Cert. No. 1152.01
Electrical (EMC)

DATE: 06 March 2008

I.T.L. (PRODUCT TESTING) LTD.

FCC EMC/Radio Test Report

for

MobileAccess Networks

Equipment under test:

WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points

860M With WCE*

* See customer's declaration on page 7.

Written by: _____
D. Shidlowsky, Documentation

Approved by: _____
E. Pitt, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

Cert. No. 1152.01
Electrical (EMC)

Measurement/Technical Report for

MobileAccess Networks

WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points

860M With WCE

FCC ID: OJFMA860WCO

06 March 2008

This report concerns: Original Grant x Class II change

Class B verification ___ Class A verification_____Class I change

Equipment type: Direct Sequence Spread Spectrum Transmitter
Request Issue of Grant:
__**x**__Immediately upon completion of review

Limits used:
CISPR 22 _____ Part 15 __x__

Measurement procedure used is ANSI C63.4-2003.

Application for Certification
prepared by:
Ishaishou Raz
ITL (Product Testing) Ltd.
Kfar Bin Nun
D.N. Shimshon 99780
Israel
e-mail Sraz@itl.co.il

Applicant for this device:
(different from "prepared by")
Steve Blum
Mobile Access Networks
8391 Old Courthouse Rd., Suite #300
Vienna, VA. 22182
U.S.A.
Tel: +1-541-758-2880
Fax: +1-703-848-0260
e-mail: sblum@mobileaccess.com

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1. General Information

1.1 Administrative Information

Manufacturer:	MobileAccess Networks
Manufacturer's Address:	8391 Old Courthouse Rd. Suite #300 Vienna, VA 22182 U.S.A. Tel: +1-541-758-2880 Fax: +1-703-848-0260
Manufacturer's Representative:	Steve Blum
Equipment Under Test (E.U.T):	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Equipment Model No.:	860M With WCE (See customer's declaration on following page).
Equipment Serial No.:	1. 860M: 73903D 2. WCE: 739038
Date of Receipt of E.U.T:	10.02.08
Start of Test:	10.02.08
End of Test:	06.03.08
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	See Section 2

15/11/2007

DECLARATION

I HEREBY DECLARE THAT THE FOLLOWING PRODUCT:

860M

IS IDENTICAL ELECTRONICALLY, PHYSICALLY, AND MECHANICALLY TO:

MA-860

Please relate to them all (from an EMC point of view) as the same product.

Thank you,

Signature: 

Shai Rachamim
Verification Engineer
MobileAccess Networks
Ofek One Center,Bldg.2
Northern Industrial Zone
Lod, Israel 71293

E-mail: ShaiR@MobileAccess.com
Wired: +972-8-9183804
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1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), File No. IC 4025.
6. TUV Product Services, England, ASLLAS No. 97201.
7. Nemko (Norway), Authorization No. ELA 207.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

The MobileAccess 860 WLAN Solution delivers pervasive WLAN coverage throughout enterprise environments using a unique multi-service wireless architecture. With the MA-860 approach, enterprises can seamlessly translate their WLAN investments and design expertise into a comprehensive, multi-service wireless solution.

The MA-860 combines WLAN services with signals from other wireless sources, including voice and data services from multiple wireless operators, public safety, and building automation applications. It then distributes the combined RF signals over a common set of broadband cables and antennas. One-Click calibration between the MA-860 module and the MobileAccess Wi-Fi Coverage Expander (WCE) ensures optimal coverage by mirroring the coverage footprint and system behavior of "AP-on-Ceiling" deployments for 802.11a and 802.11b/g WLAN services.

This Wire-it-Once™ approach spreads WLAN deployment costs across multiple wireless service needs, providing facility-wide coverage for WLAN and all other wireless services while creating a flexible infrastructure that adapts to evolving technology requirements.

In addition, the MA-860 WLAN solution locates Access Points (APs) in secure telecom closets alongside other LAN internetworking equipment, yielding significant operational benefits:

Provides physical security of the APs

Makes APs more accessible to IT staff

Reduces ongoing operational expenses

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing August 22, 2006).
I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

Radiated Emission

The Open Site complies with the ±4 dB Normalized Site Attenuation requirements of ANSI C63.4-2003. In accordance with Paragraph 5.4.6.1 of this standard, this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.

2. System Test Configuration

2.1 Justification

The EUT consists of the 860M, WCE and 4 identical access points. The system combines 802.11 signals with the cellular signals. The cellular signal are represented in the setup by the CELL and PCS portion of the setup, which were connected to the EUT through MobileAccess standard infrastructure (i.e. RIU, BU, RHU and a controller) to represent a normal installation of the EUT.

An “Exercise” SW on the laptops was used to trigger the access points to transmit continuously, while the EUT output was connected to the spectrum analyzer.

2.2 EUT Exercise Software

The Access Points (APs) (as part of the EUT) were triggered to transmit using an “Exercise SW”.

The program “Air Magnet” was used to trigger the AP to continuously transmit packets.

2.3 Special Accessories

No special accessories were needed to achieve compliance.

2.4 Equipment Modifications

No modifications were necessary in order o achieve compliance.

2.5 Configuration of Tested System

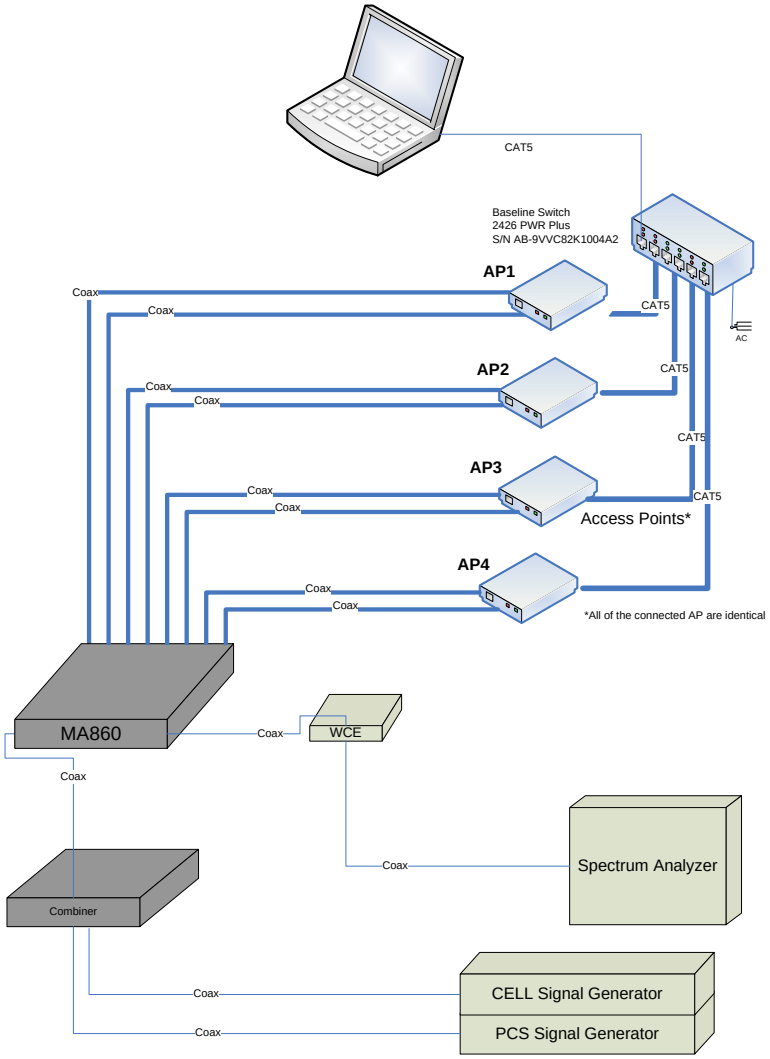


Figure 1. Configuration of Tested System

Note: The system was tested using four identical Colubris Access Points M/N MAP-330, S/N: 8060-00624, S/N: 8060-00522, S/N: 8060-00201, S/N: 8060-0065, FCC ID: RTP-550-10016-5.

3. Theory of Operation

3.1 Theory of Operation

mobileaccess

Making Wireless an Indoor State of Mind

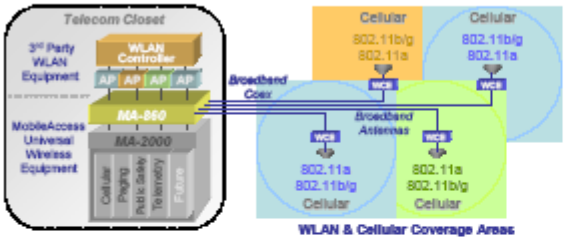
MA-860 WLAN Solution

MA-860 Solution Overview

The MobileAccess 860 WLAN Solution delivers pervasive WLAN coverage throughout enterprise environments using a unique multi-service wireless architecture. With the MA-860 approach, enterprises can seamlessly translate their WLAN investments and design expertise into a comprehensive, multi-service wireless solution.

The MA-860 combines WLAN services with signals from other wireless sources, including voice and data services from multiple wireless operators, public safety, and building automation applications. It then distributes the combined RF signals over a common set of broadband cables and antennas. One-Click calibration between the MA-860 module and the MobileAccess Wi-Fi Coverage Expander (WCE) ensures optimal coverage by mirroring the coverage footprint and system behavior of "AP-on-Ceiling" deployments for 802.11a and 802.11b/g WLAN services.

This Wire-it-Once™ approach spreads WLAN deployment costs across multiple wireless service needs, providing facility-wide coverage for WLAN and all other wireless services while creating a flexible infrastructure that adapts to evolving technology requirements.



WLAN & Cellular Coverage Areas

In addition, the MA-860 WLAN solution locates Access Points (APs) in secure telecom closets alongside other LAN internetworking equipment, yielding significant operational benefits:

- Provides physical security of the APs
- Makes APs more accessible to IT staff
- Reduces ongoing operational expenses

MobileAccess 860 WLAN Module

Benefits

Cost-Effective Multi-Service Solution
- Delivers WLAN and other wireless RF signals over a single multi-service infrastructure
- Spreads WLAN deployment costs across multiple wireless services

Dependable WLAN Coverage
- MobileAccess WLAN architecture mirrors the behaviors and coverage footprint of "AP-on-Ceiling" deployment
- One-Click compensation ensures optimal 802.11b/g and 802.11a coverage
- Dedicated AP to antenna relationships ensure transparent support for WLAN applications such as VOIP and location services (RTLS)
- Redundant power option

Centralized & Secure AP Management
- Lowers operating expenses
- Provides physical security and simplifies management

Proactive End-to-End Monitoring
- Remote SNMP monitoring for status, alerting, and fault detection
- Monitoring extends to attached multi-service antennas

Simplified IT Deployment Model
- Uses standard WLAN design techniques

CISCO PARTNER Technology Developer

8391 Old Courthouse Road, Suite 300, Vienna, VA 22182
Tel: (866)436-9266, (703) 848-0200 TAC:(800) 787-1266 Fax:(703) 848-0280
www.mobileaccess.com

MA-860 Product Specifications

802.11 RF Parameters

860(M/R) with Wi-Fi Coverage Expander (WCE):

	802.11a	802.11b/g
Gain TX (dB)	0	0
Output Power (dBm)	17	b: 20 g: 17
Gain RX (dB)	4	4
NF RX (dB)	5	5
Flatness (dB)	+/- 2.0	+/- 1.5

860(M/R) Module Standalone:

	802.11a	802.11b/g
Insertion Loss (dB)	3	2
Flatness (dB)	+/- 1.0	+/- 1.0

Mobile Services Parameters

	Cell			PCS
Band (MHz)	698-960			1710-1990
Insertion Loss (dB)				
MA-860	1.0			2.5
WCE	1.2			3.5
System	2.2			6.0

RF Connections

860(M/R)

802.11 b/g	(4) SMA Female, 50 ohm
802.11 a	(4) SMA Female, 50 ohm
Mobile Services	(4) SMA Female, 50 ohm
Antenna Ports	(4) N-type Female, 50 ohm

WCE

Coax (860 facing)	(1) N-type Male
Coax (Ant facing)	(1) N-type Female

Standards and Approvals

FCC–47, CFR 15.109, Part 15 Sections B, C, and E
UL / IEC 60950 -1
UL1950 Fire Safety requirements
UL2043 Fire/Plenum (WCE)
CE EN 60950
CAN/CSA C22.2 No 60950

Management

The 860(M/R) can be configured and monitored through either a local RS-485 connection or a Web browser application via an RJ-45 Ethernet connection

Power

Power	2 DC Power Inputs DC-1 = 28V Mandatory DC Power, 66 Watts DC-2= 9.8V Optional Redundant Power, 40 Watts

Physical Specifications

Dimensions	860(M/R):	242 mm x 279 mm x 38 mm (9.54 in x 10.98 in x 1.5 in)
	WCE:	130 mm x 120 mm x 20 mm (5.12 in x 4.73in x 0.8 in)
Weight	860(M/R):	2.82 kg (6.2 lb)
	WCE:	0.80 kg (1.8 lb)

Environmental Specifications

Temperature	
Operating	0°C to +50°C (32°F to 122°F)
Storage	-20°C to +85°C (-4°C to 185°C)
Humidity	
Operating	95% (non-condensing)
Storage	95% (non-condensing)

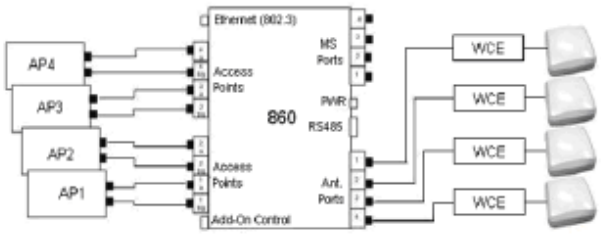
Ordering Information

860M	860 WLAN Module
860R	860 WLAN Module - Redundant Power Supply Option
WCE	Wi-Fi Coverage Expander

Accessory Kits for mounting 860(M/R):

AK-860-1000	860 with MA-1000
AK-860-1200	860 with MA-1200
AK-860-MDLT	860 with ModuLite
AK-860-2000	860 with MA-2000
AK-860-SA	860 stand alone
AK-860-2000L	860 with MA-2000 Lite
AK-860-PWR	Redundant Power Supply

Wiring Diagram



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www.mobileaccess.com

4. Spurious Radiated Emission in the Restricted Band, Below 1 GHz 2.4GHz Transmitter 802.11b/g+802.11a Signals

4.1 Test Specification

9kHz-1000 MHz, F.C.C., Part 15, Subpart C

4.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The frequency range 9 kHz-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30 MHz, the loop antenna was rotated on its vertical axis, The antenna height (center of loop) was 1 meter.

In the frequency range 30-1000 MHz, the readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods:

Turning the E.U.T on and off.
Using a frequency span less than 10 MHz.
Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

The E.U.T. was tested at the operating frequencies of 2412, 2437, and 2462 MHz using the following modulations: DBPSK, BPSK, CCK, and 64QAM.

4.3 Test Data

JUDGEMENT: Passed

No signals were found in the frequency band 9 kHz-1000 MHz.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification.

The results for all three operating frequencies and modulations were the same.

TEST PERSONNEL:

Tester Signature: _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

4.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	November 12, 2007	1 year
RF Section	HP	85420E	3427A00103	November 12, 2007	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	March 22, 2007	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 22, 2007	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 15, 2007	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

4.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[dB\mu v/m]\ FS = RA + AF + CF$$

FS: Field Strength [dBμv/m]
RA: Receiver Amplitude [dBμv]
AF: Receiving Antenna Correction Factor [dB/m]
CF: Cable Attenuation Factor [dB]

No external pre-amplifiers are used.

5. Spurious Radiated Emission in the Restricted Band, Above 1 GHz 2.4GHz Transmitter 802.11 b/g + 802.11a Signals

5.1 Radiated Emission Above 1 GHz

The E.U.T operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.
In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used.
In the frequency range 2.9-25.0 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.
The test distance was 3 meters.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The E.U.T. was tested at the operating frequencies of 2412, 2437, and 2462 MHz using the following modulations: DBPSK, BPSK, CCK, and 64QAM.

5.2 Test Data

JUDGEMENT: Passed by 12.9

For the operation frequency of 2412 MHz, the margin between the emission level and the specification limit is 21.9in the worst case at the frequency of 4824.00 MHz, horizontal polarization.

For the operation frequency of 2437 MHz, the margin between the emission level and the specification limit is 22.0 dB in the worst case at the frequency of 4874.00 MHz, horizontal polarization.

For the operation frequency of 2462 MHz, the margin between the emission level and the specification limit is 12.9 dB in the worst case at the frequency of 4924.00 MHz, horizontal polarization.

The results for all modulations were the same.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification.

TEST PERSONNEL:

Tester Signature: _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

Radiated Emission Above 1 GHz

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Peak
Operation Frequency: 2412 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
4824.00	H	43.6*	74.0	-30.4
4824.00	V	42.4*	74.0	-31.6

Figure 2. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Average
Operation Frequency: 2412 MHz

Freq.	Polarity	Average Amp	Average Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
4824.00	H	32.1*	54.0	-21.9
4824.00	V	31.8*	54.0	-22.2

Figure 3. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Amp" includes correction factor.

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Radiated Emission Above 1 GHz

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
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Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Peak
Operation Frequency: 2437 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
4874.00	H	42.7*	74.0	-31.3
4874.00	V	42.0*	74.0	-32.0

Figure 4. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

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Radiated Emission Above 1 GHz

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
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Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Average
Operation Frequency: 2437 MHz

Freq.	Polarity	Average Amp	Average Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
4874.00	H	32.0*	54.0	-22.0
4874.00	V	31.5*	54.0	-22.5

Figure 5. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Amp" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Peak
Operation Frequency: 2462 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
2483.50	H	53.2**	74.0	-20.8
2483.50	V	53.1**	74.0	-20.9
4924.00	H	41.6*	74.0	-32.4
4924.00	V	41.3*	74.0	-32.7

Figure 6. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

**"Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Average
Operation Frequency: 2462 MHz

Freq.	Polarity	Average Amp	Average Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
2483.50	H	41.1**	54.0	-12.9
2483.50	V	40.7**	54.0	-13.3
4924.00	H	31.7*	54.0	-22.3
4924.00	V	31.4*	54.0	-22.6

Figure 7. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Amp" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

**"Correction Factor" = Antenna Factor + Cable Loss

5.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3411A00102	November 12, 2007	1 year
RF Section	HP	85420E	3427A00103	November 12, 2007	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	February 4, 2007	2 years
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 15, 2006	2 years
Horn Antenna	ARA	SWH-28	1008	December 8, 2006	2 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 2, 2007	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	February 8, 2007	1 year
Low Noise Amplifier	MK Milliwave	MKT6-3000 400-30-13P	399	February 8, 2007	1 year
Spectrum Analyzer	HP	8593EM	3536A00120	February 26, 2008	1 year
Spectrum Analyzer	HP	8546E	3442A00275	November 14, 2007	1 year
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

6. 26 dB Bandwidth 2.4 GHz Transmitter 802.11 b/g + 802.11a Signals

6.1 Test procedure

The E.U.T. was set to the applicable test frequency. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20 dB) and appropriate coaxial cable (cable loss = 1 dB). The spectrum analyzer was set to 100 kHz resolution BW. The spectrum bandwidth of the E.U.T. was measured and recorded.

The E.U.T. was tested at 2412, 2437, and 2462 MHz with the following modulations: DBPSK (1Mbit/sec), BPSK (6Mbit/sec), CCK (11Mbit/sec) and 64QAM (54Mbit/sec).

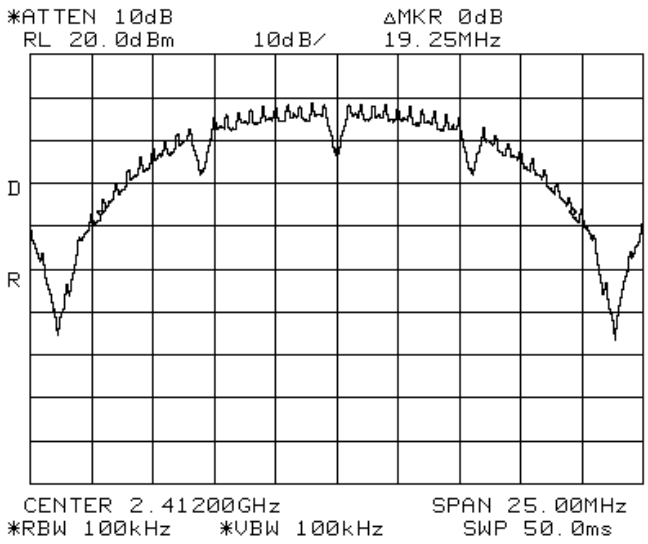

Figure 8 —2412 MHz DBPSK

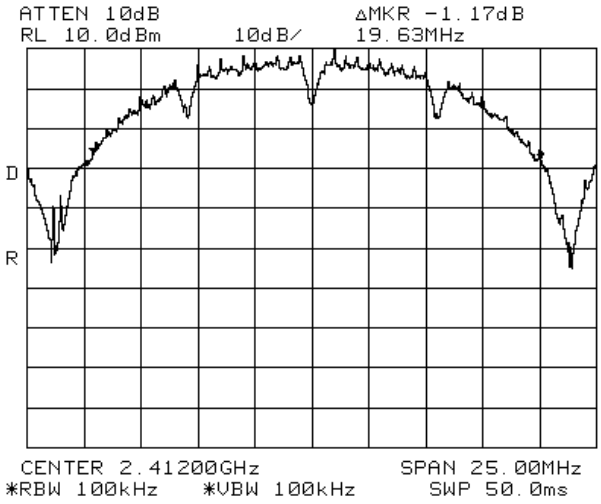

Figure 9 —2412 MHZ BPSK

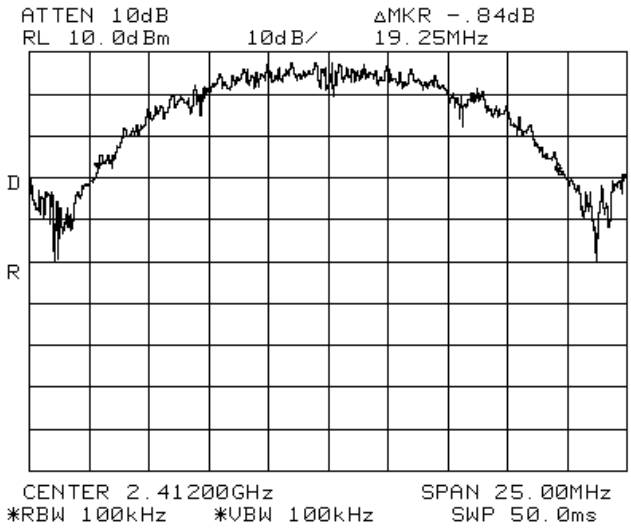

Figure 10 —2412 MHz CCK

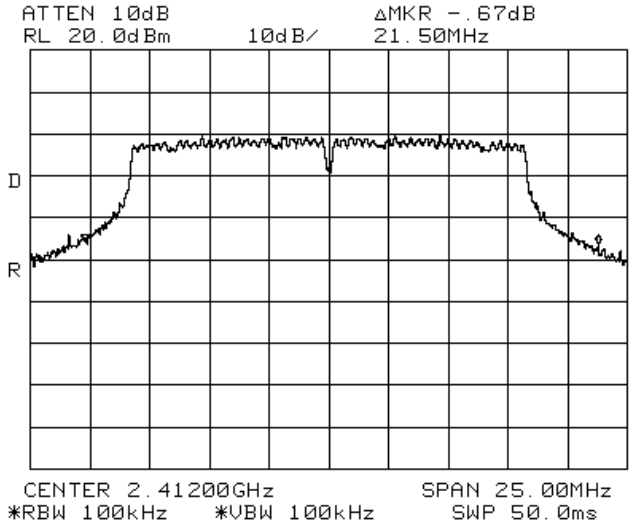

Figure 11 —2412 MHZ 64QAM

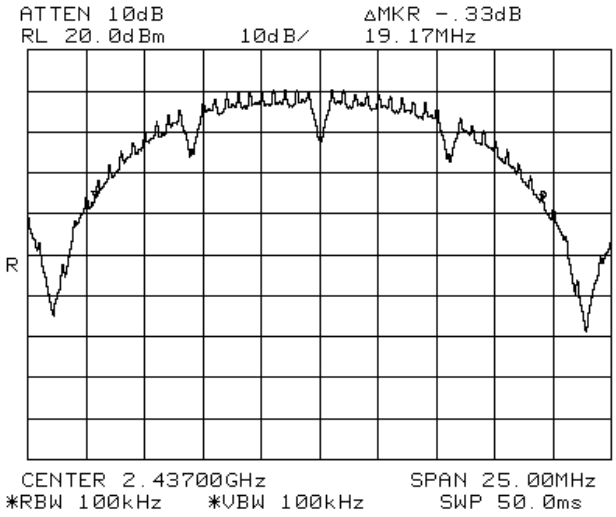

Figure 12 —2437 MHz DBPSK

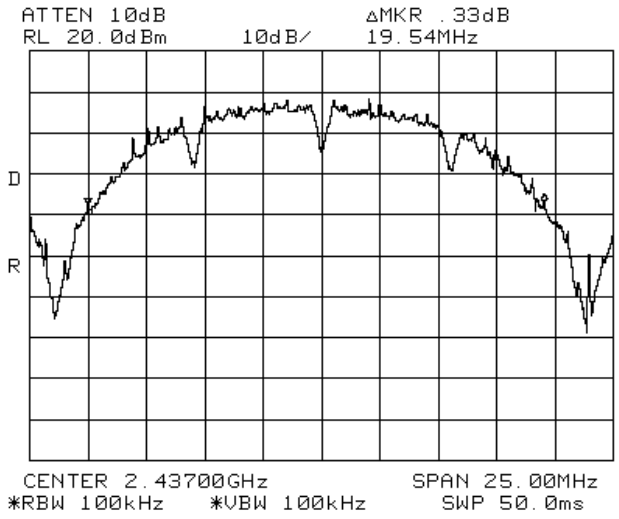

Figure 13 —2437 MHZ BPSK

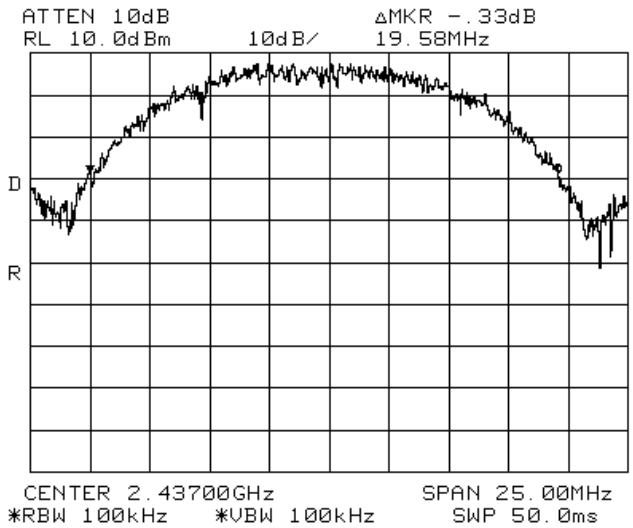

Figure 14 —2437 MHz CCK

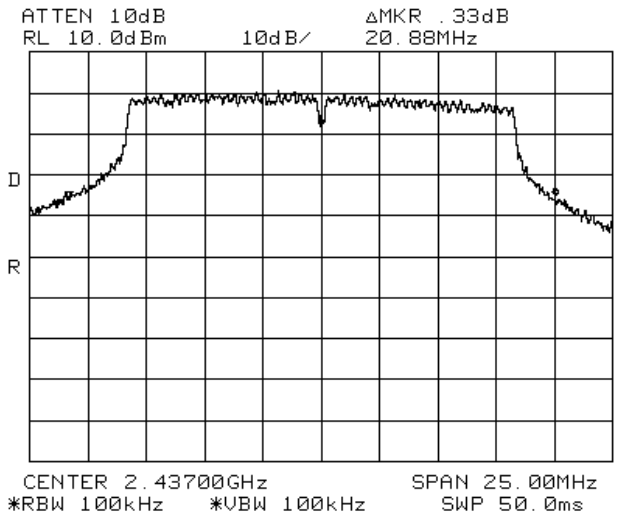

Figure 15 —2437 MHZ 64QAM

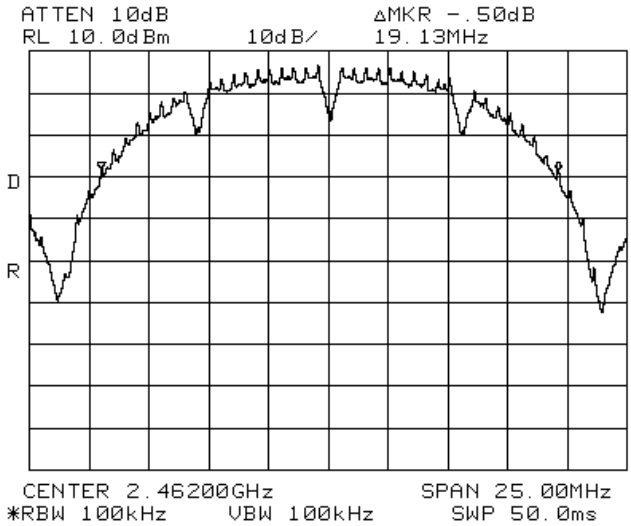

Figure 16 —2462 MHz DBPSK

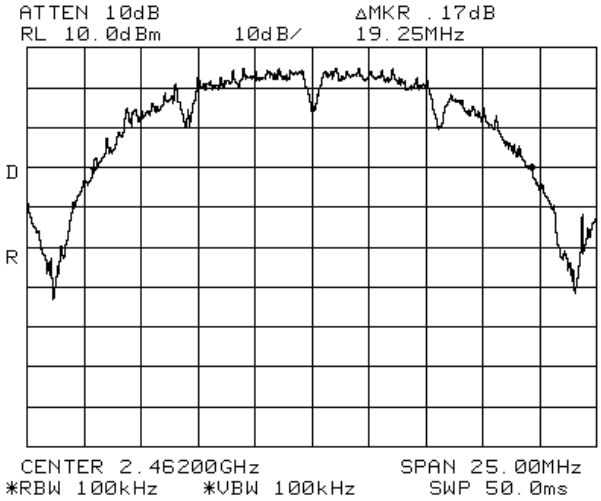

Figure 17 —2462 MHZ BPSK

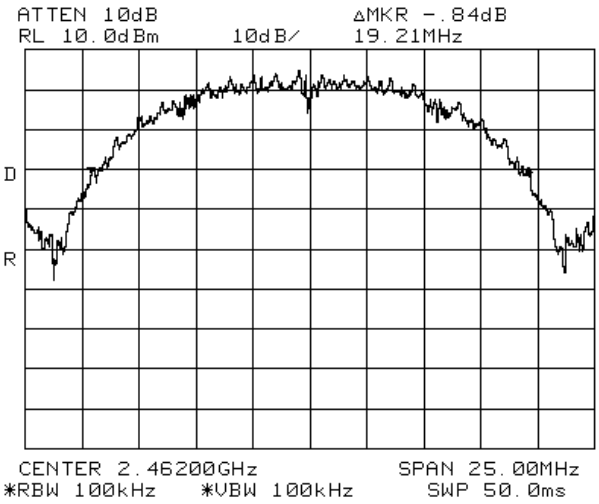

Figure 18 —2462 MHz CCK

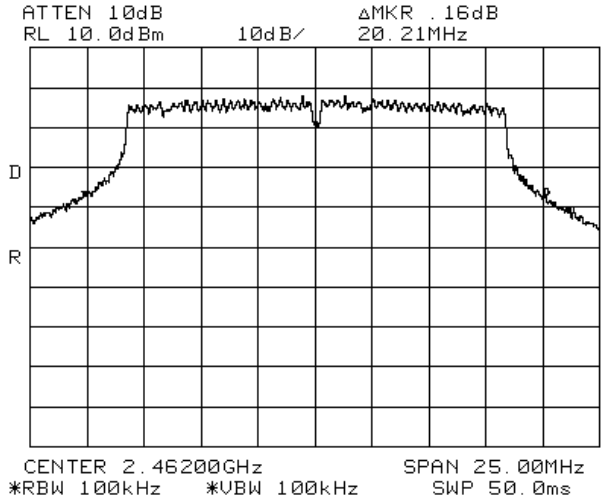

Figure 19 —2462 MHZ 64QAM

Operation Frequency (MHz)	Modulation	26 dB Bandwidth (dBm)
2412	DBPSK	19.25
	BPSK	19.63
	CCK	19.25
	64QAM	21.50
2437	DBPSK	19.17
	BPSK	19.54
	CCK	19.58
	64QAM	20.88
2462	DBPSK	19.13
	BPSK	19.25
	CCK	19.21
	64QAM	20.21

TEST PERSONNEL:

Tester Signature: _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

6.2 Test Equipment Used.

26 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	May 9, 2007	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

Figure 20 Test Equipment Used

7. Maximum Transmitted Peak Power Output 2.4 GHz Transmitter 802.11 b/g + 802.11a Signals

7.1 Test procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator (20 dB) and an appropriate coaxial cable (cable loss = 1 dB). The Spectrum Analyzer was set to 1.0 MHz resolution BW. Peak power level was measured at selected operation frequencies.

The E.U.T. was tested at 2412, 2437, and 2462 MHz with the following modulations: DBPSK (1Mbit/sec), BPSK (6Mbit/sec), CCK (11Mbit/sec) and 64QAM (54Mbit/sec).

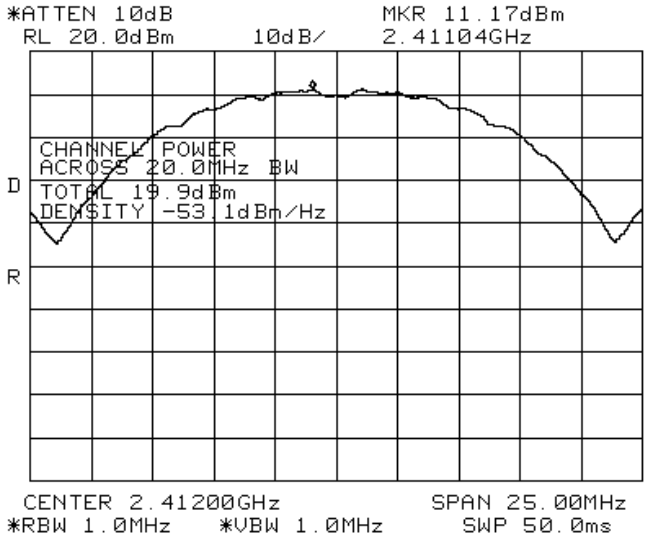

Figure 21 2412 DBPSK

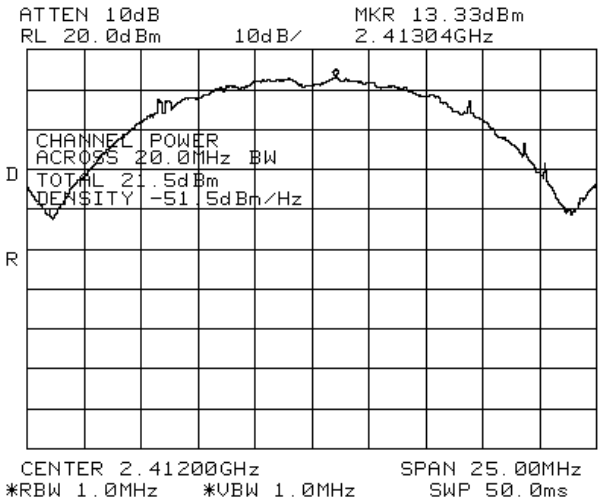

Figure 22 2412 MHz BPSK

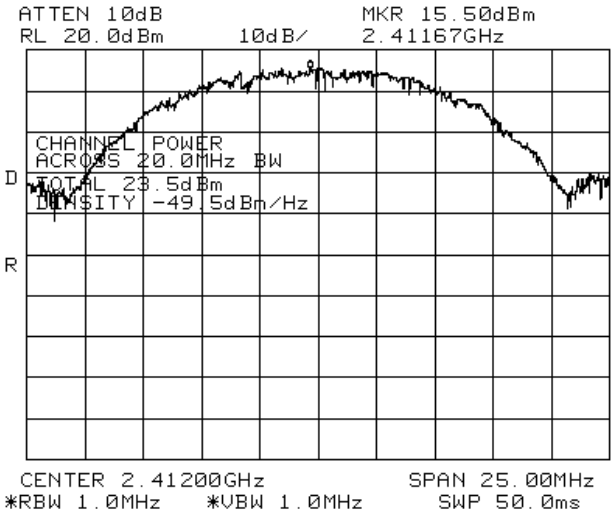

Figure 23 2412 MHz CCK

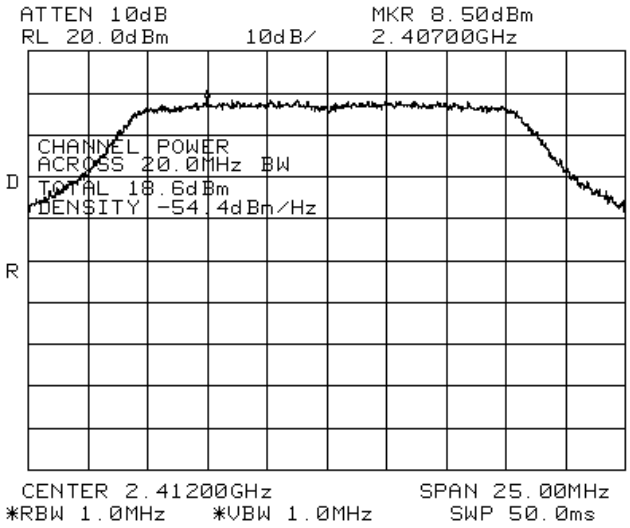

Figure 24 2412 MHz 64QAM

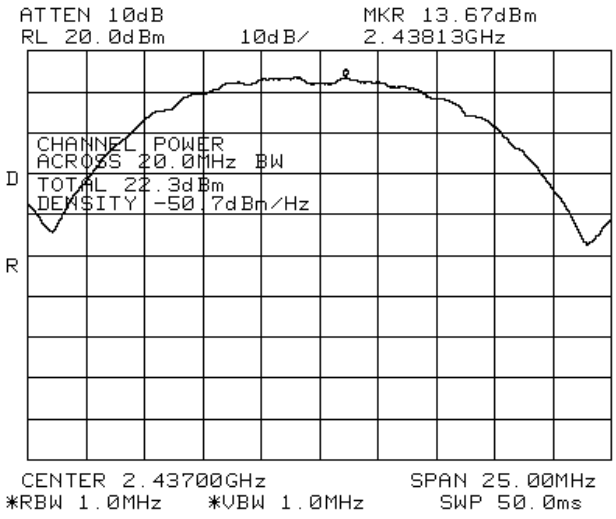

Figure 25 2437 MHz DBPSK

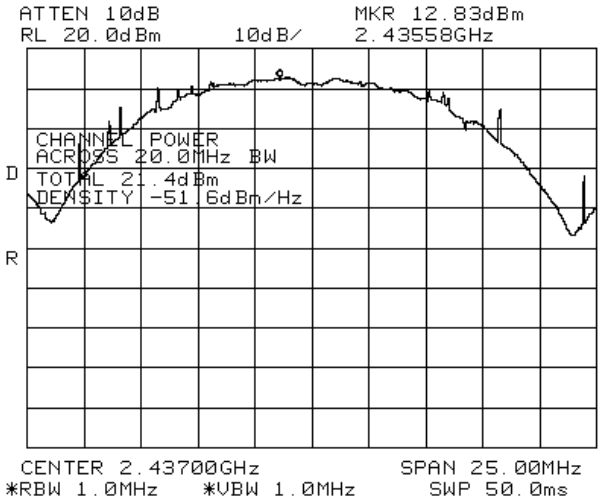

Figure 26 2437 MHz BPSK

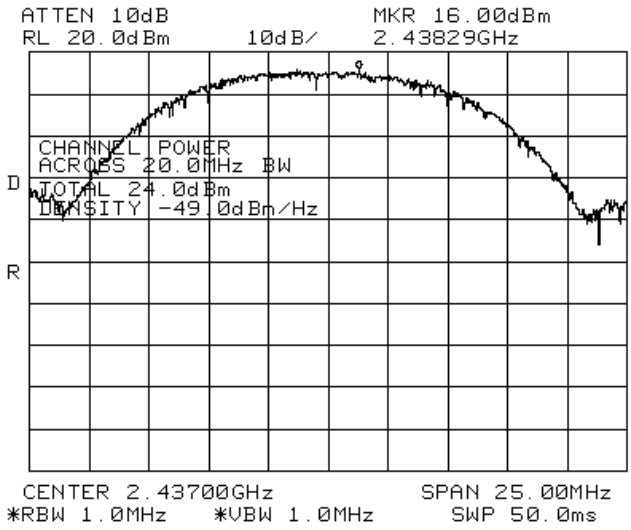

Figure 27 2437 MHz CCK

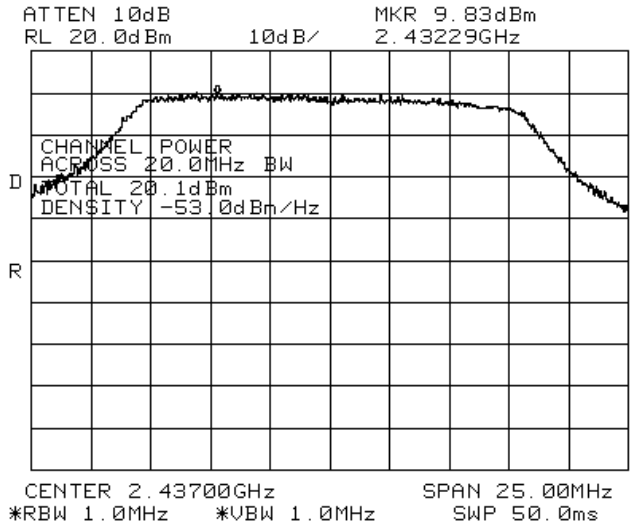

Figure 28 2437 MHz 64QAM

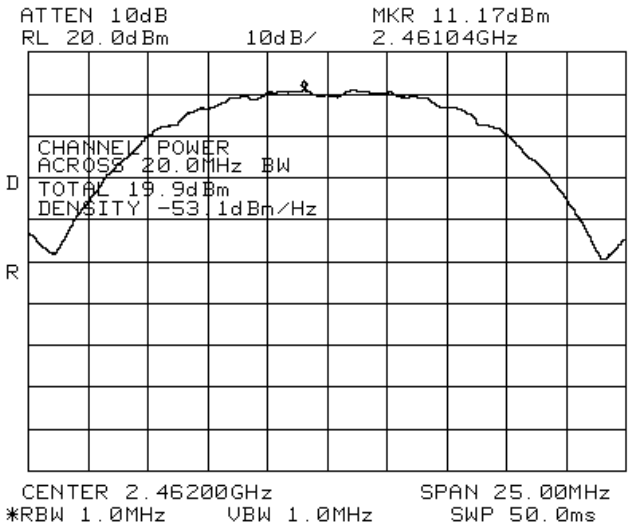

Figure 29 2462 MHz DBPSK

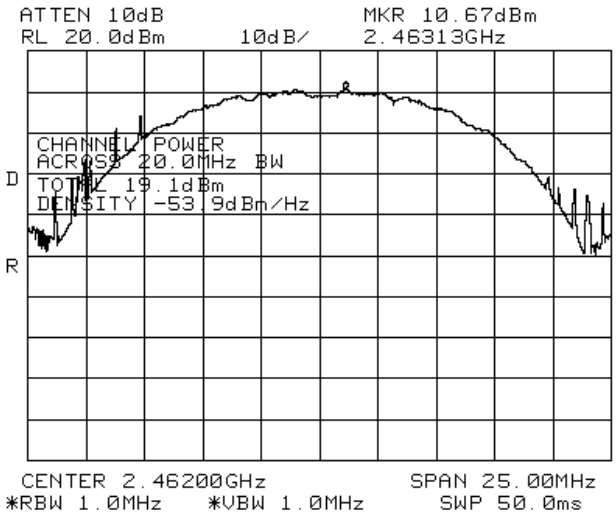

Figure 30 2462 MHz BPSK

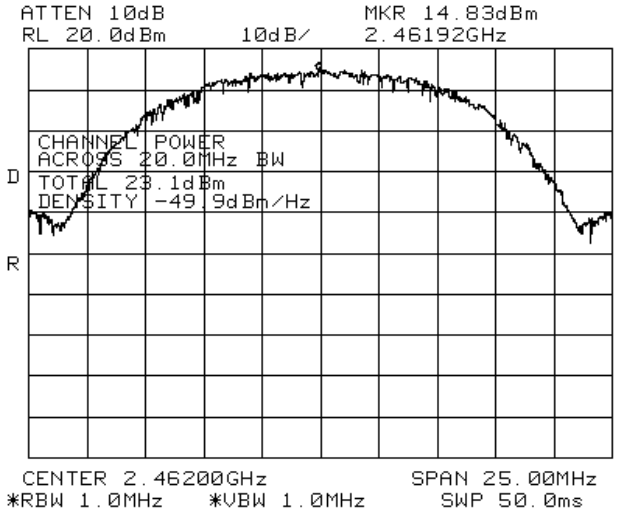

Figure 31 2462 MHz CCK

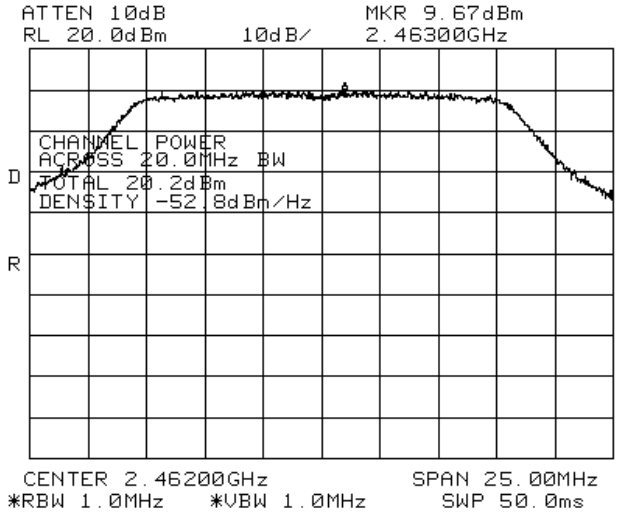

Figure 32 2462 MHz 64QAM

7.2 Results table

E.U.T. Description: WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Model No.: 860M With WCE
Serial Number: 1. 860M: 73903D 2. WCE: 739038
Specification: F.C.C. Part 15, Subpart C

Operation Frequency (MHz)	Modulation	Power (dBm)	Specification (dBm)	Margin (dB)
2412	DBPSK	19.9	29.0	-9.1
	BPSK	21.5	29.0	-7.5
	CCK	23.5	29.0	-5.5
	64QAM	18.6	29.0	-10.4
2437	DBPSK	22.3	29.0	-6.7
	BPSK	21.4	29.0	-7.8
	CCK	24.0	29.0	-5.0
	64QAM	20.1	29.0	-8.9
2462	DBPSK	19.9	29.0	-9.1
	BPSK	19.1	29.0	-9.9
	CCK	23.1	29.0	-5.9
	64QAM	20.2	29.0	-6.8

Figure 33 Maximum Peak Power Output

Note: Antenna Gain is 7 dBi

JUDGEMENT: Passed by 5.0 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

7.3 Test Equipment Used.

Peak Power Output

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	May 9, 2007	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

Figure 34 Test Equipment Used

8. Peak Power Output Out of 2400-2483.5 MHz Band 2.4 GHz Transmitter 802.11 b/g +a Signals

8.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20 dB) and an appropriate coaxial cable (cable loss = 1 dB). The spectrum analyzer was set to 100 kHz resolution BW except for the frequency range
9 kHz-150 kHz where the RBW was set to 1kHz and the frequency range
150 kHz-10 MHz where the RBW was set to 10kHz. The frequency range from 9 kHz to 25 GHz was scanned. Level of spectrum components out of the 2400-2483.5 MHz was measured at the selected operation frequencies.

The E.U.T. was tested at 2412, 2437, and 2462 MHz with the following modulations: DBPSK (1Mbit/sec), BPSK (6Mbit/sec), CCK (11Mbit/sec) and 64QAM (54Mbit/sec).

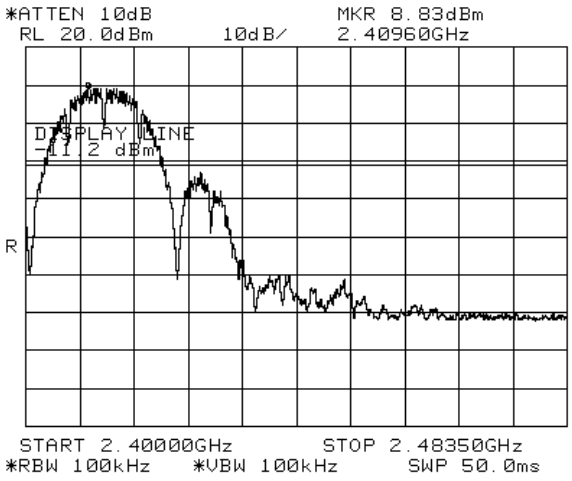

Figure 35 —2412 MHz DBPSK

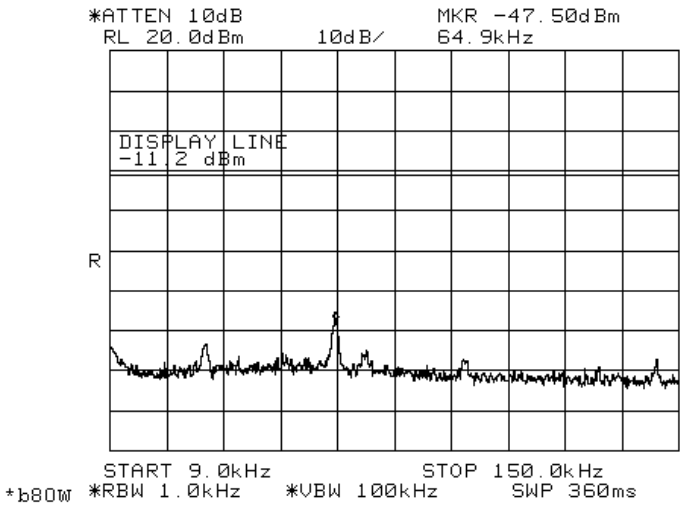

Figure 36 —2412 MHz DBPSK

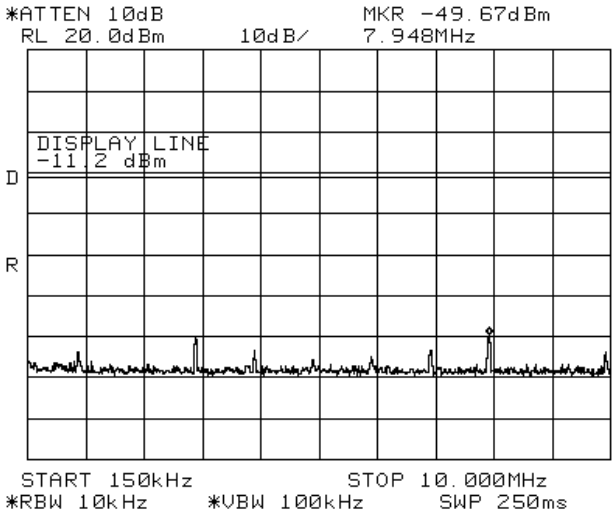

Figure 37 —2412 MHz DBPSK

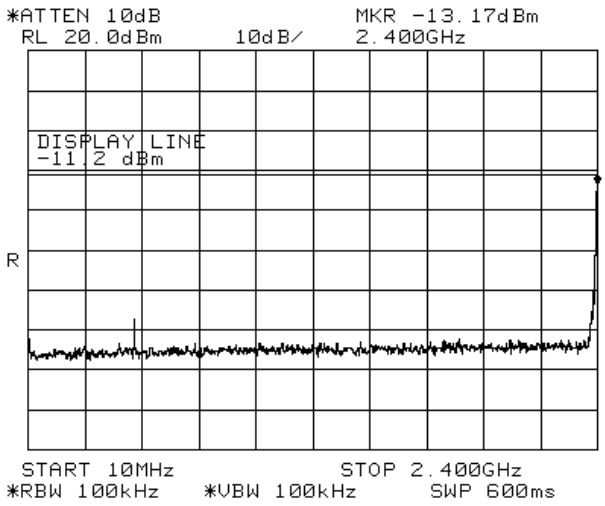

Figure 38 —2412 MHz DBPSK

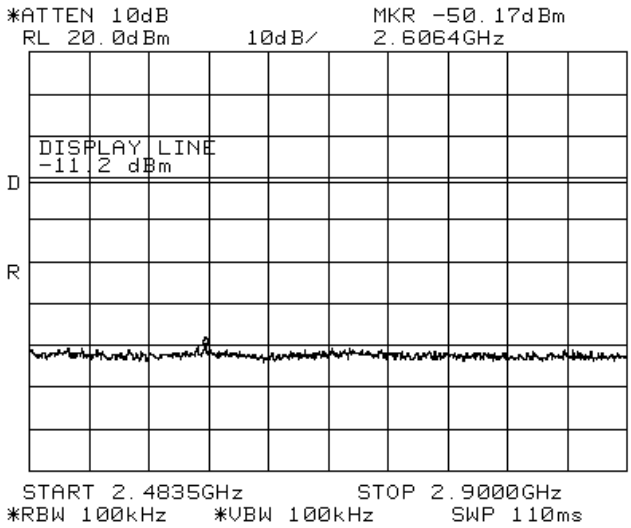

Figure 39 —2412 MHz DBPSK

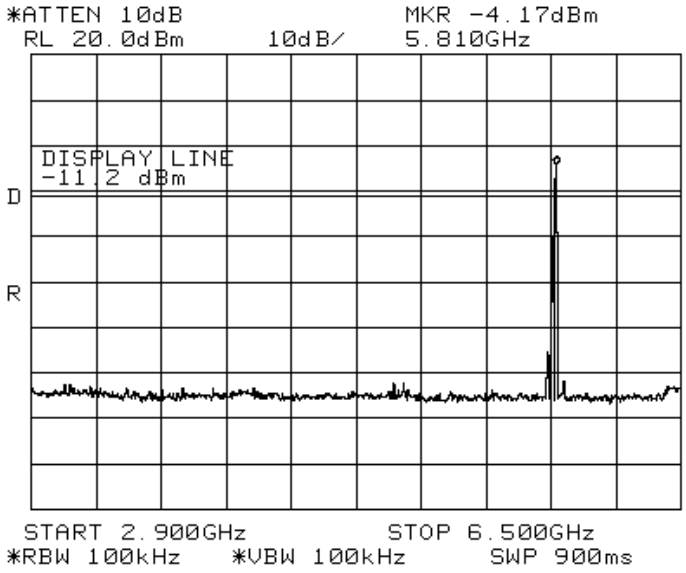

Figure 40 —2412 MHz DBPSK

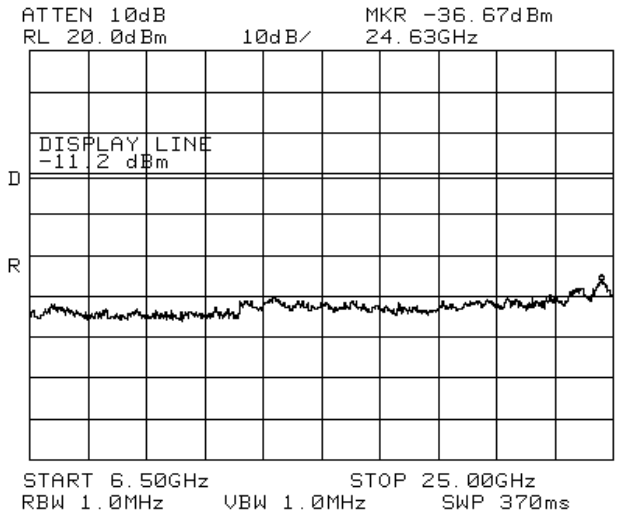

Figure 41 —2412 MHz DBPSK

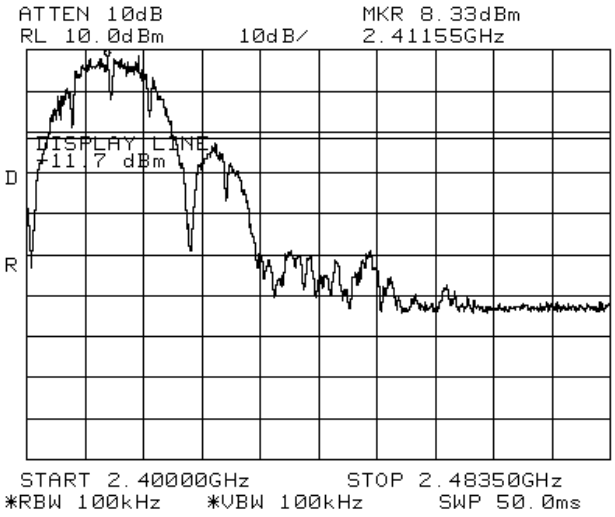

Figure 42 —2412 MHz BPSK

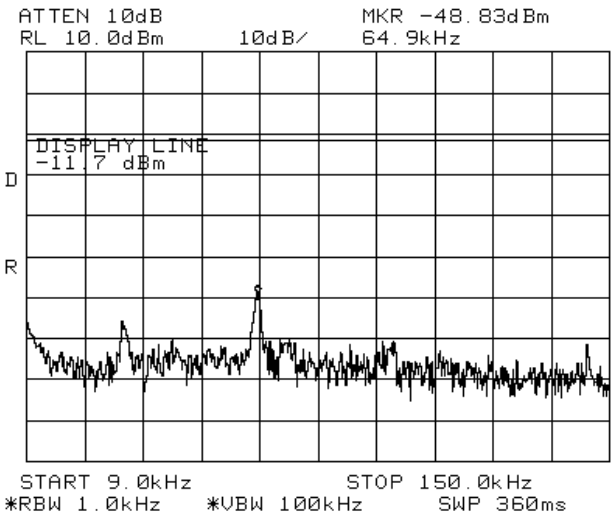

Figure 43 —2412 MHz BPSK

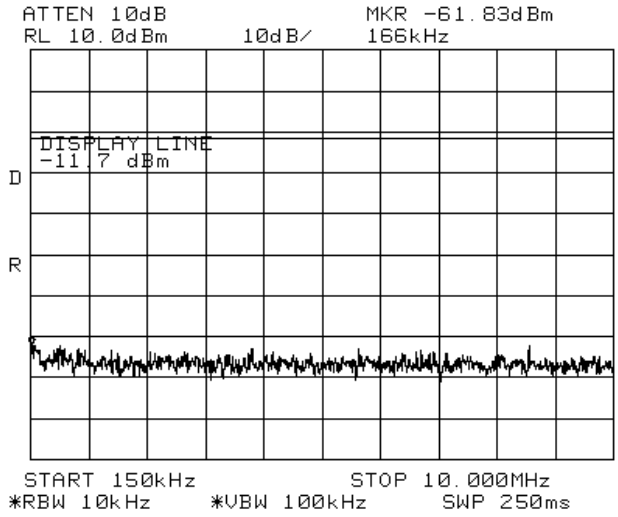

Figure 44 —2412 MHz BPSK

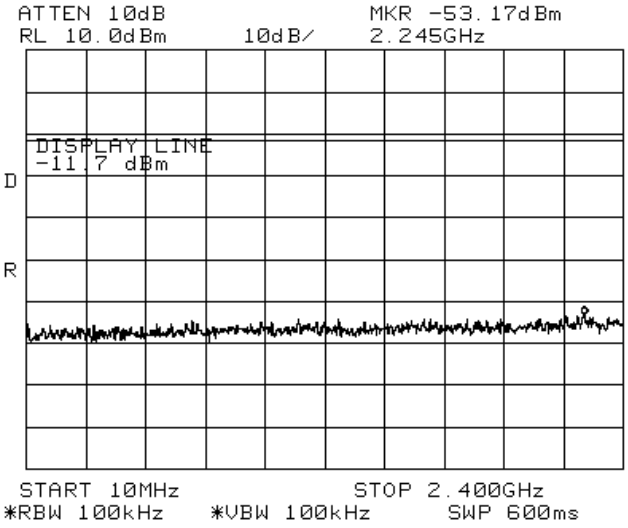

Figure 45 —2412 MHz BPSK

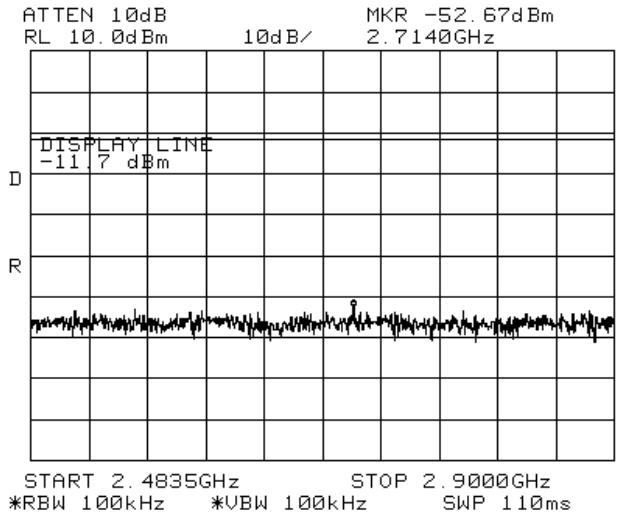

Figure 46 —2412 MHz BPSK

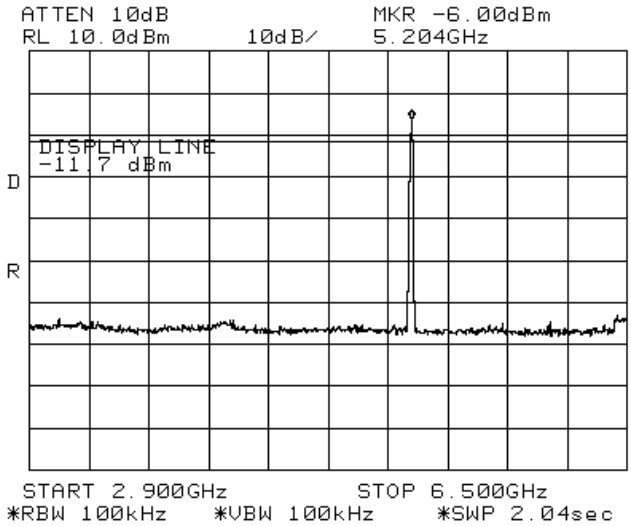

Figure 47 —2412 MHz BPSK

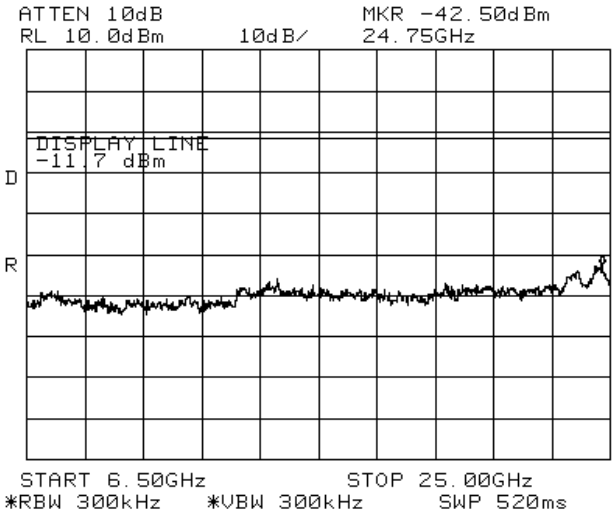

Figure 48 —2412 MHz BPSK

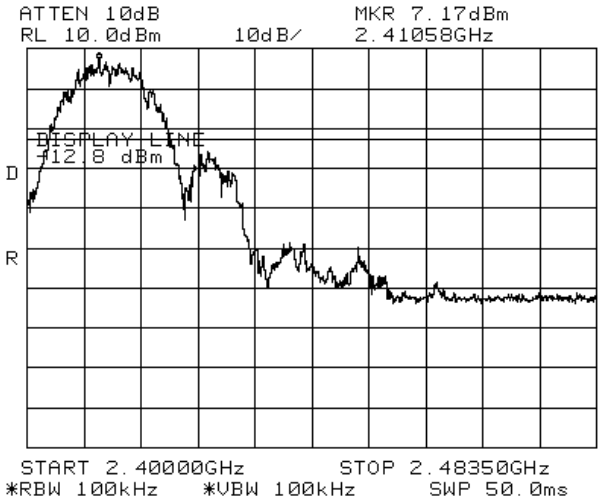

Figure 49 —2412 MHz CCK

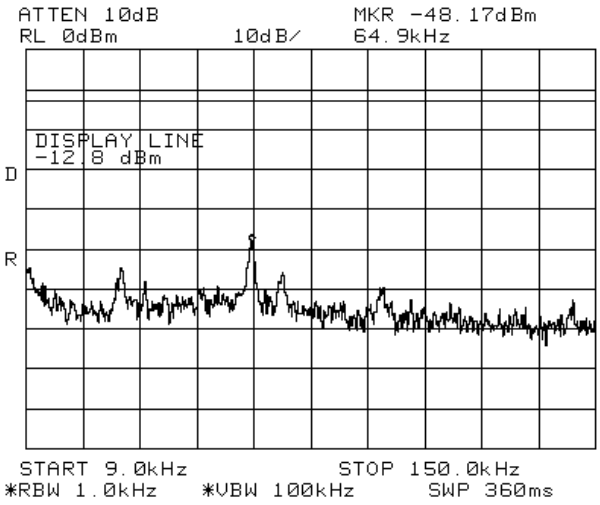

Figure 50 —2412 MHz CCK

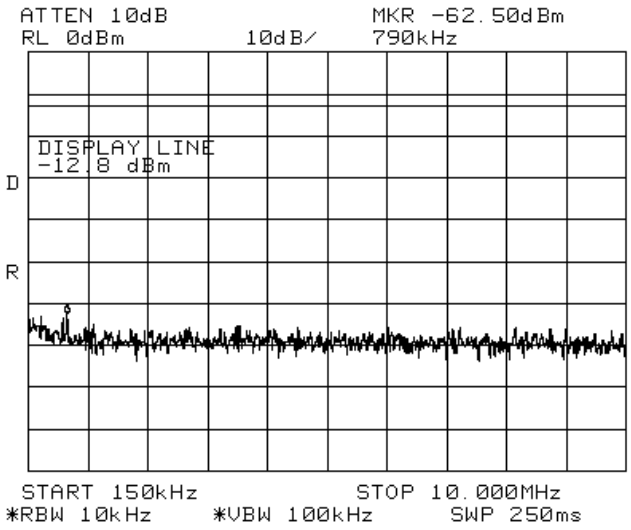

Figure 51 —2412 MHz CCK

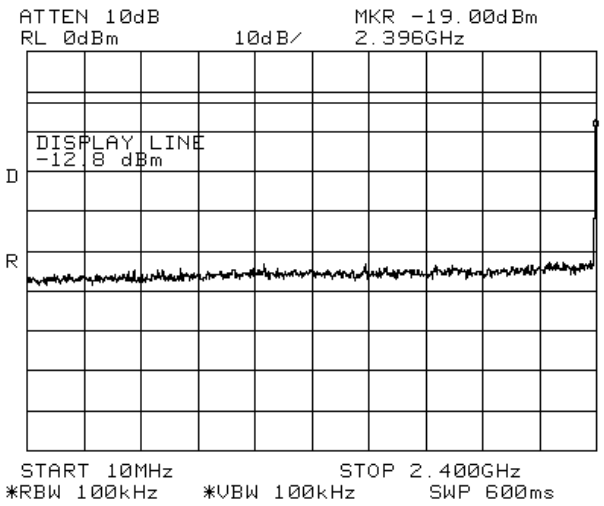

Figure 52 —2412 MHz CCK

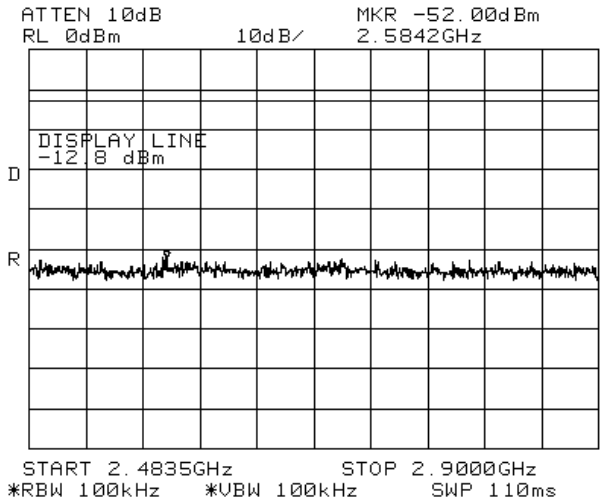

Figure 53 —2412 MHz CCK

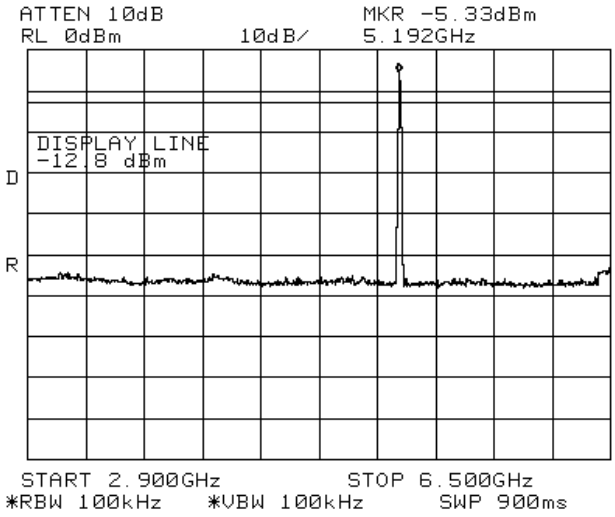

Figure 54 —2412 MHz CCK

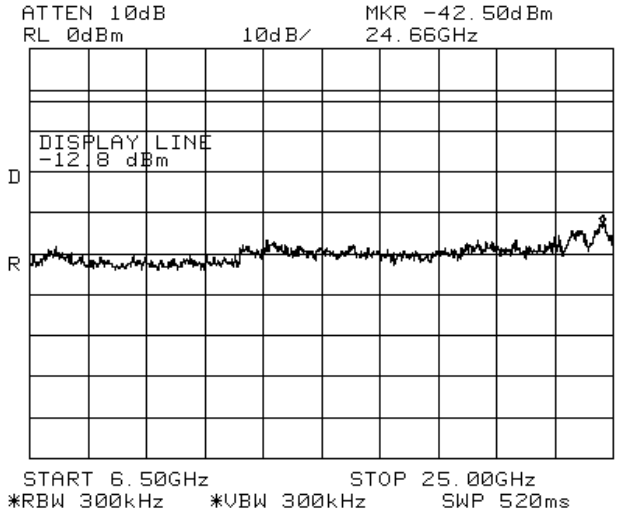

Figure 55 —2412 MHz CCK

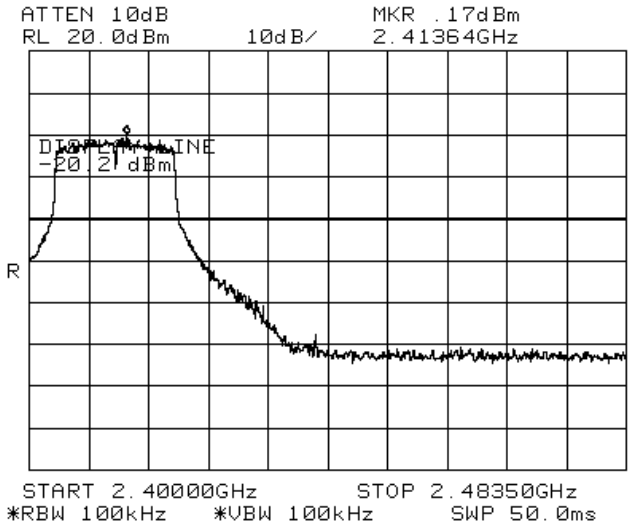

Figure 56 —2412 MHz 64QAM

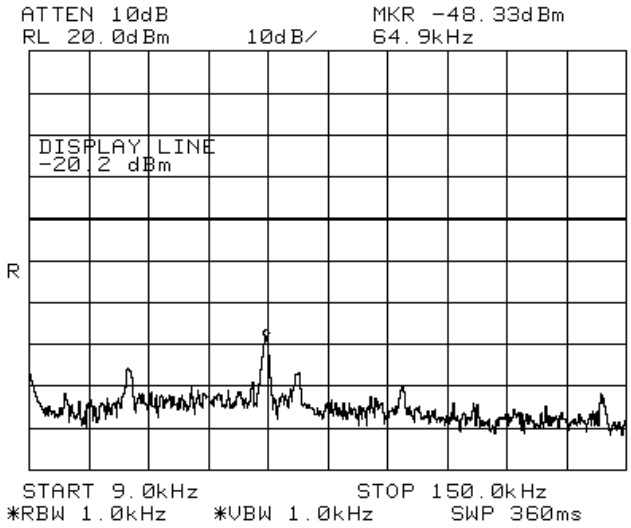

Figure 57 —2412 MHz 64QAM

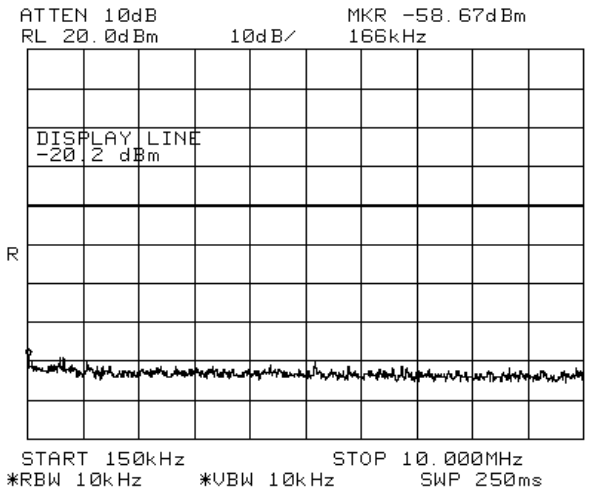

Figure 58 —2412 MHz 64QAM

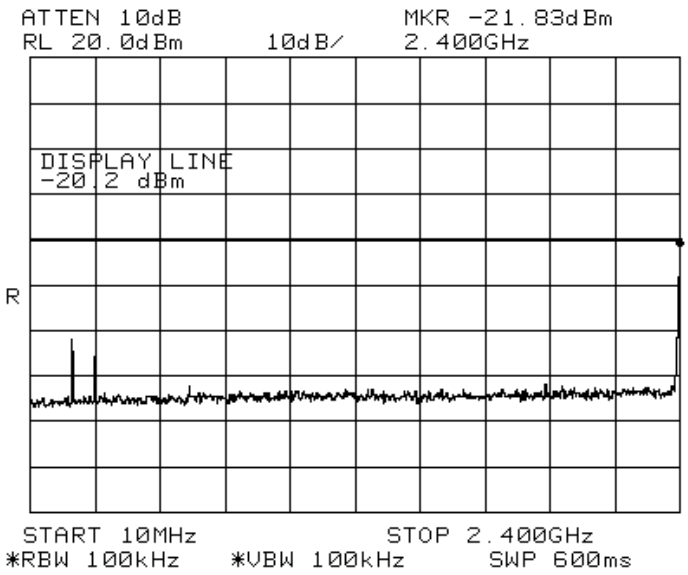

Figure 59 —2412 MHz 64QAM

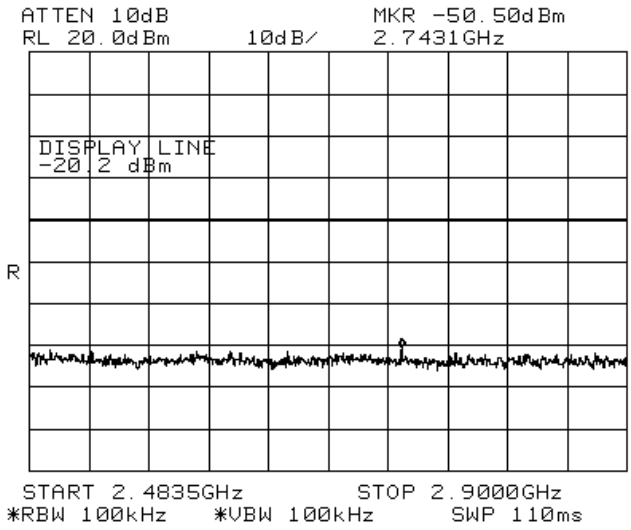

Figure 60 —2412 MHz 64QAM

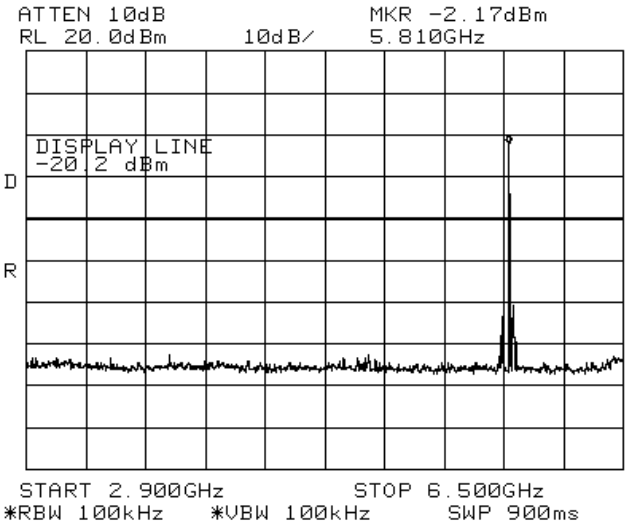

Figure 61 —2412 MHz 64QAM

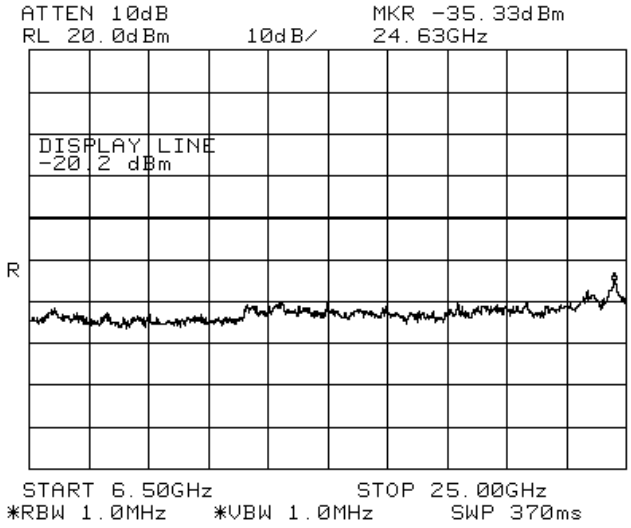

Figure 62 —2412 MHz 64QAM

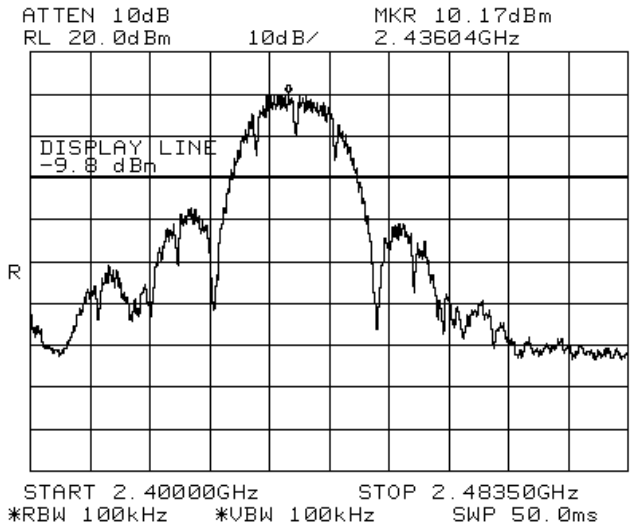

Figure 63 —2437 MHz DBPSK

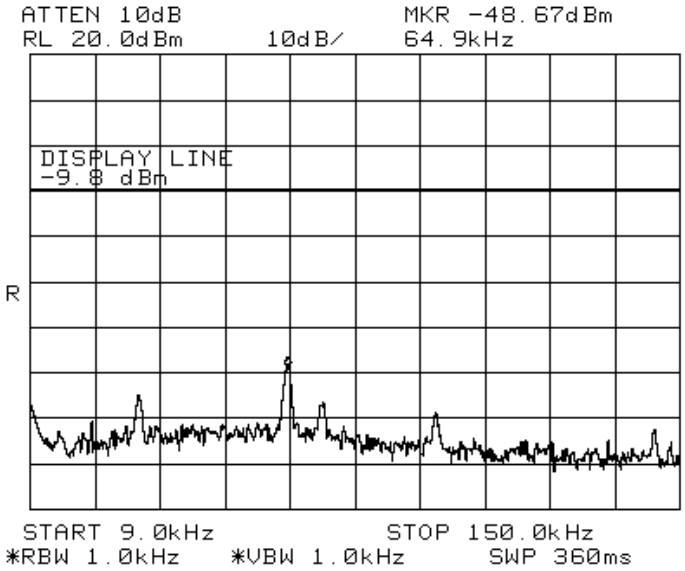

Figure 64 —2437 MHz DBPSK

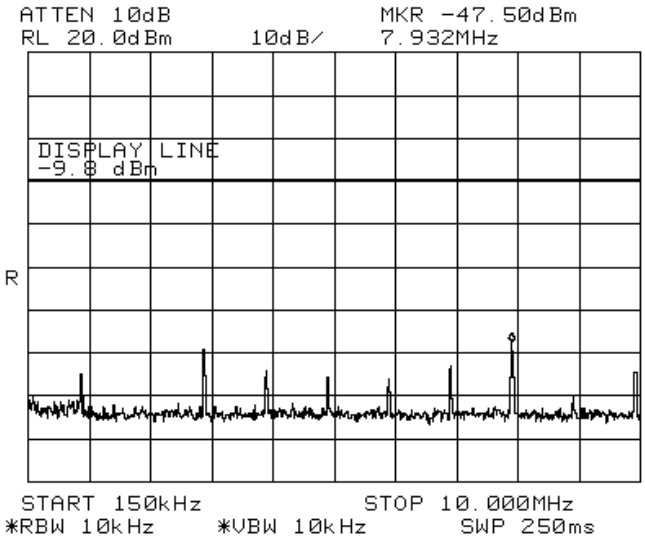

Figure 65 —2437 MHz DBPSK

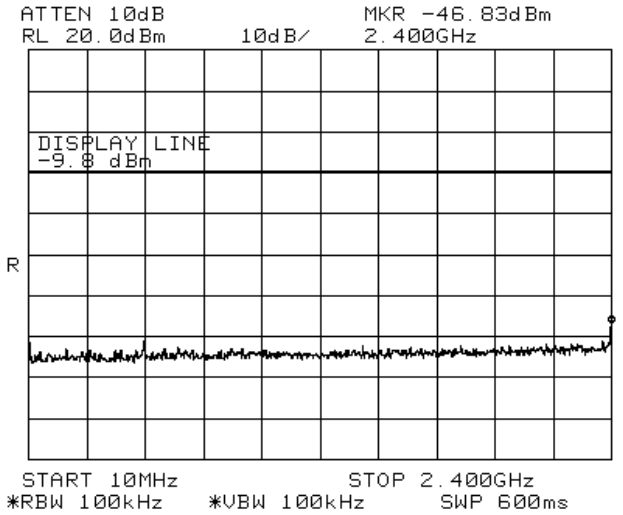

Figure 66 —2437 MHz DBPSK

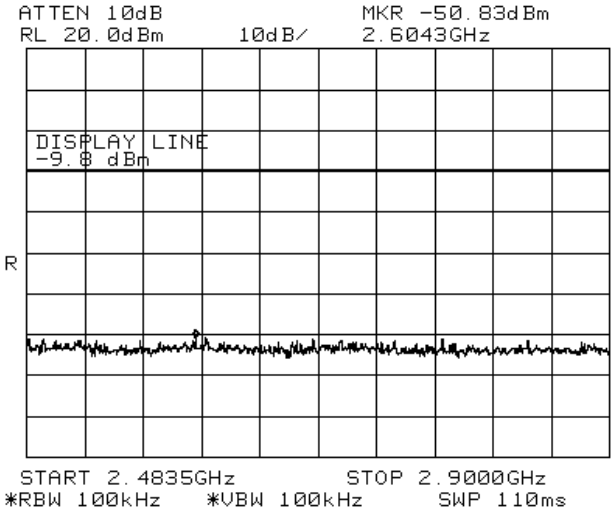

Figure 67 —2437 MHz DBPSK

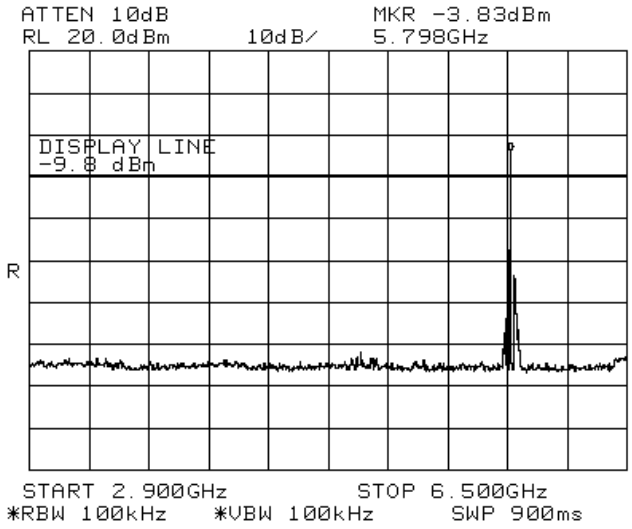

Figure 68 —2437 MHz DBPSK

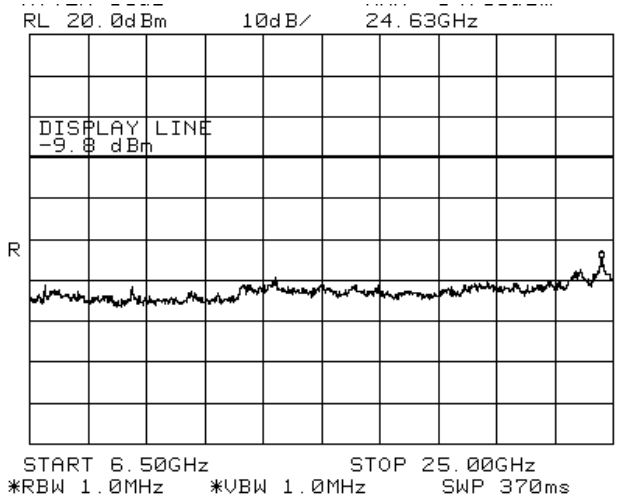

Figure 69 —2437 MHz DBPSK

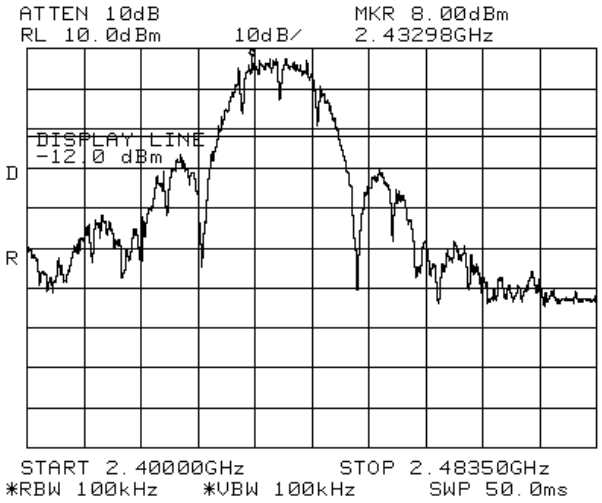

Figure 70 —2437 MHz BPSK

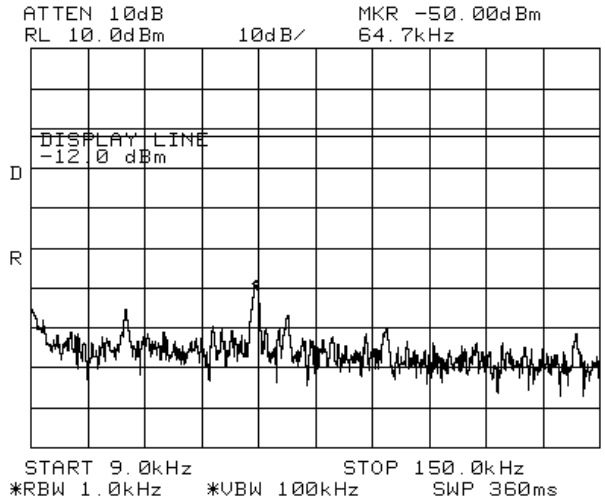

Figure 71 —2437 MHz BPSK

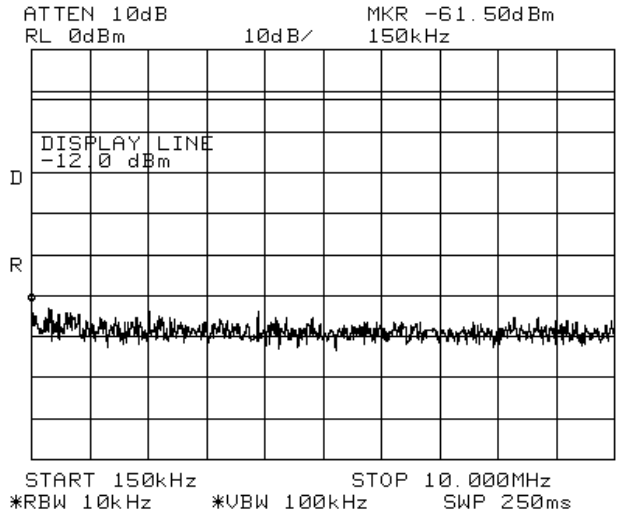

Figure 72 —2437 MHz BPSK

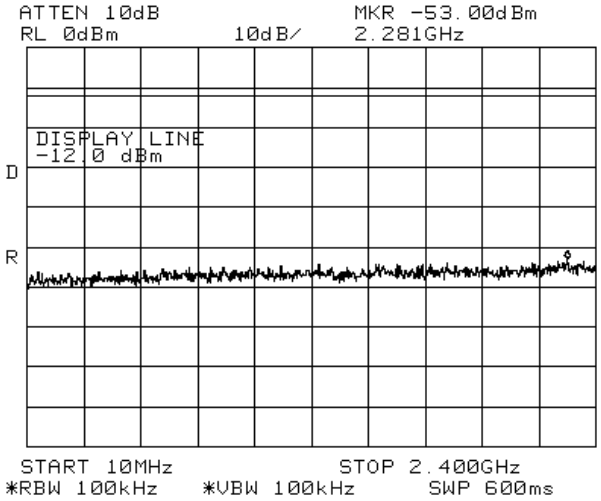

Figure 73 —2437 MHz BPSK

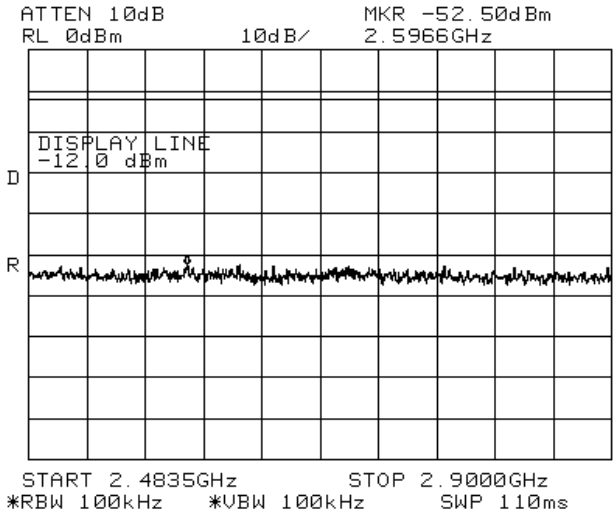

Figure 74 —2437 MHz BPSK

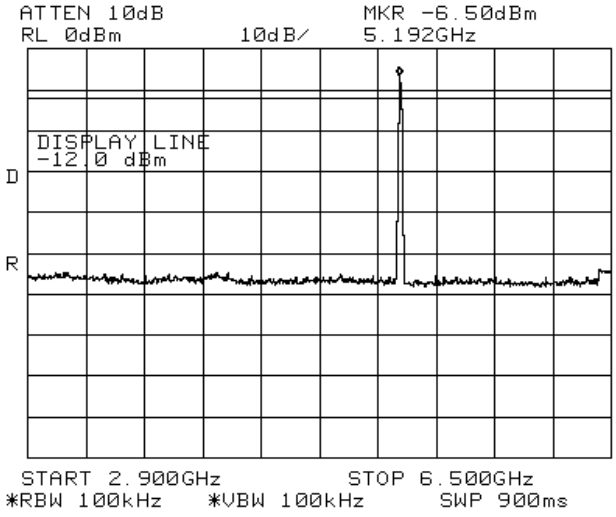

Figure 75 —2437 MHz BPSK

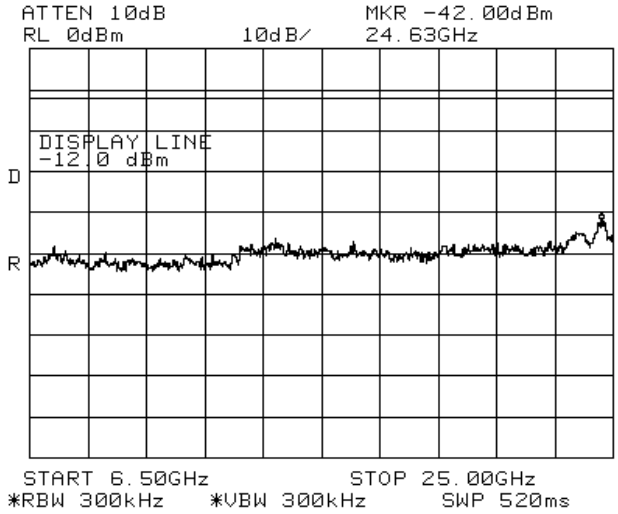

Figure 76 —2437 MHz BPSK

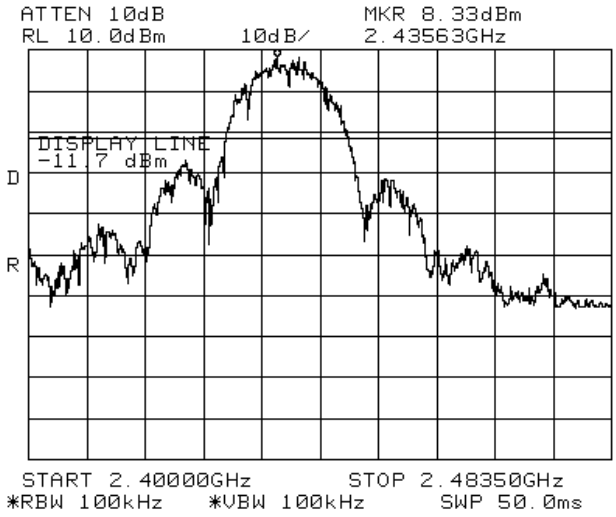

Figure 77 —2437 MHz CCK

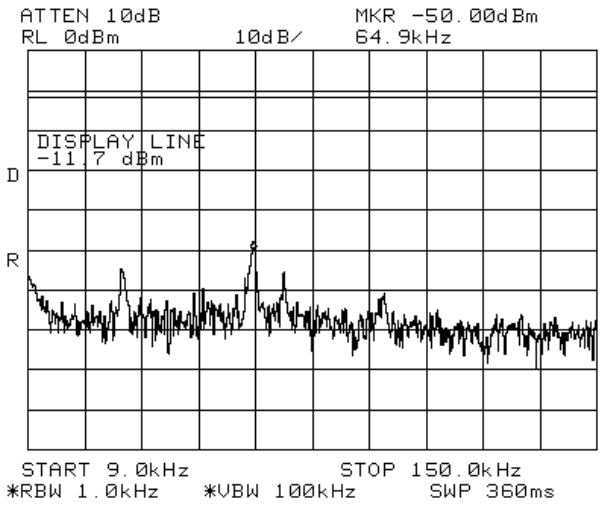

Figure 78 —2437 MHz CCK

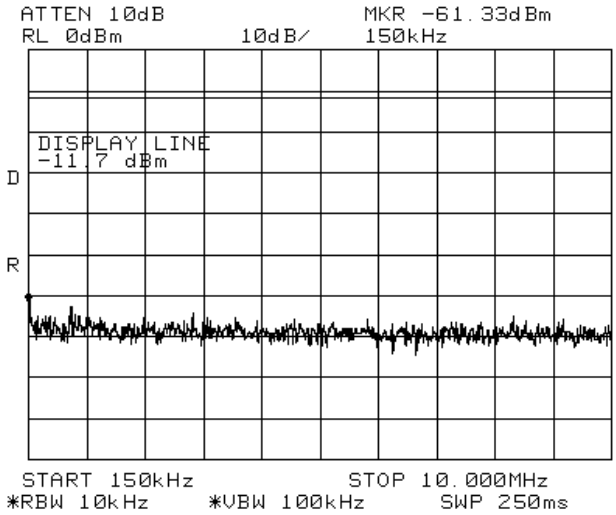

Figure 79 —2437 MHz CCK

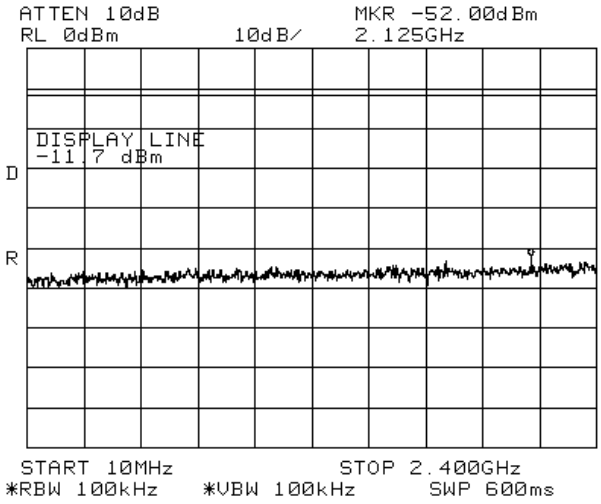

Figure 80 —2437 MHz CCK

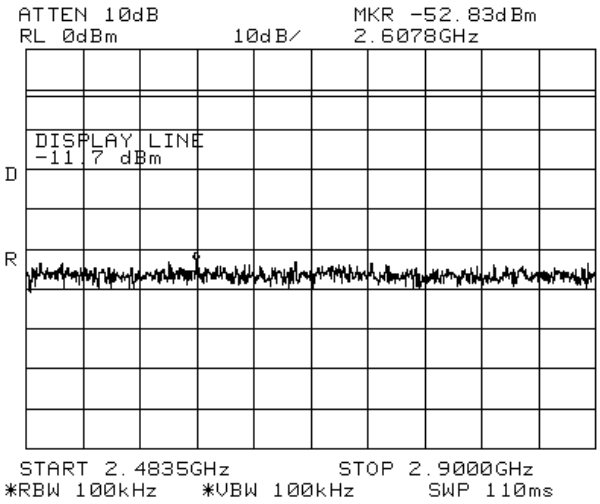

Figure 81 —2437 MHz CCK

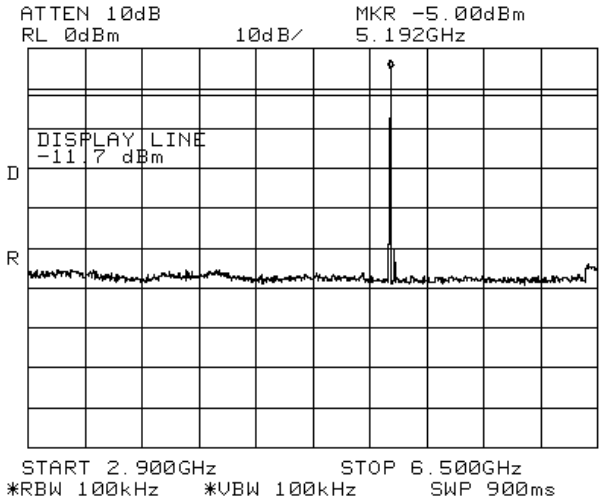

Figure 82 —2437 MHz CCK

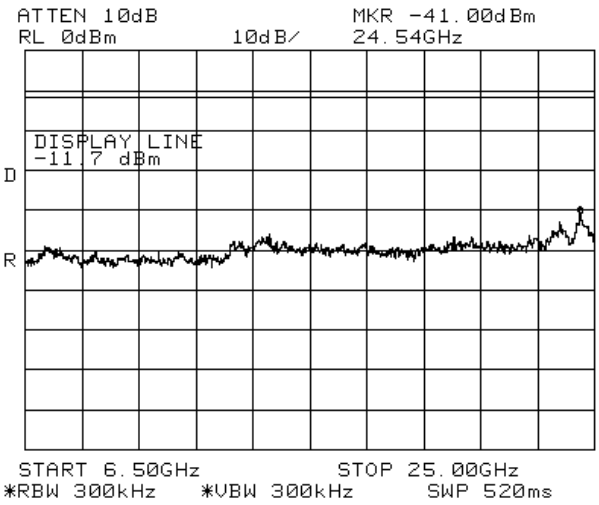

Figure 83 —2437 MHz CCK

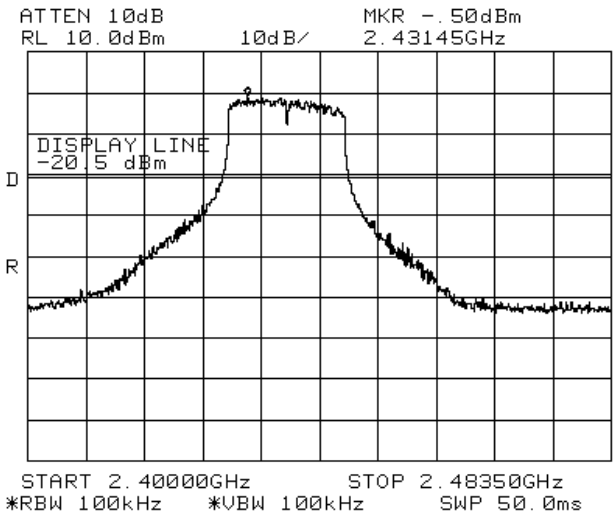

Figure 84 —2437 MHz 64QAM

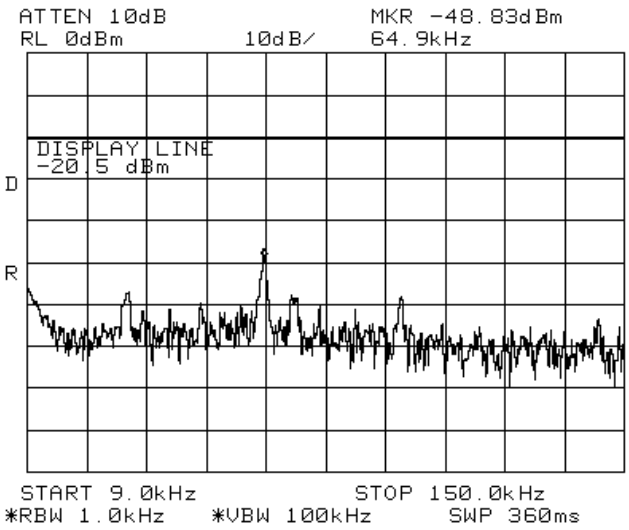

Figure 85 —2437 MHz 64QAM

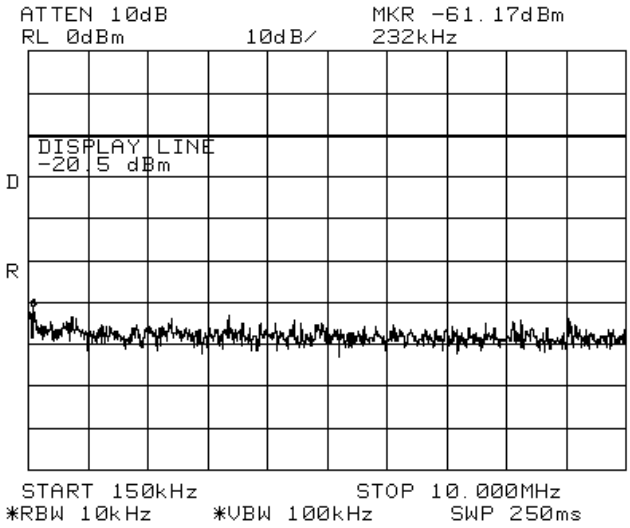

Figure 86 —2437 MHz 64QAM

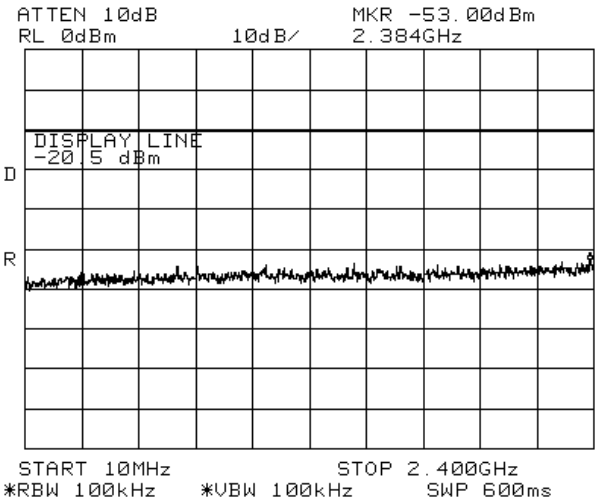

Figure 87 —2437 MHz 64QAM

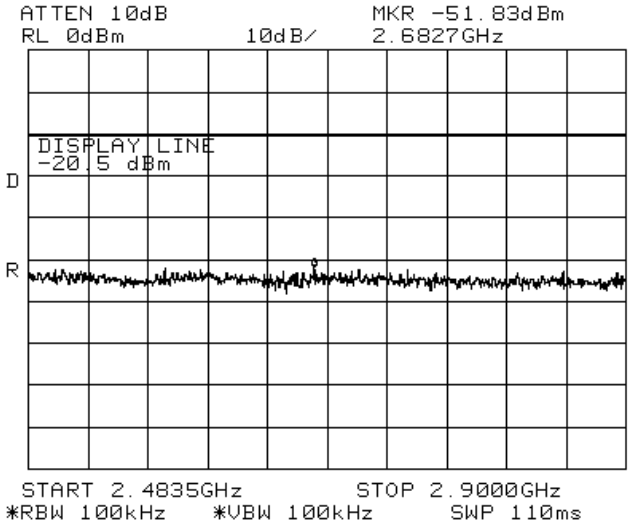

Figure 88 —2437 MHz 64QAM

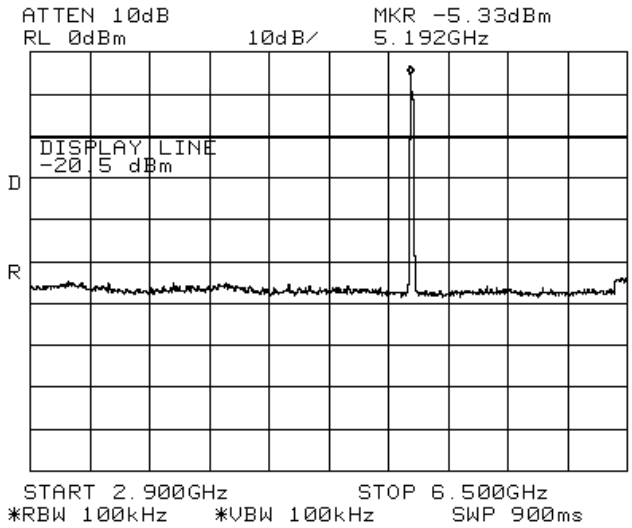

Figure 89 —2437 MHz 64QAM

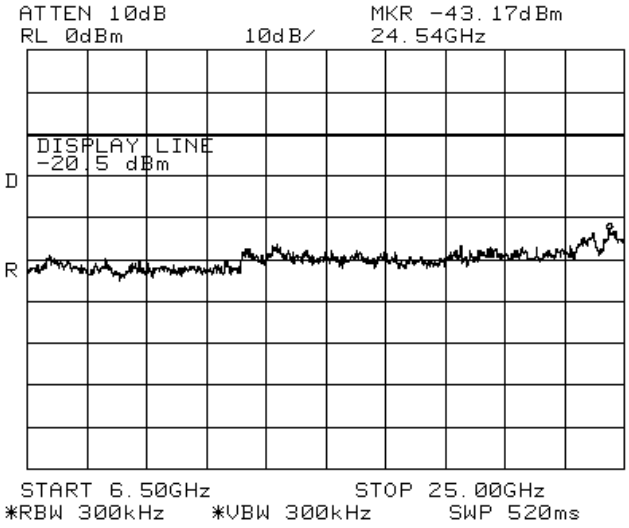

Figure 90 —2437 MHz 64QAM

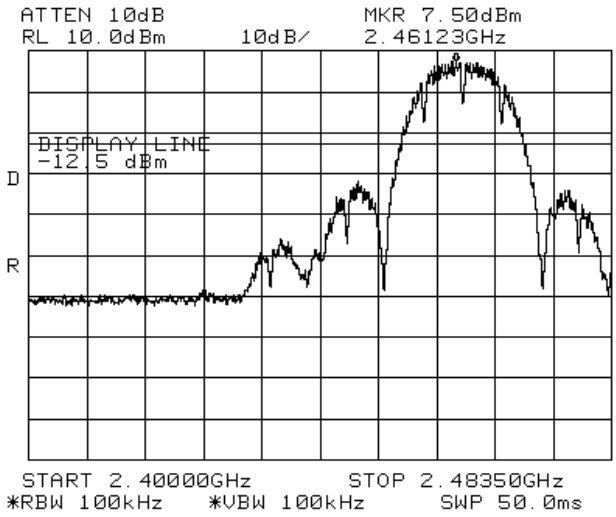

Figure 91 —2462 MHz DBPSK

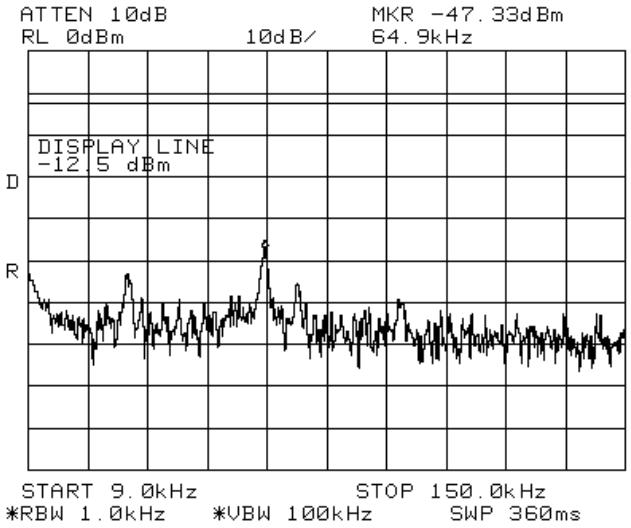

Figure 92 —2462 MHz DBPSK

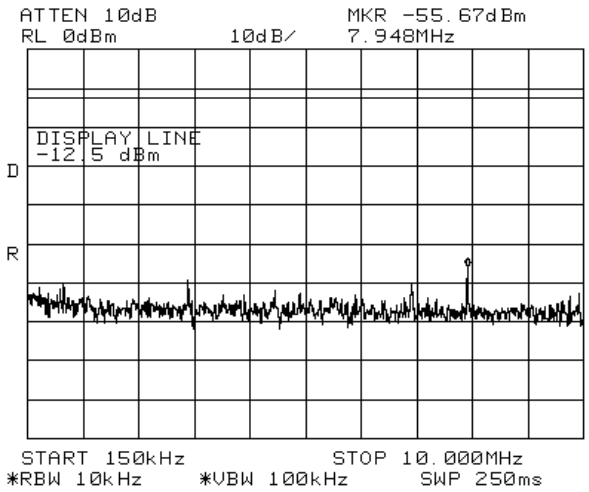

Figure 93 —2462 MHz DBPSK

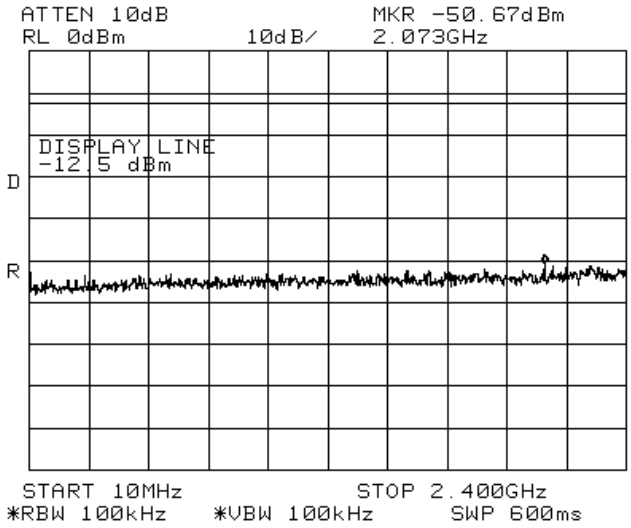

Figure 94 —2462 MHz DBPSK

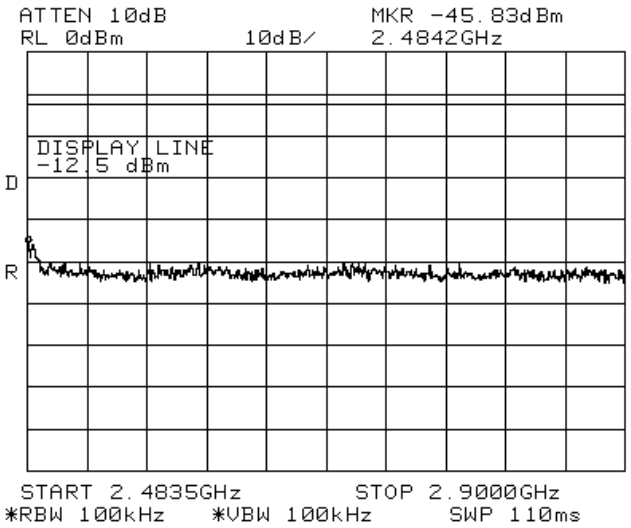

Figure 95 —2462 MHz DBPSK

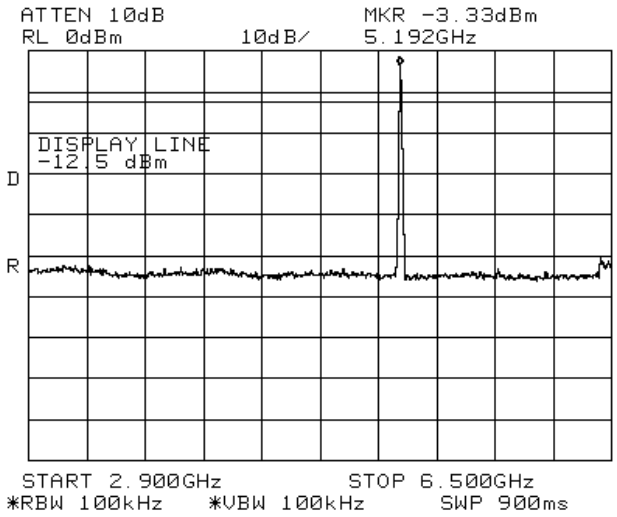

Figure 96 —2462 MHz DBPSK

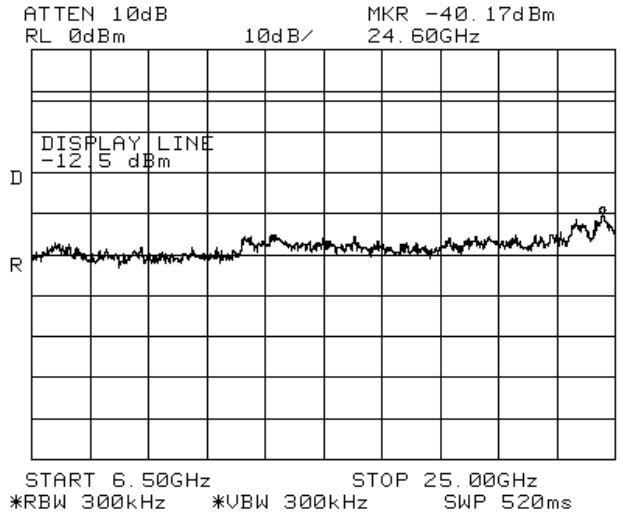

Figure 97 —2462 MHz DBPSK

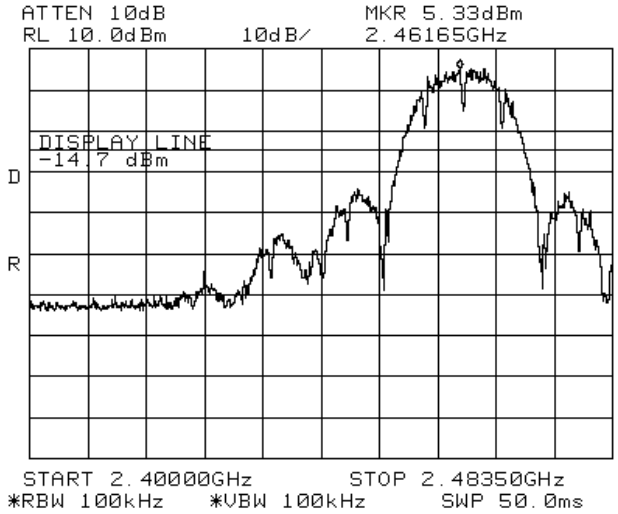

Figure 98 —2462 MHz BPSK

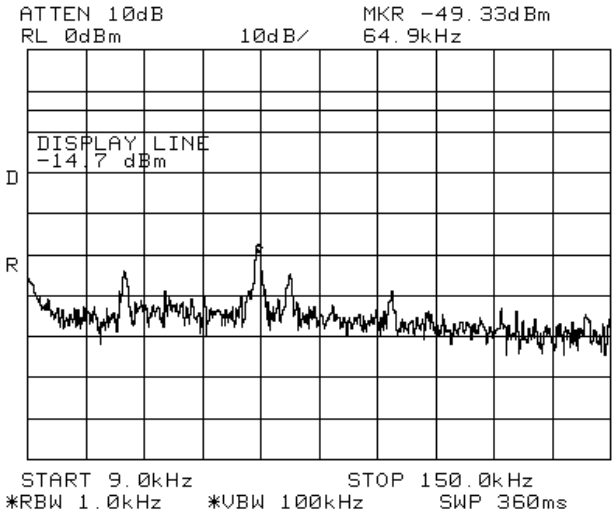

Figure 99 —2462 MHz BPSK

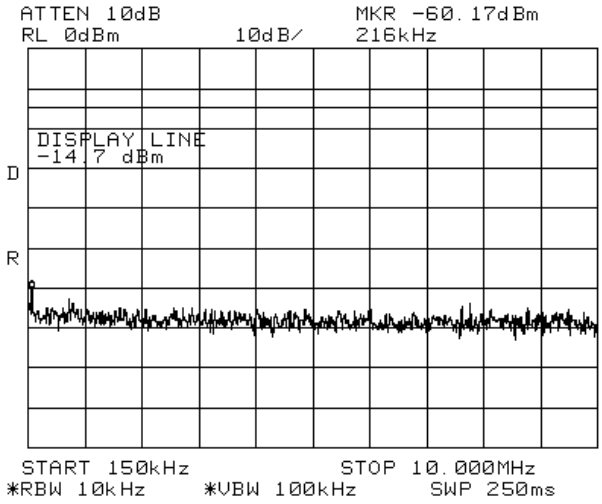

Figure 100 —2462 MHz BPSK

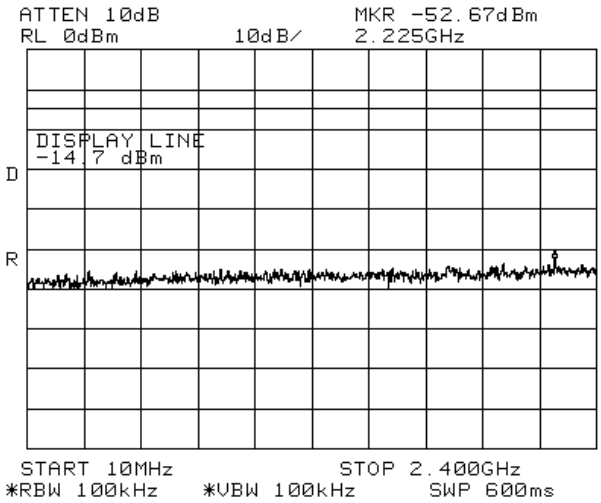

Figure 101 —2462 MHz BPSK

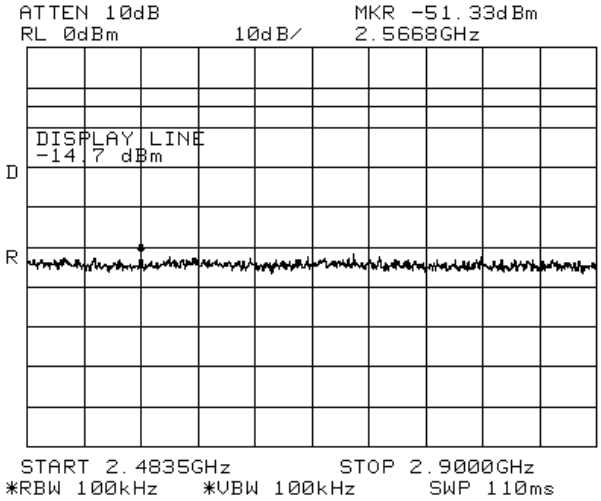

Figure 102 —2462 MHz BPSK

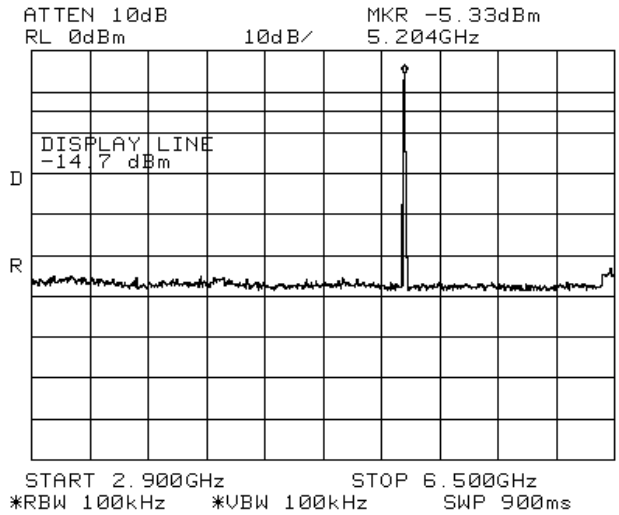

Figure 103 —2462 MHz BPSK

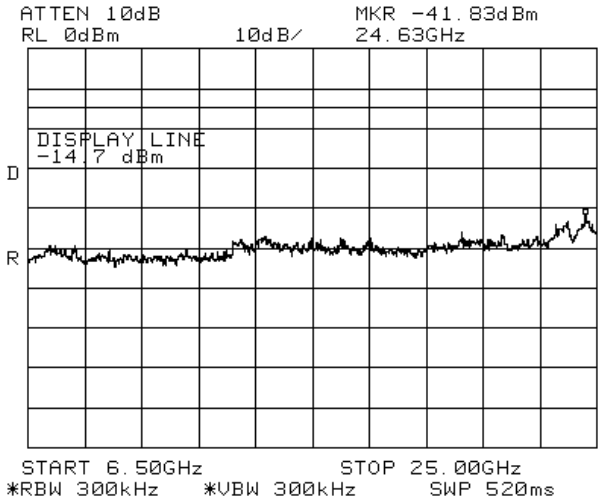

Figure 104 —2462 MHz BPSK

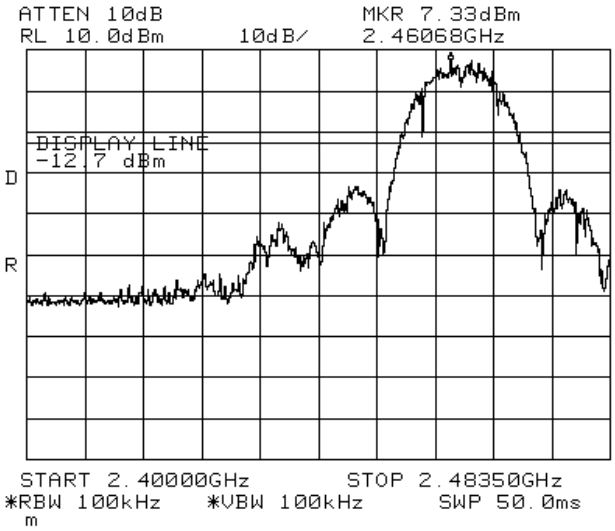

Figure 105 —2462 MHz CCK

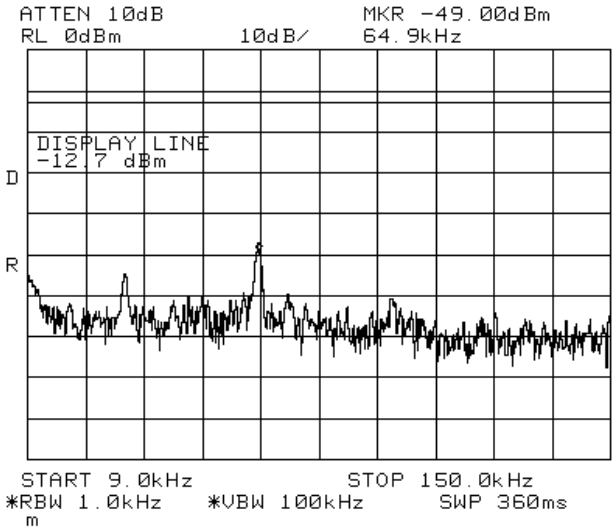

Figure 106 —2462 MHz CCK

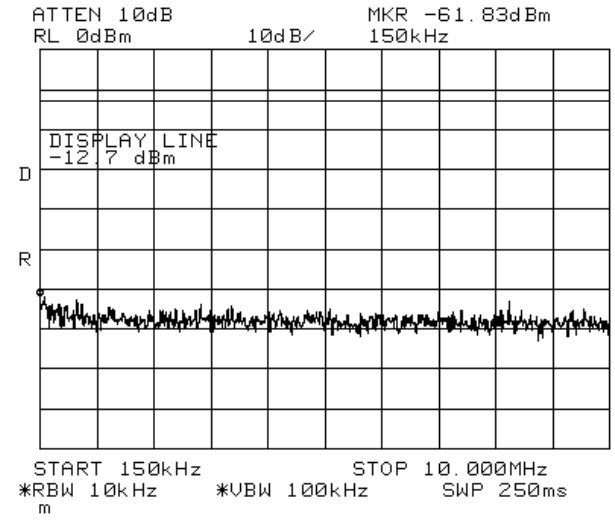

Figure 107 —2462 MHz CCK

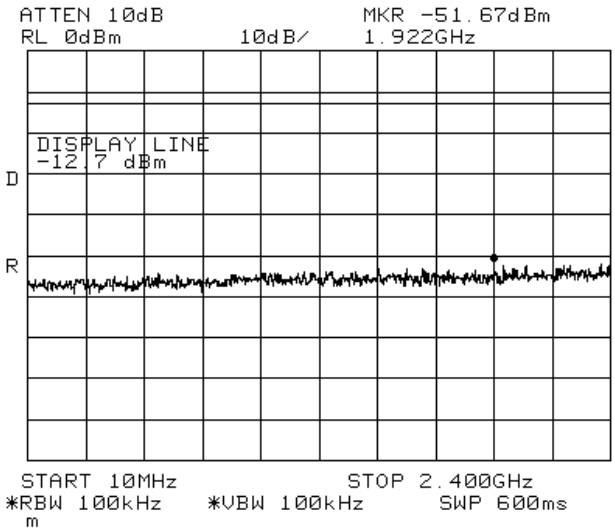

Figure 108 —2462 MHz CCK

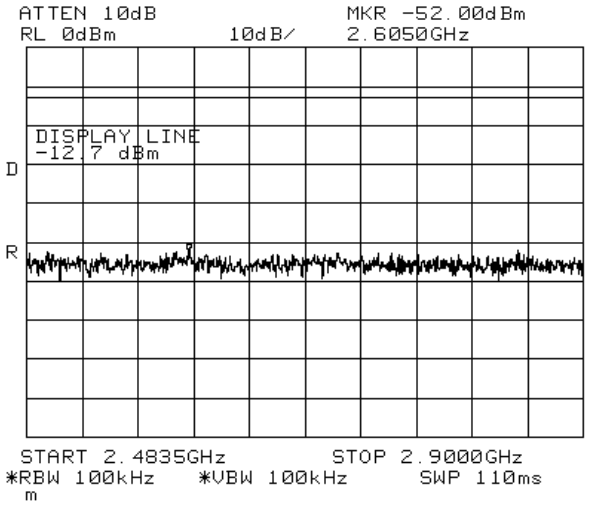

Figure 109 —2462 MHz CCK

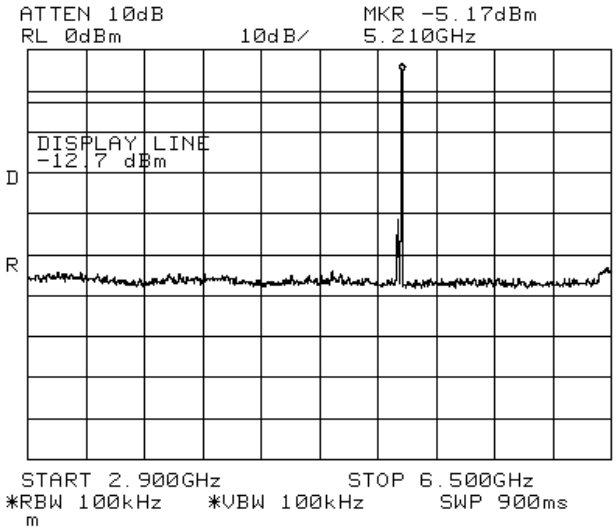

Figure 110 —2462 MHz CCK

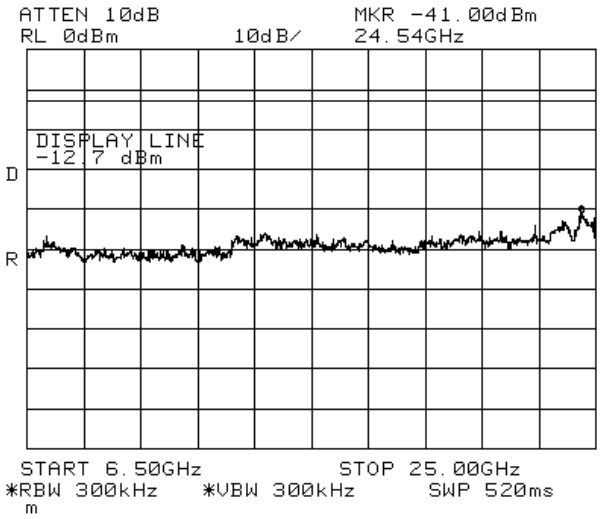

Figure 111 —2462 MHz CCK

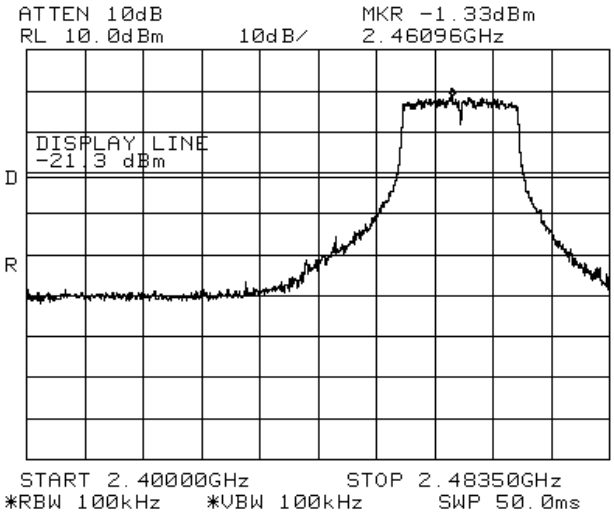

Figure 112 —2462 MHz 64QAM

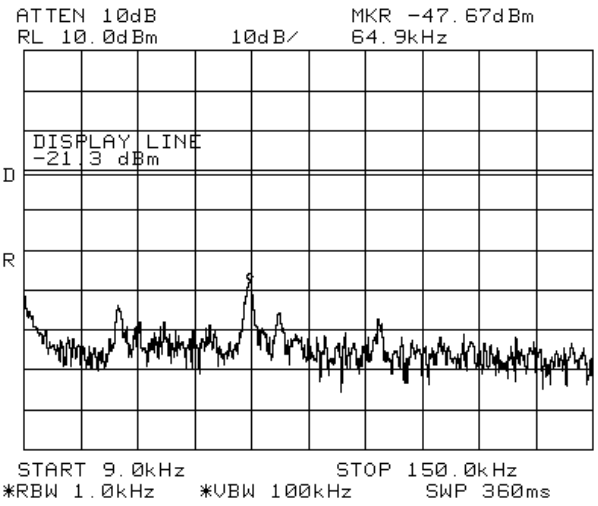

Figure 113 —2462 MHz 64QAM

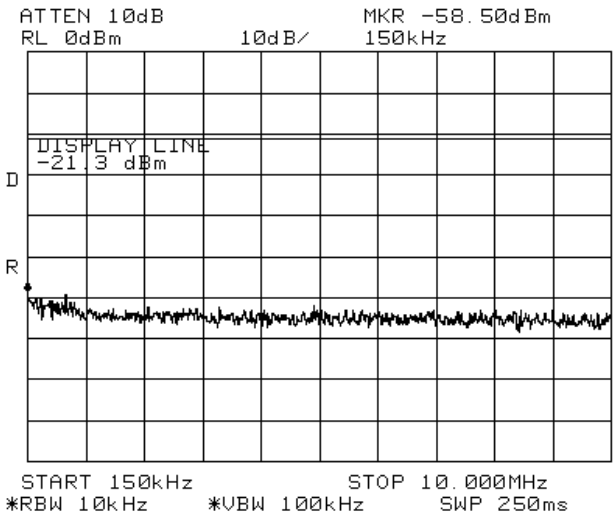

Figure 114 —2462 MHz 64QAM

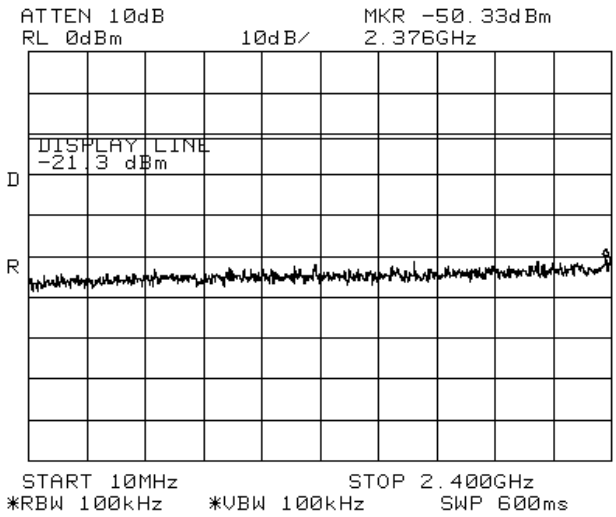

Figure 115 —2462 MHz 64QAM

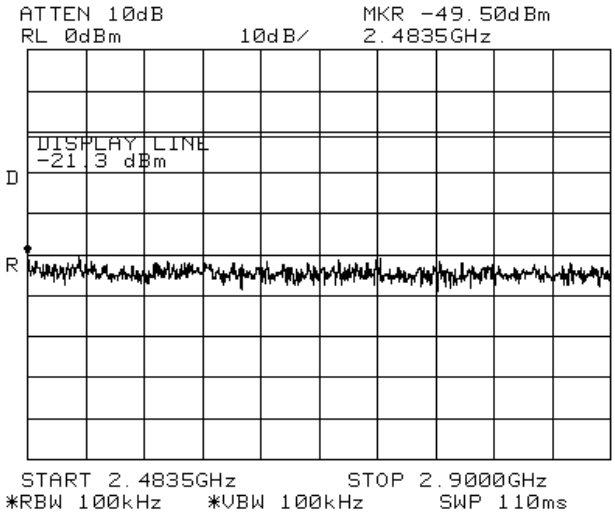

Figure 116 —2462 MHz 64QAM

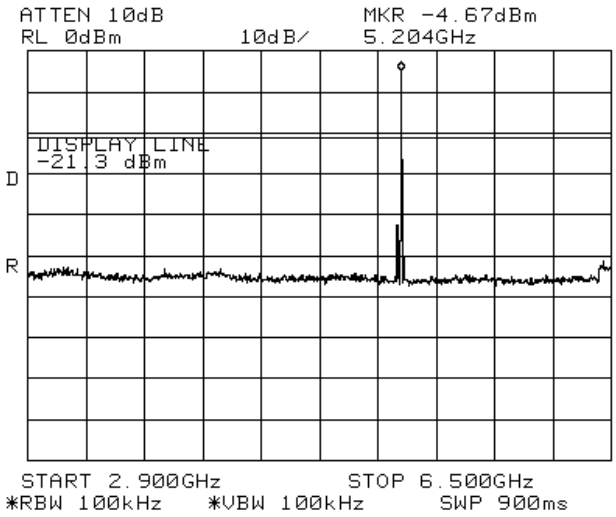

Figure 117 —2462 MHz 64QAM

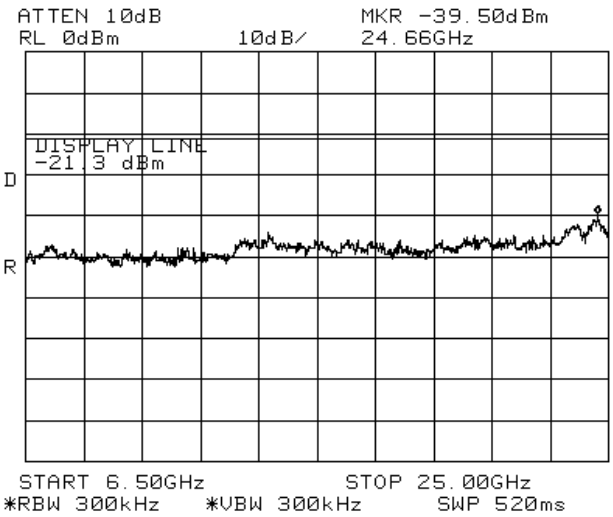

Figure 118 —2462 MHz 64QAM

8.2 Results table

E.U.T Description: WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Model No.: 860M With WCE
Serial Number: 1. 860M: 73903D
2. WCE: 739038
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Modulation	Reading (dBc)	Specification (dBc)	Margin (dB)
2412	DBPSK	21.97	20.0	-1.97
	BPSK	50.8	20.0	-30.80
	CCK	26.2	20.0	-6.20
	64QAM	21.63	20.0	-1.63
2437	DBPSK	57.03	20.0	-37.03
	BPSK	50.00	20.0	-30.00
	CCK	49.3	20.0	-29.30
	64QAM	42.67	20.0	-22.67
2462	DBPSK	47.67	20.0	-27.67
	BPSK	47.13	20.0	-27.13
	CCK	48.3	20.0	-46.30
	64QAM	38.2	20.0	-18.20

Figure 119 Peak Power Output of 2400-2483.5 MHz Band

JUDGEMENT: Passed by 1.63 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

8.3 Test Equipment Used.

Peak Power Output of 2400-2438.5 MHz Band

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	May 9, 2007	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

Figure 120 Test Equipment Used

9. 6 dB Minimum Bandwidth 2.4GHz Transmitter 802.11b/g + 802.11a Signals

9.1 Test procedure

The E.U.T. was set to the applicable test frequency. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20 dB) and an appropriate coaxial cable (cable loss = 1 dB). The spectrum analyzer was set to 100 kHz resolution BW. The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded.

The E.U.T. was tested at 2412, 2437, and 2462 MHz with the following modulations: DBPSK (1Mbit/sec), BPSK (6Mbit/sec), CCK (11Mbit/sec) and 64QAM (54Mbit/sec).

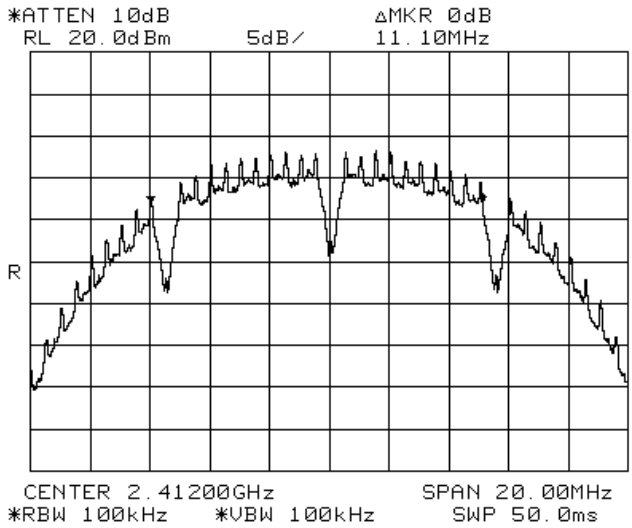

Figure 121 —2412 MHz DBPSK

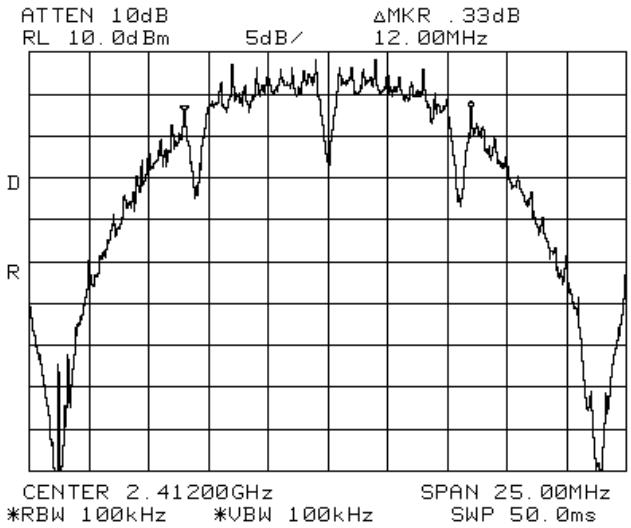

Figure 122 —2412 MHz BPSK

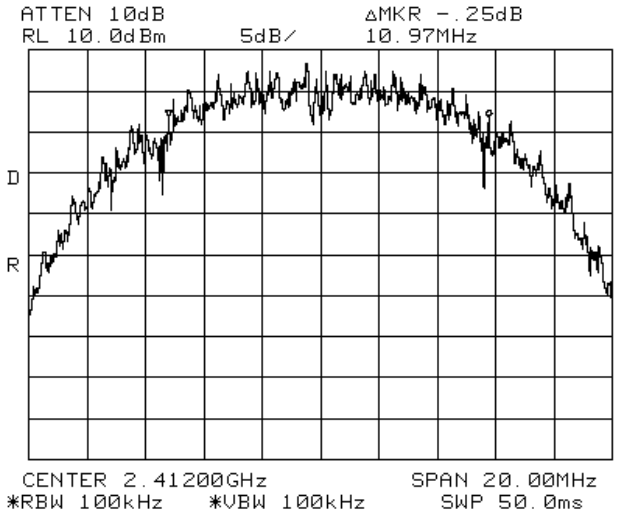

Figure 123 —2412 MHz CCK

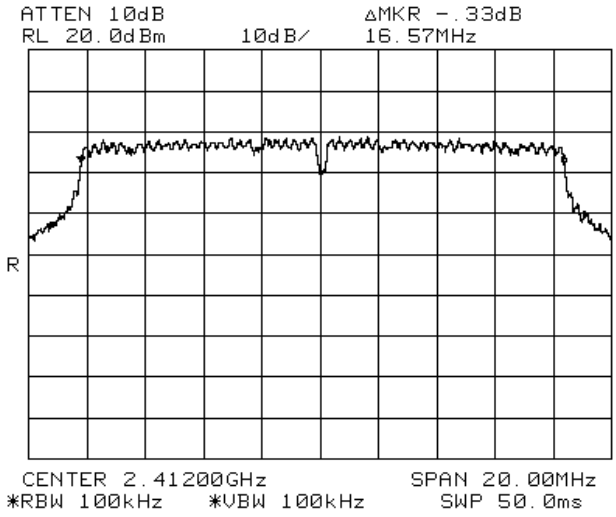

Figure 124 —2412 MHz 64QAM

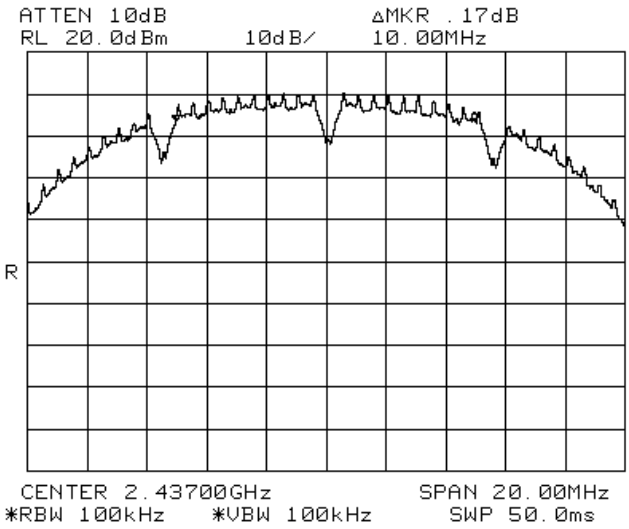

Figure 125 —2437 MHz DBPSK

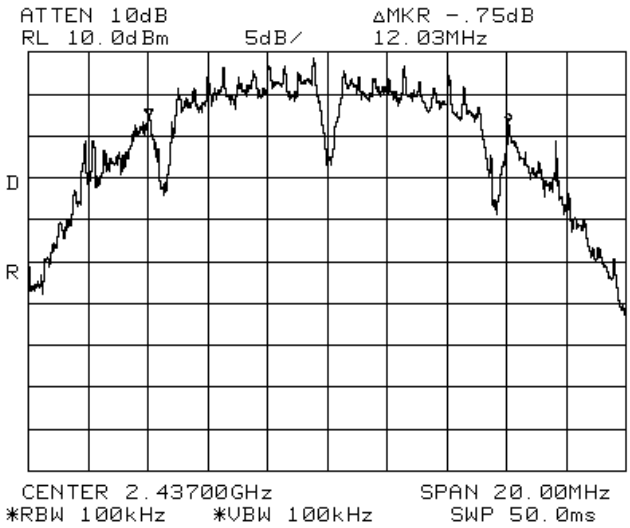

Figure 126 —2437 MHz BPSK

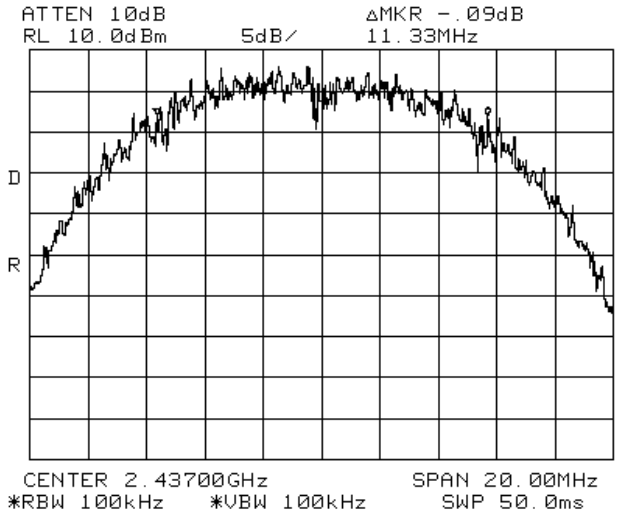

Figure 127 —2437 MHz CCK

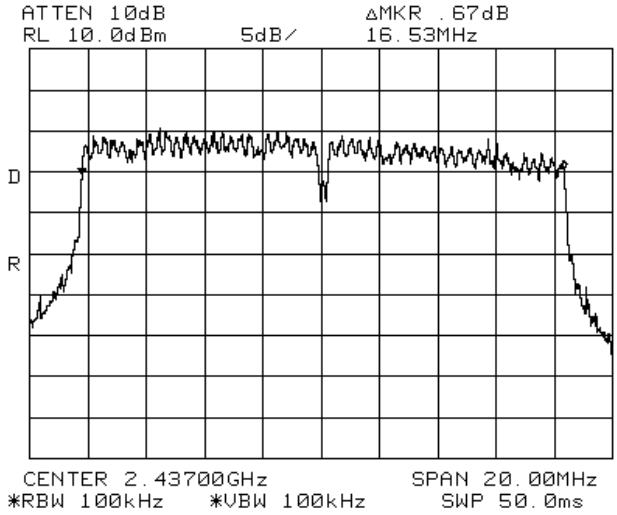

Figure 128 —2437 MHz 64QAM

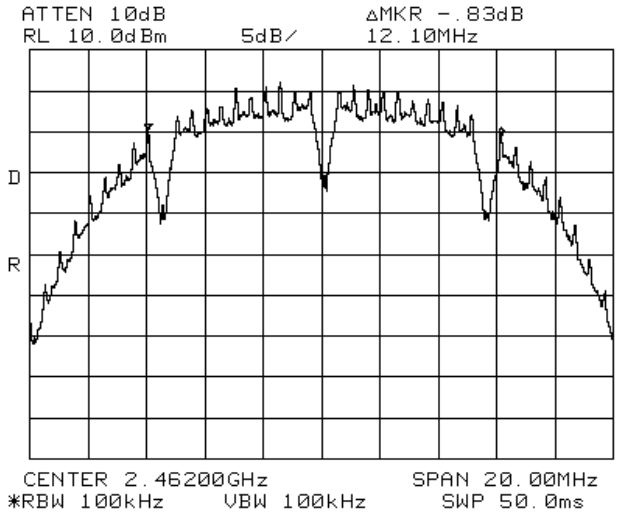

Figure 129 —2462 MHz DBPSK

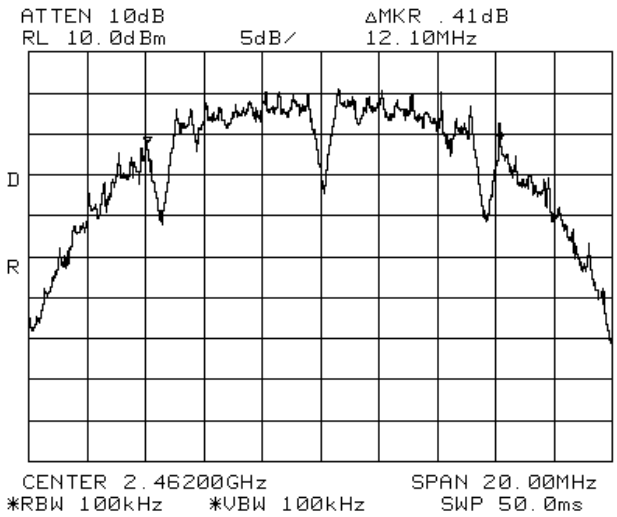

Figure 130 —2462 MHz BPSK

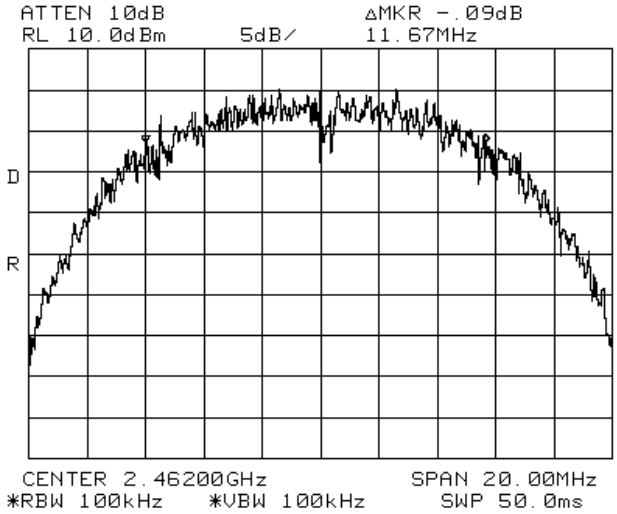

Figure 131 —2642 MHz CCK

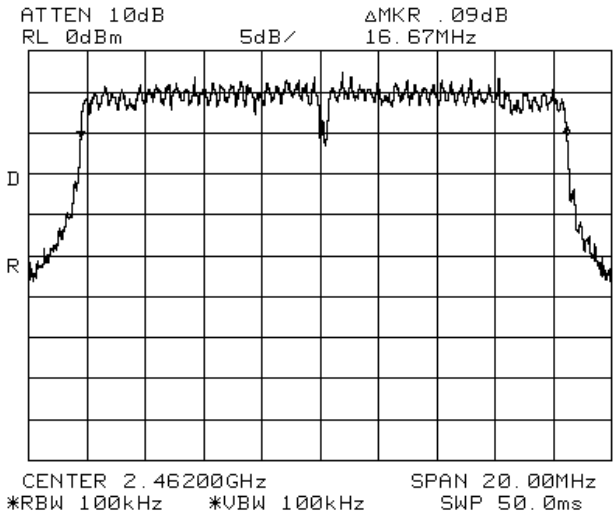

Figure 132 —2462 MHz 64QAM

9.2 Results table

E.U.T Description: WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Model No.: 860M With WCE
Serial Number: 1. 860M: 73903D
2. WCE: 739038
Specification: F.C.C. Part 15, Subpart C: (15.247-a2)

Operation Frequency (MHz)	Modulation	Reading (MHz)	Specification (MHz)
2412	DBPSK	11.10	0.5
	BPSK	12.00	0.5
	CCK	10.97	0.5
	64QAM	16.57	0.5
2437	DBPSK	10.00	0.5
	BPSK	12.03	0.5
	CCK	11.33	0.5
	64QAM	16.53	0.5
2462	DBPSK	12.10	0.5
	BPSK	12.10	0.5
	CCK	11.67	0.5
	64QAM	16.67	0.5

Figure 133 6 dB Minimum Bandwidth

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: ____  _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

9.3 Test Equipment Used.

6 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	May 9, 2007	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

Figure 134 Test Equipment Used

10. Band Edge Spectrum 2.4GHz Transmitter 802.11b/g + 802.11a Signals

[In Accordance with section 15.247(c)]

10.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20 dB) and an appropriate coaxial cable (cable loss = 1 dB). The spectrum analyzer was set to 100 kHz resolution BW. Maximum power level below 2400 MHz and above 2483.5 MHz was measured relative to power level at 2412 MHz, and 2462 MHz correspondingly.

The E.U.T. was tested using the following modulations: DBPSK (1Mbit/sec), BPSK (6Mbit/sec), CCK (11Mbit/sec) and 64QAM (54Mbit/sec).

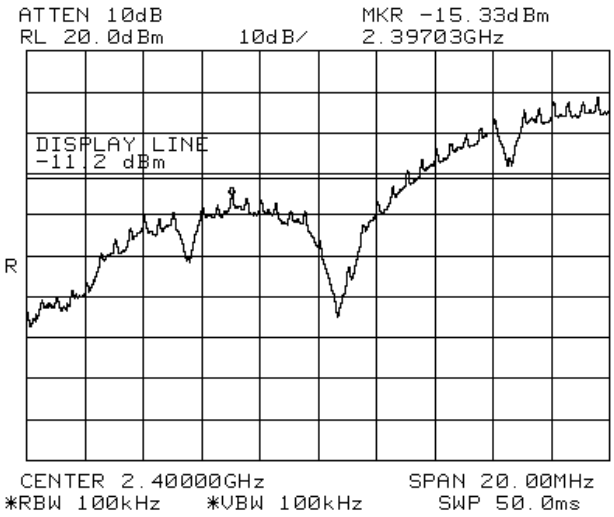

Figure 135 —2412 MHz DBPSK

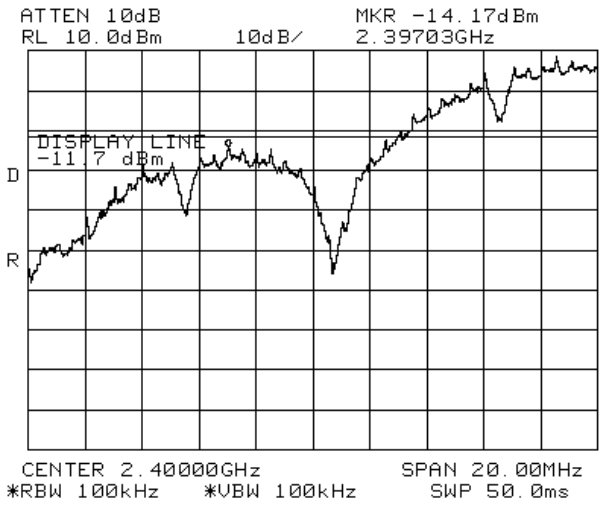

Figure 136 —2412 MHz BPSK

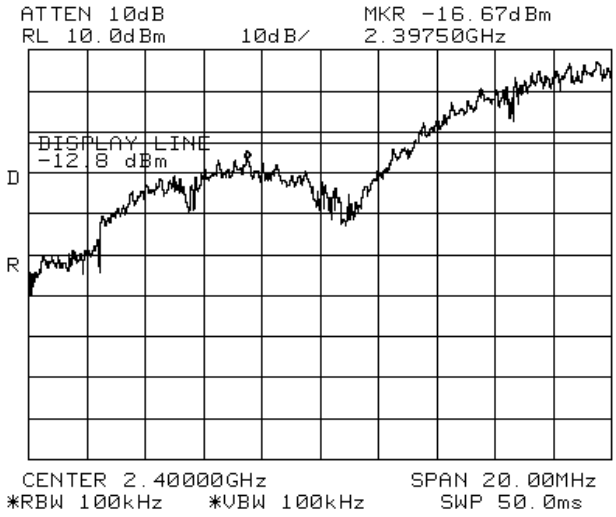

Figure 137 —2412 MHz CCK

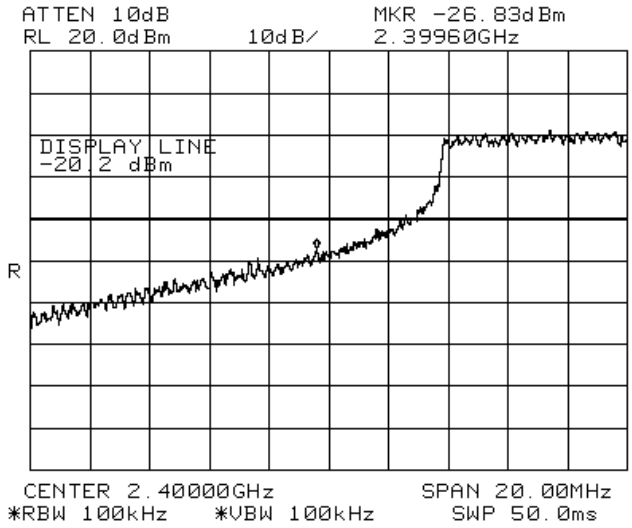

Figure 138 —2412 MHz 64QAM

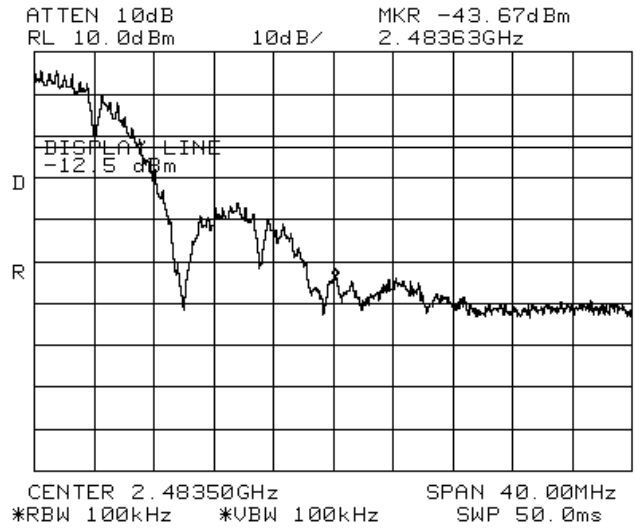

Figure 139 —2462 MHz DBPSK

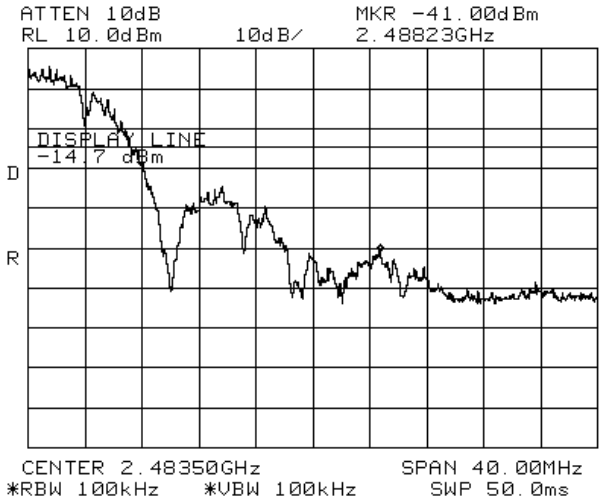

Figure 140 —2462 MHz BPSK

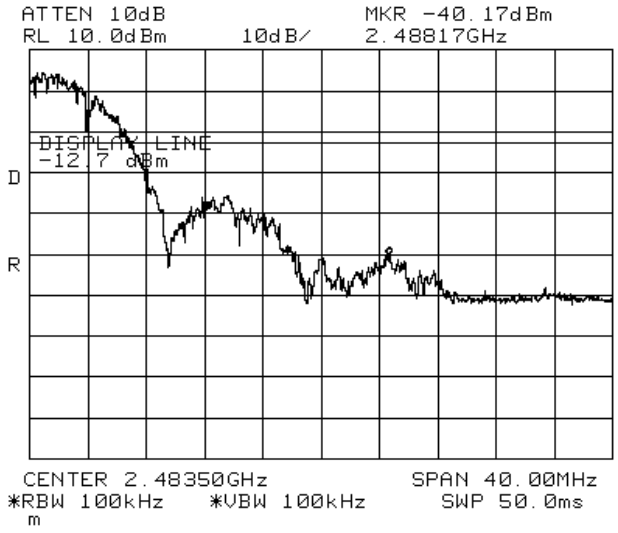

Figure 141 —2462 MHz CCK

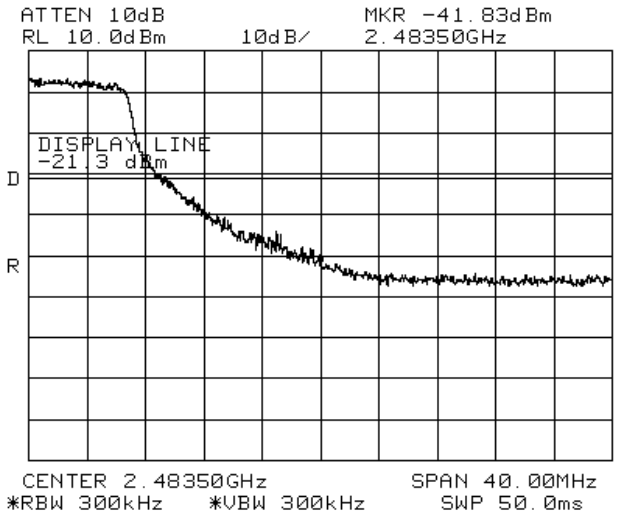

Figure 142 —2462 MHz 64QAM

10.2 Results table

E.U.T. Description: WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Model No.: 860M With WCE
Serial Number: 1. 860M: 73903D
2. WCE: 739038
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Modulation	Band Edge Frequency (MHz)	Spectrum Level (dBc)	Specification (dBc)	Margin (dB)
2412	DBPSK	2397	24.13	20.0	-4.13
	BPSK	2397	22.47	20.0	-2.47
	CCK	2397	23.87	20.0	-3.87
	64QAM	2399	26.63	20.0	-6.63
2642	DBPSK	2483	51.17	20.0	-31.17
	BPSK	2488	46.3	20.0	-26.30
	CCK	2488	47.47	20.0	-27.47
	64QAM	2483	40.53	20.0	-20.53

Figure 143 Band Edge Spectrum

JUDGEMENT: Passed by 2.47 dB

TEST PERSONNEL:

Tester Signature: _____ _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

10.3 Test Equipment Used.

Band edge Spectrum

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	May 9, 2007	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

Figure 144 Test Equipment Used

11. Transmitted Power Density 2.4GHz Transmitter 802.11 b/g +a Signals

[In accordance with section 15.247(d)]

11.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20dB) and an appropriate coaxial cable (cable loss = 1 dB). The spectrum analyzer was set to 3 kHz resolution BW. and sweep time of 1 second for each 3 kHz “window”. The spectrum peaks were located at each of the 3 operating frequencies.

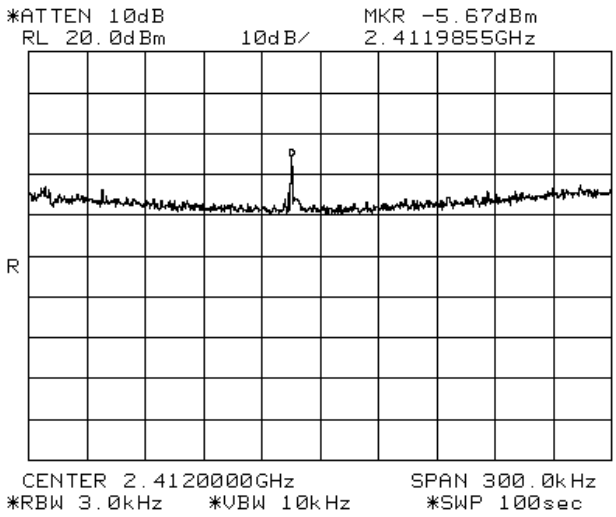

Figure 145 —2412 MHz DBPSK

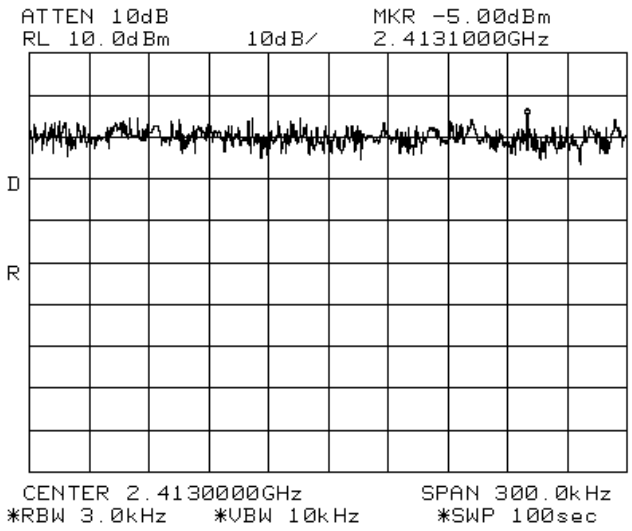

Figure 146 —2412 MHz BPSK

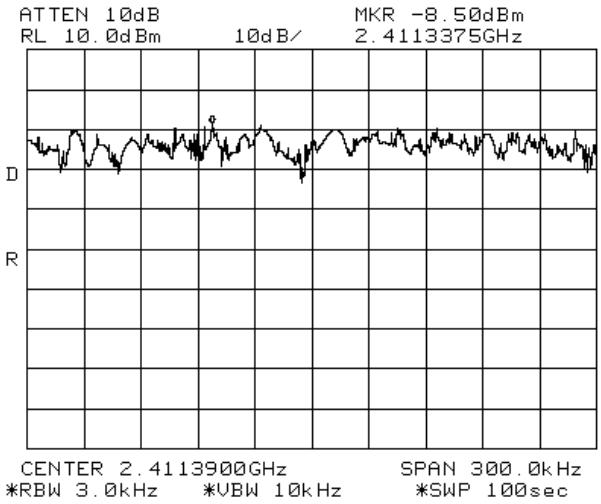

Figure 147 —2412 MHz CCK

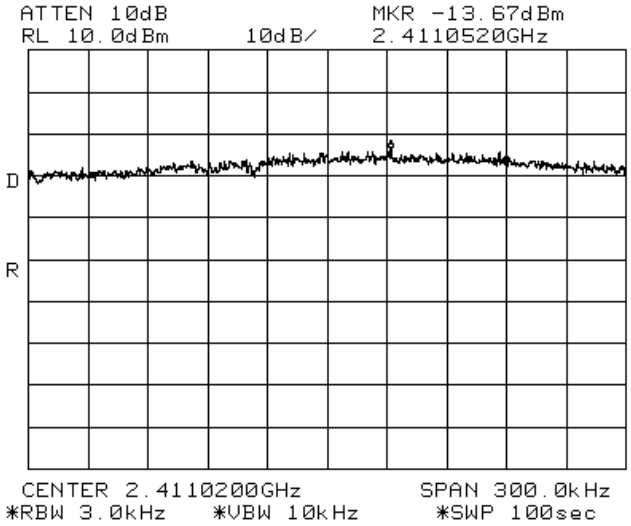

Figure 148 —2412 MHz 64QAM

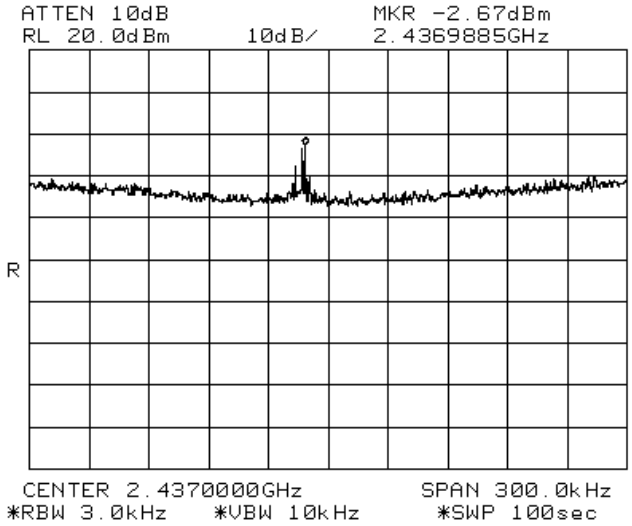

Figure 149 —2437 MHz DBPSK

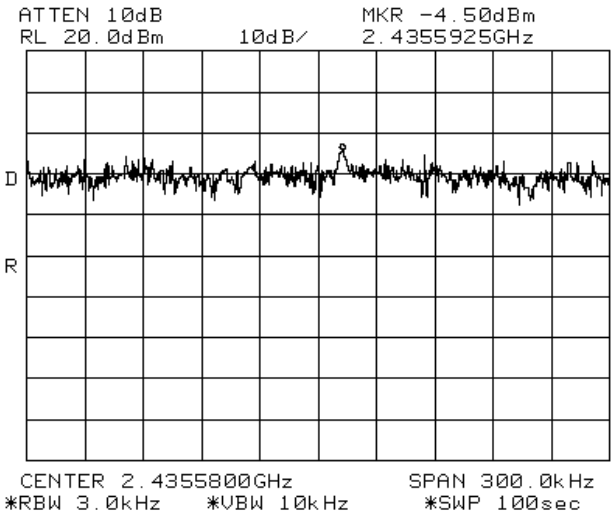

Figure 150 —2437 MHz BPSK

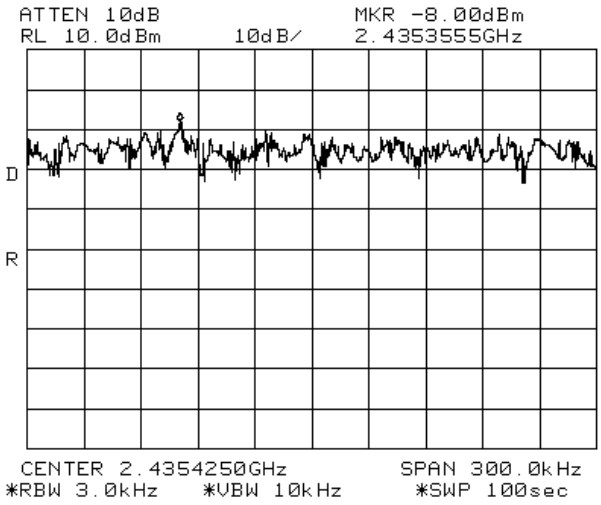

Figure 151 —2437 MHz CCK

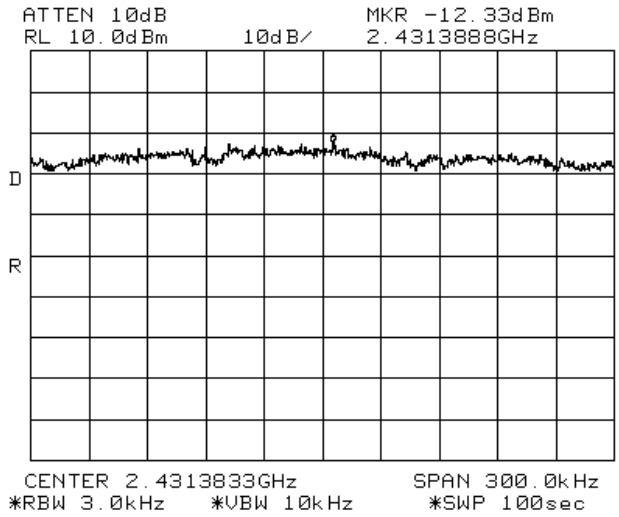

Figure 152 —2437 MHz 64QAM

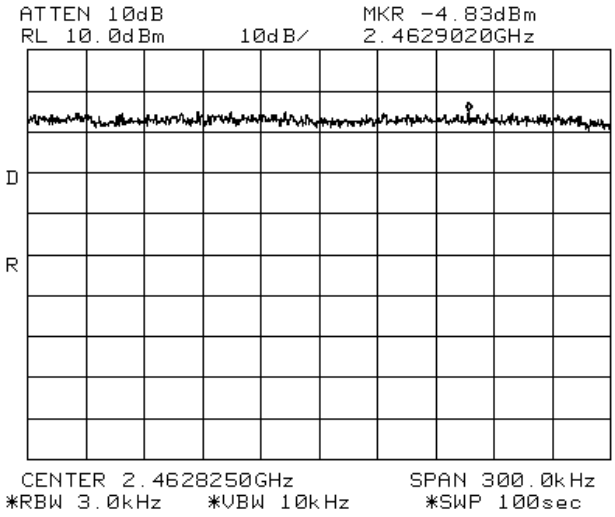

Figure 153 —2462 MHz DBPSK

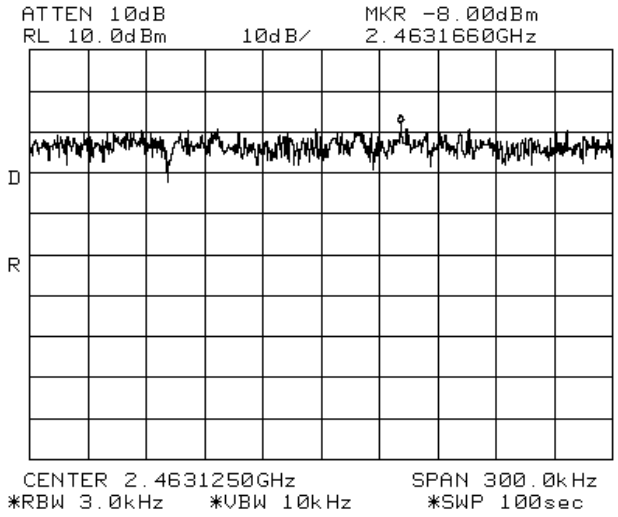

Figure 154 —2462 MHz BPSK

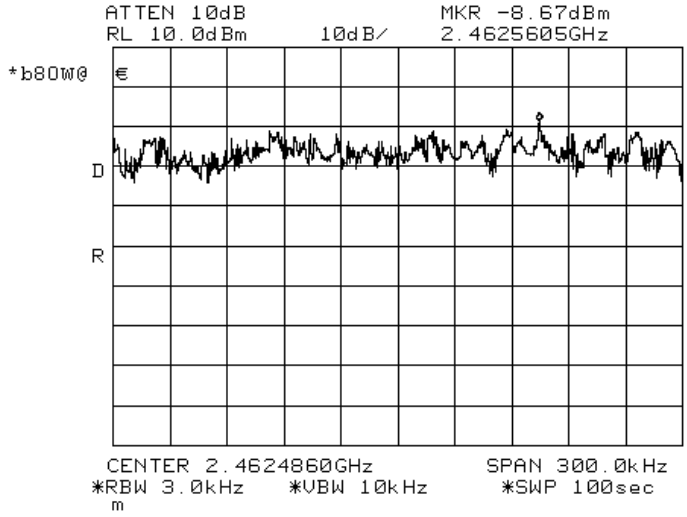

Figure 155 —2462 MHz CCK

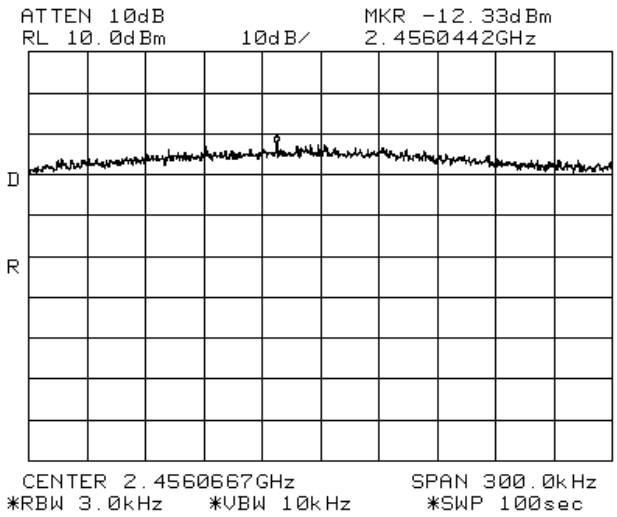

Figure 156 —2462 MHz 64QAM

11.2 Results table

E.U.T. Description: WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Model No.: 860M With WCE
Serial Number: 1. 860M: 73903D
2. WCE: 739038
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Modulation	Reading Spectrum Analyzer (dBm)	Specification (dBm)	Margin (dB)
2412	DBPSK	-5.67	8.0	-13.67
2412	BPSK	-5.00	8.0	-13.00
2412	CCK	-8.50	8.0	-16.50
2412	64QAM	-13.67	8.0	-21.67
2437	DBPSK	-2.67	8.0	-10.67
2437	BPSK	-4.50	8.0	-12.50
2437	CCK	-8.00	8.0	-16.00
2437	64QAM	-12.33	8.0	-20.33
2462	DBPSK	-8.67	8.0	-16.67
2462	BPSK	-8.00	8.0	-16.00
2462	CCK	-8.67	8.0	-16.67
2462	64QAM	-12.33	8.0	-20.33

Figure 157 Test Results

JUDGEMENT: Passed by 10.67 dB

TEST PERSONNEL:

Tester Signature: _____ _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

11.3 Test Equipment Used.

Transmitted Power Density

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	May 9, 2007	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

Figure 158 Test Equipment Used

12. Antenna Gain 2.4GHz Transmitter 802.11 b/g +a Signals

The antenna gain is 7 dBi.

13. R.F Exposure/Safety 2.4GHz Transmitter 802.11 b/g +a Signals

Typical use of the E.U.T. is repeating WiFi signals for DAS. The typical placement of the E.U.T. is on a wall near the ceiling. The typical distance between the E.U.T. and the user in the worst case application, is >1 m.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) Requirements

(a) FCC limits at 2437 MHz is: $1\frac{mW}{cm^2}$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is

$$S = \frac{P_t G_t}{4\pi R^2}$$

P_t- Transmitted Power 251.2mw (Peak) = 24.0dBm

G_T- Antenna Gain, 7 dBi = 5

R- Distance from Transmitter using 1 m worst case

(c) The peak power density is :

$$S_p = \frac{251.2 \times 5}{4\pi(100)^2} = 10 \times 10^{-3} \frac{mW}{cm^2}$$

(d) The duty cycle of transmission in actual worst case is 50%.

The average power source is:

$125.6mW$

(e) The averaged power density of the E.U.T. is:

$$S_{AV} = 5 \times 10^{-3} \frac{mW}{cm^2}$$

(f) This is 3 orders of magnitude below the FCC limit.

14. Radiated Emission Per FCC Part 15 Sub-Part B Test Data 802.11 b/g +802.11a Signals

14.1 Test Specification

30-25000 MHz, FCC Part 15, Subpart B, CLASS A

14.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 4.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission.

The frequency range 30-25000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 2.9 - 25 GHz, a spectrum analyzer including a low noise amplifier was used. The test distance was 3 meters. During peak measurements, the I.F. bandwidth was 1 MHz, and video bandwidth 3 MHz. During average measurements, the I.F. bandwidth was 1 MHz and video bandwidth was 100 Hz.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The emissions were measured at a distance of 3 meters.
The E.U.T. was tested in both Rx and Tx modes.
The E.U.T. was tested at the operating frequencies of 2412, 2437, and 2462 MHz using the following modulations: DBPSK, BPSK, CCK, and 64QAM.

14.3 Test Data

JUDGEMENT: Passed by 4.9 dB.

The margin between the emission level and the specification limit is 4.9 dB in the worst case at the frequency of 128.38 MHz, vertical polarization.

The signals in the band 1.0 – 25.0 GHz were more than 20 dB below the specification limit.

The EUT met the requirements of the F.C.C. Part 15, Subpart B, Class A, specification.

The results for all three operating frequencies and modulations were the same.

TEST PERSONNEL:

Tester Signature: _____  _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

Radiated Emission

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC Part 15, Subpart B, Class A

Antenna Polarization: Horizontal
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

Signal Number	Frequency (MHz)	Peak dBuV/m	QP dBuV/m	QP Delta L 1 (dB)	Av Delta L 2 (dB)	Corr (dB)
1	299.894100	39.0	33.3	-23.5		23.4
2	375.000000	42.3	38.9	-18.0		18.7
3	500.015000	43.7	40.1	-16.8		21.0
4	625.010000	43.2	38.5	-18.4		24.7
5	700.010000	43.4	39.7	-17.2		25.3
6	750.010000	43.5	38.8	-18.1		25.8

Figure 159. Radiated Emission. Antenna Polarization: HORIZONTAL. Detectors: Peak, Quasi-peak

Note: QP Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC Part 15, Subpart B, Class A

Antenna Polarization: Horizontal
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

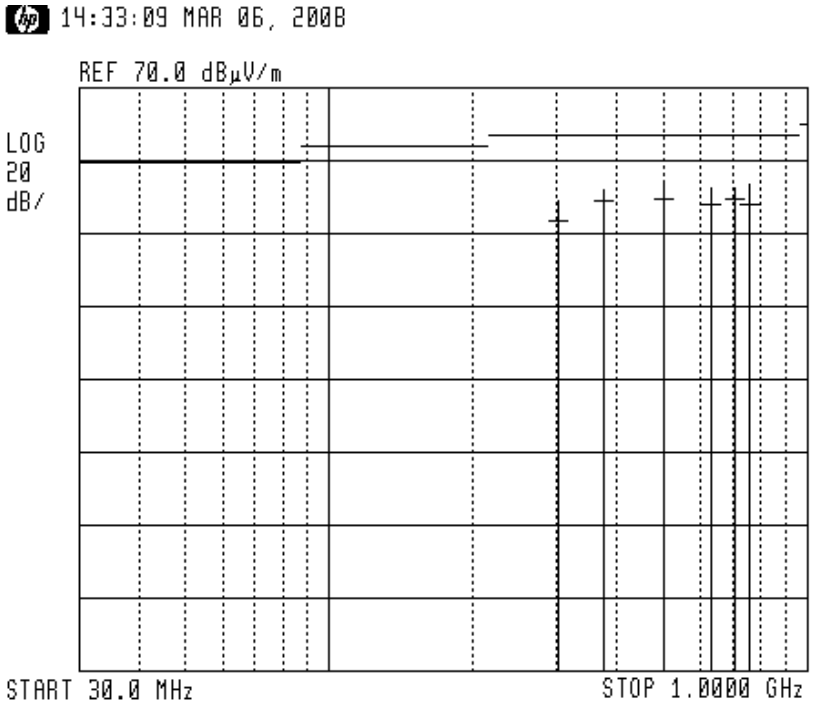

Figure 160. Radiated Emission. Antenna Polarization: HORIZONTAL Detectors: Peak, Quasi-peak

Note:

1. *Horizontal axis shows logarithmic frequency scale.*
2. *The vertical axis shows amplitude (in dB µV/m).*
3. *Peak detection is designated by the top of each vertical line.*
4. *Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.*

Radiated Emission

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC Part 15, Subpart B, Class A

Antenna Polarization: Vertical
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

Signal Number	Frequency (MHz)	Peak dBuV/m	QP dBuV/m	QP Delta L 1 (dB)	Av Delta L 2 (dB)	Corr (dB)
1	56.970000	40.2	34.9	-14.6		10.8
2	125.005000	42.3	40.9	-13.1		13.8
3	128.380000	52.0	49.1	-4.9		13.9
4	250.007500	53.2	51.9	-5.0		20.9
5	256.850000	46.5	42.0	-14.9		21.3
6	500.000000	43.5	40.0	-16.9		21.0
7	700.015000	45.8	40.7	-16.2		25.3

Figure 161. Radiated Emission. Antenna Polarization: VERTICAL. Detectors: Peak, Quasi-peak

Note: QP Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC Part 15, Subpart B, Class A

Antenna Polarization: Vertical
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

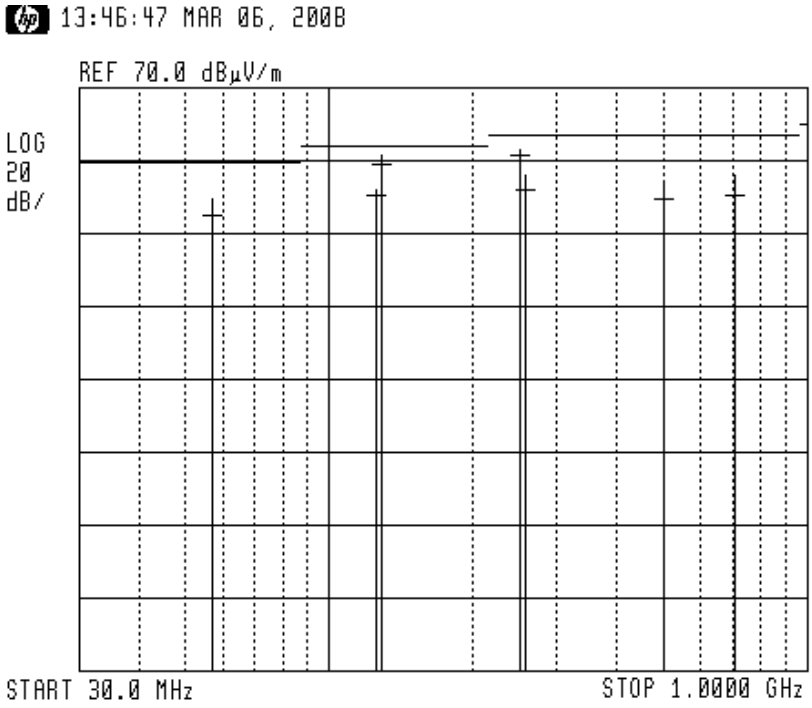

Figure 162. Radiated Emission. Antenna Polarization: VERTICAL. Detectors: Peak, Quasi-peak

Note:

1. *Horizontal axis shows logarithmic frequency scale.*
2. *The vertical axis shows amplitude (in dB µV/m).*
3. *Peak detection is designated by the top of each vertical line.*
4. *Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.*

14.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial No.	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 12, 2007	1Year
RF Filter Section	HP	85420E	3705A00248	November 12, 2007	1Year
Antenna Biconical	ARA	BCD 235/B	1041	March 22, 2007	1Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 22, 2007	1 Year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	February 4, 2007	2 Years
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 15, 2006	2 Years
Horn Antenna	ARA	SWH-28	1008	December 8, 2006	2 Years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 2, 2007	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	January 9, 2007	1 Year
Low Noise Amplifier	MK Milliwave	MKT6-3000 4000-30-13P	399	January 9, 2007	1 Year
Spectrum Analyzer	HP	8593EM	3536A00120	February 26, 2008	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

14.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

FS:	Field Strength [dBμv/m]
RA:	Receiver Amplitude [dBμv]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

No external pre-amplifiers are used.

15. Spurious Radiated Emission in the Restricted Band, Below 1 GHz 2.4GHz Transmitter 802.11b/g + 802.11a + CELL + PCS Signals

15.1 Test Specification

9kHz-1000 MHz, F.C.C., Part 15, Subpart C

15.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The frequency range 9 kHz-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30 MHz, the loop antenna was rotated on its vertical axis, The antenna height (center of loop) was 1 meter.

In the frequency range 30-1000 MHz, the readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods:

Turning the E.U.T on and off.
Using a frequency span less than 10 MHz.
Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

The E.U.T. was tested at the operating frequencies of 2412, 2437, and 2462 MHz using the following modulations: DBPSK, BPSK, CCK, and 64QAM.

15.3 Test Data

JUDGEMENT: Passed

No signals were found in the frequency band 9 kHz-1000 MHz.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification.

The results for all three operating frequencies and modulations were the same.

TEST PERSONNEL:

Tester Signature: _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

15.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	November 12, 2007	1 year
RF Section	HP	85420E	3427A00103	November 12, 2007	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	March 22, 2007	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 22, 2007	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 15, 2007	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

15.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[dB\mu v/m]\ FS = RA + AF + CF$$

FS:	Field Strength [dBμv/m]
RA:	Receiver Amplitude [dBμv]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

No external pre-amplifiers are used.

16. Spurious Radiated Emission in the Restricted Band, Above 1 GHz 2.4GHz Transmitter 802.11b/g + 802.11a + CELL + PCS Signals

16.1 Radiated Emission Above 1 GHz

The E.U.T operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.
In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used.
In the frequency range 2.9-25.0 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.
The test distance was 3 meters.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The E.U.T. was tested at the operating frequencies of 2412, 2437, and 2462 MHz using the following modulations: DBPSK, BPSK, CCK, and 64QAM.

16.2 Test Data

JUDGEMENT: Passed by 12.9

For the operation frequency of 2412 MHz, the margin between the emission level and the specification limit is 21.9in the worst case at the frequency of 4824.00 MHz, horizontal polarization.

For the operation frequency of 2437 MHz, the margin between the emission level and the specification limit is 22.0 dB in the worst case at the frequency of 4874.00 MHz, horizontal polarization.

For the operation frequency of 2462 MHz, the margin between the emission level and the specification limit is 12.9 dB in the worst case at the frequency of 4924.00 MHz, horizontal polarization.

The results for all modulations were the same.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification.

TEST PERSONNEL:

Tester Signature: _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

Radiated Emission Above 1 GHz

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Peak
Operation Frequency: 2412 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
4824.00	H	43.6*	74.0	-30.4
4824.00	V	42.4*	74.0	-31.6

Figure 163. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Average
Operation Frequency: 2412 MHz

Freq.	Polarity	Average Amp	Average Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
4824.00	H	32.1*	54.0	-21.9
4824.00	V	31.8*	54.0	-22.2

Figure 164. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Amp" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Peak
Operation Frequency: 2437 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
4874.00	H	42.7*	74.0	-31.3
4874.00	V	42.0*	74.0	-32.0

Figure 165. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Average
Operation Frequency: 2437 MHz

Freq.	Polarity	Average Amp	Average Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
4874.00	H	32.0*	54.0	-22.0
4874.00	V	31.5*	54.0	-22.5

Figure 166. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Amp" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission Above 1 GHz

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Peak
Operation Frequency: 2462 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
2483.50	H	53.2**	74.0	-20.8
2483.50	V	53.1**	74.0	-20.9
4924.00	H	41.6*	74.0	-32.4
4924.00	V	41.3*	74.0	-32.7

Figure 167. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

**"Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Average
Operation Frequency: 2462 MHz

Freq.	Polarity	Average Amp	Average Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
2483.50	H	41.1**	54.0	-12.9
2483.50	V	40.7**	54.0	-13.3
4924.00	H	31.7*	54.0	-22.3
4924.00	V	31.4*	54.0	-22.6

Figure 168. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Amp" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

**"Correction Factor" = Antenna Factor + Cable Loss

16.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3411A00102	November 12, 2007	1 year
RF Section	HP	85420E	3427A00103	November 12, 2007	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	February 4, 2007	2 years
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 15, 2006	2 years
Horn Antenna	ARA	SWH-28	1008	December 8, 2006	2 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 2, 2007	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	February 8, 2007	1 year
Low Noise Amplifier	MK Milliwave	MKT6-3000 400-30-13P	399	February 8, 2007	1 year
Spectrum Analyzer	HP	8593EM	3536A00120	February 26, 2008	1 year
Spectrum Analyzer	HP	8546E	3442A00275	November 14, 2007	1 year
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

17. 26 dB Bandwidth 2.4 GHz Transmitter 802.11b/g + 802.11a + CELL + PCS Signals

17.1 Test procedure

The E.U.T. was set to the applicable test frequency. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20 dB) and appropriate coaxial cable (cable loss = 1 dB). The spectrum analyzer was set to 100 kHz resolution BW. The spectrum bandwidth of the E.U.T. was measured and recorded.

The E.U.T. was tested at 2412, 2437, and 2462 MHz with the following modulations: DBPSK (1Mbit/sec), BPSK (6Mbit/sec), CCK (11Mbit/sec) and 64QAM (54Mbit/sec).

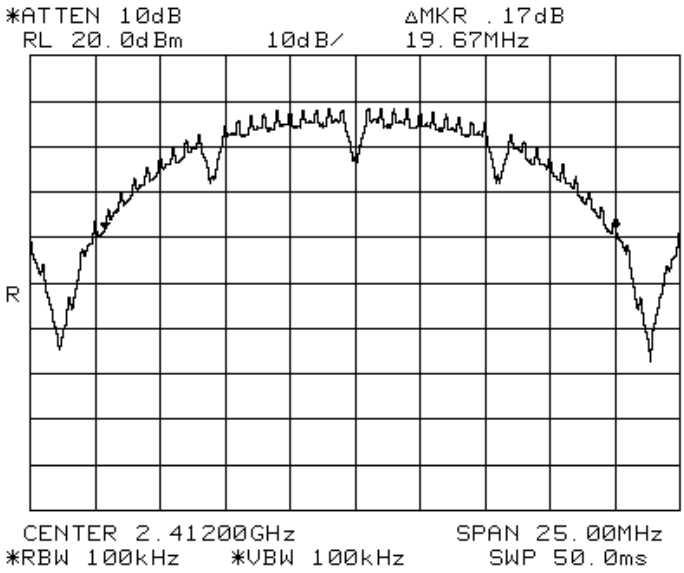

Figure 169 —2412 MHz DBPSK

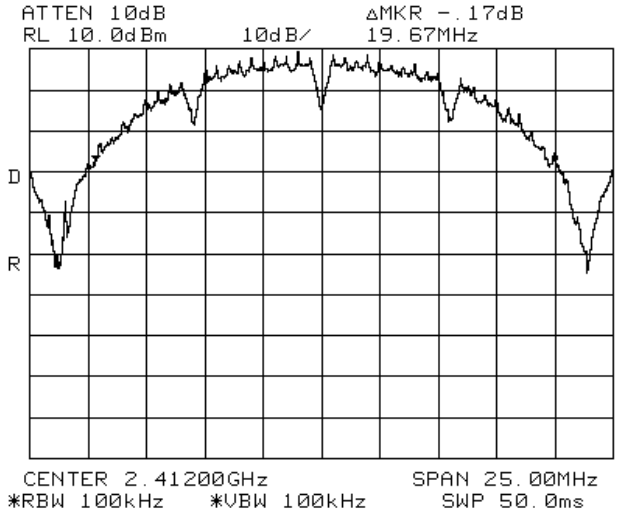

Figure 170 —2412 MHz BPSK

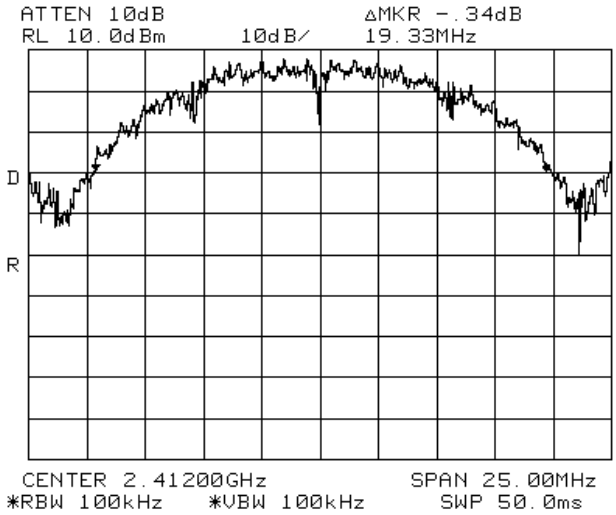

Figure 171 —2412 MHz CCK

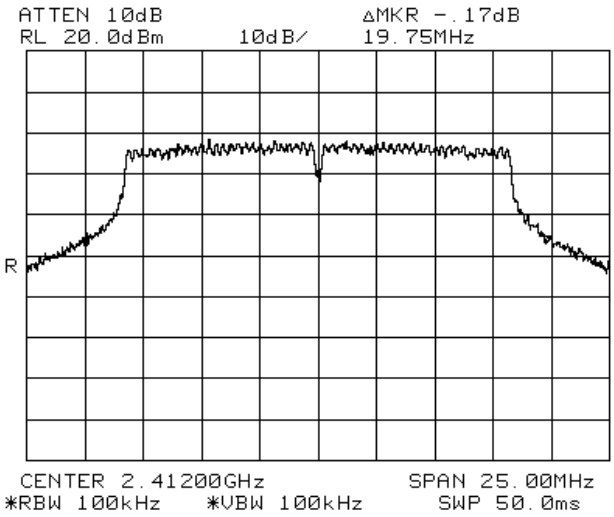

Figure 172 —2412 MHz 64QAM

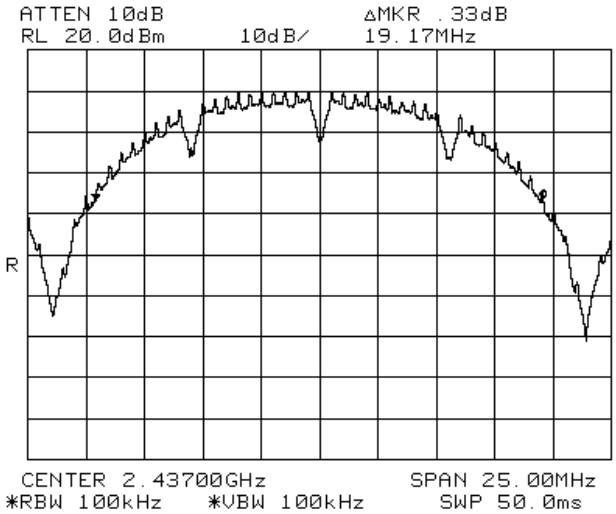

Figure 173 —2437 MHz DBPSK

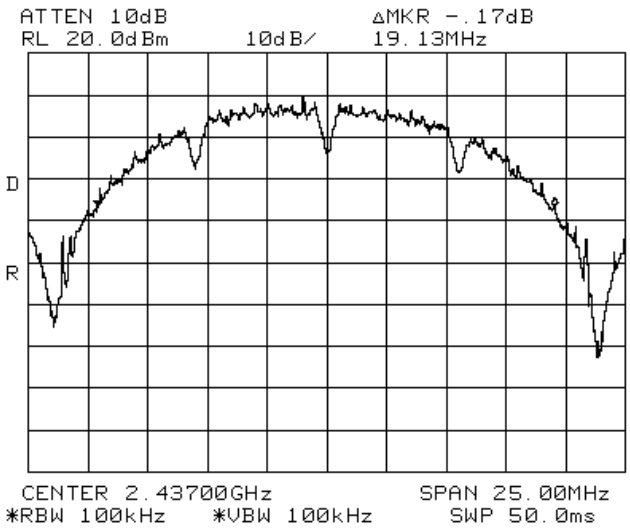

Figure 174 —2437 MHz BPSK

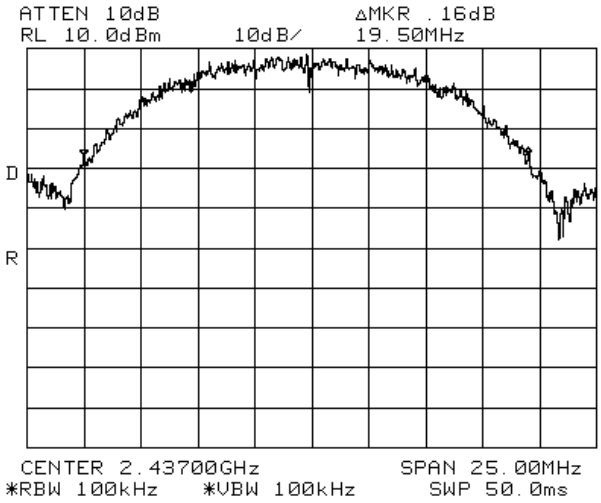

Figure 175 —2437 MHz CCK

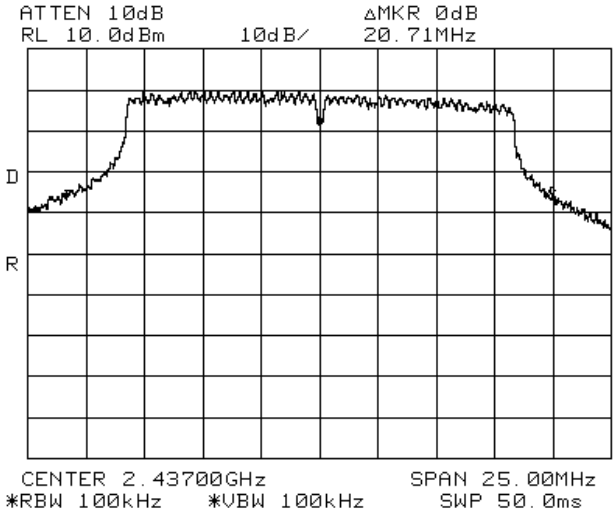

Figure 176 —2437 MHz 64QAM

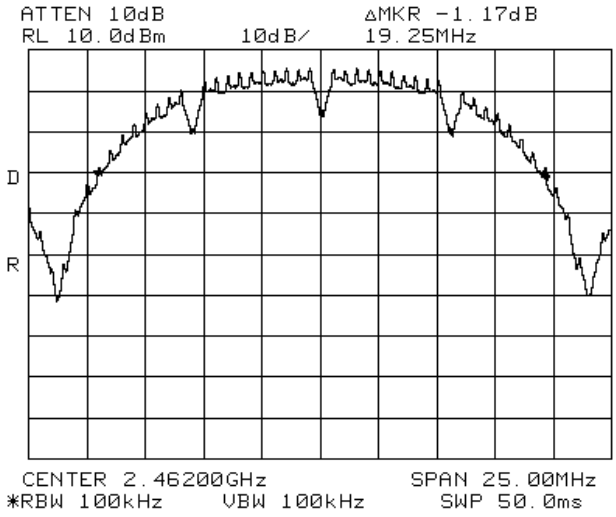

Figure 177 —2462 MHz DBPSK

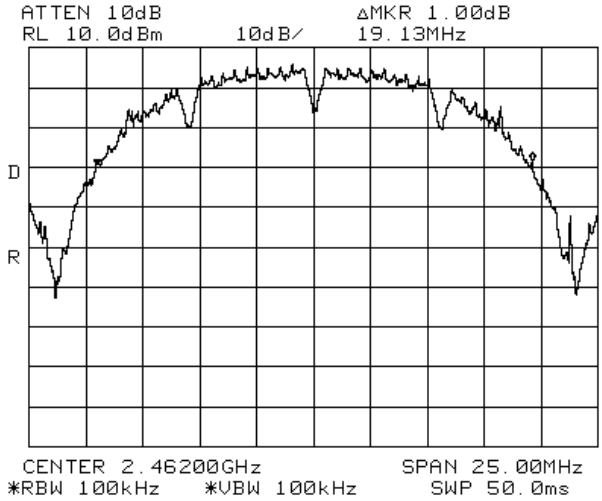

Figure 178 —2462 MHz BPSK

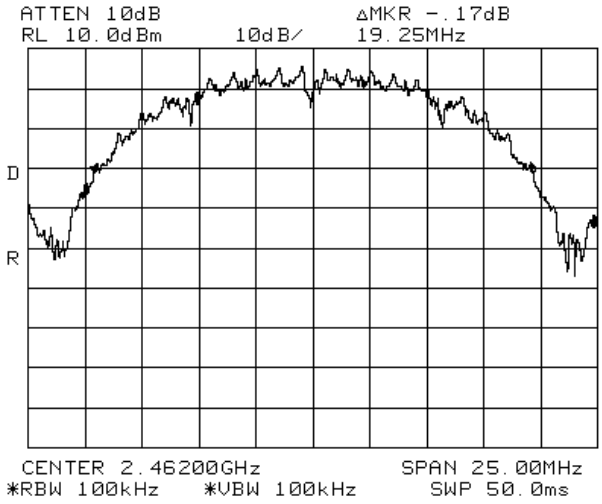

Figure 179 —2462 MHz CCK

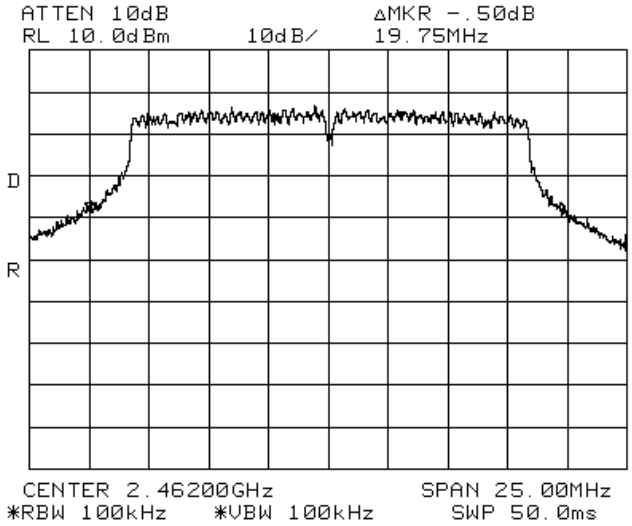

Figure 180 —2462 MHz 64QAM

Operation Frequency (MHz)	Modulation	26 dB Bandwidth (dBm)
2412	DBPSK	19.67
	BPSK	19.67
	CCK	19.33
	64QAM	19.75
2437	DBPSK	19.147
	BPSK	19.13
	CCK	19.50
	64QAM	20.71
2462	DBPSK	19.25
	BPSK	19.13
	CCK	19.25
	64QAM	19.75

TEST PERSONNEL:

Tester Signature: _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

17.2 Test Equipment Used.

26 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	May 9, 2007	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

Figure 181 Test Equipment Used

18. Maximum Transmitted Peak Power Output 2.4 GHz Transmitter 802.11b/g + 802.11a + CELL + PCS Signals

18.1 Test procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator (20 dB) and an appropriate coaxial cable (cable loss = 1 dB). The Spectrum Analyzer was set to 1.0 MHz resolution BW. Peak power level was measured at selected operation frequencies.

The E.U.T. was tested at 2412, 2437, and 2462 MHz with the following modulations: DBPSK (1Mbit/sec), BPSK (6Mbit/sec), CCK (11Mbit/sec) and 64QAM (54Mbit/sec).

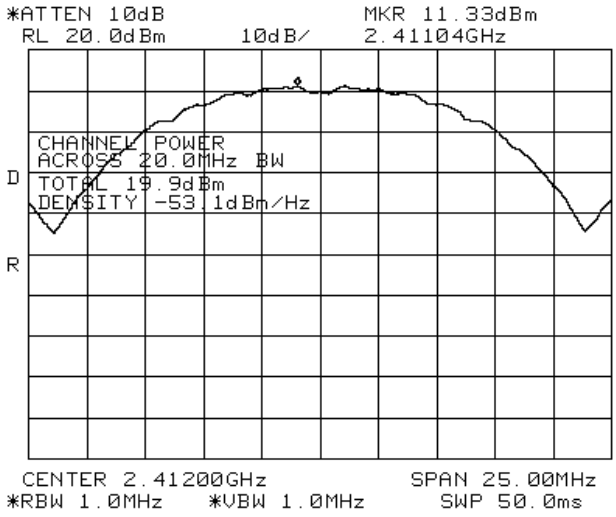

Figure 182 2412 MHz DBPSK

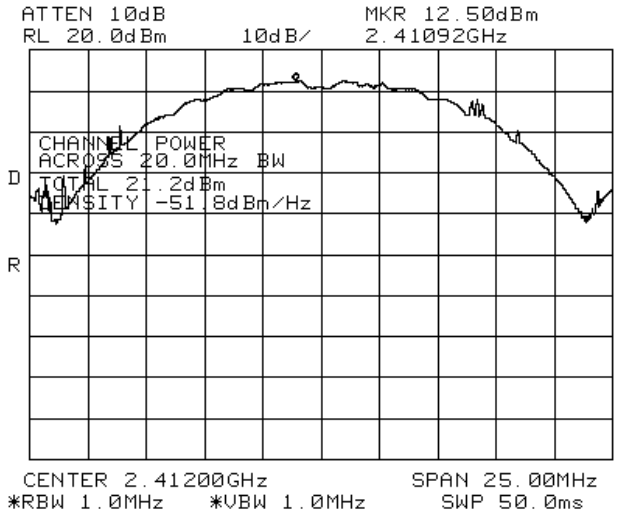

Figure 183 2412 MHz BPSK

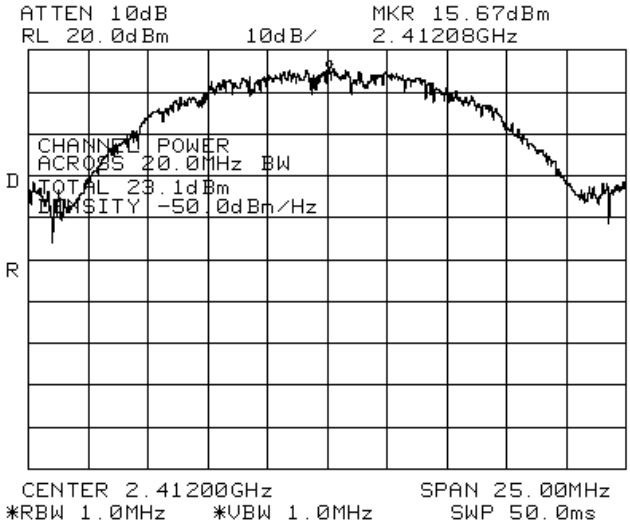

Figure 184 2412 MHz CCK

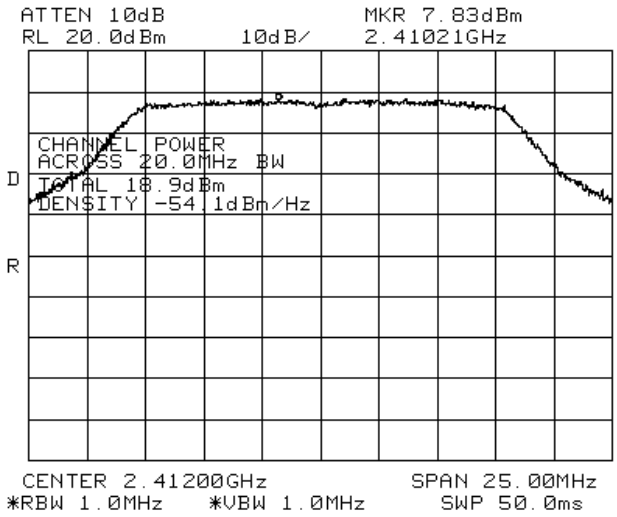

Figure 185 2412 MHz 64QAM

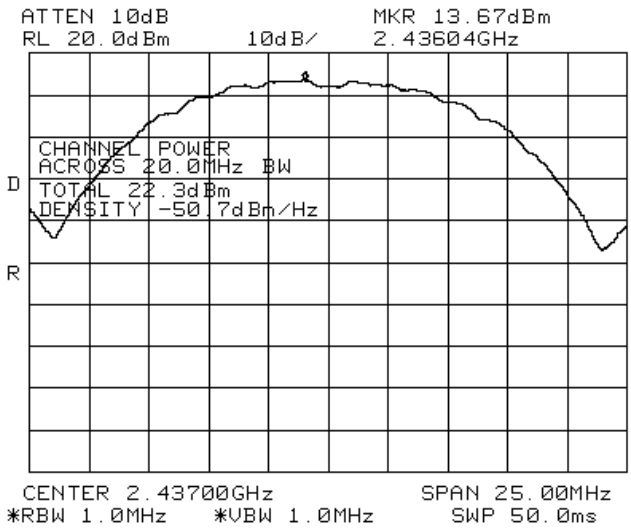

Figure 186 2437 MHz DBPSK

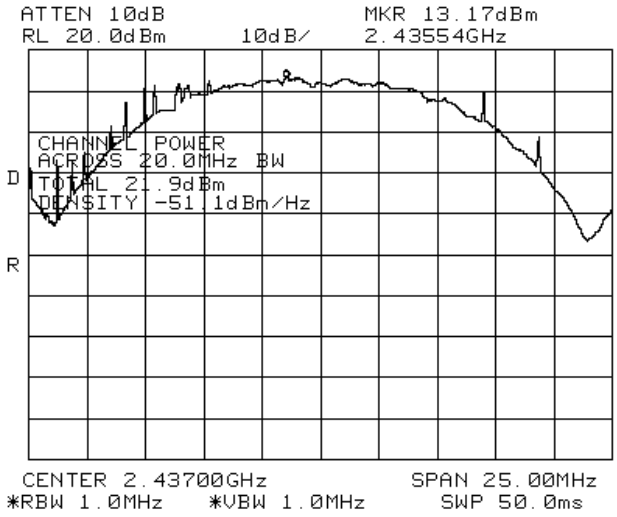

Figure 187 2437 MHz BPSK

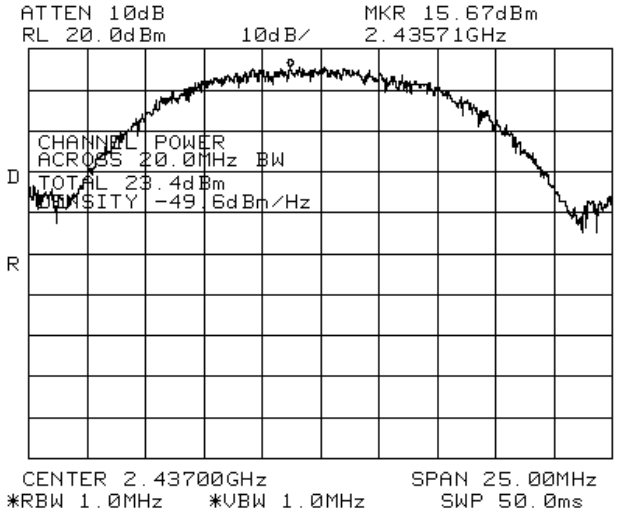

Figure 188 2437 MHz CCK

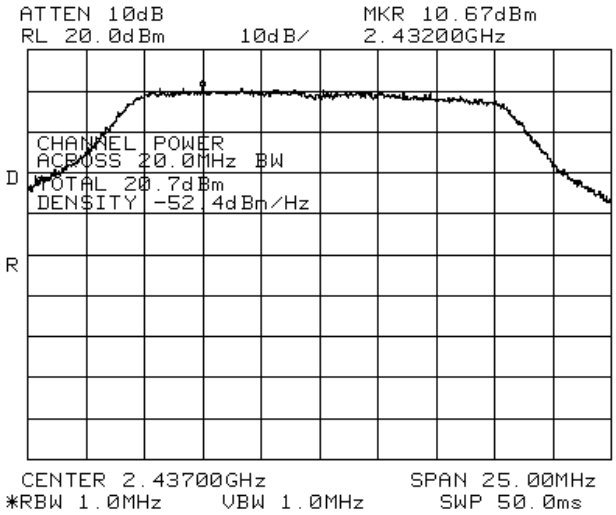

Figure 189 2437 MHz 64QAM

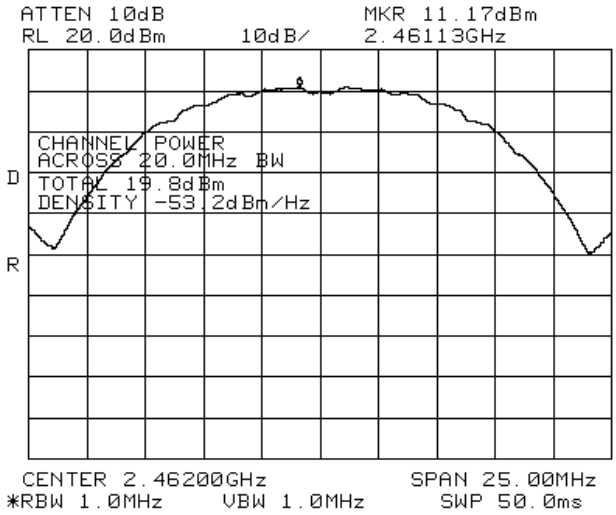

Figure 190 2462 MHz DBPSK

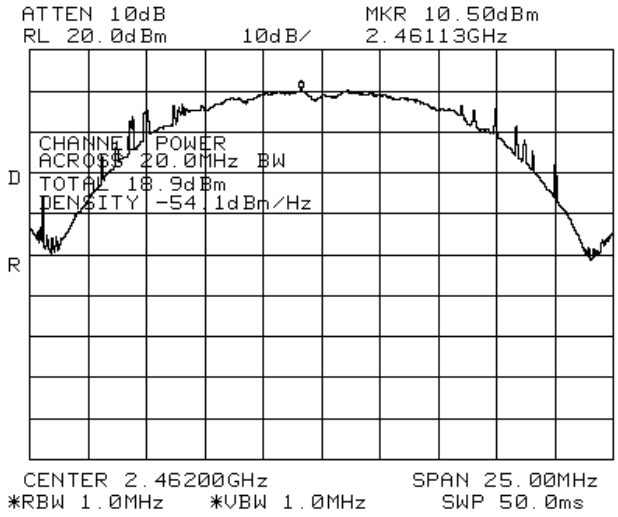

Figure 191 2462 MHz BPSK

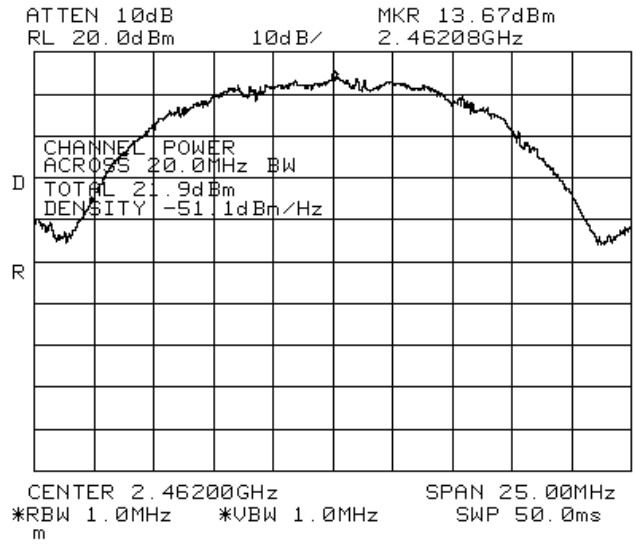

Figure 192 2462 MHz CCK

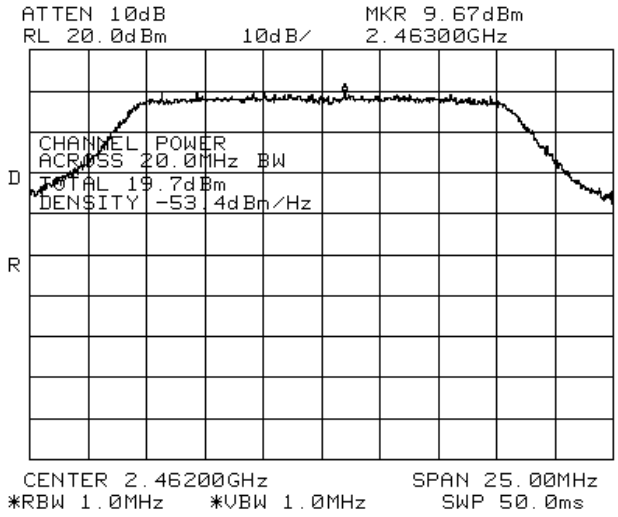

Figure 193 2462 MHz 64QAM

18.2 Results table

E.U.T. Description: WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Model No.: 860M With WCE
Serial Number: 1. 860M: 73903D 2. WCE: 739038
Specification: F.C.C. Part 15, Subpart C

Operation Frequency (MHz)	Modulation	Power (dBm)	Specification (dBm)	Margin (dB)
2412	DBPSK	19.9	29.0	-9.1
	BPSK	21.2	29.0	-7.8
	CCK	23.1	29.0	-5.9
	64QAM	18.9	29.0	-10.1
2437	DBPSK	22.3	29.0	-6.7
	BPSK	21.9	29.0	-7.1
	CCK	23.4	29.0	-5.6
	64QAM	20.7	29.0	-8.3
2462	DBPSK	19.8	29.0	-9.2
	BPSK	18.9	29.0	-10.1
	CCK	21.9	29.0	-7.1
	64QAM	19.7	29.0	-9.3

Figure 194 Maximum Peak Power Output

Note: Antenna Gain is 7 dBi

JUDGEMENT: Passed by 5.6 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

18.3 Test Equipment Used.

Peak Power Output

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	May 9, 2007	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

Figure 195 Test Equipment Used

19. Peak Power Output Out of 2400-2483.5 MHz Band 2.4 GHz Transmitter 802.11 b/g +a + CELL + PCS Signals

19.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20 dB) and an appropriate coaxial cable (cable loss = 1 dB). The spectrum analyzer was set to 100 kHz resolution BW except for the frequency range
9 kHz-150 kHz where the RBW was set to 1kHz and the frequency range
150 kHz-10 MHz where the RBW was set to 10kHz. The frequency range from 9 kHz to 25 GHz was scanned. Level of spectrum components out of the 2400-2483.5 MHz was measured at the selected operation frequencies.

The E.U.T. was tested at 2412, 2437, and 2462 MHz with the following modulations: DBPSK (1Mbit/sec), BPSK (6Mbit/sec), CCK (11Mbit/sec) and 64QAM (54Mbit/sec).

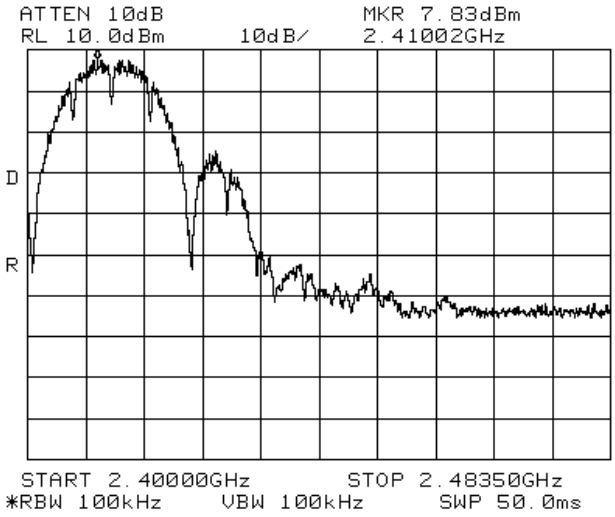

Figure 196 —2412 MHz DBPSK

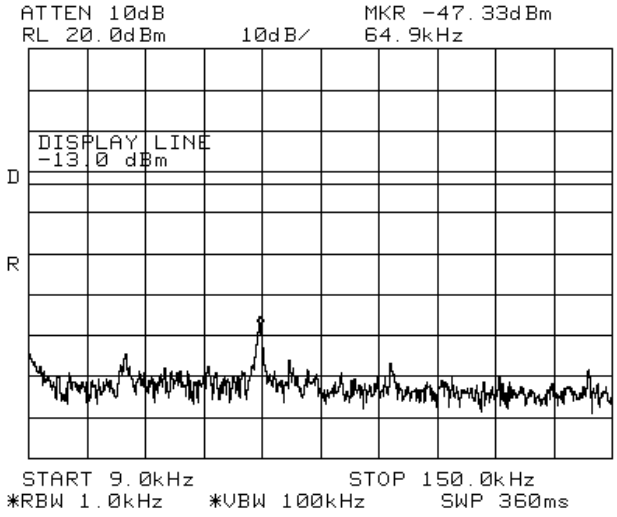

Figure 197 —2412 MHz DBPSK

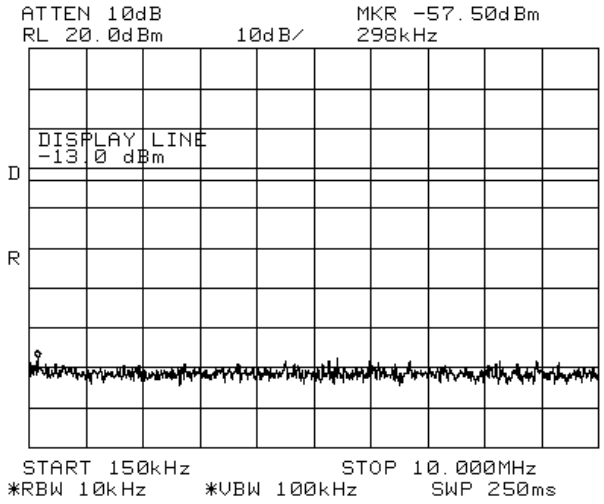

Figure 198 —2412 MHz DBPSK

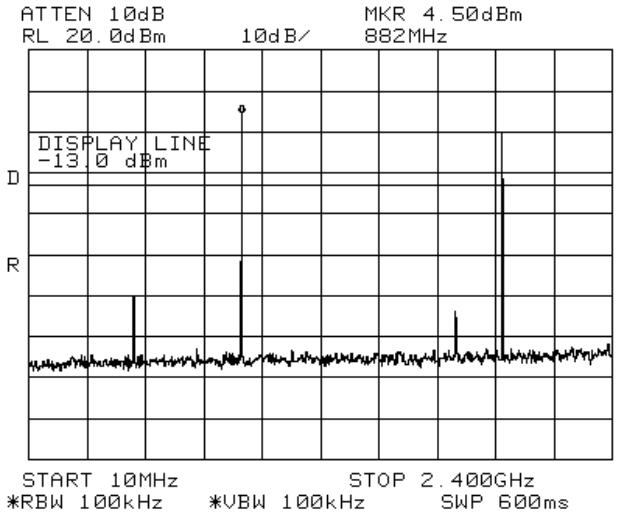

Figure 199 —2412 MHz DBPSK

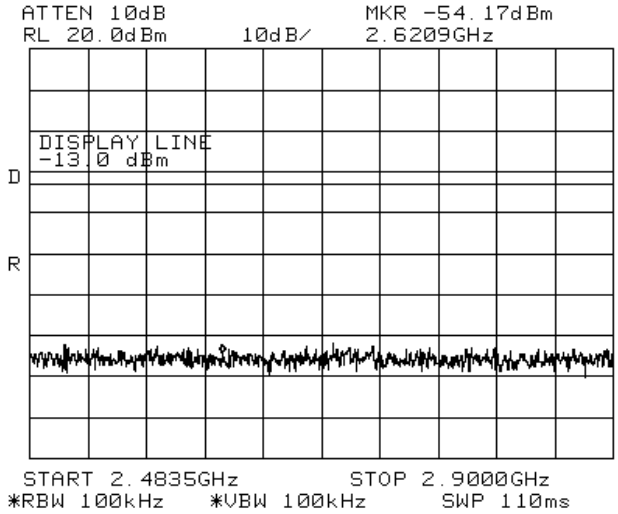

Figure 200 —2412 MHz DBPSK

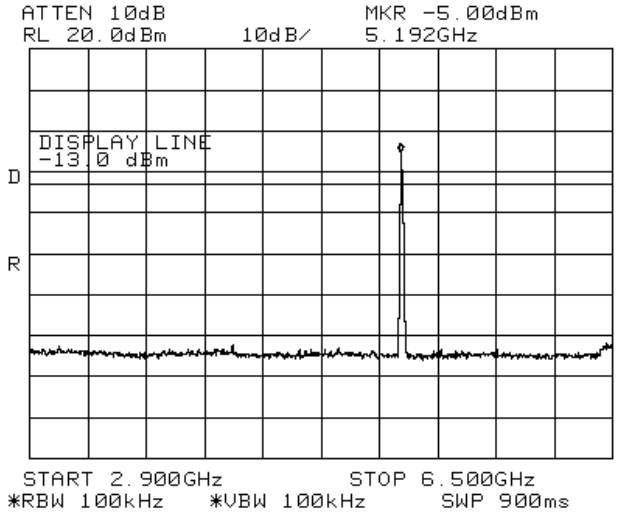

Figure 201 —2412 MHz DBPSK

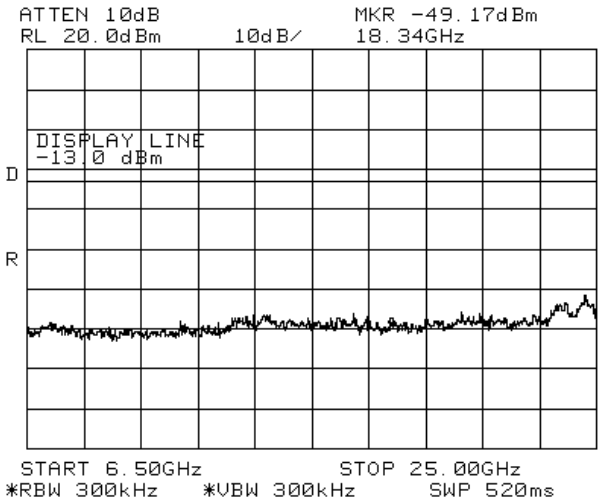

Figure 202 —2412 MHz DBPSK

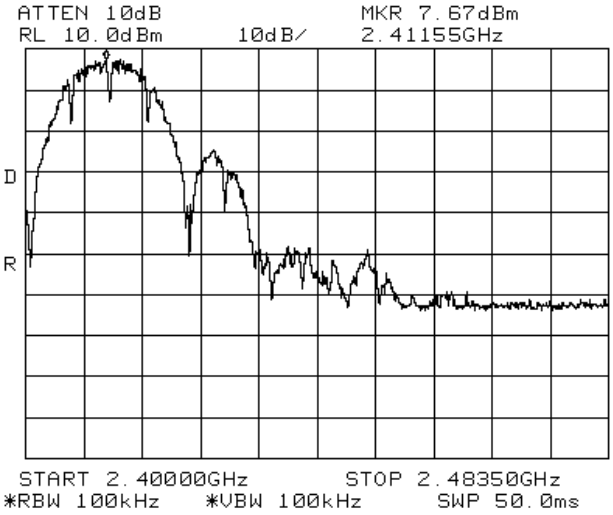

Figure 203 —2412 MHz BPSK

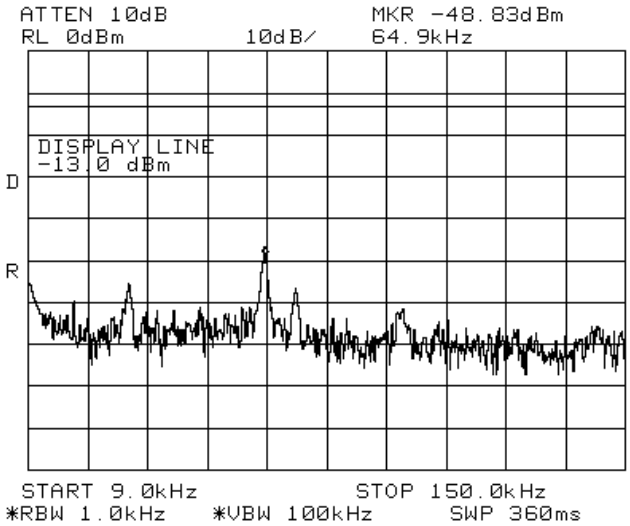

Figure 204 —2412 MHz BPSK

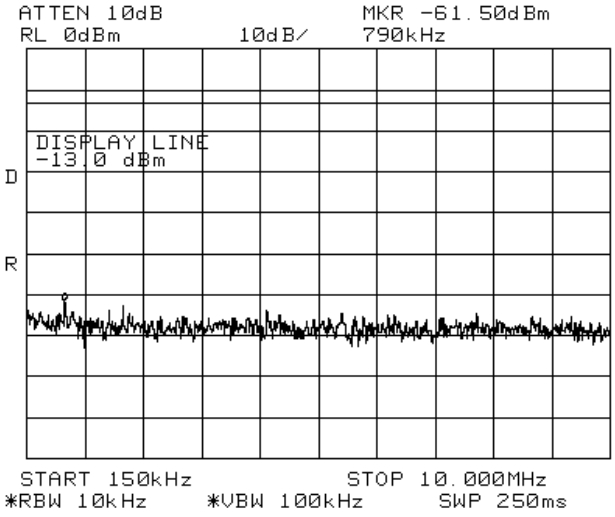

Figure 205 —2412 MHz BPSK

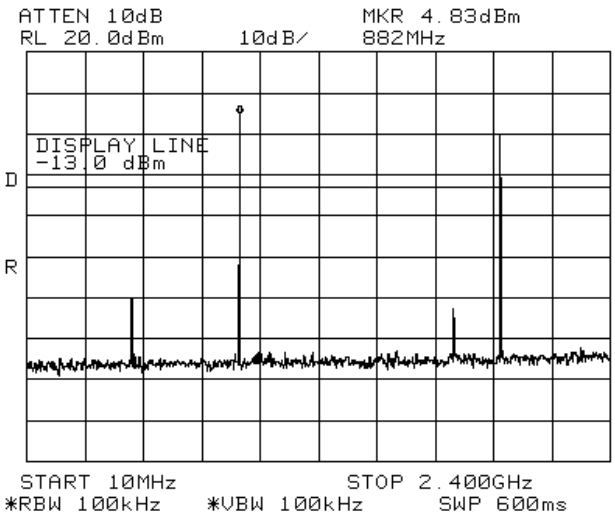

Figure 206 —2412 MHz BPSK

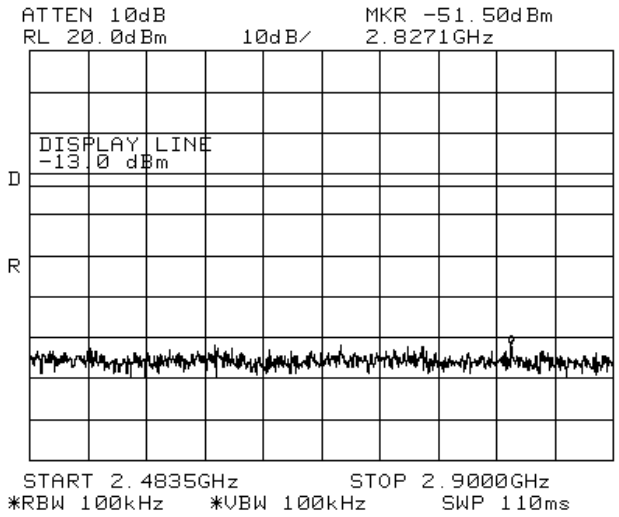

Figure 207 —2412 MHz BPSK

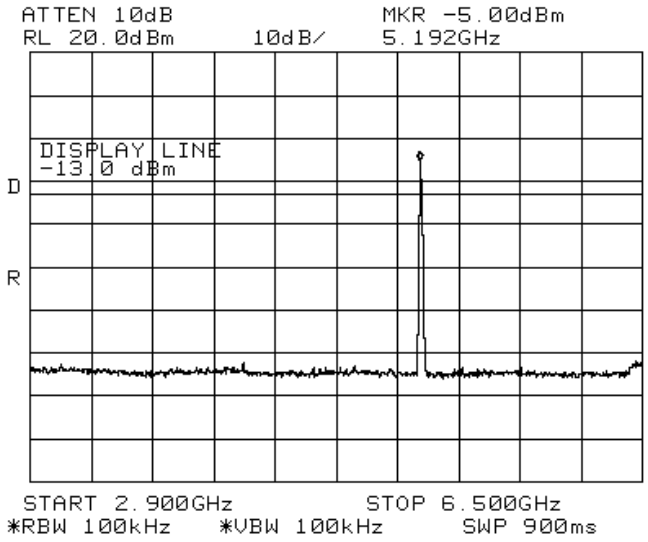

Figure 208 —2412 MHz BPSK

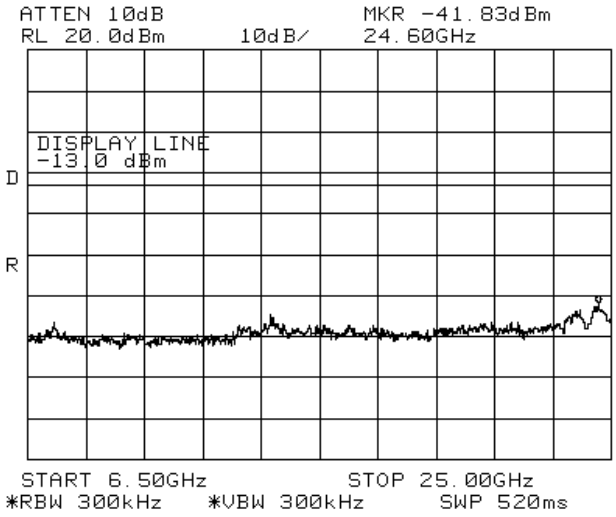

Figure 209 —2412 MHz BPSK

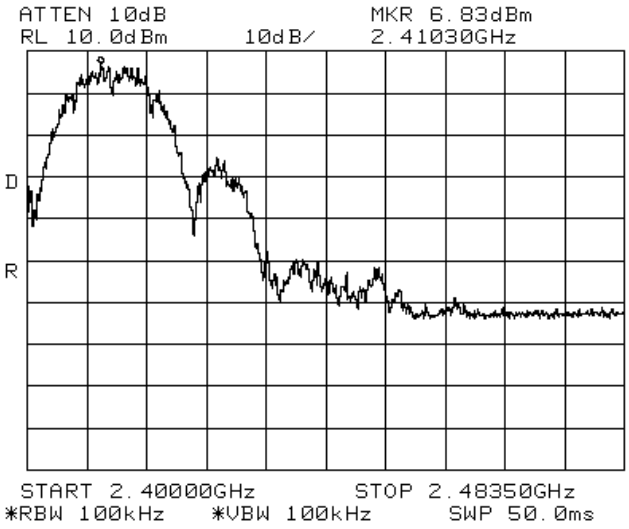

Figure 210 —2412 MHz CCK

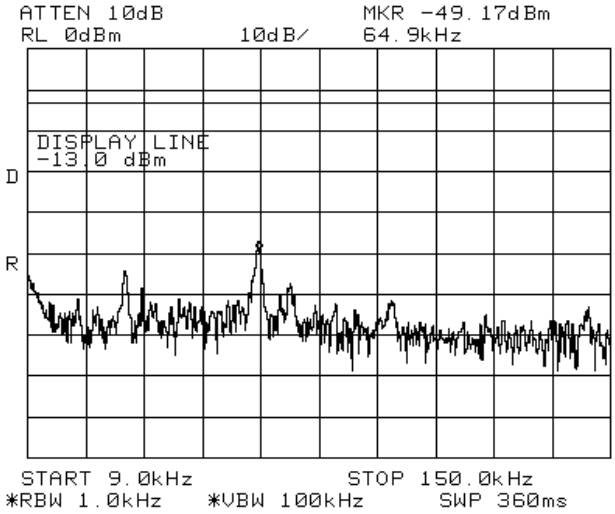

Figure 211 —2412 MHz CCK

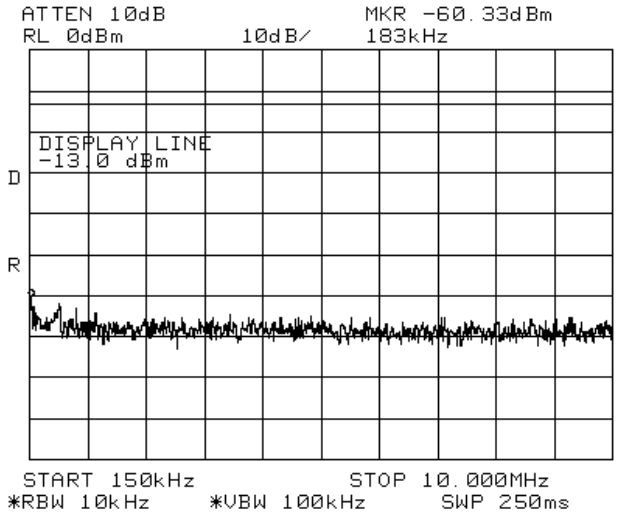

Figure 212 —2412 MHz CCK

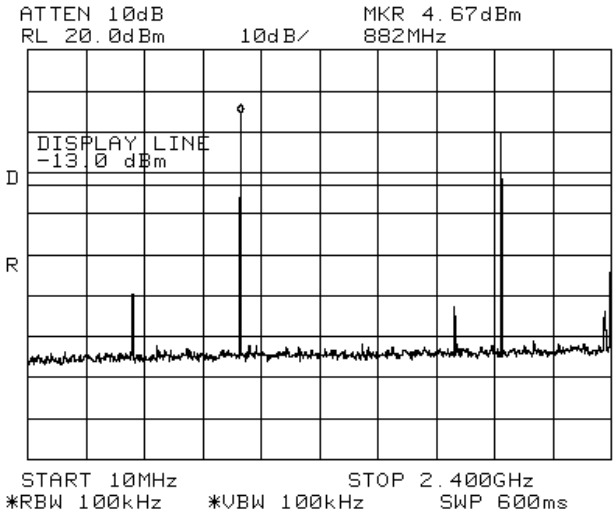

Figure 213 —2412 MHz CCK

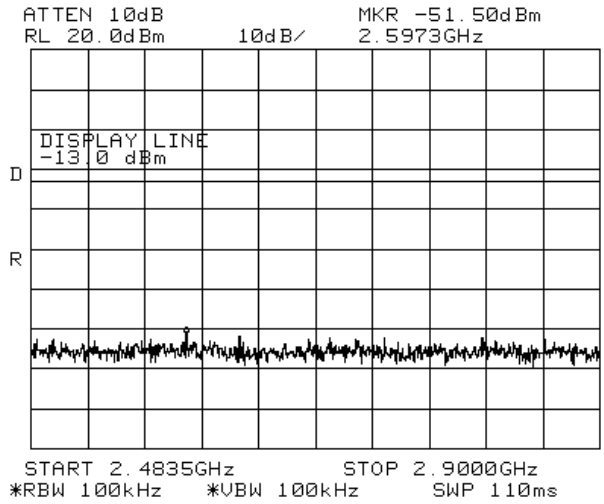

Figure 214 —2412 MHz CCK

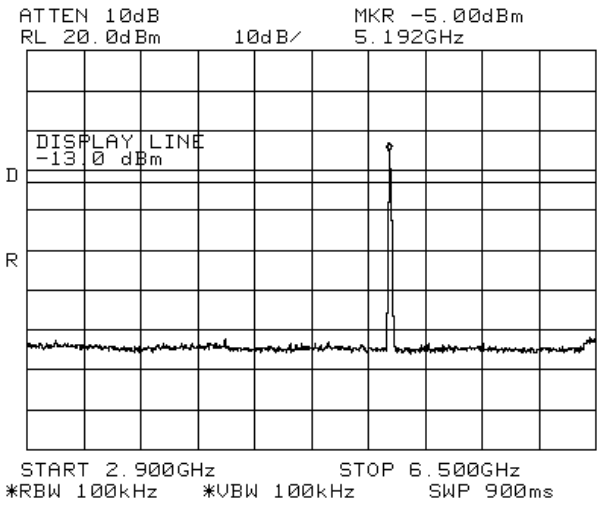

Figure 215 —2412 MHz CCK

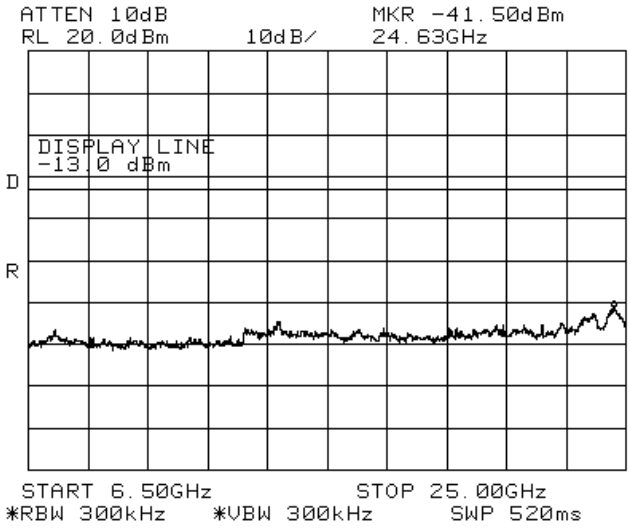

Figure 216 —2412 MHz CCK

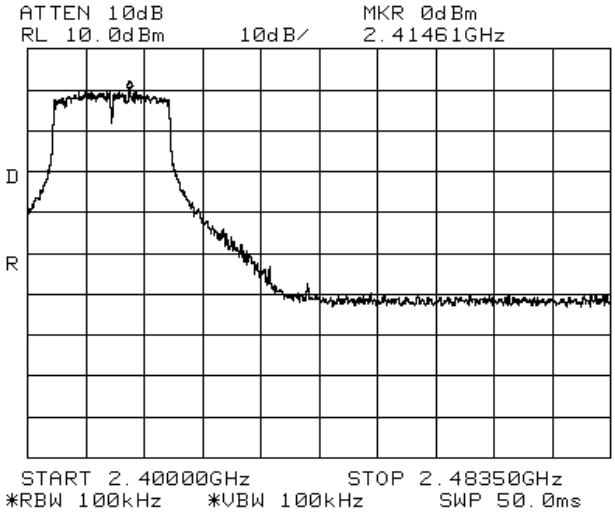

Figure 217 —2412 MHz 64QAM

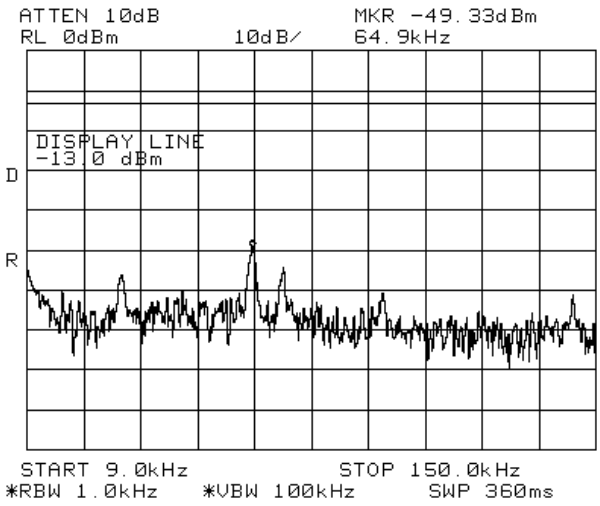

Figure 218 —2412 MHz 64QAM

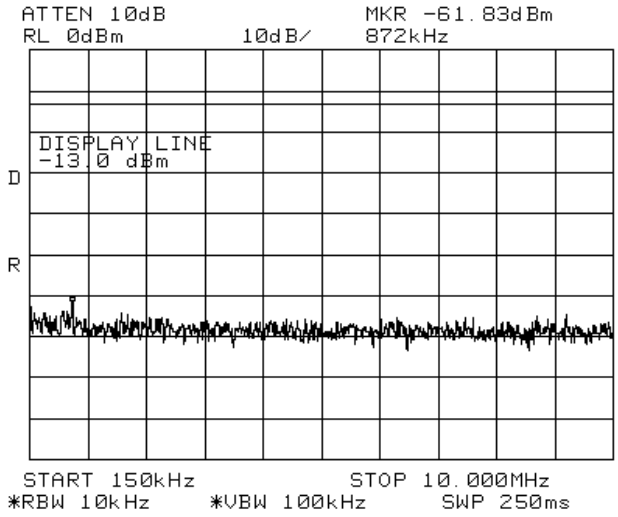

Figure 219 —2412 MHz 64QAM

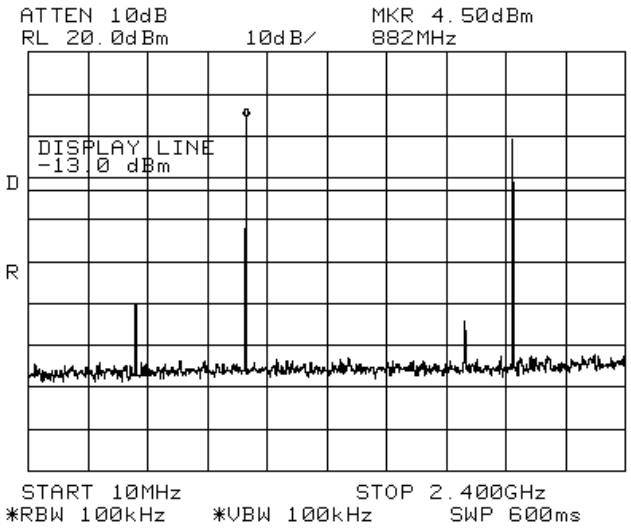

Figure 220 —2412 MHz 64QAM

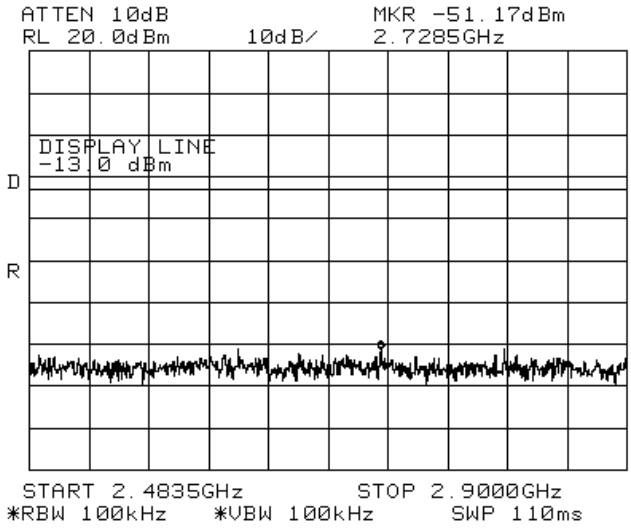

Figure 221 —2412 MHz 64QAM

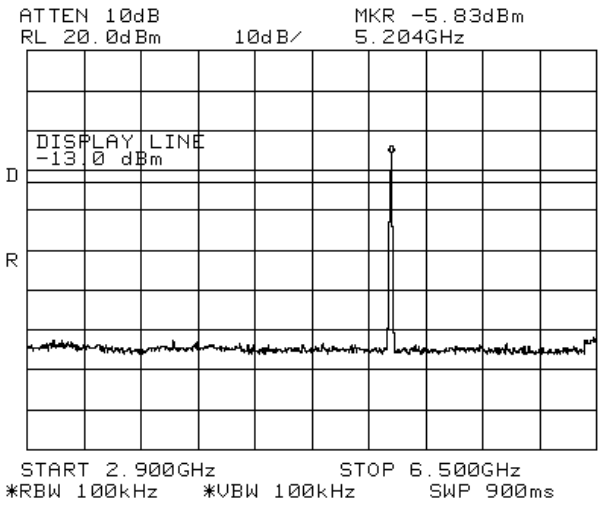

Figure 222 —2412 MHz 64QAM

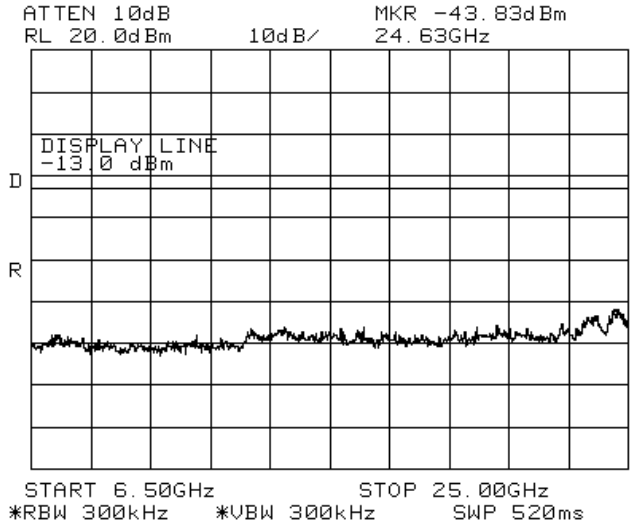

Figure 223 —2412 MHz 64QAM

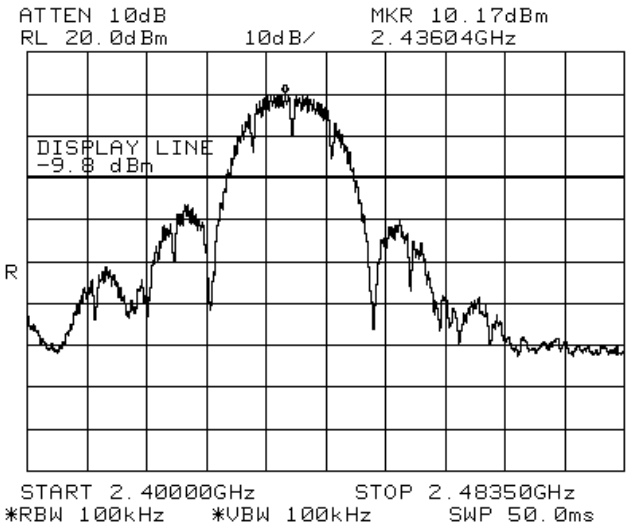

Figure 224 —2437 MHz DBPSK

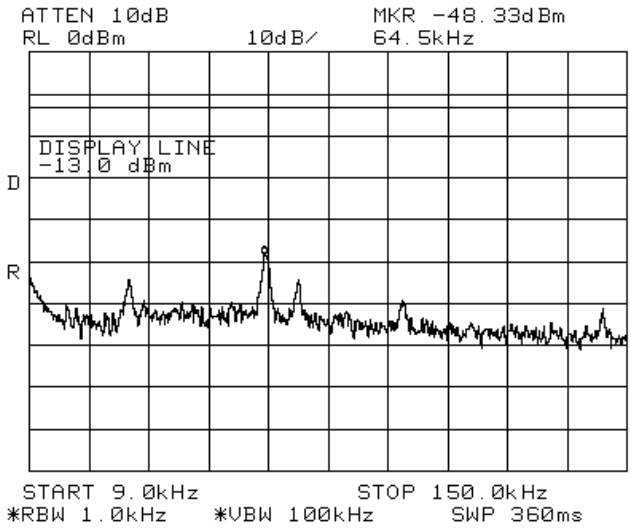

Figure 225 —2437 MHz DBPSK

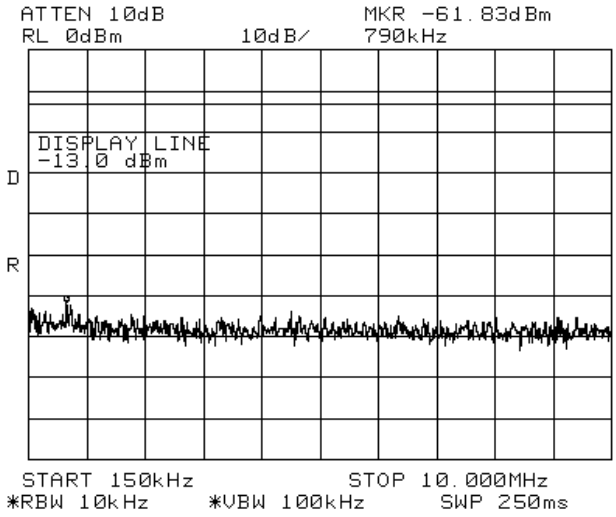

Figure 226 —2437 MHz DBPSK

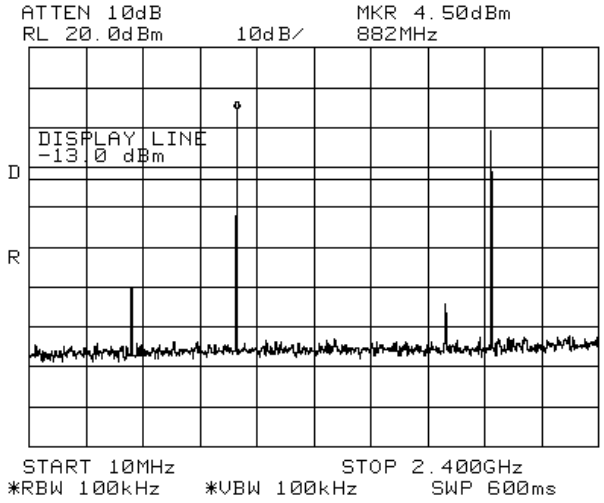

Figure 227 —2437 MHz DBPSK

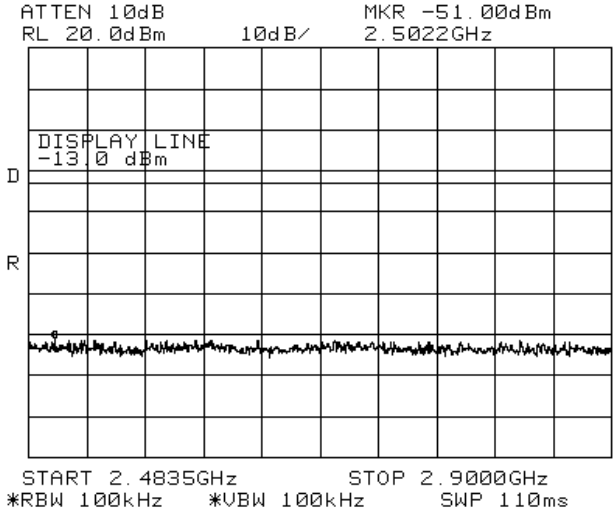

Figure 228 —2437 MHz DBPSK

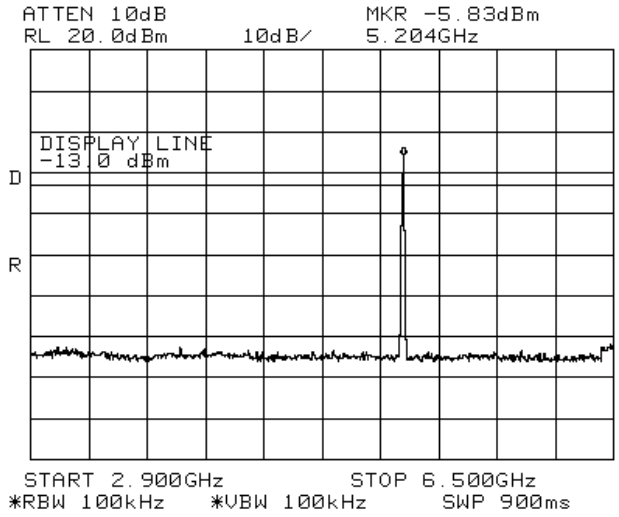

Figure 229 —2437 MHz DBPSK

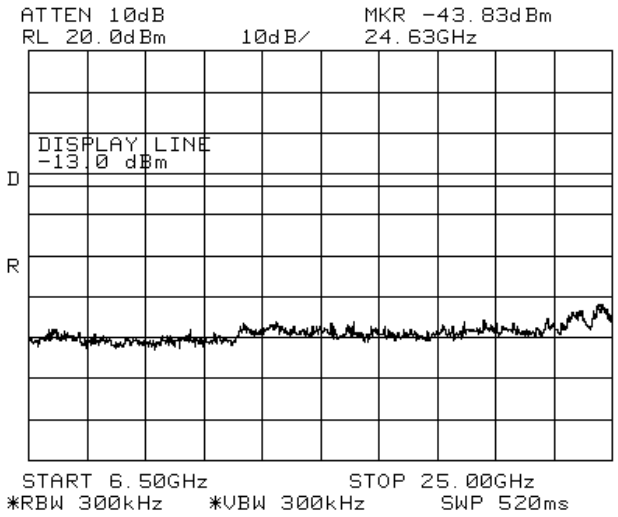

Figure 230 —2437 MHz DBPSK

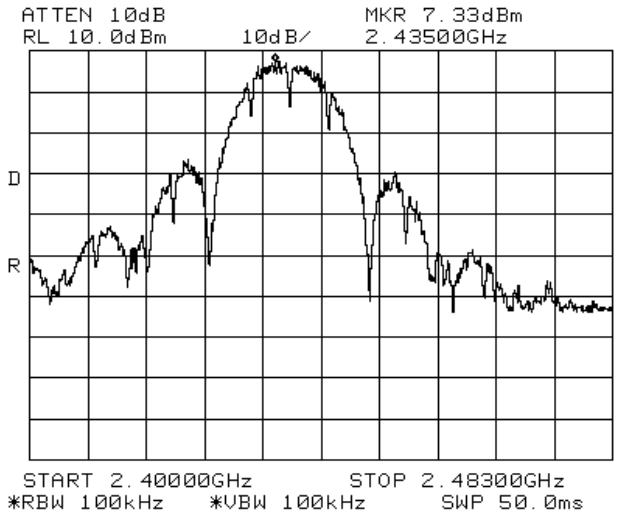

Figure 231 —2437 MHz BPSK

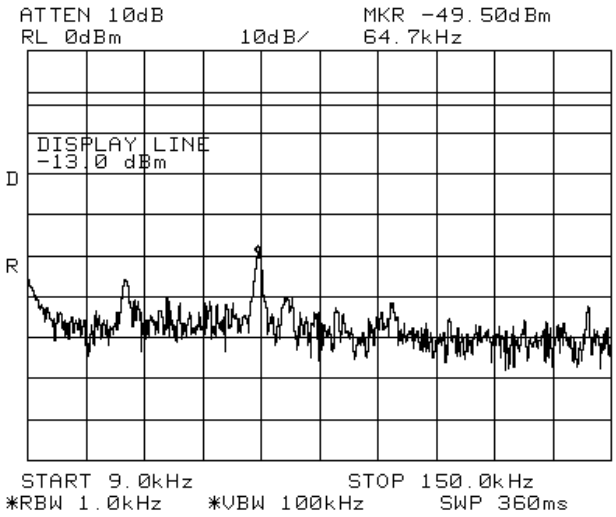

Figure 232 —2437 MHz BPSK

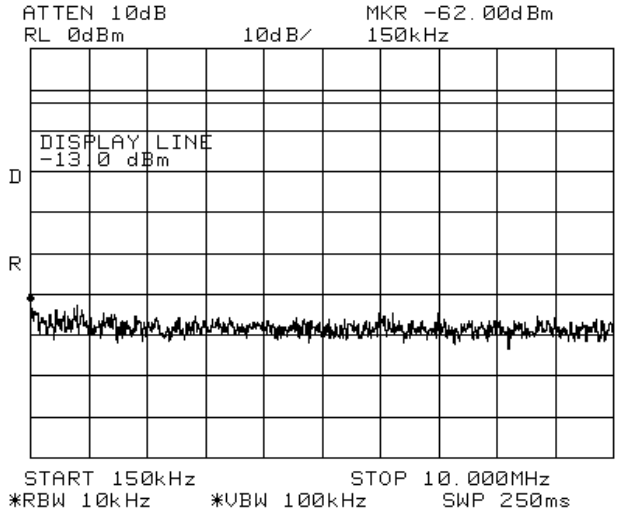

Figure 233 —2437 MHz BPSK

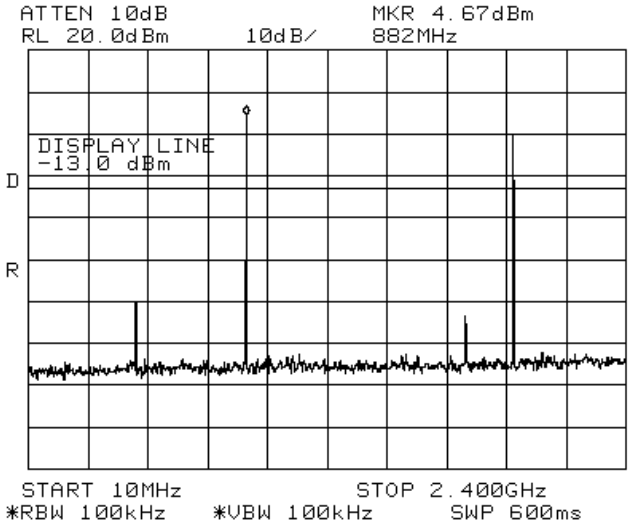

Figure 234 —2437 MHz BPSK

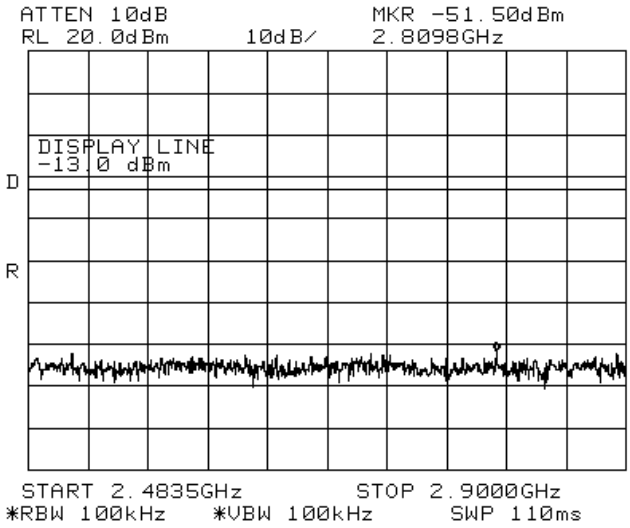

Figure 235 —2437 MHz BPSK

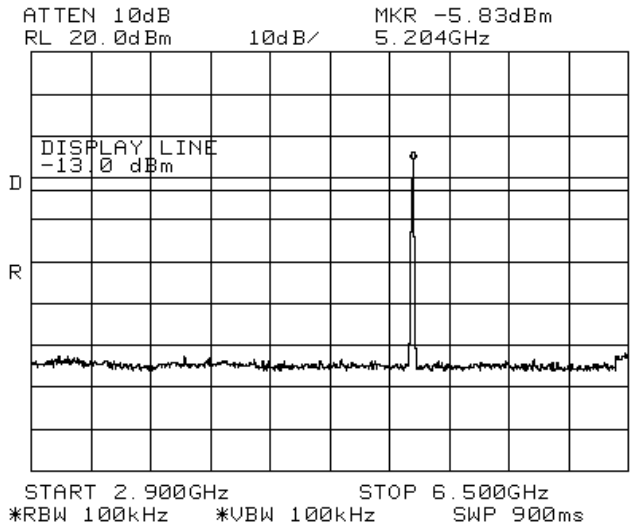

Figure 236 —2437 MHz BPSK

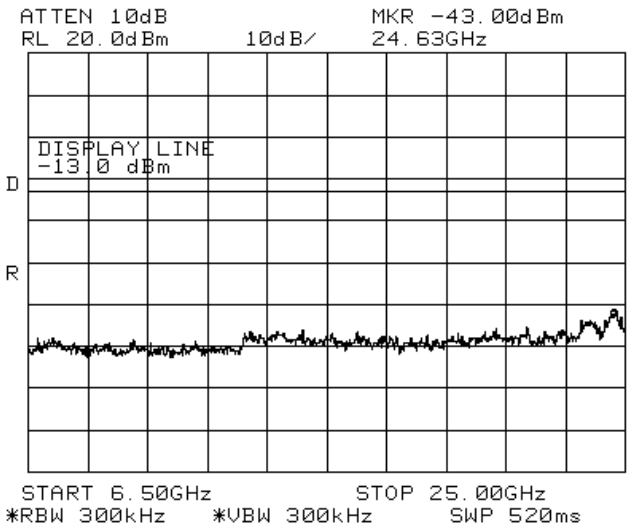

Figure 237 —2437 MHz BPSK

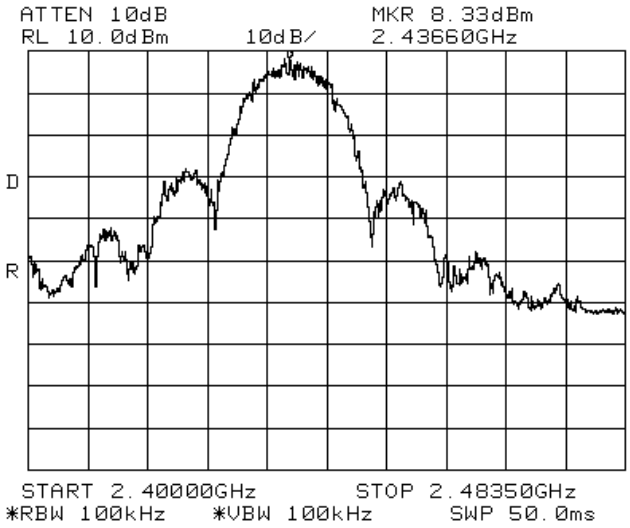

Figure 238 —2437 MHz CCK

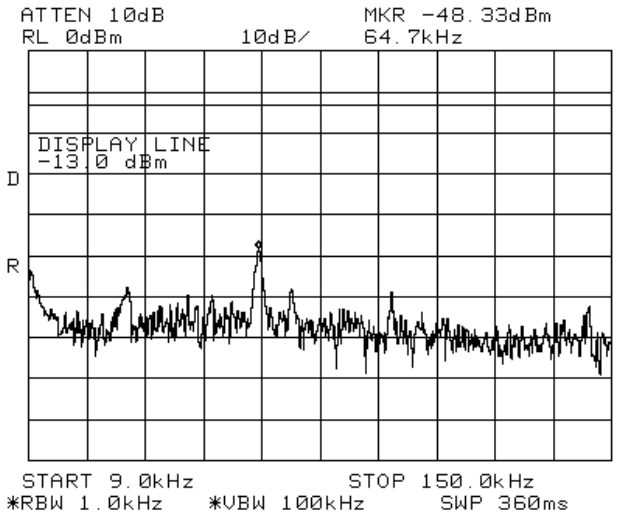

Figure 239 —2437 MHz CCK

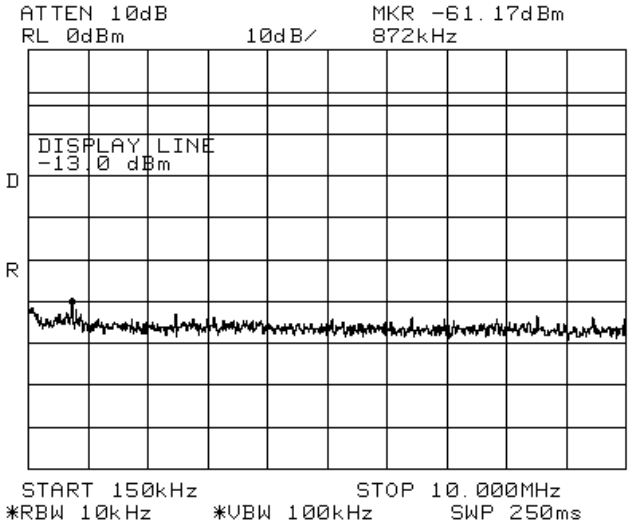

Figure 240 —2437 MHz CCK

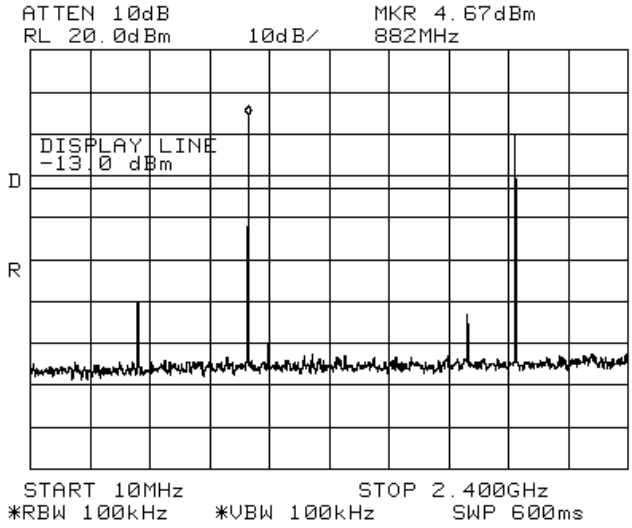

Figure 241 —2437 MHz CCK

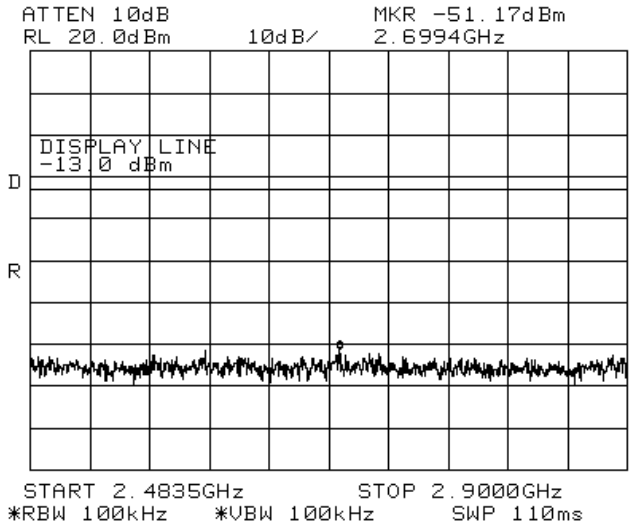

Figure 242 —2437 MHz CCK

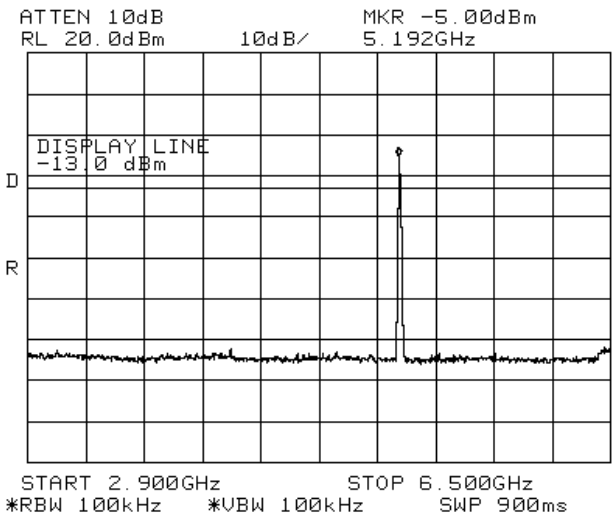

Figure 243 —2437 MHz CCK

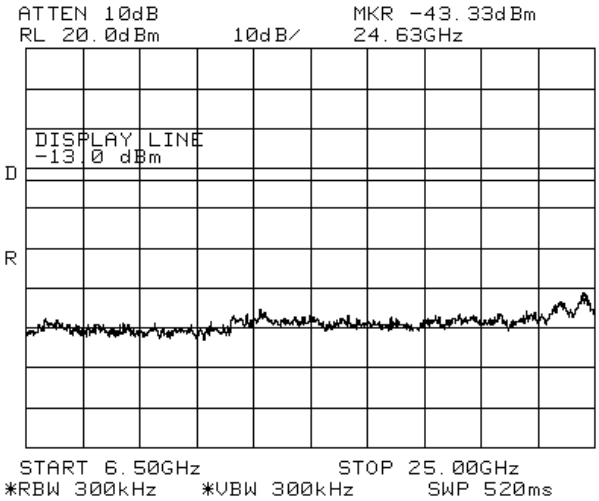

Figure 244 —2437 MHz CCK

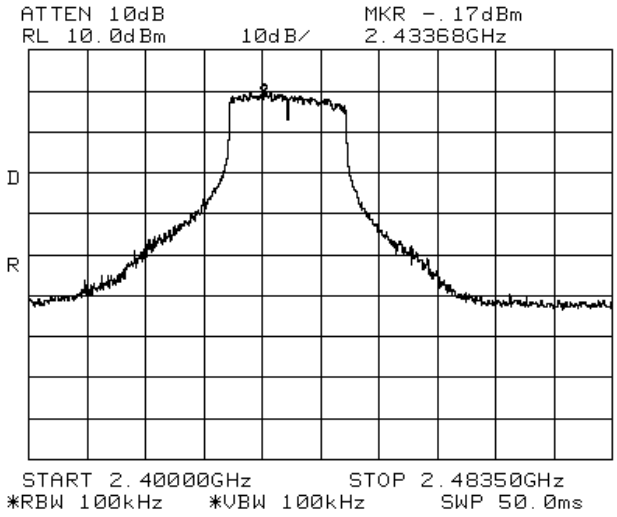

Figure 245 —2437 MHz 64QAM

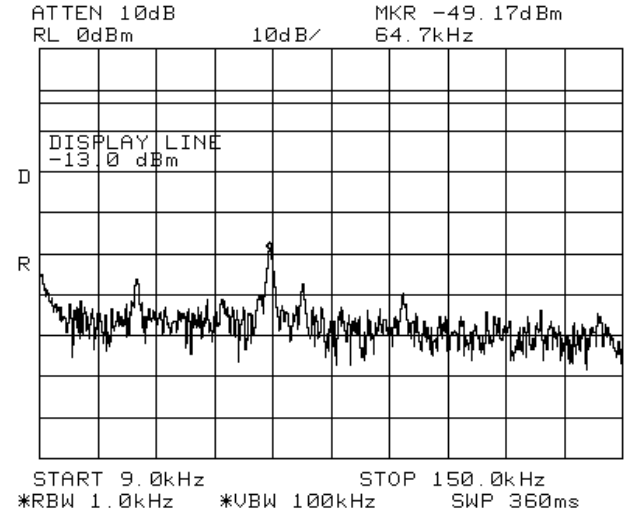

Figure 246 —2437 MHz 64QAM

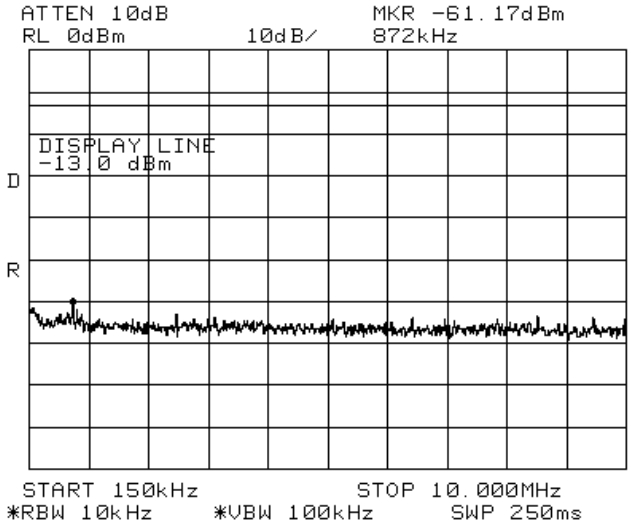

Figure 247 —2437 MHz 64QAM

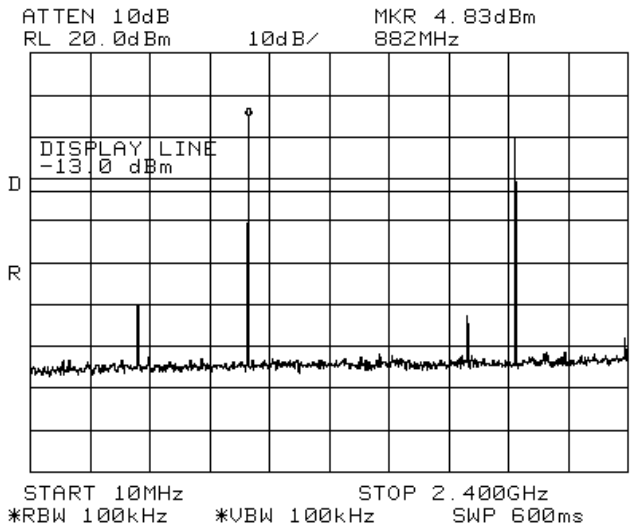

Figure 248 —2437 MHz 64QAM

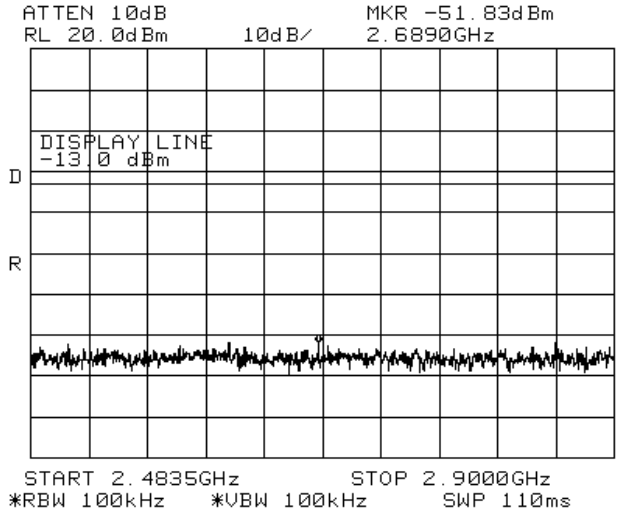

Figure 249 —2437 MHz 64QAM

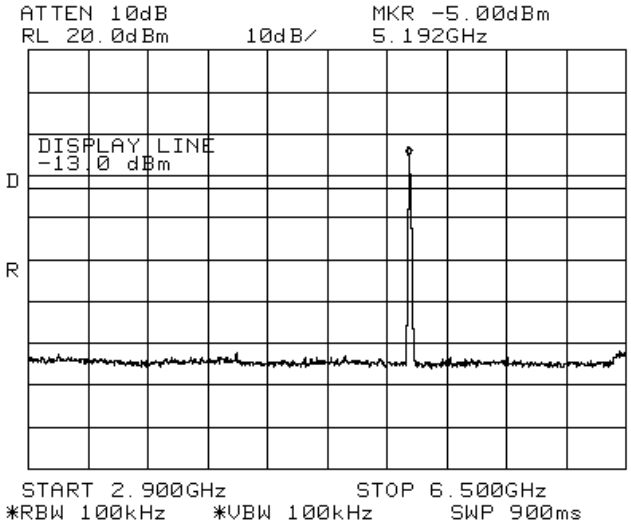

Figure 250 —2437 MHz 64QAM

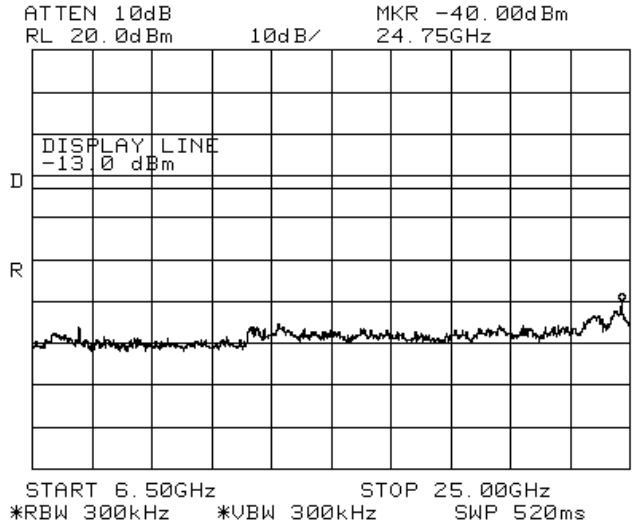

Figure 251 —2437 MHz 64QAM

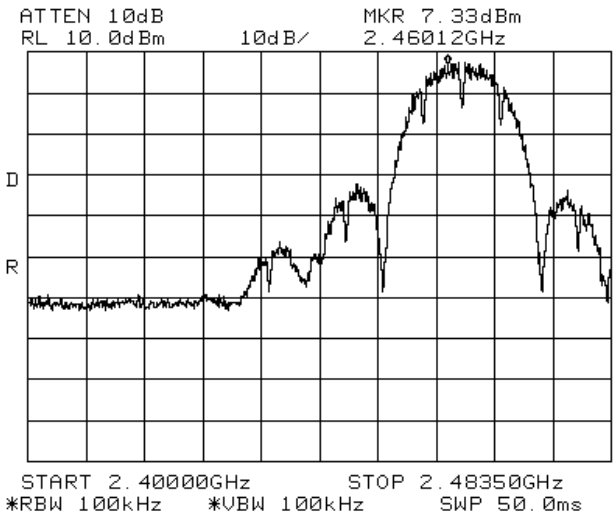

Figure 252 —2462 MHz DPSK

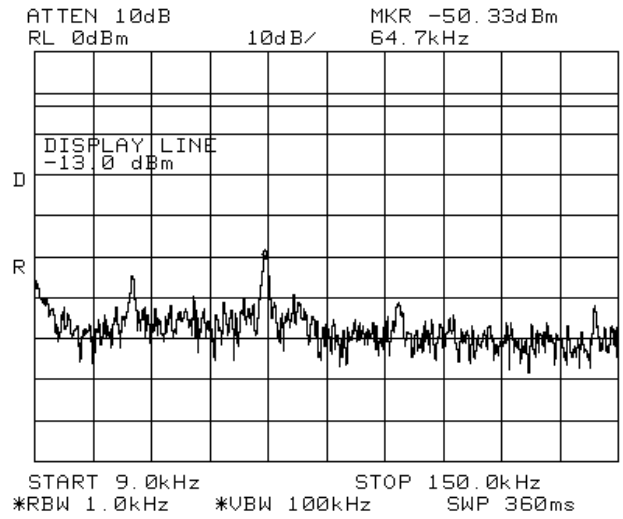

Figure 253 —2462 MHz DBPSK

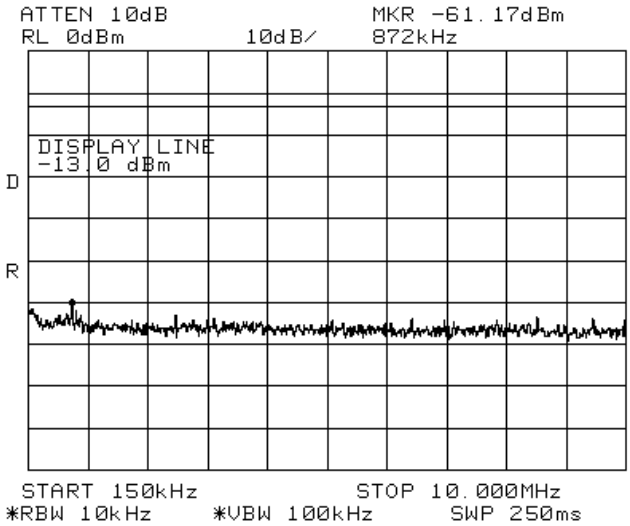

Figure 254 —2462 MHz DBPSK

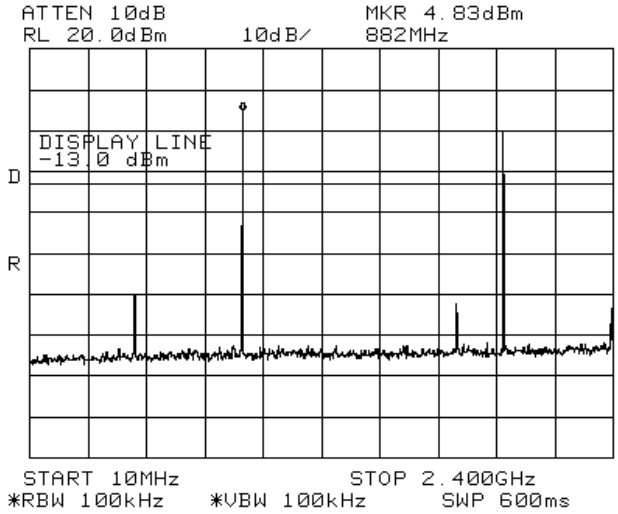

Figure 255 —2462 MHz DBPSK

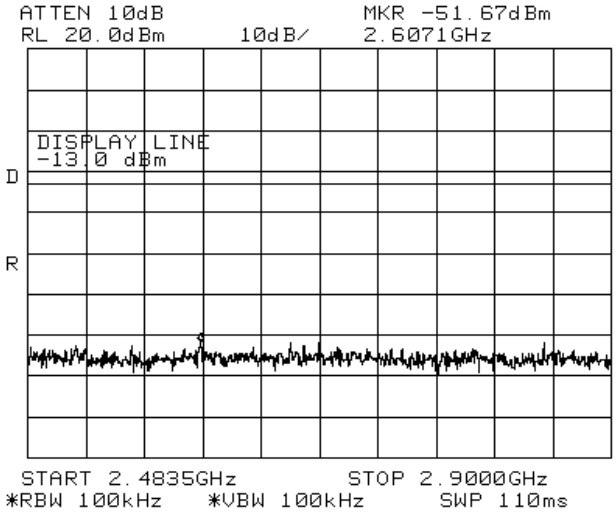

Figure 256 —2462 MHz DBPSK

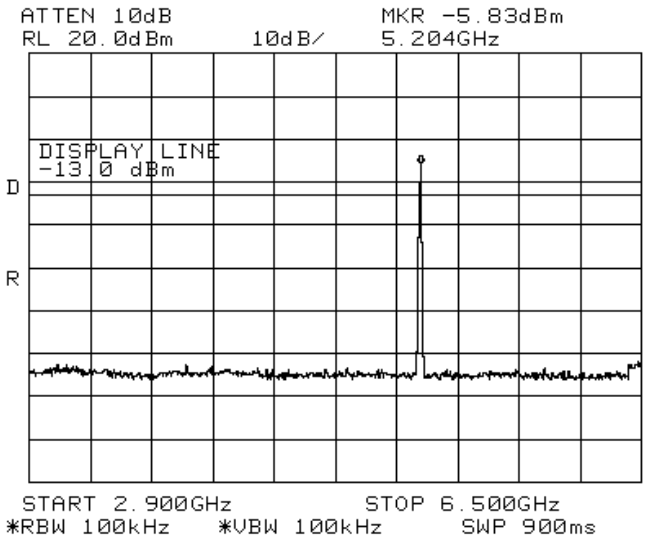

Figure 257 —2462 MHz DBPSK

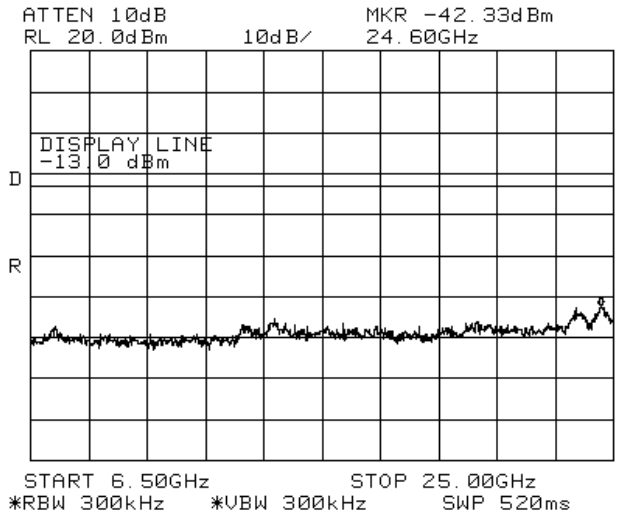

Figure 258 —2462 MHz DBPSK

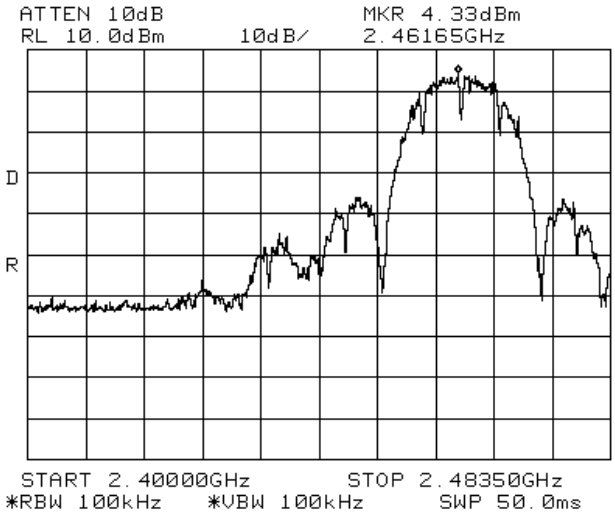

Figure 259 —2462 MHz BPSK

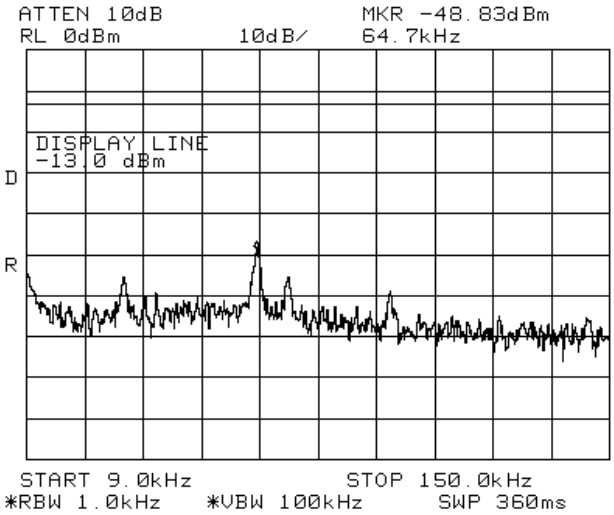

Figure 260 —2462 MHz BPSK

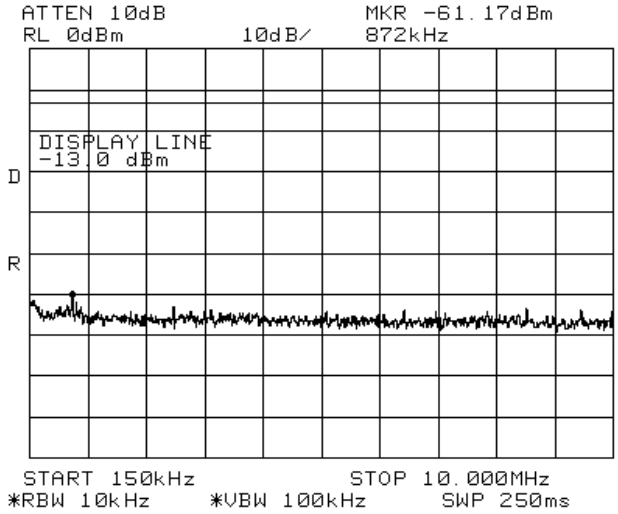

Figure 261 —2462 MHz BPSK

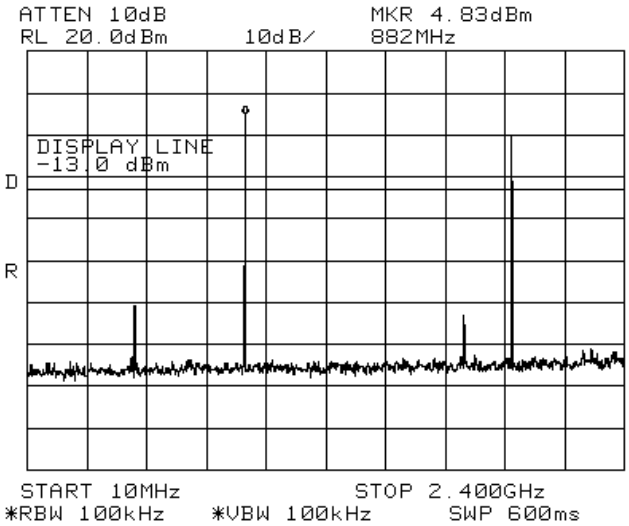

Figure 262 —2462 MHz BPSK

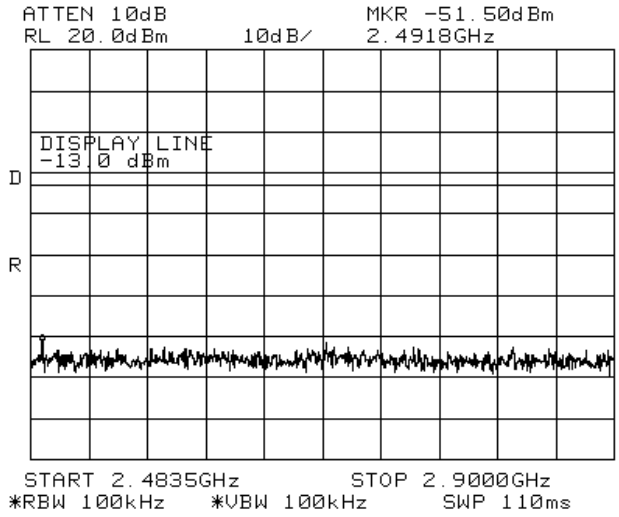

Figure 263 —2462 MHz BPSK

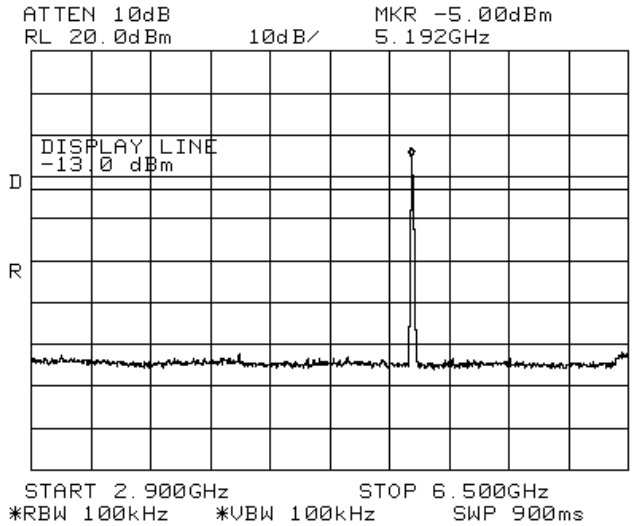

Figure 264 —2462 MHz BPSK

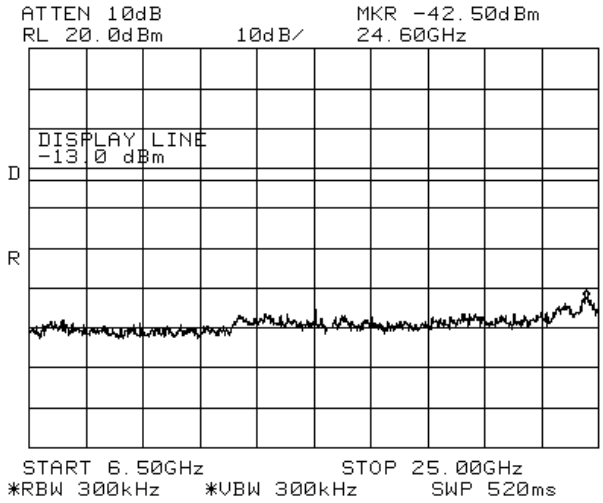

Figure 265 —2462 MHz BPSK

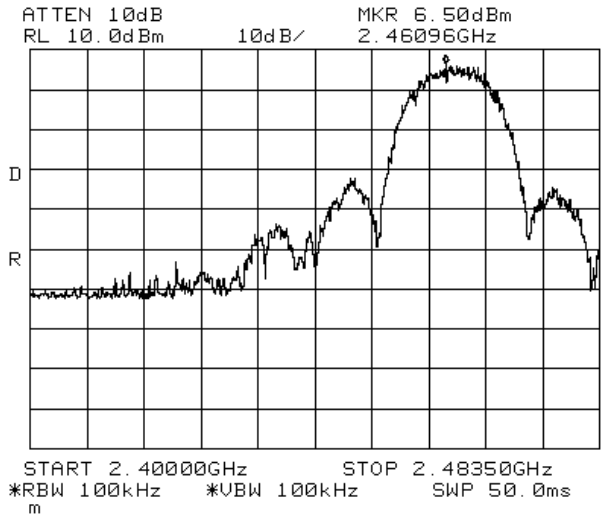

Figure 266 —2462 MHz CCK

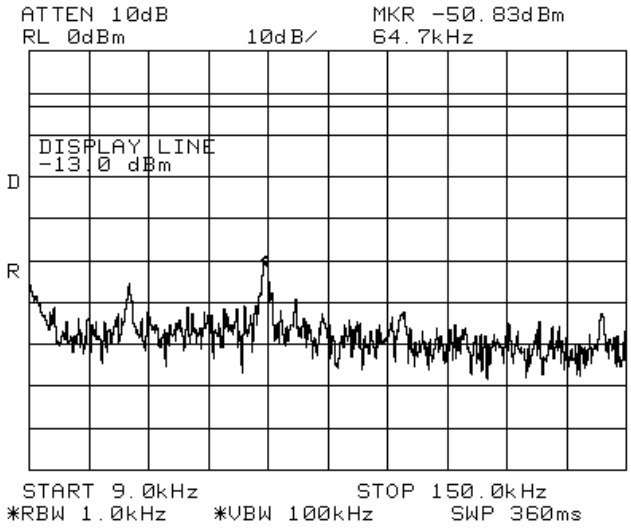

Figure 267 —2462 MHz CCK

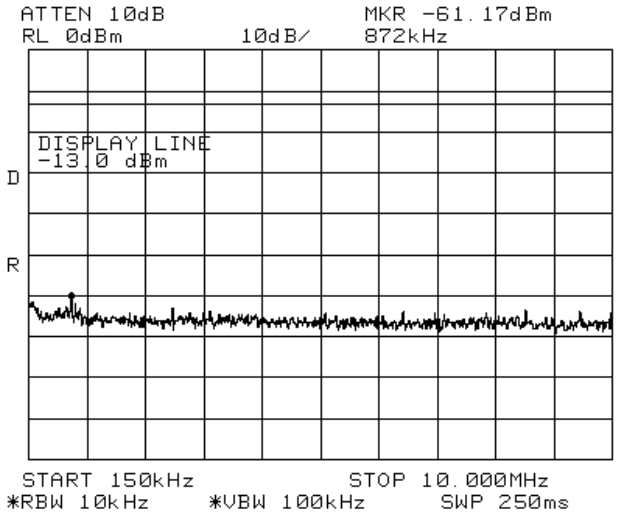

Figure 268 —2462 MHz CCK

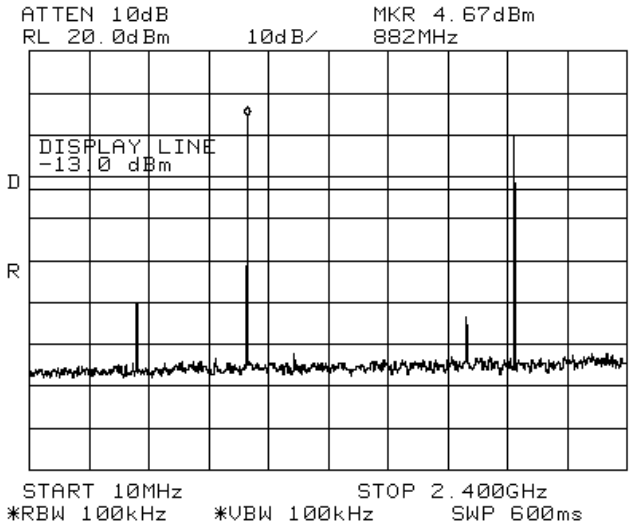

Figure 269 —2462 MHz CCK

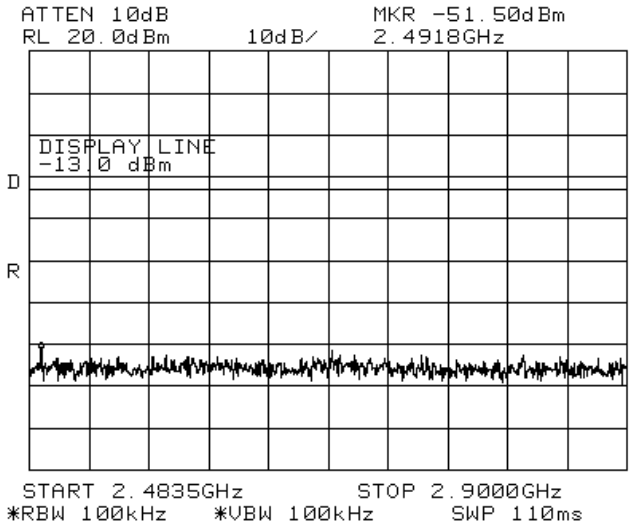

Figure 270 —2462 MHz CCK

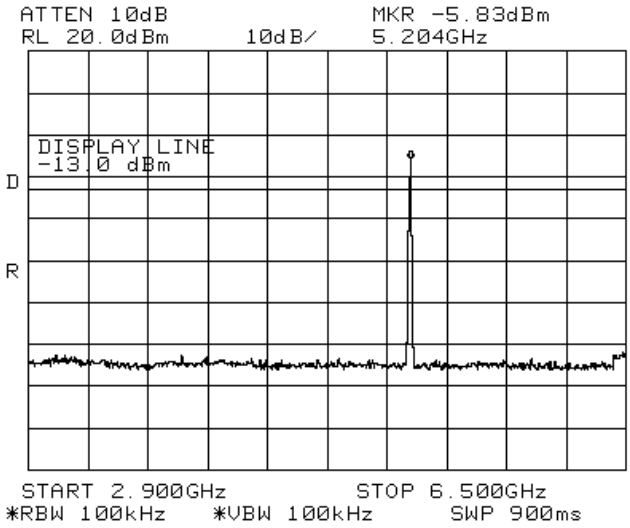

Figure 271 —2462 MHz CCK

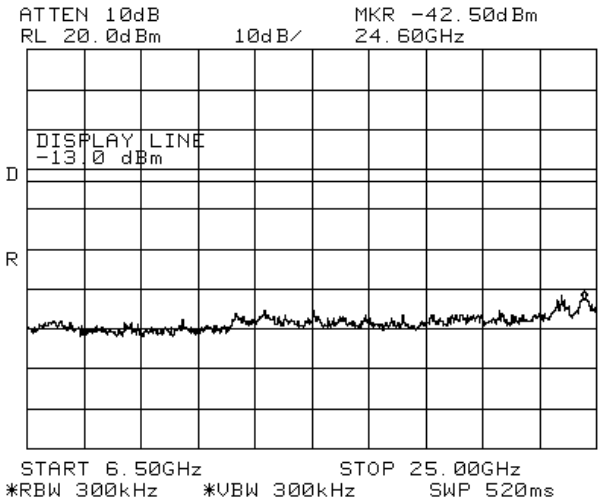

Figure 272 —2462 MHz CCK

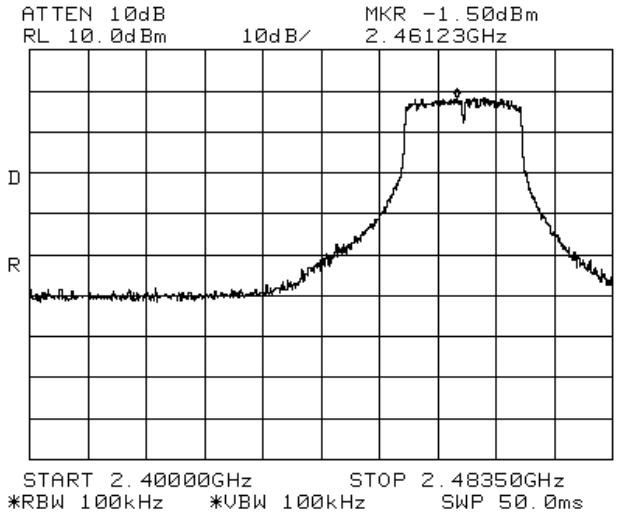

Figure 273 —2462 MHz 64QAM

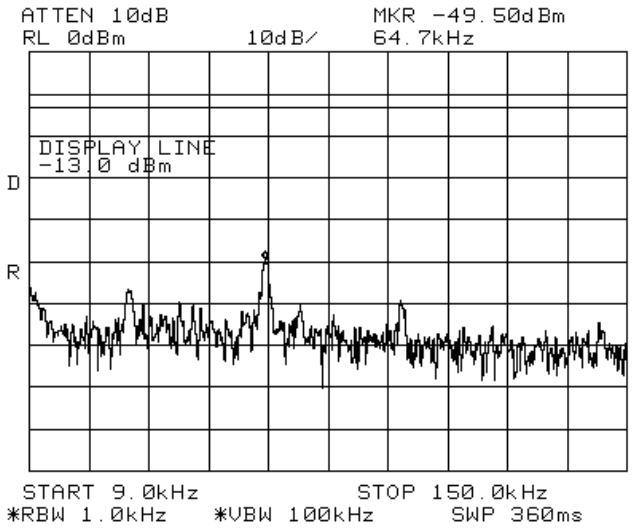

Figure 274 —2462 MHz 64QAM

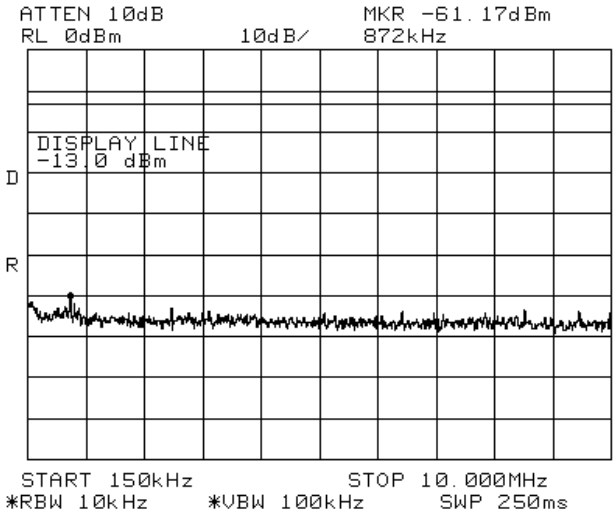

Figure 275 —2462 MHz 64QAM

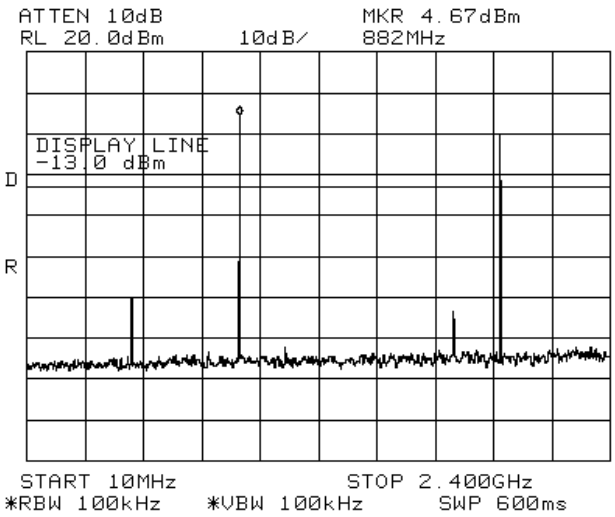

Figure 276 —2462 MHz 64QAM

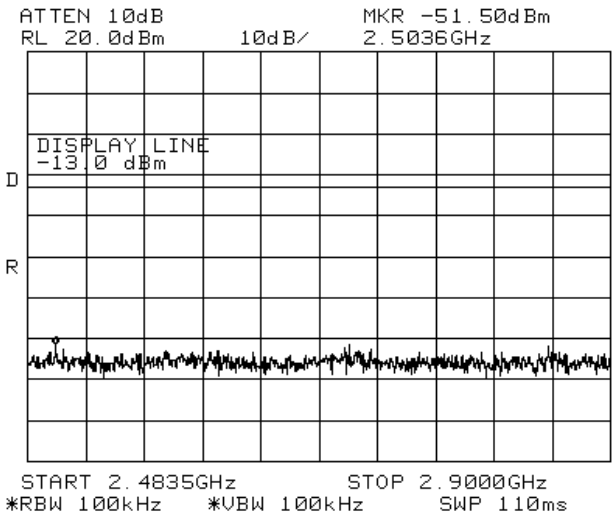

Figure 277 —2462 MHz 64QAM

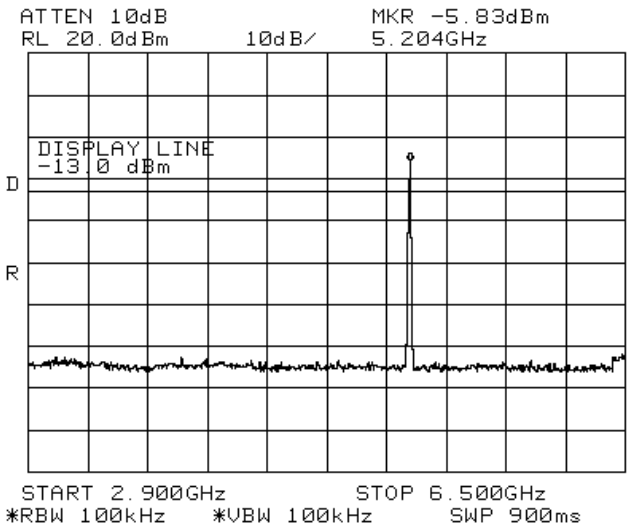

Figure 278 —2462 MHz 64QAM

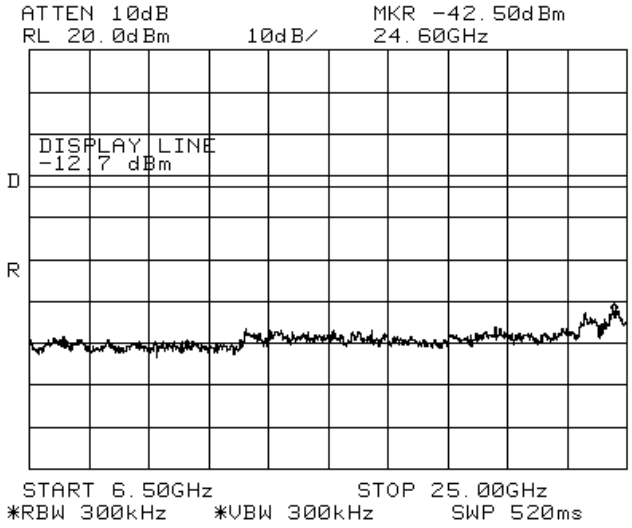

Figure 279 —2462 MHz 64QAM

19.2 Results table

E.U.T Description: WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Model No.: 860M With WCE
Serial Number: 1. 860M: 73903D
2. WCE: 739038
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Modulation	Reading (dBm)	Specification (dBm)	Margin (dB)
2412	DBPSK	-43.77	-13.0	-30.77
	BPSK	-41.83	-13.0	-28.83
	CCK	-41.50	-13.0	-28.50
	64QAM	-43.83	-13.0	-30.83
2437	DBPSK	-43.83	-13.0	-30.83
	BPSK	-43.00	-13.0	-30.00
	CCK	-43.33	-13.0	-26.33
	64QAM	-40.00	-13.0	-27.00
2462	DBPSK	-42.33	-13.0	-29.33
	BPSK	-42.50	-13.0	-29.50
	CCK	-42.50	-13.0	-29.50
	64QAM	-42.50	-13.0	-29.50

Figure 280 Peak Power Output of 2400-2483.5 MHz Band

JUDGEMENT: Passed by 26.33 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

19.3 Test Equipment Used.

Peak Power Output of 2400-2438.5 MHz Band

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	May 9, 2007	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

Figure 281 Test Equipment Used

20. 6 dB Minimum Bandwidth 2.4GHz Transmitter 802.11b/g + 802.11a + CELL + PCS Signals

20.1 Test procedure

The E.U.T. was set to the applicable test frequency. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20 dB) and an appropriate coaxial cable (cable loss = 1 dB). The spectrum analyzer was set to 100 kHz resolution BW. The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded.

The E.U.T. was tested at 2412, 2437, and 2462 MHz with the following modulations: DBPSK (1Mbit/sec), BPSK (6Mbit/sec), CCK (11Mbit/sec) and 64QAM (54Mbit/sec).

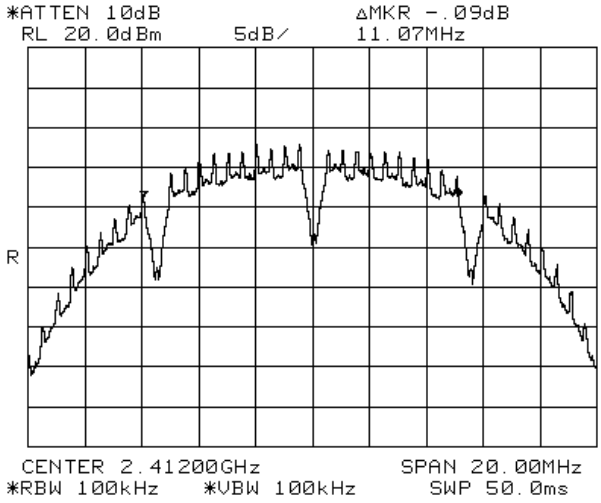

Figure 282 —2412 MHz DBPSK

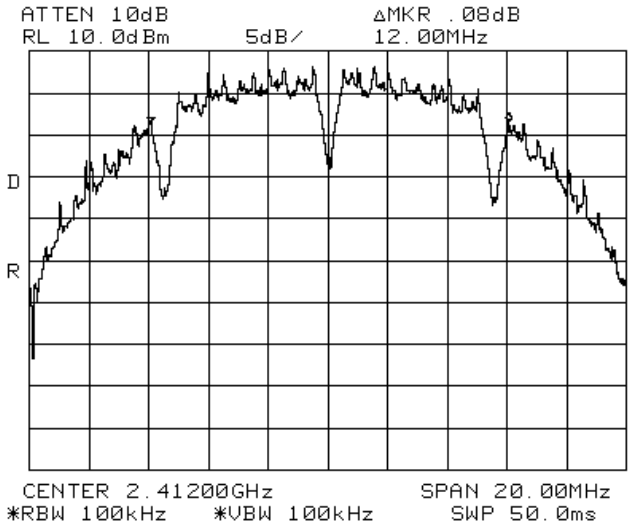

Figure 283 —2412 MHz BPSK

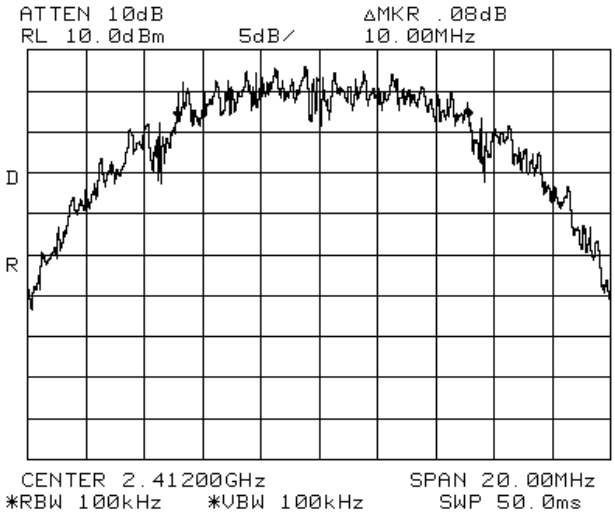

Figure 284 —2412 MHz CCK

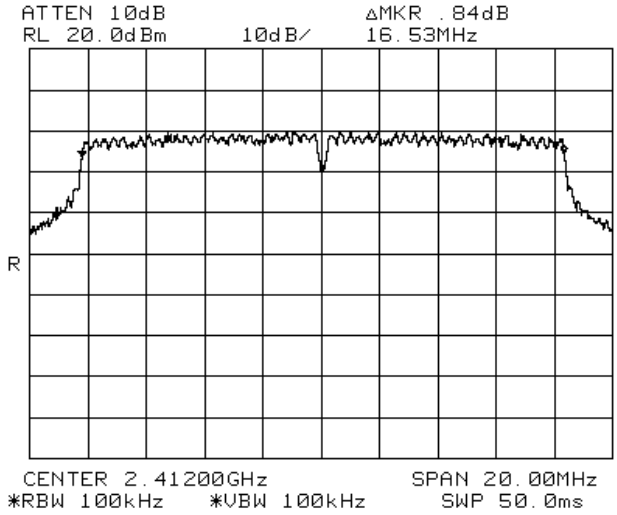

Figure 285 —2412 MHz 64QAM

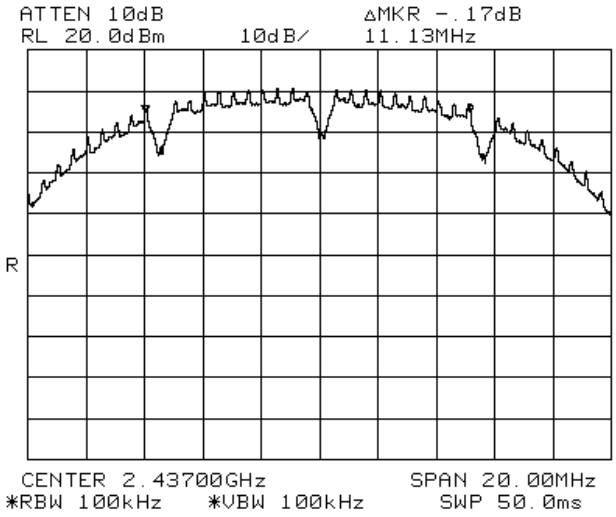

Figure 286 —2437 MHz DBPSK

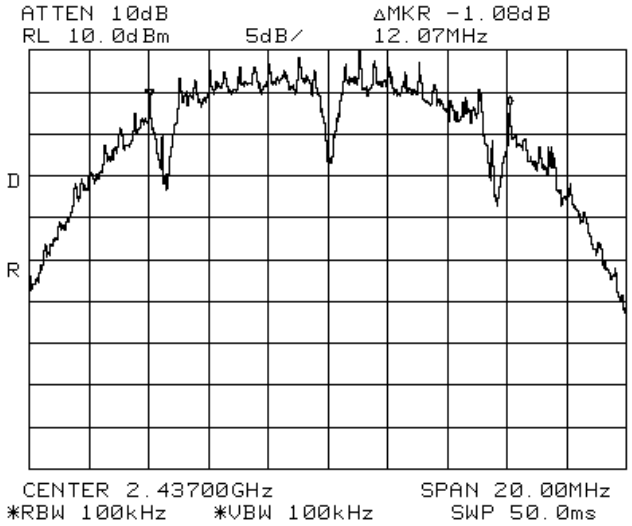

Figure 287 —2437 MHz BPSK

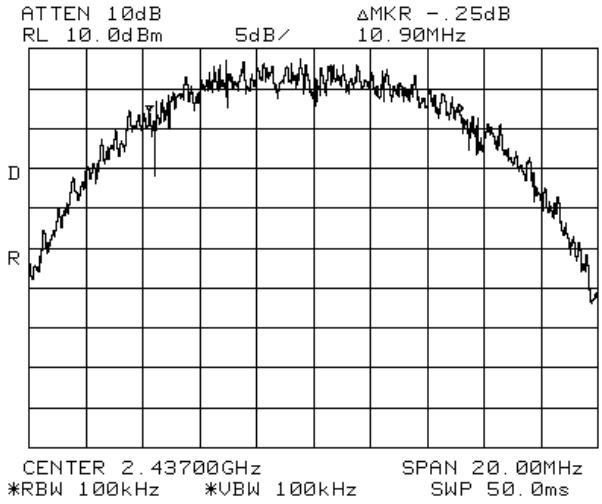

Figure 288 —2437 MHz CCK

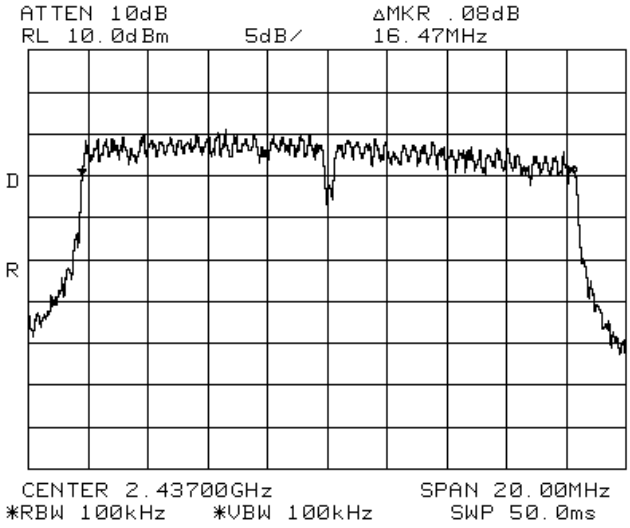

Figure 289 —2437 MHz 64QAM

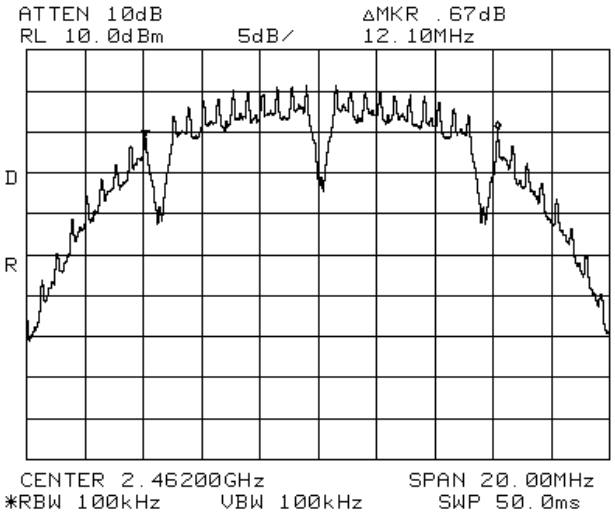

Figure 290 —2462 MHz DBPSK

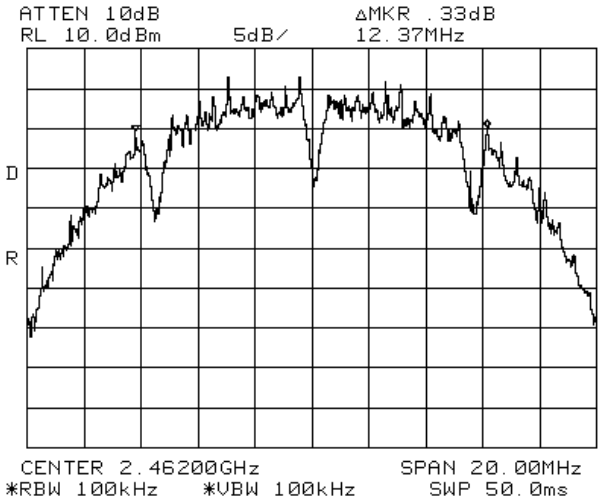

Figure 291 —2462 MHz BPSK

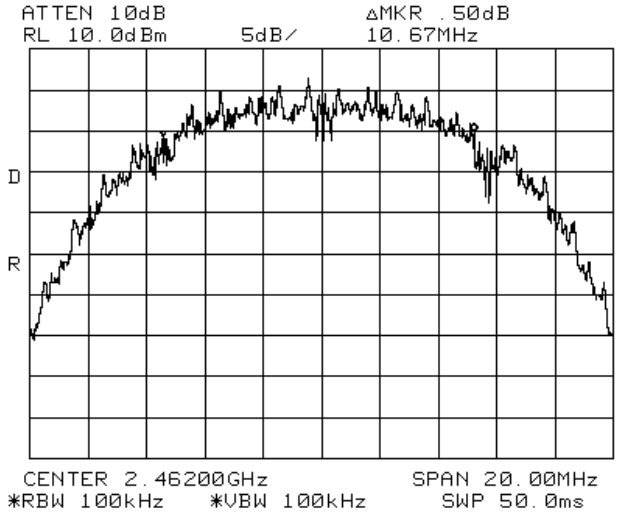

Figure 292 —2642 MHz CCK

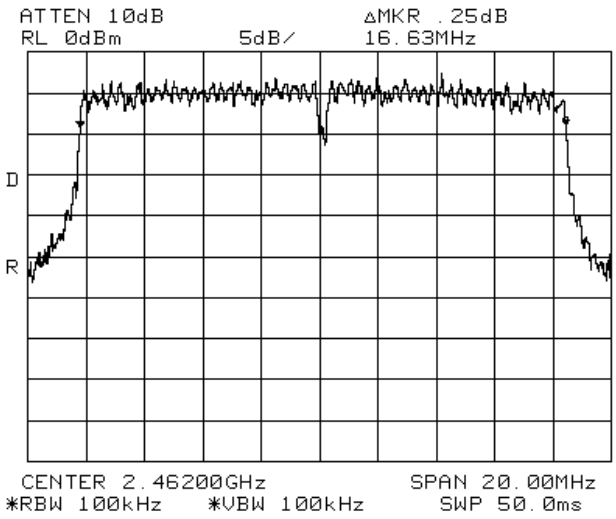

Figure 293 —2462 MHz 64QAM

20.2 Results table

E.U.T Description: WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Model No.: 860M With WCE
Serial Number: 1. 860M: 73903D
2. WCE: 739038
Specification: F.C.C. Part 15, Subpart C: (15.247-a2)

Operation Frequency (MHz)	Modulation	Reading (MHz)	Specification (MHz)
2412	DBPSK	11.07	0.5
	BPSK	12.00	0.5
	CCK	10.00	0.5
	64QAM	16.53	0.5
2437	DBPSK	11.13	0.5
	BPSK	12.07	0.5
	CCK	10.90	0.5
	64QAM	16.47	0.5
2462	DBPSK	12.10	0.5
	BPSK	12.37	0.5
	CCK	10.67	0.5
	64QAM	16.63	0.5

Figure 294 6 dB Minimum Bandwidth

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

20.3 Test Equipment Used.

6 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	May 9, 2007	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

Figure 295 Test Equipment Used

21. Band Edge Spectrum 2.4GHz Transmitter 802.11b/g + 802.11a + CELL + PCS Signals

[In Accordance with section 15.247(c)]

21.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20 dB) and an appropriate coaxial cable (cable loss = 1 dB). The spectrum analyzer was set to 100 kHz resolution BW. Maximum power level below 2400 MHz and above 2483.5 MHz was measured relative to power level at 2412 MHz, and 2462 MHz correspondingly.

The E.U.T. was tested using the following modulations: DBPSK (1Mbit/sec), BPSK (6Mbit/sec), CCK (11Mbit/sec) and 64QAM (54Mbit/sec).

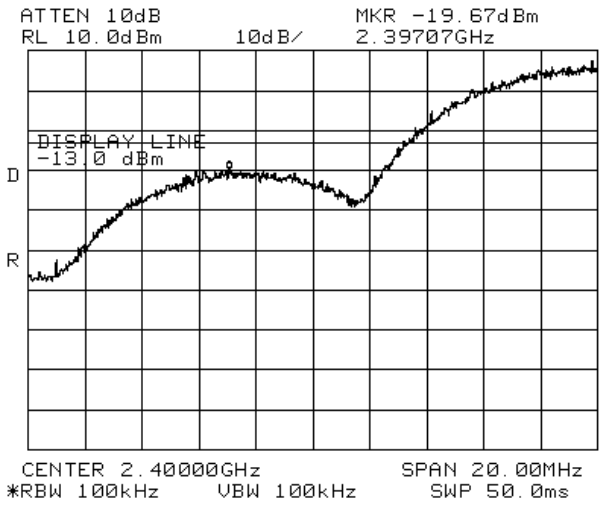

Figure 296 —2412 MHz DBPSK

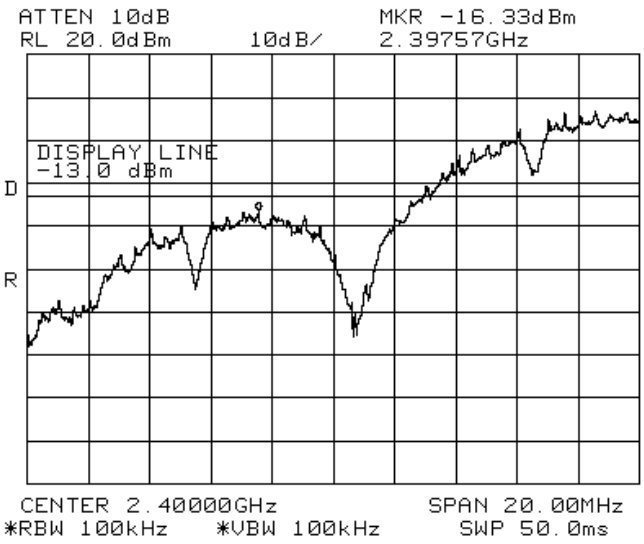

Figure 297 —2412 MHz BPSK

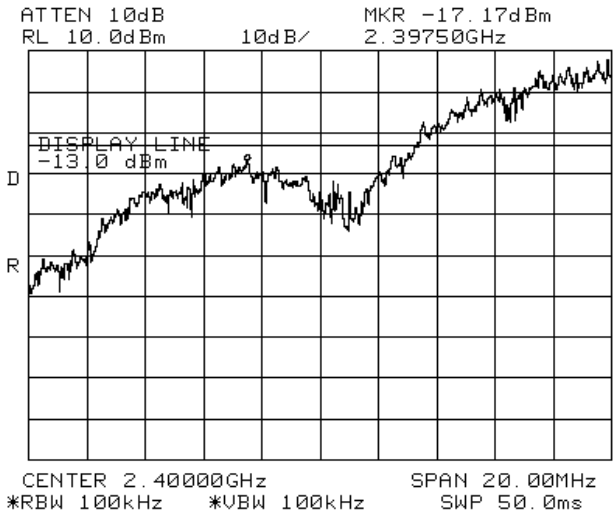

Figure 298 —2412 MHz CCK

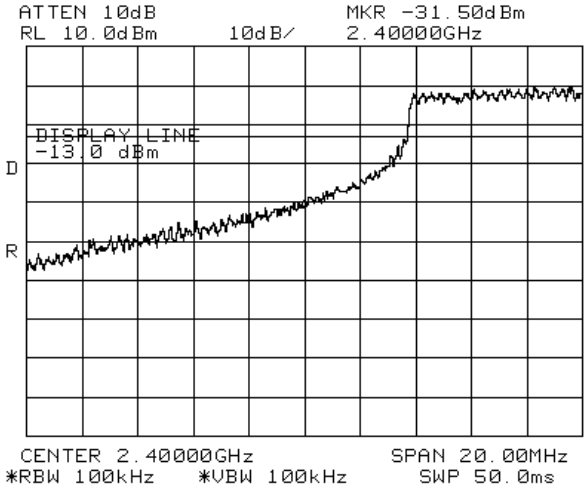

Figure 299 —2412 MHz 64QAM

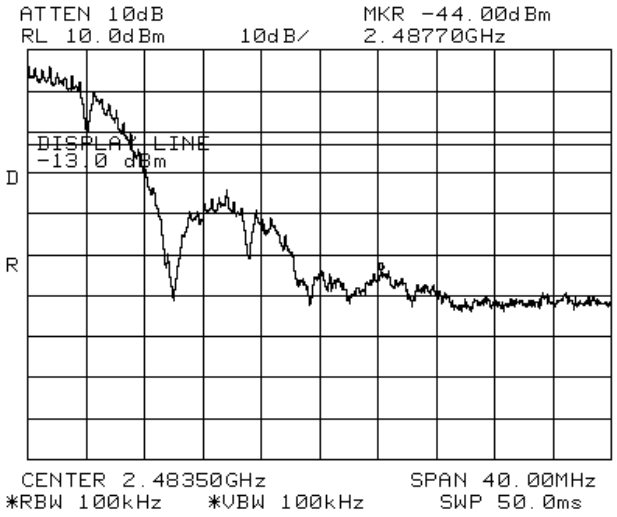

Figure 300 —2462 MHz DBPSK

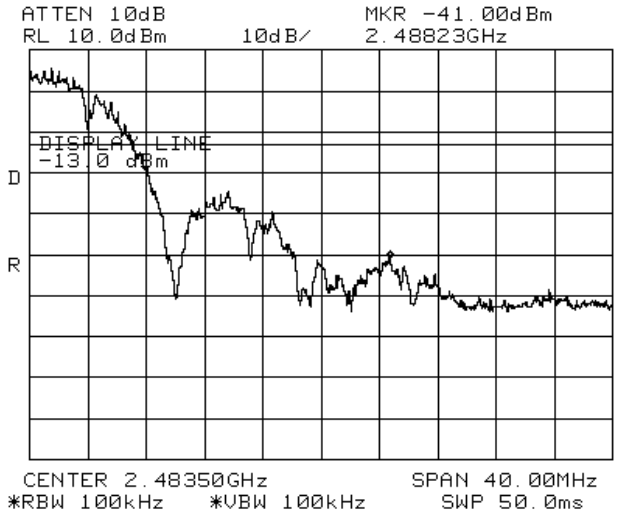

Figure 301 —2462 MHz BPSK

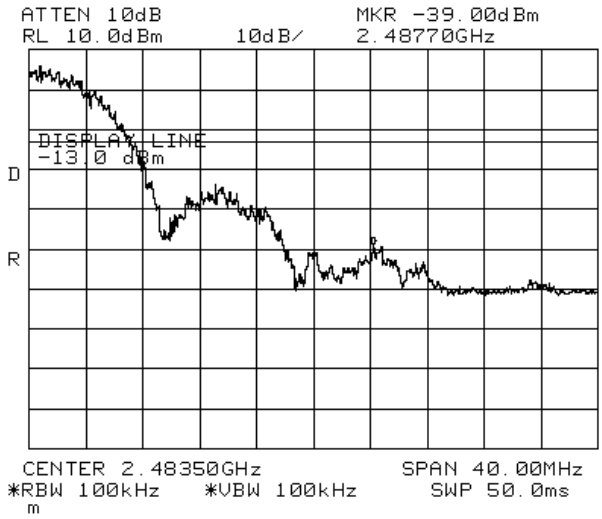

Figure 302 —2462 MHz CCK

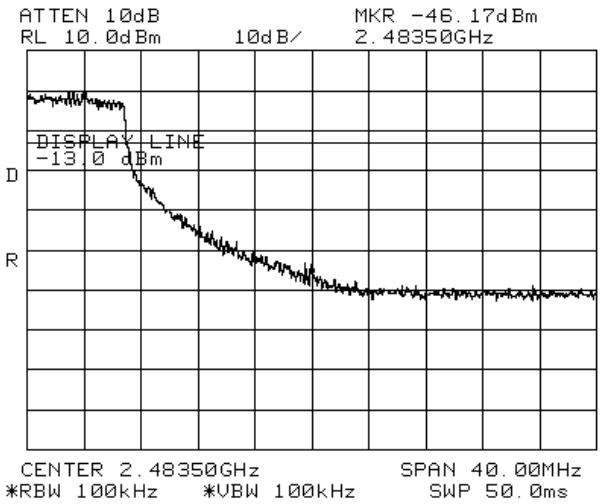

Figure 303 —2462 MHz 64QAM

21.2 Results table

E.U.T. Description: WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Model No.: 860M With WCE
Serial Number: 1. 860M: 73903D
2. WCE: 739038
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Modulation	Band Edge Frequency (MHz)	Spectrum Level (dBm)	Specification (dBm)	Margin (dB)
2412	DBPSK	2397	-19.67	-13.0	-6.67
	BPSK	2397	-16.33	-13.0	-3.33
	CCK	2397	-17.17	-13.0	-4.17
	64QAM	2400	-31.50	-13.0	-18.50
2642	DBPSK	2487	-44.00	-13.0	-31.00
	BPSK	2488	-41.00	-13.0	-28.00
	CCK	2487	-39.00	-13.0	-26.00
	64QAM	2483	-46.17	-13.0	-33.17

Figure 304 Band Edge Spectrum

JUDGEMENT: Passed by 3.33 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

21.3 Test Equipment Used.

Band edge Spectrum

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	May 9, 2007	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

Figure 305 Test Equipment Used

22. Transmitted Power Density 2.4GHz Transmitter 802.11b/g + 802.11a + CELL + PCS Signals

[In accordance with section 15.247(d)]

22.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20dB) and an appropriate coaxial cable (cable loss = 1 dB). The spectrum analyzer was set to 3 kHz resolution BW. and sweep time of 1 second for each 3 kHz “window”. The spectrum peaks were located at each of the 3 operating frequencies.

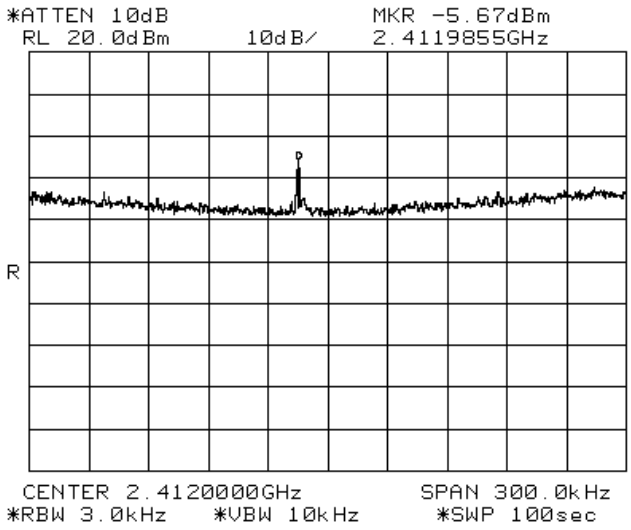

Figure 306 —2412 MHz DBPSK

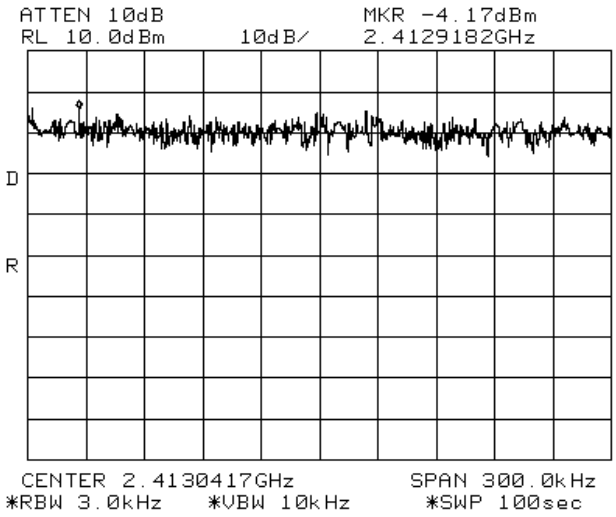

Figure 307 —2412 MHz BPSK

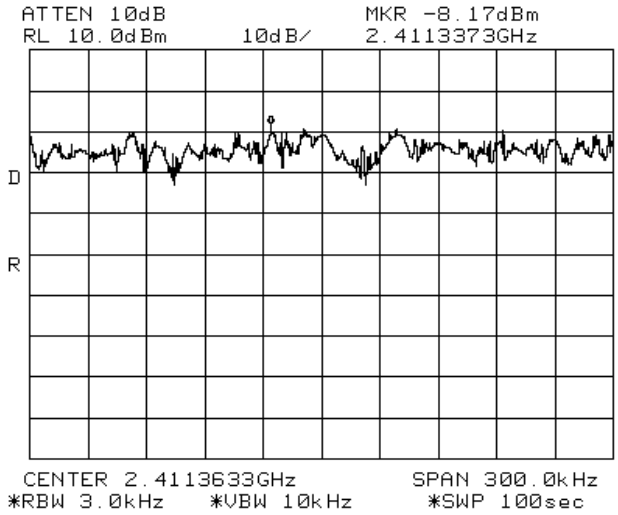

Figure 308 —2412 MHz CCK

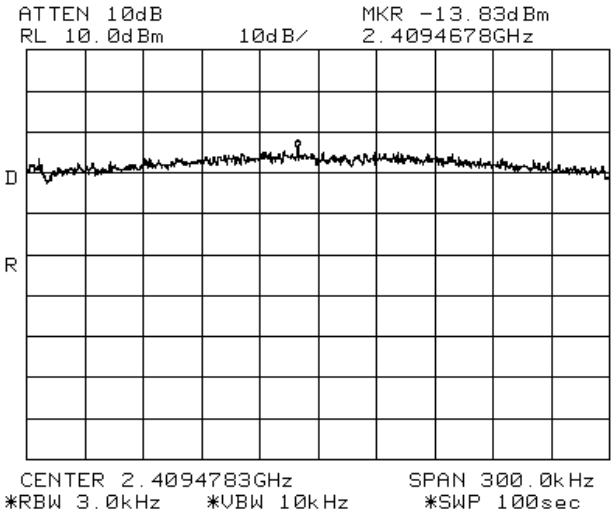

Figure 309 —2412 MHz 64QAM

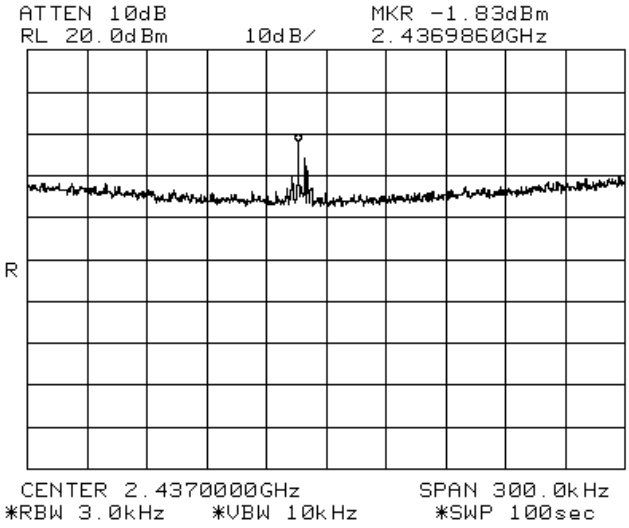

Figure 310 —2437 MHz DBPSK

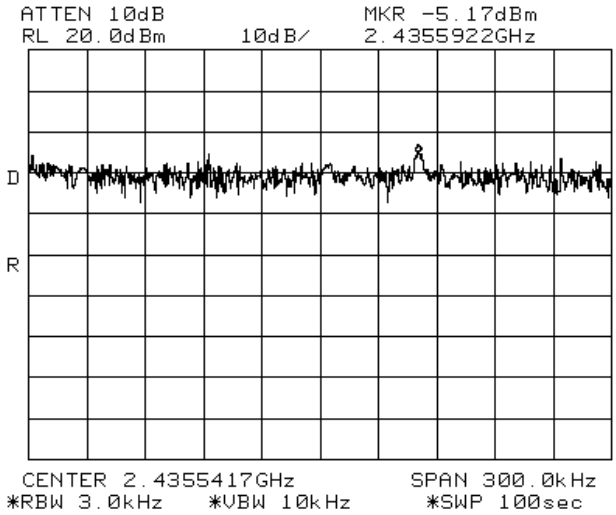

Figure 311 —2437 MHz BPSK

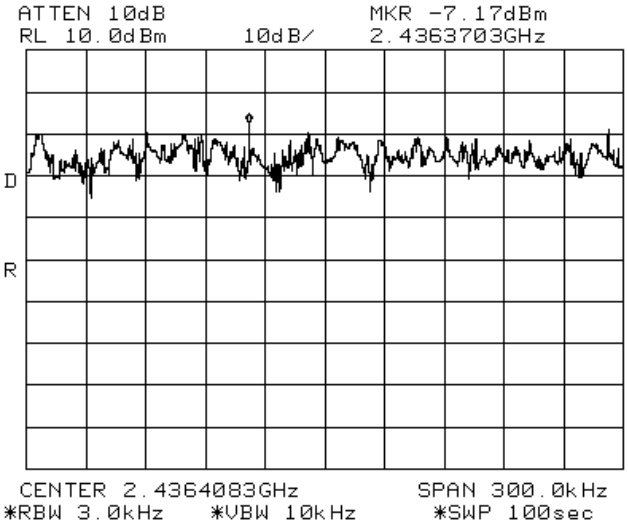

Figure 312 —2437 MHz CCK

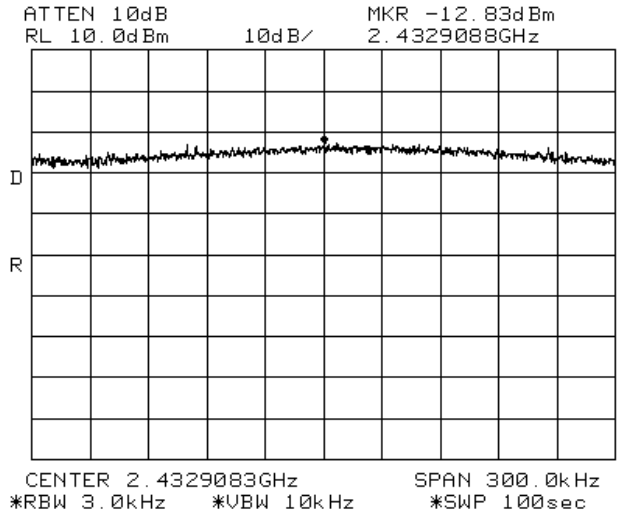

Figure 313 —2437 MHz 64QAM

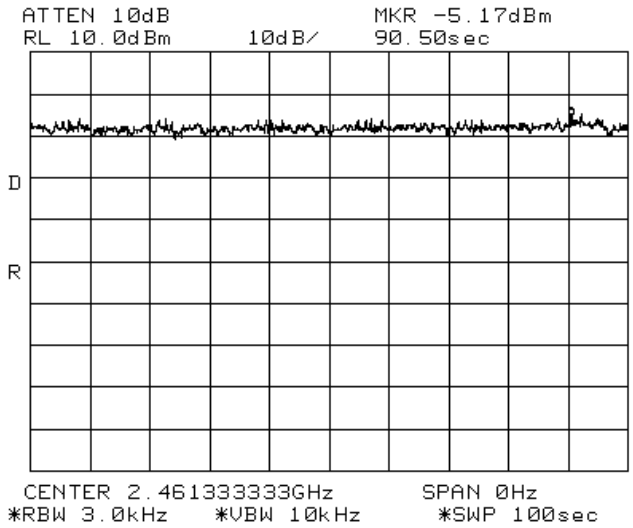

Figure 314 —2462 MHz DBPSK

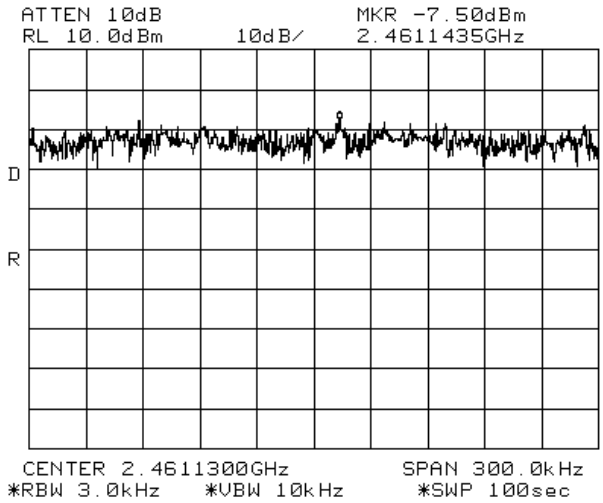

Figure 315 —2462 MHz BPSK

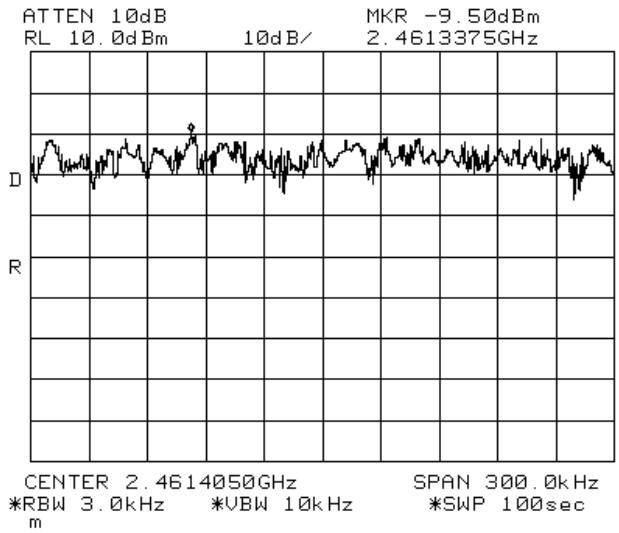

Figure 316 —2462 MHz CCK

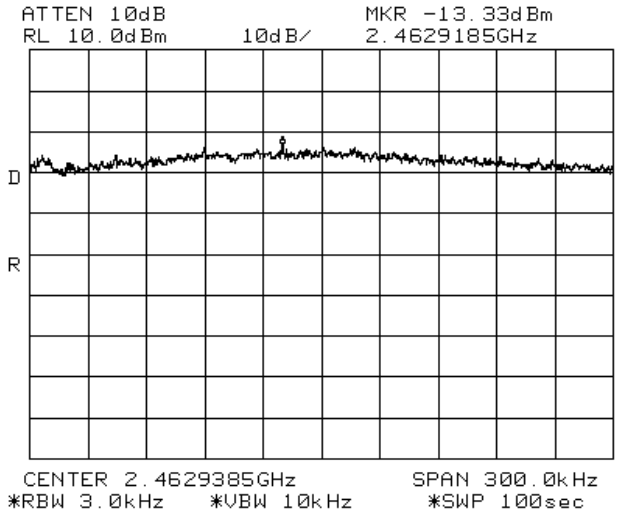

Figure 317 —2462 MHz 64QAM

22.2 Results table

E.U.T. Description: WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Model No.: 860M With WCE
Serial Number: 1. 860M: 73903D
2. WCE: 739038
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Modulation	Reading Spectrum Analyzer (dBm)	Specification (dBm)	Margin (dB)
2412	DBPSK	-5.67	8.0	-13.67
2412	BPSK	-4.17	8.0	-12.17
2412	CCK	-8.17	8.0	-16.17
2412	64QAM	-13.83	8.0	-21.83
2437	DBPSK	-1.83	8.0	-9.83
2437	BPSK	-5.17	8.0	-13.17
2437	CCK	-7.17	8.0	-15.17
2437	64QAM	-12.83	8.0	-20.83
2462	DBPSK	-5.17	8.0	-13.17
2462	BPSK	-7.50	8.0	-15.50
2462	CCK	-9.50	8.0	-17.50
2462	64QAM	-13.33	8.0	-21.33

Figure 318 Test Results

JUDGEMENT: Passed by 983

TEST PERSONNEL:

Tester Signature: _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

22.3 Test Equipment Used.

Transmitted Power Density

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	May 9, 2007	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

Figure 319 Test Equipment Used

23. Antenna Gain 2.4GHz Transmitter 802.11b/g + 802.11a + CELL + PCS Signals

The antenna gain is 7 dBi.

24. R.F Exposure/Safety 2.4GHz Transmitter 802.11b/g + 802.11a + CELL + PCS Signals

Typical use of the E.U.T. is repeating WiFi signals for DAS. The typical placement of the E.U.T. is on a wall near the ceiling. The typical distance between the E.U.T. and the user in the worst case application, is >1 m.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) Requirements

(f) FCC limits at 2437 MHz is: $1\frac{mW}{cm^2}$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(g) The power density produced by the E.U.T. is

$$S = \frac{P_t G_t}{4\pi R^2}$$

P_t- Transmitted Power 218.8 mw (Peak) = 23.4 dBm

G_T- Antenna Gain, 7 dBi = 5

R- Distance from Transmitter using 1 m worst case

(h) The peak power density is :

$$S_p = \frac{218.8 \times 5}{4\pi(100)^2} = 8.7 \times 10^{-3} \frac{mW}{cm^2}$$

(i) The duty cycle of transmission in actual worst case is 50%.

The average power source is:

$109.9mW$

(j) The averaged power density of the E.U.T. is:

$$S_{AV} = 4.35 \times 10^{-3} \frac{mW}{cm^2}$$

(f) This is 3 orders of magnitude below the FCC limit.

25. Radiated Emission Per FCC Part 15 Sub-Part B Test Data 802.11 b/g +802.11a Signals

25.1 Test Specification

30-25000 MHz, FCC Part 15, Subpart B, CLASS A

25.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 4.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission.

The frequency range 30-25000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 2.9 - 25 GHz, a spectrum analyzer including a low noise amplifier was used. The test distance was 3 meters. During peak measurements, the I.F. bandwidth was 1 MHz, and video bandwidth 3 MHz. During average measurements, the I.F. bandwidth was 1 MHz and video bandwidth was 100 Hz.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The emissions were measured at a distance of 3 meters.
The E.U.T. was tested in both Rx and Tx modes.
The E.U.T. was tested at the operating frequencies of 2412, 2437, and 2462 MHz using the following modulations: DBPSK, BPSK, CCK, and 64QAM.

25.3 Test Data

JUDGEMENT: Passed by 4.9 dB.

The margin between the emission level and the specification limit is 4.9 dB in the worst case at the frequency of 128.38 MHz, vertical polarization.

The signals in the band 1.0 – 25.0 GHz were more than 20 dB below the specification limit.

The EUT met the requirements of the F.C.C. Part 15, Subpart B, Class A, specification.

The results for all three operating frequencies and modulations were the same.

TEST PERSONNEL:

Tester Signature: _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

Radiated Emission

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC Part 15, Subpart B, Class A

Antenna Polarization: Horizontal
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

Signal Number	Frequency (MHz)	Peak dBuV/m	QP dBuV/m	QP Delta L 1 (dB)	Av Delta L 2 (dB)	Corr (dB)
1	299.894100	39.0	33.3	-23.5		23.4
2	375.000000	42.3	38.9	-18.0		18.7
3	500.015000	43.7	40.1	-16.8		21.0
4	625.010000	43.2	38.5	-18.4		24.7
5	700.010000	43.4	39.7	-17.2		25.3
6	750.010000	43.5	38.8	-18.1		25.8

Figure 320. Radiated Emission. Antenna Polarization: HORIZONTAL. Detectors: Peak, Quasi-peak

Note: QP Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC Part 15, Subpart B, Class A

Antenna Polarization: Horizontal
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

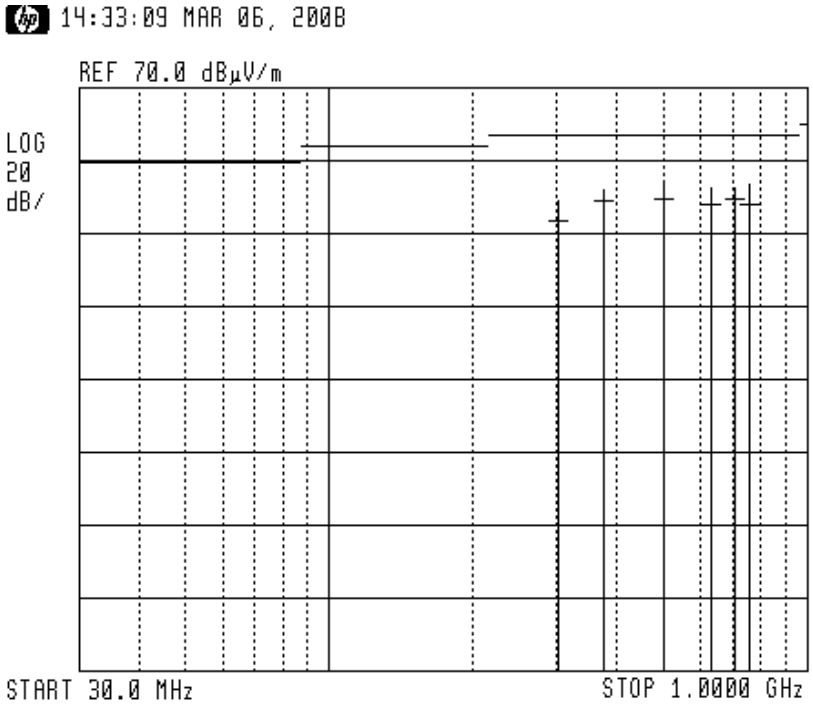

Figure 321. Radiated Emission. Antenna Polarization: HORIZONTAL Detectors: Peak, Quasi-peak

Note:

1. *Horizontal axis shows logarithmic frequency scale.*
2. *The vertical axis shows amplitude (in dB µV/m).*
3. *Peak detection is designated by the top of each vertical line.*
4. *Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.*

Radiated Emission

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC Part 15, Subpart B, Class A

Antenna Polarization: Vertical
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

Signal Number	Frequency (MHz)	Peak dBuV/m	QP dBuV/m	QP Delta L 1 (dB)	Av Delta L 2 (dB)	Corr (dB)
1	56.970000	40.2	34.9	-14.6		10.8
2	125.005000	42.3	40.9	-13.1		13.8
3	128.380000	52.0	49.1	-4.9		13.9
4	250.007500	53.2	51.9	-5.0		20.9
5	256.850000	46.5	42.0	-14.9		21.3
6	500.000000	43.5	40.0	-16.9		21.0
7	700.015000	45.8	40.7	-16.2		25.3

Figure 322. Radiated Emission. Antenna Polarization: VERTICAL. Detectors: Peak, Quasi-peak

Note: QP Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Colubris MAP-330 Access Points
Type	860M With WCE
Serial Number:	1. 860M: 73903D 2. WCE: 739038

Specification: FCC Part 15, Subpart B, Class A

Antenna Polarization: Vertical
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

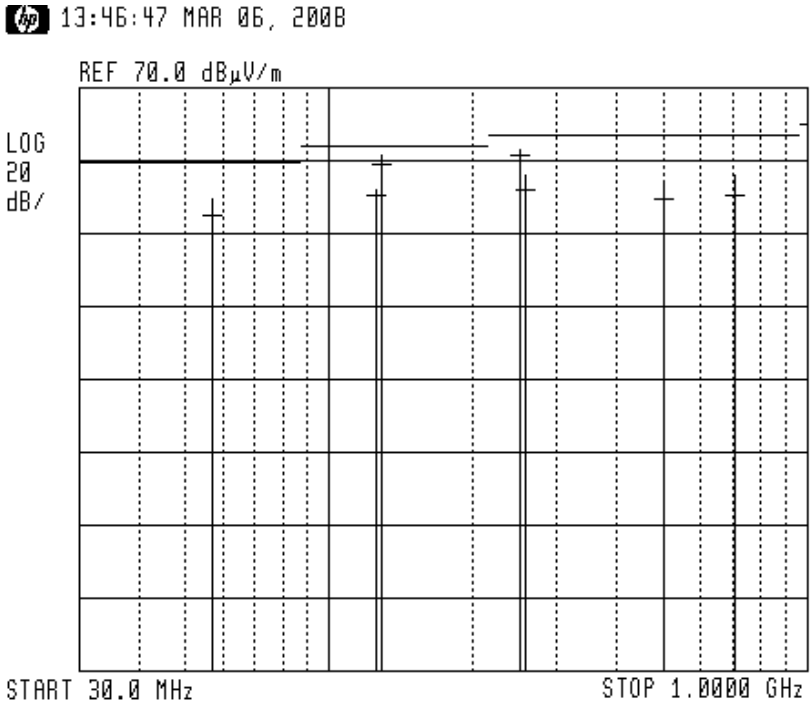

Figure 323. Radiated Emission. Antenna Polarization: VERTICAL. Detectors: Peak, Quasi-peak

Note:

1. *Horizontal axis shows logarithmic frequency scale.*
2. *The vertical axis shows amplitude (in dB µV/m).*
3. *Peak detection is designated by the top of each vertical line.*
4. *Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.*

25.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial No.	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 12, 2007	1Year
RF Filter Section	HP	85420E	3705A00248	November 12, 2007	1Year
Antenna Biconical	ARA	BCD 235/B	1041	March 22, 2007	1Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 22, 2007	1 Year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	February 4, 2007	2 Years
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 15, 2006	2 Years
Horn Antenna	ARA	SWH-28	1008	December 8, 2006	2 Years
Horn Antenna	Narda	V637	0410	December 8, 2006	2 Years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 2, 2007	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	January 9, 2007	1 Year
Low Noise Amplifier	MK Milliwave	MKT6-3000 4000-30-13P	399	January 9, 2007	1 Year
Spectrum Analyzer	HP	8593EM	3536A00120	February 26, 2008	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

25.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

FS:	Field Strength [dBμv/m]
RA:	Receiver Amplitude [dBμv]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

No external pre-amplifiers are used.

26. Intermodulation Tests

26.1 Test procedure

An access point having maximum RF output power was used for this test.

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20 dB) and an appropriate coaxial cable
(cable loss = 3.5 dB). The spectrum analyzer was set to 1 kHz resolution BW for the frequency range 9.0-150.0 kHz, 10kHz for the frequency range
10kHz–10.0MHz, 100kHz for the frequency range 10.0MHz-2.4385GHz, and 1MHz for the frequency range 2.4385-25.0GHz.

4 input signals were sent simultaneously to the E.U.T. as follows:

802.11b/g: in the frequency range 2400-2483 MHz, 2412MHz 64QAM

802.11a: in the frequency range 5150-5250 MHz, 5180MHz BPSK

CELL: in the frequency range 869-894 MHz, 890MHz FM dev. 100kHz

PCS: in the frequency range 1930-1990 MHz, 1985MHz CDMA

The frequency range of 9kHz – 40.0GHz was scanned for unwanted signals.

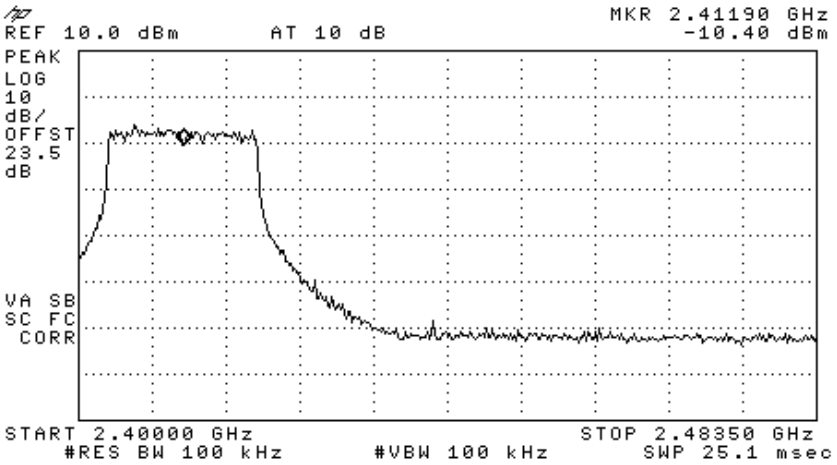

Figure 324 —2412MHz 64QAM

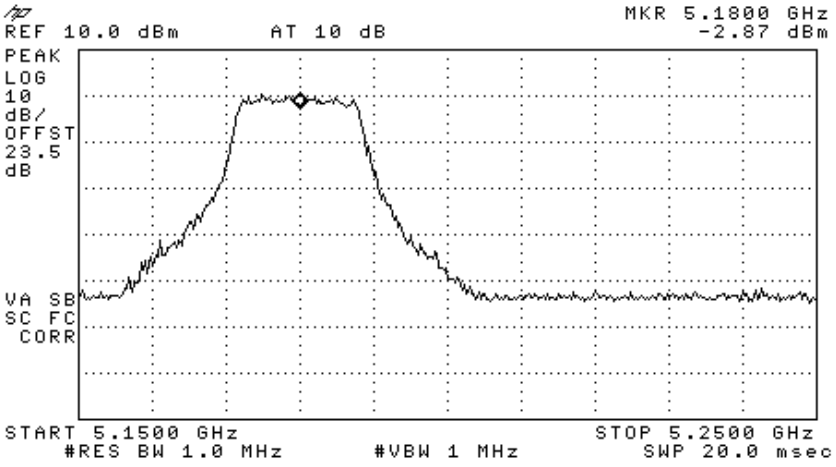

Figure 325 —5180MHz BPSK

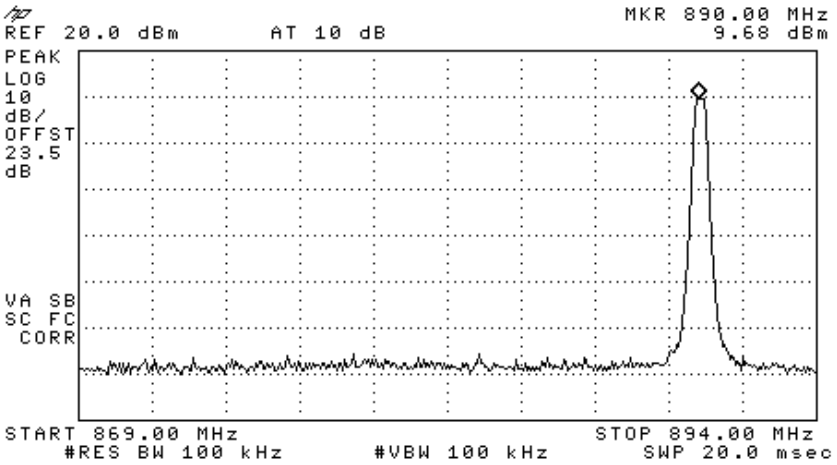

Figure 326 —890MHz FM

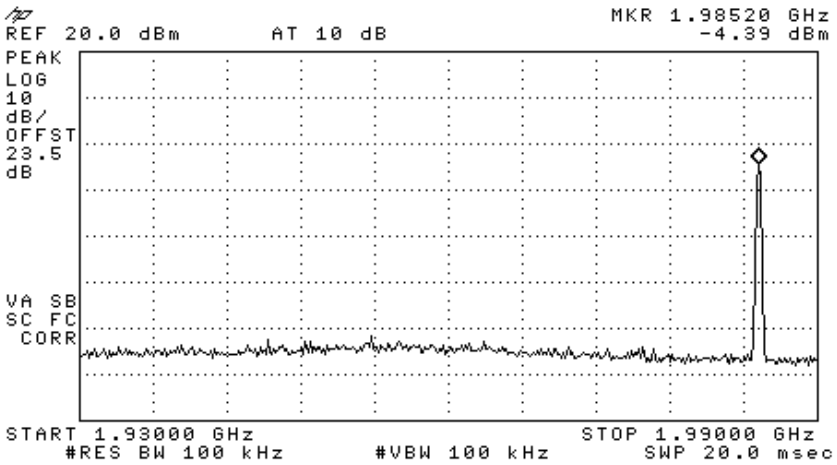

Figure 327 —1985MHz CDMA

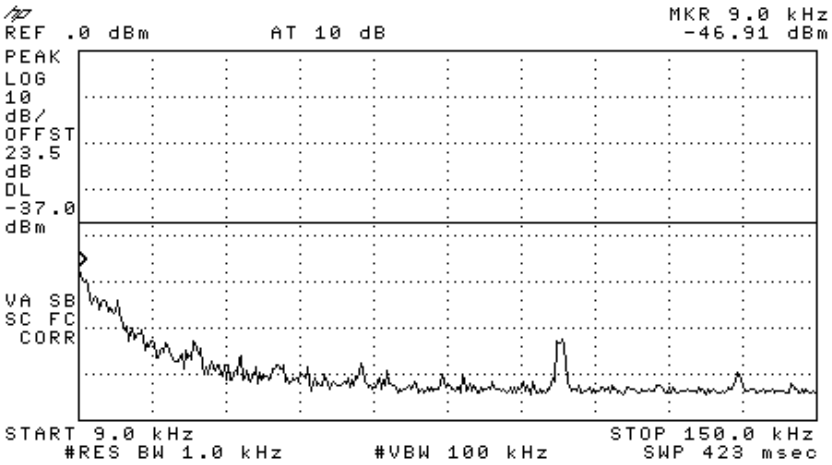

Figure 328

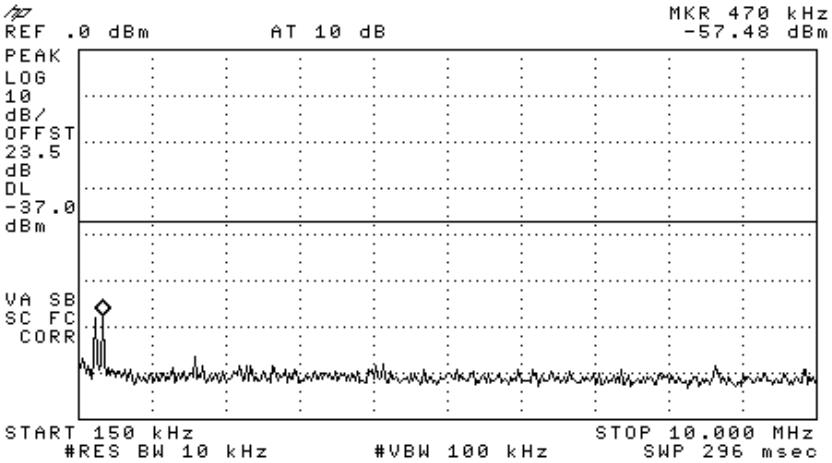

Figure 329

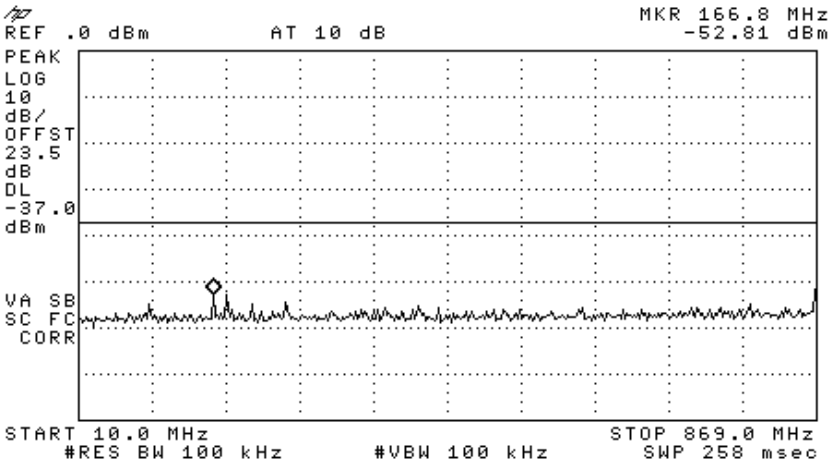

Figure 330

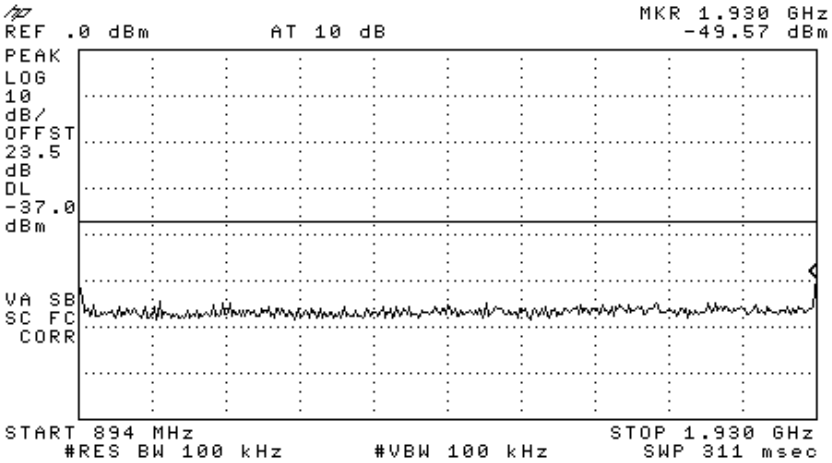

Figure 331

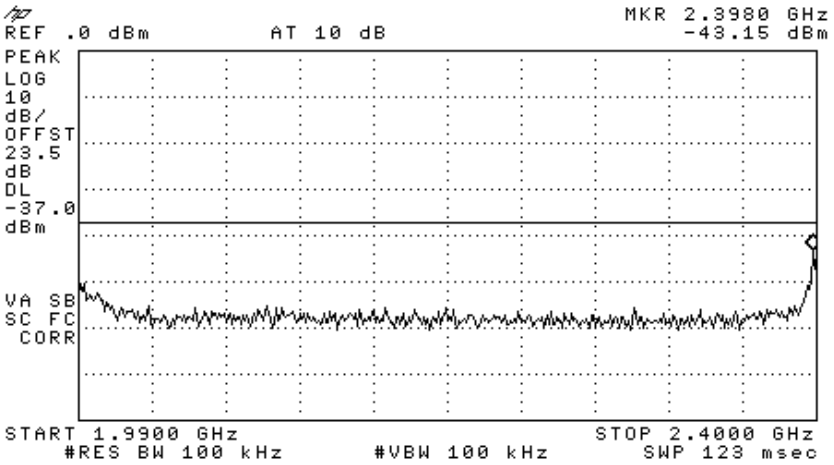

Figure 332

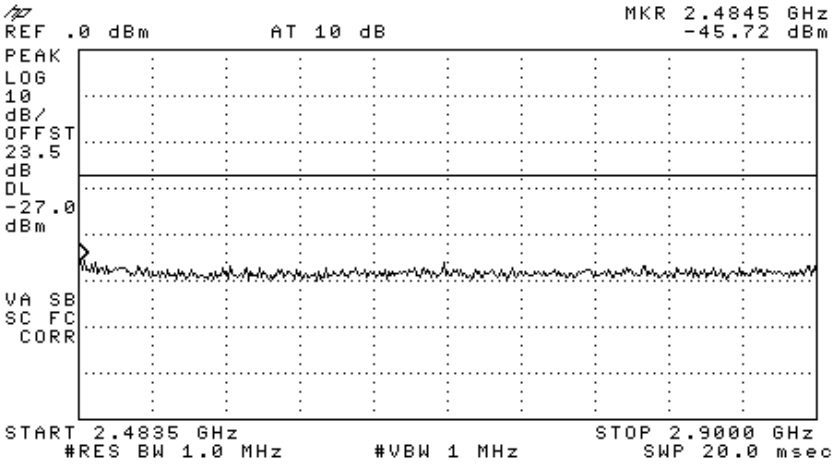

Figure 333

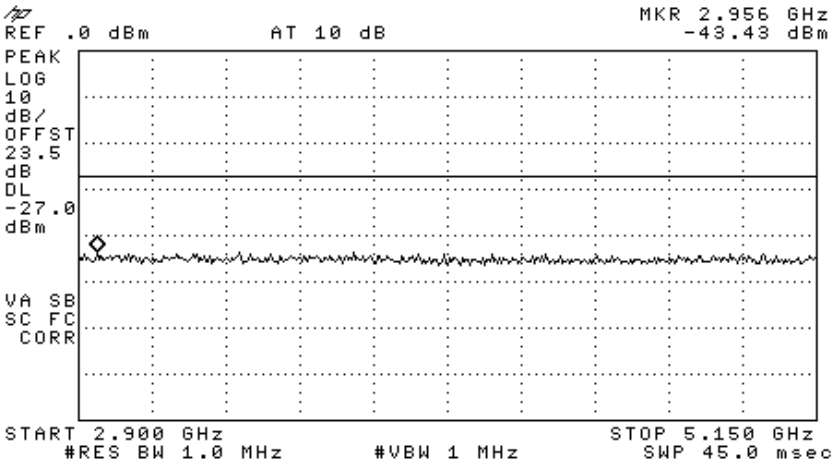

Figure 334

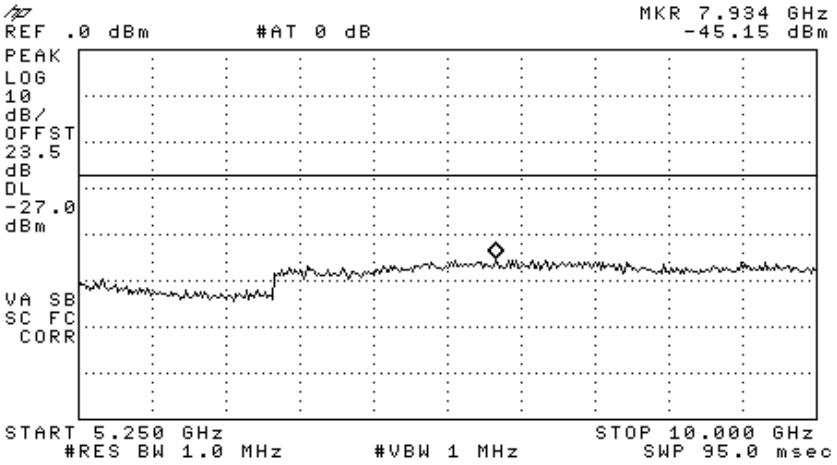

Figure 335

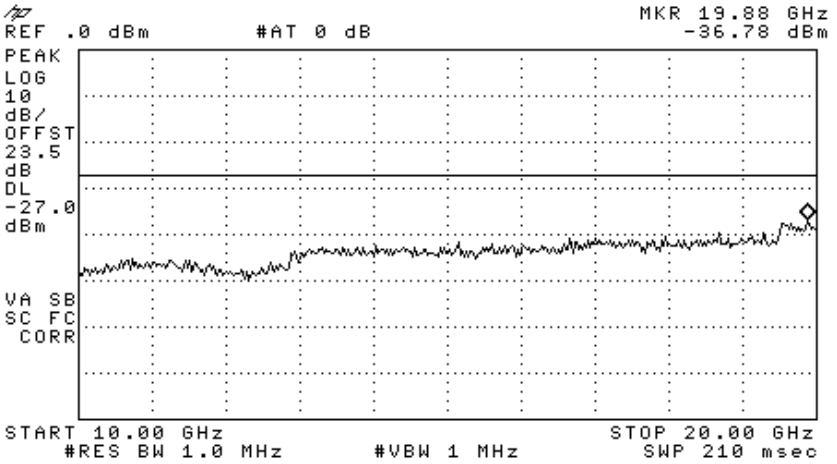

Figure 336

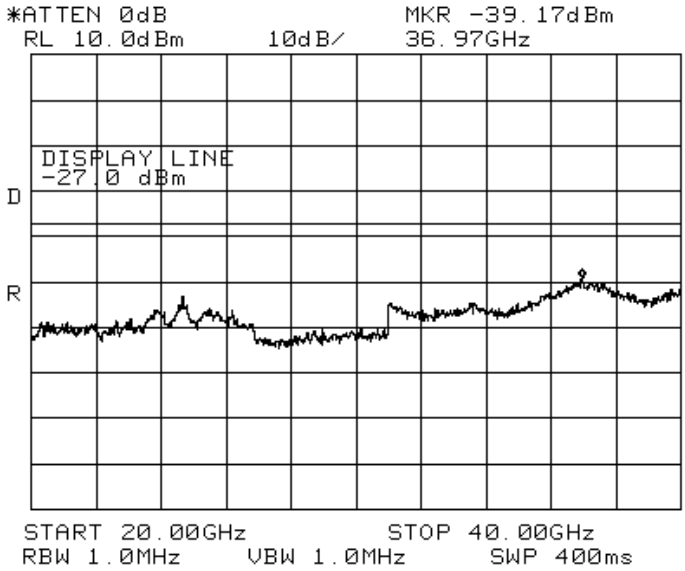

Figure 337

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 09.03.08

Typed/Printed Name: E. Pitt

26.2 Test Equipment Used.

Intermodulation

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 22, 2007	1 year
Spectrum Analyzer	HP	8564E	3442A00275	November 26, 2006	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	May 9, 2007	1 year
Cable	Rhophase	KPS-1501-1000	A1675	February 8, 2008	1 year

Figure 338 Test Equipment Used

27. APPENDIX A - CORRECTION FACTORS

27.1 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.6
30.0	0.8
40.0	0.9
50.0	1.1
60.0	1.2
70.0	1.3
80.0	1.4
90.0	1.6
100.0	1.7
150.0	2.0
200.0	2.3
250.0	2.7
300.0	3.1
350.0	3.4
400.0	3.7
450.0	4.0
500.0	4.3
600.0	4.7
700.0	5.3
800.0	5.9
900.0	6.3
1000.0	6.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.3
1400.0	7.8
1600.0	8.4
1800.0	9.1
2000.0	9.9
2300.0	11.2
2600.0	12.2
2900.0	13.0

NOTES:

1. The cable type is RG-214.

2. The overall length of the cable is 27 meters.

3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".

27.2 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

NOTES:

1. The cable type is RG-8.

2. The overall length of the cable is 10 meters.

27.3 Correction factors for CABLE

from spectrum analyzer to test antenna above 2.9 GHz

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

NOTES:

1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.

2. The cable is used for measurements above 2.9 GHz.

3. The overall length of the cable is 10 meters.

27.4 Correction factors for CABLE

from EMI receiver to test antenna at 10 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.8
30.0	0.9
40.0	1.2
50.0	1.4
60.0	1.6
70.0	1.8
80.0	1.9
90.0	2.0
100.0	2.1
150.0	2.6
200.0	3.2
250.0	3.8
300.0	4.2
350.0	4.6
400.0	5.1
450.0	5.3
500.0	5.6
600.0	6.3
700.0	7.0
800.0	7.6
900.0	8.0
1000.0	8.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	9.8
1400.0	10.0
1600.0	11.3
1800.0	12.2
2000.0	13.1
2300.0	14.5
2600.0	15.9
2900.0	16.4

NOTES:

1. The cable type is RG-214.

2. The overall length of the cable is 34 meters.

3. The above data is located in file 34M10MO.CBL on the disk marked "Radiated Emissions Tests EMI Receiver".

12.6 Correction factors for LOG PERIODIC ANTENNA

Type LPD 2010/A
at 3 and 10 meter ranges.

Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

NOTES:

1. *Antenna serial number is 1038.*
2. *The above lists are located in file number 38M3O.ANT for a 3 meter range, and file number 38M100.ANT for a 10 meter range.*
3. *The files mentioned above are located on the disk marked "Radiated Emission Test EMI Receiver".*

27.5 Correction factors for LOG PERIODIC ANTENNA

Type SAS-200/511
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

NOTES:

1. *Antenna serial number is 253.*
2. *The above lists are located in file number SAS3M0.ANT for a 3 meter range.*
3. *The files mentioned above are located on the disk marked "Antenna Factors".*

27.6 Correction factors for BICONICAL ANTENNA

Type BCD-235/B, at 3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

NOTES:

1. Antenna serial number is 1041.

2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

27.7 Correction factors for BICONICAL ANTENNA

Type BCD-235/B, 10 meter range

FREQUENCY (MHz)	AFE (dB/m)
30.0	12.1
40.0	10.6
50.0	10.6
60.0	8.9
70.0	8.5
80.0	9.6
90.0	9.4
100.0	9.6
110.0	10.3
120.0	10.7
130.0	12.6
140.0	12.7
150.0	12.7
160.0	13.8
170.0	13.7
180.0	14.9
190.0	13.4
200.0	13.1
210.0	14.0
220.0	14.5
230.0	15.8
240.0	16.0
250.0	16.6
260.0	16.7
270.0	18.3
280.0	18.5
290.0	19.3
300.0	20.9

NOTES:

1. *Antenna serial number is 1041.*
2. *The above list is located in file 41BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".*

27.8 Correction factors for Double-Ridged Waveguide Horn

Model: 3115, S/N 29845
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			

27.9 Correction factors for Horn Antenna

Model: SWH-28
at 1 meter range.

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4

27.10 Correction factors for Horn Antenna

Model: V637

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
26.0	43.6	14.9
27.0	43.7	15.1
28.0	43.8	15.3
29.0	43.9	15.5
30.0	43.9	15.8
31.0	44.0	16.0
32.0	44.1	16.2
33.0	44.1	16.4
34.0	44.1	16.7
35.0	44.2	16.9
36.0	44.2	17.1
37.0	44.2	17.4
38.0	44.2	17.6
39.0	44.2	17.8
40.0	44.2	18.0

27.11 Correction factors for ACTIVE LOOP ANTENNA

Model 6502
S/N 9506-2950

FREQUENCY	Magnetic Antenna Factor	Electric Antenna Factor
(MHz)	(dB)	(dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2