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Electromagnetic Emissions Test Report
In Accordance With
FCC Part 90
on the
Cisco Systems
Transmitter
Model: U58H068

FCC ID NUMBER:	LDKXSCLCR15
GRANTEE:	Cisco Systems 170 West Tasman Drive San Jose, CA 95134-1706
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	September 1, 2005
FINAL TEST DATE:	August 23 and August 24, 2005

AUTHORIZED SIGNATORY:

Juan Martinez
Senior EMC Engineer

A2LA ACCREDITED
2016-01

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FCC CERTIFICATION INFORMATION

The following information is in accordance with FCC Rules, 47CFR Part 2, Subpart J, Section 2.1033(C).

2.1033(c)(1) Applicant:

Cisco Systems
170 West Tasman Drive
San Jose, CA 95134-1706

2.1033(c)(2) FCC ID: LDKXSCLCR15

2.1033(c)(3) & RSP-100 (7.2(a)) Instructions/Installation Manual

Please refer to Exhibit 7: User Manual, Theory of Operation, and Tune-up Procedure

2.1033(c)(4) & RSP-100 (7.2(b)(iii)) Type of emissions

FCC 90: 5M00X1D, 10M0X1D, 20M0X1D

2.1033(c)(5) & RSP-100 (7.2(a)) Frequency Range

FCC 90: **4940 – 4990 MHz**

2.1033(c)(6) & RSP-100 (7.2(a)) Range of Operation Power

FCC 90**: 21.4 dBm (137 mW)**

2.1033(c)(7) & RSP-100 (7.2(a)) Maximum FCC & IC Allowed Power Level

FCC 90.210**:** Maximum power is 27 dBm (500mW)

2.1033(c)(8) & RSP-100 (7.2(a)) Applied voltage and currents into the final transistor elements

+5Vdc, 1amp

2.1033(c)(9) & RSP-100 (7.2(a)) Tune-up Procedure

There are no tune able components on the Radio. All transmitter parameters are controlled by software and by AR5414 chip

2.1033(c)(10) & RSP 100 (7.2(a)) Schematic Diagram of the Transmitter

Refer to Exhibit 6: Schematic diagram

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Frequency Stabilization

Y1 = 40 MHz (XTAL) Frequency stability.

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Suppression of Spurious radiation

F2 DEA165850LT-1197B2 low pass filter

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Limiting Modulation

Controlled by software in the Atheros chip U1 (AR5414)

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Limiting Power

Controlled by software in the Atheros chip U1 (AR5414) and scrip files.

2.1033(c)(11) & RSP-100 (7.2(g)) Photographs or Drawing of the Equipment Identification Plate or Label

Refer to Exhibit 4

2.1033(c)(12) & RSP-100 (7.2(c)) Photographs of equipment

Refer to Exhibit 5

2.1033(c)(13) & RSP-100 (7.2(a)) Equipment Employing Digital Modulation & 90.203 (Certification Requirements)

N/A

2.1033(c)(14) & RSP-100 (7.2(b)(ii)) Data taken per Section 2.1046 to 2.1057 and RSS-133 issue 2, Rev. 1.

Refer to Exhibit 2

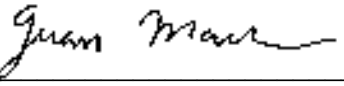
DECLARATIONS OF COMPLIANCE

Equipment Name and Model:
U58H068

Manufacturer:
Cisco Systems
170 West Tasman Drive
San Jose, CA 95134-1706

Tested to applicable standards:
FCC Part 90 (Private Land Mobile Radio Service)

I declare that the testing was performed or supervised by me; that the test measurements were made in accordance with the above mentioned departmental standards (through the use of TIA/EIA-603 and the specific RSS standards applicable to this device); and that the equipment performed in accordance with the data submitted in this report.

Signature	
Name	Juan Martinez
Title	Senior EMC Engineer
	Elliott Laboratories Inc.
Address	684 W. Maude Ave
	Sunnyvale, CA 94086
	USA
Date:	September 1, 2005

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

SCOPE

FCC Part 90 testing was performed for the equipment mentioned in this report. The equipment was tested in accordance with the procedures specified in Sections 2.1046 to 2.1057 of the FCC Rules. TIA-603 was also used as a test procedure guideline to perform some of the required tests.

The intentional radiator above was 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.

OBJECTIVE

The primary objective of the manufacturer is compliance with the FCC Part 90. Certification of these devices is required as a prerequisite to marketing as defined in Section 2.1033.

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

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

SUMMARY OF TEST RESULTS

Part 90 Test Summary

Measurement Required	FCC Part 2 & 90 Sections	RSS-119 Section	Test Performed	Measured Value	Test Procedure Used	Result
Modulation Tested	GMSK	GMSK	-	-	-	-
Modulation characteristics	2.1047/	5.7	Modulated with appropriated signal	-	H	-
Radiated RF power output (ERP/EIRP)	2.1046 / 90.279 & 90.205(g)	6.2	Radiated Output Power Test	-	-	-
Conducted RF power output	2.1046 / 90.279 & 90.205(g)	6.2	Conducted Output Power Test	21.4dBm (.137 Watts)	B	Complies
Spurious emissions at antenna Port	2.1051/ 90.210(d)	6.3 & 6.4(d)	Emission Limits and/or Unwanted Emission 30MHz – 40GHz (**Antenna Conducted**)	All spurious emissions < -31dBm	J	Complies
Occupied Bandwidth	2.1049/ 90.210(c) & (d)	6.4(c) & 6.4(d)	Emission Mask and 99% Bandwidth	Refer to Plots	C & D	Complies
Field strength of spurious radiation	2.1053 / 90.210(d)	6.3 & 6.4(d)	Radiated Spurious Emissions 30MHz – 40GHz	-50.2 dBm @ 9889.1 MHz (-6.5 dB)	N	Complies
Frequency stability	2.1055 / 90.213	7	Frequency Vs. Temperature	18.2 ppm	K	Complies
Frequency stability	2.1055 / 90.213	7	Frequency Vs. Voltage	Battery End Point is 1.85Vdc	L & M	Complies
Transient Frequency Behavior	90.214	6.5	Transient Behavior	Refer to Plots	I	Complies
Exposure to Mobile devices	2.1091	9	Exposure of Humans to RF Fields	N/A	-	
Receiver	15.109	8	Receiver Spurious Emissions	N/A	N/A	Complies

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 UKAS document LAB 34.

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 Cisco Systems model U58H068 is an Atheros base 802.11a radio which Clear Creek will use for Public Safety organizations for applications that require high throughput and citywide coverage in the United States. 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 5Vdc.

The sample was received on August 23, 2005 and tested on August 23 and August 24, 2005. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Cisco Systems	U58H068	4.9 GHz radio module	N/A	LDKXSCLC R15

ENCLOSURE

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

MODIFICATIONS

The EUT did not require modifications during testing in order to comply with the emission specifications.

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for emissions testing:

Manufacturer	Model	Description	Serial Number	FCC ID
IBM	91P9024	Laptop	97P0282	DoC

No remote support equipment was used during emissions testing.

EUT INTERFACE PORTS

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

Port	Connected to	Description	Shielded or Unshielded	Length (m)
Antenna power	termination	coaxial	Shielded	0.5

EUT OPERATION DURING TESTING

Device transmitting continuously at the data rate and power stated in each run description. For frequency stability the device was placed into a CW mode (ART software showed "Single Carrier" mode).

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on August 23 and August 24, 2005 at the Elliott Laboratories Open Area Test Site #1 and Chamber 2 located at 684 West Maude Avenue, Sunnyvale, California. Pursuant to Section 2.948 of the FCC Rules, construction, calibration, and equipment data has been filed with the Commission.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing are performed in conformance with Section 2 of FCC Rules. Measurements are made with the EUT connected to a spectrum analyzer through an attenuator to prevent overloading the analyzer.

RADIATED EMISSIONS CONSIDERATIONS

Radiated measurements are performed in an open field environment or Anechoic Chamber. The test site is maintained free of conductive objects within the CISPR 16-1 defined elliptical area.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers are capable of measuring 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 particular 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. If average measurements above 1000MHz are performed, the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz is used.

INSTRUMENT CONTROL COMPUTER

A personal computer is utilized to record the receiver measurements of the field strength at the antenna, which is then compared directly with the appropriate specification limit. The receiver is programmed with appropriate factors to convert the received voltage into filed strength at the antenna. Results are printed in a graphic and/or tabular format, as appropriate.

The test receiver also provides a visual display of the signal being measured.

PEAK POWER METER

A peak power meter and thermister mount may be used for 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 EUT and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transmitters and 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 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.

The requirements of ANSI C63.4:2003 were used for configuration of the equipment turntable. It 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 appendix of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

General: For Transmitters with detachable antenna, direct measurements for output power, modulation characterization, occupied bandwidth, and frequency stability are performed with the antenna port of the EUT connected to either the power meter, modulation analyzer, or spectrum analyzer via a suitable attenuator and/or filter. The attenuators and/or filters are used to ensure that the transmitter fundamental will not overload the front end of the measurement instrument.

Procedure B – Power Measurement (Conducted Method): The following procedure was used for transmitters that do use external antennas.

1) Set the EUT to maximum power and to the lowest channel.
2) Either a power meter or a spectrum analyzer was used to measure the power output.
3) If a spectrum analyzer was used a resolution and video bandwidth 10kHz was used to measure the power output. Corrected for any external attenuation used for the protection of the input of analyzer. In addition, For CDMA or TDMA modulations set spectrum analyzer resolution to 2MHz and video to 3 MHz.
4) If a power meter was used, corrected for any external attenuation used for the protection of the input of the sensor head. Also set the power sensor correction by setting up the frequency range that will be measured.
5) Repeat this for the high channel and all modulations that will be used and all output ports used for transmission

Procedure C - Occupied Bandwidth (Conducted Method): Either for analog, digital, or data modulations, occupied bandwidth was performed. The EUT was set to transmit the appropriate modulation at maximum power. The bandwidth was measured using following methods:

1) The built-in 99% function of the spectrum analyzer was used.
2) If the built-in 99% is not available then the following method is used:

   26-dB or 20-dB was subtracted to the maximum peak of the emission. Then the display line function was used, in conjunction with the marker delta function, to measure the emissions bandwidth.

3) For the above two methods a resolution and video bandwidth of 100 or 300 Hz was used to measure the emission's bandwidth.

Procedure D - Occupied Bandwidth (Conducted Emission Mask): Either for analog, digital, or data modulations, emission mask was performed. The EUT was set to transmit the appropriate modulation at maximum power. The following method was used:

Taken from Part 90.210 Emission Mask M

The following Resolution and Video bandwidth was used to show compliance for the above requirement: 1% of the occupied bandwidth.

Procedure H - Other Types of Equipment: Either digital or data modulated signals were simulated, by software or external sources, to performed the required tests. The EUT was set to transmit the appropriate digital modulation.

Procedure J – Antenna Conducted Emissions: For spurious emission measurements at the antenna terminal the following procedure was performed:

1) Set the transmitting signal at the middle of the operating range of the transmitter, as specified in the standard. Power is set to maximum and then to minimum.
2) Set the spectrum analyzer display line function to –31-dBm.
3) Set the spectrum analyzer bandwidth to 1MHz <1GHz and 1 MHz >1GHz.
4) For the spectrum analyzer, the start frequency was set to 30 MHz and the stop frequency set to the 10^{th} harmonic of the fundamental. All spurious or intermodulation emission must not exceed the –31dBm limit.
5) Steps 1 to 4 were repeated for all modulations and output ports that will be used for transmission.

Procedure K - Frequency Stability: The EUT is placed inside a temperature chamber with all support and test equipment located outside of the chamber. The spectrum analyzer is configured to give a 6-digit display for the marker-frequency function. The spectrum analyzer's built-in frequency counter is used to measure the maximum deviation of the fundamental frequency at each temperature. The Temperature chamber was varied from –30 to +50° C (or +60° C for some IC RSS standards, if applicable) in 10 degrees increment. The EUT was allowed enough time to stabilize for each temperature variation.

Procedure L - Frequency Stability: For AC or DC operated devices the nominal voltage is varied to 85% and to 115% at either room temperature or at a controlled +20°C temperature.

Procedure M - Frequency Stability: For battery-powered devices the voltage battery end-point is determined by reducing the dc voltage until the unit ceases to function. This is performed at either room temperature or at a controlled +20°C temperature.

Procedure N - Field Strength Measurement: The EUT was set on the turntable and the search antenna position 3 meters away. The output antenna terminal was terminated with a 50-ohm terminator. The EUT was set at the middle of the frequency band and set at maximum output power.

For the first scan, a pre-liminary measurement is performed. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. One or more of these is with the antenna polarized vertically while the one or more of these are with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

For the final measurement, Substitution method is performed on spurious emissions not being 20-dB below the calculated radiated limit. Substitution method is performed by replacing the EUT with a transmit antenna and signal generator. The substitution antenna can be reference to a half-wave dipole in dBi. The signal generator is then set to a fix output level of either –10 or –20dBm. This is then injected into the substitution antenna. The field strength produced by the substitution antenna is then measured. This measured value is then used to determine the conversion factor to convert the EUTs field strength levels to a dBm value.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

RADIATED EMISSIONS SPECIFICATION LIMITS

The limits for radiated emissions are based on the power of the transmitter at the operating frequency. Data is measured in the logarithmic form of decibels relative to one milliwatt (dBm) or one microvolt/meter (dBuV/m,). The field strength of the emissions from the EUT is measured on a test site with a receiver.

Below is a formula example used to calculate the attenuation requirement, relative to the transmitters power output, in dBuV/m. For this example an operating power range of 3 watts is used. The radiated emissions limit for spurious signals outside of the assigned frequency block is $43+10\text{Log}_{10}$ (mean output power in watts) dB below the measured amplitude at the operating power.

CALCULATIONS – EFFECTIVE RADIATED POWER

$$E(V/m) = \frac{\sqrt{30 * P * G}}{d}$$

E= Field Strength in V/m
P= Power in Watts (for this example we use 3 watts)
G= Gain of antenna in numeric gain (Assume 1.64 for ERP)
d= distance in meters

$$E(V/m) = \frac{\sqrt{30 * 3 \text{ watts} * 1.64 \text{ dB}}}{3 \text{ meters}}$$

20 * log (4.049 V/m * 1,000,000) = 132.14 dBuV/m @ 3 meters

FCC Rules request an attenuation of 43 + 10 log (3) or 47.8 dB for all emissions outside the assigned block, the limit for spurious and harmonic emissions is:

132.1 dBuV/m – 47.8 dB = 84.3 dBuV/m @ 3 meter.

Note: Substitution Method is performed for spurious emission not being 20-dB below the calculated field strength.

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Power Output and Antenna Spurious Emissions, 23-Aug-05
Engineer: Juan Martinez

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	EMC Spectrum Analyzer 30Hz - 40GHz, Sunnyvale (SA40)	8564E (84125C)	1148	01-Sep-05
Rohde & Schwarz	Power Sensor 100uW - 10 Watts	NRV-Z53	1236	01-Mar-06
Rohde & Schwarz	Power Meter, Single Channel	NRVS	1422	01-Nov-05

Radiated Emissions, 1000 - 40,000MHz, 24-Aug-05
Engineer: Chris Byleckie

Manufacturer	Description	Model #	Asset #	Cal Due
EMCO	Horn antenna, D. Ridge 1-18GHz (SA40 system antenna)30Hz sunnyvale	3115	1142	11-Jun-06
Hewlett Packard	Microwave EMI test system (SA40, 30Hz - 40GHz), Sunnyvale	84125C	1149	01-Sep-05
EMCO	Horn antenna, 18-26.5 GHz (SA40 30Hz)	3160-09 (84125C)	1150	09-Jun-06
EMCO	Horn antenna, 26.5-40 GHz (SA40 30Hz)	3160-10 (84125C)	1151	09-Jun-06
Hewlett Packard	Signal Generator (sweep) 0.01 - 26.5 GHz	8340A	1244	N/A
Hewlett Packard	EMC Spectrum Analyzer, 9KHz - 22GHz	8593EM	1319	28-Mar-06
ETS-Lindgren	Horn Antenna, D. Ridge 1-18GHz	3117	1662	11-Apr-06

Frequency Stability, 25-Aug-05
Engineer: Mark Briggs

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	EMC Spectrum Analyzer 30Hz - 40GHz, Sunnyvale (SA40)	8564E (84125C)	1148	01-Sep-05

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T60948 22 Pages

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EMC Test Data

Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Emissions Spec:	FCC part 90	Class:	Radio
Immunity Spec:	-	Environment:	-

EMC Test Data

For The

Cisco Systems

Model

U58H068 Mini PCI

Date of Last Test: 8/25/2005

Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Emissions Spec:	FCC part 90	Class:	Radio
Immunity Spec:	-	Environment:	-

EUT INFORMATION

General Description

The EUT is an Atheros based 802.11a radio which Clear Creek will use for Public Safety organizations for applications that require high throughput and citywide coverage in the United States in the 4.94 - 4.99 GHz band. 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 5Vdc.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Cisco Systems	U58H068	4.9 GHz radio module	N/A	LDKXSCLCR15

EUT Enclosure

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

Modification History

Mod. #	Test	Date	Modification
1	-	-	None

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

Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Emissions Spec:	FCC part 90	Class:	Radio
Immunity Spec:	-	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
IBM	91P9024	Laptop and power adapter	97P0282	DoC
Cisco	-	Test fixture	-	-
-	-	test fixture power 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)
Antenna power	termination	coaxial	Shielded	0.5

EUT Operation During Emissions Tests

Device transmitting continuously at the data rate and power stated in each run description. For frequency stability the device was placed into a CW mode (ART software showed "Single Carrier" mode).

Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	N/A

Radiated Spurious Emissions, FCC Part 90

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: 8/24/2005
Test Engineer: Chris Byleckie
Test Location: SVOATS #1
Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

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

The measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 18 °C
Rel. Humidity: 65 %

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	RE, 1000 - 40,000 MHz - Spurious Emissions Transmit	FCC 90	Pass	-50.2dBm @ 9889.1MHz (-6.5dB)
2	RE, 1000 - 40,000 MHz - Spurious Emissions Transmit	FCC 90	Pass	-54.1Pin1 @ 9959.8MHz (-10.4dB)

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Art Software	
Data rates	Bandwitdth
(Mbps)	(MHz)
1.5	5
3	10
6	20

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EMC Test Data

Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	N/A

Run #1: Radiated Spurious Emissions, Transmit Mode: Final Field Strength and Substitution Measurements
Frequency = 4945 MHz (5MHz), Target power setting = 20

Frequency	Level	Pol	FCC 90 Note 1		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
9889.70	53.4	V	64.3	-10.9	AVG	279	1.4	
14834.03	39.0	V	64.3	-25.3	AVG	262	1.4	
9889.03	46.7	H	64.3	-17.6	AVG	288	1.3	
14834.97	39.1	H	64.3	-25.2	AVG	328	1.2	
19783.25	32.6	V	64.3	-31.7	Avg	289	1.2	
19781.96	33.5	H	64.3	-30.8	Avg	299	1.3	
Frequency = 4950 MHz (10MHz), Target power setting = 20								
9899.67	41.9	H	64.3	-22.4	Avg	310	1.2	
14849.07	34.0	H	64.3	-30.3	Avg	296	1.2	
9899.60	48.6	V	64.3	-15.7	Avg	283	1.4	
14849.67	34.6	V	64.3	-29.7	Avg	28	1.7	
19799.36	31.6	V	64.3	-32.7	Avg	302	1.3	
19798.54	32.1	H	64.3	-32.2	Avg	285	1.1	
Frequency = 4950 MHz (20MHz), Target power setting = 21.5								
9895.87	50.3	V	64.3	-14.0	Avg	279	1.5	
14846.70	39.1	V	64.3	-25.2	Avg	320	2.0	
9898.97	43.2	H	64.3	-21.1	Avg	311	1.4	
14844.23	40.6	H	64.3	-23.7	Avg	332	1.2	
19801.23	33.0	V	64.3	-31.3	Avg	286	1.1	
19798.98	32.4	H	64.3	-31.9	Avg	277	1.2	

Note 1:	The field strength limit in the tables above was calculated from the erp/eirp limit detailed in the standard using the free space propagation equation: E= (30PG)/d. This limit is conservative - it does not consider the presence of the ground plane and, for erp limits, the dipole gain (2.2dBi) has not been included. The erp or eirp for all signals with less than 10dB of margin relative to this field strength limit is determined using substitution measurements.
Note 2:	Above 20GHz, no emissions were observed above the noise floor

Elliott

EMC Test Data

Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	N/A

Horizontal

Frequency	Substitution measurements			Site	EUT measurements			eirp Limit	erp Limit	Margin
MHz	Pin[1]	Gain[2]	FS[3]	Factor[4]	FS[5]	eirp (dBm)	erp (dBm)	dBm	dBm	dB
9889.03	-54.6	12.7	46.7	88.6	46.7	-41.9	-44.1	-31.0		-10.9

Vertical

Frequency	Substitution measurements			Site	EUT measurements			eirp Limit	erp Limit	Margin
MHz	Pin[1]	Gain[2]	FS[3]	Factor[4]	FS[5]	eirp (dBm)	erp (dBm)	dBm	dBm	dB
9889.07	-50.2	12.7	53.4	90.9	53.4	-37.5	-39.7	-31.0		-6.5
9895.87	-52.9	12.7	50.3	90.5	50.3	-40.2	-42.4	-31.0		-9.2
9899.60	-53.6	12.7	48.6	89.5	48.6	-40.9	-43.1	-31.0		-9.9

Note 1:	Pin is the input power (dBm) to the substitution antenna
Note 2:	Gain is the gain (dBi) for the substitution antenna. A dipole has a gain of 2.2dBi.
Note 3:	FS is the field strength (dBuV/m) measured from the substitution antenna.
Note 4:	Site Factor - this is the site factor to convert from a field strength in dBuV/m to an eirp in dBm.
Note 5:	EUT field strength as measured during initial run.

Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	N/A

Run #2: Radiated Spurious Emissions, Transmit Mode: Final Field Strength and Substitution Measurements
Frequency = 4985 MHz (5MHz), Target power setting = 20

Frequency	Level	Pol	FCC 90 Note 1		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
9970.00	42.5	H	64.3	-21.8	Avg	283	1.3	
14955.10	39.2	H	64.3	-25.1	Avg	290	1.1	
9969.63	46.4	V	64.3	-17.9	Avg	287	1.3	
14954.27	39.3	V	64.3	-25.0	Avg	258	1.8	
19941.66	33.5	V	64.3	-30.8	Avg	301	1.2	
19940.32	32.8	H	64.3	-31.5	Avg	271	1.2	
Frequency = 4980 MHz (10MHz), Target power setting = 20								
9959.80	46.1	V	64.3	-18.3	Avg	282	1.3	
14941.23	36.4	V	64.3	-27.9	Avg	258	1.8	
9957.57	39.6	H	64.3	-24.7	Avg	310	1.3	
14939.83	32.5	H	64.3	-31.8	Avg	296	1.2	
19918.54	34.6	V	64.3	-29.7	Avg	285	1.1	
19920.12	32.5	H	64.3	-31.8	Avg	293	1.3	
Frequency = 4970 MHz (20MHz), Target power setting = 21.5								
9938.37	36.8	H	64.3	-27.5	Avg	307	1.1	
14904.23	35.7	H	64.3	-28.6	Avg	290	1.1	
9936.17	45.9	V	64.3	-18.4	Avg	283	1.4	
14917.03	32.5	V	64.3	-31.8	Avg	52	1.3	
19881.93	34.5	V	64.3	-29.8	Avg	273	1.2	
19883.87	31.0	H	64.3	-33.3	Avg	299	1.1	

Note 1:	The field strength limit in the tables above was calculated from the erp/eirp limit detailed in the standard using the free space propagation equation: E= (30PG)/d. This limit is conservative - it does not consider the presence of the ground plane and, for erp limits, the dipole gain (2.2dBi) has not been included. The erp or eirp for all signals with less than 10dB of margin relative to this field strength limit is determined using substitution measurements.
Note 2:	Above 20GHz, no emissions were observed above the noise floor

Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	N/A

Vertical

Frequency	Substitution measurements			Site	EUT measurements			eirp Limit	erp Limit	Margin
MHz	Pin[1]	Gain[2]	FS[3]	Factor[4]	FS[5]	eirp (dBm)	erp (dBm)	dBm	dBm	dB
9959.80	-54.1	12.7	46.1	87.5	46.1	-41.4	-43.6	-31.0		-10.4
9969.63	-54.7	12.7	46.4	88.4	46.4	-42.0	-44.2	-31.0		-11.0
9936.17	-55.3	12.7	45.9	88.5	45.9	-42.6	-44.8	-31.0		-11.6

Note 1:	Pin is the input power (dBm) to the substitution antenna
Note 2:	Gain is the gain (dBi) for the substitution antenna. A dipole has a gain of 2.2dBi.
Note 3:	FS is the field strength (dBuV/m) measured from the substitution antenna.
Note 4:	Site Factor - this is the site factor to convert from a field strength in dBuV/m to an eirp in dBm.
Note 5:	EUT field strength as measured during initial run.

Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	Radio

OCCUPIED BANDWITDH (EMISSION MASK)

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: 8/23/2005
Test Engineer: Juan Martinez
Test Location: Chamber# 2
Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

Connected the radios antenna port directly to the spetrum analyzer. Used external attenuation to protect the analyzer input. Any losses were included into the measurements.

Ambient Conditions:

Temperature: 19 °C
Rel. Humidity: 48 %

Summary of Results

Run #	Test Performed	Limit	Result	Comment
1	Occupied Bandwith	FCC 90.210 (Mask M)	Pass	Refer to plots

Modifications Made During Testing:

No modifications were made to the EUT during testing

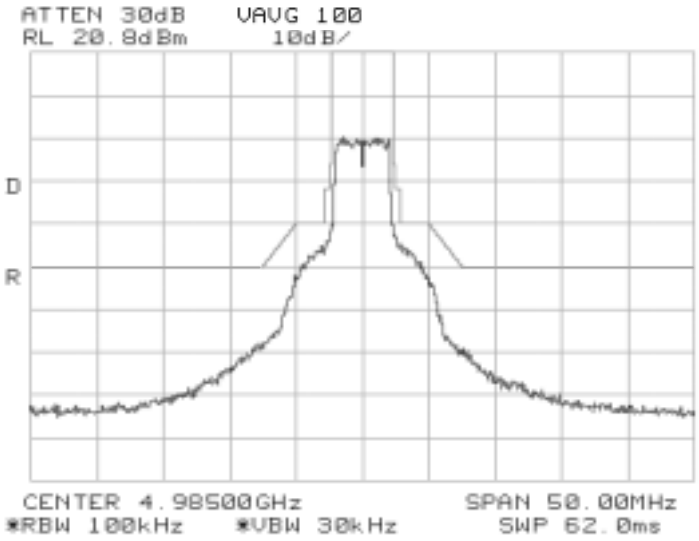
Deviations From The Standard

No deviations were made from the requirements of the standard.

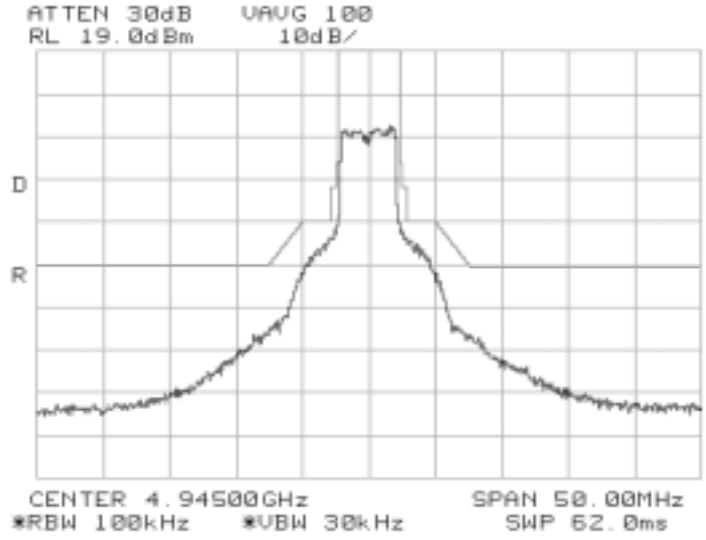
Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	Radio

Run #1: Emission Mask Plots

5MHz (4985 MHz)

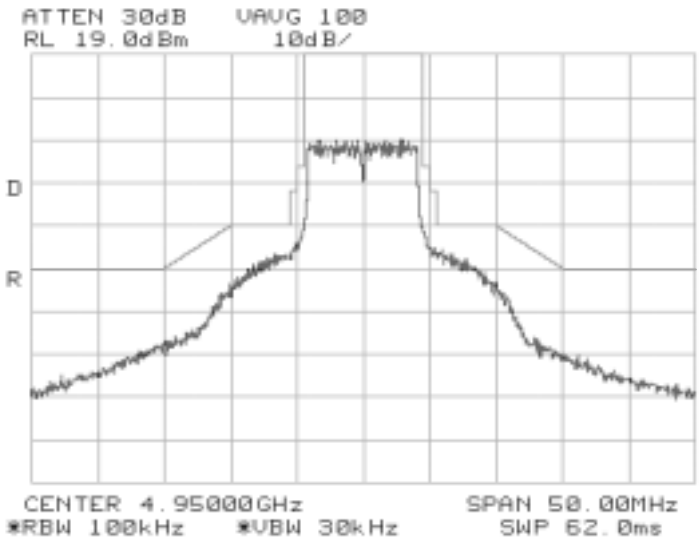


5MHz (4945 MHz)

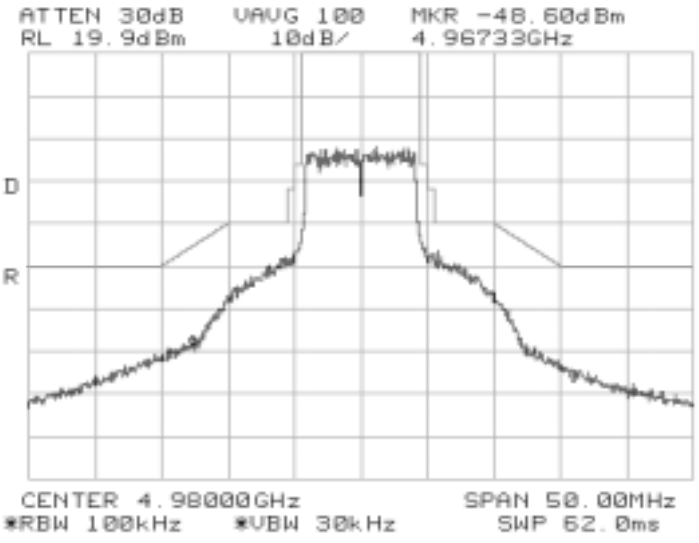


Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	Radio

10MHz (4950 MHz)

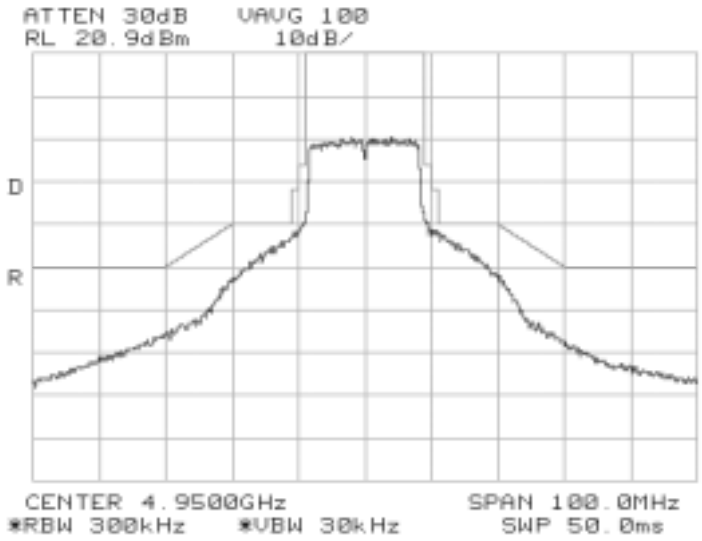


10 MHz (4980 MHz)

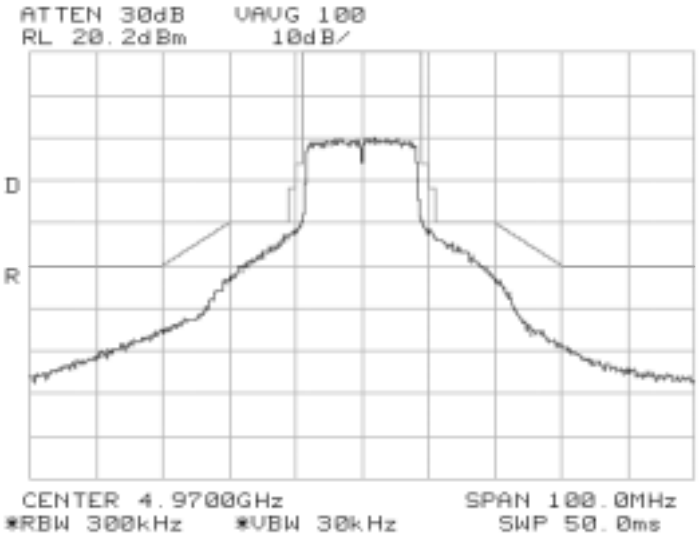


Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	Radio

20MHz (4950 MHz)



20 MHz (4970 MHz)



Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	Radio

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: 8/23/2005
Test Engineer: Juan Martinez
Test Location: Chamber# 2
Config. Used: 1
Config Change: None
EUT Voltage: 5Vdc

General Test Configuration

Connected the radios antenna port directly to the spetrum analyzer. Used external attenuation to protect the analyzer input. Any losses were included into the measurements.

For the out of band measurements the limit is based on the following: 20.1dBm (Average Power) and Per 90.210 (m)(6) 50 dB attenuation. Per this emissions must be below 19 dBm - 50 dB = **-31 dBm. (Note: 19 dBm was selected as this gives the worse case attenuation for both Spurious conducted and radiated).**

Ambient Conditions:

Temperature: 19 °C
Rel. Humidity: 48 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Power Output & PSD	Part 90	Pass	Refer to run
2	Out of Band	Part 90	Pass	All emissions < -31 dBm

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

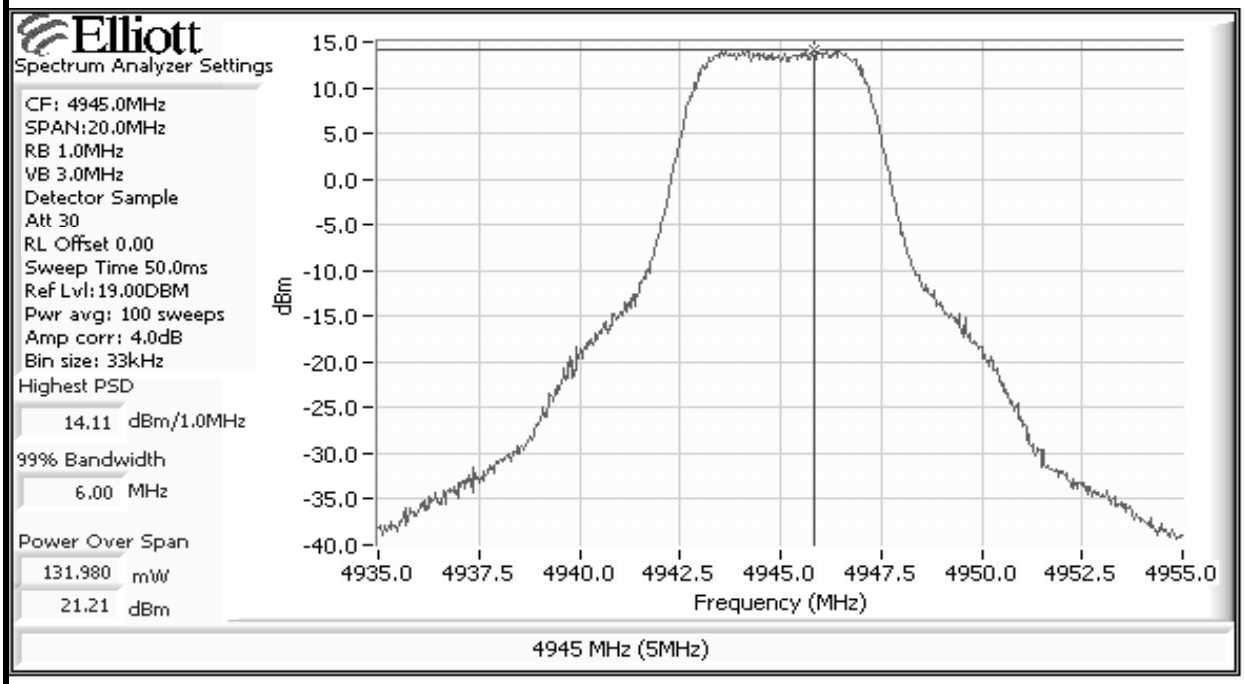
No deviations were made from the requirements of the standard.

EMC Test Data

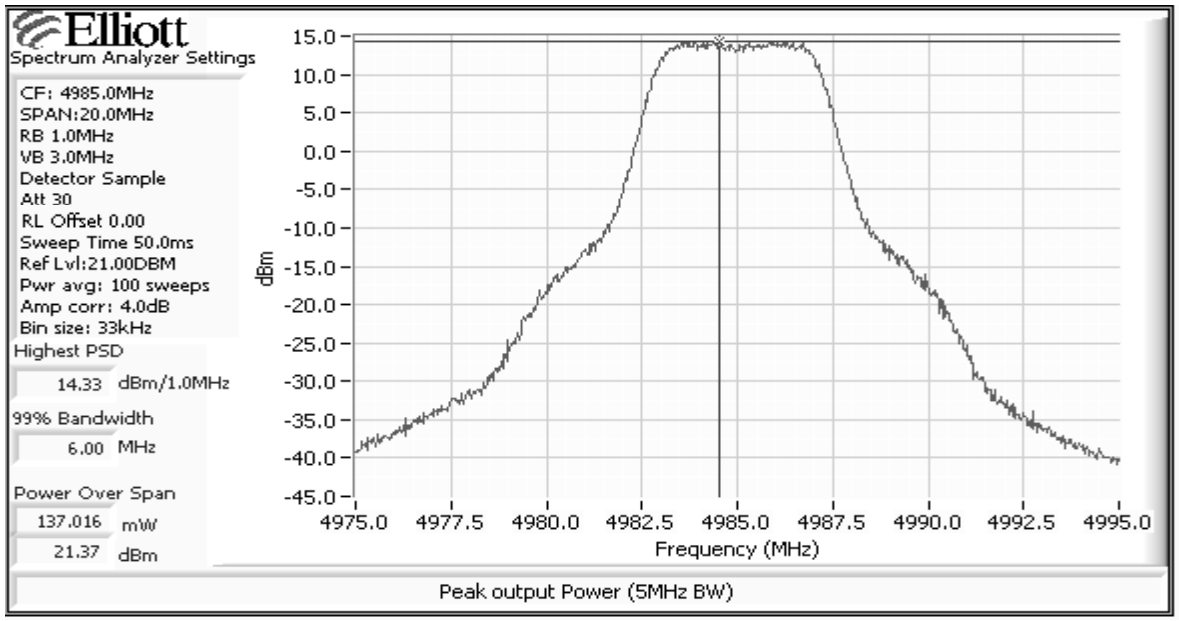
Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	Radio

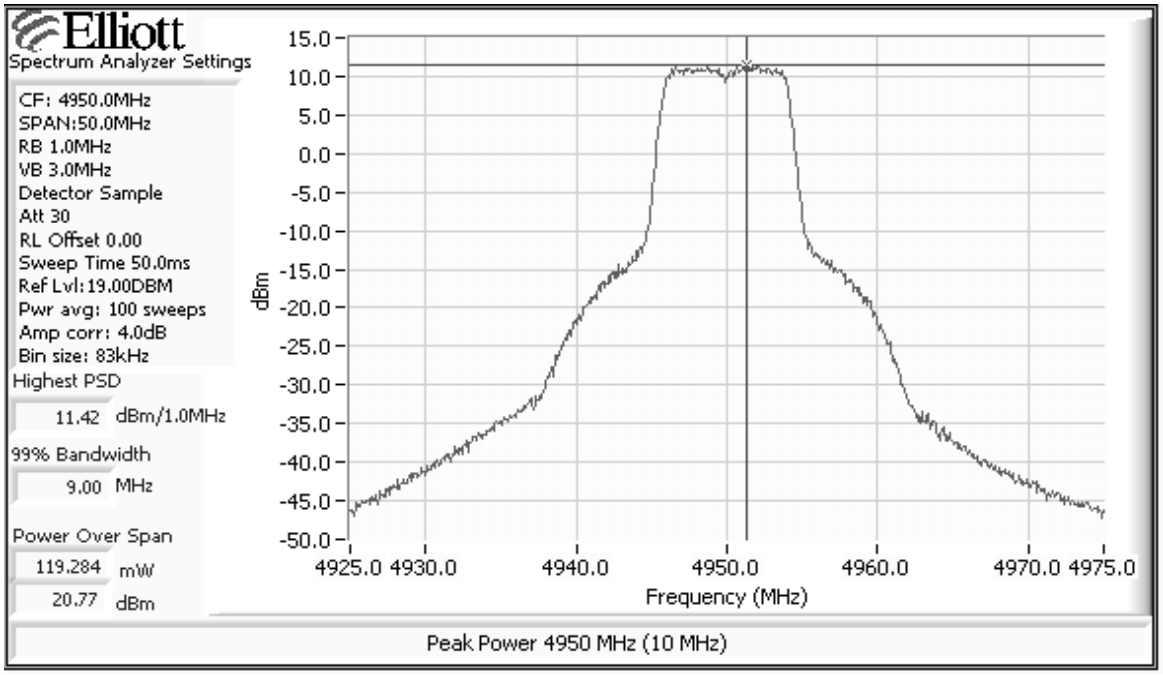
Run #1: Power Output and Power Spectral Density

	Freq.	Average Power	Max Power	Limit	PSD	PSD limit	Bandwidth	Setting
	(MHz)	(dBm)	(dBm)		(dBm)	(dBm)	(MHz)	
4945.000	4945.0	19.0	21.2	27.0	14.1	21.0	5.0	20.0
4950.000	4952.5	19.3	20.8	30.0	11.4	21.0	10.0	20.0
4950.000	4952.5	20.9	20.4	33.0	8.5	21.0	20.0	21.5
4985.000	4987.5	20.9	21.4	27.0	14.8	21.0	5.0	20.0
4980.000	4982.5	19.9	19.1	30.0	9.6	21.0	10.0	20.0
4970.000	4972.5	20.2	19.3	33.0	7.6	21.0	20.0	21.5

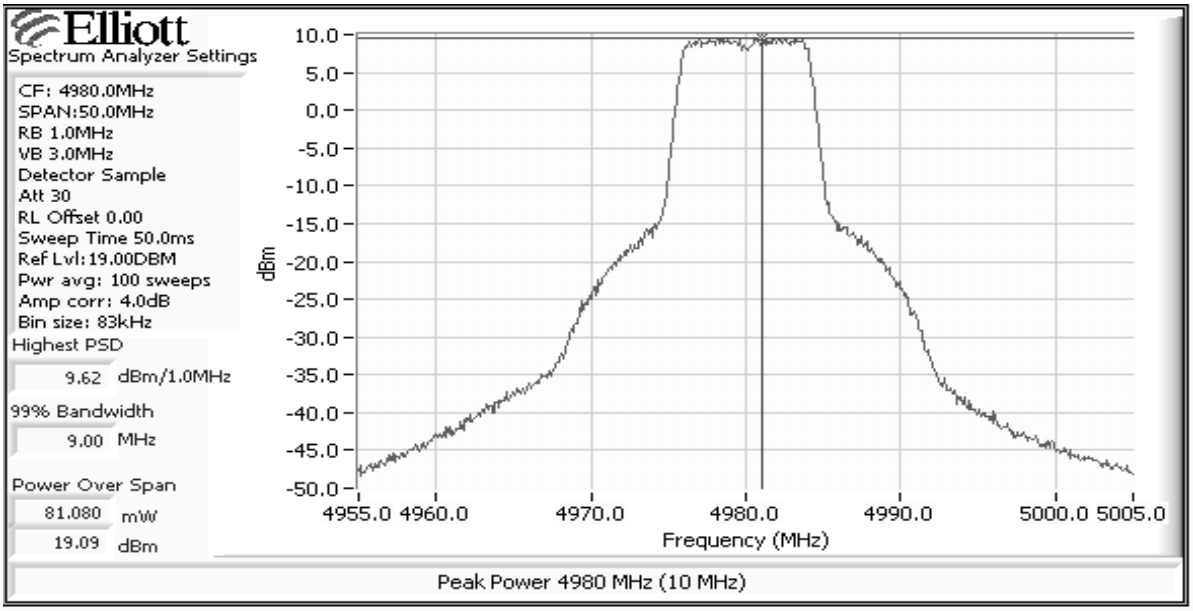


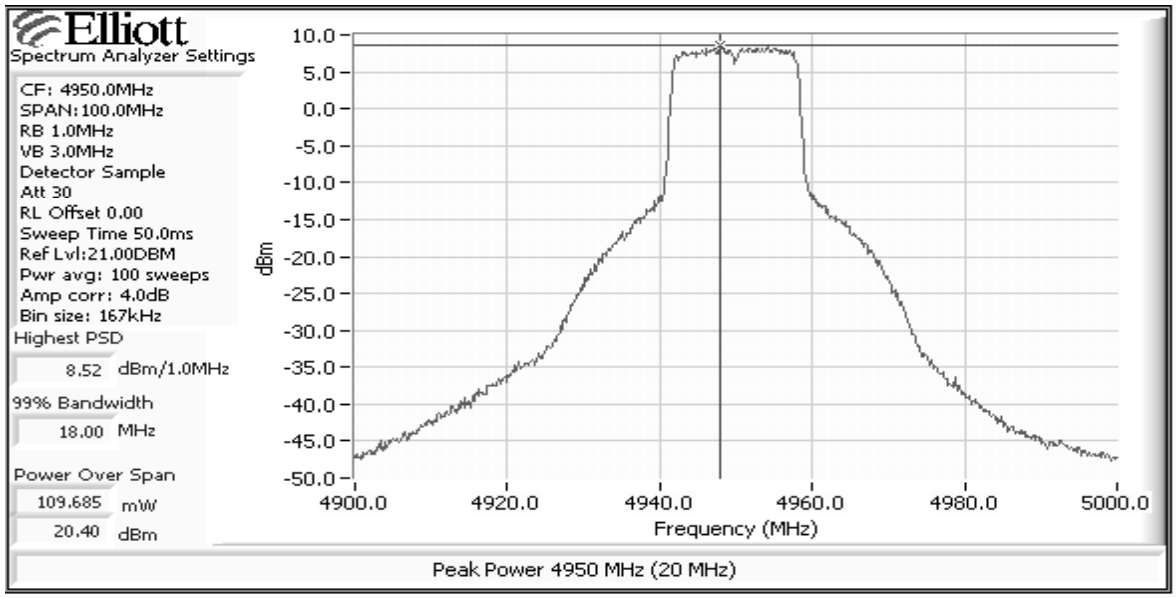
Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	Radio



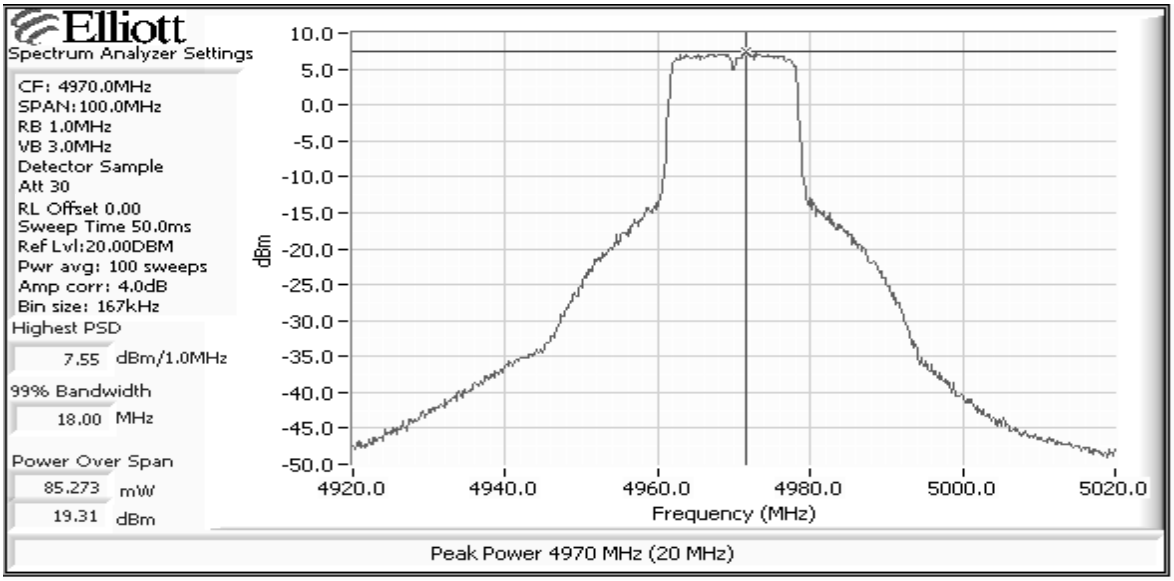


Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	Radio





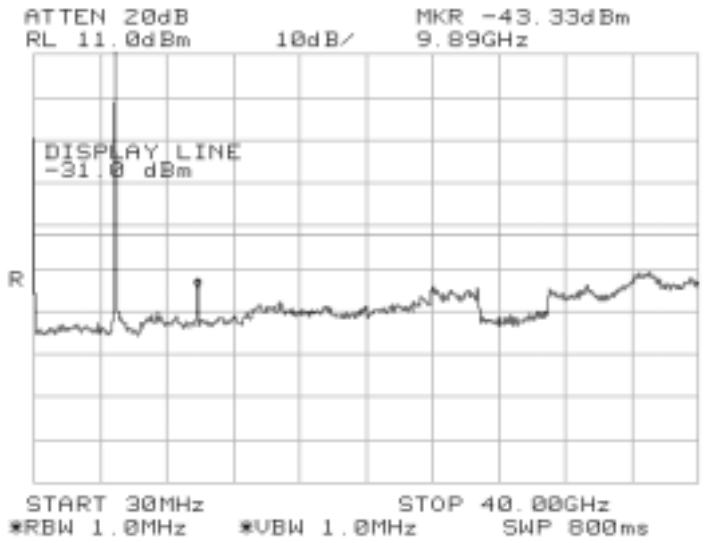
Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	Radio



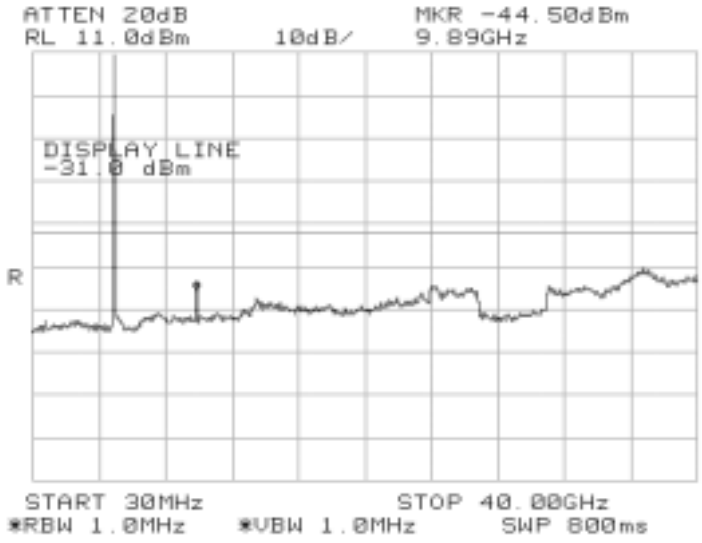
Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	Radio

Run #2: Out of Band

20MHz out of band



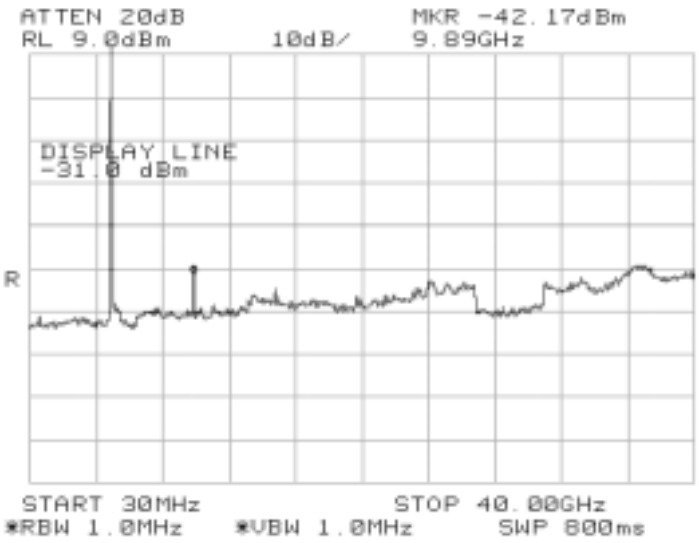
4950 MHz



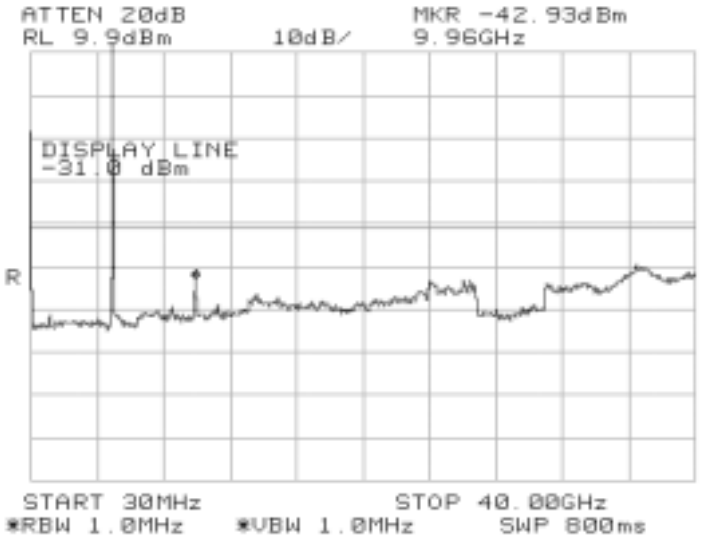
4970 MHz

Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	Radio

10MHz out of band



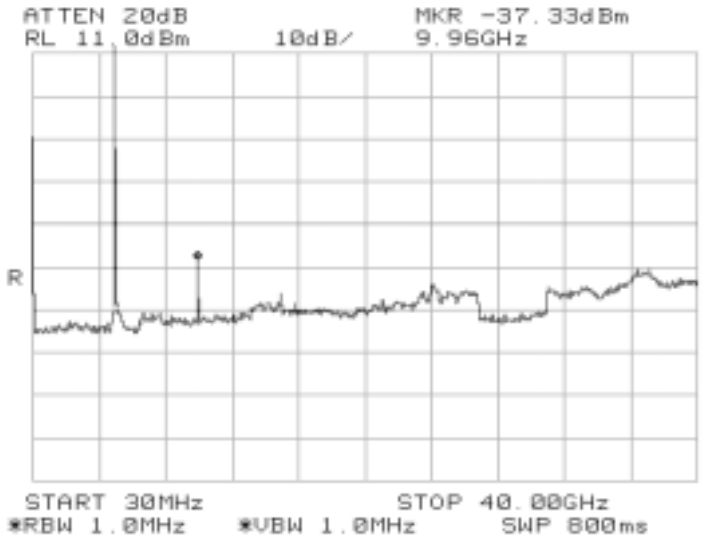
4950 MHz



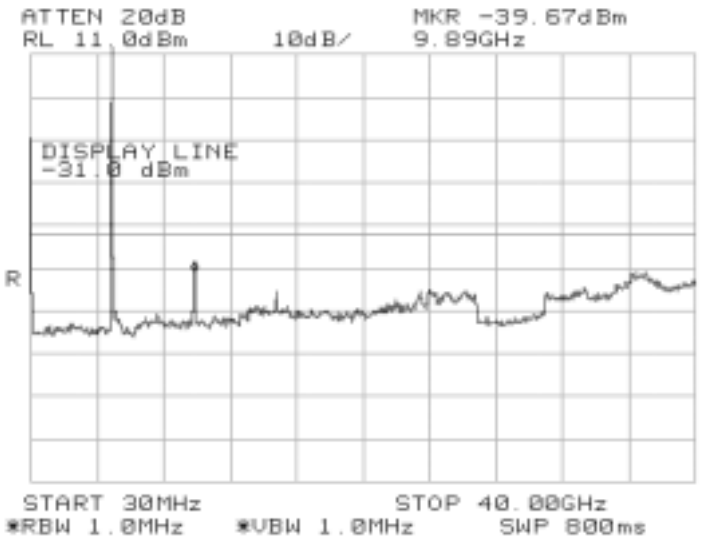
4980 MHz

Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	Radio

5MHz out of band



4985 MHz



4945 MHz

Client:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	Radio

Radio Performance Test - Part 90
Frequency Stability

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: 8/25/2005
Test Engineer: Mark Briggs
Test Location: Environmental Chamber
Config. Used: 1
Config Change: None
EUT Voltage: 5Vdc

General Test Configuration

The EUT's rf port was connected to the measurement instrument's rf port, via an attenuator or dc-block if necessary. EUT was place inside an environmental chamber.

Summary of Results

Run #	Test Performed	Limit	Result	Value / Margin
1-2	Frequency and Voltage Stability	Part 90	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:	Cisco Systems	Job Number:	J60899
Model:	U58H068 Mini PCI	T-Log Number:	T60948
		Account Manager:	Susan Pelzl
Contact:	Fred Leffingwell		
Spec:	FCC part 90	Class:	Radio

Run #1: Temperature Vs. Frequency

T (°C)	Ref Frequency[1] (MHz)	Frequency at T (MHz)	Drift (Hz)	Drift (ppm)
-30	4949.9235	4949.9485	25000	5.1
-20	4949.9235	4949.9400	16500	3.3
-10	4949.9235	4949.9265	3000	0.6
0	4949.9235	4949.9185	-5000	-1.0
10	4949.9235	4949.9180	-5500	-1.1
20	4949.9235	4949.9235	0	0.0
30	4949.9235	4949.9495	26000	5.3
40	4949.9235	4949.9550	31500	6.4
50	4949.9235	4949.9355	12000	2.4
		Frequency drift:	+31500/-5500Hz	+6.4/-1.1ppm

Note 1:	Ref. Frequency: Frequency measured at 20°C and nominal input voltage(s).

Run #2: Voltage Vs. Frequency

Nominal Voltage is: 3.3 Vdc

Voltage (Dc)	Ref Frequency[1] (MHz)	Frequency Drift (MHz)	Drift (Hz)	Drift (ppm)	Comment
85%	4949.9235	4949.9210	-2500	-0.5	2.8 v
115%	4949.9235	4949.9285	5000	1.0	3.8 v

Note 1:	Ref. Frequency: Frequency measured at 20°C and nominal input voltage(s).
Note 2:	DC voltage to main circuit adjusted from nominal 3.3V. The 5V supply to the power amplifier was not adjusted as this voltage does not power any circuits that determine frequency stability.

Battery endpoint is 1.5 Vdc

Voltage (Dc)	Reference Frequency (MHz)	Frequency Drift (MHz)	Drift (Hz)	Drift (ppm)	Comment
2.2Vdc -	4949.9235	4949.932700	9200	1.9	Note 1
2.8Vdc	4949.9235	4949.955700	32200	6.5	Note 1
2	4949.9235	4950.013700	90200	18.2	Note 2
1.85					Note 3

Note 1:	As the voltage dropped from 2.8Vdc to 2.2Vdc the frequency varied, but the drift never exceeded 6.5ppm.
Note 2:	At between 2.1V and 2.0V the power level dropped by 50dB and frequency increased to 4950.0137 MHz, gradually dropping to a stable reading of 4950.003 MHz.
Note 3:	At 1.85Vdc the device stopped operating

EXHIBIT 3: Test Configuration Photographs

Uploaded as A Separate Attachment

EXHIBIT 4: Theory of Operation
Cisco Systems Model U58H068

Uploaded as A Separate Attachment

EXHIBIT 5: Proposed FCC ID Label & Label Location

Uploaded as A Separate Attachment

EXHIBIT 6: Detailed Photographs
Cisco Systems Model 4.9 Ghz Radio.2for Cisco Mobile Router

Uploaded as A Separate Attachment

EXHIBIT 7: Installation Guide
Cisco Systems Model U58H068

Uploaded as A Separate Attachment

EXHIBIT 8: Block Diagram
Cisco Systems Model U58H068

Uploaded as A Separate Attachment

EXHIBIT 9: Schematic Diagrams
Cisco Systems Model U58H068

Uploaded as A Separate Attachment

EXHIBIT 10: Advertising Literature

Uploaded as A Separate Attachment