Radio Test Report R79065

Japanese Radio Law - Item 19 of Article 12
WIDE-BAND LOW-POWER DATA COMMUNICATIONS SYSTEMS
Category WW (2400 - 2483.5 MHz)
Category GZ (2471 - 2497 MHz)

MANUFACTURER: Summit Data Communications

MODEL(s): 802.11abg MSD30AG

TEST SITE: Elliott Laboratories, LLC
684 W. Maude Avenue
Sunnyvale, CA 94085

SIGNATORY: Mark Briggs
Staff Engineer

Revision History

Rev #	Made By	Date	Comments
1	-	27-Apr-10	First release
2	M Briggs	17-May-10	Added photograph of connector on the module. Added hardware revision: MSD30AG Rev G

Elliott An NTS company

Table of Contents

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Elliott An NAT company

Product Information

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
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Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Product Information

Product Information

The Summit Data Communication model SDC-MSD30AG is an 802.11 abg Mini SDIO Radio Module for installation by system integrators. The serial number of the sample tested was 1000FC5

EUT Software

Summit Client Utility (SCU) - Driver V3.01.13, SCU V2.03.42
Summit Regulatory Utility (SRU) - V3.1.13

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.

Test Environment

Temperature:	15-30 °C
Rel. Humidity:	20-75 %
Pressure:	86-106 kPa

Product Power Supply - Determination of Voltage Regulator

The device is designed to be powered from a nominal voltage of: **3.3 Vdc**

Testing performed at voltage extremes, as the regulator and regulator information is not accessible.

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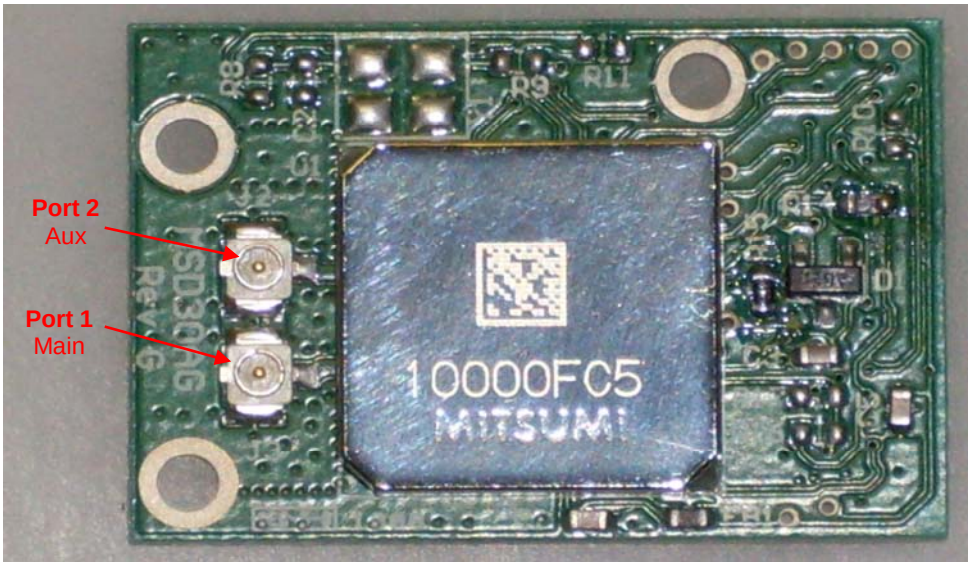
RF Accessibility (Article 2, Item (19) Notice 88 Appendix 43, 44, 45)

Requirement

The EUT shall be constructed in such a way that sensitive RF parts, (like modulation and oscillator parts) cannot be reached easily by the user. These parts shall be covered by soldered metal caps or glue or by other mechanical covers. If the covers are fixed with screws, these shall be not the common type(s) like a Phillips, but special versions like Torx, so that the user cannot open the device with common tools.

Results

The outer enclosure covers all of the rf sensitive circuitry with the exception of the antenna connectors. The outer case is not designed to be removed (see first set of pictures below).



Metal cover is soldered into place over rf circuitry

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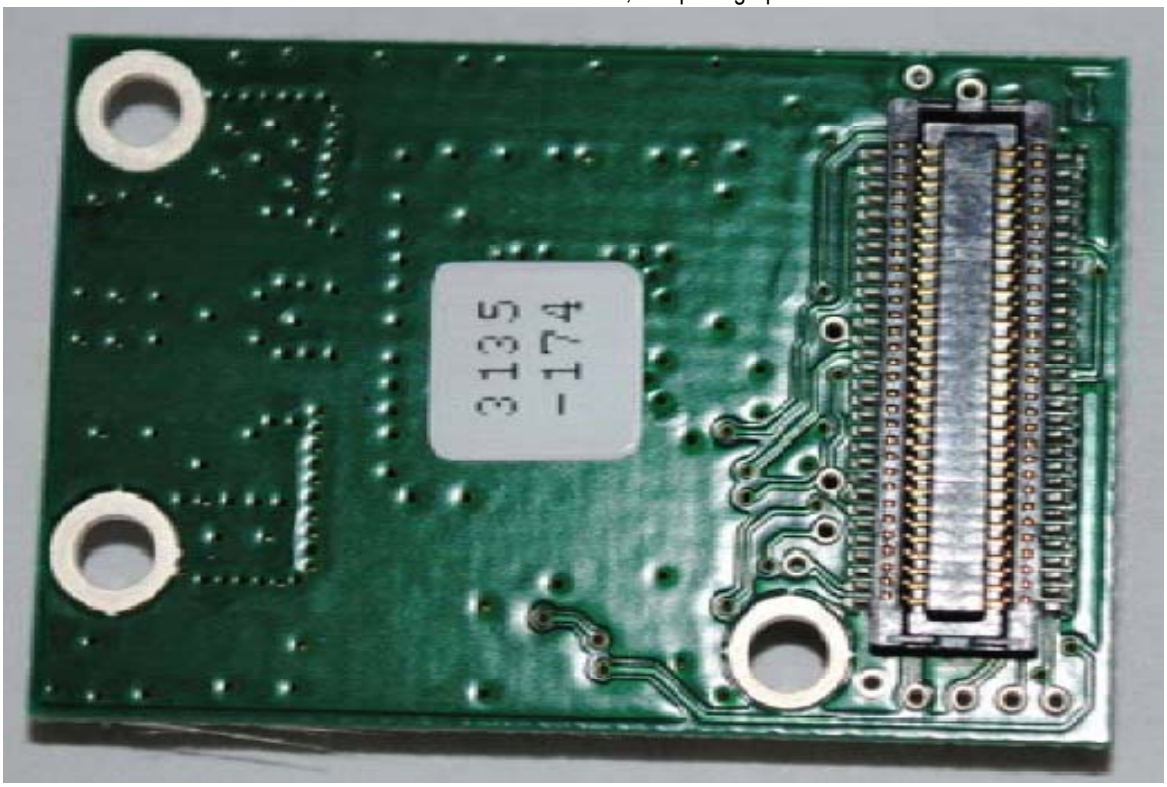
Module Connector

Requirement

Modular approval is only permitted for devices with an interface connector. Modular approval is not allowed for modules that are soldered directly into the host system.

Results

The module uses a connector found on the back-side of the circuit board, see photograph below.



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Antenna Characterisitics

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RADIO EQUIPMENT USED FOR 2.4 GHz BAND WIDE-BAND LOW-POWER DATA COMMUNICATIONS SYSTEM (Radio station using 2400 - 2483.5 MHz)

Antenna Gain(s)

Antenna	Mode	Requirement	Antenna Gain	Result
Summit SDC-CF22G	802.11b and 802.11g (2400-2483.5MHz)	Omni-directional antennas: Maximum eirp allowed is 12.15dBm/MHz.	0 dBi	Pass
Larsen, R380.500.314			1.6 dBi	Pass
Cisco Air-Ant 4941			2.0 dBi	Pass
Huber+Suhner, SOA 2459/360/5/0/V_C			3 dBi	Pass

Antenna Gain
Refer to attached data sheets showing antenna gain and pattern for each antenna.

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Summit SDC-CF22G

"High Frequency Ceramic Solutions"

2450 MHz Antenna — P/N 2450AT42B100

Ground Clearance Requirements Minimized

Detail Specification: 11/20/2008

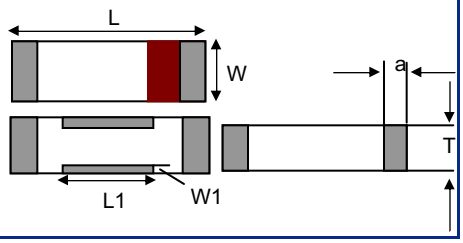
General Specifications

Part Number	2450AT42B100
Frequency Range	2400 - 2500 Mhz
Peak Gain	0 dBi typ. (XZ-V)
Average Gain	-1.5 dBi typ. (XZ-V)
Return Loss	9.5 dB min.

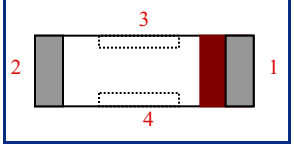
Input Power	3W max.
Impedance	50 Ω
Operating Temperature	-40 to +85°C
Reel Quanity	2,000

Mechanical Dimensions

	In	mm
L	0.197 ± 0.008	5.00 ± 0.20
W	0.079 ± 0.008	2.00 ± 0.20
L1	0.102 ± 0.008	2.60 ± 0.20
W1	0.020 ± 0.008	0.50 ± 0.20
T	0.079 +.004/-.008	2.00 +0.1/-0.2
a	0.020 ± 0.012	0.50 ± 0.30



No.	Function
1	Feed Point
2	Anchoring Pin-NC
3	* Anchoring Pin-NC
4	* Anchoring Pin-NC

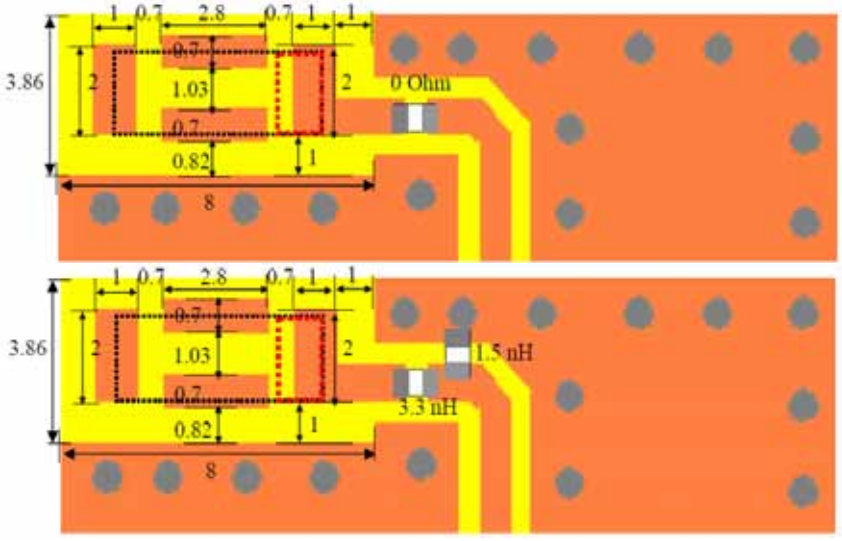


Mounting Considerations

Mount these devices with brown mark facing up. Units: mm

Line width should be designed to provide 50Ω impedance matching characteristics.

* Note: Pins 3 & 4, although "No Connect", must be soldered to its PCB pads for proper electrical operation



a) Without Matching Circuit

b) With Matching Circuit

JTI P/N for Matching Circuit:
Inductor (1.5nH): L-07C1N5SV6T
Inductor (3.3nH): L-07C3N3SV6T

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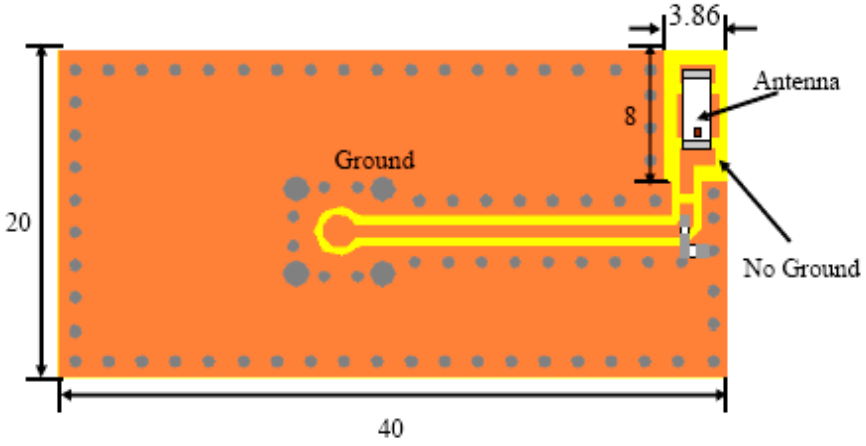
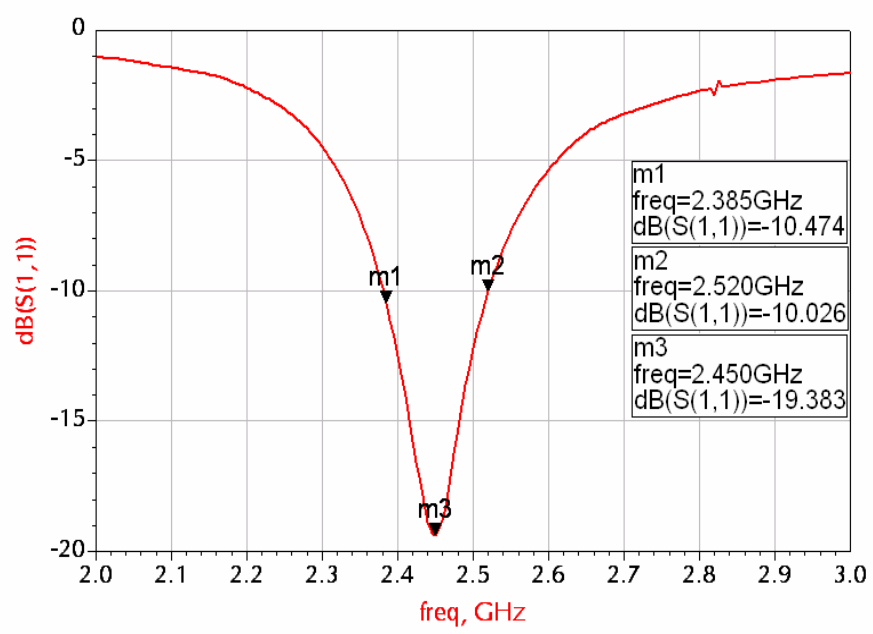
Typical Electrical Characteristics (T=25°C)

Test Board:



Return Loss

a) With Matching Circuit



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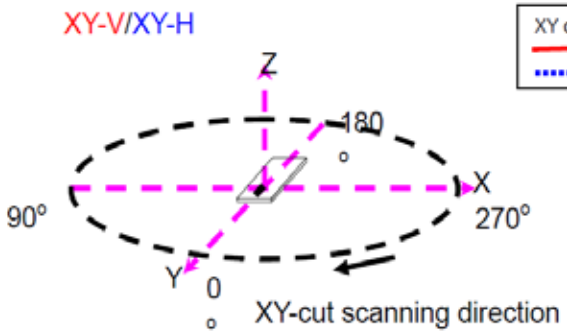
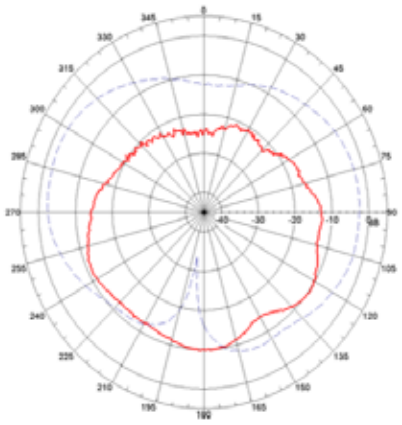
2450 MHz Antenna **P/N 2450AT42B100**

Detail Specification: 11/20/08 Page 3 of 3

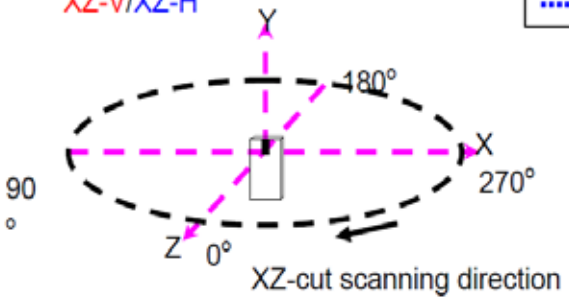
Typical Radiation Patterns

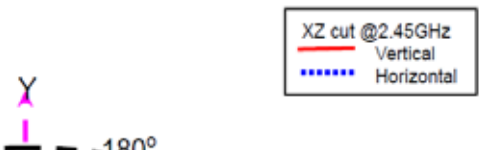
XY-V/XY-H

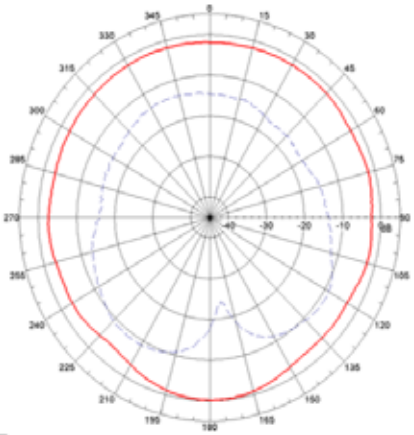




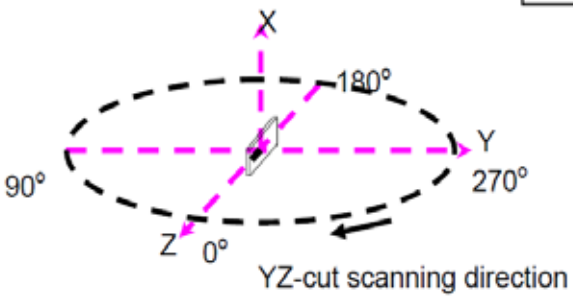
XZ-V/XZ-H

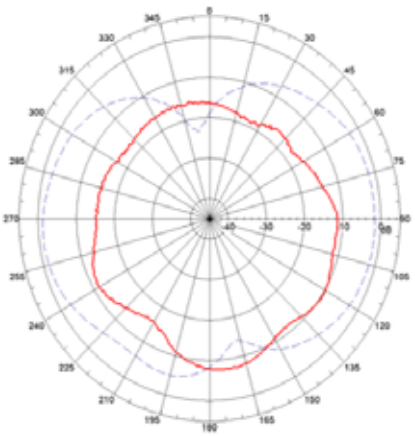






YZ-V/YZ-H





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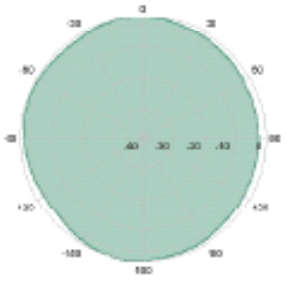
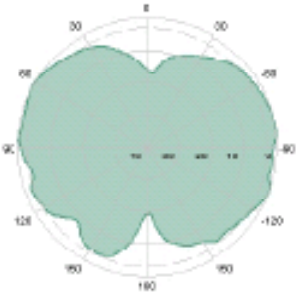
Huber+Suhner, SOA 2459/360/5/0/V_C

HUBER+SUHNER®
SENCITY® ANTENNA
FOR WIRELESS COMMUNICATION

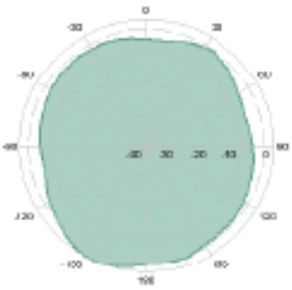
SOA 2459/360/5/0/V_C



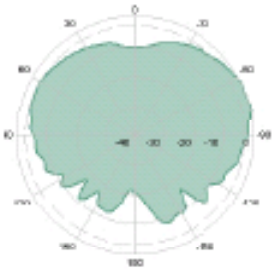
Horizontal 2450MHz



Vertical 2450MHz



Horizontal 5600MHz



Vertical 5600MHz

Technical Data

Electrical Properties		
Frequency range	2400 - 2500MHz	5150 – 5875MHz
Impedance	50 Ω	
VSWR	≤ 2	
Polarization	linear, vertical	
Gain	3 dBi	6.5dB
10 dB beamwidth horizontal	360°	360°
10 dB beamwidth vertical	140°	60°
Max. power	0.1 W (CW) at 25°C	

Mechanical Properties	
Operating temperature range	- 40°C to + 80°C
Storage temperature range	- 40°C to + 80°C

Available Types	Article no.	
1399.99.0020	84038866	Pigtail with UFL connector (0.24m)

Documents	
01.02.0777	security instruction

HUBER+SUHNER is certified according to ISO 9001 and ISO 14001

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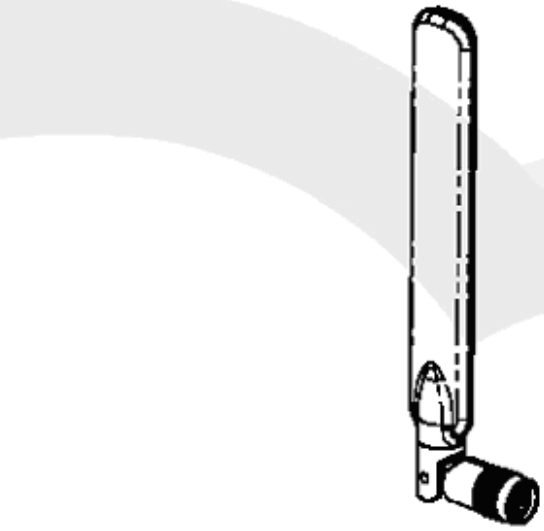
Larsen, R380.500.314

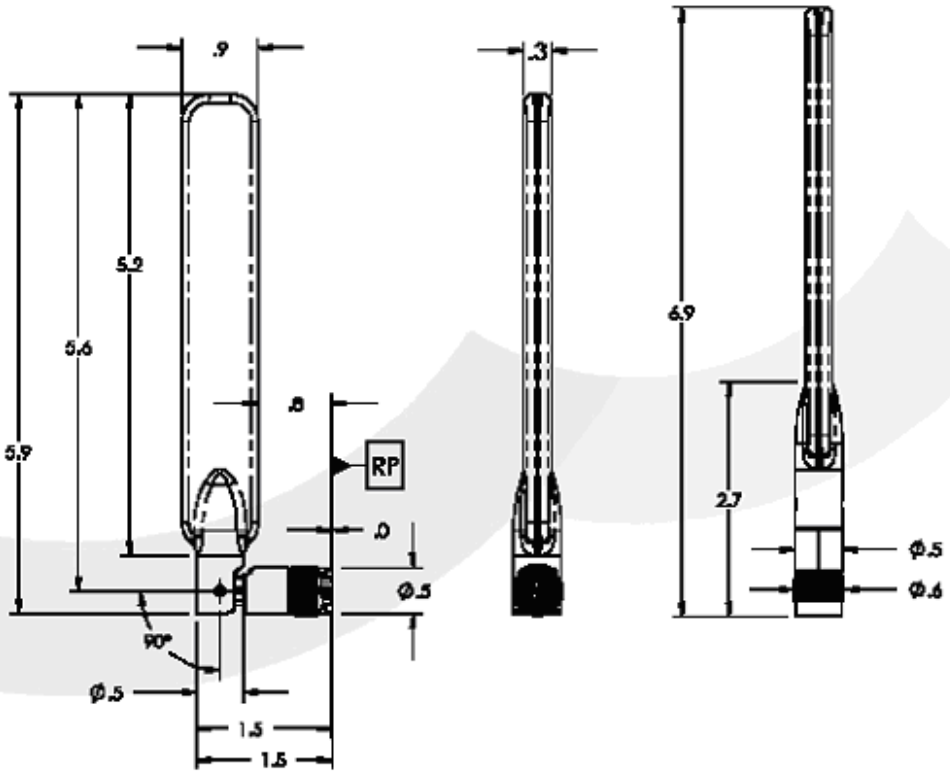
Dual Band Swivel Mount Dipole RP-TNC Blade

2.40-2.50/4.90-5.90 GHz

R380.500.314

Series : **ANTENNA**





All dimensions are inches

Issue : 0717

In the effort to improve our products, we reserve the right to make changes judged to be necessary.

RoHS COMPLIANT

Dual Band Swivel Mount Dipole RP-TNC Blade

2.40-2.50/4.90-5.90 GHz

R380.500.314

Series : **ANTENNA**

ELECTRICAL SPECIFICATIONS

Frequency :	**2.40-2.50/4.90-5.90** GHz
Nominal Impedance :	**50** Ω
VSWR :	**2:1** Max
Gain (Radiating element) :	**1.6/5.0** dBi ± 1 dB
Radiation Pattern	
HPBW in Horizontal Plane :	**360** ° ± 2 °
Ripple level in Horizontal Plane :	**±3** dB Max
HPBW in Elevation	
Low Band :	**85** °
High Band :	**30** °
Polarization :	**Linear Vertical**
Connector type :	**Reverse Polarity TNC**
Cable type :	**RG316**

Dual Band Swivel Mount Dipole RP-TNC Blade

2.40-2.50/4.90-5.90 GHz

R380.500.314

Series : **ANTENNA**

MECHANICAL SPECIFICATIONS

Plastic radome :	**ABS+PC**	
Color :	**Black**	
Flammability Rating :	**V-0**	UL 94
Weight :	**1.2**	oz
Overall length :	**6.9**	Inches
Bent	**5.9**	Inches
Fixing system :		
Azimuth adjustment		° ± 4°
Elevation adjustment		° ± 4°

ENVIRONMENTAL SPECIFICATIONS

Operating temperature :	**-30/+70**	° C
Storage temperature : ……..	**-40/+85**	° C
Humidity :	**95%**	@ 24° C

OTHER SPECIFICATIONS

Dual Band Swivel Mount Dipole RP-TNC Blade

2.40-2.50/4.90-5.90 GHz

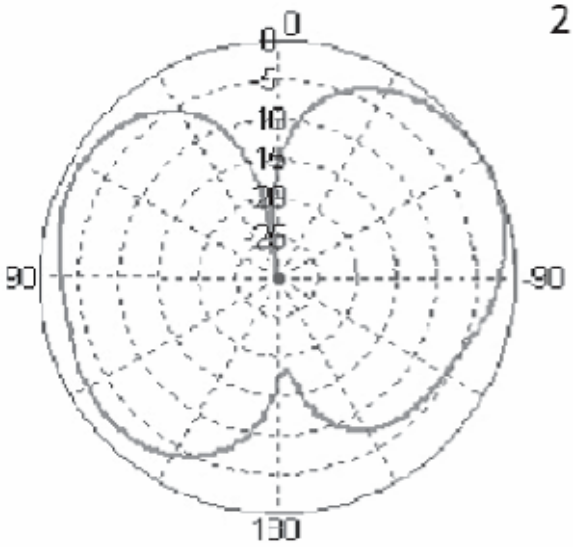
R380.500.314

Series : **ANTENNA**

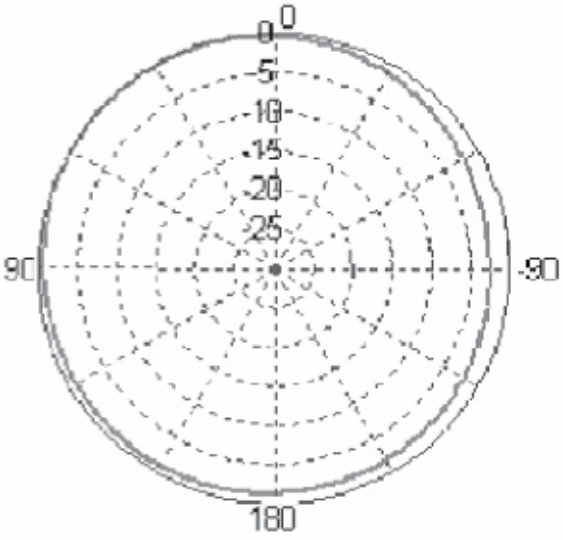
Pattern Data

E-PLANE

2 GHz

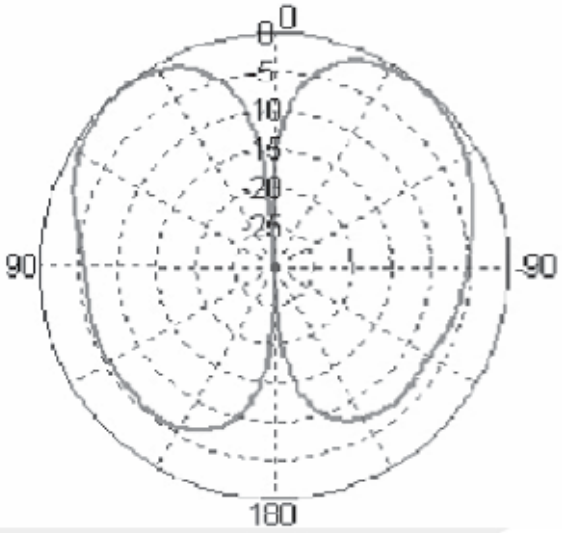


H-PLANE

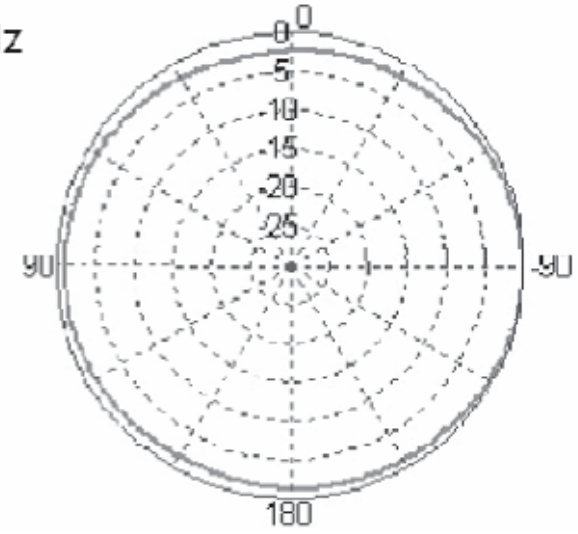


E-PLANE

5 GHz



H-PLANE



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Cisco Air-Ant 4941

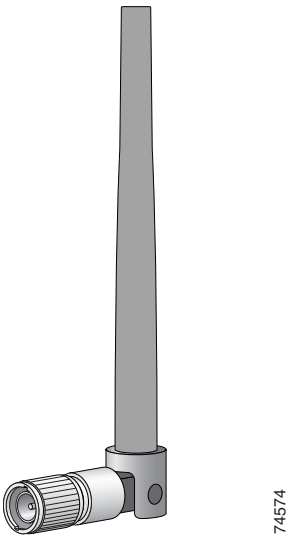
Cisco Aironet 2.4 Ghz Articulated Dipole Antenna (AIR-ANT4941)

Overview

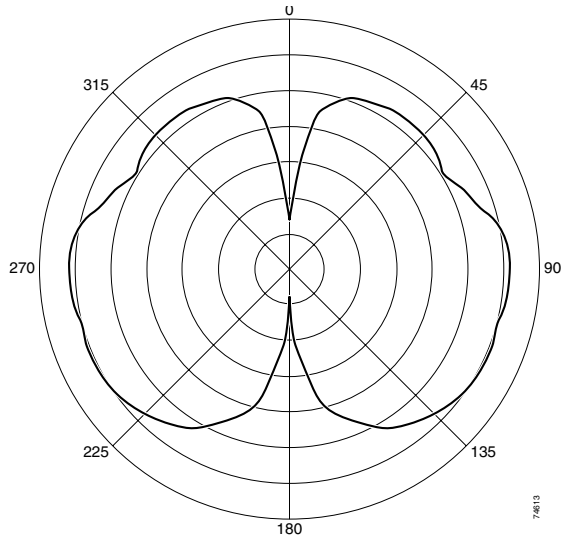
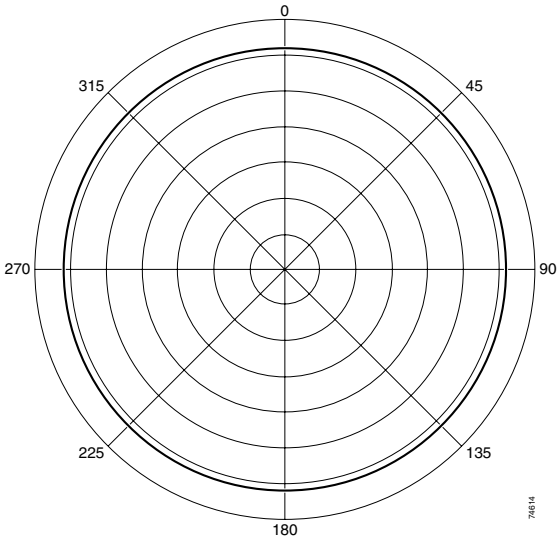
This document outlines the specifications and description of the 2.2-dBi articulating dipole antenna. This antenna operates in the 2.4- 2.5-GHz band and is designed for use with Cisco Aironet radio products utilizing a reverse-polarity threaded naval connector (RP-TNC).

Technical Specifications

Antenna type	Dipole
Operating frequency range	2402-2495 MHz
Nominal input impedance	50 Ω
2:1 VSWR bandwidth	2385 - 2515 Mhz
Peak gain	2 dBi
Polarization	Linear, vertical
E-Plane 3-dB beamwidth	70 degrees
H-Plane 3-dB beamwidth	Omnidirectional
Dimensions	5.5 in. (13 cm)
Weight	1 oz.
Connector type	RP-TNC plug
Environment	Indoor
Operating temperature range	32°F to 140°F (0°C to 60°C)



Corporate Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

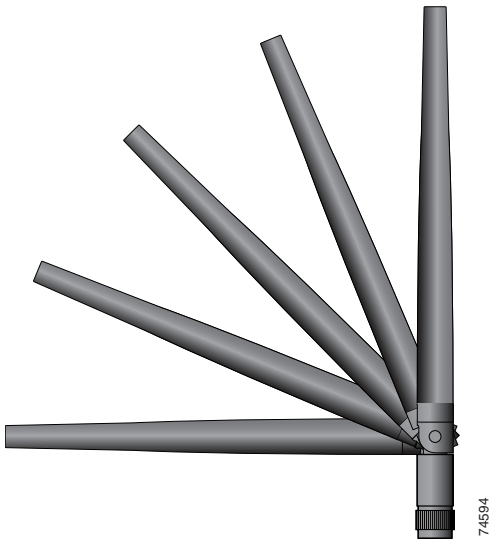
E-Plane Pattern	H-Plane Pattern
	

System Requirements

This antenna is compatible with any 2.4-GHz Cisco Aironet device that utilizes a RP-TNC plug.

Features

The antenna has an articulated base that can be rotated 360 degrees at the connection point and from 0 to 90 degrees at its knuckle. The articulated base is shown in the following illustration.



Obtaining Documentation

Cisco provides several ways to obtain documentation, technical assistance, and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

Cisco.com

You can access the most current Cisco documentation on the World Wide Web at this URL:

http://www.cisco.com/univercd/home/home.htm

You can access the Cisco website at this URL:

http://www.cisco.com

International Cisco websites can be accessed from this URL:

http://www.cisco.com/public/countries_languages.shtml

Documentation CD-ROM

Cisco documentation and additional literature are available in a Cisco Documentation CD-ROM package, which may have shipped with your product. The Documentation CD-ROM is updated regularly and may be more current than printed documentation. The CD-ROM package is available as a single unit or through an annual or quarterly subscription.

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San Jose, CA 95134-9883

We appreciate your comments.

Obtaining Technical Assistance

Cisco provides Cisco.com, which includes the Cisco Technical Assistance Center (TAC) website, as a starting point for all technical assistance. Customers and partners can obtain online documentation, troubleshooting tips, and sample configurations from the Cisco TAC website. Cisco.com registered users have complete access to the technical support resources on the Cisco TAC website, including TAC tools and utilities.

Cisco.com

Cisco.com offers a suite of interactive, networked services that let you access Cisco information, networking solutions, services, programs, and resources at any time, from anywhere in the world.

Cisco.com provides a broad range of features and services to help you with these tasks:

- Streamline business processes and improve productivity
- Resolve technical issues with online support
- Download and test software packages
- Order Cisco learning materials and merchandise
- Register for online skill assessment, training, and certification programs

To obtain customized information and service, you can self-register on Cisco.com at this URL:

http://tools.cisco.com/RPF/register/register.do

Technical Assistance Center

The Cisco TAC is available to all customers who need technical assistance with a Cisco product, technology, or solution. Two types of support are available: the Cisco TAC website and the Cisco TAC Escalation Center. The type of support that you choose depends on the priority of the problem and the conditions stated in service contracts, when applicable.

We categorize Cisco TAC inquiries according to urgency:

- Priority level 4 (P4)—You need information or assistance concerning Cisco product capabilities, product installation, or basic product configuration. There is little or no impact to your business operations.
- Priority level 3 (P3)—Operational performance of the network is impaired, but most business operations remain functional. You and Cisco are willing to commit resources during normal business hours to restore service to satisfactory levels.

- Priority level 2 (P2)—Operation of an existing network is severely degraded, or significant aspects of your business operations are negatively impacted by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.
- Priority level 1 (P1)—An existing network is "down," or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

Cisco TAC Website

The Cisco TAC website provides online documents and tools to help troubleshoot and resolve technical issues with Cisco products and technologies. To access the Cisco TAC website, go to this URL:

http://www.cisco.com/tac

All customers, partners, and resellers who have a valid Cisco service contract have complete access to the technical support resources on the Cisco TAC website. Some services on the Cisco TAC website require a Cisco.com login ID and password. If you have a valid service contract but do not have a login ID or password, go to this URL to register:

http://tools.cisco.com/RPF/register/register.do

If you are a Cisco.com registered user, and you cannot resolve your technical issues by using the Cisco TAC website, you can open a case online at this URL:

http://www.cisco.com/tac/caseopen

If you have Internet access, we recommend that you open P3 and P4 cases online so that you can fully describe the situation and attach any necessary files.

Cisco TAC Escalation Center

The Cisco TAC Escalation Center addresses priority level 1 or priority level 2 issues. These classifications are assigned when severe network degradation significantly impacts business operations. When you contact the TAC Escalation Center with a P1 or P2 problem, a Cisco TAC engineer automatically opens a case.

To obtain a directory of toll-free Cisco TAC telephone numbers for your country, go to this URL:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

Before calling, please check with your network operations center to determine the Cisco support services to which your company is entitled: for example, SMARTnet, SMARTnet Onsite, or Network Supported Accounts (NSA). When you call the center, please have available your service agreement number and your product serial number.

Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- The *Cisco Product Catalog* describes the networking products offered by Cisco Systems, as well as ordering and customer support services. Access the *Cisco Product Catalog* at this URL:

  http://www.cisco.com/en/US/products/products_catalog_links_launch.html

- Cisco Press publishes a wide range of networking publications. Cisco suggests these titles for new and experienced users: *Internetworking Terms and Acronyms Dictionary, Internetworking Technology Handbook, Internetworking Troubleshooting Guide,* and the *Internetworking Design Guide.* For current Cisco Press titles and other information, go to Cisco Press online at this URL:

  http://www.ciscopress.com

- *Packet* magazine is the Cisco quarterly publication that provides the latest networking trends, technology breakthroughs, and Cisco products and solutions to help industry professionals get the most from their networking investment. Included are networking deployment and troubleshooting tips, configuration examples, customer case studies, tutorials and training, certification information, and links to numerous in-depth online resources. You can access *Packet* magazine at this URL:

  http://www.cisco.com/go/packet

- iQ Magazine is the Cisco bimonthly publication that delivers the latest information about Internet business strategies for executives. You can access iQ Magazine at this URL:

  http://www.cisco.com/go/iqmagazine

- Internet Protocol Journal is a quarterly journal published by Cisco Systems for engineering professionals involved in designing, developing, and operating public and private internets and intranets. You can access the Internet Protocol Journal at this URL:

  http://www.cisco.com/en/US/about/ac123/ac147/about_cisco_the_internet_protocol_journal.html

- Training—Cisco offers world-class networking training. Current offerings in network training are listed at this URL:

  http://www.cisco.com/en/US/learning/le31/learning_recommended_training_list.html

Elliott An NTS company

Transmitter Characteristics Test Data

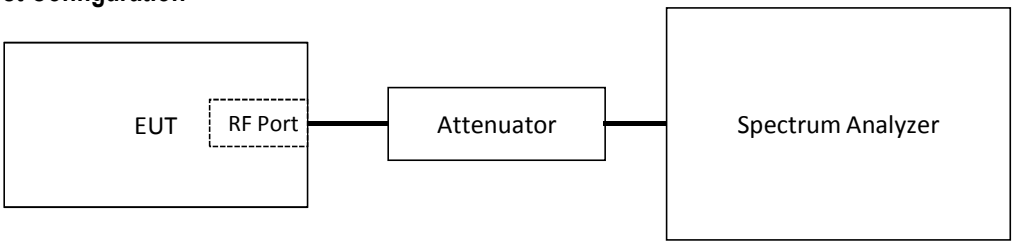
Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

RADIO EQUIPMENT USED FOR 2.4 GHz BAND WIDE-BAND LOW-POWER DATA COMMUNICATIONS SYSTEM (Radio station using 2400 - 2483.5 MHz)

Summary of Results

Test Performed	Mode	Requirement	Measurement	Result
Frequency Error	802.11b 802.11g	50ppm or better	4.23 ppm	Pass
Occupied bandwidth (2400 - 2483.5MHz)	802.11b 802.11g	DSSS: 500kHz < BW < 26MHz OFDM: < 38MHz	DSSS: 15.61 MHz OFDM: 17.05 MHz	Pass
Spreading Rate (2400-2483.5MHz)	802.11b 802.11g	5 or more	802.11b: 8.2 802.11g: 17.05	Pass
OFDM Carrier Spacing	802.11g	-	52 carriers with a spacing of 0.3125MHz	-
Spurious Emissions	802.11b 802.11g	Below 2387MHz: < 2.5uW/MHz 2387 - 2400 MHz < 25uW/MHz 2483.5-2496.5MHz < 25uW/MHz (2497 - 2510 for #14) Above 2496.5 MHz: 2.5uW/MHz	802.11b: 0.048uW @ 4823.77MHz 802.11g: 0.025uW @ 3250.25MHz	Pass
Antenna power	802.11b	Maximum permitted: BW < 26MHz: 10mW/MHz BW < 38MHz: 5mW/MHz Power Tolerance: -80% to +20%	Rated Power: 4.74 mW/MHz Deviation: - 33.2 % to -26.8 %	Pass
	802.11g		Rated Power: 2.89 mW/MHz Deviation: -41.2 % to -18.8 %	Pass
EIRP	802.11b 802.11g	Omni-directional antennas: maximum eirp is 12.15dBm/MHz	9.8 dBm/MHz	Pass

Test Configuration



Test Environment

Temperature:	15-30	°C	
Rel. Humidity:	20-75	%	
Pressure:	86-106	kPa	
Nominal Supply Voltage	3.3	Vdc	(provided by host device)

Elliott An NTS company

Transmitter Characteristics Test Data

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Duty Cycle and Transmission Cycle Time

Data Rate	Duty Cycle	Transmission cycle time
Mbs	%	ms
1	100	N/A
11	99.5	0.05
6	99.3	0.05
54	94.5	0.05

Elliott An NTS company

Transmitter Characteristics Test Data

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Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Run #1: Frequency Error

Date of Test: 3/29/2010 Test Engineer: Mehran Birgani

Test Location: Radio Lab

The center frequency was measured at nominal and extreme voltage conditions.

For OFDM modulation with no provision for operating with an unmodulated signal measurements were made on a **modulated** signal at the top, center and bottom channels. The operating frequency was determined by measuring the frequency of the carrier observed at the center of the waveform that appears as a small peak within the central null. The analyzer was configured with RB=300Hz VB=10**Hz**, peak detector and max hold, as this gave the cleanest signal.

For CCK modulation with no provision for operating with an unmodulated signal measurements were made on a **modulated** signal at the top, center and bottom channels. The operating frequency was determined by measuring the frequency at the null created at the center of the signal. The analyzer was configured with RB=300Hz VB=10Hz, peak detector and max hold, as this gave the cleanest signal.

Nominal Frequency (MHz) - 802.11b

Low Channel	2412.0	Center Channel	2437.0	High Channel	2472.0

	Measured Frequency (MHz)			Frequency Error (ppm)		
Voltage	Nominal -10%	Nominal	Nominal + 10%			
	3.0 V	3.3 V	3.6 V	3.0 V	3.3 V	3.6 V
Low Channel	2412.001656	2412.001707	2412.001997	0.69	0.71	0.83
Center Channel	2437.009668	2437.009858	2437.009984	3.97	4.05	**4.10**
Center Channel (Aux Port)	2437.009658	2437.009903	2437.009903	3.96	4.06	4.06
High Channel	2472.001947	2472.002387	2472.002533	0.79	0.97	1.02
				Requirement (ppm):		**50.0**

Nominal Frequency (MHz) - 802.11g

Low Channel	2412.0	Center Channel	2437.0	High Channel	2472.0

	Measured Frequency (MHz)			Frequency Error (ppm)		
Voltage	Nominal -10%	Nominal	Nominal + 10%			
	3.0 V	3.3 V	3.6 V	3.0 V	3.3 V	3.6 V
Low Channel	2412.009664	2412.009709	2412.009770	4.01	4.03	4.05
Center Channel	2437.009532	2437.009692	2437.010313	3.91	3.98	**4.23**
High Channel	2472.000556	2472.001510	2472.001106	0.22	0.61	0.45
				Requirement (ppm):		**50.0**

Notes:

All testing performed at 1Mbs for 802.11b (CCK) and 6Mbs for 802.11g (OFDM).

Unless otherwise noted, TX Diversity switch was set to main only. Testing was performed on the Main connector.

Elliott An NTS company

Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Run #2: Occupied bandwidth and spreading bandwidth

Date of Test: 3/30/2010 Test Engineer: Mehran Birgani
Test Location: Radio Lab

The occupied bandwidth was measured with the spectrum analyzer configured according to the table below. The occupied bandwidth was determined from the 99% power bandwidth by determining the highest and lowest frequencies at which 99.5% of the power was captured and then subtracting the two numbers. the calculation was done by either the analyzer directly or via the software used to capture the plot. One plot for each mode tested is provided for reference.

The spreading bandwidth was measured with the spectrum analyzer configured according to the table below. The spreading bandwidth was the 90% power bandwidth determined by the highest and lowest frequencies at which 95% of the power was captured and then subtracting the two numbers. This calculation was done by either the analyzer directly or via the software used to capture the plot. One plot for each mode tested is provided for reference.

Instrument Settings and Test Requirements

Modulation Type	Analyzer settings				Bandwidth Requirement	
	Span	RB	VB	Other	Occupied	Spreading
OFDM (e.g. 802.11gn)	76-133	≤ 1140kHz	300kHz	Sample detector, averaging (10 sweeps)[2], sweep time auto[1]	≤ 38.0MHz	
Direct Sequence (e.g. 802.11b)	52-91	≤ 780kHz	300kHz	Positive peak detector, max hold, sweep time auto[1]	≤ 26.0MHz	≥ 500kHz

Note 1: For burst transmissions sweep time set to ensure dwell time in each bandwidth > transmission cycle time (sweep time = transmit cycle time x span/ measurement bandwidth)
Note 2: For burst transmissions trace set for max hold and detector set to positive peak

Test Results, 802.11b Mode (Direct Sequence, 500kHz ≤ bandwidth ≤ 26MHz) - 99% Pwr Bandwidth

Channel	Mode	Port	Chain	Data Rate	Nominal -10% 3.0 V	Nominal 3.3 V	Nominal + 10% 3.6 V
1	802.11b	Main		1Mb/s	15.79	15.82	15.82
6	802.11b	Main		1Mb/s	15.79	15.79	15.79
6	802.11b	Aux		1Mb/s	15.79	15.79	15.79
13	802.11b	Main		1Mb/s	15.82	15.82	15.82
1	802.11b	Main		11Mb/s	15.68	15.65	15.65
6	802.11b	Main		11Mb/s	15.65	15.65	15.65
6	802.11b	Aux		11Mb/s	15.65	15.61	15.65
13	802.11b	Main		11Mb/s	15.65	15.65	15.65

Test Results, 802.11b Mode (Direct Sequence, 500kHz ≤ bandwidth ≤ 26MHz) - 90% Pwr Bandwidth

Channel	Mode	Port	Chain	Data Rate	Nominal -10% 3.0 V	Nominal 3.3 V	Nominal + 10% 3.6 V
1	802.11b	Main		1Mb/s	11.52	11.52	11.55
6	802.11b	Main		1Mb/s	11.48	11.48	11.48
13	802.11b	Main		1Mb/s	11.52	15.55	11.55
1	802.11b	Main		11Mb/s	11.38	11.41	11.34
6	802.11b	Main		11Mb/s	11.41	11.38	11.38
13	802.11b	Main		11Mb/s	11.38	11.38	11.38

Spreading bandwidth
Symbol rate for 802.11b is 1Msym/s for 1Mb/s and 1.375Msym/s for data rates of 5.5Mb/s and above.

	Data rate	Symbol Rate (Msym/s)	90% Signal Bandwidth	Spreading rate	Requirement
2400 - 2483.5 MHz:	1Mb/s	1.000	11.48	11.5	5.0
2400 - 2483.5 MHz:	5.5Mb/s & 11Mb/s	1.375	11.34	**8.2**	5.0

Transmitter Characteristics Test Data

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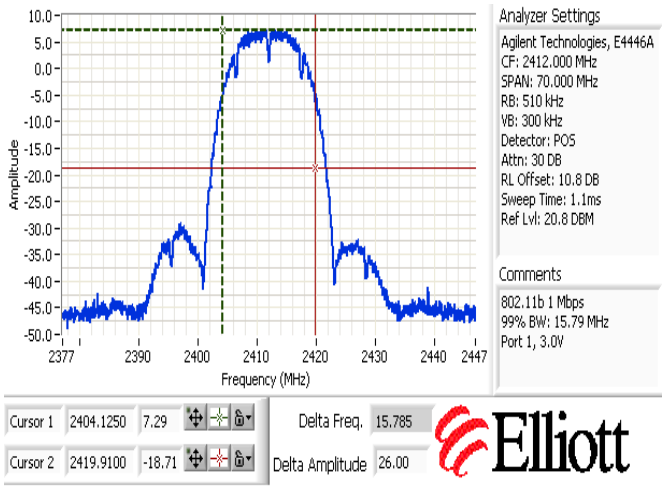

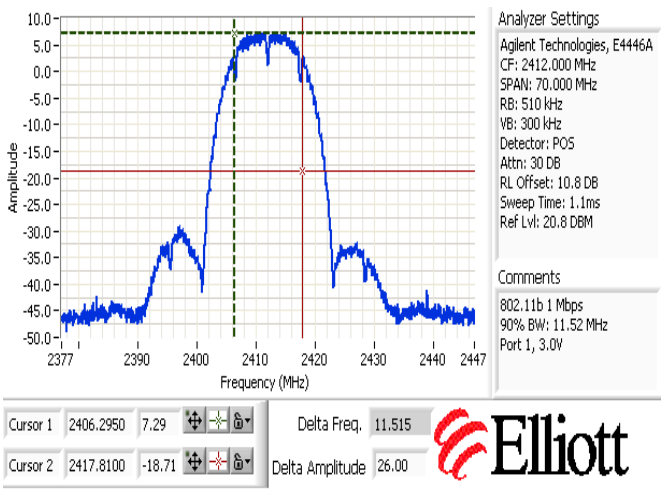

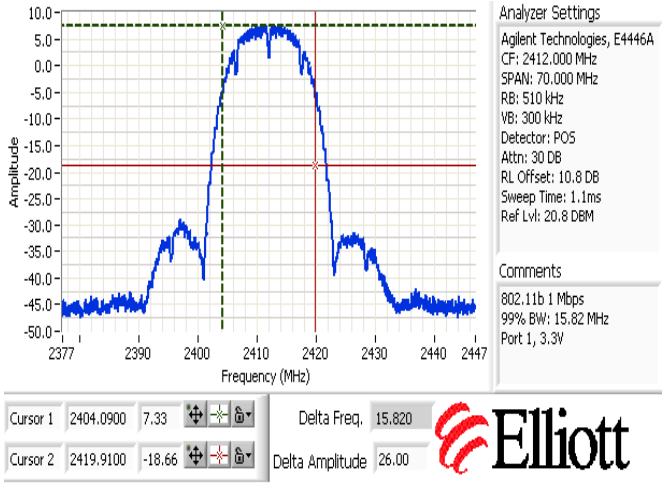

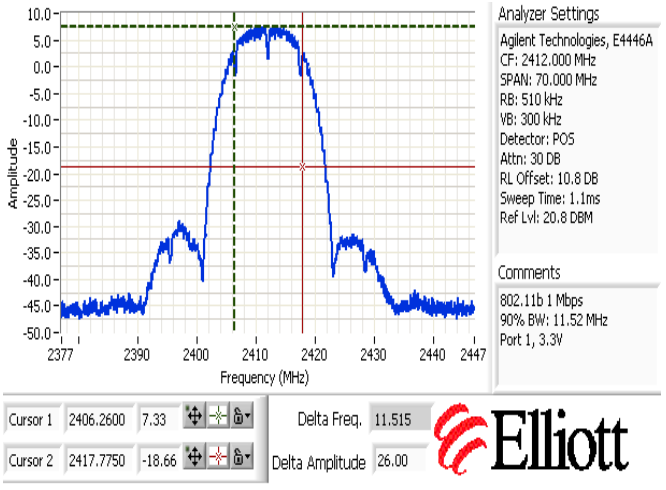

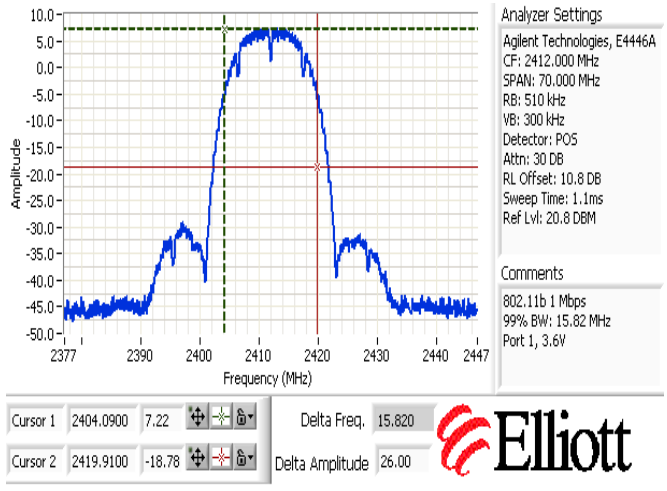

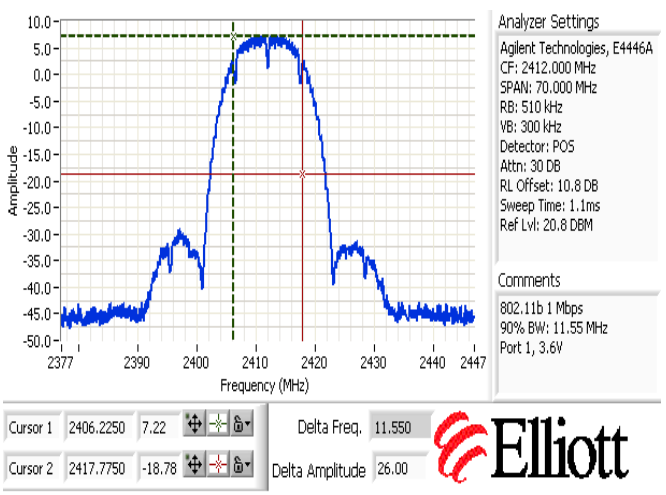

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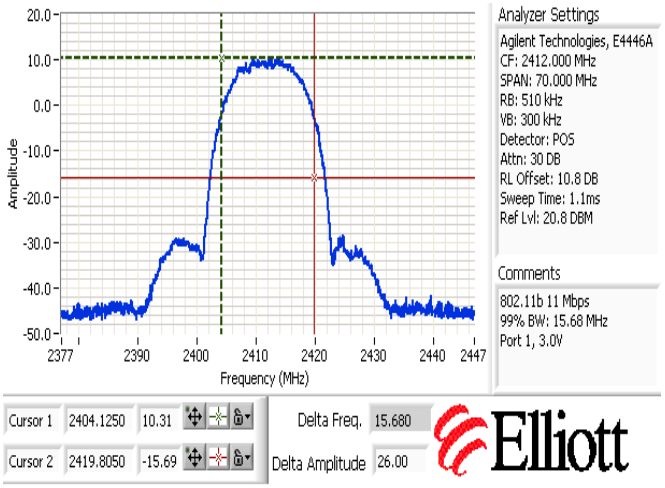

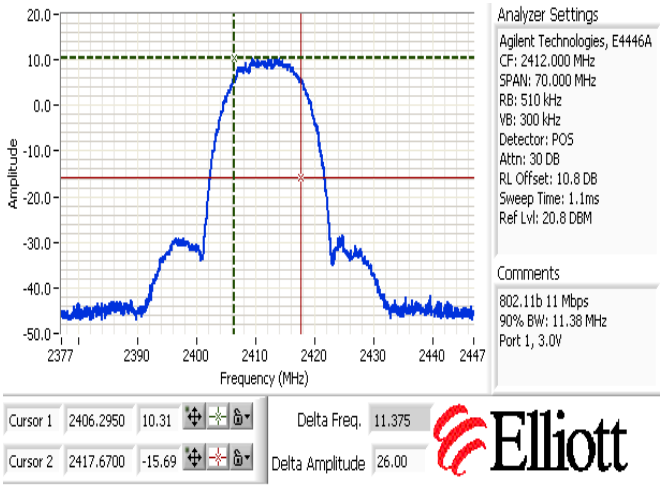

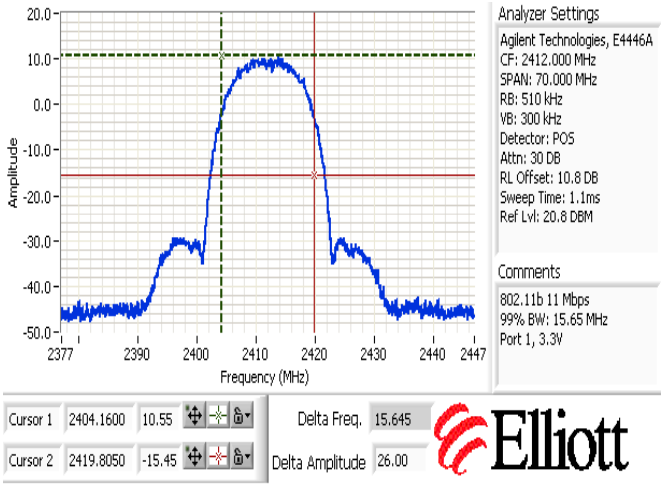

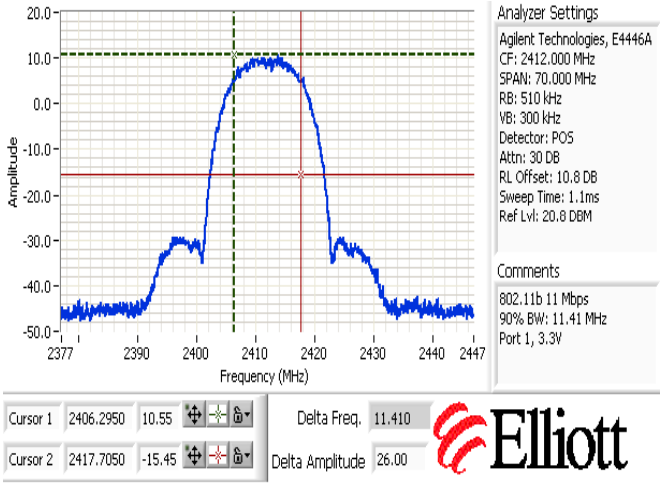

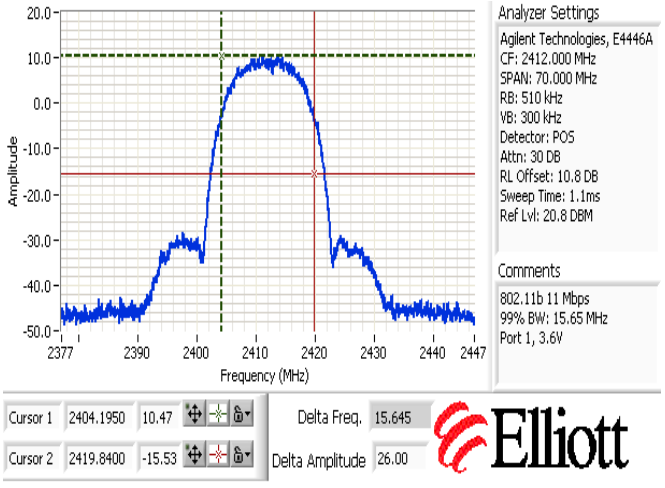

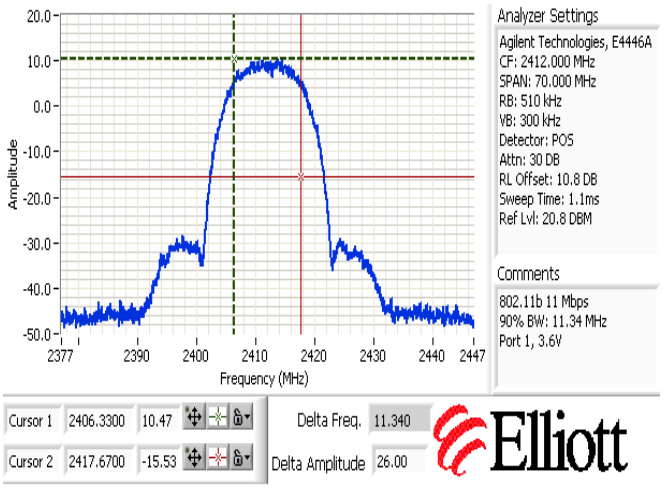

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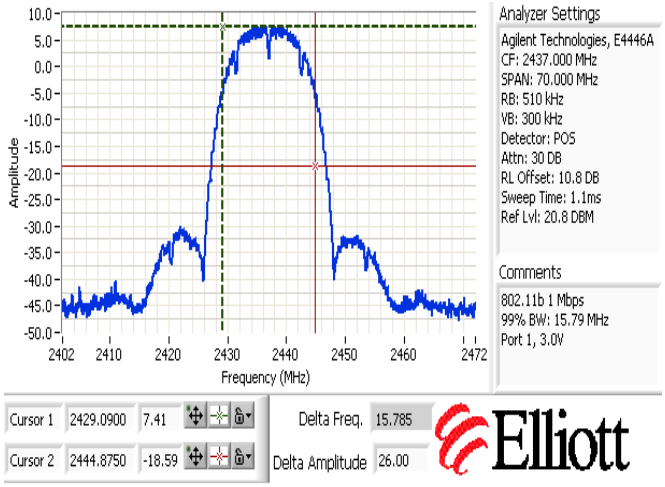

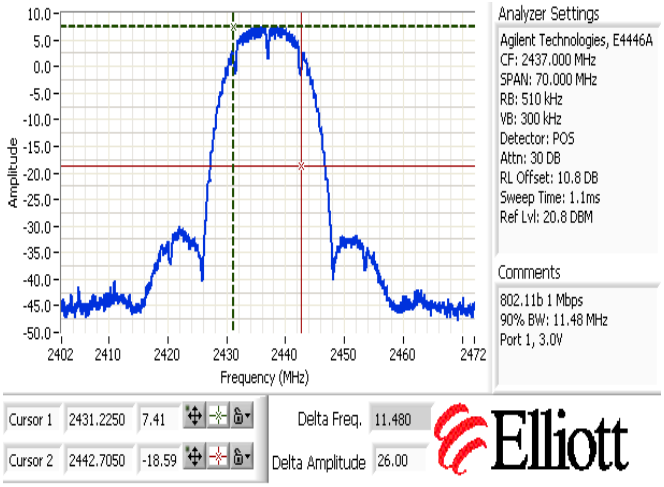

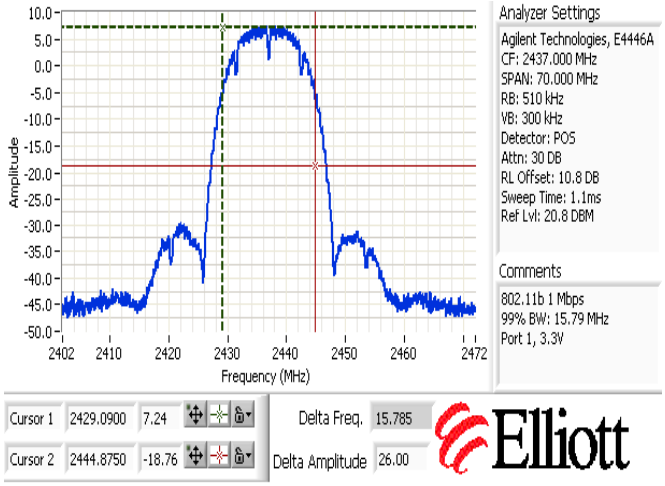

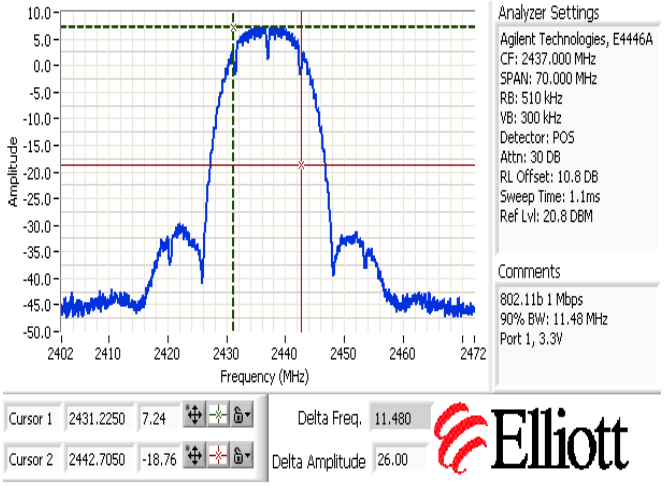

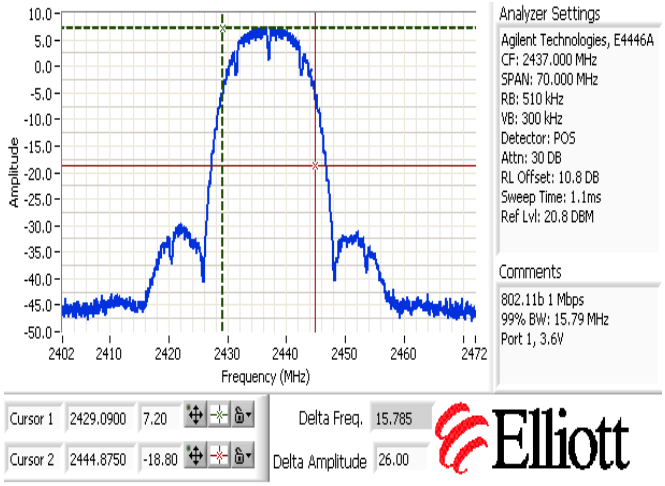

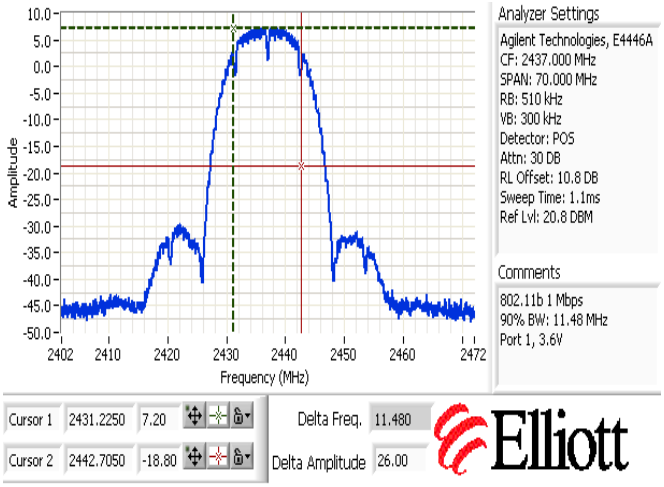

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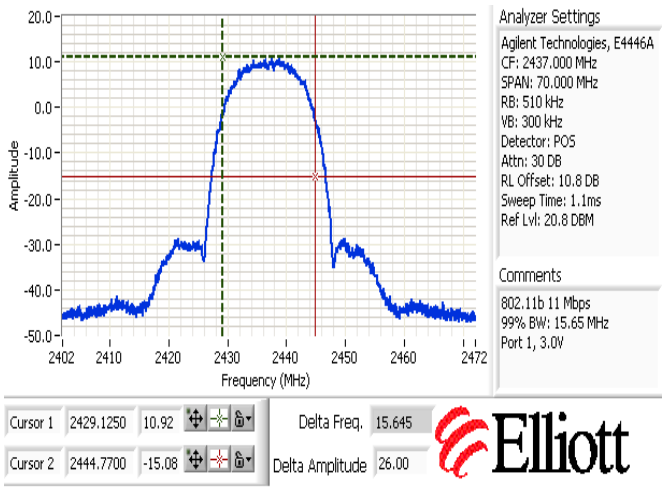

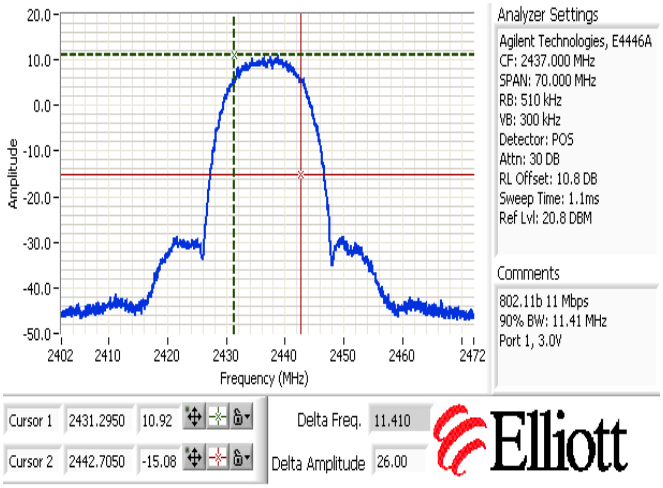

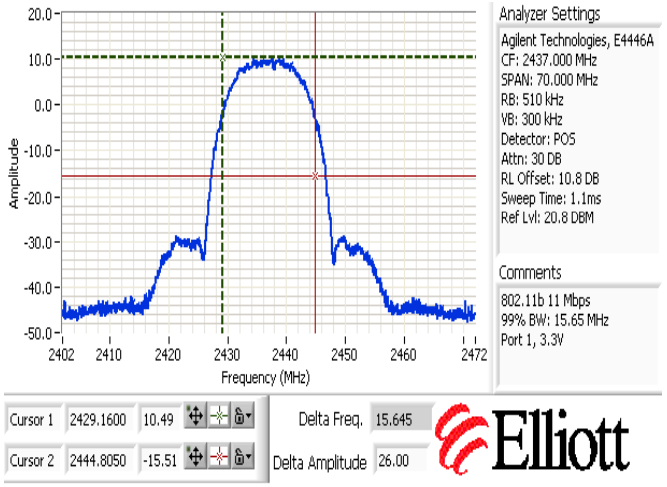

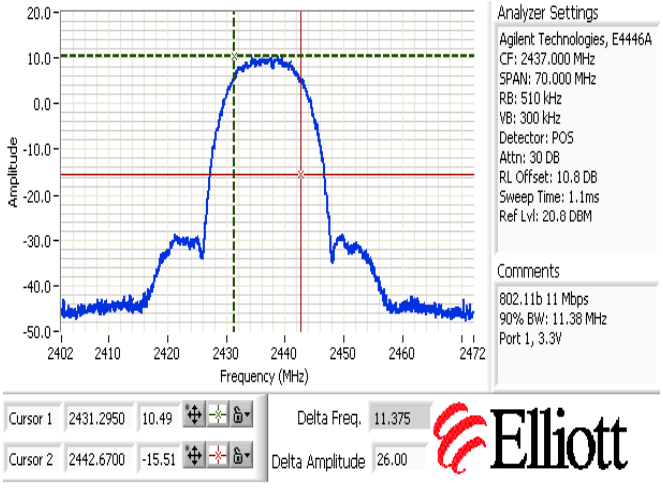

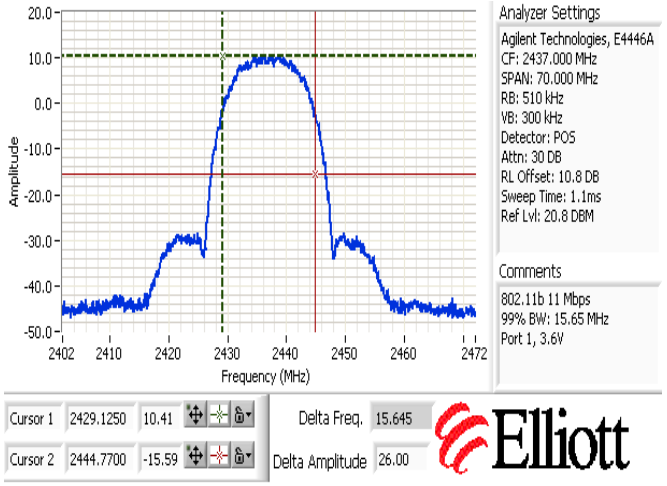

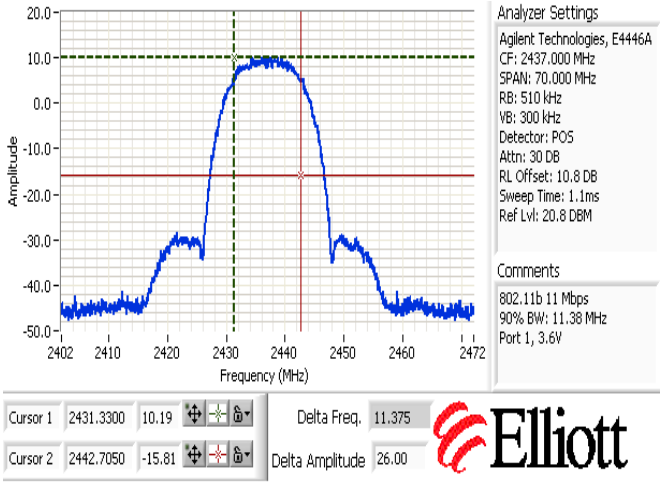

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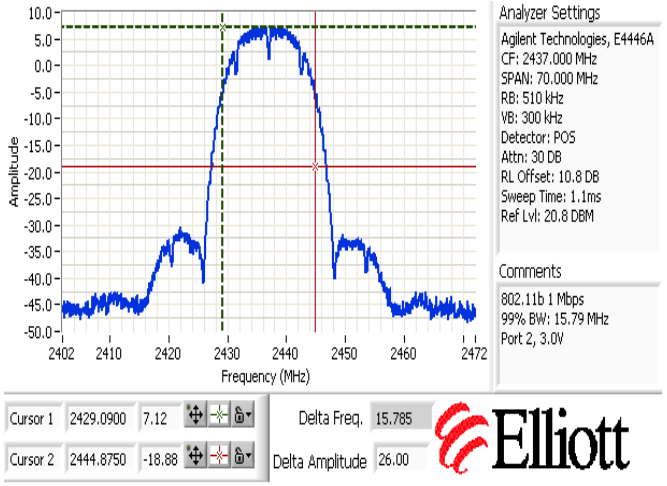
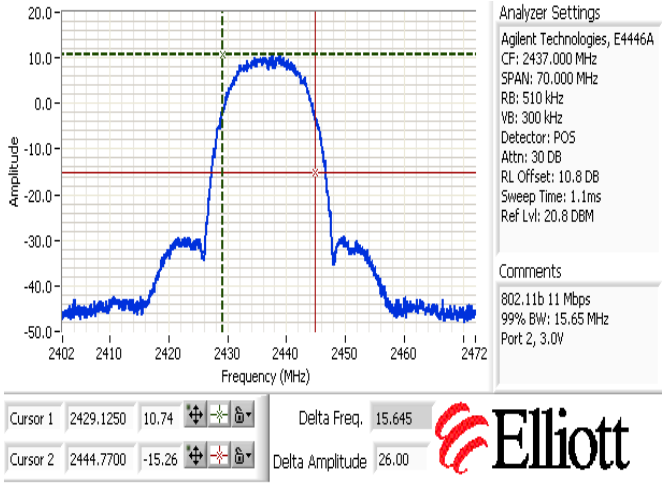
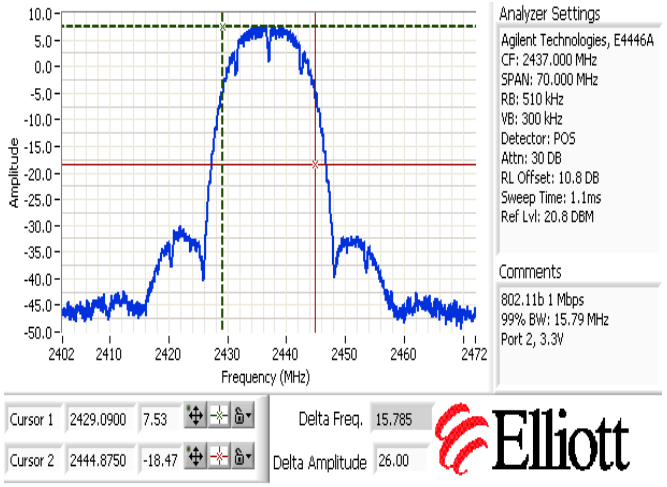
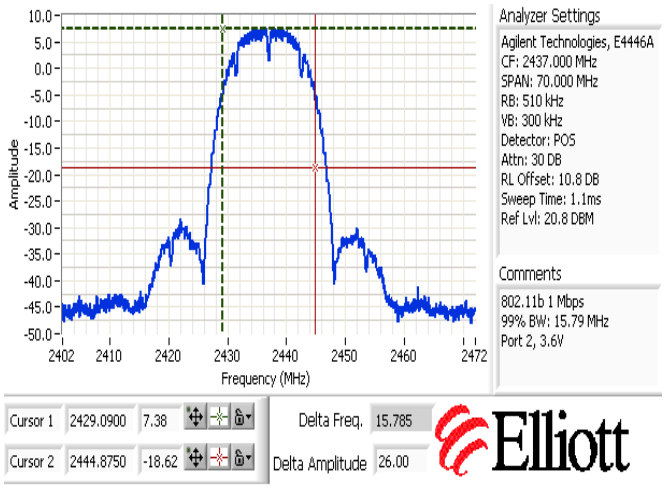
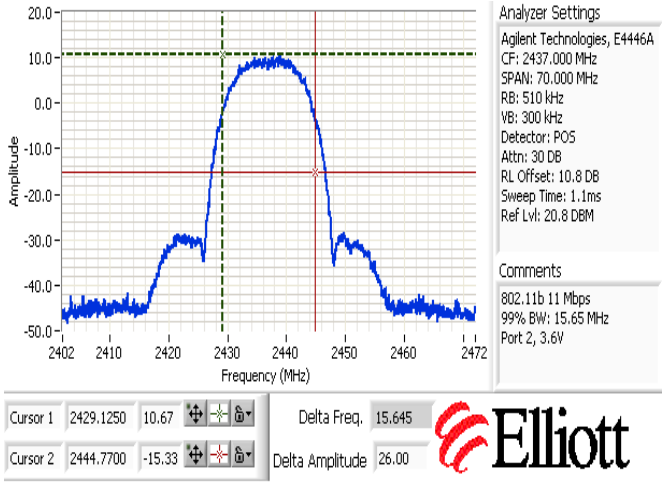




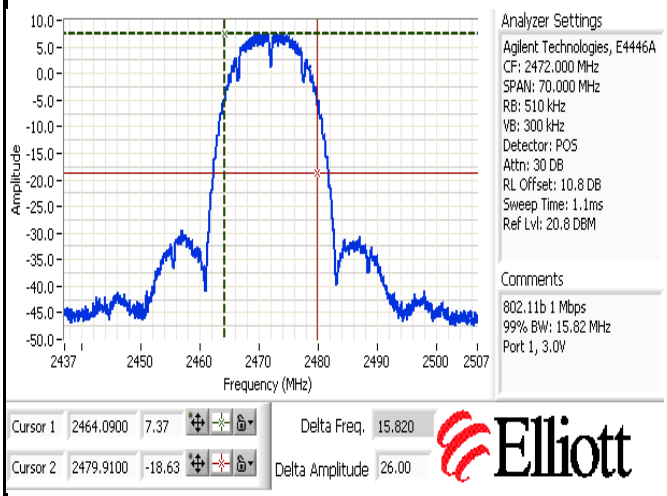


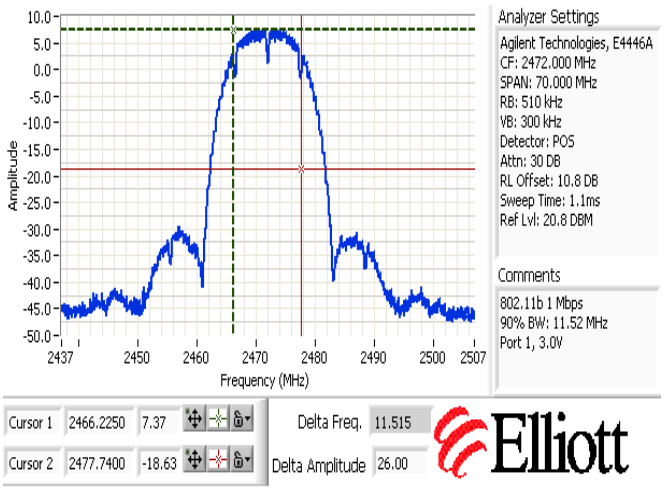


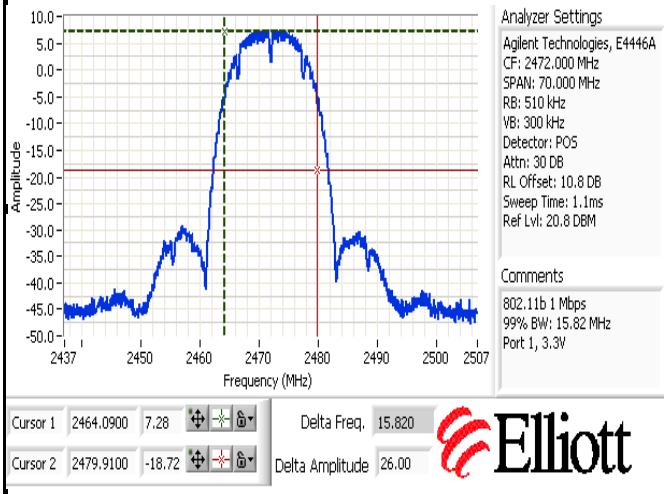


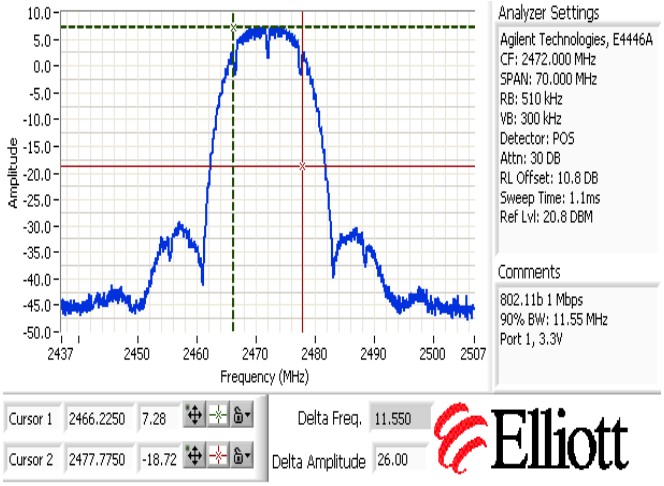
Transmitter Characteristics Test Data

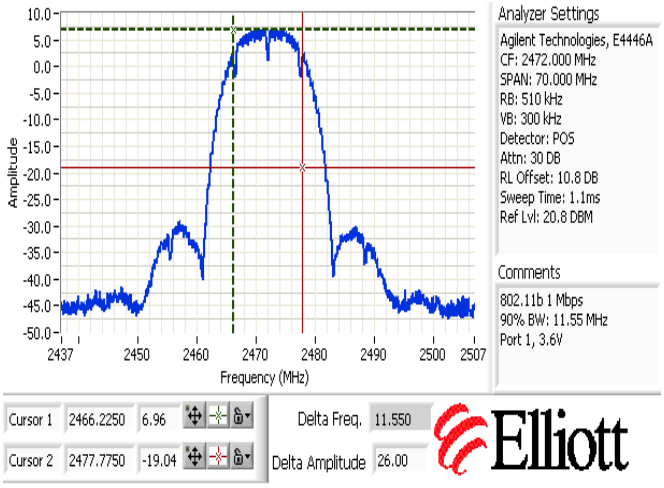
Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski











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Transmitter Characteristics Test Data

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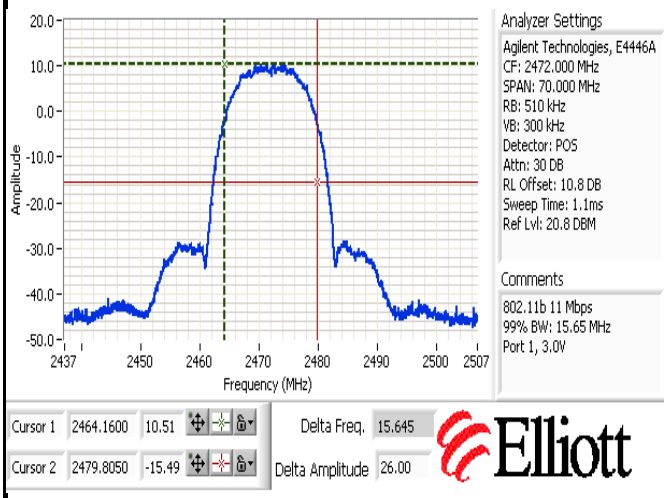

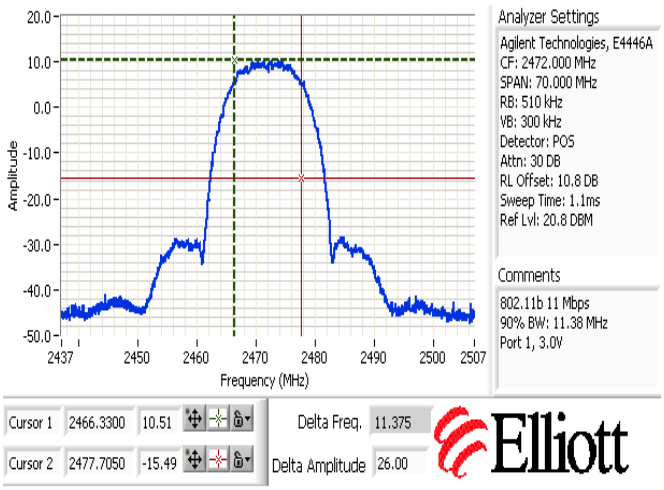

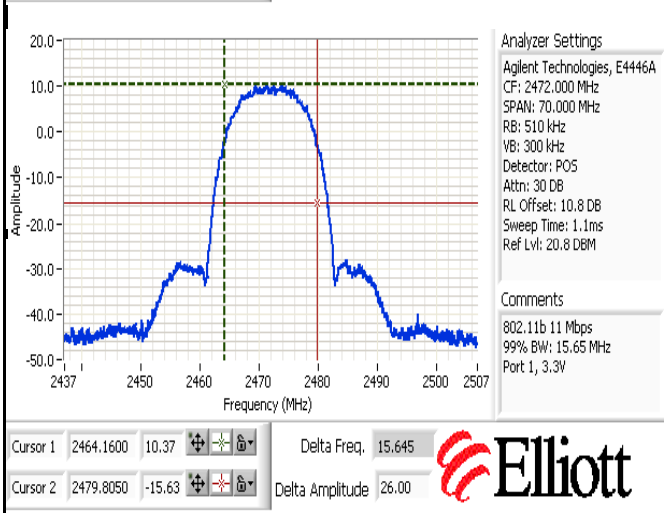

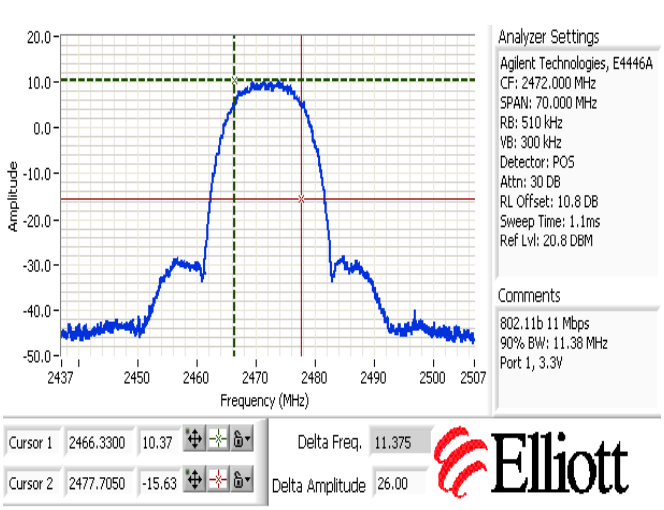

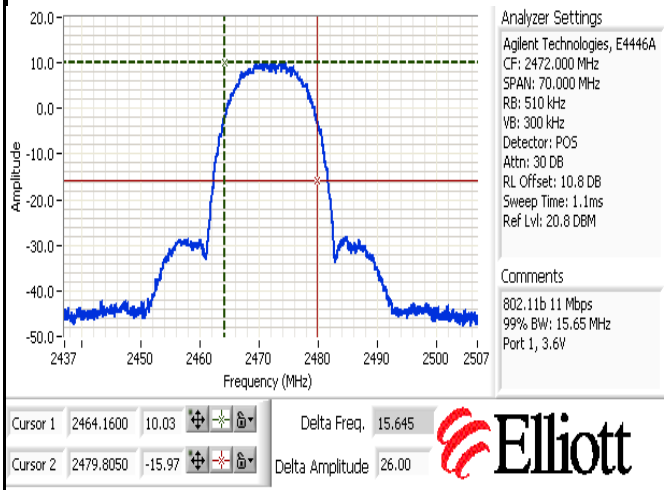

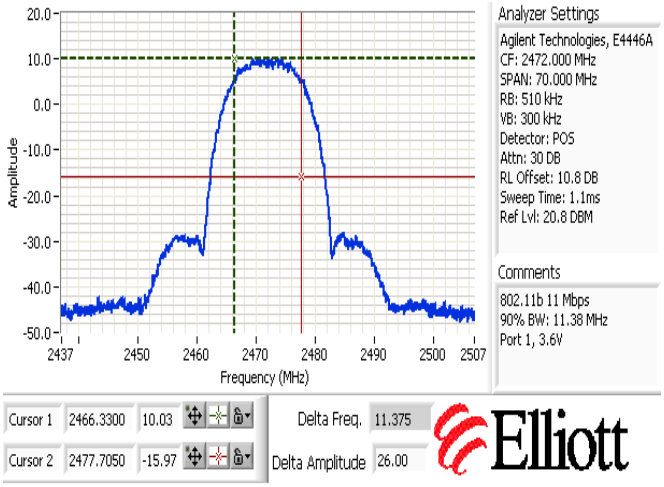

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Test Results, 802.11g Mode (OFDM, 500kHz ≤ bandwidth ≤ 38MHz) - 99% Pwr Bandwidth

Channel	Mode	Port	Chain	Data Rate	Nominal -10% 3.0 V	Nominal 3.3 V	Nominal + 10% 3.6 V
1	802.11g	Main		6Mb/s	17.20	17.20	17.20
6	802.11g	Main		6Mb/s	17.20	17.20	17.25
6	802.11g	Aux		6Mb/s	17.20	17.15	17.05
13	802.11g	Main		6Mb/s	17.30	17.25	17.25
1	802.11g	Main		54Mb/s	17.20	17.20	17.15
6	802.11g	Main		54Mb/s	17.40	17.20	17.20
6	802.11g	Aux		54Mb/s	17.10	17.05	17.05
13	802.11g	Main		54Mb/s	17.15	17.10	17.15

Test Results, 802.11g Mode (OFDM, 500kHz ≤ bandwidth ≤ 38MHz) - 90% Pwr Bandwidth

Channel	Mode	Port	Chain	Data Rate	Nominal -10% 3.0 V	Nominal 3.3 V	Nominal + 10% 3.6 V
1	802.11g	Main		6Mb/s	15.15	15.10	15.20
6	802.11g	Main		6Mb/s	15.00	15.05	15.20
13	802.11g	Main		6Mb/s	15.15	15.10	15.05
1	802.11g	Main		54Mb/s	15.10	15.00	14.90
6	802.11g	Main		54Mb/s	15.75	15.20	15.40
13	802.11g	Main		54Mb/s	14.90	15.10	15.05

Spreading bandwidth

Symbol rate for 802.11g has a 4us period (250kHz symbol rate) for all data rates.

	Symbol Rate (Msym/s)	90% Signal Bandwidth	Spreading rate	Requirement
2400 - 2483.5 MHz:	0.250	14.90	59.6	Min 5

Transmitter Characteristics Test Data

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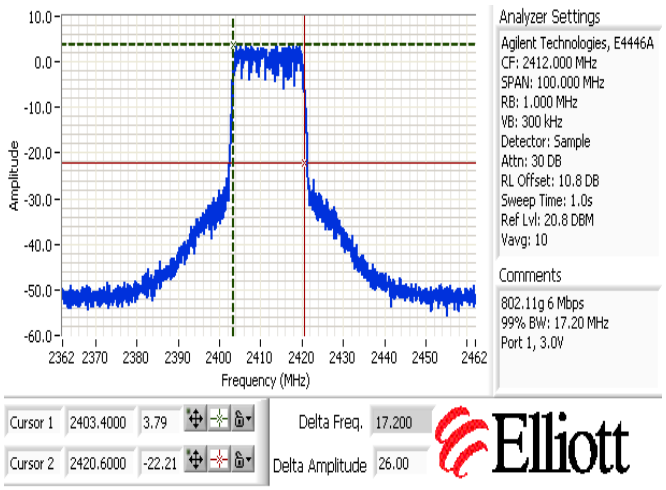
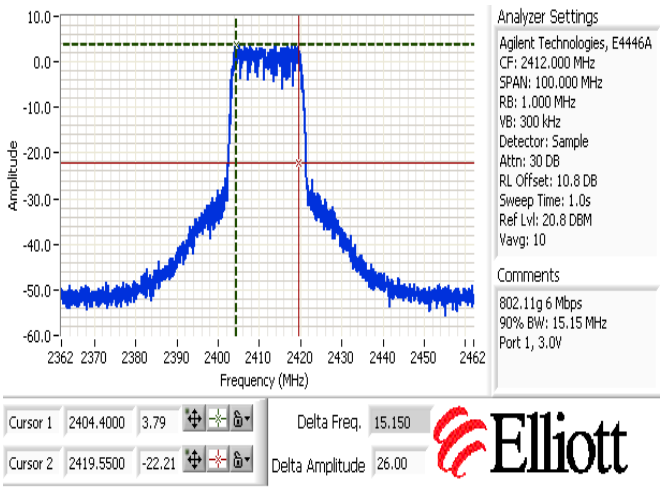
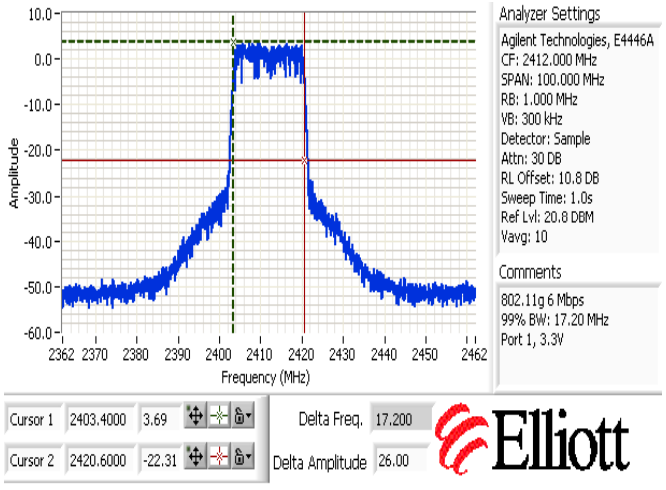
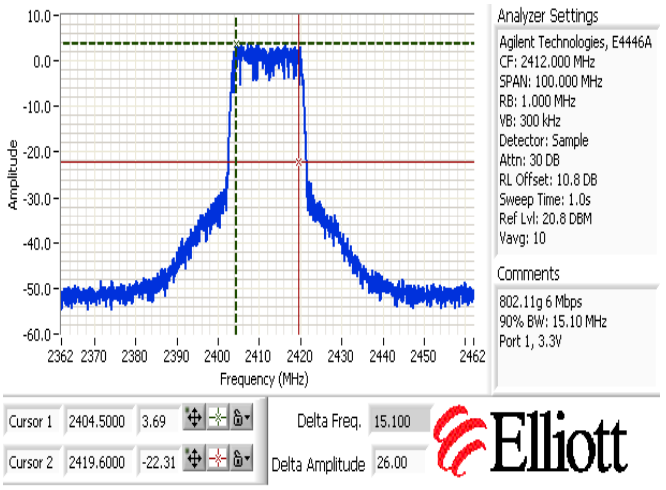
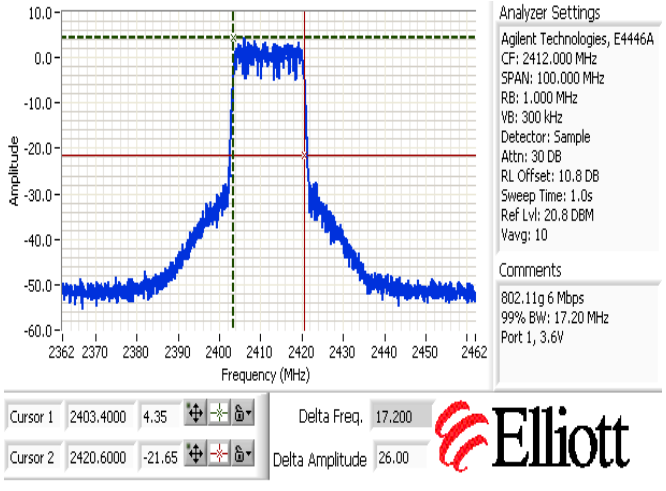
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

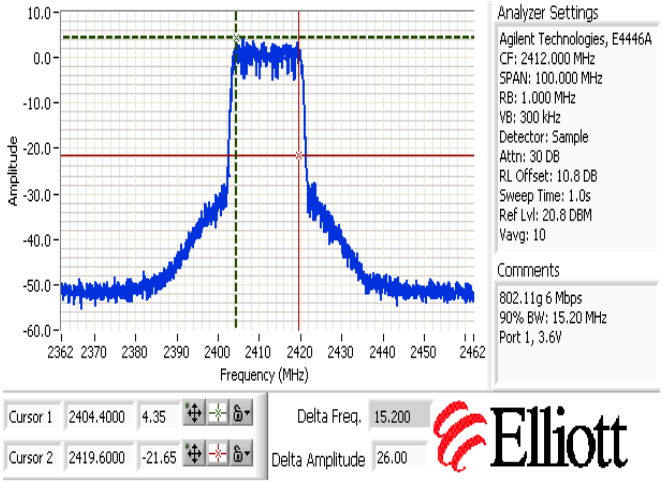












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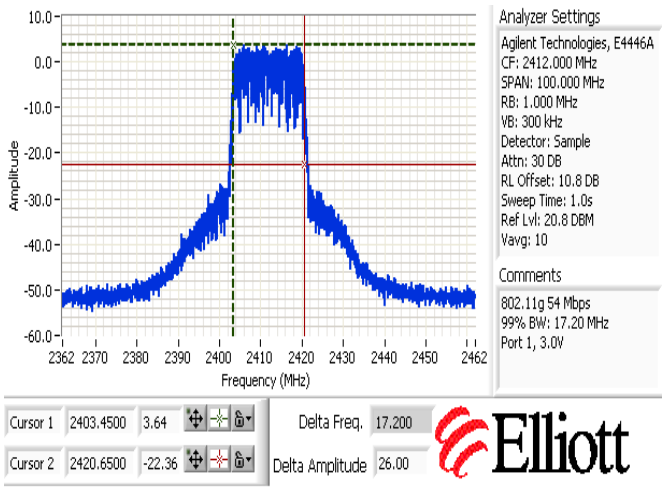

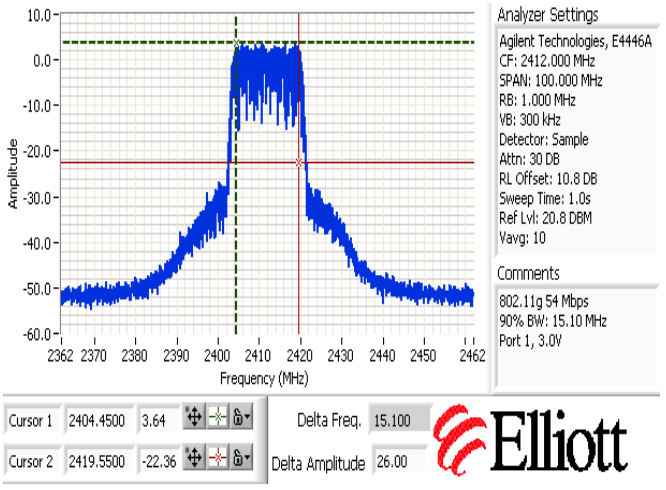

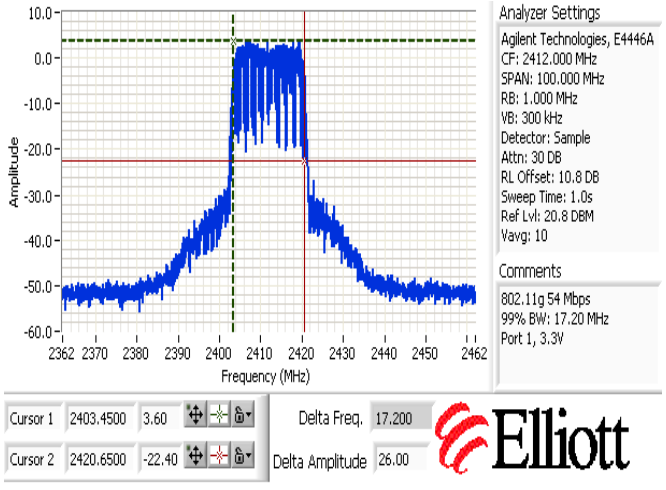

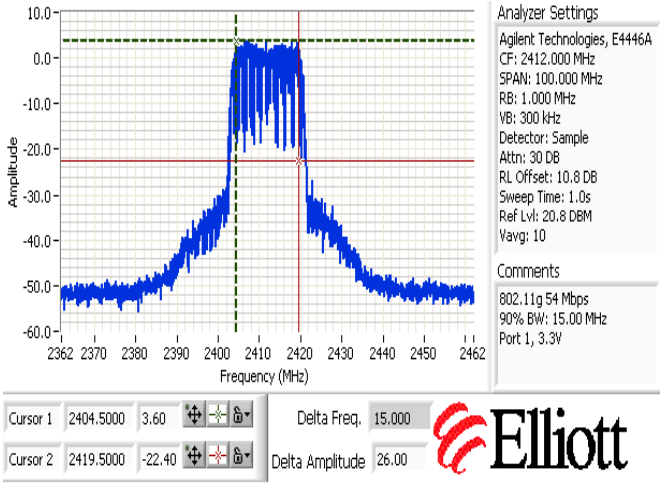

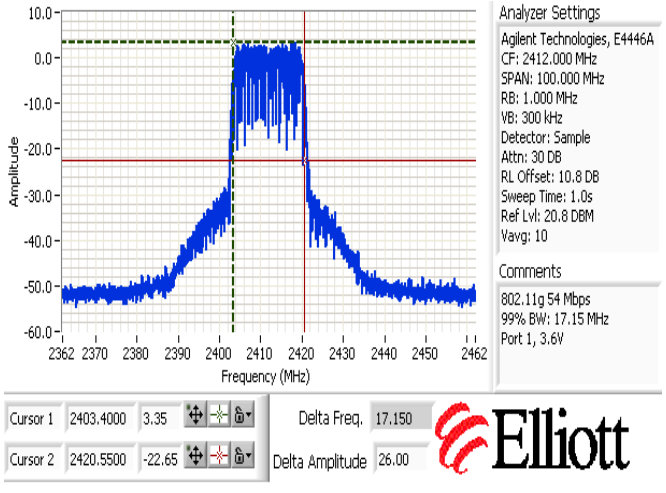

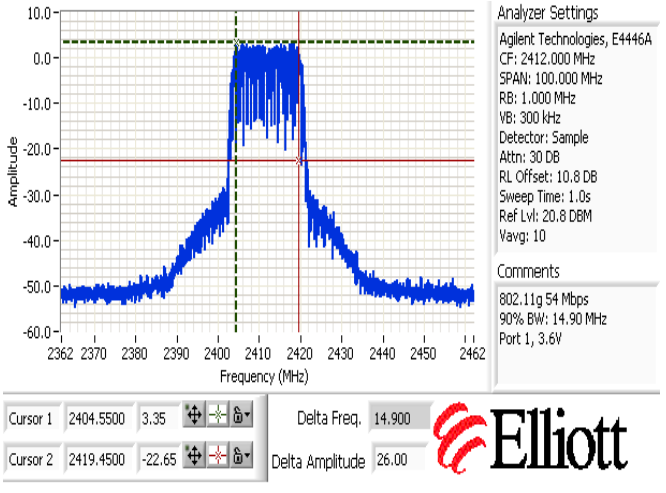

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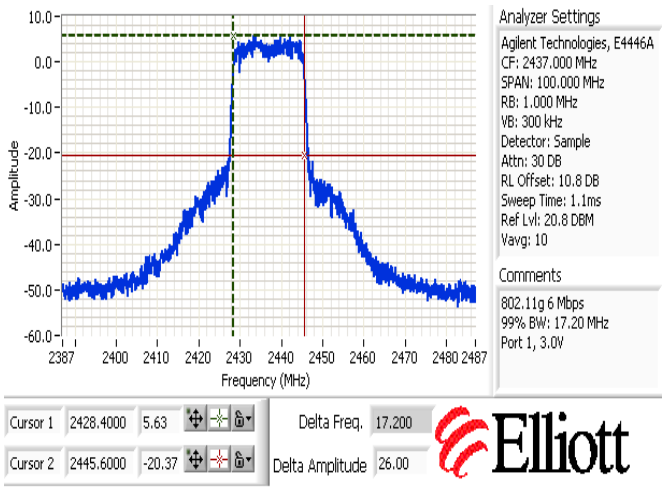

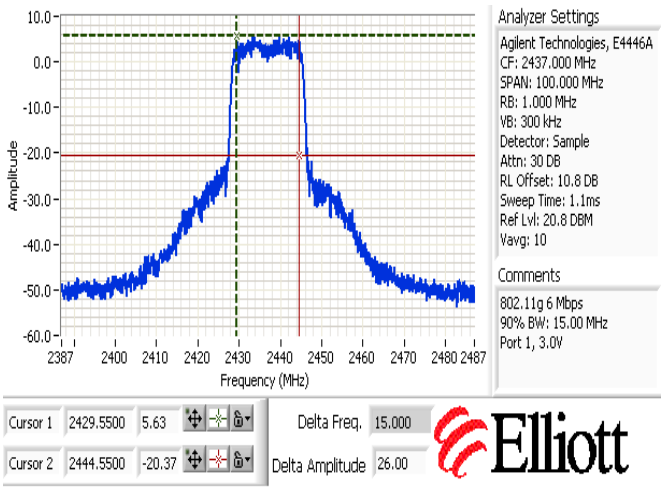

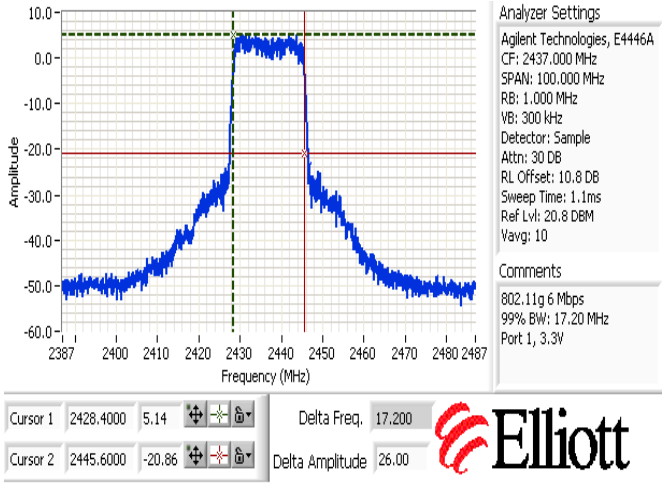

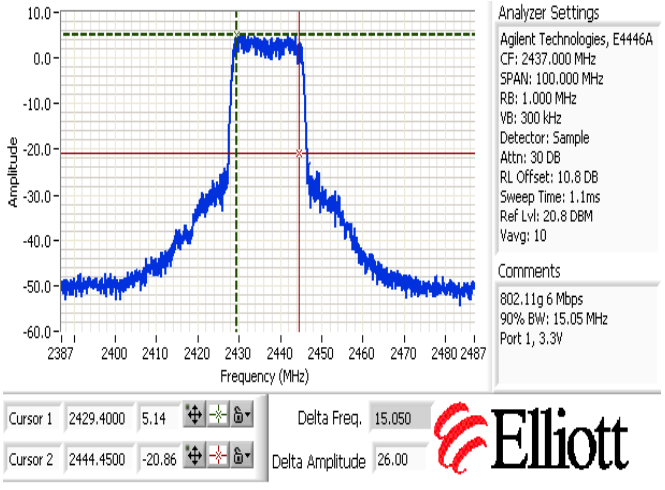

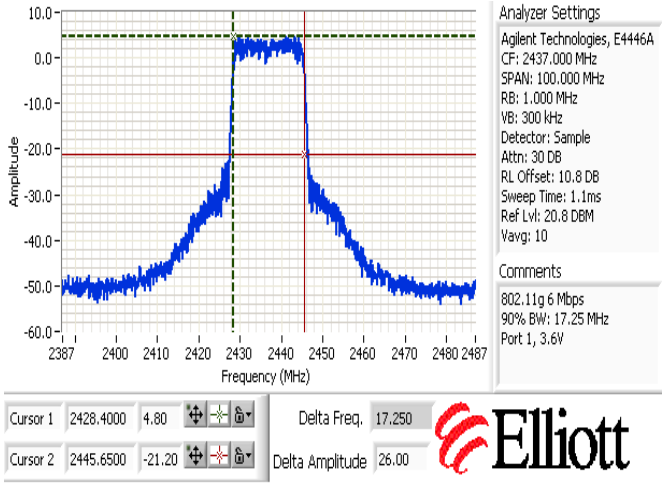

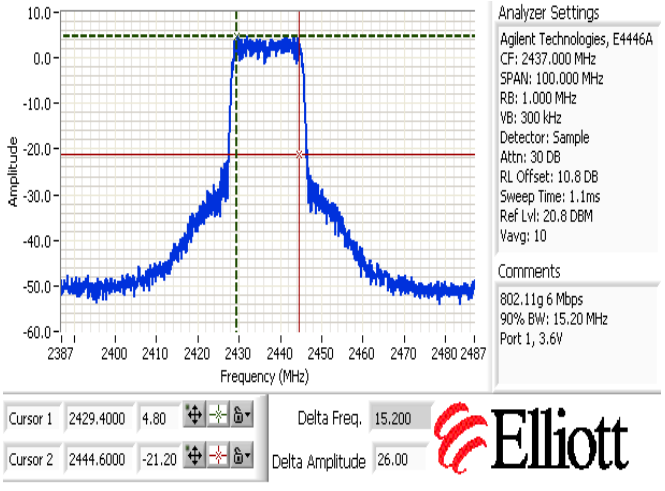

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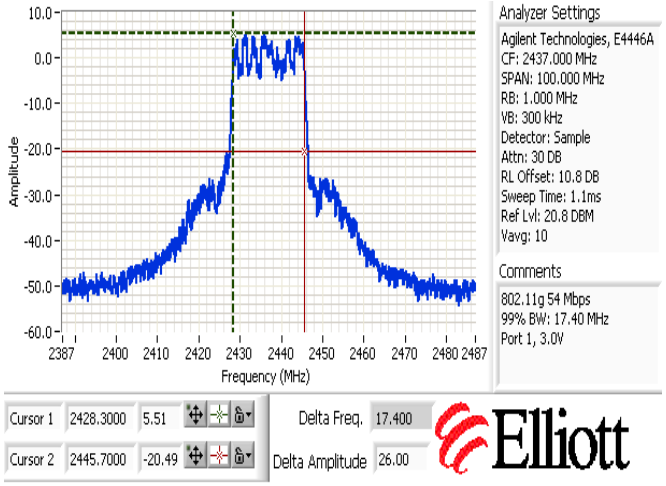

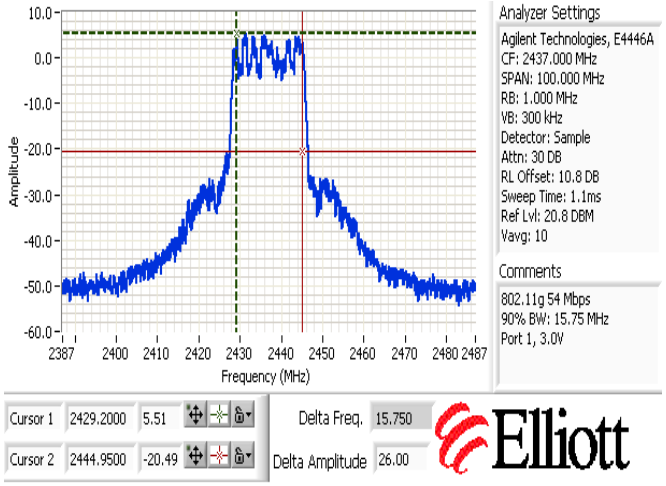

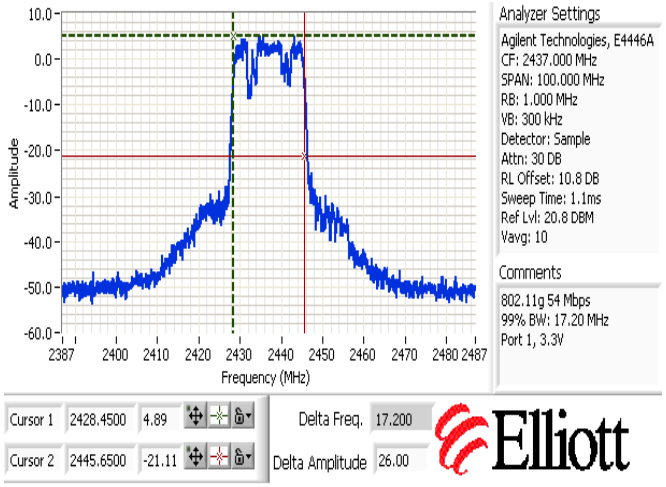

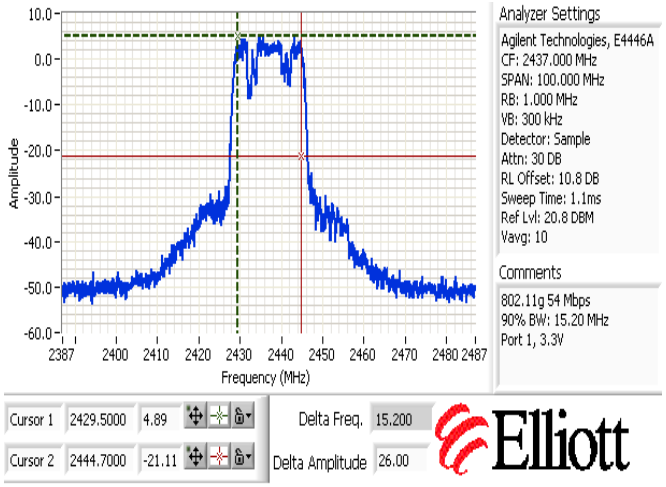

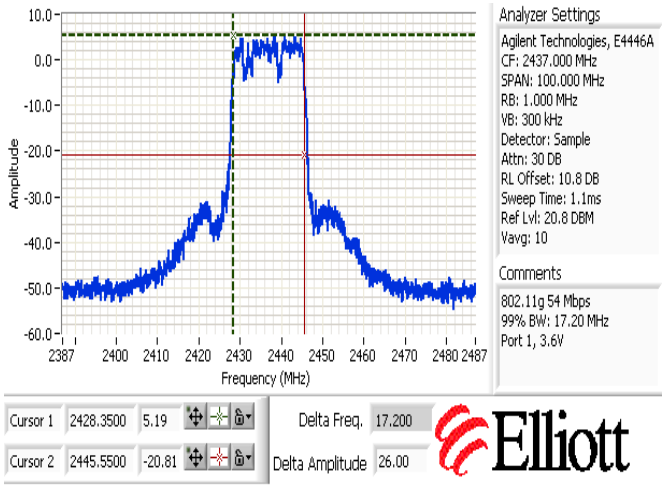

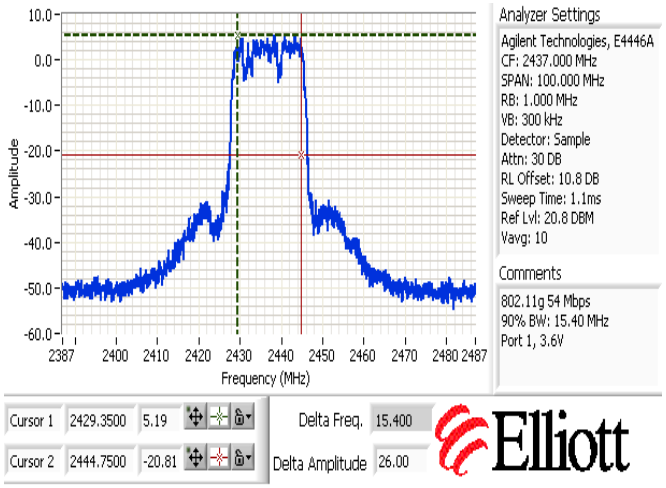

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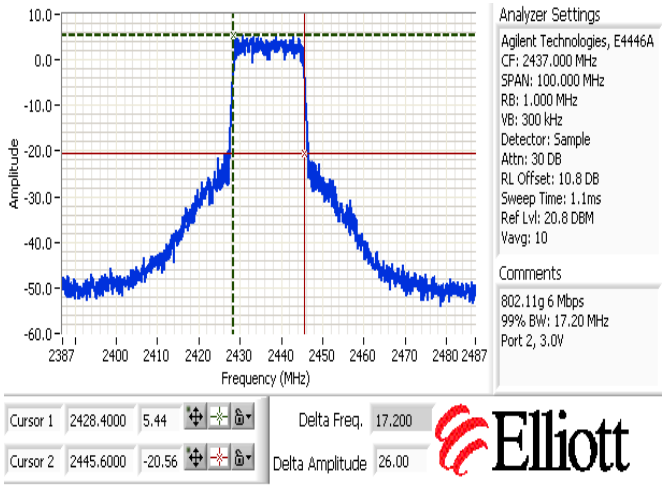

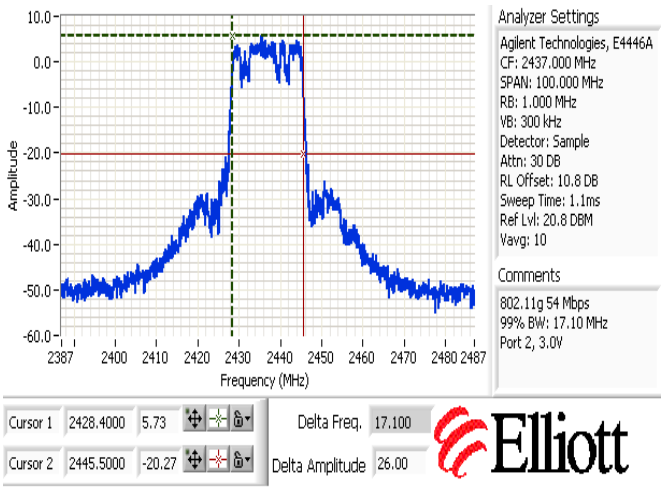

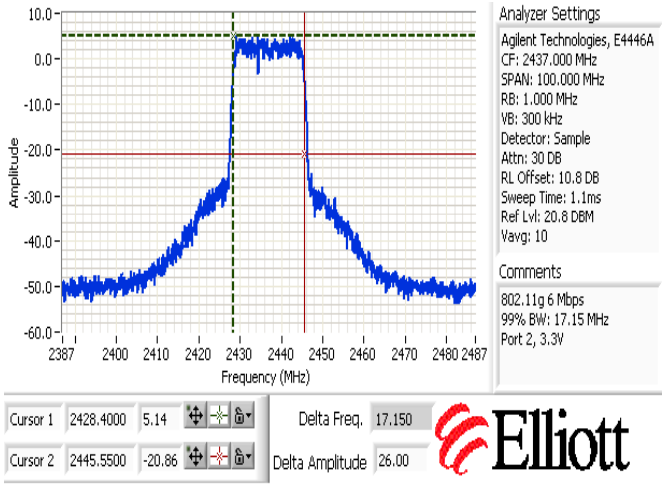

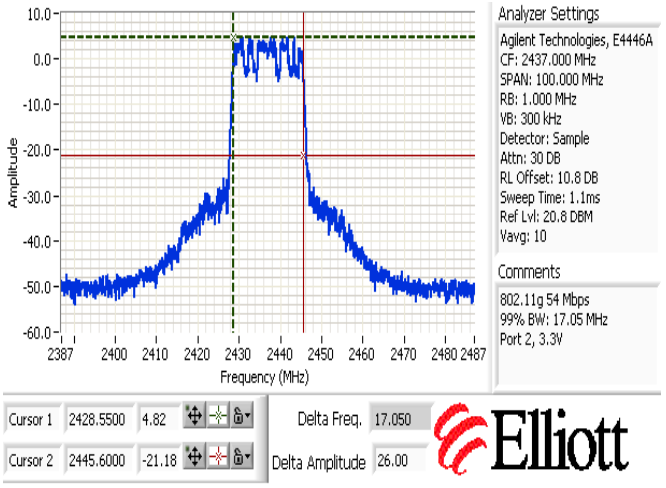

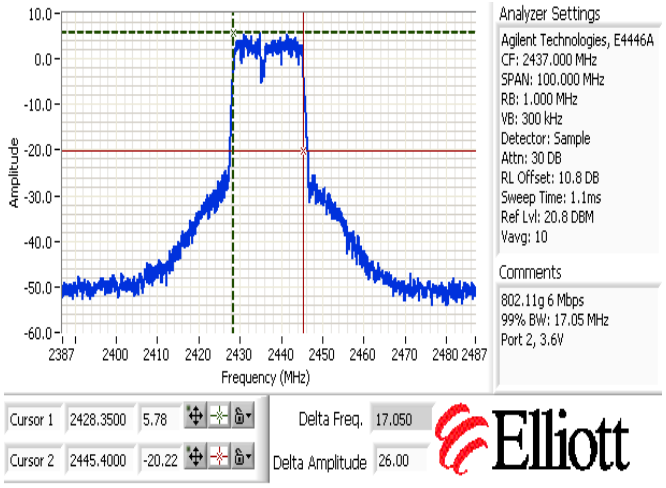

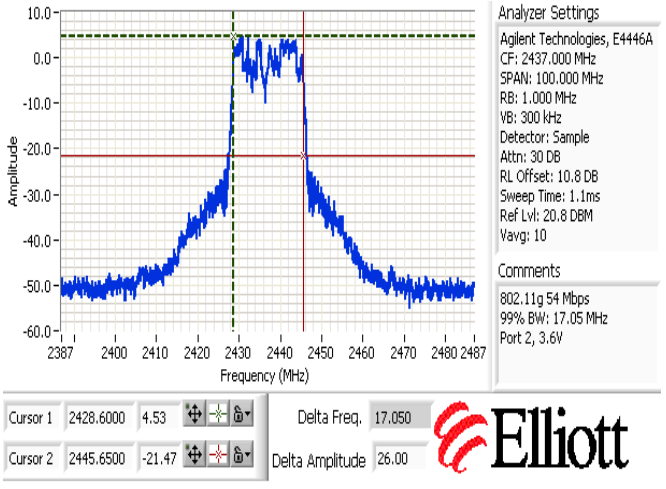

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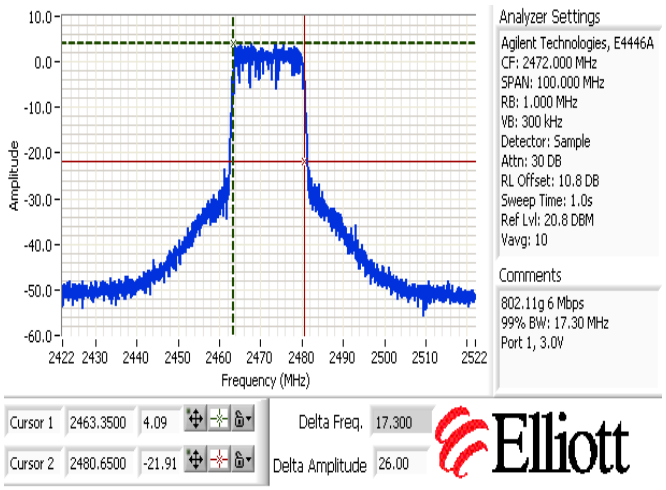

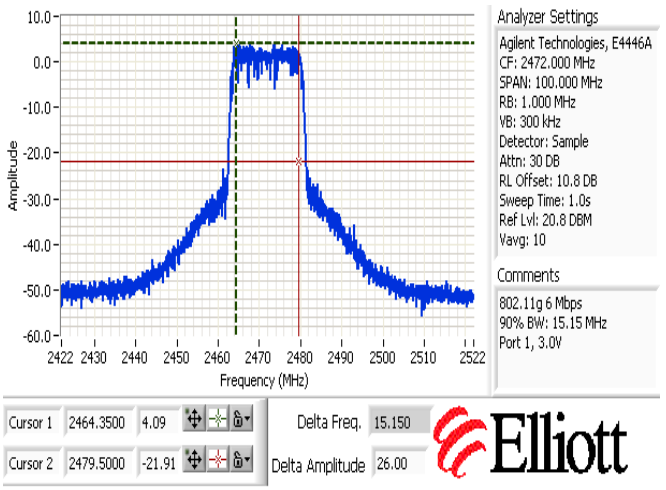

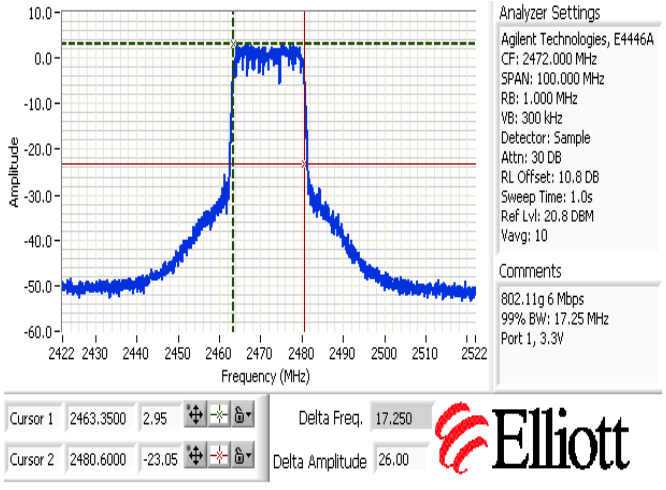

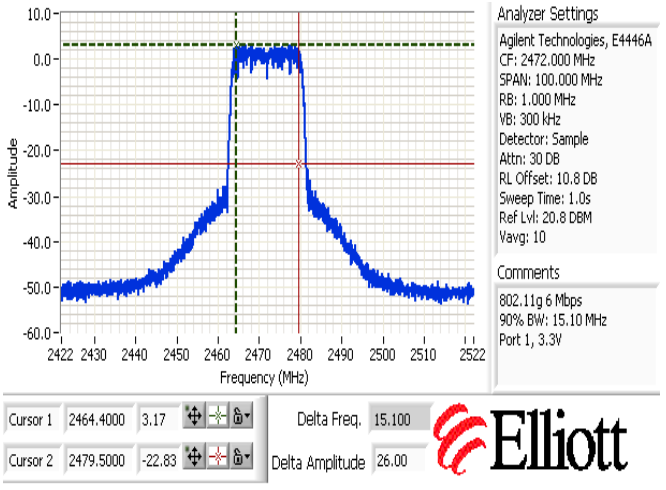

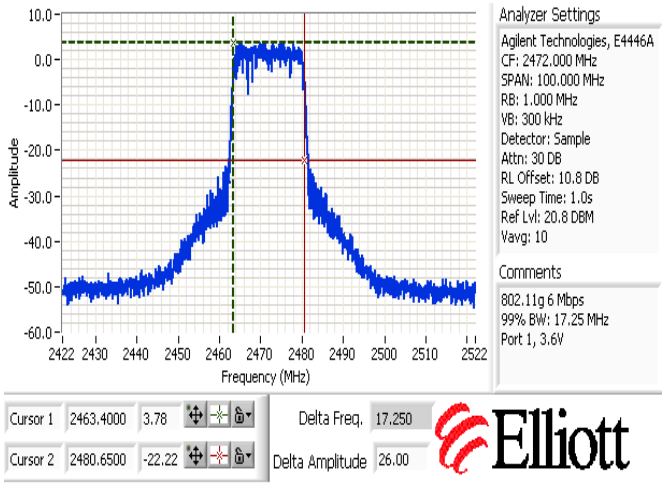

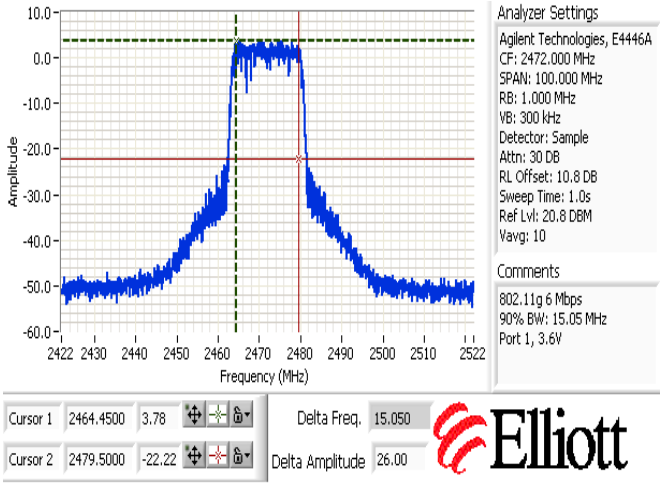

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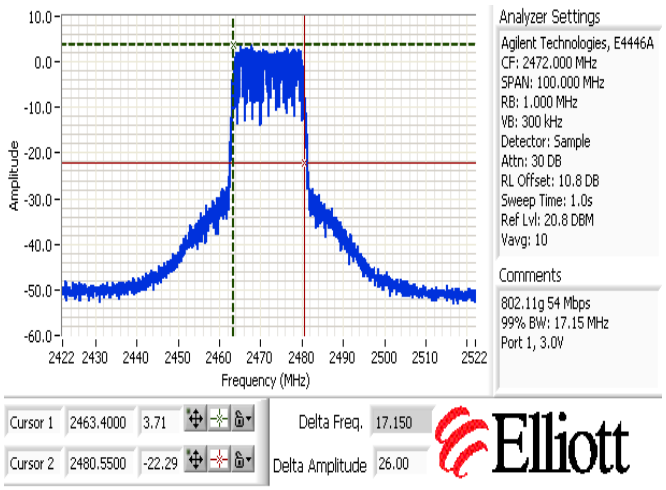
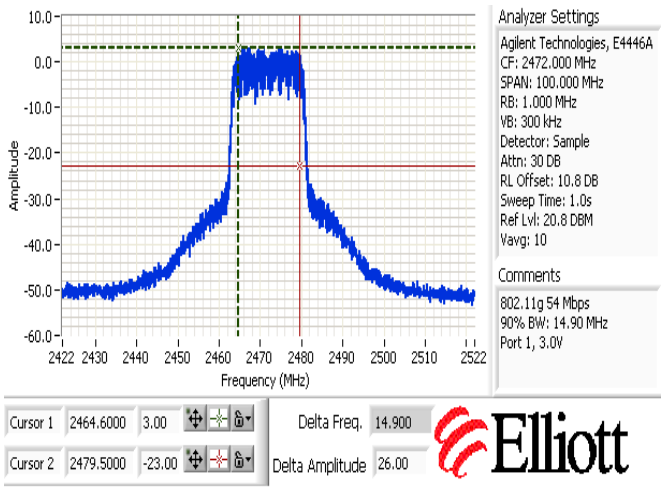
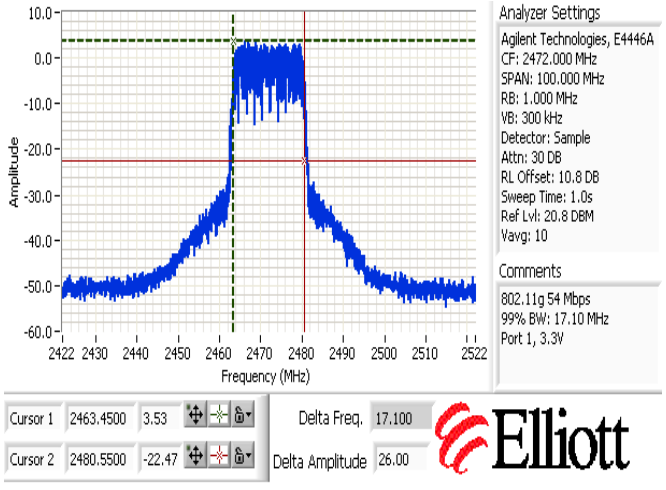
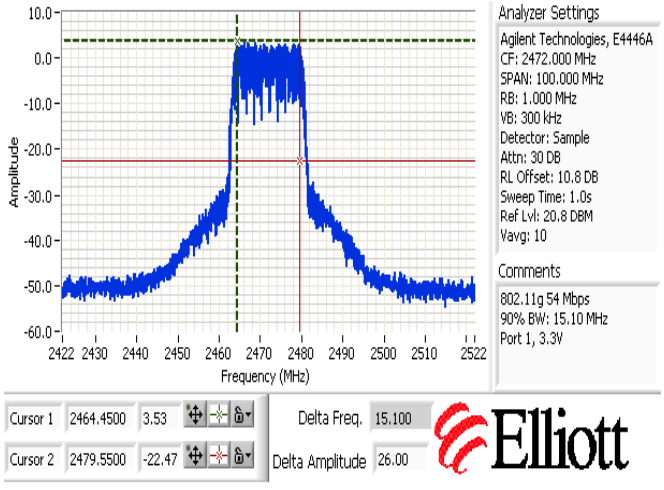
Transmitter Characteristics Test Data

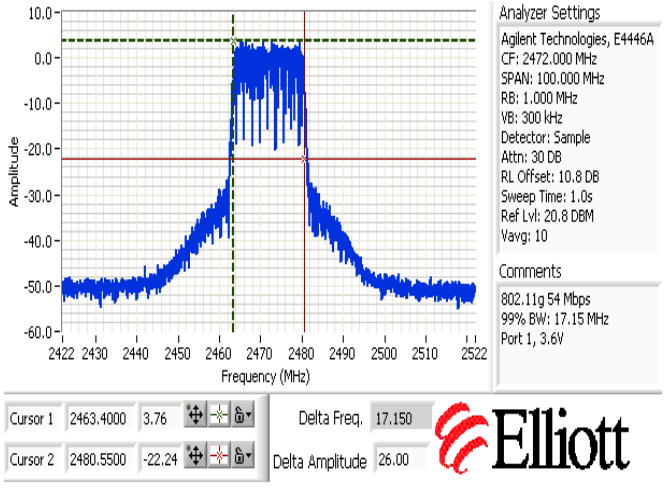
Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

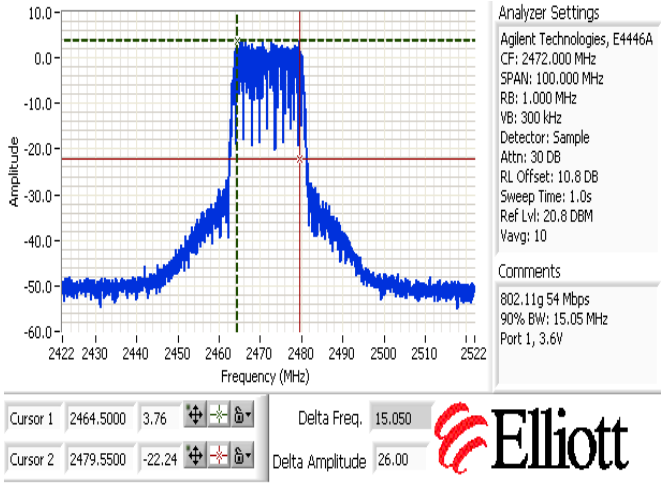












Elliott An NTS company

Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Run #3: Spurious and unwanted emissions

Date of Test: 3/5/2010
Test Location: Radio Lab

Test Engineer: Mehran Birgani

Test Requirements

Frequency Range (MHz)	Limit uW/MHz	Limit dBm/MHz
30 - 2387	2.5	-26.0
2387 - 2400	25.0	-16.0
2483.5 - 2496.5	25.0	-16.0
2496.5 - 12500	2.5	-26.0

The limit is for a 1MHz measurement bandwidth.

Measurement Summary - Highest emissions in each operating mode

Frequency MHz	Level dBm	Antenna Port	Limit	Margin	Detector	Comments	Voltage	Channel	Mode
4823.770	-43.2	Aux	-26.0	-17.2	Peak		3.0	1	b
4873.290	-45.0	Aux	-26.0	-19.0	Peak		3.0	6	b
4942.980	-47.7	Aux	-26.0	-21.7	Peak		3.0	13	b
3217.240	-50.4	Aux	-26.0	-24.4	Peak		3.3	1	g
3250.250	-45.9	Aux	-26.0	-19.9	Peak		3.3	6	g
3296.100	-46.7	Aux	-26.0	-20.7	Peak		3.3	13	g

Measurements made at operating voltage that produced the highest output power.

Preliminary Measurements :

Instrument Settings: RB=VB=1MHz, Positive peak detector and maximum hold for a minimum of 10 sweeps, but until the spectrum displayed becomes stable and no new signals are observed.

The device transmits continuously so the analyzer sweep time is auto-coupled.

Burst repetition frequency **0.05 ms**

Frequency (MHz) Start	Frequency (MHz) Stop	Bandwidth (MHz) RB	Bandwidth (MHz) VB	Sweep	
30	1000	1	1	49 ms	
1000	2483.5	1	1	74 ms	
2374	2400	1	1	1 ms	
2483.5	2900	1	1	21 ms	**Channels 1 through 13**
2900	6000	1	1	155 ms	
6000	12500	1	1	325 ms	

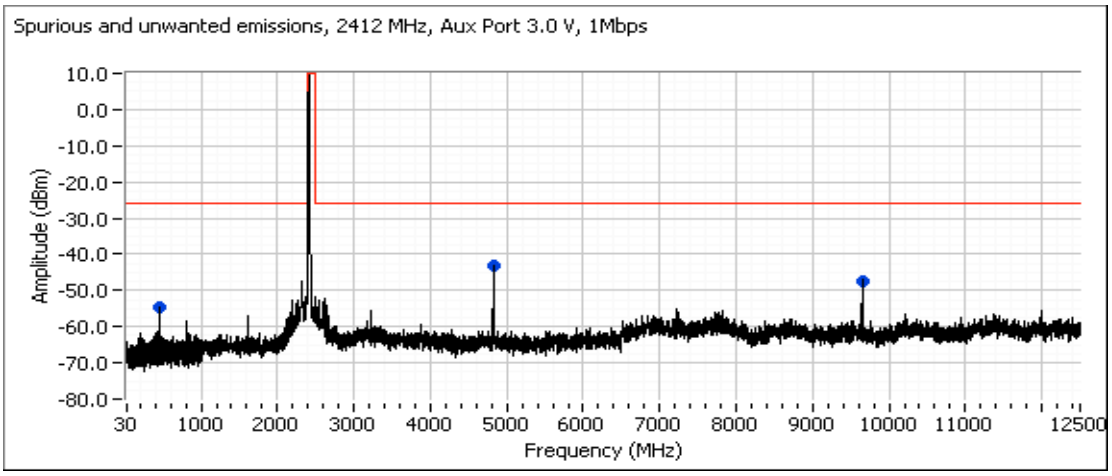
Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Preliminary measurement - 802.11b mode, Channels 1,6 and 13 (2400 - 2483.5MHz)
All plots generated using a 1MHz RBW
For emissions below 2387 MHz and above 2496.5 MHz the limit is 2.5uW/MHz (-26dBm/MHz).
From 2387 - 2400 MHz the limit is 25uW/MHz (-16dBm/MHz). From 2483.5 - 2496.5 MHz the limit is 25uW/MHz (-16dBm/MHz).

Frequency MHz	Level dBm	Antenna Port	Limit	Margin	Detector	Comments	Operating Voltage	Operating Channel
451.217	-54.4	Aux	-26.0	-28.4	Peak		3.0	Ch 1, 1Mbps
476.230	-53.6	Main	-26.0	-27.6	Peak		3.3	Ch 6, 1Mbps
476.230	-53.8	Aux	-26.0	-27.8	Peak		3.0	Ch 6, 1Mbps
476.230	-54.5	Aux	-26.0	-28.5	Peak		3.6	Ch 6, 1Mbps
476.230	-54.6	Main	-26.0	-28.6	Peak		3.6	Ch 6, 1Mbps
476.230	-54.6	Main	-26.0	-28.6	Peak		3.0	Ch 6, 11Mbps
476.230	-54.9	Main	-26.0	-28.9	Peak		3.0	Ch 6, 1Mbps
476.230	-55.0	Aux	-26.0	-29.0	Peak		3.3	Ch 6, 1Mbps
479.232	-57.8	Main	-26.0	-31.8	Peak		3.3	Ch 6, 11Mbps
511.248	-57.0	Aux	-26.0	-31.0	Peak		3.0	Ch 13, 1Mbps
4823.770	**-43.2**	Aux	-26.0	**-17.2**	Peak		3.0	Ch 1, 1Mbps
4873.290	**-45.0**	Aux	-26.0	**-19.0**	Peak		3.0	Ch 6, 1Mbps
4873.290	-45.0	Aux	-26.0	-19.0	Peak		3.3	Ch 6, 1Mbps
4873.290	-45.5	Aux	-26.0	-19.5	Peak		3.6	Ch 6, 1Mbps
4873.290	-47.9	Main	-26.0	-21.9	Peak		3.6	Ch 6, 1Mbps
4873.290	-48.5	Main	-26.0	-22.5	Peak		3.3	Ch 6, 11Mbps
4873.290	-48.6	Main	-26.0	-22.6	Peak		3.3	Ch 6, 1Mbps
4873.290	-50.3	Main	-26.0	-24.3	Peak		3.0	Ch 6, 11Mbps
4873.290	-50.9	Main	-26.0	-24.9	Peak		3.6	Ch 6, 11Mbps
4875.120	-48.1	Main	-26.0	-22.1	Peak		3.0	Ch 6, 1Mbps
4942.980	**-47.7**	Aux	-26.0	**-21.7**	Peak		3.0	Ch 13, 1Mbps
9649.050	-47.3	Aux	-26.0	-21.3	Peak		3.0	Ch 1, 1Mbps

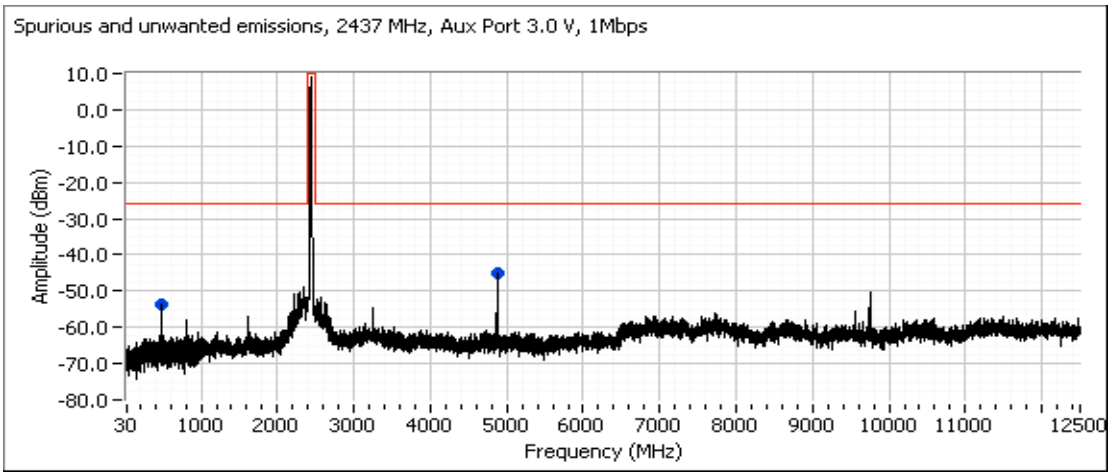
Broadband plots from 30MHz to 12.5GHz for channels 1, 6 and 13

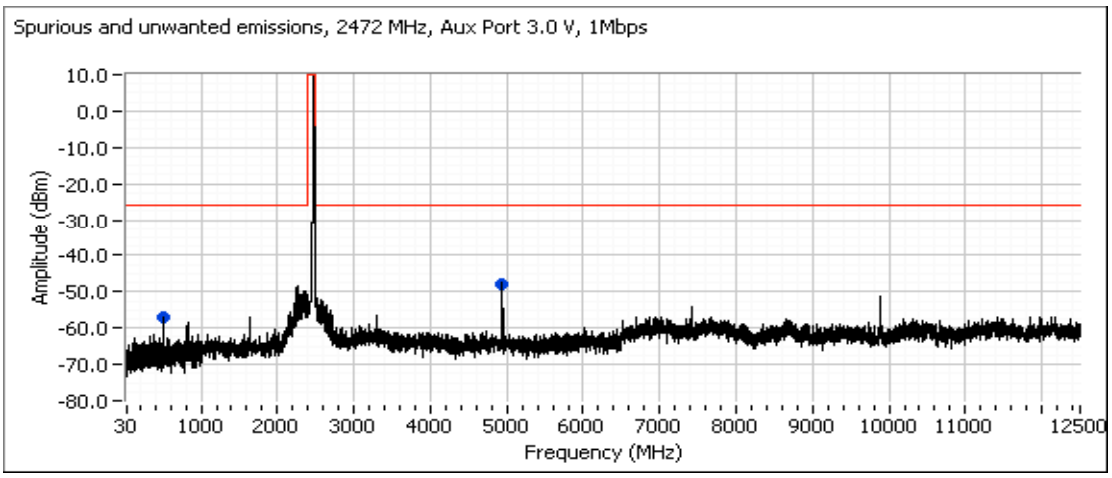


Elliott An NTS company

Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski





Final (Zero-Span) measurement - 802.11b mode

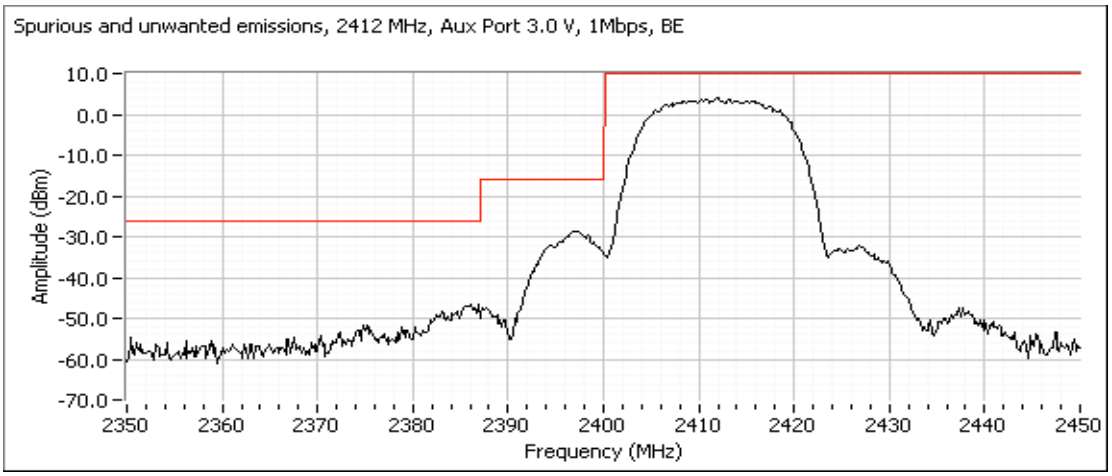
Measurements are made only on those frequencies that exceed the limit during the preliminary measurements and at the operating voltage that produced the highest emission level. As there were no emissions above the limit during the preliminary (peak) scan, no final measurements were required.

Elliott An NTS company

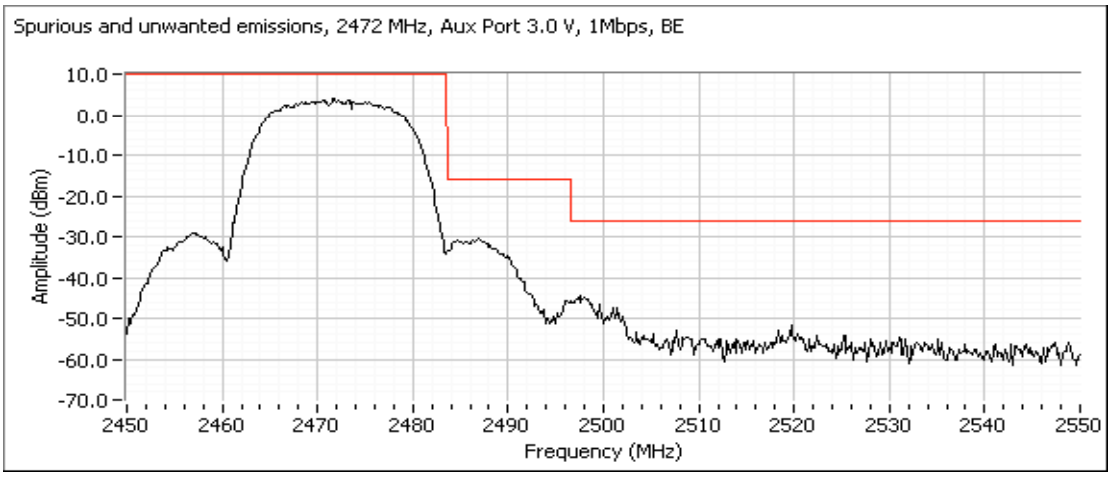
Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Channel 1 - Emissions at band edge. Cursors are placed on the highest signal below 2387 MHz and the highest signal from 2387MHz to 2400 MHz.



Channel 13 emissions at band edge. Cursors placed on the highest signal above 2496.5 MHz and the highest signal between 2383.5 - 2496.5 MHz.



Transmitter Characteristics Test Data

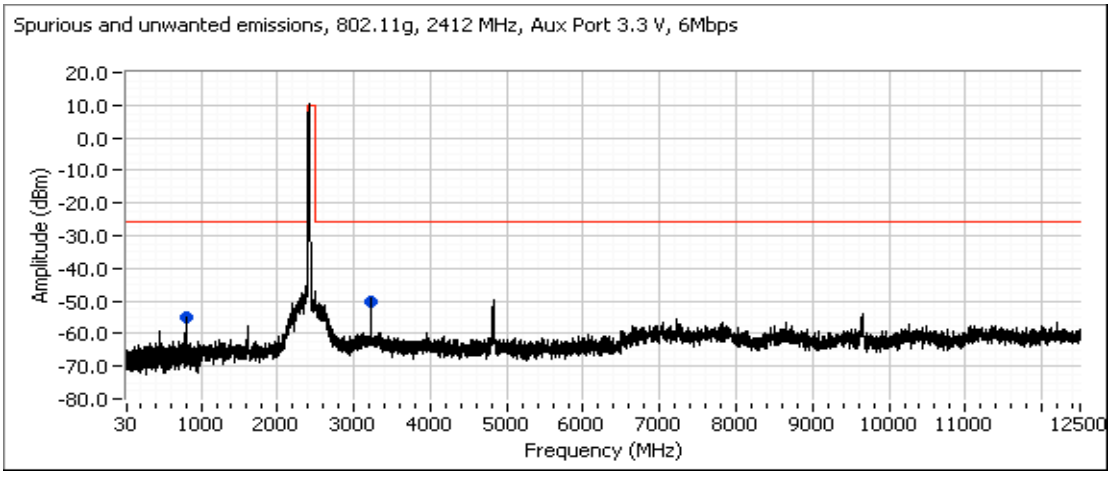
Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Preliminary measurement - 802.11g mode
All plots generated using a 1MHz RBW
For emissions below 2387 MHz the limit is 2.5uW/MHz (-26dBm/MHz).
From 2387 - 2400 MHz the limit is 25uW/MHz (-16dBm/MHz). From 2483.5 - 2496.5 MHz the limit is 25uW/MHz (-16dBm/MHz).

Emissions Test Data - 802.11g Preliminary Measurements

Frequency MHz	Level dBm	Antenna Port	Limit	Margin	Detector	Comments	Operating Voltage	
797.396	-55.0	Aux	-26.0	-29.0	Peak		3.3	Ch 1, 6Mbps
808.401	-50.9	Aux	-26.0	-24.9	Peak		3.6	Ch 6, 6Mbps
816.405	-51.1	Aux	-26.0	-25.1	Peak		3.3	Ch 6, 54Mbps
816.405	-51.9	Aux	-26.0	-25.9	Peak		3.6	Ch 6, 54Mbps
817.406	-50.0	Aux	-26.0	-24.0	Peak		3.0	Ch 6, 6Mbps
817.406	-50.2	Aux	-26.0	-24.2	Peak		3.0	Ch 6, 54Mbps
818.907	-50.5	Aux	-26.0	-24.5	Peak		3.3	Ch 6, 6Mbps
819.407	-50.6	Main	-26.0	-24.6	Peak		3.3	Ch 6, 6Mbps
821.408	-50.5	Aux	-26.0	-24.5	Peak		3.3	Ch 13, 6Mbps
3217.240	**-50.4**	Aux	-26.0	**-24.4**	Peak		3.3	Ch 1, 6Mbps
3250.250	**-45.9**	Aux	-26.0	**-19.9**	Peak		3.3	Ch 6, 6Mbps
3250.250	-46.0	Aux	-26.0	-20.0	Peak		3.6	Ch 6, 54Mbps
3250.250	-46.0	Aux	-26.0	-20.0	Peak		3.3	Ch 6, 54Mbps
3250.250	-46.1	Aux	-26.0	-20.1	Peak		3.6	Ch 6, 6Mbps
3250.250	-46.3	Aux	-26.0	-20.3	Peak		3.0	Ch 6, 6Mbps
3250.250	-46.3	Aux	-26.0	-20.3	Peak		3.0	Ch 6, 54Mbps
3250.250	-46.8	Main	-26.0	-20.8	Peak		3.3	Ch 6, 6Mbps
3296.100	**-46.7**	Aux	-26.0	**-20.7**	Peak		3.3	Ch 13, 6Mbps

Broadband plots from 30MHz to 12.5GHz for channels 1, 6 and 13



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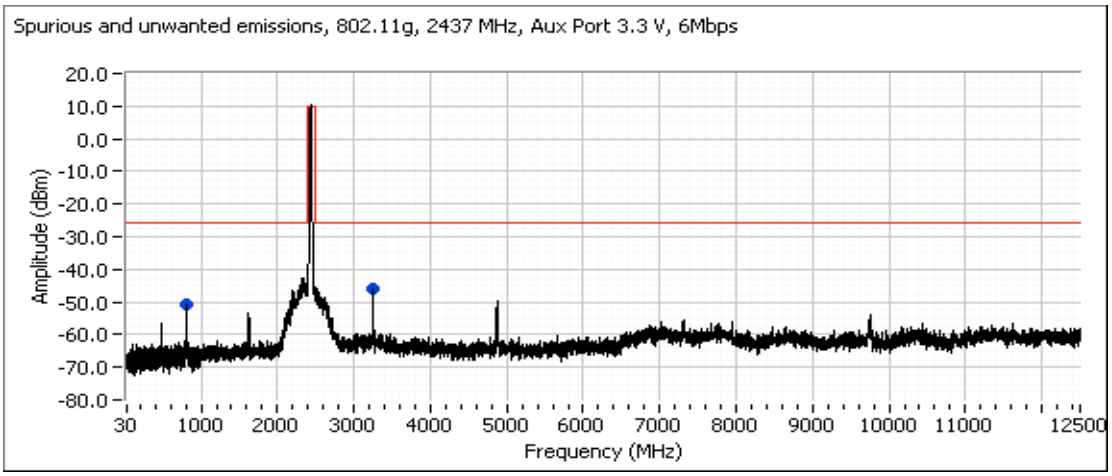
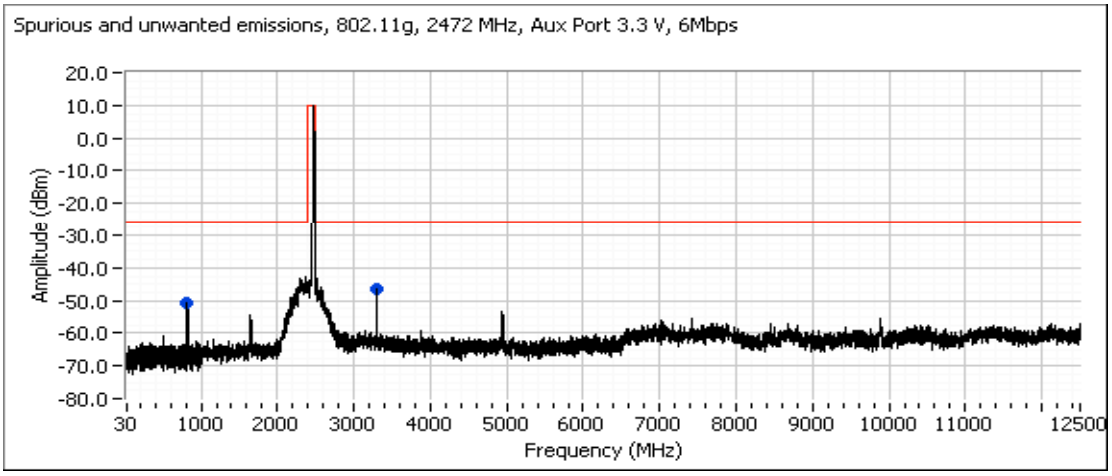
Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski





Final (Zero-Span) measurement - 802.11g mode

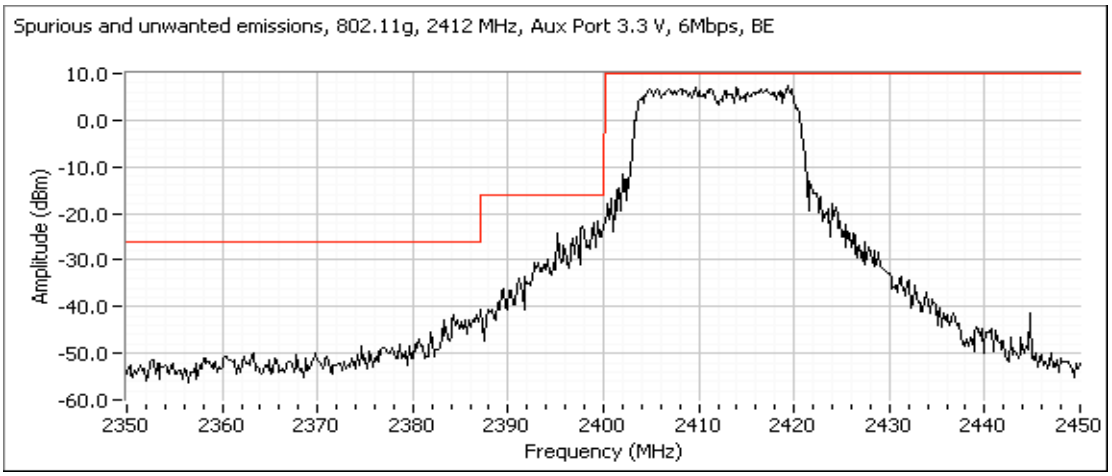
Measurements are made only on those frequencies that exceed the limit during the preliminary measurements and at the operating voltage that produced the highest emission level. As there were no emissions above the limit during the preliminary (peak) scan, no final measurements were required.

Elliott An NTS company

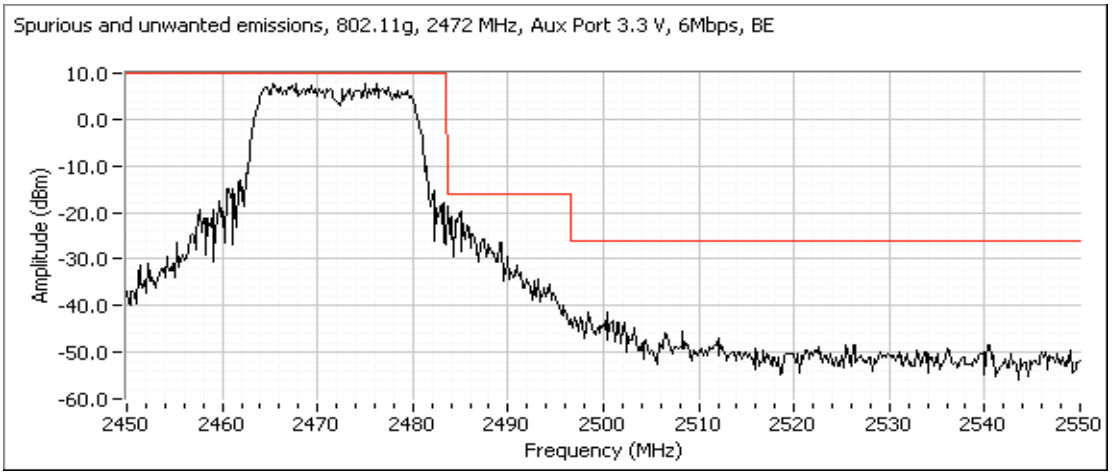
Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Channel 1 - Emissions at band edge. Cursors are placed on the highest signal below 2387 MHz and the highest signal from 2387MHz to 2400 MHz.



Channel 13 emissions at band edge. Cursors placed on the highest signal above 2496.5 MHz and the highest signal between 2383.5 - 2496.5 MHz.



Elliott An NTS company

Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Run #4: Antenna Power

Date of Test: 3/5/2010 Test Engineer: Mehran Birgani
Test Location: Radio Lab

Test Procedure:

Step 1:Determine the frequency of the signal with the highest power spectral density

Instrument Settings: RB=1MHz, VB=3MHz, Span > Occupied bandwidth, peak detector, max hold, sampling points > 400.

Once the display has settled (no more peaks added) the marker is paced at the peak of the signal.
The spectrum analyzer center frequency is adjusted to the marker frequency (Mkr -> CF feature), the span is then set to zero span.

Step 2:Measure the output power

Instrument Settings: RB=VB=1MHz, continuous sweep, trace clear-write

The output power is the power measured by the average power meter connected to the IF output of the analyzer, corrected for the IF path loss, the value of the external attenuator (if used) and the duty cycle of the transmission sequence if the product is not transmitting continuously.

802.11b mode - initial measurements on center channel to determine worst-case mode and rf port with highest output power.

Channel	Mode	Port	Chain	Data Rate	Nominal -10% 3.0 V	Nominal 3.3 V	Nominal + 10% 3.6 V
Center	802.11b	Main	-	1Mb/s	3.47 mw/MHz	3.31 mw/MHz	3.24 mw/MHz
Center	802.11b	Aux	-	1Mb/s	3.31 mw/MHz	3.31 mw/MHz	3.31 mw/MHz
Center	802.11b	Main	-	11Mb/s	3.18 mw/MHz	3.11 mw/MHz	3.11 mw/MHz
802.11b mode - final measurements.							
Low	802.11b	Main	-	1 Mb/s	3.24 mw/MHz	3.16 mw/MHz	3.16 mw/MHz
Center	802.11b	Main	-	1 Mb/s	3.47 mw/MHz	3.24 mw/MHz	3.24 mw/MHz
High	802.11b	Main	-	1 Mb/s	3.31 mw/MHz	3.24 mw/MHz	3.24 mw/MHz

Lowest Output Power: 3.16 mw/MHz
Highest Output Power: 3.47 mw/MHz

Nominal Output Power: 4.74 mw/MHz
Deviation In Output Power: -33.2% to -26.8%

EIRP Calculation

Nominal Output Power: 4.74 mw/MHz
Nominal Output Power: 6.8 dBm/MHz
Antenna Gain: 3.0 dBi
EIRP: 9.8 dBm/MHz

Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

802.11g mode - initial measurements on center channel to determine worst-case data rate Measurements in 802.11bg mode were used to determine which antenna port had the highest output power.

Channel	Mode	Port	Chain	Data Rate	Nominal -10% 3.0 V	Nominal 3.3 V	Nominal + 10% 3.6 V
802.11g mode - initial measurements on center channel to determine worst-case mode/antenna:							
Center	802.11g	Main		6Mb/s	2.34 mw/MHz	2.24 mw/MHz	2.24 mw/MHz
Center	802.11g	Main		54Mb/s	2.16 mw/MHz	1.97 mw/MHz	1.97 mw/MHz
802.11g mode - final measurements.							
Low	802.11g	Main		6 Mb/s	1.70 mw/MHz	1.70 mw/MHz	1.70 mw/MHz
Center	802.11g	Main		6 Mb/s	2.34 mw/MHz	2.24 mw/MHz	2.24 mw/MHz
High	802.11g	Main		6 Mb/s	1.86 mw/MHz	1.74 mw/MHz	1.74 mw/MHz

Lowest Output Power: 1.7 mw/MHz
Highest Output Power: 2.3 mw/MHz

Nominal Output Power: 2.89 mw/MHz
Deviation In Output Power: -41.2% to -18.8%

EIRP Calculation

Nominal Output Power: 2.89 mw/MHz
Nominal Output Power: 4.6 dBm/MHz
Antenna Gain: 3.0 dBi
EIRP: 7.6 dBm/MHz

Elliott An NTS company

Transmitter Characteristics Test Data

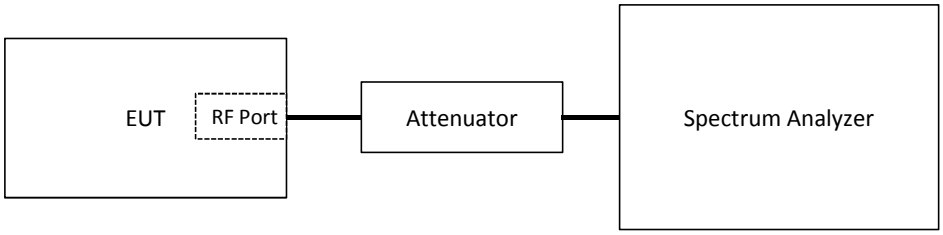
Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

RADIO EQUIPMENT USED FOR 2.4 GHz BAND
WIDE-BAND LOW-POWER DATA COMMUNICATIONS SYSTEM
(Radio station using 2471 - 2497 MHz - Category GZ)

Summary of Results

Test Performed	Mode	Requirement	Measurement	Result
Frequency Error	802.11b	50ppm or better	802.11b: 4.05 ppm	Pass
Occupied bandwidth (2484 MHz)	802.11b	DSSS: 500kHz < BW < 26MHz	DSSS: 19.53 MHz	Pass
Spreading Rate (2484 MHz)	802.11b	10 or more	802.11b: 10.7	Pass
Spurious Emissions	802.11b	Below 2387 MHz: < 2.5uW/MHz 2387 - 2400 MHz < 25uW/MHz 2497-2510 MHz < 25uW/MHz Above 2496.5 MHz: 2.5uW/MHz	802.11b: 0.012 uW @ 4968.66MHz	Pass
Antenna power	802.11b	Maximum permitted: BW < 26MHz: 10mW/MHz BW < 38MHz: 5mW/MHz Power Tolerance: -80% to +20%	Rated Power: 4.05 mW/MHz Deviation: - 35 % to -25 %	Pass
EIRP	802.11b	Omni-directional antennas: maximum eirp is 12.15dBm/MHz	9.1 dBm/MHz	Pass

Test Configuration



Test Environment

Temperature:	15-30	°C	
Rel. Humidity:	20-75	%	
Pressure:	86-106	kPa	
Nominal Supply Voltage	3.3	Vdc	(provided by host device)

Duty Cycle and Transmission Cycle Time

Data Rate	Duty Cycle	Transmission cycle time
Mbs	%	ms
1	100	N/A
11	99.5	N/A

Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Run #1: Frequency Error

Date of Test: 3/30/2010 Test Engineer: Mehran Birgani

Test Location: Radio Lab

The center frequency was measured at nominal and extreme voltage conditions.

For OFDM modulation with no provision for operating with an unmodulated signal measurements were made on a **modulated** signal at the top, center and bottom channels. The operating frequency was determined by measuring the frequency of the carrier observed at the center of the waveform that appears as a small peak within the central null. The analyzer was configured with RB=300Hz VB=10Hz, peak detector and max hold, as this gave the cleanest signal.

For CCK modulation with no provision for operating with an unmodulated signal measurements were made on a **modulated** signal at the top, center and bottom channels. The operating frequency was determined by measuring the frequency at the null created at the center of the signal. The analyzer was configured with RB=300Hz VB=10Hz, peak detector and max hold, as this gave the cleanest signal.

Nominal Frequency (MHz) - 802.11b

Low Channel		Center Channel	2484.0	High Channel	

	Measured Frequency (MHz)			Frequency Error (ppm)		
Voltage	Nominal -10% 3.0 V	Nominal 3.3 V	Nominal + 10% 3.6 V	3.0 V	3.3 V	3.6 V
Center Channel	2484.010052	2484.010067	2484.009917	4.05	4.05	3.99
Center Channel (Aux Port)	2484.009690	2484.009695	2484.009627	3.90	3.90	3.88
			Requirement (ppm):		**50.0**	

Notes:

All testing performed at 1Mbs for 802.11b (CCK).

Unless otherwise noted, TX Diversity switch was set to main only. Testing was performed on the Main connector.

Elliott An NTS company

Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Run #2: Occupied bandwidth and spreading bandwidth

Date of Test: 3/31/2010 Test Engineer: Mehran Birgani
Test Location: Radio Lab

The occupied bandwidth was measured with the spectrum analyzer configured according to the table below. The occupied bandwidth was determined from the 99% power bandwidth by determining the highest and lowest frequencies at which 99.5% of the power was captured and then subtracting the two numbers. the calculation was done by either the analyzer directly or via the software used to capture the plot. One plot for each mode tested is provided for reference.

The spreading bandwidth was measured with the spectrum analyzer configured according to the table below. The spreading bandwidth was the 90% power bandwidth determined by the highest and lowest frequencies at which 95% of the power was captured and then subtracting the two numbers. This calculation was done by either the analyzer directly or via the software used to capture the plot. One plot for each mode tested is provided for reference.

Instrument Settings and Test Requirements

Modulation Type	Analyzer settings				Bandwidth Requirement	
	Span	RB	VB	Other	Occupied	Spreading
Direct Sequence (e.g. 802.11b)	52-91	≤ 780kHz	300kHz	Positive peak detector, max hold, sweep time auto[1]	≤ 26.0MHz	≥ 500 kHz

Note 1: For burst transmissions sweep time set to ensure dwell time in each bandwidth > transmission cycle time (sweep time = transmit cycle time x span/ measurement bandwidth)
Note 2: For burst transmissions trace set for max hold and detector set to positive peak

Test Results, 802.11b Mode (Direct Sequence, 500kHz ≤ bandwidth ≤ 26MHz) - 99% Pwr Bandwidth

Channel	Mode	Port	Chain	Data Rate	Nominal -10% 3.0 V	Nominal 3.3 V	Nominal + 10% 3.6 V
#14	802.11b	Main		1Mb/s	19.67	19.60	19.60
#14	802.11b	Main		11Mb/s	19.60	19.57	19.57
#14	802.11b	Aux		1Mb/s	19.67	19.60	19.60
#14	802.11b	Aux		11Mb/s	19.60	19.53	19.60

Test Results, 802.11b Mode (Direct Sequence, 500kHz ≤ bandwidth ≤ 26MHz) - 90% Pwr Bandwidth

Channel	Mode	Port	Chain	Data Rate	Nominal -10% 3.0 V	Nominal 3.3 V	Nominal + 10% 3.6 V
#14	802.11b	Main		1Mb/s	14.88	14.88	14.88
#14	802.11b	Main		11Mb/s	14.74	14.74	14.74
#14	802.11b	Aux		1Mb/s	14.88	14.88	14.88
#14	802.11b	Aux		11Mb/s	14.67	14.70	14.67

Spreading bandwidth
Symbol rate for 802.11b is 1Msym/s for 1Mb/s and 1.375Msym/s for data rates of 5.5Mb/s and above.

	Data rate	Symbol Rate (Msym/s)	90% Signal Bandwidth	Spreading rate	Requirement
2484 MHz:	1Mb/s	1.000	14.880	14.9	10.0
2484 MHz:	5.5Mb/s & 11Mb/s	1.375	14.670	**10.7**	10.0

Transmitter Characteristics Test Data

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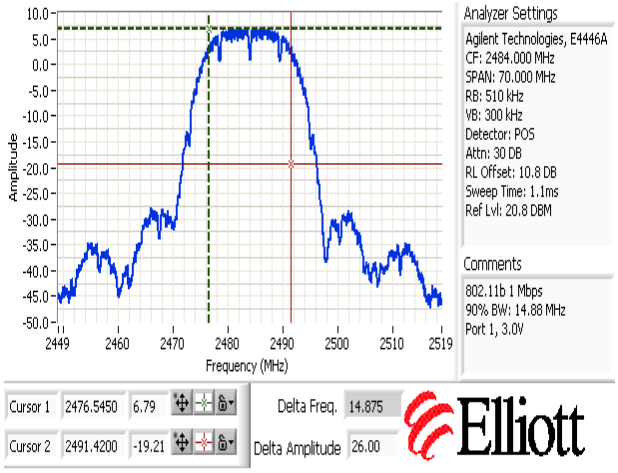
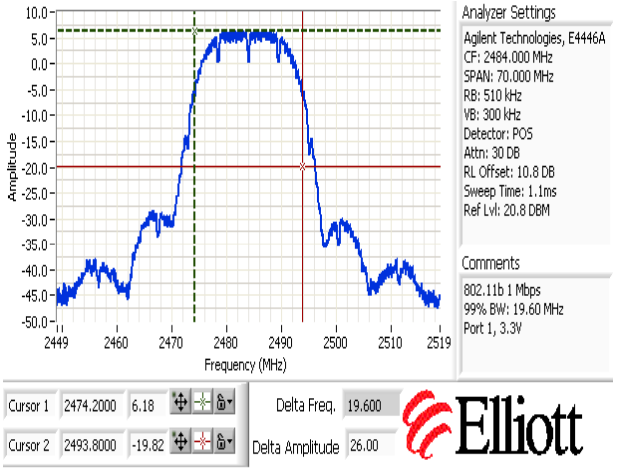
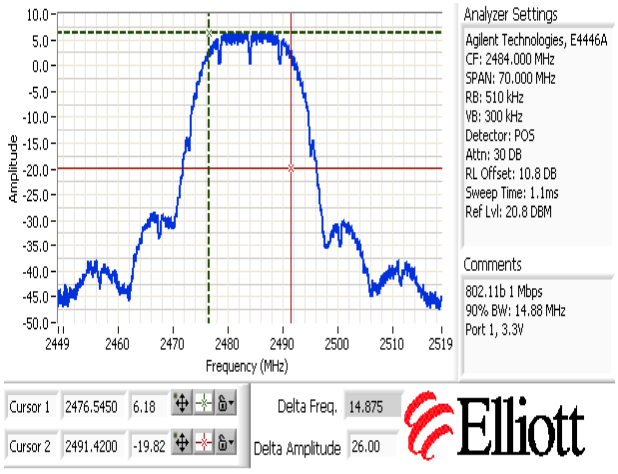
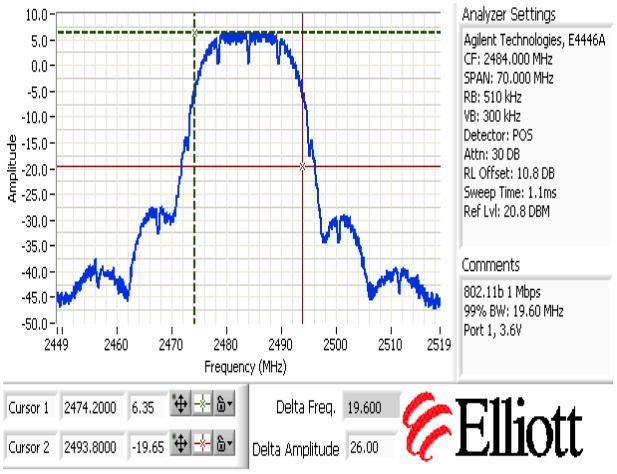
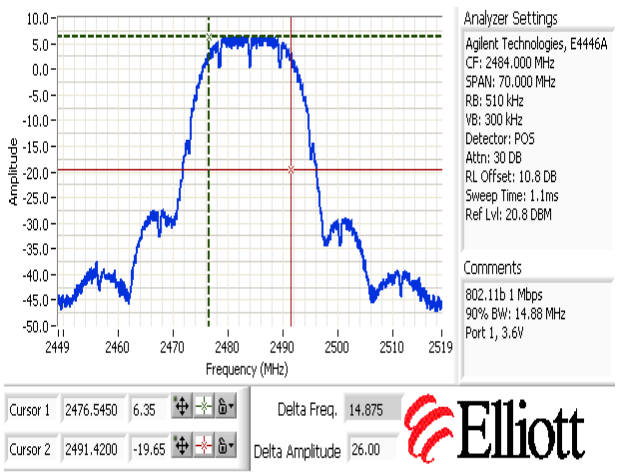
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski





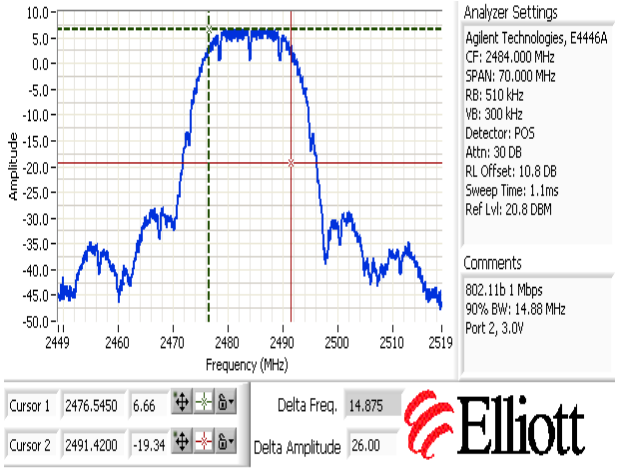


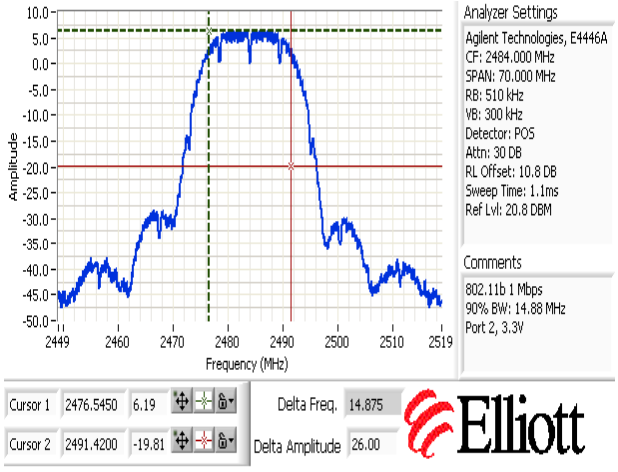




Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski





Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
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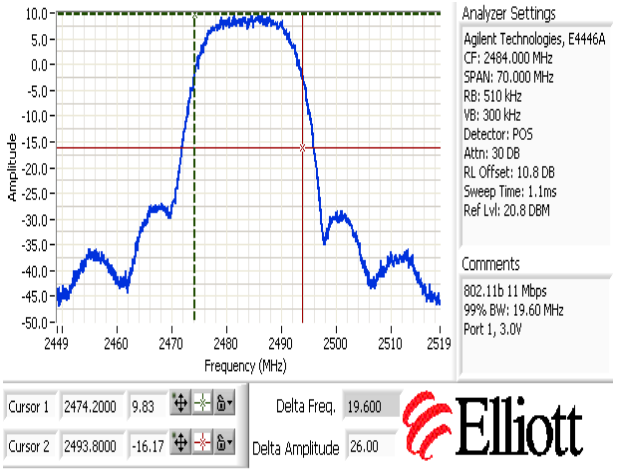
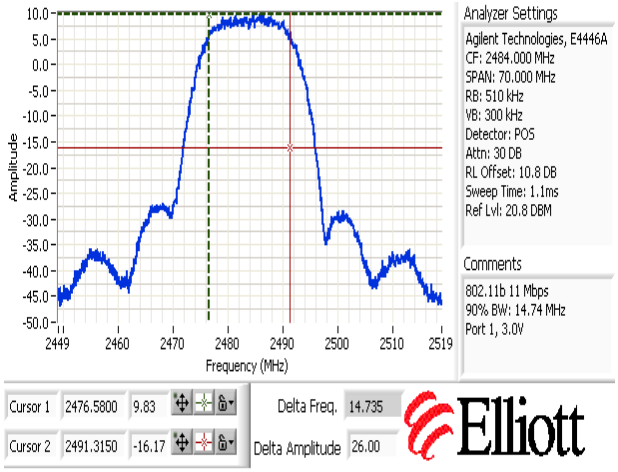
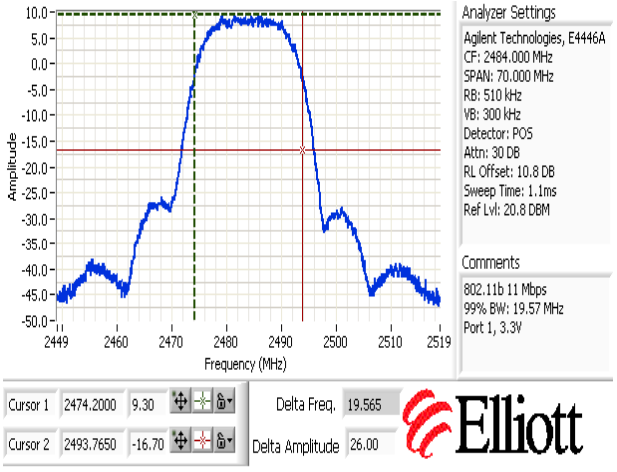
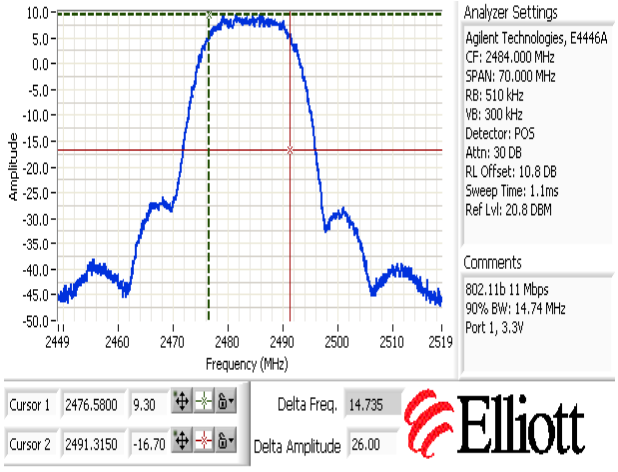


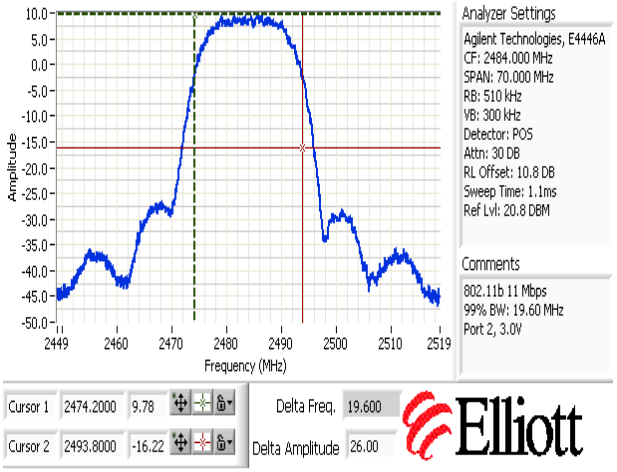


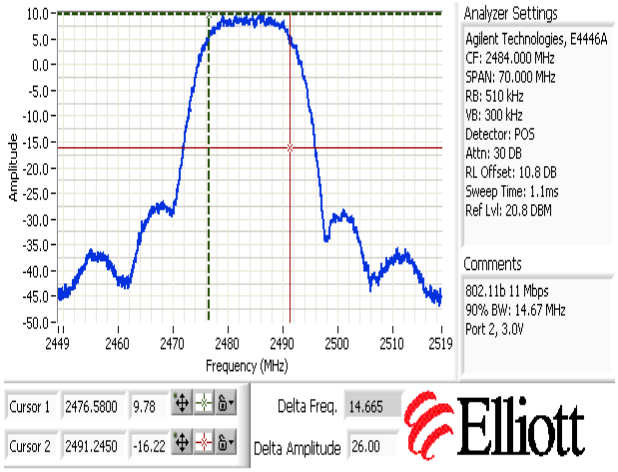


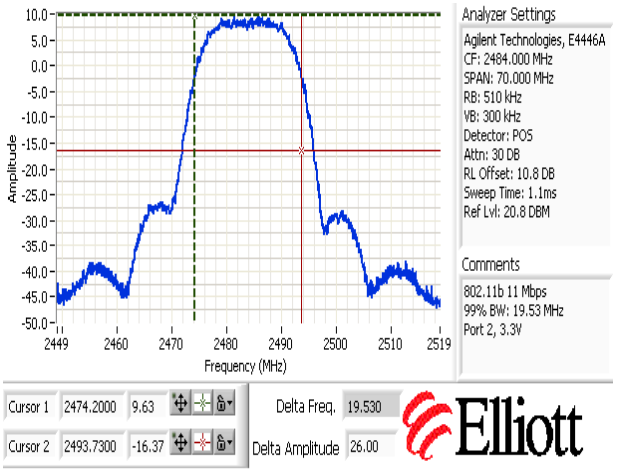


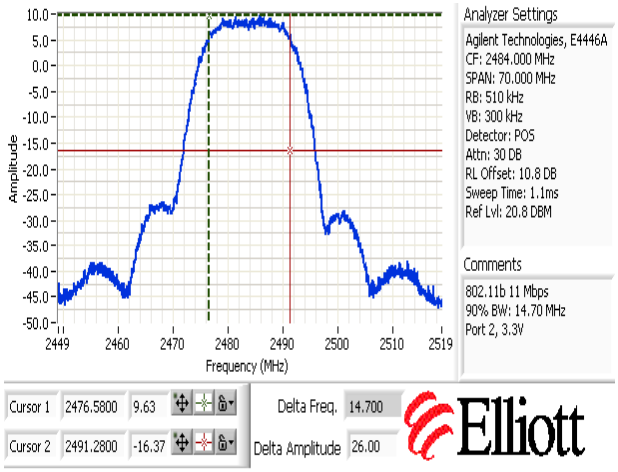
Transmitter Characteristics Test Data

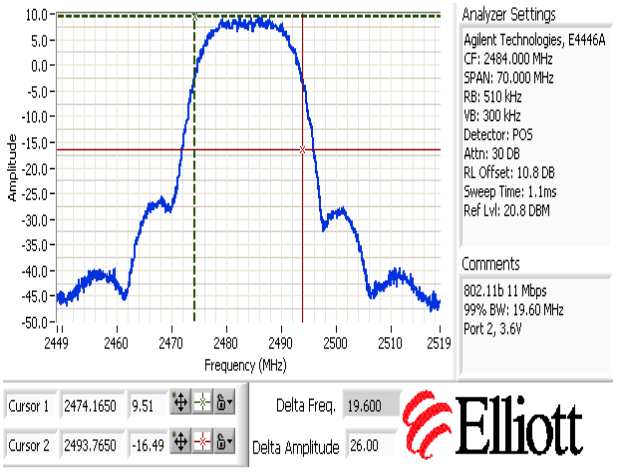
Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

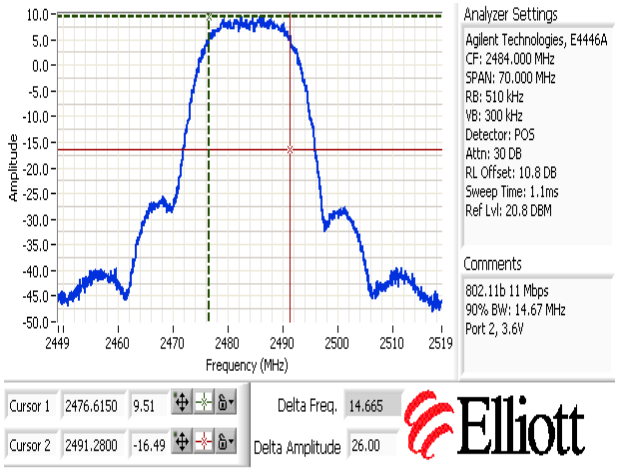












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Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Run #3: Spurious and unwanted emissions

Date of Test: 4/6/2010 Test Engineer: Mehran Birgani
Test Location: Radio Lab

Test Requirements

Frequency Range (MHz)	Limit uW/MHz	Limit dBm/MHz
30 - 2458	2.5	-26.0
2458 - 2471	25.0	-16.0
2497 - 2510	25.0	-16.0
2496.5 - 12500	2.5	-26.0

The limit is for a 1MHz measurement bandwidth.

Measurement Summary - Highest emissions in each operating mode

Frequency MHz	Level dBm	Antenna Port	Limit	Margin	Detector	Comments	Voltage	Channel	Mode
4968.660	**-49.3**	Aux	-26.0	**-23.3**	Peak		3.0	14	b

Measurements made at operating voltage that produced the highest output power.

Preliminary Measurements :

Instrument Settings: RB=VB=1MHz, Positive peak detector and maximum hold for a minimum of 10 sweeps, but until the spectrum displayed becomes stable and no new signals are observed.

The device transmits continuously so the analyzer sweep time is auto-coupled.

The device transmits in a burst mode, sweep time is calculated for each band tested as shown below. The plots are composite plots of the individual frequency bands. so the analyzer sweep time is auto-coupled.

Burst repetition frequency **0.05 ms**

Frequency (MHz)		Bandwidth (MHz)		Sweep
Start	**Stop**	**RB**	**VB**	
30	1000	1	1	49 ms
1000	2458	1	1	73 ms
2408	2471	1	1	3 ms
2497	2560	1	1	3 ms
2510	6000	1	1	175 ms
6000	12500	1	1	325 ms

Preliminary measurement - 802.11b mode - GZ Band

All plots generated using a 1MHz RBW

For emissions below 2458 MHz the limit is 2.5uW/MHz (-26dBm/MHz).

From 2458 - 2471 MHz the limit is 25uW/MHz (-16dBm/MHz). From 2497 - 2510 MHz the limit is 25uW/MHz (-16dBm/MHz).

Frequency MHz	Level dBm	Antenna Port	Limit	Margin	Detector	Comments	Operating Voltage	Operating Channel
523.254	-57.2	Aux	-26.0	-31.2	Peak		3.0	14
4968.660	**-49.3**	Aux	-26.0	**-23.3**	Peak		3.0	14
9935.150	-50.1	Aux	-26.0	-24.1	Peak		3.0	14

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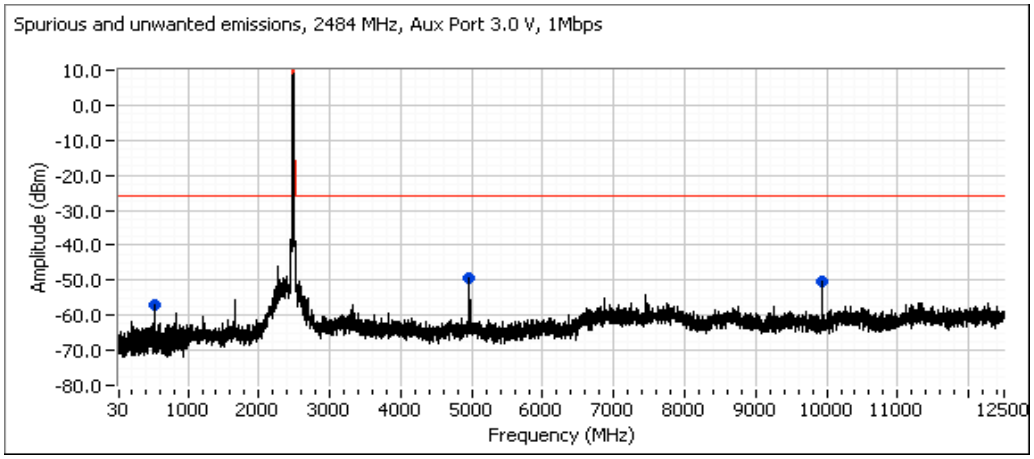
Transmitter Characteristics Test Data

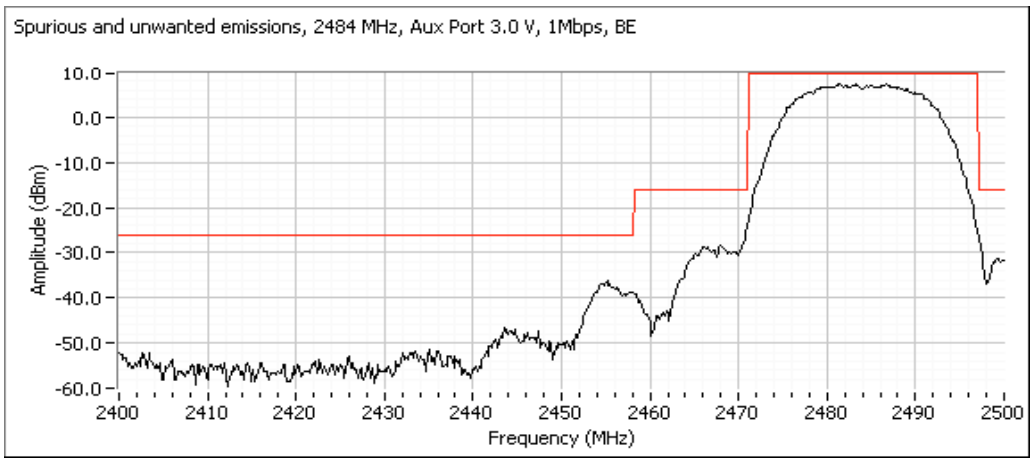
Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Preliminary measurement scans - 802.11b mode - GZ Band

Broadband plot from 30MHz to 12.5GHz for channel 14



Plots showing emissions close to band edges with cursors on the highest points below 2458 MHz, above 2510 MHz and in the frequency ranges 2458 MHz - 2471 MHz and 2497 - 2510 MHz



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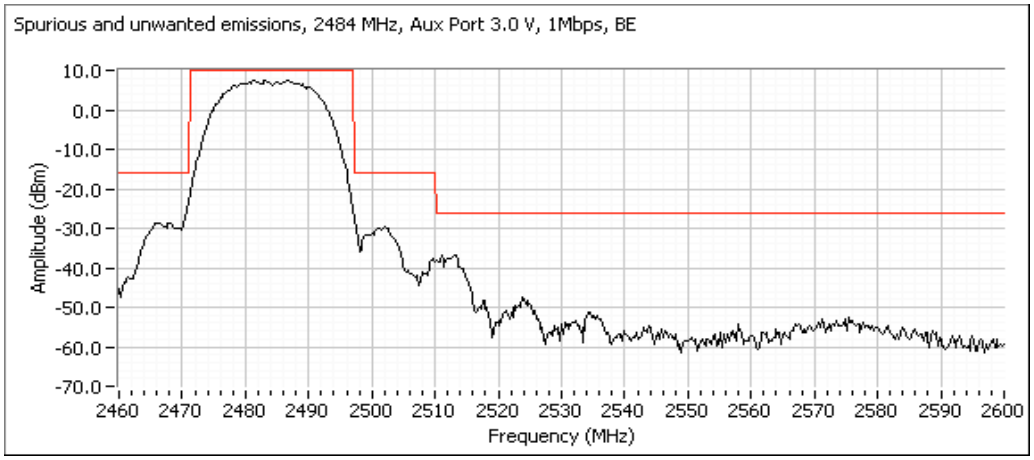
Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski



Final (Zero-Span) measurement

Measurements are made only on those frequencies that exceed the limit during the preliminary measurements and at the operating voltage that produced the highest emission level. As there were no emissions above the limit during the preliminary (peak) scan, no final measurements were required.

Elliott An NTS company

Transmitter Characteristics Test Data

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Run #4: Antenna Power

Date of Test: 4/5/2010 Test Engineer: Mehran Birgani
Test Location: Radio Lab

Test Procedure:

Step 1:Determine the frequency of the signal with the highest power spectral density

Instrument Settings: RB=1MHz, VB=3MHz, Span > Occupied bandwidth, peak detector, max hold, sampling points > 400.

Once the display has settled (no more peaks added) the marker is paced at the peak of the signal.
The spectrum analyzer center frequency is adjusted to the marker frequency (Mkr -> CF feature), the span is then set to zero span.

Step 2:Measure the output power

Instrument Settings: RB=VB=1MHz, continuous sweep, trace clear-write

The output power is the power measured by the average power meter connected to the IF output of the analyzer, corrected for the IF path loss, the value of the external attenuator (if used) and the duty cycle of the transmission sequence if the product is not transmitting continuously.

Channel	Mode	Port	Chain	Data Rate	Nominal -10% 3.0 V	Nominal 3.3 V	Nominal + 10% 3.6 V
14	802.11b	Main	-	1Mb/s	3.02 mw/MHz	2.69 mw/MHz	2.63 mw/MHz
14	802.11b	Aux	-	1Mb/s	2.95 mw/MHz	2.88 mw/MHz	2.88 mw/MHz
14	802.11b	Main	-	11Mb/s	3.04 mw/MHz	2.77 mw/MHz	2.77 mw/MHz

Lowest Output Power: 2.63 mw/MHz
Highest Output Power: 3.04 mw/MHz

Nominal Output Power: 4.05 mw/MHz
Deviation In Output Power: -35.0% to -25.0%

EIRP Calculation

Nominal Output Power: 4.05 mw/MHz
Nominal Output Power: 6.1 dBm/MHz
Antenna Gain: 3.0 dBi
EIRP: 9.1 dBm/MHz

Elliott An NTS company

Radio Test Data - Spurious Emissions

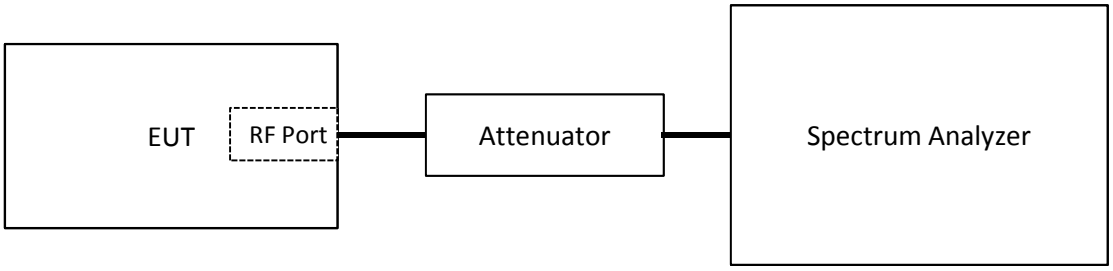
Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

RADIO EQUIPMENT USED FOR 2.4 GHz BAND WIDE-BAND LOW-POWER DATA COMMUNICATIONS SYSTEM (Radio station using 2400 - 2483.5 MHz and 2471 - 2497 MHz)

Secondary Radiated Emissions

Test Performed	Mode	Requirement	Measurement	Result
Secondary Radiated Emissions (Receiver Spurious Emissions)	-	30-1000MHz: 4nW or less >1000MHz: 20nW or less	0.01 nW 0.36 nW	PASS

Test Configuration



Test Environment

Temperature: 15-30 °C
Rel. Humidity: 20-75 %
Pressure: 86-106 kPa

Secondary Radiated Emissions

Date of Test: 4/1/2010
Test Location: Radio Lab
Test Engineer: Mehran Birgani

Test Requirements						
Frequency Range (MHz)	Limit					
	Single Chain		2x2 MIMO, per Chain		3x3 MIMO, per Chain	
	nW	dBm/MHz	uW/MHz	dBm/MHz	uW/MHz	dBm/MHz
30 - 1000	4.0	-54.0	2.0	-57.0	1.3	-58.8
1000 - 12500	20.0	-47.0	10.0	-50.0	6.7	-51.8

Measurement Summary - Emission with the least margin from all measurements

Frequency MHz	Level nW	Antenna Port	Limit nW	Margin dB	Detector	Comments	Voltage	Channel	
30-1000	0.01	0.0	4.0	-26.0	Peak	Highest level below 1GHz	3.3	6	
1000-12500	0.36	0.0	20.0	-17.4	Peak	Highest level above 1GHz	3.3	6	

Radio Test Data - Spurious Emissions

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Preliminary Measurements :

Instrument Settings: RB and VB as detailed below, Positive peak detector and maximum hold for a minimum of 10 sweeps, but until the spectrum displayed becomes stable and no new signals are observed.

Sweep Settings

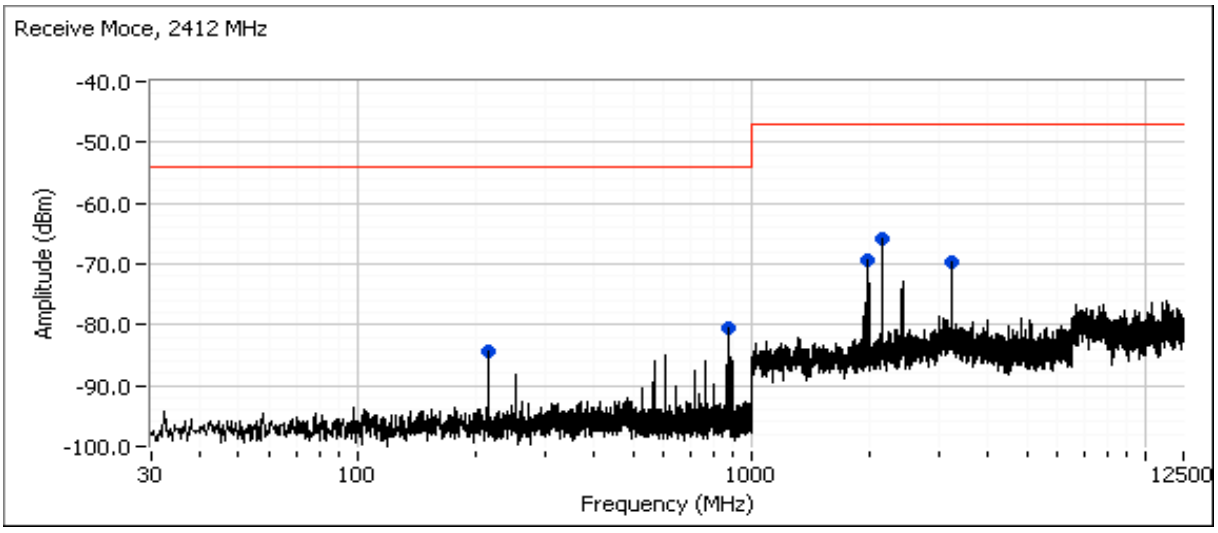
Frequency (MHz)		Bandwidth (MHz)		Sweep Time
Start	Stop	RB	VB	
30	1000	0.1	0.1	AUTO ms
1000	12500	1.0	1.0	AUTO ms

Frequency MHz	Level dBm	Antenna Port	Limit	Margin	Detector	Comments	Operating Voltage	Operating Channel
214.361	-83.3	RF Port	-54.0	-29.3	Peak		3.3	CH 14
214.361	-83.7	RF Port	-54.0	-29.7	Peak		3.3	CH 6
214.361	-84.5	RF Port	-54.0	-30.5	Peak		3.3	CH 1
870.624	-80.3	RF Port	-54.0	-26.3	Peak		3.3	CH 14
870.947	**-79.9**	RF Port	-54.0	**-25.9**	Peak	0.010 nW	3.3	CH 6
870.947	-80.6	RF Port	-54.0	-26.6	Peak		3.3	CH 1
1977.490	**-64.4**	RF Port	-47.0	**-17.4**	Peak	0.36 nW	3.3	CH 6
1977.490	-68.7	RF Port	-47.0	-21.7	Peak		3.3	CH 14
1977.490	-69.5	RF Port	-47.0	-22.5	Peak		3.3	CH 1
2153.550	-66.0	RF Port	-47.0	-19.0	Peak		3.3	CH 1
3215.410	-69.8	RF Port	-47.0	-22.8	Peak		3.3	CH 1
3250.250	-73.0	RF Port	-47.0	-26.0	Peak		3.3	CH 6
3312.600	-70.3	RF Port	-47.0	-23.3	Peak		3.3	CH 14

Channel 13 plots showed no significant signals within 20dB of the limit.

Preliminary scans at the voltage extremes showed no significant difference in the level of receiver spurious emissions. Plots and data for nominal voltage are provided in full.

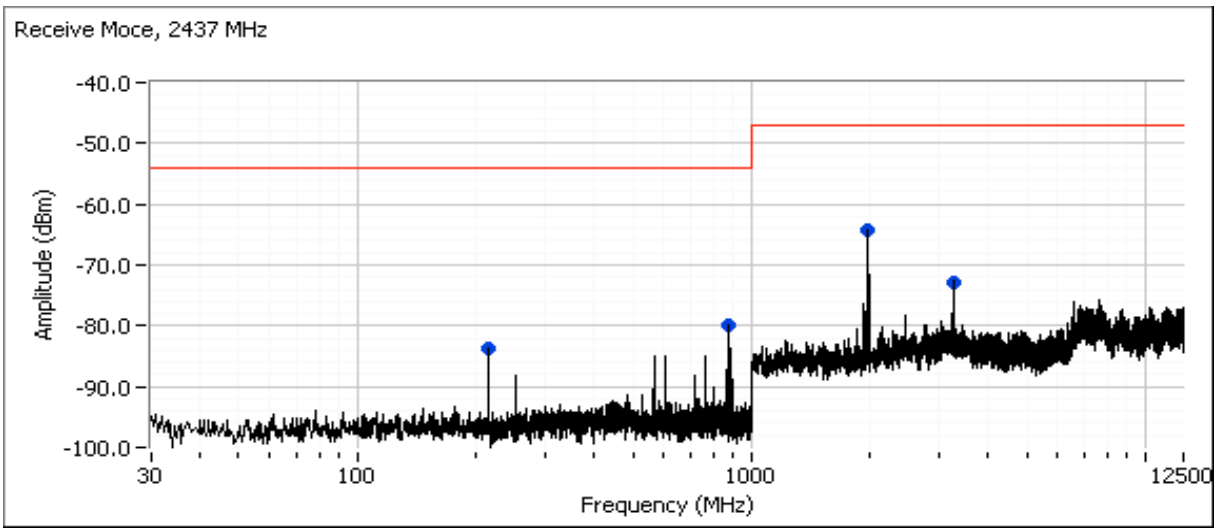
Broadband plots from 30MHz to 12.5GHz for channel #1



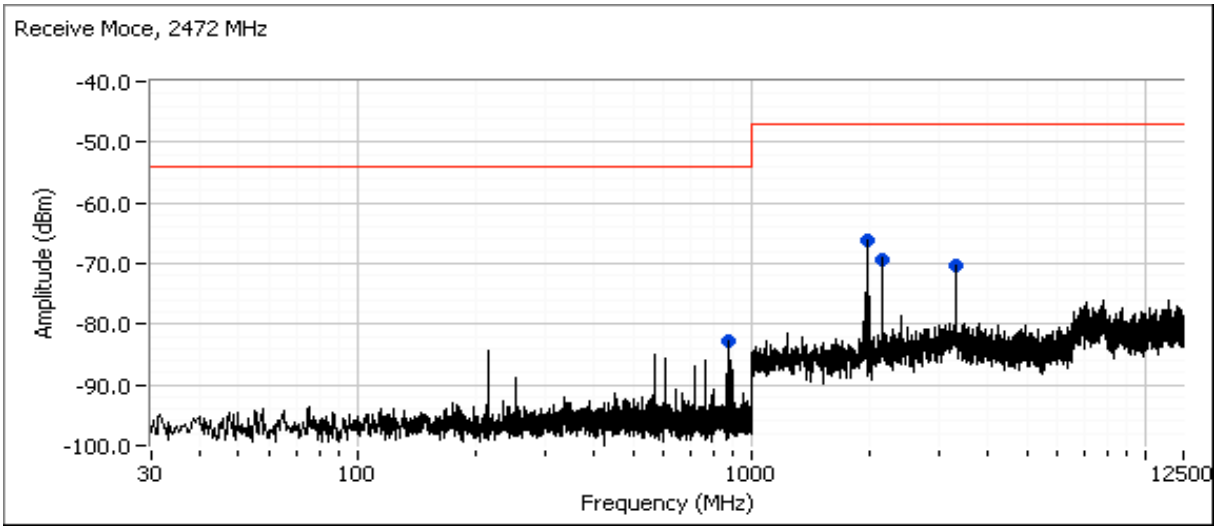
Radio Test Data - Spurious Emissions

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Broadband plots from 30MHz to 12.5GHz for centre channel (channel 6)



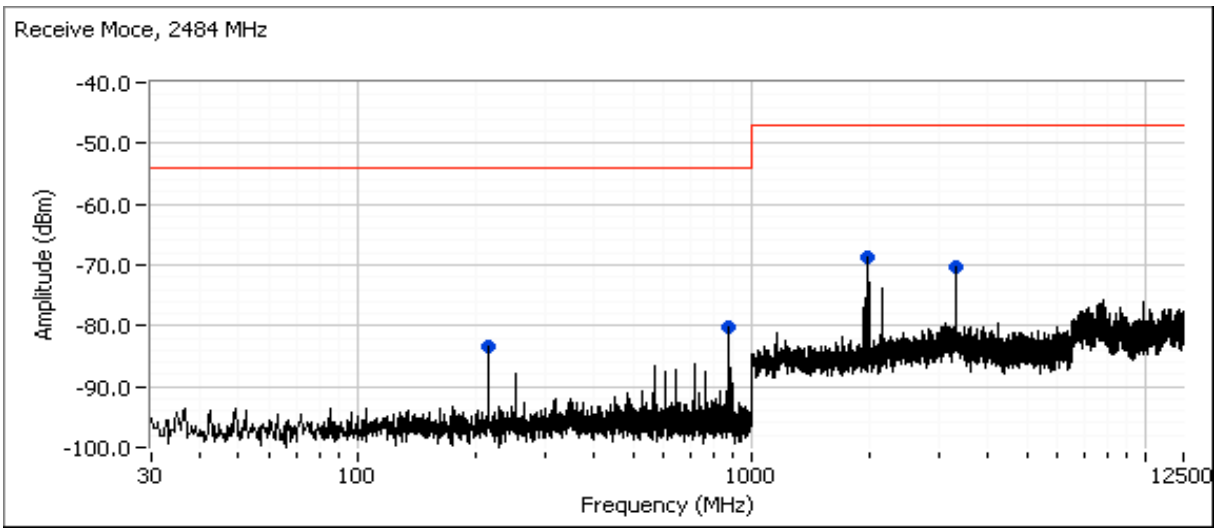
Broadband plots from 30MHz to 12.5GHz for high channel (channel 13)



Radio Test Data - Spurious Emissions

Client:	Summit Data Communications	Job Number:	J78216
Model:	802.11abg MSD30AG	T-Log Number:	T78634
		Account Manager:	Pamela Tucker
Standard:	Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Broadband plots from 30MHz to 12.5GHz for channel 14



Final Measurements :

Instrument Settings: RB=VB=100kHz (below 1GHz) or RB=VB=1MHz (above 1GHz), Zero Span (Span = 0Hz), sample detector, single

Elliott An NTS company

Test Equipment Used

Client: Summit Data Communications	Job Number:	J78216
Model: 802.11abg MSD30AG	T-Log Number:	T78634
	Account Manager:	Pamela Tucker
Standard: Japanese Radio Law - Item 19 of Article 12	Contact:	Jerry Pohmurski

Manufacturer	Description	Model #	Asset #	Cal Due
Rohde & Schwarz	Power Meter, Dual Channel	NRVD	1071	09-Jun-10
Hewlett Packard	EMC Spectrum Analyzer, 9 KHz - 22 GHz	8593EM	1319	19-Aug-10
Rohde & Schwarz	Attenuator, 20 dB, 10W, DC-18 GHz	20dB, 10W, Type N	1795	03-Jun-10
Rohde & Schwarz	Power Sensor 100 uW - 10 Watts	NRV-Z53	1796	03-Jun-10
Agilent	PSG Vector Signal Generator (250kHz - 20GHz)	E8267C	1877	24-Mar-12
Rohde & Schwarz	Power Sensor, 1 nW-20 mW, 10 MHz-18 GHz, 50ohms	NRV-Z1	2114	10-Nov-10
Agilent	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	06-Jan-11