

DATE: 13 October 2010

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

FCC Radio Test Report

for

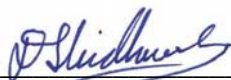
Orpak Systems Ltd.

Equipment under test:

Nozzle Reader

Nozzle Reader-H Orpak

Written by:



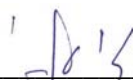
D. Shidlow, Documentation

Approved by:



A. Sharabi, Test Engineer

Approved by:



I. Raz, EMC Laboratory Manager

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This report relates only to items tested.

Measurement/Technical Report for Orpak Systems Ltd.

Nozzle Reader

Nozzle Reader-H Orpak

FCC ID: W8F800939105

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

Equipment type: Part 15 Low Power Transmitter Below 1705 kHz and
Digital Transmission System

Limits used:
47CFR15 Section 15.209, 15.247

Measurement procedure used is ANSI C63.4-2003.

Application for Certification
prepared by:
Ishaishou Raz
ITL (Product Testing) Ltd.
Kfar Bin Nun
D.N. Shimshon 99780
Israel
e-mail Sraz@itl.co.il

Applicant for this device:
(different from "prepared by")
Gideon Segal
Orpak Systems Ltd.
31 Lechi St.
P.O.B. 1461
Bnei-Brak 5114
Israel
Tel: +972- 3 - 577 - 6868
Fax: +972- 6 - 579 - 6310
e-mail: gidi@orpak .com

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1. General Information

1.1 Administrative Information

Manufacturer:	Orpak Systems Ltd.
Manufacturer's Address:	31 Lechi St. Bnei Brak 51114 Israel Tel: +972-3-577-6868 Fax: +972-3-579-6310
Manufacturer's Representative:	Rami Zamir
Equipment Under Test (E.U.T):	Nozzle Reader
Equipment Model No.:	Nozzle Reader-H Orpak
Part No.:	800939100 (See customer's declaration on following page).
Date of Receipt of E.U.T:	13.12.09
Start of Test:	13.12.09
End of Test:	15.12.09
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15 Subpart C

Date: 3 August 2010

DECLARATION

I HEREBY DECLARE THAT THE FOLLOWING PRODUCT(S):

Product P/N	Product Name
800939005	NOZZLE READER UL TYPE-3,ORPAK
800939006	NOZZLE READER UL TYPE-2,ORPAK
800939007	NOZZLE READER UL TYPE-1,ORPAK
800939100	NOZZLE READER-H ORPAK
800939105	NOZZLE READER-H (UL)-ORPAK
800939101	NOZZLE READER-T FOR ORTC
800939106	NOZZLE READER-T (UL)-ORPAK

ARE IDENTICAL ELECTRONICALLY, PHYSICALLY, AND MECHANICALLY TO:

P/N 800939100	Product Name: NOZZLE READER-H ORPAK
---------------	-------------------------------------

Please relate to them all (from an EMC point of view) as the same product.

Thank you,
Signature:



Printed Name: Gidi Segal

Quality Assurance Director
Orpak Systems Ltd.

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.
7. Nemko (Norway), Authorization No. ELA 207.

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 Nozzle Reader 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 Nozzle Reader has only mechanical interface to the nozzle without any wires or electronic interface to the nozzle, dispenser or any other station equipment.

The Nozzle Reader reads (Frequency: 125 kHz) the vehicle information from the RFID FuelOpass and transmits (Frequency: 2.405-2.485 GHz) it to the WGT over wireless channel.

The difference between the models is minor differences in the plastic enclosure. All hardware and software is identical.

1.4 *Test Methodology*

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 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 September 03, 2009).

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

1.6 *Measurement Uncertainty*

Radiated Emission

The Open Site complies with the ± 4 dB Normalized Site Attenuation requirements of ANSI C63.4-2003. In accordance with Paragraph 5.4.6.1 of this standard, this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.

2. System Test Configuration

2.1 *Justification*

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

After locking the operating frequency of the nozzle, the laptop was disconnected.

2.2 *EUT Exercise Software*

Commands were sent via hyper terminal to the Vbis 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 Vbis 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

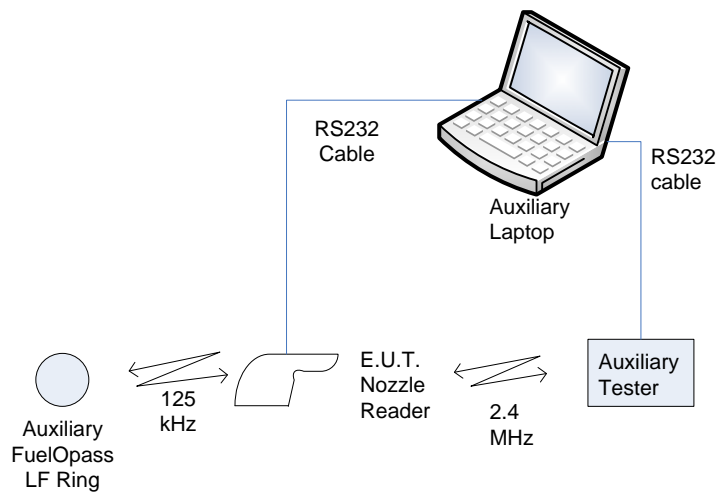


Figure 1. Configuration of Tested System

3. Test Setup Photograph



Figure 2. 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 20.73 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 3.

TEST PERSONNEL:

Tester Signature:  Date: 14.10.10

Typed/Printed Name: A. Sharabi

Field Strength of Fundamental

E.U.T Description Nozzle Reader
 Model Number Nozzle Reader-H Orpak
 Part Number: 800939100

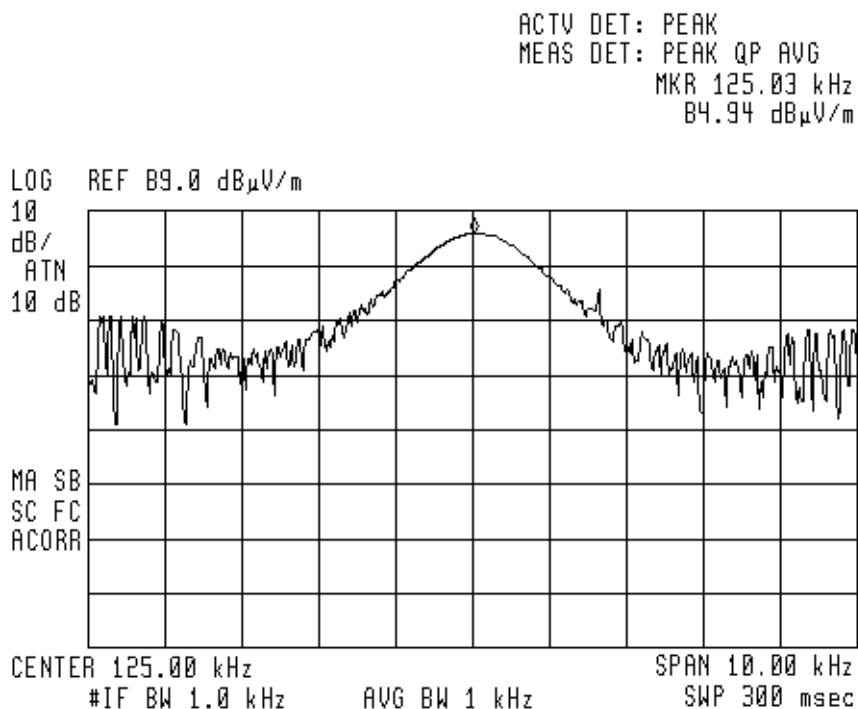


Figure 3. Field Strength of Fundamental
Detector: Peak

$$\begin{aligned}
 L_{im300m} &= 25.67 \text{ dB}\mu\text{V/m} \\
 L_{im3m} &= 25.67 \text{ dB}\mu\text{V/m} + 80.0 \text{ dB}\mu\text{V/m} = 105.67 \text{ dB}\mu\text{V/m}
 \end{aligned}$$

4.4 Test Instrumentation Used, Field Strength of Fundamental

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	November 10, 2009	1 year
EMI Receiver Filter Section	HP	85420E	3427A00103	November 10, 2009	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2009	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 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 operated at the frequency of 125 kHz. This frequency was measured using a peak detector.

5.3 Test Results

JUDGEMENT: Passed by 33.57 dB

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

The margin between the emission levels and the specification limit is 33.57 dB.

TEST PERSONNEL:

Tester Signature: 

Date: 14.10.10

Typed/Printed Name: A. Sharabi

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

E.U.T Description Nozzle Reader
Model Number Nozzle Reader-H Orpak
Part Number: 800939100

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 μ V/m)	Average Factor (dB)	Average Result (dB μ V/m)	Average Specification (dB μ V/m)	Margin (dB)
0.125	84.94	-12.84	72.1	105.67	-33.57
0.130	65.15	-12.84	52.3	105.33	-53.03
0.375	57.15	-12.84	44.3	96.12	-51.82

Figure 4. 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.

“Peak Reading” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss

Average Factor = $20\log(22.798/100) = -12.84$ dB

Average Result = Peak Reading + Average Factor



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRA 11.027 msec
1.49 dB

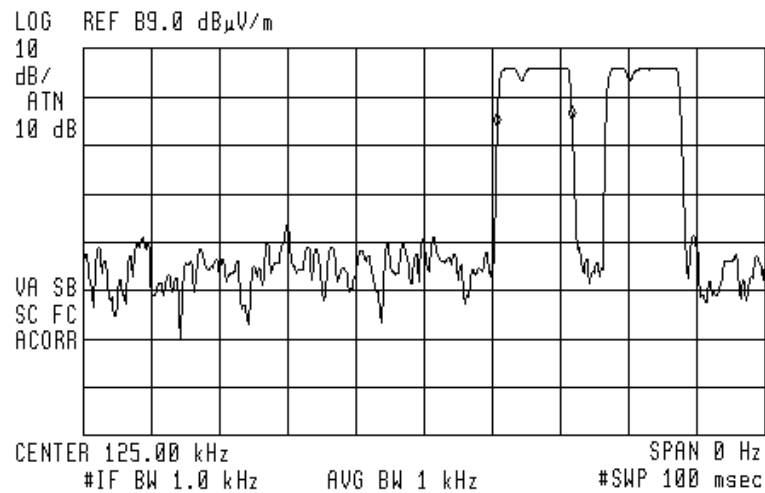


Figure 5. Transmitter “On” Time During 100 milliseconds



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRA 11.528 msec
.11 dB

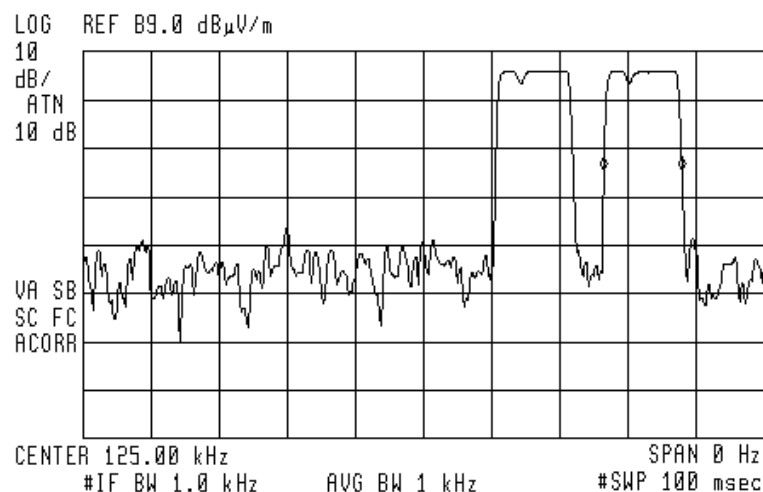


Figure 6. Transmitter “On” Time During 100 milliseconds

5.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 10, 2009	1 year
RF Section	HP	85420E	3705A00248	November 10, 2009	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2009	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 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 dB μ V (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dB μ V

No external pre-amplifiers are used.

6. 6dB Minimum Bandwidth

6.1 Test Specification

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

6.2 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 30 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)).

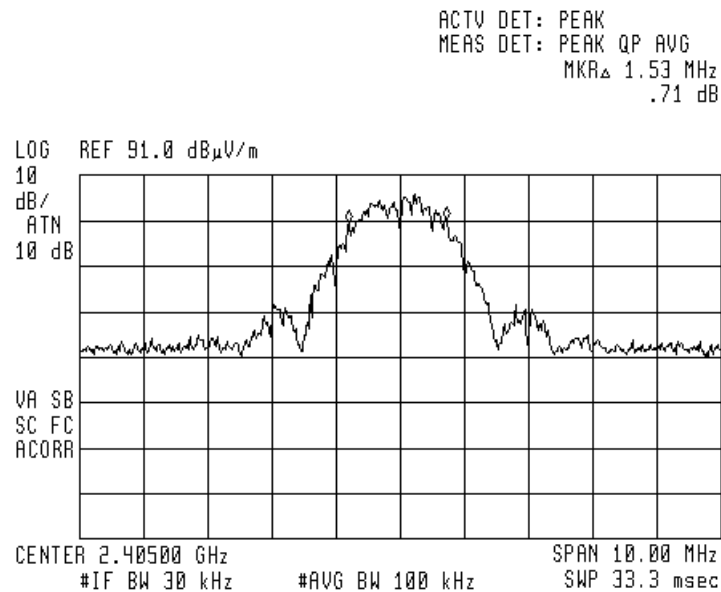


Figure 7. 2405 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR Δ 1.35 MHz
-1.05 dB

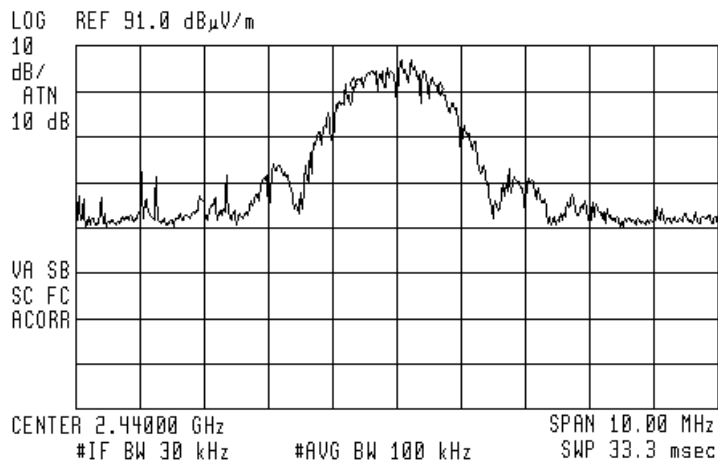


Figure 8. 2440 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR Δ 1.40 MHz
-.61 dB

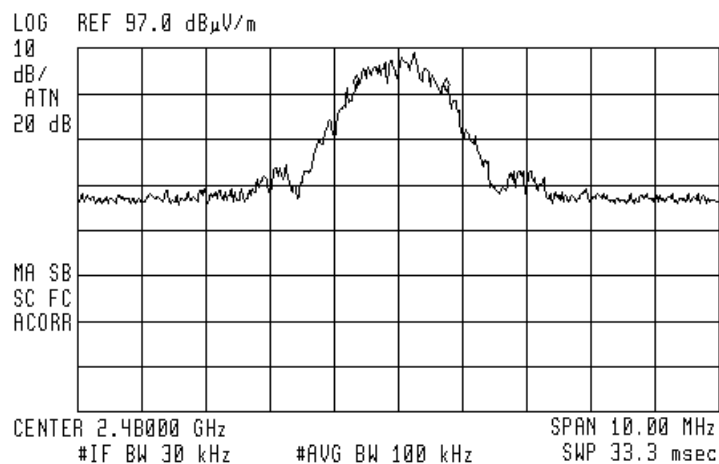


Figure 9. 2480 MHz

6.3 Test Results

E.U.T Description: Nozzle Reader

Model: Nozzle Reader-H Orpak

Serial Number: 800939100

Operation Frequency (MHz)	Bandwidth Reading (MHz)	Specification (MHz)
2405	1.53	>0.5
2440	1.35	>0.5
2480	1.40	>0.5

Figure 10 Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____

Date: 14.10.10

Typed/Printed Name: A. Sharabi

6.4 Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 10, 2009	1 year
RF Section	HP	85420E	3705A00248	November 10, 2009	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 29, 2009	2 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 11 Test Equipment Used

7. 26dB 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 30kHz 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)).

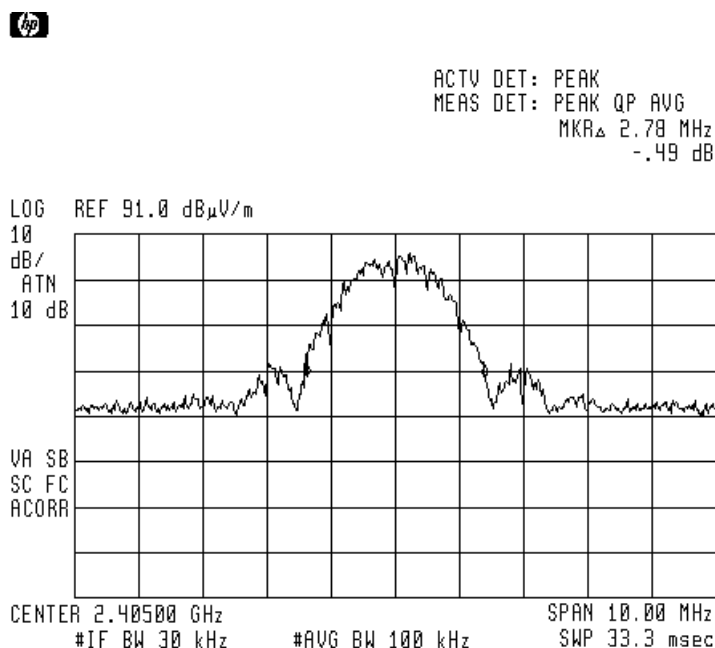


Figure 12. 2405 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 2.00 MHz
-.93 dB

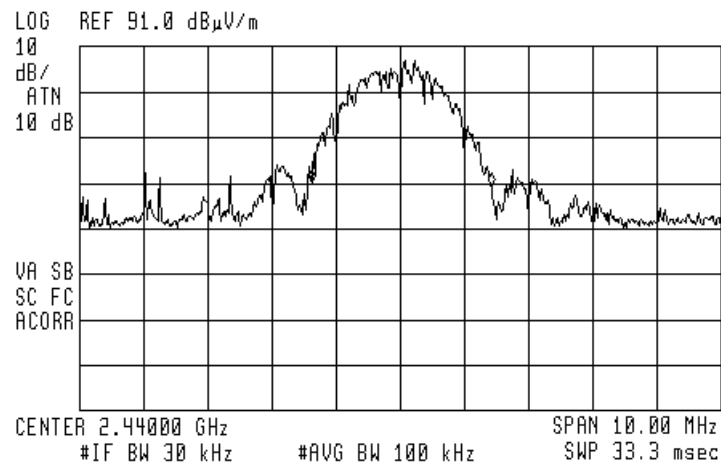


Figure 13. 2440 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 2.00 MHz
.36 dB

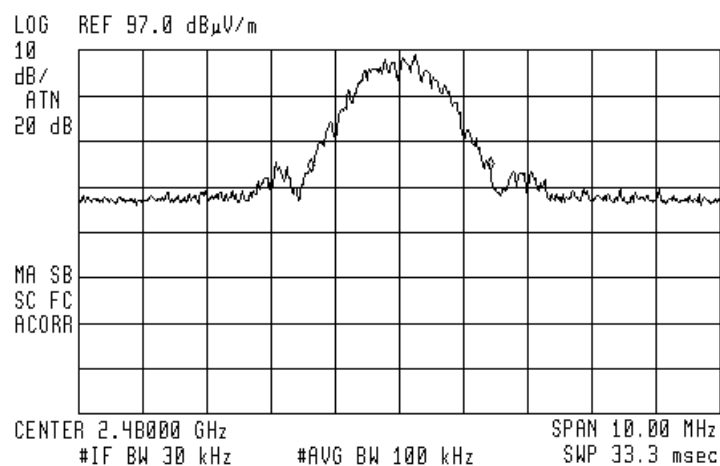


Figure 14. 2480 MHz

7.3 Test Results

E.U.T Description: Nozzle Reader

Model: Nozzle Reader-H Orpak

Serial Number: 800939100

Operation Frequency (MHz)	Bandwidth Reading (MHz)
2405	2.78
2440	2.80
2480	2.80

Figure 15 Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____

Date: 14.10.10

Typed/Printed Name: A. Sharabi

7.4 Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 10, 2009	1 year
RF Section	HP	85420E	3705A00248	November 10, 2009	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 29, 2009	2 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 16 Test Equipment Used

8. Radiated Power Output

8.1 Test Specification

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

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 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)).

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 with QPSK modulation.

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.404513 GHz
100.61 dB μ V/m

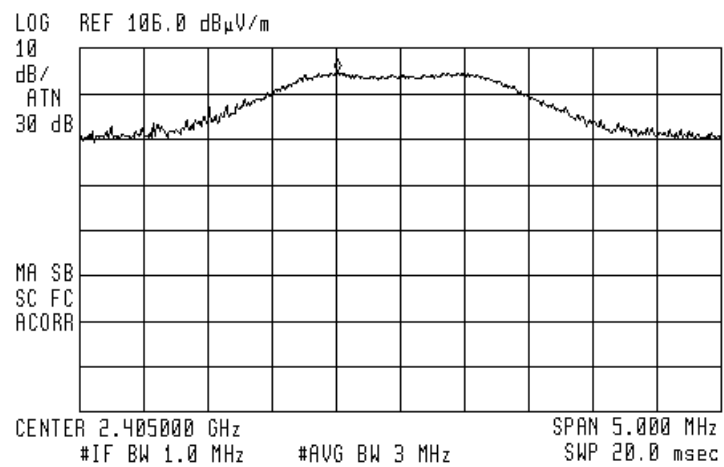


Figure 17 2405.00 MHz

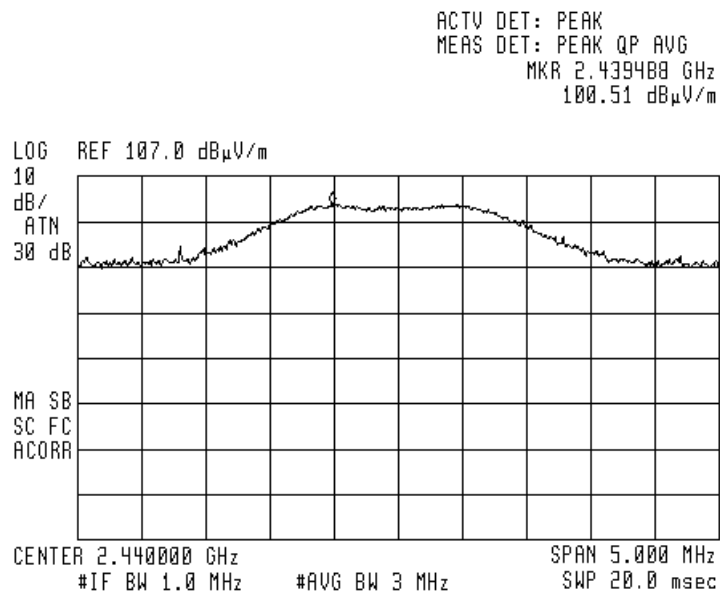


Figure 18 2440.00 MHz

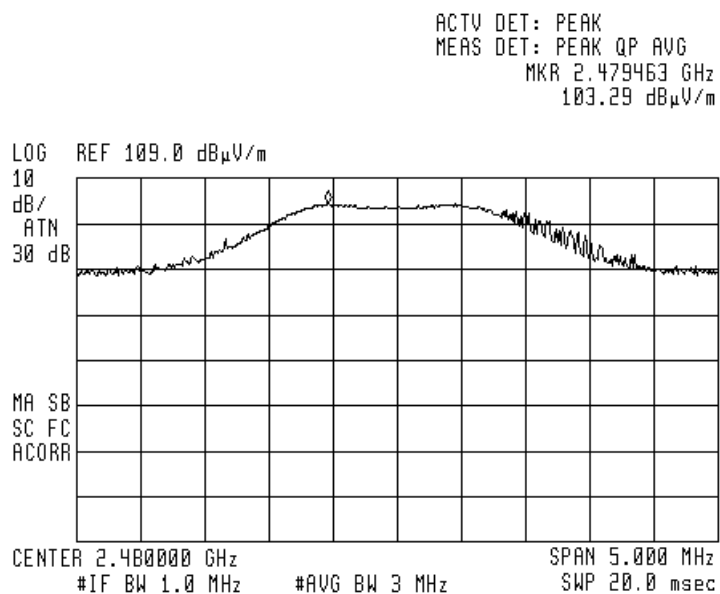


Figure 19 2480.00 MHz

8.3 Test Results Calculation

E.U.T. Description: Nozzle Reader
Model No.: Nozzle Reader-H Orpak
Serial Number: 800939100
Specification: F.C.C. Part 15, Subpart C

Frequency	E	E	Antenna Gain	Antenna Distance	Calculated Results	Limit	Margin
(MHz)	(dBμV/m)	(V/m)	(dBi)	(m)	(mW)	(W)	(mW)
2405.00	100.61	0.11	0	3	3.63	1	996.37
2440.00	100.51	0.11	0	3	3.63	1	996.37
2480.00	103.29	0.15	0	3	6.75	1	993.25

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 14.10.10

Typed/Printed Name: A. Sharabi

8.4 Test Equipment Used.

Radiated Maximum Power Output

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3906A00276	November 10, 2009	1 year
RF Section	HP	85420E	3705A00248	November 10, 2009	1 year
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 29, 2009	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. Band Edge

[In Accordance with section 15.247(d)]

9.1 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 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)).

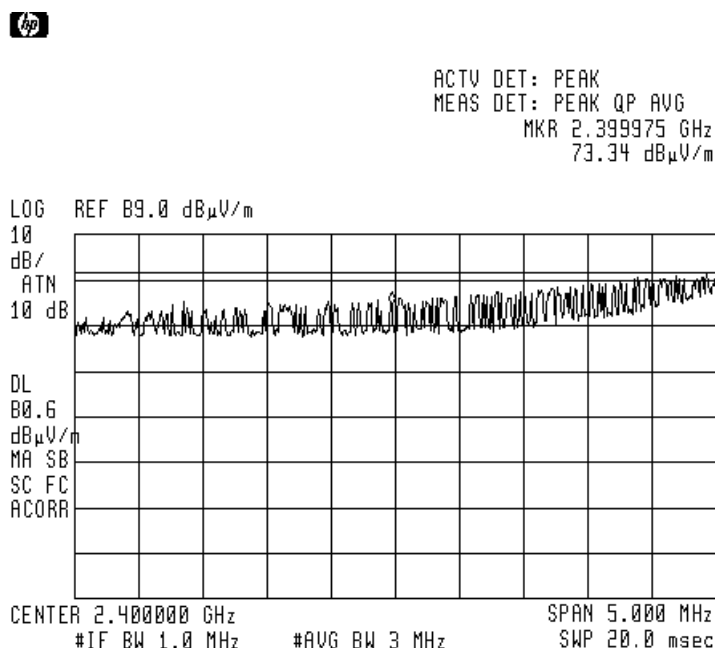


Figure 21 — 2405.00 MHz



ACTV DET: PEAK
 MEAS DET: PEAK QP AVG
 MKR 2.484060 GHz
 58.26 dB μ V/m

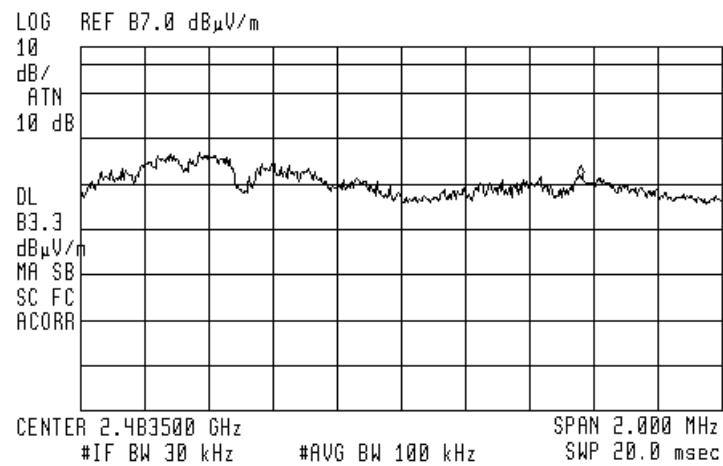


Figure 22 — 2480 MHz

9.2 Test Results

E.U.T. Description: Nozzle Reader

Model No.: Nozzle Reader-H Orpak

Serial Number: 800939100

Specification: F.C.C. Part 15, Subpart C (15.247 (d))

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Specification (dBc)	Margin (dB)
2405.00	2399.975	73.34	-20.0	-53.34
2480.00	2484.060	58.26	-20.0	-38.26

Figure 23 Band Edge

JUDGEMENT: Passed by -38.26 dB

TEST PERSONNEL:

Tester Signature: 

Date: 14.10.10

Typed/Printed Name: A. Sharabi

9.3 Test Equipment Used.

Band edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3906A00276	November 10, 2009	1 year
RF Section	HP	85420E	3705A00248	November 10, 2009	1 year
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 29, 2009	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 24 Test Equipment Used

10. Radiated Emission, 9 kHz – 30 MHz

10.1 Test Specification

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

10.2 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 1.

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)).

10.3 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: 14.10.10

Typed/Printed Name: A. Sharabi

10.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 10, 2009	1 year
RF Section	HP	85420E	3705A00248	November 10, 2009	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2009	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

10.5 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 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 dB μ V (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dB μ V

No external pre-amplifiers are used.

11. **Spurious Radiated Emission** **30 MHz – 25.0 GHz**

11.1 **Test Specification**

30 MHz-25.0 GHz, F.C.C., Part 15, Subpart C

11.2 **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 frequency range 30 MHz – 25.0 GHz 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.

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)).

11.3 Test Results

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification. The results for all three operation channels were the same.

The signals in the band 30 MHz – 1.0 GHz were below the spectrum analyzer noise level, at least 20 dB below the specification limit.

For the operation channel 11 (2.405 GHz), the margin between the emission level and the specification limit is 5.7 dB in the worst case at the frequency of 4810.00 MHz, horizontal polarization.

For the operation channel 18 (2.440 GHz), the margin between the emission level and the specification limit is 5.1 dB in the worst case at the frequency of 4880.00 MHz, vertical polarization.

For the operation channel 26 (2.480 GHz), the margin between the emission level and the specification limit is 2.9 dB in the worst case at the frequency of 4960.00 MHz, vertical polarization.

JUDGEMENT: Passed by 2.9 dB

TEST PERSONNEL:

Tester Signature: 

Date: 14.10.10

Typed/Printed Name: A. Sharabi

Radiated Emission 30 MHz- 25.0 GHz

E.U.T Description Nozzle Reader
Type Nozzle Reader-H Orpak
Serial Number: 800939100

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	Freq.	Polarity	Peak Reading*	Peak. Specification	Peak. Margin
(MHz)	(MHz)	(H/V)	(dB μ V/m)	(dB μ V/m)	(dB)
2405.00	2390.00	H	53.9	74.0	-20.1
2405.00	2390.00	V	52.8	74.0	-21.2
2405.00	4810.00	H	68.3	74.0	-5.7
2405.00	4810.00	V	67.8	74.0	-6.2
2440.00	4880.00	H	67.8	74.0	-6.2
2440.00	4880.00	V	68.9	74.0	-5.1
2480.00	2483.50	H	53.5	74.0	-20.5
2480.00	2483.50	V	54.7	74.0	-19.3
2480.00	4960.00	H	69.9	74.0	-4.1
2480.00	4960.00	V	71.1	74.0	-2.9

**Figure 25. 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 Above 1 GHz

E.U.T Description Nozzle Reader
Type Nozzle Reader-H Orpak
Serial Number: 800939100

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Test Distance: 3 meters

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Operation Frequency	Freq.	Polarity	Average Reading*	Average Specification	Average Margin
(MHz)	(MHz)	(H/V)	(dB μ V/m)	(dB μ V/m)	(dB)
2405.00	2390.00	H	40.2	54.0	-13.8
2405.00	2390.00	V	40.4	54.0	-13.6
2405.00	4810.00	H	41.8	54.0	-12.2
2405.00	4810.00	V	41.5	54.0	-12.5
2440.00	4880.00	H	43.3	54.0	-10.7
2440.00	4880.00	V	43.5	54.0	-10.5
2480.00	2483.50	H	43.9	54.0	-10.1
2480.00	2483.50	V	45.0	54.0	-9.0
2480.00	4960.00	H	43.5	54.0	-10.5
2480.00	4960.00	V	43.4	54.0	-10.6

**Figure 26. 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 Reading" includes correction factor.

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

11.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 10, 2009	1 year
RF Section	HP	85420E	3705A00248	November 10, 2009	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	August 3, 2009	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 26, 2009	1 year
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 16, 2008	2 Years
Horn Antenna	ARA	SWH-28	1008	December 23, 2008	2 Years
Horn Antenna	Narda	V637	0410	December 23, 2008	2 Years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS- 0411N313	013	January 7, 2009	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	January 9, 2009	1 Year
Low Noise Amplifier	MK Milliwave	MKT6-3000 4000-30-13P	A0399	January 15, 2009	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	December 15, 2009	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

12. Radiated Power Spectral Density

[In accordance with section 15.247(d)]

12.1 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:

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

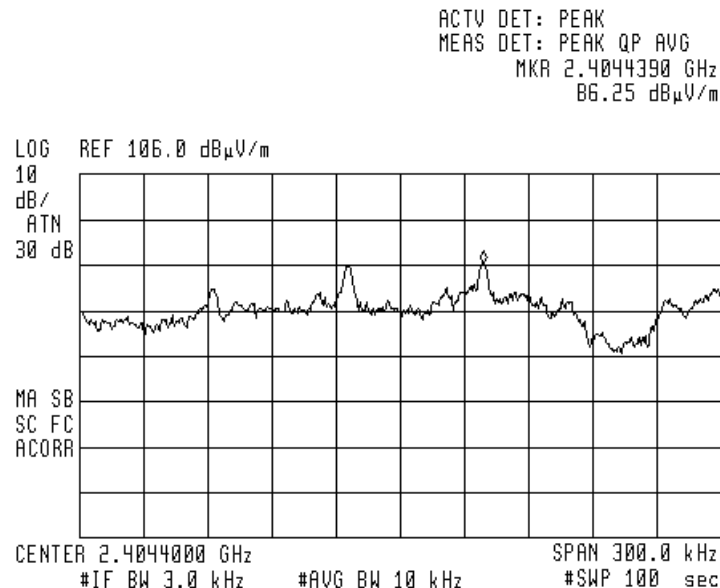


Figure 27 — 2405.00 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.4396255 GHz
88.10 dB μ V/m

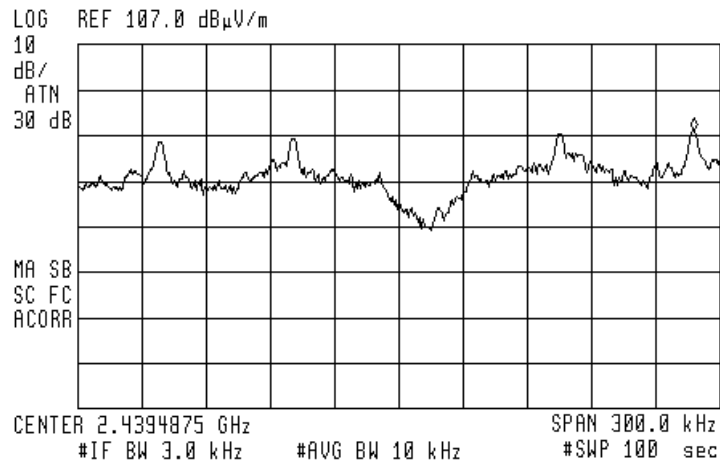


Figure 28 — 2440.00 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.4795645 GHz
90.34 dB μ V/m

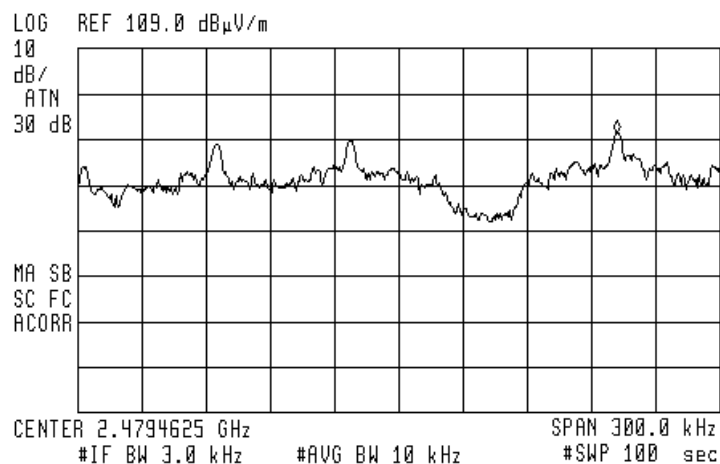


Figure 29 — 2480.00 MHz

12.2 Test Results

E.U.T. Description: Nozzle Reader
 Model No.: Nozzle Reader-H Orpak
 Serial Number: 800939100
 Specification: F.C.C. Part 15, Subpart C (15.247(d))

Frequency	E	Spectral Density Result	Antenna Gain	Antenna Distance	Calculated Results	Spec.	Margi n
(MHz)	(db μ V/m)	(V/m)	(dBi)	(m)	(mW)	(mW)	(mW)
2405	86.25	0.02	0	3	0.12	6.3	-6.18
2440	88.10	0.03	0	3	0.27	6.3	-6.03
2480	90.34	0.03	0	3	0.27	6.3	-6.03

Figure 30 Test Results

JUDGEMENT: Passed by 6.03 mW

TEST PERSONNEL:

Tester Signature: _____

Date: 14.10.10

Typed/Printed Name: A. Sharabi

12.3 Test Equipment Used.

Transmitted Power Density

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 10, 2009	1 year
RF Section	HP	85420E	3705A00248	November 10, 2009	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 29, 2009	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 31 Test Equipment Used

13. Antenna Gain/Information

The antenna gain is 0 dBi simulated.

14. APPENDIX B - CORRECTION FACTORS

14.1 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".

14.2 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.

14.3 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.

14.4 Correction factors for LOG PERIODIC ANTENNA

Type LPD 2010/A
at 3 and 10 meter ranges.

Distance of 3 meters

FREQUENCY (MHz)	AFE (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

FREQUENCY (MHz)	AFE (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".

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

FREQUENCY	ANTENNA FACTOR
(GHz)	(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	ANTENNA FACTOR
(GHz)	(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".

14.6 Correction factors for **BICONICAL ANTENNA**

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

FREQUENCY (MHz)	AFE (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".

14.7 Correction factors for Double-Ridged Waveguide Horn

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

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (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			

14.8 Correction factors for

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

FREQUENCY (GHz)	APE (dB /m)	Gain (dBi)
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

14.9 Correction factors for

Horn Antenna Model: V637

FREQUENCY (GHz)	APE (dB /m)	Gain (dB1)
26.0	43.6	14.9
27.0	43.7	15.1
28.0	43.8	15.3
29.0	43.9	15.5
30.0	43.9	15.8
31.0	44.0	16.0
32.0	44.1	16.2
33.0	44.1	16.4
34.0	44.1	16.7
35.0	44.2	16.9
36.0	44.2	17.1
37.0	44.2	17.4
38.0	44.2	17.6
39.0	44.2	17.8
40.0	44.2	18.0

14.10 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