

# Emissions Test Report

**EUT Name:** Single Phase REX2 Meter

**EUT Model:** REX2EA

**FCC ID** QZC-R2EA

FCC Title 47, Part 15, SubpartC, RSS-210 Issue 7

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*Report/Issue Date:* 9 October 2007

*Report Number:* 30762387PC.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:* Single Phase REX2 Meter

*Operation Frequency Range:* 902.4 MHz to 927.6 MHz

*Type of Equipment:* Intentional Radiator

*Application of Regulations:* FCC Title 47, Part 15, SubpartC, RSS-210 Issue 7

*Test Dates:* 05 August 2008 to 05 August 2008

## Guidance Documents:

Emissions: FCC 47 CFR Part 15, RSS-210 Issue 7

## Test Methods:

Emissions: ANSI C63.4:2003

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.

9 October  
2008

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NVLAP Signatory

Date



Industry Canada

IC3755

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## 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, RSS-210 Issue 7 based on the results of testing performed on *05 August 2008* through *05 August 2008* on the *Single Phase REX2 Meter* Model No. *REX2EA* 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.

This report is to cover two component changes in the transmitter circuit for a Class II Permissive Change.

### 1.3 Summary of Test Results

Table 1 - Summary of Test Results

Test	Test Method(s)	Test Parameters	Measurement	Result
Peak Output Power	FCC Part 15.247(b)(2) RSS-210, Annex 8, Section A8.4 (1)	0.25 Watts	0.232 Watts	compliant
Spurious Emissions	FCC Part 15.247(C) RSS-210, Annex 8, Section A8.5	Table FCC Part 15.209	51.15 dBuV/m @ 3meters Average @ 7318.40 MHz	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 k $\Omega$  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 k $\Omega$  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*, 1<sup>st</sup> 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  $\pm 1.2$  dB. The radiated test system has a combined standard uncertainty of  $\pm 1.6$  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.

## 2.5 Product Information



Figure 1: Photo of EUT, Front

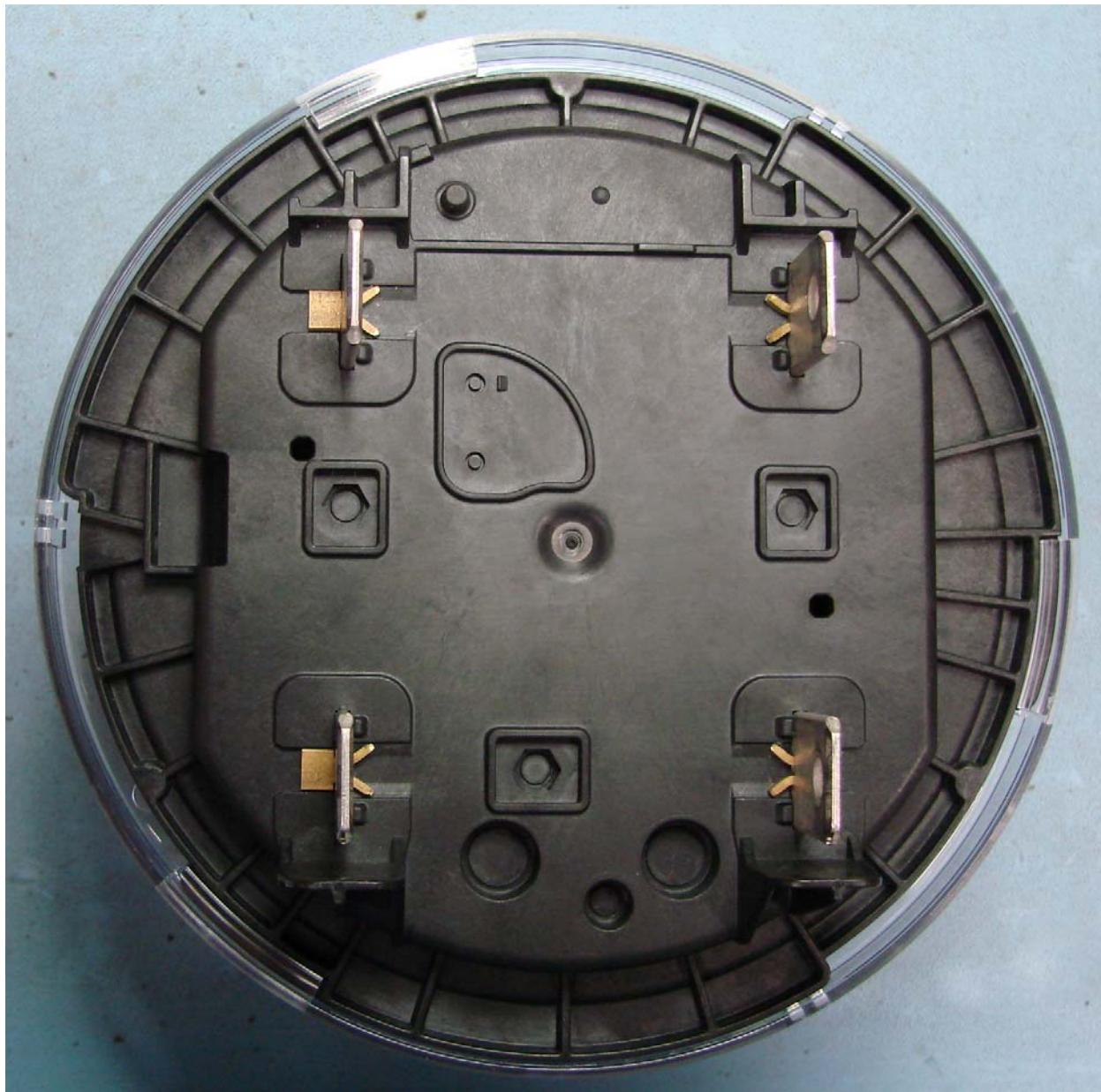


Figure 2: Photo of EUT, Rear



Figure 3: Photo of EUT, Side

## **2.6 Product Description**

The EUT is a single-phase watt-hour meter with an integrated 900 MHz band, frequency hopping radio. A block diagram and schematic showing the major sections of the electronic assembly have been included in a separate test plan document for submission.

## **2.7 Configuration**

Each meter type was installed in turn in a meter socket appropriate for measuring electricity consumption. Preliminary testing was performed on each of the three meter types to determine the configuration that produced maximum radiation. The following meter types were tested:

Meter Form	Test Voltage
Single-phase REX2 meter (Form 2S provided)	240Vac
Single-phase REX2 meter with internal service disconnect switch (Form 2S provided)	240Vac
Single-phase REX2 meter (Form 1S provided)	120Vac

All units have an internal microwave slot antenna printed on the main PCB. There are no other antenna options to be tested. The printed circuit board assembly is connected to line voltage (120 or 240V ac) and to the output of a current transformer. There are no other cables or wires connected to the Single-phase meter. For the service disconnect meter, there is a disconnect option board that connects to the main board via the 10-pin header J5.

The final configuration was selected to produce worse case radiation and place the EUT in the most susceptible state. The Rex2 meter with the internal service disconnect switch was determined to have the worst case emissions and was therefore used for all final testing displayed in this report.

### 3 Antenna Port Conducted Emissions

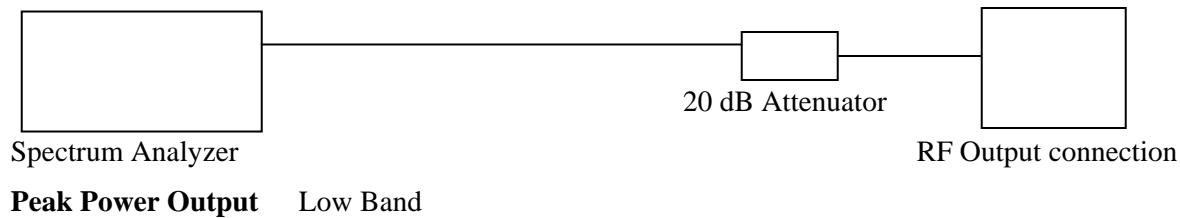
Testing was performed in accordance with 47 CFR Part 15, ANSI C63.4:2003, RSS-210 Issue 7. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

#### 3.1 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 peak output power was measured at CH1, CH15, and at CH31. 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



Spectrum Analyzer

RF Output connection

**Peak Power Output** Low Band

Channel	Frequency (MHz)	Un-modulated Peak Power (dBm)
00	902.400	21.11
31	914.802	21.99
34	916.014	22.16
48	921.626	22.58
63	927.597	21.79

Figure 4 – Un-modulated Peak Power

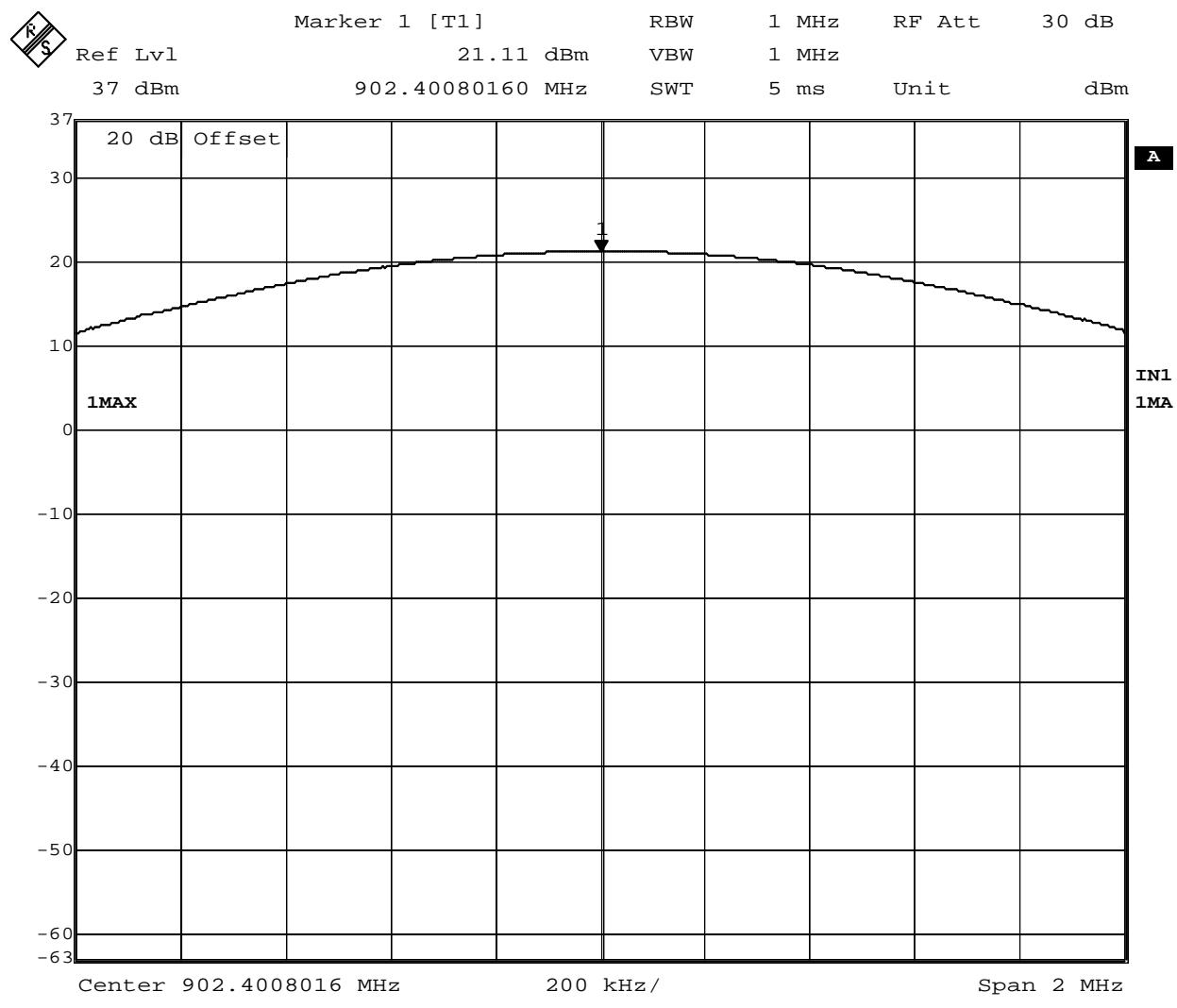
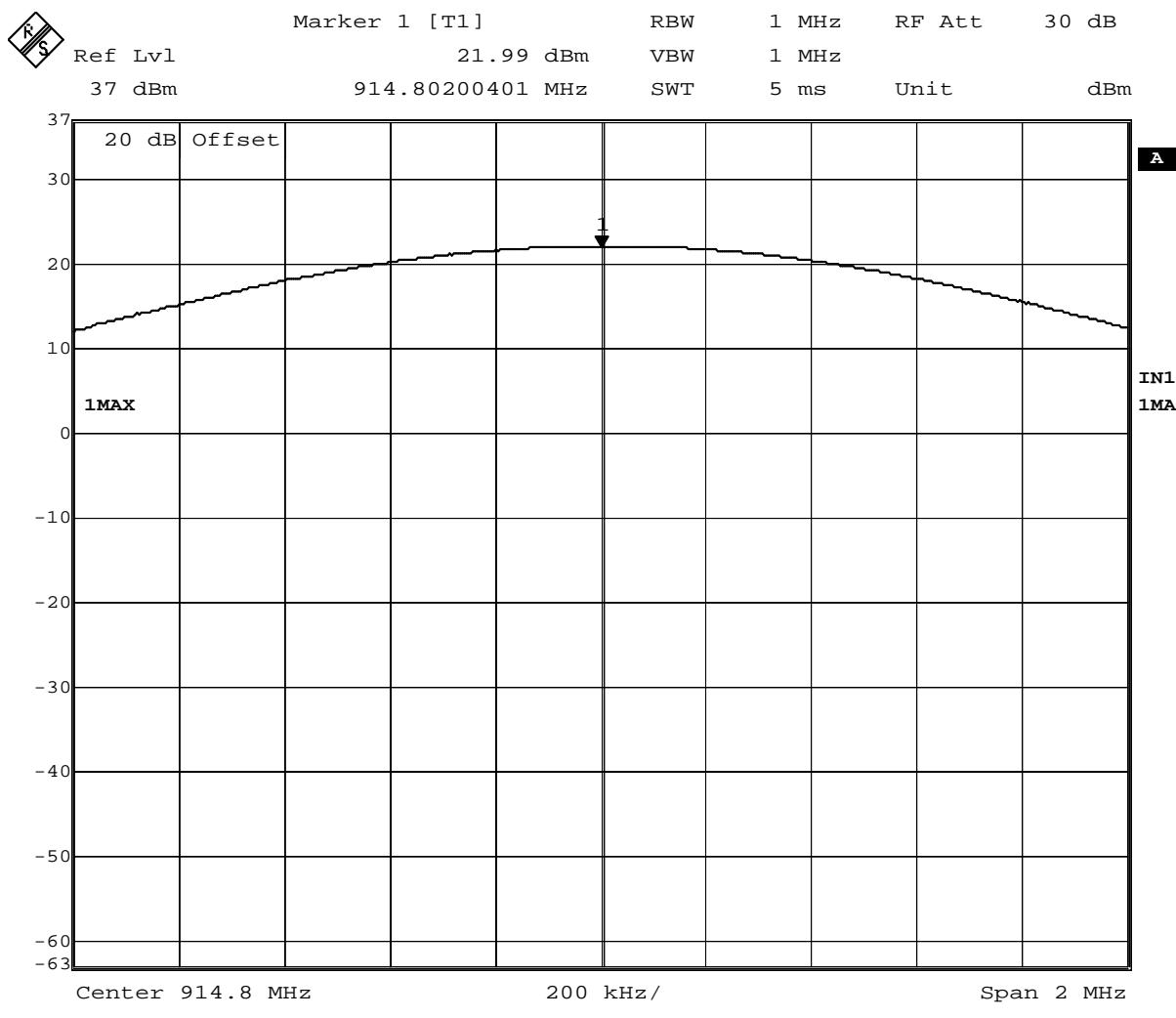
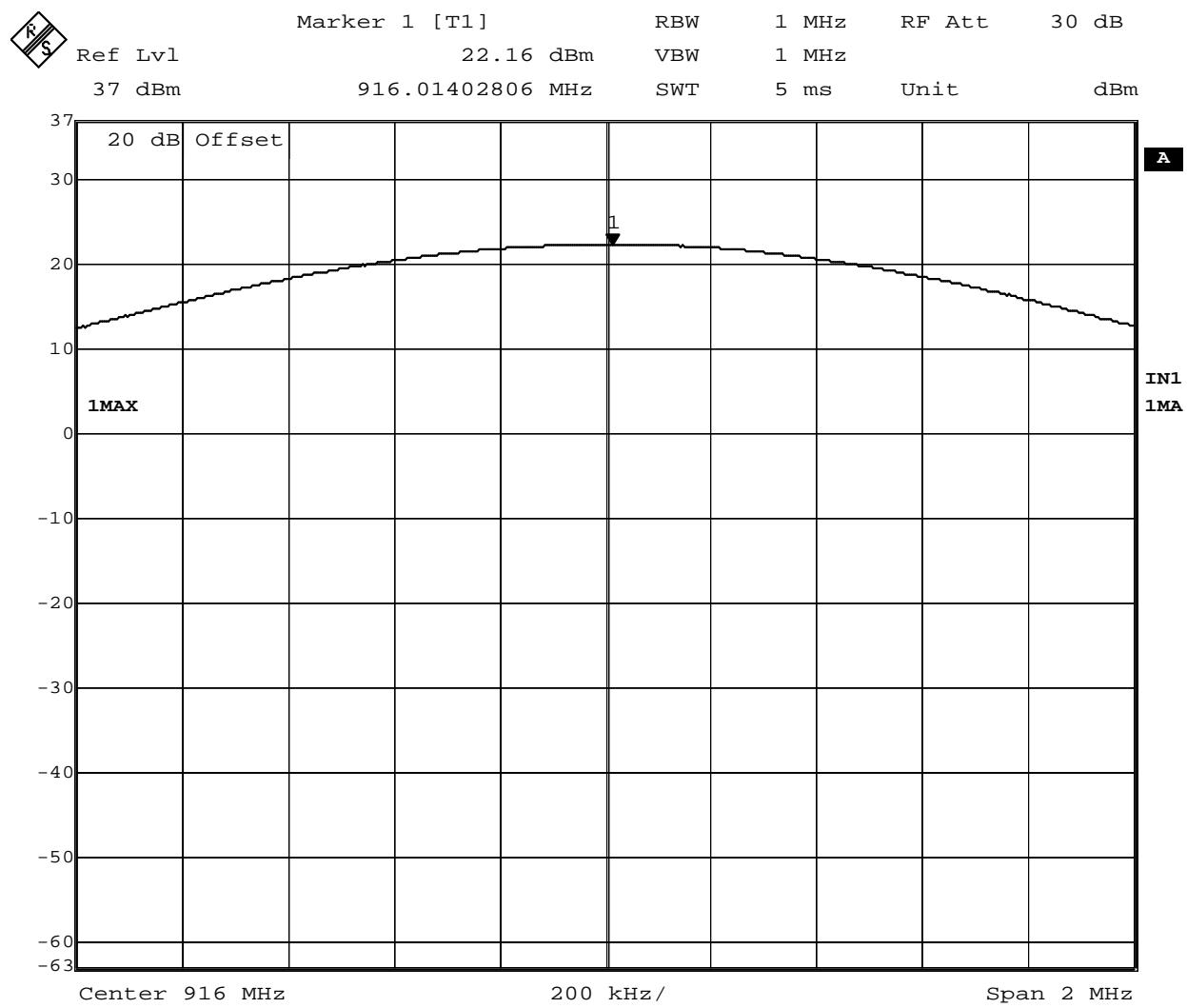


Figure 5: CH 0 (902.4 MHz) Peak Output Power



Date: 3.OCT.2008 10:16:27

Figure 6: CH 31 (914.802 MHz) Peak Output Power



Date: 3.OCT.2008 10:24:06

Figure 7: CH 34 (916.014 MHz) Peak Output Power

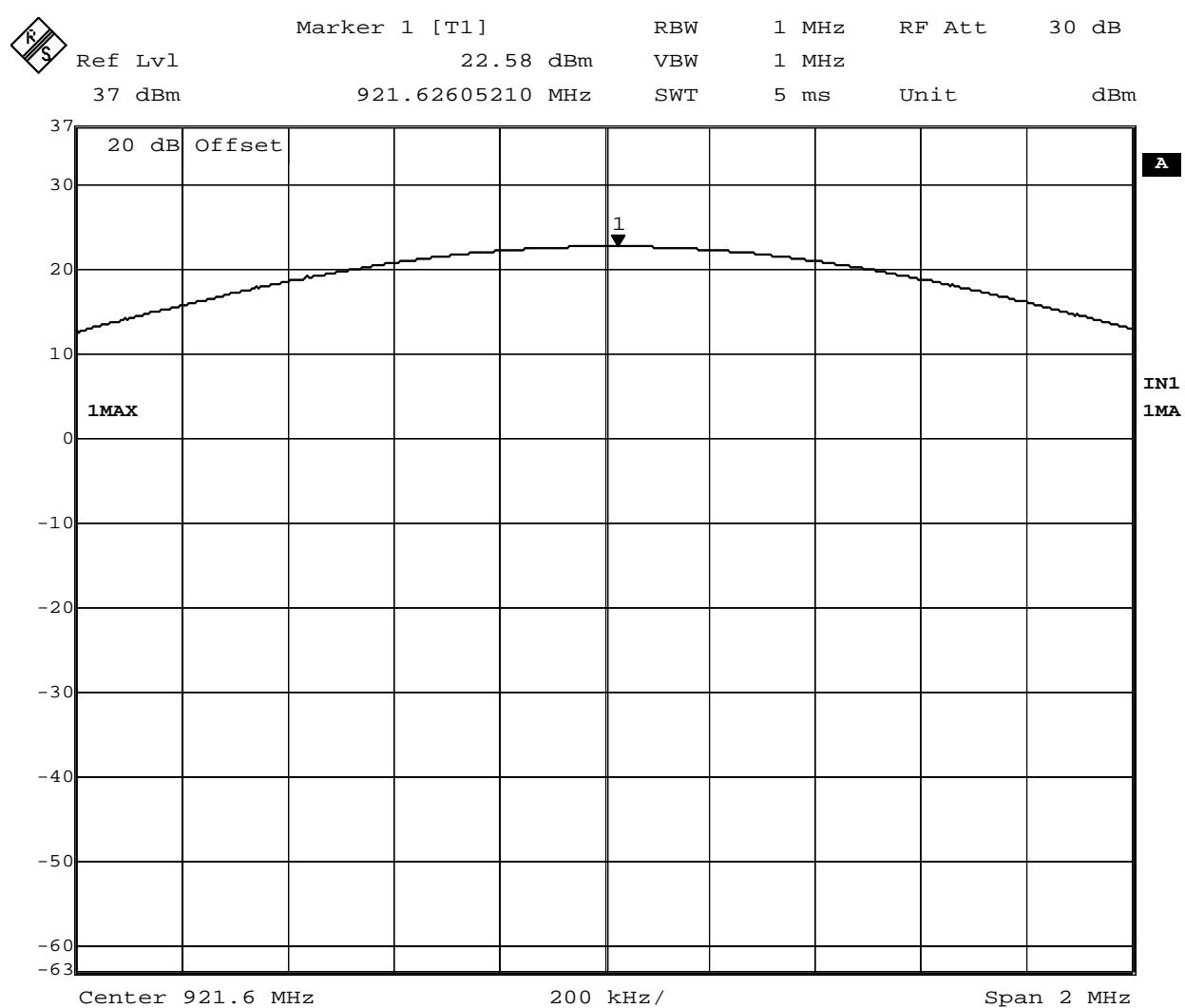


Figure 8: CH 48 (921.626 MHz) Peak Output Power

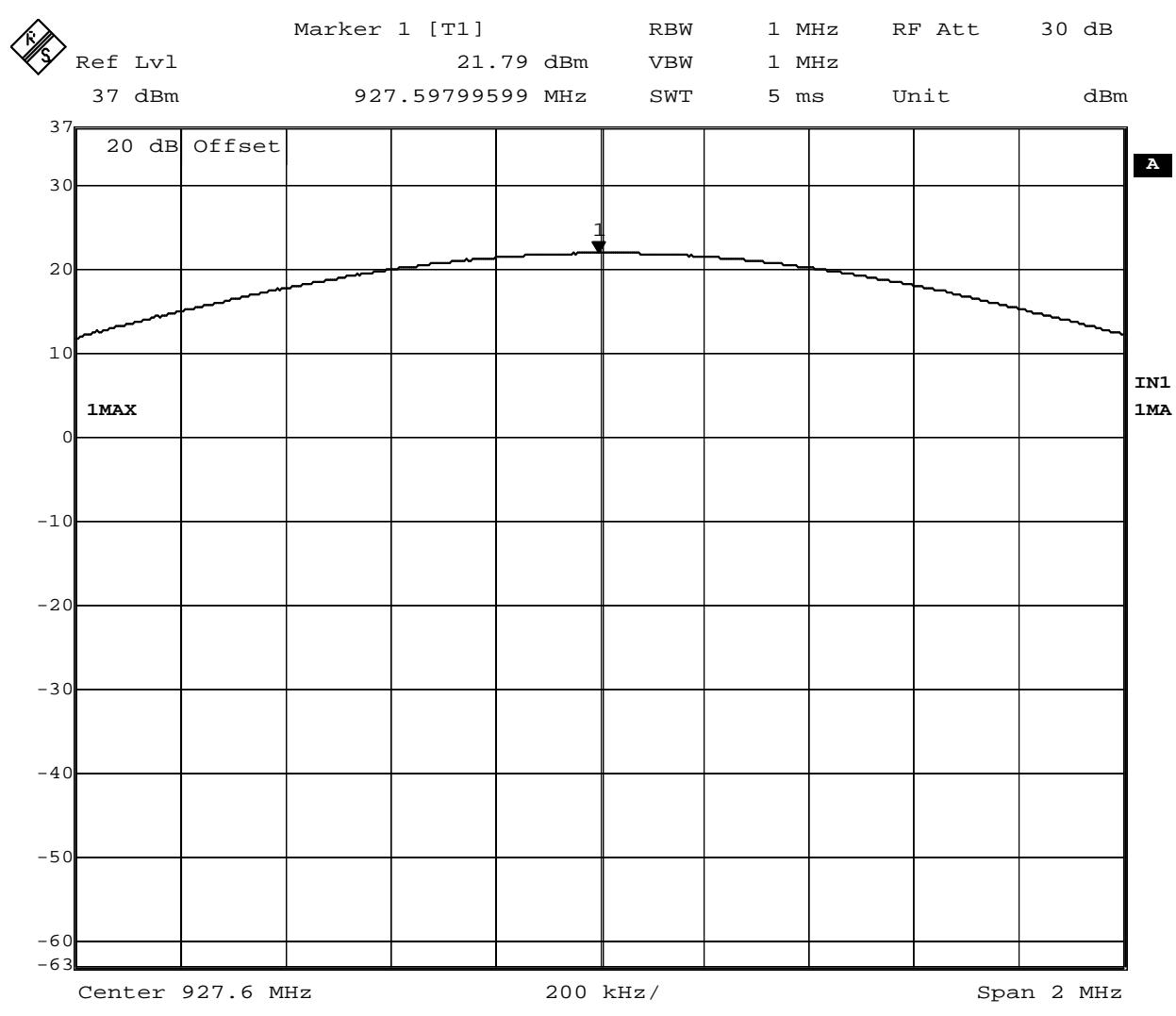


Figure 9: CH 63 (927.597 MHz) Peak Output Power

## **3.2 Spurious Emissions FCC Part 15.247(c)**

### **3.2.1 Test Methodology**

#### **3.2.1.1 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.

#### **3.2.1.2 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.

#### **3.2.1.3 Deviations**

There were no deviations from this test methodology.

### **3.2.2 Test Results**

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

SOP 1 Radiated Emissions								Tracking # 30762387PC. Page 1 of 2 001			
<b>EUT Name</b>	Single Phase REX2 Meter							<b>Date</b>	5 August 2008		
<b>EUT Model</b>	2S							<b>Temp / Hum in</b>	74 degrees F / 33%RH		
<b>EUT Serial</b>	2150							<b>Temp / Hum out</b>			
<b>Standard</b>	FCC 47 CFR Part 15, RSS-210 Issue 7							<b>Line AC / Freq.</b>	120VAC / 60hz		
<b>Deg/sweep</b>	12 degrees							<b>RBW / VBW</b>	1Mhz / 3Mhz		
<b>Dist/Ant Used</b>	3 meters / 3115							<b>Performed by</b>	Pamela Sequeira		
<b>Configuration</b>	2S 2150. L3 = 2.2nH; C28 = 3.3pF										
Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	<b>FIM Avg Value</b> (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	
902.8 MHz											
2708.60	H	1.37	256	41.70	36.01	7.81	29.68	43.19	54	-10.81	
2708.60	V	1.04	57	41.81	36.01	7.81	29.21	42.83	54	-11.17	
3611.60	H	1.04	318	33.76	35.74	9.42	31.82	39.26	54	-14.74	
3611.60	V	1.00	0	33.15	35.74	9.42	31.61	38.44	54	-15.56	
4513.20	H	1.00	233	34.60	35.83	10.51	32.43	41.71	54	-12.29	
4513.20	V	1.11	76	32.50	35.83	10.51	32.62	39.80	54	-14.2	
5416.00	H	1.00	331	32.13	35.15	11.28	34.17	42.43	54	-11.57	
5416.00	V	1.00	45	29.93	35.15	11.28	34.33	40.40	54	-13.6	
8124.20	H	1.00	359	26.34	35.46	15.81	37.27	43.96	54	-10.04	
8124.20	V	1.00	20	24.48	35.46	15.81	37.22	42.05	54	-11.95	
9026.60	H	1.29	0	21.92	35.94	15.50	37.61	39.08	54	-14.92	
9026.60	V	1.00	308	22.47	35.94	15.50	37.81	39.83	54	-14.17	
916 MHz											
2747.60	H	1.00	311	36.76	35.93	7.94	29.79	38.56	54	-15.44	
2747.60	V	1.26	0	41.16	35.93	7.94	29.34	42.51	54	-11.49	
3663.60	H	1.00	321	34.01	35.61	9.25	31.93	39.58	54	-14.42	
3663.60	V	1.00	0	32.39	35.61	9.25	31.76	37.79	54	-16.21	
4580.40	H	1.00	233	35.25	35.95	10.93	32.58	42.81	54	-11.19	
4580.40	V	1.04	69	34.81	35.95	10.93	32.74	42.54	54	-11.46	
7327.20	H	1.26	11	33.54	36.11	14.35	36.42	48.20	54	-5.8	
7327.20	V	1.46	8	31.08	36.11	14.35	36.42	45.74	54	-8.26	
8245.00	H	1.34	234	25.87	35.57	15.76	37.35	43.41	54	-10.59	
8245.00	V	1.00	0	26.28	35.57	15.76	37.34	43.82	54	-10.18	
9159.00	H	1.00	0	21.56	36.04	15.43	37.63	38.58	54	-15.42	
9159.00	V	1.02	347	21.52	36.04	15.43	37.83	38.74	54	-15.26	
921.6 MHz											
2764.60	H	1.11	0	38.06	35.95	7.99	29.84	39.94	54	-14.06	
2764.60	V	1.00	2	40.71	35.95	7.99	29.40	42.15	54	-11.85	
3686.80	H	1.00	76	33.36	35.53	9.18	31.97	38.98	54	-15.02	
3686.80	V	1.00	345	34.62	35.53	9.18	31.82	40.09	54	-13.91	
4607.40	H	1.14	357	35.86	35.98	10.94	32.64	43.46	54	-10.54	
4607.40	V	1.04	68	35.33	35.98	10.94	32.79	43.08	54	-10.92	
7373.60	H	1.28	6	35.02	36.05	14.42	36.52	49.92	54	-4.08	
7373.60	V	1.13	355	29.37	36.05	14.42	36.55	44.29	54	-9.71	
8293.20	H	1.00	25	27.19	35.59	15.73	37.38	44.71	54	-9.29	

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Avg Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
8293.20	V	1.16	353	30.12	35.59	15.73	37.39	47.65	54	-6.35
9214.80	H	1.91	353	21.56	36.12	15.41	37.64	38.50	54	-15.5
9214.80	V	1.00	5	22.49	36.12	15.41	37.84	39.63	54	-14.37
927.6 MHz										
2782.60	H	1.00	312	35.68	35.98	8.05	29.89	37.65	54	-16.35
2782.60	V	1.00	0	38.78	35.98	8.05	29.46	40.32	54	-13.68
3711.00	H	1.00	40	29.23	35.51	9.03	32.02	34.78	54	-19.22
3711.00	V	1.00	345	30.81	35.51	9.03	31.89	36.23	54	-17.77
4637.40	H	1.00	225	34.08	36.01	10.77	32.70	41.54	54	-12.46
4637.40	V	1.00	63	33.15	36.01	10.77	32.85	40.76	54	-13.24
7420.00	H	1.19	347	33.55	35.94	14.56	36.62	48.79	54	-5.21
7420.00	V	1.00	49	28.44	35.94	14.56	36.68	43.73	54	-10.27
8347.40	H	1.00	268	26.20	35.61	15.72	37.41	43.72	54	-10.28
8347.40	V	1.00	21	26.31	35.61	15.72	37.45	43.87	54	-10.13
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor $\pm$ Uncertainty										
Combined Standard Uncertainty $u_c(y) = \pm 1.6\text{dB}$ Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence										
Notes:										

## 4 Test Equipment Use List

### 4.1 *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	30-Jan-08	30-Jan-09
Amplifier, preamp	Hewlett Packard	8447D	1937A01766	30-Jan-08	30-Jan-09
Ant. BiconiLog	EMCO	3142	1007	22-Feb-07	22-Feb-09
Antenna Horn 1-18GHz	EMCO	3115	2236	25-Jan-07	25-Jan-09
Ant. BiconiLog	Chase	CBL6140A	1108	13-Jun-08	13-Jun-10
Receiver, EMI	Rohde & Schwarz	ESIB40	100043	9-Jun-08	9-Jun-09
Spectrum Analyzer	Agilent Tec.	E7405A	US39440157	04-Dec-07	04-Dec-08
Cable, Coax	Andrew	FSJ1-50A	003	25-Jan-08	25-Jan-09
Cable, Coax	Andrew	FSJ1-50A	030	30-Jan-08	30-Jan-09
Cable, Coax	Andrew	FSJ1-50A	045	30-Jan-08	30-Jan-09

- 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.