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DATE: 14 October 2012

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

FCC Radio Test Report

for

Orpak Systems Ltd.

Equipment under test:

DataPass AVL (HD)

DataPass

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.

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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):	DataPass AVL (HD)
Equipment Model No.:	DataPass
Equipment Part No.:	800907540
Date of Receipt of E.U.T:	06/03/2012
Start of Test:	06/03/2012
End of Test:	16/03/2012
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15 Sub-part C



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**

DataPass is a miniature unit that connects to the vehicle bus and captures data from the vehicle CPU/BUS. It then transmits this data to the nearest Wireless Gateway Terminal (WGT).

DataPass - connected directly to the vehicle bus harness and is used in heavy vehicles and trucks and supports most bus protocols common to those vehicles. DataPass unit supports the following vehicle protocols: J1708/J1587, FMS/J1939/CAN Bus, Odometer pulses, OBD II.

There are six types of DataPass.

1. P/N: 800907540 DATAPASS AVL (HD)
2. P/N: 800907541 DATAPASS AVL (LD)
3. P/N: 800907300 DATAPASS PLUS (LV)
4. P/N: 800907310 DATAPASS PLUS (HV)
5. P/N: 800907330 DATAPASS (LV)
6. P/N: 800907340 DATAPASS (HV)

The difference between the six types is the protocol used. The protocols are used to communicate with the vehicle's computer via cable.

DataPass is constructed from single electronic board:

819507300 PCB ASSY. DATAPASS AT BASIC

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 September 3, 2009).

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):

± 4.96 dB

2. System Test Configuration

2.1 *Justification*

The E.U.T. was tested connected to a car simulator. The EUT was pre-tested in 3 different orientations to determine worst-case emission position

2.2 *EUT Exercise Software*

Commands were sent via hyper terminal to the car simulator to operate the E.U.T.

F/W DATAPASS AVL (HD) Special Ver. 1.88.20 was used on the E.U.T.

2.3 *Special Accessories*

1. PC # 1
 - a. Hyper Terminal view WGT Log via RS232
 - b. Hyper Terminal t SSD for selecting transmitter frequency channel via RS232
2. SSD 800907591
 - a. Special F/W. AVR Ver 01.01
3. WGT
 - a. 819839304 F/W WGT ST CPU (PCB-D) Ver. 04.78
4. PC # 2
 - a. S/W Vehicle Simulator AVL
5. Vehicle Simulator AVL
 - a. F/W AVR Ver 16.0

2.4 *Equipment Modifications*

No modifications were needed in order to achieve compliance

2.5 Configuration of Tested System

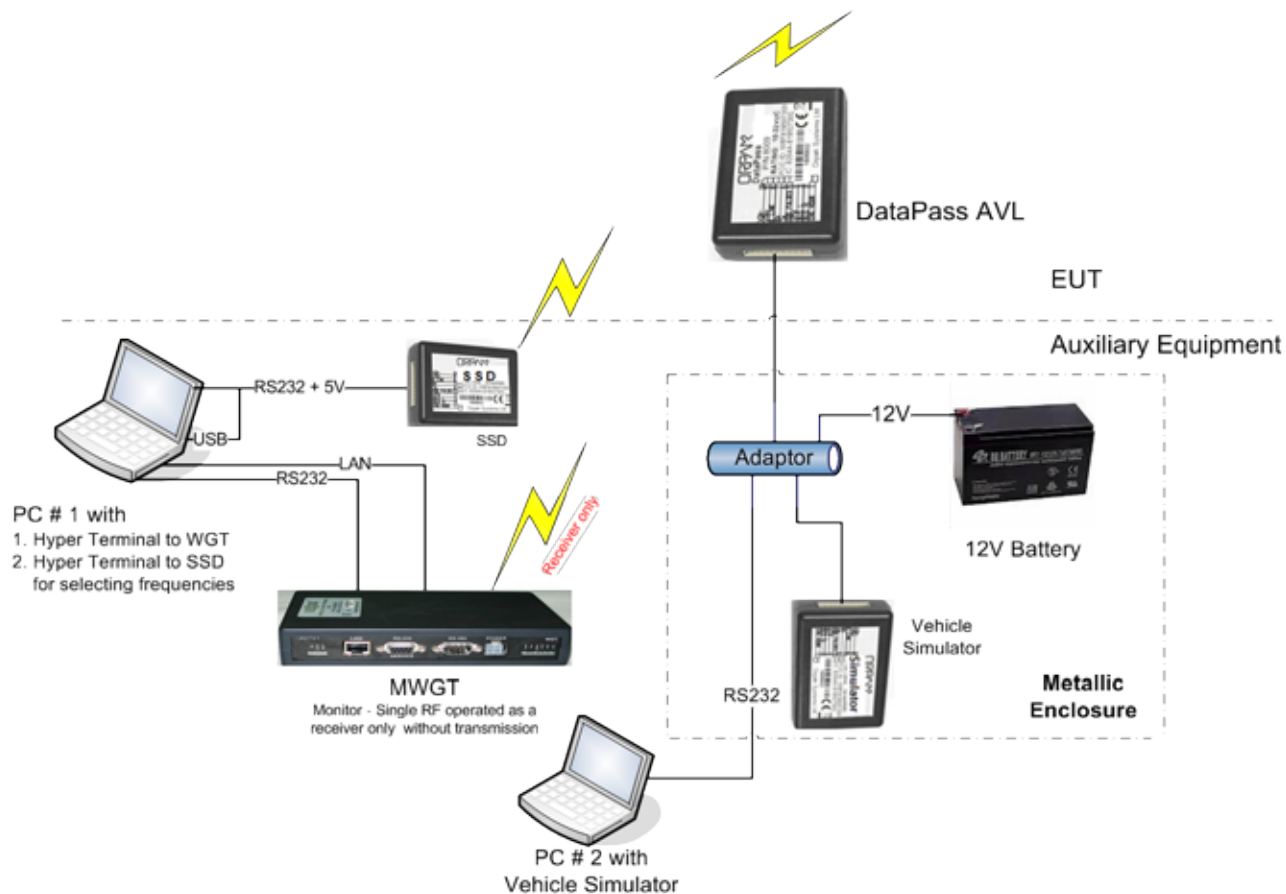


Figure 1. Configuration of Tested System

3. Test Setup Photo



Figure 2. Radiated Emission Test Setup

4. 6dB Minimum Bandwidth

4.1 Test Specification

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

4.2 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)).

4.3 Test Results

Operation Frequency (MHz)	Bandwidth Reading (MHz)	Specification (MHz)
2405.00	1.400	>0.5
2440.00	1.550	>0.5
2480.00	1.563	>0.5

Figure 3 — 6dB Minimum Bandwidth Test Results

See additional information in Figure 4 to Figure 6.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____

Date: 04.10.12

Typed/Printed Name: A. Sharabi



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 1.400 MHz
.47 dB

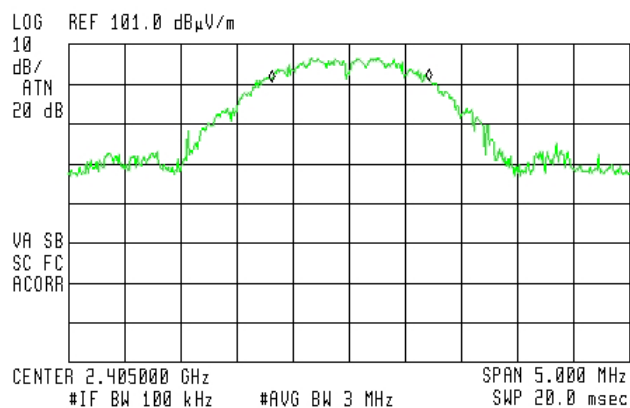


Figure 4. — 2405 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 1.550 MHz
.24 dB

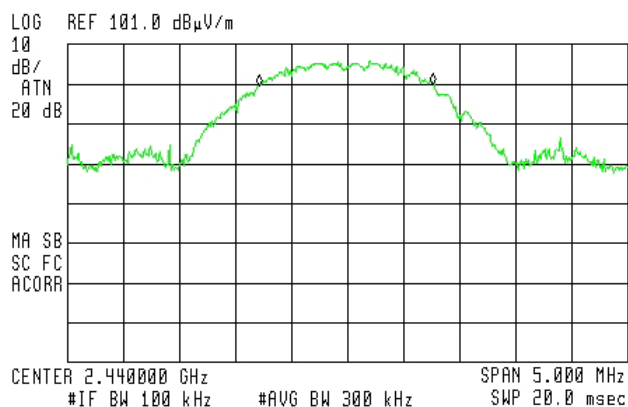


Figure 5. — 2440 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 1.563 MHz
-56 dB

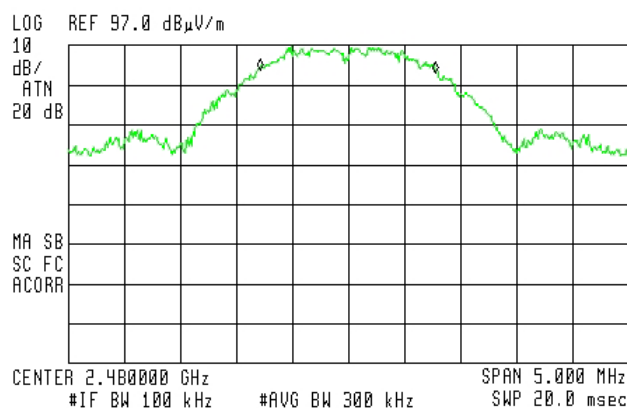


Figure 6. — 2480 MHz

4.4 Test Equipment Used, 6dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	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 7 Test Equipment Used

5. 26dB 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 operating channels and frequencies (11 (2.405 GHz); 18 (2.440 GHz); 26 (2.480 GHz)).

5.3 Test Results

Operation Frequency (MHz)	Bandwidth Reading (MHz)
2405.00	2.888
2440.00	2.963
2480.00	2.888

Figure 8 — 26 dB Minimum Bandwidth Test Results

See additional information in Figure 9 to Figure 11.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 04.10.12

Typed/Printed Name: A. Sharabi



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 2.888 MHz
-.77 dB

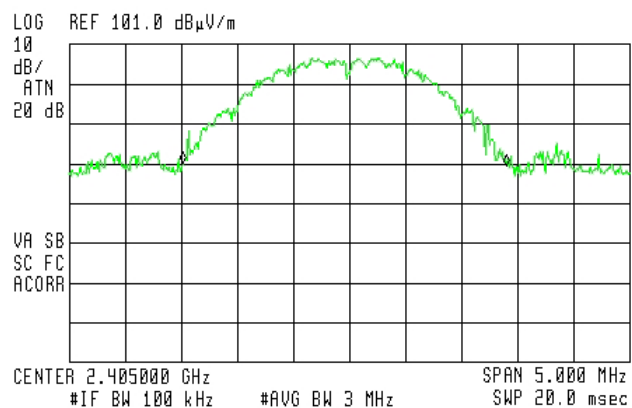


Figure 9. — 2405 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 2.963 MHz
.13 dB

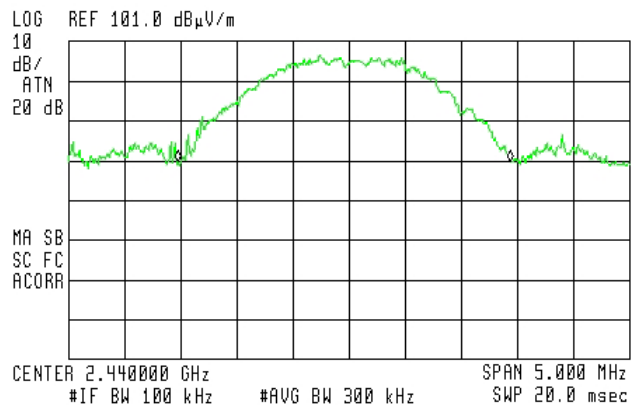


Figure 10. — 2440 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 2.000 MHz
1.57 dB

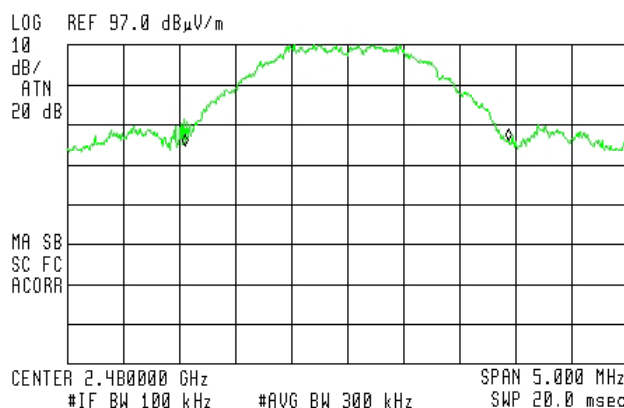


Figure 11. — 2480 MHz

5.4 Test Equipment Used, 26 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	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 12 Test Equipment Used

6. Radiated Power Output

6.1 Test Specification

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

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 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:

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

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

6.3 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	102.66	0.136	0	3	5.55	1	-994.45
2440.00	V	102.15	0.128	0	3	4.92	1	-995.08
2480.00	V	101.66	0.121	0	3	4.39	1	-995.61

Figure 13 Radiated Power Output Test Results Calculation table

See additional information in Figure 14 to Figure 16.

JUDGEMENT: Passed by 994.45 mW

TEST PERSONNEL:

Tester Signature: _____

Date: 04.10.12

Typed/Printed Name: A. Sharabi



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.404463 GHz
102.66 dB μ V/m

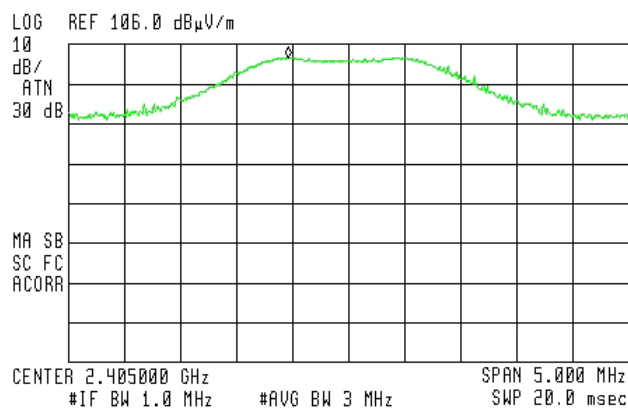


Figure 14 — 2405 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.439438 GHz
102.15 dB μ V/m

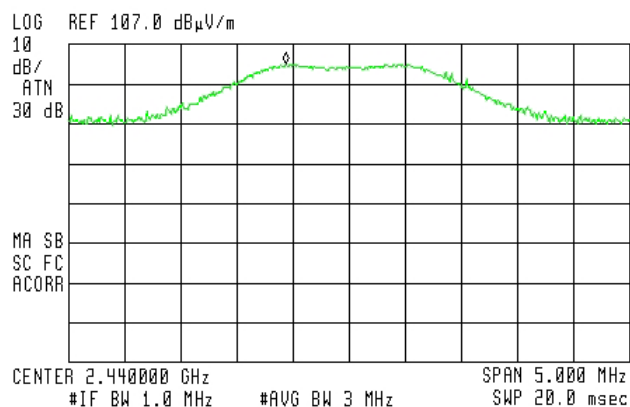


Figure 15 — 2440 MHz

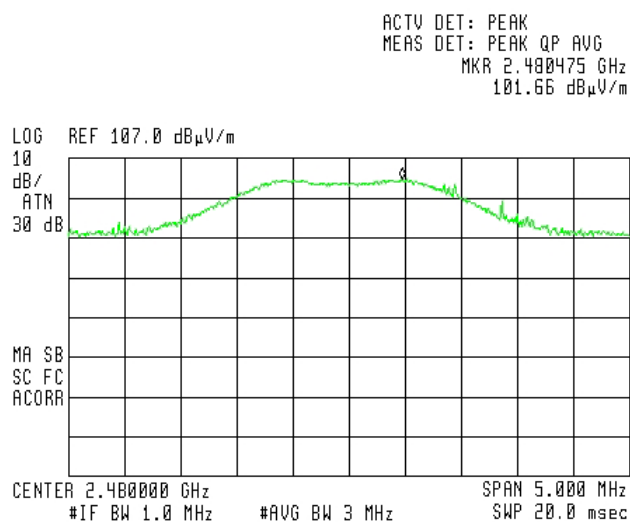


Figure 16 — 2480 MHz

6.4 Test Equipment Used, Radiated Maximum Output Power

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	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 17 Test Equipment Used

7. Band Edge Spectrum

7.1 Test Specification

FCC Part 15 Section 15.247(d0)

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 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)).

7.3 Test Results

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Specification (dBc)
2405.00	2400.00	69.72	20
2480.00	2483.50	69.06	20

Figure 18 Band Edge Spectrum Test Results Table

See additional information in Figure 19 to Figure 20.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 04.10.12

Typed/Printed Name: A. Sharabi



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.40000 GHz
69.72 dB μ V/m

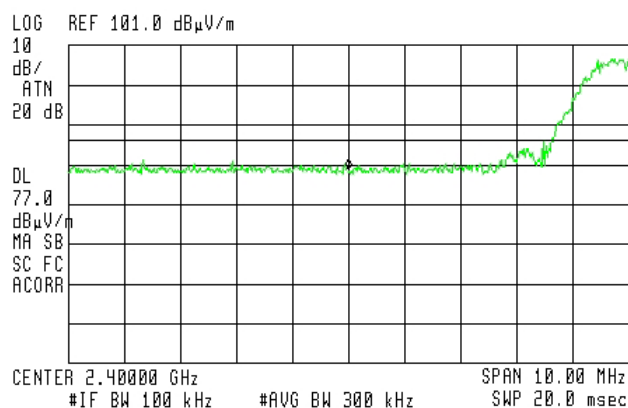


Figure 19 — 2405 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.483500 GHz
69.06 dB μ V/m

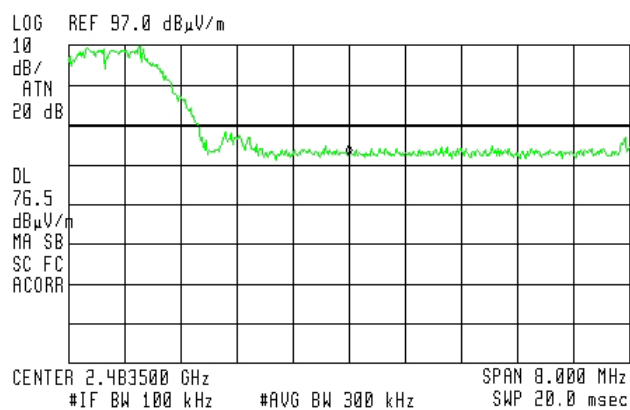


Figure 20 — 2480 MHz

7.4 Test Equipment Used, Band Edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	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 21 Test Equipment Used

8. Spurious Radiated Emission, 9 kHz – 30 MHz

8.1 Test Specification

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

8.2 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.

8.3 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: 04.10.12

Typed/Printed Name: A. Sharabi

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

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2011	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 22 Test Equipment Used

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

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

No external pre-amplifiers are used.

9. Spurious Radiated Emission, 30 – 25000 MHz

9.1 Test Specification

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

9.2 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)).



9.3 Test Results

JUDGEMENT: Passed by 4.2 dB

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 6.5 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 6.5 dB in the worst case at the frequency of 4880.00 MHz, horizontal polarization.

For the operation channel 26 (2.480 GHz), the margin between the emission level and the specification limit is 4.2 dB in the worst case at the frequency of 4960.00 MHz, horizontal polarization.

TEST PERSONNEL:

Tester Signature: _____

Date: 04.10.12

Typed/Printed Name: A. Sharabi



Radiated Emission

E.U.T Description DataPass AVL (HD)
Type DataPass
Part Number: 800907540

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 (dBμV/m)	Average Factor (dB)	Average Result (dBμV/m)	Average Specification (dB μV/m)	Margin (dB)
2405.00	2390.00	H	57.7	-27.9	29.8	54.0	-24.2
2405.00	2390.00	V	57.9	-27.9	30.0	54.0	-24.0
2405.00	4810.00	H	65.6	-27.9	37.7	54.0	-16.3
2405.00	4810.00	V	59.0	-27.9	31.1	54.0	-22.9
2440.00	4880.00	H	65.8	-27.9	37.9	54.0	-16.1
2440.00	4880.00	V	59.5	-27.9	31.6	54.0	-22.4
2480.00	2483.50	H	58.3	-27.9	30.4	54.0	-23.6
2480.00	2483.50	V	71.8	-27.9	43.9	54.0	-10.1
2480.00	4960.00	H	65.0	-27.9	37.1	54.0	-16.9
2480.00	4960.00	V	59.5	-27.9	31.6	54.0	-22.4

**Figure 23. 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

Duty Cycle = 4ms for 100 msec window

Average Factor = $20\log(48100) = -27.9\text{dB}$

Average Result (dBμV/m) = Peak Reading (dBμV/m) + Average Factor (dB)

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

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 Year
RF Filter Section	HP	85420E	3705A00248	December 12, 2011	1 Year
Antenna Biconical	ARA	BCD 235/B	1041	November 12, 2011	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 29, 2011	1 Year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 Years
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 14, 2010	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	2 Years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 5, 2011	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	January 4, 2012	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	March 5, 2012	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	January 19, 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	JPKG19982	N/A	N/A

Figure 24 Test Equipment Used

9.5 **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:

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

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

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.

10. Radiated Power Spectral Density

10.1 Test Specification

FCC Part 15 Section 15.247(e)

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 (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:

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

10.3 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	90.01	0.032	0	3	0.31	6.3	-5.99
2440.00	89.45	0.03	0	3	0.27	6.3	-6.03
2480.00	90.08	0.032	0	3	0.31	6.3	-5.99

Figure 25 Radiated Power Spectral Density Test Results Table

See additional information in Figure 26 to Figure 28.

JUDGEMENT: Passed by 5.99 mW

TEST PERSONNEL:

Tester Signature: 

Date: 04.10.12

Typed/Printed Name: A. Sharabi



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.4045463 GHz
90.01 dB μ V/m

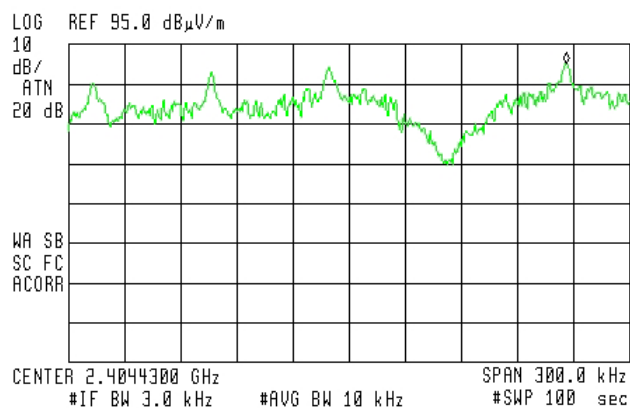


Figure 26 — 2405 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.4396070 GHz
89.45 dB μ V/m

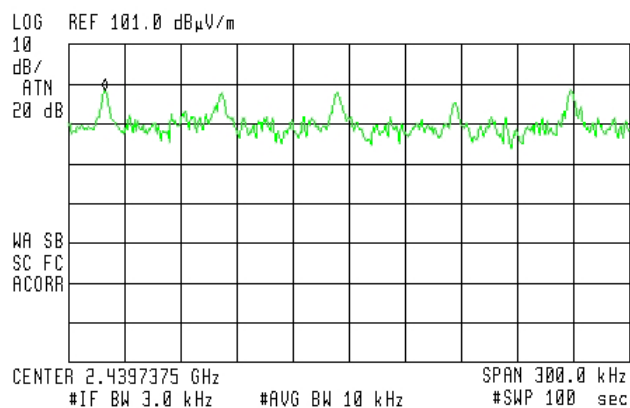


Figure 27 — 2440 MHz

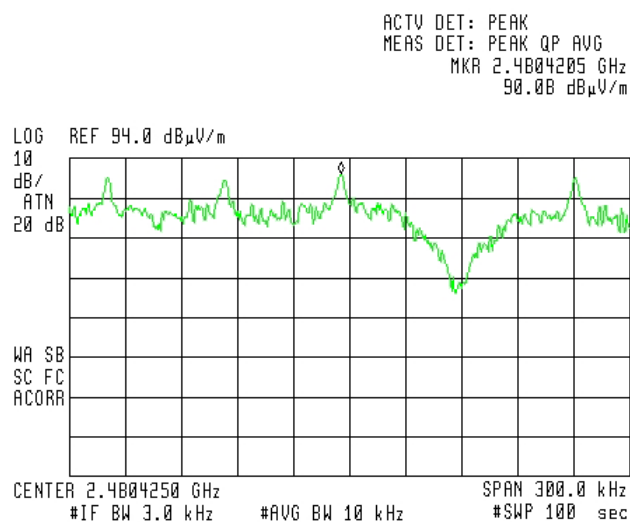


Figure 28 — 2480 MHz

10.4 Test Equipment Used.

Transmitted Power Density

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	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. Antenna Gain/Information

The antenna gain is 0 dBi simulated.

12. R.F Exposure/Safety

The typical placement of the E.U.T. is in a vehicle. The typical distance between the E.U.T. and the user in the worst case application, is 0.2 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_t- Transmitted Power 5.55 mw (Calculated P_t +G_t)

G_T- Antenna Gain, 0 dBi = 1 (Numeric)

R- Distance from Transmitter using 0.2 m worst case

(c) The peak power density is :

$$S_p = \frac{5.55}{4\pi(20)^2} = 0.001 \frac{mW}{cm^2}$$

(d) This is below the FCC limit

13. APPENDIX B - CORRECTION FACTORS

13.1 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".

13.2 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.

13.3 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 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".

13.4 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".

13.5 Correction factors for **BICONICAL ANTENNA**

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

FREQUENCY (MHz)	APE (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".



13.6 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			

13.7 Correction factors for

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

FREQUENCY (GHz)	APE (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

13.8 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



14. Comparison Industry Canada Requirements With FCC

IC: 8264A-819507300 FCC ID: W8F819507300

Test	FCC	IC
Radiated Power Output	15.247(b)	RSS 210 Issue 7 A8.4(4)
6dB BW	15.247(a)2	RSS 210 Issue 7 A8.2a
Power density	15.247(e)	RSS 210 Issue 7 A8.2b
Spurious radiated emission in the restricted band	15.205(c)	RSS 210 Issue 7 2.7(Table2)
Band edge spectrum	15.247(d)	RSS 210 Issue 7 A8.5
RF Exposure Limits	1.1307(b)(1)	RSS 102 4.4