Elliott Laboratories Inc.
www.elliottlabs.com
684 West Maude Avenue
Sunnyvale, CA 94085-3518
408-245-7800 Phone
408-245-3499 Fax

Electromagnetic Emissions Test Report In Accordance With Industry Canada Radio Standards Specification 119 Issue 6, FCC Part 90 on the Alien Technology Transmitter Model: ALR 9890-RR

FCC ID NUMBER:	P65ALR9890RR
GRANTEE:	Alien Technology 18220 Butterfield Blvd. Morgan Hill, CA 95037
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	September 12, 2006
FINAL TEST DATE:	August 1, August 15, August 28 and August 30, 2006
AUTHORIZED SIGNATORY:	Juan Martinez Senior EMC Engineer

ACCREDITED
2016-01

REVISION HISTORY

Revision #	Date	Comments	Modified By
1	September 21, 2006	Initial Release	David Guidotti

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FCC CERTIFICATION INFORMATION

The following information is in accordance with FCC Rules, 47CFR Part 2, Subpart J, Section 2.1033(C) & to Industry Canada RSP-100.

2.1033(c)(1) Applicant:

Alien Technology
18220 Butterfield Blvd.
Morgan Hill, CA 95037

2.1033(c)(2) & RSP-100 (4) FCC ID: P65ALR9890RR

2.1033(c)(3) & RSP-100 (7.2(a)) Instructions/Installation Manual

Please refer to Exhibit 7: User Manual, Theory of Operation, and Tune-up Procedure

2.1033(c)(4) & RSP-100 (7.2(b)(iii)) Type of emissions

FCC 90 & RSS-119**: 75K0F1D**

2.1033(c)(5) & RSP-100 (7.2(a)) Frequency Range

FCC 90 & RSS-119**: 910.75 – 920.75 MHz**

2.1033(c)(6) & RSP-100 (7.2(a)) Range of Operation Power

FCC 90 & RSS-119**: 33 dBm (2 Watts)**

2.1033(c)(7) & RSP-100 (7.2(a)) Maximum FCC & IC Allowed Power Level

FCC 90.205 (k) & RSS-119**: 30** Watts

2.1033(c)(8) & RSP-100 (7.2(a)) Applied voltage and currents into the final transistor elements

5Vdc, 500 mA

2.1033(c)(9) & RSP-100 (7.2(a)) Tune-up Procedure

Please refer to Exhibit 7: User Manual, Theory of Operation, and Tune-up Procedure

2.1033(c)(10) & RSP 100 (7.2(a)) Schematic Diagram of the Transmitter

Refer to Exhibit 6: Schematic diagram

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Frequency Stabilization

Not Applicable per Section 90.213 note 13.

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Suppression of Spurious radiation

Please refer to Exhibit 6: Schematic diagram

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Limiting Modulation

U112 AD8340 Microprocessor

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Limiting Power

U112 AD8340 Microprocessor

2.1033(c)(11) & RSP-100 (7.2(g)) Photographs or Drawing of the Equipment Identification Plate or Label

Refer to Exhibit 4

2.1033(c)(12) & RSP-100 (7.2(c)) Photographs of equipment

Refer to Exhibit 5

2.1033(c)(13) & RSP-100 (7.2(a)) Equipment Employing Digital Modulation & 90.203 (Certification Requirements)

Not applicable

2.1033(c)(14) & RSP-100 (7.2(b)(ii)) Data taken per Section 2.1046 to 2.1057 and RSS-133 issue 2, Rev. 1.

Refer to Exhibit 2

DECLARATIONS OF COMPLIANCE

Equipment Name and Model:
ALR 9890-RR

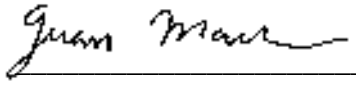
Manufacturer:
Alien Technology
18220 Butterfield Blvd.
Morgan Hill, CA 95037

Tested to applicable standards:
RSS-119, Issue 6 (Land Mobile and Fixed Radio Transmitters and Receivers, 27.41 to 960 MHz).
FCC Part 90 (Private Land Mobile Radio Service)

Measurement Facility Description Filed With Department of Industry:

Departmental Acknowledgement Number: IC2845 SV2 Dated August 16, 2007

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 TIA/EIA-603 and the specific RSS standards applicable to this device); and that the equipment performed in accordance with the data submitted in this report.

Signature	
Name	Juan Martinez
Title	Senior EMC Engineer
	Elliott Laboratories Inc.
Address	684 W. Maude Ave
	Sunnyvale, CA 94086
	USA
Date:	September 12, 2006

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.).

SCOPE

FCC Part 90 & IC RSS-119 testing was performed for the equipment mentioned in this report. The equipment was tested in accordance with the procedures specified in Sections 2.1046 to 2.1057 of the FCC Rules & IC RSS-119. TIA-603 was also used as a test procedure guideline to perform some of the required tests.

The intentional radiator above was tested in a simulated typical installation to demonstrate compliance with the relevant FCC & RSS 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.

OBJECTIVE

The primary objective of the manufacturer is compliance with the FCC Part 90 & IC RSS-119. Certification of these devices is required as a prerequisite to marketing as defined in Section 2.1033 & RSP-100.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to FCC & Industry Canada. FCC & Industry Canada issues a grant of equipment authorization and a certification number 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 subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product that 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.).

SUMMARY OF TEST RESULTS

Part 90 and RSS-119 Test Summary

Measurement Required	FCC Part 2 & 90 Sections	RSS-119 Section	Test Performed	Measured Value	Test Procedure Used	Result
Modulation Tested	OOK	OOK	-	-	-	-
Modulation characteristics	2.1047/	5.7	Modulated with appropriated signal	-	H	-
Radiated RF power output (ERP/EIRP)	2.1046 / 90.205(k)	6.2	Radiated Output Power Test	-	-	-
Conducted RF power output	2.1046 / 90.205(k)	6.2	Conducted Output Power Test	33dBm (2 Watts)	B	Complies
Spurious emissions at antenna Port	2.1051/ 90.210(k)(3)	-	Emission Limits and/or Unwanted Emission 30MHz – 5GHz (**Antenna Conducted**)	All spurious emissions < -25dBm	J	Complies
Occupied Bandwidth	2.1049/ 90.210(k)(3)	-	Emission Mask and 99% Bandwidth	Refer to Plots	C & D	Complies
Field strength of spurious radiation	2.1053 / 90.210(k)(3)	-	Radiated Spurious Emissions 30MHz – 5GHz	-26.6 dBm @ 2745.29 MHz (-1.6 dB)	N	Complies
Frequency stability	2.1055 / 90.213	7	Frequency Vs. Temperature	Not Applicable	K	-
Frequency stability	2.1055 / 90.213	7	Frequency Vs. Voltage	Not Applicable	L & M	-
Transient Frequency Behavior	90.214	6.5	Transient Behavior	Refer to Plots	I	Complies
Exposure to Mobile devices	2.1091	9	Exposure of Humans to RF Fields	Provided MPE calculation	-	
Receiver	15.109	8	Receiver Spurious Emissions	45.2dBµV/m @ 6445.2MHz (-4.3dB)	N/A	Complies

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 were calculated using the approach described in CISPR 16-4-2:2003 using a coverage factor of k=2, which gives a level of confidence of approximately 95%. The levels were found to be below levels of *U*cispr and therefore no adjustment of the data for measurement uncertainty is required.

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 ALR 9890-RR is a RFID (Radio Frequency Identification) Tag reader which is designed to read RFID tags. Normally, the EUT would be placed on a tabletop during operation. The EUT was, therefore, treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 120/, 60 Hz, .5 Amps.

The sample was received on August 1, 2006 and tested on August 1, August 15, August 28 and August 30, 2006. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Alien Technology	ALR 9890-RR	RFID	prototype	
XPiQ	HUP45-30	Power Adapter	100-45-01	

EUT ANTENNA DETAILS

The EUT antennas are linear polarized patch antennas.
The antennas are not integral to the EUT
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ENCLOSURE

The EUT enclosure is primarily constructed of aluminum fabricated sheet metal. It measures approximately 20 cm wide by 28 cm deep by 5 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 emissions testing:

Manufacturer	Model	Description	Serial Number
Dell	PP01L	Laptop	74FCDA02
Dell	AA20031	AC Adpater	9364U

No remote support equipment was used during emissions testing.

EUT INTERFACE PORTS

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

Port	Connected to	Description	Shielded or Unshielded	Length (m)
Ant 1	50Ohm	-	-	
Ant 2	50Ohm	-	-	
Ant 3	50Ohm	-	-	
Ethernet	Laptop	CAT 5	Unshielded	3
DC in	AC/DC power supply	3 wire	Unshielded	1.5

EUT OPERATION DURING TESTING

The EUT was set to maximum output power and tested at low, middle, and high channels.

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TEST SITE

GENERAL INFORMATION

Final test measurements were taken on August 1, August 15, August 28 and August 30, 2006 at the Elliott Laboratories Open Area Test Site #2 located at 684 West Maude Avenue, Sunnyvale, California. Pursuant to Section 2.948 of the FCC Rules, construction, calibration, and equipment data has been filed with the Commission.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing are performed in conformance with Section 2 of FCC Rules. Measurements are made with the EUT connected to a spectrum analyzer through an attenuator to prevent overloading the analyzer.

RADIATED EMISSIONS CONSIDERATIONS

Radiated measurements are performed in an open field environment or Anechoic Chamber. The test site is maintained free of conductive objects within the CISPR 16-1 defined elliptical area.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers are capable of measuring 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 particular 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. If average measurements above 1000MHz are performed, the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz is used.

INSTRUMENT CONTROL COMPUTER

A personal computer is utilized to record the receiver measurements of the field strength at the antenna, which is then compared directly with the appropriate specification limit. The receiver is programmed with appropriate factors to convert the received voltage into filed strength at the antenna. Results are printed in a graphic and/or tabular format, as appropriate.

The test receiver also provides a visual display of the signal being measured.

PEAK POWER METER

A peak power meter and thermister mount may be used for 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 EUT and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transmitters and 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 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.

The requirements of ANSI C63.4:2003 were used for configuration of the equipment turntable. It 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 appendix of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

General: For Transmitters with detachable antenna, direct measurements for output power, modulation characterization, occupied bandwidth, and frequency stability are performed with the antenna port of the EUT connected to either the power meter, modulation analyzer, or spectrum analyzer via a suitable attenuator and/or filter. The attenuators and/or filters are used to ensure that the transmitter fundamental will not overload the front end of the measurement instrument.

Procedure B – Power Measurement (Conducted Method): The following procedure was used for transmitters that do use external antennas.

1) Set the EUT to maximum power and to the lowest channel.
2) Either a power meter or a spectrum analyzer was used to measure the power output.
3) If a spectrum analyzer was used a resolution and video bandwidth 10kHz was used to measure the power output. Corrected for any external attenuation used for the protection of the input of analyzer. In addition, For CDMA or TDMA modulations set spectrum analyzer resolution to 1MHz and video to 30 kHz. Use video averaging with a 100-sample rate.
4) If a power meter was used, corrected for any external attenuation used for the protection of the input of the sensor head. Also set the power sensor correction by setting up the frequency range that will be measured.
5) Repeat this for the high channel and all modulations that will be used and all output ports used for transmission

Procedure C - Occupied Bandwidth (Conducted Method): Either for analog, digital, or data modulations, occupied bandwidth was performed. The EUT was set to transmit the appropriate modulation at maximum power. The bandwidth was measured using following methods:

1) The built-in 99% function of the spectrum analyzer was used.
2) If the built-in 99% is not available then the following method is used:

   26-dB or 20-dB was subtracted to the maximum peak of the emission. Then the display line function was used, in conjunction with the marker delta function, to measure the emissions bandwidth.

3) For the above two methods a resolution and video bandwidth of 100 or 300 Hz was used to measure the emission's bandwidth.

Procedure D - Occupied Bandwidth (Conducted Emission Mask): Either for analog, digital, or data modulations, emission mask was performed. The EUT was set to transmit the appropriate modulation at maximum power. The following method was used:

1) The EUT was connected directly to the spectrum analyzer and used an attenuator to protect the input of the analyzer. The EUT antenna was removable, so conducted measurements was performed. The EUT was set to transmit continuous packets of data and the Fundamental Frequency set to the middle of the EUT frequency range.

2) Section 90.210 (k)(3) was used to show compliance to the emission mask.

The following Resolution and Video bandwidth was used to show compliance for the above requirement: 100 kHz.

Procedure H - Other Types of Equipment: Either digital or data modulated signals were simulated, by software or external sources, to performed the required tests. The EUT was set to transmit the appropriate digital modulation.

Procedure J – Antenna Conducted Emissions: For spurious emission measurements at the antenna terminal the following procedure was performed:

1) Set the transmitting signal at the middle of the operating range of the transmitter, as specified in the standard. Power is set to maximum and then to minimum.
2) Set the spectrum analyzer display line function to –25-dBm.
3) Set the spectrum analyzer bandwidth to 10kHz <1GHz and 1 MHz >1GHz.
4) For the spectrum analyzer, the start frequency was set to 30 MHz and the stop frequency set to the 10^{th} harmonic of the fundamental. All spurious or intermodulation emission must not exceed the –25dBm limit.
5) Steps 1 to 4 were repeated for all modulations and output ports that will be used for transmission.

Procedure K - Frequency Stability: The EUT is placed inside a temperature chamber with all support and test equipment located outside of the chamber. The spectrum analyzer is configured to give a 6-digit display for the marker-frequency function. The spectrum analyzer's built-in frequency counter is used to measure the maximum deviation of the fundamental frequency at each temperature. The Temperature chamber was varied from –30 to +50° C (or +60° C for some IC RSS standards, if applicable) in 10 degrees increment. The EUT was allowed enough time to stabilize for each temperature variation.

Procedure L - Frequency Stability: For AC or DC operated devices the nominal voltage is varied to 85% and to 115% at either room temperature or at a controlled +20°C temperature.

Procedure M - Frequency Stability: For battery-powered devices the voltage battery end-point is determined by reducing the dc voltage until the unit ceases to function. This is performed at either room temperature or at a controlled +20°C temperature.

Procedure N - Field Strength Measurement: The EUT was set on the turntable and the search antenna position 3 meters away. The output antenna terminal was terminated with a 50-ohm terminator. The EUT was set at the middle of the frequency band and set at maximum output power.

For the first scan, a pre-liminary measurement is performed. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. One or more of these is with the antenna polarized vertically while the one or more of these are 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.

For the final measurement, Substitution method is performed on spurious emissions not being 20-dB below the calculated radiated limit. Substitution method is performed by replacing the EUT with a horn antenna and signal generator. The horn antenna factors can be reference to a half-wave dipole in dBi. The signal generator power level was adjusted until a similar level, which was measured on the first scan, is achieved on the spectrum analyzer. The level on the signal generator is than added to the antenna factor, in dBi, which will give the corrected value.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

RADIATED EMISSIONS SPECIFICATION LIMITS

The limits for radiated emissions are based on the power of the transmitter at the operating frequency. Data is measured in the logarithmic form of decibels relative to one milliwatt (dBm) or one microvolt/meter (dBuV/m,). The field strength of the emissions from the EUT is measured on a test site with a receiver.

Below is a formula example used to calculate the attenuation requirement, relative to the transmitters power output, in dBuV/m. For this example an operating power range of 3 watts is used. The radiated emissions limit for spurious signals outside of the assigned frequency block is $43+10\text{Log}_{10}$(mean output power in watts) dB below the measured amplitude at the operating power.

CALCULATIONS – EFFECTIVE RADIATED POWER

$$E(V/m) = \frac{\sqrt{30 * P * G}}{d}$$

E= Field Strength in V/m
P= Power in Watts (for this example we use 3 watts)
G= Gain of antenna in numeric gain (Assume 1.64 for ERP)
d= distance in meters

$$E(V/m) = \frac{\sqrt{30 * 3 \text{ watts} * 1.64 \text{ dB}}}{3 \text{ meters}}$$

20 * log (4.049 V/m * 1,000,000) = 132.14 dBuV/m @ 3 meters

FCC Rules request an attenuation of 43 + 10 log (3) or 47.8 dB for all emissions outside the assigned block, the limit for spurious and harmonic emissions is:

132.1 dBuV/m – 47.8 dB = 84.3 dBuV/m @ 3 meter.

Note: Substitution Method is performed for spurious emission not being 20-dB below the calculated field strength.

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Radio (Power and Spurious Emissions), 15-Aug-06
Engineer: David Bare

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	13-Jan-07
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	19-May-07
Hewlett Packard	Signal Generator (sweep) 0.01 - 26.5 GHz	8340A	1244	N/A
EMCO	Antenna, Horn, 1-18 GHz (SA40)	3115	1386	11-Jul-07
Rohde & Schwarz	Power Meter, Single Channel	NRVS	1534	21-Apr-07
EMCO	Antenna, Horn, 1-18 GHz (SA40 9kHz)	3115	1779	07-Feb-07
Rohde & Schwarz	Power Sensor, 1 nW-20 mW, 10 MHz-18 GHz, 50ohms	NRV-Z1	1798	17-Apr-07
Filtek	Filter, 1 GHz High Pass	HP12/1000-5BA	1343	16-Jan-07

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T64714 17 Pages

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Emissions Spec:	FCC Part 90	Class:	A
Immunity Spec:	-	Environment:	-

EMC Test Data

For The

Alien Technology

Model

ALR 9890-RR

Date of Last Test: 8/30/2006

Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Emissions Spec:	FCC Part 90	Class:	A
Immunity Spec:	-	Environment:	-

EUT INFORMATION

General Description

The EUT is a RFID (Radio Frequency Identification) Tag reader which is designed to read RFID tags. Normally, the EUT would be placed on a tabletop during operation. The EUT was, therefore, treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 120/, 60 Hz, .5 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Alien Technology	ALR 9890-RR	RFID	prototype	P65ALR9890RR
XPiQ	HUP45-30	Power Adapter	100-45-01	-

EUT Antenna

The EUT antennas are linear polarized patch antennas.
The antennas are not integral to the EUT
The antennas connect to the EUT with non standard reverse polarity TNC connectors, thereby meeting the requirements of FCC 15.203.

EUT Enclosure

The EUT enclosure is primarily constructed of aluminum fabricated sheet metal. It measures approximately 20 cm wide by 28 cm deep by 5 cm high.

Modification History

Mod. #	Test	Date	Modification
none	-	-	-

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

Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Emissions Spec:	FCC Part 90	Class:	A
Immunity Spec:	-	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	PP01L	Laptop	74FCDA02	n/a
Dell	AA20031	AC Adpater	9364U	n/a

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)
Ant 1	50Ohm	-	-	
Ant 2	50Ohm	-	-	
Ant 3	50Ohm	-	-	
Ethernet	Laptop	CAT 5	Unshielded	3
DC in	AC/DC power supply	3 wire	Unshielded	1.5

EUT Radio Operation During Emissions Tests

The EUT was set to maximum output power and tested at low, middle, and high channels.

EUT Digital Operation During Emissions Tests

EUT was set to receive mode during Radiated Emissions and AC conducted emissions.

Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Spec:	FCC Part 90	Class:	N/A

Antenna Conducted 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: 8/15/2006
Test Engineer: David Bare
Test Location: SVOATS #2

Config. Used: 1
Config Change: None
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 for the external attenuators used.

Ambient Conditions:

Temperature: 20 °C
Rel. Humidity: 62 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	99% Bandwidth	FCC Part 90.210	Pass	Refer to Plots
2	Output Power	FCC Part 90.210	Pass	33.0 dBm
3	Out of Band; 30 - 10,000MHz	FCC Part 90.210	Pass	-31.0dBm (0.8mW) @ 2975.0MHz (-6.0dB)
4	Bandedge	FCC Part 90.210	Pass	Refer to plots

Modifications Made During Testing:

No modifications were made to the EUT during testing

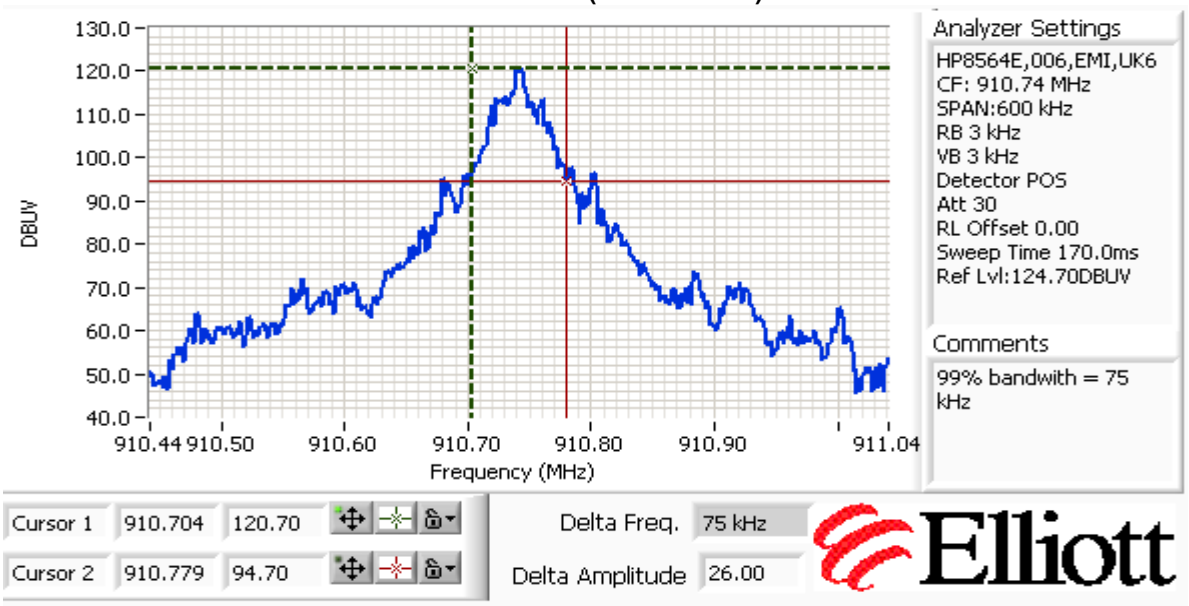
Deviations From The Standard

No deviations were made from the requirements of the standard.

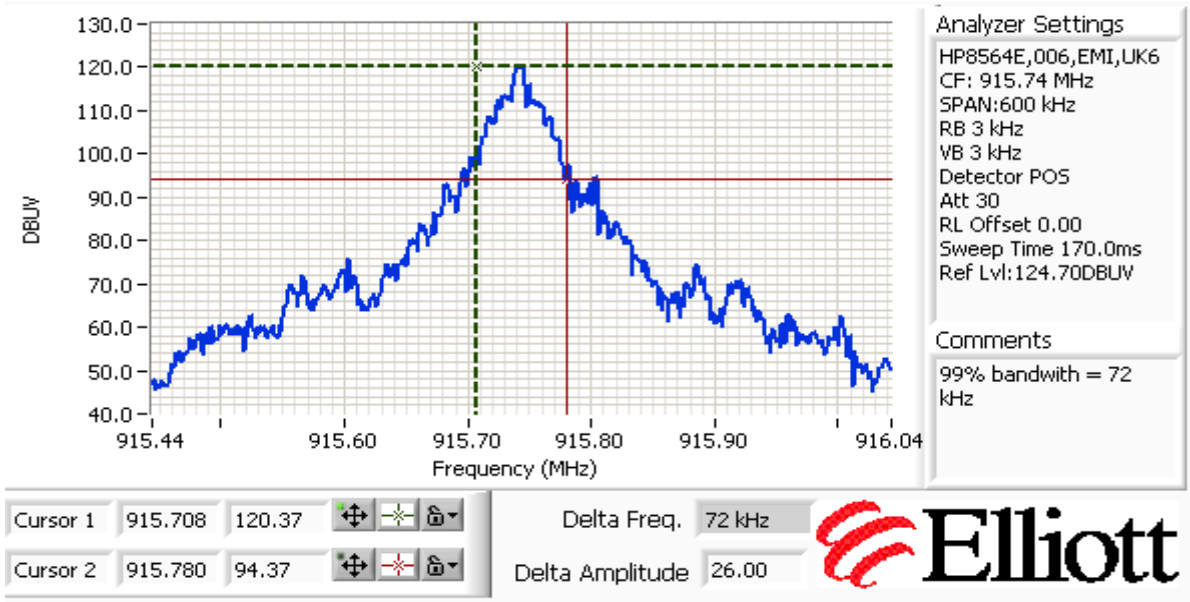
Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Spec:	FCC Part 90	Class:	N/A

Run #1: 99% bandwidth

Low Channel Plot (910.75 MHz)

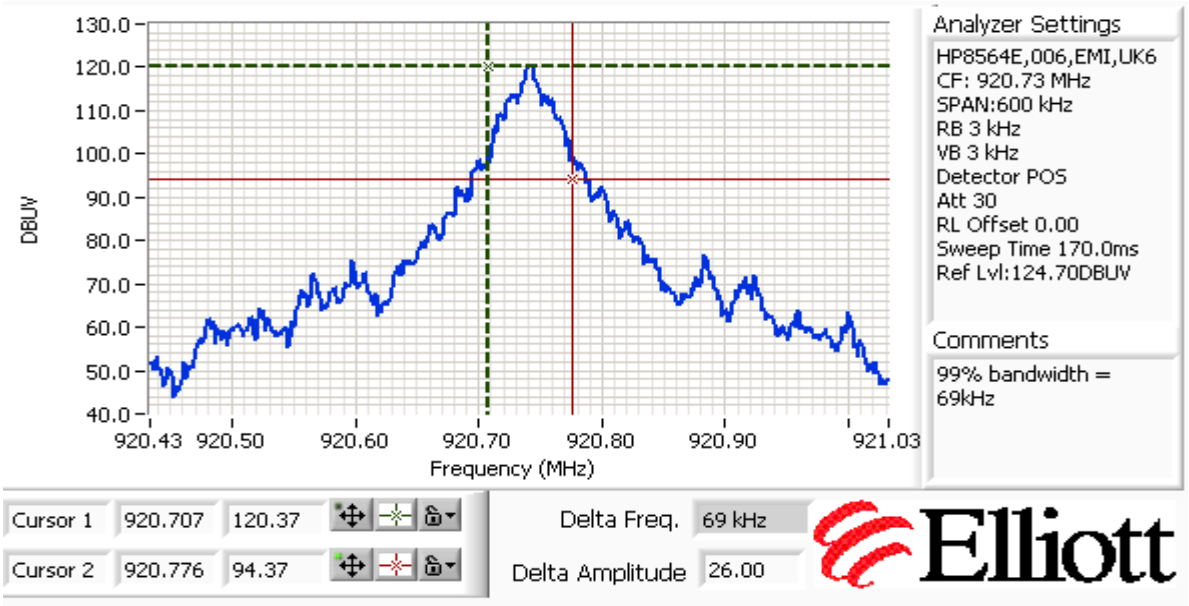


Center Channel Plot (915.75 MHz)



Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Spec:	FCC Part 90	Class:	N/A

High Channel Plot (920.75 MHz)

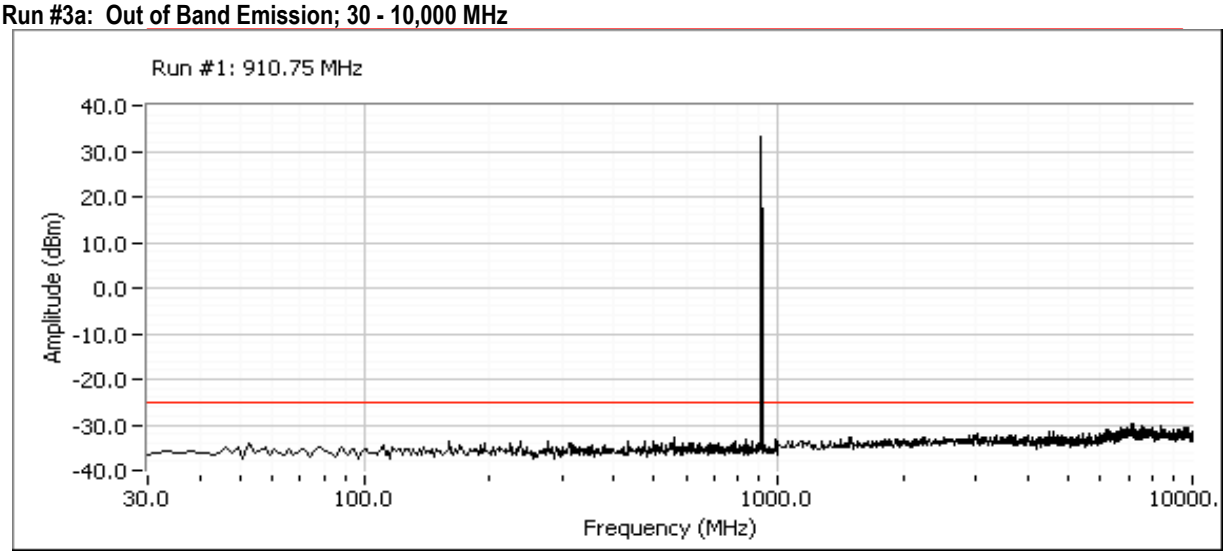


Run #2: Output Power measured with w/ Power meter

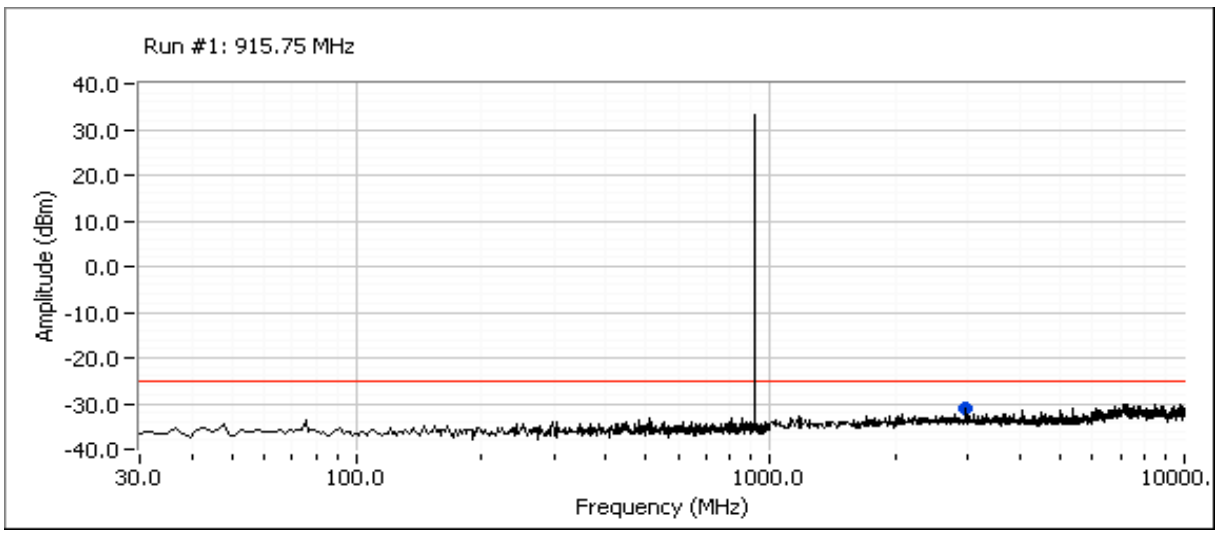
Channel	Frequency (MHz)	Output Power
Low	910.75	33.0
Center	915.75	33.0
High	920.75	32.9

Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Spec:	FCC Part 90	Class:	N/A

Run #3a: Out of Band Emission; 30 - 10,000 MHz



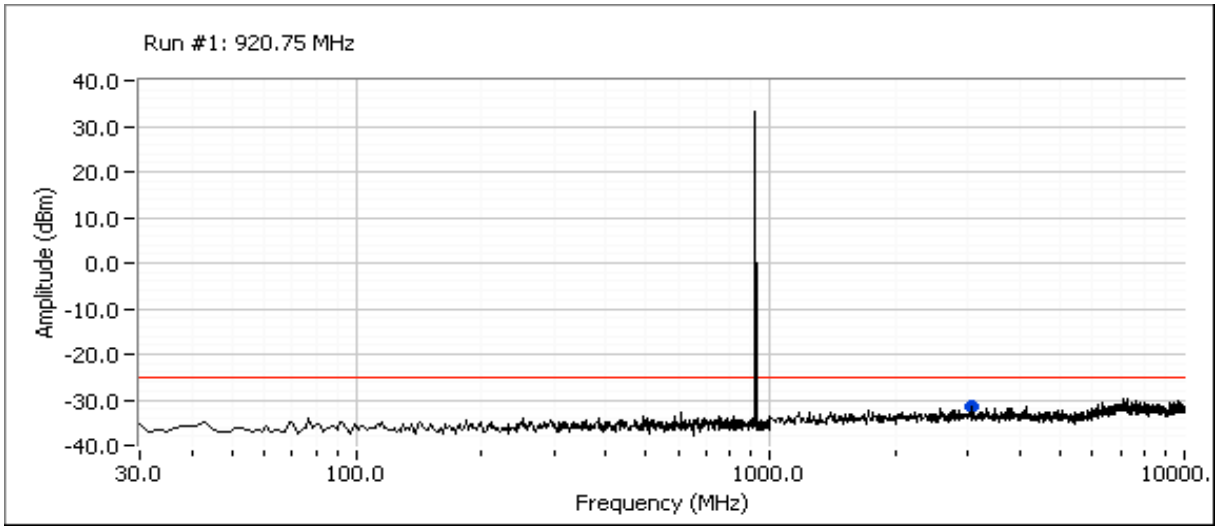
Frequency	Level	Port	Part 90		Detector	Comments
MHz	dBm		Limit	Margin	Pk/QP/Avg	
1821.636	-32.3	RF Port	-25.0	-7.3	Peak	
2732.505	-31.2	RF Port	-25.0	-6.2	Peak	



Frequency	Level	Port	Part 90		Detector	Comments
MHz	dBm		Limit	Margin	Pk/QP/Avg	
2975.042	-31.0	RF Port	-25.0	-6.0	Peak	

Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Spec:	FCC Part 90	Class:	N/A

Run #3b: Out of Band Emission; 30 - 10,000 MHz

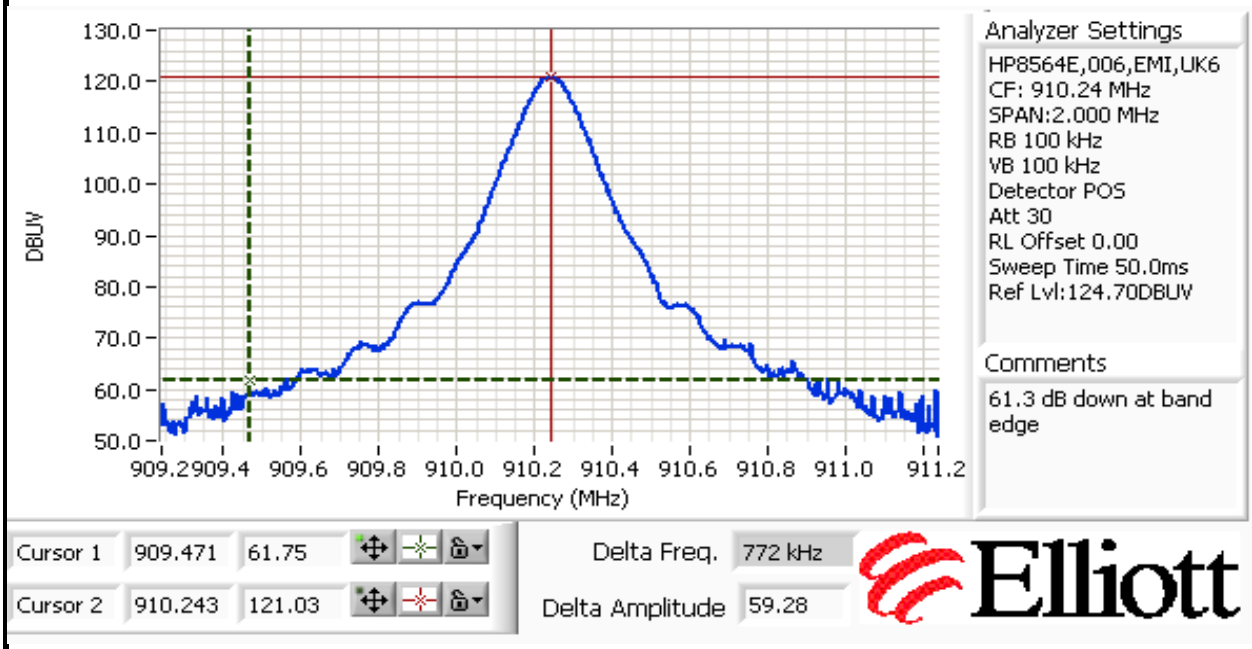


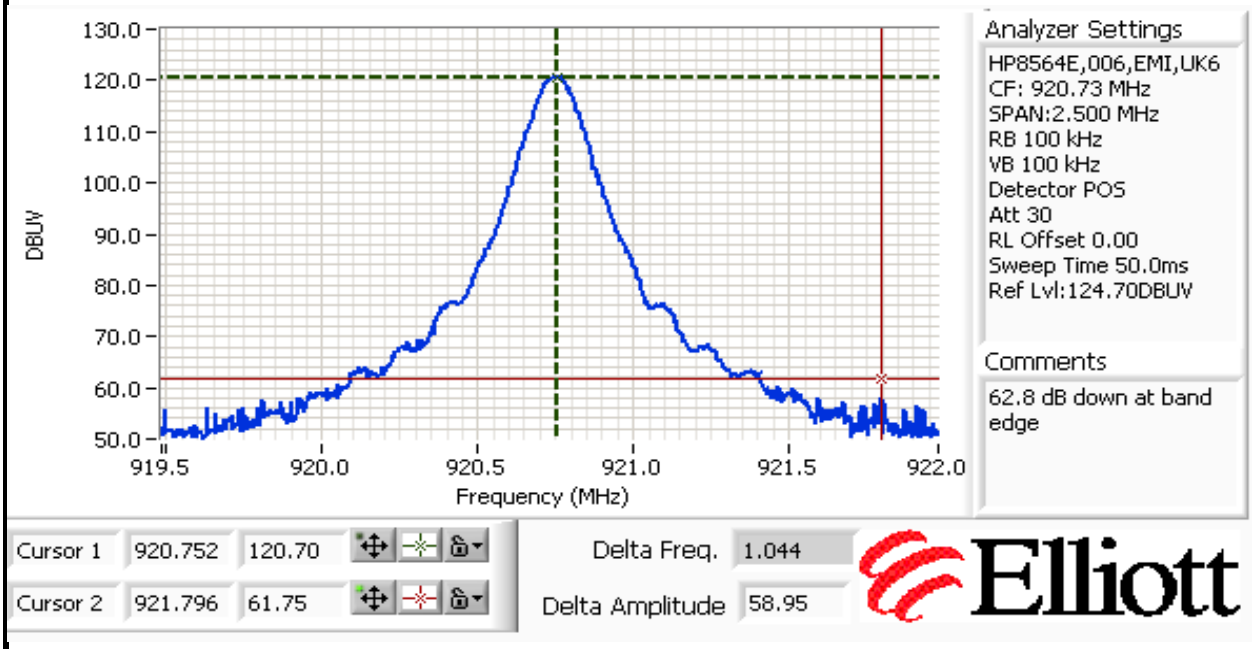
Frequency	Level	Port	Part 90		Detector	Comments
MHz	dBm		Limit	Margin	Pk/QP/Avg	
3075.042	-31.6	RF Port	-25.0	-6.6	Peak	

EMC Test Data

Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Spec:	FCC Part 90	Class:	N/A

Run #4: Bandedge





Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Spec:	FCC Part 90	Class:	N/A

FCC Part 90 - Spurious 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: 8/15/2006
Test Engineer: David Bare
Test Location: SVOATS #2

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 spurious emissions testing.

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

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.

Ambient Conditions:

Temperature: 18 °C
Rel. Humidity: 72 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1 - 3	RE, 30 - 10,000 MHz Maximized spurious emissions	FCC Part 90.210	Pass	-26.6dBm (2.2mW) @ 2745.29MHz (-1.6dB)

Modifications Made During Testing:

Extraneous wiring removed from PCB, Copper tape removed from corners of inner chassis.

Deviations From The Standard

No deviations were made from the requirements of the standard.

EUT with power setting of 33dBm.

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Spec:	FCC Part 90	Class:	N/A

Run #1: Radiated Spurious Emissions, 30 - 10,000 MHz. Mid Channel @ 915.25 MHz

Frequency	Level	Pol	Part 90.210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
1831.508	63.9	V	70.2	-6.3	PK	325	1.3	
2747.286	71.2	V	70.2	1.0	PK	358	1.2	
5494.465	71.2	V	70.2	1.0	PK	360	1.1	
6410.185	63.3	V	70.2	-6.9	PK	344	1.5	
Removed copper tape from corners of inner chassis								
1831.498	60.3	V	72.4	-12.1	PK	360	1.6	
2747.256	69.9	V	71.2	-1.3	PK	360	1.2	
5494.500	65.7	V	72.2	-6.5	PK	336	1.2	
6410.265	55.4	V	72.4	-17.0	PK	357	1.5	

Frequency	Substitution measurements			Site	EUT measurements			eirp Limit	erp Limit	Margin
MHz	Pin[1]	Gain[2]	FS[3]	Factor[4]	FS[5]	eirp (dBm)	erp (dBm)	dBm	dBm	dB
1831.500	-15.2	8.4	87.8	94.6	60.2	-34.4	-36.6		-25.0	-11.6
2747.286	-12.9	9.2	91.9	95.6	69.9	-25.7	-27.9		-25.0	-2.9
5494.465	-11.4	10.1	94.6	95.9	65.7	-30.2	-32.4		-25.0	-7.4
6410.185	-11.8	11.1	98.1	98.8	55.4	-43.4	-45.6		-25.0	-20.6

Note 1:	Pin is the input power (dBm) to the substitution antenna
Note 2:	Gain is the gain (dBi) for the substitution antenna. A dipole has a gain of 2.2dBi.
Note 3:	FS is the field strength (dBuV/m) measured from the substitution antenna.
Note 4:	Site Factor - this is the site factor to convert from a field strength in dBuV/m to an eirp in dBm.
Note 5:	EUT field strength as measured.
Note 6:	Based on preliminary testing, the measured emissions closest to the limit were with the antenna vertically polarized.

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Spec:	FCC Part 90	Class:	N/A

Run #2: Radiated Spurious Emissions, 30 - 10,000 MHz. Low Channel @ 910.75 MHz

Frequency	Level	Pol	Part 90.210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
1821.455	61.5	V	70.2	-8.7	PK	348	1.6	
2732.224	70.3	V	70.2	0.1	PK	360	1.0	
5464.462	65.2	V	70.2	-5.0	PK	357	1.2	
6375.225	61.7	V	70.2	-8.5	PK	343	1.2	

Frequency	Substitution measurements			Site	EUT measurements			eirp Limit	erp Limit	Margin
MHz	Pin[1]	Gain[2]	FS[3]	Factor[4]	FS[5]	eirp (dBm)	erp (dBm)	dBm	dBm	dB
1821.455	-15.2	8.4	87.8	94.6	61.5	-33.1	-35.3		-25.0	-10.3
2732.224	-12.9	9.2	91.9	95.6	70.3	-25.3	-27.5		-25.0	-2.5
5464.462	-11.4	10.1	94.6	95.9	65.2	-30.7	-32.9		-25.0	-7.9
6375.225	-11.8	11.1	98.1	98.8	61.7	-37.1	-39.3		-25.0	-14.3

Note 1:	Pin is the input power (dBm) to the substitution antenna
Note 2:	Gain is the gain (dBi) for the substitution antenna. A dipole has a gain of 2.2dBi.
Note 3:	FS is the field strength (dBuV/m) measured from the substitution antenna.
Note 4:	Site Factor - this is the site factor to convert from a field strength in dBuV/m to an eirp in dBm.
Note 5:	EUT field strength as measured.
Note 6:	Based on preliminary testing, the measured emissions closest to the limit were with the antenna vertically polarized.

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Spec:	FCC Part 90	Class:	N/A

Run #3: Radiated Spurious Emissions, 30 - 10,000 MHz. High Channel @ 920.75 MHz

Frequency	Level	Pol	Part 90.210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
1841.520	63.3	V	70.2	-6.9	PK	349	1.6	
2762.244	69.9	V	70.2	-0.4	PK	360	1.2	
5524.422	68.6	V	70.2	-1.7	PK	360	1.0	
6445.125	57.4	V	70.2	-12.8	PK	346	1.6	

Frequency	Substitution measurements			Site	EUT measurements			eirp Limit	erp Limit	Margin
MHz	Pin[1]	Gain[2]	FS[3]	Factor[4]	FS[5]	eirp (dBm)	erp (dBm)	dBm	dBm	dB
1841.520	-15.2	8.4	87.8	94.6	63.3	-31.3	-33.5		-25.0	-8.5
2762.244	-12.9	9.2	91.9	95.6	69.9	-25.7	-27.9		-25.0	-2.9
5524.422	-11.4	10.1	94.6	95.9	68.6	-27.3	-29.5		-25.0	-4.5
6445.125	-11.8	11.1	98.1	98.8	57.4	-41.4	-43.6		-25.0	-18.6

Note 1:	Pin is the input power (dBm) to the substitution antenna
Note 2:	Gain is the gain (dBi) for the substitution antenna. A dipole has a gain of 2.2dBi.
Note 3:	FS is the field strength (dBuV/m) measured from the substitution antenna.
Note 4:	Site Factor - this is the site factor to convert from a field strength in dBuV/m to an eirp in dBm.
Note 5:	EUT field strength as measured.
Note 6:	Based on preliminary testing, the measured emissions closest to the limit were with the antenna vertically polarized.

Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Spec:	FCC Part 90	Class:	N/A

Spurious 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.

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.

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.

Ambient Conditions:

Temperature: 17 °C
Rel. Humidity: 80 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1 - 3	RE, 30 - 10,000 MHz Maximized spurious emissions	FCC Class A	Pass	45.2dBµV/m @ 6445.2MHz (-4.3dB)

Modifications Made During Testing:

Added copper tape to I/O port

Deviations From The Standard

No deviations were made from the requirements of the standard.

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
30 - 1000 MHz	10	10	0.0
30 - 1000 MHz	3	10	-10.5

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Spec:	FCC Part 90	Class:	N/A

Date of Test: 8/30/2006
Test Engineer: Mehran Birgani
Test Location: SVOATS #2

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

Run #1: Radiated Spurious Emissions, 30 - 10,000 MHz. Low Channel @ 910.75 MHz, Rx mode

Fundamental

Frequency	Level	Pol	FCC Class A		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
910.740	32.4	H	46.4	-14.0	QP	160	1.0	Note 1
910.740	31.4	V	46.4	-15.0	QP	75	1.0	Note 1

Other Spurious Emission

Frequency	Level	Pol	FCC Class A		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
6375.198	42.1	V	49.5	-7.4	AVG	158	1.3	
8196.658	41.2	H	49.5	-8.3	AVG	151	1.4	
3642.962	39.4	V	49.5	-10.1	AVG	160	1.0	
6375.201	35.6	H	49.5	-13.9	AVG	177	1.9	
6375.198	46.9	V	69.5	-22.6	PK	158	1.3	
8196.658	46.2	H	69.5	-23.3	PK	151	1.4	
3642.962	43.4	V	69.5	-26.1	PK	160	1.0	
2732.250	22.4	H	49.5	-27.1	AVG	331	1.0	
1821.610	21.7	V	49.5	-27.8	AVG	16	2.5	
6375.201	40.9	H	69.5	-28.6	PK	177	1.9	
1821.500	18.5	H	49.5	-31.0	AVG	323	1.1	
2732.250	31.2	H	69.5	-38.3	PK	331	1.0	
1821.610	29.1	V	69.5	-40.4	PK	16	2.5	
1821.500	28.7	H	69.5	-40.8	PK	323	1.1	

Note 1	Signal was measured at 10m, due to signal was very close to noise floor, the antenna was moved to 3m and signal was extrapolated to 10m by using -10.5dB correction factor.

Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Spec:	FCC Part 90	Class:	N/A

Date of Test: 8/28/2006 Config. Used: 1
Test Engineer: Rafael varelas Config Change: None
Test Location: SVOATS #2 EUT Voltage: 120V/60Hz

Run #2: Radiated Spurious Emissions, 30 - 10,000 MHz. Mid Channel @ 915.75 MHz, Rx mode

Fundamental

Frequency	Level	Pol	FCC Class A		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
915.750	34.8	H	46.4	-11.6	QP	80	1.0	Note 1
915.750	34.1	V	46.4	-12.3	QP	345	1.0	Note 1

Other Spurious Emission

Frequency	Level	Pol	FCC Class A		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
6410.150	45.1	V	49.5	-4.4	AVG	161	1.3	
8241.670	43.2	H	49.5	-6.3	AVG	151	1.4	
3662.960	41.6	H	49.5	-7.9	AVG	117	1.7	
3663.010	41.4	V	49.5	-8.1	AVG	160	1.0	
6410.170	37.6	H	49.5	-11.9	AVG	177	1.9	
6410.150	46.7	V	69.5	-22.8	PK	161	1.3	
8241.670	46.2	H	69.5	-23.3	PK	151	1.4	
3662.960	43.4	H	69.5	-26.1	PK	117	1.7	
3663.010	43.4	V	69.5	-26.1	PK	160	1.0	
6410.170	40.9	H	69.5	-28.6	PK	177	1.9	

Note 1	Signal was measured at 10m, due to signal was very close to noise floor, the antenna was moved to 3m and signal was extrapolated to 10m by using -10.5dB correction factor.

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J64680
Model:	ALR 9890-RR	T-Log Number:	T64714
		Account Manager:	-
Contact:	Robert Martin		
Spec:	FCC Part 90	Class:	N/A

Date of Test: 8/28/2006
Test Engineer: Rafael varelas
Test Location: SVOATS #2

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

Run #3: Radiated Spurious Emissions, 30 - 10,000 MHz. High Channel @ 920.75 MHz, Rx mode

Fundamental

Frequency	Level	Pol	FCC Class A		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
920.750	35.2	H	46.4	-11.2	QP	80	1.0	Note 1
920.750	34.7	V	46.4	-11.7	QP	350	1.0	Note 1

Other Spurious Emission

Frequency	Level	Pol	FCC Class A		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
6445.160	45.2	V	49.5	-4.3	AVG	160	2.0	
8286.670	43.4	V	49.5	-6.1	AVG	179	1.0	
3683.010	42.6	V	49.5	-6.9	AVG	148	1.2	
3682.980	38.8	H	49.5	-10.7	AVG	195	1.1	
7366.020	34.5	V	49.5	-15.0	AVG	153	1.0	
9207.480	32.0	V	49.5	-17.5	AVG	162	1.5	
5524.420	28.8	V	49.5	-20.7	AVG	156	1.0	
6445.160	46.2	V	69.5	-23.3	PK	160	2.0	
8286.670	46.0	V	69.5	-23.5	PK	179	1.0	
2762.240	25.6	V	49.5	-23.9	AVG	132	1.1	
3683.010	43.9	V	69.5	-25.6	PK	148	1.2	
4603.700	23.7	V	49.5	-25.8	AVG	214	1.0	
1841.470	22.6	V	49.5	-26.9	AVG	94	1.1	
3682.980	41.1	H	69.5	-28.4	PK	195	1.1	
7366.020	40.2	V	69.5	-29.3	PK	153	1.0	
9207.480	39.8	V	69.5	-29.7	PK	162	1.5	
5524.420	36.3	V	69.5	-33.2	PK	156	1.0	
2762.240	33.3	V	69.5	-36.2	PK	132	1.1	
4603.700	32.5	V	69.5	-37.0	PK	214	1.0	
1841.470	29.9	V	69.5	-39.6	PK	94	1.1	

Note 1	Signal was measured at 10m, due to signal was very close to noise floor, the antenna was moved to 3m and signal was extrapolated to 10m by using -10.5dB correction factor.

EXHIBIT 3: Test Configuration Photographs

Uploaded as A Separate Attachment

EXHIBIT 4: Theory of Operation Alien Technology Model ALR 9890-RR

Uploaded as A Separate Attachment

EXHIBIT 5: Proposed FCC ID Label & Label Location

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EXHIBIT 6: Detailed Photographs Alien Technology Model ALR 9890-RR

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EXHIBIT 7: Installation Guide Alien Technology Model ALR 9890-RR

Uploaded as A Separate Attachment

EXHIBIT 8: Block Diagram Alien Technology Model ALR 9890-RR

Uploaded as A Separate Attachment

EXHIBIT 9: Schematic Diagrams Alien Technology Model ALR 9890-RR

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