



Electromagnetic Compatibility Test Report

Tests Performed on a Landis+Gyr

Electricity Meter w/StatSignal, Model Focus

Radiometrics Document RP-5154A



Product Detail:

FCC ID: **ROV-1MWR9165**

Equipment type: Low Power 916 MHz Transmitter

Test Standards:

US CFR Title 47, Chapter I, FCC Part 15 Subpart C

FCC Part 15 CFR Title 47: 2002

Industry Canada RSS-210, Issue 5 as required for Category I Equipment

This report concerns: Original Grant for Certification

FCC Part 15.249

RSS 210 Section 6.2.2 (m2)

Tests Performed For:

Landis+Gyr, Inc.

2800 Duncan Rd.

Lafayette, IN 47904

Test Facility:

Radiometrics Midwest Corporation

12 East Devonwood

Romeoville, IL 60446

Phone: (815) 293-0772

e-mail: info@radiomet.com

Test Date(s): (Month-Day-Year)

October 29 and 31, 2003

Document RP-5154A Revisions:

Rev.	Issue Date	Affected Pages	Revised By	Authorized Signature for Revision
0	12/30/2003			

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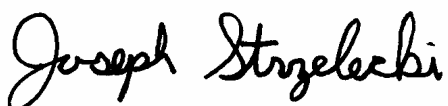
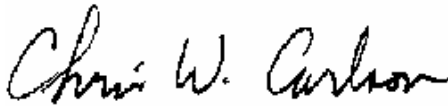
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1 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i> A Landis+Gyr, Electricity Meter w/StatSignal Model: Focus Serial Number: 86 080 716 This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics: (Month-Day-Year)</i> 10/29/03	<i>Test Date(s): (Month-Day-Year)</i> October 29 and 31, 2003
<i>Test Report Written By:</i> Joseph Strzelecki Senior EMC Engineer	<i>Test Witnessed By:</i> Saieb Alrawi Senior Product Engineer Landis+Gyr
<i>Radiometrics' Personnel Responsible for Test:</i> 	<i>Test Report Approved By</i> 
Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is an Electricity Meter w/StatSignal, Model Focus, manufactured by Landis+Gyr. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results

Environmental Phenomena	Frequency Range	Basic Standard	Test Result
RF Radiated Emissions	30-9300 MHz	RSS-210 & FCC Part 15	Pass
Conducted Emissions, AC Mains	0.15 - 30 MHz	RSS-210 & FCC Part 15	Pass
Occupied Bandwidth Test	Fundamental Freq.	RSS-210 & FCC Part 15	Pass

2.1 RF Exposure Compliance Requirements

Since the EIRP is less than 1 mW, the EUT meets the FCC requirement for RF exposure and it is exempt from RSS-102. There are no power level adjustments and the antenna is permanently attached.

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3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is an Electricity Meter with a StatSignal radio, Model Focus, manufactured by Landis+Gyr. The transmitter is used for meter reading purposes. The EUT was in good working condition during the tests, with no known defects.

3.1.1 FCC Section 15.203 & RSS-210 Section 5.5 Antenna Requirements

The EUT is professionally installed and the antenna is permanently attached internal to the EUT.

3.2 Related Submittals

Landis+Gyr is not submitting any other products simultaneously for equipment authorization related to the EUT.

4 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations.

Since the EUT is wall mounted, it was placed in an upright configuration during the tests. The EUT was tested as a stand-alone device. Power was supplied at 115 VAC, 60 Hz single-phase to its external power supply.

The identification for all equipment, plus descriptions of all cables used in the tested system, are:

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	Electricity Meter w/StatSignal	E	Landis+Gyr	Focus	86 080 716

* Type: E = EUT, P = Peripheral, S = Support Equipment; H = Host Computer

List of System Cables

QTY	Length (m)	Cable Description	Connected to (Item #)	Shielded?
1	3.5	AC input cable; Two wire	#1 Power input	No
1	3	AC Load Cable; Two wire	#1	No

4.2 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

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4.3 Equipment Modifications

The following modification was made prior to the start of compliance testing:
Resistor R907 was changed to 8.66 kOhms.

5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2002	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
ANSI C63.4-1992	1992	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IC RSS-210 Issue 5	2001	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)
IC RSS-212 Issue 1	1998	Test Methods For Radio Equipment

The test procedures used are in accordance with the FCC DA 00-75, Industry Canada RSS-212, and ANSI document C63.4-1992, (July 17, 1992) "Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters. The antenna was raised and lowered from 1 to 4 meters.

6 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics has been accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 1999 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the "basic standards" listed herein. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la.org).

The following is a list of shielded enclosures located in Romeoville, Illinois:

Chamber A: Is an anechoic chamber that measures 24' L X 12' W X 12' H. The walls and ceiling are fully lined with ferrite absorber tiles. The floor has a 10' x 10' section of ferrite absorber tiles in the located in the center. Panashield of Rowayton, Connecticut manufactured the chamber. The enclosure is NAMAS certified.

Chamber B: Is a shielded enclosure that measures 24' L X 12' W X 8' H. Erik A. Lindgren & Associates of Chicago, Illinois manufactured the enclosure.

Chamber C: Is a shielded enclosure that measures 20' L X 10' W X 8' H. Lindgren RF Enclosures Inc. of Addison, Illinois manufactured the enclosure.

Chamber D: Is a fully anechoic chamber that measures 22' L X 10' W X 10' H. The walls, ceiling and floor are fully lined with ferrite absorber tiles. Braden Shielding Systems of Tulsa, Oklahoma manufactured the chamber.

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A separate ten-foot long, brass plated, steel ground rod attached via a 6 inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

Open Area Test Site (OATS): Is located on 8625 Helmar Road in Newark, Illinois, USA and measures 56' L X 24' W X 17' H. The entire open field test site has a metal ground screen. The FCC has accepted these sites as test site number 31040/SIT 1300F2. The FCC test site Registration Number is 90897. Details of the site characteristics are on file with the Industry Canada as file number IC3124.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance to ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

8 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification. The results relate only to the EUT listed herein. Any modifications made to the EUT subsequent to the indicated test date will invalidate the data and void this certification.

9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	11/29/02
ATT-02	KDI	Attenuator	A710N	RMC1	DC-10GHz	24 Mo.	12/31/01
AMP-16	MITEQ	Pre-amplifier	AM-1300	608852	0.01-1000MHz	12 Mo.	01/28/03
ANT-03	Tensor	Biconical Antenna	4104	2231	20-200MHz	24 Mo.	08/07/03
ANT-06	EMCO	Log-Periodic Ant.	3146	1248	200-1000MHz	24 mo	08/07/03
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	09/30/02
HPF-01	Solar	High Pass Filter	7930-100	HPF-1	0.15-30MHz	24 Mo.	01/02/02
HPF-02	Microwave Cir.	High Pass Filter	H2G09G02	HPF-2	1.5-11 GHz	24 Mo.	05/01/03
LSN-01	Electrometrics	LISN	FCC/VDE 50/2	1001	0.01-30MHz	24 Mo.	1/10/03
REC-01	Hewlett Packard	Spectrum Analyzer	8566A	2106A02115, 2209A01349	30Hz-22GHz	12 Mo.	06/07/03
REC-07	Anritsu	Spectrum Analyzer	MS2601A	MT53067	0.01-2200MHz	12 Mo.	12/23/02
THM-01	Extech Inst.	Temp/Humid Meter	4465CF	001106557	N/A	12 Mo.	12/31/02

Note: All calibrated equipment is subject to periodic checks.

NCR – No Calibration Required. Device monitored by calibrated equipment. N/A: Not Applicable.

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10 TEST SECTIONS

10.1 AC Conducted Emissions; Section 15.207

A computer-controlled analyzer was used to perform the conducted emissions measurements. The frequency range was divided into 500 subranges equally spaced on a logarithmic scale. The computer recorded the peak of each subrange. This data was then plotted on semi-log graph paper generated by the computer and plotter. Adjusting the positions of the cables and orientation of the test system then maximizes the highest emissions.

Mains Conducted emission measurements were performed using a 50 Ohm/50 uH Line Impedance Stabilization Network (LISN) as the pick-up device. Measurements were repeated on both leads within the power cord. If the EUT power cord exceeded 80 cm in length, the excess length of the power cord was made into a 30 to 40 cm bundle near the center of the cord. The LISN was placed on the floor at the base of the test platform and electrically bonded to the ground plane.

FCC Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dBuV)	
	Quasi-Peak	Average
0.150 - 0.50*	66 - 56	56 - 46
0.5 - 5.0	56	46
5.0 - 30	60	50
* The limit decreases linearly with the logarithm of the frequency in this range.		

The initial step in collecting conducted data is a peak detector scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from power cord, after testing all modes of operation.

10.1.1 Conducted Emissions Test Results

Test Date: October 31, 2003

The Amplitude is the final corrected value with cable and LISN Loss.

Lead Tested	Frequency MHz	Peak Amplitude	QP Limit	Average Limit
AC Neutral	0.15	40.5	66.0	56.0
AC Neutral	0.5	36.0*	56.0	46.0
AC Neutral	10.0	38.0*	60.0	50.0
AC Neutral	20.0	38.0*	60.0	50.0
AC Hot	0.15	41.0	66.0	56.0
AC Hot	0.5	36.0*	56.0	46.0
AC Hot	10.0	38.0*	60.0	50.0
AC Hot	20.0	38.0*	60.0	50.0

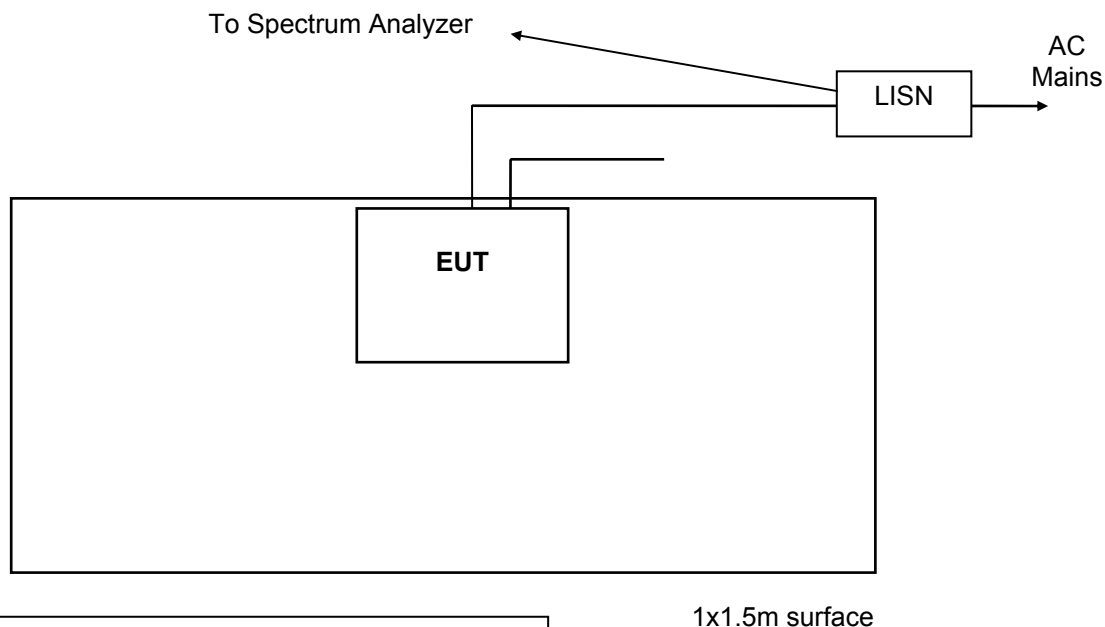
* Ambient Level (Noise floor of measurement Equipment)

Since the EUT passed with sufficient margin using the peak detector, QP and Average were not performed.

Judgment: Passed by at least 10 dB

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Figure 1. Conducted Emissions Test Setup



Notes:

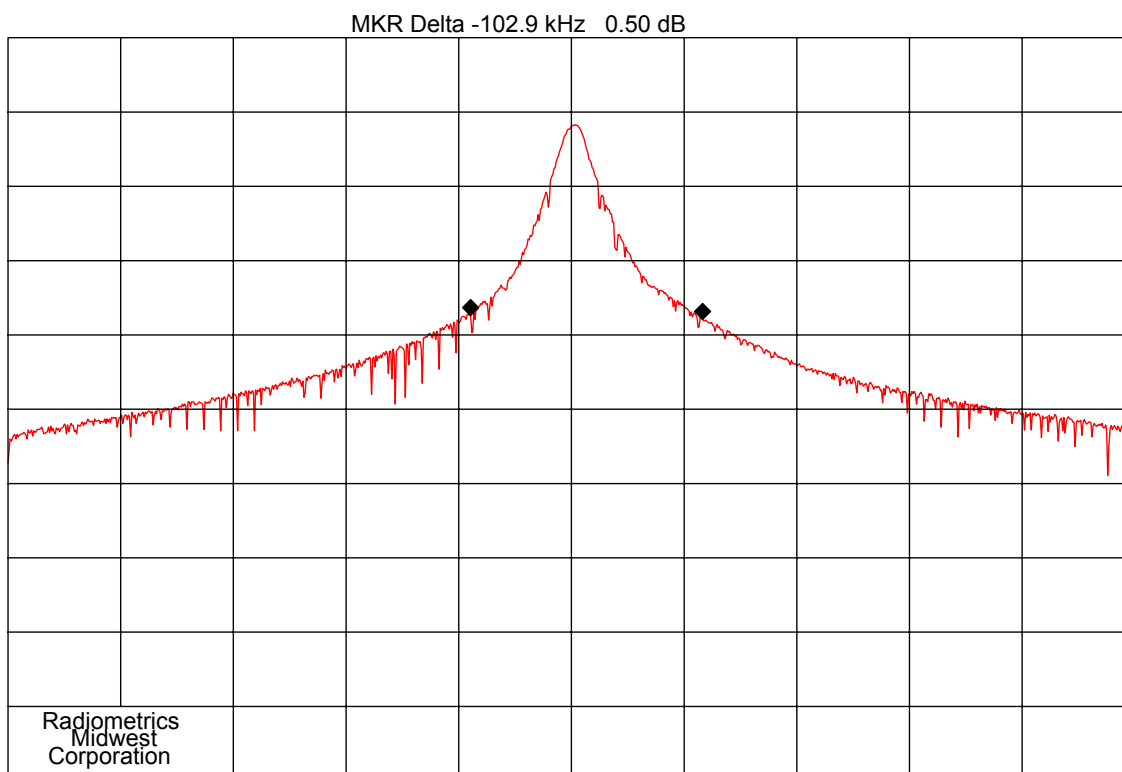
- LISN's at least 80 cm from EUT chassis
- Vertical conductive plane 40 cm from rear of table top
- EUT power cord bundled

10.2 Occupied Bandwidth (20 dB)

The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The EUT was transmitting at its maximum data rate. The trace was allowed to stabilize.

The marker-to-peak function was set to the peak of the emission. Then the marker-delta function was used to measure 26 dB down one side of the emission. The marker-delta function was reset and then moved to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 26 dB bandwidth of the emission.

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COMPANY : Landis + Gyr
 CENTER 916.572 MHz
 RES BW 10 kHz
 10 dB/
 NOTES : 26 dB Occupied Bandwidth,

ITEM : Focus form 1S
 REF 80.0 dBuV
 VBW 100 kHz
 TIME : 15:32

DATE : 10-31-2003
 SPAN 500 kHz
 ATTEN 0 dB
 SWP 30.0 msec

The 26 dB Bandwidth is 102.9 kHz

10.3 Radiated Emissions

Radiated emission measurements in the Restricted bands were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. Below 1 GHz, when a radiated emission is detected approaching the specification limit, the measurement of the emission is repeated using a tuned dipole antenna with a Roberts Balun. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists.

From 30 to 1000 MHz, an Anritsu Spectrum analyzer and a MITEQ AM-1431 amplifier with a 10 dB attenuator connected to the input were used. The out of band emissions and the ambient emissions were below the level of input overload (80 dBuV).

For tests from 1 to 9.3 GHz, an HP8566A spectrum analyzer was used with a Celeritek uWave amplifier. The out of band emissions and the ambient emissions were below the level of input overload (72 dBuV). In addition, a high pass filter was used to reduce the fundamental emission.

Radiated emission measurements are performed with linearly polarized broadband antennas. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded.

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Final radiated emissions measurements were performed in the open area test site at a test distance of 3 meters. The entire frequency range from 30 to 9300 MHz was slowly scanned and the emissions in the restricted frequency bands were recorded. Measurements were performed using the peak detector function. The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground. The open area test site used to collect the radiated data is located on 8625 Helmar Road in Newark, Illinois. The open field test site has a metal ground screen. All other tests are performed at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab.

10.3.1 Radiated Emissions Field Strength Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where: FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

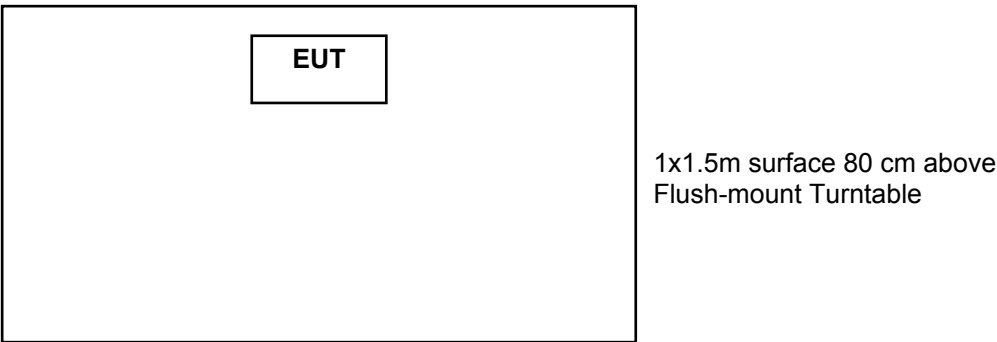
AG = Amplifier Gain

Assume a receiver reading of 49.5 dBuV is obtained. The Antenna Factor of 8.1 and a Cable Factor of 1.7 is added. The Amplifier Gain of 23.3 dB is subtracted, giving a field strength of 36 dBuV/m. The 36 dBuV/m can be mathematically converted to its corresponding level in uV/m.

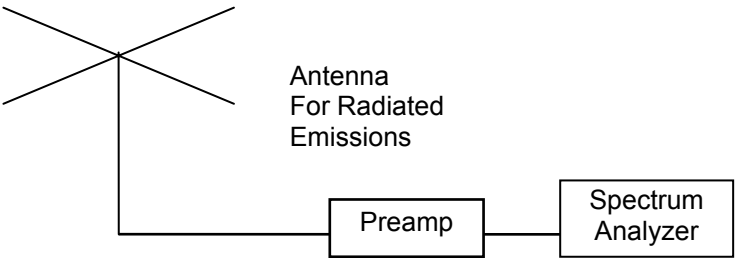
$$FS = 49.5 + 8.1 + 1.7 - 23.3 = 36.0 \text{ dBuV/m}$$

$$\text{Level in uV/m} = \text{Common Antilogarithm } [(36 \text{ dBuV/m})/20] = 63.1 \text{ uV/m}$$

Figure 2. Drawing of Radiated Emissions Setup



- Notes:**
- AC outlet with low-pass filter at the base of the turntable
 - Antenna height varied from 1 to 4 meters
 - Distance from antenna to tested system is 3 meters
 - AC Cords not shown
 - Not to Scale



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10.3.2 Radiated Emissions Test Results

The following spectrum analyzer settings were used:

RBW = 120 kHz

VBW = Off

Manufacturer	Landis+Gyr	Specification	FCC Part 15 Subpart C & RSS-210
Model	Focus	Test Date	October 31, 2003
Serial Number	86 080 716	Test Distance	3 Meters
Abbreviations	Q = Quasi-Peak BC = Biconical Antenna (ANT-3) (30 to 250 MHz) LP = Log-Periodic (ANT-6) (250 to 1000 MHz) HN = Horn (ANT-13) (1 to 10 GHz)		

Notes		Corr. Factors = Cable Loss – Preamp Gain					
Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ Type		EUT	Limit	
916.5	59.7 Q	23.8	V/LP	9.7	93.2	94.0	0.8
916.5	57.1 Q	23.8	H/LP	9.7	90.6	94.0	3.4

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW = 1 kHz RBW; Sweep = auto; Detector function = peak

Notes		Corr. Factors = Cable Loss – Preamp Gain + HP Filter Loss					
Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ Type		EUT	Limit	
1833.1	31.0	28.4	H	-16.0	43.4	54.0	10.6
2749.9	29.6	31.3	H	-20.6	40.3	54.0	13.7
3665.2	27.4	33.6	H	-20.6	40.4	54.0	13.6
4582.9	26.9	35.0	H	-22.3	39.6	54.0	14.4
5498.3	25.4	36.4	H	-22.0	39.8	54.0	14.2
6415.6	29.5	36.7	H	-21.5	44.7	54.0	9.3
7332.2	27.0	37.8	H	-20.9	43.9	54.0	10.1
8249.5	28.1	38.1	H	-21.4	44.8	54.0	9.2
9165.9	26.7	39.7	H	-20.2	46.2	54.0	7.8
1833.1	28.9	28.4	V	-16.0	41.3	54.0	12.7
2749.6	31.6	31.3	V	-20.6	42.3	54.0	11.7
3666.2	26.7	33.6	V	-20.6	39.7	54.0	14.3
4583.1	26.7	35.0	V	-22.3	39.4	54.0	14.6
5498.4	25.3	36.4	V	-22.0	39.7	54.0	14.3
7332.1	27.2	37.8	V	-20.9	44.1	54.0	9.9
9165.8	26.8	39.7	V	-20.2	46.3	54.0	7.7

Judgment: Passed by 0.8 dB Fundamental and 7.7 dB for spurious and Harmonic emissions.