Electromagnetic Compatibility Test Report

Prepared in accordance with

CFR47-15C and RSS-210, Issue 8

On

Hand-Held Interrogator

PI900W

Elster Solutions, LLC
208 South Rogers Lane
Raleigh, NC 27610 USA

Prepared by:

TUV Rheinland of North America, Inc.

Manufacturer's statement - attestation

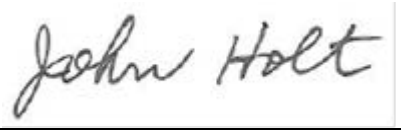
The manufacturer; Elster Solutions, LLC as the responsible party for the equipment tested, hereby affirms:

a) That he has reviewed and concurs that the test shown in this report are reflective of the operational characteristics of the device for which certification is sought;

b) That the device in this test report will be representative of production units;

c) That all changes (in hardware and software/firmware) to the subject device will be reviewed.

d) That any changes impacting the attributes, functionality or operational characteristics documented in this report will be communicated to the body responsible for approving (certifying) the subject equipment.

John Holt	
Printed name of official	Signature of official
208 South Rogers Lane Raleigh, NC 27610	25 September 2012
Address	Date
919-250-5575	John.Holt@Elster.com
Telephone number	Email address of official

Client:	Elster Solutions, LLC 208 South Rogers Lane Raleigh, NC 27610 USA	John Holt 919-250-5557 / 919-250-5486 John.Holt@us.elster.com

Identification:	Hand-Held Interrogator	***Serial No.:***	PRODUCTION SAMPLE
Test item:	PI900W	***Date tested:***	21 September 2012
Testing location:	TUV Rheinland of North America 762 Park Avenue Youngsville, NC 27596-9470 U.S.A.		Tel: (919) 554-3668 Fax: (919) 554-3542
Test specification:	**Emissions: FCC Part 15C, RSS-210 Issue 8:** FCC Parts 15.207(a) and RSS-GEN 7.2.4, FCC Part 15.31(e) FCC Parts 15.205, 15.209, 15.215(c), RSS-210 FCC Part 15.247(a)(1)(i) and RSS-210 A1.1.3, FCC Part 15.247(a)(1)(i), RSS-210, Section A8.1 and Section A1.1.3, FCC Part 15.247(a)(1) and RSS-210 A8.1(c), FCC Part 15.247(b)(2) and RSS-210 A8.4(1), FCC Part 15.247(g) and RSS-210 A8.1, FCC Part 15.247(h) and RSS-210 A8.1, FCC Parts 15.249(d), 15.209, 15.215(c) and RSS-210 A2.9, RSS-GEN 7.2.1 FCC Parts 15.249(a), 15.249(c), RSS-210 A2.9(a) FCC Parts 15.109(a) and ICES-003 and FCC Part 15.107(a) and ICES-003 FCC Part 2.1093 and RSS-102, Issue 4,		
Test Result	**The above product was found to be Compliant to the above test standard(s)**		

tested by: Mark Ryan	***reviewed by:*** Robert Richards
24 Sep 2010 ***Signature***	27 September 2012 ***Date*** ***Signature***
Other Aspects:	**None**

Abbreviations: OK, Pass, Compliant, Complies = passed
Fail, Not Compliant, Does Not Comply = failed
N/A = not applicable

90552 and 100881	**Testing Cert #3331.05**	**Industry Canada** **2932H-1 and 2932H-2**

TABLE OF CONTENTS

1 General Information

1.1 Scope

This report is intended to document the status of conformance with the requirements of the CFR47-15C and RSS-210, Issue 8 based on the results of testing performed on 21 September 2012 on the Hand-Held Interrogator, Model No. PI900W, manufactured by Elster Solutions, LLC. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All ancillary documentation will be included as a supplements.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT (Equipment Under Test) in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 Revision History

Revision	Date	Description of Revision
--	25 Sept 2012	Initial Release
A	27 Sept 2012	Corrected Model Number

1.4 Summary of Test Results

Applicant	Elster Solutions, LLC 208 South Rogers Lane Raleigh, NC 27610 USA	**Tel**	919-250-5557	**Contact**	John Holt
		Fax	919-250-5486	**e-mail**	John.Holt@us.elster.com

Description	Hand-Held Interrogator	**Model Number**	PI900W
Serial Number	PRODUCTION SAMPLE	**Test Voltage/Freq.**	7.2V Battery
Test Date Completed:	21 September 2012	**Test Engineer**	Mark Ryan

Standards	Description	Severity Level or Limit	Worst Case	Test Result
FCC Part 15, Subpart C Standard	Radio Frequency Devices-Subpart C: Intentional Radiators	See called out basic standards below	See Below	**Complies**
RSS-210 Issue 8 Standard	Low-Power Licence-exempt Radiocommunication Devices Category I Equipment	See called out basic standards below	See Below	**Complies**
FCC Part 15.247 and RSS-210 Issue 8, Annex 8				
FCC Parts 15.205, 15.209, 15.215(c), RSS-210	Radiated Emissions EUT in Transmit Mode	Below limit of sections 15.205, 15.209(a) and 15.215(c)	51.7 dBµV	Complies
FCC Part 15.207(a) and RSS-210	Conducted Emissions on Mains EUT in Transmit Mode	EUT is 7.2V Battery opered only.	NA	Not Applicable
FCC Part 15.247(a)(1)(i), RSS-210, Section A8.1	Channel Seperation	minimum 25kHz or 20dB Channel Band Width (which ever is greater)	400 kHz	Complies
FCC Part 15.247(a)(1) and RSS-210 A8.1(c)	Pseudorandom Hoppong Algorithm	25 hopping channels when the BW ≥ 250kHz	See technical description	Complies
FCC Part 15.247(a)(1)(i) and RSS-210 A1.1.3	Occupied Bandwidth	20dB ≤ 500 kHz 99% BW ≤ 500 kHz	470 kHz 472 kHz	Complies
FCC Part 15.247(d) and RSS-210 A8.5	Band Edge	Ensure 20dB bandwidth is Contained within the Frequency Band	>20dB BW is contained	Complies
FCC Part 15.247(b)(2) and RSS-210 A8.4(1)	Transmitter Output Power	Shall not exceed 0.25 Watts	0.230 W	Complies
FCC Part 15.247(g) and RSS-210 A8.1	Frequency Hopping Spread Spectrum (FHSS) Systems	Description of Hopping System	See technical description	Complies
FCC Part 15.247(h) and RSS-210 A8.1	Incorporation of Intelligence within a FHSS System	Not Applicable: EUT does not incorporate hopping intelligence	NA	Not Applicable

Standards	Description	Severity Level or Limit	Worst Case	Test Result
FCC Part 15.249 and RSS-210 Issue 8, Annex A				
FCC Part 15.249 and RSS-210 A2.9	Radiated Output Power for Fundamental and Harmonic Frequencies	Fund: Shall not exceed 50mV/m at 3m Harmonics: Shall not exceed 500µV/m (0.5 mV/m) at 3m, (unresticted bands)	93.4 dBµV/m	Complies
FCC Part 15.249(e), and RSS-210 A8.1(c)	Band Edge	Ensure 20dB bandwidth is Contained within the Frequency Band	>20dB BW is contained	Complies
FCC Parts 15.249(a), 15.249(c), RSS-210 A2.9(a)	Out-of-Band Spurious Emissions (EUT in Transmit Mode)	Below the applicable limits	35.9 dBµV	Complies
FCC Parts 15.209, 15.215(c), RSS-210 A2.9 and RSS-GEN 7.2.1	Conducted Emissions on AC Mains	NA, The EUT is 7.2V Battery operated only	NA	NA
RSS-210 A1.1.3	Occupied Bandwidth	99% BW ≤ 0.5% of center freq.	80.8 kHz	Complies
Emissions in Receive Mode				
FCC Part 15.109(a) and RSS-210 2.2 and 2.3	Receive Mode - Radiated Emissions	Below limit of the resticted bands lised in RSS-GEN section 6	38.3 dBµV	Complies
FCC Part 15.107(a) and RSS-210 2.2 and 2.3	Receive Mode - Conducted Emissions on AC Mains	NA, The EUT is 7.2V Battery operated only	NA	NA
RF Exposure				
FCC Part 2.1093 and RSS-102, Issue 4	RF Exposure	SAR or MPE Requirements	26.7 mW	Complies

2 Laboratory Information

2.1 Laboratory Certifications

2.1.1 US Federal Communications Commission

TUV Rheinland of North America located at 762 Park Avenue, Youngsville, NC 27596-9470 is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90552 and 100881). The laboratory scope of accreditation includes: Title 47 CFR Part 15, and 18. The accreditation is updated every 3 years.

2.1.2 NIST / A2LA

Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Standard 17025:2005 (Certificate Number: 3331.05, Master Code: 134288). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Industry Canada

Registration No.: 2932H-1 The OATS has been accepted by Industry Canada to perform testing to 3 and to 10 meters, based on the test procedures described in ANSI C63.4-2009.

Registration No.: 2932H-2 The 5 meter chamber has been accepted by Industry Canada to perform testing to 3 meters, based on the test procedures described in ANSI C63.4-2009.

2.1.4 Japan – VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland at the 762 Park Ave. Youngsville, N.C 27596 address has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Laboratory Registration No: A-0034).

2.1.5 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

2.1.6 Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.2 Expanded Measurement Uncertainty Emissions

	U_{lab}	U_{cispr}
Radiated Disturbance @ 3m		
30 MHz – 1,000 MHz	4.52 dB	5.2 dB
Radiated Disturbance @ 10m		
30 MHz – 1,000 MHz	4.51 dB	5.2 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	3.33 dB	3.6 dB
Disturbance Power		
30 MHz – 300 MHz	4.00 dB	4.5 dB

2.2.1 Measurement Uncertainty Immunity

The estimated combined standard uncertainty for harmonic current and flicker measurements is ± 2.50 %
The estimated combined standard uncertainty for ESD immunity measurements is 4.10 %
The estimated combined standard uncertainty for radiated immunity measurements is ± 2.05 dB
The estimated combined standard uncertainty for EFT fast transient immunity measurements is ± 2.92 %
The estimated combined standard uncertainty for surge immunity measurements is ± 2.92 %
The estimated combined standard uncertainty for conducted immunity measurements is ± 1.83 dB
The estimated combined standard uncertainty for power frequency magnetic field immunity measurements is ± 5.80 %
The estimated combined standard uncertainty for voltage variation and interruption measurements is ± 1.74 %

The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.3 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

2.4 Software Used

Manufacturer	Name	Version
Quantum Change/EMC Systems LLC.	Tile	3.2U
TopRudder	RadCon RF Immunity	1.1.13
TUV	Alt “R”	1
TUV	Alt “C”	1
VolTech Instruments	IEC61000-3 for PM6000	1.24.12
California Intruments	AC Source GUI 32	1.19
CTS	CTS 3.0	3.2.0.32
KeyTek ECAT	Surgeware	V5.31
KeyTek ECAT	Burstware	V5.31
Rohde & Schwarz	Click Rate Analyzer	1.7.0

2.5 Measurement Equipment Used

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
Radiated Emissions (5 Meter Chamber)					
Receiver, EMI	Rohde & Schwarz	ESIB40	100043	04-Sep-12	04-Sep-13
Receiver, EMI	Rohde & Schwarz	ESCI 7	100917	05-Sep-12	05-Sep-13
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	01-Sep-12	01-Sep-13
Ant. BiconiLog	Chase	CBL6140A	1108	24-Aug-11	24-Aug-13
Antenna Horn 1-18GHz	EMCO	3115	2236	13-Dec10	13-Dec-12
Cable, Coax	MicroCaox	MKR300C-0-0-1200-500500	002	01-Sep-12	01-Sep-13
Cable, Coax	MicroCaox	MKR300C-0-1968-500310	005	01-Sep-12	01-Sep-13
Cable, Coax	MicroCaox	UFB29C-1-5905-50U-50U	009	01-Sep-12	01-Sep-13
Cable, Coax	Andrew	FSJ1-50A	045	01-Sep-12	01-Sep-13
1.5 GHz High Pass Filter	Bonn Electronik	BHF 1500	025155	01-Sep-12	01-Sep-13
Antenna/Amp/Cable	ATM/Miteq/Microcoax	28-442-6/cal, JS42-26004000-28-5A, MKR300C-0-1968-500310	G047702-01	31-Aug-11	31-Aug-13
General Laboratory Equipment					
Meter, Multi	Fluke	179	90580752	06-Sep-12	06-Sep-13
Meter, Temp/Humid/Barom	Davis	7400	PB00205A13	09-May-12	09-May-13
Meter, Temp/Humid/Barom	Davis	7400	PB00205A05	09-May-12	09-May-13

3 Product Information

3.1 Product Description

See Technical Description Document.

3.2 Equipment Modifications

No modifications were needed to bring product into compliance.

3.3 Purpose of this Test Report

This test report is intended to be a new certification for an already approved device having the FCC ID; G8JHHI03 and IC ID; 4557C-HHI03. The frequency of the reference crystal is being changed in the transmitter. Refer to technical description and Block Diagram documents.

Figure 1 – Photo of EUT

Figure 2 – Photo of EUT enclosure with internal Antenna

Figure 3 – Photo of EUT enclosure with External Antenna with hand-held interrogator

FCC Part 15.247 and RSS-210 Issue 8, Annex 8

4 Intentional Radiator

4.1 Internal Antenna

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power, based on either RF conducted or radiated measurements. Conducted antenna port measurements are provided in Section 6.

4.1.1 Over View of Test

Results	**Complies** (as tested per this report)					**Date**	11 September 2012
Standard	FCC Parts 15.205, 15.209, 15.215 and RSS-210						
Product Model	PI900W			**Serial#**	Production Sample		
Test Set-up	Tested in a 5m Semi Anechoic chamber, placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane on a turn-table. See test plans for details						
EUT Powered By	7.2V Battery	**Temp**	75º F	**Humidity**	43%	**Pressure**	1012 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.1.2 Test Procedure

Testing was performed in accordance with 47 CFR Part 15, ANSI C63.10:2009, RSS-GEN Issue 2. These test methods are listed under the laboratory's A2LA Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.1.3 Deviations

There were no deviations from the test methodology listed in the test plan for the radiated emission test.

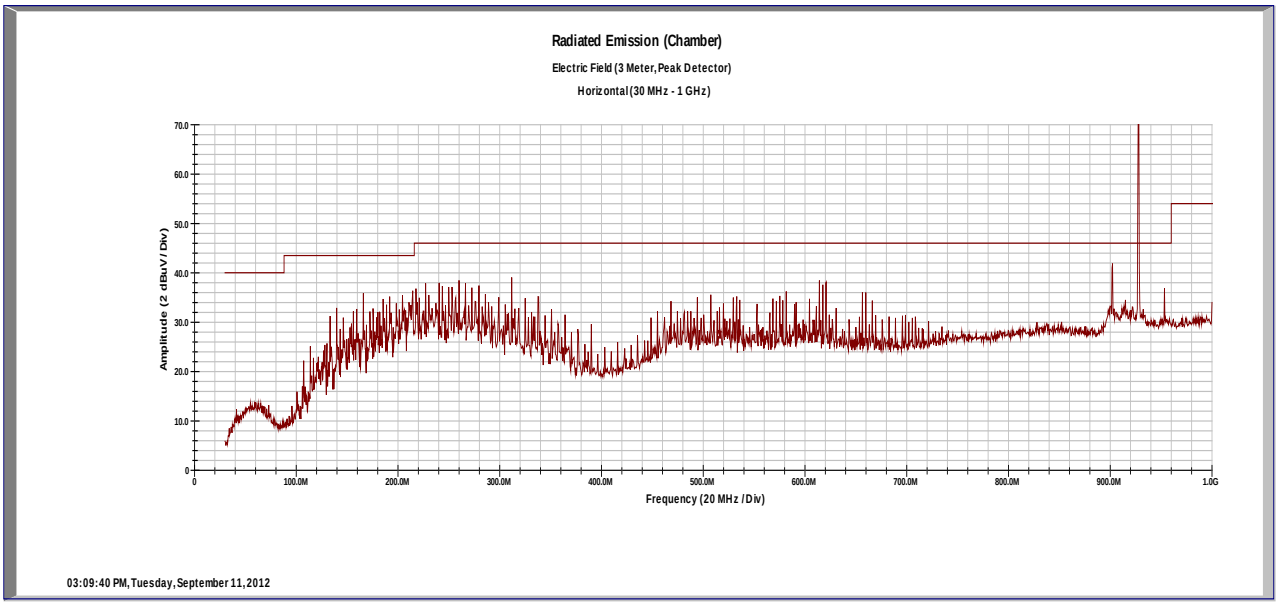
4.1.4 Final Test

All final radiated spurious emissions measurements were below (in compliance) the limits.

The worst –case emissions are shown below. All other emissions are on file at TUV Rheinland.

4.1.4.1 Emissions Outside the Frequency Band

Radiated Emissions 30 MHz – 1 GHz
Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
201.48	H	1	219	22.69	0.00	1.56	10.40	34.65	43.50	-8.85
227.48	H	1	220	23.07	0.00	1.65	10.75	35.47	46.00	-10.53
311.96	H	1	5	22.32	0.00	1.94	12.92	37.18	46.00	-8.82
607.76	H	1.1	5	12.68	0.00	2.72	19.06	34.46	46.00	-11.54

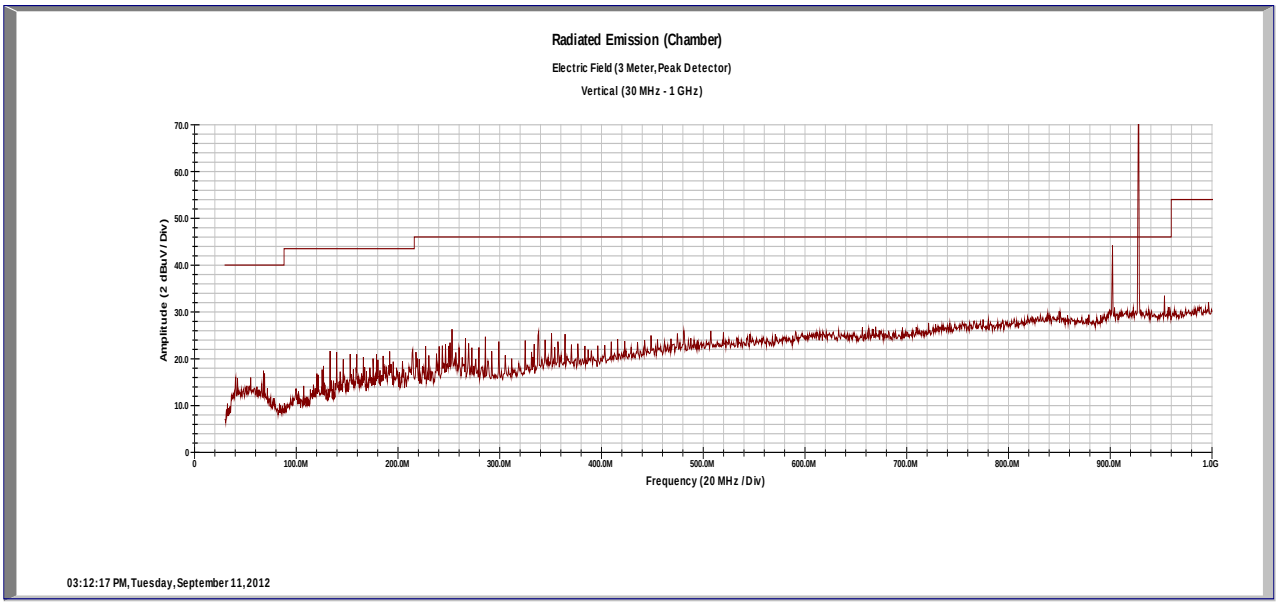
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Notes: Ch63 at 927.6 MHz w/ tunable notch filter at fundamental frequency.

All emissions are below the restricted band limits, including those that are outside the restricted bands.
Plots of the other channels are on file at TUV Rheinland

Radiated Emissions 30 MHz – 1 GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

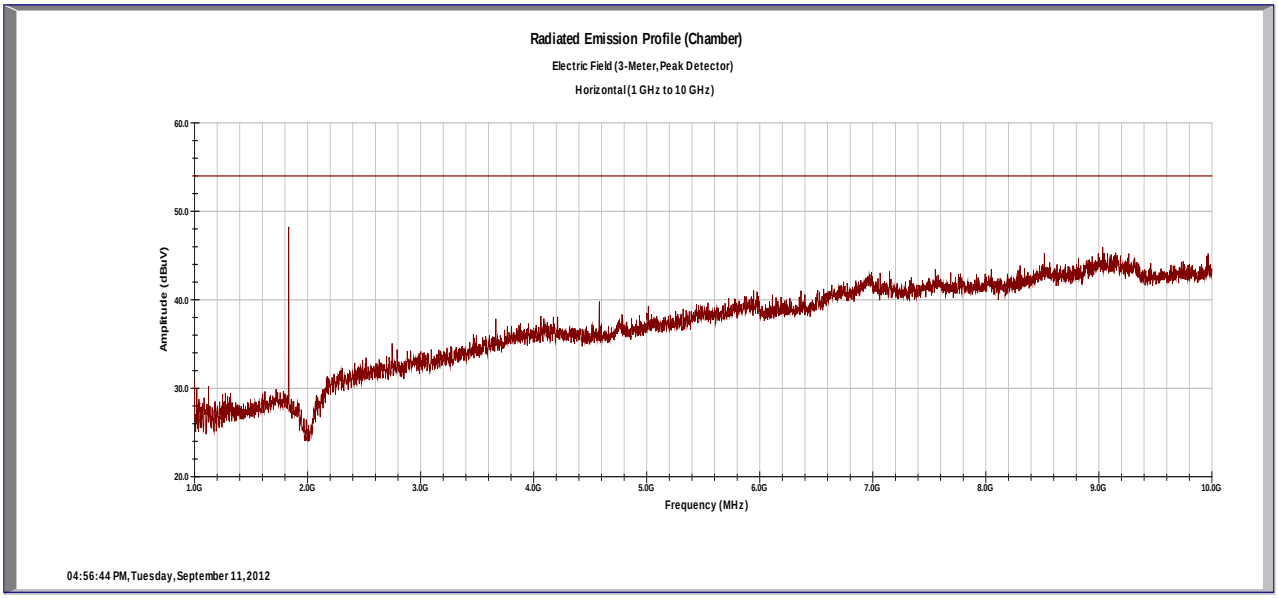
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Notes: Ch63 at 927.6 MHz w/ tunable notch filter at fundamental frequency.

All emissions are below the restricted band limits, including those that are outside the restricted bands.
Plots of the other channels are on file at TUV Rheinland

Radiated Emissions 1 – 10 GHz

Horizontal



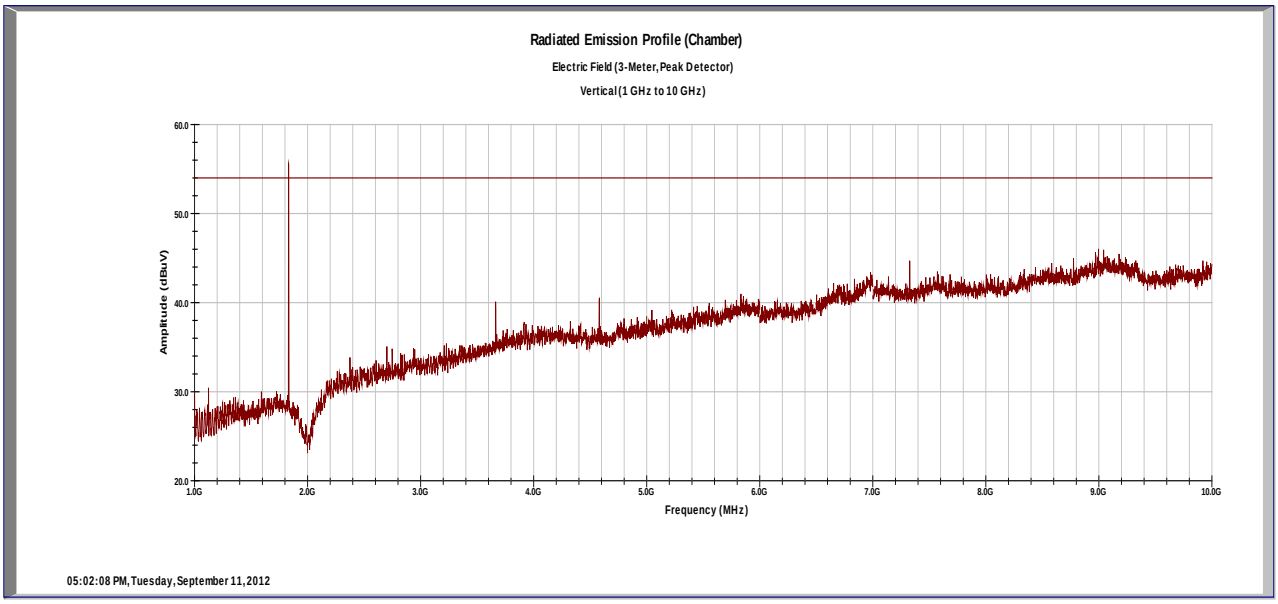
Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Notes: Worst Case harmonics at CH34 916.0 MHz, with tunable notch filter at preamp input.
All emissions are below the restricted band limits, including those that are outside the restricted bands.
Plots of the other channels are on file at TUV Rheinland

Radiated Emissions – 10 GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
1831.60	V	1.1	162	52.94	34.75	6.54	26.97	51.70	54.00	-2.30
1831.60	V	1.1	162	58.40	34.75	6.54	26.97	57.16	74.00	-16.84

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Notes: Worst Case harmonics at CH34 916.0 MHz, with tunable notch filter at preamp input.
All emissions are below the restricted band limits, including those that are outside the restricted bands.
Plots of the other channels are on file at TUV Rheinland

4.2 External Whip Antenna

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power, based on either RF conducted or radiated measurements. Conducted antenna port measurements are provided in Section 6.

4.2.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	13 September 2012	
Standard	FCC Parts 15.205, 15.209, 15.215 and RSS-210						
Product Model	PI900W			**Serial#**	Production Sample		
Test Set-up	Tested in a 5m Semi Anechoic chamber, placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane on a turn-table. See test plans for details						
EUT Powered By	7.2V Battery	**Temp**	75º F	**Humidity**	43%	**Pressure**	1020 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.2.2 Test Procedure

Testing was performed in accordance with 47 CFR Part 15, ANSI C63.10:2009, RSS-GEN Issue 2. These test methods are listed under the laboratory's A2LA Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.2.3 Deviations

There were no deviations from the test methodology listed in the test plan for the radiated emission test.

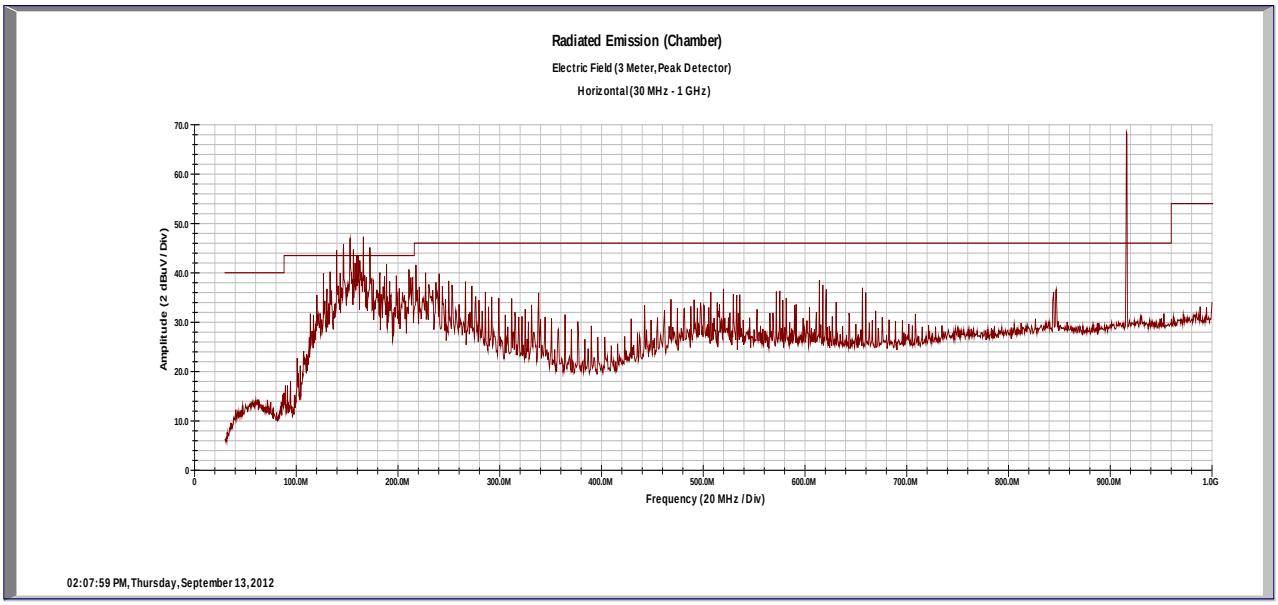
4.2.4 Final Test

All final radiated spurious emissions measurements were below (in compliance) the limits.

The worst –case emissions are shown below. All other emissions are on file at TUV Rheinland.

4.2.4.1 Emissions Outside the Frequency Band

Radiated Emissions 30 MHz – 1 GHz
Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
165.76	H	1.6	182	33.16	0.00	1.40	8.35	42.91	43.50	-0.59

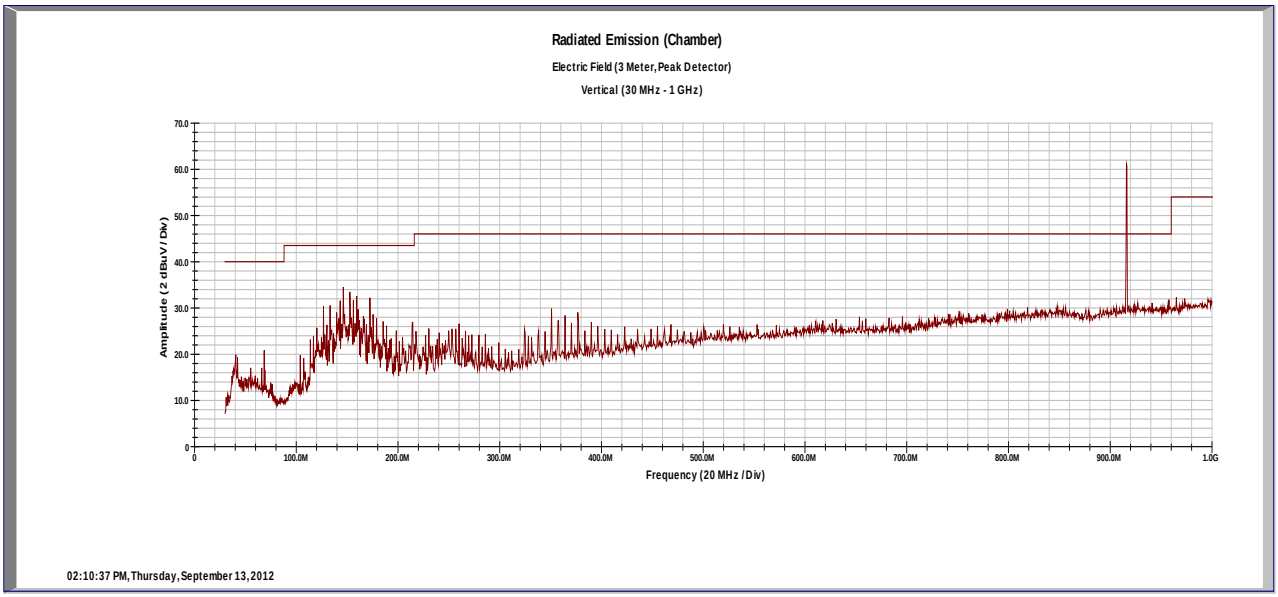
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Notes: Ch34 at 916.0 MHz w/ tunable notch filter at fundamental frequency.

All emissions are below the restricted band limits, including those that are outside the restricted bands.
Plots of the other channels are on file at TUV Rheinland

Radiated Emissions 30 MHz – 1 GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

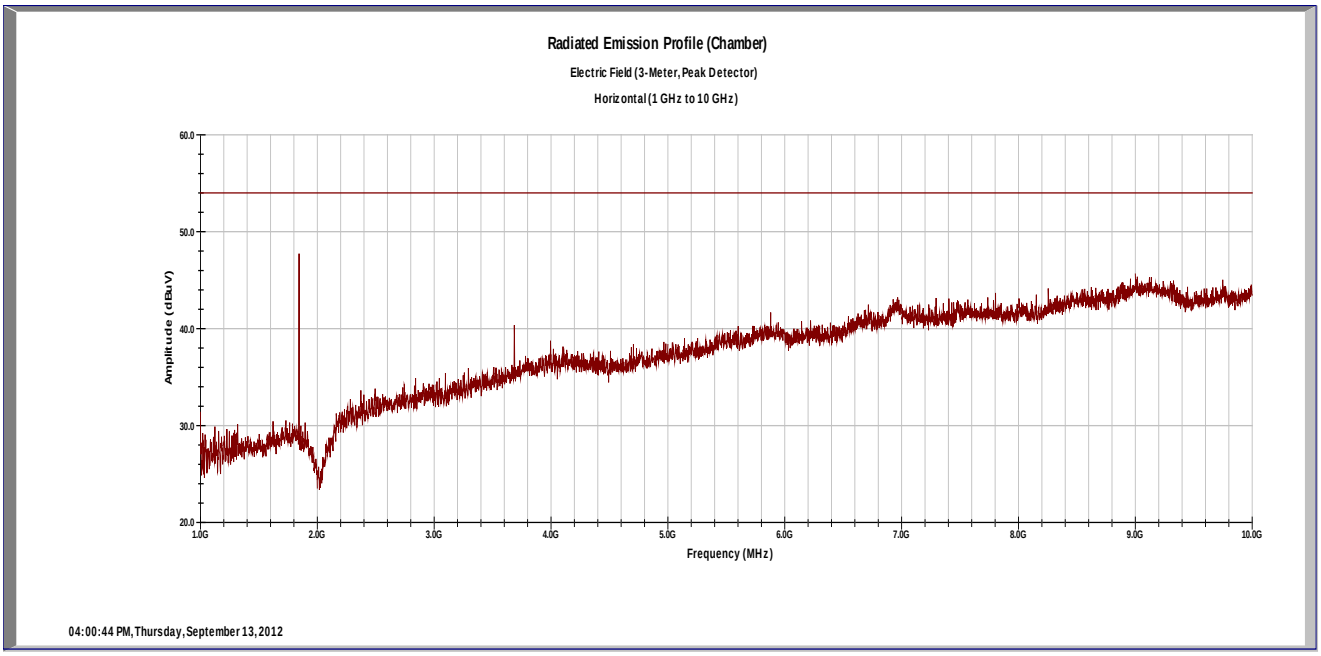
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Notes: Ch34 at 916.0 MHz w/ tunable notch filter at fundamental frequency.

All emissions are below the restricted band limits, including those that are outside the restricted bands.
Plots of the other channels are on file at TUV Rheinland

Radiated Emissions 1 – 10 GHz

Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
1843.20	H	1.3	302	47.29	34.75	6.56	26.97	46.07	54.00	-7.93
1843.20	H	1.3	302	50.81	34.75	6.56	26.97	49.59	74.00	-24.41
3686.00	H	1.3	58	29.91	34.31	9.26	32.19	37.05	54.00	-16.95
3686.00	H	1.3	58	41.39	34.31	9.26	32.19	48.53	74.00	-25.47

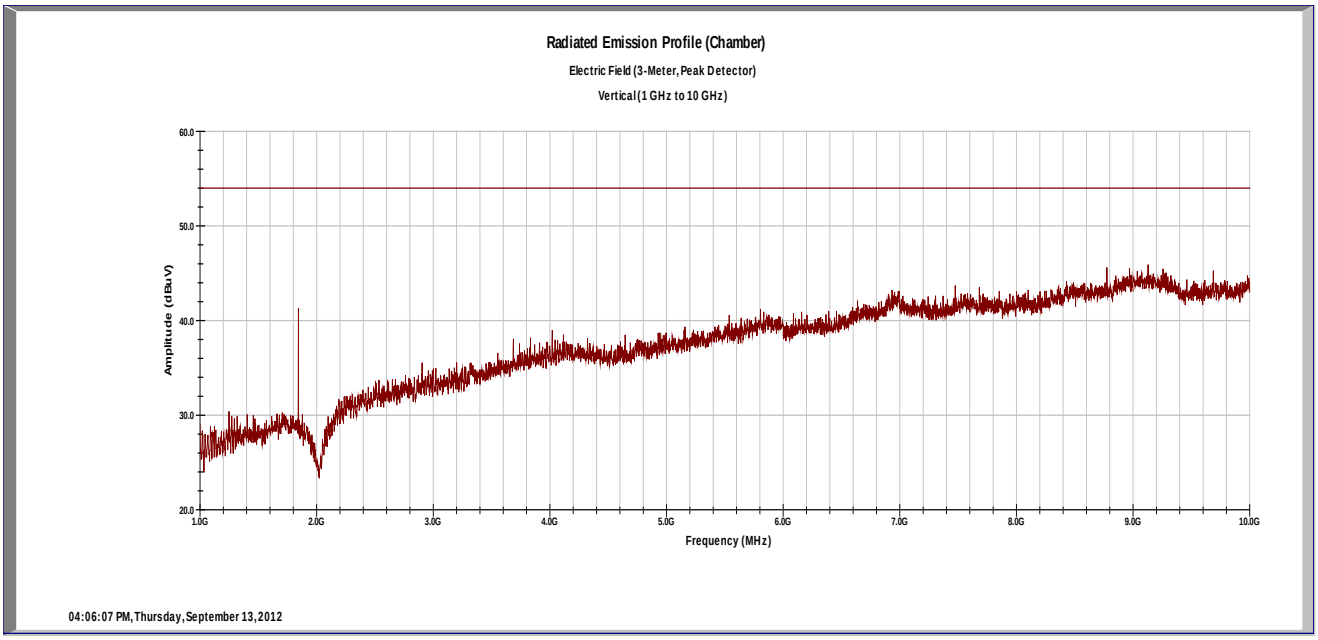
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Notes: Worst-case at CH48, with tunable notch filter.

All emissions are below the restricted band limits, including those that are outside the restricted bands.
Plots of the other channels are on file at TUV Rheinland

Radiated Emissions 1 – 10 GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Notes: Worst-case at CH48, with tunable notch filter.

All emissions are below the restricted band limits, including those that are outside the restricted bands.
Plots of the other channels are on file at TUV Rheinland

4.3 Conducted Emissions on AC Mains in Transmit mode

This test measures the electromagnet levels of spurious signals generated by the EUT on the AC power line that may affect the performance of other near by electronic equipment.

4.3.1 Test Procedure

Conducted and FCC emissions tests were performed using the procedures of ANSI C63.10-2009 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration.

The frequency range from 150 kHz – 30 MHz was investigated for conducted emissions.

Conducted Emissions measurements were performed in the shielded room using procedures specified in the test plan and standard.

4.3.2 Deviations

The EUT is 7.2V Battery operated and has no means to connect to AC Mains. When the device is in the charger, the transmitter is disabled.

4.3.3 Final Test

The EUT is 7.2V Battery operated only; therefore this test is not applicable.

4.4 *Frequency Hopping Spread Spectrum (FHSS) Systems FCC Part 15.247(g)*

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

In constant transmit mode, the PI900W Meter sends a packet nominally every 97.3 ms with a delay of 8 to 16 ms between packets. Each packet is sent on the next channel determined by the pseudo-random hop table. When presented with a continuous data stream, the EUT adheres to the 0.4 second dwell time for each 10 second window requirement. The EUT always distributes its transmissions across all 25 channels, and does not re-use a channel again until a transmission has occurred on each of the other 24 channels.

4.5 Incorporation of Intelligence within a FHSS System FCC Part 15.247(h)

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

The EUT does not incorporate intelligence relating to the hopping pattern as described above. Rather, the EUT always distributes its transmissions across the same 25 channels. A channel is not re-used until a transmission has occurred on each of the other 24 channels.

4.6 Channel Separation

4.6.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	12 September 2012
Standard	FCC Part 15.247(a)(1)(i), RSS 210 A8.1						
Product Model	PI900W			**Serial#**	Production Sample		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	7.2V Battery	**Temp**	73º F	**Humidity**	36%	**Pressure**	1010 mbar
Perf. Criteria	(Below Limit)			**Perf. Verification**	Readings Under Limit		
Mod. to EUT	None			**Test Performed By**	Mark Ryan		

4.6.2 Test Procedure

Frequency hopping Systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Maximum allowed 20dB Bandwidth = 500 kHz

Min. Channel Separation = 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater

The channel separation is greater than the measured maximum 20 dB bandwidth. Therefore the EUT is compliant with this section.

4.6.3 Deviations

There were no deviations from the test methodology listed in the test plan for this test.

4.6.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

4.6.5 Final Data

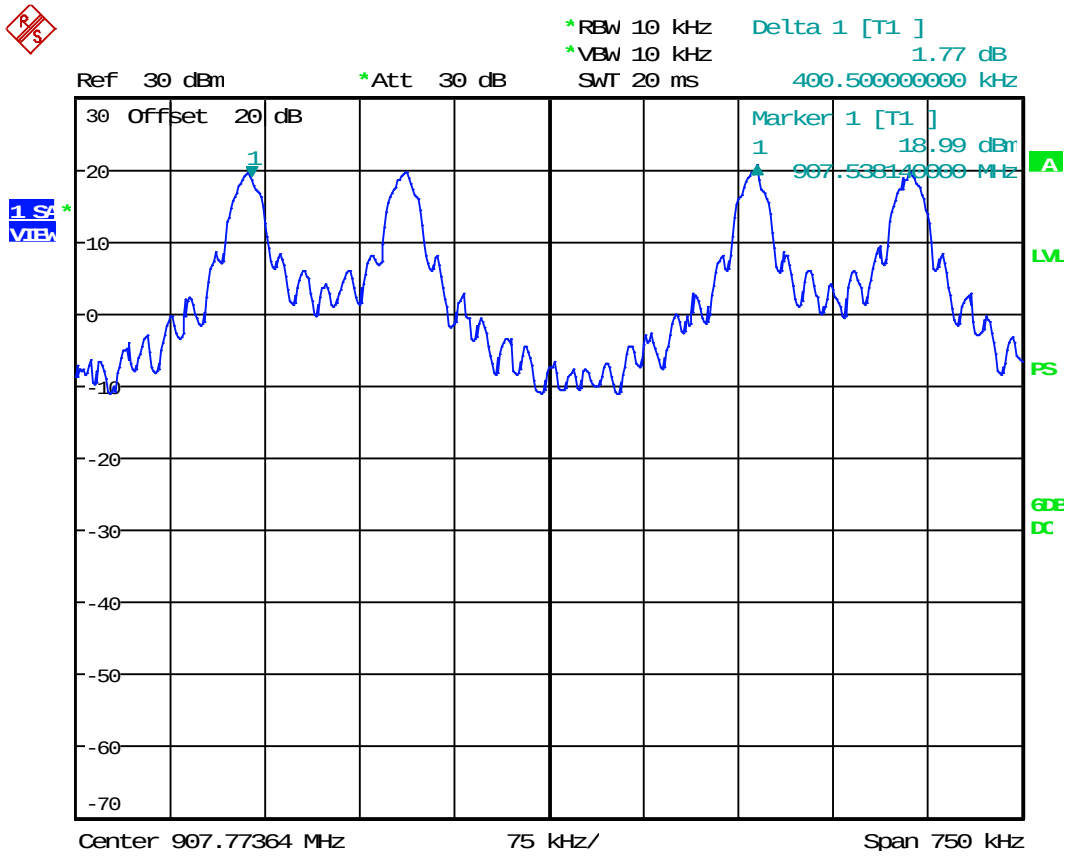


Figure 4: Channel Separation = 400 kHz

Spectrum Analyzer Parameters:
RBW=10kHz
Span=750kHz
VBW= 10kHz
LOG dB/div.= 10dB
Sweep = Auto
Detector = sample detector, max hold

4.7 Pseudorandom Hopping Algorithm

4.7.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	12 September 2012 and 21 September 2012	
Standard	FCC Part 15.247(a)(1)(i) and RSS-210, A8.1						
Product Model	PI900W			**Serial#**	Production Sample		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	7.2V Battery	**Temp**	73º F	**Humidity**	36%	**Pressure**	1010 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.7.2 Test Procedure

The channel bandwidth for this system is greater than 250 kHz. Therefore the system must use at least 25 channels that are selected at the system hopping rate, from a pseudo-randomly ordered list of hopping frequencies. Each frequency must be used equally on average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their transmitters and shall shift frequencies in synchronization with the transmitted signals.

In constant transmit mode, the EUT would send a packet every 97.3 ms with a delay of 8 to 16 ms between packets. Each packet is sent on the next channel determined by the pseudo-random hop sequence, as defined in the operation description document.

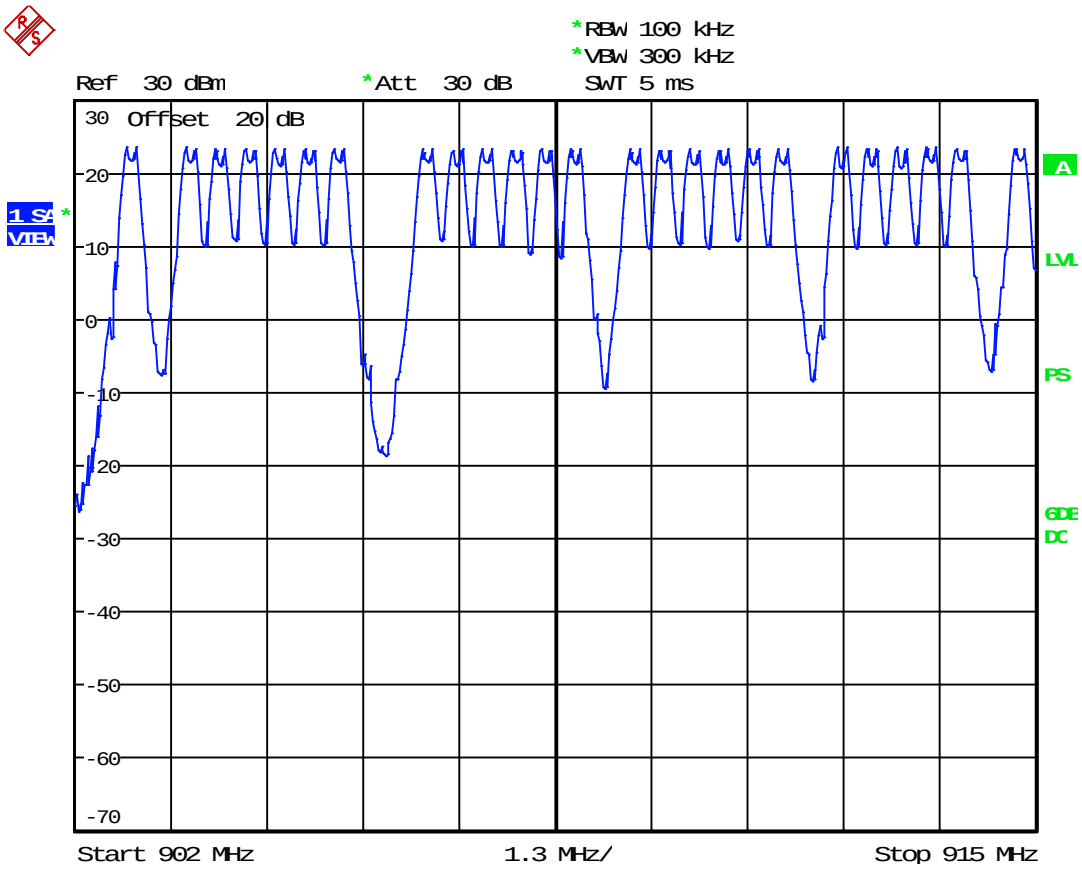
4.7.3 Deviations

There were no deviations from the test methodology listed in the test plan for this test.

4.7.4 Final Test

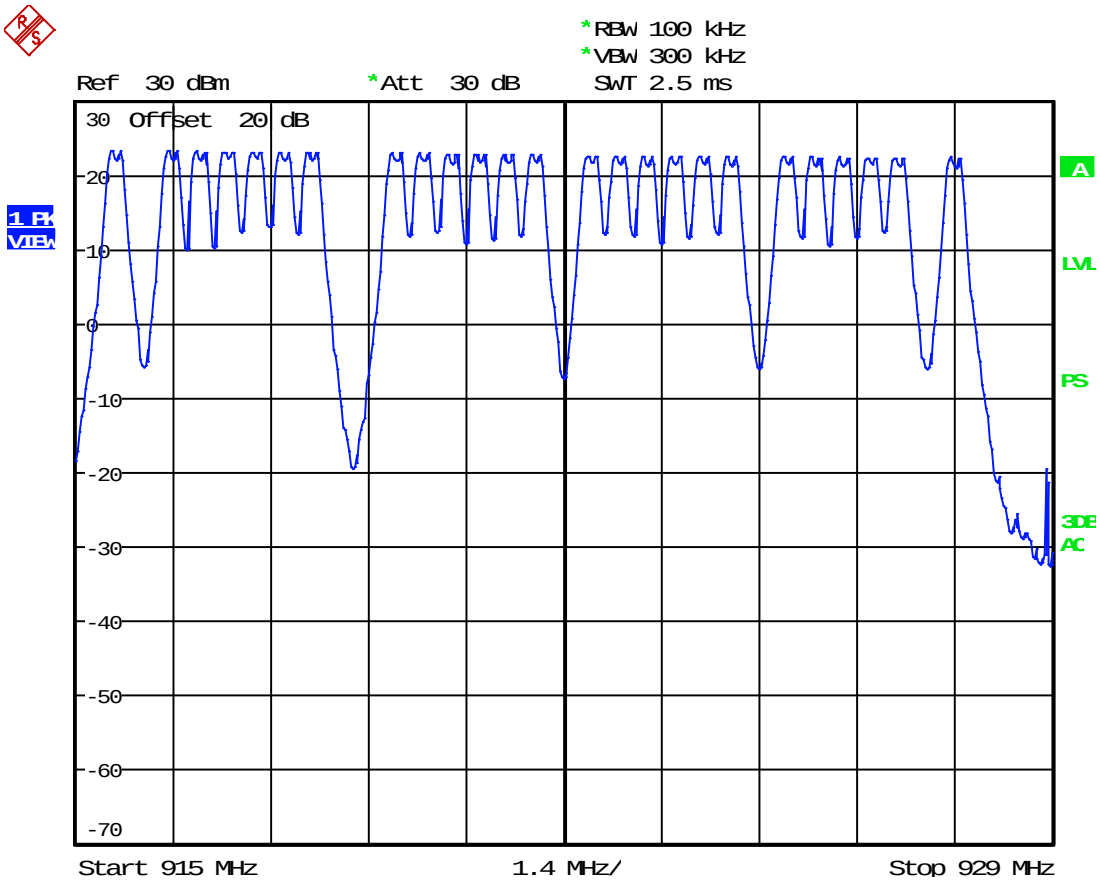
The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

4.7.5 Final Data



Date: 12.SEP.2012 10:20:55

Figure 5: Plot of hopping Channels - 902-915 MHz (Low Band)



Date: 21.SEP.2012 14:49:02

Figure 6: Plot of hopping Channels - 915-928 MHz (Upper Band)

Spectrum Analyzer Parameters:
RBW=100kHz
Span=14MHz
VBW= 300kHz
LOG dB/div.= 10dB
Sweep = Auto
Detector = sample detector, max hold

Time of Occupancy FCC Part 15.247(a)(1)(i)

Frequency Band (MHz)	20 dB Bandwidth	Number of Hopping Channels	Average Time of Occupancy
902.4-927.6	=>250 kHz	25	=<0.4 sec. In 10 sec.

There were 2 hops at 99.6 milliseconds per hop for any 10 sec. Period. Time of occupancy equals number of hops multiplied by the duration of one hop.

Time of Occupancy limit = 0.400 seconds in any 10 second period.
Calculated Time of Occupancy = 0.0996 seconds x 2 = 0.199 seconds in any 10 second period

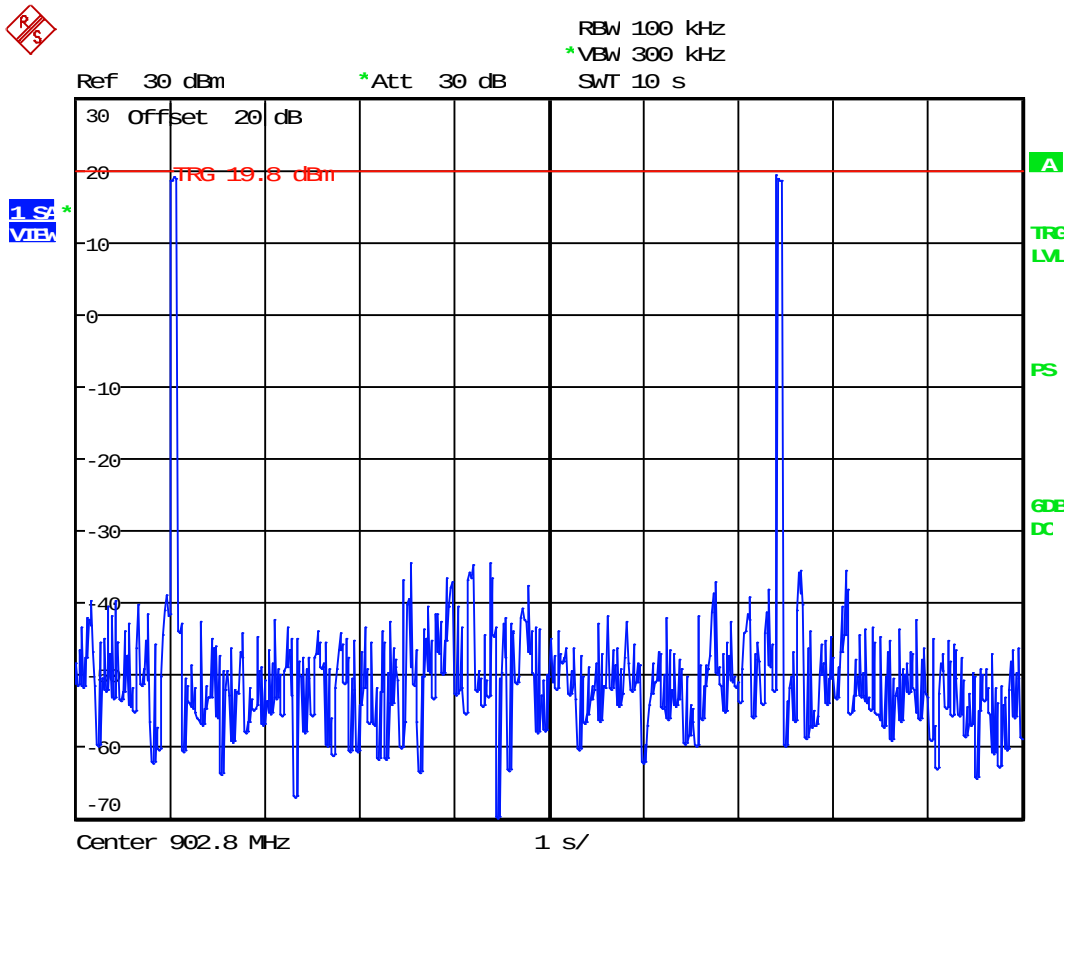
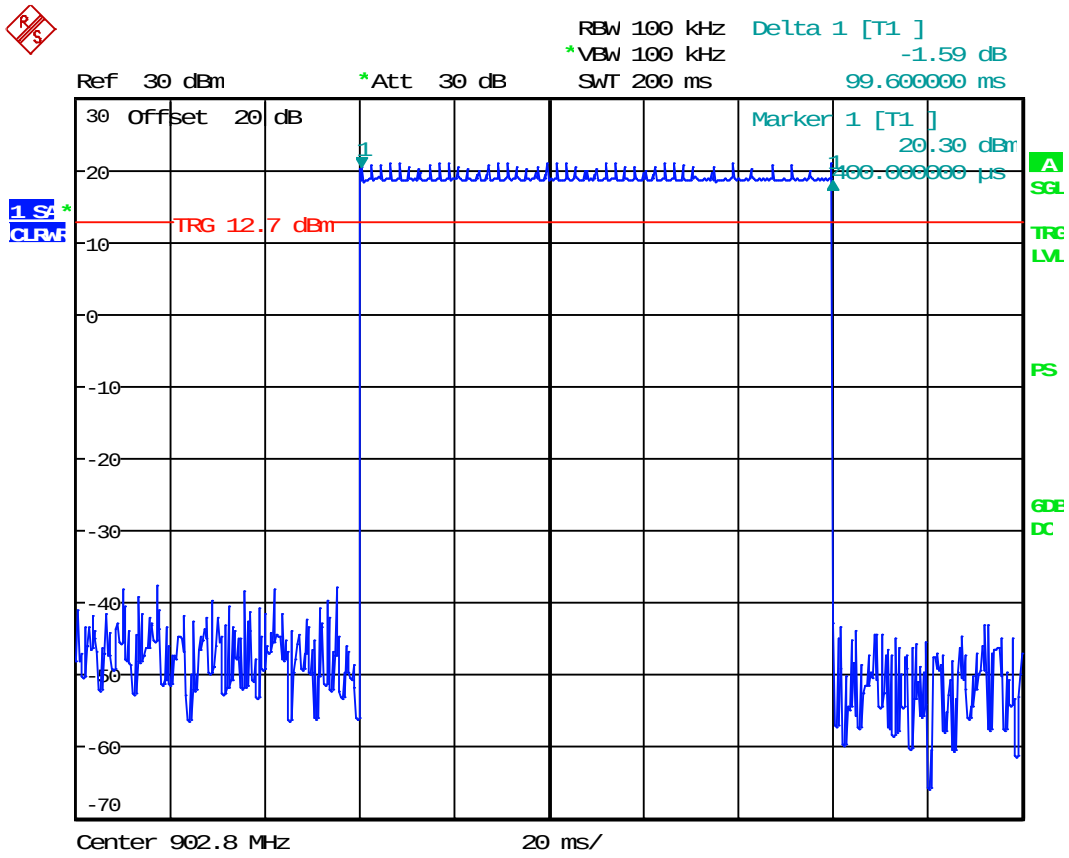


Figure 7: 10 second sweep of 902.8 MHz

Note: The on-channel traces are the two highest peaks.



Date: 12.SEP.2012 10:29:52

Figure 8: Measurement of 1 hop at 902.8 MHz

Time on Frequency = 99.6 ms

Spectrum Analyzer Parameters:
RBW=100kHz
Span=zero
VBW= 100kHz
LOG dB/div.= 10dB
Sweep = 200 ms
Detector = sample detector, max hold

4.8 Occupied Bandwidth

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

4.8.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	12 September 2012	
Standard	FCC Part 15.247(a)(1)(i)						
Product Model	PI900W			**Serial#**	Production Sample		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	7.2V Battery	**Temp**	73º F	**Humidity**	36%	**Pressure**	1010 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.8.2 Test Procedure

Frequency hopping Systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Maximum allowed 20dB Bandwidth = 500 kHz, Channel Separation = 25 kHz Min. or the 20 dB bandwidth of the hopping channel, whichever is greater

The channel separation is greater than the measured maximum 20 dB bandwidth. Therefore the EUT is compliant with this section.

4.8.3 Deviations

There were no deviations from the test methodology listed in the test plan for this test.

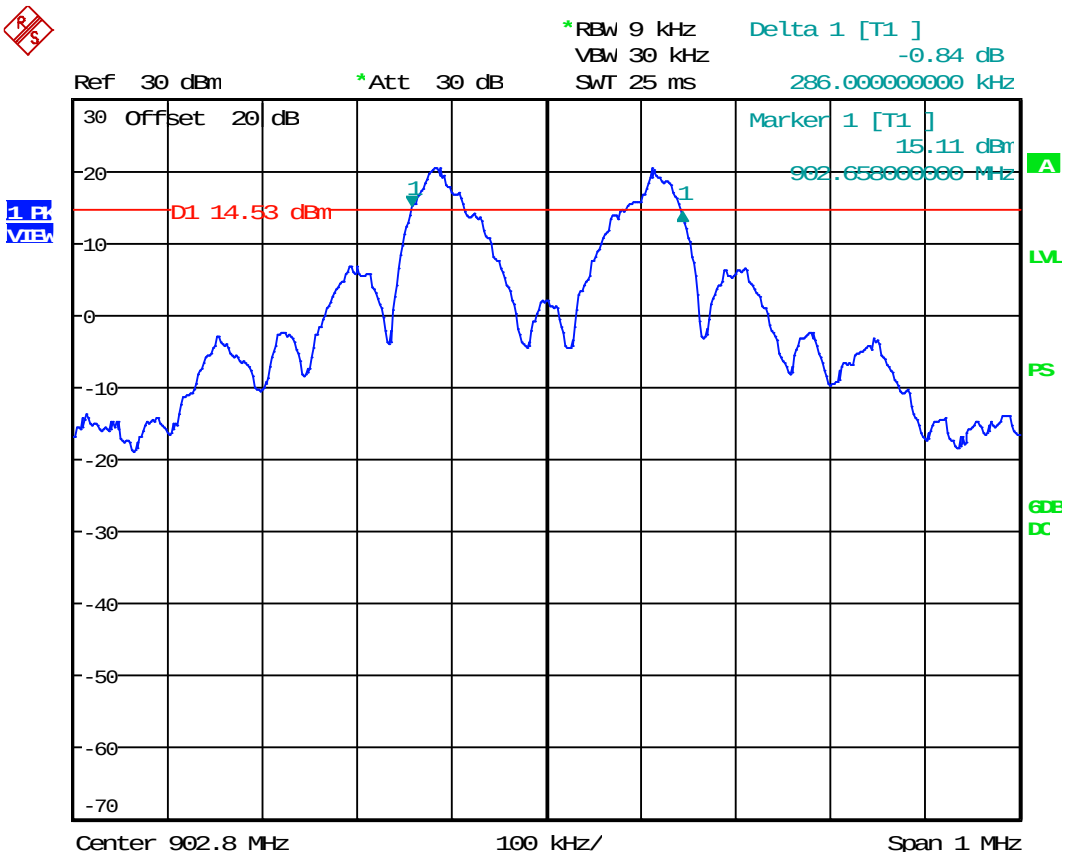
4.8.4 Final Test

The EUT met requirements of this section as no 20 dB bandwidth is greater than 500 kHz.

4.8.5 Final Data

Channel	6 dB BW (kHz)	20 dB BW (kHz)	Data Rate
1	278	462	Low
34	278	460	Low
48	276	460	Low
63	280	460	Low
1	286	470	High
34	286	460	High
48	278	466	High
63	282	464	High

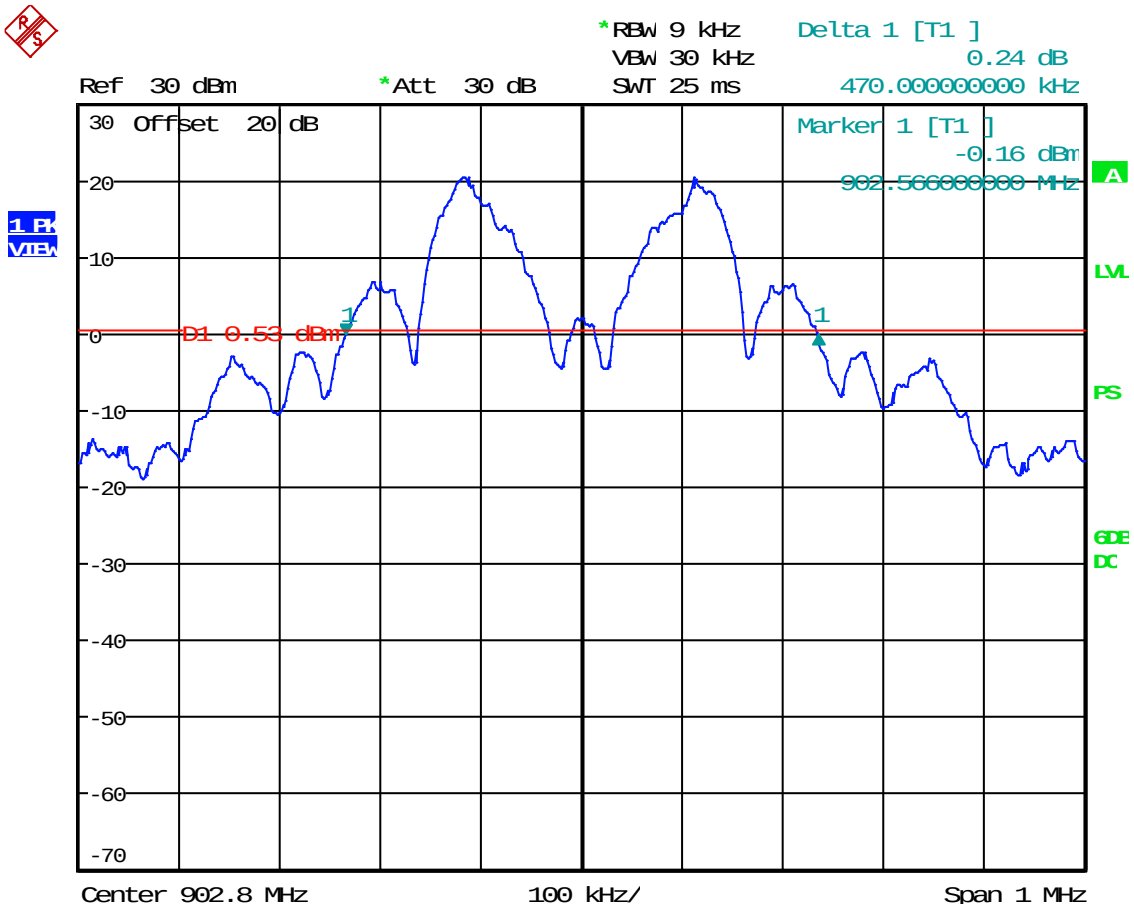
Note: Highlighted data is worst-case.



Date: 12.SEP.2012 09:41:56

***BW = 286.3 KHZ**

Figure 9: Worst Case 6 dB Occupied Bandwidth



Date: 12.SEP.2012 09:40:30

***BW = 470 KHZ**

Figure 10: Worst Case 20 dB Occupied Bandwidth

Note: Plots of other channels and data rates are on file at TUV Rheinland.

4.9 99% Power Bandwidth

For the purpose of Section A1.1, the 99% bandwidth shall be no wider than .25% of the center frequency for devices operating between 70-900MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency.

4.9.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	12 September 2012
Standard	RSS-210 Section A1.1.3						
Product Model	PI900W			**Serial#**	Production Sample		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	7.2V Battery	**Temp**	73º F	**Humidity**	36%	**Pressure**	1010 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.9.2 Test Procedure

Using the procedures of RSS-GEN section 4.6.1, the 9 kHz resolution bandwidth is 1% of the 1 MHz span. The Video bandwidth is 3 times that of the resolution bandwidth.

The limit of the bandwidth would be 0.5% of 916 MHz is 4.58 MHz. The measured 99% bandwidth is 322.65 kHz.

4.9.3 Deviations

There were no deviations from the test methodology listed in the test plan for this test.

4.9.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

4.9.1 Final Tabulated Data

Channel	99% BW (kHz)	Data Rate
1	464	Low
34	468	Low
48	464	Low
63	464	Low
1	472	High
34	470	High
48	470	High
63	466	High

Note: Highlighted data is worst-case.

4.9.2 Final Graphic Data

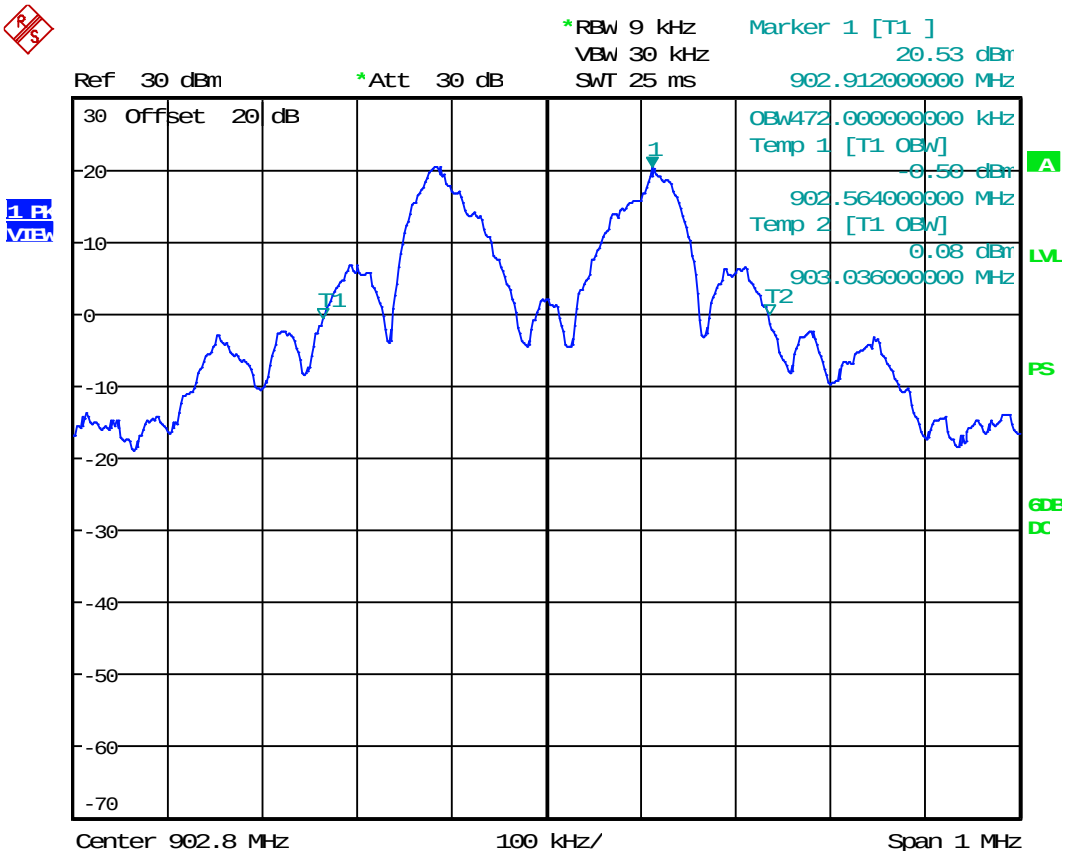


Figure 11 – 99% Power Bandwidth = 472 kHz

Spectrum Analyzer Parameters:
RBW=9kHz
Span=1MHz
VBW= 30kHz
LOG dB/div.= 10dB
Sweep = Auto
Detector = sample detector, max hold

The EUT is compliant to the requirements of RSS-210 A1.1.3

4.10 Band Edge

4.10.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	12 September 2012	
Standard	FCC Part 15.247(e), RSS 210 A8.1(c)						
Product Model	PI900W		**Serial#**	Production Sample			
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	7.2V Battery	**Temp**	73º F	**Humidity**	36%	**Pressure**	1010 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.10.2 Test Procedure

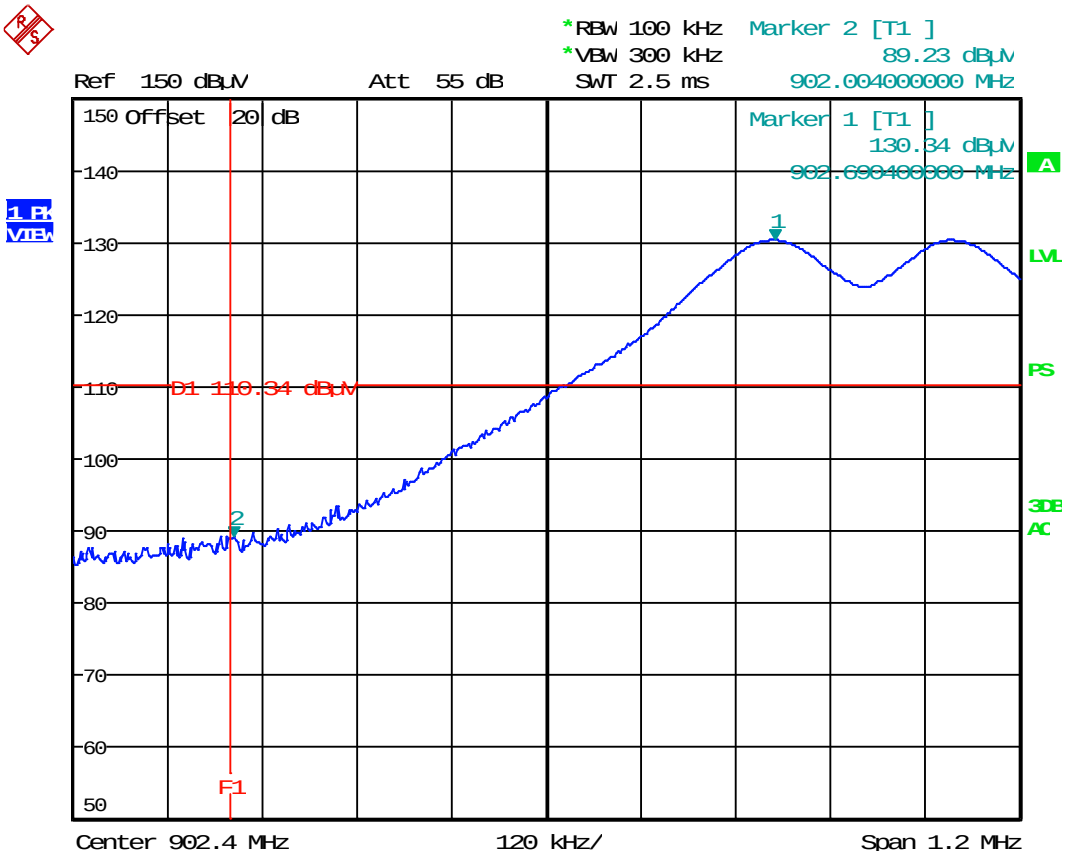
Intentional radiators operating under the alternative provisions to the general emission limits must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

4.10.3 Deviations

There were no deviations from the test methodology listed in the test plan for this test.

4.10.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.



Date: 12.SEP.2012 11:02:03

Figure 12: Lower Band Edge Measurement

Note: Band Edge (F1) is at 902 MHz

Channel Frequency is 902.8 MHz, The level at the band edge is -41.11dBc.

This is well below the -20dBc requirement.

The EUT is compliant with the rules.

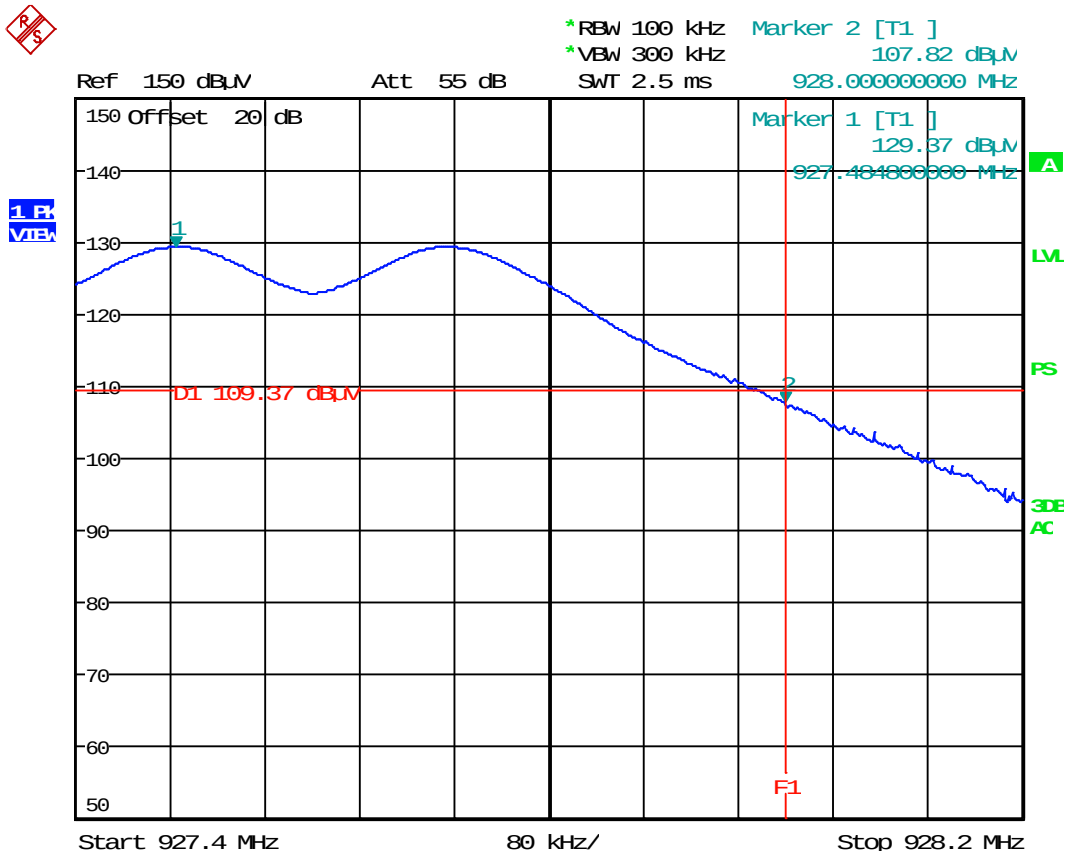


Figure 13: Upper Band Edge Measurement

Note: Band Edge (F1) is at 928 MHz

Channel Frequency is 927.6 MHz, The level at the band edge is -21.55 dBc.

This is below the -20dBc requirement.

The EUT is compliant with the rules.

4.11 Peak Output Power

The maximum peak output power of the intentional radiator shall not exceed 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels. (Conducted Measurement)

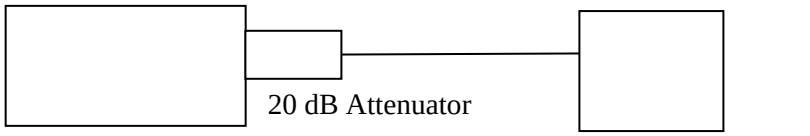
4.11.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	11 September 2012
Standard	FCC Part 15.247(b)(2) and RSS-210 A8.4(1)						
Product Model	PI900W			**Serial#**	Production Sample		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	7.2V Battery	**Temp**	75º F	**Humidity**	43%	**Pressure**	1012 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.11.2 Test Procedure

The peak output power was measured at CH01, CH34, CH48, and at CH63. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The cable loss and the attenuator was measured and added in the reference level offset in the spectrum analyzer. The spectrum analyzer's resolution bandwidth was greater than the 20dB bandwidth of the modulated carrier and the video bandwidth was equal to the resolution bandwidth.

Test Setup:



4.11.3 Deviations

There were no deviations from the test methodology listed in the test plan for this test.

4.11.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

4.11.5 Final Data - Peak Power Output

CH01: 902.8 MHz = 23.60 dBm = 0.229 Watts = 130.59 dBµV

CH34: 916.0 MHz = 23.63 dBm = 0.230 Watts = 130.62 dBµV – highest output.

CH48: 921.6 MHz = 23.13 dBm = 0.206 Watts = 130.12 dBµV

CH63: 927.6 MHz = 22.90 dBm = 0.195 Watts = 129.89 dBµV

Note: Highlighted data is worst-case.

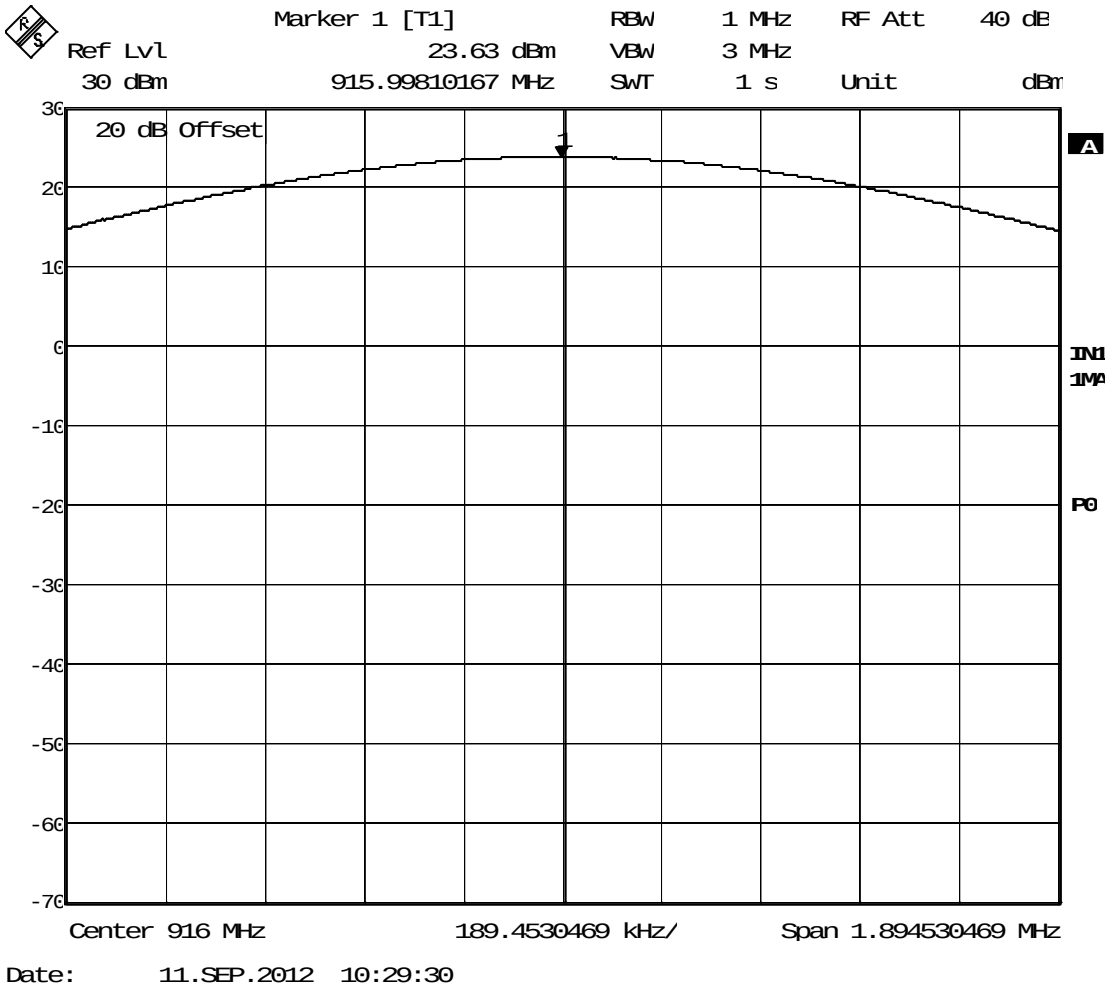


Figure 14: CH 34 (916.0 MHz) Peak Output Power - Worst Case Shown.

Plots of other channels are on file at TUV Rheinland.

4.12 Antenna Gain

The EUT cannot utilize an antenna with a gain higher than 6 dBi.

Internal Antenna gain:

The antenna gain data was supplied separately with the following results provided:

Freq. (MHz)	Peak (dBi)	Gain (Numeric)
902.0 – 928.0	0.63	1.16

Note: Highlighted data is worst-case.

External Antenna gain:

The whip antenna gain is calculated by applying the Friis equations with the values obtained is section 5.1 of this report and compared to the peak output power,.

Orientation 2 on Channel 1 produced the highest field at 3m. The measured field was 113.49 dBµV/m

Freq (MHz)	Measured Field (dBµV/m)	Friis Power Output (dBm)	Measured conducted Power (dBm)	Peak Antenna Gain (dBi)	Antenna Gain (numeric)
902.8	113.49	18.3	23.6	-5.3	0.3

Note: Highlighted data is worst-case.

Note: The external whip antenna is tuned to 450 MHz for the Part 90/ RSS-113 Wakeup function of this device. Hence the Gain of the antenna is expected to be very low.

Final Data:

The gains of both antennas are well below 6 dBi.

The Transmitter output power does not need to be rolled back.

FCC Part 15.249 and RSS-210 Issue 8, Annex A

5 Intentional Radiator Tests

5.1 Radiated emissions - FCC Parts 15.249, RSS-210 A2.9(a)

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following limits:
Fundamental Frequency: 2400 to 2483.5 MHz – 50 mV/m (94 dB µV/m) at 3m.
Harmonic Frequencies – 500 µV/m (54 dB µV/m) at 3m.

5.1.1 Over View of Test

Results	**Complies** (as tested per this report)			**Date**	14 September 2012		
Standard	FCC Parts 15.205, 15.209, 15.215(c), 15.249(a), 15.249(c), 15.249(d) RSS-210 A2.9, and RSS-GEN 7.2.1						
Product Model	PI900W		**Serial#**	Production Sample			
Test Set-up	Tested in a 5m Semi Anechoic chamber, placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane on a turn-table.						
EUT Powered By	7.2V Battery Re-chargeable 7.2V Battery	**Temp**	72º F	**Humidity**	40%	**Pressure**	997 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**	Readings Under Limit			
Mod. to EUT	None		**Test Performed By**	Mark Ryan			

5.1.2 Test Procedure

Testing was performed in accordance with 47 CFR Part 15, ANSI C63.10:2009, RSS-GEN Issue 2. These test methods are listed under the laboratory's A2LA Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

5.1.3 Deviations

Since all emissions outside the band are within the limits of FCC Part 15.209 and RSS-GEN 7.2.1, the emissions shown below are also compliant with FCC Parts 15.205, 15.209, 15.215(c), 15.249(d), RSS-210 A8.5, and RSS-GEN 7.2.1.

5.1.4 Final Test

All final radiated spurious emissions measurements were below (in compliance) the limits.

The worst –case emissions are shown below. All other emissions are on file at TUV Rheinland.

5.1.4.1 Highest Emissions inside the Frequency Band

Radiated Emissions – EA Wakeup Mode
Horizontal

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
O1:										
902.4	H	1.1	150	56.56	0	3.31	22.50	82.37	94.00	-11.63
902.4	H	1.3	133	60.4	0	3.31	22.50	86.21	94.00	-7.79
916	H	1.1	151	57.94	0	3.34	22.62	83.90	94.00	-10.10
916	V	1.2	134	62.34	0	3.34	22.62	88.30	94.00	-5.70
921.6	H	1.1	147	55.43	0	3.34	22.73	81.50	94.00	-12.50
921.6	V	1.2	134	59.57	0	3.34	22.73	85.64	94.00	-8.36
927.6	H	1.1	147	55.89	0	3.35	22.80	82.04	94.00	-11.96
927.6	V	1.3	131	60.99	0	3.35	22.80	87.14	94.00	-6.86
O2:										
902.4	H	1	217	66.02	0	3.31	22.50	91.83	94.00	-2.17
902.4	V	1	266	62.44	0	3.31	22.50	88.25	94.00	-5.75
916	H	1	222	67.48	0	3.34	22.62	93.44	94.00	-0.56
916	V	1	269	57.07	0	3.34	22.62	83.03	94.00	-10.97
921.6	H	1	224	65.64	0	3.34	22.73	91.71	94.00	-2.29
921.6	V	1	264	61.89	0	3.34	22.73	87.96	94.00	-6.04
927.6	H	1	218	67.00	0	3.35	22.80	93.15	94.00	-0.85
927.6	V	1	263	63.28	0	3.35	22.80	89.43	94.00	-4.57
O3:										
902.4	H	1.1	134	66.41	0	3.31	22.50	92.22	94.00	-1.78
902.4	V	1	94	63.05	0	3.31	22.50	88.86	94.00	-5.14
916	H	1.1	133	67.03	0	3.34	22.62	92.99	94.00	-1.01
916	V	1	94	64.47	0	3.34	22.62	90.43	94.00	-3.57
921.6	H	1.1	137	64.93	0	3.34	22.73	91.00	94.00	-3.00
921.6	V	1	91	62.22	0	3.34	22.73	88.29	94.00	-5.71
927.6	H	1	136	66.27	0	3.35	22.80	92.42	94.00	-1.58
927.6	V	1	94	61.69	0	3.35	22.80	87.84	94.00	-6.16

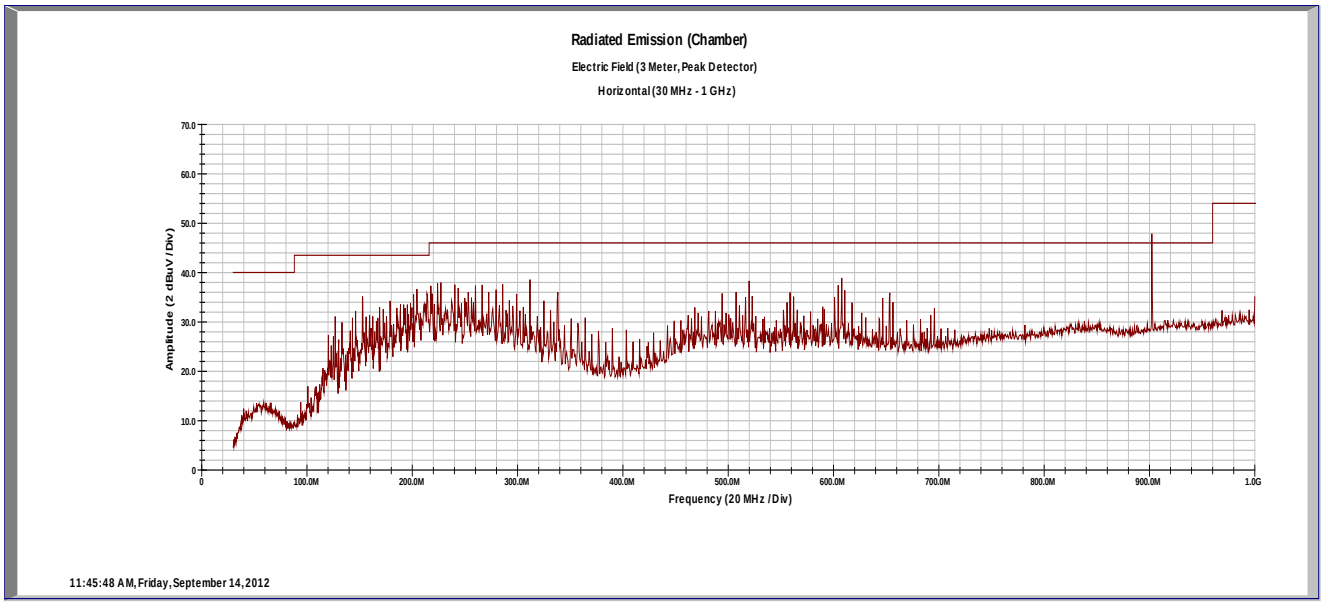
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 2.29dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Orientation 1 standing upright
Orientation 2 Side (screen facing out) – Worst Case
Orientation 3 Back (screen facing up)
The limit of 94 dBuV/m was a conversion of the 50mV/m at 3m limits.
The highlighted emission provided the highest field at 3m
The highest conducted RF power was 910MHz at -8.21 dBm = 0.00015 Watts

5.1.4.2 Emissions Outside the Frequency Band:

Radiated Emissions 30 MHz – 1000 MHz
Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
191.76	H	1	39	19.23	0.00	1.52	10.27	31.02	43.50	-12.48
237.24	H	1	40	19.91	0.00	1.69	11.37	32.97	46.00	-13.03
312.00	H	1	0	21.04	0.00	1.94	12.92	35.90	46.00	-10.10
337.96	H	1	12	15.25	0.00	2.02	13.92	31.19	46.00	-14.81
520.00	H	1.2	170	15.29	0.00	2.52	17.40	35.21	46.00	-10.79
620.72	H	1	179	12.60	0.00	2.75	19.54	34.90	46.00	-11.10
653.28	H	1	195	8.82	0.00	2.82	20.23	31.88	46.00	-14.12

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

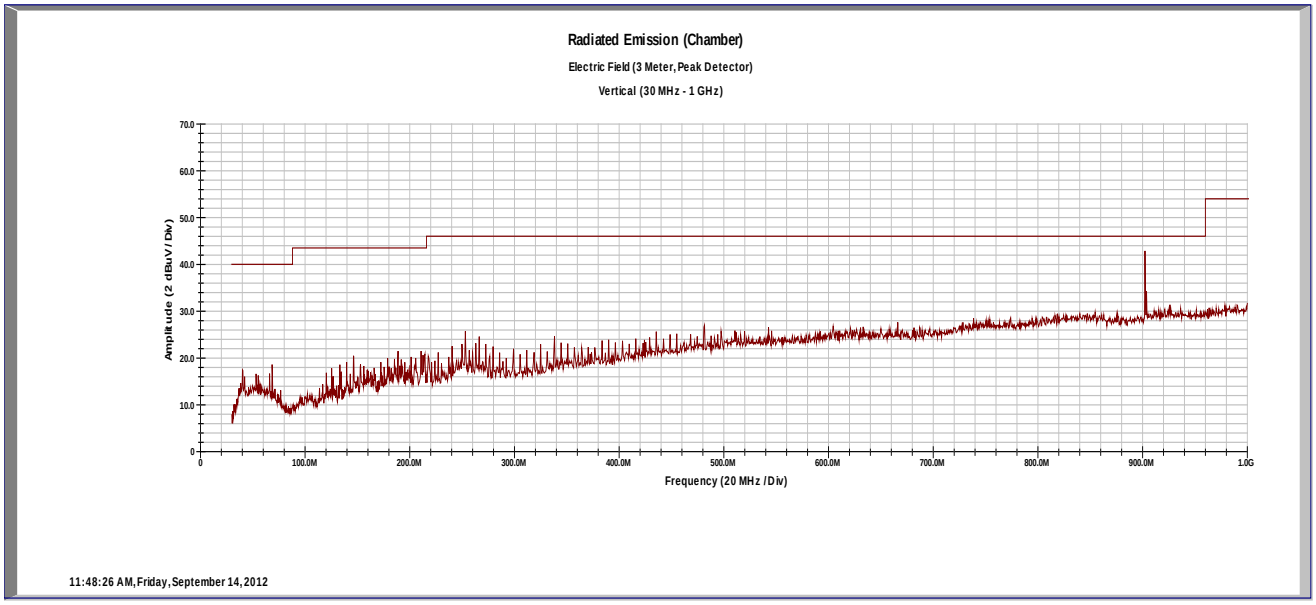
Notes: Ch 0 Internal Antenna Calibrated to MAX Field Strength (50 mV/m @ 3m)

The Peak shown at 902.4 MHz is the worst-case fundamental frequency. A tuned notch filter was used.

Plots of other channels are on file at TUV Rheinland.

Radiated Emissions 30 MHz – 1000 MHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

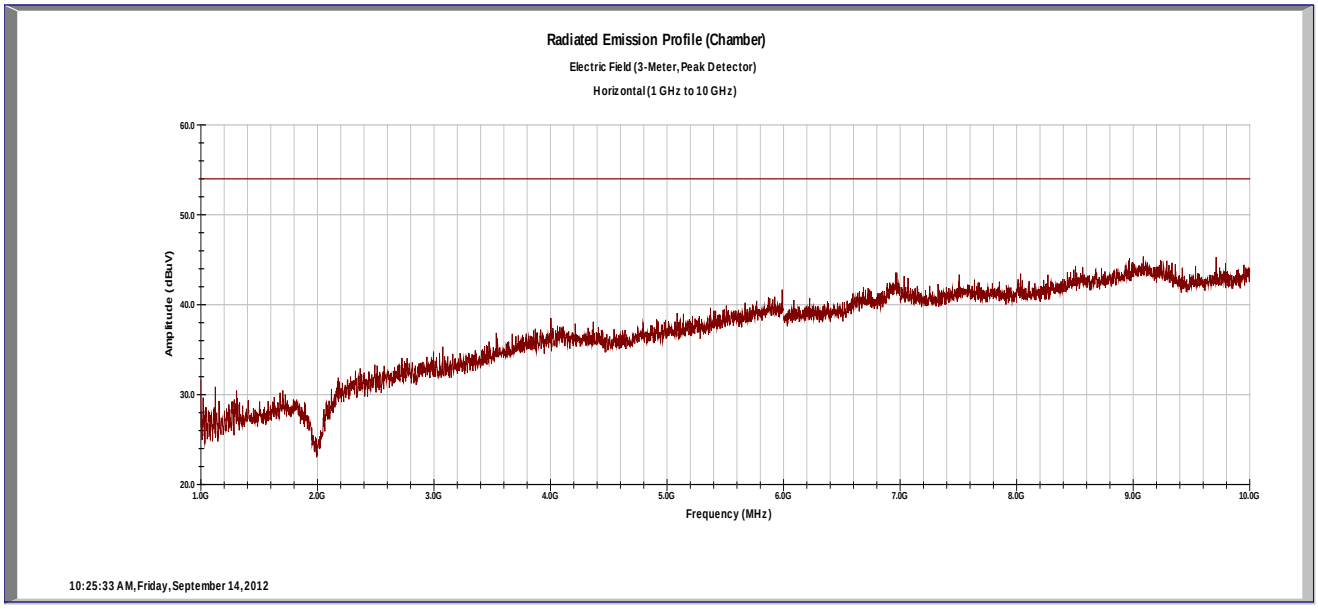
Notes: Ch 0 Internal Antenna Calibrated to MAX Field Strength (50 mV/m @ 3m)

The Peak shown at 902.4 MHz is the worst-case fundamental frequency. A tuned notch filter was used.

Plots of other channels are on file at TUV Rheinland.

Radiated Emissions 1GHz to 10 GHz

Horizontal



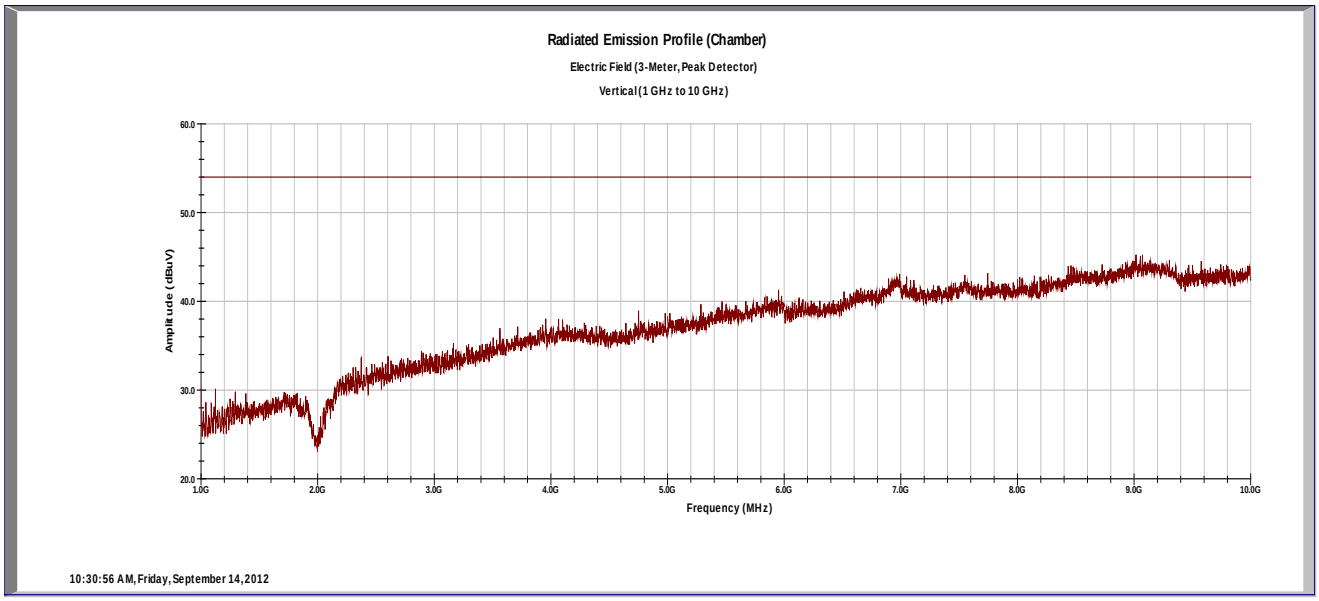
Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Notes: Ch 0
No measureable emissions found. Plots of other channels are on file at TUV Rheinland.

Radiated Emissions 1GHz to 10 GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Notes: Ch 0
No measureable emissions found. Plots of other channels are on file at TUV Rheinland.

5.2 Band Edge requirements - FCC Part 15.249(d), RSS-210 2.2

5.2.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	12 September 2012	
Standard	FCC Part 15.249(d), RSS 210 2.2						
Product Model	PI900W		**Serial#**	Production Sample			
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	7.2V Battery	**Temp**	73º F	**Humidity**	36%	**Pressure**	1010 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

5.2.2 Test Procedure

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Sec. 15.209, whichever is the lesser attenuation.

5.2.3 Deviations

There were no deviations from the test methodology listed in the test plan.

5.2.4 Final Test

The EUT met the performance criteria requirement as specified in the standards.

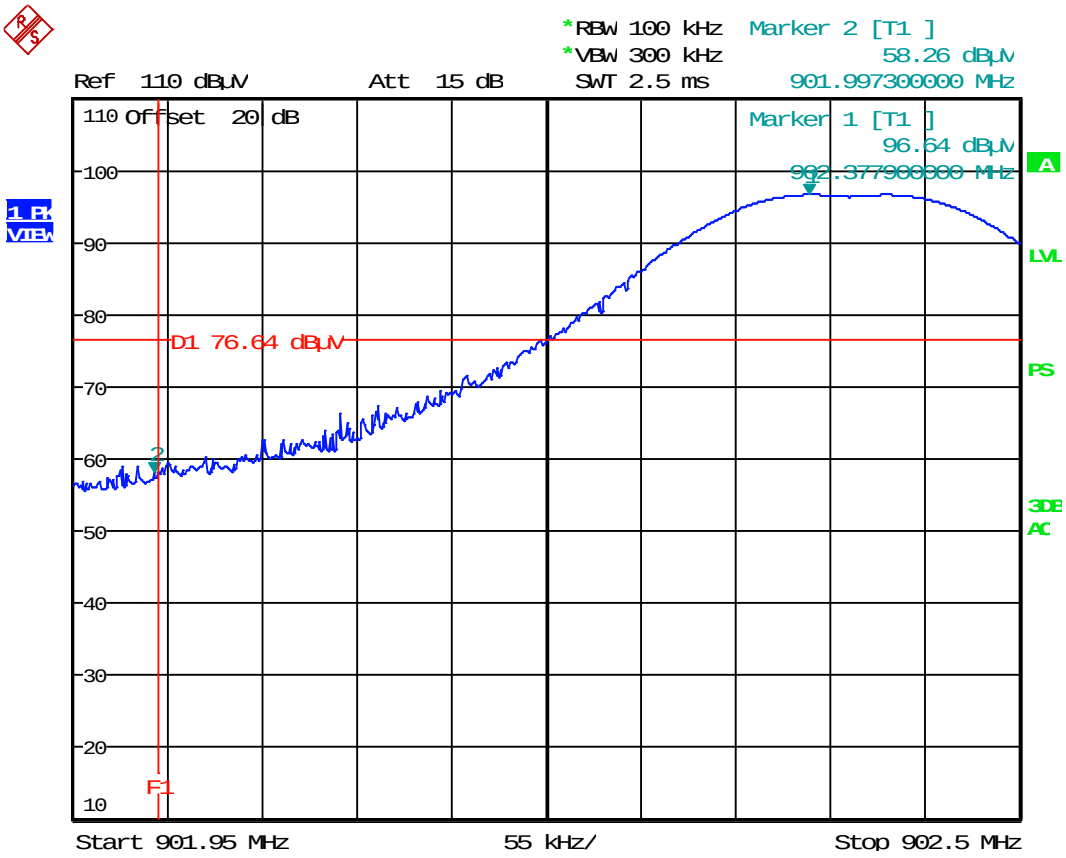


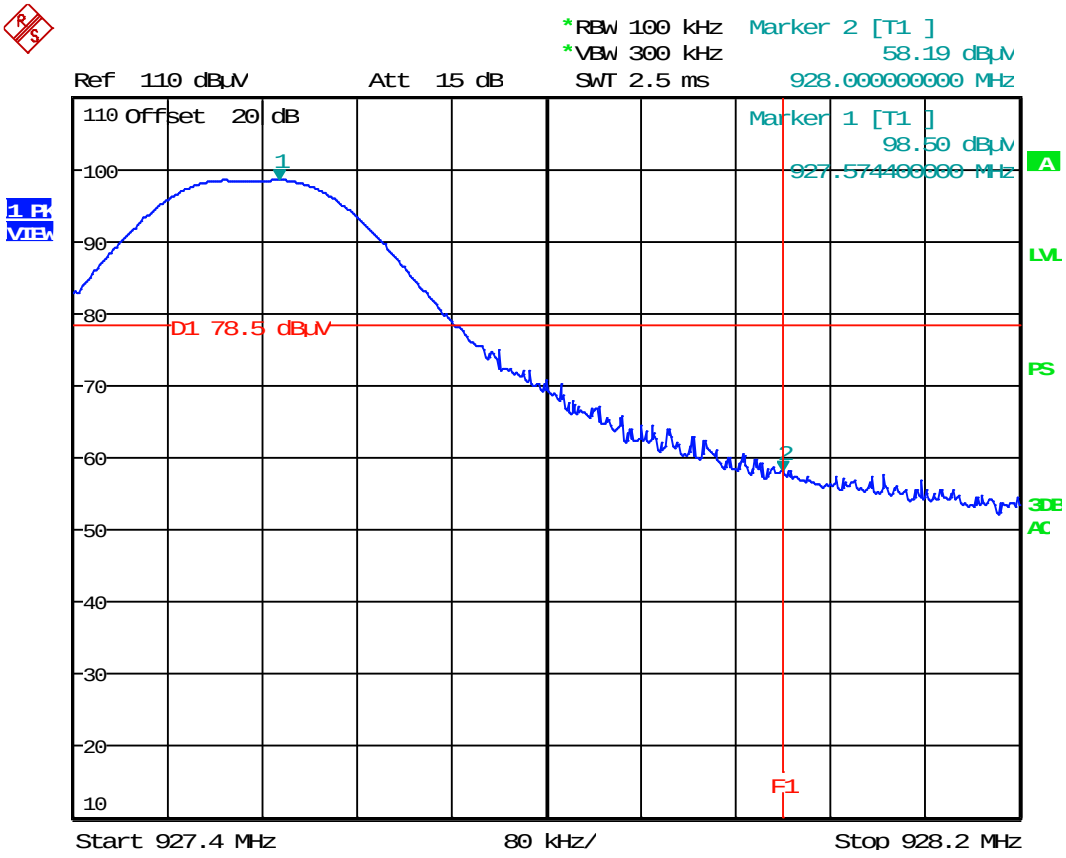
Figure 15: Lower Band Edge Measurement (Radiated Emission)

Note: Band Edge (F1) is at 902 MHz

Channel Frequency is 902.4 MHz, The level at the band edge is -38.4 dBc.

This is well below the -20dBc requirement.

The EUT is compliant with the rules.



Date: 12.SEP.2012 13:16:18

Note: Measured using the Peak detectors.

Note: Band Edge (F1) is at 928 MHz

Channel Frequency is 927.6 MHz, The level at the band edge is -40.3 dBc.

This is well below the -20dBc requirement.

The EUT is compliant with the rules.

5.3 Conducted Emissions on AC Mains – FCC 207(a) and RSS-GEN 7.2.4

This test measures the electromagnet levels of spurious signals generated by the EUT on the AC power line that may affect the performance of other near by electronic equipment.

5.3.1 Over View of Test

Results	**NA** EUT is 7.2V Battery operated only					**Date**	NA
Standard	FCC Parts 15.207(a) and RSS-GEN 7.2.4						
Product Model	PI900W			**Serial#**	NA		
Test Set-up	Tested in shielded room. EUT placed on table, see test plans for details						
EUT Powered By	7.2V Battery	**Temp**	NA	**Humidity**	NA	**Pressure**	NA
Frequency Range	150 kHz – 30 MHz						
Perf. Criteria	(Below Limit)	**Perf. Verification**		Readings Under Limit for L1 & Neutral			
Mod. to EUT	None	**Test Performed By**		NA			

5.3.2 Test Procedure

Conducted emissions tests were performed using the procedures of ANSI C64.4: 2009, including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration.

5.3.3 Deviations

The Test sample is 7.2V Battery operated only. It does not have provision for external power of any kind.

5.3.4 Final Test

This this is not applicable for the device submitted for testing

5.4 Occupied Bandwidth

5.4.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	12 September 2012
Standard	FCC Part 15.247(a)(1)(i)						
Product Model	PI900W			**Serial#**	Production Sample		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	7.2V Battery	**Temp**	73º F	**Humidity**	36%	**Pressure**	1010 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

5.4.2 Test Procedure

To determine the Emissions Designator, a 20 dB bandwidth of the hopping channel will be required.

5.4.3 Deviations

There were no deviations from the test methodology listed in the test plan for this test.

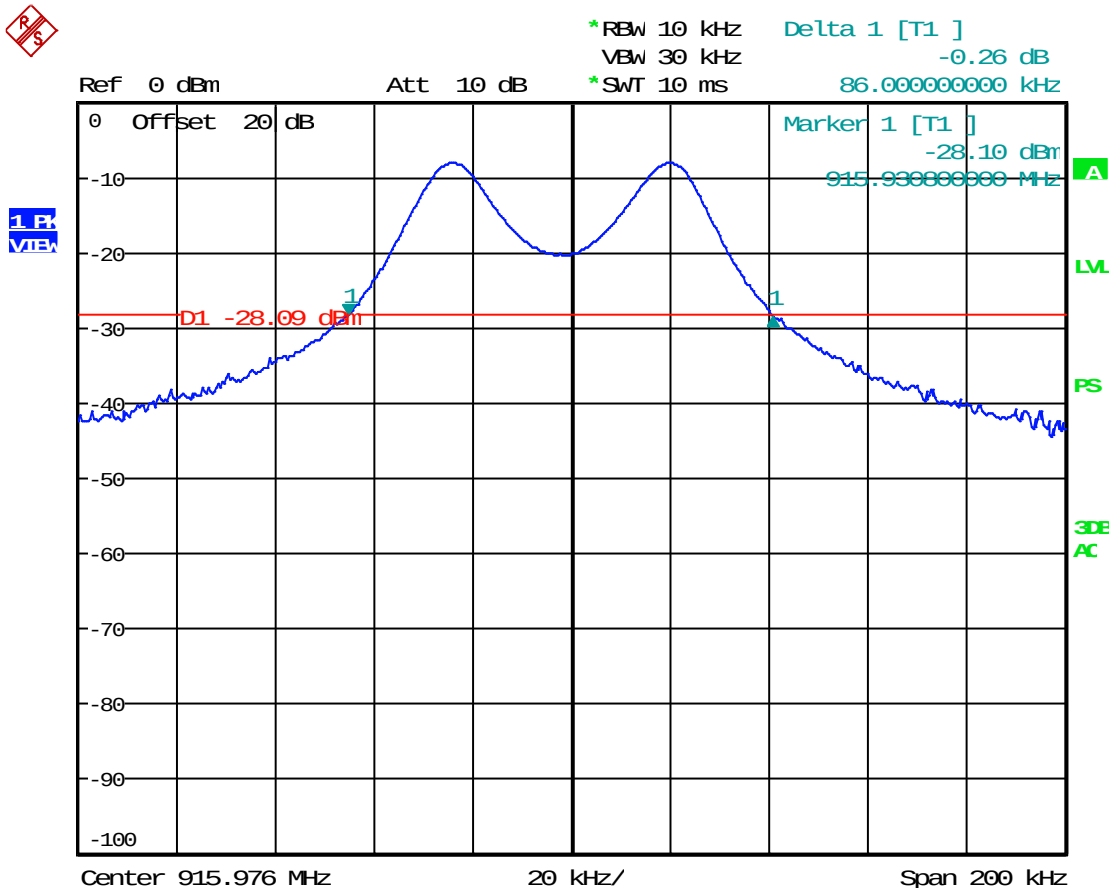
5.4.4 Final Test

The EUT met requirements of this section as no 20 dB bandwidth is greater than 500 kHz.

5.4.5 Final Data

Channel	20 dB BW (kHz)
0	85.2
34	86.0
48	85.6
63	85.2

Note: Highlighted data is worst-case.



Date: 12.SEP.2012 13:46:30

***BW = 86.0 KHZ**

Figure 16: Worst Case 20 dB Occupied Bandwidth

Note: Plots of other channels and data rates are on file at TUV Rheinland.

5.5 99% Power Bandwidth

For the purpose of Section A1.1, the 99% bandwidth shall be no wider than .25% of the center frequency for devices operating between 70-900MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency.

5.5.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	12 September 2012
Standard	RSS-210 Section A1.1.3						
Product Model	PI900W			**Serial#**	Production Sample		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	7.2V Battery	**Temp**	73º F	**Humidity**	36%	**Pressure**	1010 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

5.5.2 Test Procedure

Using the procedures of RSS-GEN section 4.6.1, the 9 kHz resolution bandwidth is 1% of the 1 MHz span. The Video bandwidth is 3 times that of the resolution bandwidth.

The limit of the bandwidth would be 0.5% of 916 MHz is 4.58 MHz. The measured 99% bandwidth is 322.65 kHz.

5.5.3 Deviations

There were no deviations from the test methodology listed in the test plan for this test.

5.5.4 Final Tabulated Data

Channel	99% BW (kHz)
0	80.4
34	82
48	80.8
63	80

Note: Highlighted data is worst-case.

5.5.5 Final Graphic Data

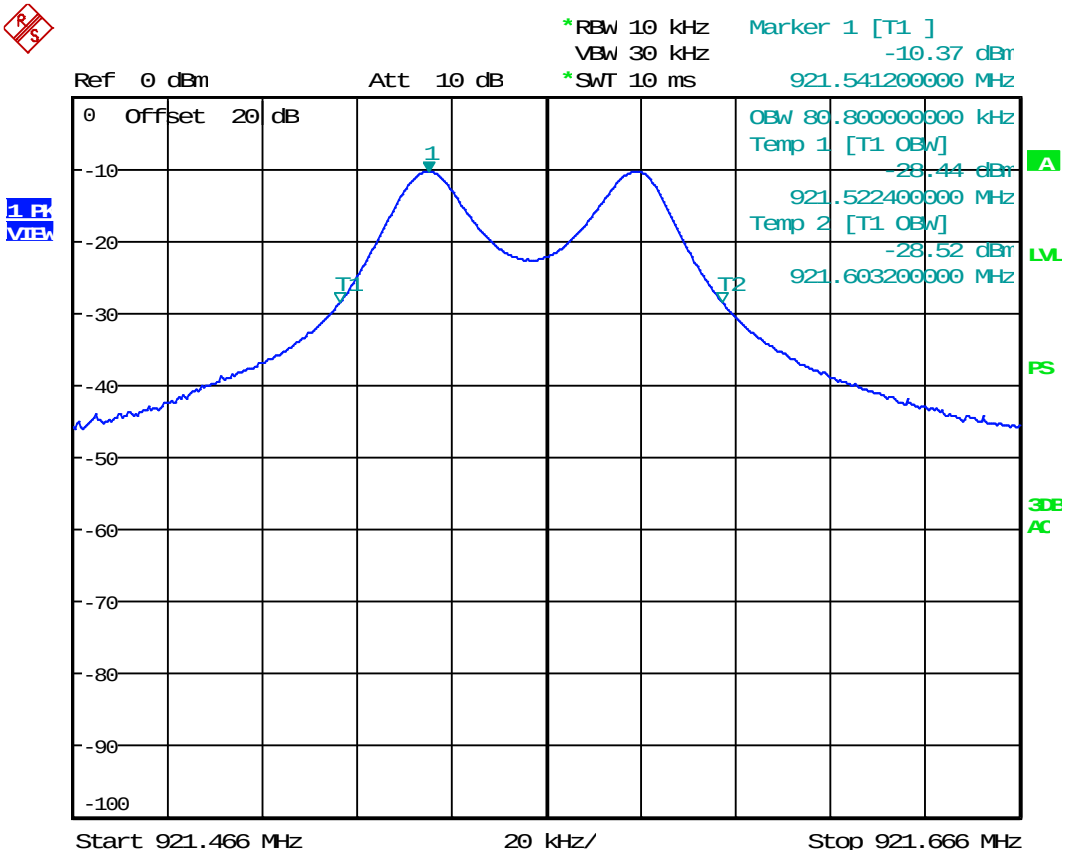


Figure 17 – 99% Power Bandwidth = 80.8 kHz

Spectrum Analyzer Parameters:
RBW=10 kHz
Span=200 kHz
VBW= 30kHz
LOG dB/div.= 10dB
Sweep = Auto
Detector = sample detector, max hold

The EUT is compliant to the requirements of RSS-210 A1.1.3

6 Unintentional Radiator tests.

6.1 Radiated Emissions in Receive mode – FCC 15.109(a), *RSS-210 2.2 and 2.3*

This test measures the electromagnetic levels of spurious signals generated by the EUT that radiated from the EUT and may affect the performance of other nearby electronic equipment.

6.1.1 Over View of Test

Results	**Complies** (as tested per this report)					**Date**	13 September 2012
Standard	FCC 15.109(a), and RSS-210 2.2 and 2.3						
Product Model	PI900W			**Serial#**	Production Sample		
Configuration	See test plan for details						
Test Set-up	Tested in a 5m Semi Anechoic chamber, placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane on a turn-table.						
EUT Powered By	7.2V Battery	**Temp**	74º F	**Humidity**	45%	**Pressure**	999 mbar
Frequency Range	30 MHz to 13 GHz @ 3m						
Perf. Criteria	(Below Limit)			**Perf. Verification**	Readings Under Limit		
Mod. to EUT	None			**Test Performed By**	Mark Ryan		

6.1.2 Test Procedure

Radiated emissions tests were performed using the procedures of ANSI C63.4:2009 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration.

The frequency range from 30 MHz to 13 GHz was investigated for radiated emissions.

Radiated emission testing was performed at a distance of 3 meters in a 5 meter semi-anechoic chamber.

6.1.3 Deviations

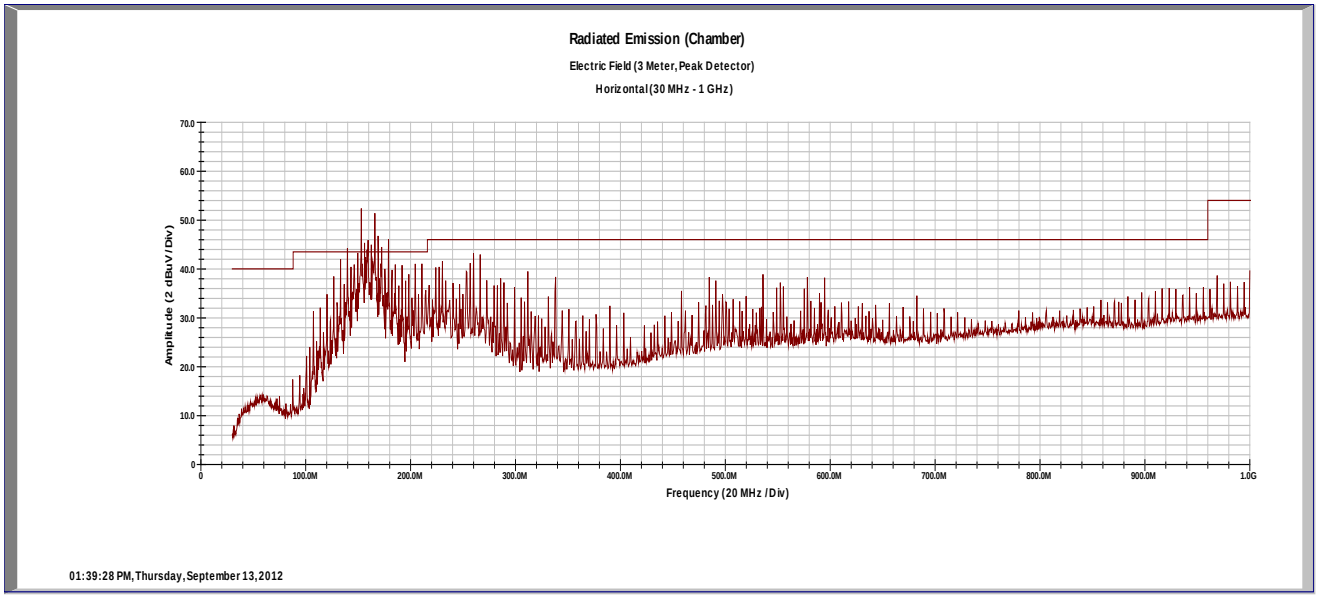
There were no deviations from the test methodology listed in the test plan for the radiated emission test.

6.1.4 Final Test

All final radiated emissions measurements were below (in compliance) the limits.

6.1.5 Final Graphs and Tabulated Data

Radiated Emissions 30 – 1000 MHz
Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
152.60	H	1.5	183	24.80	0.00	1.35	8.06	34.21	43.50	-9.29
162.52	H	1.6	180	28.38	0.00	1.39	8.50	38.27	43.50	-5.23
178.72	H	1.5	177	26.66	0.00	1.46	9.27	37.40	43.50	-6.10

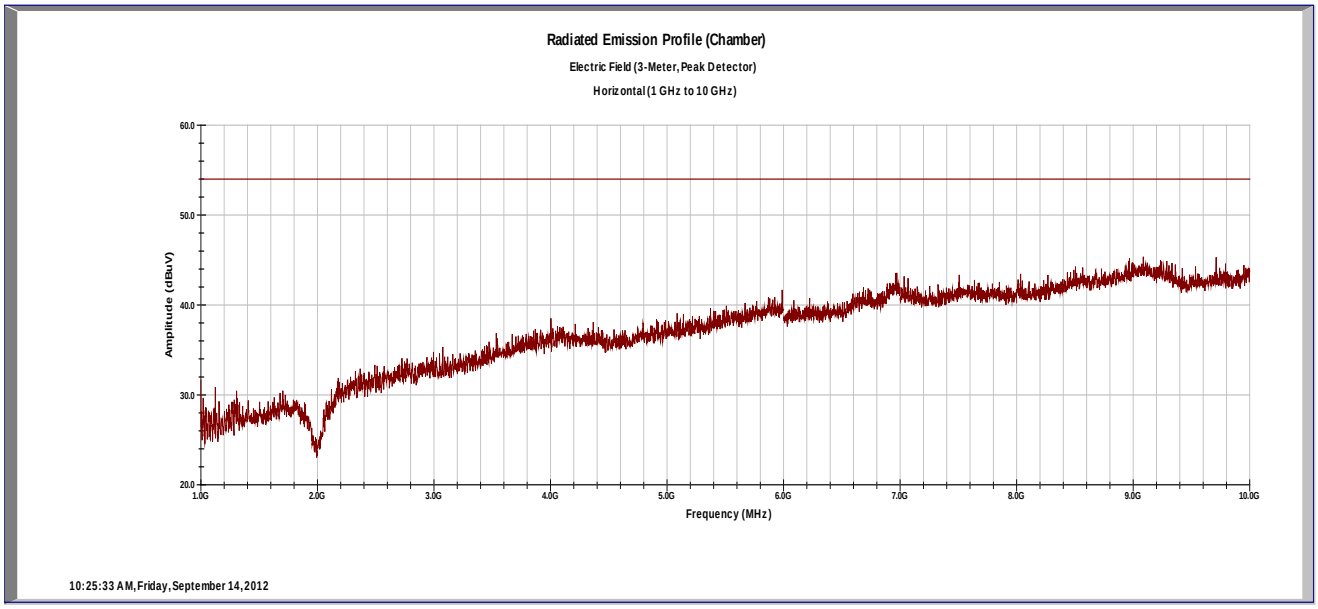
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 2.29dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Worst-case - in Idle mode PCMCIA Card powered off, with Whip Antenna connected

Radiated Emissions 1GHz to 10 GHz

Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

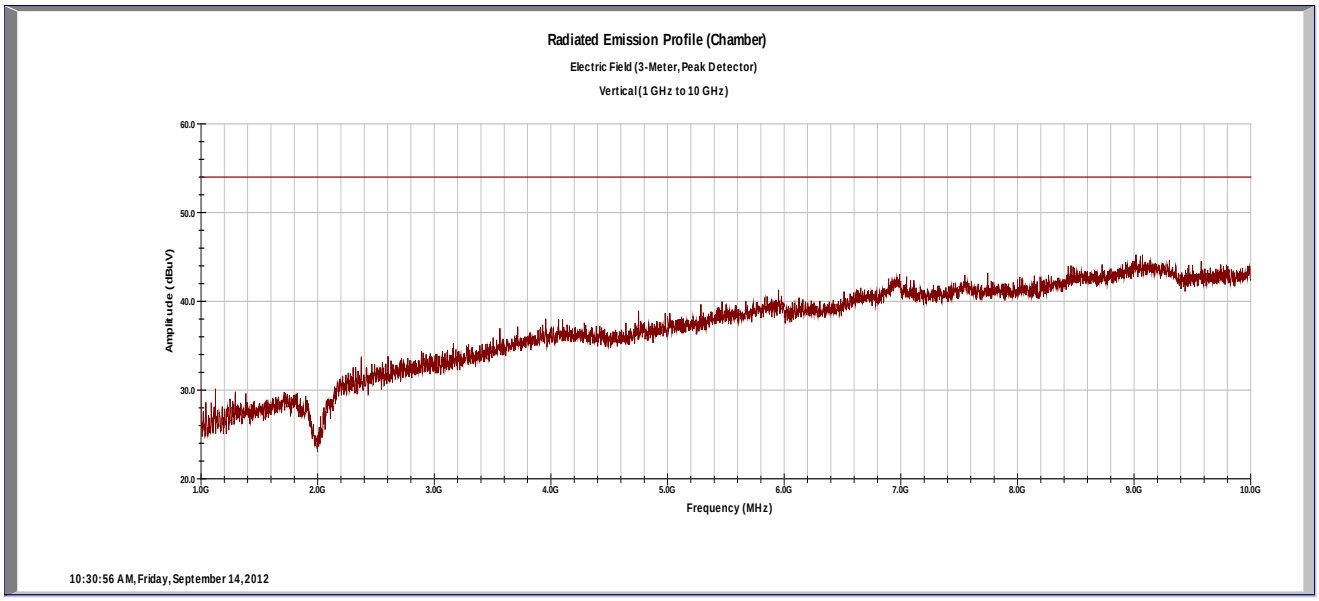
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 2.29dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Idle mode.
No measurable emissions found

Radiated Emissions 1GHz to 10 GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 2.29dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Idle mode.
No measurable emissions found

6.2 Conducted AC Emissions in Receive mode – FCC 15.107(a) and RSS-210

This test measures the electromagnet levels of spurious signals generated by the EUT on the AC power line that may affect the performance of other near by electronic equipment.

6.2.1 Over View of Test

Results	**NA** (as tested per this report)					**Date**	NA
Standard	FCC 15.107(a) and RSS-210						
Product Model	PI900W			**Serial#**	Production Sample		
Test Set-up	Tested in shielded room. EUT placed on table, see test plans for details						
EUT Powered By	7.2V Battery	**Temp**	NA	**Humidity**	NA	**Pressure**	NA
Frequency Range	150 kHz – 30 MHz						
Perf. Criteria	(Below Limit)	**Perf. Verification**	Readings Under Limit for L1 & Neutral				
Mod. to EUT	None	**Test Performed By**	NA				

6.2.2 Test Procedure

Conducted emissions tests were performed using the procedures of ANSI C64.4: 2009, including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration.

6.2.3 Deviations

The Test sample is 7.2V Battery operated only. It does not have provision for external power of any kind.

6.2.4 Final Test

This this is not applicable for the device submitted for testing

7 RF Exposure

7.1 Exposure Requirements – FCC KDB # 447498 DO1 and RSS-102 Issue 4

FCC KDB # 447498 DO1 - Mobile and Portable Device RF Exposure and Procedures and Equipment Authorization Policies section 1) c) states that unless excluded by *specific FCC test procedures*, portable devices with output power > $60/f_{(GHz)}$ mW shall include SAR data for equipment approval.

RSS-102 section 2.5.1 states that a device is exempt from SAR evaluation if the frequency is "from 3 kHz up to 1 GHz inclusively, and with output power (i.e. the higher of the conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power) that is less than or equal to 200 mW for general public use and 1000 mW for controlled use …".

7.1.1 Test Procedure

If the antenna is located > 20cm from the user, then an MPE calculation is acceptable.

If the antenna is located < 20cm (portable / mobile / hand-held device) from the user, then SAR evaluation is required.

7.1.2 Evaluation

The EUT may be used as a hand-held portable device where the antenna can be located less than 20cm from the user, therefore SAR evaluation is required. The EUT is not intended for general public use.

7.1.2.1 Evaluation for FCC

FCC 447498 D01 Mobile Portable RF Exposure v04, Paragraph 2) section a) i) states:
"A device may be used in portable exposure conditions with no restrictions on host platforms when either the source-based time-averaged output power is ≤ $60/f_{(GHz)}$ mW or all measured 1-g SAR are < 0.4 W/kg."

The minimum power that requires SAR testing is 60 / 0.902 GHz or 66.5 mW.

The maximum EIRP source-based time-averaged power output of the EUT is: 26.7 mW.

The EUT is well below the 66.5 mW power level.

7.1.2.2 Evaluation for Industry Canada

The maximum EIRP source-based time-averaged power output of the EUT is: 26.7 mW.

The EUT is well below the 1000 mW power level (for controlled use).

7.1.3 Conclusion

SAR data is not required for either FCC or Industry Canada.

7.1.4 Calculated EIRP Level

CH34: 916.0 MHz = 23.63 dBm = 0.230 Watts = 130.62 dBµV – highest output.

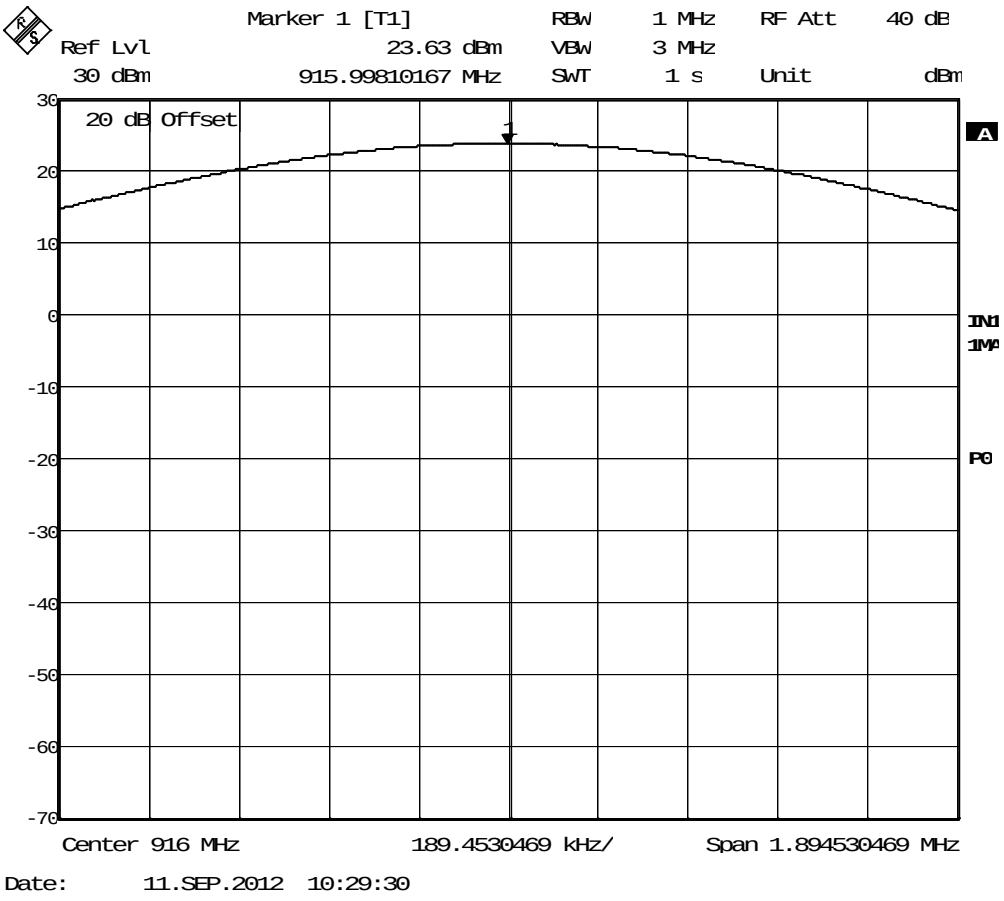


Figure 18 – Maximum Peak Power = 23.63 dBm output + 0.63dBi = 24.26 dBm EIRP = 267 mW EIRP

The normal time-averaged duty cycle is far less than 10%. For these calculations 10% will be used.

This will give a source-based time-averaged output power of:

267mW * 10% = 26.7mW (14.26 dBm) EIRP