ridge, and/or Pyramidal Horn Antennas from 1 GHz to 25 GHz. Emissions were measured in dBµV/m @ 3 meters. Testing performed demonstrated compliance with the following requirements (per CFR47 15.225).

(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 (84 dBµV/M @ 30m).

(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 (50.5 dBµV/M @ 30m).

(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 (40.5 dBµV/M @ 30m).

(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.

(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.

(f) In the case of radio frequency powered tags designed to operate with a device authorized under this section, the tag may be approved with the device or be considered as a separate device subject to its own authorization. Powered tags approved with a device under a single application shall be labeled with the same identification number as the device.

Table 5 NFC Transmitter Emissions in Frequency Band 13.110-14.010 MHz

Frequency in MHz	Level (dBµV/m)	ACFL (dB/m)	Amplifier Gain (dB)	30m Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
13.560	33.5	41.4	40	34.9	84.0	-53.7

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequencies below 1000 MHz. Peak and Average amplitude emissions are recorded above for frequency range above 1000 MHz.

NOTES:
1. Fundamental radiated emission measurements were performed using a loop antenna. The antenna was positioned in three orthogonal positions (X front, Y side, Z top) and the position with the highest emission level was recorded.
2. The EUT was positioned in three orthogonal planes to determine the orientation resulting in the worst-case emissions.
3. Measurements were performed at 3m and the data was extrapolated to the specified measurement distance of 30m using the square of an inverse linear distance extrapolation factor (40 dB/decade) as specified in §15.31(f)(2). Extrapolation Factor = 20 log10 $(30/3)^2$ = 40dB
4. All measurements were recorded using a spectrum analyzer employing a quasi-peak detector.
5. Field Strength Level [dBµV/m] = Level read from Analyzer [dBµV] + AFCL [dB/m] – Amplifier Gain (dB)
6. AFCL [dB/m] = Antenna Factor [dB/m] + Cable Loss [dB]
7. Margin [dB] = Field Strength Level [dBµV/m] – Limit [dBµV/m]

Table 6 Transmitter Harmonic Radiated Emissions Data

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
40.7	27.5	20.7	N/A	31.0	25.3	N/A	40.0
54.2	30.3	24.0	N/A	31.0	26.9	N/A	40.0
67.8	17.0	12.9	N/A	24.5	17.8	N/A	40.0
81.3	26.6	21.8	N/A	24.0	17.9	N/A	40.0
94.9	29.1	21.6	N/A	28.2	20.6	N/A	43.5
108.4	31.3	24.8	N/A	29.8	24.5	N/A	43.5
122.0	32.6	26.4	N/A	26.7	21.3	N/A	43.5
135.5	30.4	25.2	N/A	24.5	20.3	N/A	43.5

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequencies below 1000 MHz. Peak and Average amplitude emissions are recorded above for frequency range above 1000 MHz.

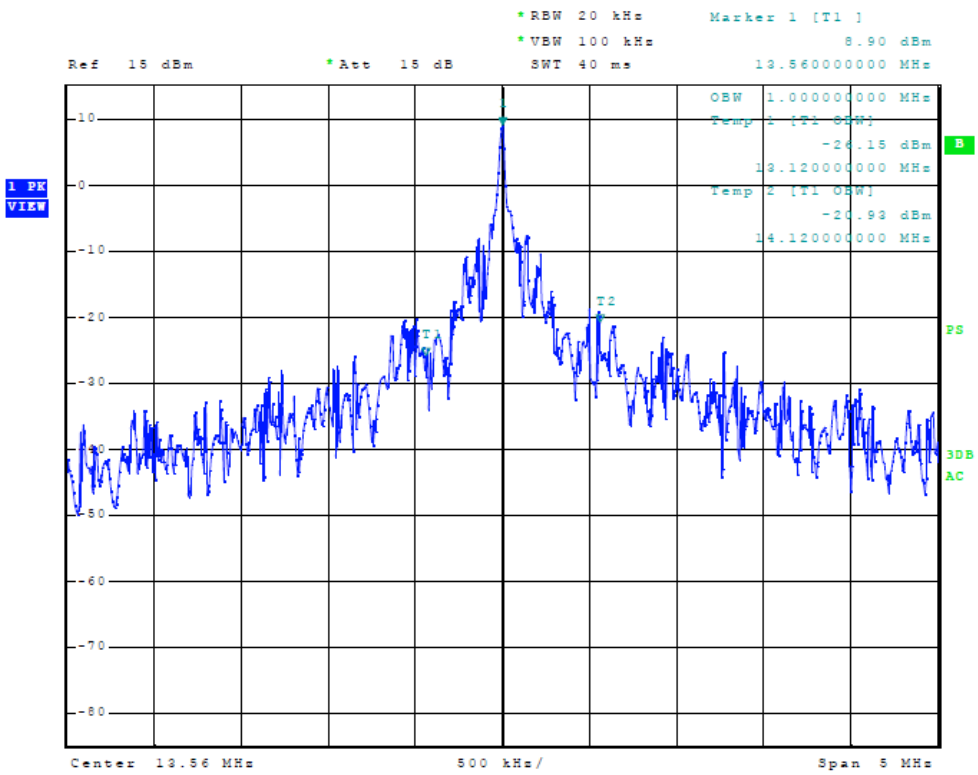


Figure 3 Plot of 99 percent Occupied Bandwidth

Frequency Stability

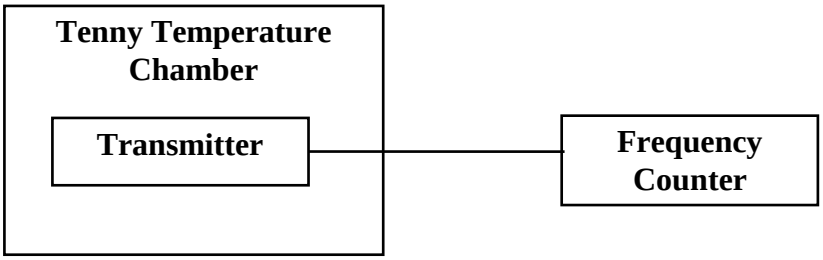
Measurements Required

The frequency stability shall be measured with variations of ambient temperature from -30° to +50° centigrade. Measurements shall be made at the extremes of the temperature range and at intervals of not more than 10° centigrade through the range. A period sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. In addition to temperature stability, the frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value.

(2) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided.

Test Arrangement



The measurement procedure outlined below shall be followed during measurement of frequency variation over temperature.

Step 1: The transmitter shall be installed in an environmental test chamber whose temperature is controllable. Provision shall be made to measure the frequency of the transmitter.

Step 2: With the transmitter inoperative (power switched "OFF"), the temperature of the test chamber shall be adjusted to +25°C. After a temperature stabilization period of one hour at +25°C, the transmitter shall be switched "ON" with standard test voltage applied.

Step 3: The carrier shall be keyed "ON", and the transmitter shall be operated at full radio frequency power output at the duty cycle, for which it is rated, for duration of at least 5 minutes. The radio frequency carrier frequency shall be monitored and measurements shall be recorded.

Step 4: The test procedures outlined in Steps 2 and 3, shall be repeated after stabilizing the transmitter at the environmental temperatures specified, -30°C to +50°C in 10-degree increments.

The frequency stability was measured with variations in the power supply voltage from 85 to 115 percent of the nominal value. A BK Precision DC Power Supply was used during measurement of frequency variation over input power. The frequency was measured and the variation in parts per million calculated. Data was taken per CFR47 Paragraphs 2.1055 and applicable paragraphs of part 15.225 and RSS-310.

Table 7 Frequency Stability vs. Temperature Results

Channel Frequency 13.56000 MHz	Frequency Stability Vs. Temperature Ambient Frequency (13.56000)								
Temperature °C	-30	-20	-10	0	+10	+20	+30	+40	+50
Change (Hz)	66,000	96,000	77,000	20,000	29,000	3,000	-66,000	-46,000	-153,000
PPM	4.867	7.079	5.678	1.475	2.139	0.221	-4.867	-3.392	-11.283
%	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	-0.001
Limit (%)	±0.01	±0.01	±0.01	±0.01	±0.01	±0.01	±0.01	±0.01	±0.01

Table 8 Frequency Stability vs. Input Power Supply Voltage Results

Channel Frequency 13.56000 MHz	Frequency Stability Vs. Voltage Variation 120.0 volts nominal; Results In Hz change		
Voltage V_{ac}	102.0	120.0	138.0
Change (Hz)	0	0	0
%	0	0	0
Limit (%)	±0.01	±0.01	±0.01

The EUT demonstrated compliance with specifications of CFR47 Paragraph 2.1046(a) and applicable Parts of 15.225 and RSS-310. There are no deviations or exceptions to the specifications.

Summary of Results for NFC Transmitter Emissions

The EUT demonstrated compliance with the radiated emissions requirements of FCC CFR 47 Part 15.225, RSS-310 and other applicable standards for Intentional Radiators. The EUT worst-case configuration demonstrated minimum margin of -53.7 dB below the fundamental emission limit. The EUT worst-case configuration demonstrated minimum radiated harmonic emission margin of -13.1 dB below the limits. Other emissions were present with amplitudes at least 20 dB below the limits.

Annex

- Annex A Measurement Uncertainty Calculations
- Annex B Rogers Labs Test Equipment List
- Annex C Rogers Qualifications
- Annex D FCC Site Registration Letter
- Annex E Industry Canada Site Registration Letter

Annex A Measurement Uncertainty Calculations

Measurement uncertainty calculations were made for the laboratory. Result of measurement uncertainty calculations are recorded below for AC line conducted and radiated emission measurements.

Measurement Uncertainty	$U_{(E)}$	$U_{(lab)}$
3 Meter Horizontal 30-200 MHz Measurements	2.08	4.16
3 Meter Vertical 30-200 MHz Measurements	2.16	4.33
3 Meter Vertical Measurements 200-1000 MHz	2.99	5.97
10 Meter Horizontal Measurements 30-200 MHz	2.07	4.15
10 Meter Vertical Measurements 30-200 MHz	2.06	4.13
10 Meter Horizontal Measurements 200-1000 MHz	2.32	4.64
10 Meter Vertical Measurements 200-1000 MHz	2.33	4.66
3 Meter Measurements 1-6 GHz	2.57	5.14
3 Meter Measurements 6-18 GHz	2.58	5.16
AC Line Conducted	1.72	3.43

Annex B Rogers Labs Test Equipment List

Equipment (Serial Number)	Calibration Due
Spectrum Analyzer: Rohde & Schwarz ESU40 (100108)	5/14
Spectrum Analyzer: HP 8562A, 11518, 11519, and 11520 (3051A05950) Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W	5/14
Spectrum Analyzer: HP 8591EM (3628A00871)	5/14
Antenna: EMCO Biconilog Model: 3143 (9607-1277)	5/14
Antenna: Sunol Biconilog Model: JB6 (A100709)	10/14
Antenna: EMCO Log Periodic Model: 3147 (40582)	10/14
Antenna: Com Power Model: AH-118 (10110)	10/14
Antenna: Com Power Model: AH-840 (101046)	10/14
Antenna: Antenna Research Biconical Model: BCD 235 (169)	10/14
Antenna: EMCO 6509 (9502-1374)	10/14
LISN: Compliance Design Model: FCC-LISN-2.Mod.cd (126)	10/14
R.F. Preamp Com-Power Model: CPPA-102 (01254)	10/14
Cable: Belden RG-58 (L1-CAT3-11590)	10/14
Cable: Belden RG-58 (L2-CAT3-11590)	10/14
Cable: Belden 8268 (L3)	10/14
Cable: Time Microwave: 4M-750HF290-750 (L4M)	10/14
Cable: Time Microwave: 10M-750HF290-750 (L10M)	10/14
Frequency Counter: Leader LDC825	2/14
Oscilloscope Scope: Tektronix 2230	2/14
Wattmeter: Bird 43 with Load Bird 8085	2/14
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/14
R.F. Generators: HP 606A, HP 8614A, HP 8640B	2/14
R.F. Power Amp 65W Model: 470-A-1010	2/14
R.F. Power Amp 50W M185- 10-501	2/14
R.F. Power Amp A.R. Model: 10W 1010M7	2/14
R.F. Power Amp EIN Model: A301	2/14
LISN: Compliance Eng. Model 240/20	2/14
LISN: Fischer Custom Communications Model: FCC-LISN-50-16-2-08	2/14
Antenna: EMCO Dipole Set 3121C	2/14
Antenna: C.D. B-101	2/14
Antenna: Solar 9229-1 & 9230-1	2/14
Audio Oscillator: H.P. 201CD	2/14
ELGAR Model: 1751	2/14
ELGAR Model: TG 704A-3D	2/14
ESD Test Set 2010i	2/14
Fast Transient Burst Generator Model: EFT/B-101	2/14
Field Intensity Meter: EFM-018	2/14
KEYTEK Ecat Surge Generator	2/14

Annex C Rogers Qualifications

Scot D. Rogers, Engineer

Rogers Labs, Inc.

Mr. Rogers has approximately 17 years' experience in the field of electronics. Engineering experience includes six years in the automated controls industry and remaining years working with the design, development and testing of radio communications and electronic equipment.

Positions Held

Systems Engineer:	A/C Controls Mfg. Co., Inc.	6 Years
Electrical Engineer:	Rogers Consulting Labs, Inc.	5 Years
Electrical Engineer:	Rogers Labs, Inc.	Current

Educational Background

1) Bachelor of Science Degree in Electrical Engineering from Kansas State University.

2) Bachelor of Science Degree in Business Administration Kansas State University.

3) Several Specialized Training courses and seminars pertaining to Microprocessors and Software programming.

Scot D Rogers

Scot D. Rogers

NVLAP Lab Code 200087-0

Annex D FCC Site Registration Letter

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

June 28, 2013

Registration Number: 90910

Rogers Labs, Inc.
4405 West 259th Terrace,
Louisburg, KS 66053

Attention: Scot Rogers,

Re: Measurement facility located at Louisburg
3 & 10 meter site
Date of Renewal: June 28, 2013

Dear Sir or Madam:

Your request for renewal of the registration of the subject measurement facility has been received. The information submitted has been placed in your file and the registration has been renewed. The name of your organization will remain on the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Phyllis Parrish
Industry Analyst

NVLAP Lab Code 200087-0

Annex E Industry Canada Site Registration Letter

Industry Canada Industrie Canada

June 19, 2013

OUR FILE: 46405-3041
Submission No: 168037

Rogers Labs Inc.
4405 West 259th Terrace
Louisburg
KS, USA
66053

Attention: Mr. Scot D. Rogers

Dear Sir:

The Bureau has received your application for the renewal of 3/10m OATS. Be advised that the information received was satisfactory to Industry Canada. The following number(s) is now associated to the site(s) for which registration / renewal was sought **(Site# 3041A-1).** Please reference the appropriate site number in the body of test reports containing measurements performed on the site. In addition, please keep for your records the following information;

- The company address code associated to the site(s) located at the above address is: **3041A**

Furthermore, to obtain or renew a unique site number, the applicant shall demonstrate that the site has been accredited to ANSI C63.4-2003 or later. A scope of accreditation indicating the accreditation by a recognized accreditation body to ANSI C63.4-2003 or later shall be accepted. Please indicate in a letter the previous assigned site number if applicable and the type of site (example: 3 metre OATS or 3 metre chamber). If the test facility is not accredited to ANSI C63.4-2003 or later, the test facility shall submit test data demonstrating full compliance with the ANSI standard. The Bureau will evaluate the filing to determine if recognition shall be granted.

The frequency for re-validation of the test site and the information that is required to be filed or retained by the testing party shall comply with the requirements established by the accrediting organization. However, in all cases, test site re-validation shall occur on an interval not to **exceed three years**. There is no fee or form associated with an OATS filing. OATS submissions are encouraged to be submitted electronically to the Bureau using the following URL;
http://strategis.ic.gc.ca/epic/internet/inceb-bhst.nsf/en/h_tt00052e.html.

If you have any questions, you may contact the Bureau by e-mail at certification.bureau@ic.gc.ca Please reference our file and submission number above for all correspondence.

Yours sincerely,

Bill Payn
For: Wireless Laboratory Manager
Certification and Engineering Bureau
3701 Carling Ave., Building 94
P.O. Box 11490, Station "H"
Ottawa, Ontario K2H 8S2
Email: Bill.Payn@ic.gc.ca
Tel. No. (613) 990-3639
Fax. No. (613) 990-4752