Electromagnetic Compatibility Criteria
Test Report

for the

Motorola, Inc.
Mesh Wide Area Network AP 7181

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class B Digital Devices
&
15.247 Subpart C & RSS-210, Issue 7, June 2007
for Intentional Radiators

MET Report: EMC27727-FCC247 Rev. 3

March 30, 2010

Prepared For:

Motorola, Inc.
1064 Greenwood Blvd. Suite 400
Lake Mary, FL 32746

Prepared By:
MET Laboratories, Inc.
914 W. Patapsco Ave.
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Shawn McMillen, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules Parts 15B, 15.247 and Industry Canada standards ICES-003, Issue 4 February 2004, RSS-210, Issue 7, June 2007 under normal use and maintenance.

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	March 23, 2010	Initial Issue.
1	March 26, 2010	Rev 1 (Update Output Power, Spectral Density Sections)
2	March 29, 2010	Rev 2 (Update Power section & MPE)
3	March 30, 2010	Revised to reflect engineer corrections.

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List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**er**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**er**z**
kPa	**k**ilo**pa**scal
kV	**k**ilovolt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**micro**henry
µ	**micro**farad
µs	**micro**seconds
NEBS	**N**etwork **E**quipment-**B**uilding **S**ystem
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Motorola, Inc. Mesh Wide Area Network AP 7181, with the requirements of Part 15, §15.247. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the Mesh Wide Area Network AP 7181. Motorola, Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Mesh Wide Area Network AP 7181, has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.247, in accordance with Motorola, Inc., purchase order number NP4876656. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference 47 CFR Part 15.247:2005	IC Reference RSS-210 Issue 7: 2007	Description	Compliance
47 CFR Part 15.107 (a)	ICES-003 Issue 4 February 2004	Conducted Emission Limits for a Class B Digital Device	Compliant
47 CFR Part 15.109 (a)	ICES-003 Issue 4 February 2004	Radiated Emission Limits for a Class B Digital Device	Compliant
Title 47 of the CFR, Part 15 §15.203	N/A	Antenna Requirement	Compliant
Title 47 of the CFR, Part 15 §15.207(a)	RSS-210(7.2.2)	Conducted Emission Voltage	Compliant
Title 47 of the CFR, Part 15 §15.247(a)(1)	RSS-210(A8.1)	Occupied Bandwidth	Compliant
Title 47 of the CFR, Part 15 §15.247(b)	RSS-210(A8.4)	RF Output Power	Compliant
Title 47 of the CFR, Part 15 §15.209, §15.247(d)	RSS-210(A8.5)	Radiated Spurious Emissions	Compliant
Title 47 of the CFR, Part 15 §15.205	RSS-210(A8.5)	Emissions at Restricted Band	Compliant
Title 47 of the CFR, Part 15 §15.209, §15.247(d)	RSS-210(A8.5)	Conducted Spurious Emissions	Not Applicable
Title 47 of the CFR, Part 15; §15.247(e)	RSS-210(A8.3)	Power Spectral Density	Compliant
Title 47 of the CFR, Part 15 §15.247(i)	RSS-Gen(5.5)	Maximum Permissible Exposure	Compliant
N/A	RSS-Gen(4.8)	Receiver Spurious Emissions	Compliant

Table 1. Executive Summary of EMC Part 15.247 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Motorola, Inc. to perform testing on the Mesh Wide Area Network AP 7181, under Motorola, Inc.'s purchase order number NP4876656.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Motorola, Inc., Mesh Wide Area Network AP 7181.

The results obtained relate only to the item(s) tested.

Model Name:	Mesh Wide Area Network AP 7181 AP-7181			
Serial Number:	683ILC0076, 683ILC0073			
EUT Specifications:	Primary Power: 120 VAC, 60 Hz			
	FCC ID: QJEMM718101 IC: 4602A-MM718101			
	Type of Modulations:	OFDM		
	Equipment Code:	DTS		
	Peak RF Output Power (EIRP):	2.4 GHz	b Mode:	35.73 dBm
			g Mode	35.77 dBm
			n Mode HT20:	35.60 dBm
			n Mode HT40:	35.66 dBm
		5 GHz	a Mode:	35.06 dBm
			n Mode HT20:	35.06 dBm
			n Mode HT40:	34.85 dBm
	EUT Frequency Ranges:	2412 – 2462 MHz and 5745 – 5825 MHz		
Analysis:	The results obtained relate only to the item(s) tested.			
Environmental Test Conditions:	Temperature: 15-35° C			
	Relative Humidity: 30-60%			
	Barometric Pressure: 860-1060 mbar			
Evaluated by:	Shawn McMillen			
Report Date(s):	March 30, 2010			

Table 2. EUT Summary Table

B. References

CFR 47, Part 15, Subpart C	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
RSS-210, Issue 7, June 2007	Low-power Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
ICES-003, Issue 4 February 2004	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
ANSI C63.4:2003	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI/NCSL Z540-1-1994	Calibration Laboratories and Measuring and Test Equipment - General Requirements
ANSI/ISO/IEC 17025:2000	General Requirements for the Competence of Testing and Calibration Laboratories

Table 3. References

C. Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave., Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Description of Test Sample

The Motorola, Inc. Mesh Wide Area Network AP 7181, Equipment Under Test (EUT), is a Dual-radio (802.11a/n and 802.11b/g/n) meshing outdoor wireless access point. Internally the EUT is a 3x3 MIMO. The 3 ports are then divided into 8 ports to feed the four antennas. Each antenna contains two cross polarized linear elements. The final end stages produces a 2x2 MIMO on each antenna element.

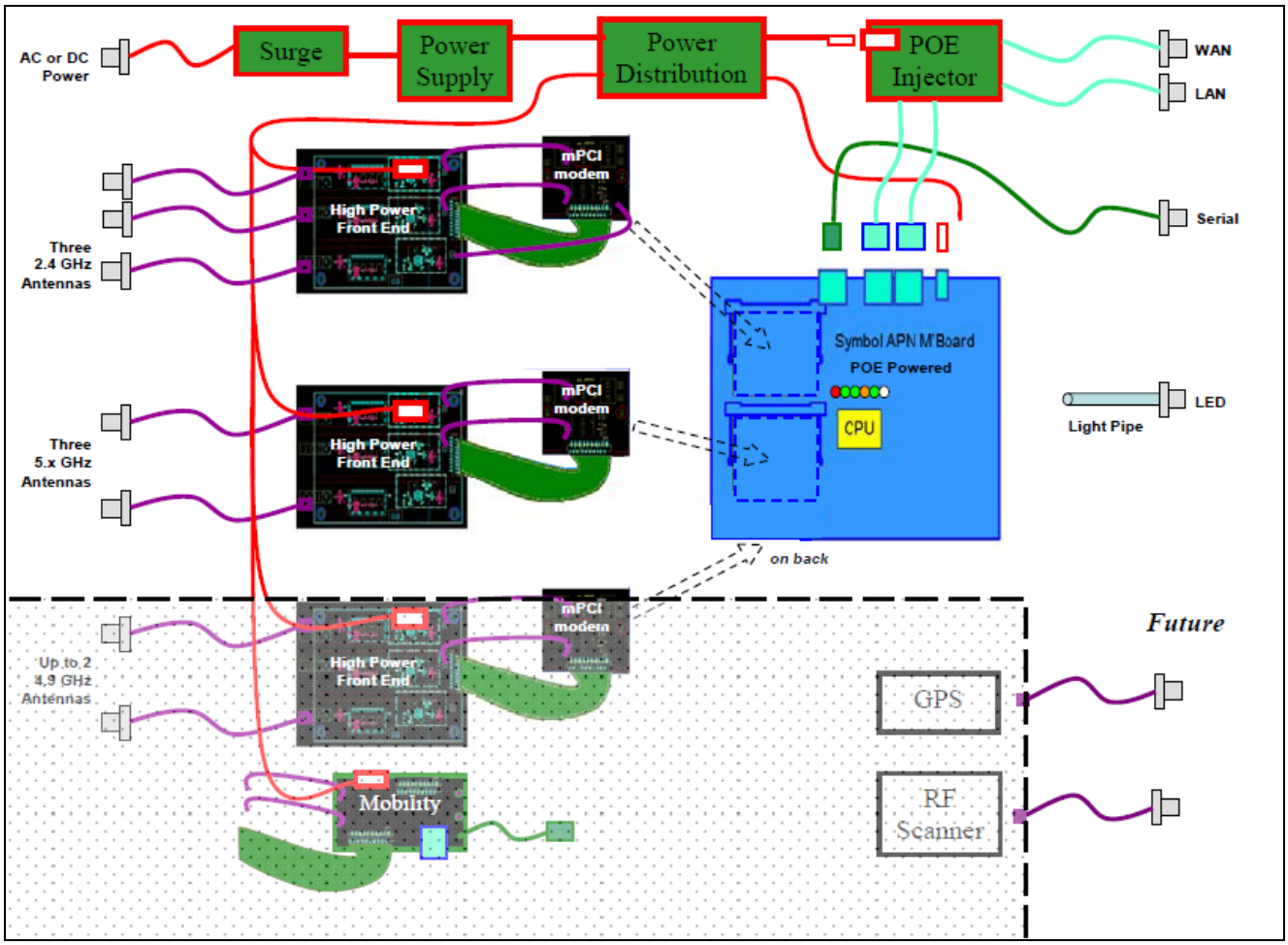


Figure 1. Block Diagram of Test Configuration

E. Equipment Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. All cards, racks, etc., incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number
1	AP 7181	AP-7181
2	Power Cable	N/A

Table 4. Equipment Configuration

F. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number
1	Laptop with ART software	Dell	D600

Table 5. Support Equipment

G. Ports and Cabling Information

Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
GE1 (LAN)	Cat5	1	N/A	Y	N/A
GE2 (WAN)	Cat5	1	N/A	Y	N/A
Console (Serial)	RJ-45	1	N/A	N	N/A
Power	16 AWG Power Cable	1	6	N/A	N/A

Table 6. Ports and Cabling Information

H. Mode of Operation

Test software (ART – Atheros Radio Test) was running on a laptop and EUT which communicated over Ethernet. The software was used to control the channel frequency, power and data rates.

I. Modifications

a) Modifications to EUT

For compliance to 15.247 Radiated Spurious, six PIN diode components in each antenna panel were replaced with higher linearity models. Skyworks Part # SMP1352.

b) Modifications to Test Standard

No modifications were made to the test standard.

J. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Motorola, Inc. upon completion of testing.

III. Electromagnetic Compatibility Criteria for Unintentional Radiators

Electromagnetic Compatibility Criteria

§ 15.107 Conducted Emissions Limits

Test Requirement(s):

15.107 (a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

15.107 (b) For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

15.207(a), Except as shown in paragraphs (b) and (c) of this section*, charging, AC adapters or battery eliminators the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the Table 7, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency range (MHz)	Class A Conducted Limits (dBµV)		*Class B Conducted Limits (dBµV)	
	Quasi-Peak	Average	Quasi-Peak	Average
* 0.15- 0.45	79	66	66 - 56	56 - 46
0.45 - 0.5	79	66	56	46
0.5 - 30	73	60	60	50

Note 1 — The lower limit shall apply at the transition frequencies.
Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz.
* -- Limits per Subsection 15.207(a).

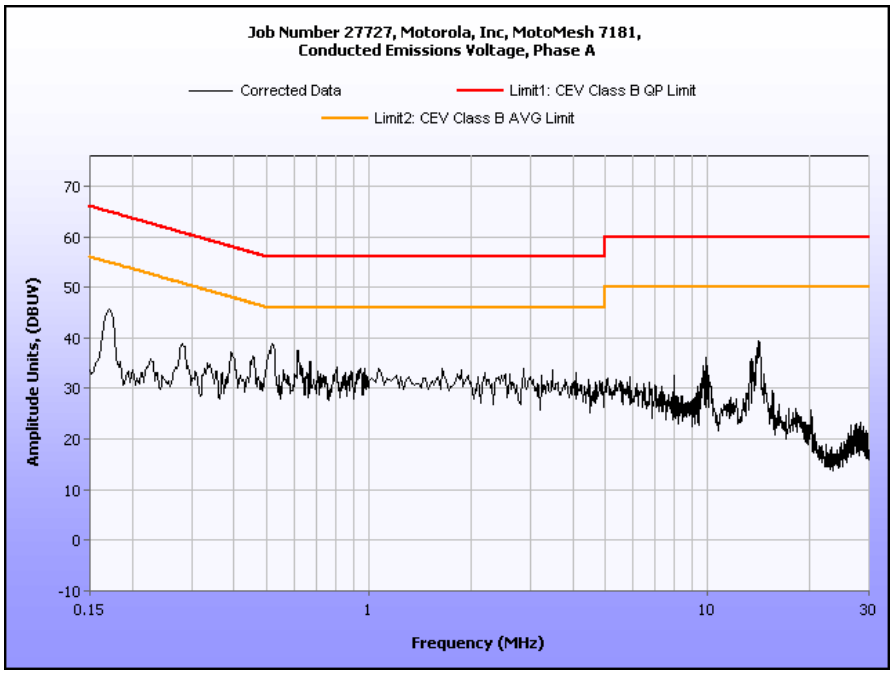
Table 7. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsections 15.107(a) (b) and 15.207(a)

Test Results: The EUT was compliant with the Class B requirement(s) of this section. Measured emissions were below applicable limits.

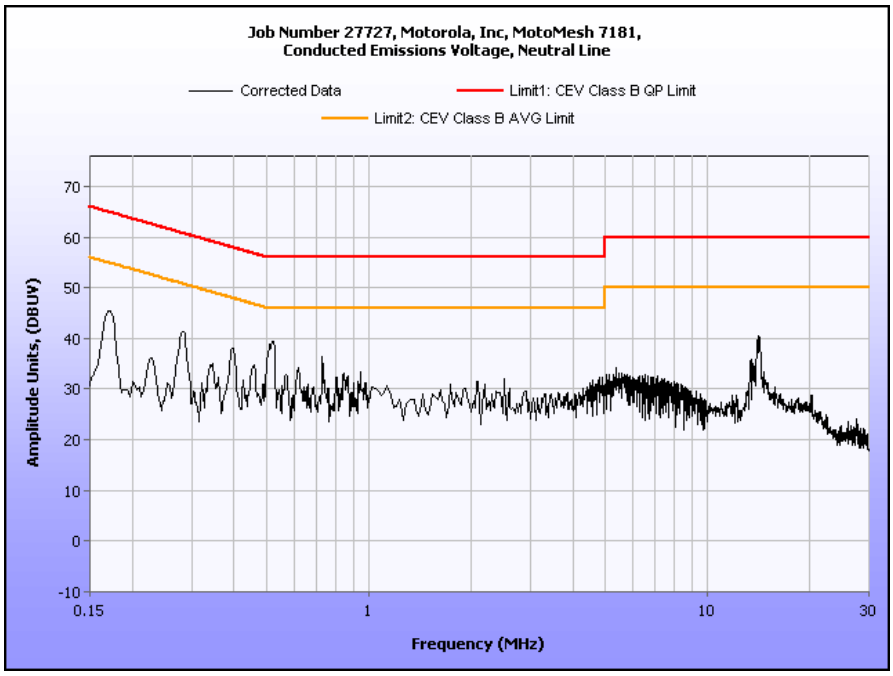
Test Engineer(s): Len Knight

Test Date(s): 03/01/10

Conducted Emissions - Voltage, AC Power (120 VAC, 60 Hz)



Plot 1. Conducted Emission, Phase Line Plot



Plot 2. Conducted Emission, Neutral Line Plot

Conducted Emission Limits Test Setup

Photograph 2. Conducted Emissions, Test Setup

Radiated Emission Limits

§ 15.109 Radiated Emissions Limits

Test Requirement(s): **15.109 (a)** Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the Class B limits expressed in Table 8.

15.109 (b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the Class A limits expressed in Table 8.

Frequency (MHz)	Field Strength (dBµV/m)	
	§15.109 (b), Class A Limit (dBµV) @ 10m	§15.109 (a),Class B Limit (dBµV) @ 3m
30 - 88	39.00	40.00
88 - 216	43.50	43.50
216 - 960	46.40	46.00
Above 960	49.50	54.00

Table 8. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)

Test Procedures: The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 3 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

Test Results: The EUT was compliant with the Class B requirement(s) of this section. Measured emissions were below applicable limits.

Test Engineer(s): Len Knight

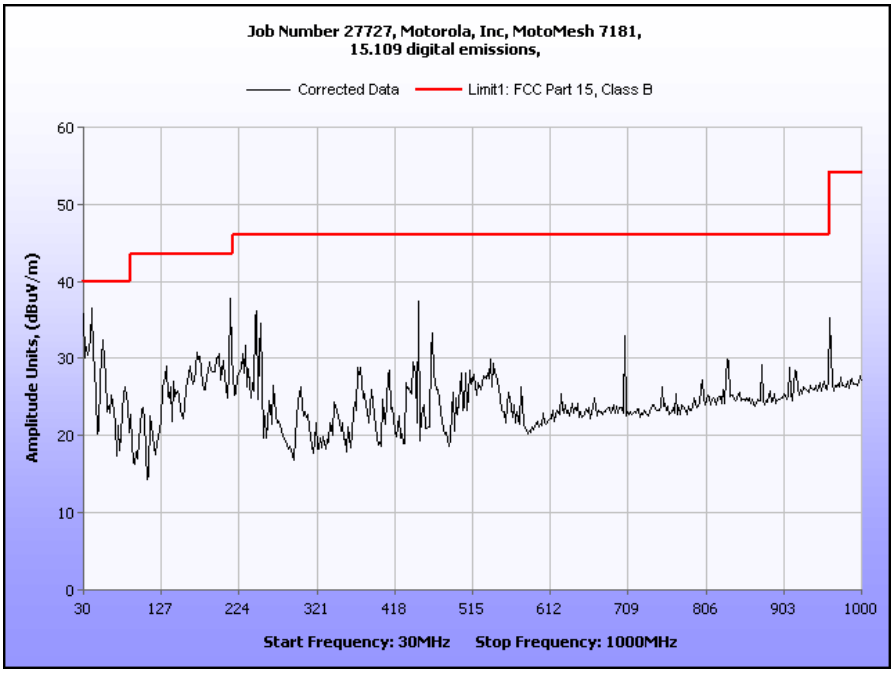
Test Date(s): 03/09/10

Radiated Emissions Limits Test Results, Class B

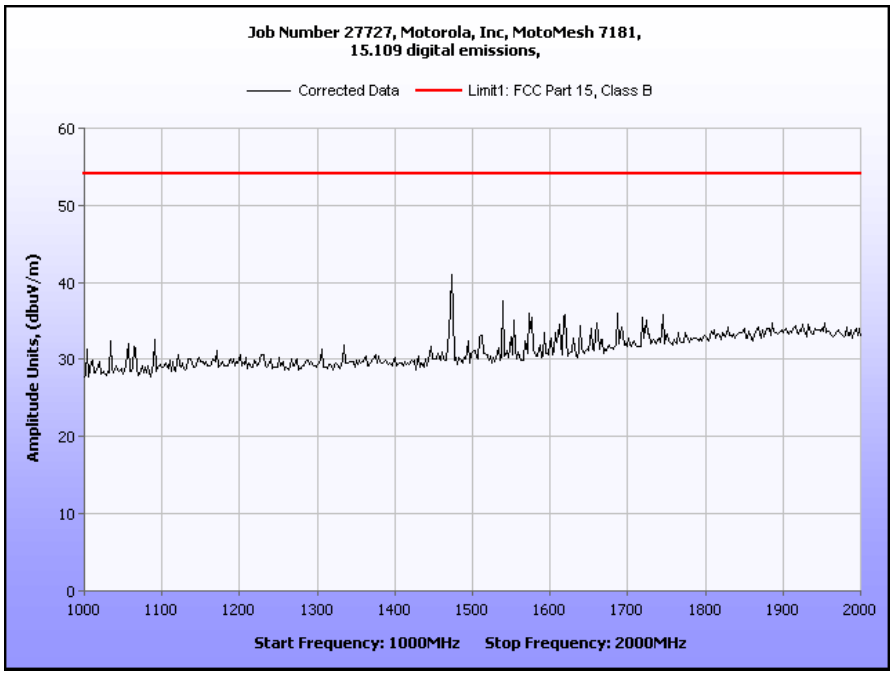
Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.080	0	H	2.46	10.84	4.74	0.23	0.00	15.81	40.00	-24.19
30.080	359	V	1.01	27.66	3.75	0.23	0.00	31.64	40.00	-8.36
35.130	46	H	1.98	5.18	7.24	0.23	0.00	12.65	40.00	-27.35
35.130	358	V	1.00	15.54	6.73	0.23	0.00	22.50	40.00	-17.50
82.725	266	H	2.59	10.37	6.91	0.23	0.00	17.51	40.00	-22.49
82.725	274	V	1.00	15.66	7.23	0.23	0.00	23.12	40.00	-16.88
200.655	106	H	1.40	12.16	10.21	0.23	0.00	22.60	43.50	-20.90
200.655	330	V	1.00	22.62	10.15	0.23	0.00	33.00	43.50	-10.50
225.626	81	H	1.35	11.36	10.61	0.24	0.00	22.21	46.00	-23.79
225.626	23	V	1.25	16.48	10.99	0.24	0.00	27.70	46.00	-18.30
447.985	103	H	1.17	21.58	16.36	1.00	0.00	38.94	46.00	-7.06
447.985	117	V	1.00	22.72	16.72	1.00	0.00	40.44	46.00	-5.56

Table 9. Radiated Emissions Limits, Test Results, 30 MHz – 1 GHz, FCC Limits

Note: The EUT was tested at 3 m.



Plot 3. Radiated Emissions, 30 MHz - 1 GHz, FCC Limits



Plot 4. Radiated Emissions, 1 GHz – 2 GHz, FCC Limits

Radiated Emissions Limits Test Results, Class B

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.080	0	H	2.46	10.84	4.74	0.23	10.46	5.35	30.00	-24.65
30.080	359	V	1.01	27.66	3.75	0.23	10.46	21.18	30.00	-8.82
35.130	46	H	1.98	5.18	7.24	0.23	10.46	2.19	30.00	-27.81
35.130	358	V	1.00	15.54	6.73	0.23	10.46	12.04	30.00	-17.96
82.725	266	H	2.59	10.37	6.91	0.23	10.46	7.05	30.00	-22.95
82.725	274	V	1.00	15.66	7.23	0.23	10.46	12.66	30.00	-17.34
200.655	106	H	1.40	12.16	10.21	0.23	10.46	12.14	30.00	-17.86
200.655	330	V	1.00	22.62	10.15	0.23	10.46	22.54	30.00	-7.46
225.626	81	H	1.35	11.36	10.61	0.24	10.46	11.75	30.00	-18.25
225.626	23	V	1.25	16.48	10.99	0.24	10.46	17.24	30.00	-12.76
447.985	103	H	1.17	21.58	16.36	1.00	10.46	28.48	37.00	-8.52
447.985	117	V	1.00	22.72	16.72	1.00	10.46	29.98	37.00	-7.02

Table 10. Radiated Emissions Limits, Test Results, ICES-003 Limits

Note: The EUT was tested at 3 m.

Radiated Emission Limits Test Setup

IV. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

Test Requirement: **§ 15.203:** An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

a.) Antenna must be permanently attached to the unit.

b.) Antenna must use a unique type of connector to attach to the EUT.

c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Results: The antenna is integral and therefore is compliant the criteria of §15.203.

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 03/15/10

The antenna panels are dual-band (2.4/5.8GHz) antennas with each radiating element made of four dual-feed planar patches which when combined form a 12dBi radiator in both the horizontal and vertical polarities.

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.207 Conducted Emissions Limits

Test Requirement(s): **§ 15.207 (a):** For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	§ 15.207(a), Conducted Limit (dBμV)	
	Quasi-Peak	Average
* 0.15- 0.45	66 - 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 11. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Test Procedure: The EUT was placed on a 0.8 m-high wooden table inside a screen room. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-2003 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω/50 μH LISN as the input transducer to an EMC/field intensity meter. For the purpose of this testing, the transmitter was turned on. Scans were preformed with the transmitter on.

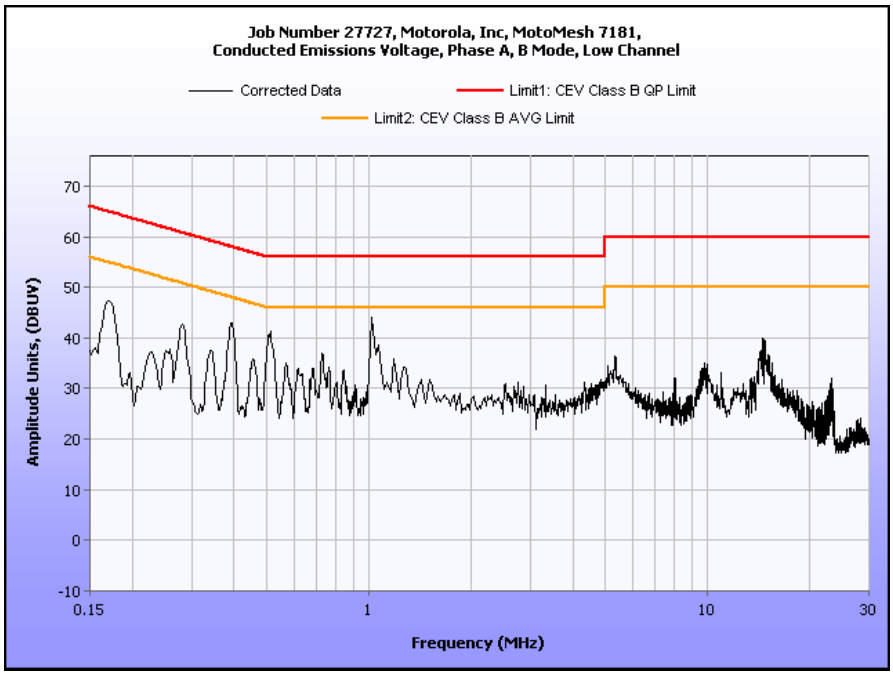
For the purpose of the testing, the radio was running and set to various different frequencies and data rates.

Test Results: The EUT was compliant with this requirement.

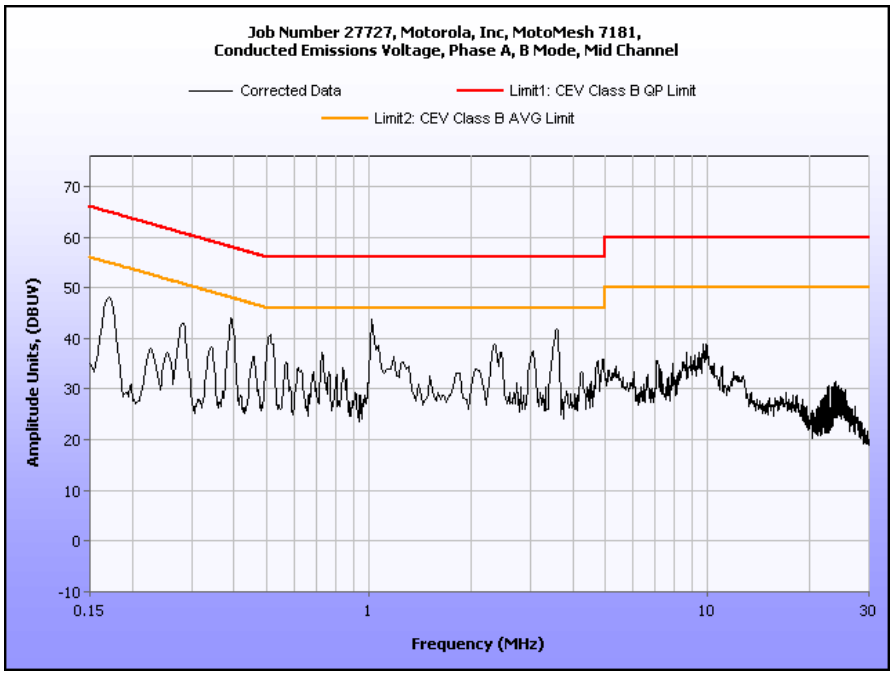
Test Engineer(s): Len Knight

Test Date(s): 03/03/10

15.207 Conducted Emissions Test Results

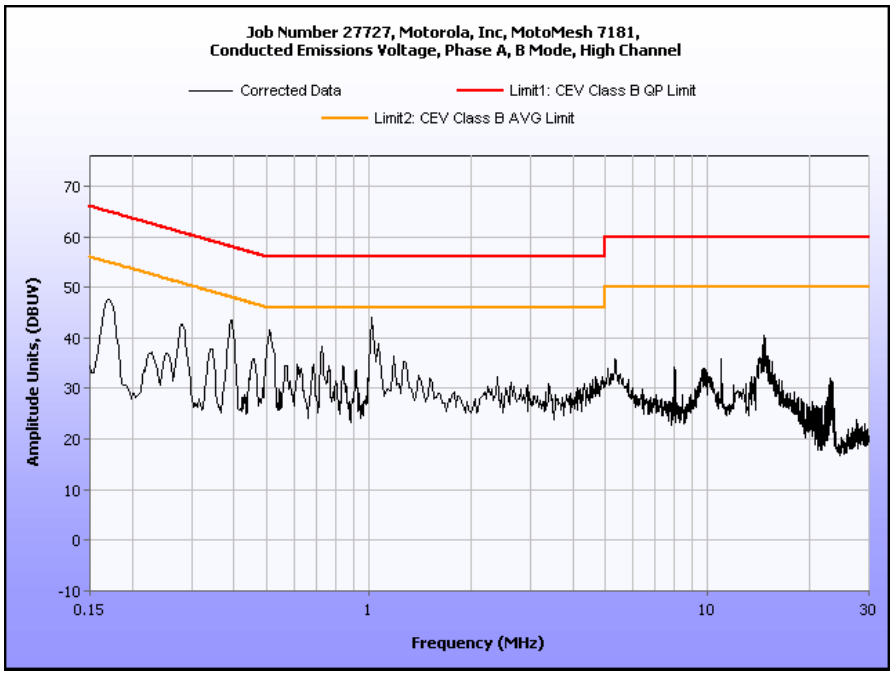


Plot 5. Conducted Emissions, Phase Line, b Mode, Low Channel

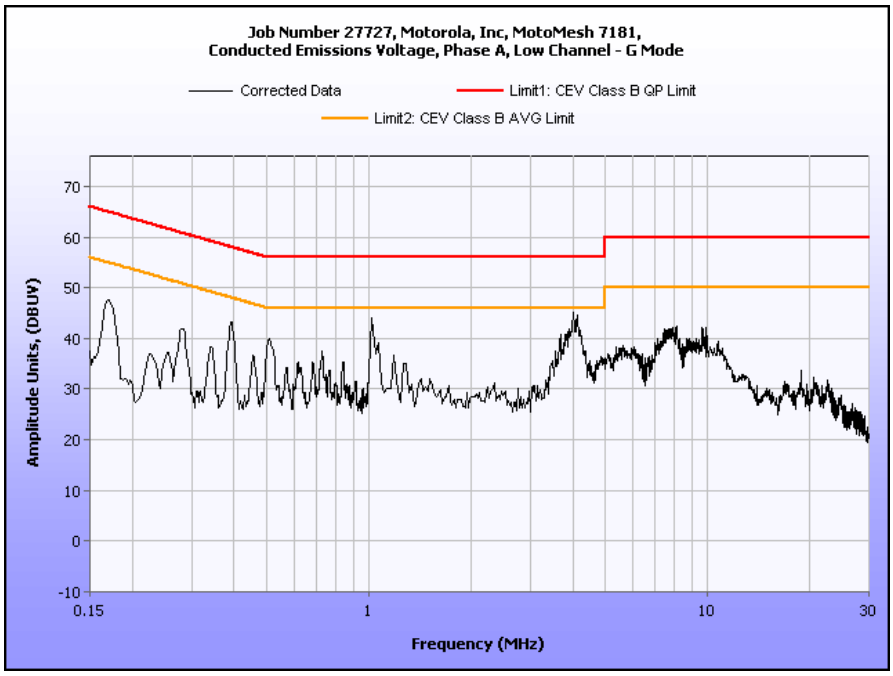


Plot 6. Conducted Emissions, Phase Line, b Mode, Mid Channel

15.207 Conducted Emissions Test Results

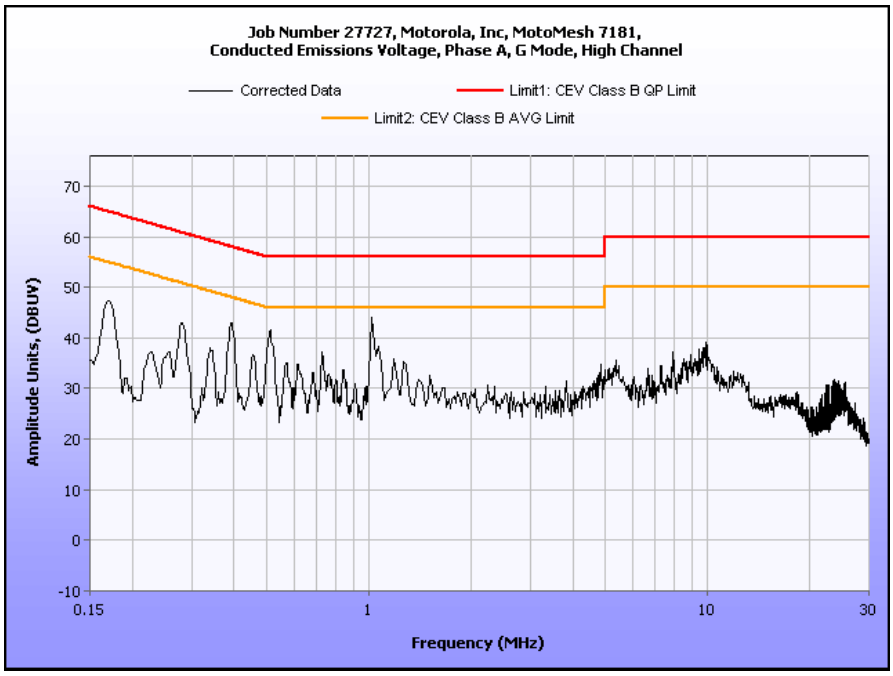


Plot 7. Conducted Emissions, Phase Line, b Mode, High Channel

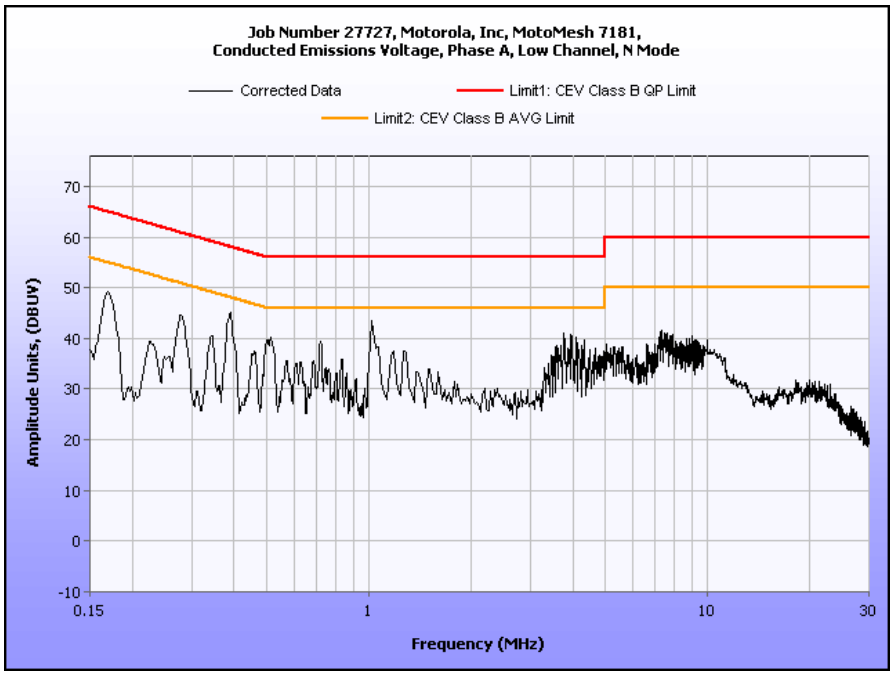


Plot 8. Conducted Emissions, Phase Line, g Mode, Low Channel

15.207 Conducted Emissions Test Results

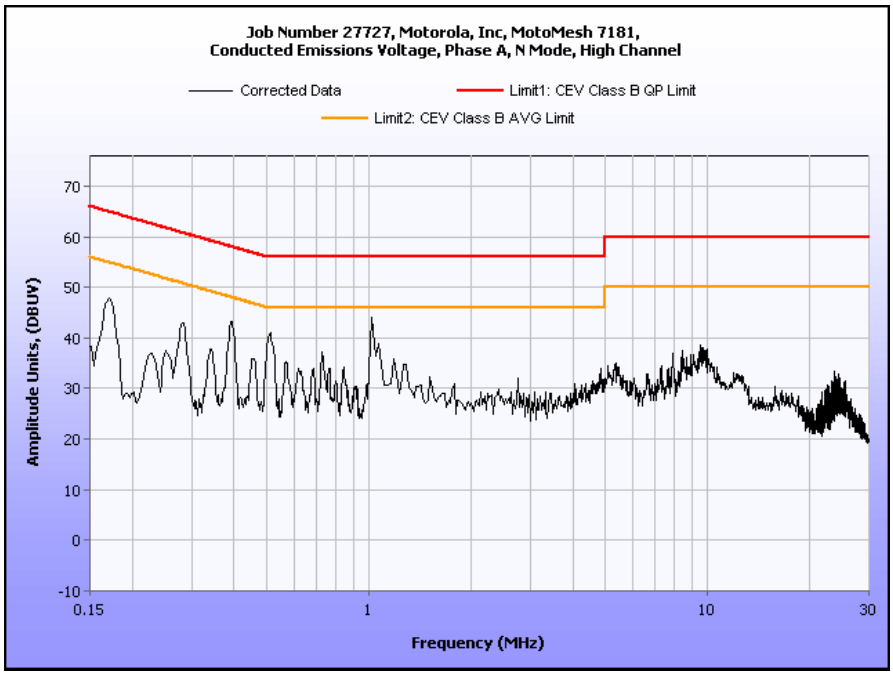


Plot 9. Conducted Emissions, Phase Line, g Mode, High Channel

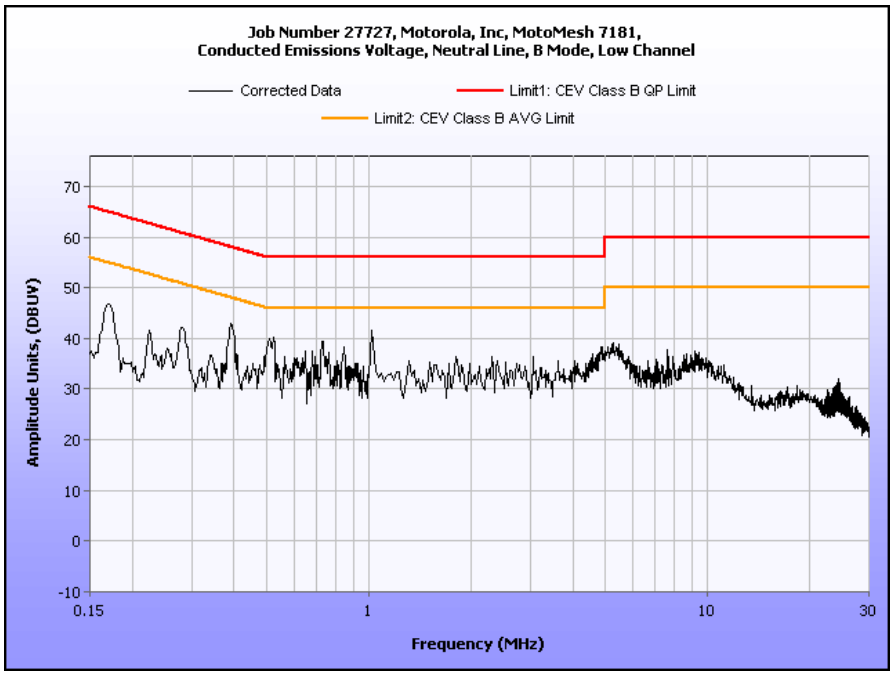


Plot 10. Conducted Emissions, Phase Line, n Mode, Low Channel

15.207 Conducted Emissions Test Results

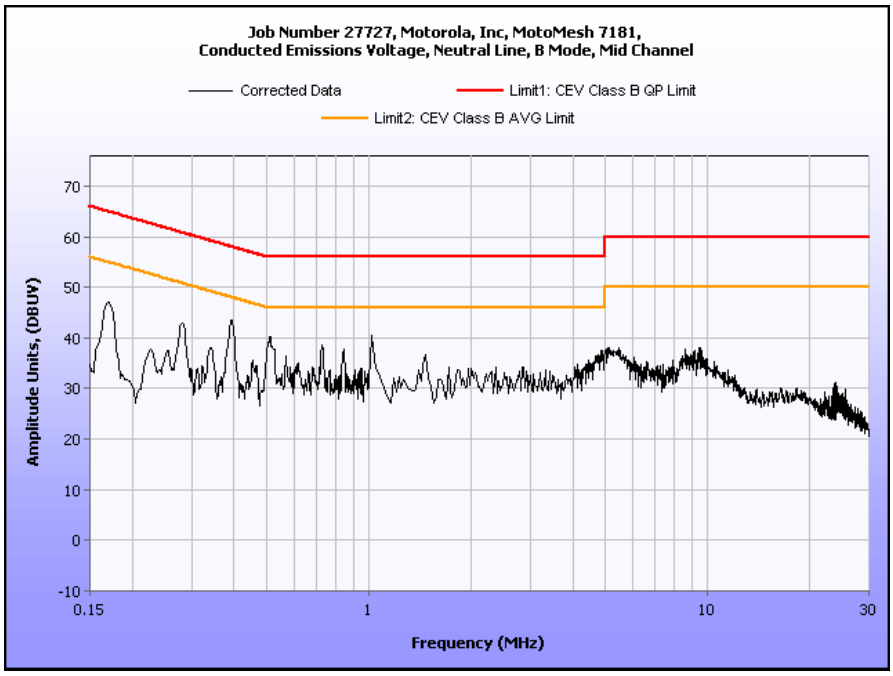


Plot 11. Conducted Emissions, Phase Line, n Mode, High Channel

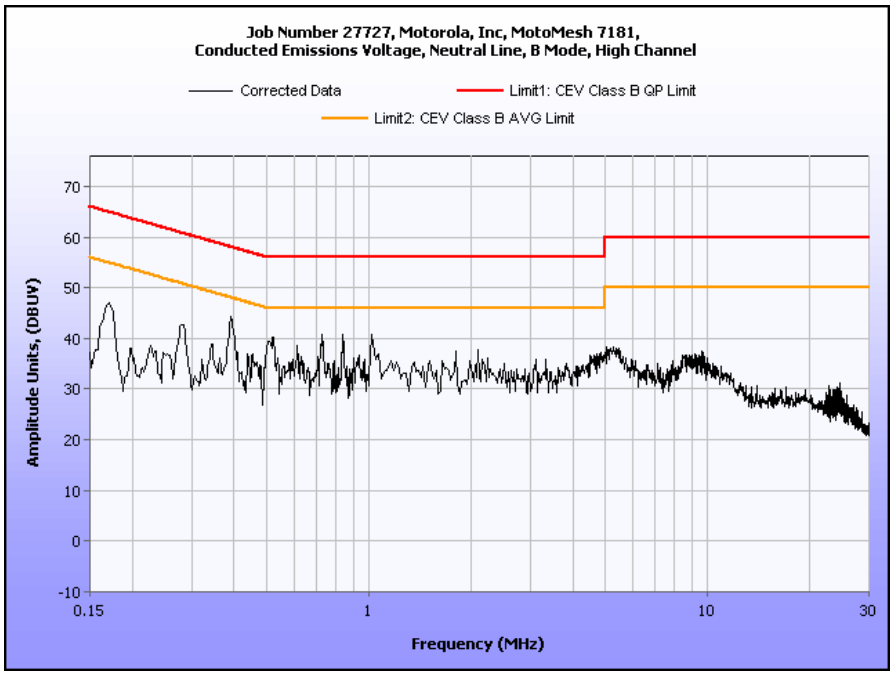


Plot 12. Conducted Emissions, Neutral Line, b Mode, Low Channel

15.207 Conducted Emissions Test Results

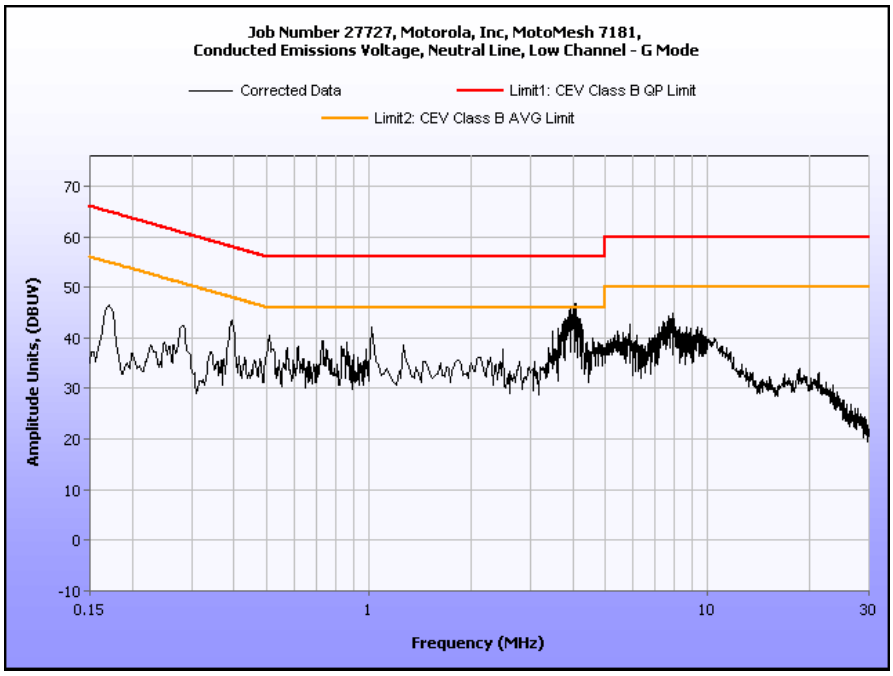


Plot 13. Conducted Emissions, Neutral Line, b Mode, Mid Channel

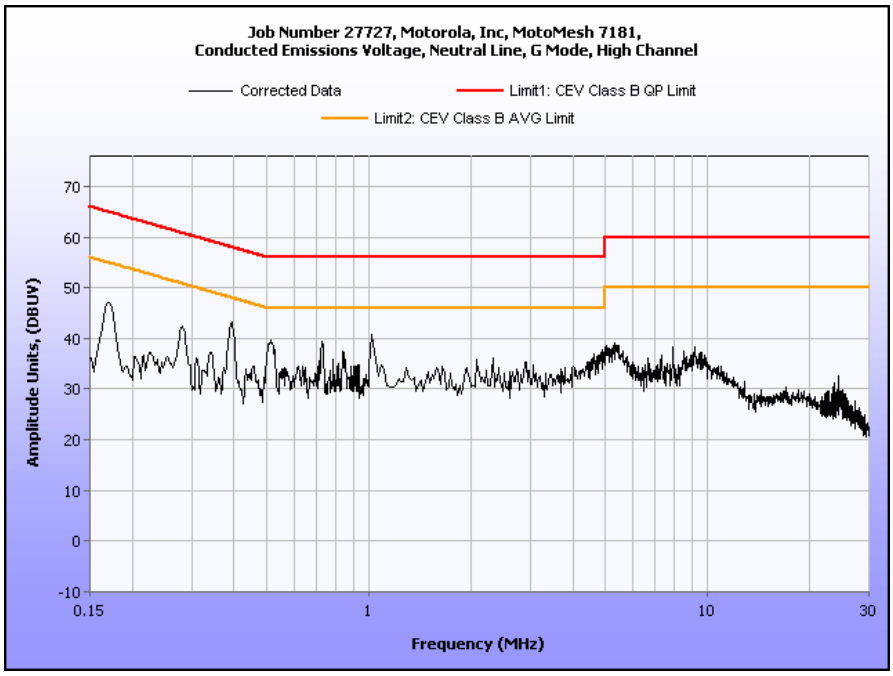


Plot 14. Conducted Emissions, Neutral Line, b Mode, High Channel

15.207 Conducted Emissions Test Results

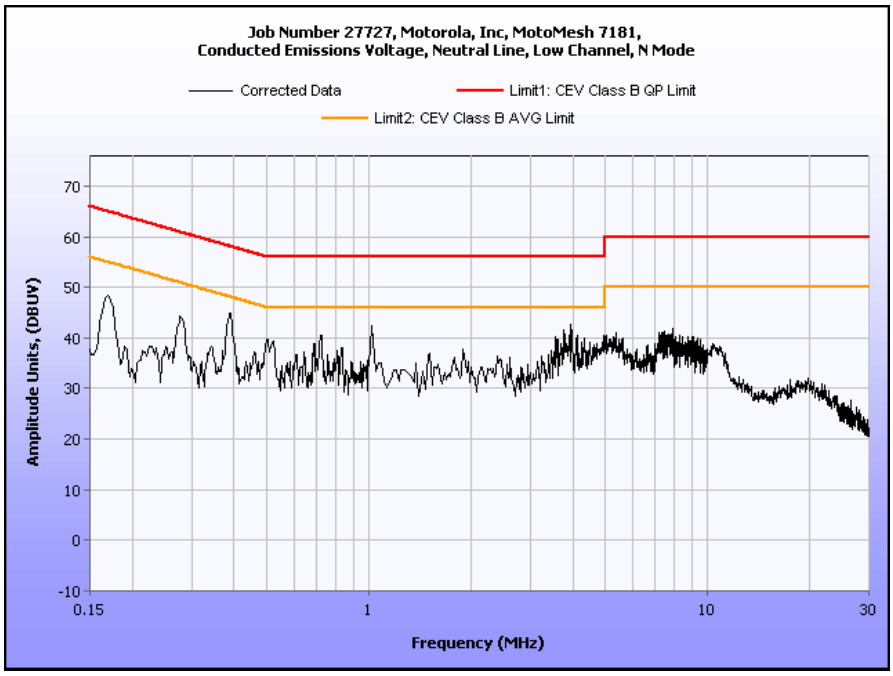


Plot 15. Conducted Emissions, Neutral Line, g Mode, Low Channel

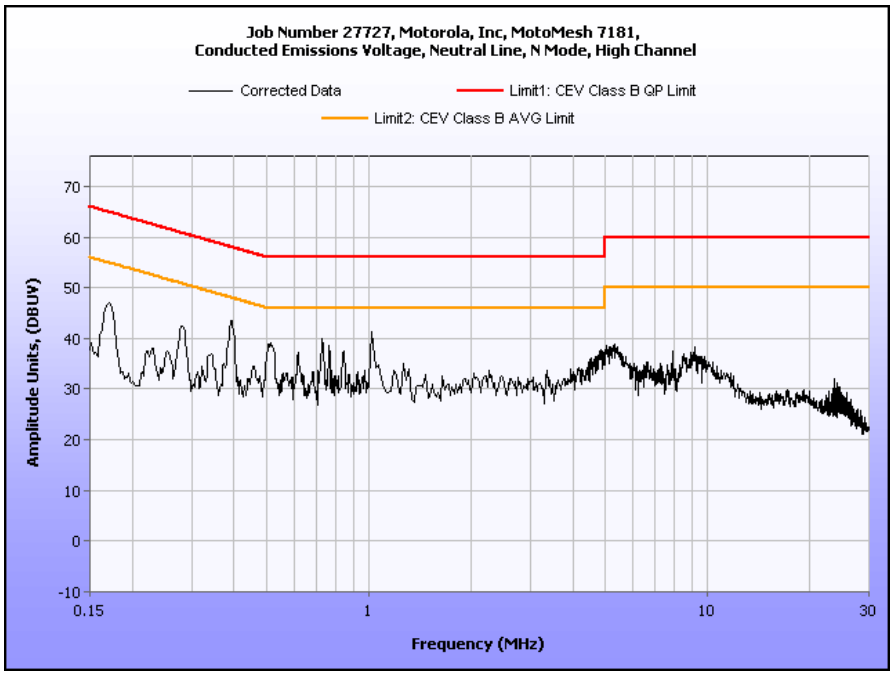


Plot 16. Conducted Emissions, Neutral Line, g Mode, High Channel

15.207 Conducted Emissions Test Results



Plot 17. Conducted Emissions, Neutral Line, n Mode, Low Channel



Plot 18. Conducted Emissions, Neutral Line, n Mode, High Channel

15.207 Conducted Emissions Test Setup Photo

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a) 6 dB and 99% Bandwidth

Test Requirements: **§ 15.247(a):** Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

For systems using digital modulation techniques, the EUT may operate in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Procedure: The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately 1% of the total emission bandwidth, VBW > RBW. The 6 dB Bandwidth was measured and recorded. The measurements were performed on the low, mid and high channels of both the 2.4 GHz and 5 GHz side. All measurements were taken radiated.

Test Results The EUT was compliant with § 15.247 (a).

The 6 dB and 99% Bandwidth was determined from the plots on the following pages.

Test Engineer(s): Len Knight

Test Date(s): 03/15/10

Occupied Bandwidth Test Results

Occupied Bandwidth			
Carrier Channel	**Frequency (MHz)**	**Measured 6 dB Bandwidth (MHz)**	**Measured 99% Bandwidth (MHz)**
Low	2412	9.576	15.5163
Mid	2437	8.557	15.8164
High	2462	8.640	14.9516

Table 12. Occupied Bandwidth, 802.11b Mode, Test Results, 2.4 GHz

Occupied Bandwidth			
Carrier Channel	**Frequency (MHz)**	**Measured 6 dB Bandwidth (MHz)**	**Measured 99% Bandwidth (MHz)**
Low	2412	16.420	16.7527
Mid	2437	16.352	16.9558
High	2462	15.738	16.4941

Table 13. Occupied Bandwidth, 802.11g Mode, Test Results, 2.4 GHz

Occupied Bandwidth			
Carrier Channel	**Frequency (MHz)**	**Measured 6 dB Bandwidth (MHz)**	**Measured 99% Bandwidth (MHz)**
Low	2412	17.504	17.8904
Mid	2437	17.783	18.2520
High	2462	15.179	17.7385

Table 14. Occupied Bandwidth, 802.11n Mode HT20, Test Results, 2.4 GHz

Occupied Bandwidth			
Carrier Channel	**Frequency (MHz)**	**Measured 6 dB Bandwidth (MHz)**	**Measured 99% Bandwidth (MHz)**
Low	2422	36.472	37.4439
High	2452	30.151	36.8856

Table 15. Occupied Bandwidth, 802.11a Mode 40MHz, Test Results, 2.4 GHz

Occupied Bandwidth			
Carrier Channel	**Frequency (MHz)**	**Measured 6 dB Bandwidth (MHz)**	**Measured 99% Bandwidth (MHz)**
Low	5745	16.300	16.7874
Mid	5785	14.841	16.6802
High	5825	16.425	16.6191

Table 16. Occupied Bandwidth, 802.11a Mode, Test Results, 5 GHz

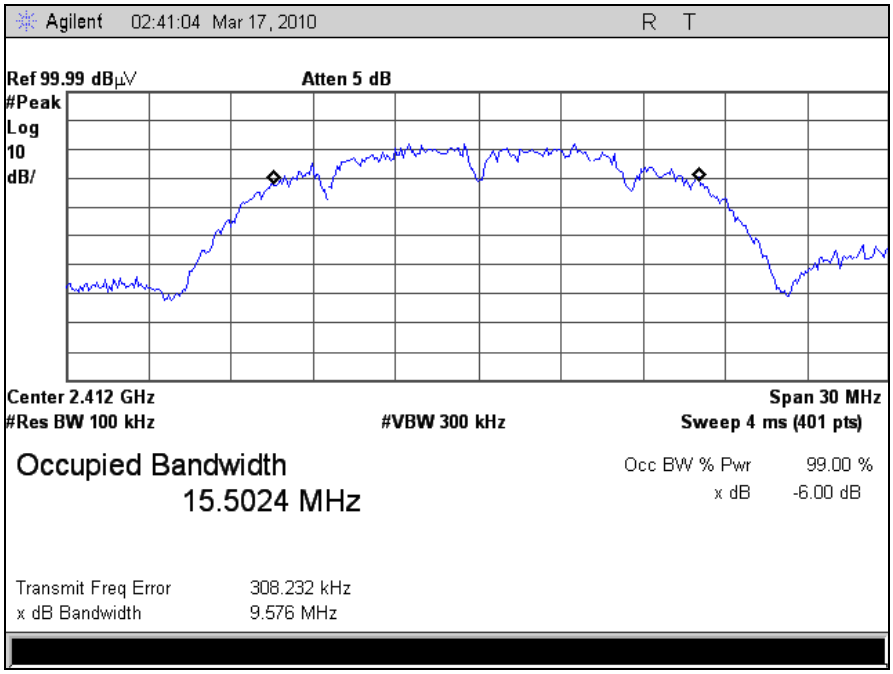
Occupied Bandwidth			
Carrier Channel	**Frequency (MHz)**	**Measured 6 dB Bandwidth (MHz)**	**Measured 99% Bandwidth (MHz)**
Low	5745	13.659	18.3078
Mid	5785	17.606	17.9152
High	5825	16.375	18.0472

Table 17. Occupied Bandwidth, 802.11n Mode HT20, Test Results, 5 GHz

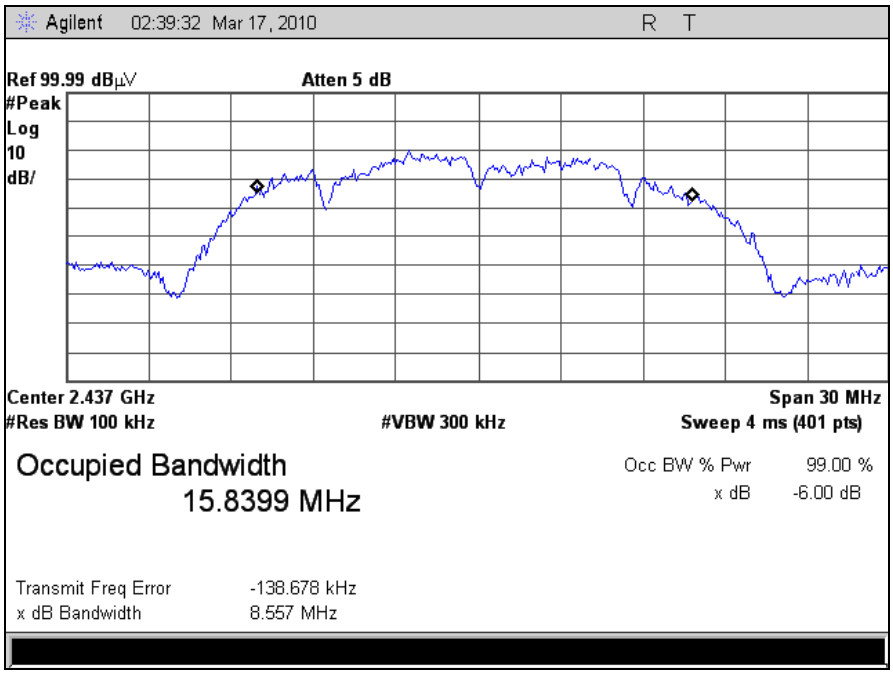
Occupied Bandwidth			
Carrier Channel	**Frequency (MHz)**	**Measured 6 dB Bandwidth (MHz)**	**Measured 99% Bandwidth (MHz)**
Low	5755	36.325	36.8207
Mid	5785	36.208	37.4753
High	5815	36.420	37.8368

Table 18. Occupied Bandwidth, 802.11n Mode HT40, Test Results, 5 GHz

Occupied Bandwidth Test Results

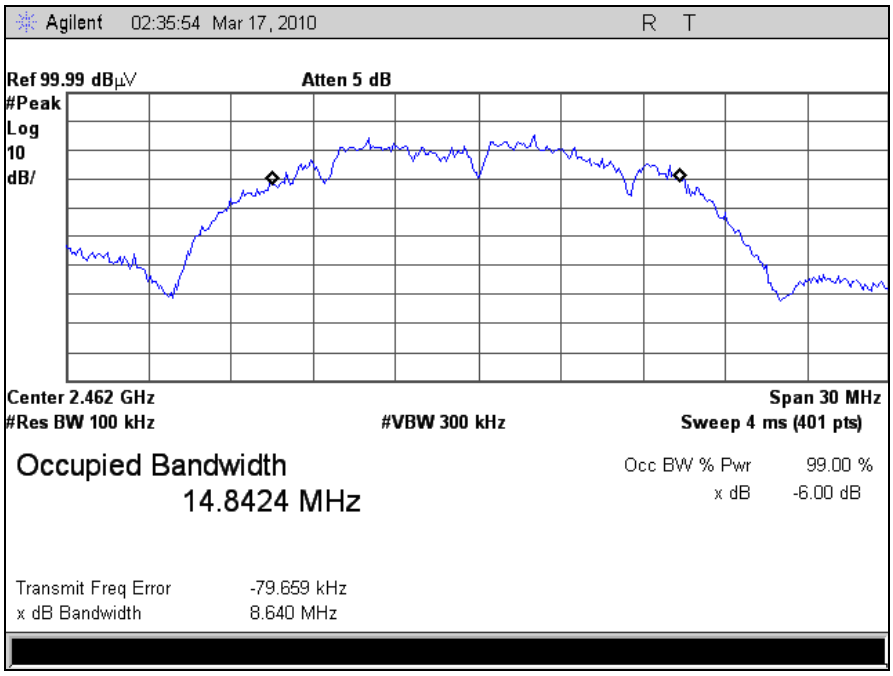


Plot 19. 6 dB Bandwidth, Low Channel, b Mode, 2.4 GHz

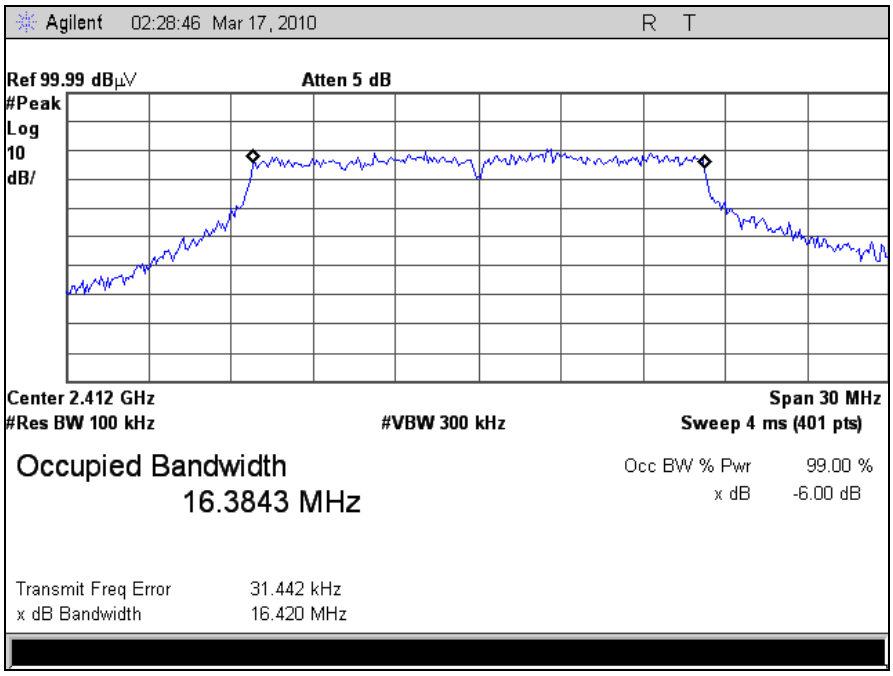


Plot 20. 6 dB Bandwidth, Mid Channel, b Mode, 2.4 GHz

Occupied Bandwidth Test Results

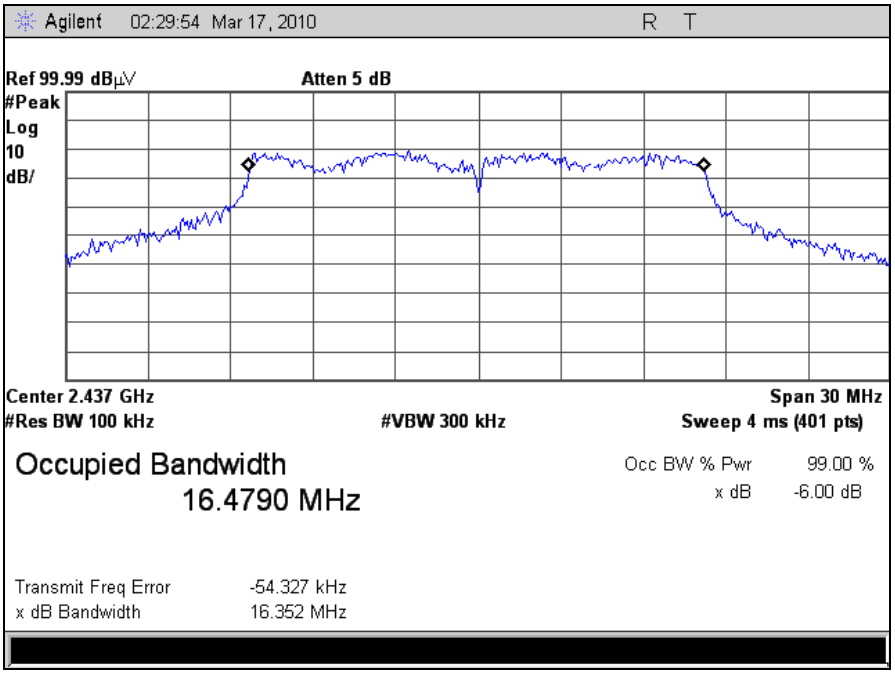


Plot 21. 6 dB Bandwidth, High Channel, b Mode, 2.4 GHz

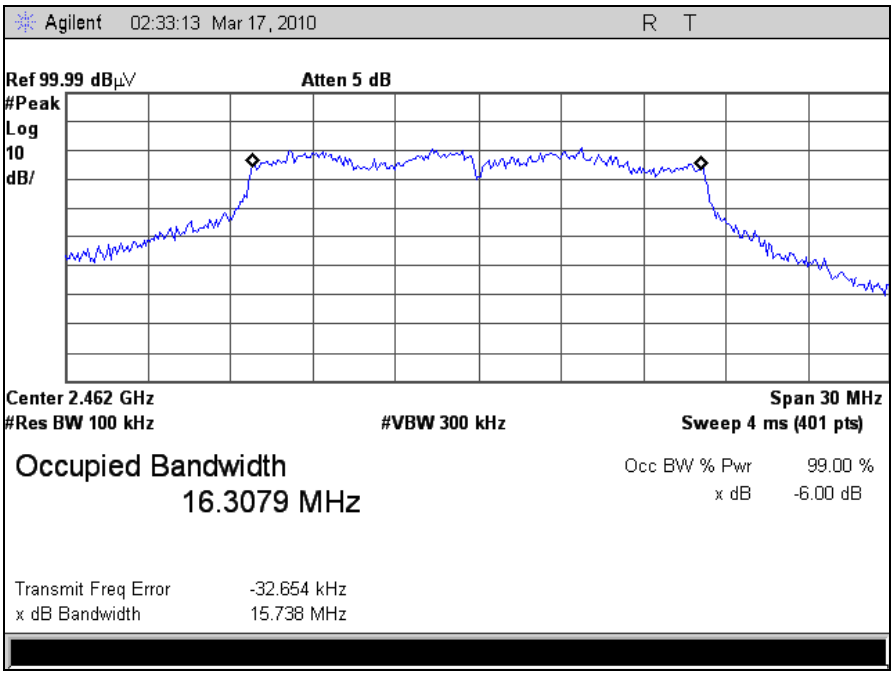


Plot 22. 6 dB Bandwidth, Low Channel, g Mode, 2.4 GHz

Occupied Bandwidth Test Results

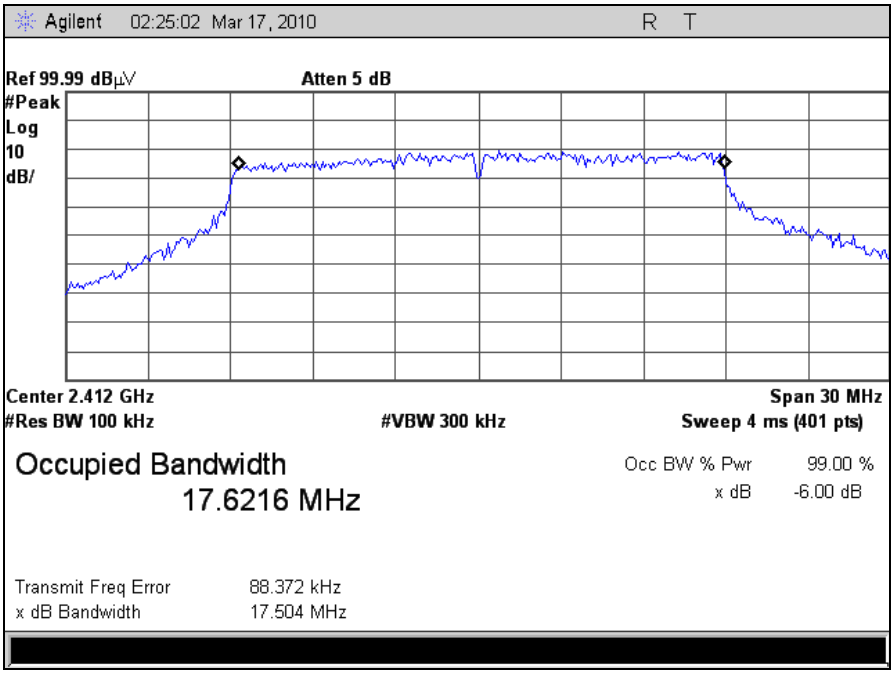


Plot 23. 6 dB Bandwidth, Mid Channel, g Mode, 2.4 GHz

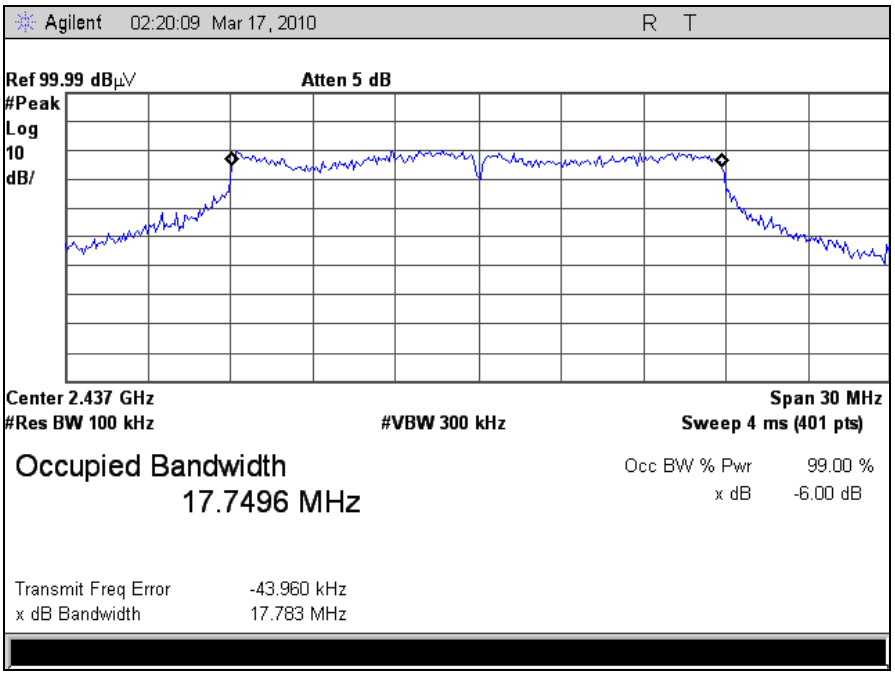


Plot 24. 6 dB Bandwidth, High Channel, g Mode, 2.4 GHz

Occupied Bandwidth Test Results

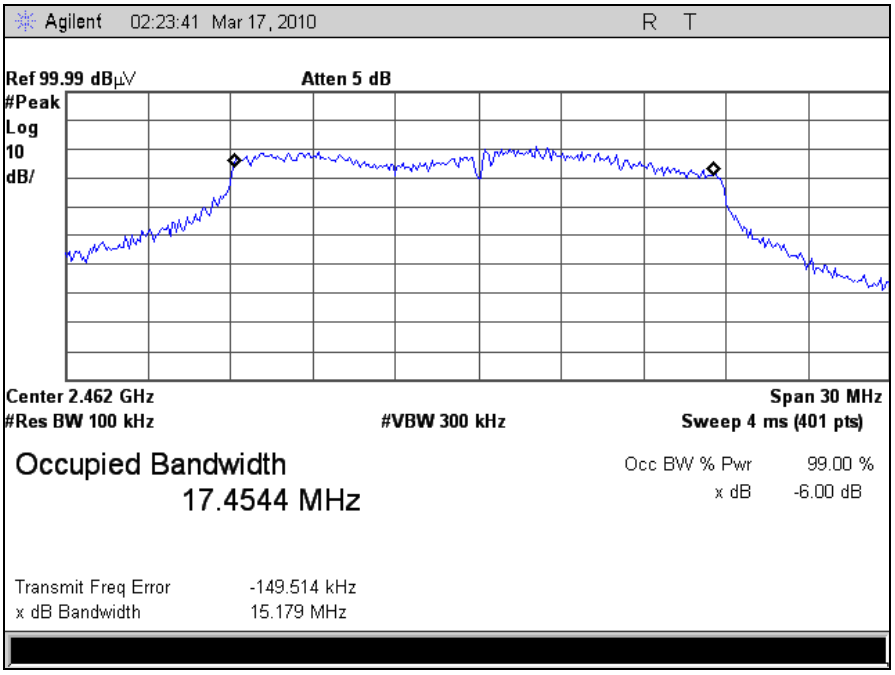


Plot 25. 6 dB Bandwidth, Low Channel, n Mode HT20, 2.4 GHz

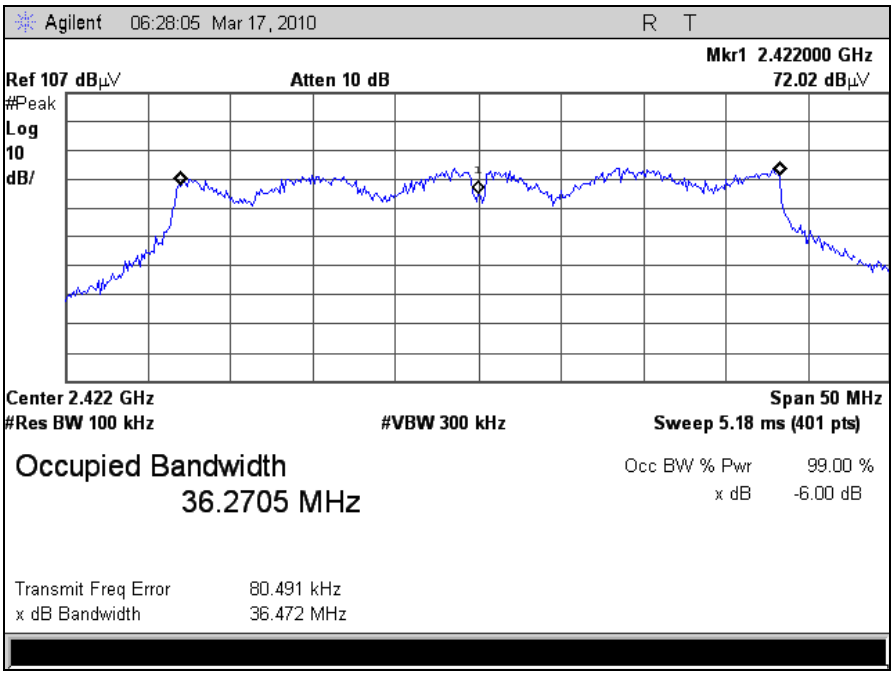


Plot 26. 6 dB Bandwidth, Mid Channel, n Mode HT20, 2.4 GHz

Occupied Bandwidth Test Results

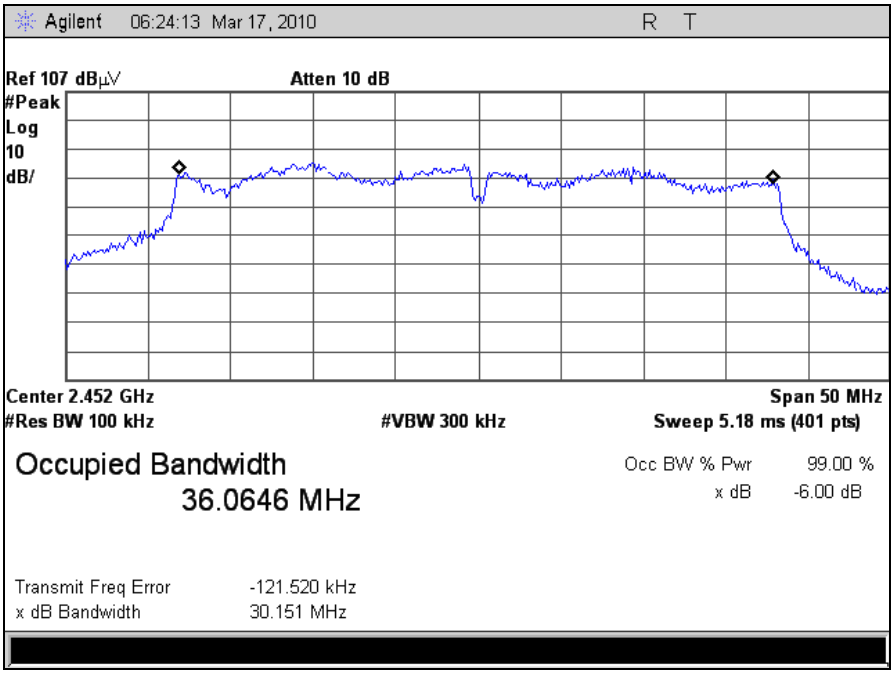


Plot 27. 6 dB Bandwidth, High Channel, n Mode HT20, 2.4 GHz

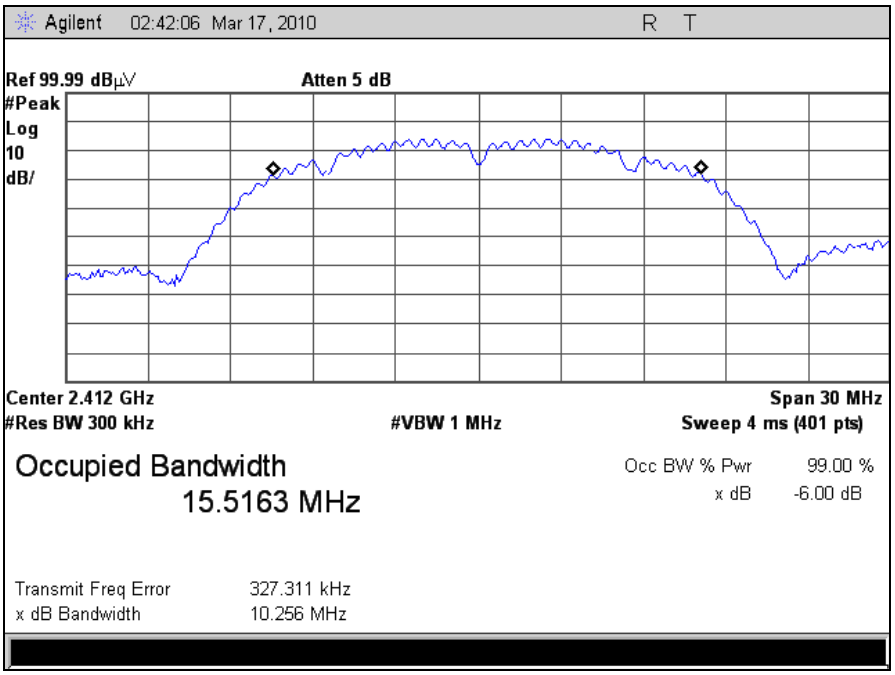


Plot 28. 6 dB Bandwidth, Low Channel, n Mode HT40, 2.4 GHz

Occupied Bandwidth Test Results

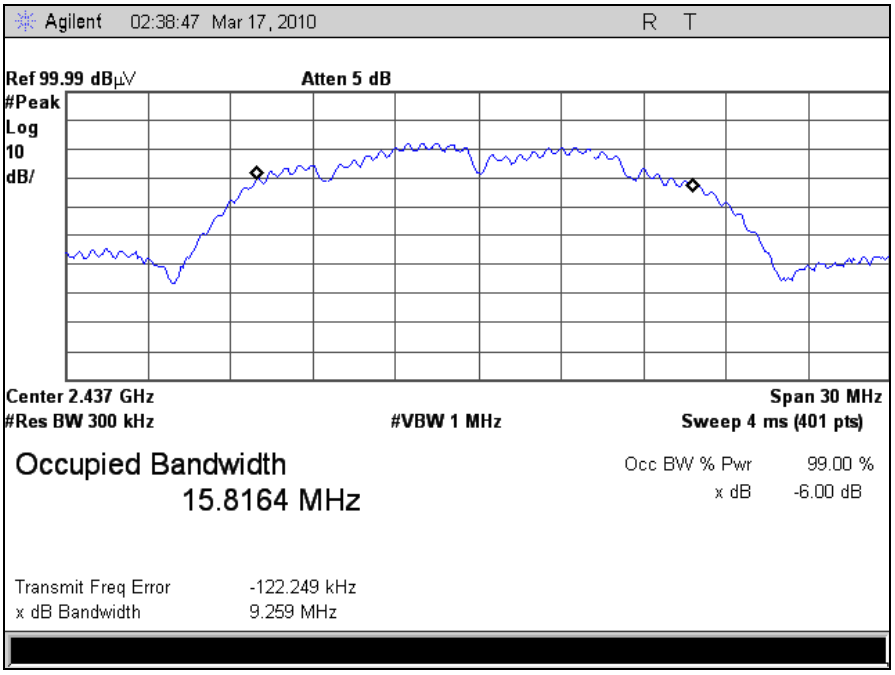


Plot 29. 6 dB Bandwidth, High Channel, n Mode HT40, 2.4 GHz

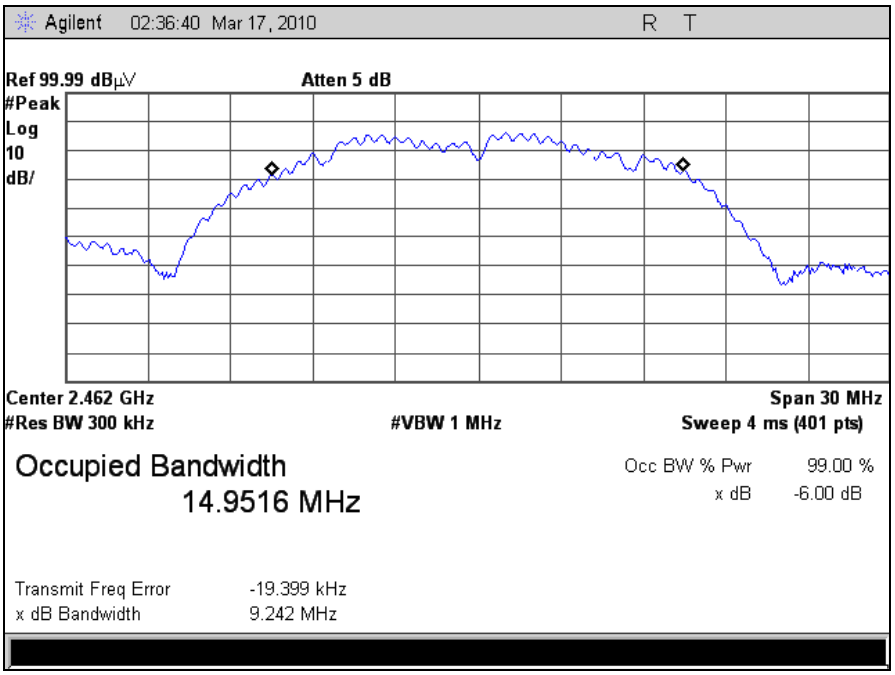


Plot 30. 99% Occupied Bandwidth, Low Channel, b Mode, 2.4 GHz

Occupied Bandwidth Test Results

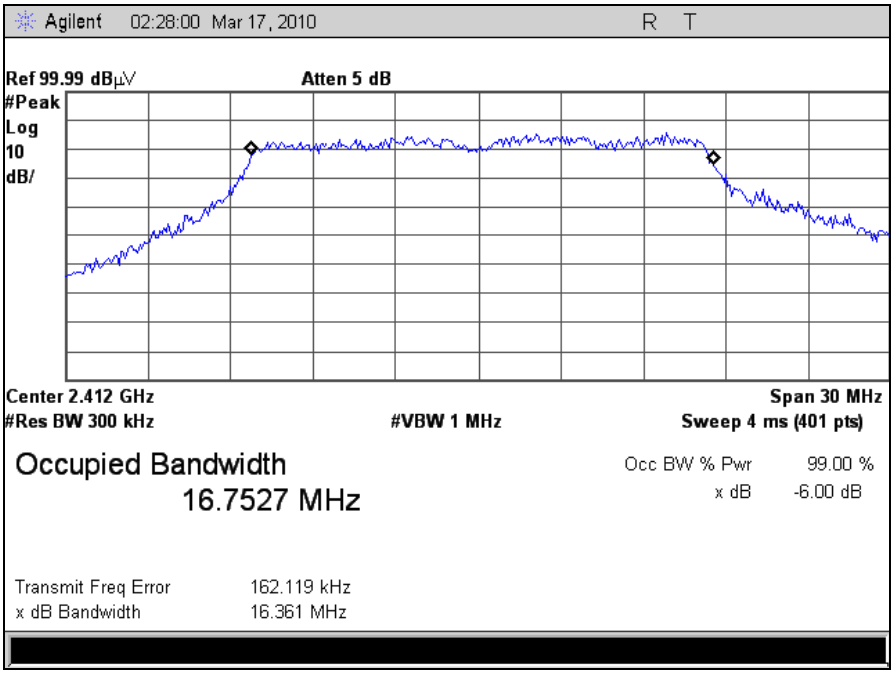


Plot 31. 99% Occupied Bandwidth, Mid Channel, b Mode, 2.4 GHz

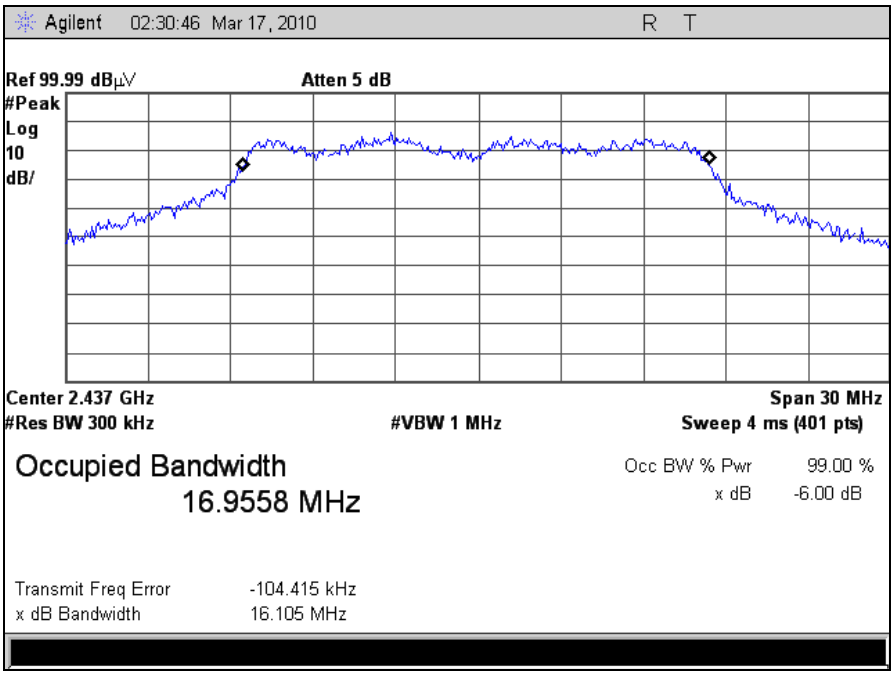


Plot 32. 99% Occupied Bandwidth, High Channel, b Mode, 2.4 GHz

Occupied Bandwidth Test Results

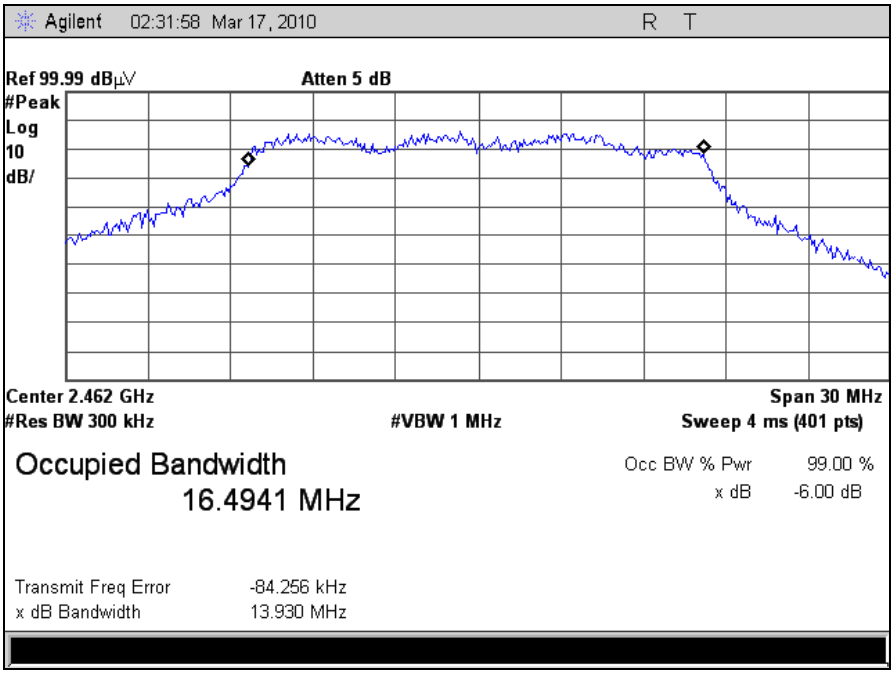


Plot 33. 99% Occupied Bandwidth, Low Channel, g Mode, 2.4 GHz

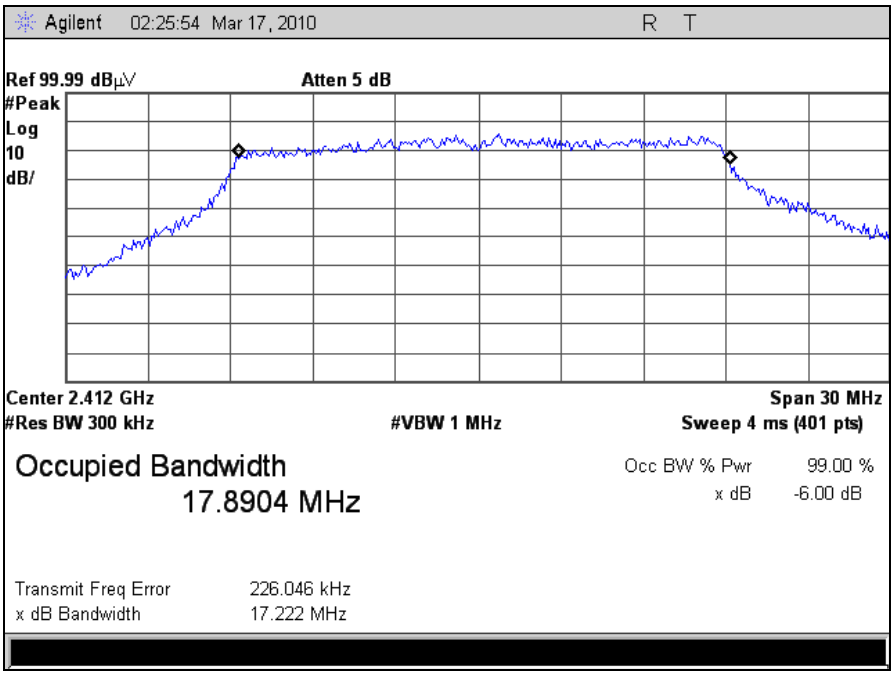


Plot 34. 99% Occupied Bandwidth, Mid Channel, g Mode, 2.4 GHz

Occupied Bandwidth Test Results

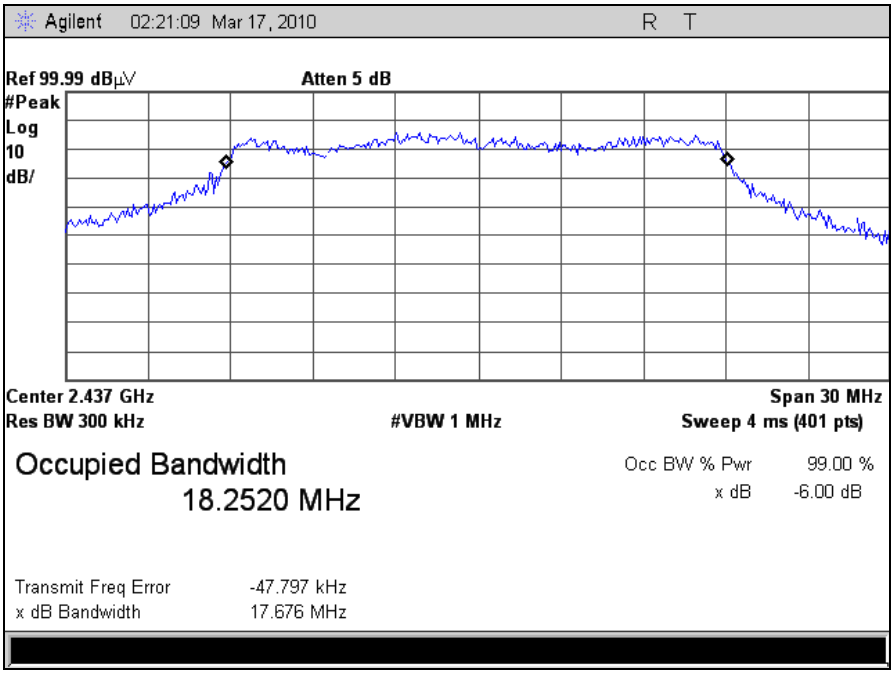


Plot 35. 99% Occupied Bandwidth, High Channel, g Mode, 2.4 GHz

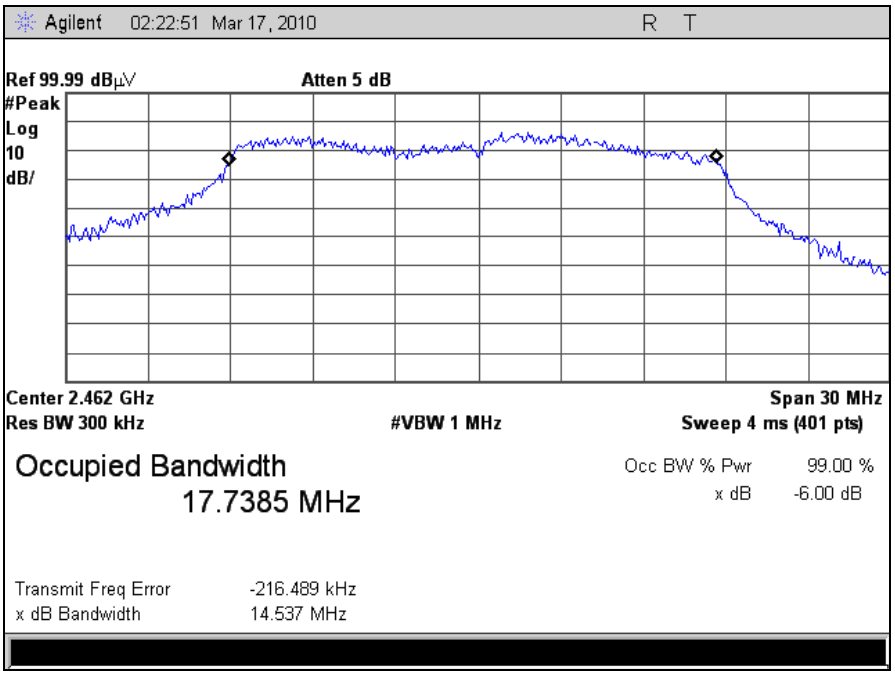


Plot 36. 99% Occupied Bandwidth, Low Channel, n Mode HT20, 2.4 GHz

Occupied Bandwidth Test Results

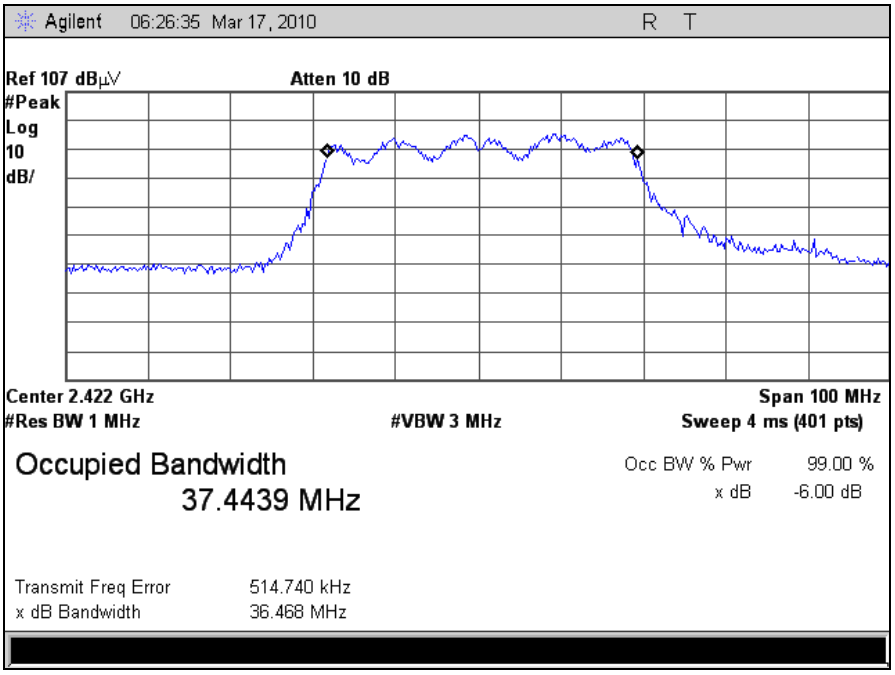


Plot 37. 99% Occupied Bandwidth, Mid Channel, n Mode HT20, 2.4 GHz

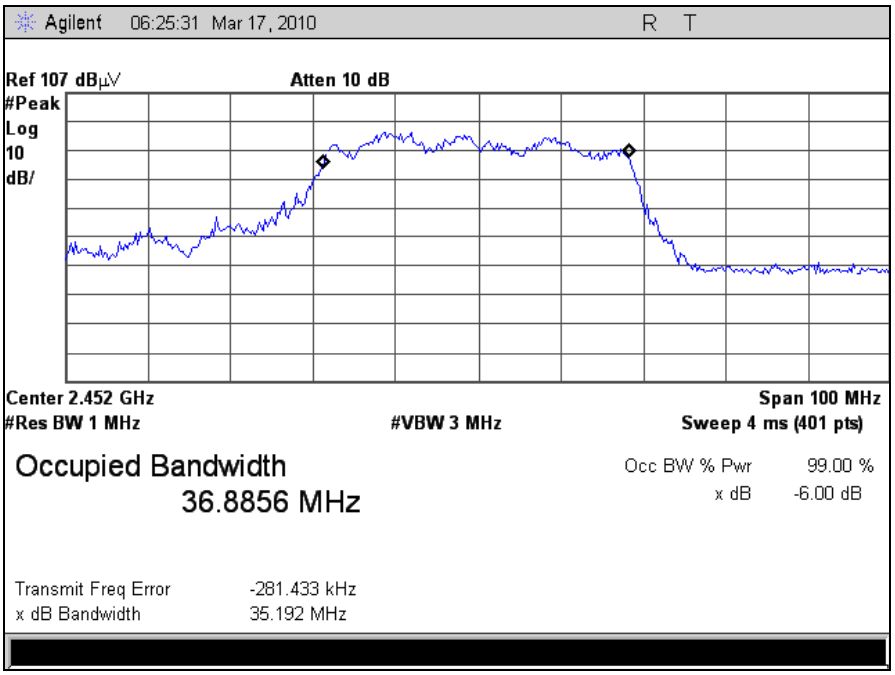


Plot 38. 99% Occupied Bandwidth, High Channel, n Mode HT20, 2.4 GHz

Occupied Bandwidth Test Results

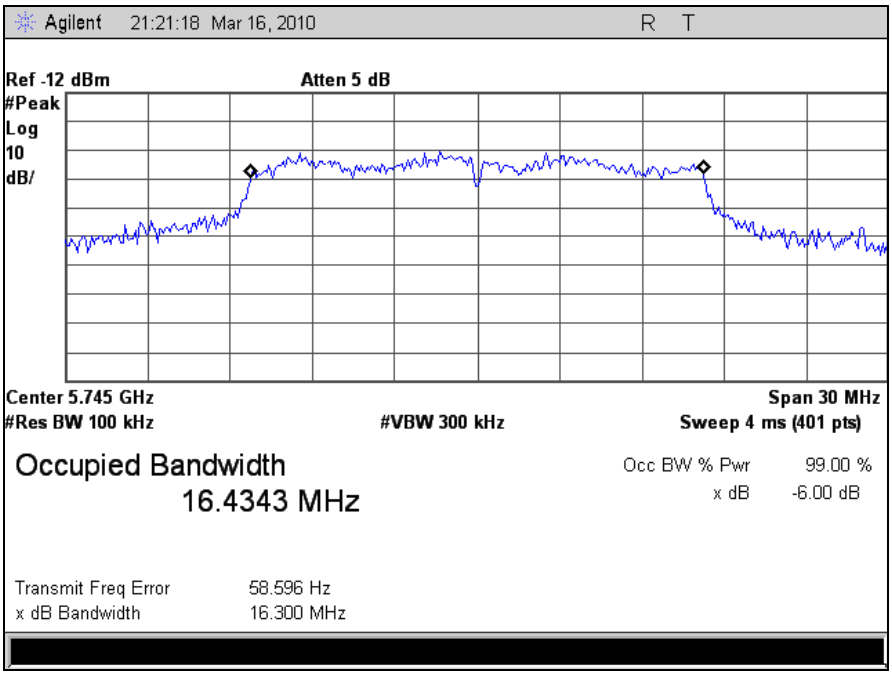


Plot 39. 99% Occupied Bandwidth, Low Channel, n Mode HT40, 2.4 GHz

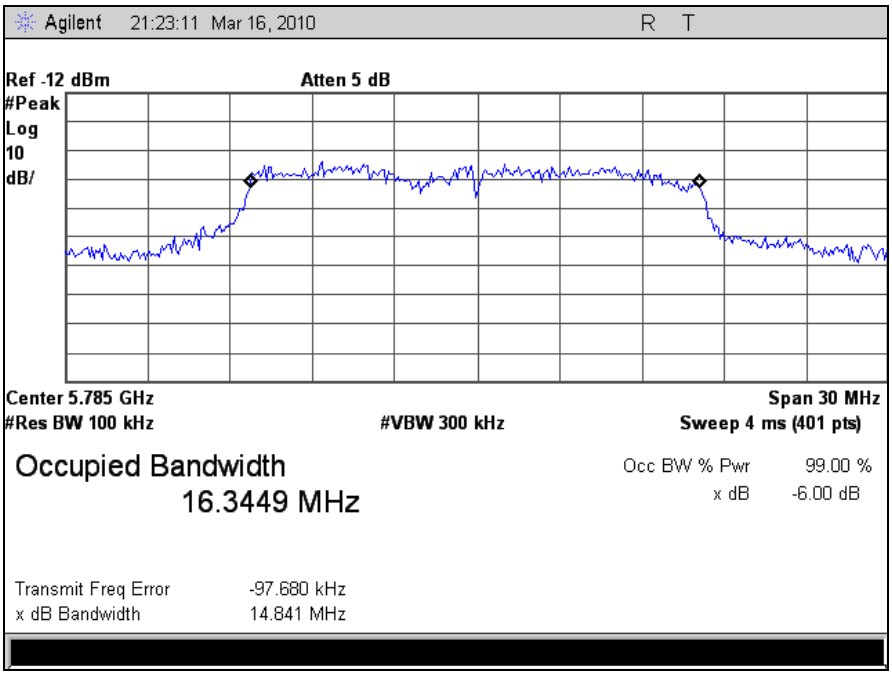


Plot 40. 99% Occupied Bandwidth, High Channel, n Mode HT40, 2.4 GHz

Occupied Bandwidth Test Results

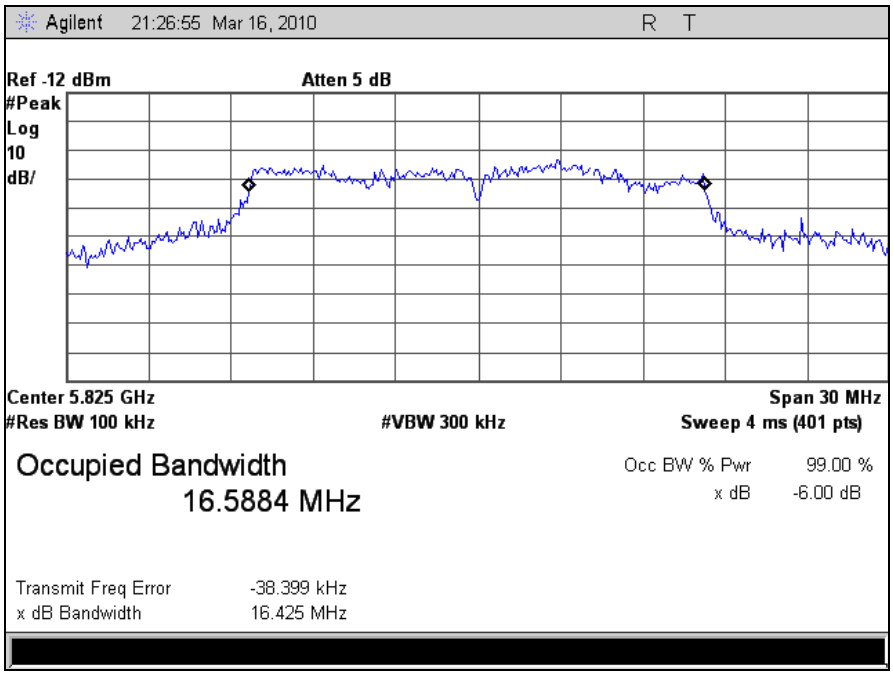


Plot 41. 6 dB Bandwidth, Low Channel, a Mode, 5 GHz

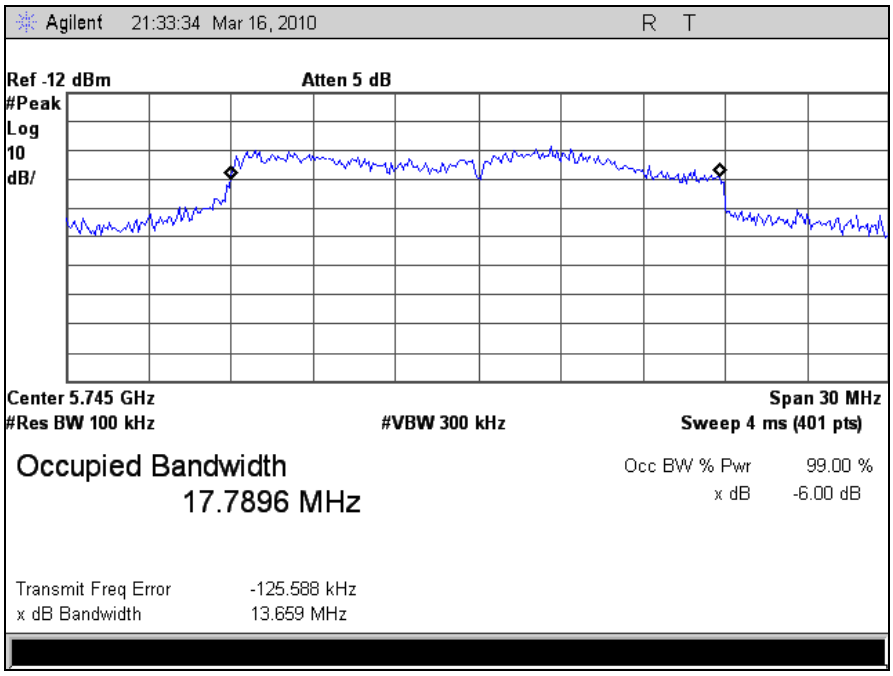


Plot 42. 6 dB Bandwidth, Mid Channel, a Mode, 5 GHz

Occupied Bandwidth Test Results

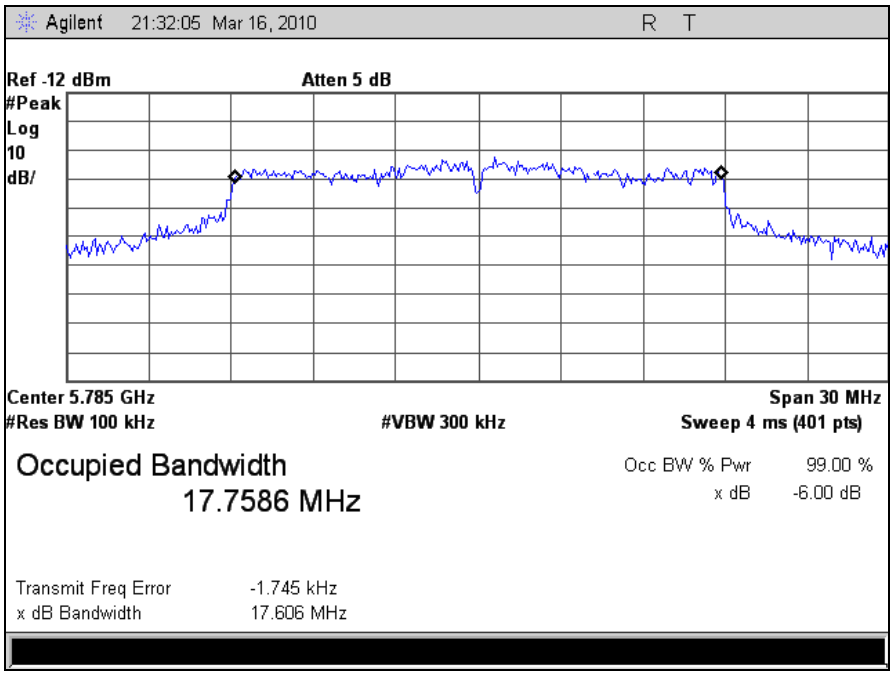


Plot 43. 6 dB Bandwidth, High Channel, a Mode, 5 GHz

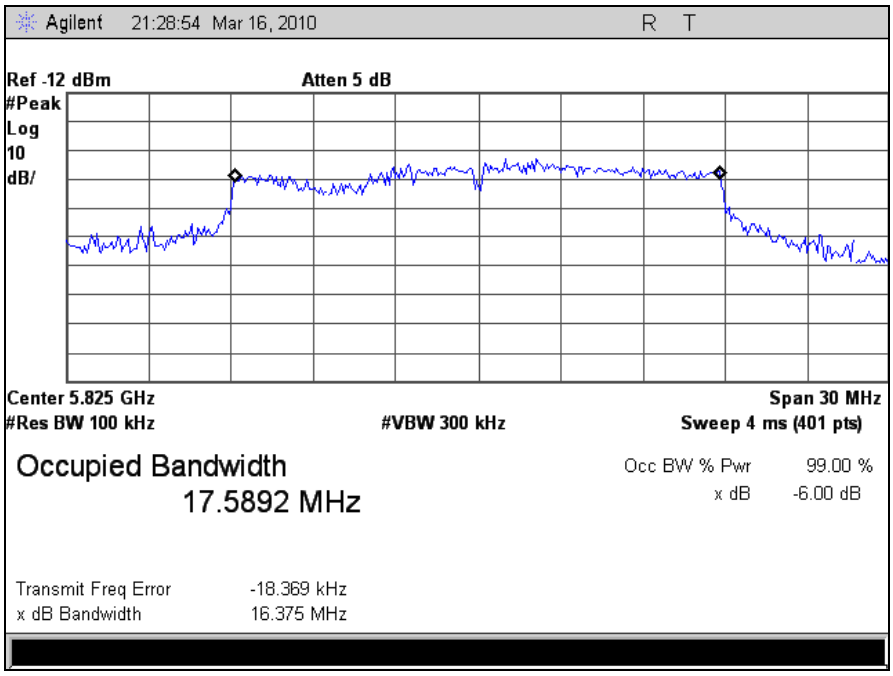


Plot 44. 6 dB Bandwidth, Low Channel, n Mode HT20, 5 GHz

Occupied Bandwidth Test Results

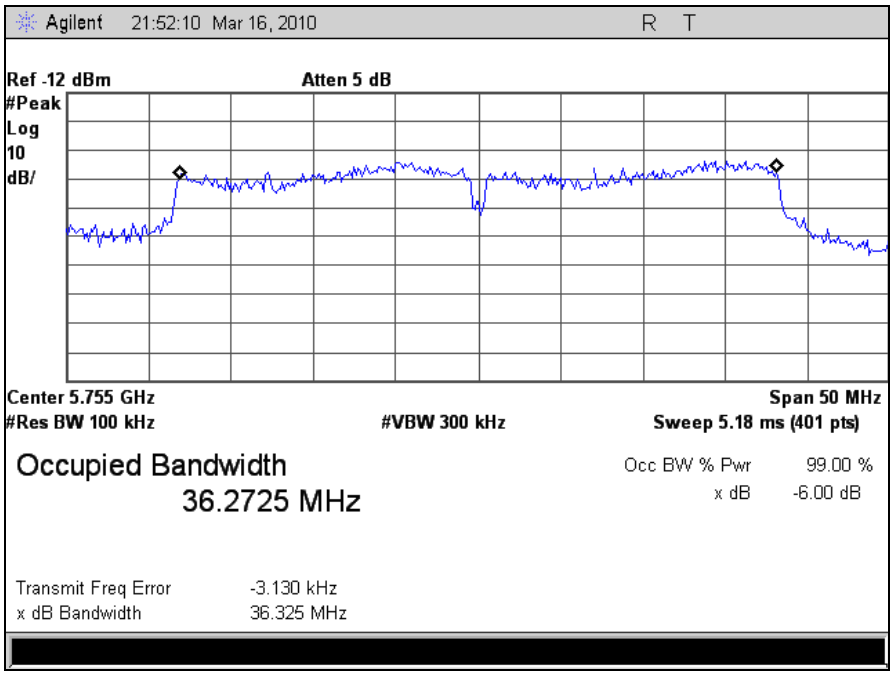


Plot 45. 6 dB Bandwidth, Mid Channel, n Mode HT20, 5 GHz

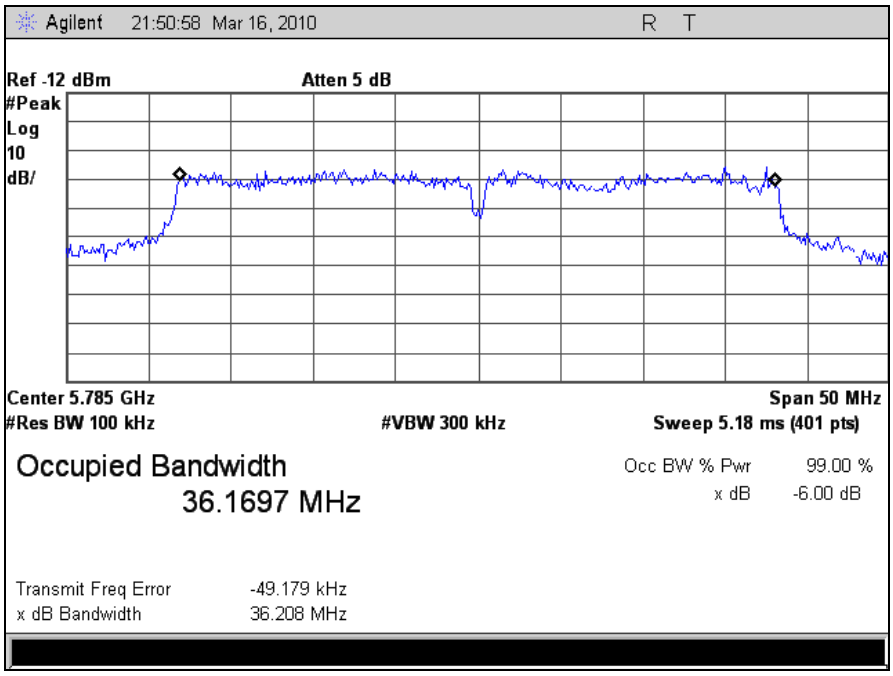


Plot 46. 6 dB Bandwidth, High Channel, n Mode HT20, 5 GHz

Occupied Bandwidth Test Results

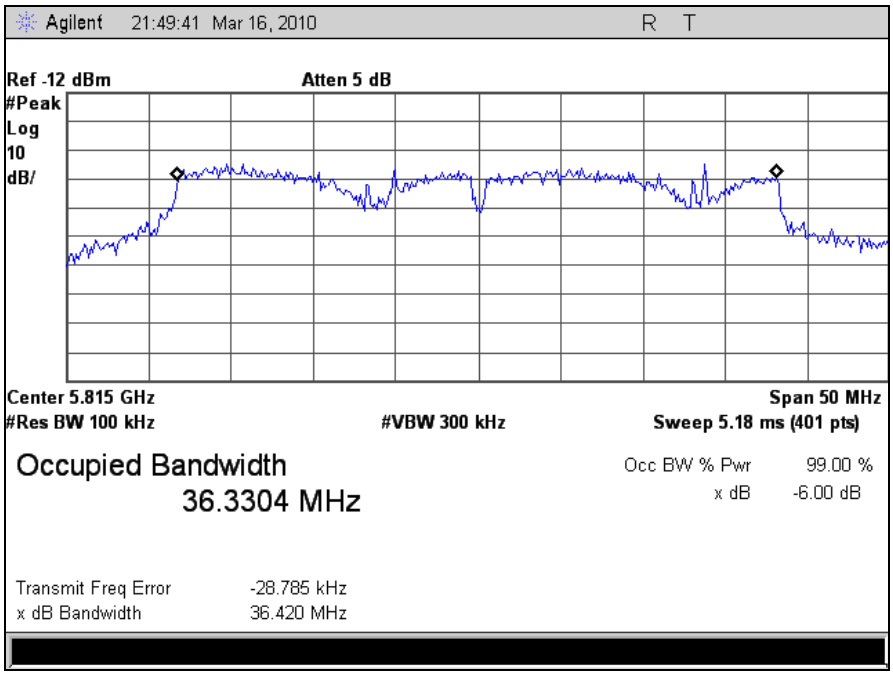


Plot 47. 6 dB Bandwidth, Low Channel, n Mode HT40, 5 GHz

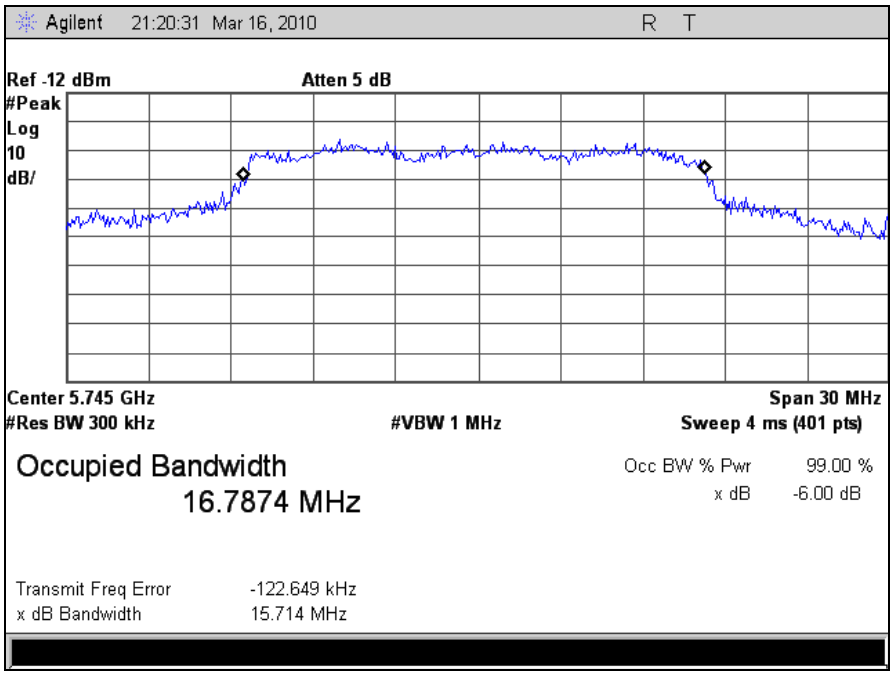


Plot 48. 6 dB Bandwidth, Mid Channel, n Mode HT40, 5 GHz

Occupied Bandwidth Test Results

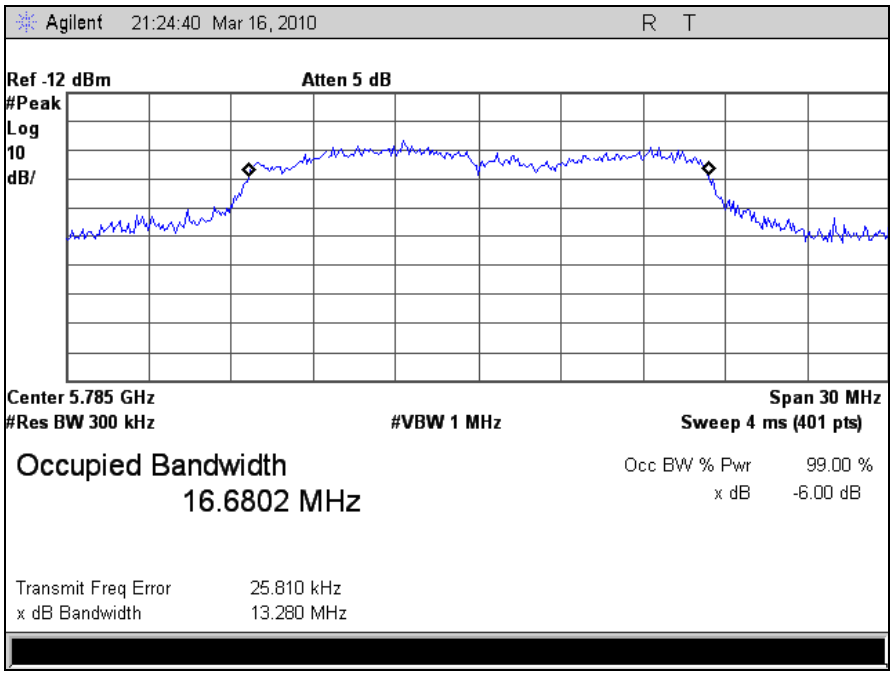


Plot 49. 6 dB Bandwidth, High Channel, n Mode HT40, 5 GHz

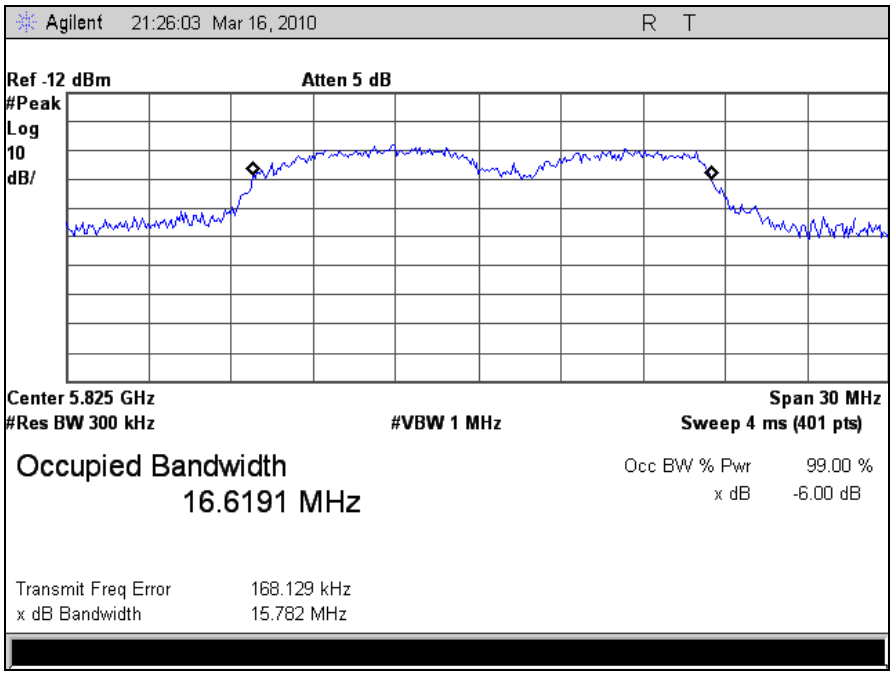


Plot 50. 99% Occupied Bandwidth, Low Channel, a Mode, 5 GHz

Occupied Bandwidth Test Results

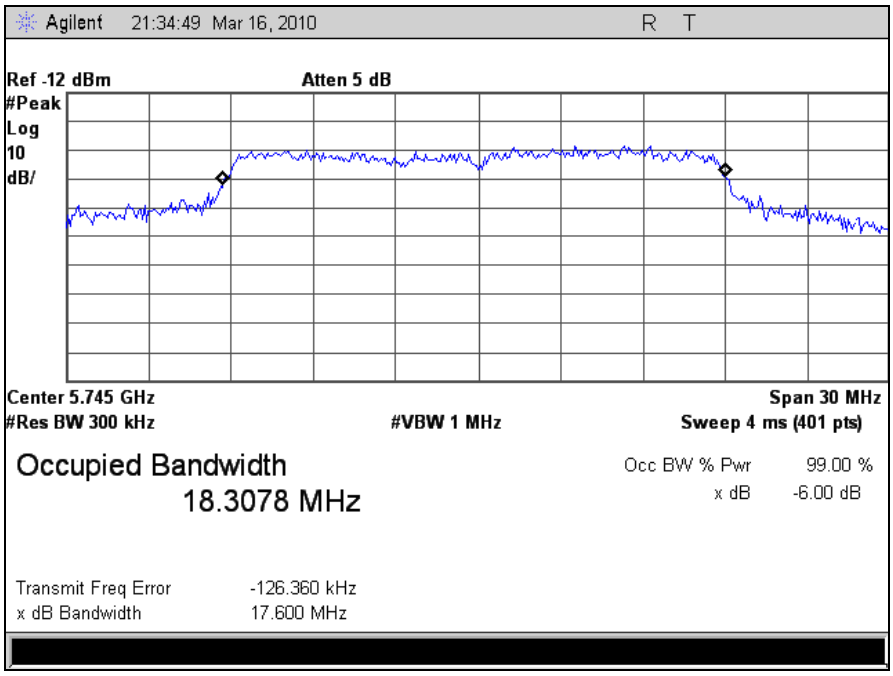


Plot 51. 99% Occupied Bandwidth, Mid Channel, a Mode, 5 GHz

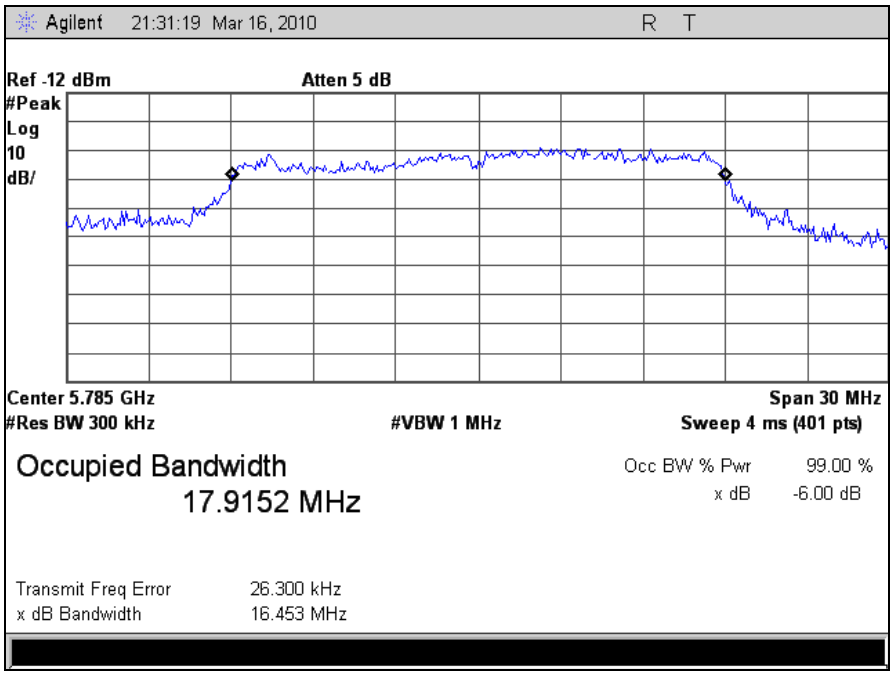


Plot 52. 99% Occupied Bandwidth, High Channel, a Mode, 5 GHz

Occupied Bandwidth Test Results

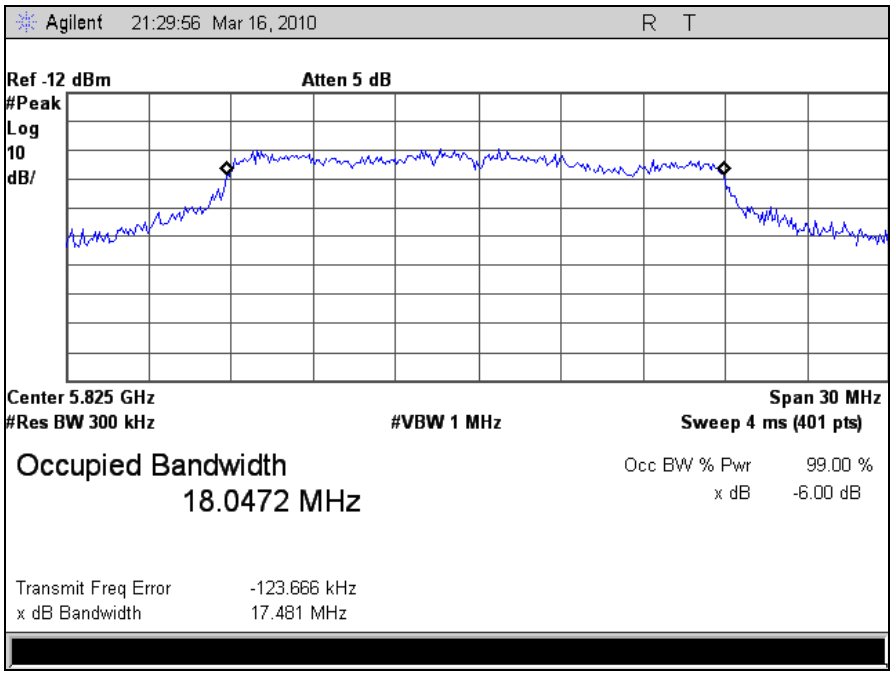


Plot 53. 99% Occupied Bandwidth, Low Channel, n Mode HT20, 5 GHz

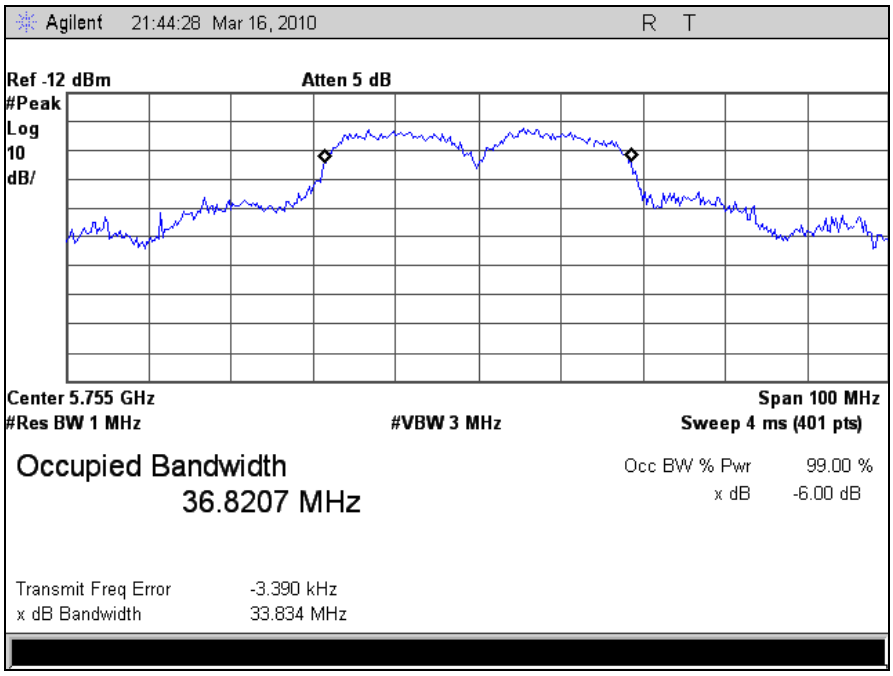


Plot 54. 99% Occupied Bandwidth, Mid Channel, n Mode HT20, 5 GHz

Occupied Bandwidth Test Results

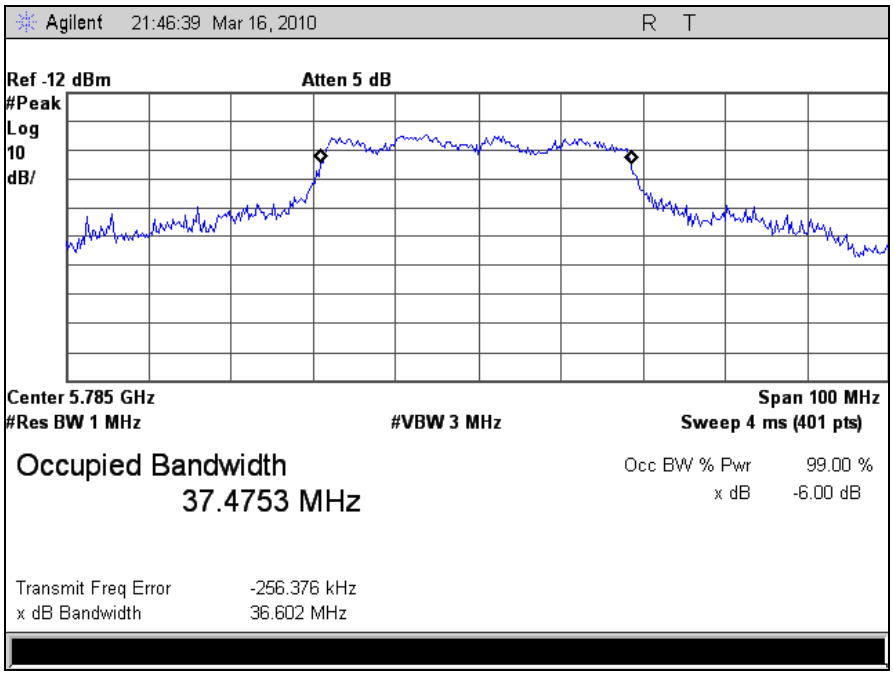


Plot 55. 99% Occupied Bandwidth, High Channel, n Mode HT20, 5 GHz

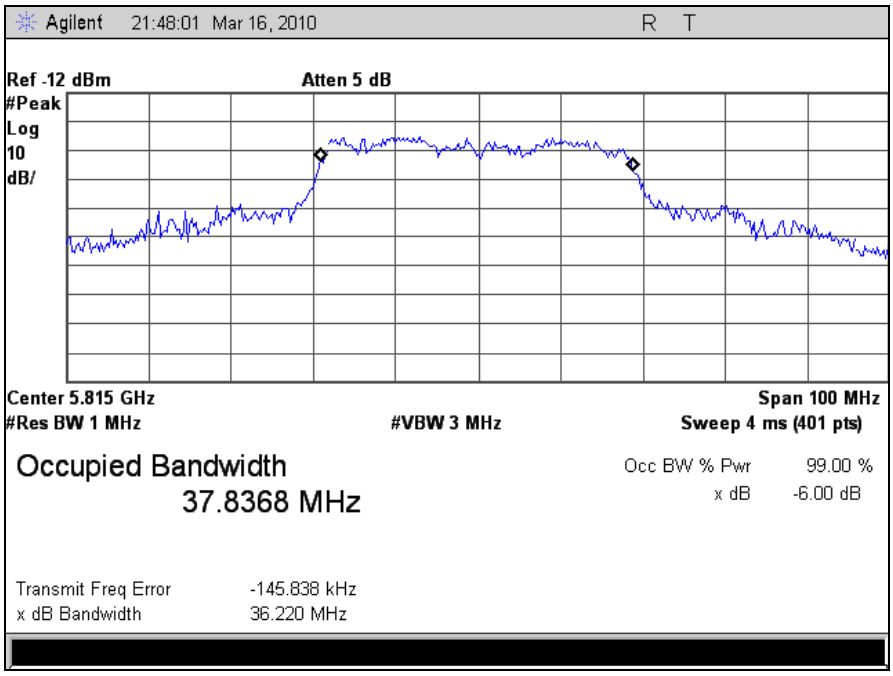


Plot 56. 99% Occupied Bandwidth, Low Channel, n Mode HT40, 5 GHz

Occupied Bandwidth Test Results



Plot 57. 99% Occupied Bandwidth, Mid Channel, n Mode HT40, 5 GHz



Plot 58. 99% Occupied Bandwidth, High Channel, n Mode HT40, 5 GHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) Peak Power Output and RF Exposure

Test Requirements: **§15.247(b):** The maximum peak output power of the intentional radiator shall not exceed the following:

Digital Transmission Systems (MHz)	Output Limit (Watts)
902-928	1.000
2400–2483.5	1.000
5725– 5850	1.000

Table 19. Output Power Requirements from §15.247

§15.247(c): if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in the Table 19, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400 – 2483.5 MHz band and using a point to point application may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Fixed, point-to-point operation excludes the use of point-to-multipoint systems, omni-directional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

Test Procedure: Because of the integral operation between the antennas and the power amplifier, measurements were performed radiated. The methods as described in FCC DTS guide March 23, 2005 (KDB# 558074) were used. From the plots taken, EIRP was calculated using the following equation:
EIRP = E_0 + 20log(d) – 104.77. The Conducted power was determined by subtracting the antenna gain from the measured EIRP. Since there are essentially two cross polarized antenna elements in each sector antenna the maximum aggregate EIRP from both polarizations would be the measured maximum plus the cross polarization antenna which is at least 6dB less. Therefore the highest conducted aggregate power per antenna panel would be:
2.4GHz Band - 22.99 + 16.99 = 23.96dBm
5.8GHz Band - 22.99 + 16.99 = 23.96dBm
Therefore the total aggregate power across all elements is < 30dBm
Note: 2.4GHz and 5GHz radios do not operate simultaneously

Test Results: The EUT was compliant with the Peak Power Output limits of **§15.247(b)**.

Test Engineer(s): Len Knight

Test Date(s): 03/16/10

RF Power Output Test Results

Output Power – 2.4 GHz					
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured Peak Output Power dBm**	**Antenna Gain**	**Calculated Conducted Power dBm**
b Mode	Low	2412	34.15	12	22.15
	Mid	2437	34.3	12	22.3
	High	2462	34.95	12	22.95
g Mode	Low	2412	34.29	12	22.29
	Mid	2437	34.75	12	22.75
	High	2462	34.99	12	22.99
n Mode HT20	Low	2412	34.41	12	22.41
	Mid	2437	34.82	12	22.82
	High	2462	34.77	12	22.77
n Mode HT40	Low	2422	34.88	12	22.88
	High	2452	34.82	12	22.82

Table 20. RF Output Power, Test Results, 2.4 GHz

Output Power – 5 GHz					
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured Peak Output Power dBm**	**Antenna Gain**	**Calculated Conducted Power dBm**
a Mode	Low	5745	34.99	12	22.99
	Mid	5785	34.98	12	22.98
	High	5825	34.94	12	22.94
n Mode HT20	Low	5745	34.99	12	22.99
	Mid	5785	34.7	12	22.7
	High	5825	34.63	12	22.63
n Mode HT40	Low	5755	34.62	12	22.62
	Mid	5785	34.17	12	22.17
	High	5815	34.78	12	22.78

Table 21. RF Output Power, Test Results, 5 GHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) RF Exposure

RF Exposure Requirements: **§1.1307(b)(1) and §1.1307(b)(2):** Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

RF Radiation Exposure Limit: **§1.1310:** As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

MPE Limit Calculation: EUT's operating frequencies @ 2412-2462 MHz and 5745-5825 MHz **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

Highest EIRP 2412-2462 MHz

Equation from page 18 of OET 65, Edition 97-01

$S = PG / 4\pi R^2$ or $R = \sqrt{PG / 4\pi S}$

where, $S = PG / 4\pi R^2$
P=23.96(248.8mW)
G=12dBi(15.8)
$S = 3931.04 / 4\pi(20)^2$
$S = 0.782$ mW/cm^2

Highest EIRP 5745-5825 MHz

Equation from page 18 of OET 65, Edition 97-01

$S = PG / 4\pi R^2$ or $R = \sqrt{PG / 4\pi S}$

where, $S = PG / 4\pi R^2$
P=23.96(248.8mW)
G=12dBi(15.8)
$S = 3931.04 / 4\pi(20)^2$
$S = 0.782$ mW/cm^2

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Radiated Spurious Emissions Requirements and Band Edge

Test Requirements: **§15.247(d); §15.205:** Emissions outside the frequency band.

§15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

§15.205(a): Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090–0.110----------	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505----------	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905----------	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128----------	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775----------	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775----------	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218----------	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825----------	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225----------	123–138	2200–2300	14.47–14.5
8.291–8.294----------	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366----------	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675----------	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475----------	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293----------	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025----------	240–285	3345.8–3358 36.	43–36.5
12.57675–12.57725----------	322–335.4	3600–4400	([2])

Table 22. Restricted Bands of Operation

[1] Until February 1, 1999, this restricted band shall be 0.490 – 0.510 MHz.
[2] Above 38.6

Test Requirement(s): **§ 15.209 (a):** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 23.

Frequency (MHz)	§ 15.209(a),Radiated Emission Limits (dBµV) @ 3m
30 - 88	40.00
88 - 216	43.50
216 - 960	46.00
Above 960	54.00

Table 23. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)

Test Procedures: The transmitter was turned. Measurements were performed at the low, mid and high channels at each different data rate. The EUT was rotated and the measurement antenna height adjusted. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit like.

Test Results: The EUT was compliant with the Radiated Spurious Emission limits of **§ 15.247(d)**.

Test Engineer(s): Len Knight

Test Date(s): 03/09/10

Harmonic Emissions Requirements – Radiated

Mode	GUI	Channel	Frequency (GHz)	Rx Antenna Polarity (H/V)	Corrected Measurement Peak (dBuV/m)	Limit Peak (dBuV/m)	Corrected Measurement Average (dBuV/m)	Limit Average (dBuV/m)
b Mode	24.5	Low	4824	H	54.4	74	52.4	54
				V	54.1	74	52.95	54
			7.236	H	46.2	74	44.1	54
				V	47.1	74	43.7	54
			9.648	H	41.82	74	37.05	54
				V	40.19	74	32.73	54
	22.5	Mid	4.874	H	51.39	74	47.52	54
				V	53.31	74	54.21	54
			7.311	H	42.66	74	30.21	54
				V	43.27	74	31.68	54
			89.74	H	42.11	74	39.44	54
				V	39.67	74	34.02	54
	26	High	4.924	H	57.32	74	39.21	54
				V	58.99	74	37.12	54
			7.386	H	63.02	74	32.21	54
				V	58.94	74	32.72	54
			9.884	H	43.43	74	39.93	54
				V	43.3	74	35.27	54

Table 24. Radiated Harmonic Emissions, Test Results, b Mode, 2.4 GHz

Mode	GUI	Channel	Frequency (GHz)	Rx Antenna Polarity (H/V)	Corrected Measurement Peak (dBuV/m)	Limit Peak (dBuV/m)	Corrected Measurement Average (dBuV/m)	Limit Average (dBuV/m)
g Mode	26.5	Low	4824	H	58.18	74	45.21	54
				V	62.24	74	50.23	54
			7.236	H	44.23	74	33.69	54
				V	45.26	74	34.01	54
	26.5	Mid	4.874	H	54.93	74	41.5	54
				V	48.48	74	41.8	54
			7.311	H	42.54	74	33.87	54
				V	42.94	74	32.98	54
	24.5	High	4.924	H	50.81	74	36.91	54
				V	52.88	74	41.37	54
			7.386	H	39.52	74	30.43	54
				V	39.87	74	30.28	54

Table 25. Radiated Harmonic Emissions, Test Results, g Mode, 2.4 GHz

Harmonic Emissions Requirements – Radiated

Mode	GUI	Channel	Frequency (GHz)	Rx Antenna Polarity (H/V)	Corrected Measurement Peak (dBuV/m)	Limit Peak (dBuV/m)	Corrected Measurement Average (dBuV/m)	Limit Average (dBuV/m)
n Mode HT20	26.5	Low	4.824	H	57.88	74	44.45	54
				V	61.89	74	48.32	54
			7.236	H	48.99	74	33.65	54
				V	49.52	74	36.04	54
	26.5	Mid	4.874	H	54.96	74	40.88	54
				V	58.21	74	46.55	54
			7.311	H	44.75	74	32.57	54
				V	43.67	74	35.54	54
	25	High	4.924	H	53.15	74	38.63	54
				V	54.69	74	41.09	54
			7.386	H	41.77	74	29.9	54
				V	39.58	74	32.87	54

Table 26. Radiated Harmonic Emissions, Test Results, n Mode HT20, 2.4 GHz

Mode	GUI	Channel	Frequency (GHz)	Rx Antenna Polarity (H/V)	Corrected Measurement Peak (dBuV/m)	Limit Peak (dBuV/m)	Corrected Measurement Average (dBuV/m)	Limit Average (dBuV/m)
a Mode	26.5	Low	11.49	H	51.6	74	37.61	54
				V	49.68	74	33.23	54
			17.235	H	55.03	74	32.07	54
				V	51.9	74	31.69	54
	29	Mid	11.57	H	52.61	74	38.95	54
				V	55.82	74	41.56	54
			17.55	H	64	74	35.31	54
				V	64	74	33.85	54
	29	High	11.65	H	57.32	74	39.03	54
				V	58.99	74	37.12	54
			17.475	H	63.02	74	32.21	54
				V	58.94	74	31.72	54

Table 27. Radiated Harmonic Emissions, Test Results, a Mode, 5 GHz

Harmonic Emissions Requirements – Radiated

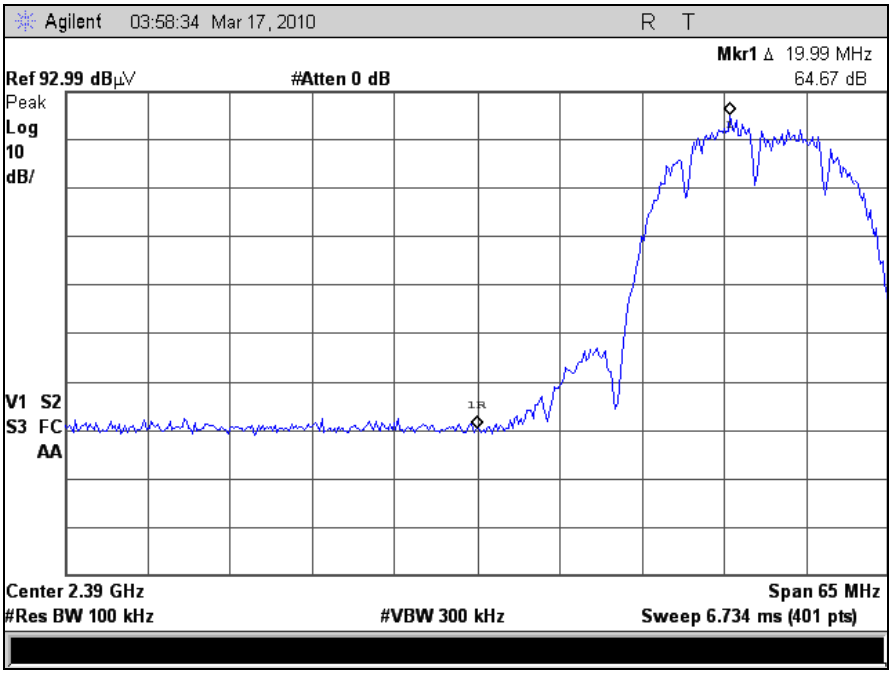
Mode	GUI	Channel	Frequency (GHz)	Rx Antenna Polarity (H/V)	Corrected Measurement Peak (dBuV/m)	Limit Peak (dBuV/m)	Corrected Measurement Average (dBuV/m)	Limit Average (dBuV/m)
n Mode HT20	26.5	Low	11.49	H	51.81	74	36.27	54
				V	50.01	74	36.3	54
			17.235	H	53.02	74	30.95	54
				V	53.22	74	30.23	54
	29	Mid	11.57	H	53.63	74	38.58	54
				V	53.88	74	39.26	54
			17.55	H	65.21	74	34.51	54
				V	61.58	74	33.91	54
	29	High	11.65	H	57.43	74	37.67	54
				V	56.72	74	37.39	54
			17.475	H	54.98	74	26.13	54
				V	53.11	74	25.67	54

Table 28. Radiated Harmonic Emissions, Test Results, n Mode HT20, 5 GHz

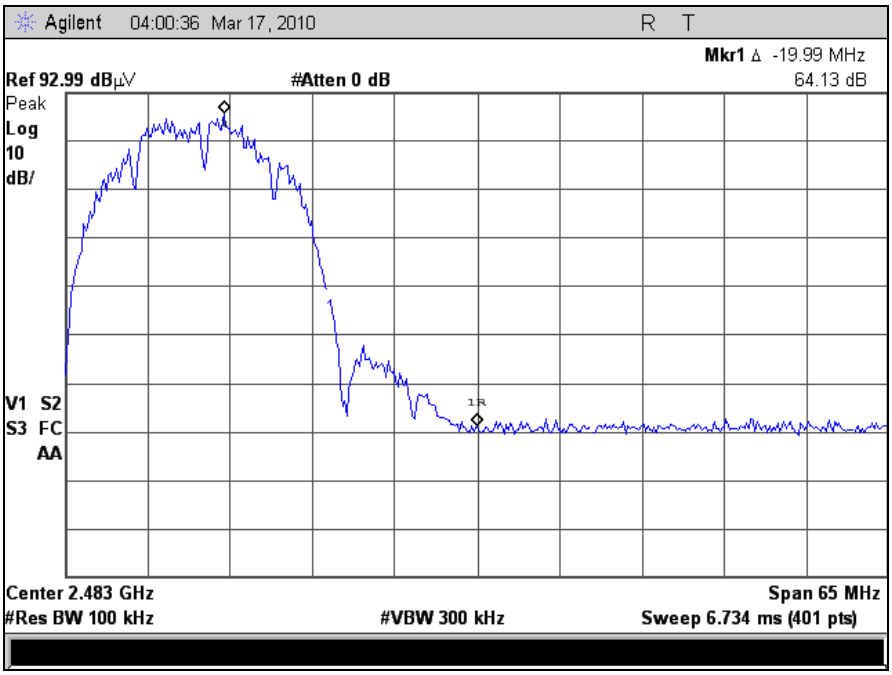
Mode	GUI	Channel	Frequency (GHz)	Rx Antenna Polarity (H/V)	Corrected Measurement Peak (dBuV/m)	Limit Peak (dBuV/m)	Corrected Measurement Average (dBuV/m)	Limit Average (dBuV/m)
n Mode HT40	26.5	Low	11.51	H	53.74	74	34	54
				V	47.26	74	34.17	54
			17.265	H	52.54	74	29.87	54
				V	55.03	74	30	54
	28.5	Mid	11.57	H	57.76	74	43.91	54
				V	61.2	74	47.81	54
			17.55	H	64.47	74	33.5	54
				V	65.97	74	35.44	54
	29	High	11.63	H	60.54	74	42.09	54
				V	59.49	74	41.72	54
			17.445	H	62.36	74	31.99	54
				V	60.09	74	32.96	54

Table 29. Radiated Harmonic Emissions, Test Results, n Mode HT40, 5 GHz

Radiated Spurious Emissions Test Results

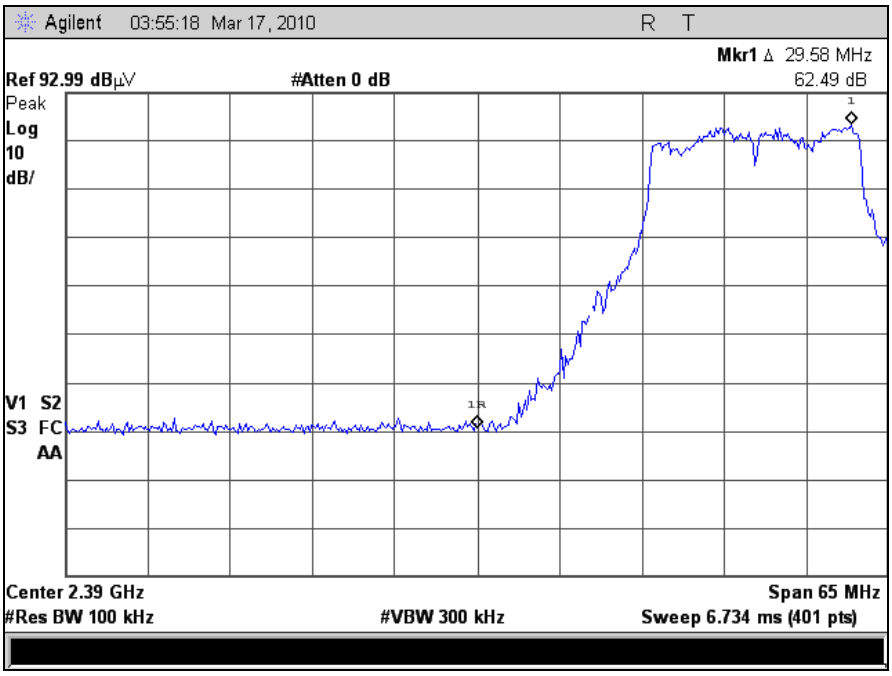


Plot 59. Radiated Spurious Emissions, b Mode, Low Channel, 2.4 GHz, 20 dBc

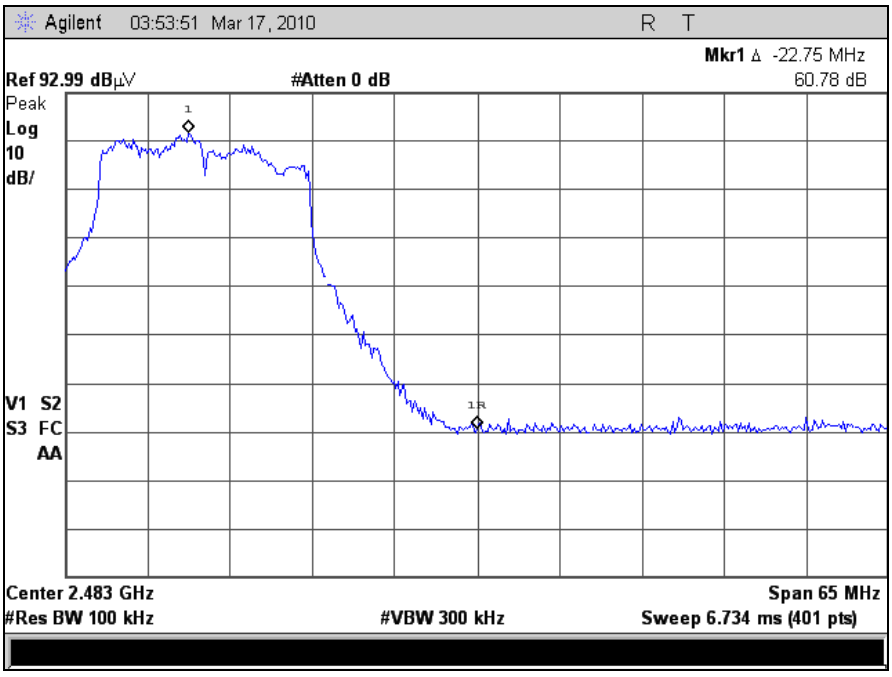


Plot 60. Radiated Spurious Emissions, b Mode, High Channel, 2.4 GHz, 20 dBc

Radiated Spurious Emissions Test Results

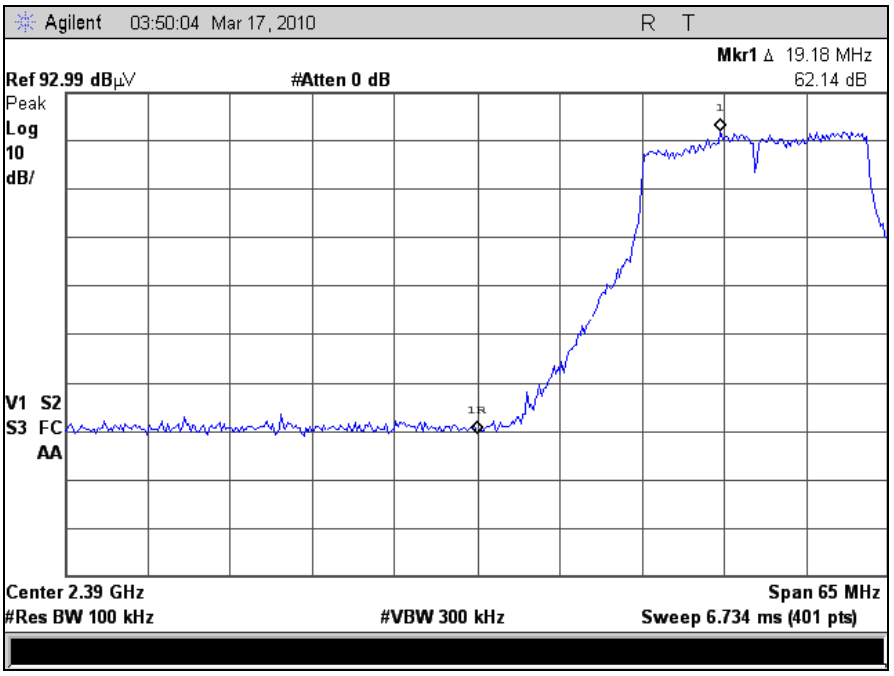


Plot 61. Radiated Spurious Emissions, g Mode, Low Channel, 2.4 GHz, 20 dBc

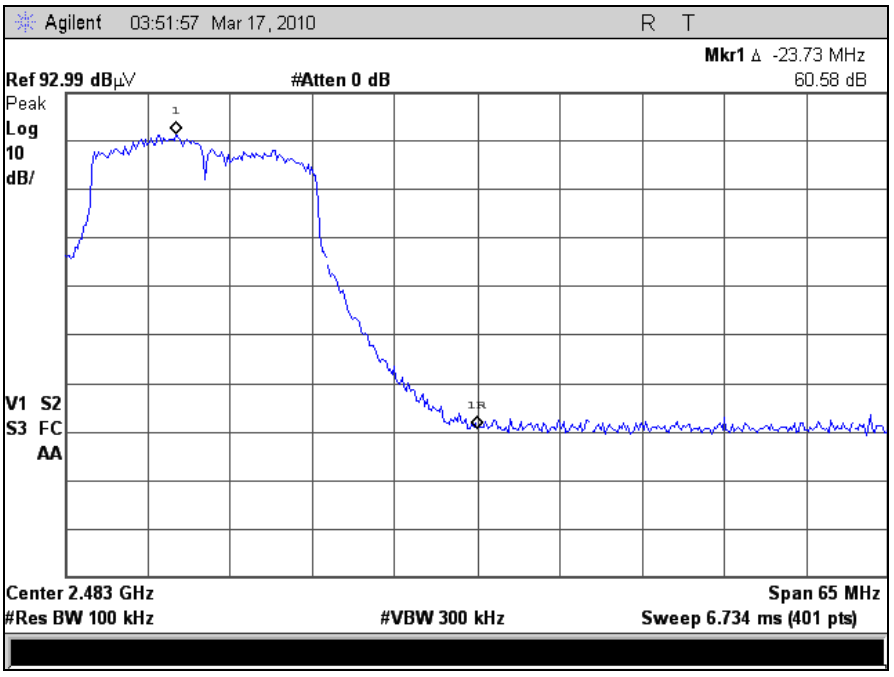


Plot 62. Radiated Spurious Emissions, g Mode, High Channel, 2.4 GHz, 20 dBc

Radiated Spurious Emissions Test Results

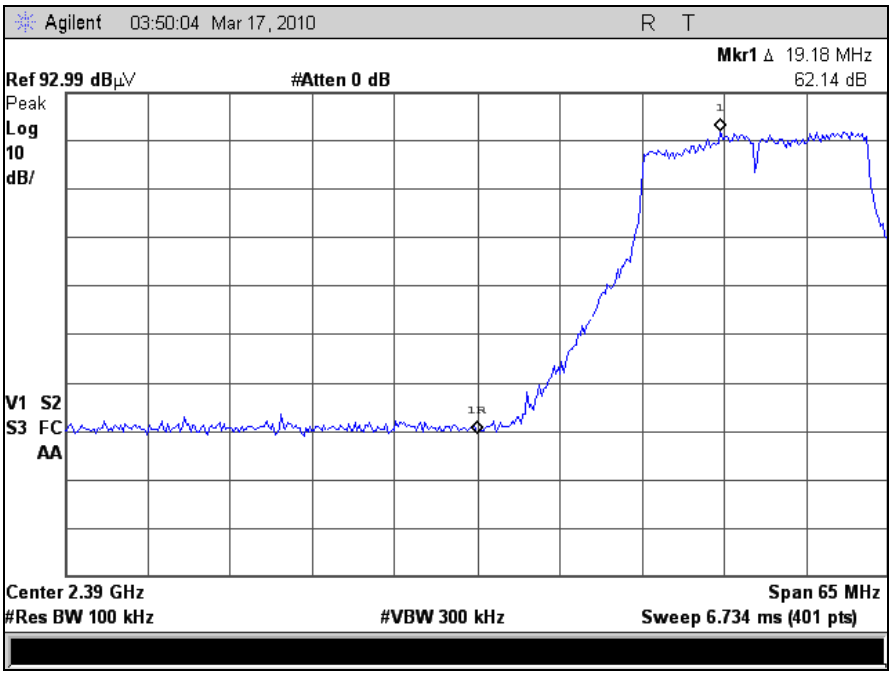


Plot 63. Radiated Spurious Emissions, n Mode HT20, Low Channel, 2.4 GHz, 20 dBc

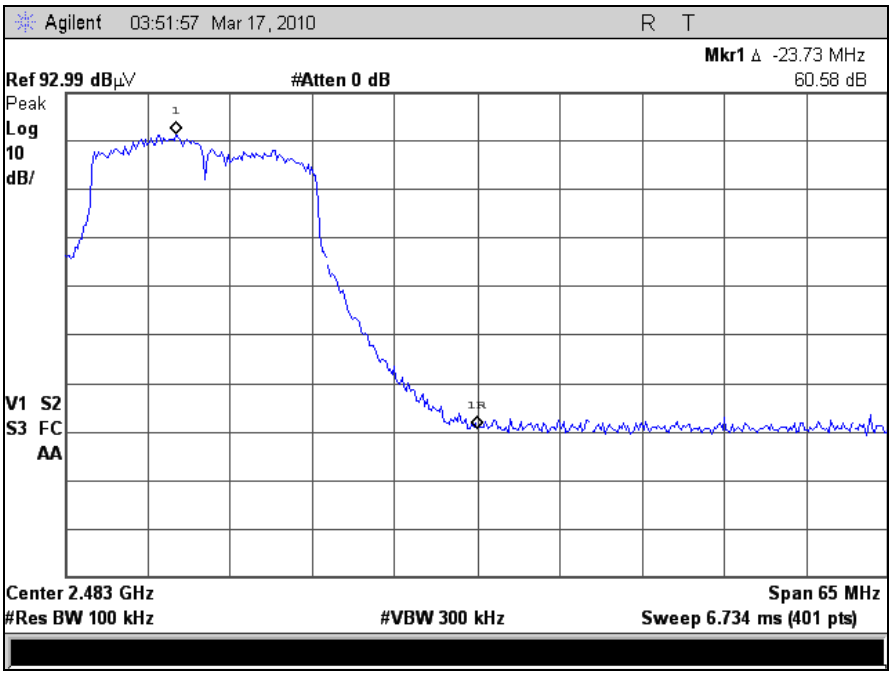


Plot 64. Radiated Spurious Emissions, n Mode HT20, High Channel, 2.4 GHz, 20 dBc

Radiated Spurious Emissions Test Results

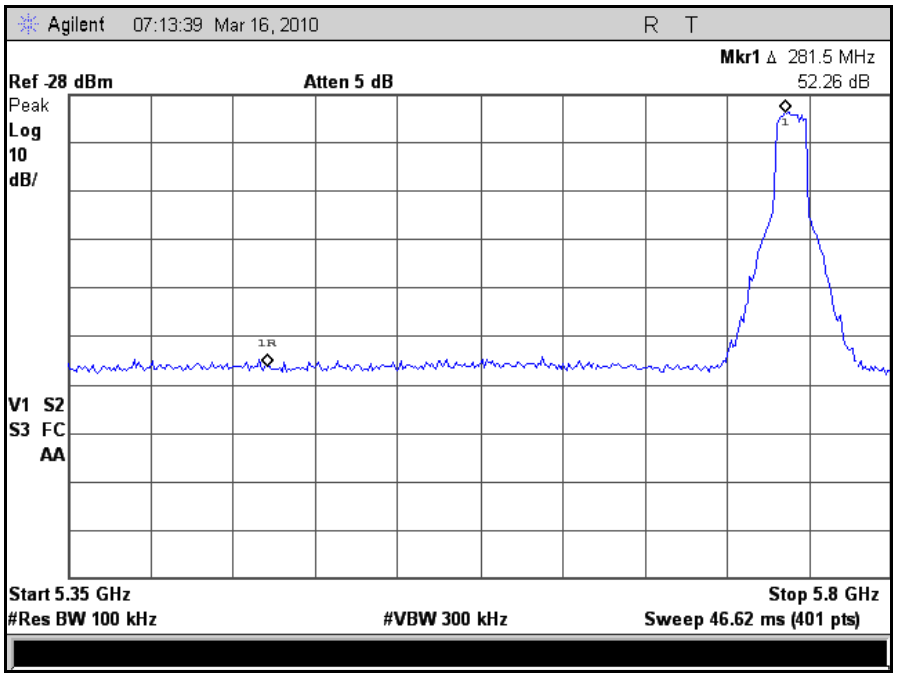


Plot 65. Radiated Spurious Emissions, n Mode HT40, Low Channel, 2.4 GHz, 20 dBc

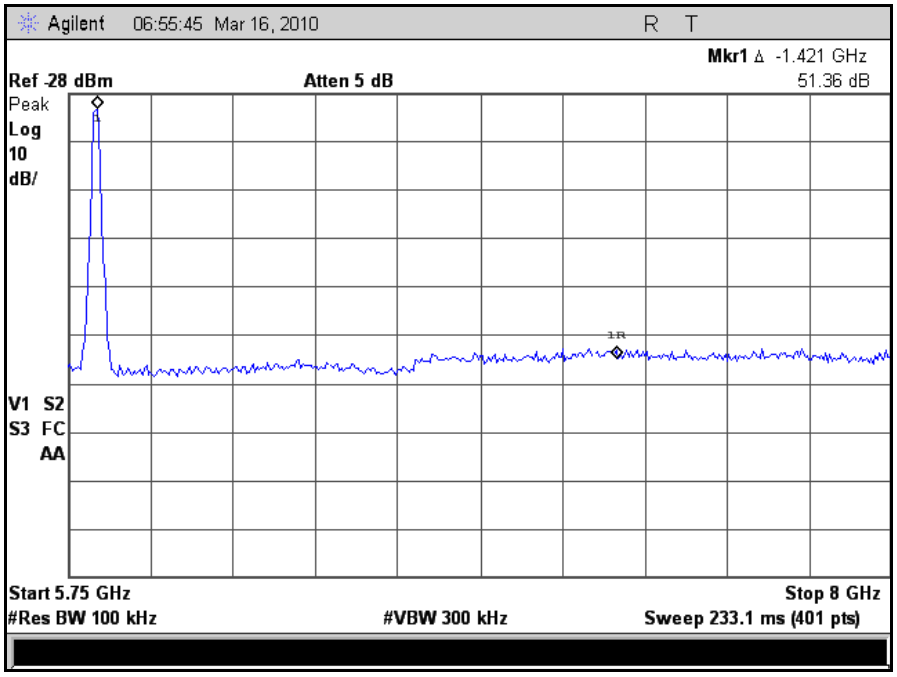


Plot 66. Radiated Spurious Emissions, n Mode HT40, High Channel, 2.4 GHz, 20 dBc

Radiated Spurious Emissions Test Results

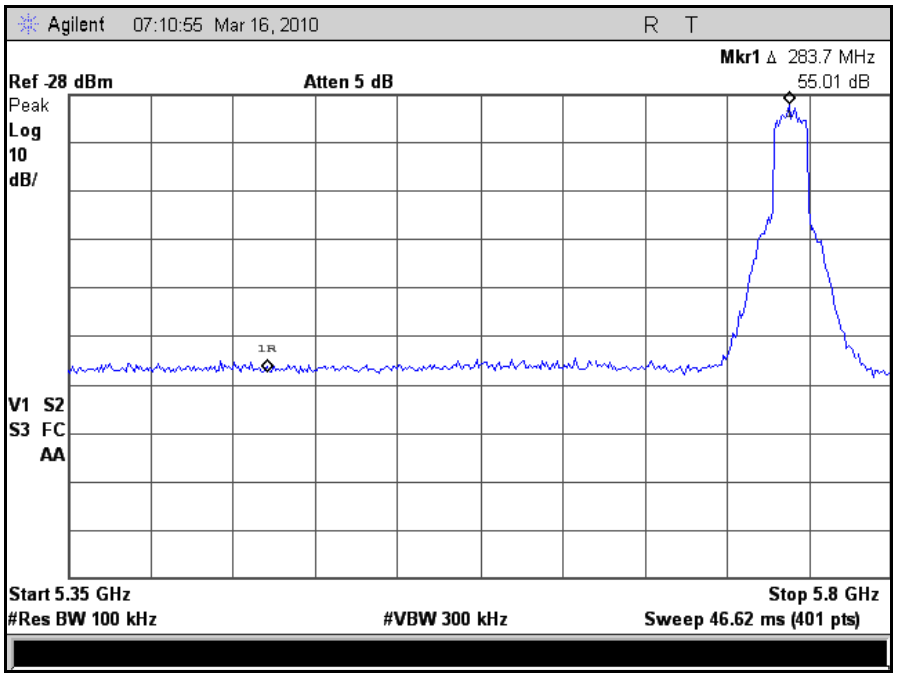


Plot 67. Radiated Spurious Emissions, a Mode, Low Channel, 5 GHz, 20 dBc

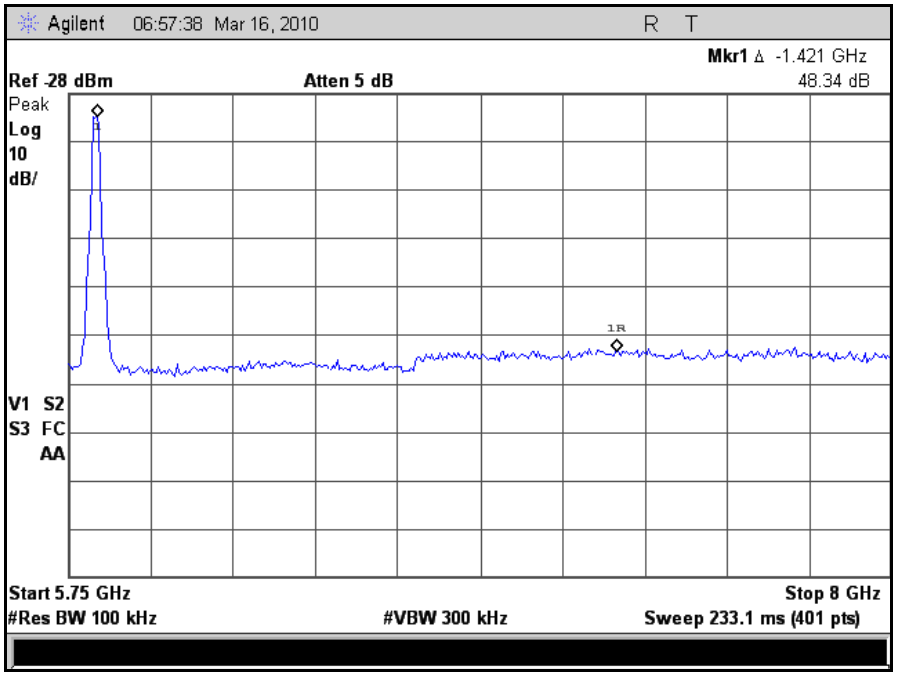


Plot 68. Radiated Spurious Emissions, a Mode, High Channel, 5 GHz, 20 dBc

Radiated Spurious Emissions Test Results

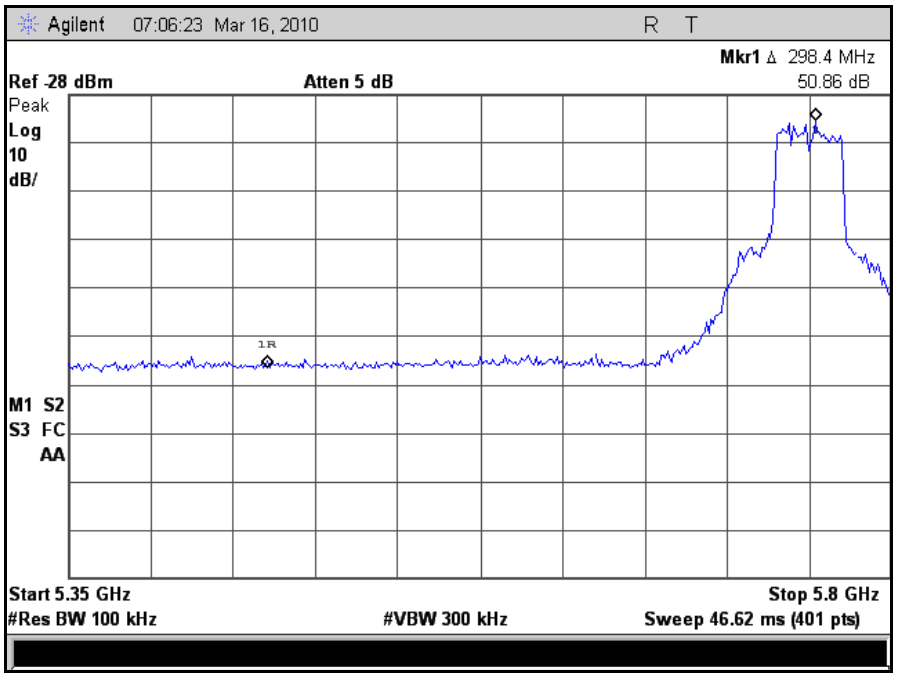


Plot 69. Radiated Spurious Emissions, n Mode 20HT, Low Channel, 5 GHz, 20 dBc

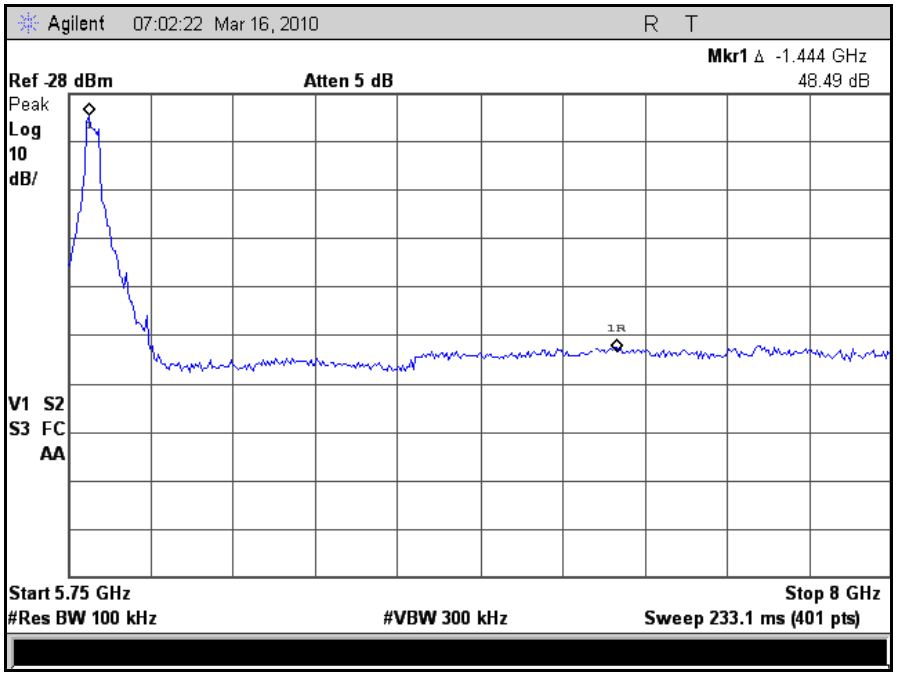


Plot 70. Radiated Spurious Emissions, n Mode 20HT, High Channel, 5 GHz, 20 dBc

Radiated Spurious Emissions Test Results

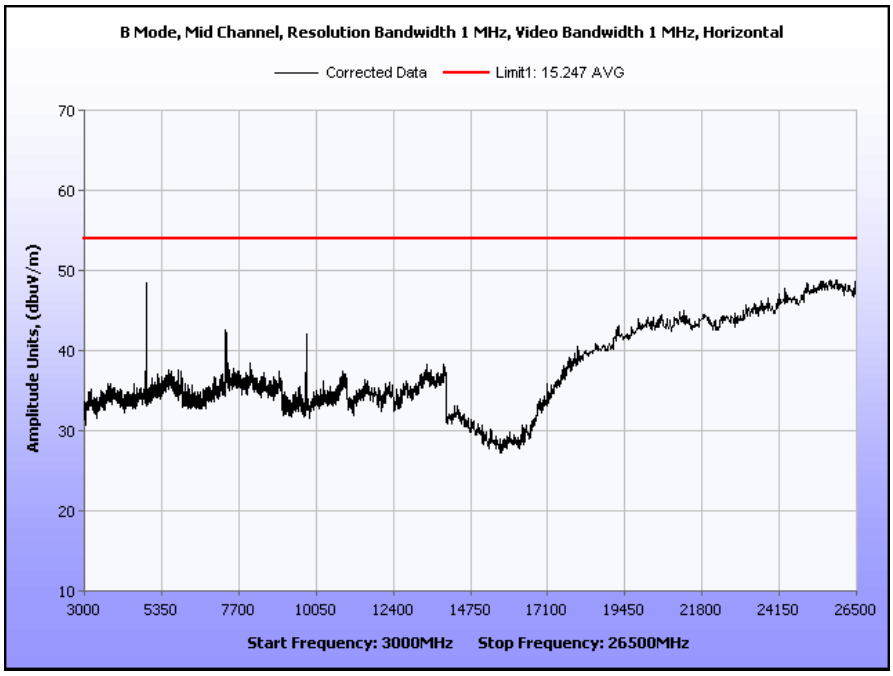


Plot 71. Radiated Spurious Emissions, n Mode 40HT, Low Channel, 5 GHz, 20 dBc

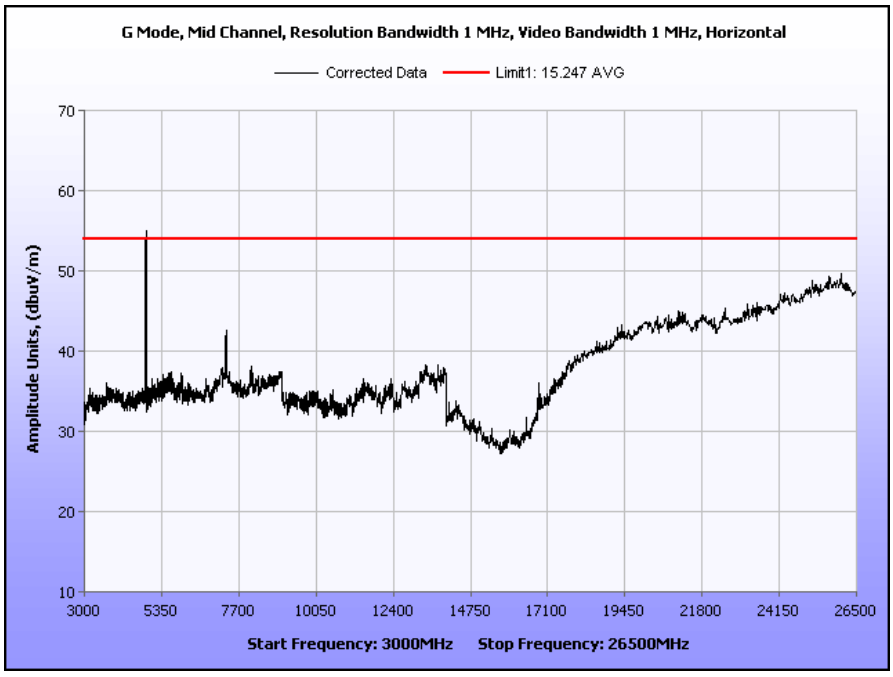


Plot 72. Radiated Spurious Emissions, n Mode 40HT, High Channel, 5 GHz, 20 dBc

Radiated Spurious Emissions Test Results

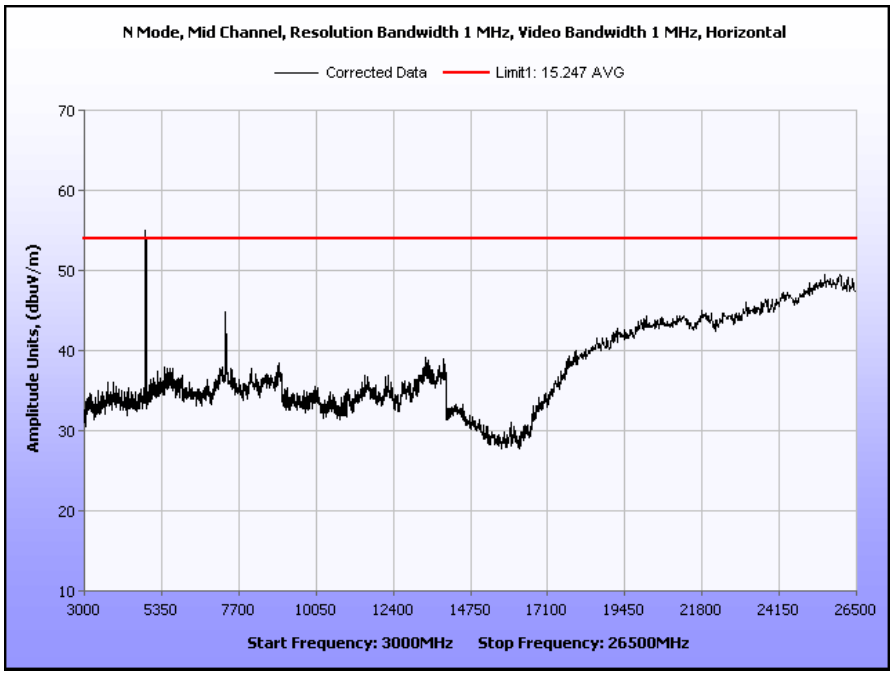


Plot 73. Radiated Spurious Emissions, b Mode, Peak Horizontal, 2.4 GHz



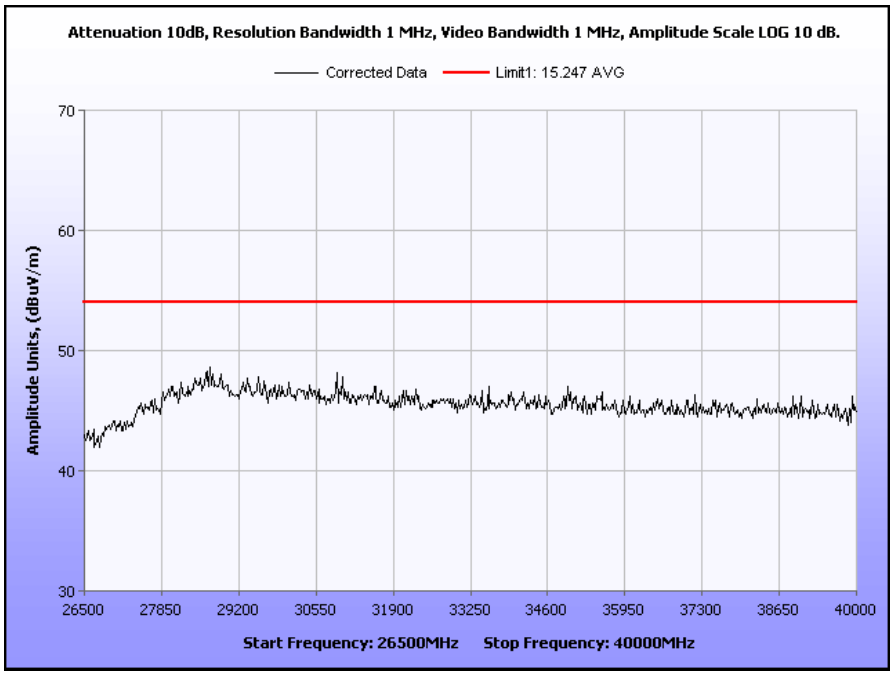
Plot 74. Radiated Spurious Emissions, g Mode, Peak Horizontal, 2.4 GHz

Radiated Spurious Emissions Test Results

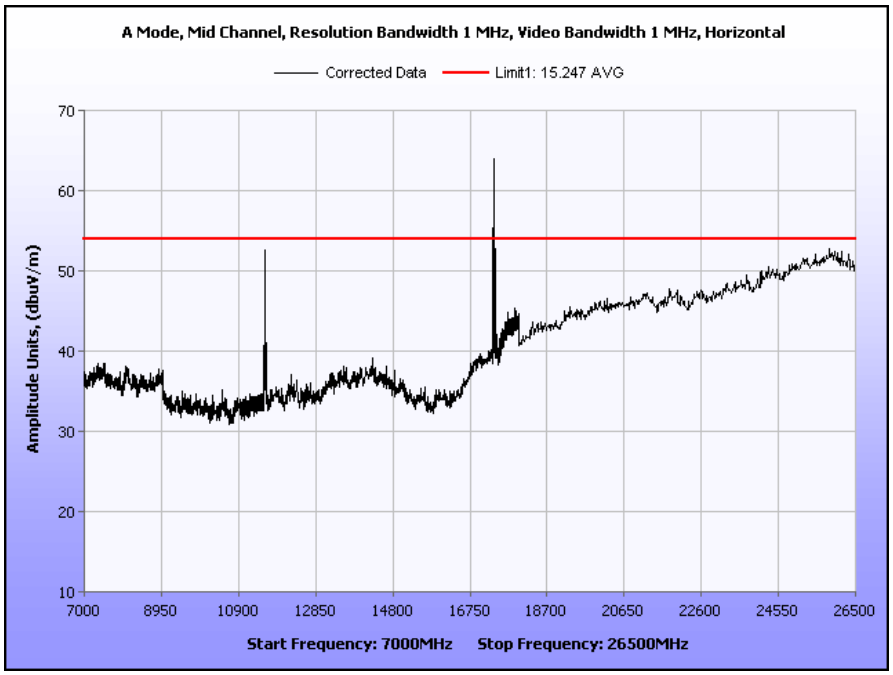


Plot 75. Radiated Spurious Emissions, n Mode, Peak Horizontal, 2.4 GHz

Radiated Spurious Emissions Test Results

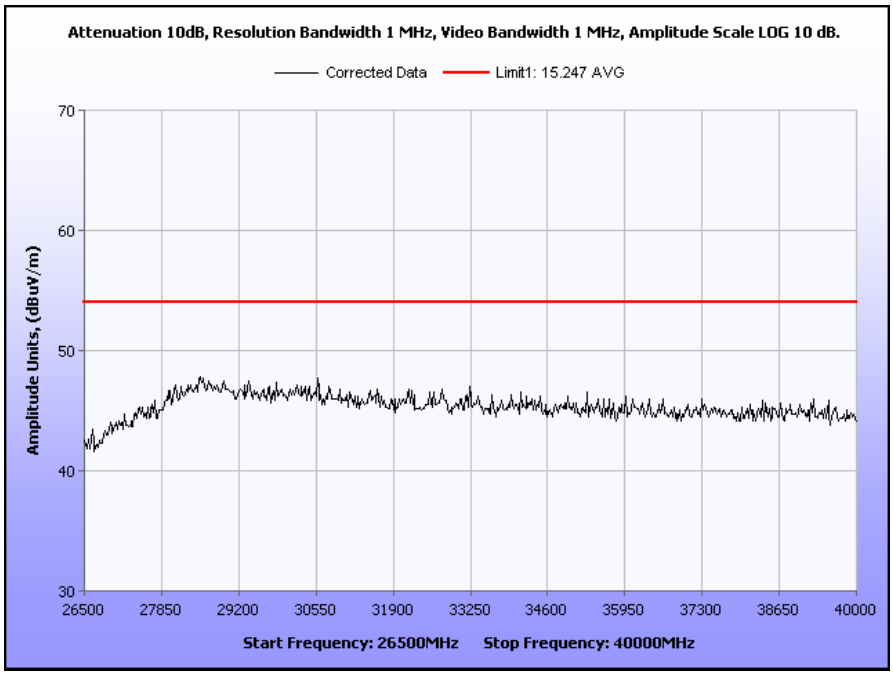


Plot 76. Radiated Spurious Emissions, a Mode, Peak Vertical, 5 GHz

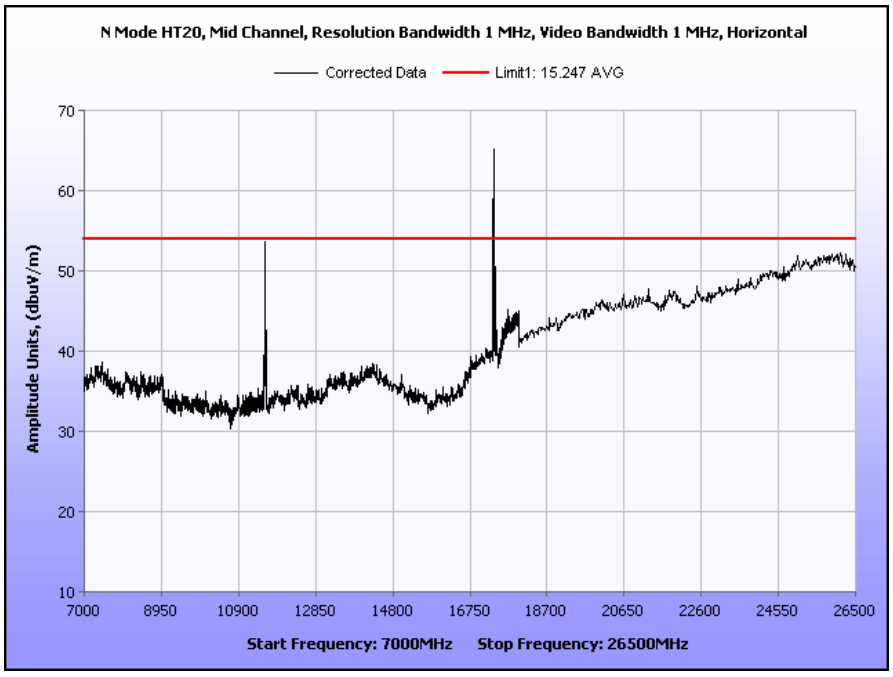


Plot 77. Radiated Spurious Emissions, a Mode, Peak Horizontal, 5 GHz

Radiated Spurious Emissions Test Results

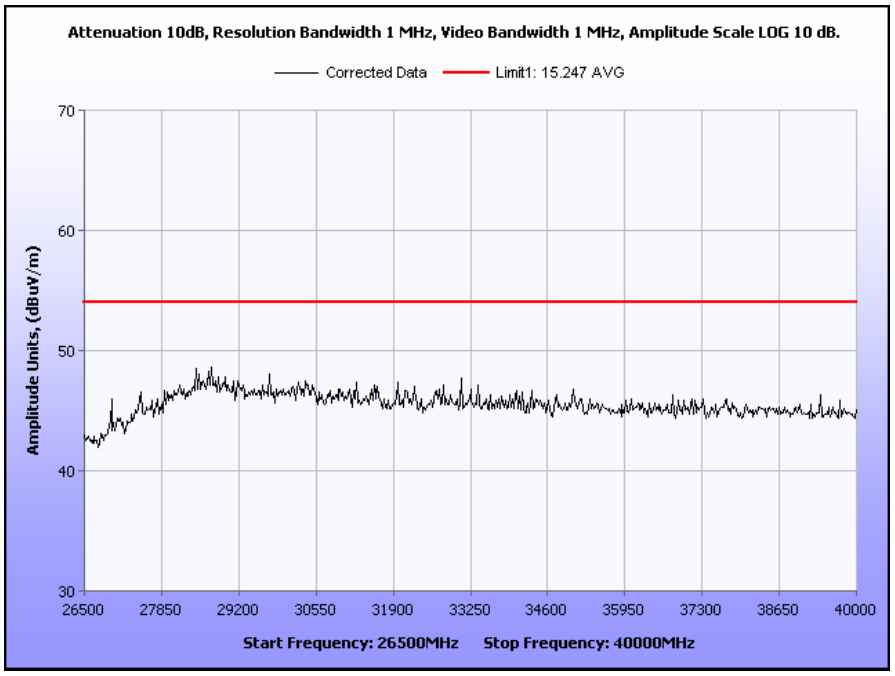


Plot 78. Radiated Spurious Emissions, n Mode HT20, Peak Vertical, 5 GHz

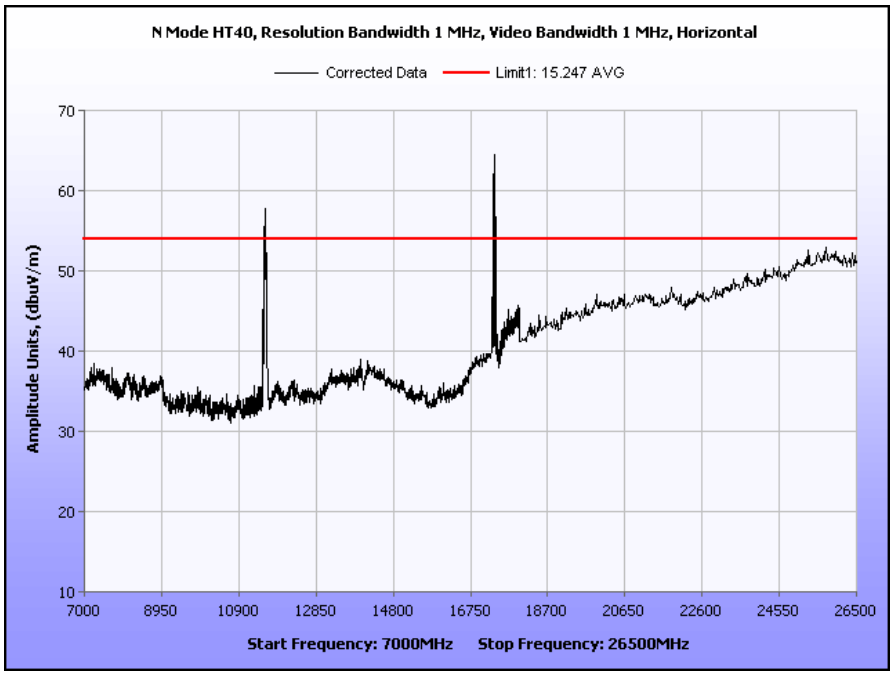


Plot 79. Radiated Spurious Emissions, n Mode HT20, Peak Horizontal, 5 GHz

Radiated Spurious Emissions Test Results



Plot 80. Radiated Spurious Emissions, n Mode HT40, Peak Vertical, 5 GHz

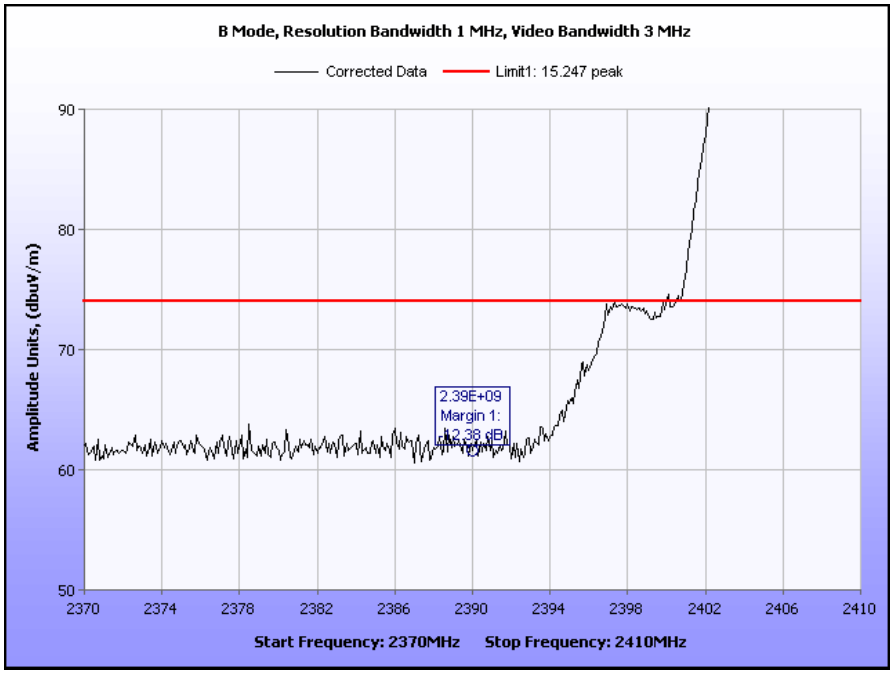


Plot 81. Radiated Spurious Emissions, n Mode HT40, Peak Horizontal, 5 GHz

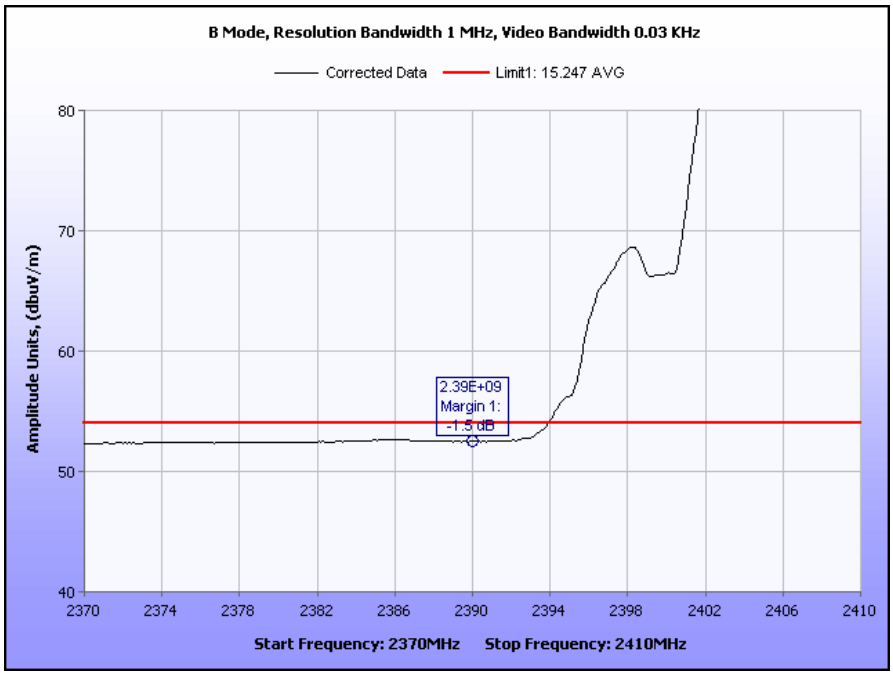
Radiated Spurious Emissions Test Setup

Radiated Band Edge Measurements

Test Procedures: The transmitter was turned. Measurements were performed of the low, mid and high Channels. The EUT was rotated. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit like.

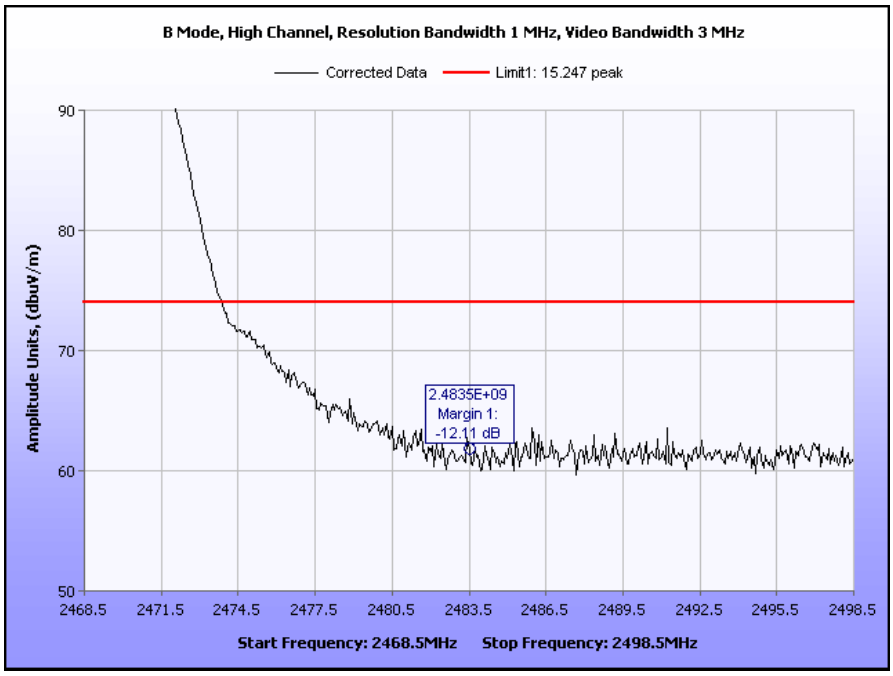


Plot 82. Radiated Restricted Band, Low Channel, b Mode, Peak, 2.4 GHz

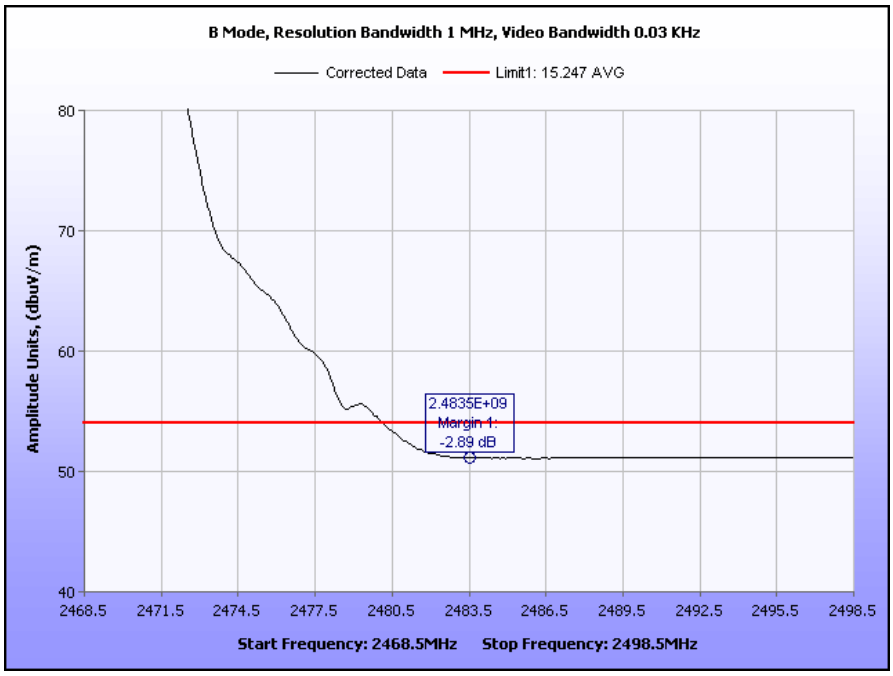


Plot 83. Radiated Restricted Band, Low Channel, b Mode, Average, 2.4 GHz

Radiated Band Edge Measurements Test Results

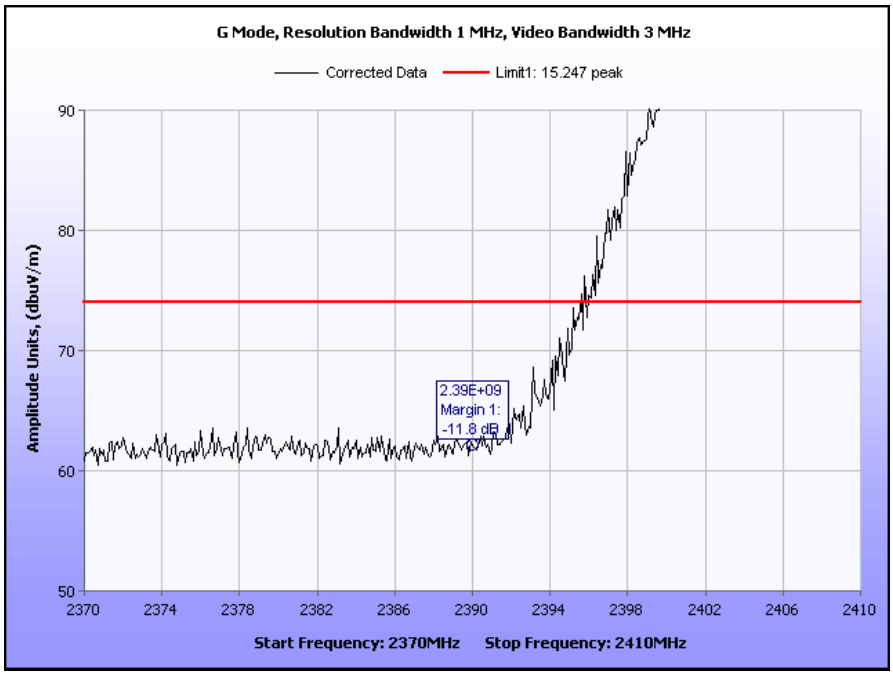


Plot 84. Radiated Restricted Band, High Channel, b Mode, Peak, 2.4 GHz

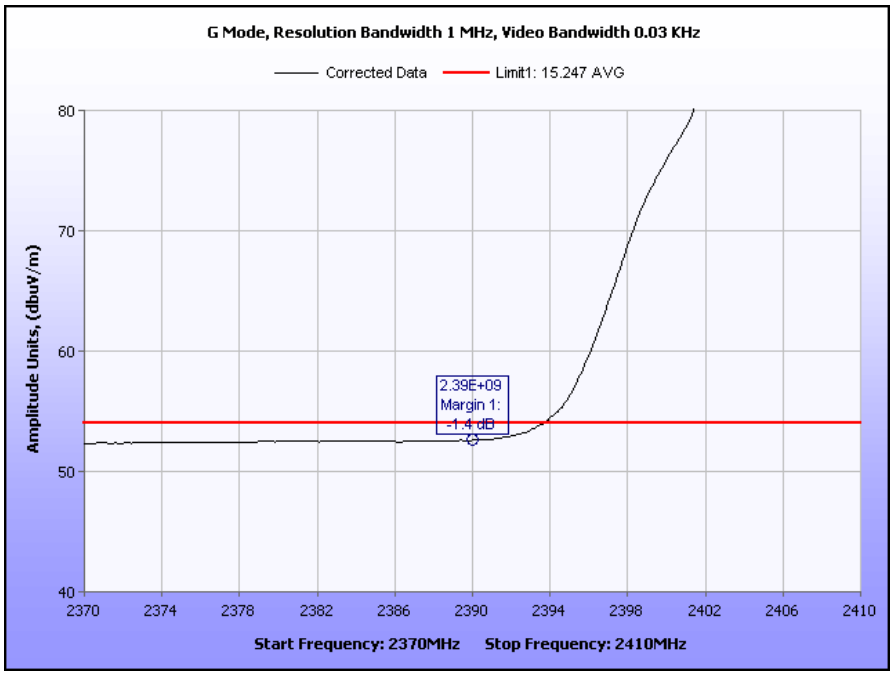


Plot 85. Radiated Restricted Band, High Channel, b Mode, Average, 2.4 GHz

Radiated Band Edge Measurements Test Results

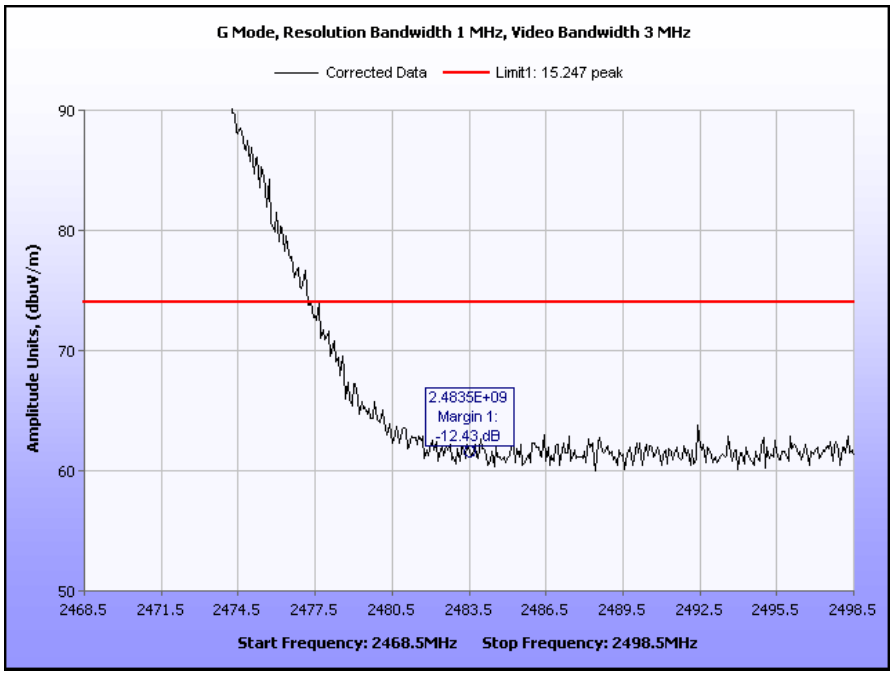


Plot 86. Radiated Restricted Band, Low Channel, g Mode, Peak, 2.4 GHz

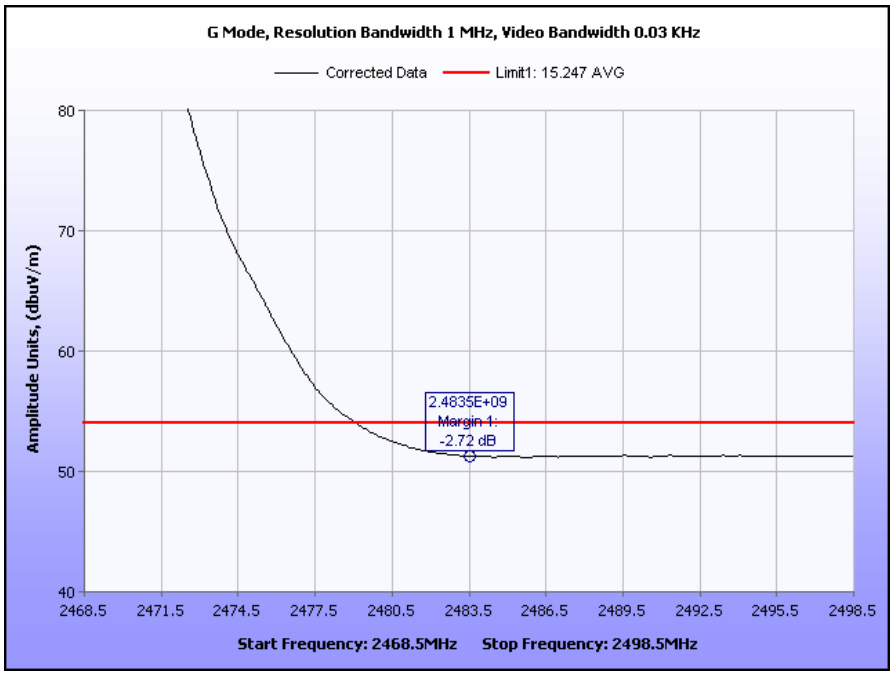


Plot 87. Radiated Restricted Band, Low Channel, g Mode, Average, 2.4 GHz

Radiated Band Edge Measurements Test Results

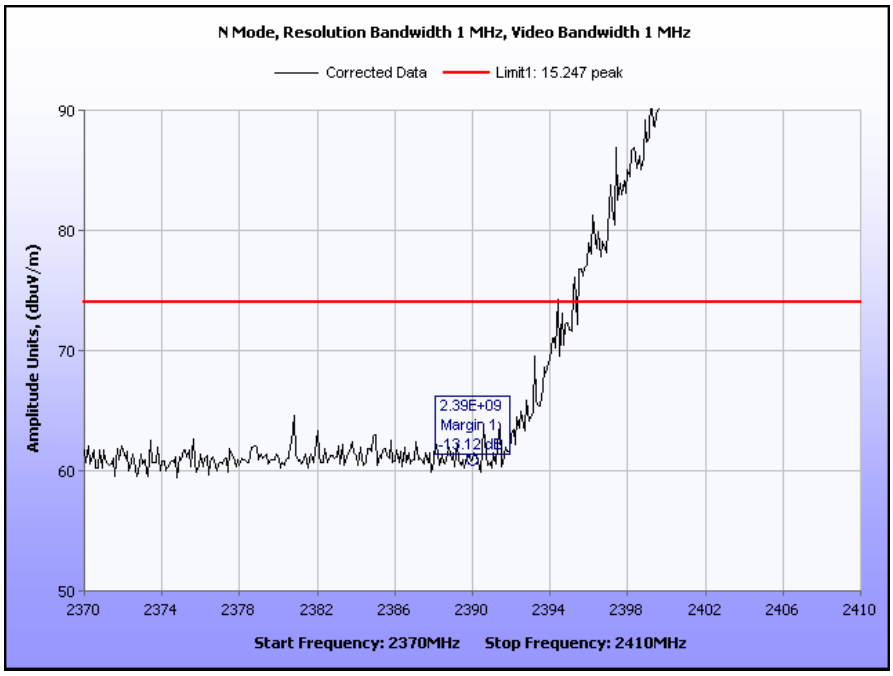


Plot 88. Radiated Restricted Band, High Channel, g Mode, Peak, 2.4 GHz

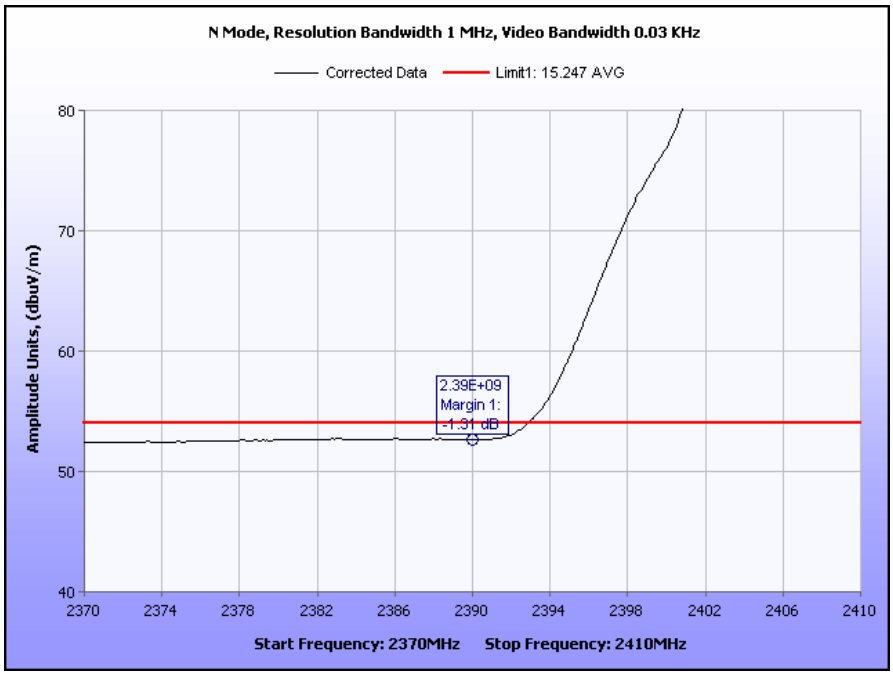


Plot 89. Radiated Restricted Band, High Channel, g Mode, Average, 2.4 GHz

Radiated Band Edge Measurements Test Results

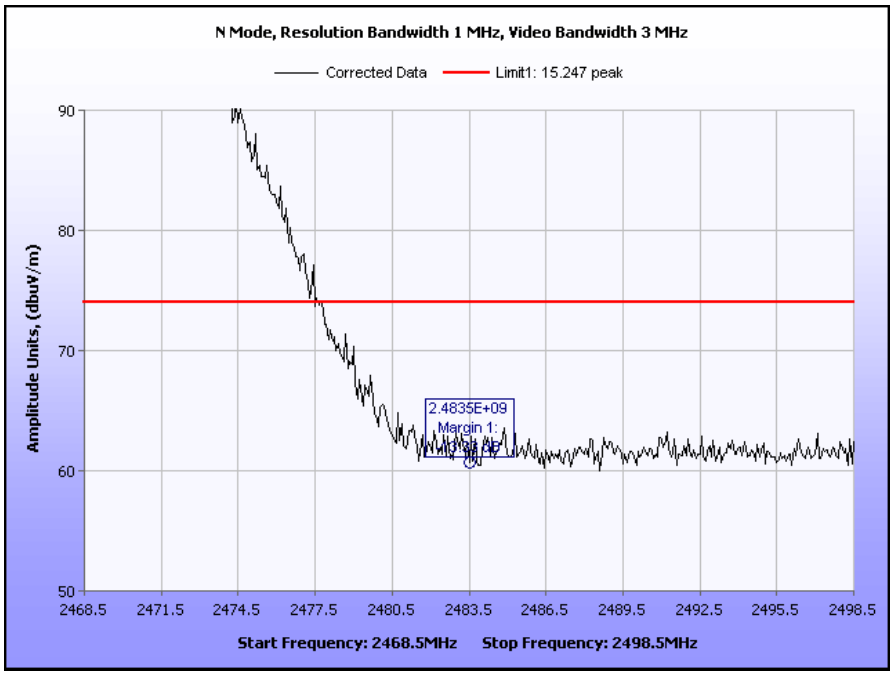


Plot 90. Radiated Restricted Band, Low Channel, n Mode HT20, Peak, 2.4 GHz

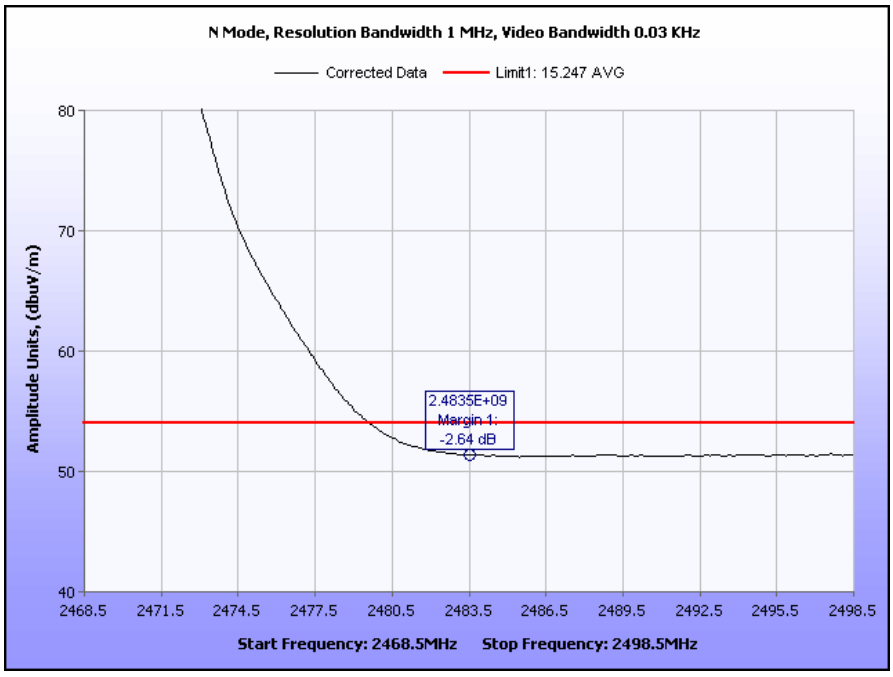


Plot 91. Radiated Restricted Band, Low Channel, n Mode HT20, Average, 2.4 GHz

Radiated Band Edge Measurements Test Results

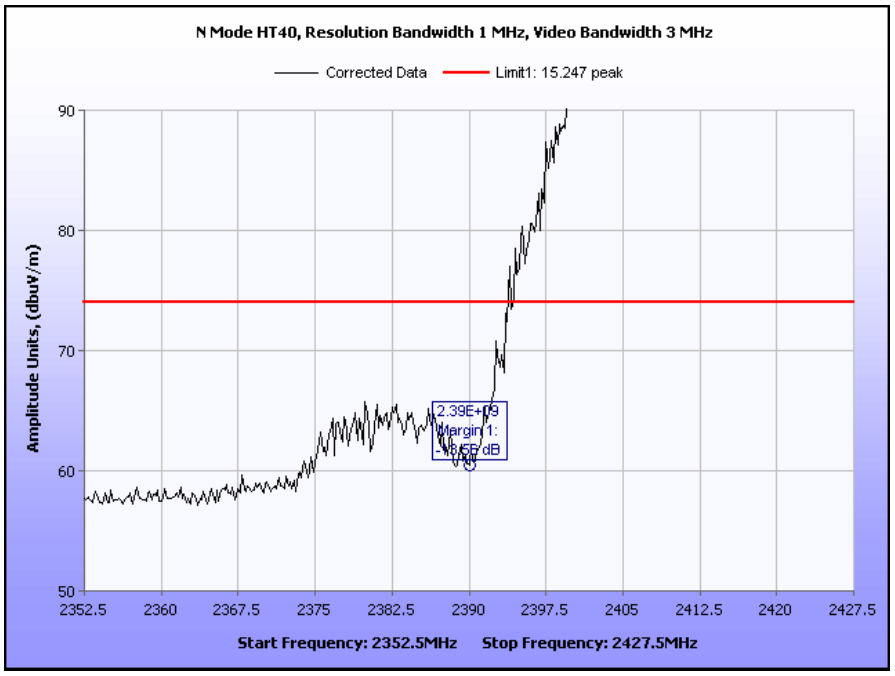


Plot 92. Radiated Restricted Band, High Channel, n Mode HT20, Peak, 2.4 GHz

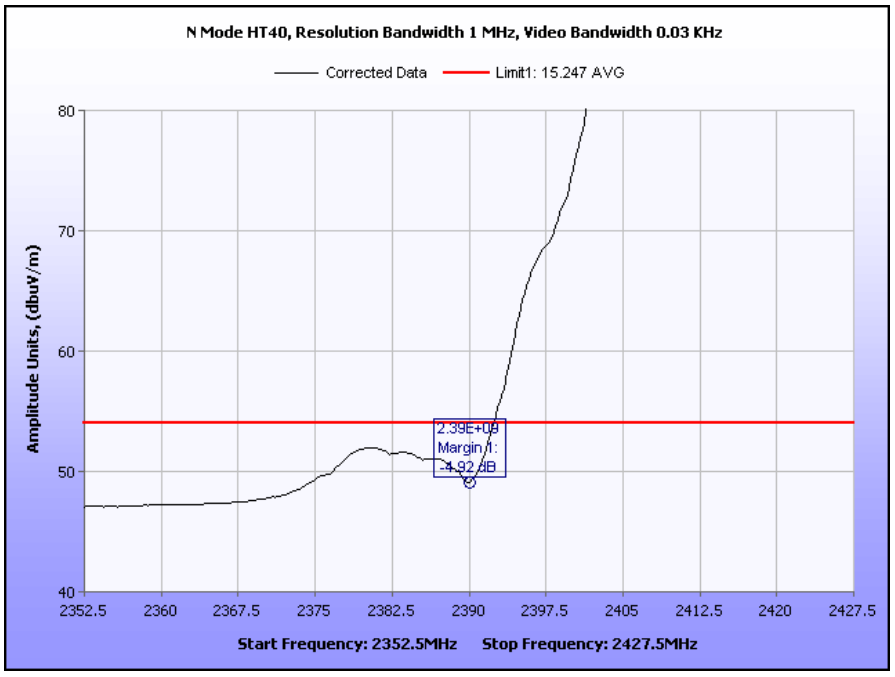


Plot 93. Radiated Restricted Band, High Channel, n Mode HT20, Average, 2.4 GHz

Radiated Band Edge Measurements Test Results

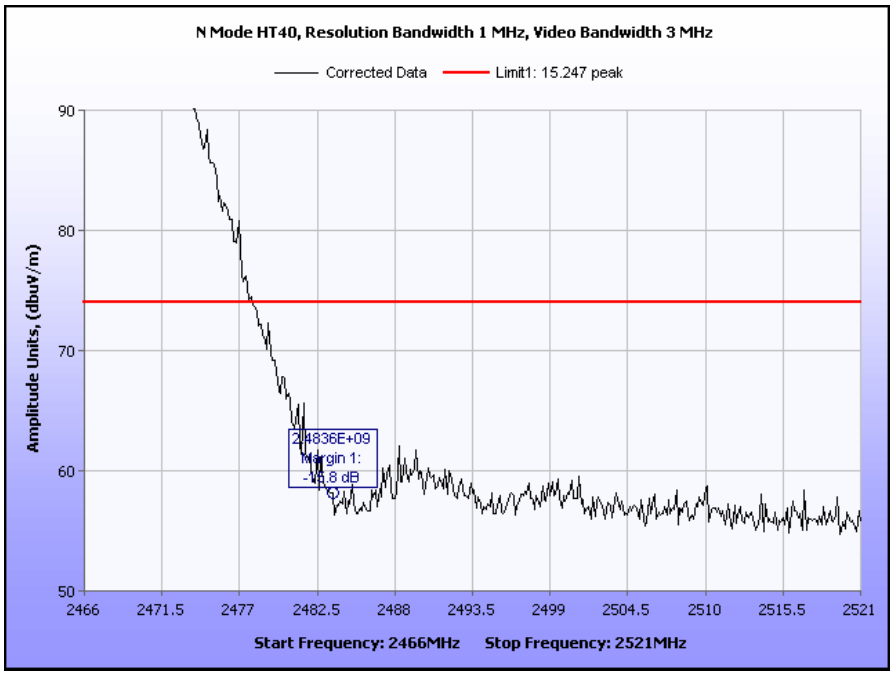


Plot 94. Radiated Restricted Band, Low Channel, n Mode HT40, Peak, 2.4 GHz

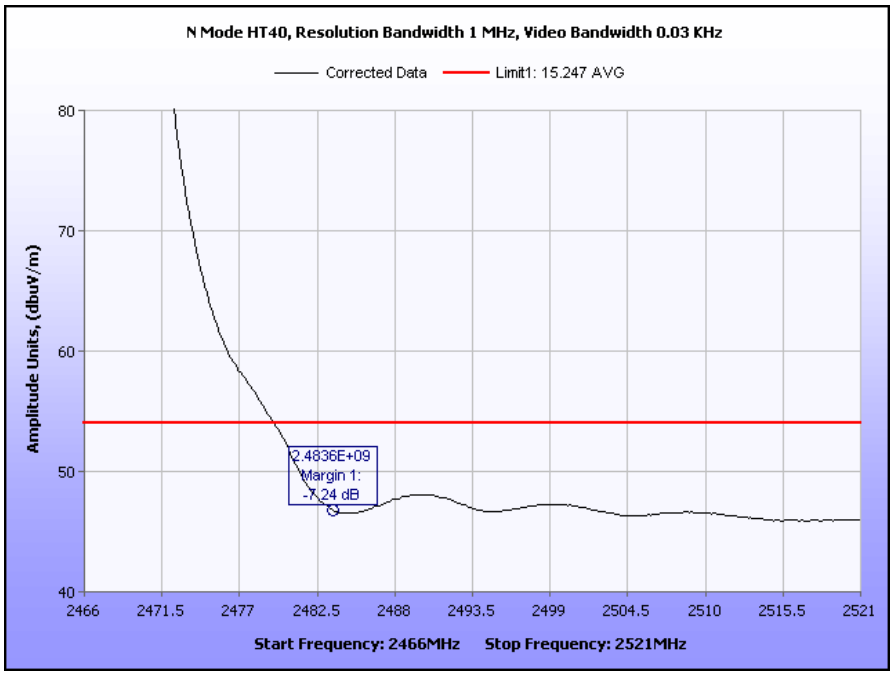


Plot 95. Radiated Restricted Band, Low Channel, n Mode HT40, Average, 2.4 GHz

Radiated Band Edge Measurements Test Results

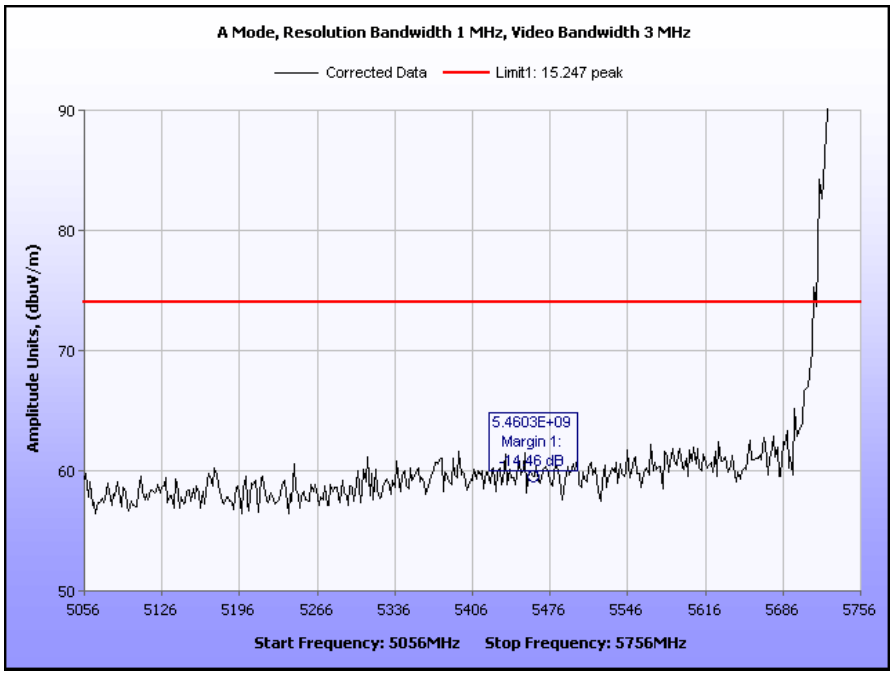


Plot 96. Radiated Restricted Band, High Channel, n Mode HT40, Peak, 2.4 GHz

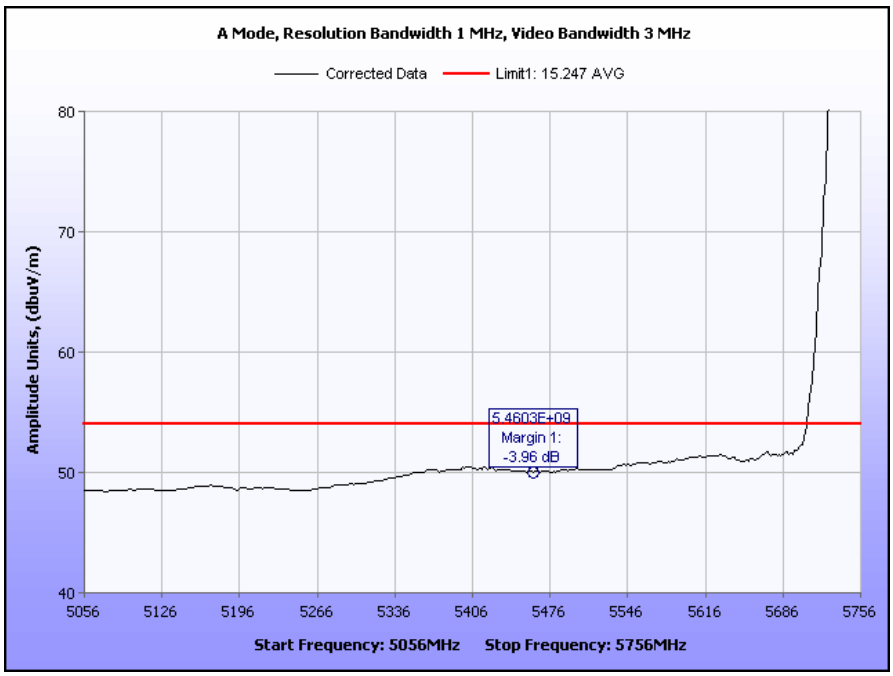


Plot 97. Radiated Restricted Band, High Channel, n Mode HT40, Average, 2.4 GHz

Radiated Band Edge Measurements Test Results

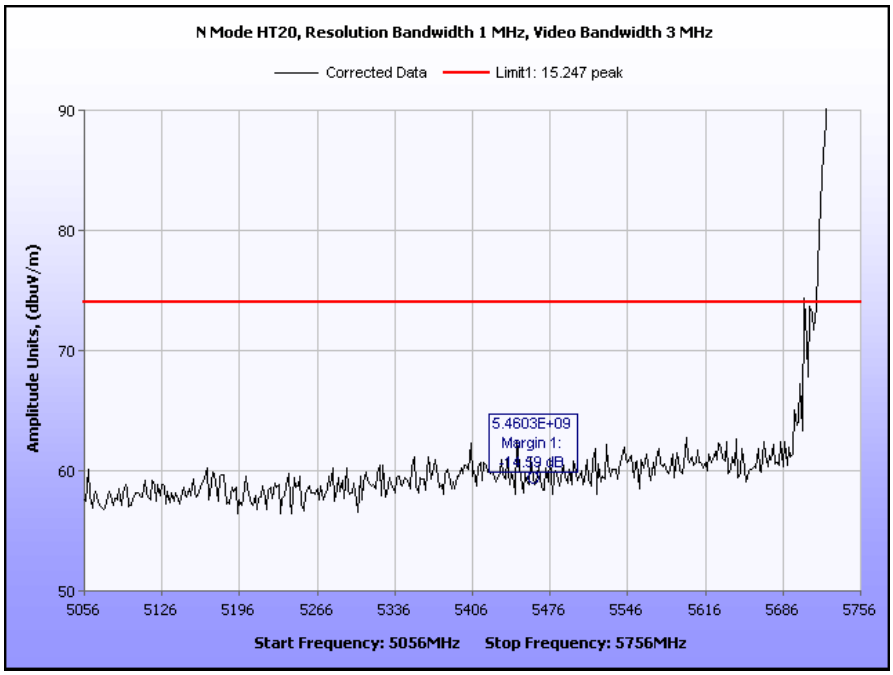


Plot 98. Radiated Restricted Band, Low Channel, a Mode, Peak

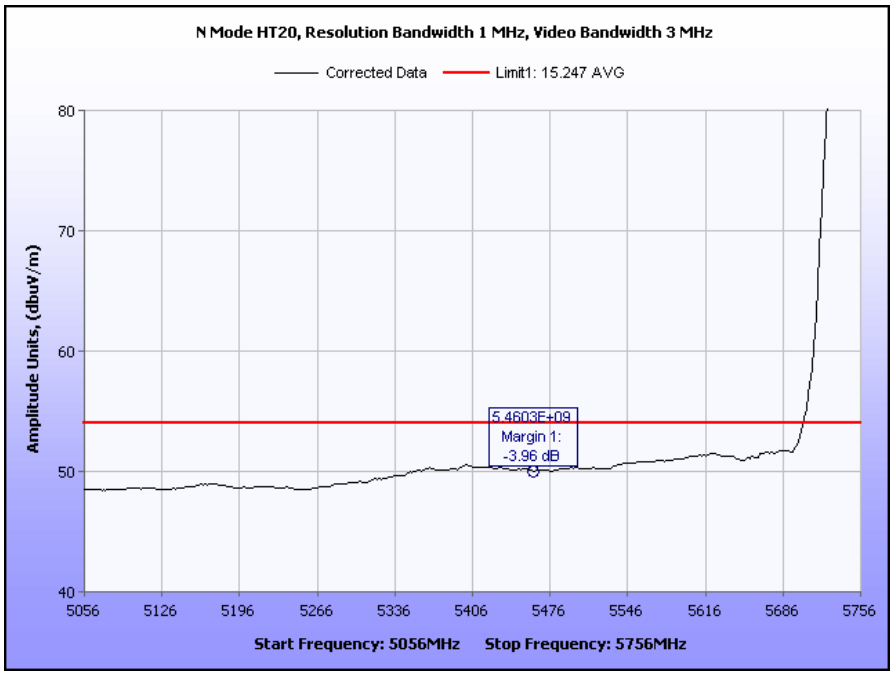


Plot 99. Radiated Restricted Band, Low Channel, a Mode, Average

Radiated Band Edge Measurements Test Results

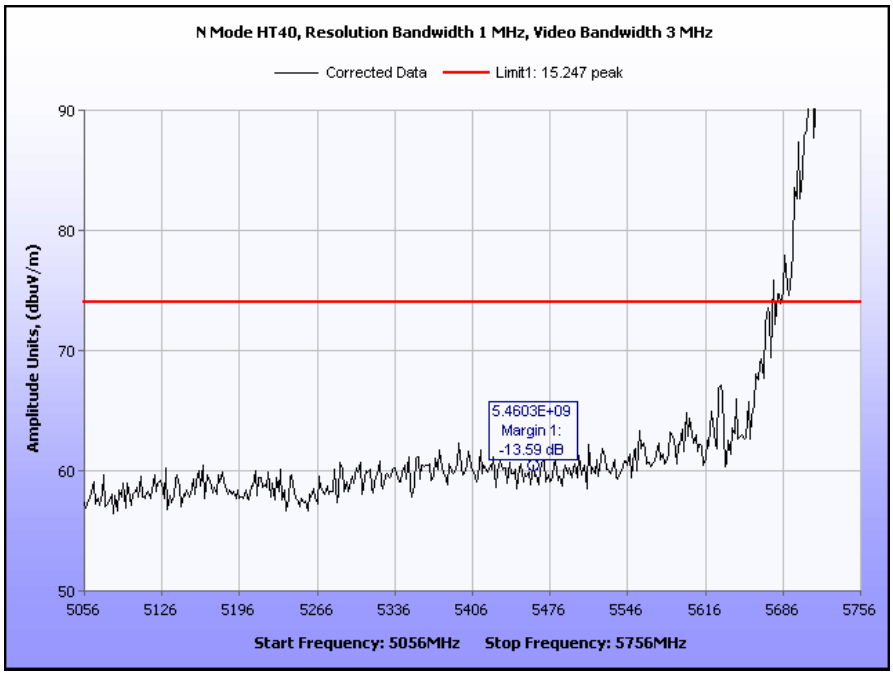


Plot 100. Radiated Restricted Band, Low Channel, n Mode HT20, Peak

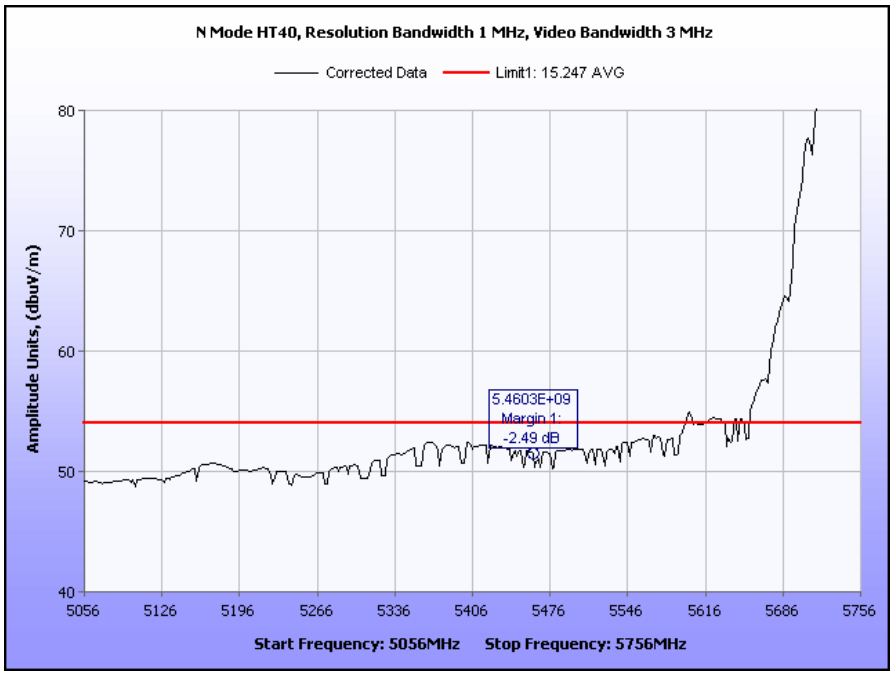


Plot 101. Radiated Restricted Band, Low Channel, n Mode HT20, Average

Radiated Band Edge Measurements Test Results



Plot 102. Radiated Restricted Band, Low Channel, n Mode HT40, Peak



Plot 103. Radiated Restricted Band, Low Channel, n Mode HT40, Average

Electromagnetic Compatibility Criteria for Intentional Radiators

RSS-GEN Receiver Spurious Emissions Requirements

Test Requirements: The following receiver spurious emission limits shall be complied with:

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 30.

Spurious Frequency (MHz)	Field Strength (microvolt/m at 3 metres)
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

Table 30. Spurious Emission Limits for Receivers

(b) If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

Test Procedures: The EUT was set for receive mode only. The EUT was rotated and the receive antenna adjusted between 1m and 4m.

Test Results: Equipment is compliant with the Receiver Spurious Emissions Requirements of RSS-GEN.

Test Engineer(s): Len Knight

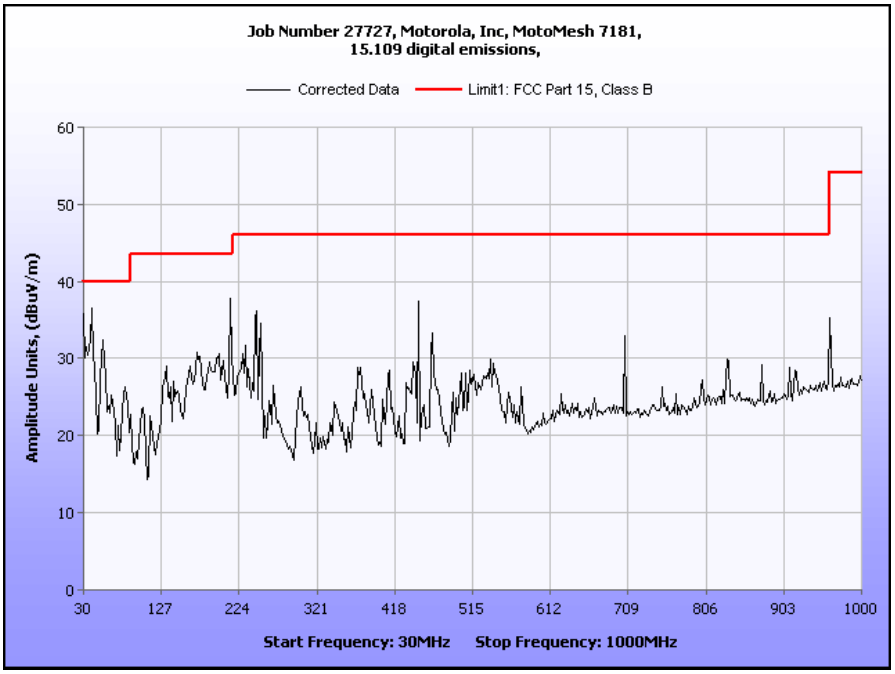
Test Date(s): 03/09/10

Conducted Receiver Spurious Emissions

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.080	0	H	2.46	10.84	4.74	0.23	10.46	5.35	30.00	-24.65
30.080	359	V	1.01	27.66	3.75	0.23	10.46	21.18	30.00	-8.82
35.130	46	H	1.98	5.18	7.24	0.23	10.46	2.19	30.00	-27.81
35.130	358	V	1.00	15.54	6.73	0.23	10.46	12.04	30.00	-17.96
82.725	266	H	2.59	10.37	6.91	0.23	10.46	7.05	30.00	-22.95
82.725	274	V	1.00	15.66	7.23	0.23	10.46	12.66	30.00	-17.34
200.655	106	H	1.40	12.16	10.21	0.23	10.46	12.14	30.00	-17.86
200.655	330	V	1.00	22.62	10.15	0.23	10.46	22.54	30.00	-7.46
225.626	81	H	1.35	11.36	10.61	0.24	10.46	11.75	30.00	-18.25
225.626	23	V	1.25	16.48	10.99	0.24	10.46	17.24	30.00	-12.76
447.985	103	H	1.17	21.58	16.36	1.00	10.46	28.48	37.00	-8.52
447.985	117	V	1.00	22.72	16.72	1.00	10.46	29.98	37.00	-7.02

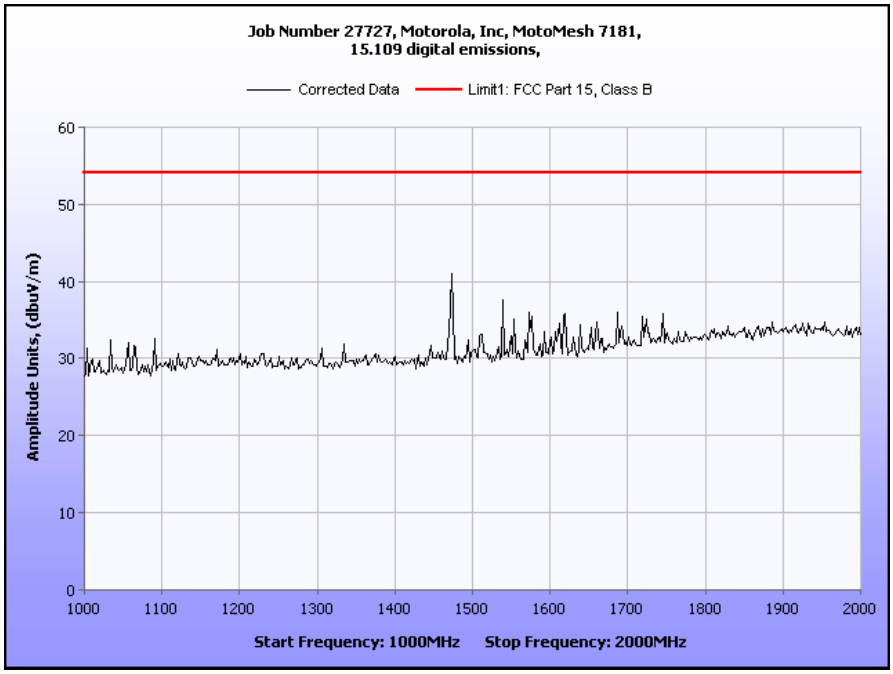
Table 31. Receiver Spurious Emissions, Test Results

Note: The EUT was tested at 3 m.



Plot 104. Receiver Spurious Emissions, 30 MHz - 1 GHz

Conducted Receiver Spurious Emissions



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) RF Conducted Spurious Emissions Requirements and Band Edge

Test Requirement: **15.247(d)** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at leas 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Test Results: The EUT was Not Applicable with the Conducted Spurious Emission limits of **§15.247(d)**. Since the radio cannot be operated properly without the antennas attached, all measurements must be made radiated.

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(e) Peak Power Spectral Density

Test Requirements: **§15.247(e):** For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

Test Procedure: Because of the integral operation between the antennas and the power amplifier, measurements were performed radiated. Conducted Spectral Density was determined by subtracting the antenna gain from the measured Radiated Spectral Density.

The methods as described in FCC DTS guide March 23, 2005 (KDB# 558074) were used.

A. Tune the analyzer to the highest point of the maximized fundamental emission. Reset the analyzer to a RBW = 3 kHz, VBW > RBW, span = 300 kHz, sweep = 100 sec.
B. From the peak level obtained in (A), derive the field strength, E, by applying the appropriate antenna factor, cable loss, pre-amp, etc. Using the equation:
$P = (E \cdot d)^2 / 30 \times G$
G = numeric gain of EUT antenna = 15.849
E = field strength V/m
d = distance in meters

Test Results: The EUT was compliant with the peak power spectral density limits of **§ 15.247 (e)**.
The conducted spectral density was determined by subtracting the antenna gain from the measured radiated spectral. Since there are essentially two cross polarized antenna elements in each sector antenna the maximum aggregate spectral density from both polarizations would be the measured maximum plus the cross polarization antenna which is at least 6dB less. Therefore the highest conducted aggregate spectral density per antenna panel would be:
2.4GHz Band – (-0.784 + -6.784) = 0.189dBm
5.8GHz Band - (-3.478 + -9.478) = -2.5dBm
Therefore the total aggregate power across all elements is < 8dBm
Note: 2.4GHz and 5GHz radios do not operate simultaneously

Test Engineer: Len Knight

Test Date: 03/12/10

Peak Power Spectral Density Test Results

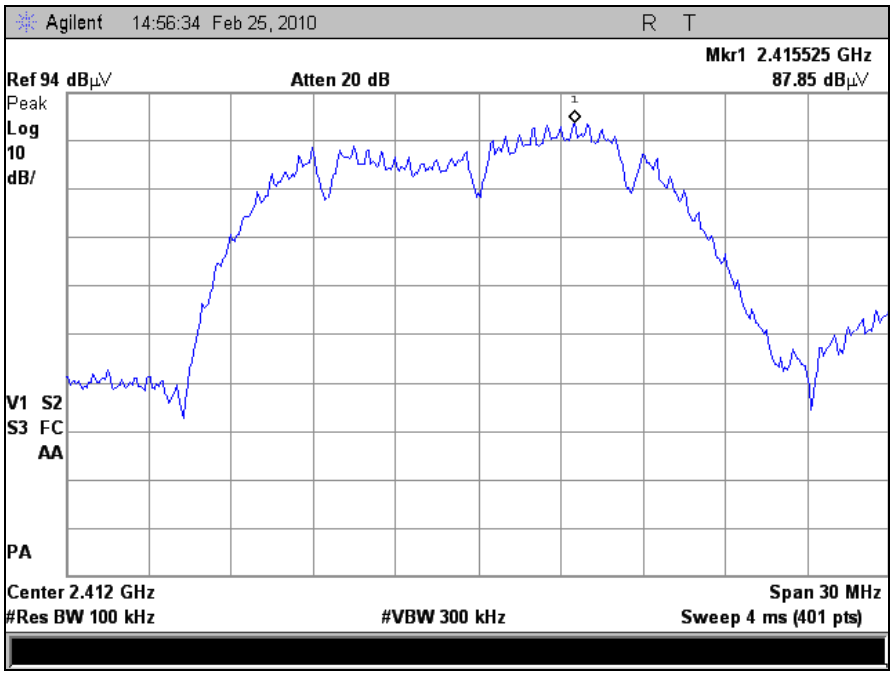
Peak Power Spectral Density – 2.4 GHz				
Mode	**Channel**	**Frequency (MHz)**	**Result (dBm)**	**Limit (dBm)**
b Mode	Low	2412	-0.784	8
	Mid	2437	-1.653	8
	High	2462	-2.62	8
g Mode	Low	2412	-5.645	8
	Mid	2437	-2.019	8
	High	2462	-6.4	8
n Mode HT20	Low	2412	-7.229	8
	Mid	2437	-4.95	8
	High	2462	-4.95	8
n Mode HT40	Low	2422	-6.4	8
	High	2452	-5.645	8

Table 32. Peak Power Spectral Density, Test Results, 2.4 GHz

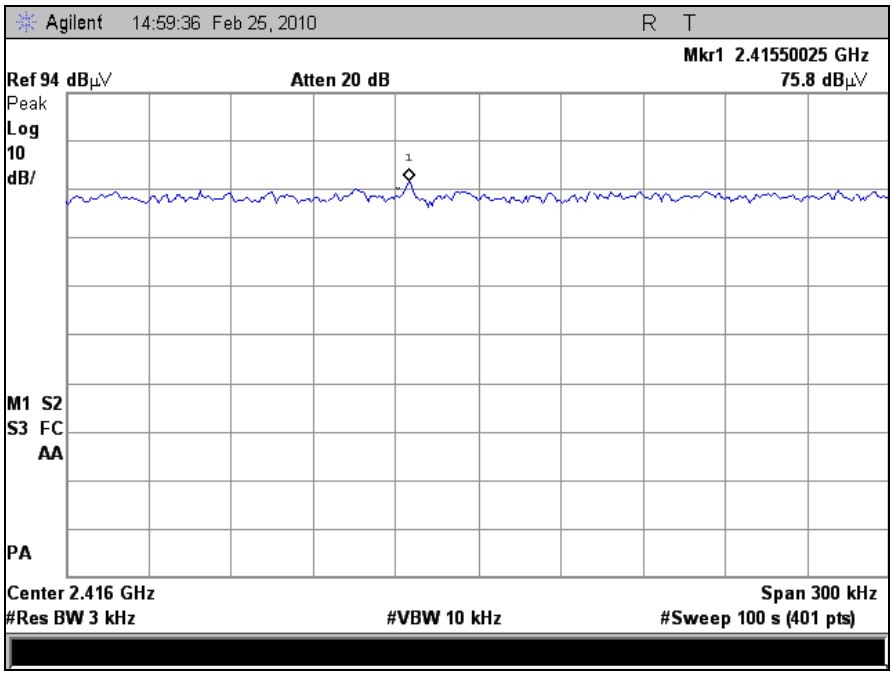
Peak Power Spectral Density – 5 GHz				
Mode	**Channel**	**Frequency (MHz)**	**Result (dBm)**	**Limit (dBm)**
a Mode	Low	5745	-3.478	8
	Mid	5785	-5.544	8
	High	5825	-4.369	8
n Mode HT20	Low	5745	-8.029	8
	Mid	5785	-4.431	8
	High	5825	-6.772	8
n Mode HT40	Low	5755	-10.49	8
	Mid	5785	-6.69	8
	High	5815	-10.269	8

Table 33. Peak Power Spectral Density, Test Results, 5 GHz

Peak Power Spectral Density

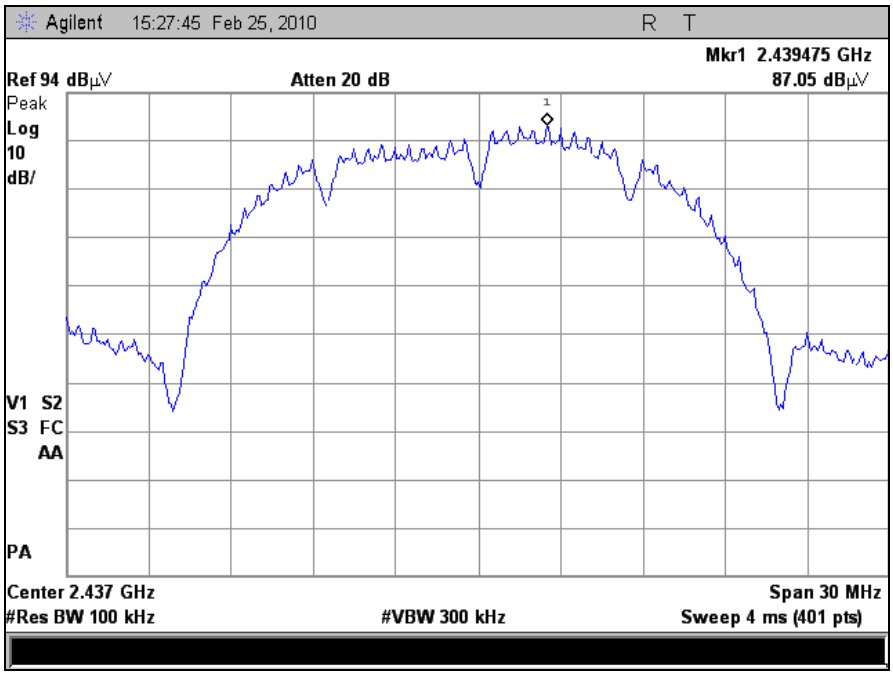


Plot 106. Peak Determination, Low Channel, b Mode, 2.4 GHz

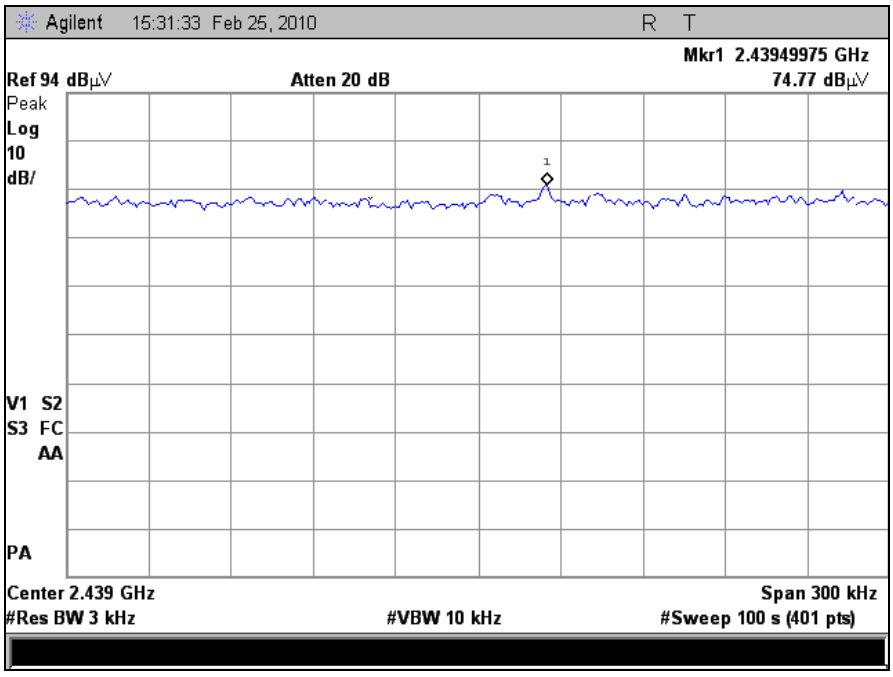


Plot 107. Peak Power Spectral Density, Low Channel, b Mode, 2.4 GHz

Peak Power Spectral Density

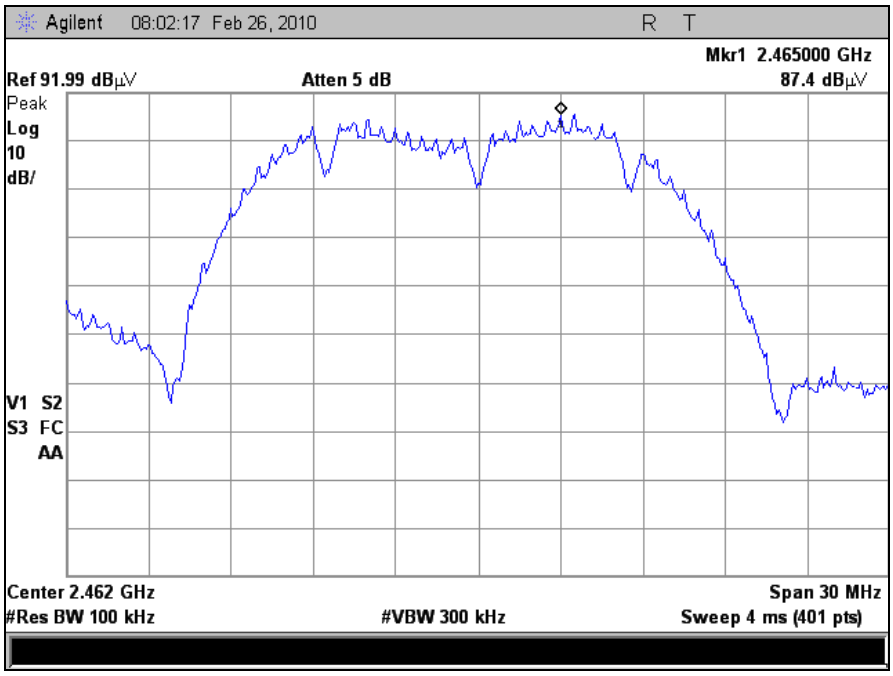


Plot 108. Peak Determination, Mid Channel, b Mode, 2.4 GHz

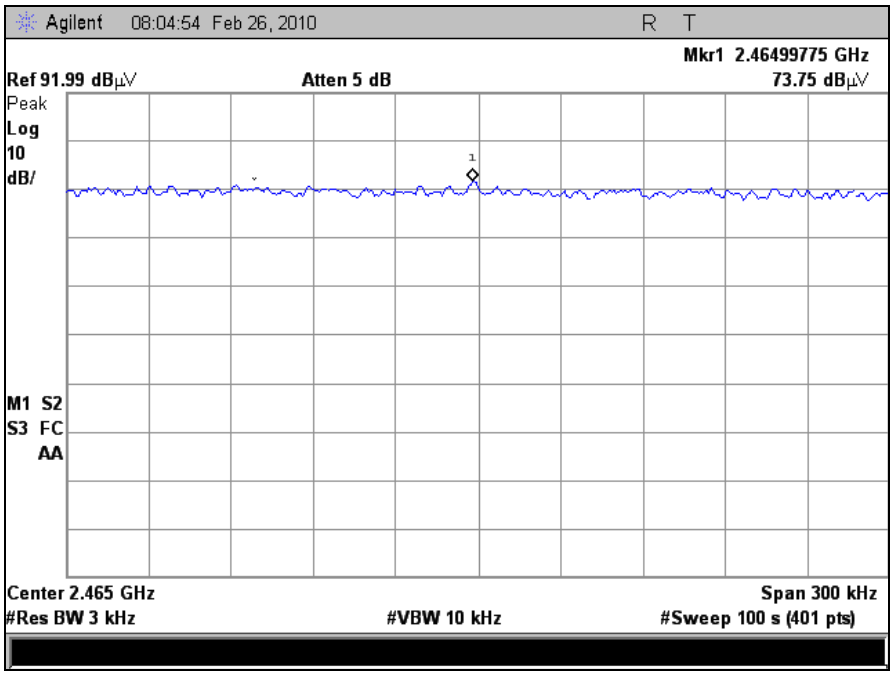


Plot 109. Peak Power Spectral Density, Mid Channel, b Mode, 2.4 GHz

Peak Power Spectral Density

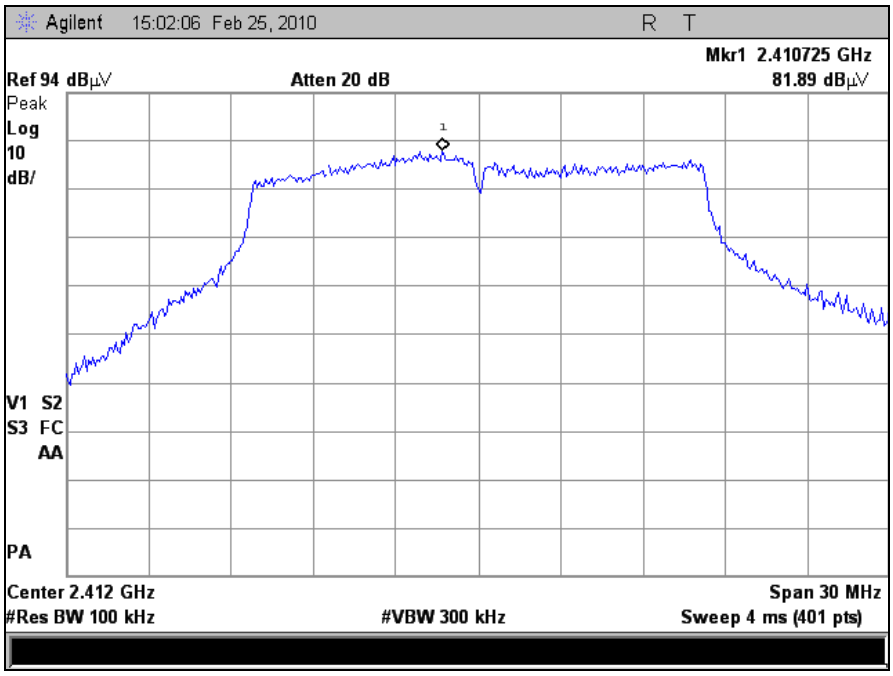


Plot 110. Peak Determination, High Channel, b Mode, 2.4 GHz

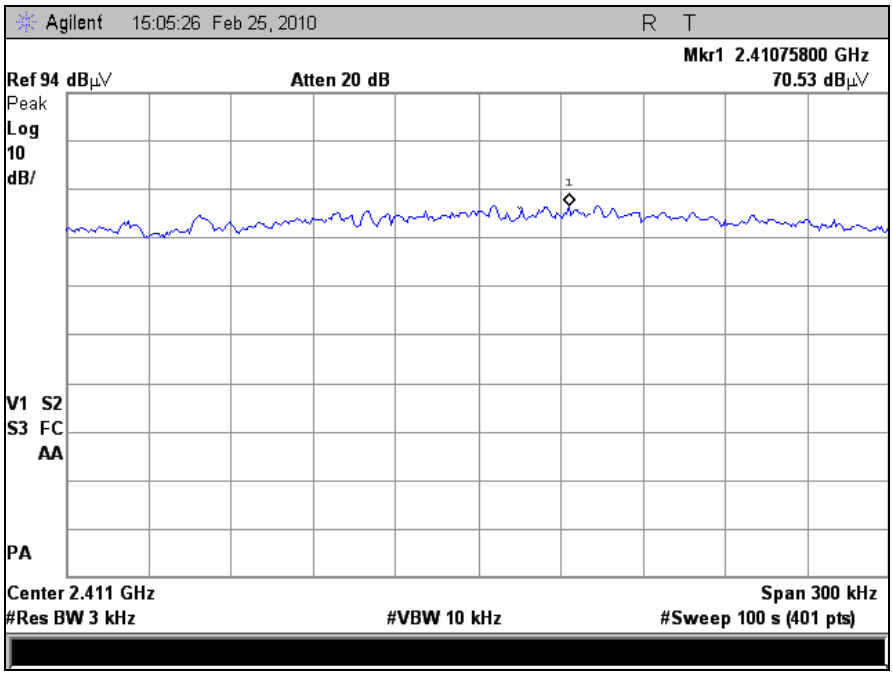


Plot 111. Peak Power Spectral Density, High Channel, b Mode, 2.4 GHz

Peak Power Spectral Density

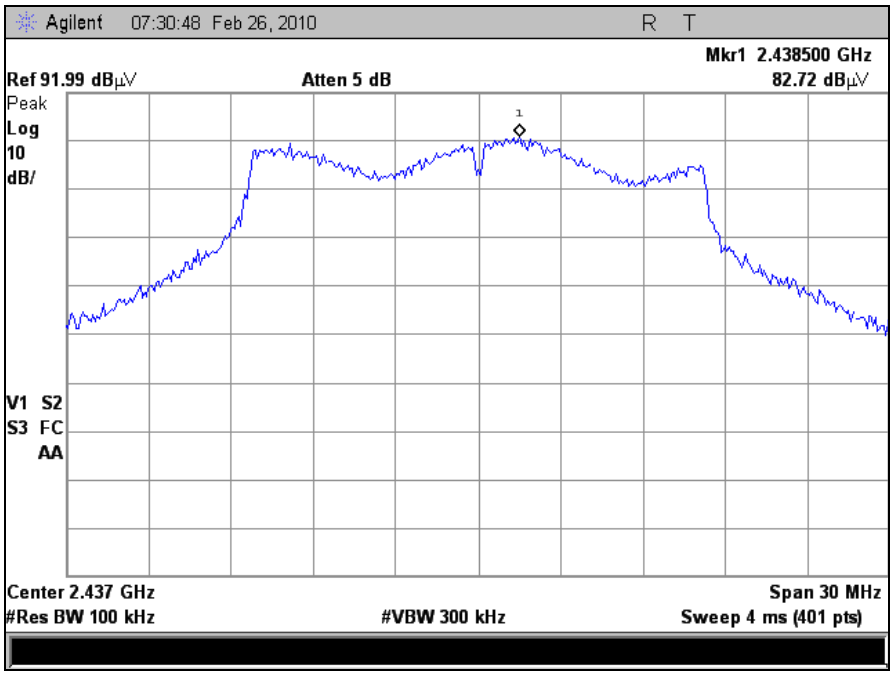


Plot 112. Peak Determination, Low Channel, g Mode, 2.4 GHz

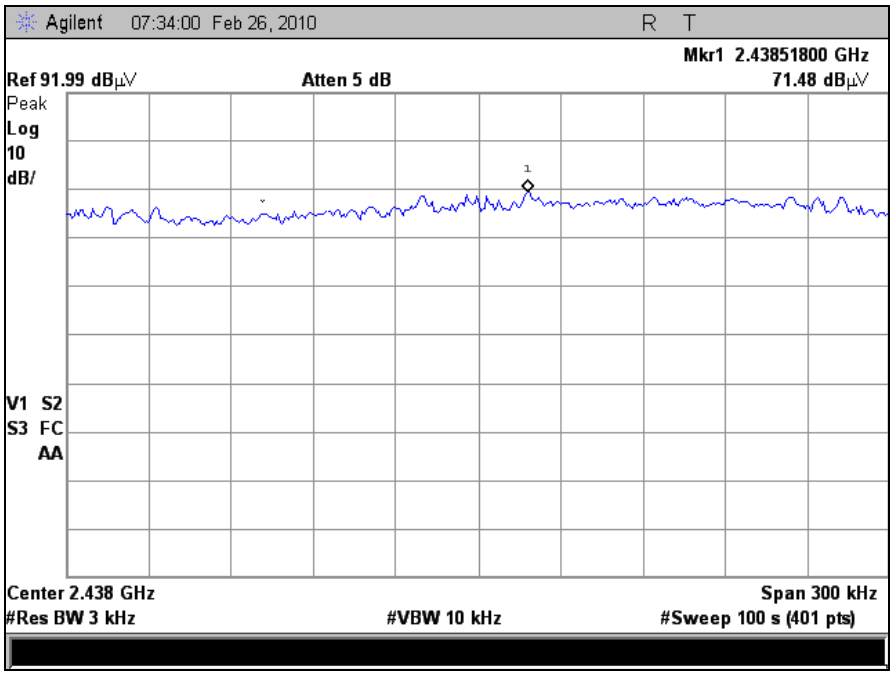


Plot 113. Peak Power Spectral Density, Low Channel, g Mode, 2.4 GHz

Peak Power Spectral Density

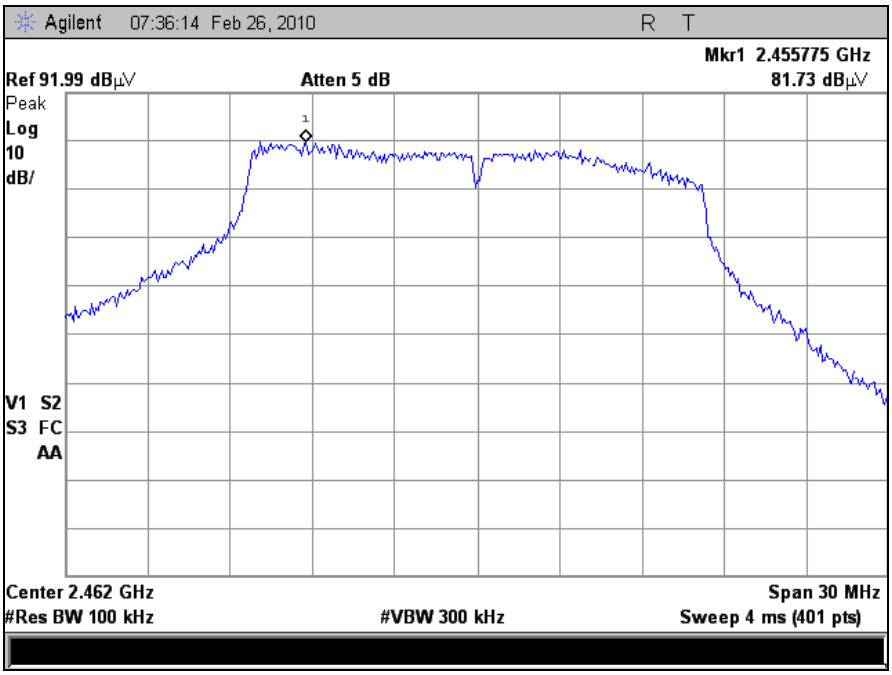


Plot 114. Peak Determination, Mid Channel, g Mode, 2.4 GHz

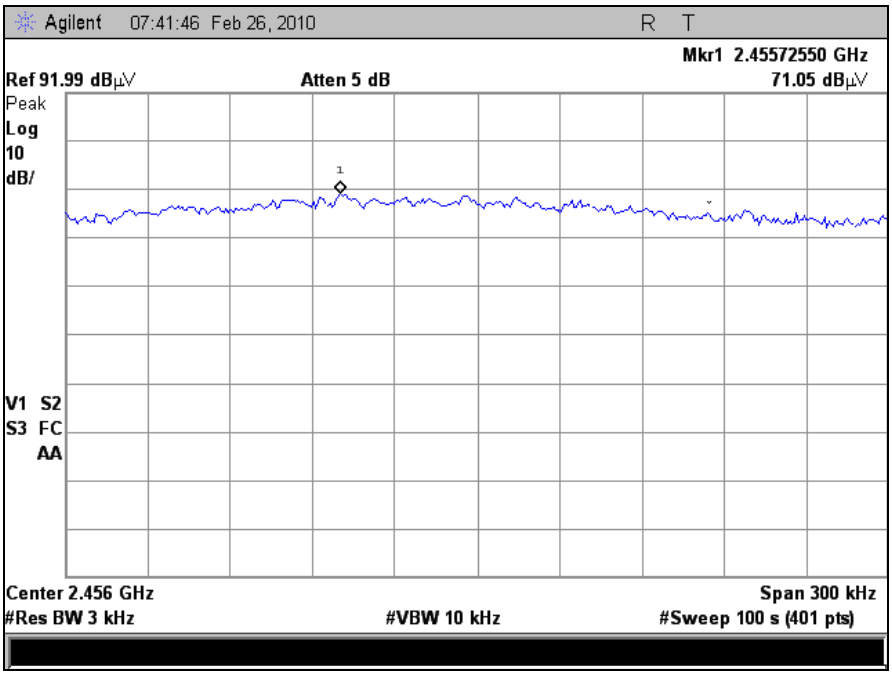


Plot 115. Peak Power Spectral Density, Mid Channel, g Mode, 2.4 GHz

Peak Power Spectral Density

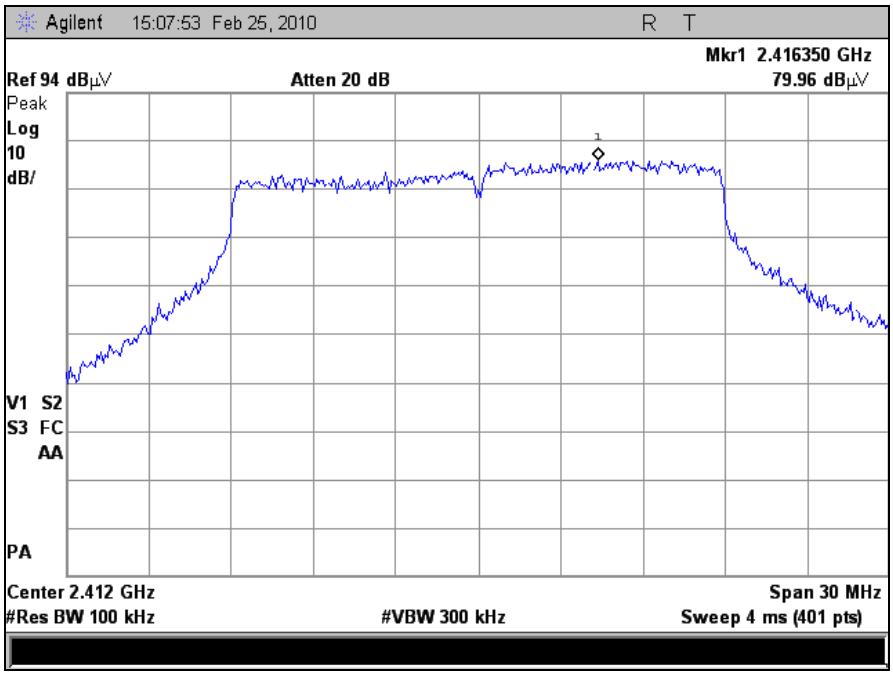


Plot 116. Peak Determination, High Channel, g Mode, 2.4 GHz

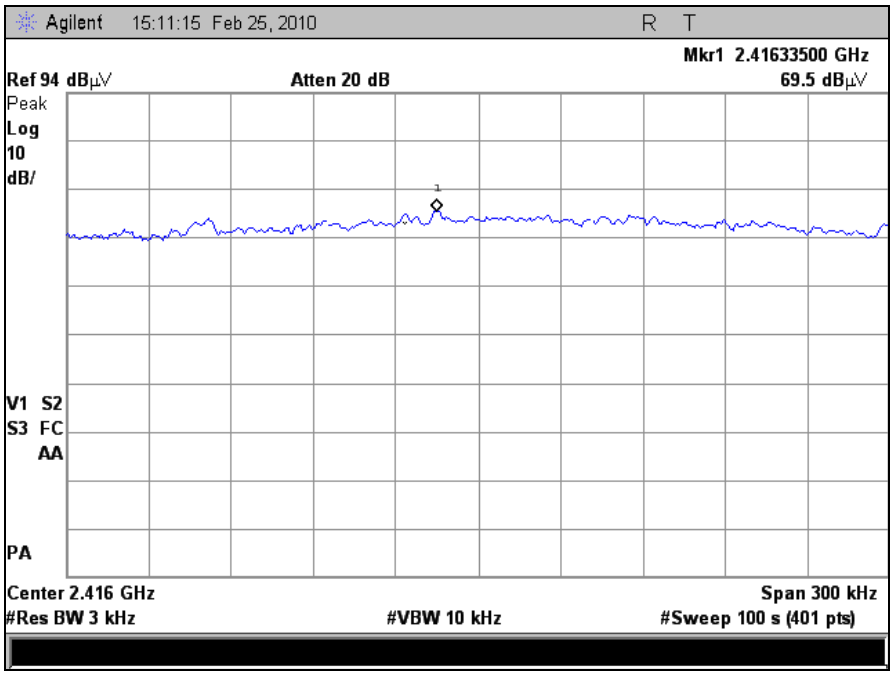


Plot 117. Peak Power Spectral Density, High Channel, g Mode, 2.4 GHz

Peak Power Spectral Density

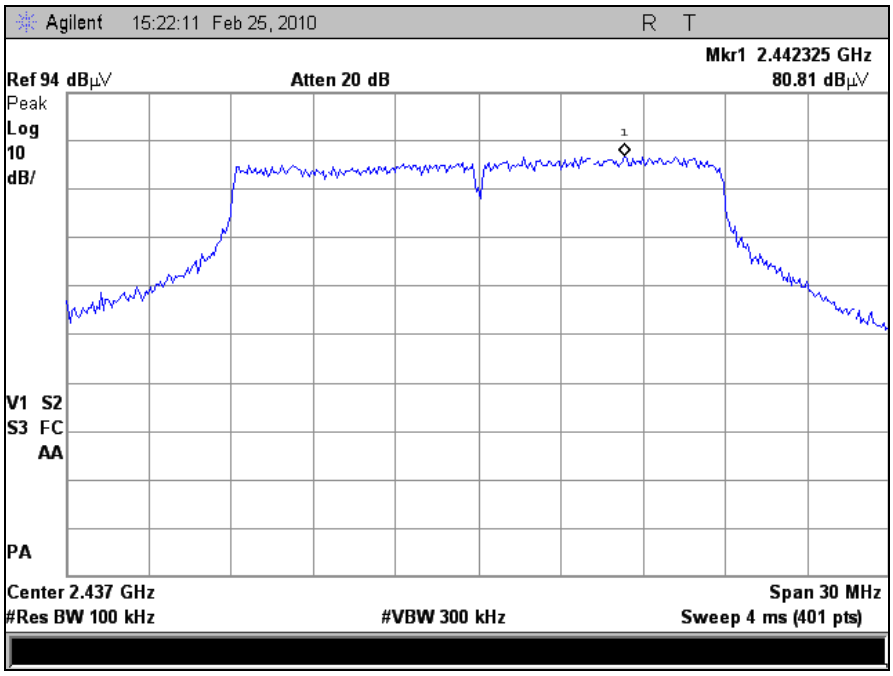


Plot 118. Peak Determination, Low Channel, n Mode HT20, 2.4 GHz

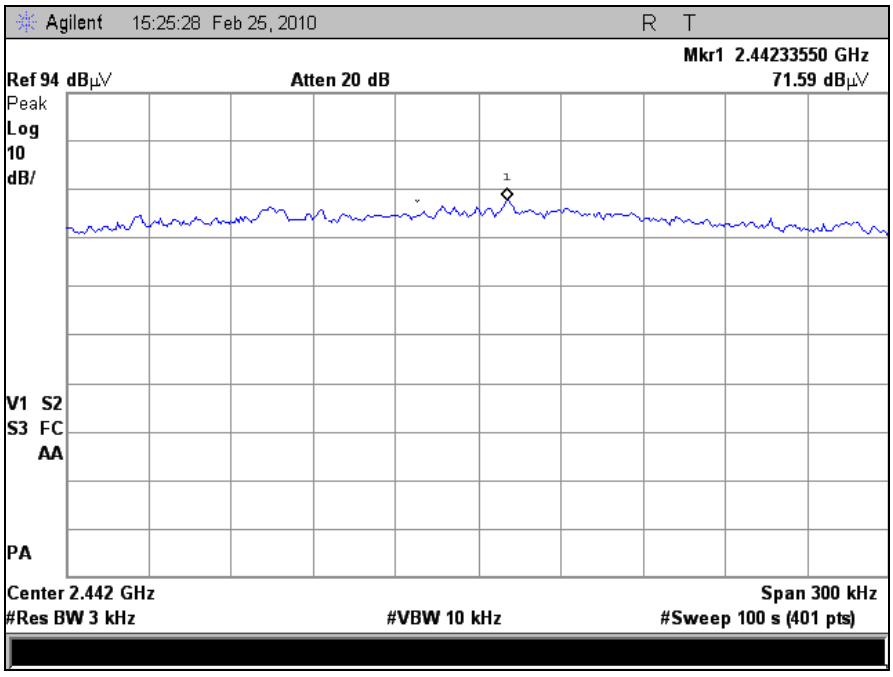


Plot 119. Peak Power Spectral Density, Low Channel, n Mode HT20, 2.4 GHz

Peak Power Spectral Density

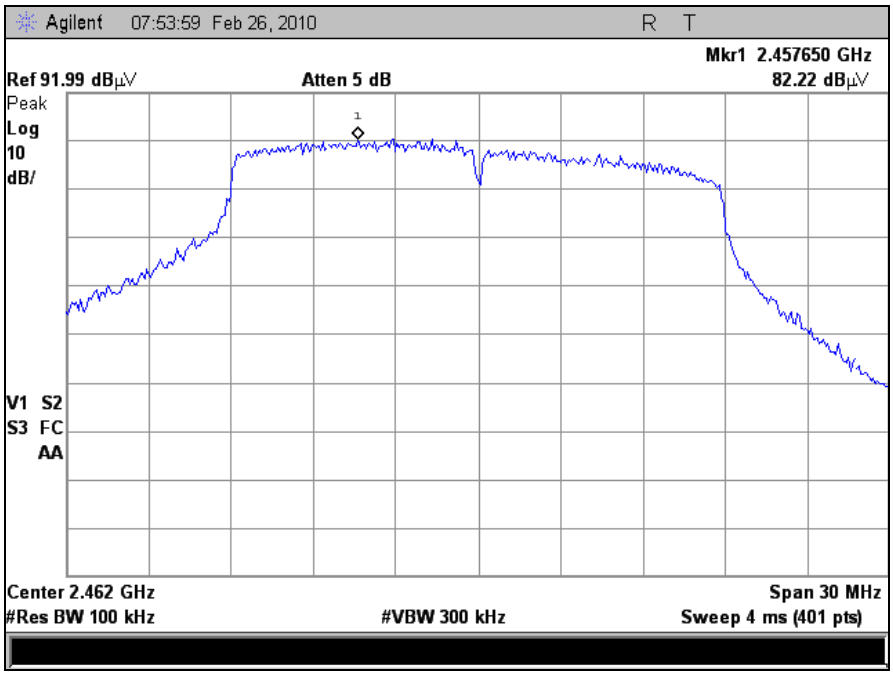


Plot 120. Peak Determination, Mid Channel, n Mode HT20, 2.4 GHz

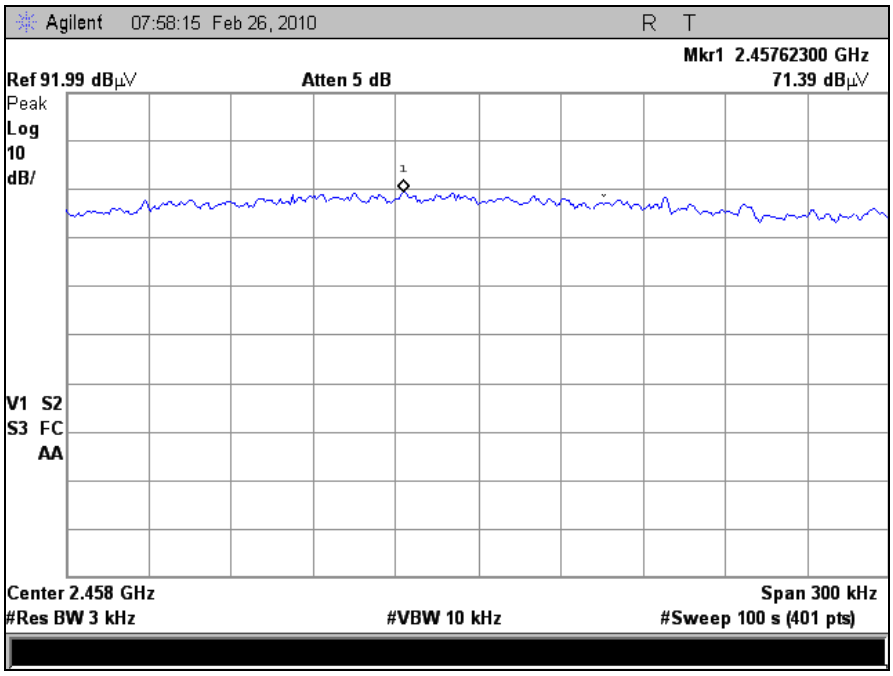


Plot 121. Peak Power Spectral Density, Mid Channel, n Mode HT20, 2.4 GHz

Peak Power Spectral Density

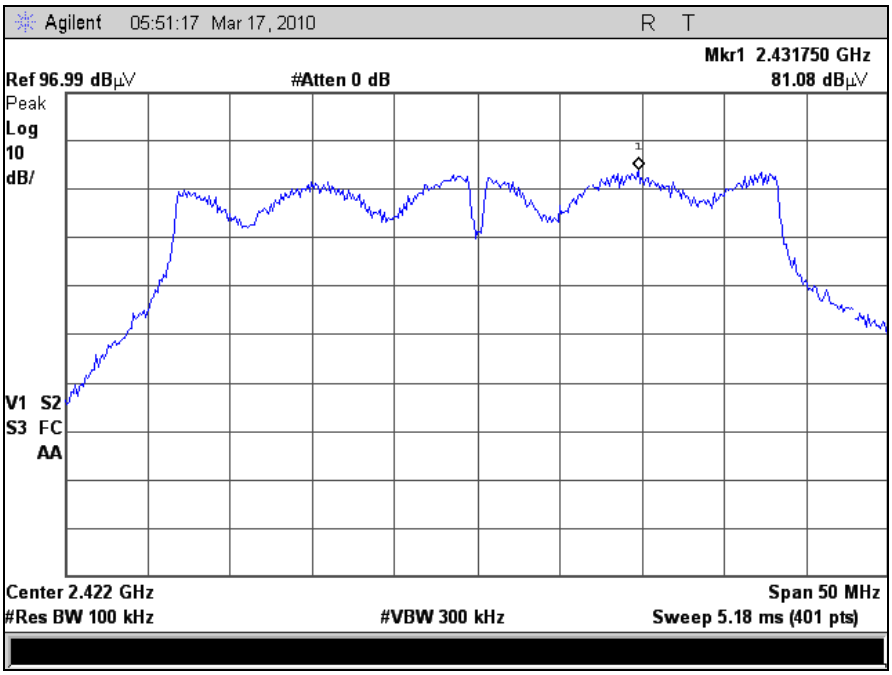


Plot 122. Peak Determination, High Channel, n Mode HT20, 2.4 GHz

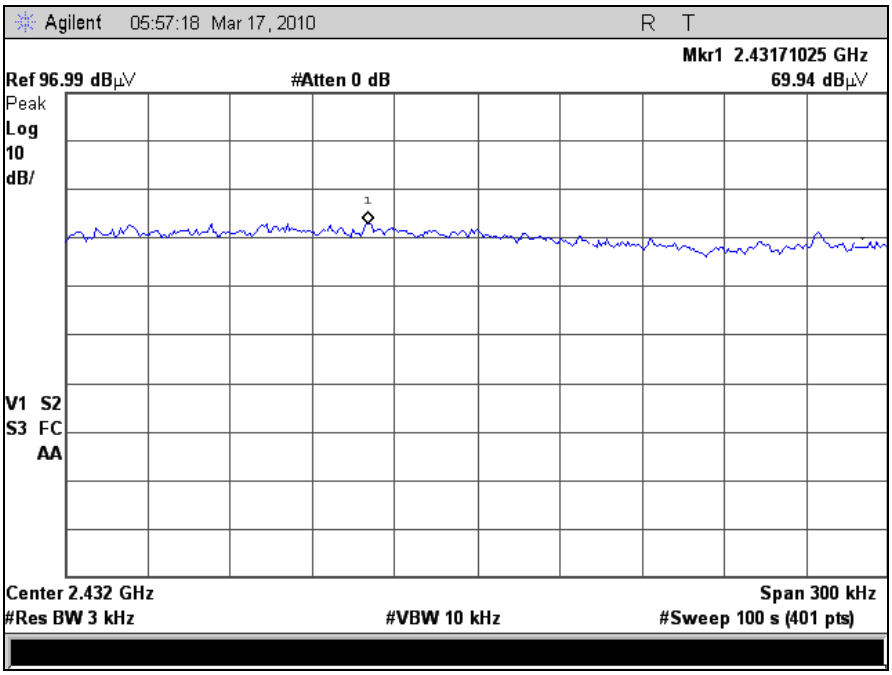


Plot 123. Peak Power Spectral Density, High Channel, n Mode HT20, 2.4 GHz

Peak Power Spectral Density

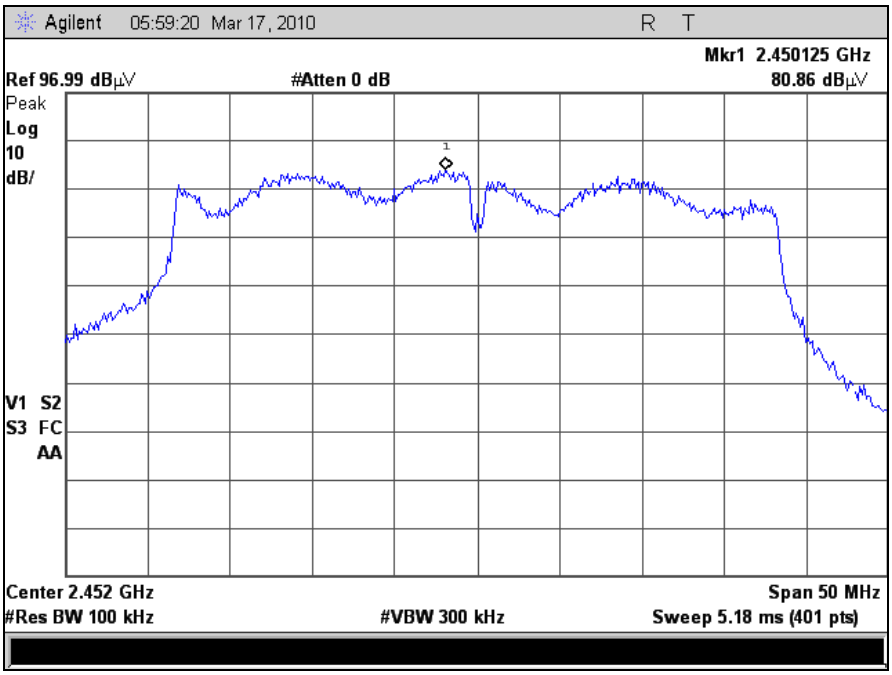


Plot 124. Peak Determination, Low Channel, n Mode HT40, 2.4 GHz

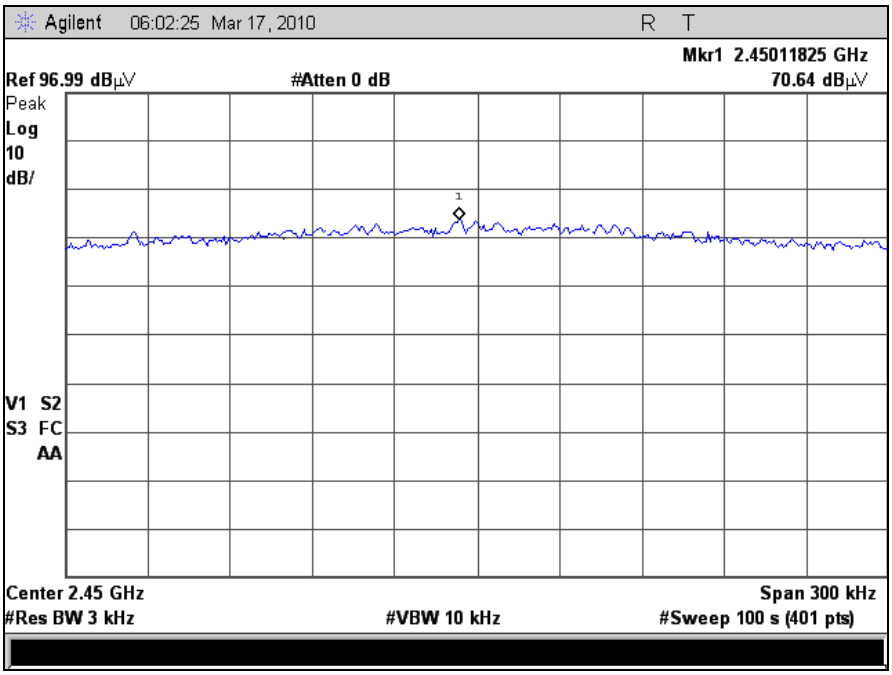


Plot 125. Peak Power Spectral Density, Low Channel, n Mode HT40, 2.4 GHz

Peak Power Spectral Density

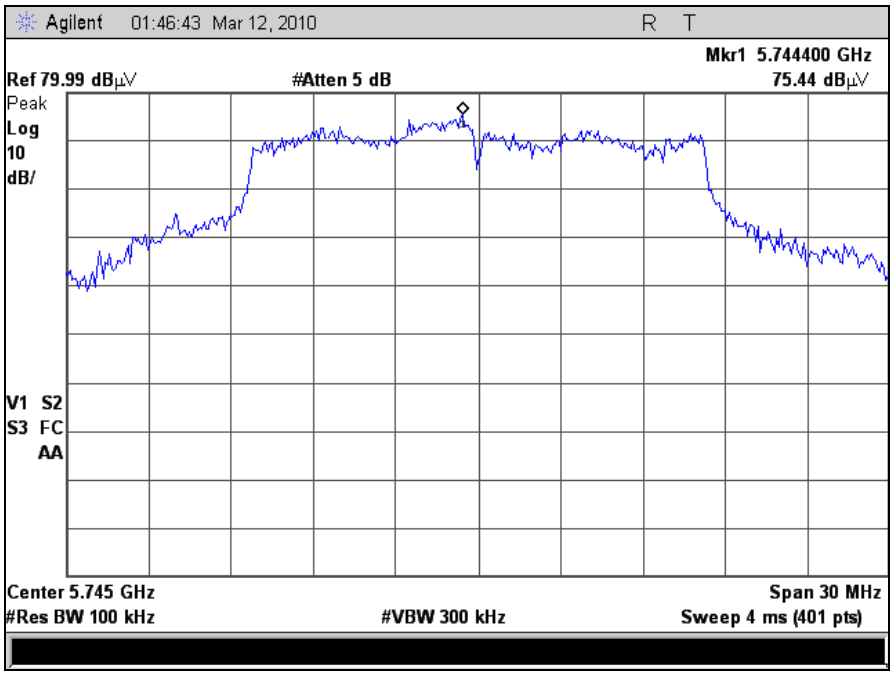


Plot 126. Peak Determination, High Channel, n Mode HT40, 2.4 GHz

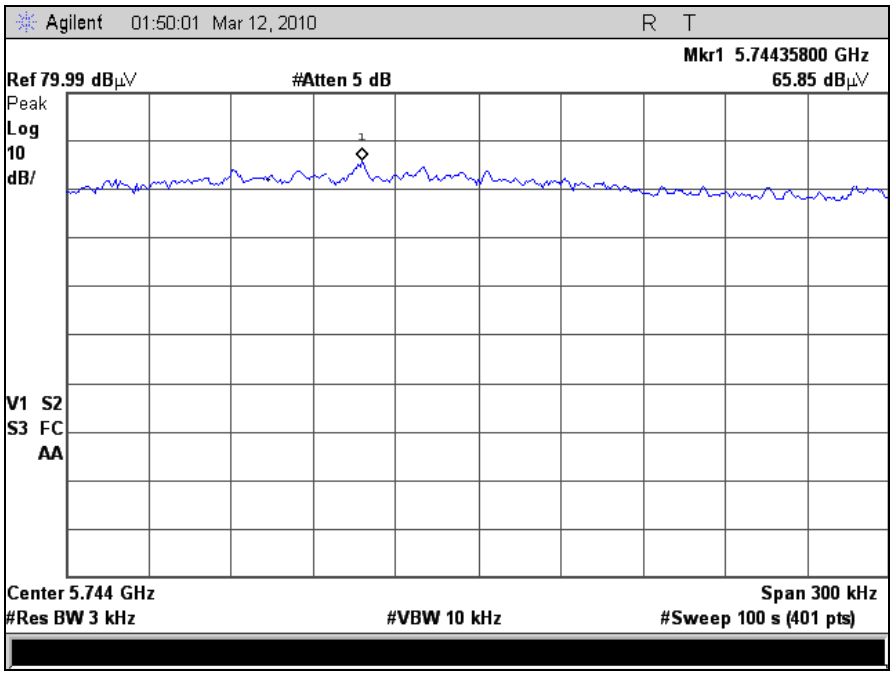


Plot 127. Peak Power Spectral Density, High Channel, n Mode HT40, 2.4 GHz

Peak Power Spectral Density

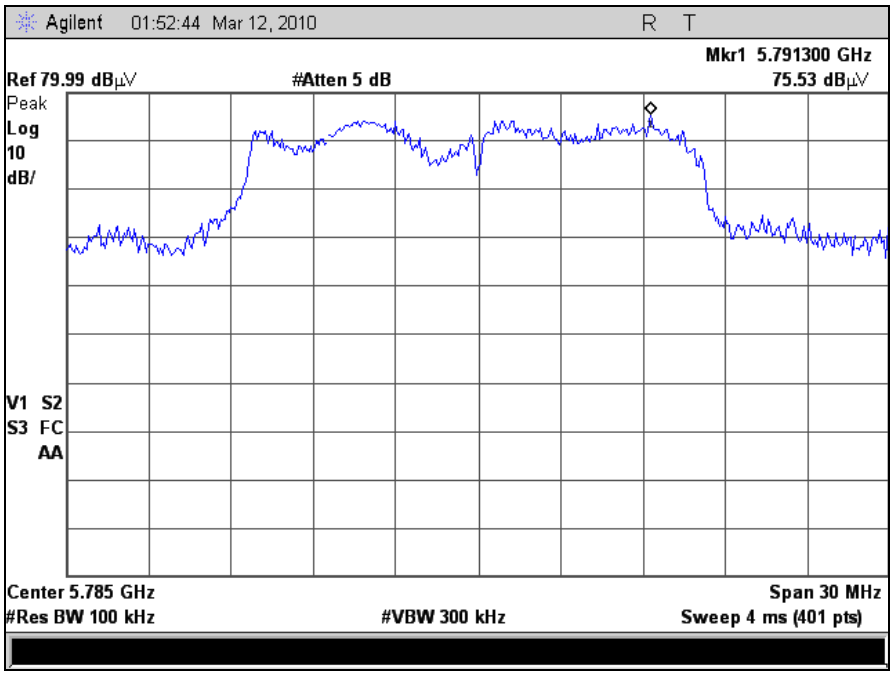


Plot 128. Peak Determination, Low Channel, a Mode, 5 GHz

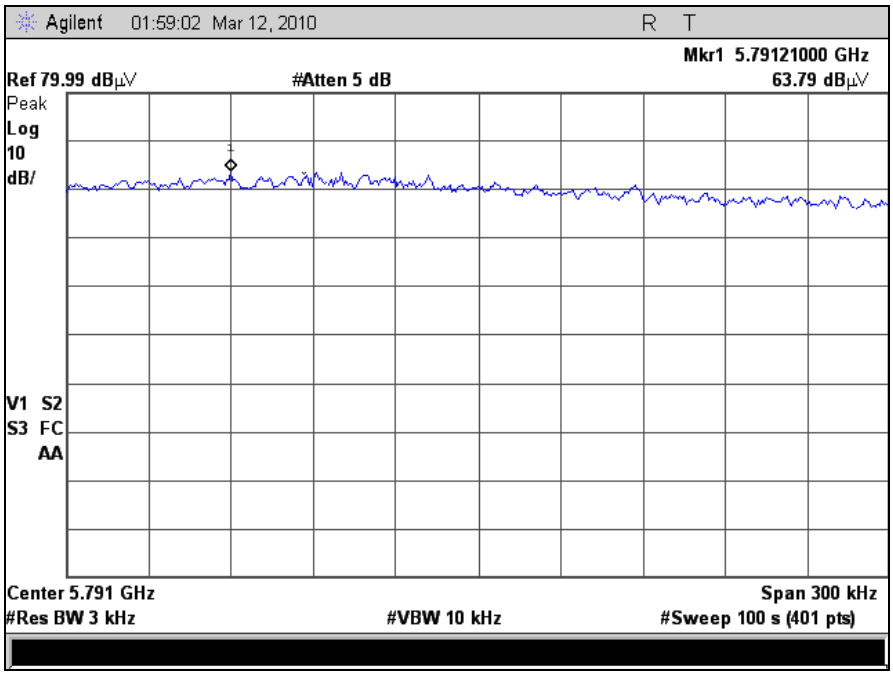


Plot 129. Peak Power Spectral Density, Low Channel, a Mode, 5 GHz

Peak Power Spectral Density

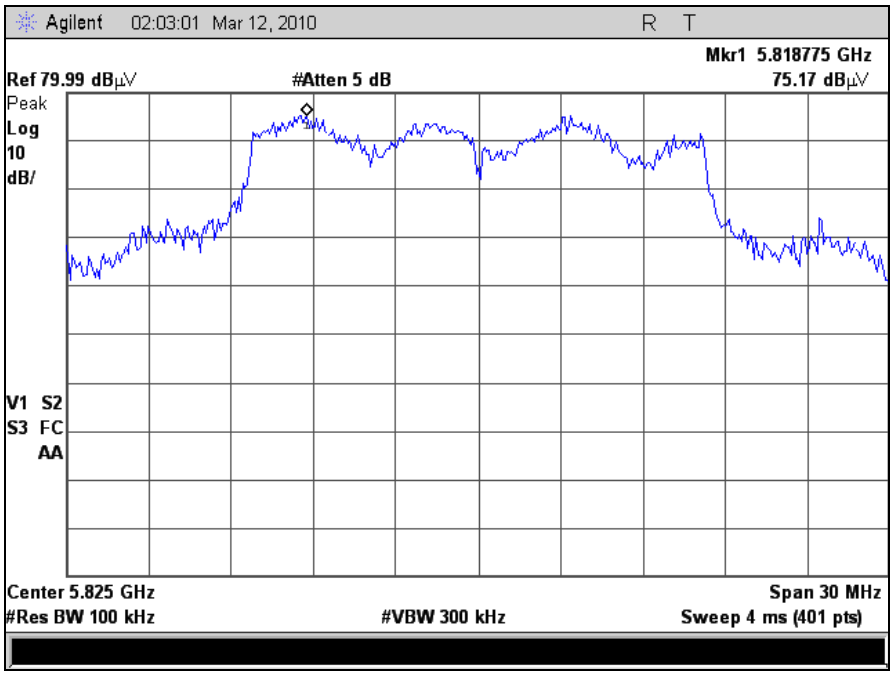


Plot 130. Peak Determination, Mid Channel, a Mode, 5 GHz

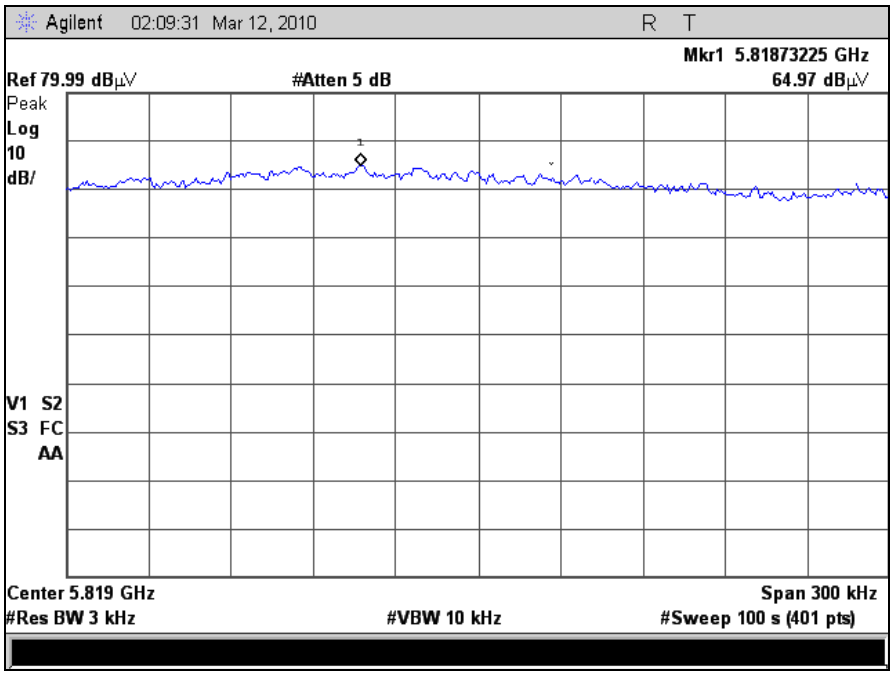


Plot 131. Peak Power Spectral Density, Mid Channel, a Mode, 5 GHz

Peak Power Spectral Density

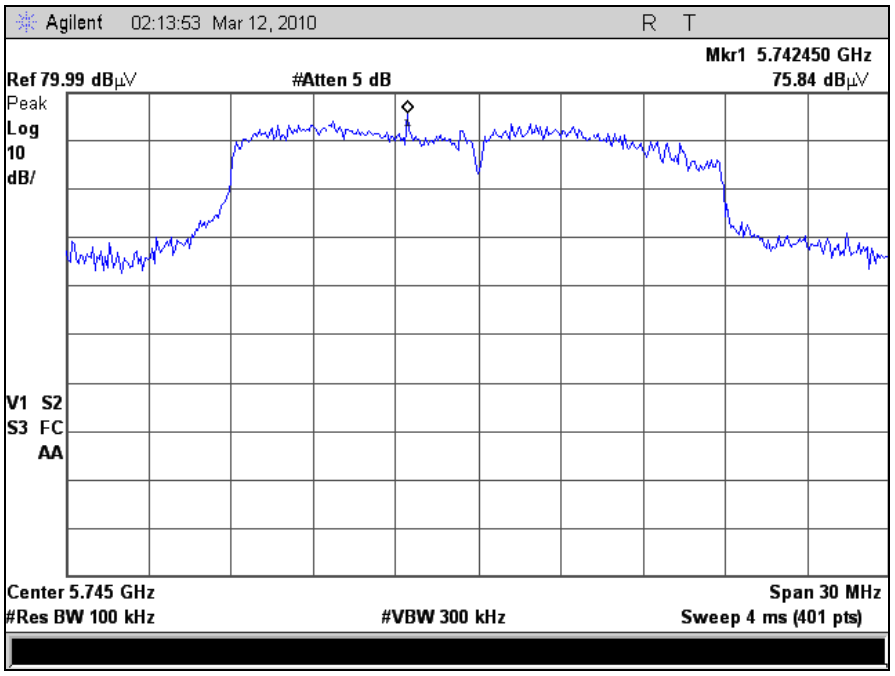


Plot 132. Peak Determination, High Channel, a Mode, 5 GHz

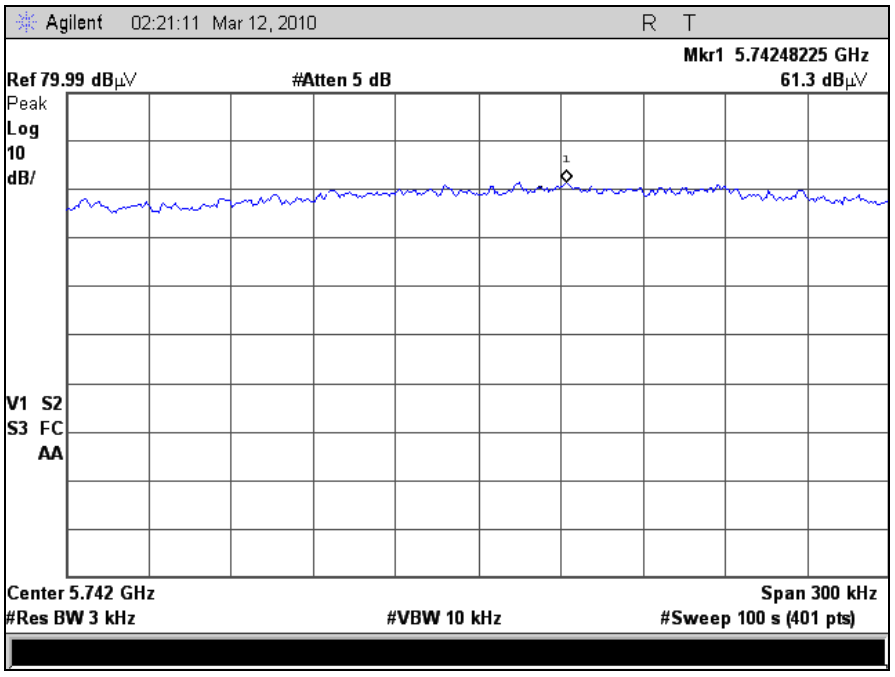


Plot 133. Peak Power Spectral Density, High Channel, a Mode, 5 GHz

Peak Power Spectral Density

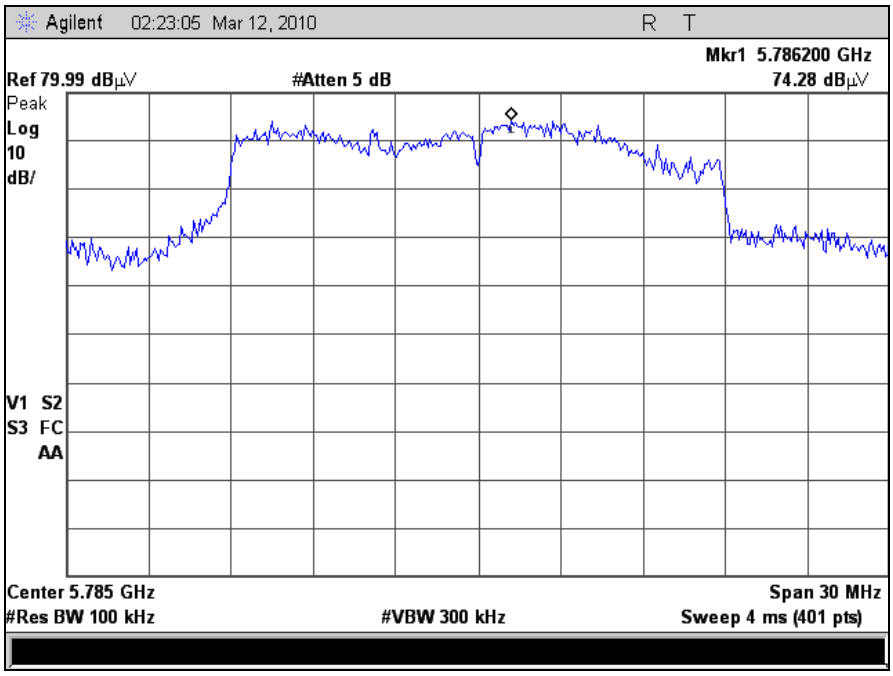


Plot 134. Peak Determination, Low Channel, n Mode HT20, 5 GHz

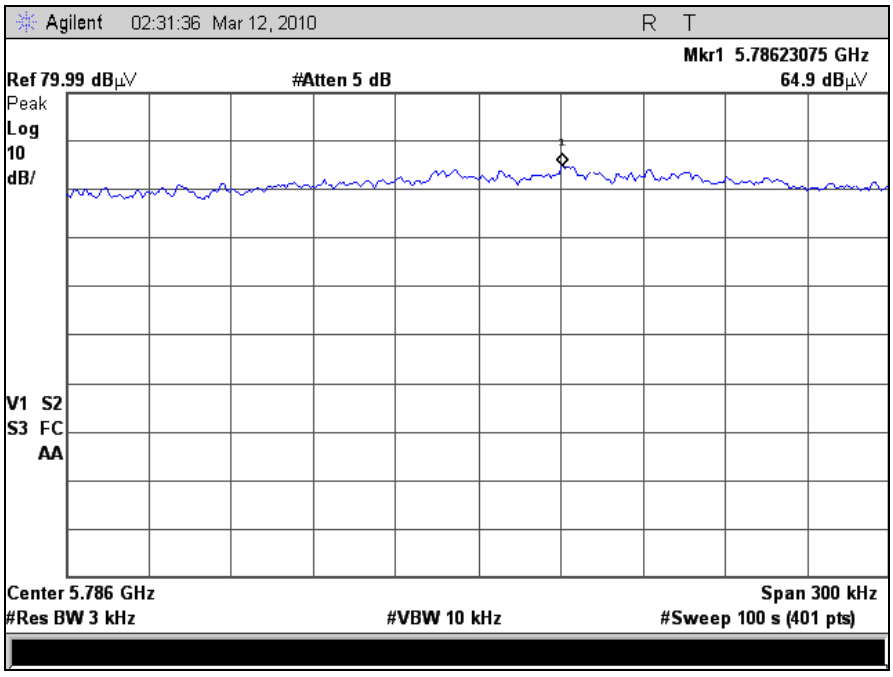


Plot 135. Peak Power Spectral Density, Low Channel, n Mode HT20, 5 GHz

Peak Power Spectral Density

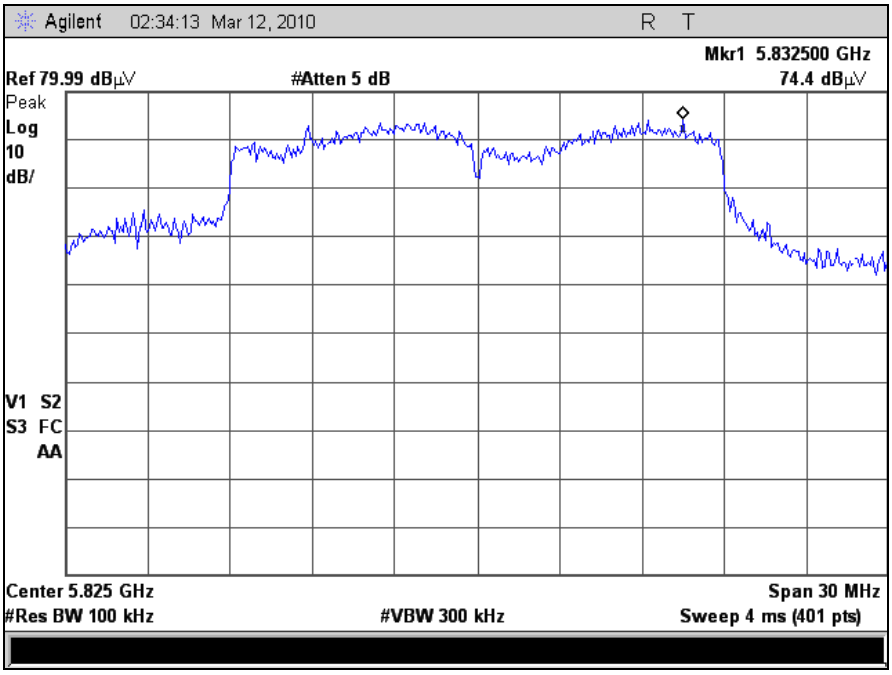


Plot 136. Peak Determination, Mid Channel, n Mode HT20, 5 GHz

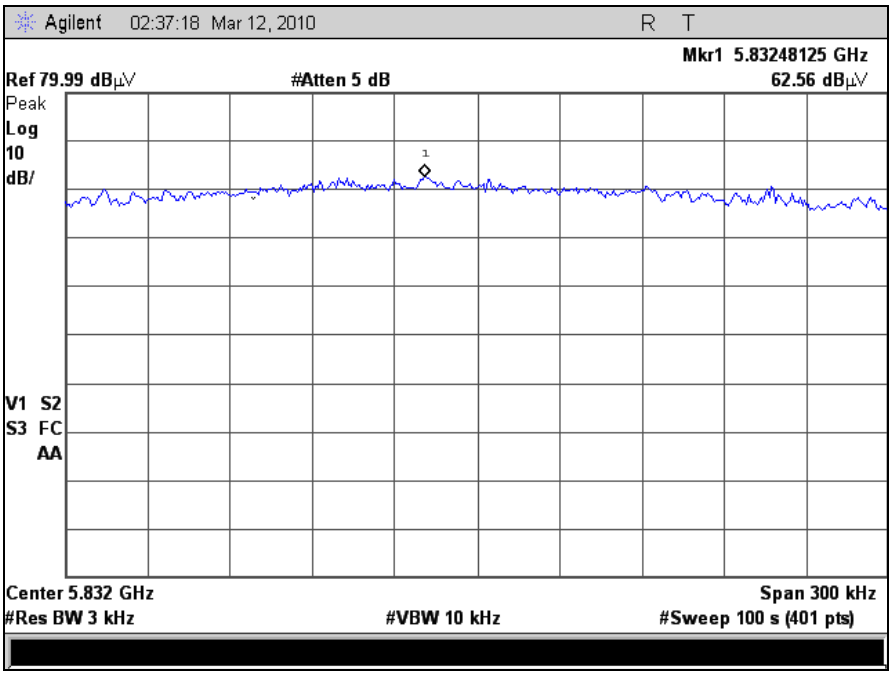


Plot 137. Peak Power Spectral Density, Mid Channel, n Mode HT20, 5 GHz

Peak Power Spectral Density

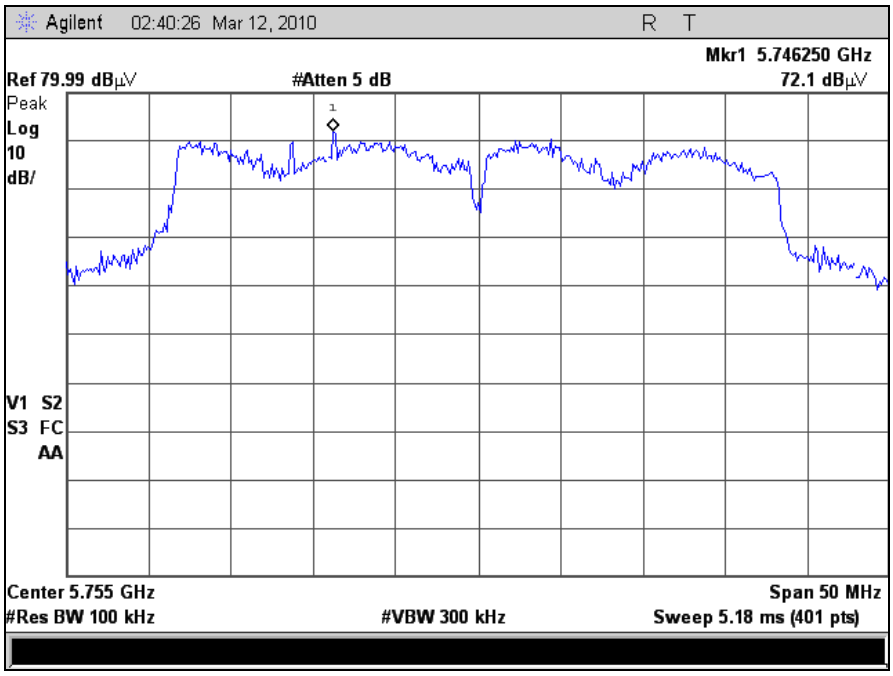


Plot 138. Peak Determination, High Channel, n Mode HT20, 5 GHz

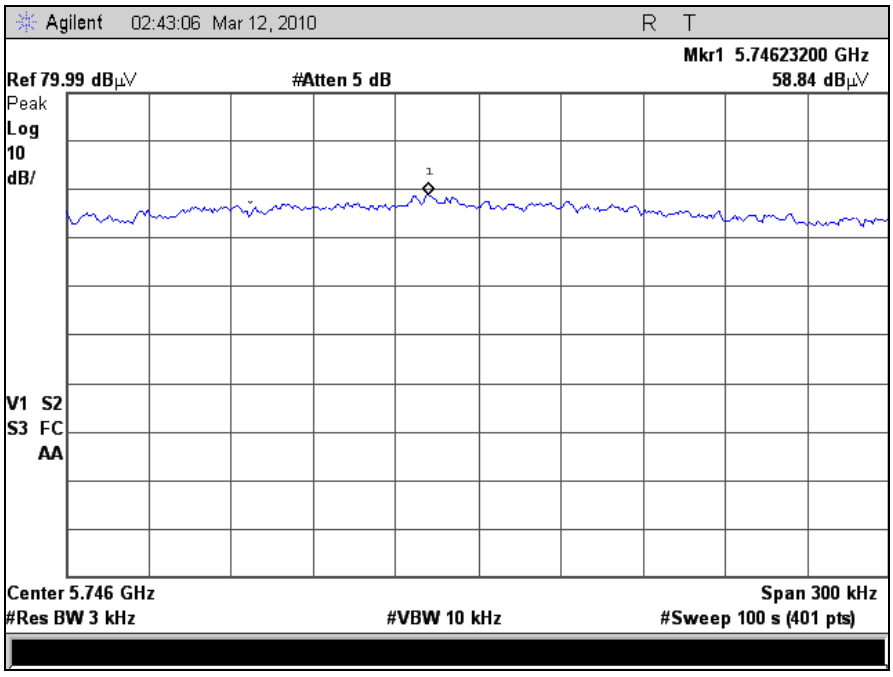


Plot 139. Peak Power Spectral Density, High Channel, n Mode HT20, 5 GHz

Peak Power Spectral Density

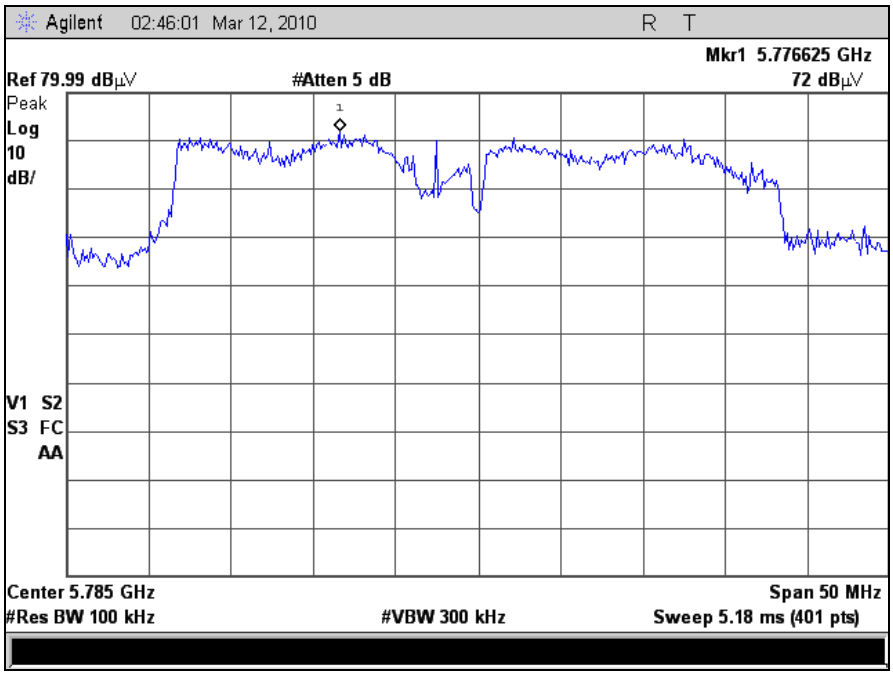


Plot 140. Peak Determination, Low Channel, n Mode HT40, 5 GHz

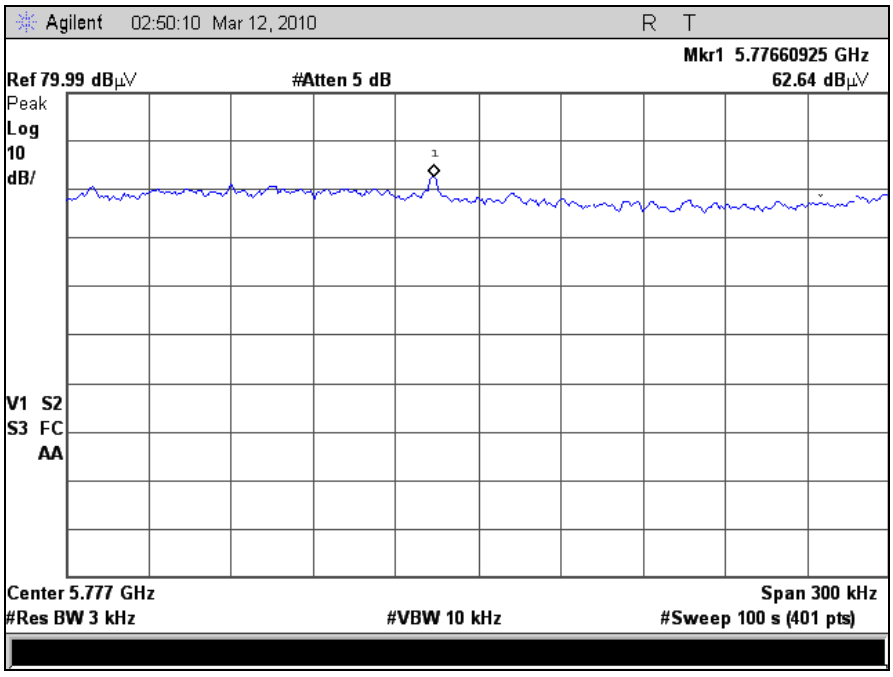


Plot 141. Peak Power Spectral Density, Low Channel, n Mode HT40, 5 GHz

Peak Power Spectral Density

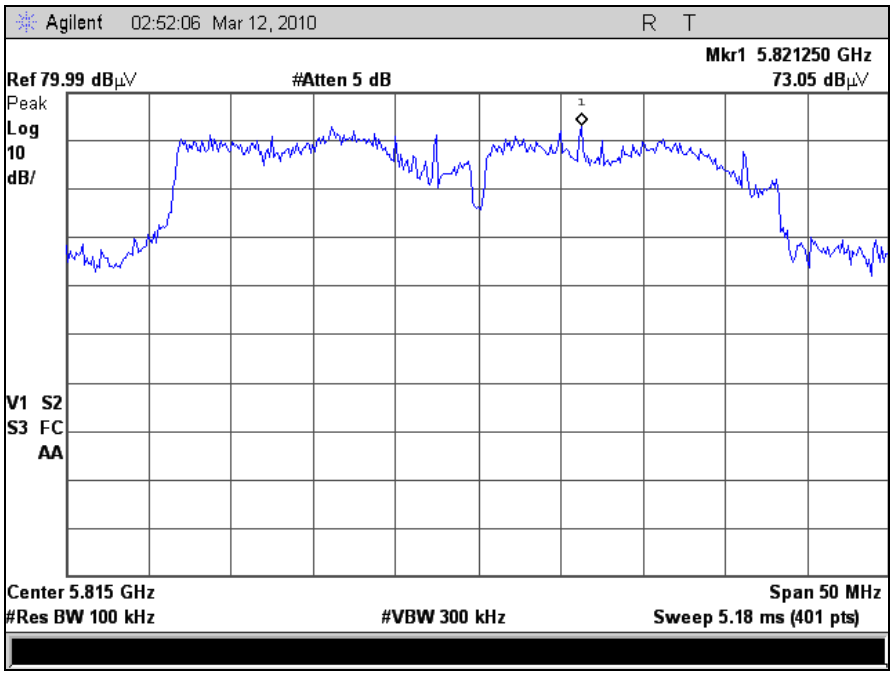


Plot 142. Peak Determination, Mid Channel, n Mode HT40, 5 GHz

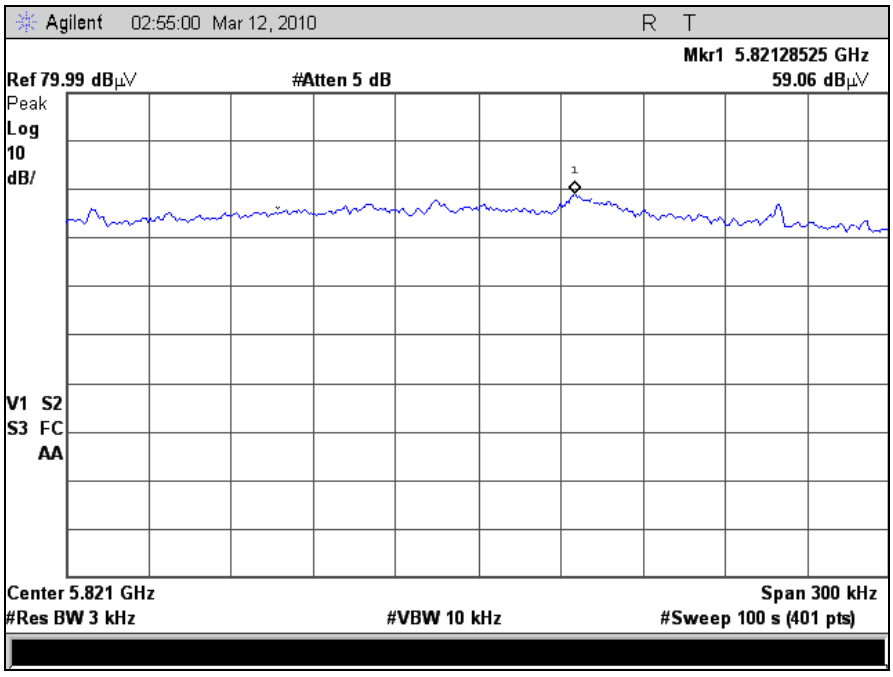


Plot 143. Peak Power Spectral Density, Mid Channel, n Mode HT40, 5 GHz

Peak Power Spectral Density



Plot 144. Peak Determination, High Channel, n Mode HT40, 5 GHz



Plot 145. Peak Power Spectral Density, High Channel, n Mode HT40, 5 GHz

Peak Power Spectral Density Test Setup

IV. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSL Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4502	COMB GENERATOR	COM-POWER	CGC-255	09/23/2009	09/23/2010
1T4621	ESA-E SERIES SPECTRUM ANALYZER	AGILENT	E4402B	03/20/2009	03/20/2010
1T4503	SHIELDED ROOM	UNIVERSAL SHIELDING CORP	N/A	SEE NOTE	
1T4564	LISN (24 AMP)	SOLAR ELECTRONICS	9252-50-R-24-BNC	09/09/2009	09/09/2010
1T4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	08/24/2007	08/24/2010
1T2665	HORN ANTENNA	EMCO	3115	07/06/2009	07/06/2010
1T4442	PRE-AMPLIFIER, MICROWAVE	MITEQ	AFS42-01001800-30-10P	SEE NOTE	
1T4612	ESA-E SERIES SPECTRUM ANALYZER	AGILENT	E4407B	09/09/2009	09/09/2010
1T4592	RF FILTER KIT	VARIOUS	N/A	SEE NOTE	
1T4688	HORN ANTENNA	CUSTOM MICROWAVE, INC.	HO42S	SEE NOTE	
1T4689	HORN ANTENNA	CUSTOM MICROWAVE, INC.	HO28S	SEE NOTE	
1T4668	HARMONIC MIXER	HEWLETT PACKARD	11970A	07/14/2009	07/14/2010

Table 34. Test Equipment List

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

V. Certification & User's Manual Information

Certification & User's Manual Information

A. Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

§ 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

(a) The various types of radio communication transmitting devices described throughout this chapter.

(b) The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.

(c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.

(d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

§ 2.803 Marketing of radio frequency devices prior to equipment authorization.

(a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:

(1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or

(2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.

(d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.

(e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:

(i) Compliance testing;

(ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or

(v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.

(e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.

(f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

Certification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:

§ 2.901 Basis and Purpose

(a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.[1] *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer*, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.

(b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

§ 2.907 Certification.

(a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.

(b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

[1] In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart B (of Part 15), which deals with unintentional radiators.

Certification & User's Manual Information

§ 2.948 Description of measurement facilities.

(a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.

(1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.

(i) If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.

(ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.

(2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.

Certification & User's Manual Information

Label and User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart A — General:

§ 15.19 Labeling requirements.

(a) In addition to the requirements in Part 2 of this chapter, a device subject to certification or verification shall be labeled as follows:

(1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73 of this chapter, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

(2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

(3) All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

§ 15.21 Information to user.

The users manual or instruction manual for an intentional or unintentional 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.

Verification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart B — Unintentional Radiators:

§ 15.105 Information to the user.

(a) For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at own expense.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

– Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

– Consult the dealer or an experienced radio/TV technician for help.

ICES-003 Procedural & Labeling Requirements

From the Industry Canada Electromagnetic Compatibility Advisory Bulletin entitled, "Implementation and Interpretation of the Interference-Causing Equipment Standard for Digital Apparatus, ICES-003" (EMCAB-3, Issue 2, July 1995):

> "At present, CISPR 22: 2002 and ICES technical requirements are essentially equivalent. Therefore, if you have CISPR 22: 2002 approval by meeting CISPR Publication 22, the only additional requirements are: to attach a note to the report of the test results for compliance, indicating that these results are deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations; to maintain these records on file for the requisite five year period; and to provide the device with a notice of compliance in accordance with ICES-003."

Procedural Requirements:

According to Industry Canada's Interference Causing Equipment Standard for Digital Apparatus ICES-003 Issue 4, February 2004:

Section 6.1: A record of the measurements and results, showing the date that the measurements were completed, shall be retained by the manufacturer or importer for a period of at least five years from the date shown in the record and made available for examination on the request of the Minister.

Section 6.2: A written notice indicating compliance must accompany each unit of digital apparatus to the end user. The notice shall be in the form of a label that is affixed to the apparatus. Where because of insufficient space or other constraints it is not feasible to affix a label to the apparatus, the notice may be in the form of a statement in the user's manual.

Labeling Requirements:

The suggested text for the notice, in English and in French, is provided below, from the Annex of ICES-003:

> This Class [2] digital apparatus complies with Canadian ICES-003.
>
> Cet appareil numérique de la classe [1] est conforme à la norme NMB-003 du Canada.

[2] Insert either A or B but not both as appropriate for the equipment requirements.

End of Report