NVLAP Lab Code 200087-0

Application For Class 2 Permissive Change Certification

FOR

Models: **Z24FEE01L/Z24FEE01H**
"SAF FreeMile-24"

Low Power Transmitter
FCC ID: W9Z-CFIP-24
IC ID: 8855A-CFIP24

FOR

SAF TEHNIKA AS
24a, Ganibu dambis
Riga Latvia LV-1005

Test Report Number 111031A

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

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Models: Z24FEE01L/Z24FEE01H

"SAF FreeMile-24"

Low Power Transmitter

Frequency Range: 24,053 - 24,245 MHz

FCC ID: W9Z-CFIP-24
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Test Report Number: 111031A

Test Date: October 31, 2011

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This report documents supporting information for requesting Class 2 permissible change to certified equipment. The submitted exhibits and this document offer supporting information and demonstration of compliance for use of additional antennas, model number, and enclosure change. The electromagnetic emissions compatibility testing required for demonstration of compliance with class 2 permissible change as authorized by CFR47 Dated October 1, 2010, Paragraphs 2.1043, 15.247, KDB 178919, and Industry Canada RSS-210 have been conducted on the Z24FEE01L/Z24FEE01H and antenna system. The results have been reviewed and equipment found to demonstrate compliance with all the requirements investigated for this report.

Name of Applicant: SAF TEHNIKA AS
24a, Ganibu dambis
Riga Latvia LV-1005

Models: Z24FEE01L/Z24FEE01H, "SAF FreeMile-24"

FCC ID: W9Z-CFIP-24 IC: 8855A-CFIP24

Frequency Range: 24,053 - 24,245 MHz

Operating Power: Less than 5 mW (as design specification, measured average 103.5 dBµV/m @ 3 meters), for operation in the 24,053 - 24,245 MHz, Occupied band width 9,615 kHz, or 28,766 kHz

Opinion / Interpretation of Results

Tests Performed	Margin (dB)	Results
CFR 47 paragraphs 2 and 15.205, RSS-210	-0.3	Complies
CFR 47 paragraphs 2 and 15.207, RSS-210	-6.1	Complies
CFR 47 paragraphs 2 and 15.209, RSS-210	-5.6	Complies
CFR 47 paragraphs 2 and 15.249, RSS-210	-0.3	Complies

Applicable Standards & Test Procedures

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2010, 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, KDB 178919, and RSS-210 the following information is submitted.

Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in the ANSI C63.4-2009 Document, FCC documents KDB 718828, KDB 412172, and/or TIA/EIA 603-1. Testing for the AC line-conducted emissions were performed as defined in sections 7 and 13.1.3, testing of the radiated emissions was performed as defined in sections 8 and 13.1.4 of ANSI C63.4-2009. Testing of the intentional radiated emissions was performed as defined in section 13 of ANSI C63.4-2009.

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	Calibration Date	Due
LISN	Comp. Design	FCC-LISN-2-MOD.CD	10/11	10/12
Antenna	ARA	BCD-235-B	10/11	10/12
Antenna	EMCO	3147	10/11	10/12
Antenna	Com Power	AH-118	10/11	10/12
Antenna	EMCO	3143	5/11	5/12
Analyzer	HP	8591EM	5/11	5/12
Analyzer	HP	8562A	5/11	5/12
Analyzer	Rohde & Schwarz	ESU40	5/11	5/12

Environmental Conditions

Ambient Temperature	25.9° C
Relative Humidity	32%
Atmospheric Pressure	1015.7 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)

Application for Certification

(1) Manufacturer: SAF TEHNIKA AS
24a, Ganibu dambis
Riga Latvia LV-1005

(2) Identification: FCC I.D.: W9Z-CFIP-24 IC: 8855A-CFIP24

(3) Copy of the installation and operating manual: Refer to exhibit for Draft Instruction Manual.

(4) Description of Circuit Functions, Device Operation: The Z24FEE01L/Z24FEE01H is a point-to-point communications system incorporating a low power Transmitter. This device features low power transmitter operation in communications frequency band of 24.0-24.25 GHz.

(5) Block Diagram with Frequencies: Refer to exhibit for the Block Diagram

(6) Report of measurements demonstrating compliance with the pertinent FCC technical requirements is provided in this report.

(7) Photographs of equipment are provided in application exhibits.

(8) Peripheral equipment or accessories for the equipment. Optional equipment available for the EUT includes AC/DC (Power Over Ethernet (POE)) power adapter. The available configuration options were investigated for this and other reports in compliance to required standards with worst-case data presented.

(9) Transition Provisions of 15.37 are not being requested.

(10) The equipment is not a scanning receiver.

(11) The equipment is not a transmitter operating in the 59-64 GHz frequency range.

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

Equipment Tested

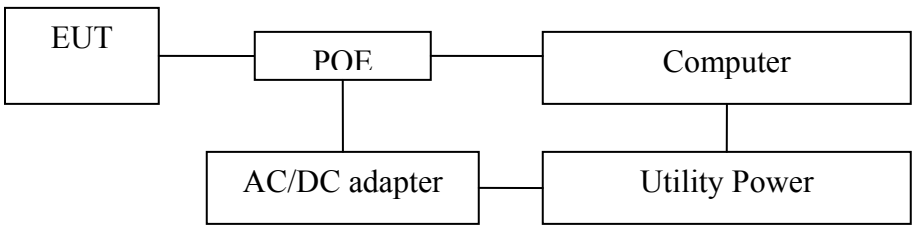
Equipment	Serial Number	FCC I.D.#
Z24FEE01L (EUT Low)	325570100129	W9Z-CFIP-24
Z24FEE01H (EUT High)	325560100130	W9Z-CFIP-24
AC/DC Adapter (CFIP-AC-PS)	361570105862	N/A
POE Adapter (CFIP-TPI)	326170200468	N/A
CPU (Dell)	2574199693	N/A
Antenna (HAA2499_09, 45.1dB gain)	322730200009	N/A

Antenna Options Include: Arkivator AB models, HAA2499_09, HAA2406_00, and HAA2403_00

Equipment Function and Configuration

The Z24FEE01L/Z24FEE01H is a point-to-point transceiver offering high bandwidth and low power communications solution. The transmitter section allows for communications to other compliant devices. The EUT was arranged typical user equipment configurations for testing purposes. This change request includes the addition of alternate antenna option available for the product model: HAA2499_09, changes to enclosure, PCB, models, and frequency listing. The highest gain antenna (M/N: HAA2499_09, 45.1 dBi) was used during testing. The antennas comply with requirements of CFR47 15.249; gain higher than 33 dBi and beam width less than 3.5 degrees. The transmitter offers no other interface connections than those in the configuration options shown below. The EUT receives power from externally provided POE option as shown in configuration diagram. As requested by the manufacturer and required by regulations, the unit 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.

Configuration options for the EUT



Change in Equipment

Changes in equipment form original application include:

- Changed PCB – removal of I/O port options and connectors
- Enclosure change
- Different E1 Connectors (18pin connector changed to RJ45 connector)
- Supports 2 x E1 instead of 4 x E1
- Absence of twin BNC connector
- Different mounting bracket
- Additional antenna
- Different RSSI port (Used RJ45 port instead of BNC connector)
- Changes in software reflecting altered frequency band of operation

Test Procedures

AC Line Conducted Emission Test Procedure

Testing for the AC line-conducted emissions was performed as defined in sections 7.2.4 and 13 of ANSI C63.4-2009. The test setup, including the EUT, was arranged in the test configurations as shown above and 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 photographs in exhibits for EUT placement used during testing.

Radiated Emission Test Procedure

Testing for the radiated emissions was performed as defined in sections 8.3 and 13.1 of ANSI C63.4-2009. The EUT was arranged in the test configurations as shown above and 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. 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 final data was taken using a spectrum analyzer. Refer to photographs in exhibits for EUT placement used during testing.

Intentional Radiators

As per CFR47 Part 15, Subpart C and RSS-210 the following information is submitted for consideration in obtaining a grant of certification for unlicensed intentional radiators.

Antenna Requirements

The design utilizes a unique mount offering connection for approved antenna. The end product is marketed and sold for professional installation only. The antenna connection point complies with the unique antenna connection requirements. The requirements of 15.203 and RSS-210 are fulfilled and 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 a 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 63.4-2009 paragraphs 13.1 and 8.3.1.2 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 radiated field strength, receive antenna correction factor, amplifier gain stage, and test system cable losses.

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)
115.0	30.9	34.5	N/A	32.1	25.1	N/A	43.5
115.5	30.2	24.5	N/A	32.6	24.1	N/A	43.5
116.5	36.2	24.2	N/A	32.2	24.7	N/A	43.5
250.0	35.7	31.0	N/A	34.7	29.9	N/A	46.0
1598.5	57.8	31.4	N/A	56.7	31.4	N/A	54.0
24000.0	47.3	N/A	40.2	47.8	N/A	40.6	54.0
48110.0	47.8	N/A	41.4	48.7	N/A	41.8	54.0
48250.0	46.8	N/A	40.9	47.1	N/A	41.3	54.0
48490.0	47.3	N/A	40.7	47.5	N/A	41.1	54.0
72165.0	58.7	N/A	50.5	58.9	N/A	50.6	54.0
72375.0	58.5	N/A	49.3	58.4	N/A	50.0	54.0
72735.0	58.1	N/A	49.5	58.1	N/A	49.9	54.0
96220.0	62.6	N/A	53.1	62.9	N/A	53.6	54.0
96500.0	64.2	N/A	53.0	64.2	N/A	53.4	54.0
96980.0	63.1	N/A	53.6	63.3	N/A	53.7	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 of 30-1000 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 FCC CFR47 Part 15.205 restricted bands of operation. The EUT worst-case configuration demonstrated minimum margin of -0.3 dB below the FCC limits. Other emissions were present with amplitudes at least 20 dB below the required limits.

AC Line Conducted Emissions Procedure

The EUT was arranged in typical equipment configurations (AC power adapter). Testing was performed with the EUT 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. Testing for the line-conducted emissions were the procedures of ANSI 63.4-2009 paragraphs 13.1.3 and 7.2.4. The AC adapter for the EUT was connected to the LISN for line-conducted emissions testing. 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 was 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 frequencies of each of the emissions, which had the highest amplitudes. 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 data was recorded with maximum conducted emissions levels. Refer to Figures one and two showing plots of the worst-case AC Line conducted emissions frequency spectrum taken in the screen room.

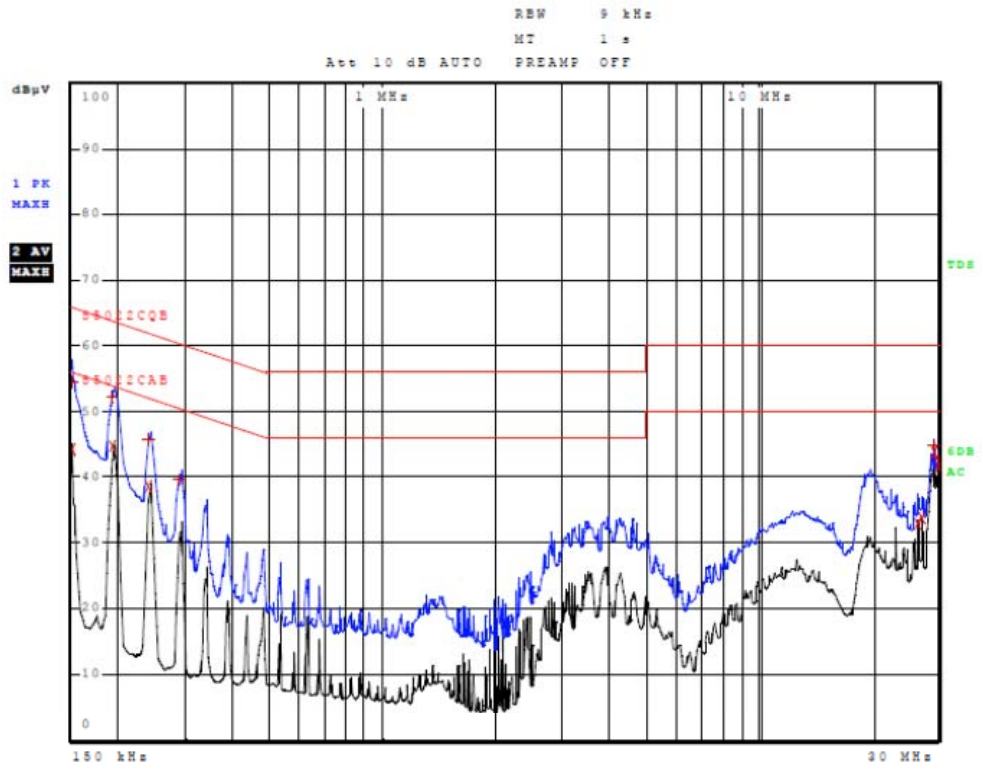


Figure One AC Line Conducted emissions of EUT line 1

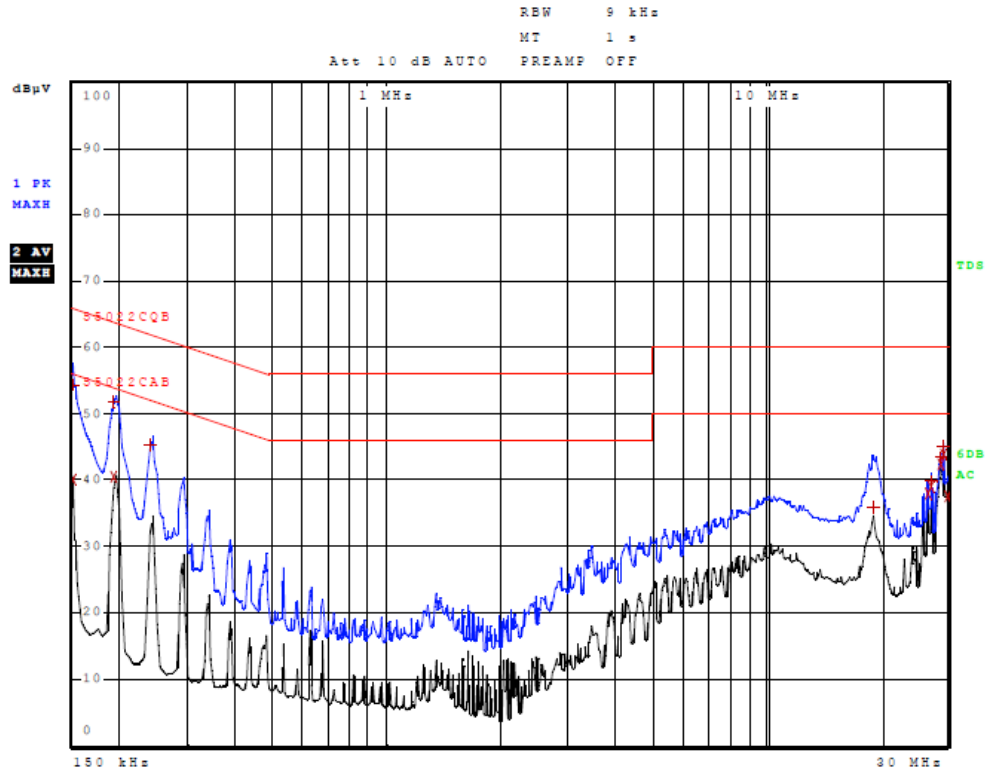


Figure Two AC Line Conducted emissions of EUT line 2

Data Conducted Emissions (7 Highest Emissions)

AC Line Conducted Emissions Data (Highest Emissions)

Line 1

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	150.000000000 kHz	54.56	Quasi Peak	-11.44
2	150.000000000 kHz	44.25	Average	-11.75
2	194.000000000 kHz	44.62	Average	-9.24
1	194.000000000 kHz	52.14	Quasi Peak	-11.73
2	242.000000000 kHz	38.64	Average	-13.38
1	242.000000000 kHz	45.59	Quasi Peak	-16.44
1	290.000000000 kHz	39.67	Quasi Peak	-20.86
2	26.488000000 MHz	32.91	Average	-17.09
2	27.160000000 MHz	33.68	Average	-16.32
2	29.236000000 MHz	43.86	Average	-6.14
1	29.236000000 MHz	44.92	Quasi Peak	-15.08
2	29.908000000 MHz	41.49	Average	-8.51
1	29.908000000 MHz	42.72	Quasi Peak	-17.28

Line 2

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	150.000000000 kHz	54.37	Quasi Peak	-11.63
2	150.000000000 kHz	39.93	Average	-16.07
1	194.000000000 kHz	51.78	Quasi Peak	-12.08
2	194.000000000 kHz	40.37	Average	-13.50
1	242.000000000 kHz	45.36	Quasi Peak	-16.66
1	19.120000000 MHz	35.86	Quasi Peak	-24.14
2	26.608000000 MHz	37.89	Average	-12.11
2	27.160000000 MHz	38.95	Average	-11.05
1	27.160000000 MHz	39.89	Quasi Peak	-20.11
2	28.684000000 MHz	42.36	Average	-7.64
1	28.684000000 MHz	43.35	Quasi Peak	-16.65
2	29.236000000 MHz	43.73	Average	-6.27
1	29.236000000 MHz	45.04	Quasi Peak	-14.96
2	29.908000000 MHz	37.45	Average	-12.55

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

Summary of Results for AC Line Conducted General Emissions

The EUT demonstrated compliance with the conducted emissions requirements of CFR47 Part 15C and other applicable standards for Intentional Radiators. The EUT worst-case configuration demonstrated minimum margin of -6.1 dB below the limit. Other emissions were present with recorded data representing the worst-case amplitudes.

Operation in the Band 24.0-24.25 GHz

The power output was measured on an open area test site @ 3 meters. Test procedures of ANSI 63.4-2009 paragraphs 13.1 and 8.3.1.2 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 meters from the FSM antenna. The peak and quasi-peak amplitude of frequencies below 1000 MHz were measured using a spectrum analyzer. The peak and average amplitude of frequencies above 1000 MHZ were measured using a spectrum analyzer. The amplitude of the emission was then recorded from the analyzer display. Emissions radiated outside of the specified bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in 15.209, whichever is the lesser attenuation. Radiated emissions investigations were performed to identify the frequencies, which produced the highest emissions. Radiated emissions were checked in the screen room from 9 kHz to 110,000 MHz. Plots were made of the frequency spectrum from 30 MHz to 110,000 MHz during preliminary investigation for reference. Refer to figures three through eighteen demonstrating compliance with frequency and amplitude of emission requirements. The amplitudes of each radiated emission were measured at the OATS at a distance of 3 meters from the FSM antenna. The amplitude of each radiated spurious emission was maximized by varying the FSM antenna height, polarization, and by rotating the turntable. Antennas used for measuring emissions include, loop from 9 kHz to 30 MHz, Biconilog Antenna from 30 to 1000 MHz, a Log Periodic Antenna for 200 to 1000 MHz, and Double-ridge horn and/or Pyramidal Horn Antennas from 4 GHz to 40 GHz, and mixers above 40 GHz. Emissions were measured in dBµV/m @ 3 meters.

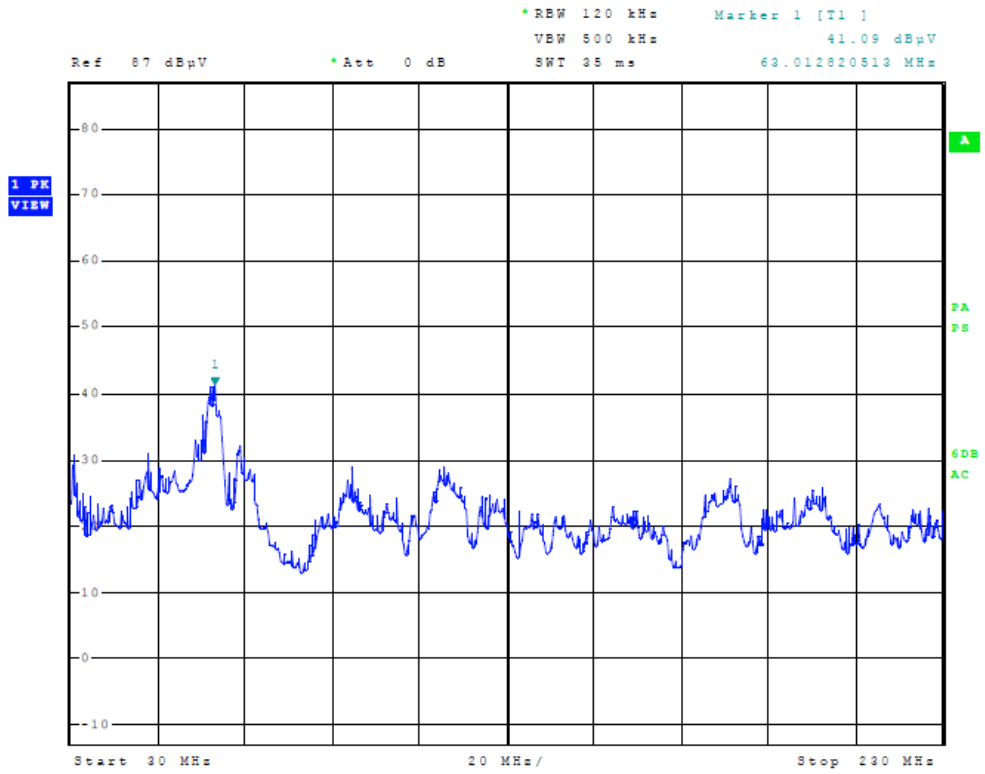


Figure Three Radiated Emissions in screen room

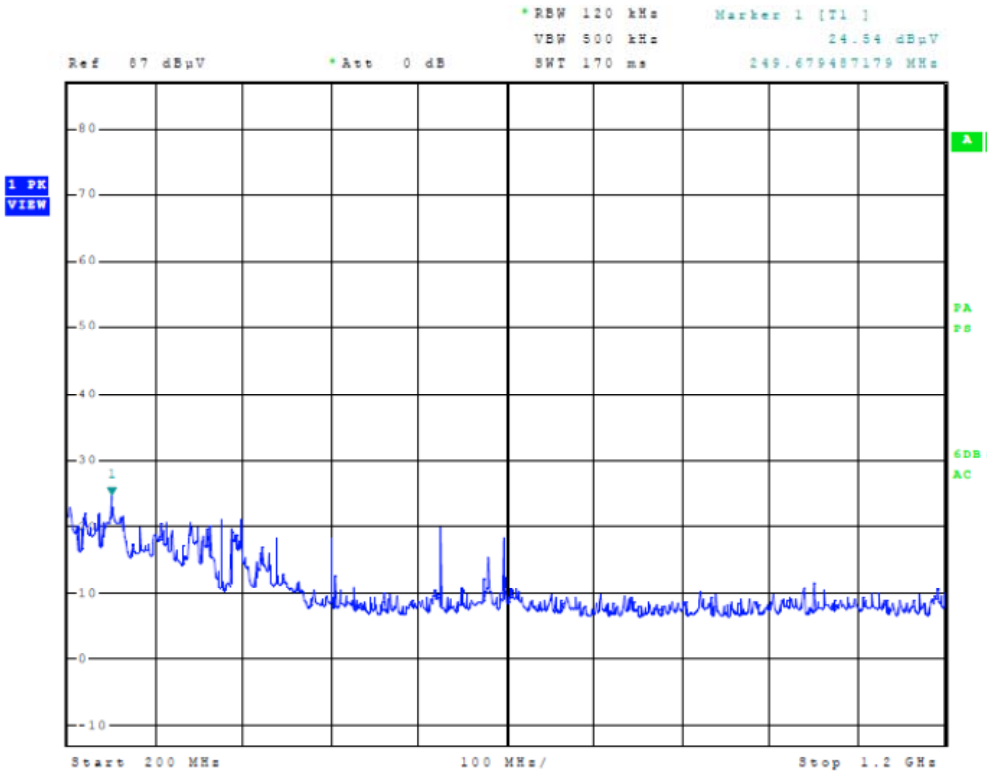


Figure Four Radiated Emissions in screen room

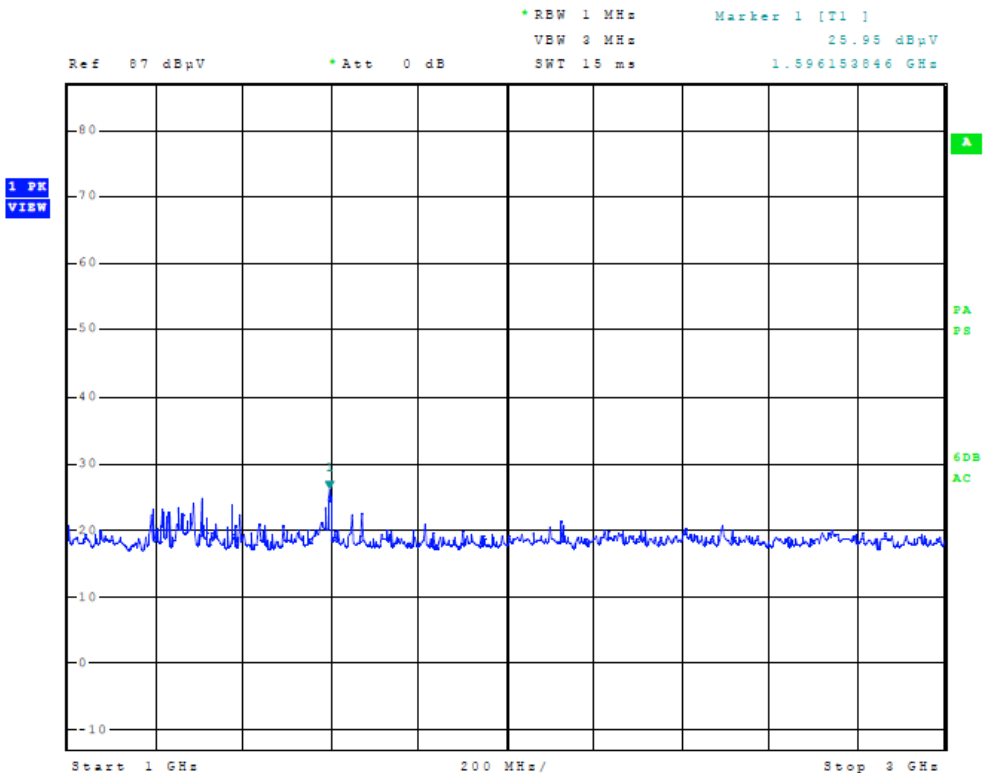


Figure Five Radiated Emissions in screen room

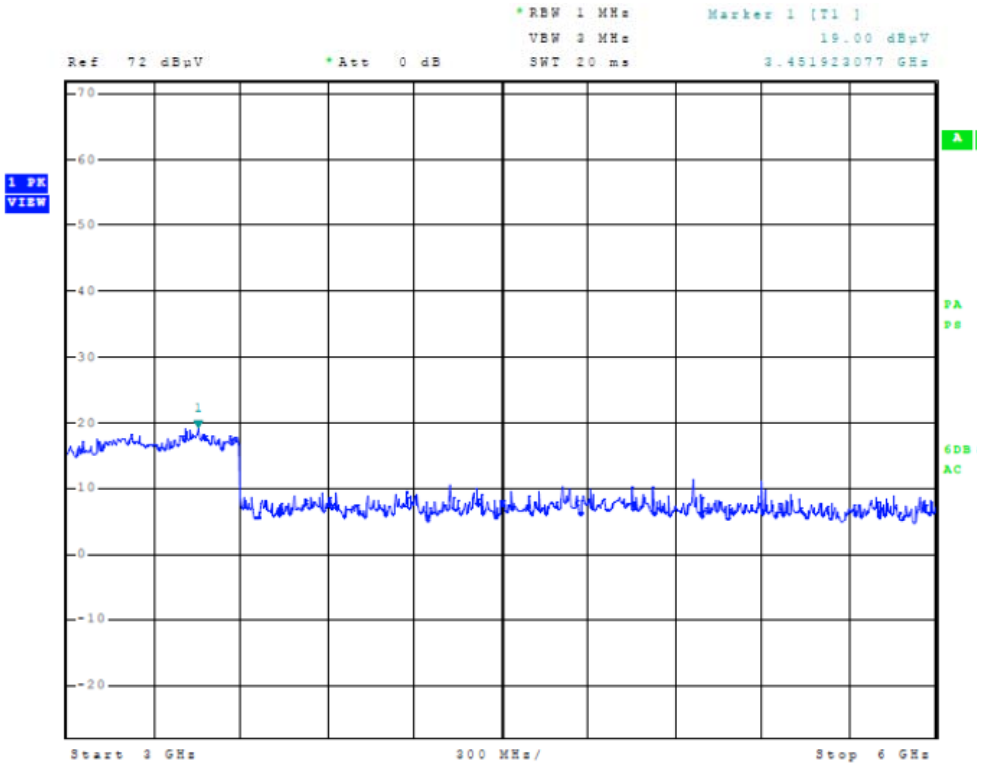


Figure Six Radiated Emissions in screen room

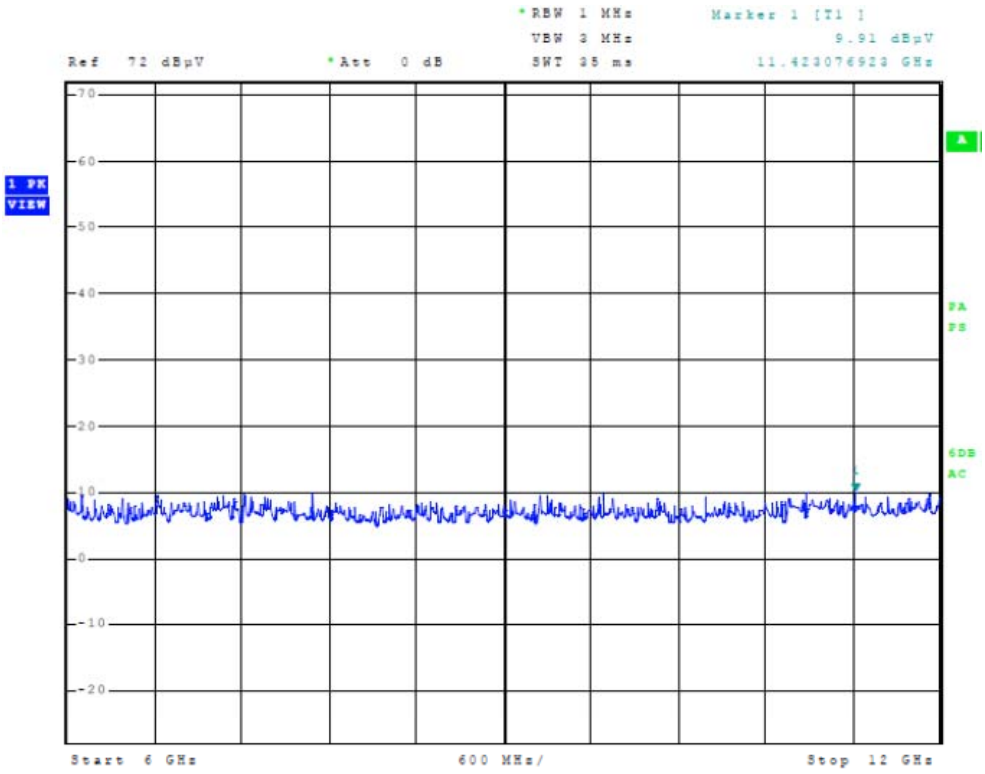


Figure Seven Radiated Emissions in screen room

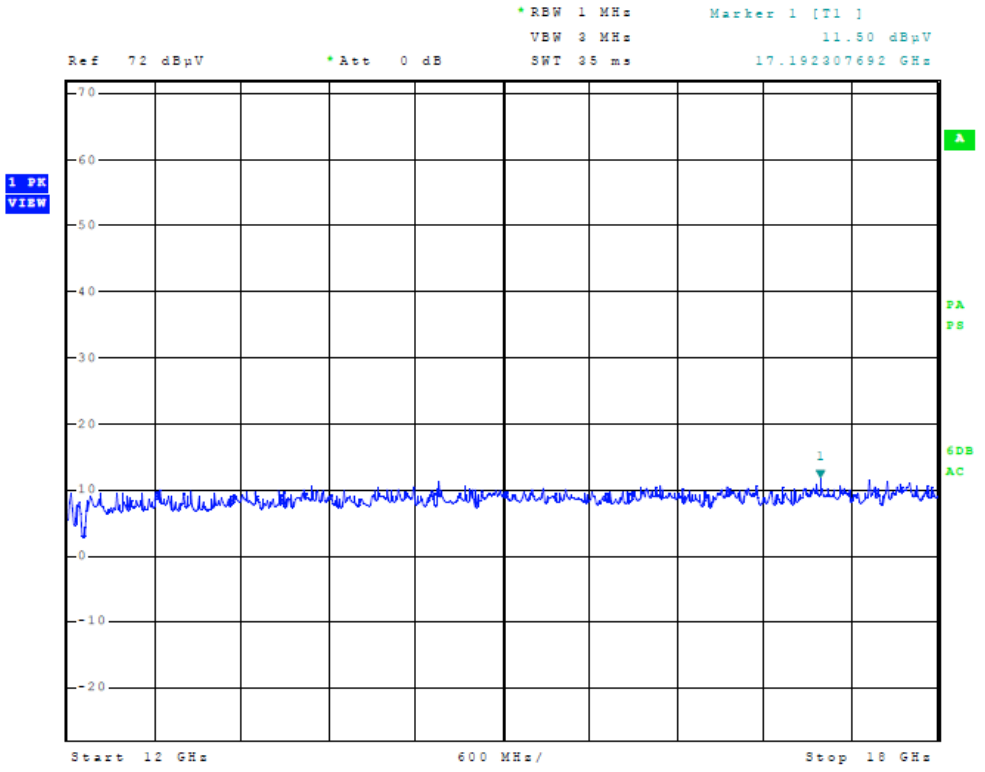


Figure Eight Radiated Emissions in screen room

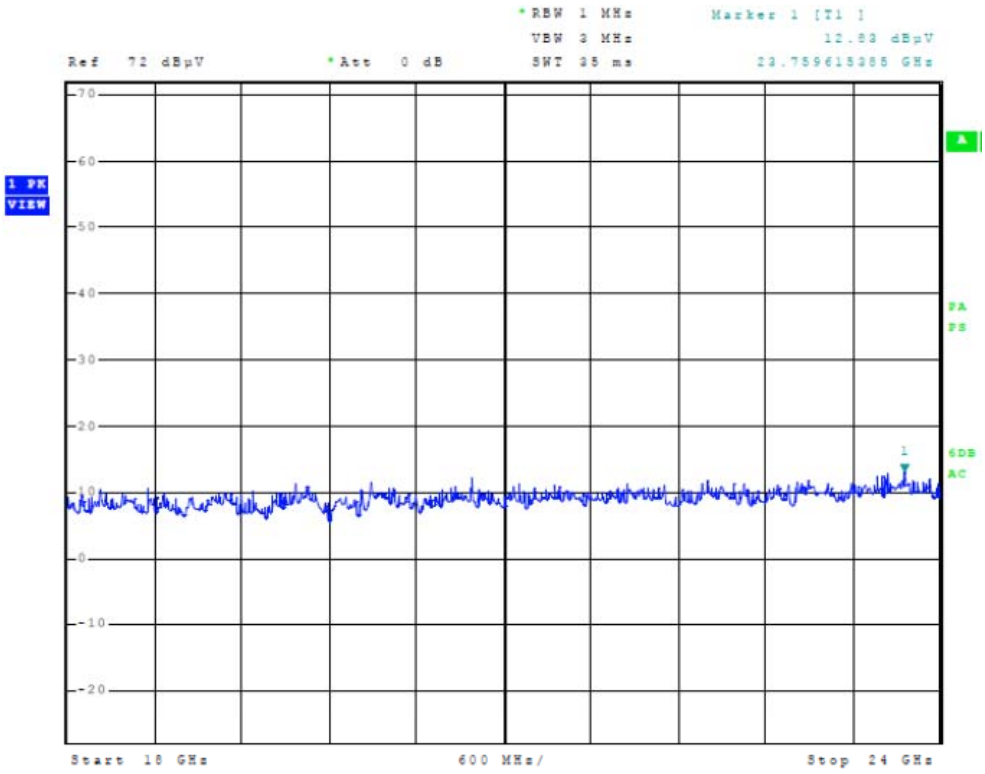


Figure Nine Radiated Emissions in screen room

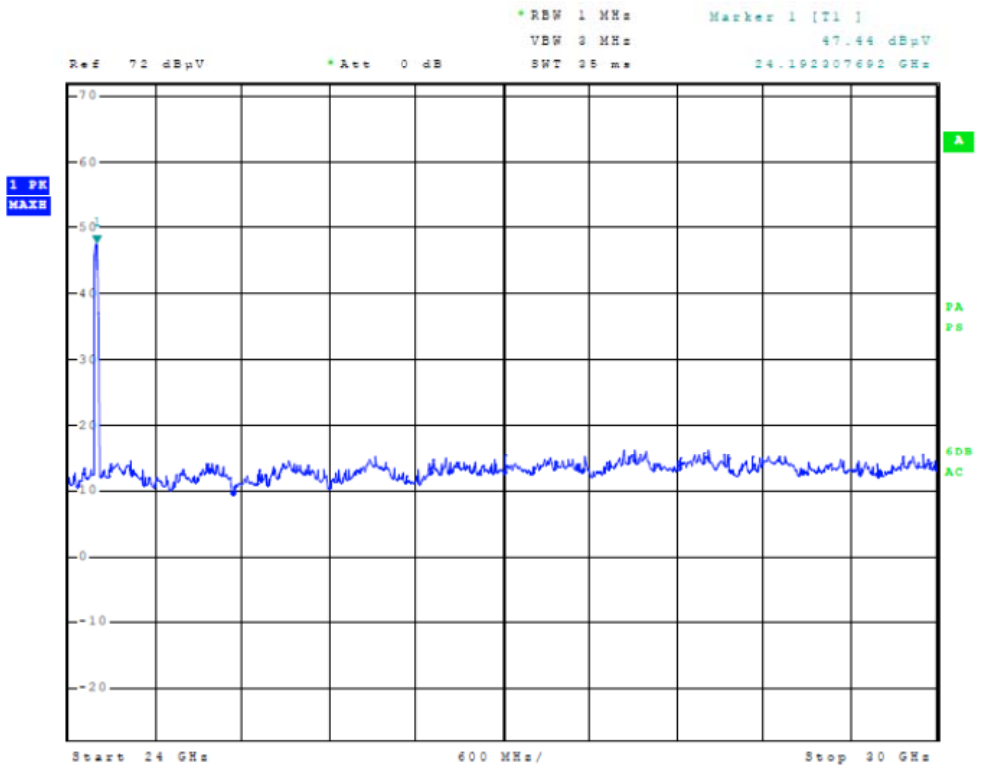


Figure Ten Radiated Emissions in screen room

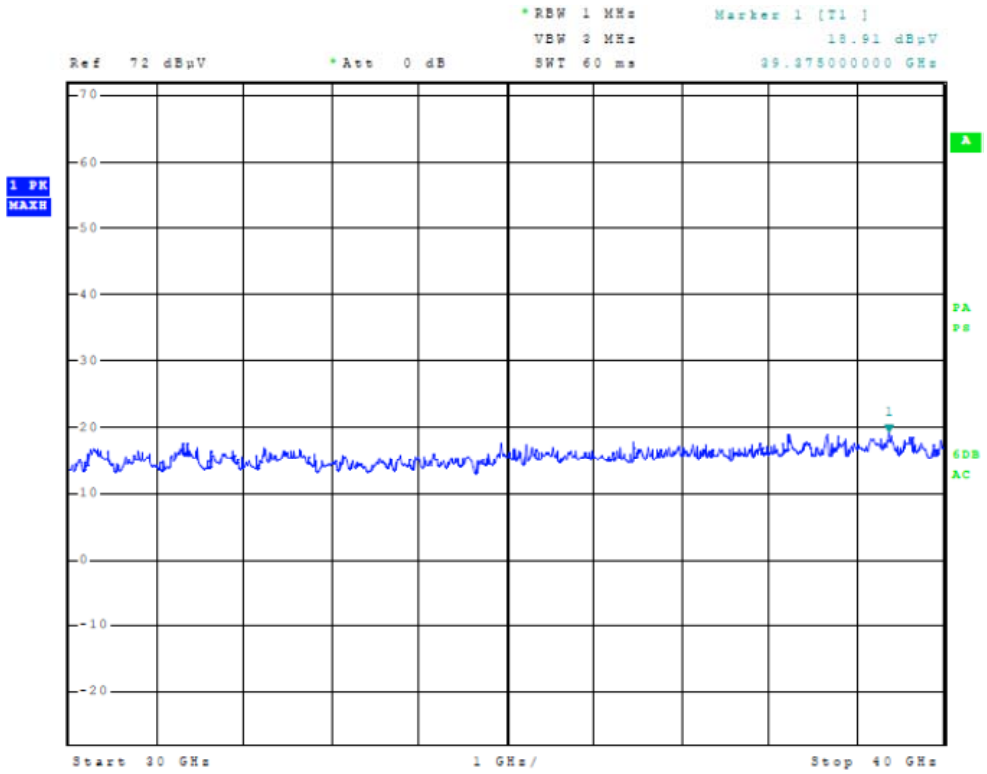


Figure Eleven Radiated Emissions in screen room

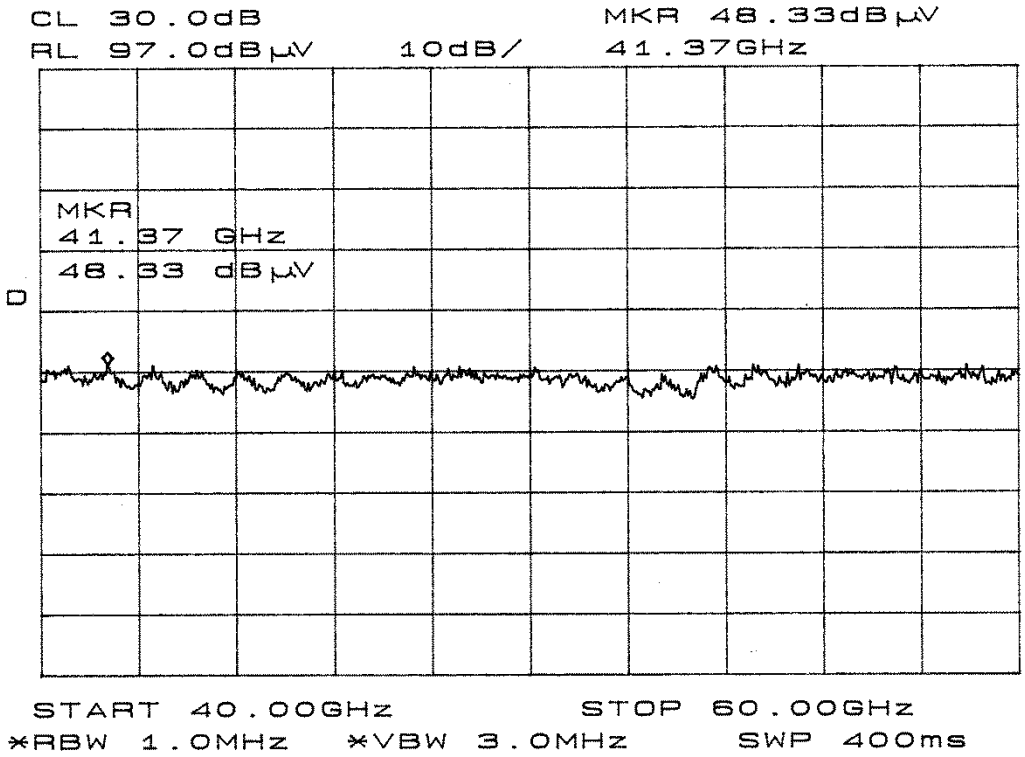


Figure Twelve Radiated Emissions in screen room

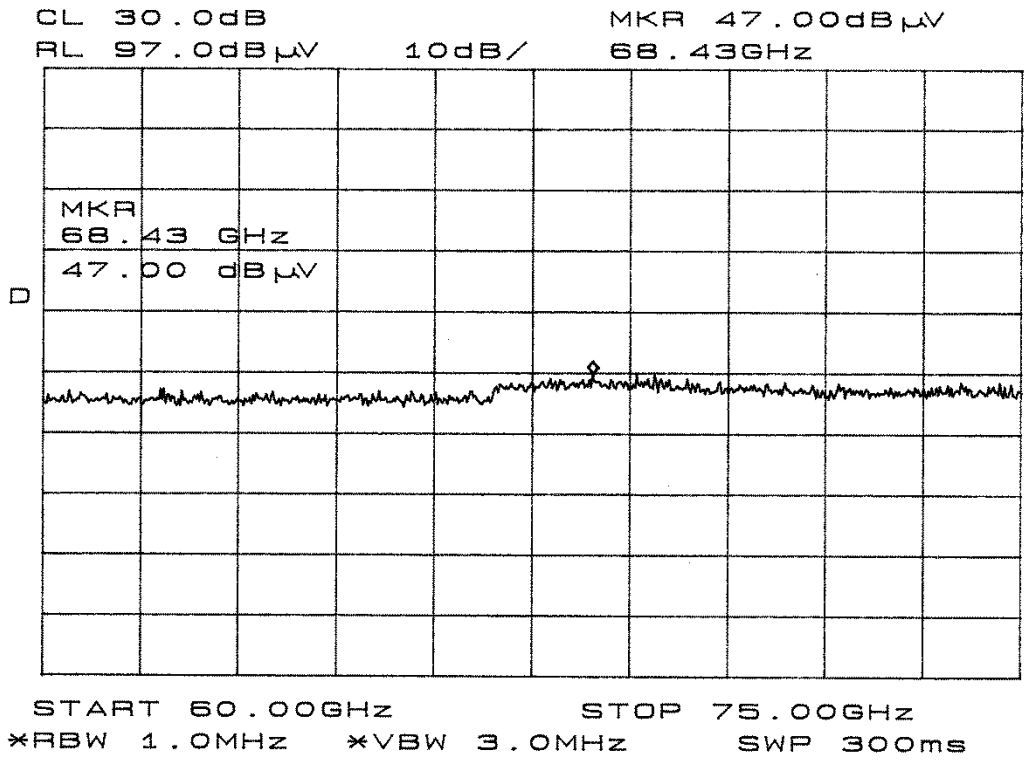


Figure Thirteen Radiated Emissions in screen room

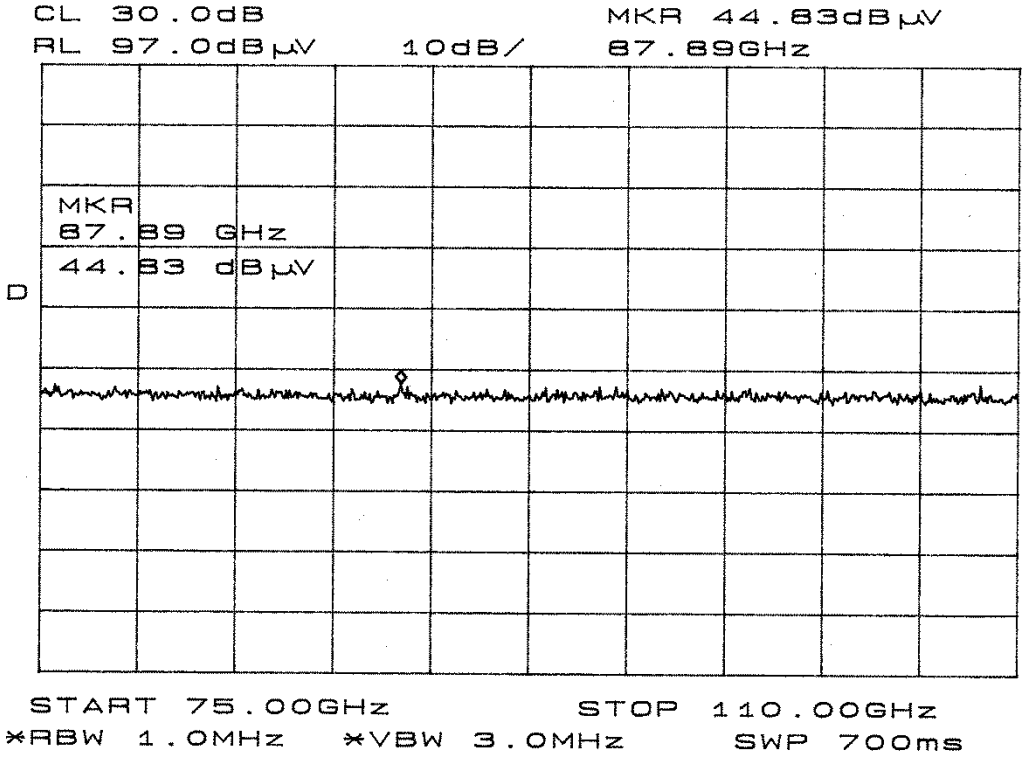


Figure Fourteen Radiated Emissions in screen room

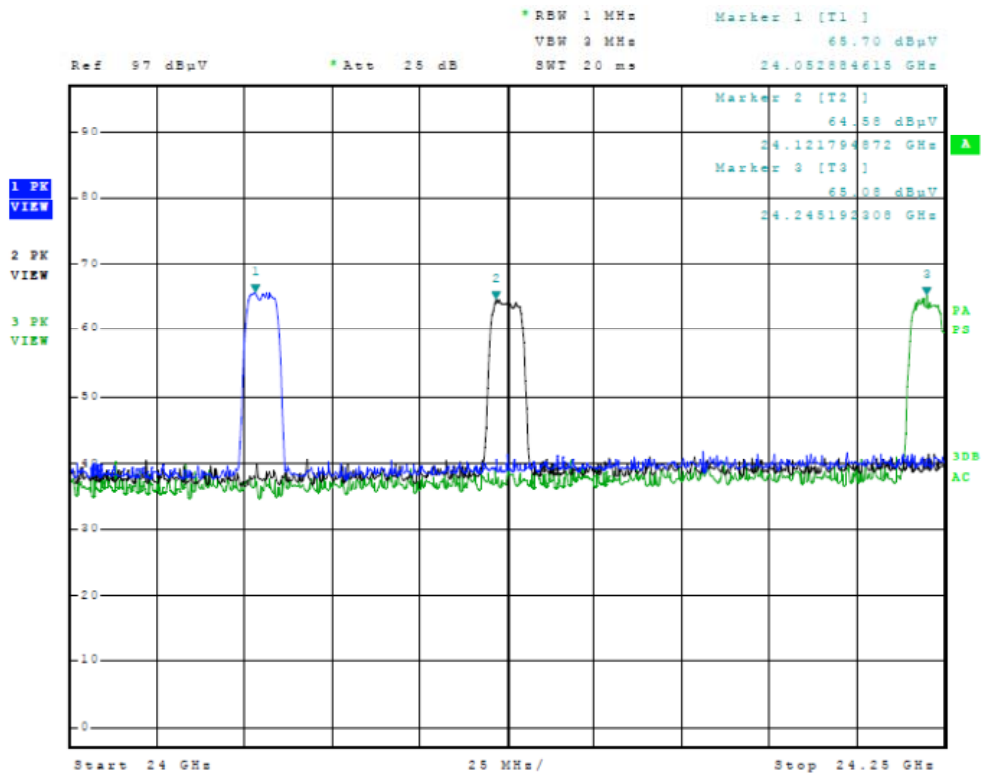


Figure Fifteen Output Power in Band (10 MHz Mode)

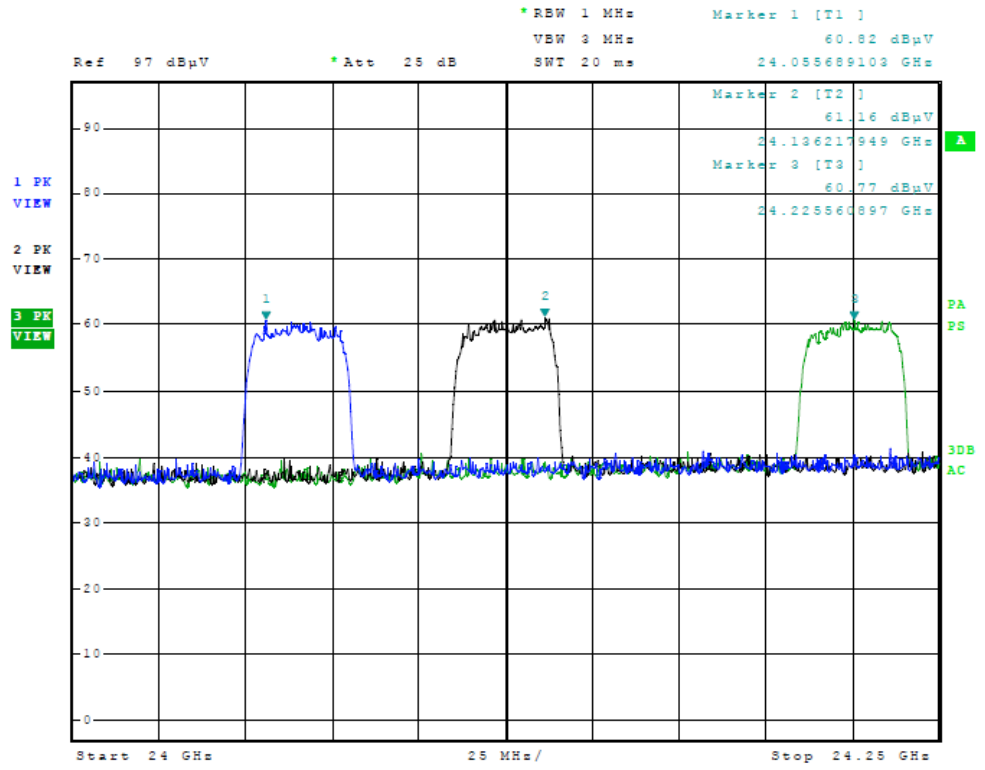


Figure Sixteen Output Power in Band (30 MHz Mode)

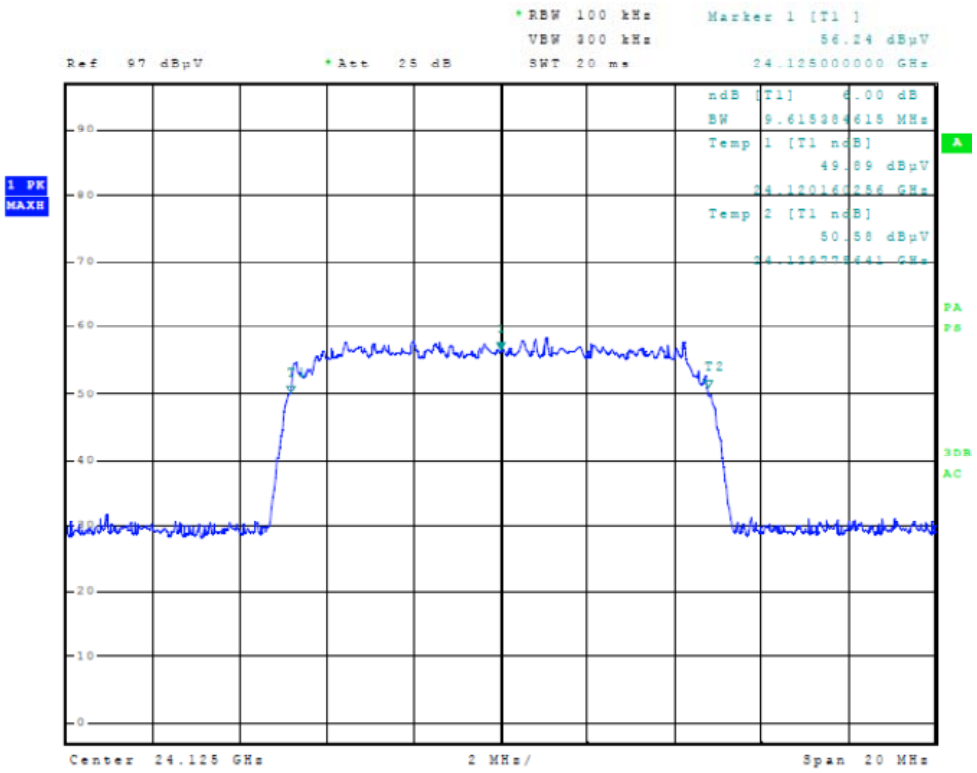


Figure Seventeen Occupied Bandwidth (10 MHz Operation)

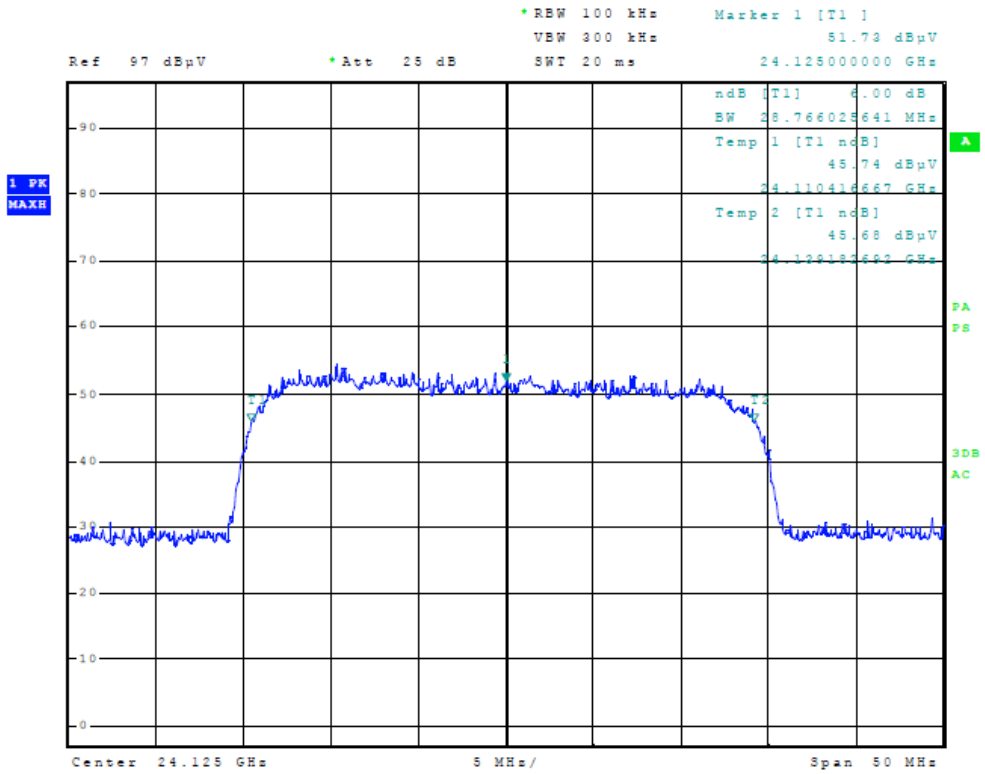


Figure Eighteen Occupied Bandwidth (30 MHz Operation)

Transmitter Emissions Data

General 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)
62.2	34.6	31.5	N/A	39.4	34.2	N/A	40.0
62.7	34.0	34.0	N/A	36.6	33.0	N/A	40.0
63.0	36.6	31.6	N/A	39.0	34.4	N/A	40.0
68.5	29.7	24.4	N/A	31.2	25.4	N/A	40.0
115.0	30.9	34.5	N/A	32.1	25.1	N/A	43.5
115.5	30.2	24.5	N/A	32.6	24.1	N/A	43.5
116.5	36.2	24.2	N/A	32.2	24.7	N/A	43.5
181.2	36.0	30.1	N/A	27.9	22.2	N/A	43.5
218.0	34.5	29.7	N/A	33.1	27.3	N/A	46.0
233.8	32.4	27.1	N/A	32.7	27.2	N/A	46.0
250.0	35.7	31.0	N/A	34.7	29.9	N/A	46.0
375.0	39.8	37.6	N/A	37.0	35.1	N/A	46.0
1598.5	57.8	N/A	31.4	56.7	N/A	31.4	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 of 30-1000 MHz. Peak and Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Transmitter Radiated Emissions Data

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
24055.0	102.5	91.8	113.7	103.5	108.0
48110.0	47.8	41.4	48.7	41.8	54.0
72165.0	58.7	50.5	58.9	50.6	54.0
96220.0	62.6	53.1	62.9	53.6	54.0
24125.0	102.5	92.0	113.2	102.3	108.0
48250.0	46.8	40.9	47.1	41.3	54.0
72375.0	58.5	49.3	58.4	50.0	54.0
96500.0	64.2	53.0	64.2	53.4	54.0
24245.0	101.4	90.3	111.8	101.8	108.0
48490.0	47.3	40.7	47.5	41.1	54.0
72735.0	58.1	49.5	58.1	49.9	54.0
96980.0	63.1	53.6	63.3	53.7	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 of 30-1000 MHz. Peak and Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Summary of Results for Transmitter Radiated Emissions

The EUT demonstrated compliance with the radiated emissions requirements of FCC CFR47 Part 15.249, RSS-210 and other applicable standards for Intentional Radiators. The EUT worst-case configuration demonstrated maximum average amplitude emission of 103.5 dBμV/m and Peak amplitude of 113.7 dBμV/m. The EUT worst-case configuration demonstrated minimum radiated harmonic emission -0.3 dB below the limit. The EUT worst-case configuration demonstrated minimum margin of -5.6 dB below the general radiated emission limits. Other radiated emissions found in the restricted bands presented with amplitudes at least 20 dB below limits. Other emissions were present with amplitudes at least 20 dB below the Limits.

Statement of Modifications and Deviations

No modifications to the EUT were required for the equipment to demonstrate compliance with the FCC CFR47 Part 15Cnad RSS-210 Emissions Standards. There were no deviations to the specifications.

Annex

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

Annex A Measurement Uncertainty Calculations

Radiated Emissions Measurement Uncertainty Calculation

Measurement of vertically polarized radiated field strength over the frequency range 30 MHz to 1 GHz on an open area test site at 3m and 10m includes following uncertainty:

Contribution	Probability Distribution	Uncertainty (dB)
Antenna factor calibration	normal (k = 2)	±0.58
Cable loss calibration	normal (k = 2)	±0.2
Receiver specification	rectangular	±1.0
Antenna directivity	rectangular	±0.1
Antenna factor variation with height	rectangular	±2.0
Antenna factor frequency interpolation	rectangular	±0.1
Measurement distance variation	rectangular	±0.2
Site Imperfections	rectangular	±1.5

Combined standard uncertainty $u_c(y)$ is

$$U_c(y) = \pm \sqrt{\left[\frac{1.0}{2}\right]^2 + \left[\frac{0.2}{2}\right]^2 + \left[\frac{1.0^2 + 0.1^2 + 2.0^2 + 0.1^2 + 0.2^2 + 1.5^2}{3}\right]}$$

$U_c(y) = \pm 1.6$ dB

It is probable that $u_c(y) / s(q_k) > 3$, where $s(q_k)$ is estimated standard deviation from a sample of n readings unless the repeatability of the EUT is particularly poor, and a coverage factor of k = 2 will ensure that the level of confidence will be approximately 95%, therefore:

$$s(q_k) = \sqrt{\frac{1}{(n-1)} \sum_{k-1}^{n} (q_k - \bar{q})^2}$$

$U = 2\, U_c(y) = 2 \times \pm 1.6$ dB $= \pm 3.2$ dB

Notes:

1.1 Uncertainties for the antenna and cable were estimated, based on a normal probability distribution with k = 2.

1.2 The receiver uncertainty was obtained from the manufacturer's specification for which a rectangular distribution was assumed.

1.3 The antenna factor uncertainty does not take account of antenna directivity.

1.4 The antenna factor varies with height and since the height was not always the same in use as when the antenna was calibrated an additional uncertainty is added.

1.5 The uncertainty in the measurement distance is relatively small but has some effect on the received signal strength. The increase in measurement distance as the antenna height is increased is an inevitable consequence of the test method and is therefore not considered a contribution to uncertainty.

1.6 Site imperfections are difficult to quantify but may include the following contributions:
-Unwanted reflections from adjacent objects.
-Ground plane imperfections: reflection coefficient, flatness, and edge effects.
-Losses or reflections from "transparent" cabins for the EUT or site coverings.
-Earth currents in antenna cable (mainly effect biconical antennas).

The specified limits for the difference between measured site attenuation and the theoretical value (± 4 dB) were not included in total since the measurement of site attenuation includes uncertainty contributions already allowed for in this budget, such as antenna factor.

Conducted Measurements Uncertainty Calculation

Measurement of conducted emissions over the frequency range 9 kHz to 30 MHz includes following uncertainty:

Contribution	Probability Distribution	Uncertainty (dB)
Receiver specification	rectangular	±1.5
LISN coupling specification	rectangular	±1.5
Cable and input attenuator calibration	normal (k=2)	±0.5

Combined standard uncertainty $u_c(y)$ is

$$U_c(y) = \pm \sqrt{\left[\frac{0.5}{2}\right]^2 + \frac{1.5^2 + 1.5^2}{3}}$$

$U_c(y) = \pm 1.2$ dB

As with radiated field strength uncertainty, it is probable that $u_c(y) / s(q_k) > 3$ and a coverage factor of k = 2 will suffice, therefore:

$U = 2\ U_c(y) = 2 \times \pm 1.2$ dB $= \pm 2.4$ dB

Annex B Test Equipment List For Rogers Labs, Inc.

The test equipment is maintained in calibration and good operating condition. Use of this calibrated equipment ensures measurements are traceable to national standards.

List of Test Equipment	Calibration Date
Spectrum Analyzer: Rohde & Schwarz ESU40	5/11
Spectrum Analyzer: HP 8562A, HP Adapters: 11518, 11519, and 11520 Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W	5/11
Spectrum Analyzer: HP 8591EM	5/11
Antenna: EMCO Biconilog Model: 3143	5/11
Antenna: Sunol Biconilog Model: JB6	10/11
Antenna: EMCO Log Periodic Model: 3147	10/11
Antenna: Com Power Model: AH-118	10/11
Antenna: Antenna Research Biconical Model: BCD 235	10/11
LISN: Compliance Design Model: FCC-LISN-2.Mod.cd, 50 µHy/50 ohm/0.1 µf	10/11
R.F. Preamp CPPA-102	10/11
Attenuator: HP Model: HP11509A	10/11
Attenuator: Mini Circuits Model: CAT-3	10/11
Attenuator: Mini Circuits Model: CAT-3	10/11
Cable: Belden RG-58 (L1)	10/11
Cable: Belden RG-58 (L2)	10/11
Cable: Time Microwave: 4M-750HF290-750	10/11
Cable: Time Microwave: 10M-750HF290-750	10/11
Frequency Counter: Leader LDC825	2/11
Oscilloscope Scope: Tektronix 2230	2/11
Wattmeter: Bird 43 with Load Bird 8085	2/11
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/11
R.F. Generators: HP 606A, HP 8614A, HP 8640B	2/11
R.F. Power Amp 65W Model: 470-A-1010	2/11
R.F. Power Amp 50W M185- 10-501	2/11
R.F. Power Amp A.R. Model: 10W 1010M7	2/11
R.F. Power Amp EIN Model: A301	2/11
LISN: Compliance Eng. Model 240/20	2/11
LISN: Fischer Custom Communications Model: FCC-LISN-50-16-2-08	2/11
Antenna: EMCO Dipole Set 3121C	2/11
Antenna: C.D. B-101	2/11
Antenna: Solar 9229-1 & 9230-1	2/11
Antenna: EMCO 6509	2/11
Audio Oscillator: H.P. 201CD	2/11
Peavey Power Amp Model: IPS 801	2/11
ELGAR Model: 1751	2/11
ELGAR Model: TG 704A-3D	2/11
ESD Test Set 2010i	2/11
Fast Transient Burst Generator Model: EFT/B-101	2/11
Field Intensity Meter: EFM-018	2/11
KEYTEK Ecat Surge Generator	2/11
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

May 18, 2010

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: May 18, 2010

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

May 26, 2010

OUR FILE: 46405-3041
Submission No: 140719

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

Attention: Mr. Scot D. Rogers

Dear Sir/Madame:

The Bureau has received your application for the renewal of a 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 **(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;

- Your primary code is: **3041**

- The company number 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 two 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,

Dalwinder Gill

Dalwinder Gill
For: Wireless Laboratory Manager
Certification and Engineering Bureau
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