NVLAP Lab Code 200087-0

Application Submittal Report For Grant of Certification

FOR

Model: ENCOMPASS 4H
902.5-927.5 MHz
DSS Transmission System

FCC ID: FIH05939
IC: 1584A-05939

FOR

Transcore Amtech Technology Center

8600 Jefferson Street, NE
Albuquerque, NM 87113

Test Report Number: 150511
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
Paragraph 15.247
License Exempt Intentional Radiator

For

Transcore Amtech Technology Center

8600 Jefferson Street, NE
Albuquerque, NM 87113

Model: ENCOMPASS 4H
DSS Transmission System
Frequency Range 902.5-927.5 MHz
FCC ID#: FIH05939
IC: 1584A-05939

Test Date: May 11, 2015

Certifying Engineer: Scot D Rogers

Scot D. Rogers
Rogers Labs, Inc.
4405 West 259th Terrace
Louisburg, KS 66053
Telephone/Facsimile: (913) 837-3214

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Revisions

Revision 1 Issued July 6, 2015

Forward

The following information is submitted for consideration in obtaining Grant of Certification for License Exempt DSS Intentional Radiator operating under 47CFR Paragraph 15.247 operations in the 902 – 928 MHz frequency band.

Name of Applicant: Transcore Amtech Technology Center
8600 Jefferson Street, NE
Albuquerque, NM 87113

Model: ENCOMPASS 4H
FCC I.D.: FIH05939 IC: 1584A-05939
Frequency Range: 902.5-927.5MHz
Operating Power: 0.291 Watts, Occupied Bandwidth 198.0 kHz,

Opinion / Interpretation of Results

Test Performed per 47CFR	Minimum Margin (dB)	Results
Antenna requirement per CFR 47 15.203	N/A	Complies
Restricted Bands (General Emissions) from Support Equipment	-9.9	Complies
Restricted Bands (Tx) Emissions as per 15.205	-24.1	Complies
AC Line Conducted Emissions as per 15.207	-25.4	Complies
Radiated Emissions as per 15.209	-6.0	Complies
Radiated Emissions per 15.247 (harmonics)	-15.7	Complies

Equipment Tested

Equipment	Model / PN	Serial Number	FCC Identifier	IC Identifier
EUT	ENCOMPASS 4H	ENG1	FIH-05939	1584A-05939
CPU	Dell XPS Studio	N/A	N/A	N/A

Test results in this report relate only to the items tested

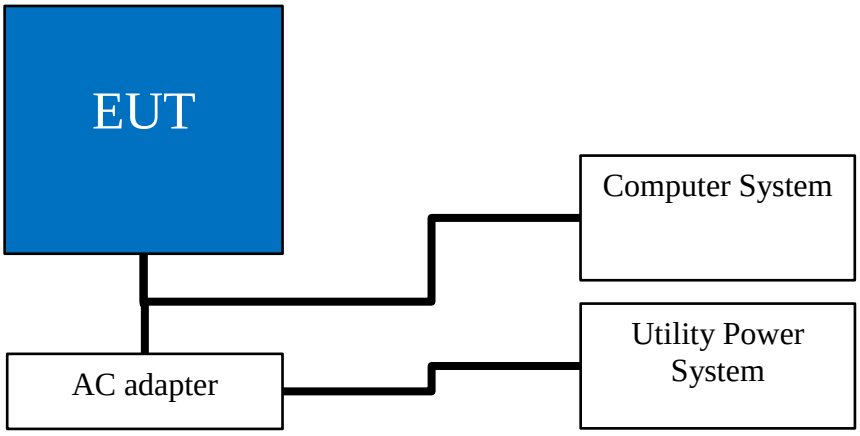
Equipment Function and Configuration

The EUT is a 902.5 - 927.5 MHz frequency hopping spread spectrum transceiver. The design is typically used in RFID tag reading installations.

The design operates from dedicated power supplied from remotely located AC adapter. The design utilizes internal fixed antenna system and offers no provision for antenna replacement or modification. Two test samples were provided for testing, (Sample #1) representative of production design and (sample #2) modified with antenna port connector in place of integral antenna. Software was provided which allowed testing personnel operational control of the transmitter for testing purposes. The EUT was arranged as described by the manufacturer emulating typical use configuration for testing purposes. The EUT offers no other interface connections than those documented in the configuration options presented.

For testing purposes, the EUT received power from manufacturer supplied external power adapter and was configured to operate in available modes. During testing all interface connections were appropriately terminated. As requested by the manufacturer and required by regulations, the equipment was tested for emissions compliance using the available configurations with the worst-case data presented. Test results in this report relate only to the products described in this report.

Equipment Configuration



Application for Certification

(1) Manufacturer: Transcore Amtech Technology Center
8600 Jefferson Street, NE
Albuquerque, NM 87113

(2) Identification: Model: ENCOMPASS 4H
FCC I.D.: FIH05939
IC: 1584A-05939

(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 power received from supporting equipment. An AC adapter was provided for use in conducting AC line conducted emissions testing. The EUT provides serial communications to CPU through the RS-232 interface. The design incorporates an 11 dBi gain integral antenna and offers no provision for modification or replacement. The EUT offers no other connection ports than those presented in this filing

(9) Transition Provisions of 15.37 are not being 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 Code of Federal Regulations, dated October 1, 2013, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057, and applicable parts of paragraph 15, Part 15C Paragraph 15.247 and Industry Canada standard RSS-210 Issue 8 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, FCC documents KDB 867751 and DA00-705.

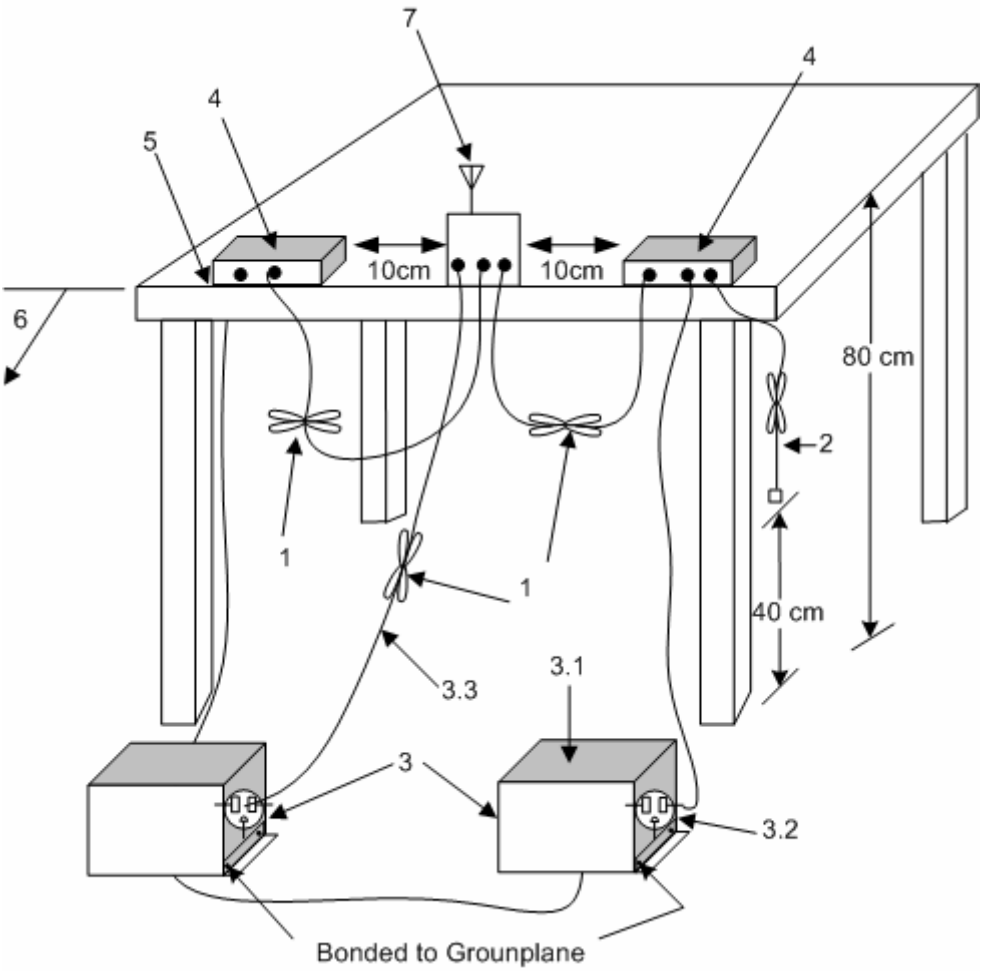
Equipment Testing Procedures

AC Line Conducted Emission Test Procedure

Testing for the AC line-conducted emissions was performed as defined in ANSI C63.10-2009. For testing purposes, the manufacturer supplied AC power adapter was used to power the EUT. 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.

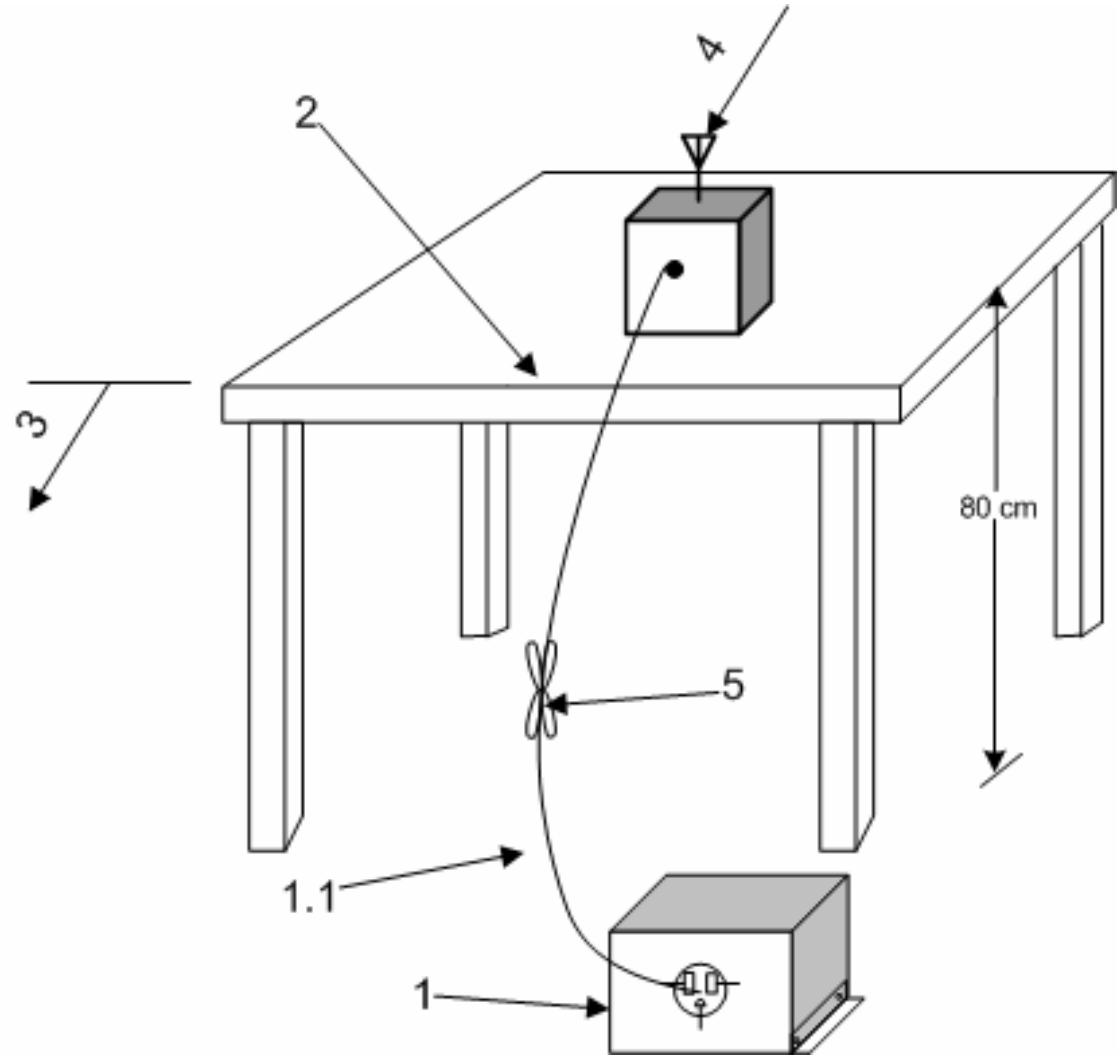
Radiated Emission Test Procedure

The EUT was placed on a rotating 1 x 1.5-meter wooden platform, elevated as required 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 and specified in 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 10,000 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.



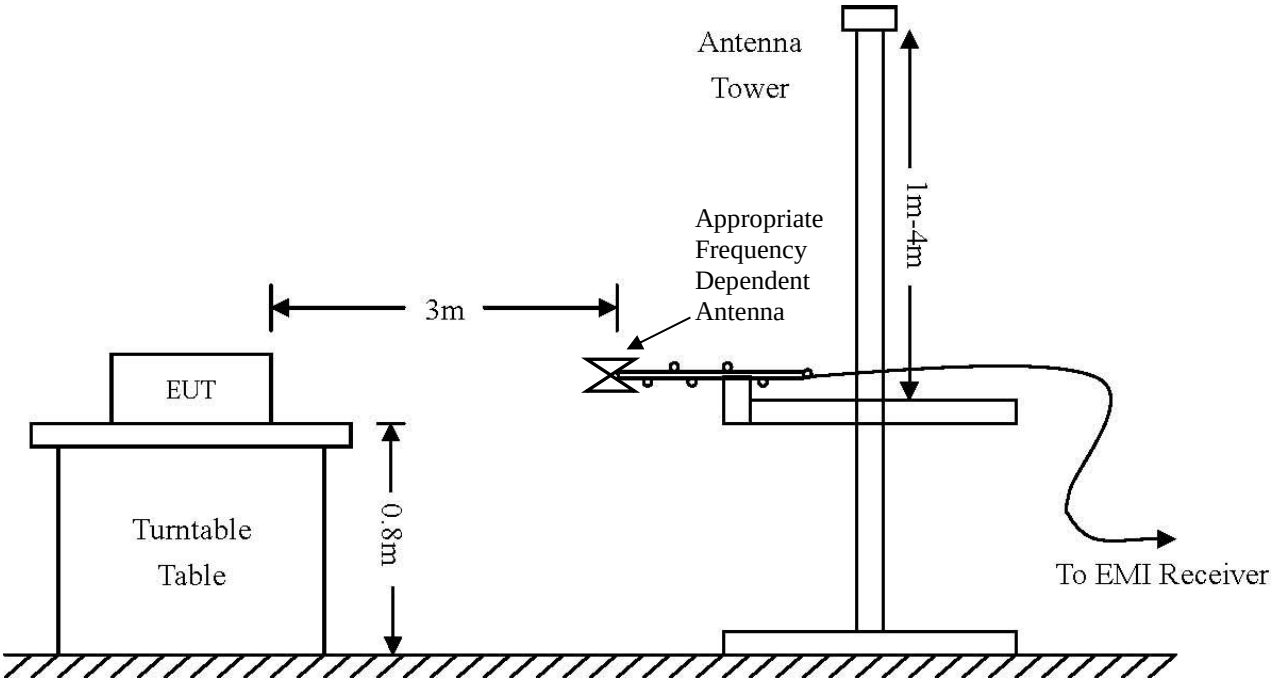
1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long see (see 6.2.3.1).
2. I/O cables that are not connected to an accessory shall be bundled in the center. The end of the cable may be terminated, if 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 _ loads. LISN can be placed on top of, or immediately beneath, reference ground plane (see 6.2.2 and 6.2.3).
   a) All other equipment powered from additional LISN(s).
   b) A multiple-outlet strip can be used for multiple power cords of non-EUT equipment.
   c) 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 edge 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
Antenna Height 1m	Antenna Height 1-4m	Antenna Height 1-4m

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

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

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	10/16
☒ Antenna	Com Power	AH-840 (101046)	18-40 GHz	5/15	5/17
☒ 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	5/15	5/17
☐ Antenna	EMCO	3143 (9607-1277)	20-1200 MHz	5/15	5/16
☐ Analyzer	HP	8591EM (3628A00871)	9kHz-1.8GHz	5/15	5/16
☐ Analyzer	HP	8562A (3051A05950)	9kHz-110GHz	5/15	5/16
☒ Analyzer	Rohde & Schwarz	ESU40 (100108)	20Hz-40GHz	5/15	5/16
☒ 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

Environmental Conditions

Ambient Temperature	21.3° C
Relative Humidity	42%
Atmospheric Pressure	1027.5 mb

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/m) - Gain (dB)

Statement of Modifications and Deviations

No modifications to the EUT were required for the unit to demonstrate compliance with the CFR47 Part 15C and RSS-247 emission requirements. There were no deviations to the specifications.

Intentional Radiators

As per 47CFR, Subpart C, paragraph 15.247 the following information is submitted.

Antenna Requirements

The EUT utilizes permanently attached printed circuit board antenna design providing 11-dBi gain. 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 a distance of three meters on the OATS. The EUT utilizes frequency, determining circuitry, which generates harmonics falling in the restricted bands. Emissions were measured at the OATS, using appropriate antennas or pyramidal horns, amplification stages, and a spectrum analyzer. Emissions emanating from the support computer system in the restricted bands of operation are presented in Table 1. Emissions emanating from the transmitter module in restricted bands of operation are presented in Table 2. No other significant emission was observed which fell into the restricted bands of operation.

Table 1 Radiated Emissions in Restricted Bands Data General

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)
115.2	29.9	25.1	N/A	34.1	30.0	N/A	43.5
240.0	38.3	36.1	N/A	32.4	27.1	N/A	46.0
250.0	34.9	29.6	N/A	31.0	25.6	N/A	46.0
400.0	31.1	24.1	N/A	30.7	23.6	N/A	46.0

Other emissions present had amplitudes at least 20 dB below the limit.
Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz.
Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Table 2 Radiated Emissions in Restricted Bands 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)
2707.5	36.3	N/A	23.9	36.5	N/A	23.9	54.0
2745.0	37.2	N/A	24.6	37.2	N/A	24.6	54.0
2782.5	38.2	N/A	24.8	37.7	N/A	24.8	54.0
3610.0	36.6	N/A	24.0	36.9	N/A	23.9	54.0
3660.0	35.9	N/A	22.8	35.6	N/A	22.8	54.0
3710.0	36.2	N/A	23.6	36.0	N/A	23.5	54.0
4512.5	41.1	N/A	28.9	41.9	N/A	29.0	54.0
4575.0	39.2	N/A	26.6	39.4	N/A	26.6	54.0
4637.5	43.2	N/A	29.9	42.8	N/A	29.9	54.0
5415.0	41.3	N/A	28.7	41.6	N/A	28.7	54.0

Other emissions present had amplitudes at least 20 dB below the limit. Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz. 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 transmitter demonstrated a minimum margin of –24.1 dB below the requirements. The EUT support computer system demonstrated a minimum margin of -9.9 dB below the requirements. 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 LISN was positioned on the floor of the screen room 80-cm from the rear of the EUT. The manufacturer supplied AC power adapter for the EUT test fixture 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 EUT 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 worst-case 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 EUT test fixture AC Power Line conducted emissions.

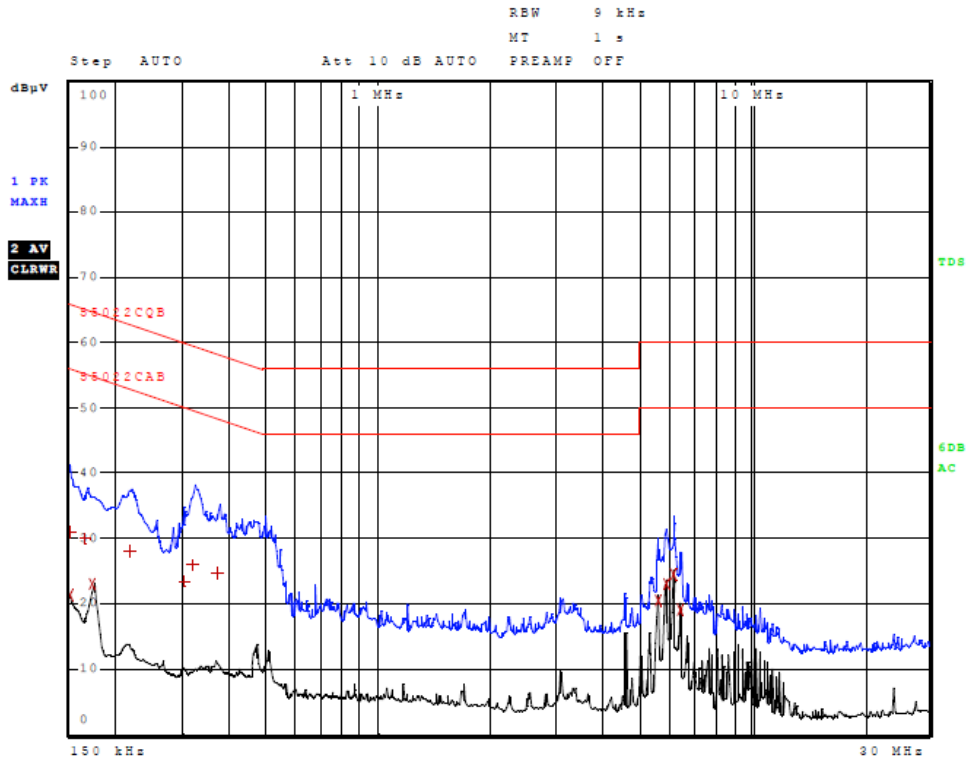


Figure 1 AC Line Conducted Emissions Line 1

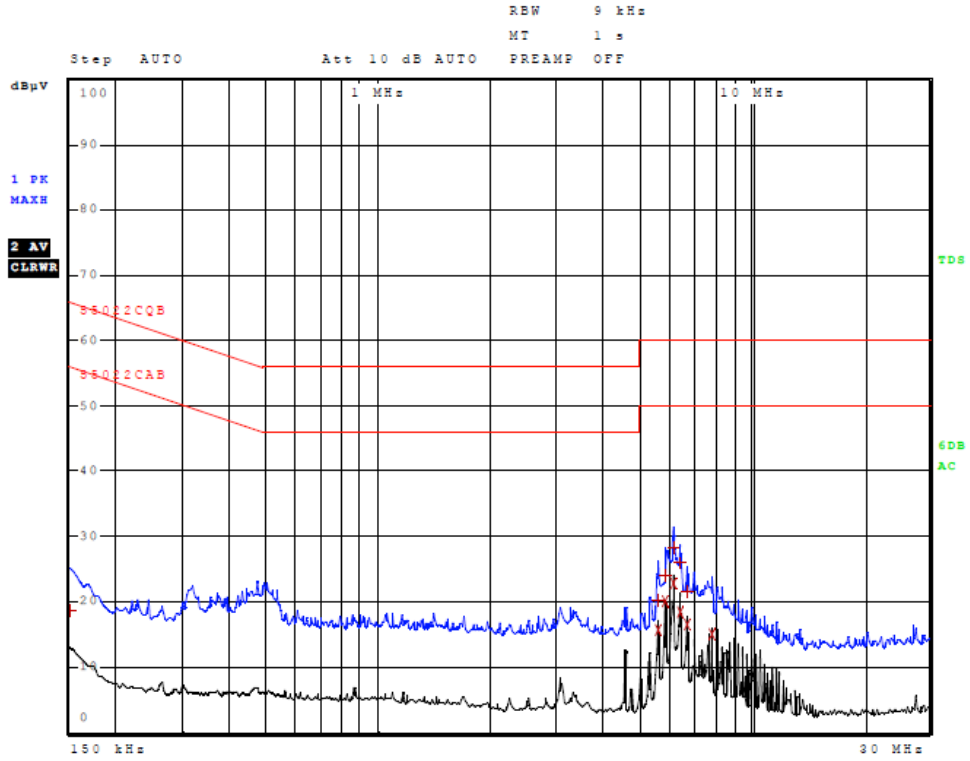


Figure 2 AC Line Conducted Emissions Line 2

Table 3 AC Line Conducted Emissions Data (7 Highest Emissions)

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	150.000000000 kHz	30.98	Quasi Peak	-35.02
2	150.000000000 kHz	21.25	Average	-34.75
1	166.000000000 kHz	29.85	Quasi Peak	-35.30
2	174.000000000 kHz	23.08	Average	-31.69
1	218.000000000 kHz	28.03	Quasi Peak	-34.87
1	302.000000000 kHz	23.37	Quasi Peak	-36.82
1	322.000000000 kHz	25.98	Quasi Peak	-33.68
1	374.000000000 kHz	24.68	Quasi Peak	-33.73
2	5.624000000 MHz	20.57	Average	-29.43
2	5.916000000 MHz	22.92	Average	-27.08
2	6.188000000 MHz	24.55	Average	-25.45
2	6.468000000 MHz	18.95	Average	-31.05

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

Table 4 AC Line Conducted Emissions Data (7 Highest Emissions)

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	150.000000000 kHz	18.60	Quasi Peak	-47.40
1	5.616000000 MHz	20.28	Quasi Peak	-39.72
2	5.640000000 MHz	15.73	Average	-34.27
1	5.892000000 MHz	24.11	Quasi Peak	-35.89
2	5.896000000 MHz	20.02	Average	-29.98
2	6.172000000 MHz	22.89	Average	-27.11
1	6.176000000 MHz	28.26	Quasi Peak	-31.74
2	6.448000000 MHz	18.35	Average	-31.65
1	6.452000000 MHz	25.97	Quasi Peak	-34.03
1	6.728000000 MHz	21.53	Quasi Peak	-38.47
2	6.732000000 MHz	16.58	Average	-33.42
2	7.860000000 MHz	15.09	Average	-34.91

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

Summary of Results for AC Line Conducted Emissions

The EUT demonstrated compliance with the conducted emissions requirements of CFR 47 Part 15C. The EUT demonstrated minimum margin of -25.4 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 EMI Testing Procedure

The EUT was arranged in the test fixture emulating worst-case equipment configuration and operated through all available modes with worst-case data recorded. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM. Investigations were performed to identify the frequencies, which produced the highest radiated emissions. Radiated emission investigations were performed from 9 kHz to 10,000 MHz with the EUT positioned in three orthogonal axes per regulations. Frequencies of interest were recorded for use during testing on the OATS. Each investigated emission was then maximized at the OATS site before final radiated emissions measurements were performed. Final data was taken with the EUT located at the open area test site at a distance of 3 meters between the EUT and the receiving antenna. Peak and average amplitudes of frequencies above 1000 MHz were compared to the required limits with worst-case data presented below. Measured emission levels were maximized by EUT placement on the table, changing cable location, rotating the turntable through 360 degrees, varying the antenna height between 1 and 4 meters above the ground plane and changing antenna polarization between horizontal and vertical. Antennas used were Loop from 0.09 to 30 MHz, Broadband Biconical from 30 MHz to 200 MHz, Log Periodic from 200 MHz to 1 GHz, and/or Biconilog from 30 MHz to 1000 MHz, and above 1 GHz, Double Ridge or Pyramidal Horns, notch filters and appropriate amplifiers and mixers were utilized.

Table 5 General Radiated Emissions Data (worst-case)

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)
72.0	27.2	22.3	N/A	35.1	30.5	N/A	43.5
96.0	27.4	23.3	N/A	35.8	29.7	N/A	43.5
115.2	29.9	25.1	N/A	34.1	30.0	N/A	43.5
216.0	40.6	37.5	N/A	36.6	32.7	N/A	43.5
221.2	34.8	31.2	N/A	32.5	27.1	N/A	46.0
221.7	34.1	29.6	N/A	32.1	26.8	N/A	46.0
240.0	38.3	36.1	N/A	32.4	27.1	N/A	46.0
250.0	34.9	29.6	N/A	31.0	25.6	N/A	46.0
400.0	31.1	24.1	N/A	30.7	23.6	N/A	46.0
492.5	29.1	26.6	N/A	27.9	23.3	N/A	46.0
499.0	33.4	27.3	N/A	29.7	20.7	N/A	46.0

Other emissions present had amplitudes at least 20 dB below the limit.
Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz.
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 general radiated emissions requirements of CFR 47 Part 15C. The EUT demonstrated a minimum margin of -6.0 dB below general radiated emissions requirements. There are no other significantly measurable emissions in the restricted bands other than those recorded in this report. Other emissions were present with amplitudes at least 20 dB below the requirements.

Operation in the Band 902 – 928 MHz

The power output was measured both at the antenna connection port and at the open area test site at a three-meter distance with the authorized antenna system. Band edge and harmonic radiated emission measurements were taken while EUT was operated in both DSS and test modes. Data presented below represents worst-case emissions from all modes investigated during testing. Figures three through nine present antenna conducted emissions across the frequency spectrum.

Dwell Time on channel: The transmitter resides on a channel 2 times over 20 seconds, each time transmitting for 96.7 mS which equates to average time of occupancy of 194 mS which is less than 400 mS requirement demonstrating compliance with regulations.

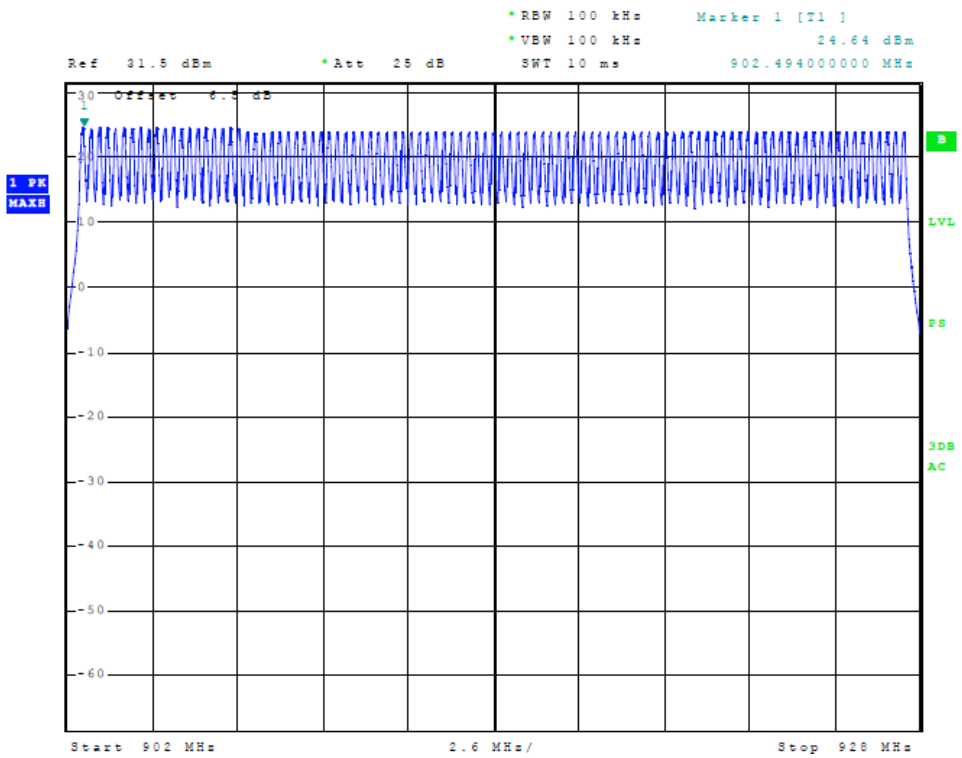


Figure 3 of Antenna Port Conducted Emissions (Frequency band)

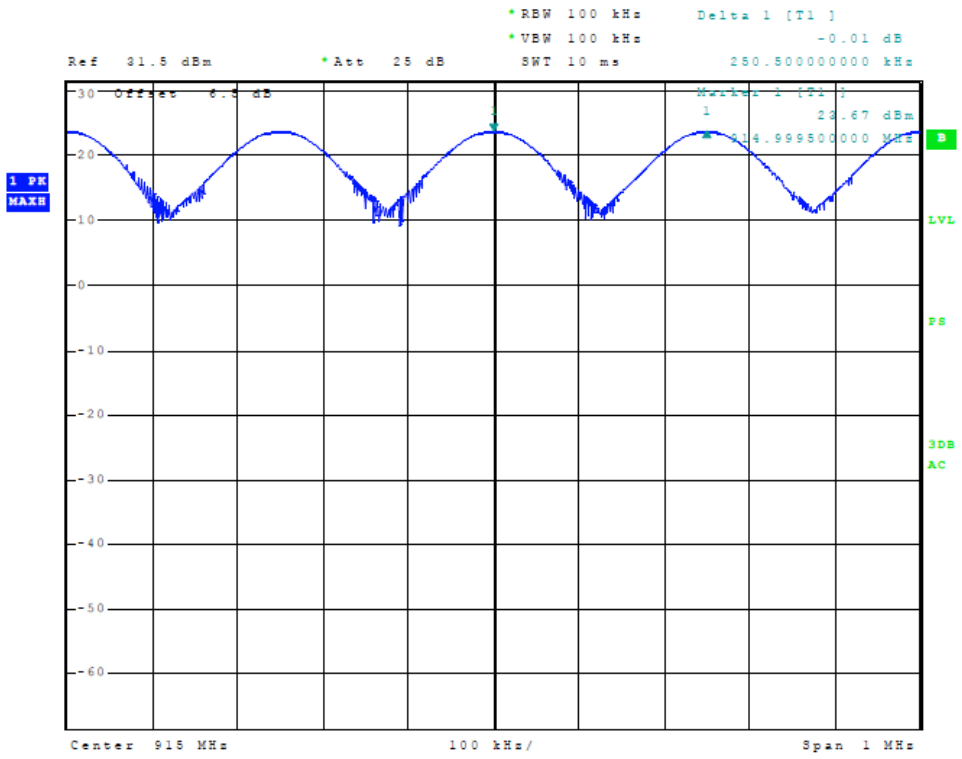


Figure 4 of Antenna Port Conducted Emissions (Channel Separation)

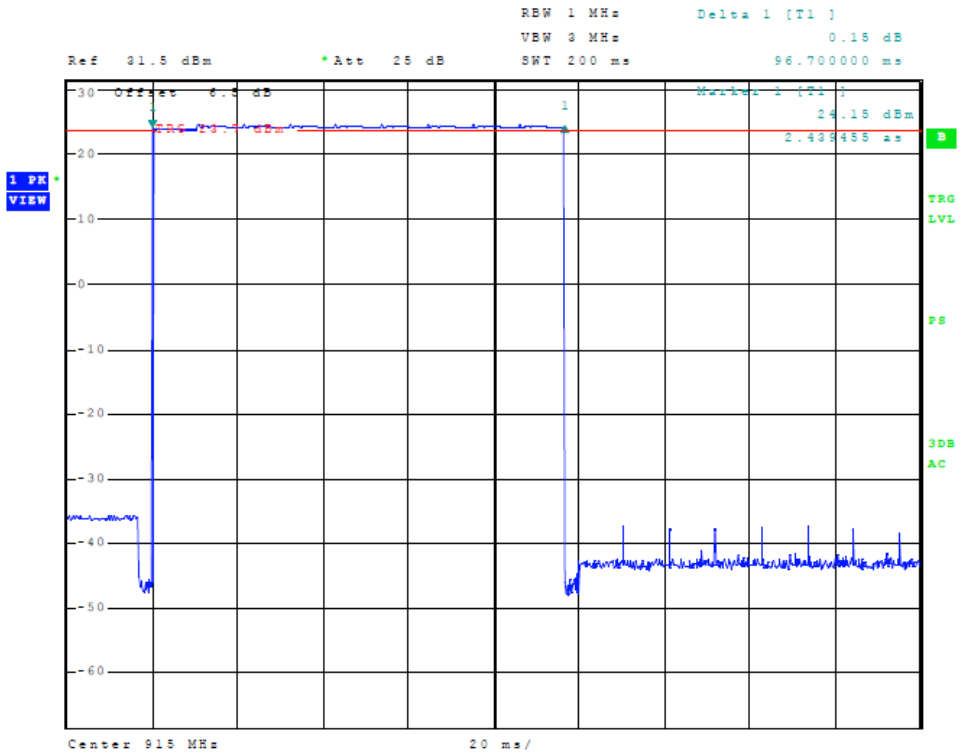


Figure 5 of Antenna Port Conducted Emissions (Dwell Time on Channel)

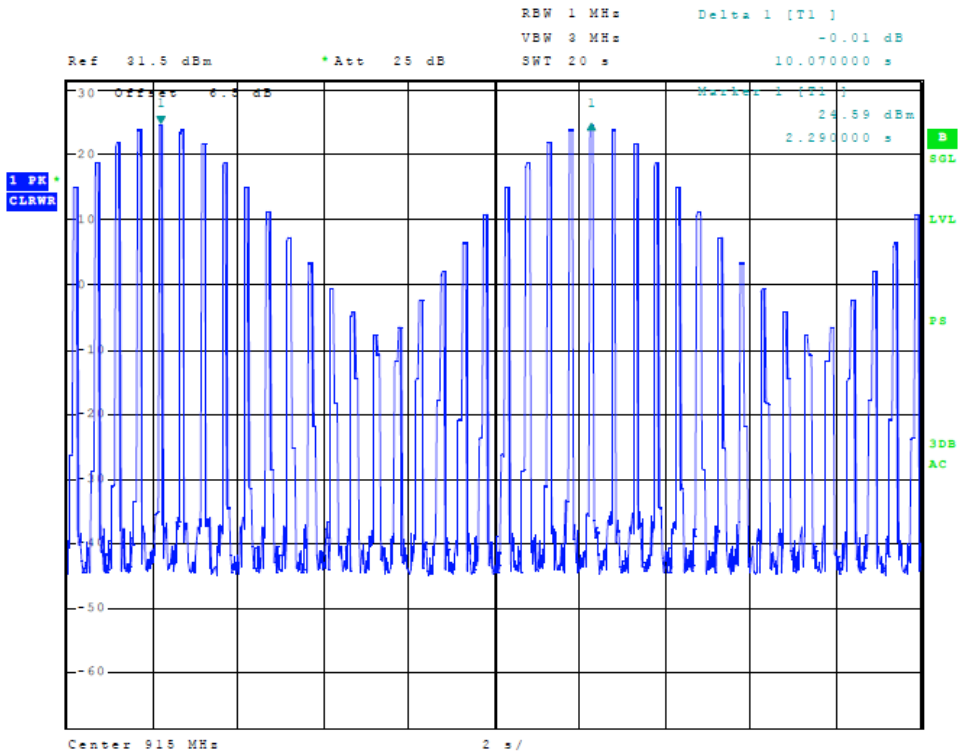


Figure 6 of Antenna Port Conducted Emissions (number of Times on Channel)

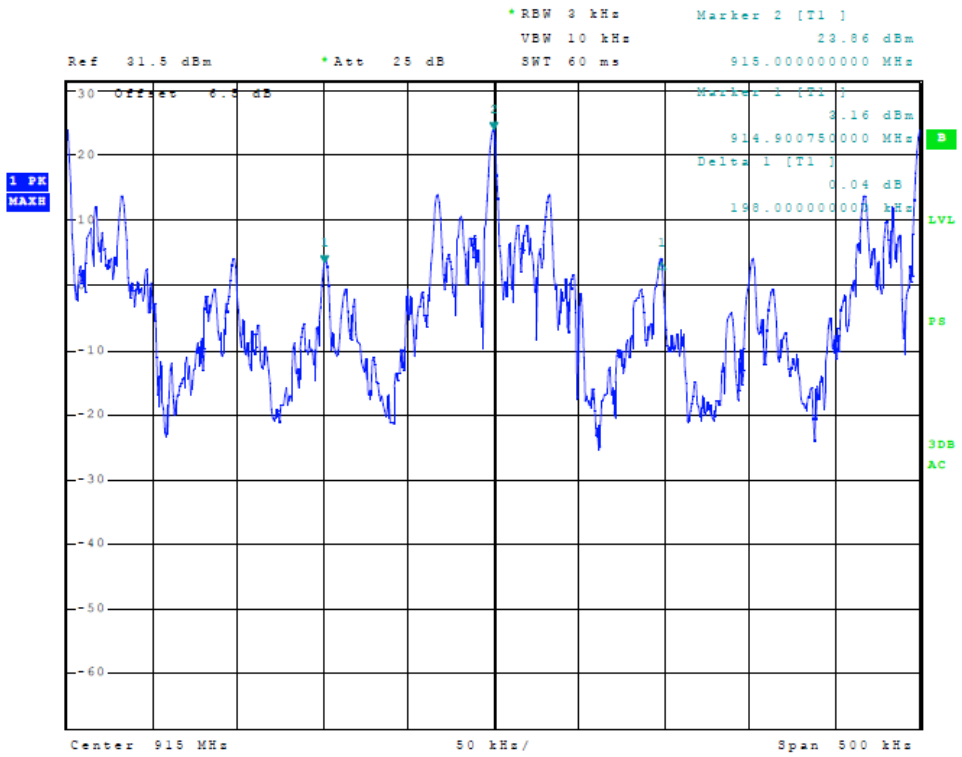


Figure 7 of Antenna Port Conducted Emissions (Occupied Bandwidth)

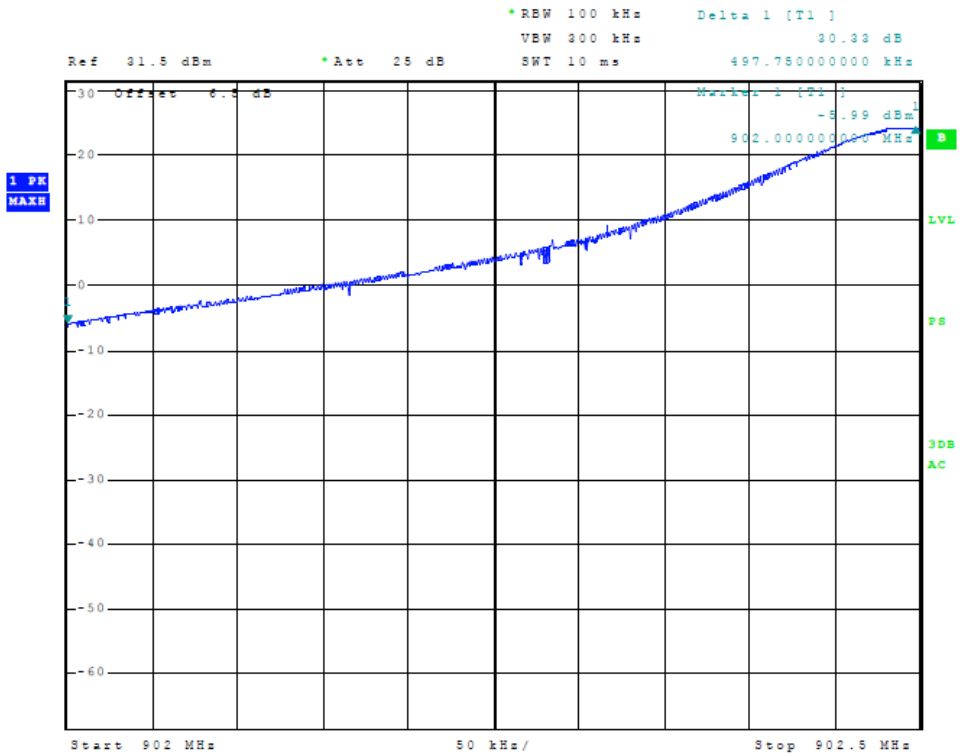


Figure 8 of Antenna Port Conducted Emissions (Low Band Edge)

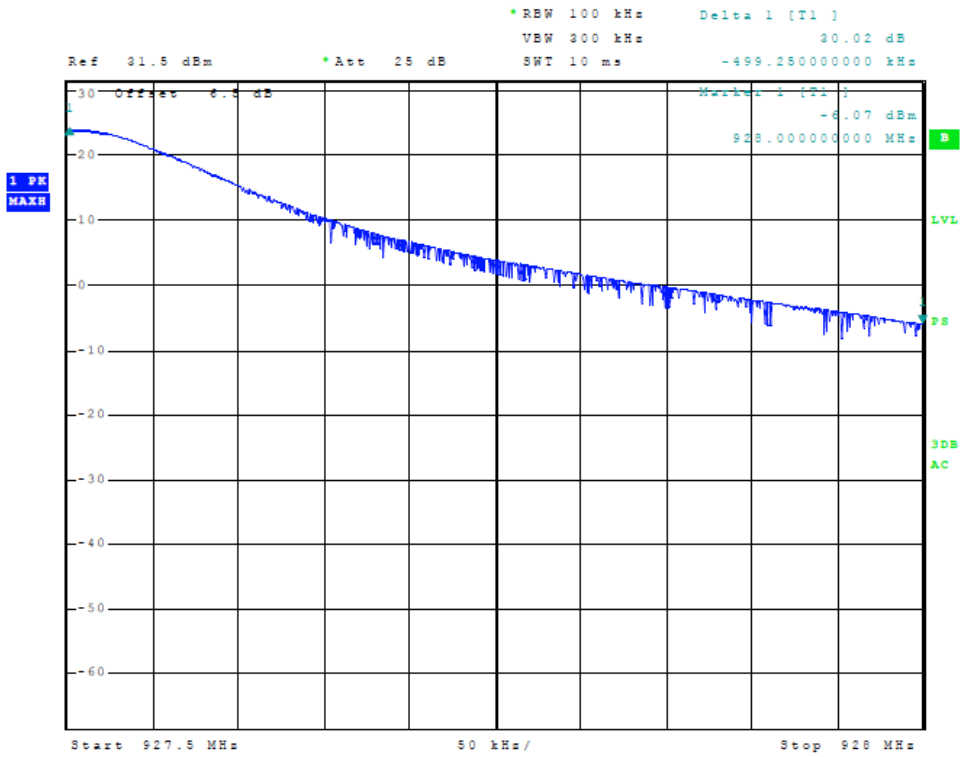


Figure 9 of Antenna Port Conducted Emissions (High Band Edge)

Transmitter Emissions Data

Table 6 Transmitter Radiated Emission 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)
902.5	--	--	--	--	--	--	--
1805.0	50.4	N/A	38.3	42.3	N/A	29.5	54.0
2707.5	36.3	N/A	23.9	36.5	N/A	23.9	54.0
3610.0	36.6	N/A	24.0	36.9	N/A	23.9	54.0
4512.5	41.1	N/A	28.9	41.9	N/A	29.0	54.0
5415.0	41.3	N/A	28.7	41.6	N/A	28.7	54.0
915.0	--	--	--	--	--	--	--
1830.0	48.5	N/A	36.4	37.5	N/A	24.4	54.0
2745.0	37.2	N/A	24.6	37.2	N/A	24.6	54.0
3660.0	35.9	N/A	22.8	35.6	N/A	22.8	54.0
4575.0	39.2	N/A	26.6	39.4	N/A	26.6	54.0
5490.0	43.2	N/A	30.0	42.7	N/A	30.0	54.0
927.5	--	--	--	--	--	--	--
1855.0	49.6	N/A	37.3	36.3	N/A	23.8	54.0
2782.5	38.2	N/A	24.8	37.7	N/A	24.8	54.0
3710.0	36.2	N/A	23.6	36.0	N/A	23.5	54.0
4637.5	43.2	N/A	29.9	42.8	N/A	29.9	54.0
5565.0	42.8	N/A	30.1	42.8	N/A	30.1	54.0

Other emissions present had amplitudes at least 20 dB below the limit.
Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz.
Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Table 7 Transmitter Antenna Conducted Emissions Data

The antenna conducted output power and 20-dB bandwidth were measured while operating in available modes for the lowest, middle and highest available channels. The data reported below represents the worst-case operational conditions.

Operational Mode	Frequency MHz	Antenna Conducted Output Power dBm	Antenna Conducted Output Power Watts	Occupied Bandwidth kHz
Hop Set	902.5	24.64	0.291	198.0
Hop Set	915.0	24.45	0.278	198.0
Hop Set	927.5	24.55	0.285	198.0

Summary of Results for Radiated Emissions of Intentional Radiator

The EUT demonstrated antenna conducted output power of 291 Milliwatts (0.291 Watts) at antenna port. The EUT demonstrated a minimum margin of -15.7 dB below the harmonic emissions requirements. The EUT and support equipment demonstrated a minimum margin of-9.9 dB below the emissions requirements in restricted bands (general emissions of support equipment). The EUT tested was observed in compliance with the radiated emissions requirements of 47CFR Part 15.247 Intentional Radiators. There were no other significantly measurable emissions observed in restricted bands other than those recorded in this report. Other emissions were present with amplitudes at least 20 dB below the requirements. There were no deviations or exceptions to the requirements.

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

List of Test Equipment	Calibration Date	Due
Spectrum Analyzer: Rohde & Schwarz ESU40	5/15	5/16
Spectrum Analyzer: HP 8562A, HP Adapters: 11518, 11519, and 11520	5/15	5/16
Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W		
Spectrum Analyzer: HP 8591EM	5/15	5/16
Antenna: EMCO Biconilog Model: 3143	5/15	5/16
Antenna: Sunol Biconilog Model: JB6	10/14	10/15
Antenna: EMCO Log Periodic Model: 3147	10/14	10/15
Antenna: Com Power Model: AH-118	10/14	10/16
Antenna: Com Power Model: AH-840	5/15	5/17
Antenna: Antenna Research Biconical Model: BCD 235	10/14	10/15
Antenna: EMCO 6509	10/14	10/15
LISN: Compliance Design Model: FCC-LISN-2.Mod.cd, 50 µHy/50 ohm/0.1 µf	10/14	10/15
R.F. Preamp CPPA-102	10/14	10/15
Attenuator: HP Model: HP11509A	10/14	10/15
Attenuator: Mini Circuits Model: CAT-3	10/14	10/15
Attenuator: Mini Circuits Model: CAT-3	10/14	10/15
Cable: Belden RG-58 (L1)	10/14	10/15
Cable: Belden RG-58 (L2)	10/14	10/15
Cable: Belden 8268 (L3)	10/14	10/15
Cable: Time Microwave: 4M-750HF290-750	10/14	10/15
Cable: Time Microwave: 10M-750HF290-750	10/14	10/15
Frequency Counter: Leader LDC825	2/15	2/16
Oscilloscope Scope: Tektronix 2230	2/15	2/16
Wattmeter: Bird 43 with Load Bird 8085	2/15	2/16
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/15	2/16
R.F. Generators: HP 606A, HP 8614A, HP 8640B	2/15	2/16
R.F. Power Amp 65W Model: 470-A-1010	2/15	2/16
R.F. Power Amp 50W M185- 10-501	2/15	2/16
R.F. Power Amp A.R. Model: 10W 1010M7	2/15	2/16
R.F. Power Amp EIN Model: A301	2/15	2/16
LISN: Compliance Eng. Model 240/20	2/15	2/16
LISN: Fischer Custom Communications Model: FCC-LISN-50-16-2-08	2/15	2/16
Antenna: EMCO Dipole Set 3121C	2/15	2/16
Antenna: C.D. B-101	2/15	2/16
Antenna: Solar 9229-1 & 9230-1	2/15	2/16
Audio Oscillator: H.P. 201CD	2/15	2/16
ELGAR Model: 1751	2/15	2/16
ELGAR Model: TG 704A-3D	2/15	2/16
ESD Test Set 2010i	2/15	2/16
Fast Transient Burst Generator Model: EFT/B-101	2/15	2/16
Field Intensity Meter: EFM-018	2/15	2/16
KEYTEK Ecat Surge Generator	2/15	2/16
Shielded Room 5 M x 3 M x 3.0 M		

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

April 16, 2015

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: April 16, 2015

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