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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 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 18410 Butterfield Blvd, Ste 150 Morgan Hill, CA 95037
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	March 29, 2004
FINAL TEST DATE:	February 24, February 26 and March 24, 2004
AUTHORIZED SIGNATORY:	David W. Bare CTO

ACCREDITED

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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 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 C63.4-2001 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 Greg Katterhagen of Alien Technology.

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules and RSS-210 Issue 5 for license-exempt low power devices for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

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

SUMMARY OF RESULTS

FCC Part 15 Section	RSS 210 Section	Description	Measured Value	Comments	Result
15.247(a)	6.2.2(o)(a)	20dB Bandwidth	373 kHz	The channel spacing shall be greater than the 20dB bandwidth	Complies
15.247(a)	6.2.2(o)(a)	Channel Separation	400 kHz		Complies
15.247(a)	6.2.2(o)(a)	Receiver bandwidth	Not measured	Refer to Theory of Operations	Complies
15.247(a)	6.2.2(o)(a)	Number of Channels	63	Average time of occupancy <0.4 second within a 10 second period.	Complies
15.247(a)	6.2.2(o)(a)	Channel Dwell Time	158.7 milliseconds per 10 seconds		Complies
15.247(a)	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) (2)	6.2.2(o)(a)	Output Power,	29.7 dBm (0.993 Watts)	Maximum permitted is 1Watt, with EIRP limited to 4 Watts for a 50-channel system.	Complies
15.247(c)	6.2.2(o)(e1)	Conducted Spurious Emissions – 30MHz – 9.28GHz	All spurious emissions < -20dBc	All spurious emissions < -20dBc.	Complies
15.247(c) / 15.209		Radiated Spurious Emissions 30MHz – 9.28GHz	45.5 dBuV/m @ 960 MHz (-0.5dB)	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	30.4 dBuV @ 3.233 MHz (-29.6dB)		Complies
	6.6	AC Conducted Emissions	30.4 dBuV @ 3.233 MHz (-17.6dB)		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 6 dBi.

MEASUREMENT UNCERTAINTIES

ISO Guide 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	30 to 1000	± 3.6

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Alien Technology model ALR-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 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 120/240 V, 50/60 Hz, 1.5 Amps.

The sample was received on February 24, 2004 and tested on February 24, February 26 and March 24, 2004. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number	Proposed FCC ID #
Alien Technology ALR-9640 Smart Antenna	-	P65ALR9640

OTHER EUT DETAILS

Under normal operating conditions, the device is used in a continuous mode to monitor for tags passing within the vicinity of the reader. This ensures that all hopping channels are used equally.

The system does not incorporate any intelligence to recognize other users within the spectrum band. It does not employ any means of coordinating frequency hopping to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

There are two receive channels that are parallel channels used to create spatial diversity for the received signal using two mixers, in the down conversion, of back scattered RF to base band. The RF input for both mixers originates at the same location in the system, which in this case is the RF output of an amplifier which is driven by the receive antenna. The LO inputs for each mixer originate from the same frequency hopping LO except that one LO signal path is physically phase shifted by 90 degrees. The base band output of the mixers form two IF chains with one being phase shifted by 90 degrees relative to the other. This allows for a backscattered signal, which could in a null on one channel due to phase cancellation (because of the distance between the reader and tag being conducive for this effect), to have a signal at a relative maximum on the other channel. This I/Q relationship compensates for backscatter phase cancellations due to the physical location of the tag to the reader i.e., when one channel is in a spatial null, the other channel is in a spatial maximum. The DSP circuitry selects the most robust signal to perform further signal processing.

ENCLOSURE

The EUT enclosure is primarily constructed of 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 Number
Dell PP01L Laptop	526	-
PhiHong PSA31U-120 AC Adapter	-	-

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	Terminated	multiwire	Shielded	2
Ethernet	Laptop	CAT5	Unshielded	1
Serial	Laptop	multiwire	Shielded	1.5
Pwt in	AC adapter	2 wire	Unshielded	1
AC adapter in	AC Mains	2 wire	Unshielded	2

EUT OPERATION DURING TESTING

For transmitter tests, the device was transmitting continuously on the specified channel (spurious emissions measurements and power/bandwidth measurements) or hopping across all available channels (occupancy and channel spacing measurements). The transmissions consisted 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.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on February 24, February 26 and March 24, 2004at the Elliott Laboratories Open Area Test Sites #1, 2 & 3 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 C63.4-2001. 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 1000 MHz 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 & 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 that 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 that 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 - 26,500 MHz, 24-Feb-04
Engineer: Chris Byleckie

Manufacturer	Description	Model #	Asset #	Cal Due
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	487	24-Apr-04
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	23-Jan-05
Hewlett Packard	EMC Spectrum Analyzer, Opt. 026 □9 KHz - 26.5GHz	8593EM	1141	19-Mar-04
Hewlett Packard	High Pass filter, 3.5GHz	84300-80038	1157	11-Sep-04
Hewlett Packard	High Pass filter, 1.5GHz	P/N 84300-80037	1158	17-Apr-04
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1321	31-Mar-04

Radiated Emissions, 30 - 6,500 MHz, 26-Feb-04
Engineer: Rod Wong

Manufacturer	Description	Model #	Asset #	Cal Due
Elliott Laboratories	Biconical Antenna, 30-300 MHz	EL30.300	773	18-Mar-04
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	12-Jan-05
Hewlett Packard	High Pass filter, 1.5GHz	P/N 84300-80037	1158	17-Apr-04
Hewlett Packard	EMC Spectrum Analyzer, 9KHz - 22GHz	8593EM	1319	20-Nov-04
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1321	31-Mar-04
Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	1332	24-Jul-04

Radiated Emissions, 30 - 6,500 MHz, 26-Feb-04
Engineer: Rod Wong

Manufacturer	Description	Model #	Asset #	Cal Due
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	786	28-Feb-04

Conducted Emissions - AC Power Ports, 26-Feb-04
Engineer: Rod Wong

Manufacturer	Description	Model #	Asset #	Cal Due
Elliott Laboratories	FCC / CISPR LISN	LISN-3, OATS	304	01-Jul-04
Solar Electronics Co	LISN	8028-50-TS-24-BNC support	904	07-Aug-04
Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	1332	24-Jul-04
Rohde& Schwarz	Pulse Limiter	ESH3 Z2	1398	12-Jan-05

Radiated Emissions, 30 - 12,000 MHz, 24-Mar-04
Engineer: Juan Martinez

Manufacturer	Description	Model #	Asset #	Cal Due
Narda West	High Pass Filter 1.9 GHz	HPF-161	248	26-Mar-04
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	487	24-Apr-04
Hewlett Packard	EMC Spectrum Analyzer 9kHz - 6.5GHz	8595EM	780	26-Feb-05
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	12-Jan-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

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

Radio T54583 30 Pages
Digital T54583 10 Pages

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Emissions Spec:	FCC 15.247	Class:	A
Immunity Spec:		Environment:	

EMC Test Data

For The

Alien Technology

Model

ALR-9640

Date of Last Test: 2/26/2004

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Emissions Spec:	FCC 15.247	Class:	A
Immunity Spec:	Enter immunity spec on cover	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 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 120/240 V, 50/60 Hz, 1.5 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Alien Technology	ALR-9640	Smart Antenna	-	-

EUT Enclosure

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

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:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Emissions Spec:	FCC 15.247	Class:	A
Immunity Spec:	Enter immunity spec on cover	Environment:	

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	PP01L	Laptop	526	-
PhiHong	PSA31U-120	AC adapter	-	-

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	Terminated	multiwire	Shielded	2
Ethernet	Laptop	CAT5	Unshielded	1
Serial	Laptop	multiwire	Shielded	1.5
Pwt in	AC adapter	2 wire	Unshielded	1
AC adapter in	AC Mains	2 wire	Unshielded	2

EUT Operation During Emissions

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

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		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: 2/24/2004
Test Engineer: Mark Briggs
Test Location: SVOATS #2
Config. Used: 1
Config Change: 2
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: 12 °C
Rel. Humidity: 45 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 - 10000 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	
2	20dB Bandwidth	15.247(a)	Pass	373kHz
3	Output Power	15.247(b)	Pass	29.7dBm
4	Channel Occupancy / Separation	15.247(a)	Pass	400kHz
5	Number of Channels	15.247(a)	Pass	63

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:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1a: Radiated Spurious Emissions, 30 - 9300 MHz. Low Channel @ 902.8 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	131.8	132.3
Limit for emissions outside of restricted bands:	112.3 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	
EUT antenna "horizontal"								
1805.200	92.0	V	112.3	-20.3	Peak	330	1.2	Not in restricted band, RBW=100kHz
2707.800	40.4	V	54.0	-13.6	Avg	20	1.1	Note 3
2707.800	52.4	V	74.0	-21.6	pk	20	1.1	
4514.000	50.2	V	54.0	-3.8	Avg	345	1.1	Note 3
4514.000	63.4	V	74.0	-10.6	pk	345	1.1	
5415.600	53.5	V	54.0	-0.5	Avg	13	1.2	Note 3
5415.600	66.7	V	74.0	-7.3	pk	13	1.2	
1805.200	91.7	H	112.3	-20.6	Peak	345	1.0	Not in restricted band, RBW=100kHz
2707.800	41.4	H	54.0	-12.6	Avg	0	1.5	Note 3
2707.800	52.5	H	74.0	-21.5	pk	0	1.5	
4514.000	50.0	H	54.0	-4.0	Avg	40	1.6	Note 3
4514.000	61.7	H	74.0	-12.3	pk	40	1.6	
5415.600	56.9	H	54.0	2.9	Avg	352	1.9	Note 3
5415.600	68.3	H	74.0	-5.8	pk	352	1.9	
EUT antenna "vertical"								
1805.200	92.2	V	112.3	-20.1	Peak	341	1.2	Not in restricted band, RBW=100kHz
2707.800	41.2	V	54.0	-12.8	Avg	0	1.0	Note 3
2707.800	52.7	V	74.0	-21.3	pk	0	1.0	
4514.000	55.7	V	54.0	1.7	Avg	354	1.3	Note 3
4514.000	64.2	V	74.0	-9.8	pk	354	1.3	
5415.600	48.0	V	54.0	-6.0	Avg	-	-	Note 3,Noise floor
5415.600	59.9	V	74.0	-14.1	pk	-	-	Note 3,Noise floor
1805.200	95.2	H	112.3	-17.1	Peak	336	2.2	Not in restricted band, RBW=100kHz
2707.800	40.7	H	54.0	-13.3	Avg	15	1.2	Note 3
2707.800	53.2	H	74.0	-20.8	pk	15	1.2	
4514.000	51.9	V	54.0	-2.2	Avg	358	1.9	Note 3
4514.000	61.0	V	74.0	-13.0	pk	358	1.9	
5415.600	48.0	H	54.0	-6.0	Avg	-	-	Note 3,Noise floor
5415.600	59.9	H	74.0	-14.1	pk	-	-	Note 3,Noise floor

Run #1a continued on next page

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1a continued

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:	Note that the EUT was tested with the vertical antenna active and then all measuremetns repeated with the horizontal antenna active. The highest readings are recorded in the table above. Fundamental was highest with the measurement antenna horizontal and transmit antenna horizontal. With measurement and transmit antennas cross-polarized, the field strength dropped by about 3dB.
Note 3:	For average measurements the video bandwidth was reduced to 1kHz. Due to the pulsed nature of the transmission using a lower vale of VBW caused pulse desensitization.

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1b: Radiated Spurious Emissions, 30 - 9300 MHz. Center Channel @ 915.2 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	131.6	131.4
Limit for emissions outside of restricted bands:	111.6 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	
EUT antenna "horizontal"								
1830.400	86.6	V	111.6	-25.0	Peak	332	1.0	Not in restricted band, RBW=100kHz
2745.600	46.5	V	54.0	-7.5	Avg	36	1.6	Note 3
2745.600	54.8	V	74.0	-19.2	pk	36	1.6	
4576.000	54.1	V	54.0	0.1	Avg	356	1.3	Note 3
4576.000	66.5	V	74.0	-7.5	pk	356	1.3	
5491.200	56.9	V	54.0	2.9	Avg	335	1.3	Note 3
5491.200	70.8	V	74.0	-3.2	pk	335	1.3	
1830.400	91.3	H	111.6	-20.3	Peak	345	1.0	Not in restricted band, RBW=100kHz
2745.600	42.2	H	54.0	-11.8	Avg	0	1.0	Note 3
2745.600	51.2	H	74.0	-22.8	pk	0	1.0	
4576.000	53.2	H	54.0	-0.8	Avg	0	1.0	Note 3
4576.000	61.9	H	74.0	-12.1	pk	0	1.0	
EUT antenna "vertical"								
1830.400	88.4	V	111.6	-23.3	Peak	329	1.0	Not in restricted band, RBW=100kHz
2745.600	43.5	V	54.0	-10.5	Avg	0	1.0	Note 3
2745.600	50.8	V	74.0	-23.2	pk	0	1.0	
4576.000	55.0	V	54.0	1.0	Avg	323	1.2	Note 3
4576.000	62.8	V	74.0	-11.2	pk	323	1.2	
5491.200	57.7	V	54.0	3.7	Avg	332	1.2	Note 4
5491.200	68.4	V	74.0	-5.6	pk	332	1.2	Note 3
1830.400	87.6	H	111.6	-24.1	Peak	347	1.0	Not in restricted band, RBW=100kHz
2745.600	42.6	H	54.0	-11.4	Avg	0	1.0	Note 3
2745.600	53.7	H	74.0	-20.3	pk	0	1.0	
4576.000	53.3	H	54.0	-0.8	Avg	342	1.0	Note 3
4576.000	62.8	H	74.0	-11.2	pk	342	1.0	
5491.200	54.0	H	54.0	0.0	Avg	341	1.0	
5491.200	65.2	H	74.0	-8.8	pk	341	1.0	Note 3

Run #1b continued on next page

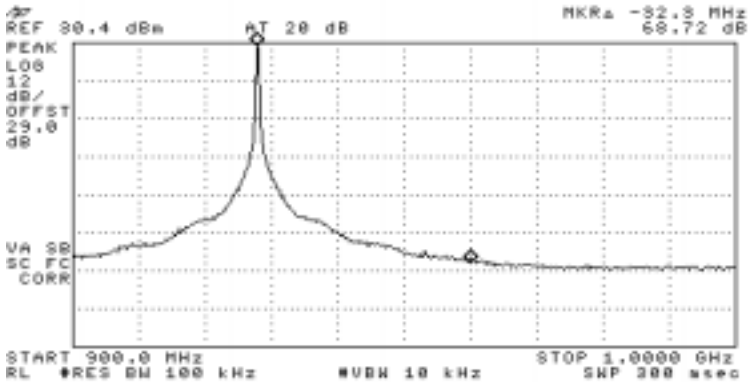
Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1b continued

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:	Note that the EUT was tested with the vertical antenna active and then all measuremetns repeated with the horizontal antenna active. The highest readings are recorded in the table above. Fundamental washighest with the measurement antenna horizontal and transmit antenna horizontal.
Note 3:	For average measurements the video bandwidth was reduced to 1kHz. Due to the pulsed nature of the transmission using a lower vale of VBW caused pulse desensitization.
Note 4:	Terminating the module output resulted in dropping the emission level to the noise floor

Run #1c: Radiated Spurious Emissions, 30 - 9300 MHz. High Channel @ 927.6 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	132.5	132.1
Limit for emissions outside of restricted bands:	112.5 dBµV/m	



960 MHz Restricted Band: Plot above shows the signal level does not drop below the general 15.209 limit until 970MHz. Device should be under this limit at 960 MHz as the frequency band 960 - 1240 MHz is a restricted band.

132.1 51.1

Run #1c continued on next page

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1c continued

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
EUT antenna "horizontal"								
960.000	53.0	H	46.0	7.0	QP	350	1.1	Device on highest channel
960.000	62.1	H	46.0	16.1	QP	350	1.1	Device hopping across all channels
1855.225	93.3	H	112.5	-19.2	Peak	40	1.8	Not in restricted band, RBW=100kHz
1855.225	93.3	H	112.5	-19.2	Peak	22	2.0	Not in restricted band, RBW=100kHz
1855.225	89.2	V	112.5	-23.3	Peak	325	1.1	Not in restricted band, RBW=100kHz
1855.225	89.1	V	112.5	-23.4	Peak	340	1.3	Not in restricted band, RBW=100kHz
2782.800	46.1	H	54.0	-7.9	Avg	0	1.0	Note 3
2782.800	47.1	V	54.0	-6.9	Avg	12	1.4	Note 3
2782.825	57.8	H	74.0	-16.2	pk	0	1.0	
2782.825	54.7	H	74.0	-19.3	pk	350	1.0	
2782.825	56.5	V	74.0	-17.5	pk	12	1.4	
4638.000	49.8	V	54.0	-4.2	Avg	320	1.2	Note 3
4638.000	66.2	V	74.0	-7.8	pk	320	1.2	
4638.000	48.8	H	54.0	-5.2	Avg	0	1.0	Note 3
4638.000	64.7	H	74.0	-9.3	pk	0	1.0	
EUT antenna "vertical"								
1855.225	93.3	H	112.5	-19.2	Peak	22	2.0	Not in restricted band, RBW=100kHz
1855.225	89.1	V	112.5	-23.4	Peak	340	1.3	Not in restricted band, RBW=100kHz
2782.800	44.7	H	54.0	-9.3	Avg	350	1.0	Note 3
2782.800	47.1	V	54.0	-6.9	Avg	20	1.2	Note 3
2782.825	54.7	H	74.0	-19.3	pk	350	1.0	
2782.825	57.2	V	74.0	-16.8	pk	20	1.2	
4638.000	50.2	V	54.0	-3.8	Avg	352	1.0	Note 3
4638.000	59.0	V	74.0	-15.0	pk	352	1.0	
4638.000	49.4	H	54.0	-4.6	Avg	344	1.1	Note 3
4638.000	59.8	H	74.0	-14.2	pk	344	1.1	

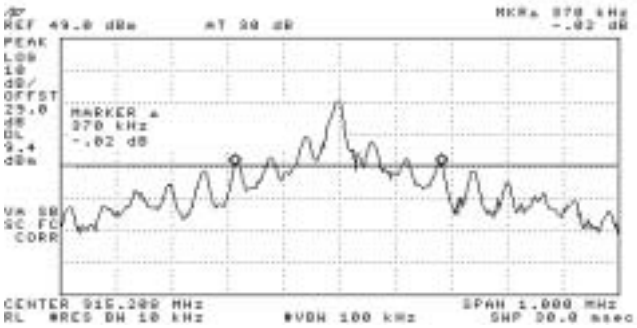
Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.
Note 2:	Note that the EUT was tested with the vertical antenna active and then all measurements repeated with the horizontal antenna active. The highest readings are recorded in the table above. Fundamental was highest with the measurement antenna horizontal and transmit antenna horizontal.
Note 3:	For average measurements the video bandwidth was reduced to 1kHz. Due to the pulsed nature of the transmission using a lower vale of VBW caused pulse desensitization.

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #2: Signal Bandwidth

Channel	Frequency (MHz)	Resolution Bandwidth	20dB Signal Bandwidth	Channel Separation
Low	902.8	10kHz	373	400kHz
Mid	915.2	10kHz	370	400kHz
High	927.6	10kHz	373	400kHz

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



Run #3: Output Power

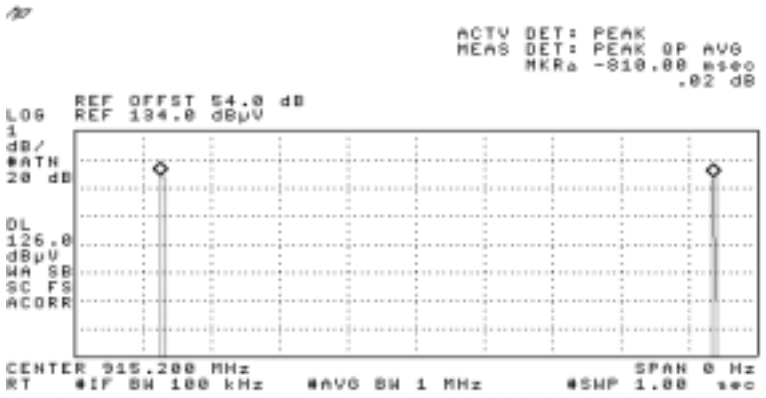
Channel	Frequency (MHz)	Res BW	Output Power	Antenna Gain
Low	902.8	3 MHz	29.7	
Mid	915	3 MHz	29.7	
High	927.8	3 MHz	29.5	

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.

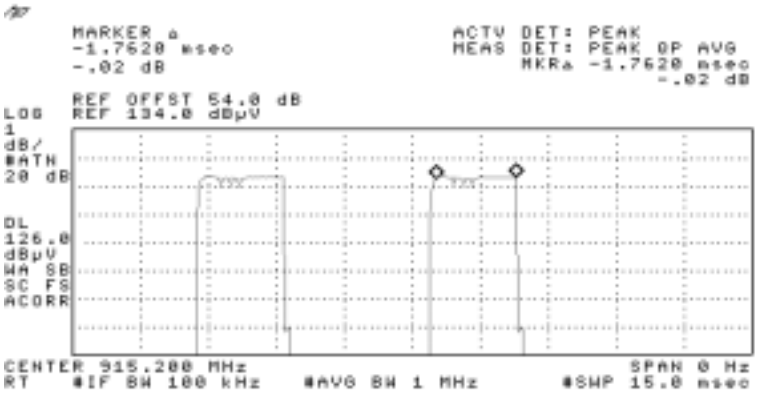
Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #4: Channel Occupancy And Spacing

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



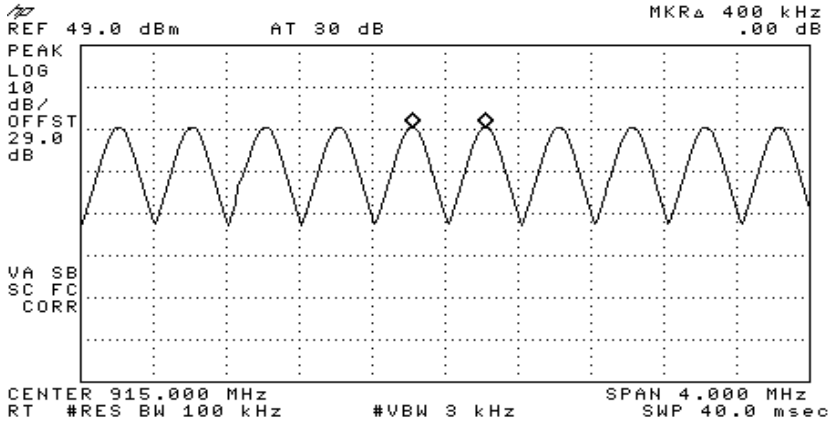
Time between successive hops on the same channel (~810ms)

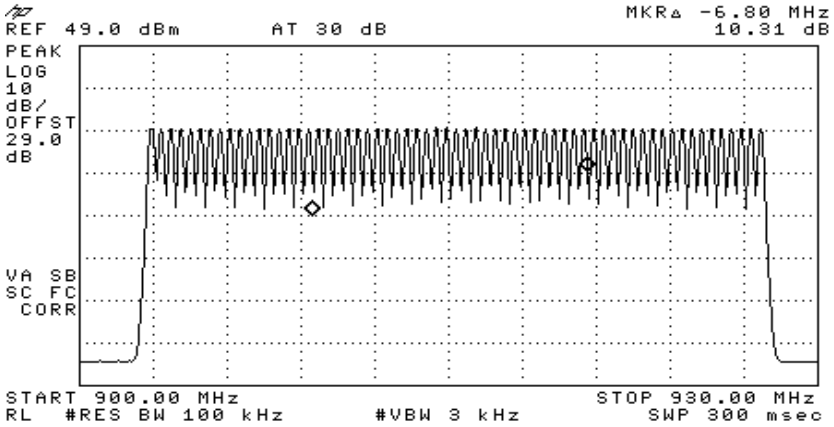


Transmission on a single frequency - two pulses ~ 1.8ms long with ~3ms delay between them.

The number of channels was:	63	
The channel spacing was:	400.0	kHz
Time between successive hops on a single channel was:	0.8	seconds
The average dwell time on any channel per hop:	12.9	ms
The average dwell time on any channel per 10s:	158.7	ms

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

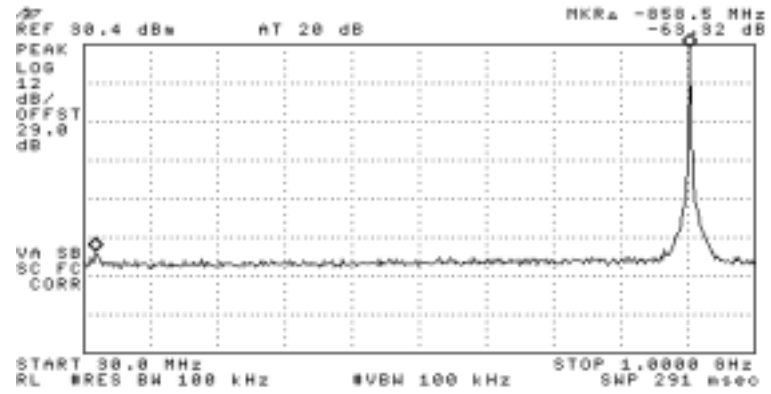


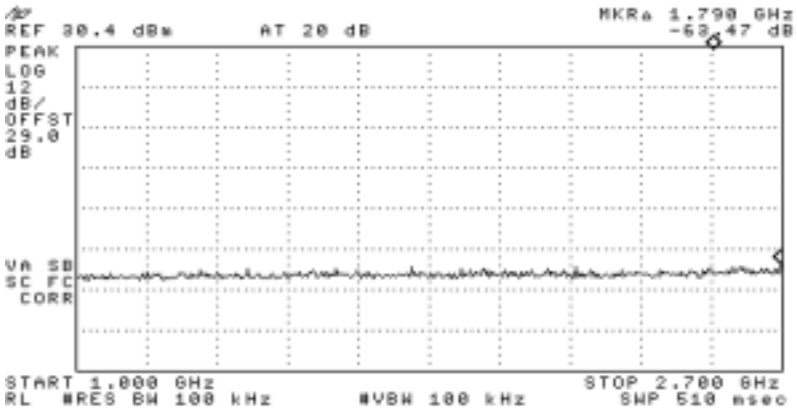


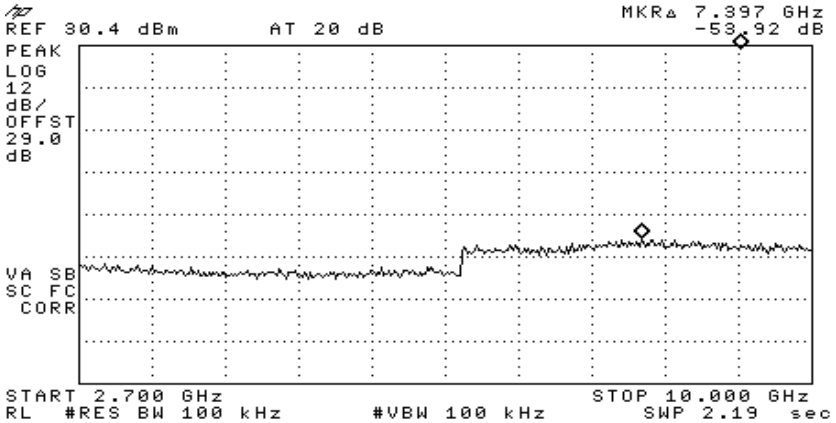
Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #6 Out of Band Emissions

Low Channel

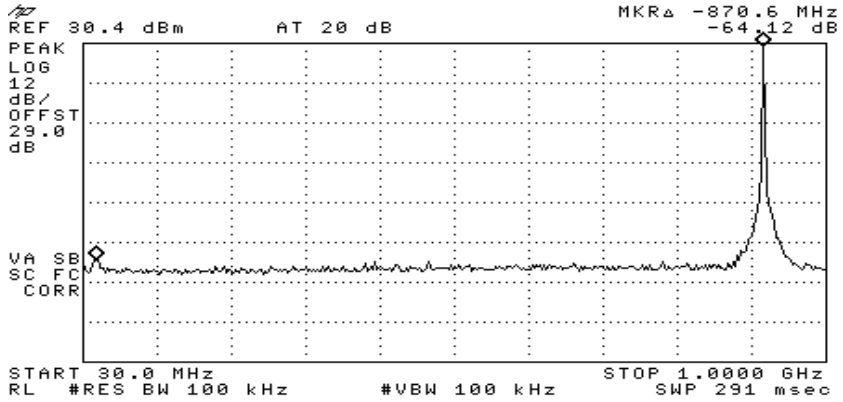


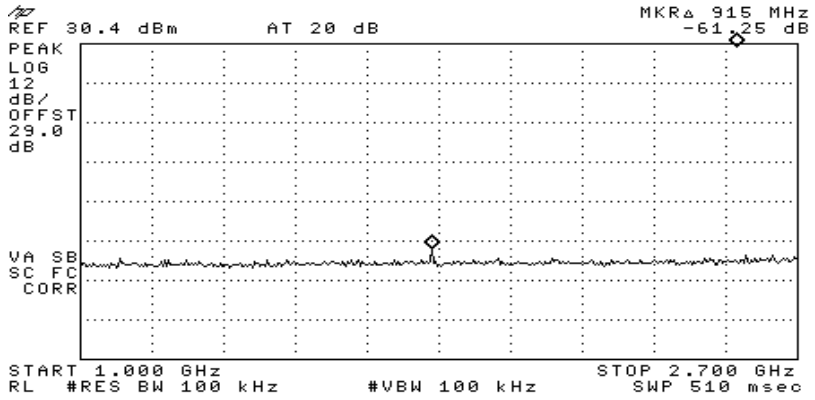


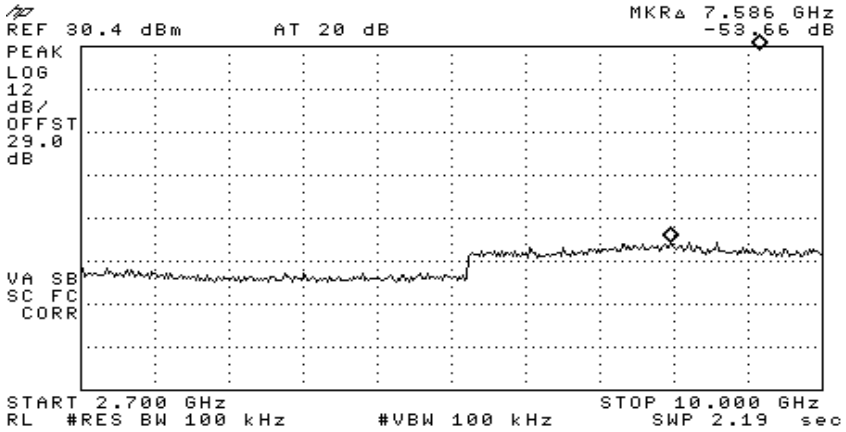


Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Mid Channel



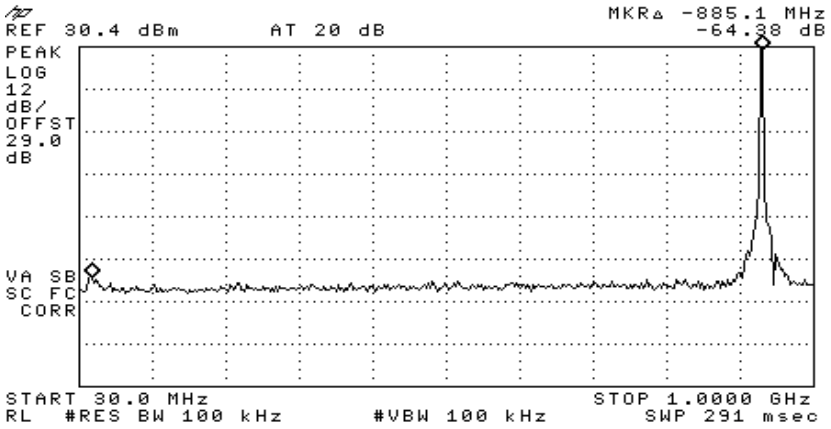


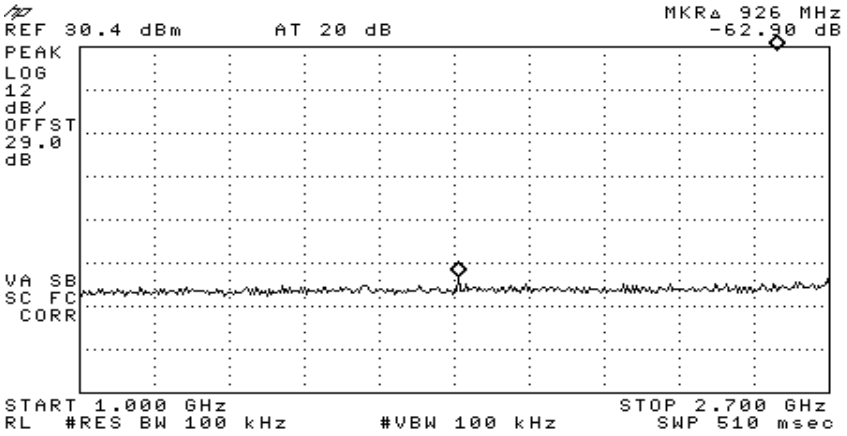


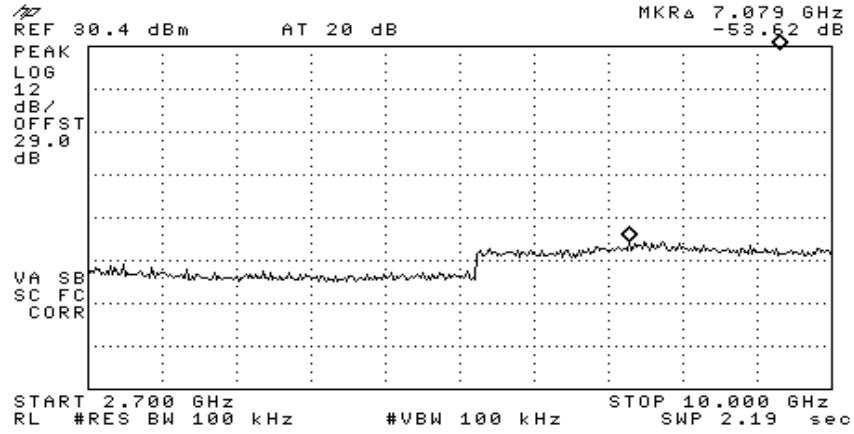
EMC Test Data

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

High Channel







Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		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: 2/24 & 3/24/2004
Test Engineer: Mark Briggs & Juan Martinez
Test Location: SVOATS #1 & #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:

	2/24/2004	3/24/2004	
Temperature:	12	11	°C
Rel. Humidity:	45	35	%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1a	RE, 30 - 10,000 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	-6.8dB @ 5415.65 MHz
1b	RE, 30 - 10,000 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	-4.7dB @ 5491.25 MHz
1c	RE, 30 - 10,000 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	-0.5dB @ 960 MHz
2	20dB Bandwidth	15.247(a)	Pass	373kHz
3	Output Power	15.247(b)	Pass	29.7dBm
4	Channel Occupancy / Separation	15.247(a)	Pass	400kHz
5	Number of Channels	15.247(a)	Pass	63

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Modifications Made During Testing:

No modifications were made to the EUT during testing. Prior to testing, the transmitter modulation circuit was changed to linear modulation and the radio to antenna cable was changed to hard line.

Deviations From The Standard

No deviations were made from the requirements of the standard.

Run #1a: Radiated Spurious Emissions, 30 - 10,000 MHz. Low Channel @ 902.8 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	131.8	132.3
Limit for emissions outside of restricted bands:	112.3 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	
EUT antenna in Vertical Mode								
5415.600	47.2	v	54.0	-6.8	Avg	0	1.0	
5415.600	46.8	h	54.0	-7.2	Avg	360	1.0	
4514.000	44.0	v	54.0	-10.0	Avg	360	1.0	
4514.000	43.8	h	54.0	-10.2	Avg	0	1.0	
2707.800	41.2	v	54.0	-12.8	Avg	0	1.0	Note 3
2707.800	40.7	h	54.0	-13.3	Avg	15	1.2	Note 3
5415.600	60.4	v	74.0	-13.6	Pk	0	1.0	
5415.600	59.6	h	74.0	-14.4	Pk	360	1.0	
1805.200	95.2	h	112.3	-17.1	Peak	336	2.2	Not in restricted band, RBW=100kHz
4514.000	56.8	v	74.0	-17.2	Pk	360	1.0	
4514.000	56.2	h	74.0	-17.8	Pk	0	1.0	
1805.200	92.2	v	112.3	-20.1	Peak	341	1.2	Not in restricted band, RBW=100kHz
2707.800	53.2	h	74.0	-20.8	pk	15	1.2	
2707.800	52.7	v	74.0	-21.3	pk	0	1.0	
EUT antenna in Horizontal Mode								
5415.600	47.1	v	54.0	-6.9	Avg	360	1.0	
5415.600	47.0	h	54.0	-7.0	Avg	0	1.0	
4514.000	44.1	v	54.0	-9.9	Avg	0	1.0	
4514.000	44.0	h	54.0	-10.0	Avg	360	1.0	
2707.800	41.4	h	54.0	-12.6	Avg	0	1.5	Note 3
2707.800	40.4	v	54.0	-13.6	Avg	20	1.1	Note 3
5415.600	59.9	v	74.0	-14.1	Pk	360	1.0	
5415.600	59.9	h	74.0	-14.1	Pk	0	1.0	

Run #1a continued on next page

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1a continued

4514.000	57.5	h	74.0	-16.5	Pk	360	1.0	
4514.000	56.8	v	74.0	-17.2	Pk	0	1.0	
1805.200	92.0	v	112.3	-20.3	Peak	330	1.2	Not in restricted band, RBW=100kHz
1805.200	91.7	h	112.3	-20.6	Peak	345	1.0	Not in restricted band, RBW=100kHz
2707.800	52.5	h	74.0	-21.5	pk	0	1.5	
2707.800	52.4	v	74.0	-21.6	pk	20	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:	Note that the EUT was tested with the vertical antenna active and then all measuremetns repeated with the horizontal antenna active. The highest readings are recorded in the table above. Fundamental was highest with the measurement antenna horizontal and transmit antenna horizontal. With measurement and transmit antennas cross-polarized, the field strength dropped by about 3dB.
Note 3:	For average measurements the video bandwidth was reduced to 1kHz. Due to the pulsed nature of the transmission using a lower vale of VBW caused pulse desensitization.

Run #1b: Radiated Spurious Emissions, 30 - 10,000 MHz. Center Channel @ 915.2 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	131.6	131.4
Limit for emissions outside of restricted bands:	111.6 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	
EUT antenna in Vertical Mode								
5491.200	49.3	v	54.0	-4.7	Avg	360	1.0	
5491.200	47.9	h	54.0	-6.1	Avg	0	1.0	
4576.000	44.5	v	54.0	-9.5	Avg	0	1.0	
4576.000	44.5	h	54.0	-9.5	Avg	360	1.0	
5491.200	62.4	v	74.0	-11.6	Pk	360	1.0	
2707.800	41.2	v	54.0	-12.8	Avg	0	1.0	Note 3
2707.800	40.7	h	54.0	-13.3	Avg	15	1.2	Note 3
5491.200	60.6	h	74.0	-13.4	Pk	0	1.0	
4576.000	58.0	h	74.0	-16.0	Pk	360	1.0	
1805.200	95.2	h	112.3	-17.1	Peak	336	2.2	Not in restricted band, RBW=100kHz
4576.000	56.8	v	74.0	-17.2	Pk	0	1.0	
1805.200	92.2	v	112.3	-20.1	Peak	341	1.2	Not in restricted band, RBW=100kHz

Run #1b continued on next page

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1b continued

2707.800	53.2	h	74.0	-20.8	pk	15	1.2	
2707.800	52.7	v	74.0	-21.3	pk	0	1.0	
EUT antenna in Horizontal Mode								
1830.400	86.6	v	111.6	-25.0	Peak	332	1.0	Not in restricted band, RBW=100kHz
2745.600	46.5	v	54.0	-7.5	Avg	36	1.6	Note 3
2745.600	54.8	v	74.0	-19.2	pk	36	1.6	
5491.200	56.7	v	74.0	-17.3	Pk	0	1.0	
5491.200	43.9	v	54.0	-10.1	Avg	0	1.0	
5491.200	60.5	h	74.0	-13.5	Pk	360	1.0	
5491.200	47.8	h	54.0	-6.2	Avg	360	1.0	
4576.000	59.4	v	74.0	-14.6	Pk	0	1.0	
4576.000	47.5	v	54.0	-6.5	Avg	0	1.0	
4576.000	58.2	h	74.0	-15.8	Pk	360	1.0	
4576.000	44.4	h	54.0	-9.6	Avg	360	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:	Note that the EUT was tested with the vertical antenna active and then all measuremetns repeated with the horizontal antenna active. The highest readings are recorded in the table above. Fundamental was highest with the measurement antenna horizontal and transmit antenna horizontal. With measurement and transmit antennas cross-polarized, the field strength dropped by about 3dB.
Note 3:	For average measurements the video bandwidth was reduced to 1kHz. Due to the pulsed nature of the transmission using a lower vale of VBW caused pulse desensitization.

Run #1c: Radiated Spurious Emissions, 30 - 9300 MHz. High Channel @ 927.6 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	132.5	132.1
Limit for emissions outside of restricted bands:	112.5 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	
EUT antenna "horizontal"								
960.000	45.5	v	46.0	-0.5	QP	339	1.2	
960.000	43.0	h	46.0	-3.0	QP	0	1.0	
1855.225	93.3	h	112.5	-19.2	Peak	40	1.8	Not in restricted band, RBW=100kHz
1855.225	93.3	h	112.5	-19.2	Peak	22	2.0	Not in restricted band, RBW=100kHz
1855.225	89.2	v	112.5	-23.3	Peak	325	1.1	Not in restricted band, RBW=100kHz
1855.225	89.1	v	112.5	-23.4	Peak	340	1.3	Not in restricted band, RBW=100kHz

Run #1b continued on next page

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1b continued								
2782.800	46.1	h	54.0	-7.9	Avg	0	1.0	Note 3
2782.800	47.1	v	54.0	-6.9	Avg	12	1.4	Note 3
2782.825	57.8	h	74.0	-16.2	pk	0	1.0	
2782.825	54.7	h	74.0	-19.3	pk	350	1.0	
2782.825	56.5	v	74.0	-17.5	pk	12	1.4	
4638.000	49.8	v	54.0	-4.2	Avg	320	1.2	Note 3
4638.000	66.2	v	74.0	-7.8	pk	320	1.2	
4638.000	48.8	h	54.0	-5.2	Avg	0	1.0	Note 3
4638.000	64.7	h	74.0	-9.3	pk	0	1.0	
EUT antenna "vertical"								
960.000	45.0	v	46.0	-1.0	QP	332	1.0	
960.000	42.8	h	46.0	-3.2	QP	0	1.6	
1855.225	93.3	h	112.5	-19.2	Peak	22	2.0	Not in restricted band, RBW=100kHz
1855.225	89.1	v	112.5	-23.4	Peak	340	1.3	Not in restricted band, RBW=100kHz
2782.800	44.7	h	54.0	-9.3	Avg	350	1.0	Note 3
2782.800	47.1	v	54.0	-6.9	Avg	20	1.2	Note 3
2782.825	54.7	h	74.0	-19.3	pk	350	1.0	
2782.825	57.2	v	74.0	-16.8	pk	20	1.2	
4638.000	50.2	v	54.0	-3.8	Avg	352	1.0	Note 3
4638.000	59.0	v	74.0	-15.0	pk	352	1.0	
4638.000	49.4	h	54.0	-4.6	Avg	344	1.1	Note 3
4638.000	59.8	h	74.0	-14.2	pk	344	1.1	

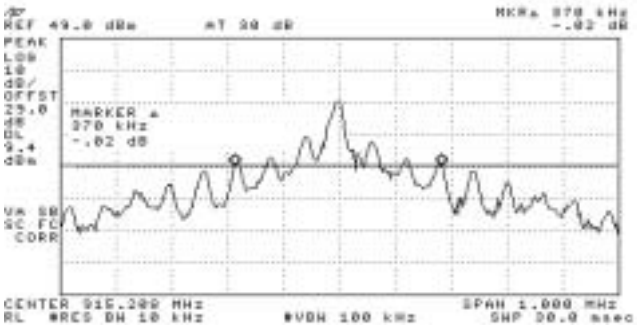
Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.
Note 2:	Note that the EUT was tested with the vertical antenna active and then all measurements repeated with the horizontal antenna active. The highest readings are recorded in the table above. Fundamental was highest with the measurement antenna horizontal and transmit antenna horizontal.
Note 3:	For average measurements the video bandwidth was reduced to 1kHz. Due to the pulsed nature of the transmission using a lower vale of VBW caused pulse desensitization.

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #2: Signal Bandwidth

Channel	Frequency (MHz)	Resolution Bandwidth	20dB Signal Bandwidth	Channel Separation
Low	902.8	10kHz	373	400kHz
Mid	915.2	10kHz	370	400kHz
High	927.6	10kHz	373	400kHz

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



Run #3: Output Power

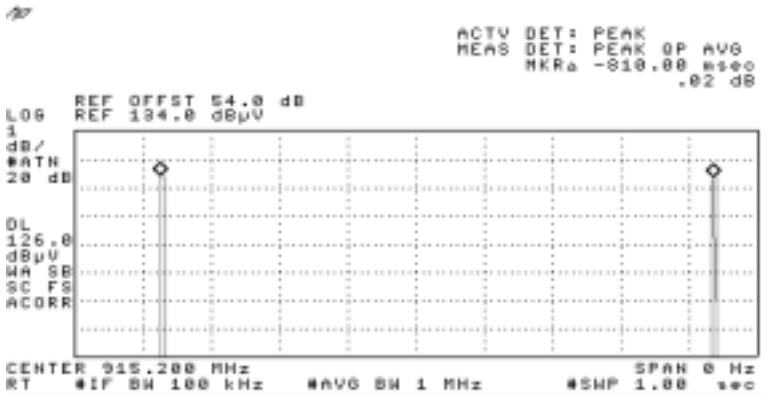
Channel	Frequency (MHz)	Res BW	Output Power	Antenna Gain
Low	902.8	3 MHz	29.7	
Mid	915	3 MHz	29.7	
High	927.8	3 MHz	29.5	

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.

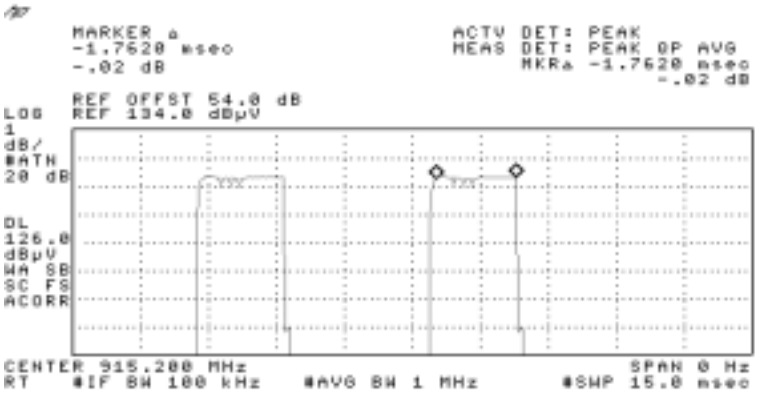
Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #4: Channel Occupancy And Spacing

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



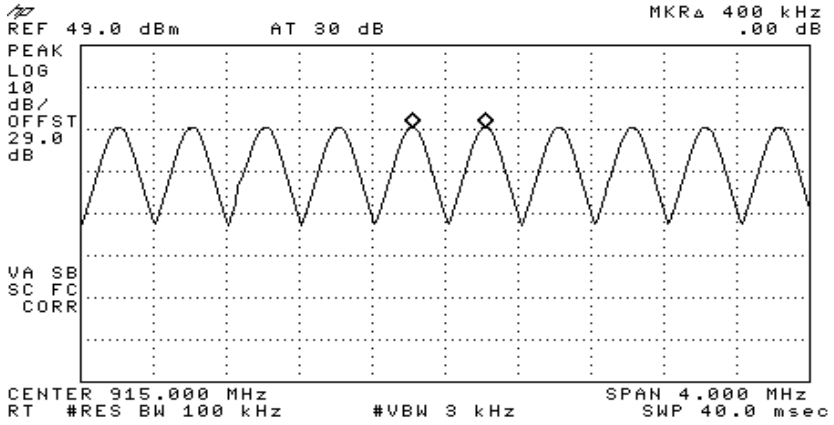
Time between successive hops on the same channel (~810ms)

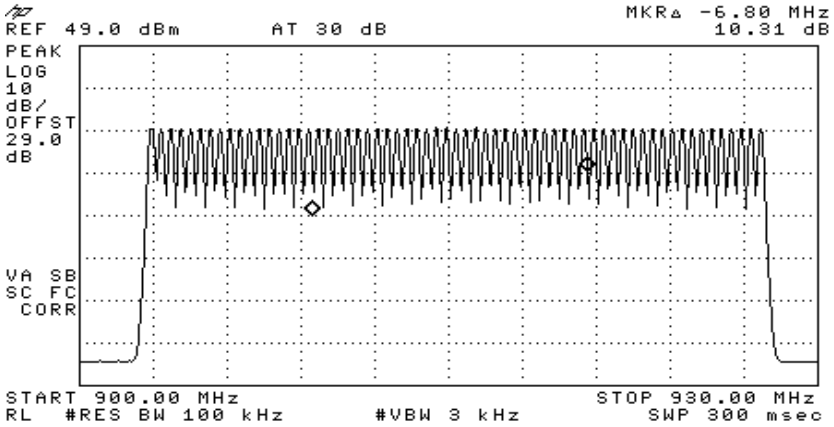


Transmission on a single frequency - two pulses ~ 1.8ms long with ~3ms delay between them.

The number of channels was:	63	
The channel spacing was:	400.0	kHz
Time between successive hops on a single channel was:	0.8	seconds
The average dwell time on any channel per hop:	12.9	ms
The average dwell time on any channel per 10s:	158.7	ms

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

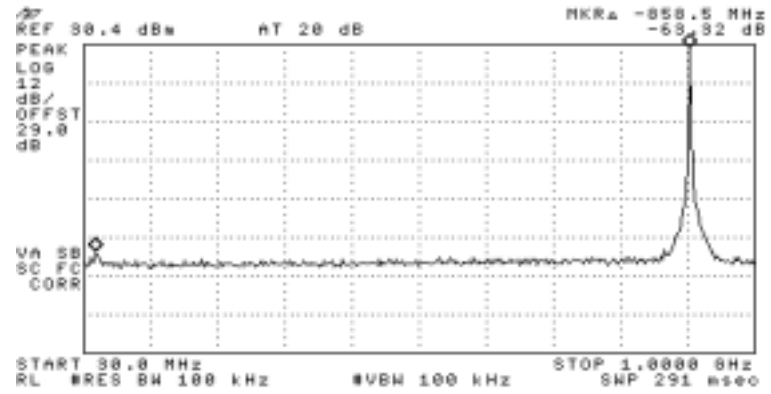


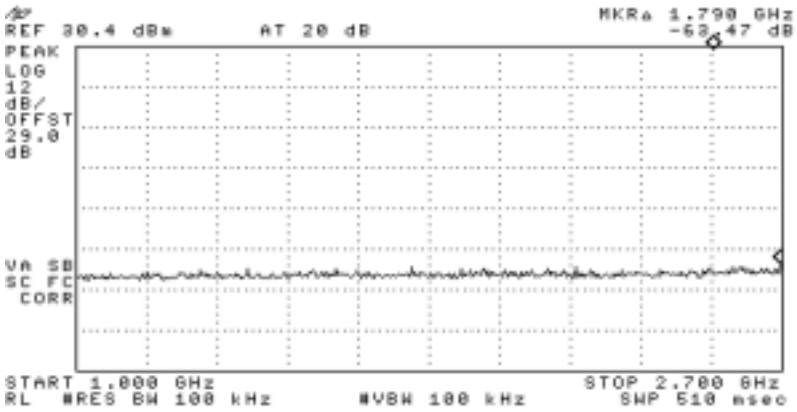


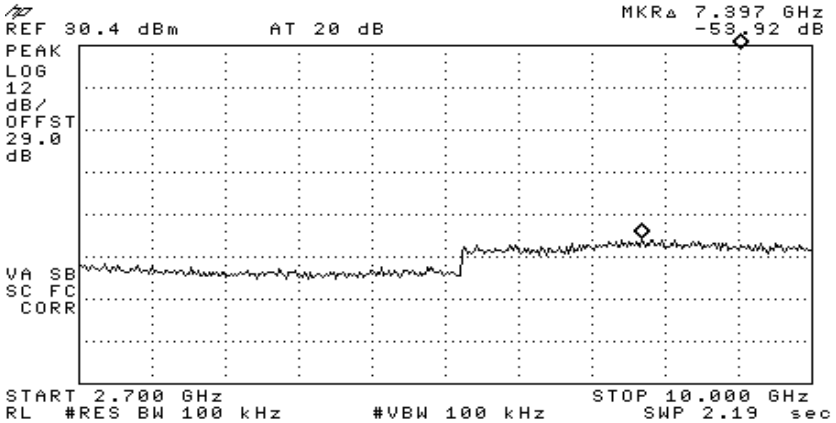
Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #6 Out of Band Emissions

Low Channel

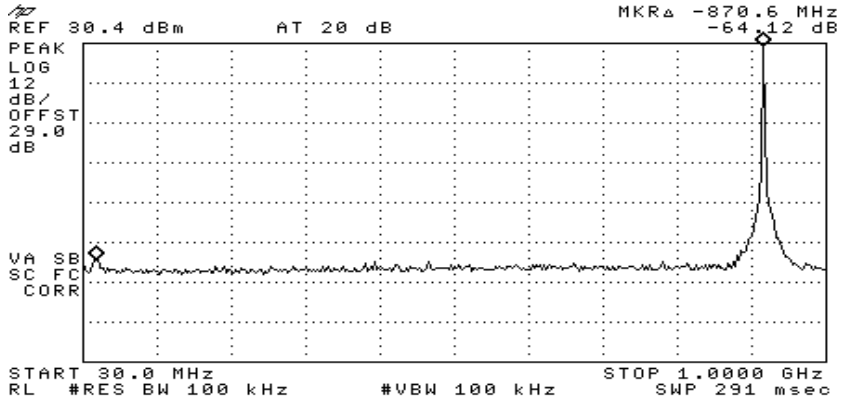


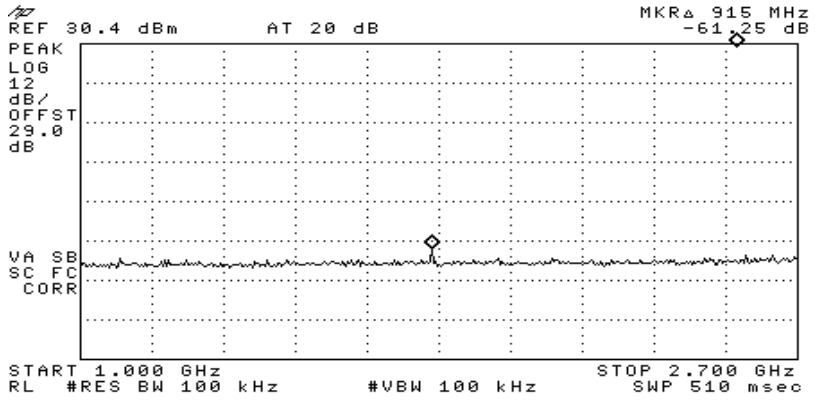


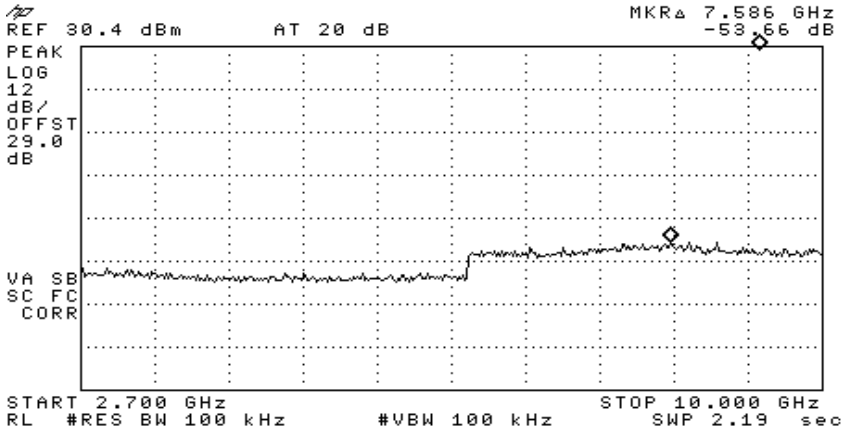


Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Mid Channel



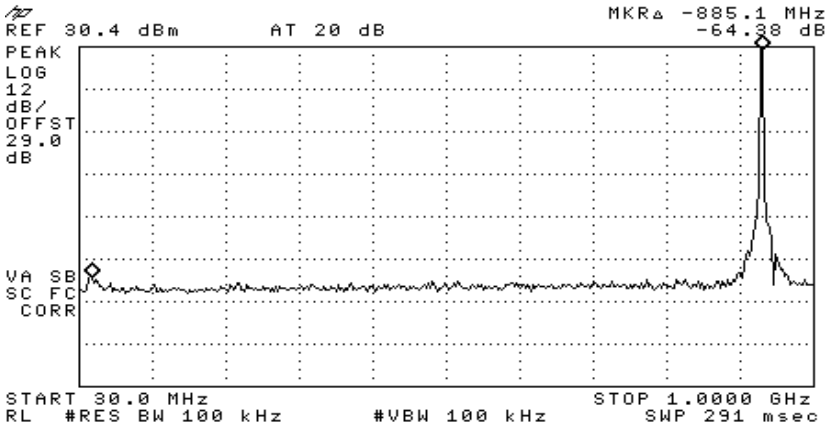


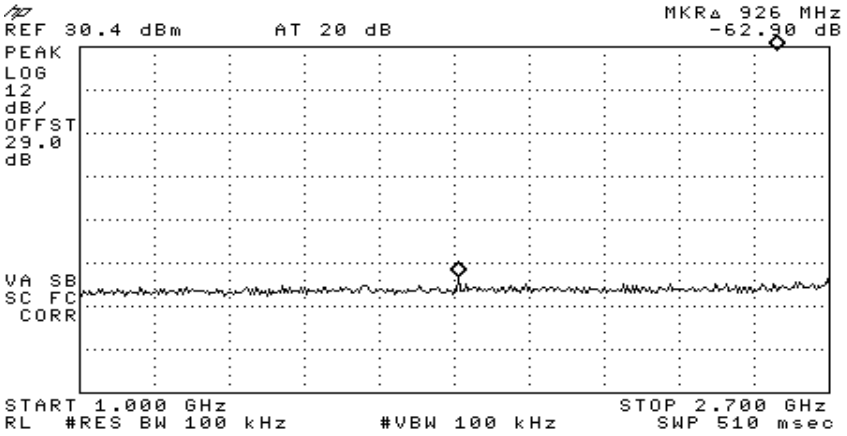


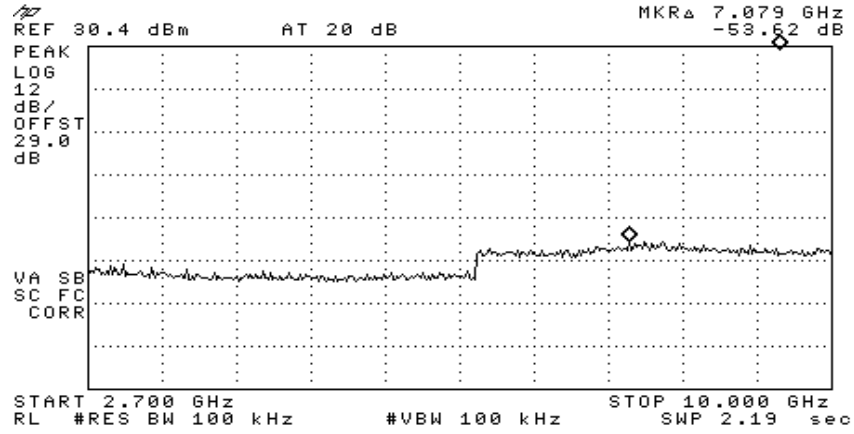
EMC Test Data

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

High Channel







Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		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: 3/24/2004
Test Engineer: Juan Martinez
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.

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

Ambient Conditions:

Temperature: 11 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1a	RE, 30 - 10,000 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	-6.8dB @ 5415.65 MHz
1b	RE, 30 - 10,000 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	-4.7dB @ 5491.25 MHz
1c	RE, 30 - 10,000 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	-0.5dB @ 960 MHz

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 - 10,000 MHz. Low Channel @ 902.8 MHz

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
EUT antenna in Vertical Mode								
5415.600	60.4	v	74.0	-13.6	Pk	0	1.0	
5415.600	47.2	v	54.0	-6.8	Avg	0	1.0	
5415.600	59.6	h	74.0	-14.4	Pk	360	1.0	
5415.600	46.8	h	54.0	-7.2	Avg	360	1.0	
4514.000	56.8	v	74.0	-17.2	Pk	360	1.0	
4514.000	44.0	v	54.0	-10.0	Avg	360	1.0	
4514.000	56.2	h	74.0	-17.8	Pk	0	1.0	
4514.000	43.8	h	54.0	-10.2	Avg	0	1.0	
EUT antenna in Horizontal Mode								
5415.600	59.9	v	74.0	-14.1	Pk	360	1.0	
5415.600	47.1	v	54.0	-6.9	Avg	360	1.0	
5415.600	59.9	h	74.0	-14.1	Pk	0	1.0	
5415.600	47.0	h	54.0	-7.0	Avg	0	1.0	
4514.000	56.8	v	74.0	-17.2	Pk	0	1.0	
4514.000	44.1	v	54.0	-9.9	Avg	0	1.0	
4514.000	57.5	h	74.0	-16.5	Pk	360	1.0	
4514.000	44.0	h	54.0	-10.0	Avg	360	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.

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1b: Radiated Spurious Emissions, 30 - 10,000 MHz. Center Channel @ 915.2 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:		
Limit for emissions outside of restricted bands:	-20 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	
EUT antenna in Vertical Mode								
5491.200	62.4	v	74.0	-11.6	Pk	360	1.0	
5491.200	49.3	v	54.0	-4.7	Avg	360	1.0	
5491.200	60.6	h	74.0	-13.4	Pk	0	1.0	
5491.200	47.9	h	54.0	-6.1	Avg	0	1.0	
4576.000	56.8	v	74.0	-17.2	Pk	0	1.0	
4576.000	44.5	v	54.0	-9.5	Avg	0	1.0	
4576.000	58.0	h	74.0	-16.0	Pk	360	1.0	
4576.000	44.5	h	54.0	-9.5	Avg	360	1.0	
EUT antenna in Horizontal Mode								
5491.200	56.7	v	74.0	-17.3	Pk	0	1.0	
5491.200	43.9	v	54.0	-10.1	Avg	0	1.0	
5491.200	60.5	h	74.0	-13.5	Pk	360	1.0	
5491.200	47.8	h	54.0	-6.2	Avg	360	1.0	
4576.000	59.4	v	74.0	-14.6	Pk	0	1.0	
4576.000	47.5	v	54.0	-6.5	Avg	0	1.0	
4576.000	58.2	h	74.0	-15.8	Pk	360	1.0	
4576.000	44.4	h	54.0	-9.6	Avg	360	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:	

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	N/A

Run #1c: Radiated Spurious Emissions, 30 - 9300 MHz. High Channel @ 927.6 MHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	132.5	132.1
Limit for emissions outside of restricted bands:	112.5 dBµV/m	

960 MHz Restricted Band: Plot above shows the signal level does not drop below the general 15.209 limit until 970MHz. Device should be under this limit at 960 MHz as the frequency band 960 - 1240 MHz is a restricted band.

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
EUT antenna "horizontal"								
960.000	45.5	V	46.0	-0.5	QP	339	1.2	Device on highest channel
960.000	43.0	H	46.0	-3.0	QP	0	1.0	Device on highest channel

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EMC Test Data

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Emissions Spec:	FCC 15.247	Class:	A
Immunity Spec:		Environment:	

EMC Test Data

For The

Alien Technology

Model

ALR-9640

Date of Last Test: 2/26/2004

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Emissions Spec:	FCC 15.247	Class:	A
Immunity Spec:	Enter immunity spec on cover	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 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 120/240 V, 50/60 Hz, 1.5 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Alien Technology	ALR-9640	Smart Antenna	-	-

EUT Enclosure

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

Modification History

Mod. #	Test	Date	Modification
1			

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

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Emissions Spec:	FCC 15.247	Class:	A
Immunity Spec:	Enter immunity spec on cover	Environment:	

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	PP01L	Laptop	526	-
PhiHong	PSA31U-120	AC adapter	-	-

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	Terminated	multiwire	Shielded	2
Ethernet	Laptop	CAT5	Unshielded	1
Serial	Laptop	multiwire	Shielded	1.5
Pwt in	AC adapter	2 wire	Unshielded	1
AC adapter in	AC Mains	2 wire	Unshielded	2

EUT Operation During Emissions

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

Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	A

Conducted Emissions - Power Ports

Test Specifics

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

Date of Test: 2/26/2004
Test Engineer: Rod Wong
Test Location: SVOATS #2

Config. Used: #1
Config Change: None
EUT Voltage: Refer to individual run

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. All I/O connections were running on top of the groundplane.

Ambient Conditions:

Temperature: 12.2 °C
Rel. Humidity: 72 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power, 120V/60Hz	CISPR A	Pass	-29.6dB @ 3.233MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

EMC Test Data

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	A

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz
PhiHong PSA31U-120

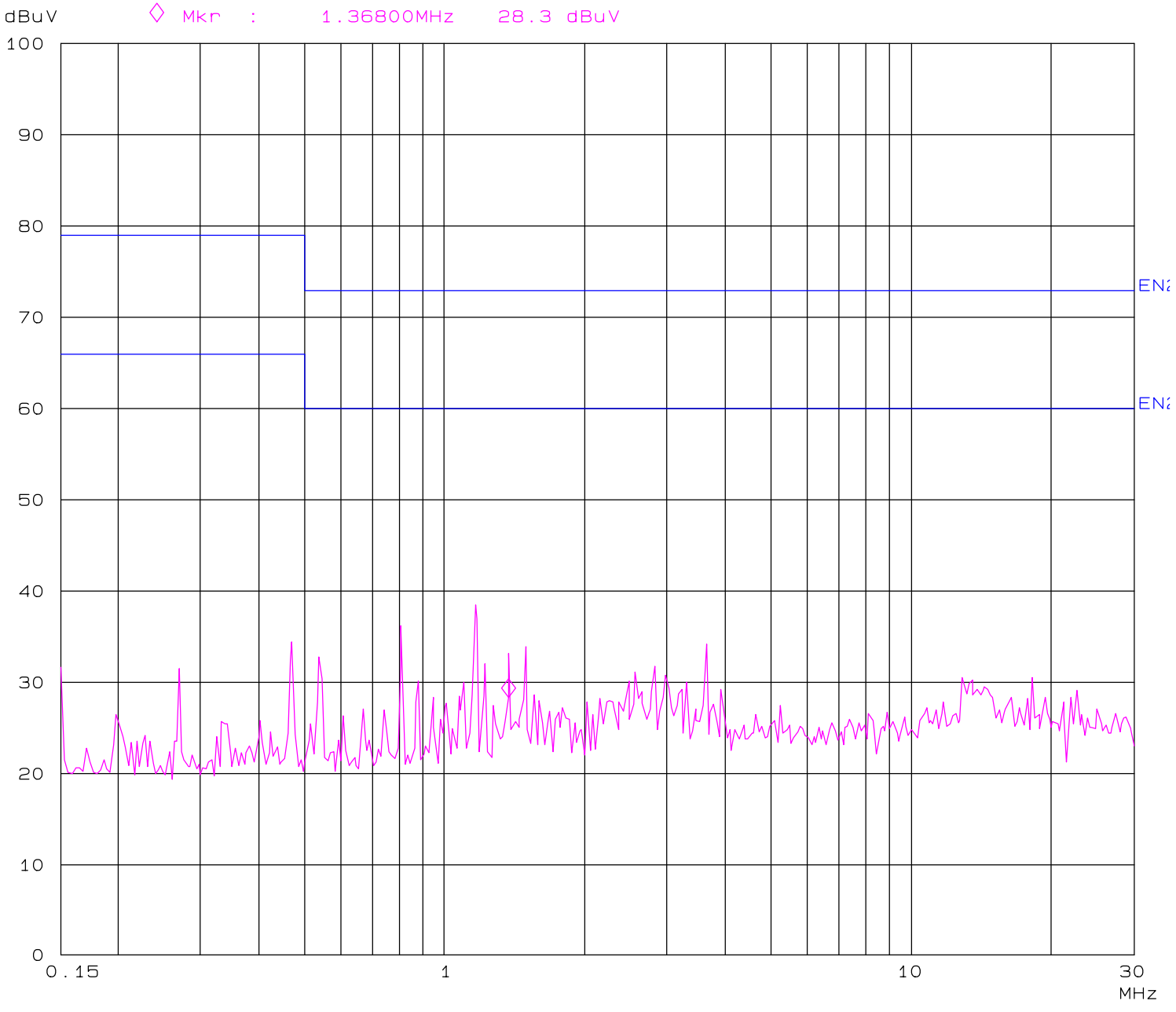
Frequency	Level	AC	EN55022 A		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
3.233	30.4	Line	60.0	-29.6	Average	
0.538	29.8	Neutral	60.0	-30.2	Average	
0.471	34.1	Line	66.0	-31.9	Average	
0.471	32.7	Neutral	66.0	-33.3	Average	
3.640	25.5	Neutral	60.0	-34.5	Average	
3.233	35.8	Line	73.0	-37.2	QP	
0.538	34.1	Neutral	73.0	-38.9	QP	
13.040	20.5	Line	60.0	-39.5	Average	
3.640	32.4	Neutral	73.0	-40.6	QP	
0.471	37.8	Line	79.0	-41.2	QP	
0.471	36.7	Neutral	79.0	-42.3	QP	
13.040	27.6	Line	73.0	-45.4	QP	

Elliott Laboratories
AC Conducted Emissions

26. Feb 04 14:43

Operator: Rod Wong
Comment: Alien Technology
J54463 / T54583
CISPR A

120V / 60Hz
run 1 Neutral

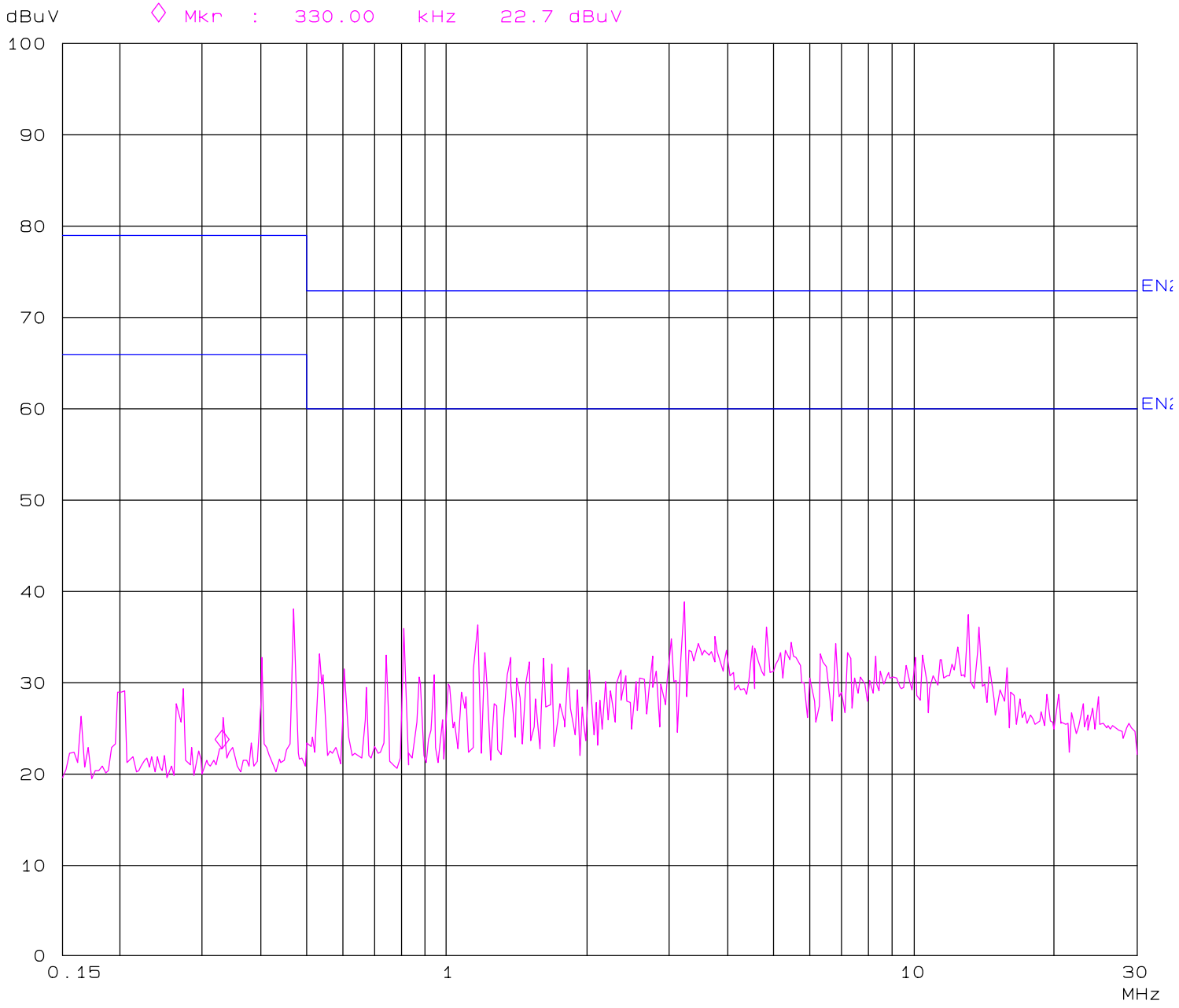


Elliott Laboratories
AC Conducted Emissions

26. Feb 04 14:34

Operator: Rod Wong
Comment: Alien Technology
J54463 / T54583
CISPR A

120V / 60Hz
Run 1 Line



Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	A

Radiated Emissions

Test Specifics

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

Date of Test: 2/26/2004
Test Engineer: Rod Wong
Test Location: SVOATS #3
Config. Used: #1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

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

Unless otherwise specified, the measurement antenna was located 10 meters from the EUT for the measurement range 30 - 1000 MHz and 3m from the EUT for the frequency range 1 - 10 GHz.

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.

Note, for testing above 1 GHz, the FCC specifies the limit as an average measurement. In addition, the FCC states that the peak reading of any emission above 1 GHz, can not exceed the average limit by more than 20 dB.

Ambient Conditions:

Temperature: 12.2 °C
Rel. Humidity: 74 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 -1000 MHz, Preliminary Scan	FCC Class A	Eval	Refer to individual runs
2	RE, 30 - 1000MHz, Maximized Emissions	FCC Class A	Pass	-10.1dB @ 167.235MHz
3	RE, 1000 - 6500 MHz, Maximized Emissions	FCC Class A	Pass	-13.8dB @ 5647.0MHz

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:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	A

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

Frequency	Level	Pol	FCC Class A		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
167.235	33.0	h	43.5	-10.5	QP	0	3.9	Broadband
272.000	29.7	h	46.4	-16.7	QP	0	2.8	
600.000	29.6	h	46.4	-16.8	QP	326	3.4	
32.900	22.0	v	39.1	-17.1	QP	192	1.0	
316.255	29.0	h	46.4	-17.4	QP	0	3.1	Broadband
280.000	28.0	h	46.4	-18.4	QP	18	2.9	
320.000	26.0	h	46.4	-20.4	QP	0	3.5	
480.000	25.6	h	46.4	-20.8	QP	29	3.0	
320.000	25.4	v	46.4	-21.0	QP	330	1.0	
39.000	18.1	v	39.1	-21.0	QP	0	1.0	
240.000	25.3	h	46.4	-21.1	QP	20	2.7	
302.400	23.7	h	46.4	-22.7	QP	0	4.0	Broadband
326.250	23.2	v	46.4	-23.2	QP	315	1.0	
308.750	21.9	v	46.4	-24.5	QP	191	1.0	
300.416	21.2	v	46.4	-25.2	QP	0	1.0	
456.738	19.9	v	46.4	-26.5	QP	0	1.0	
400.000	19.2	v	46.4	-27.2	QP	0	1.0	
416.810	15.4	v	46.4	-31.0	QP	321	1.1	
240.000	27.0	v	46.4	-19.4	QP	0	1.0	

Run #2: Maximized Readings From Run #1

Frequency	Level	Pol	FCC Class A		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
167.235	33.4	h	43.5	-10.1	QP	0	3.9	Broadband
272.000	30.4	h	46.4	-16.0	QP	0	2.8	
600.000	29.8	h	46.4	-16.6	QP	326	3.4	
32.900	22.2	v	39.1	-16.9	QP	192	1.0	
280.000	29.2	h	46.4	-17.2	QP	18	2.9	
316.255	29.0	h	46.4	-17.4	QP	0	3.1	Broadband

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EMC Test Data

Client:	Alien Technology	Job Number:	J54463
Model:	ALR-9640	T-Log Number:	T54583
		Account Manager:	Christine Vu
Contact:	Greg Katterhagen		
Spec:	FCC 15.247	Class:	A

Run #3: Maximized readings, 1000 - 6500 MHz

Measurements made at 3m test distance and extrapolated to 10m using -10.5 correction factor.

Frequency	Level	Pol	FCC Class A		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5647.000	35.7	v	49.5	-13.8	Avg	0	1.0	Noise floor measurement
5647.000	49.2	v	69.5	-20.3	Pk	0	1.0	Noise floor measurement

Note 1:	No significant signals found from 1000MHz-6500MHz