MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
914 WEST PATAPSCO AVENUE ● BALTIMORE, MARYLAND 21230-3432 ● PHONE (410) 354-3300 ● FAX (410) 354-3313
33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587 ● PHONE (510) 489-6300 ● FAX (510) 489-6372
3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408 748-3585 ● FAX (510) 489-6372

September 27, 2011

Fortress Technologies, Inc.
2 Technology Park Drive
Westford, MA 01886

Dear John Pacheco,

Enclosed is the EMC Wireless test report for compliance testing of the Fortress Technologies, Inc., Vehicle Mesh Point ES820 (containing M25 Radio) as tested to the requirements of Title 47 of the CFR, FCC Part 15 Subpart C, and RSS-210, Issue 8, Dec. 2010 for Intentional Radiators.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\Fortress Technologies, Inc.\EMC31155A-FCC247 Rev. 1)

Electromagnetic Compatibility Criteria
Test Report

for the

Fortress Technologies, Inc.
Vehicle Mesh Point ES820 (containing M25 Radio)

Tested under
the FCC Certification Rules
contained in
15.247 Subpart C & RSS-210, Issue 8, Dec. 2010
for Intentional Radiators

MET Report: EMC31155A-FCC247 Rev. 1

September 27, 2011

Prepared For:

Fortress Technologies, Inc.
2 Technology Park Drive
Westford, MA 01886

Prepared By:
MET Laboratories, Inc.
914 W. Patapsco Ave
Baltimore, MD 21230

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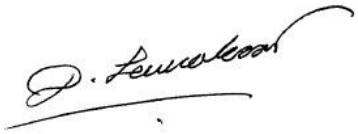

Dusmantha Tennakoon, Project Engineer
Electromagnetic Compatibility Lab

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 Part 15.247 and Industry Canada standard RSS-210, Issue 8, Dec. 2010 under normal use and maintenance.

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	July 21, 2011	Initial Issue.
1	September 27, 2011	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**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**microh**enry
µ	**microf**arad
µs	**micros**econds
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 Fortress Technologies, Inc. Vehicle Mesh Point ES820 (containing M25 Radio), 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 Vehicle Mesh Point ES820 (containing M25 Radio). Fortress Technologies, Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Vehicle Mesh Point ES820 (containing M25 Radio), 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 Fortress Technologies, Inc., purchase order number 3020. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference 47 CFR Part 15.247:2005	IC Reference RSS-210 Issue 8: 2010; RSS-GEN Issue 3: 2010	Description	Compliance
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-GEN (7.2.4)	Conducted Emission Limits	N/A –Class II PC
Title 47 of the CFR, Part 15 §15.247(a)(2)	RSS-Gen(4.6)	6dB Occupied Bandwidth	Compliant
		99% Occupied Bandwidth	Compliant
Title 47 of the CFR, Part 15 §15.247(b)	RSS-210(A8.4)	Peak Power Output	Compliant
Title 47 of the CFR, Part 15 §15.247(d); §15.209; §15.205	RSS-210(A8.5)	Radiated Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15 §15.247(d)	RSS-210(A8.5)	RF Conducted Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15 §15.247(d)	RSS-210(A8.5)	RF Conducted Band Edge	Compliant
Title 47 of the CFR, Part 15; §15.247(e)	RSS-210(A8.2)	Peak Power Spectral Density	Compliant
Title 47 of the CFR, Part 15 §15.247(i)	RSS-Gen(5.6)	Maximum Permissible Exposure (MPE)	N/A – Class II PC
N/A	RSS-Gen(4.10)	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 Fortress Technologies, Inc. to perform testing on the Vehicle Mesh Point ES820 (containing M25 Radio), under Fortress Technologies, Inc.'s purchase order number 3020.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Fortress Technologies, Inc., Vehicle Mesh Point ES820 (containing M25 Radio).

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

Model(s) Tested:	Vehicle Mesh Point ES820 (containing M25 Radio)			
Model(s) Covered:	Vehicle Mesh Point ES820 (containing M25 Radio)			
Filing Info:	Class II change to add HT20 and HT40 modes			
EUT Specifications:	Primary Power: 120 VAC, 60 Hz			
	FCC ID: WYK-ES820 IC: 8190A-ES820			
	Type of Modulations:	OFDM		
	Equipment Code:	DTS		
	Peak RF Output Power:		HT20	HT40
		2.4	108.39 mW	119.40 mW
		5.8	83.18 mW	64.00 mW
	EUT Frequency Ranges:	HT20		HT40
		2412 – 2462 MHz 5745 – 5825 MHz		2422 – 2452 MHz 5755 – 5795 MHz
Analysis:	The results obtained relate only to the item(s) tested.			
Environmental Test Conditions:	Temperature: 15-35º C			
	Relative Humidity: 30-60%			
	Barometric Pressure: 860-1060 mbar			
Evaluated by:	Dusmantha Tennakoon			
Report Date(s):	September 27, 2011			

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
CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
RSS-210, Issue 8, Dec. 2010	Low-power Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
RSS-GEN, Issue 3, Dec. 2010	General Requirements and Information for the Certification of Radio Apparatus
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
ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices

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 3 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 Fortress Technologies, Inc. Vehicle Mesh Point ES820 (containing M25 Radio), Equipment Under Test (EUT), is a dual radio access point/bridge. It embeds two COTS high power radios and two Ethernet ports in a ruggedized enclosure. The radio operates in accordance to the 802.11a/g/n standards. This test report addresses the 802.11n operation (i.e. HT20 and HT40 modes). The other modes have been tested and reported in previous test reports.

The ES820 is intended to provided outdoor mobile connectivity in a secure manner both wired and wirelessly.

Photograph 1. Fortress Technologies, Inc. Vehicle Mesh Point ES820 (containing M25 Radio)

E. Equipment Configuration

All cards, racks, etc., incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number	Serial Number
1	Fortress Vehicle Mesh Point	ES820	109260332

Table 4. Equipment Configuration

F. Support Equipment

Support equipment was not necessary for the operation and testing of the Vehicle Mesh Point ES820 (containing M25 Radio).

G. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded (Y/N)	Termination Box ID & Port Name
N/A	Ant (1 & 2)	Antenna	2	N/A	N/A	Spectrum Analyzer
N/A	AC Pwr	Provides power	1	N/A	N/A	External AC Charger
N/A	N/A	37-pin cable to provide connections for Ethernet, serial, LEDs, and push buttons	1	N/A	N/A	N/A

Table 5. Ports and Cabling Information

H. Mode of Operation

HT20 and HT40 modes may be configured using the UI of the product. Additionally, these modes may be configured using the UI of the product. Additionally, these modes may be entered by using ART, the Atheros Radio Test tool. This is a standard tool provide by Atheros for directly manipulating and configuring their chips during testing and manufacturing.

I. Modifications

a) Modifications to EUT
No modifications were made to the EUT.

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 Fortress Technologies, Inc. upon completion of testing.

III. 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 EUT as tested is compliant the criteria of §15.203. The EUT uses a 9 dBi Omni antenna for both the 2.4 GHz and 5.8 GHz bands. The antennas are professionally installed.

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 03/31/11

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a)(2) 6 dB and 99% Bandwidth

Test Requirements: **§ 15.247(a)(2):** 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.

Test Results The EUT was compliant with § 15.247 (a)(2).

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

Test Engineer(s): Jeff Pratt

Test Date(s): 04/04/11

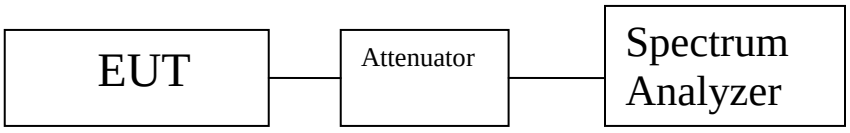


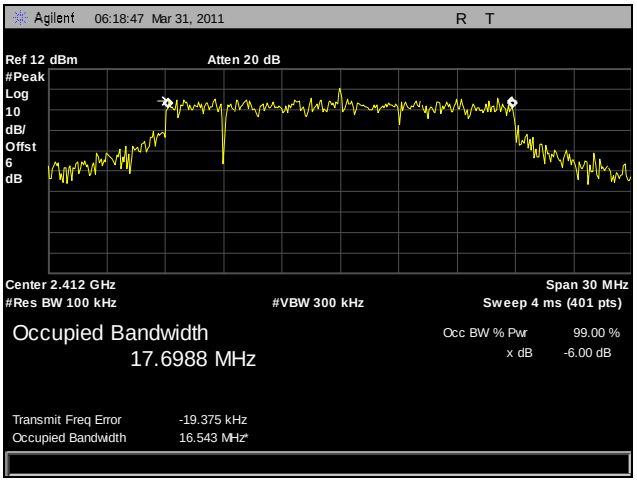
Figure 1. Block Diagram, Occupied Bandwidth Test Setup

Occupied Bandwidth Test Results

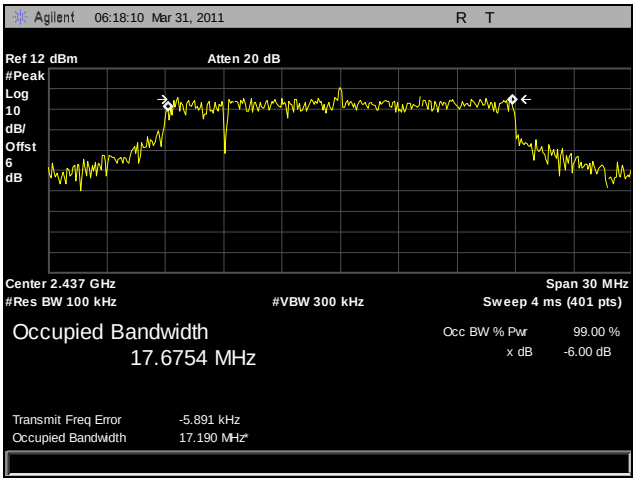
Mode	Channel	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)
HT20	2412	16.543	17.7735
	2437	17.190	17.6837
	2462	16.310	17.8186
	5745	17.546	17.7391
	5785	17.688	17.8022
	5825	16.814	17.8193
HT40	2422	35.311	36.1014
	2437	34.569	36.2460
	2452	36.355	36.1092
	5755	35.094	36.7133
	5795	36.306	36.2546

Table 6. Occupied Bandwidth, Test Results

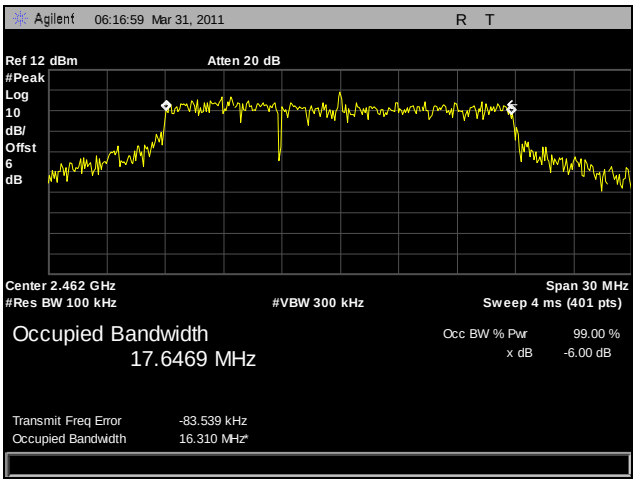
6 dB Occupied Bandwidth Test Results, 2.4 GHz, HT20



Plot 1. 6 dB Occupied Bandwidth, Low Channel, 2.4 GHz, HT20

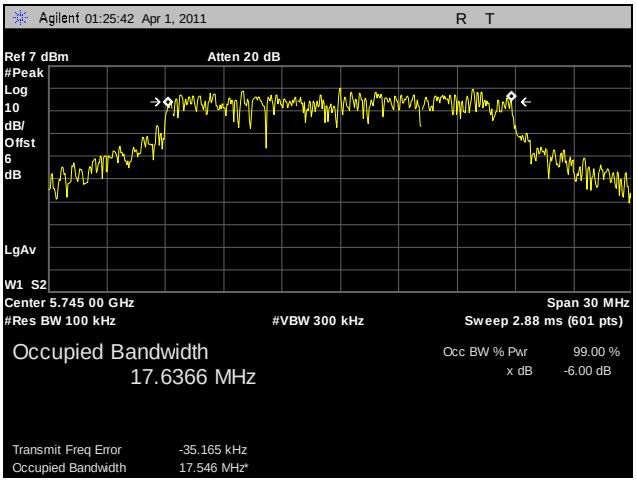


Plot 2. 6 dB Occupied Bandwidth, Mid Channel, 2.4 GHz, HT20

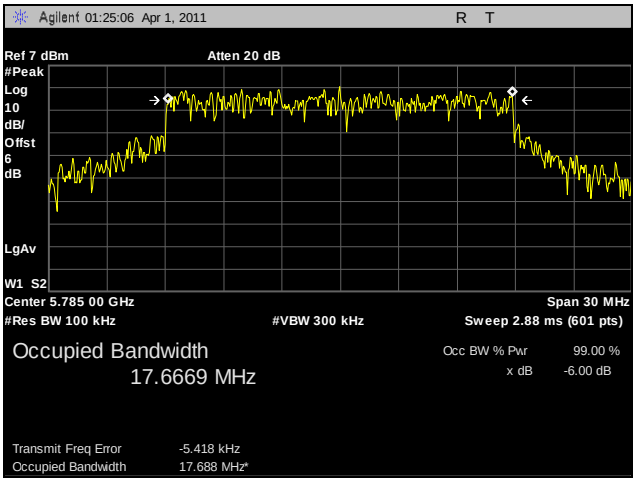


Plot 3. 6 dB Occupied Bandwidth, High Channel, 2.4 GHz, HT20

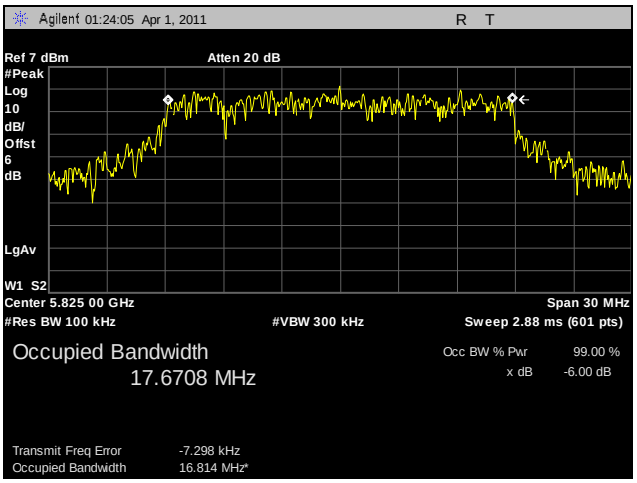
6 dB Occupied Bandwidth Test Results, 5.8 GHz, HT20



Plot 4. 6 dB Occupied Bandwidth, Low Channel, 5.8 GHz, HT20

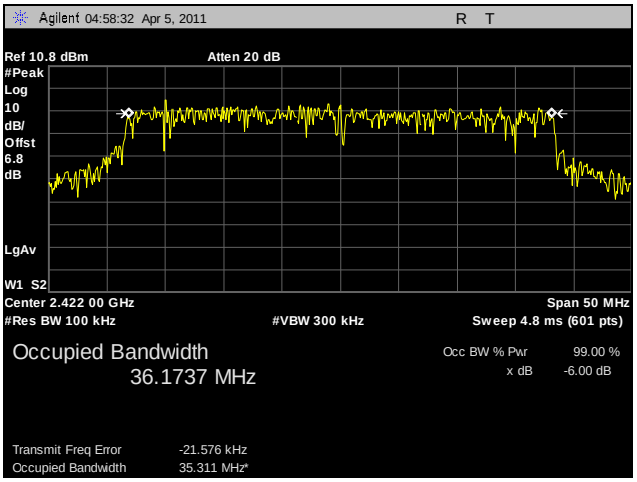


Plot 5. 6 dB Occupied Bandwidth, Mid Channel, 5.8 GHz, HT20

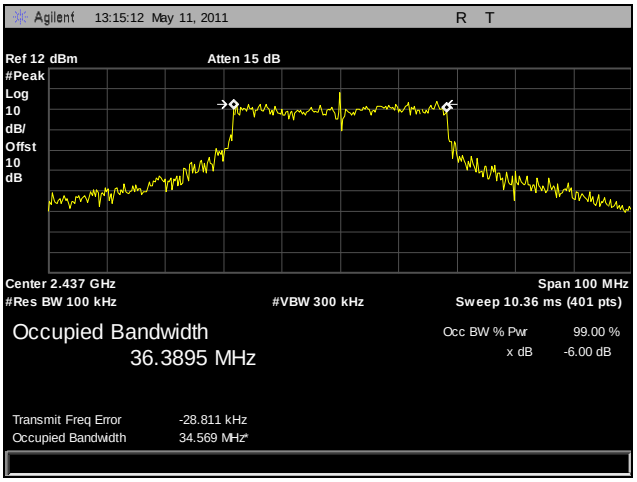


Plot 6. 6 dB Occupied Bandwidth, High Channel, 5.8 GHz, HT20

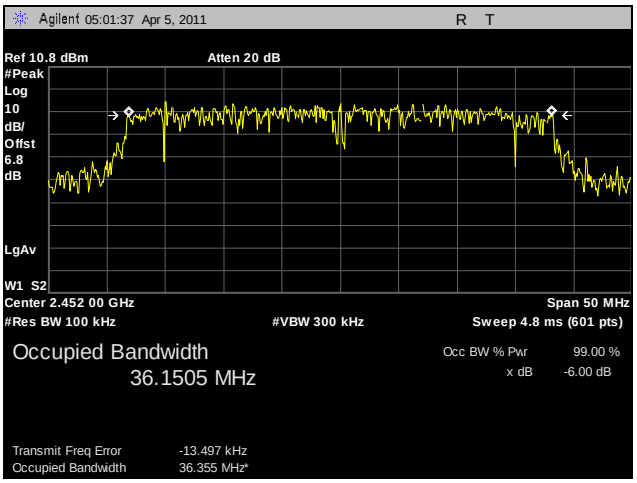
6 dB Occupied Bandwidth Test Results, 2.4 GHz, HT40



Plot 7. 6 dB Occupied Bandwidth, Low Channel, 2.4 GHz, HT40

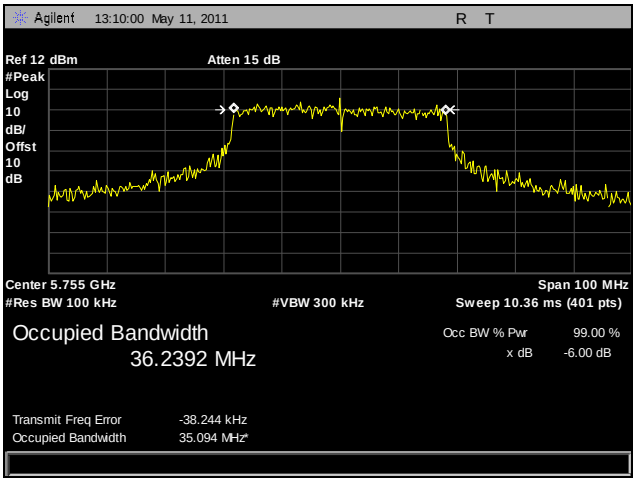


Plot 8. 6 dB Occupied Bandwidth, Mid Channel, 2.4 GHz, HT40

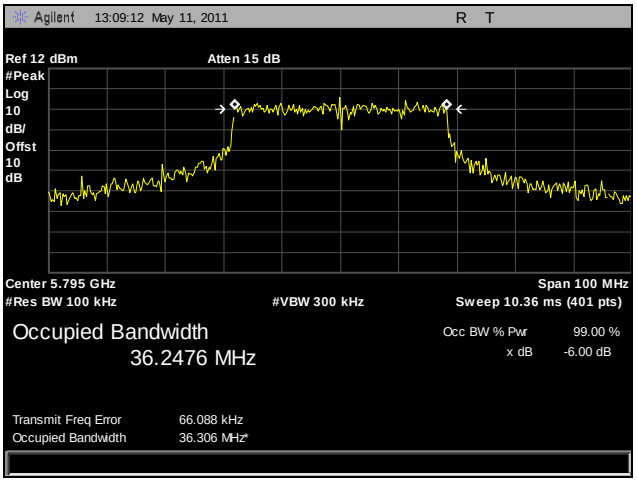


Plot 9. 6 dB Occupied Bandwidth, High Channel, 2.4 GHz, HT40

6 dB Occupied Bandwidth Test Results, 5.8 GHz, HT40

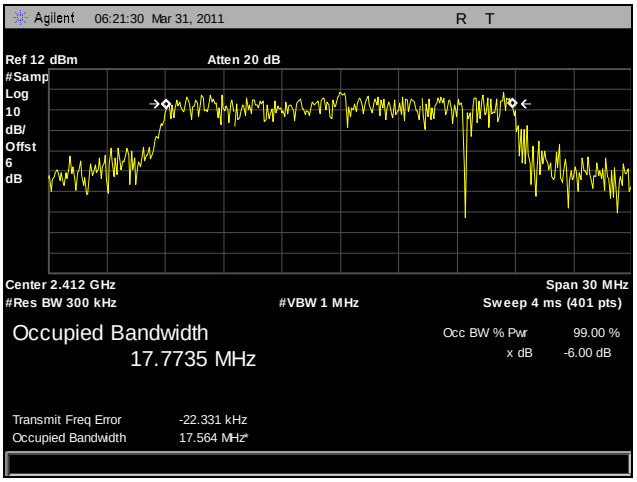


Plot 10. 6 dB Occupied Bandwidth, Low Channel, 5.8 GHz, HT40

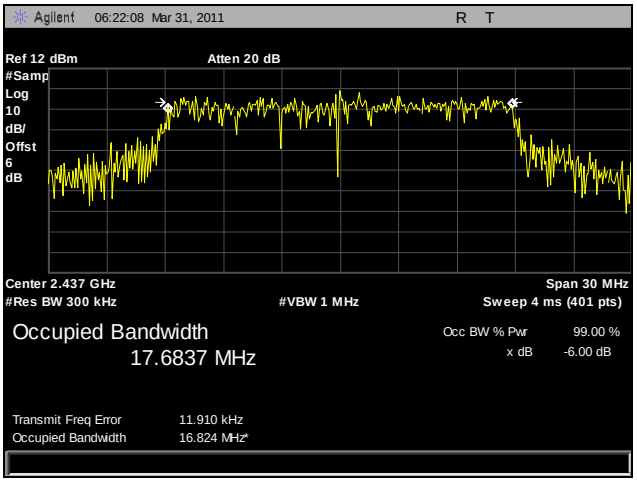


Plot 11. 6 dB Occupied Bandwidth, High Channel, 5.8 GHz, HT40

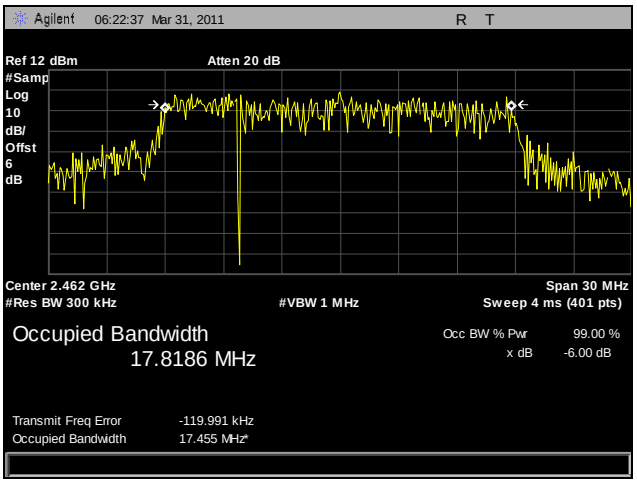
99% Occupied Bandwidth Test Results, 2.4 GHz, HT20



Plot 12. 99% Occupied Bandwidth, Low Channel, 2.4 GHz, HT20

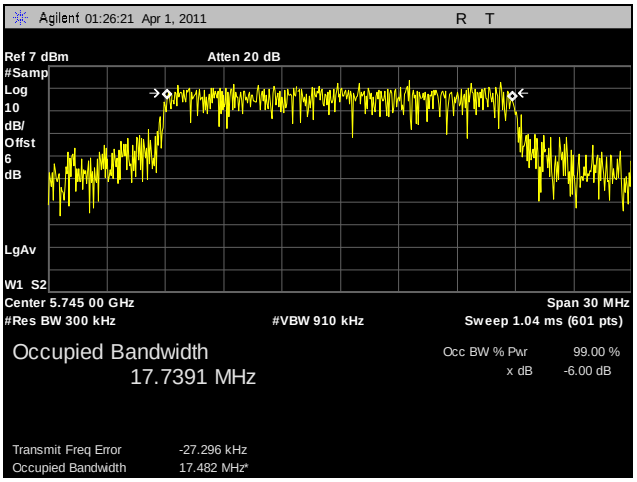


Plot 13. 99% Occupied Bandwidth, Mid Channel, 2.4 GHz, HT20

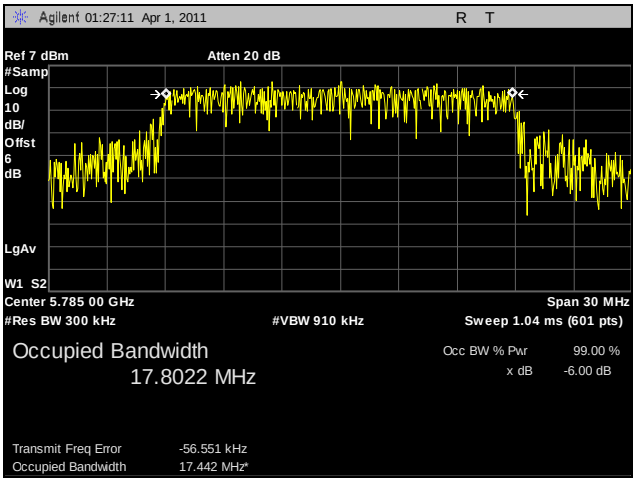


Plot 14. 99% Occupied Bandwidth, High Channel, 2.4 GHz, HT20

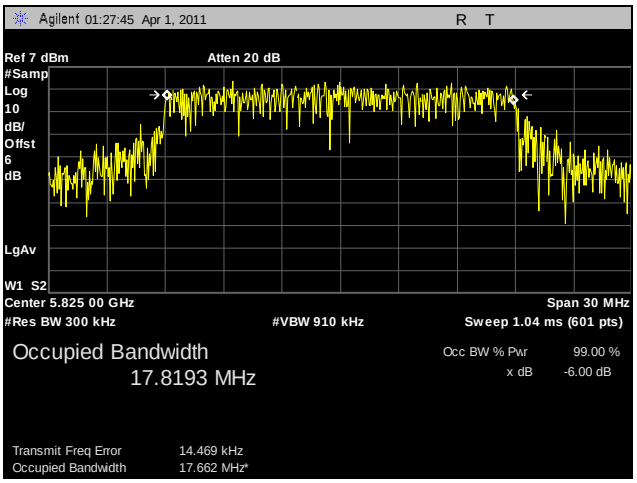
99% Occupied Bandwidth Test Results, 5.8 GHz, HT20



Plot 15. 99% Occupied Bandwidth, Low Channel, 5.8 GHz, HT20

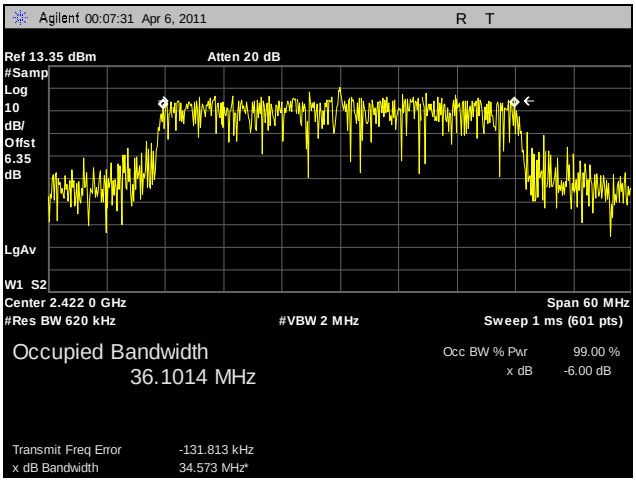


Plot 16. 99% Occupied Bandwidth, Mid Channel, 5.8 GHz, HT20

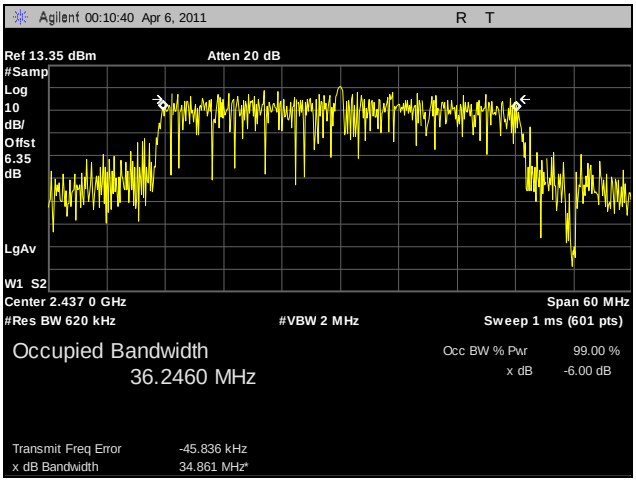


Plot 17. 99% Occupied Bandwidth, High Channel, 5.8 GHz, HT20

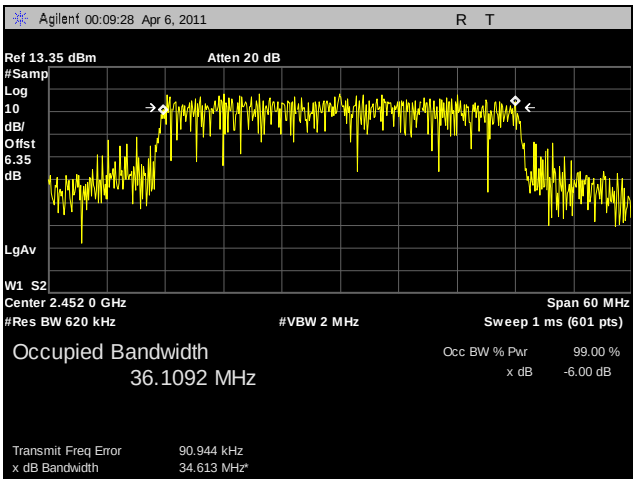
99% Occupied Bandwidth Test Results, 2.4 GHz, HT40



Plot 18. 99% Occupied Bandwidth, Low Channel, 2.4 GHz, HT40

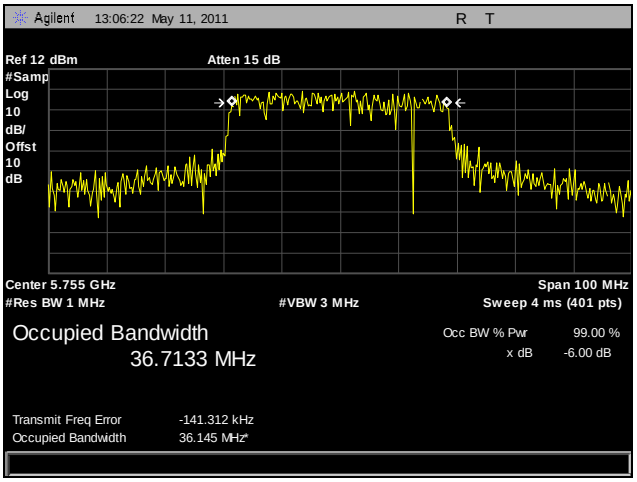


Plot 19. 99% Occupied Bandwidth, Mid Channel, 2.4 GHz, HT40

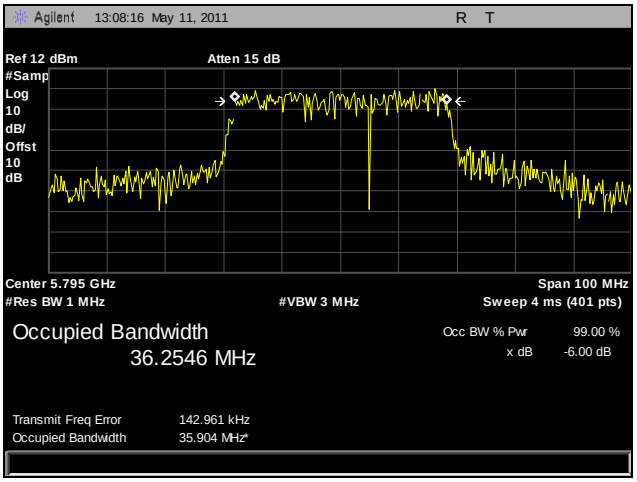


Plot 20. 99% Occupied Bandwidth, High Channel, 2.4 GHz, HT40

99% Occupied Bandwidth Test Results, 5.8 GHz, HT40



Plot 21. 99% Occupied Bandwidth, Low Channel, 5.8 GHz, HT40



Plot 22. 99% Occupied Bandwidth, High Channel, 5.8 GHz, HT40

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) Peak Power Output

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 7. Output Power Requirements from §15.247(b)

§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 7, 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: The transmitter was connected to a calibrated spectrum analyzer. The EUT was measured at the low, mid and high channels of each band at the maximum power level.

Test Results: The EUT was compliant with the Peak Power Output limits of **§15.247(b)** and is lower than the originally granted values.

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 05/12/11

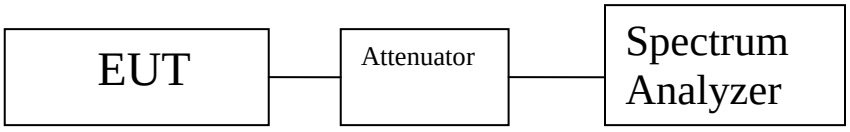


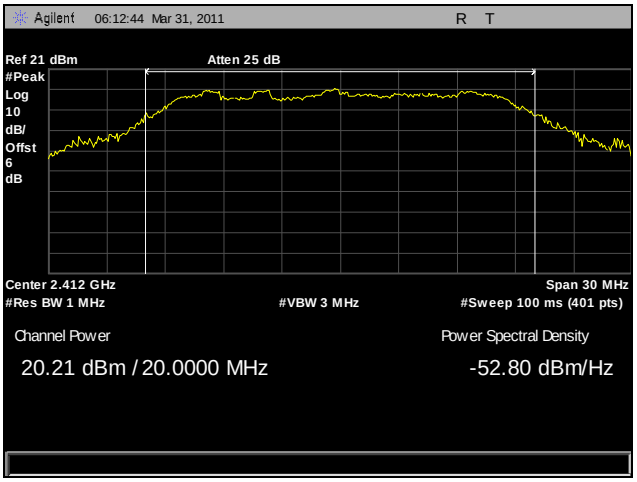
Figure 2. Peak Power Output Test Setup

Peak Power Output Test Results

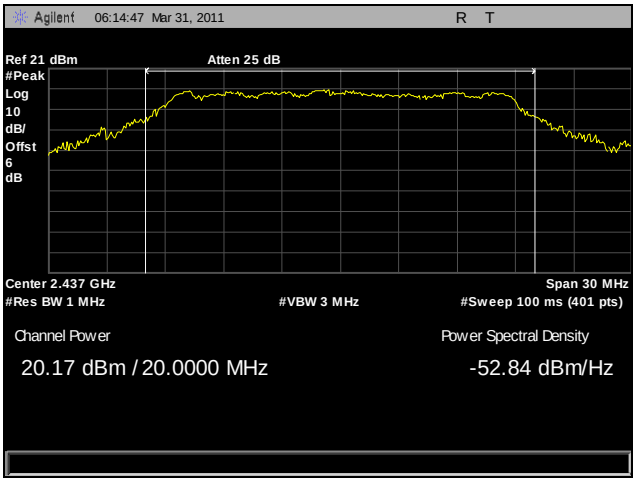
Mode	Channel	Conducted Power (dBm)	Conducted Power (mW)
HT20	2412	20.21	104.95
	2437	20.17	104.00
	2462	20.35	108.39
	5745	19.01	79.62
	5785	19.08	80.90
	5825	19.2	83.18
HT40	2422	16.72	47.00
	2437	20.77	119.40
	2452	18	63.10
	5755	18.04	63.70
	5795	18.06	64.00

Table 8. Peak Power Output, Test Results

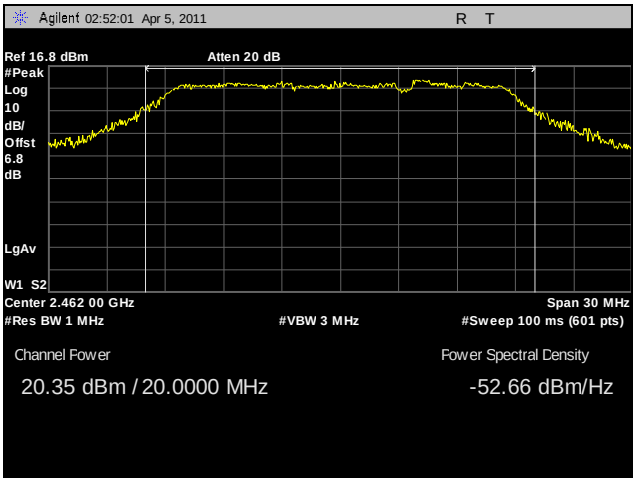
Peak Power Output Test Results, 2.4 GHz, HT20



Plot 23. Peak Power Output, Low Channel, 2.4 GHz, HT20

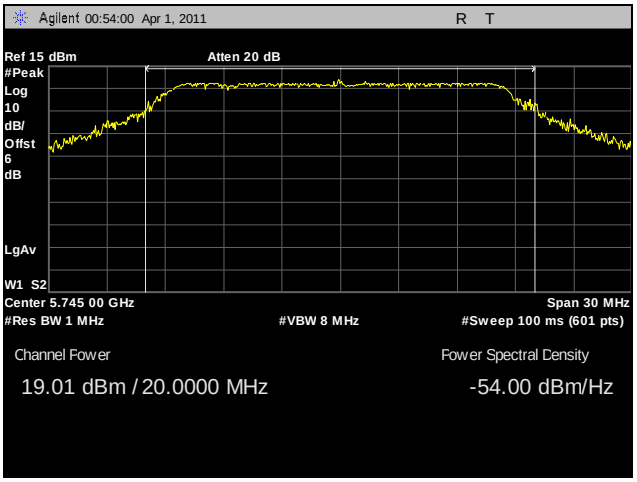


Plot 24. Peak Power Output, Mid Channel, 2.4 GHz, HT20

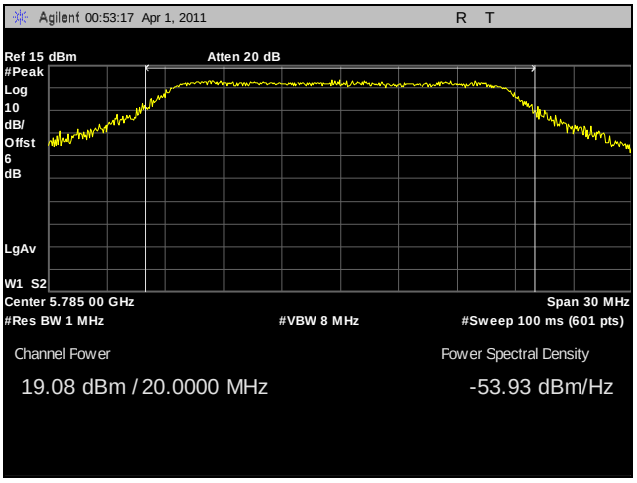


Plot 25. Peak Power Output, High Channel, 2.4 GHz, HT20

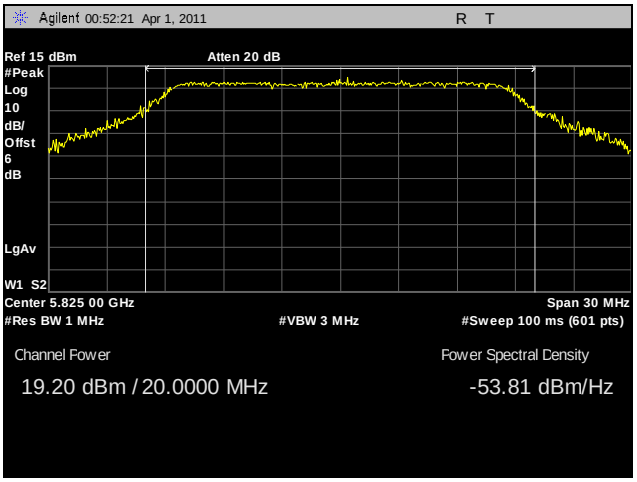
Peak Power Output Test Results, 5.8 GHz, HT20



Plot 26. Peak Power Output, Low Channel, 5.8 GHz, HT20

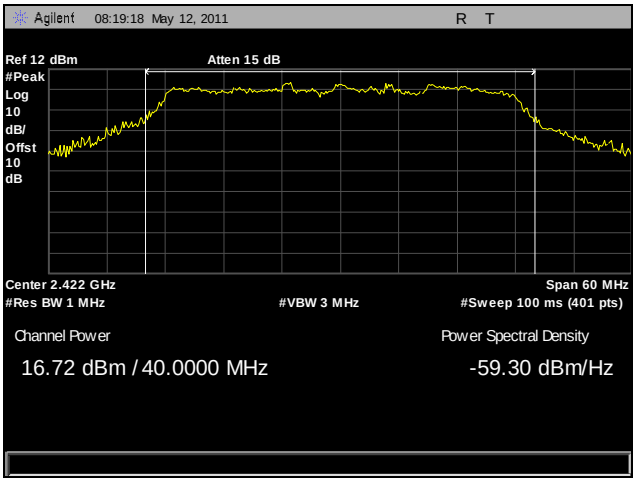


Plot 27. Peak Power Output, Mid Channel, 5.8 GHz, HT20

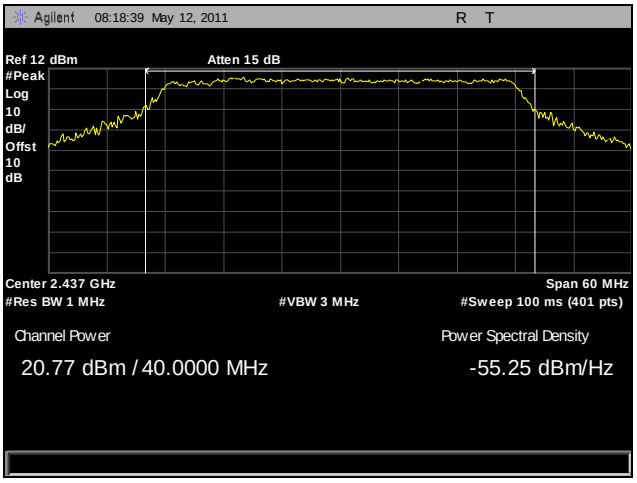


Plot 28. Peak Power Output, High Channel, 5.8 GHz, HT20

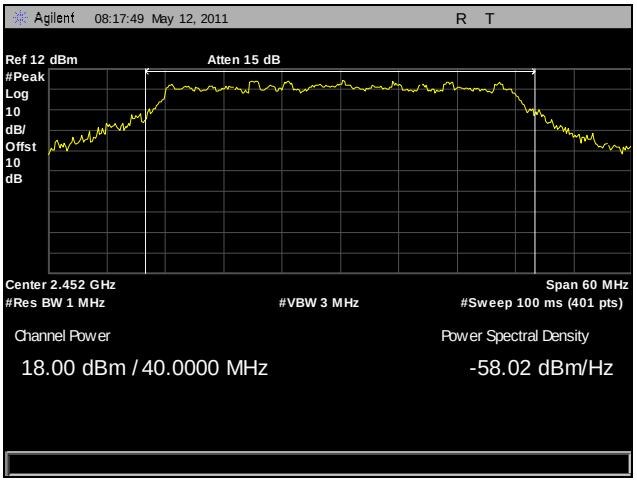
Peak Power Output Test Results, 2.4 GHz, HT40



Plot 29. Peak Power Output, Low Channel, 2.4 GHz, HT40

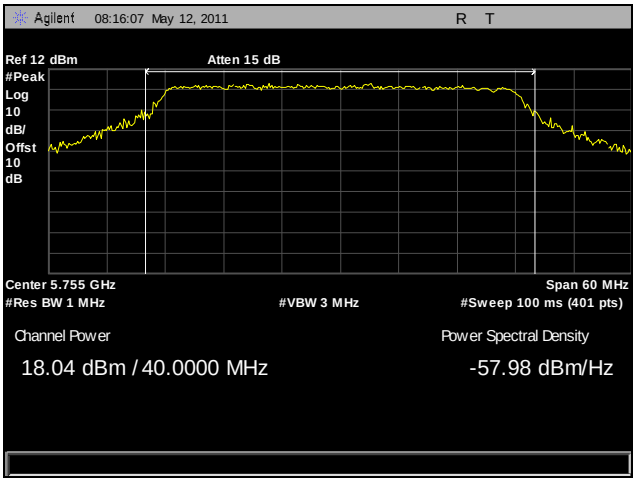


Plot 30. Peak Power Output, Mid Channel, 2.4 GHz, HT40

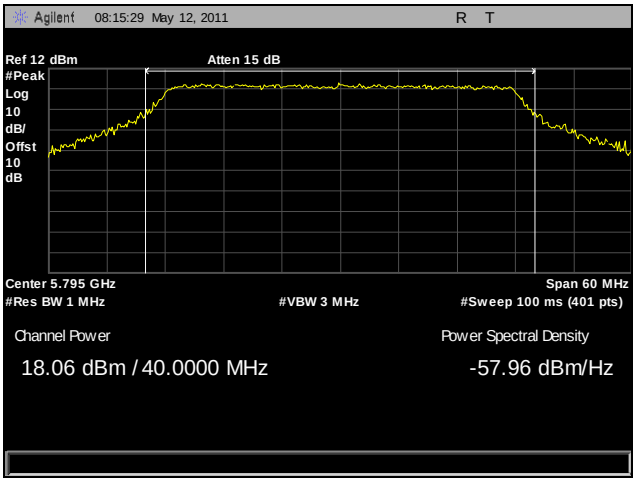


Plot 31. Peak Power Output, High Channel, 2.4 GHz, HT40

Peak Power Output Test Results, 5.8 GHz, HT40



Plot 32. Peak Power Output, Low Channel, 5.8 GHz, HT40



Plot 33. Peak Power Output, High Channel, 5.8 GHz, HT40

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 9. 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 10.

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

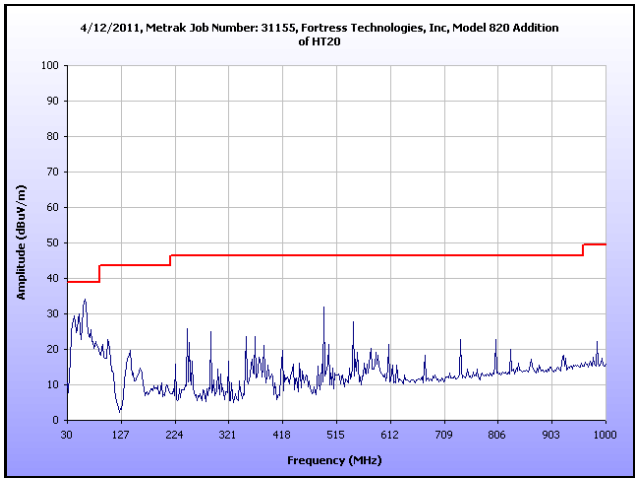
Test Procedures: The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. Only noise floor was measured above 18 GHz.

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

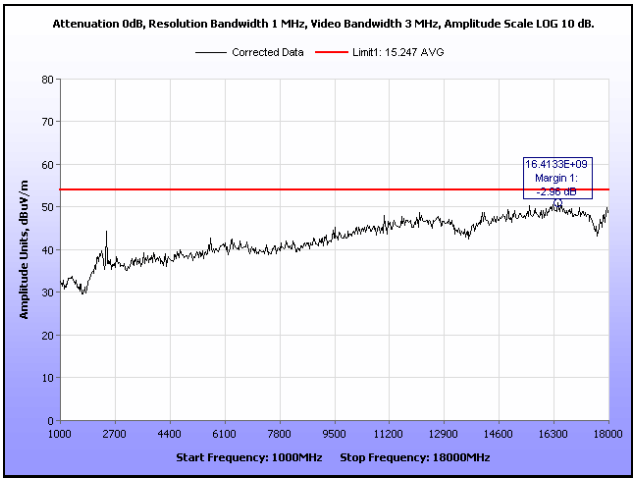
Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 05/12/11

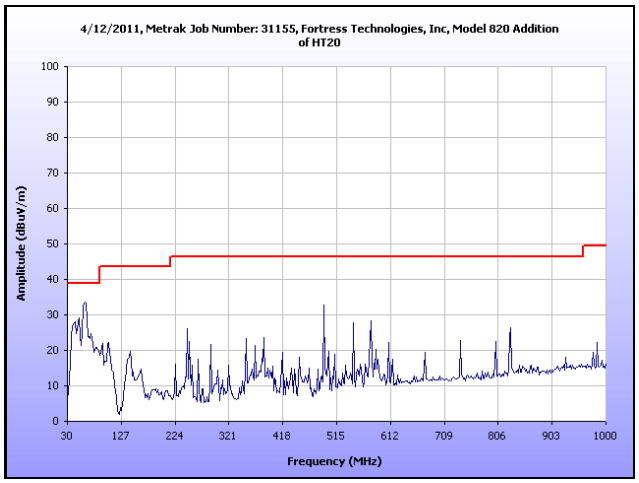
Radiated Spurious Emissions Test Results, 2.4 GHz, HT20



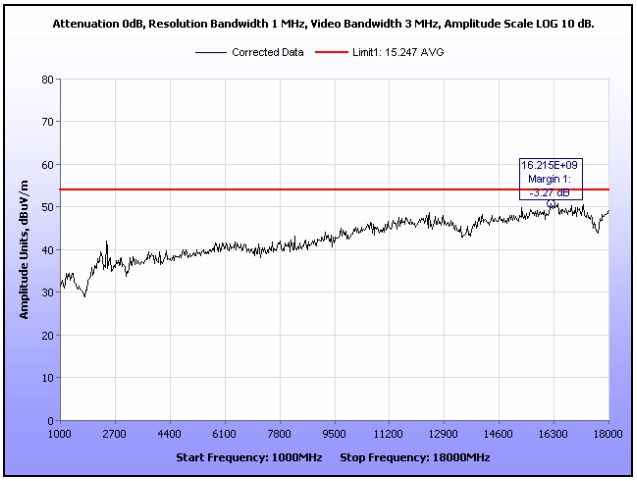
Plot 34. Radiated Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 2.4 GHz, HT20



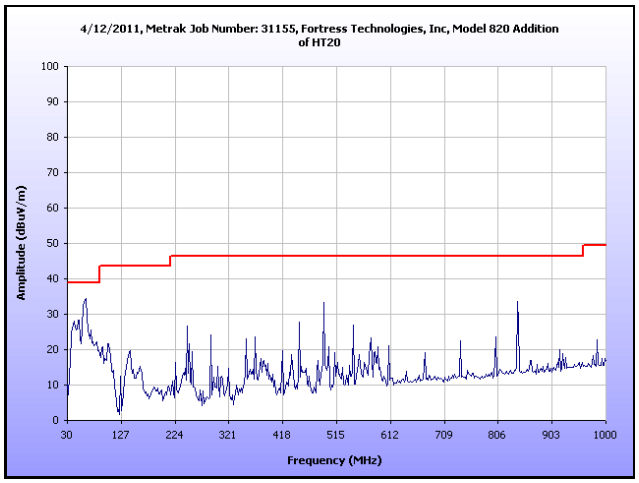
Plot 35. Radiated Spurious Emissions, Low Channel, 1 GHz – 18 GHz, 2.4 GHz, HT20



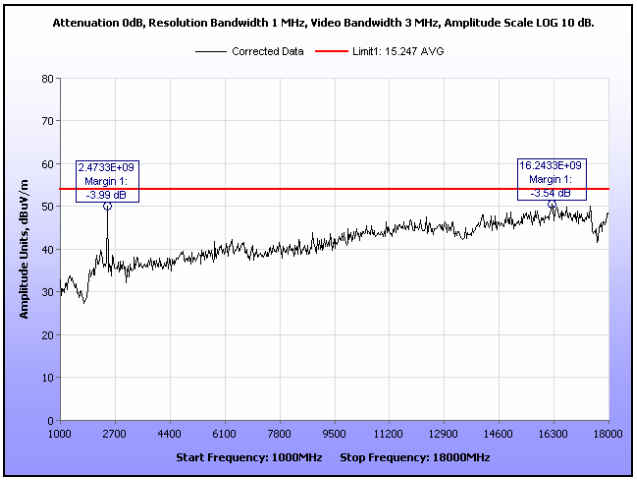
Plot 36. Radiated Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 2.4 GHz, HT20



Plot 37. Radiated Spurious Emissions, Mid Channel, 1 GHz – 18 GHz, 2.4 GHz, HT20

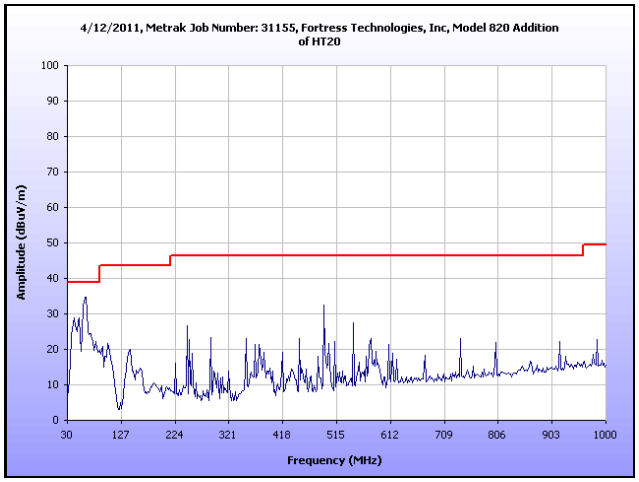


Plot 38. Radiated Spurious Emissions, High Channel, 30 MHz – 1 GHz, 2.4 GHz, HT20

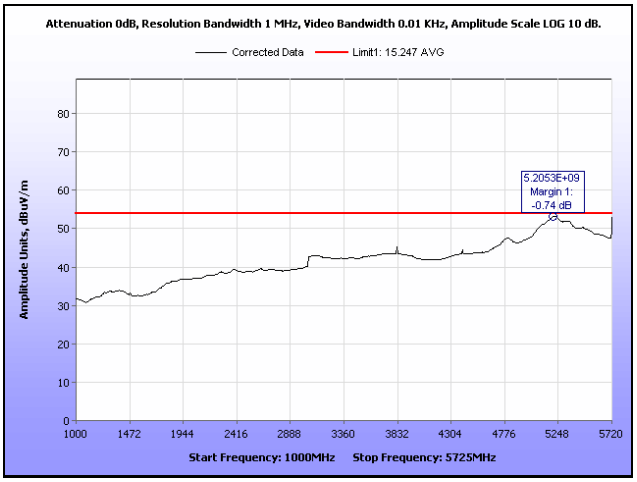


Plot 39. Radiated Spurious Emissions, High Channel, 1 GHz – 18 GHz, 2.4 GHz, HT20

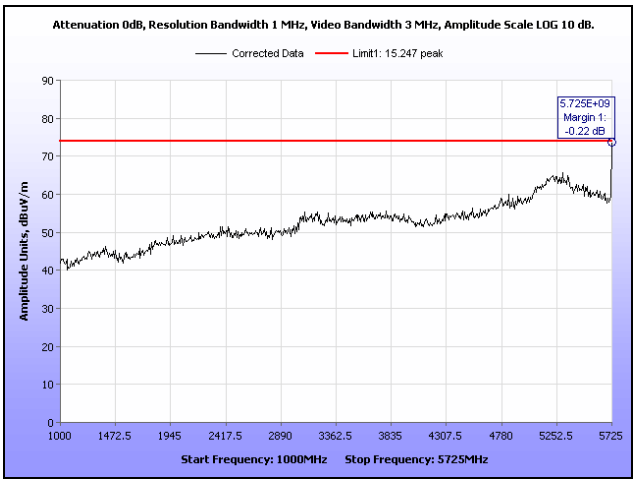
Radiated Spurious Emissions Test Results, 5.8 GHz, HT20



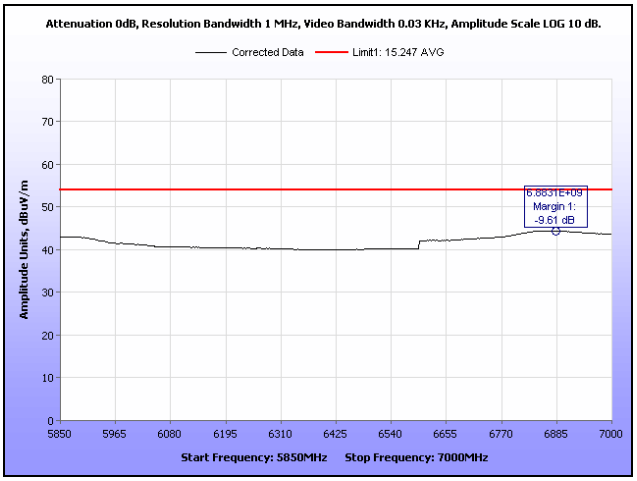
Plot 40. Radiated Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 5.8 GHz, HT20



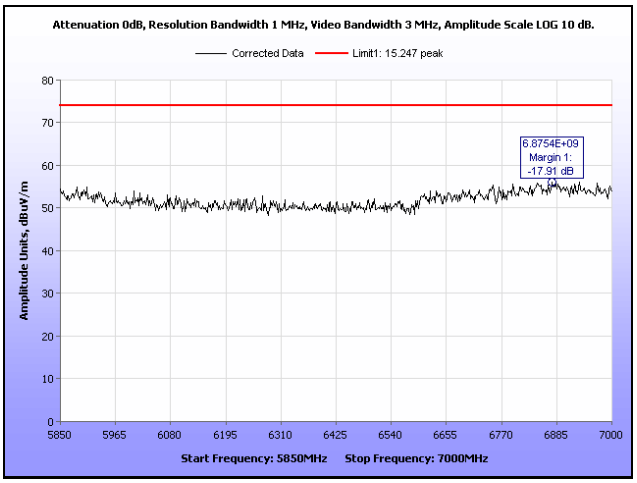
Plot 41. Radiated Spurious Emissions, Low Channel, 1 GHz – 5.725 GHz, Average, 5.8 GHz, HT20



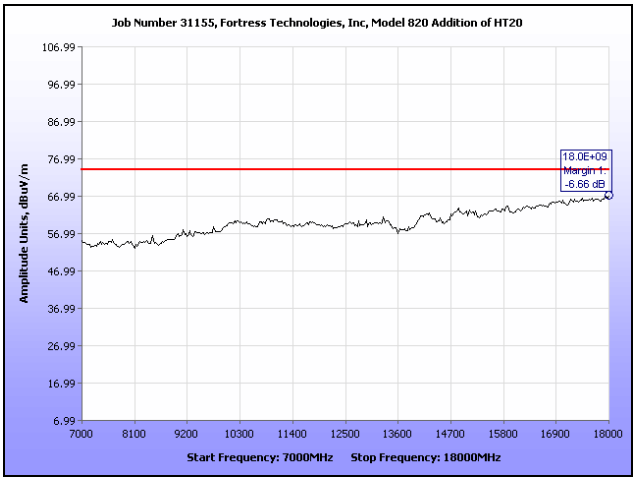
Plot 42. Radiated Spurious Emissions, Low Channel, 1 GHz – 5.725 GHz, Peak, 5.8 GHz, HT20



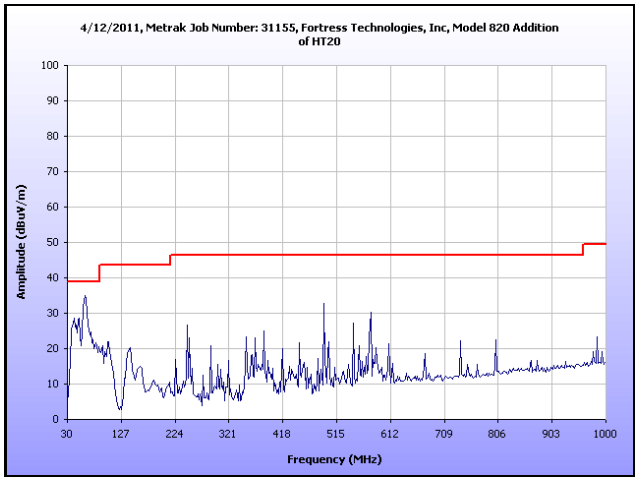
Plot 43. Radiated Spurious Emissions, Low Channel, 5.850 GHz – 7 GHz, Average, 5.8 GHz, HT20



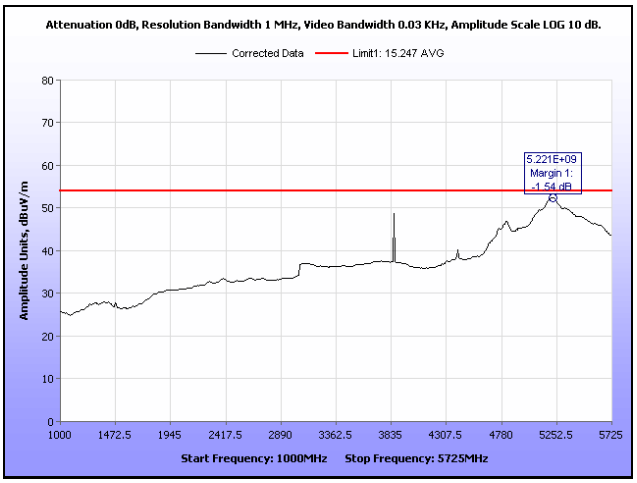
Plot 44. Radiated Spurious Emissions, Low Channel, 5.850 GHz – 7 GHz, Peak, 5.8 GHz, HT20



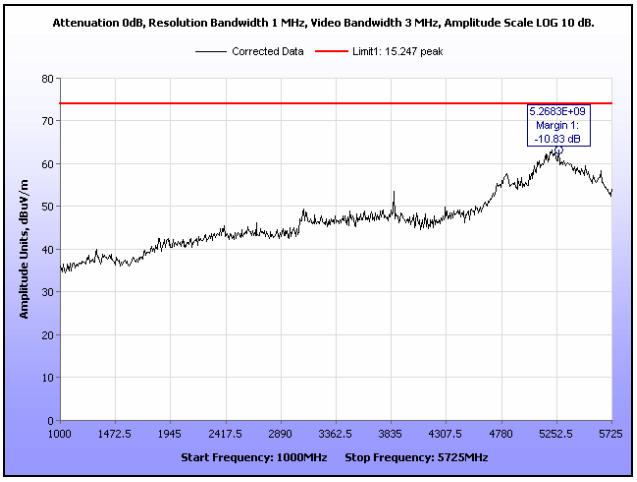
Plot 45. Radiated Spurious Emissions, Low Channel, 7 GHz – 18 GHz, 5.8 GHz, HT20



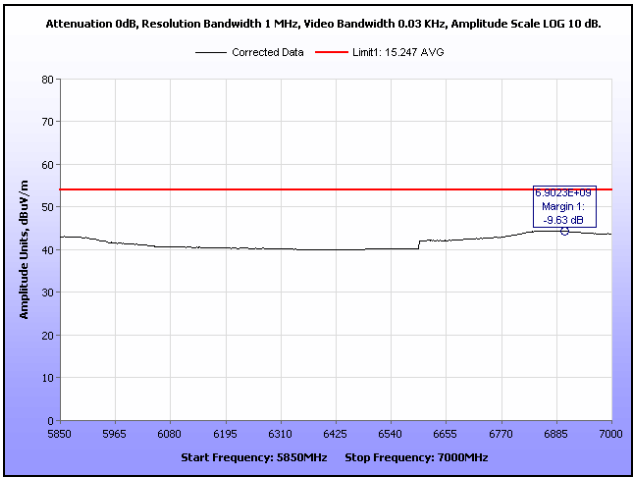
Plot 46. Radiated Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 5.8 GHz, HT20



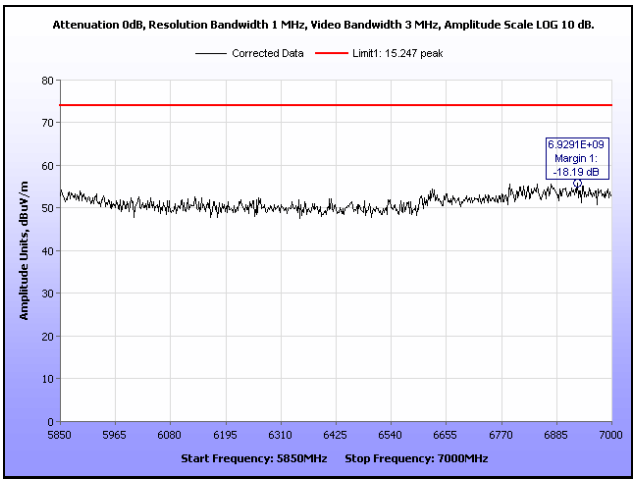
Plot 47. Radiated Spurious Emissions, Mid Channel, 1 GHz – 5.725 GHz, Average, 5.8 GHz, HT20



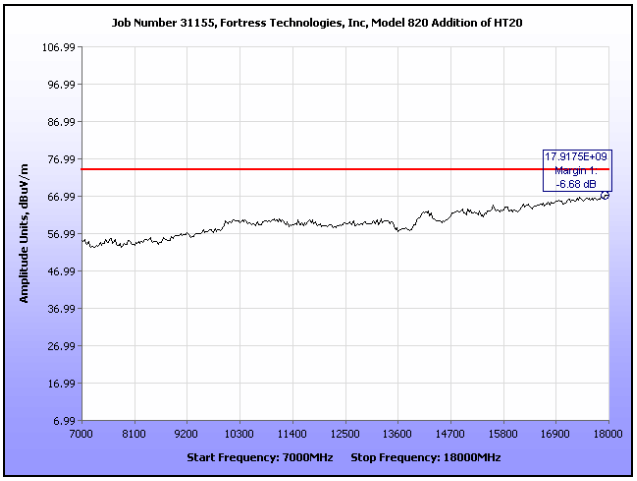
Plot 48. Radiated Spurious Emissions, Mid Channel, 1 GHz – 5.725 GHz, Peak, 5.8 GHz, HT20



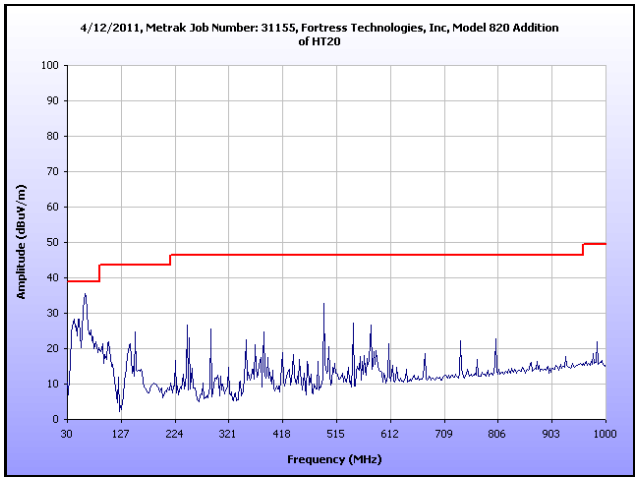
Plot 49. Radiated Spurious Emissions, Mid Channel, 5.850 GHz – 7 GHz, Average, 5.8 GHz, HT20



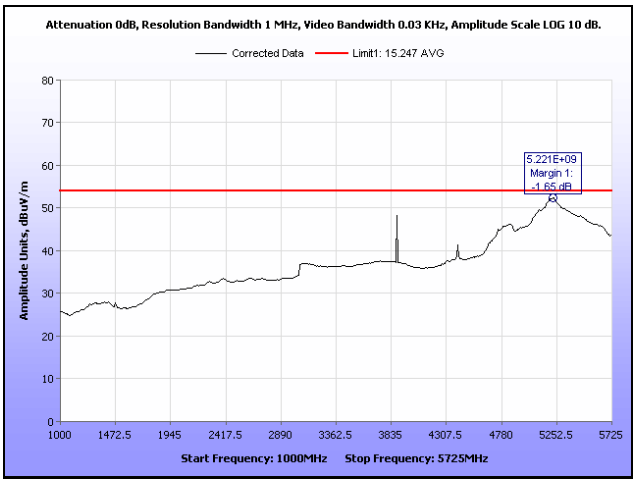
Plot 50. Radiated Spurious Emissions, Mid Channel, 5.850 GHz – 7 GHz, Peak, 5.8 GHz, HT20



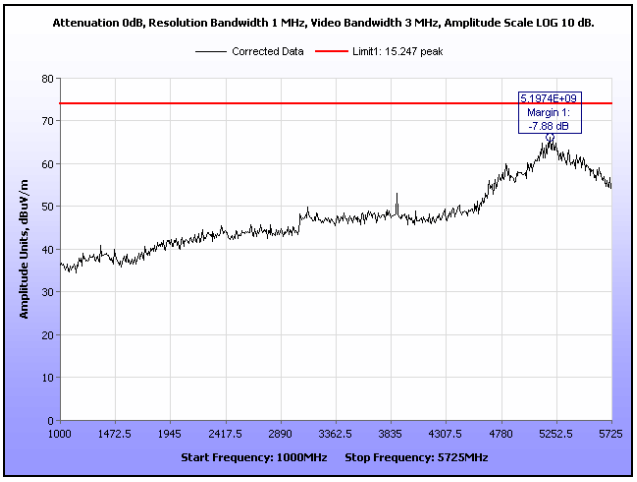
Plot 51. Radiated Spurious Emissions, Mid Channel, 7 GHz – 18 GHz, 5.8 GHz, HT20



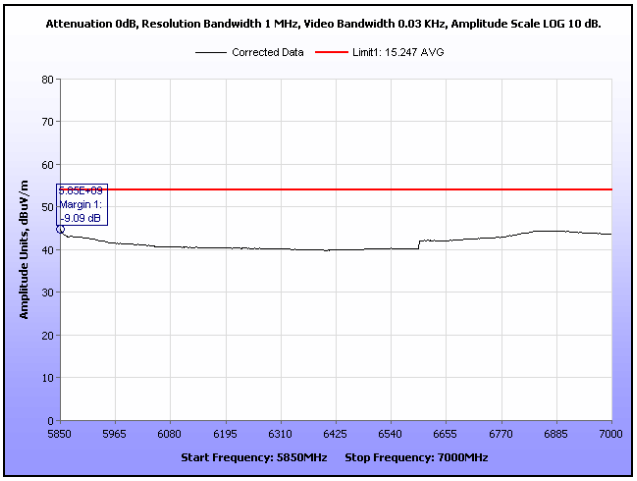
Plot 52. Radiated Spurious Emissions, High Channel, 30 MHz – 1 GHz, 5.8 GHz, HT20



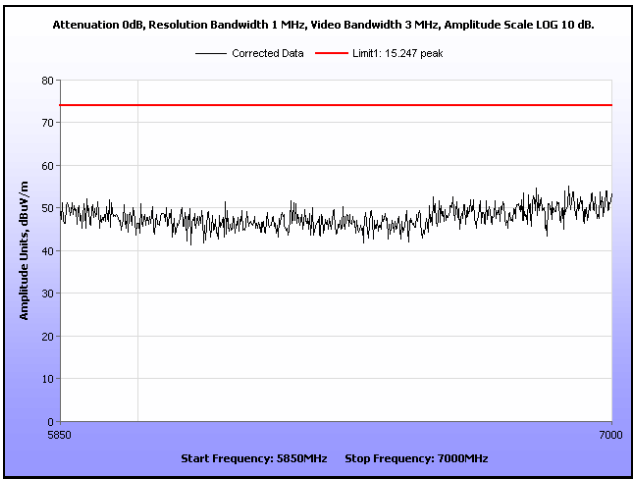
Plot 53. Radiated Spurious Emissions, High Channel, 1 GHz – 5.725 GHz, Average, 5.8 GHz, HT20



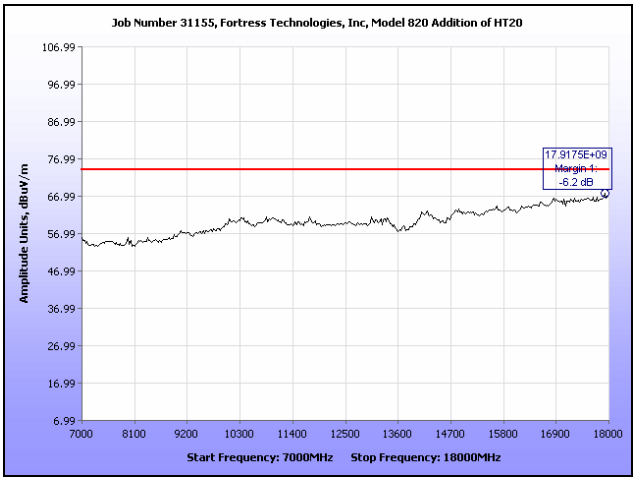
Plot 54. Radiated Spurious Emissions, High Channel, 1 GHz – 5.725 GHz, Peak, 5.8 GHz, HT20



Plot 55. Radiated Spurious Emissions, High Channel, 5.850 GHz – 7 GHz, Average, 5.8 GHz, HT20

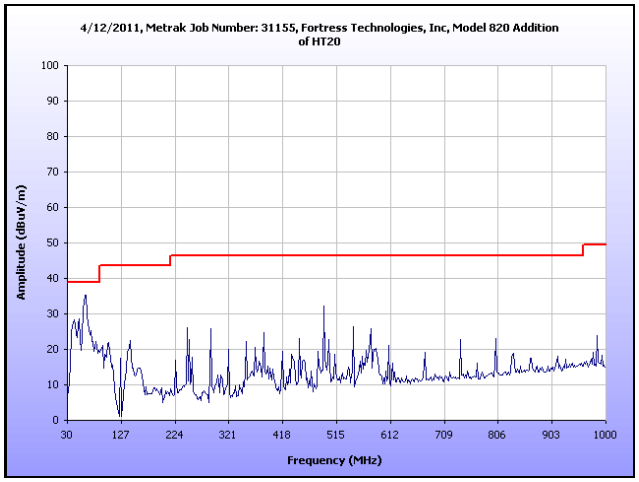


Plot 56. Radiated Spurious Emissions, High Channel, 5.850 GHz – 7 GHz, Peak, 5.8 GHz, HT20

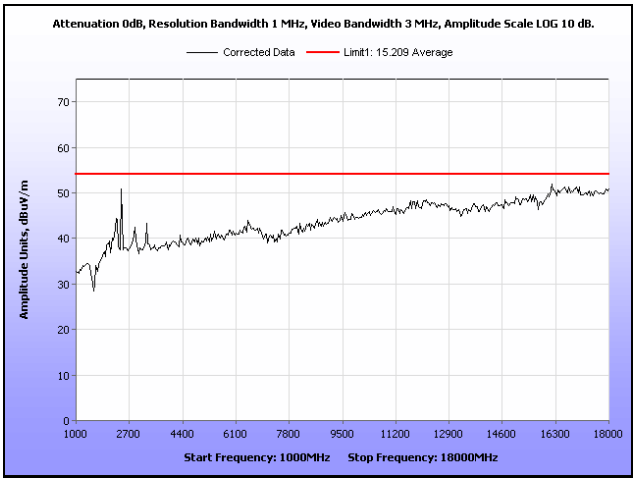


Plot 57. Radiated Spurious Emissions, High Channel, 7 GHz – 18 GHz, 5.8 GHz, HT20

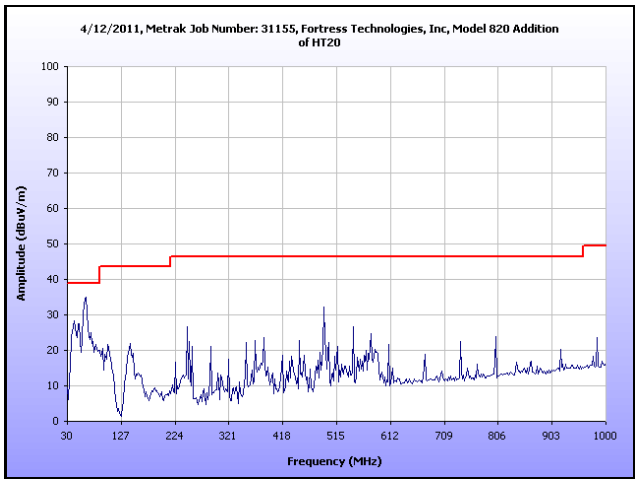
Radiated Spurious Emissions Test Results, 2.4 GHz, HT40



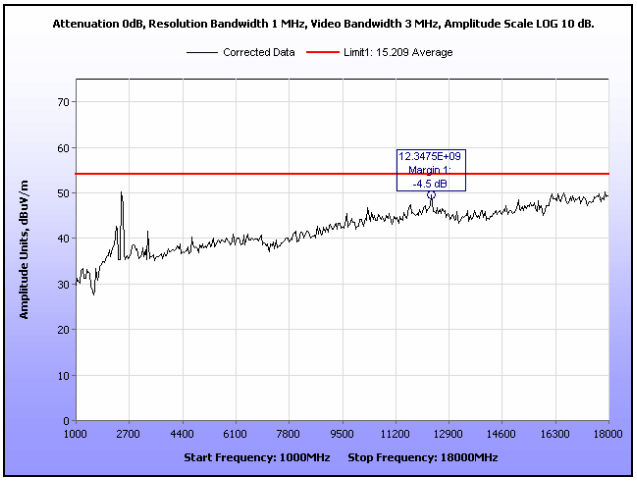
Plot 58. Radiated Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 2.4 GHz, HT40



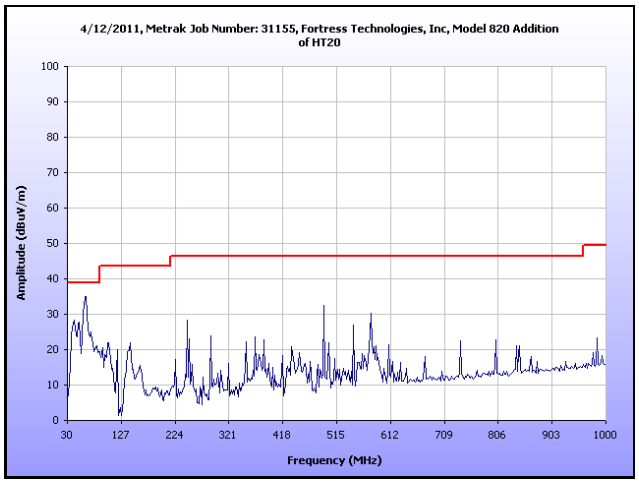
Plot 59. Radiated Spurious Emissions, Low Channel, 1 GHz – 18 GHz, 2.4 GHz, HT40



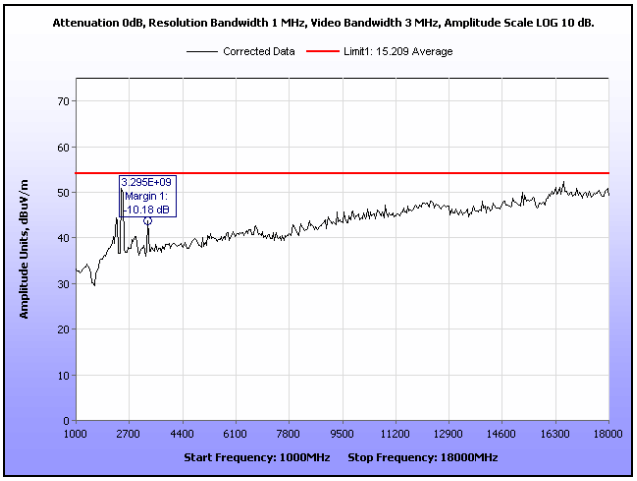
Plot 60. Radiated Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 2.4 GHz, HT40



Plot 61. Radiated Spurious Emissions, Mid Channel, 1 GHz – 18 GHz, 2.4 GHz, HT40

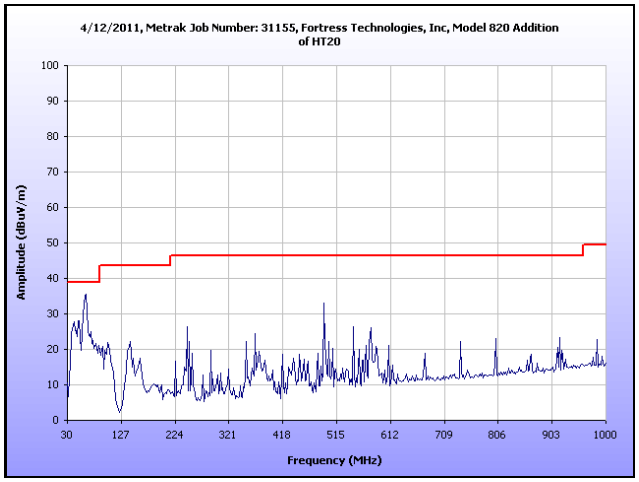


Plot 62. Radiated Spurious Emissions, High Channel, 30 MHz – 1 GHz, 2.4 GHz, HT40

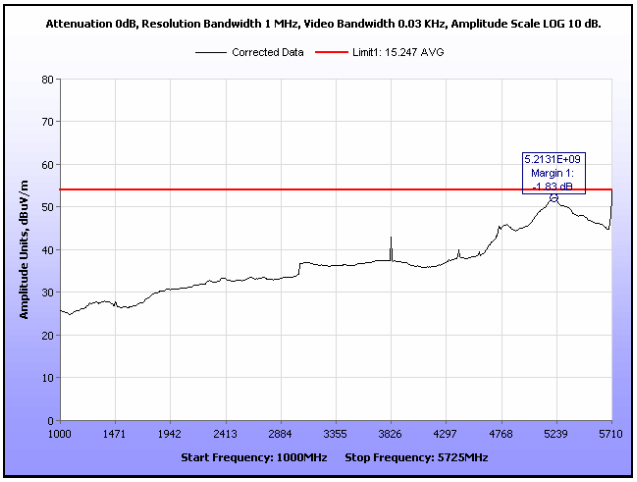


Plot 63. Radiated Spurious Emissions, High Channel, 1 GHz – 18 GHz, 2.4 GHz, HT40

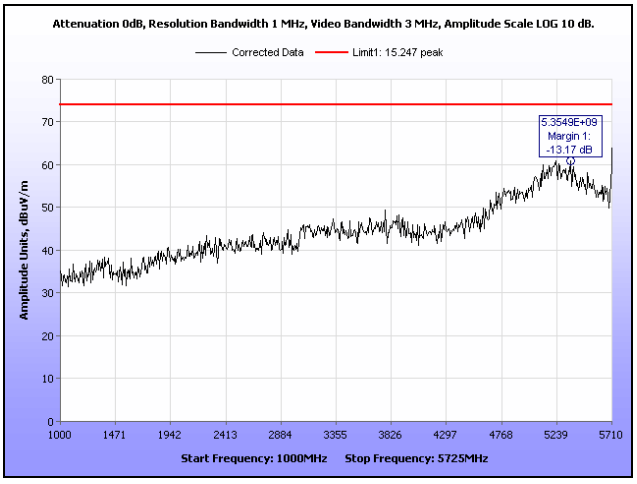
Radiated Spurious Emissions Test Results, 5.8 GHz, HT40



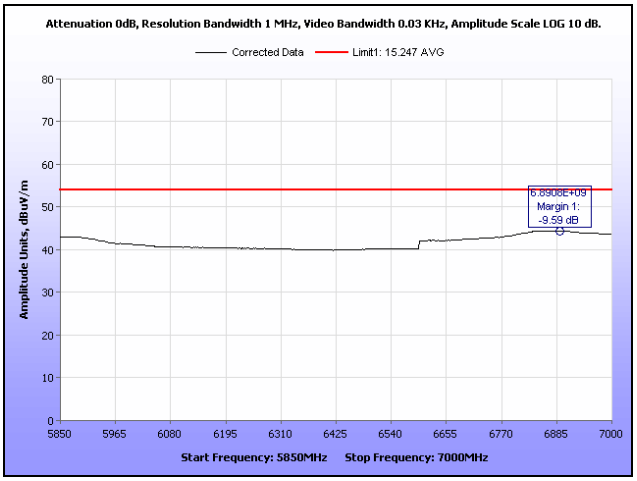
Plot 64. Radiated Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 5.8 GHz, HT40



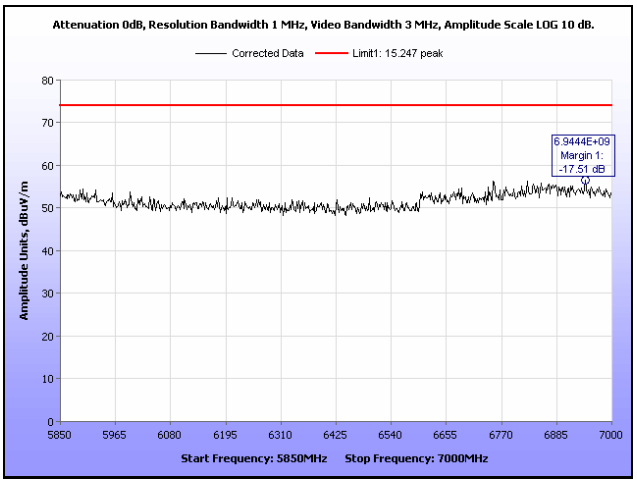
Plot 65. Radiated Spurious Emissions, Low Channel, 1 GHz – 5.725 GHz, Average, 5.8 GHz, HT40



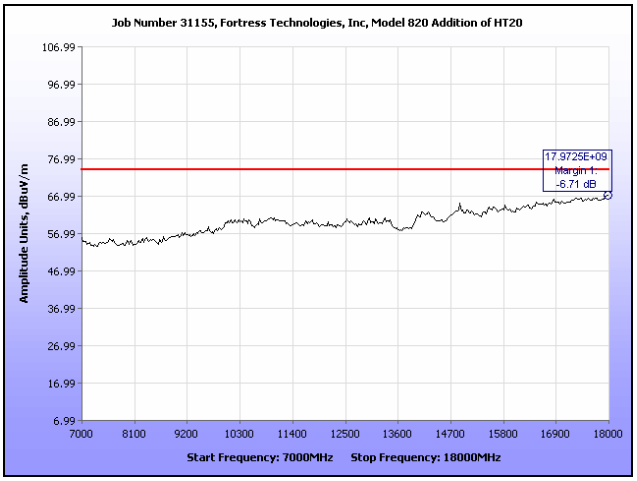
Plot 66. Radiated Spurious Emissions, Low Channel, 1 GHz – 5.725 GHz, Peak, 5.8 GHz, HT40



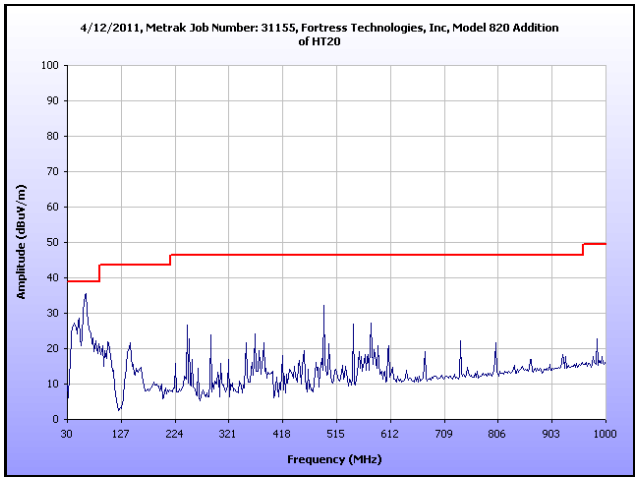
Plot 67. Radiated Spurious Emissions, Low Channel, 5.850 GHz – 7 GHz, Average, 5.8 GHz, HT40



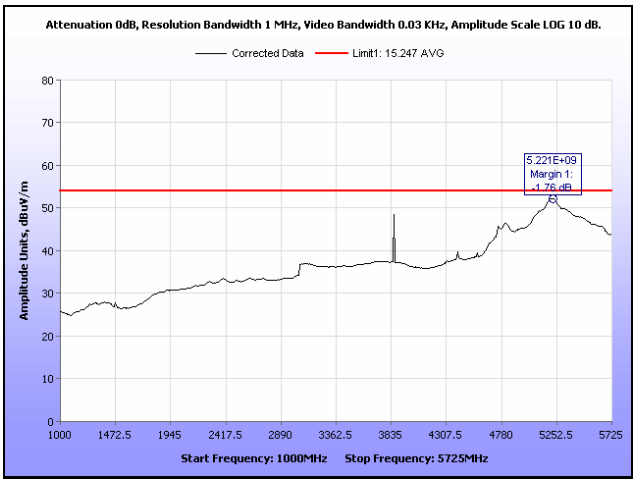
Plot 68. Radiated Spurious Emissions, Low Channel, 5.850 GHz – 7 GHz, Peak, 5.8 GHz, HT40



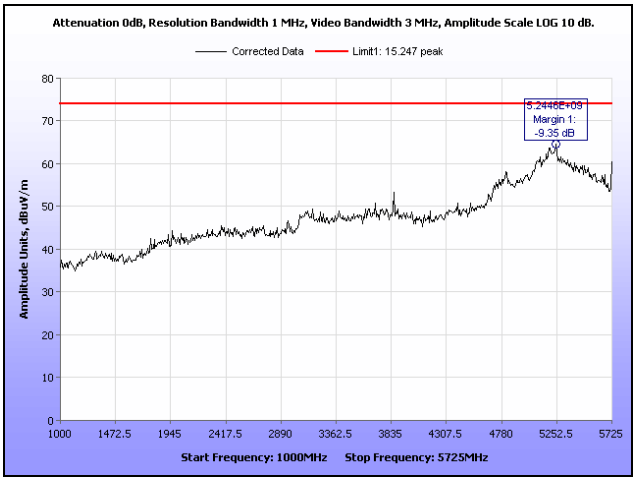
Plot 69. Radiated Spurious Emissions, Low Channel, 7 GHz – 18 GHz, 5.8 GHz, HT40



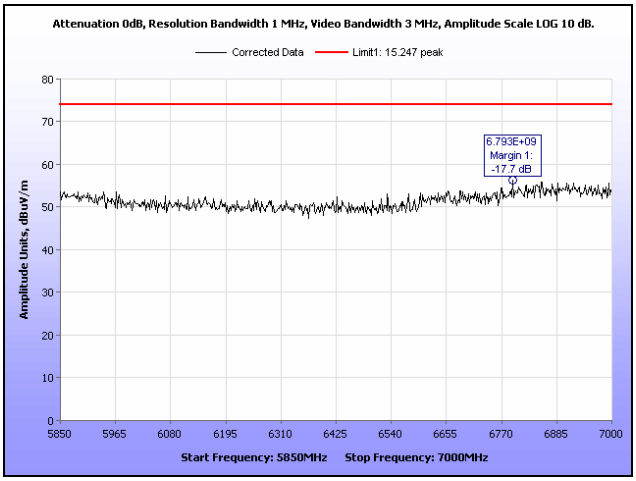
Plot 70. Radiated Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 5.8 GHz, HT40



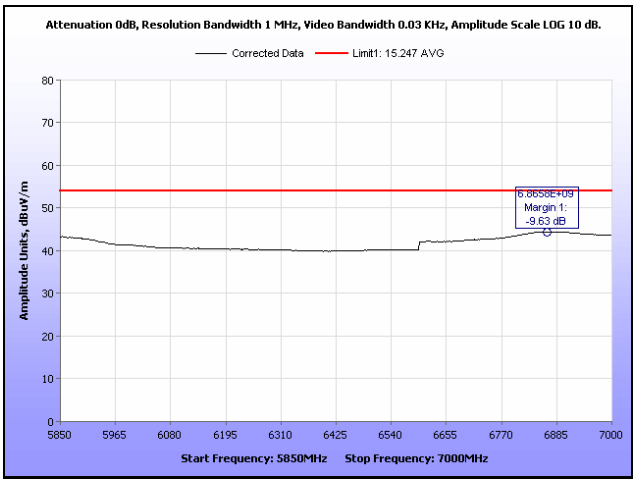
Plot 71. Radiated Spurious Emissions, Mid Channel, 1 GHz – 5.725 GHz, Average, 5.8 GHz, HT40



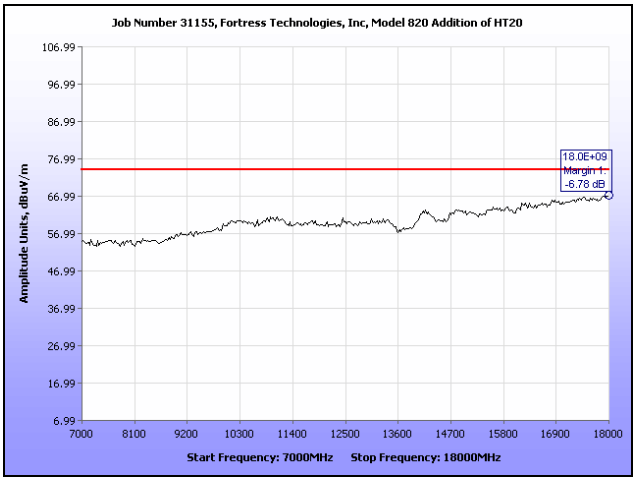
Plot 72. Radiated Spurious Emissions, Mid Channel, 1 GHz – 5.725 GHz, Peak, 5.8 GHz, HT40



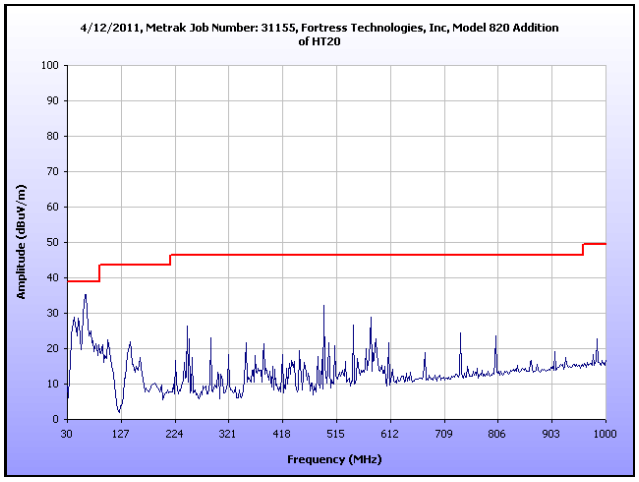
Plot 73. Radiated Spurious Emissions, Mid Channel, 5.850 GHz – 7 GHz, Average, 5.8 GHz, HT40



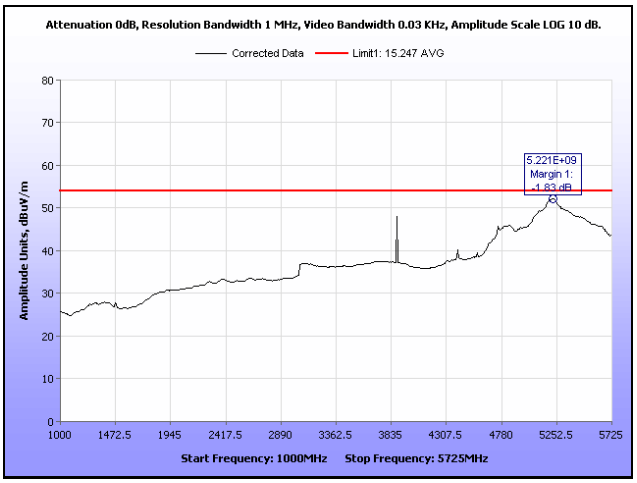
Plot 74. Radiated Spurious Emissions, Mid Channel, 5.850 GHz – 7 GHz, Peak, 5.8 GHz, HT40



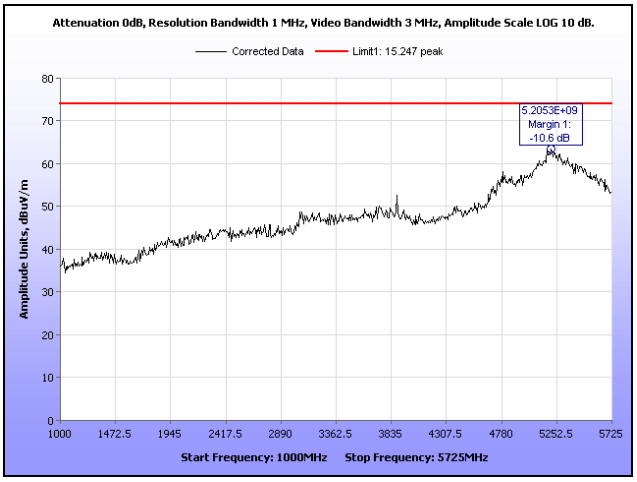
Plot 75. Radiated Spurious Emissions, Mid Channel, 7 GHz – 18 GHz, 5.8 GHz, HT40



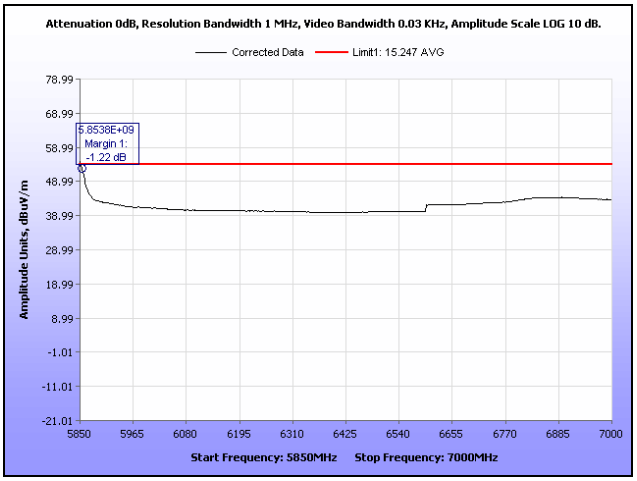
Plot 76. Radiated Spurious Emissions, High Channel, 30 MHz – 1 GHz, 5.8 GHz, HT40



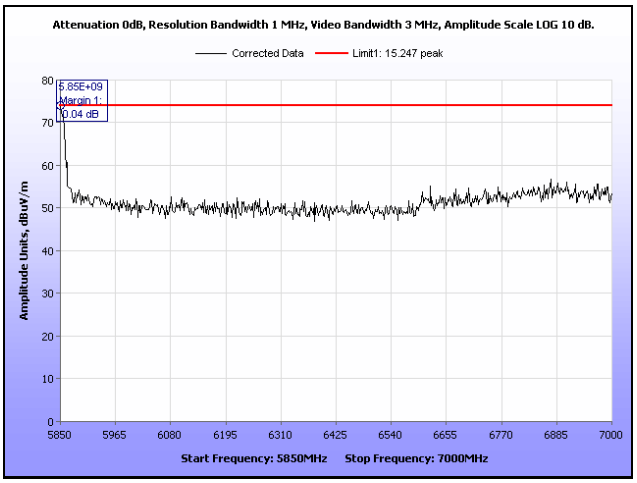
Plot 77. Radiated Spurious Emissions, High Channel, 1 GHz – 5.725 GHz, Average, 5.8 GHz, HT40



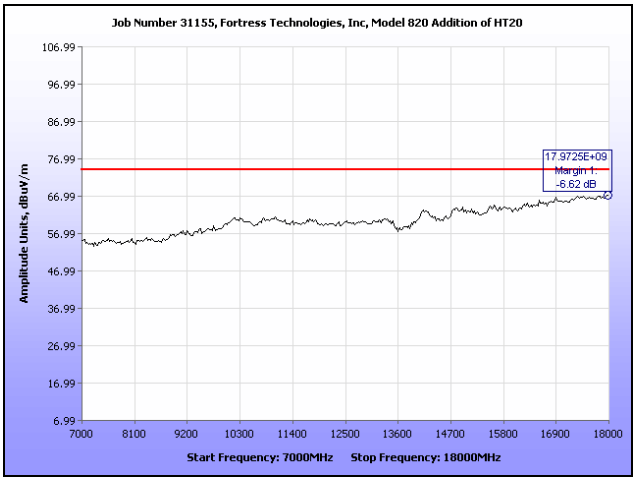
Plot 78. Radiated Spurious Emissions, High Channel, 1 GHz – 5.725 GHz, Peak, 5.8 GHz, HT40



Plot 79. Radiated Spurious Emissions, High Channel, 5.850 GHz – 7 GHz, Average, 5.8 GHz, HT40



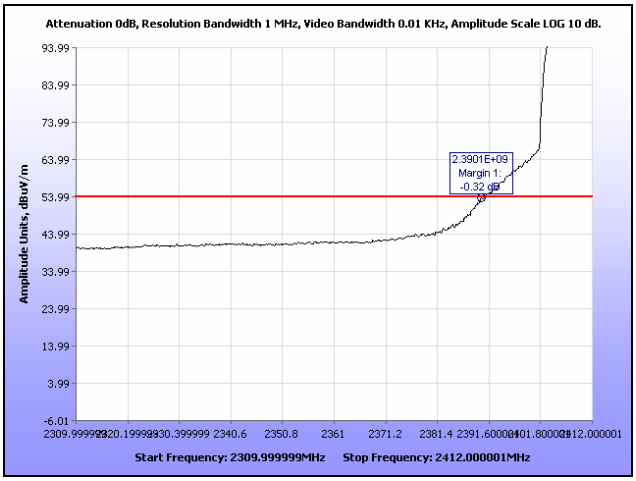
Plot 80. Radiated Spurious Emissions, High Channel, 5.850 GHz – 7 GHz, Peak, 5.8 GHz, HT40



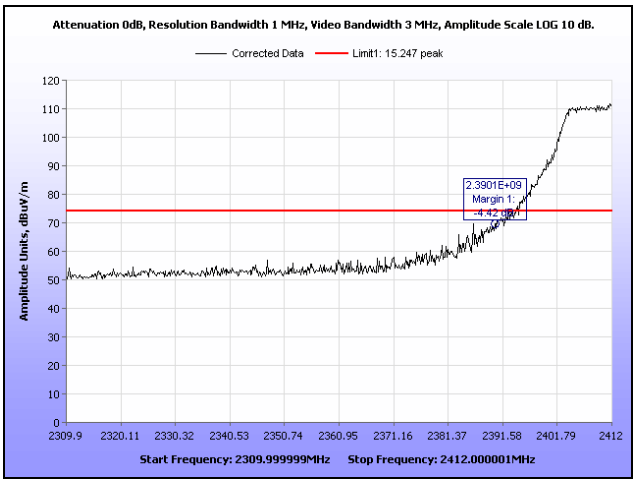
Plot 81. Radiated Spurious Emissions, High Channel, 7 GHz – 18 GHz, 5.8 GHz, HT40

Radiated Band Edge Measurements

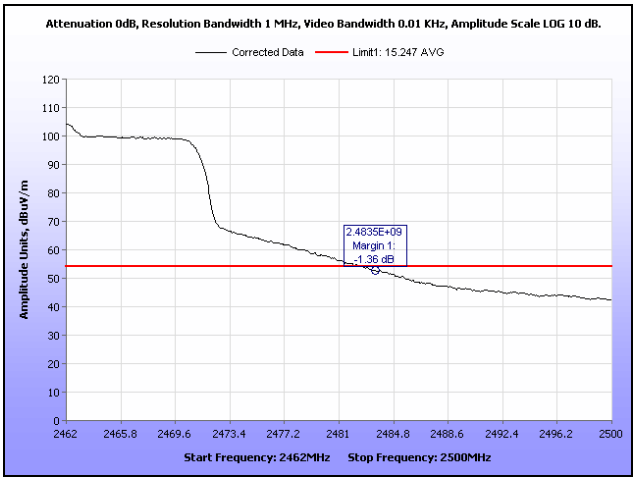
Test Procedures: The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line.



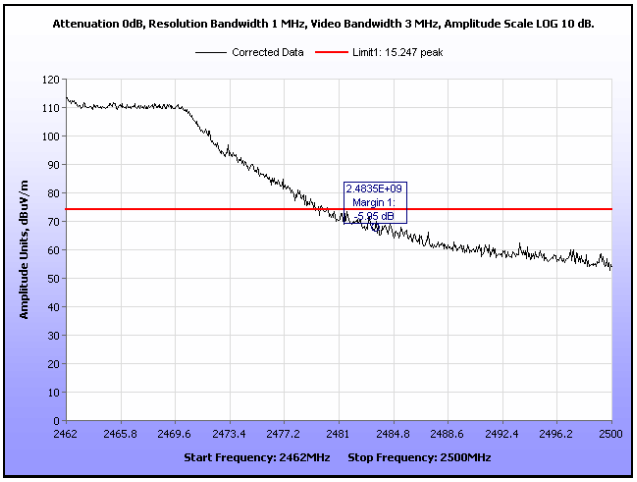
Plot 82. Radiated Restricted Band Edge, Low Channel, Average, HT20



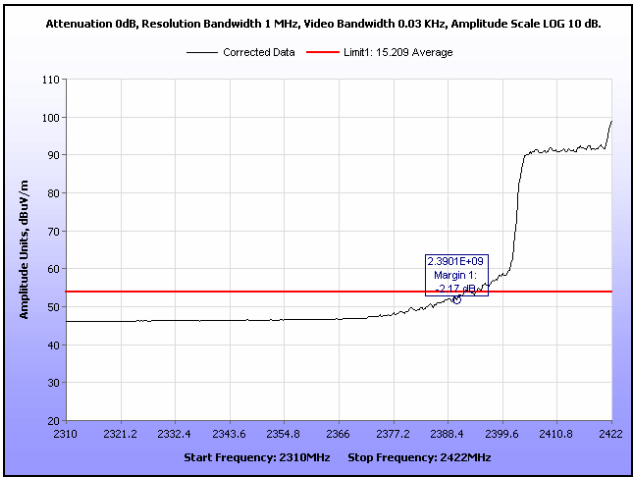
Plot 83. Radiated Restricted Band Edge, Low Channel, Peak, HT20



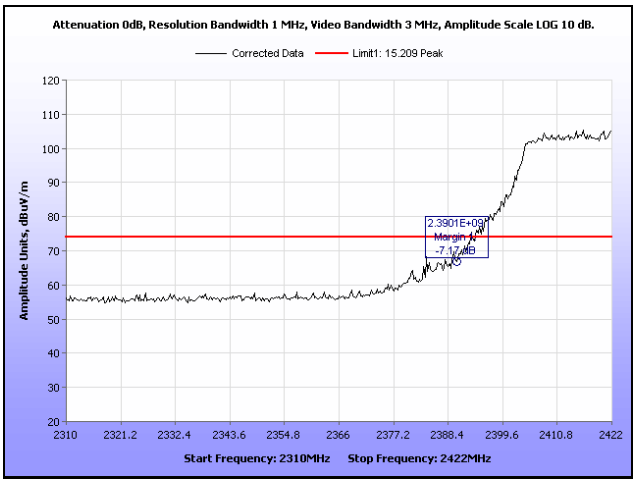
Plot 84. Radiated Restricted Band Edge, High Channel, Average, HT20



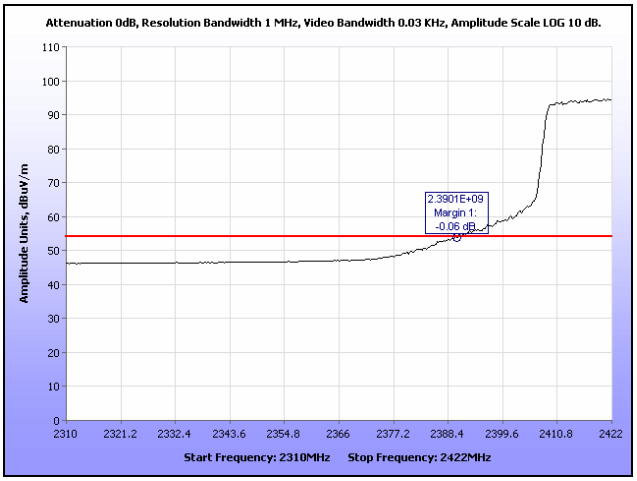
Plot 85. Radiated Restricted Band Edge, High Channel, Peak, HT20



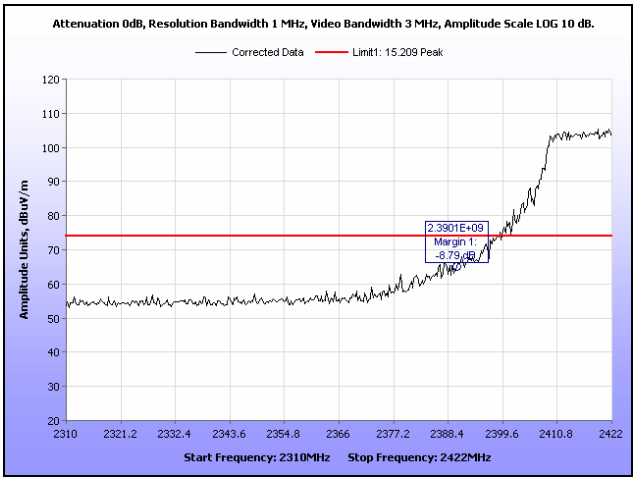
Plot 86. Radiated Restricted Band Edge, 2422 MHz, Average, HT40



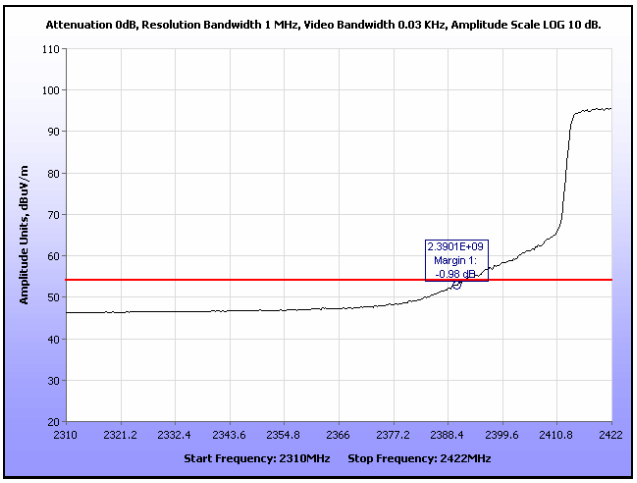
Plot 87. Radiated Restricted Band Edge, 2422 MHz, Peak, HT40



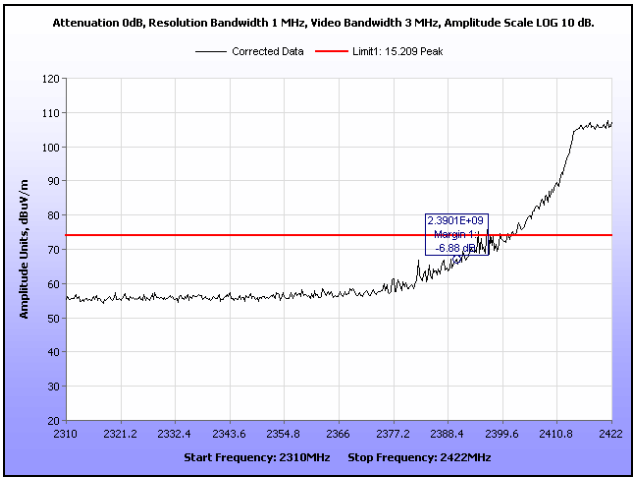
Plot 88. Radiated Restricted Band Edge, 2427 MHz, Average, HT40



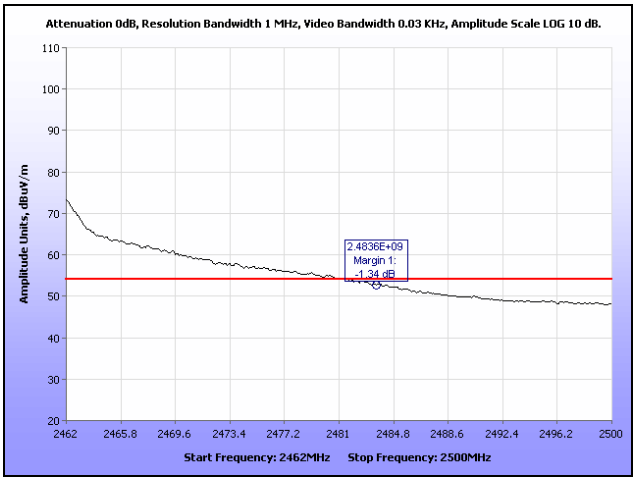
Plot 89. Radiated Restricted Band Edge, 2427 MHz, Peak, HT40



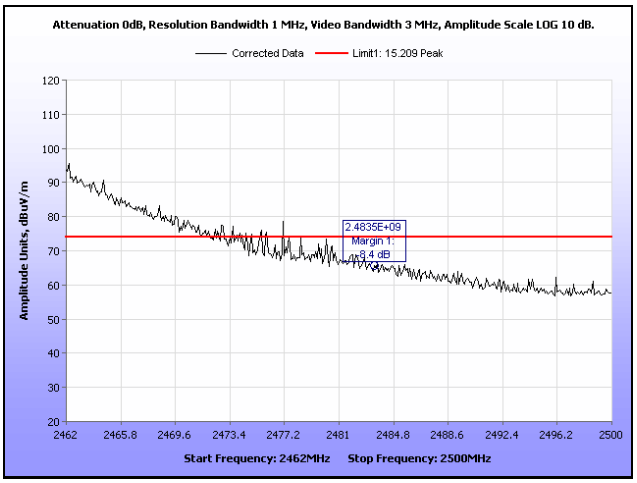
Plot 90. Radiated Restricted Band Edge, 2432 MHz, Average, HT40



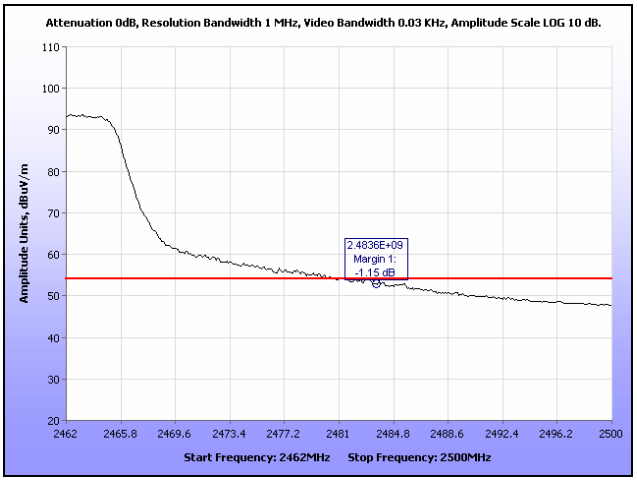
Plot 91. Radiated Restricted Band Edge, 2432 MHz, Peak, HT40



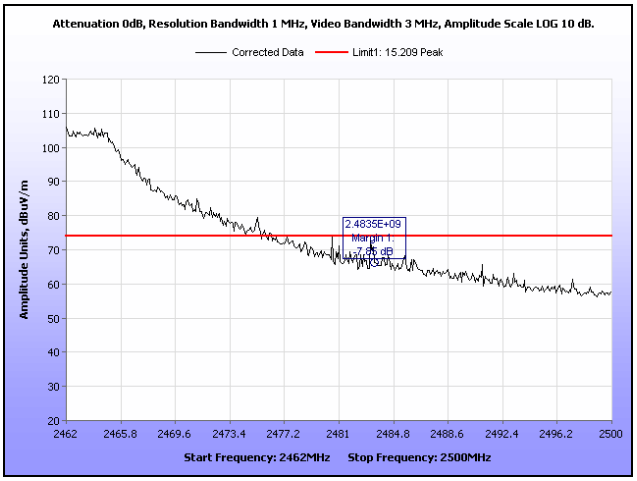
Plot 92. Radiated Restricted Band Edge, 2442 MHz, Average, HT40



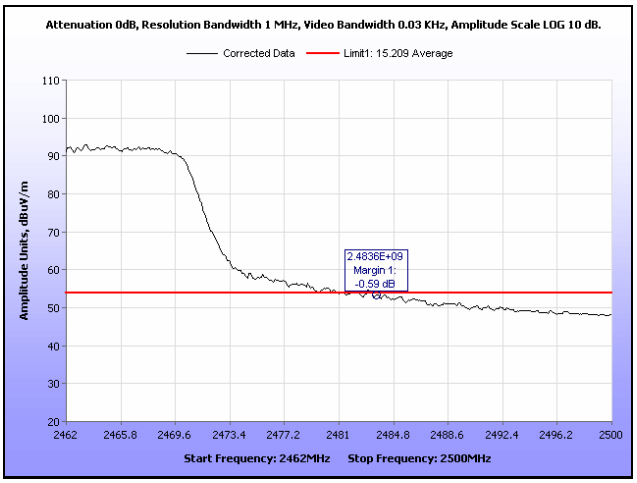
Plot 93. Radiated Restricted Band Edge, 2442 MHz, Peak, HT40



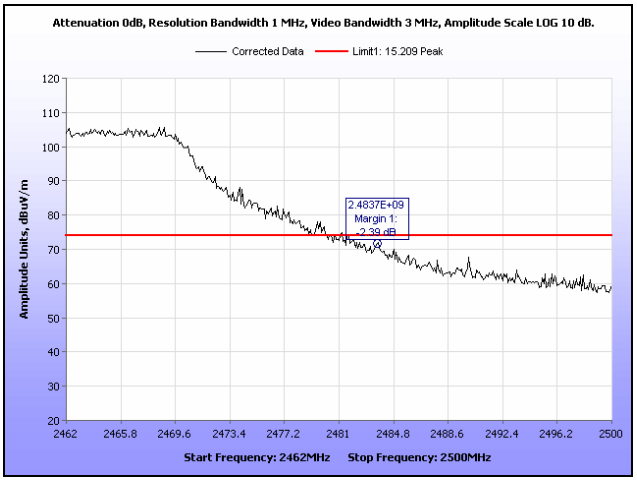
Plot 94. Radiated Restricted Band Edge, 2447 MHz, Average, HT40



Plot 95. Radiated Restricted Band Edge, 2447 MHz, Peak, HT40

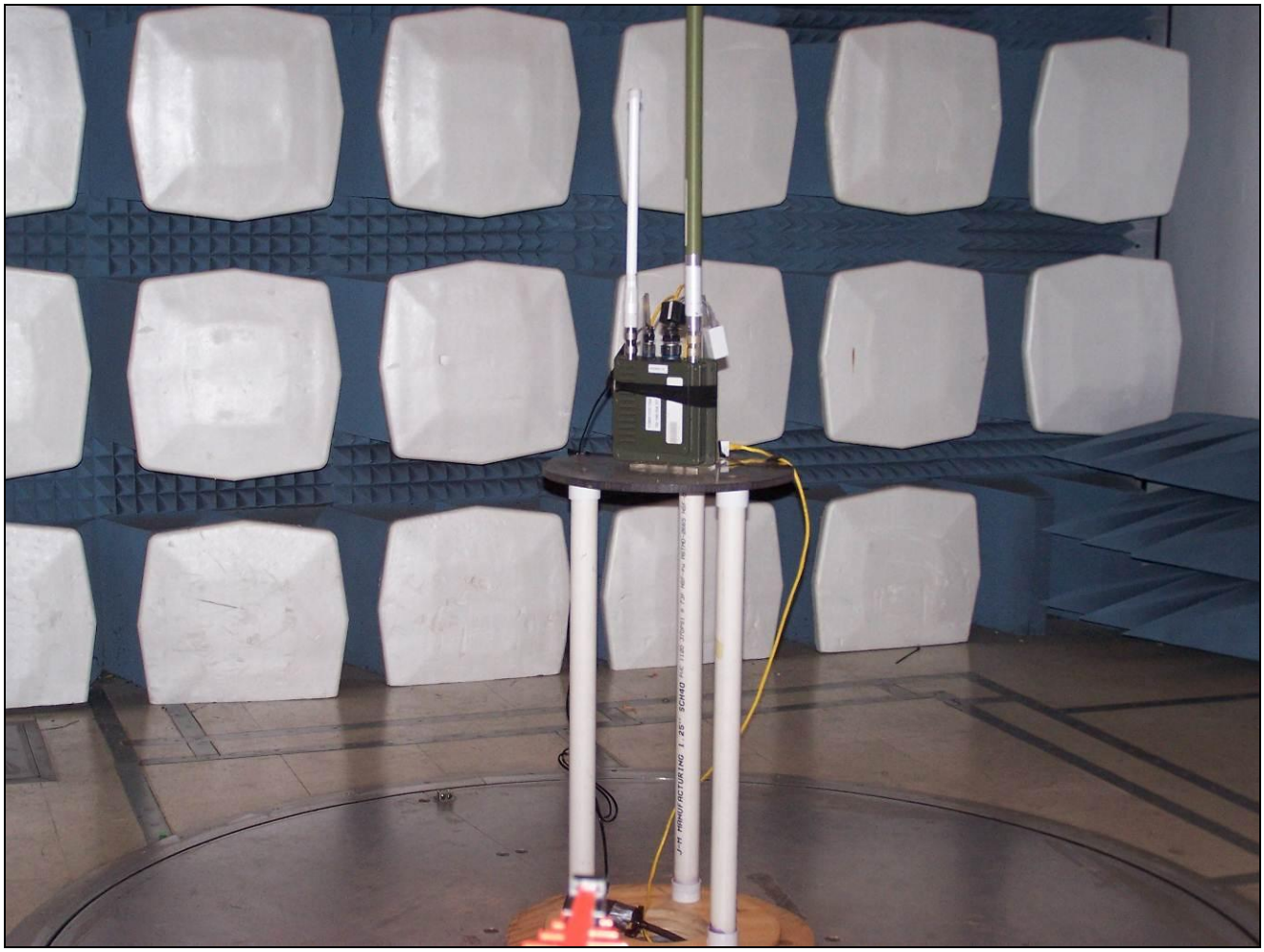


Plot 96. Radiated Restricted Band Edge, 2452 MHz, Average, HT40



Plot 97. Radiated Restricted Band Edge, 2452 MHz, Peak, HT40

Radiated Spurious Emissions Test Setup



Photograph 2. Radiated Spurious Emissions, Test Setup

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 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, 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 Procedure: For intentional radiators with a digital device portion which operates below 10 GHz, the spectrum was investigated as per §15.33(a)(1) and §15.33(a)(4); i.e., the lowest RF signal generated or used in the device up to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

See following pages for detailed test results with RF Conducted Spurious Emissions.

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

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 05/13/11

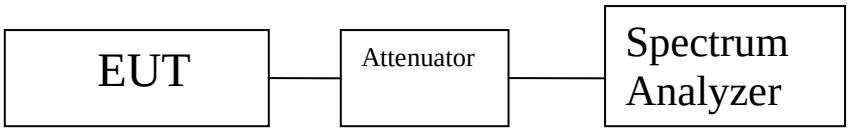
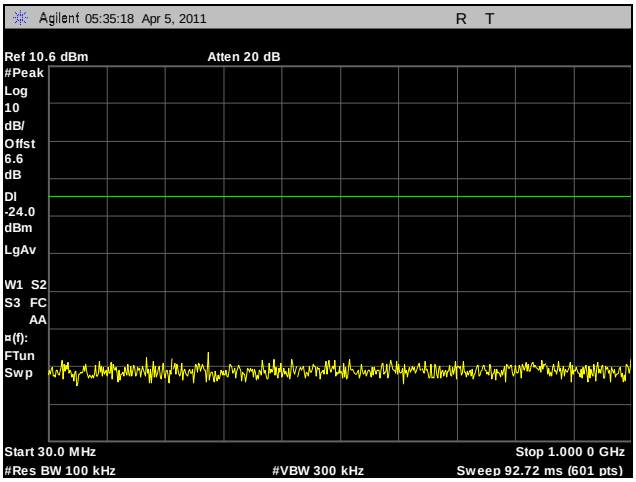
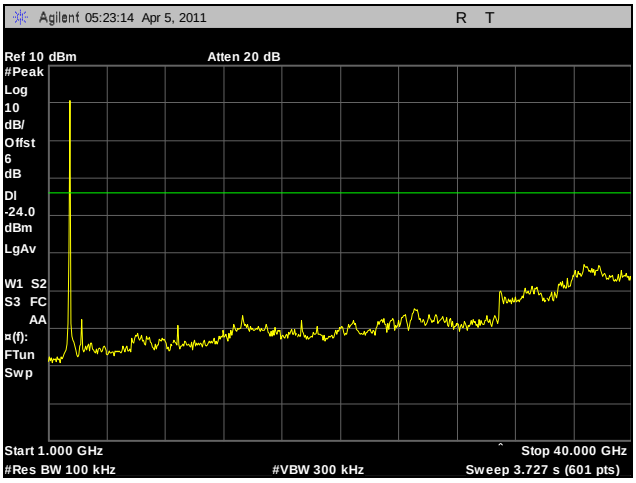


Figure 3. Block Diagram, Conducted Spurious Emissions Test Setup

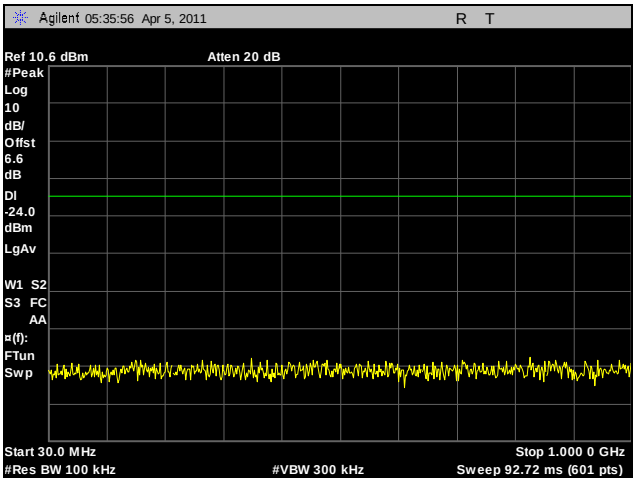
Conducted Spurious Emissions Test Results, 2.4 GHz, HT20



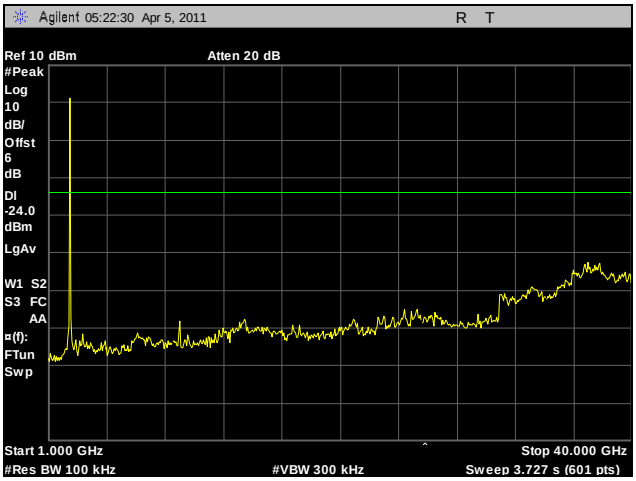
Plot 98. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 2.4 GHz, HT20



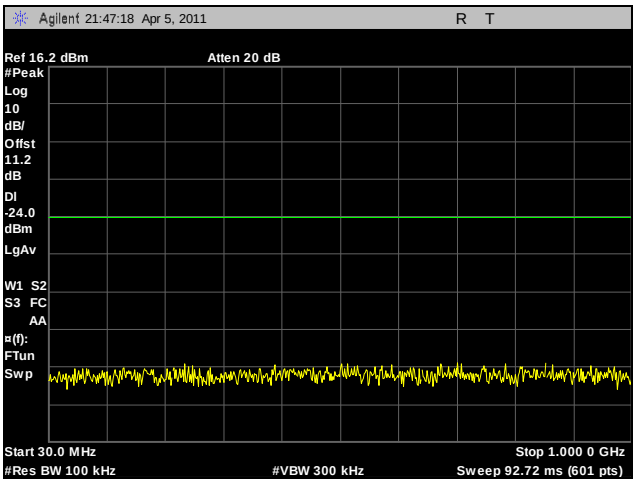
Plot 99. Conducted Spurious Emissions, Low Channel, 1 GHz – 40 GHz, 2.4 GHz, HT20



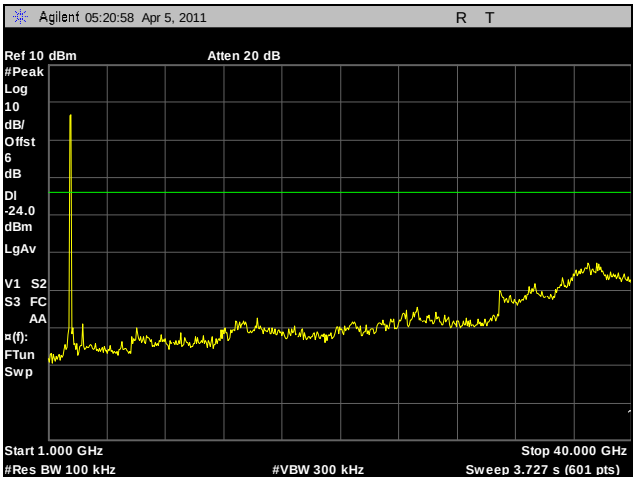
Plot 100. Conducted Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 2.4 GHz, HT20



Plot 101. Conducted Spurious Emissions, Mid Channel, 1 GHz – 40 GHz, 2.4 GHz, HT20

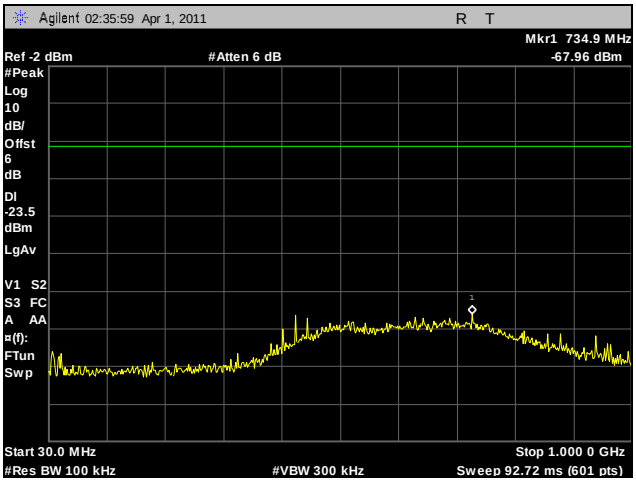


Plot 102. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 2.4 GHz, HT20

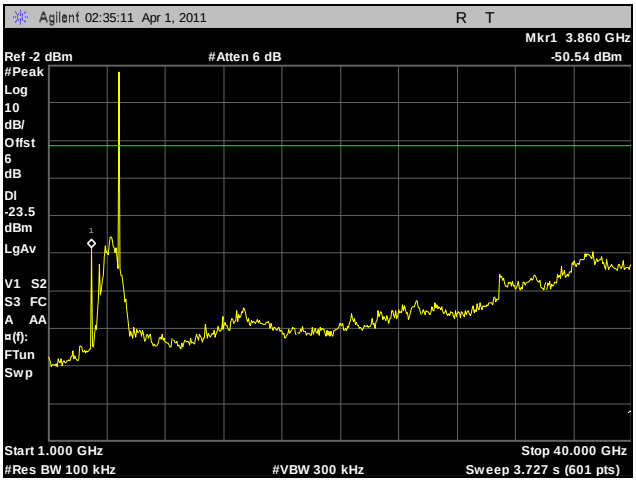


Plot 103. Conducted Spurious Emissions, High Channel, 1 GHz – 40 GHz, 2.4 GHz, HT20

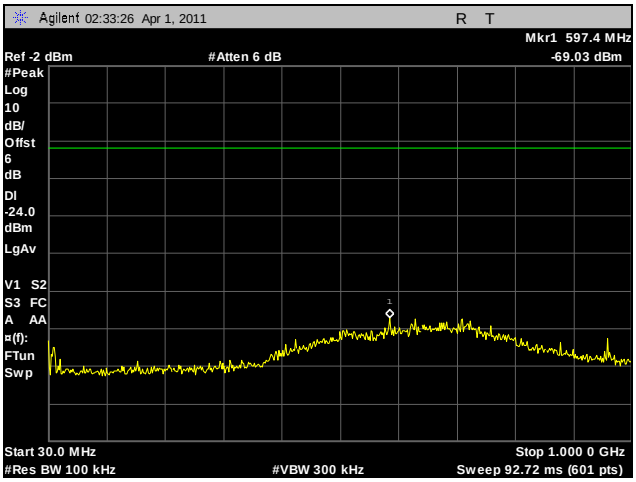
Conducted Spurious Emissions Test Results, 5.8 GHz, HT20



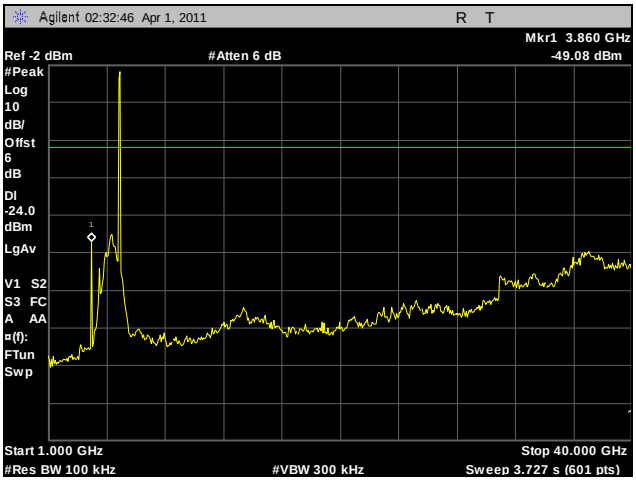
Plot 104. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 5.8 GHz, HT20



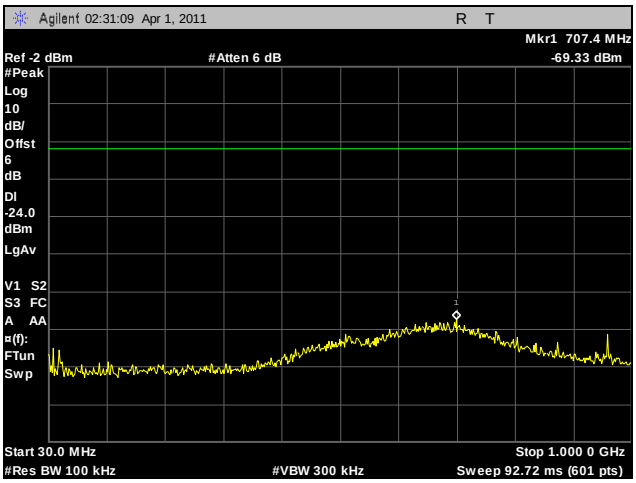
Plot 105. Conducted Spurious Emissions, Low Channel, 1 GHz – 40 GHz, 5.8 GHz, HT20



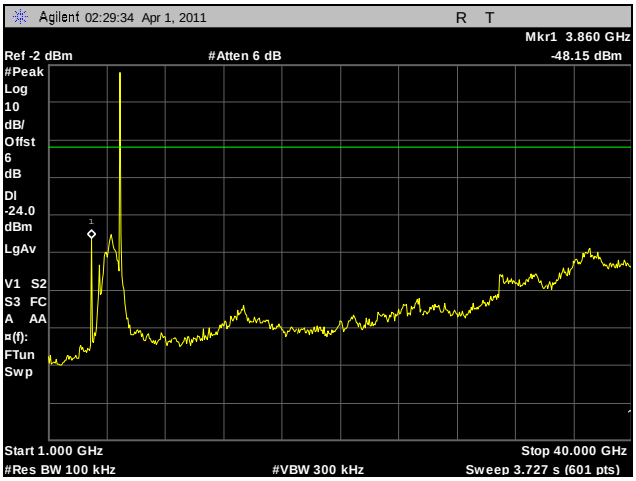
Plot 106. Conducted Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 5.8 GHz, HT20



Plot 107. Conducted Spurious Emissions, Mid Channel, 1 GHz – 40 GHz, 5.8 GHz, HT20

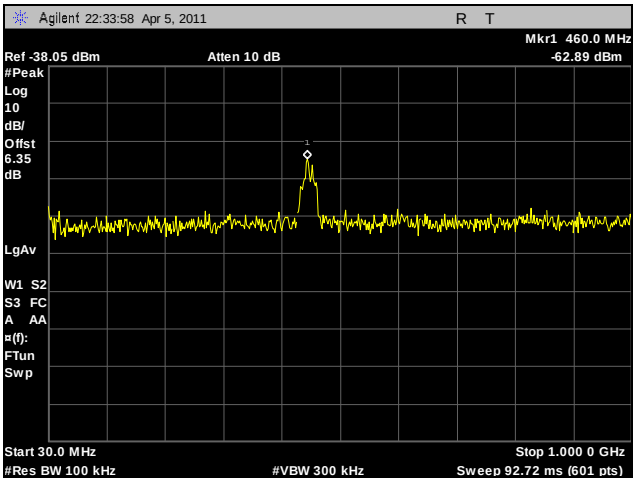


Plot 108. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 5.8 GHz, HT20

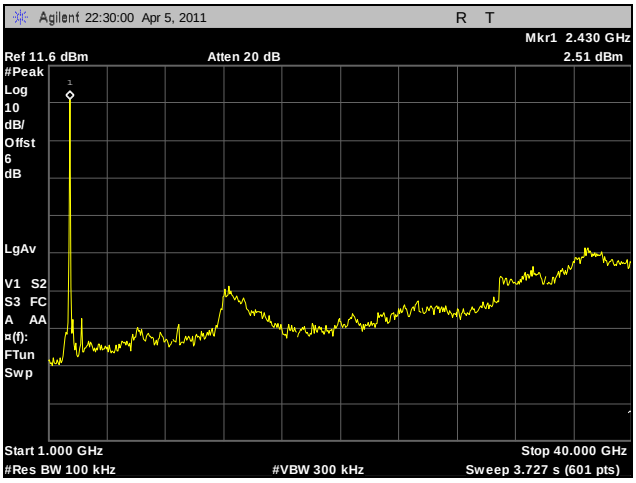


Plot 109. Conducted Spurious Emissions, High Channel, 1 GHz – 40 GHz, 5.8 GHz, HT20

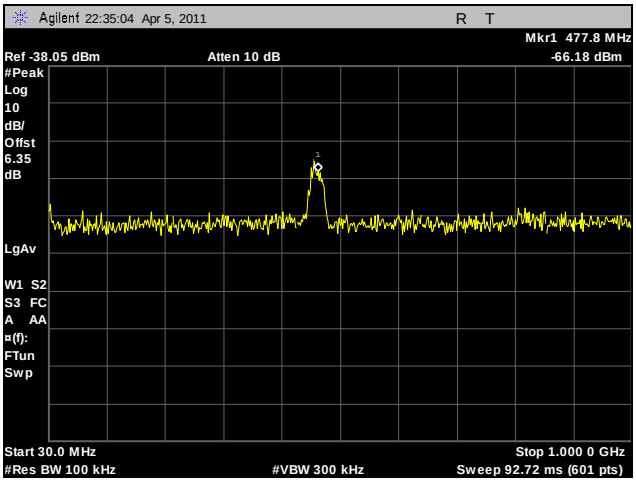
Conducted Spurious Emissions Test Results, 2.4 GHz, HT40



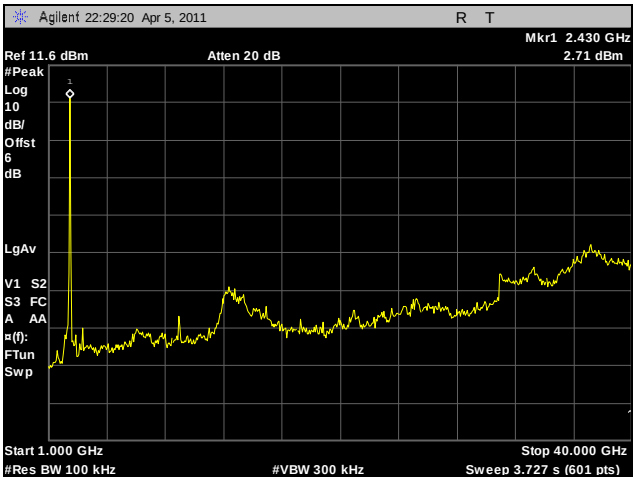
Plot 110. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 2.4 GHz, HT40



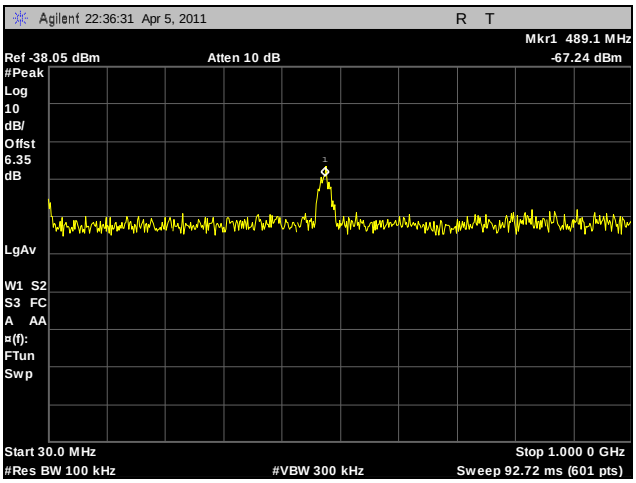
Plot 111. Conducted Spurious Emissions, Low Channel, 1 GHz – 40 GHz, 2.4 GHz, HT40



Plot 112. Conducted Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 2.4 GHz, HT40



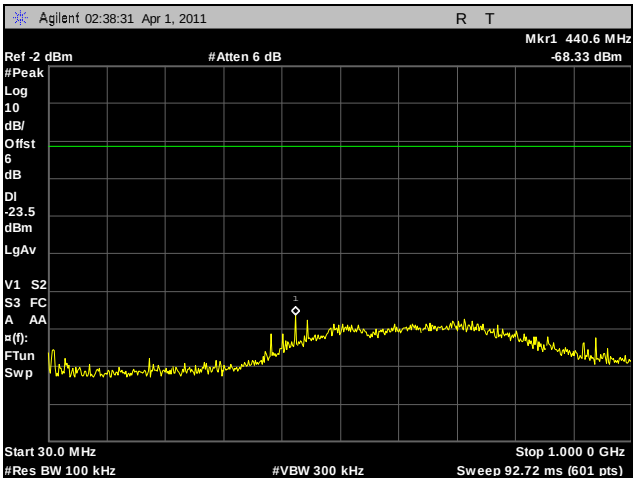
Plot 113. Conducted Spurious Emissions, Mid Channel, 1 GHz – 40 GHz, 2.4 GHz, HT40



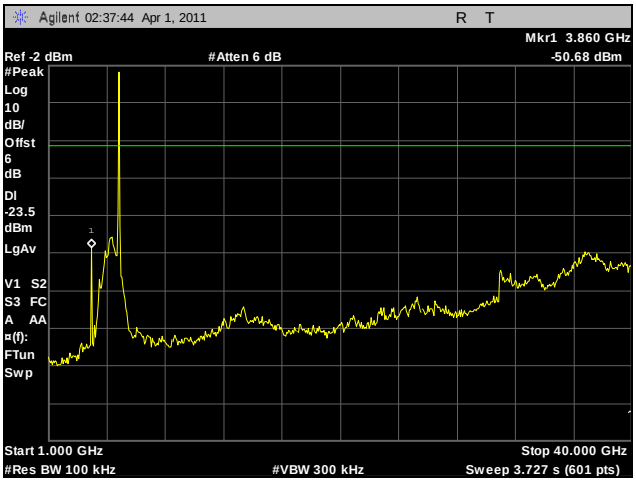
Plot 114. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 2.4 GHz, HT40

Plot 115. Conducted Spurious Emissions, High Channel, 1 GHz – 40 GHz, 2.4 GHz, HT40

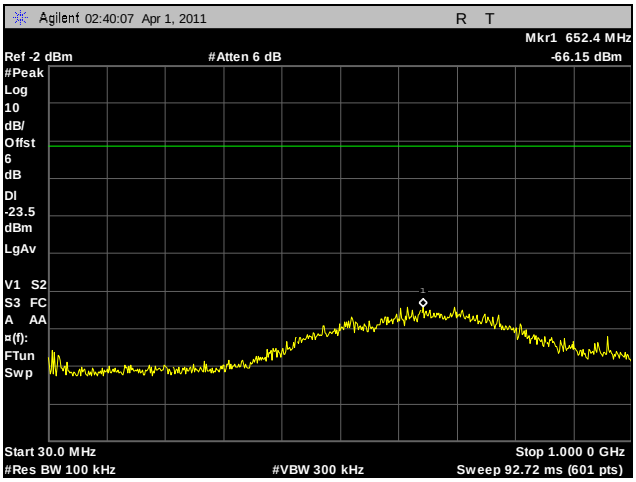
Conducted Spurious Emissions Test Results, 5.8 GHz, HT40



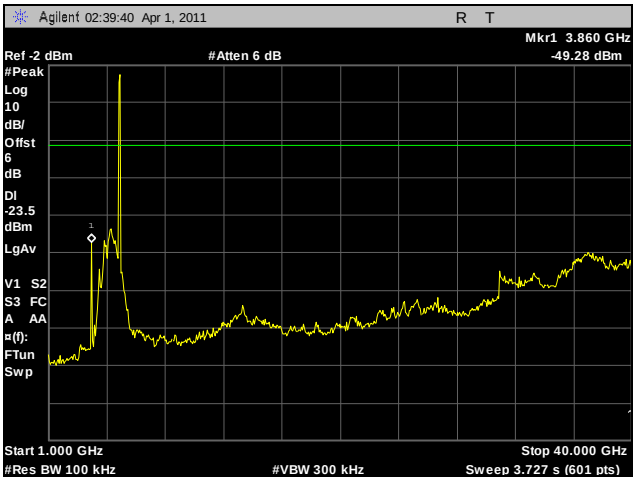
Plot 116. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 5.8 GHz, HT40



Plot 117. Conducted Spurious Emissions, Low Channel, 1 GHz – 40 GHz, 5.8 GHz, HT40

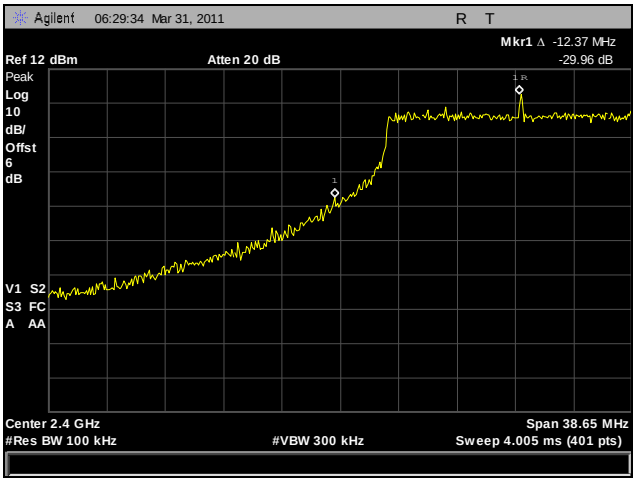


Plot 118. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 5.8 GHz, HT40

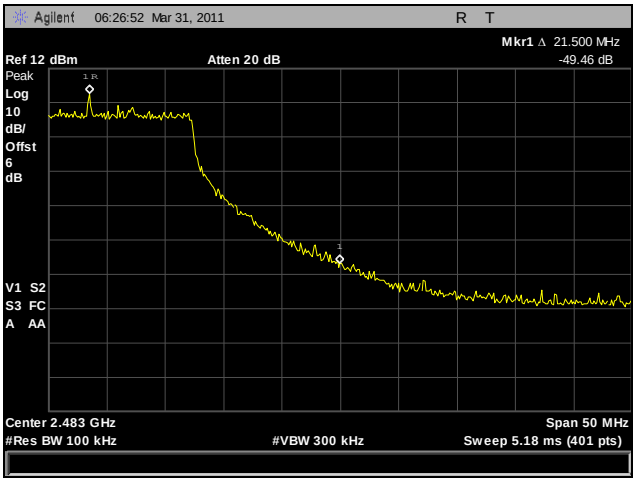


Plot 119. Conducted Spurious Emissions, High Channel, 1 GHz – 40 GHz, 5.8 GHz, HT40

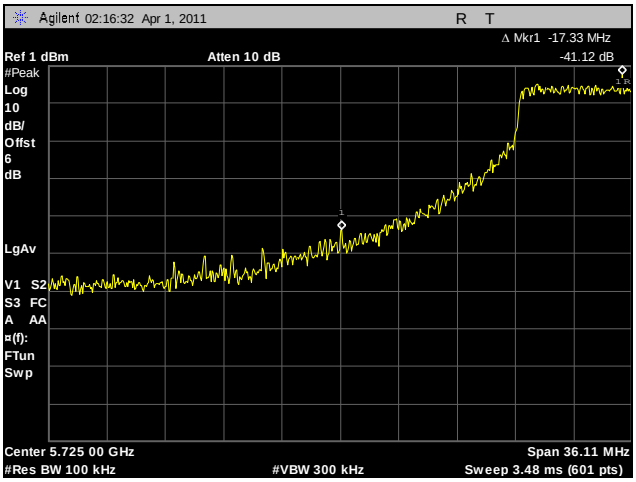
Conducted Band Edge Test Results, HT20



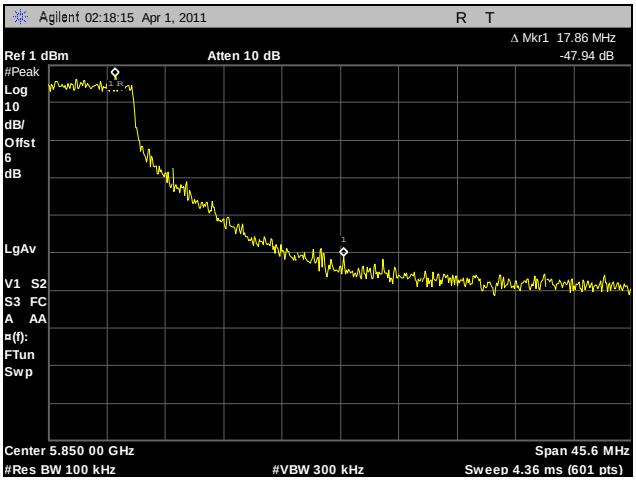
Plot 120. Conducted Band Edge, Low Channel, 2.4 GHz, HT20



Plot 121. Conducted Band Edge, High Channel, 2.4 GHz, HT20

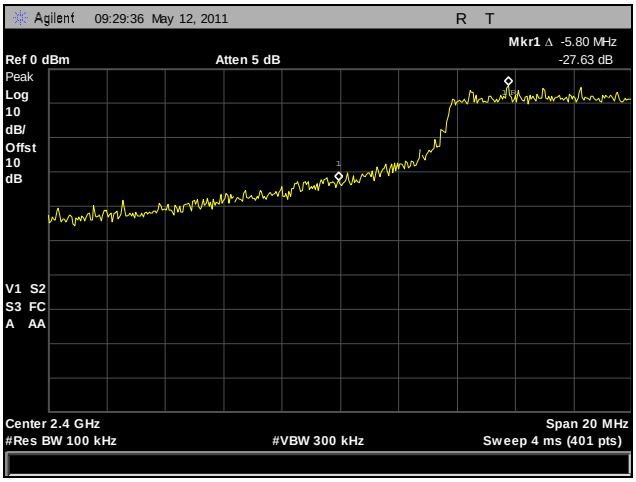


Plot 122. Conducted Band Edge, Low Channel, 5.8 GHz, HT20

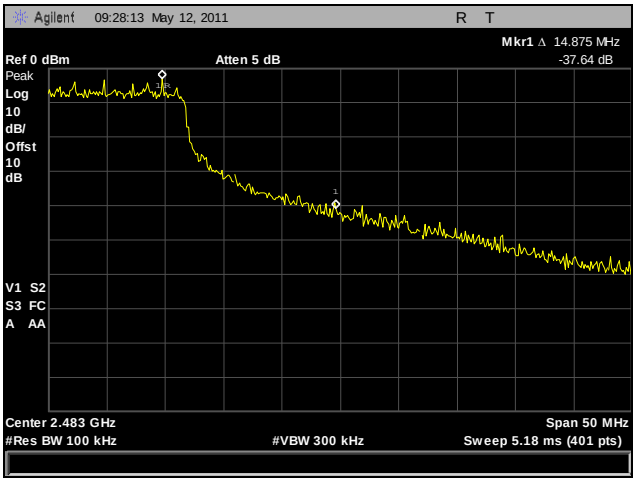


Plot 123. Conducted Band Edge, High Channel, 5.8 GHz, HT20

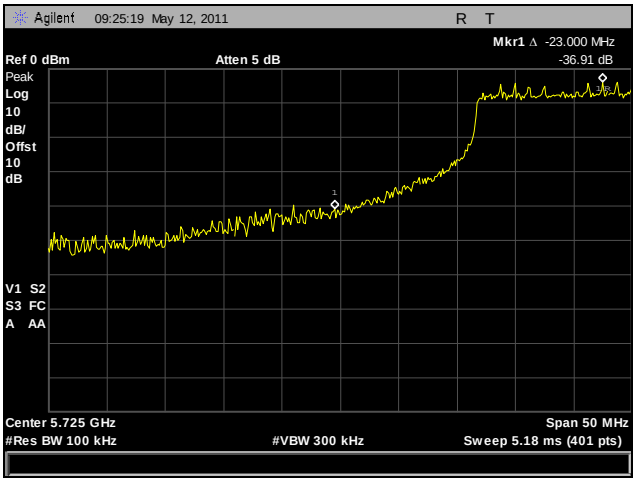
Conducted Band Edge Test Results, HT40



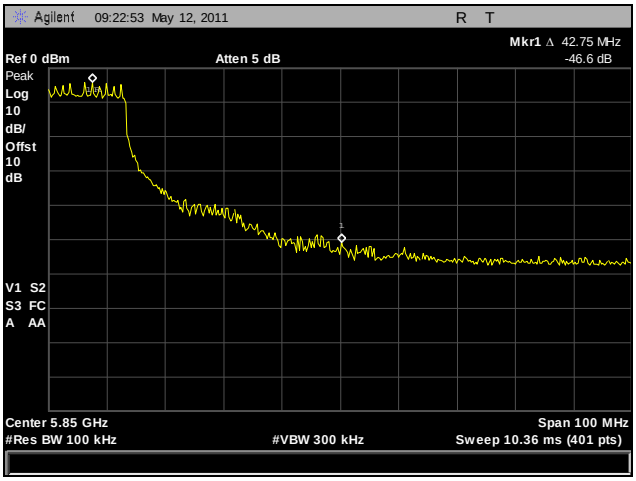
Plot 124. Conducted Band Edge, Low Channel, 2.4 GHz, HT40



Plot 125. Conducted Band Edge, High Channel, 2.4 GHz, HT40



Plot 126. Conducted Band Edge, Low Channel, 5.8 GHz, HT40



Plot 127. Conducted Band Edge, High Channel, 5.8 GHz, HT40

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: The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level throughout each of the 100 sweeps of power averaging. The RBW was set to 3 kHz and a VBW set to 9 kHz or greater. The spectrum analyzer was set to an auto sweep time and a peak detector was used. Measurements were carried out at the low, mid and high channels.

Test Results: The EUT was compliant with the peak power spectral density limits of **§ 15.247 (e)**.

The peak power spectral density was determined from plots on the following page(s).

Test Engineer: Dusmantha Tennakoon

Test Date: 05/12/11

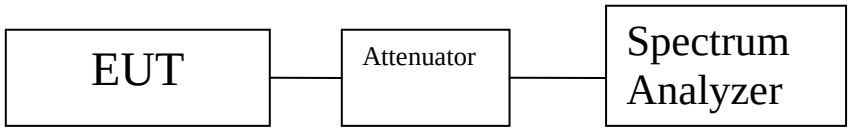
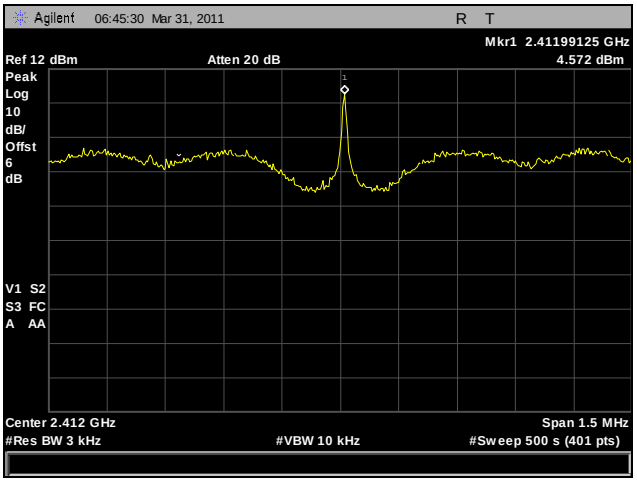
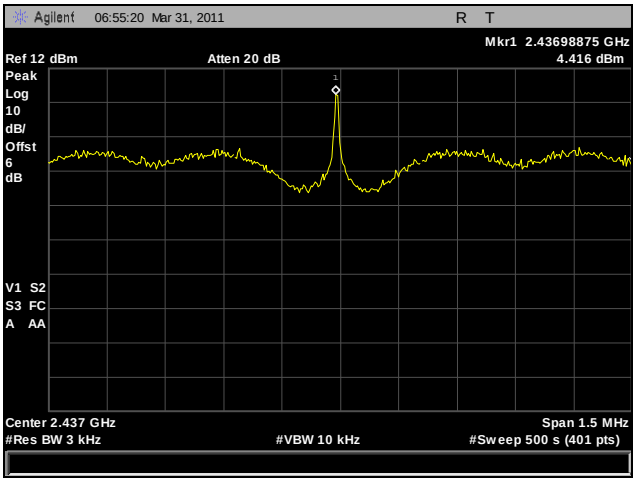


Figure 4. Block Diagram, Peak Power Spectral Density Test Setup

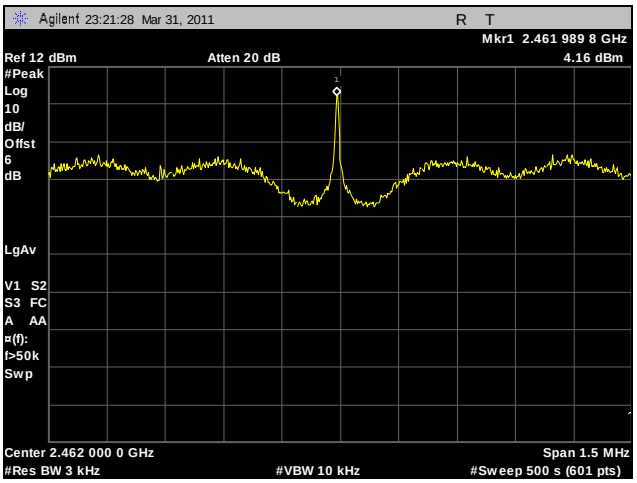
Peak Power Spectral Density, 2.4 GHz, HT20



Plot 128. Peak Power Spectral Density, Low Channel, 2.4 GHz, HT20

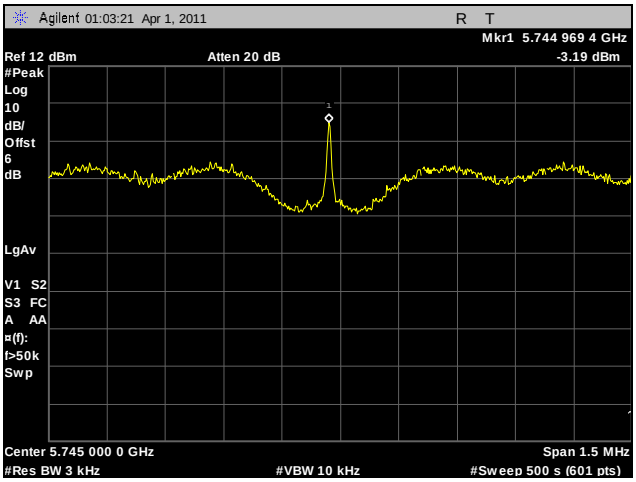


Plot 129. Peak Power Spectral Density, Mid Channel, 2.4 GHz, HT20

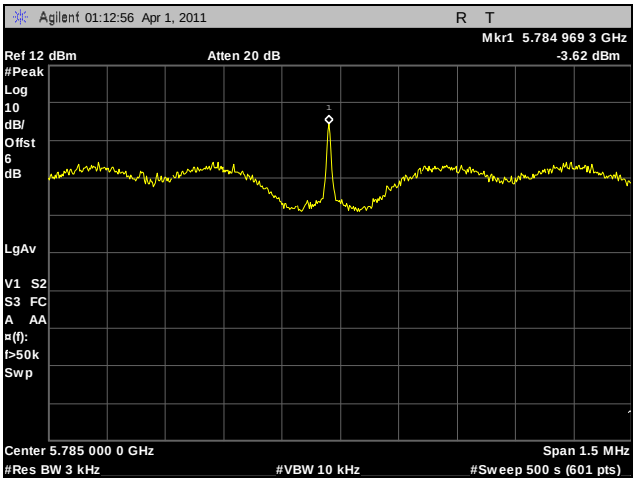


Plot 130. Peak Power Spectral Density, High Channel, 2.4 GHz, HT20

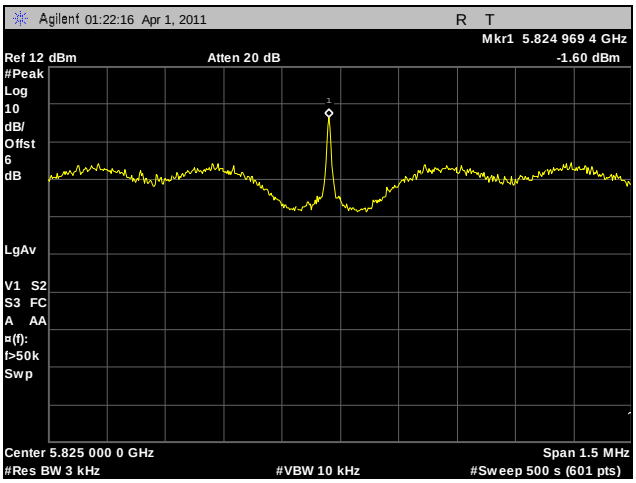
Peak Power Spectral Density, 5.8 GHz, HT20



Plot 131. Peak Power Spectral Density, Low Channel, 5.8 GHz, HT20

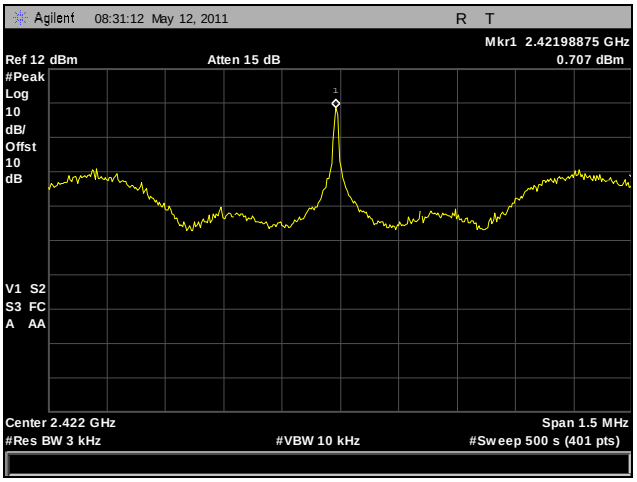


Plot 132. Peak Power Spectral Density, Mid Channel, 5.8 GHz, HT20

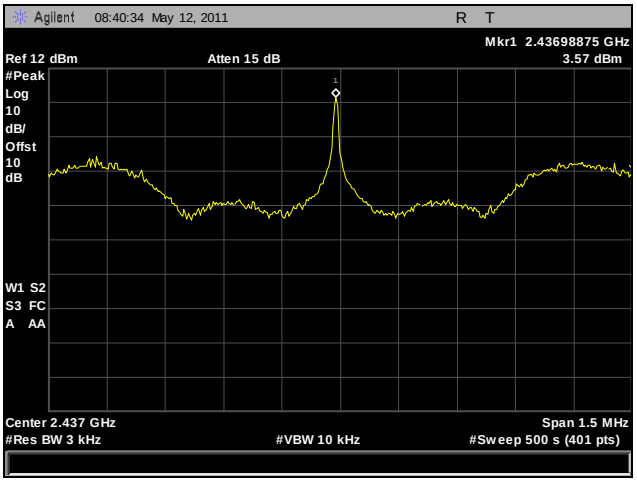


Plot 133. Peak Power Spectral Density, High Channel, 5.8 GHz, HT20

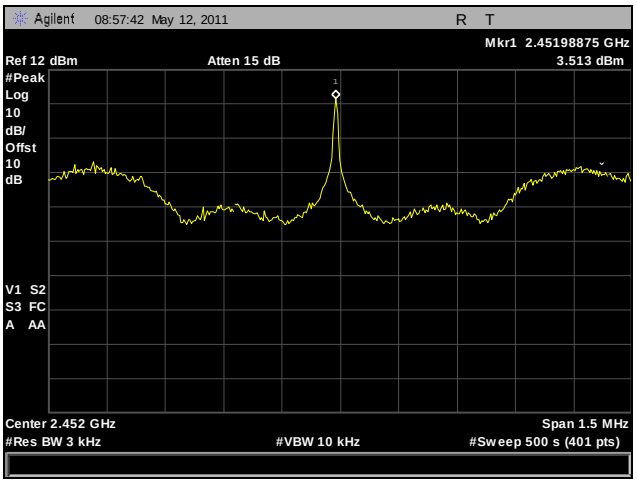
Peak Power Spectral Density, 2.4 GHz, HT40



Plot 134. Peak Power Spectral Density, Low Channel, 2.4 GHz, HT40

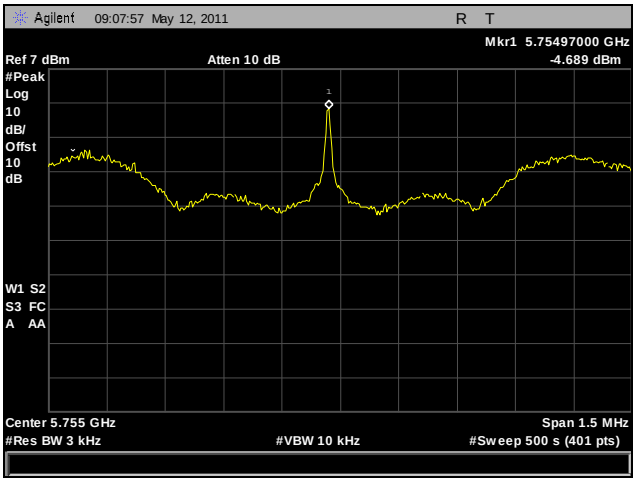


Plot 135. Peak Power Spectral Density, Mid Channel, 2.4 GHz, HT40

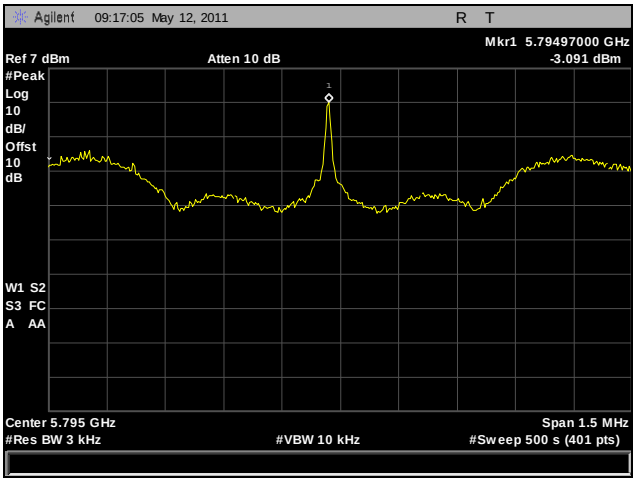


Plot 136. Peak Power Spectral Density, High Channel, 2.4 GHz, HT40

Peak Power Spectral Density, 5.8 GHz, HT40



Plot 137. Peak Power Spectral Density, Low Channel, 5.8 GHz, HT40



Plot 138. Peak Power Spectral Density, High Channel, 5.8 GHz, HT40

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 11.

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

Table 11. 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 to receive mode only and rotated orthogonally through all three axes. From 30 MHz to 1 GHz, a resolution bandwidth of 100 kHz was used. Above 1 GHz, a resolution bandwidth of 1 MHz was used. Plots shown are corrected for antenna correction factor, cable loss, and distance and compared to a 3m limit line.

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

Test Engineer(s): Jeff Pratt and Dusmantha Tennakoon

Test Date(s): 05/13/11

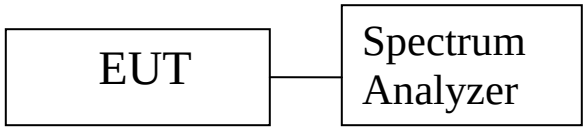
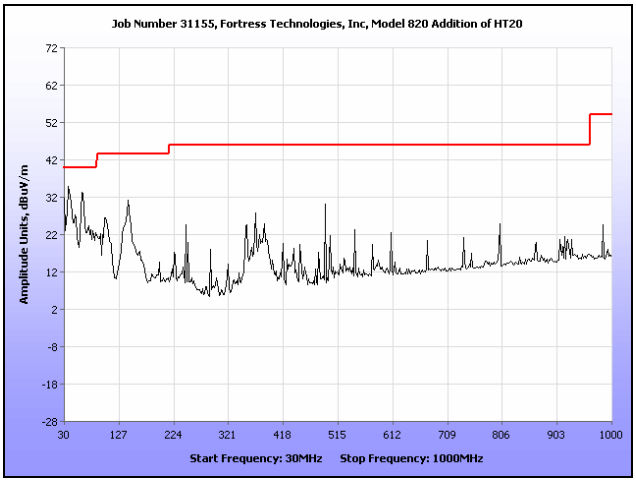
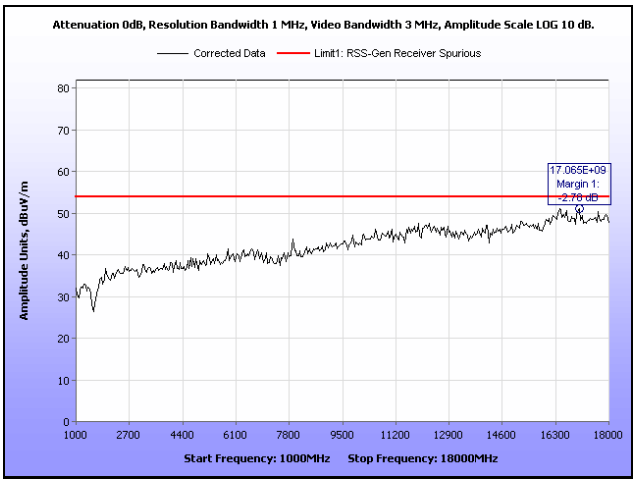


Figure 5. Block Diagram, Conducted Receiver Spurious Emissions Test Setup

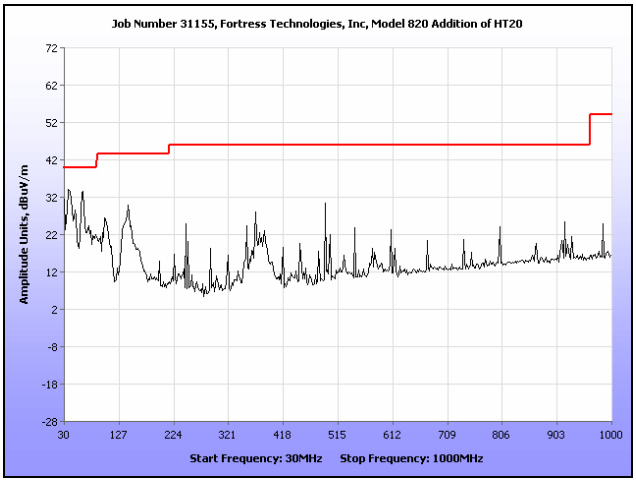
Conducted Receiver Spurious Emissions, HT20



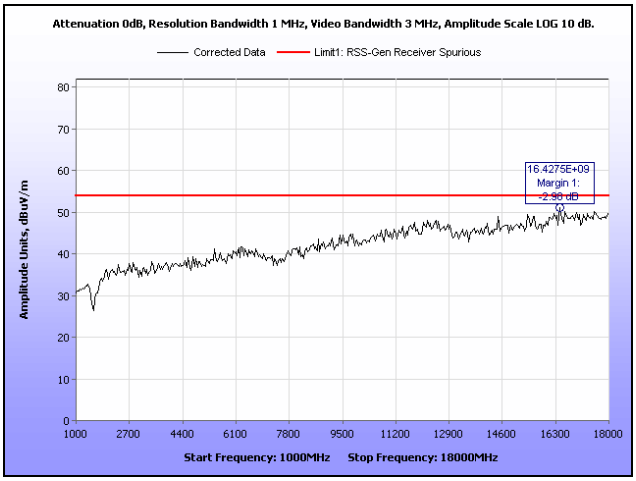
Plot 139. Receiver Spurious Emission, 30 MHz – 1 GHz, 2.4 GHz, HT20



Plot 140. Receiver Spurious Emission, 1 GHz – 18 GHz, 2.4 GHz, HT20

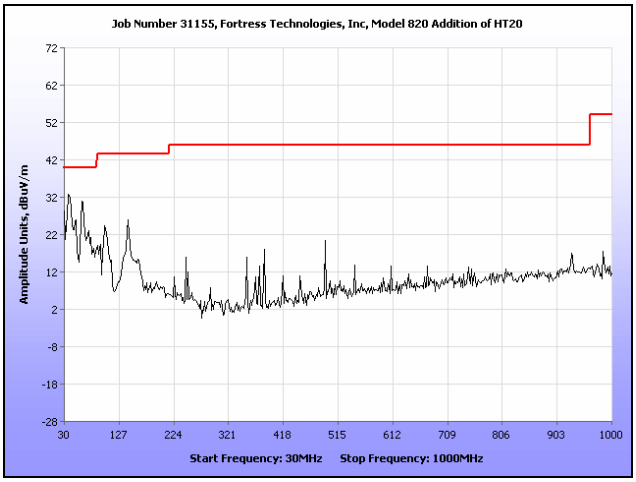


Plot 141. Receiver Spurious Emission, 30 MHz – 1 GHz, 5.8 GHz, HT20

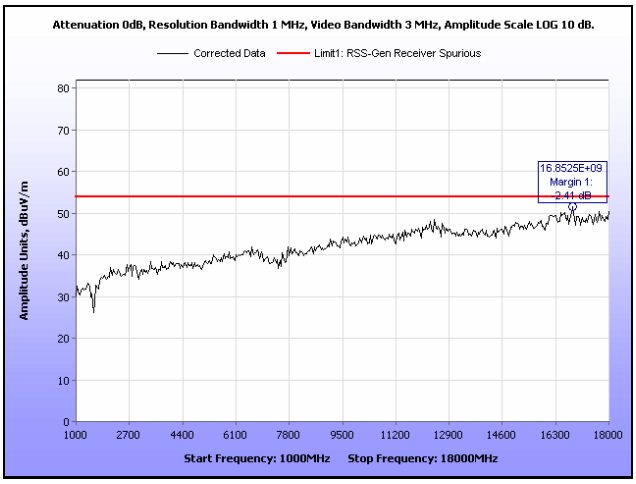


Plot 142. Receiver Spurious Emission, 1 GHz – 18 GHz, 5.8 GHz, HT20

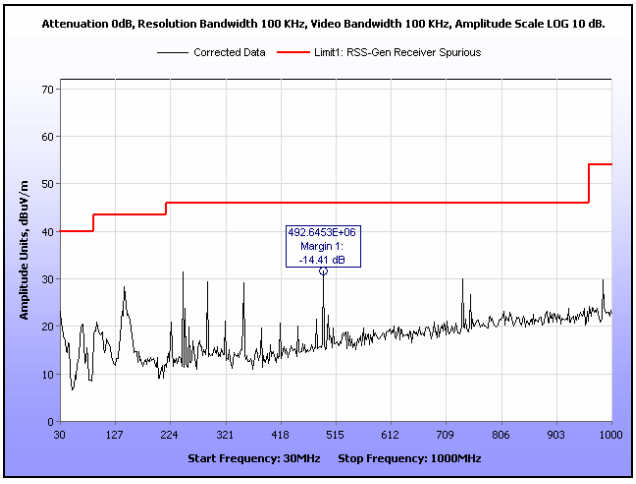
Conducted Receiver Spurious Emissions, HT40



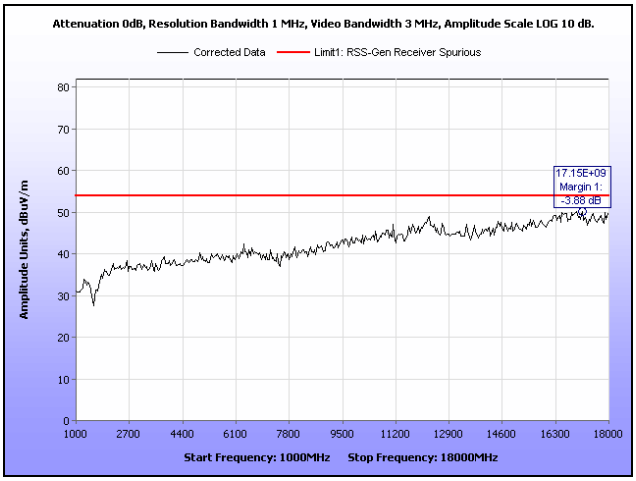
Plot 143. Receiver Spurious Emission, 30 MHz – 1 GHz, 2.4 GHz, HT40



Plot 144. Receiver Spurious Emission, 1 GHz – 18 GHz, 2.4 GHz, HT40



Plot 145. Receiver Spurious Emission, 30 MHz – 1 GHz, 5.8 GHz, HT40



Plot 146. Receiver Spurious Emission, 1 GHz – 18 GHz, 5.8 GHz, HT40

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
1T4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	08/23/2010	08/23/2011
1T4621	ESA-E SERIES SPECTRUM ANALYZER	AGILENT	E4402B	05/10/2010	05/10/2011
1T2665	HORN ANTENNA	EMCO	3115	07/15/2010	07/15/2011
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	05/25/2010	05/25/2011
1T4354	SIGNAL GENERATOR	HEWLETT PACKARD	83752A	03/11/2010	03/11/2011
1T4744	ANTENNA, HORN	ETS-LINDGREN	3116	6/14/2011	6/14/2012
1T4737	HIGH FREQUENCY PREAMP	MITEQ	AFS42-01001800	SEE NOTE	
1T4592	RF FILTER KIT	VARIOUS	N/A	SEE NOTE	
1T4752	PRE-AMPLIFIER	MITEQ	JS44-18004000-35-8P	SEE NOTE	

Table 12. 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

1. 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