



Flom Test Labs
EMI, EMC, RF Testing Experts Since 1963

toll-free: (866) 311-3268
fax: (480) 926-3598
<http://www.flomlabs.com>
info@flomlabs.com

Date: July 23, 2007

Federal Communications Commission
Via: Electronic Filing

Attention: Authorization & Evaluation Division
Applicant: Black Diamond Advanced Technology
Equipment: SWBK102
FCC ID: VHUSWBK102
FCC Rules: 15.247

Gentlemen:

On behalf of the Applicant, enclosed please find Application Form 731, Engineering Test Report and all pertinent documentation, the whole for approval of the referenced equipment as shown.

We trust the same is in order. Should you need any further information, kindly contact the writer who is authorized to act as agent.

Sincerely yours,

Hoosamuddin S. Bandukwala, Lab Director

enclosure(s)
cc: Applicant
HSB/je

Flom Test Labs
3356 N. San Marcos Place, Suite 107
Chandler, Arizona 85225-7176
(866) 311-3268 phone, (480) 926-3598 fax

p0770001, d0770013

List Of Exhibits
(FCC **Certification** (Transmitters) - Revised 9/28/98)

Applicant: Black Diamond Advanced Technology

FCC ID: VHUSWBK102

By Applicant:

1. Letter Of Authorization
2. Identification Drawings
 - ___ Id Label
 - ___ Location Info
 - ___ Attestation Statement(S)
 - ___ Location of Compliance Statement
3. Documentation: 2.1033(B)
 - (3) User Manual(S)
 - (4) Operational Description
 - (5) Block Diagram
 - (5) Schematic Diagram
 - (7) External Photographs
 - Internal Photographs
 - Parts List
 - Active Devices

By F.T.L. Inc.

- A. Testimonial & Statement of Certification
- B. Statement of Qualifications



Flom Test Labs
EMI, EMC, RF Testing Experts Since 1963

toll-free: (866) 311-3268
fax: (480) 926-3598
<http://www.flomlabs.com>
info@flomlabs.com

Transmitter Certification

of

FCC ID: VHUSWBK102
Model: SWBK102

to

Federal Communications Commission

Rule Part(s) 15.247

Date Of Report: July 23, 2007

On the Behalf of the Applicant: Black Diamond Advanced Technology
7450 S. Priest Dr
Tempe, AZ 85283

Attention of: Norman Lange
(480) 247-8700
nlange@bdatech.com

Supervised By:

Hoosamuddin S. Bandukwala, Lab Director

Flom Test Labs
3356 N. San Marcos Place, Suite 107
Chandler, Arizona 85225-7176
(866) 311-3268 phone, (480) 926-3598 fax

p0770001, d0770013

The applicant has been cautioned as to the following:

15.21 Information to User.

The users manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) Special Accessories.

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge.

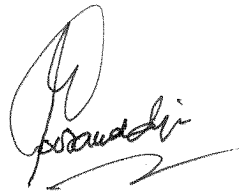
Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Testimonial And Statement Of Certification

This is to certify that:

1. **That** the application was prepared either by, or under the direct supervision of, the undersigned.
2. **That** the technical data supplied with the application was taken under my direction and supervision.
3. **That** the data was obtained on representative units, randomly selected.
4. **That**, to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct.

Certifying Engineer:



Hoosamuddin S. Bandukwala, Lab Director

Table Of Contents

Rule	Description	Page
	Test Report	1
2.1033(c)	General Information Required	2
	Standard Test Conditions and Engineering Practices	4
	Test Results Summary	5
15.247(b)	Peak Output Power	6
15.247(d)	Conducted Spurious Emissions	6
15.247(c),	Radiated Spurious Emissions	14
15.247(c),	Emissions At Band Edges	15
15.247(a)(2)	Occupied Bandwidth	18
15.247(d)	Transmitter Power Spectral Density (PSD)	25
15.207	A/C Powerline Conducted Emissions	29
	Test Equipment Utilized	30

Required information per ISO 17025-2005, paragraph 5.10:

a) **Test Report**

b) Laboratory: Flom Test Lab, Inc.
(FCC: 31040/SIT) 3356 N. San Marcos Place, Suite 107
(Canada: IC 2044) Chandler, AZ 85225

c) Report Number: d0770013

d) Client: Black Diamond Advanced Technology

e) Identification: SWBK102
FCC ID: VHUSWBK102
Description: Rugged PC

f) EUT Condition: Not required unless specified in individual tests.

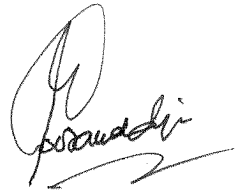
g) Report Date: July 23, 2007
EUT Received:

h, j, k): As indicated in individual tests.

i) Sampling method: No sampling procedure used.

l) Uncertainty: In accordance with FTL internal quality manual.

m) Supervised by:



Hoosamuddin S. Bandukwala, Lab Director

n) Results: The results presented in this report relate only to the item tested.

o) Reproduction: This report must not be reproduced, except in full, without written permission from this laboratory.

List Of General Information Required For Certification

In Accordance with FCC Rules and Regulations,
Volume II, Part 2 and to

15.247

Sub-Part 2.1033

(c)(1):

Name and Address of Applicant: Black Diamond Advanced Technology

(c)(2): **FCC ID:** VHUSWBK102

Model Number: SWBK102

(c)(3): **Instruction Manual(s):**

Please See Attached Exhibits

(c)(4): **Type of Emission:** DTS

(c)(5): **FREQUENCY RANGE, MHz:** 2412-2462

(c)(6): **Power Rating, W:** 50 mW
_____ Switchable _____ Variable X N/A

(c)(7): **Maximum Power Rating, W:** 50 mW

15.203: Antenna Requirement:

- X The antenna is permanently attached to the EUT
_____ The antenna uses a unique coupling
_____ The EUT must be professionally installed
_____ The antenna requirement does not apply

The unit was tested with an internal embedded antenna with a gain of 2.0 dBi.

Subpart 2.1033 (continued)**(c)(8): Circuit Diagram/Circuit Description:**

Including description of circuitry & devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation and limiting power.

Please See Attached Exhibits

(c)(9): Label Information:

Please See Attached Exhibits

(c)(10): Photographs:

Please See Attached Exhibits

(c)(11): Digital Modulation Description:

☐ Attached Exhibits

☒ N/A

(c)(12): Test And Measurement Data :

Follows

Sub-part
2.1033(b):

Test And Measurement Data

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2 and the following individual Parts:

15.247 Operation within bands 2400-2483.5 MHz (spread spectrum)

Standard Test Conditions and Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.4-2004, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104 °F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Prior to testing, the EUT was tuned up in accordance with the manufacturer's alignment procedures. All external gain controls were maintained at the position of maximum and/or optimum gain throughout the testing.

Measurement results, unless otherwise noted, are worst-case measurements.

A2LA

"A2LA has accredited Flom Test Labs, Inc. Chandler, AZ for technical competence in the field of Electrical testing. The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO 17025:2005 'General Requirements for the Competence of Testing and Calibration Laboratories' and any additional program requirements in the identified field of testing."

Please refer to www.a2la.org for current scope of accreditation.

Certificate number: 2152.01



Test Results Summary

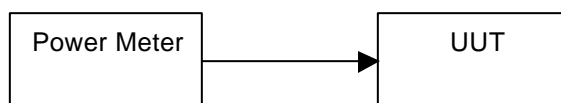
Specification	Test Name	Pass, Fail, N/A	Comments
15.247(b)	Peak Output Power	Pass	
15.247(d)	Conducted Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Radiated Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Emissions At Band Edges	Pass	
15.247(a)(2)	Occupied Bandwidth	Pass	
15.247(e)	Transmitter Power Spectral Density	Pass	
15.207	A/C Powerline Conducted Emissions	Pass	

Name of Test: Peak Output Power
Specification: 15.247(b)
Test Equipment Utilized i00228, i00317

Test Procedure

The UUT was connected directly to a power meter input. The peak readings were taken and the result was then compared to the limit.

Test Setup



Transmitter Peak Output Power

11 MBPs QPSK

Tuned Frequency MHz	Recorded Measurement	Specification Limit	Result
2412	16.74 dBm	30 dBm	Pass
2437	16.58 dBm	30 dBm	Pass
2462	16.31 dBm	30 dBm	Pass

54 MBPs ODFM

Tuned Frequency MHz	Recorded Measurement	Specification Limit	Result
2412	16.54 dBm	30 dBm	Pass
2437	16.33 dBm	30 dBm	Pass
2462	15.95 dBm	30 dBm	Pass

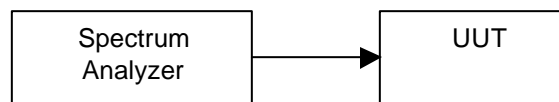
Name of Test: Conducted Spurious Emissions
Specification: 15.247(d)
Spec. Limit -20 dBc
Test Equipment Utilized i00029, i00329

Test Procedure

The UUT was connected directly to a spectrum analyzer to verify that the UUT met the requirements for spurious emissions. The reference level was offset for the peak power output with the resolution bandwidth set for 1 MHz. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed. Only detectable spurious emissions were recorded and plotted. The reference level is added to the recorded measurement to provide the corrected level dBc

Only the worst case is recorded in the Conducted Spurious Emissions Summary Test Table.

Test Setup



Conducted Spurious Emissions Summary Test Table

11 MBPs QPSK

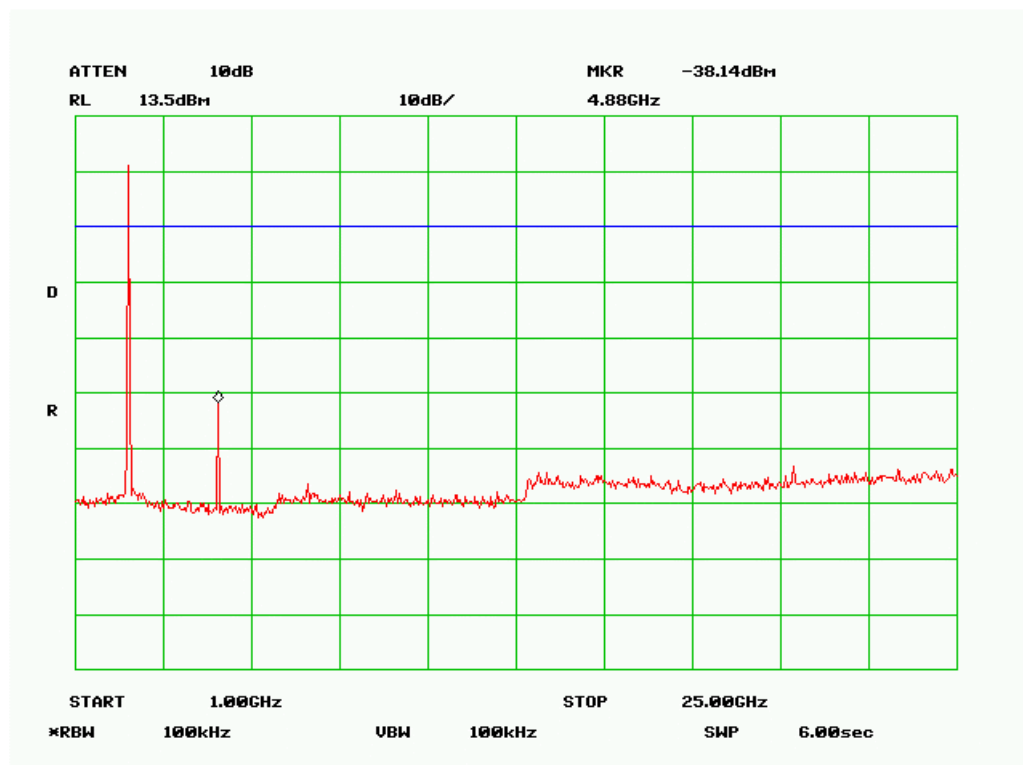
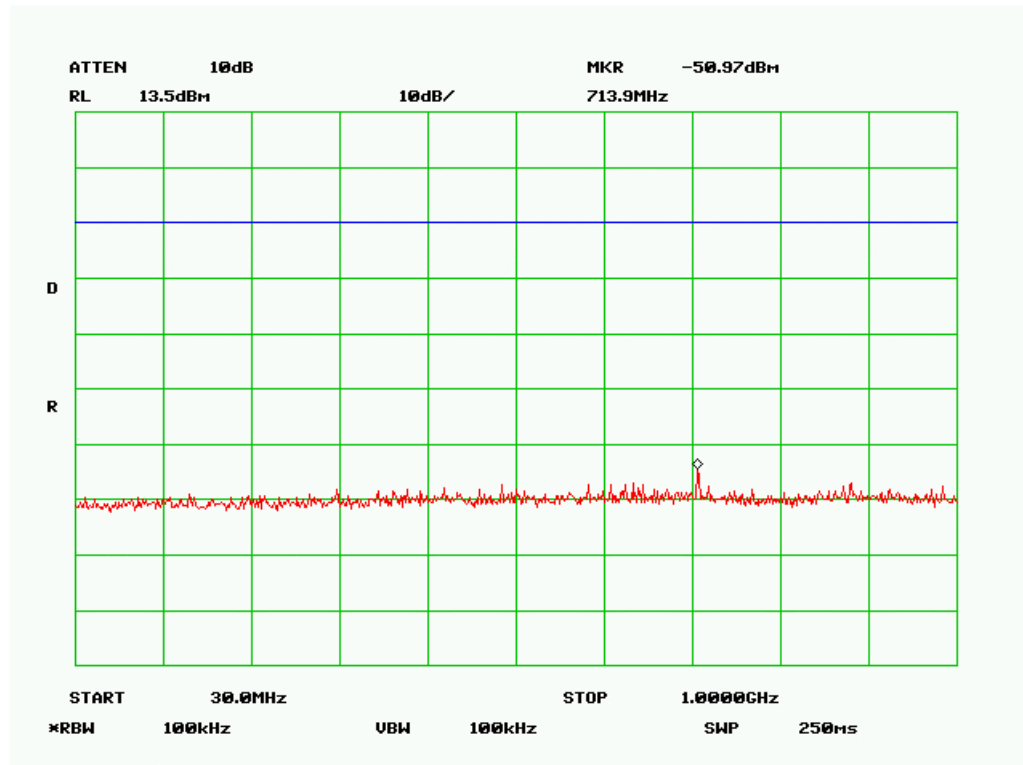
Tuned Frequency MHz	Emission Frequency MHz	Recorded Measurement	Reference Level	Corrected Measurement	Specification Limit	Result
2412	4880	-38.14	13.5	51.64 dBc	-20 dBc	Pass
2437	4920	-39.80	13.5	53.50 dBc	-20 dBc	Pass
2462	4960	-41.64	13.5	55.14 dBc	-20 dBc	Pass

54 MBPs ODFM

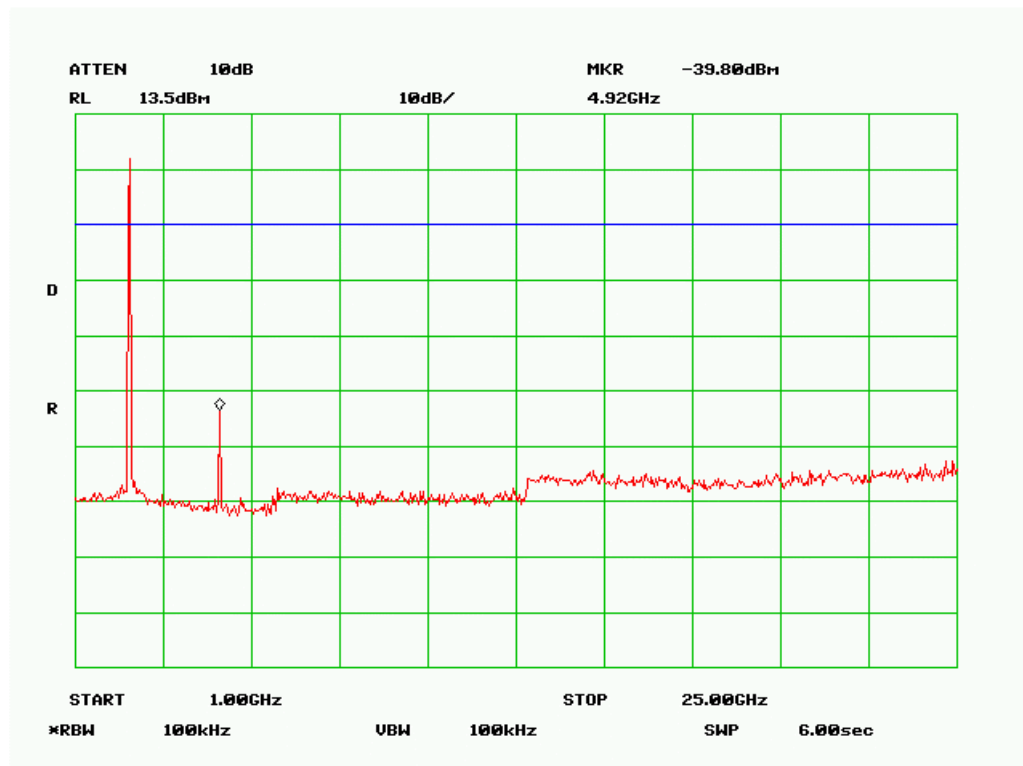
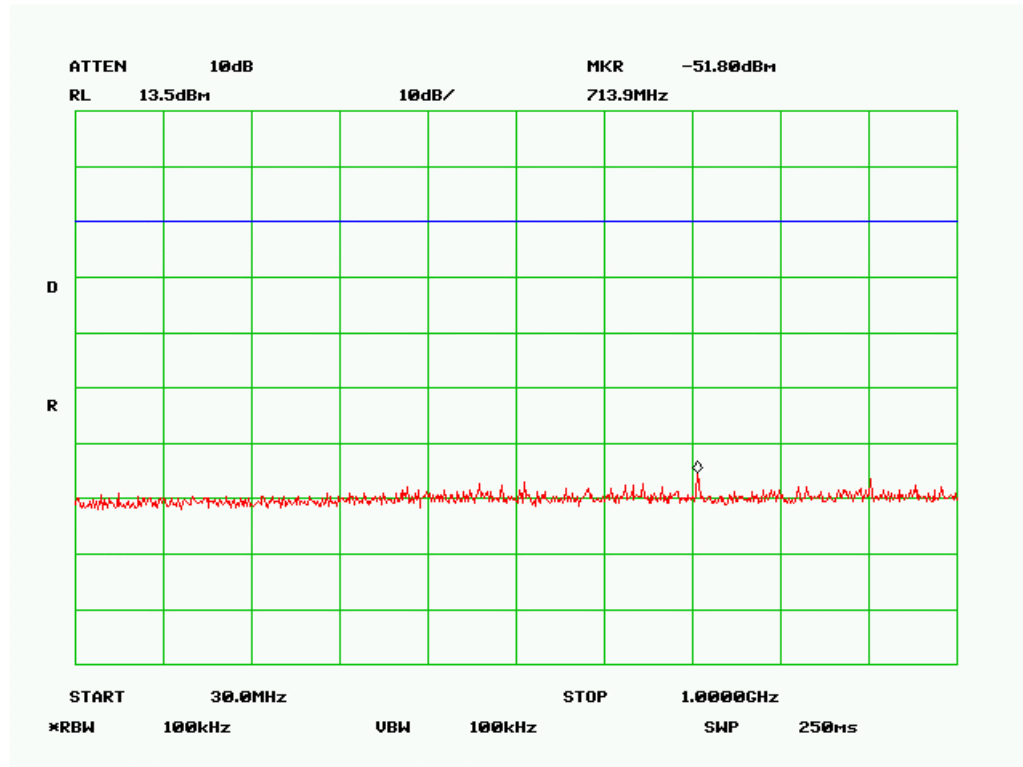
Tuned Frequency MHz	Emission Frequency MHz	Recorded Measurement	Reference Level	Corrected Measurement	Specification Limit	Result
2412	4880	-41.90	13.6	55.50 dBc	-20 dBc	Pass
2437	4920	-43.40	13.9	57.30 dBc	-20 dBc	Pass
2462	4960	-43.07	13.4	56.47 dBc	-20 dBc	Pass

11 MBPs QPSK

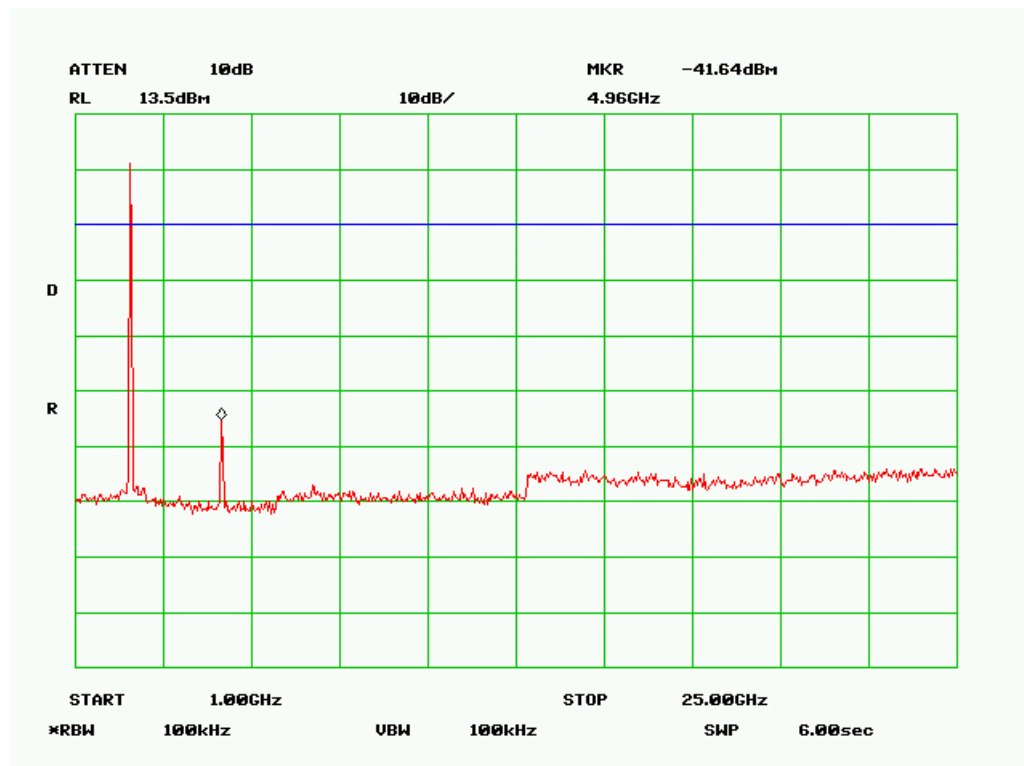
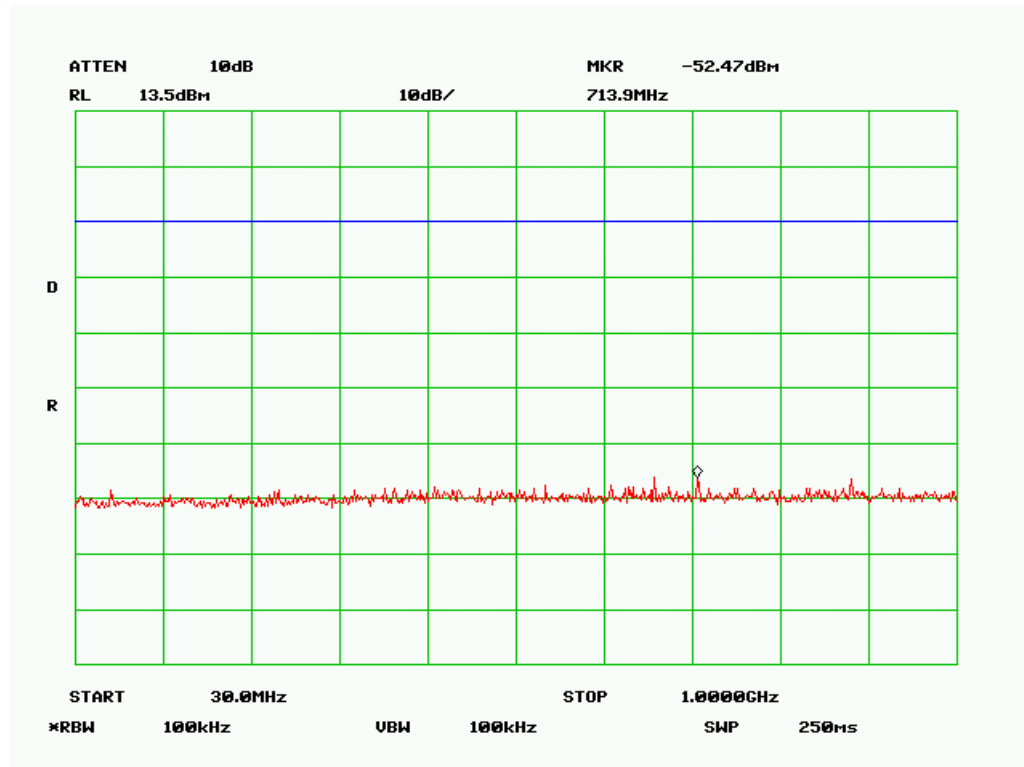
Conducted Spurious Emissions 2412 MHz



Conducted Spurious Emissions 2437 MHz

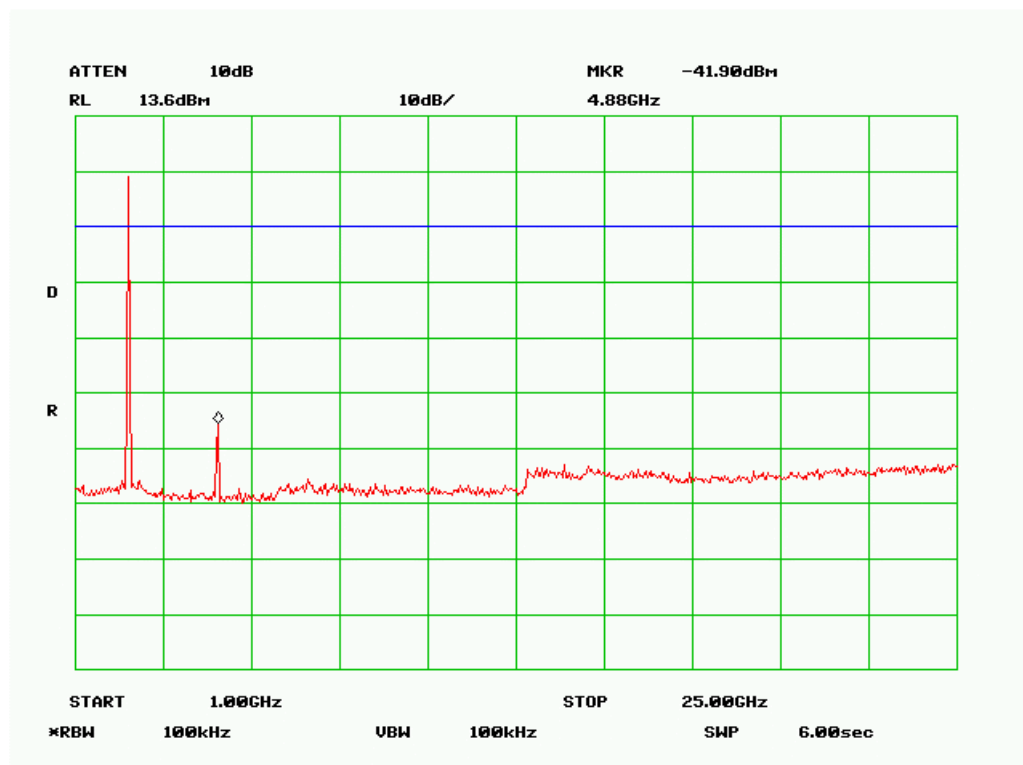
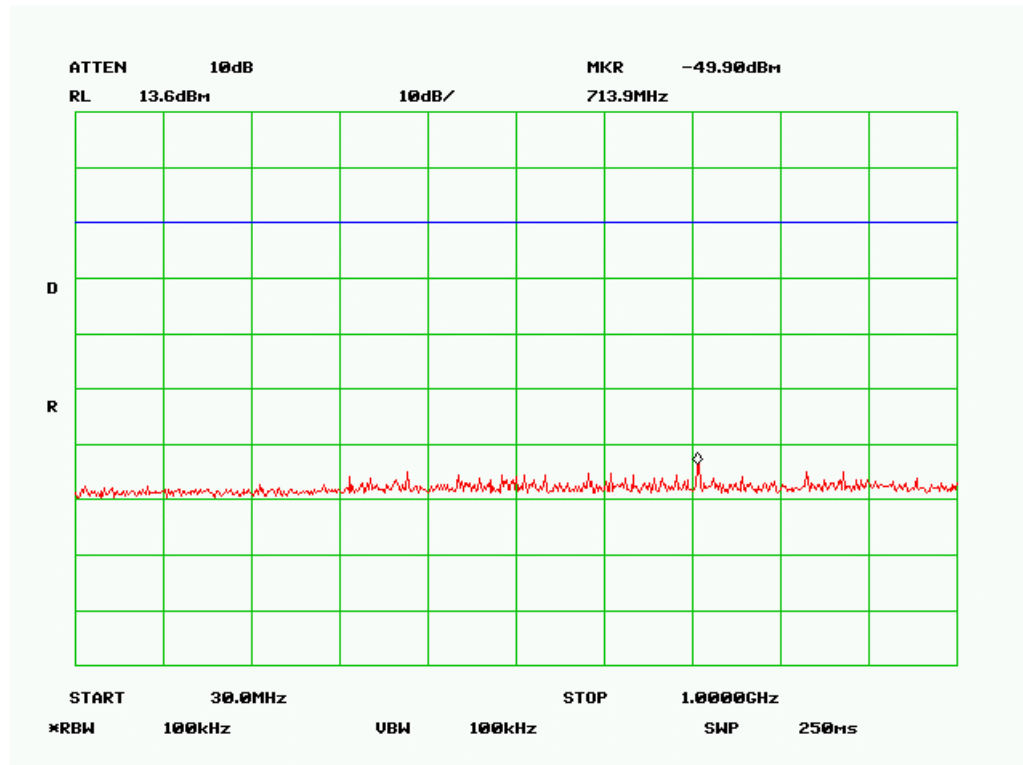


Conducted Spurious Emissions 2462 MHz

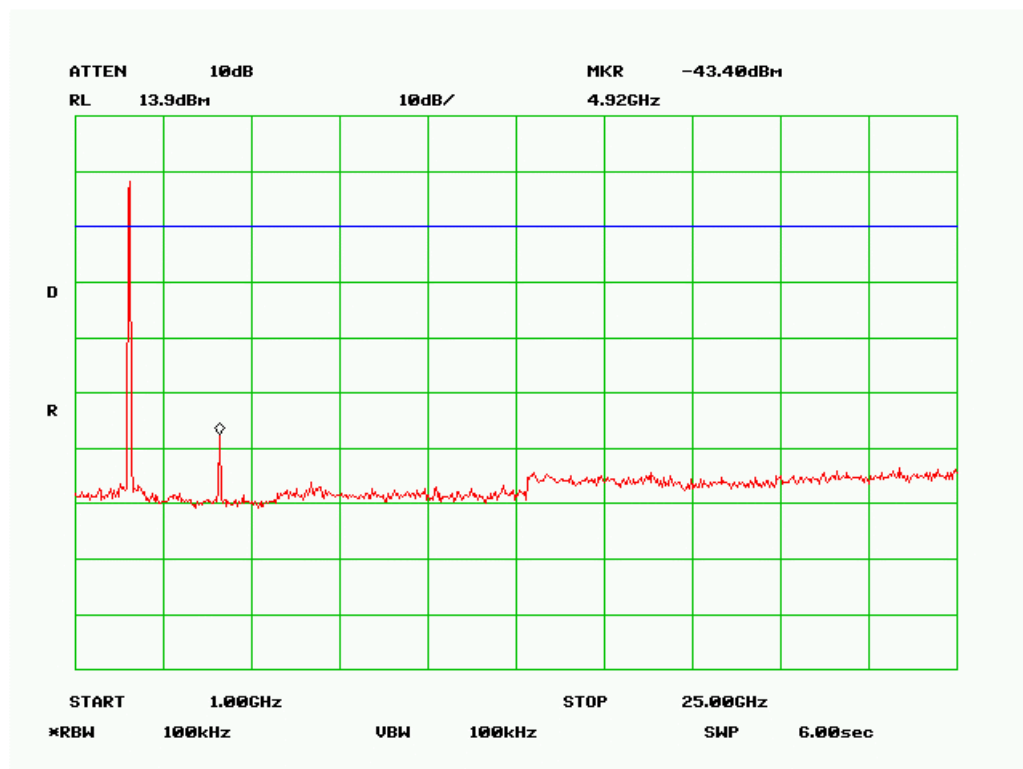
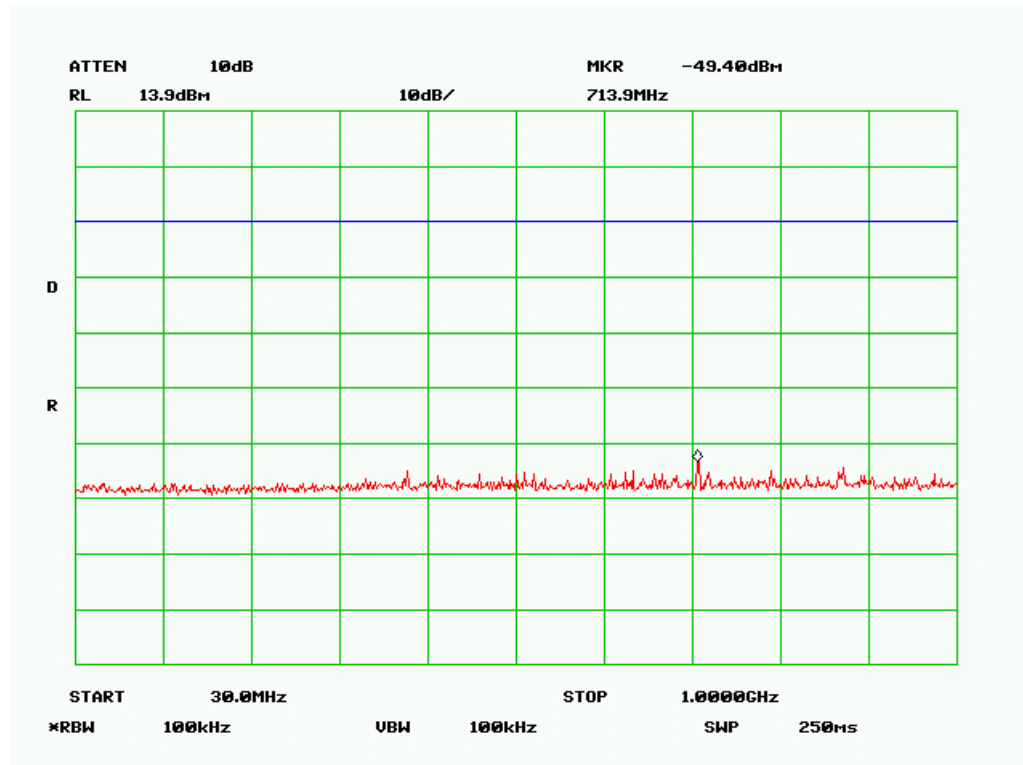


54 MBPs ODFM

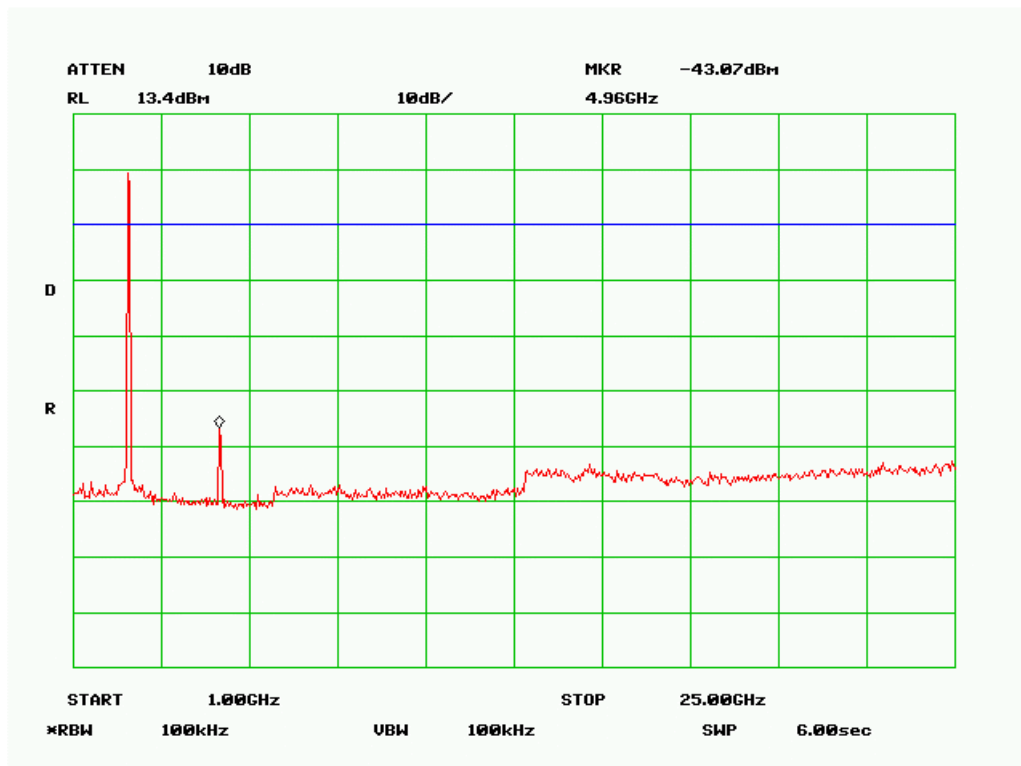
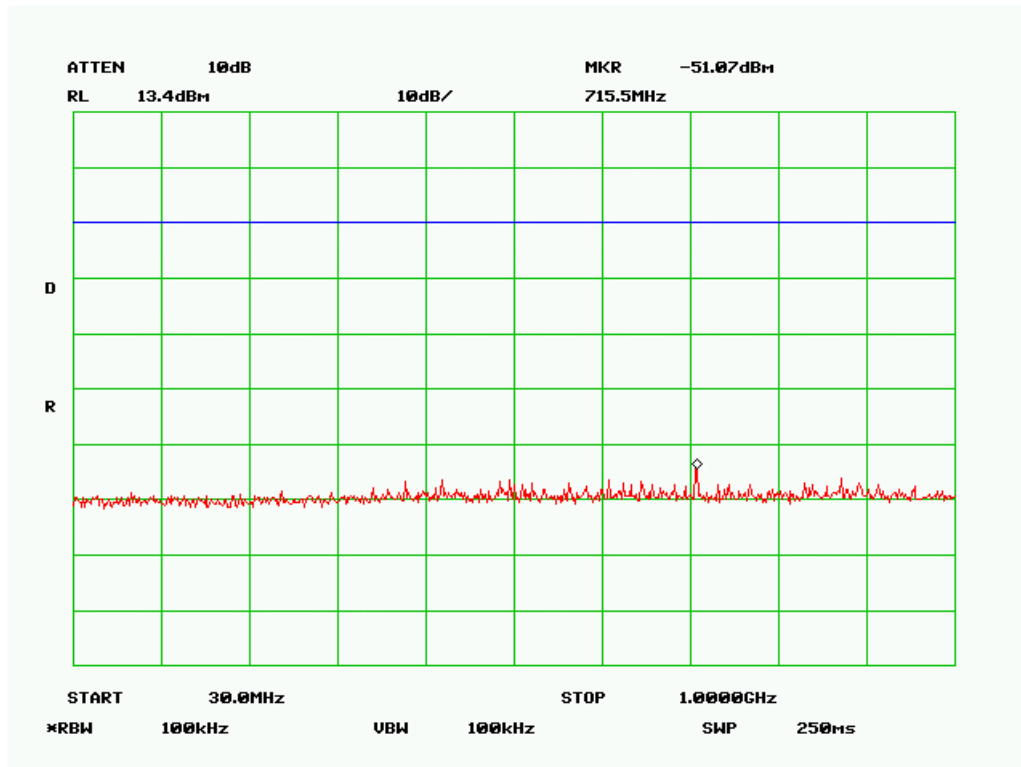
Conducted Spurious Emissions 2412 MHz



Conducted Spurious Emissions 2437 MHz



Conducted Spurious Emissions 2462 MHz

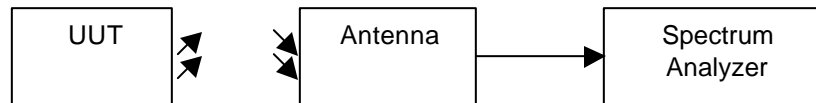


Name of Test: Radiated Spurious Emissions
Specification: 15.247(c), 15.209(a), 15.205
Spec. Limit -20 dBc and for restricted band 54 dBuV average and 74 dBuV peak
Test Equipment Utilized i00029, i00033, i00088, i00089, i00103

Test Procedure

The UUT was tested in an Open Area Test Site (OATS) set 3m from the receiving transducer. A spectrum analyzer was used to verify that the UUT met the requirements for Radiated Spurious Emissions. The antennas were tested in both the vertical and horizontal orientation and raised from 1 to 4 meters while rotating the UUT 360° to ensure the TX signal levels were maximized. The signals were investigated to the 10th harmonic however because of the UUT system losses there were no detectable harmonic emissions above 1000 MHz.

Test Setup



Settings below 1000 MHz RBW = 100 KHz, VBW = 100KHz, Detector – Quasi Peak

Settings above 1000 MHz RBW = 1 MHz, VBW = 10 Hz, Detector – Average

Sample Calculations

Corrected Level = Recorded Level + Correction factor

Correction Factor = ACF + Cable loss + Distance Correction factor

Radiated Spurious Emissions

Tuned Freq (MHz)	Emission Freq (MHz)	Monitored Level (dBuV/m)	Correction Factor (dB)	Corrected Value (dBuV/m)	Limit (dBuV/m)	Result
2412	39.569	15.2	14.4	29.6	40.0	Pass
2412	225.267	12.8	19.8	32.6	40.0	Pass
2412	331.754	12.8	20.5	33.3	47.0	Pass
2412	500.021	14.0	23.4	37.4	47.0	Pass
2412	600.025	12.3	25.7	38.0	47.0	Pass
2412	800.034	11.8	27.3	39.1	47.0	Pass

Tuned Freq (MHz)	Emission Freq (MHz)	Monitored Level (dBuV/m)	Correction Factor (dB)	Corrected Value (dBuV/m)	Limit (dBuV/m)	Result
2437	39.569	15.2	14.4	29.6	40.0	Pass
2437	225.267	12.8	19.8	32.6	40.0	Pass
2437	331.754	12.8	20.5	33.3	47.0	Pass
2437	500.021	14.0	23.4	37.4	47.0	Pass
2437	600.025	12.3	25.7	38.0	47.0	Pass
2437	800.034	11.8	27.3	39.1	47.0	Pass

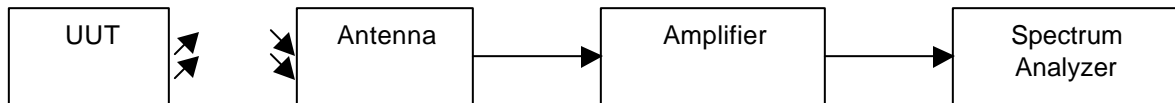
Tuned Freq (MHz)	Emission Freq (MHz)	Monitored Level (dBuV/m)	Correction Factor (dB)	Corrected Value (dBuV/m)	Limit (dBuV/m)	Result
2462	39.569	15.2	14.4	29.6	40.0	Pass
2462	225.267	12.8	19.8	32.6	40.0	Pass
2462	331.754	12.8	20.5	33.3	47.0	Pass
2462	500.021	14.0	23.4	37.4	47.0	Pass
2462	600.025	12.3	25.7	38.0	47.0	Pass
2462	800.034	11.8	27.3	39.1	47.0	Pass

Name of Test: Emissions At Band Edges
Specification: 15.247(c), 15.209(a), 15.205
Limit -20 dBC and for restricted band 54 dBuV average and 74 dBuV peak
Test Equipment Utilized i00028, i00271, i00290

Test Procedure

The UUT was tested in a semi-anechoic chamber set 3m from the receiving transducer. A spectrum analyzer was used to verify that the UUT met the requirements for band edge with both peak and average measurements. The cable and transducer correction factors were input into the analyzer as a reference level offset to ensure accurate readings were obtained.

Test Setup



Band Edge / Restricted Band Emissions Summary

11 MBPs QPSK

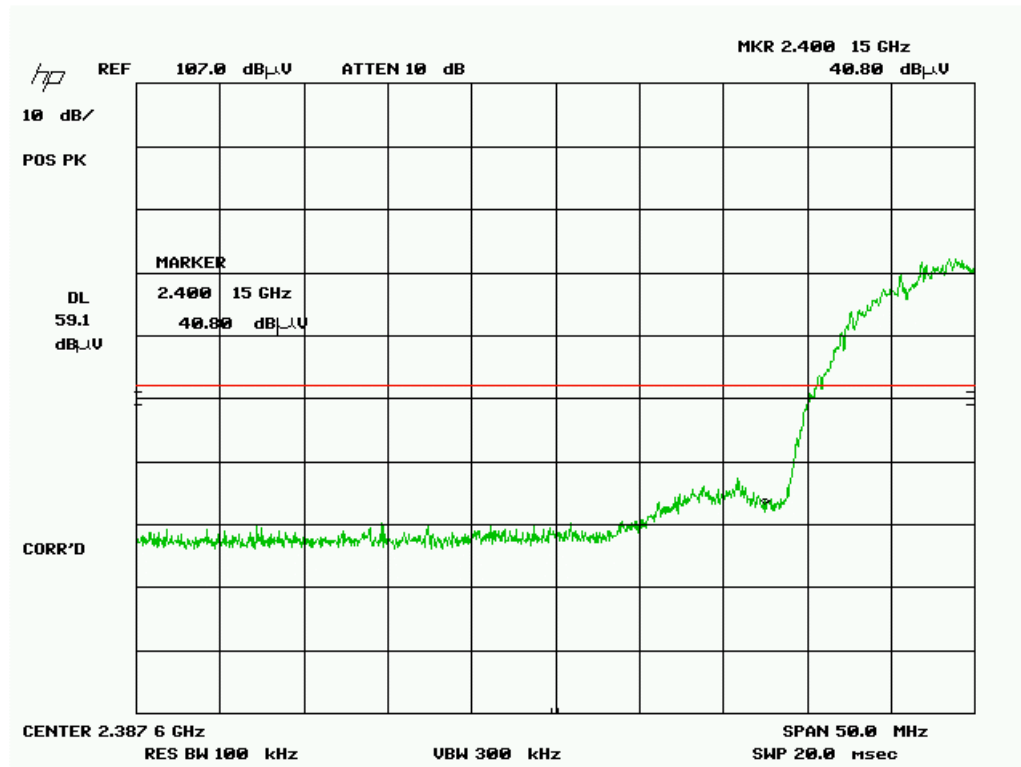
Tuned Freq (MHz)	Emission Freq (MHz)	Monitored Level (dBuV/m)	Detector	Limit (dBuV/m)	Result
2412	2400	40.80	Peak	74	Pass
2467	2483.5	35.50	Peak	74	Pass

54 MBPs ODFM

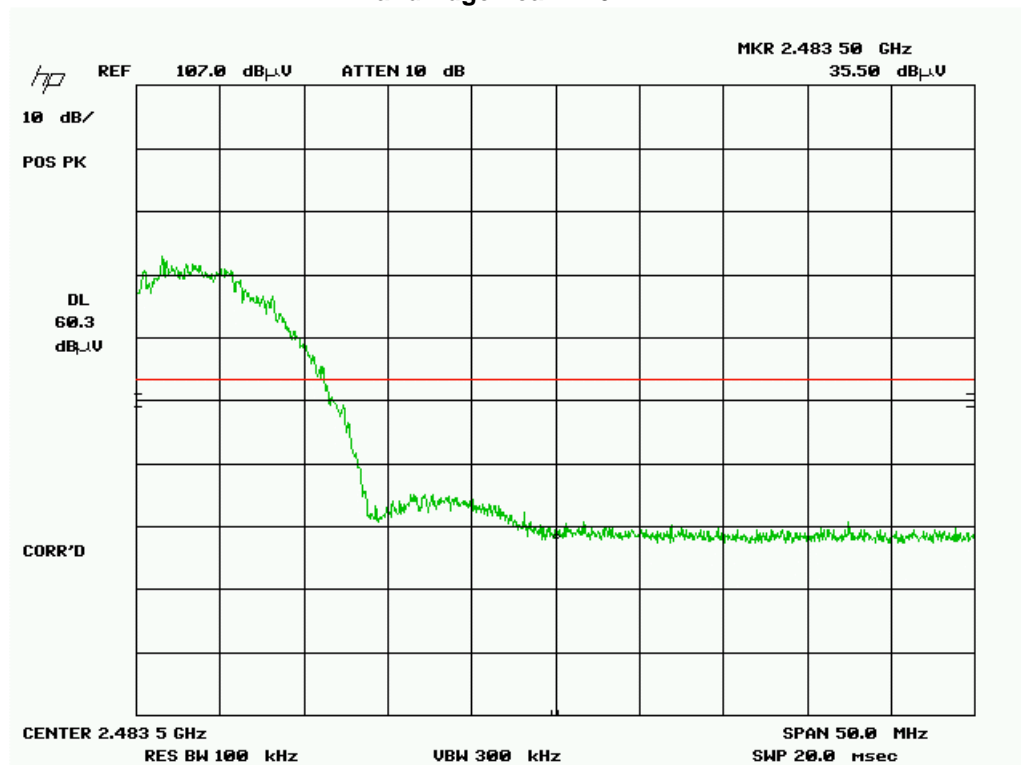
Tuned Freq (MHz)	Emission Freq (MHz)	Monitored Level (dBuV/m)	Detector	Limit (dBuV/m)	Result
2412	2400	43.60	Peak	74	Pass
2467	2483.5	36.50	Peak	74	Pass

11 MBPs QPSK

Band Edge Peak 2412 MHz

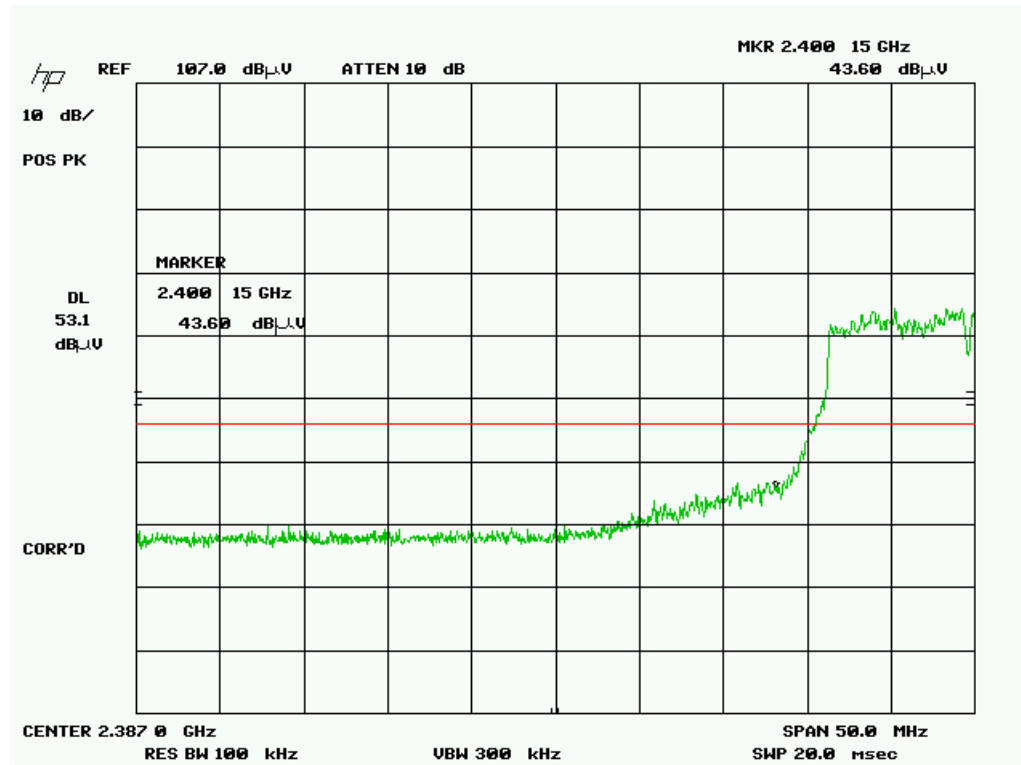


Band Edge Peak 2467 MHz

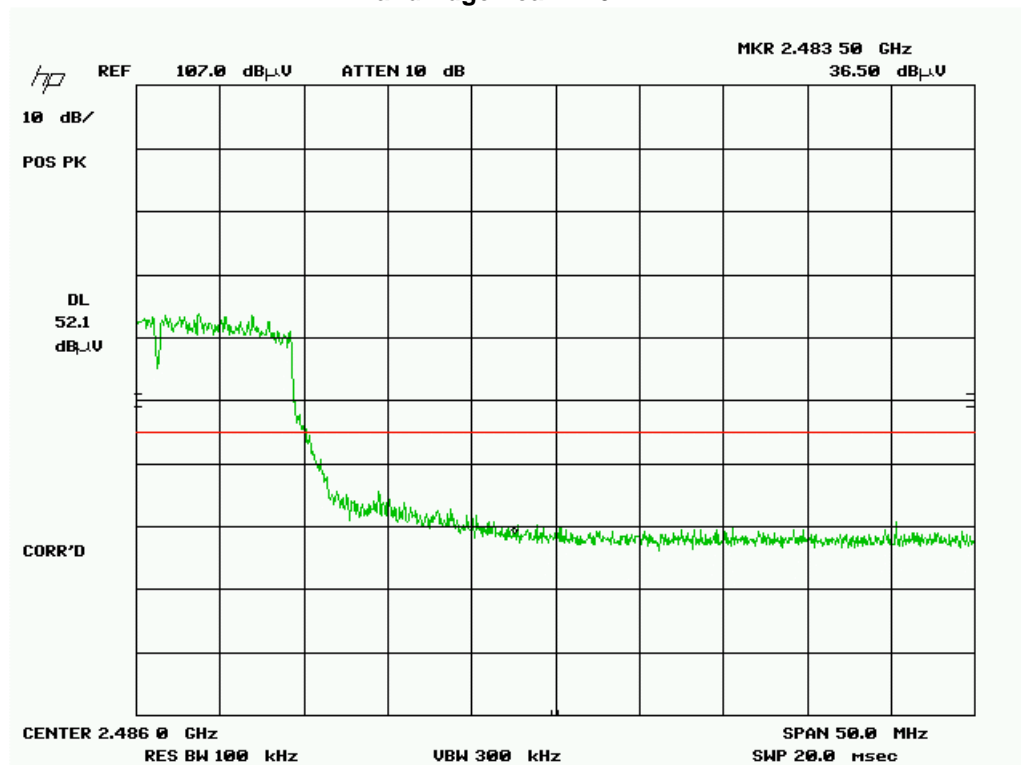


54 MBPs ODFM

Band Edge Peak 2412 MHz



Band Edge Peak 2467 MHz

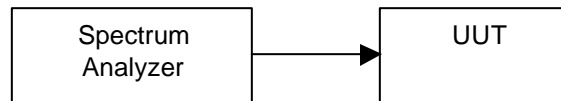


Name of Test: Occupied Bandwidth
Specification: 15.247(a)(2)
Limit BW = 500 KHz
Test Equipment Utilized i00329

Test Procedure

The UUT was connected directly to a spectrum analyzer. The Span was set wide enough to capture the entire transmit spectrum and the resolution bandwidth was set to at least 1% of the span. The analyzer was set to max hold and when the entire spectrum was captured the 6dB and 99% bandwidths were measured to verify the bandwidth met the specification.

Test Setup



Occupied Bandwidth Summary

11 MBPs QPSK

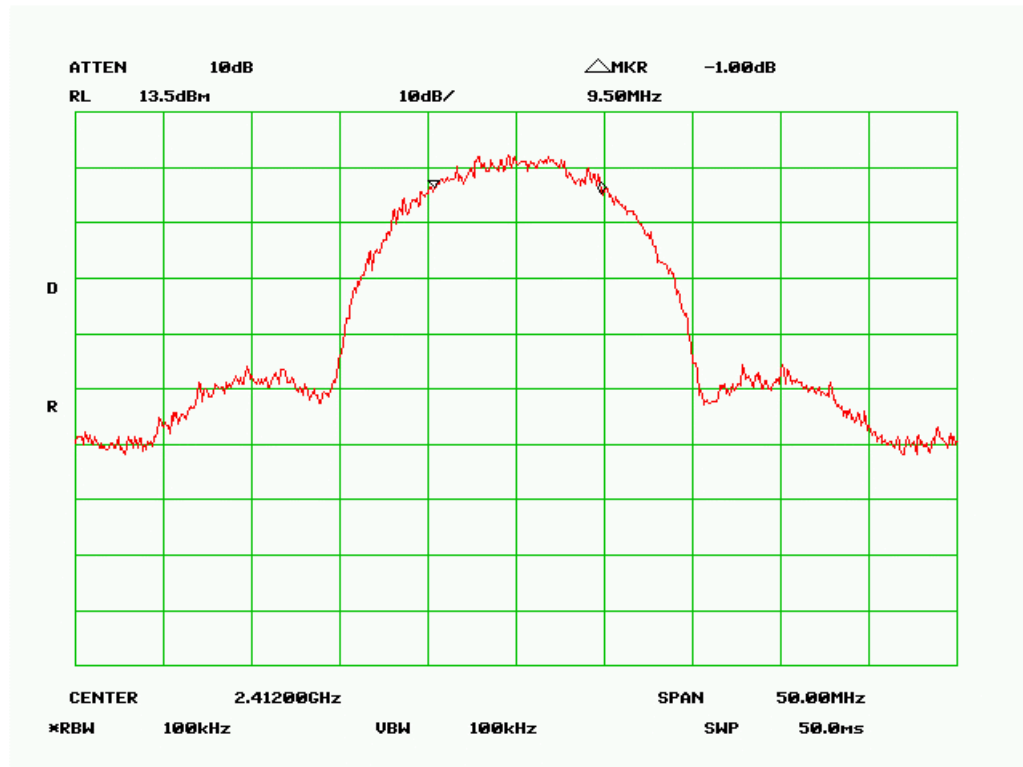
Frequency MHz	Recorded Measurement	Specification Limit	Result
2412	9.50 MHz	= 500 KHz	Pass
2437	8.75 MHz	= 500 KHz	Pass
2462	8.83 MHz	= 500 KHz	Pass

54 MBPs ODFM

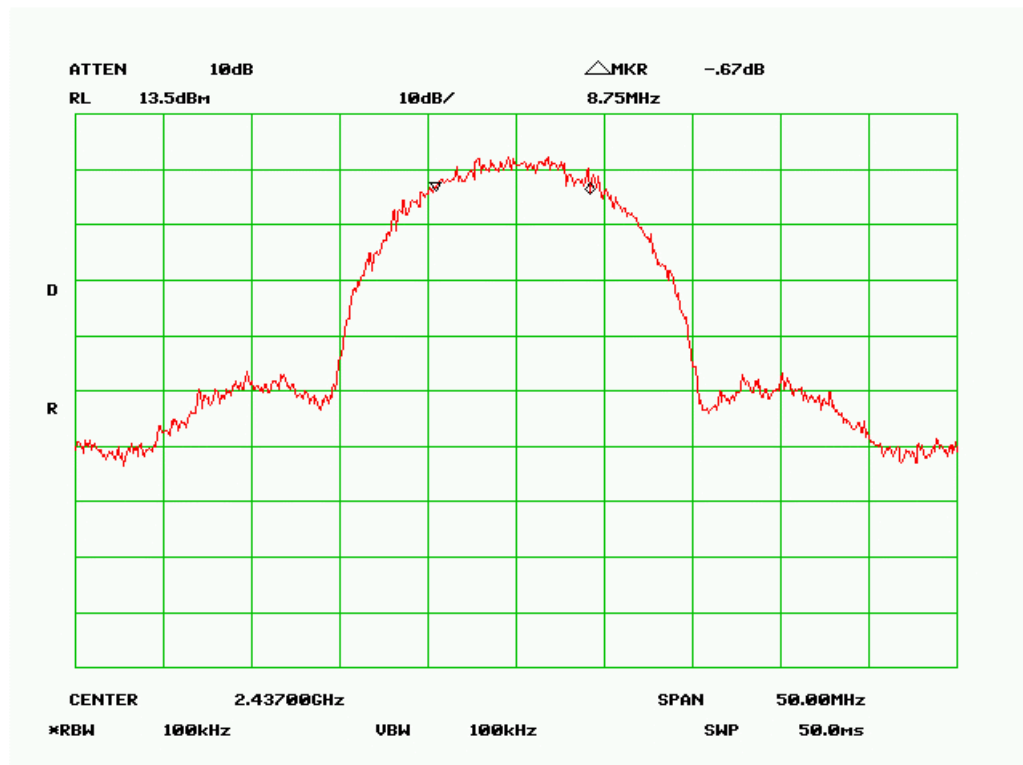
Frequency MHz	Recorded Measurement	Specification Limit	Result
2412	16.67 MHz	= 500 KHz	Pass
2437	16.60 MHz	= 500 KHz	Pass
2462	16.60 MHz	= 500 KHz	Pass

11 MBPs QPSK

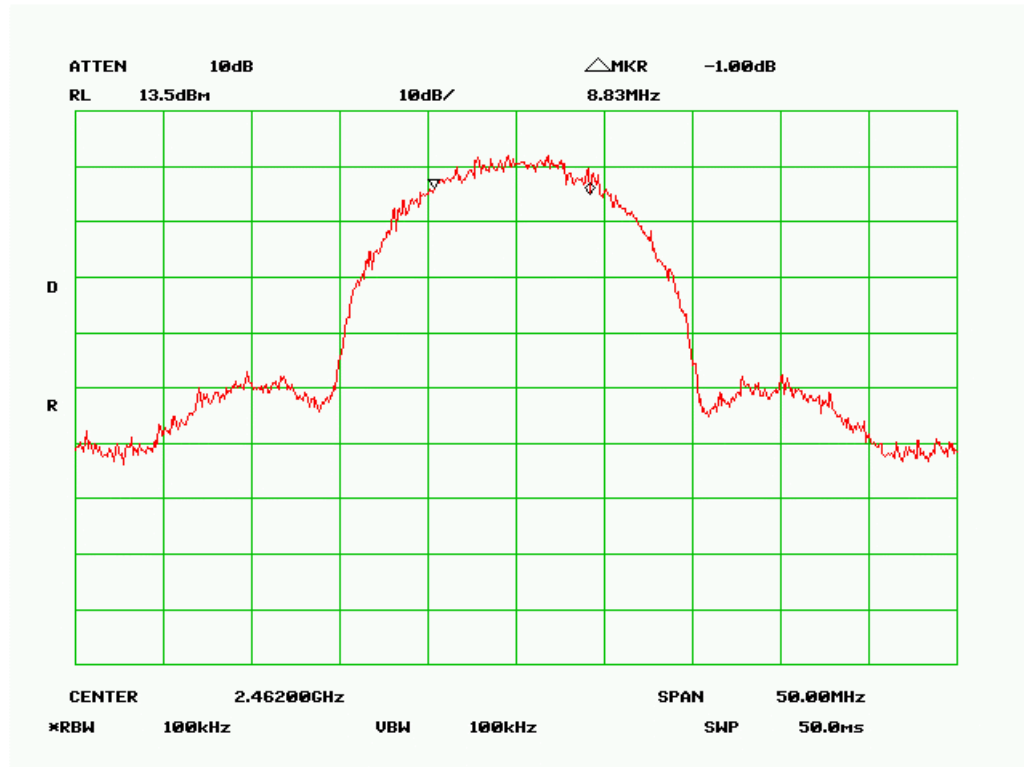
6dB Bandwidth 2412 MHz



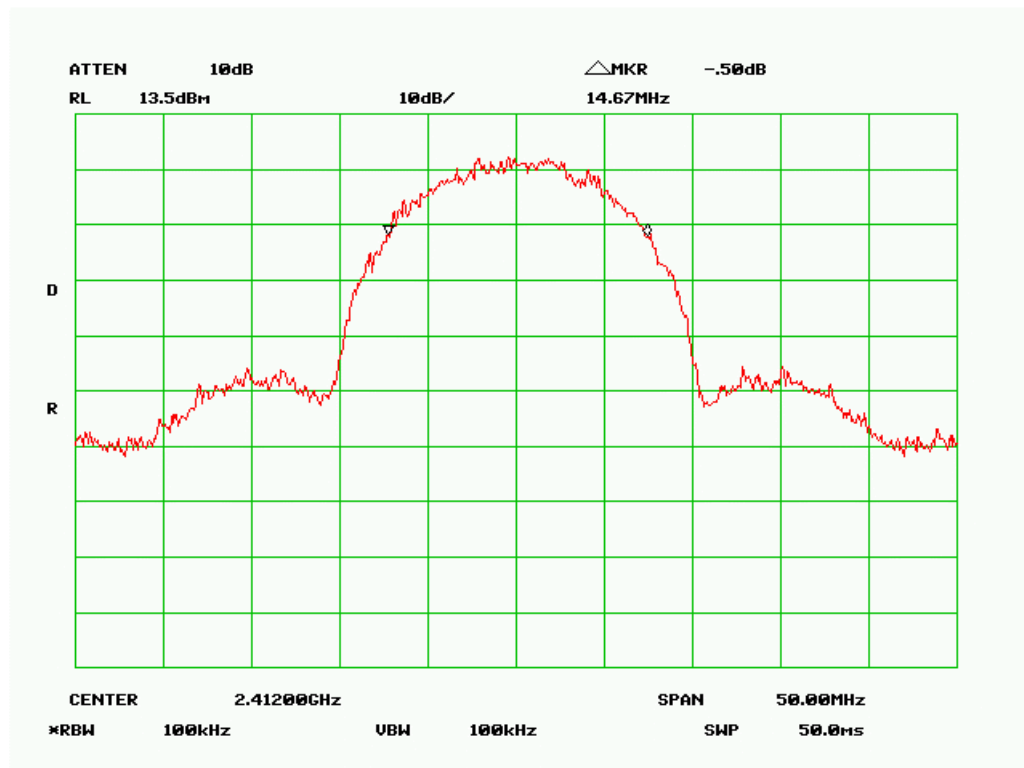
6dB Bandwidth 2437 MHz



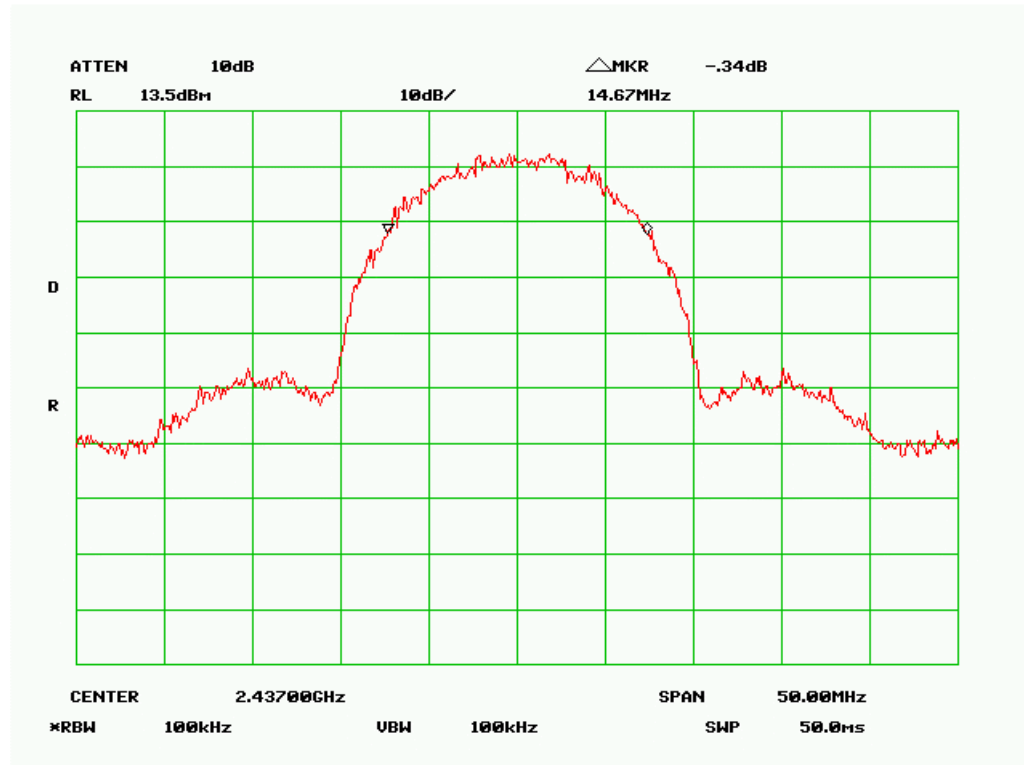
6dB Bandwidth 2462 MHz



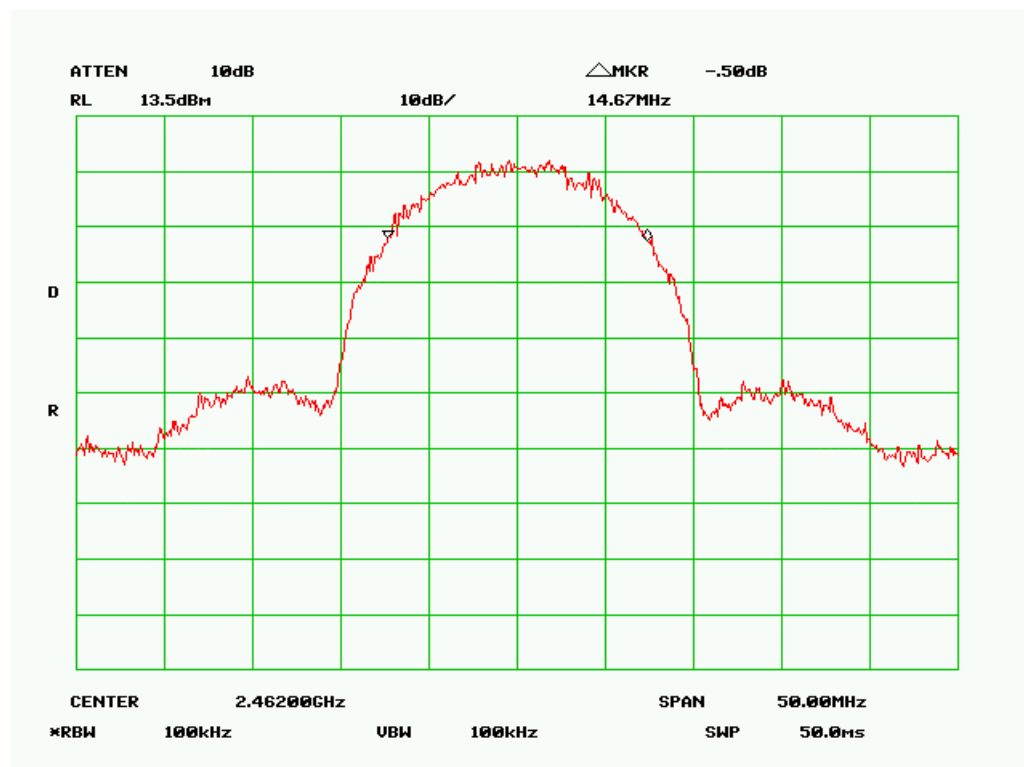
99% Bandwidth 2412 MHz



99% Bandwidth 2437 MHz



99% Bandwidth 2462 MHz

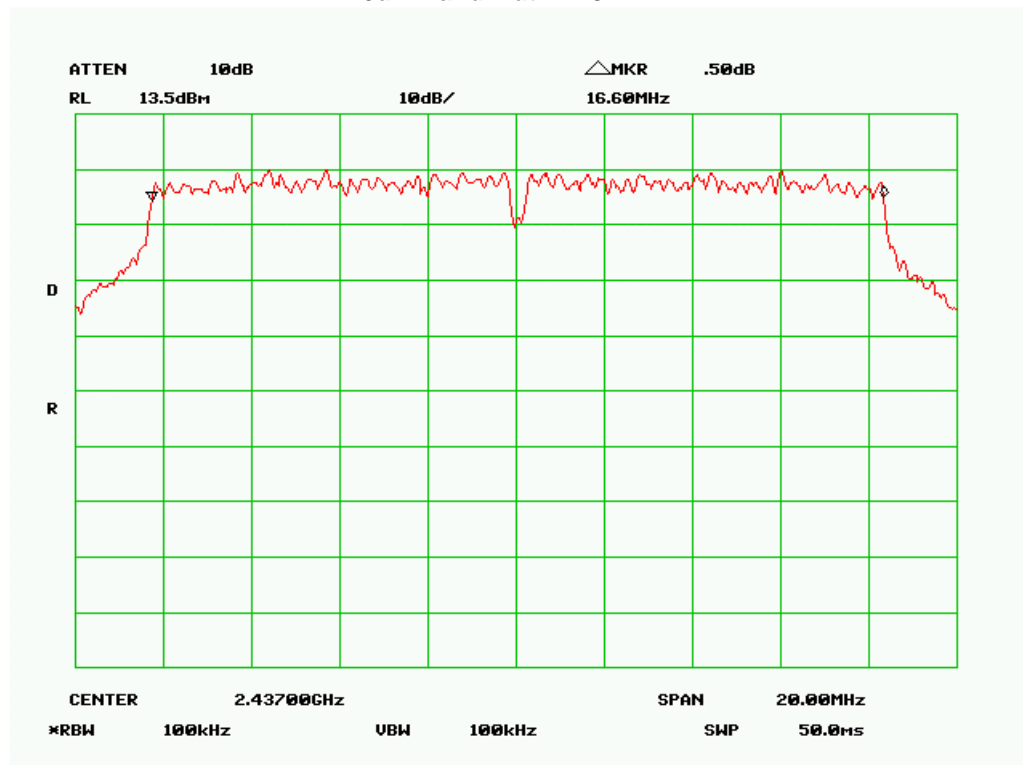


54 MBPs ODFM

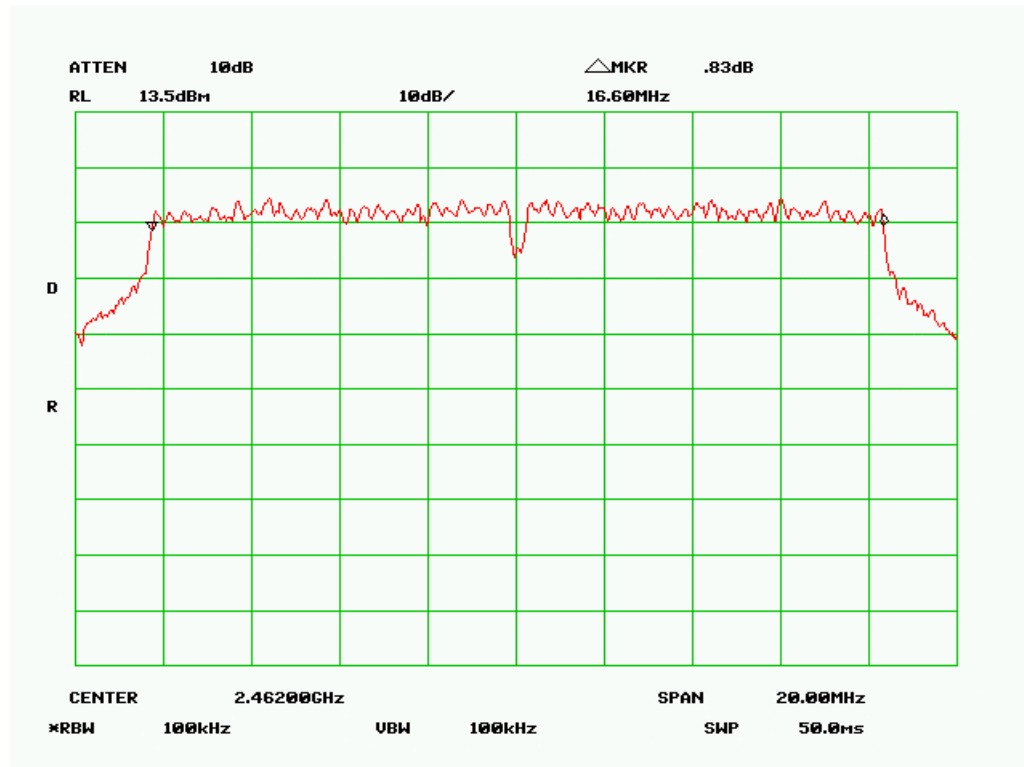
6dB Bandwidth 2412 MHz



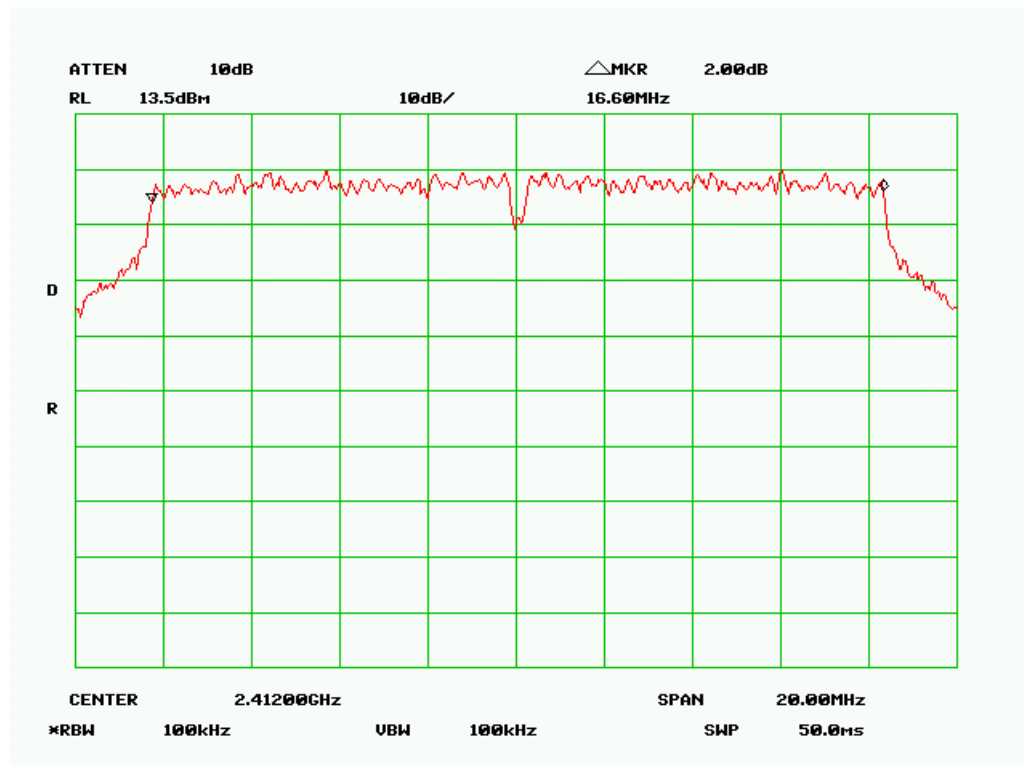
6dB Bandwidth 2437 MHz



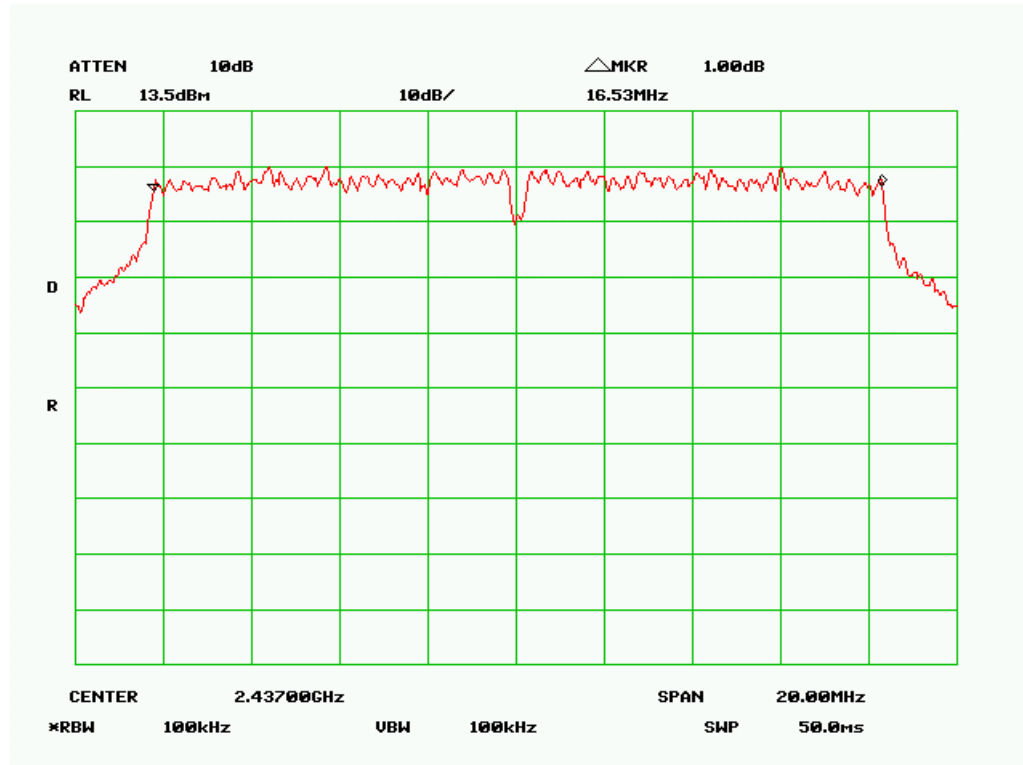
6dB Bandwidth 2462 MHz



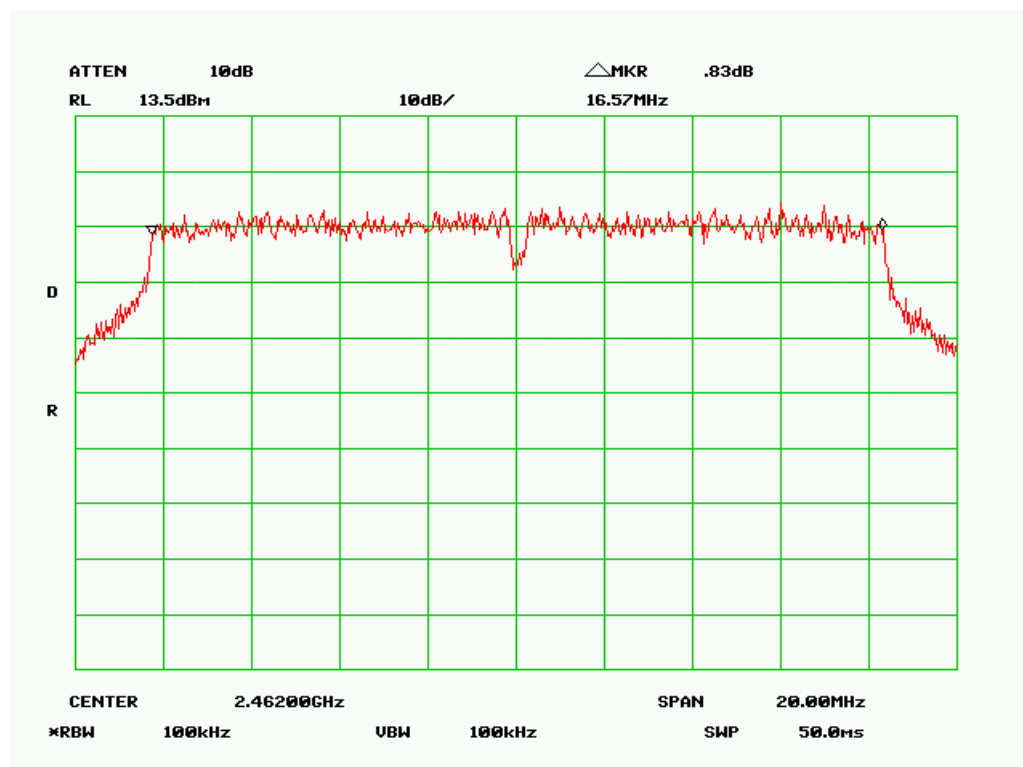
99% Bandwidth 2412 MHz



99% Bandwidth 2437 MHz



99% Bandwidth 2462 MHz

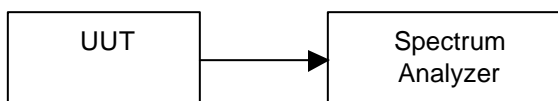


Name of Test: Transmitter Power Spectral Density (PSD)
Specification: 15.247(d)
Limit 8 dBm in any 3 kHz Bandwidth
Test Equipment Utilized i00329

Test Procedure

The UUT was connected directly to a spectrum analyzer. The Span was set to 1.5 MHz and the resolution bandwidth was set to 3 KHz. The analyzer was set for a sweep time of 500 seconds. When the entire spectrum was captured the marker peak function of the analyzer was utilized to verify the PSD met the specification.

Test Setup



PSD Summary

11 MBPs QPSK

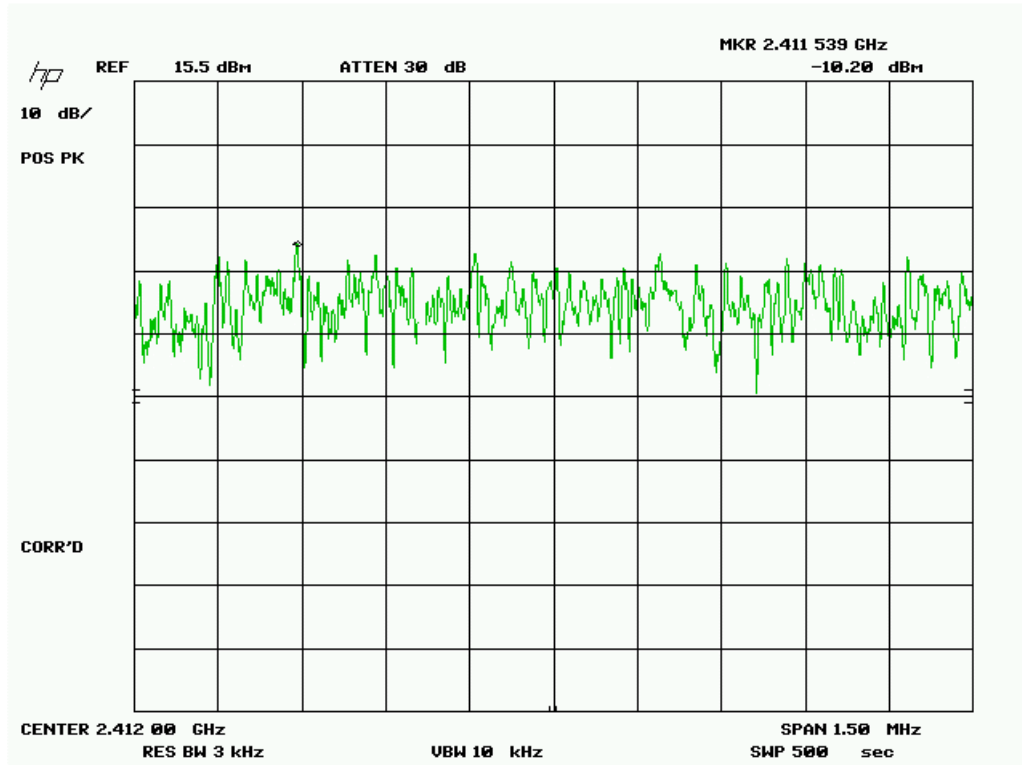
Frequency MHz	Recorded Measurement	Specification Limit	Result
2412	-10.20 dBm	8 dBm	Pass
2437	-10.10 dBm	8 dBm	Pass
2462	-10.50 dBm	8 dBm	Pass

54 MBPs OFDM

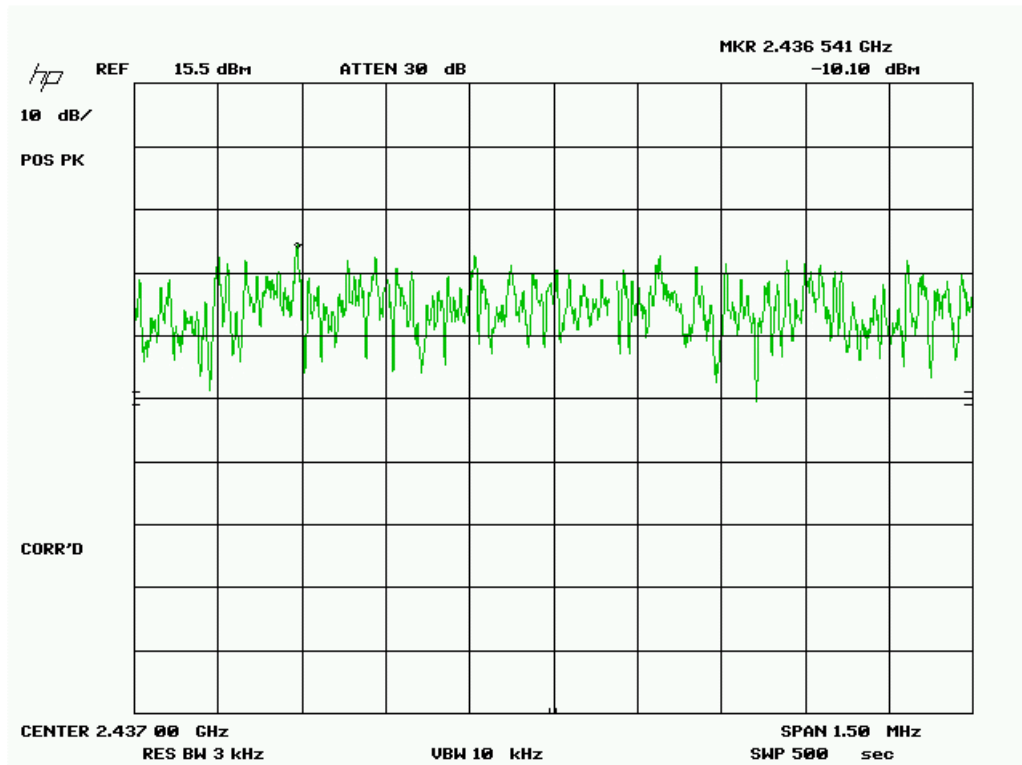
Frequency MHz	Recorded Measurement	Specification Limit	Result
2412	-10.80 dBm	8 dBm	Pass
2437	-10.90 dBm	8 dBm	Pass
2462	-11.3 dBm	8 dBm	Pass

11 MBPs QPSK

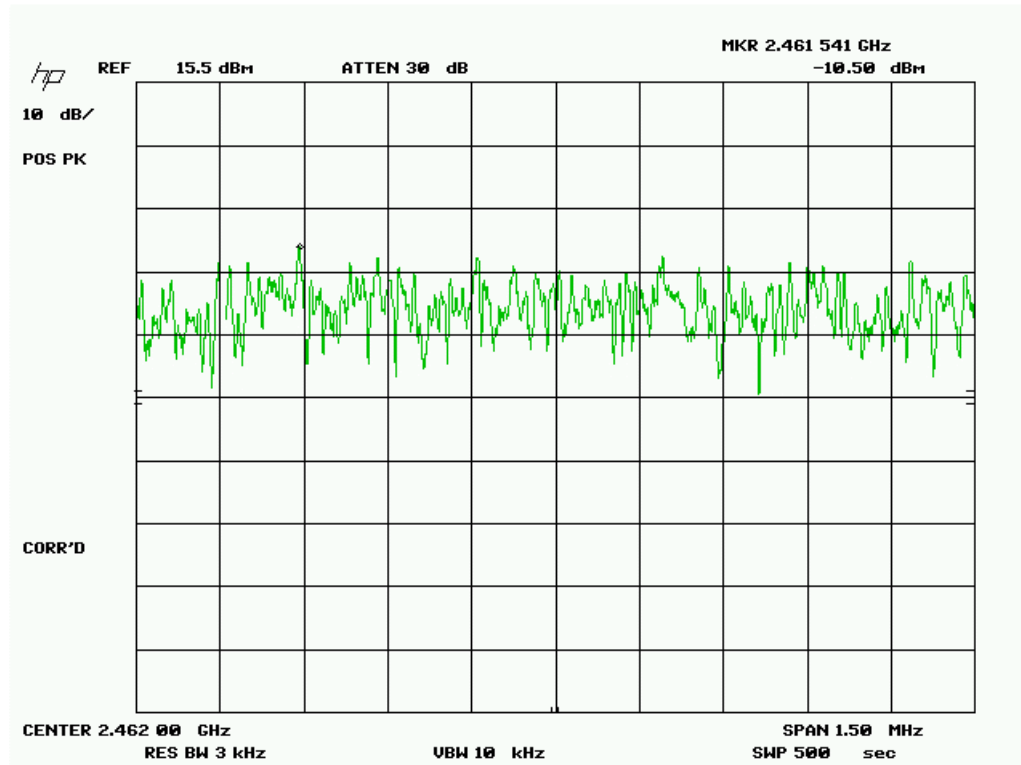
PSD 2412 MHz



PSD 2437 MHz

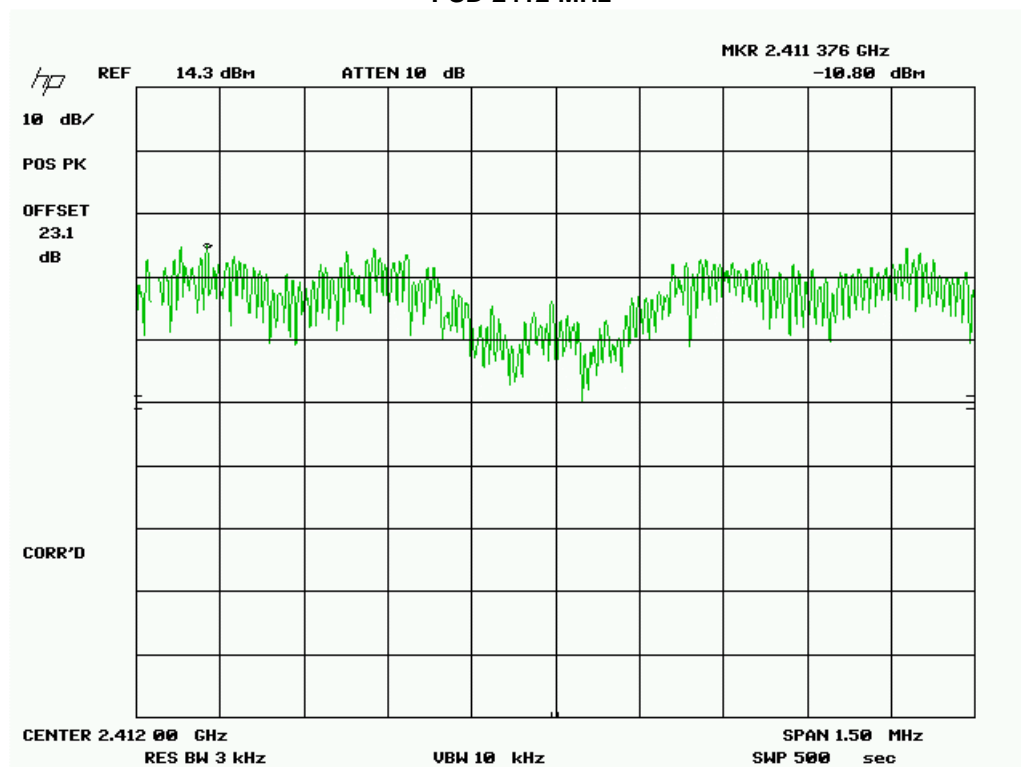


PSD 2462 MHz

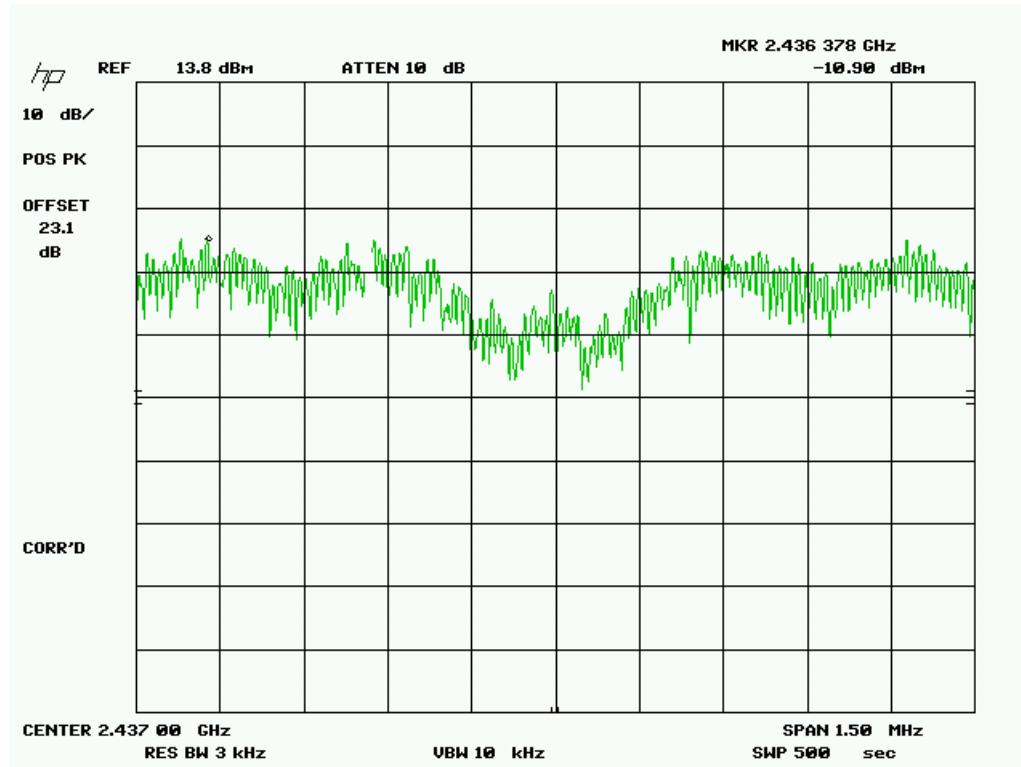


54 MBPs ODFM

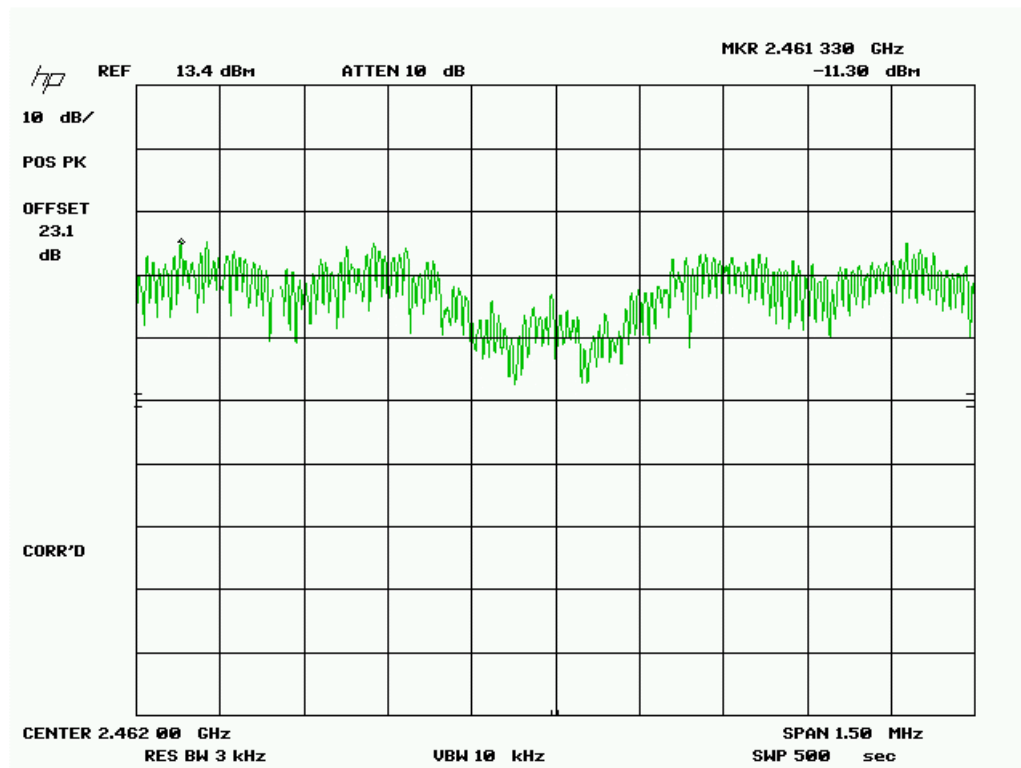
PSD 2412 MHz



PSD 2437 MHz



PSD 2462 MHz

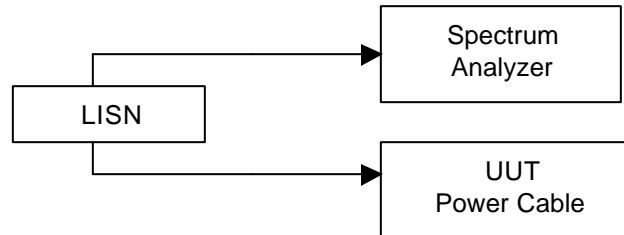


Name of Test: A/C Powerline Conducted Emissions
Specification: 15.207
Test Equipment Utilized i00033, i00270

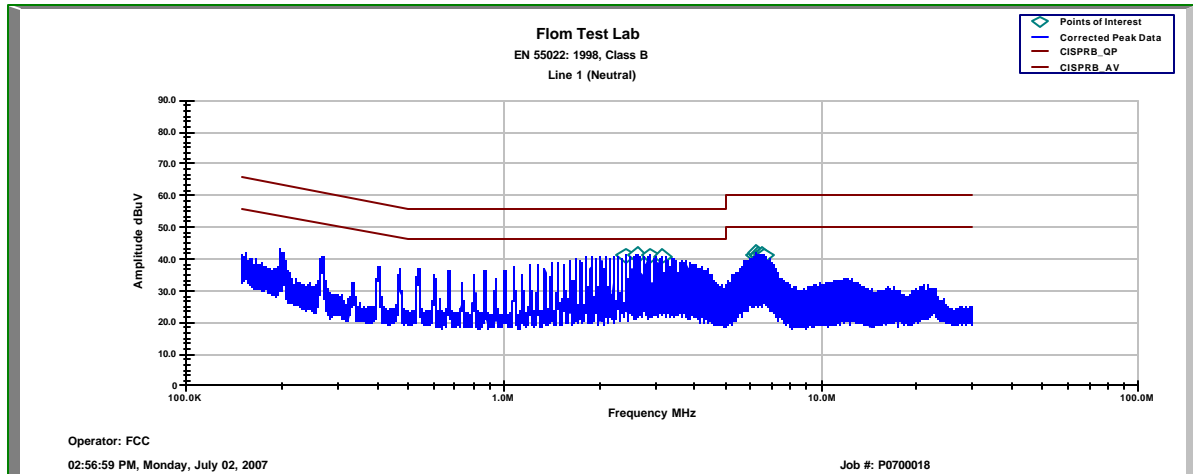
Test Procedure

The UUT power cable connected to a LISN and the monitored output of the LISN was connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were monitored and compared to the specification limits. The peak values were below the average and quasi-peak limits as shown in the plots below.

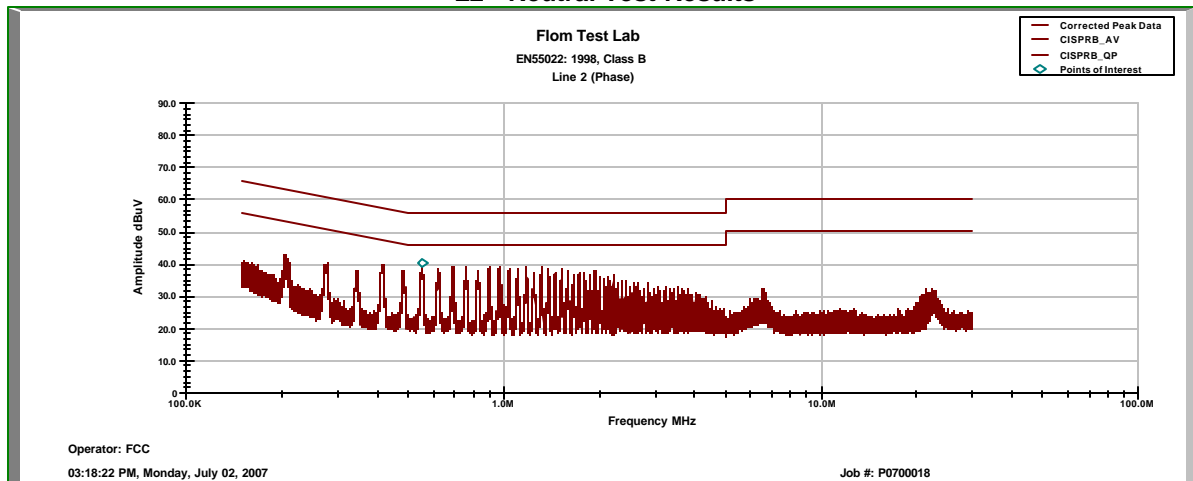
Test Setup



L1 – Phase Test Results



L2 - Neutral Test Results



Test Equipment Utilized

Description	MFG	Model Number	FTL Asset Number	Last Cal Date	Cal Due Date
RF Pre-Amplifier	HP	8449	i00028	1/23/07	1/23/09
Spectrum Analyzer	HP	8563E	i00029	3/9/07	3/9/08
Spectrum Analyzer	HP	85462A	i00033	11/03/06	11/03/07
Bi-conical Antenna	EMCO	3109B	i00088	10/14/05	10/14/07
Log Periodic Antenna	Apriel	2001	i00089	10/20/05	10/20/07
Horn Antenna	EMCO	3115	i00103	9/5/06	9/5/07
Power Sensor	HP	E4418B	i00228	8/1/06	8/1/07
LISN	FCC	FCC-LISN-50-32-2-01	i00270	10/25/05	10/25/07
Power Meter	HP	8481A	i00317	10/1/06	10/1/07
Spectrum Analyzer	HP	8566B	i00329	4/16/07	4/16/08

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT