

***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 (LELEAN Devices)
on the D-Link Corporation
Model: DW-290***

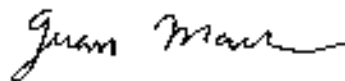
FCC ID: KA22001120013-1

GRANTEE: D-Link Corporation
No.8, Li-shing Road VII
Hsinchu, Taiwan

TEST SITE: Elliott Laboratories, Inc.
684 W. Maude Avenue
Sunnyvale, CA 94086

REPORT DATE: December 28, 2001

FINAL TEST DATE: December 19 and December 20, 2001



AUTHORIZED SIGNATORY: _____

Juan Martinez
Senior EMC Engineer

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DECLARATIONS OF COMPLIANCE

Equipment Name and Model:
Mini-PCI module, DW-290

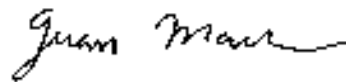
Manufacturer:
D-Link Corporation
No.8, Li-shing Road VII
Hsinchu, Taiwan

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 **SV3**, Dated July 30, 2001
Departmental Acknowledgement Number: IC2845 **SV4**, Dated July 19, 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 Juan Martinez
Title Senior EMC Engineer
Company Elliott Laboratories Inc.
Address 684 W. Maude Ave
Sunnyvale, CA 94086
USA

Date: December 28, 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.).

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SCOPE

An electromagnetic emissions test has been performed on the D-Link Corporation model DW-290 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 D-Link Corporation model DW-290 and therefore apply only to the tested sample. The sample was selected and prepared by Shinglin Chung of D-Link Corporation

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				
		As the device operates in the 5.15 – 5.25 GHz band the antenna must be integral to the device.	Antenna Gain = 3 dBi The antenna is integral	JoyMax Antenna
		As the device operates in the 5.15 – 5.25 GHz band the antenna must be integral to the device.	Antenna Gain = 4 dBi The antenna is integral	Atheros Antenna
15.407(e)		Indoor operation only	Refer to user's manual in Appendix 6	COMPLIES
15.407(a) (1)		26dB Bandwidth	41 – 43.3 MHz in Turbo Mode 29.25 MHz in 802.11a (Normal) Mode	N/A
	6.2.2 q1 (i)	20dB Bandwidth	33 MHz in Turbo Mode 21.17 MHz in 802.11a Mode	N/A
15.407(a) (1)	6.2.2 q1 (i)	Output Power	13.9 dBm in Turbo Mode 11.5 dBm in 802.11a Mode	COMPLIES
15.407(a) (1)	6.2.2 q1 (i)	Power Spectral Density	-1.0 dBm in Turbo Mode -2.0 dBm in 802.11a Mode	COMPLIES
15.407(b) (2)	6.2.2 q1 (ii)	Spurious Emissions above 1GHz	-1.0 dB @ 15750MHz in turbo mode -5.0 dB @ 15540MHz in 802.11a Mode	Atheros Antenna
15.407(b) (2)	6.2.2 q1 (ii)	Spurious Emissions above 1GHz	-1.6 dB @ 15630MHz in turbo mode -0.4 dB @ 15540MHz in 802.11a Mode	JoyMax Antenna
Operation in the 5.25 – 5.35 GHz Band Note: The device is restricted to indoor use only, therefore the spectral density of spurious emissions in the 5.15 – 5.25 GHz band were limited to the power spectral limits for intentional signals detailed in FCC 15.407(a)(1) and RSS 210 6.2.2 q1 (i)				
		Maximum Antenna Gain /Integral Antenna	Antenna Gain = 3 dBi The antenna is integral	JoyMax Antenna
		Maximum Antenna Gain /Integral Antenna	Antenna Gain = 4 dBi The antenna is integral	Atheros Antenna
15.407(a) (1)		26dB Bandwidth	46 MHz in Turbo Mode 29.25 MHz in 802.11a (Normal) Mode	N/A
	6.2.2 q1 (i)	20dB Bandwidth	33 MHz in Turbo Mode 21.17 MHz in 802.11a Mode	N/A
15.407(a) (1)	6.2.2 q1 (i)	Output Power	14.9 dBm in Turbo Mode 12.3 dBm in 802.11a Mode	COMPLIES
15.407(a) (1)	6.2.2 q1 (i)	Power Spectral Density	-0.92 dBm in Turbo Mode 1.8 dBm in 802.11a Mode	COMPLIES
15.407(b) (2)	6.2.2 q1 (ii)	Spurious Emissions above 1GHz	-3.0 dB @ 15870MHz in turbo mode -2.8 dB @ 15780MHz in 802.11a Mode	Atheros Antenna
15.407(b) (2)	6.2.2 q1 (ii)	Spurious Emissions above 1GHz	-2.0 dB @ 15870MHz in turbo mode -1.0 dB @ 15780MHz in 802.11a Mode	JoyMax Antenna

General requirements for all bands				
	6.2.2 q(iv)(a)	Digital Modulation	Digital Modulation is used, refer to the "Theory of Operations" (Appendix 9) for a detailed explanation.	COMPLIES
	6.2.2 q(iv)(b)	Peak Spectral Density	9.33 dBm/MHz in turbo mode 10.9 dBm/MHz in 802.11a Mode	COMPLIES
15.407(a)(6)		Peak Excursion Ratio	Less than 13dB	COMPLIES
	6.2.2 q(iv)(c)	Channel Selection	The channels used represent the highest, lowest and center channels available.	N/A
15.407 (c)	6.2.2 q(iv)(d)	Automatic Discontinuation of Operation in the absence of information to transmit	Operation is discontinued in the absence of information to transmit, refer to the "Theory of Operations" in Appendix 9 for a detailed explanation.	COMPLIES
15.407 (g)	6.2.2 q(iv)(e)	Frequency Stability	Frequency stability is 20 ppm, refer to the "Theory of Operations" in Appendix 9 for a detailed analysis.	COMPLIES
	6.2.2 q(iv)(g)	User Manual information	All relevant statements have been included in the user's manuals. Refer to Appendix 6 for details	COMPLIES
15.407 (f)	6.2.2 q(iv)(g)	RF Exposure Requirements	Refer to MPE calculations in Appendix 11	COMPLIES
15.407(b) / 15.207	6.6	AC Conducted Emissions	- 6.6 dB @ 2.18 MHz	COMPLIES

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 D-Link Corporation model DW-290 is a mini PCI UNII Radio Module, which is designed to operate in the 5.15-5.25GHz and 5.25-5.35GHz UNII/LELEAN bands. The EUT is designed to be installed in the Mini-PCI slot of D-Link's UNII devices, such as the Access Point. A modular approval is being sought for this product.

The sample was received on December 19, 2001 and tested on December 19 and December 20, 2001. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number
D-Link/DW-290/MINI PCI module	-
D-Link/ DW-1150 & DWL-5000AP/Access Point	-

ANTENNA

The EUT uses an integral antenna with a gain of 3 dBi (JoyMax Antenna) & 4 dBi (Atheros Antenna). The antenna connector will not be accessible by the end user and will be contained within the enclosure of the host system. D-Link will provide clear instructions to ensure that this is done when the module is used in different host systems to meet the requirements of FCC Part 15.203 and RSS-210.

ENCLOSURE

The EUT enclosure is primarily constructed of fabricated sheet steel/plastic. It measures approximately 6 cm wide by .2 cm deep by 6.5 cm high.

MODIFICATIONS

The EUT required the following modification during testing in order to comply with the emission specifications:

- 1) The original Shield was extended to cover the half portion of the MINI PCI card.

SUPPORT EQUIPMENT

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

Manufacturer/Model/Description	Serial Number	FCC ID Number
Dell PP01L Laptop	96FFC AOO	-
HP THINKJET 22256 Printer	2714540166	ZD#D516XU2225

No remote support equipment was used during emissions testing.

EUT INTERFACE PORTS

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length (m)
Ethernet	Laptop	Access Point	Unshielded	1
Parallel	Printer	Parallel	Shielded	3
Serial	Laptop	Serial	Shielded	3
AC	Adaptor	Two Wire	Unshielded	2

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 in that mode (12Mb/s).

ANTENNA REQUIREMENTS

As the device is intended to operate in the 5.15 – 5.25 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, which is equipped with a non-standard reverse connector.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on December 19 and December 20, 2001 at the Elliott Laboratories Open Area Test Site #4 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 and Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

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

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

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

POWER METER

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 Appendix 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 terms 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:

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

where P is the eirp (Watts)

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

FCC 15.407 (a) OUTPUT POWER LIMITS

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

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

For system using antennas with gains exceeding 6dBi, the output power and power spectral density limits are reduced by 1dB for every dB the antenna gain exceeds 6dBi.

Fixed point-to-point applications using the 5725 – 5825 MHz band may use antennas with gains of up to 23dBi without this limitation. If the gain exceeds 23dBi then the output power limit of 1 Watt is reduced by 1dB for every dB the gain exceeds 23dBi.

RS-210 6.2.2(q1) OUTPUT POWER LIMITS

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

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

For system using antennas with gains exceeding 6dBi, the output power and power spectral density limits are reduced by 1dB for every dB the antenna gain exceeds 6dBi.

Fixed point-to-point applications using the 5725 – 5825 MHz band may use antennas with gains of up to 23dBi without this limitation. If the gain exceeds 23dBi then the output power limit of 1 Watt is reduced by 1dB for every dB the gain exceeds 23dBi.

SPURIOUS RADIATED EMISSIONS LIMITS

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

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

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

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

Note 1: If operation is restricted to indoor use only then emissions in the band 5.15 – 5.25 GHz must meet the power spectral density limits for the intentional signals detailed in RSS 210 and FCC Subpart E for devices operating in the 5.15 – 5.25 GHz band.

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

Note 3: Applies to spurious signals within 10 MHz of the allocated band.

AC POWER PORT CONDUCTED EMISSIONS LIMITS

The table below shows the limits for emissions on the AC power line as detailed in FCC Part 15.205 and Industry Canada RSS-210 section 6.6.

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

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

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

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

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

SAMPLE CALCULATIONS - RADIATED EMISSIONS

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

$$F_d = 20 * \text{LOG}_{10} (D_m/D_s)$$

where:

$$F_d = \text{Distance Factor in dB}$$

$$D_m = \text{Measurement Distance in meters}$$

$$D_s = \text{Specification Distance in meters}$$

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:

$$R_r = \text{Receiver Reading in dBuV/m}$$

$$F_d = \text{Distance Factor in dB}$$

$$R_c = \text{Corrected Reading in dBuV/m}$$

$$L_s = \text{Specification Limit in dBuV/m}$$

$$M = \text{Margin in dB Relative to Spec}$$

APPENDIX 1: Test Equipment Calibration Data

APPENDIX 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T 45752 63 Pages



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Emissions Spec: FCC Part 15 B and E, RSS-210	Class: B
Immunity Spec: N/A	Environment: -

EMC Test Data

For The

D-Link Corporation

Model

DW-290 (MINI PCI Module)



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
Contact: Shinglin Chung	Proj Eng: Mark Briggs
Emissions Spec: FCC Part 15 B and E, RSS-210	Class: B
Immunity Spec: N/A	Environment: -

EUT INFORMATION

General Description

The EUT is a mini PCI UNII Radio Module which is designed to operate in the 5.15-5.25GHz and 5.25-5.35GHz UNII/LELEAN bands. The EUT is designed to be installed in the mini-PCI slot of D-Link's UNII devices, such as the Access Point. A modular approval is being sought for this product. The electrical rating for the Access Point is 120Vac, 60Hz. The MINI PCI module card receives its power from the product's pci slot.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
D-Link	DW-290	Mini PCI UNII module	N/A	KA22001120013-1
D-Link	DW-1150 (USA)	Accesspoint	N/A	KA22001120012-1
D-Link	DWL-5000AP (Taiwan)	Accesspoint	N/A	KA22001120012-1

Antenna

The EUT uses an integral antenna (JoyMax) with a gain of 3 dBi and (Atheros) with a gain of 4 dBi

The antenna connector will not be accessible by the end user and will be contained within the enclosure of the host system. D-Link will provide clear instructions to ensure that this is done when the module is used in different host systems to meet the requirements of FCC Part 15.203 and RSS-210.

EUT Enclosure (MINI PCI Card)

The EUT enclosure is primarily constructed of fabricated sheet steel/plastic. It measures approximately 6 cm wide by .2 cm deep by 6.5 cm high.

EUT Enclosure (Access Point)

The EUT enclosure is primarily constructed of plastic. It measures approximately 20 cm wide by 13 cm deep by 3 cm high.

Modification History

Mod. #	Test	Date	Modification
1	Radio Radiated emissions	12/19/01	The original Shield was extended to cover the half portion of the MINI PCI card.



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
Contact: Shinglin Chung	Proj Eng: Mark Briggs
Emissions Spec: FCC Part 15 B and E, RSS-210	Class: B
Immunity Spec: N/A	Environment: -

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	PPO1L	Laptop	96FFC AOO	DoC
HP THINKJET	22256	Printer	2714540166	ZD#D516XU2225

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
NONE				

Interface Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Paralled printer	Laptop	DB25	shielded	2
Serial	Laptop	DB9	shielded	2
Ethernet	Laptop	RJ-45	unshielded	1

EUT Operation During Emissions Testing (Digital)

The radio was continuously transmitting at the stated power on the specified channels at a data rate of 6Mb/s in 802.11a Normal mode.



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
Contact: Shinglin Chung	Proj Eng: Mark Briggs
Emissions Spec: FCC Part 15 B and E, RSS-210	Class: B
Immunity Spec: N/A	Environment: -

Test Configuration #2

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	PPO1L	Laptop	96FFC AOO	DoC

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
NONE				

Interface Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Serial	Laptop	DB9	shielded	2
Ethernet	Laptop	RJ-45	unshielded	1

Note 1: Printer was not connected during measurements above 1 GHz.

EUT Operation During Emissions Testing (Radio)

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 in that mode (12Mb/s).



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, 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: 12/21/01	Config. Used: 1
Test Engineer: Blair Wright	Config Change: N/A
Test Location: SVOATS #3	EUT Voltage: 120V/60Hz

General Test Configuration

For tabletop equipment, the EUT and host system was located on a wooden table, 40 cm from a vertical coupling plane and 80cm from the LISN. A second LISN was used for all local support equipment.

Ambient Conditions: Temperature: 11°C
Rel. Humidity: 41%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power 120V/60Hz	FCC B	Pass	- 6.6 dB @ 2.18 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.



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

Run #1: AC Power Port Conducted Emissions, 0.45 - 30MHz, 120V/60Hz

Frequency MHz	Level dB μ V	AC Line	FCC B		Detector QP/Ave	Comments
			Limit	Margin		
2.1790	41.4	n	48.0	-6.6	QP	
2.1910	40.9	Line	48.0	-7.1	QP	
2.8930	35.8	n	48.0	-12.2	QP	
1.0660	35.6	n	48.0	-12.4	QP	
1.0510	33.1	Line	48.0	-14.9	QP	
4.4890	32.8	Line	48.0	-15.2	QP	



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

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: 12/19 & 12/20/2001	Config. Used: 2
Test Engineer: Jmartinez/Rafael	Config Change: N/A
Test Location: SVOATS# 4	Host Unit Voltage: 120Vac, 60Hz

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: 8.9°C
 Rel. Humidity: 89%

Summary of Results: Turbo Mode

Run #	Test Performed	Limit	Result	Comments
1	Output Power	15.407(a) (1), (2)	Pass	13.9dBm@ 5210 MHz, 14.9dBm@5290 MHz
2	Power Spectral Density (PSD)	15.407(a) (1), (2)	Pass	-1dBm@ 5250 MHz, -.92dBm@5290MHz
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 & 7	RE, 1000 - 40000 MHz - Spurious Emissions	15.407(b)(6)	Pass	Refer to individual



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

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: 4 dBi (Used the highest gain antenna)

Channel	Frequency (MHz)	PC_DAC	Output Power (dBm)	FCC Limit (dBm) (note 3)	Comments
Low	5210	11	13.7	17.0	Note 2
	5210	11	13.9	17.0	Note 1 / (101)
Mid	5250	12	13.6	17.0	Note 2
	5250	12	13.8	17.0	Note 1 / (102)
High	5290	16	14.7	24.0	Note 2
	5290	16	14.9	24.0	Note 1 / (103)

Note 1: Measured using spectrum analyzer's power measurement function (RBW = 1MHz, VBW = 30kHz) which summed the power over the occupied bandwidth (26dB bandwidth).

Note 2: Measured using a Power Meter with a thermal sensor

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.



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

Run #2: Power Spectral Density

Antenna Gain: 4 dBi (Used the highest gain antenna)

Channel	Frequency (MHz)	Power Spectral Density (dBm/MHz)	FCC Limit (dBm) note 2	Peak Power Spectral Density (dBm)	
low	5210	-1.50	4.0	9.33	Note 1
mid	5250	-1.00	4.0	7.83	Note 1
high	5290	-0.92	11.0	8.58	Note 1

Note 1: The above measurements were made using RBW = 1MHz, VBW = 3MHz, 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). The peak PSD (measured with RBW=VBW=1MHz) of 9.33 **dBm** did not exceed the maximum permitted average PSD of 10dBm (5.15 to 5.25 GHz band) or 11dBm (5.25-5.35GHz band) so 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.

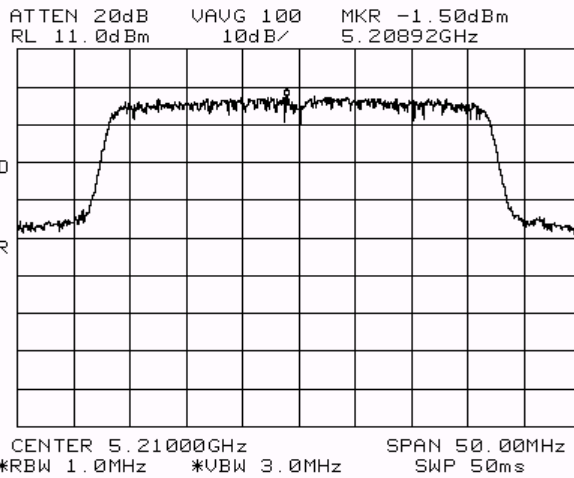


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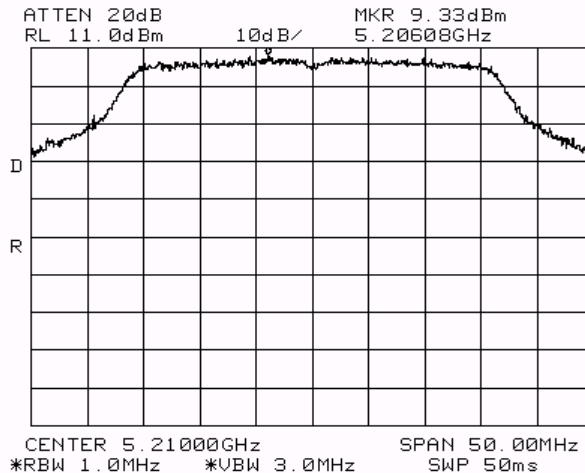
Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

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

FCC Power Density



Canada Power Density

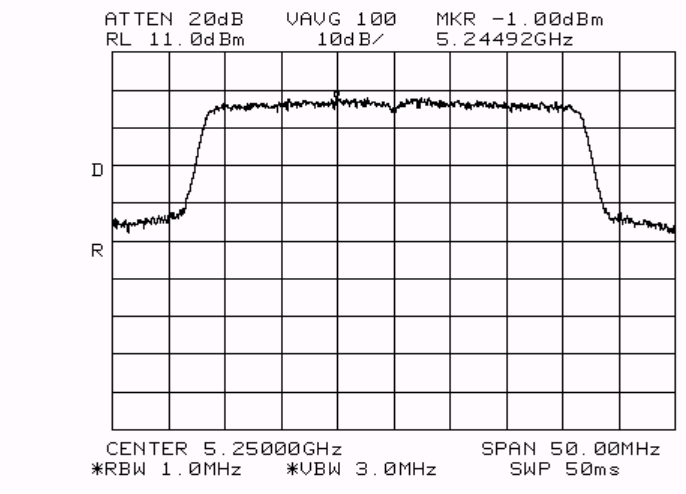




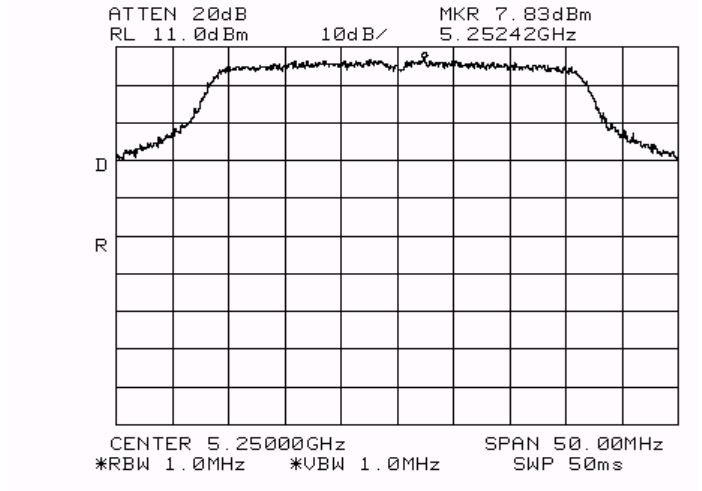
EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

FCC Power Density



Canada Power Density

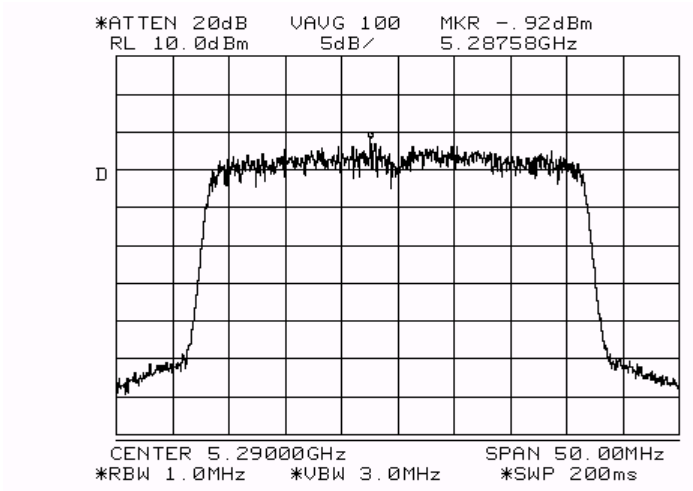




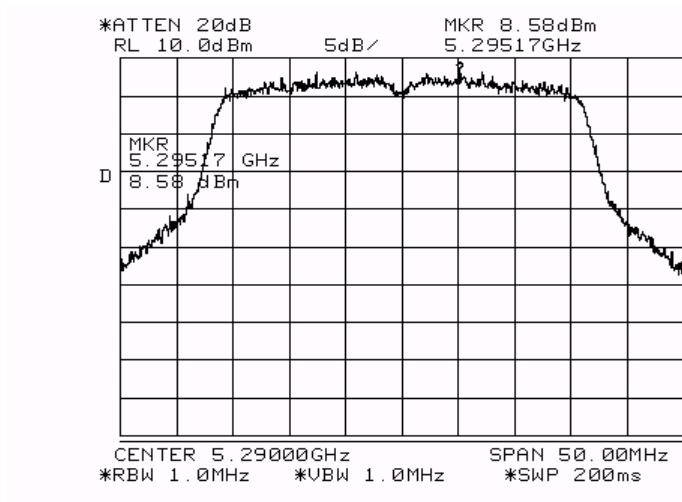
EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

FCC Power Density



Canada Power Density





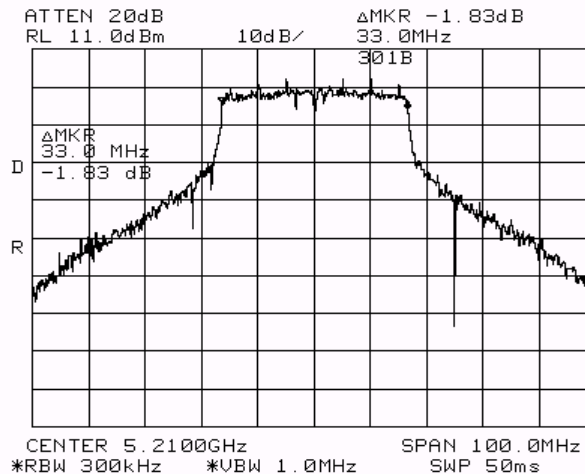
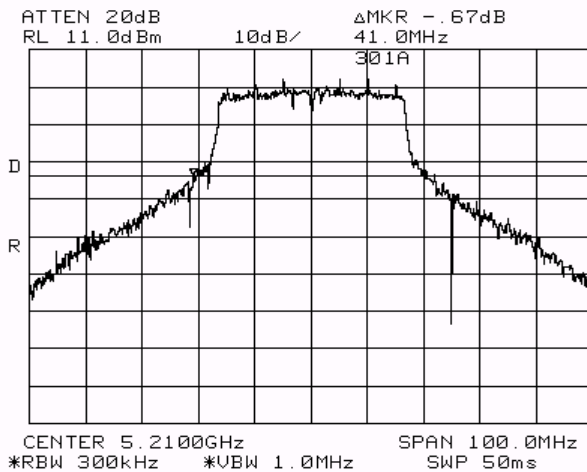
EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

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	41.00	33.00	301A and 301B
mid	5250	300 kHz	43.30	33.00	302A and 302B
high	5290	300 kHz	46.00	33.00	303A and 303B

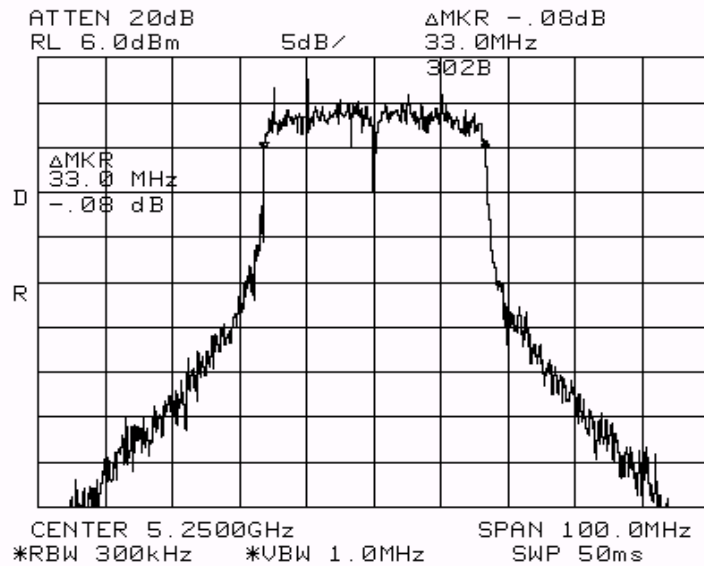
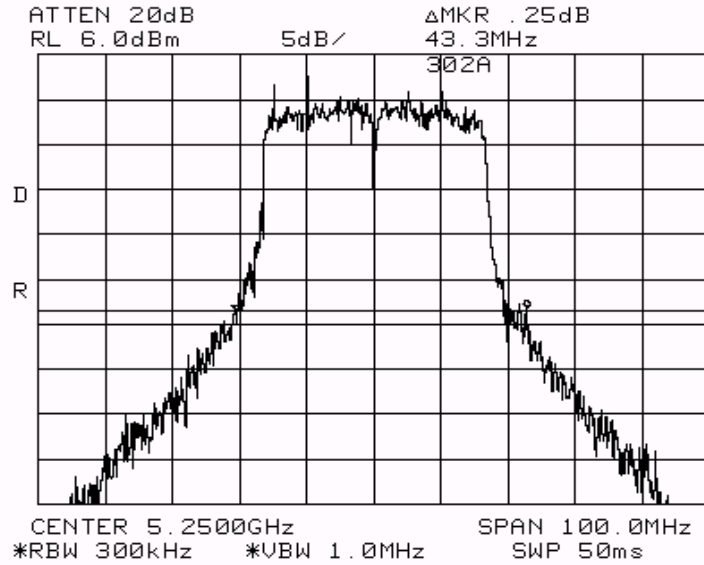
Plots Showing Signal Bandwidth





EMC Test Data

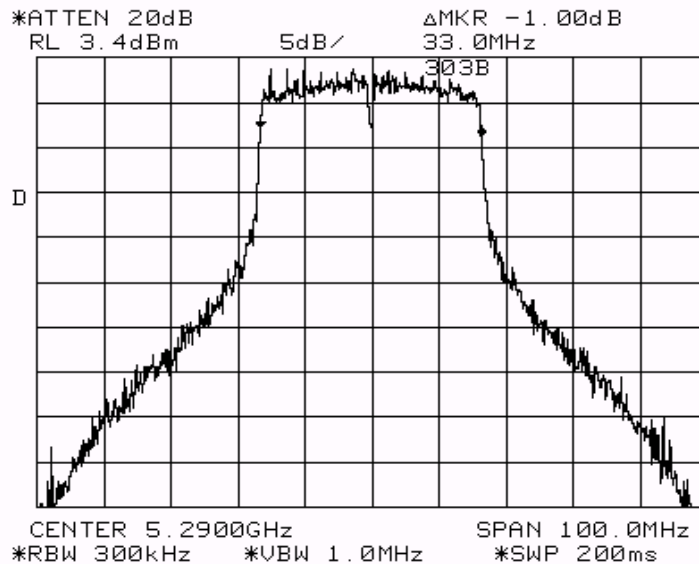
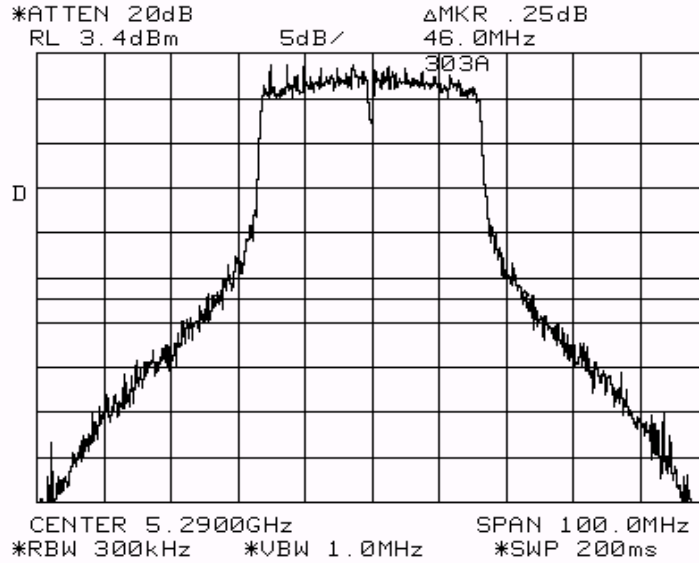
Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B





EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B



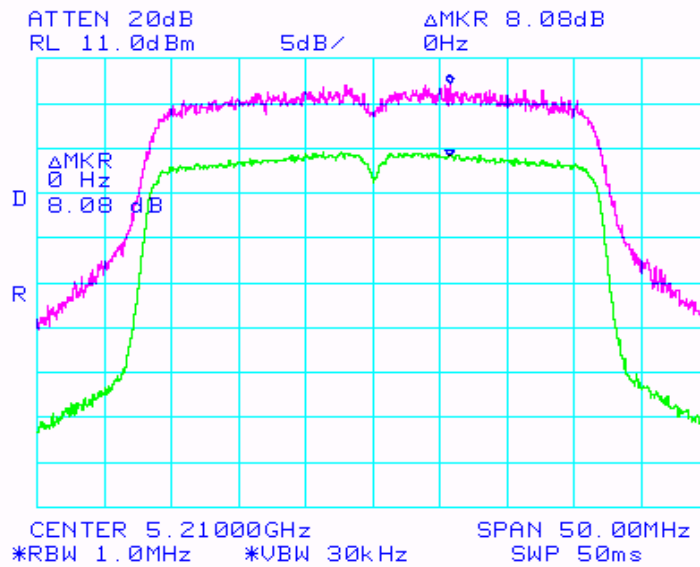
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Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

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 = 8.08 dB

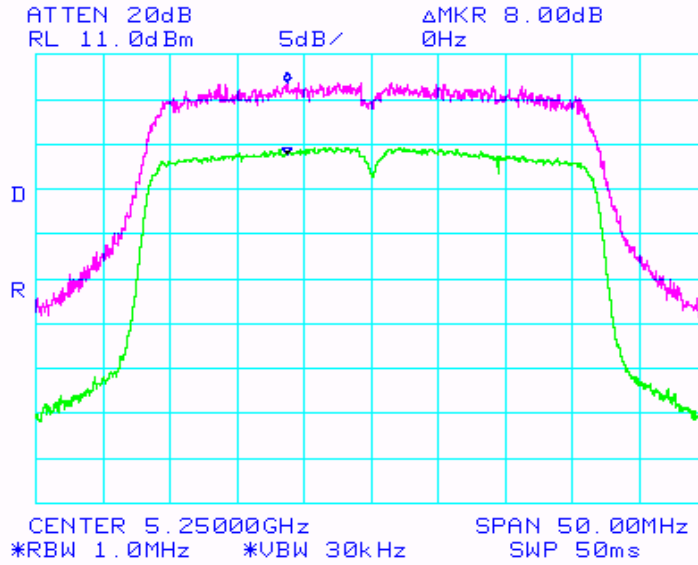




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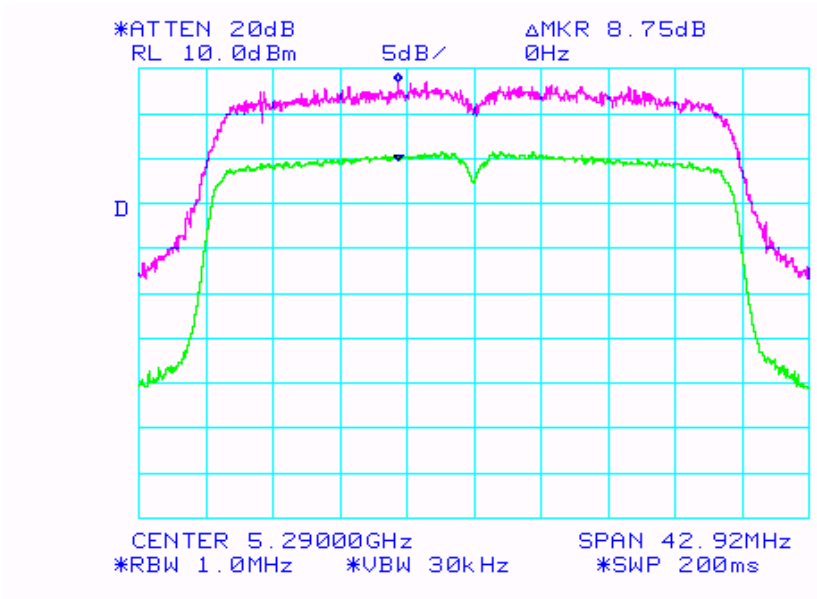
Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

Middle Channel; Peak Excursion =8.00 dB



Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
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Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

High Channel; Peak Excursion = 8.75 dB





EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

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

The antenna gain of the radios integral antenna is 4 dBi. The EIRP limit is -27dBm/MHz for all out of band signals that do not fall in restricted bands. A limit of -31 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 4 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	501
		1 to 5.15 GHz	4182 (Note 1)	502
		5.25 to 10 GHz	6271 (Note 3)	503
		10 GHz to 20 GHz	15670 (Note 1)	504
		20 GHz to 40 GHz	None	505
mid	5250	30 - 1000 MHz	Note 4	506
		1 to 5.25 GHz	4216 (Note 1)	507
		5.35 to 10 GHz	6319 (Note 2)	508
		10 GHz to 20 GHz	None	509
		20 GHz to 40 GHz	None	510
high	5290	30 - 1000 MHz	Note 4	511
		1 to 5.30 GHz	4247 (Note 1)	512
		5.34 to 10 GHz	6365 (Note 3)	513
		10 GHz to 20 GHz	15870 (Note 1)	514
		20 GHz to 40 GHz	None	515

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.

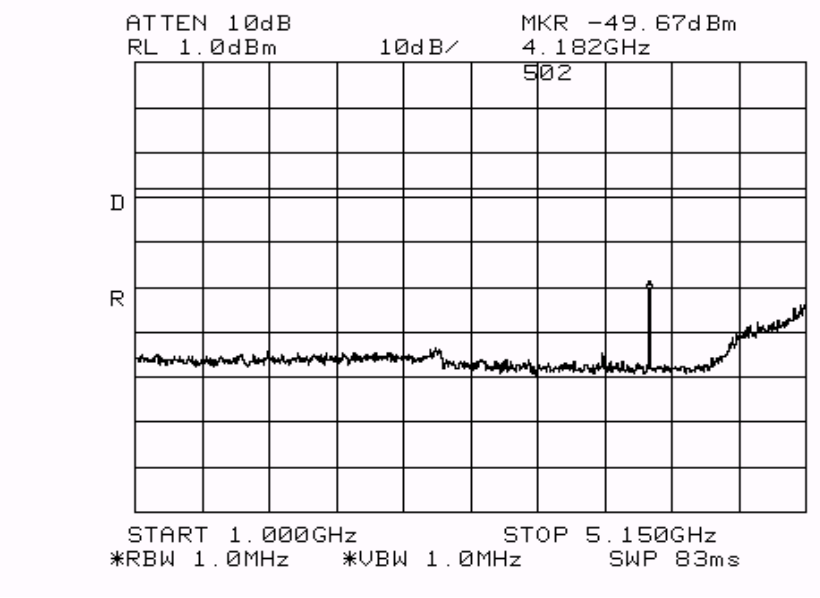
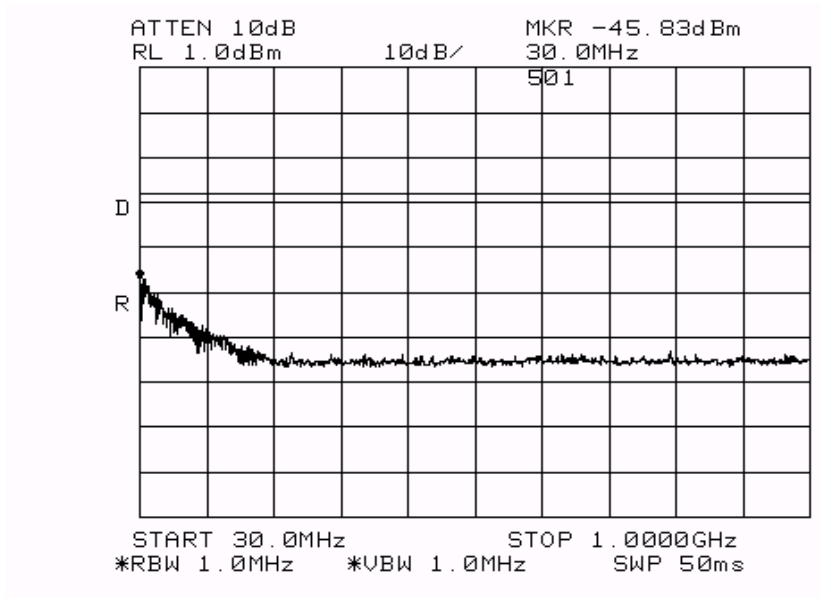


EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

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

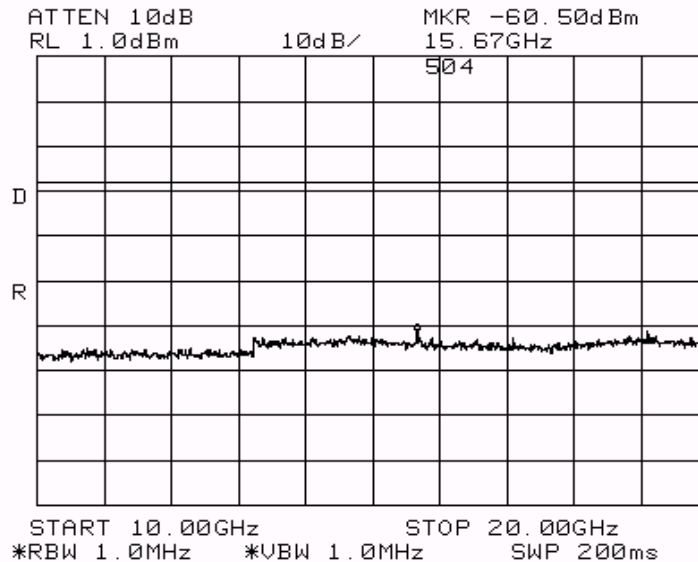
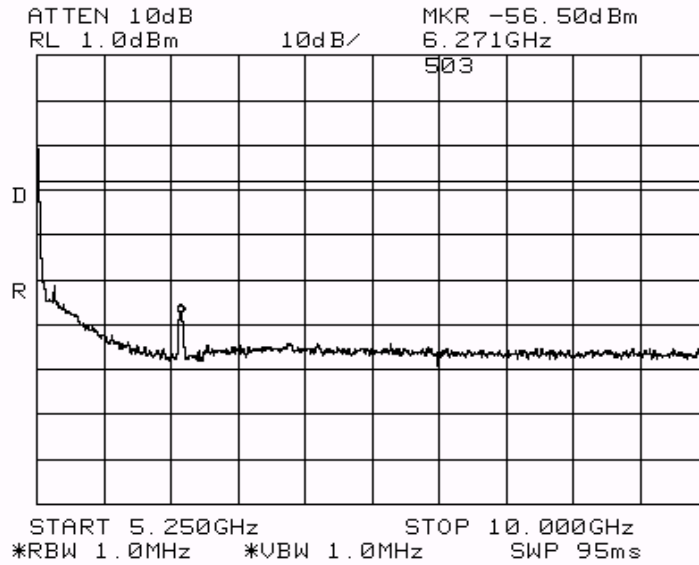
EUT operating at 5.21 GHz:





EMC Test Data

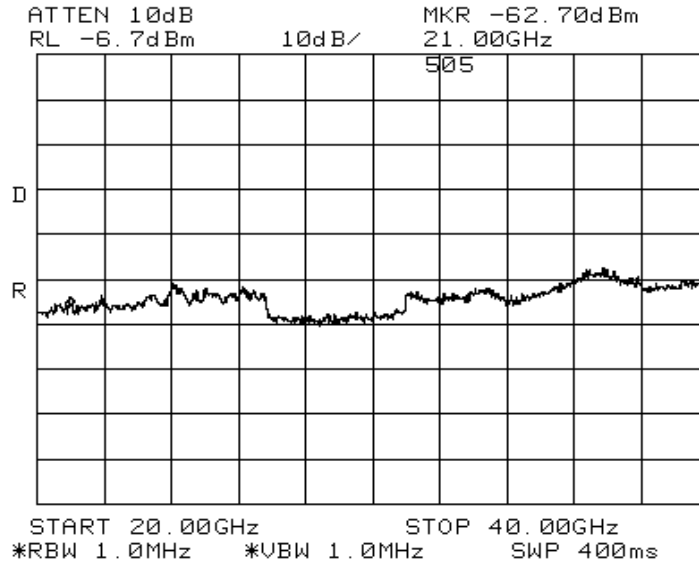
Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
Contact: Shinglin Chung	Proj Eng: Mark Briggs
Spec: FCC Part 15 B and E, RSS-210	Class: B



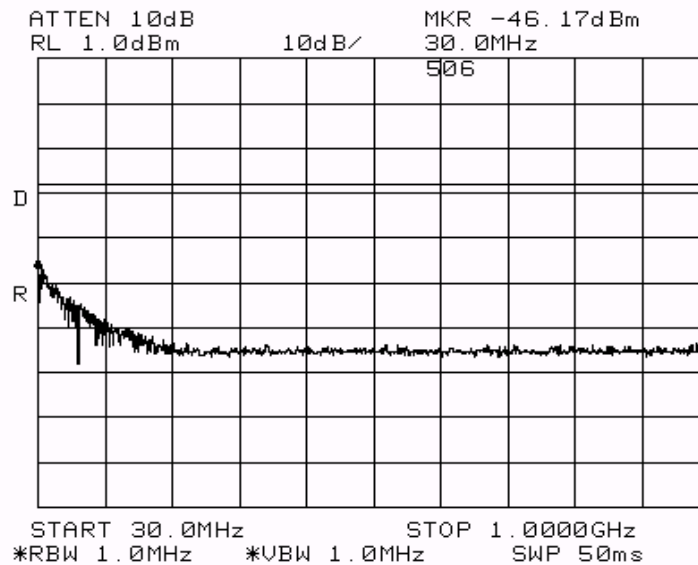


EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B



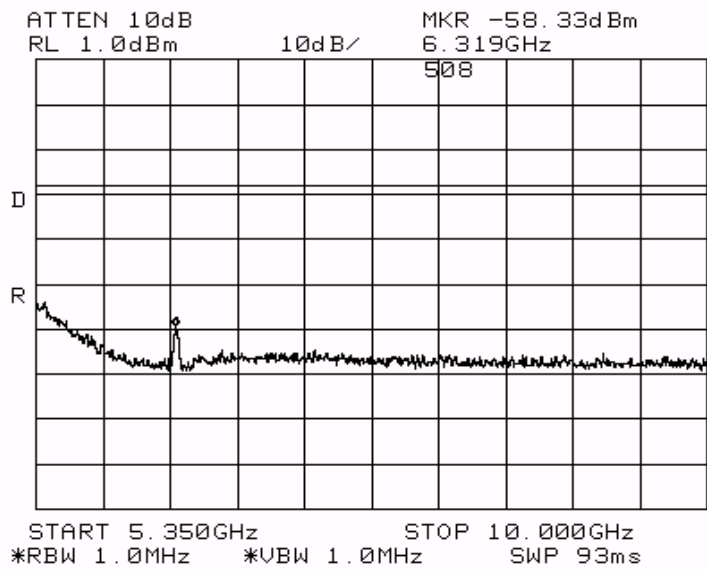
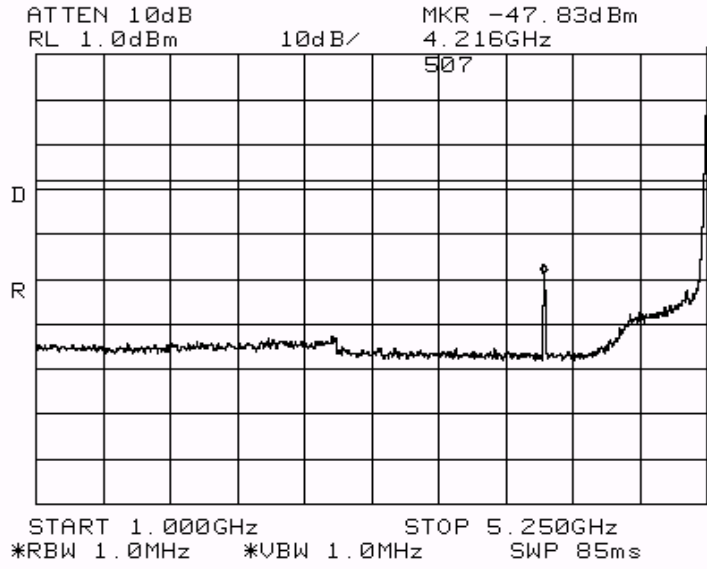
EUT operating at 5.25GHz:





EMC Test Data

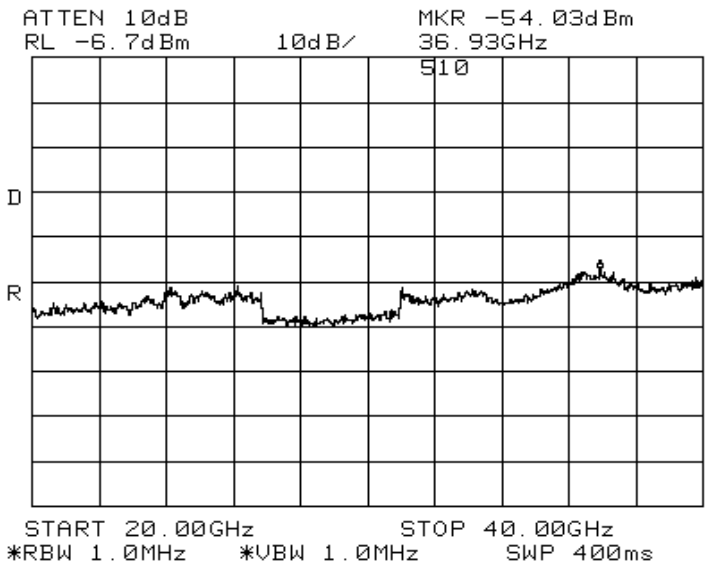
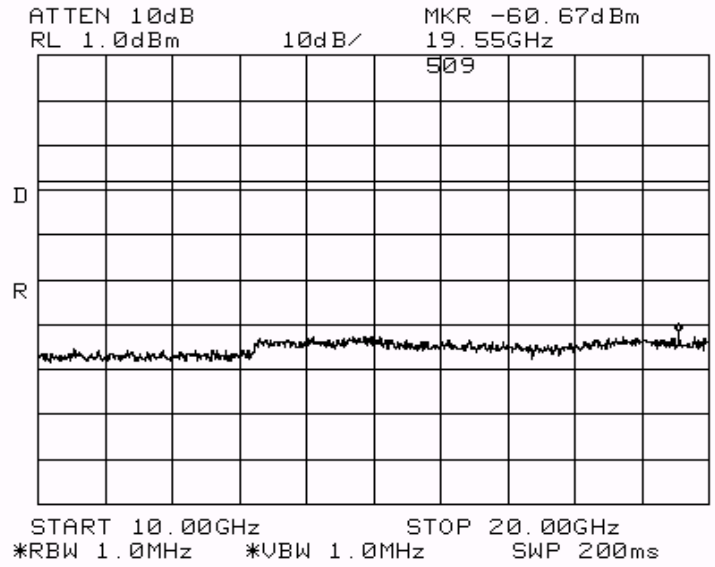
Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B





EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

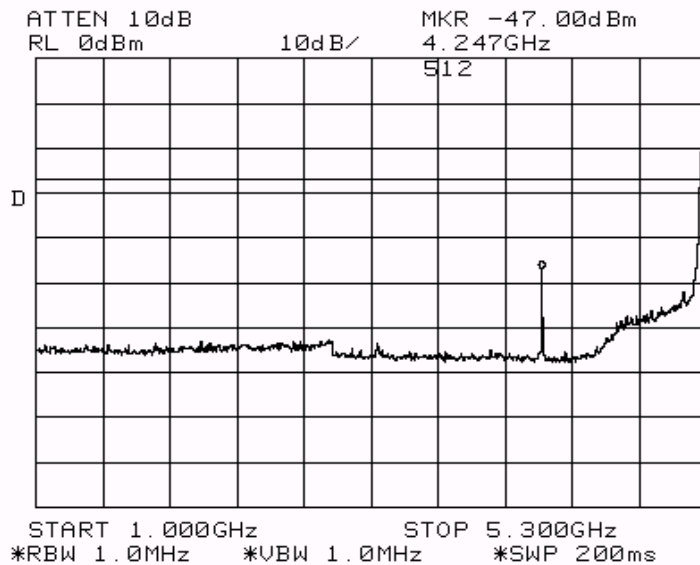
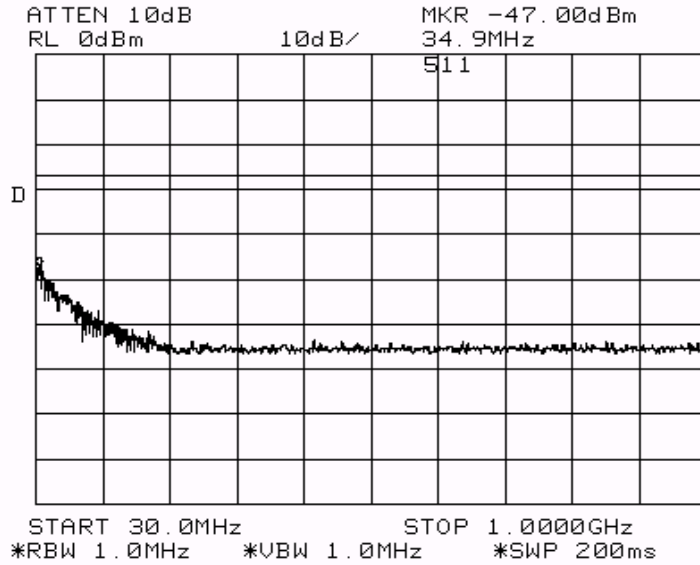




EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

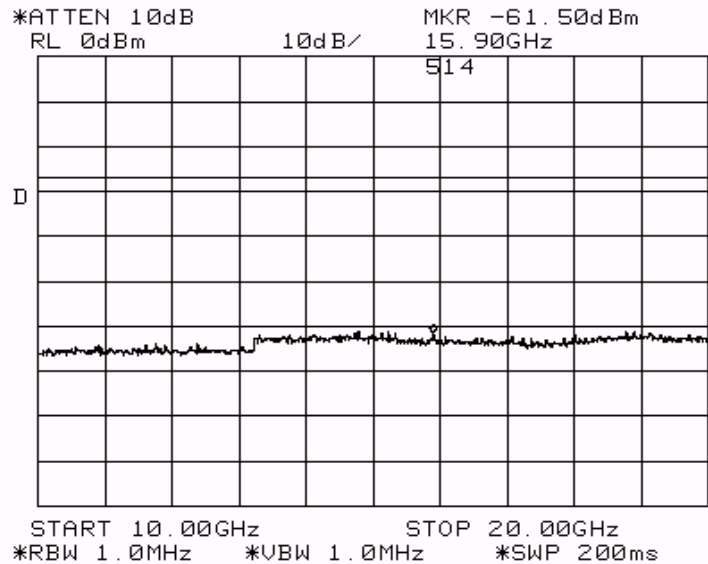
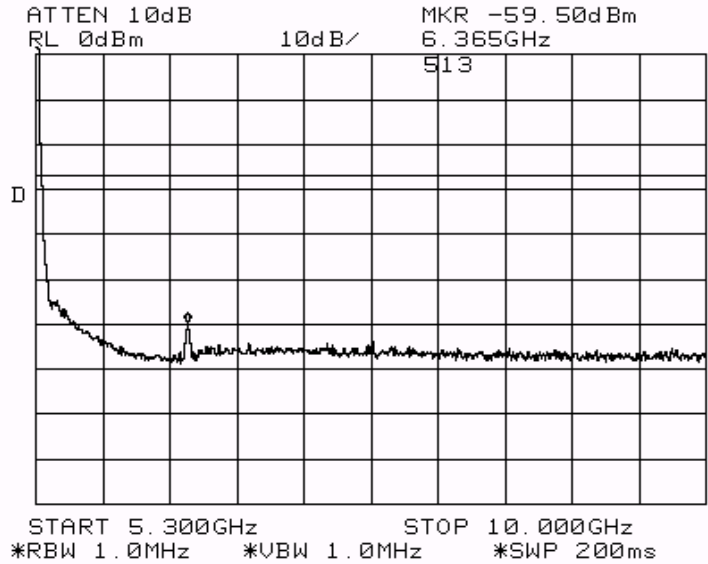
EUT operating at 5.29GHz:





EMC Test Data

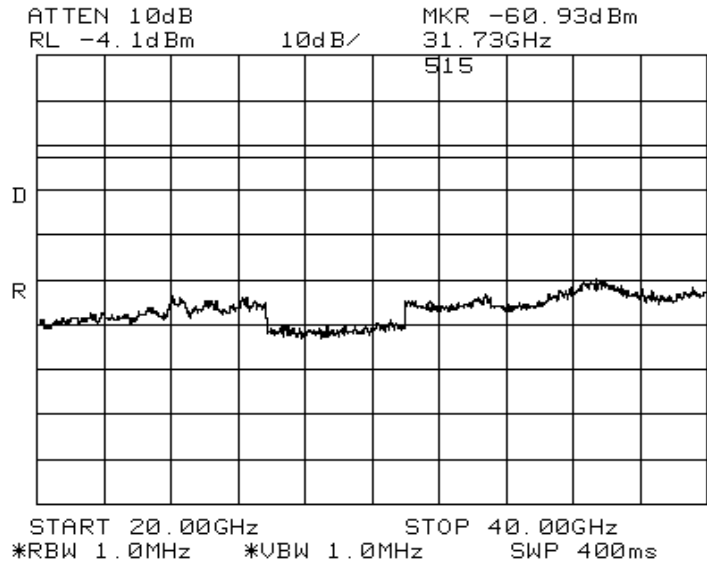
Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
Contact: Shinglin Chung	Proj Eng: Mark Briggs
Spec: FCC Part 15 B and E, RSS-210	Class: B





EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B





EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

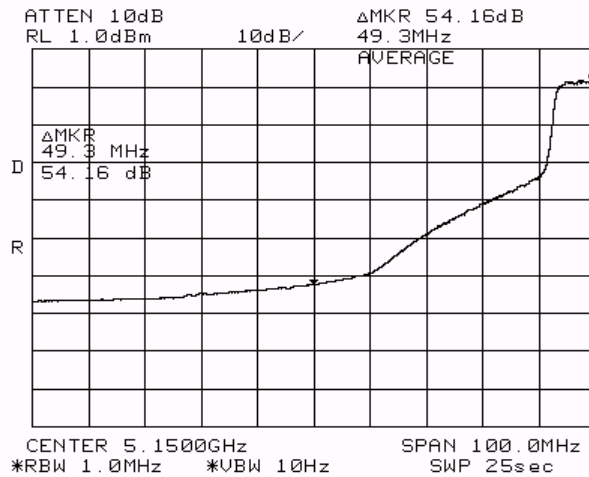
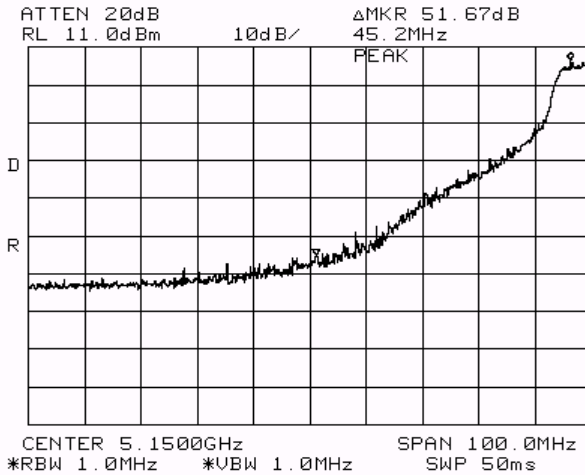
Band Edge Measurements:

For signals in the restricted bands immediately above and below the 5.15 to 5.35 GHz allocated band a measurement was made of the amplitude of the spurious emissions with respect to the intentional signals. The relative amplitude, in dBc, was then 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, PC-Dac 11

The highest signal within 60 MHz of the 5.15 GHz band was -51.67 dBc (Peak) / -54.16 dBc (Average)



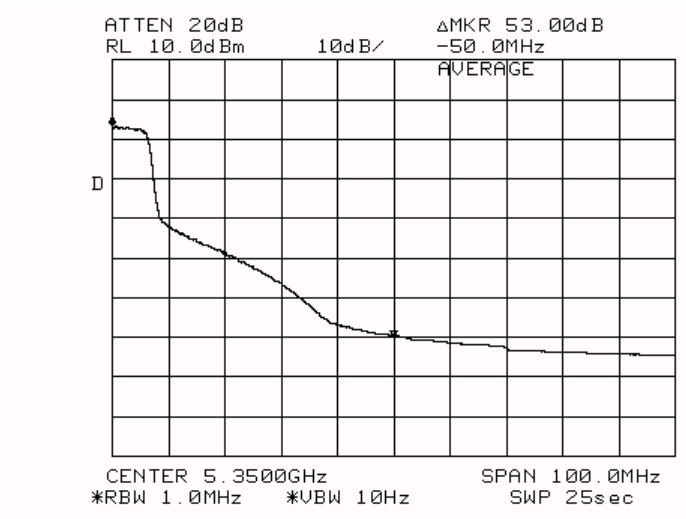
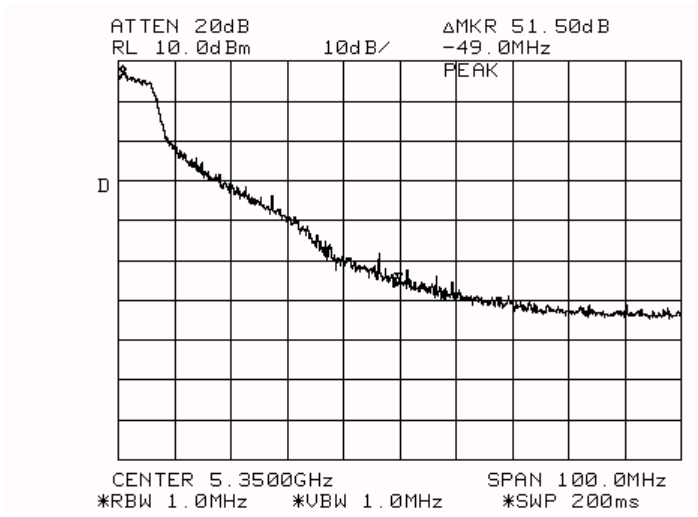


EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

5.35 GHz band edge EUT operating on highest channel:

The highest signal in the 5.35 to 5.46 GHz band was -51.5 dBc (Peak) / -53.0 dBc (Average)





EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

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

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

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

Frequency MHz	Level dB μ V/m	Pol v/h	15.209 / 15.407		Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
			Limit	Margin				
5209.325	102.0	V	74.0	28.0	Pk	181	1.5	Peak reading, peak limit
5209.015	91.9	V	54.0	37.9	Avg	181	1.5	Average reading, average limit
5209.560	90.8	H	74.0	16.8	Pk	168	1.0	Peak reading, peak limit
5209.019	81.3	H	54.0	27.3	Avg	168	1.0	Average reading, average limit
5289.425	101.0	V	74.0	27.0	Pk	189	1.3	Peak reading, peak limit
5289.129	92.9	V	54.0	38.9	Avg	189	1.3	Average reading, average limit
5289.295	94.0	H	74.0	20.0	Pk	0	0.0	Peak reading, peak limit
5289.172	84.7	H	54.0	30.7	Avg	0	0.0	Average reading, average limit

Band Edge Field Strength Calculations

Frequency MHz	Level dB μ V/m	Pol v/h	15.209 / 15.407		Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
			Limit	Margin				
5150.0	50.3	v	74.0	-23.7	Pk			Note 1
5150.0	37.7	v	54.0	-16.3	Avg			Note 1
5150.0	39.1	h	74.0	-34.9	Pk			Note 1
5150.0	27.1	h	54.0	-26.9	Avg			Note 1
5350.0	29.8	v	74.0	-44.2	Pk			Note 2
5350.0	39.9	v	54.0	-14.1	Avg			Note 2
5350.0	42.5	h	74.0	-31.5	Pk			Note 2
5350.0	31.7	h	54.0	-22.3	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 (-51.67 dBc for peak and -54.16 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 (-51.5 dBc for peak and -53 dBc for average) applied to the highest peak and average field strength measurements of the fundamental signal level.



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

**Run #6b: Radiated Spurious Emissions, 1000 - 40000 MHz
EUT On Lowest Channel Available (5.21 GHz), Atheros antenna. PC-Dac 11**

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
15630.0	52.1	v	54.0	-1.9	Avg	259	1.3	Note 2
10420.0	60.8	v	68.3	-7.5	Note 3	59	1.5	Note 4
20840.0	45.3	v	54.0	-8.7	Avg	290	1.2	Note 2
15630.0	64.0	v	74.0	-10.0	Pk	259	1.3	Note 2
4168.0	43.3	v	54.0	-10.7	Avg	230	1.1	Note 2
20840.0	42.9	h	54.0	-11.1	Avg	215	1.2	Note 2
15630.0	42.5	h	54.0	-11.5	Avg	299	1.5	Note 2
20840.0	58.8	v	74.0	-15.2	Pk	290	1.2	Note 2
20840.0	55.2	h	74.0	-18.8	Pk	215	1.2	Note 2
15630.0	54.6	h	74.0	-19.4	Pk	299	1.5	Note 2
4168.0	33.7	h	54.0	-20.3	Avg	15	1.3	Note 2
4168.0	49.9	v	74.0	-24.1	Pk	230	1.1	Note 2
10420.0	43.0	h	68.3	-25.3	Note 3	294	1.4	Note 4
4168.0	45.6	h	74.0	-28.4	Pk	15	1.3	Note 2
6252.0	36.5	h	68.3	-31.8	Note 3	300	1.0	Note 4
6252.0	36.1	v	68.3	-32.2	Note 3	0	1.2	Note 4



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

EUT On Center Channel (5.25 GHz), Atheros Antenna PC-dac 12

15750.0	53.0	v	54.0	-1.0	Avg	274	1.2	Note 2
15750.0	46.6	h	54.0	-7.4	Avg	270	1.3	Note 2
10500.0	58.8	v	68.3	-9.5	Note 3	34	1.5	Note 4
15750.0	64.3	v	74.0	-9.7	Pk	274	1.2	Note 2
4200.0	43.9	v	54.0	-10.2	Avg	350	1.4	Note 2
21000.0	43.2	v	54.0	-10.8	Avg	40	1.3	Note 2
21000.0	40.3	h	54.0	-13.7	Avg	0	1.0	Note 2
15750.0	59.4	h	74.0	-14.6	Pk	270	1.3	Note 2
21000.0	56.8	v	74.0	-17.2	Pk	40	1.3	Note 2
10500.0	50.8	h	68.3	-17.5	Note 3	331	1.4	Note 4
4200.0	34.6	h	54.0	-19.4	Avg	330	1.3	Note 2
21000.0	53.6	h	74.0	-20.4	Pk	0	1.0	Note 2
4200.0	44.1	h	74.0	-29.9	Pk	330	1.3	Note 2
6300.0	36.0	v	68.3	-32.3	Note 3	150	1.1	Note 4
6300.0	35.2	h	68.3	-33.1	Note 3	100	1.0	Note 4
4200.0	27.9	v	74.0	-46.2	Pk	350	1.4	Note 2

EUT On Highest Channel Available (5.29 GHz), Atheros antenna PC-dac 16

15870.0	51.0	v	54.0	-3.0	Avg	270	1.4	Note 2
4232.0	46.4	v	54.0	-7.7	Avg	55	1.6	Note 2
21160.0	45.8	v	54.0	-8.2	Avg	20	1.4	Note 2
10580.0	58.5	v	68.3	-9.8	Note 3	38	1.6	Note 4
15870.0	63.1	v	74.0	-11.0	Avg	270	1.4	Note 2
15870.0	42.7	h	54.0	-11.3	Avg	295	1.6	Note 2
21160.0	41.7	h	54.0	-12.3	Avg	300	1.2	Note 2
4232.0	40.4	h	54.0	-13.6	Avg	0	1.0	Note 2
21160.0	59.3	v	74.0	-14.7	Pk	20	1.4	Note 2
15870.0	54.9	h	74.0	-19.1	Pk	295	1.6	Note 2
21160.0	54.7	h	74.0	-19.3	Pk	300	1.2	Note 2
10580.0	45.7	h	68.3	-22.6	Note 3	118	1.8	Note 4
4232.0	50.0	v	74.0	-24.0	Pk	55	1.6	Note 2
4232.0	46.1	h	74.0	-27.9	Pk	0	1.0	Note 2
6348.0	37.7	v	68.3	-30.6	Note 3	320	1.2	Note 4
6348.0	37.0	h	68.3	-31.3	Note 3	350	1.1	Note 4



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

Run #7a: Radiated Spurious Emissions, 1000 - 40000 MHz

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

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

Frequency MHz	Level dB μ V/m	Pol v/h	15.209 / 15.407		Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
			Limit	Margin				
5212.804	105.2	V	74.0	31.2	Pk	142	1.4	Peak reading, peak limit
5212.648	96.1	V	54.0	42.1	Avg	142	1.4	Average reading, average limit
5197.553	92.7	H	74.0	18.7	Pk	80	1.1	Peak reading, peak limit
5198.748	84.2	H	54.0	30.2	Avg	80	1.1	Average reading, average limit
5290.578	105.9	V	74.0	31.9	Pk	213	1.6	Peak reading, peak limit
5289.215	96.7	V	54.0	42.7	Avg	213	1.6	Average reading, average limit
5290.585	87.9	H	74.0	13.9	Pk	66	1.3	Peak reading, peak limit
5289.062	79.0	H	54.0	25.0	Avg	66	1.3	Average reading, average limit

Band Edge Field Strength Calculations

Frequency MHz	Level dB μ V/m	Pol v/h	15.209 / 15.407		Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
			Limit	Margin				
5150.0	53.5	v	74.0	-20.5	Pk			Note 1
5150.0	41.9	v	54.0	-12.1	Avg			Note 1
5150.0	41.0	h	74.0	-33.0	Pk			Note 1
5150.0	30.0	h	54.0	-24.0	Avg			Note 1
5350.0	54.4	v	74.0	-19.6	Pk			Note 2
5350.0	43.7	v	54.0	-10.3	Avg			Note 2
5350.0	36.4	h	74.0	-37.6	Pk			Note 2
5350.0	26.0	h	54.0	-28.0	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 (-51.67 dBc for peak and -54.16 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 (-51.5 dBc for peak and -53 dBc for average) applied to the highest peak and average field strength measurements of the fundamental signal level.



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

Run #7b: Radiated Spurious Emissions, 1000 - 40000 MHz
EUT On Lowest Channel Available (5.21 GHz), JoyMax antenna

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
PC-Dac 11								
15630.0	52.4	v	54.0	-1.6	Avg	104	1.3	Note 2
10420.0	61.6	v	68.3	-6.7	Note 3	244	1.6	Note 4
4168.0	46.8	v	54.0	-7.2	Avg	280	1.5	Note 2
15630.0	45.3	h	54.0	-8.7	Avg	140	1.5	Note 2
20840.0	44.9	v	54.0	-9.1	Avg	35	1.4	Note 2
15630.0	64.9	v	74.0	-9.1	Pk	104	1.3	Note 2
20840.0	42.9	h	54.0	-11.1	Avg	235	1.3	Note 2
10420.0	53.3	h	68.3	-15.0	Note 3	55	1.5	Note 4
20840.0	58.7	v	74.0	-15.3	Pk	35	1.4	Note 2
15630.0	58.4	h	74.0	-15.6	Pk	140	1.5	Note 2
20840.0	56.1	h	74.0	-17.9	Pk	235	1.3	Note 2
4168.0	34.4	h	54.0	-19.6	Avg	25	1.2	Note 2
4168.0	51.3	v	74.0	-22.7	Pk	280	1.5	Note 2
4168.0	45.5	h	74.0	-28.5	Pk	25	1.2	Note 2
6252.0	36.9	v	68.3	-31.4	Note 3	15	1.0	Note 4
6252.0	36.1	h	68.3	-32.2	Note 3	300	1.0	Note 4



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

EUT On Center Channel (5.25 GHz), JoyMax Antenna

PC_Dac 12

15750.0	50.1	v	54.0	-3.9	Avg	232	1.3	Note 2
4200.0	47.0	v	54.0	-7.0	Avg	10	1.4	Note 2
15750.0	43.7	h	54.0	-10.3	Avg	125	1.4	Note 2
21000.0	42.9	v	54.0	-11.1	Avg	360	1.3	Note 2
10500.0	57.0	v	68.3	-11.3	Note 3	43	1.5	Note 4
15750.0	61.8	v	74.0	-12.2	Pk	232	1.3	Note 2
21000.0	40.8	h	54.0	-13.2	Avg	270	1.3	Note 2
15750.0	56.2	h	74.0	-17.8	Pk	125	1.4	Note 2
21000.0	56.1	v	74.0	-17.9	Pk	360	1.3	Note 2
10500.0	49.9	h	68.3	-18.4	Note 3	75	1.4	Note 4
21000.0	54.1	h	74.0	-19.9	Pk	270	1.3	Note 2
4200.0	33.6	h	54.0	-20.4	Avg	350	1.3	Note 2
4200.0	50.9	v	74.0	-23.1	Pk	10	1.4	Note 2
4200.0	44.4	h	74.0	-29.6	Pk	350	1.3	Note 2
6300.0	36.7	v	68.3	-31.6	Note 3	30	1.0	Note 4
6300.0	35.0	h	68.3	-33.3	Note 3	360	1.1	Note 4

EUT On Highest Channel Available (5.29 GHz), JoyMax antenna

PC-Dac 16

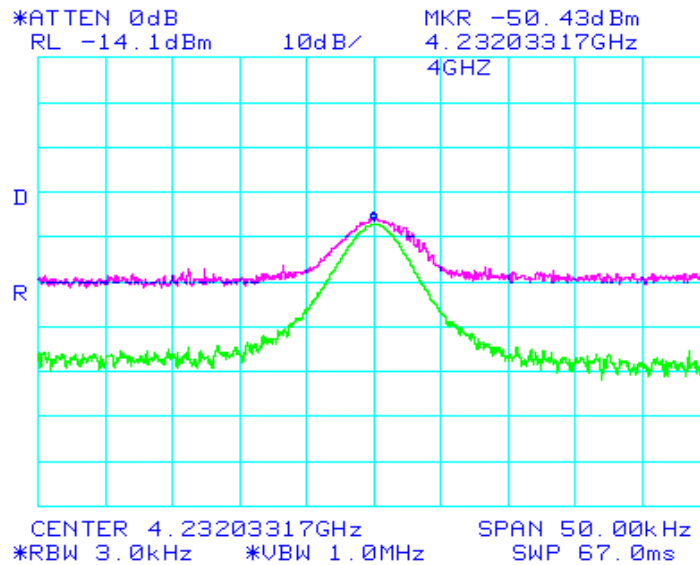
15870.0	52.0	v	54.0	-2.0	Avg	206	1.2	Note 2
4232.0	49.4	v	54.0	-4.6	Avg	10	1.4	Note 2
15870.0	64.2	v	74.0	-9.8	Avg	206	1.2	Note 2
21160.0	44.2	v	54.0	-9.8	Avg	350	1.3	Note 2
15870.0	42.5	h	54.0	-11.5	Avg	140	1.0	Note 2
10580.0	55.8	v	68.3	-12.5	Note 3	74	1.5	Note 4
21160.0	40.9	h	54.0	-13.1	Avg	50	1.2	Note 2
21160.0	57.1	v	74.0	-16.9	Pk	350	1.3	Note 2
10580.0	50.0	h	68.3	-18.3	Note 3	50	1.4	Note 4
15870.0	54.5	h	74.0	-19.5	Pk	140	1.0	Note 2
4232.0	33.6	h	54.0	-20.4	Avg	15	1.1	Note 2
21160.0	53.5	h	74.0	-20.5	Pk	50	1.2	Note 2
4232.0	53.0	v	74.0	-21.0	Pk	10	1.4	Note 2
4232.0	44.7	h	74.0	-29.3	Pk	15	1.1	Note 2
6348.0	36.2	v	68.3	-32.1	Note 3	325	1.4	Note 4
6348.0	35.9	h	68.3	-32.4	Note 3	10	1.2	Note 4

See following page for test notes...

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

...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. All other measurements, RBW = 1MHz and VBW = 3MHz, video averaging on (100 samples).
Note 4:	Signal does not fall in a restricted band.
Note 5:	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 trasmitted signal but pass the spuroius 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.



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

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:	12/19 & 12/20/2001	Config. Used:	#2
Test Engineer:	Mark Briggs/Rafael	Config Change:	N/A
Test Location:	SVOATS #4	Host Unit Voltage:	120V/60Hz

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: 8.9°C
Rel. Humidity: 89%

Summary of Results

Run #	Test Performed	Limit	Result	Comments
1	Output Power	15.407(a) (1), (2)	Pass	11.5dBm@5180MHz, 12.3dBm@5260MHz
2	Power Spectral Density (PSD)	15.407(a) (1), (2)	Pass	-2dBm@5180MHz, 1.8dBm@5260MHz
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 & 7	RE, 1000 - 40000 MHz - Spurious Emissions	15.407(b)(6)	Pass	Refer to individual



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

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: 4 dBi (Used the highest gain antenna)

PCDAC	Frequency (MHz)	Output Power	FCC Limit (dBm) (note 3)	Comments
6	5180	11.0	17.0	Note 1
	5180	11.5	17.0	Note 2
12	5260	12.3	24.0	Note 1
	5260	12.3	24.0	Note 2
9	5320	10.4	24.0	Note 1
	5320	10.3	24.0	Note 2

Note 1:	Measured using spectrum analyzer's power measurement function (RBW = 1MHz, VBW = 30kHz)
Note 2:	Measured using a power meter with a thermal sensor head.
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.



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
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	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

Run #2: Power Spectral Density

Antenna Gain: 4 dBi (Used the highest gain antenna)

PCDAC	Frequency (MHz)	Power Spectral Density (dBm/MHz)	FCC Limit (dBm) note 2	Graph Reference	
6	5180	-2.0	4.0	201	Note 1
12	5260	1.8	11.0	202	Note 1
9	5320	-0.8	11.0	203	Note 1

Note 1: The above measurements were made using RBW = 1MHz, VBW = 3MHz, 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). The peak PSD of 10.9 **dBm** did not exceed the maximum permitted average PSD of 10dBm (5.15 to 5.25 GHz band) or 11dBm (5.25-5.35GHz band) so no restriction is placed on the output power or average PSD with respect to RSS 210.

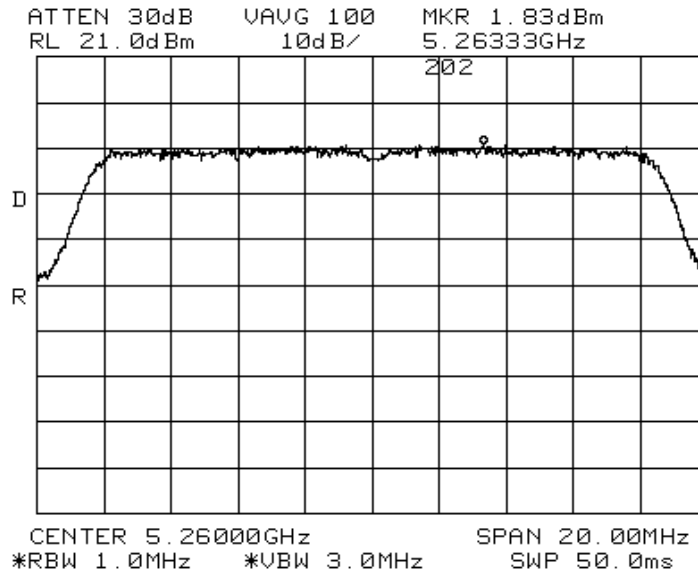
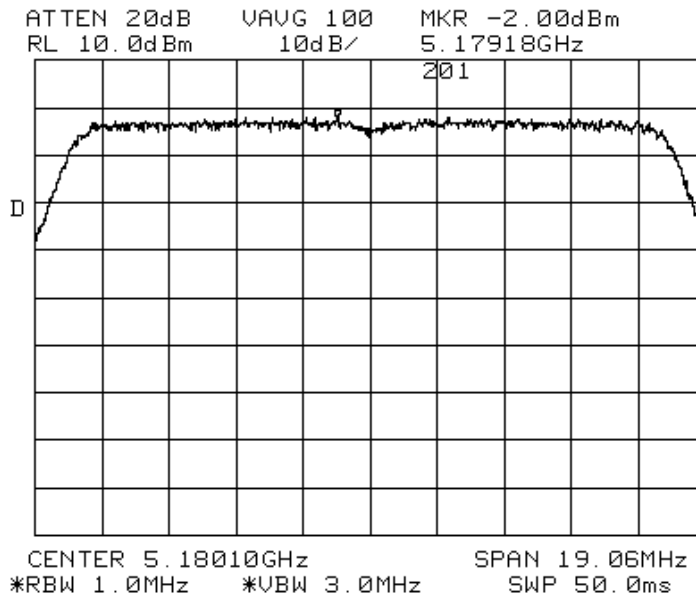
Note 2: RSS 210 limit is 10dBm/MHz in the 5.15 to 5.25 GHz band, 6dB higher than the FCC limit.



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

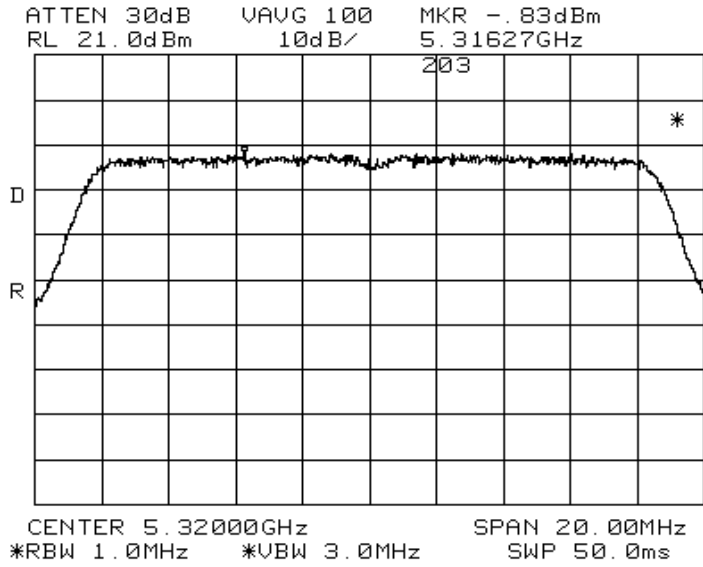
Plots Showing Power Spectral Density (RBW = 1MHz, VBW = 3 MHz, video averaging ON)





EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B





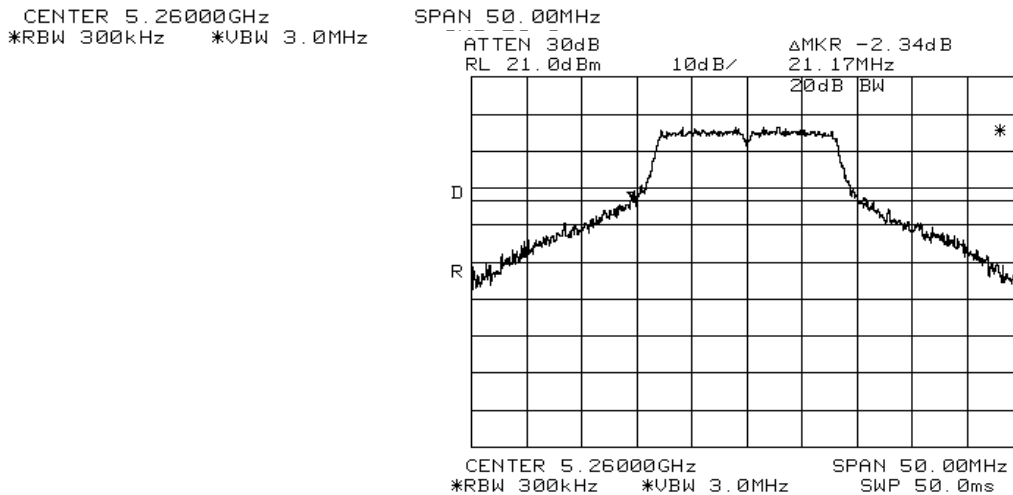
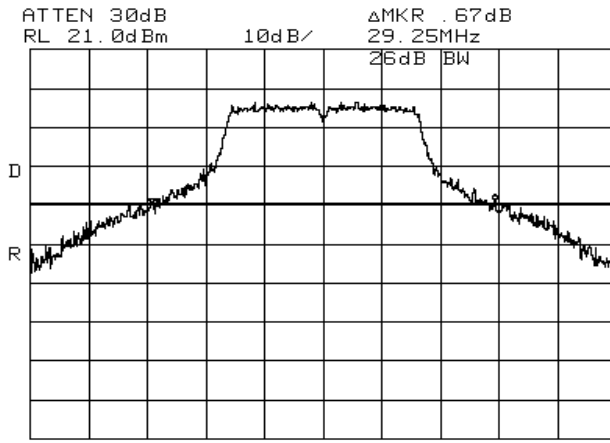
EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

Run #3: Signal Bandwidth

PCDAC	Frequency (MHz)	Resolution Bandwidth	26 dB Signal Bandwidth (MHz)	20 dB Signal Bandwidth (MHz)	
6		300 kHz			Measured the highest power channel only.
12	5260	300 kHz	29.25 MHz	21.17 MHz	
9		300 kHz			

Plots Showing Signal Bandwidth





EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

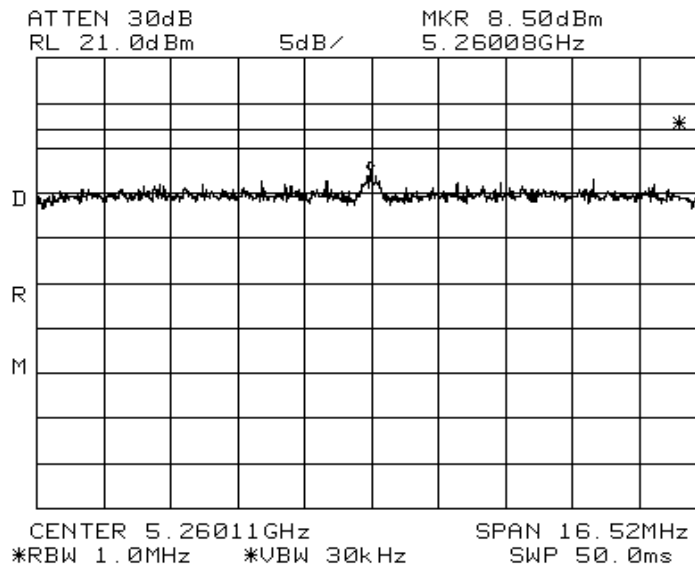
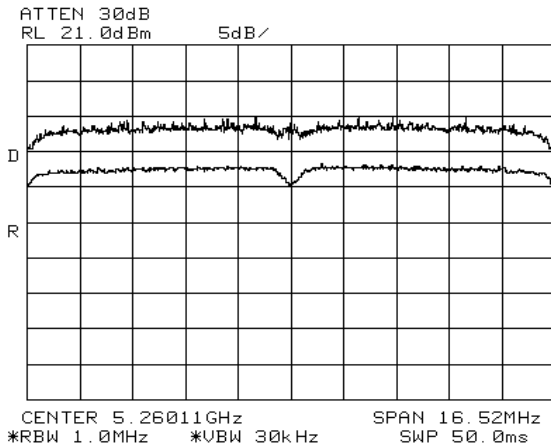
Run #4: Peak Excursion Measurement

Plots Showing Peak Excursion

Trace A: RBW = VBW = 1MHz

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

5.26 GHz: Peak Excursion = 8.5dB. Peak power spectral density (RSS210 only) = 10.92dBm.





EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

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

The antenna gain of the radios integral antenna is 4 dBi. The EIRP limit is -27dBm/MHz for all out of band signals that do not fall in restricted bands. A limit of -31 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 4 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		30 - 1000 MHz	Note 4	501
		1 to 5.15 GHz		502
		5.25 to 10 GHz		503
		10 GHz to 20 GHz		504
		20 GHz to 40 GHz	-62dBm @ 36 GHz	505
Mid		30 - 1000 MHz	Note 4	510
		1 to 5.25 GHz	-45.5dBm @ 4.208GHz	511
		5.35 to 10 GHz	-57.7dBm @ 6.3GHz	512
		10 GHz to 20 GHz	-55.8dBm @ 15.7GHz	513
		20 GHz to 40 GHz		514
High		30 - 1000 MHz	Note 4	520
		1 to 5.725 GHz		521
		5.825 to 10 GHz		522
		10 GHz to 20 GHz		523
		20 GHz to 40 GHz		524

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

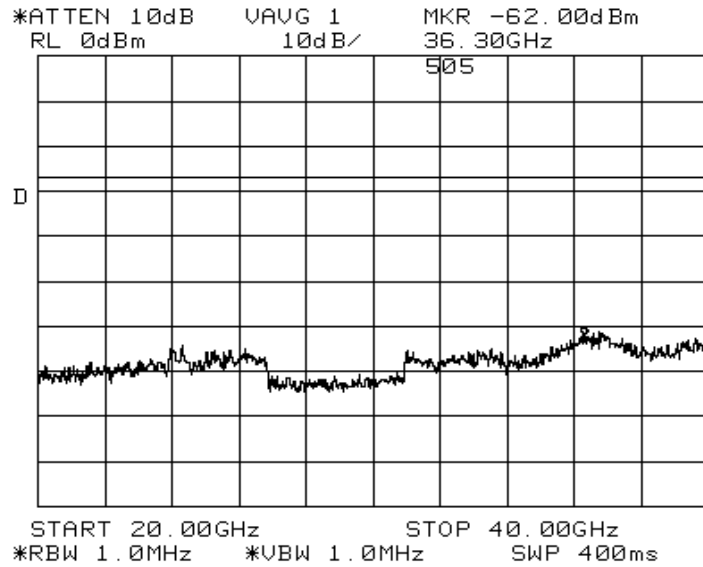


EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

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

EUT operating at 5.18GHz:

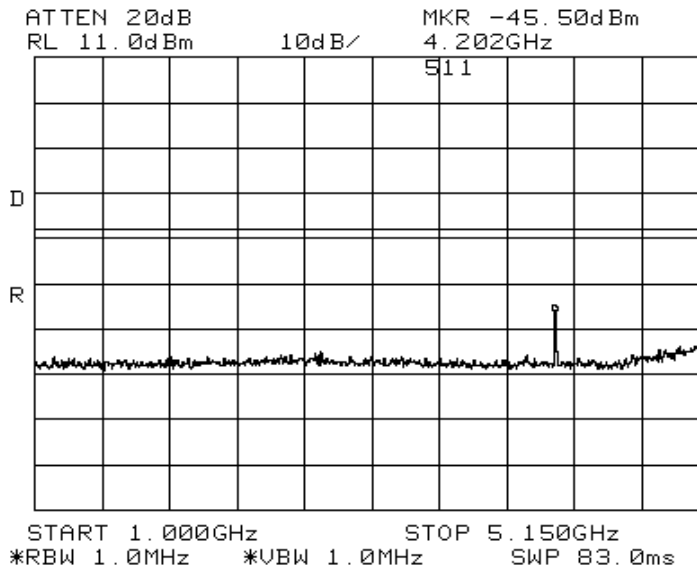
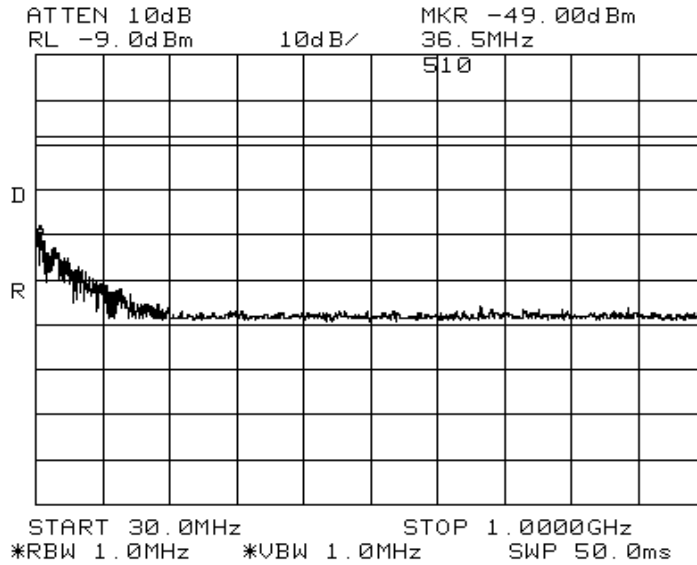




EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

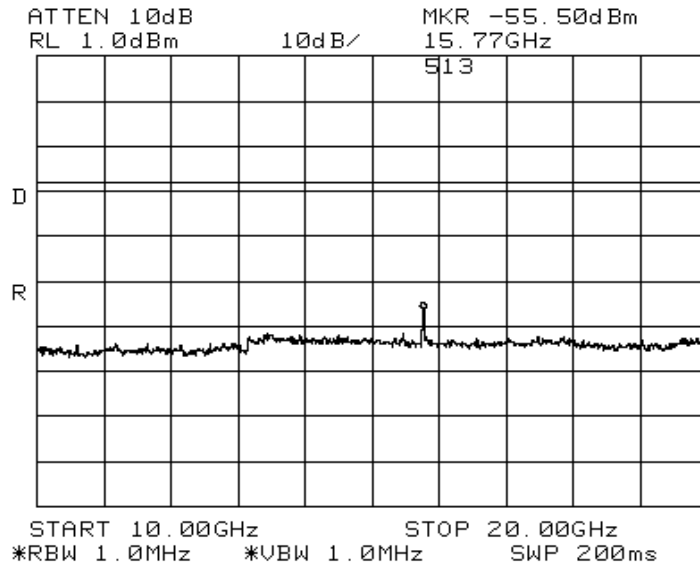
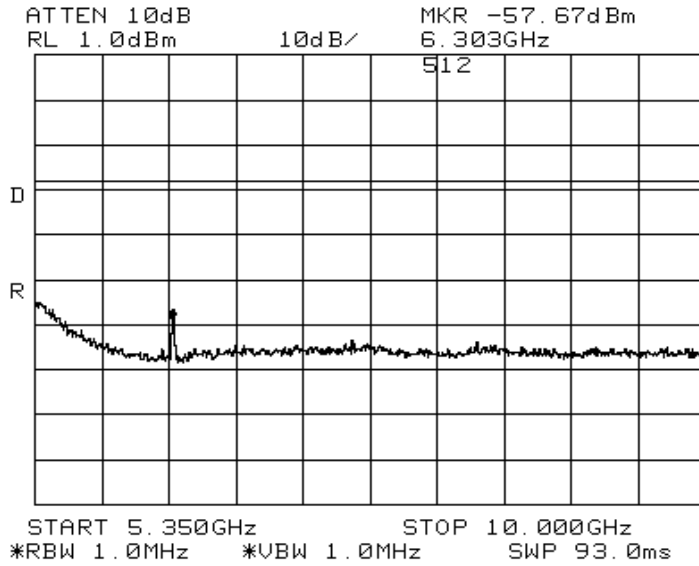
EUT at 5.26GHz





EMC Test Data

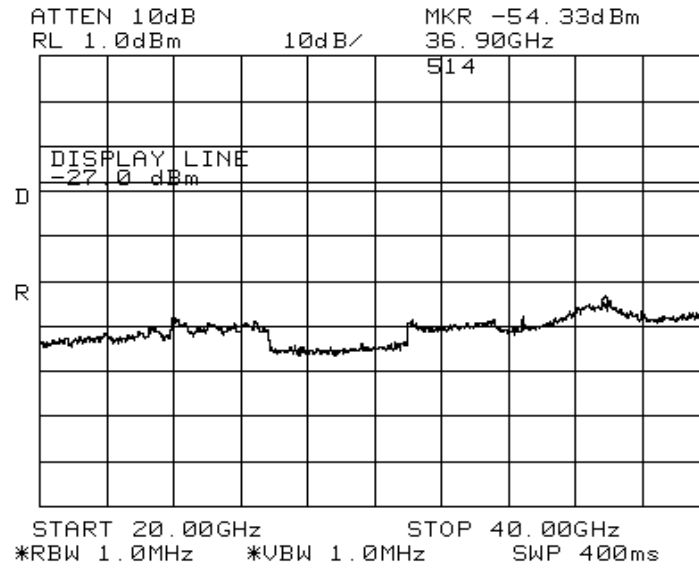
Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
Contact: Shinglin Chung	Proj Eng: Mark Briggs
Spec: FCC Part 15 B and E, RSS-210	Class: B



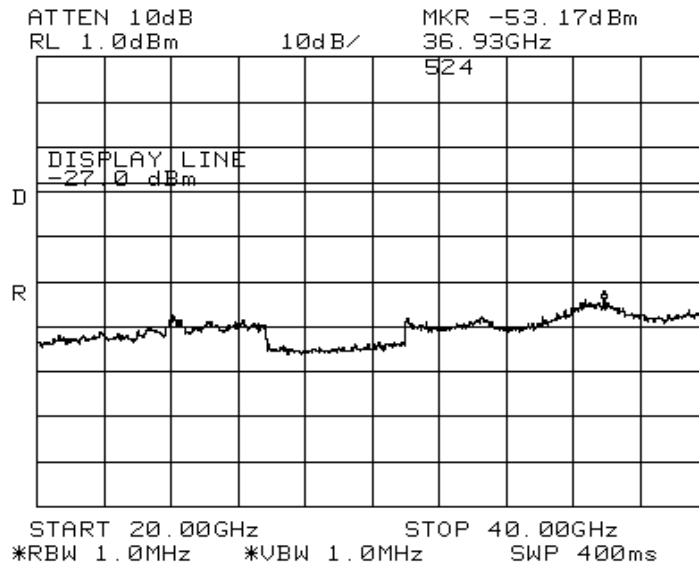


EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B



EUT at 5.32 GHz





EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
Contact: Shinglin Chung	Proj Eng: Mark Briggs
Spec: FCC Part 15 B and E, RSS-210	Class: B

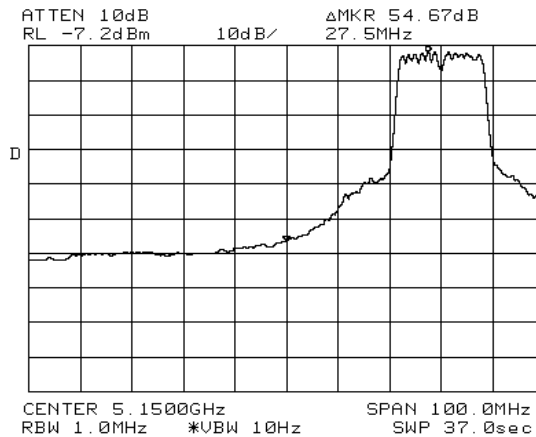
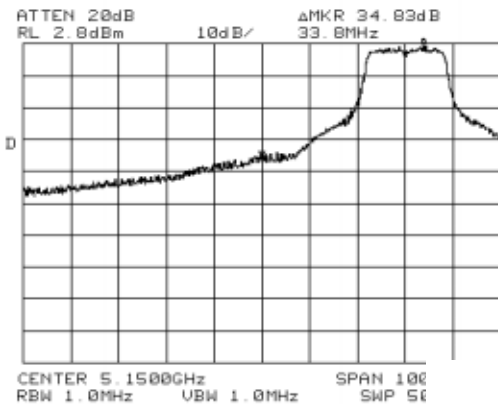
Band Edge Measurements:

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

The highest signal within 50 MHz of the 5.15 GHz band was -34.83 dBc (Peak) / -54.67 dBc (Average)

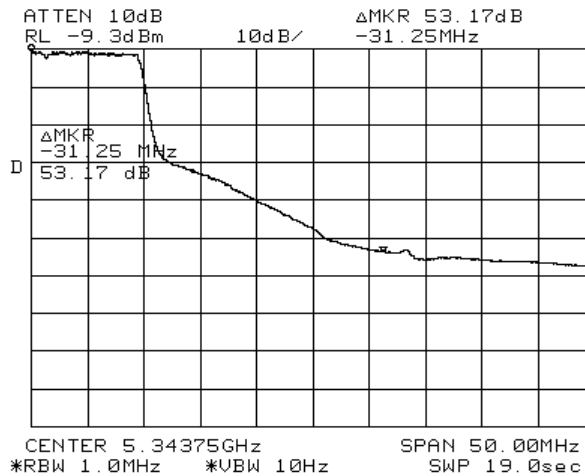
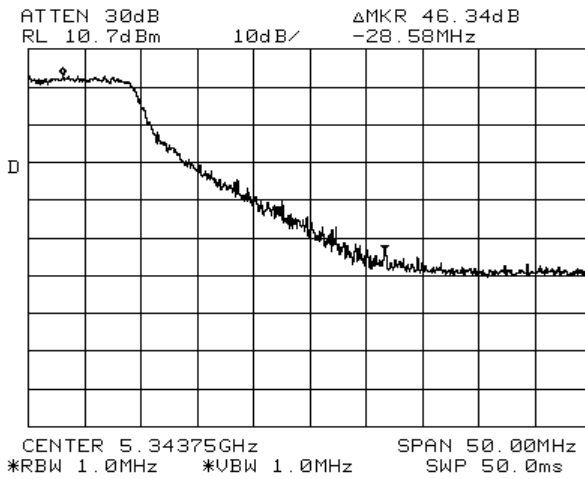




EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

5.35 GHz band edge EUT operating on channel 17 (highest channel):
The highest signal in the 5.35 to 5.46 GHz band was -46.34 dBc (Peak) / -53.17 dBc (Average)





EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

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

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

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

Frequency MHz	Level dB μ V/m	Pol v/h	15.209 / 15.407		Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
			Limit	Margin				
5180.290	107.2	V	74.0	33.2	Pk	0	0.0	Peak reading, peak limit
5181.066	98.3	V	54.0	44.3	Avg	0	0.0	Average reading, average limit
5183.567	98.6	H	74.0	24.6	Pk	0	0.0	Peak reading, peak limit
5182.417	88.9	H	54.0	34.9	Avg	0	0.0	Average reading, average limit
5319.910	105.3	V	74.0	31.3	Pk	0	0.0	Peak reading, peak limit
5319.234	96.3	V	54.0	42.3	Avg	0	0.0	Average reading, average limit
5319.295	94.8	H	74.0	20.8	Pk	0	0.0	Peak reading, peak limit
5319.066	85.9	H	54.0	31.9	Avg	0	0.0	Average reading, average limit

Band Edge Field Strength Calculations

Frequency MHz	Level dB μ V/m	Pol v/h	15.209 / 15.407		Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
			Limit	Margin				
5150.0	72.4	v	74.0	-1.6	Pk			Note 1
5150.0	43.6	v	54.0	-10.4	Avg			Note 1
5150.0	63.8	h	74.0	-10.2	Pk			Note 1
5150.0	34.2	h	54.0	-19.8	Avg			Note 1
5350.0	59.0	v	74.0	-15.0	Pk			Note 2
5350.0	43.1	v	54.0	-10.9	Avg			Note 2
5350.0	48.5	h	74.0	-25.5	Pk			Note 2
5350.0	32.7	h	54.0	-21.3	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 (-34.83 dBc for peak and -54.67 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 (-46.34 dBc for peak and -53.17 dBc for average) applied to the highest peak and average field strength measurements of the fundamental signal level.



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

Run #6b: Radiated Spurious Emissions, 1000 - 40000 MHz
EUT On Lowest Channel Available (5.18 GHz), Atheros antenna
pc_DAC 6

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
15540.0	49.0	v	54.0	-5.0	Avg	285	1.3	Note 2
4144.0	47.2	v	54.0	-6.8	Avg	100	1.6	Note 2
15540.0	65.0	v	74.0	-9.0	Pk	285	1.3	Note 2
15540.0	43.5	h	54.0	-10.5	Avg	0	1.1	Note 2
4144.0	42.1	h	54.0	-11.9	Avg	180	1.8	Note 2
25900.0	41.3	v	54.0	-12.7	Avg	320	1.2	Note 2
25900.0	40.7	h	54.0	-13.3	Avg	80	1.2	Note 2
20720.0	40.5	v	54.0	-13.5	Avg	50	1.2	Note 2
20720.0	39.9	h	54.0	-14.1	Avg	360	1.3	Note 2
10360.0	53.2	v	68.3	-15.1	Note 3	270	1.6	Note 4
15540.0	57.8	h	74.0	-16.2	Pk	0	1.1	Note 2
20720.0	57.1	v	74.0	-16.9	Pk	50	1.2	Note 2
25900.0	56.7	v	74.0	-17.3	Pk	320	1.2	Note 2
20720.0	54.6	h	74.0	-19.4	Pk	360	1.3	Note 2
25900.0	54.2	h	74.0	-19.8	Pk	80	1.2	Note 2
10360.0	45.7	h	68.3	-22.6	Note 3	10	2.0	Note 4
4144.0	50.0	v	74.0	-24.0	Pk	100	1.6	Note 2
4144.0	47.3	h	74.0	-26.7	Pk	180	1.8	Note 2
6216.0	40.3	v	68.3	-28.0	Note 3	15	1.1	Note 4
6216.0	38.6	h	68.3	-29.7	Note 3	150	1.0	Note 4



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

EUT On Center Channel (5.26 GHz), Atheros Antenna

pc_DAC 12

Frequency MHz	Level dB μ V/m	Pol v/h	15.209 / 15.407		Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
			Limit	Margin				
15780.0	51.2	v	54.0	-2.8	Avg	250	1.3	Note 2
4208.0	49.4	v	54.0	-4.6	Avg	100	1.8	Note 2
15780.0	66.4	v	74.0	-7.6	Pk	250	1.3	Note 2
15780.0	45.6	h	54.0	-8.4	Avg	315	1.4	Note 2
4208.0	44.9	h	54.0	-9.1	Avg	150	1.8	Note 2
21040.0	43.9	v	54.0	-10.1	Avg	300	1.0	Note 2
31560.0	43.6	v	54.0	-10.4	Avg	130	1.2	Note 2
10520.0	57.8	v	68.3	-10.5	Note 3	300	1.5	Note 4
26300.0	42.6	v	54.0	-11.4	Avg	310	1.2	Note 2
10520.0	56.3	h	68.3	-12.0	Note 3	360	1.4	Note 4
21040.0	61.6	v	74.0	-12.4	Pk	300	1.0	Note 2
21040.0	40.8	h	54.0	-13.2	Avg	0	1.3	Note 2
26300.0	40.8	h	54.0	-13.2	Avg	0	1.1	Note 2
15780.0	59.7	h	74.0	-14.3	Pk	315	1.4	Note 2
26300.0	58.3	v	74.0	-15.7	Pk	310	1.2	Note 2
31560.0	57.4	v	74.0	-16.6	Pk	130	1.2	Note 2
21040.0	55.9	h	74.0	-18.1	Pk	0	1.3	Note 2
4208.0	54.0	v	74.0	-20.0	Pk	100	1.8	Note 2
26300.0	54.0	h	74.0	-20.0	Pk	0	1.1	Note 2
4208.0	50.2	h	74.0	-23.8	Pk	150	1.8	Note 2
6312.0	42.3	v	68.3	-26.0	Note 3	360	1.2	Note 4
6312.0	40.1	h	68.3	-28.2	Note 3	0	1.2	Note 4



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

EUT On Highest Channel Available (5.32 GHz), Atheros antenna

pc_DAC 9								
Frequency	Level	Pol	15.209	15.407	Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
10640.0	50.7	v	54.0	-3.3	Avg	185	1.5	Note 2
10640.0	68.7	v	74.0	-5.3	Pk	185	1.5	Note 2
15960.0	46.5	v	54.0	-7.5	Avg	295	1.2	Note 2
10640.0	46.2	h	54.0	-7.8	Avg	120	1.8	Note 2
15960.0	62.9	v	74.0	-11.1	Pk	295	1.2	Note 2
15960.0	42.8	h	54.0	-11.2	Avg	315	1.9	Note 2
10640.0	61.5	h	74.0	-12.5	Pk	120	1.8	Note 2
21280.0	39.9	v	54.0	-14.1	Avg	20	1.3	Note 2
21280.0	39.4	h	54.0	-14.6	Avg	350	1.1	Note 2
15960.0	57.8	h	74.0	-16.2	Pk	315	1.9	Note 2
4256.0	33.8	v	54.0	-20.2	Avg	160	1.8	Note 2
21280.0	53.0	h	74.0	-21.0	Pk	350	1.1	Note 2
21280.0	52.3	v	74.0	-21.7	Pk	20	1.3	Note 2
4256.0	23.8	h	54.0	-30.2	Avg	0	1.2	Note 2
4256.0	38.3	v	74.0	-35.7	Pk	160	1.8	Note 2
6384.0	31.9	v	68.3	-36.4	Note 3	0	1.0	Note 4
4256.0	34.8	h	74.0	-39.2	Pk	0	1.2	Note 2
6384.0	26.9	h	68.3	-41.4	Note 3	0	1.2	Note 4



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

Run #7a: Radiated Spurious Emissions, 1000 - 40000 MHz, JoyMax Antenna

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

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

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5185.981	106.6	V	74.0	32.6	Pk	0	0.0	Peak reading, peak limit
5184.972	97.5	V	54.0	43.5	Avg	0	0.0	Average reading, average limit
5183.214	91.1	H	74.0	17.1	Pk	0	0.0	Peak reading, peak limit
5182.102	80.5	H	54.0	26.5	Avg	0	0.0	Average reading, average limit
5323.109	106.6	V	74.0	32.6	Pk	0	0.0	Peak reading, peak limit
5322.305	97.1	V	54.0	43.1	Avg	0	0.0	Average reading, average limit
5322.307	93.0	H	74.0	19.0	Pk	262	1.4	Peak reading, peak limit
5322.190	83.4	H	54.0	29.4	Avg	262	1.4	Average reading, average limit

Band Edge Field Strength Calculations

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5150.0	71.8	v	74.0	-2.2	Pk			Note 1
5150.0	42.8	v	54.0	-11.2	Avg			Note 1
5150.0	56.3	h	74.0	-17.7	Pk			Note 1
5150.0	26.5	h	54.0	-27.5	Avg			Note 1
5350.0	60.4	v	74.0	-13.6	Pk			Note 2
5350.0	43.9	v	54.0	-10.1	Avg			Note 2
5350.0	46.8	h	74.0	-27.2	Pk			Note 2
5350.0	30.2	h	54.0	-23.8	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 (-34.83 dBc for peak and -54 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 (-46.34 dBc for peak and -53.17 dBc for average) applied to the highest peak and average field strength measurements of the fundamental signal level.



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

**Run #7b: Radiated Spurious Emissions, 1000 - 40000 MHz
EUT On Lowest Channel Available (5.18 GHz), JoyMax Antenna**

PC-dac 6								
Frequency	Level	Pol	15.209	15.407	Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
15540.0	53.6	v	54.0	-0.4	Avg	275	1.3	Note 2
10360.0	62.0	v	68.3	-6.3	Note 3	74	1.5	Note 4
15540.0	46.7	h	54.0	-7.3	Avg	65	1.4	Note 2
15540.0	66.2	v	74.0	-7.8	Pk	275	1.3	Note 2
20720.0	44.1	v	54.0	-9.9	Avg	290	1.2	Note 2
20720.0	42.7	h	54.0	-11.3	Avg	320	1.3	Note 2
4144.0	41.3	v	54.0	-12.7	Avg	240	1.5	Note 2
20720.0	60.9	v	74.0	-13.1	Pk	290	1.2	Note 2
15540.0	59.3	h	74.0	-14.7	Pk	65	1.4	Note 2
10360.0	52.2	h	68.3	-16.1	Note 3	340	1.3	Note 4
20720.0	56.6	h	74.0	-17.4	Pk	320	1.3	Note 2
4144.0	33.0	h	54.0	-21.0	Avg	50	1.1	Note 2
4144.0	48.1	v	74.0	-25.9	Pk	240	1.5	Note 2
4144.0	44.6	h	74.0	-29.4	Pk	50	1.1	Note 2
6216.0	36.9	h	68.3	-31.4	Note 3	35	1.2	Note 4
6216.0	36.2	v	68.3	-32.1	Note 3	320	1.4	Note 4



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

**EUT On Center Channel (5.26 GHz), Atheros Antenna, JoyMax Antenna
PC_Dac 12**

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
15780.0	53.0	v	54.0	-1.0	Avg	279	1.2	Note 2
4208.0	49.5	v	54.0	-4.5	Avg	20	1.2	Note 2
15780.0	48.1	h	54.0	-5.9	Avg	261	1.3	Note 2
15780.0	67.3	v	74.0	-6.7	Pk	279	1.2	Note 2
21040.0	44.5	v	54.0	-9.5	Avg	50	1.3	Note 2
10520.0	58.2	v	68.3	-10.1	Note 3	312	1.5	Note 4
21040.0	61.1	v	74.0	-12.9	Pk	50	1.3	Note 2
15780.0	60.9	h	74.0	-13.1	Pk	261	1.3	Note 2
21040.0	40.4	h	54.0	-13.6	Avg	350	1.1	Note 2
4208.0	37.3	h	54.0	-16.7	Avg	65	1.6	Note 2
10520.0	51.3	h	68.3	-17.0	Note 3	90	1.3	Note 4
4208.0	53.4	v	74.0	-20.6	Pk	20	1.2	Note 2
21040.0	53.2	h	74.0	-20.8	Pk	350	1.1	Note 2
4208.0	45.9	h	74.0	-28.1	Pk	65	1.6	Note 2
6312.0	36.9	v	68.3	-31.4	Note 3	15	1.0	Note 4
6312.0	36.3	h	68.3	-32.0	Note 3	50	1.0	Note 4



EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

EUT On Highest Channel Available (5.32 GHz), JoyMax Antenna

Frequency	Level	Pol	15.209 / 15.407		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
PC-dac 9								
10640.0	51.5	v	54.0	-2.5	Avg	134	1.5	Note 2
10640.0	68.0	v	74.0	-6.0	Pk	134	1.5	Note 2
4256.0	47.7	v	54.0	-6.3	Avg	15	1.2	Note 2
10640.0	46.2	h	54.0	-7.8	Avg	120	1.8	Note 2
15960.0	45.1	v	54.0	-8.9	Avg	320	1.3	Note 2
15960.0	42.8	h	54.0	-11.2	Avg	315	1.9	Note 2
10640.0	61.5	h	74.0	-12.5	Pk	120	1.8	Note 2
21280.0	40.6	v	54.0	-13.4	Avg	10	1.2	Note 2
21280.0	40.4	h	54.0	-13.6	Avg	360	1.0	Note 2
15960.0	60.3	v	74.0	-13.7	Pk	320	1.3	Note 2
15960.0	57.8	h	74.0	-16.2	Pk	315	1.9	Note 2
21280.0	54.4	v	74.0	-19.6	Pk	10	1.2	Note 2
4256.0	34.2	h	54.0	-19.8	Avg	50	1.4	Note 2
21280.0	53.2	h	74.0	-20.8	Pk	360	1.0	Note 2
4256.0	51.0	v	74.0	-23.0	Pk	15	1.2	Note 2
4256.0	44.2	h	74.0	-29.8	Pk	50	1.4	Note 2
6384.0	36.5	v	68.3	-31.8	Note 3	350	1.1	Note 4
6384.0	36.3	h	68.3	-32.0	Note 3	10	1.1	Note 4

See following page for test notes...

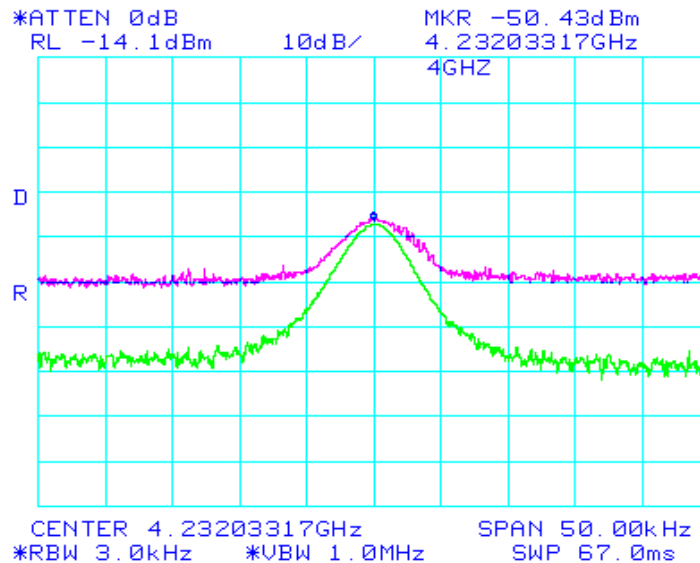


EMC Test Data

Client: D-Link Corporation	Job Number: J45656
Model: DW-290 (MINI PCI Module)	T-Log Number: T45752
	Proj Eng: Mark Briggs
Contact: Shinglin Chung	
Spec: FCC Part 15 B and E, RSS-210	Class: B

...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. All other measurements, RBW = 1MHz and VBW = 3MHz, video averaging on (100 samples).
Note 4:	Signal does not fall in a restricted band.
Note 5:	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 trasmitted signal but pass the spurois 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.