L.S. Compliance, Inc.
W66 N220 Commerce Court
Cedarburg, WI 53012
262-375-4400
Fax: 262-375-4248

Assigned Engineer: Ken Boston

Compliance Testing of:

Prepared For:

Qtronics Manufacture, Inc.
2421 Canoe Avenue
Coquitlam, BC V3K 6A9 Canada

Test Report Number:

301468 Rev. 2

Dates of Testing:

December 11th, 22nd, 2001 and January 9th, 30th, 2002

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1. L.S. Compliance in Review

L. S. Compliance, Inc. is located in Cedarburg, Wisconsin – United States.

We may be contacted by:

Mail: L. S. Compliance, Inc.
W66 N220 Commerce Court
Cedarburg, Wisconsin 53102

Phone: 262-375-4400
Fax: 262-375-4248
E-Mail: eng@lsr.com

As an EMC testing laboratory, our accreditation and assessments are recognized through the following:

A2LA – American Association for Laboratory Accreditation
Accreditation based on ISO/IEC 17025: 1999
With electrical (EMC) Scope of Accreditation
A2LA Certificate Number: **1255.01**

U.S. Conformity Assessment Body (CAB) Validation
Validated by the European Commission as a U.S. conformity assessment Body operating under the U.S./EU, Mutual Recognition Agreement (MRA) operating under the European Union EMC Directive 89/336/EEC, Article 10.2
Date of Validation: **January 16, 2001**

Federal Communications Commission (FCC) – USA
Listing of 3 Meter Semi-Anechoic Chamber based on 47CFR 2.948
FCC Registration Number: **90756**

Listing of 3 and 10 Meter OATS based on 47CFR 2.948
FCC Registration Number: **90757**

Industry Canada
On-file, 3 Meter Semi-Anechoic Chamber based on 47CFR 2.948
File Number: **IC 3088**

On-file 3 and 10 meter OATS based on RSS-210
File Number: **IC 3088-A**

2. A2LA Certificate of Accreditation

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

L.S. COMPLIANCE, INC.
Cedarburg, WI

for technical competence in the field of

Electrical (EMC) Testing

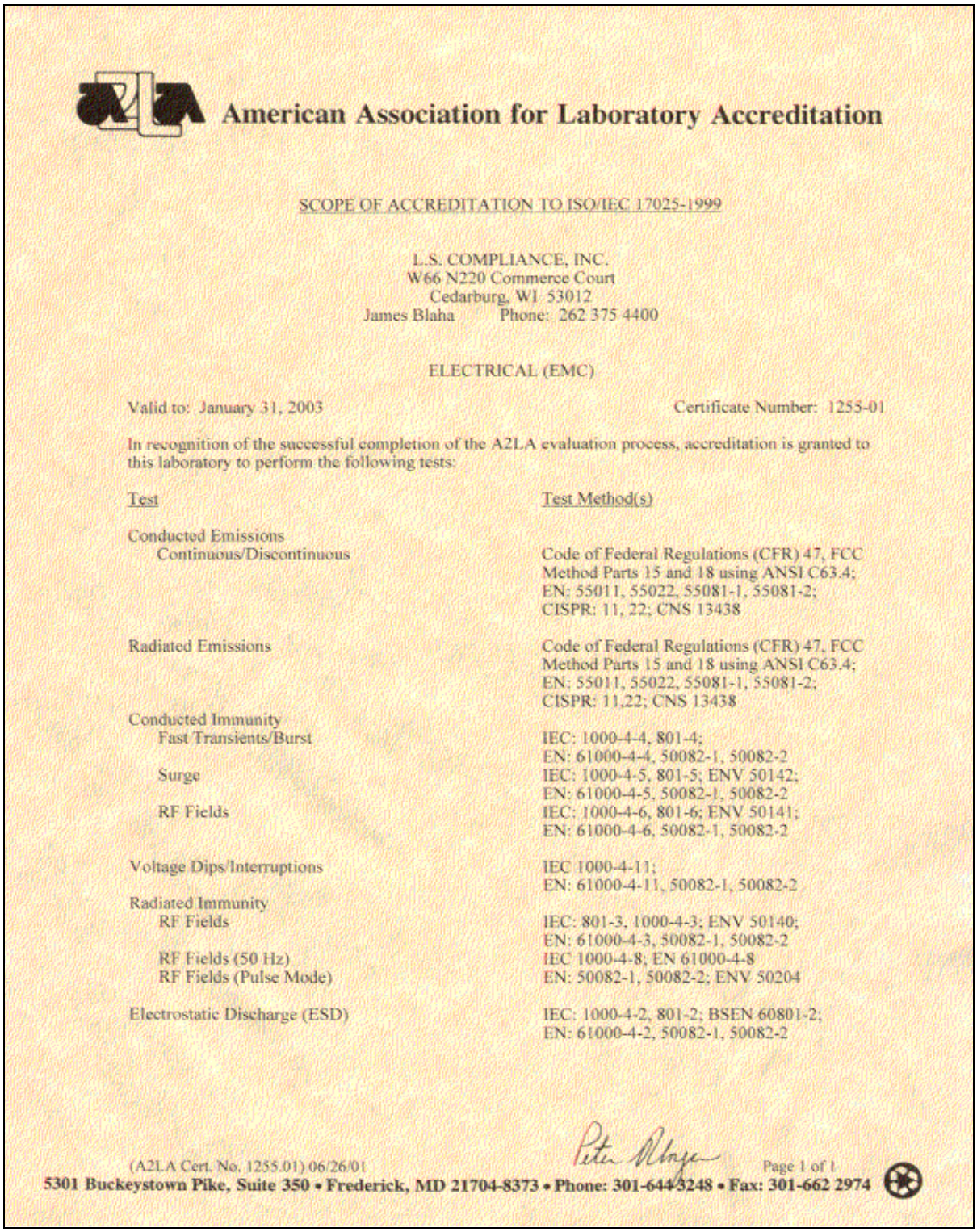
The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing. Testing and calibration laboratories that comply with this International Standard also operate in accordance with ISO 9001 or ISO 9002.

Presented this 26th day of June, 2001.

President
For the Accreditation Council
Certificate Number 1255.01
Valid to January 31, 2003

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical (EMC) Scope of Accreditation

3. A2LA Scope of Accreditation



American Association for Laboratory Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025-1999

L.S. COMPLIANCE, INC.
W66 N220 Commerce Court
Cedarburg, WI 53012
James Blaha Phone: 262 375 4400

ELECTRICAL (EMC)

Valid to: January 31, 2003 Certificate Number: 1255-01

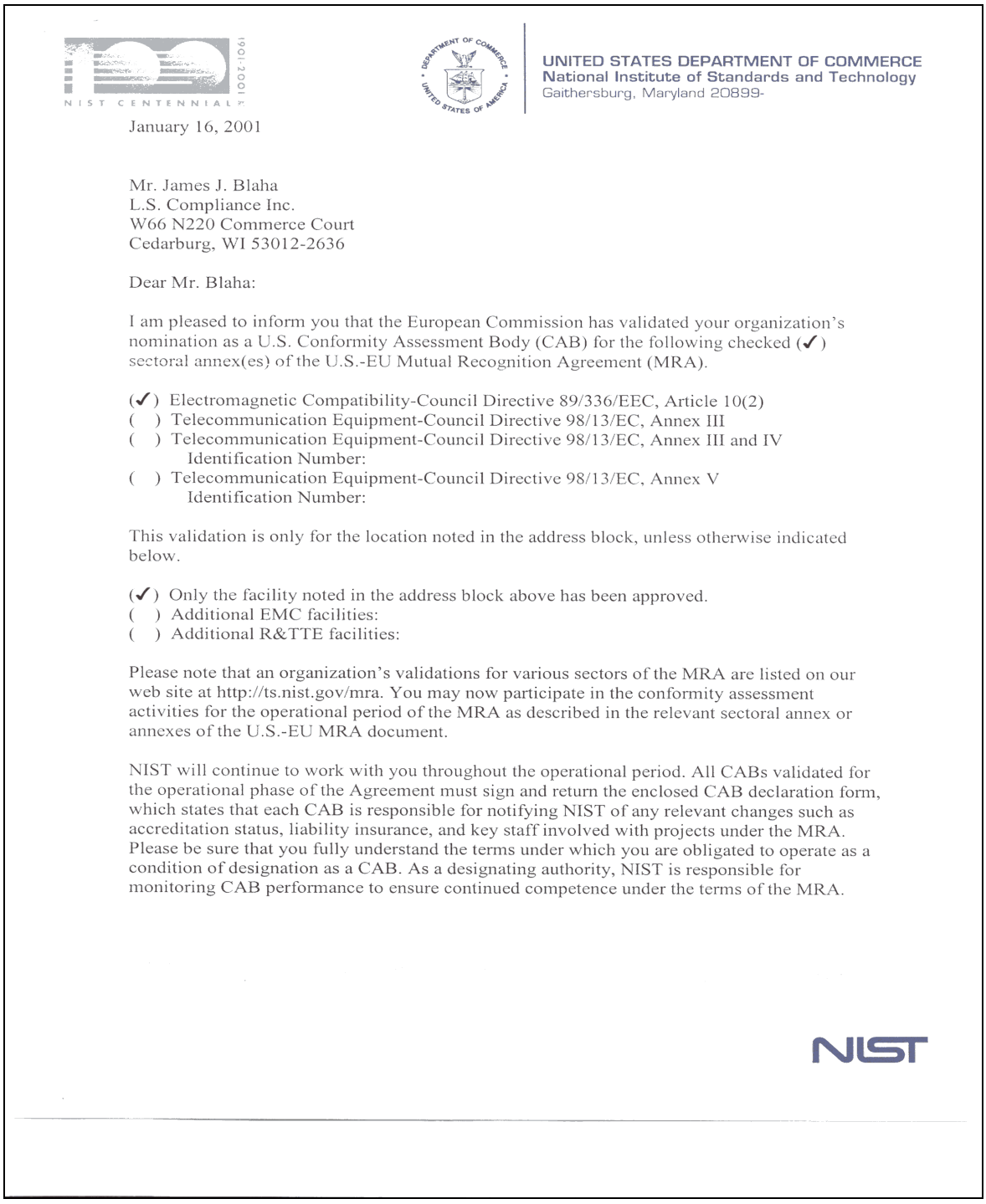
In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following tests:

Test	Test Method(s)
Conducted Emissions Continuous/Discontinuous	Code of Federal Regulations (CFR) 47, FCC Method Parts 15 and 18 using ANSI C63.4; EN: 55011, 55022, 55081-1, 55081-2; CISPR: 11, 22; CNS 13438
Radiated Emissions	Code of Federal Regulations (CFR) 47, FCC Method Parts 15 and 18 using ANSI C63.4; EN: 55011, 55022, 55081-1, 55081-2; CISPR: 11,22; CNS 13438
Conducted Immunity Fast Transients/Burst	IEC: 1000-4-4, 801-4; EN: 61000-4-4, 50082-1, 50082-2
Surge	IEC: 1000-4-5, 801-5; ENV 50142; EN: 61000-4-5, 50082-1, 50082-2
RF Fields	IEC: 1000-4-6, 801-6; ENV 50141; EN: 61000-4-6, 50082-1, 50082-2
Voltage Dips/Interruptions	IEC 1000-4-11; EN: 61000-4-11, 50082-1, 50082-2
Radiated Immunity RF Fields	IEC: 801-3, 1000-4-3; ENV 50140; EN: 61000-4-3, 50082-1, 50082-2
RF Fields (50 Hz)	IEC 1000-4-8; EN 61000-4-8
RF Fields (Pulse Mode)	EN: 50082-1, 50082-2; ENV 50204
Electrostatic Discharge (ESD)	IEC: 1000-4-2, 801-2; BSEN 60801-2; EN: 61000-4-2, 50082-1, 50082-2

(A2LA Cert. No. 1255.01) 06/26/01 Page 1 of 1

5301 Buckeystown Pike, Suite 350 • Frederick, MD 21704-8373 • Phone: 301-644-3248 • Fax: 301-662 2974

4. Validation Letter – U.S. Competent Body for EMC Directive 89/336/EEC



UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, Maryland 20899-

January 16, 2001

Mr. James J. Blaha
L.S. Compliance Inc.
W66 N220 Commerce Court
Cedarburg, WI 53012-2636

Dear Mr. Blaha:

I am pleased to inform you that the European Commission has validated your organization's nomination as a U.S. Conformity Assessment Body (CAB) for the following checked (✓) sectoral annex(es) of the U.S.-EU Mutual Recognition Agreement (MRA).

(✓) Electromagnetic Compatibility-Council Directive 89/336/EEC, Article 10(2)
( ) Telecommunication Equipment-Council Directive 98/13/EC, Annex III
( ) Telecommunication Equipment-Council Directive 98/13/EC, Annex III and IV
Identification Number:
( ) Telecommunication Equipment-Council Directive 98/13/EC, Annex V
Identification Number:

This validation is only for the location noted in the address block, unless otherwise indicated below.

(✓) Only the facility noted in the address block above has been approved.
( ) Additional EMC facilities:
( ) Additional R&TTE facilities:

Please note that an organization's validations for various sectors of the MRA are listed on our web site at http://ts.nist.gov/mra. You may now participate in the conformity assessment activities for the operational period of the MRA as described in the relevant sectoral annex or annexes of the U.S.-EU MRA document.

NIST will continue to work with you throughout the operational period. All CABs validated for the operational phase of the Agreement must sign and return the enclosed CAB declaration form, which states that each CAB is responsible for notifying NIST of any relevant changes such as accreditation status, liability insurance, and key staff involved with projects under the MRA. Please be sure that you fully understand the terms under which you are obligated to operate as a condition of designation as a CAB. As a designating authority, NIST is responsible for monitoring CAB performance to ensure continued competence under the terms of the MRA.

NIST

5. Signature Page

January 11, 2002

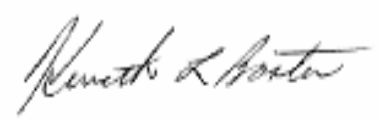
Prepared By: _____

Teresa A. White, Document Coordinator **Date**

January 11, 2002

Tested By: _____

Kenneth L. Boston, PE, EMC Lab Manager **Date**



January 11, 2002

Approved By: _____

Kenneth L. Boston, EMC Lab Manager **Date**
PE #31926 Licensed Professional Engineer
Registered in the State of Wisconsin, United States

6. Product and General Information

Manufacturer:	Qtronics Manufacture, Inc.
Model:	GSS2001RF, GSS2002RF, GSS2003RF and RF2001W
Serial:	Preproduction
Description:	Low power periodic transmitter
Frequency Range:	433.9 MHz
Test Voltage:	115VAC into a 12 VDC wall transformer

Environmental Conditions in the Test Lab:

Temperature:	20-25◦ C
Atmospheric Pressure:	30-60%
Humidity:	86kPa-106kPa

7. Introduction

On December 11th, 22nd, 2001 and January 9th, 2002, a series of Radiated Emissions tests were performed on the GSS2001RF GSS2002RF, GSS2003RF and RF2001W. This product operates by means of a short burst of data transmission containing an I.D. Code. On January 30th, 2001, emission tests were performed on the RF2001W Module to verify its similar performance to the GSS2001RF. A Voltage Variation test was also performed on the GSS2001RF to verify 15.31 (e) performance.

These tests were preformed using the test procedure outlined in ANSI C63.4, 1992 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.231b, for a periodic transmitter.

8. Purpose

The above-mentioned tests were performed in order to determine the compliance of the EUT, with limits contained in various provisions of Title 47CFR, FCC Part 15, including: 15.207, 15.209, 15.231b, 15.231c and 15.31(e).

All radiated emission tests were performed to measure the emissions in the frequency bands and to determine whether said emissions are below the limits established by the above sections.

These tests were performed in accordance with the procedures described in the American National Standard for methods of measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4, 1992).

Also used as a reference for the EMI Receiver specification is the International special Committee on Radio Interference – CISPR 16-1, 1993.

9. Summary of Test Report

The Qtronics GSS2001RF was found to MEET the requirements as described within the specifications of Title 47 CFR, Part 15.231 and RSS-210, Section 6.2.2 for a low power periodic transmitter.

10. Product Description

The Qtronics GSS2001 is a wireless CO and Gas detector module; the GSS2002RF is a CO Monitor, and the GSS2003RF is a Gas Monitor. It is powered from a 12 VDC wall adapter, and can be connected to a safety gas sensor. All three of the GSS series monitors are physically and electrically identical. When activated by an alarm, the device sends a short coded burst out to a receiver (RFT2001), which reproduces the alarm. The RF2001W is a wireless water sensor module that is nearly identical to the GSS2001 gas module, but is used to transmit an alarm, if a water alarm is sensed. The RF2001W is housed in a smaller case than the GSS series monitors.

11. Test Requirements

The Qtronics GSS2001 will be tested to the following FCC Parts: 15.231b, 15.231c, 15.207 and 15.31(e).

12. Radiated Emission Test

12a. Test Setup

The EUT was operated within the 3 Meter FCC listed Semi-Anechoic Chamber, located at L.S. Compliance, Inc., Cedarburg, Wisconsin. The EUT was placed on an 80cm high wooden pedestal, which was centered on the flush mounted 2m diameter metal turntable. The EUT was configured to run in a continuous transmit mode during the 15.231b measurements. One sample was modified to transmit continuously for tests of the fundamental and spurious/harmonic emissions. This unit was then returned to normal operation for testing of the data packet length and occupied bandwidth.

12b. Test Procedure

The fundamental and spurious (harmonic) emissions of the transmitter were tested for compliance to Title 47CFR, FCC Part 15.231b limits for periodic devices.

The EUT was tested from the lowest frequency generated by the transmitter (without going below 9 kHz) to the 10^{th} harmonic of the fundamental frequency generated by the device. The appropriate limits were also observed when the fundamental or spurious signals were located within any of the restricted bands as described in Part 15.205a.

The EUT was placed on a 80 cm high pedestal, with the Antenna Mast placed 3 m from the EUT. A Biconical Antenna or Tuned Dipole was used to measure emissions from 30 MHz to 200 MHz, a Log Periodic or Tuned Dipole was used to measure emissions from 200 MHz to 1000 MHz, and a Double Ridged Waveguide Horn Antenna was used to measure emissions above 1 GHz.

The EUT was programmed to operate in continuous transmit. The resultant signals were maximized by rotating the turntable 360 degrees, and by raising and lowering the Antenna between 1 and 4 meters. The EUT was also given different orientations to determine the maximum signal levels, using both horizontal and vertical antenna polarities. While oriented in the maximum direction, the transmitter radiated output was monitored, while the AC line voltage to the transformer powering the unit was varied. The lowest voltage used was 98VAC (85% of 115VAC) and the highest voltage used was 132VAC (115%).

12c. Test Results

No significant emissions were found aside from the transmitter fundamental and several harmonics. The unit was scanned for emissions, over the range of 30 to 4500 MHz to establish compliance with Part 15.231b and 15.205 while in continuous transmit mode. At frequencies below the fundamental, no spurious signals, other than the noise floor of the system could be found within 20dB of the limits. While conducting the 15.31(e) measurements, the fundamental carrier level was not seen to vary over the voltage variation, with the exception that the unit dropped out of transmit when the AC voltage was decreased below 105VAC.

12d. Occupied Bandwidth

In addition to measuring the levels of radiated emissions, the occupied bandwidth of the transmitter was measured. In accordance with FCC Part 15.231c, the 20dB bandwidth of the transmitted signal should be within a window of 0.25% of the center carrier frequency. The resolution bandwidth was set to the closest available filter setting on the HP8546A EMI system than corresponded to 5% of the allowable bandwidth determined in the calculation mentioned above, without going below the resolution bandwidth of 10kHz, as dictated in ANSI C63.4-1992 Section 13.1.7.

The sample was activated to transmit in a single burst mode and was placed on the aforementioned test configuration within the 3 meter Chamber. The transmitted signal was captured on the Log Periodic Antenna and fed to the HP8546A EMI Receiver, where the fundamental frequency was displayed, and a plot of the occupied bandwidth was produced.

From the graph shown on the following page, the bandwidth was seen to be 53.8 kHz, which is within the allowable 0.25% bandwidth of 1085 kHz by a large margin.

12e. Test Equipment Utilized, Radiated Emissions

A list of the test equipment and antennas used for the tests can be found in Appendix A. All equipment is calibrated and used according to the user manuals supplied by the manufacturer. All antenna calibrations were performed at a N.I.S.T. traceable site, and the resultant correction factors were entered into the HP8546A EMI Receiver software database.

The connecting cables used were also measured for loss using a calibrated Signal Generator and the HP8546A EMI Receiver. The resulting loss factors were entered into the HP8546A database. This allowed for automatic change in the antenna correction factor, as well as cable. The resulting data taken from the HP8546A EMI Receiver is an actual reading and can be entered into the database as a corrected meter reading. When a reading is taken using the peak detector, a duty cycle correction factor can be applied for conversion to an average reading. This operation can be used when measuring periodic data transmission, under FCC Part 15.231b and Part 15.231c.

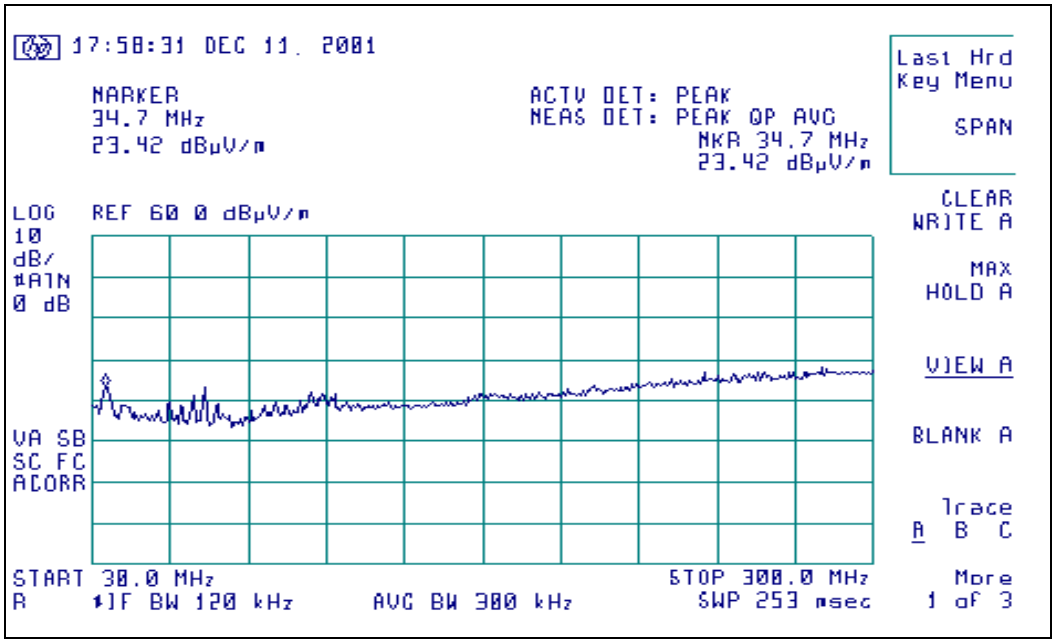
The resulting average reading was then compared to the appropriate limit in order to determine compliance. The HP8546a EMI Receiver was operated with a bandwidth of 120 kHz when receiving signals below 1 GHz, and with a bandwidth of 1 MHz when receiving signals above 1 GHz, in accordance with CISPR 16.

The Peak, Quasi-Peak and Average detector functions were all used.

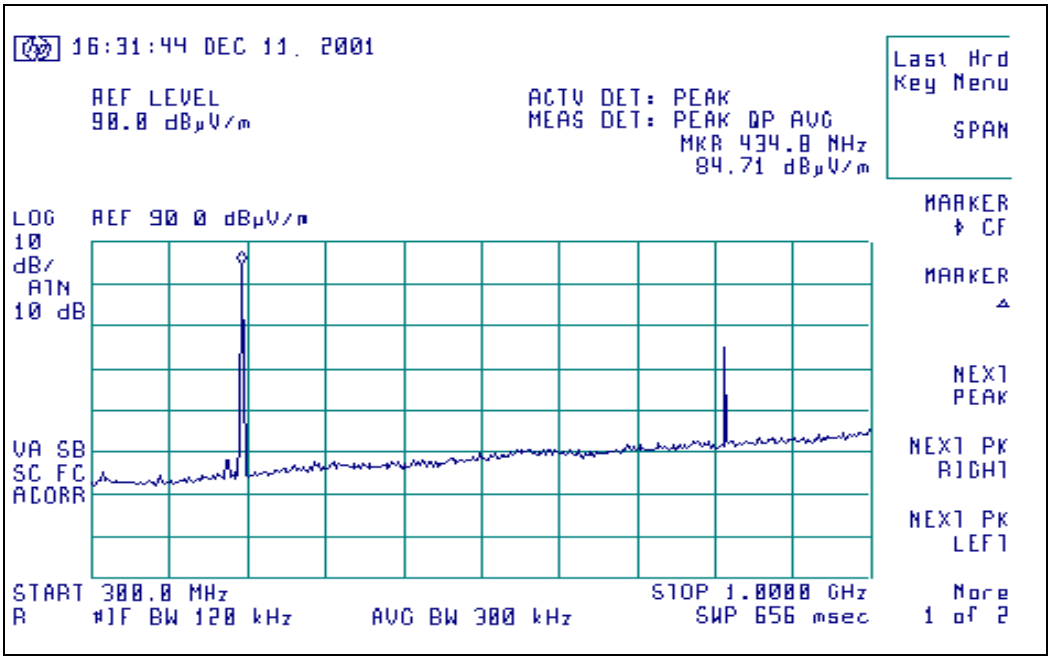
12f. Photo of Setup for Radiated Emissions Test in the 3 Meter Semi-Anechoic Chamber

12g. Signature Scans – Radiated Emissions: GSS2001 Test Sample, unless noted.

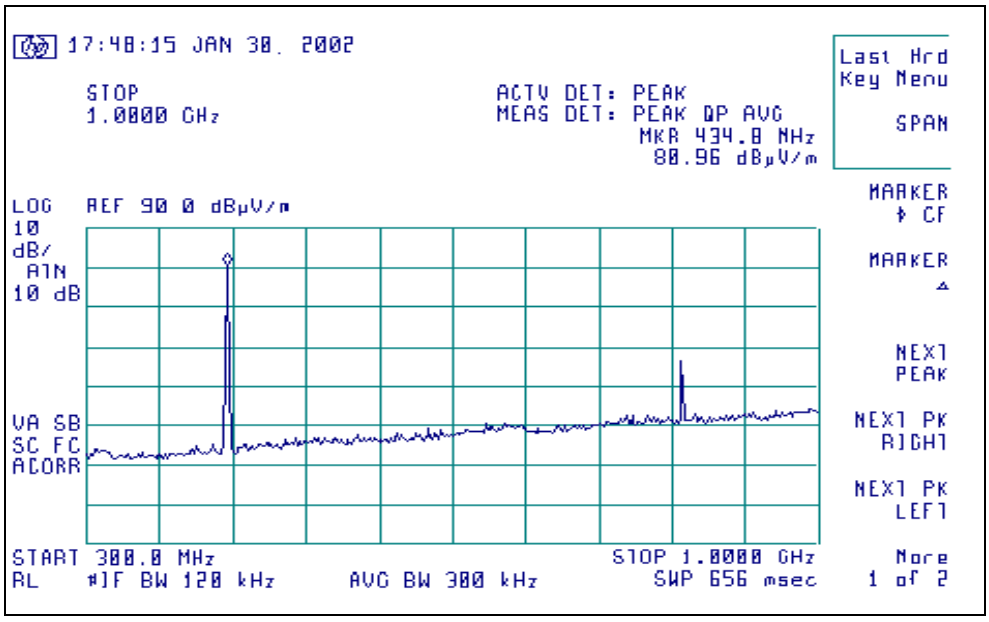
Signature Scan, Vertical Polarization
30 MHz – 300 MHz



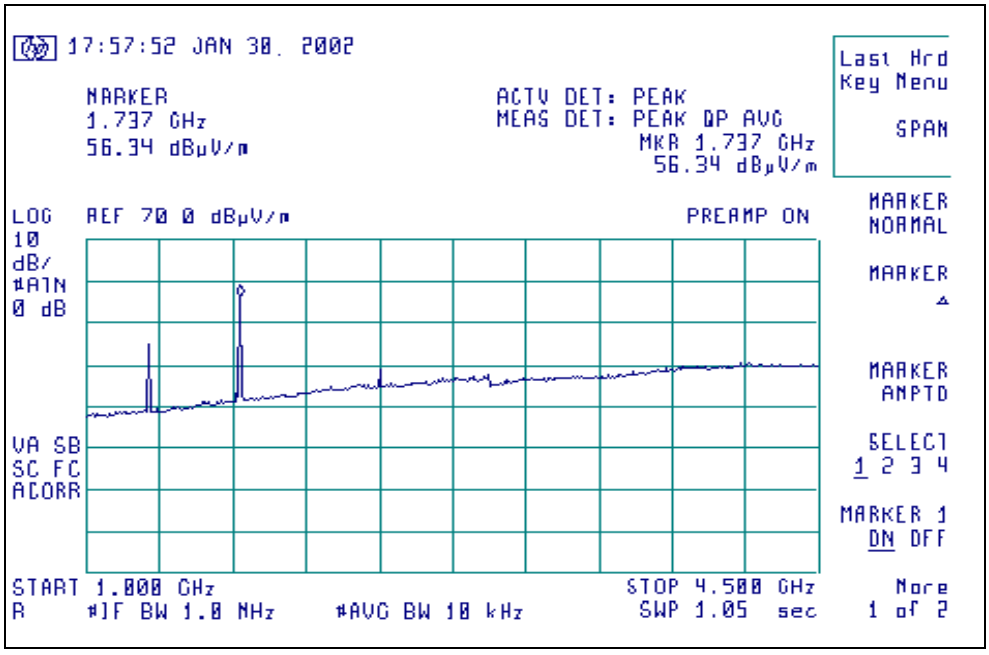
Signature Scan, Horizontal Polarization
300 MHz – 1000 MHz



Signature Scan, Vertical Polarization (RF2001W)
300 MHz – 1000 MHz

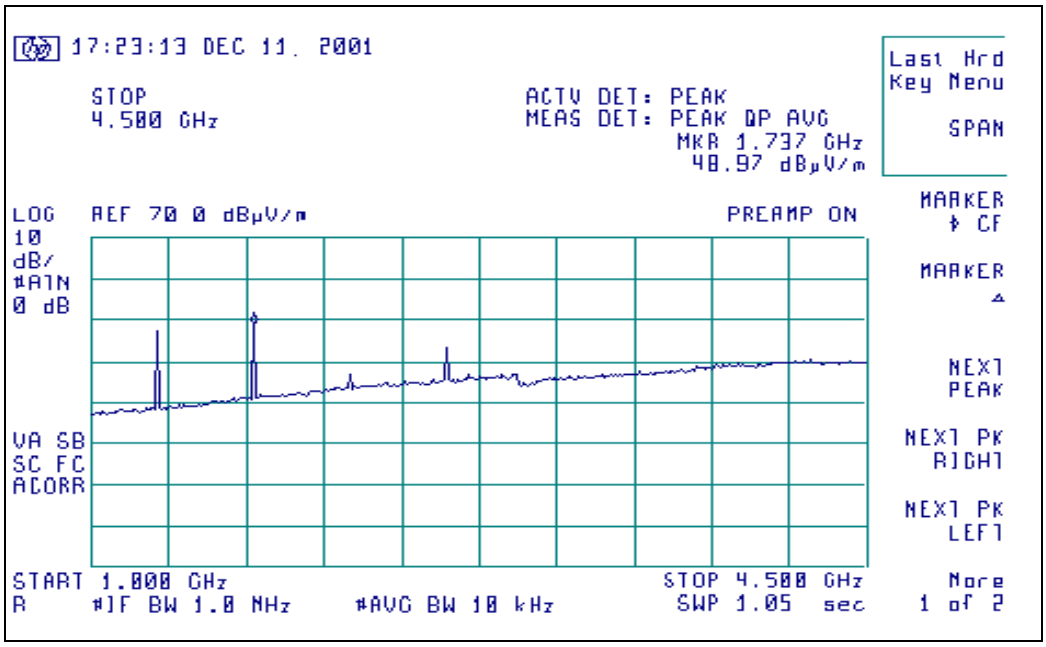


Signature Scan, Horizontal Polarization (RF2001W)
1000 MHz – 4500 MHz

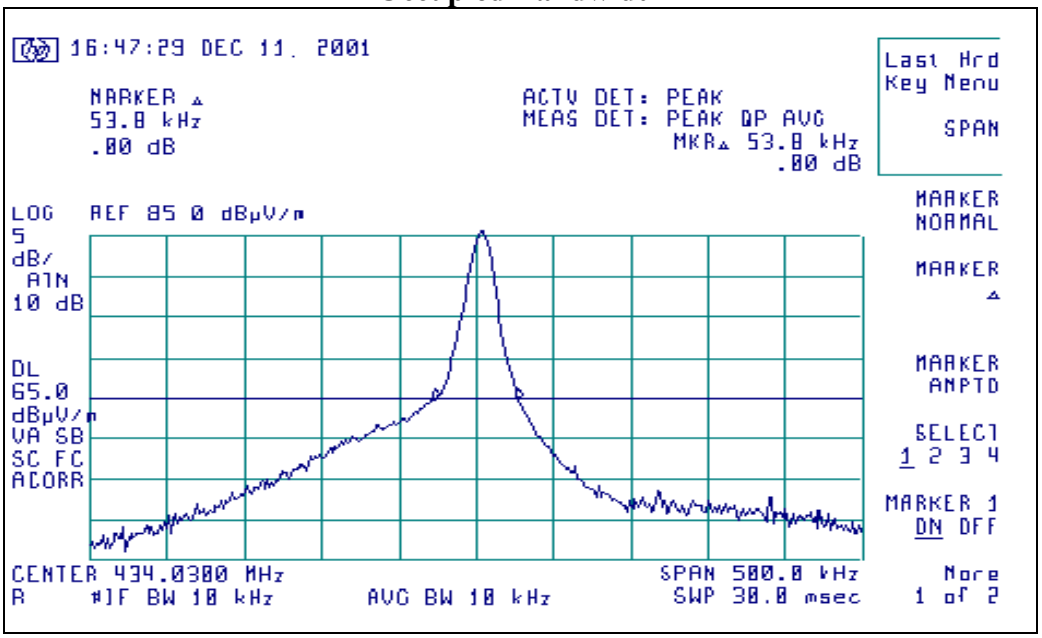


Note: The above scans are included to show the nearly identical performance of the transmitter module in the smaller case.

Signature Scan, Vertical Polarization
1000 MHz – 4500 MHz

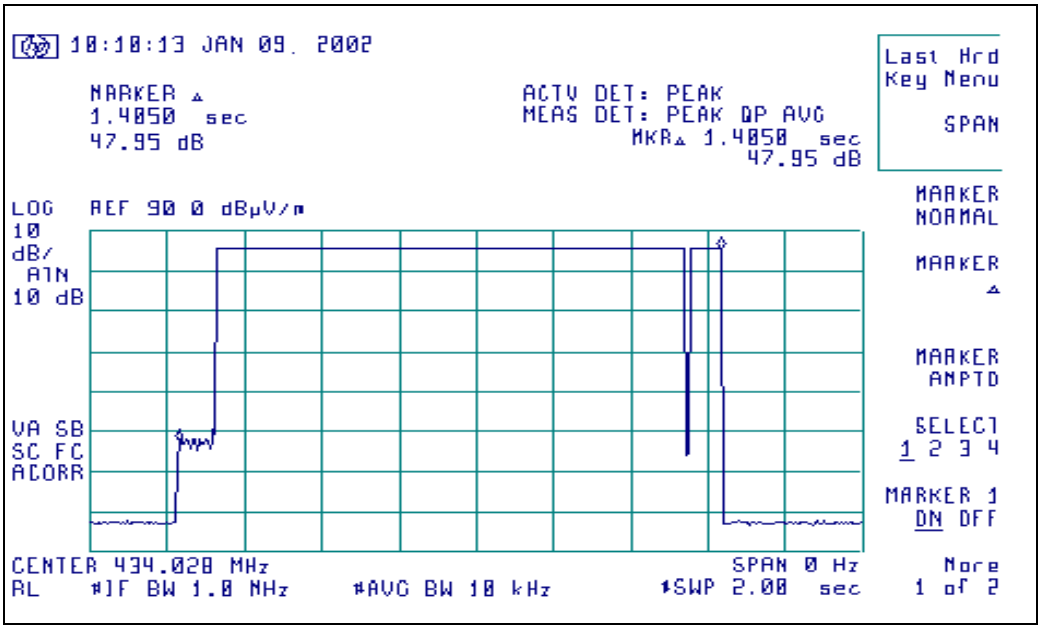


Signature Scan
Occupied Bandwidth

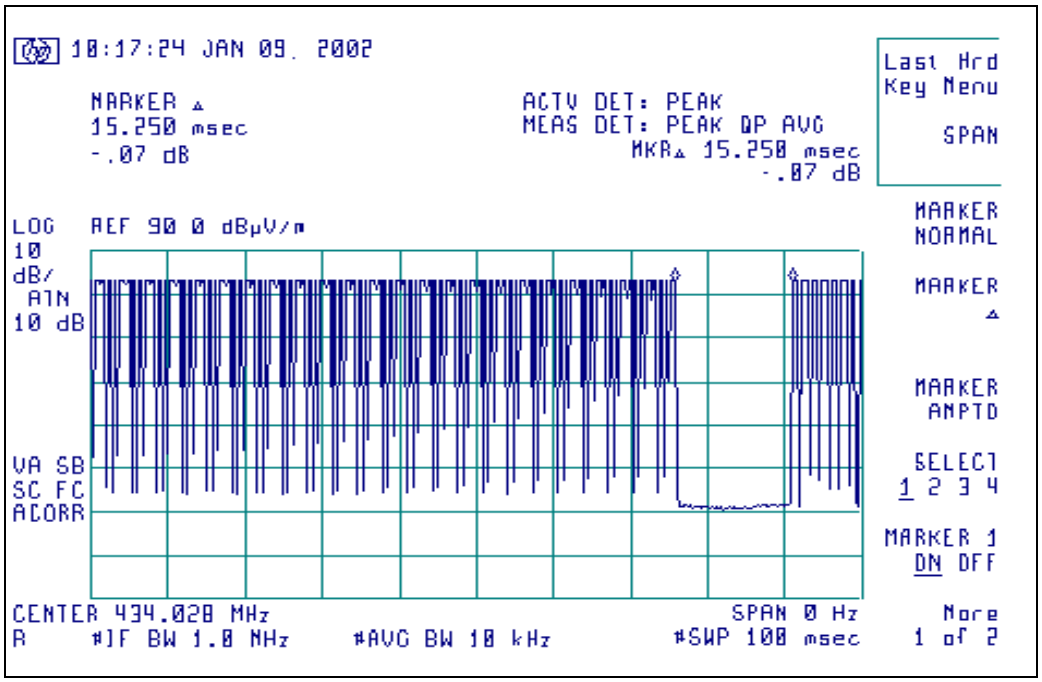


12h. Data Packet Detail – Radiated Emissions

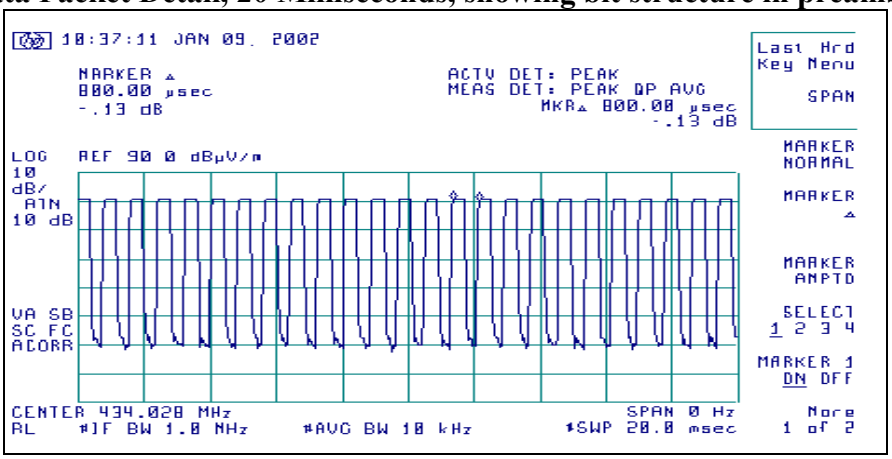
Data Packet Detail, 2 Seconds, showing 1 entire packet



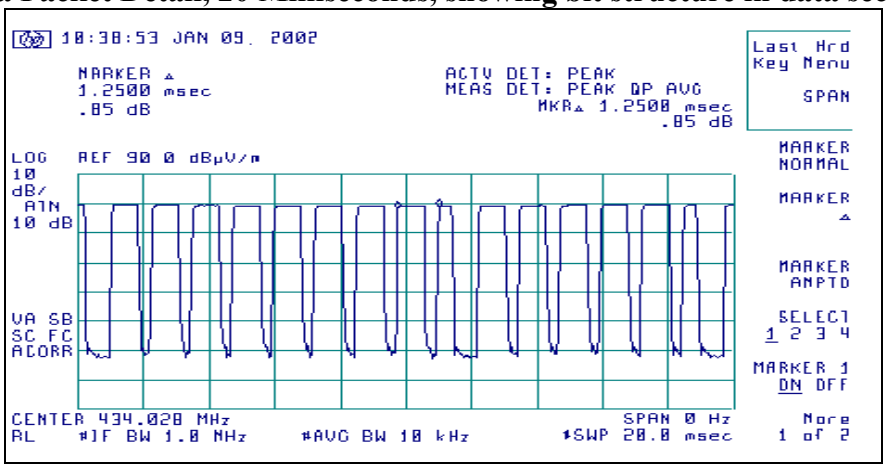
Data Packet Detail, 100 Milliseconds, showing 15 msec header break



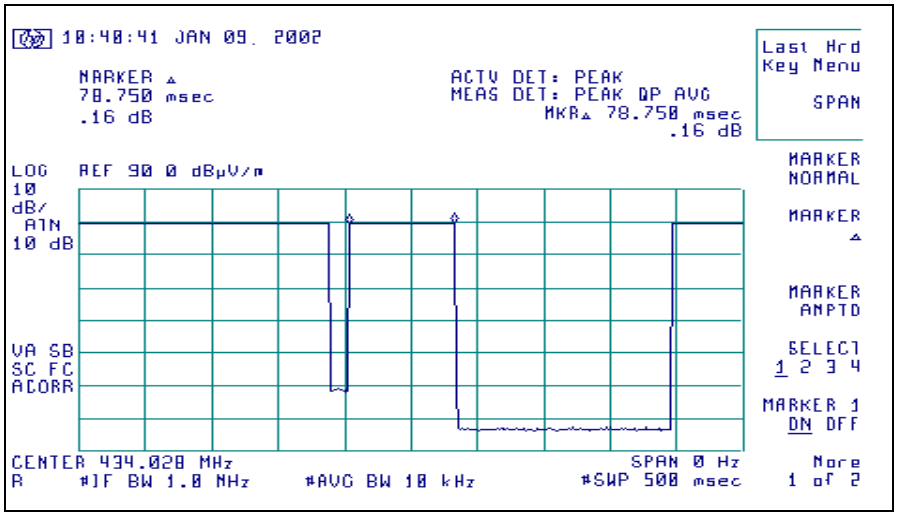
Data Packet Detail, 20 Milliseconds, showing bit structure in preamble



Data Packet Detail, 20 Milliseconds, showing bit structure in data section



Data Packet Detail, 500 Milliseconds, showing the 78 Milliseconds length of the data section



12i. Measurement of Electromagnetic Radiated Emissions

Measurement of Electromagnetic Radiated Emissions Within the 3 Meter Semi-Anechoic FCC Listed Chamber

Manufacturer:	Qtronics Manufacture, Inc.
Date of Test:	December 11, 2001
Model:	GSS2001 and RF2001W
Serial:	Preproduction
Specifications:	15.231b and 15.209
Distance:	3 Meters
Detector(s) Used:	Peak
Frequency Range Inspected:	30 to 4500 MHz
Configuration:	Continuous Data Transmit
Equipment:	HP 8546 A EMI Receiver; EMCO 3115 Double-Ridged Wave Guide/Horn Antenna; EMCO 93146 Log Periodic Antenna; EMCO 3121C Dipole Set Antenna; EMCO 3110B Biconical Antenna

The following table depicts the level of significant fundamental and harmonic emissions found.

GSS2001

Frequency (MHz)	Antenna Polarity	Height (Meters)	Azimuth (0◦-360◦)	EMI Meter Reading (dBµV/m)	Duty Cycle Correction (dB)	Corrected Reading (dBµV/m)	15.231b Limit (dBµV/m)	Margin (dB)
433.92	H	1.0	340	85.6	5.15	80.45	80.82	.37
433.92	V	1.15	135	85.8	5.15	80.65	80.82	.17
868	H	1.0	15	65.9	5.15	60.75	60.82	.07
1302	V	1.0	175	50.1	5.15	44.95	60.82	15.87
1736	H	1.1	325	55.6	5.15	50.45	60.82	10.37
2170	V	1.3	0	45.7	5.15	40.55	60.82	20.27
2604	V	4.55	0	49.3	5.15	44.15	60.82	16.67
3038	--	--	--	37.7*	5.15	32.55	60.82	28.27
3472	V	1.15	0	48.6	5.15	43.45	54.0	10.55
3906	--	--	--	47.7*	5.15	42.55	54.0	11.45
4340	--	--	--	49.8*	5.15	44.65	54.0	9.35

*Higher order harmonics were found to be below the noise floor of the receiving system.

RF2001W (Small Sensor)

433.92	V	1.0	120	84.9	5.15	79.75	80.82	1.07
868	H	1.0	70	62.0	5.15	56.85	60.82	3.97
1302	V	1.0	0	45.0	5.15	39.85	60.82	20.97
1736	H	1.1	0	57.0	5.15	51.85	60.82	8.97

13. Conducted Emission Test

13a. Test Setup

The Conducted Emission tests were performed within an 8 by 10 foot Shielded Room, located at L.S. Compliance, Inc., in Cedarburg, WI. The test item was placed on a non-conductive rubber cart with a height of 80 cm above the reference ground plane. The test object was spaced 40 cm from the rear wall of the Shielded Room and further than 80 cm from adjacent walls, and the test object power supply was plugged into a 50 Ohm 50/250µH Line Impedance Stabilization Network (LISN). The test area and setup are in accordance with ANSI C63.4-1992, Sections 5,6, and 7. The AC power supply to the LISN was fed into the Shielded Room via an appropriate broadband EMI filter. The test sample was modified to transmit continuously during the Conducted Emission Test.

13b. Test Procedure

After the EUT was setup in the Shielded Room and connected to the LISN, the RF sampling port of the LISN was cabled to a 10 dB Attenuator-Limiter, and then to the EMI Analyzer. The EMCO LISN used has the facility to terminate the unused port with a 50 Ohm load when switched to either L1 (line) or L2 (neutral). The appropriate frequency range and bandwidths were entered into the HP 8546A EMC Receiver, and measurements were made. The test object cables and position were varied to find the maximum signal levels. Final readings were then taken and recorded. The test procedure guidelines used are found in ANSI C63.4-1992: Sections 7 and 11, including Annex E1 and E2.

The limits for Conducted Emissions for this test object are found in Title 47CFR, FCC Part 15.207(b) for an intentional radiator. The levels of these limits are 250µV (48dBµV) from 450 kHz to 30 MHz. Test results are located in Appendix II and pictures of the test setup are in Section 1.11.

13c. Test Results

No significant emissions were found emanating from the wall transmitter. The unit was scanned for emissions, over the range of 0.45 to 30 MHz to establish compliance with Part 15.207 while in continuous transmit mode.

13d. Test Equipment Utilized

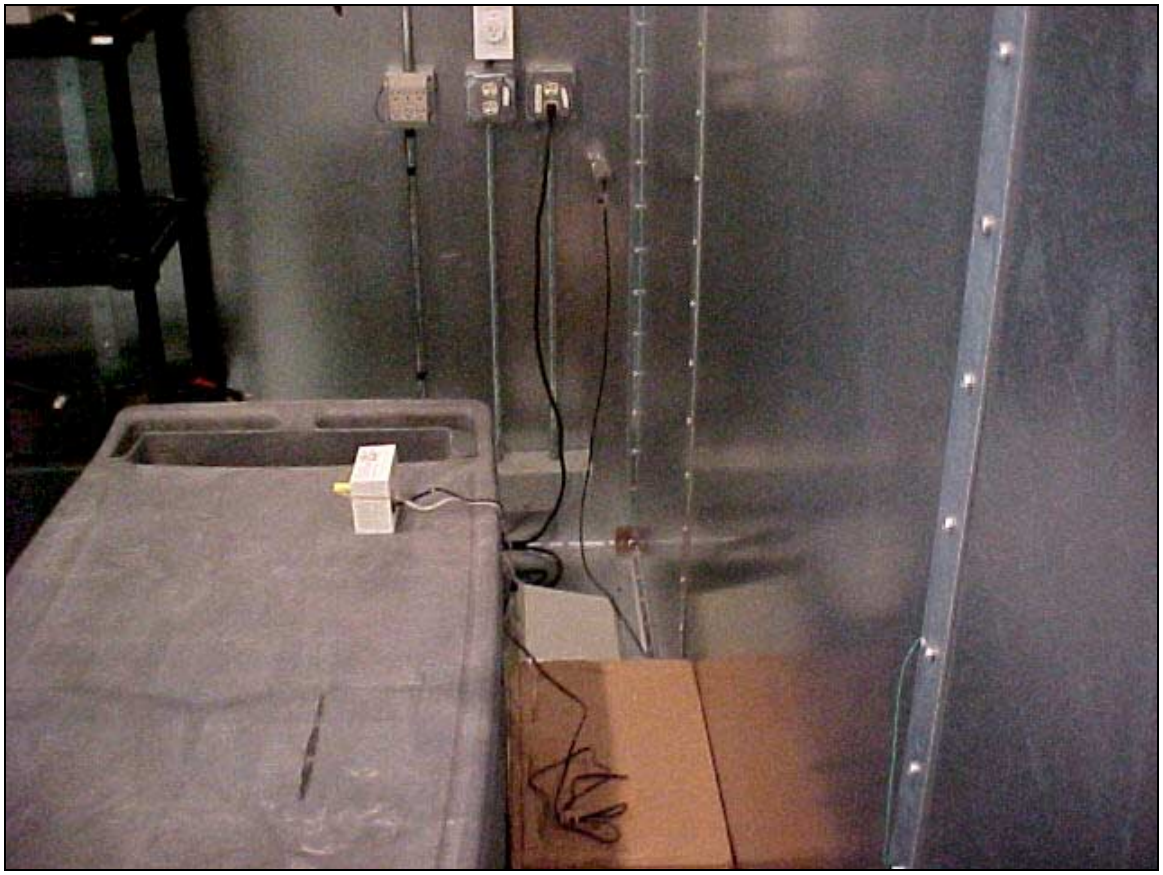
A list of the test equipment and antennas used for the tests can be found in Appendix A. All equipment is calibrated and used according to the user manuals supplied by the manufacturer. All antenna calibrations were performed at a N.I.S.T. traceable site, and the resultant correction factors were entered into the HP8546A EMI Receiver software database.

The connecting cables used were also measured for loss using a calibrated Signal Generator and the HP8546A EMI Receiver. The resulting loss factors were entered into the HP8546A database. This allowed for automatic change in the antenna correction factor, as well as cable. The resulting data taken from the HP8546A EMI Receiver is an actual reading and can be entered into the database as a corrected meter reading. When a reading is taken using the peak detector, a duty cycle correction factor can be applied for conversion to an average reading. This operation can be used when measuring periodic data transmission, under FCC Part 15.231b and Part 15.231c.

The resulting average reading was then compared to the appropriate limit in order to determine compliance. The HP8546a EMI Receiver was operated with a bandwidth of 9 kHz while receiving signals from 450 kHz to 30 MHz in accordance with CISPR 16.

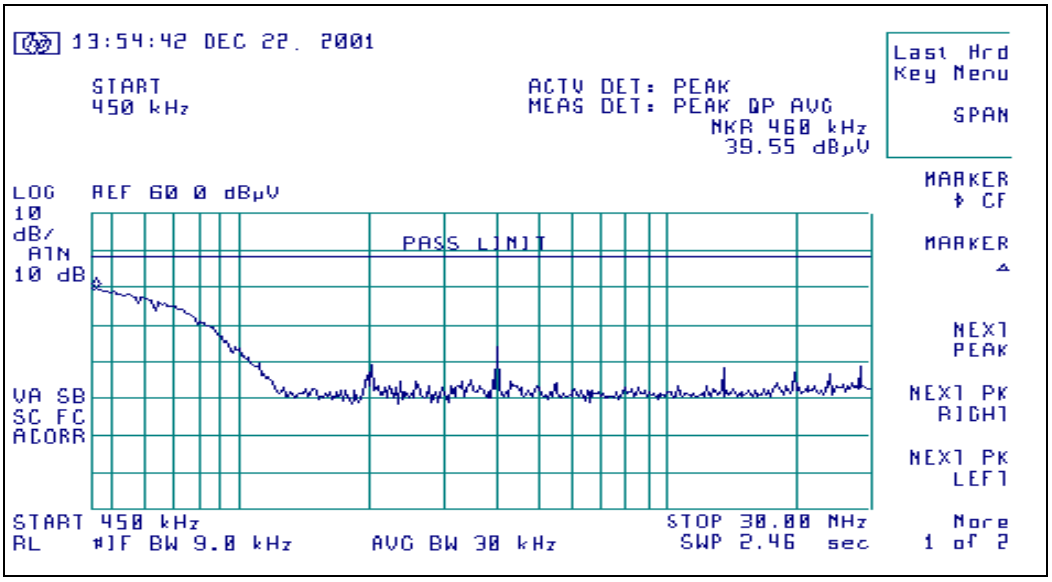
The Quasi-Peak detector function was used.

13e. Photo of Setup for Conducted Emissions Test

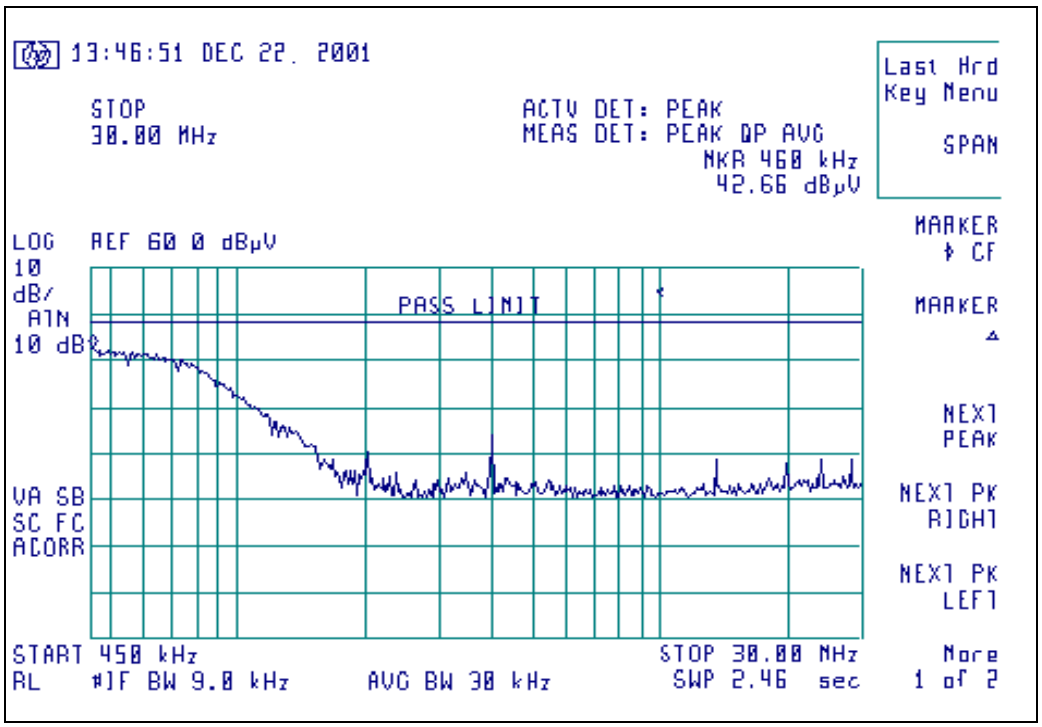


13f. Signature Scans – Conducted Emissions

Signature Scan
450 kHz – 30 MHz L1



Signature Scan
450 kHz – 30 MHz L2



13g. Measurement of Conducted Emissions

Measurement of Conducted Emissions
In the FCC Listed Shielded Room

Manufacturer:	Qtronics Manufacture, Inc.
Date of Test:	December 11, 2001
Model:	GSS2001 RF
Serial:	Pre-production
Specifications:	15.207
Distance:	N/A
Detector(s) Used:	Quasi-Peak
Frequency Range Inspected:	0.450 – 30.0 MHz
Configuration:	Continuous Data Transmit
Equipment:	HP 8546 A EMI Receiver; EMCO 3816/2NM LISN

The following table depicts Conducted Emissions measured.

Frequency (MHz)	Line	EMI Meter Reading (dBµV)	15.207 Limit (dBµV)	Margin (dB)
0.453	L1	33.7	48.0	14.3
0.471	L1	32.8	48.0	15.2
0.525	L1	32.4	48.0	15.6
0.461	L2	35.9	48.0	12.1
0.481	L2	35.2	48.0	12.8
0.509	L2	34.8	48.0	13.2
0.517	L2	34.5	48.0	13.5
0.525	L2	34.9	48.0	13.1

APPENDIX A

Calculations

Manufacturer:	Qtronics Manufacture, Inc.
Date of Test:	December 11, 2001
Model:	GSS2001 RF
Serial:	Pre-production
Specifications:	15.207

CALCULATION OF RADIATED EMISSIONS LIMITS FOR FCC PART 15.231(B) (260-470 MHz)

FIELD STRENGTH OF FUNDAMENTAL FREQUENCIES:
The calculation involves a linear interpolation of 3,750 to 12,500 µV/m over 260-470 MHz, where field strength of the fundamental frequency (f_o) when $260 \leq f_o \leq 470$ MHz, Can be found by: $3{,}750 + 41.667(f_o - 260)$, where f_o is in MHz.

FIELD STRENGTH OF SPURIOUS/HARMONIC FREQUENCIES:
The calculation involves a linear interpolation of 375 to 1,250 µV/m over 260 to 470 MHz, where field strength of the harmonic frequencies ($2f_o$, $3f_o$...), when $260 \leq f_o \leq 470$ MHz, can be found by: $375 + 1.667(f_o - 260)$, where f_o is in MHz.

** Where f_o = 434 MHz
Fundamental: 3,750 + 41.667 (434-260)= 11,000µV/m
Harmonic: 375 + 1.667 (390-260) = 1,100 µV/m

Frequency (MHz)	Fundamental Limit (µV/m)	Fundamental Limit (dBµV/m)	Harmonic Limit (µV/m)	Harmonic Limit (dBµV/m)
434	11,000	80.82	1,100	60.82

DUTY CYCLE CORRECTION FACTOR CALCULATION

For a graphical presentation of the data bursts being transmitted from the Transmitter, refer to Pages 15 and 16. This plot was taken of a unit which has been programmed to send its activation code repeatedly, by holding down one of the buttons, to permit radiated emissions tests to be readily performed.

Average (Relaxation) Factor

Average Factor = 20 * Log (Worst Case On-time over 100 ms)

Message Format: Upon receiving an alarm, or test activation, the EUT sends a 1200 ms (1500 bit) preamble, followed by a 15 ms header, and then a data package (64 bit) of 76.8 ms length. The preamble is always a 50% duty cycle (.400 bit high, then 0.400 ms bit low). The header is 15 ms low, and the 64 bit data package is 2/3 high, 1/3 low (0.800 ms then 0.400 ms) for a worst case packet; all 1's for data bits.

Averaging Factor Calculation: [On – time / 100 ms period]

Worst Case (all data bits = 1)

The worst case 100 milliseconds then occurs at the END of the 1300 ms (approximate) packet. With a data portion length of 76.8 ms, preceded by a 15 ms header (all low), leaves only an 8.2 ms section on the back end of the preamble.

So 8.2 (x.5) = 4.1 ms plus 76.8 (x.5) = 51.2 equals 55.3 ms total on time.

When the total on-time is computed over a 100 millisecond window, according to FCC Part 15.35(c) where the pulse train exceeds 100 milliseconds, a total of 55.3 milliseconds re obtained. This results in a relaxation factor of 5.15 dB, which is under the allowable cap of 20 dB, as stated in FCC Part 15.35(b).

Relaxation Factor = 20 log (0.553) = 5.15

Occupied Bandwidth Calculations

FCC part 15.231(c) states that the bandwidth of the periodic device shall be no wider than 0.25% of the center frequency for devices operating between 70 and 900 MHz.

Said bandwidth is determined at the -20 dB reference to peak carrier points.

For 434 MHz, the 20 dB bandwidth is 0.0025 x 434 = 1.085 MHz

Refer to the set of graphs that show the actual occupied bandwidth of the EUT, which for this sample is 0.054 MHz, well within the limits.

APPENDIX B

Test Equipment List

Asset #	Manufacturer	Model #	Serial #	Description	Calibration Information	
					Date	Due Date
AA960004	EMCO	93146	9512-4276	Log-Periodic Antenna	02-28-01	02-28-02
AA960005	EMCO	3110B	9601-2280	Biconical Antenna	09-24-01	09-24-02
AA960008	EMCO	3816/2NM	9701-1057	Line Impedance Stabilization	09-11-01	09-11-02
AA960014	Fischer	FCC-801-M3-25	148	Coupler-De-Coupler Network	10-06-01	10-06-02
AA960023	Werlatone	C3910	5167	Directional Coupler 40dB	06-19-01	Note 1*
AA960024	Pasternack	100 Watts	PE 7021-6	DC-1.5 GHz Attenuator	I/O	Note 1*
AA960031	HP	11947A	3107A01708	Transient Limiter	10-22-00	10-03-01
AA960054	Giga-Tronics	80301A	1830164	Power Sensor	08-21-01	08-21-02
AA960050	Chase	BiCBL6140A	Bilog 1106	Bilog Antenna	06-19-01	Note 1*
CC00181C	HP	33120A	US36013549	Signal Generator	09-29-00	N/A
EE960003	Amplifier Research	100W 1000M1A	19821	100 Watts Amp	06-19-01	Note 1*
EE960005	Giga-Tronics	8542C	1831450	Dual Channel Power Meter	08-15-01	08-15-02
EE960006	Haefely Trench	PESD 1600	H604079	ESD Gun	10-24-01	10-24-02
EE960007	Haefely Trench	Pline 1610	083732-19	Line Fluctuation Generator	10-30-01	10-30-02
EE960010	Haefely Trench	P-Surge-4	083061-08	Power Surge Generator	10-25-01	10-25-02
EE960011	Haefely Trench	PEFT 4010	083180-21	EFT/Burst Generator	10-18-01	10-18-02
EE960013	HP	8546A	3617A00320	Receiver RF Section	10-31-01	10-31-02
EE960014	HP	85460A	3448A00296	Receiver Pre-Selector	10-31-01	10-31-02
EE960015	HP	6843A	3531A-00145	AC Power Source/Analyzer	10-22-00	N/A
EE960016	Marconi	2024	112120/044	Signal Generator	08-15-01	08-15-02
FF666001	Fischer	FCC-LISN-50-100-4-01	9901	100 A (4Line) LISN	05-10-01	05-10-02
FF666002	Fischer	F201-32mm	347	Absorbing Clamp	02-01-01	02-01-02
FF666003	Fischer	F2031-32mm	361	EM Injection Clamp	06-22-01	N/A
FF666013	HP	8698A	3636A02735	Signal Generator	05-15-01	05-15-02
FF666022	Amplifier Research	75A250	21952	75 Watts Amp	06-22-01	Note 1*
EE960145	Voltech	PMI	00934644	Impedance Network	02-02-01	02-02-02
EE960144	Voltech	Standard 555	IB71/6968	Precision Power Analyzer	02-27-01	02-27-02

Note 1* - Equipment calibrated within a traceable system.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uc Value in Appropriate Units
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.24 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.8 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.18 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.92 dB
Conducted Emissions	Shielded Room/EMCO LISN	1.60 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	1.128 Volts/Meter
Conducted Immunity	3 Volts level	1.0 V