Israel Testing Laboratories

ACCREDITED
Cert. No. 1152.01
Electrical (EMC)

DATE: 18 February 2009

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

FCC Radio Test Report

for

MobileAccess Networks

Equipment under test:

WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Cisco 1242 Access Points

2.4 GHz Transmitter

860M-AU With WCE-AU

Written by: _____
D. Shidlowsky, Documentation

Approved by: _____
A. Sharabi, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

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Measurement/Technical Report for

MobileAccess Networks

WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Cisco 1242 Access Points

860M-AU With WCE-AU

FCC ID: OJFMA860WCE-AU

This report concerns:	Original Grant:	X
	Class I Change:	
	Class II Change:	

Equipment type: DTS

Limits used:
47CFR15 Section 15.247

Measurement procedure used is ANSI C63.4-2003.

Application for Certification
prepared by:
Ishaishou Raz
ITL (Product Testing) Ltd.
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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
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U.S.A.
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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 Cisco 1242 Access Points
Equipment Model No.:	860M-AU With WCE-AU
Equipment Serial No.:	860M-AU: 0837453; WCE-AU:0847A54
Date of Receipt of E.U.T:	01.02.09
Start of Test:	01.02.09
End of Test:	05.02.09
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	See Section 2

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), IC File No.: 46405-4025; Site No. IC 4025B-1.
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 E.U.T. was originally authorized for FCC under FCC ID OJFMA860WCE. Due to changes in both the 860M and the WCE a new certification is required. Testing was performed according to correspondence with Mr. Joe Dichoso of the FCC dated 29 May 2008 :

"**From:** Steve Blum [mailto:sblum@mobileaccess.com]
Sent: Thursday, May 29, 2008 3:06 PM
To: Joe Dichoso
Subject: RE: FCC Guidance
Yes, we have two issues: summary of test data attached. Let me know if you need more details.
1. MobileAccess is requesting updated guidance on the part 15 testing for the model 860. The 860 is essentially a part 15 subpart C amplifier for 802.11 b/g/a WLAN services.
a. Main difference is the 860 couples licensed services (via certificated transmitters) onto the coax with the 802.11b/g and a services.
1. Licensed services are passively coupled and all services are filtered to prevent interference.
b. Previous guidance from FCC from March 2006, requires 3 sets of tests, b/g only, b/g and a, b/g with a and cell/pcs.
c. Test data from all submissions to date (summary attached) shows that "b/g and a" is worse case while passing all b/g and a tests.
d. Request that guidance be modified to require only "b/g and a" test for future submissions
1. MobileAccess agrees that the 860 is professionally installed and must be tested and sold with labels on transmitter for the specific transmitter approved.
Reply: As before, the amplifier must be certified with a specific transmitter FCC ID XXXXXX it was tested with. Please note marketing requirements per 15.204(d). The amplifier must be marketed with the transmitter or designed in such a fashion that it can be used only with that transmitter. You can submit full tests with all "b/g and a" and cell/pcs active. Prescan tests can be made in all other modes.
Steve Blum
Product Manager
MobileAccess
Office 541 758-2880
Mobile 541 990-3470
Making Wireless an Indoor State of Mind

This electronic mail message and any attached files or documents contain information intended for the exclusive use of the party or parties to whom it is addressed and may contain information that is confidential, proprietary and/or privileged. If you are not an intended recipient, or the person responsible for delivering the e-mail to the intended recipient, you are hereby notified that you have received this message in error and that any viewing, copying, disclosure, distribution, dissemination, forwarding, printing or other use of this information is strictly prohibited and may be subject to legal restriction or sanction. Please notify the sender, by electronic mail or telephone, of any unintended recipients and destroy all copies of this message and the attachments (if any) without making any copies thereof."

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 WMTS and AWS 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

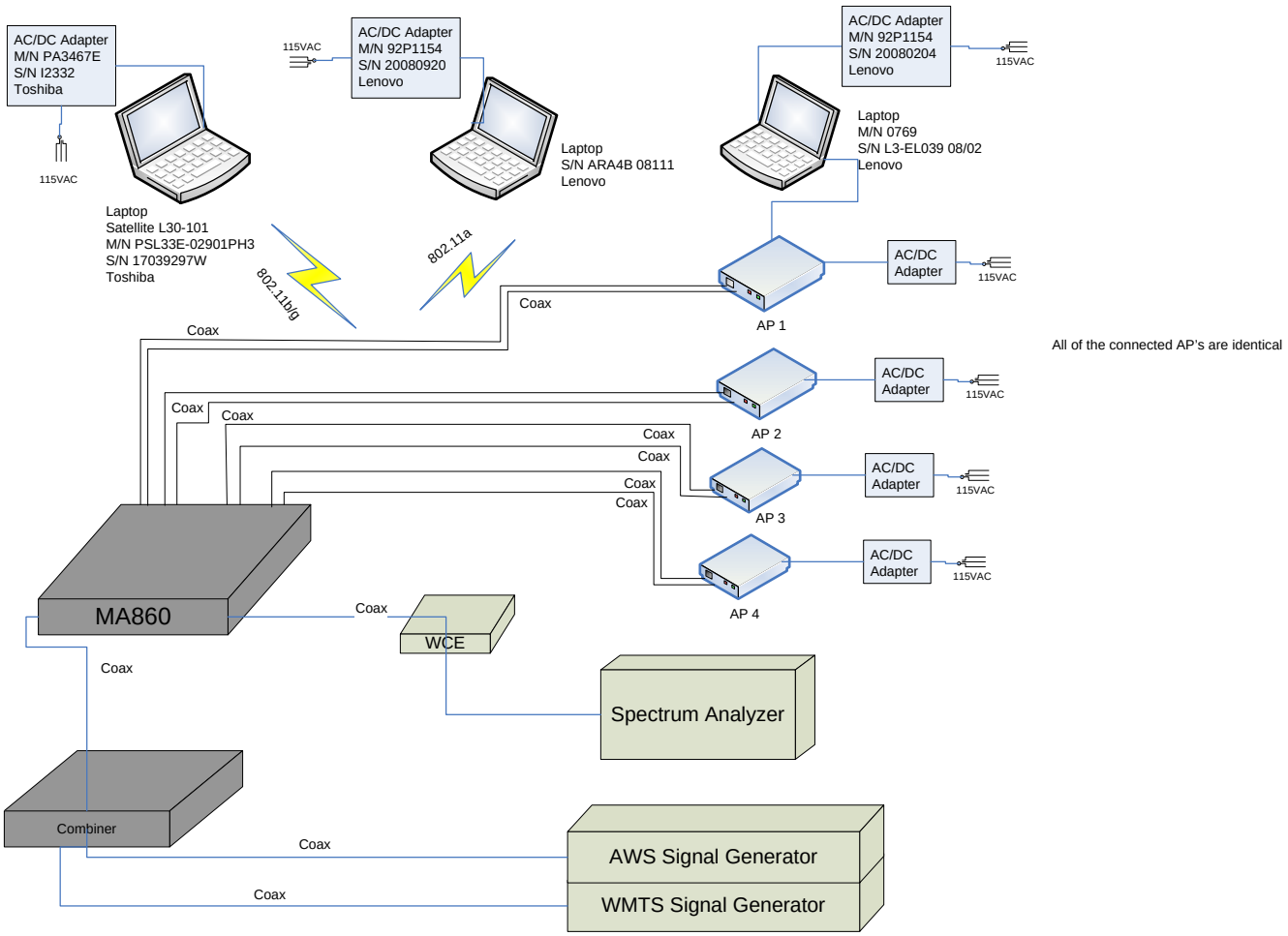


Figure 1. Configuration of Tested System

Note: The system was tested using four identical Cisco Access Points M/N 1242, S/N FTX1108B616, S/N FTX11013B13Q, S/N FTX1108B60Z, S/N FTX1108B605, FCC ID: LDK102056.

3. Theory of Operation

3.1 Theory of Operation

mobileaccess

Making Wireless an Indoor State of Mind

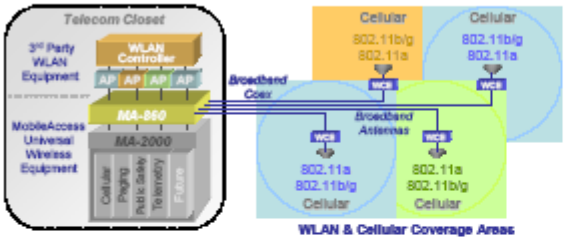
MA-860 WLAN Solution

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)

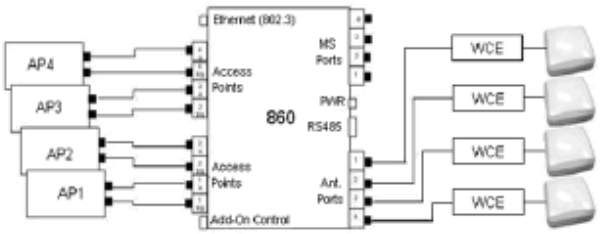
Ordering Information

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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4. Conducted Emission Data

4.1 Test Specification

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 3.1. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room, with the E.U.T placed on an 0.8 meter high wooden table, 0.4 meter from the room's vertical wall.

The E.U.T was powered from 115 V AC / 60 Hz via a 50 Ohm / 50 µHn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver via a 3.5" floppy disk and are displayed on the receiver's spectrum display.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, and using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

4.3 Measured Data

JUDGEMENT: Passed by 1.6 dB

The margin between the emission levels and the specification limit was, in the worst case, 1.6 dB for the phase line at 1.23 MHz and 9.7 dB for the neutral line at 9.88 MHz.

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

The details of the highest emissions are given in *Figure 2* to *Figure 5*.
TEST PERSONNEL:

Tester Signature: _____ Date: 22.02.09

Typed/Printed Name: A. Sharabi

Conducted Emission

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Cisco 1242 Access Points
Type	860M-AU With WCE-AU
Serial Number:	860M-AU: 0837453; WCE-AU:0847A54

Specification:	FCC Part 15, Subpart C
Lead:	Phase
Detectors:	Peak, Quasi-peak, Average

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	0.168282	43.7	36.0	-29.1	31.3	-23.8	0.0
2	0.341864	41.6	40.5	-18.7	39.4	-9.8	0.0
3	1.230928	48.0	45.7	-10.3	44.3	-1.6	0.0
4	2.496622	45.5	42.4	-13.6	39.5	-6.4	0.0
5	5.202922	49.4	45.2	-14.8	29.4	-20.6	0.0
6	9.886600	43.5	42.5	-17.5	36.7	-13.4	0.0

Figure 2. Detectors: Peak, Quasi-peak, AVERAGE .

Note: QP Delta/Av Delta refer 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.

Conducted Emission

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Cisco 1242 Access Points
Type	860M-AU With WCE-AU
Serial Number:	860M-AU: 0837453; WCE-AU:0847A54

Specification:	FCC Part 15, Subpart C
Lead:	Phase
Detectors:	Peak, Quasi-peak, Average

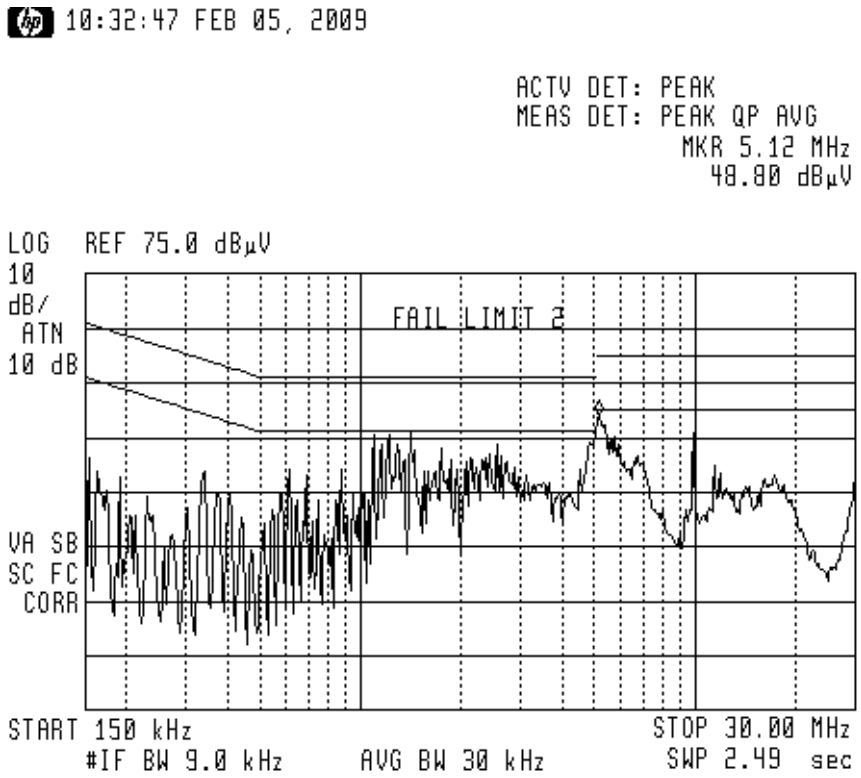


Figure 3. Detectors: Peak, Quasi-peak, Average

Note: Fail indication on the spectral plot results from peak detector level reading above the limit. This indication is for information only and it should not be interpreted as a test failure.

Conducted Emission

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Cisco 1242 Access Points
Type	860M-AU With WCE-AU
Serial Number:	860M-AU: 0837453; WCE-AU:0847A54

Specification:	FCC Part 15, Subpart C
Lead:	Neutral
Detectors:	Peak, Quasi-peak, Average

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	0.167876	41.8	33.3	-31.8	11.9	-43.2	0.0
2	1.037234	12.9	5.1	-50.9	-3.1	-49.1	0.0
3	1.230733	31.8	30.1	-25.9	29.3	-16.7	0.0
4	5.272493	40.8	35.7	-24.3	20.7	-29.3	0.0
5	6.862503	34.8	30.3	-29.7	16.7	-33.3	0.0
6	9.884819	45.5	42.7	-17.4	40.3	-9.7	0.0

Figure 4. Detectors: Peak, Quasi-peak, AVERAGE

Note: QP Delta/Av Delta refer 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.

Conducted Emission

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Cisco 1242 Access Points
Type	860M-AU With WCE-AU
Serial Number:	860M-AU: 0837453; WCE-AU:0847A54

Specification:	FCC Part 15, Subpart C
Lead:	Neutral
Detectors:	Peak, Quasi-peak, Average

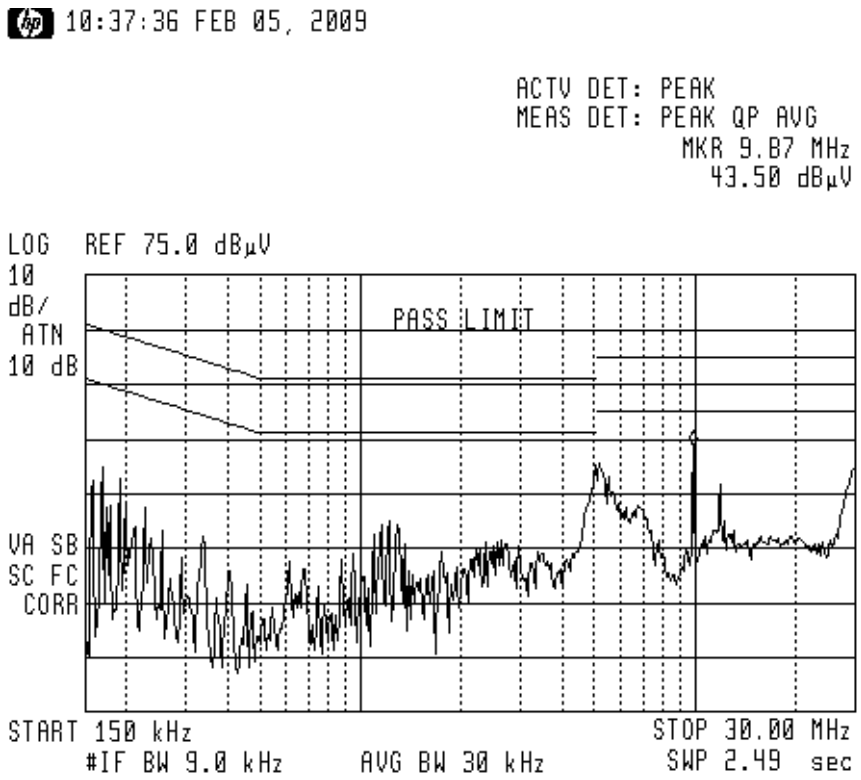


Figure 5 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak, Average

4.4 Test Instrumentation Used, Conducted Measurement

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
LISN	Fischer	FCC-LISN-2A	127	March 8, 2008	1 Year
LISN	Fischer	FCC-LISN-2A	128	March 8, 2008	1 Year
EMI Receiver	HP	85422E	3906A00276	November 17, 2008	1Year
RF Filter Section	HP	85420E	3705A00248	November 16, 2008	1Year
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

5. Spurious Radiated Emission in the Restricted Band, Below 1 GHz 802.11b/g+802.11a + WMTS + AWS Signals

5.1 Test Specification

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

5.2 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.

5.3 Test Data

JUDGEMENT: Passed

The signals in the band 9 kHz – 1.0 GHz were below the spectrum analyzer noise level, at least 20 dB below the specification limit.
The results for all three operating frequencies and modulations were the same.

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

TEST PERSONNEL:

Tester Signature: _____ Date: 22.02.09

Typed/Printed Name: A. Sharabi

5.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 17, 2008	1 year
RF Section	HP	85420E	3705A00248	November 16, 2008	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	March 23, 2008	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 06, 2008	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 15, 2008	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

5.5 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.

6. Spurious Radiated Emission in the Restricted Band, Above 1 GHz 802.11 b/g + 802.11a + WMTS + AWS Signals

6.1 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.

6.2 Test Data

JUDGEMENT: Passed by 1.3 dB

For the operation frequency of 2412 MHz, the margin between the emission level and the specification limit is 4.1 dB in the worst case at the frequency of 2398.00 MHz, horizontal polarization.

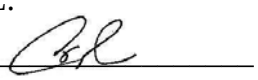
For the operation frequency of 2437 MHz, the margin between the emission level and the specification limit is 2.7 dB in the worst case at the frequency of 4874.00 MHz, vertical polarization.

For the operation frequency of 2462 MHz, the margin between the emission level and the specification limit is 1.3 dB in the worst case at the frequency of 2483.50 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: 22.02.09

Typed/Printed Name: A. Sharabi

Radiated Emission Above 1 GHz

E.U.T Description	WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Cisco 1242 Access Points
Type	860M-AU With WCE-AU
Serial Number:	860M-AU: 0837453; WCE-AU:0847A54

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. (MHz)	Polarity (H/V)	Peak Reading (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2398.0	V	52.9	74.0	-21.1
2398.0	H	57.0	74.0	-17.0
4828.0	V	58.5	74.0	-15.5
4828.0	H	58.3	74.0	-15.7

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 Reading" 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 Cisco 1242 Access Points
Type	860M-AU With WCE-AU
Serial Number:	860M-AU: 0837453; WCE-AU:0847A54

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. (MHz)	Polarity (H/V)	Average Reading (dBµV/m)	Average Specification (dB µV/m)	Peak. Margin (dB)
2398.0	V	48.8	54.0	-5.2
2398.0	H	49.9	54.0	-4.1
4848.0	V	47.8	54.0	-6.2
4838.0	H	45.7	54.0	-8.3

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 Reading" 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 Cisco 1242 Access Points
Type	860M-AU With WCE-AU
Serial Number:	860M-AU: 0837453; WCE-AU:0847A54

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. (MHz)	Polarity (H/V)	Peak Reading (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
4874.0	V	48.3	74.0	-25.7
4874.0	H	44.8	74.0	-29.2

Figure 8. 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 Reading" 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 Cisco 1242 Access Points
Type	860M-AU With WCE-AU
Serial Number:	860M-AU: 0837453; WCE-AU:0847A54

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. (MHz)	Polarity (H/V)	Average Reading (dBµV/m)	Average Specification (dB µV/m)	Peak. Margin (dB)
4874.0	V	51.3	54.0	-2.7
4874.0	H	38.8	54.0	-15.2

Figure 9. 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 Reading" 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 Cisco 1242 Access Points
Type	860M-AU With WCE-AU
Serial Number:	860M-AU: 0837453; WCE-AU:0847A54

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. (MHz)	Polarity (H/V)	Peak Reading (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2483.5	V	63.4	74.0	-10.6
2483.5	H	72.7	74.0	-1.3
2924.0	V	50.6	74.0	-23.4
2924.0	H	52.5	74.0	-21.5

Figure 10. 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 Reading" 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 Cisco 1242 Access Points
Type	860M-AU With WCE-AU
Serial Number:	860M-AU: 0837453; WCE-AU:0847A54

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. (MHz)	Polarity (H/V)	Average Reading (dBµV/m)	Average Specification (dB µV/m)	Peak. Margin (dB)
2483.5	V	48.4	54.0	-5.6
2483.5	H	52.5	54.0	-1.5
2924.0	V	45.8	54.0	-8.2
2924.0	H	47.5	54.0	-6.5

Figure 11. 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 Reading" includes correction factor.

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

6.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3411A00102	November 17, 2008	1 year
RF Section	HP	85420E	3427A00103	November 16, 2008	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	January 29, 2009	2 years
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 15, 2006	2 years
Horn Antenna	ARA	SWH-28	1008	December 23, 2008	2 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 3, 2008	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	January 8, 2009	1 year
Low Noise Amplifier	MK Milliwave	MKT6-3000 400-30-13P	399	January 8, 2009	1 year
Spectrum Analyzer	HP	8592L	3826A01204	March 5, 2008	1 year
Spectrum Analyzer	HP	8546E	3442A00275	December 15, 2008	1 year
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

7. 26 dB Bandwidth 802.11 b/g + 802.11a + WMTS + AWS Signals

7.1 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).

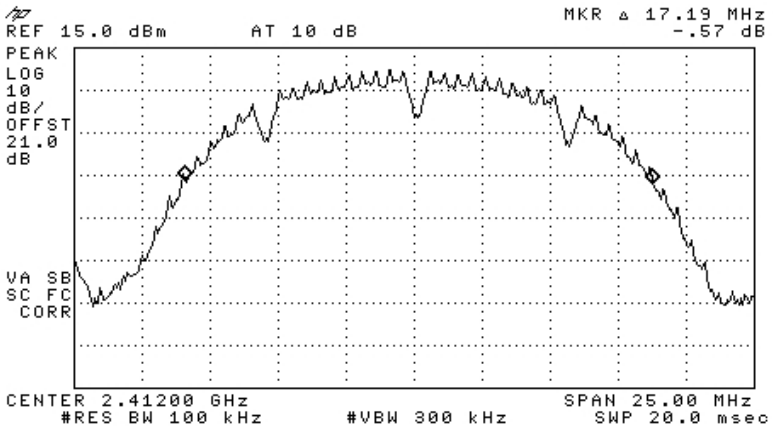


Figure 12 —2412 MHz DBPSK

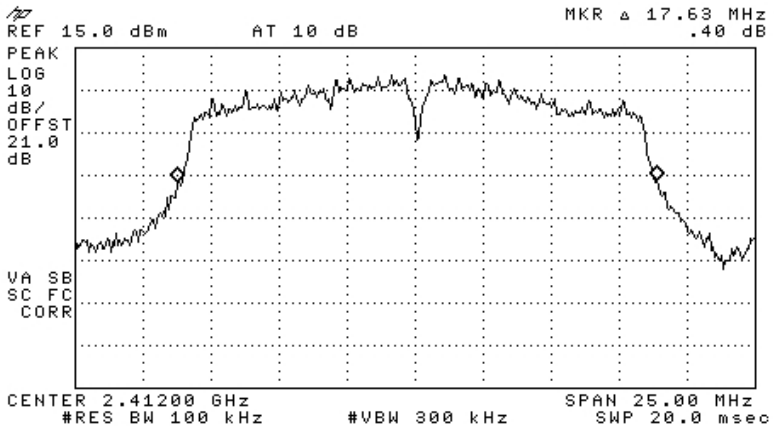


Figure 13 —2412 MHZ BPSK

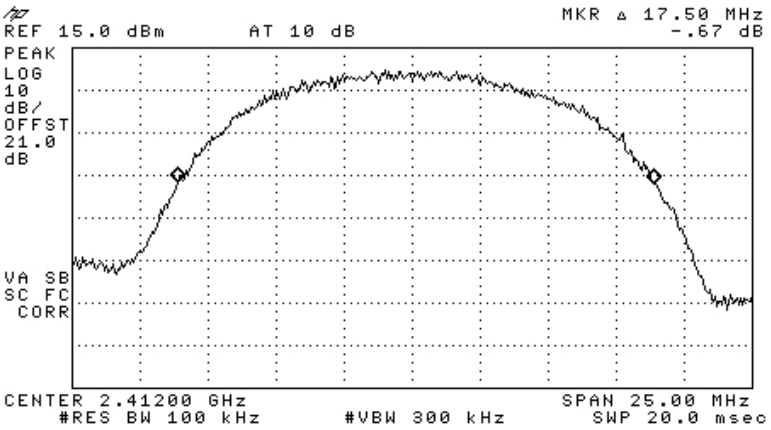


Figure 14 —2412 MHz CCK

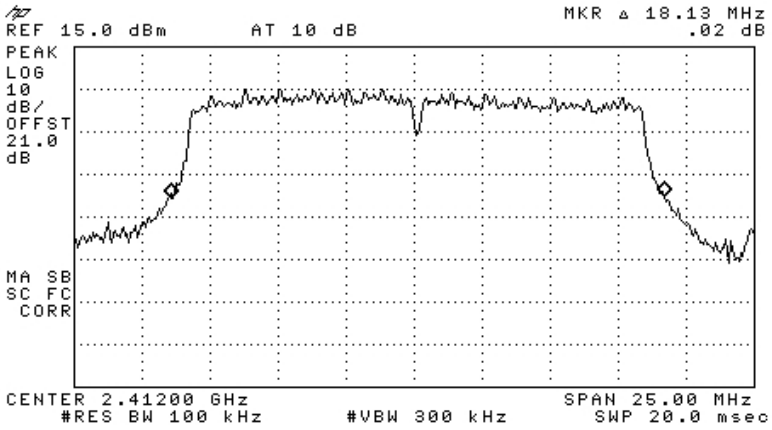


Figure 15 —2412 MHZ 64QAM

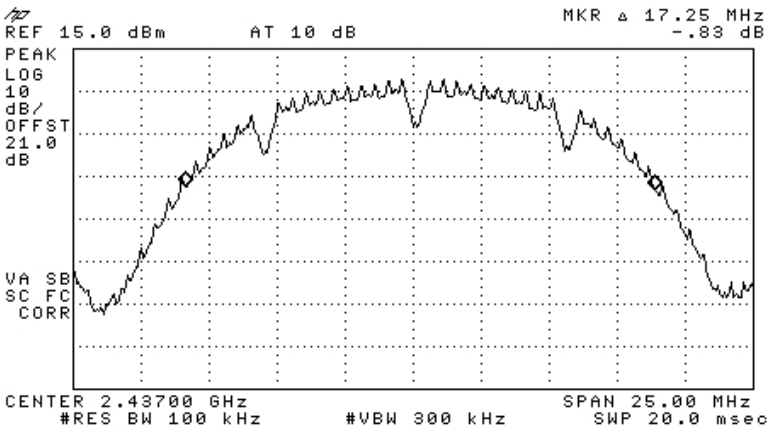


Figure 16 —2437 MHz DBPSK

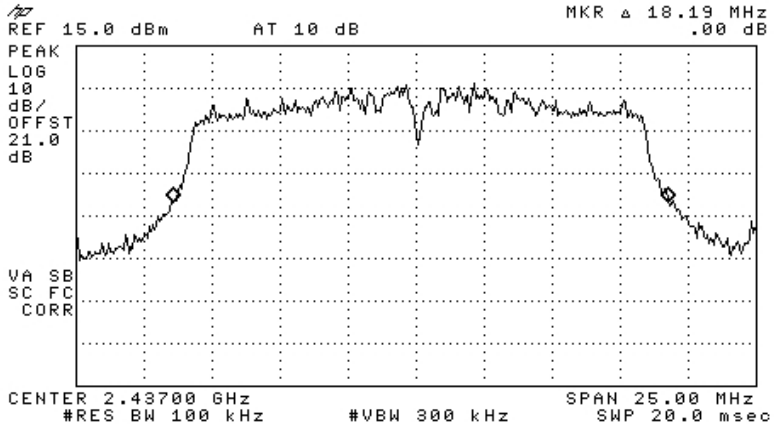


Figure 17 —2437 MHZ BPSK

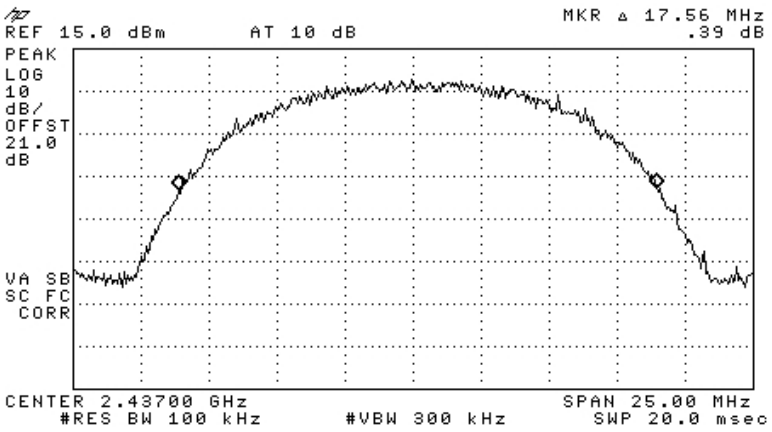


Figure 18 —2437 MHz CCK

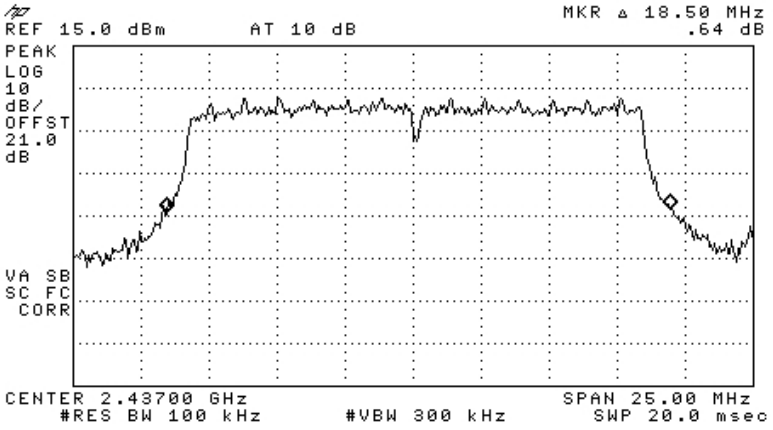


Figure 19 —2437 MHZ 64QAM

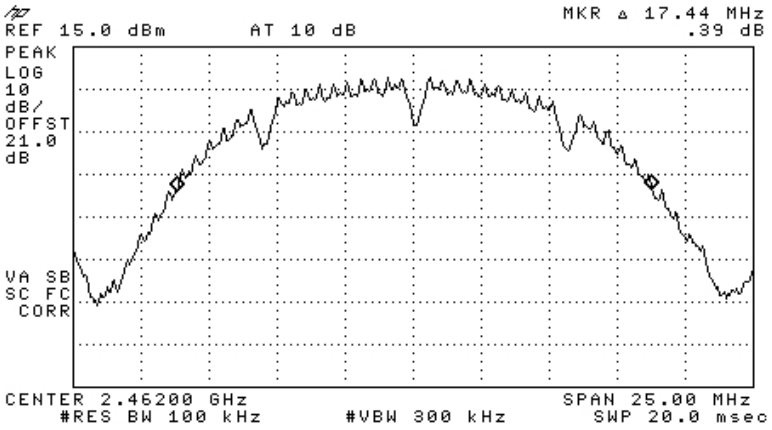


Figure 20 —2462 MHz DBPSK

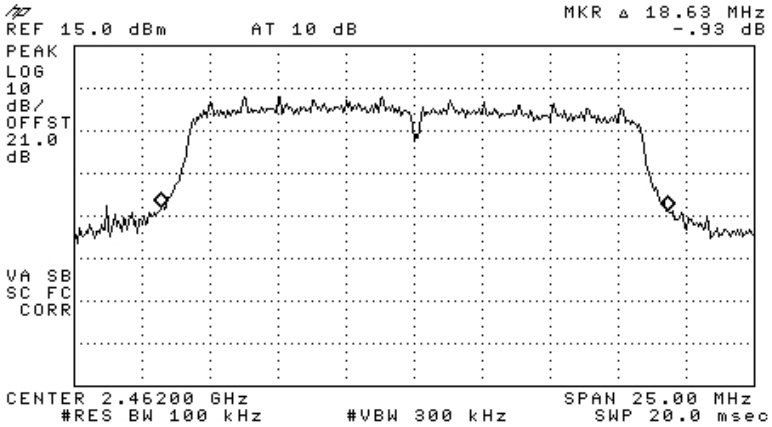


Figure 21 —2462 MHZ BPSK

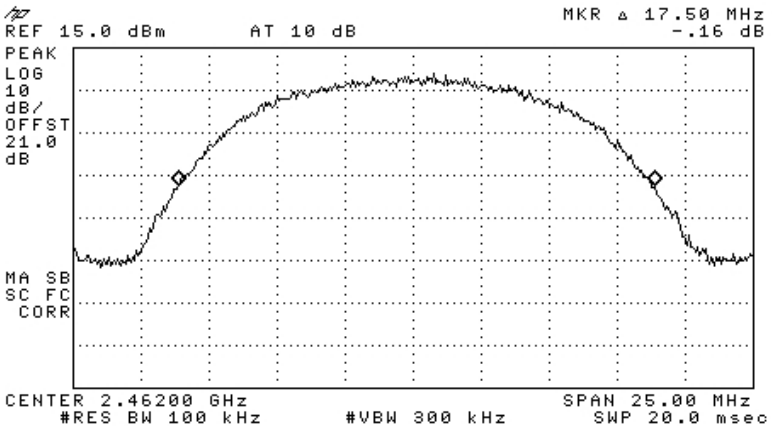


Figure 22 —2462 MHz CCK

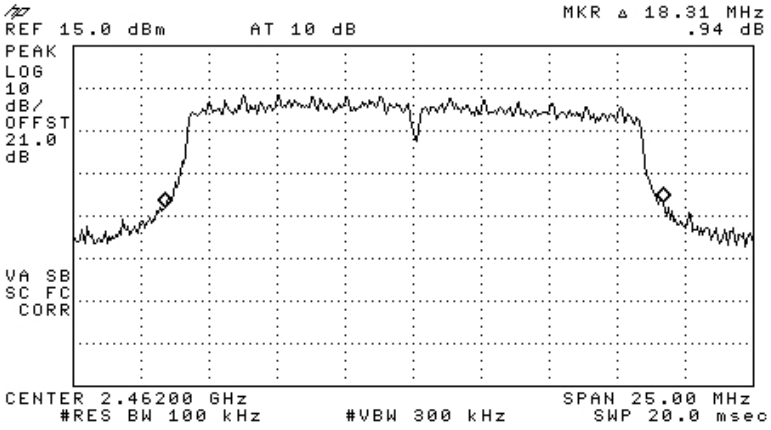


Figure 23 —2462 MHZ 64QAM

Operation Frequency (MHz)	Modulation	26 dB Bandwidth (dBm)
2412	DBPSK	17.19
	BPSK	17.63
	CCK	17.50
	64QAM	18.13
2437	DBPSK	17.25
	BPSK	18.19
	CCK	17.56
	64QAM	18.50
2462	DBPSK	17.44
	BPSK	18.63
	CCK	17.50
	64QAM	18.31

TEST PERSONNEL:

Tester Signature: _____ Date: 22.02.09

Typed/Printed Name: A. Sharabi

7.2 Test Equipment Used.

26 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 5, 2008	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	February 1, 2009	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 1, 2009	1 year

Figure 24 Test Equipment Used

8. Maximum Transmitted Peak Power Output 802.11 b/g + 802.11a + WMTS + AWS 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 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).

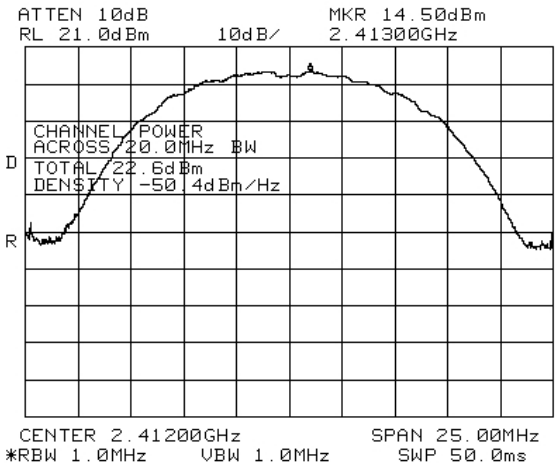


Figure 25 2412 DBPSK

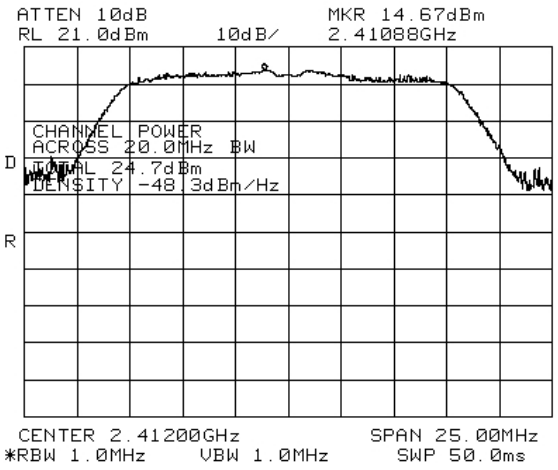


Figure 26 2412 MHz BPSK

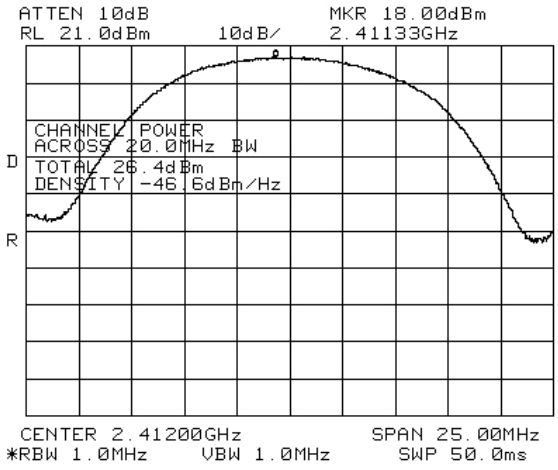


Figure 27 2412 MHz CCK

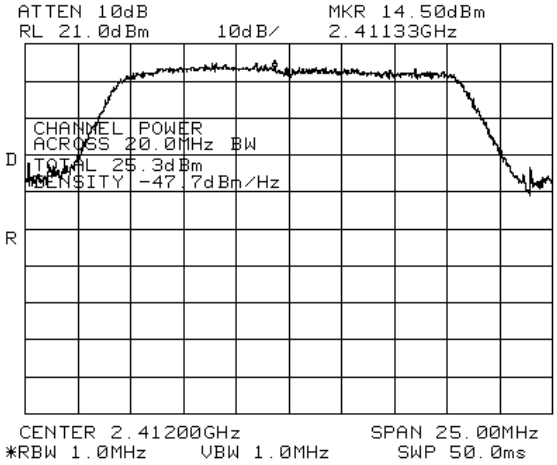


Figure 28 2412 MHz 64QAM

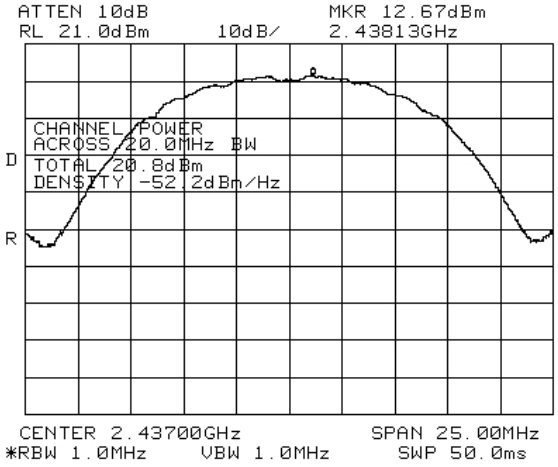


Figure 29 2437 MHz DBPSK

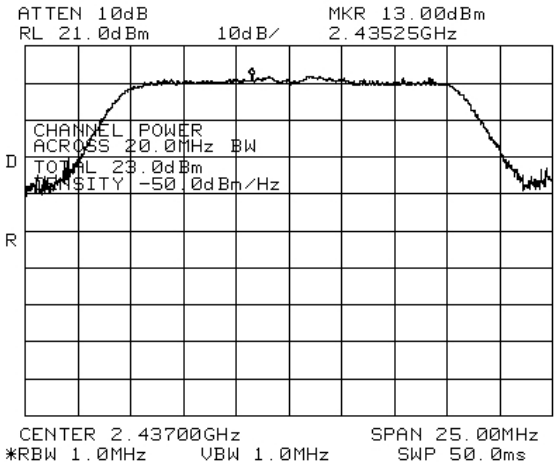


Figure 30 2437 MHz BPSK

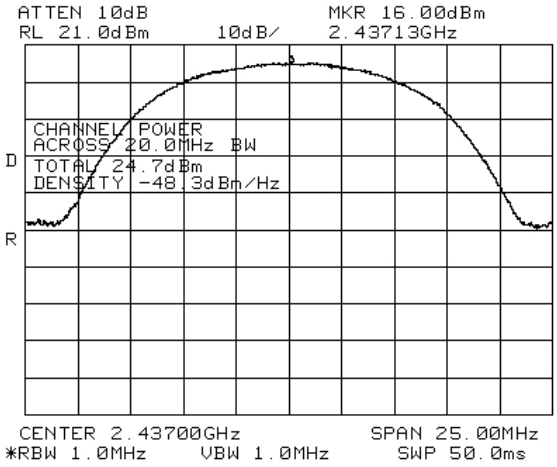


Figure 31 2437 MHz CCK

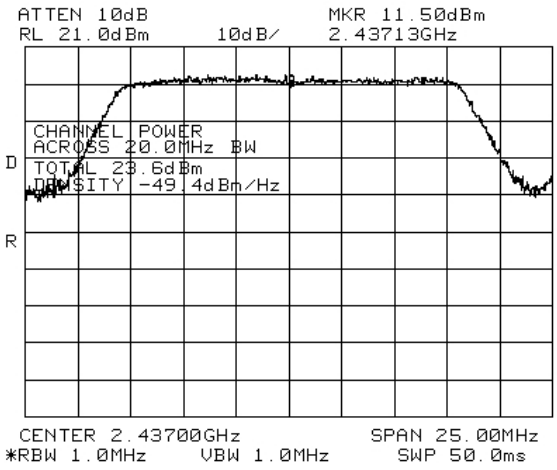


Figure 32 2437 MHz 64QAM

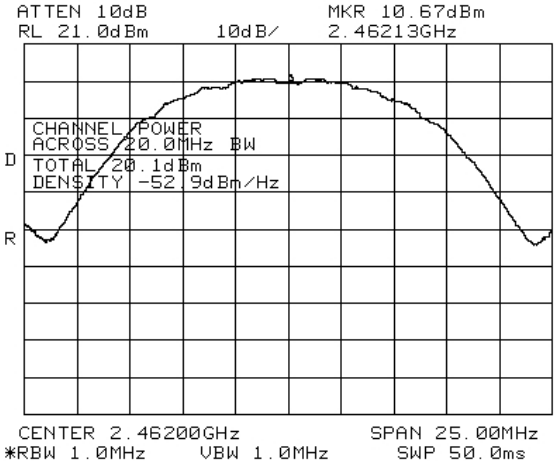


Figure 33 2462 MHz DBPSK

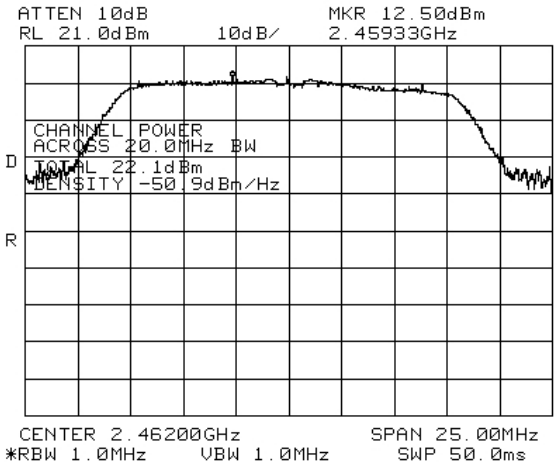


Figure 34 2462 MHz BPSK

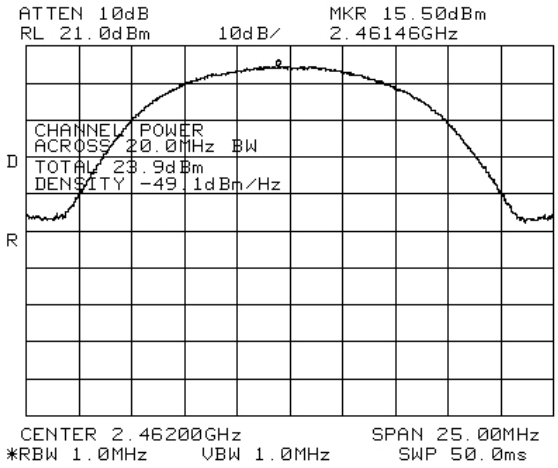


Figure 35 2462 MHz CCK

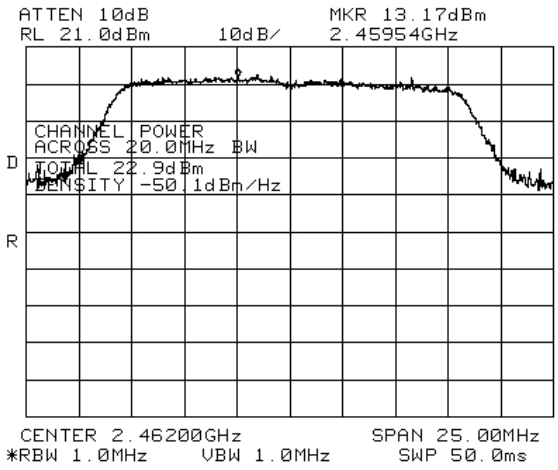


Figure 36 2462 MHz 64QAM

8.2 Results table

E.U.T. Description: WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Cisco 1242 Access Points
Model No.: 860M-AU With WCE-AU
Serial Number: 860M-AU: 0837453; WCE-AU:0847A54
Specification: F.C.C. Part 15, Subpart C

Operation Frequency (MHz)	Modulation	Power (dBm)	Specification (dBm)	Margin (dB)
2412	DBPSK	22.6	29.0	-6.4
	BPSK	24.7	29.0	-4.3
	CCK	26.4	29.0	-2.6
	64QAM	25.3	29.0	-3.7
2437	DBPSK	20.8	29.0	-8.2
	BPSK	23.0	29.0	-6.0
	CCK	24.7	29.0	-4.3
	64QAM	23.6	29.0	-5.4
2462	DBPSK	20.1	29.0	-8.9
	BPSK	22.1	29.0	-6.9
	CCK	23.9	29.0	-5.1
	64QAM	22.9	29.0	-6.1

Figure 37 Maximum Peak Power Output

Note: Antenna Gain is 7 dBi

JUDGEMENT: Passed by 2.6 dB

TEST PERSONNEL:

Tester Signature:  Date: 22.02.09

Typed/Printed Name: A. Sharabi

8.3 Test Equipment Used.

Peak Power Output

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	December 15, 2008	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	February 1, 2009	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 1, 2009	1 year

Figure 38 Test Equipment Used

9. Peak Power Output Out of 2400-2483.5 MHz Band 802.11 b/g +802.11a + WMTS + AWS Signals

9.1 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. 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).

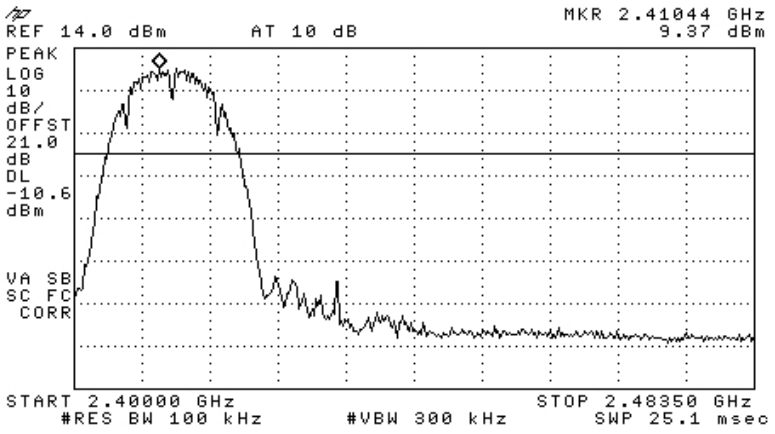


Figure 39 —2412 MHz DBPSK

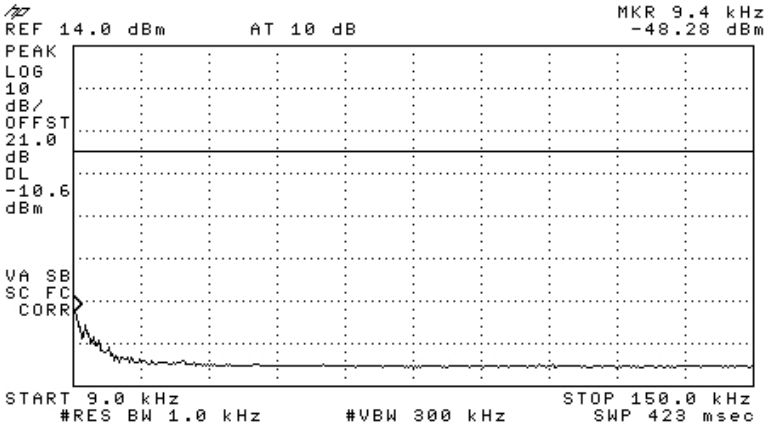


Figure 40 —2412 MHz DBPSK

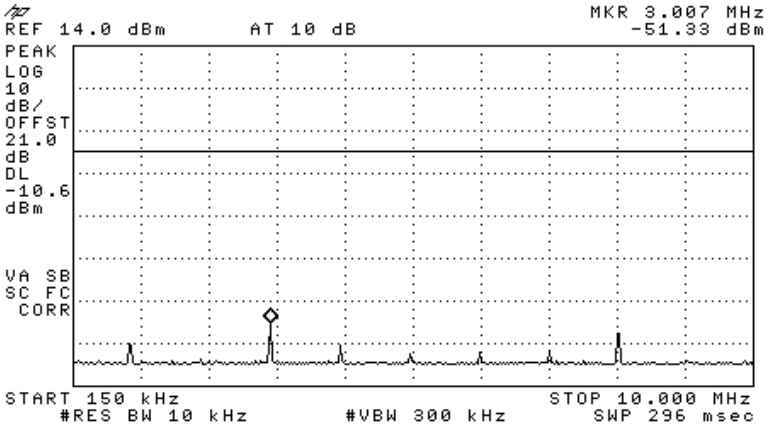


Figure 41 —2412 MHz DBPSK

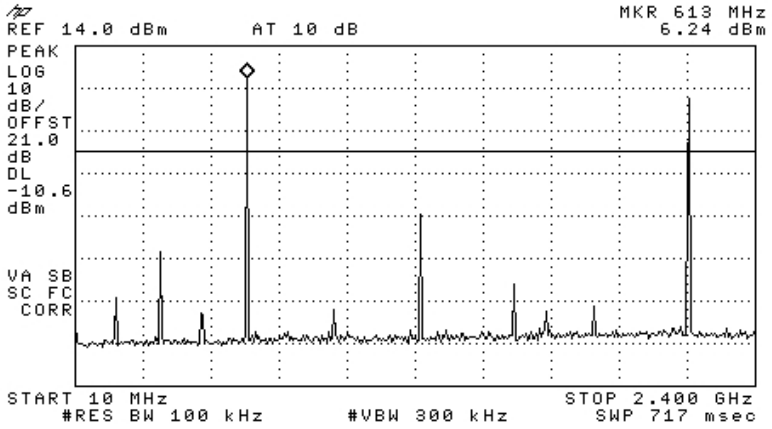


Figure 42 —2412 MHz DBPSK

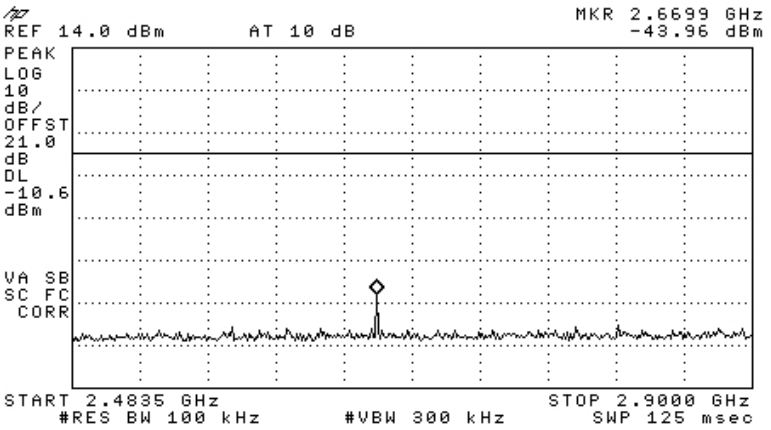


Figure 43 —2412 MHz DBPSK

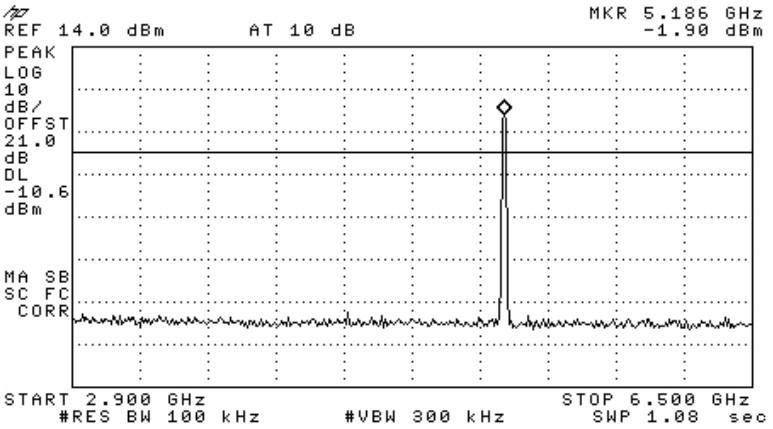


Figure 44 —2412 MHz DBPSK

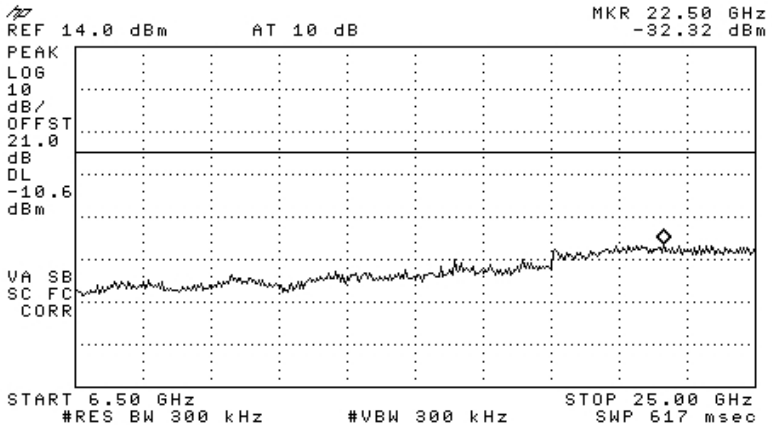


Figure 45 —2412 MHz DBPSK

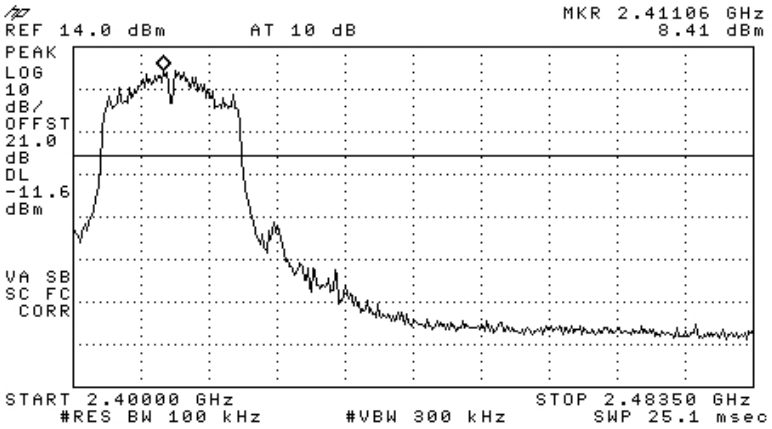


Figure 46 —2412 MHz BPSK

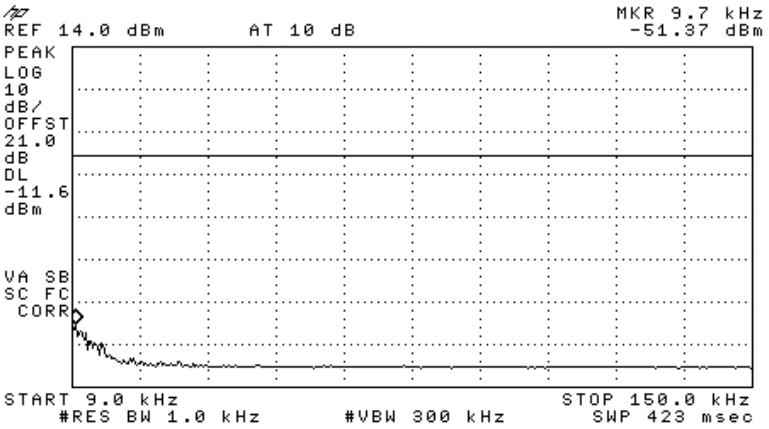


Figure 47 —2412 MHz BPSK

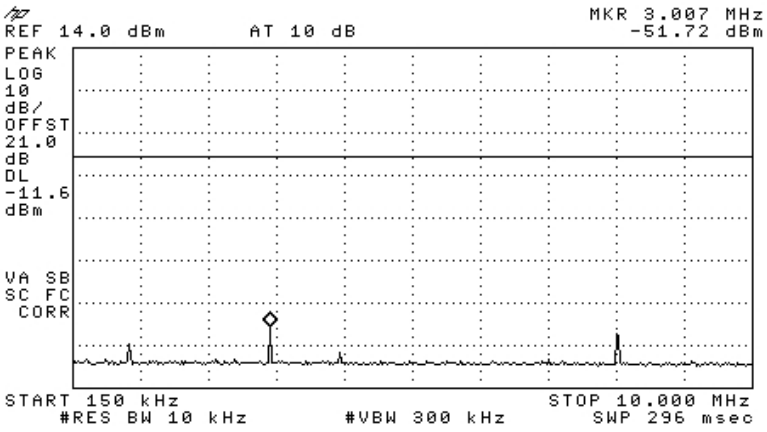


Figure 48 —2412 MHz BPSK

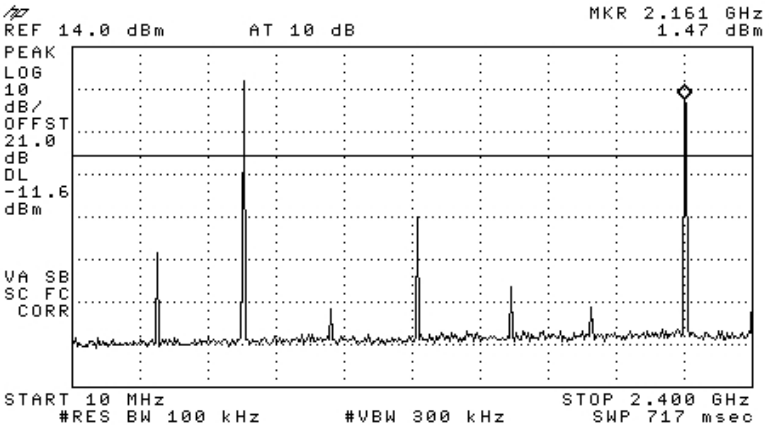


Figure 49 —2412 MHz BPSK

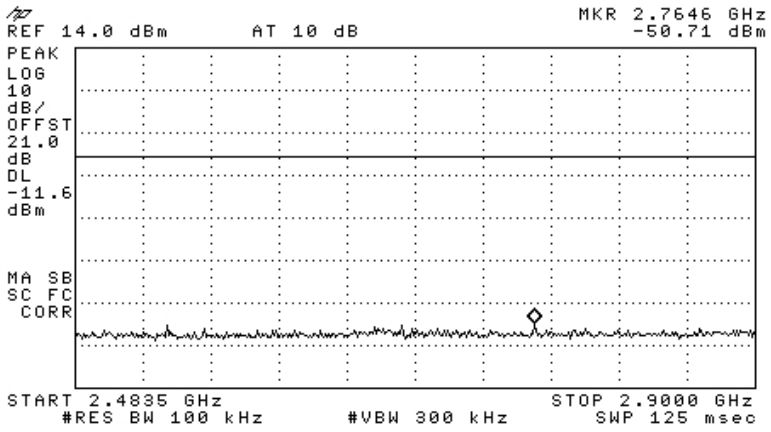


Figure 50 —2412 MHz BPSK

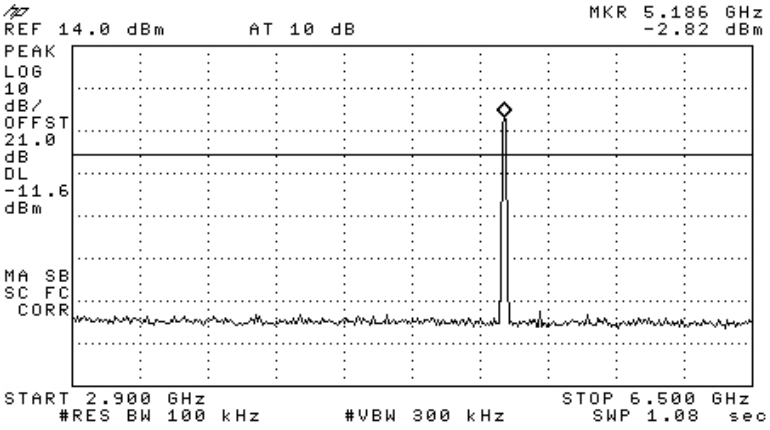


Figure 51 —2412 MHz BPSK

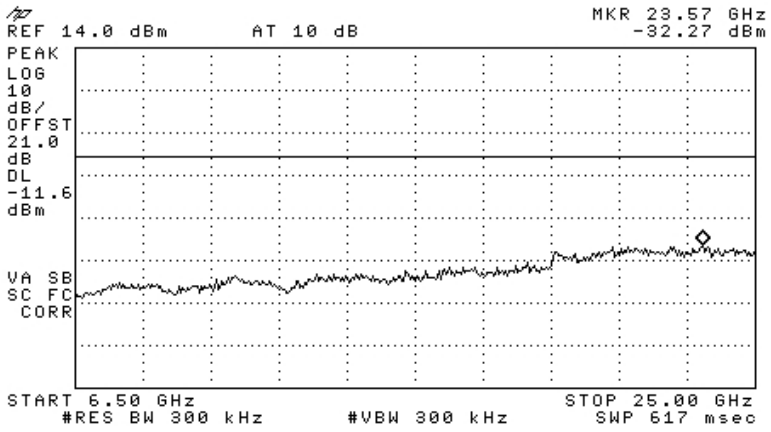


Figure 52 —2412 MHz BPSK

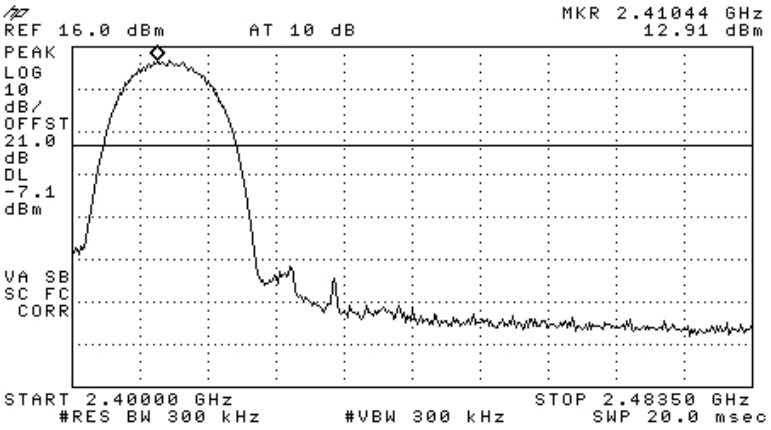


Figure 53 —2412 MHz CCK

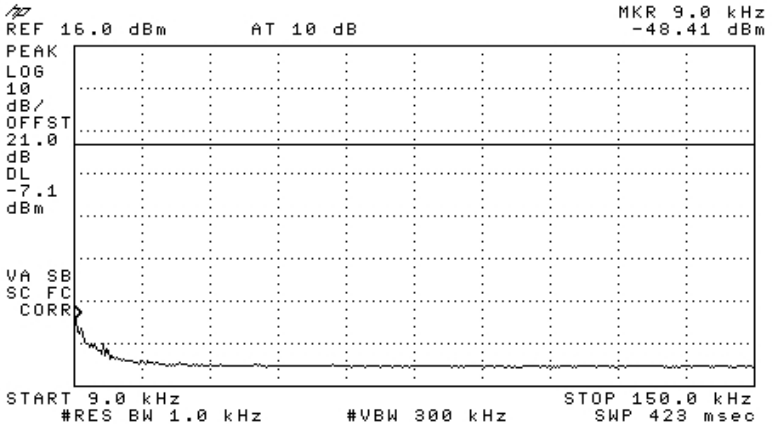


Figure 54 —2412 MHz CCK

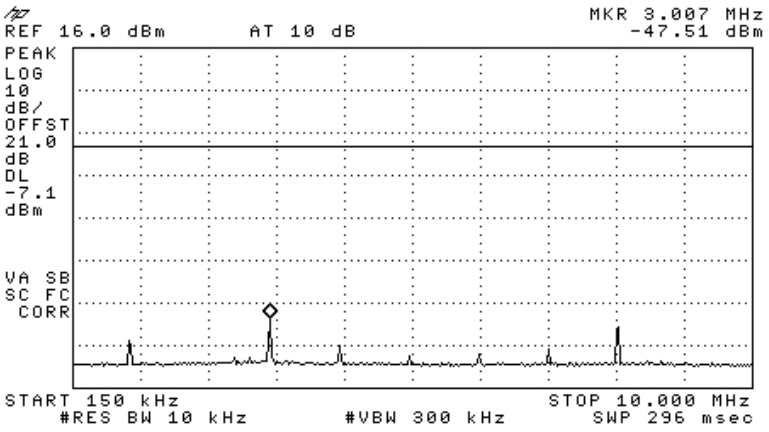


Figure 55 —2412 MHz CCK

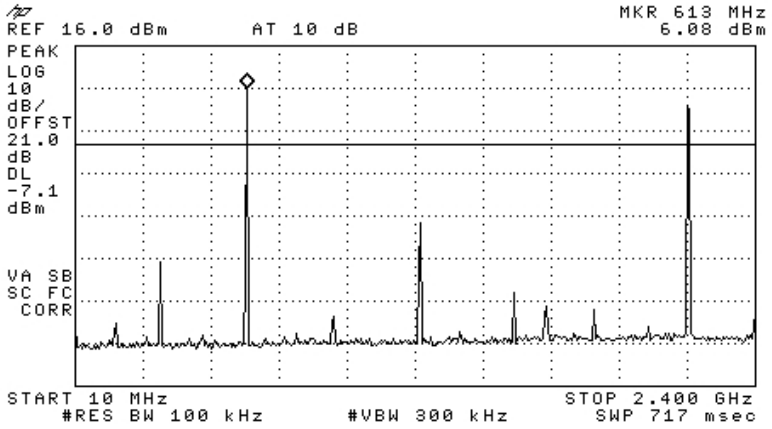


Figure 56 —2412 MHz CCK

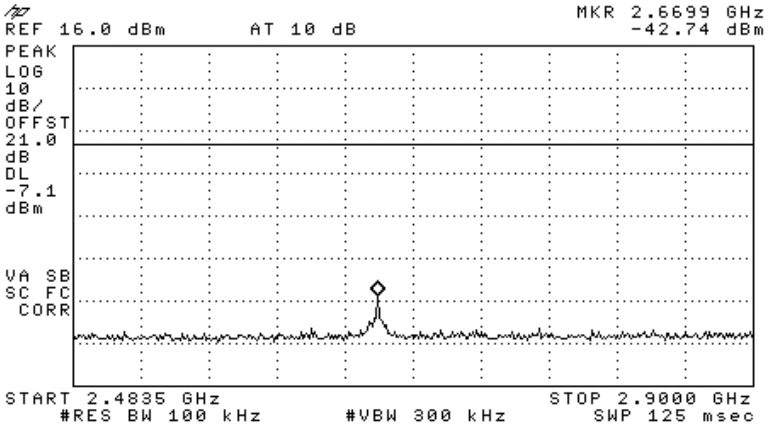


Figure 57 —2412 MHz CCK

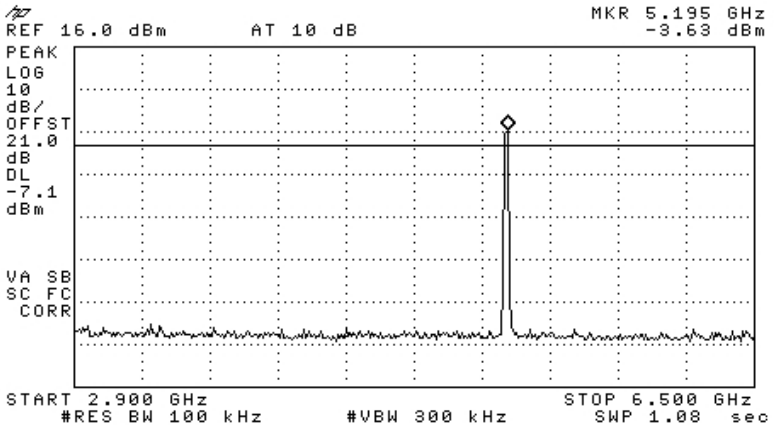


Figure 58 —2412 MHz CCK

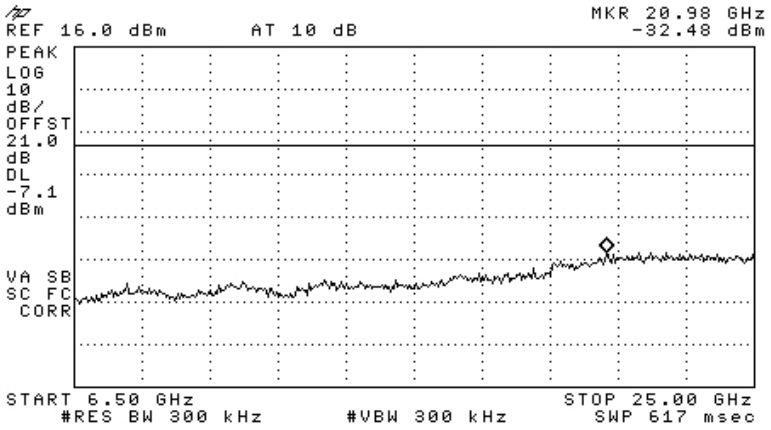


Figure 59 —2412 MHz CCK

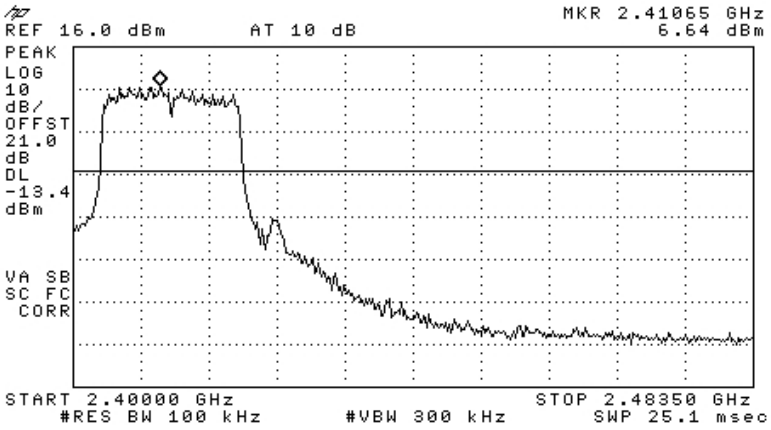


Figure 60 —2412 MHz 64QAM

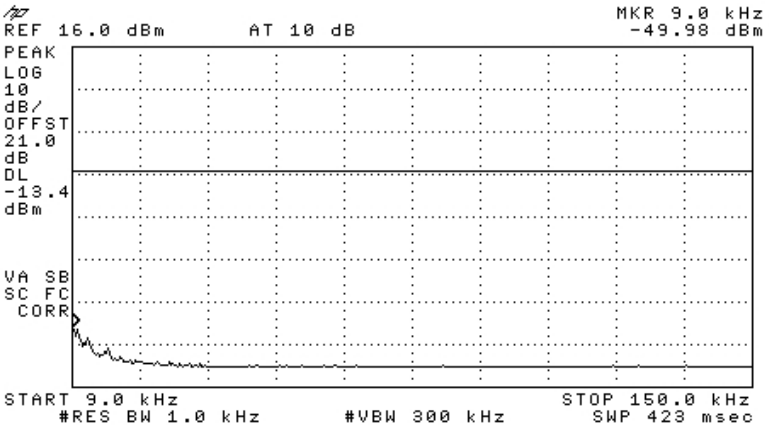


Figure 61 —2412 MHz 64QAM

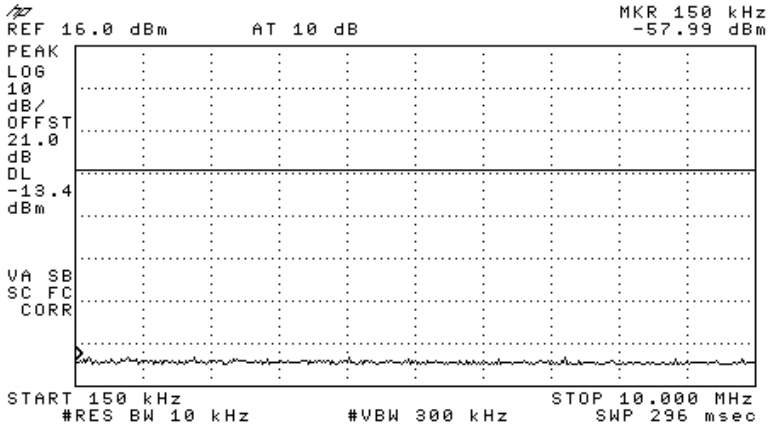


Figure 62 —2412 MHz 64QAM

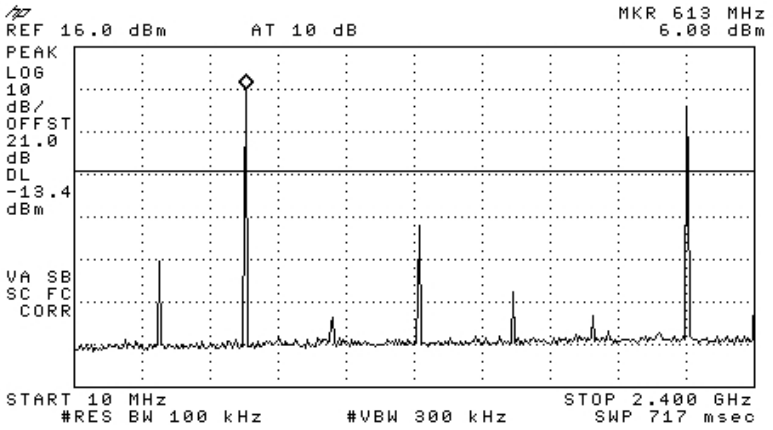


Figure 63 —2412 MHz 64QAM

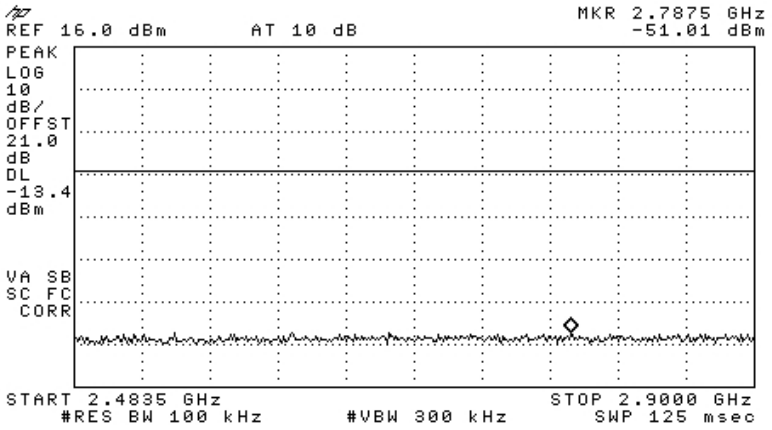


Figure 64 —2412 MHz 64QAM

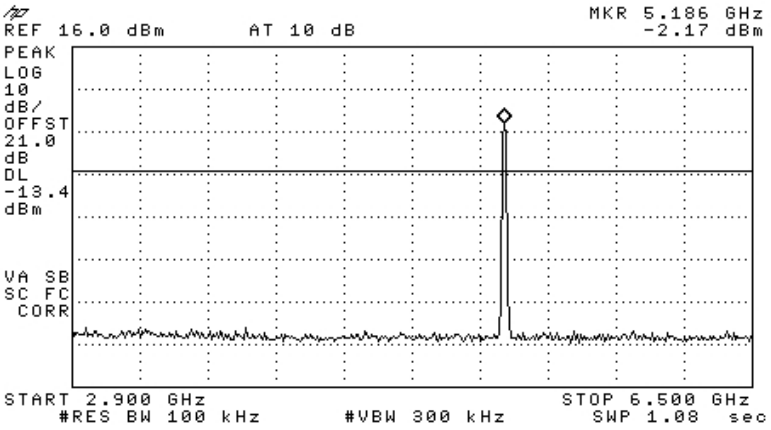


Figure 65 —2412 MHz 64QAM

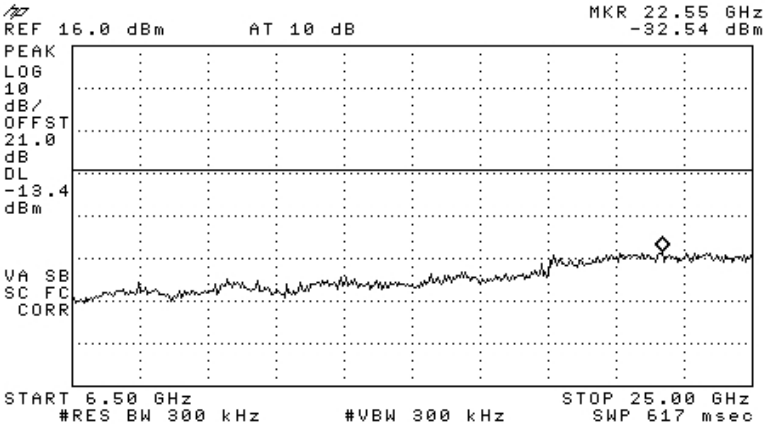


Figure 66 —2412 MHz 64QAM

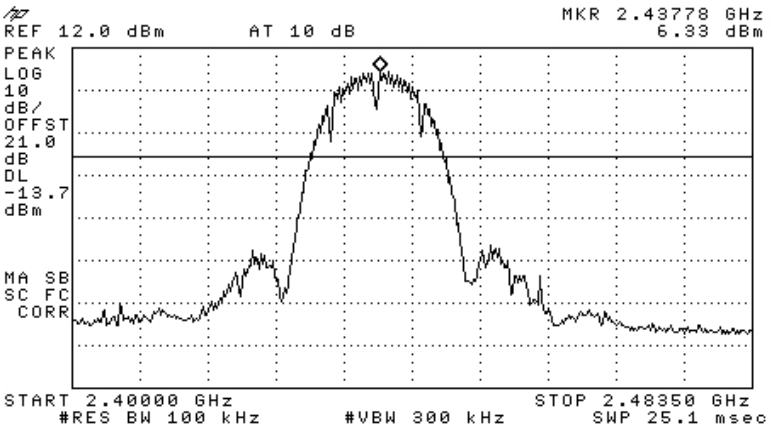


Figure 67 —2437 MHz DBPSK

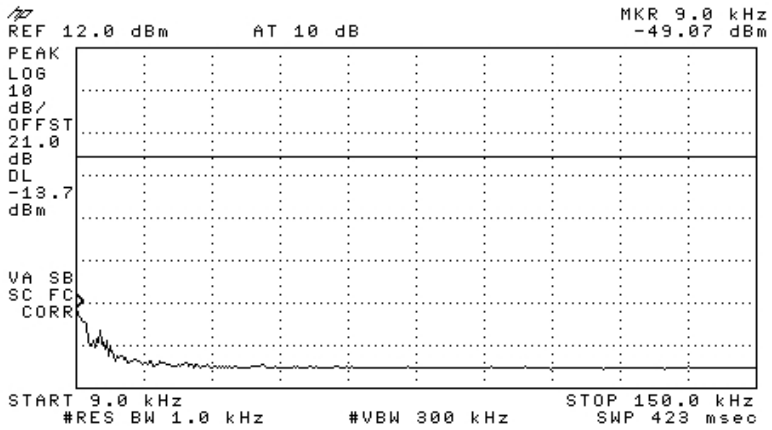


Figure 68 —2437 MHz DBPSK

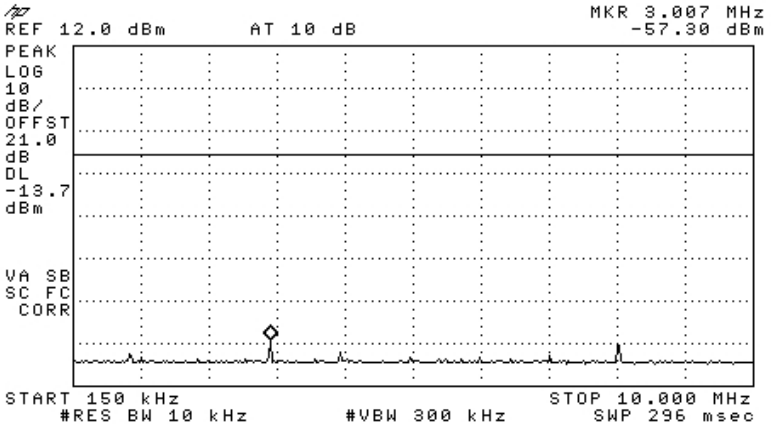


Figure 69 —2437 MHz DBPSK

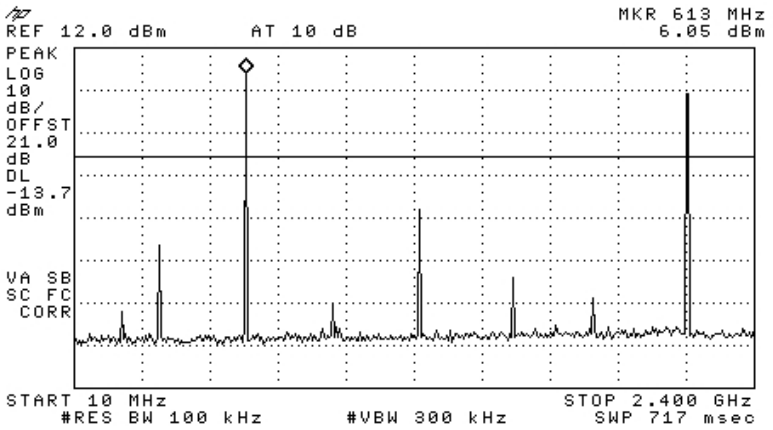


Figure 70 —2437 MHz DBPSK

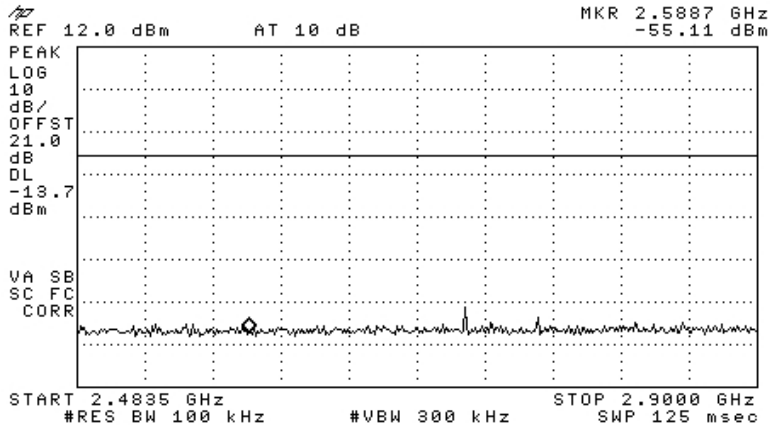


Figure 71 —2437 MHz DBPSK

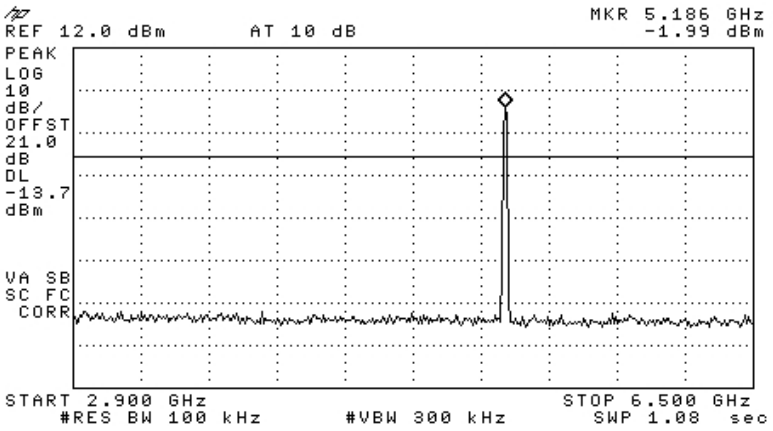


Figure 72 —2437 MHz DBPSK

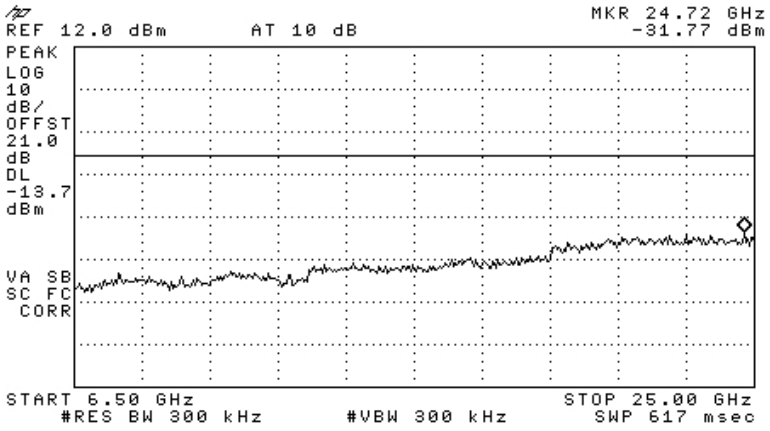


Figure 73 —2437 MHz DBPSK

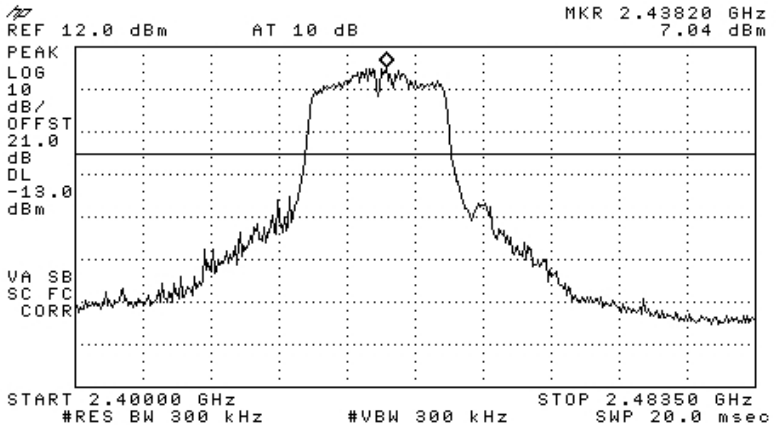


Figure 74 —2437 MHz BPSK

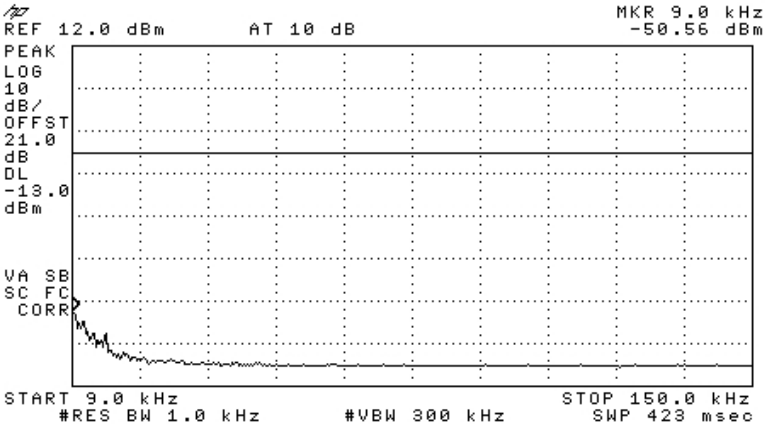


Figure 75 —2437 MHz BPSK

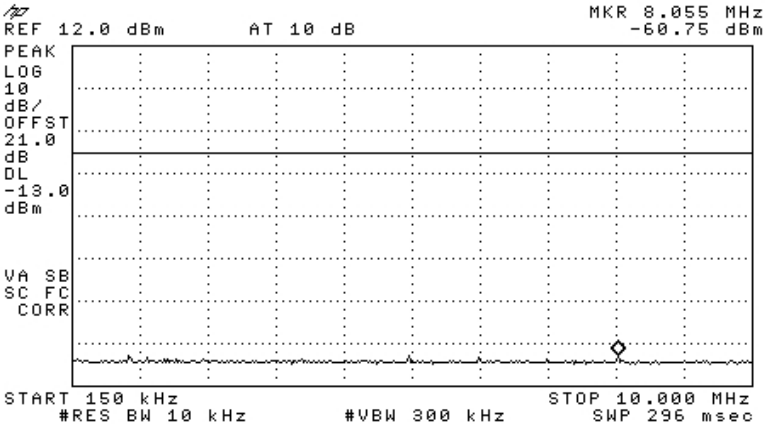


Figure 76 —2437 MHz BPSK

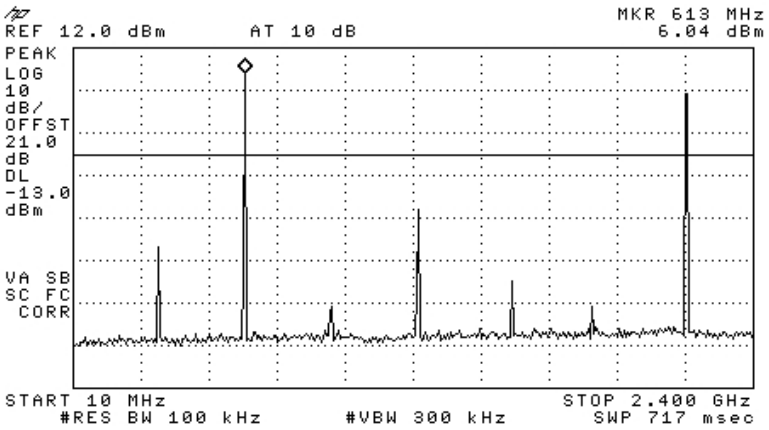


Figure 77 —2437 MHz BPSK

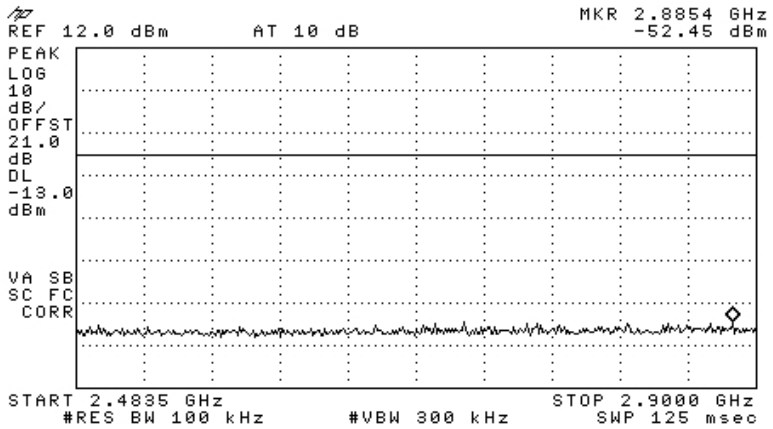


Figure 78 —2437 MHz BPSK

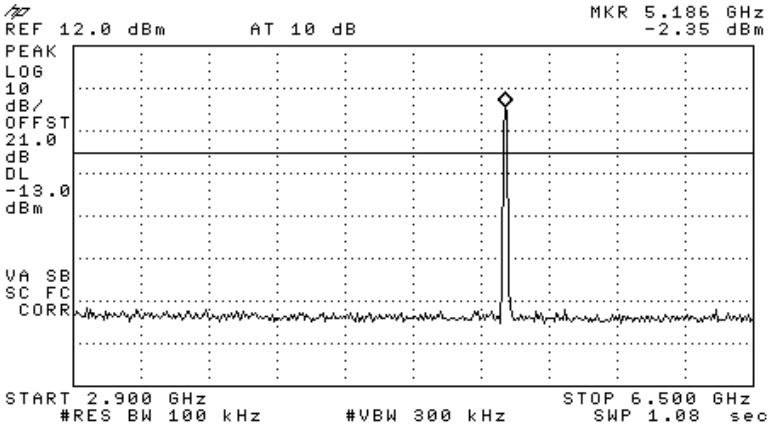


Figure 79 —2437 MHz BPSK

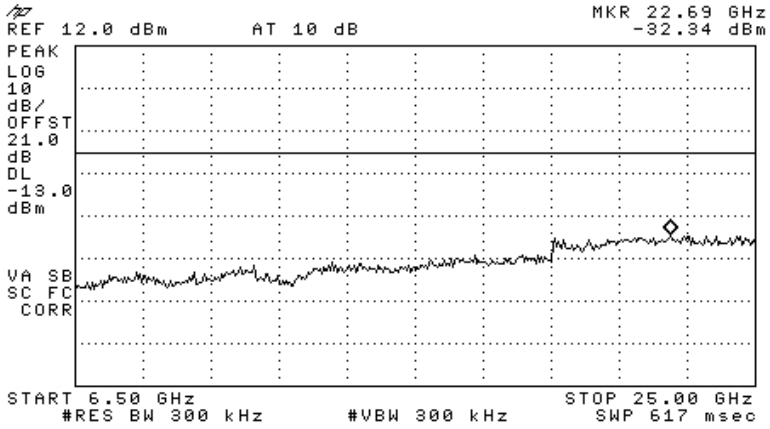


Figure 80 —2437 MHz BPSK

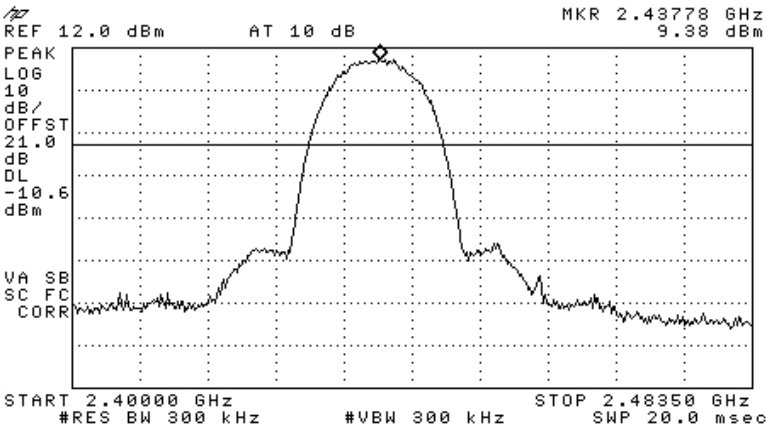


Figure 81 —2437 MHz CCK

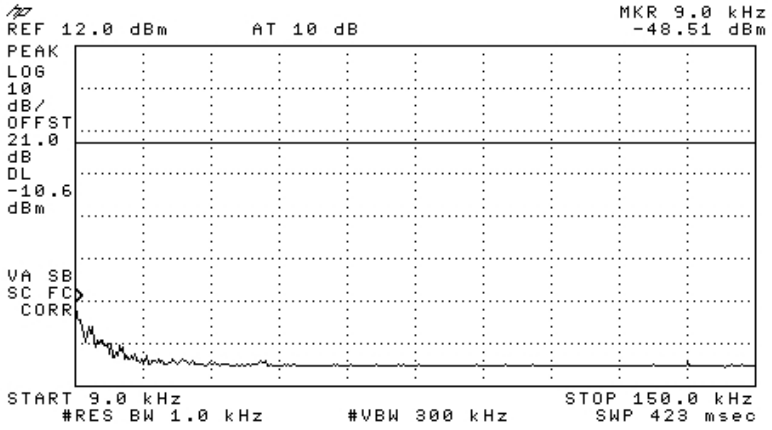


Figure 82 —2437 MHz CCK

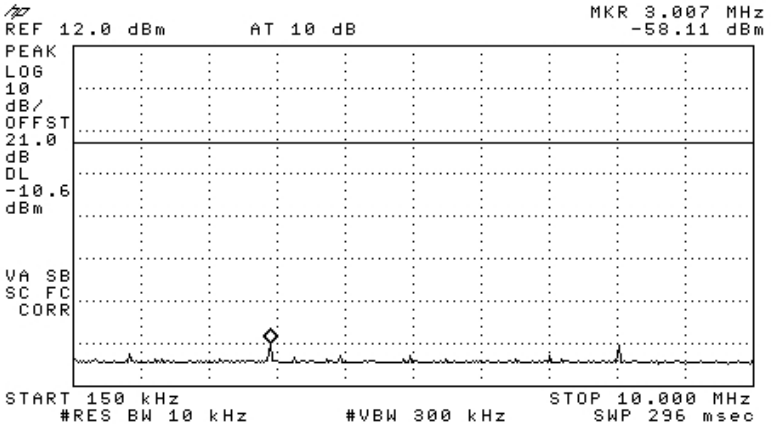


Figure 83 —2437 MHz CCK

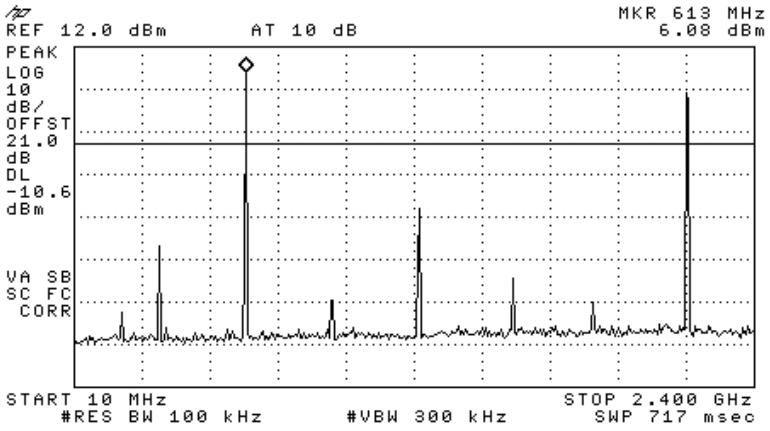


Figure 84 —2437 MHz CCK

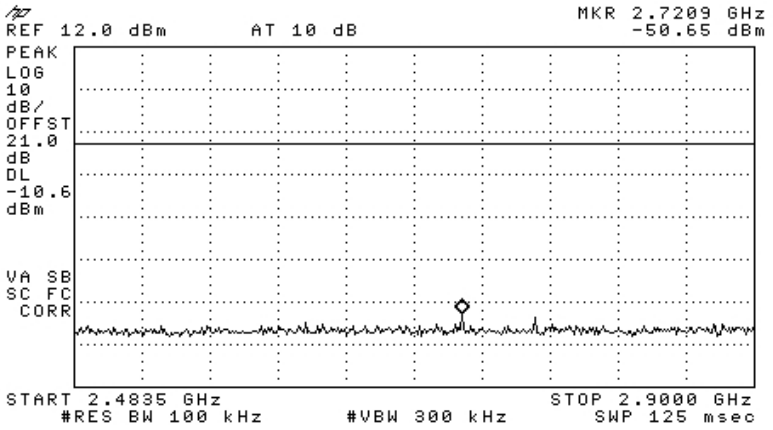


Figure 85 —2437 MHz CCK

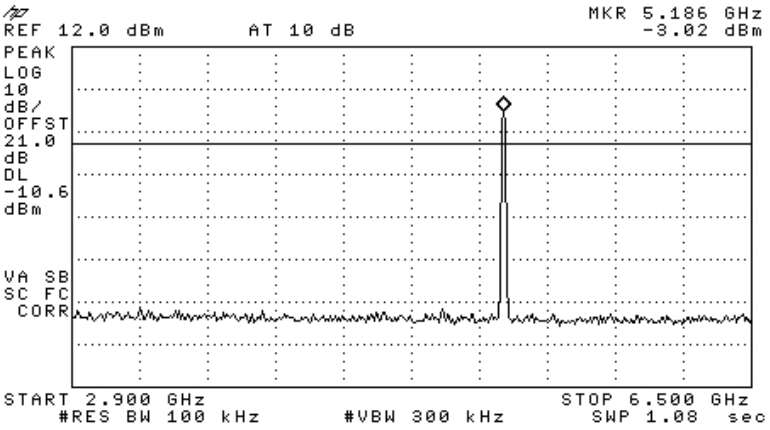


Figure 86 —2437 MHz CCK

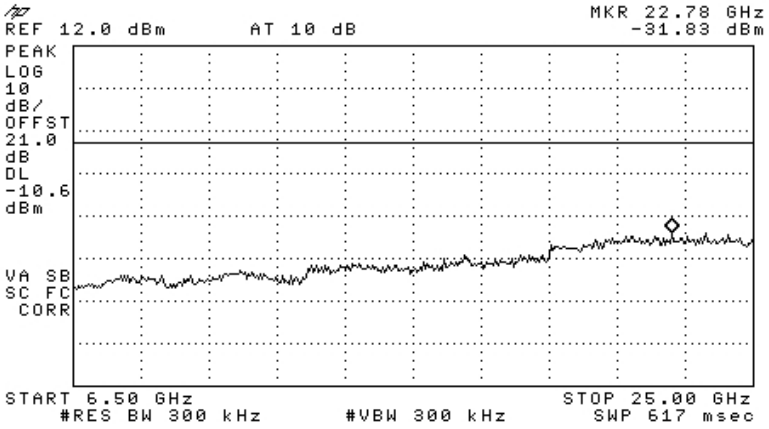


Figure 87 —2437 MHz CCK

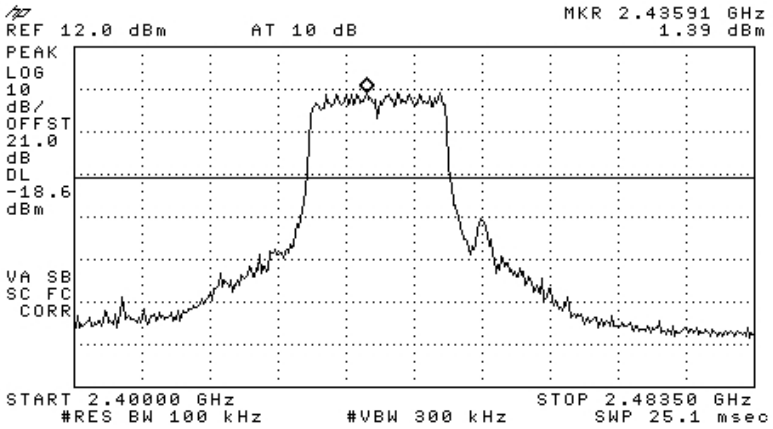


Figure 88 —2437 MHz 64QAM

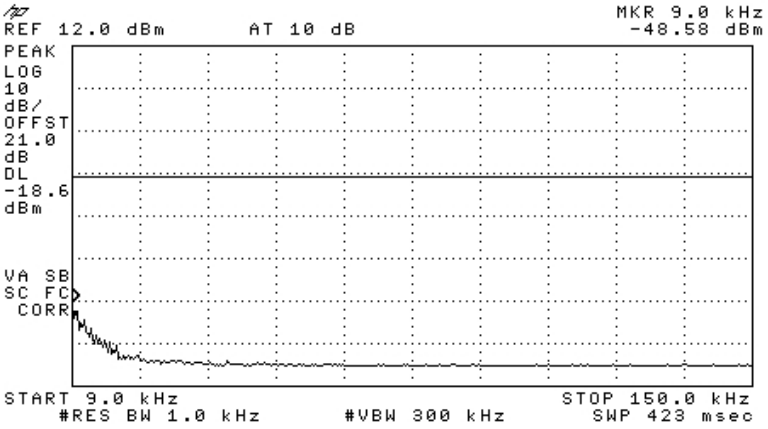


Figure 89 —2437 MHz 64QAM

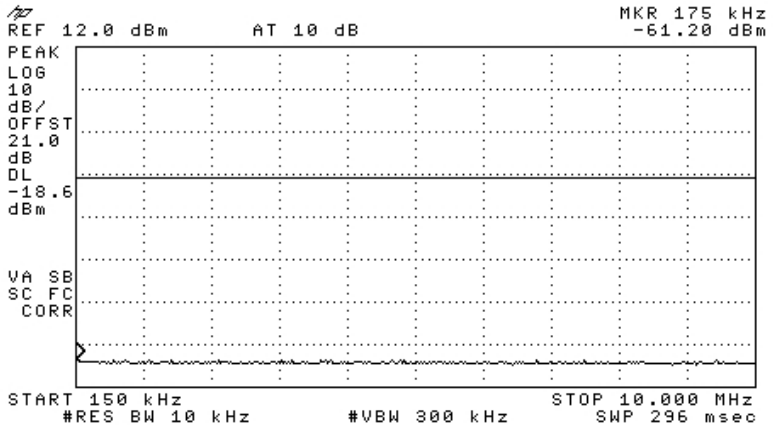


Figure 90 —2437 MHz 64QAM

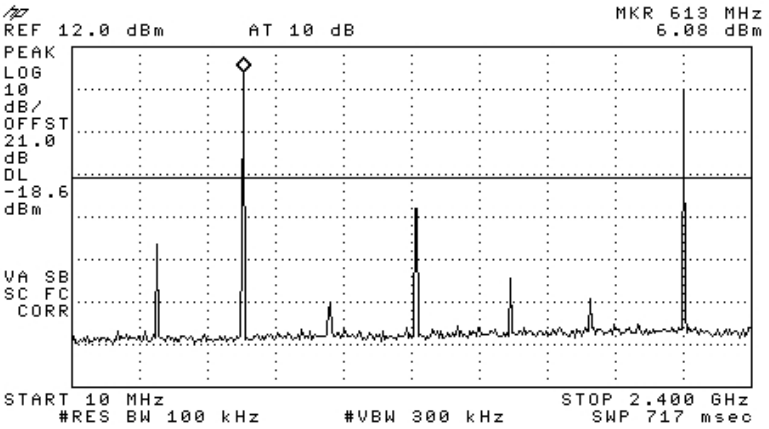


Figure 91 —2437 MHz 64QAM

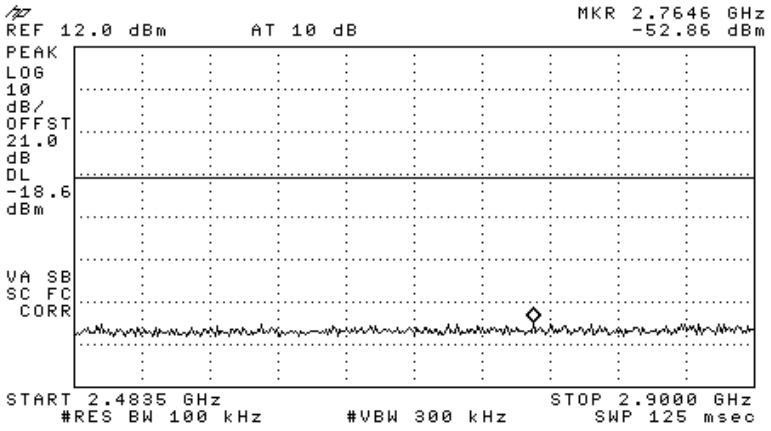


Figure 92 —2437 MHz 64QAM

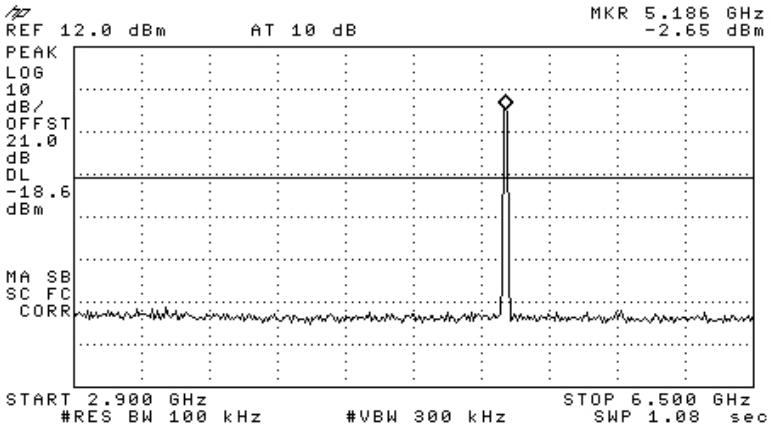


Figure 93 —2437 MHz 64QAM

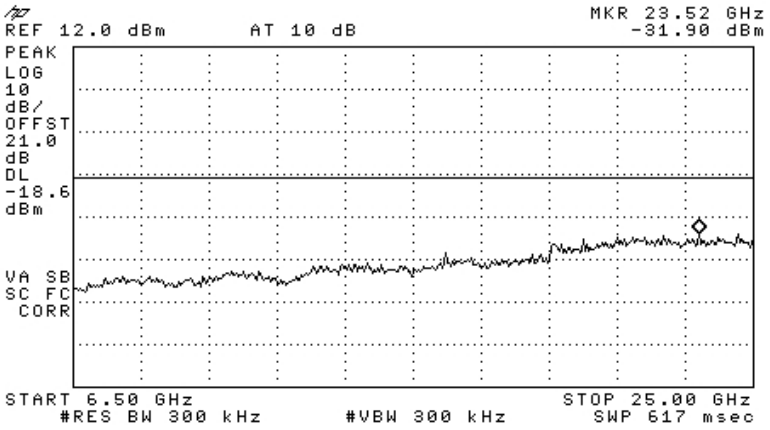


Figure 94 —2437 MHz 64QAM

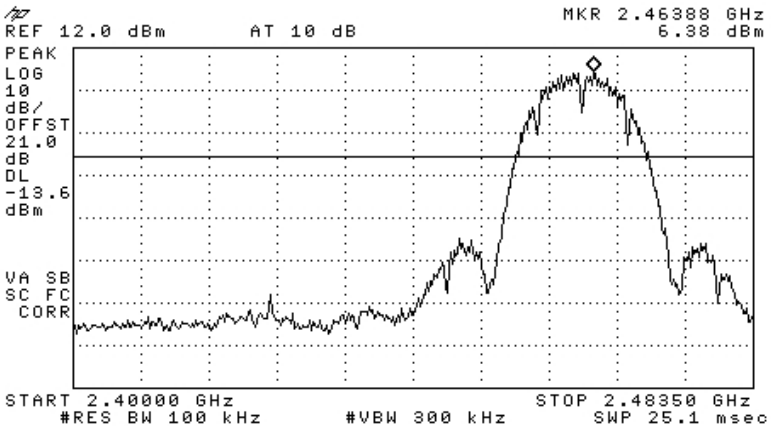


Figure 95 —2462 MHz DBPSK

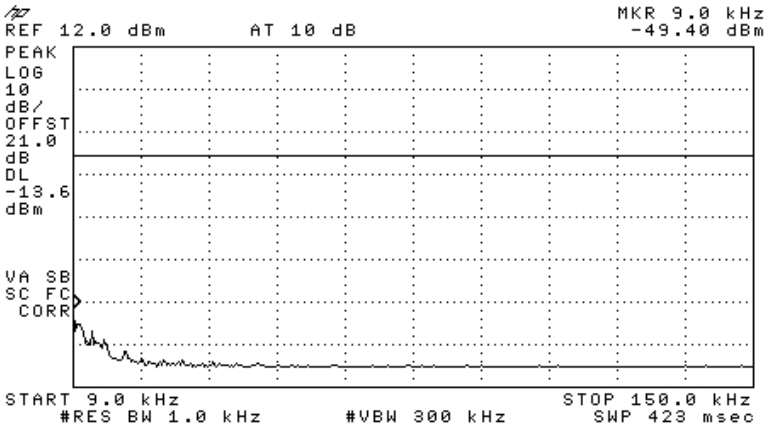


Figure 96 —2462 MHz DBPSK

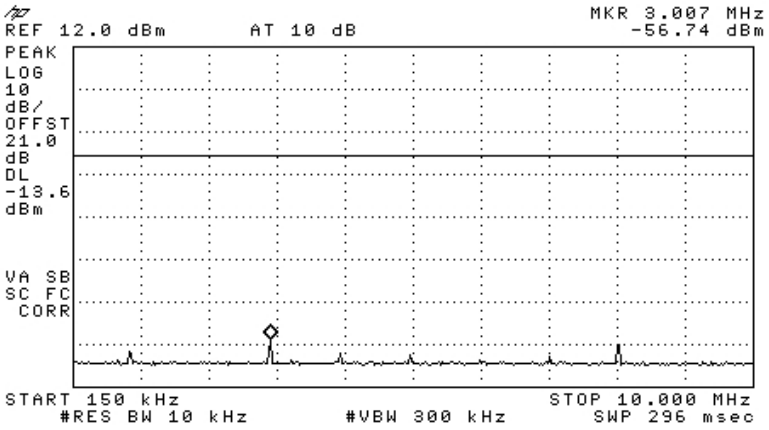


Figure 97 —2462 MHz DBPSK

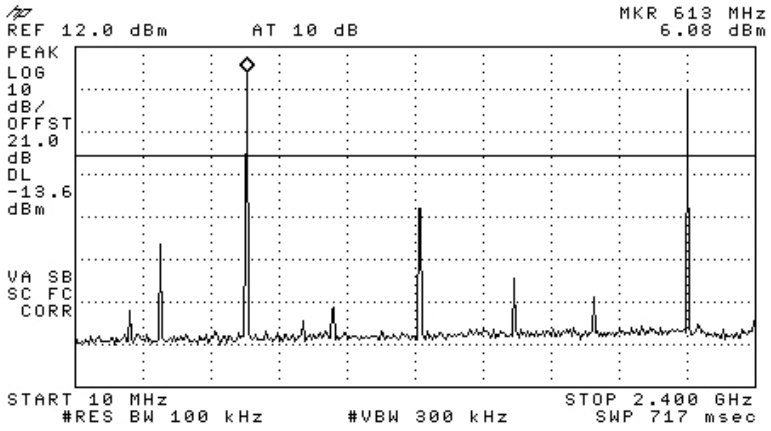


Figure 98 —2462 MHz DBPSK

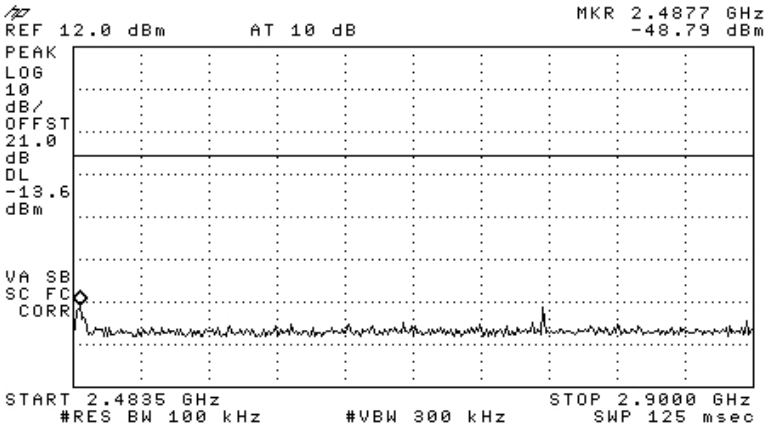


Figure 99 —2462 MHz DBPSK

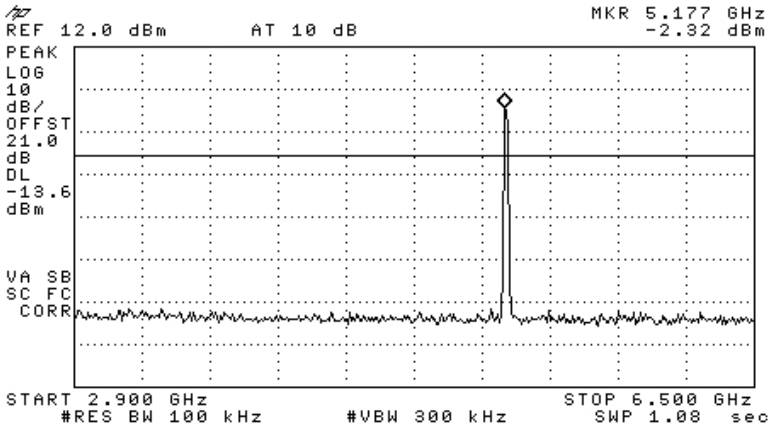


Figure 100 —2462 MHz DBPSK

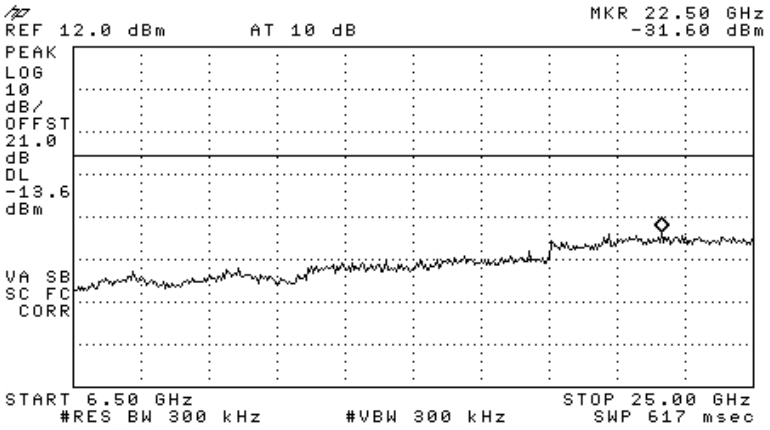


Figure 101 —2462 MHz DBPSK

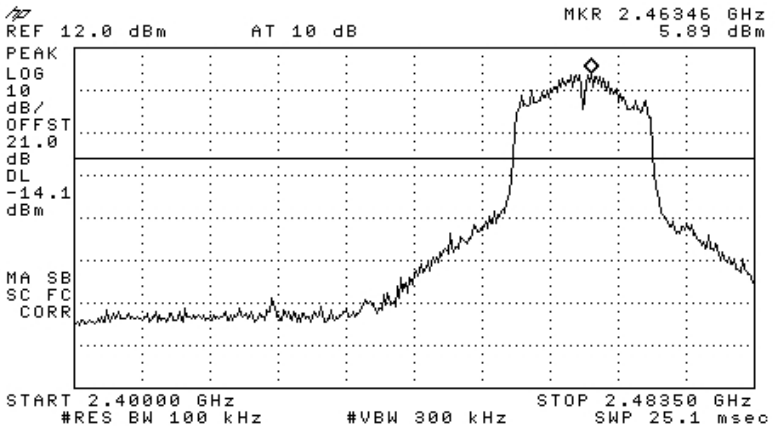


Figure 102 —2462 MHz BPSK

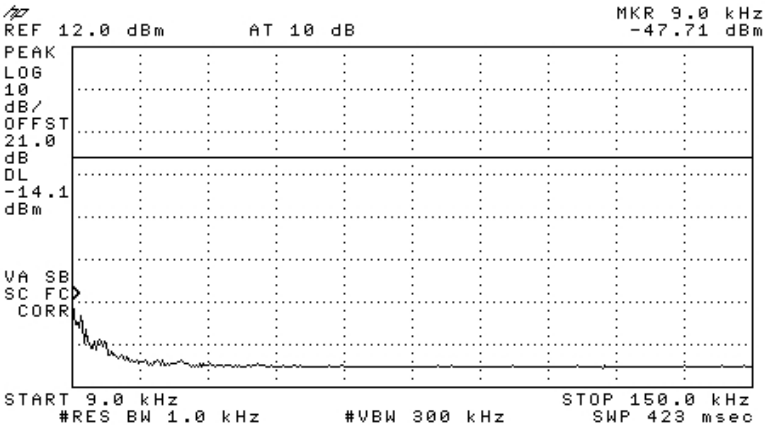


Figure 103 —2462 MHz BPSK

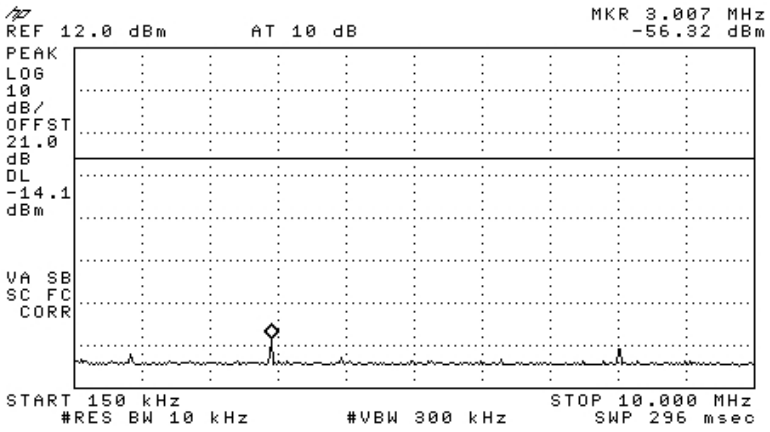


Figure 104 —2462 MHz BPSK

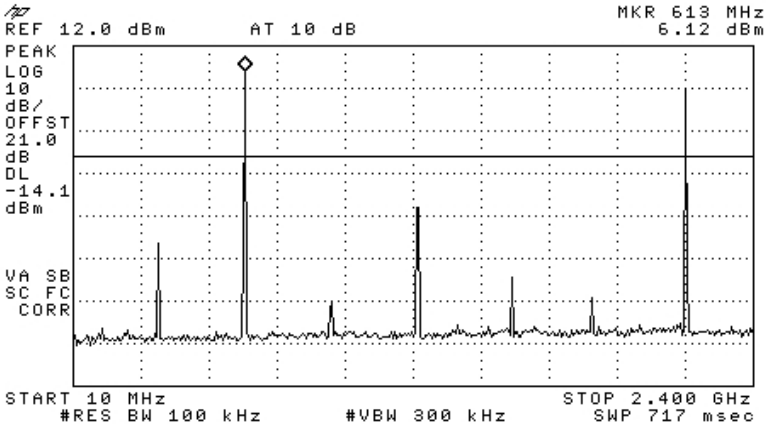


Figure 105 —2462 MHz BPSK

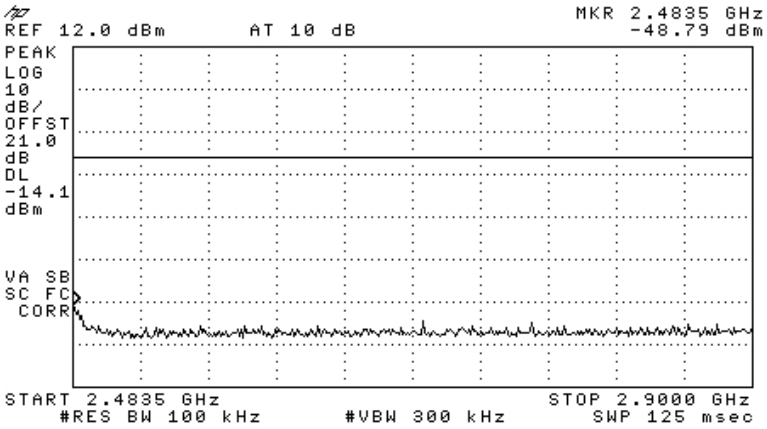


Figure 106 —2462 MHz BPSK

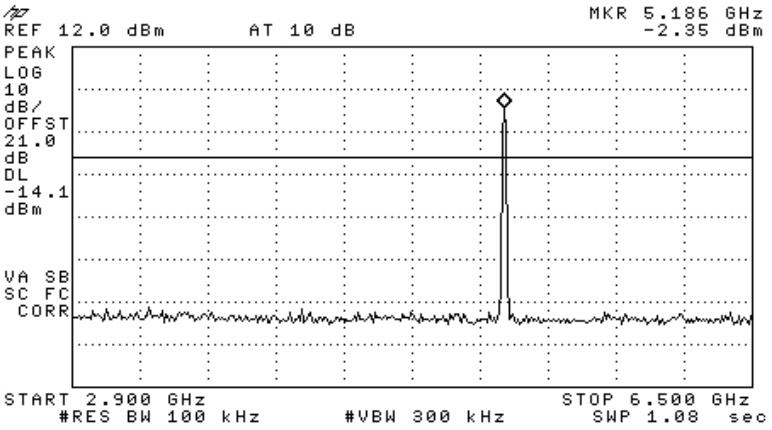


Figure 107 —2462 MHz BPSK

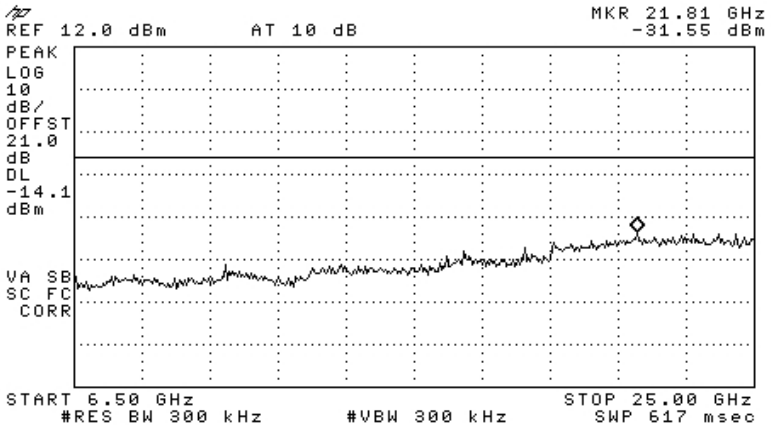


Figure 108 —2462 MHz BPSK

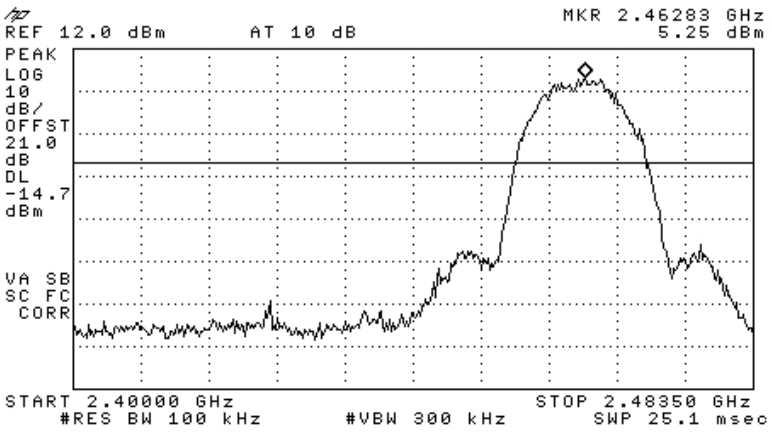


Figure 109 —2462 MHz CCK

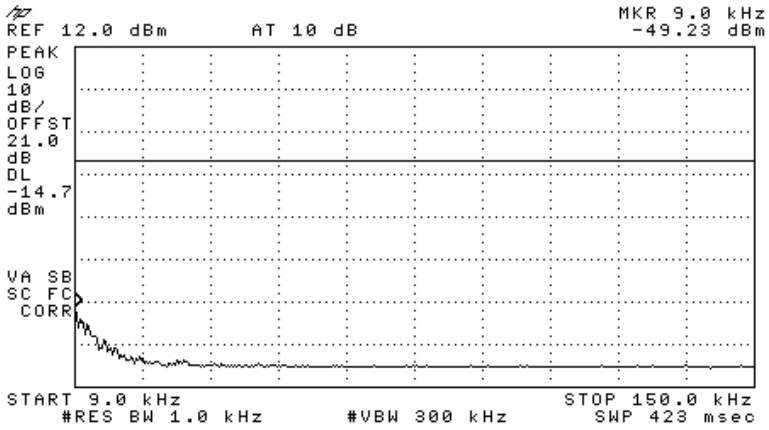


Figure 110 —2462 MHz CCK

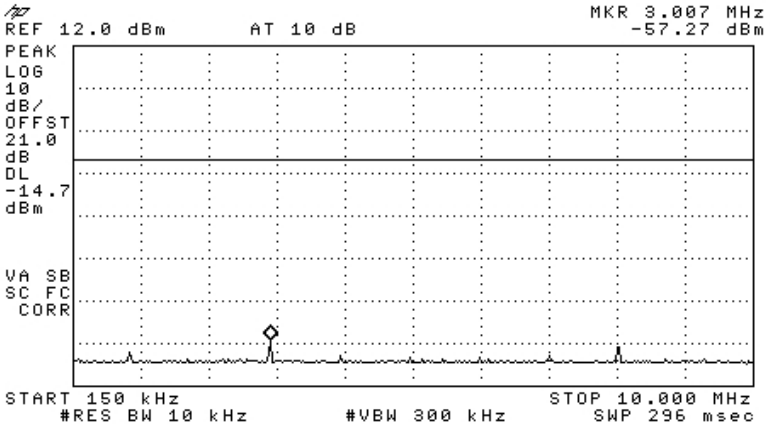


Figure 111 —2462 MHz CCK

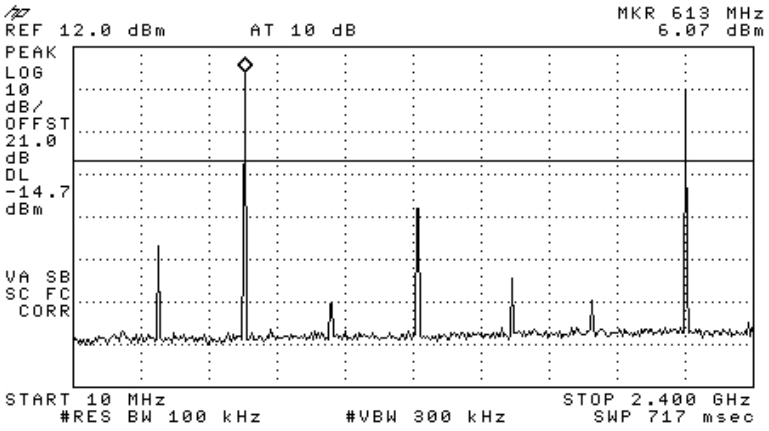


Figure 112 —2462 MHz CCK

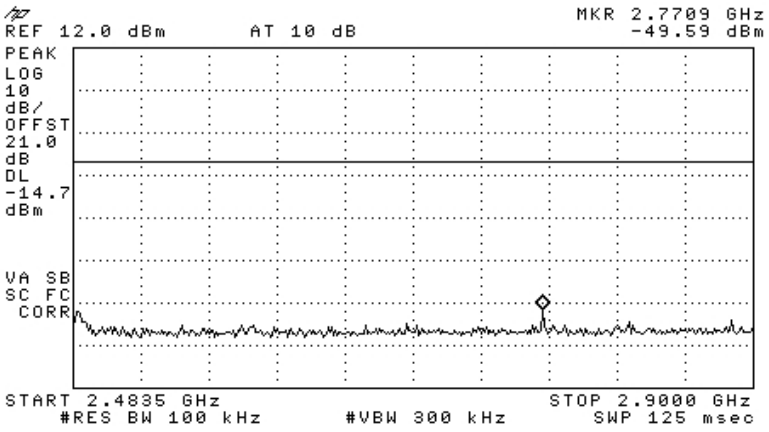


Figure 113 —2462 MHz CCK

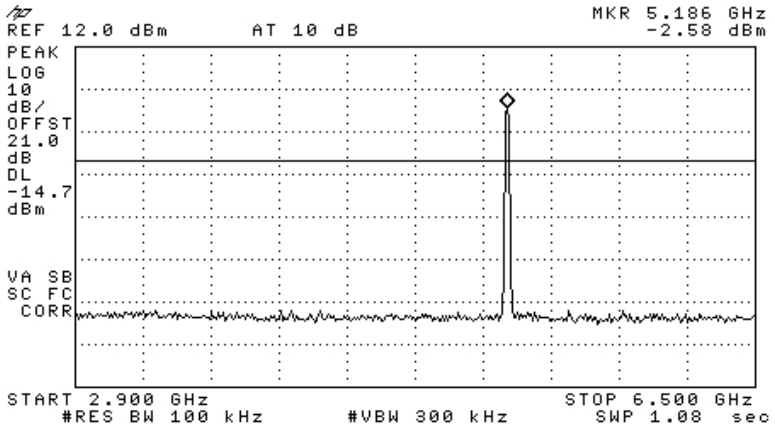


Figure 114 —2462 MHz CCK

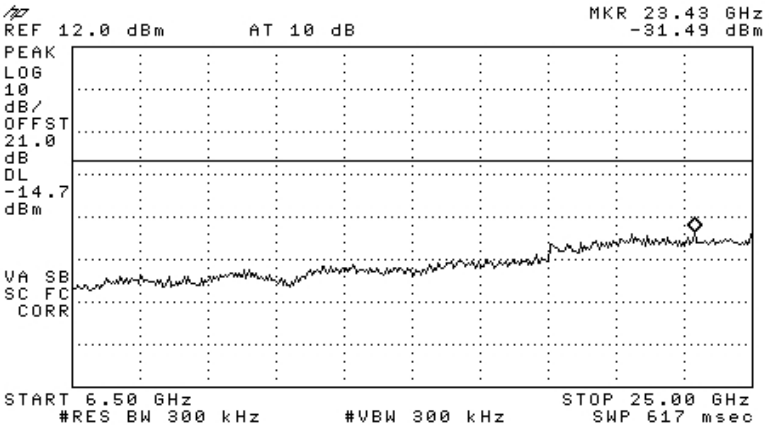


Figure 115 —2462 MHz CCK

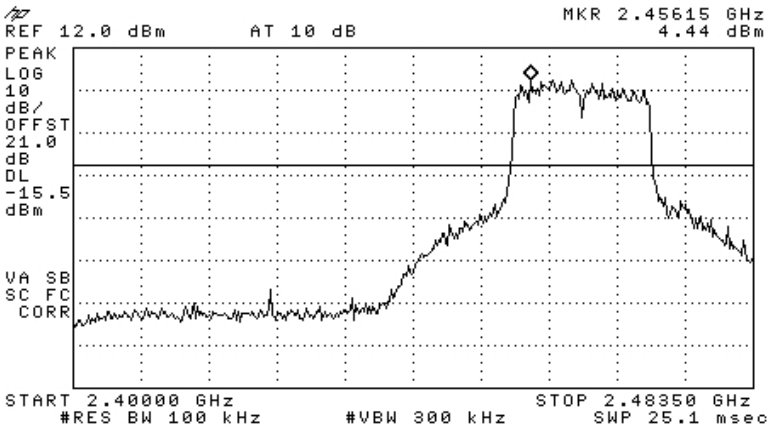


Figure 116 —2462 MHz 64QAM

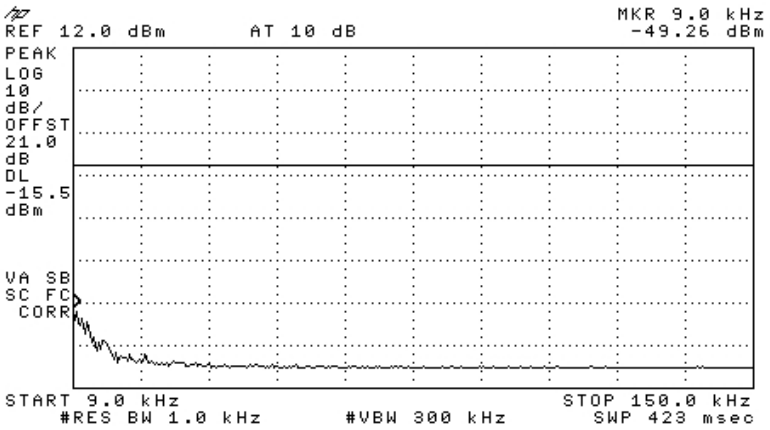


Figure 117 —2462 MHz 64QAM

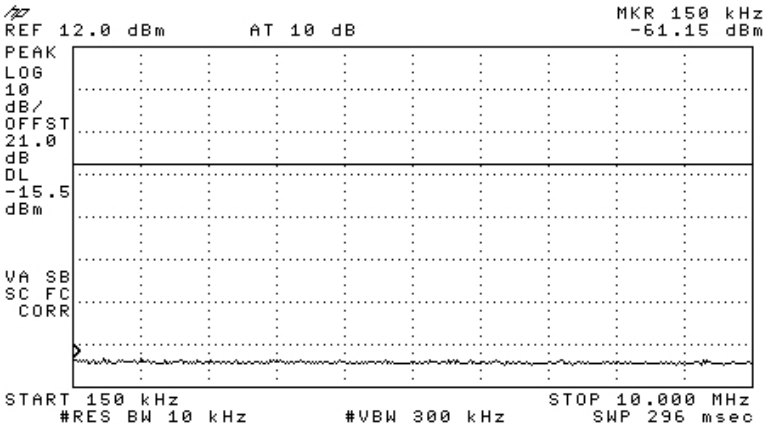


Figure 118 —2462 MHz 64QAM

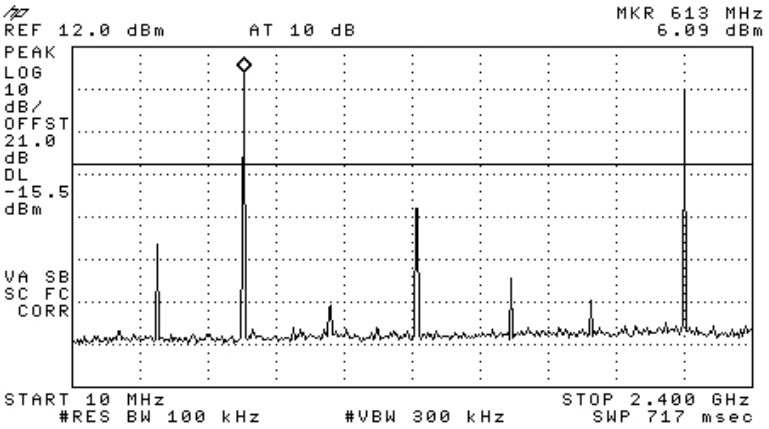


Figure 119 —2462 MHz 64QAM

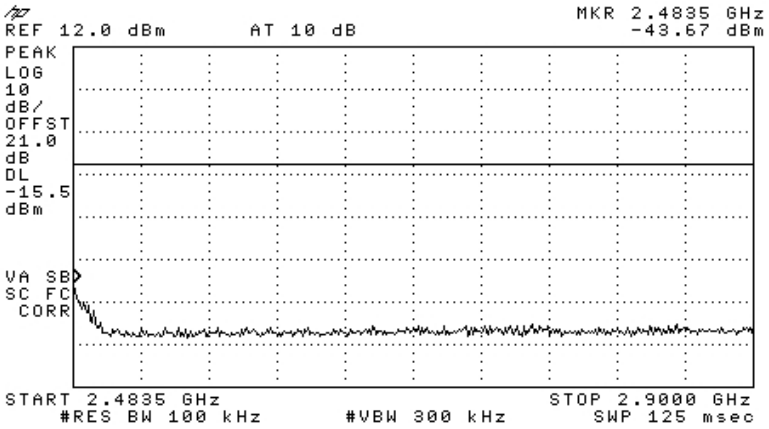


Figure 120 —2462 MHz 64QAM

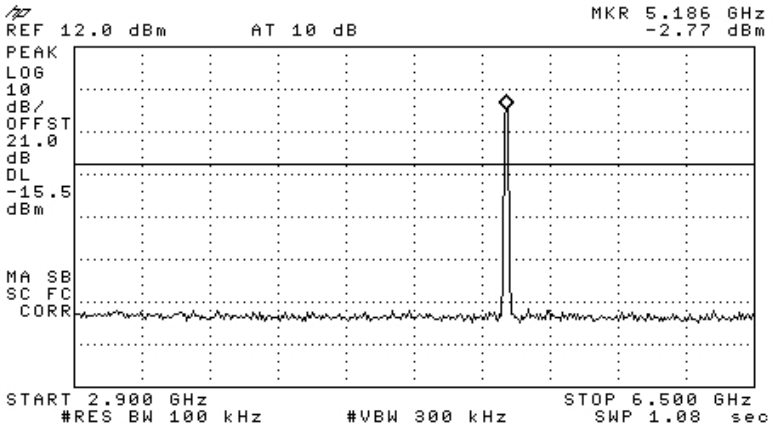


Figure 121 —2462 MHz 64QAM

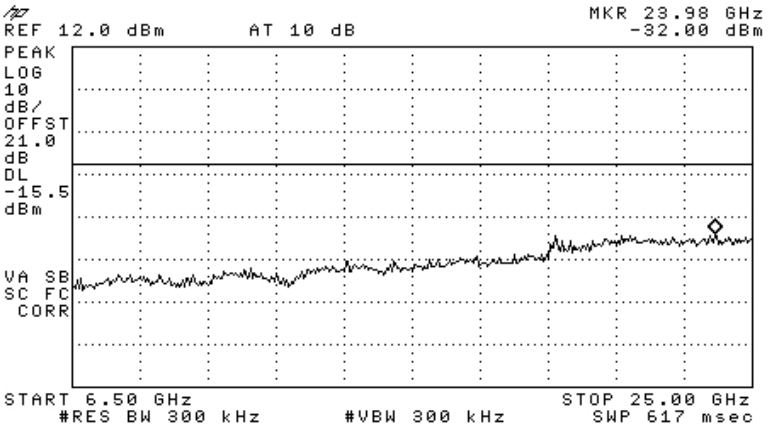


Figure 122 —2462 MHz 64QAM

9.2 Results table

E.U.T Description: WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Cisco 1242 Access Points
Model No.: 860M-AU With WCE-AU
Serial Number: 860M-AU: 0837453; WCE-AU:0847A54
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Modulation	Reading (dBc)	Specification (dBc)	Margin (dB)
2412	DBPSK	-32.32	20.0	-21.72
	BPSK	-32.27	20.0	-20.67
	CCK	-32.48	20.0	-25.38
	64QAM	-32.54	20.0	-19.14
2437	DBPSK	-31.77	20.0	-18.07
	BPSK	-32.34	20.0	-19.34
	CCK	-31.83	20.0	-21.23
	64QAM	-31.90	20.0	-13.30
2462	DBPSK	-31.60	20.0	-18.00
	BPSK	-31.55	20.0	-17.45
	CCK	-31.50	20.0	-16.80
	64QAM	-32.00	20.0	-16.50

Figure 123 Peak Power Output of 2400-2483.5 MHz Band

JUDGEMENT: Passed by 13.3 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 22.02.09

Typed/Printed Name: A. Sharabi

9.3 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	8592L	3826A01204	March 5, 2008	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	February 1, 2009	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 9, 2009	1 year

Figure 124 Test Equipment Used

10. 6 dB Minimum Bandwidth 802.11b/g + 802.11a + WMTS + AWS Signals

10.1 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).

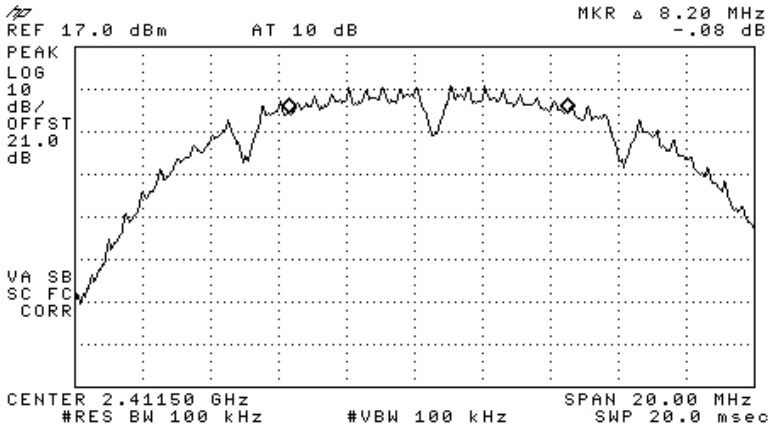


Figure 125 —2412 MHz DBPSK

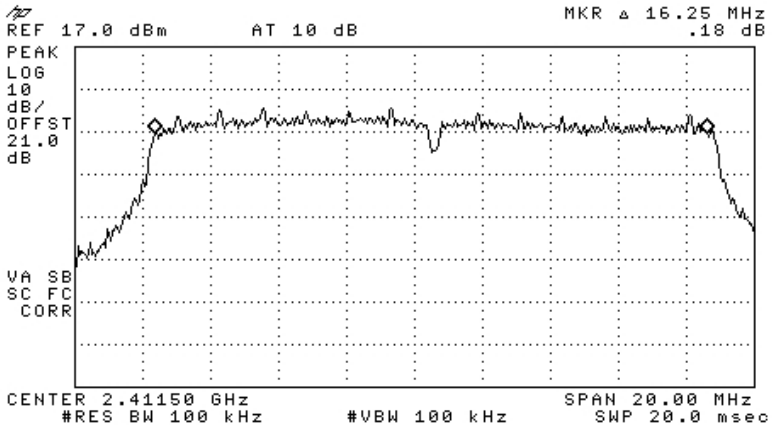


Figure 126 —2412 MHz BPSK

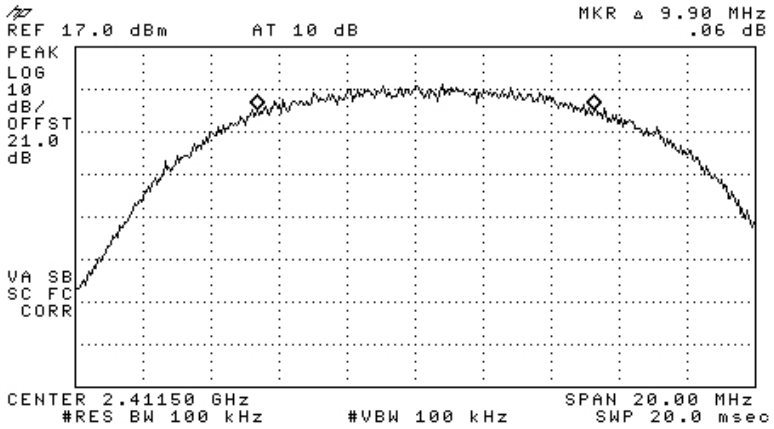


Figure 127 —2412 MHz CCK

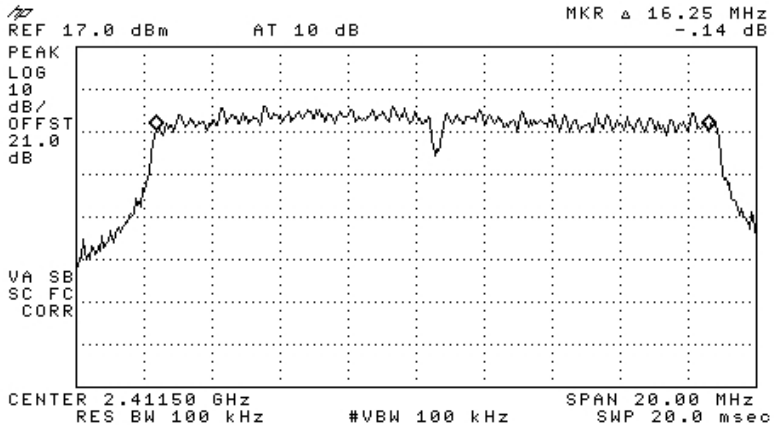


Figure 128 —2412 MHz 64QAM

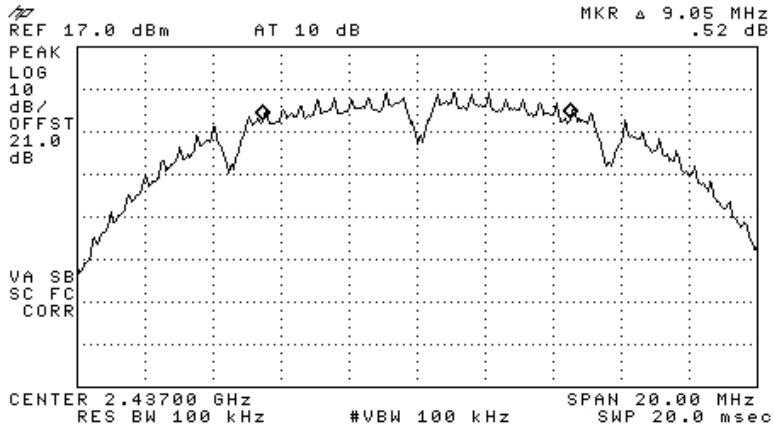


Figure 129 —2437 MHz DBPSK

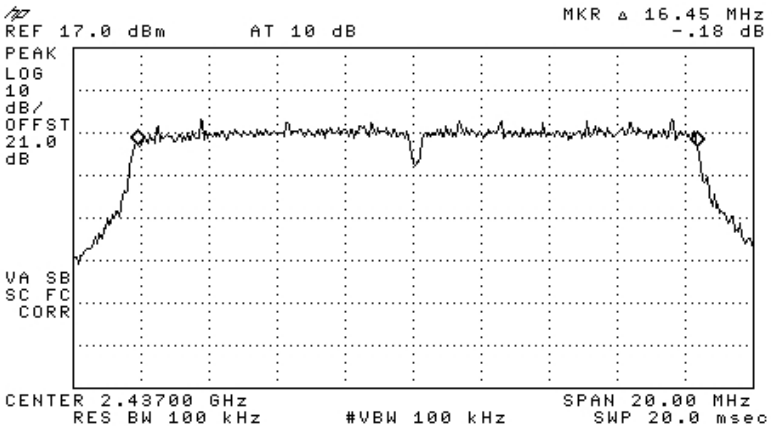


Figure 130 —2437 MHz BPSK

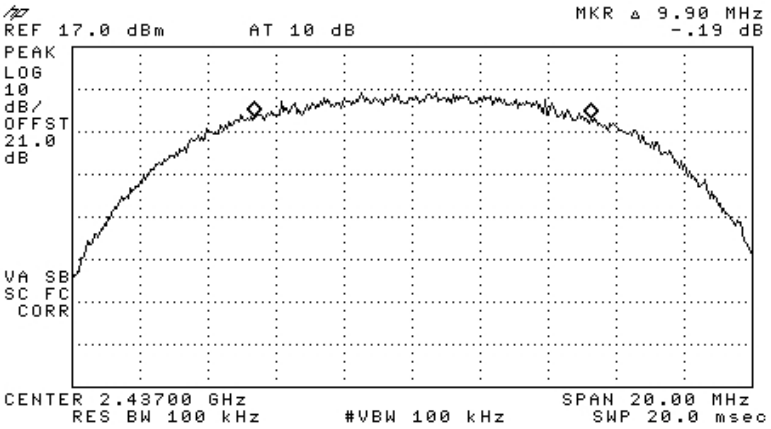


Figure 131 —2437 MHz CCK

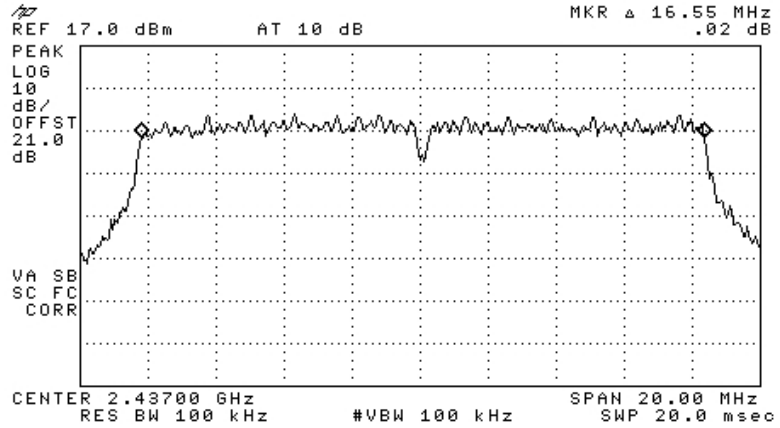


Figure 132 —2437 MHz 64QAM

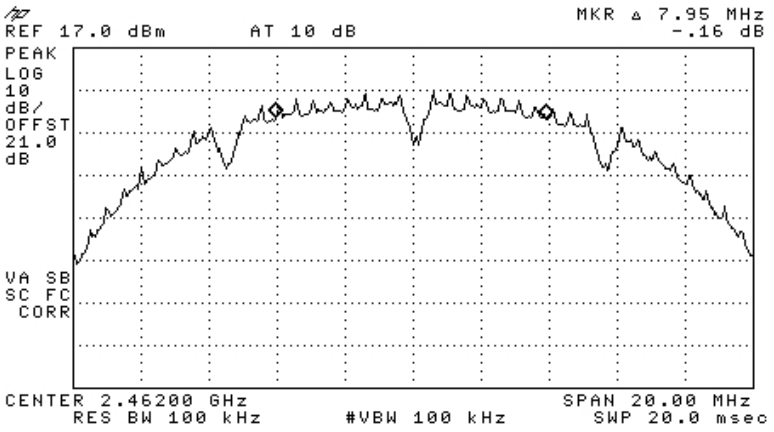


Figure 133 —2462 MHz DBPSK

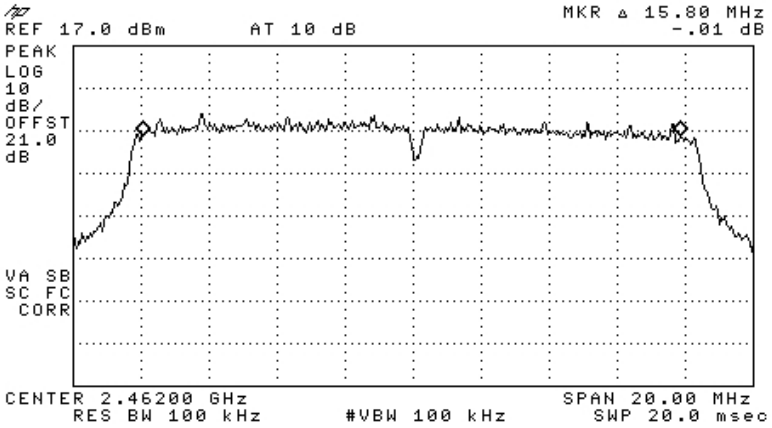


Figure 134 —2462 MHz BPSK

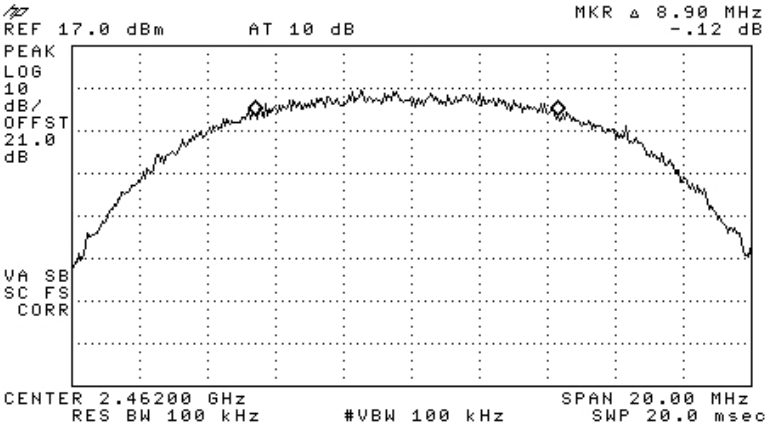


Figure 135 —2462 MHz CCK

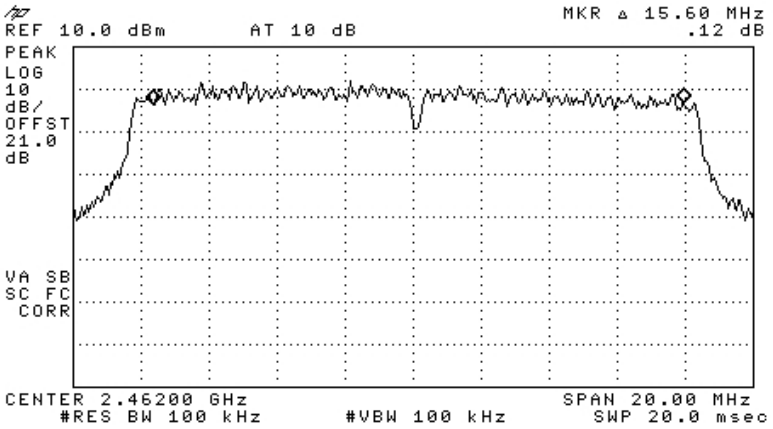


Figure 136 —2462 MHz 64QAM

10.2 Results table

E.U.T Description: WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Cisco 1242 Access Points
Model No.: 860M-AU With WCE-AU
Serial Number: 860M-AU: 0837453; WCE-AU:0847A54
Specification: F.C.C. Part 15, Subpart C: (15.247-a2)

Operation Frequency (MHz)	Modulation	Reading (MHz)	Specification (MHz)
2412	DBPSK	8.2	0.5
	BPSK	16.3	0.5
	CCK	9.9	0.5
	64QAM	16.3	0.5
2437	DBPSK	9.0	0.5
	BPSK	16.5	0.5
	CCK	9.9	0.5
	64QAM	16.6	0.5
2462	DBPSK	8.0	0.5
	BPSK	15.8	0.5
	CCK	8.9	0.5
	64QAM	15.6	0.5

Figure 137 6 dB Minimum Bandwidth

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 22.02.09

Typed/Printed Name: A. Sharabi

10.3 Test Equipment Used.

6 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 5, 2008	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	February 1, 2009	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 1, 2009	1 year

Figure 138 Test Equipment Used

11. Band Edge Spectrum 802.11b/g + 802.11a + WMTS + AWS Signals

[In Accordance with section 15.247(c)]

11.1 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).

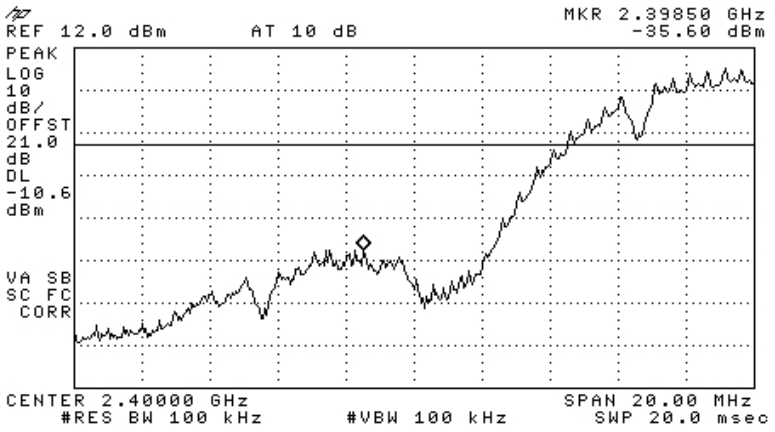


Figure 139 —2412 MHz DBPSK

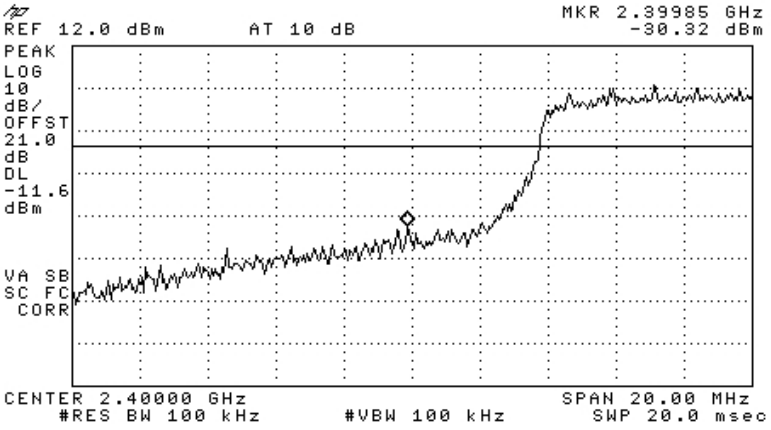


Figure 140 —2412 MHz BPSK

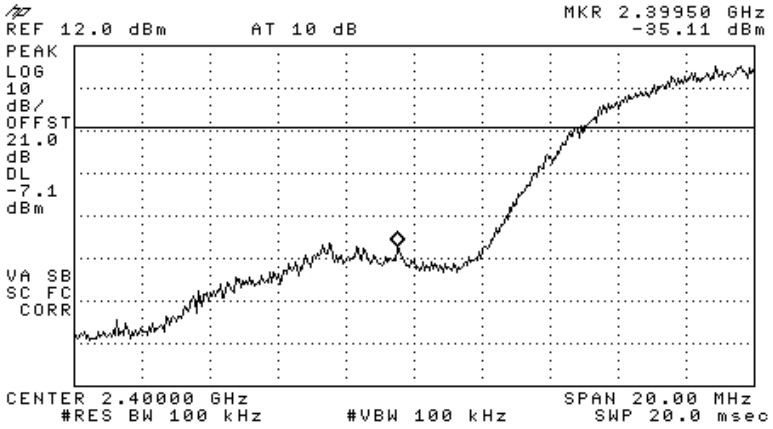


Figure 141 —2412 MHz CCK

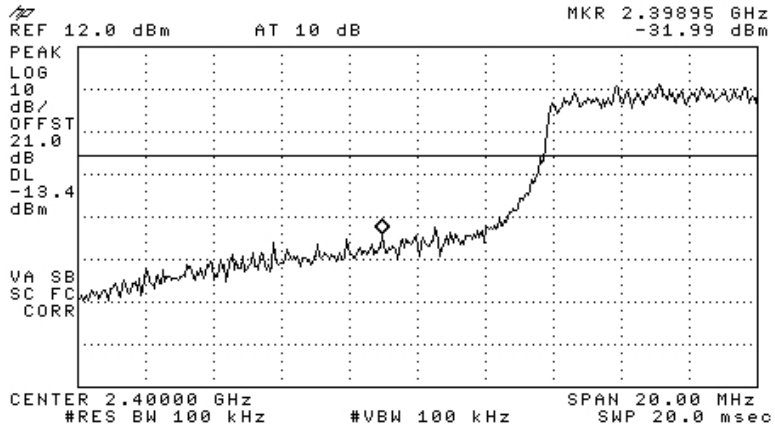


Figure 142 —2412 MHz 64QAM

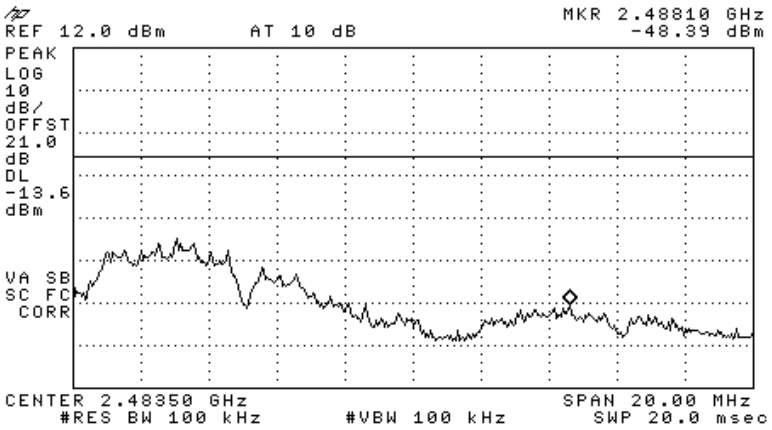


Figure 143 —2462 MHz DBPSK

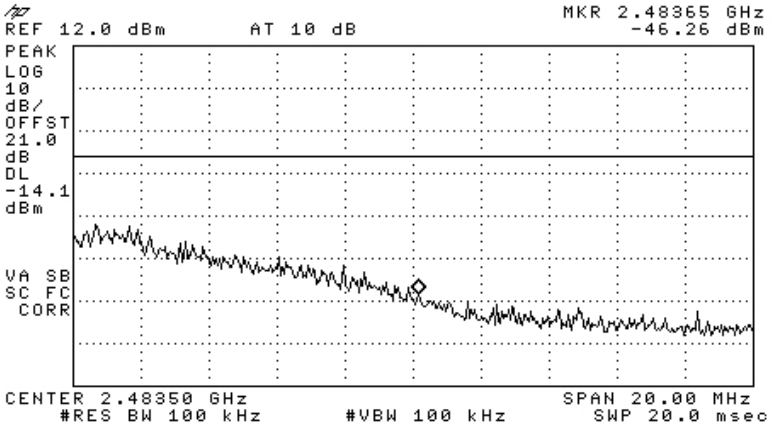


Figure 144 —2462 MHz BPSK

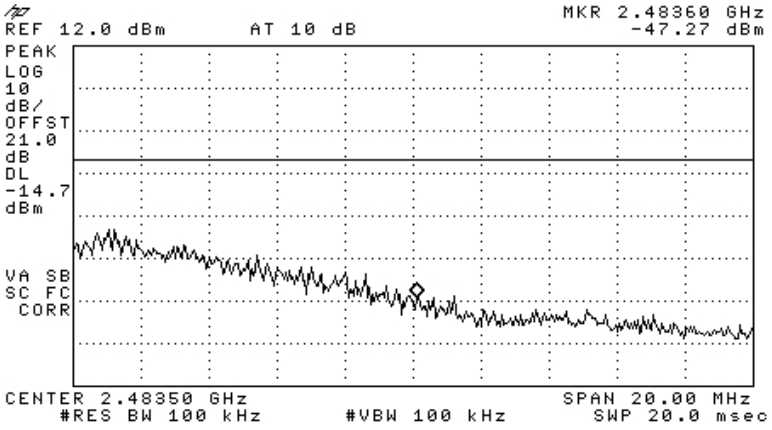


Figure 145 —2462 MHz CCK

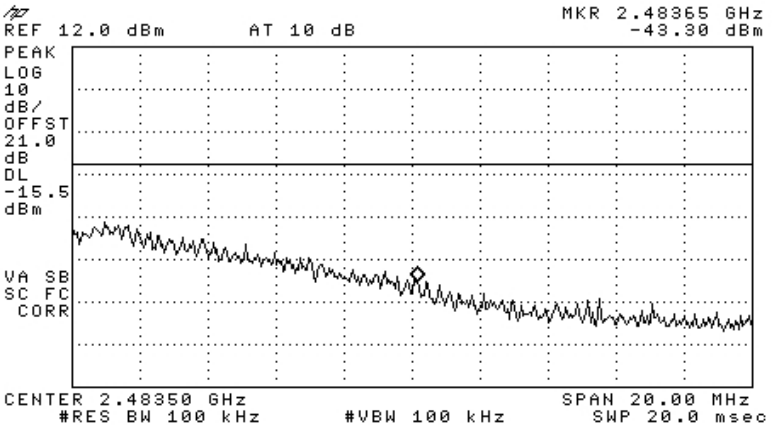


Figure 146 —2462 MHz 64QAM

11.2 Results table

E.U.T. Description: WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Cisco 1242 Access Points
Model No.: 860M-AU With WCE-AU
Serial Number: 860M-AU: 0837453; WCE-AU:0847A54
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Modulation	Band Edge Frequency (MHz)	Spectrum Level (dBm)	Specification (dBc)	Margin (dB)
2412	DBPSK	2.3985	-35.6	20.0	-25.0
	BPSK	2.39985	-30.3	20.0	-18.7
	CCK	2.39950	-35.1	20.0	-28.0
	64QAM	2.39895	-32.0	20.0	-18.6
2642	DBPSK	2.48810	-48.4	20.0	-34.8
	BPSK	2.48365	-46.3	20.0	-32.2
	CCK	2.483360	-47.3	20.0	-32.6
	64QAM	2.48365	-43.3	20.0	-27.8

Figure 147 Band Edge Spectrum

JUDGEMENT: Passed by 18.6 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 22.02.09

Typed/Printed Name: A. Sharabi

11.3 Test Equipment Used.

Band edge Spectrum

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 5, 2008	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	February 1, 2009	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 1, 2009	1 year

Figure 148 Test Equipment Used

12. Transmitted Power Density 802.11 b/g + 802.11a + WMTS + AWS Signals

[In accordance with section 15.247(d)]

12.1 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 = 1dB). 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.

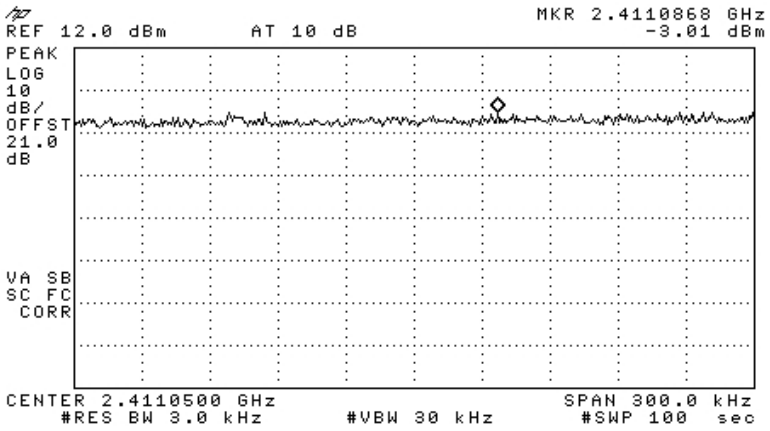


Figure 149 —2412 MHz DBPSK

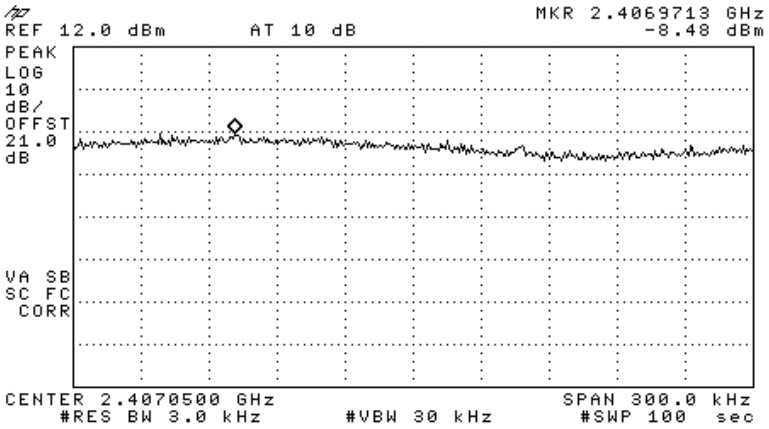


Figure 150 —2412 MHz BPSK

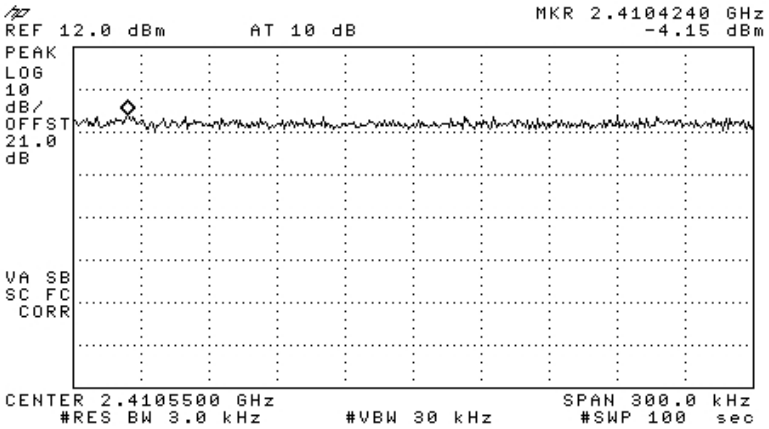


Figure 151 —2412 MHz CCK

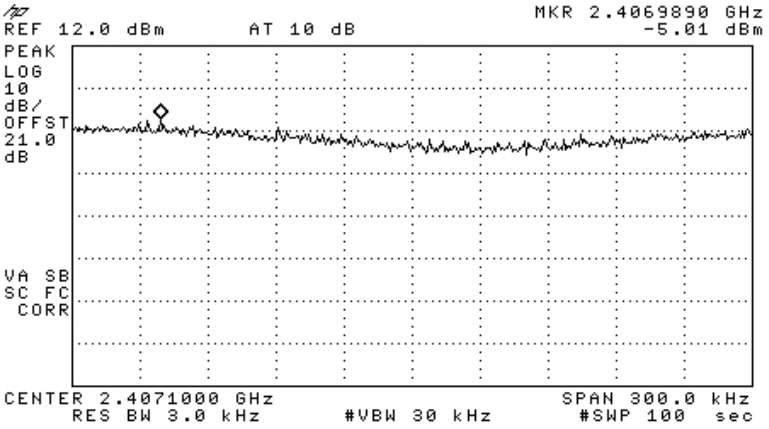


Figure 152 —2412 MHz 64QAM

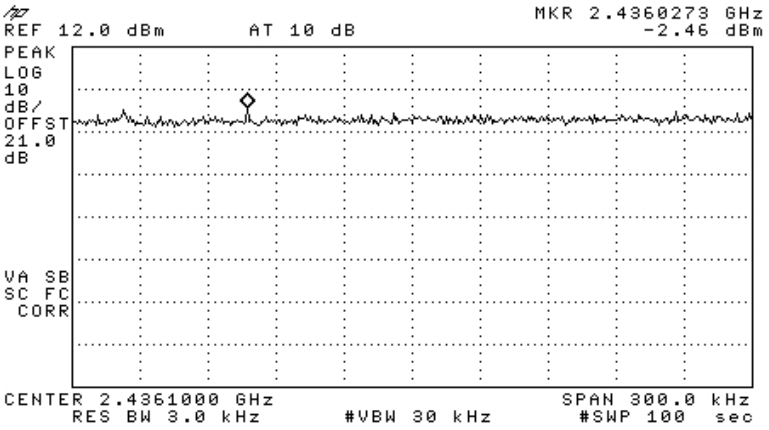


Figure 153 —2437 MHz DBPSK

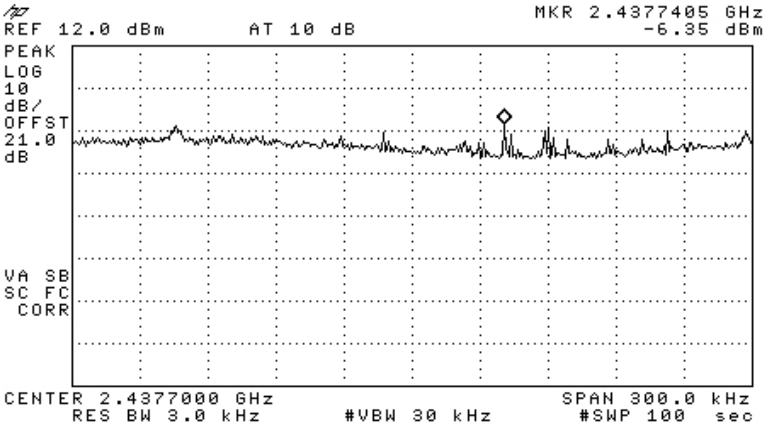


Figure 154 —2437 MHz BPSK

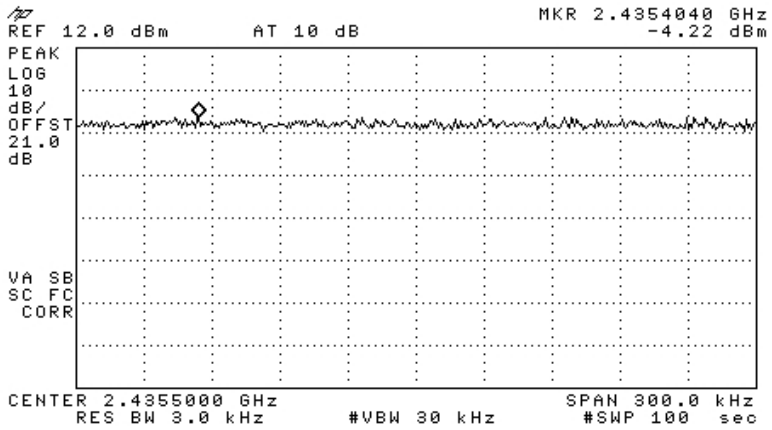


Figure 155 —2437 MHz CCK

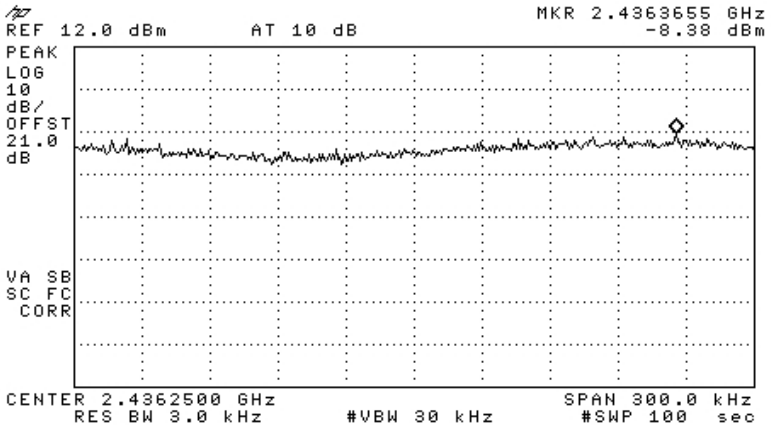


Figure 156 —2437 MHz 64QAM

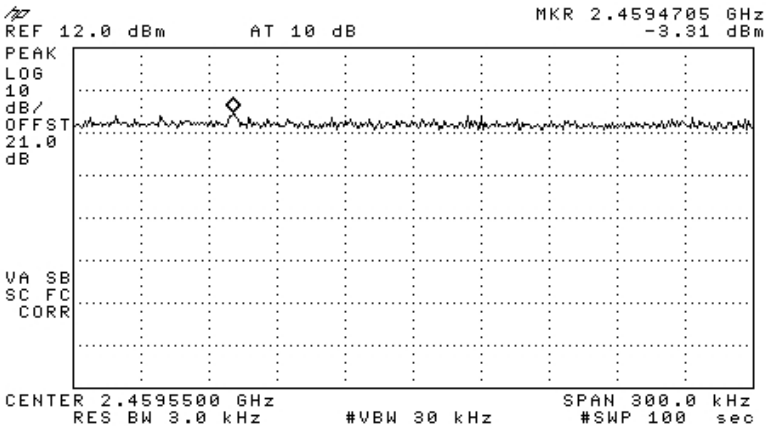


Figure 157 —2462 MHz DBPSK

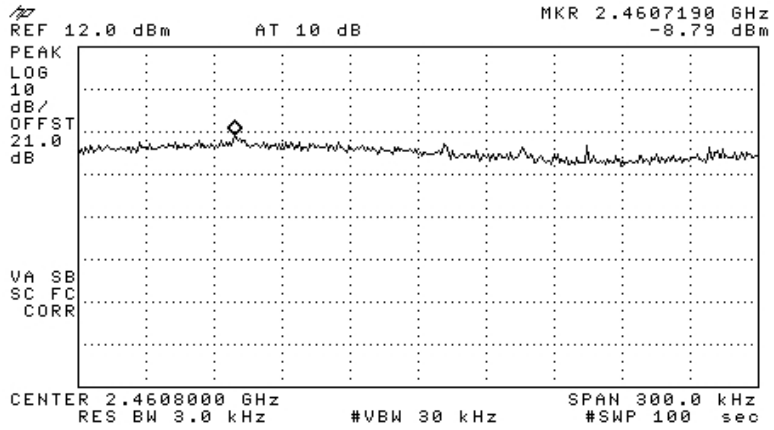


Figure 158 —2462 MHz BPSK

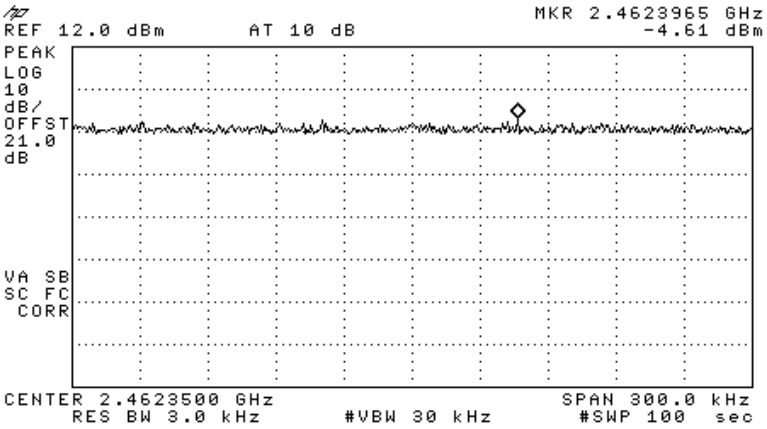


Figure 159 —2462 MHz CCK

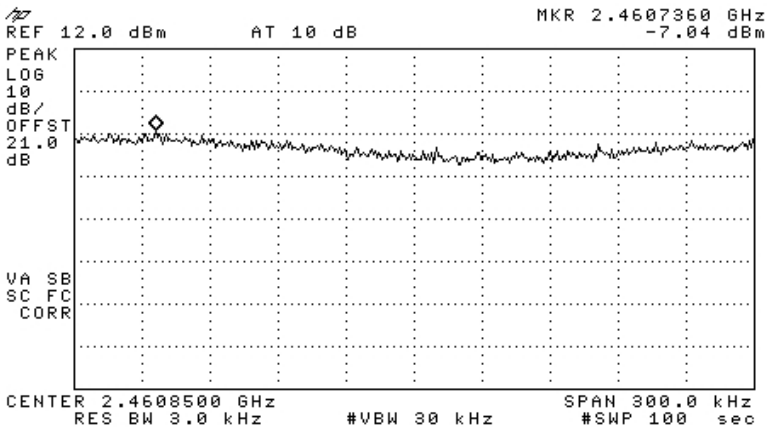


Figure 160 —2462 MHz 64QAM

12.2 Results table

E.U.T. Description: WLAN Module With WCE (WiFi Coverage Extender) for DAS With Four Cisco 1242 Access Points
Model No.: 860M-AU With WCE-AU
Serial Number: 860M-AU: 0837453; WCE-AU:0847A54
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Modulation	Reading Spectrum Analyzer (dBm)	Specification (dBm)	Margin (dB)
2412	DBPSK	-3.0	8.0	-11.0
2412	BPSK	-8.5	8.0	-16.5
2412	CCK	-4.2	8.0	-12.2
2412	64QAM	-5.0	8.0	-13.0
2437	DBPSK	-2.5	8.0	-10.5
2437	BPSK	-6.4	8.0	-14.4
2437	CCK	-4.2	8.0	-12.2
2437	64QAM	-8.4	8.0	-16.4
2462	DBPSK	-3.3	8.0	-11.3
2462	BPSK	-8.8	8.0	-16.8
2462	CCK	-4.6	8.0	-12.6
2462	64QAM	-7.0	8.0	-15.0

Figure 161 Test Results

JUDGEMENT: Passed by 10.5 dB

TEST PERSONNEL:

Tester Signature:  Date: 22.02.09

Typed/Printed Name: A. Sharabi

12.3 Test Equipment Used.

Transmitted Power Density

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 5, 2008	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	February 1, 2009	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 1, 2009	1 year

Figure 162 Test Equipment Used

13. Antenna Gain 2.4GHz Transmitter 802.11 b/g +802.11.a + WMTS + AWS Signals

The antenna gain is 7 dBi.

14. R.F Exposure/Safety 2.4GHz Transmitter 802.11b/g + 802.11a + WMTS + AWS 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 436.5 mw (Peak) = 26.4 dBm

G_T- Antenna Gain, 7 dBi = 5

R- Distance from Transmitter using 1 m worst case

(c) The peak power density is :

$$S_p = \frac{5 \times 436.5}{4\pi(100)^2} = 17.3 \times 10^{-3} \frac{mW}{cm^2}$$

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

The average power source is:

$$218.3mW$$

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

$$S_{AV} = \frac{218.3 \times 5}{4\pi(100)^2} = 8.68 \times 10^{-3} \frac{mW}{cm^2}$$

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

15. Intermodulation Tests

15.1 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 = 1 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

WMTS: in the frequency range 608-614 MHz, 608 MHz CW

AWS: in the frequency range 2110-2155 MHz, 2155MHz CW

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

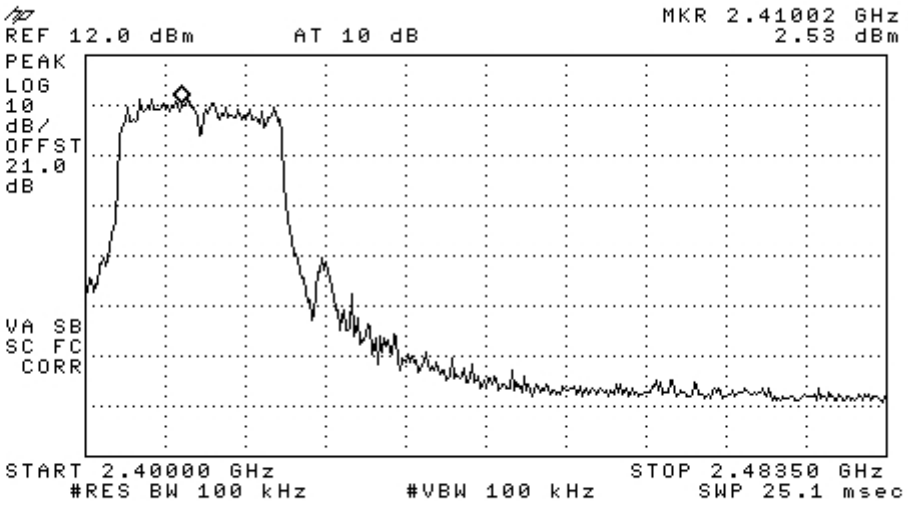


Figure 163 —2412MHz 64QAM

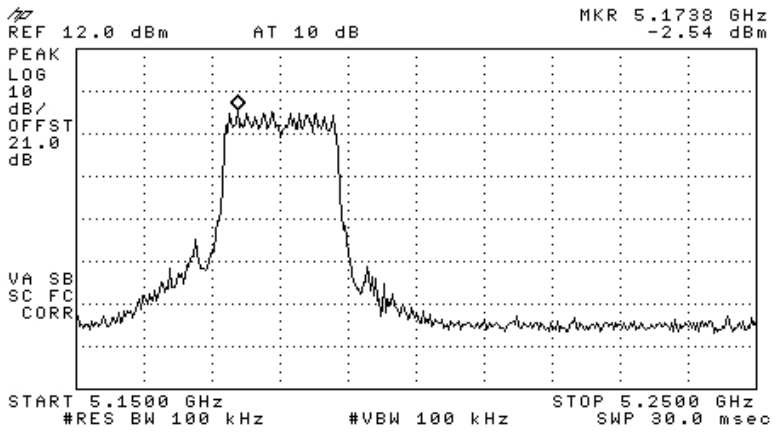


Figure 164 —5180MHz BPSK

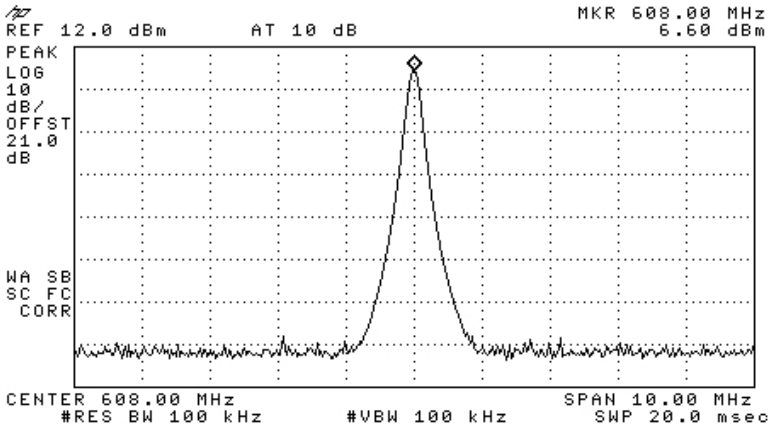


Figure 165 — 608MHz CW

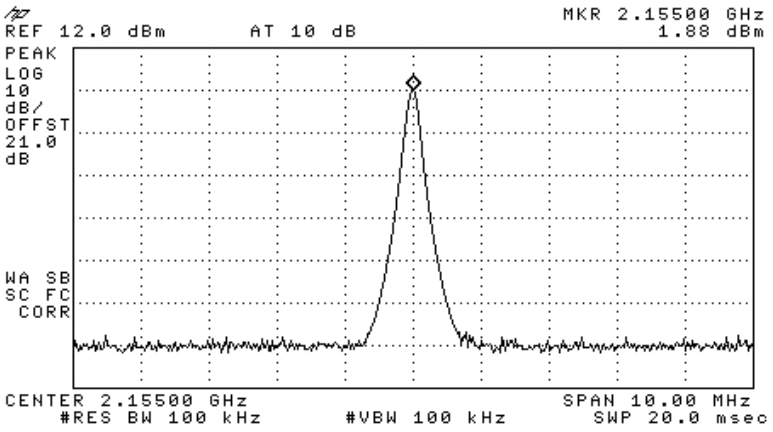


Figure 166 —2155MHz CW

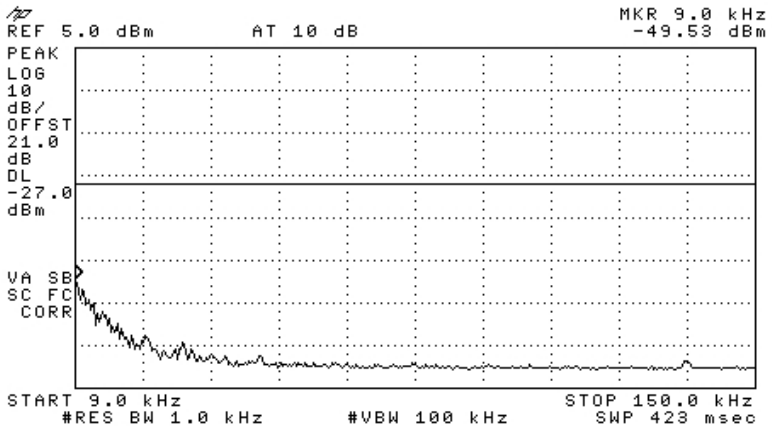


Figure 167

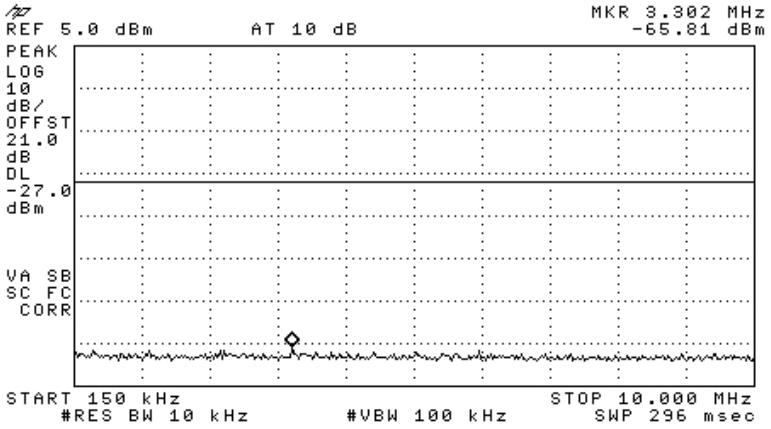


Figure 168

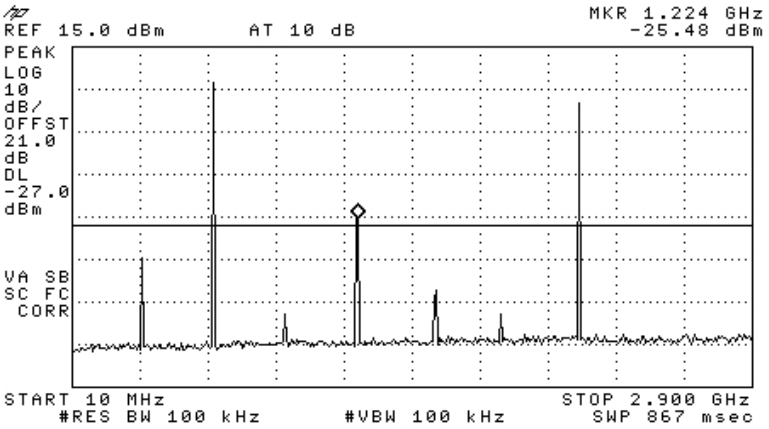


Figure 169 (Seconed harmonic of the 608MHz Signal generator)

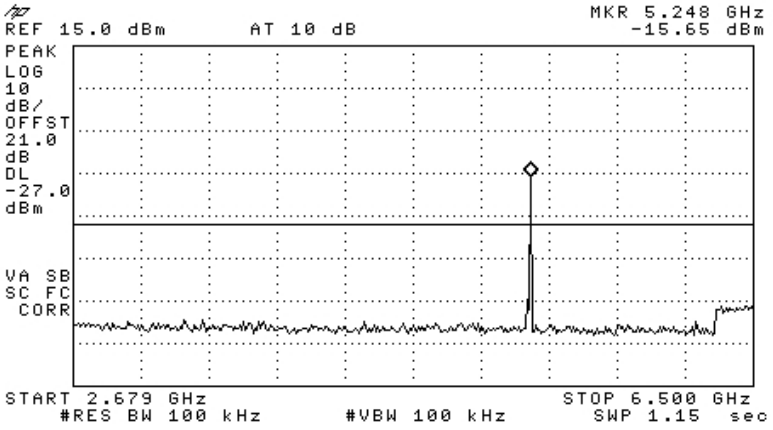


Figure 170

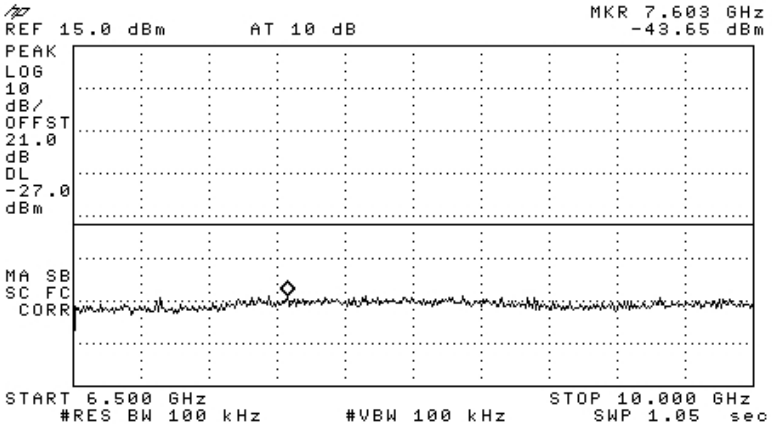


Figure 171

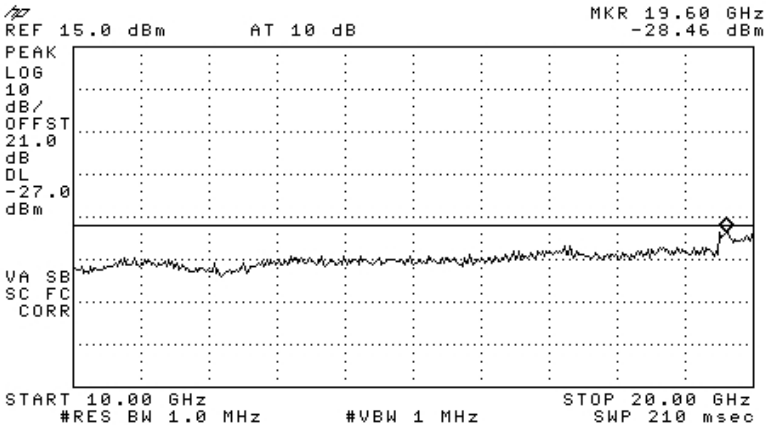


Figure 172

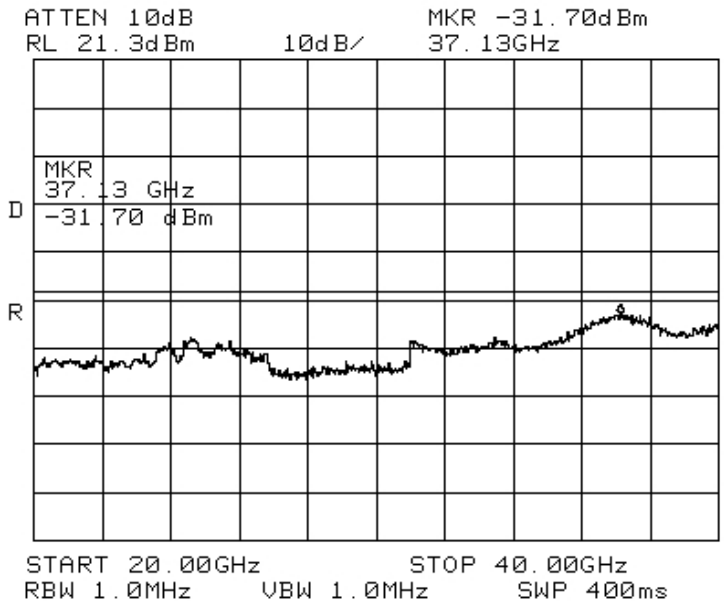

ATTEN 10dB
RL 21.3dBm
10dB/
MKR -31.70dBm
37.13GHz
MKR
37.13 GHz
-31.70 dBm
D
R
START 20.00GHz
STOP 40.00GHz
RBW 1.0MHz
VBW 1.0MHz
SWP 400ms

Figure 173

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature:  Date: 22.02.09

Typed/Printed Name: A. Sharabi

15.2 Test Equipment Used.

Intermodulation

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 5, 2008	1 year
Spectrum Analyzer	HP	8564E	3442A00275	December 15, 2008	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	February 1, 2009	1 year
Cable	Rhophase	KPS-1501-1000	A1675	February 1, 2009	1 year

Figure 174 Test Equipment Used

16. APPENDIX A - CORRECTION FACTORS

16.1 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".

16.2 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.

16.3 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.

16.4 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".*

16.5 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".*

16.6 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".

16.7 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".*

16.8 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			

16.9 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

16.10 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

16.11 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