LS Research, LLC
ACCREDITED
Cert. # 1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012 ● USA
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com

COMPLIANCE TESTING OF:

Scout 1000 Sensor

PREPARED FOR:

Pentar Inc.
Attn: Jim Bailey
906 Bob Wallace Ave Suite F
Huntsville, AL 35801

TEST REPORT NUMBER: 308276

LSR Job #: C-396

TEST DATE(S):

November 18-23, 2008

Table of Contents

1. LS Research, LLC In Review

LS Research, LLC - Accreditations and Listing's

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 : 2005
with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: 1255.01

Federal Communications Commission (FCC) – USA

Listing of 3 Meter Semi-Anechoic Chamber based on Title 47 CFR – Part 2.948
FCC Registration Number: 90756

Industry Canada

On file, 3 Meter Semi-Anechoic Chamber based on RSS-212 – Issue 1
File Number: IC 3088-A

On file, 3 and 10 Meter OATS based on RSS-212 – Issue 1
File Number: IC 3088

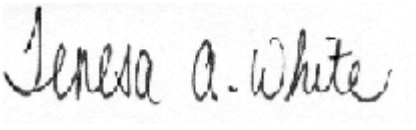
U. S. Conformity Assessment Body (CAB) Validation

Validated by the European Commission as a U. S. Competent Body operating under the U. S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union Electromagnetic Compatibility –Council Directive 2004/108/EC (formerly 89/336/EEC, Article 10.2)
Date of Validation: January 16, 2001

Validated by the European Commission as a U.S. Notified Body operating under the U.S./EU, Mutual Recognition Agreement (MRA) operating under the European Union Telecommunication Equipment – Council Directive 99/5/EC, Annex V.

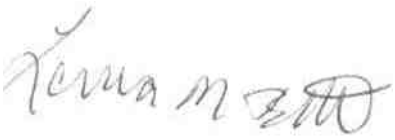
Date of Validation: November 20, 2002
Notified Body Identification Number: 1243

2. Signature Page



Reviewed By: December 9, 2008

Teresa A. White, Document Quality Manager Date



Tested By: December 9, 2008

Laura Bott, EMC Engineer Date

Approved By: December 9, 2008

Kenneth L. Boston, PE, Sr. EMC Engineer Date

3. Product and General Information

Manufacturer:	Pentar Inc.					
Date(s) of Test:	November 18-23, 2008					
Test Engineer(s):	x	Laura Bott		Ryan Urness		Ken Boston
Model #:	Scout 1000 Sensor					
Serial #:	n/a					
Voltage:	3.0 VDC					
Operation Mode:	Normal, continuous modulated transmit					

4. Introduction

On November 18-23, a series of Radiated Emission tests were performed on one sample of the Scout 1000 Sensor henceforth referred to as the "*Equipment Under Test*" or "*EUT*". These tests were performed using the procedures outlined in ANSI C63.4-2003 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.249 (Industry Canada RSS-210, Issue 7, 2007) for a low power transmitter. These tests were performed by Laura Bott, EMC Engineer of LS Research, LLC.

All Radiated and Conducted Emission tests were performed upon the EUT to measure the emissions in the frequency bands described in FCC Title 47 CFR Part 15, including 15.35, 15.209, 15.249 and Industry Canada RSS-210, Issue 7, 2007 to determine whether these emissions are below the limits expressed within the standards. These tests were performed in accordance with the procedures described in the American National Standard for methods of measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2003). Another document used as a reference for the EMI Receiver specification was the Comite International Special Des Perturbations Radioelelectriques (CISPR) Number 16-1, 2003.

5. Product Description

The Scout 1000 System is a portable motion detection system consisting of a wrist worn receiver and up to six sensors. Sensors detect motion using pyroelectric IR sensing and send short data packets wirelessly to the receiver. Data packets are also sent once per minute when no motion is detected. Sensors operate in simplex mode and packets are always sent twice with a random interval of up to one second between them. Packets contain 128 bits at 28 KBPS. Packet data includes the unique serial number of the sensor and various status information. The carrier frequency is 920 MHz and modulation is MSK. Sensors are powered from two AA alkaline batteries and have an internal wire antenna that approximates a ¼ wave whip.

6. EUT'S TECHNICAL SPECIFICATIONS

Additional Information:

Frequency Range (in MHz)	920 MHz
RF Power in Watts	0.0005 Watts
Conducted Output Power (in dBm)	-3 dBm
EIRP (in mW)	N/A
Field Strength (and at what distance)	93.6 dBµV/m at 3 meters (920 MHz)
Occupied Bandwidth (99% BW)	n/a
Type of Modulation	MSK
Emission Designator	20K0F1D
Transmitter Spurious (worst case)	49.50 dBµV/m at 1 meter (1840 MHz)
Receiver Spurious (worst case)	n/a
Frequency Tolerance %, Hz, ppm	n/a
Microprocessor Model # (if applicable)	n/a
EUT will be operated under FCC Rule Part(s)	CFR 47 15.249
Antenna Information:	
a) Antenna Type	Whip
b) Detachable/Non-Detachable	Non=detachable
c) Antenna Gain (in dBi)	0 dBi
Modular Filing	☐ Yes ☒ No
Portable/Mobile	☐ Portable ☒ Mobile

RF Technical Information:

Type of Evaluation (check one)		SAR Evaluation: Device Used in the Vicinity of the Human Head
		SAR Evaluation: Body-worn Device
	x	RF Evaluation

If RF Evaluation checked above, test engineer to complete the following:

- Evaluated against exposure limits: ☒ General Public Use ☐ Controlled Use
- Duty Cycle used in evaluation: 100 %
- Standard used for evaluation: OET 65
- Measurement Distance: 3 m
- RF Value: 0.0001 ☐ V/m ☐ A/m ☒ W/m^2
  ☐ Measured ☐ Computed ☒ Calculated

Note: See Appendix E for MPE Calculation.

7. Test Requirements

The above mentioned tests were performed in order to determine the compliance of the Scout 1000 Sensor, with limits contained in various provisions of Title 47 CFR, FCC Part 15, including:

15.31	15.205
15.33	15.207
15.35	15.209
15.37	15.249

8. Summary of Test Report

DECLARATION OF CONFORMITY

The Scout 1000 Sensor was found to meet the requirements as described within the specification of Title 47 CFR FCC, Part 15.249, Subpart (a); and Industry Canada RSS-210, Issue 7, 2007 Section 6.2 for a *'Non-Momentarily Operated Transmitting Device'*.

Some emissions are seen to be within 3dB of their respective limits. As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

The enclosed test results pertain to the sample(s) of the test item listed, and only for the tests performed on the data sheets. Any subsequent modification or changes to the test items could invalidate the data contained herein, and could therefore invalidate the findings of this report.

9. Radiated Emissions Test

Test Setup

The test setup was assembled in accordance with Title 47, CFR FCC Part 15 and ANSI C63.4-2003. The EUT was placed on an 80cm high non-conductive pedestal centered on a flush mounted 2-meter diameter turntable inside the 3 Meter Semi-Anechoic, FCC listed Chamber located at LS Research, LLC Cedarburg, Wisconsin. The EUT was tested on its single operating channel, in continuous transmit mode using power provided by two AAA alkaline batteries. The EUT was tested at a 3 meter separation distance from the receiving antenna, per Section 15.249(c). Measurements above 4 GHz were performed at a 1.0 meter separation distance. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a list of the test equipment.

Test Procedure

Radiated RF measurements were performed on the EUT in the 3 Meter Semi-Anechoic, FCC listed Chamber, located at LS Research, LLC, in Cedarburg, Wisconsin. The frequency range from 30 MHz to 10000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. The EUT was placed on the non-conductive pedestal in the 3 Meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the EUT. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, and a Log Periodic Antenna was used to measure emissions from 300 MHz to 1000 MHz. A Double Ridged Waveguide Horn Antenna was used from 1 GHz to 10 GHz. The maximum radiated RF emissions were found by raising and lowering the antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities. The battery voltage was checked frequently, and the batteries were replaced as necessary.

Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at an N.I.S.T. traceable site. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and a HP 8546A EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the HP 8546A EMI Receiver database. As a result, the data taken from the HP 8546A EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The HP 8546A EMI Receiver was operated with a resolution bandwidth of 120 kHz for measurements below 1 GHz (video bandwidth of 300 kHz), and a bandwidth of 1 MHz for measurements above 1 GHz (video bandwidth of 1 MHz). From 1 GHz to 10 GHz, an HP E4407 Spectrum Analyzer and an EMCO Horn Antenna were used.

Test Results

The EUT was found to meet the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.249 for a transmitter (Canada RSS-210). The frequencies with significant signals were recorded and plotted as shown in the Data Charts and Graphs.

CALCULATION OF RADIATED EMISSIONS LIMITS:

Field Strength of Fundamental Frequencies:

The fundamental emissions for an intentional radiator in the 902-928 MHz band, operating under FCC part 15.249 limits, must have electric field strength of no greater than 50 mV/m, for the fundamental frequency, when measured at 3 meters, and harmonic field strength of no greater than 500 μV/m, when measured at 3 meters. Spurious emissions outside the 902-928 MHz band shall be attenuated by at least 50 dB below the level of the fundamental, or meet the limits expressed in FCC part 15.209 under general emission limits.

Field Strength of Fundamental Frequencies is Limited to 50,000 μV/m, or 94 dBμV/m.

Field Strength of Harmonic and Spurious Frequencies is Limited by FCC 15.249(c)

The harmonic limit of –50 dBc with respect to the fundamental limit would be:

94 dBμV/m – 50 dB = 44 dBμV/m,

with the exception of where FCC 15.209 allows for a higher limit to be used.

Frequency (MHz)	3 m Limit (μV/m)	3 m Limit (dBμV/m)
902-928	50,000	94.0
30-88 ; 88-216	159	44.0
216-902 ; 928-960	500	46.0*
960-40,000	500	54.0*

The following table depicts the general radiated emission limits obtained from Title 47 CFR, part 15.209a, for radiated emissions measurements, including restricted band limits as expressed in 47 CFR, part 15.205.

Frequency (MHz)	3 m Limit (μV/m)	3 m Limit (dBμV/m)
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
960-40,000	500	54.0

Sample conversion from field strength μV/m to dBμV/m:

$dB\mu V/m = 20 \log_{10}$ (3m limit)

from 30 - 88 MHz for example: $dB\mu V/m = 20 \log_{10} (100)$

40.0 $dB\mu V/m = 20 \log_{10} (100)$

For measurements made at 1 meter, a 9.5 dB correction may be been invoked.

960 MHz to 40,000 MHz

500 μV/m or 54.0 dBμV/m at 3 meters

54.0 + 9.5 = 63.5 dBμV/m at 1 meter

Note: Limits are conservatively rounded to the nearest tenth of a whole number.

Summary of Results and Conclusions

Based on the procedures outlined in this report, and the test results, it can be determined that the EUT does meet the emission requirements of Title 47 CFR, FCC Part 15.249, for a frequency modulated transmitter.

The enclosed test results pertain to the samples of the test item listed, and only for the tests performed per the data sheets. Any subsequent modification or changes to the test items could invalidate the data contained herein, and could therefore invalidate the findings of this report.

Radiated Emissions Data Chart

3 Meter Measurements of Electromagnetic Radiated Emissions

Test Standard: Title 47 CFR 15.249

Frequency Range Inspected: 30 MHz to 10000 MHz

Manufacturer:	Pentar Inc					
Date(s) of Test:	November 18-23, 2008					
Test Engineer(s):	x	Laura Bott		Ryan Urness		Ken Boston
Model #:	Scout 1000 Sensor					
Serial #:	N/A					
Voltage:	3.0 VDC					
Operation Mode:	Normal , Continuous Modulated Transmit					
EUT Power:		Single Phase ___VAC		3 Phase ___VAC		
	x	Battery		Other:		
EUT Placement:	x	80cm non-conductive table		10cm Spacers		
EUT Test Location:	x	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS		
Measurements:		Pre-Compliance		Preliminary	x	Final
Detectors Used:	x	Peak	x	Quasi-Peak	x	Average

Environmental Conditions in the Lab:
Temperature: 20 – 25°C
E4407B
Relative Humidity: 30 – 60 %

Test Equipment Used:
EMI Measurement Instrument: HP8546A and Agilent

Log Periodic Antenna: EMCO #93146
Horn Antenna: EMCO #3115
Biconical Antenna: EMCO 93110
Pre-Amp: Advanced Microwave WHA6224
Standard Gain Horn: EMCO 3160-09

The following table depicts the level of significant radiated emissions found:

Fundamentals

Frequency (MHz)	Height (m)	Azimuth (degree)	Quasi Peak Reading (dBµV/m)	Quasi Peak Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
920	1.17	104	79.6	94.0	14.4	Horizontal	Vertical
920	1.14	290	90.8	94.0	3.2	Vertical	Vertical
920	1.00	0	92.4	94.0	1.6	Horizontal	Side
920	2.58	53	84.2	94.0	9.8	Vertical	Side
920	1.00	273	93.6	94.0	0.4	Horizontal	Flat
920	1.45	0	85.3	94.0	8.7	Vertical	Flat

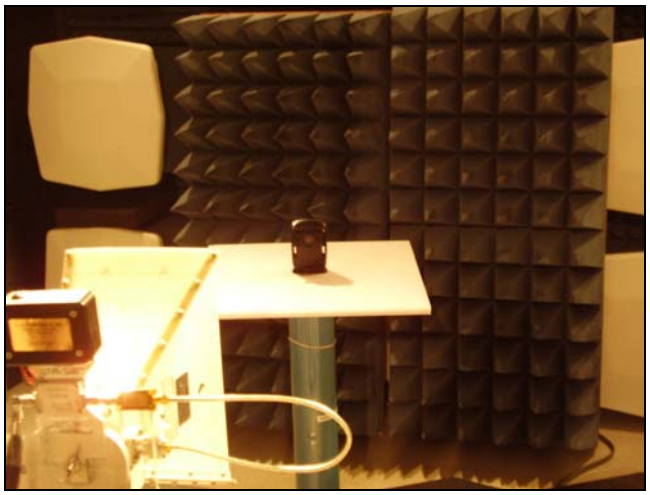
Radiated Spurious Emissions

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Peak Reading with Relaxation (dBµV/m)	15.249 Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
1840	1.00	130	69.5	49.5	63.5	14.0	Vertical	Vertical
2760	1.00	0	58.8	38.8	63.5	24.7	Vertical	Vertical
3680	1.00	202	64.7	44.7	63.5	18.8	Horizontal	Flat
4600	1.07	103	55.3	35.3	63.5	28.2	Vertical	Side
5520	1.05	208	65.8	45.8	63.5	17.7	Vertical	Vertical
6440	1.08	98	61.4	41.4	63.5	22.1	Vertical	Side
7360	1.00	94	50.6	30.6	63.5	32.9	Vertical	Side
8280	1.05	118	52.2	32.2	63.5	31.3	Horizontal	Side
9200	1.00	142	52.6	32.6	63.5	30.9	Horizontal	Side

Notes: 1. A Quasi-Peak Detector was used in measurements below 1 GHz, and Peak Detector was used in measurements above 1 GHz.
2. All radiated spurious emissions under 1 G were greater than 10 dB below the limit.

Photos Taken During Radiated Emission Testing

Setup for the Radiated Emissions Test



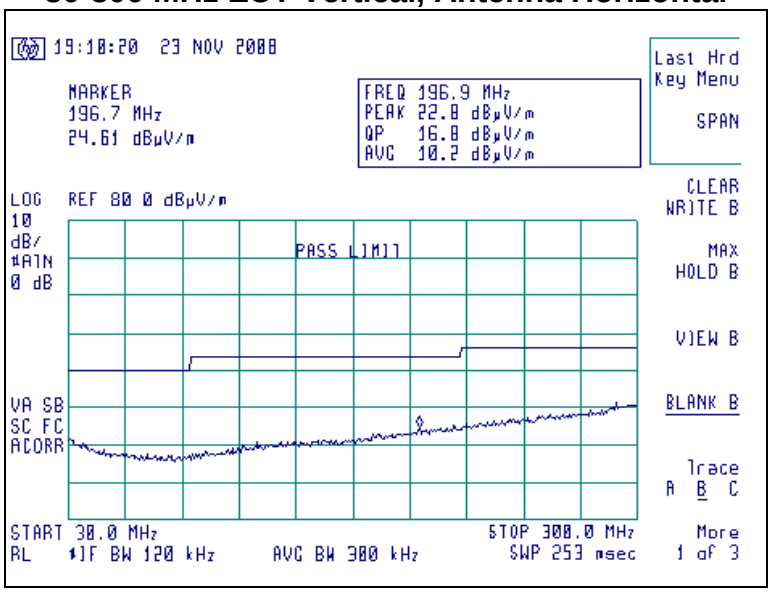
GRAPHS

Screen Captures of Radiated RF Emissions:

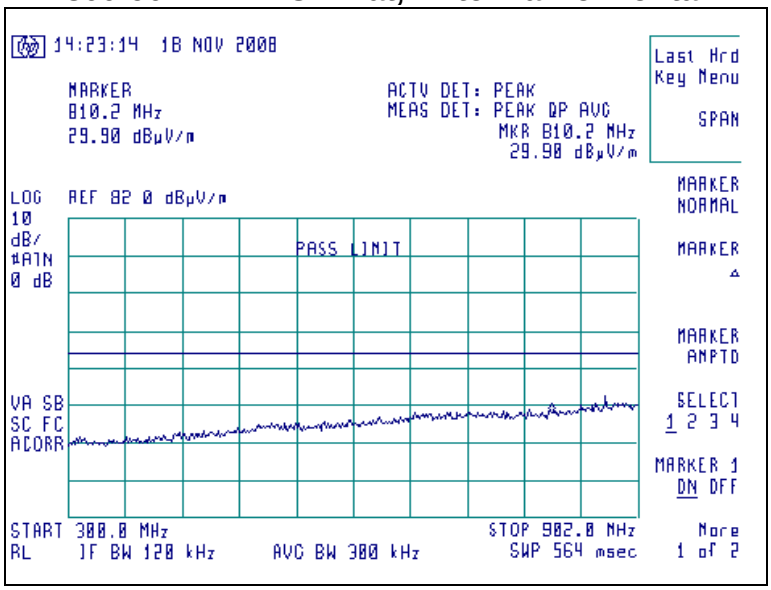
Please note these screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz, and an Average detector function is utilized when measuring frequencies above 1 GHz.

The signature scans shown here are from worst-case emissions, as measured on channel 920 MHz with the sense and EUT antennas both in vertical polarity for worst case presentations.

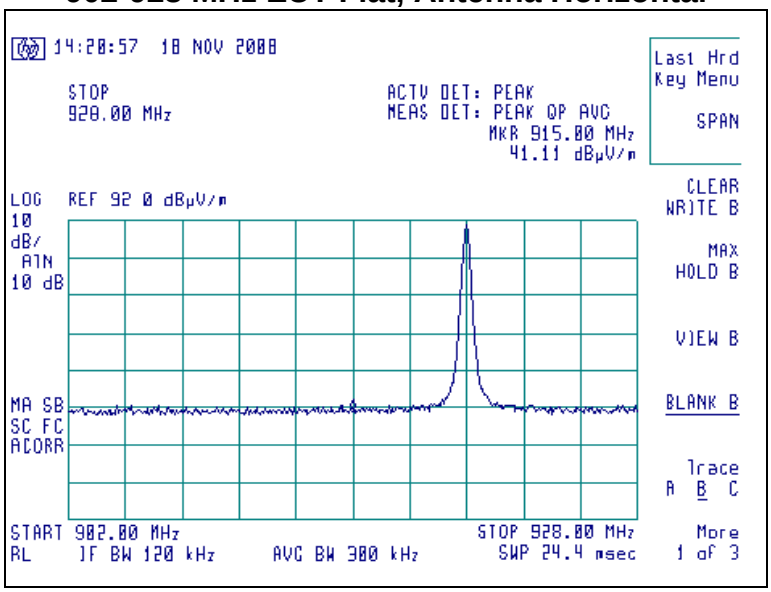
Signature Scan of Peak Radiated Emissions
30-300 MHz EUT Vertical, Antenna Horizontal



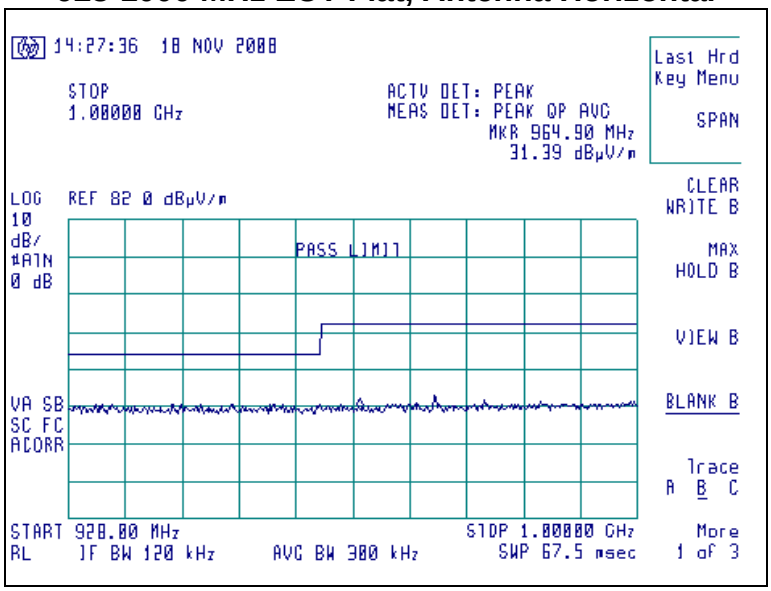
Signature Scan of Peak Radiated Emissions
300-902 MHz EUT Flat, Antenna Horizontal



Signature Scan of Peak Radiated Emissions
902-928 MHz EUT Flat, Antenna Horizontal

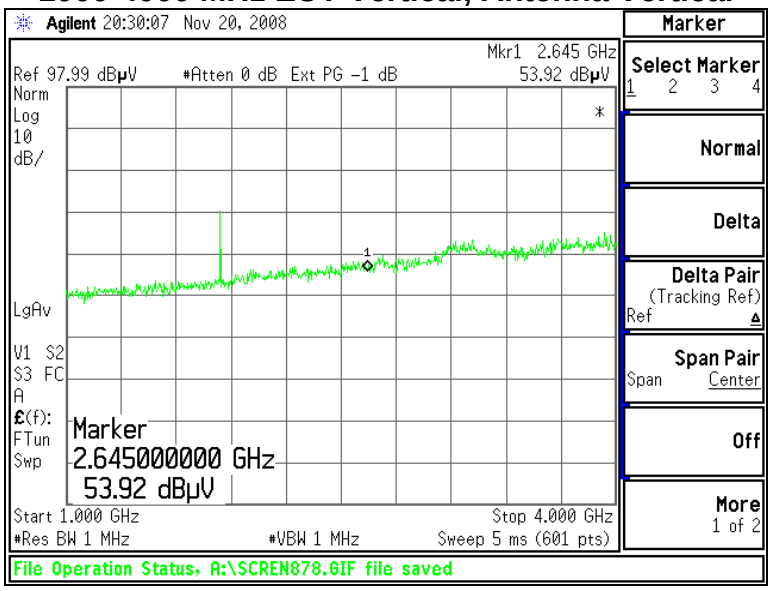


Signature Scan of Peak Radiated Emissions
928-1000 MHz EUT Flat, Antenna Horizontal

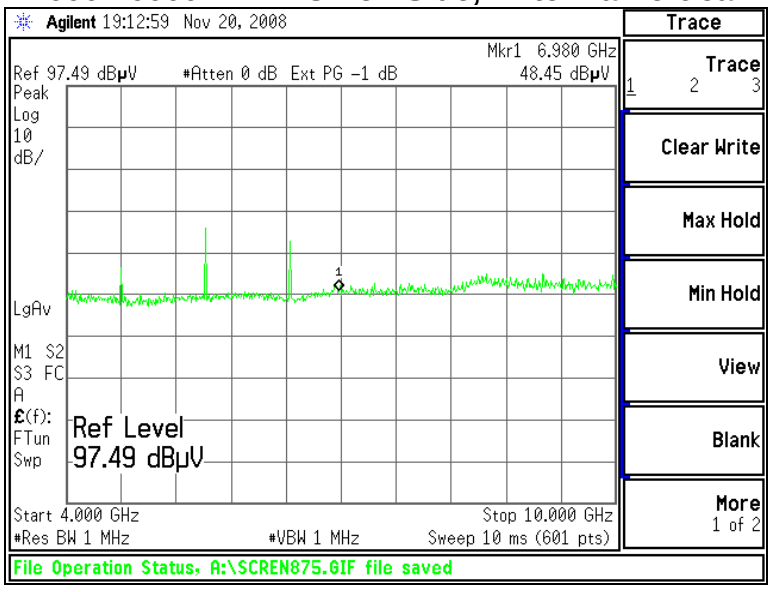


Graphs made during Radiated Emission Testing (continued)

Signature Scan of Peak Radiated Emissions
1000-4000 MHz EUT Vertical, Antenna Vertical



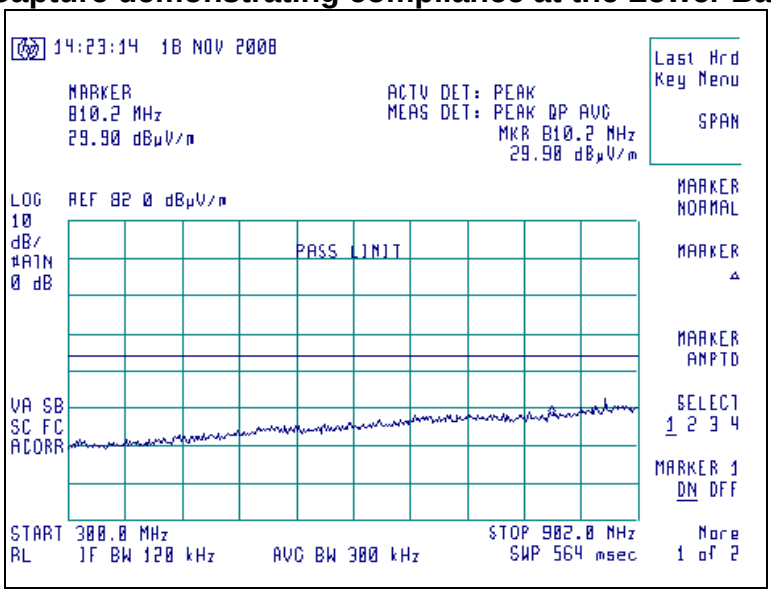
Signature Scan of Peak Radiated Emissions
4000-10000 MHz EUT on Side, Antenna Vertical



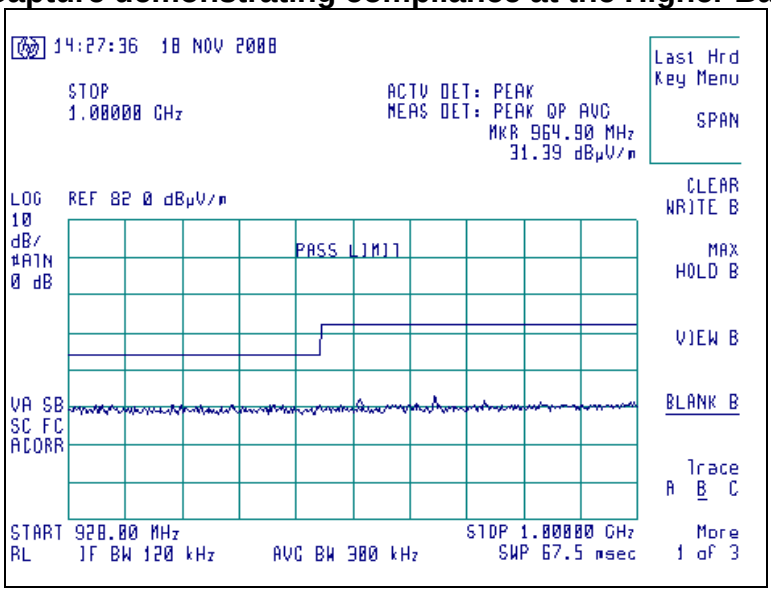
10. Band-Edge Measurements

FCC 15.209(b) and 15.249(d) require a measurement of spurious emission levels, in particular at the band-edges where the intentional radiator operates. The following screen captures demonstrate compliance of the intentional radiator at the 902-928 MHz band-edges. The EUT was operated at the lowest channel, with continuous modulation.

Screen Capture demonstrating compliance at the Lower Band-Edge



Screen Capture demonstrating compliance at the Higher Band-Edge



APPENDIX A

Test Equipment List

Asset #	Manufacturer	Model #	Serial #	Description	Date	Due
AA960008	EMCO	3816/2NM	9701-1057	Line Impedance Stabilization Network	12/6/07	12/6/08
AA960031	HP	119474A	3107A01708	Transient Limiter	Note 1	Note 1
AA960077	EMCO	93110B	9702-2918	Biconical Antenna	11/24/08	11/24/09
AA960078	EMCO	93146	9701-4855	Log-Periodic Antenna	10/20/08	10/20/09
AA960081	EMCO	3115	6907	Double Ridge Horn Antenna	12/04/07	12/04/08
CC00221C	Agilent	E4407B	US39160256	Spectrum Analyzer	2/19/08	2/19/09
EE960004	EMCO	2090	9607-1164	Device Controller	N/A	N/A
EE960013	HP	8546A	3617A00320	Receiver RF Section	9/23/08	9/23/09
EE960014	HP	85460A	3448A00296	Receiver Pre-Selector	9/23/08	9/23/09
EE960073	Agilent	E4446A	US45300564	Spectrum Analyzer	9/26/08	9/26/09
N/A	LSC	Cable	0011	3 Meter ½" Armored Cable	Note 1	Note 1
N/A	LSC	Cable	0050	10 Meter RG 214 Cable	Note 1	Note 1
N/A	Pasternack	Attenuator	N/A	10 dB Attenuator	Note 1	Note 1

Note 1 - Equipment calibrated within a traceable system.

APPENDIX B
TEST STANDARDS – CURRENT PUBLICATION DATES RADIO

STANDARD #	DATE	Am. 1	Am. 2
ANSI C63.4	2003		
CISPR 11	2003-03	2004-05	2006-06
CISPR 14-1	2005-11	2008-11	
CISPR 14-2	2001-11	2001-11	2008-05
CISPR 16-1-1 Note 1	2006-03	2006-09	2007-07
CISPR 16-1-2 Note 1	2003	2004-04	2006-07
CISPR 22	2008		
CISPR 24	1997-09	2001-07	2002-10
EN 55011	2007-05		
EN 55014-1	2006		
EN 55014-2	1997		
EN 55022	2006		
EN 60601-1-2	2007		
EN 61000-3-2	2006-05		
EN 61000-3-3	1994	1995	
EN 61000-4-2	2001	1998	2001
EN 61000-4-3	2006-07	2008-05	
EN 61000-4-4	2004		
EN 61000-4-5	2006-12		
EN 61000-4-6	2007-08		
EN 61000-4-8	1993	1994-01	
EN 61000-4-11	2004-10		
EN 61000-6-1	2007-02		
EN 61000-6-2	2005-12		
EN 61000-6-3	2007-02		
EN 61000-6-4	2007-02		
FCC 47 CFR, Parts 0-15, 18, 90, 95	2007		
FCC Public Notice DA 00-1407	2000		
FCC ET Docket # 99-231	2002		
FCC Procedures	2007		
ICES 001	2006-06		
ICES 002	2007-02		
ICES 003	2004-02		
IEC 60601-1-2 Note 1	2007-03		
IEC 61000-3-2	2005	2008-03	
IEC 61000-3-3	2008-06		
IEC 61000-4-2	2001-04	1998	2000
IEC 61000-4-3	2006-02	incl in 2006	
IEC 61000-4-4	2004-07		

STANDARD #	DATE	Am. 1	Am. 2
IEC 61000-4-5	2005-11		
IEC 61000-4-6	2008-07		
IEC 61000-4-8	2001-03	2000	
IEC 61000-4-11	2004-03		
IEC 61326-1	2005-12		
ISO 14082	1998-07		
MIL Std. 461E	1999-08		
RSS GEN	2007-06		
RSS 119	2007-06		
RSS 123	1999-11		
RSS 125	2000-03		
RSS 131	2003-07		
RSS 136	2002-10		
RSS 137	1999-09		
RSS 210	2007-06		
RSS 213	2005-12		
RSS 243	2005-11		
RSS 310	2007-06		
Note 1: Test not on LSR Scope of Accreditation.			

APPENDIX C
Uncertainty Statement

This uncertainty represents an expanded uncertainty
expressed at approximately the 95% confidence level, using a coverage factor of k=2.

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

Measurement Type	Particular Configuration	Uncertainty Values
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

APPENDIX D
Duty Cycle Correction Justification

According to Pentar documentation, the following describes the transmission of the radio on board:

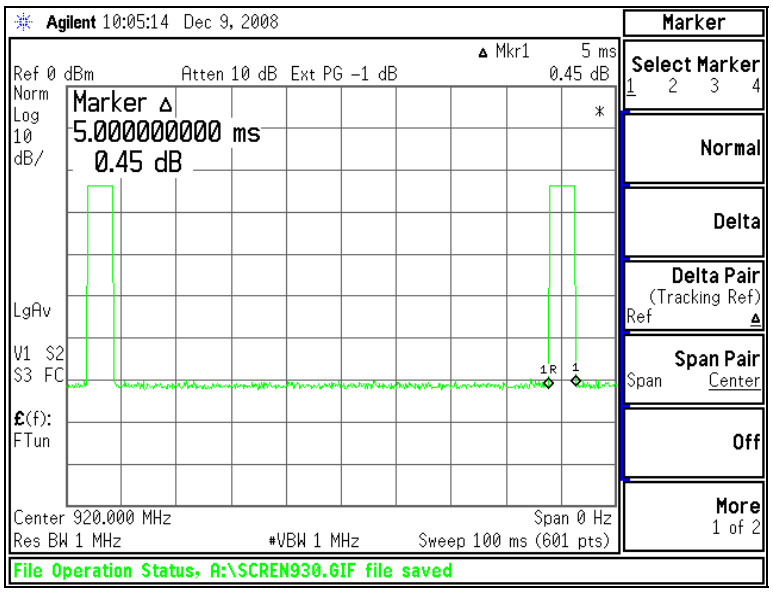
Scout 1000 packets last 5.0 msec (i.e. 128 bits at 28 KBPS). Packets are always transmitted in pairs separated in time by a random interval between 0.125 and 1.125 seconds. Packet pairs are transmitted periodically once per minute or when motion is detected. Motion detects may occur at a maximum rate of once per 3 second interval due to a hold-off feature.

The maximum transmission time in a 100 ms window is 2*5.0 ms = 10 ms.

Therefore the duty cycle correction factor may be calculated as:

20*log(10 ms /100 ms) = -20

Thus, a 20 dB relaxation may be invoked.



APPENDIX E

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	-3.00	(dBm)
Maximum peak output power at antenna input terminal:	0.501	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1.000	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	1000	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.000100	(mW/cm^2)
Maximum allowable antenna gain:	40.0	(dBi)
Margin of Compliance at 20 cm =	40.0	dB