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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to FCC Part 15, Subpart E (UNII Devices) and Industry Canada RSS 210 Issue 4 (LELEAN Devices) on the Netgear Model: HA311

FCC ID:	PY3HA311
GRANTEE:	Netgear 4500 Great America Parkway Santa Clara, CA. 95054
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	April 18, 2002
FINAL TEST DATE:	April 8 and April 9, 2002

AUTHORIZED SIGNATORY: Mark Briggs

Mark Briggs
Director of Engineering

DECLARATIONS OF COMPLIANCE

Equipment Name and Model:
HA311

Manufacturer:
Netgear
4500 Great America Parkway
Santa Clara, CA. 95054

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 **SV1** 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	Mark Briggs
Title	Director of Engineering
Company	Elliott Laboratories Inc.
Address	684 W. Maude Ave Sunnyvale, CA 94086 USA
Date:	April 18, 2002

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 Netgear model HA311 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 Netgear model HA311 and therefore apply only to the tested sample. The sample was selected and prepared by Stephen Tsai of Netgear

OBJECTIVE

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

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

SUMMARY OF RESULTS

FCC Part 15 Section	RSS 210 Section	Description	Comments	Result
Operation in the 5.15 – 5.25 GHz Band				
15.407 (d)		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 to the device and permanently attached.	COMPLIES
15.407(e)		Indoor operation only	Refer to user's manual in Exhibit 6	COMPLIES
15.407(a) (1)		26dB Bandwidth	Turbo Mode: 43.1 MHz 802.11 Mode: 26.4 MHz	N/A
	6.2.2 q1 (i)	20dB Bandwidth	Turbo Mode: 33.2 MHz 802.11 Mode: 26.4 MHz	N/A
	RSP 100	99% power Bandwidth	Turbo Mode: 33.2 MHz 802.11 Mode: 17.3 MHz	N/A
15.407(a) (1)	6.2.2 q1 (ii)	Output Power	Turbo Mode: 15.7 dBm 802.11 Mode: 15.8 dBm	COMPLIES
15.407(a) (1))	6.2.2 q1 (i)	Power Spectral Density	Turbo Mode: -6.33 dBm/MHz 802.11 Mode: -3.18 dBm/MHz	COMPLIES
Operation in the 5.25 – 5.35 GHz Band Note: The device is restricted to indoor use only, therefore the spectral density of spurious emissions in the 5.15 – 5.25 GHz band were limited to the power spectral limits for intentional signals detailed in FCC 15.407(a)(1) and RSS 210 6.2.2 q1 (i)				
		Antenna Gain	Antenna Gain = 3 dBi	COMPLIES
15.407(a) (2)	6.2.2 q1 (ii)	26dB Bandwidth	Turbo Mode: 65.5 MHz 802.11 Mode: 34.6 MHz	N/A
	6.2.2 q1 (i)	20dB Bandwidth	Turbo Mode: 44.0 MHz 802.11 Mode: 22.3 MHz	N/A
	RSP 100	99% power Bandwidth	Turbo Mode: 37.8 MHz 802.11 Mode: 18.7 MHz	N/A
15.407(a) (2)	6.2.2 q1 (ii)	Output Power	Turbo Mode: 20.2 dBm 802.11 Mode: 18.6 dBm	COMPLIES
15.407(a) (2))	6.2.2 q1 (ii)	Power Spectral Density	Turbo Mode: -3.42 dBm/MHz 802.11 Mode: -0.77 dBm/MHz	COMPLIES

General requirements for all bands				
15.407(b) (5) / 15.209	6.2.2 q1 (ii)	Spurious Emissions below 1GHz	-3.4dB @ 319.995MHz	COMPLIES
15.407(b) (2)	6.2.2 q1 (ii)	Spurious Emissions above 1GHz	-0.1dB @ 10507.82	COMPLIES
	6.2.2 q(iv)(a)	Digital Modulation	Digital Modulation is used, refer to the "Theory of Operations" (Exhibit 9) for a detailed explanation.	COMPLIES
	6.2.2 q(iv)(b)	Peak Spectral Density	5.8 dB	COMPLIES
15.407(a)(6)		Peak Excursion Ratio	5.75-7.92 dB	COMPLIES
	6.2.2 q(iv)(c)	Channel Selection	The channels selected to be to tested represent the highest, lowest and center channels available.	N/A
15.407 (c)	6.2.2 q(iv)(d)	Automatic Discontinuation of Operation	Operation is discontinued in the absence of information to transmit, refer to the "Theory of Operations" in Exhibit 9 for a detailed explanation.	COMPLIES
15.407 (g)	6.2.2 q(iv)(e)	Frequency Stability	Frequency stability is +/- 20 ppm, refer to the "Theory of Operations" in Exhibit 9 for a detailed analysis.	COMPLIES
	6.2.2 q(iv)(g)	User Manual information	All relevant statements have been included in the user's manuals. Refer to Exhibit 6 for details	COMPLIES
15.407 (f)	6.2.2 q(iv)(g)	RF Exposure Requirements	Refer to MPE calculations in Exhibit 11	COMPLIES
15.407(b) / 15.207	6.6	AC Conducted Emissions	-5.8dB @ .489MHz	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 Netgear model HA311 is a UNII radio which is designed to operate in the 5.15-5.25GHz and 5.25-5.35GHz UNII/LELAN bands. The EUT is PCI card, which is designed to be installed into a desktop PC. The card provides data rates of up to 54 Mb/s while operating in 802.11 mode (nominal bandwidth of 20 MHz) and data rates of up to 72 Mb/s operating in a turbo mode (nominal bandwidth of 40 MHz).
Normally, the host system would be tabletop during operation. The host system was treated as tabletop equipment during testing to simulate the end user environment.

The sample was received on April 8, 2002 and tested on April 8 and April 9, 2002. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number	Proposed FCC ID #
Delta HA311 UNII PCI Card	Card #1	

ENCLOSURE

The EUT does not have an enclosure, as it is a PCI card designed to be installed into a host PC. The card does have two integral shields.

MODIFICATIONS

The EUT require modifications during testing in order to comply with the emission, which was shielding on rear (solder side of PCI card) of PCB. Refer to external photos.

SUPPORT EQUIPMENT

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

Manufacturer/Model/Description	Serial Number	FCC ID Number
Dell DHS PC	599GJ01	DoC
Dell D1726T-HS Monitor	7172104	AK8GDM17SE2T
Hewlett Packard E03633HLUS-C Keyboard	51825521	C1GE03633
Logitech M-S69 Mouse	LNA11311085	JNZ211443

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)
PC SVGA	Monitor	Multiconductor	Shielded	2
PC PS2	Keyboard	Multiconductor	Shielded	2
PC PS2	Mouse	Multiconductor	Shielded	2
PC PCI slot	EUT	Direct connection	-	-

Note 1: Printer and Serial Devices were not connected during the Radio test. These ports are not required during the radio test.

EUT OPERATION DURING TESTING

The radio was transmitting at the stated power level on the specified channels with a duty cycle of 99 % (maximum allowed). The EUT was transmitting at a data rate of 6 Mb/s in 802.11 mode and at a data rate of 72 Mb/s in Turbo mode. The data rates selected produced the highest output power spectral density for their respective modes. The channels were selected since they are at the top, center and bottom of the allocated bands.

ANTENNA REQUIREMENTS

As the device is intended to operate in the 15.15 – 15.25 GHz band an integral antenna as detailed in 15.407 (d) and RSS-210 6.2.2(q1) (i) is required. The EUT uses an integral antenna with a gain of 3 dBi. The antenna is connected to a standard connector, which will be seal under the permanent shield this way meeting the requirements of the FCC Part 15.203 and RSS-210.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on April 8 and April 9, 2002at 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 are 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 exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

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

CONDUCTED EMISSIONS

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

RADIATED EMISSIONS

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

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

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

CONDUCTED EMISSIONS FROM ANTENNA PORT

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

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

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

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

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

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

where P is the eirp (Watts)

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

FCC 15.407 (a) OUTPUT POWER LIMITS

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

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

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

RS-210 6.2.2(q1) OUTPUT POWER LIMITS

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

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

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

SPURIOUS RADIATED EMISSIONS LIMITS

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

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

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

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

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

AC POWER PORT CONDUCTED EMISSIONS LIMITS

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

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

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

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

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

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

SAMPLE CALCULATIONS - RADIATED EMISSIONS

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

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

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

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

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

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

EXHIBIT 1: Test Equipment Calibration Data

Radiated Emissions, 1 - 40 GHz, 11-Apr-02
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Hewlett Packard	High Pass filter, 8.2GHz	P/N 84300-80039	1156	12	3/25/2002	2/25/2003
EMCO	Horn Antenna D. Ridge 1-18 GHz	3115	1386	12	1/31/2002	1/31/2003
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	1242	12	10/9/2001	10/9/2002
Miteq	Pre-amp, 1-18GHz	AFS44	1346	12	1/7/2002	1/7/2003
Hewlett Packard	Spectrum Analyzer 9KHz - 26GHz	8563E	284	12	3/21/2002	3/21/2003
Hewlett Packard	Spectrum Analyzer 9kHz - 40 GHz	8564E (84125C)	1393	12	2/21/2002	2/21/2003

Antenna Conducted Emissions, 11-Apr-02
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Hewlett Packard	Spectrum Analyzer 9kHz - 40 GHz	8564E (84125C)	1393	12	2/21/2002	2/21/2003

Conducted and Radiated Emissions, 10-Apr-02
Engineer: mfaustino

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Elliott Laboratories	Biconical Antenna, 30-300 MHz	EL30.300	54	12	1/4/2002	1/4/2003
Elliott Laboratories	FCC / CISPR LISN	LISN-3, OATS	304	12	6/14/2001	6/14/2002
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	786	12	3/2/2002	3/2/2003
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1347	12	10/16/2001	10/16/2002
Filtek	High Pass Filter, 1GHz	HP12/1000-5BA	957	12	3/25/2002	3/25/2003
Hewlett Packard	EMC Spectrum Analyzer, Opt. 026 □9 KHz -26.5GHz	8593EM	1141	12	3/11/2002	3/11/2003
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	12	8/21/2001	8/21/2002
Rohde& Schwarz	Pulse Limiter	ESH3 Z2	1398	12	2/7/2002	2/7/2003
Rohde & Schwarz	Test Receiver, 9kHz-2750MHz	ESCS 30 EMI	1337	12	12/26/2001	12/26/2002
Solar Electronics Co	LISN	8028-50-TS-24-BNC	904	12	5/18/2001	5/18/2002

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T46833 61 Pages
T46889 9 Pages

Elliott

EMC Test Data

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Emissions Spec:	FCC Part 15 B and E, RSS-210	Class:	B
Immunity Spec:	N/A	Environment:	-

EMC Test Data

For The

Delta

Model

HA311

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
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 UNII Radio which is designed to operate in the 5.15-5.25GHz and 5.25-5.35GHz UNII/LELAN bands. The EUT is PCI card which is designed to be installed into a desktop PC. The card provides data rates of up to 54 Mb/s while operating in 802.11 mode (nominal bandwidth of 25 MHz) and data rates of up to 72 Mb/s operating in a turbo mode (nominal bandwidth of 50 MHz).

Normally, the host system would be table-top during operation. The host system was treated as table-top equipment during testing to simulate the end user environment.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Delta	HA311	UNII PCI Card	Card #1	

Antenna

The EUT uses an integral antenna with a gain of 3 dBi.

The antenna is connected to a standard connector, which will be seal under the permanent shield this way meeting the requirements of of FCC Part 15.203 and RSS-210.

EUT Enclosure

The EUT does not have an enclosure as it is a PCI card designed to be installed into a host PC. The card does have two integral shields.

Modification History

Mod. #	Test	Date	Modification
1			

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Emissions Spec:	FCC Part 15 B and E, RSS-210	Class:	B
Immunity Spec:	N/A	Environment:	-

Test Configuration #1 (Radio Spurious Emissions)

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	DHS	PC	599GJ01	DoC
Dell	D1726T-HS	Monitor	7172104	AK8GDM17SE2T
Hewlett Packard	E03633HLUS-C	Keyboard	51825521	C1GE03633
Logitech	M-S69	Mouse	LNA11311085	JNZ211443

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None required				

Interface Ports

		Cable(s)		
Port	Connected To	Description	Shielded or Unshielded	Length(m)
PC SVGA	Monitor	Multiconductor	Shielded	2
PC PS2	Keyboard	Multiconductor	Shielded	2
PC PS2	Mouse	Multiconductor	Shielded	2
PC PCI slot	EUT	Direct connection	-	-

Note 1:	Printer and Serial Devices were not connected during the Radio test. These ports are not required during the radio test.

EUT Operation During Emissions Testing (Radio)

The radio was transmitting at the stated power level on the specified channels with a duty cycle of 99 % (maximum allowed). The EUT was transmitting at a data rate of 6 Mb/s in 802.11 mode and at a data rate of 72 Mb/s in Turbo mode. The data rates selected produced the highest output power spectral density for their respective modes. The channels were selected since they are at the top, center and bottom of the allocated bands.

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
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:	4/9/2002	Config. Used:	1
Test Engineer:	Jmartinez	Config Change:	None
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: 20°C
Rel. Humidity: 55%

Summary of Results

Run #	Test Performed	Limit	Result	Comments
1	Output Power (5.15 - 5.25GHz band)	15.407(a) (1)	Pass	15.8 dBm
1	Output Power (5.25 - 5.35GHz band)	15.407(a) (2)	Pass	20.2 dBm
2	Power Spectral Density (5.15 - 5.25GHz)	15.407(a) (1)	Pass	-6.3 dBm
2	Power Spectral Density (5.25-5.35GHz)	15.407(a) (2)	Pass	-3.42 dBm
3	26dB Bandwidth	15.407	Pass	43.1 - 65.5 MHz
3	20 dB Bandwidth	RSS 210	Pass	33.2 - 44.0 MHz
4	Peak Excursion Envelope	15.407(a) (6)	Pass	6.67 - 7.75 dB
5	Antenna Conducted - Out of Band Spurious	15.407(b)	Pass	> -27 dBm

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
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

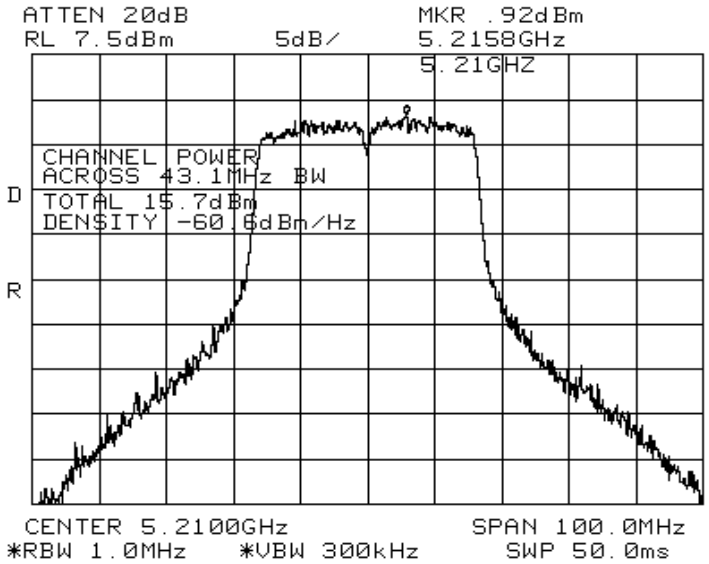
No deviations were made from the requirements of the standard.

Run #1: Output Power

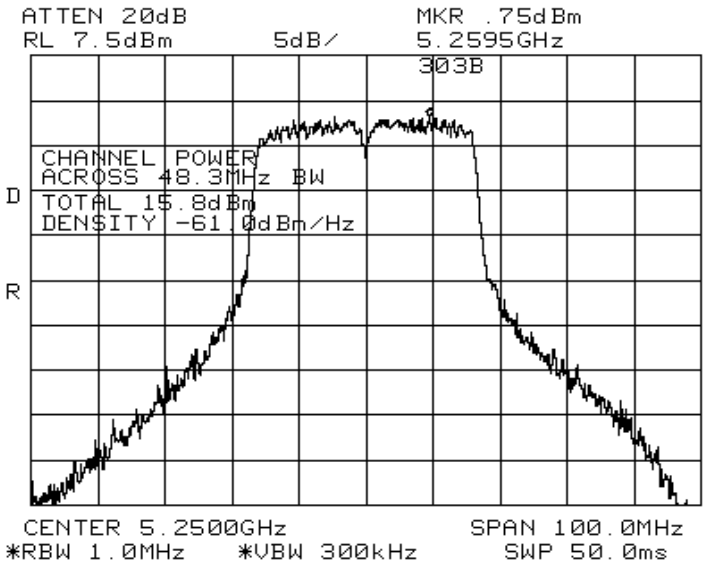
Antenna Gain: 3 dBi

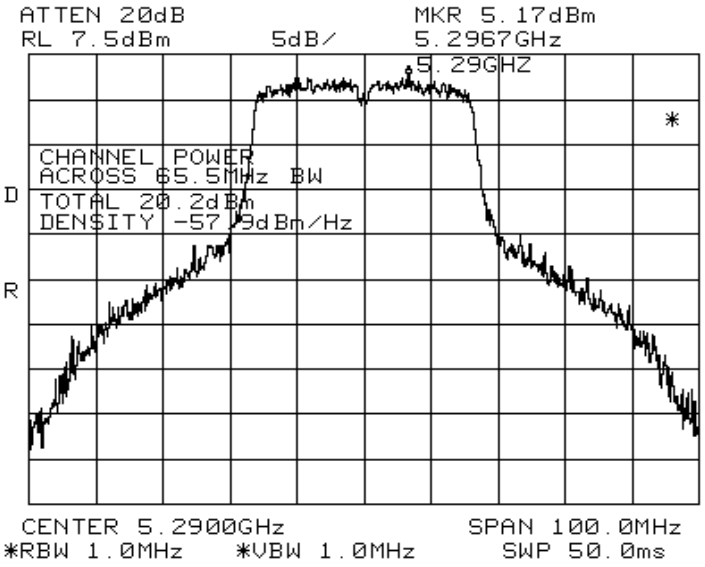
PC-Nom	Frequency (MHz)	VBW (kHz)	26-dB EBW	Measured Power (dBm)	FCC Limit (dBm) (note 3)
6	5210	228	43.07	15.7	17.0
11	5250	256	48.30	15.8	17.0
10	5290	347	65.50	20.2	24.0

Note 1:	Measured using spectrum analyzer's power measurement function (RBW = 1MHz, VBW = (Note 2)) which summed the power over the occupied bandwidth (26dB bandwidth).
Note 2:	VBW was determine by the following formulas: EBW/2*pi*30 or 1/2*pi*T, whichever gives the largest VBW.



Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B





Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

Run #2: Power Spectral Density

Antenna Gain: 3 dBi

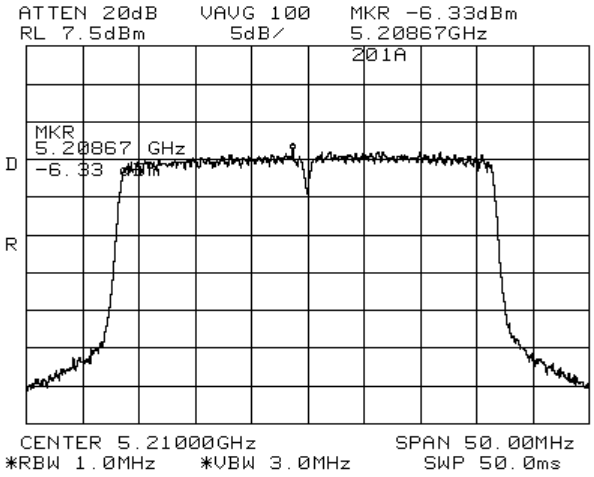
Channel	Frequency (MHz)	Power Spectral Density (dBm/MHz)	FCC Limit (dBm) note 2	Peak Power Spectral Density (dBm)	Graph Reference
low	5210	-6.33	4.0	3.33	201a & 201b
mid	5250	-6.00	4.0	3.08	202a & 202b
high	5290	-3.42	11.0	5.83	203a & 203b

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 (meausred with RBW=VBW=1MHz) of 3.33 **dBm** did not exceed the maximum permitted average PSD of 10dBm (5.15 to 5.25 GHz band) or 5.83 **dBm** (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.

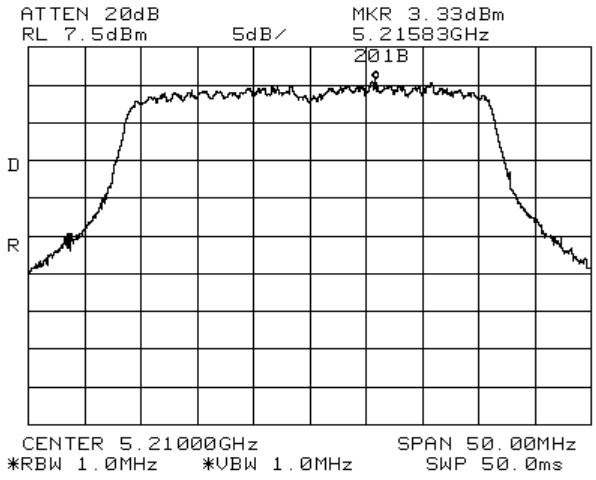
Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

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

FCC

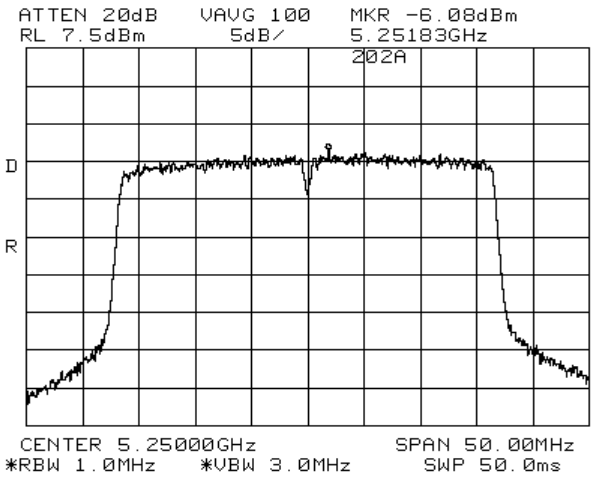


IC RSS-210



Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

FCC



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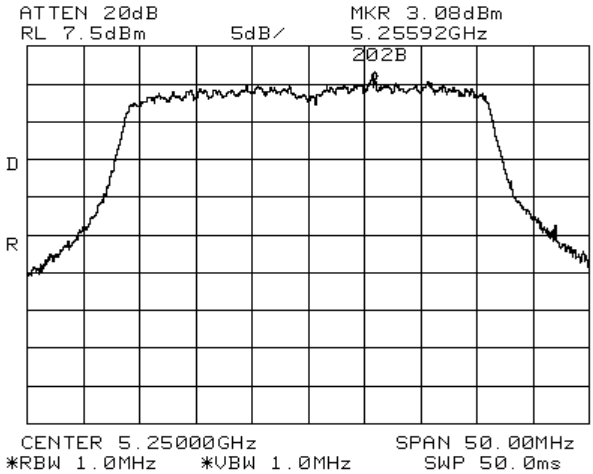
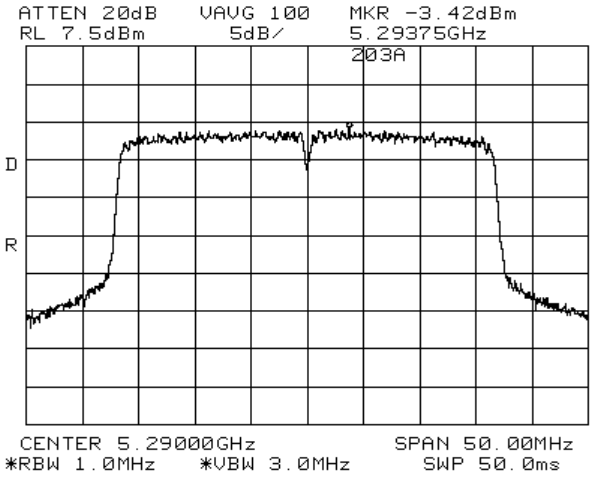
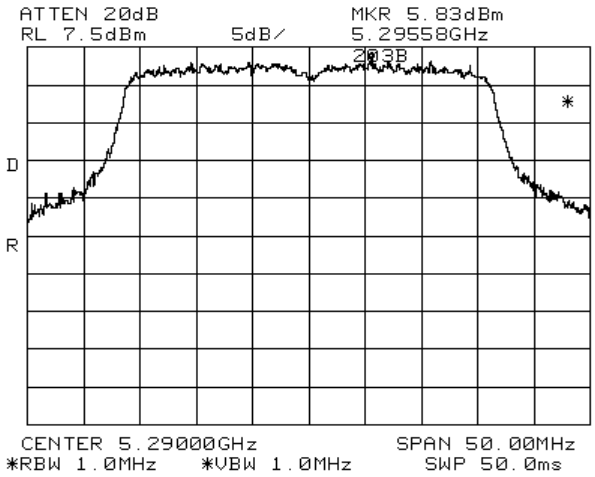


Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

FCC



IC RSS-210

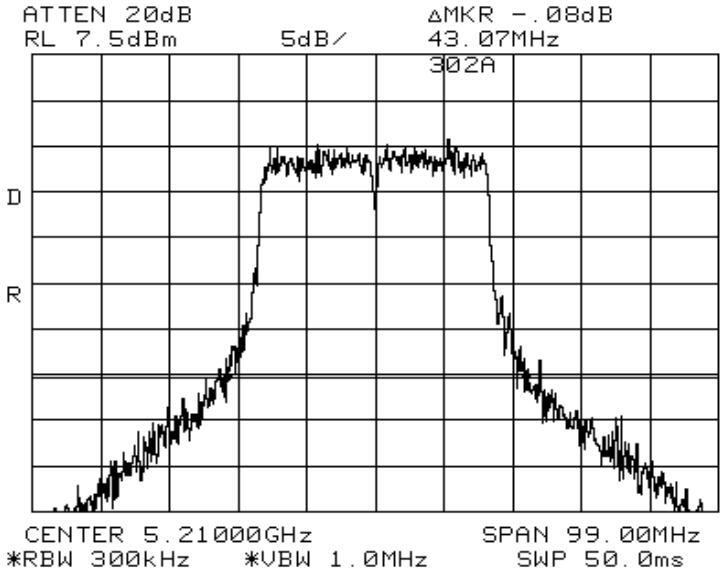


Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

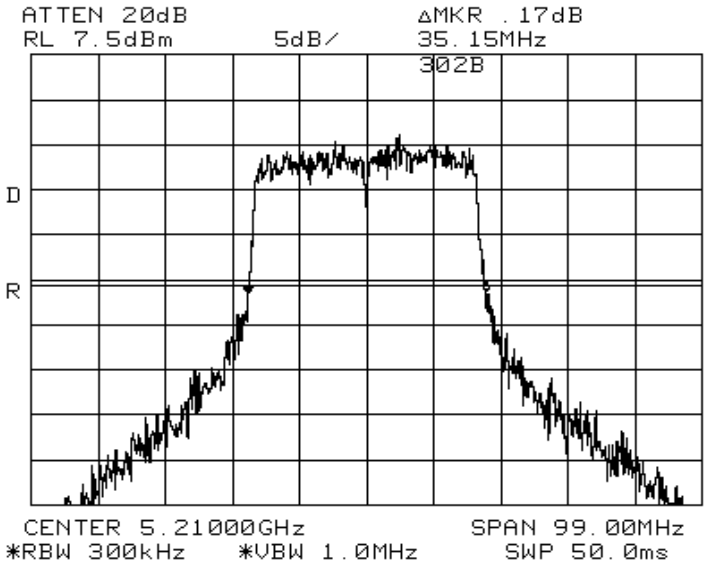
Run #3: Signal Bandwidth

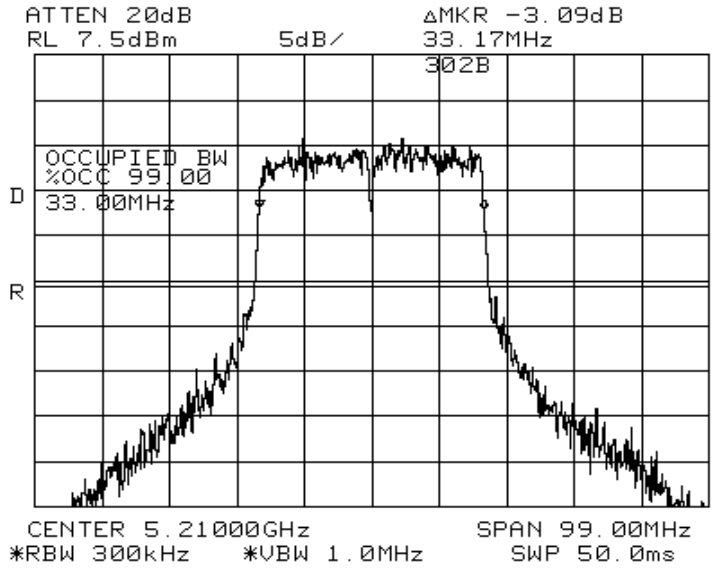
Channel	Frequency (MHz)	Resolution Bandwidth	26 dB Signal Bandwidth (MHz)	20 dB Signal Bandwidth (MHz)	99 % BW (MHz)	Graph reference #
Low	5210	300 kHz	43.1	33.2	33.2	302a & 302b
Middle	5250	300 kHz	48.3	36.7	33.3	303a & 303b
High	5290	1 MHz	65.5	44.0	37.8	301a & 301b

Plots Showing Signal Bandwidth

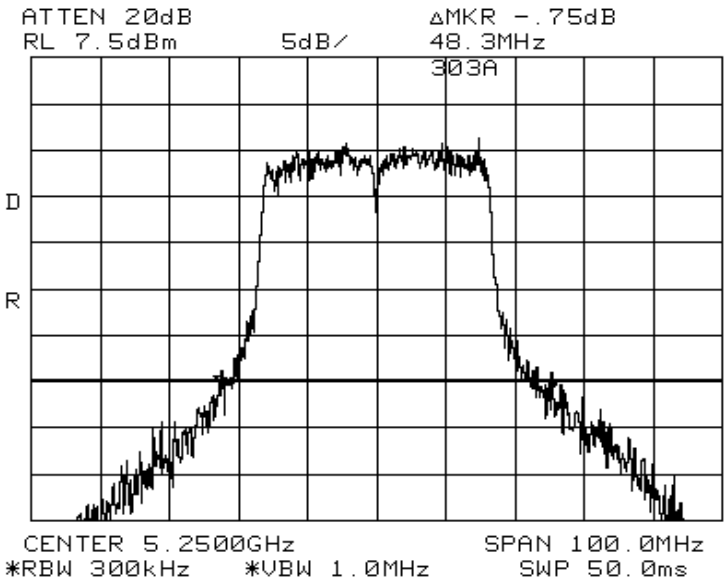


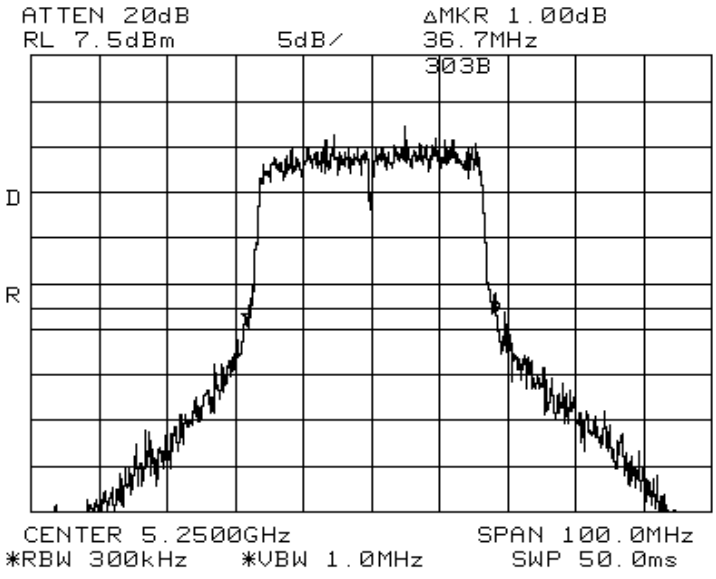
Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B





Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B





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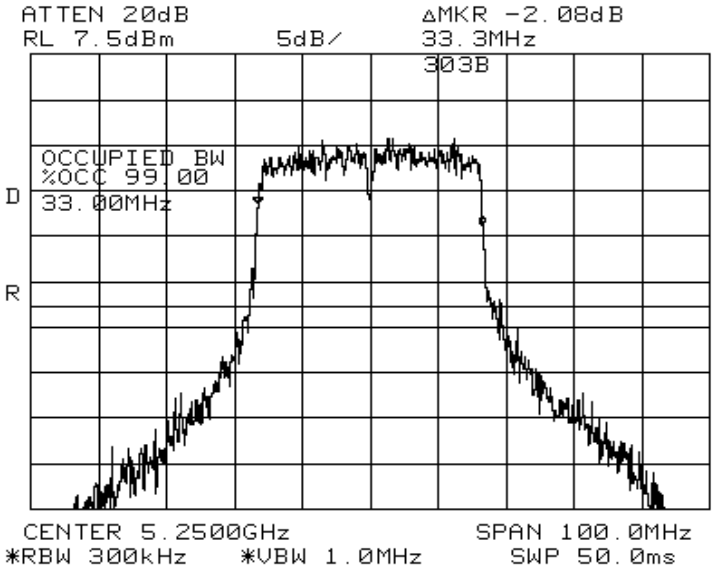
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B



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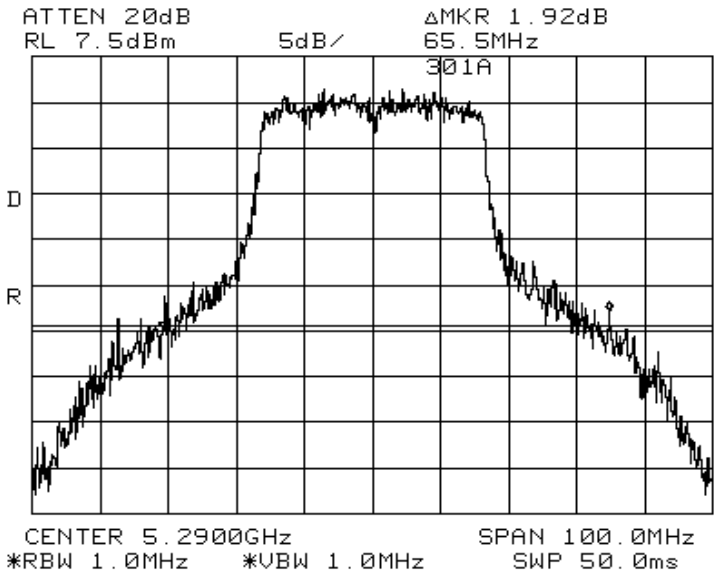
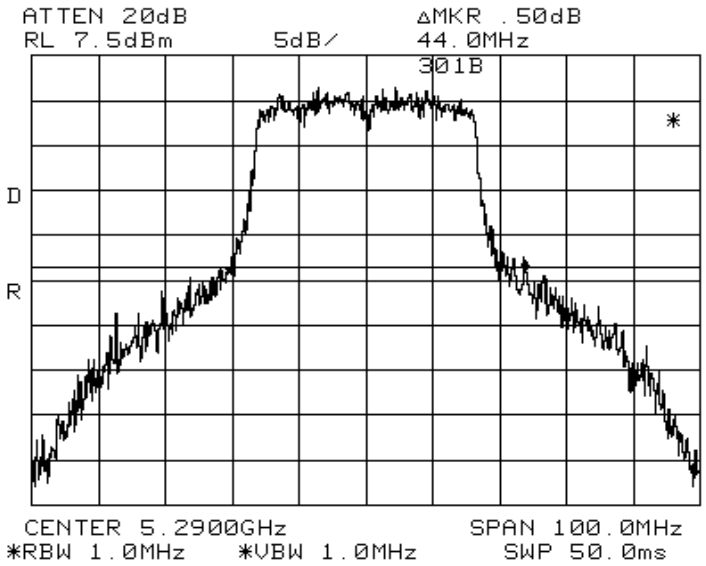
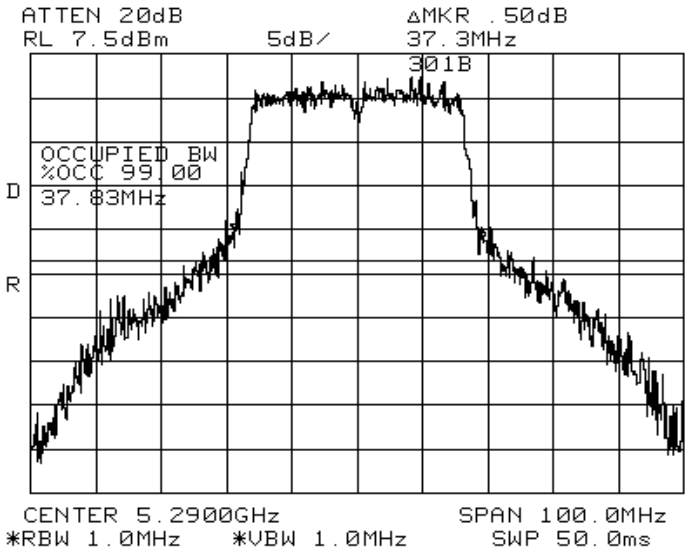
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B





Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B



Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

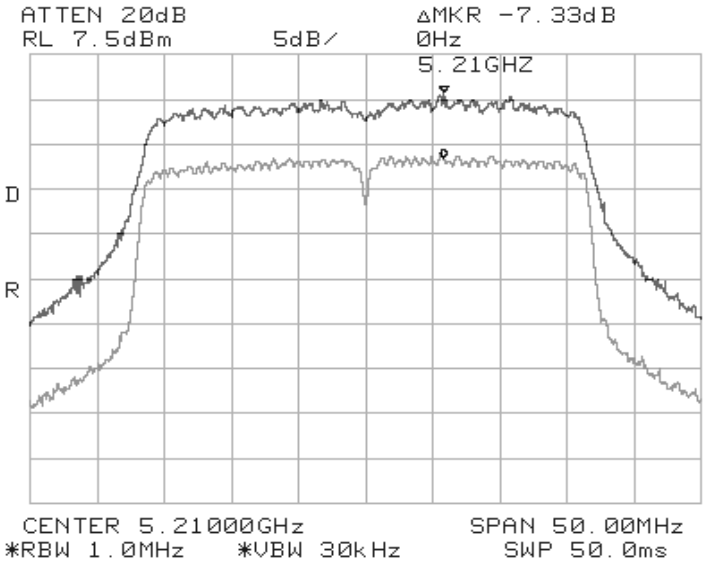
Run #4: Peak Excursion Measurement

Plots Showing Peak Excursion

Trace A: RBW = VBW = 1MHz

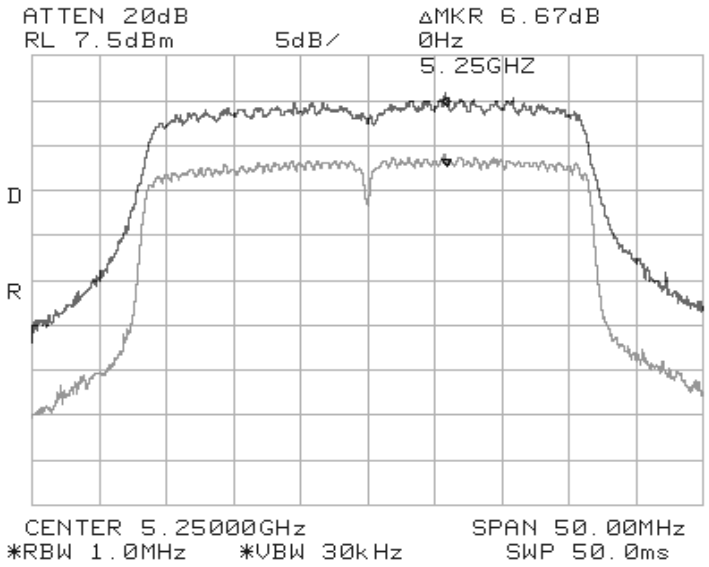
Trace B: RBW = 1 MHz, VBW = 30kHz

Low Channel Peak Excursion = 7.33 dB



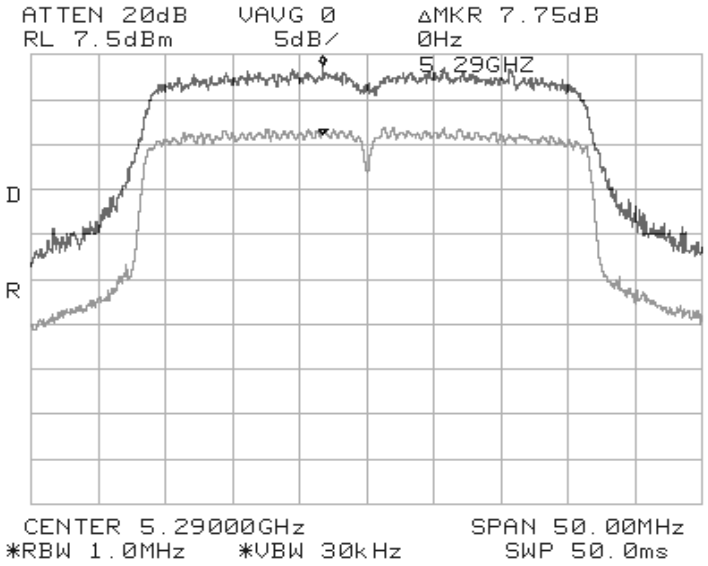
Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

Middle Channel Peak Excursion = 6.67 dB



Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

High Channel Peak Excursion = 7.75 dB.



Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
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 3 dBi. The EIRP limit is -27dBm/MHz for all out of band signals that do not fall in restricted bands. A limit of -30.0 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 3 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.

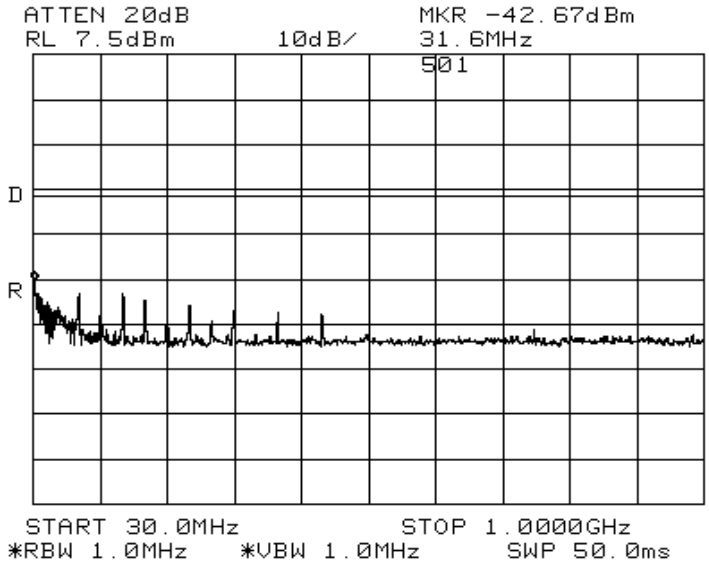
Channel	Frequency (MHz)	Frequency Range	Highest Spurious Signal	Graph reference #
	5.21	30 - 1000 MHz	Note 4	501
		1 to 5.15 GHz	3123 MHz (-50.7 dBm, Note 2), 4168 MHz (-43.7 dBm, Note 1)	502
		5.25 to 10 GHz	6248 MHz (-40.3 dBm, Note 2)	503
		10 GHz to 20 GHz	15620 MHz (-47 dBm, Note 1)	504
		20 GHz to 40 GHz	None	505
	5.25	30 - 1000 MHz	Note 4	506
		1 to 5.25 GHz	3139 MHz (-51.5 dBm, Note 2), 4209 MHz (-44.5 dBm, Note 1)	507
		5.35 to 10 GHz	6296 MHz (-41.8 dBm, Note 2)	508
		10 GHz to 20 GHz	None	509
		20 GHz to 40 GHz	None	510
	5.29	30 - 1000 MHz	Note 4	511
		1 to 5.29 GHz	3174 MHz (-49.7 dBm, Note 2), 4232 MHz (-44.7 dBm, Note 1)	512
		5.34 to 10 GHz	6342 MHz (-41.3 dBm, Note 2)	513
		10 GHz to 20 GHz	None	514
		20 GHz to 40 GHz	None	515

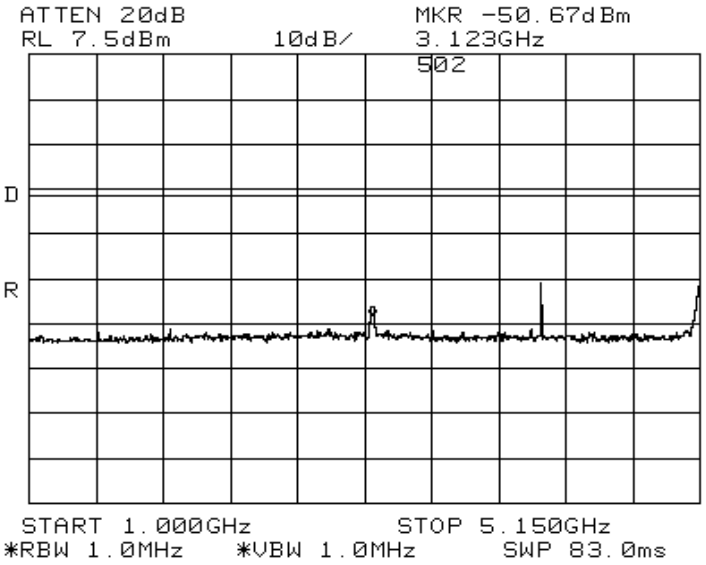
Note 1:	Signal is in a restricted band. Refer to run #6 for field strength measurements.
Note 2:	Signal is not in restricted band. Limit is -27dBm eirp. As the signal strength is significantly lower than -27dBm no field strength measurements required.
Note 3:	Signal is not in restricted band. Limit is -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.

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

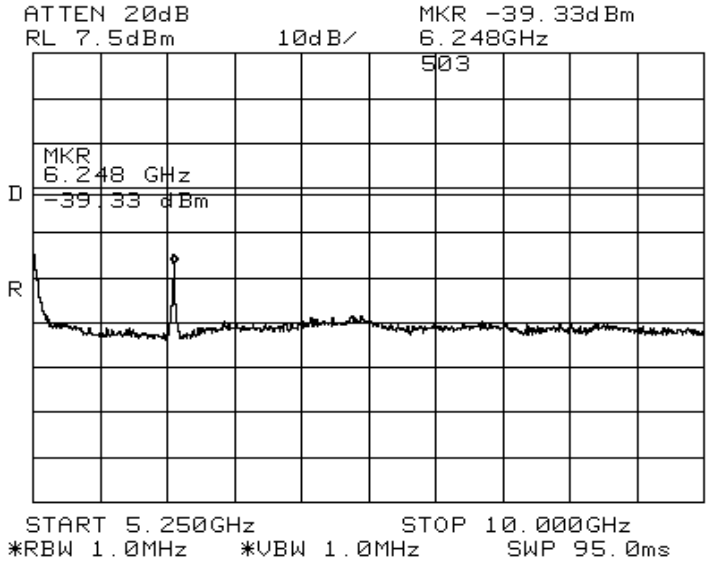
Plots Showing Out-Of-Band Emissions (RBW=VBW=1MHz)

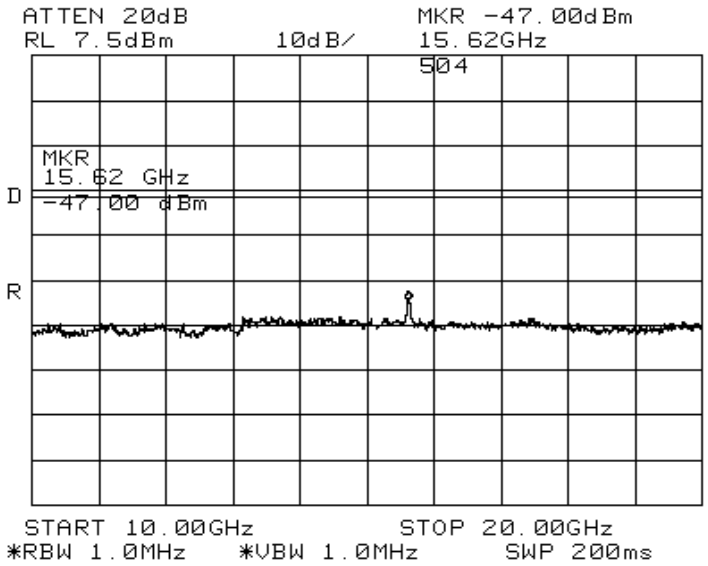
Low Channe 5.21 GHz



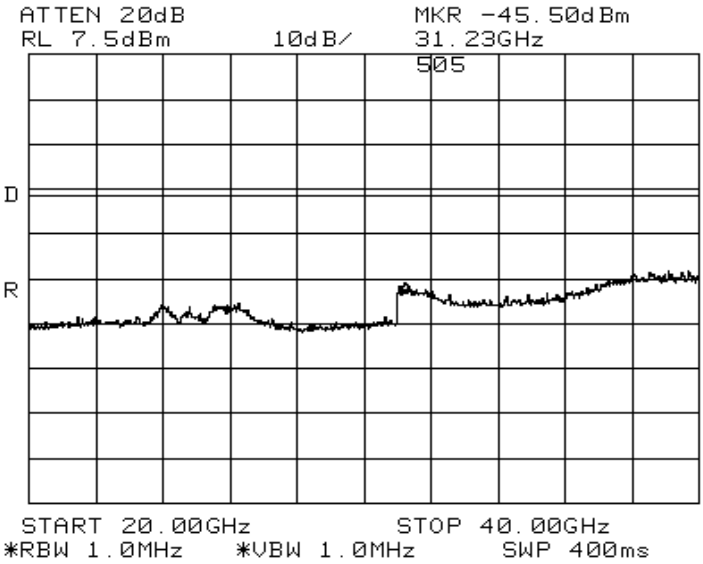


Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

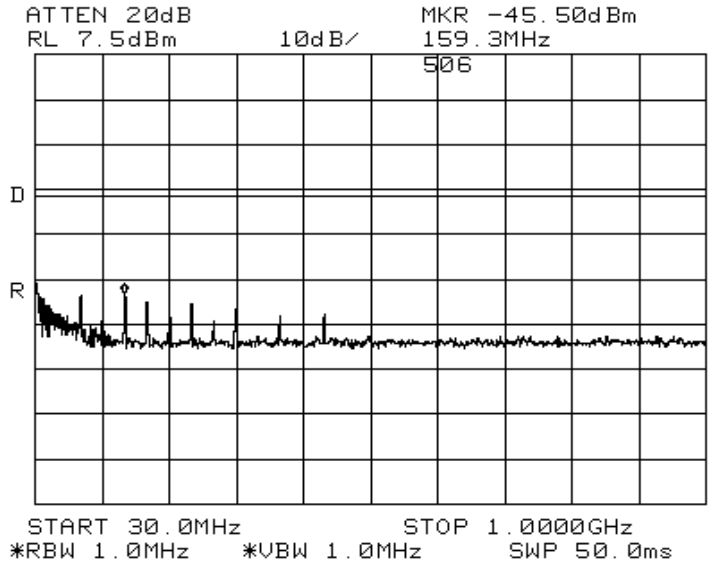




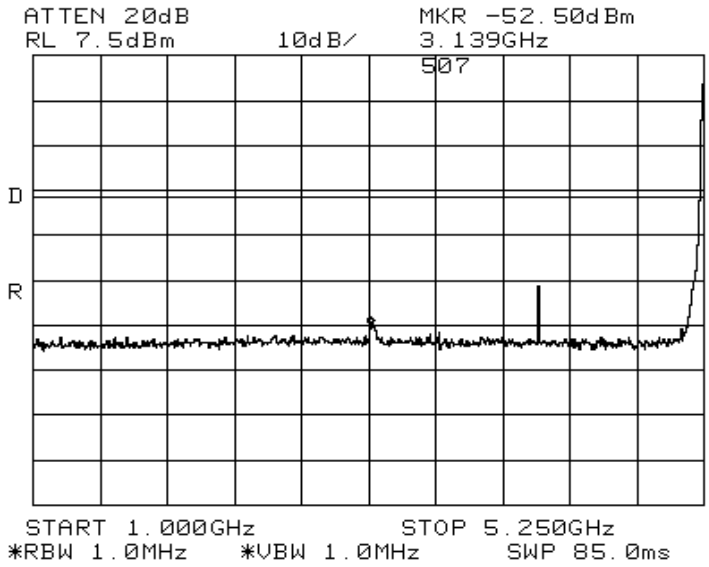
Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

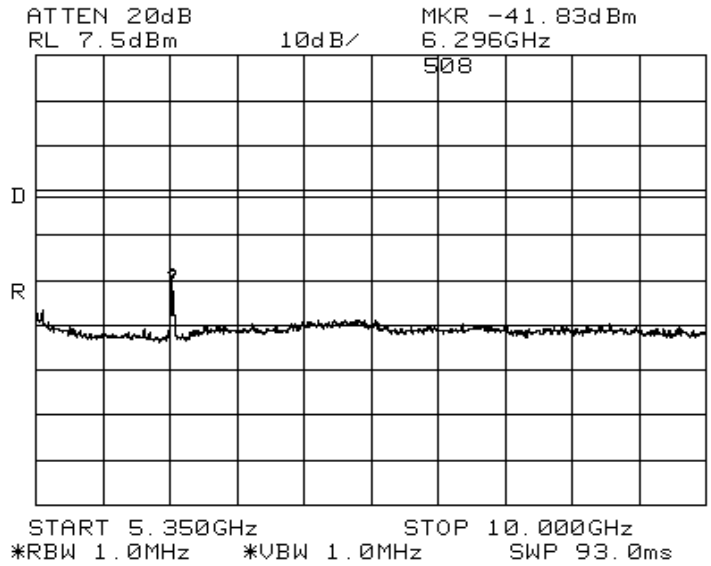


Middle Channe 5.25 GHz

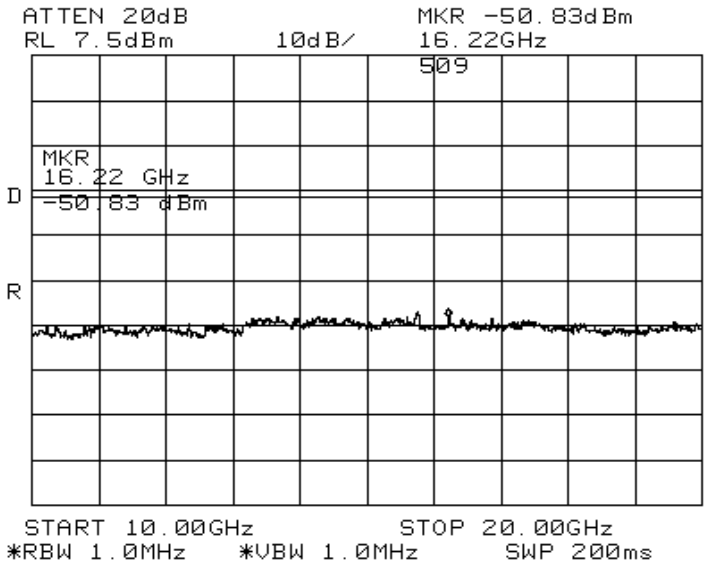


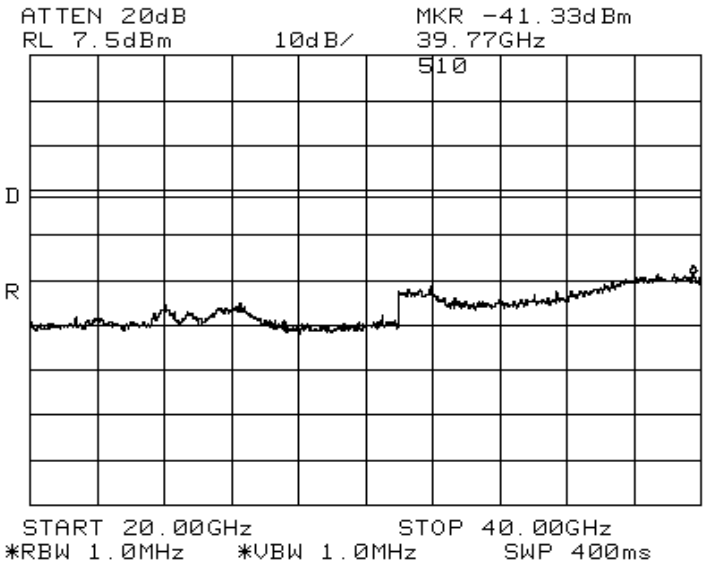
Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B





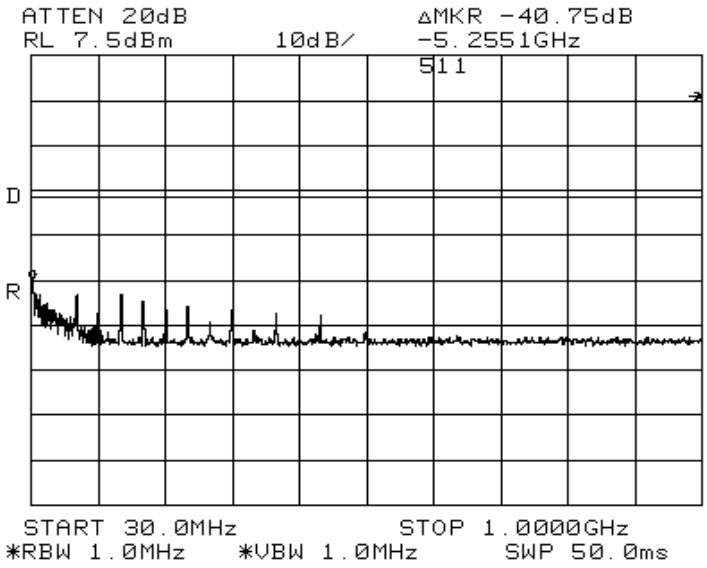
Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

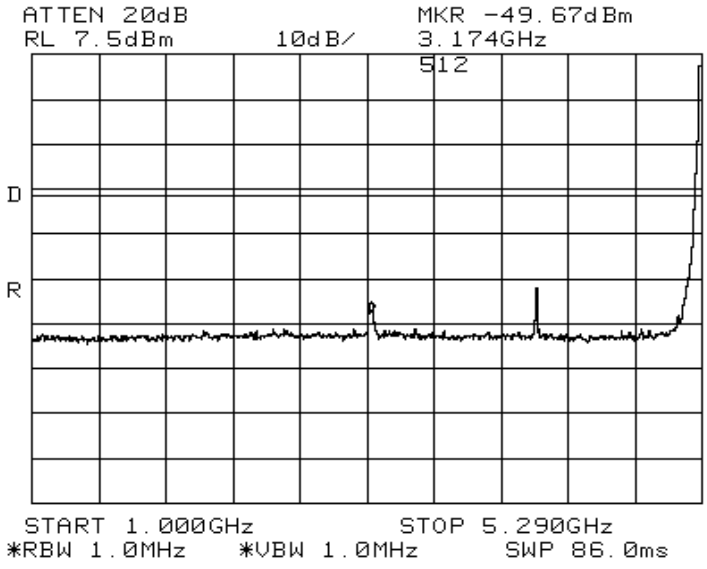




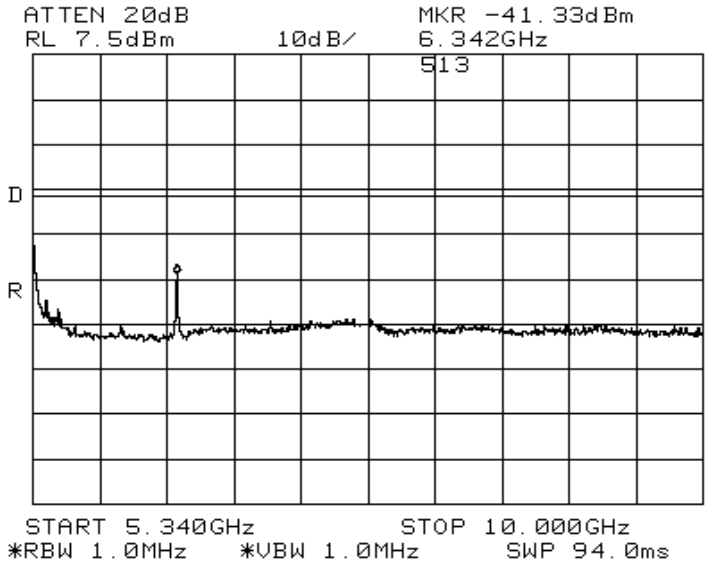
Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

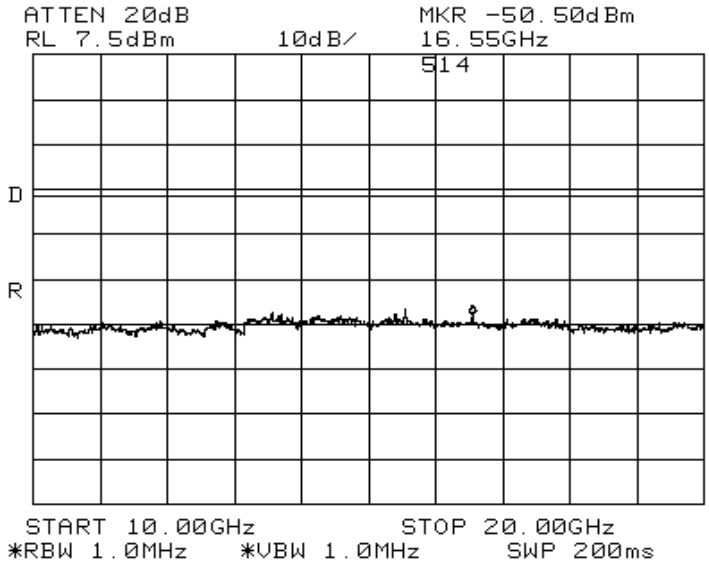
High Channe 5.32 GHz



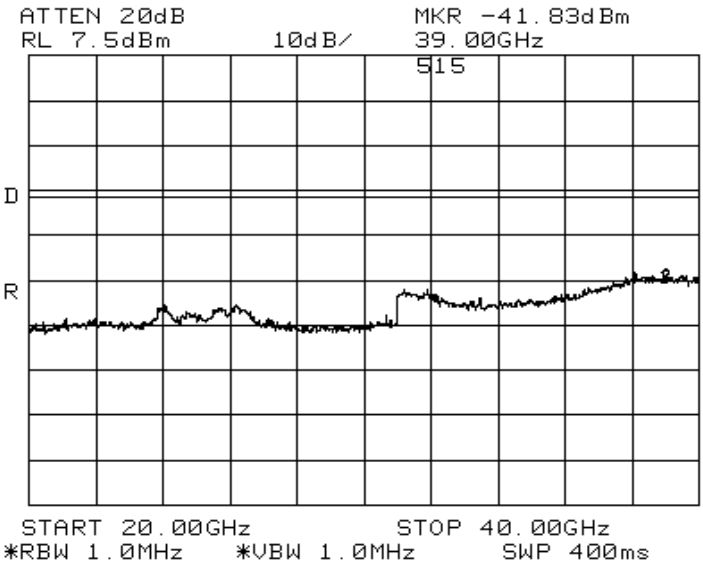


Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B





Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B



Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

FCC Part 15 Subpart E Tests

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:	4/9/2002	Config. Used:	1
Test Engineer:	Jmartinez	Config Change:	None
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: 20°C
Rel. Humidity: 55%

Summary of Results

Run #	Test Performed	Limit	Result	Comments
1	Output Power (5.15 - 5.25GHz band)	15.407(a) (1)	Pass	15.8 dBm
1	Output Power (5.25 - 5.35GHz band)	15.407(a) (2)	Pass	18.6 dBm
2	Power Spectral Density (5.15 - 5.25GHz)	15.407(a) (1)	Pass	-3.18 dBm
2	Power Spectral Density (5.25-5.35GHz)	15.407(a) (2)	Pass	-0.77 dBm
3	26dB Bandwidth	15.407	Pass	26.4 - 34.6 MHz
3	20 dB Bandwidth	RSS 210	Pass	21.0 - 22.3 MHz
4	Peak Excursion Envelope	15.407(a) (6)	Pass	5.75 - 7.92 dB
5	Antenna Conducted - Out of Band Spurious	15.407(b)	Pass	> -27 dBm

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
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

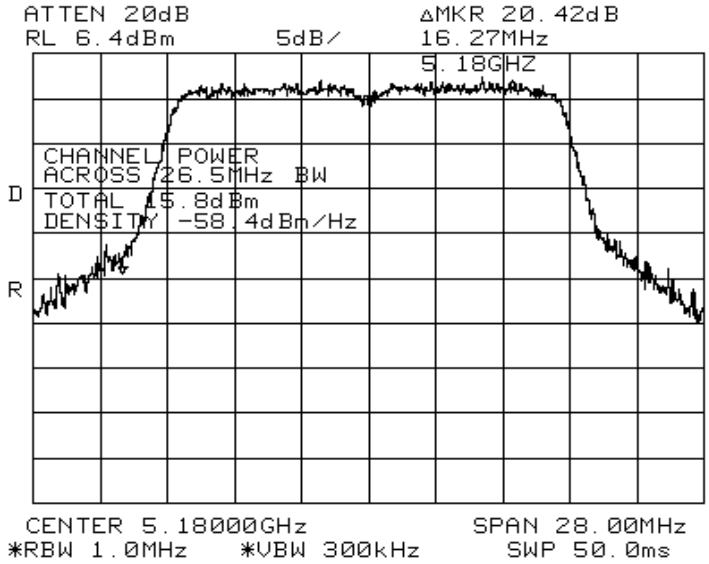
No deviations were made from the requirements of the standard.

Run #1: Output Power

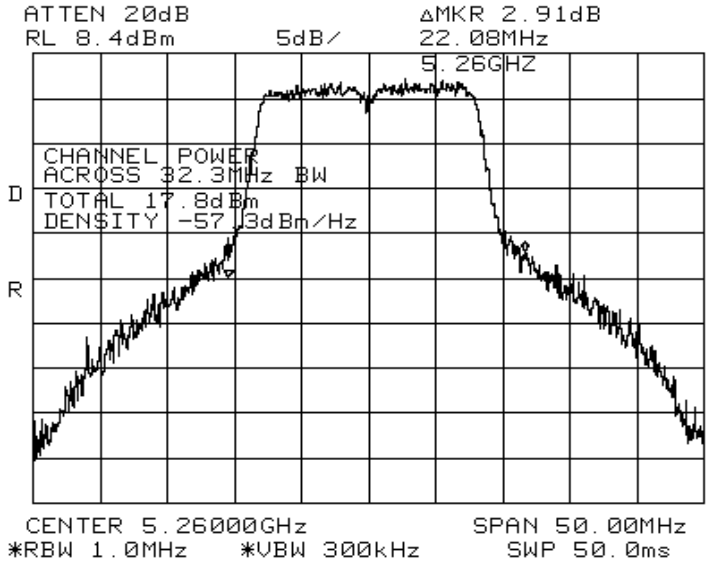
Antenna Gain: 3 dBi

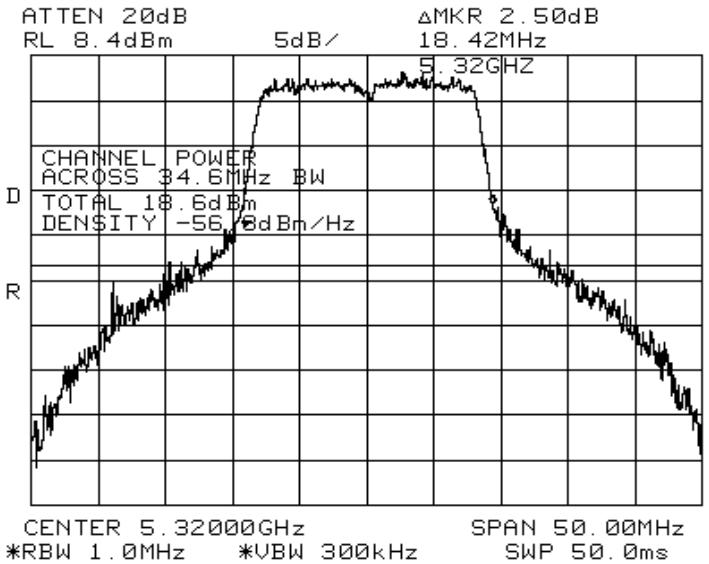
PC-Nom	Frequency (MHz)	VBW (kHz)	26-dB EBW	Measured Power (dBm)	FCC Limit (dBm) (note 3)
6	5180	140	26.42	15.8	17.0
10	5260	171	32.25	17.8	24.0
10	5320	183	34.58	18.6	24.0

Note 1:	Measured using spectrum analyzer's power measurement function (RBW = 1MHz, VBW = (Note 2)) which summed the power over the occupied bandwidth (26dB bandwidth).
Note 2:	VBW was determine by the following formulas: EBW/2*pi*30 or 1/2*pi*T, whichever gives the largest VBW.



Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B





Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

Run #2: Power Spectral Density

Antenna Gain: 3 dBi

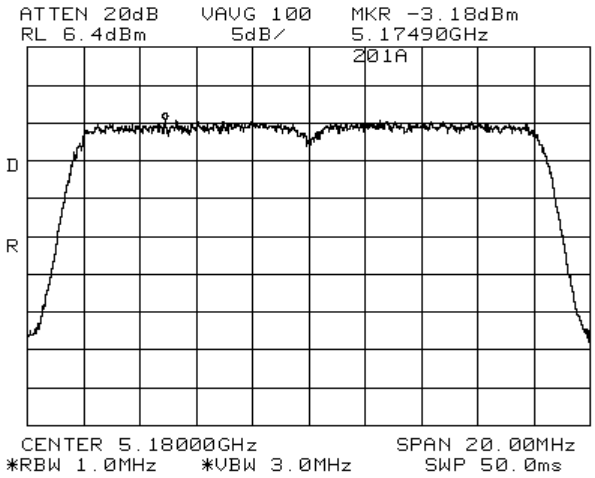
Channel	Frequency (MHz)	Power Spectral Density (dBm/MHz)	FCC Limit (dBm) note 2	Peak Power Spectral Density (dBm)	Graph Reference
low	5180	-3.18	4.0	5.82	201a & 201b
mid	5260	-1.68	11.0	5.90	202a & 202b
high	5320	-0.77	11.0	8.50	203a & 203b

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 (meausred with RBW=VBW=1MHz) of 3.33 **dBm** did not exceed the maximum permitted average PSD of 10dBm (5.15 to 5.25 GHz band) or 5.83 **dBm** (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.

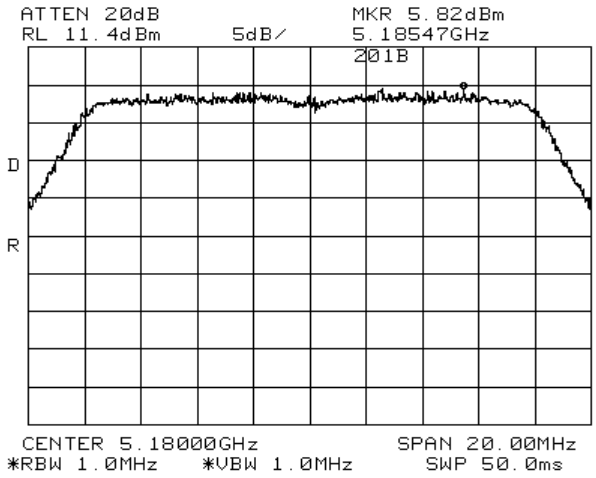
Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

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

FCC

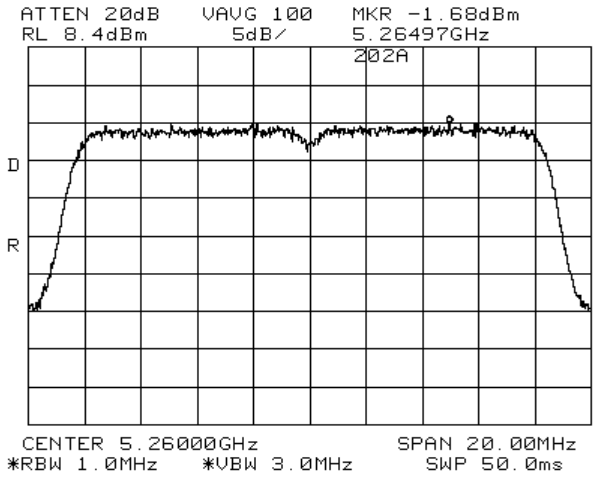


IC RSS-210



Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

FCC



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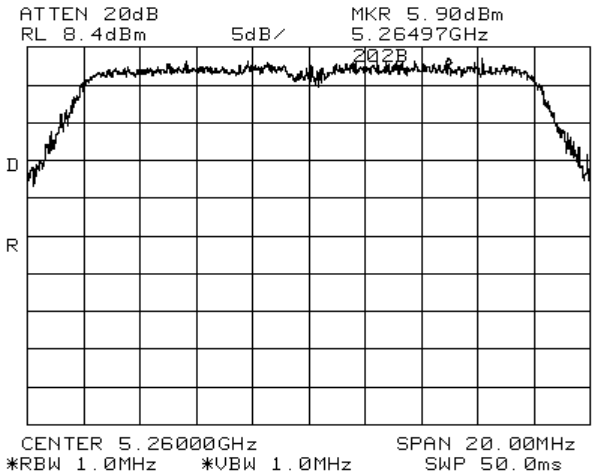
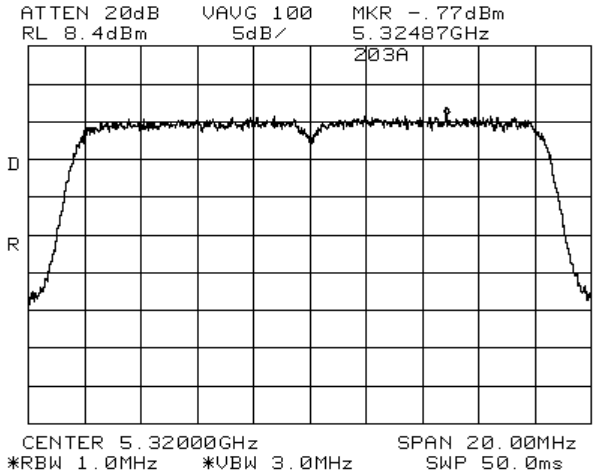


Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

FCC



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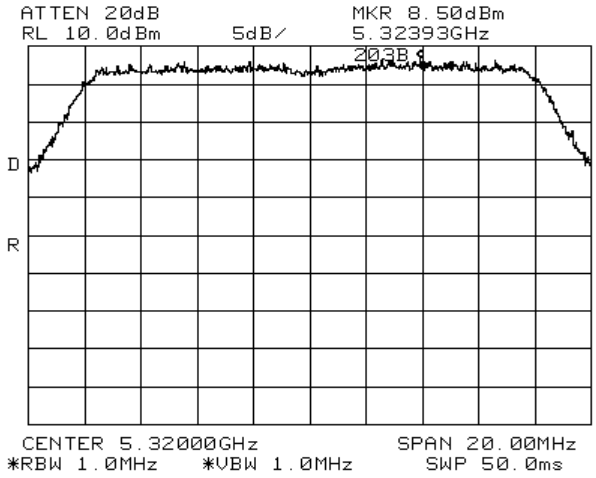
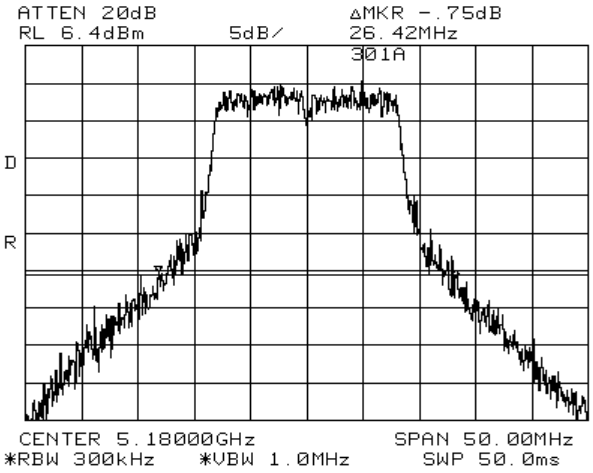


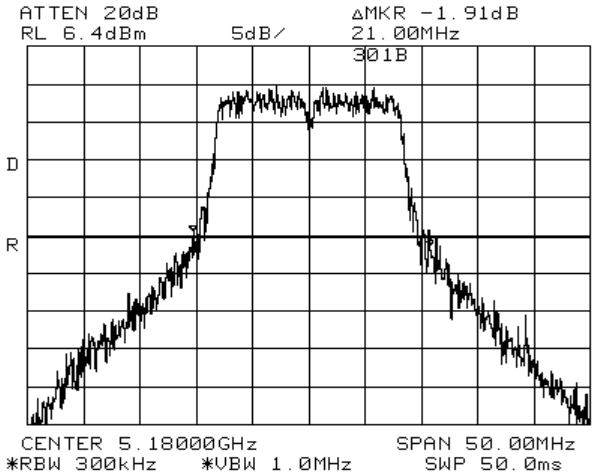
Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

Run #3: Signal Bandwidth

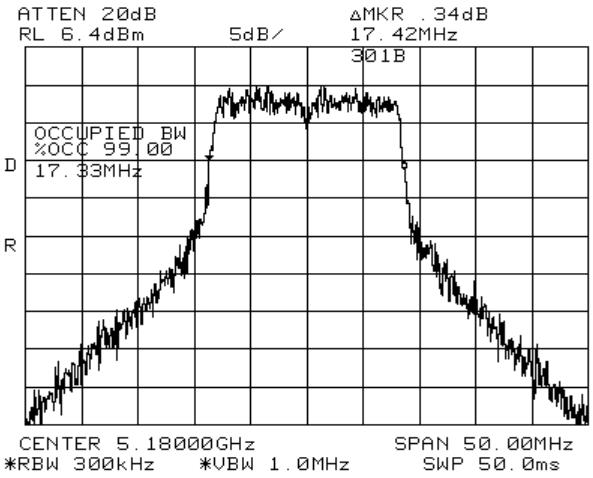
Channel	Frequency (MHz)	Resolution Bandwidth	26 dB Signal Bandwidth (MHz)	20 dB Signal Bandwidth (MHz)	99 % BW (MHz)	Graph reference #
Low	5180	300 kHz	26.4	21.0	17.3	301a & 301b
Middle	5260	300 kHz	32.3	22.1	18.2	302a & 302b
High	5320	1 MHz	34.6	22.3	18.7	303a & 303b

Plots Showing Signal Bandwidth

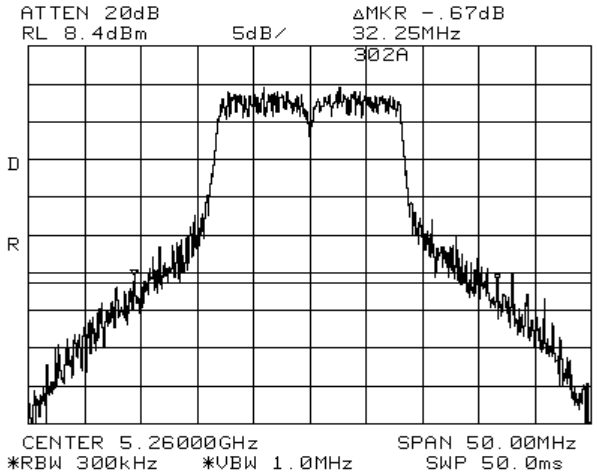


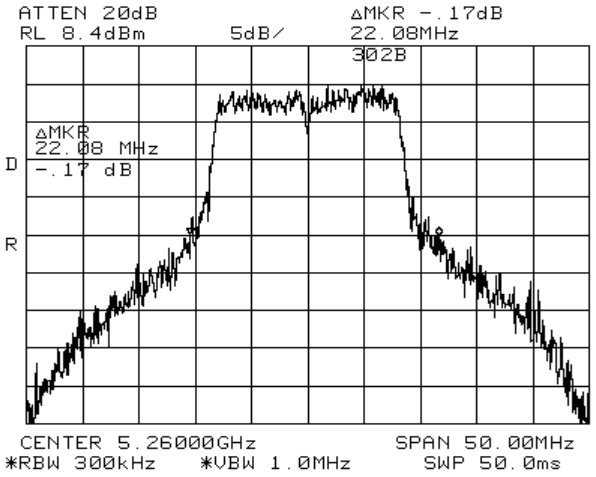


Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B



Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B





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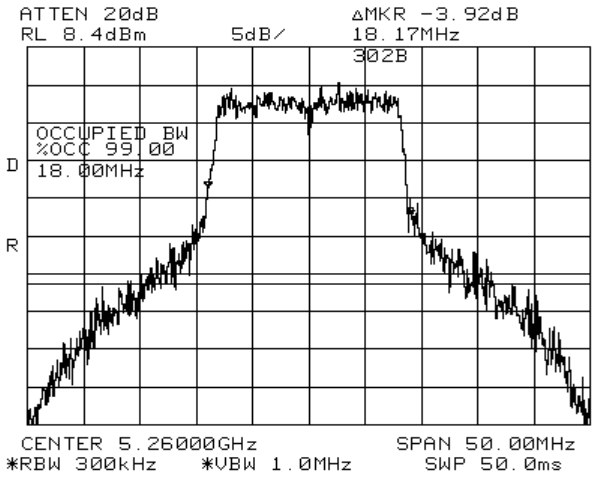
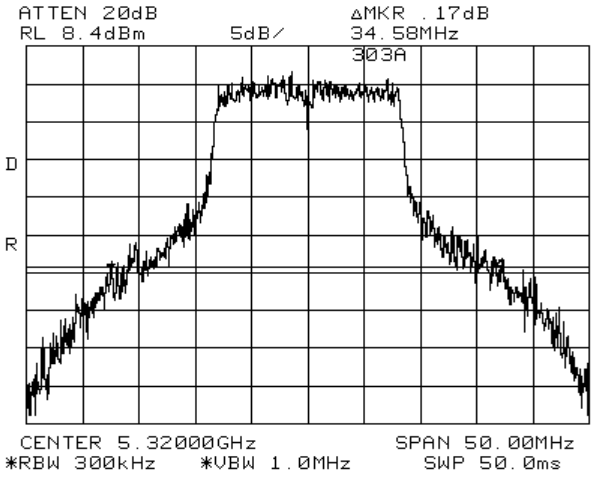
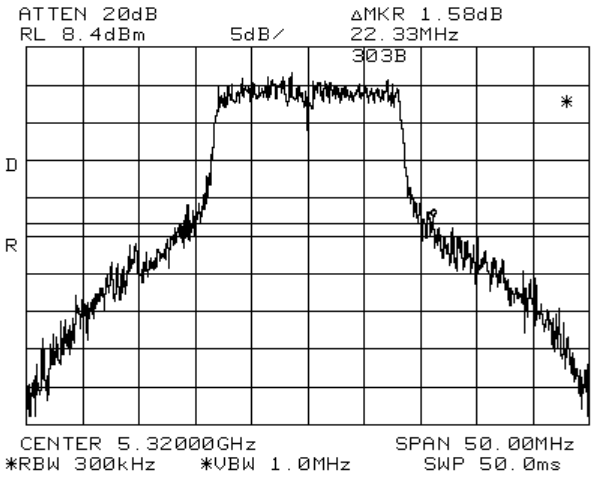
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

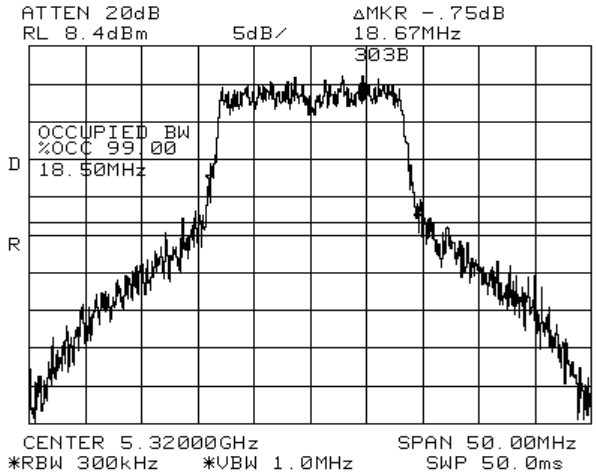


Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B





Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B



Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

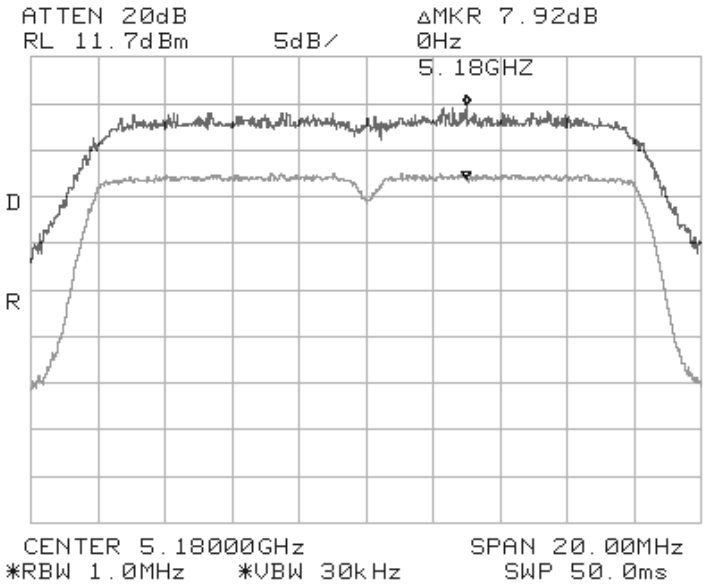
Run #4: Peak Excursion Measurement

Plots Showing Peak Excursion

Trace A: RBW = VBW = 1MHz

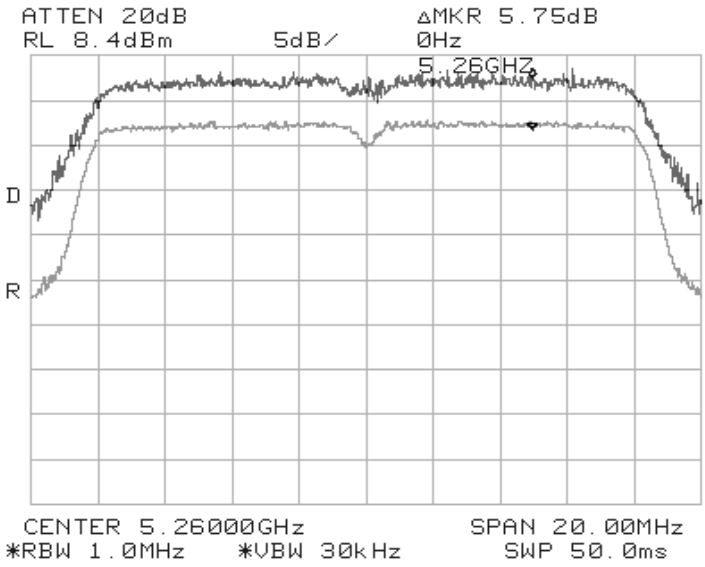
Trace B: RBW = 1 MHz, VBW = 30kHz

Low Channel Peak Excursion = 7.92 dB



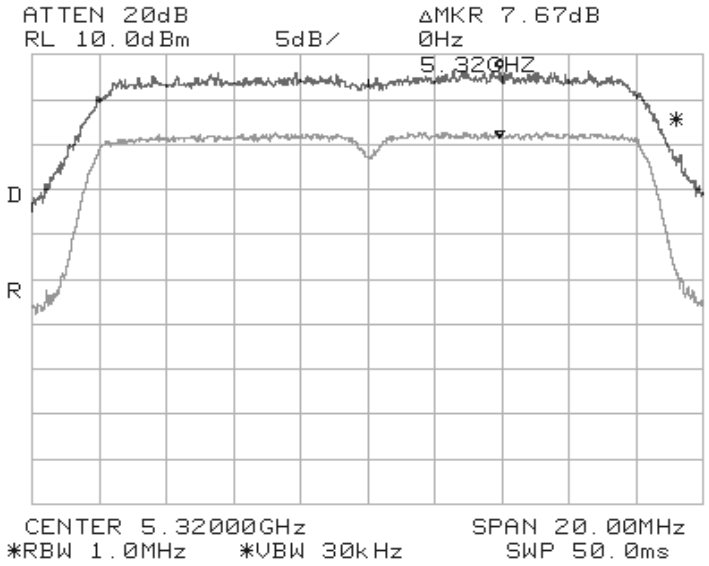
Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

Middle Channel Peak Excursion = 5.75 dB



Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

High Channel Peak Excursion = 7.67 dB.



Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
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 3 dBi. The EIRP limit is -27dBm/MHz for all out of band signals that do not fall in restricted bands. A limit of -30.0 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 3 within 100 MHz of the upper and lower band edges. For signals removed from the band edge by more than 100MHz, radiated measurements were made (refer to run #6) if the signal amplitude exceeded -37dBm.

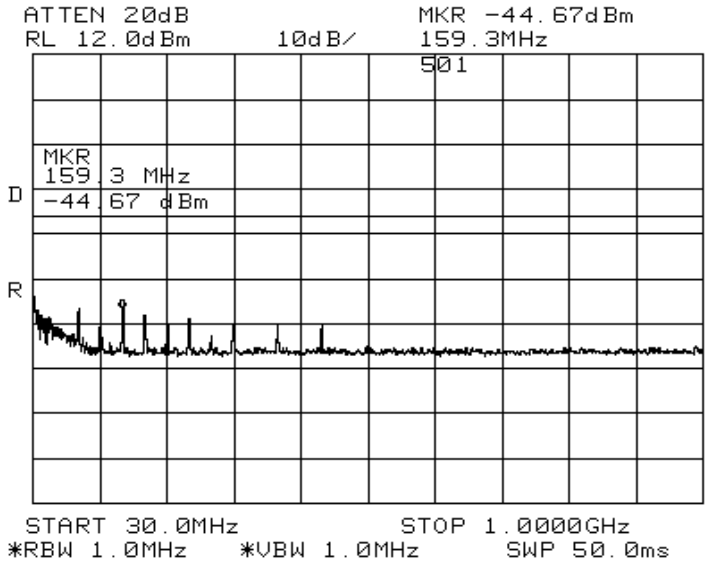
Channel	Frequency (MHz)	Frequency Range	Highest Spurious Signal	Graph reference #
Low	5180	30 - 1000 MHz	Note 4	501
		1 to 5.15 GHz	3103 MHz (-48.2 dBm, Note 2), 4140 MHz (-43.8 dBm, Note 1)	502
		5.25 to 10 GHz	6208 MHz (-36.5 dBm, Note 2)	503
		10 GHz to 20 GHz	15530 MHz (-46.2 dBm, Note 1)	504
		20 GHz to 40 GHz	None	505
Midd	5260	30 - 1000 MHz	Note 4	506
		1 to 5.25 GHz	3153 MHz (-48.2 dBm, Note 2), 4202 MHz (-44.1 dBm, Note 1)	507
		5.35 to 10 GHz	6311 MHz (-42.27 dBm, Note 2)	508
		10 GHz to 20 GHz	None	509
		20 GHz to 40 GHz	None	510
High	5320	30 - 1000 MHz	Note 4	511
		1 to 5.29 GHz	3195 MHz (-47.8 dBm, Note 2), 4253 MHz (-43.8 dBm, Note 1)	512
		5.34 to 10 GHz	6381 MHz (-44.0 dBm, Note 2)	513
		10 GHz to 20 GHz	None	514
		20 GHz to 40 GHz	None	515

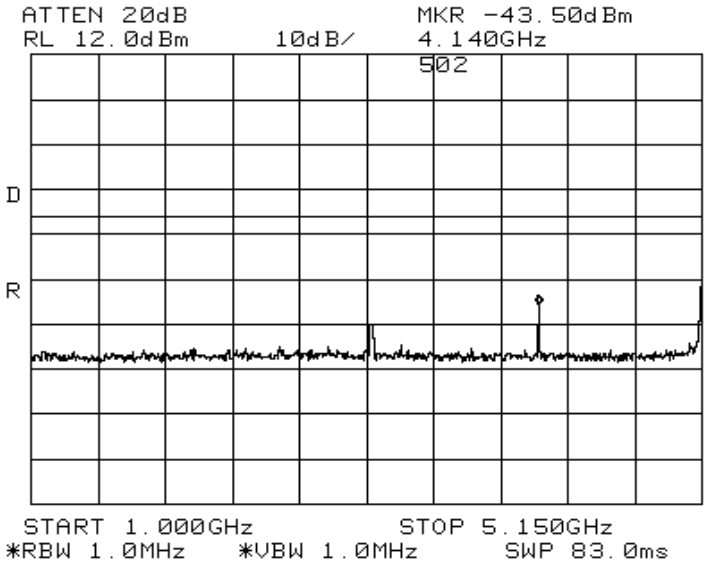
Note 1:	Signal is in a restricted band. Refer to run #6 for field strength measurements.
Note 2:	Signal is not in restricted band. Limit is -27dBm eirp. As the signal strength is significantly lower than -27dBm no field strength measurements required.
Note 3:	Signal is not in restricted band. Limit is -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.

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

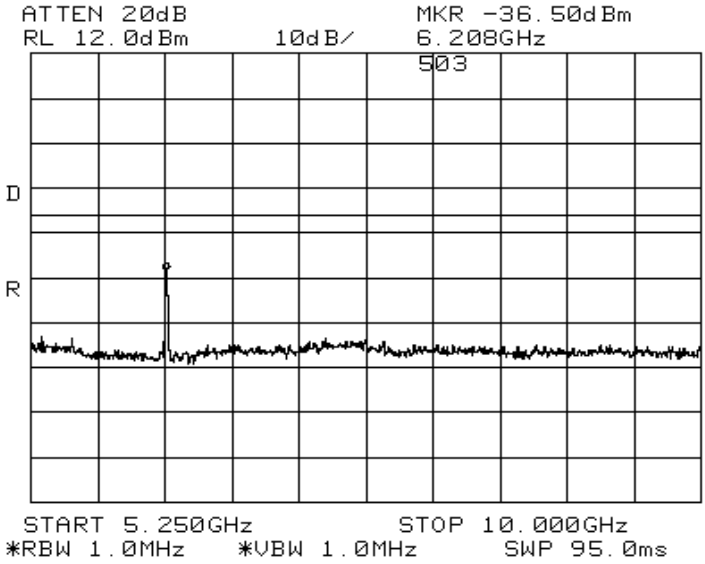
Plots Showing Out-Of-Band Emissions (RBW=VBW=1MHz)

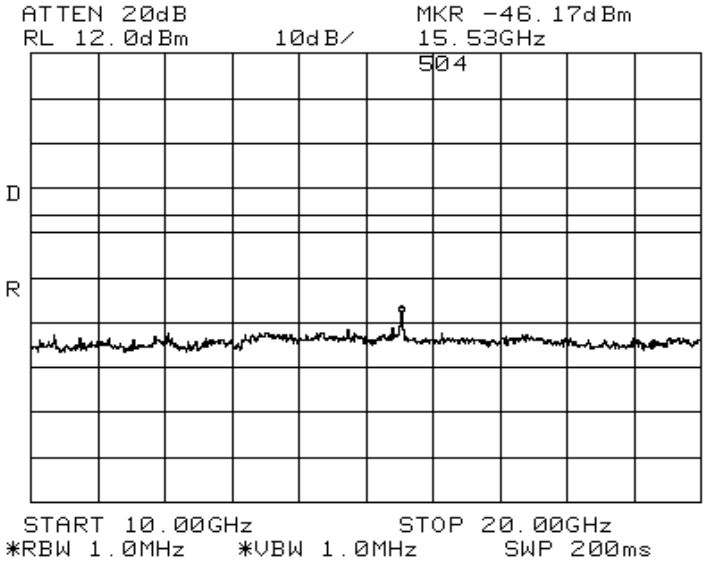
Low Channe 5.21 GHz



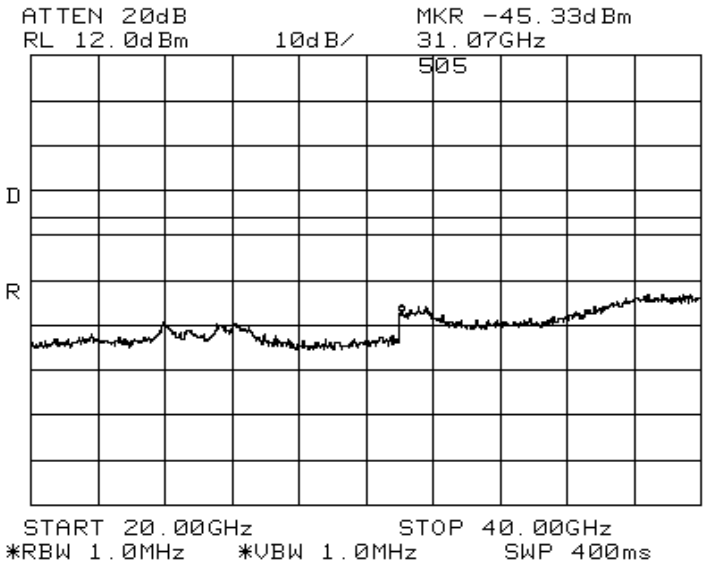


Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

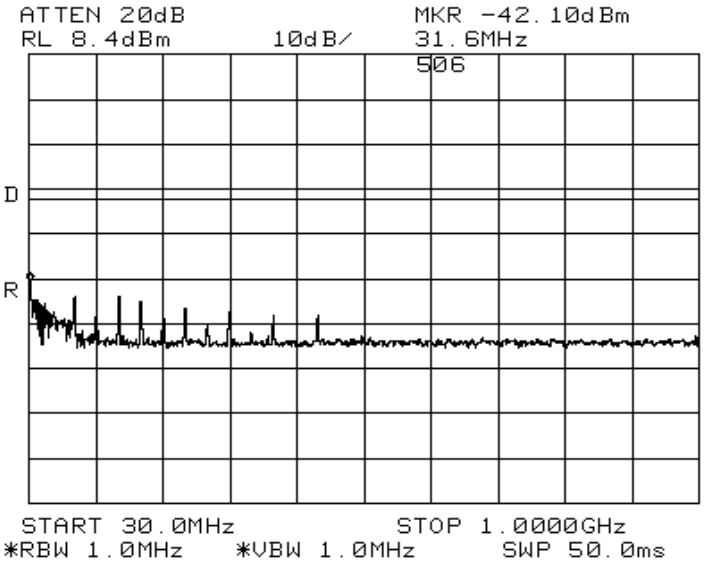




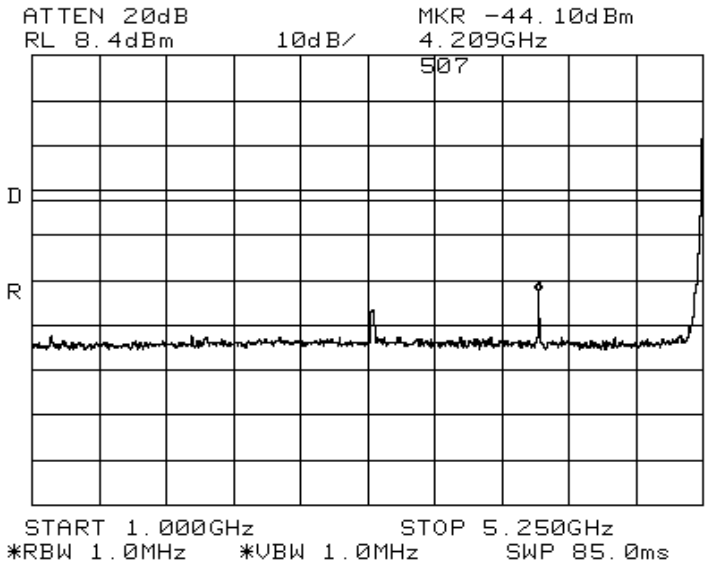
Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

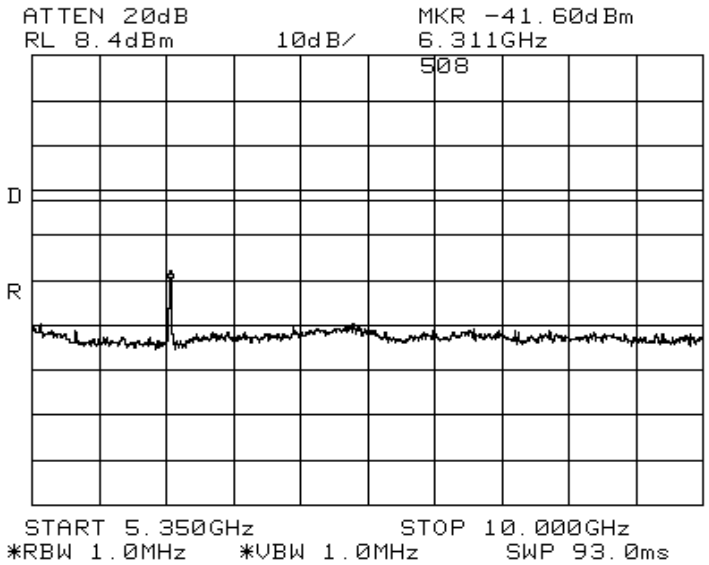


Middle Channe 5.25 GHz

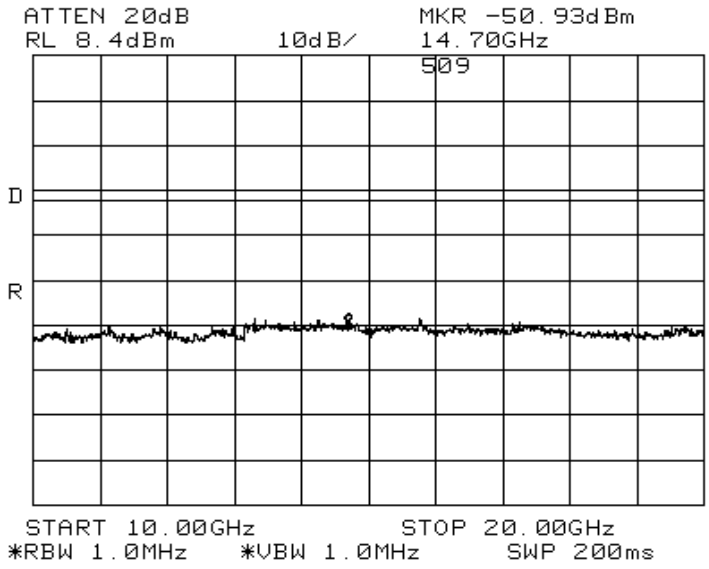


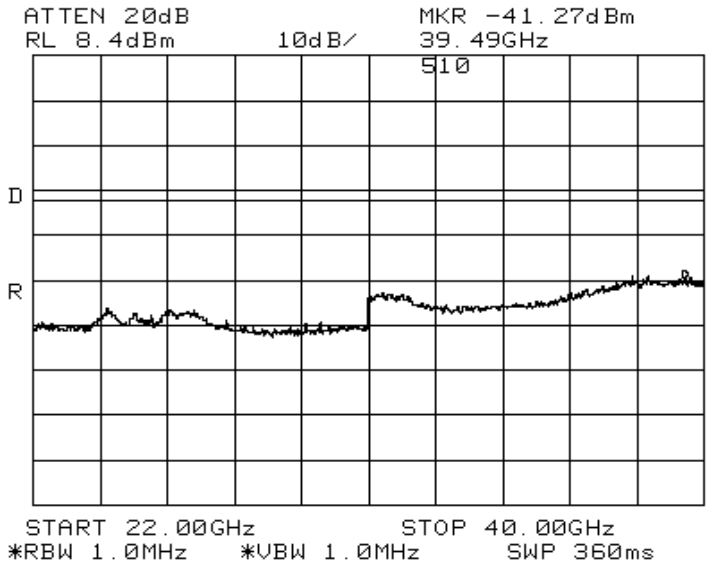
Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B





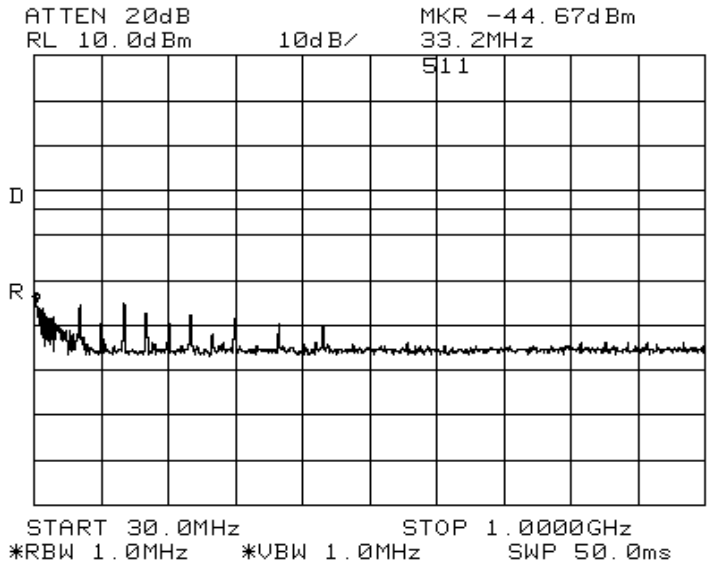
Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

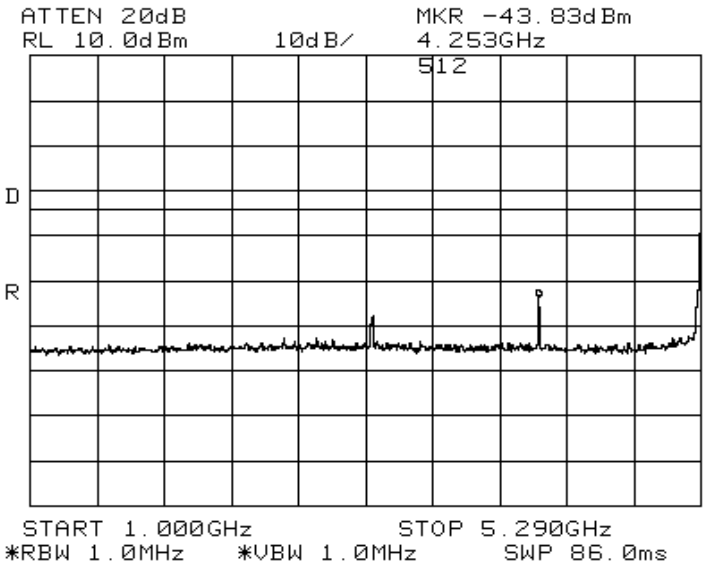




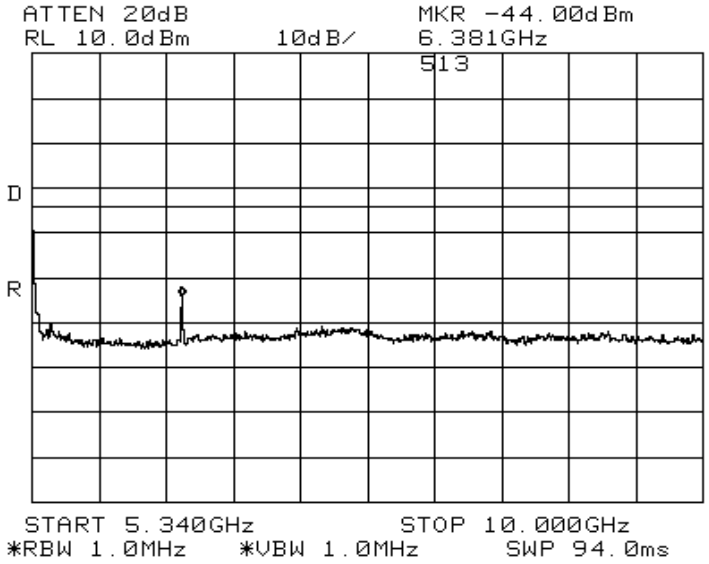
Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

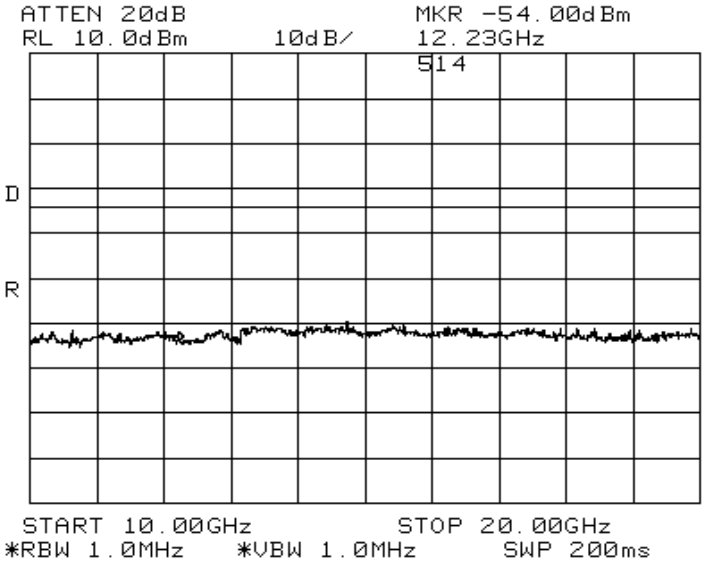
High Channe 5.32 GHz



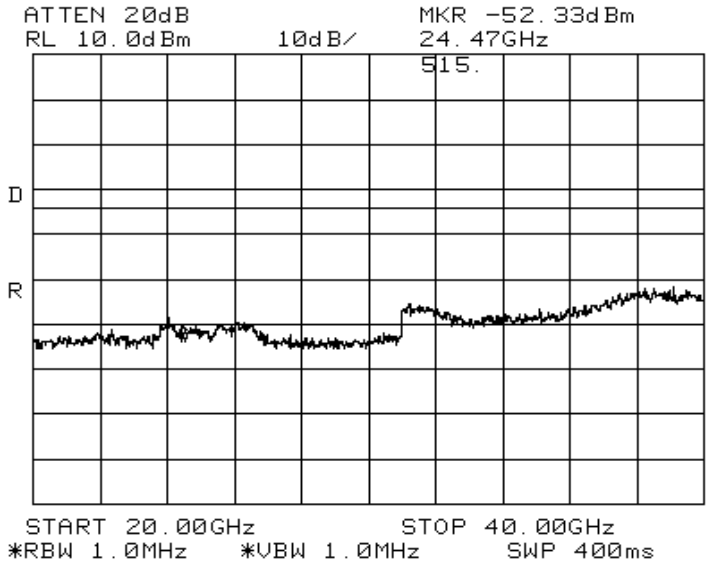


Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B





Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B



Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

Radiated Emissions-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: 4/8/2002
Test Engineer: mfaustino
Test Location: SVOATS #4

Config. Used:
Config Change:
EUT Voltage 120V/60Hz

General Test Configuration

The host system and all local support equipment were located on the turntable for radiated emissions testing.
On the OATS, the measurement antenna was located 10 meters from the EUT for the measurement range 30 - 1000 MHz and 3m from the EUT for the frequency range 1 - 10 GHz.
Note, for testing above 1 GHz, the FCC specifies the limit as an average measurement. In addition, the FCC states that the peak reading of any emission above 1 GHz, can not exceed the average limit by more than 20 dB.

Ambient Conditions:

Temperature: 15°C
Rel. Humidity: 64%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 1 - 40 GHz, Turbo Mode	RSS 210 / FCC 15E	Pass	-0.1dB @ 10507.82

Modifications Made During Testing:

Modifications are detailed under each run description.

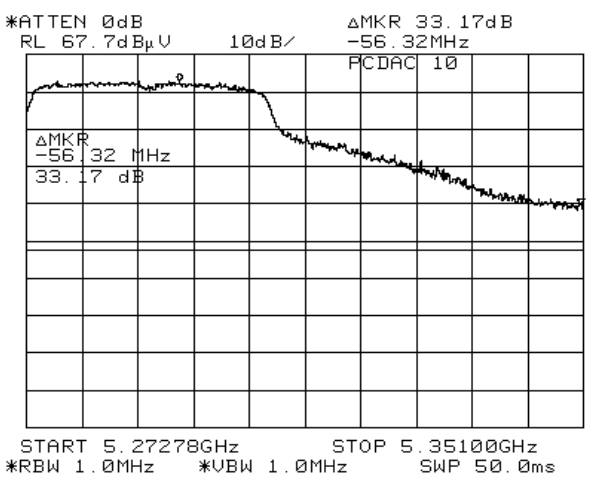
Deviations From The Standard

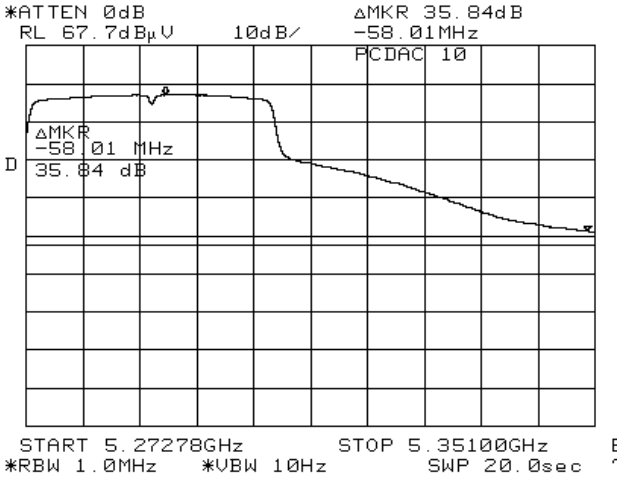
No deviations were made from the requirements of the standard.

Elliott — EMC Test Data

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

Run #1a: Radiated Emissions - Spurious Emissions Above 1GHz, EUT Tx @ 5.29 GHz
EUT Card #4 - shielding on rear of PCB





Channel / Mode / Data Rate: 5.29 GHz / turbo / 6Mb/s

Output Power: _____ dBm **PCDAC:** 10

Field Strength of Fundamental: Avg: 87.1 dBuV/m

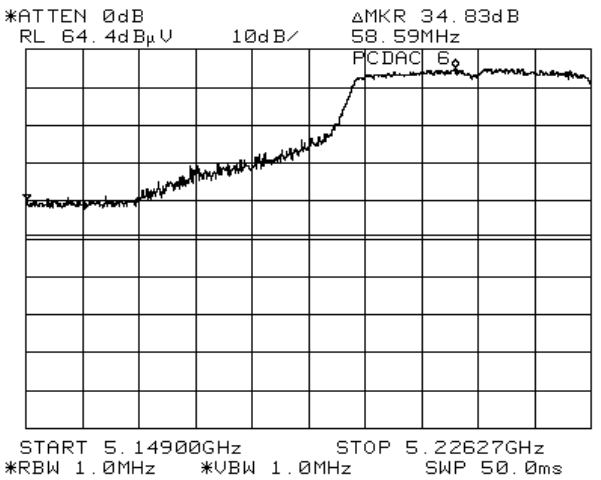
Peak: 96.9 dBuV/m

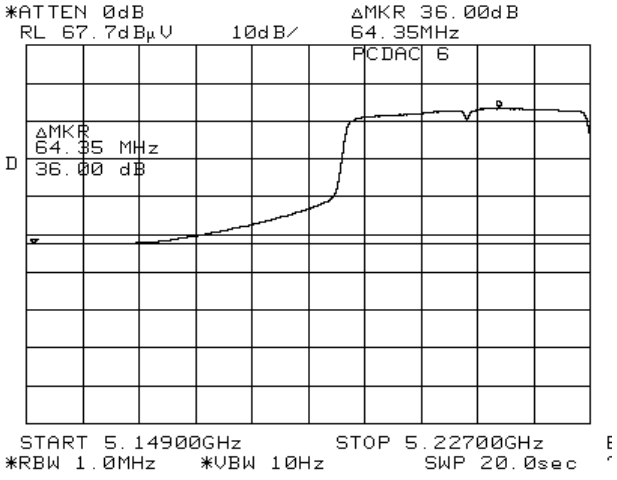
Frequency	Level	Pol	RSS210 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5350.000	51.3	v	54.0	-2.7	Avg	210	1.2	Band Edge - note 2,6, -35.8dBc
15870.00	50.7	V	54.0	-3.3	Avg	330	1.0	
4232.000	50.5	v	54.0	-3.5	Avg	210	1.2	
15870.00	49.4	H	54.0	-4.7	Avg	347	1.0	
21160.00	48.8	H	54.0	-5.2	Avg	30	1.0	
10580.00	59.6	V	68.3	-8.8	-	15	1.0	Note 4
15870.00	64.5	V	74.0	-9.5	Pk	330	1.0	
5350.000	63.7	v	74.0	-10.3	Pk	210	1.2	Band Edge - note 2,6, -33.2dBc
15870.00	63.6	H	74.0	-10.4	Pk	347	1.0	
4232.000	63.5	v	74.0	-10.5	Pk	210	1.2	
21160.00	62.7	H	74.0	-11.3	Pk	30	1.0	
10580.00	52.0	H	68.3	-16.3	-	348	1.0	Note 4

Elliott — EMC Test Data

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

Run #1b: Radiated Emissions - Spurious Emissions Above 1GHz, EUT Tx @ 5.21 GHz





Channel / Mode / Data Rate: 5.21 / turbo / 6Mb/s

Output Power: _____ dBm **PCDAC:** 6

Field Strength of Fundamental: Avg: 85.5 dBuV/m

Peak: 95.5 dBuV/m

Frequency	Level	Pol	RSS210 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
10429.49	50.0	V	54.0	-4.0	Avg	12	1.0	Average reading, average limit
5150.000	49.5	v	54.0	-4.5	Avg	210	1.2	Band Edge - note 2,6, -36dBc
15624.41	46.5	V	54.0	-7.5	Avg	23	1.0	Average reading, average limit
10430.61	44.9	H	54.0	-9.1	Avg	0	0.0	Average reading, average limit
15638.37	44.8	H	54.0	-9.2	Avg	59	1.0	Average reading, average limit
4167.980	44.3	v	54.0	-9.7	Pk	237	1.2	RBW = 3kHz - note ??
10429.74	63.7	V	74.0	-10.3	Pk	12	1.0	Peak reading, peak limit
5150.000	60.7	v	74.0	-13.3	Pk	210	1.2	Band Edge - note 2,6, -34.8dBc
15624.65	59.6	V	74.0	-14.4	Pk	23	1.0	Peak reading, peak limit
15639.07	57.6	H	74.0	-16.4	Pk	59	1.0	Peak reading, peak limit
10430.78	57.6	H	74.0	-16.4	Pk	0	0.0	Peak reading, peak limit
20840.00	54.7	H	74.0	-16.4	Pk	0	1.0	Peak reading, peak limit
20840.00	40.3	H	54.0	-16.4	Avg	0	1.0	Peak reading, peak limit

.*checked 4th and 5th harmonic, no significant signals found

Elliott

EMC Test Data

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

Run #1c: Radiated Emissions - Spurious Emissions Above 1GHz, EUT Tx @ 5.25 GHz
EUT Card #3 - shielding on rear of PCB

Channel / Mode / Data Rate: 5.25 GHz / turbo / 6Mb/s
Output Power: _____ dBm **PCDAC:** 11
Field Strength of Fundamental: Avg: 90.13 dBuV/m
Peak: 100.3 dBuV/m

Frequency	Level	Pol	RSS210 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
10507.82	53.9	V	54.0	-0.1	Avg	0	0.0	Average reading, average limit
21000.00	51.9	V	54.0	-2.1	Avg	352	1.0	Average reading, average limit
10504.22	50.3	H	54.0	-3.7	Avg	8	1.0	Average reading, average limit
10508.02	67.8	V	74.0	-6.2	Pk	0	0.0	Peak reading, peak limit
15752.37	45.9	V	54.0	-8.1	Avg	18	1.0	Average reading, average limit
21000.00	64.8	V	74.0	-9.2	Pk	352	1.0	Peak reading, peak limit
10504.37	63.9	H	74.0	-10.1	Pk	8	1.0	Peak reading, peak limit
15753.55	43.8	H	54.0	-10.2	Avg	359	1.0	Average reading, average limit
26250.00	41.3	V	54.0	-12.7	Avg	352	1.0	Average reading, average limit
4200.000	41.0	v	54.0	-13.0	Avg	200	1.0	RBW = 3kHz - note ??
15752.49	59.2	V	74.0	-14.8	Pk	18	1.0	Peak reading, peak limit
15753.79	56.6	H	74.0	-17.4	Pk	359	1.0	Peak reading, peak limit
26250.00	53.5	V	74.0	-20.5	Pk	352	1.0	Peak reading, peak limit
4200.000	45.3	v	74.0	-28.7	Pk	200	1.0	RBW = 3kHz - note ??

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 transmitted signal but pass the spurious signal). The signal was a narrowband signal (as verified during the conducted antenna measurements) and so the amplitude (peak/average) in a 3kHz bandwidth would be the same as that in a 1MHz bandwidth (please refer to the plot below). The peak reading has been compared with the average limit.

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

Radiated Emissions-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: 4/8/2002
Test Engineer: mfaustino
Test Location: SVOATS #4

Config. Used:
Config Change:
EUT Voltage 120V/60Hz

General Test Configuration

The host system and all local support equipment were located on the turntable for radiated emissions testing.
On the OATS, the measurement antenna was located 10 meters from the EUT for the measurement range 30 - 1000 MHz and 3m from the EUT for the frequency range 1 - 10 GHz.
Note, for testing above 1 GHz, the FCC specifies the limit as an average measurement. In addition, the FCC states that the peak reading of any emission above 1 GHz, can not exceed the average limit by more than 20 dB.

Ambient Conditions:

Temperature: 15°C
Rel. Humidity: 64%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 1 - 40 GHz, Normal mode	RSS 210 / FCC 15E	Pass	-0.1dB @ 10638.29

Modifications Made During Testing:

Rear shield soldered to PCB along front and re-seated the circuit board during testing to reduce the levels of emissions.

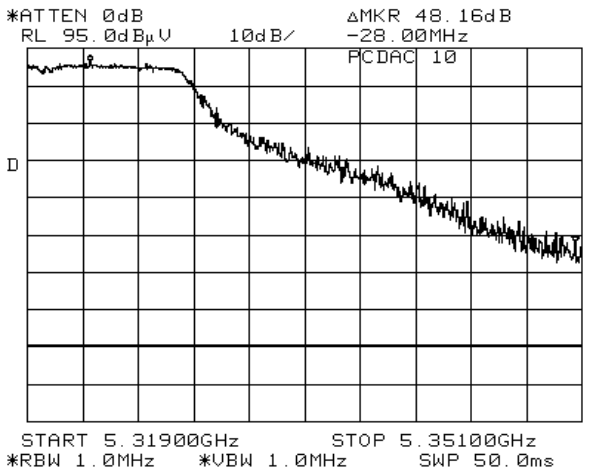
Deviations From The Standard

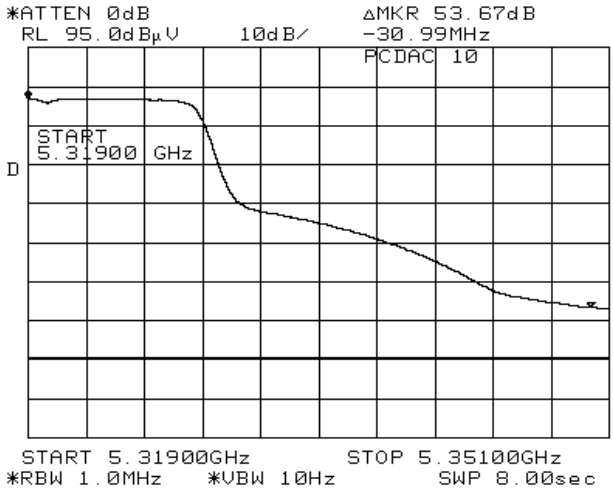
No deviations were made from the requirements of the standard.

Elliott — EMC Test Data

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

Run #1a: Radiated Emissions - Spurious Emissions Above 1GHz, EUT Tx @ 5.32 GHz
EUT Card #3 - shielding on rear of PCB





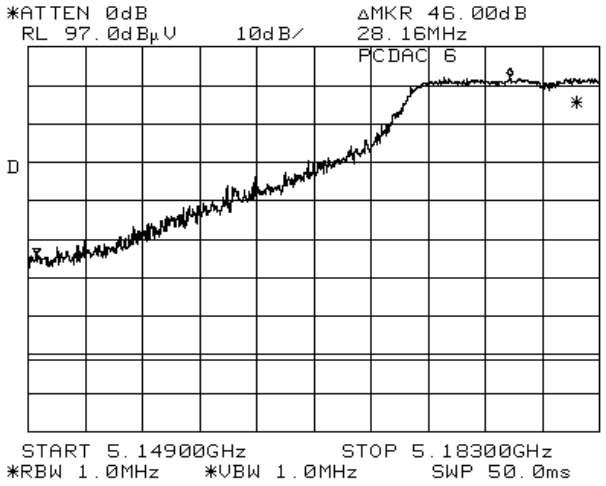
Channel / Mode / Data Rate: 5.32 GHz / 802.11 / 6Mb/s
Output Power: _____ dBm **PCDAC:** 10
Field Strength of Fundamental: Avg: 105.25 dBuV/m
Peak: 102.62 dBuV/m

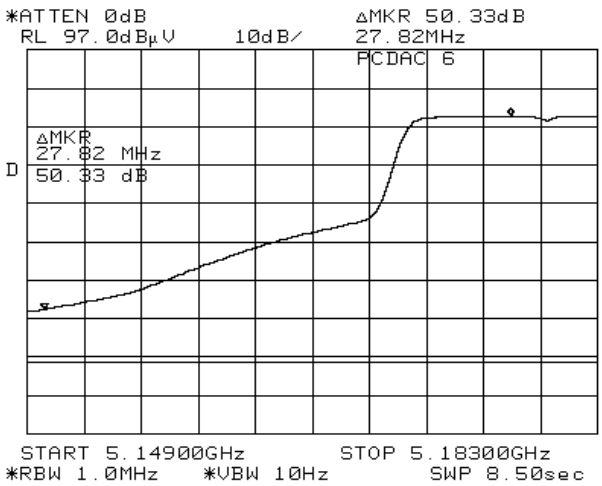
Frequency	Level	Pol	RSS210 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
10638.29	53.9	V	54.0	-0.1	Avg	350	1.1	
5350.000	51.6	v	54.0	-2.5	Avg	244	1.2	Band Edge - note 2,6, -53.7dBc
4255.990	51.4	v	54.0	-2.6	Avg	237	1.2	RBW = 3kHz - note ??
10638.29	50.5	H	54.0	-3.5	Avg	215	1.6	
15960.00	48.5	V	54.0	-5.5	Avg	195	1.0	
10638.54	67.7	V	74.0	-6.3	Pk	350	1.1	
15960.00	44.4	H	54.0	-9.6	Avg	195	1.0	
10638.54	62.7	H	74.0	-11.3	Pk	215	1.6	
15960.00	59.7	V	74.0	-14.3	Pk	195	1.0	
15960.00	57.9	H	74.0	-16.1	Pk	195	1.0	
5350.000	54.4	v	74.0	-19.6	Pk	244	1.2	Band Edge - note 2,6, -48.2dBc
4255.990	52.9	v	74.0	-21.1	Pk	237	1.2	RBW = 3kHz - note ??
21280.00	59.3	v	74.0	-14.7	Pk	18	1.2	
21280.00	46.4	v	54.0	-7.7	Avg	18	1.2	
26600.00	55.0	v	68.3	-13.3	Pk	360	1.0	
26600.00	57.0	h	68.3	-11.3	Pk	0	1.1	

Elliott — EMC Test Data

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

Run #1b: Radiated Emissions - Spurious Emissions Above 1GHz, EUT Tx @ 5.18 GHz





Channel / Mode / Data Rate: 5.18 GHz / 802.11 / 6Mb/s

Output Power: _____ dBm **PCDAC:** 6

Field Strength of Fundamental: Avg: 101.75 dBuV/m

Peak: 111.85 dBuV/m

Frequency	Level	Pol	RSS210 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
15540.00	53.8	H	54.0	-0.2	Avg	250	1.0	
15540.00	53.7	V	54.0	-0.3	Avg	251	1.0	reseated board, PCDAC 6
5150.000	51.5	v	54.0	-2.6	Avg			Band Edge - note 2,6, -50.3dBc
15540.00	68.6	V	74.0	-5.4	Pk	244	1.0	reseated board, PCDAC 6
15540.00	68.6	H	74.0	-5.4	Pk	250	1.0	
5150.000	65.9	v	74.0	-8.1	Pk			Band Edge - note 2,6, -46dBc
10360.00	54.2	V	68.3	-14.1	Avg			Reseated board, PCDAC 6
10360.00	50.5	H	68.3	-17.8	Avg	225	1.6	
4144.000	35.3	v	54.0	-18.7	Avg			RBW = 3kHz - note ??
10360.00	66.6	V	88.3	-21.7	Pk			Reseated board, PCDAC 6
10360.00	64.1	H	88.3	-24.2	Pk	225	1.6	
4144.000	46.6	v	74.0	-27.4	Pk			RBW = 3kHz - note ??
20720.00	54.7	v	74.0	-19.3	Pk	37	1.0	
20720.00	45.1	v	54.0	-8.9	Avg	37	1.0	
25900.00	55.2	v	68.3	-13.1	Pk	328	1.0	
25900.00	53.5	h	68.3	-14.8	Pk	312	1.1	

Elliott

EMC Test Data

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46833
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

Run #1c: Radiated Emissions - Spurious Emissions Above 1GHz, EUT Tx @ 5.26 GHz

Channel / Mode / Data Rate: 5.26 GHz / 802.11 / 6Mb/s

Output Power: _____ dBm **PCDAC:** 10

Field Strength of Fundamental: Avg: 40.95 dBuV/m

Peak: 70.9 dBuV/m

Frequency	Level	Pol	RSS210 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
15780.00	53.7	V	54.0	-0.3	Avg	334	1.1	Rear shield soldered to PCB along front
15780.00	51.5	H	54.0	-2.5	Avg	6	1.0	Rear shield soldered to PCB along front
5260.000	70.9	v	74.0	-3.1	Pk			Band Edge - note 2,6, dBc
15780.00	63.2	H	74.0	-10.8	Pk			Rear shield soldered to PCB along front
15780.00	50.3	V	54.0	-3.7	Avg	33	1.1	Rear shield soldered to PCB along front
5260.000	41.0	v	54.0	-13.1	Avg			Band Edge - note 2,6, dBc
10520.00	54.7	H	68.3	-13.6	-	282	1.0	
10520.00	54.0	V	68.3	-14.3	-			
6311.98	53.6	V	68.3	-14.7	-			
4208.000	36.0	v	54.0	-18.1	Pk			
21040.00	67.9	h	74.0	-6.1	Pk	241	1.0	
21040.00	51.6	h	54.0	-2.4	Avg	241	1.0	
21040.00	66.5	v	74.0	-7.5	Pk	195	1.0	
21040.00	53.2	v	54.0	-0.9	Avg	195	1.0	
26299.00	55.0	v	68.3	-13.3	Pk	189	1.0	
26299.00	54.2	h	68.3	-14.1	Pk	0	1.0	

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 transmitted signal but pass the spurious signal). The signal was a narrowband signal (as verified during the conducted antenna measurements) and so the amplitude (peak/average) in a 3kHz bandwidth would be the same as that in a 1MHz bandwidth (please refer to the plot below). The peak reading has been compared with the average limit.

Elliott

EMC Test Data

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46889
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Emissions Spec:	FCC Part 15 B and E, RSS-210	Class:	B
Immunity Spec:	N/A	Environment:	-

EMC Test Data

For The

Delta

Model

HA311

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46889
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
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 UNII Radio which is designed to operate in the 5.15-5.25GHz and 5.25-5.35GHz UNII/LELAN bands. The EUT is PCI card which is designed to be installed into a desktop PC. The card provides data rates of up to 54 Mb/s while operating in 802.11 mode (nominal bandwidth of 25 MHz) and data rates of up to 72 Mb/s operating in a turbo mode (nominal bandwidth of 50 MHz).

Normally, the host system would be table-top during operation. The host system was treated as table-top equipment during testing to simulate the end user environment. The electrical rating of the host system is 120/240 V, 50/60 Hz.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Delta	HA311	UNII PCI Card	Card #1	

EUT Enclosure

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

Modification History

Mod. #	Test	Date	Modification
1	-	-	None

Elliott

EMC Test Data

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46889
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
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	DHS	PC	599GJ01	DoC
Dell	D1726T-HS	Monitor	7172104	AK8GDM17SE2T
Hewlett Packard	E03633HLUS-C	Keyboard	51825521	C1GE03633
Epson	P952A	Pinter	ADA0013241	BKMFBP9528
US Robotics	Pilot 1000	PDA	604819965702	MQ90001
Logitech	M-S69	Mouse	LNA11311085	JNZ211443

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None required				

Interface Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
PC SVGA	Monitor	Multiconductor	Shielded	2
PC PS2	Keyboard	Multiconductor	Shielded	2
PC PS2	Mouse	Multiconductor	Shielded	2
PC DB9	PDA	Multiconductor	Shielded	3
PC parallel	Printer	Multiconductor	Shielded	3
PC PCI slot	EUT	Direct connection	-	-

EUT Operation During Emissions

The EUT was in stand-by mode as the Host displayed scrolling H's on the screen and executed the scrolling H pattern on the printer.

Elliott

EMC Test Data

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46889
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

Radiated Emissions

Test Specifics

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

Date of Test: 4/10/2002
Test Engineer: Marissa Faustino
Test Location: SVOATS #1

Config. Used:
Config Change:
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.
On the OATS, the measurement antenna was located 3 meters from the EUT for the measurement range 30 - 1000 MHz and 3m from the EUT for the frequency range 1 - 10 GHz.
Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.
Note, for testing above 1 GHz, the FCC specifies the limit as an average measurement. In addition, the FCC states that the peak reading of any emission above 1 GHz, can not exceed the average limit by more than 20 dB.

Ambient Conditions:

Temperature: 21°C
Rel. Humidity: 43%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, Preliminary Scan 30 - 1000 MHz	FCC B	Eval	-4.1dB @ 319.995MHz
2	RE, 30 - 1000MHz - Maximized Emissions	FCC B	Pass	-3.4dB @ 319.995MHz
3	RE, 1000 - 6000 MHz Maximized Emissions	FCC B	Pass	-7.4dB @ 4382.96MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Elliott

EMC Test Data

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46889
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

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

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
319.995	41.9	H	46.0	-4.1	QP	308	1.0	
319.995	41.3	V	46.0	-4.7	QP	170	1.5	
816.120	38.5	H	46.0	-7.5	QP	169	1.0	
816.120	38.1	V	46.0	-7.9	QP	177	1.0	
336.050	38.1	H	46.0	-7.9	QP	133	1.0	
607.985	36.3	V	46.0	-9.7	QP	222	1.0	
666.450	35.5	H	46.0	-10.5	QP	45	1.0	
528.070	35.4	V	46.0	-10.6	QP	133	1.0	
299.745	35.3	H	46.0	-10.7	QP	7	1.0	
798.545	34.0	V	46.0	-12.0	QP	230	1.0	
336.050	33.7	V	46.0	-12.3	QP	50	2.2	
528.070	33.6	H	46.0	-12.4	QP	67	1.0	
288.040	32.7	H	46.0	-13.3	QP	91	1.2	
256.000	32.5	H	46.0	-13.5	QP	94	1.3	
298.360	32.5	H	46.0	-13.5	QP	1	1.2	
299.745	31.9	V	46.0	-14.1	QP	247	1.6	
299.220	31.3	H	46.0	-14.7	QP	69	1.0	
272.030	31.0	H	46.0	-15.0	QP	128	1.3	
399.290	30.0	V	46.0	-16.0	QP	175	1.0	
288.040	29.9	V	46.0	-16.1	QP	48	1.0	
298.360	29.5	V	46.0	-16.5	QP	135	1.0	
300.690	29.3	H	46.0	-16.7	QP	3	1.0	
299.220	29.0	V	46.0	-17.0	QP	72	1.0	
267.000	29.0	H	46.0	-17.0	QP	115	1.0	
186.140	25.8	H	43.5	-17.7	QP	267	1.8	
166.360	25.7	V	43.5	-17.8	QP	224	1.0	
272.030	28.1	V	46.0	-17.9	QP	64	1.0	
666.450	28.0	V	46.0	-18.0	QP	24	1.0	
798.545	28.0	H	46.0	-18.0	QP	128	1.0	
186.140	25.0	V	43.5	-18.5	QP	355	1.0	
166.360	25.0	H	43.5	-18.5	QP	123	1.0	
256.000	26.7	V	46.0	-19.3	QP	64	1.0	
300.690	26.7	V	46.0	-19.3	QP	207	1.0	
399.290	26.0	H	46.0	-20.0	QP	294	1.0	
232.390	25.6	H	46.0	-20.4	QP	200	1.0	
266.260	25.3	V	46.0	-20.7	QP	302	1.0	

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46889
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
Spec:	FCC Part 15 B and E, RSS-210	Class:	B

Run #2: Maximized Readings From Run #1

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
319.995	42.6	H	46.0	-3.4	QP	308	1.0	
319.995	41.3	V	46.0	-4.7	QP	170	1.5	
816.120	39.1	H	46.0	-6.9	QP	169	1.0	
336.050	38.4	H	46.0	-7.6	QP	133	1.0	
816.120	38.1	V	46.0	-7.9	QP	177	1.0	
607.985	36.3	V	46.0	-9.7	QP	222	1.0	

Run #3: Maximized readings, 1000 - 6000 MHz

Measurements made at 3m per FCC requirements.

Frequency	Level	Pol	FCC B	FCC B	Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4382.960	46.6	V	54.0	-7.4	Avg	0	2.0	
4382.960	46.6	H	54.0	-7.4	Avg	0	1.0	
4382.960	61.0	V	74.0	-13.0	Pk	0	2.0	
4382.960	58.0	H	74.0	-16.0	Pk	0	1.0	

Client:	Delta	Job Number:	J46830
Model:	HA311	T-Log Number:	T46889
		Proj Eng:	Mark Briggs
Contact:	Larry and Glen		
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: 4/10/2002
Test Engineer: Marissa Faustino
Test Location: SVOATS #1
Config. Used:
Config Change:
EUT Voltage: 120V/60Hz

General Test Configuration

For tabletop equipment, the 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: 21°C
Rel. Humidity: 43%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power 120V/60Hz	FCC B	Pass	-5.8dB @ .489MHz

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.

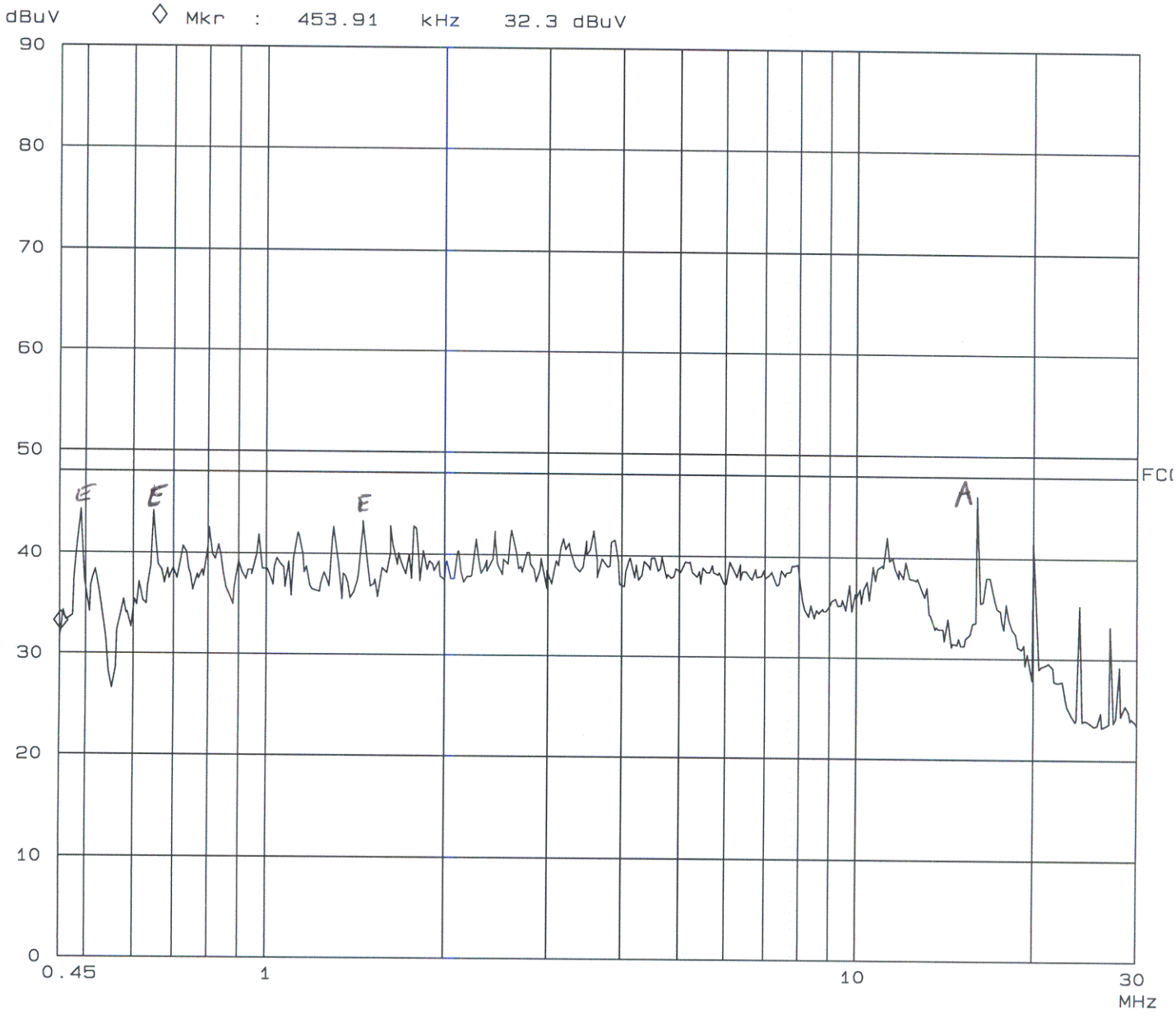
Run #1: AC Power Port Conducted Emissions, 0.45 - 30MHz, 120V/60Hz

Frequency	Level	AC	FCC B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.4891	42.2	Neutral	48.0	-5.8	QP	
1.4660	41.4	Neutral	48.0	-6.6	QP	
1.6250	41.0	Neutral	48.0	-7.0	QP	
0.4891	41.7	Line	48.0	-6.3	QP	
0.6492	41.4	Line	48.0	-6.6	QP	
1.4620	41.4	Line	48.0	-6.6	QP	

Elliott Laboratories
AC Conducted Emissions

10. Apr 02 16:21

EUT:	HA311 PCI card
Manuf:	Delta
Op Cond:	Run1 Line
Operator:	Marissa Faustino
Test Spec:	FCC B
Comment:	120V/60Hz
	J46830/T46833



Elliott Laboratories
AC Conducted Emissions

10. Apr 02 16:07

EUT:	HA311 PCI card
Manuf:	Delta
Op Cond:	Run1 Neutral
Operator:	Marissa Faustino
Test Spec:	FCC B
Comment:	120V/60Hz
	J46830/T46833

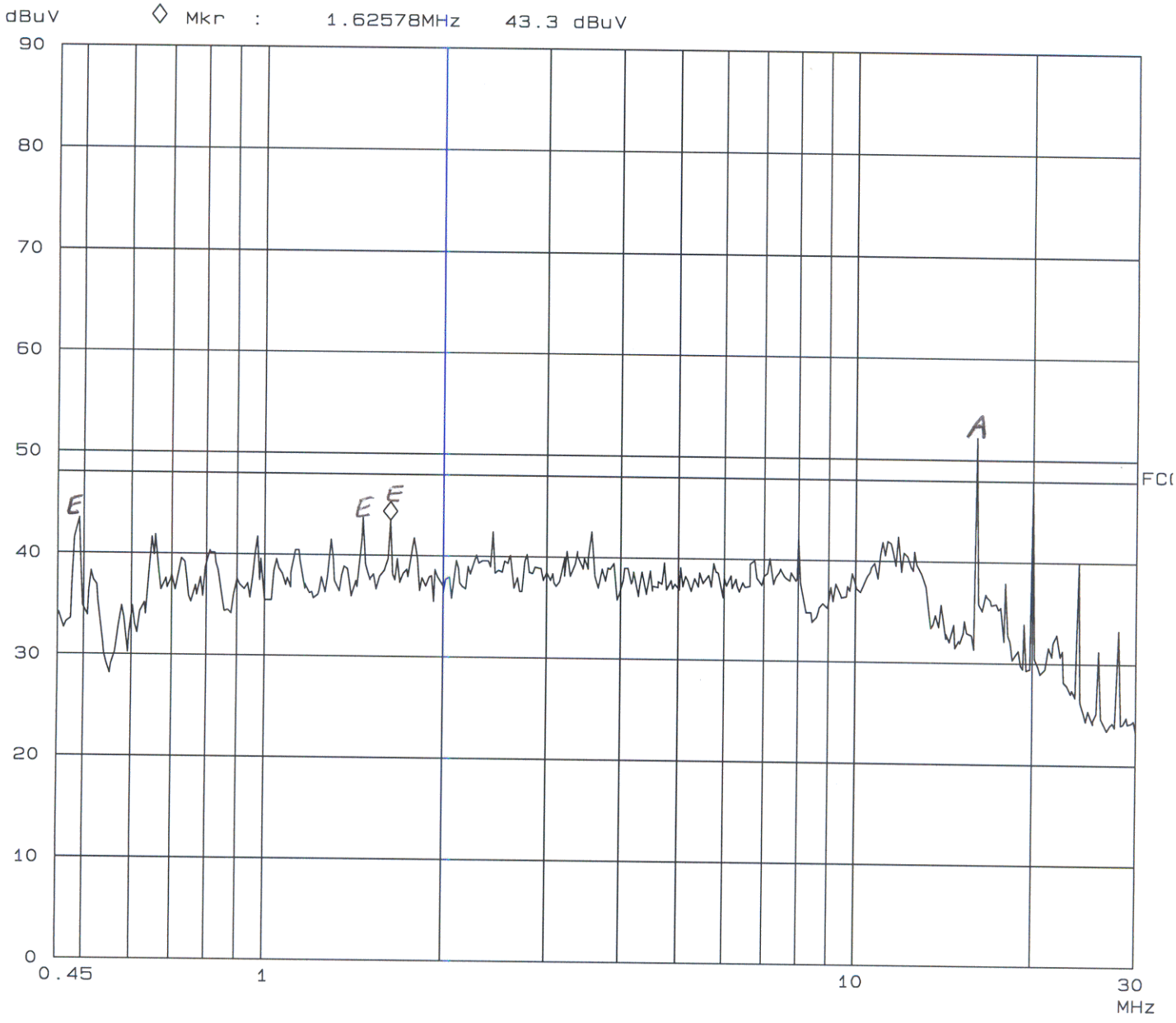


EXHIBIT 3: Test Configuration Photographs

3 Pages

EXHIBIT 4: Proposed FCC ID Label & Label Location

2 Pages

EXHIBIT 5: Detailed Photographs of Netgear Model HA311Construction

EXHIBIT 6: Operator's Manual for Netgear Model HA311

22 Pages

EXHIBIT 7: Block Diagram of Netgear Model HA311

1 Page

EXHIBIT 8: Schematic Diagrams for Netgear Model HA311

Schematics 4 Pages
Layout 12 Pages

EXHIBIT 9: Theory of Operation for Netgear Model HA311

1 Page

EXHIBIT 10: Advertising Literature

None available at this time.

EXHIBIT 11: RF Exposure Information

1 Page