Elliott Laboratories Inc. 684 West Maude Avenue 408-245-7800 Phone
www.elliottlabs.com Sunnyvale, CA 94086-3518 408-245-3499 Fax

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 4 (LELAN Devices) on the Netgear Model: HA501

FCC ID:	PY3HA501
GRANTEE:	Netgear 4401 Great America Parkway Santa Clara, CA. 95052-8185
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	November 12, 2001
FINAL TEST DATE:	October 18, 2001
AUTHORIZED SIGNATORY:	Mark Briggs Director of Engineering

DECLARATIONS OF COMPLIANCE

Equipment Name and Model:

HA501

Manufacturer:

Netgear
4401 Great America Parkway
Santa Clara, CA. 95052-8185

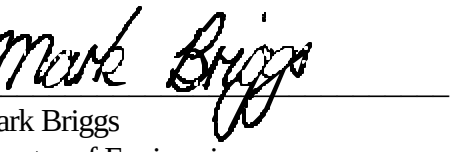
Tested to applicable standards:

RSS-210, Issue 4, December 2000 (Low Power License-Exempt Radiocommunication Devices)
FCC Part 15 Subpart E (UNII Devices)

Measurement Facility Description Filed With Department of Industry:

Departmental Acknowledgement Number: IC2845 **SV2** Dated August 8, 2001
Departmental Acknowledgement Number: IC2845 **SV4** Dated August 20, 2001

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

Signature	
Name	Mark Briggs
Title	Director of Engineering
Company	Elliott Laboratories Inc.
Address	684 W. Maude Ave Sunnyvale, CA 94086 USA
Date:	November 12, 2001

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.).

TABLE OF CONTENTS

SCOPE

An electromagnetic emissions test has been performed on the Atheros Communications model AR5BCB-00013 pursuant to Subpart E of Part 15 of FCC Rules for Unlicensed National Information Infrastructure (UNII) devices and RSS-210 Issue 4 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 Atheros Communications model AR5BCB-00013 and therefore apply only to the tested sample. The sample was selected and prepared by Eric Dukatz of Atheros Communications.

The NetGear model HA501 is electrically identical to the model Atheros Communications model AR5BCB-00013 tested. A letter from NetGear explaining this has been included with the application package.

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 (Normal Mode)				
15.407 (d)		Maximum Antenna Gain /Integral Antenna	1.5 dBi Integral	Pass
15.407(e)		Indoor operation only	Refer to user's manual in Exhibit 7	Pass
15.407(a) (1)	6.2.2 q1 (i)	Bandwidth	27.67 MHz (26-dB), 17.33 MHz (20-dB)	N/A
15.407(a) (1)	6.2.2 q1 (i)	Output Power	14.8 dBm	Pass
15.407(a) (1))	6.2.2 q1 (i)	Power Spectral Density	.27 dBm/MHz	Pass
Operation in the 5.25 – 5.35 GHz Band (Normal Mode)				
		Maximum Antenna Gain	1.5 dBi Integral	Pass
15.407(a) (2)	6.2.2 q1 (ii)	Bandwidth	38.25 MHz (26-dB), 20.83 MHz (20-dB)	N/A
15.407(a) (2)	6.2.2 q1 (ii)	Output Power	19.1 dBm	Pass
15.407(a) (2))	6.2.2 q1 (ii)	Power Spectral Density	4.0 dBm/MHz	Pass
Operation in the 5.15 – 5.25 GHz Band (Turbo Mode)				
15.407 (d)		Maximum Antenna Gain /Integral Antenna	1.5 dBi Integral	Pass
15.407(e)		Indoor operation only	Refer to user's manual in Exhibit 7	Pass
15.407(a) (1)	6.2.2 q1 (i)	Bandwidth	51.7 MHz (26-dB), 33.33 MHz (20-dB)	N/A
15.407(a) (1)	6.2.2 q1 (i)	Output Power	15.4 dBm	Pass
15.407(a) (1))	6.2.2 q1 (i)	Power Spectral Density	-2.6 dBm / MHz	Pass
Operation in the 5.25 – 5.35 GHz Band (Turbo Mode)				
		Maximum Antenna Gain	1.5 dBi Integral	Pass
15.407(a) (2)	6.2.2 q1 (ii)	Bandwidth	72.3 MHz (26-dB), 45.5 MHz (20-dB)	N/A
15.407(a) (2)	6.2.2 q1 (ii)	Output Power	19.1 dBm	Pass
15.407(a) (2))	6.2.2 q1 (ii)	Power Spectral Density	1.6 dBm/MHz	Pass
Spurious Emissions (All Modes)				
15.407(b) (5) / 15.209	6.2.2 q1 (ii)	Spurious Emissions below 1GHz	-9.2 dB @ 479.1 MHz	Pass
15.407(b) (2)	6.2.2 q1 (ii)	Spurious Emissions above 1GHz	-4.4dB @ 15,540 MHz	Pass

FCC Part 15 Section	RSS 210 Section	Description	Comments	Result
Other Requirements (Both Modes)				
	6.2.2 q(iv)(a)	Digital Modulation	Digital Modulation is used, refer to the "Theory of Operations" in exhibit 8 for a detailed explanation.	Pass
	6.2.2 q(iv)(b)	Peak Spectral Density	12.8 dBm/MHz in Normal mode	Pass
15.407(a)(6)		Peak Excursion Ratio	Less than 13dB	Pass
	6.2.2 q(iv)(c)	Channel Selection	The device was tested on the following channels in turbo mode: 9, 13 and 17. The device was tested on the following channels in normal mode: 6, 14 and 20. These channels represent the lowest, center and highest frequencies of operation in each mode.	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.	Pass
15.407 (g)	6.2.2 q(iv)(e)	Frequency Stability	Frequency stability is =/-20ppm. Refer to the "Theory of Operations" (exhibit 9) for a detailed analysis.	Pass
	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	N/A
15.407 (f)	6.2.2 q(iv)(g)	RF Exposure Requirements	Refer to the SAR test report (Exhibit 11)	Pass
15.407(b) / 15.207	6.6	AC Conducted Emissions	-31.1 dB @ 3.238 MHz	Pass

MEASUREMENT UNCERTAINTIES

ISO Guide 25 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	± 3.2

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Netgear model HA501 is a Carbus card, which is designed to provide a wireless LAN connection. Normally, the EUT would be installed in a Carbus slot of a host laptop PC during testing. The EUT was, therefore, installed in a table-top laptop PC during testing to simulate the end-user environment. The EUT derives power from the host laptop PC.

Note that the actual device tested was the Atheros Communications model AR5BCB-00013. Netgear is manufacturing an identical device, the HA501. Please reference the letter that Netgear has provided attesting to this fact.

The sample was received on October 15, 2001 and tested on October 18, 2001. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number
Atheros Communications AR5BCB-00013 Wireless LAN Carbus Card	-

ENCLOSURE

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 5.33 cm wide by 11.68 cm deep by 1.02 cm high.

MODIFICATIONS

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

SUPPORT EQUIPMENT

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

Manufacturer	Model	Description	Serial Number	FCC ID
Toshiba	Tecra 8200	Host Laptop PC	51212942PU	CJ6PT820WL
Toshiba	PA3048U-1ACA	AC Adaptor for PC	0102 A 0465055G	None
Boonton	4531	Power Meter	100201	N/A
Boonton	57318	Power Sensor	2110	N/A

No remote support equipment was used during testing.

EUT INTERFACE PORTS

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

EUT Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
EUT, CARDBUS Port	Installed in Host Laptop PC's CARDBUS Slot	-	-	-
Host PC, DC Power Input	External AC Adaptor DC Output	Power Cable	Unshielded	1.0
External AC Adaptor AC Input	AC Power Source	Power Cable	Unshielded	1.0

EUT OPERATION

The radio was transmitting at full power on the specified channel with a duty cycle of 99% (maximum allowed). The EUT was tested in both normal mode (channel bandwidth of approximately 30 MHz) and turbo mode (channel bandwidth of approximately 60 MHz).

"Normal Mode" allows data rates of up to 54 Mb/s. The device was, therefore, tested in Normal mode at the data rate that produced the highest output power for normal mode (6 Mb/s).

"Turbo Mode" allows data rates of up to 72Mb/s. At data rates higher than 12Mb/s the PA gain is reduced to improve signal fidelity. The device was, therefore, tested in turbo mode at the data rate that produced the highest output power for turbo mode (12Mb/s).

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 with a gain of 1.5 dBi.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on October 18, 200 at the Elliott Laboratories Open Area Test Site #2 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Federal Communications Commission. In accordance with Industry Canada rules detailed in RSS 210 Issue 4 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 & 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 ran 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

Either a spectrum analyzer or a power meter and thermister mount are used for all direct output power measurements from transmitters.

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 band.

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	68.3 dBuV/m
5725 – 5825	-27 dBm (note 1)	68.3 dBuV/m
	-17 dBm (note 2)	78.3 dBuV/m

Note 1: Applies to spurious signals separated by more than 10 MHz from the allocated band.
Note 2: 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

APPENDIX 1: Test Equipment Calibration Data

Antenna Conducted Emissions, 18-Oct-01 12:40 PM
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Hewlett Packard	Microwave EMI test system (SA40, 30Hz - 40GHz)	84125C	1149	12	2/5/2001	2/5/2002

Conducted and Radiated Emissions, 18-Oct-01 04:47 PM
Engineer: Conrad

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	Biconical Antenna, 30-300 MHz	3110B	1320	12	5/23/2001	5/23/2002
EMCO	LISN, 10kHz-100MHz	3825/2	1292	12	4/9/2001	4/9/2002
EMCO	Log Periodic Antenna, 0.2-1 GHz	3146	1294	12	3/27/2001	3/27/2002
Rohde& Schwarz	Pulse Limiter	ESH3 Z2	812	12	1/23/2001	1/23/2002
Rohde & Schwarz	Test Receiver, 0.009-30 MHz	ESH3	1316	12	5/9/2001	5/9/2002
Rohde & Schwarz	Test Receiver, 20-1300 MHz	ESVP	1317	12	5/9/2001	5/9/2002
Solar Electronics	LISN	8012-50-R-24-BNC	305	12	7/30/2001	7/30/2002

Antenna Conducted and Radiated Emissions, 22-Oct-01 03:09 PM
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Hewlett Packard	Microwave EMI test system (SA40, 30Hz - 40GHz)	84125C	1149	12	2/5/2001	2/5/2002
Hewlett Packard	Preamplifier, 1-26.5 GHz	8449B	TY,84299	12	4/1/2001	4/1/2002
Hewlett Packard	Spectrum Analyzer, 9KHz - 22GHz	8593EM	1319	12	5/31/2001	5/31/2002

APPENDIX 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T 45059 70 Pages

Elliott

EMC Test Data

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Emissions Spec:	FCC 15 B & 15E, RSS-210	Class:	B
Immunity Spec:	-	Environment:	-

EMC Test Data

For The

Atheros Communications

Model

AR5BCB-00013

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Emissions Spec:	FCC 15 B & 15E, RSS-210	Class:	B
Immunity Spec:	-	Environment:	-

EUT INFORMATION

General Description

The EUT is a Cardbus card which is designed to provide a 802.11a wireless LAN connection. Normally, the EUT would installed in a Cardbus slot of a host laptop PC during testing. The EUT was, therefore, installed in a table-top laptop PC during testing to simulate the end-user environment. The EUT derives power from the host laptop PC.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Atheros Communications	AR5BCB-00013	802.11a Wireless LAN Cardbus Card		PPD-AR5BCB-00013

EUT Enclosure

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 5.33 cm wide by 11.68 cm deep by 1.02 cm high.

Modification History

Mod. #	Test	Date	Modificaiton
1			None made

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Emissions Spec:	FCC 15 B & 15E, RSS-210	Class:	B
Immunity Spec:	-	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Toshiba	Tecra 8200	Host Laptop PC	51212942PU	CJ6PT820WL
Toshiba	PA3048U-1ACA	AC Adaptor for PC	0102 A 0465055G	None
3Com	Palm IIIe	PDA	BODD11700375	DoC
3Com	Serial HotSync Cradle	-	-	-
Epson	Stylus Photo P952A	Inkjet Parallel Printer	ADA0013241	BKMFBP952A

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None	-	-	-	-

Interface Port Configuration

EUT Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
EUT, Carbus Port	Installed in Host Laptop PC's carbus Slot	-	-	-
Host PC, Parallel Port	Epson Printer	Parallel Cable	Shielded	2.0
Host PC, Serial Port	Palm IIIe PDA in Serial HotSync Cradle	Serial Cable	Shielded	1.0
Host PC, DC Power Input	External AC Adaptor DC Output	Power Cable	Unshielded	1.0
External AC Adaptor AC Input	AC Power Source	Power Cable	Unshielded	1.0

EUT Operation During Emissions

The EUT was installed in a host laptop PC during testing and continuously transmitted. A batch file was run to fully exercise the host laptop PC, including printing "H" characters to the display and to the attached parallel printer. In addition the EUT was transmitting at its nominal output power on the center channel.

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Emissions Spec:	FCC 15 B & 15E, RSS-210	Class:	B
Immunity Spec:	-	Environment:	-

Test Configuration #2

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Toshiba	Tecra 8200	Host Laptop PC	51212942PU	CJ6PT820WL
Toshiba	PA3048U-1ACA	AC Adaptor for PC	0102 A 0465055G	None

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None	-	-	-	-

Interface Port Configuration

		Cable(s)		
EUT Port	Connected To	Description	Shielded or Unshielded	Length(m)
EUT, Carbus Port	Installed in Host Laptop PC's carbus Slot	-	-	-
Host PC, DC Power Input	External AC Adaptor DC Output	Power Cable	Unshielded	1.0
External AC Adaptor AC Input	AC Power Source	Power Cable	Unshielded	1.0

EUT Operation During Testing

The radio was transmitting at full power on the specified channel with a duty cycle of 99% (maximum allowed). The EUT was tested in both normal mode (channel bandwidth of approximately 30 MHz) and turbo mode (channel bandwidth of approximately 60 MHz).

"Normal Mode" allows data rates of up to 54 Mb/s. The device was, therefore, tested in Normal mode at the data rate that produced the highest output power for normal mode (6 Mb/s).

"Turbo Mode" allows data rates of up to 72Mb/s. At data rates higher than 12Mb/s the PA gain is reduced to improve signal fidelity. The device was, therefore, tested in turbo mode at the data rate that produced the highest output power for turbo mode (12Mb/s).

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

FCC Part 15 Subpart E Tests: Normal Mode

Test Specifics

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

Date of Test:	10/18/2001	Config. Used:	#2
Test Engineer:	J Martinez	Config Change:	None
Test Location:	SVOATS# 2	Host Unit Voltage	120Vac, 60 Hz

General Test Configuration

The EUT was located on the turntable for radiated spurious emissions testing.
For radiated emissions testing the measurement antenna was located 3 meters from the EUT unless stated otherwise.
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: 15°C
Rel. Humidity: 55%

Summary of Results: Normal Mode

Run #	Test Performed	Limit	Result	Comments
1	Output Power	15.407(a) (1), (2)	Pass	
2	Power Spectral Density (PSD)	15.407(a) (1), (2)	Pass	
3	26dB Bandwidth	15.407	Pass	> 20 MHz
3	20 dB Bandwidth	RSS 210	Pass	> 20 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	All emissions below the 27dBm/MHz limit
6	RE, 1000 - 40000 MHz - Spurious Emissions	15.407(b)(6)	Pass	-4.4dB @ 15,540 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.

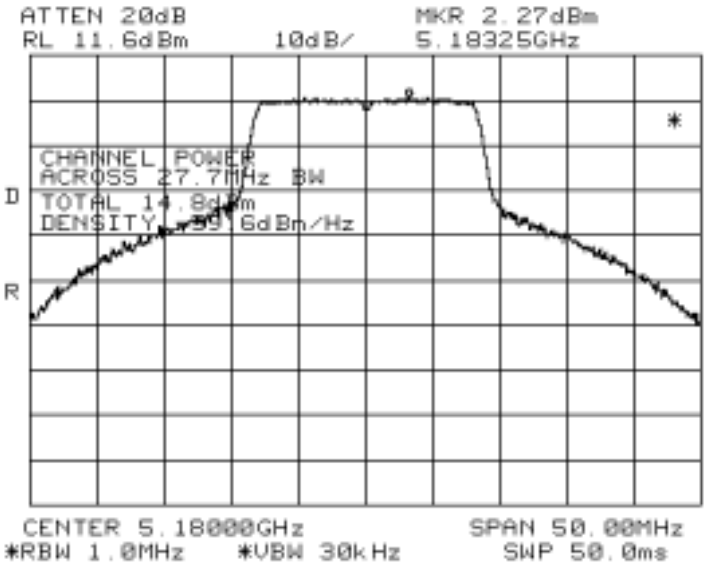
Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Run #1: Output Power

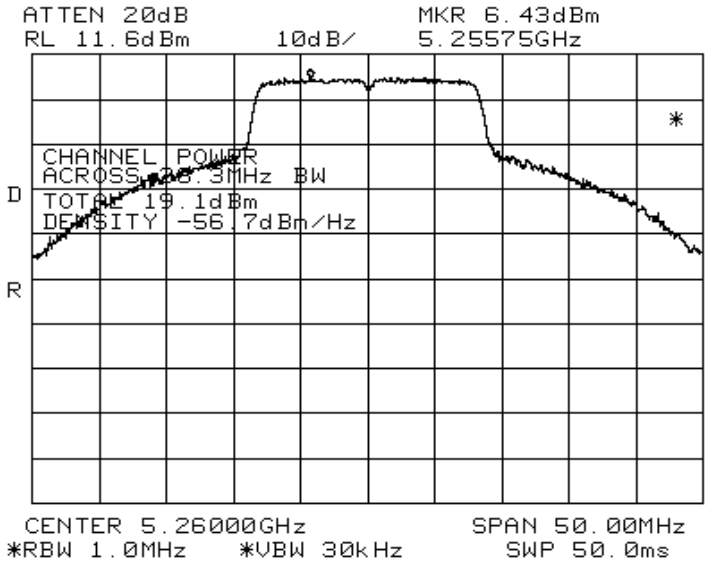
Antenna Gain: 1.5 dBi

Channel	Frequency (MHz)	26-dB Signal BW	Output Power	FCC Limit (dBm) (note 3)	Comments
Low	5180	27.7	**13.8**	17.0	Note 2
	5180	27.7	14.8	17.0	Note 1
Mid	5260	38.25	**17.6**	24.0	Note 2
	5260	38.25	19.1	24.0	Note 1
High	5320	35.5	**16.3**	24.0	Note 2
	5320	35.5	17.8	24.0	Note 1

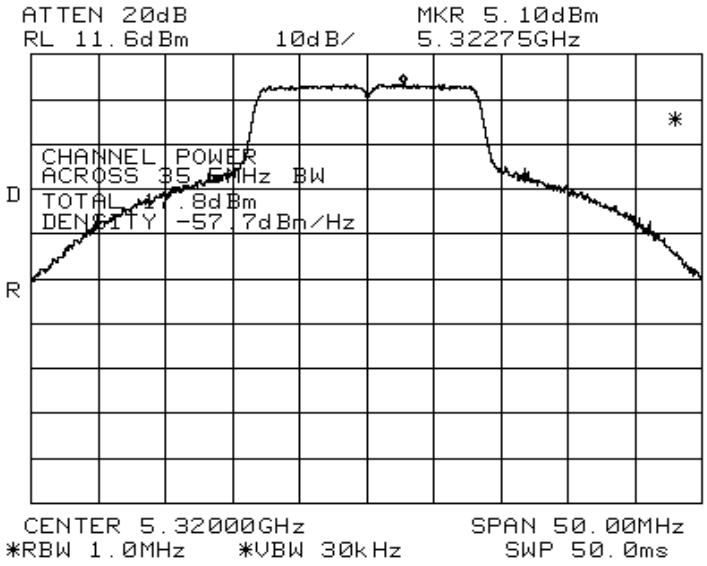
Note 1:	Measured using spectrum analyzer's power measurement function (RBW = 1MHz, VBW = 30kHz)
Note 2:	Measured using a Boonton Power Meter with a peak power sensor in average mode
Note 3:	RSS 210 limit is 23dBm in the 5.15 to 5.25 GHz band, 6dB higher than the FCC limit. This limit is based on the emission bandwidth and operating frequency.
Note 4:	RSS 210 limit is 24dBm in the 5.25 to 5.35 GHz band, same as the FCC limit. This limit is based on the emission bandwidth and operating frequency.



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-



Spectrum Analyzer channel power (16.3 dBm @ 5.32 GHz)



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Run #2: Power Spectral Density

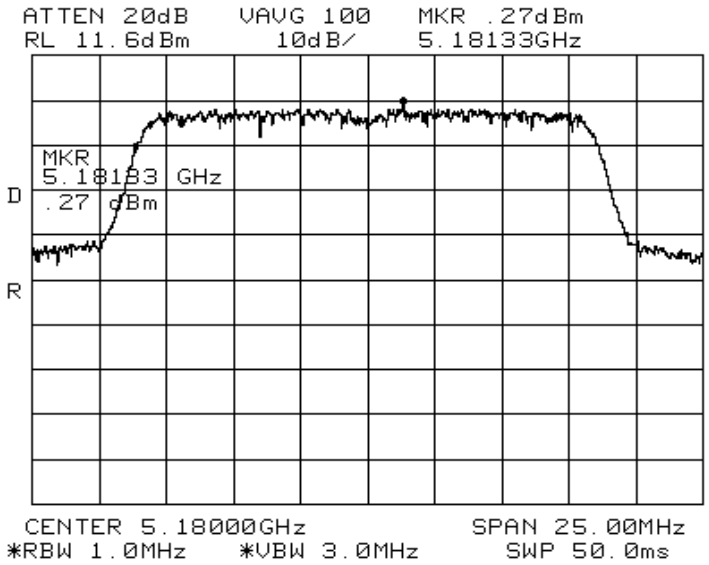
Antenna Gain: 1.5 dBi

Channel	Frequency (MHz)	Power Spectral Density (dBm/MHz)	FCC Limit (dBm) note 2	Graph Reference	
Low	5180	0.27	4.0	T45059/203	Note 1
Mid	5260	4.0	11.0	T45059/204	Note 1
High	5320	2.8	11.0	T45059/207	Note 1

Note 1:	The above measurements were made using RBW = 1MHz, VBW = 1MHz, video averaging on. To demonstrate compliance with RSS 210, the peak PSD was also measured using RBW= VBW=1MHz, video averaging off during the peak excursion measurements (run #4). As per RSS 210 requirements, the peak PSD of **12.85 dBm** in the 5.15 to 5.25 GHz band did not exceed the maximum permitted average PSD of 10dBm by more than 6dB. Similarly, in the 5.25-5.35GHz band, the peak power spectral density of **12.42 dBm** did not exceed the maximum permitted average PSD of 11dBm by more than 6dB. No restriction is placed on the output power or average PSD with respect to RSS 210.
Note 2:	RSS 210 limit is 10dBm/MHz in the 5.15 to 5.25 GHz band, 6dB higher than the FCC limit.

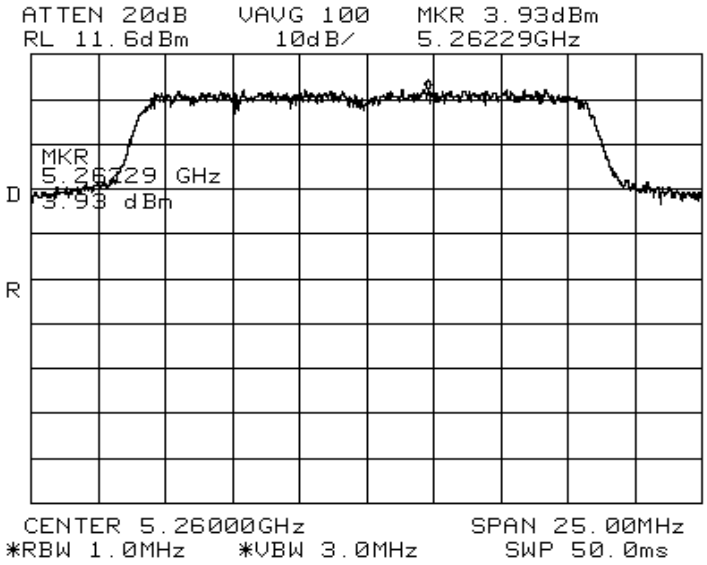
Plots Showing Power Spectral Density (RBW = 1MHz, VBW = 1 MHz, video averaging ON)

T45059 / 203 @ 13.8 dBm

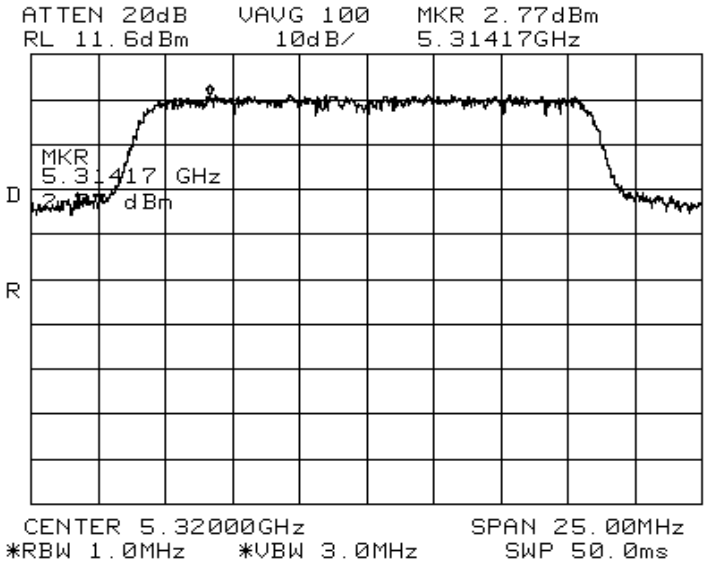


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45059 / 204 @ 17.6 dBm



T45059 / 207 @ 16.3 dBm



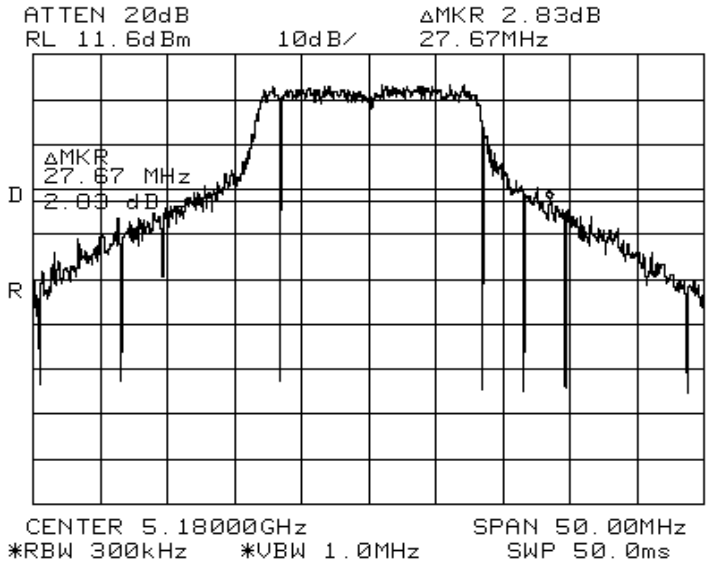
Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Run #3: Signal Bandwidth

Channel	Frequency (MHz)	Resolution Bandwidth	26 dB Signal Bandwidth (MHz)	20 dB Signal Bandwidth (MHz)	Graph reference #
Low	5180	300 kHz	27.67	17.33	T45059/303
Mid	5260	300 kHz	38.25	20.83	T45059/304
High	5320	300 kHz	35.5	18.58	T45059/307

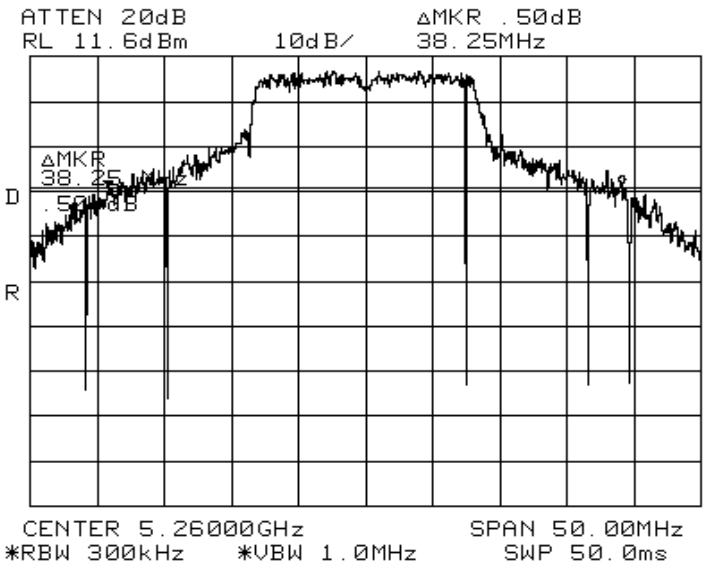
Plots Showing Signal Bandwidth

T45059 / 303 @ 13.8 dBm

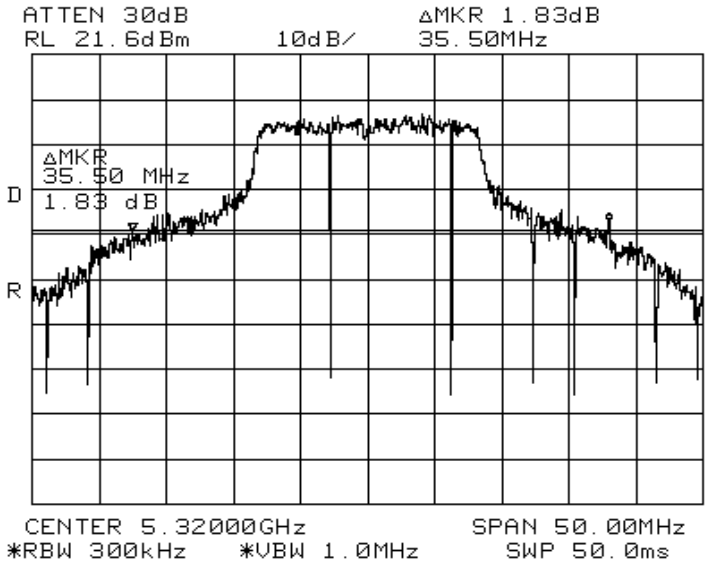


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45059 / 304 @ 17.6 dBm



T45059 / 307 @ 16.3 dBm



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Run #4: Peak Excursion Measurement

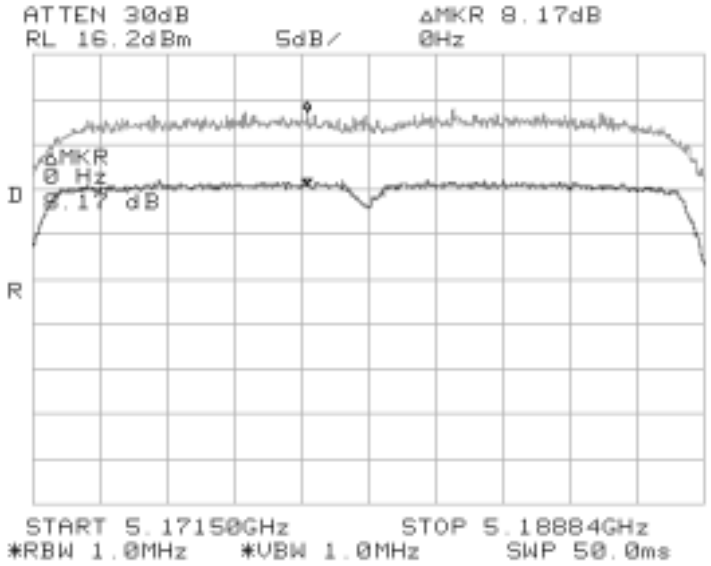
Plots Showing Peak Excursion

Trace A: RBW = VBW = 1MHz

Trace B: RBW = 1 MHz, VBW = 30kHz

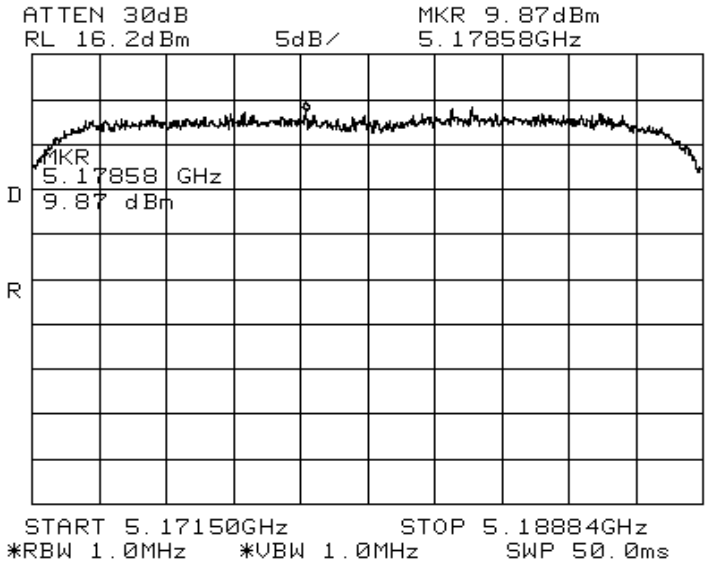
Low Channel Peak Excursion = 8.17 dB. Peak power spectral density (RSS210 only) = 9.87 dBm. Power @ 13.8 dBm

FCC Peak Excursion



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

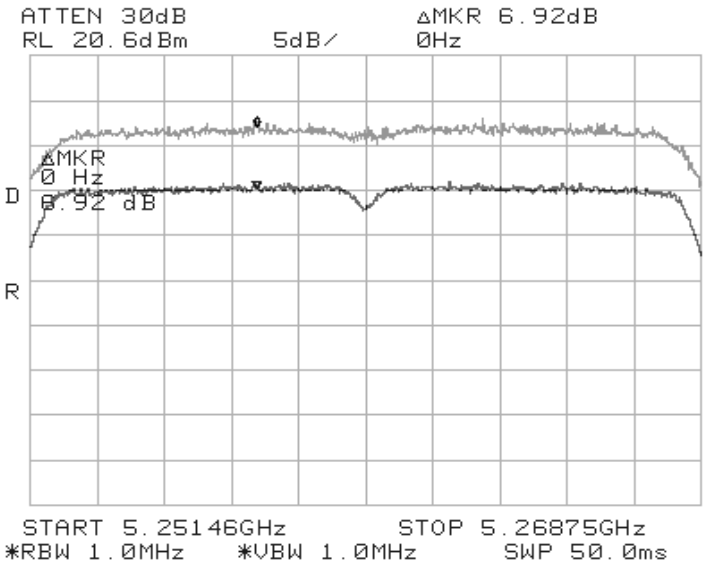
Canada Power Spectral Density



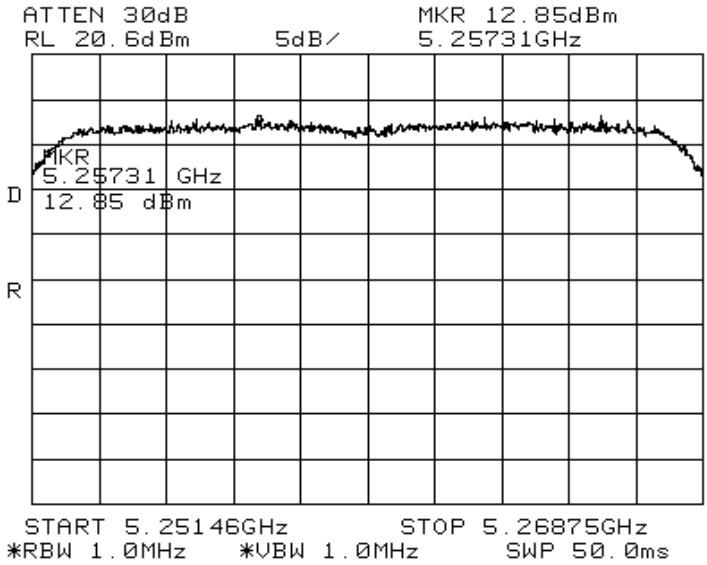
Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Mid Channel Peak Excursion = 6.92 dB. Peak power spectral density (RSS210 only) = 12.85 dBm. Power @ 17.6 dBm

FCC Peak Excursion



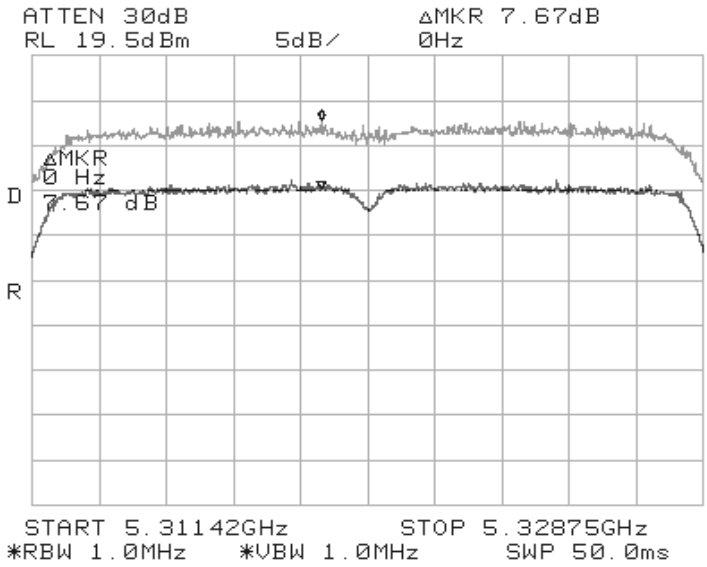
Canada Power Spectral Density



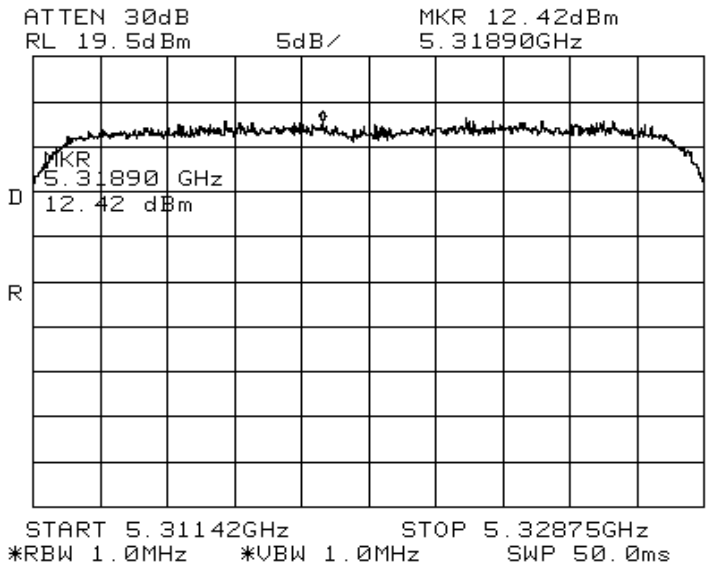
Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

High Channel Peak Excursion = 7.67 dB. Peak power spectral density (RSS210 only) = 12.42 dBm. Power @ 16.3 dBm

FCC Peak Excursion



Canada Power Spectral Density



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Run #5: Out Of Band Spurious Emissions - Antenna Conducted

The antenna gain of the radios integral antenna is 1.5 dBi. The EIRP limit is -27dBm/MHz for all out of band signals that do not fall in restricted bands. A limit of -28.5 dBm was, therefore, used for signals not in restricted bands and close to the intentional band with the assumption that the antenna gain was equal to 1.5 within 100 MHz of the upper and lower band edges. For signals removed from the band edge by more than 100MHz, radiated measurements were made (refer to run #6) if the signal amplitude exceeded -37dBm.

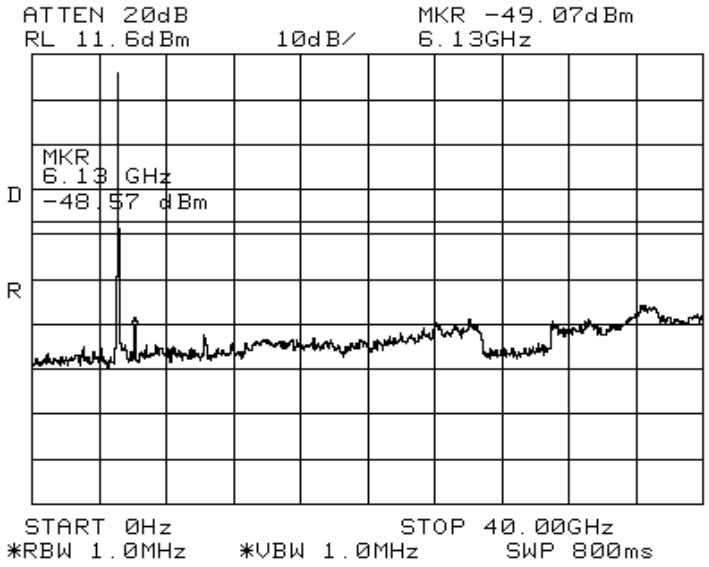
Channel	Frequency (MHz)	Frequency Range	Highest Spurious Signal	Graph reference #
Low	5180	30 - 1000 MHz	Note 4	T45059/801
		1 to 7 GHz	3100 (Note 2), 4144 (Note 1), 6182 (Note 3)	T45059/801 & 802
		7 to 10 GHz	10359 (Note 3)	T45059/801 & 803
		10 GHz to 20 GHz	15539 (Note 1)	T45059/801 & 804
		20 GHz to 40 GHz	None	T45059/801
Mid	5260	30 - 1000 MHz	Note 4	T45059/806
		1 to 7 GHz	3160 (Note 2), 4208 (Note 1), 6312 (Note 3)	T45059/806 & 807
		7 to 10 GHz	10520 (Note 3)	T45059/806 & 808
		10 GHz to 20 GHz	15790 (Note 1)	T45059/806 & 809
		20 GHz to 40 GHz	21.04GHz (Note 1)	T45059/806 & 810
High	5320	30 - 1000 MHz	Note 4	T45059/811
		1 to 7 GHz	3188 (Note 2), 4256 (Note 1), 6383 (Note 3)	T45059/811 & 812
		7 to 10 GHz	10640 (Note 1)	T45059/811 & 813
		10 GHz to 20 GHz	15960 (Note 1)	T45059/811 & 814
		20 GHz to 40 GHz	None	T45059/811

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.

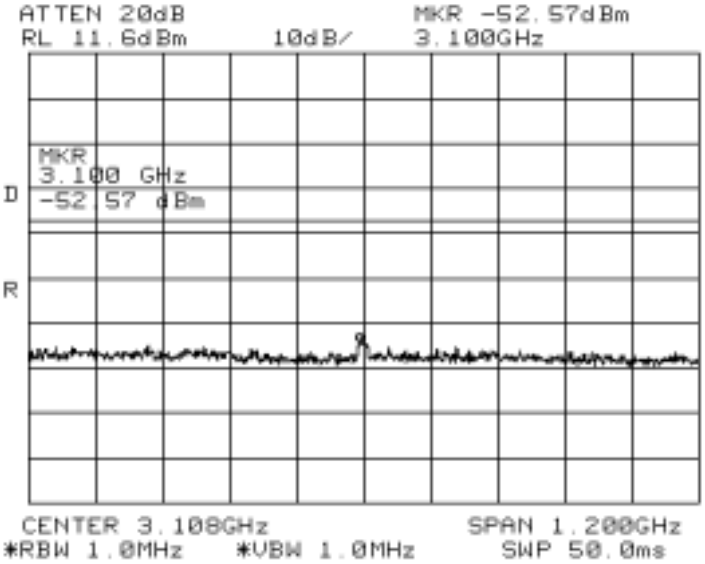
Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

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

T45059/801 0 - 40,000 MHz (13.8 dBm @ 5.18 GHz)

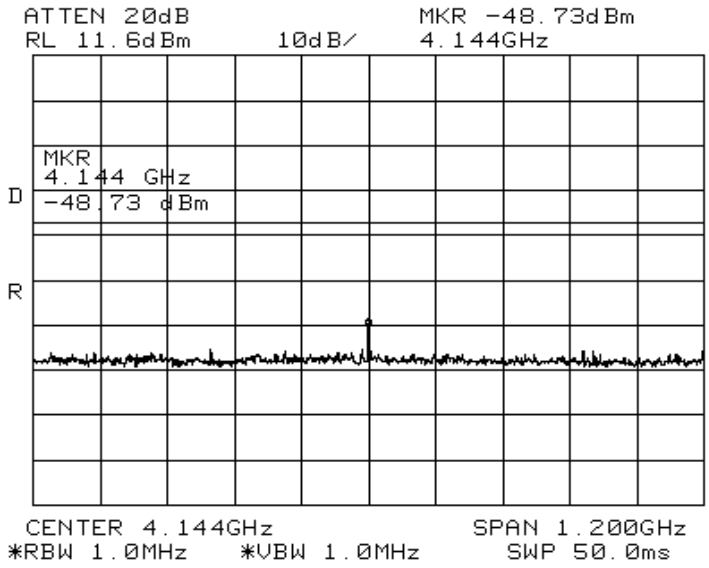


T45059/802 (3 GHz)

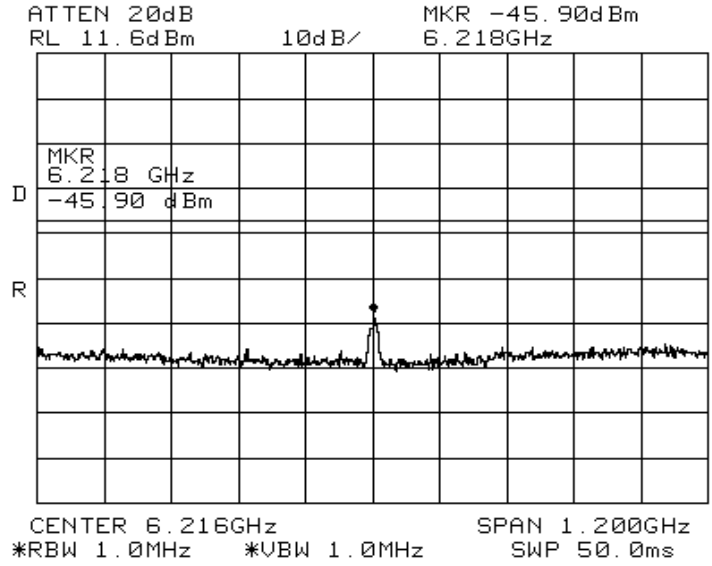


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45059/802 (4 GHz)

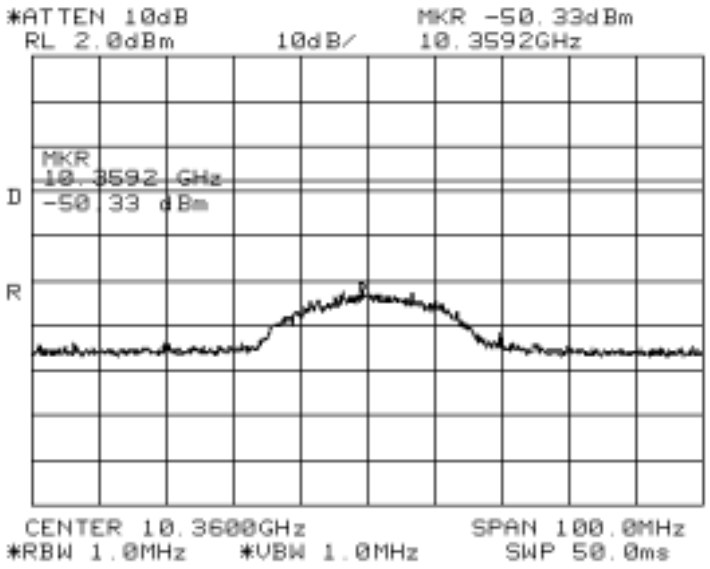


T45059/802 (6 GHz)

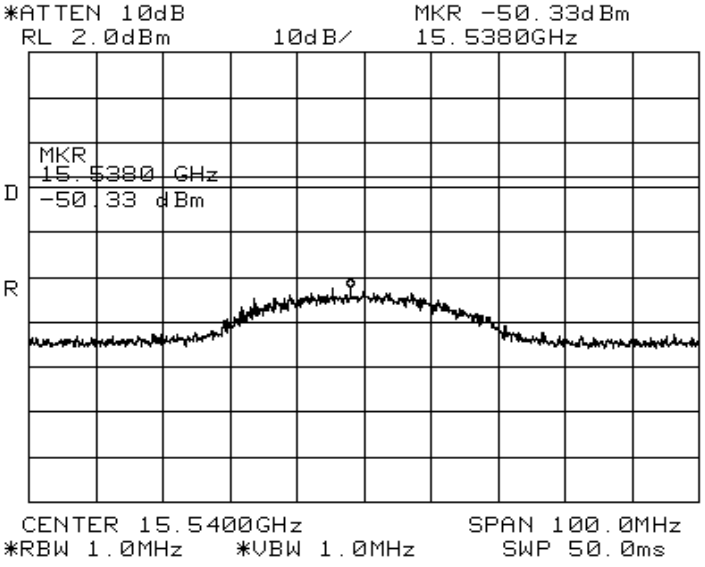


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45059/803

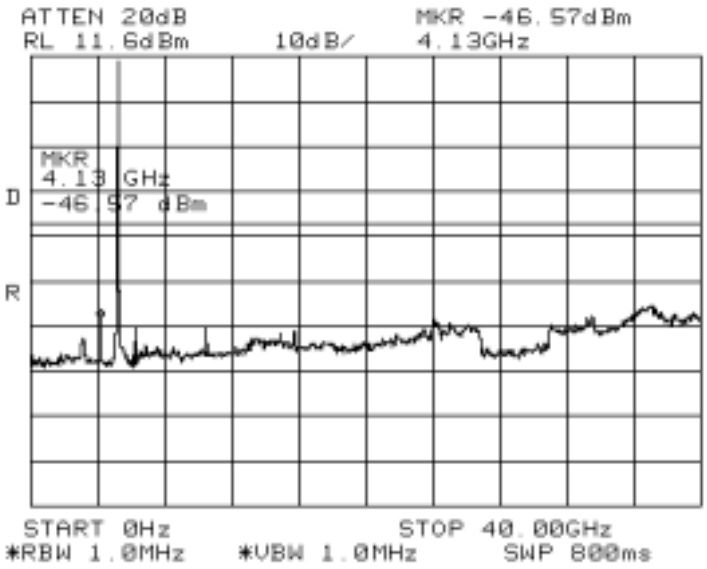


T45059/804

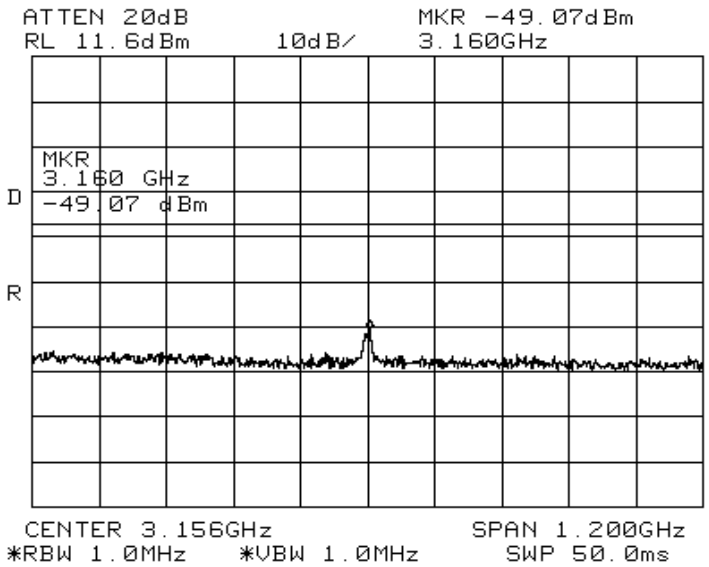


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45059/806 0 - 40,000 MHz (17.6 dBm @ 5.26 GHz)

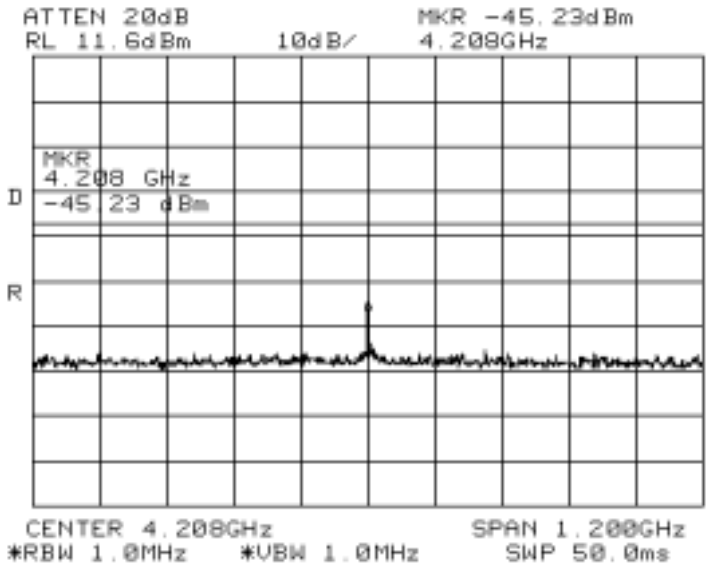


T45059/807 (3 GHz)

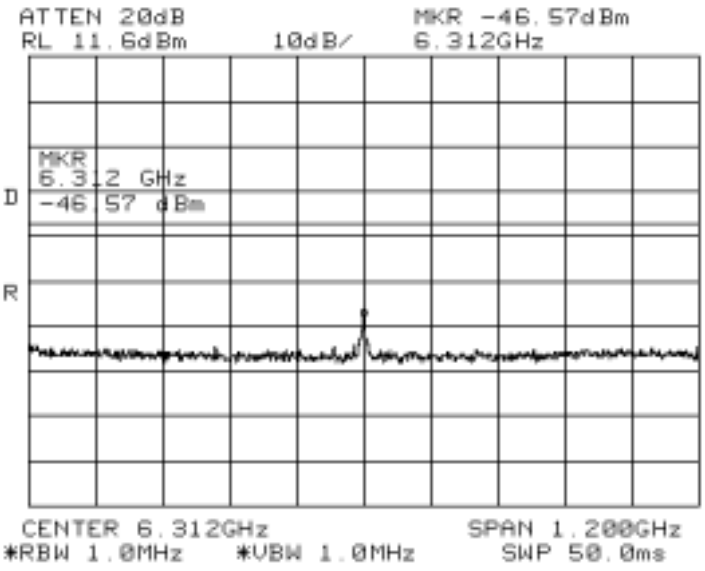


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45059/807 (4 GHz)

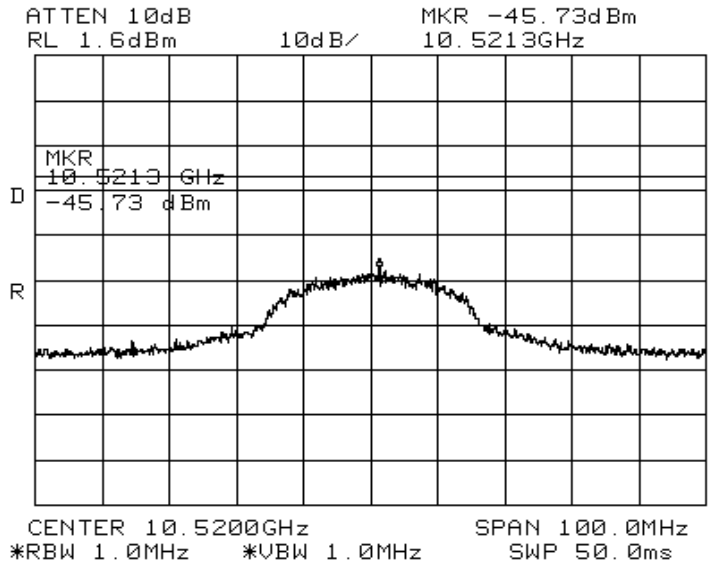


T45059/807 (6 GHz)

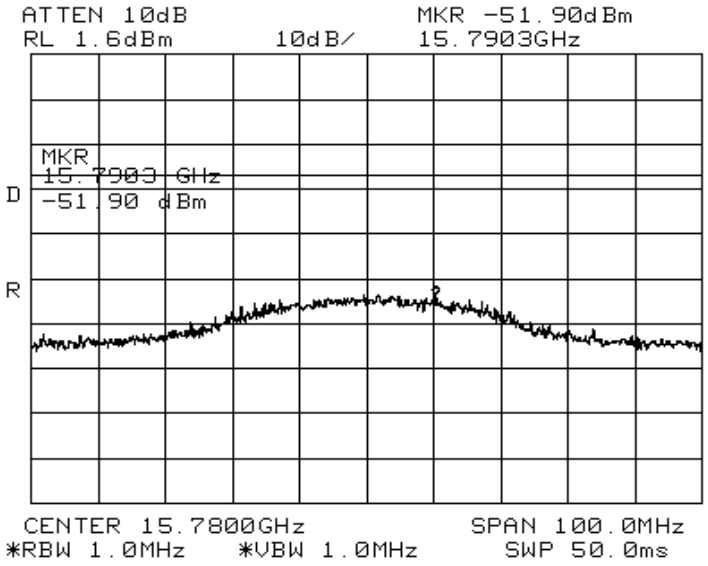


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45059/808

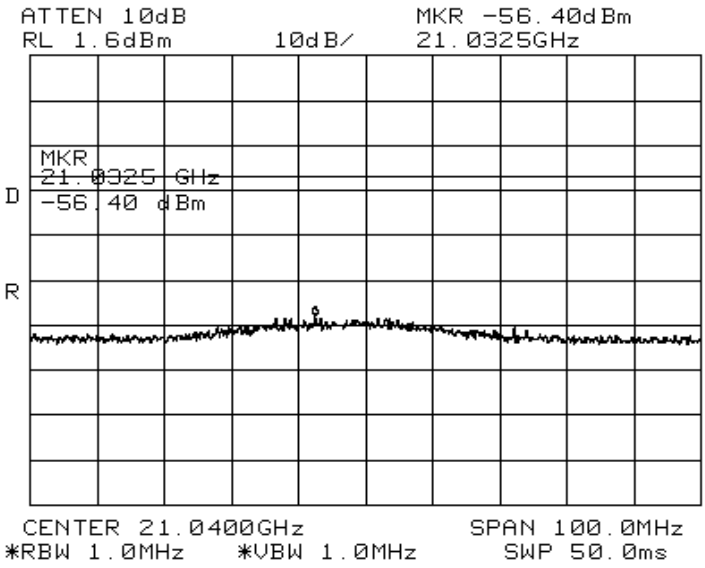


T45059/809



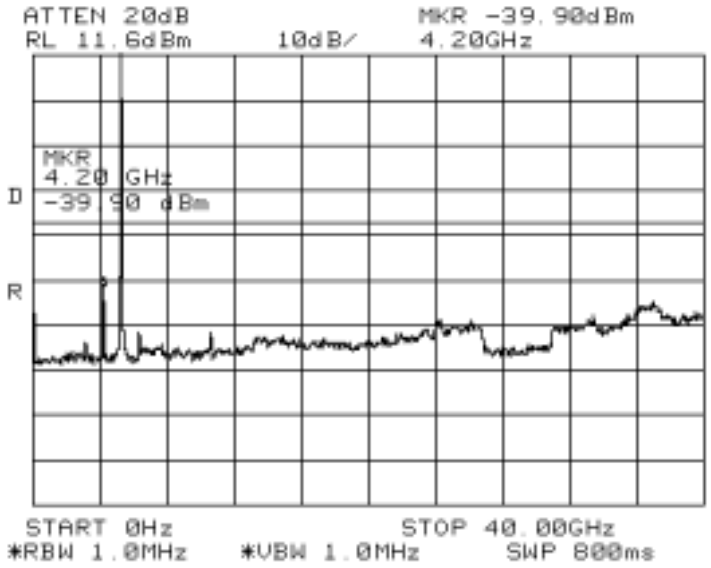
Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45059/810

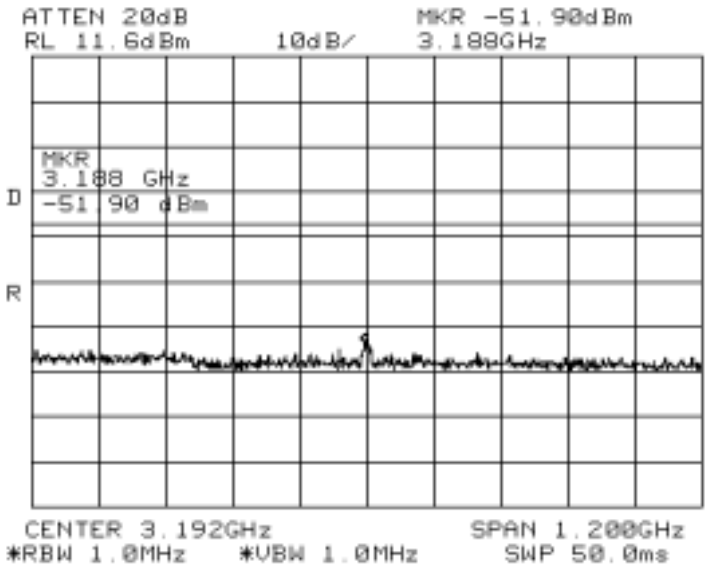


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45059/811 0 - 40,000 MHz (17.2 dBm @ 5.32 GHz)

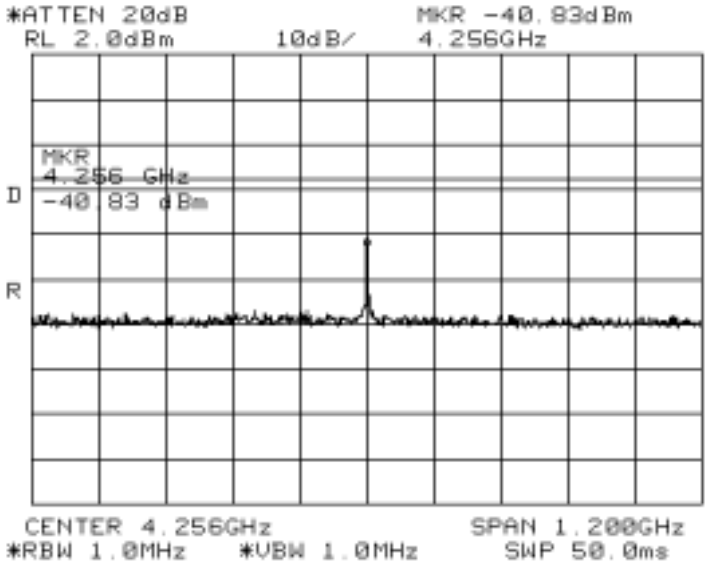


T45059/812 (3 GHz)

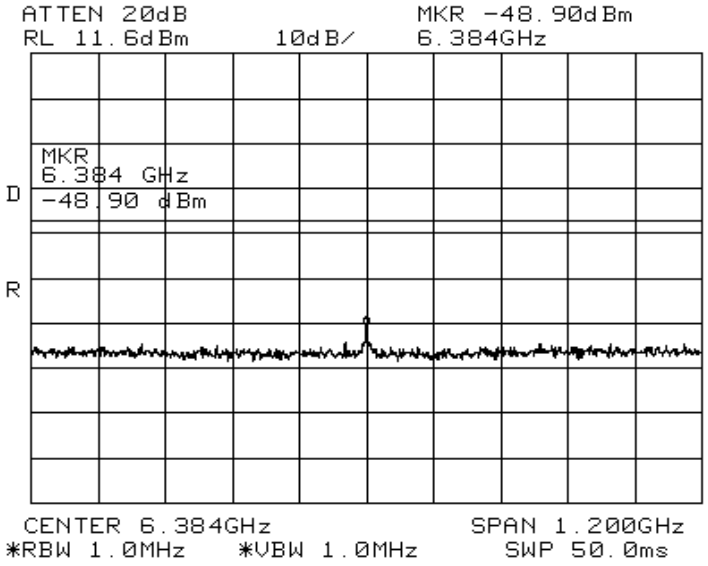


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45059/812 (4 GHz)

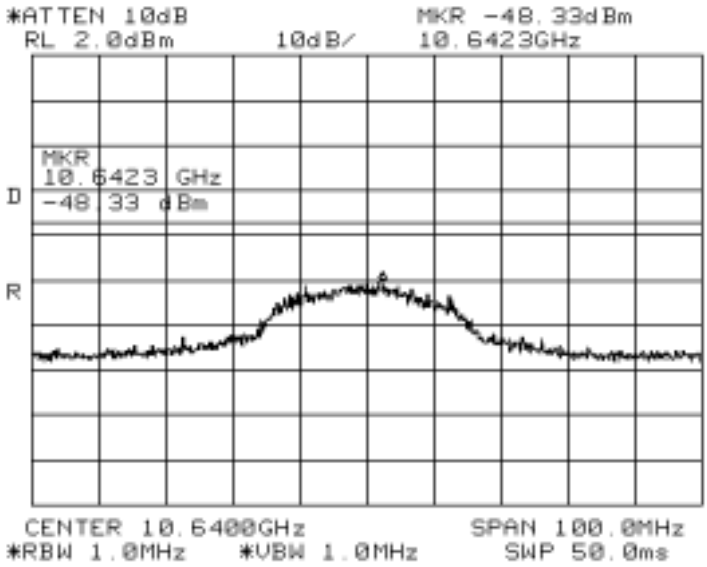


T45059/812 (6 GHz)

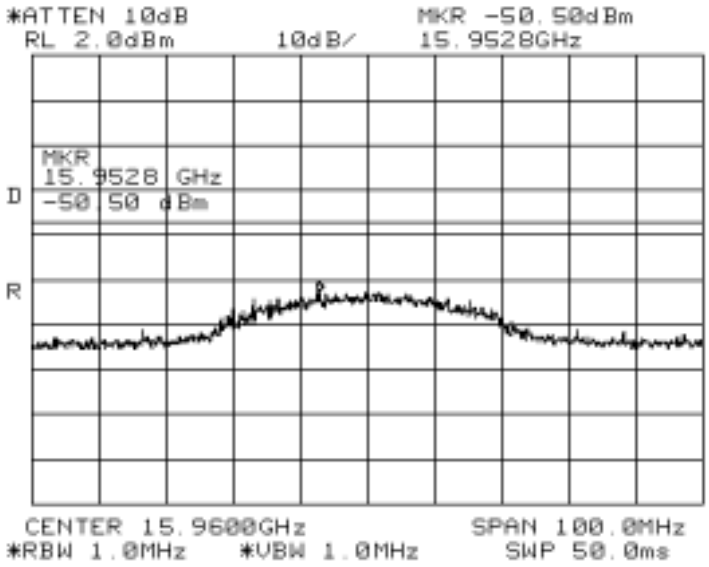


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45029 / 813



T45029 / 814



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Band Edge Measurements:

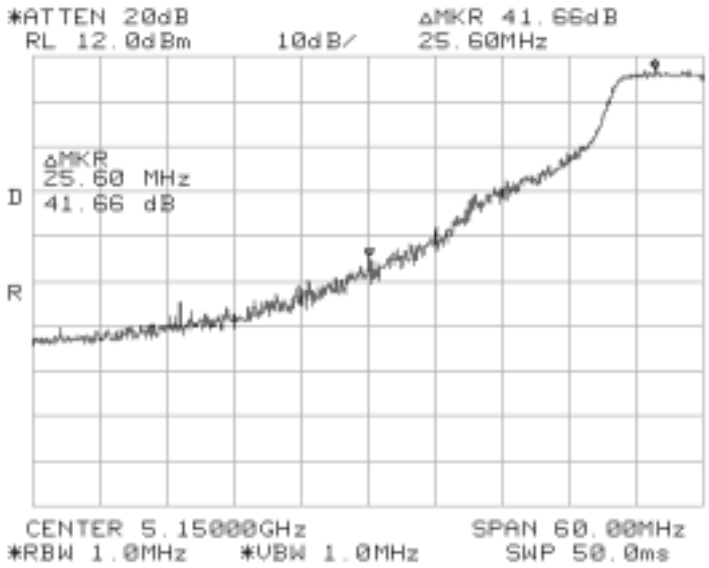
For signals in the restricted bands immediately above and below the 5.15 to 5.35 GHz allocated band a measurement was made of the amplitude of the spurious emissions with respect to the intentional signals. The relative amplitude, in dBc, was then applied to the average and peak field strength of the intentional signal made on the OATS to calculate the field strength of the unintentional signals.

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. Power = 13.8 dBm

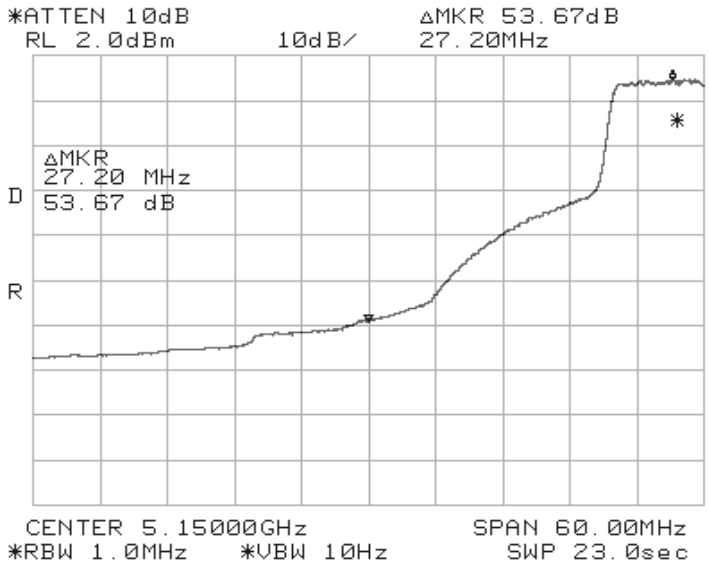
The highest signal within 50 MHz of the 5.15 GHz band was -41.66 dBc (Peak) / -53.67 dBc (Average)

Peak Bandedge



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Average Bandedge

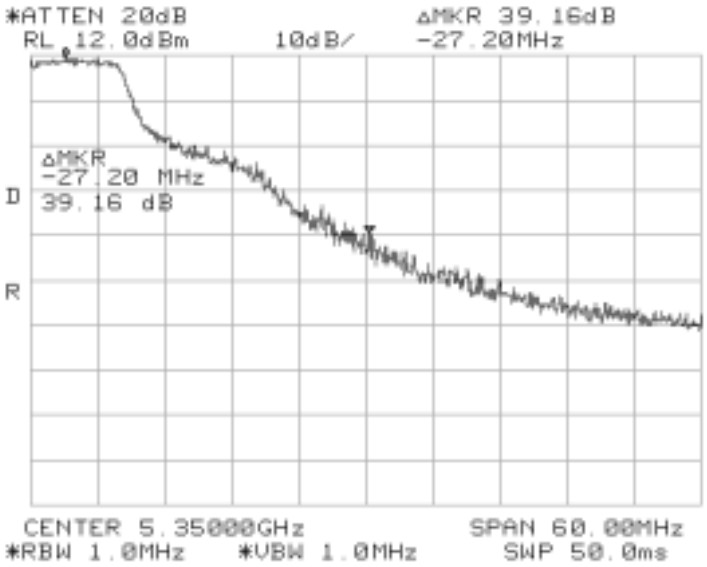


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

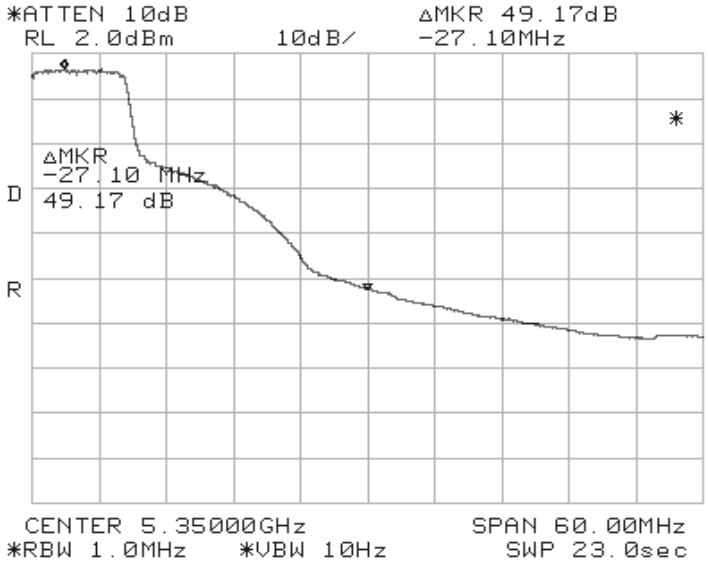
5.35 GHz band edge EUT operating on the highest channel. Power = 16.3 dBm

The highest signal within 50 MHz of the 5.35 GHz band was -39.16 dBc (Peak) / -49.17 dBc (Average)

Peak Bandedge



Average Bandedge



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Run #6a: 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 10-15-2001

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): Power = 13.8 dBm @ 5180 MHz, 16.5 dBm @ 5320 MHz.

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	106.4	v	-	-	Pk	157	1.6	RBW = VBW = 1 MHz
5180.0	96.1	v	-	-	Avg	157	1.6	RBW = 1MHz, VBW = 10Hz
5180.0	98.2	h	-	-	Pk	132	1.6	RBW = VBW = 1 MHz
5180.0	88.6	h	-	-	Avg	132	1.6	RBW = 1MHz, VBW = 10Hz
5320.0	110.1	v	-	-	Pk	293	1.5	RBW = VBW = 1 MHz
5320.0	100.0	v	-	-	Avg	293	1.5	RBW = 1MHz, VBW = 10Hz
5320.0	99.5	h	-	-	Pk	93	1.4	RBW = VBW = 1 MHz
5320.0	89.3	h	-	-	Avg	93	1.4	RBW = 1MHz, VBW = 10Hz

Band Edge Field Strength Calculations Power = 13.8 dBm @ 5180 MHz, 16.5 dBm @ 5320 MHz.

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	64.7	v	74.0	-9.3	Pk			Note 1
5150.0	42.5	v	54.0	-11.5	Avg			Note 1
5150.0	56.5	h	74.0	-17.5	Pk			Note 1
5150.0	34.9	h	54.0	-19.1	Avg			Note 1
5350.0	70.9	v	74.0	-3.1	Pk			Note 2
5350.0	50.8	v	54.0	-3.2	Avg			Note 2
5350.0	60.3	h	74.0	-13.7	Pk			Note 2
5350.0	40.1	h	54.0	-13.9	Avg			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 (-41.7 dBc for peak and -53.7 dBc 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 (-39.2 dBc for peak and -49.2 dBc for average) applied to the highest peak and average field strength measurements of the fundamental signal level.

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Run #6b: Radiated Spurious Emissions, 1000 - 40000 MHz

EUT On Lowest Channel Available (Low Channel, 5.18 GHz) Power @ 13.8 dBm

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
6216.0	45.9	v	68.3	-22.4	Note 5	145	1.3	Note 4 & 6
6216.0	43.7	h	68.3	-24.6	Note 5	0	1.3	Note 4 & 6
4144.0	40.7	v	74.0	-33.3	Pk	100	1.5	Note 2& 6; Noise Floor Measurement
4144.0	30.5	v	54.0	-23.5	Avg	100	1.5	Note 2& 6; Noise Floor Measurement
4144.0	41.2	h	74.0	-32.8	Pk	25	1.2	Note 2& 6; Noise Floor Measurement
4144.0	30.6	h	54.0	-23.4	Avg	25	1.2	Note 2& 6; Noise Floor Measurement
10360.0	53.4	v	68.3	-14.9	Note 5	130	1.7	Note 4
10360.0	52.1	h	68.3	-16.2	Note 5	141	1.7	Note 4
15540.0	61.4	v	74.0	-12.6	Pk	0	1.2	Note 2; Noise Floor Measurement
15540.0	49.0	v	54.0	-5.0	Avg	0	1.2	Note 2; Noise Floor Measurement
15540.0	61.7	h	74.0	-12.3	Pk	0	1.2	Note 2; Noise Floor Measurement
15540.0	49.6	h	54.0	-4.4	Avg	0	1.2	Note 2; Noise Floor Measurement
EUT On Center Channel (Middle Channel, 5.26 GHz) Power @ 17.6 dBm								
6312.0	40.3	v	68.3	-28.0	Note 5	86	1.3	Note 4 & 6
6312.0	44.3	h	68.3	-24.0	Note 5	148	1.3	Note 4 & 6
4208.0	41.0	v	74.0	-33.0	Pk	289	1.5	Note 2 & 6
4208.0	30.2	v	54.0	-23.8	Avg	289	1.5	Note 2 & 6
4208.0	41.4	h	74.0	-32.6	Pk	100	1.2	Note 2 & 6
4208.0	30.5	h	54.0	-23.5	Avg	100	1.2	Note 2 & 6
10520.0	49.0	h	68.3	-19.3	Note 5	160	1.5	Note 4
10520.0	55.4	v	68.3	-12.9	Note 5	122	1.5	Note 4
15780.0	61.8	v	74.0	-12.2	Pk	153	1.1	Note 2; Noise Floor Measurement
15780.0	48.7	v	54.0	-5.3	Avg	153	1.1	Note 2; Noise Floor Measurement
15780.0	61.0	h	74.0	-13.0	Pk	0	1.2	Note 2; Noise Floor Measurement
15780.0	48.7	h	54.0	-5.3	Avg	0	1.2	Note 2; Noise Floor Measurement

Elliott

EMC Test Data

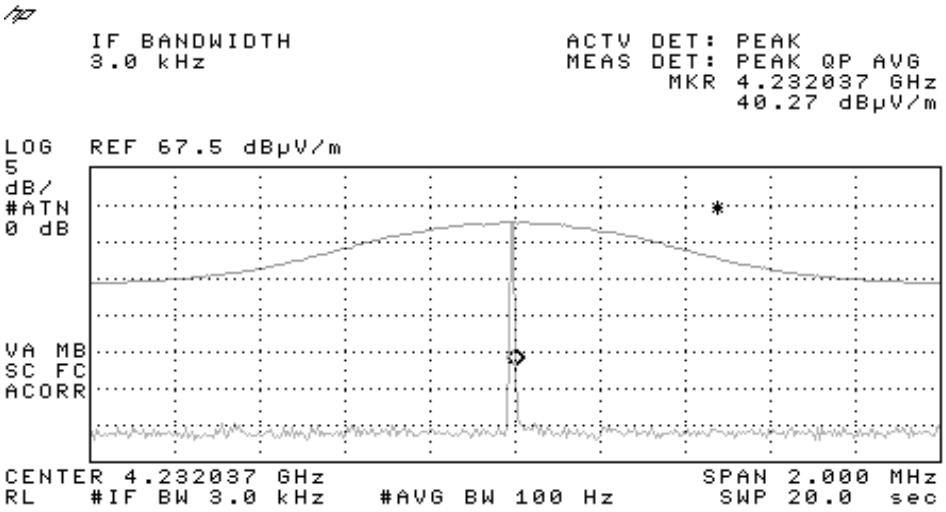
Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

EUT On Highest Channel Available (High Channel, 5.32 GHz) Power @ 16.5 dBm

6383.0	33.7	v	68.3	-34.6	Note 5	0	1.3	Note 4
6383.0	35.0	h	68.3	-33.3	Note 5	180	1.3	Note 4
4256.0	49.1	v	74.0	-24.9	Pk	210	1.3	Note 2 & 6
4256.0	40.1	v	54.0	-13.9	Avg	210	1.3	Note 2 & 6
4256.0	50.9	h	74.0	-23.1	Pk	0	1.3	Note 2& 6; Noise Floor Measurement
4256.0	40.2	h	54.0	-13.8	Avg	0	1.3	Note 2& 6; Noise Floor Measurement
10640.0	63.1	v	74.0	-10.9	Pk	97	1.7	Note 2
10640.0	49.1	v	54.0	-4.9	Avg	97	1.7	Note 2
10640.0	64.1	h	74.0	-9.9	Pk	132	1.5	Note 2
10640.0	49.2	h	54.0	-4.8	Avg	132	1.5	Note 2
15960.0	61.6	v	74.0	-12.4	Pk	0	1.2	Note 2; Noise Floor Measurement
15960.0	48.5	v	54.0	-5.5	Avg	0	1.2	Note 2; Noise Floor Measurement
15960.0	60.5	h	74.0	-13.5	Pk	193	1.0	Note 2; Noise Floor Measurement
15960.0	48.4	h	54.0	-5.6	Avg	193	1.0	Note 2; Noise Floor Measurement

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:	Signal does not fall in a restricted band.
Note 5:	Signals not falling in restricted band, RBW = 1MHz and VBW = 3MHz, video averaging on (100 samples).
Note 6:	This measurement was made using a resolution bandwidth of 3 kHz The instrumentation noise floor was too high to allow measurements with RBW = 1MHz because a preamplifier could not be used (with the EUT operating the intentional signal would overload the amplifier and there is no low pass filter with sufficient shape factor to reject the intentionally transmitted signal but pass the spurious signal). The signal was a narrowband signal (as verified during the conducted antenna measurements) and so the amplitude (peak/average) in a 3kHz bandwidth would be the same as that in a 1MHz bandwidth (please refer to the plot below). The peak reading has been compared with the average limit.

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-



Plot showing LO signal at 4GHz measured using RBW = 1MHz and RBW = 3kHz. Amplitude of the signal does not change with resolution bandwidth.

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

FCC Part 15 Subpart E Tests: Turbo Mode

Test Specifics

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

Date of Test:	10/18/2001	Config. Used:	#2
Test Engineer:	J Martinez	Config Change:	None
Test Location:	SVOATS# 2	Host Unit Voltage	120Vac, 60 Hz

General Test Configuration

The EUT was located on the turntable for radiated spurious emissions testing.
For radiated emissions testing the measurement antenna was located 3 meters from the EUT unless stated otherwise.
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: 15°C
Rel. Humidity: 55%

Summary of Results: Turbo Mode

Run #	Test Performed	Limit	Result	Comments
1	Output Power	15.407(a) (1), (2)	Pass	
2	Power Spectral Density (PSD)	15.407(a) (1), (2)	Pass	
3	26dB Bandwidth	15.407	Pass	> 20 MHz
3	20 dB Bandwidth	RSS 210	Pass	> 20 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	All emissions below the 27dBm/MHz limit
6	RE, 1000 - 40000 MHz - Spurious Emissions	15.407(b)(6)	Pass	-4.7dB @ 15,630 MHz

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Run #1: Output Power;

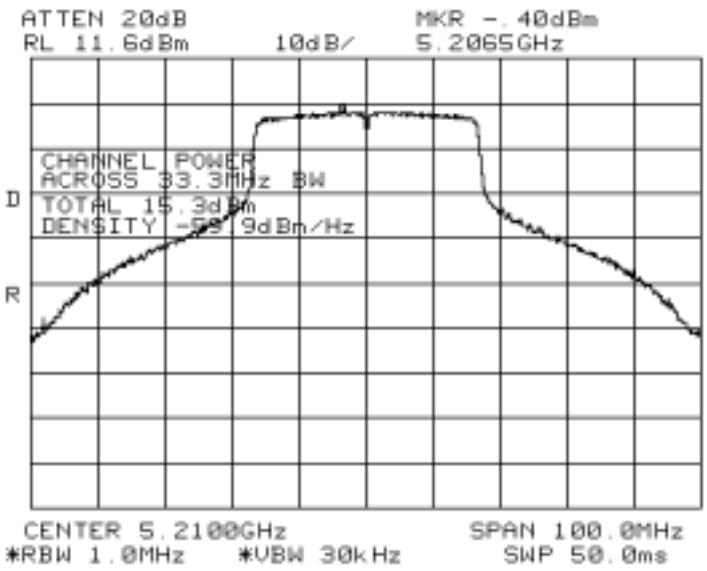
Antenna Gain: 1.5 dBi

Channel	Frequency (MHz)	26-dB Signal BW	Output Power (dBm)	FCC Limit (dBm) (note 3)	Comments
Low	5210		**13.8**	17.0	Note 2
	5210		15.2	17.0	Note 1
Mid	5250		**13.9**	17.0	Note 2
	5250		15.4	17.0	Note 1
High	5290		**17.5**	24.0	Note 2
	5290		19.1	24.0	Note 1

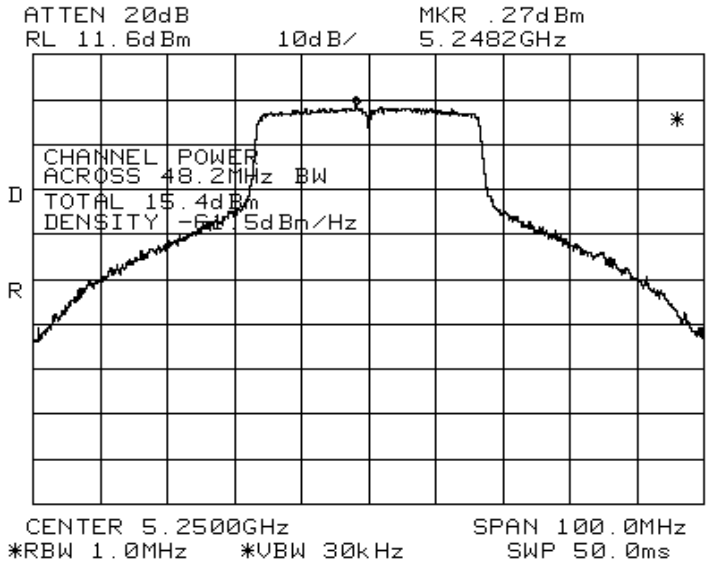
Note 1:	Measured using spectrum analyzer's power measurement function (RBW = 1MHz, VBW = 30kHz)
Note 2:	Measured using a Boonton Power Meter with a peak power sensor in average mode
Note 3:	RSS 210 limit is 23dBm in the 5.15 to 5.25 GHz band, 6dB higher than the FCC limit. This limit is based on the emission bandwidth and operating frequency.
Note 4:	RSS 210 limit is 24dBm in the 5.25 to 5.35 GHz band, same as the FCC limit. This limit is based on the emission bandwidth and operating frequency.

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Spectrum Analyzer channel power @ 5.21 GHz

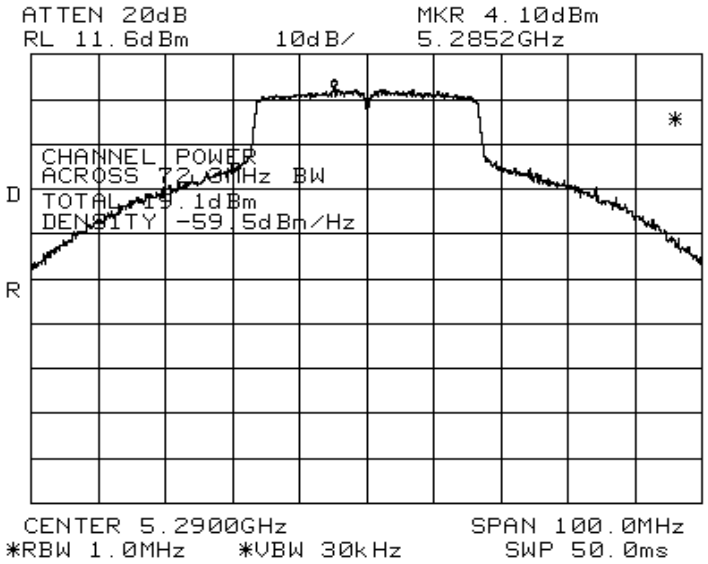


Spectrum Analyzer channel power @ 5.25 GHz



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Spectrum Analyzer channel power 17.5 dBm @ 5.29 GHz



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Run #2: Power Spectral Density

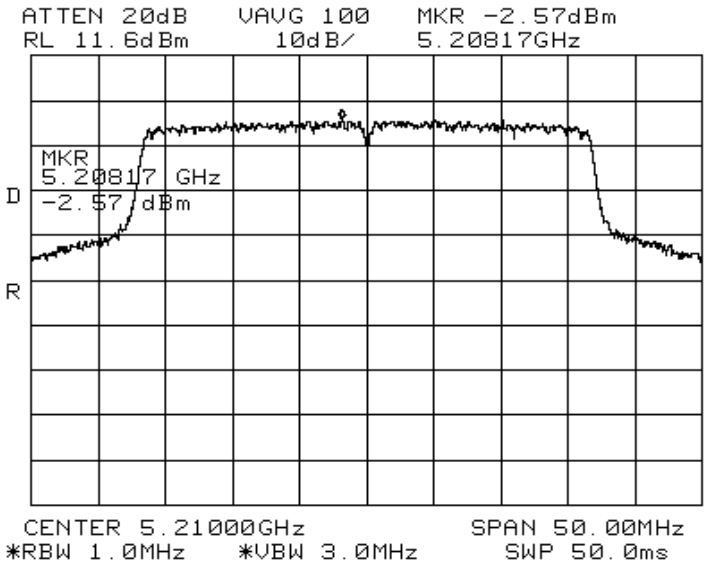
Antenna Gain: 1.5 dBi

Channel	Frequency (MHz)	Power Spectral Density (dBm/MHz)	FCC Limit (dBm) note 2	Graph Reference	
Low	5210	-2.6	4.0	T45059/903	Note 1
Mid	5250	-1.9	4.0	T45059/904	Note 1
High	5290	1.6	11.0	T45059/905	Note 1

Note 1:	The above measurements were made using RBW = 1MHz, VBW = 1MHz, video averaging on. To demonstrate compliance with RSS 210, the peak PSD was also measured using RBW= VBW=1MHz, video averaging off during the peak excursion measurements (run #4). As per RSS 210 requirements, the peak PSD of **6.2 dBm** in the 5.15 to 5.25 GHz band did not exceed the maximum permitted average PSD of 10dBm by more than 6dB. Similarly, in the 5.25-5.35GHz band, the peak power spectral density of **10.25 dBm** did not exceed the maximum permitted average PSD of 11dBm by more than 6dB. No restriction is placed on the output power or average PSD with respect to RSS 210.
Note 2:	RSS 210 limit is 10dBm/MHz in the 5.15 to 5.25 GHz band, 6dB higher than the FCC limit.

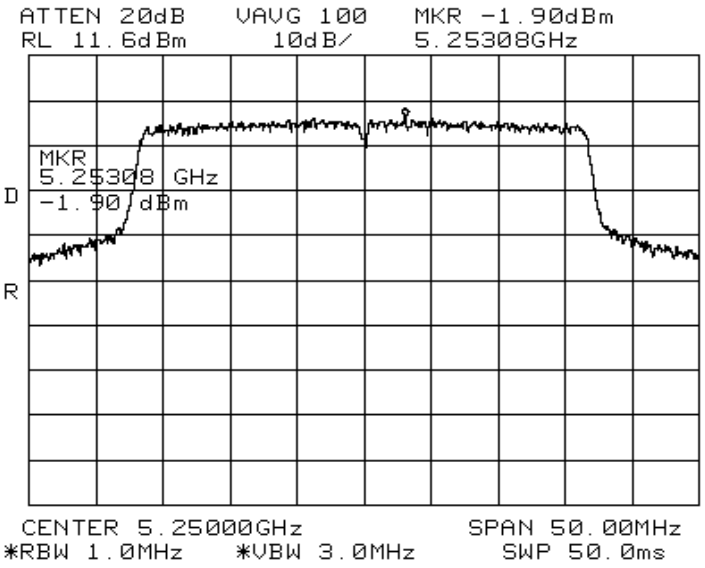
Plots Showing Power Spectral Density (RBW = 1MHz, VBW = 1 MHz, video averaging ON)

T45059 / 903 @ 13.8 dBm

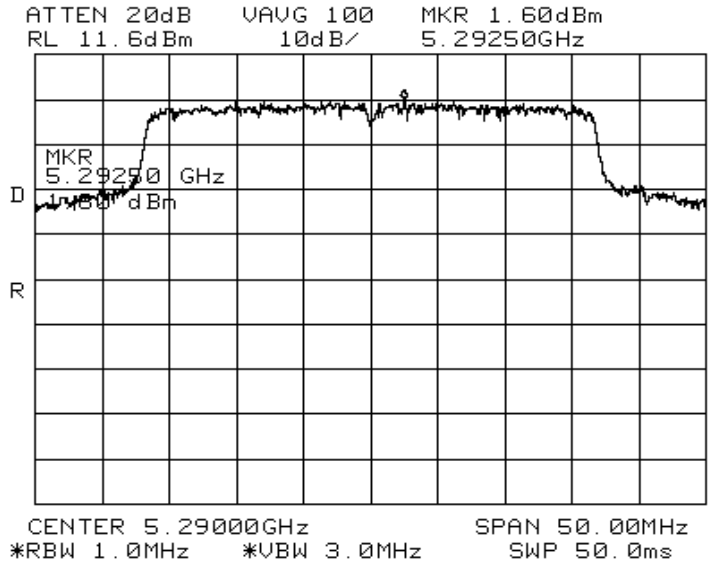


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45059 / 904 @ 13.9 dBm



T45059 / 905 @ 17.5 dBm



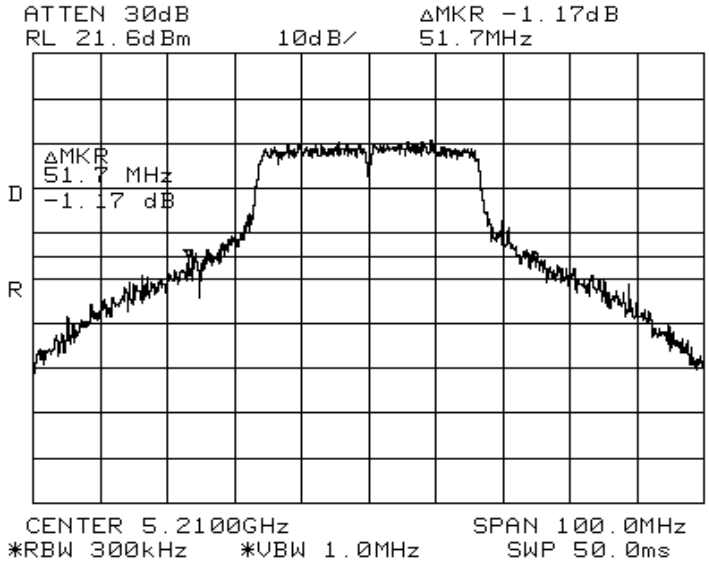
Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Run #3: Signal Bandwidth

Channel	Frequency (MHz)	Resolution Bandwidth	26 dB Signal Bandwidth (MHz)	20 dB Signal Bandwidth (MHz)	Graph reference #
Low	5210	300 kHz	51.7	36.7	T45029/1001
Mid	5250	300 kHz	45.2	35.0	T45029/1002
High	5290	300 kHz	72.3	45.5	T45029/1003

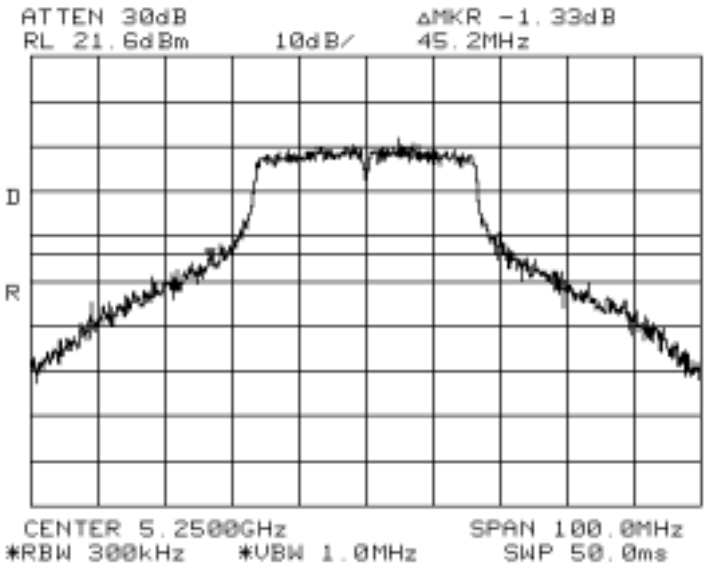
Plots Showing Signal Bandwidth

T45059 / 1001 @ 13.8 dBm

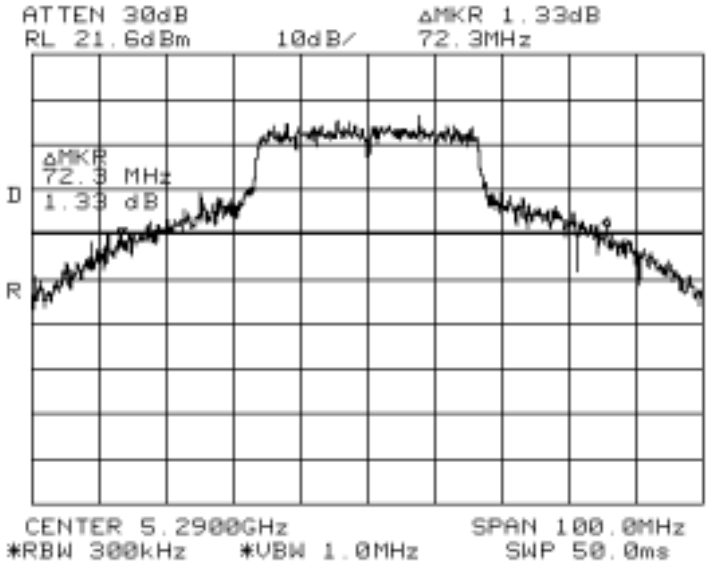


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45059 / 1002 @ 13.9 dBm



T45059 / 1003 @ 17.5 dBm



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Run #4: Peak Excursion Measurement

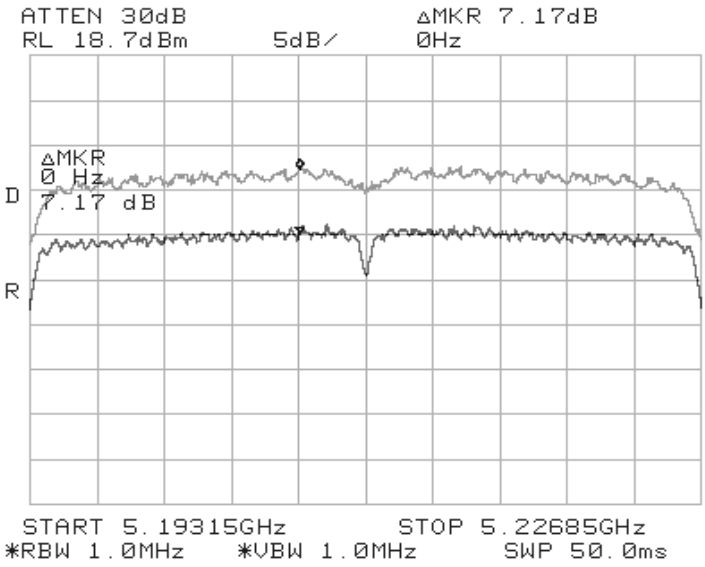
Plots Showing Peak Excursion

Trace A: RBW = VBW = 1MHz

Trace B: RBW = 1 MHz, VBW = 30kHz

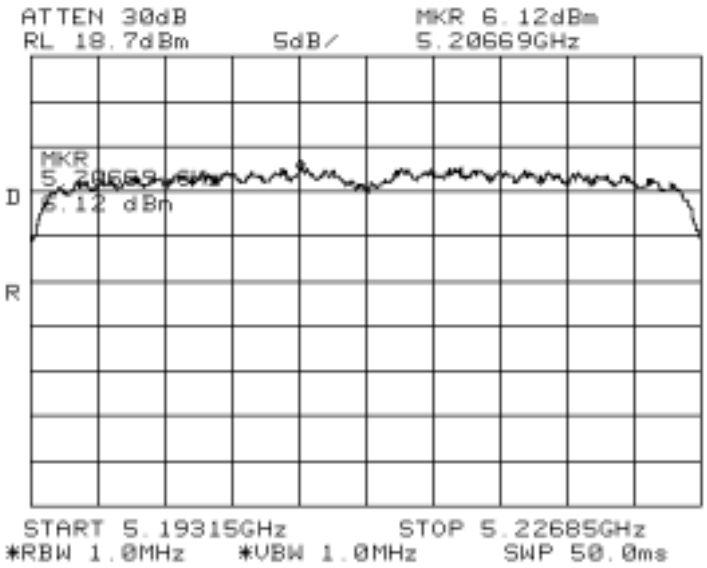
Low Channel Peak Excursion = 7.17 dB. Peak power spectral density (RSS210 only) = 6.12 dBm. Power @ 13.8 dBm

FCC Peak Excursion



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

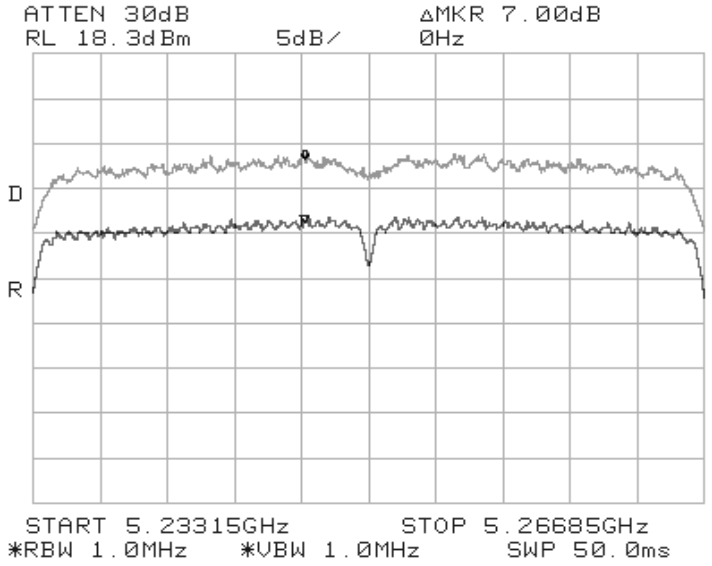
Canada Power Spectral Density



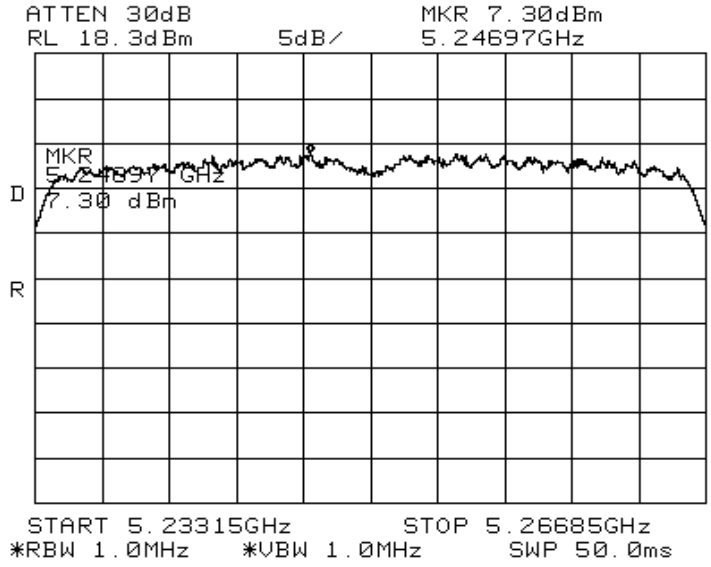
Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Mid Channel Peak Excursion = 7.0 dB. Peak power spectral density (RSS210 only) =7.3 dBm. Power @ 13.9 dBm

FCC Peak Excursion



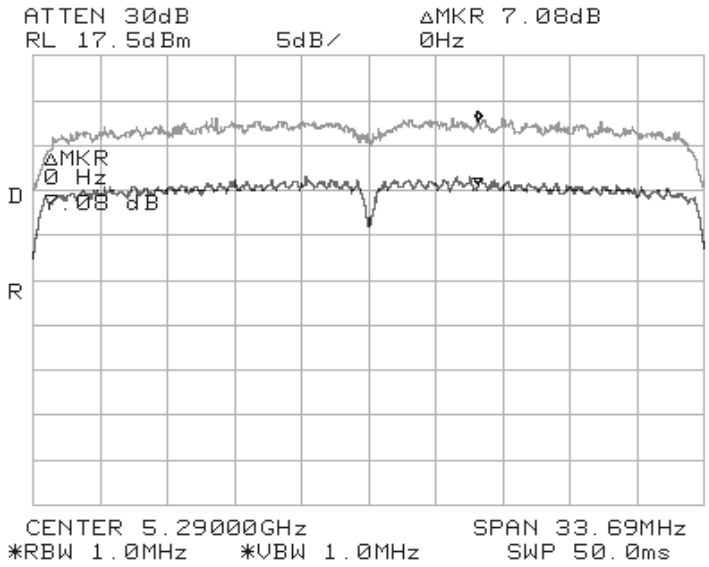
Canada Power Spectral Density



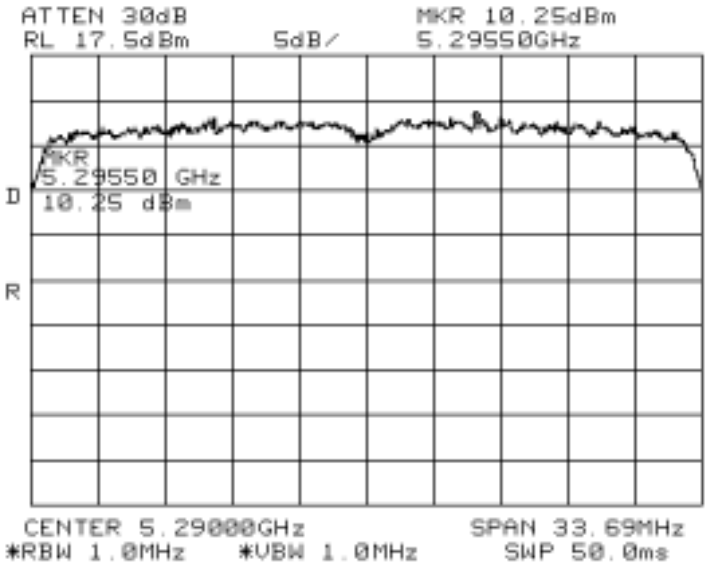
Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

High Channel Peak Excursion = 7.08 dB. Peak power spectral density (RSS210 only) = 10.25 dBm. Power @ 17.5 dBm

FCC Peak Excursion



Canada Power Spectral Density



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Run #5: Out Of Band Spurious Emissions - Antenna Conducted

The antenna gain of the radios integral antenna is 1.5 dBi. The EIRP limit is -27dBm/MHz for all out of band signals that do not fall in restricted bands. A limit of -28.5 dBm was, therefore, used for signals not in restricted bands and close to the intentional band with the assumption that the antenna gain was equal to 1.5 within 100 MHz of the upper and lower band edges. For signals removed from the band edge by more than 100MHz, radiated measurements were made (refer to run #6) if the signal amplitude exceeded -37dBm.

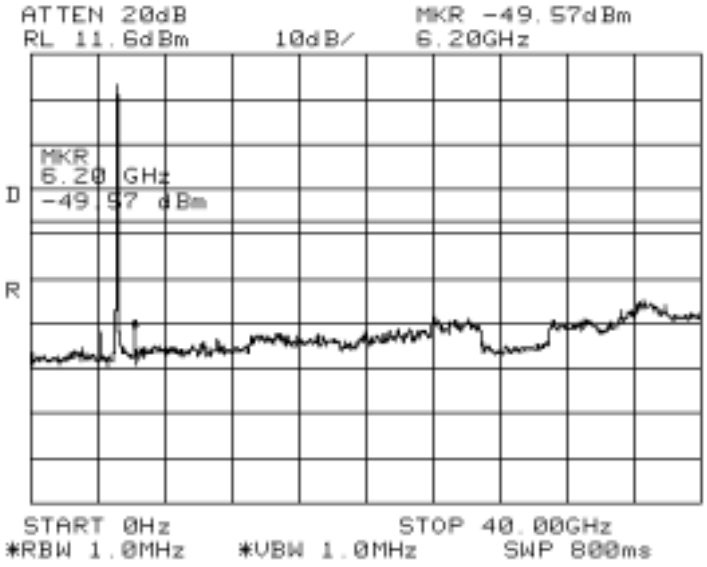
Channel	Frequency (MHz)	Frequency Range	Highest Spurious Signal	Graph reference #
Low	5210	30 - 1000 MHz	Note 4	T45029/1011
		1 to 5.15 GHz	3126 (Note 2), 4168 (Note 1)	T45029/1011 & 1012
		5.25 to 10 GHz	6254 (Note 3)	T45029/1011 & 1013
		10 GHz to 20 GHz	10410(Note 3), 15630 (Note 1)	T45029/1011 & 1014
		20 GHz to 40 GHz	None	T45029/1011
Mid	5250	30 - 1000 MHz	Note 4	T45029/1016
		1 to 7 GHz	3140 (Note 2), 4200 (Note 1), 6300 (Note 3)	T45029/1016 & 1017
		7 to 10 GHz	10420 (Note 3)	T45029/1016 & 1018
		10 GHz to 20 GHz	15750 (Note 1)	T45029/1016 & 1019
		20 GHz to 40 GHz	None	T45029/1016
High	5290	30 - 1000 MHz	Note 4	T45029/1021
		1 to 7 GHz	2110(Note 2), 3160 (Note 2),4232 (Note 1), 6348.2 (Note 3)	T45029/1021 & 1022
		7 to 10 GHz	7406 (Note1), 10583 (Note 3)	T45029/1021 & 1023
		10 GHz to 20 GHz	15854 (Note 1)	T45029/1021 & 1024
		20 GHz to 40 GHz	None	T45029/1021

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.

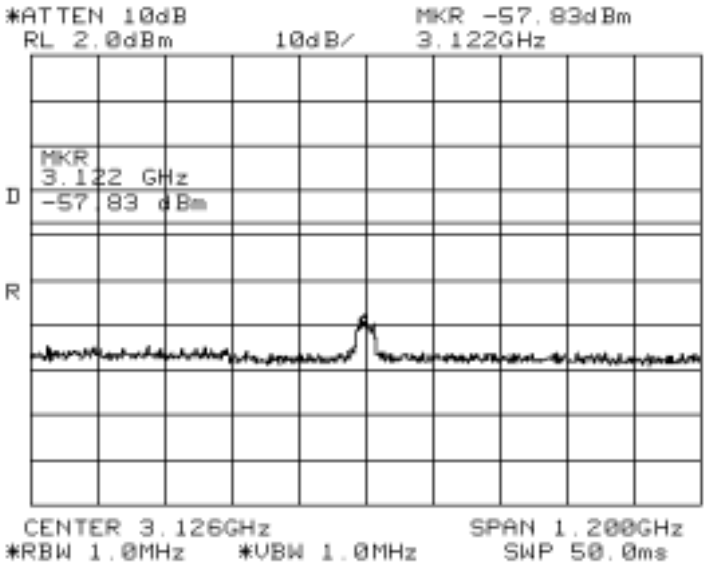
Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

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

T45059 / 1011 0 - 40,000 MHz (13.8 dBm @ 5.21 GHz)

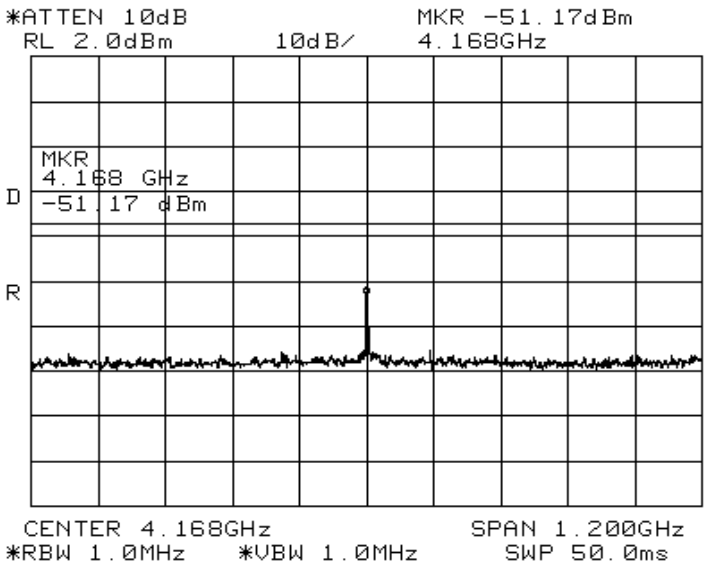


T45059/1012 (3GHz)

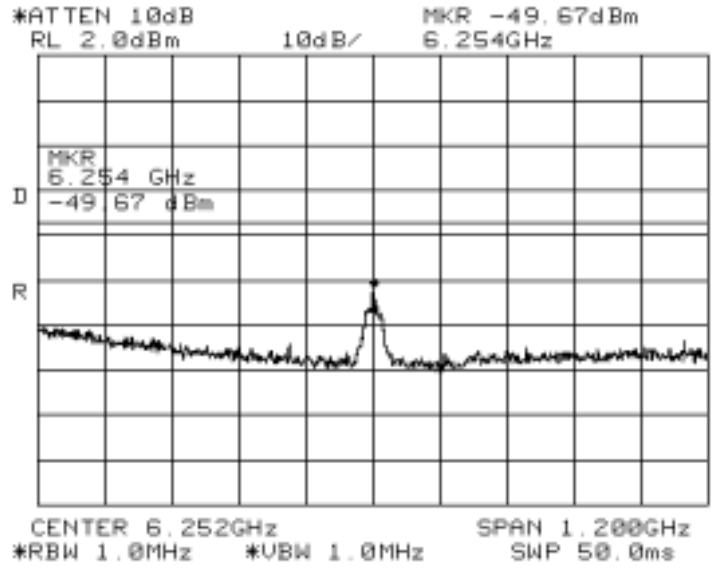


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45059/1012 (4GHz)

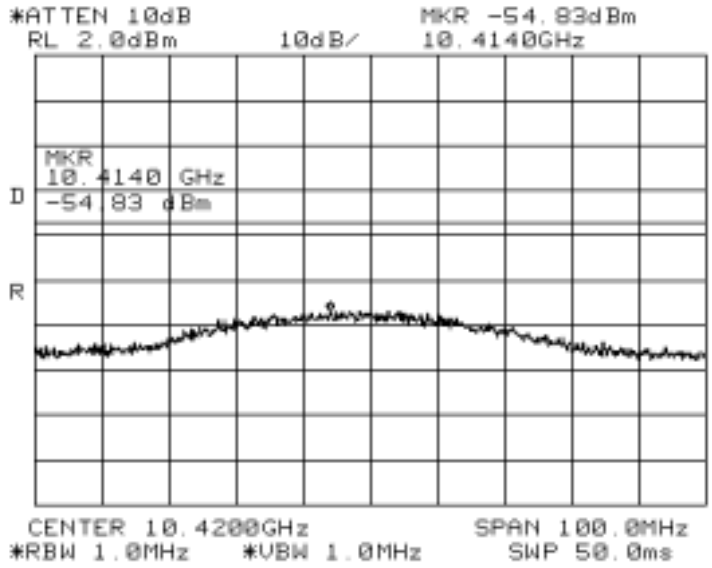


T45059/1013

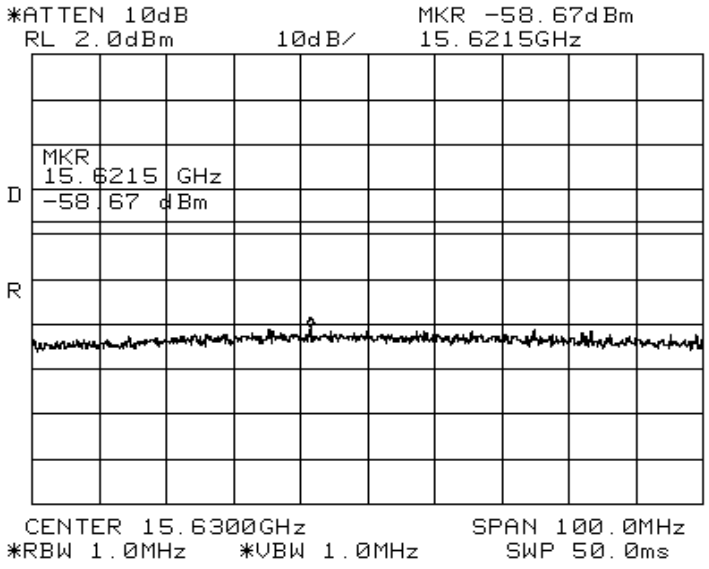


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45059/1014 (10 GHz)

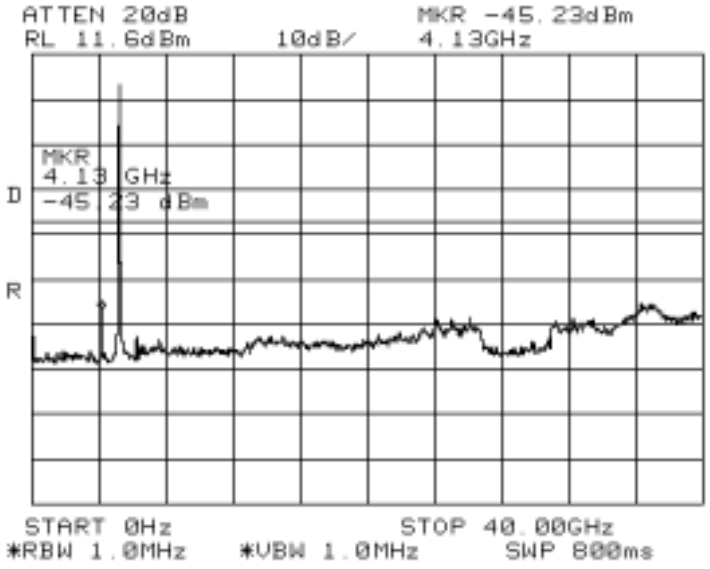


T45059/1014 (15 GHz)

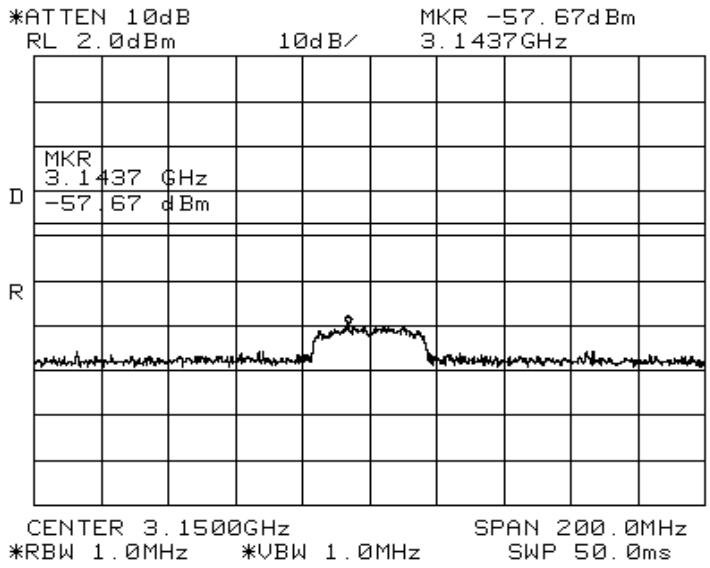


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45029/1016 0 - 40,000 MHz (13.9 dBm @ 5.25 GHz)

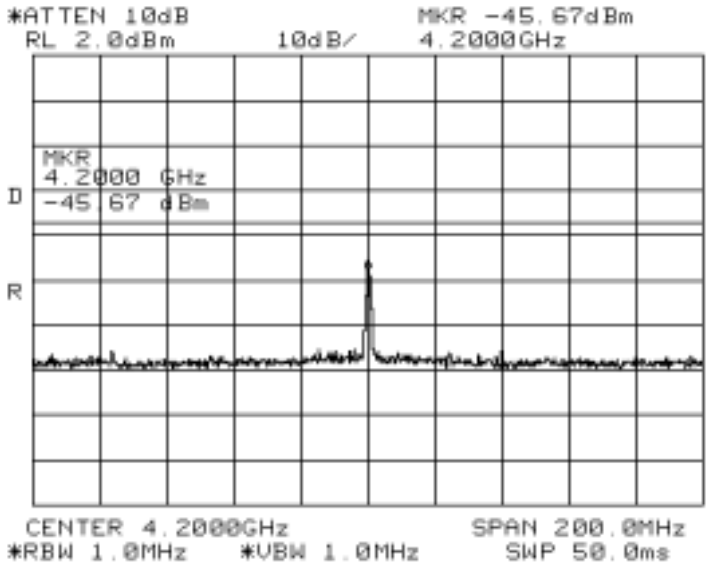


T45029 / 1017 (3 GHz)

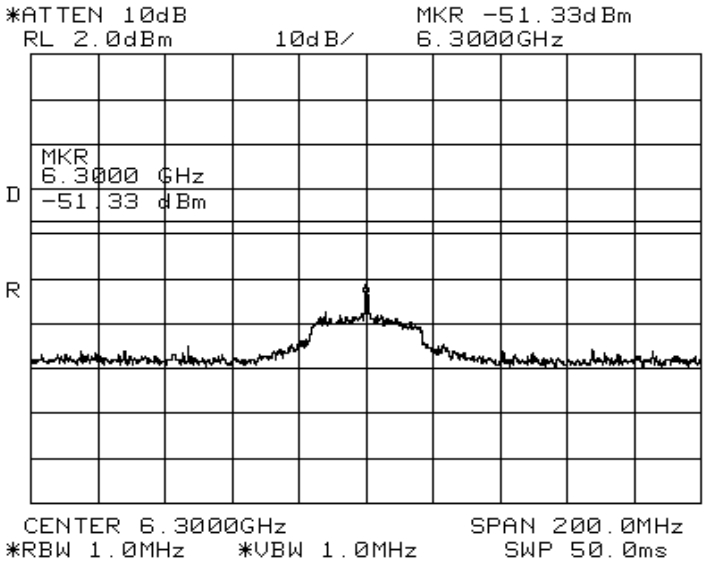


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45029 / 1017 (4 GHz)

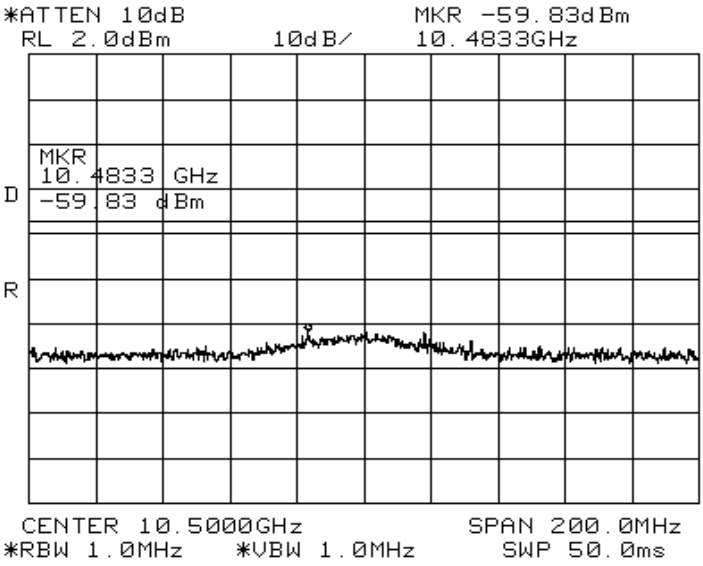


T45029 / 1017 (6 GHz)

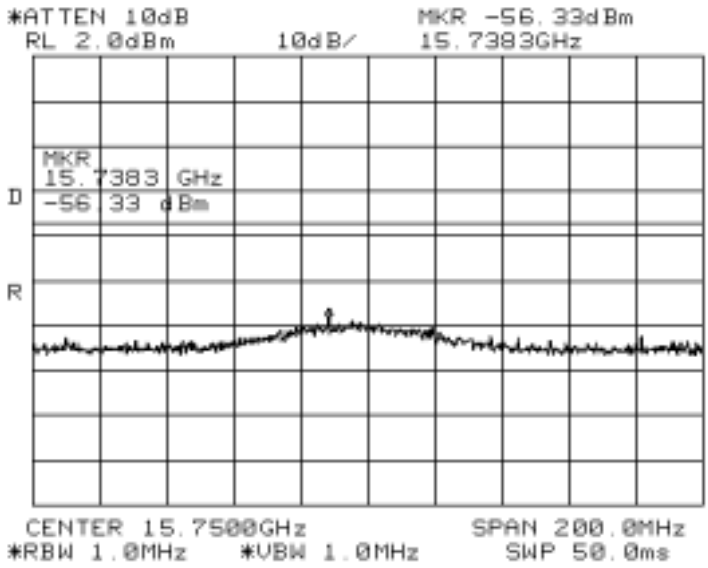


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45029 / 1018

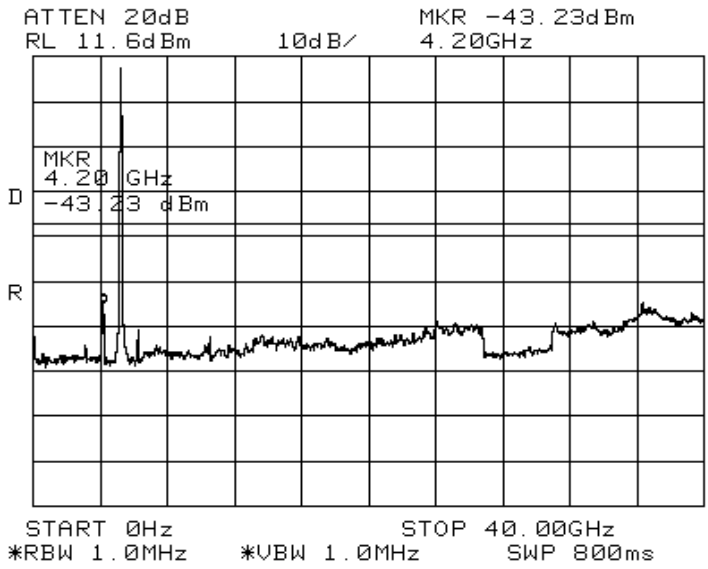


T45029 / 1019

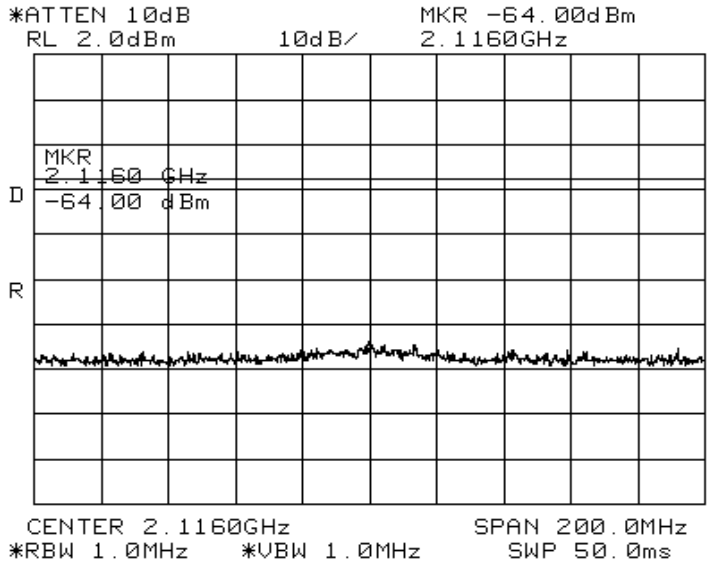


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45029/1021 0 - 40,000 MHz (17.5 dBm @ 5.29 GHz)

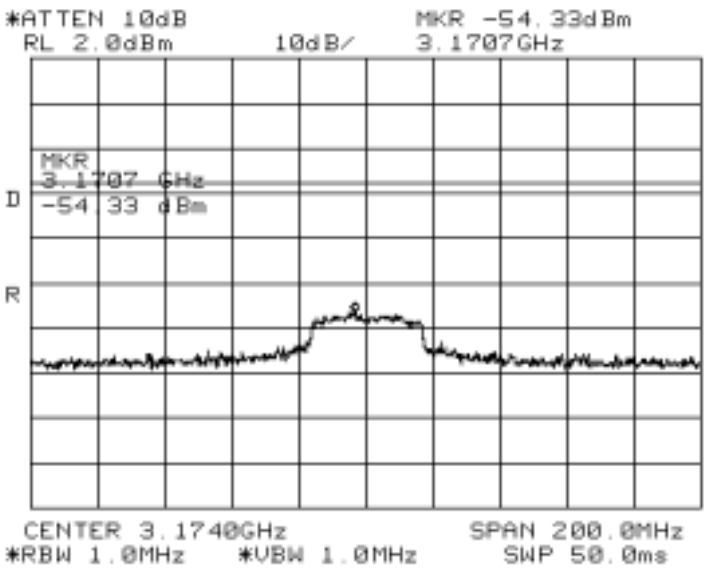


T45029 / 1022 (2 GHz)

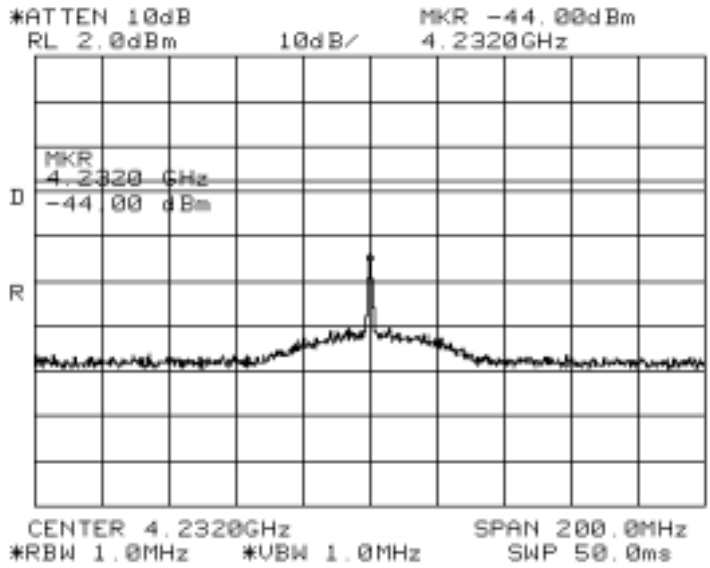


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45029 / 1022 (3 GHz)

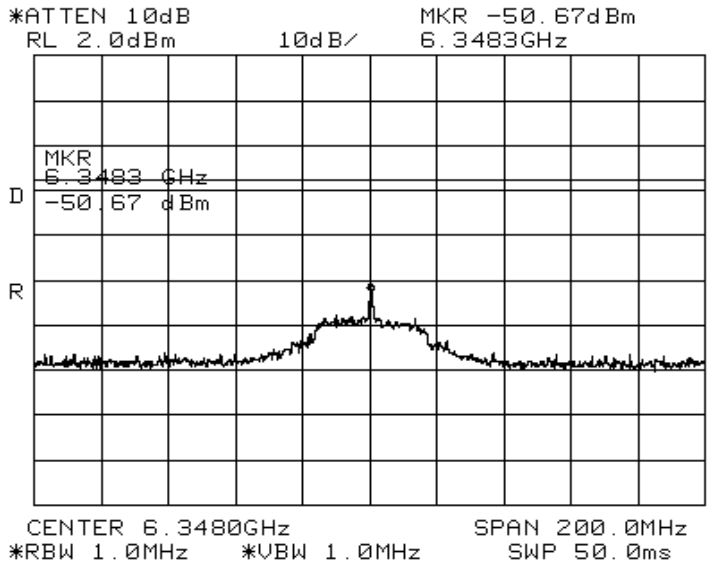


T45029 / 1022 (4 GHz)

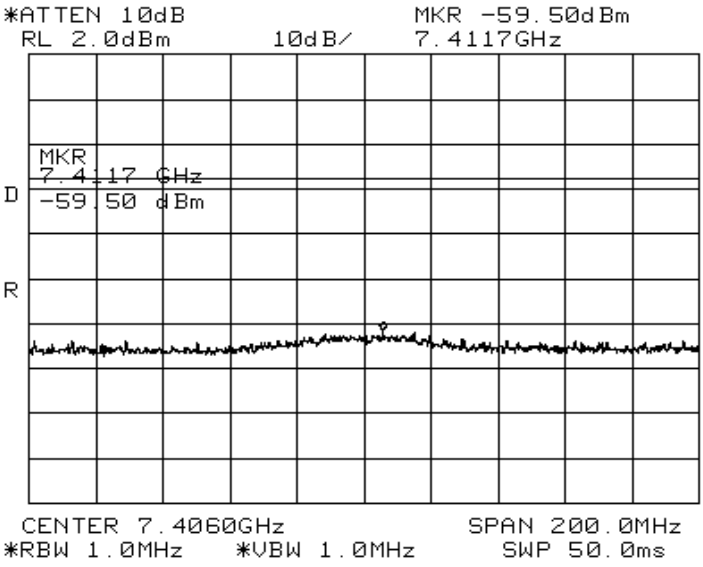


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45029 / 1022 (6 GHz)

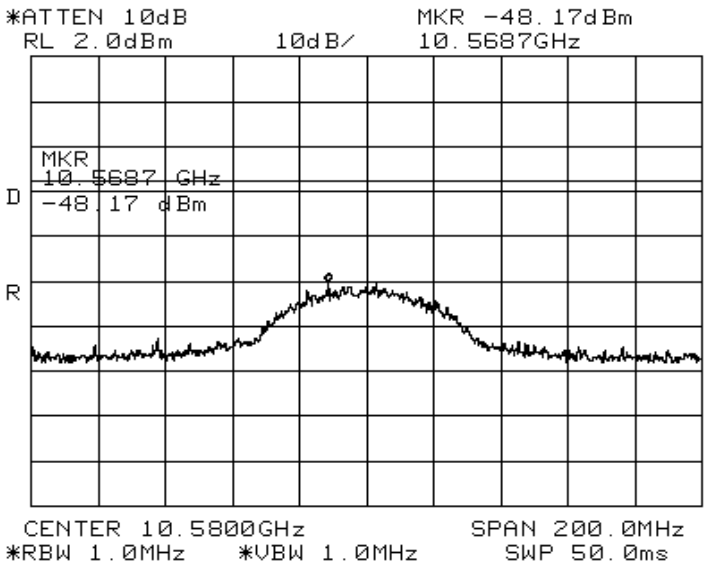


T45029 / 1023 (7 GHz)

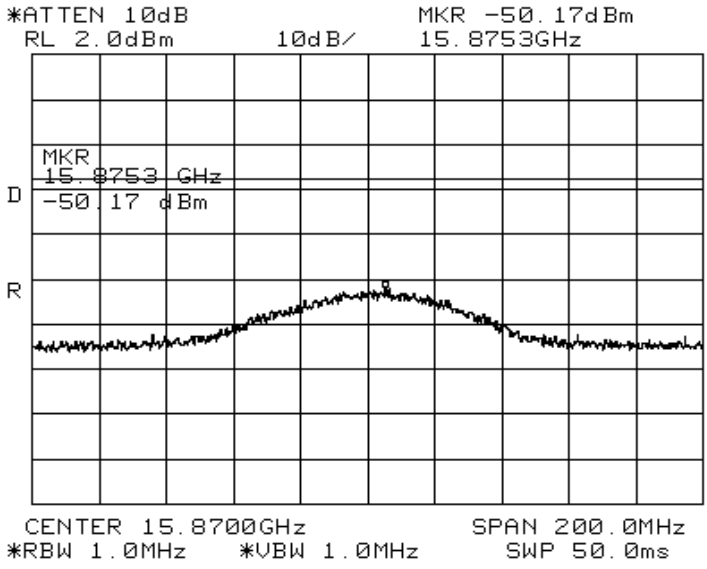


Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

T45029 / 1023 (10 GHz)



T45029 / 1024



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Band Edge Measurements:

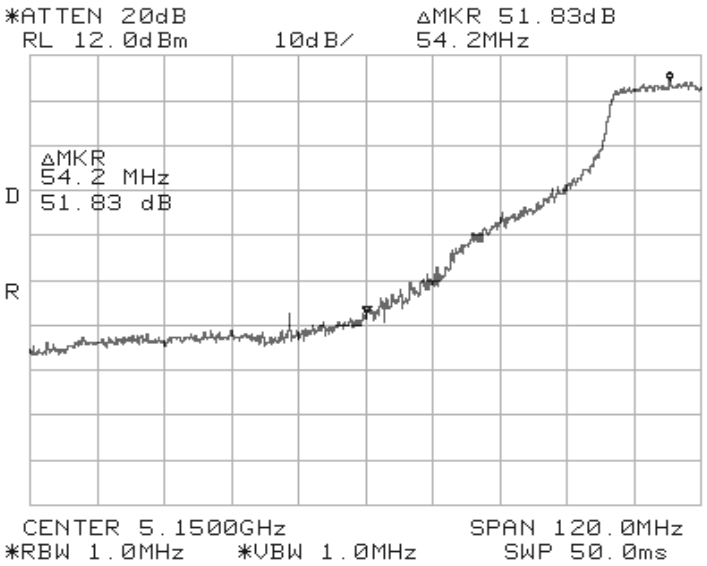
For signals in the restricted bands immediately above and below the 5.15 to 5.35 GHz allocated band a measurement was made of the amplitude of the spurious emissions with respect to the intentional signals. The relative amplitude, in dBc, was then applied to the average and peak field strength of the intentional signal made on the OATS to calculate the field strength of the unintentional signals.

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. Power = 13.8 dBm

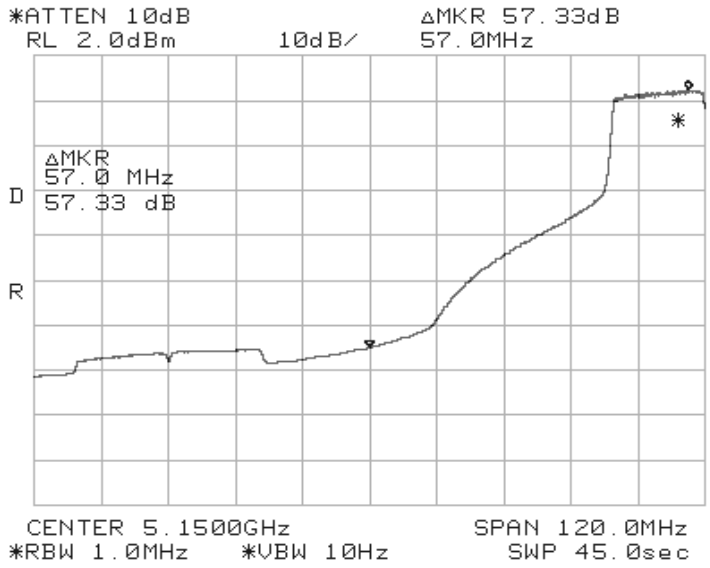
The highest signal within 60 MHz of the 5.15 GHz band was -51.83 dBc (Peak) / -57.33 dBc (Average)

Peak Bandedge



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

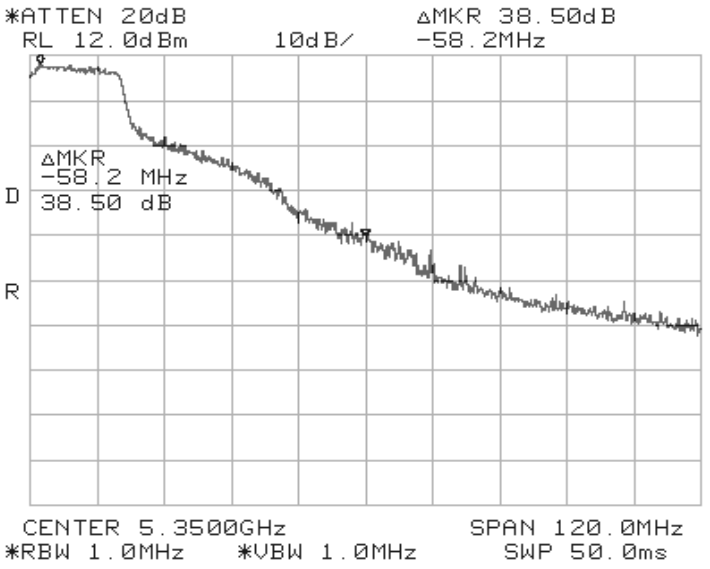
Average Bandedge



5.35 GHz band edge EUT operating on the highest channel. Power = 17.5 dBm

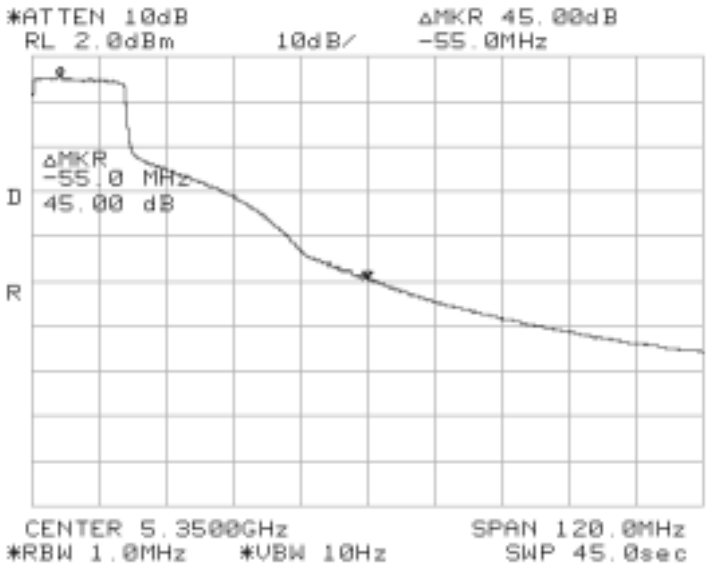
The highest signal within 60 MHz of the 5.35GHz band was -38.5 dBc (Peak) / -45 dBc (Average)

Peak Bandedge



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Average Bandedge



Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Run #6a: 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 10-15-2001

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): Power= 13.9 dBm @ 5210MHz, 17.5 dBm @ 5290 MHz

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5210.0	104.5	v	-	-	Pk	298	1.5	RBW = VBW = 1 MHz
5210.0	95.0	v	-	-	Avg	298	1.5	RBW = 1MHz, VBW = 10Hz
5210.0	99.6	h	-	-	Pk	111	1.7	RBW = VBW = 1 MHz
5210.0	90.2	h	-	-	Avg	111	1.7	RBW = 1MHz, VBW = 10Hz
5290.0	107.6	v	-	-	Pk	132	1.5	RBW = VBW = 1 MHz
5290.0	97.8	v	-	-	Avg	132	1.5	RBW = 1MHz, VBW = 10Hz
5290.0	100.5	h	-	-	Pk	113	1.4	RBW = VBW = 1 MHz
5290.0	89.9	h	-	-	Avg	113	1.4	RBW = 1MHz, VBW = 10Hz

Band Edge Field Strength Calculations; Power= 13.9 dBm @ 5210MHz, 17.5 dBm @ 5290 MHz

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	52.7	v	74.0	-21.3	PK			Note 1
5150.0	37.7	v	54.0	-16.3	Avg			Note 1
5150.0	47.8	h	74.0	-26.2	PK			Note 1
5150.0	32.9	h	54.0	-21.1	Avg			Note 1
5350.0	69.1	v	74.0	-4.9	PK			Note 2
5350.0	52.8	v	54.0	-1.2	Avg			Note 2
5350.0	62.0	h	74.0	-12.0	PK			Note 2
5350.0	44.9	h	54.0	-9.1	Avg			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 (-51.8 dBc for peak and -57.3 dBc 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 (-38.3 dBc for peak and -45.0 dBc for average) applied to the highest peak and average field strength measurements of the fundamental signal level.

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

Run #6b: Radiated Spurious Emissions, 1000 - 40000 MHz

EUT On Lowest Channel Available (Low Channel, 5.21 GHz); Power = 13.8 dBm

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
6252.0	48.2	v	68.3	-20.1	Note 5	100	1.3	Note 4 & 6
6252.0	35.0	h	68.3	-33.3	Note 5	61	1.2	Note 4 & 6
4168.0	41.8	v	74.0	-32.2	Pk	174	1.3	Note 2&6; Noise Floor measurement
4168.0	31.6	v	54.0	-22.4	Avg	174	1.3	Note 2&6; Noise Floor measurement
4168.0	41.8	h	74.0	-32.2	Pk	124	1.3	Note 2&6; Noise Floor measurement
4168.0	30.4	h	54.0	-23.6	Avg	124	1.3	Note 2&6; Noise Floor measurement
10420.0	51.0	v	68.3	-17.3	Note 5	154	1.4	Note 4
10420.0	49.2	h	68.3	-19.1	Note 5	187	1.6	Note 4
15630.0	62.0	v	74.0	-12.0	Pk	0	1.4	Note 2; Noise Floor measurement
15630.0	49.3	v	54.0	-4.7	Avg	0	1.0	Note 2; Noise Floor measurement
15630.0	62.1	h	74.0	-11.9	Pk	136	1.4	Note 2; Noise Floor measurement
15630.0	49.1	h	54.0	-4.9	Avg	136	1.4	Note 2; Noise Floor measurement
EUT On Center Channel (Middle Channel 5.25 GHz); Power = 13.9 dBm								
4200.0	45.6	v	74.0	-28.4	Pk	196	1.2	Note 2 & 6
4200.0	38.5	v	54.0	-15.5	Avg	196	1.2	Note 2 & 6
4200.0	41.0	h	74.0	-33.0	Pk	45	1.0	Note 2&6; Noise Floor measurement
4200.0	30.4	h	54.0	-23.6	Avg	45	1.0	Note 2&6; Noise Floor measurement
6230.0	45.5	v	68.3	-22.8	Note 5	120	1.3	Note 4 & 6
6230.0	44.7	h	68.3	-23.6	Note 5	55	1.3	Note 4 & 6
10500.0	50.2	v	68.3	-18.1	Note 5	130	1.5	Note 4
10500.0	47.0	h	68.3	-21.3	Note 5	167	1.5	Note 4
15750.0	60.6	v	74.0	-13.4	Pk	162	1.0	Note 2; Noise Floor Measurement
15750.0	48.9	v	54.0	-5.1	Avg	162	1.0	Note 2; Noise Floor Measurement
15750.0	60.8	h	74.0	-13.2	Pk	144	1.0	Note 2; Noise Floor Measurement
15750.0	48.3	h	54.0	-5.7	Avg	144	1.0	Note 2; Noise Floor Measurement

Elliott

EMC Test Data

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

EUT On Highest Channel Available (High Channel, 5.29 GHz); Power= 17.5 dBm

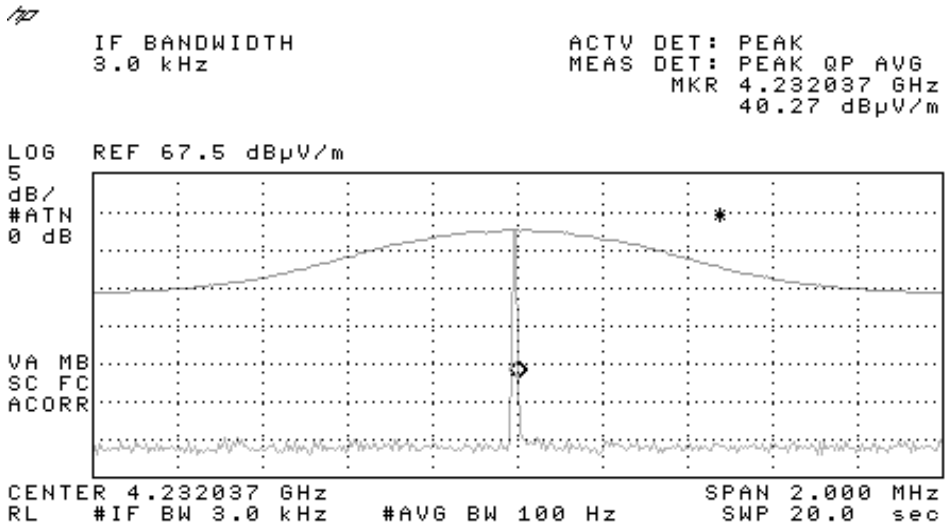
4232.0	45.2	v	74.0	-28.8	Pk	0	1.2	Note 2&6; Noise Floor measurement
4232.0	35.4	v	54.0	-18.6	Avg	0	1.2	Note 2&6; Noise Floor measurement
4232.0	39.8	h	74.0	-34.2	Pk	94	1.4	Note 2&6; Noise Floor measurement
4232.0	39.2	h	54.0	-14.8	Avg	94	1.4	Note 2&6; Noise Floor measurement
6348.0	40.0	v	68.3	-28.3	Note 5	128	1.9	Note 4 & 6
6348.0	41.9	h	68.3	-26.4	Note 5	184	1.4	Note 4 & 6
10538.0	51.8	v	68.3	-16.6	Note 5	122	1.5	Note 4
10538.0	48.9	h	68.3	-19.4	Note 5	134	1.5	Note 4
10600.0	63.7	v	74.0	-10.3	Pk	122	1.5	Note 2
10600.0	49.1	v	54.0	-4.9	Avg	122	1.5	Note 2
10600.0	59.8	h	74.0	-14.2	Pk	134	1.5	Note 2
10600.0	46.6	h	54.0	-7.4	Avg	134	1.5	Note 2
15870.0	60.6	h	74.0	-13.4	Pk	134	1.1	Note 2; Noise Floor Measurement
15870.0	48.4	h	54.0	-5.6	Avg	134	1.1	Note 2; Noise Floor Measurement
15870.0	61.1	v	74.0	-12.9	Pk	360	1.2	Note 2; Noise Floor measurement
15870.0	47.8	v	54.0	-6.2	Avg	360	1.2	Note 2; Noise Floor measurement

See following page for test notes...

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	-

...test notes for run 6b

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:	Signal does not fall in a restricted band.
Note 5:	Signals not falling in restricted band, RBW = 1MHz and VBW = 3MHz, video averaging on (100 samples).
Note 6:	This measurement was made using a resolution bandwidth of 3 kHz The instrumentation noise floor was too high to allow measurements with RBW = 1MHz because a preamplifier could not be used (with the EUT operating the intentional signal would overload the amplifier and there is no low pass filter with sufficient shape factor to reject the intentionally transmitted signal but pass the spurious signal). The signal was a narrowband signal (as verified during the conducted antenna measurements) and so the amplitude (peak/average) in a 3kHz bandwidth would be the same as that in a 1MHz bandwidth (please refer to the plot below). The peak reading has been compared with the average limit.



Plot showing LO signal at 4GHz measured using RBW = 1MHz and RBW = 3kHz. Amplitude of the signal does not change with resolution bandwidth.

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	B

Conducted Emissions - Power Ports

Test Specifics

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

Date of Test: 10/18/2001
Test Engineer: Conrad
Test Location: SVOATS #2

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

General Test Configuration

For tabletop equipment, the EUT and host system were 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: 24°C
Rel. Humidity: 43%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Conducted Emissions, AC Power 120V/60Hz	FCC B	Pass	-31.1 dB @ 3.238 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.

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	B

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

The AC input of the host laptop PC was tested since the EUT derives power from the host

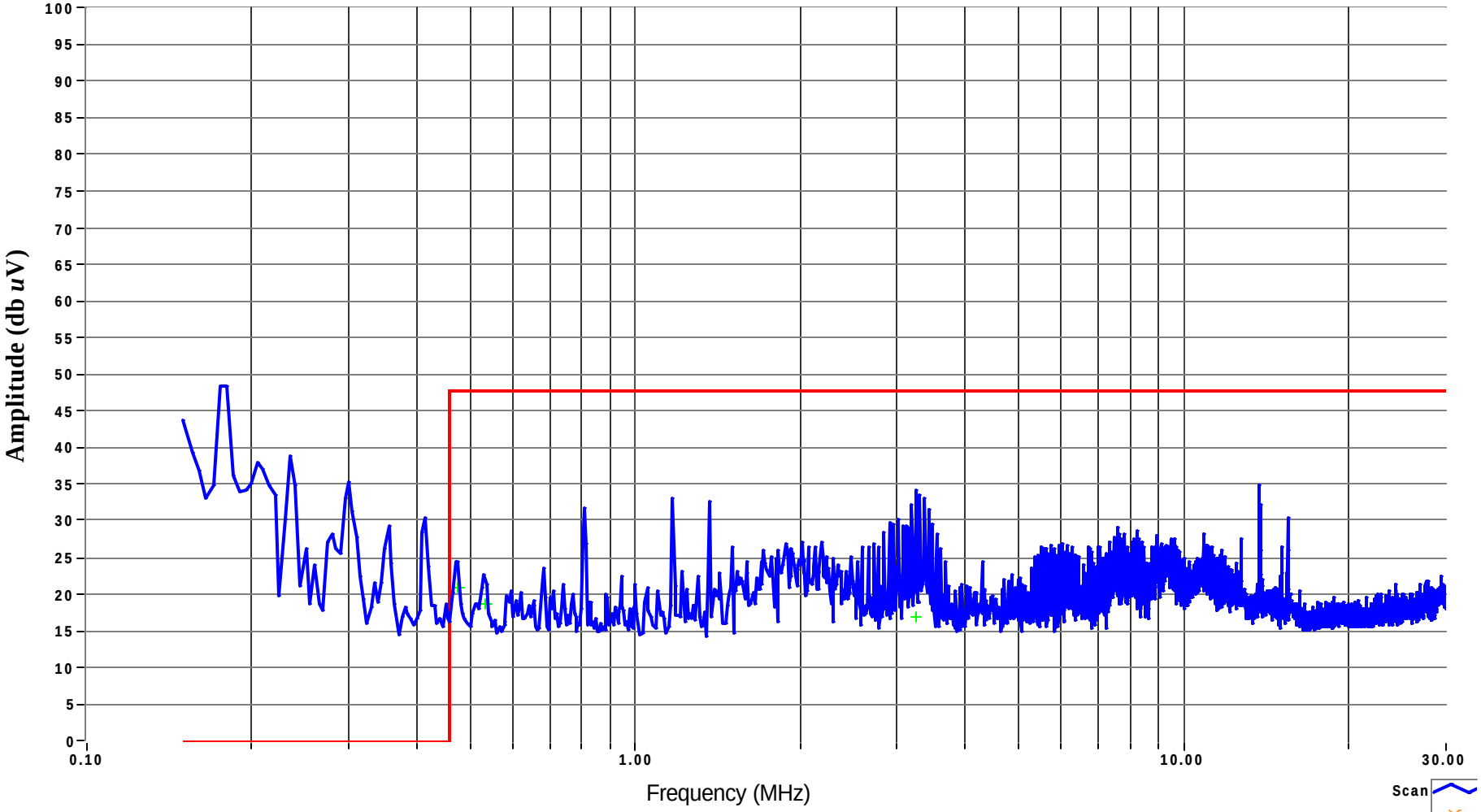
Frequency	Level	AC	FCC B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
3.238	16.9	Neutral	48.0	-31.1	QP	
3.238	16.3	Line 1	48.0	-31.7	QP	
0.533	18.8	Neutral	48.0	-29.2	QP	
0.532	23.6	Line 1	48.0	-24.4	QP	
0.473	24.6	Line 1	48.0	-23.4	QP	
0.473	21.0	Neutral	48.0	-27.0	QP	

SVOATS #2: Atheros AR5BCB-00013 Run 1

Spec:
FCC-B

120V/60Hz

Mains Lead
Neutral



T45059, / = EUT, A = Ambient

Scan
Peak
Quasi-peak
Average
QuasiPeak Limit
QuasiPeak Limit

10/30/2001

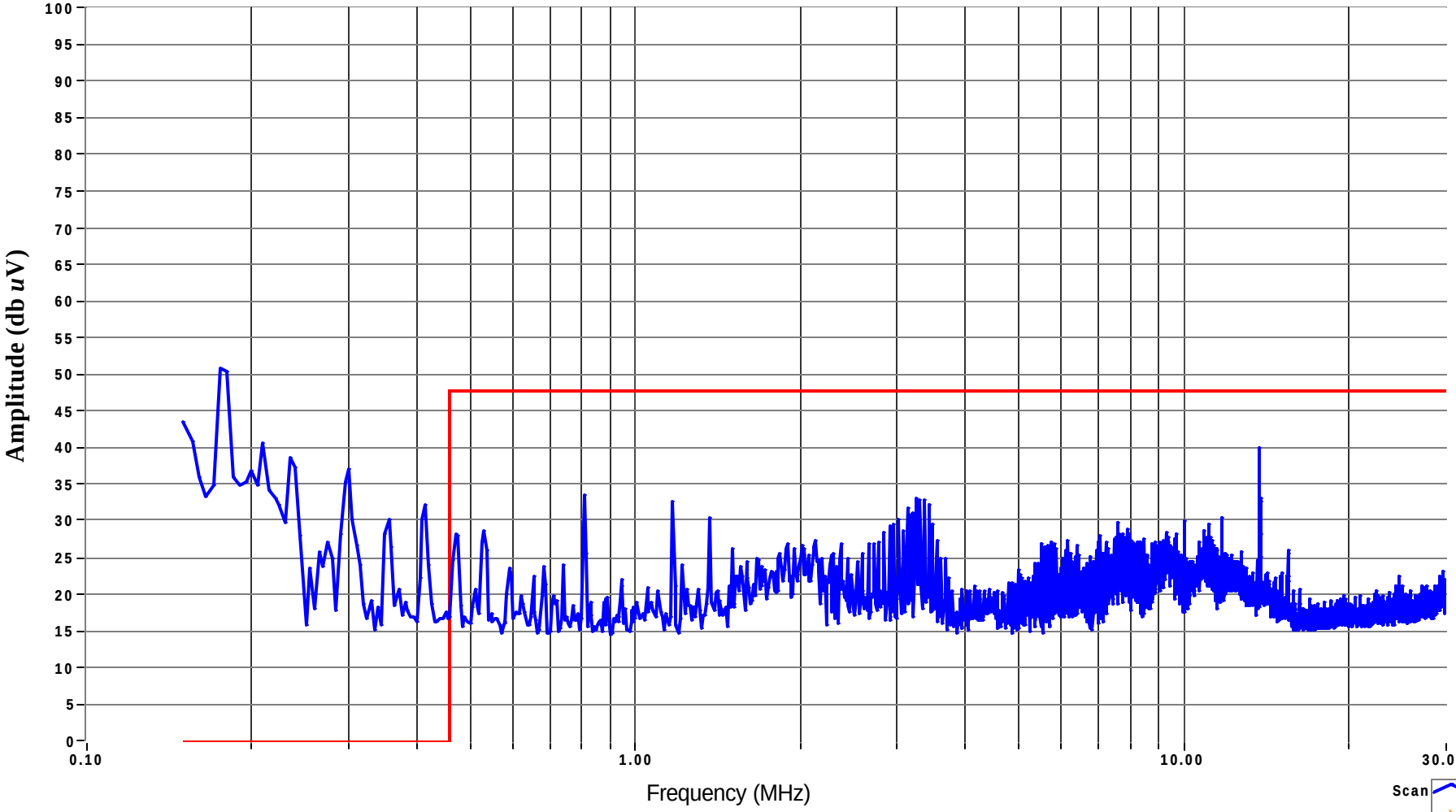
Conrad Chu

SVOATS #2: Atheros AR5BCB-00013 Run 1

Spec:
FCC-B

120V/60Hz

Mains Lead
Line



T45059, / = EUT, A = Ambient

Scan
Peak
Quasi-peak
Average
QuasiPeak Limit
QuasiPeak Limit

10/30/2001

Conrad Chu

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	B

Radiated Emissions

Test Specifics

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

Date of Test: 10/18/2001
Test Engineer: Conrad
Test Location: SVOATS #2

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

General Test Configuration

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

On the OATS, the measurement antenna was located 3 meters from the EUT for the measurement range 30 - 1000 MHz. Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

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: 24°C
Rel. Humidity: 43%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
2	RE, 30 - 1000MHz - Maximized Emissions	FCC B	Pass	-9.2 dB @ 479.1 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.

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	B

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

Readings taken at 3 meters as per FCC requirements

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
497.100	36.8	h	46.0	-9.2	QP	0	1.2	
428.697	36.2	v	46.0	-9.8	QP	265	2.1	
497.100	35.9	v	46.0	-10.1	QP	270	1.4	
689.880	31.2	v	46.0	-14.8	QP	90	1.0	
796.910	30.5	v	46.0	-15.5	QP	81	1.0	
931.320	30.0	v	46.0	-16.0	QP	174	1.0	
796.910	30.0	h	46.0	-16.0	QP	310	1.0	
405.735	30.0	h	46.0	-16.0	QP	330	1.0	
628.300	29.7	v	46.0	-16.3	QP	281	1.0	
384.900	27.3	h	46.0	-18.7	QP	38	1.0	
399.590	27.2	v	46.0	-18.8	QP	197	1.2	
432.050	26.9	h	46.0	-19.1	QP	0	1.0	
110.600	24.1	v	43.5	-19.4	QP	125	1.0	
399.920	26.5	v	46.0	-19.5	QP	197	1.0	
412.840	26.4	h	46.0	-19.6	QP	310	1.0	
440.150	26.0	h	46.0	-20.0	QP	355	1.0	
32.420	20.0	v	40.0	-20.0	QP	200	1.0	
232.900	25.0	v	46.0	-21.0	QP	200	2.2	
159.900	22.4	v	43.5	-21.1	QP	187	1.2	
427.500	24.5	v	46.0	-21.5	QP	162	1.0	
349.630	24.0	v	46.0	-22.0	QP	162	1.6	
566.000	23.9	v	46.0	-22.1	QP	44	1.1	
336.100	23.7	h	46.0	-22.3	QP	273	1.2	
412.840	23.0	v	46.0	-23.0	QP	185	1.0	
566.000	23.0	v	46.0	-23.0	QP	44	1.5	
263.900	23.0	v	46.0	-23.0	QP	188	1.0	
405.735	22.2	v	46.0	-23.8	QP	208	1.0	
440.150	22.0	v	46.0	-24.0	QP	125	1.0	
427.500	22.0	h	46.0	-24.0	QP	353	1.0	
432.050	18.0	v	46.0	-28.0	QP	152	1.0	

Client:	Atheros Communications	Job Number:	J44998
Model:	AR5BCB-00013	T-Log Number:	T45059
		Proj Eng:	Mark Briggs
Contact:	Eric Dukatz		
Spec:	FCC 15 B & 15E, RSS-210	Class:	B

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	
497.100	36.8	h	46.0	-9.2	QP	0	1.2	
428.697	36.2	v	46.0	-9.8	QP	265	2.1	
497.100	36.7	v	46.0	-9.3	QP	44	1.0	
689.880	33.0	v	46.0	-13.0	QP	0	1.0	
796.910	32.4	v	46.0	-13.6	QP	77	1.0	
931.320	30.0	v	46.0	-16.0	QP	174	1.0	