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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to FCC Part 15, Subpart C (15.247) FHSS and RSS 210 Specifications for an Intentional Radiator on the Alien Technology Model: ALR9930-ADEV

FCC ID:	P65ALR9930-ADEV
UPN:	4370A-9930ADEV
GRANTEE:	Alien Technology 18220 Butterfield Blvd. Morgan Hill, CA 95037
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	July 15, 2004
REISSUE DATE:	January 21, 2005
FINAL TEST DATE:	June 14 and December 3, 2004
AUTHORIZED SIGNATORY:	Mark Briggs Vice President of Engineering

2016-01

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

SCOPE

An electromagnetic emissions test has been performed on the Alien Technology model ALR9930-ADEV 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 ALR9930-ADEV and therefore apply only to the tested sample. The sample was selected and prepared by Greg Katterhagen of Alien Technology

The report was reissued on January 21, 2005 to add test data for an additional antenna (centurion quarter-wave whip).

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 that are subsequently manufactured.

SUMMARY OF RESULTS

FCC Part 15 Section	RSS 210	Description	Measured Value	Comments	Result
15.247	6.2.2 (o) (a)	20dB Bandwidth	290 kHz	The channel spacing shall be greater than the 20dB bandwidth	Complies
15.247	6.2.2 (o) (a)	Channel Separation	400 kHz		Complies
15.247	6.2.2 (o) (a)	Number of Channels	63	50 hopping frequencies: average time of occupancy <0.4 second within a 20 second period.	Complies
15.247	6.2.2 (o) (a)	Channel Dwell Time	317.5 seconds per 20 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, 902 - 928 MHz	30 dBm (1 Watts) EIRP = 4 W	Maximum permitted is 1Watt, with EIRP limited to 4 Watts for a 50-channel system.	Complies
15.247(c)	6.2.2 (o) (e1)	Transmitter Spurious Emissions –30MHz – 10GHz	All spurious emissions < -20dBc	All spurious emissions < -20dBc.	Complies
15.247(c) / 15.209	6.2.2(o) (e1)	Transmitter Radiated Spurious Emissions 30MHz – 10GHz	**6dBi Antenna:** 47.4dBµV/m (234.4µV/m) @ 5416.8MHz (-6.6dB) **¼-wave Whip:** 49.6dBµV/m (302.3µV/m) @ 2745.0MHz (-4.4dB)	Emissions in restricted bands must meet the radiated emissions limits detailed in 15.207. All others must be < -20dBc (Note – RSS 210 limit is the less stringent of -20dBc or Table 3)	Complies
15.109	8	Receiver Spurious Emissions	The receiver does not operate unless the transmitter is also operating. It is not possible to extract the "receiver"-related emissions from the transmit mode emissions since they use the same LO signals.		
15.207	-	AC Conducted Emissions	57.3 dBµV @ 0.150 MHz (-8.7dB dB)	FCC 15.207	Complies
-	6.6		45.9dBµV @ 0.470MHz (-2.1dB)	RSS 210 section 6.6(a)	Complies
15.247 (b) (5)	RSS 210 Section 14	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 22.9cm derivation. Refer to User's Guide for installation instructions requiring a 23cm separation	Complies
15.203	6.2.2 (o) (e2)	RF Connector	Reverse TNC and MMCX	Integral antenna or specialized connector required	Complies

EIRP calculated using antenna gain of 6dBi, which is the highest gain antenna available with the system.

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 ALR9930-ADEV is a transceiver development kit operating in the 900MHz ISM band. They are a reference design to aid manufacturers in software development. 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 V, 60 Hz via an external AC-DC adapter.

The sample was received on June 14, 2004 and tested on June 14 and December 3, 2004. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Alien Technology	ALR9930-ADEV	900MHz transceiver development kit	-	P65ALR9930-ADEV
CVI Inc.	EPA-151DA06	AC adapter	-	-
Alien Technology	ALR9610-C	Circular polaroized patch antenna (6dBi gain)	-	-
Centurion	EXC902 TNX	Antenna (1/4 -wave whip)	-	-

OTHER EUT DETAILS

The RF module that provides the 900 MHz FHSS transceiver is a WJ SX2000 S/N 40021040563

The following antennas were used during radiated emissions testing:

Alien Technology ALR9610-C 6dBi circularly polarized patch antenna;
Centurion model EXC 902 TNX quarter-wave whip antenna, 0 dBi gain.

Both antennas connect to the device using a reverse TNC connector via a MMCX-reverse TNC adapter.

The EUT comes in two configurations. The differences pertain to the serial interface signal levels. One ALR9932 unit works with standard serial levels, the ALR9930 works with a 5V serial level. The only difference is that the ALR9932 contains a level shifter. The ALR9932 was the unit under test

ENCLOSURE

The EUT does not have an enclosure as it is designed to be installed within the enclosure of a host system

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
Dell	PP01L	Laptop	HQH9N01	DoC
Dell	ADP70ED	AC adpater	-	-
HP	Deskjet 3820	AC adpater		

No equipment was used as remote support equipment for emissions 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)
RF	Antenna	Coax	Shielded	
Serial	Laptop	Multiwire	Shielded	1
DC	AC adapter	2 wire	Unshielded	

EUT OPERATION DURING TESTING

The EUT was transmitting continuously on either the low (902.8MHz), the middle (915.2MHz) or the high (927.6MHz) channel

ANTENNA REQUIREMENTS

The antenna port is a non standard, MMCX connector, which meets the requirements of 15.203. The circular-polarized antenna uses a reverse TNC connector and Alien provide a specialized adapter to convert the MMCX EUT connection to a reverse TNC connector for the antenna. The Centurion 1/4-wave antenna uses a MMCX connector.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on June 14, 2004 at the Elliott Laboratories Open Area Test Site #1 and December 3, 2004 at the Elliott Laboratories Open Area Test Site #2 located at 684 West Maude Avenue, Sunnyvale, California. The test sites contain 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 temrs of Watts, milliwatts or dBm. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

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

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

where P is the eirp (Watts)

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

FCC 15.407 (a)and 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)

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5850 MHz band are not subject to this restriction.

RSS 210 (o) AND FCC 15.247 SPURIOUS RADIATED EMISSIONS LIMITS

T limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands detailed in Part 15.205 and for all spurious emissions from the receiver are:

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

All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level.

FCC AC POWER PORT CONDUCTED EMISSIONS LIMITS

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

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

RSS-210 SECTION 6.6 AC POWER PORT CONDUCTED EMISSIONS LIMITS

The table below shows the limits for emissions on the AC power line as detailed in 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:

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

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

Radio Antenna Port (Power and Spurious Emissions), 14-Jun-04
Engineer: Chris Byleckie

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	EMC Spectrum Analyzer, 9KHz-26.5GHz	8593EM	1141	23-Mar-05
Rohde & Schwarz	Power Meter, Single Channel	NRVS	1422	11-Sep-04
Rohde & Schwarz	Peak Power Sensor 100uW - 2 Watts	NRV-Z32	1423	18-Mar-05

Radiated Emissions, 30 - 10,000 MHz, 14-Jun-04
Engineer: Chris Byleckie

Manufacturer	Description	Model #	Asset #	Cal Due
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	487	13-May-06
Narda West	High Pass Filter	HPF-161	833	11-Sep-04
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	12-Jan-05
Hewlett Packard	EMC Spectrum Analyzer, 9KHz-26.5GHz	8593EM	1141	23-Mar-05

Conducted Emissions - AC Power Ports, 14-Jun-04
Engineer: Chris Byleckie

Manufacturer	Description	Model #	Asset #	Cal Due
Solar Electronics	Support Equipment LISN, 0.150-30.0 MHz	8012-50-F	305	08-Apr-05
Fischer Custom Comm.	LISN, Freq. 0.9 -30 MHz,16 Amp	FCC-LISN	1079	01-Jul-04
Rohde & Schwarz	Test Receiver, 9kHz-2750MHz	ESCS 30	1337	05-Jan-05
Rohde& Schwarz	Pulse Limiter	ESH3 Z2	1593	04-May-05

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T55973 22 Pages

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EMC Test Data

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Emissions Spec:	FCC 15.247	Class:	N/A
Immunity Spec:	N/A	Environment:	-

EMC Test Data

For The

Alien Technology

Model

ALR9930-ADEV

Date of Last Test: 11/3/2004

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Emissions Spec:	FCC 15.247	Class:	N/A
Immunity Spec:	N/A	Environment:	-

EUT INFORMATION

General Description

The EUT is a transceiver development kit operating in the 900MHz ISM band, which is a reference design to aid manufacturers in software development. Normally, the EUT would be placed on a table top 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 V, 60 Hz.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Alien Technology	ALR9932-ADEV	900MHz transceiver development kit		P65ALR9932ADEV
Alien Technology	ALR9930-ADEV	900MHz transceiver development kit	-	P65ALR9930ADEV
Alien Technology	ALR9610-C	Circular polaroized patch antenna (6dBi gain)	-	-
Centurion	EXC902 TNX	Antenna (1/4 -wave whip, 0 dBi Gain)	-	-
CVI Inc.	EPA-151DA06	AC adapter	-	-

Other EUT Details

The RF module is a WJ SX2000 S/N 40021040563
The following antenna was used during testing: Alien Technology ALR9610-C
The EUT can comes in two configurations. The differences pertain the the serial signal levels. One ALR9932 unit works with standard serial levels , the ALR9930 works with a 5V serial level. The only difference is that the ALR9932 contains a level shifter. The ALR9932 was the unit under test as it represented the worst-case model in that it had the most circuitry.

EUT Enclosure

The EUT does not have an enclosure as it is designed to be installed within the enclosure of a host system

Modification History

Mod. #	Test	Date	Modification
1			

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

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Emissions Spec:	FCC 15.247	Class:	N/A
Immunity Spec:	N/A	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	PP01L	Laptop	HQH9N01	DoC
Dell	ADP70ED	AC adpater	-	-
HP	Deskjet 3820	AC adpater		

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	
Serial	Laptop	Multiwire	Shielded	1
DC	AC adapter	2 wire	Unshielded	

EUT Operation During Emissions

The EUT was transmitting continously on either the low (90s.8MHz), the middle (915.2MHz) or the high (927.6MHz) channel

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Radiated Emissions - Centurion 1/4 Wave Whip Antenna

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: 12/3/2004
Test Engineer: Juan Martinez
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.

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

Ambient Conditions:

Temperature: 14 °C
Rel. Humidity: 29 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 960 - 10,000 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	49.6dBµV/m (302.3µV/m) @ 2745.0MHz (-4.4dB)

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1a: Radiated Spurious Emissions, 960 - 10,000 MHz. Low Channel @ 903 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	125.1	110.2
Limit for emissions outside of restricted bands:	105.1 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	
9031.000	39.8	h	54.0	-14.2	Avg	0	1.2	Noise Floor, Restricted
8128.000	38.5	h	54.0	-15.5	Avg	0	1.2	Noise Floor, Restricted
8128.000	38.0	v	54.0	-16.0	Avg	0	1.2	Noise Floor, Restricted
2709.000	36.1	v	54.0	-17.9	Avg	0	1.2	Noise Floor, Restricted
2709.000	35.1	h	54.0	-18.9	Avg	0	1.2	Noise Floor, Restricted
9031.000	34.2	v	54.0	-19.8	Avg	0	1.2	Noise Floor, Restricted
4515.000	33.1	v	54.0	-20.9	Avg	0	1.2	Noise Floor, Restricted
3612.000	33.0	v	54.0	-21.0	Avg	0	1.2	Noise Floor, Restricted
5419.000	32.5	h	54.0	-21.5	Avg	0	1.2	Noise Floor, Restricted
5419.000	32.1	v	54.0	-21.9	Avg	0	1.2	Noise Floor, Restricted
9031.000	51.7	h	74.0	-22.3	Pk	0	1.2	Noise Floor, Restricted
4515.000	31.5	h	54.0	-22.5	Avg	0	1.2	Noise Floor, Restricted
3612.000	30.1	h	54.0	-23.9	Avg	0	1.2	Noise Floor, Restricted
8128.000	49.8	h	74.0	-24.2	Pk	0	1.2	Noise Floor, Restricted
8128.000	46.1	v	74.0	-27.9	Pk	0	1.2	Noise Floor, Restricted
5419.000	45.6	h	74.0	-28.4	Pk	0	1.2	Noise Floor, Restricted
5419.000	45.5	v	74.0	-28.6	Pk	0	1.2	Noise Floor, Restricted
3612.000	45.1	v	74.0	-28.9	Pk	0	1.2	Noise Floor, Restricted
2709.000	45.0	h	74.0	-29.0	Pk	0	1.2	Noise Floor, Restricted
3612.000	44.8	h	74.0	-29.2	Pk	0	1.2	Noise Floor, Restricted
9031.000	44.5	v	74.0	-29.5	Pk	0	1.2	Noise Floor, Restricted
4515.000	44.1	v	74.0	-29.9	Pk	0	1.2	Noise Floor, Restricted
4515.000	43.5	h	74.0	-30.5	Pk	0	1.2	Noise Floor, Restricted
2709.000	42.1	v	74.0	-31.9	Pk	0	1.2	Noise Floor, Restricted

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.

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1b: Radiated Spurious Emissions, 960 - 10,000 MHz. Center Channel @ 915 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	126.1	111
Limit for emissions outside of restricted bands:	106.1 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	
2745.000	49.6	h	54.0	-4.4	Avg	0	1.2	Restricted
2745.000	38.0	v	54.0	-16.0	Avg	0	1.2	Noise Floor, Restricted
9150.000	36.5	h	54.0	-17.5	Avg	0	1.2	Noise Floor, Restricted
7320.000	36.5	v	54.0	-17.5	Avg	0	1.2	Noise Floor, Restricted
5491.000	36.1	h	54.0	-17.9	Avg	0	1.2	Noise Floor, Restricted
2745.000	54.6	h	74.0	-19.4	Pk	0	1.2	Restricted
8236.000	34.2	v	54.0	-19.8	Avg	0	1.2	Noise Floor, Restricted
5491.000	33.9	v	54.0	-20.1	Avg	0	1.2	Noise Floor, Restricted
7320.000	33.4	h	54.0	-20.6	Avg	0	1.2	Noise Floor, Restricted
3660.000	32.2	h	54.0	-21.8	Avg	0	1.2	Noise Floor, Restricted
8236.000	32.1	h	54.0	-21.9	Avg	0	1.2	Noise Floor, Restricted
4576.000	31.7	h	54.0	-22.3	Avg	0	1.2	Noise Floor, Restricted
3660.000	31.7	v	54.0	-22.3	Avg	0	1.2	Noise Floor, Restricted
9150.000	31.7	v	54.0	-22.3	Avg	0	1.2	Noise Floor, Restricted
4576.000	30.7	v	54.0	-23.3	Avg	0	1.2	Noise Floor, Restricted
9150.000	47.3	h	74.0	-26.7	Pk	0	1.2	Noise Floor, Restricted
7320.000	47.3	v	74.0	-26.7	Pk	0	1.2	Noise Floor, Restricted
7320.000	46.8	h	74.0	-27.2	Pk	0	1.2	Noise Floor, Restricted
2745.000	46.1	v	74.0	-27.9	Pk	0	1.2	Noise Floor, Restricted
8236.000	45.4	h	74.0	-28.6	Pk	0	1.2	Noise Floor, Restricted
8236.000	44.5	v	74.0	-29.5	Pk	0	1.2	Noise Floor, Restricted
4576.000	43.8	h	74.0	-30.2	Pk	0	1.2	Noise Floor, Restricted
3660.000	43.8	v	74.0	-30.2	Pk	0	1.2	Noise Floor, Restricted
9150.000	43.8	v	74.0	-30.2	Pk	0	1.2	Noise Floor, Restricted
5491.000	43.6	v	74.0	-30.4	Pk	0	1.2	Noise Floor, Restricted
3660.000	43.6	h	74.0	-30.4	Pk	0	1.2	Noise Floor, Restricted
4576.000	43.1	v	74.0	-30.9	Pk	0	1.2	Noise Floor, Restricted
5491.000	42.1	h	74.0	-31.9	Pk	0	1.2	Noise Floor, Restricted

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.

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1c: Radiated Spurious Emissions, 960 - 10,000 MHz. High Channel @ 927 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	124.8	109.4
Limit for emissions outside of restricted bands:	104.8 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	
8343.000	39.1	v	54.0	-14.9	Avg	0	1.2	Noise Floor, Restricted
7416.000	38.4	v	54.0	-15.6	Avg	0	1.2	Noise Floor, Restricted
5562.000	36.8	v	54.0	-17.2	Avg	0	1.2	Noise Floor, Restricted
960.000	28.0	v	46.0	-18.0	Pk	114	1.1	Restricted
2781.000	35.1	v	54.0	-18.9	Avg	0	1.2	Noise Floor, Restricted
3708.000	34.8	h	54.0	-19.2	Avg	0	1.2	Noise Floor, Restricted
5562.000	33.9	h	54.0	-20.1	Avg	0	1.2	Noise Floor, Restricted
2781.000	33.8	h	54.0	-20.2	Avg	0	1.2	Restricted
3708.000	33.0	v	54.0	-21.0	Avg	0	1.2	Noise Floor, Restricted
960.000	24.6	h	46.0	-21.4	Pk	150	1.1	Restricted
4635.000	32.1	v	54.0	-21.9	Avg	0	1.2	Noise Floor, Restricted
7416.000	31.8	h	54.0	-22.2	Avg	0	1.2	Noise Floor, Restricted
9270.000	31.8	h	54.0	-22.2	Avg	0	1.2	Noise Floor, Restricted
9270.000	31.4	v	54.0	-22.6	Avg	0	1.2	Noise Floor, Restricted
8343.000	30.8	h	54.0	-23.2	Avg	0	1.2	Noise Floor, Restricted
4635.000	30.7	h	54.0	-23.3	Avg	0	1.2	Noise Floor, Restricted
9270.000	48.5	v	74.0	-25.5	Pk	0	1.2	Noise Floor, Restricted
8343.000	48.2	h	74.0	-25.8	Pk	0	1.2	Noise Floor, Restricted
9270.000	47.8	h	74.0	-26.2	Pk	0	1.2	Noise Floor, Restricted
7416.000	47.5	v	74.0	-26.5	Pk	0	1.2	Noise Floor, Restricted
5562.000	47.0	v	74.0	-27.0	Pk	0	1.2	Noise Floor, Restricted
8343.000	46.1	v	74.0	-27.9	Pk	0	1.2	Noise Floor, Restricted
3708.000	46.0	h	74.0	-28.0	Pk	0	1.2	Noise Floor, Restricted
4635.000	45.4	v	74.0	-28.6	Pk	0	1.2	Noise Floor, Restricted
3708.000	45.1	v	74.0	-28.9	Pk	0	1.2	Noise Floor, Restricted
7416.000	44.6	h	74.0	-29.4	Pk	0	1.2	Noise Floor, Restricted
5562.000	43.6	h	74.0	-30.4	Pk	0	1.2	Noise Floor, Restricted
4635.000	43.1	h	74.0	-30.9	Pk	0	1.2	Noise Floor, Restricted
2781.000	41.1	v	74.0	-32.9	Pk	0	1.2	Noise Floor, Restricted
2781.000	38.4	h	74.0	-35.6	Pk	0	1.2	Restricted

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.

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
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: 6/14/2004
Test Engineer: Chris Byleckie
Test Location: SVOATS #1
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 via a suitable attenuator (30dB) 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: 20°C
Rel. Humidity: 47%

Summary of Results

Run #	Test Performed	Limit	Result	Comment
1	20dB Bandwidth	15.247(a)	Pass	290 kHz
1	99% Bandwidth	15.247(a)	-	430 kHz
2	Output Power	15.247(b)	Pass	30 dBm / 1.0W
3	Channel Separation	15.247(a)	Pass	400 kHz
3	Channel Occupancy	15.247(a)	Pass	< 400mS per 10 second period
4	Number of Channels	15.247(a)	Pass	63
5	Spurious/ Out-of Band Emissions	15.247(a)	Pass	All out of band emissions > -20dBc

Modifications Made During Testing:

No modifications were made to the EUT during testing

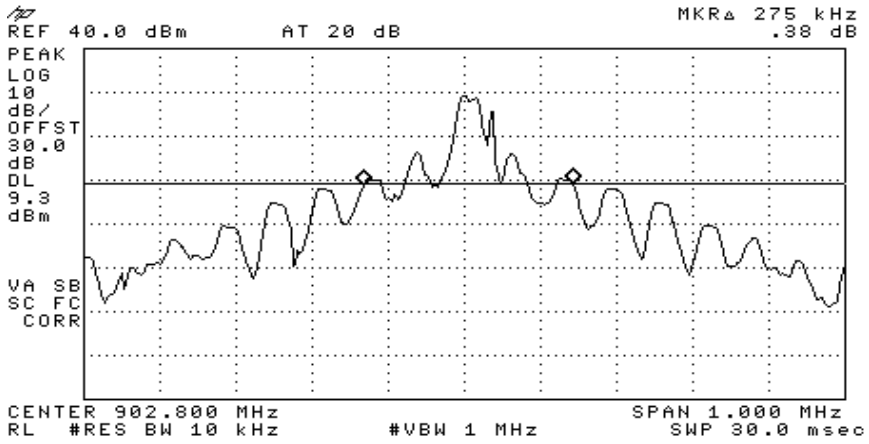
Deviations From The Standard

No deviations were made from the requirements of the standard.

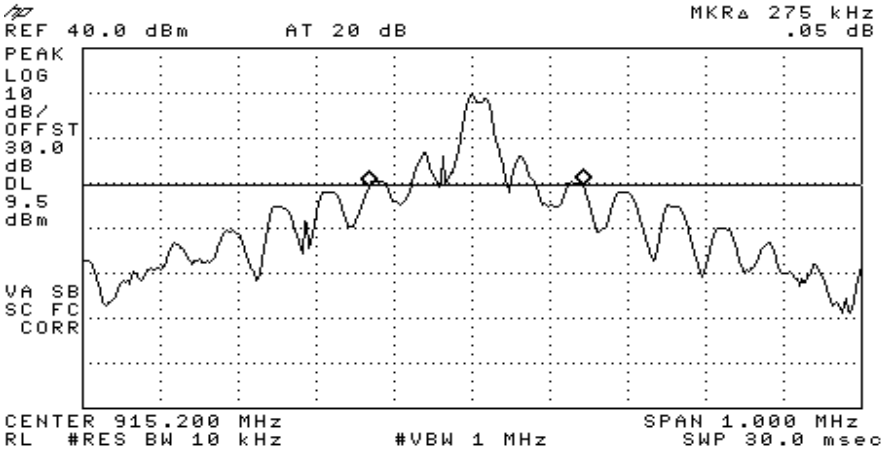
Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1: Bandwidth

Channel	Frequency (MHz)	Res BW	20dB Bandwith	99% Bandwidth
Low	902.8	10KHz	275 kHz	413 kHz
Mid	915.2	10KHz	275 kHz	430 kHz
High	927.4	10KHz	290 kHz	425 kHz

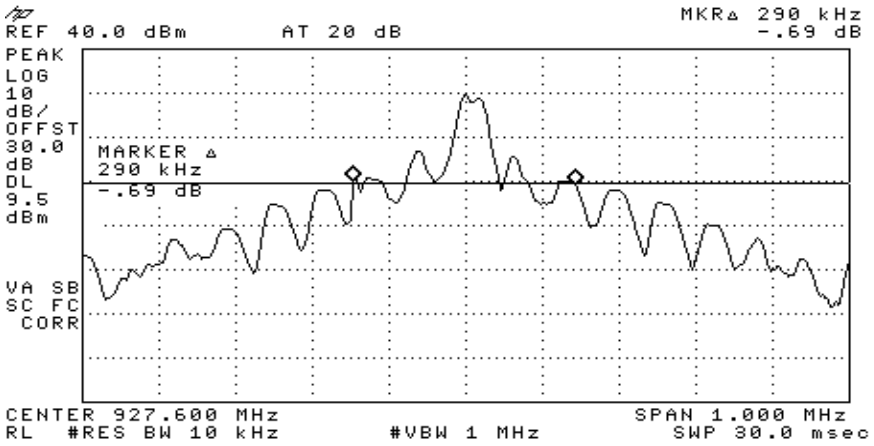


Note: signal level at 902 MHz is >20dB below the fundamental signal level



Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1: 20dB Bandiwdth Continued



Note: signal level at 928 MHz is >20dB below the fundamental signal level

Run #2: Output Power

Measured with a peak power meter

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	902.8	30	1.00
Mid	915.2	30	1.00
High	927.6	30	1.00

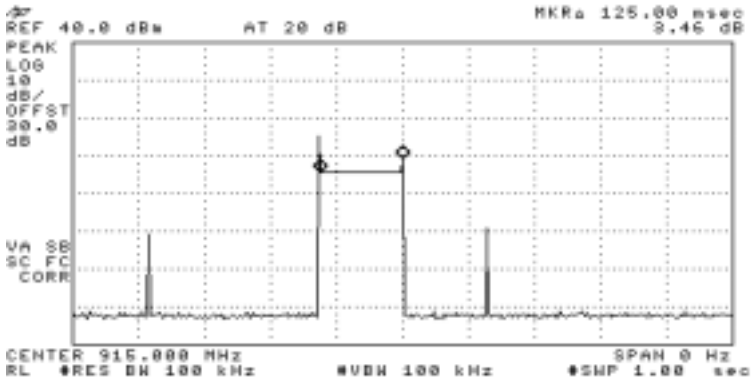
Note 1:	Maximum antenna gain used for this antenna is 6dBi, therefore, maximum permitted power for a system utilizing more than 50 channels is 30dBm (1 Watt)

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

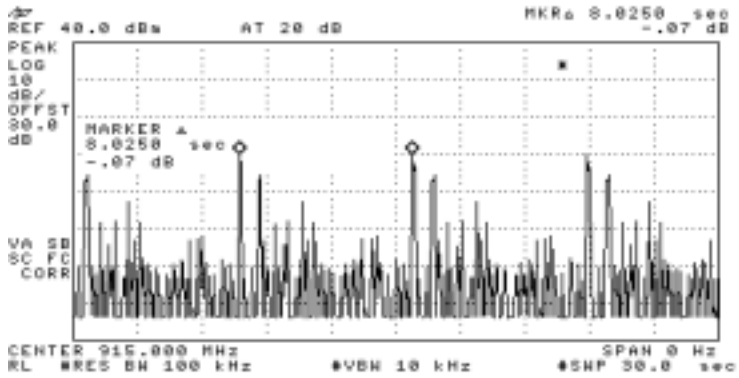
Run #3: Channel Occupancy And Spacing

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

The channel spacing was:	400	kHz	
The minimum channel separation permitted is:	290	kHz	
The transmit time on the center channel in a 20 second period was:	312.5	mS	(125mS every 8 seconds)
The dwell time on the center channel in a 20 second period was:	317.5	mS	(20s / number of channels)
The maximum permitted dwell time in a 10 second period for FCC Part 15.247/RSS 210(o), based on a signal bandwidth >250kHz:	400.0	mS	



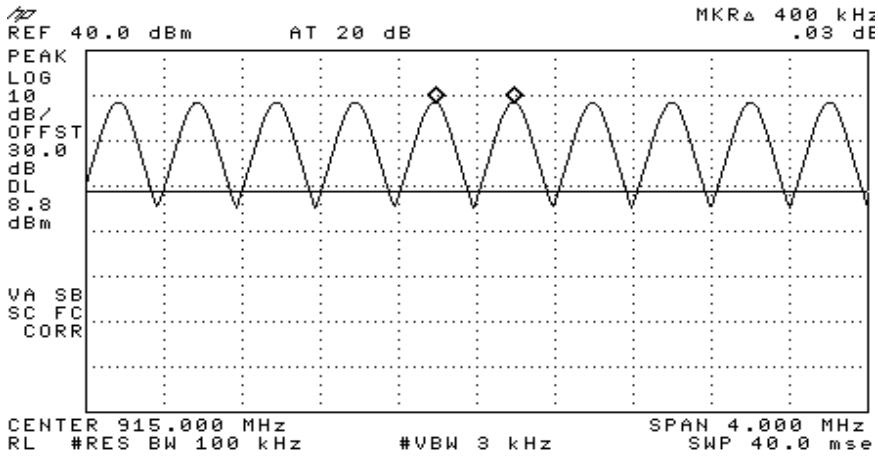
Dwell time on a single channel
125mS



Time between repeating the use of a channel
8 seconds

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #3: Channel Occupancy And Spacing (continued)

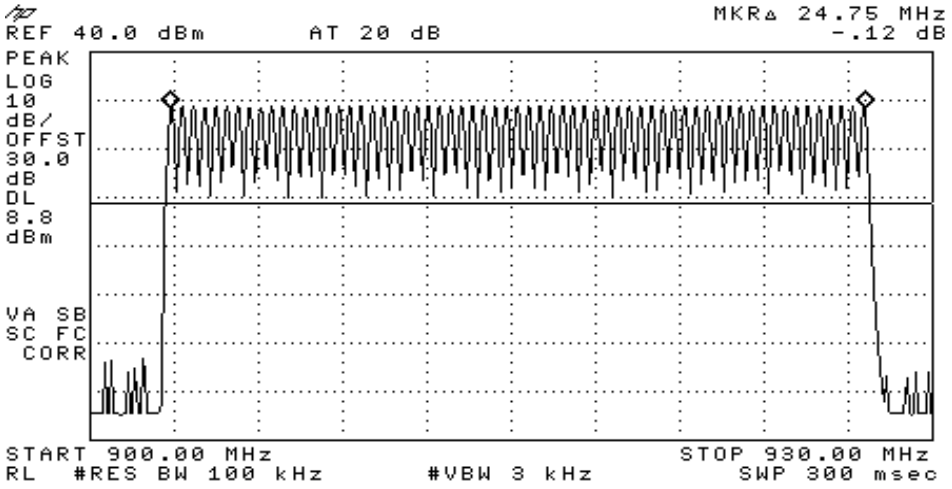


Run #4: Number of Channels

The number of channels was verified with the radio transmitting normally (i.e. In hopping mode)

The number of channels was: 63 between 902.6MHz and 927.4 MHz

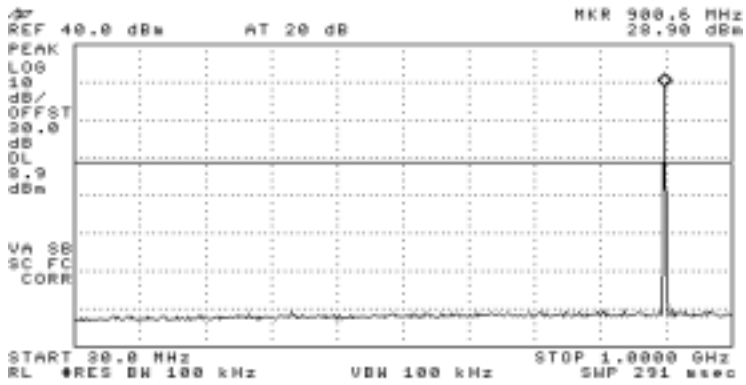
15.247 and RSS 210 require a minimum of 50 channels.



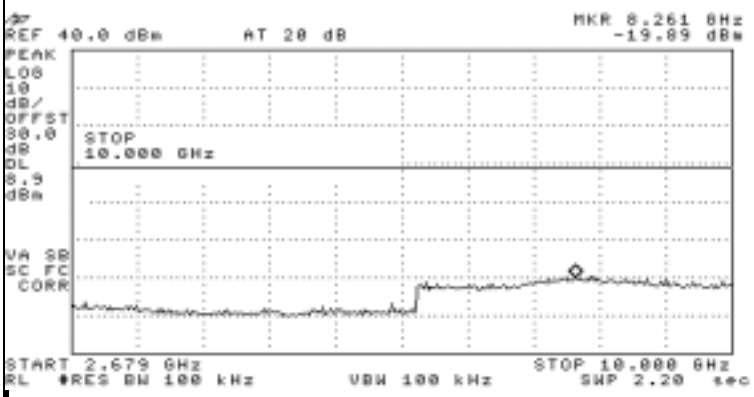
Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #5: Spurious/ Out-of Band Emissions

All spurious emissions were more than 20dB below the fundamental signal level when measured in a 100kHz bandwidth. Refer to the plots below. A plot showing the restricted band that starts at 960 MHz has also been included to demonstarte compliance in that band.



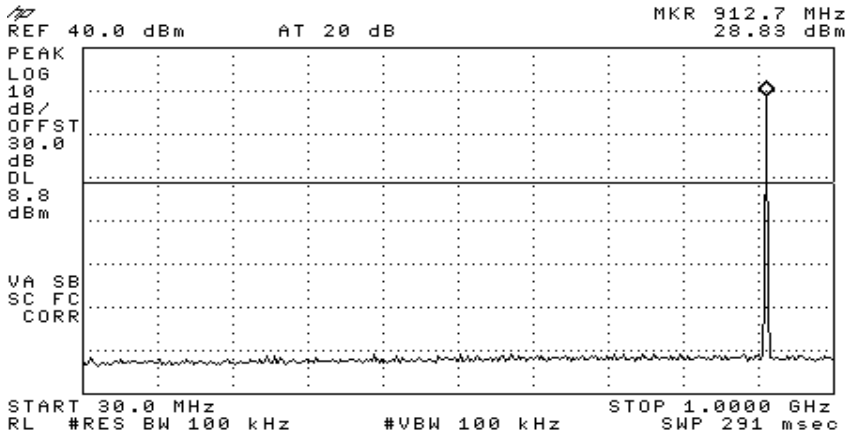
30 - 1000 MHz



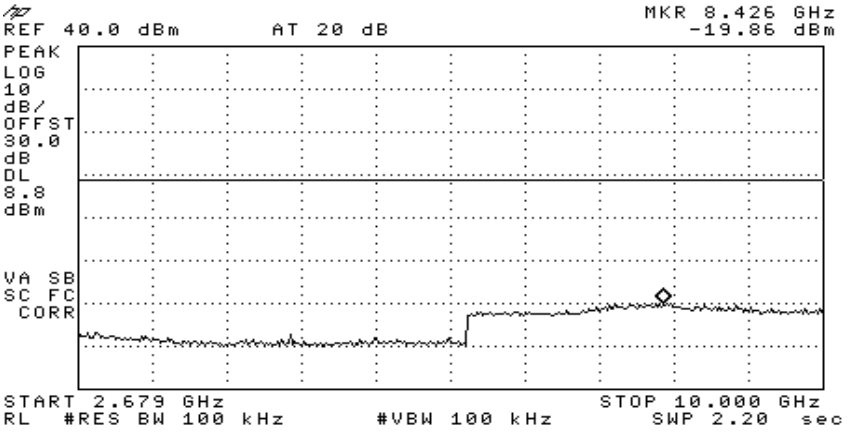
1,000 - 10,000 MHz

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #5: Continued - Spurious emissions, Center Channel



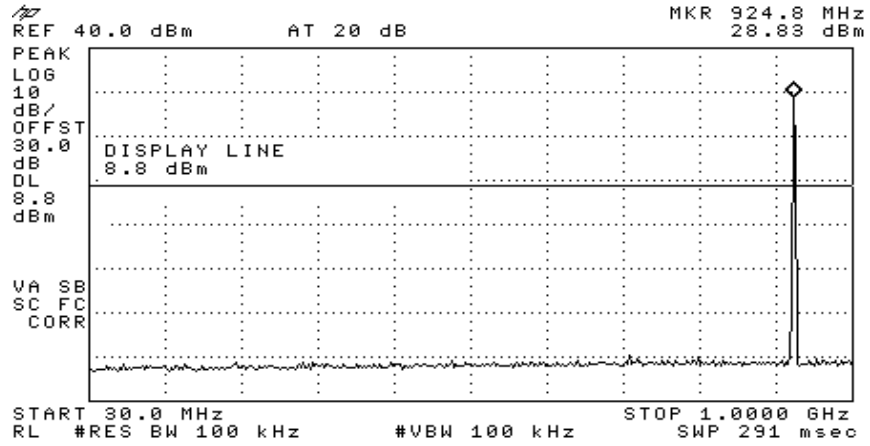
30 - 1000 MHz



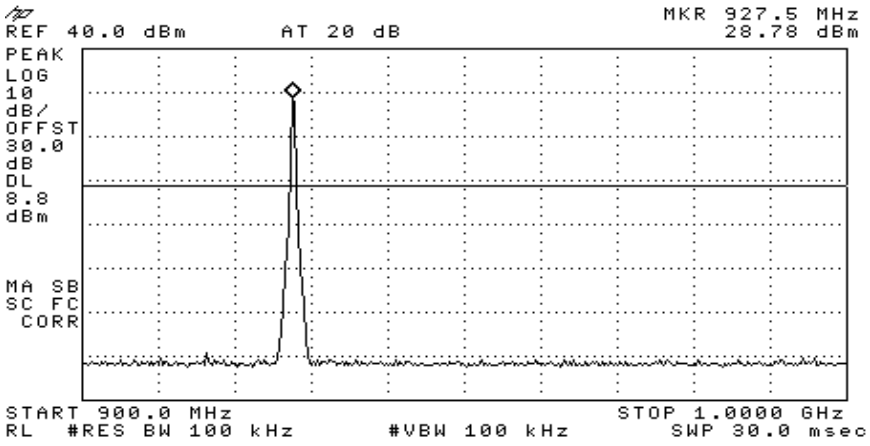
1,000 - 10,000 MHz

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #5: Continued - Spurious emissions, High Channel



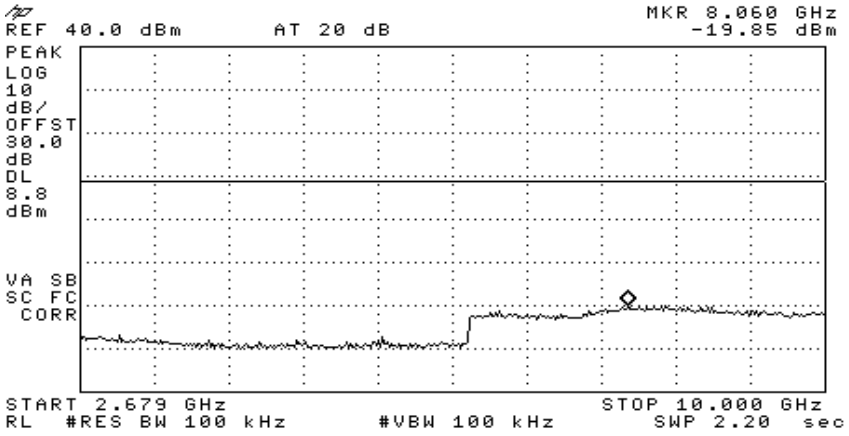
30 - 1000 MHz



960 MHz Restricted Band

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #5: Continued - Spurious emissions, High Channel



1,000 - 10,000 MHz

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Radiated Emissions
Alien 6dBi Circular-Polarized Patch Antenna

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: 6/14/2004
Test Engineer: Chris Byleckie
Test Location: SVOATS #1
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.
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: 22 °C
Rel. Humidity: 59 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 960 - 10000 MHz - Spurious Emissions In Restricted Bands	FCC Part 15.209 / 15.247(c)	Pass	47.4dBµV/m (234.4µV/m) @ 5416.8MHz (-6.6dB)

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

ALR9932-ADEV

Run #1a: Radiated Spurious Emissions, 960 - 10000 MHz. Low Channel @ 902.08 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	127.1	127.1
Limit for emissions outside of restricted bands:	107.1 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	
5416.800	47.4	v	54.0	-6.6	Avg	0	1.0	
5416.800	47.0	h	54.0	-7.0	Avg	0	1.0	
4514.000	44.4	v	54.0	-9.6	Avg	0	1.0	
4514.000	43.7	h	54.0	-10.3	Avg	0	1.0	
3611.200	43.3	h	54.0	-10.7	Avg	0	1.0	
3611.200	43.2	v	54.0	-10.8	Avg	0	1.0	
9028.000	41.5	v	54.0	-12.5	Avg	0	1.0	
9028.000	41.5	h	54.0	-12.5	Avg	0	1.0	
5416.800	60.3	v	74.0	-13.7	Pk	0	1.0	
8125.200	40.3	h	54.0	-13.7	Avg	0	1.0	
8125.200	40.2	v	54.0	-13.8	Avg	0	1.0	
5416.800	59.2	h	74.0	-14.8	Pk	0	1.0	
2708.400	38.0	h	54.0	-16.0	Avg	0	1.0	
2708.400	37.9	v	54.0	-16.1	Avg	0	1.0	
4514.000	57.3	h	74.0	-16.7	Pk	0	1.0	
4514.000	56.9	v	74.0	-17.1	Pk	0	1.0	
3611.200	56.3	h	74.0	-17.7	Pk	0	1.0	
3611.200	55.9	v	74.0	-18.1	Pk	0	1.0	
9028.000	54.1	v	74.0	-19.9	Pk	0	1.0	
8125.200	53.9	h	74.0	-20.1	Pk	0	1.0	
9028.000	53.8	h	74.0	-20.2	Pk	0	1.0	
8125.200	52.6	v	74.0	-21.4	Pk	0	1.0	
2708.400	50.6	h	74.0	-23.4	Pk	0	1.0	
2708.400	50.5	v	74.0	-23.5	Pk	0	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:	No emissions were observed above the noise floor. All readings are noise floor levels

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1b: Radiated Spurious Emissions, 960 - 10000 MHz. Center Channel @ 915.6 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	127.7	127.9
Limit for emissions outside of restricted bands:	107.9 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	
4576.000	44.8	h	54.0	-9.2	Avg	0.0	1.0	
4576.000	44.4	v	54.0	-9.6	Avg	0.0	1.0	
3660.800	42.5	v	54.0	-11.5	Avg	0.0	1.0	
3660.800	42.4	h	54.0	-11.6	Avg	0.0	1.0	
9152.000	42.3	v	54.0	-11.7	Avg	0.0	1.0	
9152.000	42.3	h	54.0	-11.7	Avg	0.0	1.0	
8236.800	40.6	h	54.0	-13.4	Avg	0.0	1.0	
8236.800	40.5	v	54.0	-13.5	Avg	0.0	1.0	
7321.600	38.9	h	54.0	-15.1	Avg	0.0	1.0	
2745.600	38.5	v	54.0	-15.5	Avg	0.0	1.0	
2745.600	38.5	h	54.0	-15.5	Avg	0.0	1.0	
4576.000	58.1	v	74.0	-15.9	Pk	0.0	1.0	
4576.000	57.1	h	74.0	-16.9	Pk	0.0	1.0	
3660.800	55.0	h	74.0	-19.0	Pk	0.0	1.0	
3660.800	54.9	v	74.0	-19.1	Pk	0.0	1.0	
9152.000	54.9	v	74.0	-19.1	Pk	0.0	1.0	
9152.000	54.6	h	74.0	-19.4	Pk	0.0	1.0	
8236.800	53.9	v	74.0	-20.1	Pk	0.0	1.0	
8236.800	53.2	h	74.0	-20.8	Pk	0.0	1.0	
7321.600	51.9	v	74.0	-22.1	Pk	0.0	1.0	
7321.600	51.4	h	74.0	-22.6	Pk	0.0	1.0	
7321.600	31.0	v	54.0	-23.0	Avg	0.0	1.0	
2745.600	50.9	v	74.0	-23.1	Pk	0.0	1.0	
2745.600	50.9	h	74.0	-23.1	Pk	0.0	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:	No emissions were observed above the noise floor. All readings are noise floor levels

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1c: Radiated Spurious Emissions, 960 - 10000MHz. High Channel @ 927.6 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	128.1	128.8
Limit for emissions outside of restricted bands:	108.8 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	
4638.000	44.9	v	54.0	-9.1	Avg	0	1.0	
4638.000	44.3	h	54.0	-9.7	Avg	0	1.0	
3710.400	42.8	h	54.0	-11.2	Avg	0	1.0	
3710.400	42.5	v	54.0	-11.5	Avg	0	1.0	
8348.400	40.6	h	54.0	-13.4	Avg	0	1.0	
7420.800	40.0	h	54.0	-14.0	Avg	0	1.0	
7420.800	39.8	v	54.0	-14.2	Avg	0	1.0	
8348.400	39.7	v	54.0	-14.3	Avg	0	1.0	
2782.800	38.4	h	54.0	-15.6	Avg	0	1.0	
2782.800	38.3	v	54.0	-15.7	Avg	0	1.0	
4638.000	57.7	v	74.0	-16.3	Pk	0	1.0	
4638.000	56.8	h	74.0	-17.2	Pk	0	1.0	
960.080	36.4	v	54.0	-17.6	Avg	174	1.8	Restricted band edge
3710.400	55.2	h	74.0	-18.8	Pk	0	1.0	
3710.400	55.0	v	74.0	-19.0	Pk	0	1.0	
7420.800	53.3	v	74.0	-20.7	Pk	0	1.0	
8348.400	53.2	h	74.0	-20.8	Pk	0	1.0	
8348.400	52.6	v	74.0	-21.4	Pk	0	1.0	
7420.800	52.6	h	74.0	-21.4	Pk	0	1.0	
2782.800	51.0	h	74.0	-23.0	Pk	0	1.0	
2782.800	50.5	v	74.0	-23.5	Pk	0	1.0	
960.080	37.8	v	74.0	-36.2	Pk	26	1.0	Restricted band edge

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:	No emissions were observed above the noise floor. All readings are noise floor levels

Client:	Alien Technology	Job Number:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	

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: 6/14/2004
Test Engineer: Chris Byleckie
Test Location: SVOATS #1
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: 26 °C
Rel. Humidity: 45 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power,120V/60Hz	FCC 15.207	Pass	57.3dBµV @ 0.150MHz (-8.7dB)
2	CE, AC Power,120V/60Hz	RSS-210	Pass	45.9dBµV @ 0.470MHz (-2.1dB)

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:	J55865
Model:	ALR9930-ADEV	T-Log Number:	T55973
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	

EUT transmitting at full power on the central channel

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

Frequency	Level	AC	FCC 15.207		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.150	57.3	Line	66.0	-8.7	QP	
0.185	55.5	Line	64.3	-8.8	QP	
0.150	57.0	Neutral	66.0	-9.0	QP	
0.195	54.4	Neutral	63.8	-9.4	QP	
0.240	52.4	Line	62.1	-9.7	QP	
0.245	51.7	Neutral	61.9	-10.2	QP	
0.470	45.9	Neutral	56.5	-10.6	QP	
0.325	48.3	Line	59.6	-11.3	QP	
0.380	45.8	Neutral	58.3	-12.5	QP	
0.400	44.1	Line	57.9	-13.8	QP	
0.515	41.4	Line	56.0	-14.6	QP	
0.590	38.9	Neutral	56.0	-17.1	QP	
0.240	30.7	Line	52.1	-21.4	Average	
0.515	23.2	Line	46.0	-22.8	Average	
0.245	28.0	Neutral	51.9	-23.9	Average	
0.150	28.1	Line	56.0	-27.9	Average	
0.470	18.1	Neutral	46.5	-28.4	Average	
0.185	25.8	Line	54.3	-28.5	Average	
0.150	27.1	Neutral	56.0	-28.9	Average	
0.195	24.7	Neutral	53.8	-29.1	Average	
0.325	19.5	Line	49.6	-30.1	Average	
0.400	17.6	Line	47.9	-30.3	Average	
0.380	17.9	Neutral	48.3	-30.4	Average	
0.590	13.5	Neutral	46.0	-32.5	Average	
0.810	47.8	Line	56.0	-8.2	QP	Ambient, radio station

Run #2: AC Power Port Conducted Emissions, 0.45 - 30MHz, 120V/60Hz

Frequency	Level	AC	RSS-210		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.470	45.9	Neutral	48.0	-2.1	QP	
0.470	42.2	Line	48.0	-5.8	QP	
0.515	41.4	Line	48.0	-6.6	QP	
0.815	40.0	Neutral	48.0	-8.0	QP	
0.590	38.9	Neutral	48.0	-9.1	QP	
0.590	36.8	Line	48.0	-11.2	QP	
0.810	47.8	Line	56.0	-8.2	QP	Ambient, radio station

EXHIBIT 3: Test Configuration Photographs

4 Pages

EXHIBIT 4: Proposed FCC ID Label & Label Location

Label 1 Page
Label Placement 1 Page

EXHIBIT 5: Detailed Photographs of Alien Technology Model ALR9932-ADEVConstruction

Alien External Photographs	1 Page
Alien BC Photographs	1 Page
Alien Internal Photographs	1 Page
WJ Internal Photographs	7 Pages

EXHIBIT 6: Operator's Manual for Alien Technology Model ALR9932-ADEV

Quick Start Guide 17 Pages

EXHIBIT 7: Block Diagram of Alien Technology Model ALR9932-ADEV

WJ Block Diagram 1 Page
Alien Block Diagram 1 Page

EXHIBIT 8: Schematic Diagrams for Alien Technology Model ALR9932-ADEV

WJ Schematics 4 Pages
Alien Schematics 1 Page

EXHIBIT 9: Theory of Operation for Alien Technology Model ALR9932-ADEV

WJ Theory of Operation 4 Pages
Alien Theory of Operation 4 Pages
WJ Bill of Materials 10 Pages

EXHIBIT 10: RF Exposure Information

Alien MPE Calculations 1 Pages