Emissions Test Report

EUT Name: Rex2

EUT Model: REX2EAI

FCC Title 47, Part 15, SubpartC

Prepared for:

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Report/Issue Date: 02 January 2007
Report Number: 30860147.001

Statement of Compliance

Manufacturer:	Elster Electricity, LLC 208 South Rogers Lane Raleigh, NC 27610 919 212-4700
Requester / Applicant:	John Holt
Name of Equipment:	Rex2
Operation Frequency Range	902.8 MHz to 927.6
Type of Equipment:	Intentional Radiator
Application of Regulations:	FCC Title 47, Part 15, SubpartC
Test Dates:	21 January 2008 to 23 January 2008

Guidance Documents:

Emissions: FCC 47 CFR Part 15.247

Test Methods:

Emissions: ANSI C63.4:2003 and DA-00-705A1

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by TUV Rheinland of North America, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that a sample of one, of the equipment described above, has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. This report contains data that are not covered by NVLAP accreditation. This report shall not be reproduced except in full, without the written authorization of the laboratory.

1 May 2008

NVLAP Signatory — Date

NVLAP	FC	Industry Canada
200094-0	90552 and 100881	IC3755

200094-0

1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the FCC Title 47, Part 15, SubpartC based on the results of testing performed on *21 January* 2008 through *23* January 2008 on the *Rex2* Model No. *REX2EAI* manufactured by Elster Electricity, LLC. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 Summary of Test Results

Table 1 - Summary of Test Results

Test	Test Method(s)	Test Parameters	Measurement	Result
Channel Separation	FCC Part 15.247(a)(1)	Greater of 25 kHz or 20 dB bandwidth	400 kHz	**compliant**
Pseudorandom Hopping Algorithm	FCC Part 15.247(a)(1)			**compliant**
Time of Occupancy	FCC Part 15.247(a)(1)(i)	=<0.4 sec in 10 sec.		**compliant**
Occupied Bandwidth	FCC Part 15.247(a)(1)(i)	=<400kHz		**compliant**
Peak Output Power	FCC Part 15.247(b)(2)	0.25 Watts		**compliant**
Spurious Emissions	FCC Part 15.247(C)	Table FCC Part 15.209		**compliant**
Frequency Hopping Spread Spectrum Systems	FCC Part 15.247(g)			**compliant**
Incorporation of Intelligence	FCC Part 15.247(h)			**compliant**
Frequency Stability	FCC Part 15.215(c)	Containment of 20 dB bandwidth between 902 and 928		**compliant**

1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

1.5 Equipment Modifications

No modifications were found to be necessary in order to achieve compliance.

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90552 and 100881). The laboratory scope of accreditation includes: Title 47 CFR Part 15, 18, and 90. The accreditation is updated every 3 years.

2.1.2 NIST / NVLAP

TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 25 and ISO 9002 (Lab code 200094-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Canada – Industry Canada

Registration No. IC3755

2.1.4 Japan - VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Registration No. R-1174 and C-1236).

2.1.5 Acceptance By Mutual Recognition Arrangement

The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address test results and test reports within the scope of the laboratory NIST / NVLAP accreditation will be accepted by each member country.

2.2 Test Facilities

All of the test facilities are located at 762 Park Ave., Youngsville, North Carolina 27596, USA.

2.2.1 Emission Test Facility

The Open Area Test Site and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:2005, at a test distance of 3 and 10 meters. This site has been described in reports dated May 12, 1997, submitted to the FCC, and accepted by letter dated June 25, 1997 (31040/SIT 1300F2). The site is listed with the FCC and accredited by NVLAP (code 200094-0). The 5m semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:2005, at a test distance of 3 meters. A report detailing this site can be obtained from TUV Rheinland of North America.

2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7m x 3.7m x 3.175mm thick aluminum floor connected to PE ground. For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of 10^9 Ohms/square on a 1.6m x 0.8m x 0.8m high non-conductive table with a 3.175mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. The Vertical Coupling Plane consists of an aluminum plate 50cm x 50cm x 3.175mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. For each of the other tests, the HCP is removed.

RF Field Immunity testing is performed in a 7.3m x 3.7m x 3.2m anechoic chamber.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.9m x 3.7m x 3.175mm thick aluminum ground plane which is connected to one end of the anechoic chamber.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st addition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or co-variances of these other quantities weighted according to how the measurement result varies with changes in these quantities. The term standard uncertainty is the result of a measurement expressed as a standard deviation.

The Expanded Uncertainty defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand. The fraction may be viewed as the coverage probability or level of confidence of the interval.

The test system for conducted emissions is defined as the LISN, spectrum analyzer, coaxial cables, and pads. The test system for radiated emissions is defined as the antenna, spectrum analyzer, pre-amplifier, coaxial cables, and pads. The conducted test system has a combined standard uncertainty of ± 1.2 dB. The radiated test system has a combined standard uncertainty of ± 1.6 dB. The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Guide 25.

3 Product Information

3.1 Equipment Configuration

A description and justification of the equipment configuration is given in the EMC Test Plan. The EUT was tested as described in the EMC Test Plan and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to warm up to normal operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

In the case of an EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

The final configuration was selected to produce worse case radiation and place the EUT in the most susceptible state.

4 Antenna Port Conducted Emissions

Testing was performed in accordance with 47 CFR Part 15, ANSI C63.4:2003, and DA-00-705A1. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.1 Channel Separation Part 15.247(a)(1)

Frequency hopping Systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Bandwidth=

Channel Separation= 400 kHz

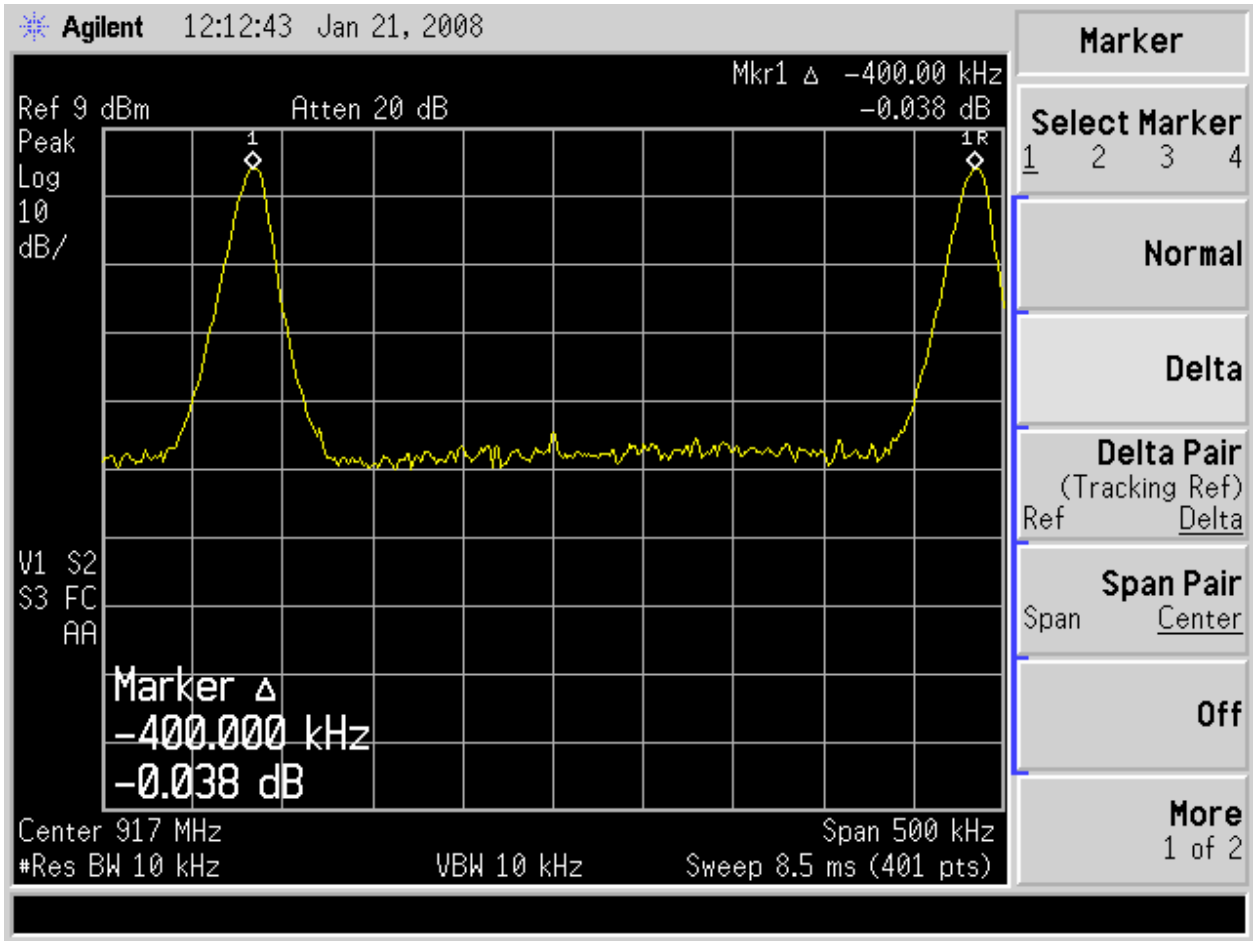


Figure 1 – Channel Separation

4.2 Pseudorandom Hopping Algorithm FCC Part 15.247(a)(1)

The system shall hop to channel frequencies that are selected from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their transmitters and shall shift frequencies in synchronization with the transmitted signals.

The pseudo-random hop table is used to determine the transmitter's frequency hop sequence. The transmitter is slow hopping frequency system where the entire data packet is sent on a single channel. After sending a data packet, the transmitter uses the next channel in the pseudo-random hop table. Each frequency in the hop table is used before the transmitter will hop to a frequency already used. The receiver is a single IF system whose bandwidth is 330 kHz. When not synchronized to a transmitting device, the receiver is constantly hopping across the 25 channels scanning for a valid preamble from a transmitter. Once a valid preamble is detected, the receiver is synchronized to the transmitter and receives the data packet. After the transmission, the receiver returns to the scanning mode where it can look for another packet from either the same device or a different device.

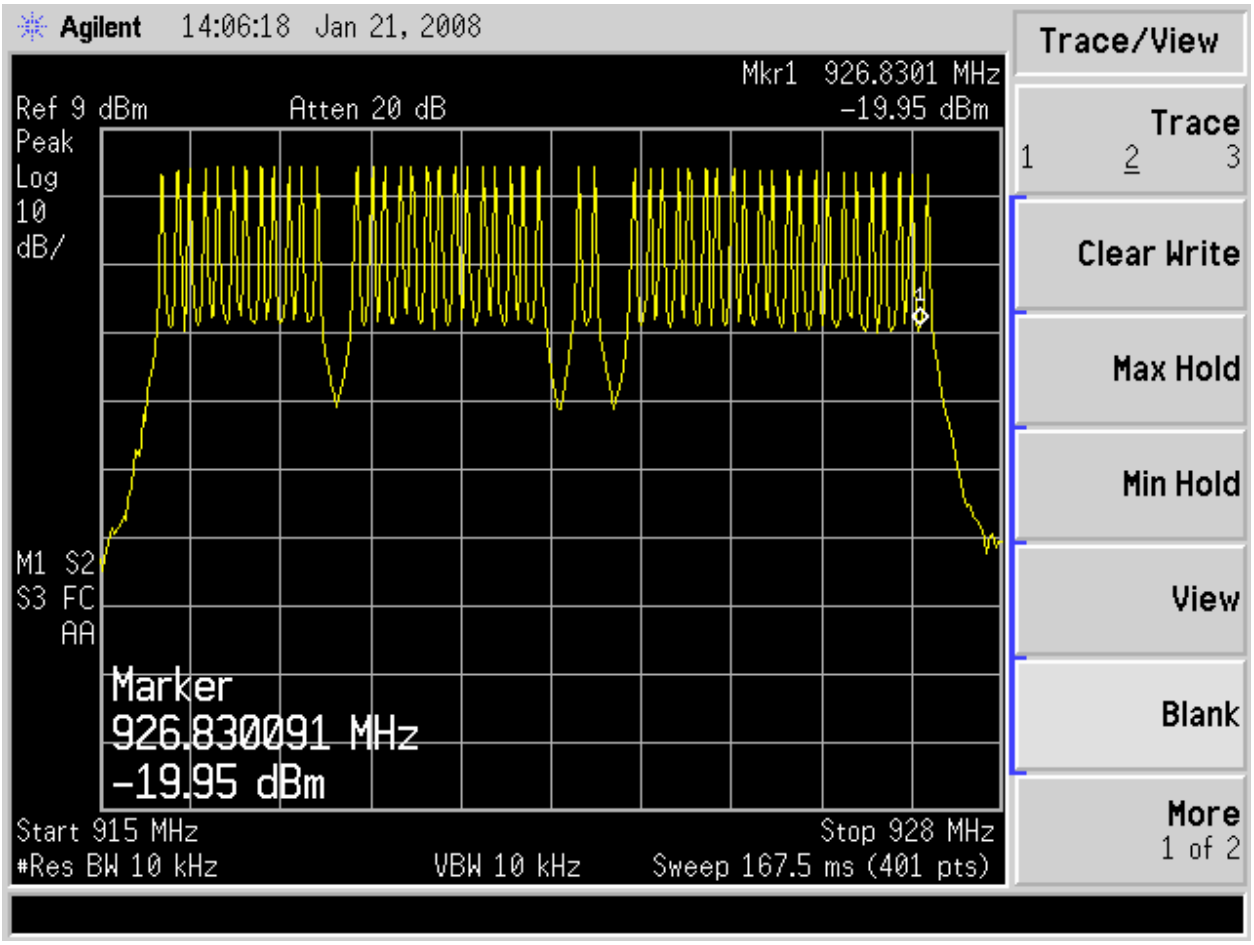


Figure 2 - Plot of available hopping Channels

4.3 Time of Occupancy FCC Part 15.247(a)(1)(i)

Frequency Band (MHz)	20 dB Bandwidth	Number of Hopping Channels	Average Time of Occupancy
916-926.8	=>250 kHz	25	=<0.4 sec. In 10 sec.

The spectrum analyzer was set as follows:

RBW=1 MHz

VBW=RBW

Span=0Hz

LOG dB/div.= 10dB

Sweep = 60 Sec.

Trigger Video

The occupancy time was measured as above. There were 23 hops within in 1 minute at .101 seconds per hop. Therefore there were 3.83 hops for any 10 sec. period averaged over 60 seconds. Time of occupancy equals average number of hops in a 10 sec. period multiplied by the duration of one hop.

Time of Occupancy = 0.387 seconds in any 10 second period.

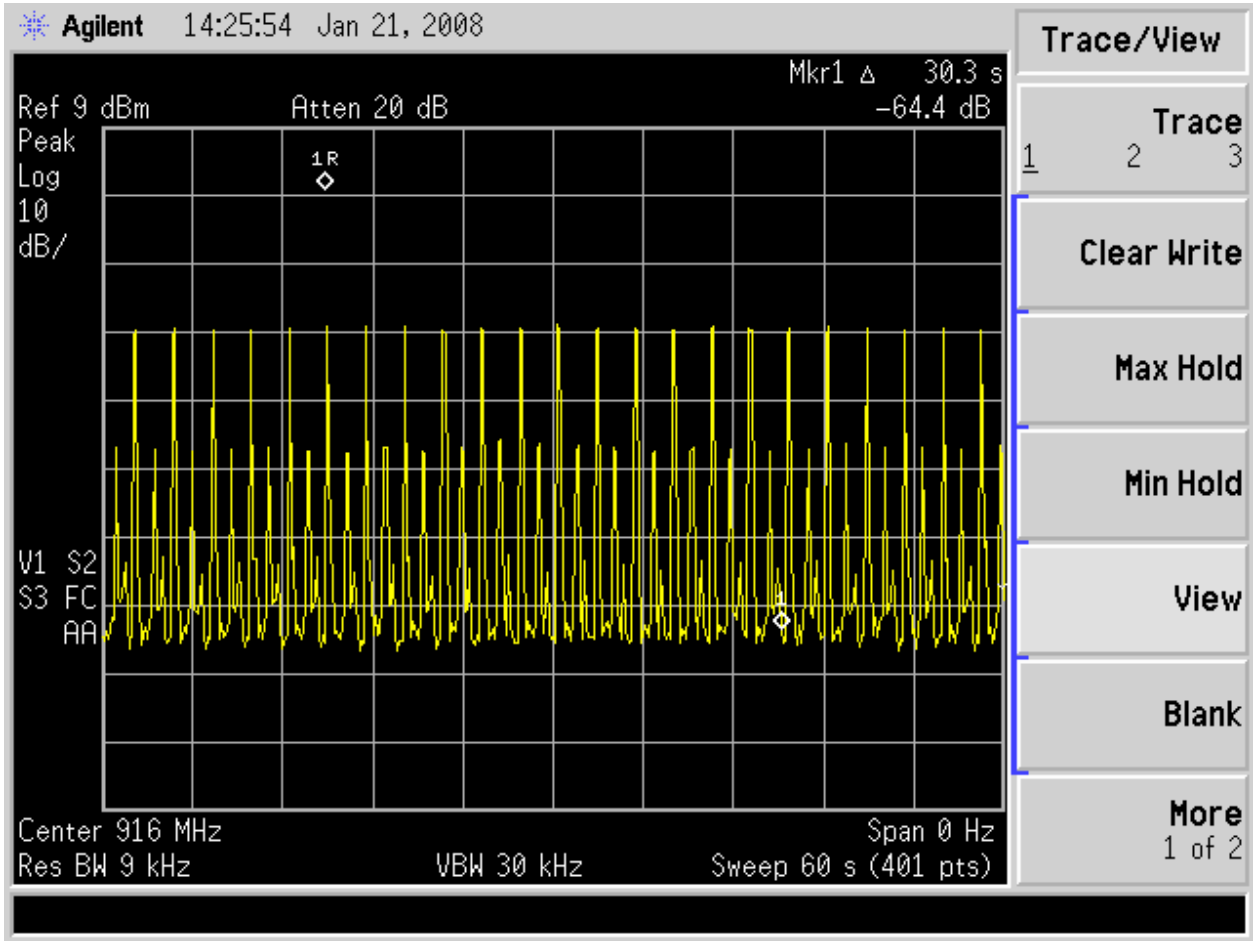


Figure 3 – 60 second sweep

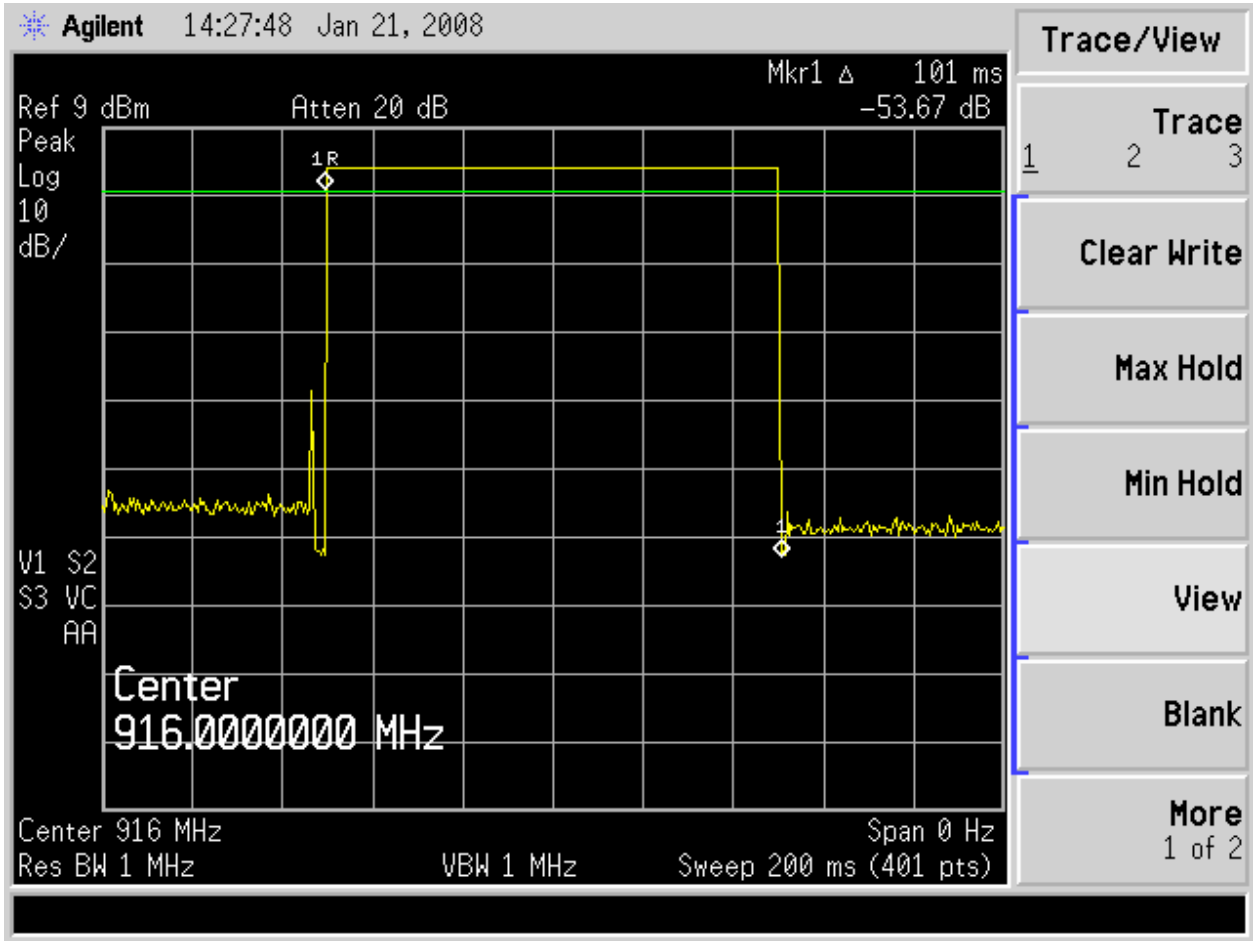


Figure 4 – Measurement of 1 hop

4.4 Occupied Bandwidth FCC Part 15.247(a)(1)(i)

The maximum allowed 20 dB bandwidth of the hopping channel is 400 kHz.

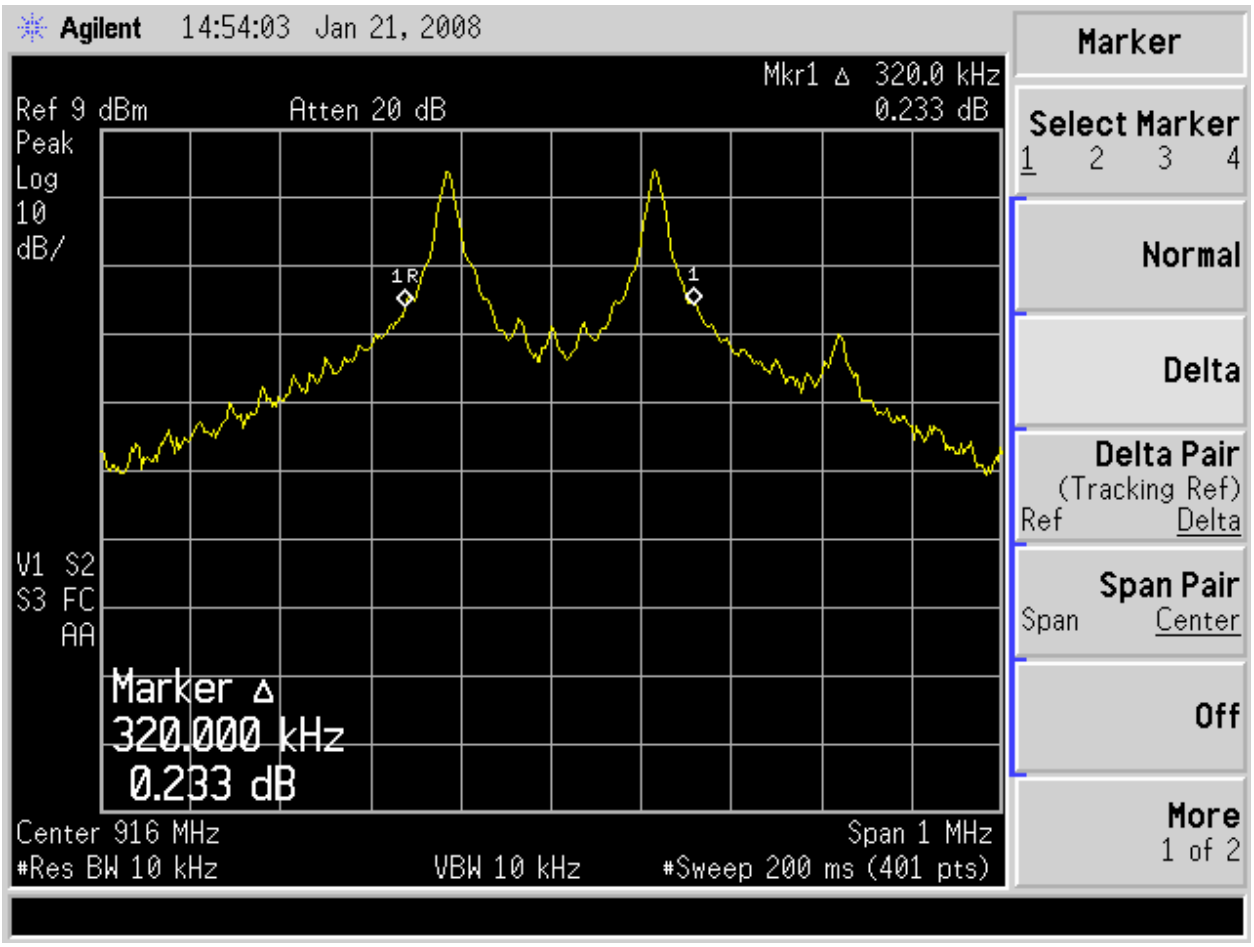


Figure 5 –916.0 MHz

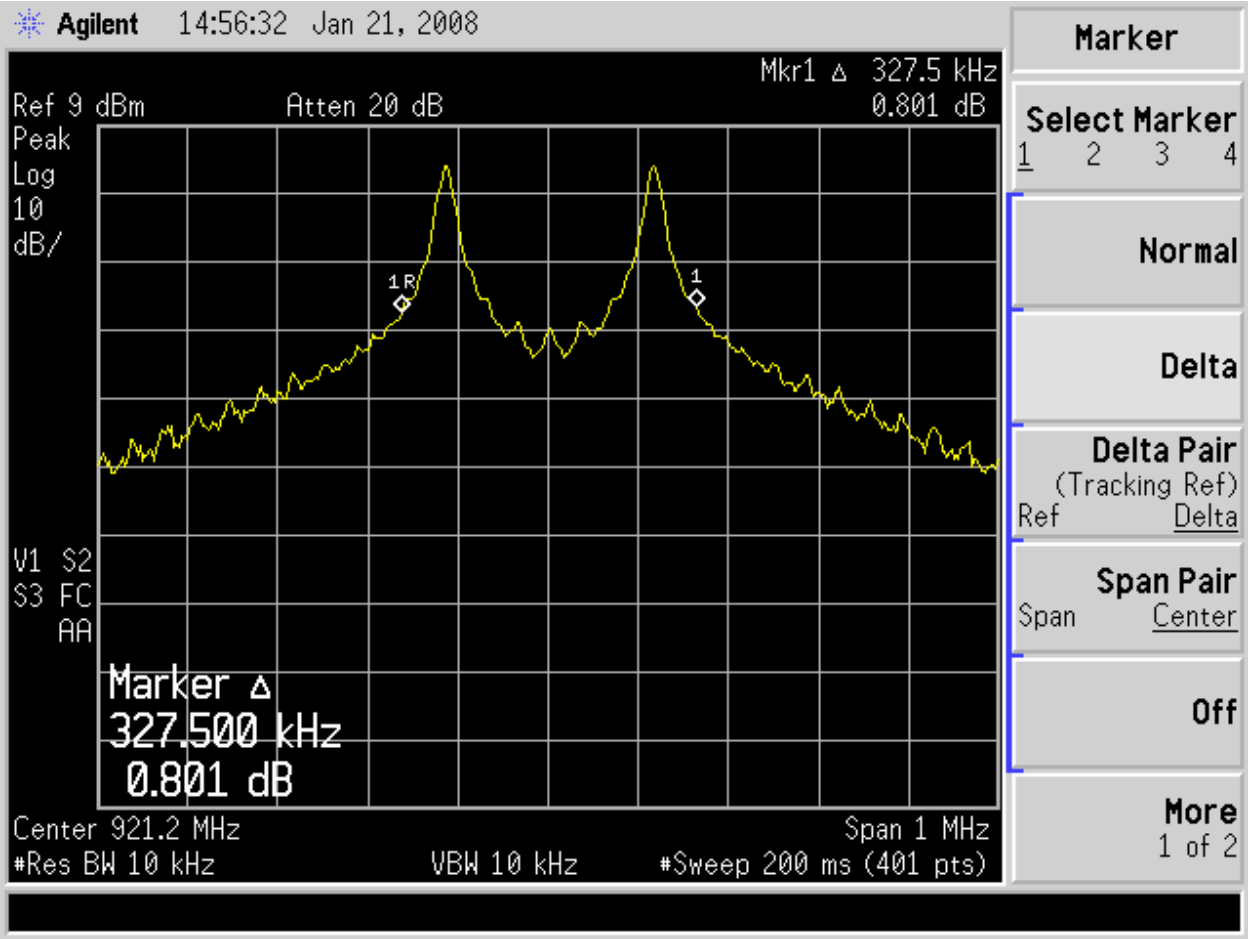


Figure 6 –921.2 MHz

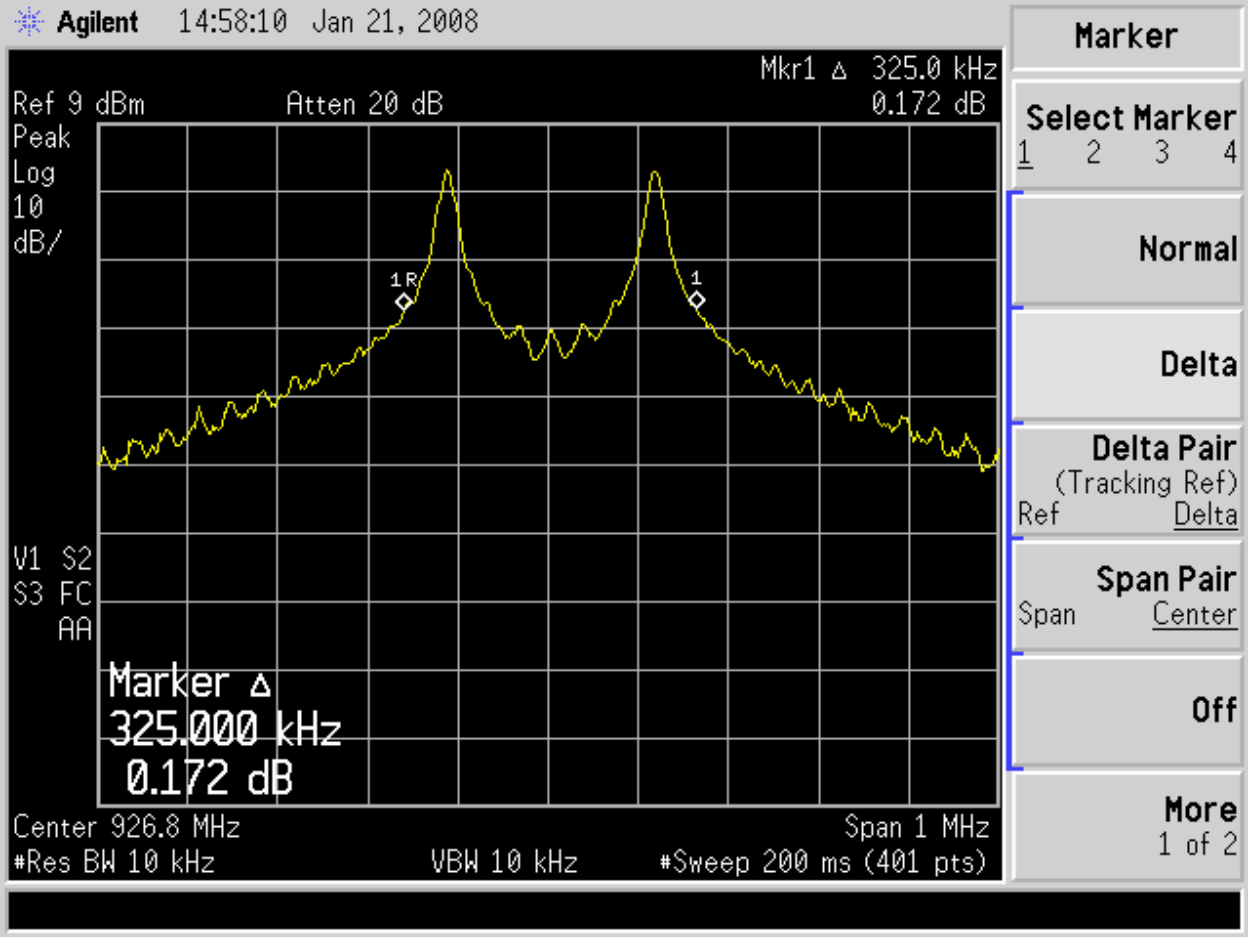


Figure 7 –926.8 MHz

4.5 Band Edge Compliance FCC Part 15.215(c)

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

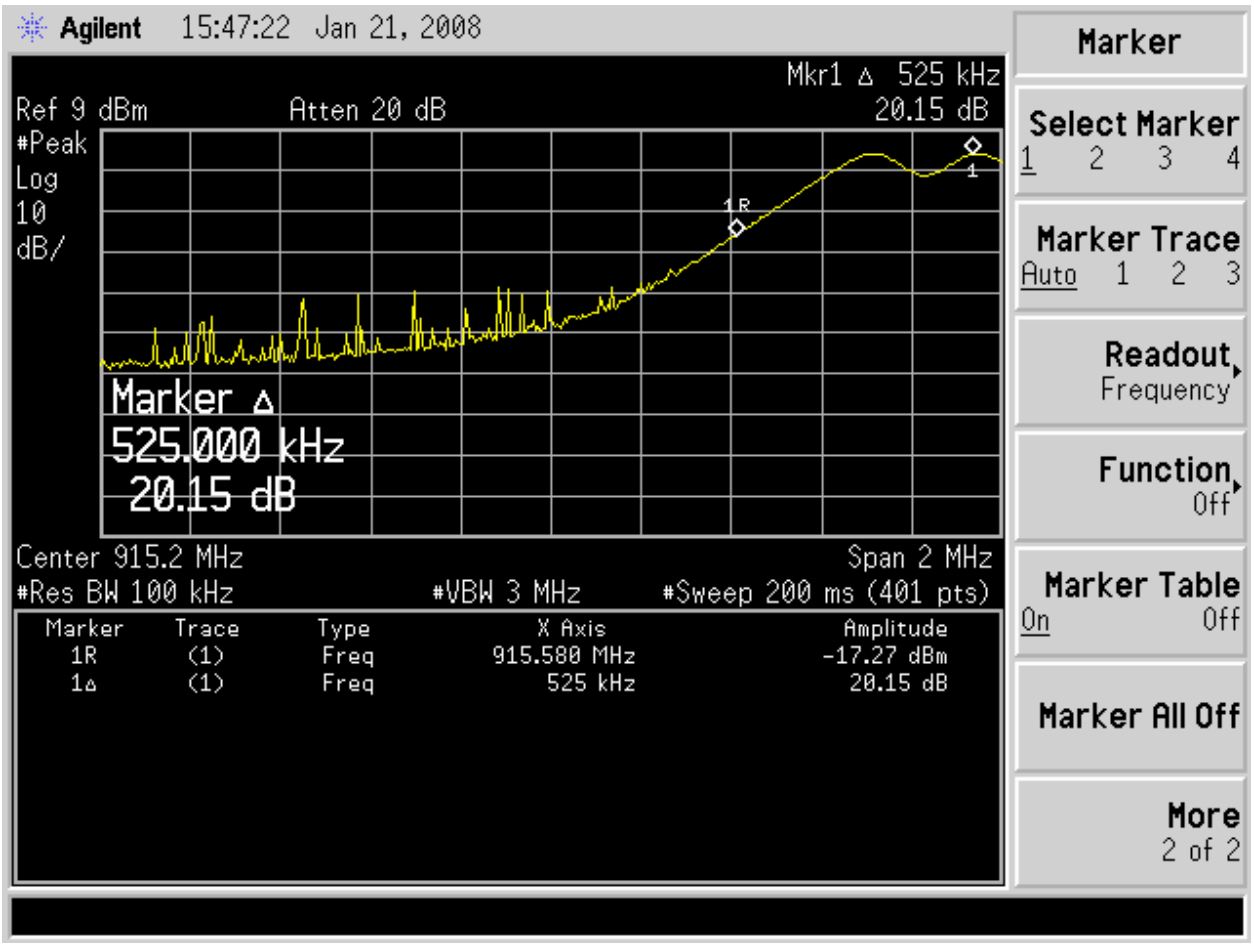


Figure 8 –916.0 MHz

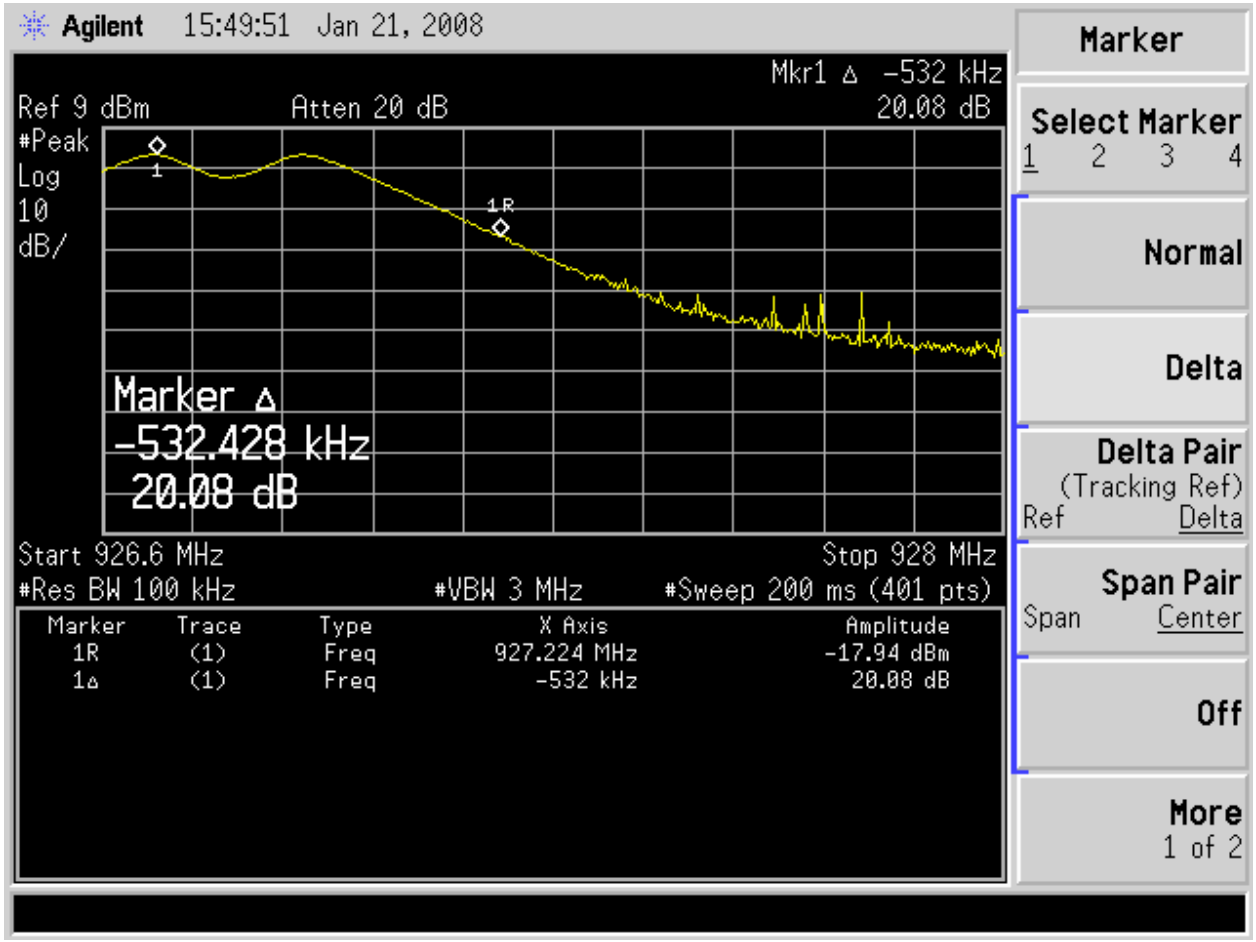


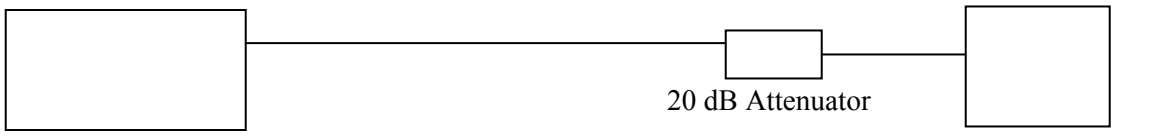
Figure 9 –926.8 MHz

4.6 Peak Output Power FCC Part 15.247(b)(2)

The maximum peak output power of the intentional radiator shall not exceed 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels. (Conducted Measurement)

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. After the measurement was made the cable loss and the attenuator was added to the measurement. The spectrum analyzer's resolution bandwidth was greater than the 20dB bandwidth of the modulated carrier and the video bandwidth was equal to the resolution bandwidth.

Test Setup



Peak Power Output

916.0 MHz = 23.256 dBm = **0.212 Watts**

921.2 MHz = 23.423 dBm = **0.220 Watts**

926.8 MHz = 22.438 dBm = **0.175 Watts**

4.7 Antenna

The antenna is integrated on the printed circuit board.

Antenna Gain is 5.64 dBi

5 Spurious Emissions

5.1 Radiated Emissions

Testing was performed in accordance with 47 CFR 15, ANSI C63.4:2003. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

5.1.1 Test Methodology

5.1.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 300 kHz and provide a reading at each frequency for each 6° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

5.1.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

5.1.1.3 Deviations

There were no deviations from this test methodology.

5.1.2 Test Results

Section 5.1.2.1 lists the final measurement data under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and 1.5.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

5.1.2.1 Final Data

The data recorded in this section contains the final results under the worst-case conditions and with any modifications or special accessories implemented as the manufacturer intends.

5.2 Spurious Emissions FCC Part 15.247(c)

5.2.1 Test Methodology

5.2.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 300 kHz and provide a reading at each frequency for each 6° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

5.2.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

5.2.1.3 Deviations

There were no deviations from this test methodology.

5.2.2 Test Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

5.2.2.1 Conducted Emissions Outside the Frequency Band

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power, based on radiated measurements.

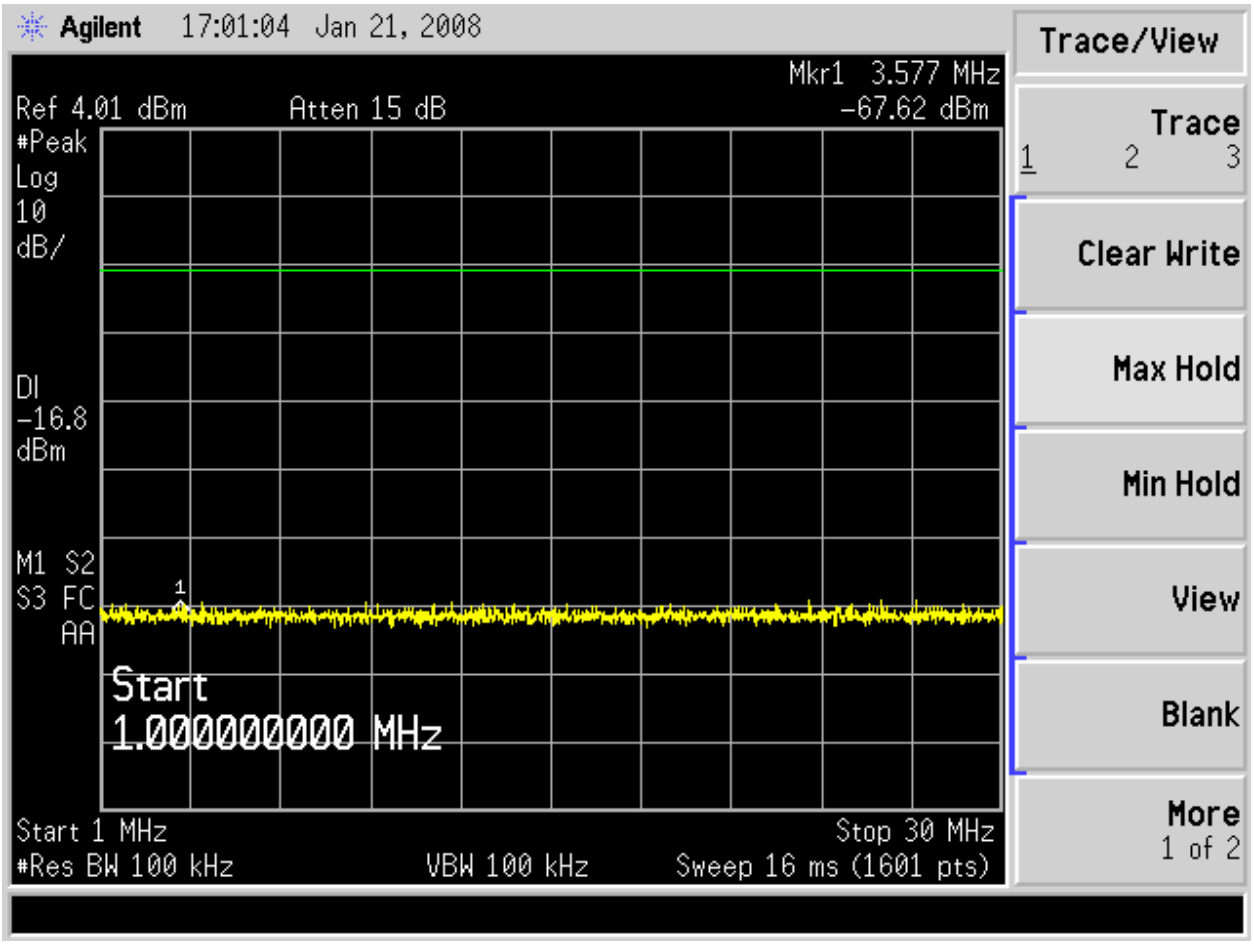


Figure 10 916.0 MHz transmit frequency

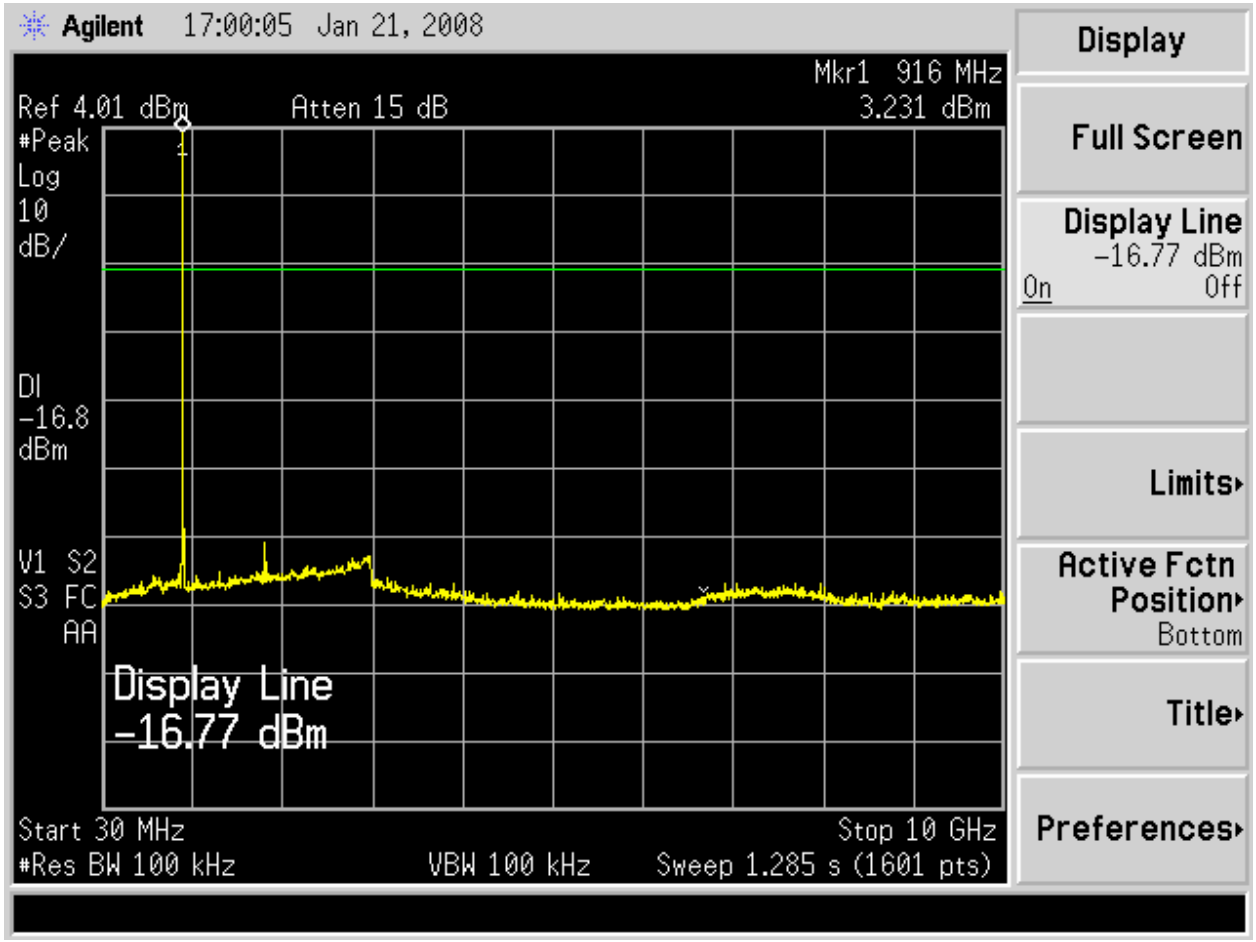


Figure 11 916.0 MHz transmit frequency

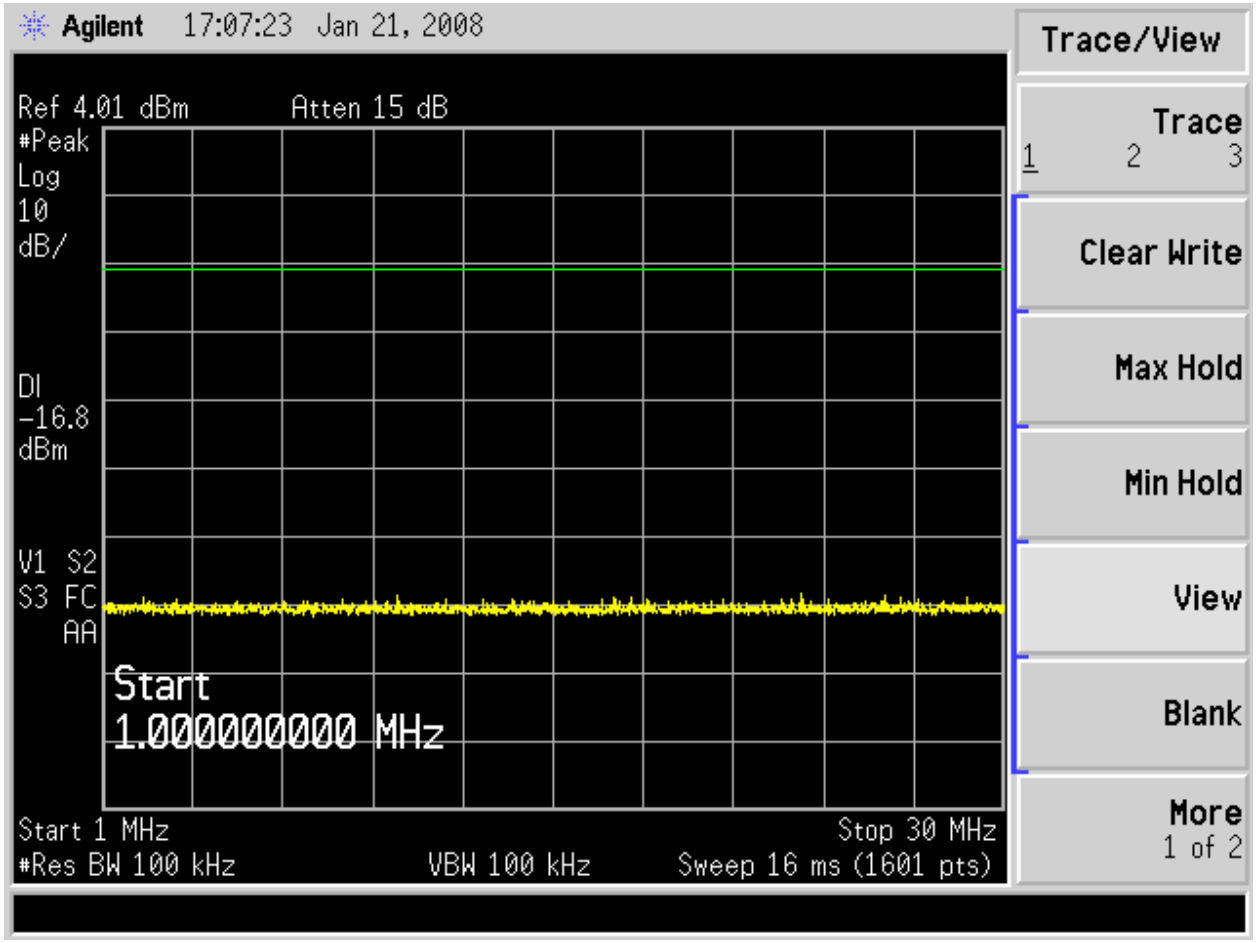


Figure 12 921.2 MHz transmit frequency

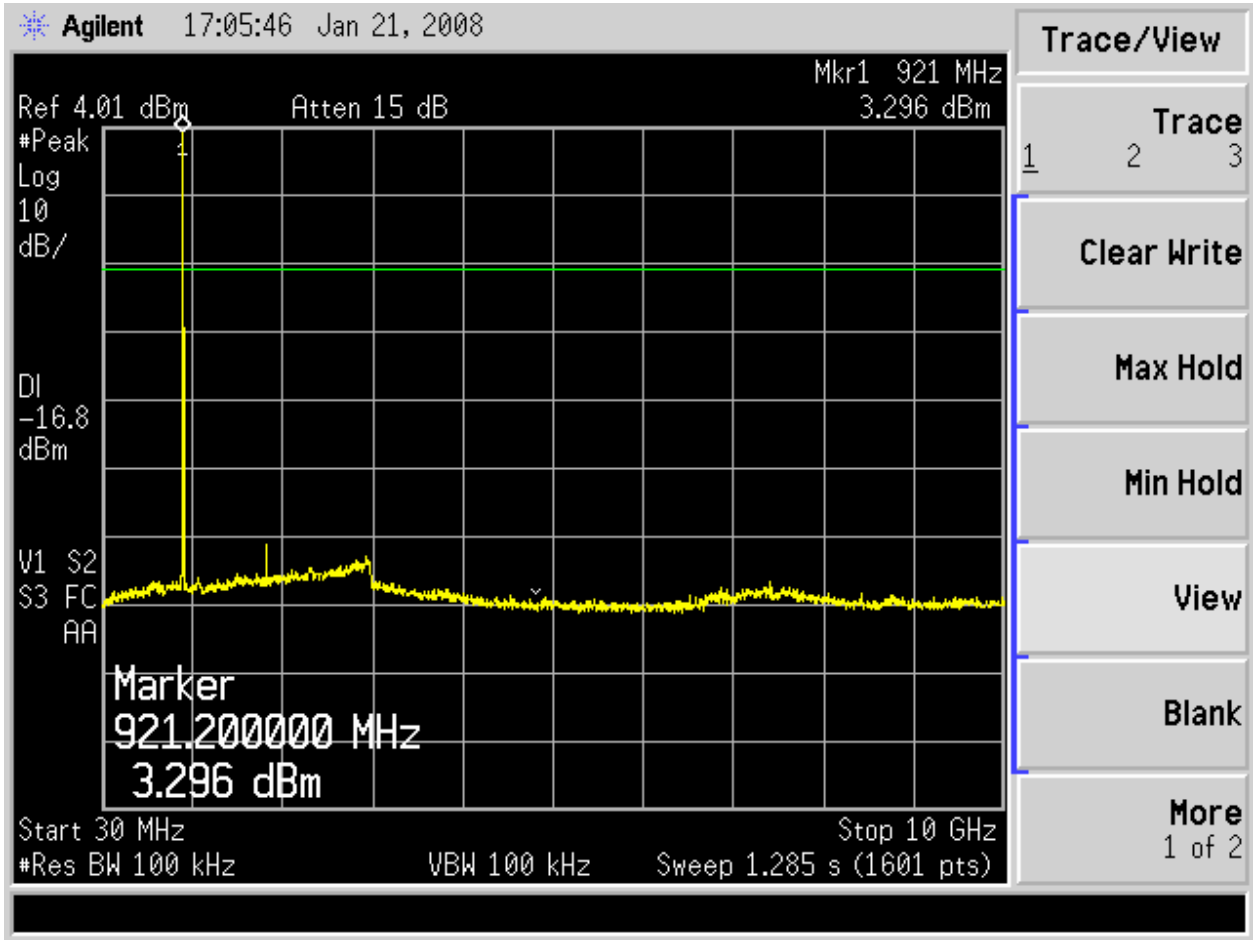


Figure 13 921.2 MHz transmit frequency

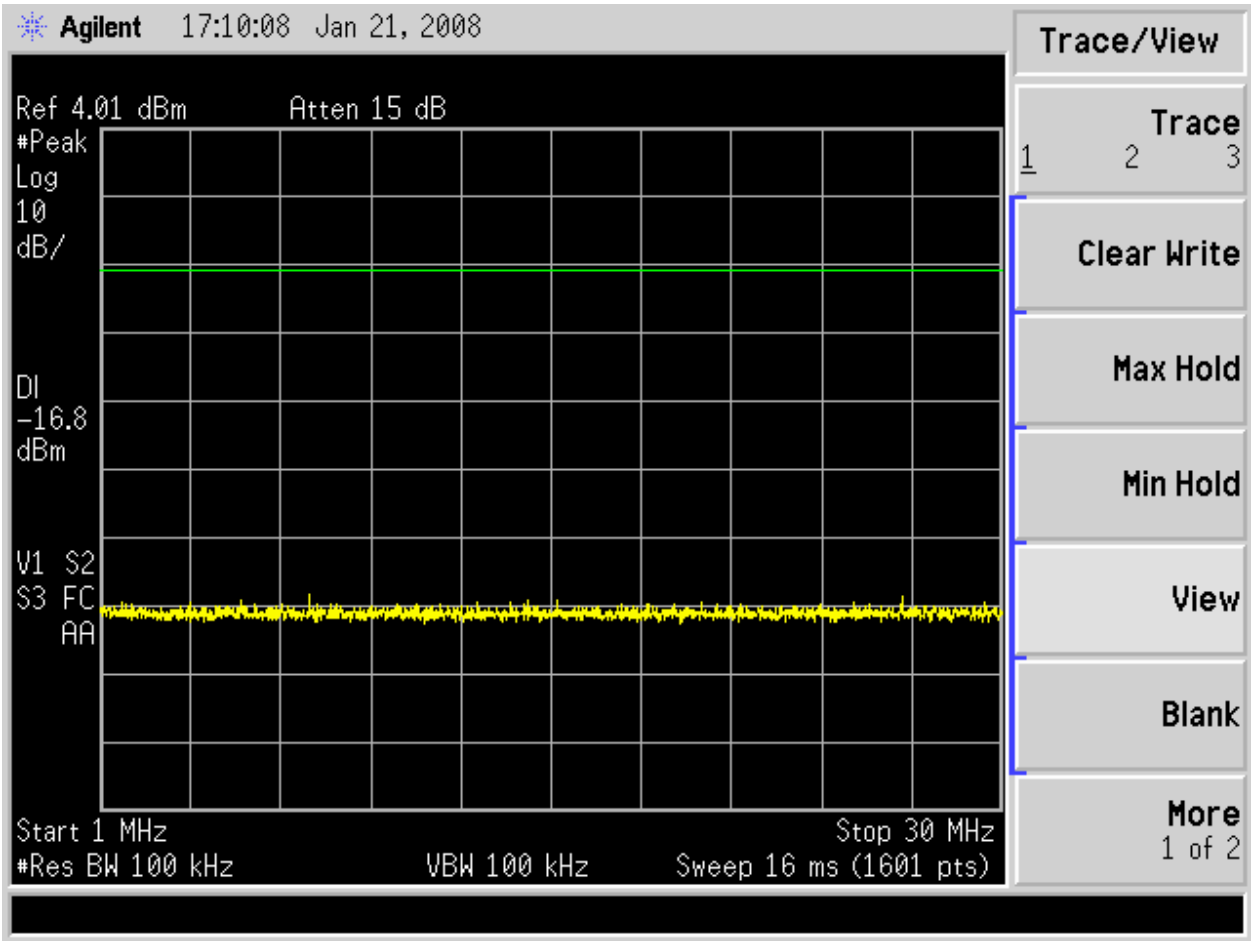


Figure 14 926.8 MHz transmit frequency

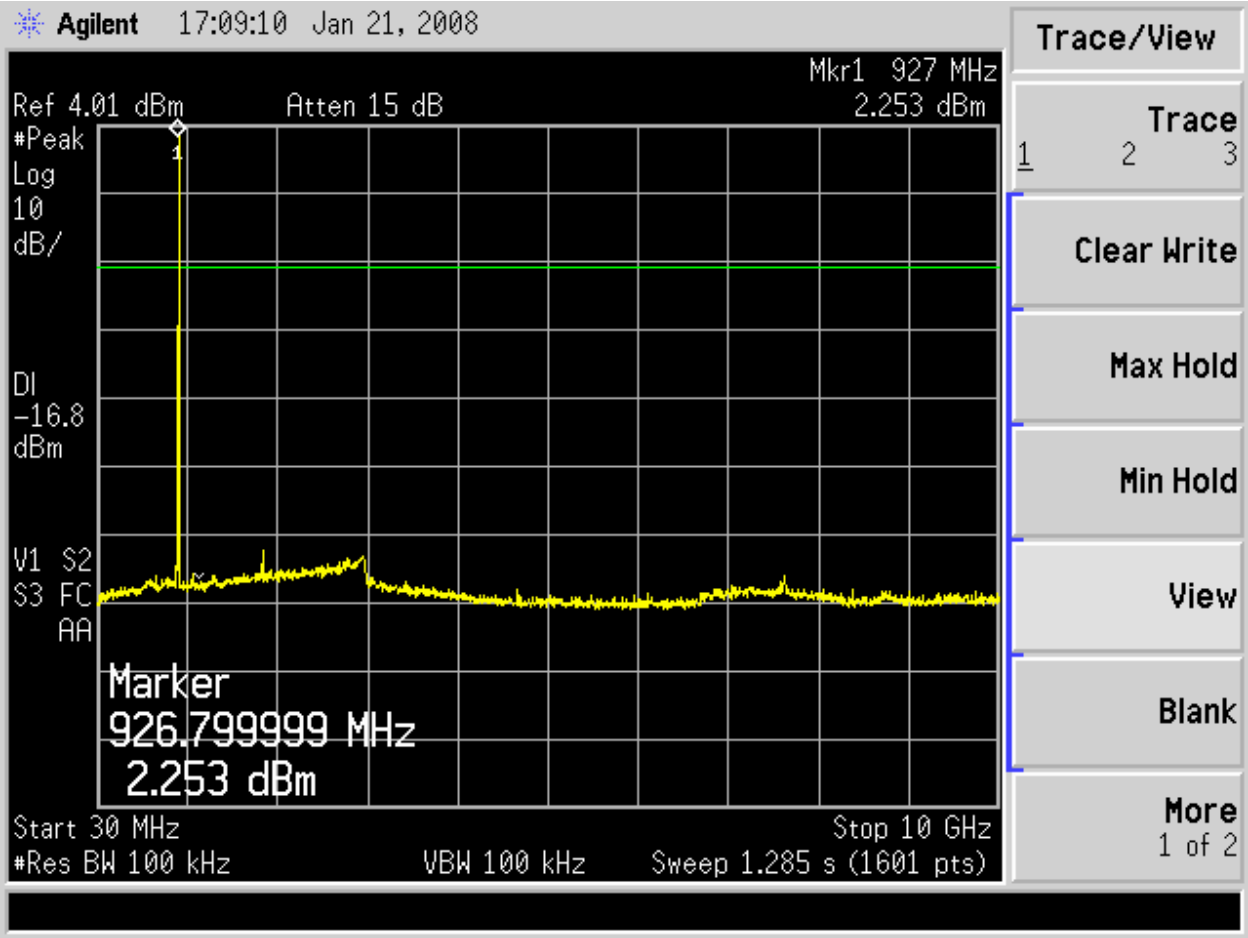


Figure 15 926.8 MHz transmit frequency

5.2.2.2 Restricted band measurements

Radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see 15.205(c)).

SOP 1 Radiated Emissions

Tracking # 30860147.001 Page 1 of 3

EUT Name	Rex2	**Date**	24 January 2008
EUT Model	REX2EAI	**Temp / Hum in**	70 deg. F / 31 %rh
EUT Serial	N/a	**Temp / Hum out**	n/a
Standard	FCC 47 CFR Part 15.247	**Line AC**	120 VAC / 60 Hz
Deg/sweep	NA	**RBW / VBW**	1 MHz / 1 MHz
Dist/Ant Used	3 meters / 3115-2236	**Performed by**	Bob Richards
Configuration	926.8 MHz		

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
Peak										
2780.00	H	1.02	307	43.68	36.61	13.03	29.88	49.98	74.00	-24.02
3707.20	H	1.06	355	41.36	35.45	14.92	32.01	52.84	74.00	-21.16
4634.00	H	1.02	24	41.12	35.77	17.18	32.69	55.22	74.00	-18.78
7414.40	H	1.53	336	36.19	35.34	21.80	36.61	59.26	74.00	-14.74
8341.20	H	1.02	360	34.62	35.70	24.21	37.40	60.54	74.00	-13.46
2780.00	V	1.41	32	43.48	36.61	13.03	29.45	49.35	74.00	-24.65
3707.20	V	1.22	5	40.50	35.45	14.92	31.88	51.85	74.00	-22.15
4634.00	V	1.22	30	39.37	35.77	17.18	32.84	53.62	74.00	-20.38
7414.40	V	1.02	0	40.10	35.34	21.80	36.66	63.22	74.00	-10.78
8341.20	V	1.02	0	39.82	35.70	24.21	37.44	65.77	74.00	-8.23
Average										
2780.00	H	1.02	307	34.47	36.61	13.03	29.88	40.77	54.00	-13.23
3707.20	H	1.06	355	29.36	35.45	14.92	32.01	40.84	54.00	-13.16
4634.00	H	1.02	24	29.71	35.77	17.18	32.69	43.81	54.00	-10.19
7414.40	H	1.53	336	22.09	35.34	21.80	36.61	45.16	54.00	-8.84
8341.20	H	1.02	360	21.55	35.70	24.21	37.40	47.47	54.00	-6.53
2780.00	V	1.41	32	35.79	36.61	13.03	29.45	41.66	54.00	-12.34
3707.20	V	1.22	5	30.30	35.45	14.92	31.88	41.65	54.00	-12.35
4634.00	V	1.22	30	26.69	35.77	17.18	32.84	40.94	54.00	-13.06
7414.40	V	1.02	0	26.21	35.34	21.80	36.66	49.33	54.00	-4.67
8341.20	V	1.02	0	26.20	35.70	24.21	37.44	52.15	54.00	-1.85

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: RBW/VBW = 1MHz/1MHz For frequencies between 1GHz and 10 GHz

Cables: SN030, SN045, SN034. Filter F1-BHF-1500. Preamp 8449B-1480.

SOP 1 Radiated Emissions

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EUT Name	Rex2	**Date**	24 January 2008
EUT Model	REX2EAI	**Temp / Hum in**	70 deg. F / 31 %rh
EUT Serial	N/a	**Temp / Hum out**	n/a
Standard	FCC 47 CFR Part 15.247	**Line AC**	120 VAC / 60 Hz
Deg/sweep	NA	**RBW / VBW**	1 MHz / 1 MHz
Dist/Ant Used	3 meters / 3115-2236	**Performed by**	Bob Richards
Configuration	921.2 MHz		

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
Peak										
2763.60	H	1.22	308	43.61	36.45	13.07	29.84	50.06	74.00	-23.94
3684.80	H	1.01	323	41.65	35.53	14.86	31.97	52.95	74.00	-21.05
4606.00	H	1.14	327	40.50	35.85	17.46	32.63	54.74	74.00	-19.26
7369.60	H	1.45	5	38.87	35.41	21.52	36.51	61.49	74.00	-12.51
8290.80	H	1.02	0	34.62	35.79	24.43	37.37	60.64	74.00	-13.36
2763.60	V	1.2	29	44.39	36.45	13.07	29.40	50.40	74.00	-23.60
3684.80	V	1.06	57	40.50	35.53	14.86	31.82	51.65	74.00	-22.35
4606.00	V	1.12	90	40.86	35.85	17.46	32.79	55.26	74.00	-18.74
7369.60	V	1.61	31	38.87	35.41	21.52	36.53	61.51	74.00	-12.49
8290.80	V	1.02	0	34.75	35.79	24.43	37.39	60.79	74.00	-13.21
Average										
2763.60	H	1.22	308	35.80	36.45	13.07	29.84	42.25	54.00	-11.75
3684.80	H	1.01	323	31.16	35.53	14.86	31.97	42.46	54.00	-11.54
4606.00	H	1.14	327	28.97	35.85	17.46	32.63	43.21	54.00	-10.79
7369.60	H	1.45	5	23.62	35.41	21.52	36.51	46.24	54.00	-7.76
8290.80	H	1.02	0	21.36	35.79	24.43	37.37	47.38	54.00	-6.62
2763.60	V	1.2	29	36.73	36.45	13.07	29.40	42.74	54.00	-11.26
3684.80	V	1.06	57	29.47	35.53	14.86	31.82	40.62	54.00	-13.38
4606.00	V	1.12	90	28.71	35.85	17.46	32.79	43.11	54.00	-10.89
7369.60	V	1.61	31	23.18	35.41	21.52	36.53	45.82	54.00	-8.18
8290.80	V	1.02	0	21.35	35.79	24.43	37.39	47.39	54.00	-6.61

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: RBW/VBW = 1MHz/1MHz For frequencies between 1GHz and 10 GHz

SOP 1 Radiated Emissions

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EUT Name	Rex2	**Date**	24 January 2008
EUT Model	REX2EAI	**Temp / Hum in**	70 deg. F / 31 %rh
EUT Serial	N/a	**Temp / Hum out**	n/a
Standard	FCC 47 CFR Part 15.247	**Line AC**	120 VAC / 60 Hz
Deg/sweep	NA	**RBW / VBW**	1 MHz / 1 MHz
Dist/Ant Used	3 meters / 3115-2236	**Performed by**	Bob Richards
Configuration	916 MHz		

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
Peak										
2748.00	H	1.16	16	43.74	36.22	13.09	29.79	50.40	74.00	-23.60
3664.00	H	1.05	337	42.18	35.59	14.86	31.93	53.38	74.00	-20.62
4580.00	H	1.03	25	40.38	35.80	17.33	32.58	54.49	74.00	-19.51
7328.00	H	1.47	61	40.38	35.32	21.25	36.42	62.73	74.00	-11.27
8244.00	H	1.02	0	35.17	35.77	24.60	37.35	61.35	74.00	-12.65
9160.00	H	1.02	0	34.48	35.77	25.23	37.63	61.57	74.00	-12.43
2748.00	V	1.45	31	43.74	36.22	13.09	29.34	49.95	74.00	-24.05
3664.00	V	1.22	63	40.25	35.59	14.86	31.76	51.28	74.00	-22.72
4580.00	V	1.02	89	39.37	35.80	17.33	32.74	53.64	74.00	-20.36
7328.00	V	1.08	311	37.63	35.32	21.25	36.42	59.98	74.00	-14.02
8244.00	V	1.02	0	35.01	35.77	24.60	37.34	61.19	74.00	-12.81
9160.00	V	1.02	0	34.62	35.77	25.23	37.83	61.91	74.00	-12.09
Average										
2748.00	H	1.16	16	36.29	36.22	13.09	29.79	42.95	54.00	-11.05
3664.00	H	1.05	337	32.77	35.59	14.86	31.93	43.97	54.00	-10.03
4580.00	H	1.03	25	28.70	35.80	17.33	32.58	42.81	54.00	-11.19
7328.00	H	1.47	61	25.17	35.32	21.25	36.42	47.52	54.00	-6.48
8244.00	H	1.02	0	21.48	35.77	24.60	37.35	47.66	54.00	-6.34
9160.00	H	1.02	0	21.12	35.77	25.23	37.63	48.21	54.00	-5.79
2748	V	1.45	31	36.34	36.22	13.09	29.79	43.00	54.00	-11.00
3664	V	1.22	63	29.58	35.59	14.86	31.93	40.78	54.00	-13.22
4580	V	1.02	89	27.14	35.80	17.33	32.58	41.25	54.00	-12.75
7328.00	V	1.08	311	23.03	35.32	21.25	36.42	45.38	54.00	-8.62
8244.00	V	1.02	0	21.45	35.77	24.60	37.34	47.63	54.00	-6.37
9160.00	V	1.02	0	21.15	35.77	25.23	37.83	48.44	54.00	-5.56

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor $\pm$ Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.6$dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes: RBW/VBW = 1MHz/1MHz For frequencies between 1GHz and 10 GHz

5.2.3 Containment of the Emission during Variations in Voltage (Part 15.31e)

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

The setup was identical section 5.2.2.2 except the temperature inside of the chamber was set to 20 deg. C.

916.0 MHz (Modulated)

Voltage 120 VAC	Frequency in MHz measured 20dB below peak closest to the band edge	Permitted Band Edge in MHz	Results
102 VAC	915.58 MHz	902 - 928	Pass
132 VAC	915.57 MHz	902 - 928	Pass

927.6 MHz (Modulated)

Temperature 120 VAC	Frequency in MHz measured 20dB below peak closest to the band edge.	Permitted Band Edge in MHz	Results
102 VAC	927.76 MHz	902 - 928	Pass
132 VAC	927.75 MHz	902 - 928	Pass

Spectrum Analyzer Parameters:

RBW=100kHz

VBW=RBW

Span=100kHz

LOG dB/div.= 10dB

Sweep = 5 mS

Trigger Video

5.3 Conducted Emissions

Testing was performed in accordance with 47 CFR 15, ANSI C63.4:2003. These test methods are listed under the laboratory's NVLAP Scope of Accreditation.

This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

5.3.1 Test Methodology

A test program that controls instrumentation and data logging was used to automate the AC Power Line Conducted emission test procedure. The frequency range of interest was divided into sub-ranges such as to yield a frequency resolution of 9 kHz. For each frequency sub-range, each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a set of 50μH / 50Ω LISNs.

Testing is either performed in the anechoic chamber or on PLC Site 2. The setup photographs clearly identify which site was used. The vertical ground plane used in the anechoic chamber is a 2m x 2m wooden frame that is covered with ¼ inch hardware cloth and is bonded to the horizontal ground plane.

In the case of tabletop equipment, the EUT is placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane and 40cm from a vertical ground reference plane. The rear of the EUT was positioned flush with the backside of the table and directly over the LISNs. The power and I/O cables were routed over the edge of the table and bundled approximately 40cm from the ground plane. Support equipment was powered from a separate LISN. Floor-standing equipment is placed directly on the ground plane.

5.3.1.1 Deviations

There were no deviations from this test methodology.

5.3.2 Test Results

Section 5.3.2.1 lists the final measurement data under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and 1.5.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Plots of the EUT's AC Line Conducted emissions are contained in the following sections. The plots show peak and/or average emissions and the corresponding peak and/or average limits. If the peak emissions are below the average limit, then the EUT is considered to pass and no average measurements are made. If the peak emissions are below the quasi-peak limit and the average emissions are below the average limit, then the EUT is considered to pass and no further measurements are made. Otherwise, individual frequencies are measured and compared to the corresponding limit for the detector used (quasi-peak or average).

5.3.2.1 Final Data

The data recorded in this section contains the final results under the worst-case conditions and with any modifications or special accessories implemented as the manufacturer intends.

SOP 2 Conducted Emissions

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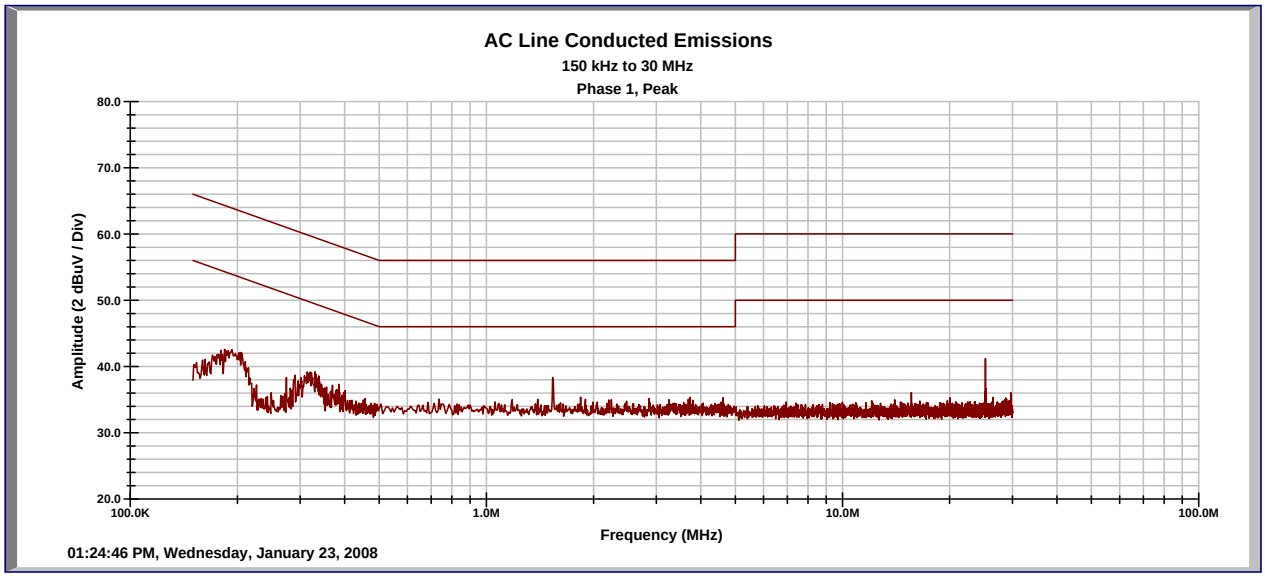
EUT Name	Rex2	**Date**	23 January 2008
EUT Model	REX2EAI	**Temperature**	73.4° F
EUT Serial	None	**Humidity**	31% RH
Standard	FCC 47 CFR Part 15.247	**Line AC /Freq**	120v 60hz
LISNs Used	LISN 15,16	**Performed by**	Bob Richards

Configuration



Emission Freq (MHz)	Line ID (1,2,3,N)	FIM Quasi (dBuV)	FIM Ave (dBuV)	Cable Loss (dB)	LISN + T Limiter (dB)	Quasi Limit (dBuV)	Ave Limit (dBuV)	Quasi Spec Margin (dB)	Ave Spec Margin (dB)
182.60	1	20.14	10.82	0.66	0.00	60.00	50.00	-39.20	-38.52
0.31	1	15.06	2.64	0.11	10.11	59.97	49.97	-34.70	-37.12
1.53	1	25.40	24.45	0.13	10.14	56.00	46.00	-20.33	-11.28
25.17	1	27.13	26.83	0.19	11.06	60.00	50.00	-21.61	-11.91

Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.2dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

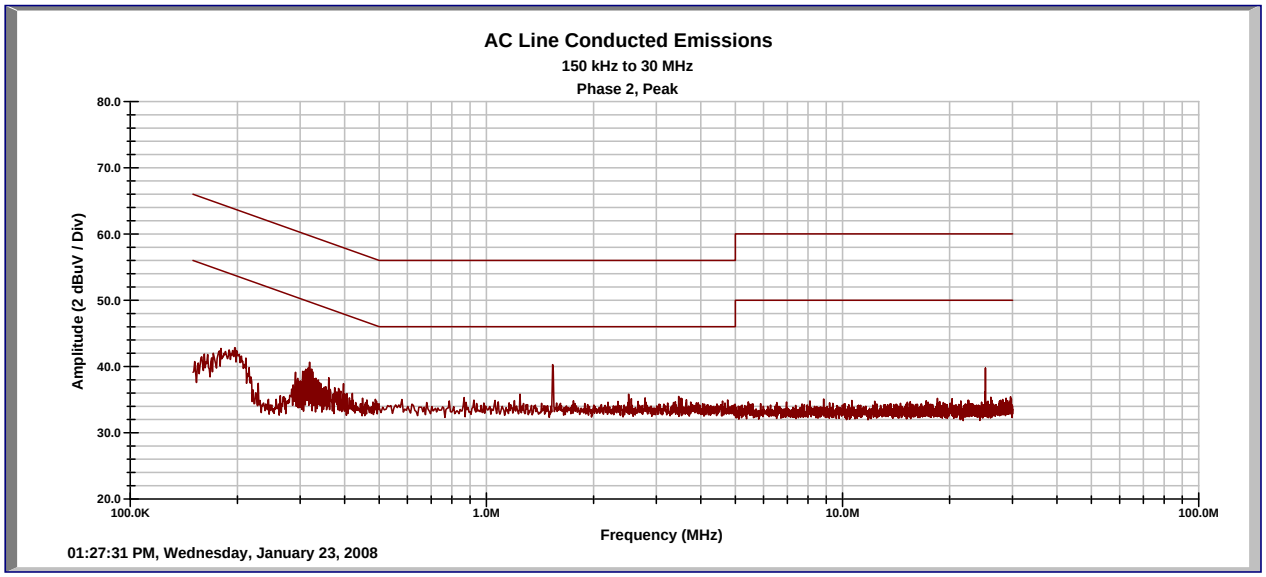
Notes:

SOP 2 Conducted Emissions

Tracking # 30860147.001 Page 2 of 2

EUT Name	Rex2	**Date**	23 January 2008
EUT Model	REX2EAI	**Temperature**	73.4° F
EUT Serial	None	**Humidity**	31% RH
Standard	FCC 47 CFR Part 15.247	**Line AC /Freq**	120v 60hz
LISNs Used	LISN 15,16	**Performed by**	Bob Richards

Configuration



Emission Freq (MHz)	Line ID (1,2,3,N)	FIM Quasi (dBuV)	FIM Ave (dBuV)	Cable Loss (dB)	LISN + T Limiter (dB)	Quasi Limit (dBuV)	Ave Limit (dBuV)	Quasi Spec Margin (dB)	Ave Spec Margin (dB)
0.18	2	21.30	13.07	0.00	10.07	64.46	54.46	-33.08	-31.31
0.30	2	18.98	4.69	0.11	10.08	60.21	50.21	-31.05	-35.34
1.53	2	27.01	26.23	0.13	10.21	56.00	46.00	-18.64	-9.42
25.17	2	25.88	25.53	0.19	12.69	60.00	50.00	-21.23	-11.58

Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.2dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes:

6 Test Equipment Use List

Test Equipment use list

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
SOP 1 - Radiated Emissions (5 Meter Chamber)					
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	10-Oct-2007	10-Oct-2008
Amplifier, preamp	Hewlett Packard	8447D	2944A10139	08-Oct-2007	08-Oct-2008
Ant. BiconiLog	EMCO	3142	1006	2-May-2006	2-May2008
Antenna Horn 1-18GHz	EMCO	3115	2236	25-Jan-2007	25-Jan-2009
Ant. BiconiLog	Chase	CBL6140A	1108	16-May-2006	16-May-2008
Receiver, EMI	Rohde & Schwarz	ESIB40	100043	12-Jul-2007	12-Jul-2008
Spectrum Analyzer	Agilent Tec.	E7405A	US39440161	29-Jun-2007	29-Jun-2008
Cable, Coax	Andrew	FSJ1-50A	036	14-Mar-2007	14-Mar-2008
Cable, Coax	Andrew	FSJ1-50A	030	1-Nov-2007	1-Nov-2008
Cable, Coax	Andrew	FSJ1-50A	045	24-Jan-2007	24-Jan-2008
SOP 2 - Conducted Emissions (AC/DC)					
LISN (6) 50mH/50Ω	Solar Electronics	8028-50-TS-24	990442	08-Oct-2007	08-Oct-2008
LISN (7) 50mH/50Ω	Solar Electronics	8028-50-TS-24	990443	08-Oct-2007	08-Oct-2008
Spectrum Analyzer[1]	Agilent Tec.	E7405A	US39440161	29-Jun-2007	29-Jun-2008
Cable, Coax	Belden	RG-213	004	9-Oct-2007	9-Oct-2008

- Calibration of equipment past due for re-calibration will be performed expeditiously. If any equipment is found to be out of tolerance at that time, affected customers will be notified accordingly.