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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to FCC Part 15, Subpart C (15.247) DTS Specifications and Industry Canada RSS 210 Issue 5 for an Intentional Radiator on the Alien Technology Model: ALR-9780

FCC ID:	P65ALR9780
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:	October 30, 2003
FINAL TEST DATE:	October 24, October 27 and October 28, 2003

AUTHORIZED SIGNATORY: Mark Briggs

Mark Briggs
Director of Engineering

ACCREDITED

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SCOPE

An electromagnetic emissions test has been performed on the Alien Technology model ALR-9780 pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators and RSS-210 Issue 5 for licence-exempt low power devices. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Alien Technology model ALR-9780 and therefore apply only to the tested sample. The sample was selected and prepared by Robert Martin 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	6.2.2(o)(a)	20dB Bandwidth	268 kHz	The channel spacing shall be greater than the 20dB bandwidth	Complies
15.247	6.2.2(o)(a)	Channel Separation	400 kHz		Complies
15.247	6.2.2(o)(a)	Number of Channels	63	**902- 928 MHz**: 50 hopping frequencies: average time of occupancy <0.4 second within a 20 second period. *More than 25 but less than 50 hopping frequencies: average time of occupancy <0.4 second within a 20 second period*	Complies
15.247	6.2.2(o)(a)	Channel Dwell Time	.185 seconds per 20 seconds		Complies
15.247	6.2.2(o)(a)	Channel Utilization	All channels are used equally	Refer to Theory of Operations for detailed description of the hopping algorithm	Complies
15.247 (b) (3)	6.2.2(o)(a)	Output Power, 902 – 928 MHz	30 dBm (1Watt) EIRP = 4 W	Multi-point applications: **902 – 928 MHz** Maximum permitted is 1Watt, with EIRP limited to 4 Watts for a 50-channel system. *Maximum permitted is 0.25 Watts, with EIRP limited to 1 Watts for a system that uses less than 50 channels*	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	49.3 dBuV/m @ 4512.985 MHz (-4.8 dB)	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	46.6 dBuV @ 7.103 MHz (-3.4dB)		Complies
	6.6	AC Conducted Emissions	46.6 dBuV @ 7.103 MHz (-1.4dB)		Complies
15.247 (b) (5)		RF Exposure Requirements	FCC /IC limits of power density not	Refer to MPE calculation for 23cm derivation.	Complies

			exceeded provided antenna is located a minimum of ?? cm from persons	Refer to User's Guide for installation instructions requiring a 20cm separation	
15.203		RF Connector	Describe antenna .	Integral antenna or specialized connector required	Complies

EIRP calculated using antenna gain of dBi (6) for the highest EIRP point-to-multipoint system. The system was evaluated with two different antenna types.

MEASUREMENT UNCERTAINTIES

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

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

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Alien Technology model ALR-9780 is a FHSS Transceiver, which is designed to interrogate tags for inventory tracking purposes. Normally, the EUT would be wall-mounted. The EUT was treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 120 Vac, 60 Hz, 1 Amps.

The sample was received on October 24, 2003 and tested on October 24, October 27 and October 28, 2003. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number	Proposed FCC ID #
Alien Technology ALR-9780 Tag Reader	-	P65ALR9780
Phihong PSA31U-120 Power Supply	1300444DA1	N/A

OTHER EUT DETAILS

ENCLOSURE

The EUT enclosure is primarily constructed of fabricated sheet steel/plastic. It measures approximately 19 cm wide by 28 cm deep by 4 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 testing:

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	PP01L	Laptop PC	9LQ8901	DoC

No remote support equipment was used during 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)
Ethernet	Laptop	Cat 5	Unshielded	1
RS-232	Laptop	Multiwire	Shielded	1.3
I/O Port	Unterminated	Multiwire	Shielded	1.4
DC input power	AC/DC adaptor	3 prong	Unshielded	0.8

EUT OPERATION DURING TESTING

The radio was transmitting at full power on the specified channels. The channels were selected since they are at the top, center and bottom of the allocated bands.

ANTENNA REQUIREMENTS

The antenna connector used is standard connector (connector description here). The system requires professional installation so the requirements of FCC Part 15.203 and RSS-210 with respect to a unique antenna connector do not apply.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on October 24, October 27, and October 28, 2003 at the Elliott Laboratories Open Area Test Site #4 and #2 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:

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

where P is the eirp (Watts)

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

FCC 15.407 (a)and RSS 210 (o) OUTPUT POWER LIMITS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Number Of Channels	Output Power
902 – 928	>=50	1 W (30 dBm)
902 – 928	< 50	0.25 W (24 dBm)
2400 – 2483.5	>= 75	1 W (30 dBm)
2400 – 2483.5	>= 75	0.125 W (21 dBm)
5725 – 5850	>=75	1 W (30 dBm)

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

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

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

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

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

FCC AC POWER PORT CONDUCTED EMISSIONS LIMITS

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

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

RSS-210 SECTION 6.6 AC POWER PORT CONDUCTED EMISSIONS LIMITS

The table below shows the limits for emissions on the AC power line as detailed in Industry Canada RSS-210 section 6.6.

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

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

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

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

* Broadband Level - Per ANSI C63.4, 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

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

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

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

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

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Radiated Spurious Emissions, 24-Oct-03
Engineer: Rafael

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Hewlett Packard	High Pass filter, 1.5GHz	P/N 84300-80037	1158	12	4/17/2003	4/17/2004
EMCO	Horn Antenna D. Ridge 1-18 GHz (SA40 horn)	3115	1386	12	3/12/2003	3/12/2004
Hewlett Packard	Spectrum Analyzer 9KHz - 40 GHz	8564E	1393	12	3/12/2003	3/12/2004

Radiated Emissions, 30 - 1000 MHz, 27-Oct-03
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Elliott Laboratories	Biconical Antenna, 30-300 MHz	EL30.300	773	12	3/18/2003	3/18/2004
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1321	12	3/31/2003	3/31/2004
Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	1332	12	7/24/2003	7/24/2004

Conducted Emissions, 27-Oct-03
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Elliott Laboratories	FCC / CISPR LISN	LISN-3, OATS	304	12	7/1/2003	7/1/2004
Rohde& Schwarz	Pulse Limiter	ESH3 Z2	1398	12	1/10/2003	1/10/2004
Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	1332	12	7/24/2003	7/24/2004
Solar Electronics Co	LISN	8028-50-TS-24-BNC support	904	12	8/7/2003	8/7/2004

Radio Antenna Port (Power and Spurious Emissions), 28-Oct-03
Engineer: David Bare

Manufacturer	Description	Model #	Assett #	Cal Due
Hewlett Packard	Spectrum Analyzer, 9KHz - 22GHz	8593EM	1319	19-Nov-03

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T53140_Radio	22 Pages
T53140_Digital	9 Pages

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EMC Test Data

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Emissions Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio
Immunity Spec:	N/A	Environment:	-

EMC Test Data

For The

Alien Technology

Model

ALR-9780

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Proj Eng:	Danni Olivas
Contact:	Robert Martin		
Emissions Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio
Immunity Spec:	N/A	Environment:	-

EUT INFORMATION

General Description

The EUT is a FHSS Transceiver, which is designed to interrogate tags for inventory tracking purposes. Normally, the EUT would be wall-mounted. The EUT was treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 120 Vac, 60 Hz, 1 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Alien Technolog	ALR-9780	Tag Reader	N/A	TBD
Phihong	PSA31U-120	Power Supply	1300444DA1	N/A

Antenna

The EUT uses the following external antennas:

Manufacturer	Model	Description	Serial Number	Antenna Gain (dBi)
Alien Technology	ALR-9610-AL	patch antenna	N/A	6

The antenna connector used is standard connector (connector description here). The system requires professional installation so the requirements of FCC Part 15.203 and RSS-210 with respect to a unique antenna connector do not apply.

EUT Enclosure

The EUT enclosure is primarily constructed of fabricated sheet steel/plastic. It measures approximately 19 cm wide by 28 cm deep by 4 cm high.

Modification History

Mod. #	Test	Date	Modification
1			

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Proj Eng:	Danni Olivas
Contact:	Robert Martin		
Emissions Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio
Immunity Spec:	N/A	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	PP01L	Laptop PC	9LQ8901	DoC

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)
Ethernet	Laptop	Cat 5	Unshielded	1
RS-232	Laptop	Multiwire	Shielded	1.3
I/O Port	Unterminated	Multiwire	Shielded	1.4
DC input power	AC/DC adaptor	3 prong	Unshielded	0.8

EUT Operation During Emissions Testing (Radio)

The radio was transmitting at full power on the specified channels. The channels were selected since they are at the top, center and bottom of the allocated bands.

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio

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: 10/24/2003
Test Engineer: Rafael
Test Location: SVOATS #4

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

General Test Configuration

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

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

Ambient Conditions:

Temperature: 17 °C
Rel. Humidity: 46 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1a-2c	RE, Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	Refer to individual runs

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio

Run #1a: Radiated Spurious Emissions. Low Channel @ 902 MHz
Alien Linear antenna, Reader 4x4, 15ft antenna cable

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	118.7	124.2
Limit for emissions outside of restricted bands:	104.2 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	
2707.785	35.7	H	54.0	-18.4	AVG	312	1.0	3rd Harmonic
2707.785	41.9	H	74.0	-32.1	PK	312	1.0	3rd Harmonic
2707.770	39.6	V	54.0	-14.4	AVG	348	1.1	3rd Harmonic
2707.770	43.6	V	74.0	-30.4	PK	348	1.1	3rd Harmonic
3610.345	38.4	V	54.0	-15.6	AVG	303	1.0	4th Harmonic
3610.345	44.3	V	74.0	-29.7	PK	303	1.0	4th Harmonic
4512.985	44.7	V	54.0	-9.3	AVG	354	1.0	5th Harmonic
4512.985	48.7	V	74.0	-25.3	PK	354	1.0	5th Harmonic
5415.580	45.4	V	54.0	**-8.6**	AVG	331	1.3	6th Harmonic
5415.580	49.5	V	74.0	-24.5	PK	331	1.3	6th Harmonic
3610.520	35.8	H	54.0	-18.2	AVG	318	1.3	4th Harmonic
3610.520	43.9	H	74.0	-30.2	PK	318	1.3	4th Harmonic
4512.970	41.6	H	54.0	-12.5	AVG	27	1.0	5th Harmonic
4512.970	47.6	H	74.0	-26.4	PK	27	1.0	5th Harmonic
5415.645	41.9	H	54.0	-12.1	AVG	337	1.4	6th Harmonic
5415.645	48.4	H	74.0	-25.6	PK	337	1.4	6th Harmonic
1805.160	32.0	H	54.0	-22.0	AVG	19	1.9	2nd Harmonic- Unrestricted
1805.160	39.8	H	74.0	-34.2	PK	19	1.9	2nd Harmonic- Unrestricted
1805.250	30.2	V	54.0	-23.8	AVG	320	1.0	2nd Harmonic- Unrestricted
1805.250	38.8	V	74.0	-35.2	PK	320	1.0	2nd Harmonic- Unrestricted

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EMC Test Data

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio

Run #1b: Radiated Spurious Emissions. Middle Channel @ 915 MHz
Alien Linear antenna, Reader 4x4, 15ft antenna cable

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1829.995	30.4	V	54.0	-23.6	AVG	17	1.0	2nd Harmonic - Unrestricted
1829.995	39.6	V	74.0	-34.4	PK	17	1.0	2nd Harmonic - Unrestricted
2745.015	35.8	V	54.0	-18.2	AVG	330	1.0	3rd Harmonic
2745.015	45.8	V	74.0	-28.2	PK	330	1.0	3rd Harmonic
3659.915	44.2	V	54.0	-9.8	AVG	342	1.2	4th Harmonic
3659.915	48.4	V	74.0	-25.7	PK	342	1.2	4th Harmonic
4574.975	39.5	V	54.0	-14.5	AVG	356	1.0	5th Harmonic
4574.975	47.0	V	74.0	-27.0	PK	356	1.0	5th Harmonic
5489.980	48.9	V	54.0	**-5.1**	AVG	356	1.3	6th Harmonic
5489.980	52.5	V	74.0	-21.6	PK	356	1.3	6th Harmonic
8234.940	43.2	V	54.0	-10.9	AVG	325	1.0	9th Harmonic
8234.940	51.3	V	74.0	-22.7	PK	325	1.0	9th Harmonic
1829.935	33.1	H	54.0	-20.9	AVG	33	1.3	2nd Harmonic - Unrestricted
1829.935	40.2	H	74.0	-33.9	PK	33	1.3	2nd Harmonic - Unrestricted
2745.010	34.5	H	54.0	-19.5	AVG	294	1.0	3rd Harmonic
2745.010	48.8	H	74.0	-25.2	PK	294	1.0	3rd Harmonic
3659.960	40.4	H	54.0	-13.7	AVG	329	1.9	4th Harmonic
3659.960	46.1	H	74.0	-27.9	PK	329	1.9	4th Harmonic
4574.995	37.9	H	54.0	-16.1	AVG	321	1.1	5th Harmonic
4574.995	46.1	H	74.0	-27.9	PK	321	1.1	5th Harmonic
5489.930	46.3	H	54.0	-7.7	AVG	311	1.0	6th Harmonic
5489.930	51.2	H	74.0	-22.8	PK	311	1.0	6th Harmonic
8235.020	40.7	H	54.0	-13.3	AVG	316	1.0	9th Harmonic
8235.020	50.3	H	74.0	-23.7	PK	316	1.0	9th Harmonic

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EMC Test Data

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio

Run #1c: Radiated Spurious Emissions. High Channel @ 928 MHz
Alien Linear antenna, Reader 4x4, 15ft antenna cable

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	122.1	123.6
Limit for emissions outside of restricted bands:	103.6 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	
3709.645	42.6	V	54.0	-11.4	AVG	317	1.2	4th Harmonic
3709.645	46.9	V	74.0	-27.1	PK	317	1.2	4th Harmonic
1854.820	31.5	V	54.0	-22.5	AVG	335	1.1	2nd Harmonic - Unrestricted
1854.820	39.5	V	74.0	-34.5	PK	335	1.1	2nd Harmonic - Unrestricted
2782.260	37.5	V	54.0	-16.5	AVG	331	1.0	3rd Harmonic
2782.260	42.8	V	74.0	-31.2	PK	331	1.0	3rd Harmonic
4636.940	37.4	V	54.0	-16.6	AVG	353	1.0	5th Harmonic
4636.940	44.6	V	74.0	-29.4	PK	353	1.0	5th Harmonic
5564.360	44.6	V	54.0	-9.4	AVG	355	1.3	6th Harmonic
5564.360	49.6	V	74.0	-24.4	PK	355	1.3	6th Harmonic
1854.815	30.1	H	54.0	-23.9	AVG	329	1.4	2nd Harmonic - Unrestricted
1854.815	39.0	H	74.0	-35.0	PK	329	1.4	2nd Harmonic - Unrestricted
2782.240	34.7	H	54.0	-19.3	AVG	295	1.0	3rd Harmonic
2782.240	41.9	H	74.0	-32.1	PK	295	1.0	3rd Harmonic
3709.555	47.1	H	54.0	-6.9	AVG	317	1.9	4th Harmonic
3709.555	50.2	H	74.0	-23.8	PK	317	1.9	4th Harmonic
4637.005	36.3	H	54.0	-17.8	AVG	27	1.0	5th Harmonic
4637.005	45.2	H	74.0	-28.8	PK	27	1.0	5th Harmonic
5564.425	45.2	H	54.0	-8.8	AVG	320	1.0	6th Harmonic
5564.425	50.2	H	74.0	-23.8	PK	320	1.0	6th Harmonic

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EMC Test Data

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio

Run #2a: Radiated Spurious Emissions. Low Channel @ 902 MHz
Alien Circular polarized antenna, Reader 4x4, 15ft antenna cable

	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	
1805.225	43.7	V	54.0	-10.3	AVG	18	1.2	2nd Harmonic - Unrestricted
1805.225	47.1	V	74.0	-26.9	PK	18	1.2	2nd Harmonic - Unrestricted
2707.755	34.5	V	54.0	-19.5	AVG	9	1.0	3rd Harmonic
2707.755	41.0	V	74.0	-33.0	PK	9	1.0	3rd Harmonic
3610.475	37.6	V	54.0	-16.4	AVG	353	1.0	4th Harmonic
3610.475	44.3	V	74.0	-29.7	PK	353	1.0	4th Harmonic
4512.985	49.3	V	54.0	**-4.8**	AVG	347	1.3	5th Harmonic
4512.985	52.5	V	74.0	-21.5	PK	347	1.3	5th Harmonic
5415.590	47.4	V	54.0	-6.7	AVG	0	1.2	6th Harmonic
5415.590	51.1	V	74.0	-22.9	PK	0	1.2	6th Harmonic
1805.260	40.1	H	54.0	-13.9	AVG	305	1.0	2nd Harmonic - Unrestricted
1805.260	44.4	H	74.0	-29.6	PK	305	1.0	2nd Harmonic - Unrestricted
2707.880	35.4	H	54.0	-18.6	AVG	329	1.0	3rd Harmonic
2707.880	42.0	H	74.0	-32.0	PK	329	1.0	3rd Harmonic
3610.505	35.7	H	54.0	-18.3	AVG	292	1.0	4th Harmonic
3610.505	44.7	H	74.0	-29.3	PK	292	1.0	4th Harmonic
4512.960	46.2	H	54.0	-7.8	AVG	317	1.0	5th Harmonic
4512.960	49.9	H	74.0	-24.1	PK	317	1.0	5th Harmonic
5415.595	42.6	H	54.0	-11.4	AVG	338	1.0	6th Harmonic
5415.595	49.2	H	74.0	-24.8	PK	338	1.0	6th Harmonic

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio

Run #2b: Radiated Spurious Emissions. Middle Channel @ 915 MHz
Alien Circular polarized antenna, Reader 4x4, 15ft antenna cable

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1829.980	38.6	V	54.0	-15.4	AVG	17	1.0	2nd Harmonic - Unrestricted
1829.980	43.4	V	74.0	-30.6	PK	17	1.0	2nd Harmonic - Unrestricted
2744.995	38.0	V	54.0	-16.0	AVG	7	1.0	3rd Harmonic
2744.995	49.6	V	74.0	-24.4	PK	7	1.0	3rd Harmonic
3660.050	43.3	V	54.0	-10.7	AVG	24	1.2	4th Harmonic
3660.050	47.3	V	74.0	-26.7	PK	24	1.2	4th Harmonic
4574.900	38.2	V	54.0	-15.8	AVG	347	1.2	5th Harmonic
4574.900	45.2	V	74.0	-28.8	PK	347	1.2	5th Harmonic
5490.050	43.7	V	54.0	-10.3	AVG	356	1.2	6th Harmonic
5490.050	49.1	V	74.0	-24.9	PK	356	1.2	6th Harmonic
8234.950	42.1	V	54.0	-12.0	AVG	322	1.0	9th Harmonic
8234.950	51.8	V	74.0	-22.2	PK	322	1.0	9th Harmonic
1830.065	36.7	H	54.0	-17.3	AVG	302	1.0	2nd Harmonic - Unrestricted
1830.065	42.1	H	74.0	-31.9	PK	302	1.0	2nd Harmonic - Unrestricted
2745.025	40.6	H	54.0	-13.4	AVG	328	1.4	3rd Harmonic
2745.025	55.3	H	74.0	-18.7	PK	328	1.4	3rd Harmonic
3659.955	45.4	H	54.0	-8.6	AVG	322	1.7	4th Harmonic
3659.955	49.3	H	74.0	-24.7	PK	322	1.7	4th Harmonic
4574.965	38.9	H	54.0	-15.2	AVG	315	1.0	5th Harmonic
4574.965	47.0	H	74.0	-27.0	PK	315	1.0	5th Harmonic
5489.960	42.3	H	54.0	-11.7	AVG	311	1.0	6th Harmonic
5489.960	48.5	H	74.0	-25.6	PK	311	1.0	6th Harmonic
8235.015	40.4	H	54.0	-13.6	AVG	316	1.3	9th Harmonic
8235.015	50.0	H	74.0	-24.0	PK	316	1.3	9th Harmonic

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EMC Test Data

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio

Run #2c: Radiated Spurious Emissions. High Channel @ 928 MHz
Alien Circular polarized antenna, Reader 4x4, 15ft antenna cable

	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	
1854.795	31.2	V	54.0	-22.8	AVG	50	1.0	2nd Harmonic - Unrestricted
1854.795	39.3	V	74.0	-34.7	PK	50	1.0	2nd Harmonic - Unrestricted
2782.255	35.3	V	54.0	-18.8	AVG	25	1.0	3rd Harmonic
2782.255	42.3	V	74.0	-31.8	PK	25	1.0	3rd Harmonic
3709.540	40.9	V	54.0	-13.1	AVG	26	1.2	4th Harmonic
3709.540	46.8	V	74.0	-27.3	PK	26	1.2	4th Harmonic
4636.990	34.3	V	54.0	-19.7	AVG	355	1.0	5th Harmonic
4636.990	44.3	V	74.0	-29.7	PK	355	1.0	5th Harmonic
5564.330	46.3	V	54.0	-7.7	AVG	2	1.4	6th Harmonic
5564.330	50.4	V	74.0	-23.6	PK	2	1.4	6th Harmonic
6491.765	40.3	V	54.0	-13.7	AVG	351	1.0	7th Harmonic
6491.765	47.4	V	74.0	-26.7	PK	351	1.0	7th Harmonic
1854.870	35.4	H	54.0	-18.6	AVG	16	1.1	2nd Harmonic - Unrestricted
1854.870	42.0	H	74.0	-32.1	PK	16	1.1	2nd Harmonic - Unrestricted
2782.225	39.5	H	54.0	-14.5	AVG	28	1.0	3rd Harmonic
2782.225	44.2	H	74.0	-29.8	PK	28	1.0	3rd Harmonic
3709.610	44.0	H	54.0	-10.0	AVG	325	1.5	4th Harmonic
3709.610	48.4	H	74.0	-25.7	PK	325	1.5	4th Harmonic
4637.045	36.3	H	54.0	-17.7	AVG	312	1.0	5th Harmonic
4637.045	45.7	H	74.0	-28.3	PK	312	1.0	5th Harmonic
5564.435	45.9	H	54.0	-8.1	AVG	310	1.0	6th Harmonic
5564.435	50.5	H	74.0	-23.5	PK	310	1.0	6th Harmonic
6491.795	36.1	H	54.0	-17.9	AVG	329	1.0	7th Harmonic
6491.795	45.4	H	74.0	-28.6	PK	329	1.0	7th Harmonic

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	N/A

Antenna Conducted Emissions

Test Specifics

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

Date of Test: 10/28/2003
Test Engineer: David Bare
Test Location: Chamber #2
Config. Used: 1
Config Change: No ethernet or I/O port cable connected
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located a bench during testing.

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 channel. The measurements were performed with 15 ft. of LMR-195 cable from radio to measurement instrument.

Ambient Conditions:

Temperature: 25 °C
Rel. Humidity: 32 %

Summary of Results

Run #	Test Performed	Limit	Result	Comment
1	20dB Bandwidth	15.247(a)	Pass	Minimum 265 kHz
1	99% Power Bandwidth	15.247(a)	Pass	Minimum 640 kHz
2	Output Power	15.247(b)	Pass	30 dBm / 1 watt
3	Channel Occupancy / Separation	15.247(a)	Pass	185 ms / 400 kHz
4	Number of Channels	15.247(a)	Pass	63
5	Spurious/ Out-of Band Emissions	15.247(a)	Pass	All out of band emissions > 20dBc

Modifications Made During Testing:

No modifications were made to the EUT during testing

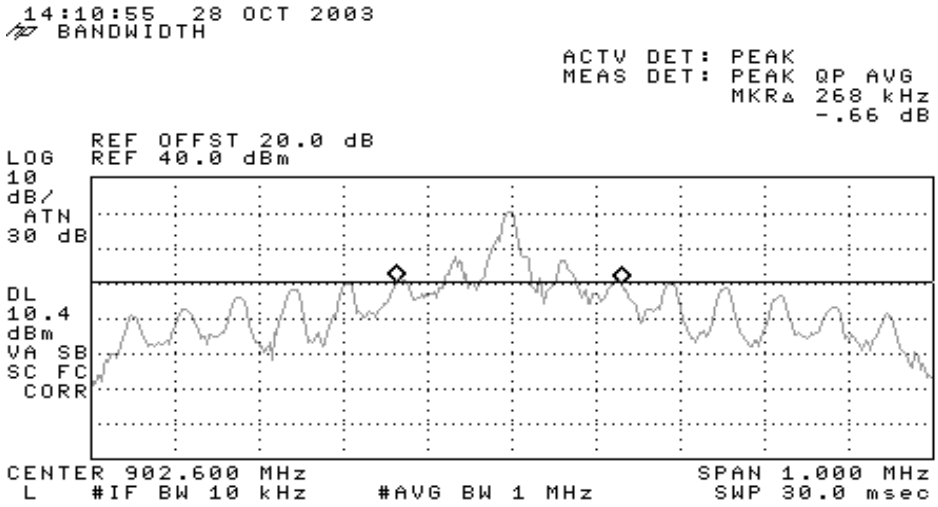
Deviations From The Standard

No deviations were made from the requirements of the standard.

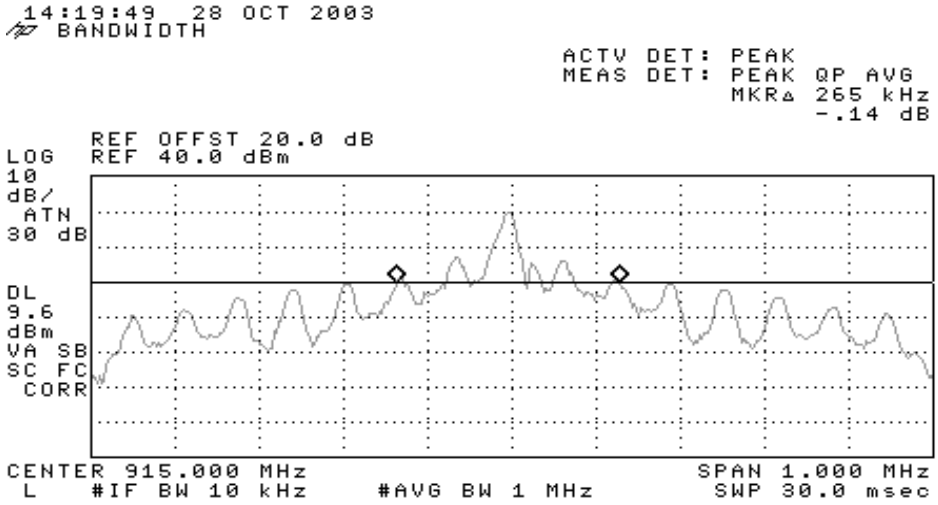
Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	N/A

Run #2: Signal Bandwidth

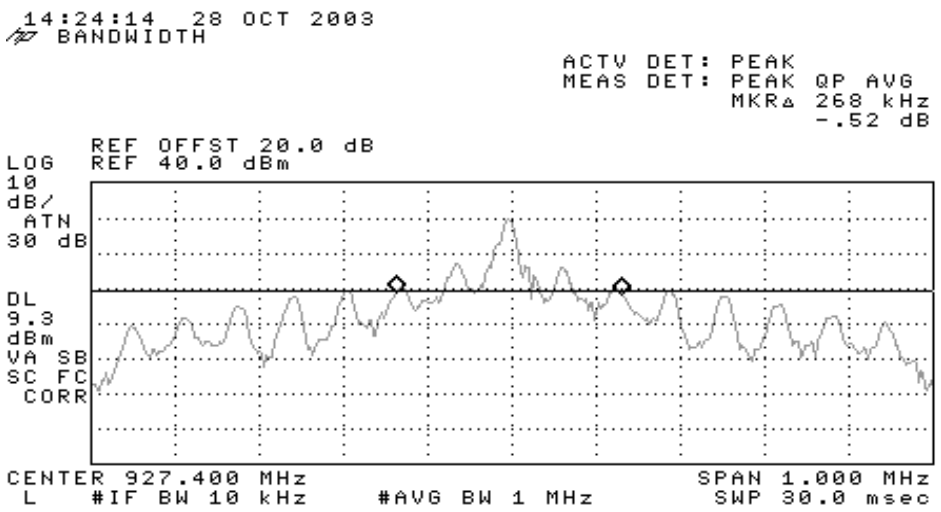
Channel	Frequency (MHz)	Resolution Bandwidth	20dB Signal Bandwidth	99% Power Bandwidth
Low	902.6	10kHz	268 kHz	645 kHz
Mid	915	10kHz	265 kHz	640 kHz
High	927.4	10kHz	268 kHz	640 kHz



Note 1:	The modulated signal level at 901.825 MHz is 32dB below the highest in band signal level. This was the highest level next to the band edge of 902 MHz.



Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	N/A



Note 1:	The modulated signal level at 928.175 MHz is 31dB below the highest in band signal level. This was the highest level next to the band edge of 928 MHz.

Run #2: Output Power

Channel	Frequency (MHz)	Res BW	Output Power (dBm)	Output Power (W)	Comment
Low	902.6	1 MHz	30	1.00	VBW=1 MHz
Mid	915	1 MHz	29.5	0.89	VBW=1 MHz
High	927.4	1 MHz	29.3	0.85	VBW=1 MHz

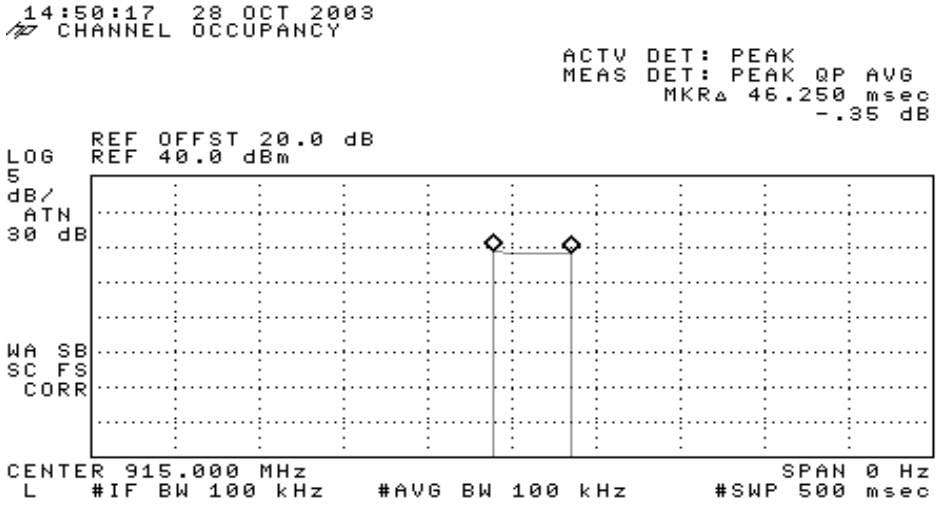
Note 1:	Maximum antenna gain used for this antenna is 6dBi, therefore, maximum permitted power for a system utilizing more than 50 channels is 30dBm (1 Watt)

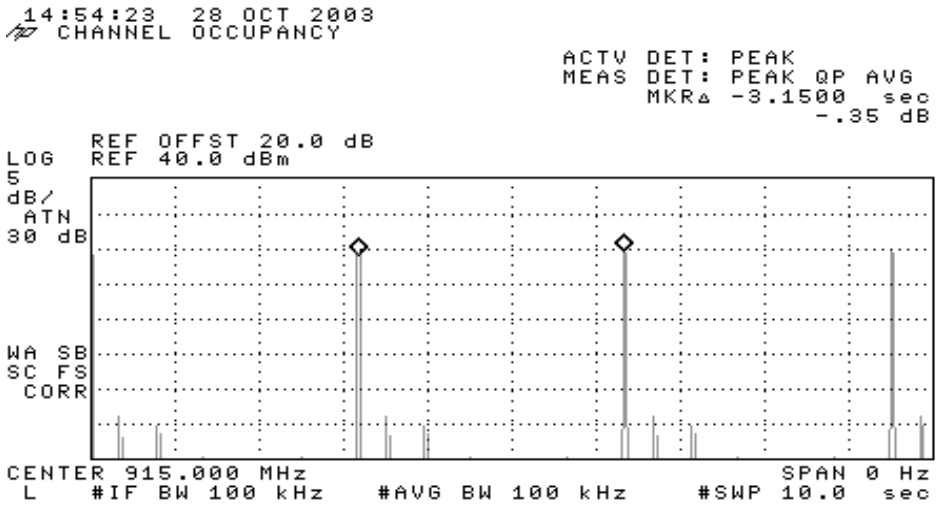
Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	N/A

Run #3: Channel Occupancy And Spacing

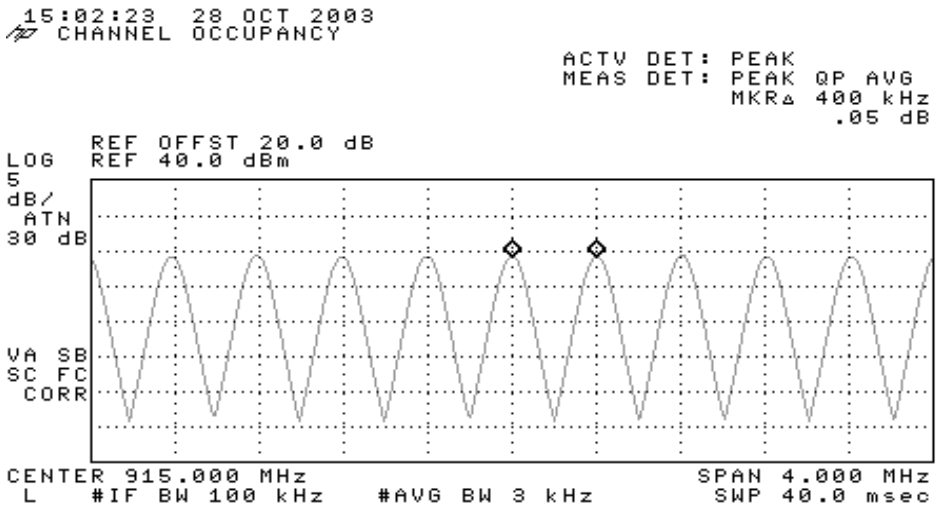
The channel occupancy was measured with the radio transmitting normally (i.e. In hopping mode)

The channel spacing was:	400 kHz
The minimum channel separation permitted is:	268 kHz
The dwell time on the center channel in a 10 second period was:	185 mS
The maximum permitted dwell time in a 10 second period for FCC	400 mS





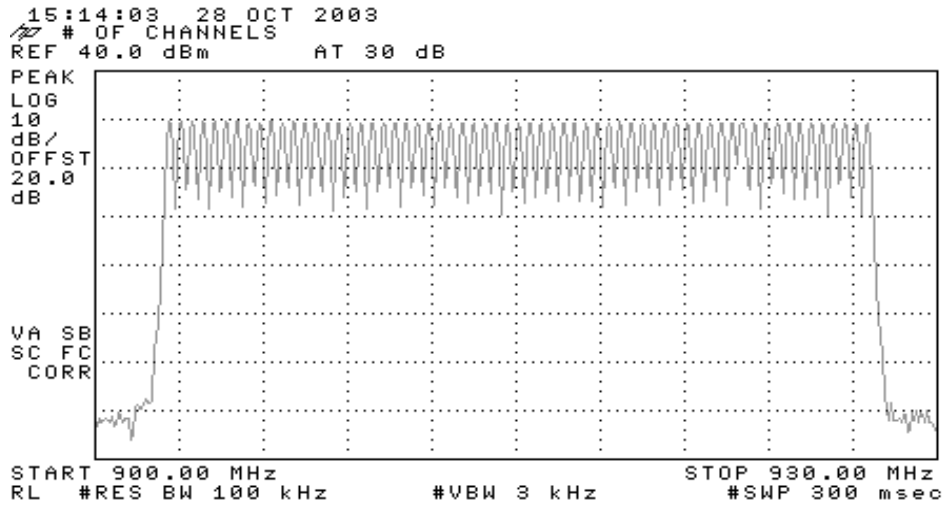
Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	N/A



Run #4: Number of Channels

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

The number of channels was: 63

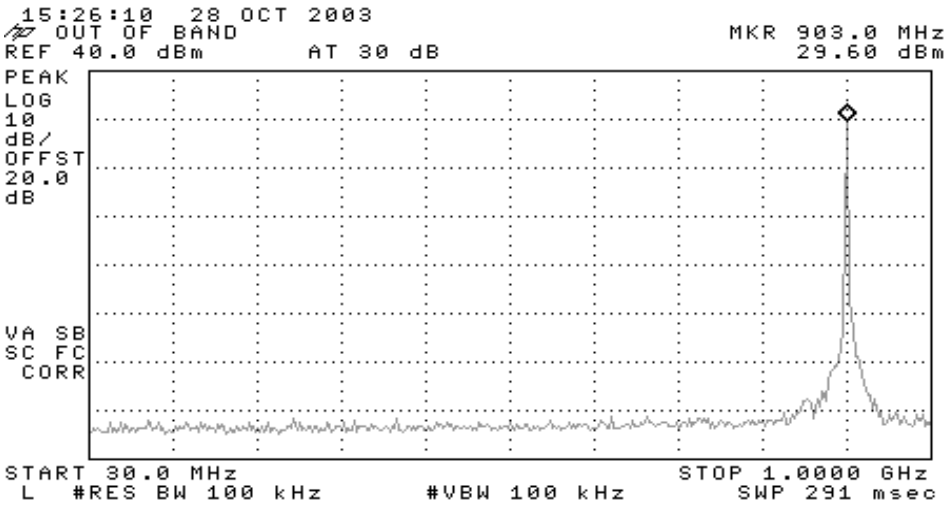


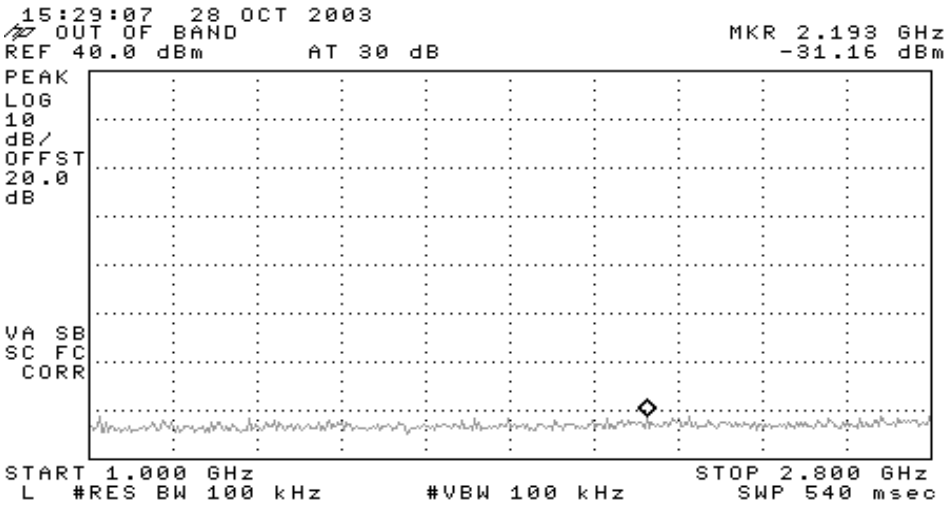
Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	N/A

Run #5: Spurious/ Out-of Band Emissions

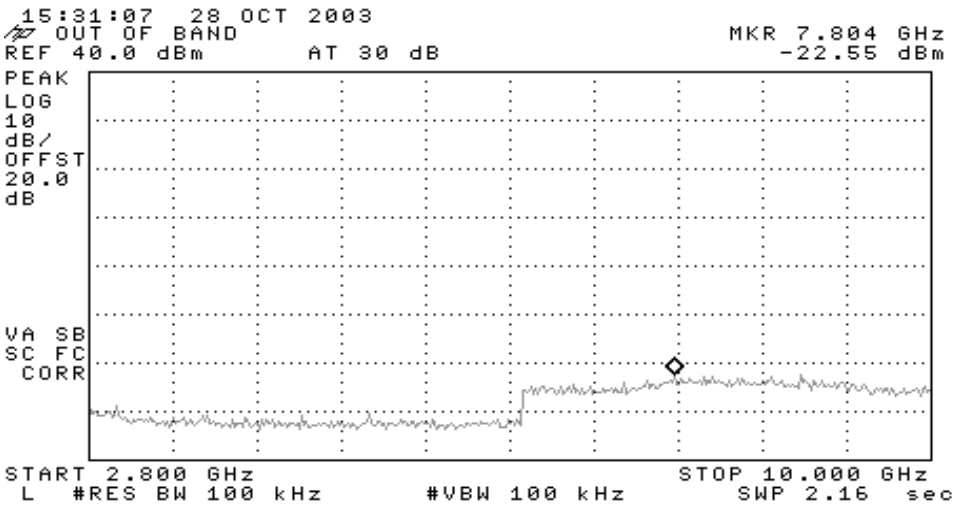
All spurious emissions were more than 20dB below the fundamental signal level when measured in a 100kHz bandwidth. Refer to the plots below. A plot showing the restricted band that starts at 960 MHz has also been included to demonstarte compliance in that band with the radio on the highest channel.

Low Channel

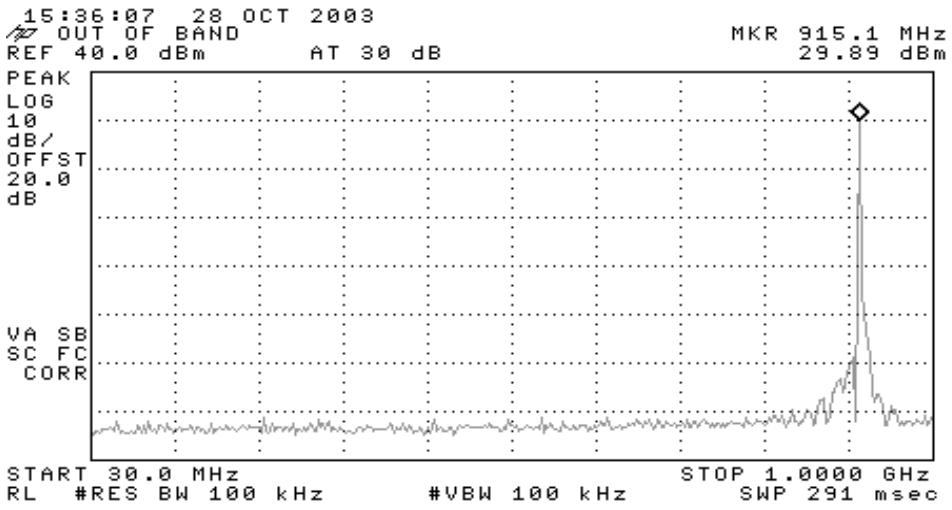




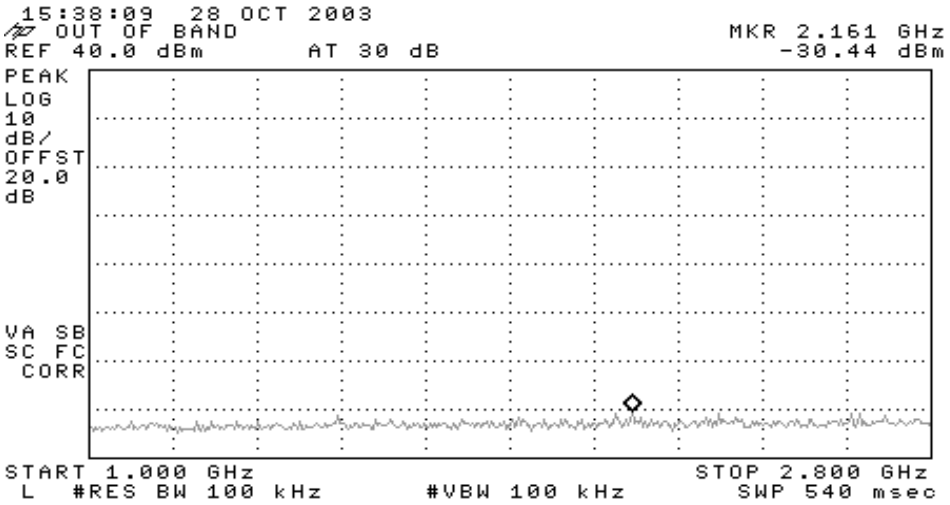
Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	N/A

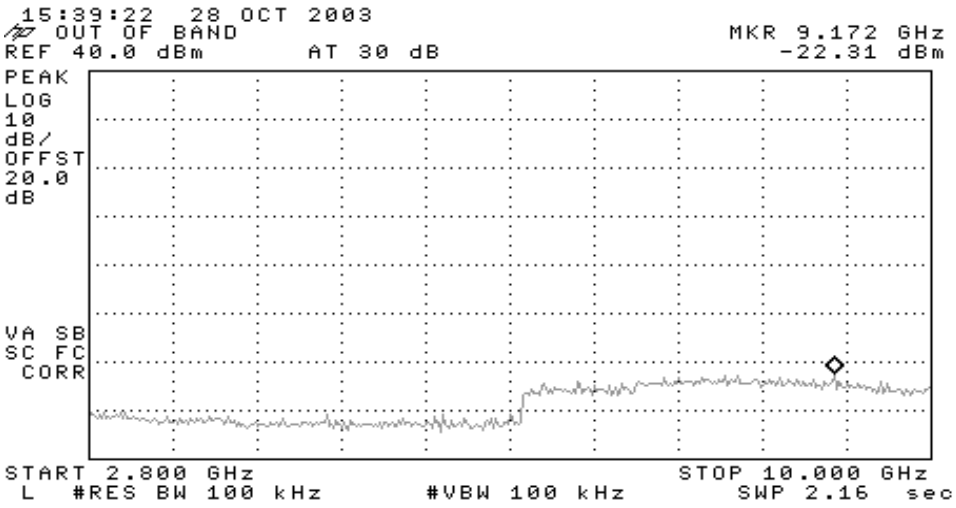


Middle channel



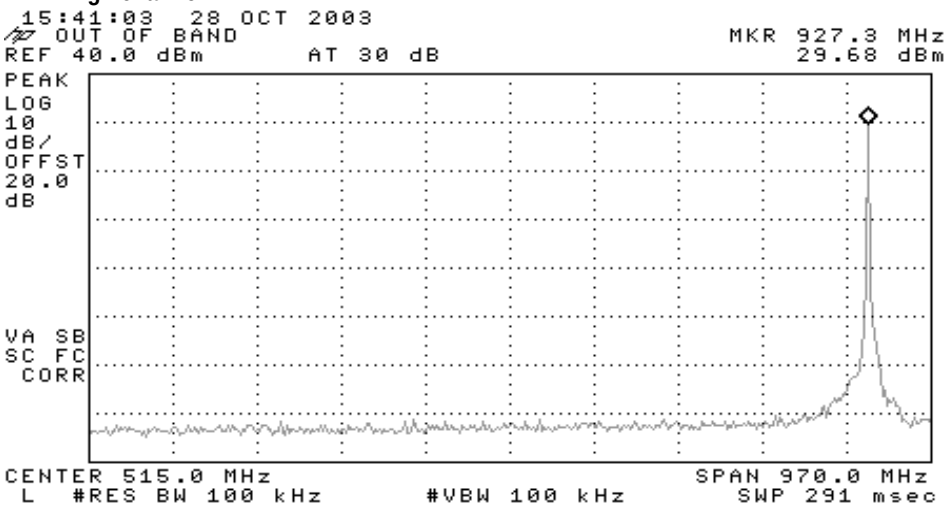
Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	N/A

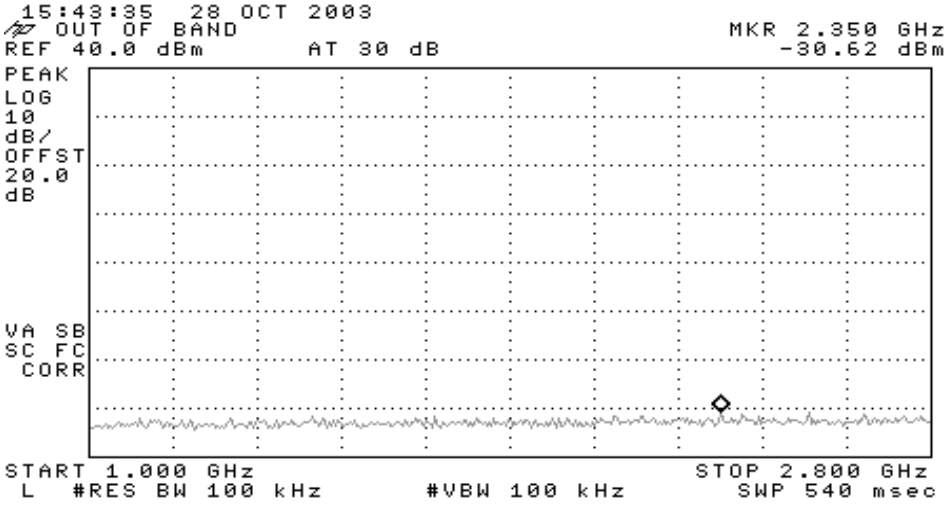




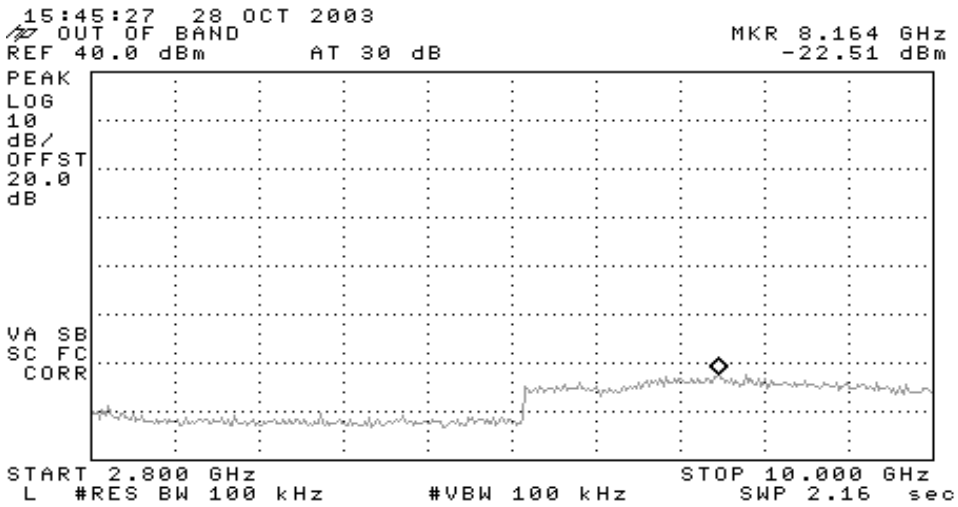
Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	N/A

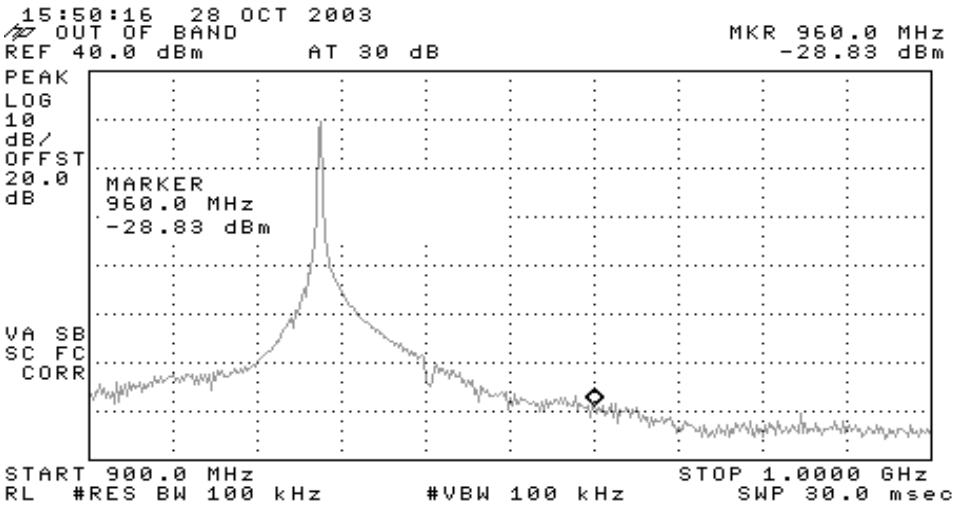
High channel





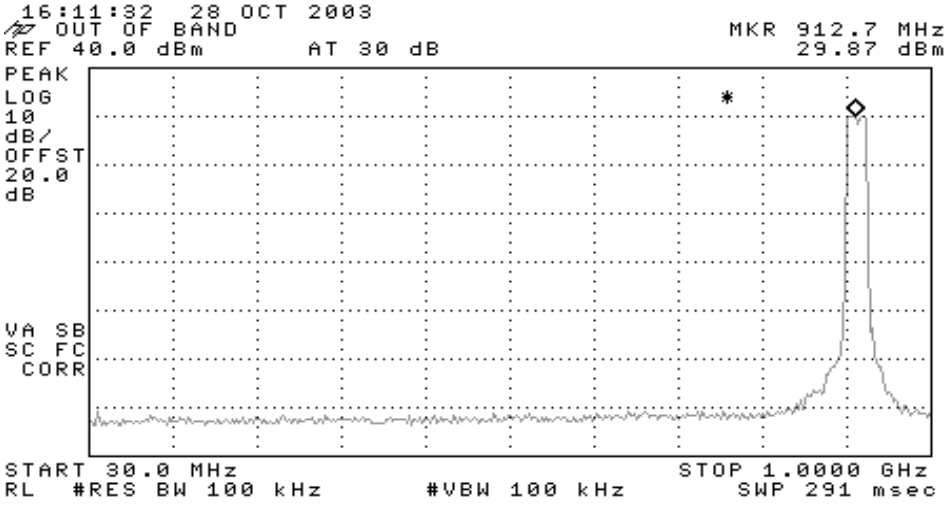
Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	N/A

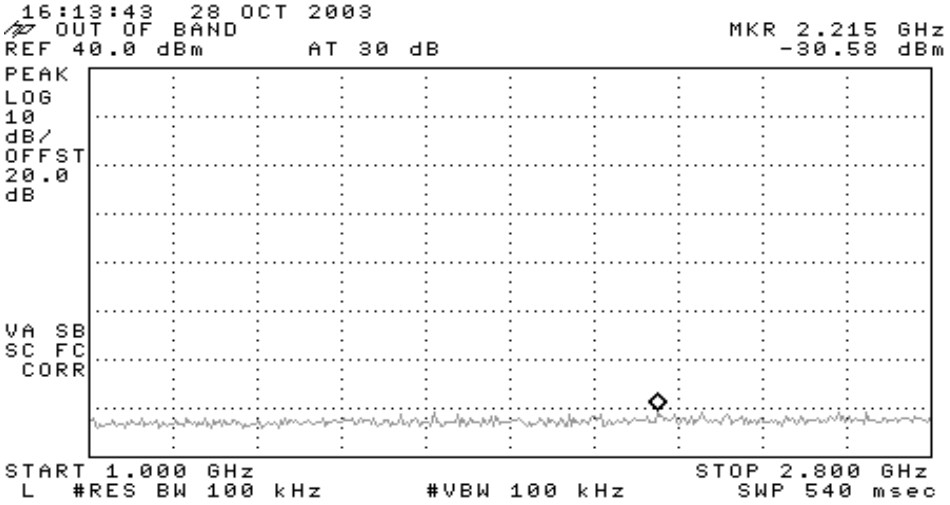




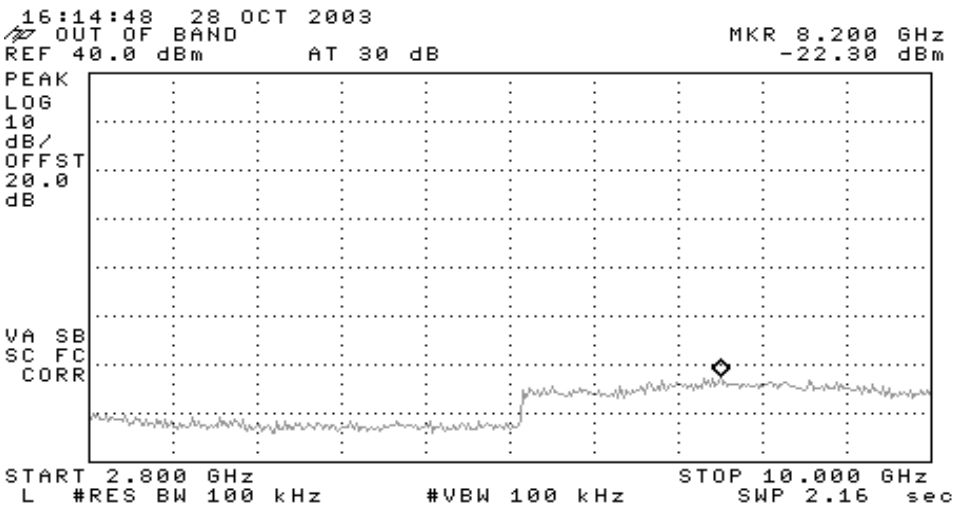
Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	N/A

Hopping





Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	N/A



Elliott

EMC Test Data

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Emissions Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio
Immunity Spec:	N/A	Environment:	-

EMC Test Data

For The

Alien Technology

Model

ALR-9780

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Proj Eng:	Danni Olivas
Contact:	Robert Martin		
Emissions Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio
Immunity Spec:	N/A	Environment:	-

EUT INFORMATION

General Description

The EUT is a FHSS Transceiver, which is designed to interrogate tags for inventory tracking purposes. Normally, the EUT would be wall-mounted. The EUT was treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 120 Vac, 60 Hz, 1 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Alien Technolog	ALR-9780	Tag Reader	N/A	TBD
Phihong	PSA31U-120	Power Supply	1300444DA1	N/A

Antenna

The EUT uses the following external antennas:

Manufacturer	Model	Description	Serial Number	Antenna Gain (dBi)
Alien Technology	ALR-9610-AL	patch antenna	N/A	6

The antenna connector used is standard connector (connector description here). The system requires professional installation so the requirements of FCC Part 15.203 and RSS-210 with respect to a unique antenna connector do not apply.

EUT Enclosure

The EUT enclosure is primarily constructed of fabricated sheet steel/plastic. It measures approximately 19 cm wide by 28 cm deep by 4 cm high.

Modification History

Mod. #	Test	Date	Modification
1			

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Proj Eng:	Danni Olivas
Contact:	Robert Martin		
Emissions Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio
Immunity Spec:	N/A	Environment:	-

Test Configuration #2

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	PP01L	Laptop PC	9LQ8901	DoC

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)
Ethernet	Laptop	Cat 5	Unshielded	1
RS-232	Laptop	Multiwire	Shielded	1.3
I/O Port	Unterminated	Multiwire	Shielded	1.4
DC input power	AC/DC adaptor	3 prong	Unshielded	0.8

EUT Operation During Emissions

EUT was set to transmit at low channel, Maximum output power.

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio

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: 10/27/2003
Test Engineer: jmartinez
Test Location: SVOATS #2

Config. Used: 2
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.

On the OATS, the measurement antenna was located 10 meters from the EUT for the measurement range 30 - 1000 MHz

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: 29 °C
Rel. Humidity: 25 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
2	RE, 30 - 1000MHz, Maximized Emissions	FCC A	Pass	-4.2dB @ 331.776MHz

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:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio

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

Frequency	Level	Pol	FCC A		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
331.776	42.2	h	46.4	-4.2	QP	122	2.2	
167.040	37.2	v	43.5	-6.3	QP	114	1.0	
320.716	36.1	h	46.4	-10.3	QP	206	2.4	
320.716	35.2	v	46.4	-11.2	QP	68	1.0	
167.040	31.5	h	43.5	-12.0	QP	313	1.6	
300.000	33.1	v	46.4	-13.3	QP	35	1.0	
213.812	30.0	v	43.5	-13.5	QP	2	1.0	
221.184	32.5	h	46.4	-13.9	QP	0	3.2	
228.564	31.3	v	46.4	-15.1	QP	360	1.0	
300.000	31.2	h	46.4	-15.2	QP	296	2.9	
221.184	31.2	v	46.4	-15.2	QP	345	1.0	
213.812	28.1	h	43.5	-15.4	QP	316	2.8	
228.566	30.1	h	46.4	-16.3	QP	111	2.3	
309.660	28.0	h	46.4	-18.4	QP	302	2.9	
331.776	27.6	v	46.4	-18.8	QP	69	1.0	
309.660	27.3	v	46.4	-19.1	QP	139	1.0	

Note 1:	Add note here
Note 2:	

Run #2: Maximized Readings From Run #1

Frequency	Level	Pol	FCC A		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
331.776	42.2	h	46.4	-4.2	QP	122	2.2	
167.040	37.2	v	43.5	-6.3	QP	114	1.0	
320.716	36.1	h	46.4	-10.3	QP	206	2.4	
320.716	35.2	v	46.4	-11.2	QP	68	1.0	
167.040	31.5	h	43.5	-12.0	QP	313	1.6	
300.000	33.1	v	46.4	-13.3	QP	35	1.0	

Note 1:	Add note here
Note 2:	

Client:	Alien Technology	Job Number:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio

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: 10/27/2003
Test Engineer: jmartinez
Test Location: SVOATS #2

Config. Used: 2
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. Remote support equipment was located approximately 30 meters from the test area.

Ambient Conditions:

Temperature: 29 °C
Rel. Humidity: 25 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power,120V/60Hz	EN55022 B	Pass	-3.4dB @ 7.103MHz

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:	J53134
Model:	ALR-9780	T-Log Number:	T53140
		Account Manager:	Danni Olivas
Contact:	Robert Martin		
Spec:	FCC Part 15 B and E, RSS-210	Class:	Radio

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

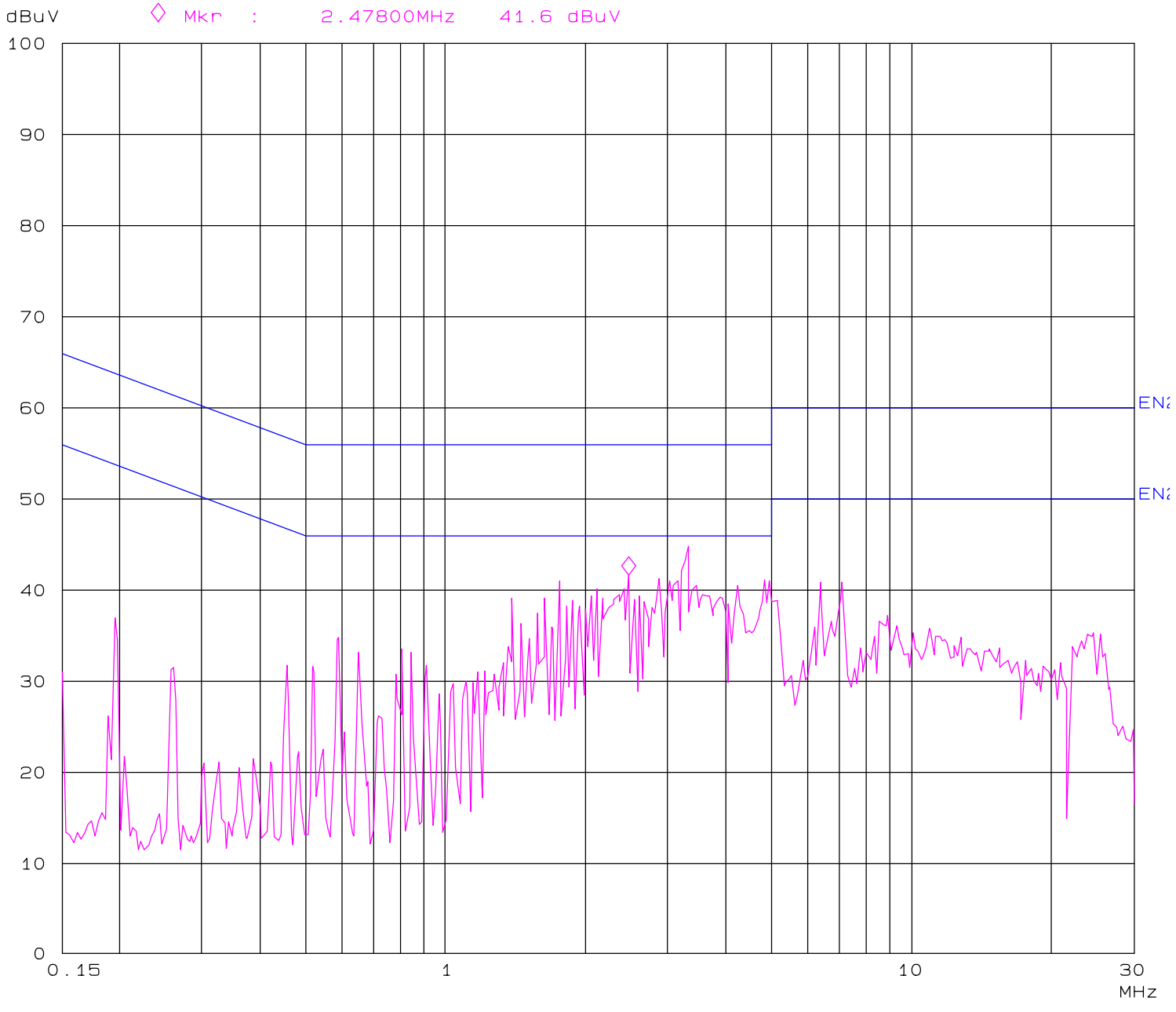
Frequency	Level	AC	EN55022 B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
7.103	46.6	Line	50.0	-3.4	Average	
4.692	39.2	Line	46.0	-6.8	Average	
3.324	37.0	Line	46.0	-9.0	Average	
3.195	35.2	Line	46.0	-10.8	Average	
7.103	49.0	Line	60.0	-11.0	QP	
4.962	33.1	Neutral	46.0	-12.9	Average	
3.324	42.4	Line	56.0	-13.6	QP	
3.327	32.0	Neutral	46.0	-14.0	Average	
3.195	41.8	Line	56.0	-14.2	QP	
4.692	41.3	Line	56.0	-14.7	QP	
3.327	40.3	Neutral	56.0	-15.7	QP	
4.962	40.0	Neutral	56.0	-16.0	QP	
2.478	29.4	Neutral	46.0	-16.6	Average	
2.478	35.2	Neutral	56.0	-20.8	QP	

Note 1:	
Note 2:	

Elliott Laboratories
AC Conducted Emissions

27. Oct 03 15:49

Operator: Juan Martinz
Comment: Alien Technology
ALR97E (FHSS RFID)
EN55022 B
Neutral



Elliott Laboratories
AC Conducted Emissions

27. Oct 03 15:56

Operator: Juan Martinz
Comment: Alien Technology
ALR97E (FHSS RFID)
EN55022 B
Line
120Vac, 60Hz