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July 8, 2014

Pruf Energy Controls
900 Washington Ave
Suite 506
Waco, TX 76701

Gentlemen:

Thank you for allowing Professional Testing (EMI), Inc. an opportunity to perform testing for Pruf Energy Controls. Enclosed is the Wireless Certification Report for the PEC915V10. This report can be used to demonstrate compliance with requirements for wireless devices in the United States and Canada.

If you have any questions, please contact me.

Sincerely,

Jeffrey A. Lenk
President

Attachment

Project 15590-15

**Pruf Energy Controls
PEC915V10**

Wireless Certification Report

Prepared for:

Pruf Energy Controls
900 Washington Ave
Suite 506
Waco, TX 76701

By

Professional Testing (EMI), Inc.
1601 North A.W. Grimes Blvd., Suite B
Round Rock, Texas 78665

July 8, 2014

Reviewed by

A handwritten signature in black ink, appearing to read 'Larry Finn'.

Larry Finn
Product Development Engineer

Written by

A handwritten signature in black ink, appearing to read 'Eric Lifsey'.

Eric Lifsey
Test Engineer

Revision History

Revision Number	Description	Date
00	Draft for review.	June 17, 2014
01	Revised per client JD comments.	June 19, 2014
02	Revised per TUV/BABT comments & BW change.	July 8, 2014

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Certificate of Compliance

Applicant	Device & Test Identification
Pruf Energy Controls 900 Washington Ave Suite 506 Waco, TX 76701 Certificate Date: July 8, 2014	FCC ID: 2ACB8-PEC915V10 Industry Canada ID: 11970A-PEC915V10 Model(s): PEC915V10 Part Number(s): N/A Laboratory Project ID: 15590-15

The device named above was tested utilizing the following documents and found to be in compliance with the required criteria:

Standard	Reference	Detail
FCC 47 CFR Part 15 C	15.247	Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
FCC 47 CFR Part 15 C	15.209	Radiated emission limits; general requirements.
FCC 47 CFR Part 15 C	15.207	Conducted limits.
FCC 47 CFR Part 15 C	15.205	Restricted Bands of Operation
KDB 558074 D01	DR01	DTS Measurement Guidance v03r02
KDB 412172	D01	Guidelines for Determining the ERP and EIRP of an RF Transmitting System
OET Bulletin 65*	Edition 97-01, and Supplement C, Ed. 01-01	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
RSS-210	Issue 8	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS-Gen	Issue 3	General Requirements and Information for the Certification of Radio Apparatus
RSS-102	Issue 4	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

*MPE is reported separately from this document.

I, Jeffrey A. Lenk, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures, have reviewed the test setup, measured data, and this report. I believe them to be true and accurate.

Jeffrey A. Lenk
President

This report has been reviewed and accepted by Pruf Energy Controls. The undersigned is responsible for ensuring that the PEC915V10 by Pruf Energy Controls will continue to comply with the applicable rules.

Representative of Pruf Energy Controls

1.0 Introduction

1.1 Scope

This report describes the extent to which the equipment under test (EUT) conformed to the intentional radiator requirements of the United States and Canada.

Professional Testing (EMI), Inc., (PTI) follows the guidelines of National Institute of Standards and Technology (NIST) for all uncertainty calculations, estimates, and expressions thereof for electromagnetic compatibility testing. The procedures of ANSI C63.4: 2009 were used for making all radiated enclosure and mains emission measurements.

1.2 EUT Description

The EUT is the **PEC915V10** by **Pruf Energy Controls**. This device is a wireless transmitter/receiver module. The EUT as tested consisted of the following:

Table 1.2.1: Equipment Under Test

Manufacturer	Model	Serial #	Description
Pruf Energy Controls	PEC915V10	V4 003 (Ant 1) V4 002 (Ant 2)	Wireless transmitter/receiver module for 902 – 928 MHz.

This device is constructed as a modular component for wireless applications. It is supplied either with an external printed-circuit antenna (Antenna 1) or a directly soldered-on helical antenna (Antenna 2).

The EUT is powered by a 3.3 Volts DC.

The EUT measures approximately 30 x 24 x 3 mm. A photograph of the EUT is provided below.



Photograph 1.2.1: EUT

1.3 EUT Operation

The EUT was exercised in a manner consistent with normal operations. This device could be powered by systems connected to the AC mains network, so mains conducted emission measurements are included.

The EUT internal software operated the transmitter in a continuous modulated mode or unmodulated mode as required.

1.4 Modifications to Equipment

No modifications were made to the EUT during the performance of the test program.

1.5 Test Site

Measurements were made at the PTI semi-anechoic facility designated Site 45 (FCC 459644, IC 3036B-1) in Austin, Texas. The site is registered with the FCC under Section 2.948 and Industry Canada per RSS-GEN, and is subsequently confirmed by laboratory accreditation (NVLAP). The test site is located at 11400 Burnet Road, Austin, Texas 78758, while the main office is located at 1601 North A.W. Grimes Boulevard, Suite B, Round Rock, Texas, 78665.

2.0 Fundamental Power

2.1 Test Procedure

Bandwidth is first determined to select correct entire bandwidth for power measurement and the fundamental power is measured.

2.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date
15.247(a)(3) // RSS-210 Issue 8, A2.9	Fundamental Power Conducted Limit: 1 Watt	2014-07-07

2.3 Test Results

Bandwidth is found to be 579 kHz in 20 dB, so 1 MHz resolution bandwidth was employed for peak power measurement.

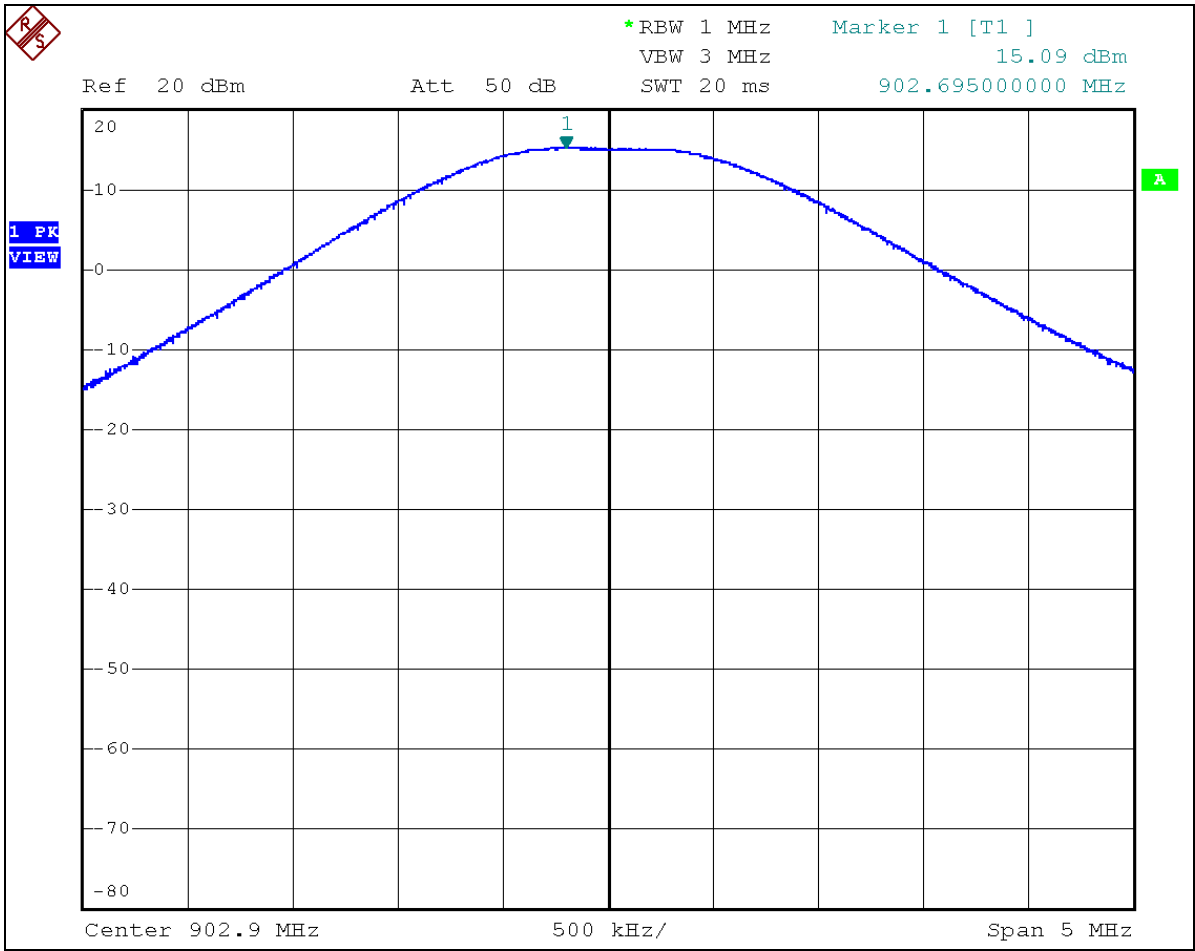
Fundamental Power Measured as Field Strength Conducted Limit 1 Watt (30 dBm)

Conducted Port Power	
Frequency (MHz)	Measured Peak Power (dBm)
902.9	15.09
915.0	14.56
927.5	14.98

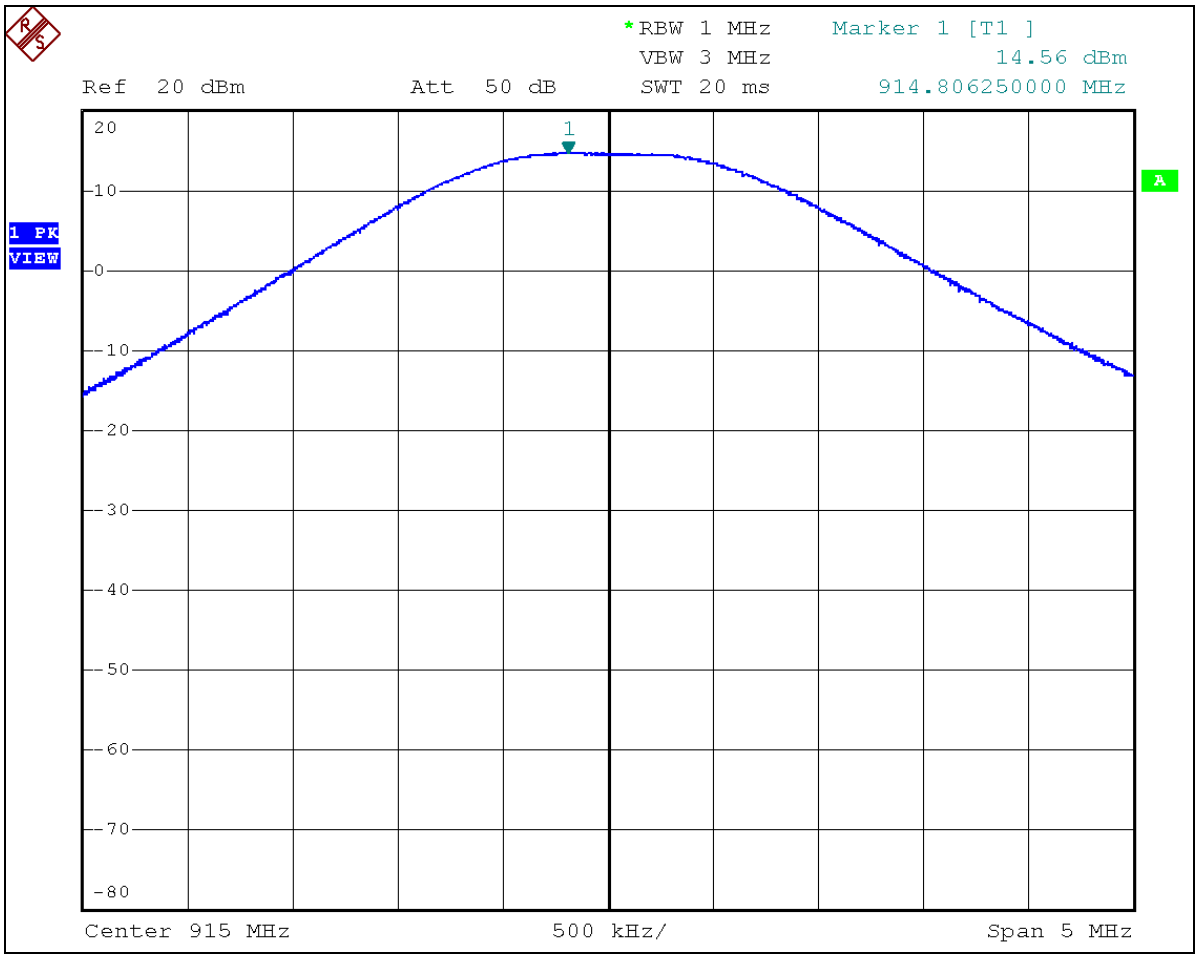
Measured in 1 MHz RBW, 3 MHz VBW.

The EUT was found to be in compliance with the applicable criteria. Plotted measurement appears below.

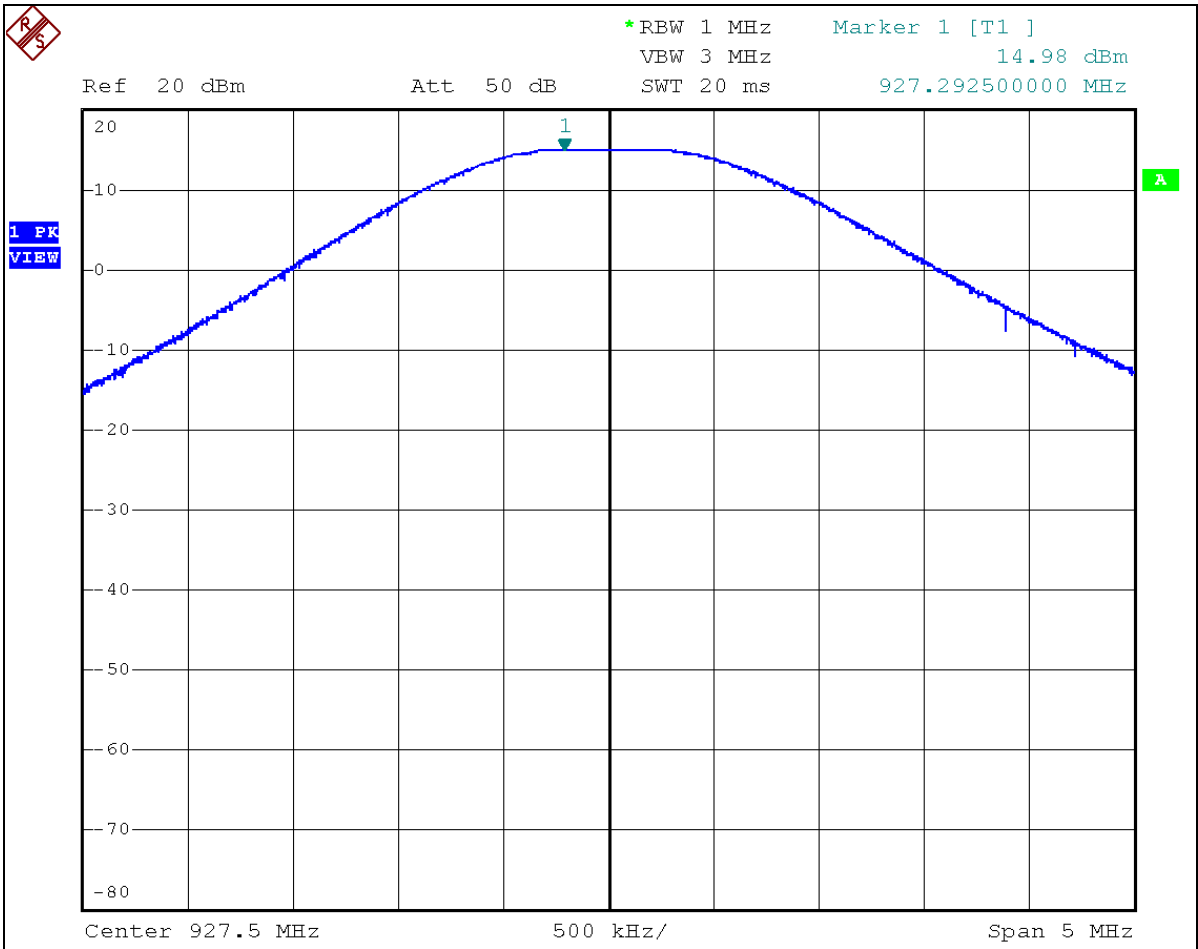
2.3.1 Low Channel



2.3.2 Middle Channel



2.3.3 High Channel



3.0 Power Spectral Density

3.1 Test Procedure

The EUT is connected to a spectrum analyzer. The spectrum analyzer is then adjusted to measure the power spectral density in the prescribed resolution bandwidth with an extended sweep time.

3.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date
15.247e // RSS-210 Issue 8, A2.9	Power Spectral Density, Conducted Limit: 8 dBm / 3 kHz	2014-07-07

3.3 Test Results

Power Spectral Density Conducted Limit 8 dBm, Measured Conducted

Frequency MHz	Corrected* Measured Peak PSD (dBm)
902.9	7.36
915.0	6.45
927.5	6.69

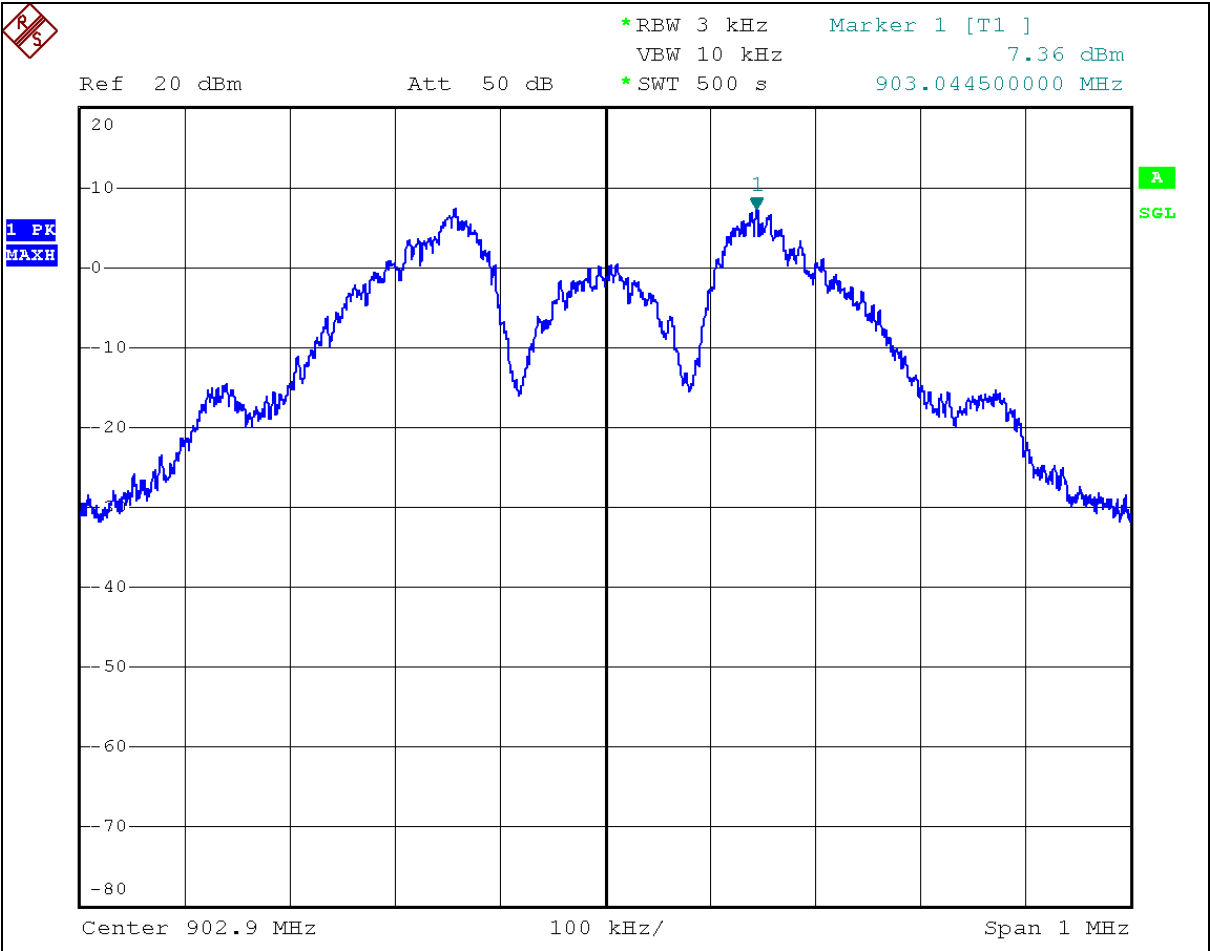
*Connection to the spectrum analyzer was direct.

Sweep time 500 seconds.

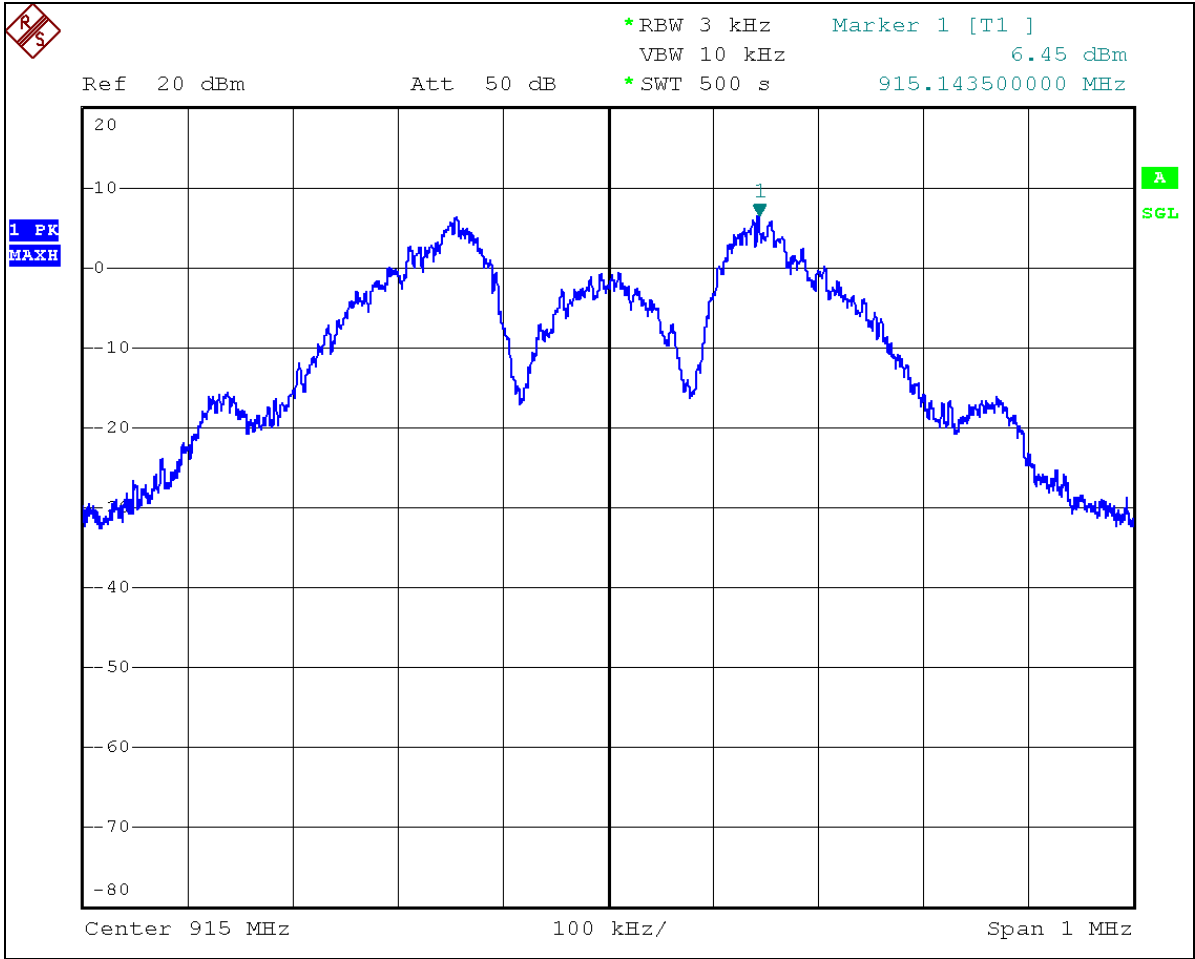
The EUT was found to be in compliance with the applicable criteria.

Plotted measurements appear below.

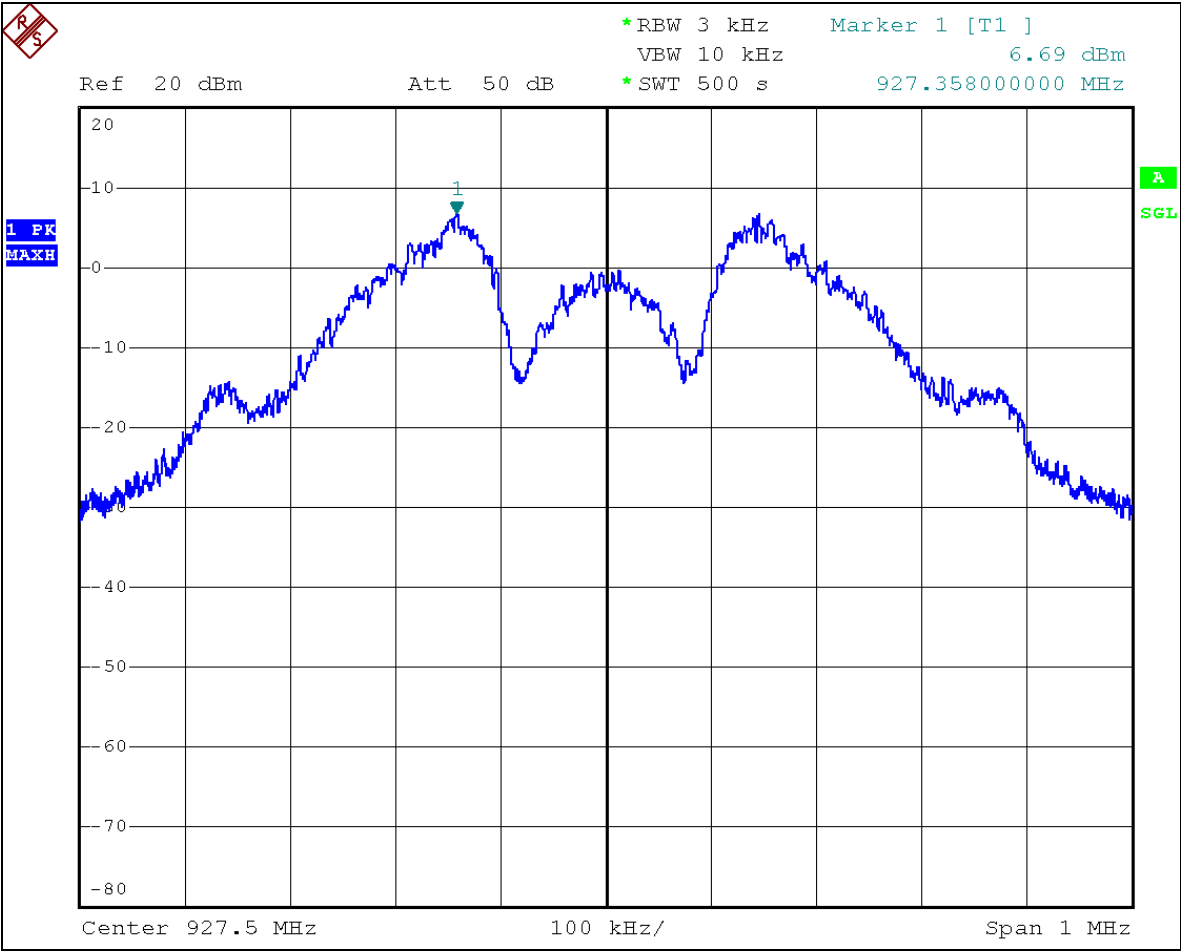
3.3.1 Low Channel PSD



3.3.2 Middle Channel PSD



3.3.3 High Channel PSD



4.0 Transmitter Duty Cycle

4.1 Test Procedure

EUT is placed into normal transmit operation to observe and record transmitter time domain performance.

4.2 Test Criteria

Measurement is based on intervals not to exceed 100 msec. Maximum transmitter on time is divided by the lesser of 100 msec or the actual measured minimum transmitter interval time. The result is converted to dB and applied as needed to peak measurements of transmitter artifacts to determine average power. This is not a pass/fail measurement.

4.3 Test Results

Due to the low peak power of the fundamental and spurious emissions, the duty cycle was not measured.

5.0 Occupied Bandwidth

5.1 Test Procedure

Bandwidth is measured by conducted means. A recording of the results is included.

5.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
14.247(a)(2), 2.1049, KDB 558074 D01 // RSS-Gen Issue 3, 4.6	Bandwidth, 6 dB, 20 dB	2014-07-07

5.3 Test Results

EUT was found to be in compliance with applicable requirements.

Bandwidth 6 dB Minimum 500 kHz (RBW 100 kHz Per FCC KDB 558074 D01)			
--	--	--	--

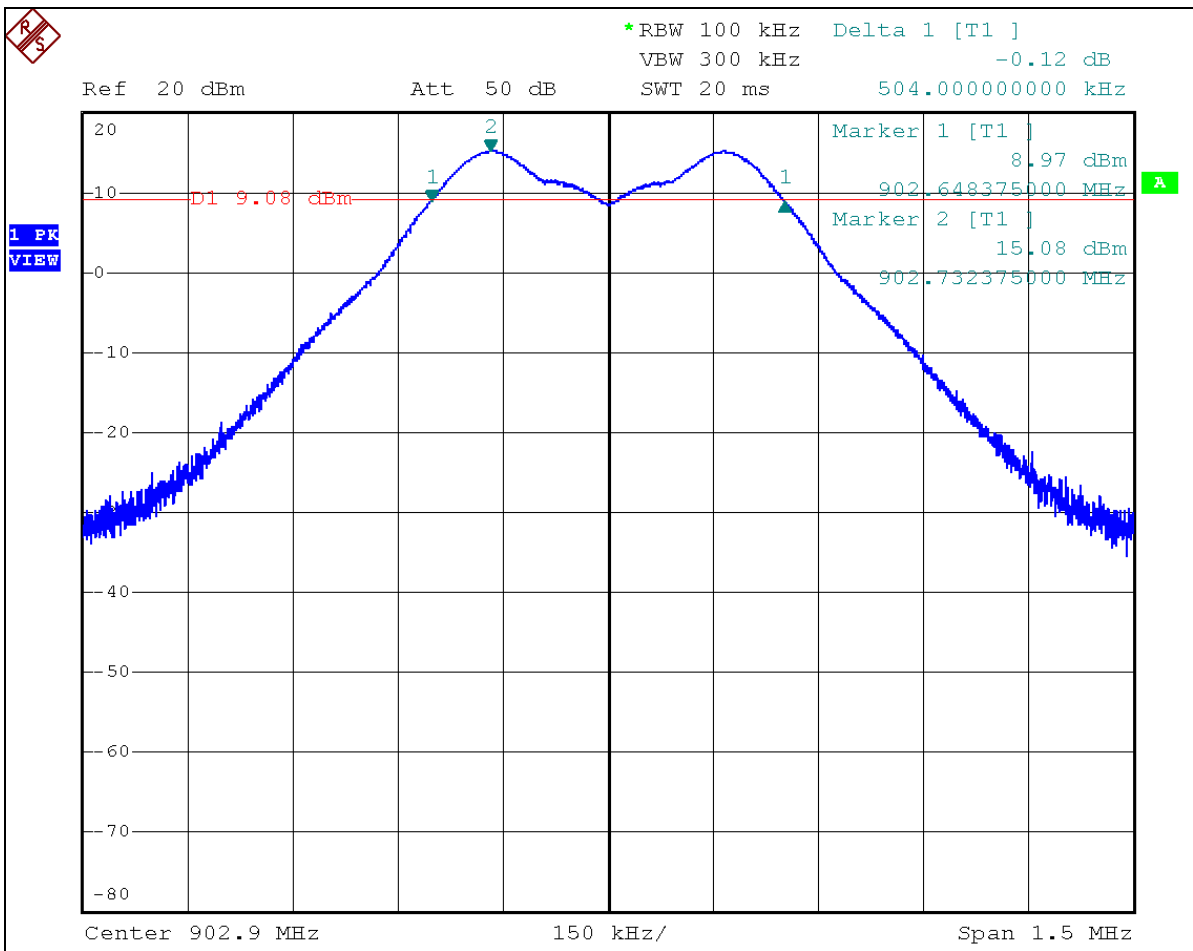
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	Minimum BW (kHz)
504.0	507.0	510.0	504.0

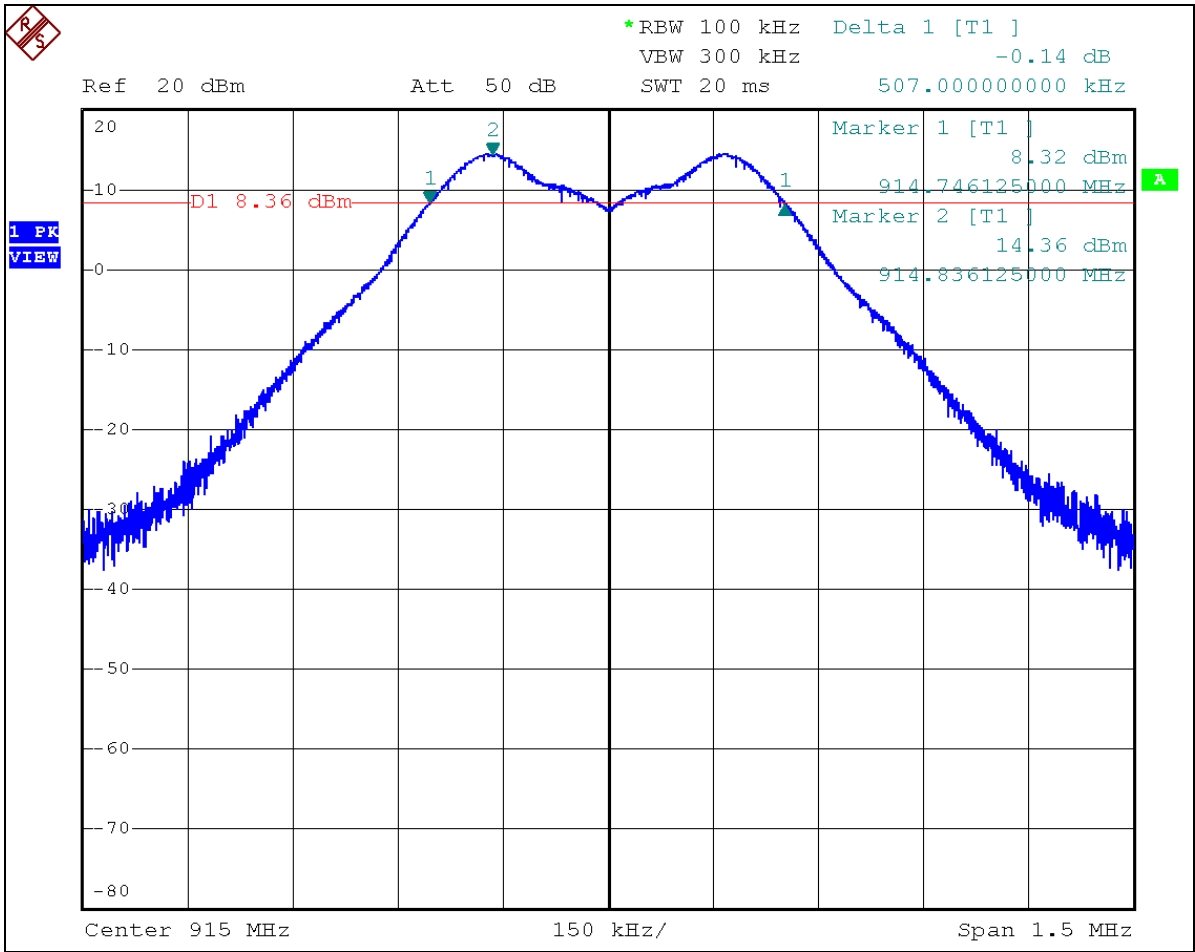
Bandwidth 20 dB Measure and Report			
---	--	--	--

Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	Reported Maximum BW (kHz)
579.0	576.0	573.0	579.0

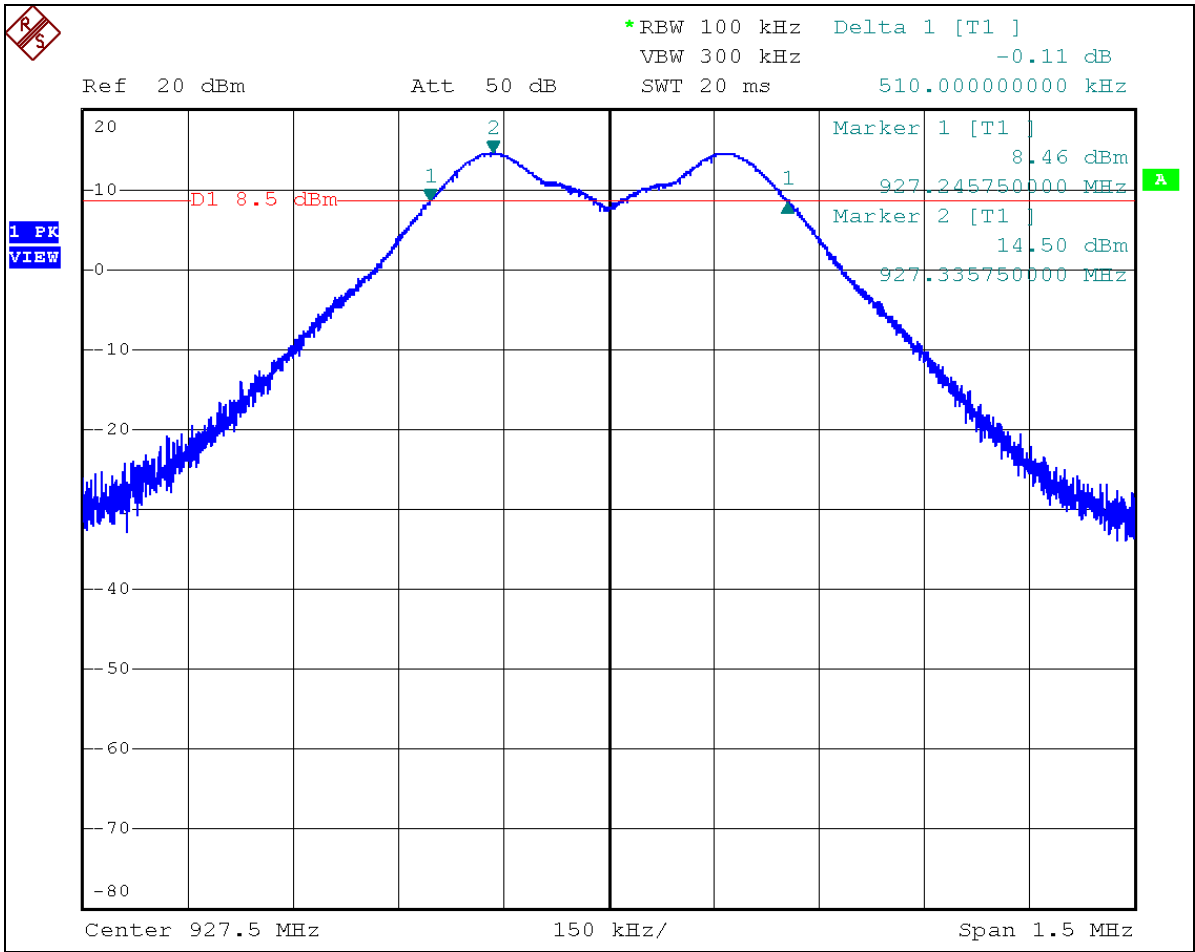
Plotted measurements appear on the following pages.

5.3.1 Bandwidth Plots, 6 dB



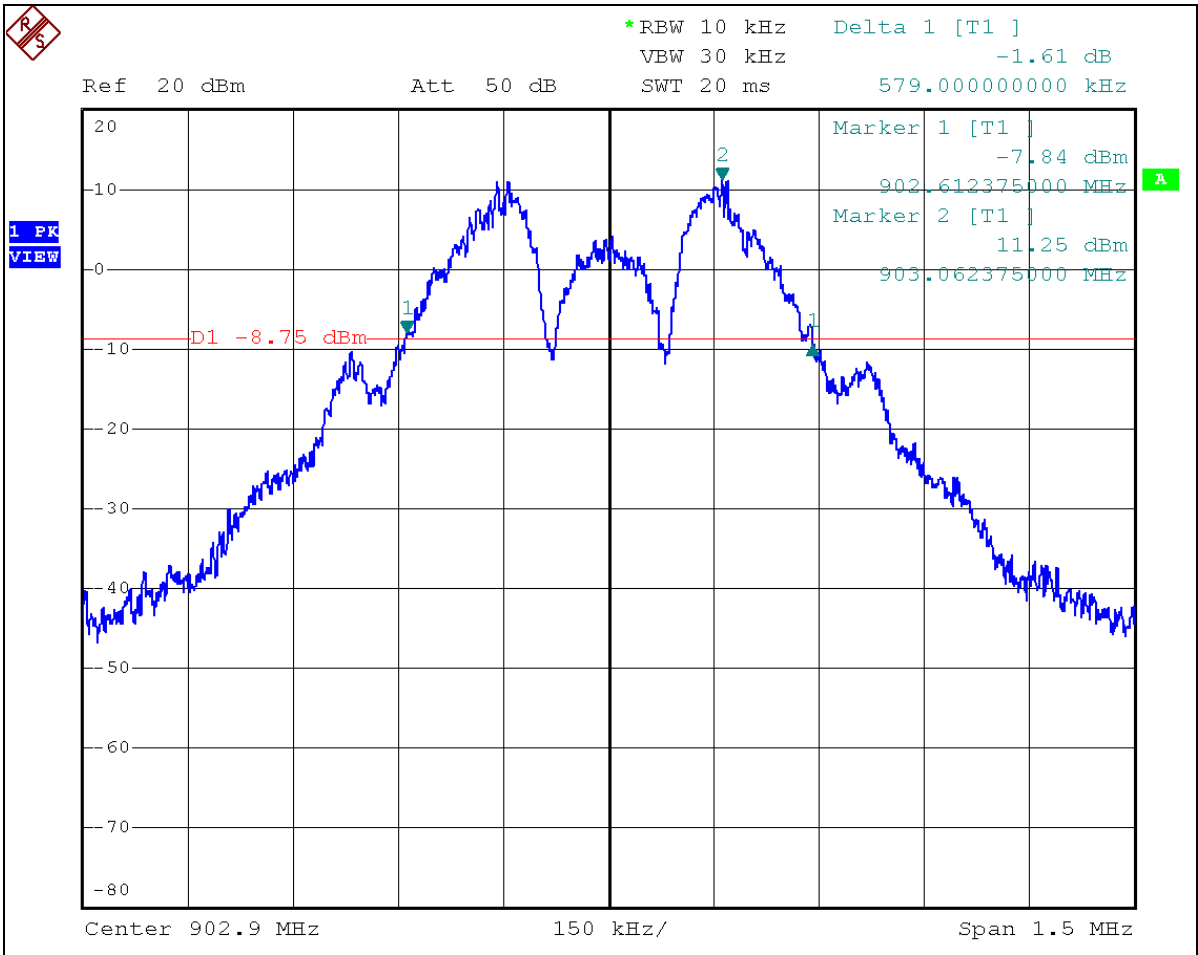


6 dB, Middle Channel

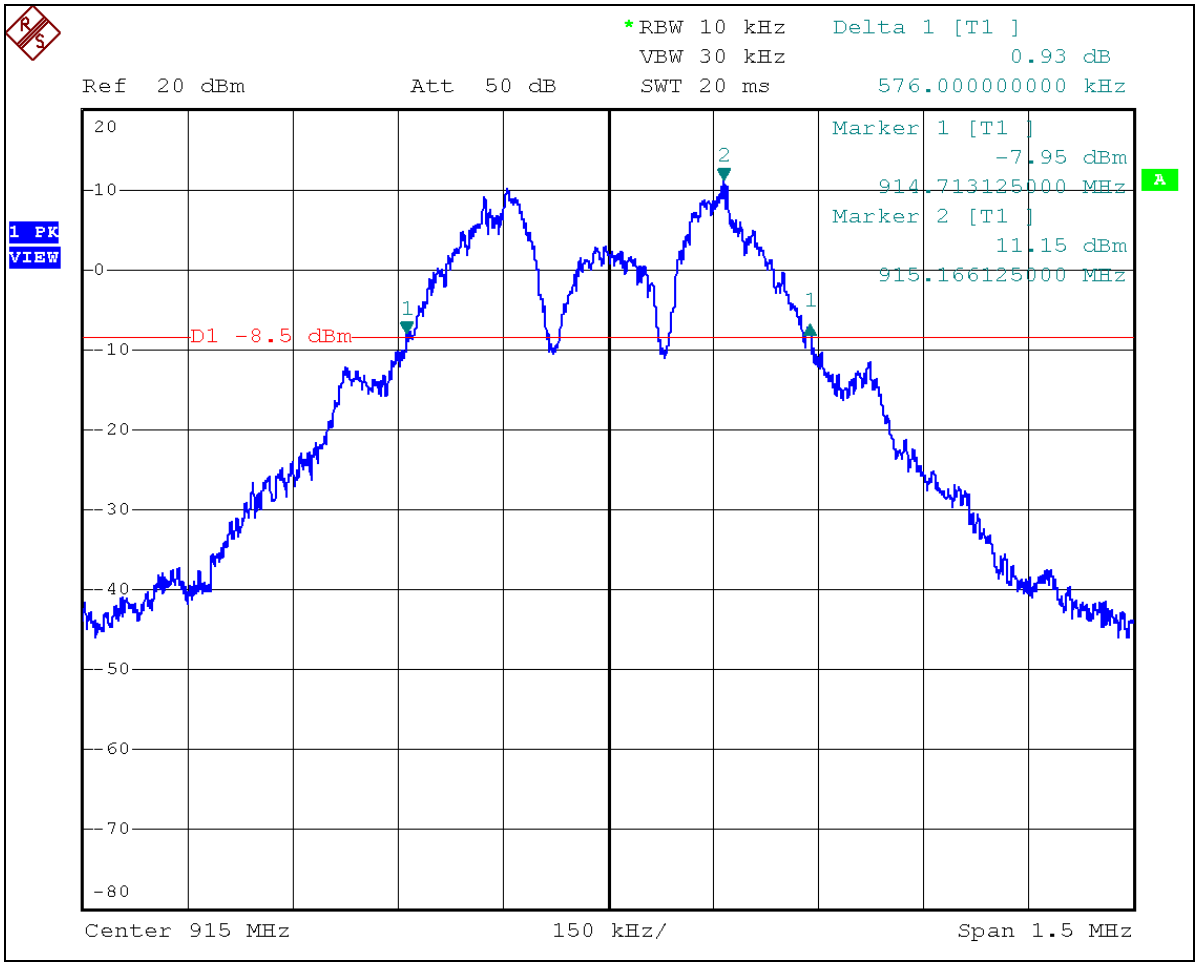


6 dB, High Channel

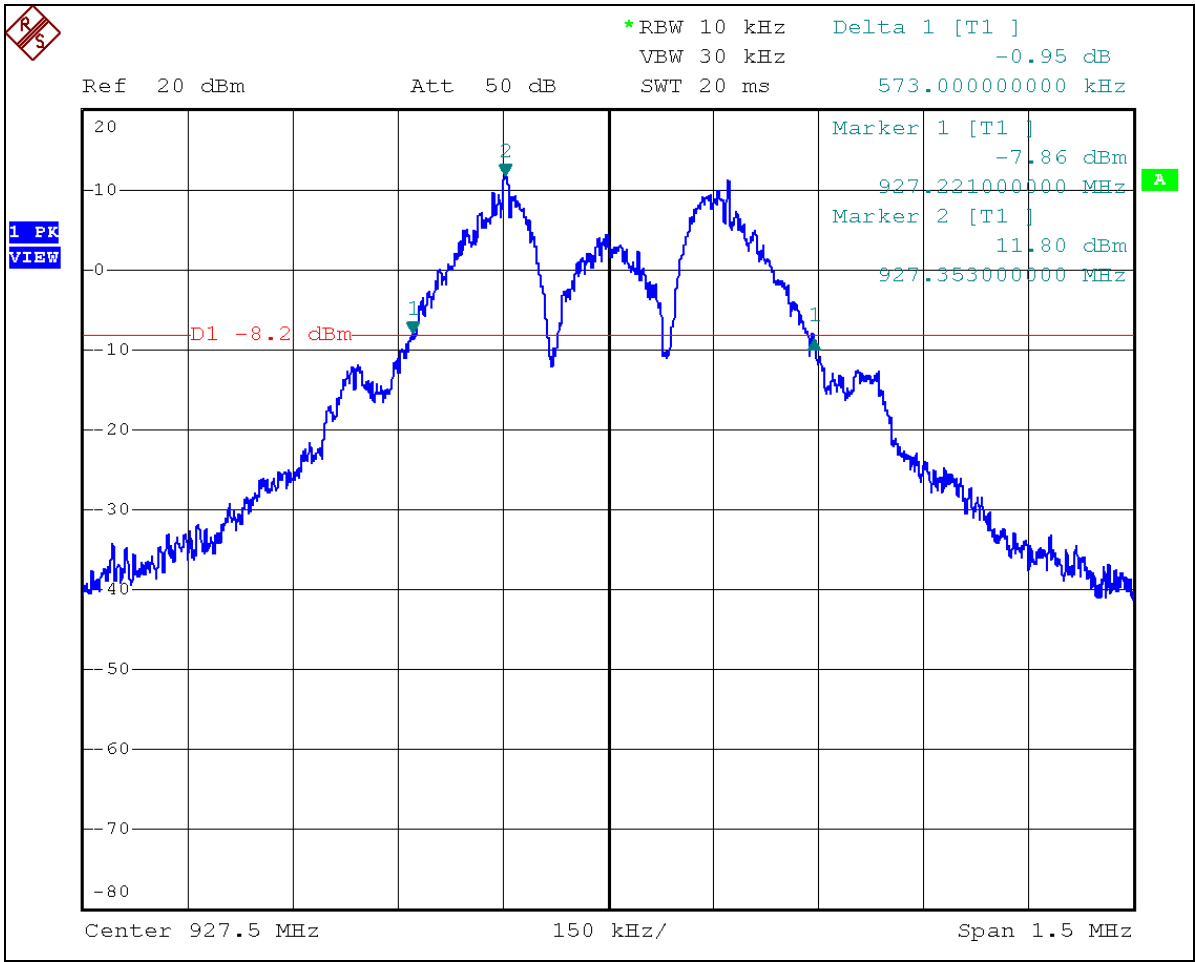
5.3.2 Bandwidth Plots, 20 dB



20 dB, Low Channel



20 dB, Middle Channel



20 dB, High Channel

6.0 Band Edge

6.1 Test Procedure

EUT is placed into normal transmit operation on the nearest band edge channel. The spectrum analyzer is centered on the band edge frequency with span sufficient to include the peak of the adjacent fundamental signal. Measurement includes two standard bandwidths from the respective band edge. If required, the band-edge marker-delta method of C63.4 is utilized.

6.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.205 // RSS-Gen Issue 3, 4.9	Unwanted Emissions Adjacent to Authorized Band, Conducted	2014-05-22

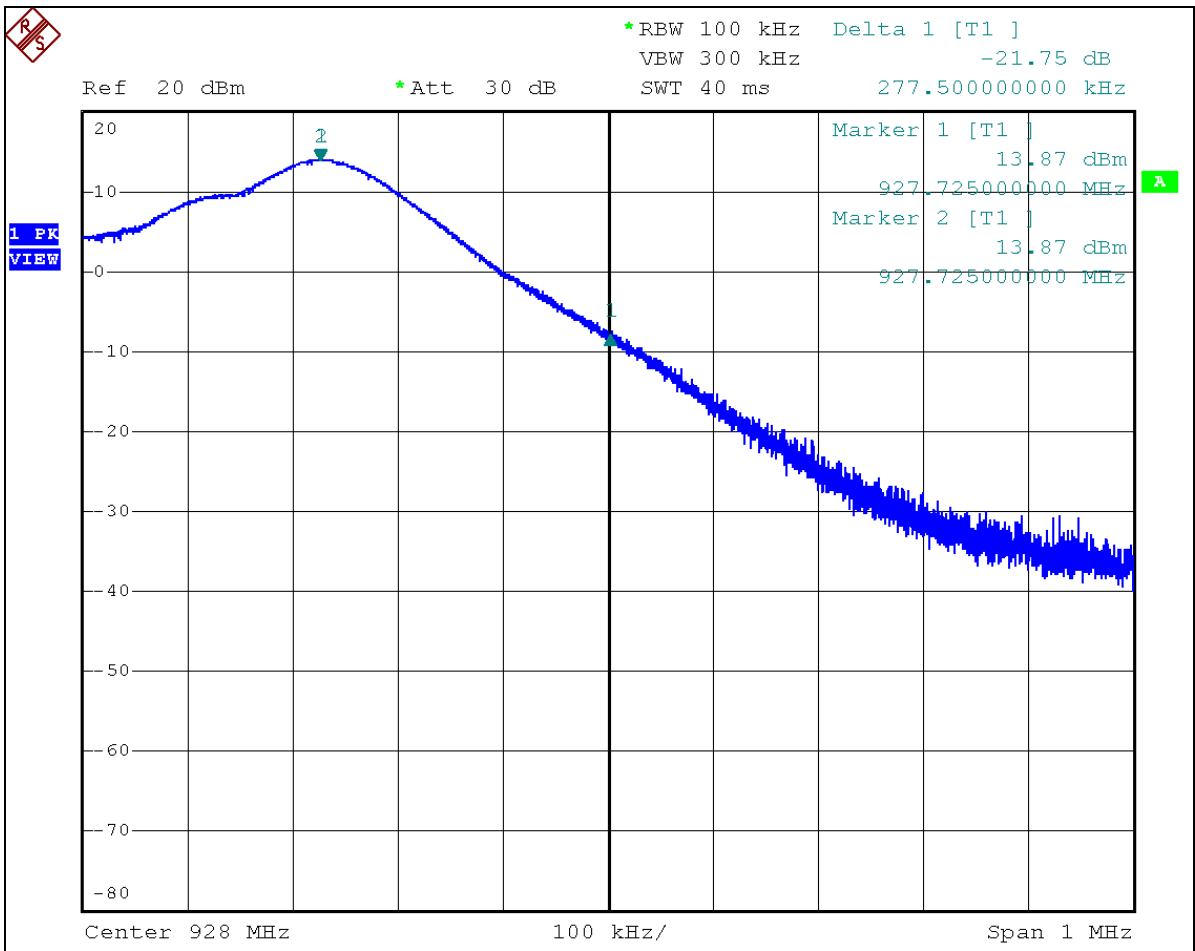
6.3 Test Results

Measurements included more than 2 standard bandwidths (standard bandwidth 100 kHz) from the band edges to provide a clear view of the declining emission levels.

Peak detection of emissions at band edges were below the -20dBc limits with worse case margin of -21.75 dB. No restricted bands are adjacent to this band.

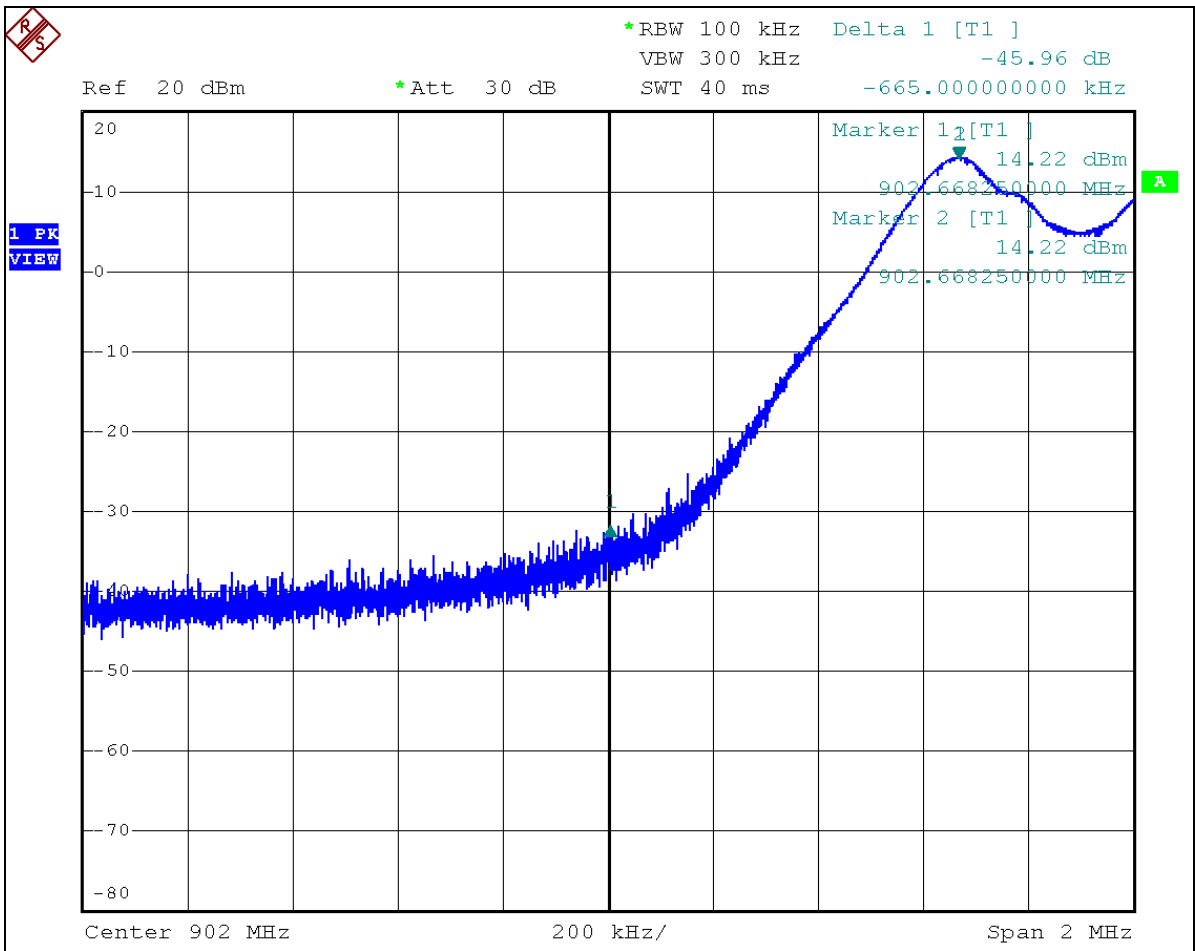
The EUT satisfied the criteria. Plotted results appears on the following pages.

6.3.1 High Channel Band Edge



Band Edge Emission, Satisfies -20dBc Criteria

6.3.2 Low Channel Band Edge



Band Edge Emission, Satisfies -20dBc Criteria

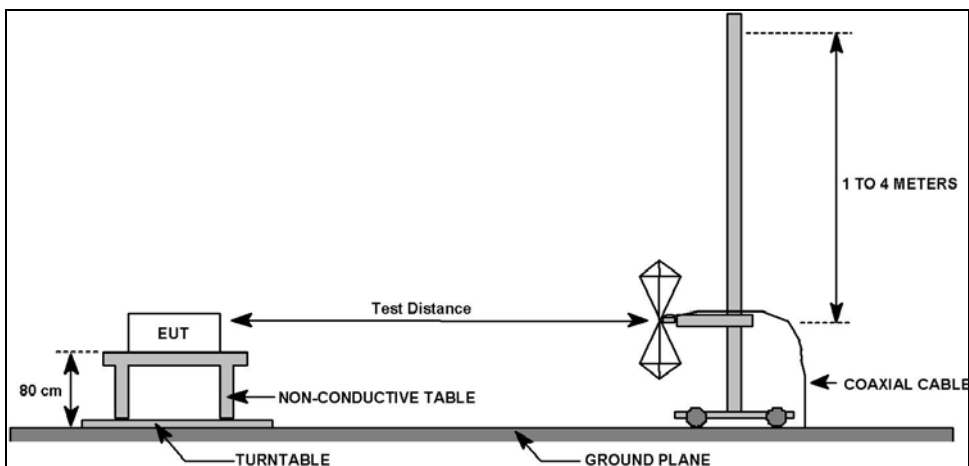
7.0 Radiated Spurious Emissions, Receive Mode

Out of band spurious/harmonic emissions measurements were performed on the EUT to determine compliance to 47 CFR, Part 15.

7.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The EUT was centered on a rotating turntable. Measurements below 1 GHz were taken at a test distance of 10 meters from the measurement antenna. Above 1 GHz the measurement distance was 3 meters.

Spurious emissions below 1 GHz were measured with quasi-peak detection with a resolution bandwidth of 120 kHz. Above 1 GHz peak measurements were taken and average measured where appropriate. A diagram showing the test setup appears below.



7.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 // RSS-Gen Issue 3, 4.9, 4.10	Field Strength of Radiated Spurious/Harmonic Emissions	2014-05-19 2014-05-20

7.3 Test Results

Emission measurements of receiver spurious were taken using the antenna with the highest gain plus largest radiating structure. The EUT was tuned to the middle channel.

The EUT satisfied the criteria. Recorded data is presented below.

Table 7.3.1: Radiated Spurious Emissions, Receive Mode, Below 1 GHz, Vertical Polarity**Antenna 1: Pulse Printed Circuit Antenna**

Professional Testing, EMI, Inc.									
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).								
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits								
Section:	15.209								
Test Date(s):	5/19/2014				EUT Serial #:	V4 003			
Customer:	BCP Controls LLC DBA Pruf Energy				EUT Part #:	None			
Project Number:	15590-15				Test Technician:	Dave Kohutek			
Purchase Order #:	PTI_014_001				Supervisor:	Rob McCollough			
Equip. Under Test:	PEC915V10				Witness' Name:	J.D. Holland			
Radiated Emissions Test Results Data Sheet								Page: 1 of 1	
EUT Line Voltage:		3.3 VDC		EUT Power Frequency:		N/A		N/A	
Antenna Orientation:		Vertical		Frequency Range:		30MHz to 1GHz			
EUT Mode of Operation:					Receiver Mode, 915MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
30.0133	10	148	0	Quasi-peak	30.8	19.788	29.5	-9.7	Pass
30.3304	10	62	2.5	Quasi-peak	24.1	12.919	29.5	-16.6	Pass
60.0208	10	242	3.83	Quasi-peak	33.2	11.862	29.5	-17.6	Pass
93.7134	10	273	3.74	Quasi-peak	28.4	7.737	33.1	-25.4	Pass
94.6828	10	78	2.18	Quasi-peak	30.3	9.767	33.1	-23.3	Pass
622.849	10	190	1.44	Quasi-peak	22.1	16.496	35.6	-19.1	Pass
876.64	10	233	3.04	Quasi-peak	21.4	20.552	35.6	-15.0	Pass
955.641	10	95	3.73	Quasi-peak	21.1	21.481	35.6	-14.1	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 10m Distance
30MHz - 1GHz Vertical Polarity Measured Emissions

Field Strength (dBμV/m)

Frequency

Operator: Dave Kohutek
15590-15_RE_V4 003_915MHz_RCV.tif
03:38:23 PM, Monday, May 19, 2014

EUT Mode: 915MHz, Receiver
EUT Power: 3.3VDC
Serial Number: V4 003

EUT: PEC915V10
Project Number: 15590-15
Client: BCP Controls LLC DBA Pruf Energy

≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.2: Radiated Spurious Emissions, Receive Mode, Below 1 GHz, Horizontal Polarity**Antenna 1: Pulse Printed Circuit Antenna**

Professional Testing, EMI, Inc.									
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).								
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits								
Section:	15.209								
Test Date(s):	5/19/2014				EUT Serial #:	V4 003			
Customer:	BCP Controls LLC DBA Pruf Energy				EUT Part #:	None			
Project Number:	15590-15				Test Technician:	Dave Kohutek			
Purchase Order #:	PTI_014_001				Supervisor:	Rob McCollough			
Equip. Under Test:	PEC915V10				Witness' Name:	J.D. Holland			
Radiated Emissions Test Results Data Sheet								Page: 1 of 1	
EUT Line Voltage:		3.3		VDC		EUT Power Frequency:		N/A N/A	
Antenna Orientation:		Horizontal				Frequency Range:		30MHz to 1GHz	
EUT Mode of Operation:					Receiver Mode, 915MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
30.731	10	185	1.26	Quasi-peak	24.2	12.763	29.5	-16.7	Pass
32.281	10	28	3.95	Quasi-peak	23.9	11.659	29.5	-17.8	Pass
42.748	10	351	1.33	Quasi-peak	23	5.505	29.5	-24.0	Pass
45.6423	10	275	3.26	Quasi-peak	23.5	4.865	29.5	-24.6	Pass
94.3566	10	34	1.74	Quasi-peak	23.4	2.806	33.1	-30.3	Pass
179.924	10	98	2.08	Quasi-peak	22.8	5.276	33.1	-27.8	Pass
721.081	10	181	3.75	Quasi-peak	21.8	17.899	35.6	-17.7	Pass
909.709	10	237	3.59	Quasi-peak	21.3	21.118	35.6	-14.5	Pass
984.666	10	145	3.56	Quasi-peak	21.1	22.02	43.5	-21.5	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 10m Distance
30MHz - 1GHz Horizontal Polarity Measured Emissions

Field Strength (dBμV/m)

Frequency

Operator: Dave Kohutek
15590-15_RE_V4 003_915Mhz_RCV.til
03:38:23 PM, Monday, May 19, 2014

EUT Mode: 915MHz, Receiver
EUT Power: 3.3VDC
Serial Number: V4 003

EUT: PEC915V10
Project Number: 15590-15
Client: BCP Controls LLC DBA Pruf Energy

≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 7.3.3: Radiated Spurious Emissions, Receive Mode, Above 1 GHz, Vertical Polarity
Antenna 1: Pulse Printed Circuit Antenna

Professional Testing, EMI, Inc.									
Test Method:		ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).							
In accordance with:		FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits							
Section:		15.209							
Test Date(s):		5/19/2014			EUT Serial #:		V4 003		
Customer:		BCP Controls LLC DBA Pruf Energy			EUT Part #:		None		
Project Number:		15590-15			Test Technician:		Dave Kohutek		
Purchase Order #:		PTI_014_001			Supervisor:		Rob McCollough		
Equip. Under Test:		PEC915V10			Witness' Name:		J.D. Holland		
Radiated Emissions Test Results Data Sheet							Page: 1 of 1		
EUT Line Voltage:		3.3		VDC		EUT Power Frequency:		N/A N/A	
Antenna Orientation:		Vertical				Frequency Range:		Above 1GHz	
EUT Mode of Operation:					Receiver Mode, 915MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1947.43	3	64	1	Average	34.7	24.467	54.0	-29.5	Pass
1974.36	3	189	1	Average	42.5	32.302	54.0	-21.7	Pass
2704.66	3	33	1	Average	34.9	27.045	54.0	-26.9	Pass
5488.04	3	136	1	Average	33.5	30.425	54.0	-23.5	Pass
10424.2	3	145	1	Average	26.8	37.063	54.0	-16.9	Pass
11607.8	3	297	1	Average	27.6	38.449	54.0	-15.5	Pass

Professional Testing, EMI, Inc

Radiated Emissions, 3m Distance

1-12GHz Vertical Polarity Measured Emissions

— Average Limit Level

△ Corrected Average Reading

— Peak Limit Level

— Corrected Peak Reading

Operator: Dave Kohutek

15590-15_RE_V4 003_915Mhz_RCV.til

02:15:58 PM, Monday, May 19, 2014

Frequency

EUT Mode: 915MHz, Receiver

EUT Power: 3.3VDC

Serial Number: V4 003

EUT: PEC915V10

Project Number: 15590-15

Client: BCP Controls LLC DBA Pruf Energy

> 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.4: Radiated Spurious Emissions, Receive Mode, Above 1 GHz, Vertical Polarity
Antenna 1: Pulse Printed Circuit Antenna

Professional Testing, EMI, Inc.										
Test Method:		ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).								
In accordance with:		FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits								
Section:		15.209								
Test Date(s):		5/19/2014			EUT Serial #:		V4 003			
Customer:		BCP Controls LLC DBA Pruf Energy			EUT Part #:		None			
Project Number:		15590-15			Test Technician:		Dave Kohutek			
Purchase Order #:		PTI_014_001			Supervisor:		Rob McCollough			
Equip. Under Test:		PEC915V10			Witness' Name:		J.D. Holland			
Radiated Emissions Test Results Data Sheet							Page: 1 of 1			
EUT Line Voltage:		3.3 VDC		EUT Power Frequency:		N/A		N/A		
Antenna Orientation:		Horizontal			Frequency Range:		Above 1GHz			
EUT Mode of Operation:					Receiver Mode, 915MHz					
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results	
2242.46	3	331	1	Average	34.6	25.659	54.0	-28.3	Pass	
3356.87	3	214	1	Average	34.2	26.593	54.0	-27.4	Pass	
5278.56	3	126	1	Average	32.5	29.028	54.0	-24.9	Pass	
8814.2	3	284	1	Average	27.2	35.497	54.0	-18.5	Pass	
11483.9	3	173	1	Average	27.4	38.681	54.0	-15.3	Pass	

Professional Testing, EMI, Inc

Radiated Emissions, 3m Distance


1-12GHz Horizontal Polarity Measured Emissions

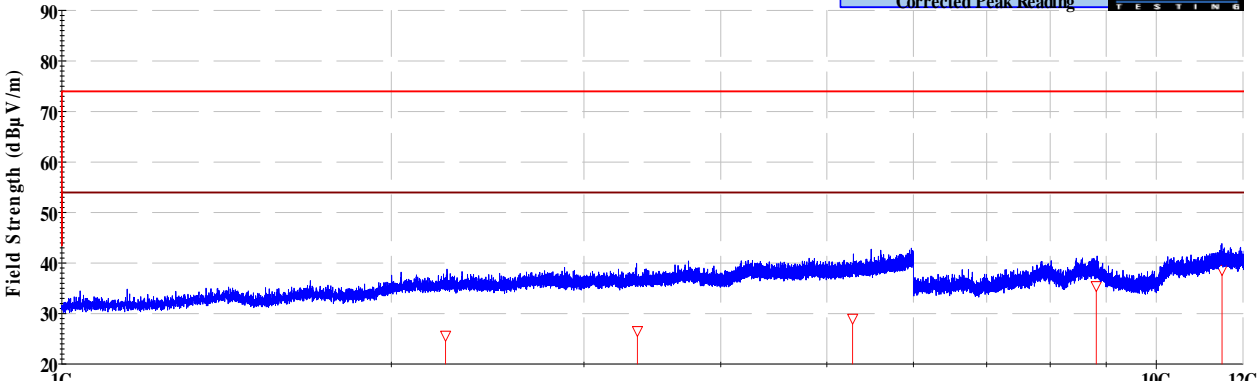
Average Limit Level

Corrected Average Reading

Peak Limit Level

Corrected Peak Reading





Operator: Dave Kohutek

15590-15_RE_V4 003_915Mhz_RCV.ttl

02:15:58 PM, Monday, May 19, 2014

Frequency

EUT Mode: 915MHz, Receiver

EUT Power: 3.3VDC

Serial Number: V4 003

EUT: PEC915V10

Project Number: 15590-15

Client: BCP Controls LLC DBA Pruf Energy

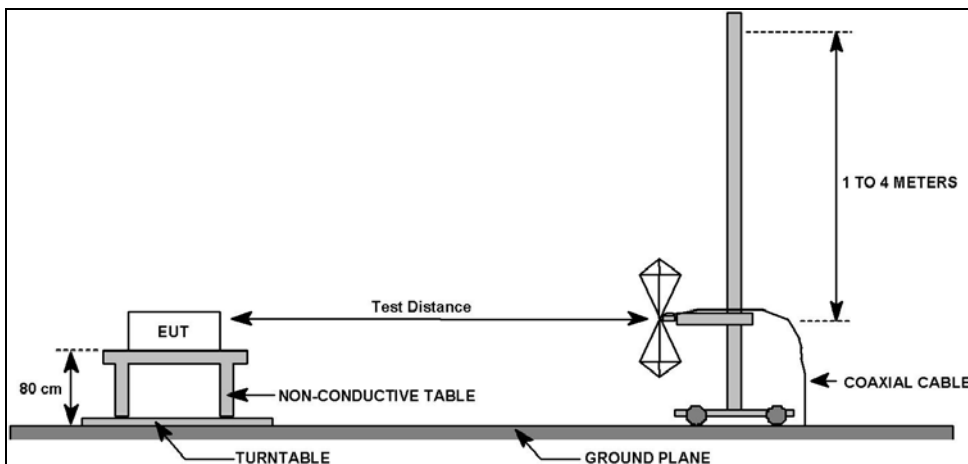
> 1GHz Horizontal Antenna Polarity Measured Emissions

8.0 Radiated Spurious Emissions, Transmit Mode, Antenna 1: Pulse

8.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The EUT was centered on a rotating turntable. Measurements below 1 GHz were taken at a test distance of 10 meters from the measurement antenna. Above 1 GHz the measurement distance was 3 meters.

Spurious emissions below 1 GHz were measured with quasi-peak detection with a resolution bandwidth of 120 kHz. Above 1 GHz peak measurements were taken and average measured where appropriate. A diagram showing the test setup appears below.



8.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 // RSS-Gen Issue 3, 4.9, 4.10	Field Strength of Radiated Spurious/Harmonic Emissions	2014-05-19, 2014-05-20

8.3 Test Results

This section reports results with the Pulse printed circuit board antenna option.

Below 1 GHz measurements were taken in transmit mode on the middle channel. Above 1 GHz measurements were taken on the three standard channels of the band.

The applicable duty cycle factor for averaging above 1 GHz is 0 dB. All peak emissions can be seen as being well below the average limit, meaning the average level would also be under the average limit.

Table 8.3.1: Radiated Spurious Emissions, TX Mode, Below 1 GHz, Vertical Polarity, Mid. Channel
Antenna 1: Pulse Printed Circuit Antenna

Professional Testing, EMI, Inc.									
Test Method:		ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).							
In accordance with:		FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits							
Section:		15.209							
Test Date(s):		5/19/2014			EUT Serial #:		V4 003		
Customer:		BCP Controls LLC DBA Pruf Energy			EUT Part #:		None		
Project Number:		15590-15			Test Technician:		Dave Kohutek		
Purchase Order #:		PTI_014_001			Supervisor:		Rob McCollough		
Equip. Under Test:		PEC915V10			Witness' Name:		J.D. Holland		
Radiated Emissions Test Results Data Sheet							Page: 1 of 1		
EUT Line Voltage:		3.3 VDC		EUT Power Frequency:		N/A N/A			
Antenna Orientation:		Vertical			Frequency Range:		30MHz to 1GHz		
EUT Mode of Operation:					Transmit Mode, 915MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
30.0098	10	291	1.37	Quasi-peak	30.3	19.245	29.5	-10.3	Pass
32.0581	10	122	1.57	Quasi-peak	24.1	11.997	29.5	-17.5	Pass
55.9652	10	326	2.67	Quasi-peak	26.1	5.219	29.5	-24.3	Pass
59.9803	10	161	3.36	Quasi-peak	33.4	12.067	29.5	-17.4	Pass
93.709	10	125	2.24	Quasi-peak	28.9	8.287	33.1	-24.8	Pass
94.6549	10	191	3.75	Quasi-peak	30.2	9.615	33.1	-23.5	Pass
257.236	10	323	3.07	Quasi-peak	22.1	8.427	35.6	-27.2	Pass
720.918	10	8	1.89	Quasi-peak	21.8	17.849	35.6	-17.8	Pass
772.448	10	327	1.72	Quasi-peak	21.6	18.298	35.6	-17.3	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 10m Distance
30MHz - 1GHz Vertical Polarity Measured Emissions

Quasi-peak Limit Level

Corrected Quasi-peak Reading

Peak Limit Level

Corrected Peak Value

PROFESSIONAL TESTING

Operator: Dave Kohutek
15590-15_RE_V4 003_915Mhz.til
01:14:58 PM, Monday, May 19, 2014

EUT Mode: 915MHz, GFSK14.36dBm Output
EUT Power: 3.3VDC
Serial Number: V4 003

EUT: PEC915V10
Project Number: 15590-15
Client: BCP Controls LLC DBA Pruf Energy

≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 8.3.2: Radiated Spurious Emissions, TX Mode, Below 1 GHz, Horizontal Polarity, Mid. Channel
Antenna 1: Pulse Printed Circuit Antenna

Professional Testing, EMI, Inc.									
Test Method:		ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).							
In accordance with:		FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits							
Section:		15.209							
Test Date(s):		5/19/2014			EUT Serial #:		V4 003		
Customer:		BCP Controls LLC DBA Pruf Energy			EUT Part #:		None		
Project Number:		15590-15			Test Technician:		Dave Kohutek		
Purchase Order #:		PTI_014_001			Supervisor:		Rob McCollough		
Equip. Under Test:		PEC915V10			Witness' Name:		J.D. Holland		
Radiated Emissions Test Results Data Sheet							Page: 1 of 1		
EUT Line Voltage:		3.3 VDC		EUT Power Frequency:		N/A N/A			
Antenna Orientation:		Horizontal			Frequency Range:		30MHz to 1GHz		
EUT Mode of Operation:					Transmit Mode, 915MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
31.1133	10	126	3.14	Quasi-peak	24.2	12.574	29.5	-16.9	Pass
36.9482	10	11	1.84	Quasi-peak	23.1	8.274	29.5	-21.2	Pass
40.0834	10	27	1.42	Quasi-peak	24	7.461	29.5	-22.0	Pass
165.223	10	352	3.58	Quasi-peak	22.8	4.082	33.1	-29.0	Pass
206.702	10	168	1.03	Quasi-peak	22.4	5.893	33.1	-27.2	Pass
737.889	10	229	2.95	Quasi-peak	21.8	18.31	35.6	-17.3	Pass
801.816	10	318	1.16	Quasi-peak	21.4	19.066	35.6	-16.5	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 10m Distance
30MHz - 1GHz Horizontal Polarity Measured Emissions

Field Strength (dBμV/m)

110
100
90
80
70
60
50
40
30
20
10
0

30M100M1G

Operator: Dave Kohutek
15590-15_RE_V4 003_915MHz.ttl
01:14:58 PM, Monday, May 19, 2014

EUT Mode: 915MHz, GFSK14.36dBm Output
EUT Power: 3.3VDC
Serial Number: V4 003

EUT: PEC915V10
Project Number: 15590-15
Client: BCP Controls LLC DBA Pruf Energy

— Quasi-peak Limit Level
▽ Corrected Quasi-peak Reading
— Peak Limit Level
— Corrected Peak Value

≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 8.3.3: Radiated Spurious Emissions, TX Mode, Above 1 GHz, Vertical Polarity, Low Channel
Antenna 1: Pulse Printed Circuit Antenna

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	5/19/2014	EUT Serial #:	V4 003
Customer:	BCP Controls LLC DBA Pruf Energy	EUT Part #:	None
Project Number:	15590-15	Test Technician:	Dave Kohutek
Purchase Order #:	PTI_014_001	Supervisor:	Rob McCollough
Equip. Under Test:	PEC915V10	Witness' Name:	J.D. Holland
Radiated Emissions Test Results Data Sheet		Page: 1 of 1	
EUT Line Voltage:	3.3	VDC	
EUT Power Frequency:	N/A	N/A	
Antenna Orientation:	Vertical		Frequency Range: Above 1GHz
EUT Mode of Operation:		Transmit Mode, 902.9MHz	
<div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-12GHz Vertical Polarity Measured Emissions</p> </div> <div style="width: 35%;"> <p>Operator: Dave Kohutek 15590-15_RE_V4 003_902.9MHz.ttl 11:26:41 AM, Monday, May 19, 2014</p> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 30%;"> <p>EUT Mode: 902.9MHz, GFSK14.36dBm Output EUT Power: 3.3VDC Serial Number: V4 003</p> </div> <div style="width: 35%;"> <p>EUT: PEC915V10 Project Number: 15590-15 Client: BCP Controls LLC DBA Pruf Energy</p> </div> </div>			
> 1GHz Vertical Antenna Polarity Measured Emissions			

Table 8.3.4: Radiated Spurious Emissions, TX Mode, Above 1 GHz, Horizontal Polarity, Low Channel Antenna 1: Pulse Printed Circuit Antenna

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	5/19/2014	EUT Serial #:	V4 003
Customer:	BCP Controls LLC DBA Pruf Energy	EUT Part #:	None
Project Number:	15590-15	Test Technician:	Dave Kohutek
Purchase Order #:	PTI_014_001	Supervisor:	Rob McCollough
Equip. Under Test:	PEC915V10	Witness' Name:	J.D. Holland
Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	3.3	VDC	EUT Power Frequency: N/A N/A
Antenna Orientation:	Horizontal		Frequency Range: Above 1GHz
EUT Mode of Operation:		Transmit Mode, 902.9MHz	
<div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-12GHz Horizontal Polarity Measured Emissions</p> <p>The graph displays the measured radiated emissions for the EUT. The y-axis represents Field Strength in dBµV/m, ranging from 20 to 90. The x-axis represents Frequency in GHz, ranging from 1G to 12G. Two horizontal red lines indicate the limit levels: the upper line is the Average Limit Level at approximately 75 dBµV/m, and the lower line is the Peak Limit Level at approximately 55 dBµV/m. The measured emissions are shown as a blue line with a noise floor that fluctuates between 30 and 45 dBµV/m, remaining well below both limit levels. A legend in the top right corner identifies the lines: Average Limit Level (red line), Corrected Average Reading (blue line with triangles), Peak Limit Level (red line), and Corrected Peak Reading (blue line with triangles). The Professional Testing, EMI, Inc logo is also present.</p> </div> <div style="width: 35%; text-align: right;"> <p>Operator: Dave Kohutek 15590-15_RE_V4 003_902.9Mhz.tif 11:26:40 AM, Monday, May 19, 2014</p> <p>EUT Mode: 902.9MHz, GFSK14.36dBm Output EUT Power: 3.3VDC Serial Number: V4 003</p> <p>EUT: PEC915V10 Project Number: 15590-15 Client: BCP Controls LLC DBA Pruf Energy</p> </div> </div>			
> 1GHz Horizontal Antenna Polarity Measured Emissions			

Table 8.3.5: Radiated Spurious Emissions, TX Mode, Above 1 GHz, Vertical Polarity, Mid. Channel
Antenna 1: Pulse Printed Circuit Antenna

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	5/19/2014	EUT Serial #:	V4 003
Customer:	BCP Controls LLC DBA Pruf Energy	EUT Part #:	None
Project Number:	15590-15	Test Technician:	Dave Kohutek
Purchase Order #:	PTI_014_001	Supervisor:	Rob McCollough
Equip. Under Test:	PEC915V10	Witness' Name:	J.D. Holland
Radiated Emissions Test Results Data Sheet		Page: 1 of 1	
EUT Line Voltage:	3.3	VDC	
EUT Power Frequency:	N/A	N/A	
Antenna Orientation:	Vertical		Frequency Range: Above 1GHz
EUT Mode of Operation:		Transmit Mode, 915MHz	
<div> Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-12GHz Vertical Polarity Measured Emissions </div> <div> <div> Operator: Dave Kohutek 15590-15_RE_V4 003_915Mhz.tif 11:53:35 AM, Monday, May 19, 2014 </div> <div> EUT Mode: 915MHz, GFSK14.36dBm Output EUT Power: 3.3VDC Serial Number: V4 003 </div> <div> EUT: PEC915V10 Project Number: 15590-15 Client: BCP Controls LLC DBA Pruf Energy </div> </div>			
> 1GHz Vertical Antenna Polarity Measured Emissions			

Table 8.3.6: Radiated Spurious Emissions, TX Mode, Above 1 GHz, Horizontal Polarity, Mid. Channel
Antenna 1: Pulse Printed Circuit Antenna

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	5/19/2014	EUT Serial #:	V4 003
Customer:	BCP Controls LLC DBA Pruf Energy	EUT Part #:	None
Project Number:	15590-15	Test Technician:	Dave Kohutek
Purchase Order #:	PTI_014_001	Supervisor:	Rob McCollough
Equip. Under Test:	PEC915V10	Witness' Name:	J.D. Holland
Radiated Emissions Test Results Data Sheet		Page: 1 of 1	
EUT Line Voltage:	3.3	VDC	
EUT Power Frequency:	N/A	N/A	
Antenna Orientation:	Horizontal		Frequency Range: Above 1GHz
EUT Mode of Operation:		Transmit Mode, 915MHz	
<div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-12GHz Horizontal Polarity Measured Emissions</p> <p>The graph displays the measured radiated emissions of the EUT (PEC915V10) in Transmit Mode at 915MHz. The y-axis represents Field Strength in dBµV/m, ranging from 20 to 90. The x-axis represents Frequency in GHz, ranging from 1G to 12G. Two horizontal red lines indicate the limit levels: the upper line is the Average Limit Level at approximately 75 dBµV/m, and the lower line is the Peak Limit Level at approximately 55 dBµV/m. The measured emissions, shown as a blue line, fluctuate between approximately 30 and 45 dBµV/m across the frequency range, remaining well below both limit levels. A legend in the top right corner identifies the lines: Average Limit Level (red line), Corrected Average Reading (blue line), Peak Limit Level (red line), and Corrected Peak Reading (blue line). The Professional Testing, EMI, Inc. logo is also present in the top right corner of the graph area.</p> </div> <div style="width: 35%;"> <p>Operator: Dave Kohutek 15590-15_RE_V4 003_915Mhz.tif 11:53:34 AM, Monday, May 19, 2014</p> <p>EUT Mode: 915MHz, GFSK14.36dBm Output EUT Power: 3.3VDC Serial Number: V4 003</p> <p>EUT: PEC915V10 Project Number: 15590-15 Client: BCP Controls LLC DBA Pruf Energy</p> </div> </div>			
> 1GHz Horizontal Antenna Polarity Measured Emissions			

Table 8.3.7: Radiated Spurious Emissions, TX Mode, Above 1 GHz, Vertical Polarity, High Channel
Antenna 1: Pulse Printed Circuit Antenna

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	5/19/2014	EUT Serial #:	V4 003
Customer:	BCP Controls LLC DBA Pruf Energy	EUT Part #:	None
Project Number:	15590-15	Test Technician:	Dave Kohutek
Purchase Order #:	PTI_014_001	Supervisor:	Rob McCollough
Equip. Under Test:	PEC915V10	Witness' Name:	J.D. Holland
Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	3.3	VDC	EUT Power Frequency: N/A N/A
Antenna Orientation:	Vertical		Frequency Range: Above 1GHz
EUT Mode of Operation:		Transmit Mode, 927.5MHz	
<div> <div> Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-12GHz Vertical Polarity Measured Emissions </div> <div> <div> Average Limit Level Corrected Average Reading Peak Limit Level Corrected Peak Reading </div> </div> </div> <div> <div> Operator: Dave Kohutek 15590-15_RE_V4 003_927.5MHz.ttl 01:36:25 PM, Monday, May 19, 2014 </div> <div> EUT Mode: 927.5MHz, GFSK14.36dBm Output EUT Power: 3.3VDC Serial Number: V4 003 </div> <div> EUT: PEC915V10 Project Number: 15590-15 Client: BCP Controls LLC DBA Pruf Energy </div> </div>			
> 1GHz Vertical Antenna Polarity Measured Emissions			

Table 8.3.8: Radiated Spurious Emissions, TX Mode, Above 1 GHz, Horizontal Polarity, High Channel Antenna 1: Pulse Printed Circuit Antenna

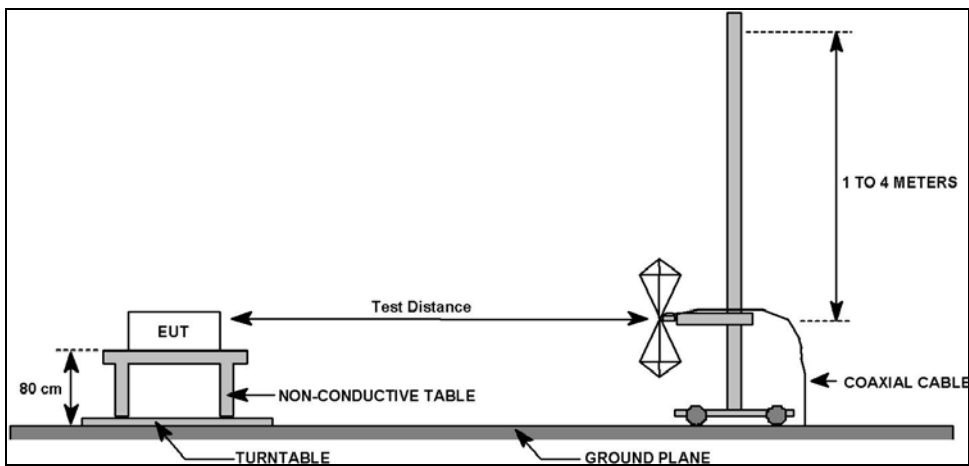
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	5/19/2014	EUT Serial #:	V4 003
Customer:	BCP Controls LLC DBA Pruf Energy	EUT Part #:	None
Project Number:	15590-15	Test Technician:	Dave Kohutek
Purchase Order #:	PTI_014_001	Supervisor:	Rob McCollough
Equip. Under Test:	PEC915V10	Witness' Name:	J.D. Holland
Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	3.3	VDC	EUT Power Frequency: N/A N/A
Antenna Orientation:	Horizontal		Frequency Range: Above 1GHz
EUT Mode of Operation:		Transmit Mode, 927.5MHz	
<div> <div> Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-12GHz Horizontal Polarity Measured Emissions </div> <div> <div> Average Limit Level Corrected Average Reading Peak Limit Level Corrected Peak Reading </div> </div> </div> <div> <div> Operator: Dave Kohutek 15590-15_RE_V4 003_927.5Mhz.ttl 01:36:23 PM, Monday, May 19, 2014 </div> <div> EUT Mode: 927.5MHz, GFSK14.36dBm Output EUT Power: 3.3VDC Serial Number: V4 003 </div> <div> EUT: PEC915V10 Project Number: 15590-15 Client: BCP Controls LLC DBA Pruf Energy </div> </div>			
> 1GHz Horizontal Antenna Polarity Measured Emissions			

9.0 Radiated Spurious Emissions, Transmit Mode, Antenna 2: Helical

9.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The EUT was centered on a rotating turntable. Measurements below 1 GHz were taken at a test distance of 10 meters from the measurement antenna. Above 1 GHz the measurement distance was 3 meters.

Spurious emissions below 1 GHz were measured with quasi-peak detection with a resolution bandwidth of 120 kHz. Above 1 GHz peak measurements were taken and average measured where appropriate. A diagram showing the test setup appears below.



9.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 // RSS-Gen Issue 3, 4.9, 4.10	Field Strength of Radiated Spurious/Harmonic Emissions	2014-05-19, 2014-05-20

9.3 Test Results

This section reports results with the helical antenna option.

Below 1 GHz measurements were taken in transmit mode on the middle channel. Above 1 GHz measurements were taken on the three standard channels of the band.

The applicable duty cycle factor for averaging above 1 GHz is 0 dB. All peak emissions can be seen as being well below the average limit, meaning the average level would also be under the average limit.

Table 9.3.1: Radiated Spurious Emissions, TX Mode, Below 1 GHz, Vertical Polarity, Mid. Channel
Antenna 2: Helical

Professional Testing, EMI, Inc.									
Test Method:		ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).							
In accordance with:		FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits							
Section:		15.209							
Test Date(s):		5/19/2014 & 5/20/2014			EUT Serial #:		V4 002		
Customer:		BCP Controls LLC DBA Pruf Energy			EUT Part #:		None		
Project Number:		15590-15			Test Technician:		Dave Kohutek		
Purchase Order #:		PTI_014_001			Supervisor:		Rob McCollough		
Equip. Under Test:		PEC915V10			Witness' Name:		J.D. Holland		
Radiated Emissions Test Results Data Sheet							Page: 1 of 1		
EUT Line Voltage:		3.3 VDC		EUT Power Frequency:		N/A N/A			
Antenna Orientation:		Vertical			Frequency Range:		30MHz to 1GHz		
EUT Mode of Operation:					Transmit Mode, 915MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
30.8376	10	170	2.15	Quasi-peak	24.2	12.731	29.5	-16.8	Pass
37.9117	10	113	2.76	Quasi-peak	23.7	8.321	29.5	-21.2	Pass
59.9874	10	292	3.23	Quasi-peak	32.7	11.392	29.5	-18.1	Pass
93.6608	10	342	1.21	Quasi-peak	28.5	7.873	33.1	-25.2	Pass
94.6398	10	55	2.07	Quasi-peak	30.2	9.609	33.1	-23.5	Pass
723.986	10	159	1.18	Quasi-peak	21.9	18.065	35.6	-17.5	Pass
743.178	10	290	3.04	Quasi-peak	21.8	18.478	35.6	-17.1	Pass
873.425	10	173	1.96	Quasi-peak	21.4	20.472	35.6	-15.1	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 10m Distance
30MHz - 1GHz Vertical Polarity Measured Emissions

— Quasi-peak Limit Level
▽ Corrected Quasi-peak Reading
— Peak Limit Level
— Corrected Peak Value

PROFESSIONAL TESTING

Operator: Dave Kohutek
15590-15_RE_V4 002_915Mhz.ttl
09:38:26 AM, Tuesday, May 20, 2014

Frequency
EUT Mode: 915MHz, GFSK14.36dBm Output
EUT Power: 3.3VDC
Serial Number: V4 002

EUT: PEC915V10
Project Number: 15590-15
Client: BCP Controls LLC DBA Pruf Energy

≤ 1GHz Vertical Antenna Polarity Measured Emissions

≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 9.3.2: Radiated Spurious Emissions, TX Mode, Below 1 GHz, Horizontal Polarity, Mid. Channel
Antenna 2: Helical

Professional Testing, EMI, Inc.									
Test Method:		ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).							
In accordance with:		FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits							
Section:		15.209							
Test Date(s):		5/19/2014 & 5/20/2014			EUT Serial #:		V4 002		
Customer:		BCP Controls LLC DBA Pruf Energy			EUT Part #:		None		
Project Number:		15590-15			Test Technician:		Dave Kohutek		
Purchase Order #:		PTI_014_001			Supervisor:		Rob McCollough		
Equip. Under Test:		PEC915V10			Witness' Name:		J.D. Holland		
Radiated Emissions Test Results Data Sheet							Page: 1 of 1		
EUT Line Voltage:		3.3 VDC		EUT Power Frequency:		N/A N/A			
Antenna Orientation:		Horizontal			Frequency Range:		30MHz to 1GHz		
EUT Mode of Operation:					Transmit Mode, 915MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
30.3061	10	60	3.45	Quasi-peak	24	12.758	29.5	-16.7	Pass
31.8996	10	205	2.82	Quasi-peak	24.2	12.09	29.5	-17.4	Pass
182.418	10	157	2.16	Quasi-peak	22.6	5.061	33.1	-28.0	Pass
189.536	10	228	2.85	Quasi-peak	22.6	4.858	33.1	-28.2	Pass
753.119	10	184	3.71	Quasi-peak	21.8	18.597	35.6	-17.0	Pass
801.24	10	97	1.78	Quasi-peak	21.4	19.06	35.6	-16.5	Pass
810.261	10	35	2.76	Quasi-peak	21.5	19.218	35.6	-16.4	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 10m Distance
30MHz - 1GHz Horizontal Polarity Measured Emissions

— Quasi-peak Limit Level
▽ Corrected Quasi-peak Reading
— Peak Limit Level
— Corrected Peak Value

Operator: Dave Kohutek
15590-15_RE_V4 002_915MHz.ttl
09:38:26 AM, Tuesday, May 20, 2014

EUT Mode: 915MHz, GFSK14.36dBm Output
EUT Power: 3.3VDC
Serial Number: V4 002

EUT: PEC915V10
Project Number: 15590-15
Client: BCP Controls LLC DBA Pruf Energy

≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 9.3.3: Radiated Spurious Emissions, TX Mode, Below 1 GHz, Vertical Polarity, Low Channel
Antenna 2: Helical

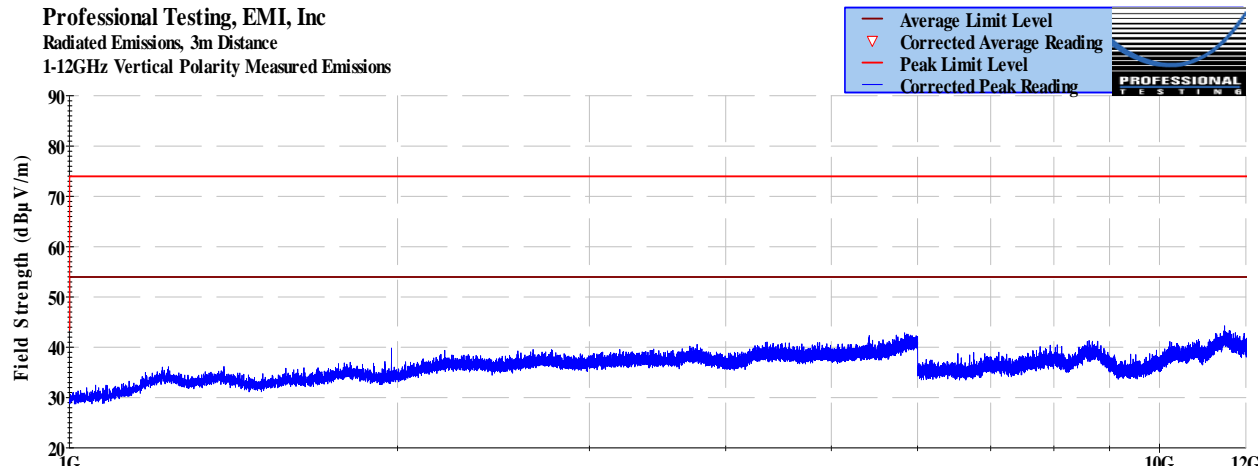
Professional Testing, EMI, Inc.					
Test Method:		ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).			
In accordance with:		FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits			
Section:		15.209			
Test Date(s):		5/19/2014 & 5/20/2014	EUT Serial #:		V4 002
Customer:		BCP Controls LLC DBA Pruf Energy	EUT Part #:		None
Project Number:		15590-15	Test Technician:		Dave Kohutek
Purchase Order #:		PTI_014_001	Supervisor:		Rob McCollough
Equip. Under Test:		PEC915V10	Witness' Name:		J.D. Holland
EUT Line Voltage:		3.3	VDC	EUT Power Frequency:	N/A N/A
Antenna Orientation:		Vertical		Frequency Range:	Above 1GHz
EUT Mode of Operation:			Transmit Mode, 902.9MHz		
<div><div><div>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-12GHz Vertical Polarity Measured Emissions</div><div><div>Field Strength (d Bu V /m)</div><div><div><div>90</div><div>80</div><div>70</div><div>60</div><div>50</div><div>40</div><div>30</div><div>20</div></div><div>1G</div><div>Operator: Dave Kohutek 15590-15_RE_V4 002_902.9Mhz.tif 04:07:54 PM, Monday, May 19, 2014</div></div><div><div>Frequency</div><div>EUT Mode: 902.9MHz, GFSK14.36dBm Output EUT Power: 3.3VDC Serial Number: V4 002</div></div></div><div><div><div>Average Limit Level</div><div>Corrected Average Reading</div><div>Peak Limit Level</div><div>Corrected Peak Reading</div></div><div></div><div><div>EUT: PEC915V10 Project Number: 15590-15 Client: BCP Controls LLC DBA Pruf Energy</div></div></div></div></div>					
> 1GHz Vertical Antenna Polarity Measured Emissions					

Table 9.3.4: Radiated Spurious Emissions, TX Mode, Below 1 GHz, Horizontal Polarity, Low Channel Antenna 2: Helical

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	5/19/2014 & 5/20/2014	EUT Serial #:	V4 002
Customer:	BCP Controls LLC DBA Pruf Energy	EUT Part #:	None
Project Number:	15590-15	Test Technician:	Dave Kohutek
Purchase Order #:	PTI_014_001	Supervisor:	Rob McCollough
Equip. Under Test:	PEC915V10	Witness' Name:	J.D. Holland
Radiated Emissions Test Results Data Sheet		Page: 1 of 1	
EUT Line Voltage:	3.3 VDC	EUT Power Frequency:	N/A N/A
Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode, 902.9MHz	
<div> <div> Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-12GHz Horizontal Polarity Measured Emissions </div> <div> <div> Average Limit Level Corrected Average Reading Peak Limit Level Corrected Peak Reading </div> </div> </div> <div> <div> Operator: Dave Kohutek 15590-15_RE_V4 002_902.9MHz.ttl 04:07:52 PM, Monday, May 19, 2014 </div> <div> EUT Mode: 902.9MHz, GFSK14.36dBm Output EUT Power: 3.3VDC Serial Number: V4 002 </div> <div> EUT: PEC915V10 Project Number: 15590-15 Client: BCP Controls LLC DBA Pruf Energy </div> </div>			
> 1GHz Horizontal Antenna Polarity Measured Emissions			

**Table 9.3.5: Radiated Spurious Emissions, TX Mode, Below 1 GHz, Vertical Polarity, Mid. Channel
Antenna 2: Helical**


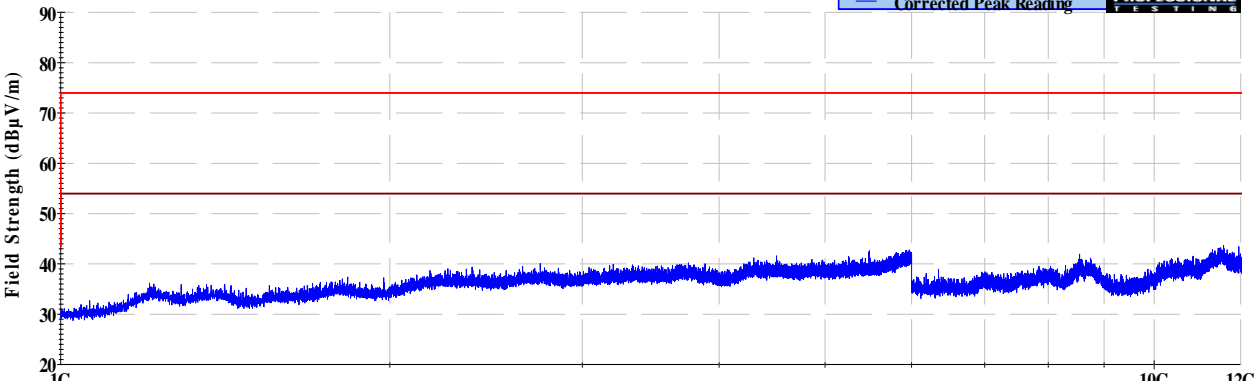
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	5/19/2014 & 5/20/2014	EUT Serial #:	V4 002
Customer:	BCP Controls LLC DBA Pruf Energy	EUT Part #:	None
Project Number:	15590-15	Test Technician:	Dave Kohutek
Purchase Order #:	PTI_014_001	Supervisor:	Rob McCollough
Equip. Under Test:	PEC915V10	Witness' Name:	J.D. Holland
Radiated Emissions Test Results Data Sheet		Page: 1 of 1	
EUT Line Voltage:	3.3 VDC	EUT Power Frequency:	N/A N/A
Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode, 915MHz	
<div> <div> Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-12GHz Vertical Polarity Measured Emissions </div> <div> <div> Average Limit Level Corrected Average Reading Peak Limit Level Corrected Peak Reading </div>  </div> </div>  <div> <div> Operator: Dave Kohutek 15590-15 RE_V4 002_915Mhz.tif 08:20:19 AM, Tuesday, May 20, 2014 </div> <div> Frequency EUT Mode: 915MHz, GFSK14.36dBm Output EUT Power: 3.3VDC Serial Number: V4 002 </div> <div> EUT: PEC915V10 Project Number: 15590-15 Client: BCP Controls LLC DBA Pruf Energy </div> </div>			
> 1GHz Vertical Antenna Polarity Measured Emissions			

Table 9.3.6: Radiated Spurious Emissions, TX Mode, Below 1 GHz, Horizontal Polarity, Mid. Channel Antenna 2: Helical


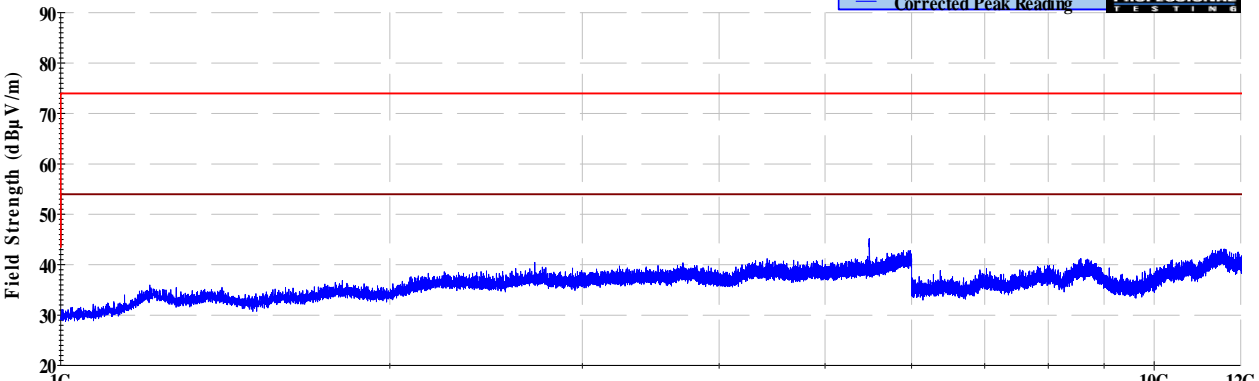
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	5/19/2014 & 5/20/2014	EUT Serial #:	V4 002
Customer:	BCP Controls LLC DBA Pruf Energy	EUT Part #:	None
Project Number:	15590-15	Test Technician:	Dave Kohutek
Purchase Order #:	PTI_014_001	Supervisor:	Rob McCollough
Equip. Under Test:	PEC915V10	Witness' Name:	J.D. Holland
Radiated Emissions Test Results Data Sheet		Page: 1 of 1	
EUT Line Voltage:	3.3 VDC	EUT Power Frequency:	N/A N/A
Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode, 915MHz	
<div> <div> Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-12GHz Horizontal Polarity Measured Emissions </div> <div> <div> Average Limit Level Corrected Average Reading Peak Limit Level Corrected Peak Reading </div>  </div> </div>  <div> <div> Operator: Dave Kohutek 15590-15_RE_V4 002_915Mhz.tif 08:20:17 AM, Tuesday, May 20, 2014 </div> <div> EUT Mode: 915MHz, GFSK14.36dBm Output EUT Power: 3.3VDC Serial Number: V4 002 </div> <div> EUT: PEC915V10 Project Number: 15590-15 Client: BCP Controls LLC DBA Pruf Energy </div> </div>			
> 1GHz Horizontal Antenna Polarity Measured Emissions			

Table 9.3.7: Radiated Spurious Emissions, TX Mode, Below 1 GHz, Vertical Polarity, High Channel Antenna 2: Helical

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	5/19/2014 & 5/20/2014	EUT Serial #:	V4 002
Customer:	BCP Controls LLC DBA Pruf Energy	EUT Part #:	None
Project Number:	15590-15	Test Technician:	Dave Kohutek
Purchase Order #:	PTI_014_001	Supervisor:	Rob McCollough
Equip. Under Test:	PEC915V10	Witness' Name:	J.D. Holland
Radiated Emissions Test Results Data Sheet		Page:	1 of 1
EUT Line Voltage:	3.3	VDC	
EUT Power Frequency:	N/A	N/A	
Antenna Orientation:	Vertical		Frequency Range: Above 1GHz
EUT Mode of Operation:		Transmit Mode, 927.5MHz	
<div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-12GHz Vertical Polarity Measured Emissions</p> </div> <div style="width: 35%; text-align: right;"> <p>— Average Limit Level △ Corrected Average Reading — Peak Limit Level — Corrected Peak Reading</p> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 30%;"> <p>Operator: Dave Kohutek 15590-15_RE_V4 002_927.5MHz.tif 04:25:52 PM, Monday, May 19, 2014</p> </div> <div style="width: 35%; text-align: center;"> <p>Frequency EUT Mode: 927.5MHz, GFSK14.36dBm Output EUT Power: 3.3VDC Serial Number: V4 002</p> </div> <div style="width: 30%; text-align: right;"> <p>EUT: PEC915V10 Project Number: 15590-15 Client: BCP Controls LLC DBA Pruf Energy</p> </div> </div>			
> 1GHz Vertical Antenna Polarity Measured Emissions			

Table 9.3.8: Radiated Spurious Emissions, TX Mode, Below 1 GHz, Horizontal Polarity, High Channel Antenna 2: Helical

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	5/19/2014 & 5/20/2014	EUT Serial #:	V4 002
Customer:	BCP Controls LLC DBA Pruf Energy	EUT Part #:	None
Project Number:	15590-15	Test Technician:	Dave Kohutek
Purchase Order #:	PTI_014_001	Supervisor:	Rob McCollough
Equip. Under Test:	PEC915V10	Witness' Name:	J.D. Holland
Radiated Emissions Test Results Data Sheet		Page: 1 of 1	
EUT Line Voltage:	3.3 VDC	EUT Power Frequency:	N/A N/A
Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode, 927.5MHz	
<div> Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-12GHz Horizontal Polarity Measured Emissions </div> <div> <div> Operator: Dave Kohutek 15590-15_RE_V4 002_927.5Mhz.tif 04:25:51 PM, Monday, May 19, 2014 </div> <div> EUT Mode: 927.5MHz, GFSK14.36dBm Output EUT Power: 3.3VDC Serial Number: V4 002 </div> <div> EUT: PEC915V10 Project Number: 15590-15 Client: BCP Controls LLC DBA Pruf Energy </div> </div>			
> 1GHz Horizontal Antenna Polarity Measured Emissions			

10.0 Conducted Spurious Emissions, Transmit Mode

10.1 Test Procedure

Spurious emissions were measured with peak detection using resolution bandwidth 100 kHz and video bandwidth 300 kHz.

10.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 // RSS-Gen Issue 3, 4.9, 4.10	Field Strength of Radiated Spurious/Harmonic Emissions	2014-05-22

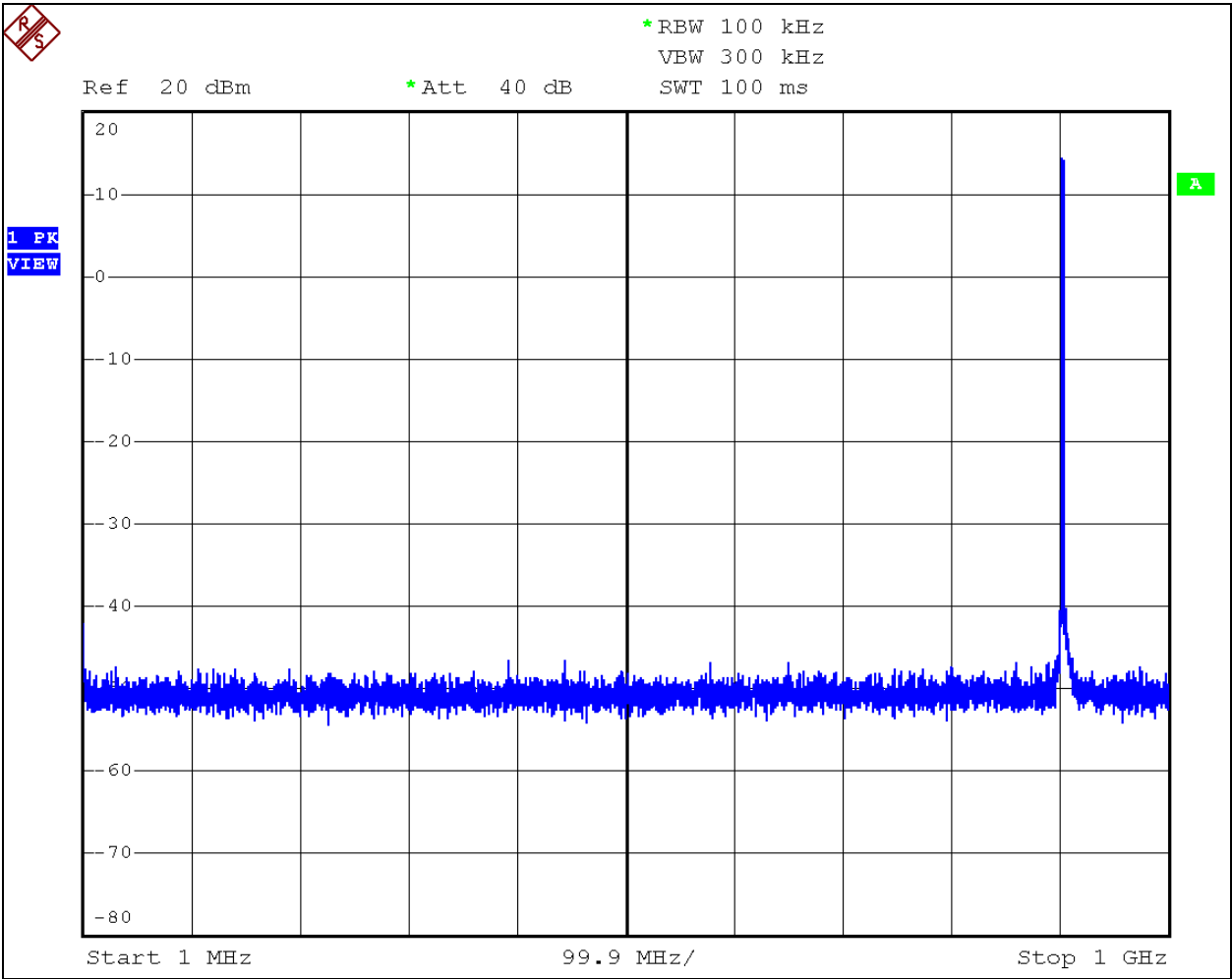
10.3 Test Results

Measurements were taken for frequency range of 1 MHz to 10 GHz and repeated for each of the three standard transmit channels.

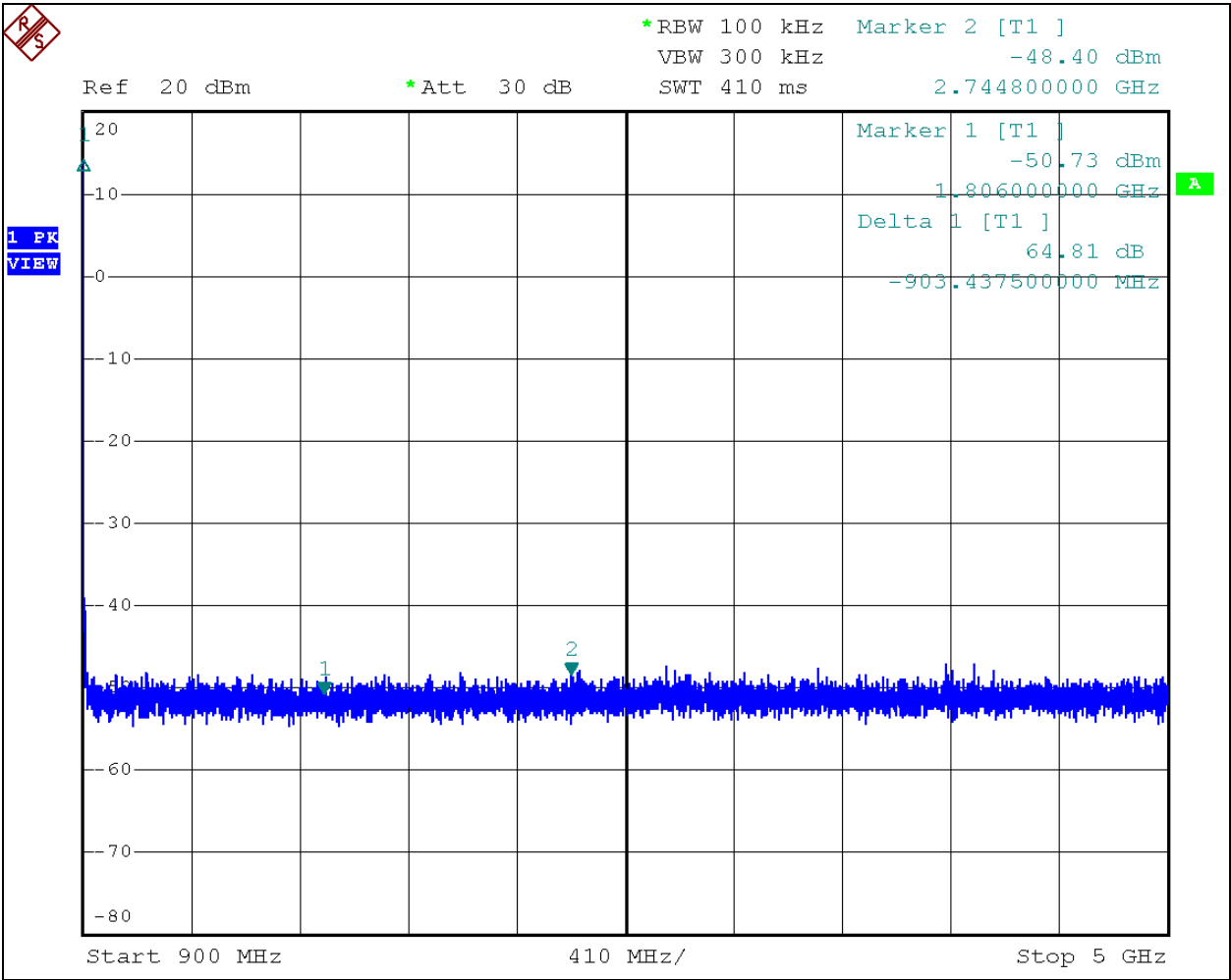
The transmitter operation was verified by including the fundamental frequency where possible.

The EUT satisfied the criteria. Plotted data appears on the following pages.

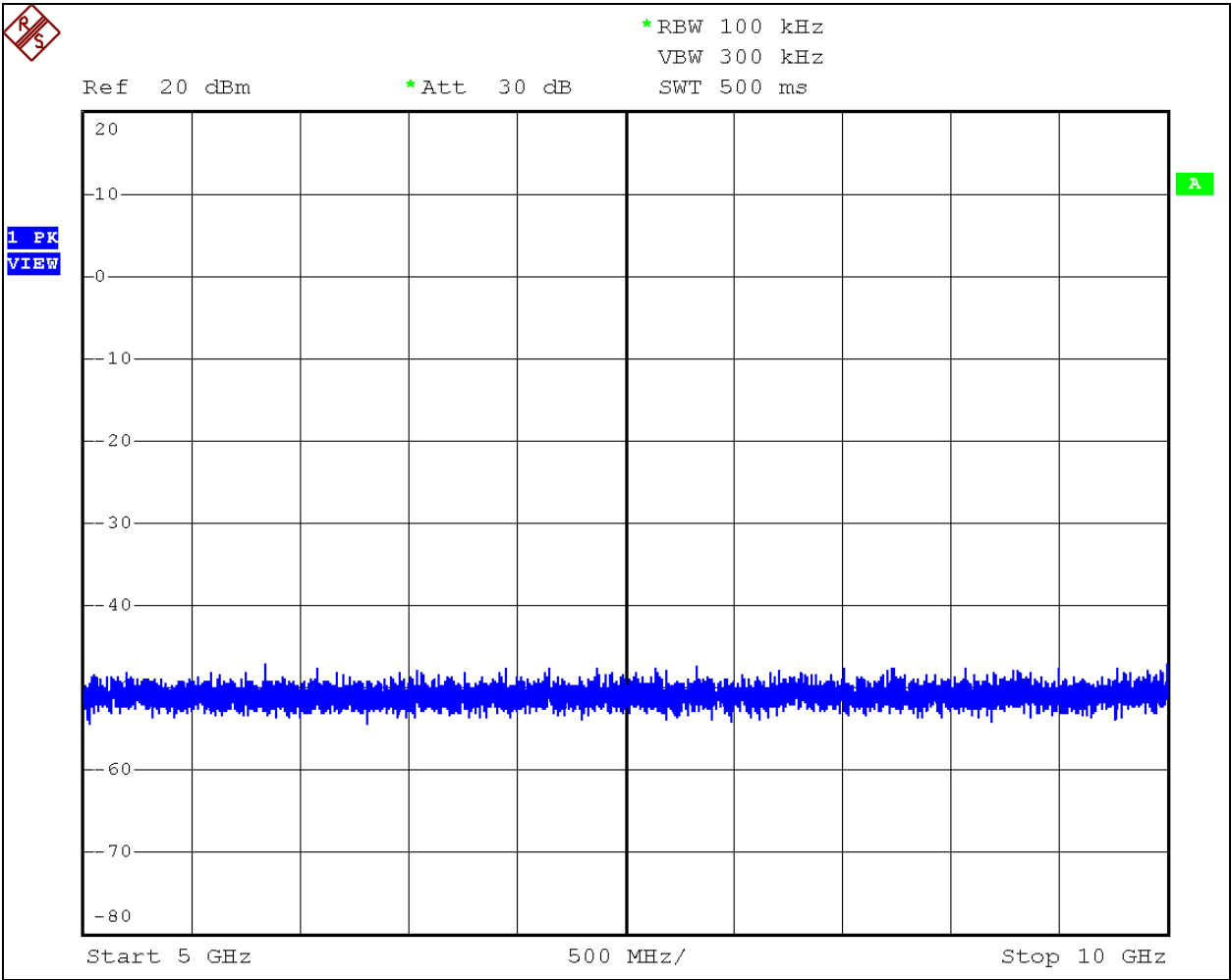
Plot 10.3.1: Conducted Spurious Emissions, TX Mode, 1 MHz to 1 GHz, Low Channel



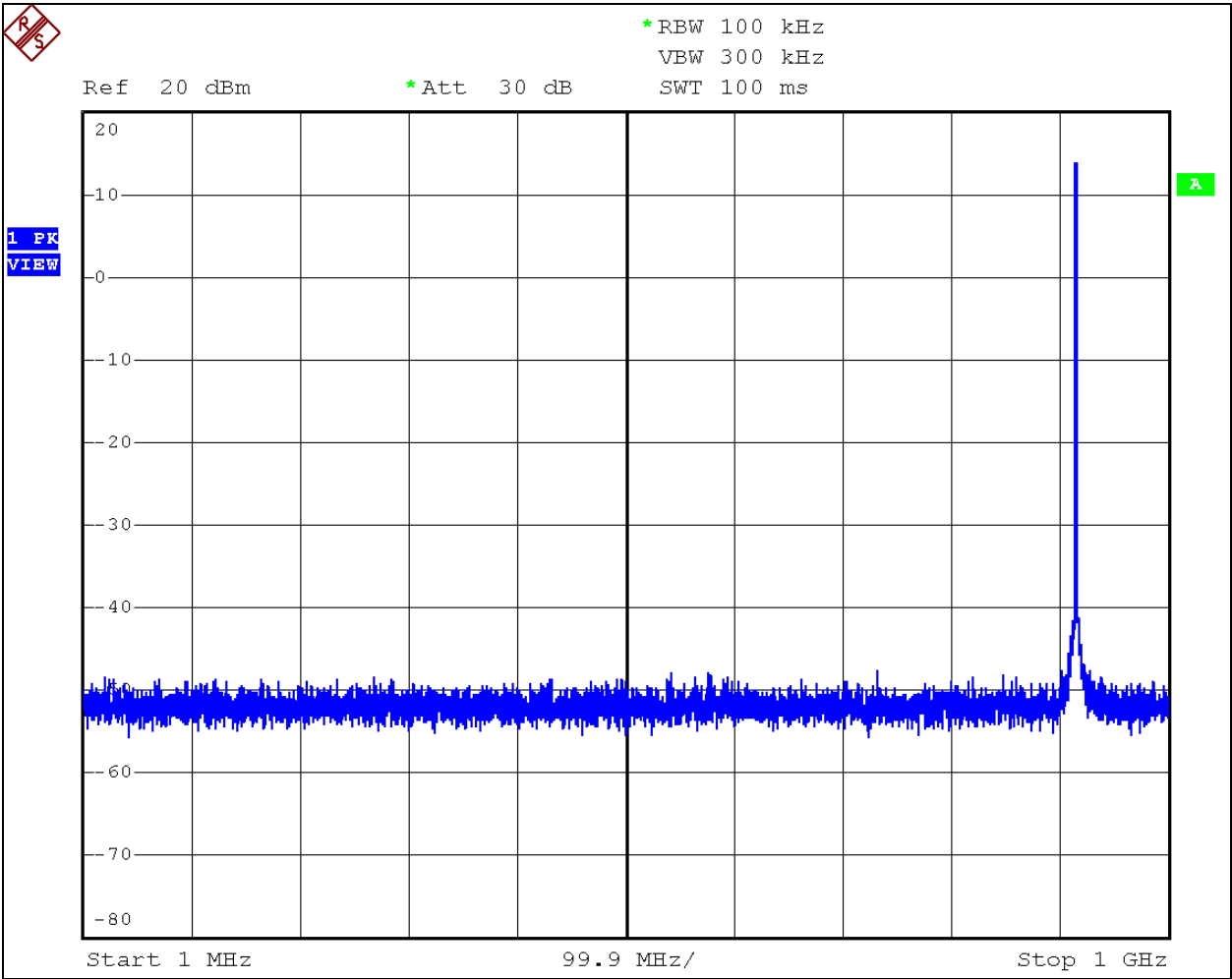
Plot 10.3.2: Conducted Spurious Emissions, TX Mode, 0.9 GHz to 5 GHz, Low Channel



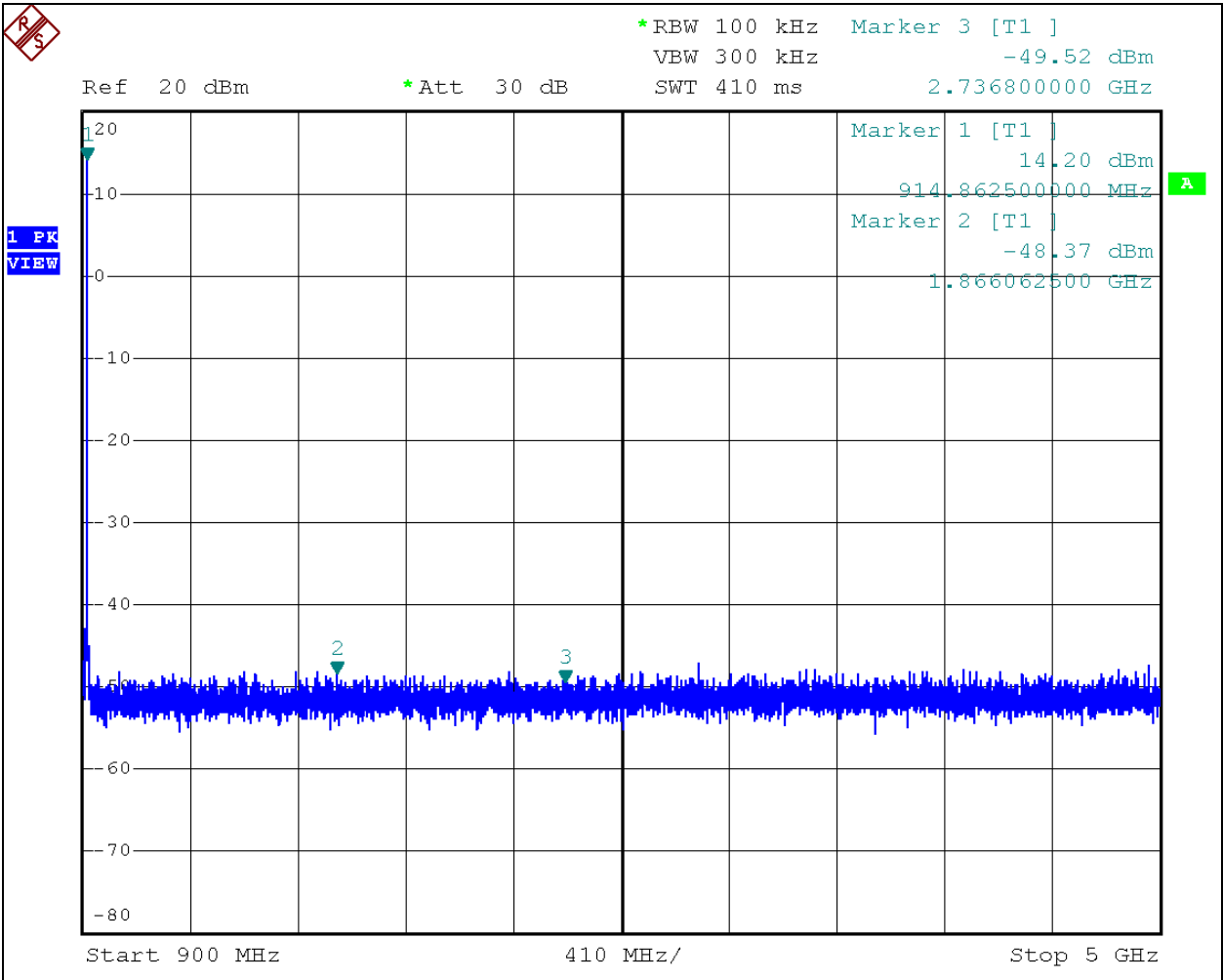
Plot 10.3.3: Conducted Spurious Emissions, TX Mode, 5 GHz to 10 GHz, Low Channel



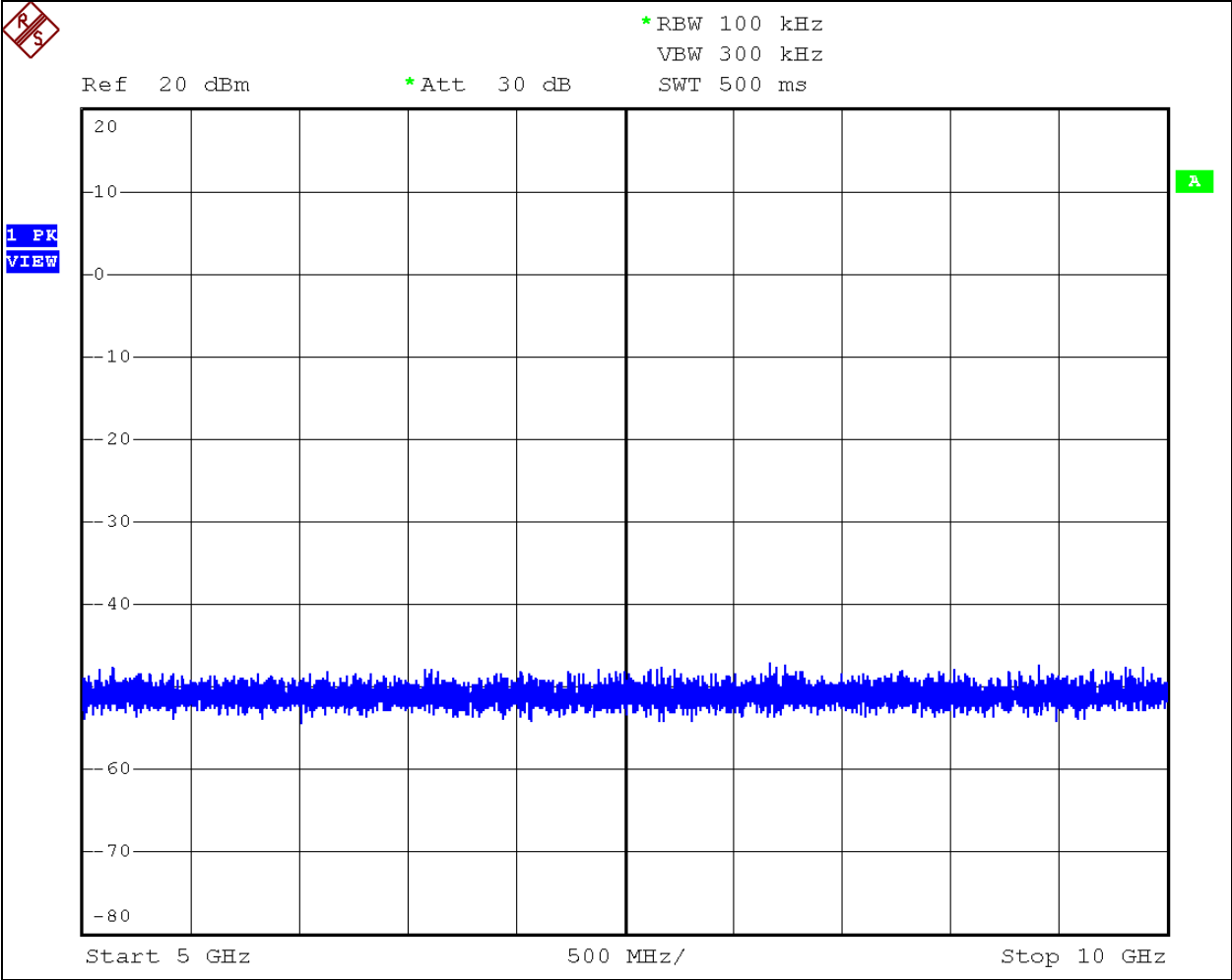
Plot 10.3.4: Conducted Spurious Emissions, TX Mode, 1 MHz to 1 GHz, Middle Channel



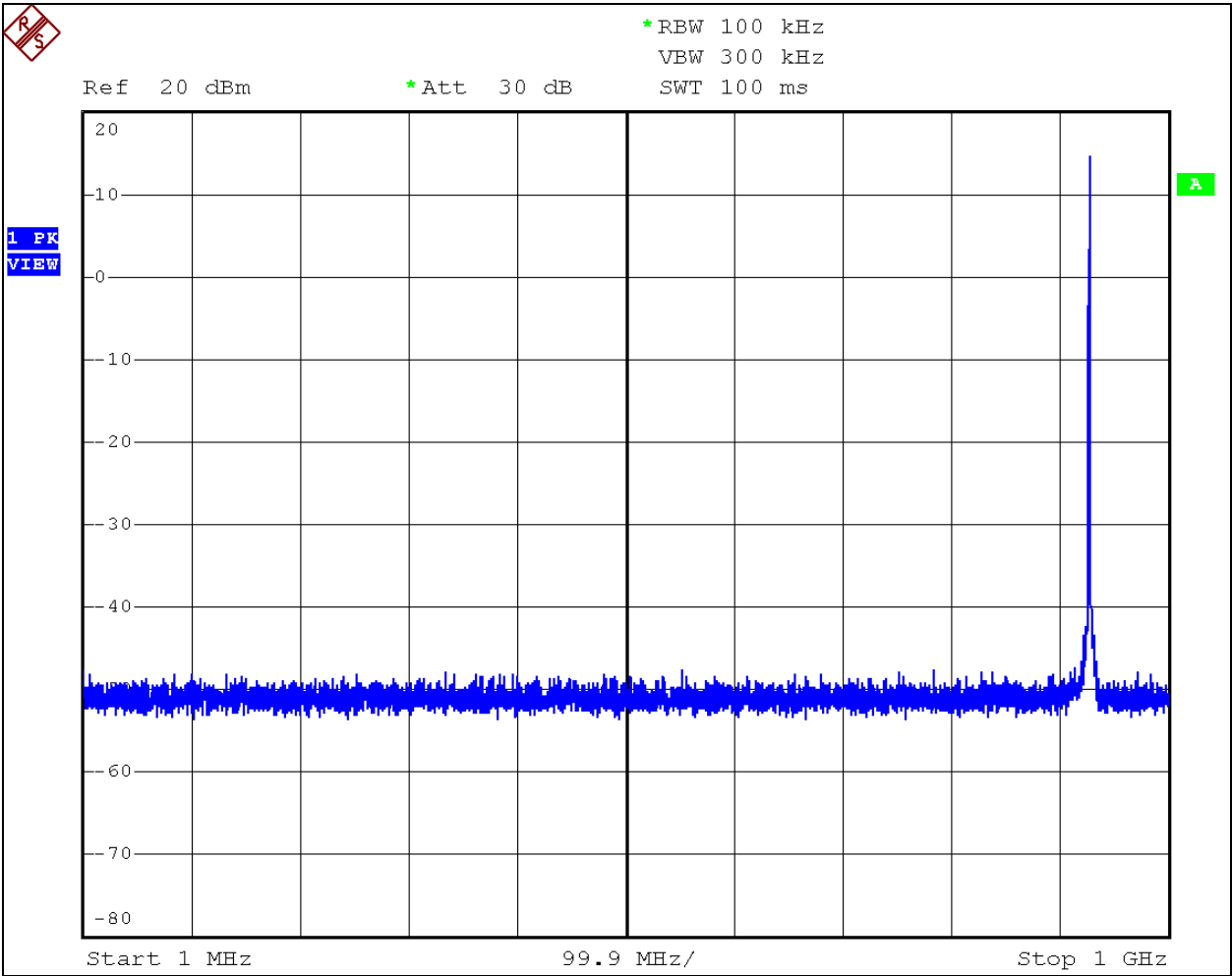
Plot 10.3.5: Conducted Spurious Emissions, TX Mode, 0.9 GHz to 5 GHz, Middle Channel



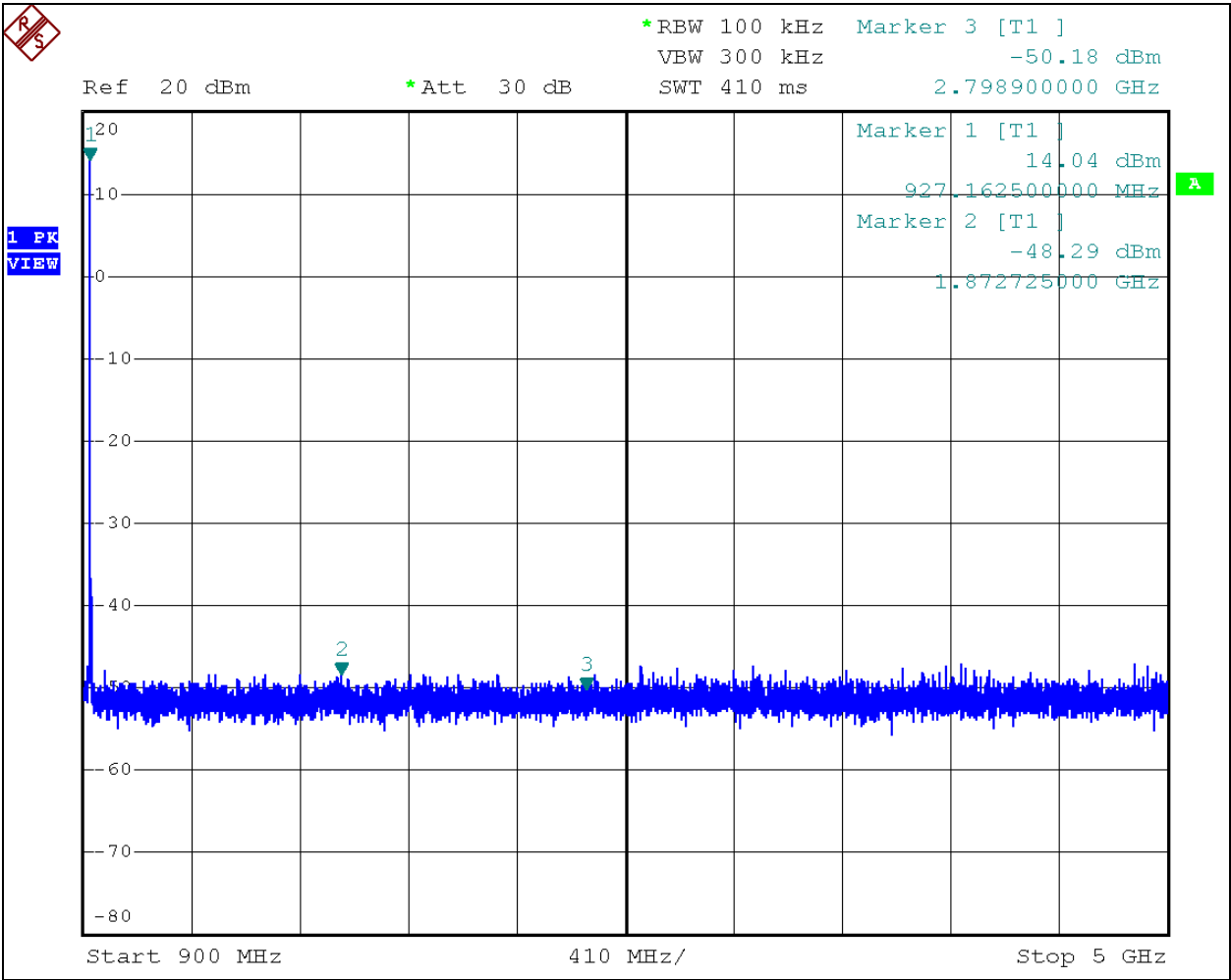
Plot 10.3.6: Conducted Spurious Emissions, TX Mode, 5 GHz to 10 GHz, Middle Channel



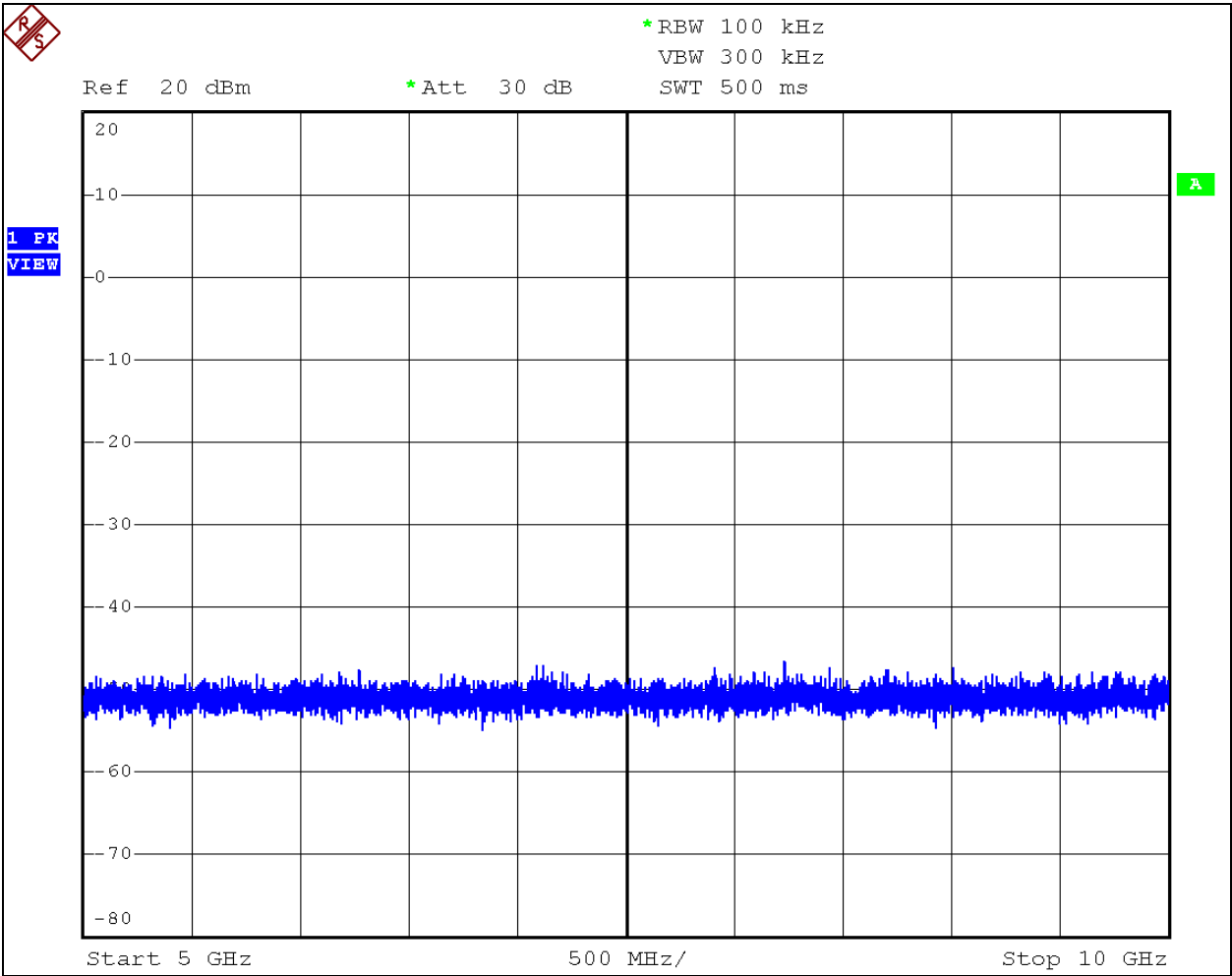
Plot 10.3.7: Conducted Spurious Emissions, TX Mode, 1 MHz to 1 GHz, High Channel



Plot 10.3.8: Conducted Spurious Emissions, TX Mode, 0.9 GHz to 5 GHz, High Channel



Plot 10.3.9: Conducted Spurious Emissions, TX Mode, 5 GHz to 10 GHz, High Channel



11.0 Conducted Emissions, Mains

11.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the floor and 0.4 meters from the conductive reference plane (wall). The EUT is powered through a line impedance stabilization network (LISN) that provides a measurement tap and a termination approximating 50 Ohms in the measurement range of 150 kHz to 30 MHz. A spectrum analyzer is connected, in turn, to each mains line measurement tap and software is employed to measure the radio frequency noise generated by the EUT.

11.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.207 // RSS-210 Issue 8	Mains conducted emissions	2014-05-20

11.3 Test Results

Note that the power supply employed had no additional or built-in EMI filtering.

The EUT satisfied the criteria. Tabular and plotted measurements appear on the following pages.

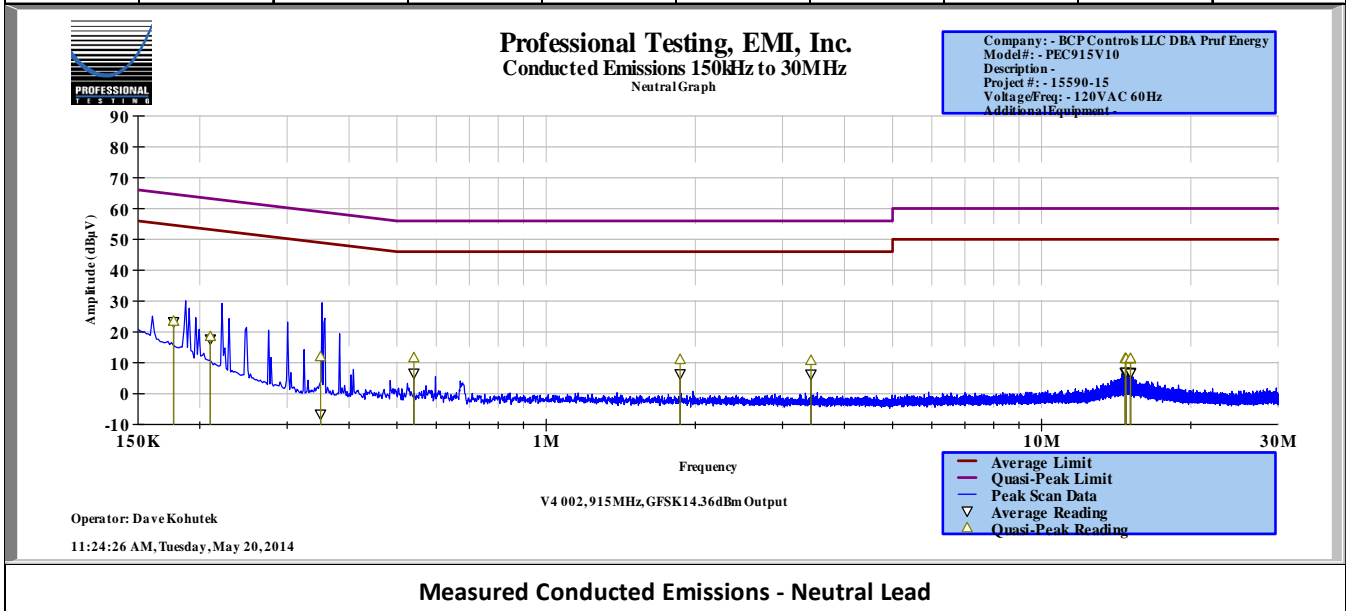
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4-2009: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	5/20/2014	EUT Serial #:	V4 002
Customer:	BCP Controls LLC DBA Pruf Energy	EUT Part #:	None
Project Number:	15590-15	Test Technician:	Dave Kohuttek
Purchase Order #:	PTI_014_001	Supervisor:	Rob McCollough
Equip. Under Test:	PEC915V10	Witness' Name:	None

Conducted Emissions Test Results Data Sheet - Neutral Lead

Page: 1 of 2

EUT Line Voltage:		120	VAC	EUT Line Frequency:		60	Hz		
Frequency Measured (MHz)	Peak Detector Reading (dBμV)	Quasi-peak Detector Reading (dBμV)	Quasi-peak Detector Limit (dBμV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBμV)	Average Detector Limit (dBμV)	Average Detector Margin (dB)	Average Detector Test Results
0.17705	34.8	23.4	64.6	-41.2	PASS	23.4	54.6	-31.3	PASS
0.21	31.9	18.5	63.2	-44.7	PASS	17.7	53.2	-35.5	PASS
0.35034	28.3	11.9	59	-47	PASS	-6.6	49	-55.6	PASS
0.54077	20.4	11.6	56	-44.4	PASS	6.6	46	-39.4	PASS
1.8631	18.2	11	56	-45	PASS	6.5	46	-39.5	PASS
3.4228	19.1	10.7	56	-45.3	PASS	6.3	46	-39.7	PASS
14.7477	18.9	11.4	60	-48.6	PASS	6.9	50	-43.1	PASS
14.8014	19.4	11.3	60	-48.7	PASS	7	50	-43	PASS
15.1112	18.4	11.2	60	-48.8	PASS	6.9	50	-43.1	PASS
15.1144	19.1	11.4	60	-48.6	PASS	6.7	50	-43.3	PASS



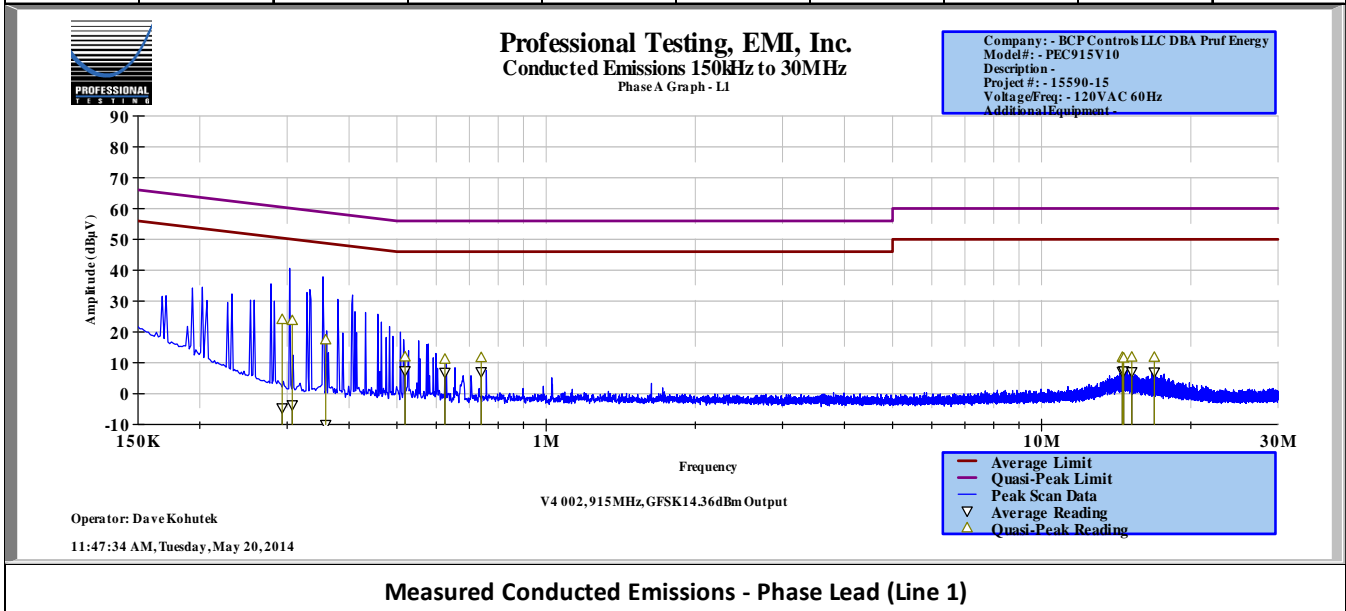
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4-2009: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	5/20/2014	EUT Serial #:	V4 002
Customer:	BCP Controls LLC DBA Pruf Energy	EUT Part #:	None
Project Number:	15590-15	Test Technician:	Dave Kohuttek
Purchase Order #:	PTI_014_001	Supervisor:	Rob McCollough
Equip. Under Test:	PEC915V10	Witness' Name:	None

Conducted Emissions Test Results Data Sheet - Phase Lead (Line 1)

Page: 2 of 2

EUT Line Voltage:		120	VAC	EUT Line Frequency:		60	Hz		
Frequency Measured (MHz)	Peak Detector Reading (dBμV)	Quasi-peak Detector Reading (dBμV)	Quasi-peak Detector Limit (dBμV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBμV)	Average Detector Limit (dBμV)	Average Detector Margin (dB)	Average Detector Test Results
0.29315	38.5	24	60.4	-36.4	PASS	-4.6	50.4	-55	PASS
0.30727	41.4	23.7	60	-36.4	PASS	-3.6	50	-53.7	PASS
0.35891	34	17.4	58.8	-41.3	PASS	-10	48.8	-58.7	PASS
0.519	19.4	11.9	56	-44.1	PASS	7.4	46	-38.6	PASS
0.6246	19.4	11.1	56	-44.9	PASS	6.9	46	-39.1	PASS
0.7394	19.1	11.6	56	-44.4	PASS	7.1	46	-38.9	PASS
14.5514	18.9	11.8	60	-48.2	PASS	7.2	50	-42.8	PASS
14.6407	19.2	11.5	60	-48.5	PASS	7.4	50	-42.6	PASS
15.2062	20.6	11.8	60	-48.2	PASS	7.1	50	-42.9	PASS
16.877	20.1	11.8	60	-48.2	PASS	7	50	-43	PASS



12.0 Antenna Construction Requirements

The design was investigated for meeting the antenna construction requirements of the applicable rules.

12.1 Procedure

A direct examination of the antenna construction is performed and compared to rule criteria that prevent wireless device antennas from being modified by end users in ways that would void their authorization to use the device. Note that this device is supplied as a modular unit.

12.2 Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.203 // RSS-210 Issue 8, A2.9	Antenna Construction	2014-06-17

12.3 Results

Antenna 1: Pulse (printed circuit antenna)

Antenna Manufacturer and Model


Specifications

Pulse Antenna USA
12220 World Trade Drive
Sand Diego, CA 92128, USA

W3538B0200 / W3538E0200/ W3538M0200 / W3538T0200

Typical free space performance, measured in test unit mechanics (position1.)

Frequency Range [MHz]	Max Gain [dBi]	Efficiency [%] / [dB]	Return loss min. [dB]	Impedance [Ω]	Operating Temperature [° C]
824 – 960	2,8 (peak) 0,5 (min)	70 / -1,6 (peak) 50 / -3,0 (min)	-6	50	-40 to +85

Antenna 2: Helical (loaded wire antenna)	
Antenna Manufacturer and Model	Specifications
Pruf Energy Controls PEC Drawing Number 34915-HELI	Helical Style (inductive loaded quarter-wave) Gain: 0 dBi <div style="text-align: center;">  </div> Appearance:

- Antennas 1 and 2 are not supplied together.
- Antenna 1 is kitted with 1 of 2 configurations of the product.
- Antenna 2 is kitted with 1 of 2 configurations of the product and is soldered to the module board.
- As a modular device, the final integrator is instructed not to substitute any other antenna.

The antenna designs above satisfy the requirements of the rules.

13.0 Equipment and Bandwidths

13.1 Equipment for Spurious Radiated Emissions 30 MHz to 12 GHz

Professional Testing, EMI, Inc.					
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits				
In accordance with:	Section: 15.209				
Test Date(s):	5/19/2014, 5/20/2014	EUT Serial #:	V4 003		
Customer:	BCP Controls LLC DBA Pruf Energy	EUT Part #:	None		
Project Number:	15590-15	Test Technician:	Dave Kohutek		
Purchase Order #:	PTI_014_001	Supervisor:	Rob McCollough		
Equip. Under Test:	PEC915V10	Witness' Name:	J.D. Holland		
Radiated Emissions Test Equipment List					
Tile! Software Version:		4.2.A, May 23, 2010, 08:38:52 AM			
Test Profile:		Radiated Emissions_Profile Version October 12, 2011			
Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1509A	Braden	N/A	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	7/29/2014
1890	HP	8447F	Preamplifier/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	1/22/2015
1937	Agilent	E4440A	Spectrum Analyzer, 3 Hz - 26.5 GHz	MY44303298	12/2/2015
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	00135454	7/29/2014
C027	N/A	RG214	Cable Coax, N-N, 25m	none	9/26/2014
1327	EMCO	1050	Controller, Antenna Mast	none	N/A
0942	EMCO	11968D	Turntable, 4ft.	9510-1835	N/A
1969	HP	11713A	Attenuator/Switch Driver	3748A04113	N/A
1509B	Braden	N/A	TDK 10M Chamber, VSWR > 1 GHz	DAC-012915-005	7/16/2014
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, .1-18GHz	0	11/19/2014
C030	N/A	0	Cable Coax, N-N, 30m	none	9/26/2014
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	00110313	1/21/2015
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A

13.2 Equipment for Mains Conducted Emissions

Professional Testing, EMI, Inc.					
Test Method:	ANSI C63.4-2009: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (incorporated by reference, FCC Part 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators,				
In accordance with:	Conducted Emissions Limits				
Section:	15.207				
Test Date(s):	5/20/2014	EUT Serial #:	V4 002		
Customer:	BCP Controls LLC DBA Pruf Energy	EUT Part #:	None		
Project Number:	15590-15	Test Technician:	Dave Kohuttek		
Purchase Order #:	PTI_014_001	Supervisor:	Rob McCollough		
Equip. Under Test:	PEC915V10	Witness' Name:	None		
Conducted Emissions Test Equipment List					
Tile! Software Version:		4.1.A.0, April 14, 2009, 11:01:00PM			
Test Profile:		Profile#: CE_2010.til, dated December 16, 2010			
Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1842	HP	8568B	Spectrum Analyzer	2732A03633	6/17/2014
0045	HP	85662A	Spec Anal Dsply for AN1842	2816A16413	N/A
0990	HP	85685A	RF Preselector	3010A01119	8/29/2014
1281	HP	85650A	Quasi Peak Adapter	2043A00063	6/5/2014
1173	PTI	100k HPF	Filter, High Pass, 100kHz	none	10/30/2014
1086	PTI	PTI-ALF2	Attenuator Limiter Filter	none	5/7/2015
C107	Pomona	RG-223	Cable 9 ft BNC RG-223 (black)	none	7/10/2014
C108	Pomona	RG-223	Cable 5.5 ft BNC RG-223 (black)	none	7/10/2014
0939	EMCO	3825/2	LISN, 10kHz-100MHz	9603-2521	10/31/2014
1668	B&K Precision	1610	Power Supply 30VDC 1 Amp	145-00069	N/A

13.3 Equipment for Timings, Bandwidth, and Conducted Spurious Measurements

Asset #	Manufacturer	Model #	Description	Calibration Due
ALN-077	Rohde & Schwarz	FSP-30	Spectrum Analyzer	2015-01-29

13.4 Measurement Bandwidths, Radiated Emissions

Radiated Emissions Spectrum Analyzer Bandwidth and Measurement Time - Peak Scan				
Frequency Band Start (MHz)	Frequency Band Stop (MHz)	6 dB Bandwidth (kHz)	Number of Ranges Used	Measurement Time per Range
0.009	0.15	0.3	2	Multiple Sweeps
0.15	30	9	6	Multiple Sweeps
30	1000	120	2	Multiple 800 mS Sweeps
1000	6000	1000	2	Multiple Sweeps
6000	18000	300	2	Multiple Sweeps
*Notes: 1. The settings above are specifically calculated for the E4440A series of spectrum analyzers, which have 8,000 data points per range. 2. The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 9-150 kHz. 3. The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz. 4. The measurement receiver resolution bandwidth setting was 120 kHz for quasi-peak measurements from 30-1000 MHz. 5. The measurement receiver resolution bandwidth setting was 1 MHz for average measurements from 1-18 GHz.				

13.5 Measurement Bandwidths, Mains Conducted Emissions

Conducted Emissions Spectrum Analyzer Bandwidth and Measurement Time				
Frequency Band Start (MHz)	Frequency Band Stop (MHz)	6 dB Bandwidth (kHz)	Number of Ranges Used	Measurement Time per Range
0.01	0.15	0.3	7	Five 1 second sweeps
0.15	30	9	20	Five 1 second sweeps
*Notes: 1. The settings above are specifically calculated for the HP856X series of spectrum analyzers, which have 1,000 data points per range. 2. The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 10-150 kHz. 3. The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz.				

Appendix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty

All uncertainty calculations, estimates and expressions thereof shall be in accordance with NIST policy. Since PTI operates in accordance with NIST (NVLAP) Handbook 150-11: 2007, all instrumentation having an effect on the accuracy or validity of tests shall be periodically calibrated or verified traceable to national standards by a competent calibration laboratory. The certificates of calibration or verification on this instrumentation shall include estimates of uncertainty as required by NIST Handbook 150-11.

1. Rationale and Summary of Expanded Uncertainty.

Each piece of instrumentation at PTI that is used in making measurements for determining conformance to a standard (or limit), shall be assessed to evaluate its contribution to the overall uncertainty of the measurement in which it is used. The assessment of each item will be based on either a type A evaluation or a type B evaluation. Most of the evaluations will be type B, since they will be based on the manufacturer's statements or specifications of the calibration tolerances, or uncertainty will be stated along with a brief rationale for the type of evaluation and the resulting stated uncertainties.

The individual uncertainties included in the combined standard uncertainty for a specific test result will depend on the configuration in which the item of instrumentation is used. The combination will always be based on the law of propagation of uncertainty. Any systematic effects will be accommodated by including their uncertainties, in the calculation of the combined standard uncertainty; except that if the direction and amount of the systematic effect cannot be determined and separated from its uncertainty, the whole effect will be treated as uncertainty and combined along with the other elements of the test setup.

Type A evaluations of standard uncertainty will usually be based on calculating the standard deviation of the mean of a series of independent observations, but may be based on a least-squares curve fit or the analysis of variance for unusual situations. Type B evaluations of standard uncertainty will usually be based on manufacturer's specifications, data provided in calibration reports, and experience. The type of probability distribution used (normal, rectangular, a priori, or u-shaped) will be stated for each Type B evaluation.

In the evaluation of the uncertainty of each type of measurement, the uncertainty caused by the operator will be estimated. One notable operator contribution to measurement uncertainty is the manipulation of cables to maximize the measured values of radiated emissions. The operator contribution to measurement uncertainty is evaluated by having several operators independently repeat the same test. This results in a Type A evaluation of operator-contributed measurement uncertainty.

A summary of the expanded uncertainties of PTI measurements is shown as Table 1. These are the worst-case uncertainties considering all operative influence factors.

Table 1: Summary of Measurement Uncertainties for Site 45

Type of Measurement	Frequency Range	Meas. Dist.	Expanded Uncertainty U, dB (k=2)
Mains Conducted Emissions	150 kHz to 30 MHz	N/A	2.9
Telecom Conducted Emissions	150 kHz to 30 MHz	N/A	2.8
Radiated Emissions	30 to 1,000 MHz	10 m	4.8
	1 to 18 GHz	3 m	5.7

End of Report

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