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Electromagnetic Emissions Test Report and Request for Class II Permissive Change pursuant to FCC Part 15, Subpart C Specifications for an Intentional Radiator on the Alien Technology Model: ALR-9780

FCC ID:	P65ALR9780
GRANTEE:	Alien Technology 18220 Butterfiled Blvd. Morgan Hill, CA. 95037
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	May 12, 2004
FINAL TEST DATE:	May 4 and May 10, 2004

AUTHORIZED SIGNATORY:

Juan Martinez
Senior EMC Engineer

ACCREDITED

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SCOPE

An electromagnetic emissions test has been performed on the Alien Technology model ALR-9780 pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators. 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 ALR-9780 and therefore apply only to the tested sample. The sample was selected and prepared by Robert Martinof Alien Technology

OBJECTIVE

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

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

STATEMENT OF COMPLIANCE

The tested sample of Alien Technology model ALR-9780 complied with the requirements of Subpart C of Part 15 of the FCC Rules for low power intentional radiators.

Maintenance of FCC compliance 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.).

SUMMARY OF RESULTS

FCC Part 15 Section	RSS 210 Section	Description	Measured Value	Comments	Result
15.247 (b) (2)	6.2.2(o)(a)	Output Power,	29.9 dBm (0.977 Watts)	Maximum permitted is 1Watt, with EIRP limited to 4 Watts for a 50-channel system.	Complies
15.247(c) / 15.209		Radiated Spurious Emissions 30MHz – 9.28GHz	52.4 dBuV/m @ 4512.955 MHz (-1.6 dB)	Emissions in restricted bands must meet the radiated emissions limits detailed in 15.207. All others must be < -20dBc	Complies
15.247 (b) (5)	RSS-212	RF Exposure Requirements	FCC /IC limits of power density not exceeded provided antenna is located a minimum of 23 cm from persons	Refer to MPE calculation for 23cm derivation. Refer to User's Guide for installation instructions requiring a 23cm separation	Complies
15.203		External Antenna	Circularly Polarized Patch	External antenna will be professionally installed	Complies

EIRP calculated using antenna gain of 6 dBi.

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 ALR-9780 is a RF ID Reader, which is designed to identify RF tags placed on inventory. Normally, the EUT would be mounted on a wall during operation. The EUT was, therefore, treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 120/240 V, 50/60 Hz.

The sample was received on May 4, 2004 and tested on May 4 and May 10, 2004. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number
Alien Technology ALR-9610-AC with LMR195 cable	-
Alien Technology ALR-9610-AC with Jyebao cable	-
Alien Technology ALR-9780 Tag Reader	-

OTHER EUT DETAILS

Cable utilized: 20 feet of Time Microwave LMR-195 coax cable or 20ft of Jyebao cable

ENCLOSURE

The Antenna enclosure is primarily constructed of molded plastic. It measures approximately 20 cm wide by 4 cm deep by 28 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	FCC ID Number
Dell Latitude Laptop	TW-0791UH-12800-15T-B122	DoC
Dell ADP-70EB AC Adapter	TH-09364U-17971-0AE-N7U6	-

No remote support equipment was used during emissions testing.

EXTERNAL I/O CABLING

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length (m)
RF	Antenna	Coax	Shielded	6
DC in	AC Adapter	2 wire	Unshielded	1
RS-232	Laptop	Multiwire	Shielded	1.5
RF (x3)	Note 1			
Ethernet	Note 1			
I/O	Note 1			

Note 1: Ports were not connected, as these were not required during transmitter testing.

TEST SOFTWARE

The EUT was transmitting continuously on the low (902MHz), middle (915MHz) or high (927MHZ) channel

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on May 4 and May 10, 2004 at the Elliott Laboratories Open Area Test Site #4 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the 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, 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 thermister mount 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, which are 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 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.

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.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. 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 specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

CONDUCTED EMISSIONS SPECIFICATION LIMITS, SECTION 15.207

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

RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.209

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

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

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

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:

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

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

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

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

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Radiated Emissions, 1000 - 10,000 MHz, 04-May-04
Engineer: Chris Byleckie

Manufacturer	Description	Model #	Asset #	Cal Due
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	786	29-Oct-04
Hewlett Packard	Microwave EMI test system (SA40, 30Hz - 40GHz), Sunnyvale	84125C	1149	02-Jun-04
Hewlett Packard	High Pass filter, 1.5GHz	P/N 84300-80037	1154	20-Jun-04

Radiated Emissions, 1000 - 10,000 MHz, 10-May-04
Engineer: Chris Byleckie

Manufacturer	Description	Model #	Asset #	Cal Due
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	786	29-Oct-04
Hewlett Packard	Microwave EMI test system (SA40, 30Hz - 40GHz), Sunnyvale	84125C	1149	02-Jun-04
Hewlett Packard	High Pass filter, 1.5GHz	P/N 84300-80037	1154	20-Jun-04

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T 55483 13 Pages

Client:	Alien Technology	Job Number:	J55443
Model:	ALR-9780	T-Log Number:	T55483
		Account Manager:	Christine Vu
Contact:	Robert Martin		
Emissions Spec:	FCC 15.247	Class:	
Immunity Spec:	-	Environment:	

EMC Test Data

For The

Alien Technology

Model

ALR-9780

Date of Last Test: 5/10/2004

Client:	Alien Technology	Job Number:	J55443
Model:	ALR-9780	T-Log Number:	T55483
		Account Manager:	Christine Vu
Contact:	Robert Martin		
Emissions Spec:	FCC 15.247	Class:	
Immunity Spec:	-	Environment:	

EUT INFORMATION

General Description

The EUT is a RF ID Reader which is designed to identify RF tags placed on inventory. Normally, the EUT would be mounted on a wall during operation. The EUT was, therefore, treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 120/240 V, 50/60 Hz.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Alien Technology	ALR-9610-AC with LMR195 cable	Antenna	N/A	-
Alien Technology	ALR-9610-AC with Jyebao cable	Antenna	N/A	-
Alien Technology	ALR-9780	Tag Reader	N/A	P65ALR9780

Other EUT Details

cable utilized: 20 feet of Time Microwave LMR-195 coax cable or 20ft of Jyebao cable

EUT Enclosure

The Antenna enclosure is primarily constructed of molded plastic. It measures approximately 20 cm wide by 4 cm deep by 28 cm high.

Modification History

Mod. #	Test	Date	Modification
1			
2			
3			

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

Client:	Alien Technology	Job Number:	J55443
Model:	ALR-9780	T-Log Number:	T55483
		Account Manager:	Christine Vu
Contact:	Robert Martin		
Emissions Spec:	FCC 15.247	Class:	
Immunity Spec:	-	Environment:	

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	Latitude	Laptop	TW-0791UH-12800-15T-B122	DoC
Dell	ADP-70EB	AC Adapter	TH-09364U-17971-0AE-N7U6	-

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)
RF	Antenna	Coax	Shielded	6
DC in	AC Adapter	2 wire	Unshielded	1
RS-232	Laptop	Multiwire	Shielded	1.5
RF (x3)	Note 1			
Ethernet	Note 1			
I/O	Note 1			

Note 1: These ports were not required to be connected for transmitter testing.

EUT Operation During Emissions

The EUT was transmitting continuously on either the low (902MHz), the middle (915MHz) or the high (927MHZ) channel

Client:	Alien Technology	Job Number:	J55443
Model:	ALR-9780	T-Log Number:	T55483
		Account Manager:	Christine Vu
Contact:	Robert Martin		
Spec:	FCC 15.247	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: 5/4/2004
Test Engineer: Chris Byleckie
Test Location: SVOATS #4
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.

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

Ambient Conditions:

Temperature: 21 °C
Rel. Humidity: 58 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1a-1d	RE, 1000 - 10000 MHz - Spurious Emissions In Restricted Bands	FCC Part 15.209 / 15.247(c)	Pass	See individual runs
2	Output Power	FCC 15.247(b)(2)	Pass	29.9 dBm

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:	J55443
Model:	ALR-9780	T-Log Number:	T55483
		Account Manager:	Christine Vu
Contact:	Robert Martin		
Spec:	FCC 15.247	Class:	N/A

ALR9610-C Antenna with 20 ft. of LMR195 cable
Run #1a: Radiated Spurious Emissions, 1000 - 10000 MHz. Low Channel @ 902.6 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1805.238	35.0	H	54.0	-19.0	AVG	24	1.0	
1805.238	45.6	H	74.0	-28.4	PK	24	1.0	
2707.780	33.9	H	54.0	-20.1	AVG	0	1.4	RB
2707.780	42.6	H	74.0	-31.4	PK	0	1.4	RB
3600.405	33.6	H	54.0	-20.4	AVG	31	1.0	RB
3600.405	44.7	H	74.0	-29.3	PK	31	1.0	RB
4512.955	52.4	H	54.0	-1.6	AVG	27	1.4	RB From RS-232 connector
4512.955	55.1	H	74.0	-18.9	PK	27	1.4	RB From RS-232 connector
4512.135	33.6	H	54.0	-20.4	AVG	27	1.1	RB Added copper tape to RS-232
4512.135	44.9	H	74.0	-29.1	PK	27	1.1	RB Added copper tape to RS-232
5417.395	37.0	H	54.0	-17.0	AVG	201	1.6	RB
5417.395	45.8	H	74.0	-28.2	PK	201	1.6	RB
6318.315	34.3	H	54.0	-19.7	AVG	207	1.0	
6318.315	46.0	H	74.0	-28.0	PK	207	1.0	
7220.675	36.6	H	54.0	-17.4	AVG	330	1.5	
7220.675	47.3	H	74.0	-26.7	PK	330	1.5	
8123.435	37.8	H	54.0	-16.2	AVG	206	1.2	RB
8123.435	47.8	H	74.0	-26.2	PK	206	1.2	RB
9025.431	37.2	H	54.0	-16.8	AVG	291	1.0	RB
9025.431	47.5	H	74.0	-26.5	PK	291	1.0	RB
1804.290	31.3	V	54.0	-22.7	AVG	149	1.1	
1804.290	48.7	V	74.0	-25.3	PK	149	1.1	
2709.290	28.4	V	54.0	-25.6	AVG	303	1.0	RB
2709.290	40.1	V	74.0	-33.9	PK	303	1.0	RB
3601.780	33.0	V	54.0	-21.0	AVG	224	1.0	RB
3601.780	45.5	V	74.0	-28.5	PK	224	1.0	RB
4513.895	34.6	V	54.0	-19.4	AVG	28	1.4	RB
4513.895	43.2	V	74.0	-30.8	PK	28	1.4	RB
5415.670	34.1	V	54.0	-19.9	AVG	88	1.1	RB
5415.670	44.9	V	74.0	-29.2	PK	88	1.1	RB
6318.755	34.0	V	54.0	-20.0	AVG	359	1.3	
6318.755	45.8	V	74.0	-28.2	PK	359	1.3	
7220.795	34.9	V	54.0	-19.1	AVG	340	1.0	
7220.795	46.3	V	74.0	-27.7	PK	340	1.0	
8124.660	34.4	V	54.0	-19.6	AVG	22	2.0	RB
8124.660	45.2	V	74.0	-28.9	PK	22	2.0	RB

Run #1a continued on next page

Client:	Alien Technology	Job Number:	J55443
Model:	ALR-9780	T-Log Number:	T55483
		Account Manager:	Christine Vu
Contact:	Robert Martin		
Spec:	FCC 15.247	Class:	N/A

Run #1a continued

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
9025.561	37.1	V	54.0	-16.9	AVG	332	1.3	RB
9025.561	49.8	V	74.0	-24.2	PK	332	1.3	RB

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:	RB - Restricted Band

Run #1b: Radiated Spurious Emissions, 1000 - 10000 MHz. Center Channel @ 915 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1828.625	34.7	V	54.0	-19.3	AVG	333	1.0	
1828.625	49.6	V	74.0	-24.5	PK	333	1.0	
2744.885	29.8	V	54.0	-24.2	AVG	358	1.0	RB
2744.885	50.0	V	74.0	-24.0	PK	358	1.0	RB
3661.445	36.5	V	54.0	-17.5	AVG	41	1.0	RB
3661.445	45.2	V	74.0	-28.8	PK	41	1.0	RB
4574.045	32.6	V	54.0	-21.4	AVG	0	1.2	RB
4574.045	47.3	V	74.0	-26.7	PK	0	1.2	RB
5490.975	33.3	V	54.0	-20.7	AVG	124	1.0	RB
5490.975	44.5	V	74.0	-29.6	PK	124	1.0	RB
6405.370	32.9	V	54.0	-21.2	AVG	361	1.0	
6405.370	43.7	V	74.0	-30.3	PK	361	1.0	
7320.270	35.1	V	54.0	-18.9	AVG	219	1.4	RB
7320.270	46.8	V	74.0	-27.2	PK	219	1.4	RB
8236.400	35.7	V	54.0	-18.3	AVG	247	1.0	RB
8236.400	46.6	V	74.0	-27.4	PK	247	1.0	RB
9149.660	37.2	V	54.0	-16.8	AVG	360	1.0	RB
9149.660	48.0	V	74.0	-26.0	PK	360	1.0	RB
1828.615	30.5	H	54.0	-23.5	AVG	271	1.0	
1828.615	43.9	H	74.0	-30.1	PK	271	1.0	
2744.880	32.4	H	54.0	-21.7	AVG	78	1.0	RB
2744.880	43.5	H	74.0	-30.5	PK	78	1.0	RB
3661.195	33.4	H	54.0	-20.6	AVG	330	1.6	RB
3661.195	45.1	H	74.0	-28.9	PK	330	1.6	RB
4575.455	34.1	H	54.0	-19.9	AVG	326	1.0	RB
4575.455	45.2	H	74.0	-28.8	PK	326	1.0	RB

Run #1b continued on next page

Client:	Alien Technology	Job Number:	J55443
Model:	ALR-9780	T-Log Number:	T55483
		Account Manager:	Christine Vu
Contact:	Robert Martin		
Spec:	FCC 15.247	Class:	N/A

Run #1b continued

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5491.130	33.5	H	54.0	-20.5	AVG	323	1.3	RB
5491.130	45.2	H	74.0	-28.8	PK	323	1.3	RB
6404.950	31.6	H	54.0	-22.4	AVG	340	1.0	
6404.950	43.3	H	74.0	-30.7	PK	340	1.0	
7320.415	37.9	H	54.0	-16.1	AVG	181	1.2	RB
7320.415	49.4	H	74.0	-24.6	PK	181	1.2	RB
8235.935	36.0	H	54.0	-18.0	AVG	334	1.0	RB
8235.935	46.9	H	74.0	-27.1	PK	334	1.0	RB
9150.445	37.4	H	54.0	-16.6	AVG	0	1.0	RB
9150.445	49.3	H	74.0	-24.7	PK	0	1.0	RB

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:	RB - Restricted Band

Run #1c: Radiated Spurious Emissions, 1000 - 10000 MHz. High Channel @ 927 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1855.095	31.7	H	54.0	-22.3	AVG	0	2.0	
1855.095	46.8	H	74.0	-27.3	PK	0	2.0	
2780.065	32.5	H	54.0	-21.5	AVG	108	2.0	RB
2780.065	40.6	H	74.0	-33.4	PK	108	2.0	RB
3707.210	33.8	H	54.0	-20.2	AVG	23	1.0	RB
3707.210	44.7	H	74.0	-29.3	PK	23	1.0	RB
4636.305	31.6	H	54.0	-22.4	AVG	124	1.0	RB
4636.305	43.3	H	74.0	-30.7	PK	124	1.0	RB
5563.060	33.3	H	54.0	-20.7	AVG	0	1.0	
5563.060	44.3	H	74.0	-29.7	PK	0	1.0	
6889.925	36.9	H	54.0	-17.1	AVG	44	1.1	
6889.925	47.7	H	74.0	-26.3	PK	44	1.1	
7416.600	38.0	H	54.0	-16.0	AVG	360	1.1	RB
7416.600	49.6	H	74.0	-24.4	PK	360	1.1	RB
8344.285	35.8	H	54.0	-18.2	AVG	221	2.0	RB
8344.285	49.1	H	74.0	-24.9	PK	221	2.0	RB
9270.775	38.2	H	54.0	-15.9	AVG	361	2.0	
9270.775	50.3	H	74.0	-23.7	PK	361	2.0	

Run #1c continued on next page

Client:	Alien Technology	Job Number:	J55443
Model:	ALR-9780	T-Log Number:	T55483
		Account Manager:	Christine Vu
Contact:	Robert Martin		
Spec:	FCC 15.247	Class:	N/A

Run #1c continued

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1852.835	33.7	V	54.0	-20.3	AVG	296	1.0	
1852.835	48.4	V	74.0	-25.6	PK	296	1.0	
2780.575	28.2	V	54.0	-25.8	AVG	317	1.0	RB
2780.575	42.4	V	74.0	-31.6	PK	317	1.0	RB
3707.775	31.3	V	54.0	-22.7	AVG	50	1.0	RB
3707.775	42.4	V	74.0	-31.6	PK	50	1.0	RB
4635.930	31.4	V	54.0	-22.6	AVG	14	1.2	RB
4635.930	42.4	V	74.0	-31.6	PK	14	1.2	RB
5561.080	31.4	V	54.0	-22.6	AVG	247	1.8	
5561.080	42.1	V	74.0	-31.9	PK	247	1.8	
6889.845	35.1	V	54.0	-18.9	AVG	361	1.0	
6889.845	47.3	V	74.0	-26.7	PK	361	1.0	
7417.160	35.2	V	54.0	-18.8	AVG	235	1.0	RB
7417.160	47.1	V	74.0	-26.9	PK	235	1.0	RB
8343.285	35.1	V	54.0	-18.9	AVG	238	1.0	RB
8343.285	46.3	V	74.0	-27.7	PK	238	1.0	RB
9271.340	37.3	V	54.0	-16.7	AVG	279	1.0	
9271.340	47.9	V	74.0	-26.1	PK	279	1.0	

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:	RB - Restricted Band

Run #1d: Radiated Spurious Emissions, 960MHz Restricted Band, EUT @ 927 MHz.
Test perfromed 6/3/2004, SVOATS #2

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
961.500	33.8	v	54.0	-20.2	QP	161	1.0	Fundamental = 126.2dBuV/m Pk
961.500	30.0	h	54.0	-24.0	QP	178	1.8	Fundamental = 112.5dBuV/m Pk

Run# 2: Output Power Verification

Frequency	Power	Power
MHz	dBm	W
902.600	29.9	0.9772
915.000	29.9	0.9772
927.000	29.9	0.9772

Power measured using a spectrum analyzer with RBW = VBW=3MHz

Client:	Alien Technology	Job Number:	J55443
Model:	ALR-9780	T-Log Number:	T55483
		Account Manager:	Christine Vu
Contact:	Robert Martin		
Spec:	FCC 15.247	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: 5/10/2004
Test Engineer: Chris Byleckie
Test Location: SVOATS #4
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. All remote support equipment was located approximately 30 meters from the EUT with all I/O connections running on top of the groundplane or routed in overhead in the GR-1089 test configuration.

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: 19 °C
Rel. Humidity: 40 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 1000 - 10000 MHz - Spurious Emissions In	FCC Part 15.209 / 15.247(c)	Pass	See individual runs

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:	J55443
Model:	ALR-9780	T-Log Number:	T55483
		Account Manager:	Christine Vu
Contact:	Robert Martin		
Spec:	FCC 15.247	Class:	N/A

ALR9610-C Antenna with 20ft of Jyebao cable
Run #1a: Radiated Spurious Emissions, 1000 - 10000 MHz. Low Channel @ 902.6 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1803.200	30.8	H	54.0	-23.2	AVG	0	2.5	
1803.200	47.3	H	74.0	-26.8	PK	0	2.5	
2706.470	28.8	H	54.0	-25.2	AVG	281	1.3	
2706.470	39.9	H	74.0	-34.1	PK	281	1.3	
3600.415	30.5	H	54.0	-23.5	AVG	89	1.2	
3600.415	42.5	H	74.0	-31.5	PK	89	1.2	
4512.933	39.8	H	54.0	-14.2	AVG	13	1.0	
4512.933	47.0	H	74.0	-27.0	PK	13	1.0	
5416.334	33.4	H	54.0	-20.6	AVG	59	1.0	
5416.334	43.9	H	74.0	-30.1	PK	59	1.0	
6317.550	32.5	H	54.0	-21.5	AVG	62	1.1	
6317.550	44.2	H	74.0	-29.8	PK	62	1.1	
7220.265	33.2	H	54.0	-20.8	AVG	145	1.0	
7220.265	46.4	H	74.0	-27.6	PK	145	1.0	
8123.380	33.8	H	54.0	-20.2	AVG	217	1.0	
8123.380	44.4	H	74.0	-29.6	PK	217	1.0	
9024.425	37.1	H	54.0	-17.0	AVG	123	1.0	
9024.425	47.4	H	74.0	-26.6	PK	123	1.0	
1803.585	34.9	V	54.0	-19.1	AVG	203	2.5	
1803.585	56.8	V	74.0	-17.3	PK	203	2.5	
2707.955	46.9	V	54.0	-7.1	AVG	3	1.0	
2707.955	54.3	V	74.0	-19.7	PK	3	1.0	
3599.090	31.3	V	54.0	-22.7	AVG	143	1.0	
3599.090	44.0	V	74.0	-30.0	PK	143	1.0	
4512.965	32.7	V	54.0	-21.4	AVG	49	1.0	
4512.965	41.6	V	74.0	-32.4	PK	49	1.0	
5417.100	32.9	V	54.0	-21.2	AVG	130	1.2	
5417.100	44.9	V	74.0	-29.1	PK	130	1.2	
6319.385	31.6	V	54.0	-22.4	AVG	104	1.0	
6319.385	42.7	V	74.0	-31.3	PK	104	1.0	
7220.630	31.9	V	54.0	-22.1	AVG	79	1.9	
7220.630	43.7	V	74.0	-30.3	PK	79	1.9	
8122.810	33.4	V	54.0	-20.7	AVG	359	1.0	
8122.810	44.5	V	74.0	-29.5	PK	359	1.0	

Run #1a continued on next page

Client:	Alien Technology	Job Number:	J55443
Model:	ALR-9780	T-Log Number:	T55483
		Account Manager:	Christine Vu
Contact:	Robert Martin		
Spec:	FCC 15.247	Class:	N/A

Run #1a continued

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
9023.820	36.5	V	54.0	-17.5	AVG	127	1.0	
9023.820	47.9	V	74.0	-26.1	PK	127	1.0	

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:	RB - Restricted Band

Run #1b: Radiated Spurious Emissions, 1000 - 10000 MHz. Center Channel @ 915 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1829.670	35.3	V	54.0	-18.7	AVG	216	1.1	
1829.670	47.1	V	74.0	-26.9	PK	216	1.1	
2745.195	42.8	V	54.0	-11.2	AVG	7	1.0	
2745.195	50.4	V	74.0	-23.6	PK	7	1.0	
3659.210	31.2	V	54.0	-22.8	AVG	228	1.0	
3659.210	42.0	V	74.0	-32.0	PK	228	1.0	
4575.965	31.3	V	54.0	-22.7	AVG	140	1.0	
4575.965	42.5	V	74.0	-31.6	PK	140	1.0	
5489.520	32.0	V	54.0	-22.0	AVG	79	1.1	
5489.520	43.9	V	74.0	-30.1	PK	79	1.1	
6406.145	31.8	V	54.0	-22.2	AVG	0	1.0	
6406.145	42.9	V	74.0	-31.1	PK	0	1.0	
7318.735	34.2	V	54.0	-19.8	AVG	83	1.3	
7318.735	45.9	V	74.0	-28.1	PK	83	1.3	
8234.250	34.7	V	54.0	-19.3	AVG	206	1.0	
8234.250	45.8	V	74.0	-28.2	PK	206	1.0	
9150.680	35.4	V	54.0	-18.6	AVG	263	1.0	
9150.680	48.2	V	74.0	-25.8	PK	263	1.0	
1830.135	31.6	H	54.0	-22.4	AVG	82	1.0	
1830.135	42.1	H	74.0	-31.9	PK	82	1.0	
2745.020	48.0	H	54.0	-6.0	AVG	306	1.0	
2745.020	50.9	H	74.0	-23.1	PK	306	1.0	
3660.945	33.3	H	54.0	-20.8	AVG	33	1.0	
3660.945	43.3	H	74.0	-30.7	PK	33	1.0	
4573.870	31.7	H	54.0	-22.3	AVG	87	1.0	
4573.870	41.6	H	74.0	-32.4	PK	87	1.0	

Run #1b continued on next page

Client:	Alien Technology	Job Number:	J55443
Model:	ALR-9780	T-Log Number:	T55483
		Account Manager:	Christine Vu
Contact:	Robert Martin		
Spec:	FCC 15.247	Class:	N/A

Run #1b continued

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5488.790	32.8	H	54.0	-21.2	AVG	307	1.0	
5488.790	42.7	H	74.0	-31.3	PK	307	1.0	
6406.160	32.5	H	54.0	-21.5	AVG	350	1.0	
6406.160	42.4	H	74.0	-31.7	PK	350	1.0	
7318.700	34.7	H	54.0	-19.3	AVG	97	1.0	
7318.700	46.1	H	74.0	-27.9	PK	97	1.0	
8236.045	35.6	H	54.0	-18.4	AVG	48	1.0	
8236.045	47.0	H	74.0	-27.0	PK	48	1.0	
9150.170	36.3	H	54.0	-17.8	AVG	229	1.0	
9150.170	47.2	H	74.0	-26.8	PK	229	1.0	

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:	RB - Restricted Band

Run #1c: Radiated Spurious Emissions, 1000 - 10000 MHz. High Channel @ 927 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1853.190	31.4	H	54.0	-22.6	AVG	156	1.6	
1853.190	46.5	H	74.0	-27.5	PK	156	1.6	
2780.990	43.0	H	54.0	-11.0	AVG	282	1.0	
2780.990	51.8	H	74.0	-22.2	PK	282	1.0	
3709.190	32.8	H	54.0	-21.2	AVG	120	1.0	
3709.190	43.9	H	74.0	-30.1	PK	120	1.0	
4634.140	32.6	H	54.0	-21.4	AVG	234	1.0	
4634.140	42.1	H	74.0	-31.9	PK	234	1.0	
5562.425	34.3	H	54.0	-19.7	AVG	283	1.0	
5562.425	44.0	H	74.0	-30.0	PK	283	1.0	
6490.440	32.8	H	54.0	-21.2	AVG	32	1.0	
6490.440	43.8	H	74.0	-30.2	PK	32	1.0	
7414.995	34.5	H	54.0	-19.5	AVG	50	1.0	
7414.995	45.5	H	74.0	-28.5	PK	50	1.0	
8344.400	33.6	H	54.0	-20.4	AVG	125	1.6	
8344.400	44.5	H	74.0	-29.5	PK	125	1.6	
9268.735	37.2	H	54.0	-16.8	AVG	219	1.0	
9268.735	48.6	H	74.0	-25.4	PK	219	1.0	

Run #1c continued on next page

Client:	Alien Technology	Job Number:	J55443
Model:	ALR-9780	T-Log Number:	T55483
		Account Manager:	Christine Vu
Contact:	Robert Martin		
Spec:	FCC 15.247	Class:	N/A

Run #1c continued

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1854.650	39.2	V	54.0	-14.8	AVG	269	1.0	
1854.650	53.2	V	74.0	-20.8	PK	269	1.0	
2780.975	46.1	V	54.0	-7.9	AVG	0	1.0	
2780.975	59.1	V	74.0	-15.0	PK	0	1.0	
3708.355	29.8	V	54.0	-24.2	AVG	267	1.0	
3708.355	41.4	V	74.0	-32.6	PK	267	1.0	
4634.455	31.2	V	54.0	-22.8	AVG	14	1.0	
4634.455	44.3	V	74.0	-29.7	PK	14	1.0	
5562.015	31.7	V	54.0	-22.3	AVG	334	1.0	
5562.015	43.0	V	74.0	-31.0	PK	334	1.0	
6489.945	31.7	V	54.0	-22.3	AVG	270	1.0	
6489.945	42.2	V	74.0	-31.9	PK	270	1.0	
7417.230	34.7	V	54.0	-19.3	AVG	290	1.5	
7417.230	45.5	V	74.0	-28.5	PK	290	1.5	
8343.295	32.7	V	54.0	-21.3	AVG	315	1.0	
8343.295	46.8	V	74.0	-27.2	PK	315	1.0	
9270.895	35.9	V	54.0	-18.1	AVG	258	2.0	
9270.895	47.5	V	74.0	-26.5	PK	258	2.0	

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:	RB - Restricted Band

EXHIBIT 3: Test Configuration Photographs

EXHIBIT 4: Proposed FCC ID Label & Label Location

EXHIBIT 5: Detailed Photographs of Alien Technology Model ALR-9780 Construction

Pages