



**DATE: 02 December 2015**

**I.T.L. (PRODUCT TESTING) LTD.  
FCC/IC Radio Test Report  
for**

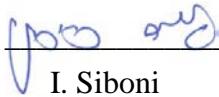
**WATTEAM Ltd.**

**Equipment under test:**

**Cycling Power Meter**

**PowerBeat 1.0**

Tested by:

  
I. Siboni

Approved by:

  
D. Shidlowsky

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This report relates only to items tested.



## Measurement/Technical Report for

WATTEAM Ltd.

Cycling Power Meter

PowerBeat 1.0

**FCC ID: 2AFE5-WTPB**

This report concerns:

Original Grant:

Class I Change:

Class II Change:

Equipment type:

FCC: Digital Transmission System (DTS)

IC: Spread Spectrum Digital Device

(2400-2483.5 MHz)

Limits used:

47CFR15 Section 15.247

RSS-247, Issue 1, May 2015

RSS Gen Issue 4, November 2014

Measurement procedure used is KDB 558074 D01 v03r03 and ANSI C63.10: 2013

Application for Certification  
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## 1 General Information

### 1.1 Administrative Information

Manufacturer:	WATTEAM Ltd.
Manufacturer's Address:	P.O.B. 27 Yodfat, D.N. Misgav 2018000, Israel Tel: +972-77-543-1360 Fax: +972-73-211-3008
Manufacturer's Representative:	Alexander Schwartz
Equipment Under Test (E.U.T):	Cycling Power Meter
Equipment Model No.:	PowerBeat 1.0
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	02.09.2015
Start of Test:	14.10.2015
End of Test:	18.10.2015
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC: Part 15, Subpart C, Section 15.247 IC: RSS-247, Issue 1, May 2015 RSS Gen Issue 4, November 2014



## 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.), Test Firm Registration #: 332439, Designation No. 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; Sites 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 EUT is cycling power meter. The device is an add-on device that can be DIY mounted on bicycle crank and providing measurements of cyclist cadence and power. The information is sent using standard ANT+ / Bluetooth protocols to standard cyclist head unit displays.

### **1.4 Test Methodology**

Radiated testing was performed according to the procedures in KDB 558074 D01 v03r03 and ANSI C63.10:2013. Radiated testing was performed at an antenna to EUT distance of 3 meters.

### **1.5 Test Facility**

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 FCC Test Firm Registration # is 332439, Designation No. IL1005.

### **1.6 Measurement Uncertainty**

#### **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):

± 4.98 dB

## 2 System Test Configuration

### 2.1 Justification

Exploratory testing was performed in 3 orthogonal polarities to determine the worst case.

The fundamental results are shown in the below table:

Frequency (MHZ)	Y axis (dBuV/m)	X axis (dBuV/m)	Z axis (dBuV/m)
2440.0	72.3	60.4	63.4

**Figure 1. Screening Results**

In all axes the spurious levels were under the noise level.

According to above results the worst case was the y axis.

The unit was evaluated when transmitting at the low channel (2402MHz), the mid channel (2440MHz) and the high channel (2480MHz).

### 2.2 EUT Exercise Software

No special exercise software was used.

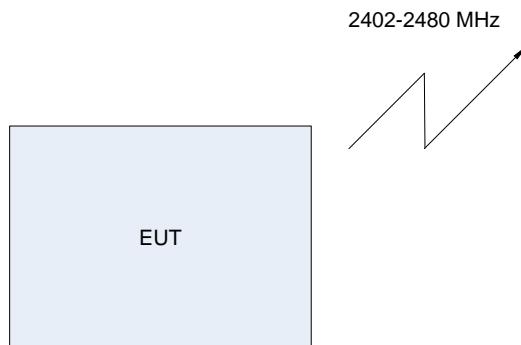
### 2.3 Special Accessories

No special accessories were needed to achieve compliance.

### 2.4 Equipment Modifications

No modifications were necessary in order to achieve compliance.

### 2.5 Configuration of Tested System



**Figure 2. Configuration of Tested System**

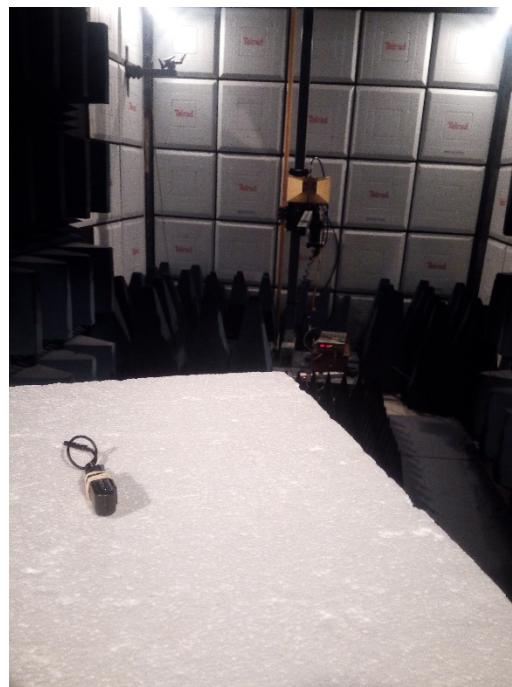
### 3 Radiated Measurement Test Set-Up Photos



**Figure 3. Radiated Emission Test**



**Figure 4. Radiated Emission Test**



**Figure 5. Radiated Emission Test**

## 4 6 dB Minimum Bandwidth

### 4.1 Test Specification

FCC Part 15, Subpart C, Section 247(a)(2)  
RSS GEN 2014, Section 6.6

### 4.2 Test Procedure

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

The E.U.T was tested at 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 2*.

The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded. The RBW was set to 100 kHz.

The unit was evaluated when transmitting at the low channel (2402MHz) the mid channel (2440MHz) and the high channel (2480MHz).

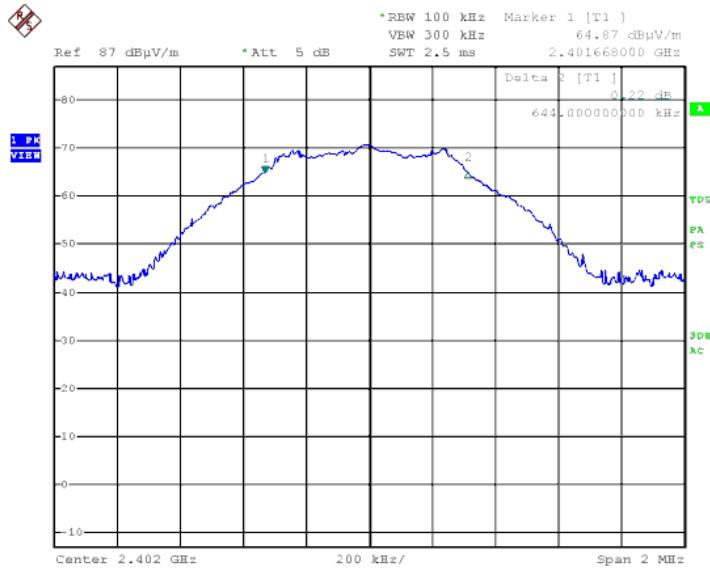
### 4.3 Test Results

Operation Frequency (MHz)	Reading (MHz)	Specification (MHz)
Low	0.644	>0.5
Mid	0.676	>0.5
High	0.692	>0.5

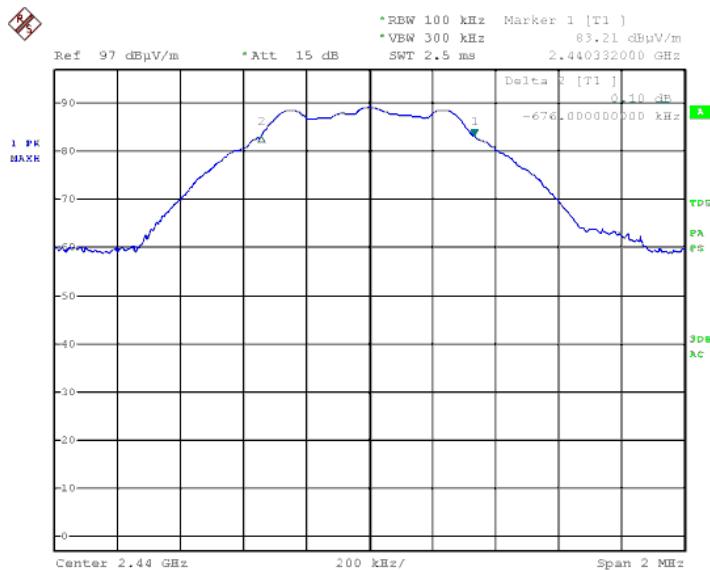
**Figure 6 6 dB Minimum Bandwidth**

JUDGEMENT: Passed

For additional information see *Figure 7 to Figure 9*.

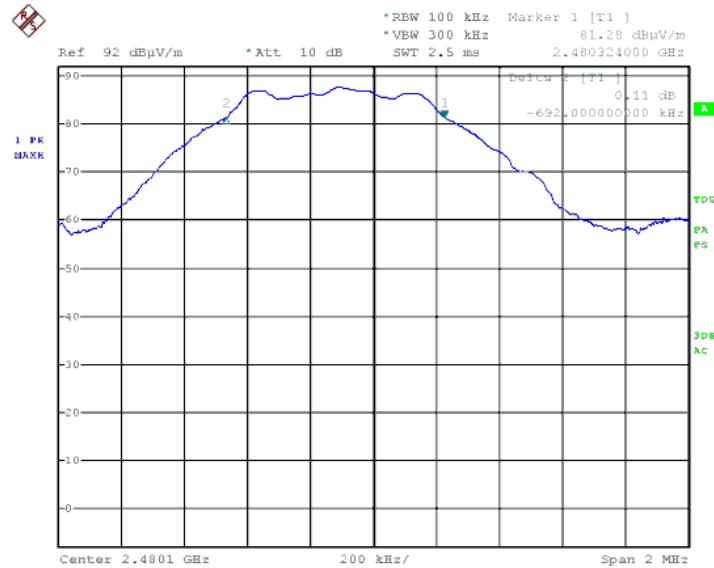


Date: 18.OCT.2015 13:10:51

**Figure 7. Low Channel (2402 MHz)**

Date: 11.OCT.2015 11:19:10

**Figure 8. Mid Channel (2440 MHz)**



Date: 11.OCT.2015 10:05:50

**Figure 9. High Channel (2480 MHz)**



#### 4.4 Test Equipment Used; 6dB Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	January 4, 2015	January 31, 2016
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	January 31, 2016
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
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 10 Test Equipment Used



## 5 Maximum Transmitted Peak Power Output

### 5.1 Test Specification

FCC, Part 15, Subpart C, Section 247(b)(3)  
RSS 247 Issue 1, May 2015, Section 5.4.4

### 5.2 Test Procedure

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

The E.U.T was evaluated in 3 channels: Low (2402 MHz), Mid (2440MHz) and High (2480MHz).

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \text{ [W]}$$

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)



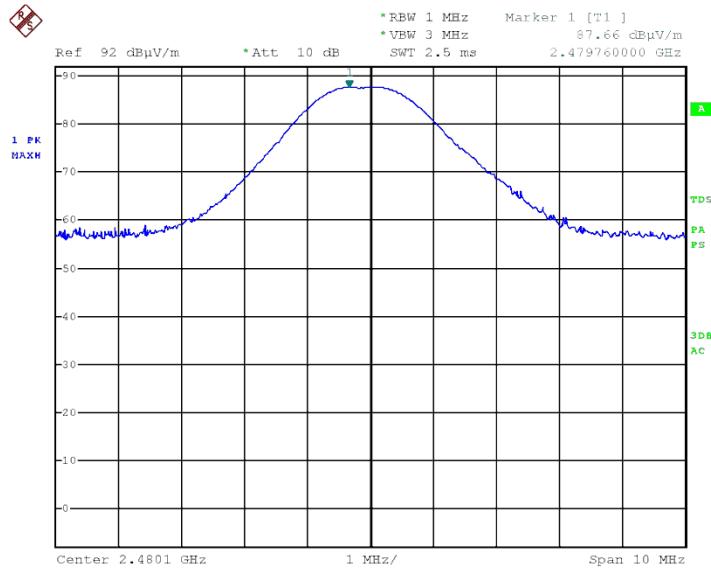
### 5.3 Test Results

Operation Frequency (MHz)	Polarization (V/H)	Power (dBuV/m)	Power (dBm)	Power (mW)	Specification (mW)	Margin (mW)
2402	V	87.66	-9.1	0.12	1000.0	-999.88
2402	H	79.28	-18.3	0.01	1000.0	-999.99
2440	V	89.23	-7.5	0.17	1000.0	-999.83
2440	H	80.13	-17.4	0.01	1000.0	-999.99
2480	V	87.66	-9.9	0.10	1000.0	-999.9
2480	H	79.25	-19.3	0.01	1000.0	-999.99

**Figure 11 Maximum Peak Power Output**

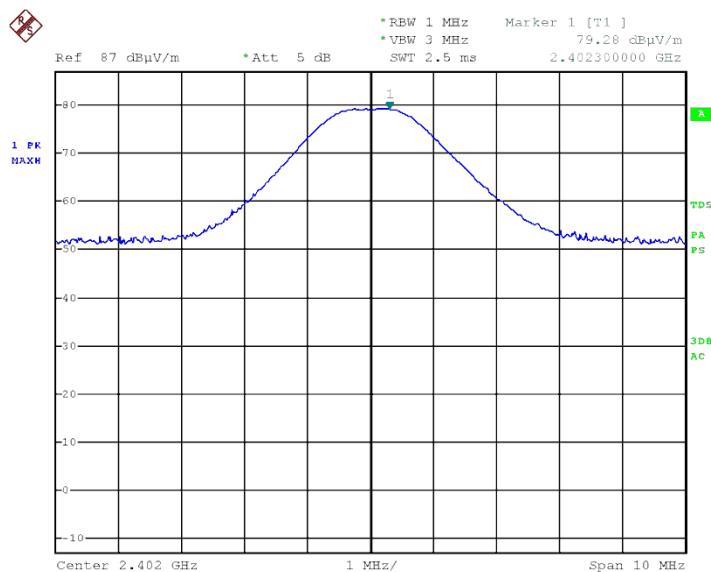
JUDGEMENT: Passed by 999.83 mW

For additional information see *Figure 12* to *Figure 17*.



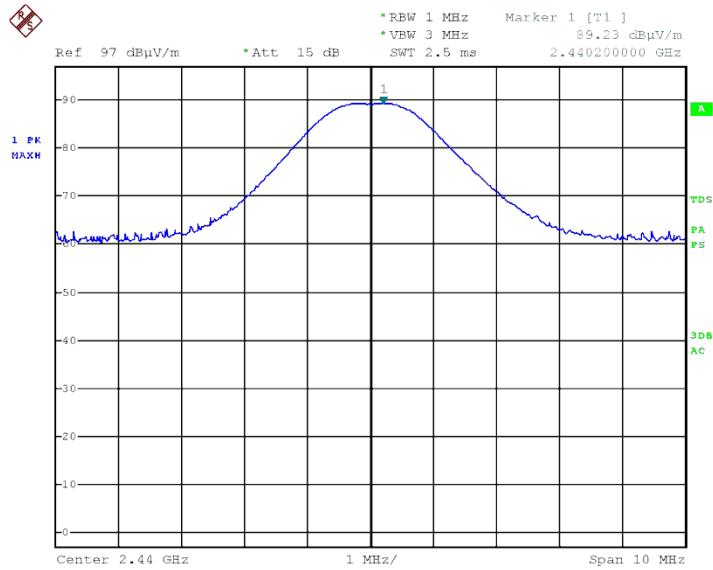
Date: 11.OCT.2015 10:11:55

**Figure 12 2402.0 MHz – Vertical**

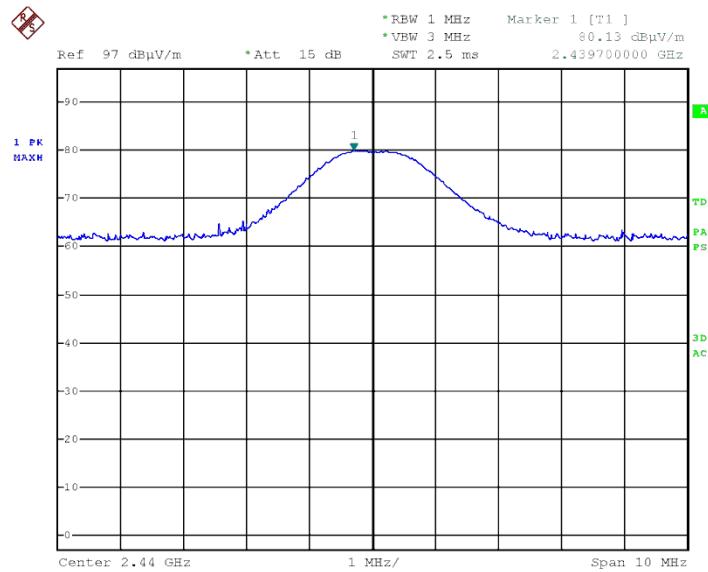


Date: 18.OCT.2015 13:14:41

**Figure 13 2402.0 MHz – Horizontal**

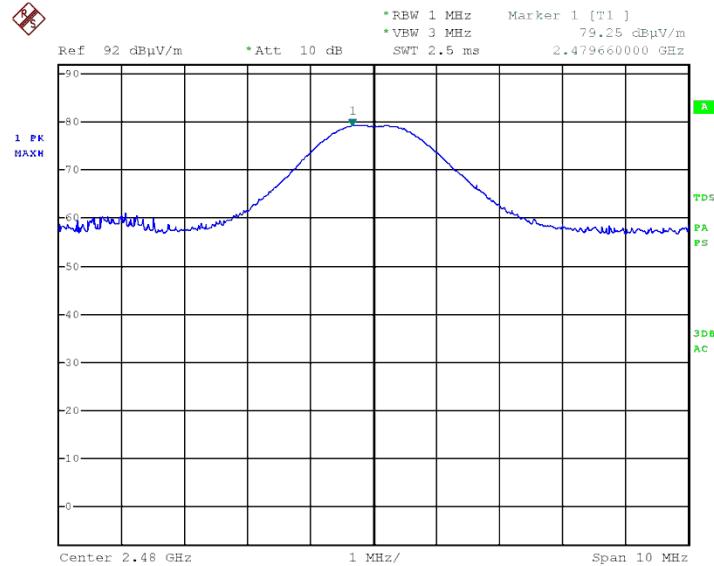


Date: 11.OCT.2015 11:20:46

**Figure 14 2440.0 MHz – Vertical**

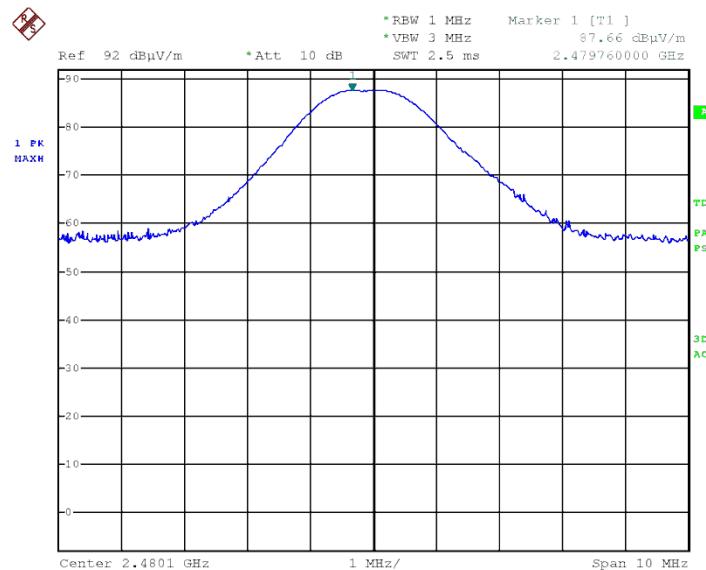
Date: 11.OCT.2015 11:34:33

**Figure 15 2440.0 MHz – Horizontal**



Date: 11.OCT.2015 10:21:58

**Figure 16 2480.0 MHz – Vertical**



Date: 11.OCT.2015 10:11:55

**Figure 17 2480.0 MHz – Horizontal**



#### 5.4 Test Equipment Used; Maximum Peak Power Output

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	January 4, 2015	January 31, 2016
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	January 31, 2016
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
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 18 Test Equipment Used



## 6 Band Edge Spectrum

### 6.1 Test Specification

FCC, Part 15, Subpart C, Section 15.247(d)  
RSS 247 Issue 1, May 2015, Section 5.5

### 6.2 Test Procedure

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

The E.U.T was evaluated in 2 channels: Low and High and with horizontal test antenna polarization as worst case.

The RBW was set to 100 kHz.

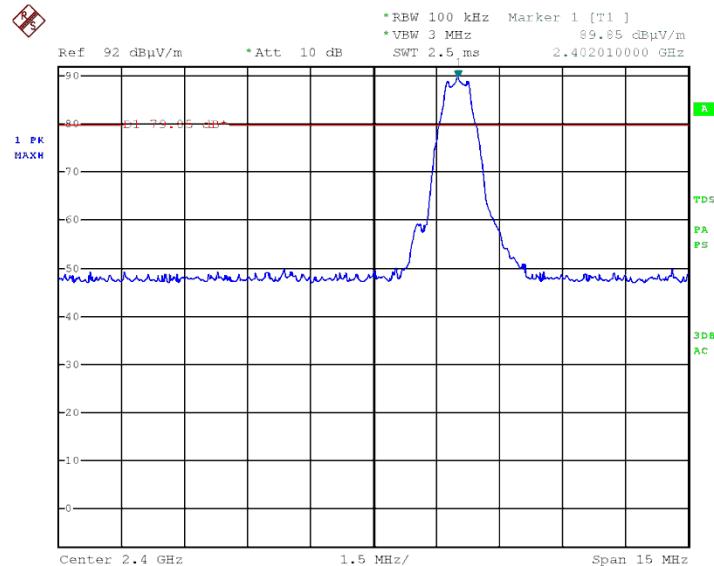
### 6.3 Test Results

Operation Frequency (MHz)	Modulation	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Specification (dBuV/m)	Margin (dB)
Low	BLE	2400.0	48.5	79.65	-31.15
High	BLE	2483.5	47.9	76.58	-28.68

**Figure 19 Band Edge Spectrum**

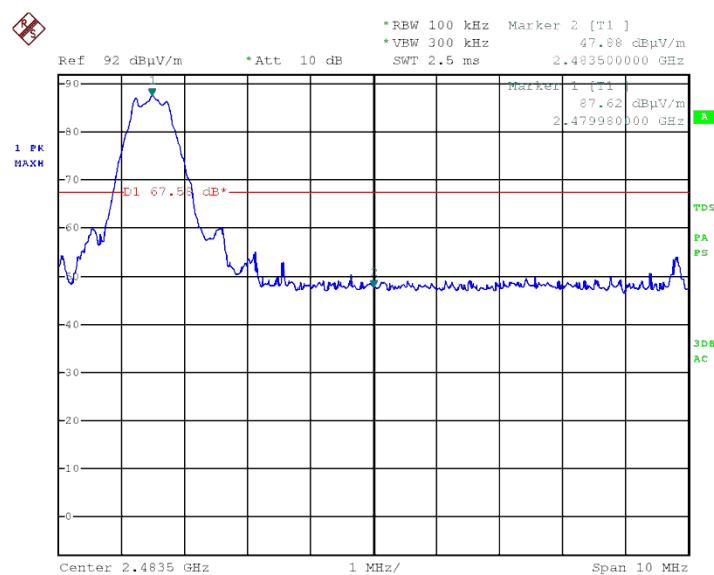
JUDGEMENT: Passed by 28.68 dB

For additional information see *Figure 20* to *Figure 21*.



Date: 18.OCT.2015 13:21:36

**Figure 20 —Lower Band Edge**



Date: 11.OCT.2015 10:15:22

**Figure 21 —Upper Band Edge**



#### 6.4 Test Equipment Used; Band Edge Spectrum

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	January 4, 2015	January 31, 2016
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	January 31, 2016
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
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 22 Test Equipment Used



## 7 Radiated Emission, 9 kHz –1000 MHz

### 7.1 Test Specification

FCC, Part 15, Subpart C, Section 247(d)

RSS GEN Issue 4: 2014, Clause 8.9

### 7.2 Test Procedure

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

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 2*.

The test distance was 3 meters.

The E.U.T. was operated at the low, mid and high channels.

The frequency range 9 kHz-1000 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

### 7.3 Test Results

JUDGEMENT: Passed

All emissions were more than the EMI receiver noise level which is more than 6dB below the specification limit.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 and RSS GEN, Issue 4: 2014, Clause 8.9 specification.



## 7.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	January 4, 2015	January 31, 2016
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	January 31, 2016
Active Loop Antenna	EMCO	6502	2950	November 4, 2014	November 5, 2015
Log Periodic	EMCO	3146	9505-4081	December 28, 2014	December 28, 2015
Biconical Antenna	EMCO	3104	2606	December 28, 2014	December 28, 2015
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 23 Test Equipment Used

## 7.5 Field Strength Calculation

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

$$FS = RA + AF + CF$$

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

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

No external pre-amplifiers are used.

## 8 Spurious Radiated Emission, 1000M – 25000 MHz

### 8.1 Test Specification

FCC, Part 15, Subpart C, Section 247(d)  
RSS GEN Issue 4: 2014, Clauses 8.9; 8.10

### 8.2 Test Procedure

The E.U.T operation mode and test set-up are as described in Section 2 of this test 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 readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization

The test distance was 3 meters.

The E.U.T. was operated at the low (2402 MHz), mid (2440 MHz) and high (2480 MHz) channels.

During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 10Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

The levels of the emissions not in the frequency ranges of the restricted bands (Clause 8.10) were compared to the limits of Table 4 General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Above 30 MHz in Clause 8.9.

The levels of the emissions within the frequency ranges of the restricted bands (Clause 8.10) were compared to the limits of the Table 4 General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Above 30 MHz in Clause 8.9.

In the frequency range 1000-7000 MHz, a computerized EMI receiver complying with CISPR 16 requirements was used.

In the frequency range 7.0-25.0 GHz, a spectrum analyzer including a low noise amplifier was used.

During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 10Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

The test distance was 3 meters.

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



### 8.3 **Test Results**

JUDGEMENT: Passed by 2.54 dB

For the operation frequency of 2480 MHz, the margin between the emission level and the specification limit is in the worst case 2.54 dB at the frequency of 4960 MHz, vertical polarization.

The EUT met the requirements of the F.C.C. Part 15, Subpart C and RSS GEN Issue 4: 2014, Clause 8.9 specification.

The details of the highest emissions are given in *Figure 24* to *Figure 25*.



## Radiated Emission

E.U.T Description: Cycling Power Meter  
Type: PowerBeat 1.0  
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C;  
RSS GEN Issue 4: 2014, Clause 8.9

Antenna Polarization: Horizontal/Vertical      Frequency range: 1.0 GHz to 25.0 GHz  
Test Distance: 3 meters      Detector: Peak

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Peak Reading (dB $\mu$ V/m)	Peak Specification (dB $\mu$ V/m)	Peak Margin (dB)
2402.0	2390.0	H	55.83	74.0	-18.17
2402.0	2390.0	V	55.85	74.0	-18.15
2402.0	4804.0	H	54.19	74.0	-19.81
2402.0	4804.0	V	54.55	74.0	-19.45
2440.0	4880.0	H	52.67	74.0	-21.33
2440.0	4880.0	V	54.50	74.0	-19.50
2480.0	4960.0	H	56.33	74.0	-17.67
2480.0	4960.0	V	56.83	74.0	-17.17
2480.0	2483.5	H	58.75	74.0	-15.25
2480.0	2483.5	V	55.44	74.0	-18.56

**Figure 24. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Peak**

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 Amp” includes correction factor.

\* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



## Radiated Emission

E.U.T Description      Cycling Power  
Meter  
Type                      PowerBeat 1.0  
Serial Number:           Not designated

Specification: FCC, Part 15, Subpart C  
RSS GEN Issue 4: 2014, Clause 8.9

Antenna Polarization: Horizontal/Vertical

Frequency range: 1.0 GHz to 25.0 GHz

Test Distance: 3 meters

Detector: Average

<b>Operation Frequency</b> (MHz)	<b>Freq.</b> (MHz)	<b>Polarity</b> (H/V)	<b>Average Reading</b> (dB $\mu$ V/m)	<b>Average Specification</b> (dB $\mu$ V/m)	<b>Average Margin</b> (dB)
2402.0	2390.0	H	49.02	54.0	-4.98
2402.0	2390.0	V	49.57	54.0	-4.43
2402.0	4804.0	H	45.48	54.0	-8.52
2402.0	4804.0	V	47.15	54.0	-6.85
2440.0	4880.0	H	48.78	54.0	-5.22
2440.0	4880.0	V	50.29	54.0	-3.71
2480.0	4960.0	H	50.64	54.0	-3.36
2480.0	4960.0	V	51.46	54.0	-2.54
2480.0	2483.5	H	46.86	54.0	-7.14
2480.0	2483.5	V	47.93	54.0	-6.07

**Figure 25. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Average**

Notes:

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 Amp” includes correction factor.

\*      Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



#### 8.4 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	January 4, 2015	January 31, 2016
Horn Antenna	ETS	3115	6142	May 19, 2015	May 19, 2018
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	March 30, 2016
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	March 3, 2016
Spectrum Analyzer	HP	8564E	3442A00275	March 11, 2015	March 31, 2016
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	March 1, 2015	March 1, 2016
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	March 1, 2015	March 1, 2016
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMC O	2090	9608-1456	N/A	N/A

Figure 26 Test Equipment Used



## 9 Transmitted Power Spectral Density

### 9.1 Test Specification

FCC, Part 15, Subpart C, Section 247(e)  
RSS 247 Issue 1: 2015, Clause 5.2.(2)

### 9.2 Test Procedure

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

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 2*.

The spectrum analyzer was set to 3 kHz RBW and VBW to 10 kHz.

The E.U.T was evaluated in 3 channels: Low (2402 MHz), Mid (2440 MHz) and High (2480 MHz).

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \quad [W]$$

E - Field Strength (V/m)

d - Distance from transmitter (m)

G - Antenna gain

P - Peak power (W)



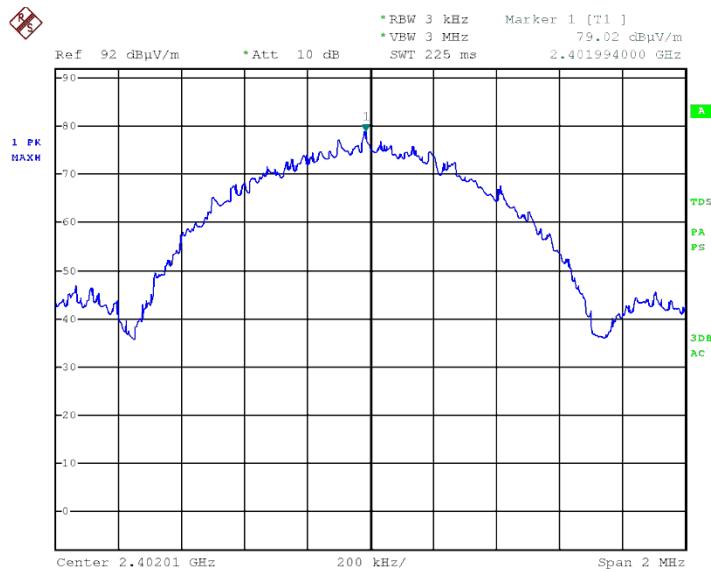
### 9.3 Test Results

Operation Frequency (MHz)	Reading Spectrum Analyzer (dB $\mu$ V/m)	Reading Spectrum Analyzer (dBm)	Specification (dBm)	Margin (dB)
Low	79.02	-17.74	8.0	-25.74
Mid	77.83	-18.93	8.0	-26.93
High	75.57	-21.81	8.0	-29.81

**Figure 27 Transmitted Power Spectral Density Results**

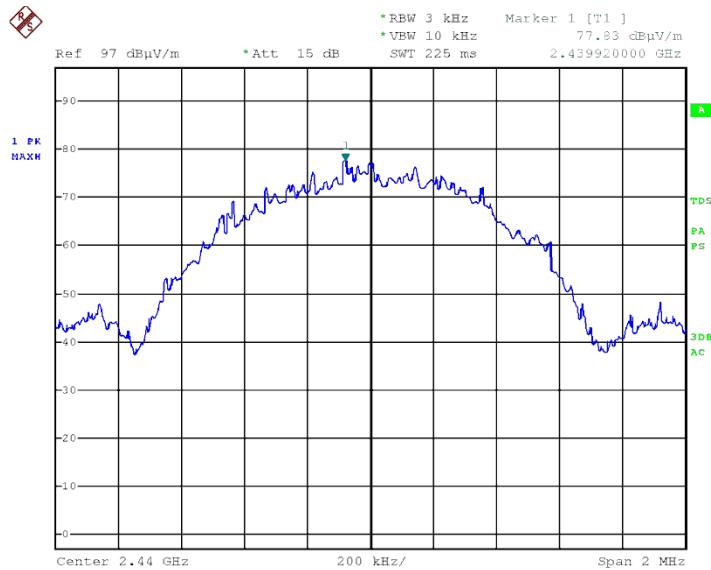
JUDGEMENT: Passed by 25.74 dB

For additional information see *Figure 28* to *Figure 30*.



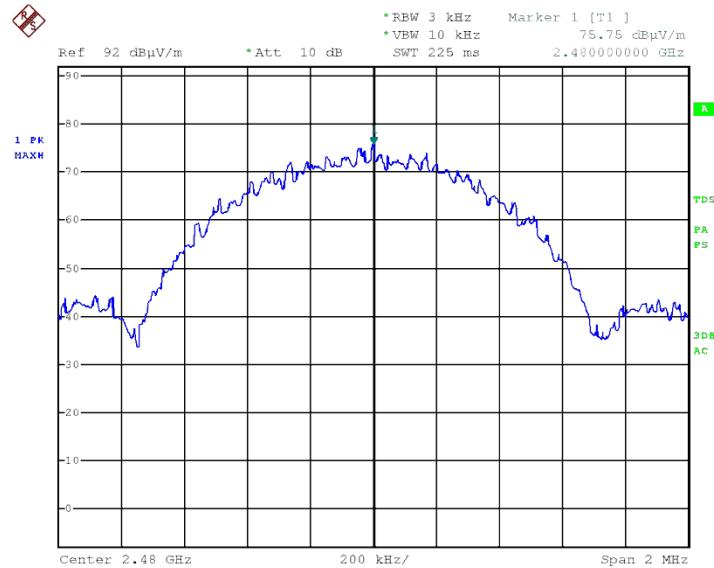
Date: 18.OCT.2015 13:25:23

**Figure 28 — Low Channel**



Date: 11.OCT.2015 11:21:45

**Figure 29 — Mid Channel**



Date: 11.OCT.2015 10:17:24

**Figure 30 — High Channel**



#### 9.4 Test Equipment Used; Transmitted Power Spectral Density

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	January 4, 2015	January 31, 2016
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	January 31, 2016
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
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 31 Test Equipment Used



## 10 Antenna Gain/Information

The antenna gain is 1.3 dBi, integral.



## 11 R.F Exposure/Safety

Typical use of the E.U.T. is a cycling power meter placed on a bicycle pedal/crank. The typical distance between the E.U.T. and the user is 0.5 cm.

### Calculation of Maximum Permissible Exposure (MPE)

Based on FCC Section 1.1310 and IC RSS 102, Issue 5 Section 2.5.2 Requirements

(a) FCC limit at 2440 MHz is:

$$1 \frac{mW}{cm^2}$$

(b) IC limit at 2440 MHz is:

$$4 \frac{mW}{cm^2}$$

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

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

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

P<sub>t</sub>- Transmitted Power 89.23 dBuV/m (Peak) = -7.5dBm = 0.17 mW (testing performed radiated; power results include antenna gain).

G<sub>T</sub>- Antenna Gain, 1.3 dBi

R- Distance from Transmitter using 0.5 cm worst case

(d) The peak power density is:

$$S = \frac{(0.17)}{4\pi(0.5)^2} = 0.54 \frac{mW}{cm^2}$$

(e) This is below the FCC/IC limits.



## 12 APPENDIX A - CORRECTION FACTORS

### 12.1 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



**12.2 Correction factors for log periodic antenna**  
**EMCO model 3146**  
**Serial # 9505-4081**

**CALIBRATION DATA**

Frequency, MHz	Antenna factor, dB/m <sup>1)</sup>
200	11.55
250	11.60
300	14.43
400	15.38
500	17.98
600	18.78
700	21.17
800	21.16
900	22.67
1000	24.09

<sup>1)</sup> The antenna factor shall be added to receiver reading in dB $\mu$ V to obtain field strength in dB $\mu$ V/m.



**12.3 Correction factors for biconical antenna**  
**EMCO model 3104**  
**Serial # 2606**

**CALIBRATION DATA**

Frequency, MHz	Near free space antenna factor, dB/m	Geometry specific correction factor, dB	Free space antenna factor, dB/m <sup>1)</sup>
30	12.97	0.13	12.84
35	12.34	0.09	12.25
40	12.03	0.06	11.97
45	11.42	0.02	11.40
50	11.91	0.03	11.88
60	11.92	0.37	11.55
70	9.60	0.25	9.35
80	6.99	-0.45	7.44
90	10.87	-0.34	11.21
100	11.51	-0.06	11.57
120	13.30	0.20	13.10
140	12.56	-0.01	12.57
160	14.49	-0.12	14.61
180	16.53	0.05	16.48
200	15.30	0.15	15.15

<sup>1)</sup> The antenna factor shall be added to receiver reading in dB $\mu$ V to obtain field strength in dB $\mu$ V/m.



#### 12.4 Correction factors for

#### *Horn Antenna*

**Model: SWH-28  
at 1 meter range.**

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4



**12.5 Correction factors for**

**ACTIVE LOOP ANTENNA**

**Model 6502**

**S/N 9506-2950**

FREQUENCY (MHz)	Magnetic Antenna Factor (dB)	Electric Antenna Factor (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



## 12.6 Correction factors for Double-Ridged Waveguide Horn

Model: 3115, S/N 6142  
10 meter range

FREQUENCY (MHz)	AFE (dB/m)	FREQUENCY (MHz)	AFE (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