FCC PART 15 SUBPART C

EMI MEASUREMENT AND TEST REPORT

For

SmartBridges Pte Ltd.

745, Toa Payoh Lorong 5, #04-01, HMB Building
Singapore 319455

FCC ID: PWGDOLPHIN

2003-04-04

This Report Concerns:	**Equipment Type:**
☒ Original Report	Wireless Ethernet Client/ Access Point

Test Engineer: Ming Jing /

Test Date: 2003-01-06

Reviewed By: Hans Mellberg /

Prepared By: Bay Area Compliance Laboratory Corporation (BACL)
230 Commercial Street
Sunnyvale, CA 94085
Tel: (408) 732-9162
Fax: (408) 732 9164

TABLE OF CONTENTS

1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The SmartBridges Pte Ltd.'s product, FCC ID: PWGDOLPHIN or the "EUT" as referred to in this report is a wireless client/access point which can be used to connect any PC with Ethernet port to a network/ PC / Internet wirelessly. The EUT operates at 2.4GHz ISM band and provide data rates up to 11Mbps.

The EUT utilized with smartBridges' power adapter, M/N: SMA10-2112C, S/N: 00000148.

airBridge Outdoor, airPointPRO Outdoor and airPoint Outdoor requires installation by professional installer.

1.2 Objective

This type approval report is prepared on behalf of. SmartBridges Pte Ltd. in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communication Commissions rules.

The new product, AirBridge Outdoor, airPointPRO Outdoor, and airPoint Outdoor are electrically identical to airBridge Outdoor and airPointPRO Outdoor which were granted on 8/22/02. The software features are changed from airPointPRO Outdoor due to marketing purposes. The device was intended to use with the following antennas:

Point to Multi-Point Antennas:

- PAWVA24-16, 16dBi Vagi Antenna: 22"L x 3"W x 4"H
- PAWOD24-12, 12dBi OmniDirectional Antenna: 40"L x 0.6"W x 0.6"H
- PAWOD24-9, 9dBi OmniDirectional Antenna: 20"L x 0.6"W x 0.6"H
- PAWSA24-12, 12dBi 90 Deg. Sector Antenna: 22"L x 4.7"W x 2.2"H
- PAWSA24-16, 16.5dBi 90 Deg. Sector Antenna: 60"L x 4.7"W x 2.2"H
- PAWES24-16, 14dBi Backfire Antenna: 10.24"L x 10.24"L x 4"H

Point-to-Point Antenna:

- PAWDC24-HD-PF1P, 24 dBi Die Cast Directional Antenna: 42"L x 24"W x 16"H

The objective of the manufacturer is to demonstrate compliance with FCC rules for Output Power, Antenna Requirements, and Spurious Radiated Emission.

1.3 Related Submittal(s)/Grant(s)

This Class II Permissive Change device has been originally granted on 2/21/02.

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-1992, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. All radiated and conducted emissions measurement was performed at BACL. The radiated testing was performed at an antenna-to-EUT distance of 3 Meters.

1.5 Test Facility

The Open Area Test site used by BACL to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, CISPR 22: 1997: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods.

1.6 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Due Date
HP	Spectrum Analyzer	8568B	Panel 2408A00105 Display 2403A06544	2003-05-01
HP	Spectrum Analyzer	8593A	29190A00242	2003-05-01
HP	Amplifier	8447E	1937A01054	2003-05-01
HP	Quasi-Peak Adapter	85650A	2521A00718	2003-05-01
Com-Power	Biconical Antenna	AB-100	14012	2003-05-01
Com-Power	LISN	LI-200	12005	2004-03-28
Com-Power	LISN	LI-200	12008	2004-03-28
Com-Power	Log Periodic Antenna	AL-100	16091	2003-05-01
Com-Power	Log Periodic Antenna	AB-900	15049	2003-05-01
Rohde & Schwarz	EMI Test Receiver	ESPI	1147 8007 07	2003-12-03

*** Statement of Traceability: BACL Corp.** certifies that all calibration has been performed using suitable traceable to the NIST.

1.7 Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Microsoft	Keyboard	PCVA-KB1P/UA	0000348	DOC
Microsoft	Mouse	MUS3P	None	JKGMUS3P01
HP	Printer	2225C	2821S14783	DOC
EVEREX	Modem	EV-945	None	E3E5UVEV-945
KDS	Monitor	EVOKD-1731	0891265478	DOC
Compaq	Desktop	CM 0204	2H04DCT6225	DOC

1.8 Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Compaq	PC System	CM 7360	2H04DCT6225J	DOC

1.9 External I/O Cabling List and Details

Cable Description	Length (M)	Port/From	To
Shielded KB Cable	1.6	KB Serial Port/Host	Microsoft Keyboard
Shielded Cable	1.5	Mouse Serial Port/Host	Microsoft Mouse
Shielded Serial Cable	1.5	Serial Port/Host	EVEREX Modem
Shielded VGA Cable	1.0	VGA/Host	Monitor
Shielded Printer Cable	2	Parallel Port/Host	HP Printer
Shielded RJ45 Cable	15	Adapter RJ45 Port	RJ45 Port/EUT
Shielded RJ45 Cable	1.0	Adapter RJ45 Port	RJ45 Port/Host
Unshielded Power Cord	1.0	AC/DC adapter	Adapter RJ45 Port
Shielded Antenna Cable	0.8	Antenna port/EUT	Antennas

2 - SYSTEM TEST CONFIGURATION

2.1 Justification

The host system was configured for testing in a typical fashion (as a normally used by a typical user).

The EUT was tested in the normal operating mode to represent *worst-case* results during the final qualification test.

2.2 EUT Exercise Software

The EUT exercising program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The test software, Atmel testing software, provided by the customer, is started the Windows 98 terminal program under the Windows 98 operating system. Once loaded, the program sequentially exercises each system component.

The sequence used is as follows:

1. Run the Change Mode utility from Start – Atmel Utilities – Change Mode Menu
2. Click on the Production Mode under SNMP Manager settings to make unit ready for RF tests, then click on Exit
3. Run the AP Configuration from the Start – Program – Atmel Utilities – AP Configuration Menu
4. Proceed to the Radio Menu & select the Radio Test sub-menu
5. Select the Continuous Tx with Modulation

This process is continuous throughout all tests.

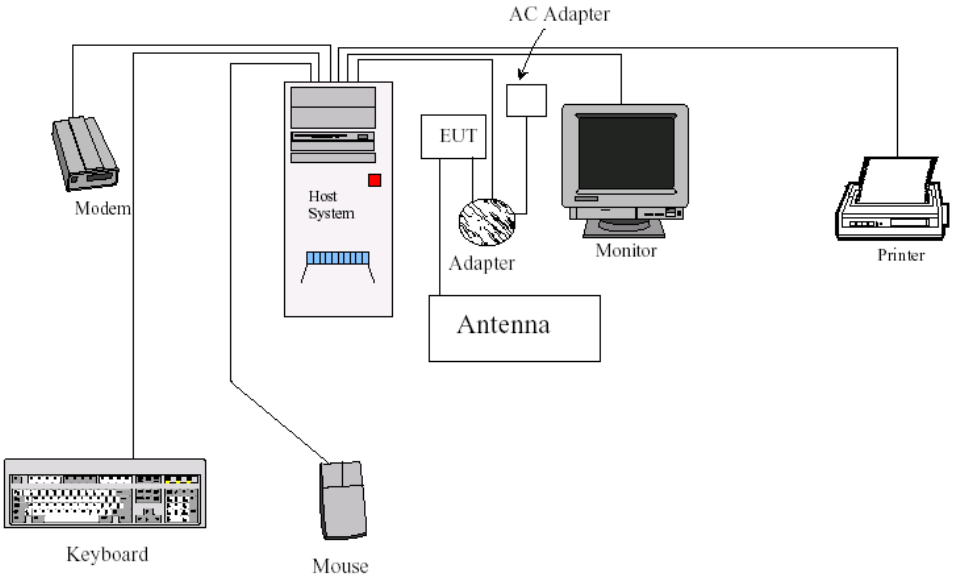
2.3 Special Accessories

As shown in section 2.5, all interface cables used for compliance testing are shielded as normally supplied by their respective support equipment manufacturers.

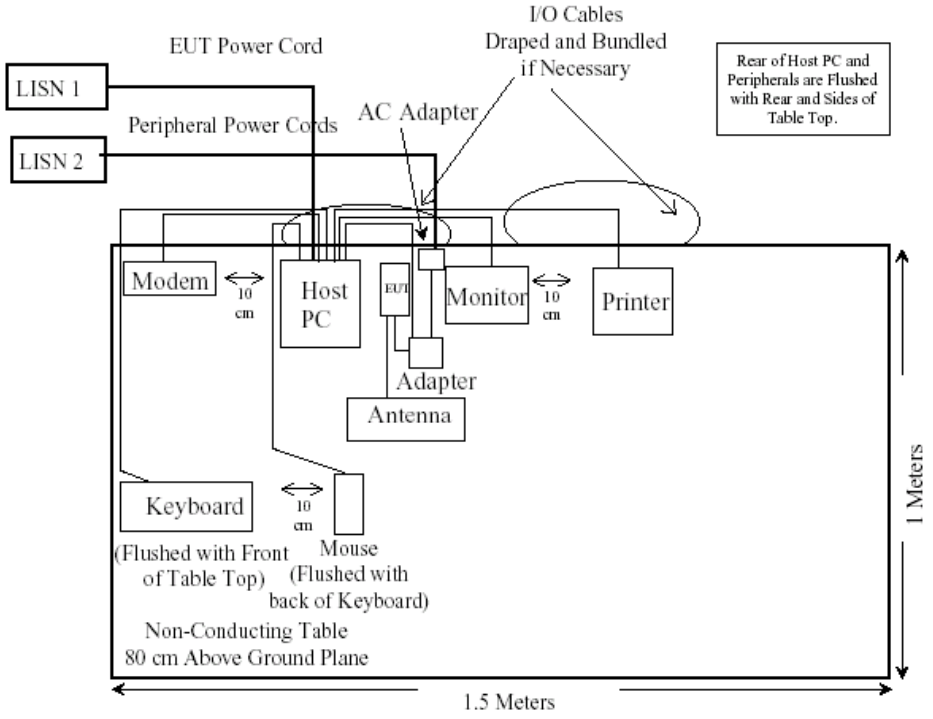
2.4 Equipment Modifications

No modifications were made by BACL Corporation to ensure the EUT to comply with the applicable limits and requirements.

2.5 Configuration of Test System



2.6 Test Setup Block Diagram



3 - SUMMARY OF TEST RESULTS

FCC Rules	Description	Result
§ 15.205	Restricted Bands	Complied
§ 2.1091	RF Safety Requirements	Complied
§15.207 (a)	Conducted Emission	Complied
§15.209 (a)	Radiated Emission	Complied
§15.209 (f)	Spurious Emission	Complied
§15.247 (a) (2)	6dB Bandwidth	Complied
§15.247 (b) (3)	Output Power	Complied
§15.247 (b) (4)	Point to Point & Point to Multi Point Antenna Output Power Reduction	Complied
§ 15.247 (c)	100 kHz Bandwidth of Frequency Band Edges	Complied
§15.247 (d)	Peak Power Spectral Density	Complied

Note: The test data gathered is from typical production samples provided by the manufacturer.

4 - CONDUCTED OUTPUT POWER MEASUREMENT

4.1 Standard Applicable

According to §15.247(b) (3), for systems using digital modulation in the 2400-2483.5 MHz: 1 Watt.

4.2 Measurement Procedure

1. Place the EUT on the turntable and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.

4.3 Measurement Result

Point to Multi Point Antennas:

Frequency (MHz)	Peak Output Power (dBm)	Correction Factor[1] (dBm)	Corrected Output Power (dBm)	Limit[2] (dB)	Result
2412	10.17	7.3	17.47	≤ 19.5	Compliant
2437	10.00	7.3	17.30	≤ 19.5	Compliant
2462	10.17	7.3	17.47	≤ 19.5	Compliant

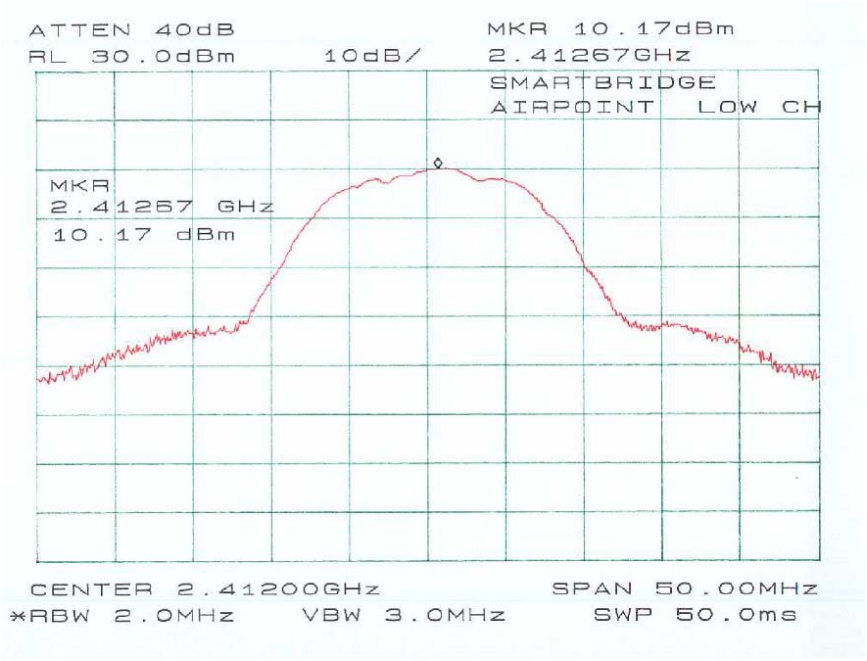
Point to Point Antenna:

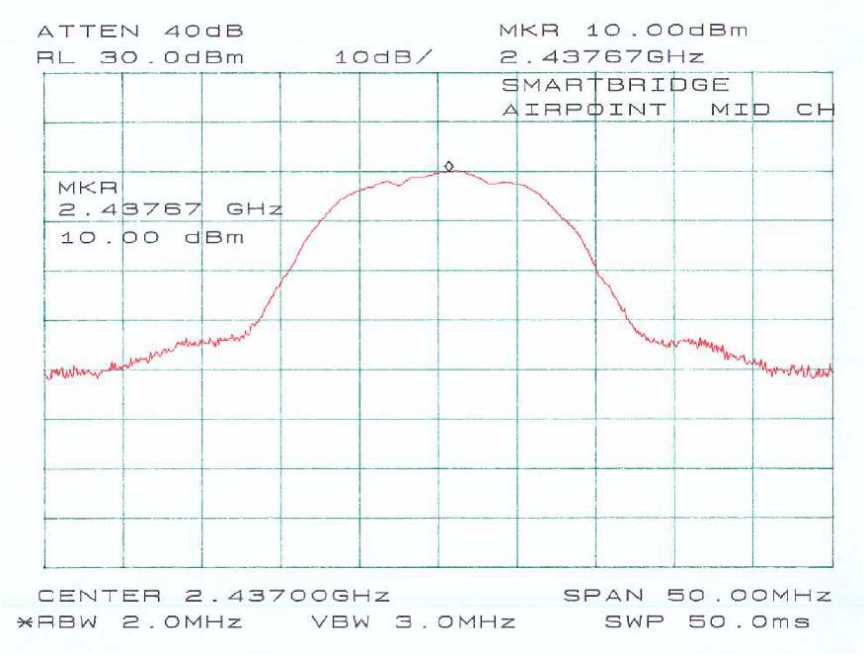
Frequency (MHz)	Peak Output Power (dBm)	Correction Factor (dBm)	Corrected Output Power (dBm)	Limit[3] (dB)	Result
2412	10.17	7.3	17.47	≤ 24	Compliant
2437	10.00	7.3	17.30	≤ 24	Compliant
2462	10.17	7.3	17.47	≤ 24	Compliant

Note:

1. Correction Factor = 10 log (BW6dB/RBW) = 10 log (10.8/2.0) = 7.3 dBm
2. A.G.: Maximum Antenna Gain for point to multi point antennas is 16.5 dBi. Limit = 30dB-(16.5-6) dB = 19.5dB
3. A.G.: Maximum Antenna Gain for point to point antenna is 24 dBi. Limit = 30dB- ((24-6)/3) dB = 24 dB

Please refer to the attached plot(s).


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 10.17dBm
2.41267GHz
SMARTBRIDGE
AIRPOINT LOW CH
MKR
2.41267 GHz
10.17 dBm
CENTER 2.41200GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 10.00dBm
2.43767GHz
SMARTBRIDGE
AIRPOINT MID CH
MKR
2.43767 GHz
10.00 dBm
CENTER 2.43700GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 10.17dBm
2.46258GHz
SMARTBRIDGE
AIRPOINT HIGH CH
MKR
2.46258 GHz
10.17 dBm
CENTER 2.46200GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms

5 – Spurious Emission

5.1 Standard Applicable

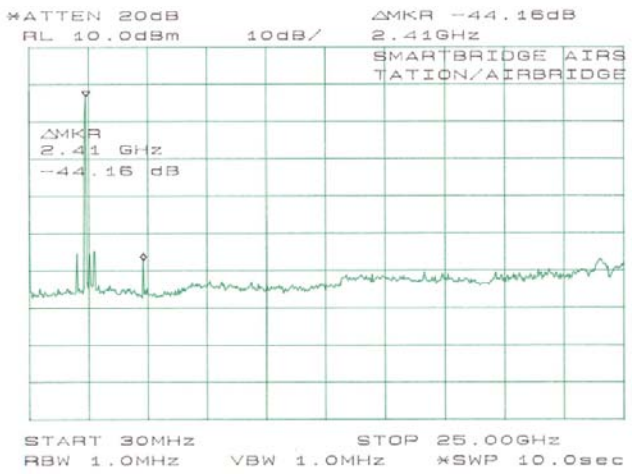
According to §15.209 (f) and §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit.

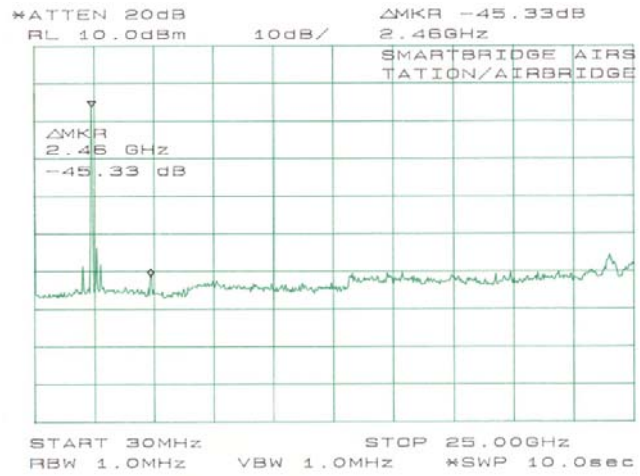
5.2 Measurement Procedure

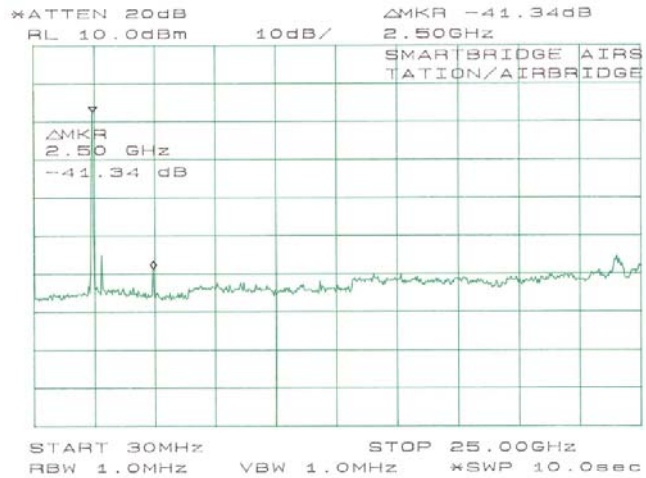
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the SA on Max-Hold Mode, and then keep the EUT in transmitting mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

5.3 Measurement Data

Plot(s) of Spurious Emission was presented hereinafter as reference.


*ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR -44.16dB
2.41GHz
SMARTBRIDGE AIRS
TATION/AIRBRIDGE
ΔMKR
2.41 GHz
-44.16 dB
START 30MHz
STOP 25.00GHz
RBW 1.0MHz
VBW 1.0MHz
*SWP 10.0sec


*ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR -45.33dB
2.46GHz
SMARTBRIDGE AIRS
TATION/AIRBRIDGE
ΔMKR
2.46 GHz
-45.33 dB
START 30MHz
STOP 25.00GHz
RBW 1.0MHz
VBW 1.0MHz
*SWP 10.0sec


*ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR -41.34dB
2.50GHz
SMARTBRIDGE AIRS
TATION/AIRBRIDGE
ΔMKR
2.50 GHz
-41.34 dB
START 30MHz
STOP 25.00GHz
RBW 1.0MHz
VBW 1.0MHz
*SWP 10.0sec

6 - POWER DENSITY

6.1 Standard Applicable

According to §15.247 (d), for digital modulation systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

6.2 Measurement Procedure

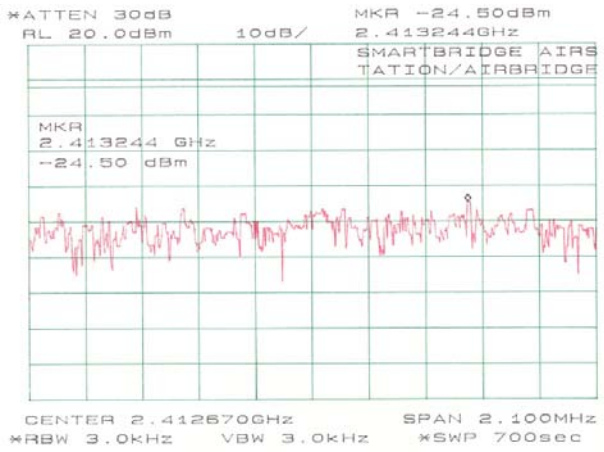
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to 2.1MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Repeat above procedures until all frequencies measured were complete.

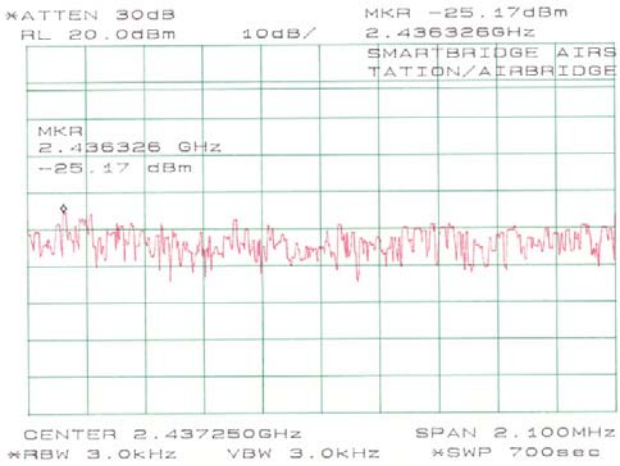
6.3 Test Equipment

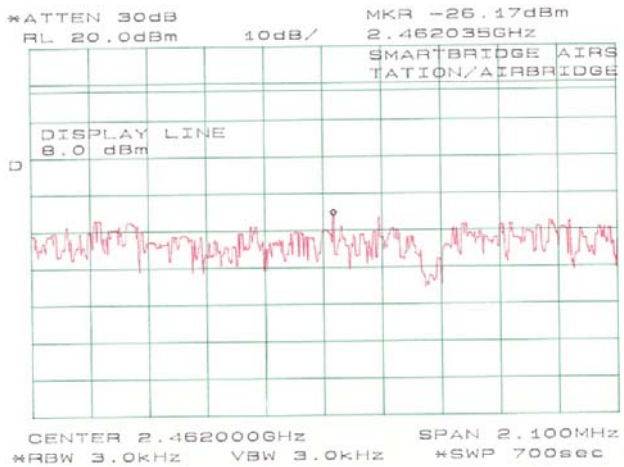
Manufacturer	Description	Model	Serial Number
HP	Spectrum Analyzer	8568B	2610A02165
HP	Spectrum Analyzer	8593B	2919A00242
HP	Plotter	7475A	N/A

6.4 Test Results

The plot(s) of power density was presented hereinafter as reference.


*ATTEN 30dB
RL 20.0dBm
10dB/
MKR -24.50dBm
2.413244GHz
SMARTBRIDGE AIRS
TATION/AIRBRIDGE
MKR
2.413244 GHz
-24.50 dBm
CENTER 2.412670GHz
SPAN 2.100MHz
*RBW 3.0kHz
VBW 3.0kHz
*SWP 700sec


*ATTEN 30dB
RL 20.0dBm
10dB/
MKR -25.17dBm
2.436326GHz
SMARTBRIDGE AIRS
TATION/AIRBRIDGE
MKR
2.436326 GHz
-25.17 dBm
CENTER 2.437250GHz
SPAN 2.100MHz
*RBW 3.0kHz
VBW 3.0kHz
*SWP 700sec


*ATTEN 30dB
RL 20.0dBm
10dB/
MKR -26.17dBm
2.462035GHz
SMARTBRIDGE AIRS
TATION/AIRBRIDGE
DISPLAY LINE
8.0 dBm
D
CENTER 2.462000GHz
SPAN 2.100MHz
*RBW 3.0kHz
VBW 3.0kHz
*SWP 700sec

7 - 6DB BANDWIDTH

7.1 Standard Applicable

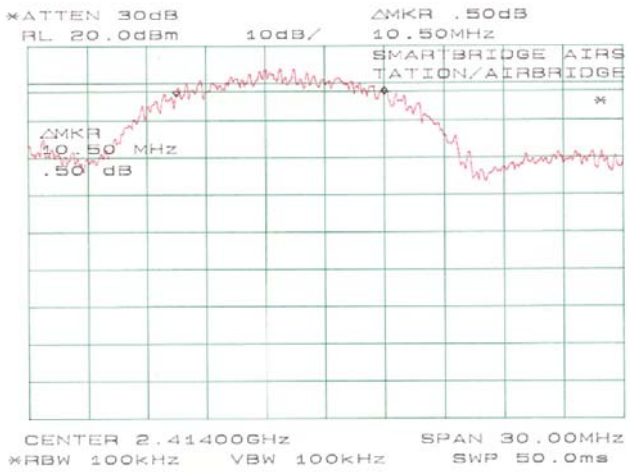
According to §15.247(a)(2), for digital modulation systems, the minimum 6dB bandwidth shall be at least 500 kHz.

7.2 Measurement Procedure

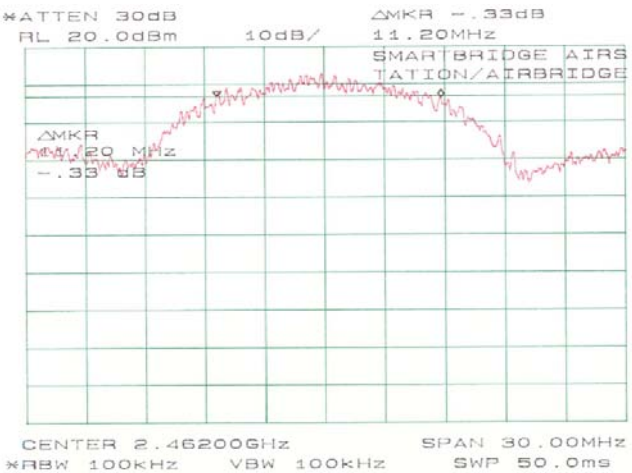
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

7.3 Test Result

The plot(s) of 6dB Bandwidth was presented hereinafter as reference.


*ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR .50dB
10.50MHz
SMARTBRIDGE AIRS
TATION/AIRBRIDGE
ΔMKR
10.50 MHz
.50 dB
CENTER 2.414000GHz
SPAN 30.00MHz
*RBW 100kHz
VBW 100kHz
SWP 50.0ms


*ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR .17dB
10.50MHz
SMARTBRIDGE AIRS
TATION/AIRBRIDGE
ΔMKR
10.50 MHz
.17 dB
CENTER 2.437250GHz
SPAN 30.00MHz
*RBW 100kHz
VBW 100kHz
SWP 50.0ms


*ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR -.33dB
11.20MHz
SMARTBRIDGE AIRS
TATION/AIRBRIDGE
ΔMKR
11.20 MHz
-.33 dB
CENTER 2.462000GHz
SPAN 30.00MHz
*RBW 100kHz
VBW 100kHz
SWP 50.0ms

8 - 100 KHZ BANDWIDTH OF BAND EDGES MEASUREMENT

8.1 Standard Applicable

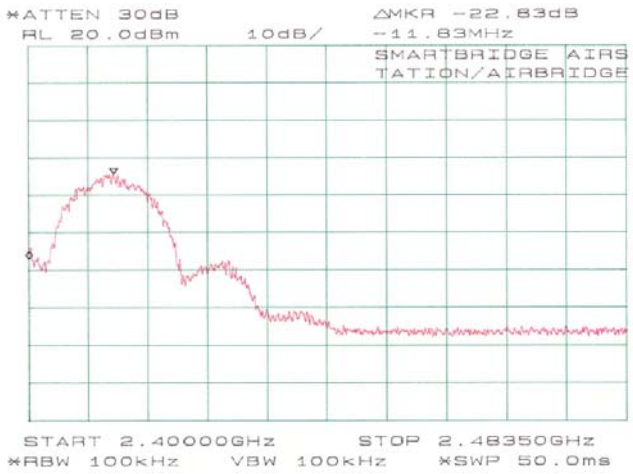
According to §15.247(c), if *any* 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in § 15.209(a), whichever results in the lesser attenuation.

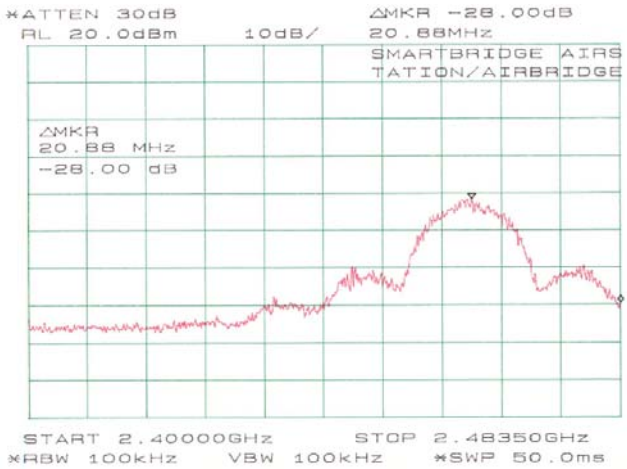
8.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

8.3 Test Results

The plot(s) of Band Edge Test Data was presented hereinafter as reference.


*ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR -22.83dB
-11.83MHz
SMARTBRIDGE AIRS
TATION/AIRBRIDGE
START 2.40000GHz
STOP 2.48350GHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0ms


*ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR -28.00dB
20.88MHz
SMARTBRIDGE AIRS
TATION/AIRBRIDGE
ΔMKR
20.88 MHz
-28.00 dB
START 2.40000GHz
STOP 2.48350GHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0ms

9 - CONDUCTED EMISSIONS TEST DATA

9.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is ±2.4 dB.

9.2 EUT Setup

The measurement was performed in the shield room, using the same setup per ANSI C63.4 - 1992 measurement procedure. The specification used was FCC 15 Subpart C limits.

The spacing between the peripherals was 10 centimeters.

Input / Output cables were draped along the edge of the test table and bundle when necessary.

The host PC system was connected with 120Vac/60Hz power source.

9.3 Spectrum Analyzer Setup

The spectrum analyzer was set with the following configurations during the conduction test:

Start Frequency	150 kHz
Stop Frequency	30 MHz
Sweep Speed	Auto
IF Bandwidth	10 kHz
Video Bandwidth	10 kHz
Quasi-Peak Adapter Bandwidth	9 kHz
Quasi-Peak Adapter Mode	Normal

9.4 Test Procedure

During the conducted emission test, the power cord of the host system was connected to the auxiliary outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of each modes tested to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (within -4 dBµV of specification limits). Quasi-peak readings are distinguished with a "**Qp**".

9.5 Summary of Test Results

According to the data in section 9.6, the EUT complied with the FCC Conducted margin for a Class B device, with the *worst* margin reading of:

-16.2dBµV at **0.780 MHz** in the **Line** mode, 150kHz - 30 MHz

9.6 Conducted Emissions Test Data

9.6.1 Test Data, 0.45 - 30 MHz.

LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency MHz	Amplitude dBμV	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dBμV	Margin dB
0.810	40.8	Ave	Neutral	46	-5.2
0.150	55.6	QP	Neutral	66	-10.4
0.150	54.8	QP	Line	66	-11.2
0.810	43.4	QP	Neutral	56	-12.6
2.420	43.1	QP	Line	56	-12.9
0.150	43.0	Ave	Neutral	56	-13.0
1.230	40.3	QP	Neutral	56	-15.7
0.300	44.3	QP	Line	60.24	-15.9
0.150	39.8	Ave	Line	56	-16.2
1.230	26.1	Ave	Neutral	46	-19.9
0.300	26.3	Ave	Line	50.24	-23.9
2.420	16.7	Ave	Line	46	-29.3

9.7 Plot of Conducted Emissions Test Data

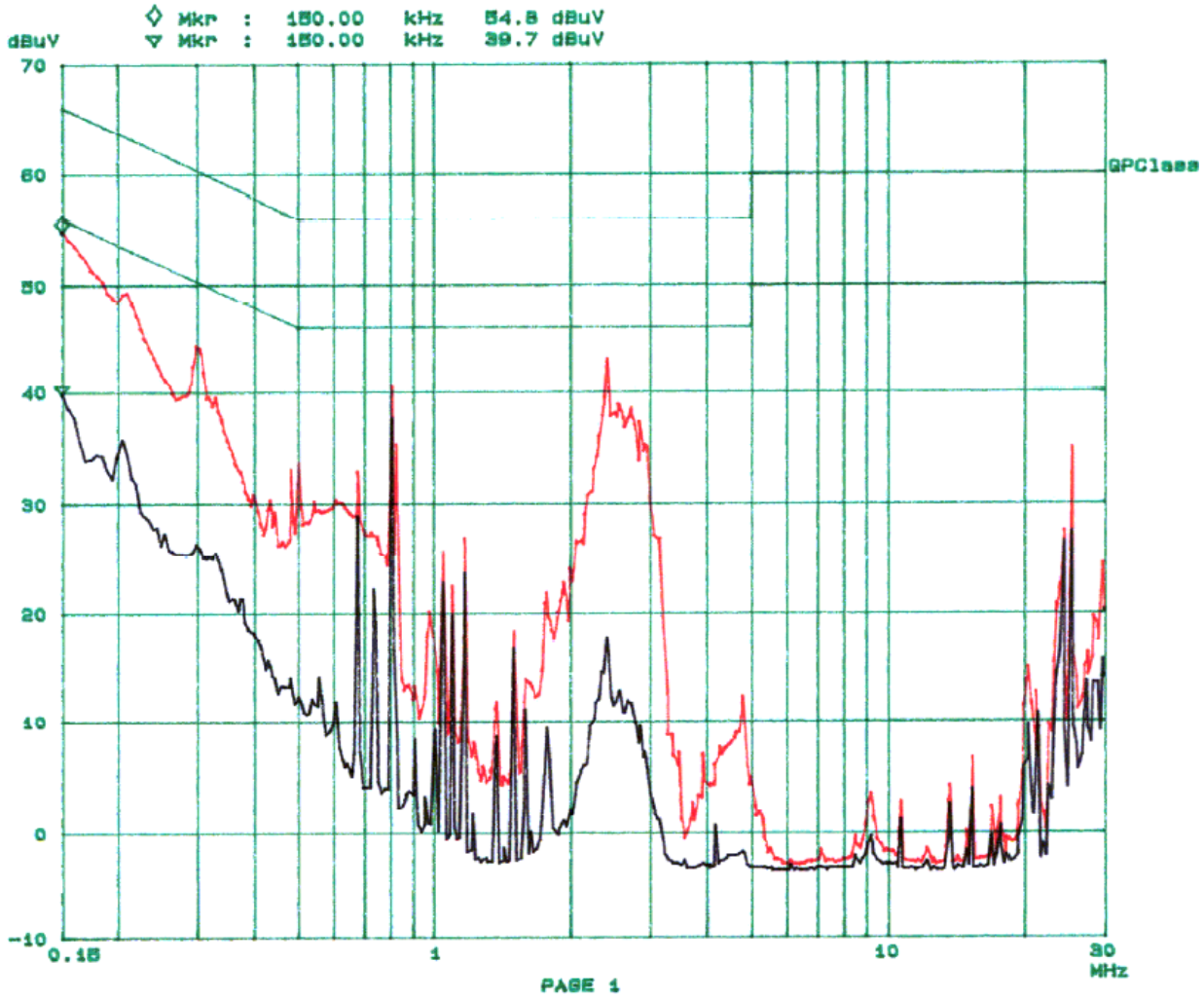
Plot(s) of Conducted Emissions Test Data is presented hereinafter as reference.

Bay Area Compliance Corporation
CISPR CLASS B

EUT: air Bridge Outdoor
Manuf: Smart Bridge
Op Cond: Normal
Operator: Jerry
Comment: L
File name: JINGNENG.RES

Scan Settings (1 Range)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	30M	5k	9K	QP+AV	20ms	10dBLN	OFF

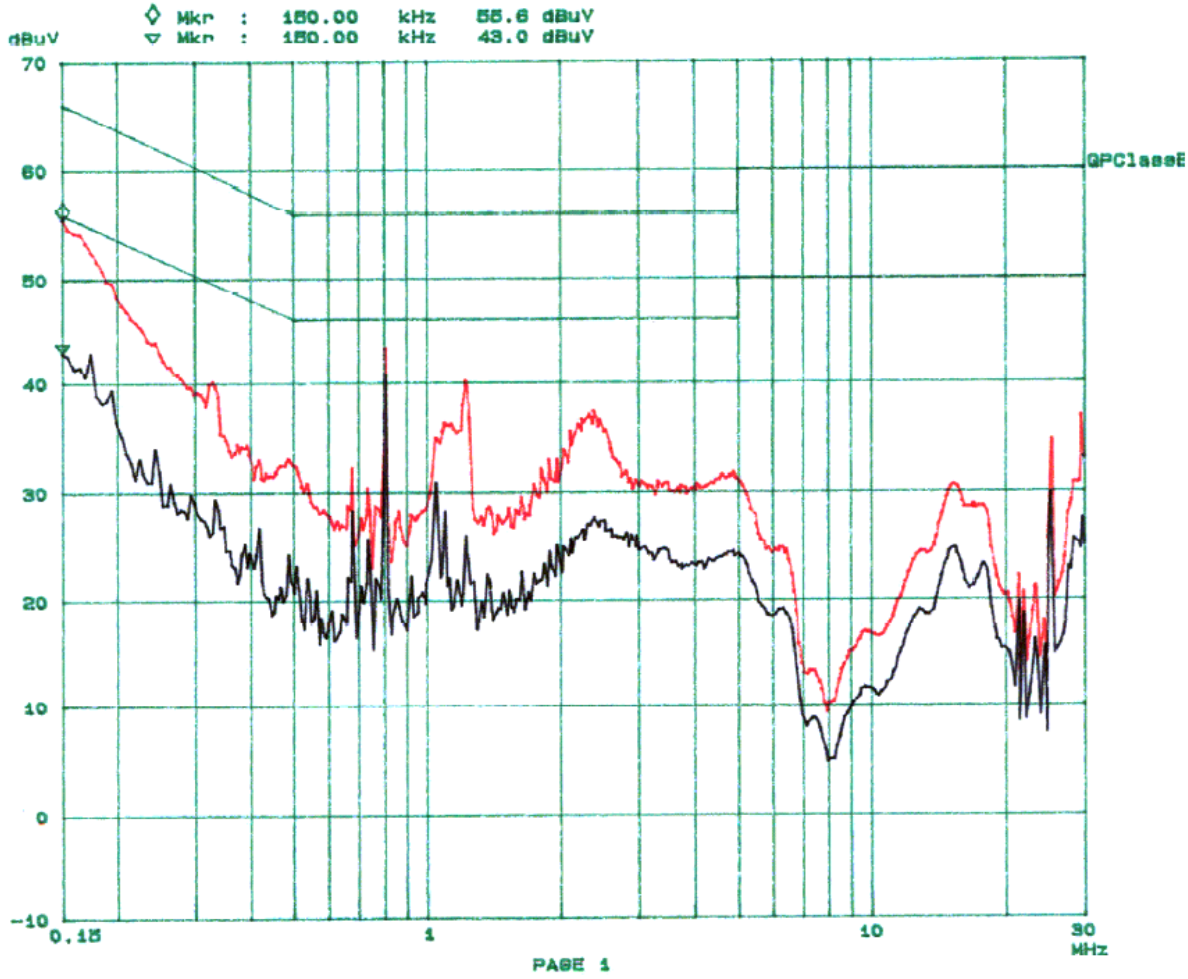


Bay Area Compliance Corporation
CISPR CLASS B

EUT: airBridge Outdoor
Manuf: Smart Bridge
Op Cond: Normal
Operator: Jerry
Comment: N
File name: SMARTB1.RES

Scan Settings (1 Range)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	30M	5k	9k	QP+AV	20ms	10dBLN	OFF



10 - RADIATED EMISSION

10.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is ±4.0 dB.

10.2 EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup in accordance with the ANSI C63.4-1992. The specification used was the FCC 15 Subpart C limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The host PC system was connected with 120Vac/60Hz power source.

10.3 Spectrum Analyzer Setup

According to FCC Rules, 47 CFR §15.33 (a) (1), the system was tested to 25GHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Start Frequency	30 MHz
Stop Frequency	25GHz
Sweep Speed	Auto
IF Bandwidth	1 MHz
Video Bandwidth	1 MHz
Quasi-Peak Adapter Bandwidth	120 kHz
Quasi-Peak Adapter Mode	Normal
Resolution Bandwidth	1MHz

10.4 Test Procedure

For the radiated emissions test, the Host PC system and all support equipment power cords were connected to the AC floor outlet since the power supply used in the EUT did not provide an accessory power outlet.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dBμV of specification limits), and are distinguished with a "**Qp**" in the data table.

10.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBμV means the emission is 7dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. - Class B Limit

10.6 Summary of Test Results

According to the data in section 10.7, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.207, and 15.247, and had the worst margin of:

PAWVA24-16, 16dB Vagi Antenna, 30MHz to 25GHz, 3 meters

-10.4 dBμV at 4824.60 MHz in the Vertical polarization, Low Channel
-10.1 dBμV at 4876.20 MHz in the Vertical polarization, Middle Channel
-10.4 dBμV at 4924.40 MHz in the Vertical polarization, High Channel
-4.7 dBμV at 351.90 MHz in the Horizontal polarization, Unwanted Emission

PAWOD24-12, 12dB OmniDirectional Antenna, 30MHz to 25GHz, 3 meters

-10.6 dBμV at 4824.60 MHz in the Vertical polarization, Low Channel
-10.4 dBμV at 4876.20 MHz in the Vertical polarization, Middle Channel
-10.5 dBμV at 4924.40 MHz in the Vertical polarization, High Channel
-1.7 dBμV at 32.02 MHz in the Vertical polarization, Unwanted Emission

PAWOD24-9, 9dB OmniDirectional Antenna, 30MHz to 25GHz, 3 meters

-11.0 dBμV at 4824.60 MHz in the Vertical polarization, Low Channel
-10.7 dBμV at 4876.20 MHz in the Vertical polarization, Middle Channel
-11.1 dBμV at 4924.40 MHz in the Vertical polarization, High Channel
-1.8 dBμV at 32.05 MHz in the Vertical polarization, Unwanted Emission

PAWSA24-12, 12dB 90Deg Sector Antenna, 30MHz to 25GHz, 3 meters

-9.9 dBμV at 4824.60 MHz in the Horizontal polarization, Low Channel
-9.7 dBμV at 4876.20 MHz in the Horizontal polarization, Middle Channel
-10.1 dBμV at 4924.40 MHz in the Horizontal polarization, High Channel
-2.6 dBμV at 32.02 MHz in the Vertical polarization, Unwanted Emission

PAWSA24-16, 16.5dB 90Deg Sector Antenna, 30MHz to 25GHz, 3 meters

-9.8 dBµV at 4824.60 MHz in the Horizontal polarization, Low Channel
-9.5 dBµV at 4876.20 MHz in the Horizontal polarization, Middle Channel
-9.9 dBµV at 4924.40 MHz in the Horizontal polarization, High Channel
-2.1 dBµV at 32.02 MHz in the Vertical polarization, Unwanted Emission

PAWDC24-HP-PF1P, 24dB Die Cast Directional Antenna, 30MHz to 25GHz, 3 meters

-7.1 dBµV at 4824.60 MHz in the Vertical polarization, Low Channel
-6.8 dBµV at 4876.20 MHz in the Vertical polarization, Middle Channel
-7.5 dBµV at 4924.40 MHz in the Vertical polarization, High Channel
-2.1 dBµV at 32.02 MHz in the Vertical polarization, Unwanted Emission

10.7 Final Test Result

10.7.1 PAWVA24-16, 16dBi Vagi Antenna, 30MHz to 25GHz, 3 meters

Indicated			Table	Antenna		Correction Factor			FCC Subpart C		
Freqency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Mode
MHz	dBμV/m	Degree	Meter	H/V	dBμV/m	dBμV/m	dB	dBμV/m	dBμV/m	dB	
Low Channel, 1 – 25 GHz											
2412.30	112.1	0	1.2	V	28.1	3.4	30.0	113.6			FUND.
2412.30	110.7	0	1.5	H	28.1	3.4	30.0	112.2			FUND.
4824.60	36.2	150	1.2	V	32.5	4.9	30.0	43.6	54	-10.4	AVG.
7236.90	32.1	210	1.2	V	35.1	5.6	30.0	42.8	54	-11.2	AVG.
7236.90	31.3	230	1.5	H	35.1	5.6	30.0	42.0	54	-12.0	AVG.
4824.60	34.4	180	1.5	H	32.5	4.9	30.0	41.8	54	-12.2	AVG.
4824.60	41.6	150	1.2	V	32.5	4.9	30.0	49.0	74	-25.0	PEAK
4824.60	39.5	180	1.5	H	32.5	4.9	30.0	46.9	74	-27.1	PEAK
7236.90	36.2	210	1.2	V	35.1	5.6	30.0	46.9	74	-27.1	PEAK
7236.90	35.5	230	1.5	H	35.1	5.6	30.0	46.2	74	-27.8	PEAK
Middle Channel, 1 – 25 GHz											
2438.10	113.2	0	1.5	V	28.1	3.4	30.0	114.7			FUND
2438.10	111.5	0	1.2	H	28.1	3.4	30.0	113.0			FUND
4876.20	36.5	340	1.5	V	32.5	4.9	30.0	43.9	54	-10.1	AVG.
7314.30	32.4	270	1.5	V	35.1	5.6	30.0	43.1	54	-10.9	AVG.
7314.30	31.7	210	1.2	H	35.1	5.6	30.0	42.4	54	-11.6	AVG.
4876.20	34.7	30	1.2	H	32.5	4.9	30.0	42.1	54	-11.9	AVG.
4876.20	41.8	340	1.5	V	32.5	4.9	30.0	49.2	74	-24.8	PEAK
4876.20	39.9	30	1.2	H	32.5	4.9	30.0	47.3	74	-26.7	PEAK
7314.30	36.6	270	1.5	V	35.1	5.6	30.0	47.3	74	-26.7	PEAK
7314.30	35.8	210	1.2	H	35.1	5.6	30.0	46.5	74	-27.5	PEAK
High Channel, 1 – 25 GHz											
2462.20	112.8	0	1.2	V	28.1	3.4	30.0	114.3			FUND
2462.20	111.3	0	1.2	H	28.1	3.4	30.0	112.8			FUND
4924.40	36.2	90	1.5	V	32.5	4.9	30.0	43.6	54	-10.4	AVG.
7386.60	32.1	230	1.2	V	35.1	5.6	30.0	42.8	54	-11.2	AVG.
7386.60	31.5	250	1.2	H	35.1	5.6	30.0	42.2	54	-11.8	AVG.
4924.40	34.5	120	1.5	H	32.5	4.9	30.0	41.9	54	-12.1	AVG.
4924.40	41.7	90	1.5	V	32.5	4.9	30.0	49.1	74	-24.9	PEAK
7386.60	36.4	230	1.2	V	35.1	5.6	30.0	47.1	74	-26.9	PEAK
4924.40	39.6	120	1.5	H	32.5	4.9	30.0	47.0	74	-27.0	PEAK
7386.60	35.7	250	1.2	H	35.1	5.6	30.0	46.4	74	-27.6	PEAK
Unintentional Emission, 30 - 1000 MHz											
351.90	48.5	180	1.0	H	15.5	2.3	25.0	41.3	46	-4.7	
224.00	51.2	45	1.5	H	11.8	2.2	25.0	40.2	46	-5.8	
959.90	37.6	45	1.0	H	23.3	4.3	25.0	40.2	46	-5.8	
225.90	50.6	225	1.5	H	11.8	2.2	25.0	39.6	46	-6.4	
192.00	44.7	270	1.0	V	13.7	2.1	25.0	35.5	43.5	-8.0	
576.10	40.2	225	1.0	H	19.3	3.0	25.0	37.5	46	-8.5	
128.00	46.3	45	1.0	V	11.9	1.6	25.0	34.7	43.5	-8.8	

10.7.2 PAWOD24-12, 12dBi OmniDirectional Antenna, 30MHz to 25GHz, 3 meters

Indicated			Table	Antenna		Correction Factor			FCC Subpart C		
Freqency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Mode
MHz	dBµV/m	Degree	Meter	H/V	dBµV/m	dBµV/m	dB	dBµV/m	dBµV/m	dB	
Low Channel, 1 – 25GHz											
2412.30	105.2	90	1.2	V	28.1	3.4	30.0	106.7			FUND.
2412.30	91.3	90	1.0	H	28.1	3.4	30.0	92.8			FUND.
4824.60	36.0	110	1.5	V	32.5	4.9	30.0	43.4	54	-10.6	AVG.
7236.90	31.8	260	1.0	V	35.1	5.6	30.0	42.5	54	-11.5	AVG.
7236.90	31.2	290	1.2	H	35.1	5.6	30.0	41.9	54	-12.1	AVG.
4824.60	33.7	130	1.2	H	32.5	4.9	30.0	41.1	54	-12.9	AVG.
4824.60	40.9	110	1.5	V	32.5	4.9	30.0	48.3	74	-25.7	PEAK
7236.90	36.4	260	1.0	V	35.1	5.6	30.0	47.1	74	-26.9	PEAK
4824.60	39.2	130	1.2	H	32.5	4.9	30.0	46.6	74	-27.4	PEAK
7236.90	35.7	290	1.2	H	35.1	5.6	30.0	46.4	74	-27.6	PEAK
Middle Channel, 1 – 25GHz											
2438.10	105.7	90	1.5	V	28.1	3.4	30.0	107.2			FUND
2438.10	91.6	90	1.8	H	28.1	3.4	30.0	93.1			FUND
4876.20	36.2	30	1.5	V	32.5	4.9	30.0	43.6	54	-10.4	AVG.
7314.30	32.2	230	1.5	V	35.1	5.6	30.0	42.9	54	-11.1	AVG.
7314.30	31.4	250	1.5	H	35.1	5.6	30.0	42.1	54	-11.9	AVG.
4876.20	33.9	60	1.2	H	32.5	4.9	30.0	41.3	54	-12.7	AVG.
4876.20	41.2	30	1.5	V	32.5	4.9	30.0	48.6	74	-25.4	PEAK
4876.20	39.5	60	1.2	H	32.5	4.9	30.0	46.9	74	-27.1	PEAK
7314.30	36.2	230	1.5	V	35.1	5.6	30.0	46.9	74	-27.1	PEAK
7314.30	35.5	250	1.5	H	35.1	5.6	30.0	46.2	74	-27.8	PEAK
High Channel, 1 – 25GHz											
2462.20	104.9	90	1.5	V	28.1	3.4	30.0	106.4			FUND
2462.20	91.2	90	1.5	H	28.1	3.4	30.0	92.7			FUND
4924.40	36.1	270	1.3	V	32.5	4.9	30.0	43.5	54	-10.5	AVG.
7386.60	31.6	160	1.5	V	35.1	5.6	30.0	42.3	54	-11.7	AVG.
7386.60	30.8	190	1.2	H	35.1	5.6	30.0	41.5	54	-12.5	AVG.
4924.40	33.4	90	1.5	H	32.5	4.9	30.0	40.8	54	-13.2	AVG.
4924.40	40.7	270	1.3	V	32.5	4.9	30.0	48.1	74	-25.9	PEAK
7386.60	36.3	160	1.5	V	35.1	5.6	30.0	47.0	74	-27.0	PEAK
4924.40	39.1	90	1.5	H	32.5	4.9	30.0	46.5	74	-27.5	PEAK
7386.60	35.5	190	1.2	H	35.1	5.6	30.0	46.2	74	-27.8	PEAK
Unintentional Emission, 30 – 1000 MHz											
32.02	47.6	135	1.0	V	14.9	0.8	25.0	38.3	40	-1.7	
160.01	51.9	315	1.0	V	12.9	1.8	25.0	41.6	43.5	-1.9	
350.99	50.2	180	1.3	H	15.5	2.3	25.0	43.0	46	-3.0	
224.10	53.9	45	1.7	H	11.8	2.2	25.0	42.9	46	-3.1	
192.03	48.3	270	1.0	V	13.7	2.1	25.0	39.1	43.5	-4.4	
255.98	50.8	225	1.4	H	13.3	2.2	25.0	41.3	46	-4.7	
447.90	44.2	180	1.2	H	16.9	2.9	25.0	39.0	46	-7.0	
128.01	47.5	225	1.2	V	11.9	1.6	25.0	35.9	43.5	-7.6	

10.7.3 PAWOD24-9, 9dBi Omnidirectional Antenna, 30MHz to 25GHz, 3 meters

Indicated			Table	Antenna		Correction Factor			FCC Subpart C		
Freqency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Mode
MHz	dBµV/m	Degree	Meter	H/V	dBµV/m	dBµV/m	dB	dBµV/m	dBµV/m	dB	
Low Channel, 1 – 25GHz											
2412.30	102.9	90	1.2	V	28.1	3.4	30.0	104.4			FUND.
2412.30	91.5	90	1.0	H	28.1	3.4	30.0	93.0			FUND.
4824.60	35.6	210	1.5	V	32.5	4.9	30.0	43.0	54	-11.0	AVG.
7236.90	31.1	90	1.2	V	35.1	5.6	30.0	41.8	54	-12.2	AVG.
7236.90	30.5	110	1.0	H	35.1	5.6	30.0	41.2	54	-12.8	AVG.
4824.60	33.1	250	1.5	H	32.5	4.9	30.0	40.5	54	-13.5	AVG.
4824.60	40.3	210	1.5	V	32.5	4.9	30.0	47.7	74	-26.3	PEAK
7236.90	35.9	90	1.2	V	35.1	5.6	30.0	46.6	74	-27.4	PEAK
4824.60	38.6	250	1.5	H	32.5	4.9	30.0	46.0	74	-28.0	PEAK
7236.90	35.1	110	1.0	H	35.1	5.6	30.0	45.8	74	-28.2	PEAK
Middle Channel, 1 – 25GHz											
2438.10	103.1	90	1.5	V	28.1	3.4	30.0	104.6			FUND
2438.10	91.8	90	1.8	H	28.1	3.4	30.0	93.3			FUND
4876.20	35.9	0	1.5	V	32.5	4.9	30.0	43.3	54	-10.7	AVG.
7314.30	31.3	250	1.5	V	35.1	5.6	30.0	42.0	54	-12.0	AVG.
7314.30	30.6	290	1.5	H	35.1	5.6	30.0	41.3	54	-12.7	AVG.
4876.20	33.2	30	1.2	H	32.5	4.9	30.0	40.6	54	-13.4	AVG.
4876.20	40.5	0	1.5	V	32.5	4.9	30.0	47.9	74	-26.1	PEAK
7314.30	36.1	250	1.5	V	35.1	5.6	30.0	46.8	74	-27.2	PEAK
4876.20	38.8	30	1.2	H	32.5	4.9	30.0	46.2	74	-27.8	PEAK
7314.30	35.3	290	1.5	H	35.1	5.6	30.0	46.0	74	-28.0	PEAK
High Channel, 1 – 25GHz											
2462.20	102.3	90	1.5	V	28.1	3.4	30.0	103.8			FUND
2462.20	90.8	90	1.8	H	28.1	3.4	30.0	92.3			FUND
4924.40	35.5	130	1.3	V	32.5	4.9	30.0	42.9	54	-11.1	AVG.
7386.60	30.7	240	1.5	V	35.1	5.6	30.0	41.4	54	-12.6	AVG.
7386.60	30.2	270	1.2	H	35.1	5.6	30.0	40.9	54	-13.1	AVG.
4924.40	32.9	90	1.5	H	32.5	4.9	30.0	40.3	54	-13.7	AVG.
4924.40	40.1	130	1.3	V	32.5	4.9	30.0	47.5	74	-26.5	PEAK
4924.40	38.4	90	1.5	H	32.5	4.9	30.0	45.8	74	-28.2	PEAK
7386.60	34.8	240	1.5	V	35.1	5.6	30.0	45.5	74	-28.5	PEAK
7386.60	33.6	270	1.2	H	35.1	5.6	30.0	44.3	74	-29.7	PEAK
Unintentional Emission, 30 – 1000 MHz											
32.02	47.5	135	1.0	V	14.9	0.8	25.0	38.2	40	-1.8	
160.01	51.7	315	1.0	V	12.9	1.8	25.0	41.4	43.5	-2.1	
224.10	53.4	45	1.7	H	11.8	2.2	25.0	42.4	46	-3.6	
350.99	49.4	180	1.3	H	15.5	2.3	25.0	42.2	46	-3.8	
192.03	48.1	270	1.0	V	13.7	2.1	25.0	38.9	43.5	-4.6	
255.98	50.5	225	1.4	H	13.3	2.2	25.0	41.0	46	-5.0	
447.90	43.9	180	1.2	V	16.9	2.9	25.0	38.7	46	-7.3	
128.01	47.2	225	1.2	V	11.9	1.6	25.0	35.6	43.5	-7.9	

10.7.4 PAWSA24-12, 12dBi 90 Deg. Sector Antenna, 30MHz to 25GHz, 3 meters

Indicated			Table	Antenna		Correction Factor			FCC Subpart C		
Freqency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Mode
MHz	dBµV/m	Degree	Meter	H/V	dBµV/m	dBµV/m	dB	dBµV/m	dBµV/m	dB	
Low Channel, 1 – 25GHz											
2412.30	90.4	0	1.2	V	28.1	3.4	30.0	91.9			FUND.
2412.30	112.9	0	1.2	H	28.1	3.4	30.0	114.4			FUND.
4824.60	36.7	210	1.5	H	32.5	4.9	30.0	44.1	54	-9.9	AVG.
7236.90	32.3	330	1.0	H	35.1	5.6	30.0	43.0	54	-11.0	AVG.
7236.90	31.0	0	1.3	V	35.1	5.6	30.0	41.7	54	-12.3	AVG.
4824.60	33.9	270	1.5	V	32.5	4.9	30.0	41.3	54	-12.7	AVG.
4824.60	41.5	210	1.5	H	32.5	4.9	30.0	48.9	74	-25.1	PEAK
4824.60	39.1	270	1.5	V	32.5	4.9	30.0	46.5	74	-27.5	PEAK
7236.90	34.2	330	1.0	H	35.1	5.6	30.0	44.9	74	-29.1	PEAK
7236.90	33.4	0	1.3	V	35.1	5.6	30.0	44.1	74	-29.9	PEAK
Middle Channel, 1 – 25GHz											
2438.10	90.8	0	1.5	V	28.1	3.4	30.0	92.3			FUND
2438.10	113.1	0	1.8	H	28.1	3.4	30.0	114.6			FUND
4876.20	36.9	210	1.2	H	32.5	4.9	30.0	44.3	54	-9.7	AVG.
7314.30	32.5	130	1.5	H	35.1	5.6	30.0	43.2	54	-10.8	AVG.
7314.30	31.1	90	1.5	V	35.1	5.6	30.0	41.8	54	-12.2	AVG.
4876.20	34.2	180	1.5	V	32.5	4.9	30.0	41.6	54	-12.4	AVG.
4876.20	41.7	210	1.2	H	32.5	4.9	30.0	49.1	74	-24.9	PEAK
4876.20	39.3	180	1.5	V	32.5	4.9	30.0	46.7	74	-27.3	PEAK
7314.30	34.1	130	1.5	H	35.1	5.6	30.0	44.8	74	-29.2	PEAK
7314.30	33.6	90	1.5	V	35.1	5.6	30.0	44.3	74	-29.7	PEAK
High Channel, 1 – 25GHz											
2462.20	90.1	0	1.2	V	28.1	3.4	30.0	91.6			FUND
2462.20	112.5	0	1.2	H	28.1	3.4	30.0	114.0			FUND
4924.40	36.5	210	1.5	H	32.5	4.9	30.0	43.9	54	-10.1	AVG.
7386.60	32.2	330	1.0	H	35.1	5.6	30.0	42.9	54	-11.1	AVG.
7386.60	30.9	0	1.3	V	35.1	5.6	30.0	41.6	54	-12.4	AVG.
4924.40	33.8	270	1.5	V	32.5	4.9	30.0	41.2	54	-12.8	AVG.
4924.40	41.3	210	1.5	H	32.5	4.9	30.0	48.7	74	-25.3	PEAK
4924.40	38.7	270	1.5	V	32.5	4.9	30.0	46.1	74	-27.9	PEAK
7386.60	34.4	330	1.0	H	35.1	5.6	30.0	45.1	74	-28.9	PEAK
7386.60	33.1	0	1.3	V	35.1	5.6	30.0	43.8	74	-30.2	PEAK
Unintentional Emission, 30 – 1000 MHz											
32.02	46.7	135	1.0	V	14.9	0.8	25.0	37.4	40	-2.6	
160.01	50.9	315	1.0	V	12.9	1.8	25.0	40.6	43.5	-2.9	
350.99	50.1	180	1.3	H	15.5	2.3	25.0	42.9	46	-3.1	
224.10	53.8	45	1.7	H	11.8	2.2	25.0	42.8	46	-3.2	
192.03	48.3	270	1.0	V	13.7	2.1	25.0	39.1	43.5	-4.4	
255.98	50.6	225	1.4	H	13.3	2.2	25.0	41.1	46	-4.9	
447.90	43.9	180	1.2	H	16.9	2.9	25.0	38.7	46	-7.3	
128.01	47.4	225	1.2	V	11.9	1.6	25.0	35.8	43.5	-7.7	
576.10	40.2	225	1.2	V	19.3	3.0	25.0	37.5	46	-8.5	

10.7.5 PAWSA24-16, 16.5dBi 90 Deg. Sector Antenna, 30MHz to 25GHz, 3 meters

Indicated			Table	Antenna		Correction Factor			FCC Subpart C		
Freqency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Mode
MHz	dBµV/m	Degree	Meter	H/V	dBµV/m	dBµV/m	dB	dBµV/m	dBµV/m	dB	
Low Channel, 1 – 25GHz											
2412.30	89.3	0	1.8	V	28.1	3.4	30.0	90.8			FUND.
2412.30	115.9	0	2.0	H	28.1	3.4	30.0	117.4			FUND.
4824.60	36.8	120	1.5	H	32.5	4.9	30.0	44.2	54	-9.8	AVG.
7236.90	32.4	30	1.5	H	35.1	5.6	30.0	43.1	54	-10.9	AVG.
7236.90	30.5	0	1.3	V	35.1	5.6	30.0	41.2	54	-12.8	AVG.
4824.60	33.5	90	1.8	V	32.5	4.9	30.0	40.9	54	-13.1	AVG.
4824.60	41.6	120	1.5	H	32.5	4.9	30.0	49.0	74	-25.0	PEAK
4824.60	37.9	90	1.8	V	32.5	4.9	30.0	45.3	74	-28.7	PEAK
7236.90	34.4	30	1.5	H	35.1	5.6	30.0	45.1	74	-28.9	PEAK
7236.90	33.6	0	1.3	V	35.1	5.6	30.0	44.3	74	-29.7	PEAK
Middle Channel, 1 – 25GHz											
2438.10	89.5	0	1.5	V	28.1	3.4	30.0	91.0			FUND
2438.10	116.2	0	1.8	H	28.1	3.4	30.0	117.7			FUND
4876.20	37.1	270	1.8	H	32.5	4.9	30.0	44.5	54	-9.5	AVG.
7314.30	32.7	90	1.3	H	35.1	5.6	30.0	43.4	54	-10.6	AVG.
7314.30	30.9	60	1.5	V	35.1	5.6	30.0	41.6	54	-12.4	AVG.
4876.20	33.8	220	2.0	V	32.5	4.9	30.0	41.2	54	-12.8	AVG.
4876.20	41.9	270	1.8	H	32.5	4.9	30.0	49.3	74	-24.7	PEAK
4876.20	38.2	220	2.0	V	32.5	4.9	30.0	45.6	74	-28.4	PEAK
7314.30	34.6	90	1.3	H	35.1	5.6	30.0	45.3	74	-28.7	PEAK
7314.30	33.8	60	1.5	V	35.1	5.6	30.0	44.5	74	-29.5	PEAK
High Channel, 1 – 25GHz											
2462.20	89.1	0	1.8	V	28.1	3.4	30.0	90.6			FUND
2462.20	115.6	0	2.0	H	28.1	3.4	30.0	117.1			FUND
4924.40	36.7	270	1.5	H	32.5	4.9	30.0	44.1	54	-9.9	AVG.
7386.60	32.2	90	1.8	H	35.1	5.6	30.0	42.9	54	-11.1	AVG.
7386.60	30.4	60	1.5	V	35.1	5.6	30.0	41.1	54	-12.9	AVG.
4924.40	33.4	220	1.8	V	32.5	4.9	30.0	40.8	54	-13.2	AVG.
4924.40	41.5	270	1.5	H	32.5	4.9	30.0	48.9	74	-25.1	PEAK
4924.40	37.8	220	1.8	V	32.5	4.9	30.0	45.2	74	-28.8	PEAK
7386.60	34.2	90	1.8	H	35.1	5.6	30.0	44.9	74	-29.1	PEAK
7386.60	33.5	60	1.5	V	35.1	5.6	30.0	44.2	74	-29.8	PEAK
Unintentional Emission, 30 – 1000 MHz											
32.02	47.2	135	1.2	V	14.9	0.8	25.0	37.9	40	-2.1	
350.99	50.9	180	1.3	H	15.5	2.3	25.0	43.7	46	-2.3	
160.01	51.2	315	1.5	V	12.9	1.8	25.0	40.9	43.5	-2.6	
224.10	54.1	45	1.5	H	11.8	2.2	25.0	43.1	46	-2.9	
192.03	49.3	270	1.5	V	13.7	2.1	25.0	40.1	43.5	-3.4	
255.98	50.8	225	1.8	H	13.3	2.2	25.0	41.3	46	-4.7	
128.01	48.5	225	1.5	V	11.9	1.6	25.0	36.9	43.5	-6.6	
447.90	44.1	180	1.5	H	16.9	2.9	25.0	38.9	46	-7.1	
576.10	40.9	225	1.5	V	19.3	3.0	25.0	38.2	46	-7.8	

10.7.6 PAWES24-16, 14dBi Backfire Antenna, 30MHz to 25GHz, 3 meters

Indicated			Table	Antenna		Correction Factor			FCC Subpart C		
Freqency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Mode
MHz	dBμV/m	Degree	Meter	H/V	dBμV/m	dBμV/m	dB	dBμV/m	dBμV/m	dB	
Low Channel, 1 – 25GHz											
2412.30	115.3	0	1.5	V	28.1	3.4	30.0	116.8			FUND.
2412.30	102.6	0	1.5	H	28.1	3.4	30.0	104.1			FUND.
4824.60	36.7	270	1.2	V	32.5	4.9	30.0	44.1	54	-9.9	AVG.
7236.90	31.9	110	1.5	V	35.1	5.6	30.0	42.6	54	-11.4	AVG.
7236.90	30.5	90	1.2	H	35.1	5.6	30.0	41.2	54	-12.8	AVG.
4824.60	33.5	250	1.2	H	32.5	4.9	30.0	40.9	54	-13.1	AVG.
4824.60	41.6	270	1.2	V	32.5	4.9	30.0	49.0	74	-25.0	PEAK
4824.60	37.7	250	1.2	H	32.5	4.9	30.0	45.1	74	-28.9	PEAK
7236.90	34.4	110	1.5	V	35.1	5.6	30.0	45.1	74	-28.9	PEAK
7236.90	33.2	90	1.2	H	35.1	5.6	30.0	43.9	74	-30.1	PEAK
Middle Channel, 1 – 25GHz											
2438.10	115.1	0	1.5	V	28.1	3.4	30.0	116.6			FUND
2438.10	102.8	0	1.2	H	28.1	3.4	30.0	104.3			FUND
4876.20	36.5	90	1.5	V	32.5	4.9	30.0	43.9	54	-10.1	AVG.
7314.30	31.8	0	1.2	V	35.1	5.6	30.0	42.5	54	-11.5	AVG.
7314.30	30.7	30	1.5	H	35.1	5.6	30.0	41.4	54	-12.6	AVG.
4876.20	33.7	70	1.5	H	32.5	4.9	30.0	41.1	54	-12.9	AVG.
4876.20	41.3	90	1.5	V	32.5	4.9	30.0	48.7	74	-25.3	PEAK
4876.20	37.9	70	1.5	H	32.5	4.9	30.0	45.3	74	-28.7	PEAK
7314.30	34.2	0	1.2	V	35.1	5.6	30.0	44.9	74	-29.1	PEAK
7314.30	33.5	30	1.5	H	35.1	5.6	30.0	44.2	74	-29.8	PEAK
High Channel, 1 – 25GHz											
2462.20	114.9	0	1.5	V	28.1	3.4	30.0	116.4			FUND
2462.20	101.7	0	1.5	H	28.1	3.4	30.0	103.2			FUND
4924.40	36.2	45	1.2	V	32.5	4.9	30.0	43.6	54	-10.4	AVG.
7386.60	31.4	120	1.5	V	35.1	5.6	30.0	42.1	54	-11.9	AVG.
7386.60	30.3	140	1.5	H	35.1	5.6	30.0	41.0	54	-13.0	AVG.
4924.40	33.1	80	1.5	H	32.5	4.9	30.0	40.5	54	-13.5	AVG.
4924.40	41.2	45	1.2	V	32.5	4.9	30.0	48.6	74	-25.4	PEAK
4924.40	37.5	80	1.5	H	32.5	4.9	30.0	44.9	74	-29.1	PEAK
7386.60	34.1	120	1.5	V	35.1	5.6	30.0	44.8	74	-29.2	PEAK
7386.60	33.2	140	1.5	H	35.1	5.6	30.0	43.9	74	-30.1	PEAK
Unintentional Emission, 30 – 1000 MHz											
32.02	47.1	135	1.2	V	14.9	0.8	25.0	37.8	40	-2.2	
160.01	51.1	315	1.5	V	12.9	1.8	25.0	40.8	43.5	-2.7	
350.99	50.2	180	1.3	H	15.5	2.3	25.0	43.0	46	-3.0	
224.10	53.8	45	1.5	H	11.8	2.2	25.0	42.8	46	-3.2	
192.03	48.7	270	1.5	V	13.7	2.1	25.0	39.5	43.5	-4.0	
255.98	50.6	225	1.8	H	13.3	2.2	25.0	41.1	46	-4.9	
128.01	48.1	225	1.5	V	11.9	1.6	25.0	36.5	43.5	-7.0	
447.90	43.9	180	1.5	H	16.9	2.9	25.0	38.7	46	-7.3	
576.10	40.2	225	1.5	V	19.3	3.0	25.0	37.5	46	-8.5	

10.7.7 PAWDC24-HD-PF1P, 24dB Die Cast Directional Antenna, 30MHz to 25GHz, 3 meters

Indicated			Table	Antenna		Correction Factor			FCC Subpart C		
Freqency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Mode
MHz	dBµV/m	Degree	Meter	H/V	dBµV/m	dBµV/m	dB	dBµV/m	dBµV/m	dB	
Low Channel, 1 – 25GHz											
2412.30	122.1	0	1.5	V	28.1	3.4	30.0	123.6	54		FUND
2412.30	119.3	0	1.5	H	28.1	3.4	30.0	120.8	54		FUND
4824.60	39.5	45	1.5	V	32.5	4.9	30.0	46.9	54	-7.1	AVG.
4824.60	37.2	60	1.3	H	32.5	4.9	30.0	44.6	54	-9.4	AVG.
7236.90	32.9	330	1.5	V	35.1	5.6	30.0	43.6	54	-10.4	AVG.
7236.90	31.2	350	1.5	H	35.1	5.6	30.0	41.9	54	-12.1	AVG.
4824.60	43.1	45	1.5	V	32.5	4.9	30.0	50.5	74	-23.5	PEAK
4824.60	41.6	60	1.3	H	32.5	4.9	30.0	49.0	74	-25.0	PEAK
7236.90	36.5	330	1.5	V	35.1	5.6	30.0	47.2	74	-26.8	PEAK
7236.90	34.3	350	1.5	H	35.1	5.6	30.0	45.0	74	-29.0	PEAK
Middle Channel, 1 – 25GHz											
2438.10	122.3	0	1.5	V	28.1	3.4	30.0	123.8			FUND
2438.10	119.5	0	1.5	H	28.1	3.4	30.0	121.0			FUND
4876.20	39.8	15	1.5	V	32.5	4.9	30.0	47.2	54	-6.8	AVG.
4876.20	37.6	30	1.3	H	32.5	4.9	30.0	45.0	54	-9.0	AVG.
7314.30	33.2	60	1.5	V	35.1	5.6	30.0	43.9	54	-10.1	AVG.
7314.30	31.5	90	1.5	H	35.1	5.6	30.0	42.2	54	-11.8	AVG.
4876.20	43.4	15	1.5	V	32.5	4.9	30.0	50.8	74	-23.2	PEAK
4876.20	41.9	30	1.3	H	32.5	4.9	30.0	49.3	74	-24.7	PEAK
7314.30	36.7	60	1.5	V	35.1	5.6	30.0	47.4	74	-26.6	PEAK
7314.30	34.4	90	1.5	H	35.1	5.6	30.0	45.1	74	-28.9	PEAK
High Channel, 1 – 25GHz											
2462.20	121.8	0	1.5	V	28.1	3.4	30.0	123.3			FUND
2462.20	118.7	0	1.5	H	28.1	3.4	30.0	120.2			FUND
4924.40	39.1	15	1.5	V	32.5	4.9	30.0	46.5	54	-7.5	AVG.
4924.40	36.8	30	1.3	H	32.5	4.9	30.0	44.2	54	-9.8	AVG.
7386.60	32.4	60	1.5	V	35.1	5.6	30.0	43.1	54	-10.9	AVG.
7386.60	30.9	80	1.5	H	35.1	5.6	30.0	41.6	54	-12.4	AVG.
4924.40	42.9	15	1.5	V	32.5	4.9	30.0	50.3	74	-23.7	PEAK
4924.40	41.3	30	1.3	H	32.5	4.9	30.0	48.7	74	-25.3	PEAK
7386.60	36.2	60	1.5	V	35.1	5.6	30.0	46.9	74	-27.1	PEAK
7386.60	34.1	80	1.5	H	35.1	5.6	30.0	44.8	74	-29.2	PEAK
Unintentional Emission, 30 – 1000 MHz											
32.02	47.2	135	1.2	V	14.9	0.8	25.0	37.9	40	-2.1	
224.10	54.7	45	1.5	H	11.8	2.2	25.0	43.7	46	-2.3	
350.99	50.8	180	1.3	H	15.5	2.3	25.0	43.6	46	-2.4	
160.01	51.1	315	1.5	V	12.9	1.8	25.0	40.8	43.5	-2.7	
192.03	49.7	270	1.5	V	13.7	2.1	25.0	40.5	43.5	-3.0	
255.98	51.4	225	1.8	H	13.3	2.2	25.0	41.9	46	-4.1	
128.01	49.2	225	1.5	V	11.9	1.6	25.0	37.6	43.5	-5.9	
576.10	42.5	225	1.5	V	19.3	3.0	25.0	39.8	46	-6.2	
447.90	44.8	180	1.5	H	16.9	2.9	25.0	39.6	46	-6.4	

11 - RF EXPOSURE

According to §15.247(b)(4) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1093 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-15000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

MPE Prediction

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal: 17.47 (dBm)
Maximum peak output power at antenna input terminal: 55.8 (mW)
Prediction distance: 20 (cm)
Predication frequency: 2400 (MHz)

Point to Multi Point Antennas:

1. PAWVA24-16, 16dB Vagi Antenna Gain (typical): 16 (dBi)
   Maximum antenna gain: 39.81 (numeric)
   Power density at predication frequency at 20 cm: 0.44 (mW/cm^2)
   MPE distance at maximum power density (1 mW/cm^2): 13.30 cm

2. PAWOD24-12, 12dB OmniDirectional Antenna, Antenna Gain (typical): 12 (dBi)
   Maximum antenna gain: 15.85 (numeric)
   Power density at predication frequency at 20 cm: 0.18 (mW/cm^2)
   MPE distance at maximum power density (1 mW/cm^2): 8.39 cm

3. PAWOD24-9, 9dB OmniDirectional Antenna, Antenna Gain (typical): 9 (dBi)
   Maximum antenna gain: 7.94 (numeric)
   Power density at predication frequency at 20 cm: 0.09 (mW/cm^2)
   MPE distance at maximum power density (1 mW/cm^2): 5.94 cm

4. PAWSA24-12, 12dB 90Deg Sector Antenna Gain (typical): 12 (dBi)
   Maximum antenna gain: 15.85 (numeric)
   Power density at predication frequency at 20 cm: 0.18 (mW/cm^2)
   MPE distance at maximum power density (1 mW/cm^2): 8.39cm

5. PAWSA24-16, 16.5dB 90 Deg Sector Antenna Gain (typical): 16.5 (dBi)
   Maximum antenna gain: 44.67 (numeric)
   Power density at predication frequency at 20 cm: 0.50 (mW/cm^2)
   MPE distance at maximum power density (1 mW/cm$^{2)}$: 14.08 cm

6. PAWES24-12, 14dB Backfire Antenna Gain (typical): 14 (dBi)
   Maximum antenna gain: 25.12 (numeric)
   Power density at predication frequency at 20 cm: 0.28 (mW/cm^2)
   MPE distance at maximum power density (1 mW/cm^2): 10.56 cm

Point to Point Antenna:

7. PAWDC24-HD-PF1P, 24dB Die Cast Directional Antenna Gain (typical): 24 (dBi)
   Maximum antenna gain: 251.19 (numeric)
   Power density at predication frequency at 20 cm: 2.79 (mW/cm^2)
   MPE distance at maximum power density (1 mW/cm^2): 33.40 cm

MPE limit for uncontrolled exposure at prediction frequency: 1 (mW/cm^2)

Test Result

The predicted power density level and MPE calculated distance are as following:

Point to Multi Point Antennas:

1. PAWVA24-16, 16dB Vagi Antenna: predicted power density level at 20 cm is 0.44 cmW/cm², MPE distance at maximum power density (1mW/cm^2) is 13.30 cm

2. PAWOD24-12, 12dB OmniDirectional Antenna: predicted power density level at 20 cm is 0.18 mW/cm², MPE distance at maximum power density (1mW/cm^2) is 8.39 cm

3. PAWOD24-9, 9dB OmniDirectional Antenna: predicted power density level at 20 cm is 0.09 mW/cm², MPE distance at maximum power density (1mW/cm^2) is 5.94 cm

4. PASA24-12, 12dB 90Deg Sector Antenna: predicted power density level at 20 cm is 0.18 mW/cm², MPE distance at maximum power density (1mW/cm^2) is 8.39 cm.

5. PAWSA24-16, 16.5dB 90 Deg Sector Antenna: predicted power density level at 20 cm is 0.50 mW/cm², MPE distance at maximum power density (1mW/cm^2) is 14.08 cm

6. PAWES24-16, 14dB Backfire Antenna: predicted power density level at 20 cm is 0.28 mW/cm², MPE distance at maximum power density (1mW/cm^2) is 10.56 cm

Point to Multi Point Antenna:

7. PAWDC24-HD-PF1P, 24dB Die Cast Directional Antenna: predicted power density level at 20 cm is 2.79 mW/cm², MPE distance at maximum power density (1mW/cm^2) is 33.40 cm.

These are below the uncontrolled exposure limit of 1mW/cm² at 2400 MHz.

The EUT is used at least 20 cm away from user's body, it is defined as mobile equipment.