

***Electromagnetic Emissions Test Report
and
Application for Grant of Equipment Authorization
pursuant to
FCC Part 15, Subpart C (15.247) DTS Specifications and
Industry Canada RSS 210 Issue 5 for an
Intentional Radiator on the
Alien Technology
Model: B2450R01-A***

FCC ID: P65B2450R01-A

GRANTEE: Alien Technology
18410 Butterfield Blvd, Ste 150
Morgan Hill, CA. 95037

TEST SITE: Elliott Laboratories, Inc.
684 W. Maude Avenue
Sunnyvale, CA 94086

REPORT DATE: May 20, 2003

FINAL TEST DATE: April 4 and April 8, 2003; May 20, 2003



AUTHORIZED SIGNATORY: _____

Mark Briggs
Director of Engineering



Elliott Laboratories, Inc. is accredited by the A2LA, certificate number 2016-01, to perform the test(s) listed in this report. This report shall not be reproduced, except in its entirety, without the written approval of Elliott Laboratories, Inc.

DECLARATIONS OF COMPLIANCE

Equipment Name and Model:

B2450R01-A

Manufacturer:

Alien Technology
18410 Butterfield Blvd, Ste 150
Morgan Hill, CA. 95037

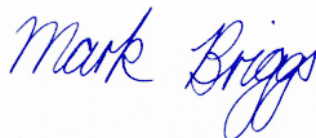
Tested to applicable standards:

RSS-210, Issue 5, November 2001 (Low Power License-Exempt Radiocommunication Devices)
FCC Part 15.247 (FHSS)

Measurement Facility Description Filed With Department of Industry:

Departmental Acknowledgement Number: IC2845 **SV1** Dated July 30, 2001
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 5); 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: April 24, 2003

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.).

TABLE OF CONTENTS

COVER PAGE.....	1
DECLARATIONS OF COMPLIANCE.....	2
TABLE OF CONTENTS	3
SCOPE.....	4
OBJECTIVE	4
SUMMARY OF RESULTS	5
MEASUREMENT UNCERTAINTIES.....	6
EQUIPMENT UNDER TEST (EUT) DETAILS.....	7
GENERAL.....	7
ENCLOSURE.....	7
MODIFICATIONS.....	7
SUPPORT EQUIPMENT.....	7
EUT INTERFACE PORTS	8
EUT OPERATION	8
ANTENNA REQUIREMENTS	8
TEST SITE.....	9
GENERAL INFORMATION.....	9
CONDUCTED EMISSIONS CONSIDERATIONS	9
RADIATED EMISSIONS CONSIDERATIONS	9
MEASUREMENT INSTRUMENTATION	10
RECEIVER SYSTEM	10
INSTRUMENT CONTROL COMPUTER	10
LINE IMPEDANCE STABILIZATION NETWORK (LISN)	10
POWER METER.....	11
FILTERS/ATTENUATORS	11
ANTENNAS.....	11
ANTENNA MAST AND EQUIPMENT TURNTABLE.....	11
INSTRUMENT CALIBRATION.....	11
TEST PROCEDURES	12
EUT AND CABLE PLACEMENT	12
CONDUCTED EMISSIONS.....	12
RADIATED EMISSIONS.....	12
CONDUCTED EMISSIONS FROM ANTENNA PORT	13
SPECIFICATION LIMITS AND SAMPLE CALCULATIONS.....	14
FCC 15.247 / RSS 210(O) OUTPUT POWER LIMITS	14
FCC 15.247 / RSS 210(O) SPURIOUS RADIATED EMISSIONS LIMITS	15
AC POWER PORT CONDUCTED EMISSIONS LIMITS.....	15
SAMPLE CALCULATIONS - CONDUCTED EMISSIONS	16
SAMPLE CALCULATIONS - RADIATED EMISSIONS	17
EXHIBIT 1: Test Equipment Calibration Data.....	1
EXHIBIT 2: Test Data Log Sheets	2

SCOPE

An electromagnetic emissions test has been performed on the Alien Technology model B2450R01-A pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators and RSS-210 Issue 5 for licence-exempt low power 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 Alien Technology model B2450R01-A and therefore apply only to the tested sample. The sample was selected and prepared by Robert Martin of Alien Technology

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules and RSS-210 Issue 5 for license-exempt low power devices 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	Measured Value	Comments	Result
15.247	6.2.2(o)(a)	20dB Bandwidth	470kHz	The channel spacing shall be greater than the 20dB bandwidth	Complies
15.247	6.2.2(o)(a)	Channel Separation	833kHz		Complies
15.247	6.2.2(o)(a)	Number of Channels	75	2400- 2483.5 MHz: 75 hopping frequencies: average time of occupancy <0.4 second within a 30 second period.	Complies
15.247	6.2.2(o)(a)	Channel Dwell Time	0.388 Seconds per 30 seconds		Complies
15.247	6.2.2(o)(a)	Channel Utilization	All channels are used equally	Refer to Theory of Operations for detailed description of the hopping algorithm	Complies
15.247 (b) (3)	6.2.2(o)(a)	Output Power, 2400 - 2483.5 MHz	29.97 dBm (0.99 Watts) EIRP = 4.0 W	2400 – 2483.5 MHz Maximum permitted is 1 Watt, with EIRP limited to 4 Watts for a 50-channel system.	Complies
15.247(c)	6.2.2(o)(e1)	Spurious Emissions – 30MHz – 25GHz	All spurious emissions < -20dBc	All spurious emissions < -20dBc.	Complies
15.247(c) / 15.209		Radiated Spurious Emissions 30MHz – 25GHz	46.8 dBuV/m @ 4900MHz (-7.21dB)	Emissions in restricted bands must meet the radiated emissions limits detailed in 15.207. All others must be < -20dBc	Complies
15.207		AC Conducted Emissions	37.1 dBuV@ 0.544MHz (-8.9dB)	Conducted emissions from the AC power port	Complies
	6.6	AC Conducted Emissions	37.6 dBuV @ 0.549 MHz (-10.4 dB)	Conducted emissions from the AC power port	Complies
15.247 (b) (5)		RF Exposure Requirements	FCC /IC limits of power density not exceeded provided antenna is located a minimum of 17.5cm from persons	Refer to MPE calculation for 17.5cm derivation. Refer to User's Guide for installation instructions requiring a 20cm separation	Complies
15.203		RF Connector	Unique antenna connector (Reverse sex TNC)	Integral antenna or specialized connector required	Complies

EIRP calculated using antenna gain of 6dBi (4) for the highest EIRP point-to-multipoint system.

The system was evaluated with two different antenna types.

MEASUREMENT UNCERTAINTIES

ISO Guide 17025 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	± 3.6

EQUIPMENT UNDER TEST (EUT) DETAILS**GENERAL**

The Alien Technology model B2450R01-A is a FHSS Transceiver, which is designed to interrogate tags for inventory tracking purposes. Normally, the EUT would be wall-mounted during normal operation. The EUT was treated as tabletop equipment during testing. The electrical rating of the EUT is 1200 V, 60 Hz, 1.5 Amps.

The EUT can use either a Brock antenna or an Alien Technology antenna, both of which have a gain of 6dBi.

The sample was received on April 4, 2003 and tested on April 4 and April 8, 2003. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Alien Technology	NanoScanner B2450R01-A	Battery Powered Tag Reader	2RB2003-00001	P65B2450R01-A
PhiHong	PSA-30V-120	AC-DC adapter	none	N/A
Alien Technology		6dBi Antenna		
Brock		6dBi antenna		

ENCLOSURE

The EUT enclosure is primarily constructed of fabricated aluminum. It measures approximately 17.8 cm wide by 24.1 cm deep by 6.7 cm high.

MODIFICATIONS

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

SUPPORT EQUIPMENT

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

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	PP01L	Laptop PC	9LQ8901	DoC
Hewlett Packard	2225C	Printer	3028S76892	DS16XU2225

No remote support equipment was used during testing.

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)
Serial	Laptop PC	Multiwire	Shielded	3
Ethernet	Laptop PC	UTP	Unshielded	3

Note: The serial port would not normally be connected during normal operation as it used for configuration purposes only. The device is not intended to be used as a PC peripheral but as a network peripheral.

EUT OPERATION

The ethernet interface was being exercised using ping software and the serial port was used to control the EUT via the PC. As there were no transmit-frequency-related emissions below 1GHz radiated emissions tests below 1GHz were performed with the radio transmitting on 2445 MHz. For radiated emissions above 1GH the device was set to transmit on the specified channel.

ANTENNA REQUIREMENTS

The antenna port is a non standard, reverse gender coaxial connector, which meets the requirements of 15.203.

TEST SITE**GENERAL INFORMATION**

Final test measurements were taken on April 4 and April 8, 2003 at the Elliott Laboratories Open Area Test Site #1 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 5 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

A power meter and peak power sensor are used for all direct output power measurements from transmitters as they provide a broadband indication of the power output.

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 terms 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.

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 15.247 / RSS 210(o) 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)	Number Of Channels	Output Power
902 – 928	≥ 50	1 W (30 dBm)
902 – 928	< 50	0.25 W (24 dBm)
2400 – 2483.5	≥ 75	1 W (30 dBm)
2400 – 2483.5	< 75	0.125 W (21 dBm)
5725 – 5850	≥ 75	1 W (30 dBm)

For system using antennas with gains exceeding 6dBi, the output limits are reduced by 1dB for every dB the antenna gain exceeds 6dBi.

Fixed point-to-point applications using the 5725 - 5850 MHz are not subject to a limitation in antenna gain.

FCC 15.247 / RSS 210(o) 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

Unwanted (spurious) emissions outside of the restricted bands are required to be 20dB below the highest in-band signal level..

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 and Industry Canada RSS-210 section 6.6.

Frequency Range (MHz)	Limit (uV)	Limit (dBuV)
0.450 to 30.000	250	48

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

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

* Broadband Level - Per ANSI C63.4, 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

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:

$$F_d = 20 * \text{LOG}_{10} (D_m/D_s)$$

where:

$$F_d = \text{Distance Factor in dB}$$

$$D_m = \text{Measurement Distance in meters}$$

$$D_s = \text{Specification Distance in meters}$$

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:

$$R_r = \text{Receiver Reading in dBuV/m}$$

$$F_d = \text{Distance Factor in dB}$$

$$R_c = \text{Corrected Reading in dBuV/m}$$

$$L_s = \text{Specification Limit in dBuV/m}$$

$$M = \text{Margin in dB Relative to Spec}$$

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Antenna conducted measurements, 30MHz- 25GHz, 04-Apr-03**Engineer: jmartinez**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Assett #</u>	<u>Cal interval</u>	<u>Last Calibrated</u>	<u>Cal Due</u>
Hewlett Packard	Microwave EMI test system (SA40, 9kHz - 40GHz)	84125C	1149	12	3/12/2003	3/12/2004

Conducted and Radiated Emissions, 05-Apr-03**Engineer: Rafael**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Assett #</u>	<u>Cal interval</u>	<u>Last Calibrated</u>	<u>Cal Due</u>
Elliott Laboratories	FCC / CISPR LISN	LISN-4, OATS	362	12	4/19/2002	4/19/2003
EMCO	Biconical Antenna, 30-300 MHz	3110B	1320	12	6/3/2002	6/3/2003
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1347	12	10/30/2002	10/30/2003
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	372	12	7/18/2002	7/18/2003
Rohde & Schwarz	Test Receiver, 0.009-30 MHz	ESH3	274	12	1/24/2003	1/24/2004
Rohde & Schwarz	Test Receiver, 20-1300MHz	ESVP	213	12	7/22/2002	7/22/2003
Solar Electronics	Support Equipment LISN, 0.150-30.0 MHz	8012-50-R-24-BNC	305	12	8/20/2002	8/20/2003

Radiated Emissions, 1 - 25 GHz, 08-Apr-03**Engineer: jmartinez**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Assett #</u>	<u>Cal interval</u>	<u>Last Calibrated</u>	<u>Cal Due</u>
Hewlett Packard	Microwave EMI test system (SA40, 9kHz - 40GHz)	84125C	1149	12	3/12/2003	3/12/2004

Conducted Emissions, 20-May-03**Engineer: Chris**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Assett #</u>	<u>Cal interval</u>	<u>Last Calibrated</u>	<u>Cal Due</u>
Elliott Laboratories	FCC / CISPR LISN	LISN-4, OATS	362	12	4/19/2002	5/30/2003
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	372	12	7/18/2002	7/18/2003
Rohde & Schwarz	Test Receiver, 0.009-30 MHz	ESH3	274	12	1/24/2003	1/24/2004

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T50752 31 Pages



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
	Account Manager: Robert Holt
Contact: Robert Martin	
Emissions Spec: FCC	Class: A
Immunity Spec: N/A	Environment: -

EMC Test Data

For The

Alien Technology

Model

B2450R01-A



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
	Account Manager: Robert Holt
Contact: Robert Martin	
Emissions Spec: FCC	Class: A
Immunity Spec: N/A	Environment: -

EUT INFORMATION

General Description

The EUT is a FHSS Transceiver, which is designed to interrogate tags for inventory tracking purposes. Normally, the EUT would be wall-mounted. The EUT was treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 1200 V, 60 Hz, 1.5 Amps.

The EUT can use either a Brock 6dBi antenna or an Alien Technology 6dBi antenna.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Alien Technology	NanoScanner B2450R01-A	Battery Powered Tag Reader	2RB2003-00001	P65B2450R01-A
PhiHong	PSA-30V-120	AC-DC adapter	none	N/A
Alien Technology		6dBi Antenna		
Brock		6dBi antenna		

Other EUT Details

This is a revision of an existing device.

EUT Enclosure

The EUT enclosure is primarily constructed of fabricated aluminum. It measures approximately 17.8 cm wide by 24.1 cm deep by 6.7 cm high.

Modification History

Mod. #	Test	Date	Modification
1	-	-	None made

Modifications applied are assumed to be used on subsequent tests unless otherwise stated as a further modification.



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
	Account Manager: Robert Holt
Contact: Robert Martin	
Emissions Spec: FCC	Class: A
Immunity Spec: N/A	Environment: -

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	PP01L	Laptop PC	9LQ8901	DoC
Hewlett Packard	2225C	Printer	3028S76892	DS16XU2225

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Serial	Laptop PC	Multiwire	Shielded	3
Ethernet	Laptop PC	UTP	Unshielded	3

Note: The serial port would not normally be connected during normal operation as it used for configuration purposes only. The device is not intended to be used as a PC peripheral but as a network peripheral.

EUT Operation During Emissions

The ethernet interface was being exercised using ping software and the serial port was used to control the EUT via the PC. As there were no transmit-frequency-related emissions below 1GHz radiated emissions tests below 1GHz were performed with the radio transmitting on 2445 MHz. For radiated emissions above 1GH the device was set to transmit on the specified channel.



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
	Account Manager: Robert Holt
Contact: Robert Martin	
Spec: FCC	Class: A

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: 5/20/2003
Test Engineer: Chris Byleckie
Test Location: SVOATS #3

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:	18 °C
Rel. Humidity:	68 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power, 120V/60Hz	EN55022 B	Pass	-8.9dB @ 0.544MHz

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.



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
	Account Manager: Robert Holt
Contact: Robert Martin	
Spec: FCC	Class: A

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

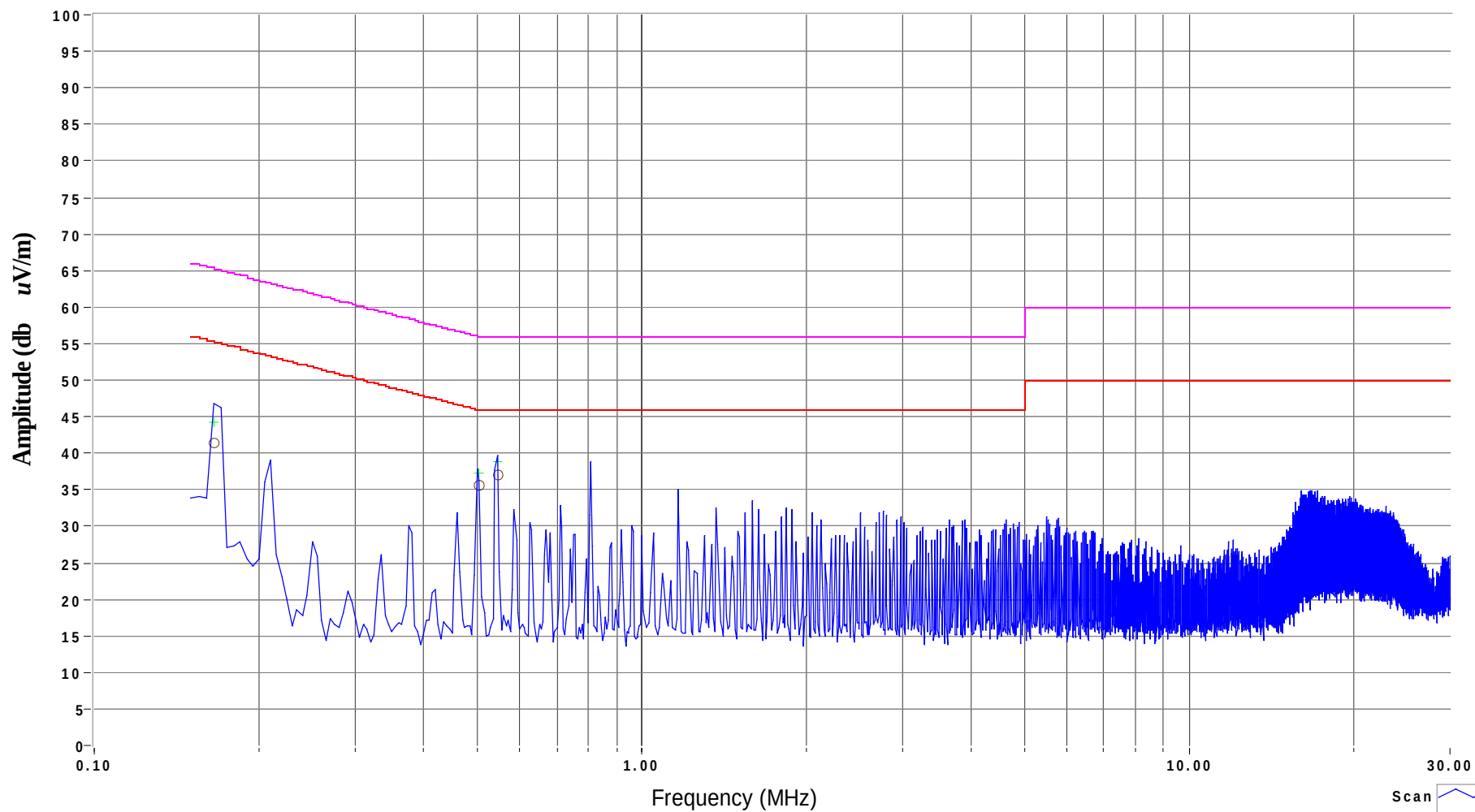
Frequency	Level	AC	EN55022 B		Detector	Comments
MHz	dB μ V	Line	Limit	Margin	QP/Ave	
0.544	37.1	Line 1	46.0	-8.9	AV	
0.500	36.3	Neutral	46.0	-9.7	AV	
0.544	35.9	Neutral	46.0	-10.1	AV	
0.503	35.6	Line 1	46.0	-10.4	AV	
0.169	44.0	Neutral	55.0	-11.0	AV	
0.165	41.5	Line 1	55.0	-13.5	AV	
0.544	38.9	Line 1	56.0	-17.1	QP	
0.500	38.2	Neutral	56.0	-17.8	QP	
0.544	37.7	Neutral	56.0	-18.3	QP	
0.503	37.3	Line 1	56.0	-18.7	QP	
0.169	45.4	Neutral	65.0	-19.6	QP	
0.165	44.2	Line 1	65.0	-20.8	QP	



SVOATS #3: Alien Technology B2450R01-A Run 1

Spec:
EN55022B
Mains Lead
Line 1

J50726 / T50752



120V / 60Hz

Scan
Peak
Quasi-peak
Average
Average Limit
QuasiPeak Limit

5/20/03

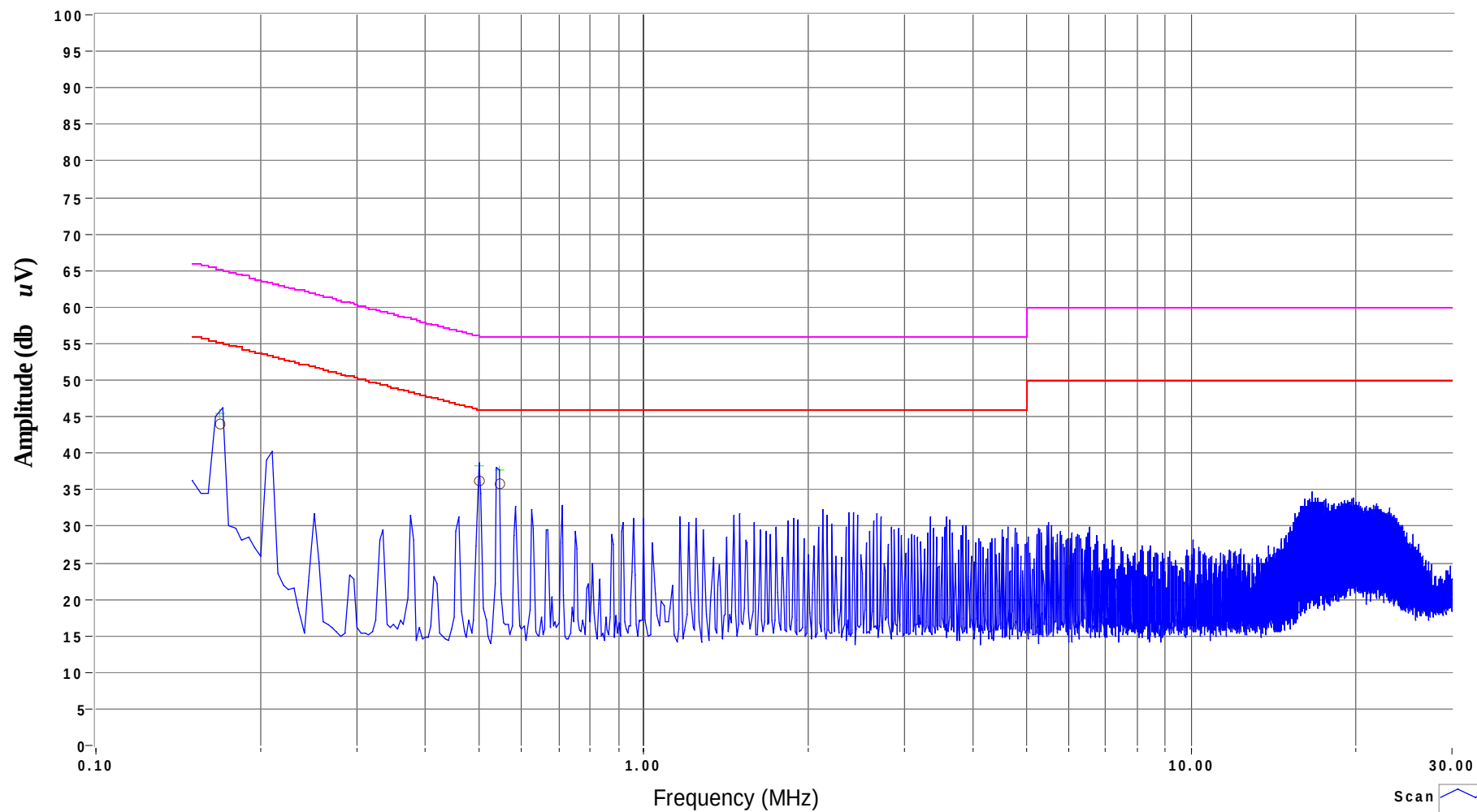
Chris Byleckie



SVOATS #3: Alien Technology B2450R01-A Run 1

Spec:
EN55022B
Mains Lead
Neutral

J50726 / T50752



120V / 60Hz

Scan
Peak
Quasi-peak
Average
Average Limit
QuasiPeak Limit

5/20/03

Chris Byleckie



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
	Account Manager: Robert Holt
Contact: Robert Martin	
Spec: FCC	Class: A

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: 4/4/2003

Test Engineer: Rafael

Test Location: SVOATS #3

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. A second LISN was used for all local support equipment.

Ambient Conditions:

Temperature: 9 °C

Rel. Humidity: 71 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power, 120V/60Hz	FCC B	Pass	-10.4dB @ 0.548MHz

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.



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
	Account Manager: Robert Holt
Contact: Robert Martin	
Spec: FCC	Class: A

Run #1: AC Power Port Conducted Emissions, 0.45 - 30MHz, 120V/60Hz

Frequency	Level	AC	FCC B		Detector	Comments
MHz	dB μ V	Line	Limit	Margin	QP/Ave	
0.549	37.6	Line 1	48.0	-10.4	QP	
0.548	37.5	Neutral	48.0	-10.5	QP	
0.591	35.3	Line 1	48.0	-12.7	QP	
0.591	35.3	Neutral	48.0	-12.7	QP	
19.655	33.6	Neutral	48.0	-14.4	QP	
8.014	33.3	Neutral	48.0	-14.7	QP	
8.016	32.9	Line 1	48.0	-15.1	QP	
19.450	32.8	Line 1	48.0	-15.2	QP	



SVOATS #3: Alien Technology B2450R01 Run 1

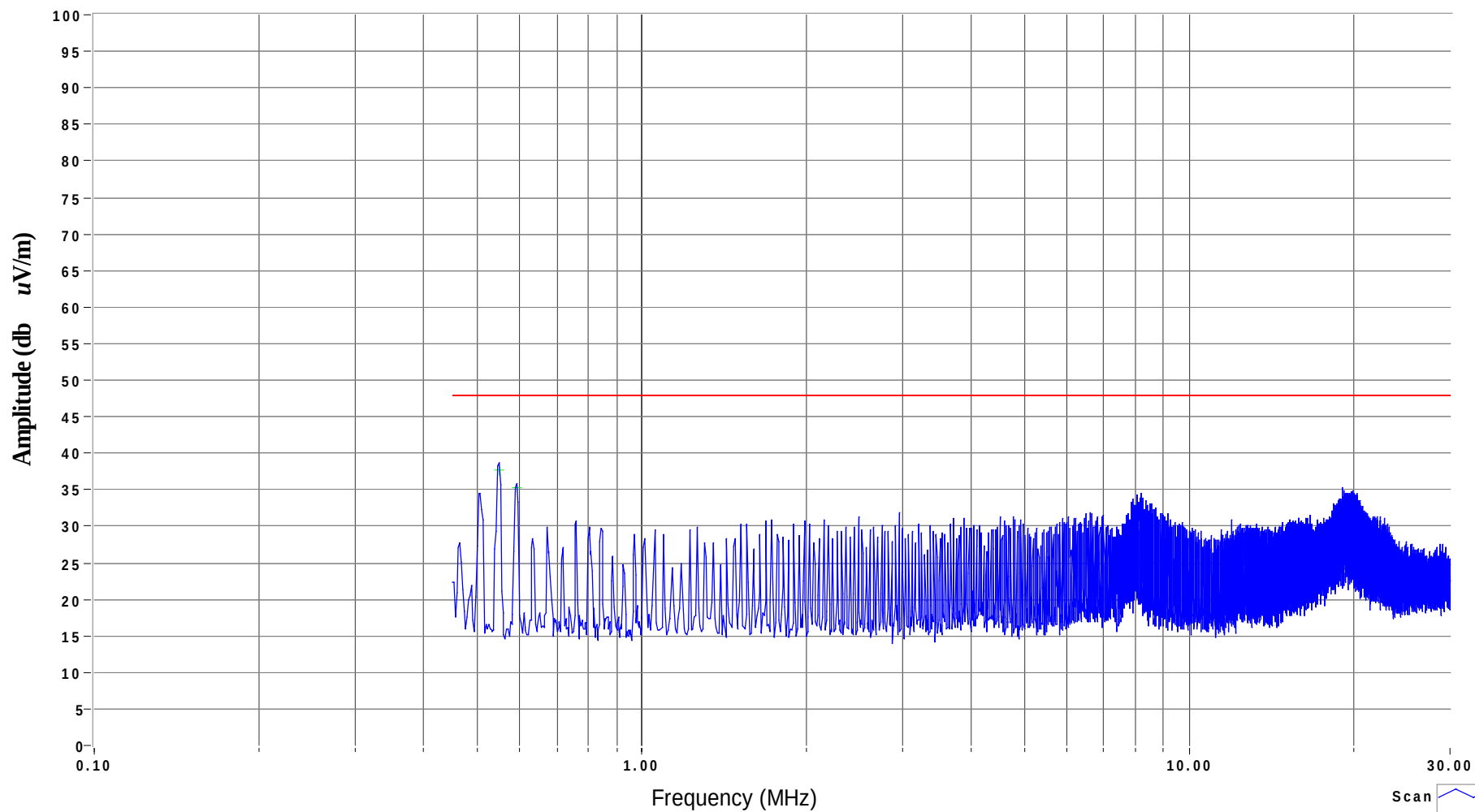
Spec:

FCC-B

Mains Lead

Line 1

T50752



120V/60Hz

Scan 
Peak 
Quasi-peak 
Average 
QuasiPeak Limit 
QuasiPeak Limit 

4/4/03

Rafael Varelas



SVOATS #3: Alien Technology B2450R01 Run 1

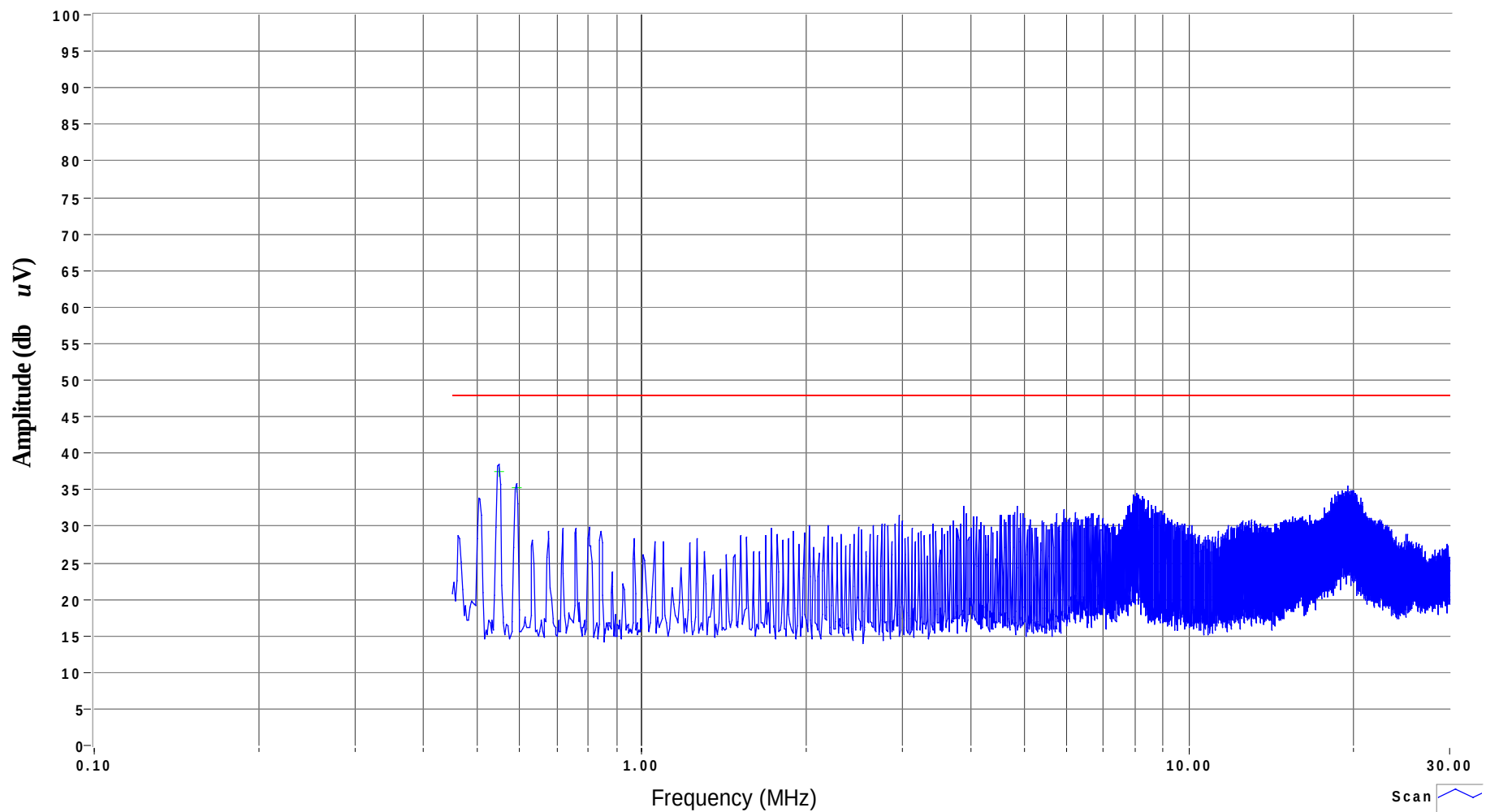
Spec:

FCC-B

Mains Lead

Neutral

T50752



120V/60Hz

Scan

Peak

Quasi-peak

Average

QuasiPeak Limit

QuasiPeak Limit

4/4/03

Rafael Varelas



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
	Account Manager: Robert Holt
Contact: Robert Martin	
Spec: FCC	Class: A

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: 4/4/2003

Test Engineer: Rafael

Test Location: SVOATS #3

Config. Used: 1

Config Change: None

EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.

On the OATS, the measurement antenna was located 10 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: 9 °C

Rel. Humidity: 71 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 -1000 MHz, Preliminary Scan	FCC A	Eval	Refer to individual runs
2	RE, 30 - 1000MHz, Maximized Emissions	FCC A	Pass	-4.1dB @ 300.010MHz

All significant emissions below 1GHz were from the digital circuitry. None of the emissions observed were related to the Tx/Rx circuitry.

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.



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
Contact: Robert Martin	Account Manager: Robert Holt
Spec: FCC	Class: A

Run #1: Preliminary Radiated Emissions, 30-1000 MHz

Frequency	Level	Pol	FCC A		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
300.010	42.3	v	46.4	-4.1	QP	175	1.0	EUT
300.010	41.4	h	46.4	-5.0	QP	100	2.3	EUT
166.440	36.7	v	43.5	-6.8	QP	310	1.1	
166.440	36.5	H	43.5	-7.0	QP	10	2.0	
199.960	36.1	v	43.5	-7.4	QP	0	1.0	Partial ambient
221.184	35.1	v	46.4	-11.3	QP	200	1.0	
294.914	34.9	H	46.4	-11.5	QP	80	1.1	
300.000	34.1	H	46.4	-12.3	QP	100	3.5	
213.812	29.7	v	43.5	-13.8	QP	350	1.0	
300.000	32.4	v	46.4	-14.0	QP	185	1.0	
331.776	31.4	v	46.4	-15.0	QP	20	1.0	
294.914	31.7	v	46.4	-14.7	QP	45	1.0	
199.960	27.7	H	43.5	-15.8	QP	300	1.8	Signal Substitution
331.776	29.3	h	46.4	-17.1	QP	80	2.4	
221.184	28.5	H	46.4	-17.9	QP	320	1.4	
213.812	25.4	H	43.5	-18.1	QP	360	1.4	
228.557	27.8	v	46.4	-18.6	QP	15	1.0	
228.557	25.8	H	46.4	-20.6	QP	295	1.5	
46.250	17.8	v	39.1	-21.3	QP	300	1.0	

Run #2: Maximized Readings From Run #1

Frequency	Level	Pol	FCC A		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
300.010	42.3	v	46.4	-4.1	QP	180	1.0	
300.010	41.4	h	46.4	-5.0	QP	100	2.3	
166.440	36.7	v	43.5	-6.8	QP	300	1.1	
166.440	36.5	h	43.5	-7.0	QP	20	2.0	
199.960	36.1	v	43.5	-7.4	QP	330	1.0	Partial ambient
221.184	35.1	v	46.4	-11.3	QP	210	1.0	



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
	Account Manager: Robert Holt
Contact: Robert Martin	
Spec: FCC	Class: N/A

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: 4/4/2003
Test Engineer: Mark Briggs
Test Location: Chamber #2

Config. Used: N/A
Config Change: N/A
EUT Voltage: 120V/60Hz

General Test Configuration

When measuring the conducted emissions from the EUT's antenna port, 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 used.

Unless stated otherwise the EUT was operating such that it constantly hopped on either the low, center or high channels.

Summary of Results

Run #	Test Performed	Limit	Result	Comments
1	20dB Bandwidth	15.247(a)	Pass	470kHz
2	Output Power	15.247(b)	Pass	29.97 dBm (0.99W)
3	Channel Occupancy	15.247(a)	Pass	0.387 seconds per 30 seconds
3	Channel Separation	15.247(a)	Pass	833 kHz
3	Number of Channels	15.247(a)	Pass	75
4	Out-of-Band Spurious	15.247(a)	Pass	All emisisions < -20dBc
4	Band Edge levels	15.247(a)	N/A	Refer to run

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.

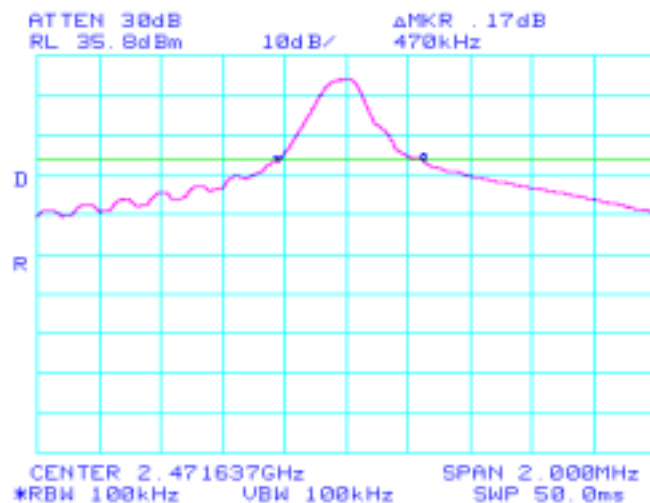
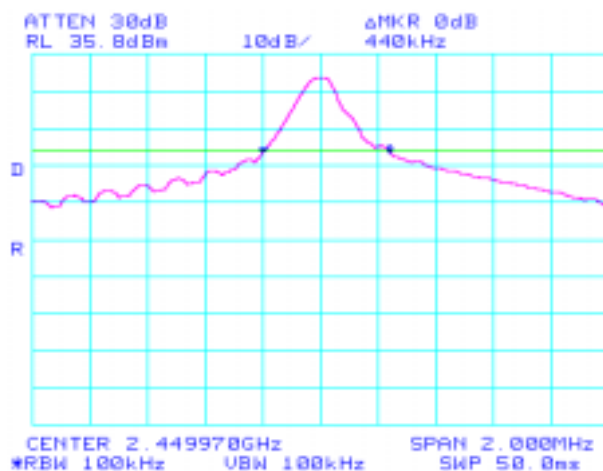
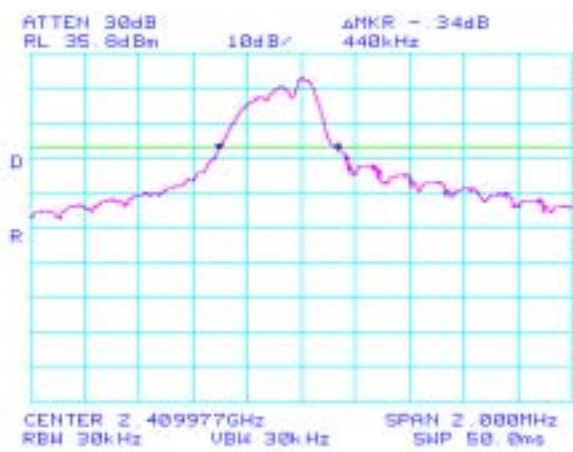


EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
Contact: Robert Martin	Account Manager: Robert Holt
Spec: FCC	Class: N/A

Run #1: Signal Bandwidth

Channel	Frequency (MHz)	Resolution Bandwidth (kHz)	20dB Signal Bandwidth
Low	2409.9	100	440kHz
Mid	2449.9	100	440kHz
High	2471.6	100	470kHz





EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
Contact: Robert Martin	Account Manager: Robert Holt
Spec: FCC	Class: N/A

Run #2: Output Power

Channel	Frequency MHz	Output Power		Notes
		dBm	Watts	
Low	2409.9	29.97	0.99	level = b9
Mid	2449.9	29.86	0.97	level = b9
High	2471.6	29.78	0.95	level = b9

Note 1: Measured using a peak power meter. Maximum antenna gain is 6dBi. Maximum permitted output power for a 75-channel; FHSS device is 1Watt.

Run #3: Channel Occupancy And Spacing

The channel occupancy was measured with the radio transmitting normally (i.e. In hopping mode)

The channel spacing was: 833 kHz

Channel spacing was wider than the 20dB bandwidth as per the requirements of FCC 15.247 / RSS 210

The transmit time on the channel was: 125 ms

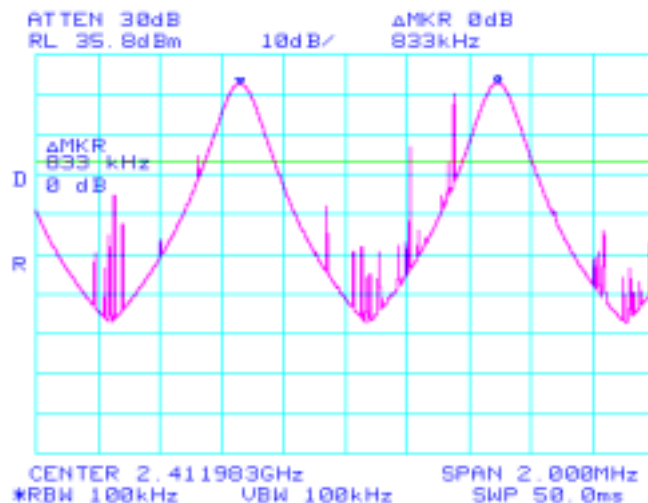
The time between hops on the same channel was: 9.675 seconds

The number of channels was: 75

Number of times per 30 seconds a channel is used: 3.1008

The transmit time per channel per 30 seconds is, therefore: 388 ms

The channel occupancy time meets the 0.4 seconds per 30 seconds (actual is 0.387 seconds transmitting per 30 seconds)

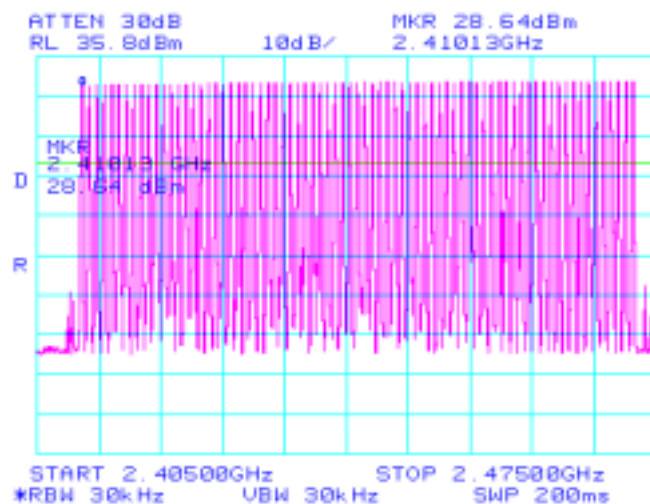


Plot showing 833kHz channel spacing

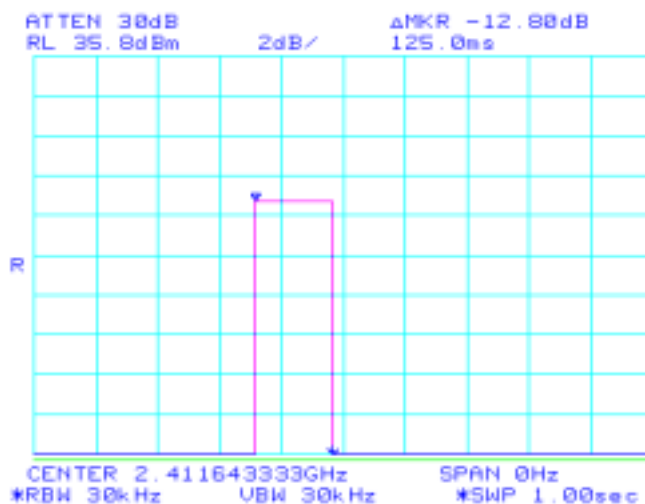


EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
Contact: Robert Martin	Account Manager: Robert Holt
Spec: FCC	Class: N/A



Plot showing all 75 channels

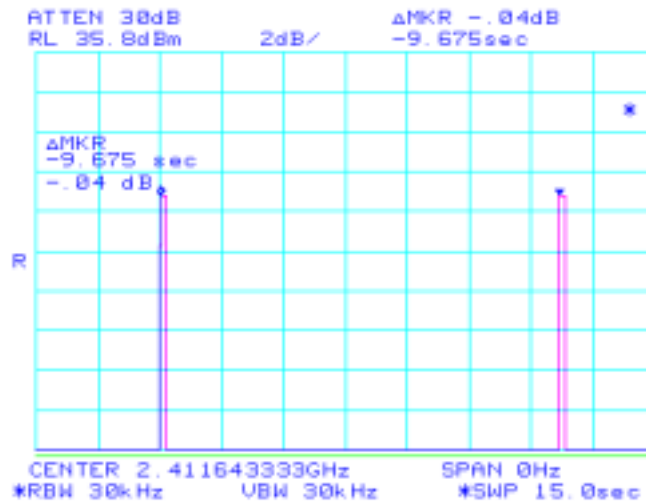


Plot showing transmit time on a channel (125ms)



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
	Account Manager: Robert Holt
Contact: Robert Martin	
Spec: FCC	Class: N/A



Plot showing time spacing between successive transmissions on the same channel (9.675 seconds)

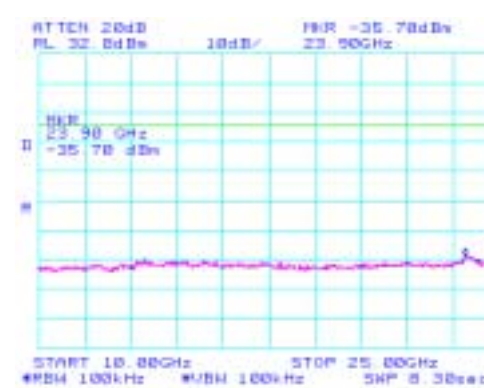
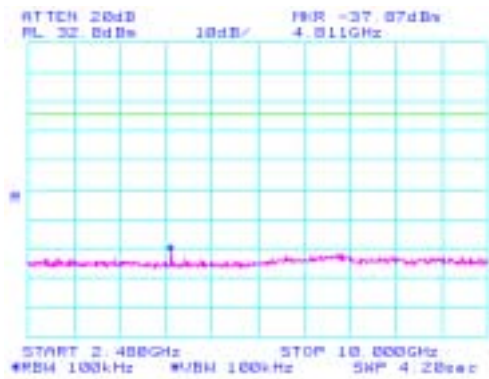
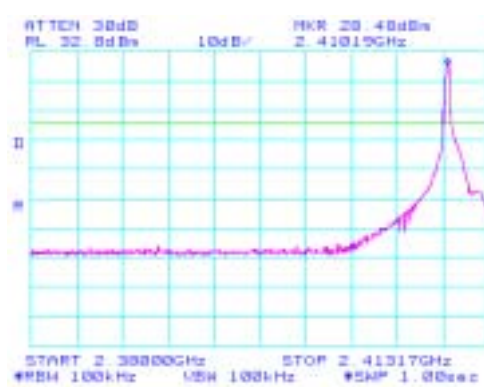
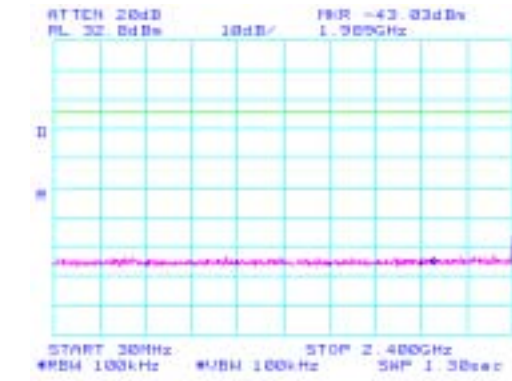


EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
Contact: Robert Martin	Account Manager: Robert Holt
Spec: FCC	Class: N/A

Run #4: Out of Band Spurious Emissions

Run #4a: Low Channel



Plot showing out of band spurious - low channel



EMC Test Data

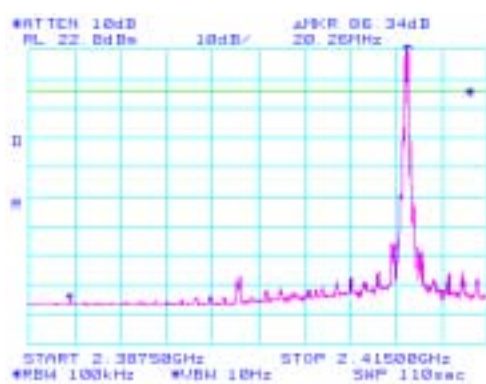
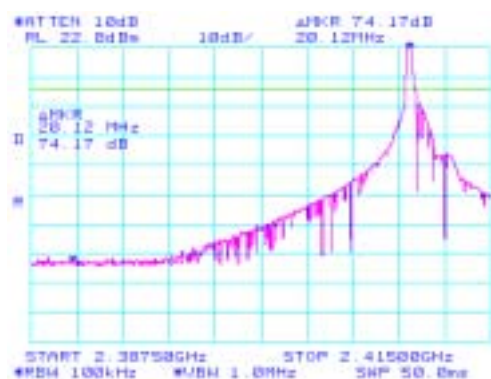
Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
Contact: Robert Martin	Account Manager: Robert Holt
Spec: FCC	Class: N/A

Band-Edge Measurements - Plots for use with radiated measurements of the fundamental

Level of fundamental: 28.8dBm (RBW=100kHz, VBW=1MHz); 28.5dBm (RBW=100kHz, VBW=10Hz)

Level at 2390MHz band edge: -52.2dBm (RBW=100kHz, VBW=1MHz); -63.5dBm (RBW=100kHz, VBW=10Hz)

Band edge level is **-81dBc (peak), -92dBc (average)**



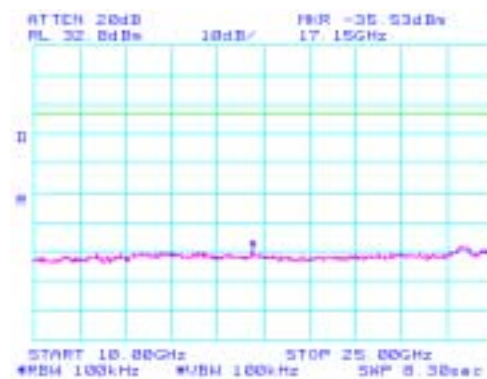
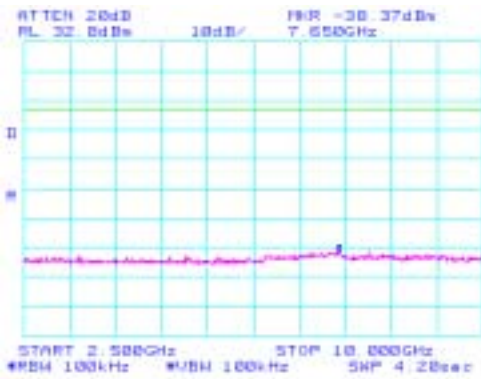
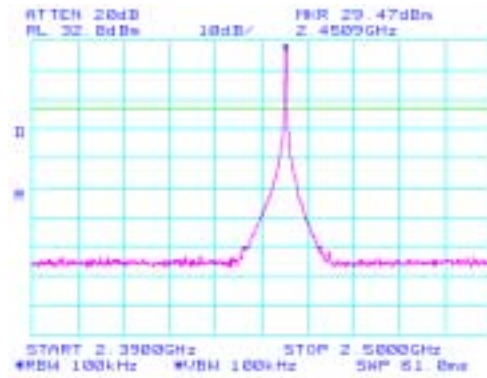
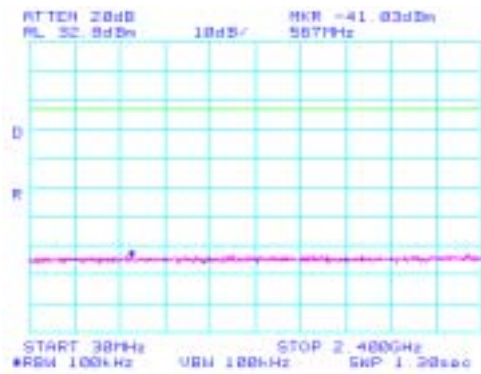
Plot of lower band edge relative to low channel signal - for reference only, the delta value in the plot does not allow for the peak of the transmit signal above the screen



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
Contact: Robert Martin	Account Manager: Robert Holt
Spec: FCC	Class: N/A

Run #4b: Middle Channel



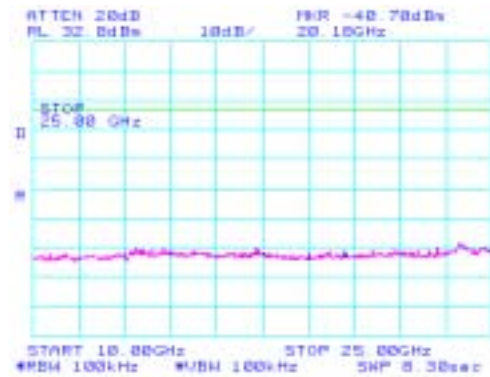
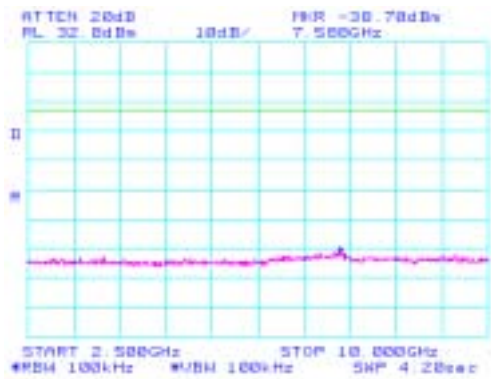
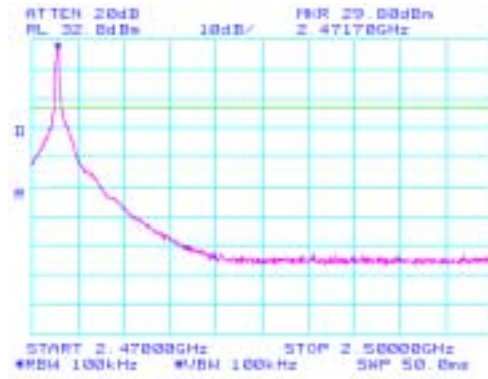
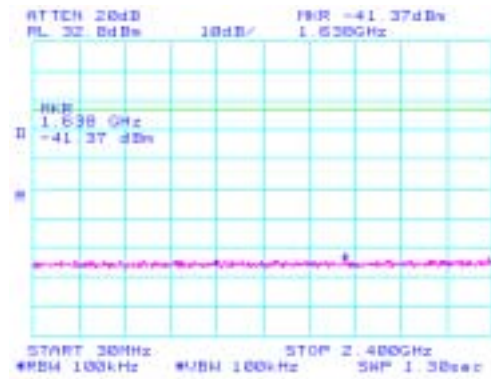
Plot showing out of band spurious - mid channel



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
Contact: Robert Martin	Account Manager: Robert Holt
Spec: FCC	Class: N/A

Run #4c: High Channel



Plot showing out of band spurious - high channel



EMC Test Data

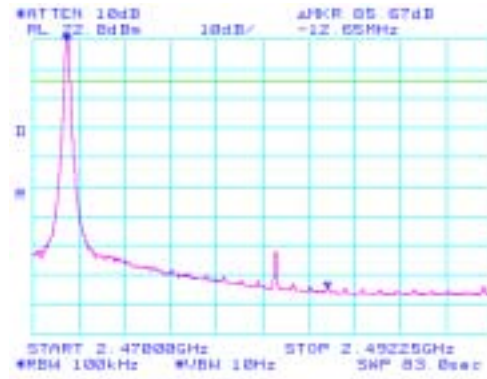
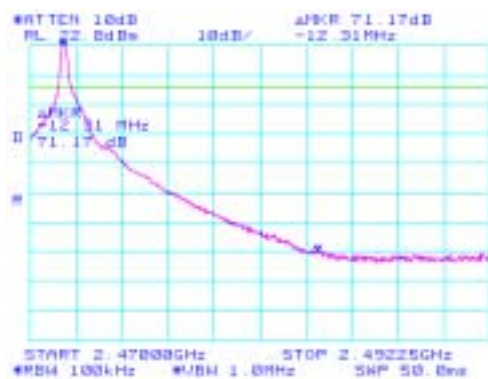
Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
Contact: Robert Martin	Account Manager: Robert Holt
Spec: FCC	Class: N/A

Band-Edge Measurements - Plots for use with radiated measurements of the fundamental

Level of fundamental: 29.6dBm (RBW=100kHz, VBW=1MHz); 28.3dBm (RBW=100kHz, VBW=10Hz)

Level at 2491.75MHz (highest signal in Restricted band): -47.4dBm (RBW=100kHz, VBW=1MHz); -61.2dBm (RBW=100kHz, VBW=10Hz)

Band edge level is **-77dBc (peak)**, **-89.5dBc (average)**



Plot of lower band edge relative to low channel signal - for reference only, the delta value in the plot does not allow for the peak of the transmit signal above the screen



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
	Account Manager: Robert Holt
Contact: Robert Martin	
Spec: FCC	Class: N/A

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: 4/8/2003
Test Engineer: Jmartinez
Test Location: SVOATS# 4

Config. Used: 1
Config Change: See run notes
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were 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 the EUT was operating such that it constantly hopped on either the low, center or high channels.

Ambient Conditions:

Temperature:	11 °C
Rel. Humidity:	80 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
-	RE, 30 - 1000 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	Refer to digital device emissions test
1	RE, 1000 - 25000 MHz - Spurious Emissions In Restricted Bands. Brock 6dBi	FCC Part 15.209 / 15.247(c)	Pass	-9.74dB @ 7230MHz

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.



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
Contact: Robert Martin	Account Manager: Robert Holt
Spec: FCC	Class: N/A

Run #1a: Radiated Spurious Emissions, 1000 - 25000 MHz. Low Channel @ 2410 MHz

					H	V		
Fundamental emission level @ 3m in 1MHz RBW:					130.5	133.2	Peak	
Fundamental emission level @ 3m in 1MHz RBW:					130.2	132.7	Average	
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7230.000	44.3	v	54.0	-9.7	Avg	261	1.0	
7230.000	42.8	h	54.0	-11.2	Avg	240	1.0	
12050.000	41.1	h	54.0	-12.9	Avg	280	1.0	
12050.000	40.9	v	54.0	-13.1	Avg	284	1.0	
2390.000	40.7	v	54.0	-13.3	Avg	360	1.1	Note 2
4820.000	38.0	v	54.0	-16.0	Avg	239	1.3	
4820.000	37.9	h	54.0	-16.1	Avg	242	1.0	
7230.000	53.5	v	74.0	-20.5	Pk	261	1.0	
12050.000	53.4	h	74.0	-20.6	Pk	280	1.0	
12050.000	53.3	v	74.0	-20.7	Pk	284	1.0	
7230.000	52.4	h	74.0	-21.6	Pk	240	1.0	
2390.000	52.2	v	74.0	-21.8	Pk	360	1.1	Note 2
4820.000	50.9	h	74.0	-23.1	Pk	242	1.0	
4820.000	50.1	v	74.0	-23.9	Pk	239	1.3	
9640.000	61.7	h	113.2	-51.5	Pk	286	1.0	Unrestricted Band
9640.000	57.7	v	113.2	-55.5	Pk	277	1.4	Unrestricted Band

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.

Note 2: Refer to plots and data taken during the antenna port conducted measurements for the measurement showing the relative level of the highest signals in the restricted bands immediately above and below the allocated band relative to the in-band signal. The peak level was -81dBc and the average level was -92dBc. These factors have been applied to the field strength measurement of the fundamental signal to calculate the field strength in the restricted band that stops as 2390MHz.



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
Contact: Robert Martin	Account Manager: Robert Holt
Spec: FCC	Class: N/A

Run #1b: Radiated Spurious Emissions, 1000 - 25000 MHz. Center Channel @ 2450 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	131	132
Limit for emissions outside of restricted bands:	112 dBμV/m	

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7350.000	43.1	v	54.0	-10.9	Avg	251	1.0	
7350.000	43.0	h	54.0	-11.1	Avg	245	1.0	
4900.000	41.8	v	54.0	-12.2	Avg	243	1.3	
4900.000	39.3	h	54.0	-14.7	Avg	267	1.0	
12250.000	38.9	v	54.0	-15.2	Avg	46	1.0	
12250.000	38.7	h	54.0	-15.3	Avg	99	1.2	
7350.000	52.6	h	74.0	-21.4	PK	245	1.0	
12250.000	51.8	h	74.0	-22.2	PK	99	1.2	
12250.000	51.6	v	74.0	-22.4	PK	46	1.0	
7350.000	51.5	v	74.0	-22.5	PK	251	1.0	
4900.000	50.8	v	74.0	-23.2	PK	243	1.3	
4900.000	50.3	h	74.0	-23.7	PK	267	1.0	
9800.000	57.8	h	112.0	-54.2	PK	163	1.0	Unrestricted
9800.000	56.1	v	112.0	-55.9	PK	311	1.9	Unrestricted



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
Contact: Robert Martin	Account Manager: Robert Holt
Spec: FCC	Class: N/A

Run #1c: Radiated Spurious Emissions, 1000 -25000 MHz. High Channel @ 2471.6 MHz

					H	V		
Fundamental emission level @ 3m in 1MHz RBW:					131.7	131.7	Peak	
Fundamental emission level @ 3m in 1MHz RBW:					131.4	130.9	Average	
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7414.880	44.2	h	54.0	-9.8	Avg	251	1.0	
7414.880	43.2	v	54.0	-10.8	Avg	255	1.1	
2483.500	41.9	h	54.0	-12.1	Avg	-	-	Note 2
12350.800	39.2	h	54.0	-14.8	Avg	230	1.0	
4943.280	39.1	h	54.0	-15.0	Avg	243	1.0	
12350.800	38.3	v	54.0	-15.7	Avg	232	1.2	
4943.280	37.0	v	54.0	-17.0	Avg	253	1.2	
2483.500	54.7	h	74.0	-19.3	Pk	-	-	Note 2
7414.880	52.4	h	74.0	-21.6	Pk	251	1.0	
7414.880	52.1	v	74.0	-21.9	Pk	255	1.1	
12350.800	51.0	h	74.0	-23.0	Pk	230	1.0	
4943.280	50.4	h	74.0	-23.6	Pk	243	1.0	
12350.800	50.4	v	74.0	-23.6	Pk	232	1.2	
4943.280	47.9	v	74.0	-26.1	Pk	253	1.2	
9866.480	58.4	h	111.7	-53.4	Pk	264	1.0	Unrestricted Band
9866.480	57.3	v	111.7	-54.4	Pk	240	1.0	Unrestricted Band

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental signal level.

Note 2: Refer to plots and data taken during the antenna port conducted measurements for the measurement showing the relative level of the highest signals in the restricted bands immediately above and below the allocated band relative to the in-band signal. The peak level was -77.1dBc and the average level was -89.5dBc. These factors have been applied to the field strength measurement of the fundamental signal to calculate the field strength in the restricted band that starts at 2483.5MHz.



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
	Account Manager: Robert Holt
Contact: Robert Martin	
Spec: FCC	Class: N/A

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: 4/8/2003
Test Engineer: Jmartinez
Test Location: SVOATS# 4

Config. Used: 1
Config Change: See run notes
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were 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 the EUT was operating such that it constantly hopped on either the low, center or high channels.

Ambient Conditions:

Temperature:	11 °C
Rel. Humidity:	80 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
-	RE, 30 - 1000 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	Refer to digital device emissions test
1	RE, 1000 - 25000 MHz - Spurious Emissions In Restricted Bands	FCC Part 15.209 / 15.247(c)	Pass	-7.21dB @ 4900MHz

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.



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
Contact: Robert Martin	Account Manager: Robert Holt
Spec: FCC	Class: N/A

Run #1a: Radiated Spurious Emissions, 1000 - 25000 MHz. Low Channel @ 2410 MHz

	H	V	
Fundamental emission level @ 3m in 1MHz RBW:	132.8	133.3	Peak
Fundamental emission level @ 3m in 1MHz RBW:	131.8	131.8	Average

Frequency	Level	Pol	15.209 / 15.247	Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters
7230.000	42.7	h	54.0	-11.3	Avg	327	1.4
4820.000	41.3	v	54.0	-12.7	Avg	232	1.0
7230.000	40.4	v	54.0	-13.6	Avg	279	1.0
2390.000	39.8		54.0	-14.2	Avg	360	1.1 Note 2
4820.000	39.7	h	54.0	-14.3	Avg	301	1.1
2390.000	52.3		74.0	-21.7	Pk	360	1.1 Note 2
7230.000	50.8	h	74.0	-23.2	Pk	327	1.4
7230.000	50.4	v	74.0	-23.6	Pk	279	1.0
4820.000	49.2	h	74.0	-24.8	Pk	301	1.1
4820.000	49.2	v	74.0	-24.8	Pk	232	1.0
9640.000	62.5	h	113.3	-50.8	Pk	289	1.0 Unrestricted Band
9640.000	58.2	v	113.3	-55.1	Pk	288	1.0 Unrestricted Band

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.

Note 2: Refer to plots and data taken during the antenna port conducted measurements for the measurement showing the relative level of the highest signals in the restricted bands immediately above and below the allocated band relative to the in-band signal. The peak level was -81dBc and the average level was -92dBc. These factors have been applied to the field strength measurement of the fundamental signal to calculate the field strength in the restricted band that stops as 2390MHz.



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
Contact: Robert Martin	Account Manager: Robert Holt
Spec: FCC	Class: N/A

Run #1b: Radiated Spurious Emissions, 1000 - 25000 MHz. Center Channel @ 2450 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	132	133
Limit for emissions outside of restricted bands:	113 dBμV/m	

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4900.000	46.8	h	54.0	-7.2	Avg	196	1.2	
17150.000	45.5	h	54.0	-8.5	Avg	284	1.2	
7350.000	42.0	v	54.0	-12.0	Avg	212	1.0	
12250.000	41.1	h	54.0	-12.9	Avg	211	1.0	
4900.000	40.8	v	54.0	-13.2	Avg	180	1.0	
7350.000	40.3	h	54.0	-13.7	Avg	243	1.2	
12250.000	38.8	v	54.0	-15.2	Avg	291	1.0	
17150.000	57.8	h	74.0	-16.3	PK	284	1.2	
4900.000	52.7	h	74.0	-21.3	PK	196	1.2	
12250.000	51.8	v	74.0	-22.2	PK	291	1.0	
12250.000	50.9	h	74.0	-23.1	PK	211	1.0	
7350.000	50.6	v	74.0	-23.4	PK	212	1.0	
7350.000	50.3	h	74.0	-23.7	PK	243	1.2	
4900.000	48.9	v	74.0	-25.1	PK	180	1.0	
9800.000	61.3	h	113.0	-51.7	PK	257	1.0	Unrestricted Band
9800.000	59.6	h	113.0	-53.4	PK	302	1.0	Unrestricted Band

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.
---------	--



EMC Test Data

Client: Alien Technology	Job Number: J50726
Model: B2450R01-A	T-Log Number: T50752
Contact: Robert Martin	Account Manager: Robert Holt
Spec: FCC	Class: N/A

Run #1c: Radiated Spurious Emissions, 1000 -25000 MHz. High Channel @ 2471.6 MHz

					H	V		
Fundamental emission level @ 3m in 1MHz RBW:					132.5	133.5	Peak	
Fundamental emission level @ 3m in 1MHz RBW:					132.1	133.2	Average	
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4943.280	44.3	h	54.0	-9.7	Avg	145	1.3	
2483.500	43.7		54.0	-10.3	Avg			Note 2
12358.000	42.5	h	54.0	-11.5	Avg	245	1.2	
7414.880	42.1	v	54.0	-11.9	Avg	179	1.0	
12358.000	42.1	v	54.0	-11.9	Avg	265	1.0	
7414.880	39.4	h	54.0	-14.6	Avg	162	1.4	
4943.280	38.6	v	54.0	-15.4	Avg	223	1.4	
12358.000	58.2	h	74.0	-15.8	Pk	245	1.2	
12358.000	57.5	v	74.0	-16.5	Pk	265	1.0	
2483.500	56.5		74.0	-17.5	Pk			Note 2
7414.880	51.3	v	74.0	-22.7	Pk	179	1.0	
7414.880	50.8	h	74.0	-23.3	Pk	162	1.4	
4943.280	50.4	h	74.0	-23.6	Pk	145	1.3	
4943.280	48.6	v	74.0	-25.4	Pk	223	1.4	
9866.480	68.5	h	113.0	-44.5	Pk	256	1.0	Unrestricted Band
9866.480	62.0	v	113.0	-51.0	PK	256	1.0	Unrestricted Band

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.

Note 2: Refer to plots and data taken during the antenna port conducted measurements for the measurement showing the relative level of the highest signals in the restricted bands immediately above and below the allocated band relative to the in-band signal. The peak level was -77.1dBc and the average level was -89.5dBc. These factors have been applied to the field strength measurement of the fundamental signal to calculate the field strength in the restricted band that starts at 2483.5MHz.