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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to FCC Part 15, Subpart E (UNII Devices) and Industry Canada RSS 210 Issue 5 (LELEAN Devices) on the RF Micro Devices Model: RD5400

FCC ID:	RFN5405RDK0401
GRANTEE:	RF Micro Devices 7628 Thorndike Road Greensboro, NC 27409
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	June 17, 2003
FINAL TEST DATE:	June 6, 2003
AUTHORIZED SIGNATORY:	Mark Briggs Director of Engineering

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SCOPE

An electromagnetic emissions test has been performed on the RF Micro Devices model RD5400 pursuant to Subpart E of Part 15 of FCC Rules for Unlicensed National Information Infrastructure (UNII) devices and RSS-210 Issue 5 for licence-exempt local area network (LELAN) 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 RF Micro Devices model RD5400 and therefore apply only to the tested sample. The sample was selected and prepared by Bill Simmons of RF Micro Devices

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart E of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

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

SUMMARY OF RESULTS

FCC Part 15 Section	RSS 210 Section	Description	Comments	Result
Operation in the 5.15 – 5.25 GHz Band				
15.407 (d)		The antenna must be integral to the device.	Antenna Gain = 4 dBi The antenna is integral.	COMPLIES
15.407(e)		Indoor operation only	Refer to user's manual in Exhibit 6	COMPLIES
15.407(a) (1)	6.2.2 q1 (i)	Bandwidth	26dB: 21.0 MHz 99%: 17.2 MHz	N/A
15.407(a) (1)	6.2.2 q1 (i)	Output Power	16.5dBm	COMPLIES
15.407(a) (1))	6.2.2 q1 (i)	Power Spectral Density	-7.9dBm/MHz	COMPLIES
15.407(b) (5) / 15.209	6.2.2 q1 (ii)	Spurious Emissions below 1GHz	-6.3dB @ 144.000MHz	COMPLIES
15.407(b) (2)	6.2.2 q1 (ii)	Spurious Emissions above 1GHz	-7.4dB @ 36260.0MHz	COMPLIES
Operation in the 5.25 – 5.35 GHz Band Note: The device is restricted to indoor use only, therefore the spectral density of spurious emissions in the 5.15 – 5.25 GHz band were limited to the power spectral limits for intentional signals detailed in FCC 15.407(a)(1) and RSS 210 6.2.2 q1 (i)				
		Maximum Antenna Gain /Integral Antenna	Antenna Gain = 4 dBi The antenna is integral	
15.407(a) (2)	6.2.2 q1 (ii)	Bandwidth	26dB: 22.0 MHz 99%: 16.9 MHz	N/A
15.407(a) (2)	6.2.2 q1 (ii)	Output Power	15.1dBm	COMPLIES
15.407(a) (2))	6.2.2 q1 (ii)	Power Spectral Density	-6.1dBm/MHz	COMPLIES
15.407(b) (5) / 15.209	6.2.2 q1 (ii)	Spurious Emissions below 1GHz	-6.3dB @ 144.000MHz	COMPLIES
15.407(b) (2)	6.2.2 q1 (ii)	Spurious Emissions above 1GHz	-6.6dB @ 36800.0MHz	COMPLIES

General requirements for all bands				
	6.2.2 q(iv)(a)	Digital Modulation	Digital Modulation (OFDM) is used, refer to the "Theory of Operations" (Exhibit 9) for a detailed explanation.	COMPLIES
	6.2.2 q(iv)(b)	Peak Spectral Density	1.9dBm/MHz	COMPLIES
15.407(a)(6)		Peak Excursion Ratio	9.8dB	COMPLIES
	6.2.2 q(iv)(c)	Channel Selection	The device was tested on the channels representing the highest, lowest and center channels available.	N/A
15.407 (c)	6.2.2 q(iv)(d)	Automatic Discontinuation of Operation in the absence of information to transmit	Operation is discontinued in the absence of information to transmit, refer to the "Theory of Operations" in Exhibit 9 for a detailed explanation.	COMPLIES
15.407 (g)	6.2.2 q(iv)(e)	Frequency Stability	Frequency stability is +/-10 ppm, refer to the "Theory of Operations" in Exhibit 9 for a detailed analysis.	COMPLIES
	6.2.2 q(iv)(g)	User Manual information	All relevant statements have been included in the user's manuals. Refer to Exhibit 6 for details	COMPLIES
15.407 (f)	6.2.2 q(iv)(g)	RF Exposure Requirements	Device meets the requirements for portable classification based on SAR evaluation.	COMPLIES
15.407(b) / 15.207	6.6	AC Conducted Emissions	-17.8dB @ 0.184MHz	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 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 RF Micro Devices model RD5400 is an 802.11a CardBus Card that is designed for PCMCIA installation in a laptop computer. 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 3.3VDC @ 650mA.

The sample was received on June 6, 2003 and tested on June 6, 2003.

The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
RF MicroDevices	RD5400	802.11a CardBus Card	-	

ENCLOSURE

The EUT enclosure is primarily constructed of metal. It meets the form factor required for a PC card.

MODIFICATIONS

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

SUPPORT EQUIPMENT

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

Manufacturer/Model/Description	Serial Number	FCC ID Number
Toshiba 1415-S173 Laptop	9207316P	DoC
FPTS-S USB Reader/Writer	USAA2L06	DoC
EPSON P110A Printer	A6R1320291	DoC

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)
LPT1	Printer		Shielded	3
USB	USB Reader		Shielded	2

EUT OPERATION DURING TESTING

The radio was transmitting at full power on the specified channels with a duty cycle of >90 % and at a data rate of 6 Mb/s. The channels were selected since they are at the top, center and bottom of the allocated bands.

For digital device - EUT was transmitting on the center channel with the host laptop displaying a scrolling 'H' pattern and communicating to the attached peripherals

ANTENNA REQUIREMENTS

As the device is intended to operate in the 15.15 – 15.25 GHz band an integral antenna as detailed in 15.407 (d) and RSS-210 6.2.2(q1) (i) is required. The antenna for the device is an integral antenna and is built into the circuit board with no user access.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on June 6, 2003at the Elliott Laboratories Open Area Test Site #1,2,3 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Federal Communications Commission. In accordance with Industry Canada rules detailed in RSS 210 Issue 5 and RSS-212, construction, calibration, and equipment data for the test sites have been filed with the Federal Communications Commission.

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

CONDUCTED EMISSIONS CONSIDERATIONS

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

RADIATED EMISSIONS CONSIDERATIONS

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

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

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

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

INSTRUMENT CONTROL COMPUTER

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

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

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

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

POWER METER

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

FILTERS/ATTENUATORS

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

ANTENNAS

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

ANTENNA MAST AND EQUIPMENT TURNTABLE

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

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

INSTRUMENT CALIBRATION

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

TEST PROCEDURES

EUT AND CABLE PLACEMENT

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

CONDUCTED EMISSIONS

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

RADIATED EMISSIONS

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

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

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

CONDUCTED EMISSIONS FROM ANTENNA PORT

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

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

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

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

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

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

where P is the eirp (Watts)

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

FCC 15.407 (a) 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)	Output Power	Power Spectral Density
5150 - 5250	50mW (17 dBm)	4 dBm/MHz
5250 - 5350	250 mW (24 dBm)	11 dBm/MHz
5725 – 5825	1 Watts (30 dBm)	17 dBm/MHz

For system using antennas with gains exceeding 6dBi, the output power and power spectral density limits are reduced by 1dB for every dB the antenna gain exceeds 6dBi.
Fixed point-to-point applications using the 5725 – 5825 MHz band may use antennas with gains of up to 23dBi without this limitation. If the gain exceeds 23dBi then the output power limit of 1 Watt is reduced by 1dB for every dB the gain exceeds 23dBi.

RS-210 6.2.2(q1) 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)	Output Power	Power Spectral Density
5150 - 5250	200mW (23 dBm)	10 dBm/MHz
5250 - 5350	250 mW (24 dBm)	11 dBm/MHz
5725 – 5825	1 Watts (30 dBm)	17 dBm/MHz

For system using antennas with gains exceeding 6dBi, the output power and power spectral density limits are reduced by 1dB for every dB the antenna gain exceeds 6dBi.
Fixed point-to-point applications using the 5725 – 5825 MHz band may use antennas with gains of up to 23dBi without this limitation. If the gain exceeds 23dBi then the output power limit of 1 Watt is reduced by 1dB for every dB the gain exceeds 23dBi.

SPURIOUS RADIATED EMISSIONS LIMITS

The table below shows the limits for unwanted (spurious) emissions falling in the restricted bands detailed in Part 15.205 and Industry Canada RSS-210 Table 2.

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

The table below shows the limits for unwanted (spurious) emissions outside of the restricted bands above 1GHz.

Operating Frequency (MHz)	EIRP Limit (dBm)	Equivalent Field Strength At 3m (dBuV/m)
5150 - 5250	-27 dBm	68.3 dBuV/m
5250 - 5350	-27 dBm (note 1)	68.3 dBuV/m
5725 – 5825	-27 dBm (note 2)	68.3 dBuV/m
	-17 dBm (note 3)	78.3 dBuV/m

Note 1: If operation is restricted to indoor use only then emissions in the band 5.15 – 5.25 GHz must meet the power spectral density limits for the intentional signals detailed in RSS 210 and FCC Subpart E for devices operating in the 5.15 – 5.25 Ghz band.
Note 2: Applies to spurious signals separated by more than 10 MHz from the allocated band.
Note 3: Applies to spurious signals within 10 MHz of the allocated band.

AC POWER PORT CONDUCTED EMISSIONS LIMITS

The table below shows the limits for emissions on the AC power line as detailed in FCC Part 15.205 and 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

Conducted and Radiated Spurious Emissions, 06-Jun-03
Engineer: mfaustino

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Hewlett Packard	EMC Spectrum Analyzer, Opt. 026 □9 KHz -26.5GHz	8593EM	1141	12	3/19/2003	3/19/2004
Hewlett Packard	High Pass filter, 3.5GHz	84300-80038	1157	18	3/1/2002	9/1/2003
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	487	12	4/24/2003	4/24/2004
Hewlett Packard	Microwave EMI test system (SA40, 30Hz - 40GHz), system 2	84125C	1410	12	4/2/2003	4/2/2004
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	12	8/14/2002	8/14/2003
Rohde & Schwarz	Power Meter, Single Channel	NRVS	1290	12	4/8/2003	4/8/2004
Rohde & Schwarz	Power Sensor, 100mW-2W, DC-18 GHz, 50ohm	NRV-Z32	1423	12	9/6/2002	9/6/2003

Conducted and Radiated Emissions, 06-Jun-03
Engineer: jgonzalez

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	Pulse Limiter	ESH3 Z2	812	12	1/10/2003	1/10/2004
Rohde & Schwarz	Test Receiver, 0.009-30 MHz	ESH3	1316	12	12/6/2002	12/6/2003
Rohde & Schwarz	Test Receiver, 20-1300 MHz	ESVP	WC,1222	12	7/12/2003	7/12/2003
Solar Electronics Co	LISN	8028-50-TS-24-BNC	904	12	6/19/2002	6/19/2003

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T51442 36 Pages

Elliott

EMC Test Data

Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Account Manager:	Christine Vu
Contact:	Bill Simmons		
Emissions Spec:	FCC Part 15 B and E	Class:	B
Immunity Spec:	N/A	Environment:	N/A

EMC Test Data

For The

RF MicroDevices

Model

RD5400

Date of Last Test: 6/6/2003

Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Account Manager:	Christine Vu
Contact:	Bill Simmons		
Emissions Spec:	FCC Part 15 B and E	Class:	B
Immunity Spec:	N/A	Environment:	N/A

EUT INFORMATION

General Description

The EUT is a 802.11a CardBus Card which is designed for PCMCIA installation in a laptop computer. 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 3.3VDC @ 650mA.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
RF MicroDevices	RD5400	802.11a CardBus Card	-	

Other EUT Details

EUT Enclosure

The EUT enclosure is primarily constructed of metal. It meets the form factor required for a PC card.

Modification History

Mod. #	Test	Date	Modification
1			
2			
3			

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

Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Account Manager:	Christine Vu
Contact:	Bill Simmons		
Emissions Spec:	FCC Part 15 B and E	Class:	B
Immunity Spec:	N/A	Environment:	N/A

Test Configuration #1(Radio)

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Toshiba	1415-S173	Laptop	9207316P	DoC

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

EUT Operation During Emissions Testing (Radio)

The radio was transmitting at full power on the specified channels with the maximum allowed duty cycle and at a data rate of 6 Mb/s. The channels were selected since they are at the top, center and bottom of the allocated bands.

Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Account Manager:	Christine Vu
Contact:	Bill Simmons		
Emissions Spec:	FCC Part 15 B and E	Class:	B
Immunity Spec:	N/A	Environment:	N/A

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Toshiba	1415-S173	Laptop	9207316P	DoC
-	FPTS-S	USB Reader/Writer	USAA2L06	DoC
EPSON	P110A	Printer	A6R1320291	DoC

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Interface Cabling and Ports (Digital Device testing)

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
LPT1	Printer		Shielded	3
USB	USB Reader		Shielded	2

EUT Operation During Emissions Testing (Radio)

The radio was transmitting at full power on the specified channels with a duty cycle of >90 % (maximum allowed) and at a data rate of 6 Mb/s. The channels were selected since they are at the top, center and bottom of the allocated bands.

EUT Operation During Emissions (Digital Device)

EUT was transmitting on the center channel with the host laptop displaying a scrolling 'H' pattern and comunicating to the attached peripherals

Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Account Manager:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

Radiated Emissions (Digital Device)

Test Specifics

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

Date of Test: 6/6/2003
Test Engineer: jgonzalez
Test Location: SVOATS #2

Config. Used: 2
Config Change: None
EUT Voltage: 230V/50Hz

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 and 3m from the EUT for the frequency range 1 - 2 GHz.

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

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

Ambient Conditions:

Temperature: 18 °C
Rel. Humidity: 73 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 -1000 MHz, Preliminary Scan	FCC B	Eval	Refer to individual runs
2	RE, 30 - 1000MHz, Maximized Emissions	FCC B	Pass	-6.3dB @ 144.000MHz
3	RE, 1000 - 2000 MHz, Maximized Emissions	FCC B	Pass	-6.4dB @ 1040.0MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Elliott

EMC Test Data

Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Account Manager:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

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

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
144.000	37.2	V	43.5	-6.3	QP	185	1.0	
144.000	36.5	H	43.5	-7.0	QP	273	1.8	
192.000	35.0	H	43.5	-8.5	QP	240	1.0	
75.928	30.4	V	40.0	-9.6	QP	220	1.0	
57.260	29.6	V	40.0	-10.4	QP	262	1.0	
292.541	34.9	H	46.0	-11.1	QP	100	1.0	
192.010	32.3	V	43.5	-11.2	QP	317	1.0	
168.000	32.2	H	43.5	-11.3	QP	225	1.0	
454.769	34.1	V	46.0	-11.9	QP	34	1.0	
33.000	27.8	V	40.0	-12.2	QP	200	1.0	
120.010	30.5	V	43.5	-13.0	QP	182	1.0	
816.022	32.8	V	46.0	-13.2	QP	348	1.0	
216.020	32.6	H	46.0	-13.4	QP	134	1.0	
120.000	29.9	H	43.5	-13.6	QP	284	1.0	
912.020	32.0	V	46.0	-14.0	QP	134	1.0	
720.027	31.9	V	46.0	-14.1	QP	187	1.0	
48.002	25.6	V	40.0	-14.4	QP	134	1.0	
335.992	31.5	H	46.0	-14.5	QP	171	1.0	
720.027	30.3	H	46.0	-15.7	QP	34	1.0	
626.680	29.4	V	46.0	-16.6	QP	346	1.0	
626.680	28.8	H	46.0	-17.2	QP	200	1.0	
335.992	27.0	V	46.0	-19.0	QP	0	1.0	

Run #2: Maximized Readings From Run #1

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
144.000	37.2	V	43.5	-6.3	QP	185	1.0	
144.000	36.5	H	43.5	-7.0	QP	273	1.8	
192.000	35.0	H	43.5	-8.5	QP	240	1.0	
75.928	30.4	V	40.0	-9.6	QP	220	1.0	
57.260	29.6	V	40.0	-10.4	QP	262	1.0	
292.541	34.9	H	46.0	-11.1	QP	100	1.0	

Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Account Manager:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

Run #3: Maximized readings, 1000 - 2000 MHz
Measurements made at 3m per FCC requirements.

Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1040.000	67.6	V	74.0	-6.4	Pk	100	1.0	
1040.000	56.4	H	74.0	-17.6	Pk	312	1.0	
1620.000	34.6	V	54.0	-19.4	Avg	347	1.0	
1000.000	30.7	V	54.0	-23.3	Avg	27	1.0	
1040.000	30.1	H	54.0	-23.9	Avg	312	1.0	
1000.000	28.9	H	54.0	-25.1	Avg	354	1.0	
1040.000	27.7	V	54.0	-26.3	Avg	100	1.0	
1620.000	46.6	V	74.0	-27.4	Pk	347	1.0	
1000.000	43.4	V	74.0	-30.6	Pk	27	1.0	
1000.000	40.1	H	74.0	-33.9	Pk	354	1.0	

Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Account Manager:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

Conducted Emissions - AC Power Ports

Test Specifics

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

Date of Test: 6/6/2003
Test Engineer: jgonzalez
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

Ambient Conditions:

Temperature: 18 °C
Rel. Humidity: 73 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power,120V/60Hz	EN55022 B	Pass	-17.8dB @ 0.184MHz

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:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Account Manager:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

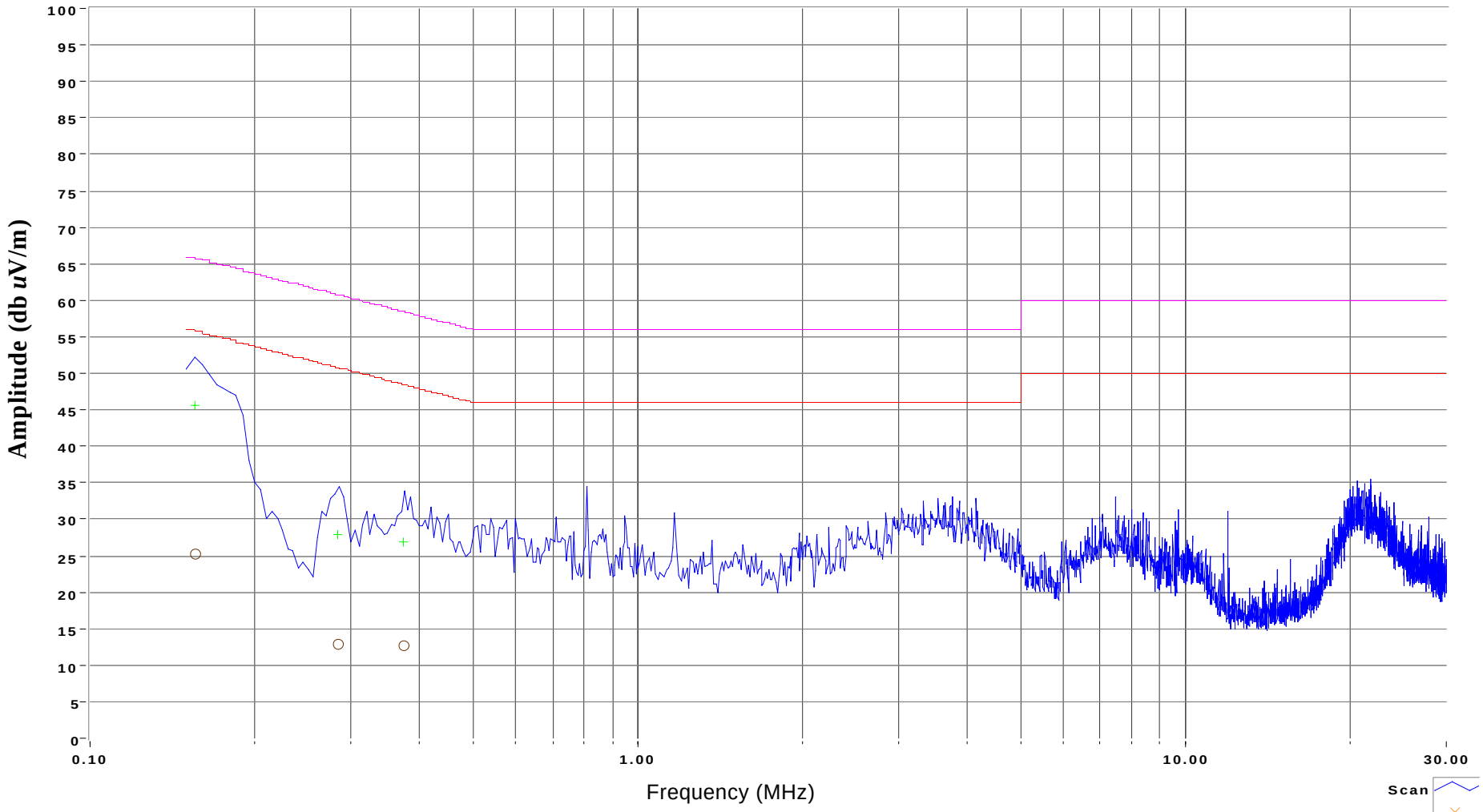
Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz

Frequency	Level	AC	15.109B/ 15.209		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.184	46.5	Neutral	64.3	-17.8	QP	
0.169	46.6	Neutral	65.0	-18.4	QP	
0.156	45.7	Line 1	65.5	-19.8	QP	
0.209	42.2	Neutral	63.2	-21.0	QP	
0.184	30.4	Neutral	54.3	-23.9	AV	
0.484	31.3	Neutral	56.3	-25.0	QP	
0.209	25.2	Neutral	53.2	-28.0	AV	
0.156	25.2	Line 1	55.5	-30.3	AV	
0.374	26.9	Line 1	58.4	-31.5	QP	
0.484	14.8	Neutral	46.3	-31.5	AV	
0.284	27.8	Line 1	60.7	-32.9	QP	
0.169	21.4	Neutral	55.0	-33.6	AV	
0.374	12.8	Line 1	48.4	-35.6	AV	
0.284	13.0	Line 1	50.7	-37.7	AV	

SVOATS# 2: RF Micro Devices 802.11a CardBus Card Run 1

Spec:
EN55022B

Mains Lead
Line 1



120V / 60Hz Line

Scan
Peak
Quasi-peak
Average
Average Limit
QuasiPeak Limit

6/6/03

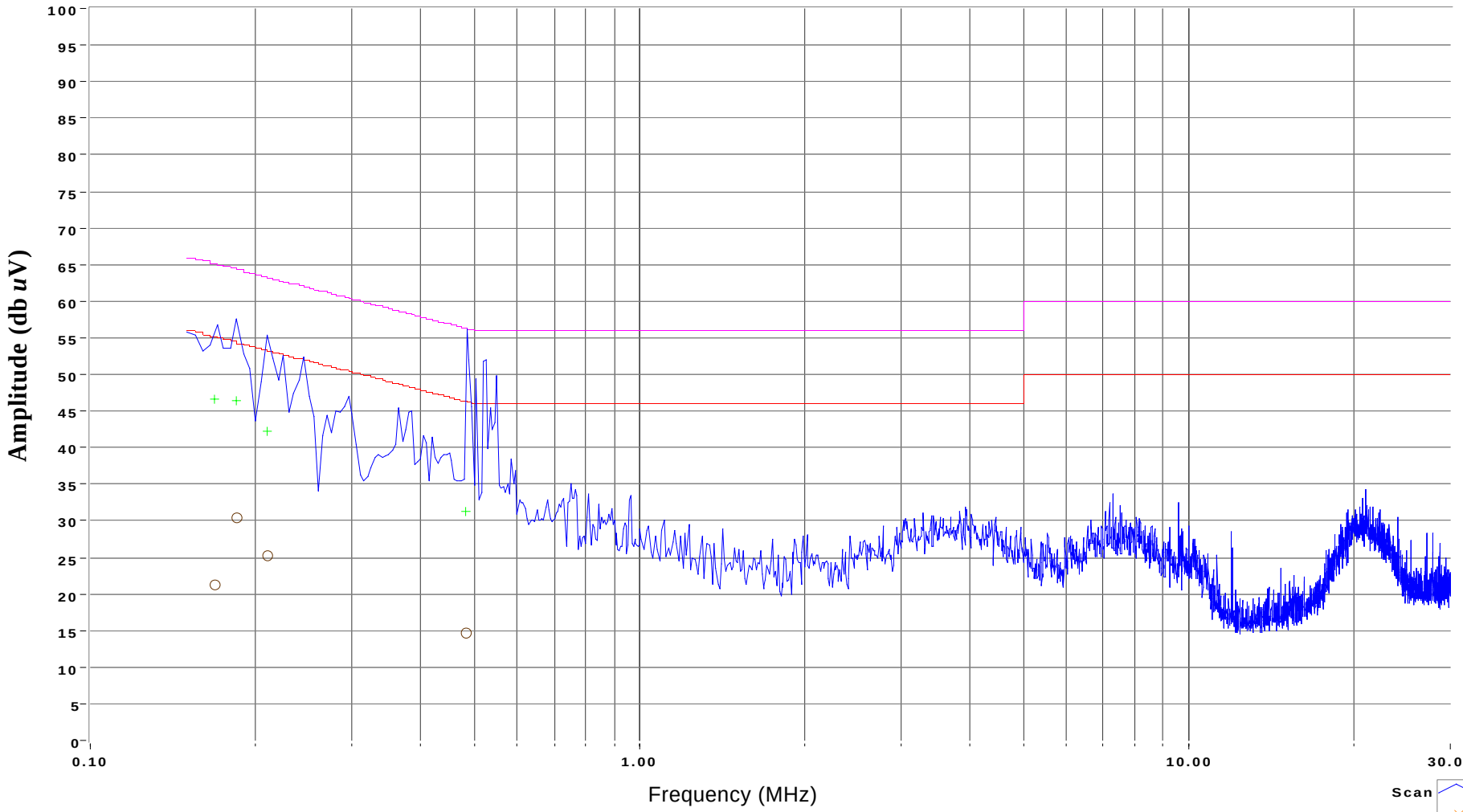
Juan Gonzalez

SVOATS# 2: RF Micro Devices 802.11a CardBus Card Run 1

Spec:

Mains Lead

Neutral



120V / 60Hz Neutral

Scan
Peak
Quasi-peak
Average
Average Limit
QuasiPeak Limit

6/6/03

Juan Gonzalez

Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

FCC Part 15 Subpart E Antenna Conducted Tests

Test Specifics

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

Date of Test: 6/6/2003
Test Engineer: Marissa Faustino
Test Location: SVOATS #3

Config. Used: 1
Config Change: none
Host Unit Voltage 120V/60Hz

General Test Configuration

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators and cables used.

Ambient Conditions:

Temperature: 21°C
Rel. Humidity: 61%

Summary of Results

Run #	Test Performed	Limit	Result	Comments
1	Output Power	15.407(a) (1), (2)	Pass	Met power requirements
1	Power Spectral Density (PSD)	15.407(a) (1), (2)	Pass	Met power requirements
2	26dB Bandwidth	15.407	Pass	> 20MHz
2	20 dB Bandwidth	RSS 210	Pass	> 16 MHz
4	Peak Excursion Envelope	15.407(a) (6)	Pass	Peak to average excursion < 13dB
5	Antenna Conducted - Out of Band Spurious	15.407(b)	Pass	Signals < -27dBm/MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Elliott

EMC Test Data

Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

Run #1: Output Power, Bandwidth and Power Spectral Density

The minimum VBW required for power measurements using a spectrum analyzer is 1/T, where T is the pulse transmission rate.

Pulse Transmission Rate:	4.0	uS	(Symbol Rate for 802.11a)
Minimum VBW:	250	kHz	
VBW Used:	300	kHz	
Antenna Gain:	4	dBi	

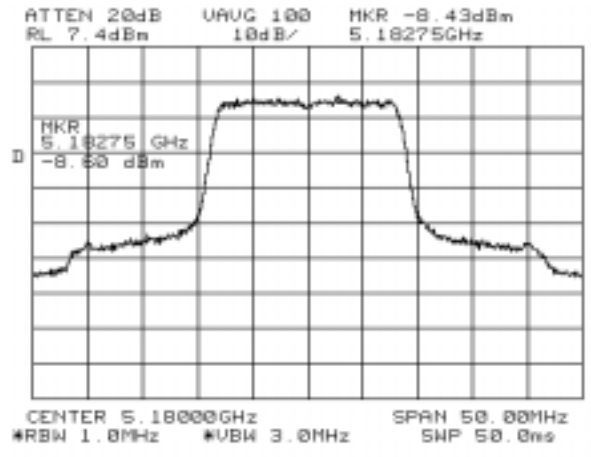
Frequency (MHz)	Bandwidth Measurements			Output Power *5		Power Spectral Density (dBm/MHz)			
						PSD[2]		RSS 210 Peak PSD[3]	
		99% (MHz)	RBW[1] (kHz)	Measured (dBm)	Limit (dBm)	Measured	Limit	Calculated	Measured
5180		17.2	100	16.5	17.0	-7.9	4.0	4.1	1.7
5260		16.9	100	14.6	24.0	-7.3	11.0	2.3	1.7
5320		16.9	100	15.1	24.0	-6.3	11.0	2.8	1.9

Note 1:	RBW = Resolution bandwidth used on the spectrum analyzer to measure the 99% signal bandwidth. This is at least 1% of the 26dB emission bandwidth
Note 2:	The PSD was measured using RBW = 1MHz, VBW >=3MHz, video averaging ON as the EUT was continuously transmitting. There was no need to time gate the analyzer or use other techniques as the EUT was continuously transmitting.
Note 3:	Calculated PSD for RSS210 is equal to the output power divided by the emissions 99% power bandwidth. The Peak PSD was measured using RBW = 1MHz, VBW 1MHz, video averaging OFF.
Note 4:	Measured using spectrum analyzer's power measurement function (RBW = 1MHz, VBW =300kHz)
Note 5:	Measured using Rohde & Schwarz Power Meter and Peak Power Sensor

Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

Plots Showing Power Spectral Density (FCC) (RBW = 1MHz, VBW = 3 MHz, video averaging ON)

201



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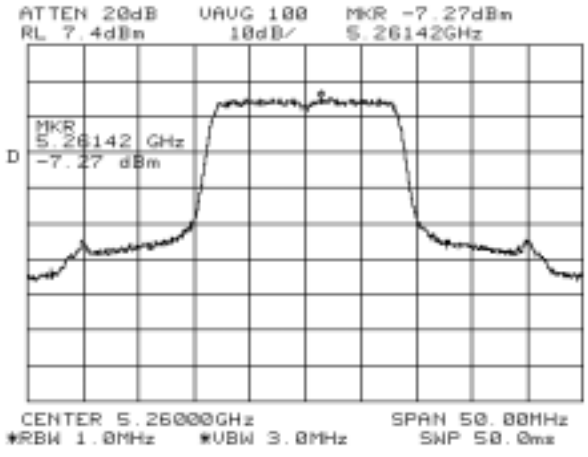

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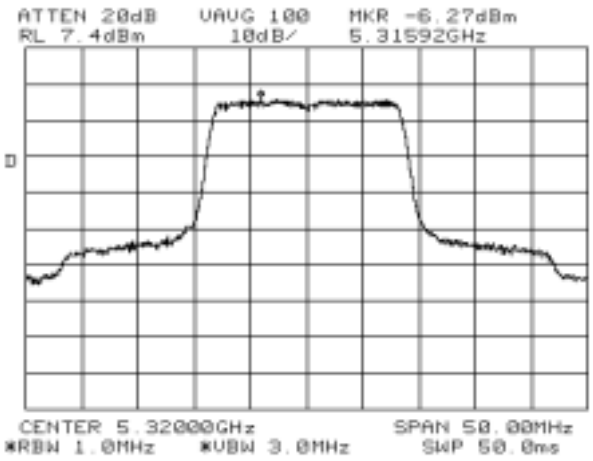
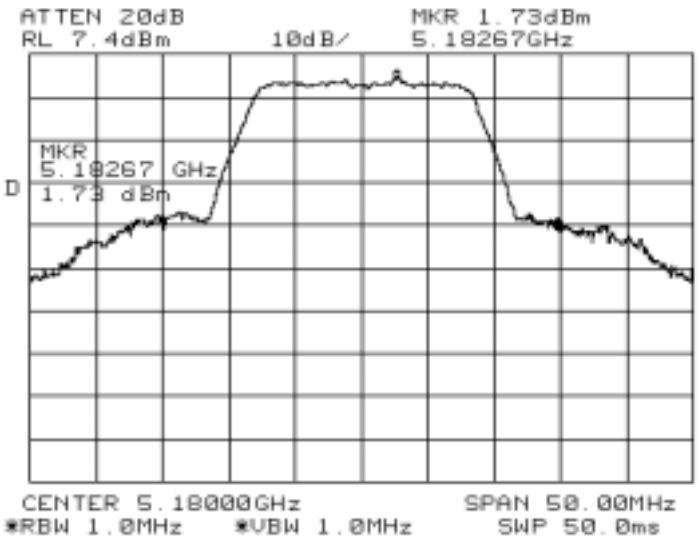


Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

Plots Showing Power Spectral Density (RSS210) (RBW = 1MHz, VBW = 1 MHz, video averaging OFF)

204



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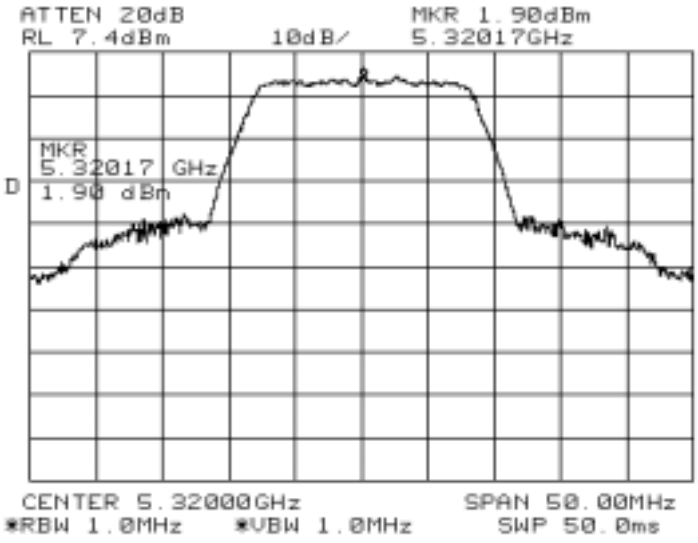
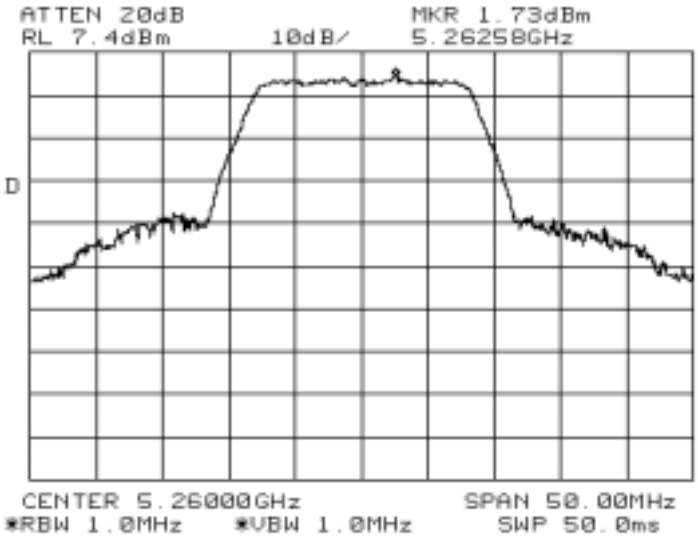


Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

206



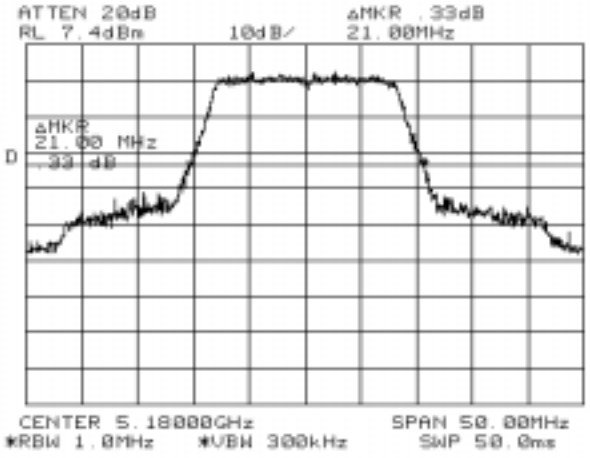
Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

Run #2: Signal Bandwidth

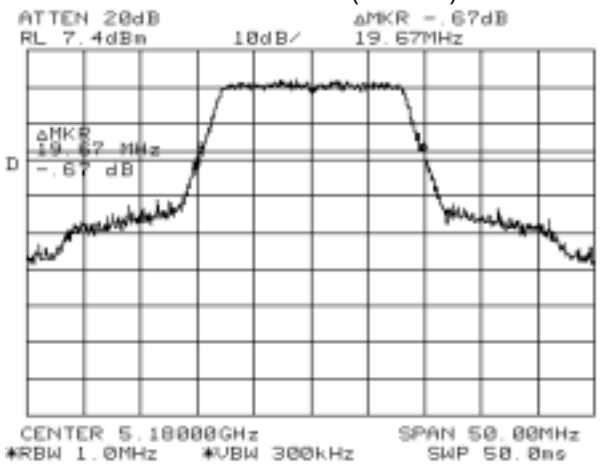
Channel	Frequency (MHz)	Resolution Bandwidth	26 dB Signal Bandwidth (MHz)	20 dB Signal Bandwidth (MHz)	Graph reference #
36	5180	300 kHz	21.0	19.7	301
52	5260	300 kHz	22.0	19.5	302
64	5320	300 kHz	20.9	19.5	303

Plots Showing Signal Bandwidth

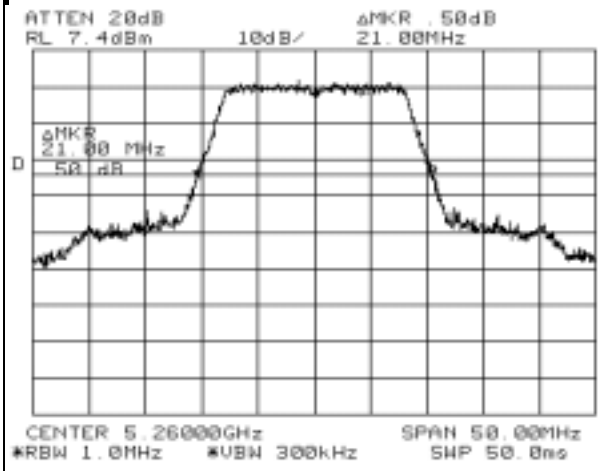
301(26 dB BW)



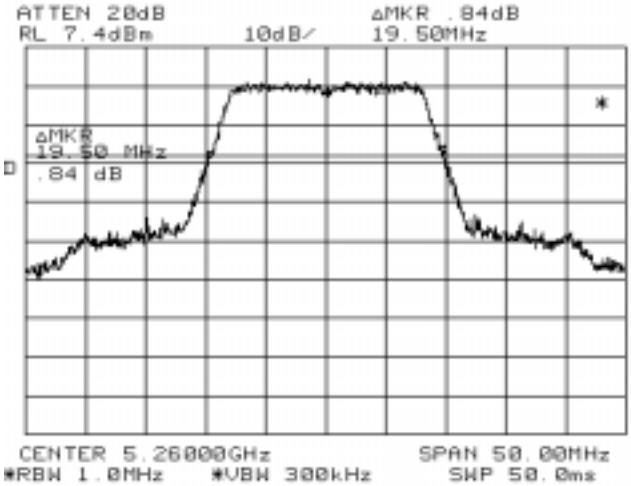
301(20dB BW)



302(26 dB BW)

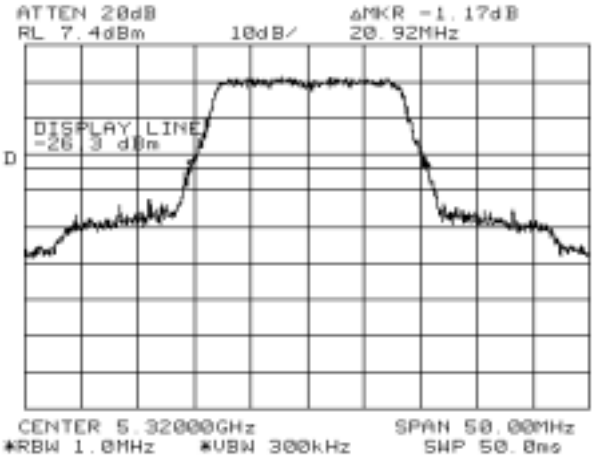


302(20 dB BW)

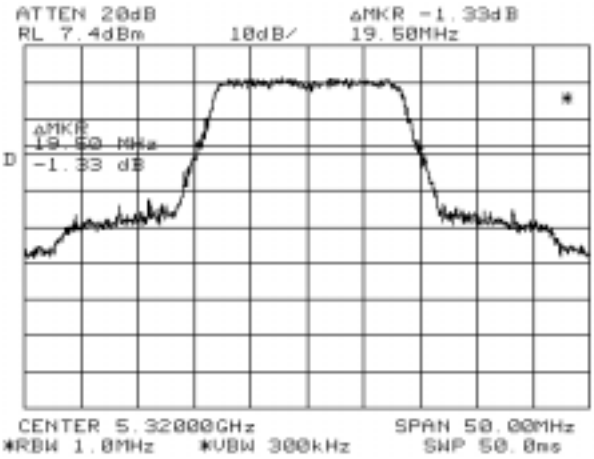


Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

303(26 dB BW)



303(20dB BW)



Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

Run #3: Peak Excursion Measurement

Plots Showing Peak Excursion

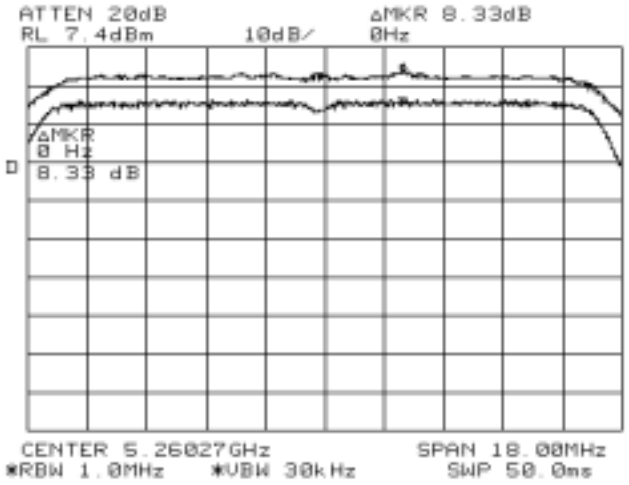
Trace A: RBW = 1 VBW = 3MHz

Trace B: RBW = 1 MHz, VBW = 300kHz

5.26 GHz

Peak Excursion = 8.3 dB.

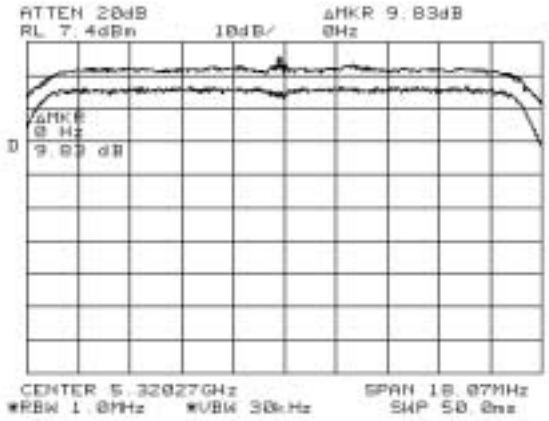
Peak Excursion



5.32 GHz

Peak Excursion =9.8 dB.

Peak Excursion

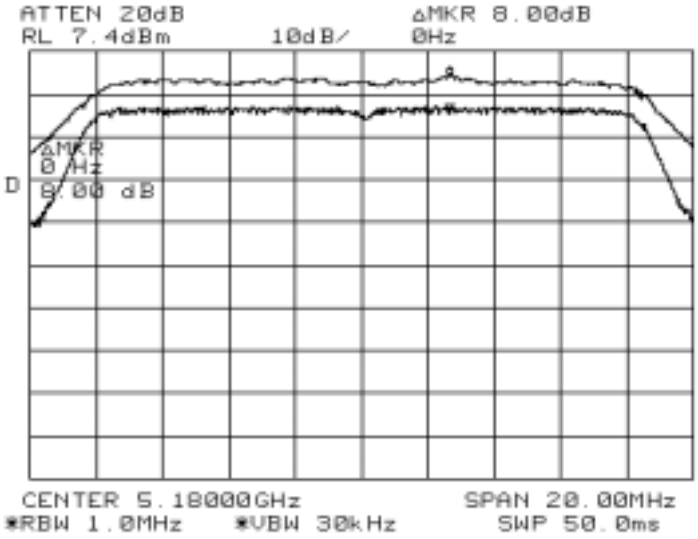


Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

5.18GHz

Peak Excursion =8 dB.

Peak Excursion



Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

Run #4: Out Of Band Spurious Emissions - Antenna Conducted

Antenna Gain: 4 dBi

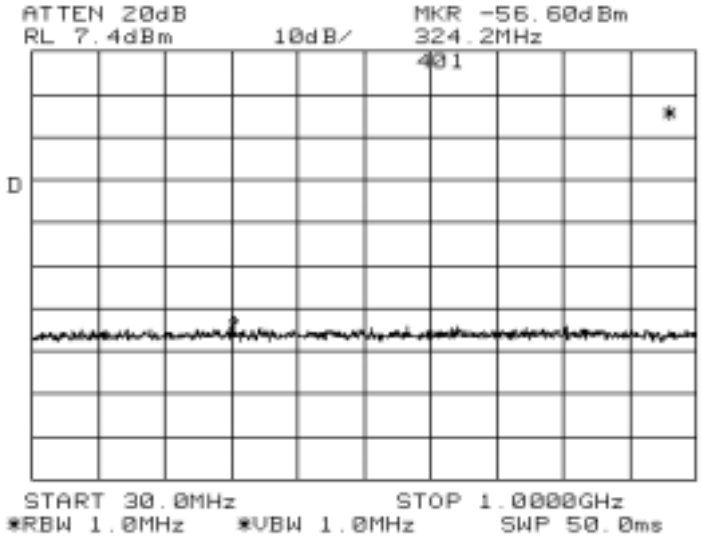
The EIRP limit is -27dBm/MHz for all out of band signals that do not fall in restricted bands. A limit of -31.0dBm was, therefore, used for signals not in restricted bands and close to the intentional band (assumption that the antenna gain remained constant within 50 MHz of the upper and lower band edges).
For signals removed from the band edge by more than 100MHz, radiated measurements were made if the signal amplitude exceeded -37dBm."

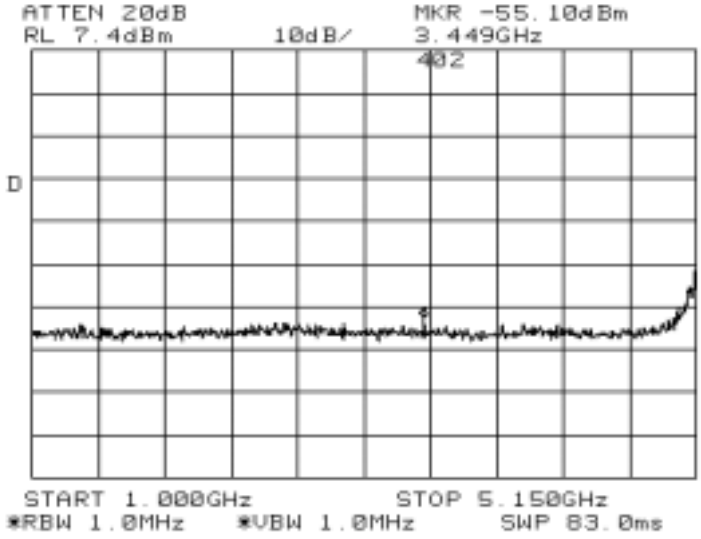
Channel	Frequency (MHz)	Frequency Range	Highest Spurious Signal	Graph reference #
36	5180	30 - 1000 MHz	Note 4	401
		1 to 5.15 GHz	3.449GHz(-55.1dB)	402
		5.25 to 10 GHz	6.905GHz(-52.1dB), 5.503GHz (-48.6dB)	403
		10 GHz to 20 GHz	none	404
		20 GHz to 40 GHz	none	405
52	5260	30 - 1000 MHz	Note 4	406
		1 to 5.15 GHz	3.504GHz(-53.6dB)	407
		5.35 to 10 GHz	5.459(-50.1)	408
		10 GHz to 20 GHz		409
		20 GHz to 40 GHz		410
64	5320	30 - 1000 MHz	Note 4	411
		1 to 5.25 GHz	3.550(-53.8)	412
		5.35 to 10 GHz	5.474GHz(-48.9)	413
		10 GHz to 20 GHz	none	414
		20 GHz to 40 GHz	none	415

Note 1:	Signal is in a restricted band. Refer to run #6 for field strength measurements.
Note 2:	Signal is not in restricted band. Limit is -27dBm eirp. As the signal strength is significantly lower than -27dBm no field strength measurements required.
Note 3:	Signal is not in restricted band. Limit is -27dBm eirp. Although the signal strength is significantly lower than -27dBm field strength measurements were made (refer to run #6)
Note 4:	All spurious signals in this frequency band measured during digital device radiated emissions test.
Note 5:	Signal is within 10MHz of the 5.725 or 5.825 Band edge. Limit is -17dBm EIRP

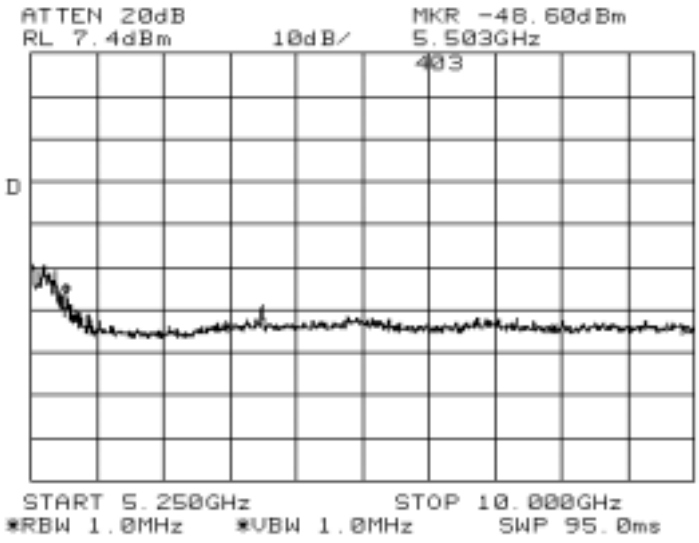
Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

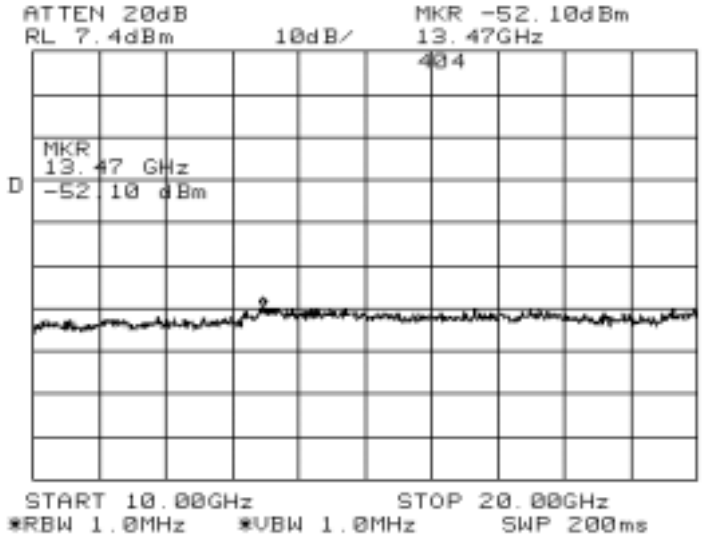
Plots Showing Out-Of-Band Emissions (RBW=VBW=1MHz)



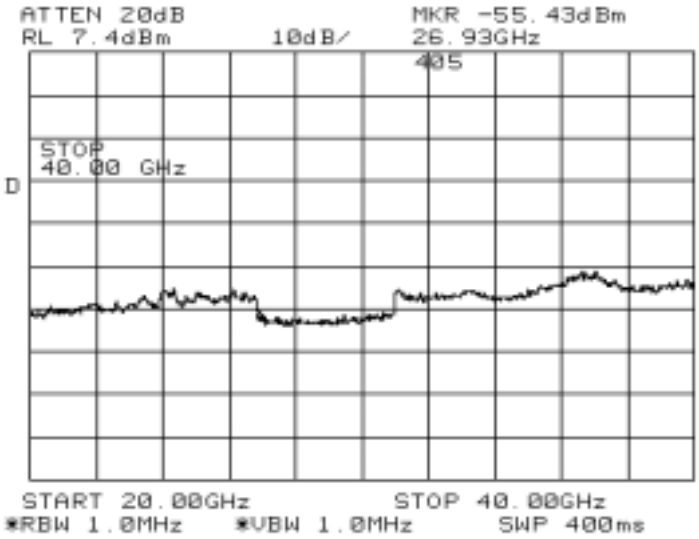


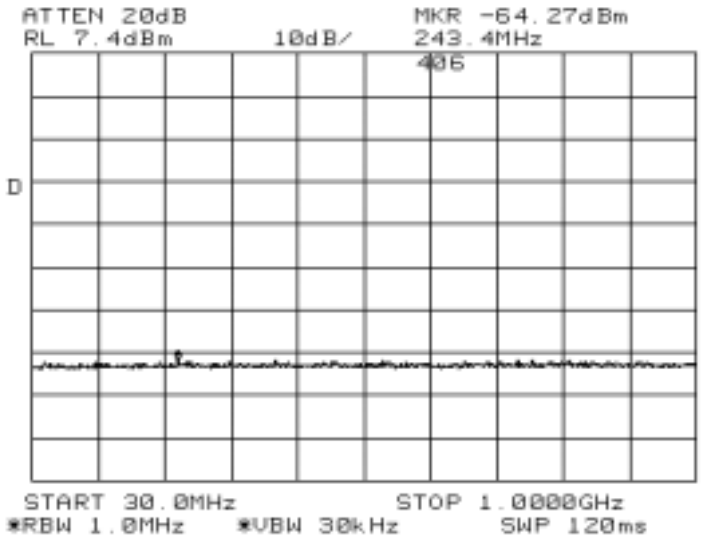
Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B



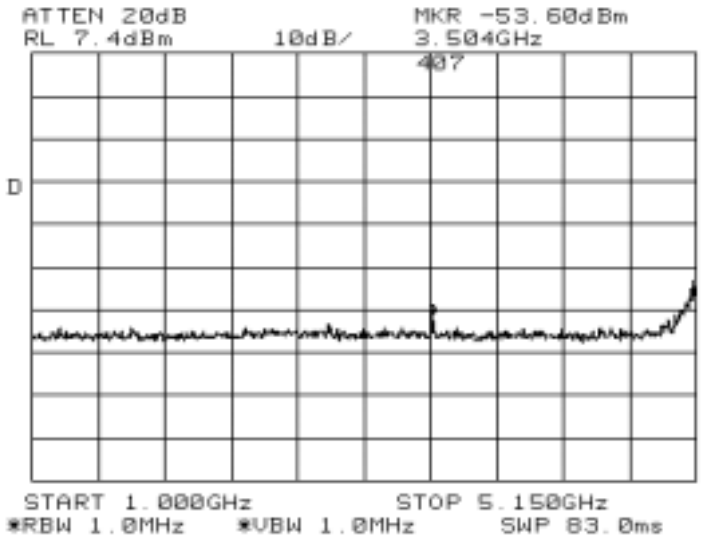


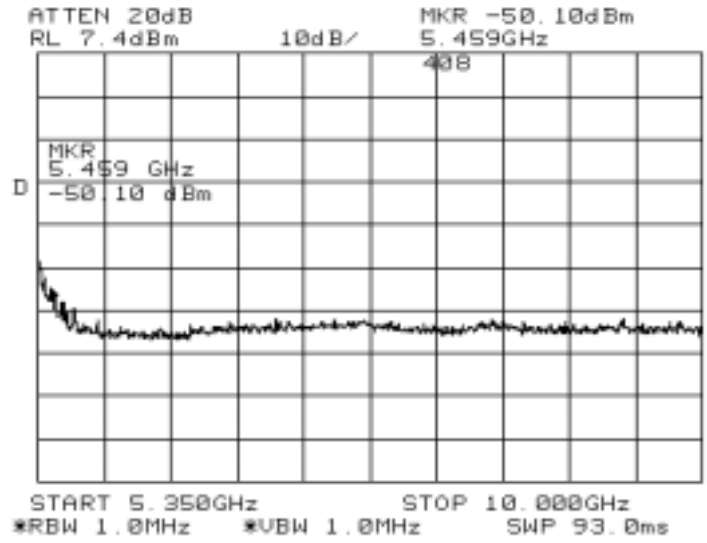
Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B



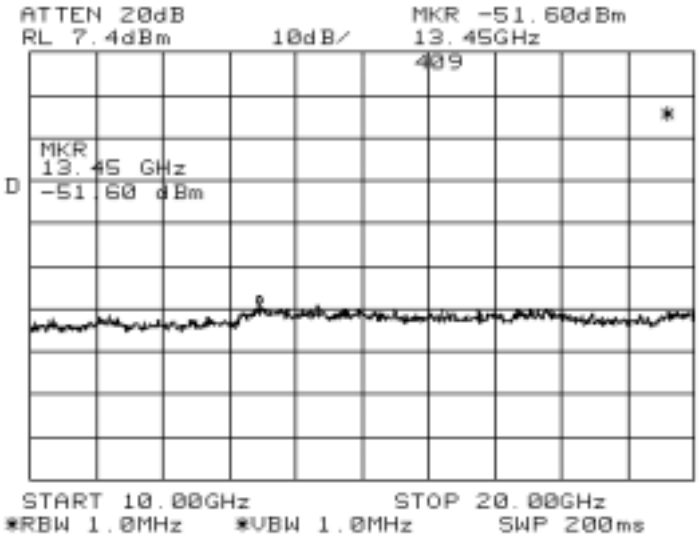


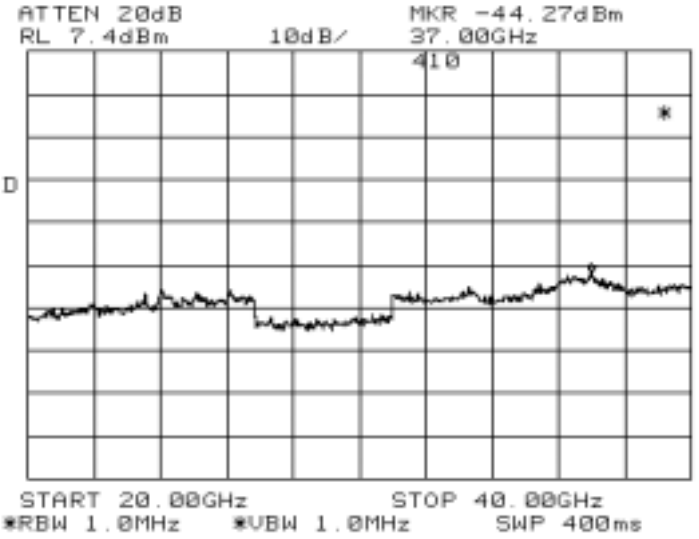
Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B



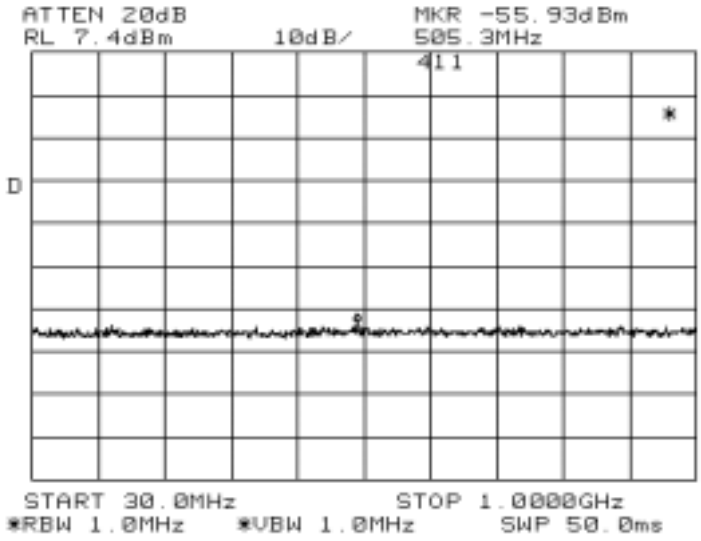


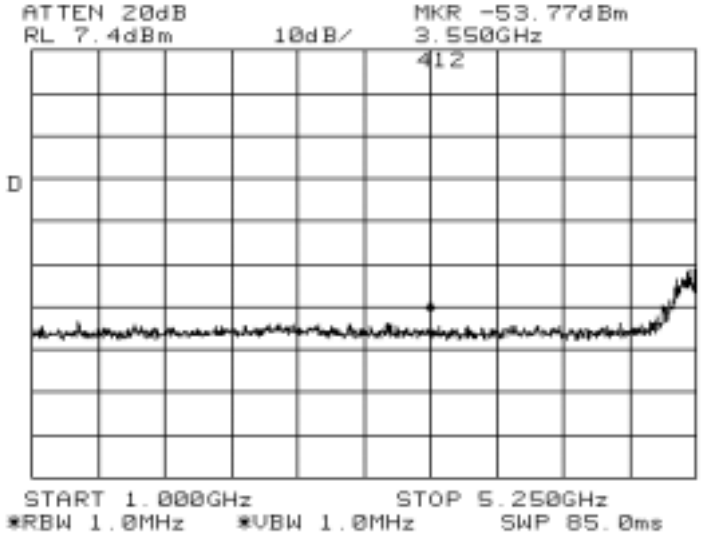
Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B



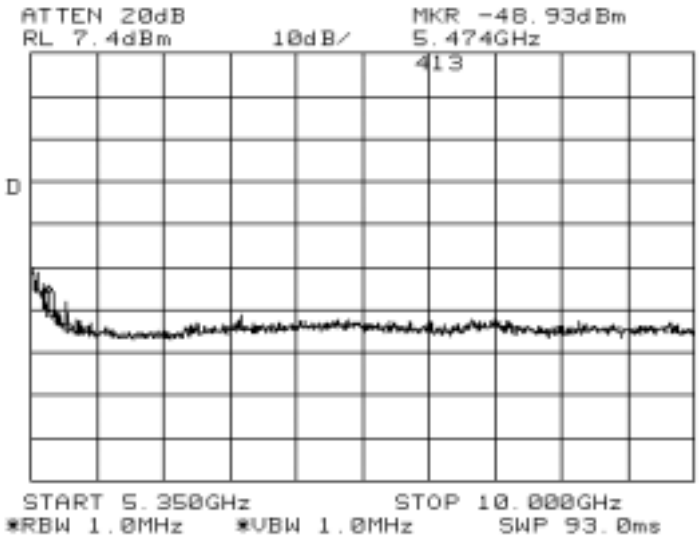


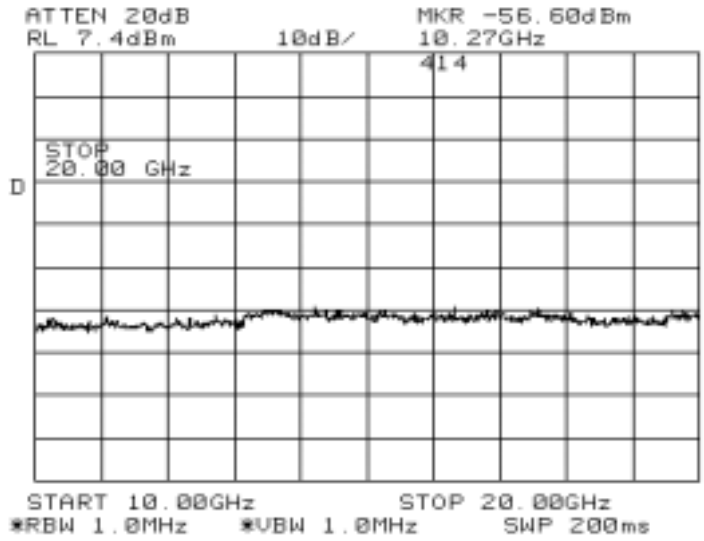
Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B



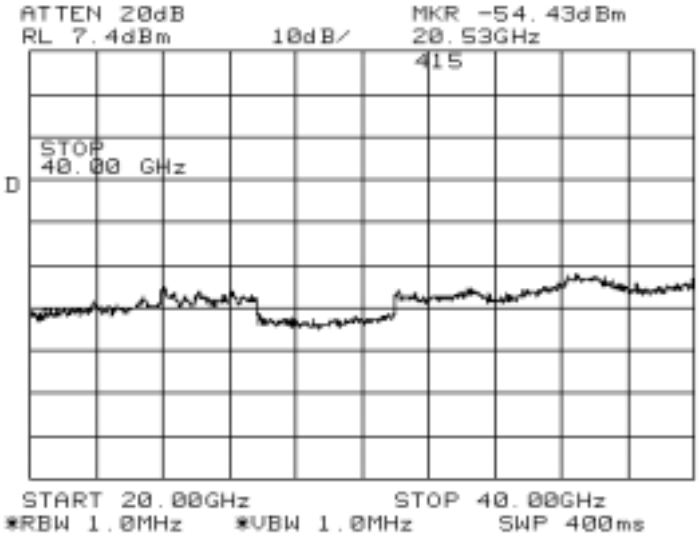


Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B





Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B



Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

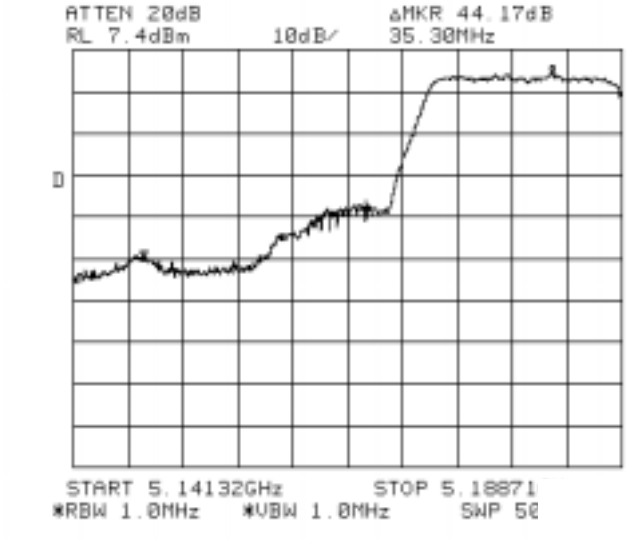
Band Edge Measurements:

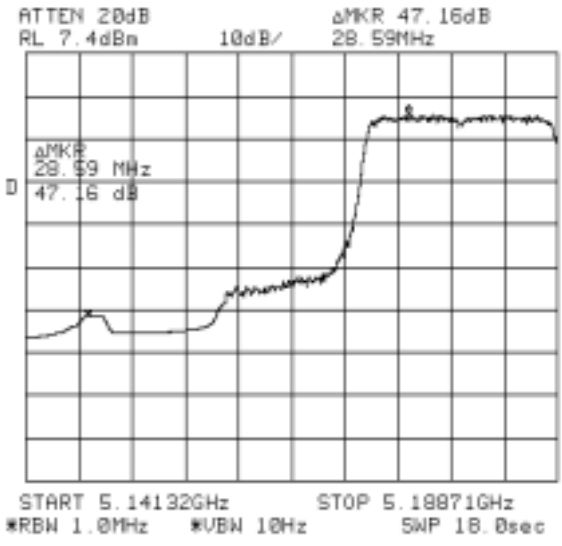
For signals in the restricted bands immediately above and below the 5.15 to 5.35 GHz allocated band a measurement was made of the amplitude of the spurious emissions with respect to the intentional signals. The relative amplitude, in dBc, was then applie

Plots Showing Out-Of-Band Emissions (Peak RBW=VBW=1MHz; Average RBW = 1MHz, VBW = 10Hz)

5.15 GHz band edge, EUT operating on the lowest channel

The highest signal within 50 MHz of the 5.15 GHz band was -44.2 dBc (Peak) / -47.1dBc (Average)

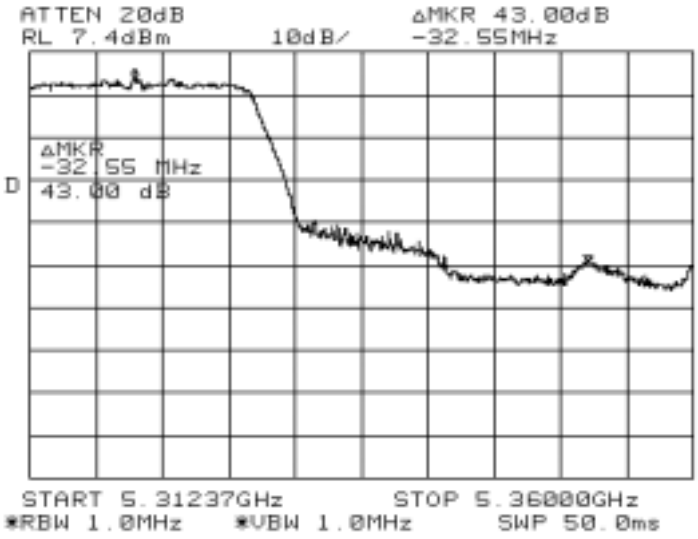


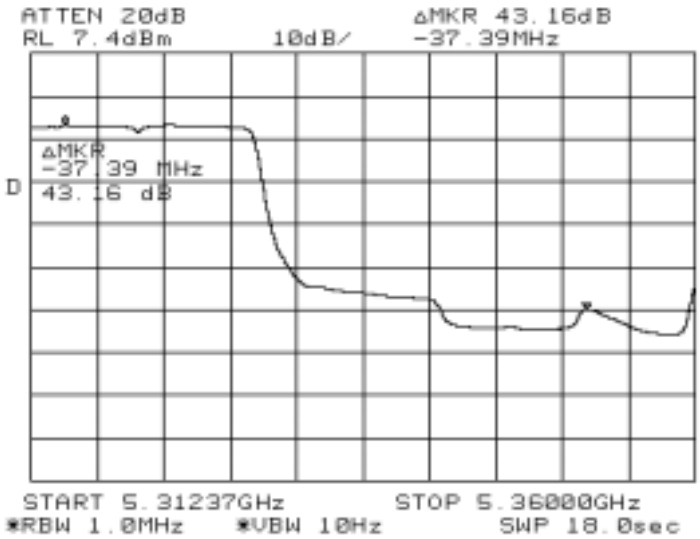


Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

5.35 GHz band edge EUT operating on channel 17 (highest channel):

The highest signal in the 5.35 to 5.46 GHz band was -43.0dBc (Peak) / - 43.2dBc (Average)





Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

FCC Part 15 Subpart B Radiated Spurious Emissions

Test Specifics

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

Date of Test: 1/17/2003
Test Engineer: Marissa Faustino
Test Location: SVOATS #1

Config. Used: 2
Config Change: none
Host Unit Voltage 120V/60Hz

General Test Configuration

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected

Ambient Conditions:

Temperature: 21°C
Rel. Humidity: 61%

Summary of Results

Run #	Test Performed	Limit	Result	Comments
1	RE, 1000 - 40000 MHz - Spurious Emissions	15.407(b)(6)	Pass	-6.6dB @ 36800.0MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

Run #1a: Radiated Spurious Emissions, 1000 - 40000 MHz

Spurious emissions from 30 - 1000 MHz were measured while performing emissions measurements of the digital device. Refer to run 1 performed on 06-06-2003.

Limit for emissions in restricted bands:	54dBuV/m (Average)	74dBuV/m (Peak)
Limit for emissions outside of restricted bands:	EIRP < -27dBm/MHz	(68dBuV/m)

Fundamental signal measurements (to calculate the band edge field strengths):

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5180.0	99.5	v	-	-	Pk	336	1.7	RBW = VBW = 1 MHz
5180.0	87.2	v	-	-	Avg	336	1.7	RBW = 1MHz, VBW = 10Hz
5180.0	103.8	h	-	-	Pk	310	2.2	RBW = VBW = 1 MHz
5180.0	91.4	h	-	-	Avg	310	2.2	RBW = 1MHz, VBW = 10Hz
5320.0	95.8	v	-	-	Pk	310	1.5	RBW = VBW = 1 MHz
5320.0	84.1	v	-	-	Avg	310	1.5	RBW = 1MHz, VBW = 10Hz
5320.0	97.1	h	-	-	Pk	311	2.2	RBW = VBW = 1 MHz
5320.0	87.9	h	-	-	Avg	311	2.2	RBW = 1MHz, VBW = 10Hz

Band Edge Field Strength Calculations

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5150.0	44.3	h	54.0	-9.7	Avg	270	2.0	Note 1
5150.0	59.6	h	74.0	-14.4	Pk	270	2.0	Note 1
5350.0	44.7	h	54.0	-9.3	Avg	270	2.0	Note 2
5350.0	54.1	h	74.0	-19.9	Pk	270	2.0	Note 2

Note 1:	EUT operating on the lowest channel available in the 5.15 - 5.25 MHz band. Signal level calculated using the relative measurements in run #5 (-44.2 dBc for peak and -47.1dBc for average) applied to the highest peak and average field strength measurements of the fundamental signal level.
Note 2:	EUT operating on highest channel available in the 5.25 - 5.35 MHz band. Signal level calculated using the relative measurements in run #5 (-43.0 dBc for peak and -43.2dBc for average) applied to the highest peak and average field strength measurements of the fundamental signal level.

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EMC Test Data

Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

Run #1b: Radiated Spurious Emissions, 1000 - 40000 MHz
EUT On Lowest Channel Available (Channel 36, 5.18 GHz)

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
36260.0	46.6	V	54.0	-7.4	Avg			Note 4
36260.0	46.6	H	54.0	-7.4	Avg			Note 4
15540.0	45.3	V	54.0	-8.7	Avg			Note 4
15540.0	45.3	H	54.0	-8.7	Avg			Note 4
31080.0	44.7	V	54.0	-9.3	Avg			Note 4
31080.0	44.7	H	54.0	-9.3	Avg			Note 4
10360.0	43.9	V	54.0	-10.1	Avg			Note 4
10360.0	43.9	H	54.0	-10.1	Avg			Note 4
25900.0	42.1	V	54.0	-11.9	Avg			Note 4
25900.0	42.1	H	54.0	-11.9	Avg			Note 4
20720.0	39.8	V	54.0	-14.2	Avg			Note 4
20720.0	39.8	H	54.0	-14.2	Avg			Note 4
36260.0	58.5	V	74.0	-15.5	Pk			Note 4
36260.0	58.5	H	74.0	-15.5	Pk			Note 4
15540.0	58.0	V	74.0	-16.0	Pk			Note 4
15540.0	58.0	H	74.0	-16.0	Pk			Note 4
10360.0	57.5	V	74.0	-16.5	Pk			Note 4
10360.0	57.5	H	74.0	-16.5	Pk			Note 4
31080.0	56.8	V	74.0	-17.2	Pk			Note 4
31080.0	56.8	H	74.0	-17.2	Pk			Note 4
25900.0	54.7	V	74.0	-19.3	Pk			Note 4
25900.0	54.7	H	74.0	-19.3	Pk			Note 4
20720.0	52.8	V	74.0	-21.2	Pk			Note 4
20720.0	52.8	H	74.0	-21.2	Pk			Note 4

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EMC Test Data

Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

EUT On Center Channel (Channel 52, 5.26 GHz)

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
36800.0	47.4	V	54.0	-6.6	Avg			Note 4
36800.0	47.4	H	54.0	-6.6	Avg			Note 4
15780.0	44.9	V	54.0	-9.1	Avg			Note 4
15780.0	44.9	H	54.0	-9.1	Avg			Note 4
31560.0	44.7	V	54.0	-9.3	Avg			Note 4
31560.0	44.7	H	54.0	-9.3	Avg			Note 4
26300.0	42.1	V	54.0	-11.9	Avg			Note 4
26300.0	42.1	H	54.0	-11.9	Avg			Note 4
36800.0	61.7	V	74.0	-12.3	Pk			Note 4
36800.0	61.7	H	74.0	-12.3	Pk			Note 4
10520.0	40.0	V	54.0	-14.0	Avg			Note 4
21040.0	40.0	V	54.0	-14.0	Avg			Note 4
10520.0	40.0	H	54.0	-14.0	Avg			Note 4
21040.0	40.0	H	54.0	-14.0	Avg			Note 4
15780.0	57.8	V	74.0	-16.2	Pk			Note 4
15780.0	57.8	H	74.0	-16.2	Pk			Note 4
31560.0	57.7	V	74.0	-16.3	Pk			Note 4
31560.0	57.7	H	74.0	-16.3	Pk			Note 4
26300.0	55.2	V	74.0	-18.8	Pk			Note 4
26300.0	55.2	H	74.0	-18.8	Pk			Note 4
21040.0	52.9	V	74.0	-21.1	Pk			Note 4
21040.0	52.9	H	74.0	-21.1	Pk			Note 4
10520.0	52.4	V	74.0	-21.6	Pk			Note 4
10520.0	52.4	H	74.0	-21.6	Pk			Note 4

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EMC Test Data

Client:	RF MicroDevices	Job Number:	J51392
Model:	RD5400	T-Log Number:	T51442
		Proj Eng:	Christine Vu
Contact:	Bill Simmons		
Spec:	FCC Part 15 B and E	Class:	B

EUT On Highest Channel Available (Channel 64, 5.32 GHz)

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
37240.0	47.3	V	54.0	-6.7	Avg			Note 4
37240.0	47.3	H	54.0	-6.7	Avg			Note 4
10640.0	45.4	V	54.0	-8.6	Avg			Note 4
10640.0	45.4	H	54.0	-8.6	Avg			Note 4
15960.0	44.9	V	54.0	-9.1	Avg			Note 4
15960.0	44.9	H	54.0	-9.1	Avg			Note 4
31900.0	44.8	V	54.0	-9.2	Avg			Note 4
31900.0	44.8	H	54.0	-9.2	Avg			Note 4
26600.0	41.9	V	54.0	-12.1	Avg			Note 4
26600.0	41.9	H	54.0	-12.1	Avg			Note 4
37240.0	60.5	V	74.0	-13.5	Pk			Note 4
37240.0	60.5	H	74.0	-13.5	Pk			Note 4
21280.0	39.4	V	54.0	-14.6	Avg			Note 4
21280.0	39.4	H	54.0	-14.6	Avg			Note 4
10640.0	57.8	V	74.0	-16.2	Pk			Note 4
15960.0	57.8	V	74.0	-16.2	Pk			Note 4
10640.0	57.8	H	74.0	-16.2	Pk			Note 4
15960.0	57.8	H	74.0	-16.2	Pk			Note 4
31900.0	57.4	V	74.0	-16.6	Pk			Note 4
31900.0	57.4	H	74.0	-16.6	Pk			Note 4
26600.0	54.8	V	74.0	-19.2	Pk			Note 4
26600.0	54.8	H	74.0	-19.2	Pk			Note 4
21280.0	53.0	V	74.0	-21.0	Pk			Note 4
21280.0	53.0	H	74.0	-21.0	Pk			Note 4

Note 1:	For emissions falling in the restricted bands detailed in 15.205 the general limits of 15.209 apply. For all other emissions the limit is EIRP < -27dBm (equivalent to a field strength at 3m of 68dBuV/m)
Note 2:	Signal is in a restricted band
Note 3:	Restricted Band Peak Measurements: Resolution and Video BW: 1 MHz, Restricted Band Average Measurements: Resolution Bw: 1MHz and Video Bw: 10 Hz.
Note 4:	Measurement of the instumentation noise floor, no signal detected at 3 meters.