

**YOUNG DESIGN, INC.
FCC INFORMATION**

RF Measurement Report

Prepared by:

National Certification Laboratory

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In Support of:

FCC APPLICATION FOR CERTIFICATION

For:

**Young Design, Inc.
8000 Lee Highway
Falls Church, VA 22042**

Model: CA2458 Converter with Agere Extended WLAN Card

FCCID: NM5-2458-AL

Demonstration of Compliance with FCC Rules Part 15.247

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December 23, 2001

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NCL PROJ.# YOUNG-588

1.0 **General Information:**

This report has been prepared on behalf of **Young Design, Inc.**, to support the attached Application for a Certification of a Part 15 Spread Spectrum Transmitter. The Equipment Under Test (EUT) was the **Model: CA2458 Converter with Agere Extended WLAN Card**. The test results reported in this document relate only to the item that was tested.

Radio-Noise Emissions tests were performed according to *FCC Public Notice 54797, titled "Guidance on Measurement for Direct Sequence SST"*. The measuring equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.1 **Summary:**

The Young Design, Inc., **CA2458 Converter with Agere Extended WLAN Card**, and a suite of specific antennas complies with the FCC limits (15.247) for a Direct Sequence SST. Tests were performed on radio channels 1, 7, and 14. These are referred to in the report as the low, mid and high channels respectively.

1.2 **Test Methodology:**

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 1992. Radiated testing was performed at an antenna to EUT distance of three (3) meters.

1.3 **Test Facility:**

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of National Certification Laboratory 8370 Court Avenue, Suite B-1, Ellicott City, Maryland 21043. This site has been fully described in a report dated May 26, 1993, submitted to and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing.

2.0 Description of Equipment Under Test (EUT):

The **Lucent Agere WaveLAN Card** is currently certified with FCCID: **IMRWLPCE24H**. Young Design, Inc. has not modified this product in any manner except for the addition of high gain antennas, and an external amplifier. The **CA2458 Converter** takes the 2.4 GHz signal from the WLAN card and upconverts to 5.8 GHz.

Professional Installation Requirement:

The converter unit incorporates a standard N connector to the antenna, therefore requiring professional installation. The User Manual specifies that only trained certified technicians should install the **CA2458 Converter**. There are many technical steps needed to install an operating system as outlined in the manual. These include antenna support structure, site survey, antenna alignment, test, and troubleshoot. All systems sold to businesses are installed under the supervision of Young Design, Inc. Marketing is limited to sales by authorized dealers.

The EUT features:

Direct Sequence Spread Spectrum Modulation

24 dBm Peak RF Output

5740 to 5811.5 MHz Frequency Range

10 MHz, 6 dB Emission Bandwidth

14 Available Channels

5 MHz Channel Separation

11 Mbps Data Rate (Radio Link)

2.1 **EMI Countermeasure:**

The following modifications were made to the EUT, by the project engineer to assure compliance to specifications:

None.

3.0 **Test Program:**

This report contains measurement charts and data as evidence for the following tests performed:

1. (15.247b) Peak RF output power.
2. (15.247a) 6 dB Emission Bandwidth.
3. (15.247c) RF Antenna Conducted output of harmonics and spurious out-of-band emissions.
4. (15.247c) Field Strength of harmonics and spurious out-of-band emissions.
5. (15.207) AC Power Line Conducted emissions.
6. (15.247c) Band Edge emissions.
7. (15.247d) Power Spectral Density.

4.0 Test Configuration for Antenna Terminal Conducted:

The PCM wireless LAN card was installed in a notebook computer for testing. A DOS program is used to control the transmitter. The external converter was connected in-line between the wireless LAN card and antenna via 75 feet of LMR400 low-loss cable. This has insertion loss of 5.1 dB at 2450 MHz. The Installation Manual will specify that the coax cable between the D.C. Injector and converter must have at least 5.1 dB loss if other than LMR400 cable is used. For example, a 75 foot cable is the minimum length of LMR400 cable to be used with the system.

RF power output measurements were taken with a Peak RF power meter at the converter antenna connector. RF antenna conducted output tests such as Bandwidth, Spurious/Harmonics, and Power Spectral Density were taken with the converter antenna connector feeding directly into the spectrum analyzer. The analyzer's internal attenuator was adjusted to prevent overloading of the front end. All four data bit-rates were checked to determine if variations in Power, Bandwidth, Bandedge, and Power Spectral Density levels were measured. The worse-case data rate was 11 Mbps, thus charts and tables given in this report, reflect this mode.

Field strength measurements were taken with the converter feeding a dish, panel, or Uni-directional antenna aimed at the receiving antenna. Testing was performed using the highest gain antenna from each design family (dish, panel, uni-directional) in order to cover the worst case range of combinations.

A list of all antennas and suggested cables that will be sold with the EUT is provided in Table 1.

4.1 Peak Power Test Results:

Limit: 1 watt (30 dBm)

Condition: Transmitter is set to a single 11 Mbps modulated channel at full power.
Measurements taken at antenna connector.

Readings from Peak RF Power Meter:

WLAN Card w/ Converter @ 5740 MHz:	23.7 dBm
WLAN Card w/ Converter @ 5770 MHz:	23.9 dBm
WLAN Card w/ Converter @ 5811 MHz:	24.0 dBm

4.2 6 dB Emission Bandwidth Test Results:

Minimum 6 dB BW: 0.500 MHz
RBW Setting on S.A.: 100 kHz

Condition: Transmitter is set to a single 11 Mbps modulated channel at full power.
Measurements taken at antenna connector.

Readings from Spectrum Analyzer:

WLAN Card w/ Converter @ 5740 MHz:	9.9 MHz
WLAN Card w/ Converter @ 5770 MHz:	9.8 MHz
WLAN Card w/ Converter @ 5811 MHz:	10.3 MHz

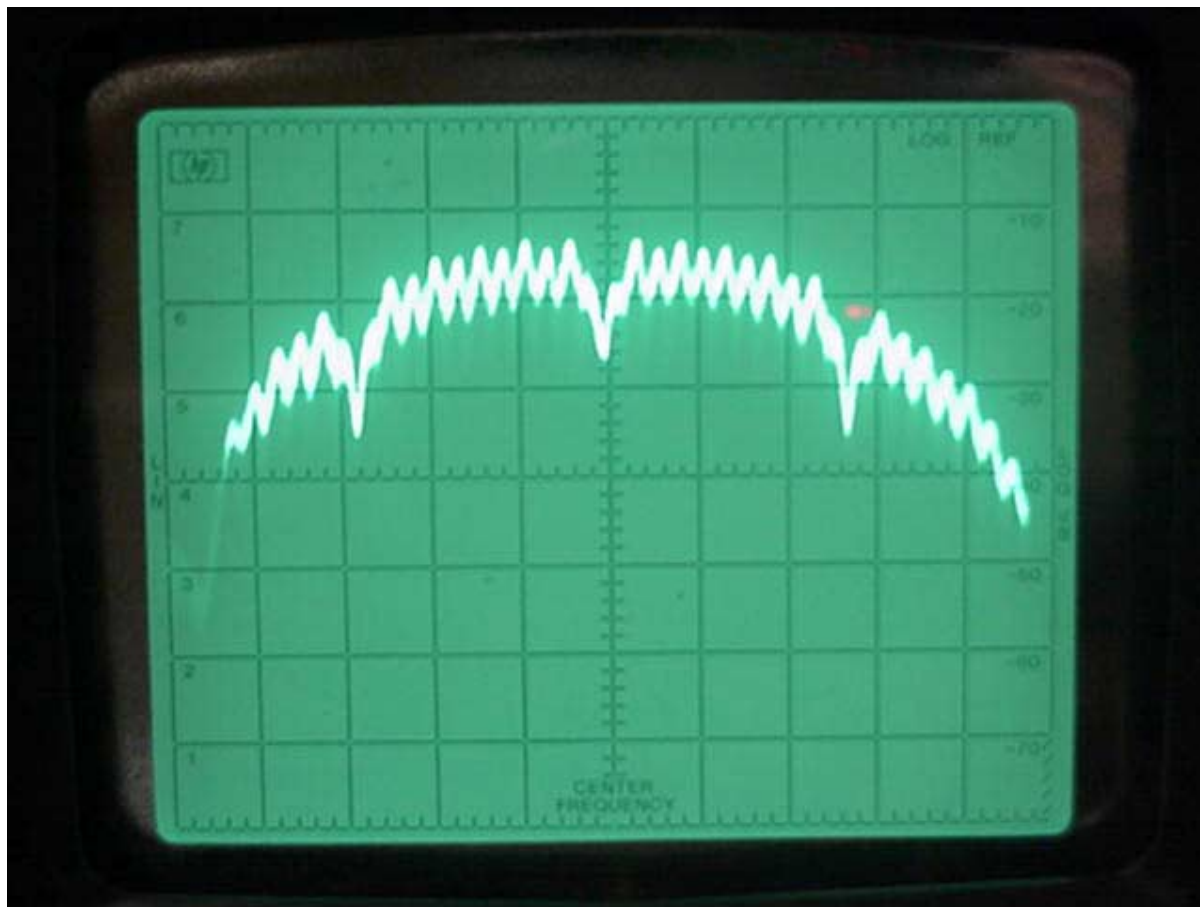
SEE FOLLOWING THREE (3) PLOTS OF MODULATED CARRIER

4.2.1 6 dB Bandwidth Emissions (100 kHz Res. BW) Low Channel Bandwidth
Plot:

6 dB EMISSION BANDWIDTH – MODULATED CARRIER
Low Channel

TOP REFERENCE LEVEL: 30 dBm
RESOLUTION BW: 100 KHZ
CENTER FREQUENCY: 5740 MHZ
FREQUENCY SPAN: 20 MHZ (2 MHz/div)

MEASURED BANDWIDTH: 9.9 MHZ

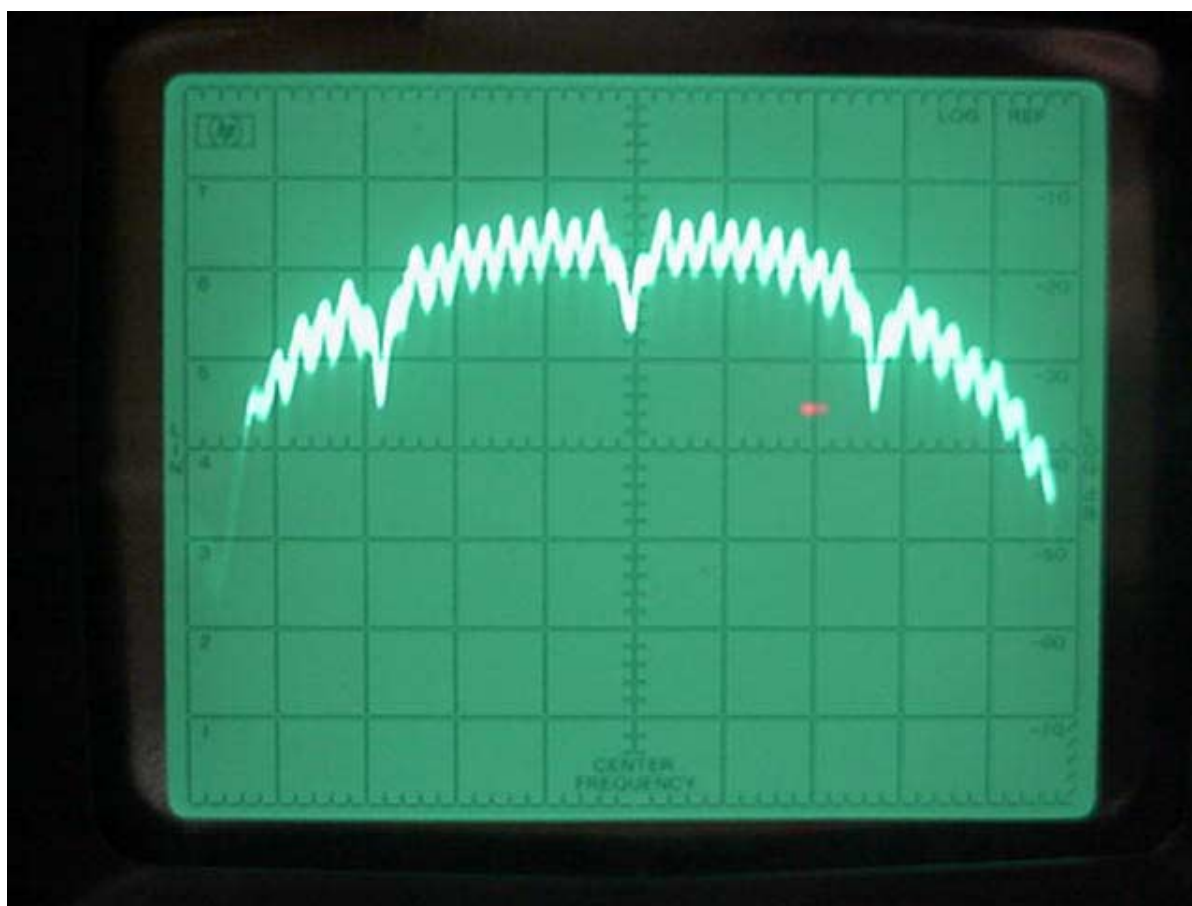


4.2.2 6 dB Bandwidth Emissions (100 kHz Res. BW) Mid Channel Bandwidth
Plot:

6 dB EMISSION BANDWIDTH – MODULATED CARRIER
Mid Channel

TOP REFERENCE LEVEL: 30 dBm
RESOLUTION BW: 100 KHZ
CENTER FREQUENCY: 5770 MHZ
FREQUENCY SPAN: 20 MHZ (2 MHz/div)

MEASURED BANDWIDTH: 9.8 MHZ

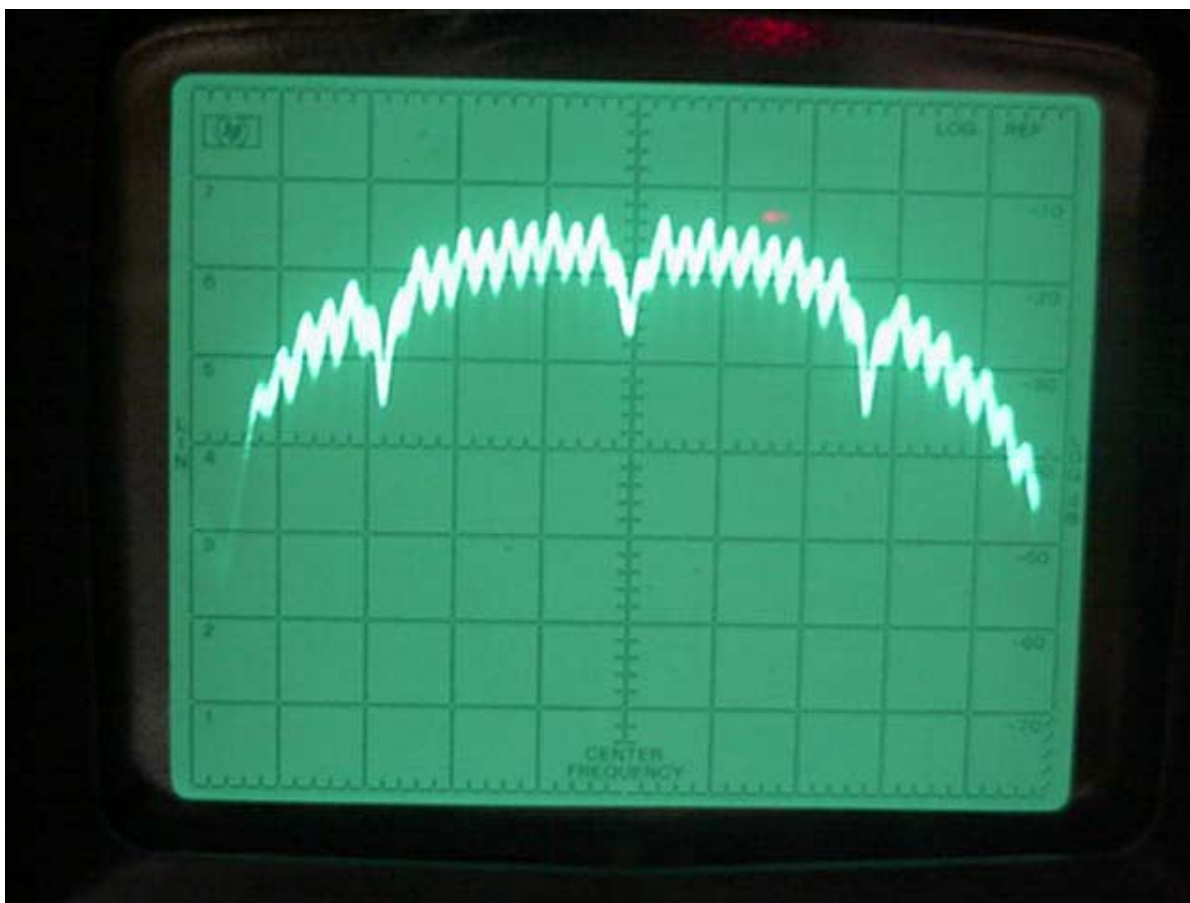


4.2.3 6 dB Bandwidth Emissions (100 kHz Res. BW) High Channel Bandwidth
Plot:

6 dB EMISSION BANDWIDTH – MODULATED CARRIER
High Channel

TOP REFERENCE LEVEL: 30 dBm
RESOLUTION BW: 100 KHZ
CENTER FREQUENCY: 5711 MHZ
FREQUENCY SPAN: 20 MHZ (2 MHz/div)

MEASURED BANDWIDTH: 10.3 MHZ



4.3 RF Antenna Conducted Spurious/Harmonics Emissions:

Limit: 20 dB below Carrier Level Measured with 100 kHz RBW
RBW Setting on S.A.: 100 kHz

Condition: Transmitter is set to a single 11 Mbps modulated channel at full power.
Measurements taken at antenna connector

Three separate measurements are performed to show harmonic and spurious emissions generated with the transmitter tuned to low, middle, and high parts of the spectral range.

SEE FOLLOWING THREE (3) DATA TABLES

4.3.1 FCC Part 15.247(c) Conducted Spurious, 5740 MHz Frequency Of Carrier:

Frequency of Carrier = 5740 MHz
 Limit = 20 dBc

Condition: Transmitter is set to a single modulated channel.

TEST RESULTS

LIMIT: -20 dB FROM PEAK CARRIER

<u>Component</u>	<u>Frequency (MHz)</u>	<u>Result (dBc)</u>
Harmonic	11480.00	-64.0
Harmonic	17220.00	-65.0
Harmonic	22960.00	-68.0
Harmonic	28700.00	-72.0
Harmonic	34440.00	-74.0
Harmonic	40180.00	-74.0
LO Spur	3328.00	-66.0

4.3.2 FCC Part 15.247(c) Conducted Spurious, 5770 MHz Frequency of Carrier:

Frequency of Carrier = 5770 MHz

Limit = 20 dBc

Condition: Transmitter is set to a single modulated channel.

TEST RESULTS

LIMIT: -20 dB FROM PEAK CARRIER

<u>Component</u>	<u>Frequency (MHz)</u>	<u>Result (dBc)</u>
Harmonic	11540.00	-65.0
Harmonic	17310.00	-67.0
Harmonic	23080.00	-71.0
Harmonic	28850.00	-70.0
Harmonic	34620.00	-74.0
Harmonic	40390.00	-74.0
LO Spur	3328.00	-69.0

4.3.3 FCC Part 15.247(c) Conducted Spurious, 5811 MHz Frequency of Carrier:

Frequency of Carrier = 5811 MHz

Limit = 20 dBc

Condition: Transmitter is set to a single modulated channel.

TEST RESULTS

LIMIT: -20 dB FROM PEAK CARRIER

<u>Component</u>	<u>Frequency (MHz)</u>	<u>Result (dBc)</u>
Harmonic	11622.00	-66.0
Harmonic	17433.00	-68.0
Harmonic	23244.00	-71.0
Harmonic	29055.00	-73.0
Harmonic	34866.00	-74.0
Harmonic	40677.00	-74.0
LO Spur	3328.00	-65.0

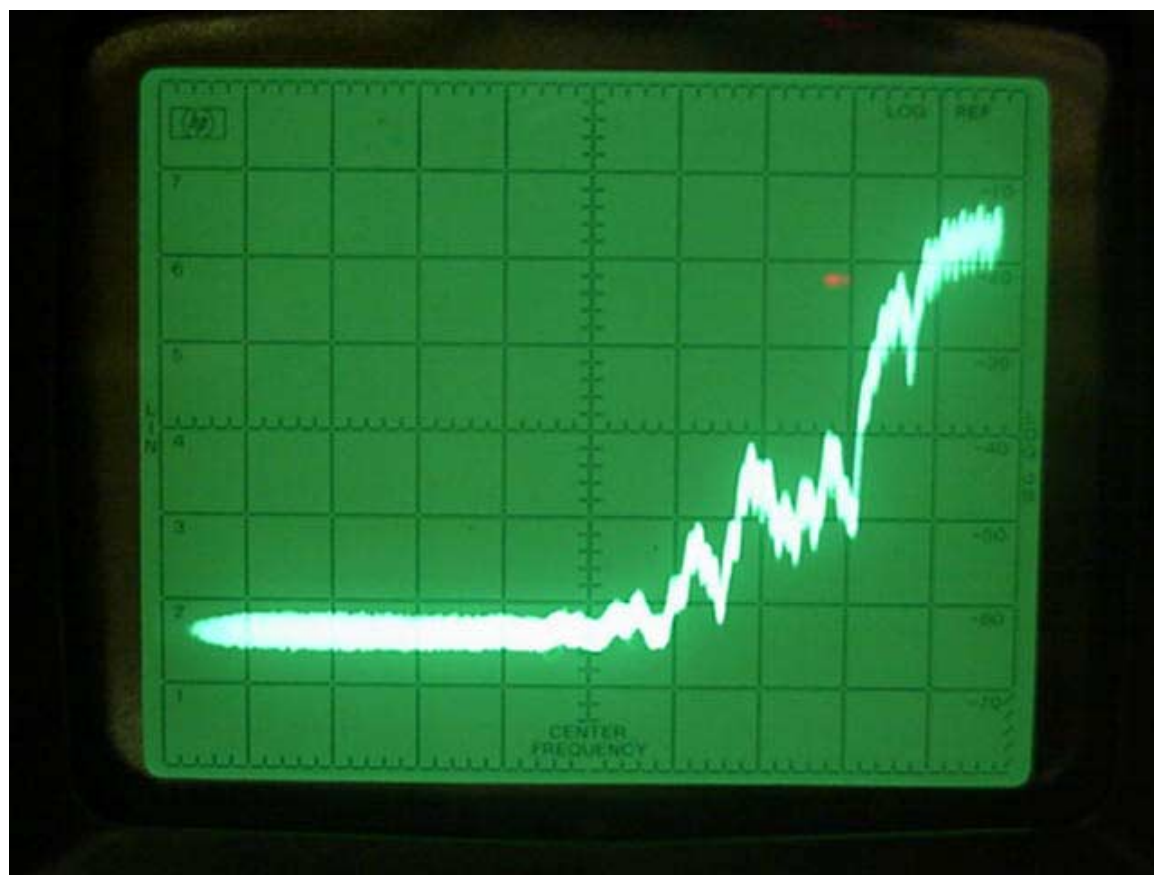
4.4 Conducted Bandedge Emissions Test Results:

4.4.1 Low Channel Conducted Bandedge Emissions Plot:

CONDUCTED BAND EDGE EMISSIONS – MODULATED CARRIER (100 kHz RES. BW)

LOW CHANNEL

TOP REFERENCE LEVEL: 30 dBm
RESOLUTION BW: 100 kHz
CENTER FREQUENCY: 5725 MHZ
FREQUENCY SPAN: 2 MHz /DIV
SWEEP TIME: 1 SEC /DIV

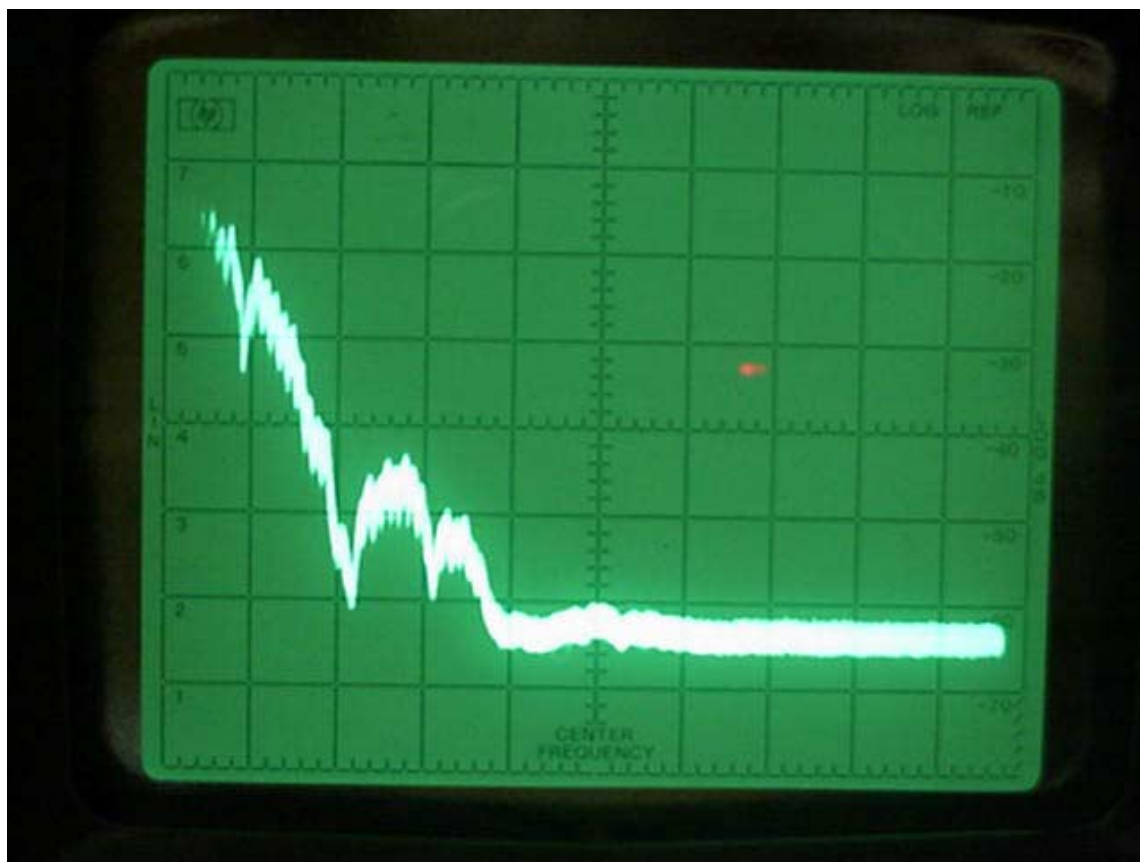


4.4.2 High Channel Conducted Bandedge Emissions Plot:

CONDUCTED BAND EDGE EMISSIONS – MODULATED CARRIER (100 kHz RES. BW)

HIGH CHANNEL

TOP REFERENCE LEVEL: 30 dBm
RESOLUTION BW: 100 kHz
CENTER FREQUENCY: 5830 MHZ
FREQUENCY SPAN: 2 MHz /DIV
SWEEP TIME: 1 SEC /DIV



4.5 Power Spectral Density:

Limit: 8 dBm

Resolution Bandwidth: 3 kHz

Average Time Interval: 1 second/3 kHz

Actual Time Interval used for testing: 1.5 seconds/3 kHz

Condition: Transmitter is set to a single 11 Mbps modulated channel at full power.
Measurements taken at amplifier antenna connector.

Readings from spectrum analyzer:

WLAN Card w/ Converter @ 5740 MHz: **4.7 dBm**

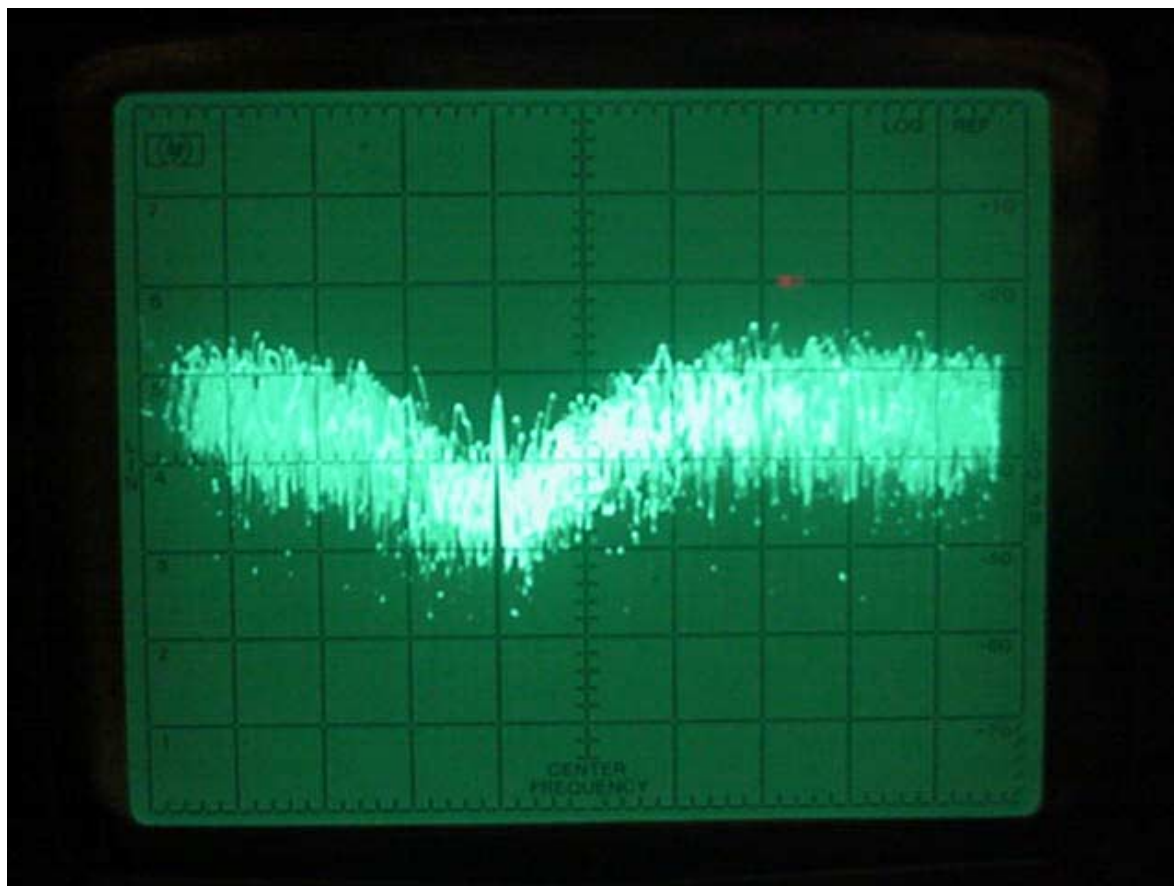
WLAN Card w/ Converter @ 5770 MHz: **5.2 dBm**

WLAN Card w/ Converter @ 5811 MHz: **5.1 dBm**

4.5.1 Power Spectral Density Low Channel Plot:

TOP REFERENCE LEVEL: 30 dBm
RESOLUTION BW: 3 kHz
CENTER FREQUENCY: 5740 MHZ
FREQUENCY SPAN: 2 MHZ
SWEEP TIME: 100 SEC/DIV

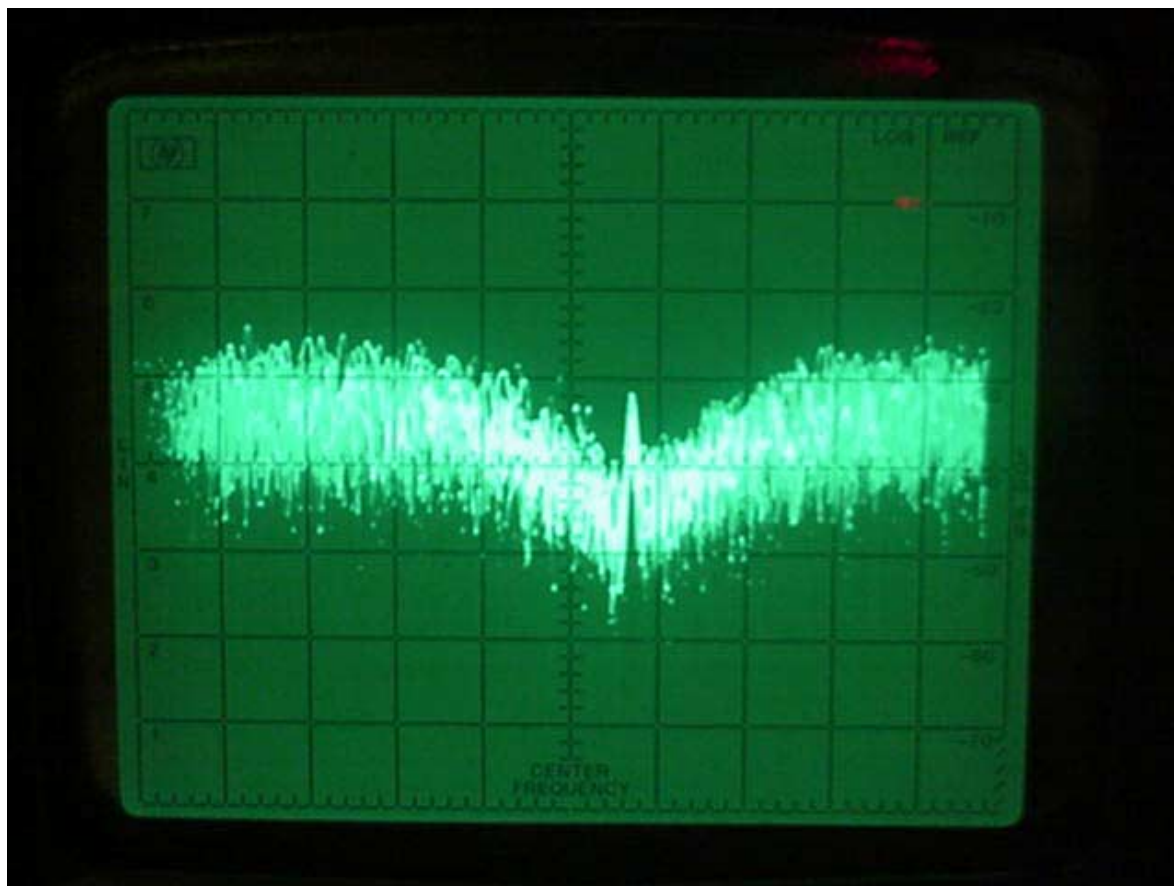
PEAK LEVEL: 4.7 dBm



4.5.1 Power Spectral Density Mid Channel Plot:

TOP REFERENCE LEVEL: 30 dBm
RESOLUTION BW: 3 kHz
CENTER FREQUENCY: 5770 MHZ
FREQUENCY SPAN: 2 MHZ
SWEEP TIME: 100 SEC/DIV

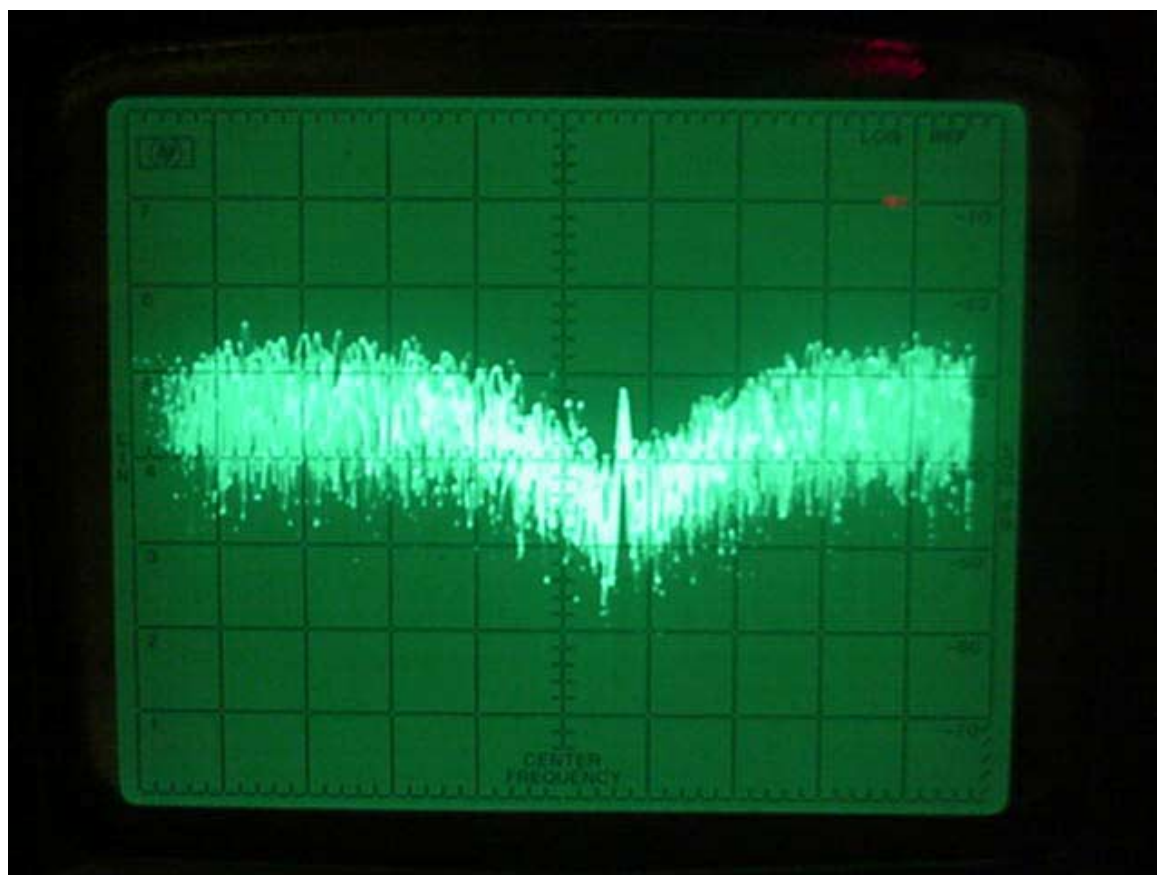
PEAK LEVEL: 5.2 dBm



4.5.3 Power Spectral Density High Channel Plot:

TOP REFERENCE LEVEL: 30 dBm
RESOLUTION BW: 3 kHz
CENTER FREQUENCY: 5811 MHZ
FREQUENCY SPAN: 2 MHZ
SWEEP TIME: 100 SEC/DIV

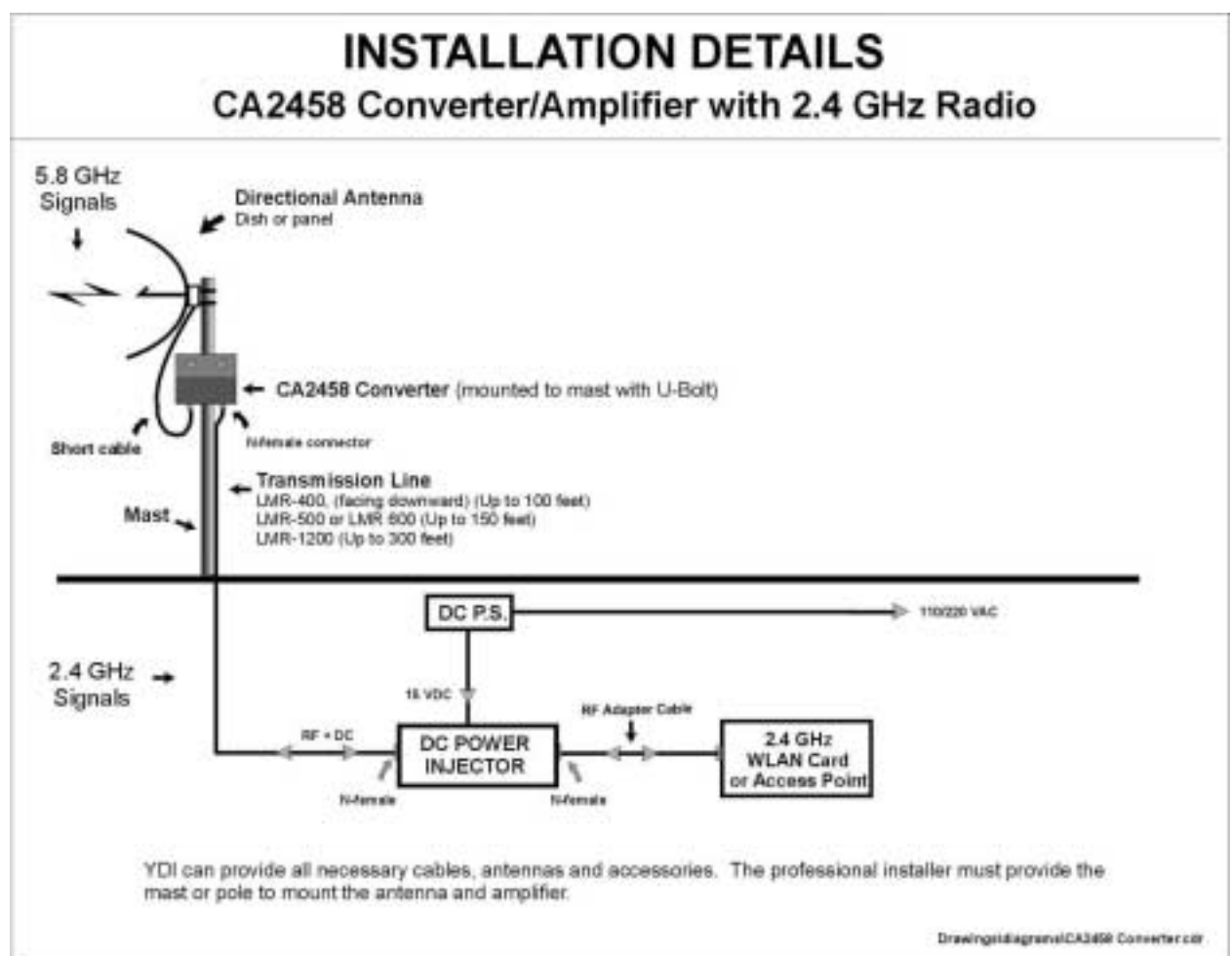
PEAK LEVEL: 5.1 dBm



5.0 Test Configuration for Conducted and Radiated Emissions:

The EUT was set up on the center of the test table, in a manner which follows the general guidelines of ANSI C63.4, Section 6 “General Operating Conditions and Configurations”.

This is described below:



6.0 A.C. Conducted Emissions Scheme:

The EUT is placed on an 80 cm high 1 X 1.5 m non-conductive table. Power to the RF amplifier is provided through a Solar Corporation 50 Ω / 50 uH Line Impedance Stabilization Network bonded to a 2.2 X 2 meter horizontal ground plane, and a 2.2 X 2 meter vertical ground plane. The LISN has its AC input supplied from a filtered AC power source. A separate LISN provides AC power to the peripheral equipment. I/O cables are moved about to obtain maximum emissions.

The 50 Ω output of the LISN is connected to the input of the spectrum analyzer and emissions in the frequency range of 450 kHz to 30 MHz are searched. The detector function is set to Quasi-Peak and the resolution bandwidth is set at 9 kHz, with all post detector filtering no less than 10 times the resolution bandwidth for final measurements. All emissions within 20 dB of the limit are recorded in the data tables.

6.1 AC Conducted Emissions Data Table

FCC CLASS "B" CONDUCTED EMISSIONS DATA

CLIENT: YOUNG DESIGN
EUT: LUCENT AGERE
 W/ CA2458

MODE: TRANSMIT

LINE 1-Neutral: Quasi-Peak Level

FREQUENCY MHz	SPEC. Ana dBuV	Calc. Volt uV	FCC LIMIT uV	MARGIN dB	CONDITION
1.15	36.00	63.10	250.00	11.96	PASS
7.17	35.00	56.23	250.00	12.96	PASS
15.1	38.20	81.28	250.00	9.76	PASS
18.9	30.80	34.67	250.00	17.16	PASS

LINE 2-Phase: Quasi-Peak Level

FREQUENCY MHz	SPEC. Ana dBuV	Calc. Volt uV	FCC LIMIT uV	MARGIN dB	CONDITION
1.12	35.60	60.26	250.00	12.36	PASS
7.23	34.60	53.70	250.00	13.36	PASS
15.1	34.80	54.95	250.00	13.16	PASS
18.8	33.40	46.77	250.00	14.56	PASS
22.3	32.00	39.81	250.00	15.96	PASS

7.0 Radiated Emissions Scheme:

The EUT is placed on an 80 cm high 1 X 1.5 meter non-conductive motorized turntable for radiated testing on the 3 meter open area test site. The emissions from the EUT are measured continuously at every azimuth by rotating the turntable. Guided horn and log periodic broadband antennas are mounted on an antenna mast to determine the height of the maximum emissions. The heights of the antennas are varied between 1 and 4 meters. Both the horizontal and vertical field components are measured.

The RF spectrum is searched from 30 MHz to 40 GHz.

The output from the antenna is connected to the input of the preamplifier. The pre-amp out is connected to the spectrum analyzer. The detector function is set to PEAK. The resolution bandwidth of the spectrum analyzer is set at 120 kHz for the frequency range of 30-1000 MHz, and 1 MHz for the frequency range of 1-40 GHz. A 10Hz video BW setting is used to average readings above 1 GHz when applicable. All emissions within 20 dB of the limit are recorded in the data tables.

To convert the spectrum analyzer reading into a quantified E-field level to allow comparison with the FCC limits, it is necessary to account for various calibration factors. These factors include cable loss (CL) and antenna factors (AF). The AF/CL in dB/m is algebraically added to the Spectrum Analyzer Voltage in dBμV/m. This level is then compared to the FCC limit.

<u>EXAMPLE</u>	
Spectrum Analyzer Voltage:	V dBμV
Composite Factor:	AF/CL dB/m
Electric Field:	E dBμV/m = V dBμV + AF/CL dB/m
Linear Conversion:	E μV/m = Antilog (E dBμV/m /20)

7.1 16 dBi Uni-directional Antenna @ 5740 MHz - Radiated Emissions Data Table

FCC RADIATED EMISSIONS DATA

CLIENT: YOUNG DESIGN
EUT: CA2458 w/LUCENT AGERE
ANTENNA: 16 dBi Uni-directional
FREQ.: 5740 MHZ
POWER: 250 mW

3 METER TEST **Detector - PEAK**

FREQUENCY MHz	POLARITY		SPEC A dBuV	AF/CL dB/m	AMP Gain dB	Average Factor dB	Peak E-Field dbuV/m	Avrg. Limit dBuV/m	MARGIN dB	CONDITION
	H	V								
11480.00		V	30.00	40.00	25.00	0.00	45.00	54.00	9.00	PASS
22960.00		V	30.00	36.00	25.00	0.00	41.00	54.00	13.00	PASS

7.2 16 dBi Uni-directional Antenna @ 5770 MHz - Radiated Emissions Data Table

FCC RADIATED EMISSIONS DATA

CLIENT: YOUNG DESIGN
 EUT: CA2458 w/LUCENT AGERE
 ANTENNA: 16 dBi Unidirectional
 FREQ.: 5770 MHZ
 POWER: 250 mW

3 METER TEST Detector - PEAK

FREQUENCY MHz	POLARITY		SPEC A dBuV	AF/CL dB/m	AMP Gain dB	Average Factor dB	Peak E-Field dbuV/m	Avrg. Limit dBuV/m	MARGIN dB	CONDITION
	H	V								
11540.00		V	31.00	40.00	25.00	0.00	46.00	54.00	8.00	PASS

7.3 16 dBi Uni-directional Antenna @ 5811 MHz - Radiated Emissions Data Table

FCC RADIATED EMISSIONS DATA

CLIENT: YOUNG DESIGN
EUT: CA2458 w/LUCENT AGERE
ANTENNA: 16 dBi Uni
FREQ.: 5811 MHZ
POWER: 250 mW

3 METER TEST **Detector - PEAK**

FREQUENCY MHz	POLARITY		SPEC A dBuV	AF/CL dB/m	AMP Gain dB	Average Factor dB	Peak E-Field dbuV/m	Avrg. Limit dBuV/m	MARGIN dB	CONDITION
	H	V								
11622.00		V	28.00	40.00	25.00	0.00	43.00	54.00	11.0	PASS

7.4 27 dBi Dish Antenna @ 5740 MHz - Radiated Emissions Data Table

FCC RADIATED EMISSIONS DATA

CLIENT: YOUNG DESIGN
 EUT: CA2458 w/LUCENT AGERE
 ANTENNA: 27 dBi Dish
 FREQ.: 5740 MHZ
 POWER: 250 mW

3 METER TEST Detector - PEAK

FREQUENCY MHz	POLARITY		SPEC A dBuV	AF/CL dB/m	AMP Gain dB	Average Factor dB	Peak E-Field dbuV/m	Avrg. Limit dBuV/m	MARGIN dB	CONDITION
	H	V								
11480.00		V	26.00	40.00	25.00	0.00	41.00	54.00	13.0	PASS
22960.00		V	31.00	36.00	25.00	0.00	42.00	54.00	12.00	PASS

7.5 27 dBi Dish Antenna @ 5770 MHz - Radiated Emissions Data Table

FCC RADIATED EMISSIONS DATA

CLIENT: YOUNG DESIGN
EUT: CA2458 w/LUCENT AGERE
ANTENNA: 27 dBi Dish
FREQ.: 5770 MHZ
POWER: 250 mW

3 METER TEST Detector - PEAK

FREQUENCY MHz	POLARITY		SPEC A dBuV	AF/CL dB/m	AMP Gain dB	Average Factor dB	Peak E-Field dbuV/m	Avrg. Limit dBuV/m	MARGIN dB	CONDITION
	H	V								
11540.00		V	28.00	40.00	25.00	0.00	43.00	54.00	11.0	PASS

7.6 27 dBi Dish Antenna @ 5811 MHz - Radiated Emissions Data Table

FCC RADIATED EMISSIONS DATA

CLIENT: YOUNG DESIGN
 EUT: CA2458 w/LUCENT AGERE
 ANTENNA: 27 dBi Dish
 FREQ.: 5811 MHZ
 POWER: 250 mW

3 METER TEST Detector - PEAK

FREQUENCY MHz	POLARITY		SPEC A dBuV	AF/CL dB/m	AMP Gain dB	Average Factor dB	Peak E-Field dbuV/m	Avrg. Limit dBuV/m	MARGIN dB	CONDITION
	H	V								
11622.00		V	26.00	40.00	25.00	0.00	41.00	54.00	13.0	PASS

7.7 27 dBi Flat Panel Antenna @ 5740 MHz - Radiated Emissions Data Table

FCC RADIATED EMISSIONS DATA

CLIENT: YOUNG DESIGN
 EUT: CA2458 w/LUCENT AGERE
 ANTENNA: dBi Panel
 FREQ.: 5740 MHZ
 POWER: 250 mW

3 METER TEST Detector - PEAK

FREQUENCY MHz	POLARITY		SPEC A dBuV	AF/CL dB/m	AMP Gain dB	Average Factor dB	Peak E-Field dbuV/m	Avrg. Limit dBuV/m	MARGIN dB	CONDITION
	H	V								
11480.00		V	28.00	40.00	25.00	0.00	43.00	54.00	11.0	PASS
22960.00		V	29.00	36.00	25.00	0.00	40.00	54.00	14.00	PASS

7.8 27 dBi Flat Panel Antenna @ 5770 MHz - Radiated Emissions Data Table

FCC RADIATED EMISSIONS DATA

CLIENT: YOUNG DESIGN
EUT: CA2458 w/LUCENT AGERE
ANTENNA: dBi Panel
FREQ.: 5770 MHZ
POWER: 250 mW

3 METER TEST Detector - PEAK

FREQUENCY MHz	POLARITY		SPEC A dBuV	AF/CL dB/m	AMP Gain dB	Average Factor dB	Peak E-Field dbuV/m	Avrg. Limit dBuV/m	MARGIN dB	CONDITION
	H	V								
11540.00		V	27.00	40.00	25.00	0.00	42.00	54.00	12.0	PASS

7.9 27 dBi Flat Panel Antenna @ 5811 MHz - Radiated Emissions Data Table

FCC RADIATED EMISSIONS DATA

CLIENT: YOUNG DESIGN
EUT: CA2458 w/LUCENT AGERE
ANTENNA: dBi Panel
FREQ.: 5811 MHZ
POWER: 250 mW

3 METER TEST Detector - PEAK

FREQUENCY MHz	POLARITY		SPEC A dBuV	AF/CL dB/m	AMP Gain dB	Average Factor dB	Peak E-Field dBuV/m	Avrg. Limit dBuV/m	MARGIN dB	CONDITION
	H	V								
11622.00		V	29.00	40.00	25.00	0.00	44.00	54.00	10.0	PASS

8.0 RF Exposure Statement:

Notice in Installation Manual:

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment when installed as directed. This equipment should be installed and operated with fix-mounted antennas that are installed with a minimum of 2 meters of separation distance between the antenna and all persons' body during normal operation.

RF Exposure Calculations:

The following information provides the **minimum** separation distance for the highest gain antenna provided with the **Model: CA2458 Converter with Agere Extended WLAN Card**, as calculated from **FCC OET 65 Appendix B, Table 1B** Guidelines for General Population/Uncontrolled Exposure. This calculation is based on the highest EIRP possible from the system, considering maximum power and antenna gain, and considering a 1.0 mW/cm² uncontrolled exposure limit. The Friss formula used was:

$$S = (P_o * G) / (4 * \pi * r^2) \quad \text{or} \quad r = \sqrt{(P_o * G) / (4 * \pi * S)}$$

Where S = 1.0 mW/cm² for 5800 MHz

Where P_o = 250 mW (Peak RF)

Where G = Isotropic antenna gain (numeric)

Where r = Minimum Safe Distance from antenna (cm)

For: 27 dBi Dish Antenna - r = 100 cm

TABLE 1 – EUT ACCESSORIES
FCC ID#: NM5-2458-AL

FCC certified systems consist of:

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- A CA2458 Converter, DC Injector and 12 VDC Power supply
- Lucent Agere WLAN card with the FCC ID#: IMRWLPCE24H
- Outdoor Antenna (Table A)
- Coax Cable (Table B)

Table 1A

Authorized Antennas

Model	Antenna Type	Antenna Gain (dBi)	Max EIRP (dBm)	MPE Distance (CM)
A5.8FP23	One foot dish	24	48	71
A5.8FP27	Two foot dish	27	51	100
A5.8-1'	One foot flat panel	24	48	71
A5.8-2'	Two foot flat panel	27	51	100
A5.8HP90-16	Uni-directional antenna	16	40	28

Notes:

1. MPE distance figures are based on a conservative “worse case” prediction, i.e. +24 dBm into antenna and using formula $S=EIRP/(4\pi R^2)$ and no calculation for duty factor. In practice the minimum distance will be much shorter. (Ref. 2)

2. The minimum MPE distance has been calculated for the maximum allowed Power Density (S) limit of 1.0 mW/cm² in the Frequency range 1500-100,000 MHz for uncontrolled environments (Ref. 2).

Reference:

1. FCC Part 15, sub-clause 15.247 (b) (4)
2. FCC OET Bulletin 65, Edition 97-01
3. FCC Supplement C to OET Bulletin 65, edition 97-01

Table 1B
Authorized Cables with Minimum Lengths

Cable Type	Minimum Length/Loss	Max Recommended Lengths
RG58/U	25 feet	40 feet
LMR195		
LMR200	30 feet	50 feet
LMR240	40 feet	65 feet
LMR400	75 feet	100 feet
LMR 500	90 feet	150 feet
LMR 600	120 feet	175 feet
LMR 900	150 feet	275 feet
LMR1200	200 feet	375 feet
LMR1700	300 feet	500 feet

NOTE: This table is for reference only. In order to comply with FCC Part 15 Certification, the installer must insure that actual coax cable used between the DC injector and the amplifier has at least 5.1 dB of insertion loss.

TABLE 2 SUPPORT EQUIPMENT
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MANUFACTURER	FCC ID #	SERIAL #
Host PC: Panasonic Model CF35 Pent. Laptop		

TABLE 3
MEASUREMENT EQUIPMENT USED

The following equipment is used to perform measurements:

EQUIPMENT	SERIAL #
HP 434A RF Peak Power Meter	1362016
EMCO Model 3110 Biconical Antenna	1619
Antenna Research MWH-1825B Horn Antenna	1005
EMCO Model 3115 Ridged Horn Antenna	3007
HP 8348A Pre-Amplifier	197-2564A
Solar 8012-50-R-24-BNC LISN	924867
Bird 8306-300-N-30dB Attenuator	29198391515
HP 14IT w/8555A Spectrum Analyzer	6-95-1124
Advanet Model R41131D Spectrum Analyzer	54378A
4 Meter Antenna Mast	
Motorized Turntable	
Heliac FSJ1-50A ¼" Superflex Coax Cable	

EXHIBIT 1.1
AC CONDUCTED EMISSIONS PHOTOGRAPHS

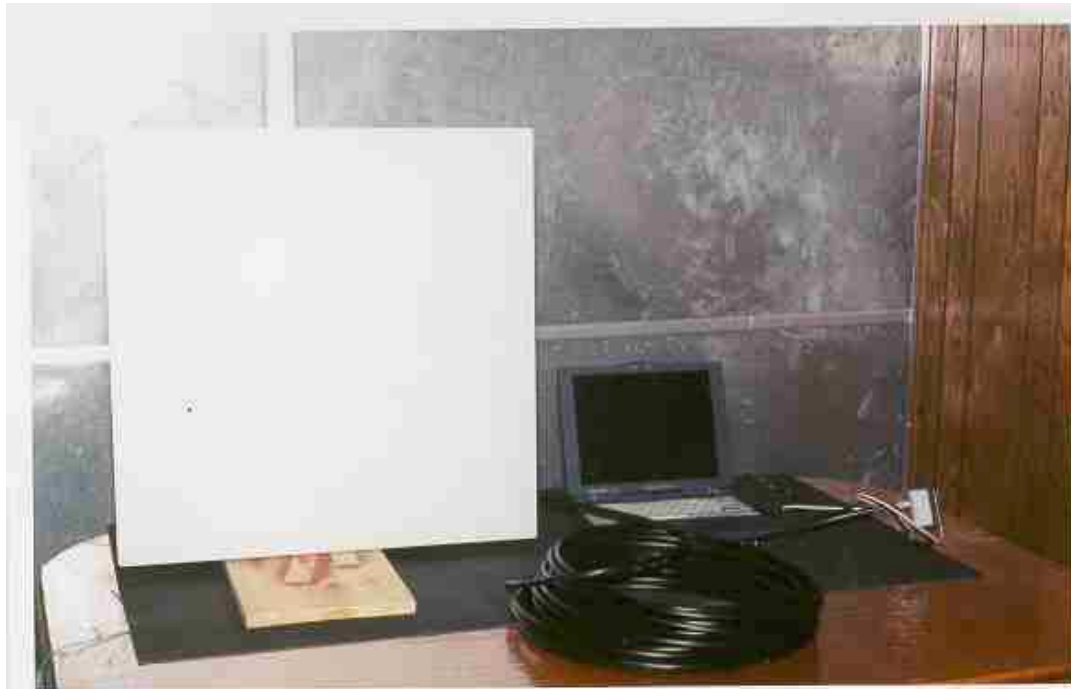


EXHIBIT 1.2
RADIATED EMISSIONS PHOTOGRAPHS

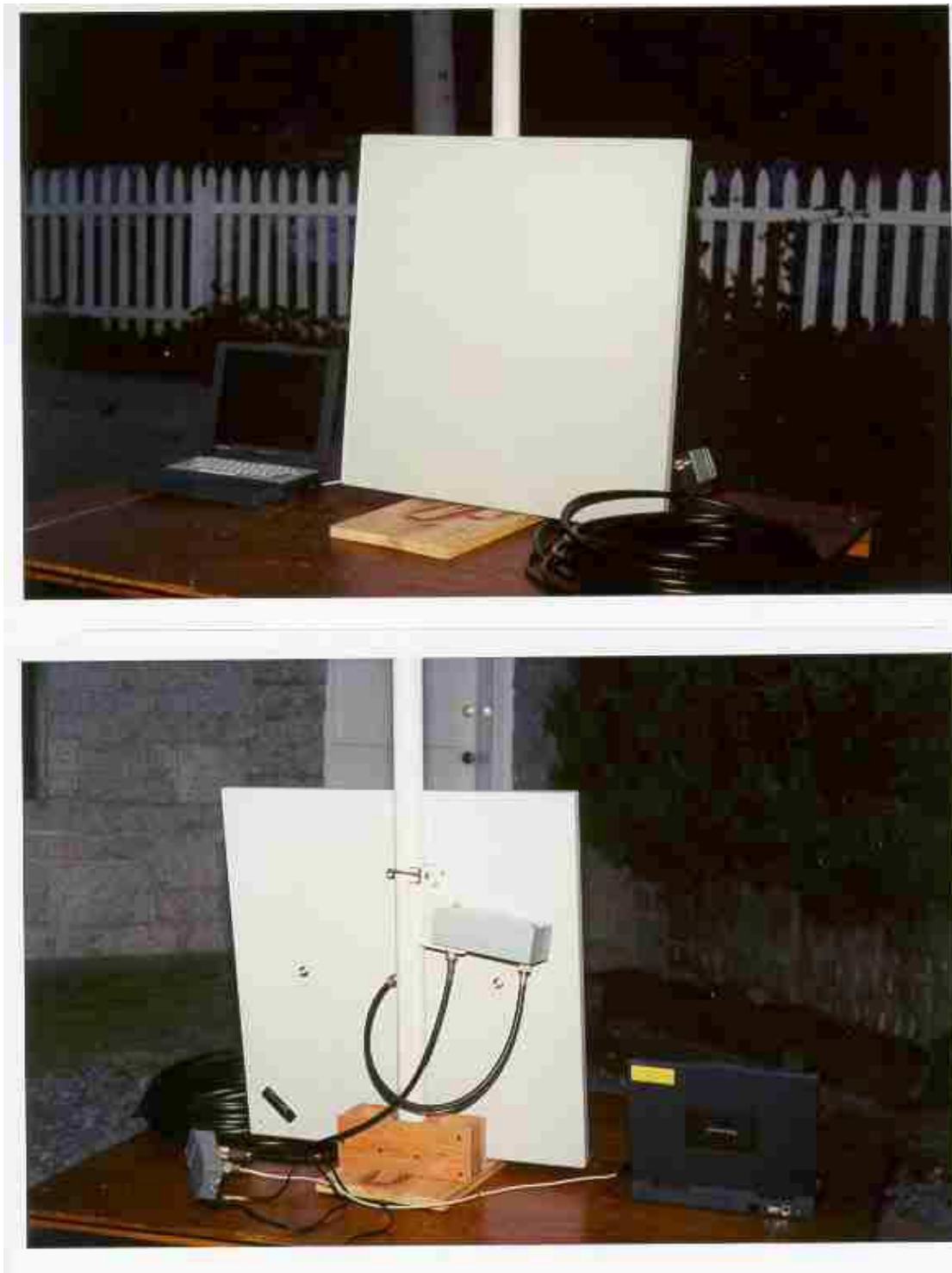


EXHIBIT 2
SCHEMATICS

EXHIBIT 3
USER'S MANUAL