

EMISSIONS TEST REPORT

Report Number: 3104706DAL-008

Project Number: 3104706

Testing performed on the

Spot RFLS Location System - Master Radio

Model: 40004A001

FCC ID: RO540004A001

To

FCC Part 15 Subpart C 15.247

Industry Canada's RSS-210 Issue 6 September 2005, Annex 8

FCC Part 15 Subpart B and ICES-003 Issue 4 February 2004

For

InnerWireless, Inc.

Test Performed by:
Intertek – ETL SEMKO
420 N Dorothy Drive,
Richardson, TX 75081 USA

Test Authorized by:
Wavetrix
801 Presidential Drive,
Richardson, TX 75081 USA

Prepared by: Skumble
Sudesh Kamble

Date: November 3, 2006

Reviewed by: Roland W. Gubisch
Roland W. Gubisch

Date: November 20, 2006

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1 Job Description

1.1 Client Information

This EUT has been tested at the request of:

Company: InnerWireless, Inc.
1155 Kas Drive,
Richardson, TX 75081 USA
Contact: Mr. James McCoy
Telephone: (972) 201-2522
Fax: (972) 479-9625

1.2 Equipment Under Test

Equipment Type: Master Radio
Model Number(s): 40004A001 (see section 1.4.3 for individual items)
Serial number(s): 1294
Manufacturer: Creation Technologies, Inc.
1001 Klein Rd, Suite 100
Plano, TX 75074 USA
Mr. Edward Goodwin
Phone : (972) 680-8394, x102

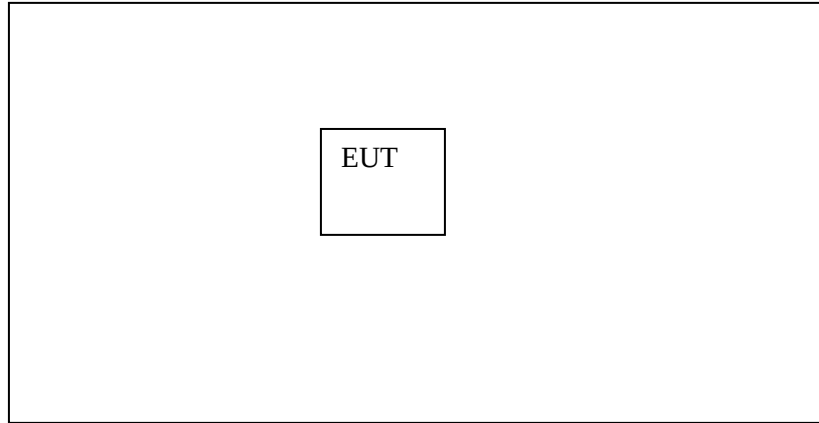
EUT receive date: 10/01/06
EUT received condition: Prototypes in Good Condition
Test start date: 10/01/06
Test end date: 10/21/06

1.3 Test Plan Reference

Tested according to the standards listed, ANSI C63.4:2003, and RSS-Gen Issue 1 September 2005.

1.4 Test Configuration

1.4.1 Block Diagram



1.4.2 Cables

Cable	Shielding	Connector	Length (m)	Qty.
Cross-Over Ethernet	None	RJ45 to RJ45	3.0	1
RS-232 Cable	None	DB9 to DB9	3.0	2

1.4.3 Support Equipment & Equipment Under Test:

Support Equipment:

Name: HP Pavilion ZE4500 Laptop PC
 Model No.: DM371AV
 Serial No.: CNF3393SWY

Equipment Under Test:

Name: Master Radio
 Model No.: 40004A001
 Serial No.: 1294

Name: AC Adapter (Cincon Electronics Co., Ltd.)
 Model No.: TR25050
 Serial No.: 25050-0003983

Name: Power Over Ethernet (PoE) Injector (HyperLink Technologies)
 Model No.: PW130
 Serial No.: N/L

Name: 8.5 dBi Omnidirectional Antenna
Manufactured by Hyperlink Technologies
Model No.: HG2409U
Serial No.: N/L

1.5 Mode(s) of Operation:

The Master Radio was fed 48V DC from the PoE injector which was powered from nominal 120V/60Hz AC power. The EUT was activated through its Ethernet port which was connected to the PC. The Master Radio was continuously transmitting a modulated carrier at low, mid, and high channels and was manipulated in three orthogonal axes.

1.6 Floor Standing Equipment:

Applicable: __ __ Not Applicable: __X__

1.7 Modifications Required for Compliance:

The Master Radio must be deployed with the following modifications:

- Remove paint from all surfaces that make contact between the top and bottom pieces of the chassis to make the enclosure as faraday cage.

2 Test Summary

TEST STANDARD		RESULTS	
FCC Part 15 Subpart C 15.247, Industry Canada's RSS-210 Issue 6 September 2005 Annex 8, FCC Part 15 Subpart B, and Industry Canada's ICES-003 Issue 4 February 2004			
SUB-TEST	TEST PARAMETER	COMMENT	
Maximum Peak Conducted Output Power and Human RF Exposure FCC 15.247(b)(3-5), RSS-210 A8.4, RSS-102 4.3	The output power of the Radio Module must not exceed 1 Watt (30 dBm) and 36 dBm EIRP. The human RF Exposure limit is 1 mW/cm ² .	Pass	
Occupied Bandwidth FCC 15.247(a)(2), RSS-210 A8.2	The 6 dB bandwidth of the Radio Module must be at least 500 kHz.	Pass	
Antenna Port Conducted Spurious Emissions FCC 15.209, 15.247(d), RSS-210 A8.5	The spurious emissions of the Radio Module must be attenuated below the level of the fundamental by at least 20 dBc.	Pass	
Radiated Spurious Emissions FCC 15.205, 15.209, 15.247(d), 15.109, RSS-210 2.2, 2.7, A8.5, ICES-003	The spurious emissions of the Radio Module must be attenuated below the level of the fundamental by at least 20 dBc. Emissions which fall in the restricted bands must meet the general limits of 15.209 and RSS-210 2.7 Table 2. The spurious emissions of the BEP must not exceed the limits of 15.109 Class A and ICES-003 Class A.	Pass	
Peak Power Spectral Density FCC 15.247(e), RSS-210 A8.2	The peak power spectral density of the Radio Module must not exceed 8 dBm / 3 kHz.	Pass	
Band Edge Compliance FCC 15.215, RSS-210 2.1, A8.5	The fundamental frequency of the Radio Module must stay within the assigned frequency band.	Pass	
AC Line-Conducted Emissions FCC 15.207, 15.107, RSS-Gen 7.2.2, ICES- 003	The AC line-conducted emissions of the Radio Module must not exceed the limits of 15.207 and RSS-Gen 7.2.2 Table 2. The AC line-conducted emissions of the BEP must not exceed the limits of 15.107 Class A and ICES-003 Class A.	Pass	

Notes: The Master Radio was tested as a Class A digital device to FCC Part 15 Subpart B and ICES-003; Intentional transmission was tested as a transmitter to the requirements of FCC Part 15 Subpart C 15.247 and RSS-210 Annex 8. Channels selected for test were:

Channel 11: 2405 MHz,
Channel 17: 2435 MHz,
Channel 26: 2480 MHz

3 REVISION SUMMARY

The following changes have been made to this Report:

<u>Date</u>	<u>Project</u> <u>No.</u>	<u>Project</u> <u>Handler</u>	<u>Page(s)</u>	<i>Item</i>	<u>Description of Change</u>
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4 Sample Calculations

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

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

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
 AF = 7.4 dB/m
 CF = 1.6 dB
 AG = 29.0 dB
 FS = 32 dB μ V/m

$$\text{Level in } \mu\text{V/m} = [10(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where

- NF = Net Reading in dB μ V
- RF = Reading from receiver in dB μ V
- LF = LISN Correction Factor in dB
- CF = Cable Correction Factor in dB
- AF = Attenuator Loss Factor in dB

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF/20)} \text{ where UF = Net Reading in } \mu\text{V}$$

Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 254 \mu\text{V/m}$$

4.1 Measurement Uncertainty

Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes.

The expanded uncertainty ($k = 2$) for radiated emissions from 30 to 1000 MHz has been determined to be:
 ± 3.6 dB at 3m

The expanded uncertainty ($k = 2$) for mains conducted emissions from 150 kHz to 30 MHz has been determined to be:

± 1.74 dB

5 Site Description

Test Site(s): 1

The test facility is located at 420 N Dorothy Drive, Richardson, TX - 75081

The FCC site registration number for this site is 10157.

The Industry Canada file no. is IC 6018.

Measurements are conducted with a quasi-peak detector instrument in the frequency range of 30 MHz to 1000 MHz. The measuring receiver meets the requirements of Section One of CISPR 16/ ANSI 63.4 and the measuring antenna correlates to a balanced dipole.

Measurements of the radiated field are made with the antenna located at a distance of 10 meters from the EUT. If the field-strength measurements at 10m cannot be made because of high ambient noise level or for other reasons, measurements of Class B equipment may be made at a closer distance, for example 3m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance.

The antenna is adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

The antenna-to-EUT azimuth is varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Equipment setup for radiated disturbance tests followed the guidelines of CISPR 16 and ANSI 63.4.

6 Test Results

6.1 Test: Transmitter Output Power and EIRP, and Human RF Exposure

Test Standard: FCC 15.247(b)(3-5), RSS-210 A8.4, RSS-102 4.3

Test Results: Pass

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	N/A	Pressure (hPa):	N/A	Ambient (°C):	N/A
Pretest Verification Performed	N/A		Equipment under Test:	Master Radio		

Maximum Test Parameters: The output power of the Radio Module must not exceed 1 Watt (30 dBm) and 36 dBm EIRP. The human RF Exposure limit is 1 mW/cm².

Test Equipment Used:

Equip. ID	Description	Manufacturer	Model	Serial Number	Cal Date	Cal Due
77	EMI Receiver	R & S	ES17	100044	10/14/05	10/14/06
192	Handheld Manometer	Omega	HHP-102F	19.99/29.0 PSIA	02/23/06	02/23/07
260	Humidity Temperature	Extech	445580	17-260	10/26/05	10/26/06
30	DMM	Fluke	8060A	6191012	02/02/06	02/02/07
82	Bi-ConiLog Antenna	Schaffner	CBL6112B	2726	06/13/06	06/13/07
128	RF Cable	Custom made	#1	none	08/01/06	08/01/07
131	RF Cable	Custom made	#4	none	08/01/06	08/01/07
271	Horn Antenna	A H Systems	SAS-571	787	02/08/06	02/08/07
101	EMI Receiver	Agilent	E7405A	US40240235	11/23/05	11/23/06
238	RF coax cable	Custom made	#238	None	08/01/06	08/01/07

Test Results:

Notes: The cable loss was compensated for in the spectrum analyzer. The EUT is exempt from SAR and RF evaluation as referenced in RSS-102 4.3 because the operating frequency is above 1.5 GHz and the EIRP does not exceed 5 watts.

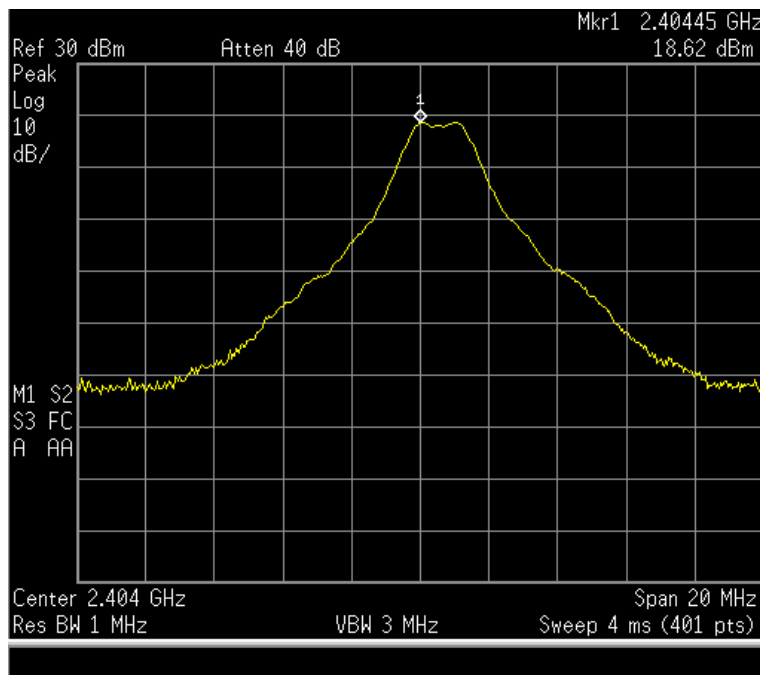
The FCC human RF exposure limit is 1 mW/cm². The power density S generated by some value of EIRP at a given distance d is related by the equation:

$$S = \text{EIRP} / (4\pi d^2)$$

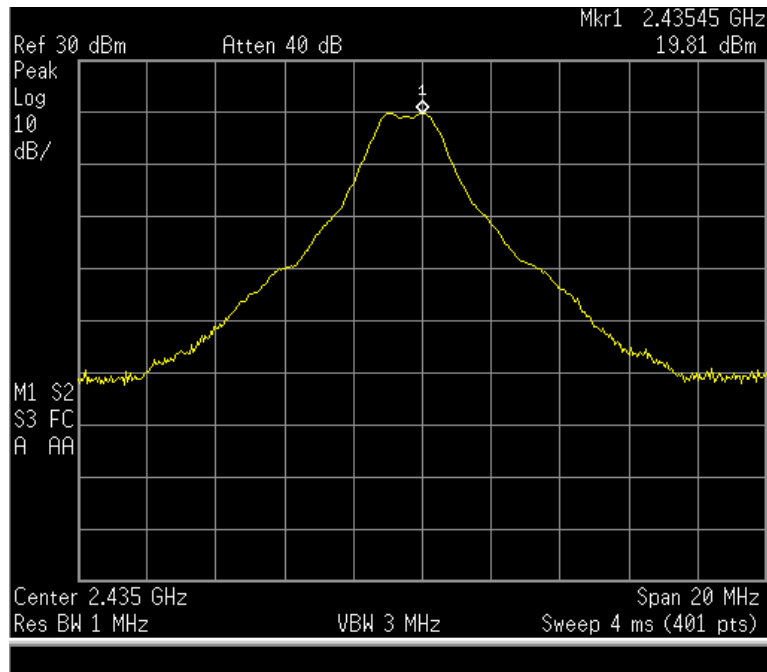
The distance, given a maximum EIRP of 23.88 dBm (244.3 mW) at which the radiated power density of the EUT is equal to the human RF exposure limit is 4.408 cm from the antenna.

Antenna	Type	Model	Connector	Gain
HyperLink Technologies	Omnidirectional Monopole	HG2409U	N-Male	8.5 dBi

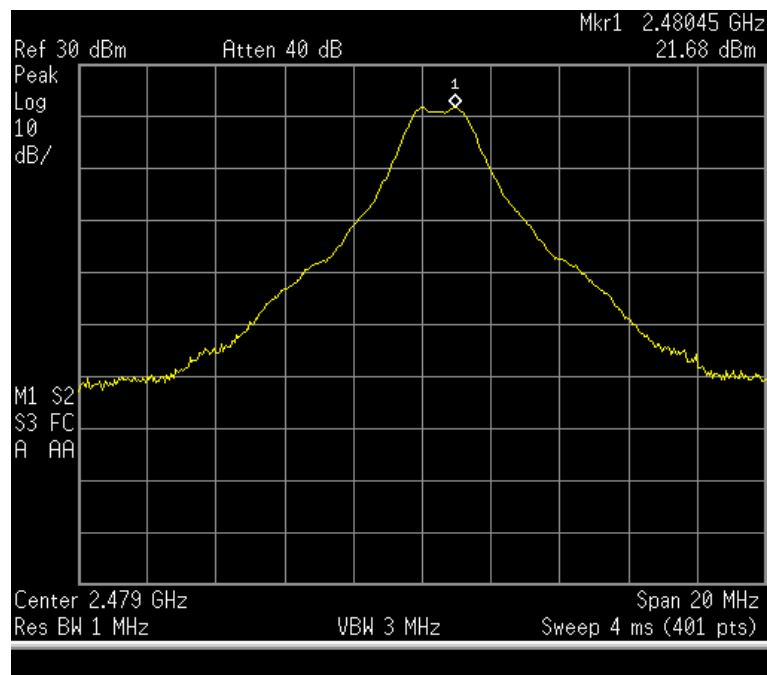
Channel	Frequency	Power	Limit	EIRP	EIRP Limit
11	24045 MHz	18.62 dBm	30.0 dBm	20.82 dBm	36.0 dBm
17	24354 MHz	19.81 dBm	30.0 dBm	22.01 dBm	36.0 dBm
26	24804 MHz	21.68 dBm	30.0 dBm	23.88 dBm	36.0 dBm



Channel 11



Channel 17



Channel 26

6.2 Test: Occupied Bandwidth

Test Standard: FCC 15.247(a)(2), RSS-210 A8.2

Test Results: Pass

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	N/A	Pressure (hPa):	N/A	Ambient (°C):	N/A
Pretest Verification Performed	N/A		Equipment under Test:	Master Radio		

Maximum Test Parameters: The 6 dB bandwidth of the Radio Module must be at least 500 kHz.

Test Equipment Used:

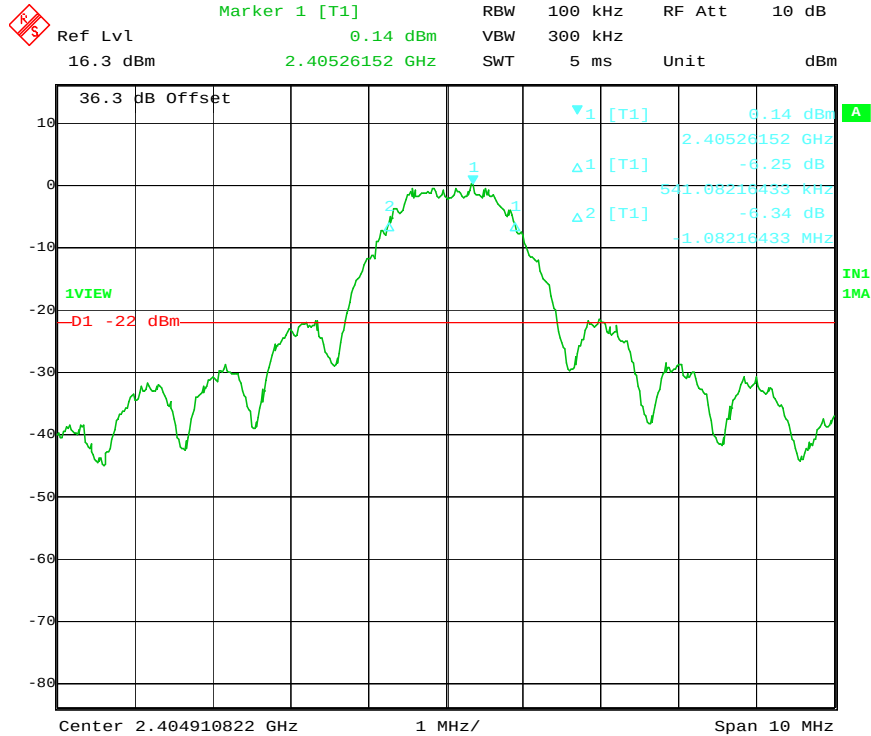
Equip. ID	Description	Manufacturer	Model	Serial Number	Cal Date	Cal Due
77	EMI Receiver	R & S	ES17	100044	10/14/05	10/14/06
192	Handheld Manometer	Omega	HHP-102F	19.99/29.0 PSIA	02/23/06	02/23/07
260	Humidity Temperature	Extech	445580	17-260	10/26/05	10/26/06
30	DMM	Fluke	8060A	6191012	02/02/06	02/02/07
82	Bi-ConiLog Antenna	Schaffner	CBL6112B	2726	06/13/06	06/13/07
128	RF Cable	Custom made	#1	none	08/01/06	08/01/07
131	RF Cable	Custom made	#4	none	08/01/06	08/01/07
271	Horn Antenna	A H Systems	SAS-571	787	02/08/06	02/08/07
101	EMI Receiver	Agilent	E7405A	US40240235	11/23/05	11/23/06

Test Results:

Notes: There is no limit on the 20 dB bandwidth; it is simply included for informational purposes. The 20 dB bandwidth is referenced to the actual RF output power.

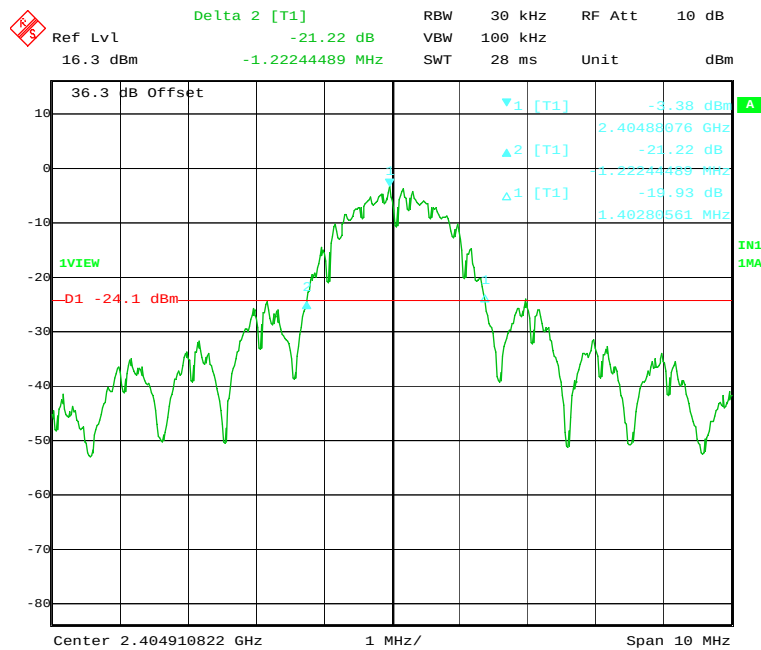
Channel	Frequency	6 dB Bandwidth
11	2405 MHz	1.62 MHz
17	2435 MHz	1.64 MHz
26	2480 MHz	1.62 MHz

Channel	Frequency	20 dB Bandwidth
11	2405 MHz	2.62 MHz
17	2435 MHz	2.64 MHz
26	2480 MHz	2.64 MHz



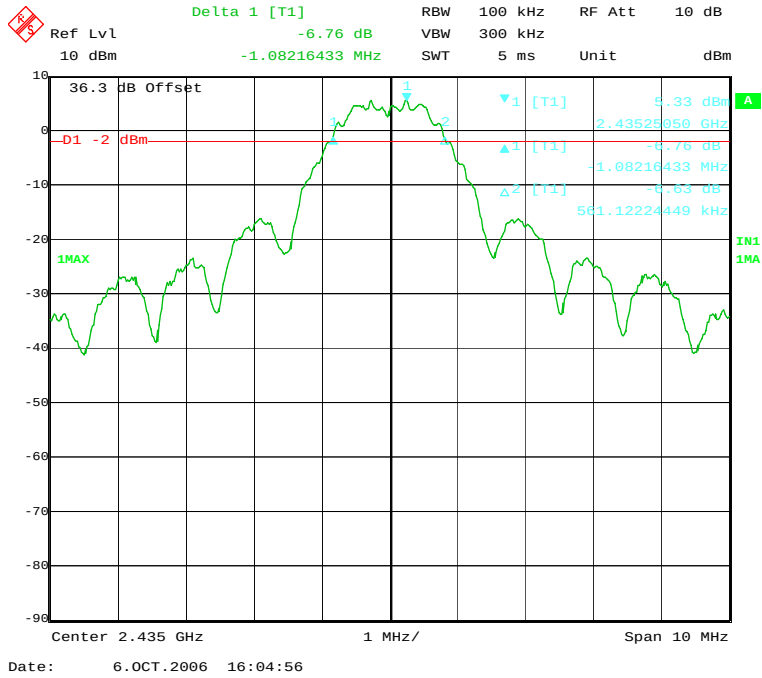
Date: 6.OCT.2006 15:11:45

Channel 11 6dB Bandwidth

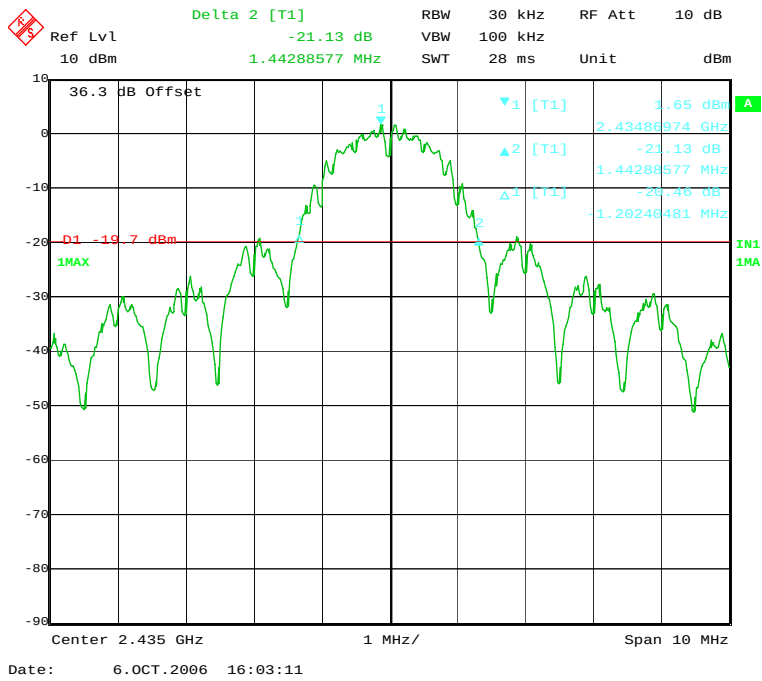


Date: 6.OCT.2006 15:14:37

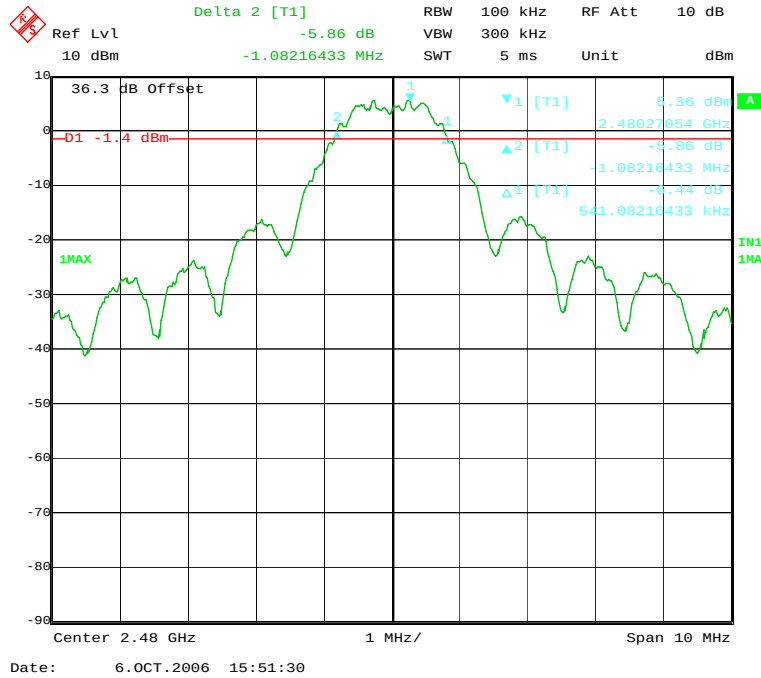
Channel 11 20 dB Bandwidth



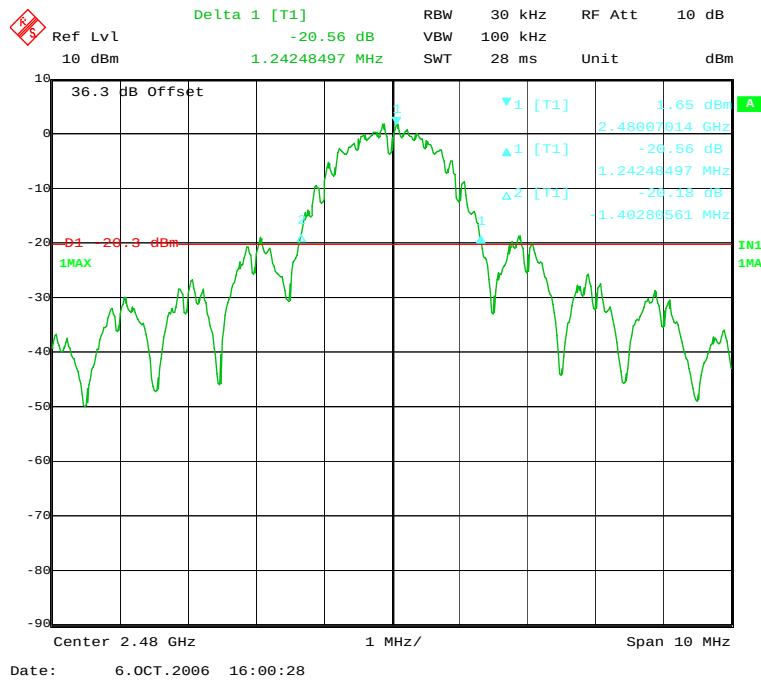
Channel 17 6 dB Bandwidth



Channel 17 20 dB Bandwidth



Channel 26 6 dB Bandwidth



Channel 26 20 dB Bandwidth

6.3 Test: Antenna Port Conducted Spurious Emissions

Test Standard: FCC 15.209, 15.247(d), RSS-210 A8.5

Test Results: Pass

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	N/A	Pressure (hPa):	N/A	Ambient (°C):	N/A
Pretest Verification Performed	N/A		Equipment under Test:	Master Radio		

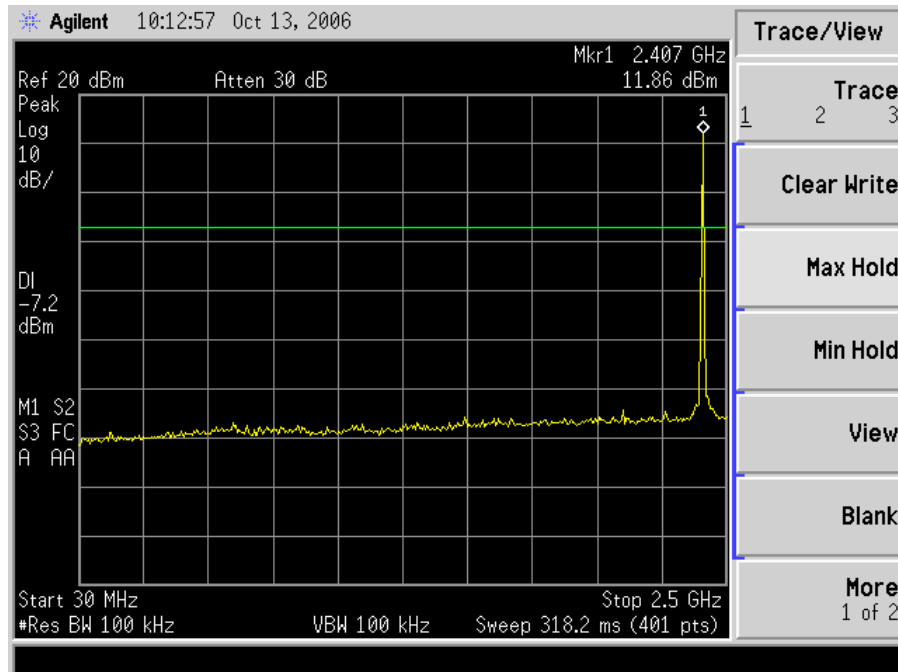
Maximum Test Parameters: The spurious emissions of the Radio Module must be attenuated below the level of the fundamental by at least 20 dBc.

Test Equipment Used:

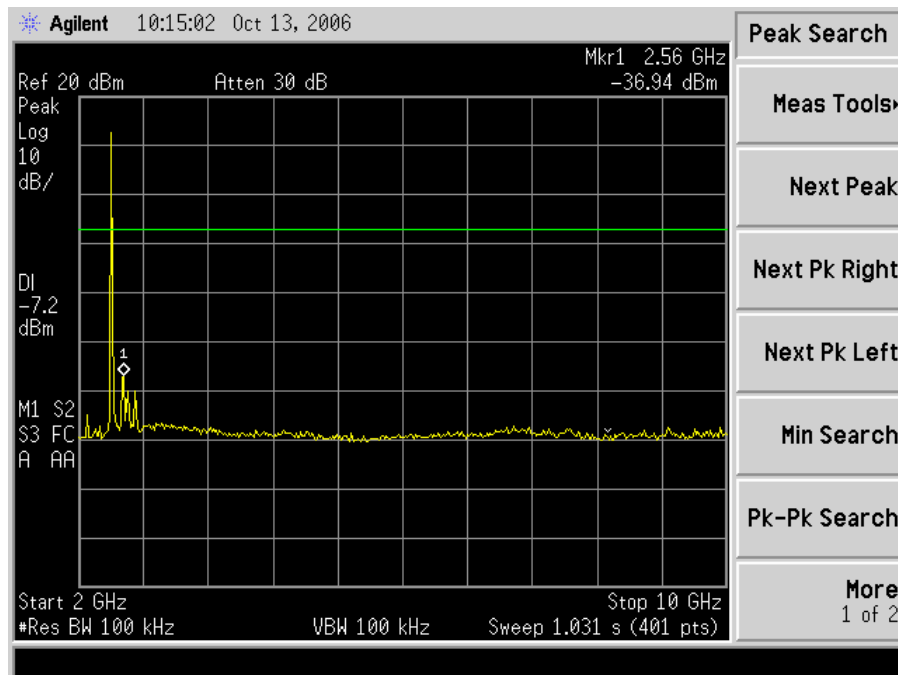
Equip. ID	Description	Manufacturer	Model	Serial Number	Cal Date	Cal Due
77	EMI Receiver	R & S	ES17	100044	10/14/05	10/14/06
192	Handheld Manometer	Omega	HHP-102F	19.99/29.0 PSIA	02/23/06	02/23/07
260	Humidity Temperature	Extech	445580	17-260	10/26/05	10/26/06
30	DMM	Fluke	8060A	6191012	02/02/06	02/02/07
82	Bi-ConiLog Antenna	Schaffner	CBL6112B	2726	06/13/06	06/13/07
128	RF Cable	Custom made	#1	none	08/01/06	08/01/07
131	RF Cable	Custom made	#4	none	08/01/06	08/01/07
271	Horn Antenna	A H Systems	SAS-571	787	02/08/06	02/08/07
101	EMI Receiver	Agilent	E7405A	US40240235	11/23/05	11/23/06
238	RF coax cable	Custom made	#238	None	08/01/06	08/01/07

Test Results:

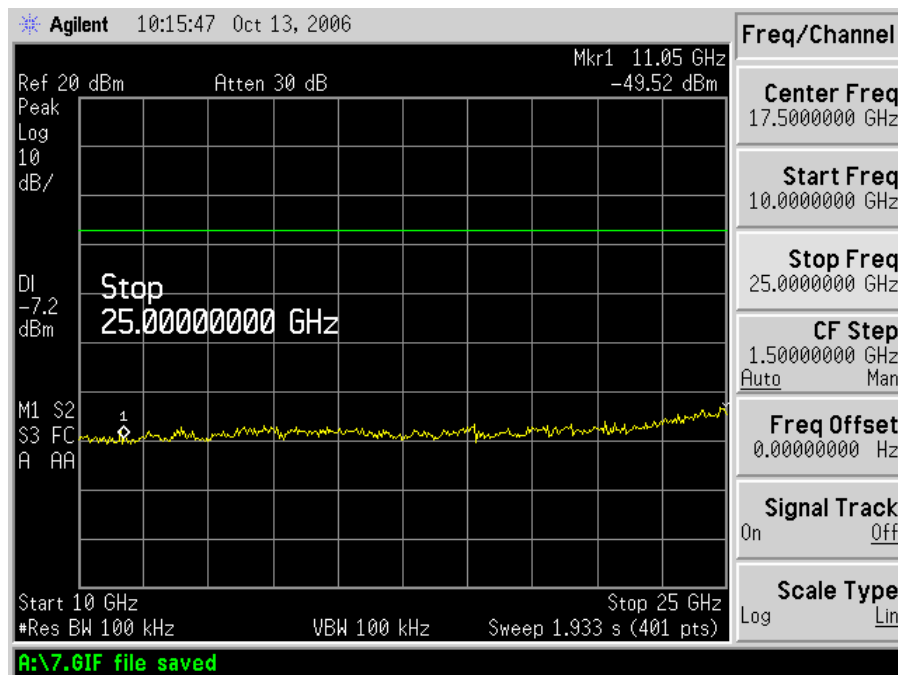
Notes: A marker was placed at the output power in a 100 kHz bandwidth of the channel under test, and a display line was placed 20 dB below the Peak of fundamental frequency. The cable loss was compensated for in the spectrum analyzer.



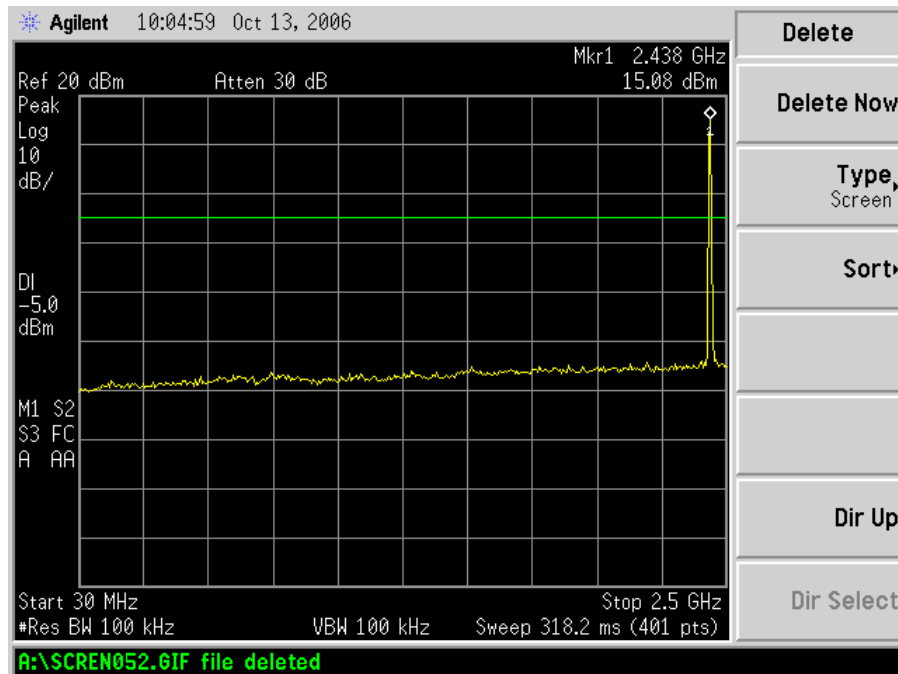
Channel 11 Tx Port 30-2500 MHz



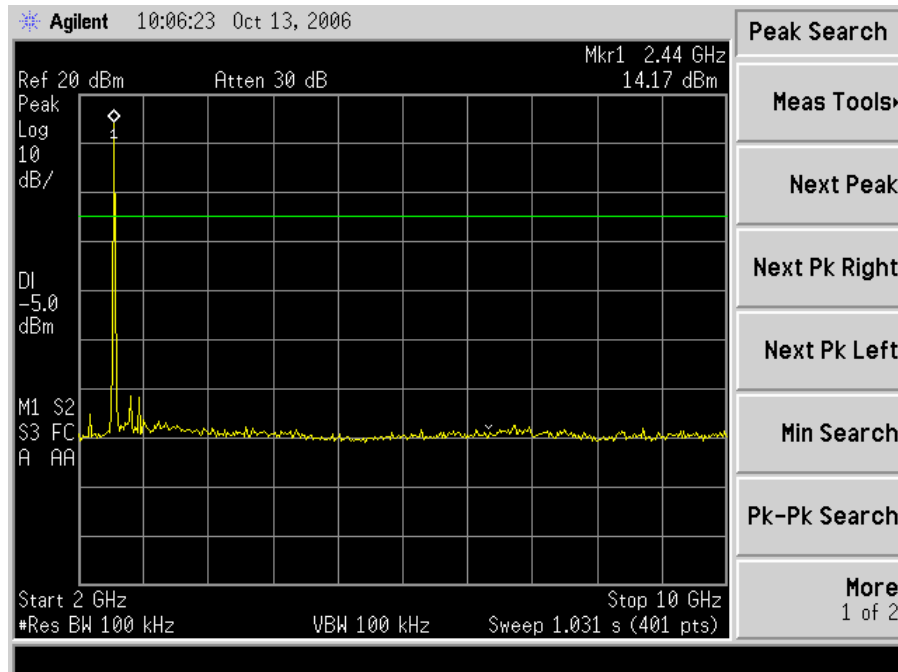
Channel 11 Tx Port 2 -10 GHz



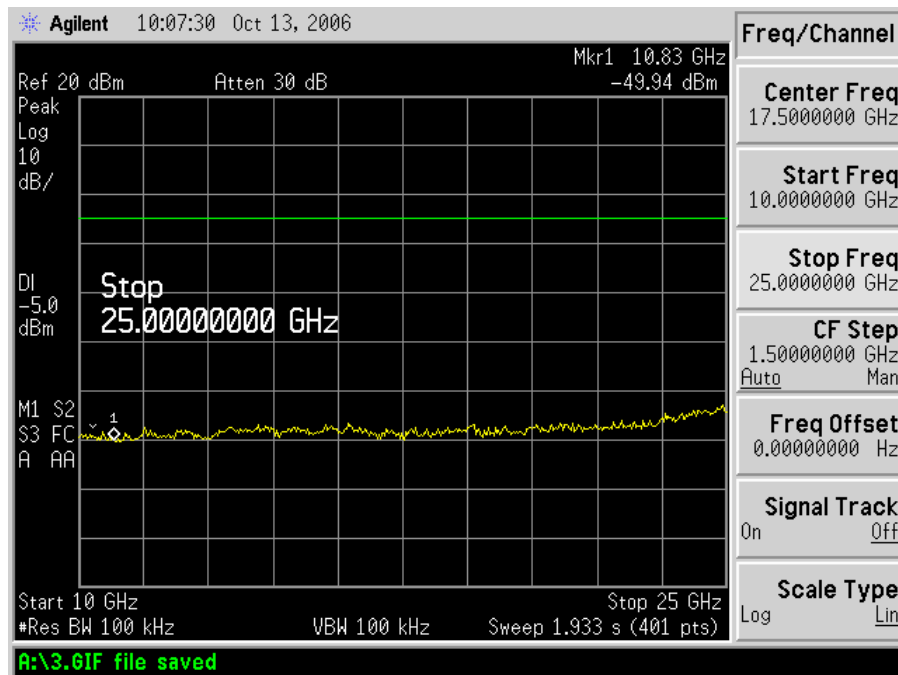
Channel 11 Tx Port 10-25 GHz



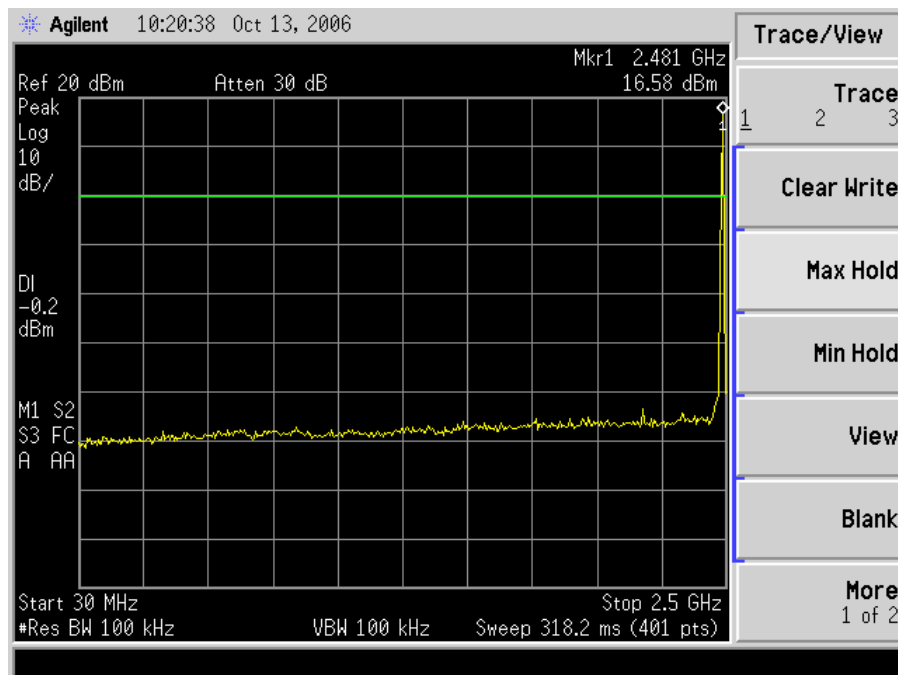
Channel 17 Tx Port 30-2500 MHz



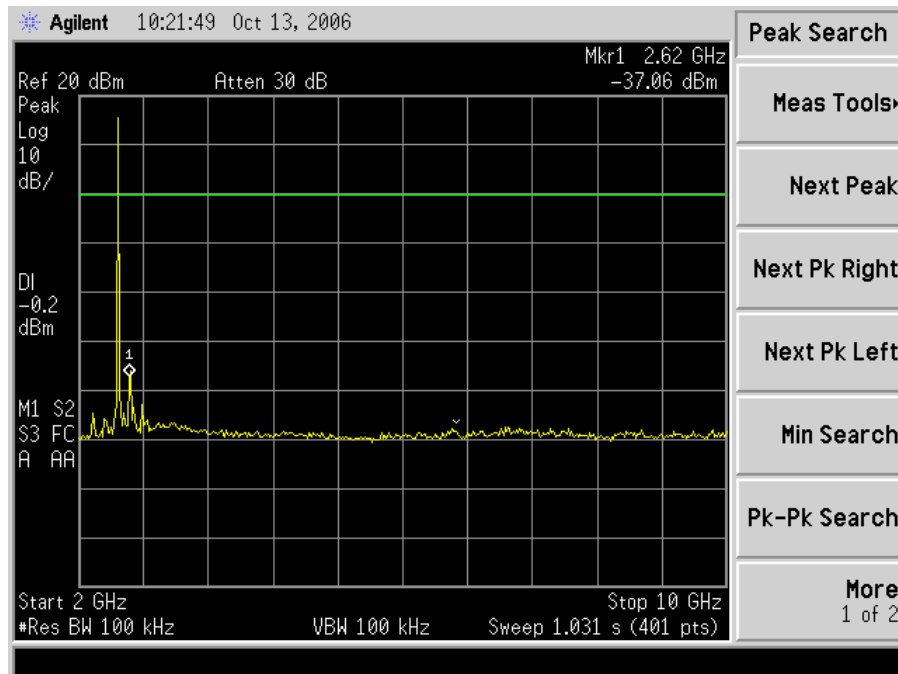
Channel 7 Tx Port 2-10 GHz



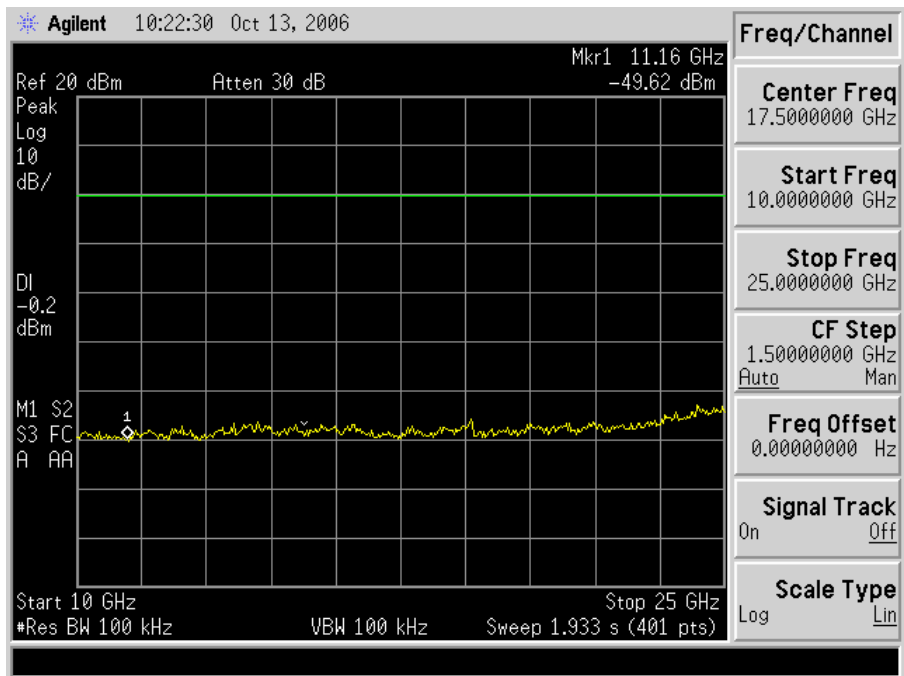
Channel 17 Tx Port 10-25 GHz



Channel 26 Tx Port 30-2500 MHz



Channel 26 Tx Port 2-10 GHz



Channel 26 Tx Port 10-25 GHz

6.4 Test: Radiated Spurious Emissions

Test Standard: FCC 15.205, 15.209, 15.247(d), 15.109, RSS-210 2.2, 2.7, A8.5, ICES-003

Test Results: Pass

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	See Tables	Pressure (hPa):	See Tables	Ambient (°C):	See Tables
Pretest Verification Performed	N/A		Equipment under Test:		Master Radio	

Maximum Test Parameters: The spurious emissions of the Radio Module must be attenuated below the level of the fundamental by at least 20 dBc. Emissions which fall in the restricted bands must meet the general limits of 15.209 and RSS-210 2.7 Table 2. The spurious emissions of the EUT must not exceed the limits of 15.109 Class A and ICES-003 Class A.

Test Equipment Used:

Equip. ID	Description	Manufacturer	Model	Serial Number	Cal Date	Cal Due
77	EMI Receiver	R & S	ES17	100044	10/14/05	10/14/06
192	Handheld Manometer	Omega	HHP-102F	19.99/29.0 PSIA	02/23/06	02/23/07
260	Humidity Temperature	Extech	445580	17-260	10/26/05	10/26/06
30	DMM	Fluke	8060A	6191012	02/02/06	02/02/07
82	Bi-ConiLog Antenna	Schaffner	CBL6112B	2726	06/13/06	06/13/07
128	RF Cable	Custom made	#1	none	08/01/06	08/01/07
131	RF Cable	Custom made	#4	none	08/01/06	08/01/07
271	Horn Antenna	A H Systems	SAS-571	787	02/08/06	02/08/07
101	EMI Receiver	Agilent	E7405A	US40240235	11/23/05	11/23/06
222	Pre-Amp	Miteq	AMF-4D-001180-24-10P	1020106	08/01/06	08/01/07
213153	High Pass Filter, 4 GHz	Reactel	7HS-4G/18G-S11	01-7	03/06/06	03/06/07
213154	High Pass Filter, 3 GHz	Filtek	HP12/3000-5AB	15B57-01	03/06/06	03/06/07
213023	Antenna, Horn, 18-40 GHz	EMCO	3166	9310-2222	3/22/06	3/26/07

Results:

Notes: Average values were obtained from peak readings using a 100% duty cycle factor. This is based on the indication from Mater Radio that the duty cycle depended on deployment circumstances and was not able to be simulated at the test laboratory. Some average values shown are noise floor readings, using an average detector

Note: The Master Radio was tested as a Class A digital device to FCC Part 15 Subpart B and ICES-003; Intentional transmission was tested as a transmitter to the requirements of FCC Part 15 Subpart C 15.247 and RSS-210 Annex 8

Standard: FCC 15.109
 Test: Radiated Emissions
 Frequency Range: 30 MHz to 1000 MHz
 Limits: Class A
 Measurement Distance: 3 meters
 EUT Configuration: Master Radio with AC/Adapter

Measurement Uncertainty: 3.6 dB
 Temperature: 24.5 °C
 Relative Humidity: 31.9 %Rh
 Atmospheric Pressure: 1000 mbar

Radiated Disturbance

Polarity	Frequency MHz	Ant Height cm	Azimuth deg.	QP dBuV/m	LIMIT dBuV/m	Margin dB
H	923.44	180.00	278.00	35.57	57	-21.43
H	874.98	191.00	286.00	50.23	57	-6.77
H	812.48	117.00	312.00	54.48	57	-2.52
H	749.99	117.00	181.00	54.32	57	-2.68
H	687.46	126.00	12.00	49.73	57	-7.27
H	549.99	148.00	81.00	35.76	57	-21.24
H	400.01	119.00	97.00	41.01	57	-15.99
H	300.00	116.00	144.00	51.23	57	-5.77
H	199.99	156.00	135.00	39.01	54	-14.99
H	31.02	345.00	285.00	29.14	50	-20.86
V	32.42	351.00	104.00	28.21	50	-21.79
V	34.48	117.00	11.00	32.16	50	-17.84
V	37.19	351.00	41.00	23.97	50	-26.03
V	300.01	116.00	344.00	47.25	57	-9.75
V	687.48	116.00	295.00	46.10	57	-10.9
V	749.99	126.00	198.00	51.01	57	-5.99
V	812.47	185.00	202.00	51.83	57	-5.17
V	874.99	115.00	178.00	45.86	57	-11.14
V	935.64	139.00	302.00	36.44	57	-20.56

Standard: FCC 15.109
 Test: Radiated Emissions
 Frequency Range: 30 MHz to 1000 MHz
 Limits: Class A
 Measurement Distance: 3 meters
 EUT Configuration: Master Radio with AC/Adapter

Measurement Uncertainty: 3.6 dB
 Temperature: 24.5 °C
 Relative Humidity: 31.9 %Rh
 Atmospheric Pressure: 1000 mbar

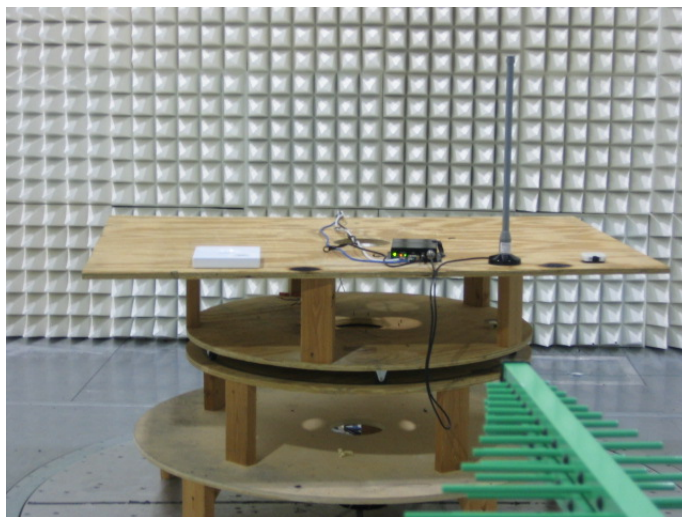
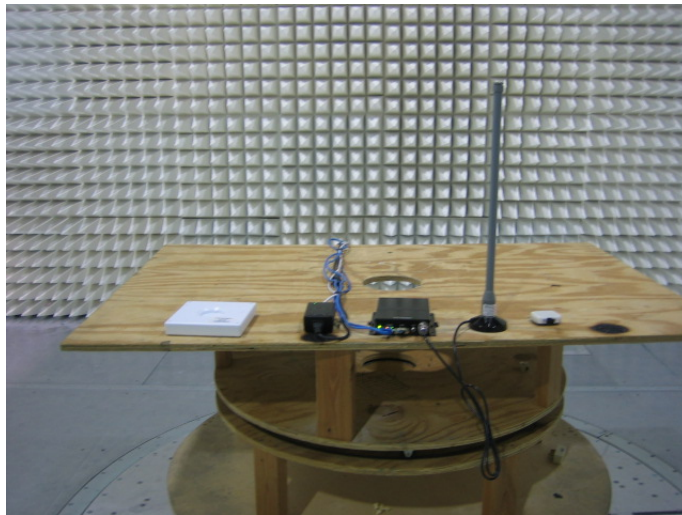
Radiated Disturbance

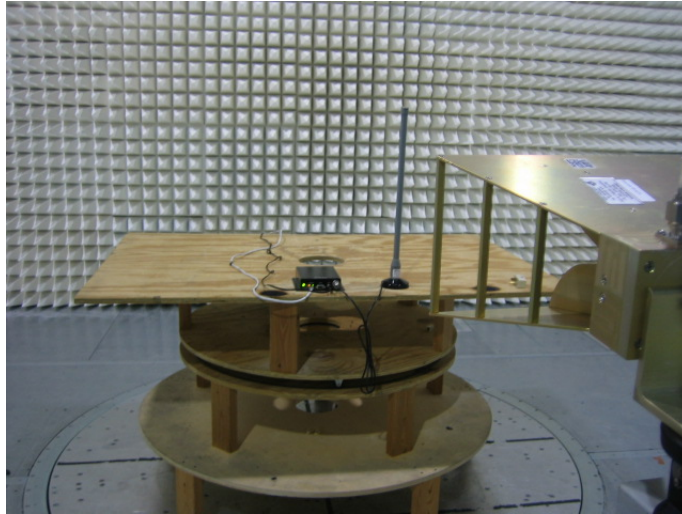
Polarity	Frequency	Ant	Azimuth	QP	LIMIT	Margin
H	874.98	115	303	43.70	57	-13.3
H	812.48	116	167	53.22	57	-3.78
H	749.97	117	148	52.23	57	-4.77
H	300.00	117	238	46.16	57	-10.84
H	250.01	116	125	39.19	57	-17.81
H	199.96	132	221	32.53	54	-21.47
H	105.30	291	285	39.35	54	-14.65
H	104.17	271	261	36.08	54	-17.92
H	102.58	254	264	37.05	54	-16.95
H	101.90	303	276	40.22	54	-13.78
H	99.31	306	270	39.46	54	-14.54
H	98.41	299	285	40.32	54	-13.68
H	96.65	260	273	33.72	54	-20.28
V	38.95	329	18	35.88	50	-14.12
V	45.63	117	42	34.11	50	-15.89
V	58.73	126	11	33.87	50	-16.13
V	59.43	116	12	35.39	50	-14.61
V	60.25	216	202	32.97	50	-17.03
V	60.89	117	19	34.73	50	-15.27
V	62.08	124	10	32.76	50	-17.24
V	62.99	211	351	36.41	50	-13.59
V	200.01	117	90	30.34	54	-23.66
V	250.01	116	120	33.91	57	-23.09
V	300.00	115	300	41.36	57	-15.64
V	749.99	116	258	46.57	57	-10.43
V	812.49	116	178	50.08	57	-6.92
V	874.98	116	326	42.67	57	-14.33

Polarity	Frequency GHz	Ant Height cm	Azimuth deg.	Peak dBuV/m	LIMIT dBuV/m	Margin dB
V	2.4055	100	0	110.36	---	---
V	2.4354	100	0	115.50	---	---
V	2.4805	100	0	116.04	---	---

Polarity	Frequency GHz	Ant Height cm	Azimuth deg.	AVG dBuV/m	LIMIT dBuV/m	Margin dB
V	4.8110	100	0	41.10	54.00	-12.90
V	4.8708	100	0	37.50	54.00	-16.50
V	4.9610	100	0	45.54	54.00	-8.46
V	7.2165	100	0	47.55	54.00	-6.45
V	7.3062	100	0	48.37	54.00	-5.63
V	7.4415	100	0	41.10	54.00	-12.90

6.4.1 Setup Photos





6.5 Test: Peak Power Spectral Density

Test Standard: FCC 15.247(e), RSS-210 A8.2

Test Results: Pass

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	N/A	Pressure (hPa):	N/A	Ambient (°C):	N/A
Pretest Verification Performed	N/A		Equipment under Test:	Master Radio		

Maximum Test Parameters: The peak power spectral density of the Radio Module must not exceed 8 dBm / 3 kHz.

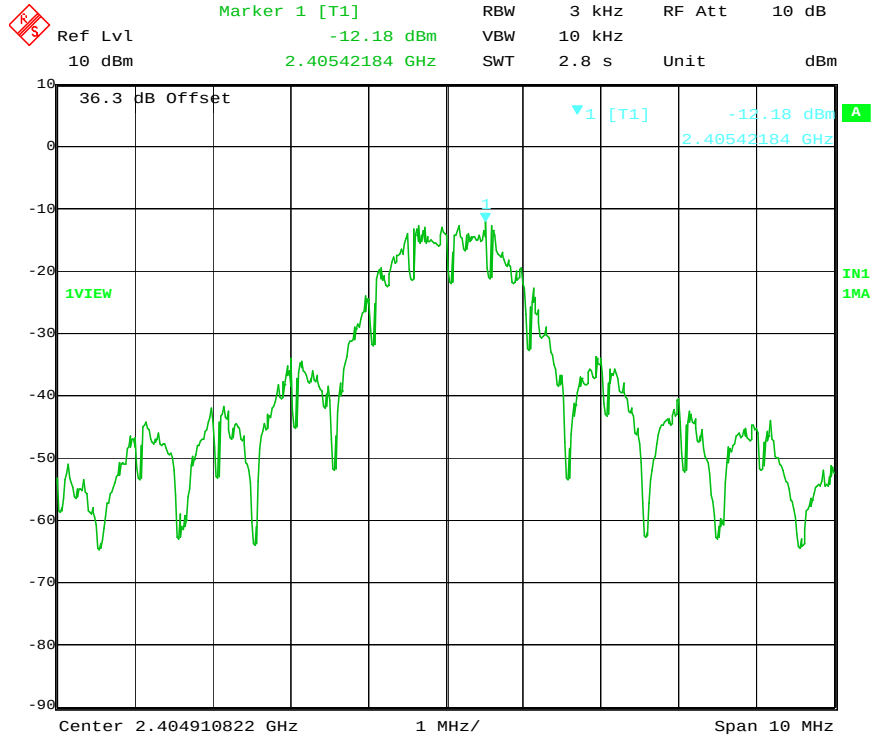
Test Equipment Used:

Equip. ID	Description	Manufacturer	Model	Serial Number	Cal Date	Cal Due
77	EMI Receiver	R & S	ES17	100044	10/14/05	10/14/06
192	Handheld Manometer	Omega	HHP-102F	19.99/29.0 PSIA	02/23/06	02/23/07
260	Humidity Temperature	Extech	445580	17-260	10/26/05	10/26/06
30	DMM	Fluke	8060A	6191012	02/02/06	02/02/07
82	Bi-ConiLog Antenna	Schaffner	CBL6112B	2726	06/13/06	06/13/07
128	RF Cable	Custom made	#1	none	08/01/06	08/01/07
131	RF Cable	Custom made	#4	none	08/01/06	08/01/07
271	Horn Antenna	A H Systems	SAS-571	787	02/08/06	02/08/07
101	EMI Receiver	Agilent	E7405A	US40240235	11/23/05	11/23/06
222	Pre-Amp	Miteq	AMF-4D-001180-24-10P	1020106	08/01/06	08/01/07
213153	High Pass Filter, 4 GHz	Reactel	7HS-4G/18G-S11	01-7	03/06/06	03/06/07
213154	High Pass Filter, 3 GHz	Filtek	HP12/3000-5AB	15B57-01	03/06/06	03/06/07
213023	Antenna, Horn, 18-40 GHz	EMCO	3166	9310-2222	3/22/06	3/26/07

Test Results:

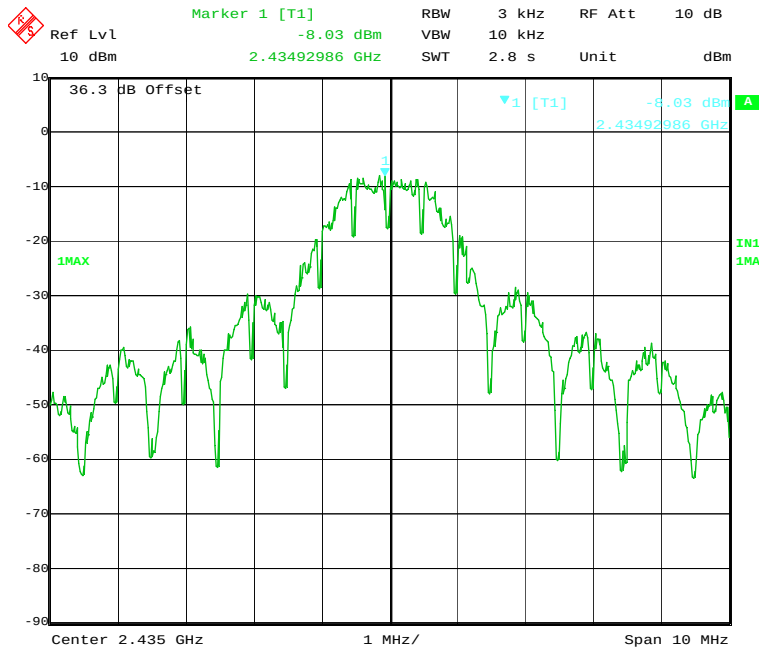
Notes: The cable loss was compensated for in the spectrum analyzer.

Channel	Frequency	Peak Power Spectral Density
11	2405 MHz	-12.18 dBm
17	2435 MHz	-8.03 dBm
26	2480 MHz	-7.89 dBm



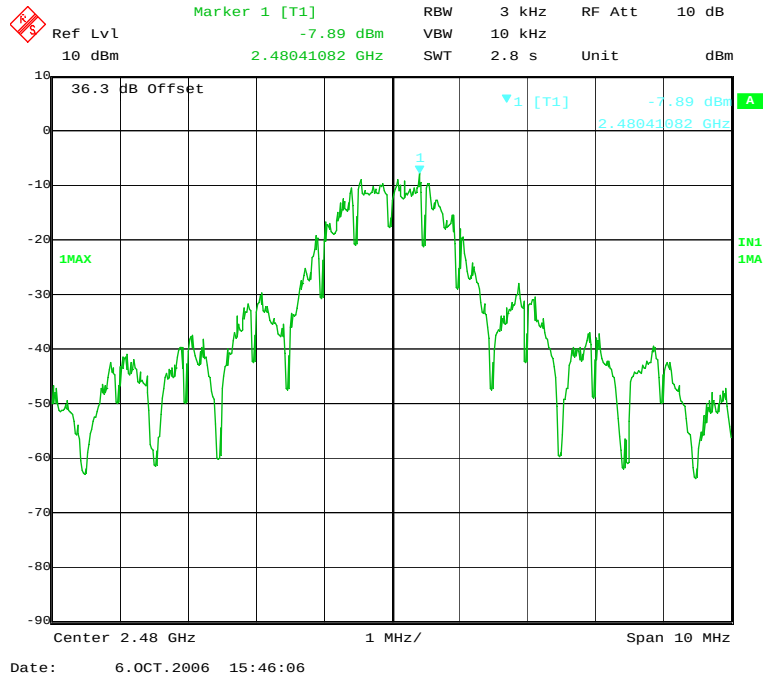
Date: 6.OCT.2006 15:18:46

Channel 11 Peak Power Spectral Density



Date: 6.OCT.2006 16:06:11

Channel 17 Peak Power Spectral Density



Channel 26 Peak Power Spectral Density

6.6 Test: Band Edge Compliance

Test Standard: FCC 15.215, RSS-210 2.1, A8.5

Test Results: Pass

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	N/A	Pressure (hPa):	N/A	Ambient (°C):	N/A
Pretest Verification Performed	N/A		Equipment under Test:	Master Radio		

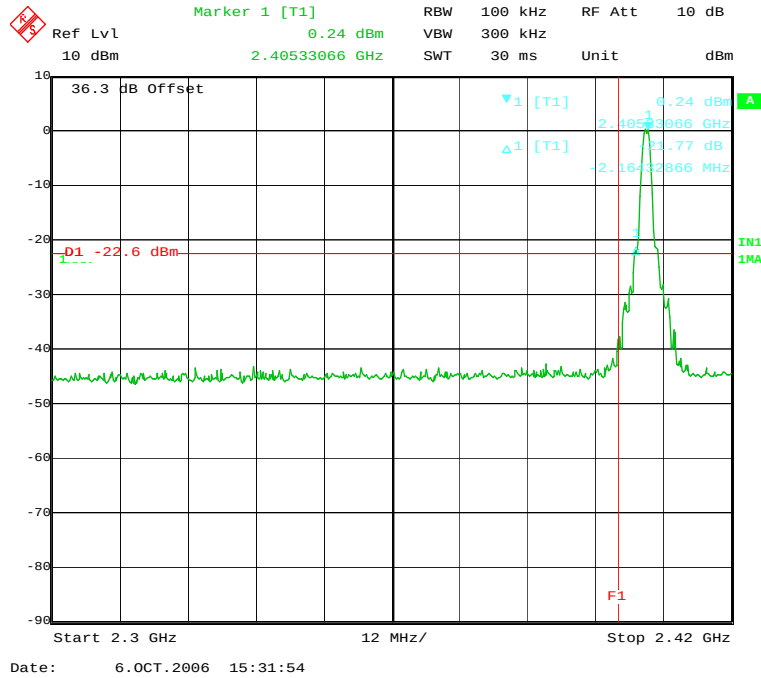
Maximum Test Parameters: The fundamental frequency of the Radio Module must stay within the assigned frequency band.

Test Equipment Used:

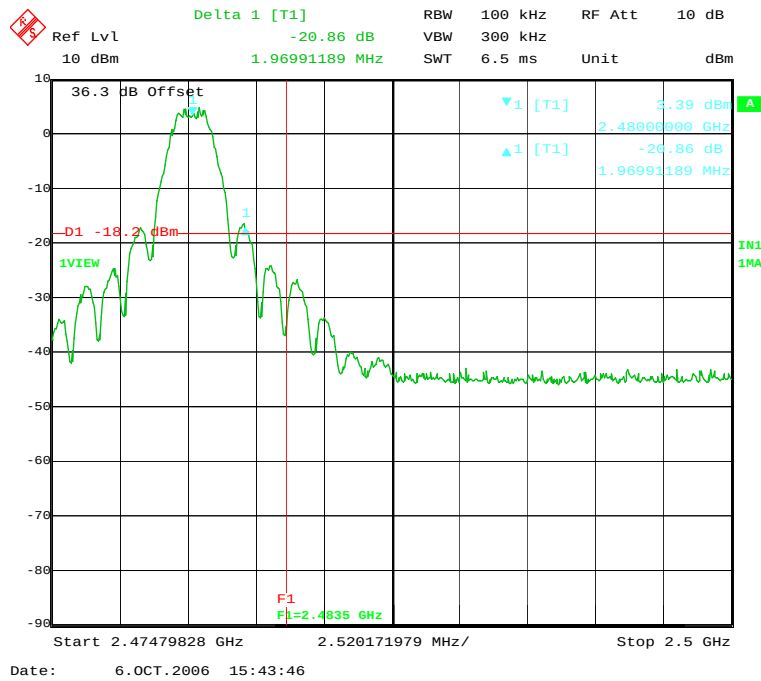
Equip. ID	Description	Manufacturer	Model	Serial Number	Cal Date	Cal Due
77	EMI Receiver	R & S	ES17	100044	10/14/05	10/14/06
192	Handheld Manometer	Omega	HHP-102F	19.99/29.0 PSIA	02/23/06	02/23/07
260	Humidity Temperature	Extech	445580	17-260	10/26/05	10/26/06
30	DMM	Fluke	8060A	6191012	02/02/06	02/02/07
82	Bi-ConiLog Antenna	Schaffner	CBL6112B	2726	06/13/06	06/13/07
128	RF Cable	Custom made	#1	none	08/01/06	08/01/07
131	RF Cable	Custom made	#4	none	08/01/06	08/01/07
271	Horn Antenna	A H Systems	SAS-571	787	02/08/06	02/08/07
101	EMI Receiver	Agilent	E7405A	US40240235	11/23/05	11/23/06
222	Pre-Amp	Miteq	AMF-4D-001180-24-10P	1020106	08/01/06	08/01/07
213153	High Pass Filter, 4 GHz	Reactel	7HS-4G/18G-S11	01-7	03/06/06	03/06/07
213154	High Pass Filter, 3 GHz	Filtek	HP12/3000-5AB	15B57-01	03/06/06	03/06/07
213023	Antenna, Horn, 18-40 GHz	EMCO	3166	9310-2222	3/22/06	3/26/07

Test Results:

Notes: The cable loss was compensated for in the spectrum analyzer. A 100 kHz bandwidth was used, and a display line was placed 20 dB down from the peak of the channel shown. A marker was placed at the band edge. Note that no signal level beyond the band edge exceeds the level of the display line, and therefore the band edge requirements are met.



Channel 11 Band Edge Compliance



Channel 26 Band Edge Compliance

6.7 Test: AC Line-Conducted Spurious Emissions

Test Standard: FCC 15.207, 15.107, RSS-Gen 7.2.2, ICES-003

Test Results: Pass

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	See Tables	Pressure (hPa):	See Tables	Ambient (°C):	See Tables
Pretest Verification Performed	N/A		Equipment under Test:		Master Radio	

Maximum Test Parameters: The AC line-conducted emissions of the Radio Module must not exceed the limits of 15.207 and RSS-Gen 7.2.2 Table 2. The AC line-conducted emissions of the BEP must not exceed the limits of 15.107 Class A and ICES-003 Class A.

Test Equipment Used:

Equip. ID	Description	Manufacturer	Model	Serial Number	Cal Date	Cal Due
87	Spectrum Analyzer	Agilent Technologies	E7405A	US40240235	11/23/05	11/23/06
192	Handheld Manometer	Omega	HHP-102F	19.99/29.0 PSIA	02/23/06	02/23/07
260	Humidity Temperature	Extech	445580	17-260	10/26/05	10/26/06
30	DMM	Fluke	8060A	6191012	02/02/06	02/02/07
136	RF Cable	Custom made	#8	none	08/01/06	08/01/07
91	LISN	FCC	FCC-LISN-50-25-2-01	1020	06/07/06	06/07/07
101	Transient Limiter	HP	11947A	3107A03304	08/01/06	08/01/07

Test Results:

Notes: The Master Radio was tested as a Class A digital device, while the Master Radio was tested to the requirements of FCC Part 15 Subpart C 15.207.

Standard: FCC 15.107

Test: Conducted Emissions

Frequency Range: 150 kHz to 30 MHz

Limits: Class A

Measurement Uncertainty: 1.74

Temperature: 24.3 °C

Relative Humidity: 49 %Rh

Atmospheric Pressure: 998 mbar

Measurements made on selected frequencies from line conductor are given below:

Conducted Disturbance at AC Mains (With AC Adapter):Line 1

Frequency MHz	L1 QP dB μ V	L1 Avg dB μ V	QP Class B Limit (dB μ V)	QP Margin dB	Avg. Class B Limit (dB μ V)	Avg. Margin dB
3.39	32.402	17.345	73.000	-40.598	60.000	-42.655
3.262	35.827	21.294	73.000	-37.173	60.000	-38.706
3.227	35.900	17.138	73.000	-37.100	60.000	-42.862
3.157	36.990	22.017	73.000	-36.010	60.000	-37.983
2.989	35.949	19.218	73.000	-37.051	60.000	-40.782
1.607	36.236	23.532	73.000	-36.764	60.000	-36.468
1.478	39.401	34.701	73.000	-33.599	60.000	-25.299
1.442	40.010	32.939	73.000	-32.990	60.000	-27.061
1.242	40.145	35.846	73.000	-32.855	60.000	-24.154
1.21	40.131	38.307	73.000	-32.869	60.000	-21.693

Conducted Disturbance at AC Mains (With AC Adapter):Line 2

Frequency MHz	L2 QP dB μ V	L2 Avg dB μ V	QP Class B Limit (dB μ V)	QP Margin dB	Avg. Class B Limit (dB μ V)	Avg. Margin dB
3.374	38.891	22.623	73.000	-34.109	60.000	-37.377
3.278	40.489	27.908	73.000	-32.511	60.000	-32.092
3.208	40.660	30.084	73.000	-32.340	60.000	-29.916
3.11	38.433	28.876	73.000	-34.567	60.000	-31.124
0.944	39.160	36.086	73.000	-33.840	60.000	-23.914
0.74	40.014	36.647	73.000	-32.986	60.000	-23.353
0.708	39.645	37.762	73.000	-33.355	60.000	-22.238
0.54	41.326	40.746	73.000	-31.674	60.000	-19.254
0.504	39.959	37.247	73.000	-33.041	60.000	-22.753
0.152	40.208	17.742	79.000	-38.792	66.000	-48.258

Results: ☒ Pass ☐ Fail ☐ N/A

Standard: FCC 15.107

Test: Conducted Emissions

Frequency Range: 150 kHz to 30 MHz

Limits: Class A

Measurement Uncertainty: 1.74

Temperature: 24.3 °C

Relative Humidity: 49 %Rh

Atmospheric Pressure: 998 mbar

Measurements made on selected frequencies from line conductor are given below:

Conducted Disturbance at AC Mains (With PoE):Line 1

Frequency MHz	L1 QP dB μ V	L1 Avg dB μ V	QP Class B Limit (dB μ V)	QP Margin dB	Avg. Class B Limit (dB μ V)	Avg. Margin dB
27.349	25.692	21.703	73.000	-47.308	60.000	-38.297
27.049	26.087	22.128	73.000	-46.913	60.000	-37.872
26.749	26.900	22.626	73.000	-46.100	60.000	-37.374
26.445	36.627	32.834	73.000	-36.373	60.000	-27.166
26.145	40.016	36.768	73.000	-32.984	60.000	-23.232
25.845	40.776	37.694	73.000	-32.224	60.000	-22.306
25.545	42.470	38.502	73.000	-30.530	60.000	-21.498
25.245	46.459	42.288	73.000	-26.541	60.000	-17.712
24.945	49.182	46.580	73.000	-23.818	60.000	-13.420
16.529	52.510	51.336	73.000	-20.490	60.000	-8.664

Conducted Disturbance at AC Mains (With PoE):Line 2

Frequency MHz	L2 QP dB μ V	L2 Avg dB μ V	QP Class B Limit (dB μ V)	QP Margin dB	Avg. Class B Limit (dB μ V)	Avg. Margin dB
27.328	43.222	39.887	73.000	-29.778	60.000	-20.113
27.028	44.718	43.341	73.000	-28.282	60.000	-16.659
26.724	52.722	51.328	73.000	-20.278	60.000	-8.672
26.428	47.077	44.936	73.000	-25.923	60.000	-15.064
26.124	55.412	54.656	73.000	-17.588	60.000	-5.344
25.824	54.647	54.006	73.000	-18.353	60.000	-5.994
25.524	53.202	52.257	73.000	-19.798	60.000	-7.743
25.224	53.561	52.652	73.000	-19.439	60.000	-7.348
24.924	53.750	53.235	73.000	-19.250	60.000	-6.765
15.316	52.392	51.771	73.000	-20.608	60.000	-8.229

Results:

☒ Pass

☐ Fail

☐ N/A

6.7.1 Setup Photos

