



**DATE: 23 June 2013**

**I.T.L. (PRODUCT TESTING) LTD.**

# **FCC Radio Test Report**

for

**Orpak Systems Ltd.**

**Equipment under test:**

**Nozzle Reader**

**µNR**

Written by:

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This report relates only to items tested.



## Measurement/Technical Report for Orpak Systems Ltd.

### Nozzle Reader

$\mu$ NR

**FCC ID: W8F800942XXX**

**IC: 8264A-800942XXX**

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

Equipment type:                      Spread Spectrum/Digital Device 2400-2483.5 MHz and  
Part 15 Low Power Transmitter Below 1705 kHz

$\mu$ NR-T (Round Coil)

Limits used:

47CFR15 Section 15.209

47CFR15 Section 15.247

Measurement procedure used is KDB 558074 D01 18 January 2012 and  
ANSI C63.4: 2003.

Application for Certification  
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## 1. General Information

### 1.1 Administrative Information

Manufacturer:	Orpak Systems Ltd.
Manufacturer's Address:	31 Lechi St. P.O.B. 1461 Bnei-Brak, 51114 Israel Tel: +972-3-577-6868 Fax: +972-3-579-6310
Manufacturer's Representative:	Gidi Segal
Equipment Under Test (E.U.T):	Nozzle Reader
Equipment Model No.:	µNR
Equipment Part No.:	Not Designated
Date of Receipt of E.U.T:	05.05.2013
Start of Test:	05.05.2013
End of Test:	17.06.2013
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15 Subpart C RSS-210 Issue 8, 2010



## **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.), Registration No. 90715.
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-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025B-1.
6. TUV Product Services, England, ASLLAS No. 97201.

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  $\mu$ NR is an add-on device designed to be installed on the dispenser's nozzle. It is a self-powered device that does not require any connections to any other existing components of the dispenser due to its wireless nature. The  $\mu$ NR has only mechanical interface to the nozzle without any wires or electronic interface to the nozzle, dispenser or any other station equipment.

The  $\mu$ NR reads (Frequency: 119 – 135 kHz) the vehicle information from the RFID FuelOpas and after that transmits (Frequency: 2.405-2.480 GHz) it to the WGT over wireless channel.

### **1.4 Test Methodology**

Radiated testing was performed according to the procedures in KDB 558074 D01 18 January 2012 and ANSI 63-4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

### **1.5 Test Facility**

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing November 21, 2012).

I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

### **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):

$\pm 4.98$  dB

## 2. System Test Configuration

### 2.1 Justification

Radiated emission screening was performed in 3 orthogonal orientations. The worst case orientation was the vertical position.

### 2.2 EUT Exercise Software

Commands were sent via hyper terminal to the SSD tester to operate the E.U.T.

### 2.3 Special Accessories

Unit operating on evaluation board simulating the installation on a fuel pump. In addition a FuelOpass ring was used to start communication with the 125 kHz transmitter and a SSD tester was used activate the 2.4 GHz transmitter.

### 2.4 Equipment Modifications

No modifications were needed in order to achieve compliance.

### 2.5 Configuration of Tested System

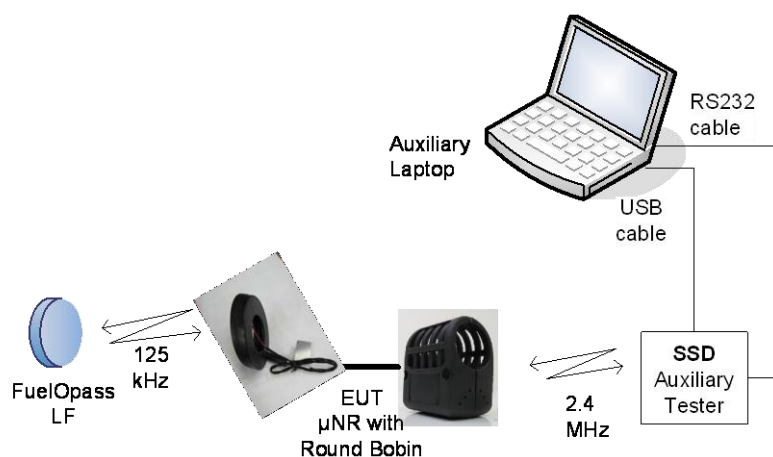


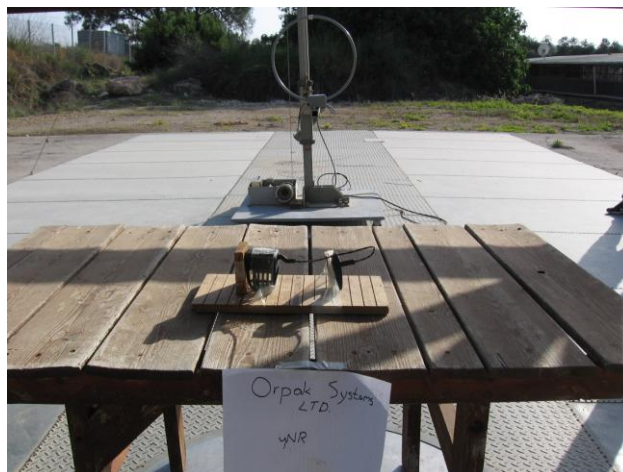
Figure 1. Configuration of Tested System



### 3. Test Setup Photo



**Figure 2. Radiated Emission Test Setup**



**Figure 3. Radiated Emission Test Setup**



**Figure 4. Radiated Emission Test Setup**



**Figure 5. Radiated Emission Test Setup**

## 4. Field Strength of Fundamental 125 kHz Transmitter

### 4.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.209

### 4.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

The E.U.T. was placed on a non-conductive table, 0.8 meters above the O.A.T.S. ground plane.

The EMI receiver was set to the E.U.T. Fundamental Frequency (125 kHz) and Peak Detection.

The distance between the E.U.T. and test antenna was 3 meters.

The turntable and antenna were adjusted for maximum level reading on the EMI receiver. The loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter.


### 4.3 Test Results

JUDGEMENT: Passed by 23.55 dB

The EUT met the FCC Part 15, Subpart C, Section 15.209 specification requirements.

The details of the highest emissions are given in *Figure 6*.

TEST PERSONNEL:

Tester Signature: 

Date: 12.06.2013

Typed/Printed Name: I. Siboni

## Field Strength of Fundamental

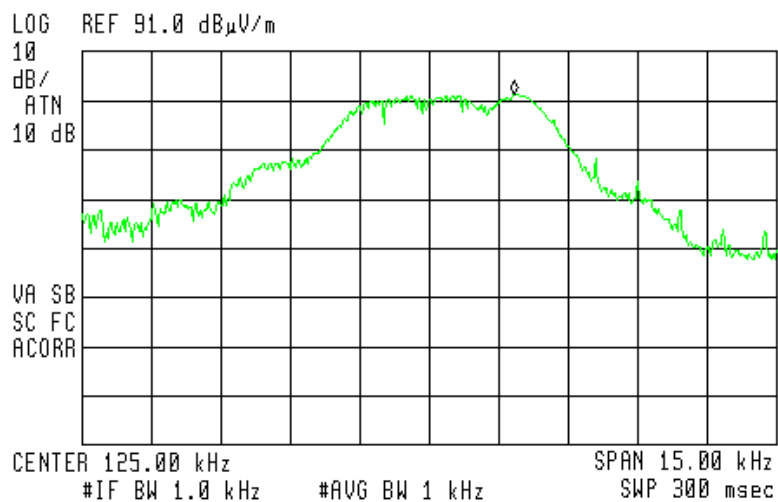
E.U.T Description Nozzle Reader

Model Number  $\mu$ NR

Part Number: Not Designated



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 126.84 kHz  
82.12 dB $\mu$ V/m



**Figure 6. Field Strength of Fundamental  
Detector: Peak**



#### **4.4 Test Instrumentation Used, Field Strength of Fundamental**

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration</b>	<b>Period</b>
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
EMI Receiver Filter Section	HP	85420E	3705A00248	February 26, 2013	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 21, 2012	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A



## 5. Radiated Emission, 9 kHz – 30 MHz for Low Frequency Transmitter (125 kHz)

### 5.1 Test Specification

9 kHz-30 MHz, FCC, Part 15, Subpart C, Section 209

### 5.2 Test Procedure

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

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 3.1.

The frequency range 9 kHz-30 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter at a distance of 3 meters.

The E.U.T. was operated at the frequency of 125 kHz. This frequency was measured using a peak detector.

### 5.3 Test Results

JUDGEMENT: Passed by 42.20 dB

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 specification.

TEST PERSONNEL:

Tester Signature: \_\_\_\_\_

Date: 12.06.2013

Typed/Printed Name: I. Siboni

## Radiated Emission 9 kHz – 30 MHz, Low Frequency Transmitter (125 kHz)

E.U.T Description    Nozzle Reader  
Model Number         $\mu$ NR  
Part Number:        Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical    Frequency range: 9 kHz to 30.0 GHz  
Test Distance: 3 meters                            Detector: Peak  
Operation Frequency: 125 kHz

Frequency (MHz)	Peak Reading (dB $\mu$ V/m)	Peak Specification (dB $\mu$ V/m)	Margin (dB)
0.250	36.4	99.65	-63.25
0.375	39.4	96.12	-56.72
0.500	31.8	74.00	-42.20

**Figure 7. Radiated Emission**

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.

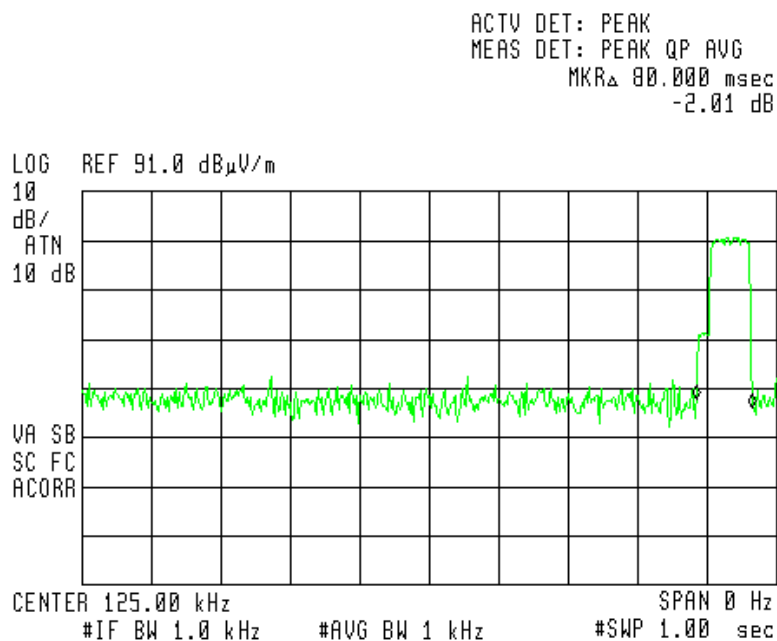


Figure 8. Transmitter “On” Time During 100 milliseconds

#### 5.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 21, 2012	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A



## 5.5 **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 $\mu$ V/m]  
 RA: Receiver Amplitude [dB $\mu$ V]  
 AF: Receiving Antenna Correction Factor [dB/m]  
 CF: Cable Attenuation Factor [dB]

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

No external pre-amplifiers are used.

## 6. Bandwidth for 125 kHz Transmitter

### 6.1 Test Specification

RSS-Gen Issue 3, Section 4.6, December 2010

### 6.2 Test procedure

The transmitter unit operated with normal modulation. The spectrum analyzer was set to 30 kHz resolution BW and center frequency of the transmitter fundamental. The spectrum bandwidth of the transmitter unit was measured and recorded. The BW was measured at 26dBc points.

The EUT was set up as shown in *Figure 1*, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on the modulation envelope.

### 6.3 Test Results

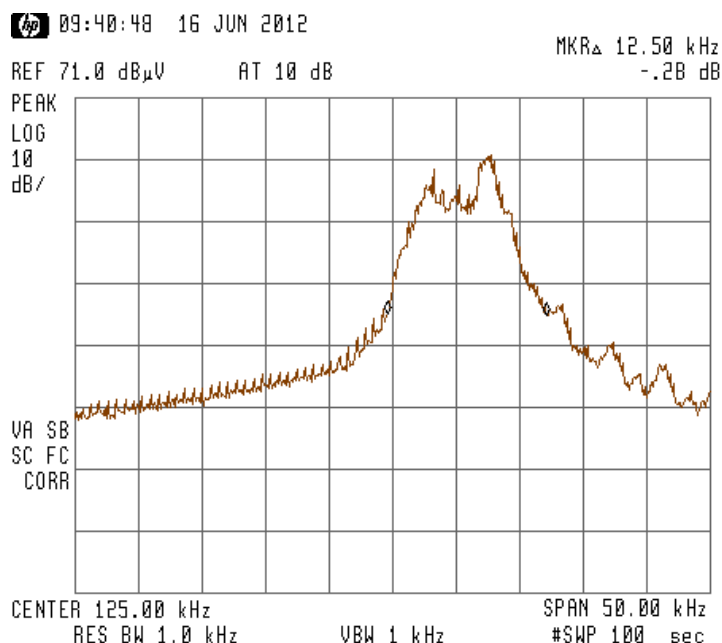
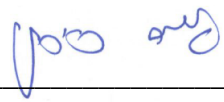


Figure 9 Bandwidth Test results Table

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 17 06.13

Typed/Printed Name: I. Siboni



#### 6.4 Test Equipment Used.

Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	8546A	3650A00365	March 17, 2013	1 Year
Active Loop Antenna	EMCO	6507	1448	April 21, 2013	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 10 Test Equipment Used

## 7. 6dB Minimum Bandwidth

### 7.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(a)(2)

### 7.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 100 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in Figure 3, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on modulation envelope. The E.U.T. was tested in three operating channels and frequencies (11 (2.405 GHz); 18 (2.440 GHz); 26 (2.480 GHz)).

### 7.3 Test Results

Operation Frequency (MHz)	Bandwidth Reading (MHz)	Specification (MHz)
2405.00	1.513	>0.5
2440.00	1.488	>0.5
2480.00	1.588	>0.5

**Figure 11 — 6dB Minimum Bandwidth Test Results**

See additional information in Figure 12 to Figure 14.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 12.06.2013

Typed/Printed Name: I. Siboni

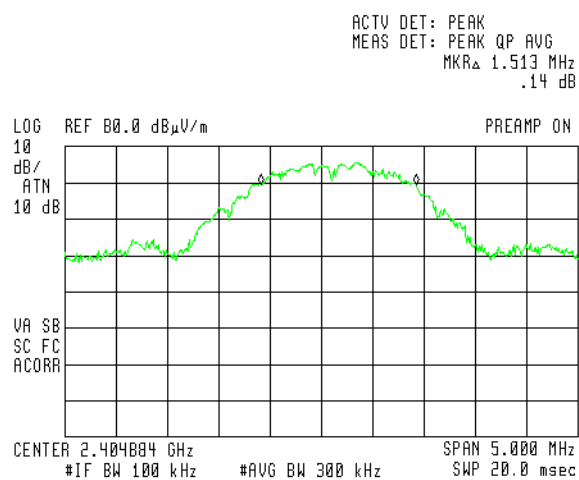


Figure 12. — 2405 MHz

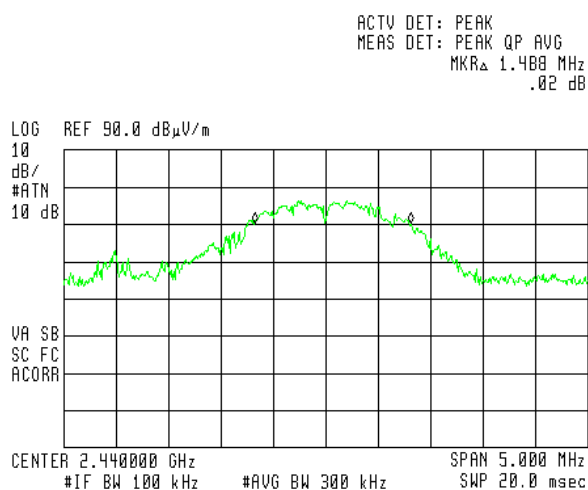


Figure 13. — 2440 MHz

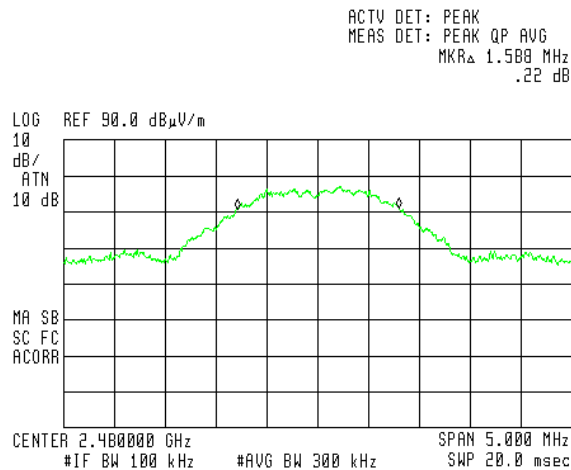


Figure 14. — 2480 MHz

#### 7.4 Test Equipment Used, 6dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 15 Test Equipment Used

## 8. 26dB Minimum Bandwidth

### 8.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(a)(2)

### 8.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 100 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in Figure 3, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on modulation envelope. The E.U.T. was tested in three operating channels and frequencies (11 (2.405 GHz); 18 (2.440 GHz); 26 (2.480 GHz)).

### 8.3 Test Results

Operation Frequency (MHz)	Bandwidth Reading (MHz)
2405.00	2.850
2440.00	2.825
2480.00	2.888

**Figure 16 — 26 dB Minimum Bandwidth Test Results**

See additional information in *Figure 17* to *Figure 19*.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 12.06.2013

Typed/Printed Name: I. Siboni

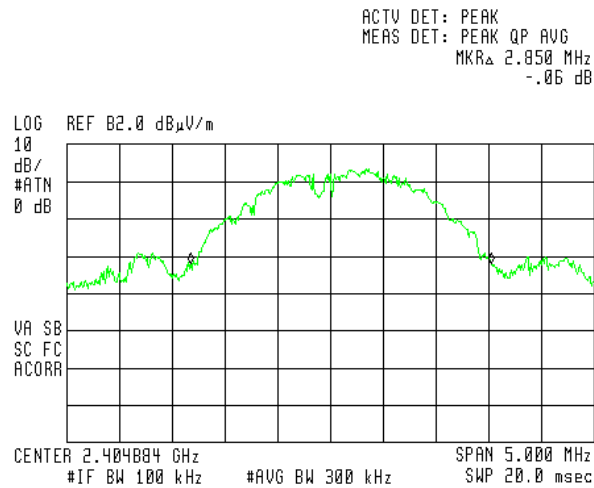


Figure 17. — 2405 MHz

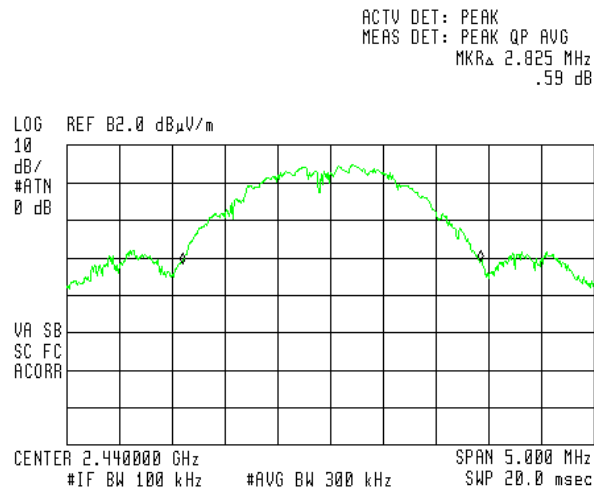


Figure 18. — 2440 MHz



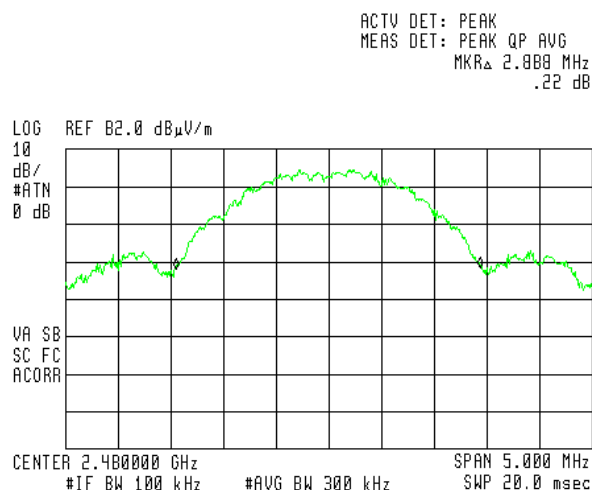


Figure 19. — 2480 MHz

#### 8.4 Test Equipment Used, 26 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 20 Test Equipment Used

## 9. Radiated Power Output

### 9.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(b)

### 9.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

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

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:

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

The E.U.T. was tested at 2405, 2440, and 2480 MHz.

### 9.3 Test Results

Frequency (MHz)	Pol	E (dBμV/m)	E (V/m)	Antenna Gain (dBi)	Antenna Distance (m)	Calculated Results (mW)	Limit (W)	Margin (mW)
2405.00	V	82.07	0.01	1.2	3	0.025	1	0.975
2440.00	H	81.18	0.01	1.2	3	0.025	1	0.975
2480.00	H	79.70	0.01	1.2	3	0.025	1	0.975

**Figure 21 Radiated Power Output Test Results Calculation table**

See additional information in *Figure 22* to *Figure 24*.

JUDGEMENT: Passed by 0.975 mW

TEST PERSONNEL:

Tester Signature: 

Date: 12.06.2013

Typed/Printed Name: I. Siboni



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 2.405496 GHz  
82.07 dB $\mu$ V/m

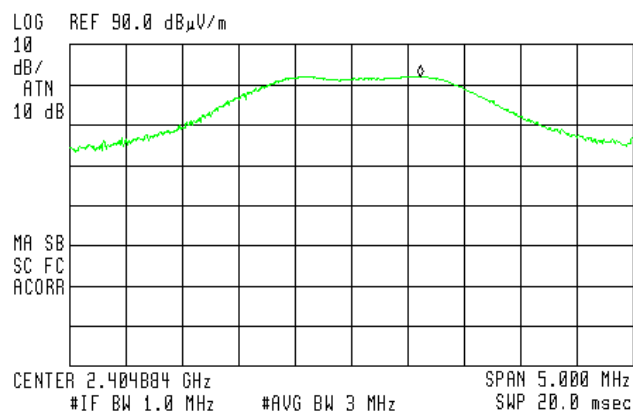


Figure 22 — 2405 MHz



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 2.439588 GHz  
81.18 dB $\mu$ V/m

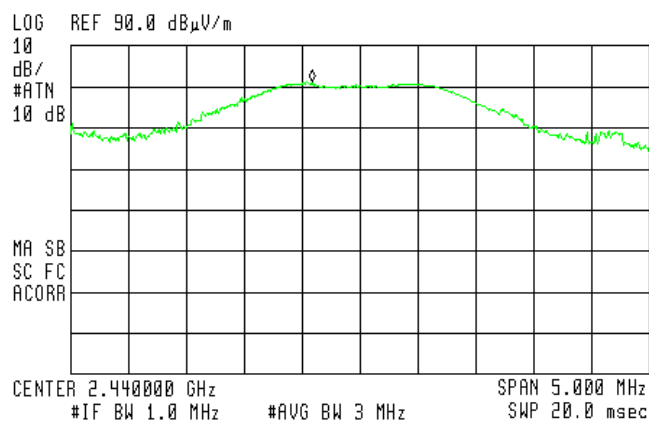


Figure 23 — 2440 MHz

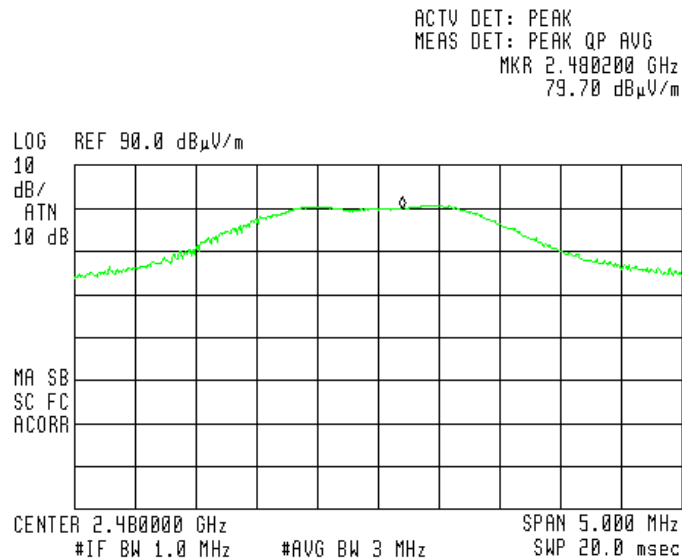


Figure 24 — 2480 MHz

#### 9.4 Test Equipment Used, Radiated Maximum Output Power

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 25 Test Equipment Used

## 10. Band Edge Spectrum

### 10.1 Test Specification

FCC Part 15 Section 15.247(d0)

### 10.2 Test Procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in *Figure 1*, and its proper operation was checked.

The EMI receiver was adjusted to the transmission channel at the maximum radiated level. The display line was set to 20 dBc and the EMI receiver was set to the band edge frequencies.

Maximum power level below 2400 MHz and above 2483.5 MHz was measured relative to power level at 2405 MHz, and 2480 MHz correspondingly.

The E.U.T. was tested in 2 operating channels and frequencies (11 (2.405 GHz); 26 (2.480 GHz)).

### 10.3 Test Results

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Specification (dBc)
2405.00	2400.00	55.01	20
2480.00	2483.50	45.17	20

**Figure 26 Band Edge Spectrum Test Results Table**

See additional information in *Figure 27* to *Figure 28*.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 12.06.2013

Typed/Printed Name: I. Siboni

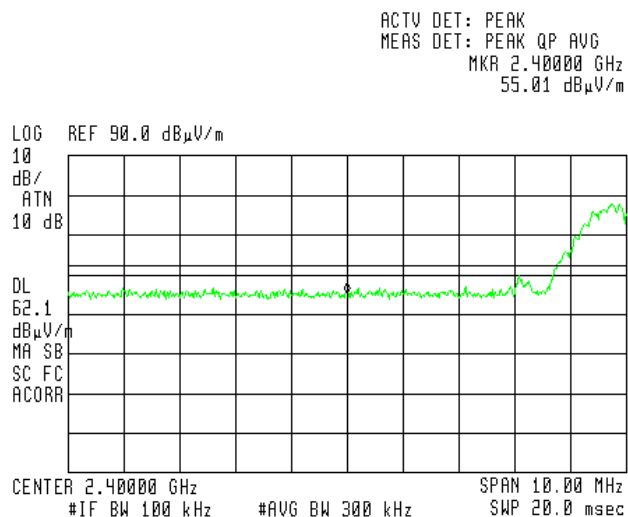


Figure 27 — 2405 MHz

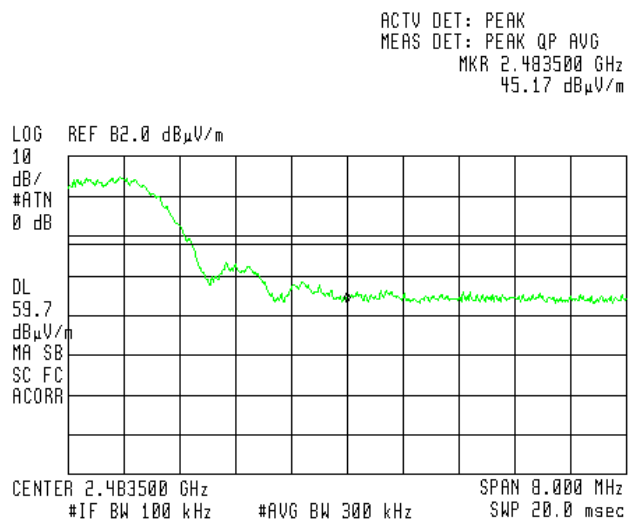


Figure 28 — 2480 MHz



#### 10.4 Test Equipment Used, Band Edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 29 Test Equipment Used

## 11. Spurious Radiated Emission, 9 kHz – 30 MHz

### 11.1 Test Specification

9 kHz-30 MHz, FCC, Part 15, Subpart C, Section 209

### 11.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

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 3.1.

The E.U.T. highest frequency source or used frequency is 2.4 GHz.

The frequency range 9 kHz-30 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter at a distance of 3 meters.

The E.U.T. was tested in three operating channels and frequencies (11 (2.405 GHz); 18 (2.440 GHz; 26 (2.480 GHz)).

These frequencies were measured using a peak detector.

### 11.3 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 specification.

The results for all three channels were the same.

No signals were detected in the frequency range of 9 kHz – 30 MHz.

TEST PERSONNEL:

Tester Signature: 

Date: 12.06.2013

Typed/Printed Name: I. Siboni



#### 11.4 Test Equipment Used, Spurious Radiated Emission, 9 kHz – 30 MHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Active Loop Antenna	EMCO	6507	1448	April 21, 2013	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

**Figure 30 Test Equipment Used**

#### 11.5 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 $\mu$ 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.

## 12. Spurious Radiated Emission, 30 – 25000 MHz

### 12.1 Test Specification

30 MHz-25000 MHz, F.C.C., Part 15, Subpart C

### 12.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

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 E.U.T. highest frequency source or used frequency is 2.4 GHz.

The frequency range 30 MHz-25000 MHz was scanned and the list of the highest emissions was verified and updated accordingly.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used.

In the frequency range 2.9-25.0 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 100Hz. 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.

Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The E.U.T. was tested in three operating channels and frequencies (11 (2.405 GHz); 18 (2.440 GHz); 26 (2.480 GHz)).



### 12.3 Test Results

JUDGEMENT: Passed 13.5 dB

TEST PERSONNEL:

Tester Signature: 

Date: 12.06.2013

Typed/Printed Name: I. Siboni

## Radiated Emission

E.U.T Description    Nozzle Reader  
Model Number         $\mu$ NR  
Part Number:        Not Designated

Specification: FCC, Part 15, Subpart C

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

Operation Frequency (MHz)	Frequency (MHz)	Polarity (H/V)	Peak Reading (dB $\mu$ V/m)	Peak Specification (dB $\mu$ V/m)	Margin (dB)
2405.00	2390.00	H	53.9	74	-20.1
2405.00	2390.00	V	55.4	74	-18.6
2405.00	4810.00	H	54.6	74	-19.4
2405.00	4810.00	V	54.5	74	-19.5
2440.00	4880.00	H	49.3	74	-24.7
2440.00	4880.00	V	53.0	74	-21.0
2480.00	2483.50	H	55.8	74	-18.2
2480.00	2483.50	V	55.7	74	-18.3
2480.00	4960.00	H	54.6	74	-19.4
2480.00	4960.00	V	54.2	74	-19.8

**Figure 31. 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 Reading” includes correction factor.

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

## Radiated Emission

E.U.T Description    Nozzle Reader  
Model Number         $\mu$ NR  
Part Number:        Not Designated

Specification: FCC, Part 15, Subpart C

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

Operation Frequency (MHz)	Frequency (MHz)	Polarity (H/V)	Average Result (dB $\mu$ V/m)	Average Specification (dB $\mu$ V/m)	Margin (dB)
2405.00	2390.00	H	40.0	54	-14.0
2405.00	2390.00	V	40.0	54	-14.0
2405.00	4810.00	H	38.9	54	-15.1
2405.00	4810.00	V	39.9	54	-14.1
2440.00	4880.00	H	39.2	54	-14.8
2440.00	4880.00	V	40.0	54	-14.0
2480.00	2483.50	H	40.5	54	-13.5
2480.00	2483.50	V	40.5	54	-13.5
2480.00	4960.00	H	40.2	54	-13.8
2480.00	4960.00	V	39.2	54	-14.8

**Figure 32. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Average**

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.

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

#### 12.4 Test Equipment Used, Spurious Radiated Emission, 30 MHz – 25 GHz

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1 Year
Antenna Biconical	EMCO	3104	2606	August 30, 2012	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	3 Years
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 21, 2012	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2012	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	February 28, 2013	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

**Figure 33 Test Equipment Used**

## 12.5 **Field Strength Calculation 30 MHz – 1000 MHz**

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  $[\text{dB}\mu\text{V/m}]$   
 RA: Receiver Amplitude  $[\text{dB}\mu\text{V}]$   
 AF: Receiving Antenna Correction Factor  $[\text{dB/m}]$   
 CF: Cable Attenuation Factor  $[\text{dB}]$

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

No external pre-amplifiers are used.

## 13. Radiated Power Spectral Density

### 13.1 Test Specification

FCC Part 15 Section 15.247(e)

### 13.2 Test Procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

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

The E.U.T. was tested in three operating channels and frequencies (11 (2.405 GHz); 18 (2.440 GHz); 26 (2.480 GHz)).

Then the EMI receiver was set to 3 kHz resolution BW, span of 300.0 kHz, and sweep time of 100 seconds. The spectrum peaks were located at each of the 3 operating frequencies.

Radiated peak output power levels were converted to power level according to the formula as shown below:

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

### 13.3 Test Results

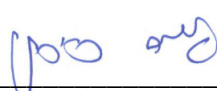
Frequency	E	Spectral Density Result	Antenna Gain	Antenna Distance	Calculated Results	Spec.	Margin
(MHz)	(dBμV/m)	(V/m)	(dBi)	(m)	(mW)	(mW)	(mW)
2405.00	72.4	0.001	1.32	3	0.00027	6.3	-6.29973
2440.00	70.42	0.001	1.32	3	0.00027	6.3	-6.29973
2480.00	69.57	0.001	1.32	3	0.00027	6.3	-6.29973

**Figure 34 Radiated Power Spectral Density Test Results Table**

See additional information in *Figure 35 to Figure 37*.

JUDGEMENT: Passed by 6.30 mW

TEST PERSONNEL:

Tester Signature: 

Date: 12.06.2013

Typed/Printed Name: I. Siboni



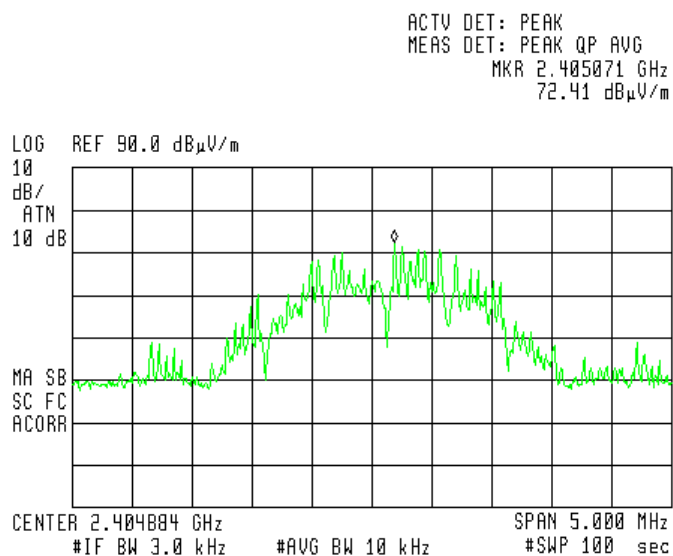


Figure 35 — 2405 MHz

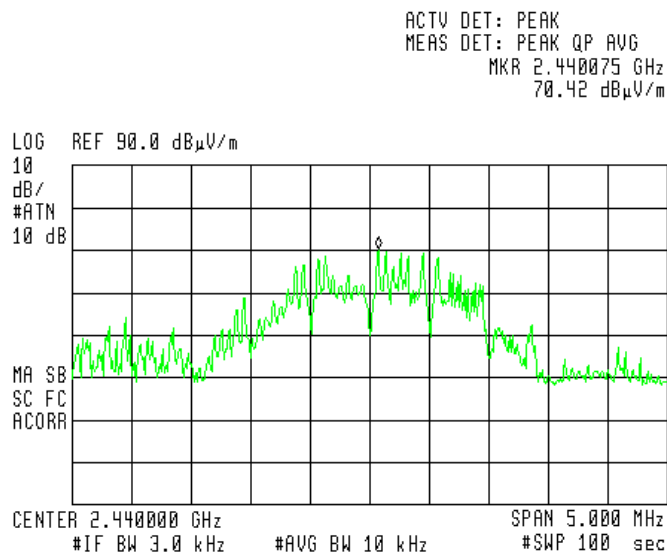


Figure 36 — 2440 MHz

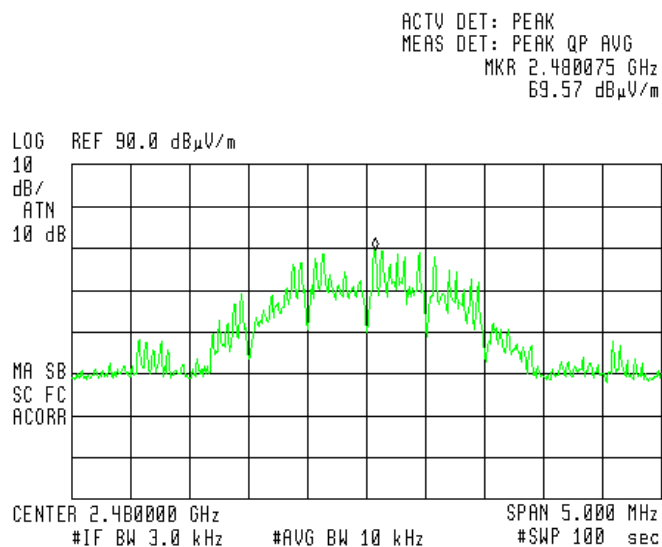


Figure 37 — 2480 MHz

### 13.4 Test Equipment Used.

#### Transmitted Power Density

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 38 Test Equipment Used



## 14. Antenna Gain/Information

The antenna gain is 1.2 dBi simulated.

## 15. R.F Exposure/Safety

The typical placement of the E.U.T. is on a fuel pump nozzle. The typical distance between the E.U.T. and the user in the worst case application, is 0.05 m.

### Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) Requirements

(a) FCC limits at 2440 MHz is:  $1 \frac{mW}{cm^2}$

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

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

P<sub>t</sub>- Transmitted Power 0.025 mW (Calculated P<sub>t</sub> +G<sub>t</sub>)

G<sub>T</sub>- Antenna Gain, 1.2 dBi

R- Distance from Transmitter using 0.05 m worst case

(c) The peak power density is :

$$S_p = \frac{0.025}{4\pi(5)^2} = 7.95 \times 10^{-5} \frac{mW}{cm^2}$$

(d) This is below the FCC limit

## 16. APPENDIX B - CORRECTION FACTORS

### 16.1 Correction factors for CABLE

from EMI receiver  
to test antenna  
at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	7.3
20.0	0.6	1400.0	7.8
30.0	0.8	1600.0	8.4
40.0	0.9	1800.0	9.1
50.0	1.1	2000.0	9.9
60.0	1.2	2300.0	11.2
70.0	1.3	2600.0	12.2
80.0	1.4	2900.0	13.0
90.0	1.6		
100.0	1.7		
150.0	2.0		
200.0	2.3		
250.0	2.7		
300.0	3.1		
350.0	3.4		
400.0	3.7		
450.0	4.0		
500.0	4.3		
600.0	4.7		
700.0	5.3		
800.0	5.9		
900.0	6.3		
1000.0	6.7		

#### NOTES:

1. The cable type is RG-214.
2. The overall length of the cable is 27 meters.
3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".

## 16.2 Correction factors for CABLE

from EMI receiver  
to test antenna  
at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

### NOTES:

1. The cable type is RG-8.
2. The overall length of the cable is 10 meters.

### 16.3 Correction factors for CABLE

from spectrum analyzer  
to test antenna above 2.9 GHz

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

**NOTES:**

1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.
2. The cable is used for measurements above 2.9 GHz.
3. The overall length of the cable is 10 meters.

**12.6 Correction factors for LOG PERIODIC ANTENNA**  
**Type LPD 2010/A**  
**at 3 and 10 meter ranges.**

**Distance of 3 meters**

<b>FREQUENCY</b> (MHz)	<b>AFE</b> (dB/m)
200.0	9.1
250.0	10.2
300.0	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

**Distance of 10 meters**

<b>FREQUENCY</b> (MHz)	<b>AFE</b> (dB/m)
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

**NOTES:**

1. Antenna serial number is 1038.
2. The above lists are located in file number 38M30.ANT for a 3 meter range,  
and file number 38M100.ANT for a 10 meter range.
3. The files mentioned above are located on the disk marked "Radiated Emission  
Test EMI Receiver".



**16.4 Correction factors for LOG PERIODIC ANTENNA**  
**Type SAS-200/511**  
**at 3 meter range.**

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

**NOTES:**

1. Antenna serial number is 253.
2. The above lists are located in file number SAS3M0.ANT for a 3 meter range.
3. The files mentioned above are located on the disk marked "Antenna Factors".

## 16.5 Correction factors for **BICONICAL ANTENNA**

**Type BCD-235/B,  
at 3 meter range**

<b>FREQUENCY</b> (MHz)	<b>AFE</b> (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

### NOTES:

1. Antenna serial number is 1041.
2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".



**16.6 Correction factors for Double-Ridged Waveguide Horn**

**Model: 3115, S/N 29845  
at 3 meter range.**

FREQUENCY	ANTENNA	ANTENN	FREQUENCY	ANTENNA	ANTENNA
(GHz)	FACTOR	A Gain	(GHz)	FACTOR	Gain
	(dB 1/m)	(dBi)		(dB 1/m)	(dBi)
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			



**16.7 Correction factors for**

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

<b>FREQUENCY</b> <b>(GHz)</b>	<b>APE</b> <b>(dB /m)</b>	<b>Gain</b> <b>(dB1)</b>
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



## 16.8 Correction factors for ACTIVE LOOP ANTENNA

**Model 6502**

**S/N 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

## 17. Comparison Industry Canada Requirements With FCC

**FCC ID: W8F800942XXX**

**IC: 8264A-800942XXX**

Test	FCC	IC
<input type="checkbox"/> Radiated Emission	15.209	RSS 210 Issue 8 Clause 2.5
<input type="checkbox"/> Max power / Peak power	15.247(b)(3)	RSS 210 Issue 8 A8.4(4)
<input type="checkbox"/> 6dB BW	15.247(a)2	RSS 210 Issue 8 A8.2a
<input type="checkbox"/> Power density	15.247(e)	RSS 210 Issue 8 A8.2b
<input type="checkbox"/> Spurious radiated emission in the restricted band	15.205(c)	RSS 210 Issue 8 2.5 RSS Gen 7.2.2 (Table 1)
<input type="checkbox"/> Band edge spectrum	15.247(d)	RSS 210 Issue 8 A8.5
<input type="checkbox"/> RF Exposure Limits	1.1307(b)(1)	RSS 102 4.4