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ACCREDITED
TESTING Cert No.1152.01

DATE: 22 September 2013

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

FCC Radio Test Report

for

OrCam Technologies Ltd.

Equipment under test:

Image Processing Vision System

ORC0011013

Written by: _____
R. Pinchuck, Documentation

Approved by: _____
A. Sharabi, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

See Customer's Declaration on Page 6.

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TESTING Cert No.1152.01

Measurement/Technical Report for

OrCam Technologies Ltd.

Image Processing Vision System

ORC0011013

FCC ID: 2AAWI00113

This report concerns:	Original Grant:	X
	Class I Change:	
	Class II Change:	
Equipment type:	Spread Spectrum Transmitter	
Limits used:	47CFR15 Section 15.247	

Measurement procedure used is DA 00-705 and 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")
Erez Naaman
13 Hartom Street
Jerusalem, 91450
Israel
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Fax: +972-2-586-0121
e-mail: erez.naaman@orcam.com

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1. General Information

1.1 Administrative Information

Manufacturer:	OrCam Technologies Ltd.
Manufacturer's Address:	13 Hartom St., Jerusalem, 91450 Israel Tel: +972-2-591-7805 Fax: +972-2-586-0121
Manufacturer's Representative:	Erez Naaman
Equipment Under Test (E.U.T):	Image Processing Vision System
Equipment Model No.:	ORC0011013
Equipment Serial No.:	OB014
Date of Receipt of E.U.T:	04.08.2013
Start of Test:	04.08.2013
End of Test:	08.08.2013
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15 Sub-part C

Date 15.9.13

DECLARATION

I hereby declare that the name, model, and serial number of the E.U.T. tested at the I.T.L. EMC laboratory between August 4, 2013 and August 8, 2013 is as follows:

E.U.T. Name:	Image Processing Vision System
Model Name:	ORC0011013
Serial Number:	OB014

Please use the above names and serial number in the test report and certificate.

Thank you,

Signature: _____
Printed Name: EREZ NAAMAN
Title: VP of Engineering and Business Development

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 OrCam ORC0011013 is an assistance device for the visually impaired. It is comprised of two units connected by a shielded cable. The head unit includes a camera with sLVDS output, a microphone and a bone conduction head phone. The base unit includes a quadcore 1.2 GHz processor and LPDDR2 at 533 MHz. The outside connections are USB2, Bluetooth, a custom connector for possible addons in the future and a power jack. The unit comes with a 2A 5V power supply.

The Bluetooth is used for one of two functions: 1. Sending audio to hearing aids that support Bluetooth. 2. Sending and receiving information from a cell phone – such as GPS data or results of our OCR.
The Bluetooth is discoverable whenever the device is on.
The data rate is up to 700 Kb/sec.

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in DA 00-705 and 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 November 21, 2012).
I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

Conducted Emission

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) 0.15 – 30 MHz:

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

± 3.6 dB

Note: See ITL Procedure No. PM 198.

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):

± 5.2 dB

Note: See ITL Procedure No. PM 198.

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

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 needed in order to achieve compliance

2.5 Configuration of Tested System

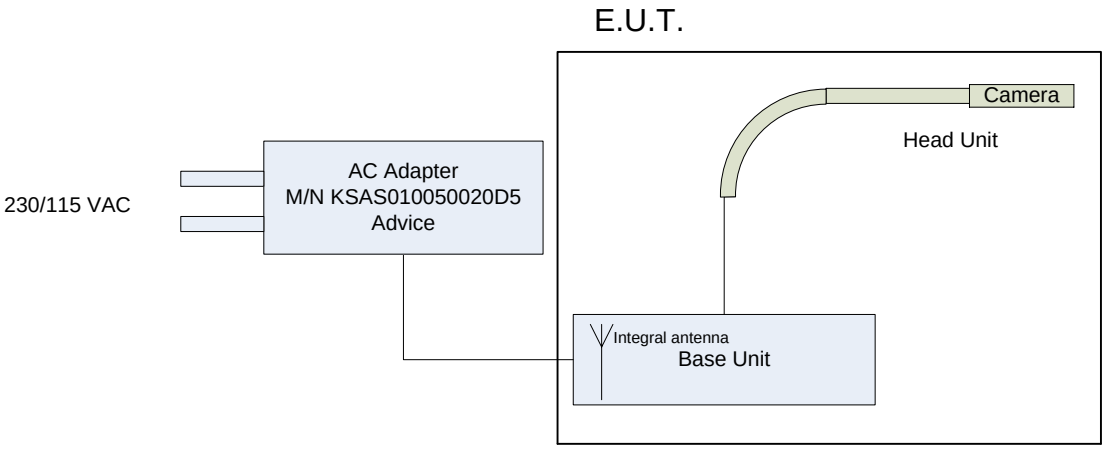

Figure 1. Configuration of Tested System

3. Conducted and Radiated Measurement Test Set-up Photo

Figure 2. Conducted Emission Test

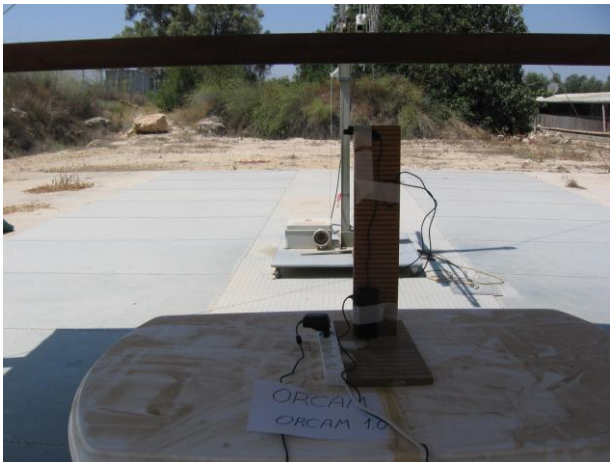

Figure 3. Radiated Emission Test

Figure 4. Radiated Emission Test

Figure 5. Radiated Emission Test

Figure 6. Radiated Emission Test

Figure 7. Radiated Emission Test

4. Conducted Emission Data

4.1 Test Specification

F.C.C., Part 15, Subpart C

4.2 Test Procedure

The E.U.T operation mode and test set-up are as described in Section 3. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room, with the E.U.T placed on a 0.8 meter high wooden table, 0.4 meter from the room's vertical wall.

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

The center of the E.U.T AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver via a 3.5" floppy disk and are displayed on the receiver's spectrum display.

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

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

4.3 Measured Data

JUDGEMENT: Passed by 11.58 dB

The margin between the emission levels and the specification limit is, in the worst case, 11.96 dB for the phase line at 0.194 MHz and 11.58 dB at 0.194 MHz for the neutral line.

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

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

TEST PERSONNEL:

Tester Signature: _____ Date: 17.09.13

Typed/Printed Name: A. Sharabi

Conducted Emission

E.U.T Description	Image Processing Vision System
Type	ORC0011013
Serial Number:	OB014

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

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	150 kHz	35.96	-30.03
1	Quasi Peak	190 kHz	50.74	-13.29
2	Average	194 kHz	41.90	-11.96
1	Quasi Peak	226 kHz	29.10	-33.48
2	Average	254 kHz	35.74	-15.88
1	Quasi Peak	258 kHz	46.57	-14.92
1	Quasi Peak	318 kHz	37.25	-22.50
2	Average	318 kHz	25.44	-24.31
1	Quasi Peak	374 kHz	38.59	-19.81
2	Average	382 kHz	26.09	-22.14
2	Average	3.33 MHz	21.88	-24.11
2	Average	5.494 MHz	21.44	-28.55
2	Average	8.886 MHz	21.12	-28.87
2	Average	15.406 MHz	20.13	-29.86
1	Quasi Peak	23.05 MHz	30.93	-29.06
2	Average	24.014 MHz	23.52	-26.48
1	Quasi Peak	25.586 MHz	27.29	-32.70
1	Quasi Peak	25.978 MHz	26.70	-33.30
1	Quasi Peak	26.17 MHz	26.39	-33.60
2	Average	27.734 MHz	21.10	-28.89

Date: 24.JUL.2013 12:36:24

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

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

Conducted Emission

E.U.T Description	Image Processing Vision System
Type	ORC0011013
Serial Number:	OB014

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

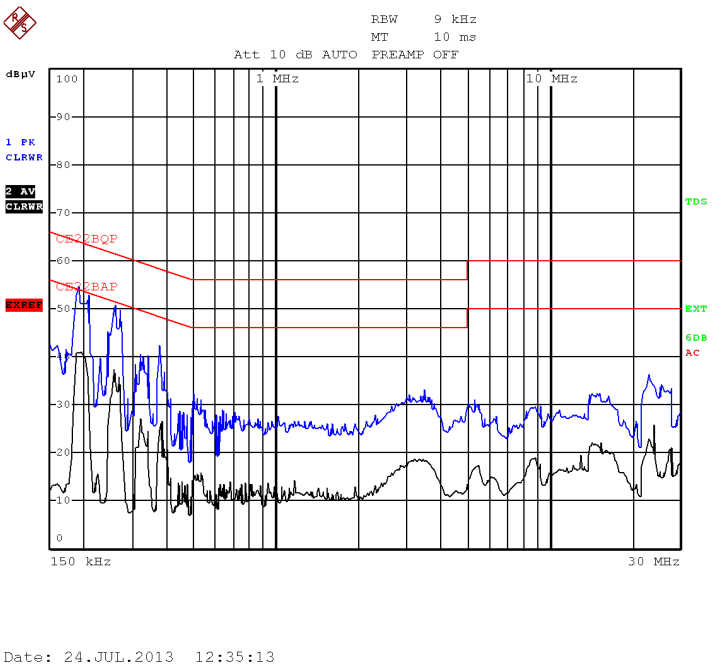

Figure 9. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description	Image Processing Vision System
Type	ORC0011013
Serial Number:	OB014

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

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

TRACE		FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	190 kHz	51.33	-12.69
2	Average	194 kHz	42.28	-11.58
1	Quasi Peak	266 kHz	47.09	-14.14
2	Average	266 kHz	36.37	-14.87
2	Average	314 kHz	26.54	-23.32
1	Quasi Peak	330 kHz	36.92	-22.52
2	Average	378 kHz	27.71	-20.60
1	Quasi Peak	394 kHz	38.80	-19.17
1	Quasi Peak	442 kHz	31.14	-25.88
1	Quasi Peak	502 kHz	33.58	-22.41
2	Average	502 kHz	20.38	-25.61
1	Quasi Peak	566 kHz	30.96	-25.03
2	Average	746 kHz	18.26	-27.73
1	Quasi Peak	1.07 MHz	30.90	-25.09
1	Quasi Peak	3.154 MHz	31.43	-24.56
2	Average	3.386 MHz	20.93	-25.06
1	Quasi Peak	5.094 MHz	27.81	-32.18
2	Average	13.002 MHz	24.81	-25.18
2	Average	24.014 MHz	22.94	-27.05
2	Average	24.034 MHz	21.31	-28.68

Date: 24.JUL.2013 12:41:35

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

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

Conducted Emission

E.U.T Description	Image Processing Vision System
Type	ORC0011013
Serial Number:	OB014

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

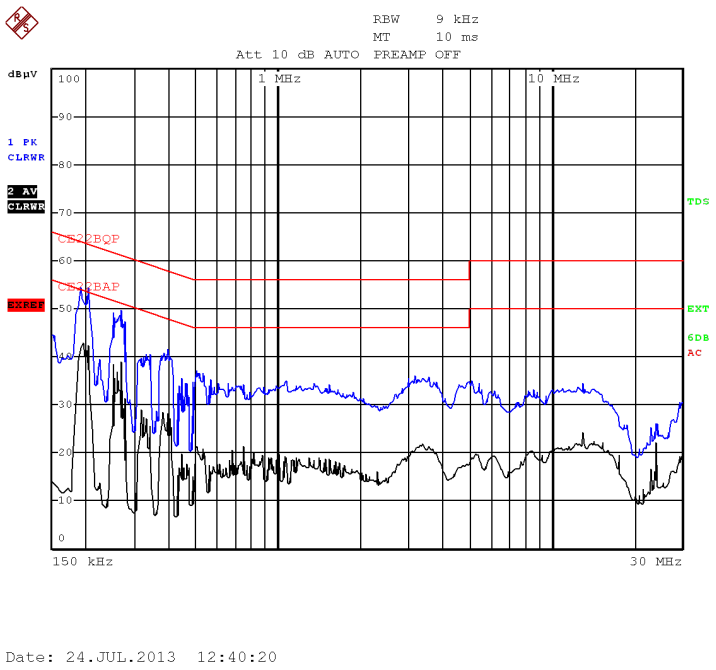

Figure 11 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak, Average

4.4 Test Instrumentation Used, Conducted Measurement

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
LISN	EMCO	3810/2BR	1297	December 16, 2012	1 Year
Transient Limiter	HP	11947A	3107A03041	February 25, 2013	1Year
EMI Receiver	Rohde & Schwarz	ESCI7	100724	December 27, 2012	1Year

5. 6dB Minimum Bandwidth

5.1 Test Specification

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

5.2 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 frequencies: Low, Mid and High.

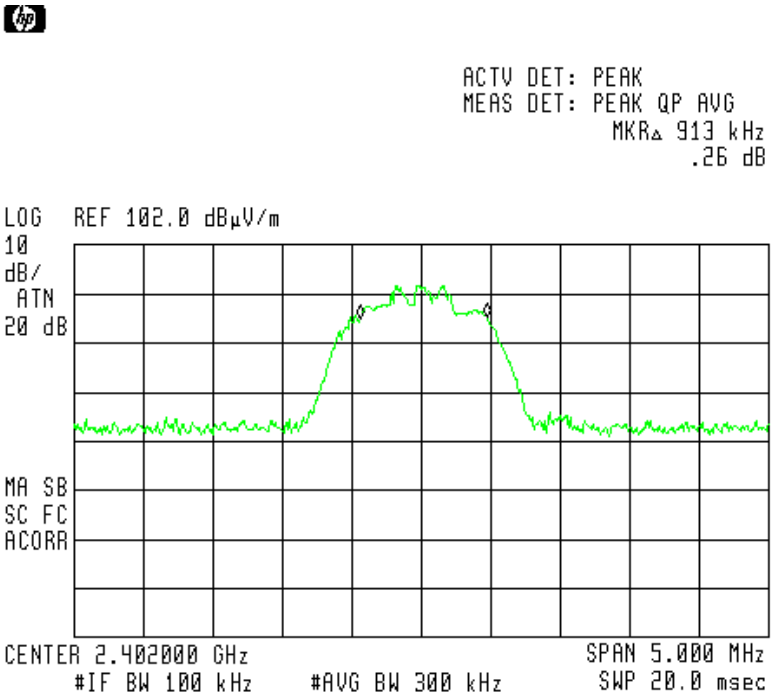

Figure 12. Low Channel

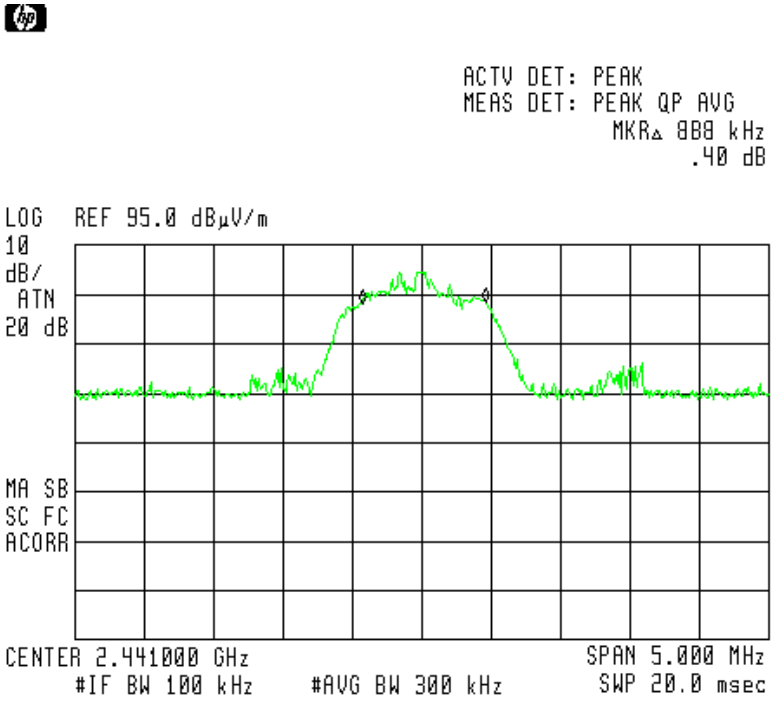

Figure 13. Mid Channel

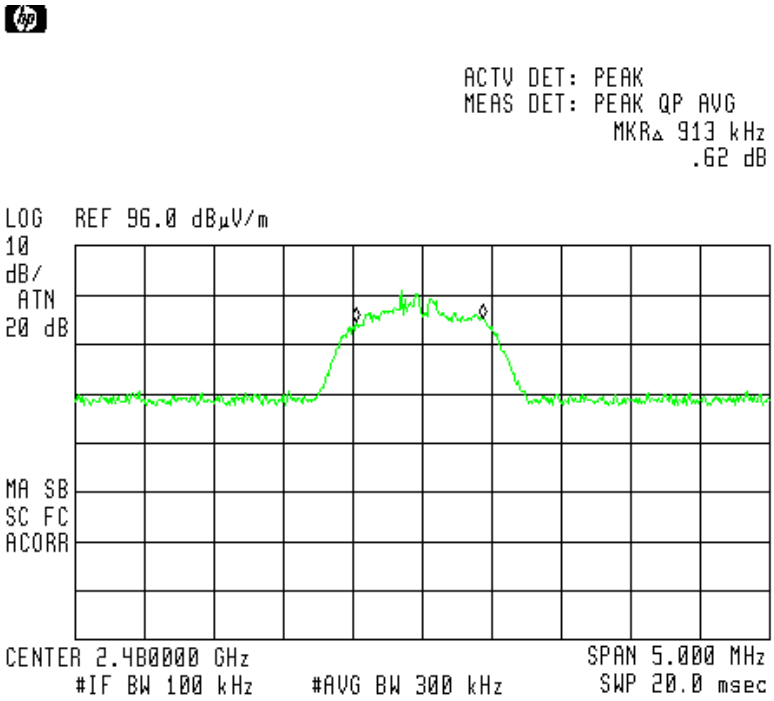

Figure 14. High Channel

5.3 Test Results

E.U.T Description: Image Processing Vision System
Model: ORC0011013
Serial Number: OB014

Operation Frequency (MHz)	Bandwidth Reading (MHz)	Specification (MHz)
2402.00	0.913	>0.5
2441.00	0.888	>0.5
2488.00	0.913	>0.5

Figure 15 Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 17.09.13

Typed/Printed Name: A. Sharabi

5.4 Test Equipment Used. 6dB 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 16 Test Equipment Used

6. 26dB 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 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 frequencies: Low, Mid and High

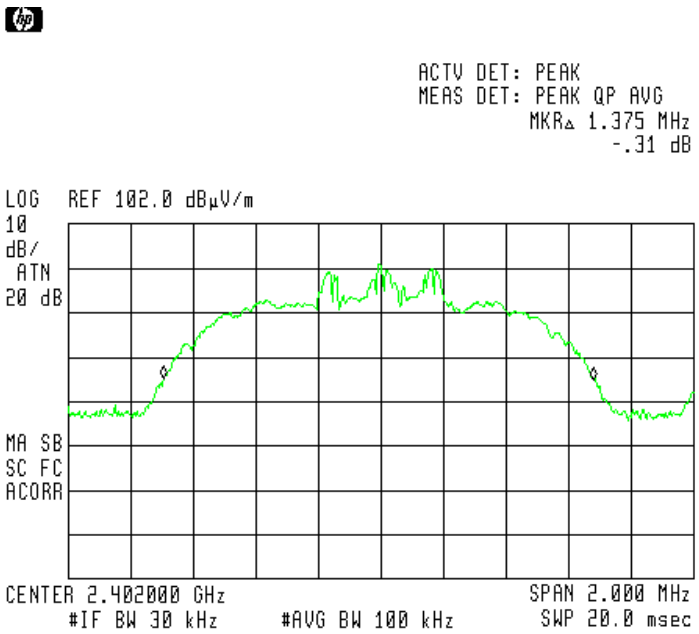

Figure 17. Low Channel

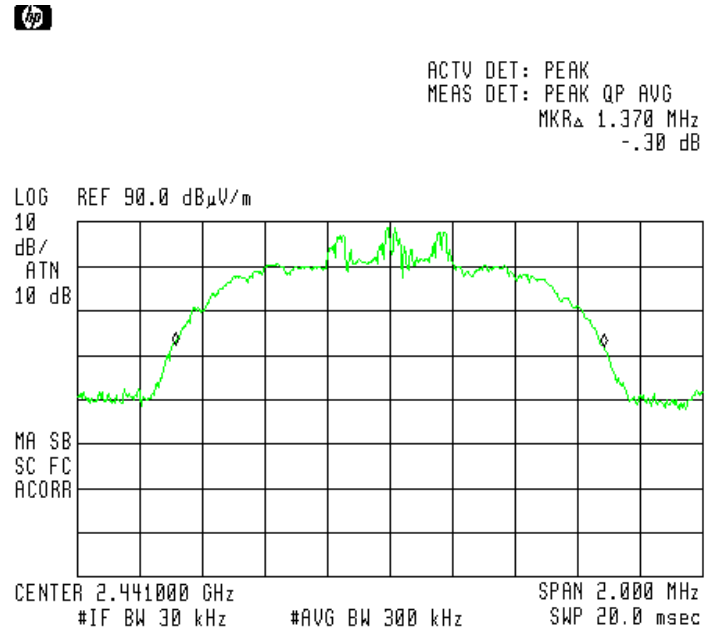

Figure 18. Mid Channel

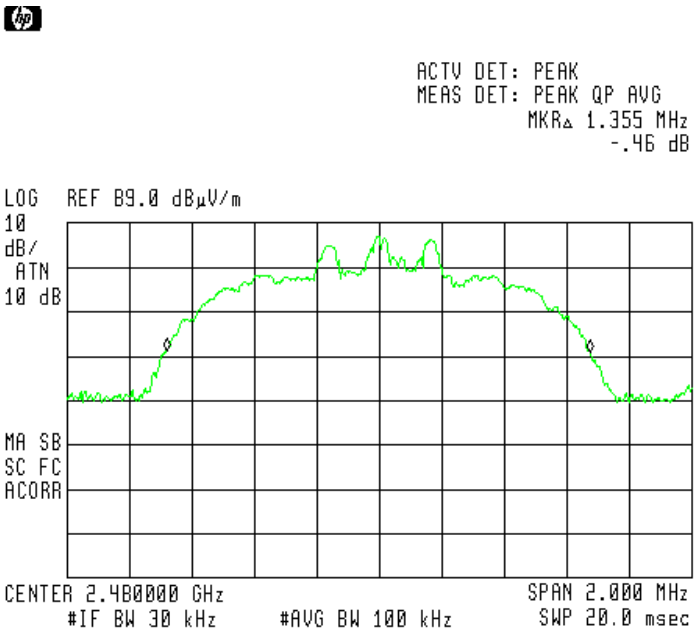

Figure 19. High Channel

6.3 Test Results

E.U.T Description: Image Processing Vision System
Model: ORC0011013
Serial Number: OB014

Operation Frequency (MHz)	Bandwidth Reading (MHz)
2402.00	1.375
2441.00	1.370
2480.00	1.355

Figure 20 Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 17.09.13

Typed/Printed Name: A. Sharabi

6.4 Test Equipment Used.

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 21 Test Equipment Used

7. 20dB Bandwidth

7.1 Test Specification

Specification: FCC Part 15, Subpart C (15.247-a2)

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 frequencies : Low, Middle and High.

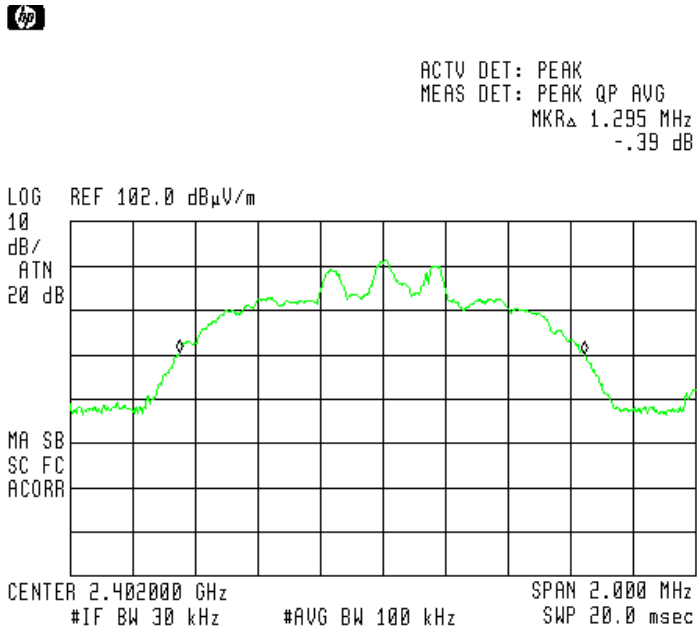

Figure 22. Low Channel

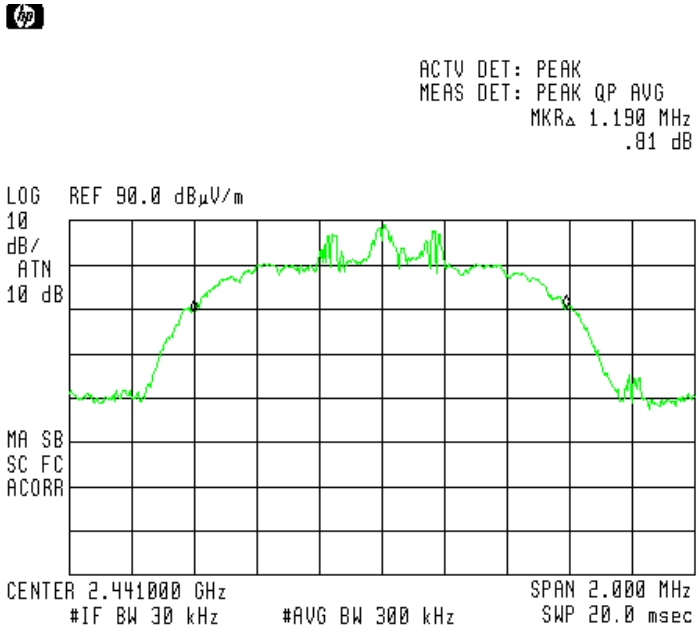

Figure 23. Mid Channel

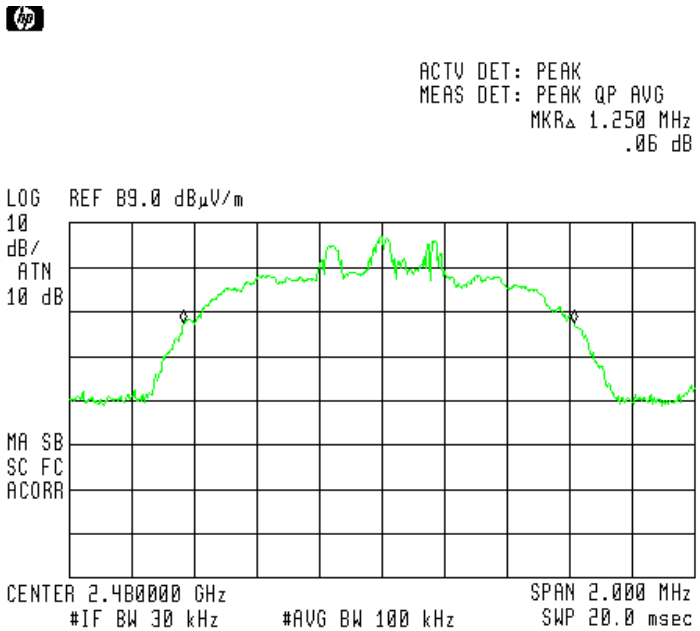

Figure 24. High Channel

7.3 Test Results

E.U.T Description: Image Processing Vision System
Model: ORC0011013
Serial Number: OB014

Operation Frequency (MHz)	Bandwidth Reading (MHz)
2402.00	1.295
2441.00	1.190
2480.00	1.250

Figure 25 Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 17.09.13

Typed/Printed Name: A. Sharabi

7.4 Test Equipment Used.

20dB 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 26 Test Equipment Used

8. Number of Hopping Frequencies Section 15.247(a)(1)(iii)

8.1 Test Specification

F.C.C., Part 15, Subpart C

8.2 Test Procedure

The E.U.T. was set to hopping mode.
The spectrum analyzer was set to the following parameters:

Span: Every 40 MHz Frequency
Band of Operation: 2402-2481 MHz
RBW: 100kHz
VBW: 300kHz
Detector Function: Peak
Trace: Maximum Hold

The number of hopping frequencies is 79 (See plots).

Number of Hopping Frequencies

E.U.T Description	Image Processing Vision System
Type	ORC0011013
Serial Number:	OB014

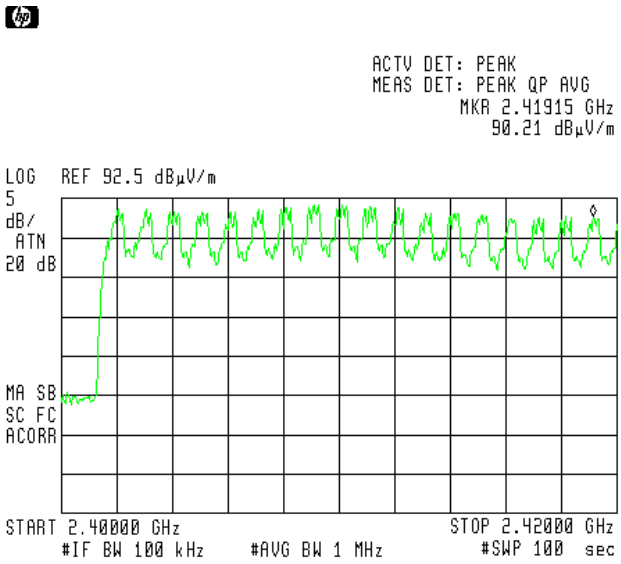

Figure 27. Frequency Hopping

Number of Hopping Frequencies

E.U.T Description	Image Processing Vision System
Type	ORC0011013
Serial Number:	OB014

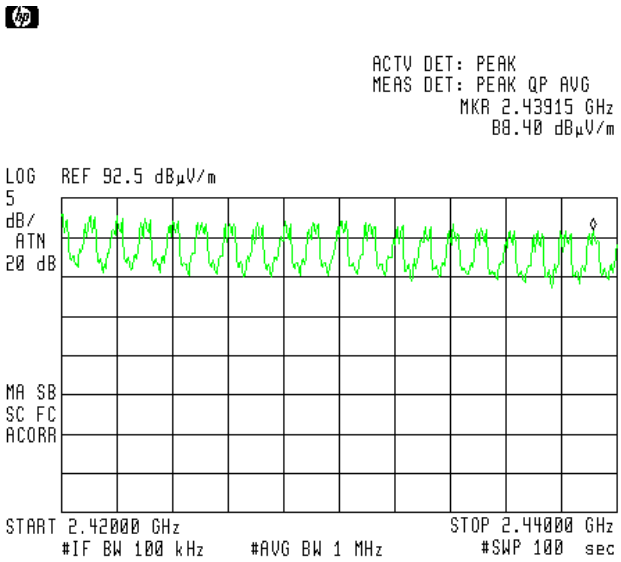

Figure 28. Frequency Hopping

Number of Hopping Frequencies

E.U.T Description	Image Processing Vision System
Type	ORC0011013
Serial Number:	OB014

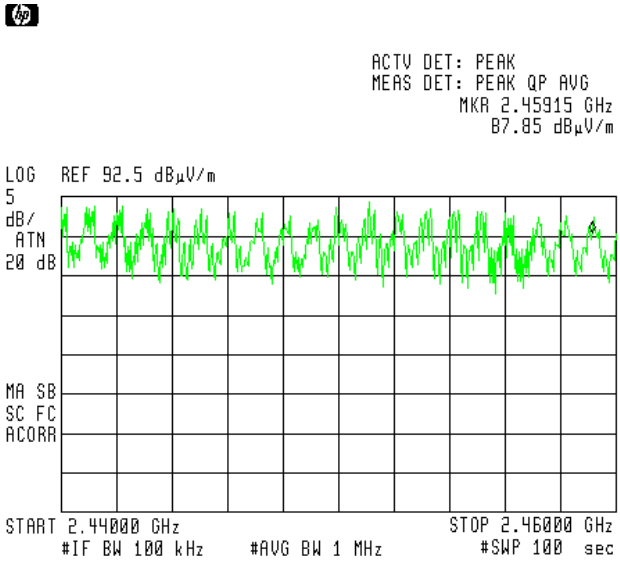

Figure 29. Frequency Hopping

Number of Hopping Frequencies

E.U.T Description	Image Processing Vision System
Type	ORC0011013
Serial Number:	OB014

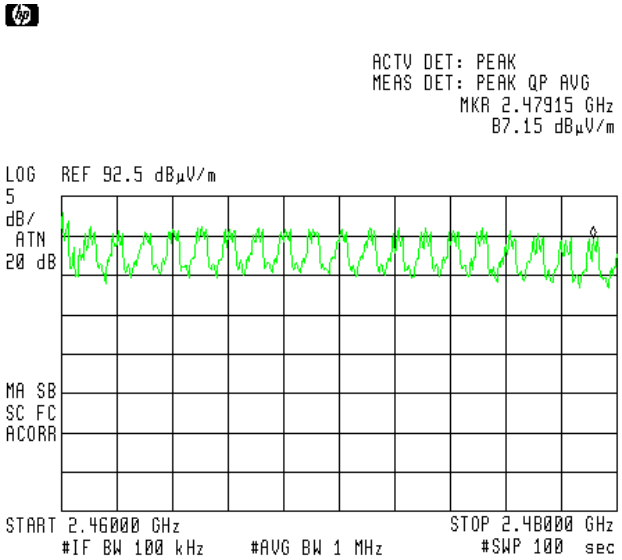

Figure 30. Frequency Hopping

8.3 Results table

E.U.T. Description: Image Processing Vision System
Model No.: ORC0011013

Serial Number: OB014

Specification: FCC Part 15, Subpart C, 15.247(a)(1)(iii)

Number of Hopping Frequencies	Specification
79	>75

Figure 31 Number of Hopping Frequencies

TEST PERSONNEL:

Tester Signature: _____ Date: 17.09.13

Typed/Printed Name: A. Sharabi

8.4 Test Instrumentation Used

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	August 28, 2012	1 year

9. Channel Frequency Separation

9.1 Test Specification

Specification: FCC Part 15, Subpart C, 15.247(a) (1)

9.2 Test procedure

The E.U.T. was set to hopping mode.
The spectrum analyzer was set to the following parameters:

Span: 2 MHz
RBW: 10kHz
VBW: 10kHz
Detector Function: Peak
Trace: Maximum Hold

The marker delta function to determine the separation between the peaks of the adjacent channels was used.

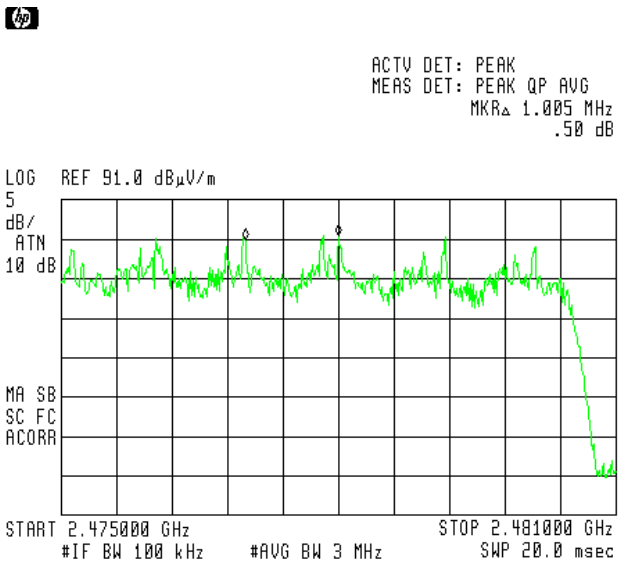

Figure 32. 2.47500 GHz

9.3 Results table

E.U.T. Description: Image Processing Vision System Model No.: ORC0011013
Serial Number: OB014
Specification: FCC Part 15, Subpart C, 15.247(a) (1)

Channel Frequency Separation (kHz)	Specification (kHz)	Result (kHz)	Margin (kHz)
2475.00	>793.00	1005.00	212.00

Figure 33 Channel Frequency Separation

JUDGEMENT: Passed by 212.00 kHz

TEST PERSONNEL:
Tester Signature: _____ Date: 17.09.13
Typed/Printed Name: A. Sharabi

9.4 Test Instrumentation Used

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	August 28, 2012	1 year

10. Radiated Power Output

10.1 Test Specification

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

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 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
(1 (2.402 GHz); 8 (2.441 GHz); 14 (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:

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

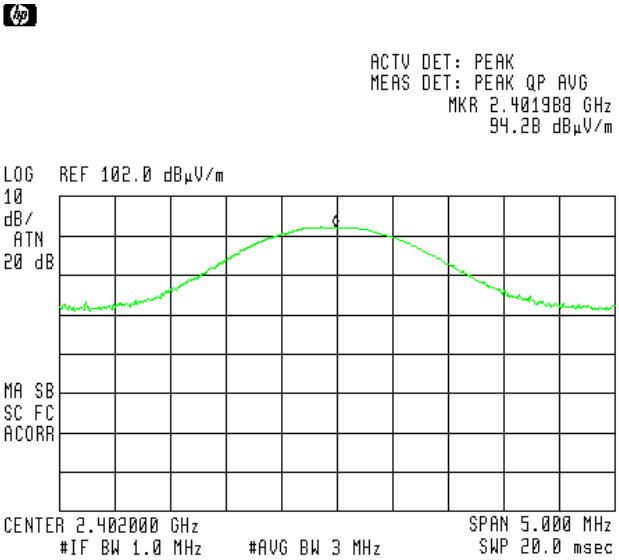

Figure 34 2402.00 MHz - Vertical

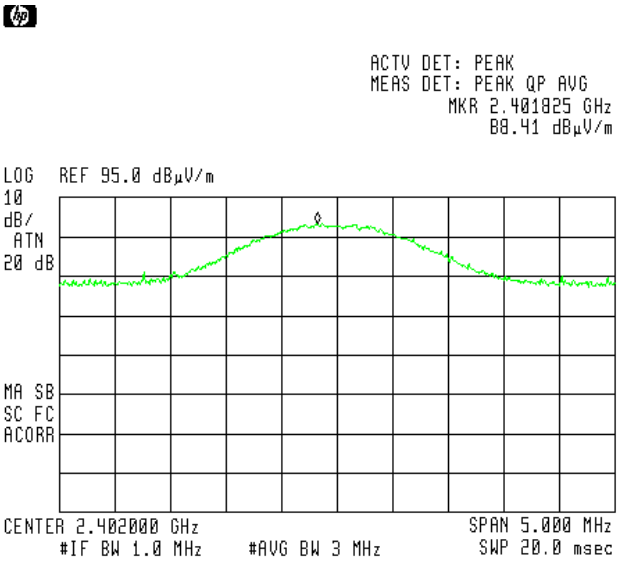

Figure 35 2402.00 MHz - Horizontal

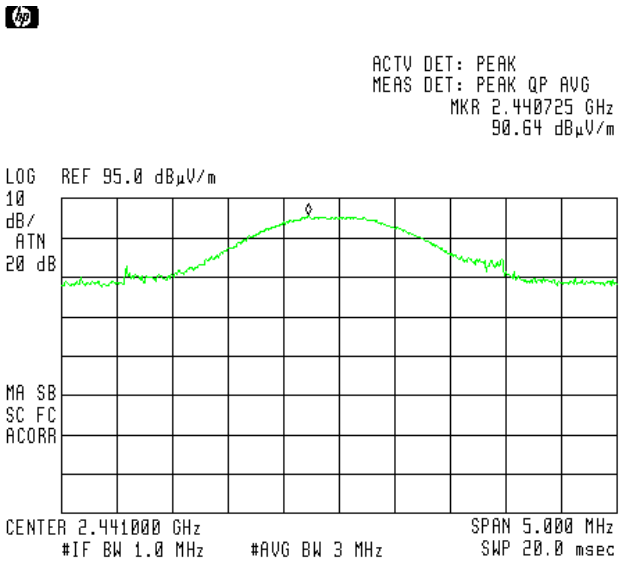

Figure 36 2441.00 MHz – Vertical

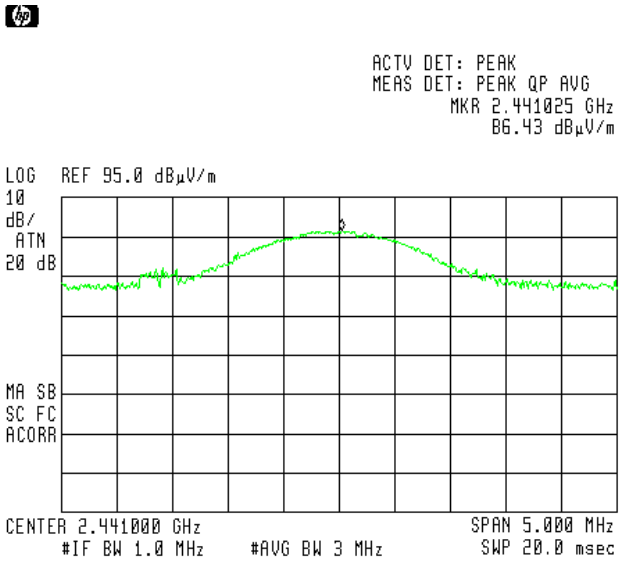

Figure 37 2441.00 MHz - Horizontal

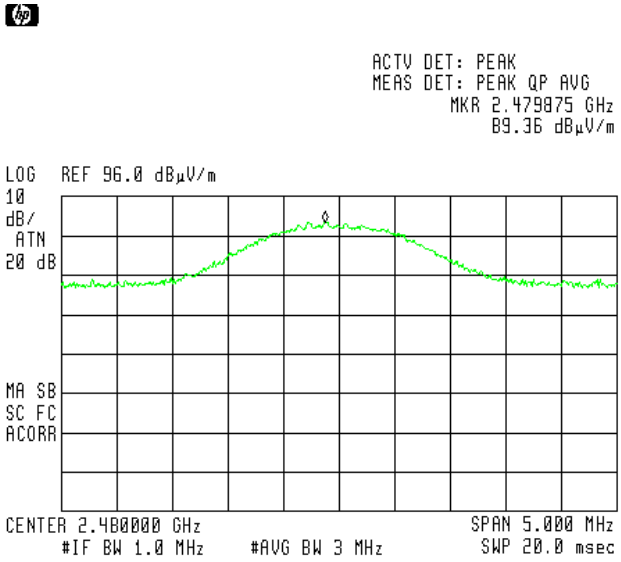

Figure 38 2480.00 MHz - Vertical

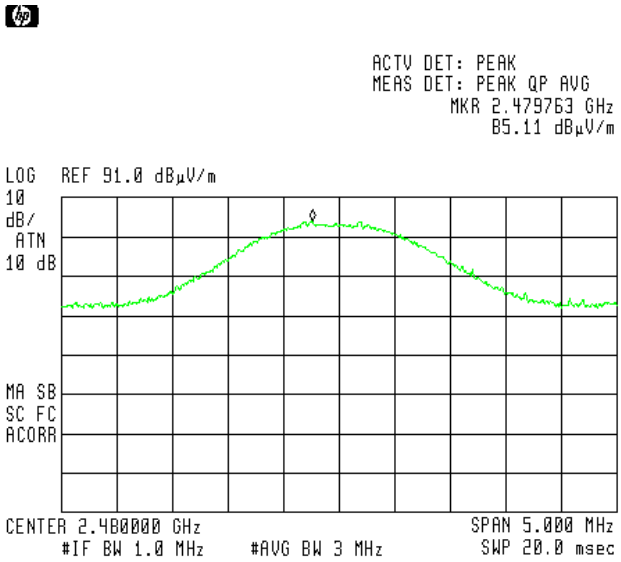

Figure 39 2480.00 MHz - Horizontal

10.3 Results Calculation

E.U.T. Description: Image Processing Vision System
Model No.: ORC0011013
Serial Number: OB014
Specification: F.C.C. Part 15, Subpart C

The following calculations were used to determine maximum radiated power output.

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

Operation Frequency (MHz)	Polarization	Power (dBuV/m)	Power (mW)	Specification (mW)	Margin (mW)
2402.00	V	94.28	0.80	1000	-999.20
2441.00	V	90.64	0.30	1000	-999.70
2480.00	V	89.36	0.30	1000	-999.70

Figure 40 Radiated Power Output

JUDGEMENT: Passed

TEST PERSONNEL:
Tester Signature: _____ Date: 17.09.13
Typed/Printed Name: A. Sharabi

10.4 Test Equipment Used, Radiated Maximum Power Output

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
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 41 Test Equipment Used

11. Dwell Time on Each Channel

11.1 Test Specification

FCC Part 15, Section 15.247(a)(1)(iii)

11.2 Test Procedure

The E.U.T. was tested in radiated mode using the substitutional antenna. The spectrum analyzer was set to 100 kHz RBW and 100 kHz VBW.

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

11.3 Test Results

The E.U.T met the requirements of the FCC Part 15, Section 15.247(a)(1)(iii).

Additional information of the results is given in *Figure 42 to Figure 43*.

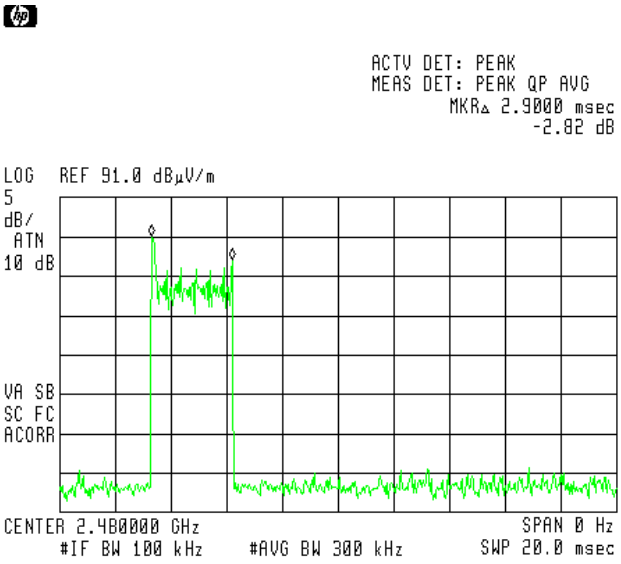

Figure 42 — Ton=2.9msec

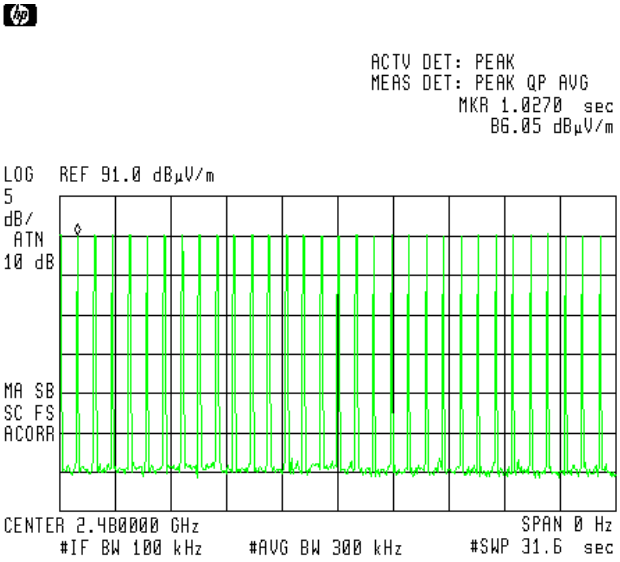

Figure 43 — Dwell time at 2.480GHz

[32 X 2.9msec = 92.8msec, limit 400msec]

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 17.09.13

Typed/Printed Name: A. Sharabi

11.4 Test Equipment Used, Dwell Time.

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 year

Figure 44 Test Equipment Used

12. Band Edge

[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 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 2410 MHz, and 2475 MHz correspondingly.

The E.U.T. was tested in 2 operating channels and frequencies
(1 (2.410 GHz); 14 (2.475 GHz)).

The E.U.T. was tested at 2410 and 2475 MHz with QPSK modulation.

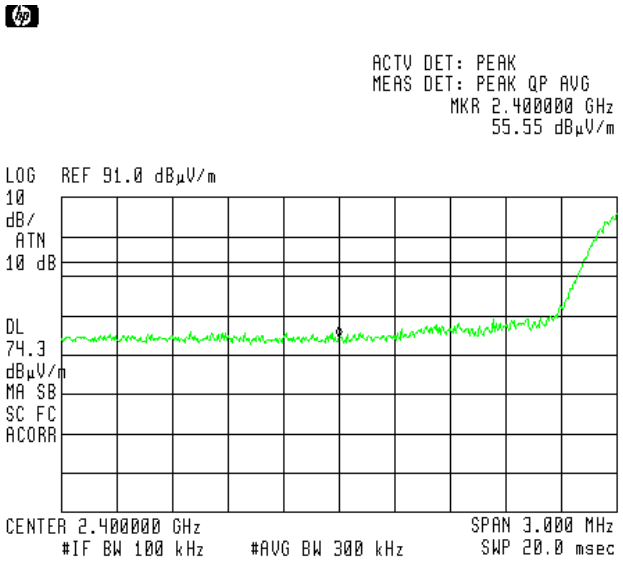

Figure 45 — Lower Band Edge

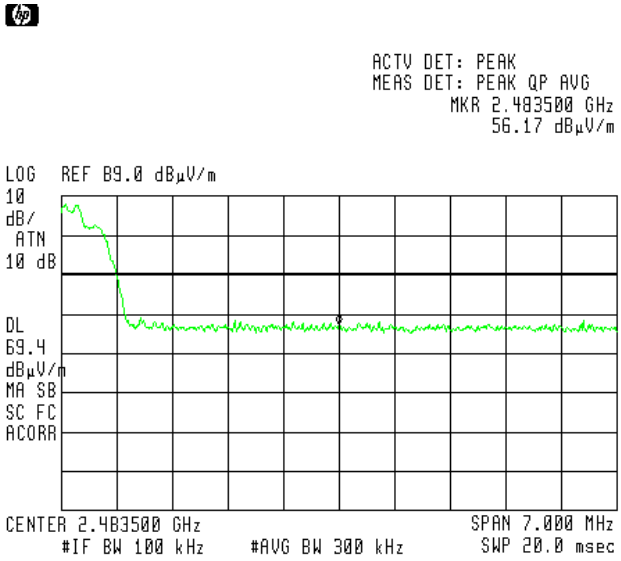

Figure 46 — Upper Band Edge

12.2 Results table

E.U.T. Description: Image Processing Vision System
Model No.: ORC0011013
Serial Number: OB014
Specification: F.C.C. Part 15, Subpart C (15.247 (d))

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Specification (dBuV/m)	Margin (dB)
2410	2400.0	55.55	74.3	-18.80
2475	2483.5	56.17	69.4	-13.23

Figure 47 Band Edge

JUDGEMENT: Passed by 13.23 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 17.09.13

Typed/Printed Name: A. Sharabi

12.3 Test Equipment Used, Band edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
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
Antenna-Log Periodic	A.H.System	SAS-200/511	253	April 2, 2013	2 years

Figure 48 Test Equipment Used

13. Radiated Emission, 9 kHz – 30 MHz

13.1 Test Specification

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

13.2 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 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 (1 (2.410 GHz); 8 (2.445 GHz; 14 (2.475 GHz)).

13.3 Measured Data

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: 17.09.13

Typed/Printed Name: A. Sharabi

13.4 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

Figure 49 Test Equipment Used

13.5 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 [dBμv/m]
RA:	Receiver Amplitude [dBμv]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

Example: FS = 30.7 dBμV (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dBμV

No external pre-amplifiers are used.

14. Spurious Radiated Emission 30 – 25000 MHz

14.1 Test Specification

30 MHz- 25,000 MHz, F.C.C., Part 15, Subpart C

14.2 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-25,000 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.

In the frequency range of 30 MHz – 2.9 GHz, 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 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
(1 (2.402 GHz); 8 (2.441 GHz; 14 (2480 GHz)).

14.3 Test Data

JUDGEMENT: Passed

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

For the operation channel 1 (2.402 GHz), the margin between the emission level and the specification limit is 13.0 db in the worst case at the frequency of 2390.00 MHz, horizontal polarization.

For the operation channel 8 (2.441 GHz), the margin between the emission level and the specification limit is 15.0 db in the worst case at the frequency of 4882.00 MHz, vertical polarization.

For the operation channel 14 (2.480 GHz), the margin between the emission level and the specification limit is 14.1 db in the worst case at the frequency of 4960.00 MHz, vertical polarizations.

TEST PERSONNEL:

Tester Signature:  Date: 17.09.13

Typed/Printed Name: A. Sharabi

Radiated Emission

E.U.T Description	Image Processing Vision System
Type	ORC0011013
Serial Number:	OB014

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)	Freq. (MHz)	Polarity (H/V)	Peak Reading (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2402.0	2390.0	H	40.9	74.0	-33.1
2402.0	2390.0	V	53.8	74.0	-20.2
2402.0	4804.0	H	48.0	74.0	-26.0
2402.0	4804.0	V	51.6	74.0	-22.4
2441.0	4882.0	H	57.8	74.0	-16.2
2441.0	4882.0	V	59.0	74.0	-15.0
2480.0	4960.0	H	58.9	74.0	-15.2
2480.0	4960.0	V	59.9	74.0	-14.1
2480.0	2483.5	H	50.7	74.0	-23.3
2480.0	2483.5	V	54.0	74.0	-20.0

Figure 50. 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 Image Processing Vision System
Type ORC0011013
Serial Number: OB014

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)	Freq. (MHz)	Polarity (H/V)	Average Reading (dBµV/m)	Average Specification (dB µV/m)	Average Margin (dB)
2402.0	2390.0	H	40.9	54.0	-13.1
2402.0	2390.0	V	41.0	54.0	-13.0
2402.0	4804.0	H	35.0	54.0	-19.0
2402.0	4804.0	V	35.3	54.0	-18.7
2441.0	4882.0	H	35.6	54.0	-18.4
2441.0	4882.0	V	36.9	54.0	-17.1
2480.0	4960.0	H	36.3	54.0	-17.7
2480.0	4960.0	V	37.0	54.0	-17.0
2480.0	2483.5	H	36.8	54.0	-17.2
2480.0	2483.5	V	37.3	54.0	-16.7

Figure 51. 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

14.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1Year
Antenna Biconical	EMCO	3104	2606	August 30, 2012	1Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	3 Years
Low Noise Amplifier	DBS MICROWAVE	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	8564E	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

14.5 Field Strength Calculation 30 – 1000 MHz

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

$$[dB\mu v/m]\ FS = RA + AF + CF$$

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

Example: FS = 30.7 dBμV (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dBμV

No external pre-amplifiers are used.

15. Antenna Gain/Information

The antenna gain is -0.5 dBi.

16. R.F Exposure/Safety

Typical use of the E.U.T. is as an assistance device for the visually impaired. The typical distance between the E.U.T. and the user is 0.25 cm.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1310 Requirements

(a) FCC limits at 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

P_t- Transmitted Power 94.28 dBm (Peak) = 0.8 mW

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

G_T- Antenna Gain, -0.5 dBi =0.891 numeric

R- Distance from Transmitter using 0.25 cm worst case

(c) The peak power density is :

$$S_p = \frac{0.8 \times 0.891}{4\pi (0.25)^2} = 0.91\frac{mW}{cm^2}$$

(d) This is below the FCC limit.

17. APPENDIX B - CORRECTION FACTORS

17.1 Correction factors for CABLE

**from EMI receiver
to test antenna
at 3 meter range.**

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.6
30.0	0.8
40.0	0.9
50.0	1.1
60.0	1.2
70.0	1.3
80.0	1.4
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

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.3
1400.0	7.8
1600.0	8.4
1800.0	9.1
2000.0	9.9
2300.0	11.2
2600.0	12.2
2900.0	13.0

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".

17.2 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.

17.3 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

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 38M3O.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".*

17.4 Correction factors for BICONICAL ANTENNA

Type 3104, S/N 2606
at 3 meter range

FREQUENCY (MHz)	AFE (dB/m)
30.0	14.5
40.0	12.8
50.0	12.7
60.0	11.2
70.0	8.7
80.0	7.5
90.0	13.0
100.0	12.3
120.0	12.5
140.0	11.2
160.0	14.8
180.0	16.4
200.0	16.0
250.0	17.8
300.0	20.7

17.5 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			

17.6 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

17.7 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