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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to FCC Part 15, Subpart E (UNII Devices) and Industry Canada RSS 210 Issue 4 (LELEAN Devices) on the Airaya Model: AI108

FCC ID:	QDE-AI108
GRANTEE:	Airaya 637 Adair Court Morgan Hill, CA 95037
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	September 9, 2002
FINAL TEST DATE:	August 29, 2002

AUTHORIZED SIGNATORY: _____

Mark Briggs
Director of Engineering

DECLARATIONS OF COMPLIANCE

Equipment Name and Model:
AI108

Manufacturer:
Airaya
637 Adair Court
Morgan Hill, CA 95037

Tested to applicable standards:
RSS-210, Issue 4, December 2000 (Low Power License-Exempt Radiocommunication Devices)
FCC Part 15 Subpart E (UNII Devices)

Measurement Facility Description Filed With Department of Industry:

Departmental Acknowledgement Number: IC2845 **SV4** Dated July 19, 2001

I declare that the testing was performed or supervised by me; that the test measurements were made in accordance with the above mentioned departmental standards (through the use of ANSI C63.4 as detailed in section 5.3 of RSS-210, Issue 4); and that the equipment performed in accordance with the data submitted in this report.

Signature	_____
Name	Mark Briggs
Title	Director of Engineering
Company	Elliott Laboratories Inc.
Address	684 W. Maude Ave Sunnyvale, CA 94086 USA
Date:	September 9, 2002

Maintenance of compliance with the above standards is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

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SCOPE

An electromagnetic emissions test has been performed on the Airaya model AI108 pursuant to Subpart E of Part 15 of FCC Rules for Unlicensed National Information Infrastructure (UNII) devices and RSS-210 Issue 4 for licence-exempt local area network (LELAN) devices. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Airaya model AI108 and therefore apply only to the tested sample. The sample was selected and prepared by Bill Pabst of Airaya

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart E of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units which are subsequently manufactured.

SUMMARY OF RESULTS

FCC Part 15 Section	RSS 210 Section	Description	Comments	Result
Operation in the 5.25 – 5.35 GHz Band – 18dBi antenna				
		Maximum Antenna Gain /Integral Antenna	18 dBi Gain of antenna, detachable or integral	COMPLIES
15.407(a) (2)	6.2.2 q1 (ii)	Bandwidth	41.7 MHz (26-dB), 35.1 MHz (20-dB), 32.83 MHz (99% BW)	N/A
15.407(a) (2)	6.2.2 q1 (ii)	Output Power	10.9 dBm	COMPLIES
15.407(a) (2))	6.2.2 q1 (ii)	Power Spectral Density	-14.15 dBm/MHz	COMPLIES
15.407(b) (5) / 15.209	6.2.2 q1 (ii)	Spurious Emissions below 1GHz	-2.7dB @ 40.090MHz	COMPLIES
15.407(b) (2)	6.2.2 q1 (ii)	Spurious Emissions above 1GHz	-8.3dB @ 10540.45 MHz	COMPLIES
Operation in the 5.25 – 5.35 GHz Band – 24dBi antenna				
		Maximum Antenna Gain	24 dBi Gain of antenna, detachable or integral	COMPLIES
15.407(a) (2)	6.2.2 q1 (ii)	Bandwidth	38.8 MHz (26-dB), 35.2 MHz (20-dB), 32.83 MHz (99% BW)	N/A
15.407(a) (2)	6.2.2 q1 (ii)	Output Power	5.9 dBm The output power at the rf connector is 8.9dBm. A 3dB attenuator or a cable with at least 3dB of loss will be placed between the rf port and the antenna to give an input power of no more than 5.9dBm. Refer to the Theory of Operations and Professional Installation Manual for further details.	COMPLIES
15.407(a) (2))	6.2.2 q1 (ii)	Power Spectral Density	-15.5 dBm/MHz	COMPLIES
15.407(b) (5) / 15.209	6.2.2 q1 (ii)	Spurious Emissions below 1GHz	-2.7dB @ 40.090MHz	COMPLIES
15.407(b) (2)	6.2.2 q1 (ii)	Spurious Emissions above 1GHz	-4.8dB @ 4215.987MHz	COMPLIES

General requirements for all bands				
	6.2.2 q(iv)(a)	Digital Modulation	Digital Modulation is used, refer to the "Theory of Operations" (Exhibit 9) for a detailed explanation.	COMPLIES
	6.2.2 q(iv)(b)	Peak Spectral Density	-1.18 dBm (18 dBi), -3.25 dBm (24 dBi)	COMPLIES
15.407(a)(6)		Peak Excursion Ratio	7.17 dB (18 dBi), 8.41 dB (24 dBi)	COMPLIES
	6.2.2 q(iv)(c)	Channel Selection	The device was tested on channel 54. This is the only channel that the system uses.	N/A
15.407 (c)	6.2.2 q(iv)(d)	Automatic Discontinuation of Operation in the absence of information to transmit	Operation is discontinued in the absence of information to transmit, refer to the "Theory of Operations" in Exhibit 9 for a detailed explanation.	COMPLIES
15.407 (g)	6.2.2 q(iv)(e)	Frequency Stability	Frequency stability is +/- 20 ppm, refer to the "Theory of Operations" in Exhibit 9 for a detailed analysis.	COMPLIES
	6.2.2 q(iv)(g)	User Manual information	All relevant statements have been included in the user's manuals. Refer to Exhibit 6 for details	COMPLIES
15.407 (f)	6.2.2 q(iv)(g)	RF Exposure Requirements	Refer to MPE calculations in Exhibit 11	COMPLIES
15.407(b) / 15.207	6.6	AC Conducted Emissions	-2.0dB @ 29.572MHz	COMPLIES

MEASUREMENT UNCERTAINTIES

ISO Guide 25 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	30 to 1000	± 3.2

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Airaya model AI108 is a transceiver that operates in the 5.25 - 5.35 GHz UNII/LELAN band. The EUT is designed to provide a building-to-building bridge for distances of up to 2.5 miles. The EUT uses an Accton/Atheros 802.11a Access-Point circuit board.

Normally, the EUT would be pole-mounted during operation. The EUT was treated as table-top equipment during testing to simulate the end user environment.

The sample was received on August 15, 2002 and tested on August 29, 2002. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number	FCC ID
Airaya Corp. AI108 Building to Building Wireless Bridge	107	QED-AI108

ENCLOSURE

The EUT enclosure is a weatherproof plastic enclosure. It measures approximately 20 cm wide by 20 cm deep by 28 cm high.

MODIFICATIONS

The EUT did not require modifications during testing in order to comply with emissions specifications.

SUPPORT EQUIPMENT

No local support equipment was used during testing.

The following equipment was used as remote support equipment for testing:

Manufacturer	Model	Description	Serial Number
Hewlett Packard	N5495	Laptop	TW14613850
Red Hawk	BL8551	POE adapter	A00299

EUT INTERFACE PORTS

The I/O cabling configuration during emissions testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length (m)
EUT Ethernet/Power	POE adater	Cat 5 UTP	Unshielded	20
POE adapter power	AC-DC adapter	2-wire	Unshielded	1
POE AdapterEthernet In	Laptop ethernet	Cat 5 UTP	Unshielded	2

EUT OPERATION

The radio was transmitting at full power on the specified channels. The duty cycle and data rate are detailed in the individual test run descriptions. The channels were selected since they are at the top, center and bottom of the allocated bands.

ANTENNA REQUIREMENTS

The EUT has two antenna ports (which cannot be used simultaneously) to provide for spatial diversity. For certain applications only one antenna port will be used, for others, both antenna ports will be used. There are two antennas available for the system, either a 18dBi or a 24dBi antenna.

Where one antenna port is utilized, it will connect to either an internally mounted antenna or an external antenna. The internally mounted antenna is connected to the radio such that all connections are located inside the enclosure and not accessible to the end-user. The external antenna connects to the system via a bulkhead N-connector.

For the configurations where both antennas are used, the two antenna ports will be implemented such that one port connects to an internally mounted antenna and the second port connects to an external antenna.

All configurations that use an external antenna are supplied via a professional installer of the system, thereby allowing the use of the "standard" N connector. The requirements for a non-standard rf connector are not applicable in instances where professional installation is required.

Configurations that only use the internally mounted antenna are provided directly to the end user and do not require professional installation. As the antenna is not accessible to the end user and forms an integral part of the unit, it meets the requirements of FCC Part 15.203 and RSS 210.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on August 29, 2002 at the Elliott Laboratories Open Area Test Site #4 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Federal Communications Commission. In accordance with Industry Canada rules detailed in RSS 210 Issue 4 and RSS-212, construction, calibration, and equipment data for the test sites have been filed with the Federal Communications Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde and Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

POWER METER

Either a spectrum analyzer or a power meter and thermister mount are used for all direct output power measurements from transmitters.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors programmed into the test receivers.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

RADIATED EMISSIONS

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements are performed with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

Measurement bandwidths (video and resolution) are set in accordance with FCC procedures for the type of radio being tested.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions from the AC power port are given in units of microvolts, the limits for radiated electric field emissions are given in units of microvolts per meter at a specified test distance and the output power limits are given in temrs of Watts, milliwatts or dBm. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp) the following formula is used to determine the field strength limit in terms of microvolts per meter at a distance of 3m from the equipment under test:

$$E = \frac{1000000 \text{ v } 30\ P}{3} \quad \text{microvolts per meter}$$

where P is the eirp (Watts)

For reference, converting the voltage and electric field strength specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. Conversion of power specification limits from linear units (in milliwatts) to decibel form (in dBm) is accomplished by taking the base ten logarithm, then multiplying by 10.

FCC 15.407 (a) OUTPUT POWER LIMITS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Output Power	Power Spectral Density
5150 - 5250	50mW (17 dBm)	4 dBm/MHz
5250 - 5350	250 mW (24 dBm)	11 dBm/MHz
5725 – 5825	1 Watts (30 dBm)	17 dBm/MHz

For system using antennas with gains exceeding 6dBi, the output power and power spectral density limits are reduced by 1dB for every dB the antenna gain exceeds 6dBi.
Fixed point-to-point applications using the 5725 – 5825 MHz band may use antennas with gains of up to 23dBi without this limitation. If the gain exceeds 23dBi then the output power limit of 1 Watt is reduced by 1dB for every dB the gain exceeds 23dBi.

RS-210 6.2.2(q1) OUTPUT POWER LIMITS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Output Power	Power Spectral Density
5150 - 5250	200mW (23 dBm)	10 dBm/MHz
5250 - 5350	250 mW (24 dBm)	11 dBm/MHz
5725 – 5825	1 Watts (30 dBm)	17 dBm/MHz

For system using antennas with gains exceeding 6dBi, the output power and power spectral density limits are reduced by 1dB for every dB the antenna gain exceeds 6dBi.
Fixed point-to-point applications using the 5725 – 5825 MHz band may use antennas with gains of up to 23dBi without this limitation. If the gain exceeds 23dBi then the output power limit of 1 Watt is reduced by 1dB for every dB the gain exceeds 23dBi.

SPURIOUS RADIATED EMISSIONS LIMITS

The table below shows the limits for unwanted (spurious) emissions falling in the restricted bands detailed in Part 15.205 and Industry Canada RSS-210 Table 2.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

The table below shows the limits for unwanted (spurious) emissions outside of the restricted bands above 1GHz.

Operating Frequency (MHz)	EIRP Limit (dBm)	Equivalent Field Strength At 3m (dBuV/m)
5150 - 5250	-27 dBm	68.3 dBuV/m
5250 - 5350	-27 dBm (note 1)	68.3 dBuV/m
5725 – 5825	-27 dBm (note 2)	68.3 dBuV/m
	-17 dBm (note 3)	78.3 dBuV/m

Note 1: If operation is restricted to indoor use only then emissions in the band 5.15 – 5.25 GHz must meet the power spectral density limits for the intentional signals detailed in RSS 210 and FCC Subpart E for devices operating in the 5.15 – 5.25 Ghz band.
Note 2: Applies to spurious signals separated by more than 10 MHz from the allocated band.
Note 3: Applies to spurious signals within 10 MHz of the allocated band.

AC POWER PORT CONDUCTED EMISSIONS LIMITS

The table below shows the limits for emissions on the AC power line as detailed in FCC Part 15.207.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

EXHIBIT 1: Test Equipment Calibration Data

Output Power Measurements, 15-Aug-02
Engineer: Mark

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Hewlett Packard	Microwave EMI test system (SA40, 30Hz - 40GHz)	84125C	1149	12	2/21/2002	2/21/2003
Rohde & Schwarz	Power Meter	NRVS	1422	12		
Rohde & Schwarz	Power Sensor 100uW - 2 Watts	NRV-Z32	1423	12		

Radiated Emissions, 30 - 1000 MHz, 31-Aug-02
Engineer: bwright

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	Biconical Antenna, 30-300 MHz	3110B	801	12	5/13/2002	5/13/2003
Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	1332	12	4/16/2002	4/16/2003
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1347	12	10/16/2001	10/16/2002

Conducted Emissions, 31-Aug-02
Engineer: bwright

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Elliott Laboratories	FCC / CISPR LISN	LISN-3, OATS	304	12	6/5/2002	6/5/2003
Rohde& Schwarz	Pulse Limiter	ESH3 Z2	812	12	1/23/2002	1/23/2003
Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	1332	12	4/16/2002	4/16/2003

Output Power Measurements, 15-Aug-02
Engineer: Mark

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Hewlett Packard	Microwave EMI test system (SA40, 30Hz - 40GHz)	84125C	1149	12	2/21/2002	2/21/2003
Rohde & Schwarz	Power Meter	NRVS	1422	12		
Rohde & Schwarz	Power Sensor 100uW - 2 Watts	NRV-Z32	1423	12		

Radiated Emissions, 1 - 40 GHz, 16-Sep-02
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	868	12	3/11/2002	3/11/2003
Hewlett Packard	Microwave EMI test system (SA40, 9Hz - 40GHz), system 2	84125C	1410	12	4/2/2002	4/2/2003
Hewlett Packard	Spectrum Analyzer 9KHz - 26GHz	8563E	284	12	3/21/2002	3/21/2003
Miteq	Pre-amp, 1-18GHz	AFS44	1346	12	1/7/2002	1/7/2003

Radiated Emissions, 1 - 40 GHz, 16-Sep-02
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Hewlett Packard	High Pass filter, 8.2GHz	P/N 84300-80039	1156	12	3/25/2002	2/25/2003

Antenna Conducted Emissions, 16-Sep-02
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	Horn antenna, D. Ridge 1-18GHz (SA40 system antenna)	3115	1142	12	4/20/2002	4/20/2003

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T48273_Digital	10 Pages
T48643_Radio	35 Pages

Elliott

EMC Test Data

Client:	Airaya	Job Number:	J42872
Model:	AI108	T-Log Number:	T42873
		Proj Eng:	Mark Briggs
Contact:	Bill		
Emissions Spec:	FCC Part 15 B & E, RSS-210	Class:	B
Immunity Spec:	N/A	Environment:	-

EMC Test Data

For The

Airaya

Model

AI108

Client:	Airaya	Job Number:	J42872
Model:	AI108	T-Log Number:	T42873
		Proj Eng:	Mark Briggs
Contact:	Bill		
Emissions Spec:	FCC Part 15 B & E, RSS-210	Class:	B
Immunity Spec:	N/A	Environment:	-

EUT INFORMATION

General Description

The EUT is a transceiver that operates in the 5.25 - 5.35 GHz UNII/LELAN band. The EUT is designed to provide a building-to-building bridge for distances of up to 2.5 miles. The EUT uses an Accton/Atheros 802.11a Access-Point circuit board.

Normally, the EUT would be pole-mounted during operation. The EUT was treated as table-top equipment during testing to simulate the end user environment.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Airaya Corp.	AI108	Building to Building Wireless Bridge	107	QDE-AI108

Antenna

The EUT uses an integral antenna. There are two antennas supplied. One antenna has a gain of 18dBi and the other has a gain of 24dBi.

The antenna is not accessible to the end user and forms an integral part of the unit, thereby meeting the requirements of FCC Part 15.203 and RSS 210.

EUT Enclosure

The EUT enclosure is a weatherproof plastic enclosure. It measures approximately 20 cm wide by 20 cm deep by 28 cm high.

Modification History

Mod. #	Test	Date	Modification
1			

Elliott

EMC Test Data

Client:	Airaya	Job Number:	J42872
Model:	AI108	T-Log Number:	T42873
		Proj Eng:	Mark Briggs
Contact:	Bill		
Emissions Spec:	FCC Part 15 B & E, RSS-210	Class:	B
Immunity Spec:	N/A	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Hewlett Packard	N5495	Laptop	TW14613850	-
Red Hawk	BL8551	POE adapter	A00299	-

EUT Interface Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length (m)
EUT Ethernet/Power	POE adater	Cat 5 UTP	Unshielded	20
POE adapter power	AC-DC adapter	2-wire	Unshielded	1
POE AdapterEthernet In	Laptop ethernet	Cat 5 UTP	Unshielded	2

EUT Operation During Emissions Testing (Radio)

The radio was transmitting at full power on the specified channels. The duty cycle and data rate are detailed in the individual test run descriptions. The channels were selected since they are at the top, center and bottom of the allocated bands.

Elliott

EMC Test Data

Client:	Airaya	Job Number:	J42872
Model:	AI108	T-Log Number:	T42873
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	B

Conducted Emissions - Power Ports

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 8/30/2002
Test Engineer: Blair Wright
Test Location: SVOATS #2

Config. Used: 1
Config Change: none
EUT Voltage: 120V/60Hz

General Test Configuration

For tabletop equipment, the EUT was located on a wooden table, 40 cm from a vertical coupling plane and 80cm from the LISN.

Ambient Conditions:

Temperature: 16°C
Rel. Humidity: 90%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power 120V/60Hz	EN55022 B	Pass	-2.0dB @ 29.572MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Elliott

EMC Test Data

Client:	Airaya	Job Number:	J42872
Model:	AI108	T-Log Number:	T42873
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	B

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz

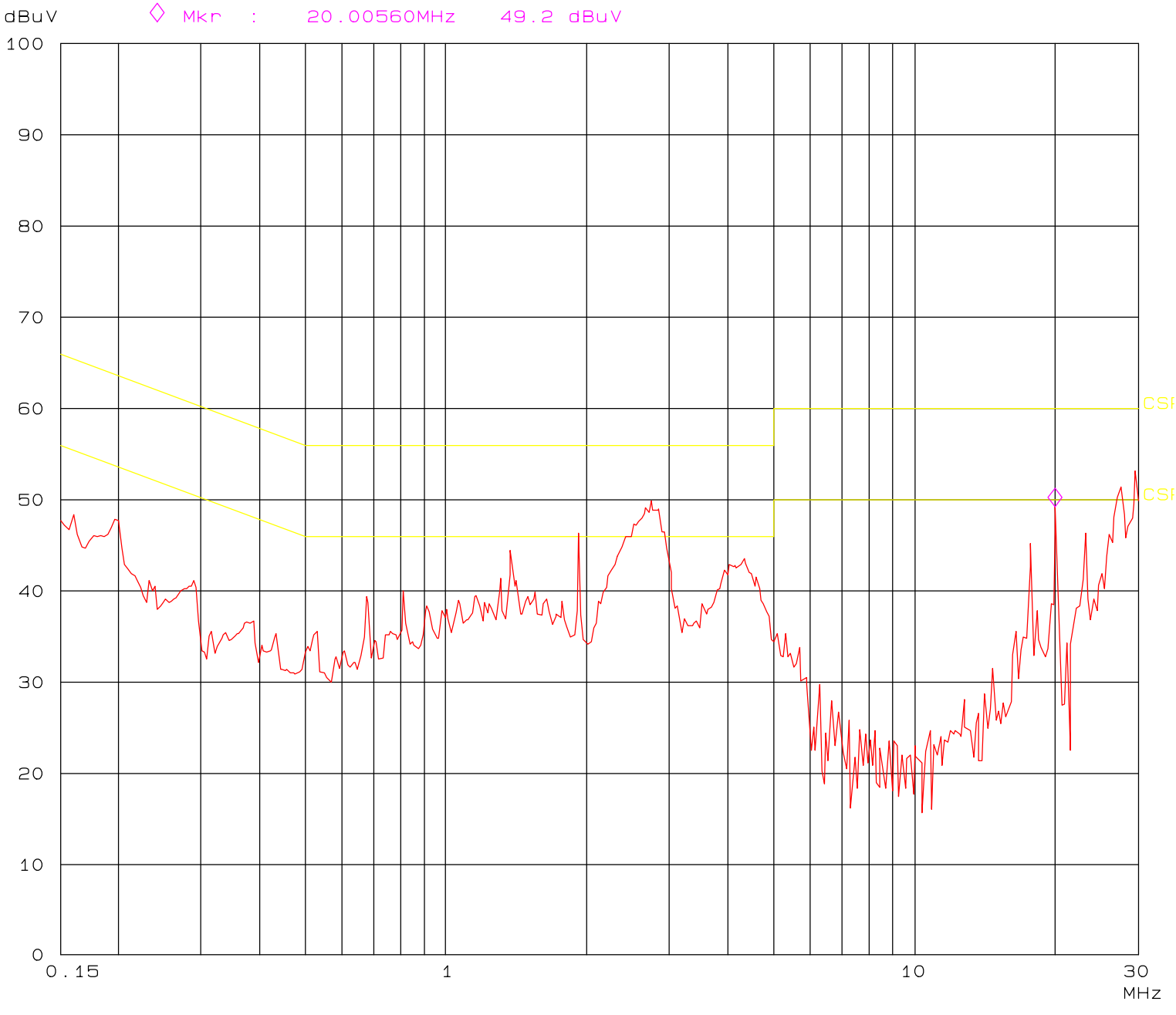
Frequency	Level	AC	EN55022 B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
29.5720	48.0	N	50.0	-2.0	Average	
19.9750	48.0	N	50.0	-2.0	Average	
30.0000	52.2	L	60.0	-7.8	QP	
2.8230	37.8	N	46.0	-8.2	Average	
2.8230	47.4	N	56.0	-8.6	QP	
29.5720	51.3	N	60.0	-8.7	QP	
2.7470	37.0	L	46.0	-9.0	Average	
2.7470	46.3	L	56.0	-9.7	QP	
30.0000	39.2	L	50.0	-10.8	Average	
19.9750	49.0	N	60.0	-11.0	QP	
4.1100	32.2	N	46.0	-13.8	Average	
4.1100	40.6	N	56.0	-15.4	QP	
20.0050	30.0	L	50.0	-20.0	Average	
20.0050	33.5	L	60.0	-26.5	QP	

Elliott LaboratoriesInc.

31. Aug 02 02:36

Conducted Emissions

Operator: Blair Wright
Comment: Airaya
J48272__T48273
AI108
CISPRB
120V/60Hz
LINE

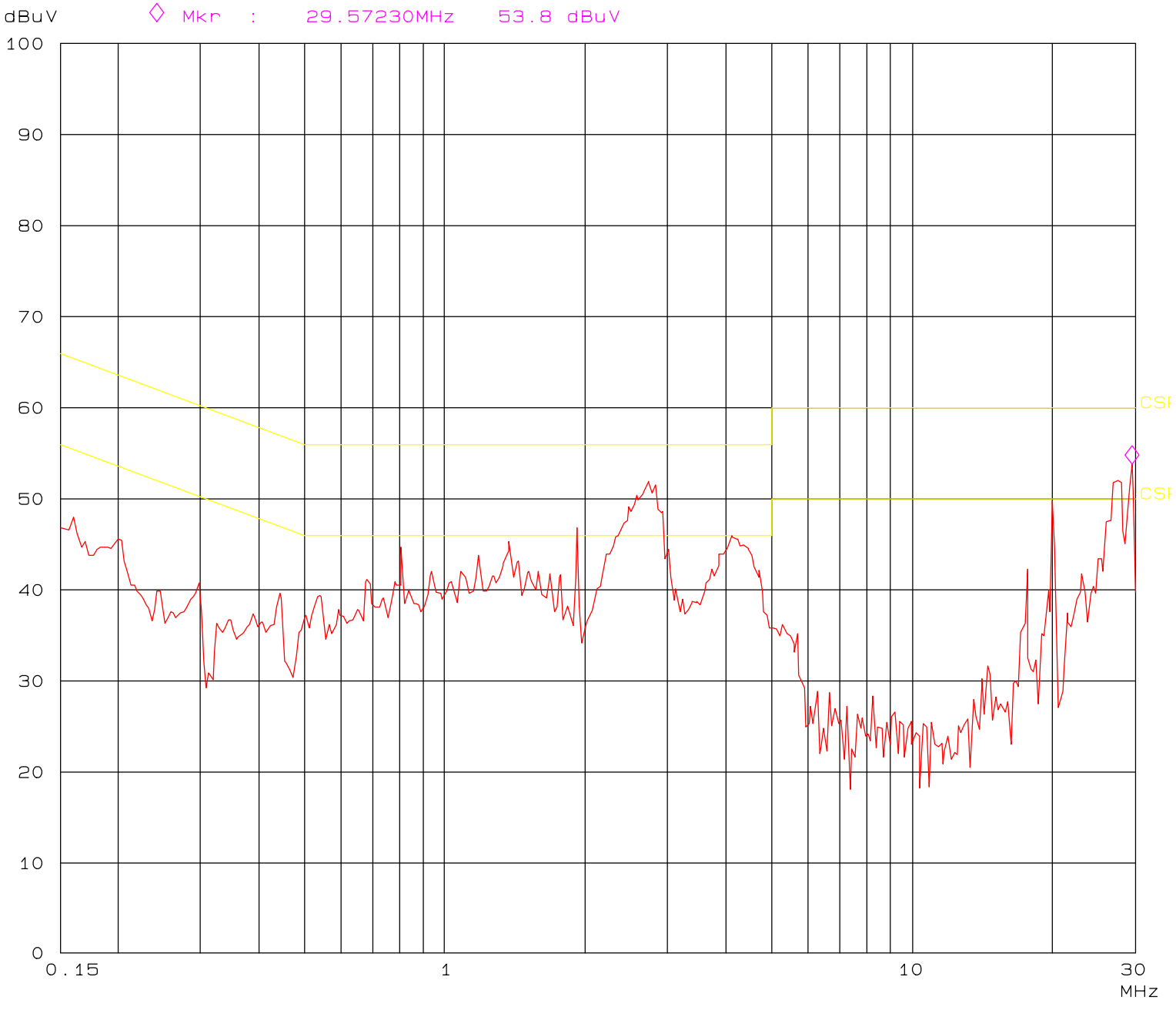


Elliott LaboratoriesInc.

31. Aug 02 02:52

Conducted Emissions

Operator: Blair Wright
Comment: Airaya
J48272__T48273
AI108
CISPRB
120V/60Hz
NEUTRAL



Elliott

EMC Test Data

Client:	Airaya	Job Number:	J42872
Model:	AI108	T-Log Number:	T42873
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	B

Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test:	8/30/2002	Config. Used:	1
Test Engineer:	Blair Wright	Config Change:	none
Test Location:	SVOATS #2	EUT Voltage:	120V/60Hz

General Test Configuration

The EUT was located on the turntable for radiated emissions testing.
On the OATS, the measurement antenna was located 3 meters from the EUT for the measurement range 30 - 1000 MHz.
Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Ambient Conditions:

Temperature: 16°C
Rel. Humidity: 90%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
2	RE, 30 - 1000MHz - Maximized Emissions	FCC B	Pass	-2.7dB @ 40.090MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Elliott

EMC Test Data

Client:	Airaya	Job Number:	J42872
Model:	AI108	T-Log Number:	T42873
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	B

Run #1: Pre-liminary Radiated Emissions, 30-1000 MHz

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
40.090	37.3	v	40.0	-2.7	QP	360	1.0	
45.573	36.9	v	40.0	-3.1	QP	360	1.0	
45.330	36.5	v	40.0	-3.5	QP	7	1.0	
49.060	36.5	v	40.0	-3.5	QP	0	2.0	
79.994	35.8	v	40.0	-4.2	QP	355	1.0	
49.060	35.4	h	40.0	-4.6	QP	360	3.7	
96.000	37.9	h	43.5	-5.6	QP	80	3.0	Signal Sub
33.450	34.3	v	40.0	-5.7	QP	360	1.5	
480.000	40.1	v	46.0	-5.9	QP	360	1.0	
45.573	34.0	h	40.0	-6.0	QP	360	3.3	
863.996	40.0	h	46.0	-6.0	QP	34	2.1	Signal Sub
671.997	39.1	h	46.0	-6.9	QP	27	1.0	
543.990	38.8	h	46.0	-7.2	QP	339	2.2	
672.000	38.7	v	46.0	-7.3	QP	22	1.0	
61.480	32.6	v	40.0	-7.4	QP	324	1.0	
61.410	31.7	h	40.0	-8.3	QP	239	2.7	
45.330	31.6	h	40.0	-8.4	QP	360	3.3	
96.000	34.1	v	43.5	-9.4	QP	360	1.0	Signal Sub
511.997	35.5	v	46.0	-10.5	QP	0	1.0	
141.240	31.7	h	43.5	-11.8	QP	244	3.6	Some BroadBand
863.996	34.1	v	46.0	-11.9	QP	324	1.4	Signal Sub
288.000	34.0	v	46.0	-12.0	QP	0	2.0	
480.000	34.0	h	46.0	-12.0	QP	360	1.2	
543.990	33.7	v	46.0	-12.3	QP	0	1.1	
70.330	27.6	v	40.0	-12.4	QP	212	1.3	
79.954	26.3	h	40.0	-13.7	QP	360	2.7	
40.090	26.0	h	40.0	-14.0	QP	180	2.4	
70.330	26.0	h	40.0	-14.0	QP	122	3.3	
33.450	23.5	h	40.0	-16.5	QP	256	2.1	
288.000	29.2	h	46.0	-16.8	QP	55	1.6	
573.500	29.1	v	46.0	-16.9	QP	0	1.5	
112.710	25.6	v	43.5	-17.9	QP	0	1.0	
147.230	25.3	v	43.5	-18.2	QP	0	1.0	
511.997	26.7	h	46.0	-19.3	QP	0	1.0	
152.170	23.9	v	43.5	-19.6	QP	360	1.0	
141.240	21.8	v	43.5	-21.7	QP	360	1.0	
152.170	19.2	h	43.5	-24.3	QP	325	2.4	

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EMC Test Data

Client:	Airaya	Job Number:	J42872
Model:	AI108	T-Log Number:	T42873
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	B

Run #2: Maximized Radiated Emissions from run# 1

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
40.090	37.3	v	40.0	-2.7	QP	360	1.0	
45.573	36.9	v	40.0	-3.1	QP	360	1.0	
45.330	36.5	v	40.0	-3.5	QP	7	1.0	
49.060	36.5	v	40.0	-3.5	QP	0	2.0	
79.994	35.8	v	40.0	-4.2	QP	355	1.0	
49.060	35.4	h	40.0	-4.6	QP	360	3.7	

Elliott

EMC Test Data

Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Emissions Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII
Immunity Spec:	N/A	Environment:	-

EMC Test Data

For The

Airaya

Model

AI108

Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Emissions Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII
Immunity Spec:	N/A	Environment:	-

EUT INFORMATION

General Description

The EUT is a transceiver that operates in the 5.25 - 5.35 GHz UNII/LELAN band. The EUT is designed to provide a building-to-building bridge for distances of up to 1 mile on channel 58 (5290MHz), which uses two 802.11a channels to provide data rates up to twice those on a single 802.11a channel. The EUT uses an Accton/Atheros 802.11a Access-Point circuit board.

Normally, the EUT would be pole-mounted during operation. The EUT was treated as table-top equipment during testing to simulate the end user environment.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Airaya Corp.	AI108	Building to Building Wireless Bridge	107	QDE-AI108

Antenna

The EUT uses an integral antenna. There are two antennas supplied. One antenna has a gain of 18dBi and the other has a gain of 24dBi.

When the antenna is mounted directly to the EUT, its rf connector is not accessible to the end user and forms an integral part of the unit, thereby meeting the requirements of FCC Part 15.203 and RSS 210.

When the antenna is mounted externally to the EUT, its rf connector is a standard "N" connector that is accessible to the end user. Systems that utilize an external antenna are only provided via professional installers who have been approved by Airaya, thereby meeting the requirements with respect to the "unique" connector requirements of the FCC and Industry Canada rules.

EUT Enclosure

The EUT enclosure is a weatherproof plastic enclosure. It measures approximately 20 cm wide by 20 cm deep by 28 cm high.

Modification History

Mod. #	Test	Date	Modification
1			

Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Emissions Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII
Immunity Spec:	N/A	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Hewlett Packard	N5495	Laptop	TW14613850	-
Red Hawk	BL8551	POE adapter	A00299	-

EUT Interface Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length (m)
EUT Ethernet/Power	POE adater	Cat 5 UTP	Unshielded	20
POE adapter power	AC-DC adapter		Unshielded	1
POE AdapterEthernet In	Laptop ethernet	Cat 5 UTP	Unshielded	2

EUT Operation During Emissions Testing (Radio)

The radio was transmitting at full power on the specified channel. The duty cycle was 100%. The channel was selected since it is the only channel used.

Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

FCC Part 15 Subpart E Tests

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test:	8/29/2002	Config. Used:	1
Test Engineer:	Jmartinez	Config Change:	None
Test Location:	SVOATS# 4	Host Unit Voltage	120Vac, 60Hz

General Test Configuration

The EUT was located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT unless stated otherwise.

When measuring the conducted emissions from the EUT's antenna port (run #s 1 through 5), the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators and cables used.

Ambient Conditions:

Temperature: 24°C

Rel. Humidity: 80%

Summary of Results

Run #	Test Performed	Limit	Result	Comments
1	Output Power	15.407(a) (1), (2)	Pass	10.9 dBm
2	Power Spectral Density (PSD)	15.407(a) (1), (2)	Pass	-14.15 dBm/MHz
3	26dB Bandwidth	15.407	Pass	> 20 MHz
3	20 dB Bandwidth	RSS 210	Pass	> 20 MHz
4	Peak Excursion Envelope	15.407(a) (6)	Pass	Peak to average excursion < 13dB
5	Antenna Conducted - Out of Band Spurious	15.407(b)	Pass	All emissions below the 27dBm/MHz limit
6	RE, 1000 - 40000 MHz - Spurious Emissions	15.407(b)(6)	Pass	-8.3dB @ 10540.45 MHz

Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

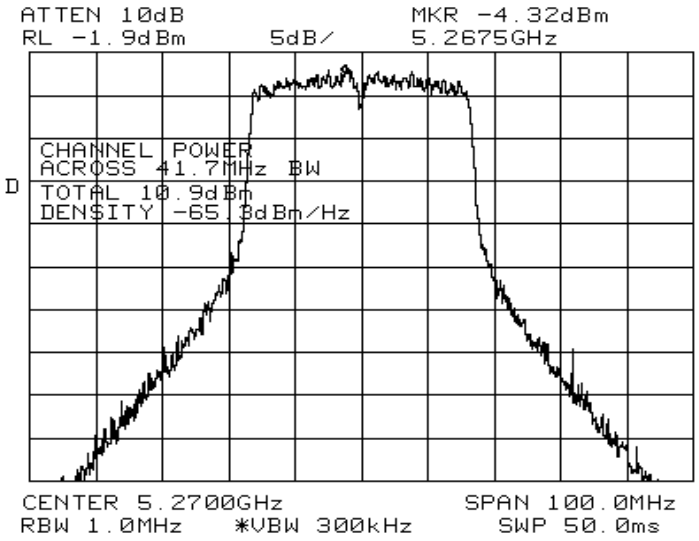
No deviations were made from the requirements of the standard.

Run #1: Output Power

Antenna Gain: 18 dBi

NOM	Frequency (MHz)	99.7% Signal BW	Output Power	FCC Limit (dBm)	Comments
5	5270	41.7	10.9	12.0	Note 2

Note 1:	Measured using spectrum analyzer's power measurement function (RBW = 1MHz, VBW = (Note 2)) which summed the power over the occupied bandwidth (26dB bandwidth).
Note 2:	VBW (300kHz) was determined by 1/T, where T = 4us for 802.11a transmissions in accordance with FCC Document DA 02-2138



Elliott

EMC Test Data

Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Run #2: Power Spectral Density

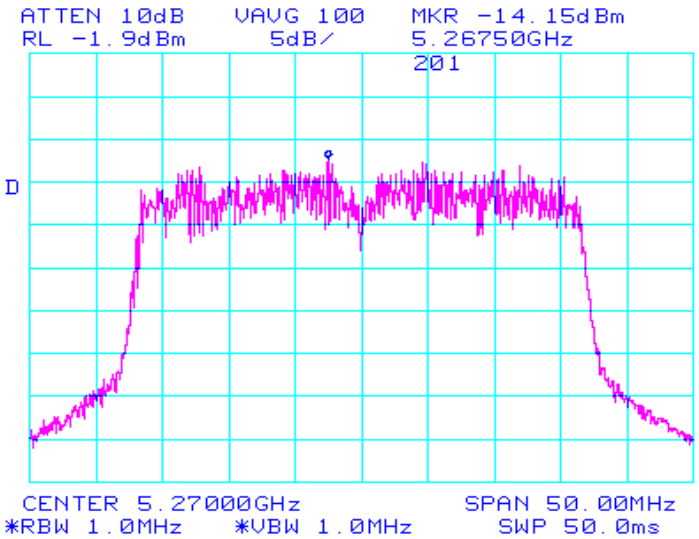
Antenna Gain: 18 dBi

NOM	Frequency (MHz)	Power Spectral Density (dBm/MHz)	FCC Limit (dBm) note 2	Graph Reference	
5	5270	-14.15	-1.0	201	Note 1

Note 1:	The above measurements were made using RBW = 1MHz, VBW = 3MHz, video averaging on. To demonstrate compliance with RSS 210, the peak PSD was also measured using RBW= VBW=1MHz, video averaging off during the peak excursion measurements (run #4). The peak PSD (meausred with RBW=VBW=1MHz) of -1.18 **dBm** did not exceed the maximum permitted average PSD of 10dBm (5.15 to 5.25 GHz band) or 11dBm (5.25-5.35GHz band) so no restriction is placed on the output power or average PSD with respect to RSS 210.
Note 2:	RSS 210 limit is 10dBm/MHz in the 5.15 to 5.25 GHz band, 6dB higher than the FCC limit.

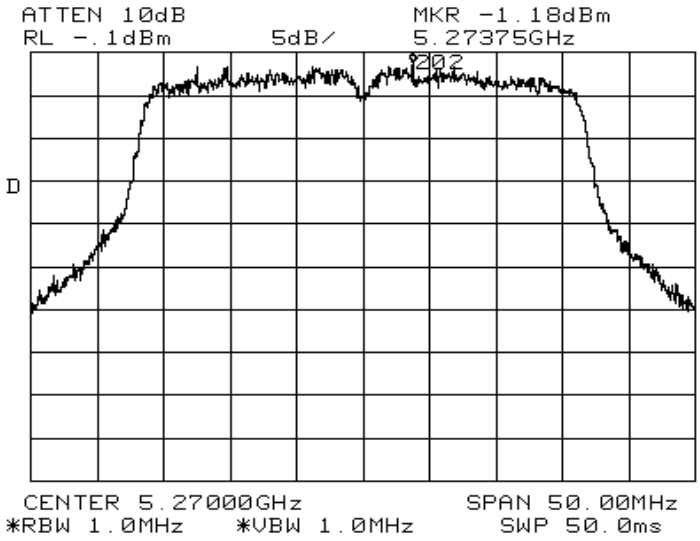
Plots Showing Power Spectral Density (RBW = 1MHz, VBW = 3 MHz, video averaging ON)

FCC Power Spectral Density



Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Industry Canaada Power Spectral Density



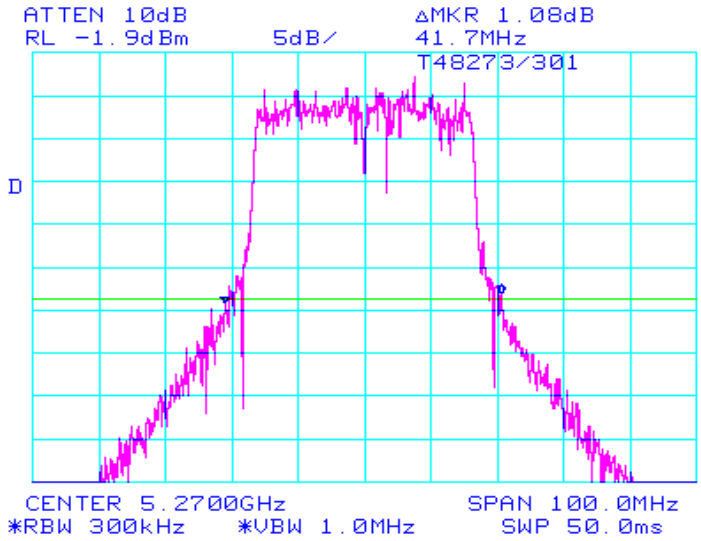
Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Run #3: Signal Bandwidth

NOM	Frequency (MHz)	Resolution Bandwidth	26 dB Signal Bandwidth (MHz)	20 dB Signal Bandwidth (MHz)	Graph reference #
5	5270	300 kHz	41.7	35.1	T48273/301

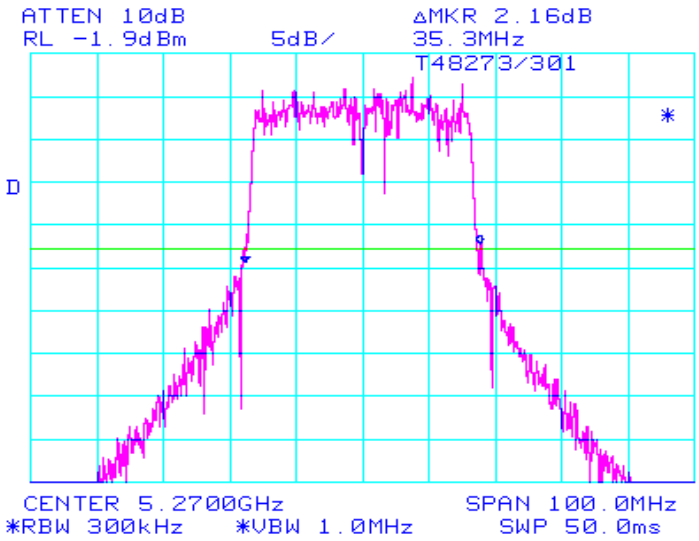
Plots Showing Signal Bandwidth

26-dB Bandwidth

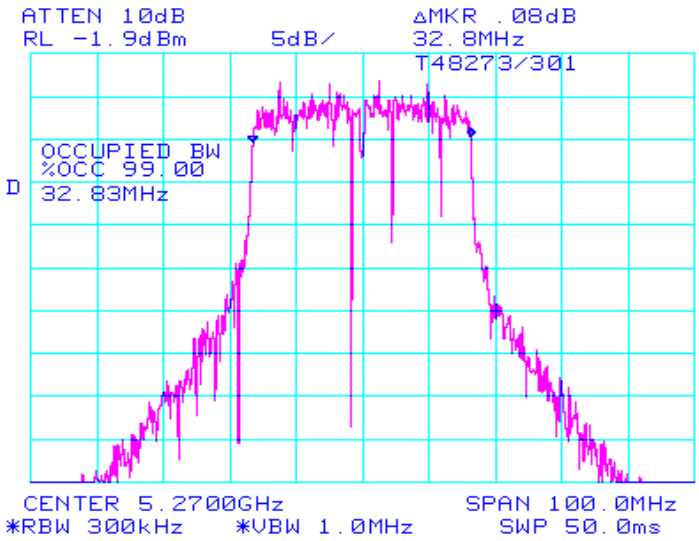


Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

20-dB Bandwidth



99% Bandwidth



Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

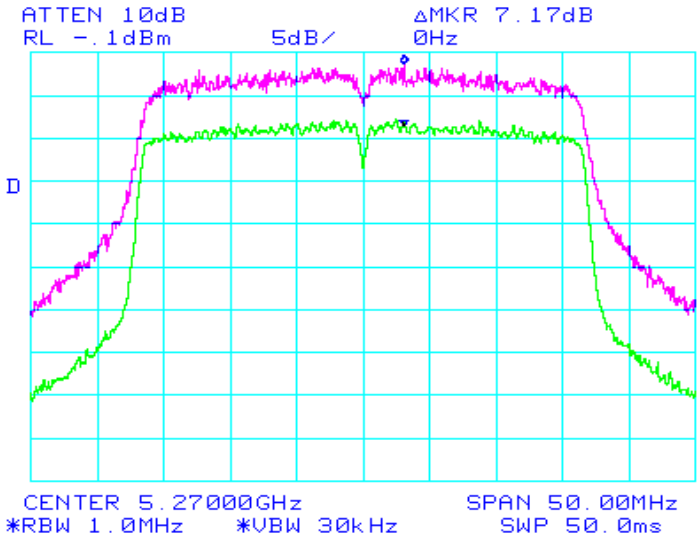
Run #4: Peak Excursion Measurement

Plots Showing Peak Excursion

Trace A: RBW = VBW = 1MHz

Trace B: RBW = 1 MHz, VBW = 30kHz

Peak Excursion = 7.17 dB.



Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Run #5: Out Of Band Spurious Emissions - Antenna Conducted

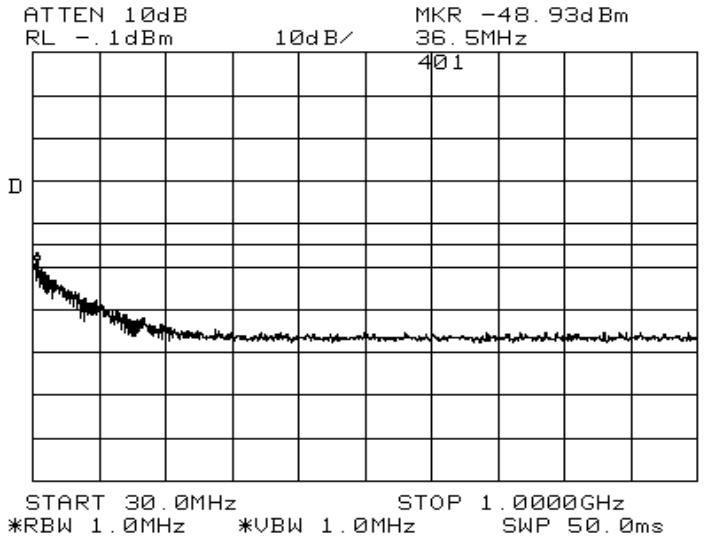
The antenna gain of the radios integral antenna is 18 dBi. The EIRP limit is -27dBm/MHz for all out of band signals that do not fall in restricted bands. A limit of -45 dBm was, therefore, used for signals not in restricted bands and close to the intentional band with the assumption that the antenna gain was equal to 45 within 100 MHz of the upper and lower band edges. For signals removed from the band edge by more than 100MHz, radiated measurements were made (refer to run #6) if the signal amplitude exceeded -37dBm.

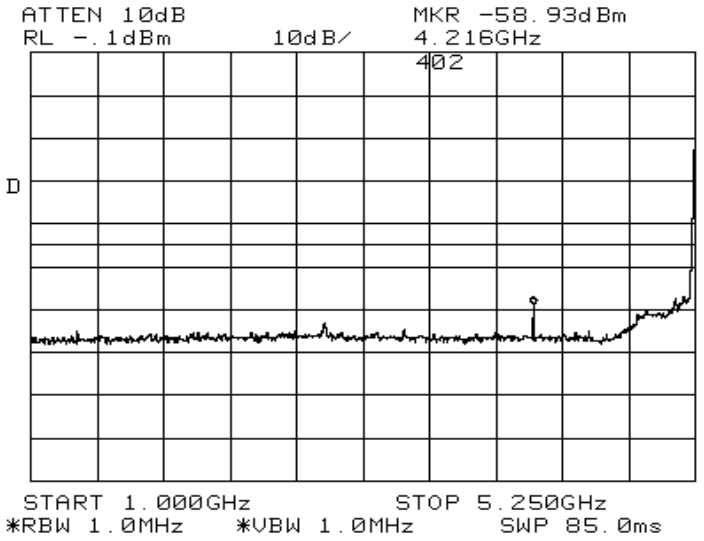
Channel	Frequency (MHz)	Frequency Range	Highest Spurious Signal	Graph reference #
54	5270	30 - 1000 MHz	Note 4	401
		1 to 5.25 GHz	-58.93 dBm @ 4126 MHz	402
		5.35 to 10 GHz	None	403
		10 GHz to 20 GHz	None	404
		20 GHz to 40 GHz	None	405

Note 1:	Signal is in a restricted band. Refer to run #6 for field strength measurements.
Note 2:	Signal is not in restricted band. Limit is -27dBm eirp. As the signal strength is significantly lower than -27dBm no field strength measurements required.
Note 3:	Signal is not in restricted band. Limit is -27dBm eirp. Although the signal strength is significantly lower than -27dBm field strength measurements were made (refer to run #6)
Note 4:	All spurious signals in this frequency band measured during digital device radiated emissions test.

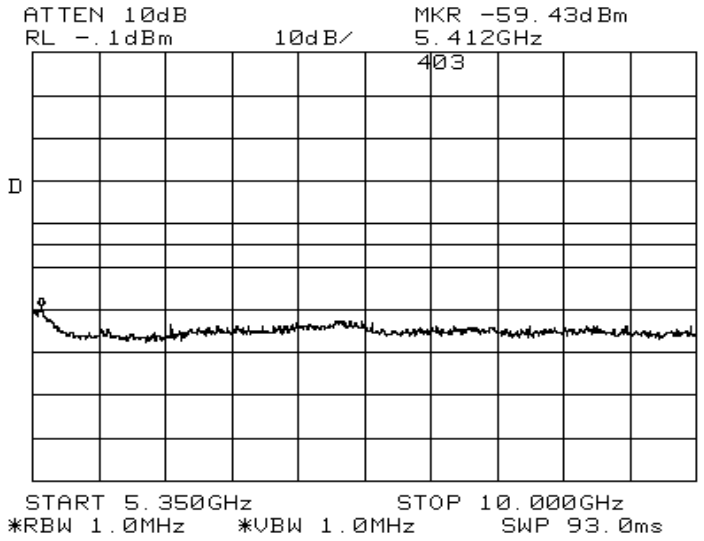
Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

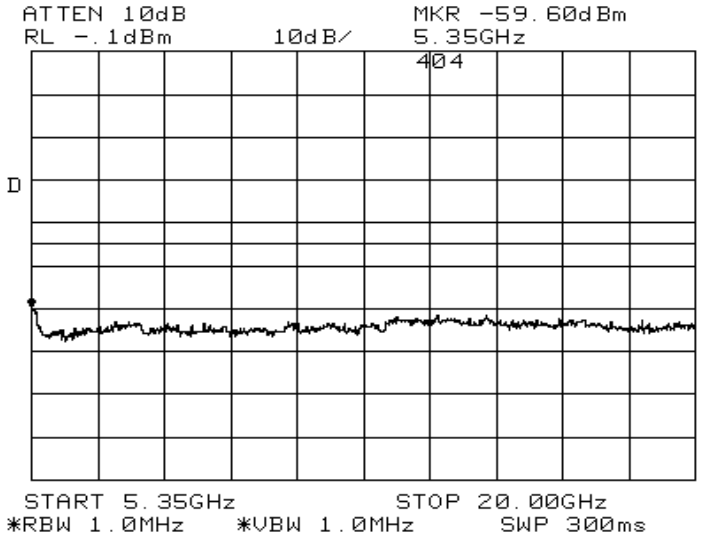
Plots Showing Out-Of-Band Emissions (RBW=VBW=1MHz)



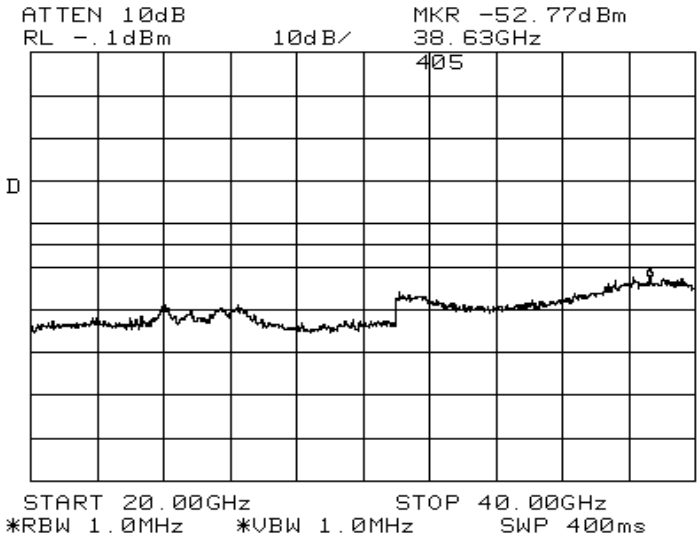


Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII





Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII



Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Band Edge Measurements:

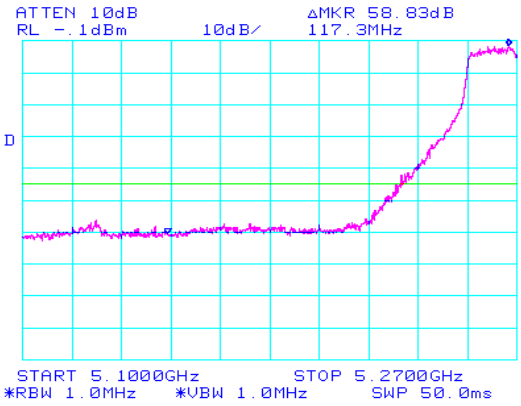
For signals in the restricted bands immediately above and below the 5.15 to 5.35 GHz allocated band a measurement was made of the amplitude of the spurious emissions with respect to the intentional signals. The relative amplitude, in dBc, was then applied to the average and peak field strength of the intentional signal made on the OATS to calculate the field strength of the unintentional signals.

Plots Showing Out-Of-Band Emissions (Peak RBW=VBW=1MHz; Average RBW = 1MHz, VBW = 10Hz)

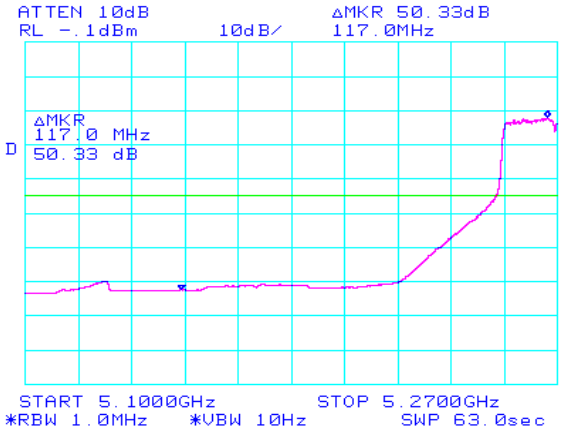
5.15 GHz band edge, EUT operating on the lowest channel

The highest signal within 50 MHz of the 5.15 GHz band was -58.83 dBc (Peak) / -50.33dBc (Average)

Peak



Average

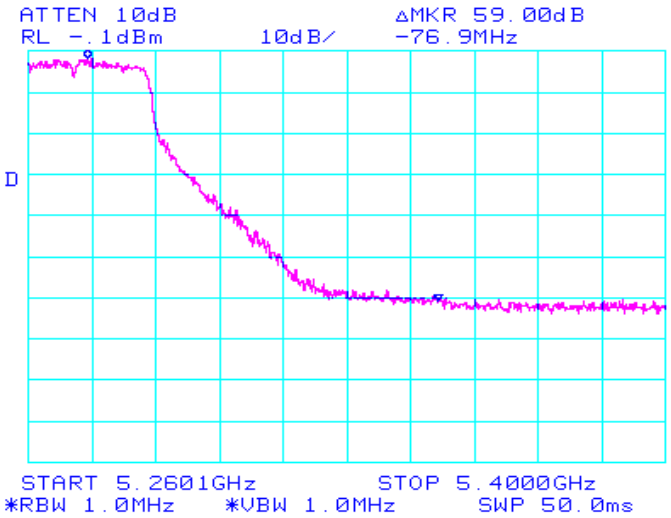


Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

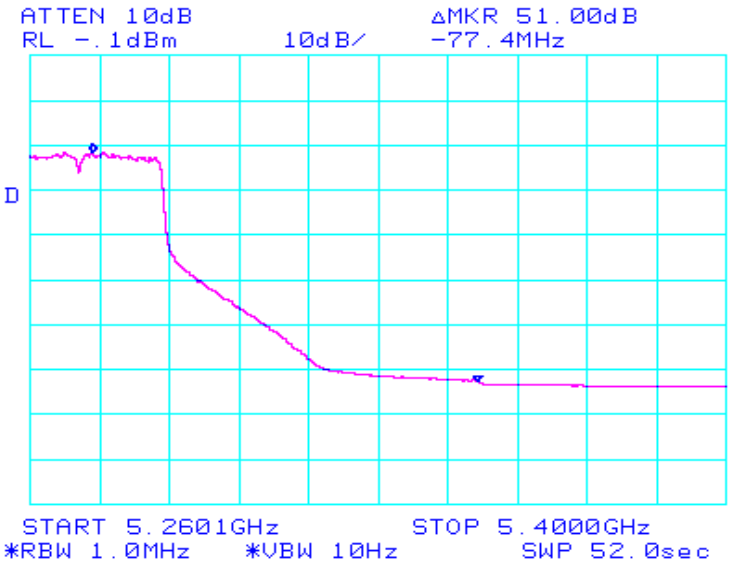
5.35 GHz band edge EUT operating on channel 17 (highest channel):

The highest signal in the 5.35 to 5.46 GHz band was -59.0 dBc (Peak) / - 51.0 dBc (Average)

Peak



Average



Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Run #6a: Radiated Spurious Emissions, 1000 - 40000 MHz

Spurious emissions from 30 - 1000 MHz were measured while performing emissions measurements of the digital device. Refer to run 2 performed on 8-30-2002

Limit for emissions in restricted bands:	54dBuV/m (Average)	74dBuV/m (Peak)
Limit for emissions outside of restricted bands:	EIRP < -27dBm/MHz	(68dBuV/m)

Fundamental signal measurements (to calculate the band edge field strengths):

18dB Antenna (Nom 5)

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5272.222	116.5	V	-	-	Pk	127	1.1	NOM5
5271.963	103.9	V	-	-	Avg	127	1.1	NOM5
5272.104	85.5	H	-	-	Pk	157	1.1	NOM5
5271.542	74.3	H	-	-	Avg	157	1.1	NOM5

Band Edge Field Strength Calculations

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5150.0	57.7	v	74.0	-16.3	Pk	127	1.1	Note 1
5150.0	53.6	v	54.0	-0.4	Avg	127	1.1	Note 1
5150.0	26.7	h	74.0	-47.3	Pk	157	1.1	Note 1
5150.0	24.0	h	54.0	-30.0	Avg	157	1.1	Note 1
5350.0	57.5	v	74.0	-16.5	Pk	127	1.1	Note 2
5350.0	52.9	v	54.0	-1.1	Avg	127	1.1	Note 2
5350.0	26.5	h	74.0	-47.5	Pk	157	1.1	Note 2
5350.0	23.3	h	54.0	-30.7	Avg	157	1.1	Note 2

Note 1:	EUT operating on the lowest channel available in the 5.15 - 5.25 MHz band. Signal level calculated using the relative measurements in run #5 (-58.83 dBc for peak and -50.33 dBc for average) applied to the highest peak and average field strength measurements of the fundamental signal level.
Note 2:	EUT operating on highest channel available in the 5.25 - 5.35 MHz band. Signal level calculated using the relative measurements in run #5 (-59.0 dBc for peak and -51.0 dBc for average) applied to the highest peak and average field strength measurements of the fundamental signal level.

Elliott

EMC Test Data

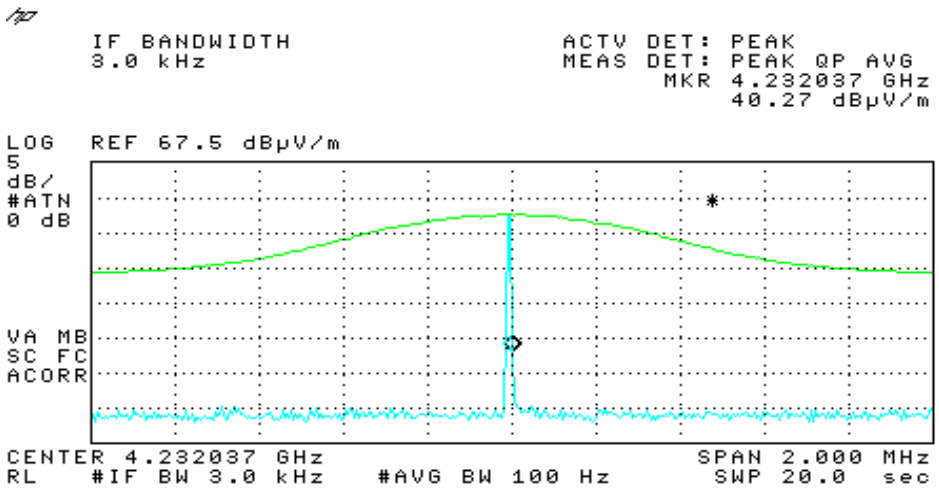
Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Run #6b: Radiated Spurious Emissions, 1000 - 40000 MHz
EUT On Lowest Channel Available (5.27 GHz)

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
10540.69	54.0	V	74.0	-20.0	Pk	120	1.2	Note 1, 3, & 4
10540.31	41.0	V	54.0	-13.0	Avg	120	1.2	Note 1, 3, & 4
15811.32	52.1	V	74.0	-21.9	Pk	132	1.2	Note 1 & 3
15811.07	39.5	V	54.0	-14.5	Avg	132	1.2	Note 1 & 3
15813.16	52.3	H	74.0	-21.7	Pk	156	1.0	Note 1 & 3
15812.95	40.0	H	54.0	-14.0	Avg	156	1.0	Note 1 & 3
10540.70	58.4	H	74.0	-15.6	Pk	110	1.0	Note 1, 3, & 4
10540.45	45.7	H	54.0	-8.3	Avg	110	1.0	Note 1, 3, & 4
4215.985	48.6	V	54.0	-5.4	Pk	124	1.2	Average limit, Peak reading (Note 5)
6323.983	46.7	V	68.3	-21.6	Note 5	124	1.2	Noise Floor
4215.982	45.3	H	54.0	-8.7	Pk	118	1.2	Average limit, Peak reading (Note 5)
6323.982	44.1	H	68.3	-24.2	Note 5	118	1.2	Noise Floor

Note 1:	For emissions falling in the restricted bands detailed in 15.205 the general limits of 15.209 apply. For all other emissions the limit is EIRP < -27dBm (equivalent to a field strength at 3m of 68dBuV/m)
Note 2:	Signal is in a restricted band
Note 3:	Restricted Band Peak Measurements: Resolution and Video BW: 1 MHz, Restricted Band Average Measurements: Resolution Bw: 1MHz and Video Bw: 10 Hz. All other measurements, RBW = 1MHz and VBW = 3MHz, video averaging on (100 samples).
Note 4:	Signal does not fall in a restricted band.
Note 5:	This measurement was made using a resolution bandwidth of 3 kHz The instrumentation noise floor was too high to allow measurements with RBW = 1MHz because a preamplifier could not be used (with the EUT operating the intentional signal would overload the amplifier and there is no low pass filter with sufficient shape factor to reject the intentionally trasmitted signal but pass the spuroius signal). The signal was a narrowband signal (as verified during the conducted antenna measurements) and so the amplitude (peak/average) in a 3kHz bandwidth would be the same as that in a 1MHz bandwidth (please refer to the plot below). The peak reading has been compared with the average limit.

Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII



Plot showing LO signal at 4GHz measured using RBW = 1MHz and RBW = 3kHz. Amplitude of the signal does not change with resolution bandwidth.

Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

FCC Part 15 Subpart E Tests

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test:	8/29/2002	Config. Used:	1
Test Engineer:	Jmartinez	Config Change:	None
Test Location:	SVOATS# 4	Host Unit Voltage	120Vac, 60Hz

General Test Configuration

The EUT was located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT unless stated otherwise.

When measuring the conducted emissions from the EUT's antenna port (run #s 1 through 5), the antenna port of the EUT was connected to a spectrum analyzer via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators and cables used.

Ambient Conditions:

Temperature: 24°C

Rel. Humidity: 80%

Summary of Results

Run #	Test Performed	Limit	Result	Comments
1	Output Power	15.407(a) (1), (2)	Pass	8.9 dBm
2	Power Spectral Density (PSD)	15.407(a) (1), (2)	Pass	-15.5 dBm/MHz
3	26dB Bandwidth	15.407	Pass	> 20 MHz
3	20 dB Bandwidth	RSS 210	Pass	> 20 MHz
4	Peak Excursion Envelope	15.407(a) (6)	Pass	Peak to average excursion < 13dB
5	Antenna Conducted - Out of Band Spurious	15.407(b)	Pass	All emissions below the 27dBm/MHz limit
6	RE, 1000 - 40000 MHz - Spurious Emissions	15.407(b)(6)	Pass	-4.8dB @ 4215.987MHz

Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

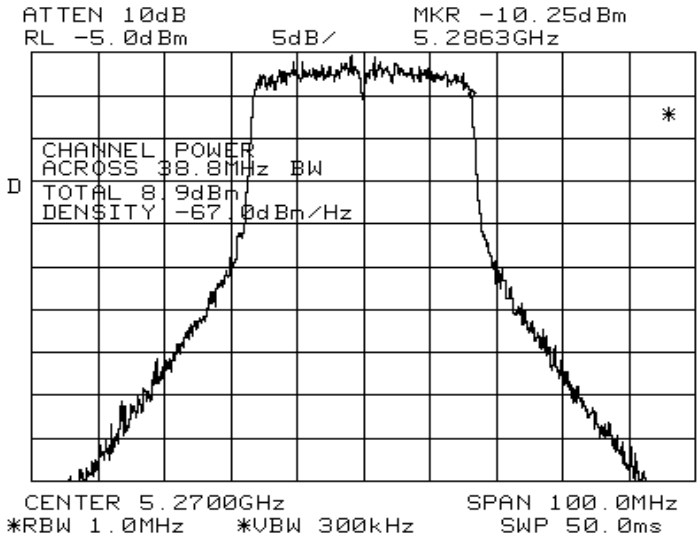
No deviations were made from the requirements of the standard.

Run #1: Output Power

Antenna Gain: 24 dBi

NOM	Frequency (MHz)	99.7% Signal BW	Output Power	Limit (dBm)	Comments
3	5270	38.8	8.9	6.0	Note 2, 3

Note 1:	Measured using spectrum analyzer's power measurement function (RBW = 1MHz, VBW = (Note 2)) which summed the power over the occupied bandwidth (26dB bandwidth).
Note 2:	VBW (300kHz) was determined by 1/T, where T = 4us for 802.11a transmissions in accordance with FCC Document DA 02-2138
Note 3:	Output power at rf port was 8.9dBm. Output power supplied to the antenna is 3dB lower than this (5.9dBm) by virtue of either a 3dB attenuator or a cable of at least 3dB loss at 5.27GHz to ensure that the limit of 6dBm is not exceeded.



Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Run #2: Power Spectral Density

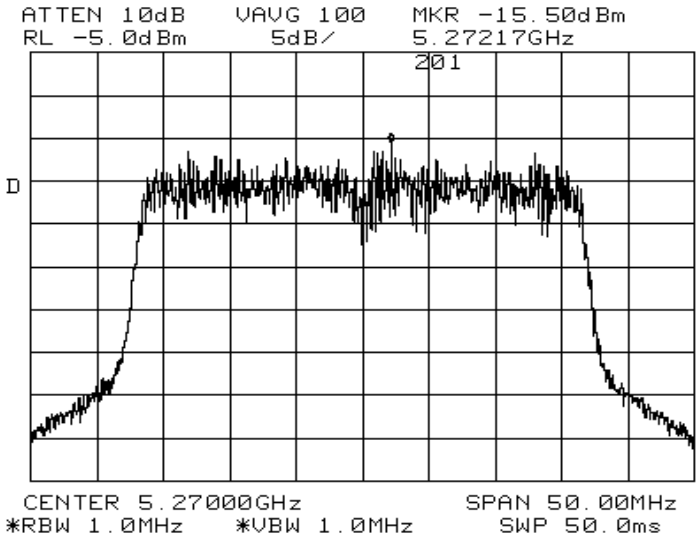
Antenna Gain: 24 dBi

NOM	Frequency (MHz)	Power Spectral Density (dBm/MHz)	FCC Limit (dBm) note 2	Graph Reference	
3	5270	-15.5	-7.0	201	Note 1

Note 1:	The above measurements were made using RBW = 1MHz, VBW = 3MHz, video averaging on. To demonstrate compliance with RSS 210, the peak PSD was also measured using RBW= VBW=1MHz, video averaging off during the peak excursion measurements (run #4). The peak PSD (meausred with RBW=VBW=1MHz) of -3.25 **dBm** did not exceed the maximum permitted average PSD of 10dBm (5.15 to 5.25 GHz band) or 11dBm (5.25-5.35GHz band) so no restriction is placed on the output power or average PSD with respect to RSS 210.
Note 2:	RSS 210 limit is 10dBm/MHz in the 5.15 to 5.25 GHz band, 6dB higher than the FCC limit.

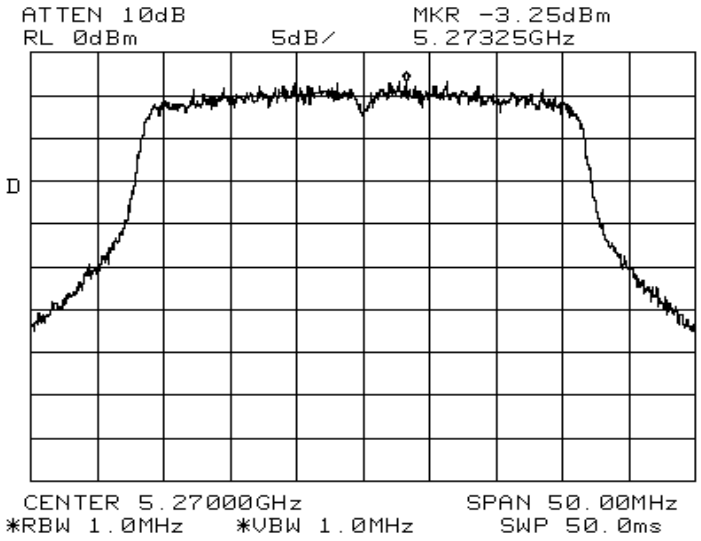
Plots Showing Power Spectral Density (RBW = 1MHz, VBW = 3 MHz, video averaging ON)

FCC Power Spectral Density



Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Industry Canada Power Spectral Density



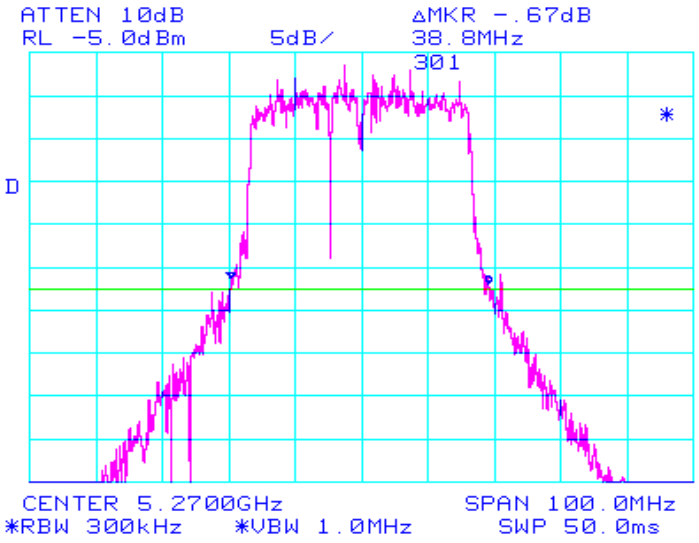
Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Run #3: Signal Bandwidth

NOM	Frequency (MHz)	Resolution Bandwidth	26 dB Signal Bandwidth (MHz)	20 dB Signal Bandwidth (MHz)	Graph reference #
3	5270	300 kHz	38.8	35.2	301

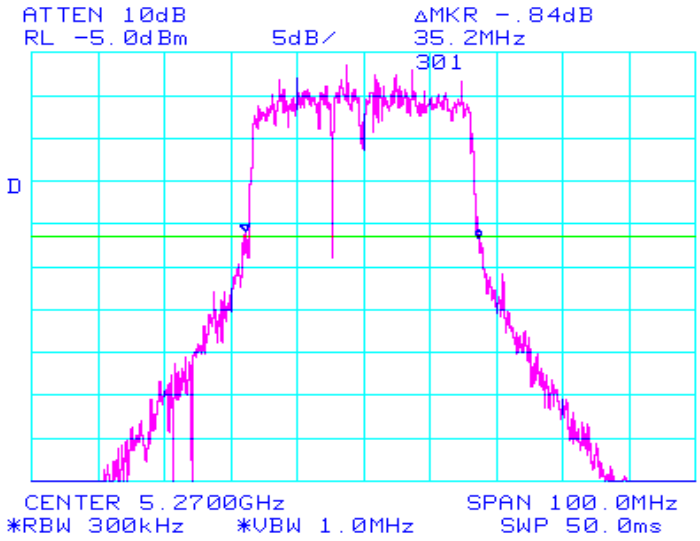
Plots Showing Signal Bandwidth

26-dB Bandwidth

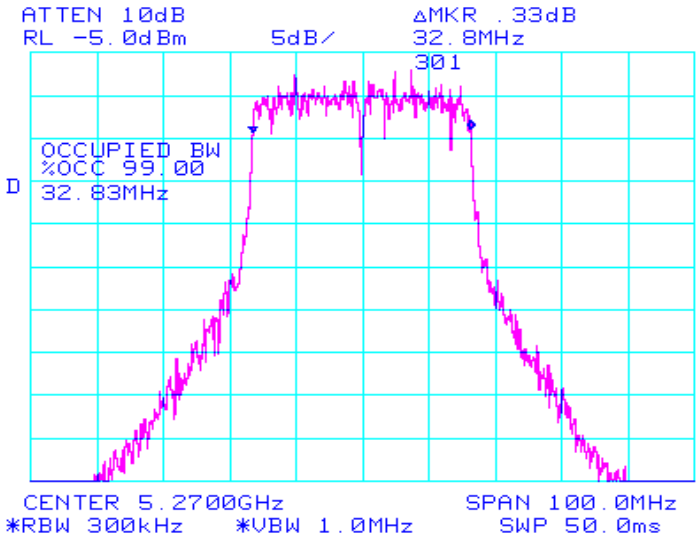


Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

20-dB Bandwidth



99% Bandwidth



Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

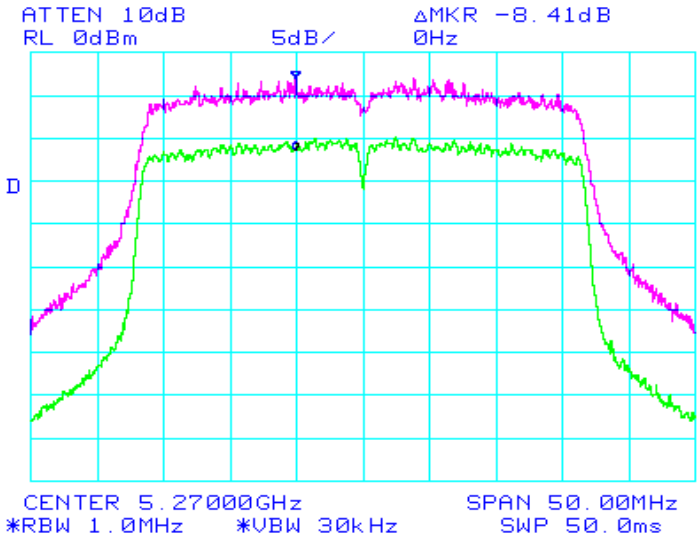
Run #4: Peak Excursion Measurement

Plots Showing Peak Excursion

Trace A: RBW = VBW = 1MHz

Trace B: RBW = 1 MHz, VBW = 30kHz

Peak Excursion = 8.41 dB.



Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Run #5: Out Of Band Spurious Emissions - Antenna Conducted

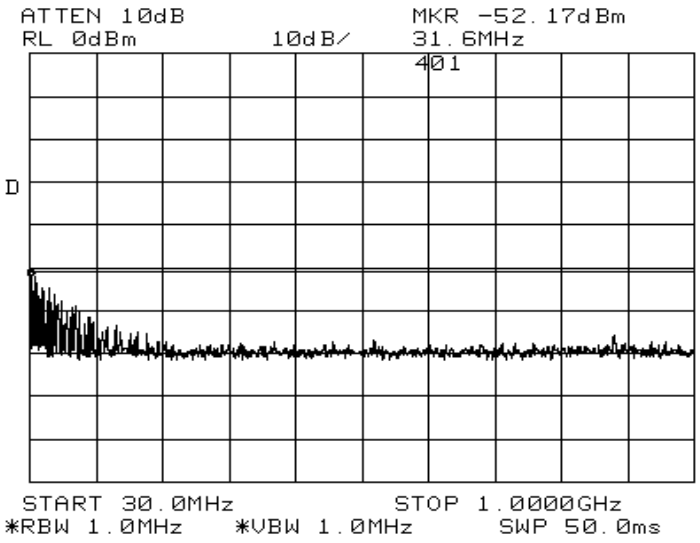
The antenna gain of the radios integral antenna is 24 dBi. The EIRP limit is -27dBm/MHz for all out of band signals that do not fall in restricted bands. A limit of -28.5 dBm was, therefore, used for signals not in restricted bands and close to the intentional band with the assumption that the antenna gain was equal to -51within 100 MHz of the upper and lower band edges. For signals removed from the band edge by more than 100MHz, radiated measurements were made (refer to run #6) if the signal amplitude exceeded -37dBm.

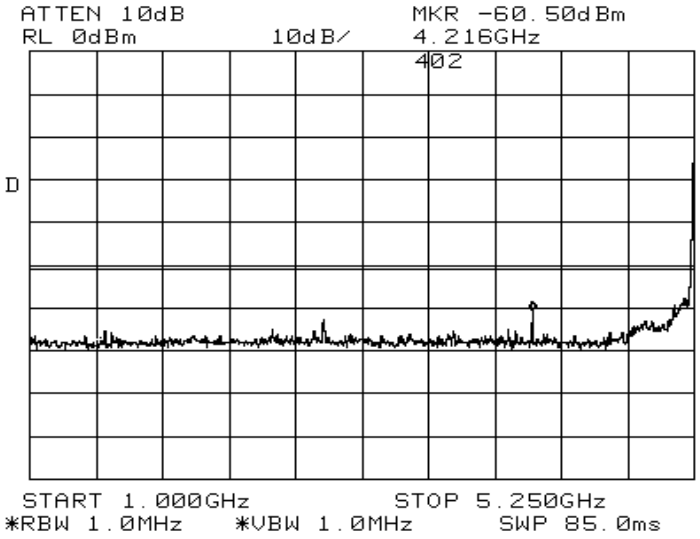
Channel	Frequency (MHz)	Frequency Range	Highest Spurious Signal	Graph reference #
54	5270	30 - 1000 MHz	Note 4	401
		1 to 5.25 GHz	-60.5 dBm @ 4126 MHz	402
		5.35 to 10 GHz	None	403
		10 GHz to 20 GHz	None	404
		20 GHz to 40 GHz	None	405

Note 1:	Signal is in a restricted band. Refer to run #6 for field strength measurements.
Note 2:	Signal is not in restricted band. Limit is -27dBm eirp. As the signal strength is significantly lower than -27dBm no field strength measurements required.
Note 3:	Signal is not in restricted band. Limit is -27dBm eirp. Although the signal strength is significantly lower than -27dBm field strength measurements were made (refer to run #6)
Note 4:	All spurious signals in this frequency band measured during digital device radiated emissions test.

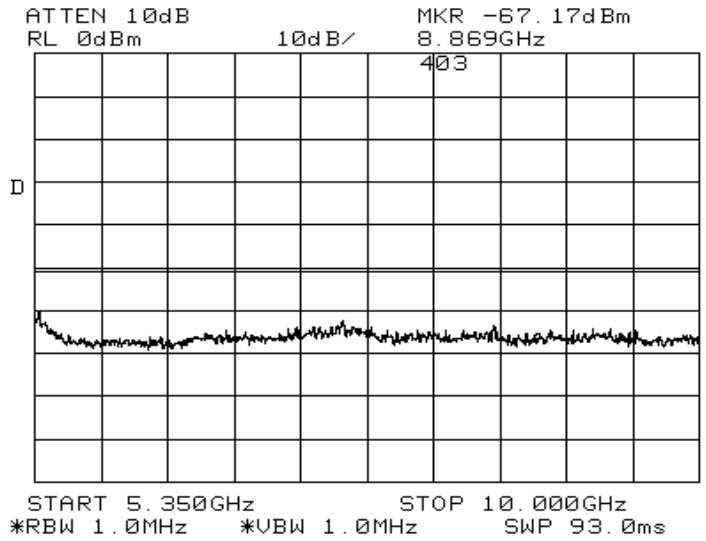
Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

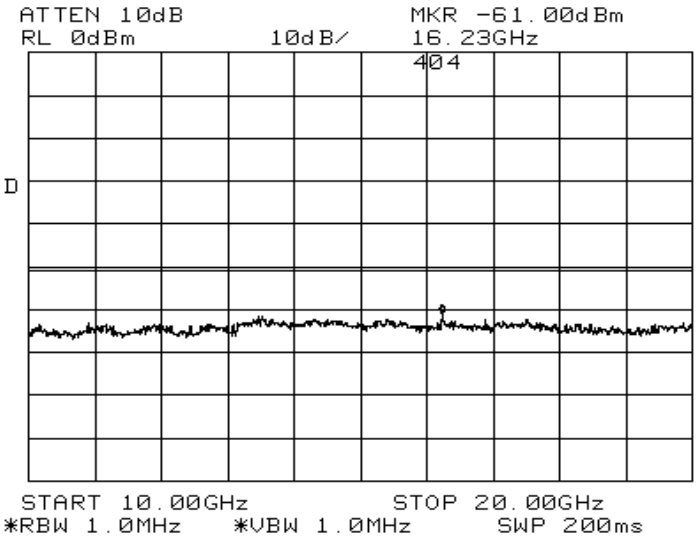
Plots Showing Out-Of-Band Emissions (RBW=VBW=1MHz)



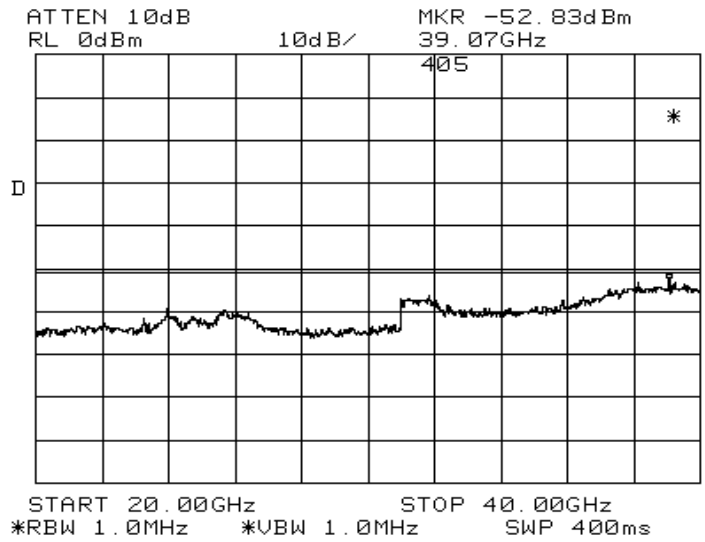


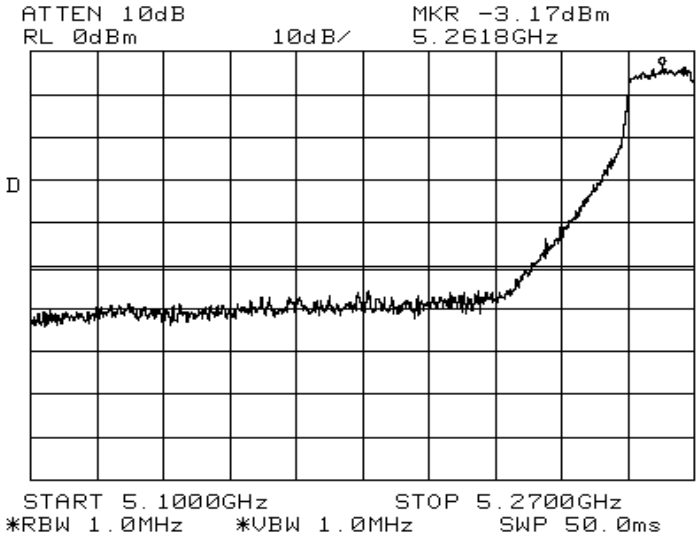
Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII





Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII





Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Band Edge Measurements:

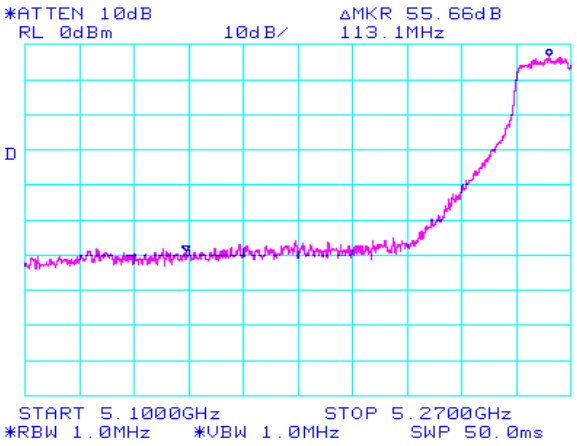
For signals in the restricted bands immediately above and below the 5.15 to 5.35 GHz allocated band a measurement was made of the amplitude of the spurious emissions with respect to the intentional signals. The relative amplitude, in dBc, was then applied to the average and peak field strength of the intentional signal made on the OATS to calculate the field strength of the unintentional signals.

Plots Showing Out-Of-Band Emissions (Peak RBW=VBW=1MHz; Average RBW = 1MHz, VBW = 10Hz)

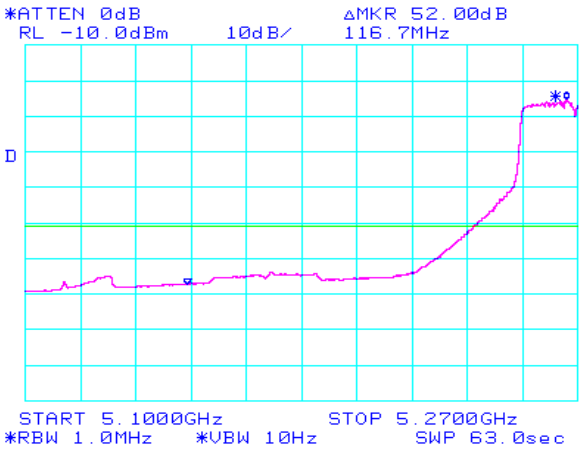
5.15 GHz band edge, EUT operating on the lowest channel

The highest signal within 50 MHz of the 5.15 GHz band was -55.66dBc (Peak) / -52dBc (Average)

Peak



Average

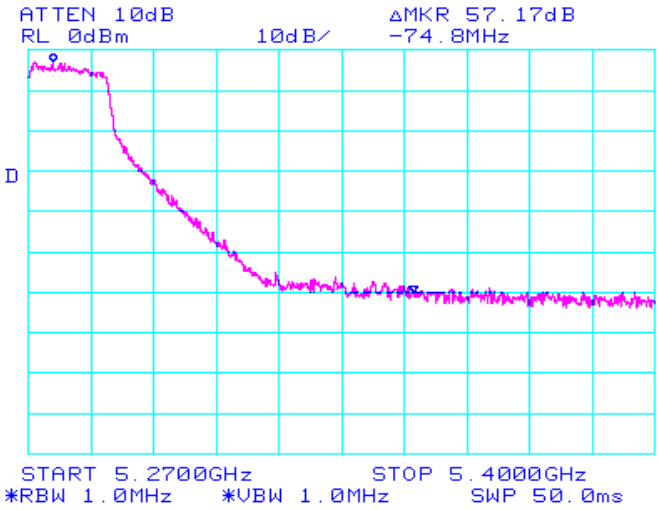


Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

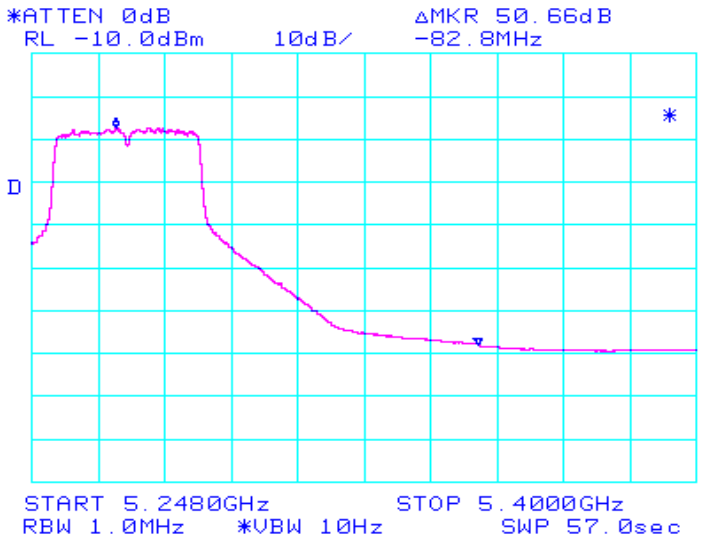
5.35 GHz band edge EUT operating on channel 17 (highest channel):

The highest signal in the 5.35 to 5.46 GHz band was -57.17dBc (Peak) / - 50.66dBc (Average)

Peak



Average



Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Run #6a: Radiated Spurious Emissions, 1000 - 40000 MHz

Spurious emissions from 30 - 1000 MHz were measured while performing emissions measurements of the digital device. Refer to run 2 performed on 8-30-2002

Limit for emissions in restricted bands:	54dBuV/m (Average)	74dBuV/m (Peak)
Limit for emissions outside of restricted bands:	EIRP < -27dBm/MHz	(68dBuV/m)

Fundamental signal measurements (to calculate the band edge field strengths):
1-dB attenuator, NOM 3

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5271.563	115.5	V	-	-	Pk	134	1.1	Peak Measurement
5271.868	103.7	V	-	-	Avg	134	1.1	Average Measurement
5271.563	101.0	h	-	-	Pk	121	1.5	Peak Measurement
5271.868	94.2	h	-	-	Avg	121	1.5	Average Measurement

Band Edge Field Strength Calculations

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5150.000	59.8	V	74.0	-14.2	Peak	132	1.0	Note 1
5150.000	51.7	V	54.0	-2.3	Avg	132	1.0	Note 1
5150.000	43.8	h	74.0	-30.2	Peak	121	1.5	Note 1
5150.000	42.2	h	54.0	-11.8	Avg	121	1.5	Note 1
5350.000	58.3	V	74.0	-15.7	Peak	132	1.0	Note 2
5350.000	53.0	V	54.0	-1.0	Avg	132	1.0	Note 2
5350.000	43.8	h	74.0	-30.2	Peak	121	1.5	Note 2
5350.000	43.5	h	54.0	-10.5	Avg	121	1.5	Note 2

Note 1:	EUT operating on the lowest channel available in the 5.15 - 5.25 MHz band. Signal level calculated using the relative measurements in run #5 (-55.66 dBc for peak and -52.00 dBc for average) applied to the highest peak and average field strength measurements of the fundamental signal level.
Note 2:	EUT operating on highest channel available in the 5.25 - 5.35 MHz band. Signal level calculated using the relative measurements in run #5 (57.17 dBc for peak and -50.66 dBc for average) applied to the highest peak and average field strength measurements of the fundamental signal level.

Elliott

EMC Test Data

Client:	Airaya	Job Number:	J48272
Model:	AI108	T-Log Number:	T48643
		Proj Eng:	Mark Briggs
Contact:	Bill		
Spec:	FCC Part 15 B & E, RSS-210	Class:	UNII

Run #6b: Radiated Spurious Emissions, 1000 - 40000 MHz
EUT On Lowest Channel Available (5.27 GHz)

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4215.987	49.2	V	54.0	-4.8	Pk	145	1.2	Note 5
6323.988	32.1	V	68.3	-36.2	Pk	157	1.1	Note 5
6323.988	40.2	H	54.0	-13.8	Pk	230	1.2	Note 5
4215.988	40.2	H	54.0	-13.8	Pk	80	1.3	Note 5
10540.00	18.2	H	68.3	-50.1	Note 3	0.0	1.0	Note 1 & 4
10540.00	18.8	V	68.3	-49.5	Note 3	0.0	1.0	Note 1 & 4
15810.00	53.2	V	74.0	-20.8	Pk	12	1.0	Note 1 & 3
15810.00	40.2	V	54.0	-13.8	Avg	12	1.0	Note 1 & 3
15810.00	55.6	H	74.0	-18.4	Pk	54	1.0	Note 1 & 3
15810.00	39.8	H	54.0	-14.2	Avg	54	1.0	Note 1 & 3

Note 1:	For emissions falling in the restricted bands detailed in 15.205 the general limits of 15.209 apply. For all other emissions the limit is EIRP < -27dBm (equivalent to a field strength at 3m of 68dBuV/m)
Note 2:	Signal is in a restricted band
Note 3:	Restricted Band Peak Measurements: Resolution and Video BW: 1 MHz, Restricted Band Average Measurements: Resolution Bw: 1MHz and Video Bw: 10 Hz. All other measurements, RBW = 1MHz and VBW = 3MHz, video averaging on (100 samples).
Note 4:	Signal does not fall in a restricted band.
Note 5:	This measurement was made using a resolution bandwidth of 3 kHz The instrumentation noise floor was too high to allow measurements with RBW = 1MHz because a preamplifier could not be used (with the EUT operating the intentional signal would overload the amplifier and there is no low pass filter with sufficient shape factor to reject the intentionally trasmitted signal but pass the spuroius signal). The signal was a narrowband signal (as verified during the conducted antenna measurements) and so the amplitude (peak/average) in a 3kHz bandwidth would be the same as that in a 1MHz bandwidth (please refer to the plot below). The peak reading has been compared with the average limit.

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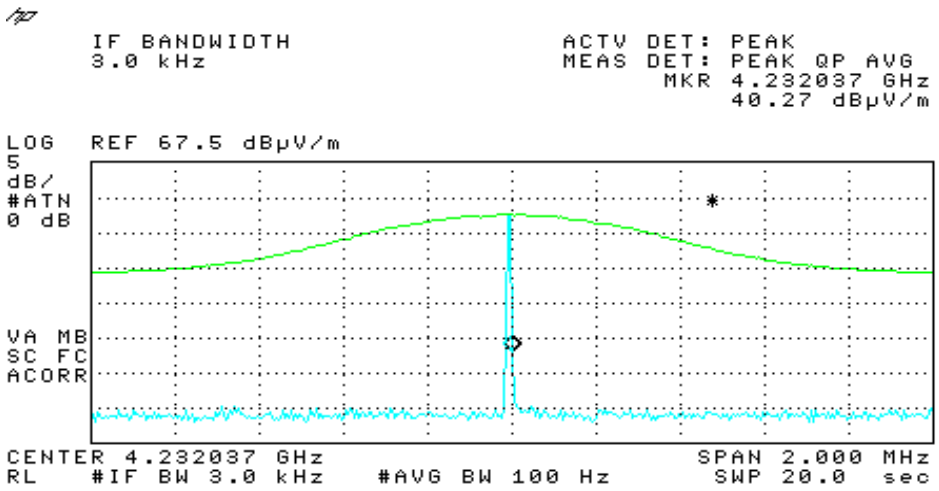

Plot showing LO signal at 4GHz measured using RBW = 1MHz and RBW = 3kHz. Amplitude of the signal does not change with resolution bandwidth.