




DATE: 06 July 2016

**I.T.L. (PRODUCT TESTING) LTD.
FCC Radio Test Report
for
Panoramic Power Ltd.**

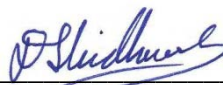
Equipment under test:

**Wireless Power Sensor
PAN-42-US**

Tested by:


M. Zohar

Approved by:


D. Shidlow

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This report relates only to items tested.



Measurement/Technical Report for Panoramic Power Ltd.

Equipment under test:

Wireless Power Sensor PAN-42-US

FCC ID: Z9M-PAN-4-2-F

This report concerns: Original Grant: X
Class I change:
Class II change:

Equipment type: Digital Transmission System

Limits used: 47CFR15 Section 15.249

Measurement procedure used is ANSI C63.4-2013 and ANSI C63.10-2013.

Application for Certification
prepared by:

R. Pinchuck
ITL (Product Testing) Ltd.
1 Bat Sheva Street
Lod
Israel
Tel: +972-8-918-6117
Fax: +972-8-915-3101
Email: Rpinchuck@itl.co.il

Applicant for this device:
(different from "prepared by")

Yael Alali
Panoramic Power Ltd.
20 Atir Yeda St.
Kfar Saba, 44643, Israel
Tel: +972-9-766-7600
Fax: +972-8-766-7610
Email: yaela@panpwr.com

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1. General Information

1.1 Administrative Information

Manufacturer: Panoramic Power Ltd.

Manufacturer's Address: 20 Atir Yeda St., Kfar Saba
44643, Israel
Tel: +972-9-766-7600
Fax: +972-9-766-7610

Manufacturer's Representative: Yael Alali

Equipment Under Test (E.U.T): Wireless Power Sensor

Equipment Model No.: PAN-42-US

Equipment Serial No.: 8005018

Date of Receipt of E.U.T: 31.05.2016

Start of Test: 02.06.2016

End of Test: 06.06.2016

Test Laboratory Location: I.T.L (Product Testing) Ltd.
1 Batsheva St.,
Lod
ISRAEL 7120101

Test Specifications: FCC Part 15, Subpart C, Section 15.249



1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation Number IL1005.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-3006, R-2729, T-1877, G-245.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025A-1, IC 4025A-2.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 **Product Description**

The PAN-42 wireless power sensor provides high accuracy real time power measurements and advanced power quality measurements for main power monitoring, sub-metering and for the metering of large devices. Designed for demanding electrical applications, supporting industry accuracy standards, PAN-42 enables the metering of power, voltage, current, power factor and power quality measurement data. Information is sent wirelessly, through Panoramic's Bridge unit, to Panoramic's advanced cloud-based analytics platform. The data is then used to provide customers with actionable analytics and real-time dashboards and alerts. PAN-42 complements the Panoramic Power sensor family (PAN-10, PAN-12 and PAN -14) that is used for more granular monitoring of individual circuits and devices. Together they deliver a comprehensive range of metering and monitoring tools to reduce energy costs and maximize energy efficiency.

Model name	PAN-42-US
Working voltage	115.0VAC
Mode of operation	Transmitter
Modulations	GFSK
Assigned Frequency Range	902.0MHz-928.0MHz
Operation frequency	915.0MHz
Antenna Gain	2.4 dBi

1.4 **Test Methodology**

Radiated testing were performed according to the procedures in ANSI C63.4-2013 and ANSI C63.10-2013. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 **Test Facility**

Radiated emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.



1.6 Measurement Uncertainty

Conducted Emission

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)

0.15-30MHz

Expanded Uncertainty (95% Confidence, K=2):

± 3.44 dB

Radiated Emission

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)
for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.96 dB

1.7 Ambient Conditions

Temperature (32°C- 22.7 °C)/Humidity (35.6%-41.1%).

2. System Test Configuration

2.1 Justification

The E.U.T. was transmitting continuously at 915.0MHz.

The E.U.T. was tested in installation position.

2.2 EUT Exercise Software

No special exercise software was needed to achieve compliance.

2.3 Special Accessories

No special exercise software was needed to achieve compliance.

2.4 Equipment Modifications

No equipment modifications were needed to achieve compliance.

2.5 Configuration of Tested System

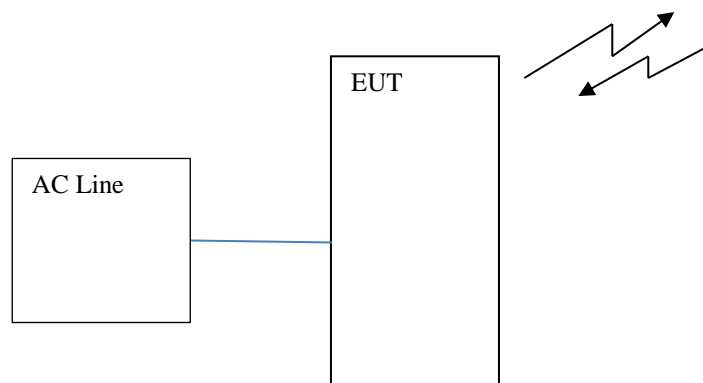


Figure 1. Configuration of Tested System

3. Test Set-Up Photos



Figure 2. Conducted Emission AC Line Test



Figure 3. Field Strength of Fundamental Test



Figure 4. Radiated Emission Test



Figure 5. Radiated Emission Test



Figure 6. Radiated Emission Test



Figure 7. Radiated Emission Test

4. Conducted Emission From AC Mains

4.1 Test Specification

FCC Part 15, Subpart C, Section 15.207

4.2 Test Procedure

The E.U.T operation mode and test setup are as described in Section 2 of this report. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room, with the E.U.T placed on a 0.8 meter high wooden table, 0.4 meter from the room's vertical wall. In the case of a floor-standing E.U.T., it was placed on the horizontal ground plane.

The E.U.T was powered from 115 V AC / 60 Hz via 50 Ohm / 50 μ Hn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T.

The center of the E.U.T.'s AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in the photograph, *Figure 2. Conducted Emission AC Line Test.*

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver and are displayed on the receiver's spectrum display.

The E.U.T was evaluated in TX operation mode.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

4.3 Test Limit

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.



4.4 Test Results

JUDGEMENT: Passed by 18.5 dB

The EUT met the F.C.C. Part 15, Subpart C specification requirements.

The margin between the emission levels and the specification limit is, in the worst case, 19.4 dB for the phase line at 1.026 MHz and 18.5 dB at 1.142 MHz for the neutral line.

The details of the highest emissions are given in *Figure 8* to *Figure 11*.

Conducted Emission

E.U.T Description Wireless Power Sensor
Type PAN-42-US
Serial Number: 8005018

Specification: FCC Part 15, Subpart C
Lead: Phase
Detectors: : Peak, Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)				
Trace1:	CE22BQP			
Trace2:	CE22BAP			
Trace3:	---			
	TRACE	FREQUENCY	LEVEL dBμV	DELTA LIMIT dB
1	Quasi Peak	230 kHz	38.90	-23.54
2	Average	230 kHz	24.61	-27.83
2	Average	570 kHz	22.71	-23.28
2	Average	686 kHz	16.99	-29.00
1	Quasi Peak	914 kHz	35.33	-20.66
2	Average	914 kHz	15.36	-30.63
1	Quasi Peak	1.026 MHz	36.56	-19.43
2	Average	1.026 MHz	18.99	-27.00
2	Average	1.37 MHz	17.80	-28.19
2	Average	1.482 MHz	16.80	-29.19
1	Quasi Peak	1.714 MHz	34.42	-21.57
1	Quasi Peak	1.826 MHz	35.59	-20.40
1	Quasi Peak	2.738 MHz	34.79	-21.20
1	Quasi Peak	3.082 MHz	34.62	-21.37
1	Quasi Peak	3.426 MHz	34.07	-21.93
1	Quasi Peak	5.022 MHz	35.05	-24.94
1	Quasi Peak	6.734 MHz	33.58	-26.41
2	Average	6.85 MHz	12.07	-37.92
2	Average	8.446 MHz	14.31	-35.68
2	Average	14.838 MHz	13.78	-36.21

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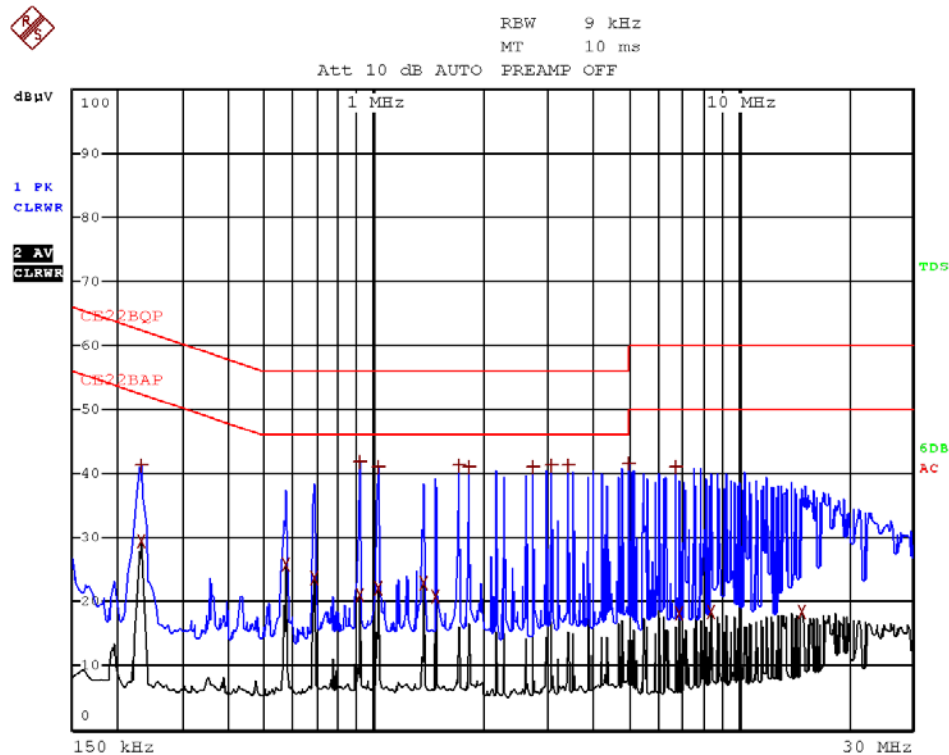
Figure 8. Detectors: Peak, Quasi-peak, Average

Note: QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description Wireless Power Sensor
Type PAN-42-US
Serial Number: 8005018

Specification: FCC Part 15, Subpart C
Lead: Phase
Detectors: Peak, Quasi-peak, Average



Date: 5.JUN.2016 09:32:14

Figure 9. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description Wireless Power Sensor
Type PAN-42-US
Serial Number: 8005018

Specification: FCC Part 15, Subpart C
Lead: Neutral
Detectors: Peak, Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)				
Trace1:	CE22BQP			
Trace2:	CE22BAP			
Trace3:	---			
TRACE	FREQUENCY	LEVEL dBμV	DELTA	LIMIT dB
1 Quasi Peak	342 kHz	39.50	-19.64	
2 Average	342 kHz	27.03	-22.12	
1 Quasi Peak	458 kHz	37.11	-19.61	
2 Average	458 kHz	25.40	-21.32	
1 Quasi Peak	1.142 MHz	37.51	-18.48	
2 Average	1.142 MHz	22.69	-23.30	
1 Quasi Peak	1.254 MHz	35.60	-20.39	
2 Average	1.254 MHz	22.33	-23.66	
2 Average	1.598 MHz	15.16	-30.83	
2 Average	2.054 MHz	15.35	-30.64	
1 Quasi Peak	2.17 MHz	34.45	-21.54	
2 Average	2.17 MHz	14.47	-31.52	
1 Quasi Peak	2.854 MHz	35.11	-20.88	
1 Quasi Peak	4.794 MHz	35.07	-20.92	
2 Average	4.794 MHz	15.16	-30.83	
1 Quasi Peak	4.91 MHz	33.71	-22.28	
1 Quasi Peak	6.734 MHz	34.35	-25.65	
2 Average	7.19 MHz	14.10	-35.89	
1 Quasi Peak	7.99 MHz	34.18	-25.81	
2 Average	7.99 MHz	13.93	-36.06	

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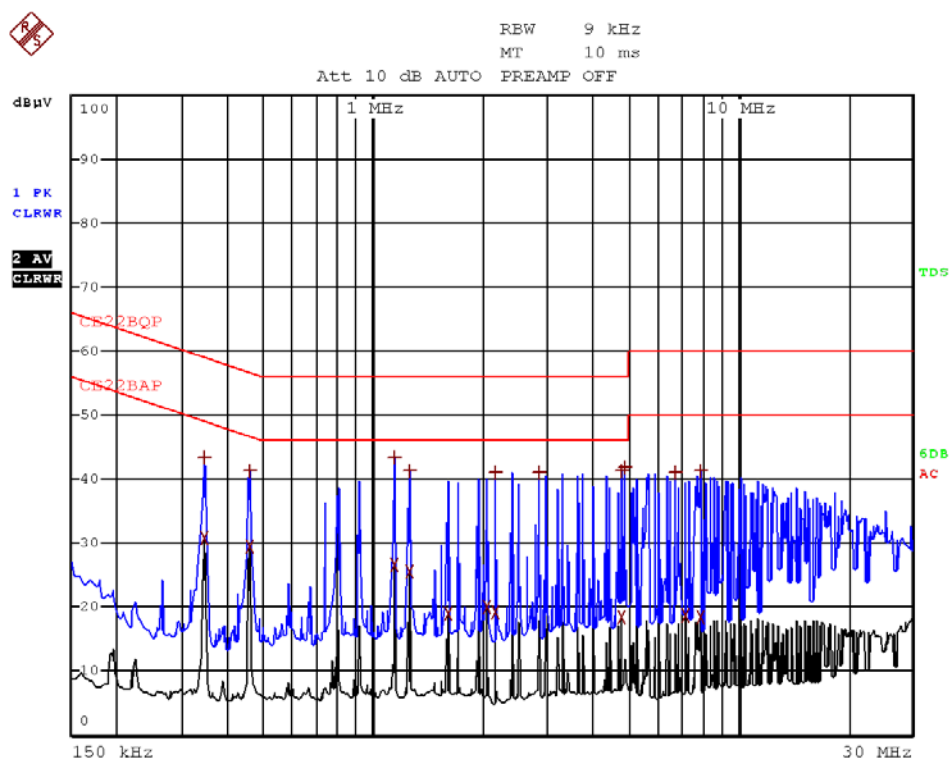
Figure 10. Detectors: Peak, Quasi-peak, Average

Note: QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description Wireless Power Sensor
Type PAN-42-US
Serial Number: 8005018

Specification: FCC Part 15, Subpart C
Lead: Neutral
Detectors: Peak, Quasi-peak, Average



Date: 5.JUN.2016 09:43:38

Figure 11 Detectors: Peak, Quasi-peak, Average



4.5 Test Equipment Used; Conducted Emission

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
LISN	Fischer	FCC-LISN-25A	127	March 16, 2015	June 30, 2016
Transient Limiter	HP	11947A	3107A03041	May 13, 2015	June 15, 2016
EMI Receiver	Rohde & Schwarz	ESCI7	100724	February 29, 2016	March 1, 2017
Low Loss Cable	Huber Suner	-	705A009301 EIM	May 30, 2016	May 30, 2017

Figure 12 Test Equipment Used

5. Field Strength of Fundamental

5.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.249(a)

5.2 Test Procedure

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure 1*.

The E.U.T was evaluated in the operating frequency of 915.0MHz.

The readings were maximized by adjusting the turntable azimuth between 0-360°, and the antenna polarization

5.3 Test Limit

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of fundamental (dBuV/m)
902.0-928.0 MHz	50.0	94.0
2400-2483.5 MHz	50.0	94.0
5725.0-5875.0 MHz	50.0	94.0
24.0-24.25 GHz	250.0	108.0

*Field strength limits are specified at a distance of 3 meters

** For frequencies above 1000 MHz, the field strength limits of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

5.4 Test Results

JUDGEMENT: Passed by 1.2 dB

The EUT met the FCC Part 15, Subpart C, Section 15.249(a) specification requirements.

The details of the highest emissions are given in *Figure 13*.

Field Strength of Fundamental

E.U.T Description Wireless Power Sensor
Model Number PAN-42-US
Serial Number: 8005018

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Horizontal/Vertical

Test Distance: 3 meters

Detector: Peak, Quasi-peak

Freq.	Pol.	Peak Reading	QP Reading	Correction Factor*	Final Result**	Limit	Margin
(MHz)	(V/H)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB)
915.0	H	68.9	68.8	24.0	92.8	94.0	-1.2
915.0	V	67.8	67.7	24.0	91.7	94.0	-2.3

Figure 13. Field Strength of Fundamental. Antenna Polarization: HORIZONTAL/VERTICAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

* "Correction Factors" = Antenna Correction Factor + Cable Loss.

** "Final result" = QP Reading + Correction Factors

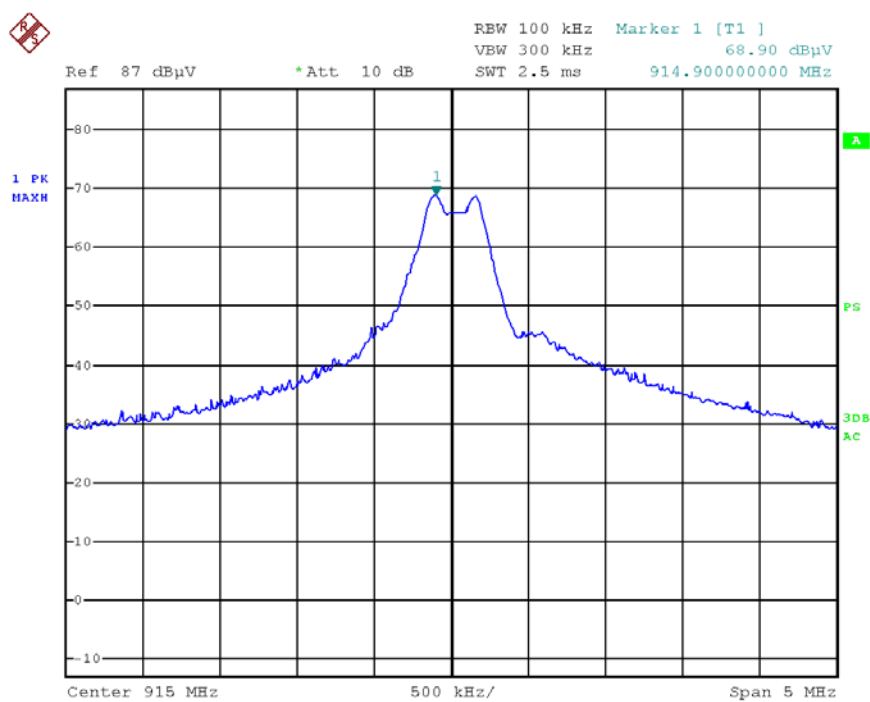
Field Strength of Fundamental

E.U.T Description Wireless Power Sensor
Model Number PAN-42-US
Serial Number: 8005018

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Horizontal
Test Distance: 3 meters

Operation Frequency: 915.0MHz
Detector: Peak



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Figure 14. Field Strength of Fundamental. Antenna Polarization: HORIZONTAL

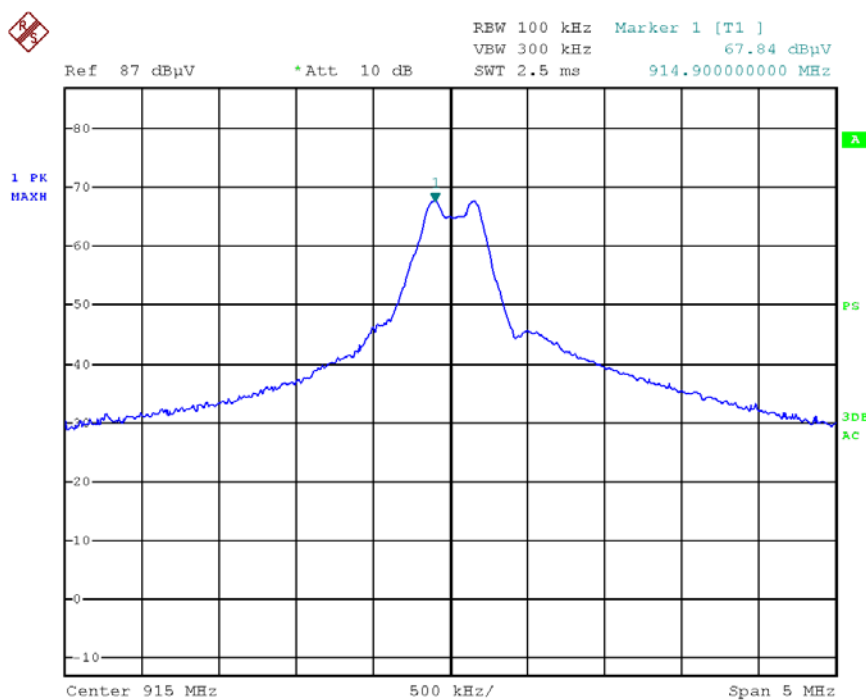
Field Strength of Fundamental

E.U.T Description Wireless Power Sensor
Model Number PAN-42-US
Serial Number: 8005018

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Vertical
Test Distance: 3 meters

Operation Frequency: 915.0MHz
Detector: Peak



Date: 5.JUN.2016 14:41:05

Figure 15. Field Strength of Fundamental. Antenna Polarization: VERTICAL



5.5 Test Instrumentation Used; Field Strength of Fundamental

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Log Periodic Antenna	EMCO	3146	9107-3158	March 24, 2016	March 24, 2017
Semi Anechoic Chamber	ETS	S81	SL 11643	NCR	NCR

Figure 16 Test Equipment Used

6. Field Strength of Harmonics

6.1 Test Specification

FCC, Part 15, Subpart C, Section 249(a)

6.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was placed in the chamber and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground.

The frequency range 1000.0MHz-10,000MHz was scanned. RBW was set to 1000 kHz. The readings were maximized by adjusting the turntable azimuth between 0-360°, and the antenna polarization.

The evaluation distance was 3 meters.

6.3 Test Limit

Fundamental frequency (MHz)	Field strength of harmonics (microvolts/meter)	Field strength of harmonics (dBuV/m)
902.0-928.0 MHz	500.0	54.0
2400-2483.5 MHz	500.0	54.0
5725.0-5875.0 MHz	500.0	54.0
24.0-24.25 GHz	2500.0	68.0

* for frequencies above 1000 MHz, the field strength limits of this section are based on average limits.

However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

6.4 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 249(a) specification.

For additional information see *Figure 17* and *Figure 18*.

Field Strength of Harmonics

E.U.T Description Wireless Power Sensor
Type PAN-42-US
Serial Number: 8005018

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency Range: 1.0 GHz to 10.0 GHz
Test Distance: 3 meters Detector: Average
Operation Frequency: 915.0MHz

Freq. (MHz)	Polarity (H/V)	Average Reading (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1829.9	H	38.6	54.0	-15.4
1829.9	V	40.5	54.0	-13.5
2745.3	H	42.0	54.0	-12.0
2744.9	V	39.4	54.0	-14.6
5490.0	H	38.3	54.0	-15.7
5489.5	V	38.8	54.0	-15.2

Figure 17. Harmonic Emission. Antenna Polarization: HORIZONTAL / VERTICAL.

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Reading” includes correction factor.

Field Strength of Harmonics

E.U.T Description Wireless Power Sensor
Type PAN-42-US
Serial Number: 8005018

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency Range: 1.0 GHz to 10.0 GHz
Test Distance: 3 meters Detector: Peak
Operation Frequency: 915.0MHz

Freq. (MHz)	Polarity (H/V)	Peak Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1829.9	H	50.2	74.0	-23.8
1829.9	V	53.5	74.0	-20.5
2745.3	H	53.9	74.0	-20.1
2744.9	V	53.1	74.0	-20.9
5490.0	H	50.3	74.0	-23.7
5489.5	V	50.5	74.0	-23.5

Figure 18. Harmonic Emission. Antenna Polarization: HORIZONTAL / VERTICAL.

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Reading” includes correction factor.



6.5 Test Instrumentation Used; Field Strength of Harmonics Measurements

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	Rohde & Schwarz	ESCI7	100724	February 29, 2016	March 1, 2017
RF Filter Section	HP	85420E	3705A00248	March 3, 2016	March 3, 2017
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Low Noise Amplifier	Narda	LNA-DBS-0411N313	13	May 25, 2016	May 25, 2017
Spectrum Analyzer	HP	8592L	3826A01204	March 13, 2016	March 13, 2017
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 19 Test Equipment Used

6.6 **Field Strength Calculation**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

FS: Field Strength [dB μ V/m]

RA: Receiver Amplitude [dB μ V]

AF: Receiving Antenna Correction Factor [dB/m]

CF: Cable Attenuation Factor [dB]

Example: $FS = 30.7 \text{ dB}\mu\text{V (RA)} + 14.0 \text{ dB (AF)} + 0.9 \text{ dB (CF)} = 45.6 \text{ dB}\mu\text{V}$

No external pre-amplifiers are used.

7. Radiated Emission

7.1 Test Specification

Part 15, Subpart C, Section 15.249(d)

7.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 2 of this report.

For measurements between 0.009MHz -30.0MHz:

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 1.5 meters above the ground. The frequency range 0.009MHz-30.0MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

For 30.0MHz-1000.0MHz range:

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in *Figure 1*. The frequency range 0.009 MHz-1000 MHz was scanned.

RBW was set to 100 kHz.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

For 1000.0MHz-10,000.0MHz range:

The E.U.T was placed in the chamber and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure 1*.

The frequency range 1000.0MHz-10,000MHz was scanned. RBW was set to 1000 kHz. The readings were maximized by adjusting the turntable azimuth between 0-360°, and the antenna polarization.

For all final evaluations the distance was 3 meters.

7.3 Test Limit

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 §15.209, whichever is the lesser attenuation.



7.4 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 15.249 specification.

For radiated emissions <30 MHz, no emissions greater than 20db below the limit were found.

The margin between the emission level and the specification limit was 5.1 dB in the worst case at the frequency of 125.7 MHz, horizontal polarization.

For information on highest emissions see *Figure 20*.

Radiated Emission

E.U.T Description Wireless Power Sensor
Type PAN-42-US
Serial Number: 8005018

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 30 MHz to 10.0 GHz
Test Distance: 3 meters Detector: Peak, Quasi-peak, Average
Operation Frequency: 915.0MHz

Freq. (MHz)	Polarity (H/V)	Peak Reading (dB μ V/m)	QP Reading (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
64.8	H	26.5	22.9	40.0	-17.1
64.8	V	38.2	26.7	40.0	-13.3
125.7	H	46.1	38.4	43.5	-5.1
125.7	V	41.0	34.8	43.5	-8.7
159.6	H	36.7	32.5	43.5	-11.0
159.6	V	36.3	31.7	43.5	-11.8

Figure 20. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak/QP Readings” include correction factor.

7.5 Test Instrumentation Used; Radiated Emission

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	Rohde & Schwarz	ESCI7	100724	February 29, 2016	March 1, 2017
EMI Receiver	HP	HP8542E	3906A00276	March 3, 2016	March 3, 2017
RF Filter Section	HP	85420E	3705A00248	March 3, 2016	March 3, 2017
Active Loop Antenna	EMCO	6502	9506-2950	November 5, 2015	November 30, 2016
Biconical Antenna	EMCO	3110B	9912-3337	March 24, 2016	March 24, 2018
Log Periodic Antenna	EMCO	3146	9505-4081	April 23, 2016	April 23, 2017
Double Ridged Waveguid Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Low Noise Amplifier	Narda	LNA-DBS-0411N313	13	May 25, 2016	May 25, 2017
Spectrum Analyzer	HP	8592L	3826A01204	March 13, 2016	March 13, 2017
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 21 Test Equipment Used

7.6 **Field Strength Calculation**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[\text{dB}\mu\text{V/m}] \text{ FS} = \text{RA} + \text{AF} + \text{CF}$$

FS:	Field Strength [dB μ V/m]
RA:	Receiver Amplitude [dB μ V]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]



8. Antenna Gain/Information

2.4 dBi

ANT-916-HETH

Data Sheet

AntennaFactor
by **Linx**

Electrical Specifications

Center Frequency:	916MHz
Recom. Freq. Range:	865–965MHz
Wavelength:	1/4-wave
VSWR:	≤ 2.0 typical at center
Peak Gain:	2.4dBi
Impedance:	50-ohms
Connection:	Through-hole
Oper. Temp. Range:	–40°C to +80°C

9. R.F Exposure/Safety

Typical use of the E.U.T. is as a wireless power sensor.

The typical placement of the E.U.T. is connected to power lines in a power box.

The typical distance between the E.U.T. and the user in the worst case application, is 0.20 cm.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1310 Requirements

(a) FCC limits at 915 MHz is:

$$f / 1500 = .61 \frac{mW}{cm^2}$$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is

P_t- Transmitted Power 68.9 dBuV/m (Peak) = -26.3 dBm = 0.002mW

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

*G_T- Antenna Gain,

*Note – because antenna is integral and tests were conducted radiated, the transmitted power, P_t, takes the antenna gain into account

R- Distance from Transmitter using 0.20cm worst case

(c) The peak power density is:

$$S_p = \frac{0.002}{4\pi(0.20)^2} = 3.97 \times 10^{-6} \frac{mW}{cm^2}$$

(e) This is below the FCC limit.

10. APPENDIX A - CORRECTION FACTORS

10.1 Correction factors for

CABLE

from EMI receiver
to test antenna
at 3 meter range.

Frequency (MHz)	Cable Loss (dB)
0.010	0.4
0.015	0.2
0.020	0.2
0.030	0.3
0.050	0.3
0.075	0.3
0.100	0.2
0.150	0.2
0.200	0.3
0.500	0.4
1.00	0.4
1.50	0.5
2.00	0.5
5.00	0.6
10.00	0.8
15.00	0.9
20.00	0.8

Frequency (MHz)	Cable Loss (dB)
50.00	1.2
100.00	0.7
150.00	2.1
200.00	2.3
300.00	2.9
500.00	3.8
750.00	4.8
1000.00	5.4
1500.00	6.7
2000.00	9.0
2500.00	9.4
3000.00	9.9
3500.00	10.2
4000.00	11.2
4500.00	12.1
5000.00	13.1
5500.00	13.5
6000.00	14.5

NOTES:

1. The cable type is SPUMA400 RF-11N(X2) and 39m long
2. The cable is manufactured by Huber + Suhner



10.2 Correction factors for RF CABLE for Semi Anechoic Chamber

FREQ (MHz)	LOSS (dB)
1000.0	1.5
2000.0	2.1
3000.0	2.7
4000.0	3.1
5000.0	3.5
6000.0	4.1
7000.0	4.6
8000.0	4.9
9000.0	5.7
10000.0	5.7
11000.0	6.1
12000.0	6.1
13000.0	6.2
14000.0	6.7
15000.0	7.4
16000.0	7.5
17000.0	7.9
18000.0	8.1
19000.0	8.8
20000.0	9.1



10.3 Correction factors for Log Periodic Antenna

Model: EMCO 3146

Serial No.:9107-3158

Frequency [MHz]	AF [dB/m]
200.0	11.12
250.0	12.16
300.0	14.97
400.0	15.77
500.0	18.11
600.0	19.04
700.0	21.03
800.0	21.27
900.0	22.54
1000.0	23.90



10.4 Correction factors for Log Periodic Antenna
Model: EMCO 3146
Serial No.:9505-4081

Frequency [MHz]	AF [dB/m]
200.0	11.47
250.0	12.06
300.0	14.77
400.0	15.77
500.0	18.01
600.0	18.84
700.0	20.93
800.0	21.27
900.0	22.44
1000.0	24.10



10.5 Correction factors for Biconical Antenna

Model: EMCO 3110B

Serial No.: 9912-3337

Frequency [MHz]	AF [dB/m]
30.0	14.18
35.0	13.95
40.0	12.84
45.0	11.23
50.0	11.10
60.0	10.39
70.0	9.34
80.0	9.02
90.0	9.31
100.0	8.95
120.0	11.53
140.0	12.20
160.0	12.56
180.0	13.49
200.0	15.27



10.6 Correction factors for Active Loop Antenna

Model: 6502

Serial No.: 9506-2950

FREQUENCY	Magnetic Antenna Factor	Electric Antenna Factor
(MHz)	(dB)	(dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2



10.7 Correction factors for Double-Ridged Waveguide Horn

Model: 3115, S/N 29845

10 meter range

FREQUENCY	AFE	FREQUENCY	AFE
(MHz)	(dB/m)	(MHz)	(dB/m)
1000	22.4	10000	36.1
2000	25.2	11000	37.0
3000	31.1	12000	41.3
4000	30.2	13000	38.1
5000	34.2	14000	41.7
6000	31.6	15000	39.0
7000	34.7	16000	38.8
8000	34.8	17000	43.2
9000	36.2	18000	43.7