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Electromagnetic Emissions Test Report and Request for Class II Permissive Change pursuant to FCC Part 15, Subpart C FHSS Specifications and Industry Canada RSS 210 Issue 5 for an Intentional Radiator on the Alien Technology Model: ALR-9640

FCC ID:	P65ALR9640
UPN:	4370A-ALR9640
GRANTEE:	Alien Technology 18220 Butterfiled Blvd. Morgan Hill, CA 95037
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	November 1, 2004
FINAL TEST DATE:	October 25 and October 26, 2004
AUTHORIZED SIGNATORY:	Mark Briggs Vice President of Engineering

ACCREDITED

DECLARATIONS OF COMPLIANCE

Equipment Name and Model:
ALR-9640

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

Tested to applicable standards:
RSS-210, Issue 5, November 2001 (Low Power License-Exempt Radiocommunication Devices)
FCC Part 15.407 (UNII)

Measurement Facility Description Filed With Department of Industry:

Departmental Acknowledgement Number: IC2845 **SV1** Dated July 30, 2001

I declare that the testing was performed or supervised by me; that the test measurements were made in accordance with the above mentioned departmental standards (through the use of ANSI C63.4 as detailed in section 5.3 of RSS-210, Issue 5); and that the equipment performed in accordance with the data submitted in this report.

Signature	
Name	Mark Briggs
Title	Vice President of Engineering
Company	Elliott Laboratories Inc.
Address	684 W. Maude Ave Sunnyvale, CA 94086 USA
Date:	November 1, 2004

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

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SCOPE

An electromagnetic emissions test has been performed on the Alien Technology model ALR-9640 pursuant to Subpart C of Part 15 of FCC Rules for Unlicensed National Information Infrastructure (UNII) devices 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 C63.4-2001 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-9640 and therefore apply only to the tested sample. The sample was selected and prepared by Richard Davidson of 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 that are subsequently manufactured.

SUMMARY OF RESULTS

Note – remove references in the table below that do not apply to the radio tested

FCC Part 15 Section	RSS 210 Section	Description	Measured Value	Comments	Result
	6.2.2(o)(a)	20dB Bandwidth	250 kHz	The channel spacing shall be greater than the 20dB bandwidth	Complies
	6.2.2(o)(a)	Channel Separation	400 kHz		Complies
	6.2.2(o)(a)	Number of Channels	63	**902- 928 MHz**: 50 hopping frequencies: average time of occupancy <0.4 second within a 20 second period.	Complies
	6.2.2(o)(a)	Channel Dwell Time	0.318 seconds per 20 seconds		Complies
	6.2.2(o)(a)	Channel Utilization	All channels are used equally	Refer to Theory of Operations for detailed description of the hopping algorithm.	Complies
15.247 (b) (3)	6.2.2(o)(a)	Output Power, 2400 - 2483.5 MHz	29.9 dBm (0.98 Watts) EIRP = 3.9 W	**902 – 928 MHz** Maximum permitted is 1Watt, with EIRP limited to 4 Watts for a 50-channel system.	Complies
15.247(c)	6.2.2(o)(e1)	Spurious Emissions – 30MHz – 25GHz	All spurious emissions < -20dBc	All spurious emissions < -20dBc.	Complies
15.247(c) / 15.209		Radiated Spurious Emissions 30MHz – 25GHz	45.1dBµV/m (178.9µV/m) @ 4638.0MHz (-9.0dB)	Emissions in restricted bands must meet the radiated emissions limits detailed in 15.207. All others must be < -20dBc	Complies
15.207		AC Conducted Emissions	41.1dBµV @ 0.611MHz (-4.9dB)		Complies
	6.6	AC Conducted Emissions	44.1dBµV @ 0.611MHz (-3.9dB)		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		Integral Antenna	Dual feed, cross polarized linear patch	Integral antenna or specialized connector required	Complies

EIRP calculated using antenna gain of 6dBi for the highest EIRP point-to-multipoint 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 ALR-9640 is a frequency hopping spread spectrum transceiver that is designed to read RFID tags in commercial and industrial locations, primarily in warehouses, for tracking high quantities of goods in and out of storage. It may also be installed in the receiving area of larger retail outlets. Normally, the EUT would be mounted to a wall during operation. The EUT was 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, 1.5 Amps.

The sample was received on October 25, 2004 and tested on October 25 and October 26, 2004. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Alien Technology	ALR-9640	Smartenna transceiver	ALR9640-04-00142	P65ALR9640

OTHER EUT DETAILS

The EUT is provided with an AC adapter manufactured by JET model RHE-120250-6.

ENCLOSURE

The EUT enclosure is primarily constructed of metal and plastic. It measures approximately 22 cm wide by 3 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
IBM	Thinkpad type 2378	Laptop	99-BV558	DoC
Alien	-	IO tester	-	-

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)
Serial	Laptop	multiwire	Shielded	2
Network	Laptop	Cat 5	Unsheilded	3
IO	IO Tester	Multiwire	Shielded	2
DC input	AC Adapter	2 wire	Unsheilded	1.5
AC Adapter input	AC Mains	3 wire	Unsheilded	1

EUT OPERATION DURING TESTING

The device was transmitting continuously (CW) on the specified channel (spurious emissions measurements and power/bandwidth measurements) or hopping across all available channels (occupancy and channel spacing measurements). Normally, the transmissions consist of pulses, 1.8ms long with a period of 5ms in continuous mode.

ANTENNA REQUIREMENTS

The antenna is an internal, dual feed, cross polarized linear patch, with a maximum of 6dBi gain.

PROPOSED MODIFICATION DETAILS

The proposed change is to modify the modulation depth of the transmitted signal. This is achieved with no change in hardware. No other changes to the device are proposed.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on October 25 and October 26, 2004at the Elliott Laboratories Open Area Test Site #1 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Federal Communications Commission. In accordance with Industry Canada rules detailed in RSS 210 Issue 5 and RSS-212, construction, calibration, and equipment data for the test sites have been filed with the Federal Communications Commission.

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

CONDUCTED EMISSIONS CONSIDERATIONS

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

RADIATED EMISSIONS CONSIDERATIONS

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

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

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

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

INSTRUMENT CONTROL COMPUTER

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

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

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

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

POWER METER

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

FILTERS/ATTENUATORS

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

ANTENNAS

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

ANTENNA MAST AND EQUIPMENT TURNTABLE

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

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

INSTRUMENT CALIBRATION

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

TEST PROCEDURES

EUT AND CABLE PLACEMENT

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

CONDUCTED EMISSIONS

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

RADIATED EMISSIONS

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

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

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

CONDUCTED EMISSIONS FROM ANTENNA PORT

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

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

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

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

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

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

where P is the eirp (Watts)

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

FCC 15.407 (a)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

Radiated Emissions, 30 - 1,000 MHz, 25-Oct-04
Engineer: Rafael Varelas

Manufacturer	Description	Model #	Asset #	Cal Due
Elliott Laboratories	FCC / CISPR LISN	LISN-3, OATS	304	01-Jul-05
EMCO	Biconical Antenna, 30-300 MHz	3110B	801	09-Jul-05
Fischer Custom Comm.	LISN, Freq. 0.9 -30 MHz,16 Amp	FCC-LISN-50/250-16-2	1079	01-Jul-05
Rohde & Schwarz	Test Receiver, 9kHz-2750MHz	ESCS 30	1337	05-Jan-05
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1347	28-Oct-04
Rohde& Schwarz	Pulse Limiter	ESH3 Z2	1398	12-Jan-05

Conducted and Radiated Emissions, 30 - 10,000 MHz, 26-Oct-04
Engineer: David Bare

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	High Pass filter, 1.5GHz	P/N 84300-80037 (84125C)	1154	11-Jun-05
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	1242	19-Oct-06
Hewlett Packard	EMC Spectrum Analyzer, 9KHz - 22GHz	8593EM	1319	20-Nov-04
Rohde & Schwarz	Test Receiver, 9kHz-2750MHz	ESCS 30	1337	05-Jan-05
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1347	28-Oct-04
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	23-Jan-05

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T57676 20 Pages

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	
Contact:	Greg Katterhagen		
Emissions Spec:	FCC15.247; FCC 15 Subpart B	Class:	B
Immunity Spec:	-	Environment:	-

EMC Test Data

For The

Alien Technology

Model

ALR-9640

Date of Last Test: 10/26/2004

Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	
Contact:	Greg Katterhagen		
Emissions Spec:	FCC15.247; FCC 15 Subpart B	Class:	B
Immunity Spec:	-	Environment:	-

EUT INFORMATION

General Description

The EUT is a frequency hopping spread spectrum transceiver that is designed to read RFID tags in commercial and industrial locations, primarily in warehouses, for tracking high quantities of goods in and out of storage. It may also be installed in the receiving area of larger retail outlets. Normally, the EUT would be mounted to a wall during operation. The EUT was 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, 1.5 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Alien Technology	ALR-9640	Smartenna transceiver	ALR9640-04-00142	P65ALR9640

Other EUT Details

The EUT is provided with an AC adapter manufactured by JET model RHE-120250-6.

EUT Enclosure

The EUT enclosure is primarily constructed of metal and plastic. It measures approximately 22 cm wide by 3 cm deep by 28 cm high.

Modification History

Mod. #	Test	Date	Modification
1	-	-	None

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

Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	
Contact:	Greg Katterhagen		
Emissions Spec:	FCC15.247; FCC 15 Subpart B	Class:	B
Immunity Spec:	-	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
IBM	Thinkpad type 2378	Laptop	99-BV558	DoC
Alien	-	IO tester	-	-

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Serial	Laptop	multiwire	Shielded	2
Network	Laptop	Cat 5	Unsheilded	3
IO	IO Tester	Multiwire	Shielded	2
DC input	AC Adapter	2 wire	Unsheilded	1.5
AC Adapter input	AC Mains	3 wire	Unsheilded	1

EUT Operation During Testing - Transmitter-Related Emissions

The device was transmitting continuously (CW) on the specified channel (spurious emissions measurements and power/bandwidth measurements) or hopping across all available channels (occupancy and channel spacing measurements). Normally, the transmissions consist of pulses, 1.8ms long with a period of 5ms in continuous mode.

EUT Operation During Testing - Digital Device Emissions

The device was powered on with the RF off. The laptop was powered on.

Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	B

Radiated Emissions

Test Specifics

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

Date of Test: 10/25/2004
Test Engineer: Rafael Varelas
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 emissions testing.

Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Ambient Conditions:

Temperature: 17 °C
Rel. Humidity: 50 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 -1000 MHz, Preliminary Scan	FCC B	Eval	Refer to individual runs
2	RE, 30 - 1000MHz, Maximized Emissions	FCC B	Pass	-2.7dB @ 499.560MHz

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:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	B

Run #1: Preliminary Radiated Emissions, 30-1000 MHz
Radio in stand by mode

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
499.560	43.3	H	46.0	-2.7	QP	225	1.0	Laptop Ethernet
499.560	42.7	V	46.0	-3.3	QP	180	1.0	Laptop Ethernet
166.460	36.0	V	43.5	-7.5	QP	20	1.0	
166.460	35.5	H	43.5	-8.0	QP	345	2.2	
364.505	34.8	H	46.0	-11.2	QP	330	1.0	
320.000	33.6	H	46.0	-12.4	QP	320	1.0	
458.626	33.1	V	46.0	-12.9	QP	185	1.0	
100.211	28.2	V	43.5	-15.3	QP	120	1.0	EUT + Ambient signal
114.540	28.0	V	43.5	-15.5	QP	205	1.0	
364.505	30.5	V	46.0	-15.5	QP	315	1.0	
200.430	27.5	V	43.5	-16.0	QP	70	1.0	
458.626	30.0	H	46.0	-16.0	QP	60	1.0	
72.140	23.6	V	40.0	-16.4	QP	130	1.0	
320.000	28.2	V	46.0	-17.8	QP	207	1.0	
229.080	27.6	V	46.0	-18.4	QP	340	1.0	
114.540	24.8	H	43.5	-18.7	QP	200	2.7	
143.164	23.4	V	43.5	-20.1	QP	350	1.0	
916.340	25.3	H	46.0	-20.7	QP	15	1.0	
596.416	25.3	H	46.0	-20.7	QP	360	1.0	

Run #2: Maximized Readings From Run #1
Radio in stand by mode

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
499.560	43.3	H	46.0	-2.7	QP	230	1.0	Laptop Ethernet
499.560	42.7	V	46.0	-3.3	QP	185	1.0	Laptop Ethernet
166.460	36.0	V	43.5	-7.5	QP	30	1.0	
166.460	35.5	H	43.5	-8.0	QP	360	2.2	
364.505	34.8	H	46.0	-11.2	QP	325	1.0	
320.000	33.6	H	46.0	-12.4	QP	330	1.0	

Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	B

Conducted Emissions - Power Ports

Test Specifics

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

Date of Test: 10/25/2004
Test Engineer: Rafael Varelas
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: 17 °C
Rel. Humidity: 50 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power,120V/60Hz	FCC 15.207 FCC 15.107	Pass	41.1dBµV @ 0.611MHz (-4.9dB)
1	CE, AC Power,120V/60Hz	RSS 210	Pass	44.1dBµV @ 0.611MHz (-3.9dB)

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:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	B

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz
Radio set to normal hopping operation

Frequency	Level	AC	FCC 15.207 / 15.107		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.611	41.1	N	46.0	-4.9	Average	
0.548	39.9	N	46.0	-6.1	Average	
0.611	39.7	L	46.0	-6.3	Average	
0.611	44.1	N	56.0	-11.9	QP	
0.611	42.7	L	56.0	-13.3	QP	
0.548	42.2	N	56.0	-13.8	QP	
0.243	34.3	L	52.0	-17.7	Average	
0.177	34.1	N	54.6	-20.5	Average	
0.243	41.3	L	62.0	-20.7	QP	
0.177	41.2	N	64.6	-23.4	QP	
0.177	29.5	L	54.6	-25.1	Average	
0.177	39.4	L	64.6	-25.2	QP	

Frequency	Level	AC	RSS 210		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.611	44.1	N	48.0	-3.9	QP	
0.611	42.7	L	48.0	-5.3	QP	
0.548	42.2	N	48.0	-5.8	QP	

Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	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: 10/26/2004
Test Engineer: David Bare
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.

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: 16 °C
Rel. Humidity: 51 %

Summary of Results

Run #	Test Performed	Limit	Result	Result / Margin
1	RE, 30 - 9276 MHz - Spurious Emissions In Restricted Bands	FCC Part 15.209 / 15.247(c)	Pass	45.1dBµV/m (178.9µV/m) @ 4638.0MHz (-9.0dB)
2	20dB Bandwidth	15.247(a)	Pass	245 kHz
3	Output Power	15.247(b)	Pass	0.977 W
4	Channel Occupancy / Separation	15.247(a)	Pass	317.5 ms / 400 kHz
5	Number of Channels	15.247(a)	Pass	63 channels
6	CE, 30-9276 MHz - Spurious Emissions	15.247(c)	Pass	> 52 dBc

Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	N/A

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Run #1a: Radiated Spurious Emissions, 30 - 9028 MHz. Low Channel @ 902.8 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	114.8	126.5
Limit for emissions outside of restricted bands:	106.5 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	
3611.005	41.9	H	54.0	-12.1	AVG	0	1.0	Noise floor
3611.110	41.8	V	54.0	-12.2	AVG	0	1.0	Noise floor
2708.325	39.5	H	54.0	-14.5	AVG	0	1.1	
2708.400	37.9	V	54.0	-16.1	AVG	30	1.0	
3611.005	53.3	H	74.0	-20.7	PK	0	1.0	Noise floor
3611.110	53.2	V	74.0	-20.8	PK	0	1.0	Noise floor
2708.400	49.1	V	74.0	-24.9	PK	30	1.0	
2708.325	48.9	H	74.0	-25.1	PK	0	1.1	
1805.555	67.7	H	106.5	-38.8	PK	5	1.4	
1805.548	67.5	V	106.5	-39.1	PK	20	1.2	

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 other emissions were found above the noise floor of the measurement system.

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	N/A

Run #1b: Radiated Spurious Emissions, 30 - 9152 MHz. Center Channel @ 915.2 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	120.3	128
Limit for emissions outside of restricted bands:	108 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	
3661.123	42.0	H	54.0	-12.0	AVG	2	1.0	Noise floor
3661.835	41.9	V	54.0	-12.1	AVG	0	1.0	Noise floor
2745.653	39.1	H	54.0	-14.9	AVG	2	1.2	
2744.280	37.7	V	54.0	-16.3	AVG	0	1.0	
3661.123	53.3	H	74.0	-20.7	PK	2	1.0	Noise floor
3661.835	52.6	V	74.0	-21.4	PK	0	1.0	Noise floor
2745.653	49.7	H	74.0	-24.3	PK	2	1.2	
2744.280	48.5	V	74.0	-25.5	PK	0	1.0	
1830.378	63.0	V	108.0	-45.0	PK	4	1.4	
1830.348	62.0	H	108.0	-46.0	PK	3	1.1	

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 other emissions were found above the noise floor of the measurement system.

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	N/A

Run #1c: Radiated Spurious Emissions, 30 - 9276 MHz. High Channel @ 927.6 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	122.8	128.6
Limit for emissions outside of restricted bands:	108.6 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	
4638.038	45.1	V	54.0	-9.0	AVG	0	1.0	Noise floor
973.600	44.9	v	54.0	-9.1	QP	0	1.0	
4638.608	44.9	H	54.0	-9.1	AVG	0	1.0	Noise floor
3710.805	42.1	V	54.0	-11.9	AVG	0	1.0	Noise floor
3709.560	42.0	H	54.0	-12.0	AVG	0	1.0	Noise floor
2782.800	39.4	V	54.0	-14.6	AVG	33	1.2	
2782.800	39.2	H	54.0	-14.8	AVG	29	1.4	
4638.038	56.4	V	74.0	-17.7	PK	0	1.0	Noise floor
4638.608	55.6	H	74.0	-18.4	PK	0	1.0	Noise floor
967.600	35.4	v	54.0	-18.6	QP	0	1.0	
3710.805	54.9	V	74.0	-19.1	PK	0	1.0	Noise floor
3709.560	52.8	H	74.0	-21.2	PK	0	1.0	Noise floor
2782.763	49.6	H	74.0	-24.4	PK	29	1.4	
2782.328	49.6	V	74.0	-24.4	PK	33	1.2	
1855.155	60.5	V	108.6	-48.1	PK	0	1.7	
1855.148	57.5	H	108.6	-51.1	PK	360	1.1	

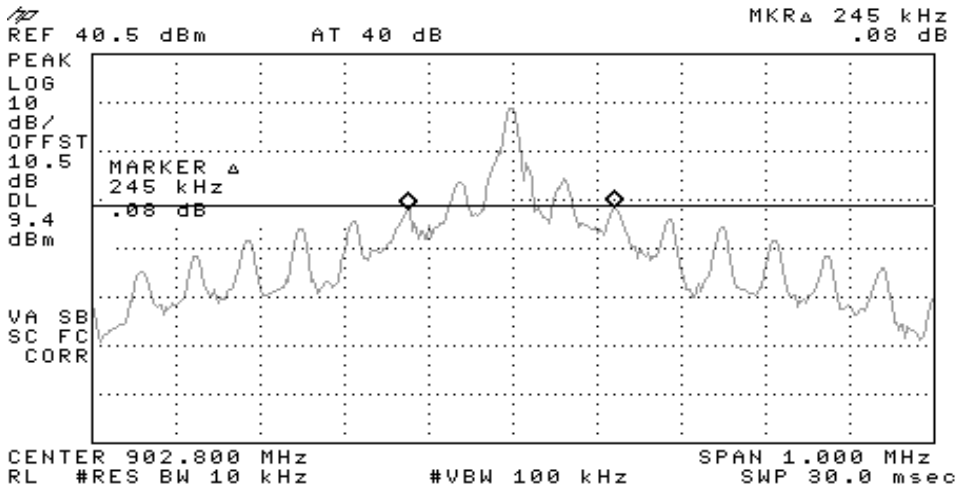
Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.
Note 2:	No other emissions were found above the noise floor of the measurement system.

Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	N/A

Run #2: Signal Bandwidth

Channel	Frequency (MHz)	Resolution Bandwidth	20dB Signal Bandwidth	
Low	902.8	10 Khz	245	
Mid	915.2	10 kHz	243	
High	927.6	10 Khz	243	

Note 1:	20dB bandwidth must be less than the channel separation.



Run #3: Output Power

Channel	Frequency (MHz)	Res BW	Output Power	Power (watts)	Software Power Setting
Low	902.8	3 MHz	29.7	0.93	01 26
Mid	915.2	3 MHz	29.9	0.98	01 26
High	927.6	3 MHz	29.8	0.95	01 26

Note 1:	Power measured using a spectrum analyzer, RBW=VBW = 3 MHz
Note 2:	Maximum allowed output power is 1 Watt, given the maximum antenna gain is 6dBi.

Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	N/A

Run #4: Channel Occupancy And Spacing

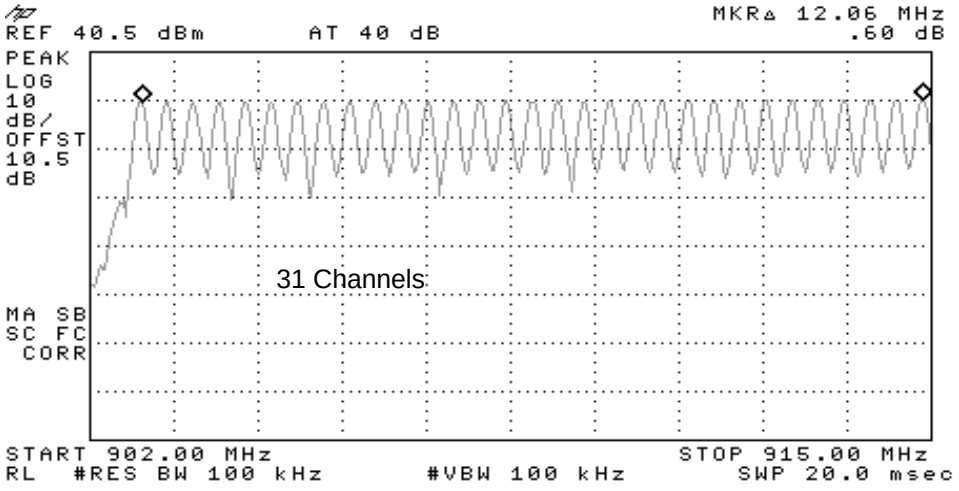
The channel occupancy was measured with the radio transmitting normally (i.e. In hopping mode)

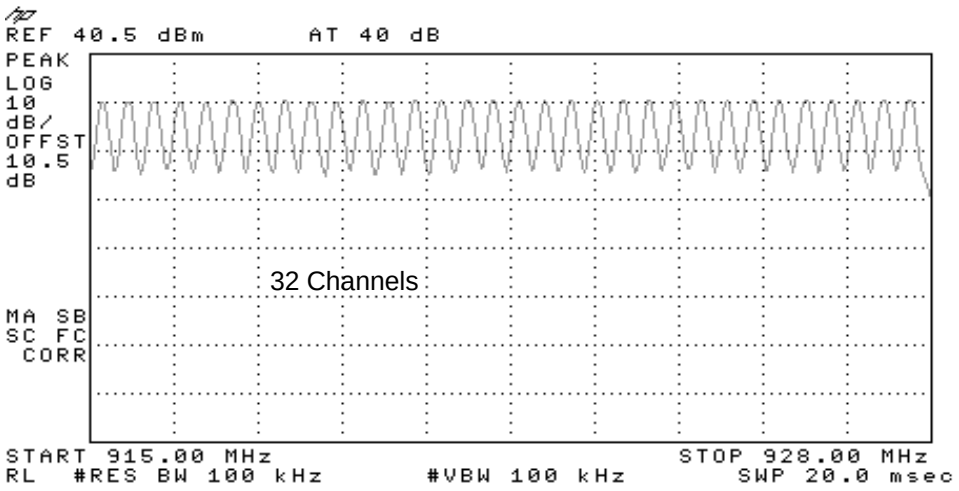
The channel spacing is:	400 kHz
The transmit time on a single channel per transmission:	105 ms
The time between successive transmissions on a channel is:	6 s
The channel occupancy per 20 seconds is:	317.5 ms

Run #5: Number of Channels

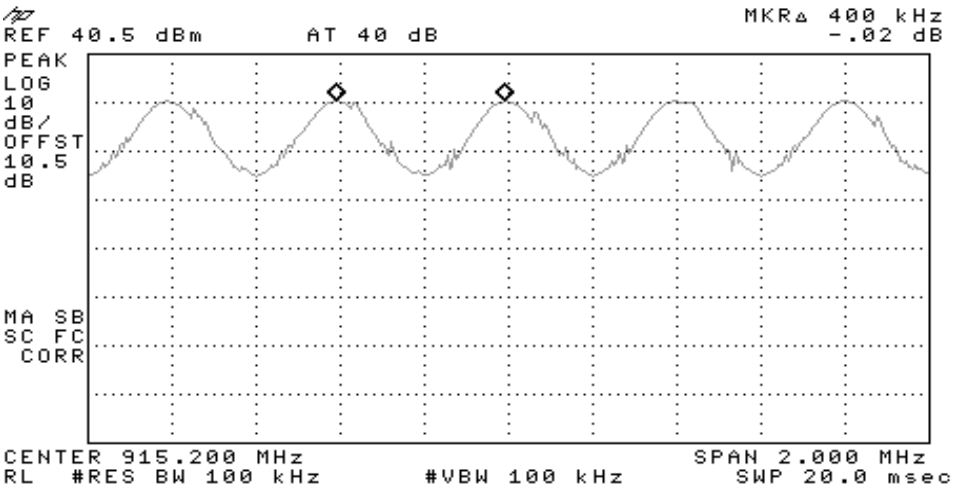
The number of channels was verified with the radio transmitting normally (i.e. In hopping mode)

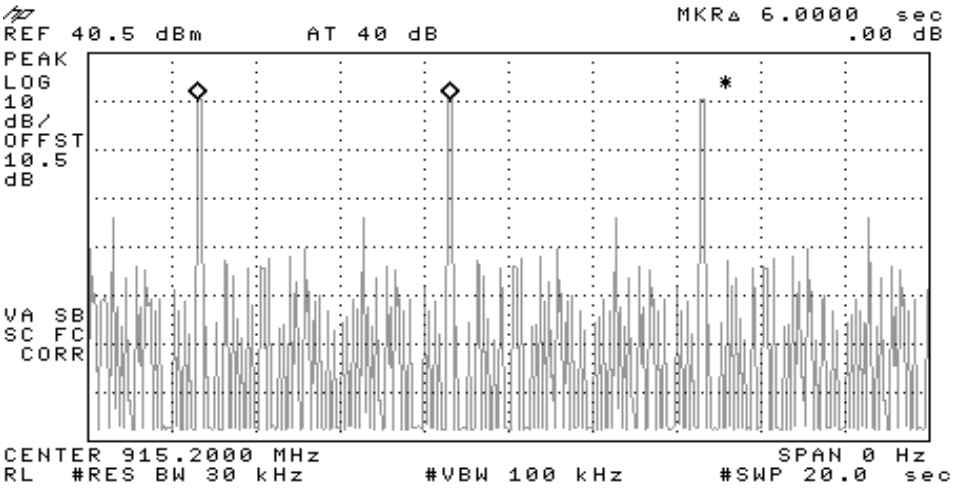
The number of channels is:	63



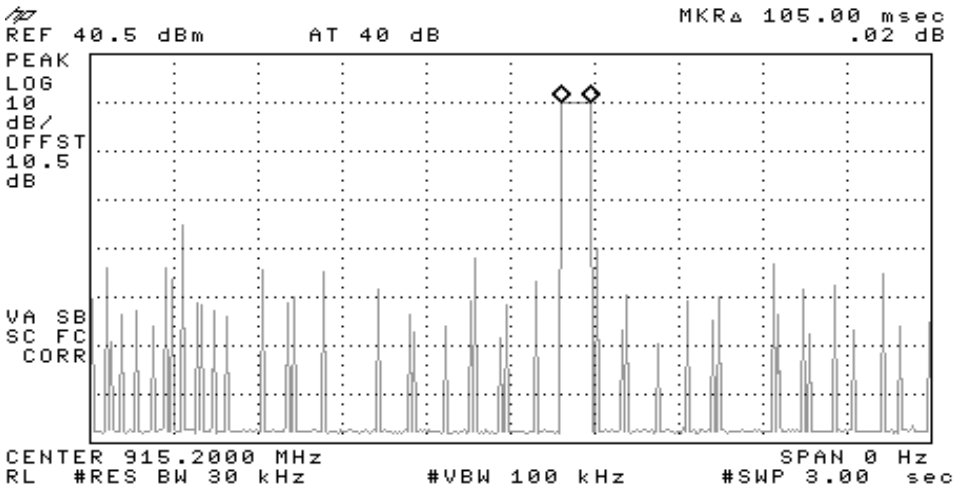


Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	N/A



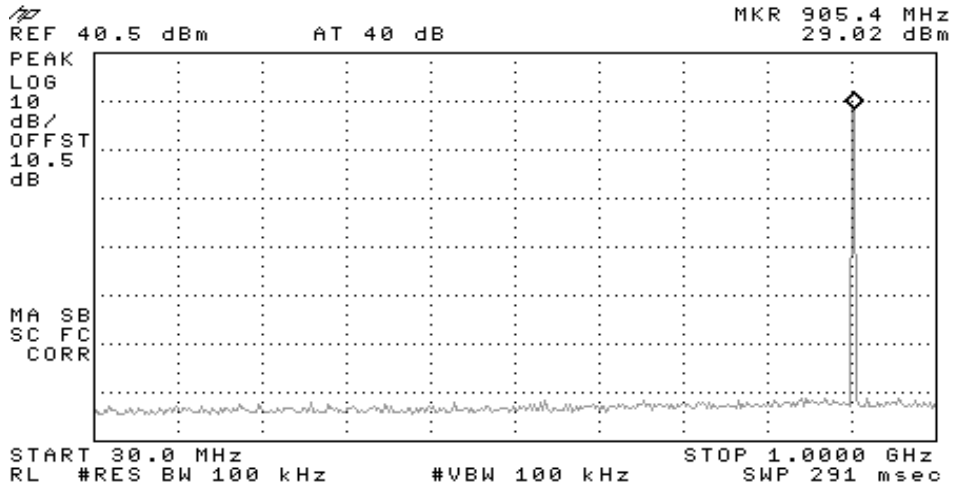


Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	N/A

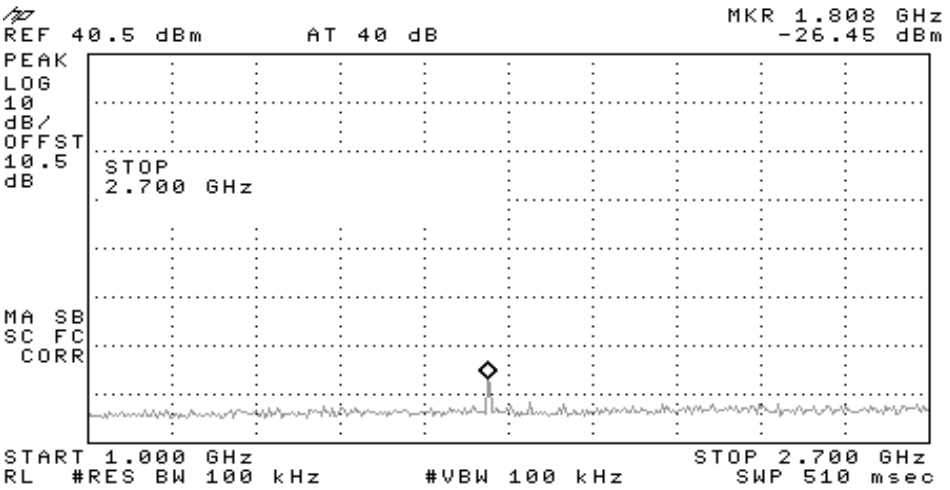


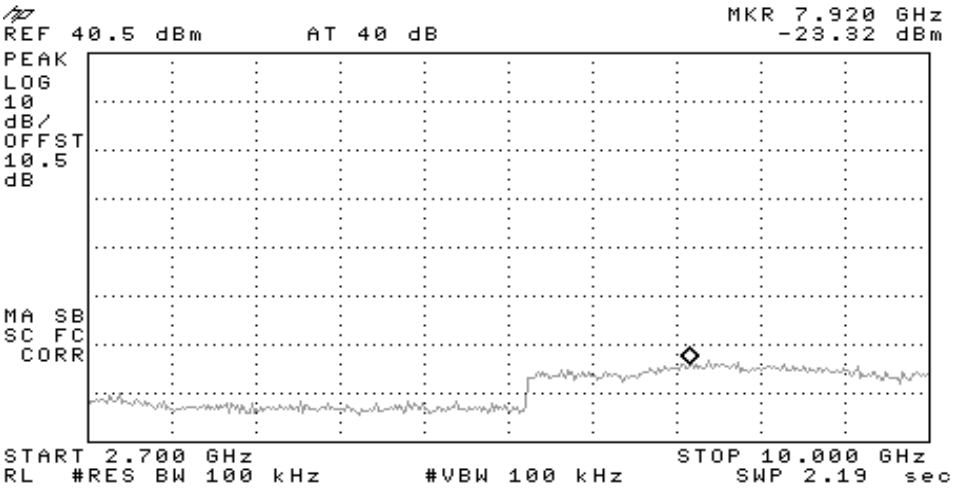
Run #6 Out of Band Emissions

Low Channel = 902.8



Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	N/A

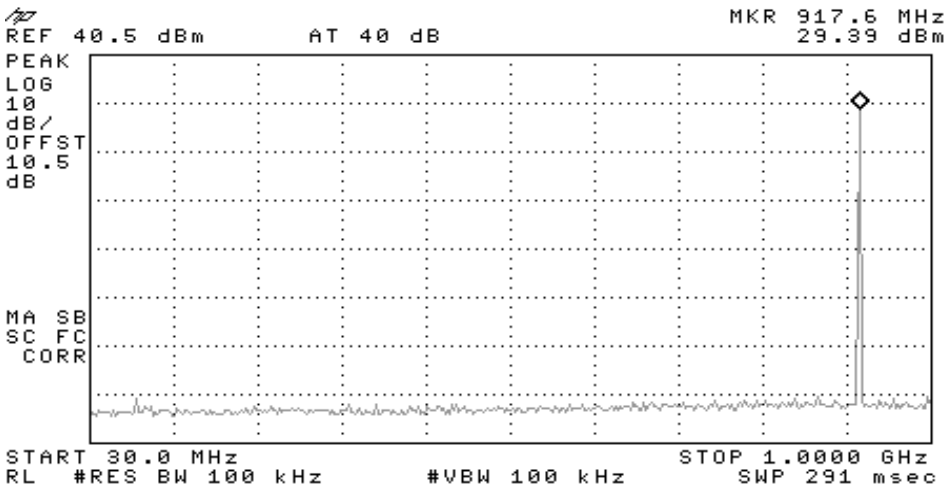


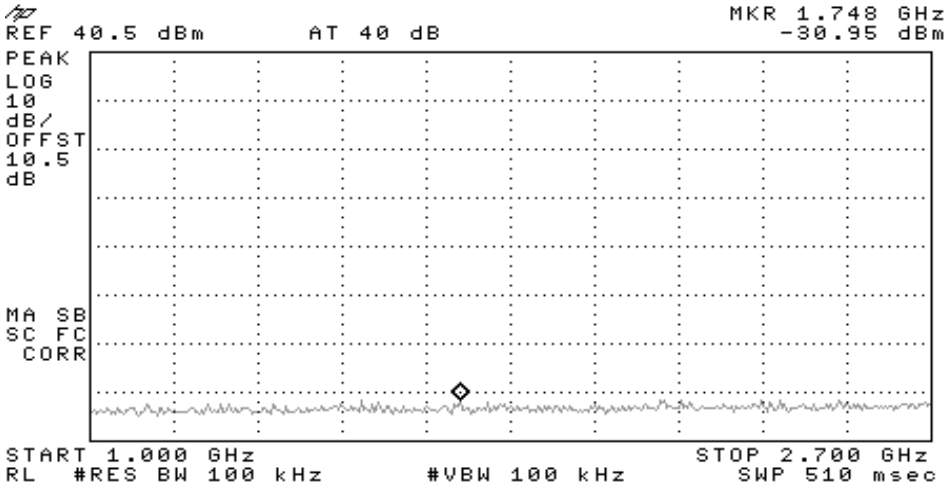


EMC Test Data

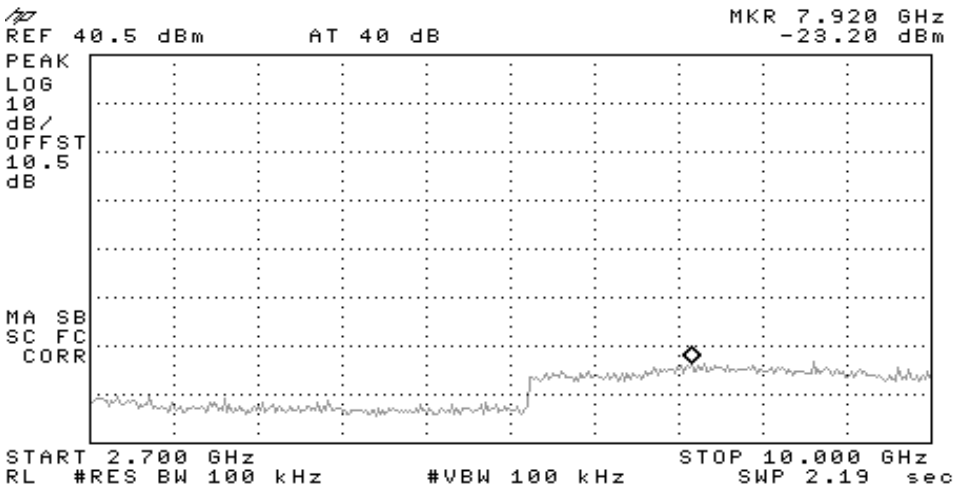
Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	N/A

Mid Channel = 915.2

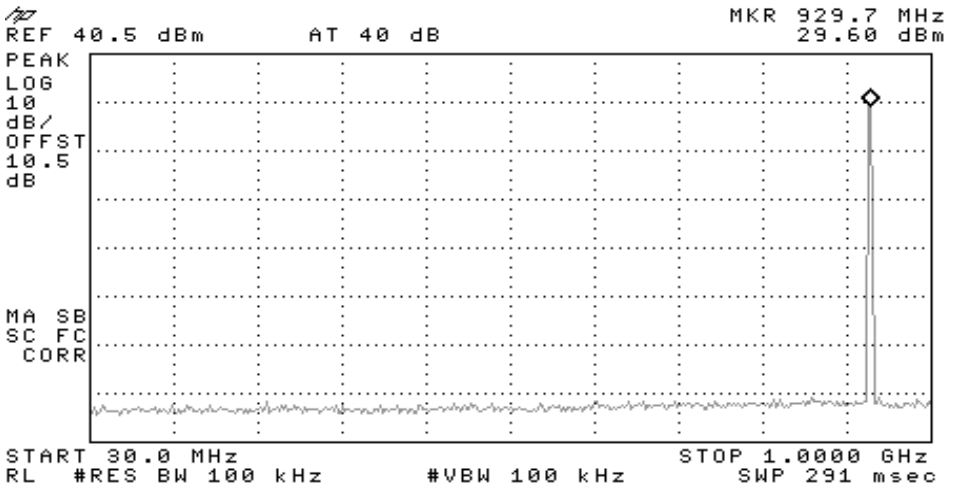




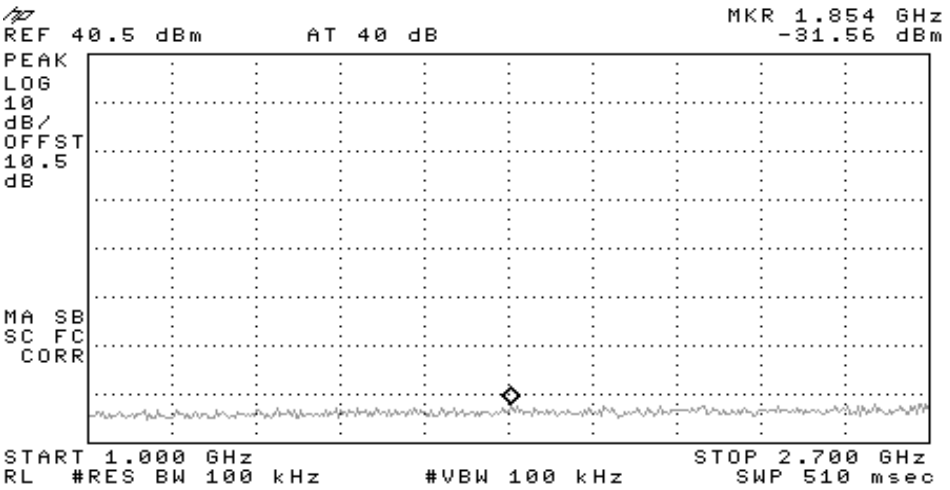
Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	N/A

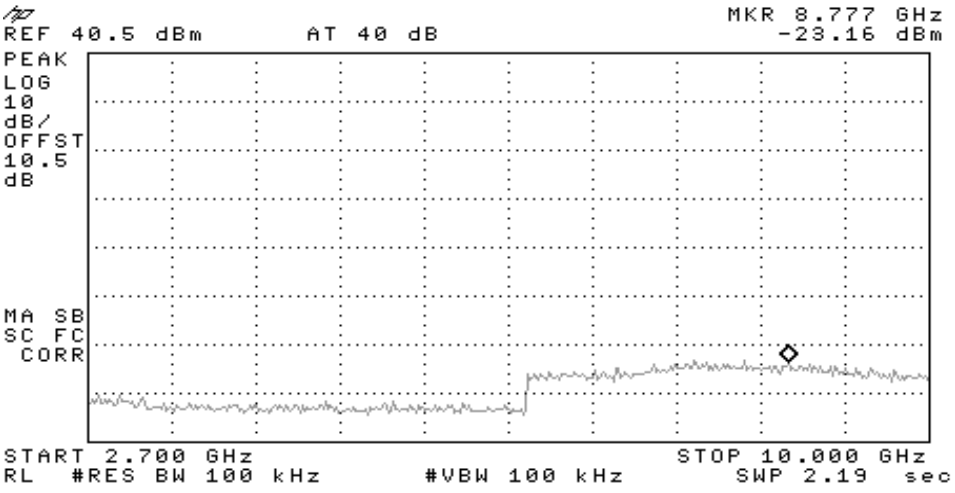


High Channel = 927.6 MHz



Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	N/A





Client:	Alien Technology	Job Number:	J57626
Model:	ALR-9640	T-Log Number:	T57676
		Account Manager:	-
Contact:	Greg Katterhagen		
Spec:	FCC15.247; FCC 15 Subpart B	Class:	N/A

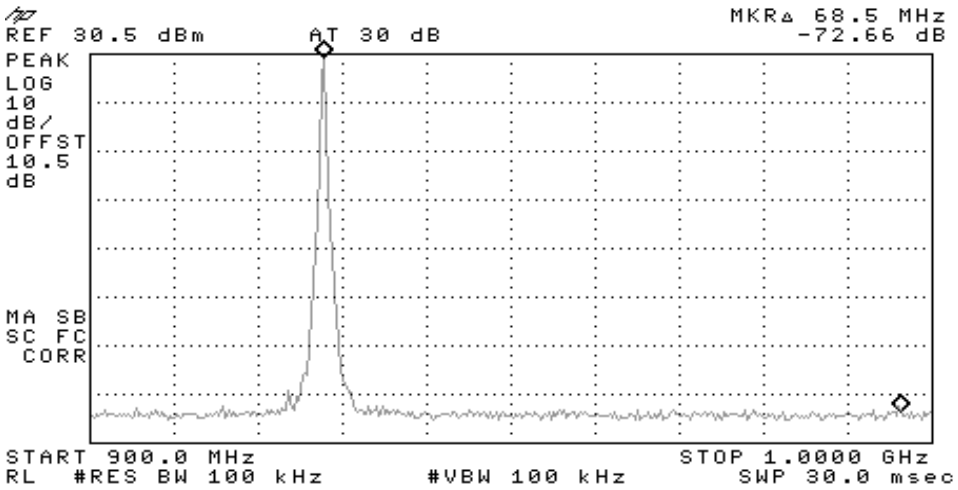


EXHIBIT 3: Test Configuration Photographs

4 Pages

EXHIBIT 4: Proposed FCC ID Label & Label Location

EXHIBIT 5: Detailed Photographs of Alien Technology Model ALR-9640Construction

Unchanged from original application

EXHIBIT 6: Operator's Manual for Alien Technology Model ALR-9640

Unchanged from original application

EXHIBIT 7: Block Diagram of Alien Technology Model ALR-9640

Unchanged from original application

EXHIBIT 8: Schematic Diagrams for Alien Technology Model ALR-9640

Unchanged from original application

EXHIBIT 9: Theory of Operation for Alien Technology Model ALR-9640

Unchanged from original application

EXHIBIT 10: Advertising Literature

Unchanged from original application

EXHIBIT 11: RF Exposure Information

Unchanged from original application