FCC CFR47 PART 15 SUBPART E
INDUSTRY CANADA RSS 210 ISSUE 7
SUPPLEMENTAL CERTIFICATION TEST REPORT

FOR

802.11a/b/g/n PCI Module

MODEL: AR5BMB82

FCC ID: PPD-AR5BMB82

IC: 4104A-AR5BMB82

REPORT NUMBER: 08U11627-1

ISSUE DATE: MARCH 06, 2008

Prepared for
ATHEROS COMMUNICATIONS, INC.
5480 GREAT AMERICA PARKWAY
SANTA CLARA, CA 95054, U.S.A.

Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
---	03/06/08	Initial Issue	T. Chan

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: ATHEROS COMMUNICATIONS, INC.
5480 GREAT AMERICA PARKWAY
SANTA CLARA, CA 95054, U.S.A.

EUT DESCRIPTION: 802.11a/b/g/n PCI Module

MODEL: AR5BMB82

SERIAL NUMBER: MB82-031-S0263

DATE TESTED: FEBRUARY 20 - MARCH 04, 2008

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart E	No Non-Compliance Noted
INDUSTRY CANADA RSS-GEN ISSUE 2	No Non-Compliance Noted
INDUSTRY CANADA RSS 210 ISSUE 7	No Non-Compliance Noted

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:

THU CHAN
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:

CHIN PANG
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC MO&O 06-96, RSS-GEN Issue 2, and RSS-210 Issue 7.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.
CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz	+/- 3.3 dB
Radiated Emission, 200 to 1000 MHz	+4.5 / -2.9 dB
Radiated Emission, 1000 to 2000 MHz	+4.5 / -2.9 dB
Power Line Conducted Emission	+/- 2.9 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11a/b/g/n PCI Module.

The radio module is manufactured by ATHEROS COMMUNICATIONS, INC.

5.2. DESCRIPTION OF CHANGES

The following changes have been made to the product as originally tested:

A) The Baseband chip AR9160 has been updated from version 1.0 to version 1.1

Changes implemented in the 1.0 version Baseband chip:

1) Corrected various digital logic bugs related to IEEE protocol functions

2) Corrected digital logic bug that sometimes caused baseband to hang during radar detection

Version 1.1 chip has the same pinout and hardware specifications as originally tested chip (1.0).

The product's capabilities, features, RF modulations and power are unchanged from the originally tested product.

B) The board has undergone minor layout change and some component changes

Changes to board & Schematic:

1) Added extra filtering in 5GHz Tx Path to improve EVM

2) Added and optimized decoupling caps to improve linearity of transmitter in each chain

3) Reduced clock voltage swing

4) Minor layout change to accommodate above changes

5.3. DESCRIPTION OF SUPPLEMENTAL MEASUREMENTS

The following supplemental measurements were made on the product with the Version 1.1 baseband chip installed: Bandwidth, Power and PPSD tests were performed on the low, middle, and high channels of each 5 GHz band. Conducted and Radiated Spurious tests were performed on the middle channel of each 5 GHz band. DFS tests were performed at both 20 MHz and 40 MHz bandwidths.

5.4. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5180 - 5320	802.11a	18.03	63.53
5180 - 5320	802.11n HT20	21.69	147.57
5190 - 5310	802.11n HT40	22.02	159.22
5500 - 5700	802.11a	20.34	108.14
5500 - 5700	802.11n HT20	20.46	111.17
5510 - 5670	802.11n HT40	22.81	190.99

5.5. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Dipole Antenna, model: TWF-614C-406, with a maximum gain of 3 dBi in the 2.4 GHz bands, and 5 dBi in the 5 GHz bands. The minimum gain dipole antenna is 0 dBi in the 5 GHz bands.

5.6. SOFTWARE AND FIRMWARE

The test utility software used during testing was ART revision 0.5 Build # 20, ART_11n.
For TX-related testing, the program puts the EUT in continuous transmitting mode with a duty cycle of 99%, for RX-related testing, the program puts the EUT in continuous receiving mode.

5.7. WORST-CASE CONFIGURATION AND MODE

EUT was tested as an external module inserted to a host Laptop PC.

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:

802.11a Mode (20 MHz BW operation): 9Mbps, OFDM, Spatial Stream 1
802.11n MIMO HT20 Mode: MCS0, 6.5Mbps, OFDM, Spatial Stream 1
802.11n MIMO HT40 Mode: MCS0, 13.5Mbps, OFDM, Spatial Stream 1

For 26 dB and 99% BW measurement preliminary testing showed that Chain 2 is worst-case chain, so final measurement was performed on chain 2 for all modes and channels.

For conducted and PSD measurements preliminary testing showed that combiner is worst-case compared to individual chains; therefore, final measurement was performed using combiner for each mode.

For conducted and radiated spurious, the test was performed on worst channel for each mode of each frequency band.

For radiated receiver spurious, the test was performed on worst channel for each frequency band.

DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacture**	**Model**	**Serial Number**	**FCC ID**
Laptop PC	ThinkPad	R50	99-C4812	DOC
AC/DC Adapter	IBM	9P1020	11S92P1020Z1Z9RM5C7131	N/A
Cardbus to MINI-PCI	VYTEK	stcbmpi3	244	N/A

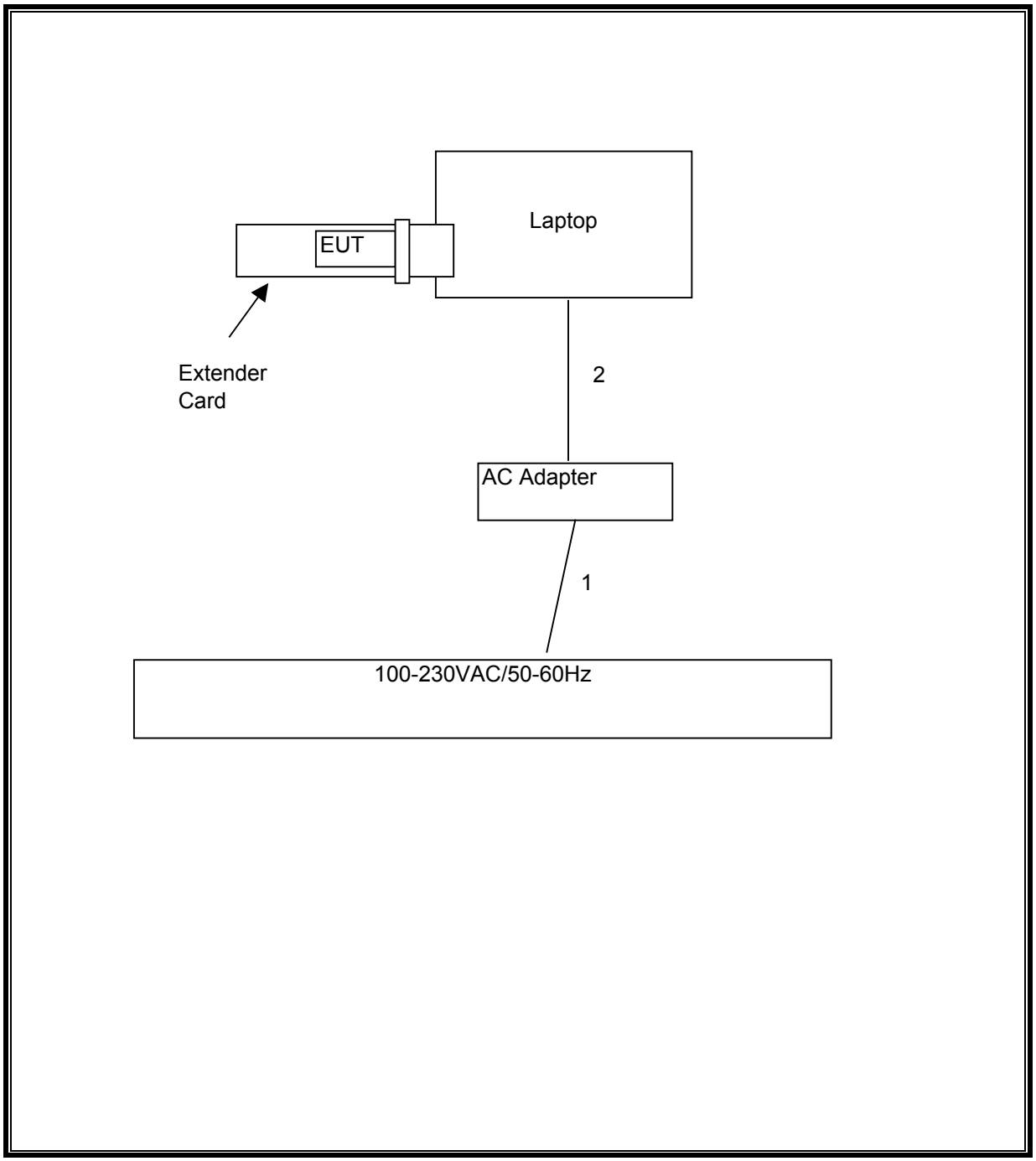
I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	1	US 115V	Un-shielded	0.8m	N/A
2	DC	1	DC	Un-shielded	1.8m	Ferrite at one end

TEST SETUP

The EUT is connected to a laptop PC via a PCI extension card during the tests. Test software exercised the radio card.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**S/N**	**Cal Due**
Power Meter	Agilent / HP	438A	C01068	09/12/08
Power Sensor, 18 GHz	Agilent / HP	8481A	N02782	04/22/08
RF Filter Section	Agilent / HP	85420E	C00958	06/12/08
Harmonic Mixer Cable	Agilent / HP	5061-5458	C00627*	CNR
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	08/07/08
Antenna, Horn, 18 GHz	EMCO	3115	C00945	04/15/08
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	08/03/08
Reject Filter, 5.15-5.35 GHz	Micro-Tronics	BRC13190	N02679	CNR
Reject Filter, 5.47-5.725 GHz	Micro-Tronics	BRC13191	N02678	CNR
Reject Filter, 5.725-5.825 GHz	Micro-Tronics	BRC13192	N02677	CNR
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	10/11/08
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	09/28/08
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	C00981	04/11/08

7. ANTENNA PORT TEST RESULTS

7.1. 802.11a THREE CHAINS LEGACY MODE IN THE 5.2 GHz BAND

7.1.1. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

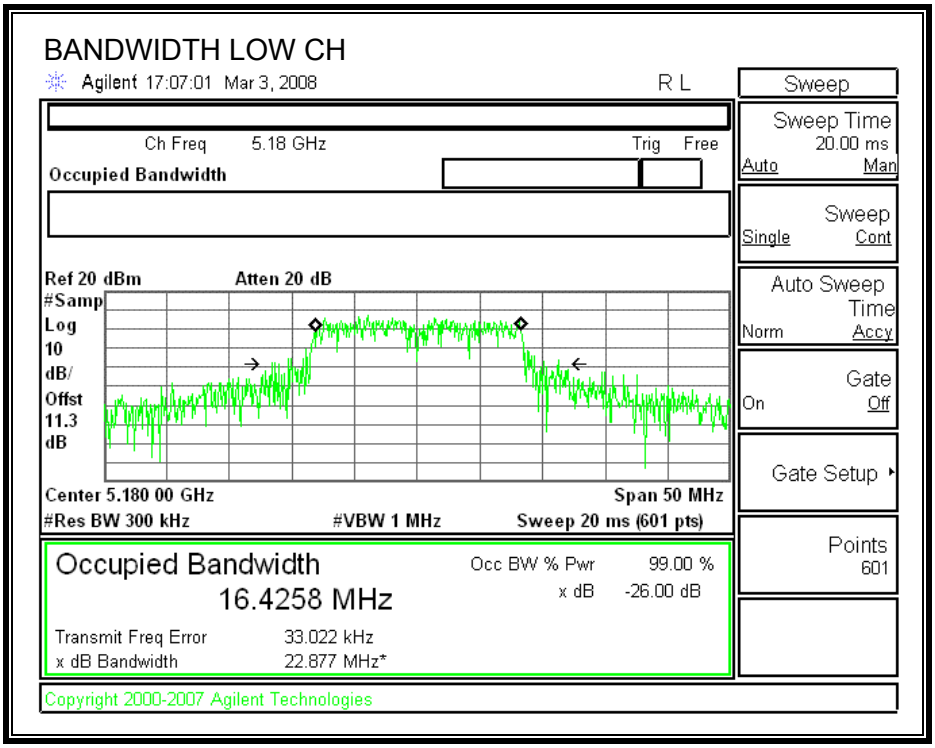
TEST PROCEDURE

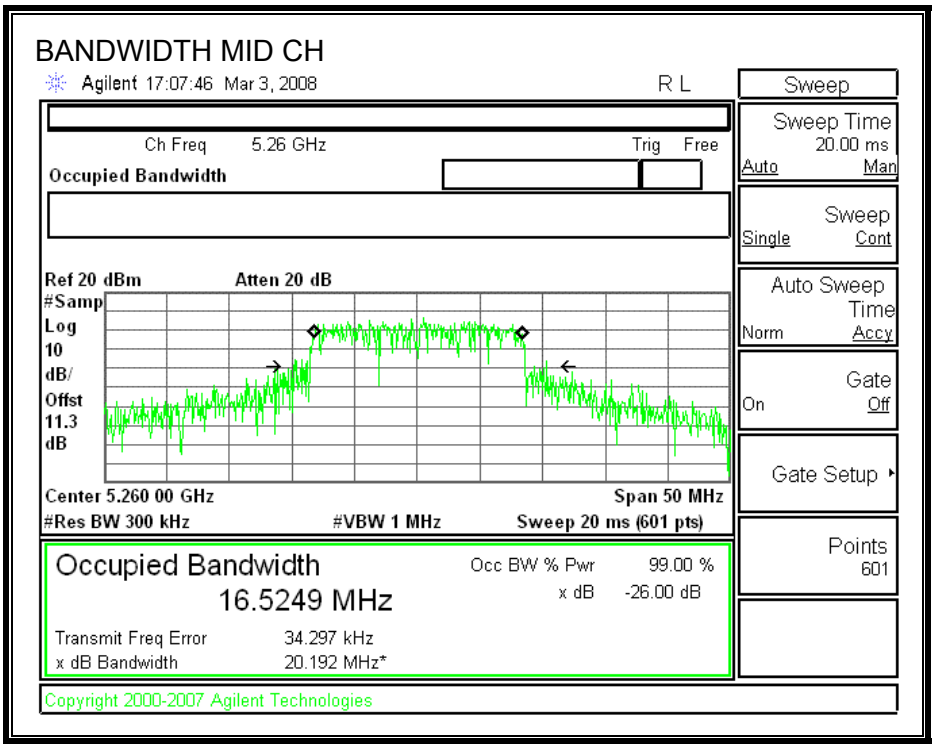
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

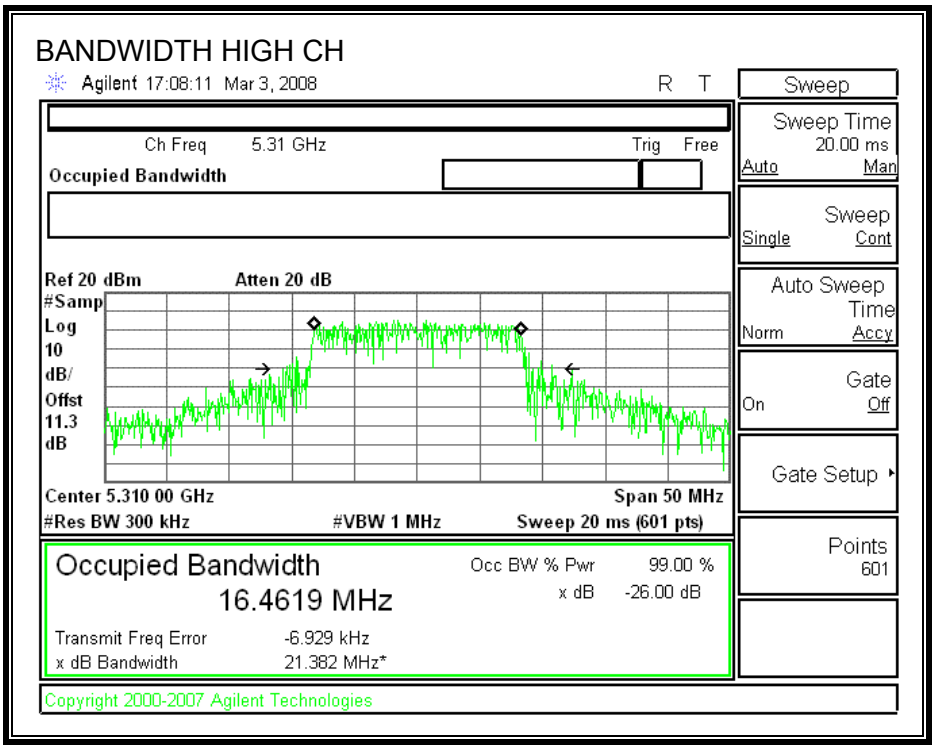
RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5180	22.877	16.4258
Middle	5260	20.192	16.5249
High	5320	21.382	16.4619

26 dB and 99% BANDWIDTH







7.1.2. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1 & 2)

IC RSS-210 A9.2 (1 & 2)

Antenna Gain (dBi)	10 Log (# Tx Chains) (dB)	Effective Legacy Gain (dBi)
5	4.77	9.77

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz.

For the 5.25-5.35 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz.

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

Limit in 5150 to 5250 MHz Band

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Effective Ant. Gain (dBi)	Limit (dBm)
Low	5180	16.99	21.114	17.25	9.77	13.22

Limit in 5250 to 5350 MHz Band

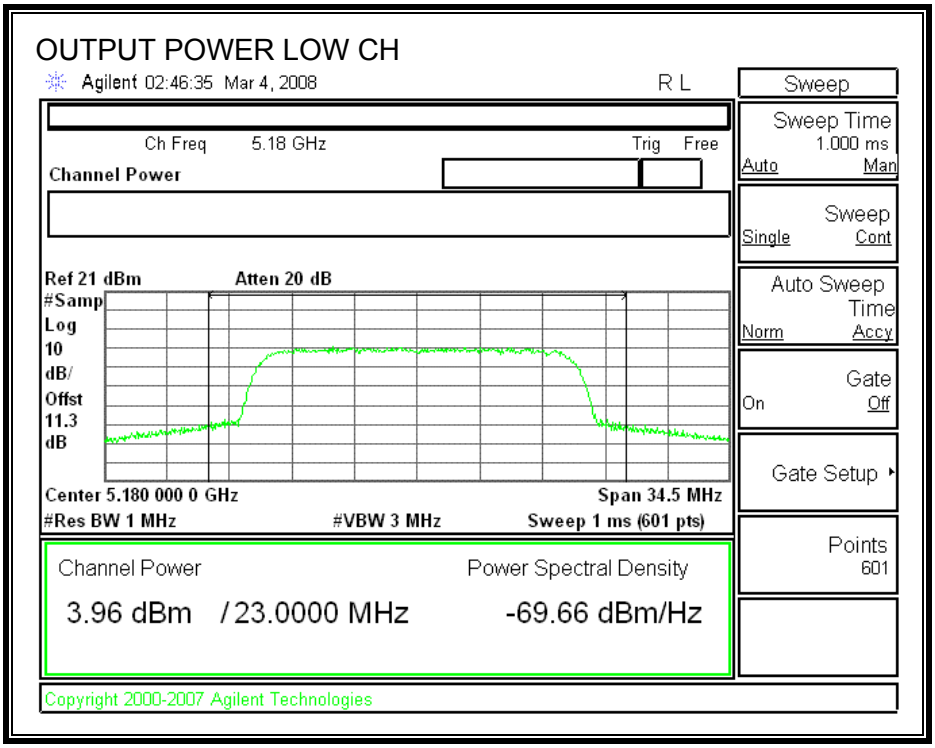
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Mid	5260	23.98	22.965	24.61	9.77	20.21
High	5320	23.98	22.614	24.54	9.77	20.21

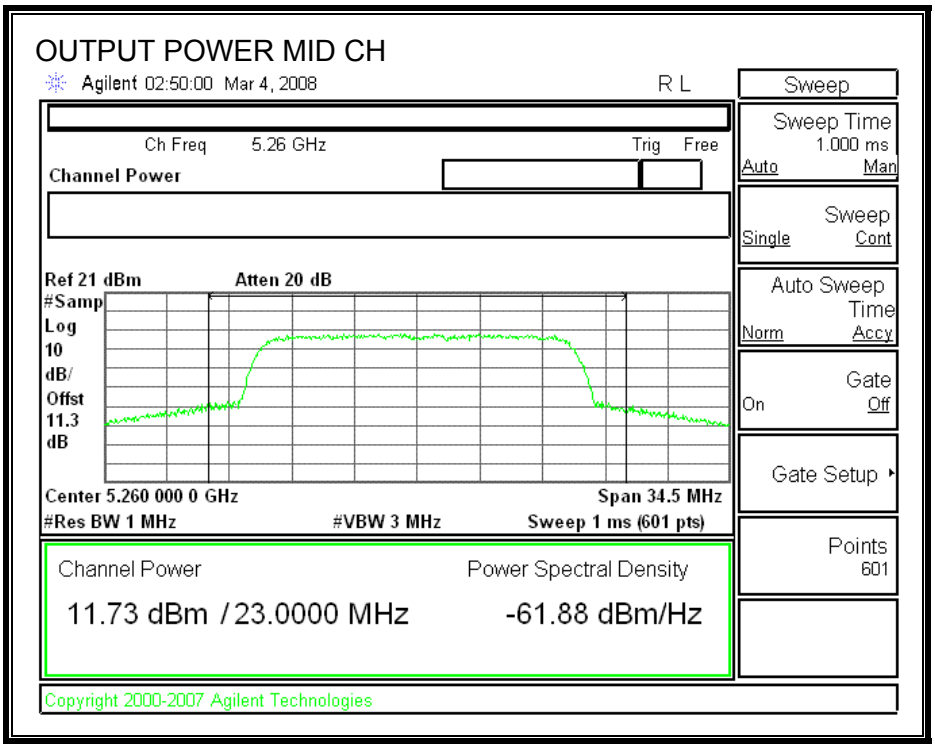
Individual Chain Results

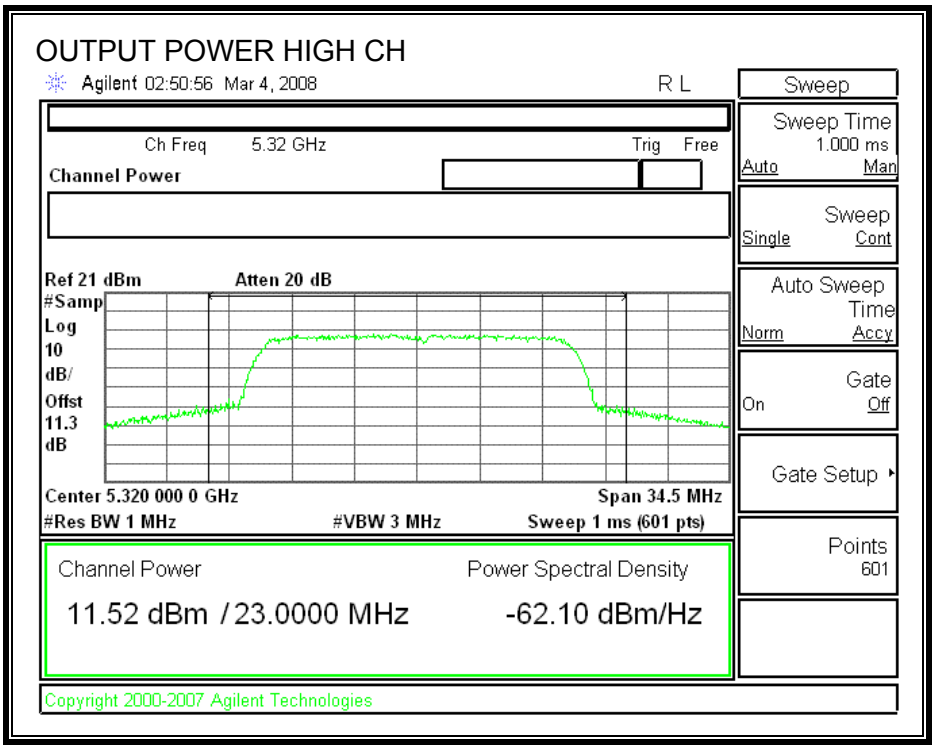
Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	3.96	6.86	7.16	10.98	13.22	-2.24
Mid	5260	11.73	14.05	13.67	18.03	20.21	-2.18
High	5320	11.52	13.84	13.84	17.97	20.21	-2.24

OUTPUT POWER

CH 0

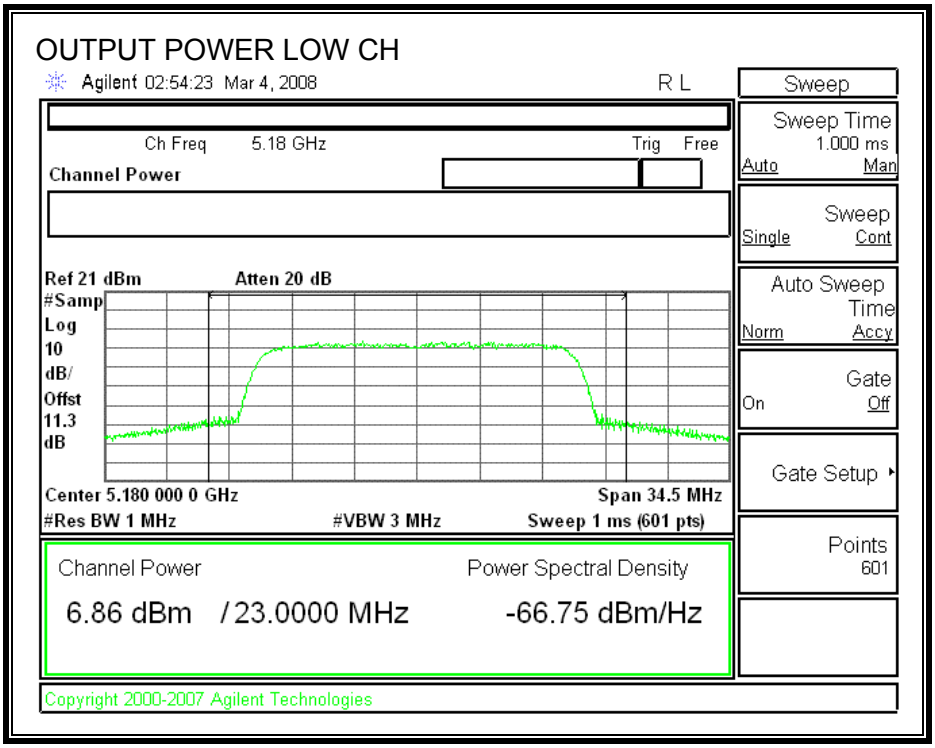


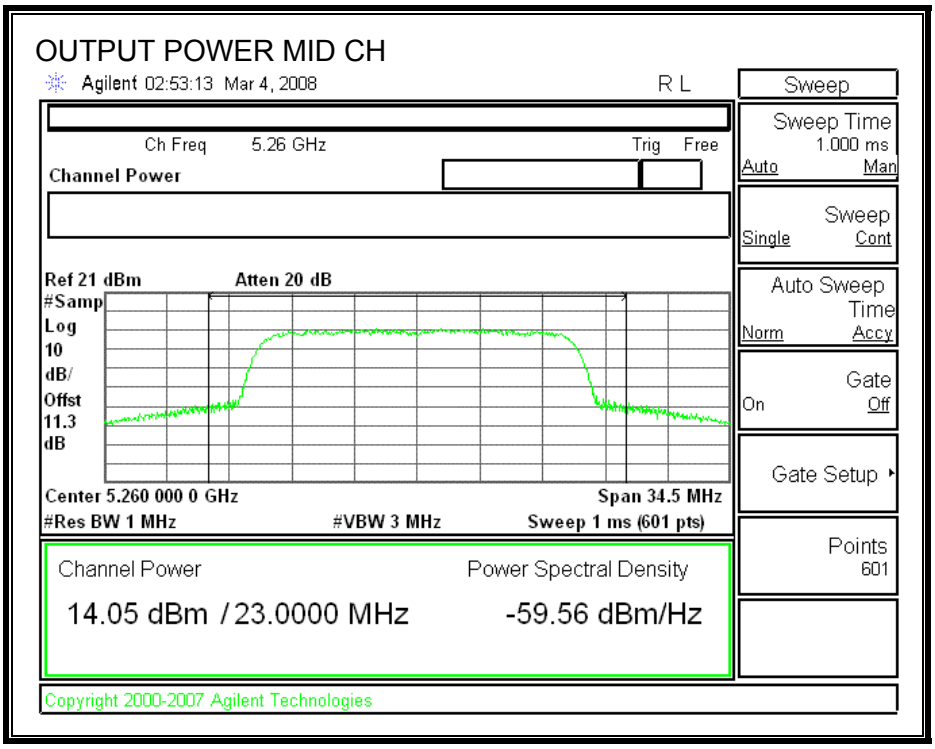


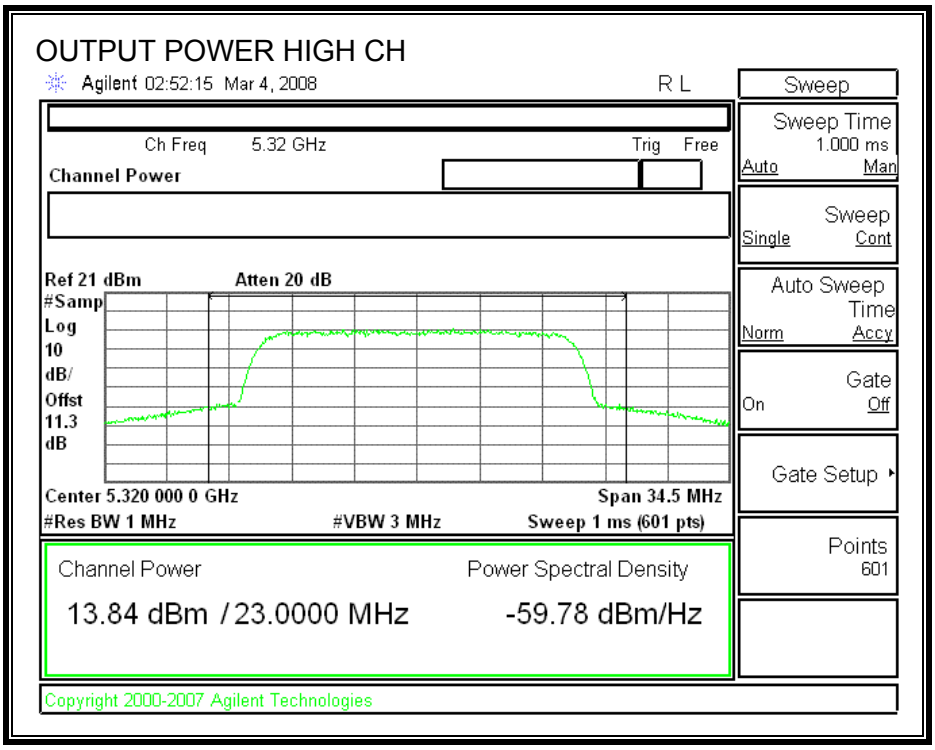


OUTPUT POWER

CH 1

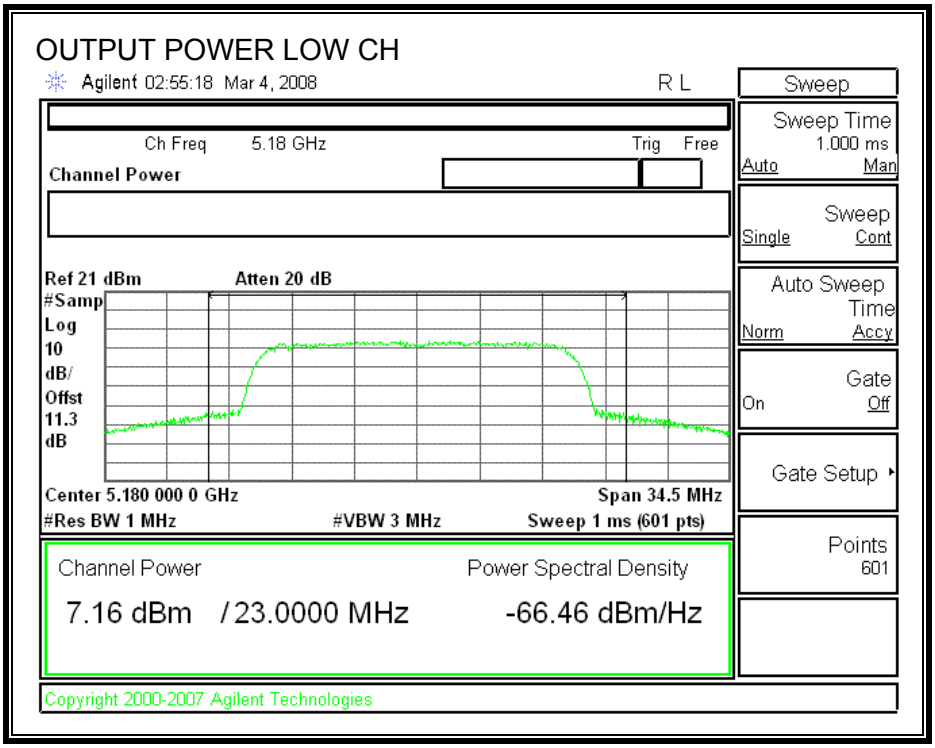


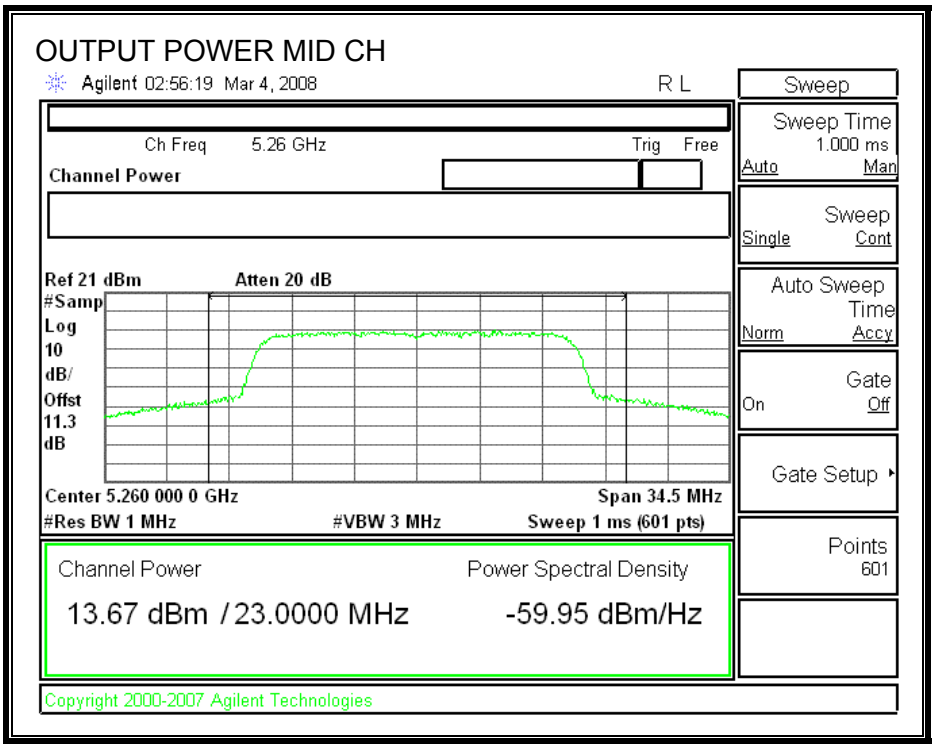




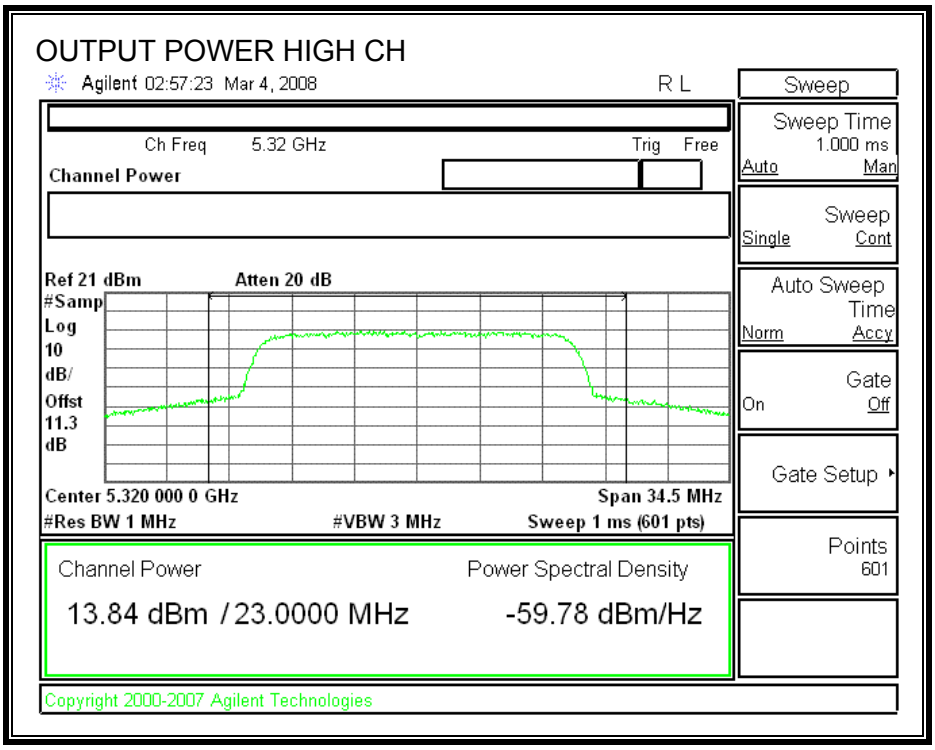
OUTPUT POWER

CH 2





OUTPUT POWER HIGH CH



7.1.3. AVERAGE POWER FOR LEGACY MODES (5.2GHz)

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	5180	4.00	6.68	7.15	10.92
Middle	5260	11.75	14.10	13.78	18.10
High	5320	11.50	14.00	13.65	17.95

7.1.4. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1 & 2)

IC RSS-210 A9.2 (1 & 2)

Antenna Gain (dBi)	10 Log (# Tx Chains) (dB)	Effective Legacy Gain (dBi)
5	4.77	9.77

For the 5.15–5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band.

For the 5.25–5.35 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum Effective antenna gain is 9.77 dBi, therefore the limit is 0.23 dBm in the lower band and 7.23 dBm in the upper band.

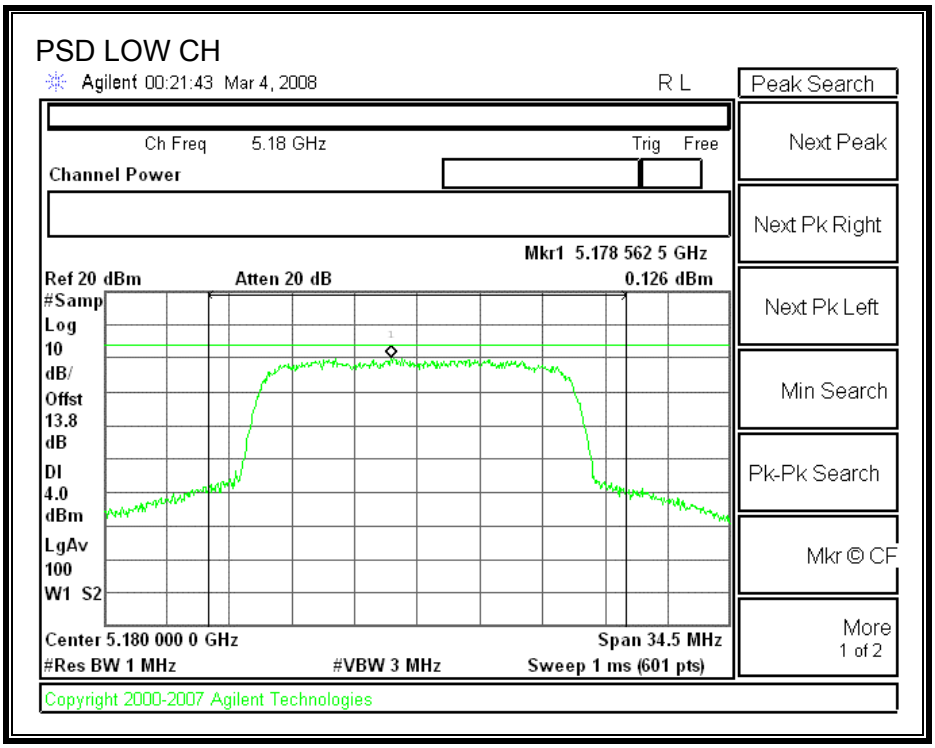
TEST PROCEDURE

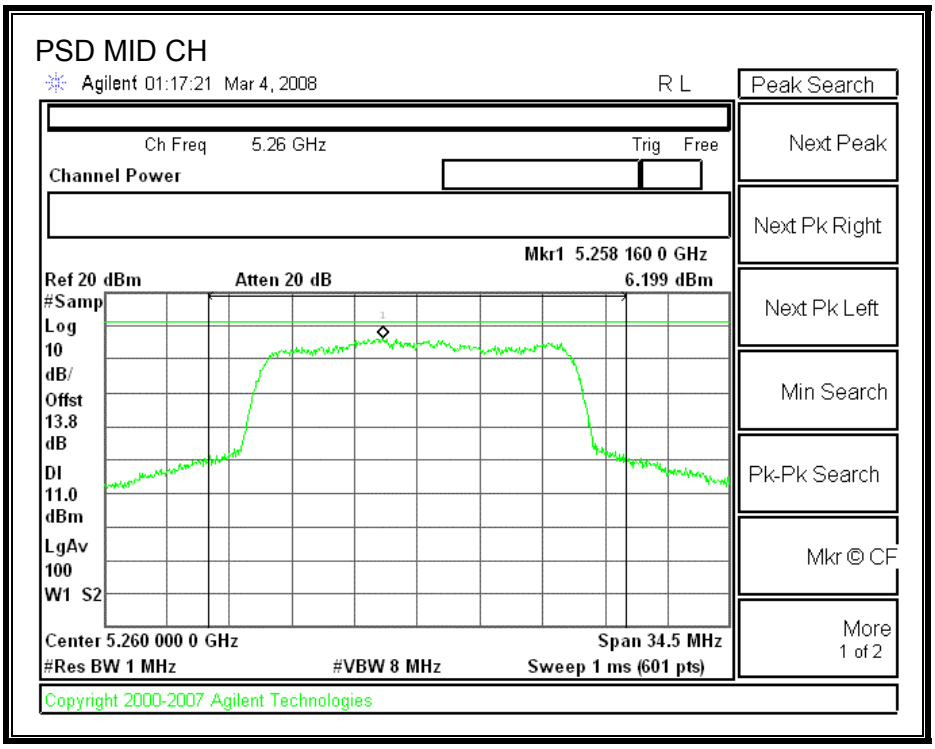
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

RESULTS

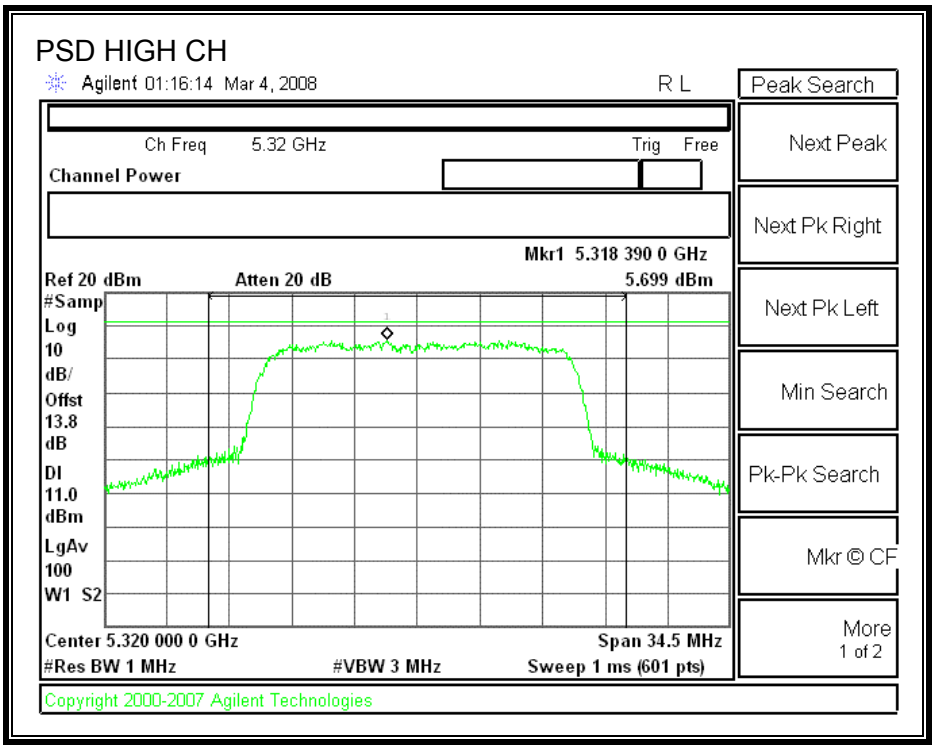
Channel	Frequency (MHz)	PPSD With Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	5180	0.126	0.230	-0.104
Middle	5260	6.199	7.230	-1.031
High	5320	5.699	7.230	-1.531

POWER SPECTRAL DENSITY (WITH COMBINER)





PSD HIGH CH



7.1.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (1 & 2)

IC RSS-210 A9.3 (1 & 2)

For transmitters operating in the 5.15-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

TEST PROCEDURE

Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

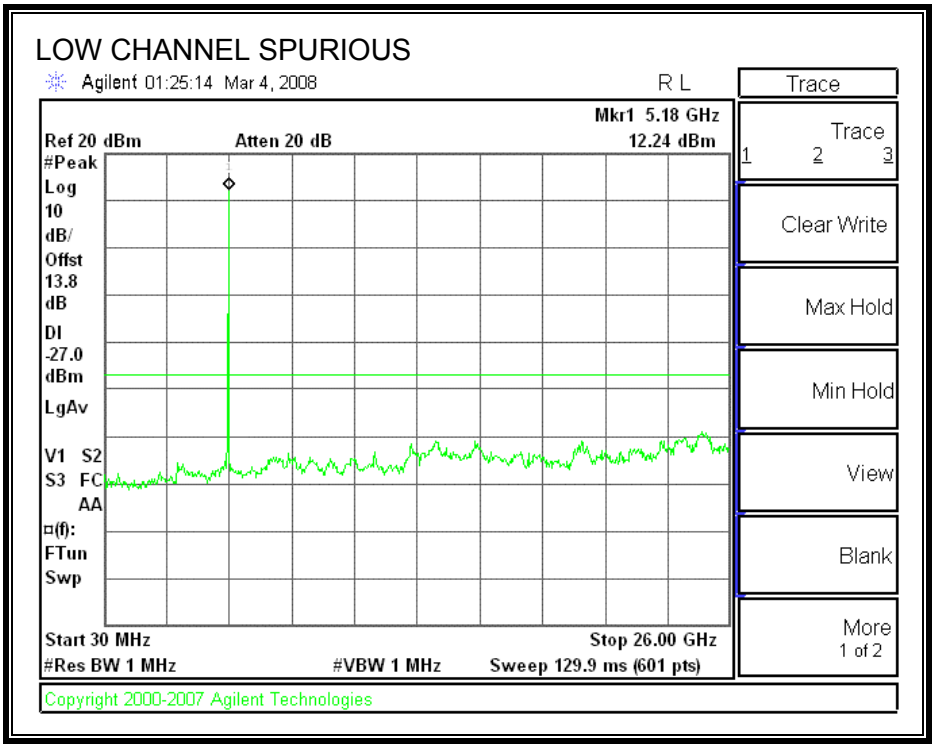
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements are made.

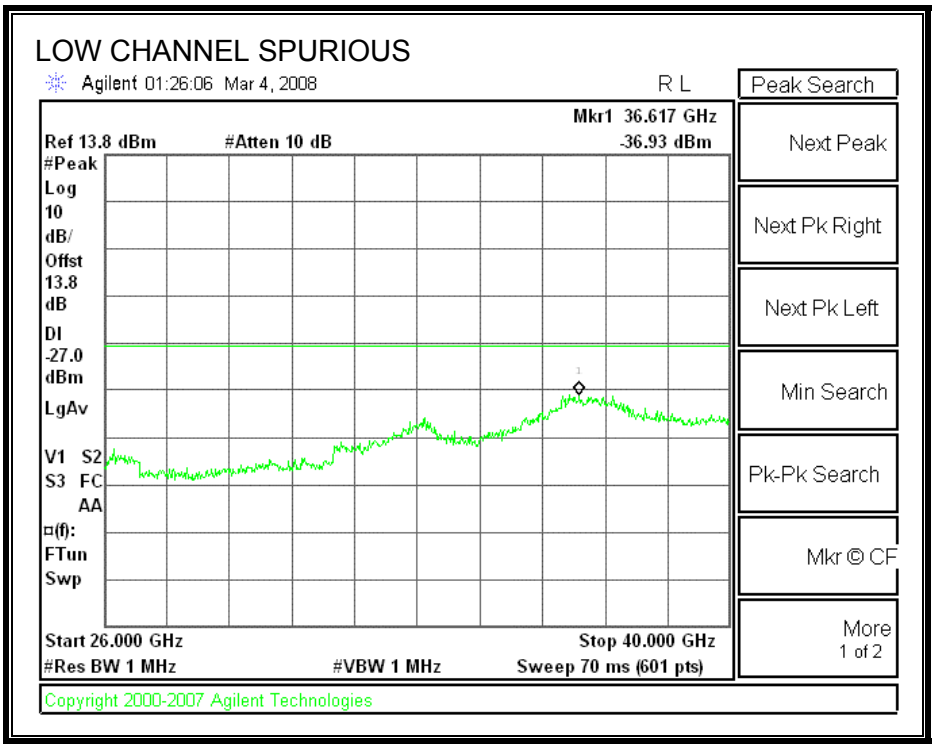
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

Offset Value = Cable Loss + Attenuation + Antenna Gain + Combiner Loss

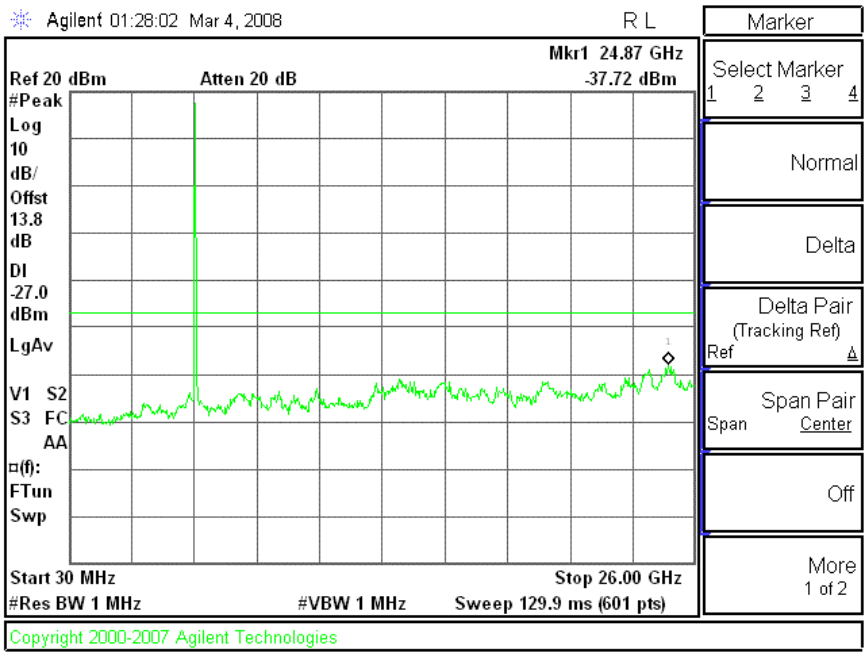
RESULTS

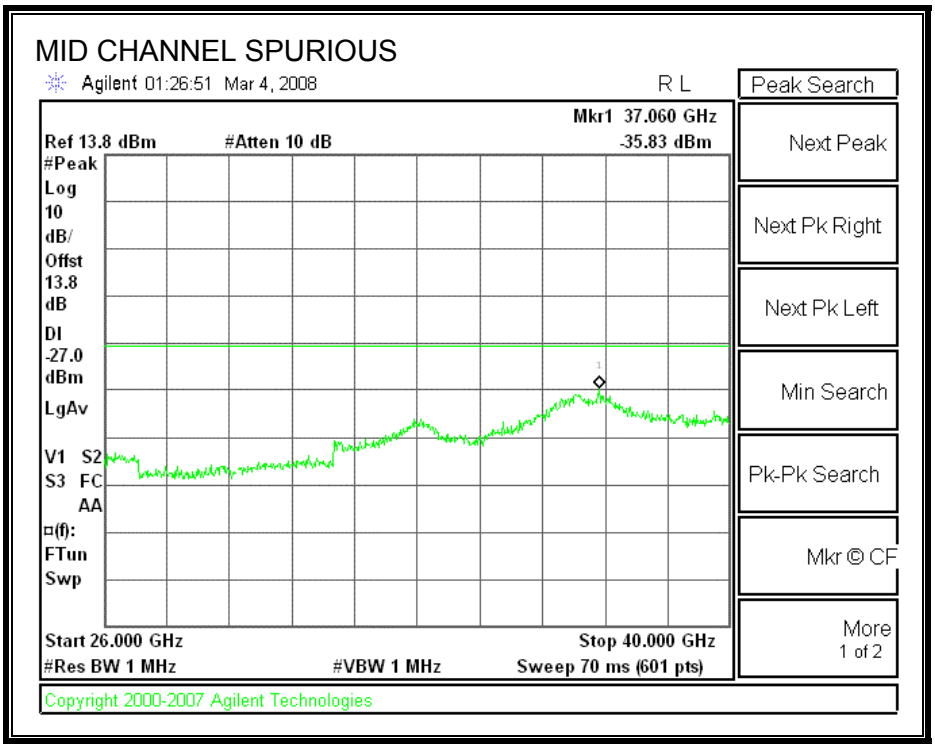
SPURIOUS EMISSIONS (WITH COMBINER)





MID CHANNEL SPURIOUS





7.2. 802.11n THREE CHAINS HT20 MODE IN THE 5.2 GHz BAND

7.2.1. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

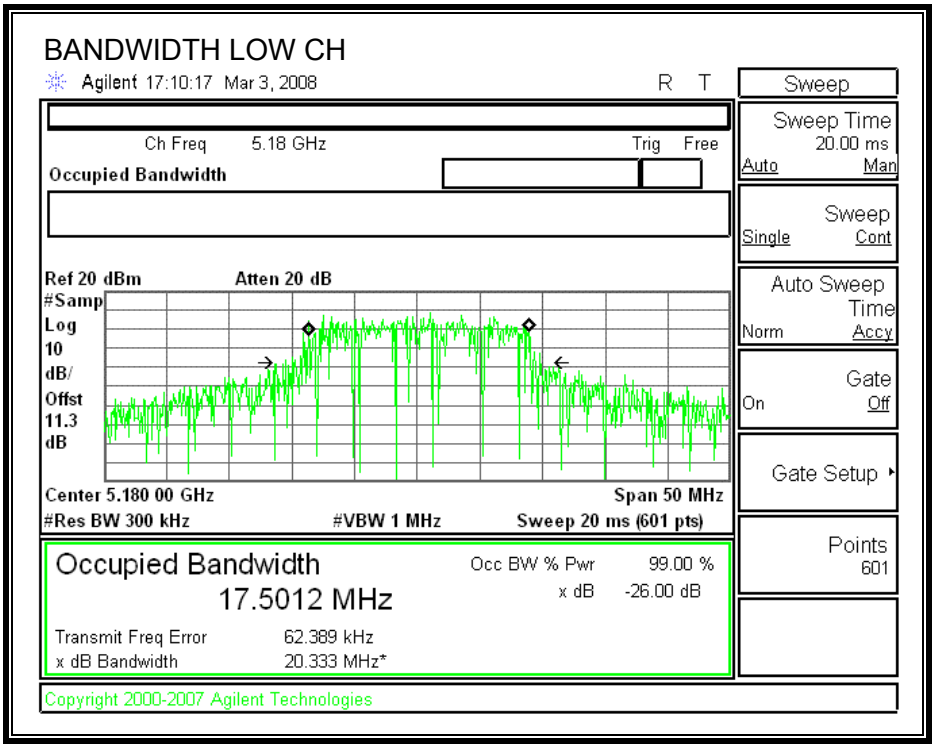
TEST PROCEDURE

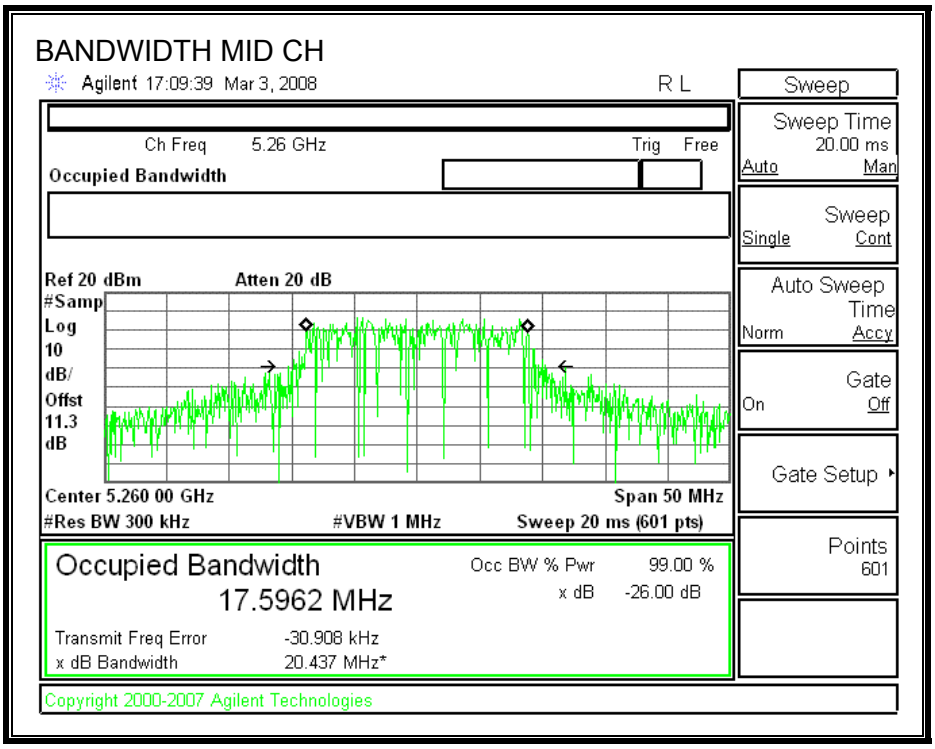
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

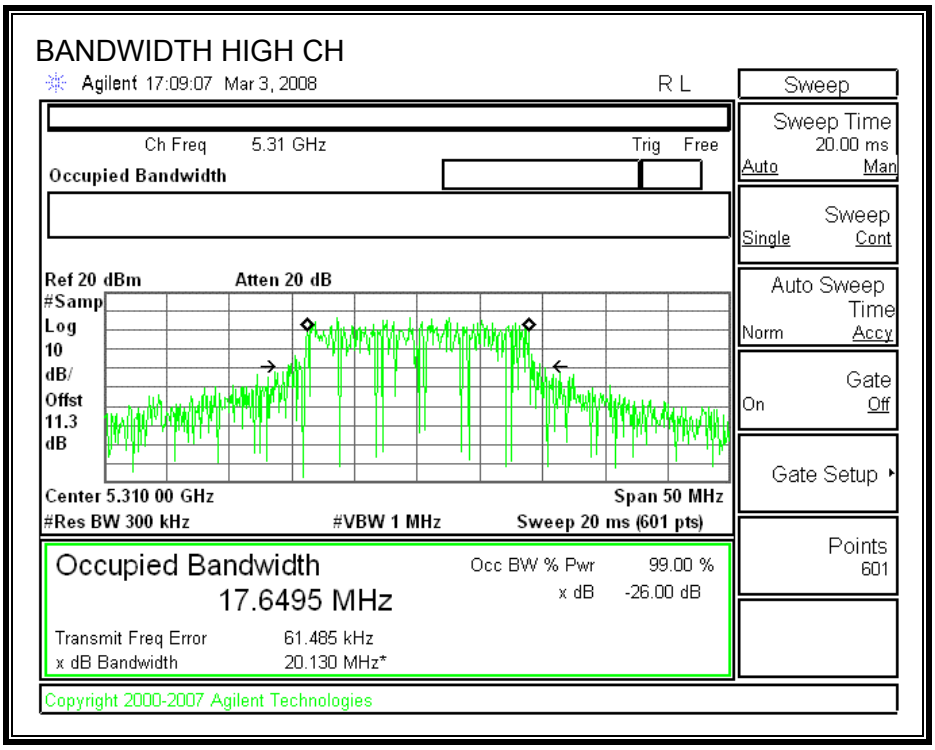
RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5180	20.3330	17.5012
Middle	5260	20.4370	17.5962
High	5320	20.1300	17.6495

26 dB and 99% BANDWIDTH







7.2.2. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1 & 2)

IC RSS-210 A9.2 (1 & 2)

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz.

For the 5.25-5.35 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz.

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

Limit in 5150 to 5250 MHz Band

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Effective Ant. Gain (dBi)	Limit (dBm)
Low	5180	16.99	21.761	17.38	5.00	16.99

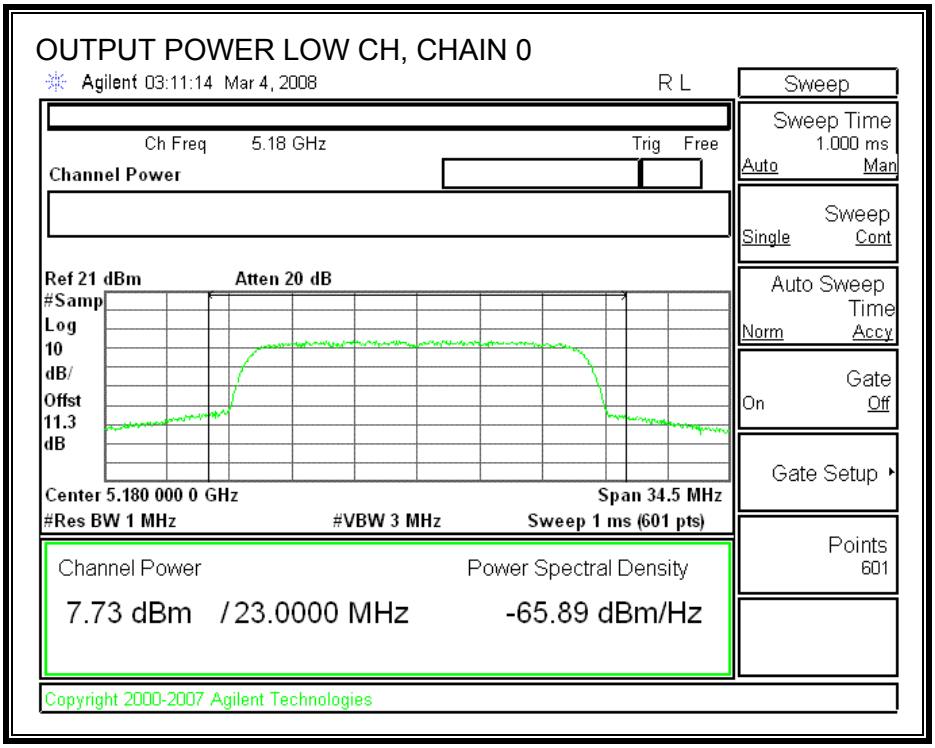
Limit in 5250 to 5350 MHz Band

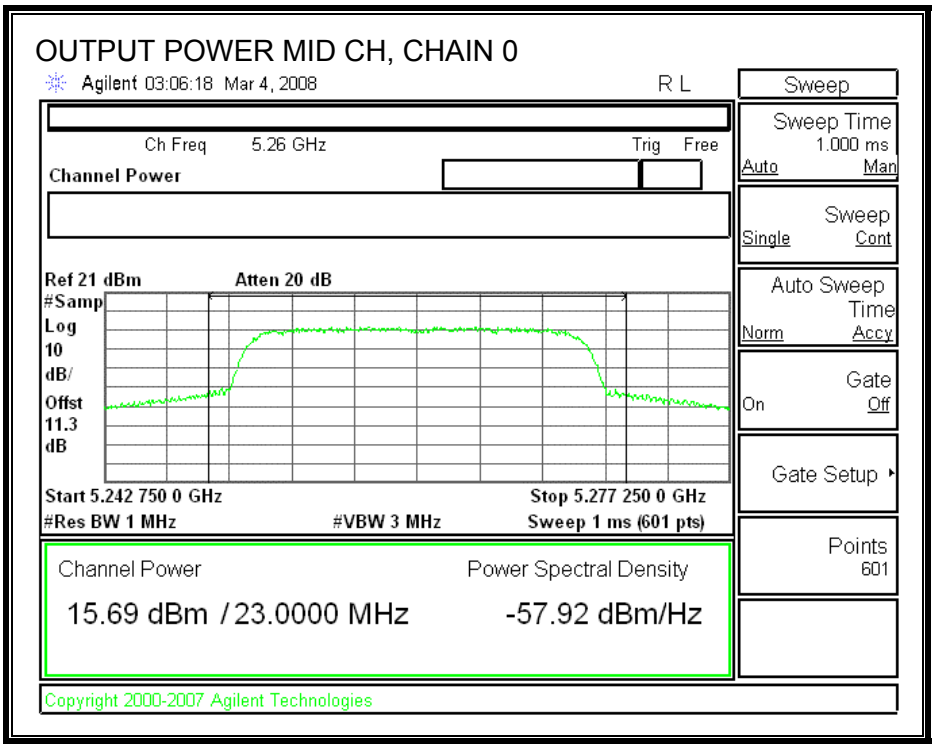
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Mid	5260	23.98	22.412	24.50	5.00	23.98
High	5320	23.98	22.736	24.57	5.00	23.98

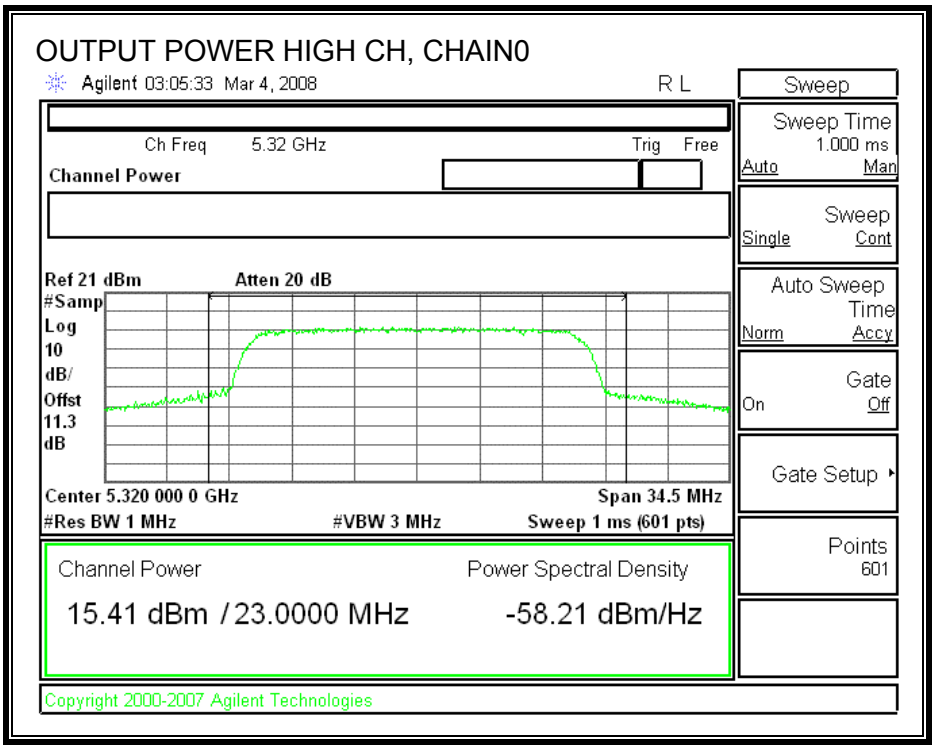
Individual Chain Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	7.73	10.82	11.40	15.03	16.99	-1.96
Mid	5260	15.69	17.60	17.24	21.69	23.98	-2.29
High	5320	15.41	17.24	17.16	21.45	23.98	-2.53

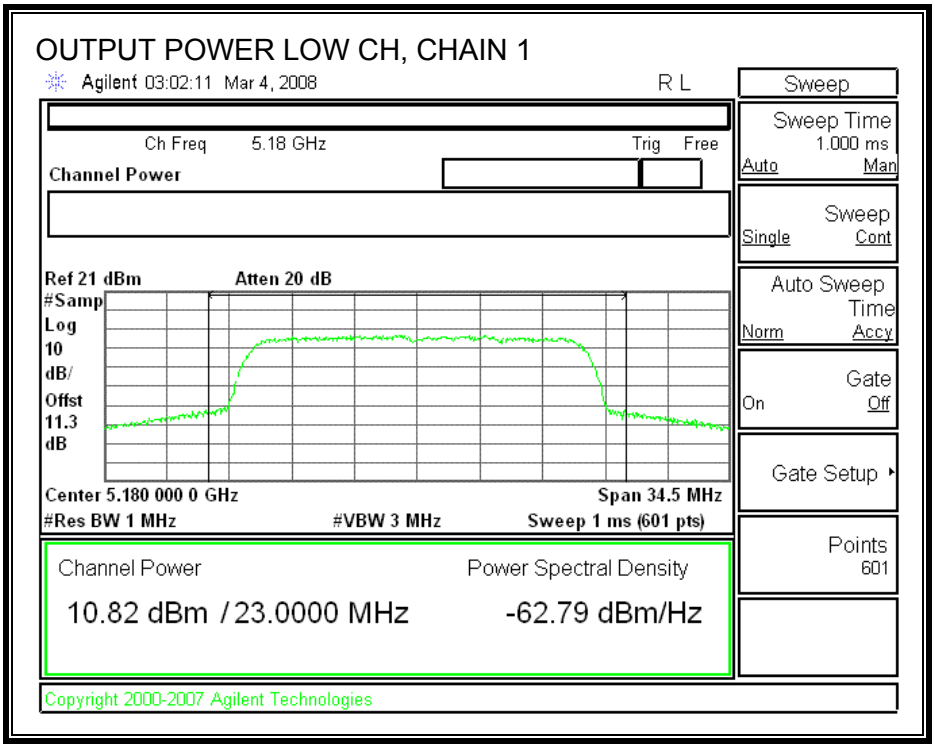
CHAIN 0 OUTPUT POWER

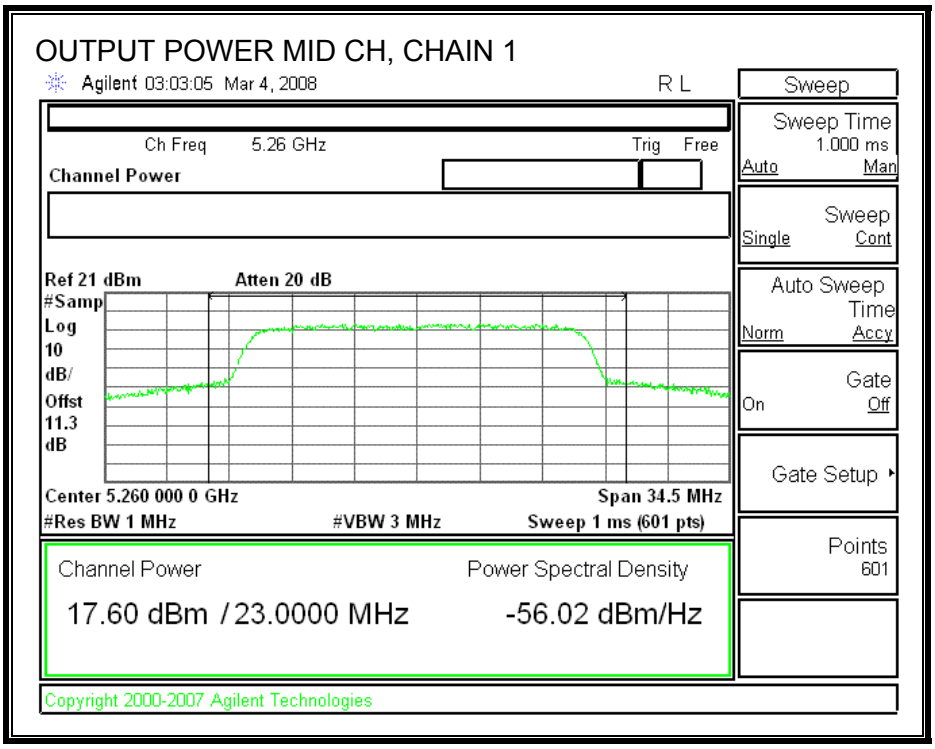


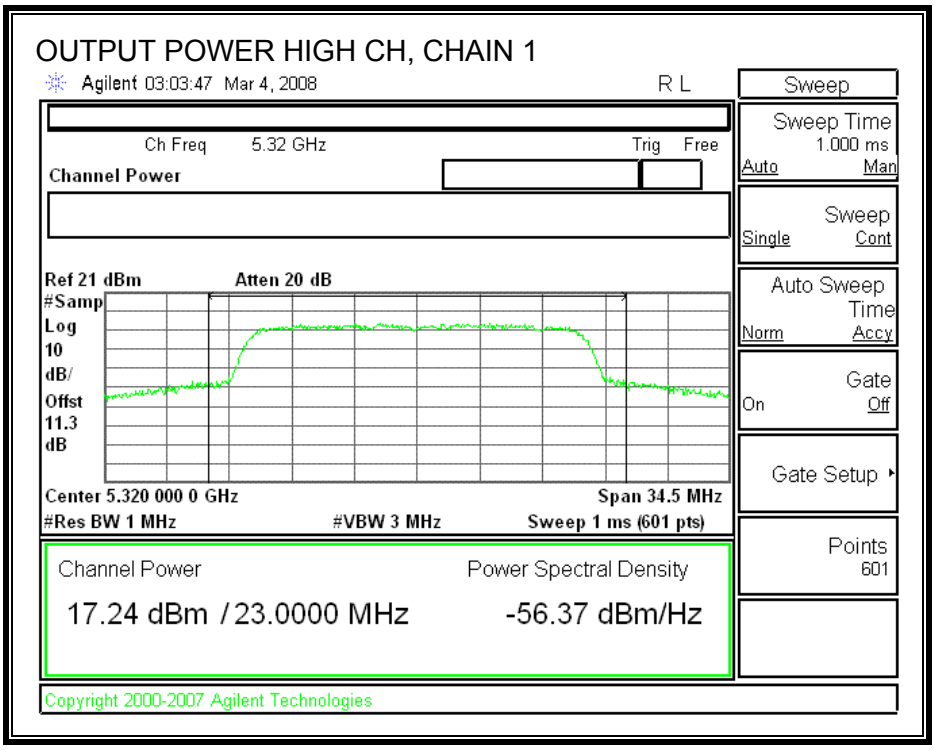




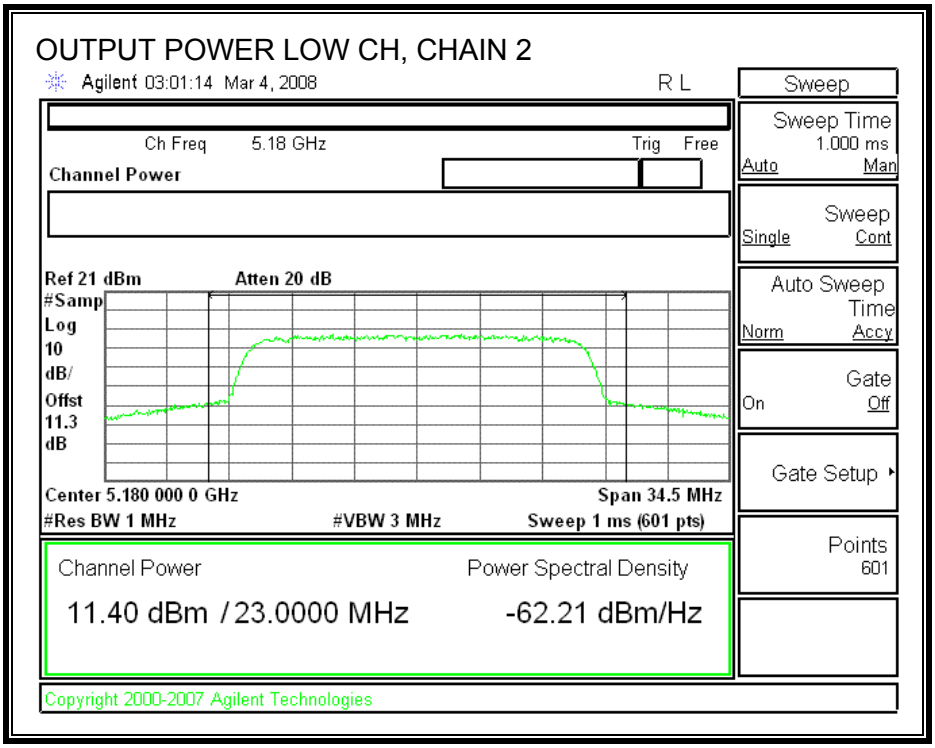
CHAIN 1 OUTPUT POWER

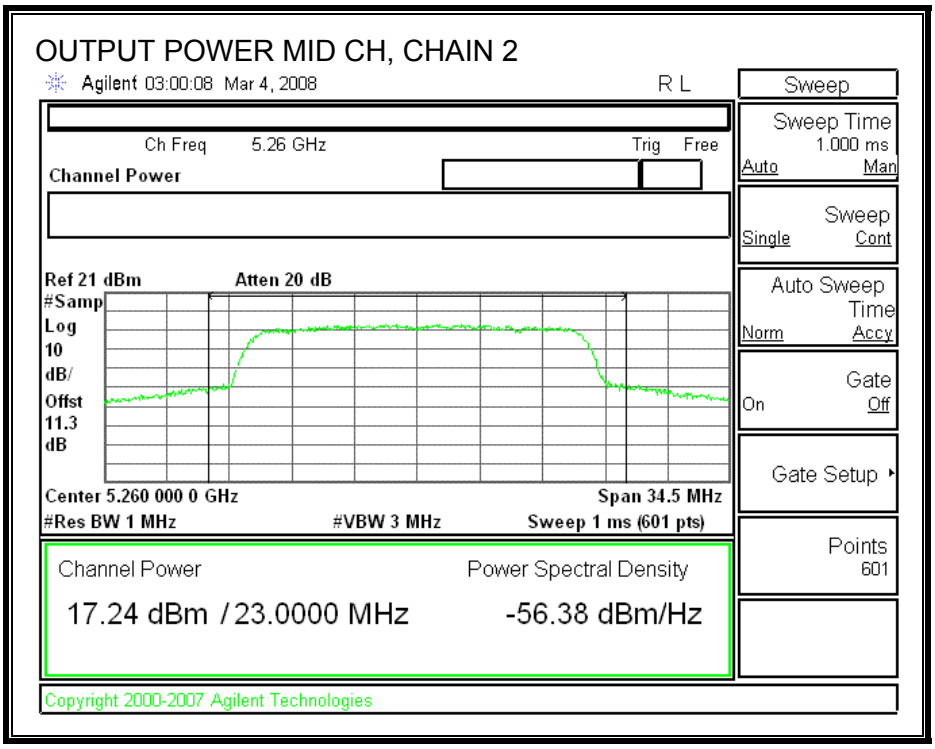


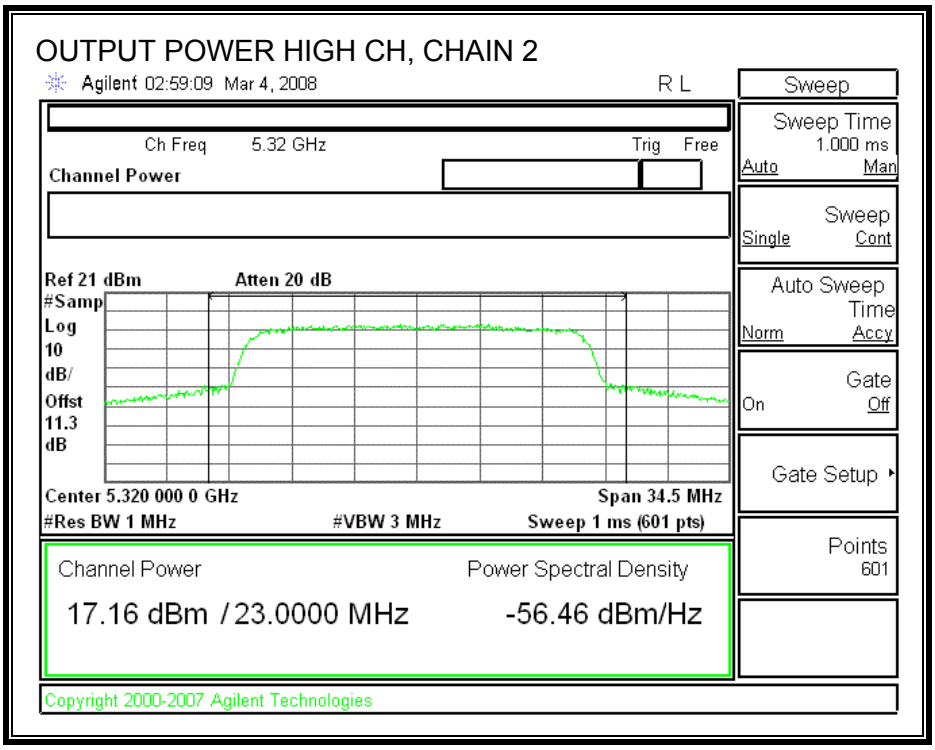




CHAIN 2 OUTPUT POWER







7.2.3. AVERAGE POWER FOR HT20 MODES (5.2GHz)

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	5180	7.71	10.79	11.39	15.01
Middle	5260	15.70	17.55	17.35	21.71
High	5320	15.50	17.33	17.26	21.55

7.2.4. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1 & 2)

IC RSS-210 A9.2 (1 & 2)

For the 5.15–5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band.

For the 5.25–5.35 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 4 dBm in the lower band and 11 dBm in the upper band.

TEST PROCEDURE

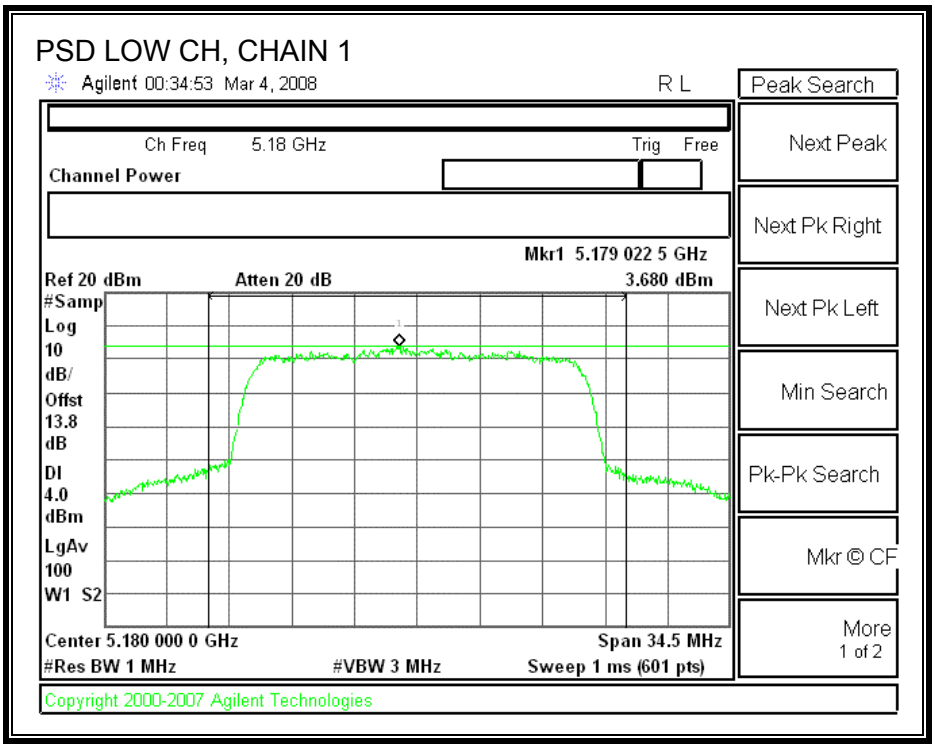
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

RESULTS

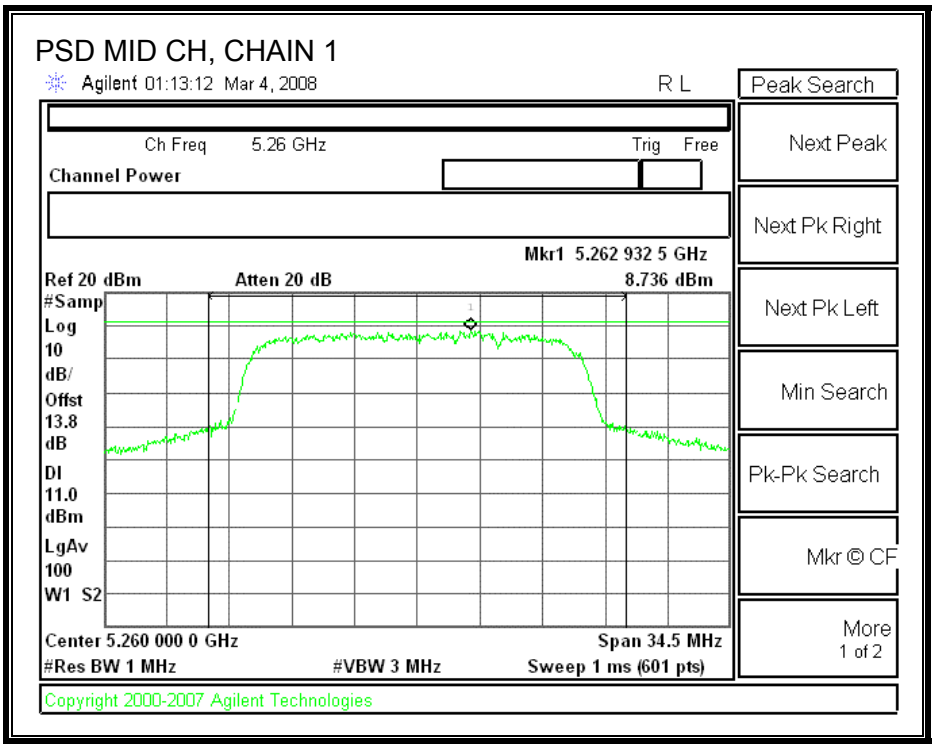
Low channel plots are included hereafter.

Channel	Frequency (MHz)	PPSD With Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	5180	3.680	4.000	-0.320
Middle	5260	8.736	11.000	-2.264
High	5320	8.133	11.000	-2.867

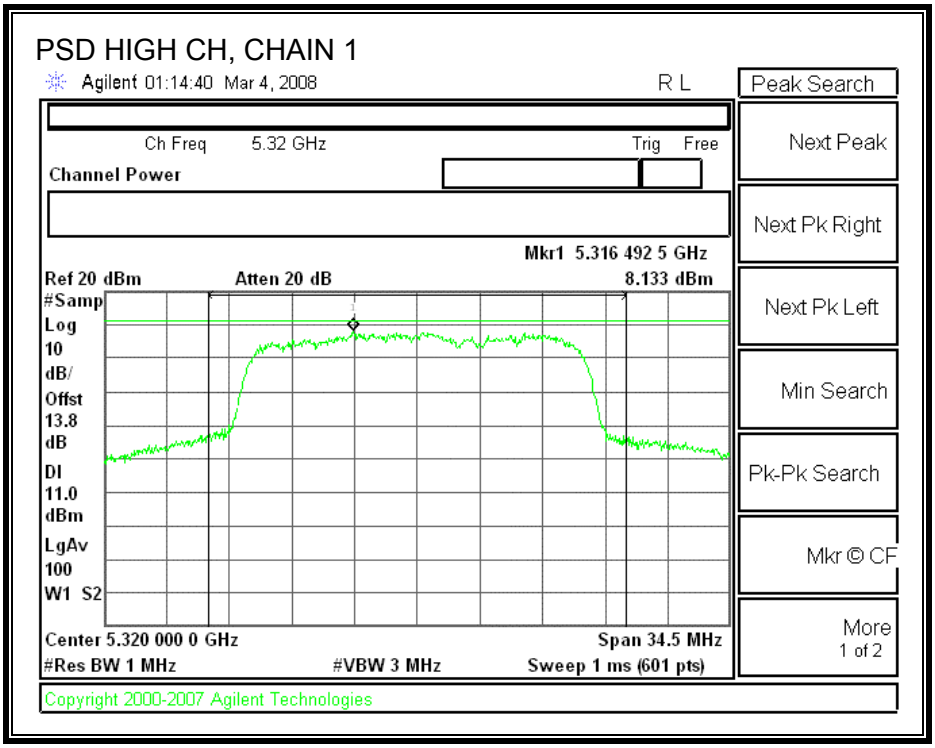
POWER SPECTRAL DENSITY (WITH COMBINER)



PSD MID CH, CHAIN 1



PSD HIGH CH, CHAIN 1



7.2.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (1 & 2)

IC RSS-210 A9.3 (1 & 2)

For transmitters operating in the 5.15-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

TEST PROCEDURE

Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

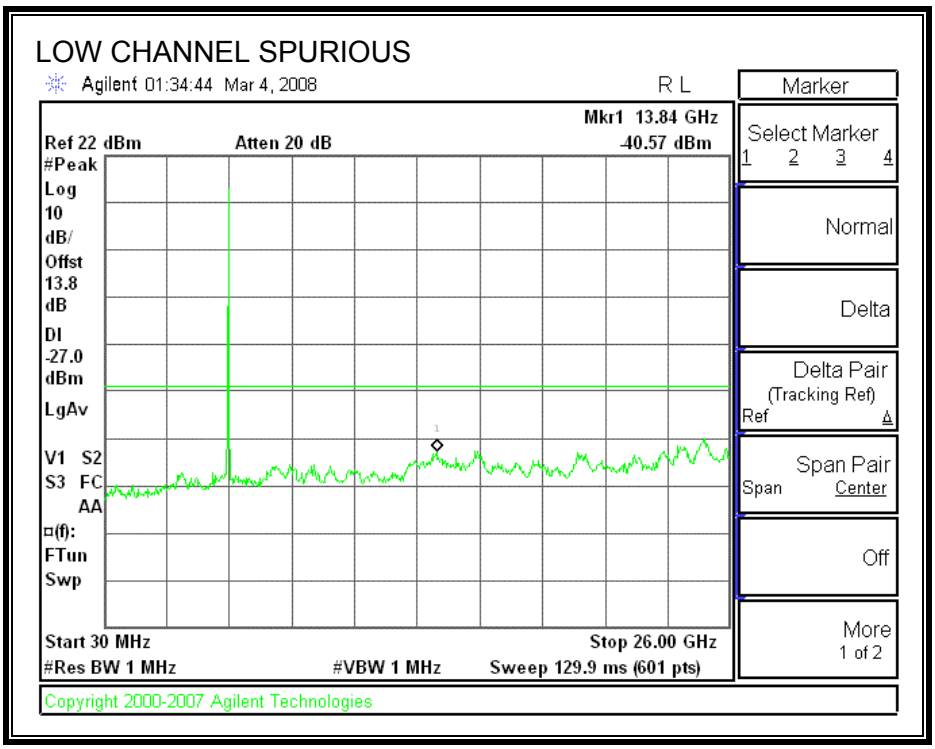
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements are made.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

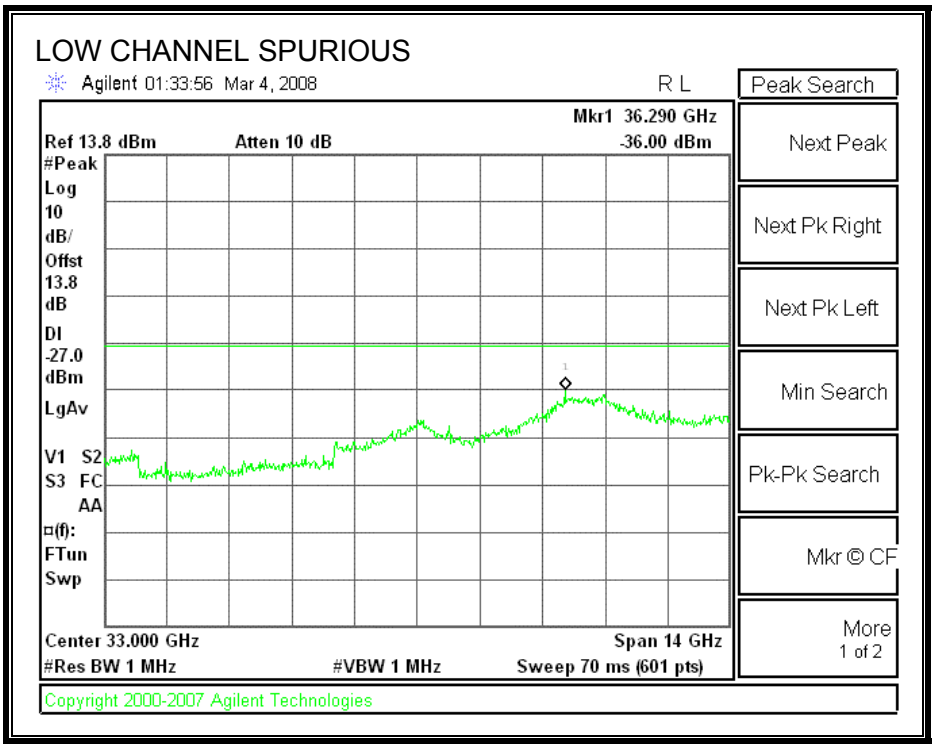
Offset Value = Cable Loss + Attenuation + Antenna Gain + Combiner Loss

RESULTS

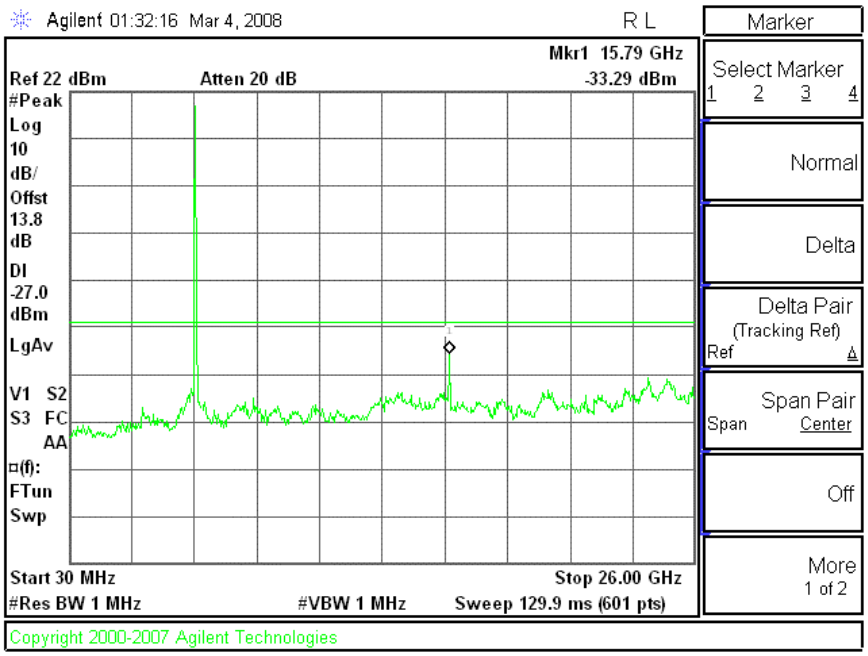
CHAIN 1 SPURIOUS EMISSIONS (WITH COMBINER)



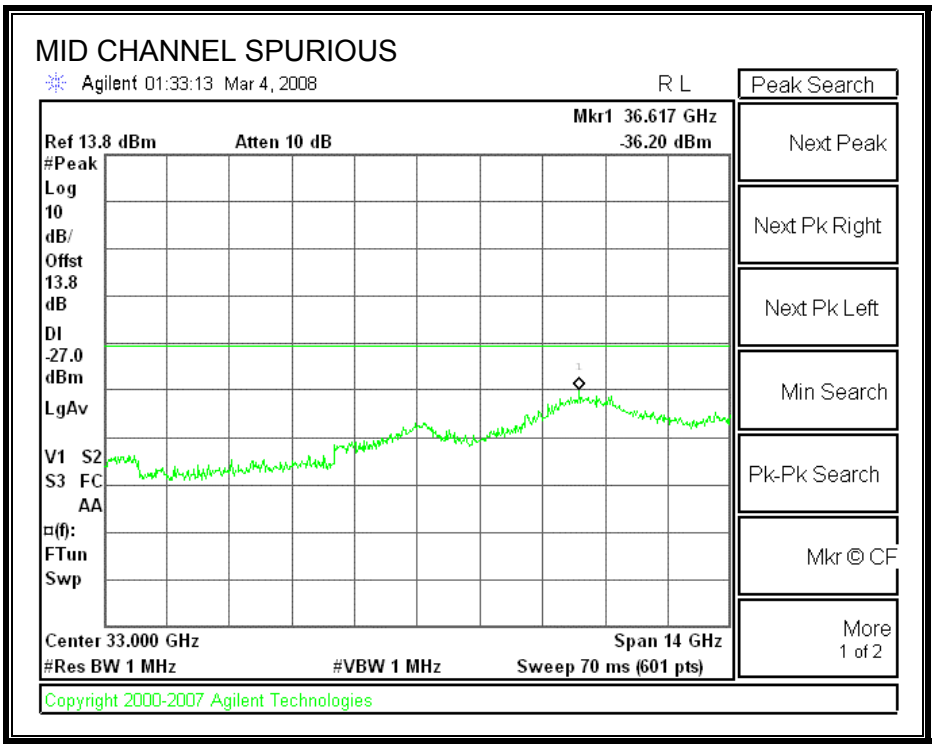
LOW CHANNEL SPURIOUS



MID CHANNEL SPURIOUS



MID CHANNEL SPURIOUS



7.3. 802.11n THREE CHAINS HT40 MODE IN THE 5.2 GHz BAND

7.3.1. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

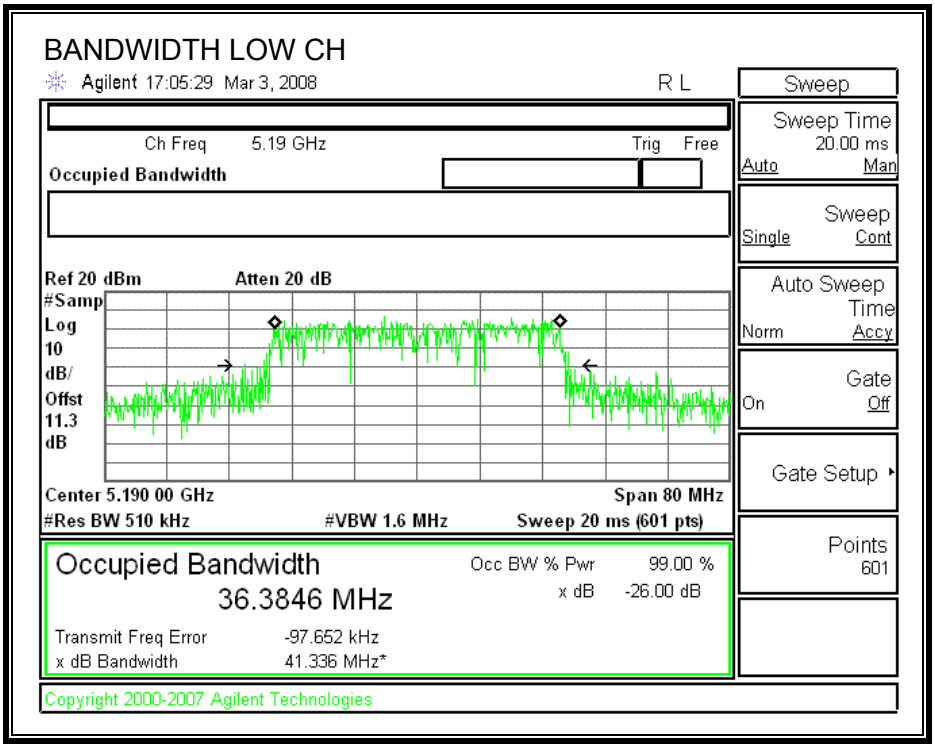
TEST PROCEDURE

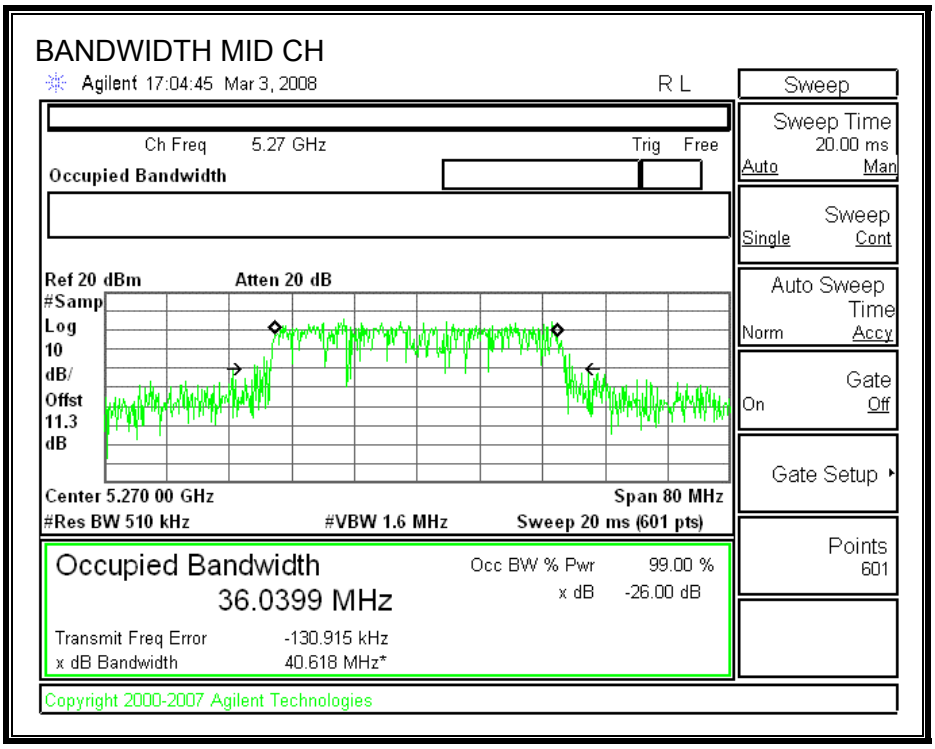
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

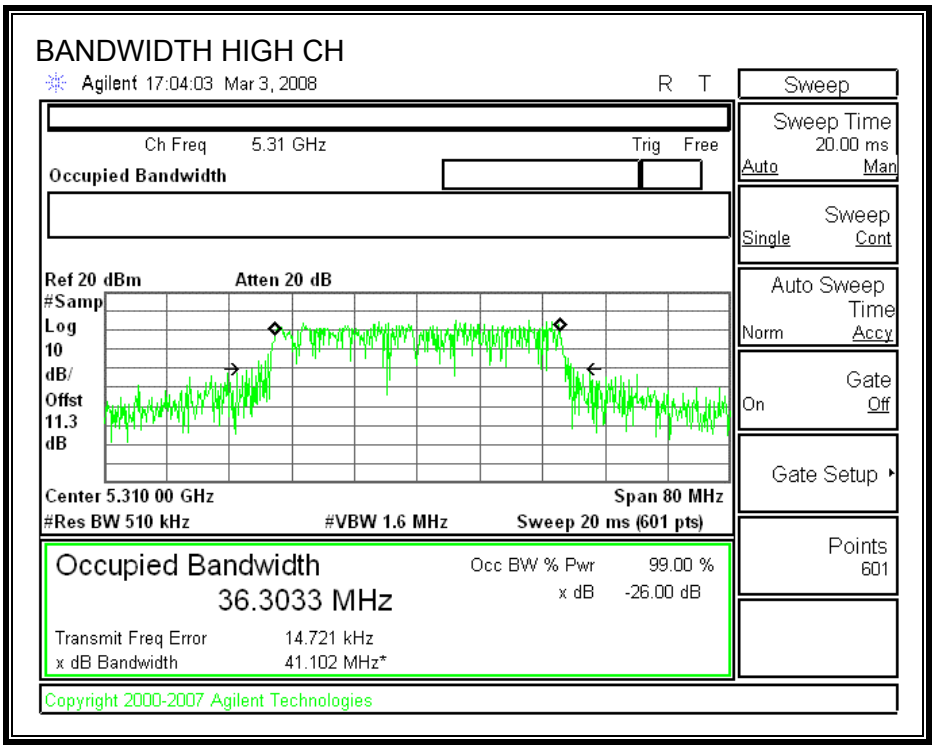
RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5190	41.3360	36.3846
Middle	5270	40.6180	36.0399
High	5310	41.1020	36.3033

26 dB and 99% BANDWIDTH







7.3.2. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1 & 2)

IC RSS-210 A9.2 (1 & 2)

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz.

For the 5.25-5.35 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz.

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

Limit in 5150 to 5250 MHz Band

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Effective Ant. Gain (dBi)	Limit (dBm)
Low	5190	16.99	42.6440	20.30	5.00	16.99

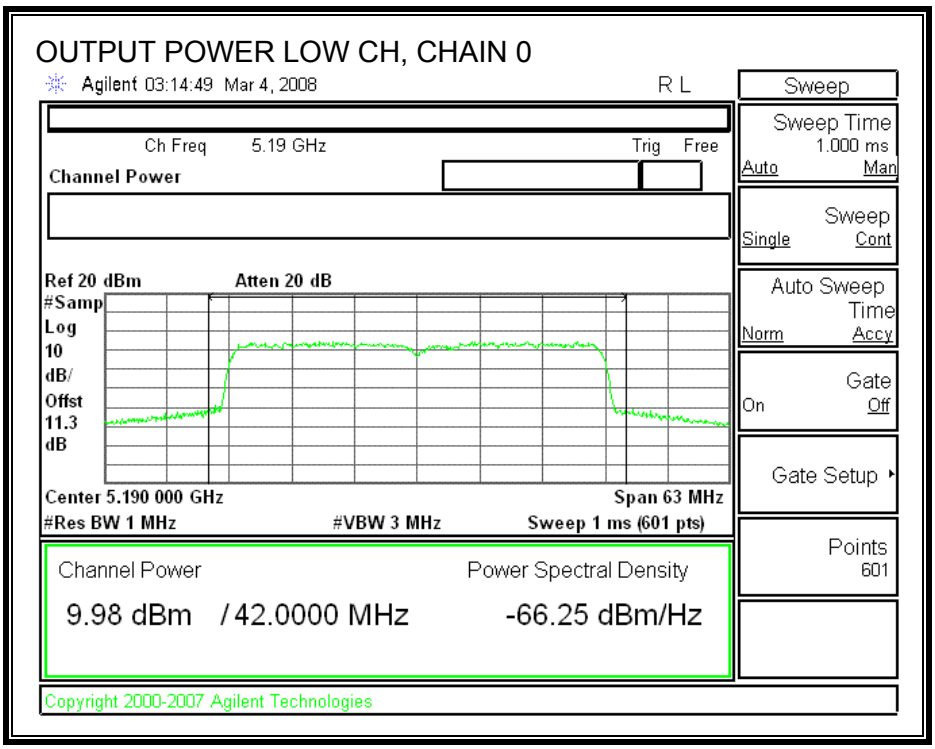
Limit in 5250 to 5350 MHz Band

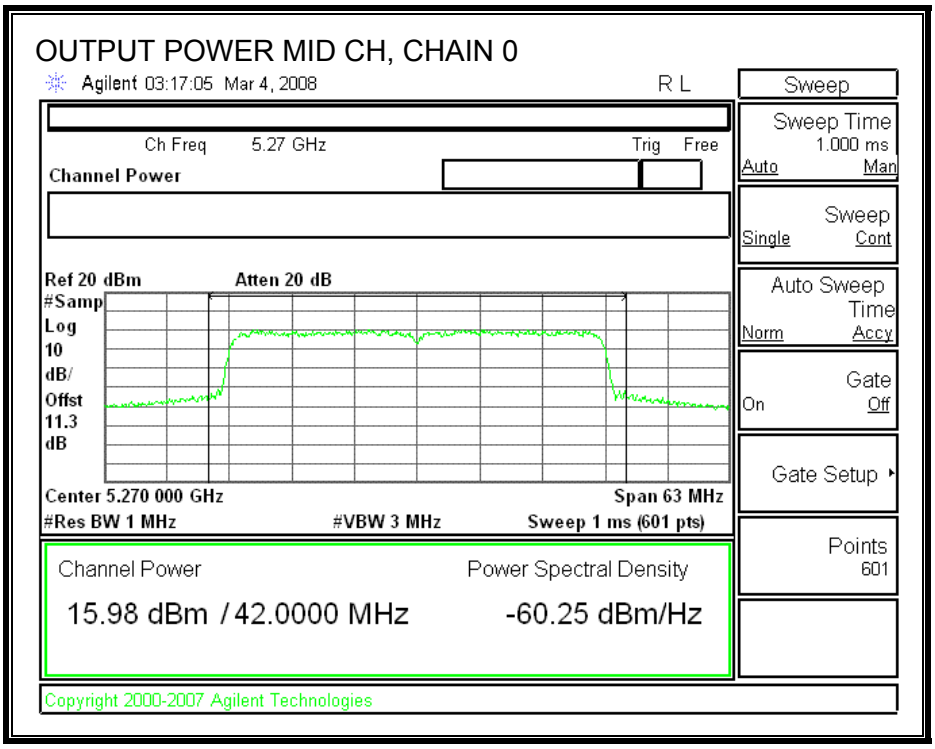
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Mid	5270	23.98	42.3160	27.27	5.00	23.98
High	5310	23.98	42.8040	27.31	5.00	23.98

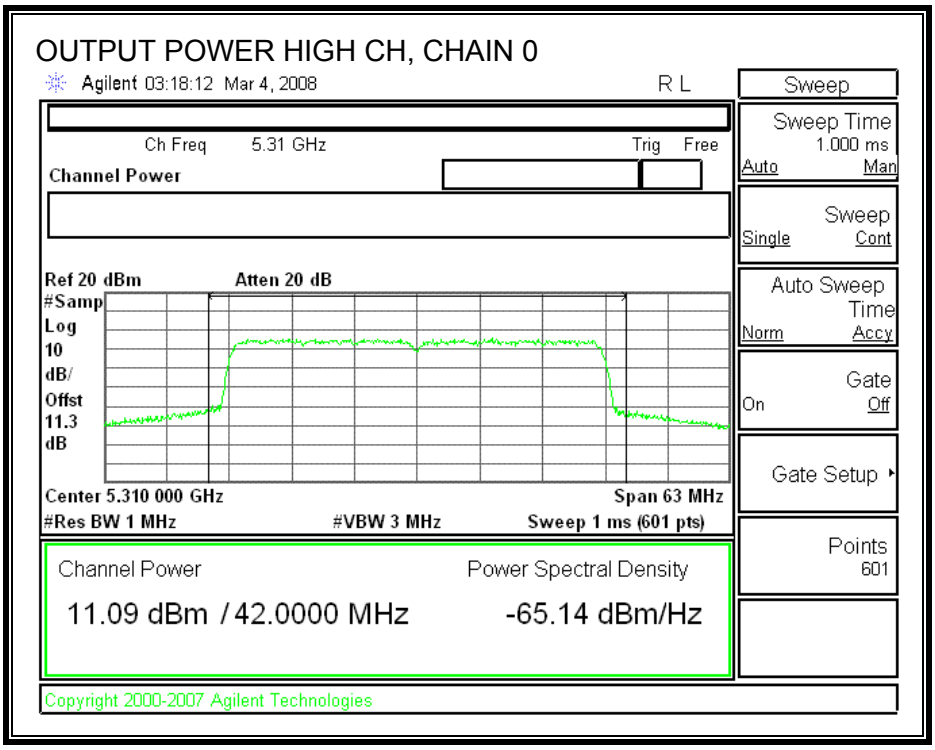
Individual Chain Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5190	9.98	12.84	12.79	16.83	16.99	-0.16
Mid	5270	15.98	17.51	18.00	22.02	23.98	-1.96
High	5310	11.09	14.30	13.54	17.95	23.98	-6.03

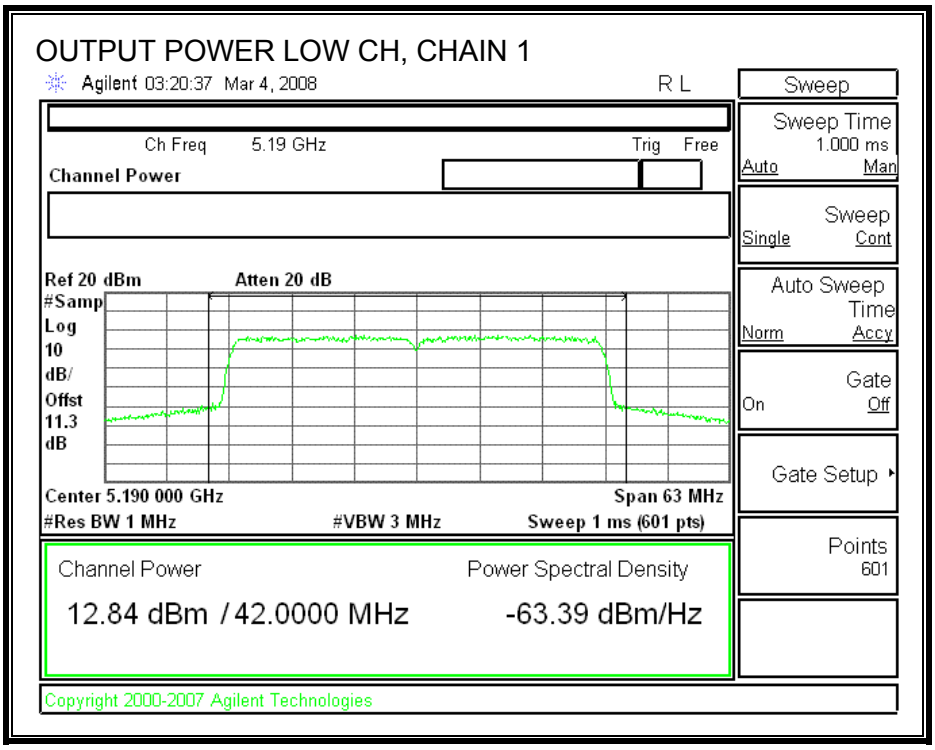
CHAIN 0 OUTPUT POWER

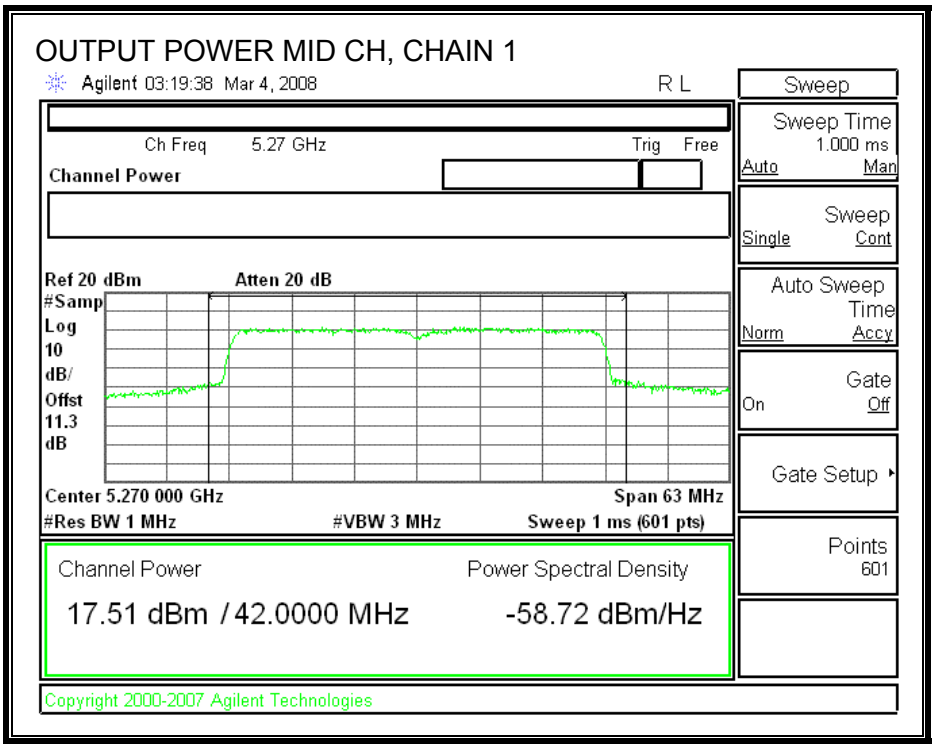


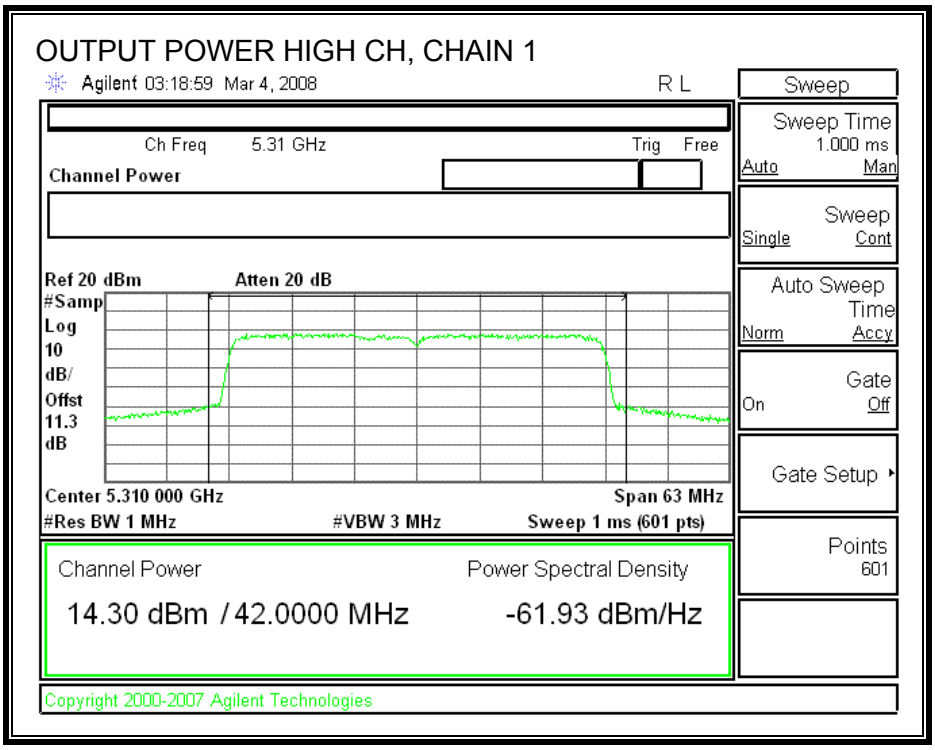




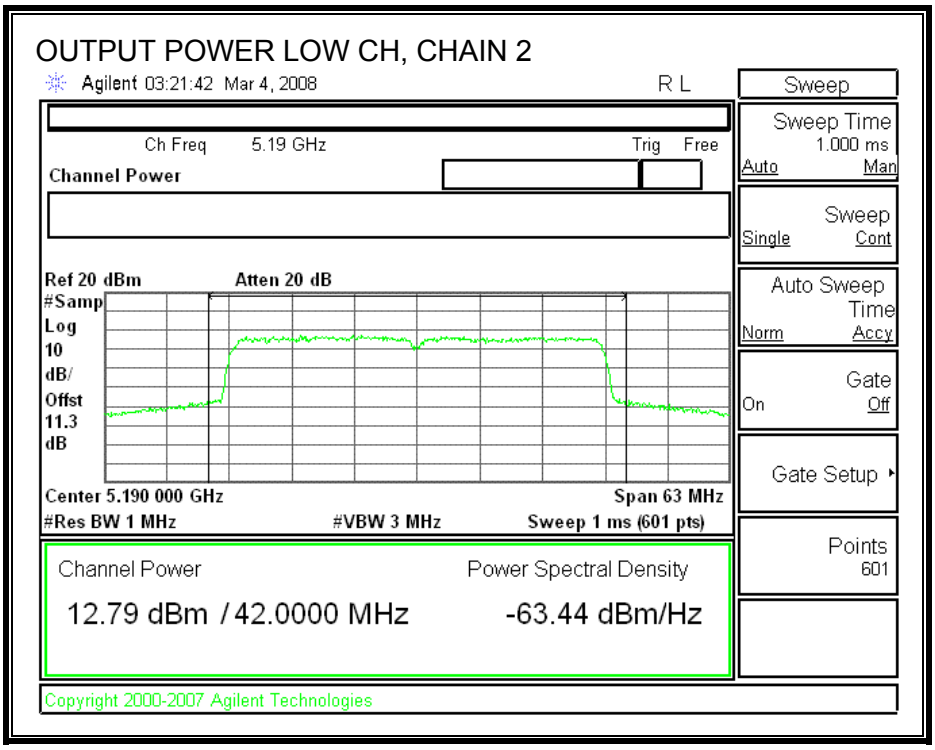
CHAIN 1 OUTPUT POWER



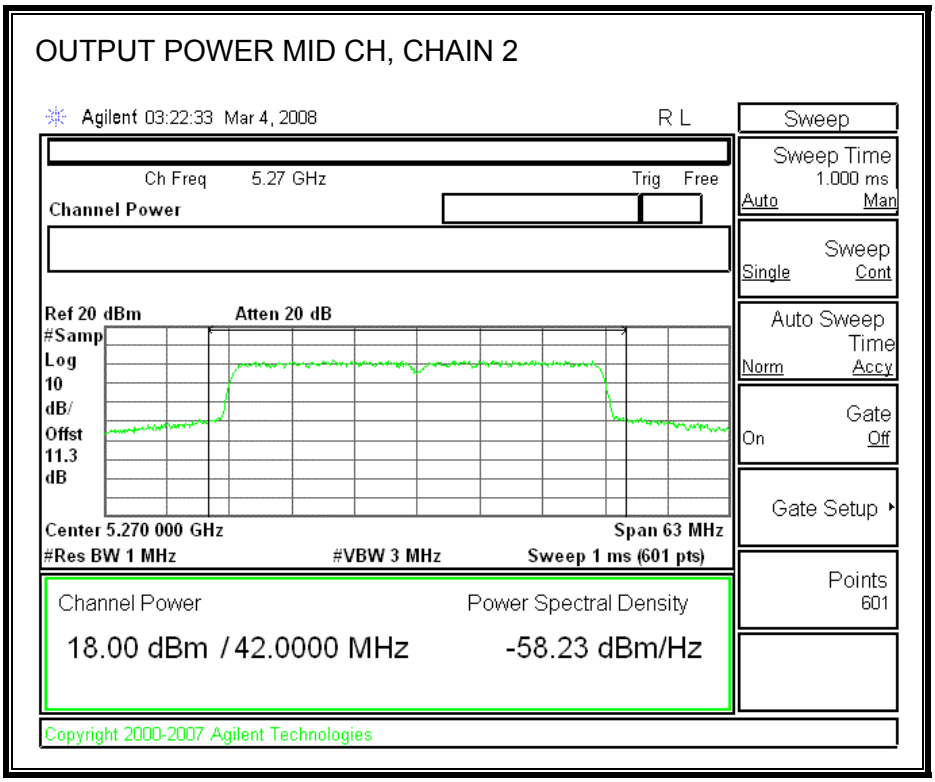


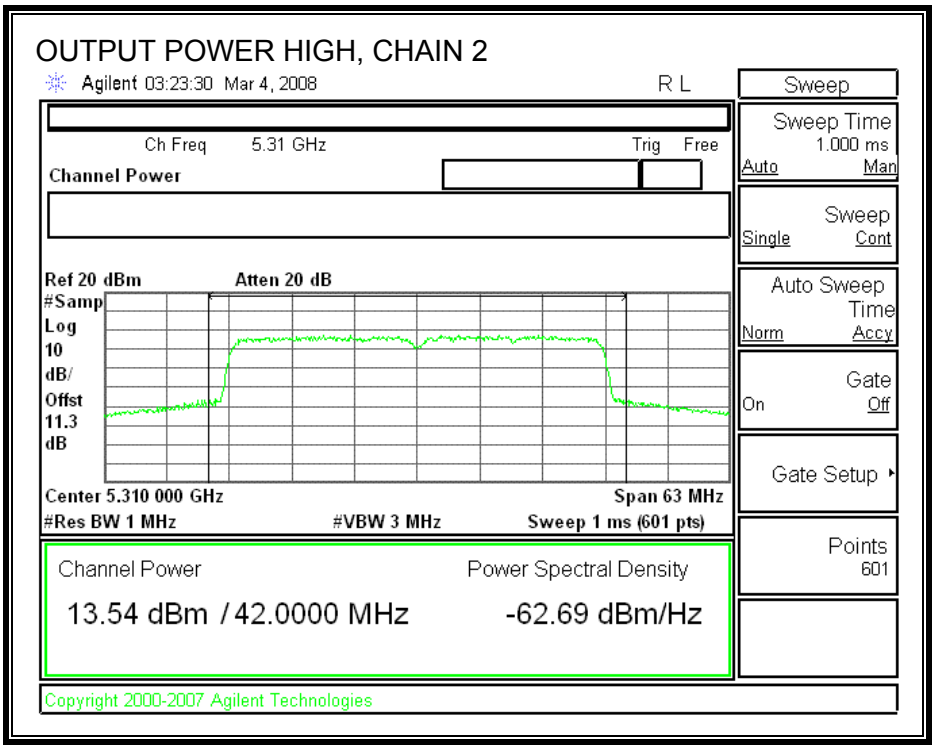


CHAIN 2 OUTPUT POWER



OUTPUT POWER MID CH, CHAIN 2





7.3.3. AVERAGE POWER FOR HT40 MODES (5.2GHz)

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	5190	10.10	12.99	12.82	16.93
Middle	5270	15.91	17.50	18.10	22.04
High	5310	11.10	14.35	13.50	17.96

7.3.4. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1 & 2)

IC RSS-210 A9.2 (1 & 2)

For the 5.15–5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band.

For the 5.25–5.35 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 4 dBm in the lower band and 11 dBm in the upper band.

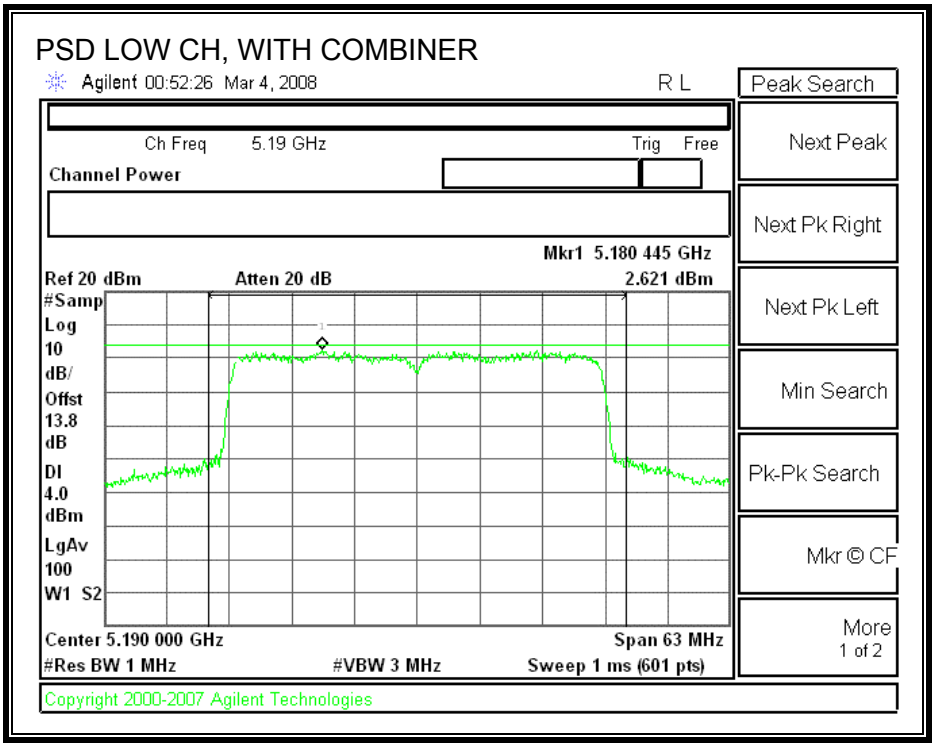
TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

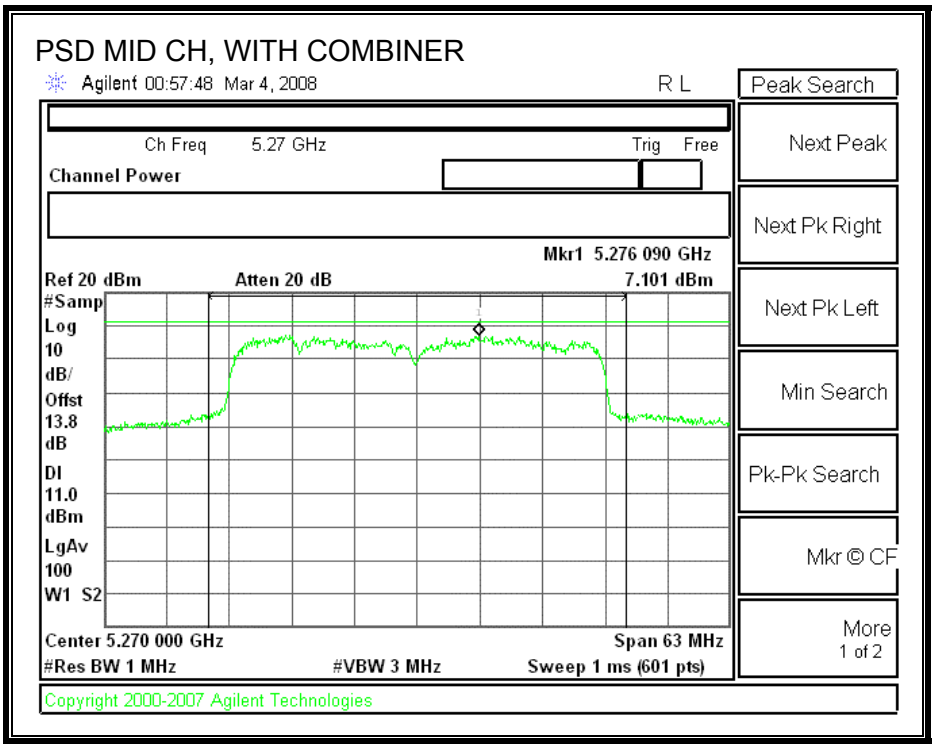
RESULTS

Channel	Frequency (MHz)	PPSD With Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	5190	2.621	4.000	-1.379
Middle	5270	7.101	11.000	-3.899
High	5310	3.158	11.000	-7.842

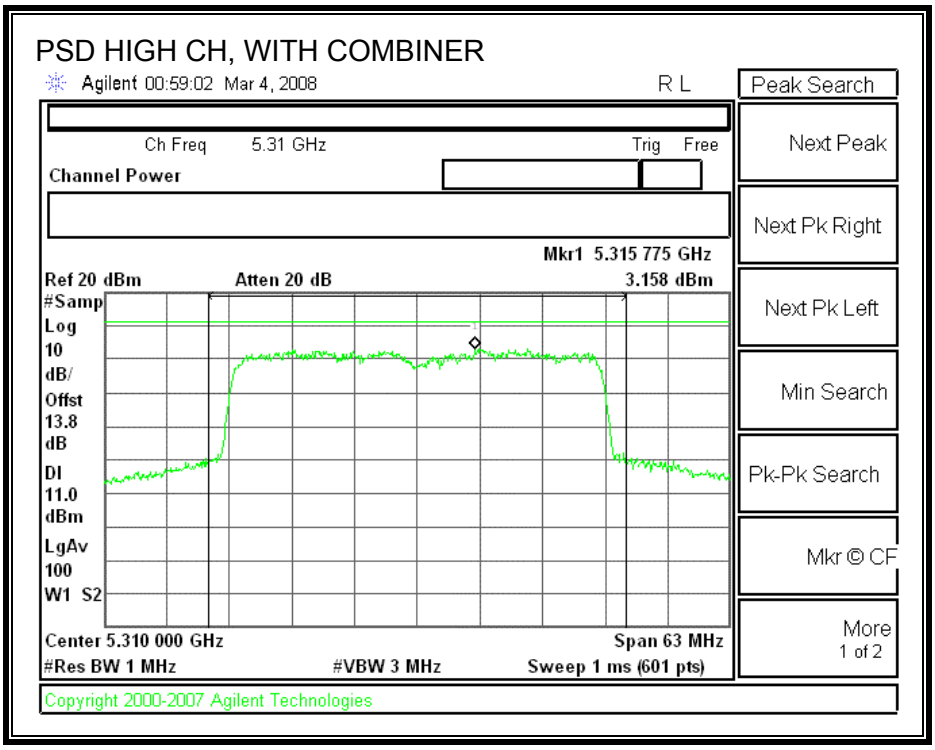
POWER SPECTRAL DENSITY (WITH COMBINER)



PSD MID CH, WITH COMBINER



PSD HIGH CH, WITH COMBINER



7.3.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (1 & 2)

IC RSS-210 A9.3 (1 & 2)

For transmitters operating in the 5.15-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

TEST PROCEDURE

Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

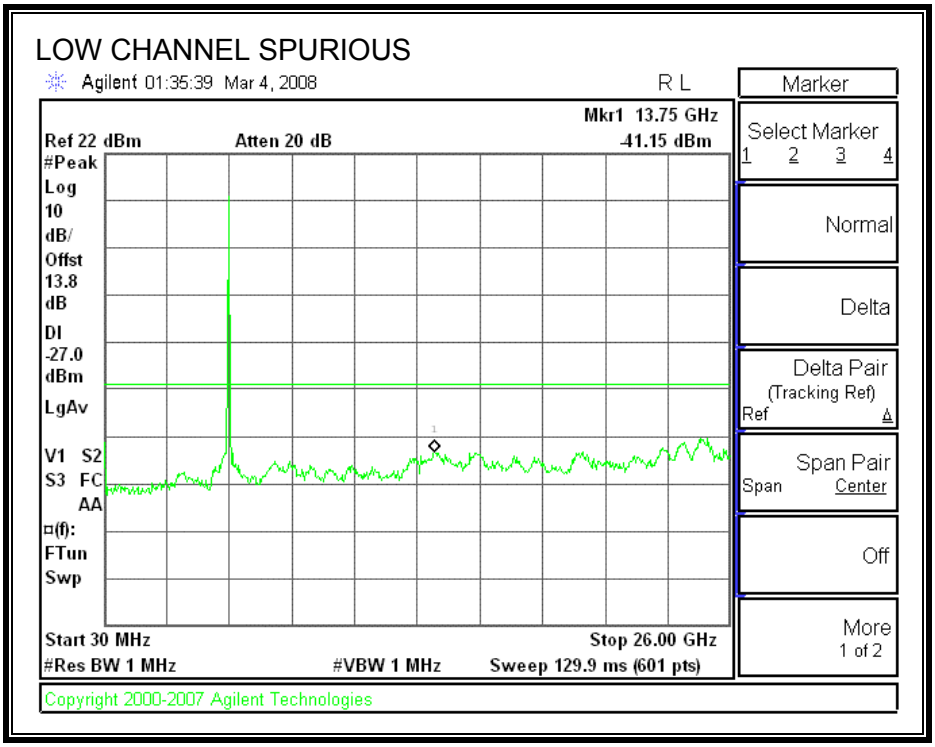
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements are made.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

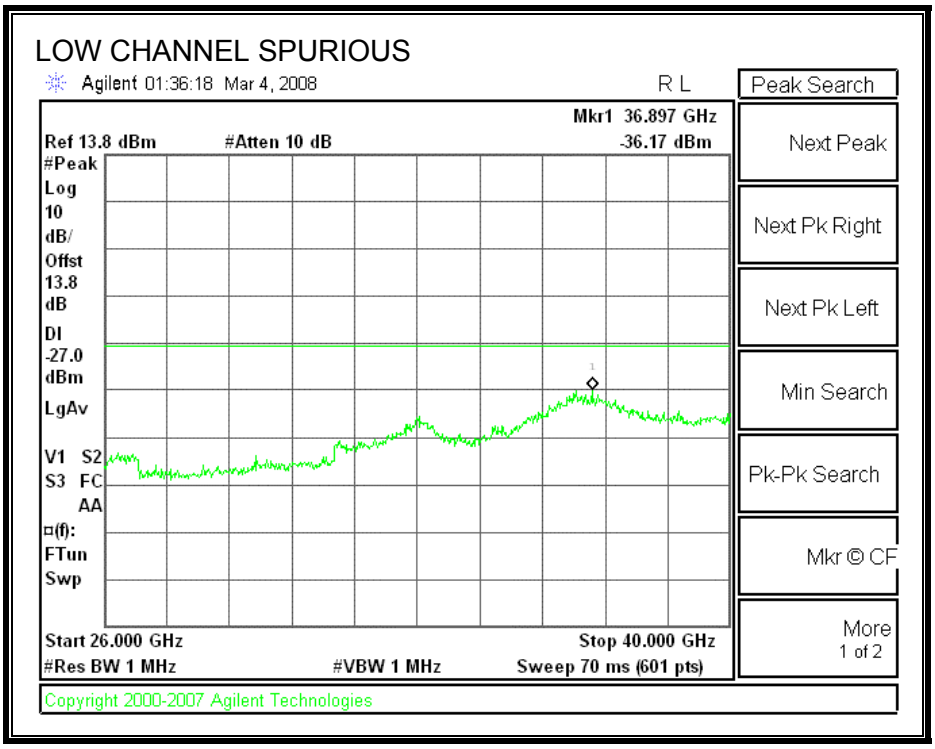
Offset Value = Cable Loss + Attenuation + Antenna Gain + Combiner Loss

RESULTS

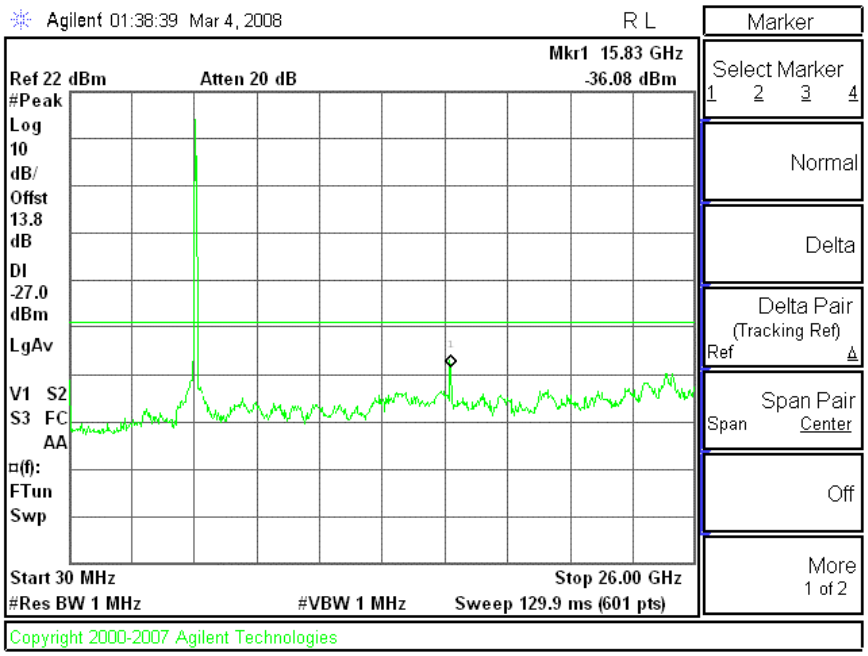
SPURIOUS EMISSIONS (WITH COMBINER)



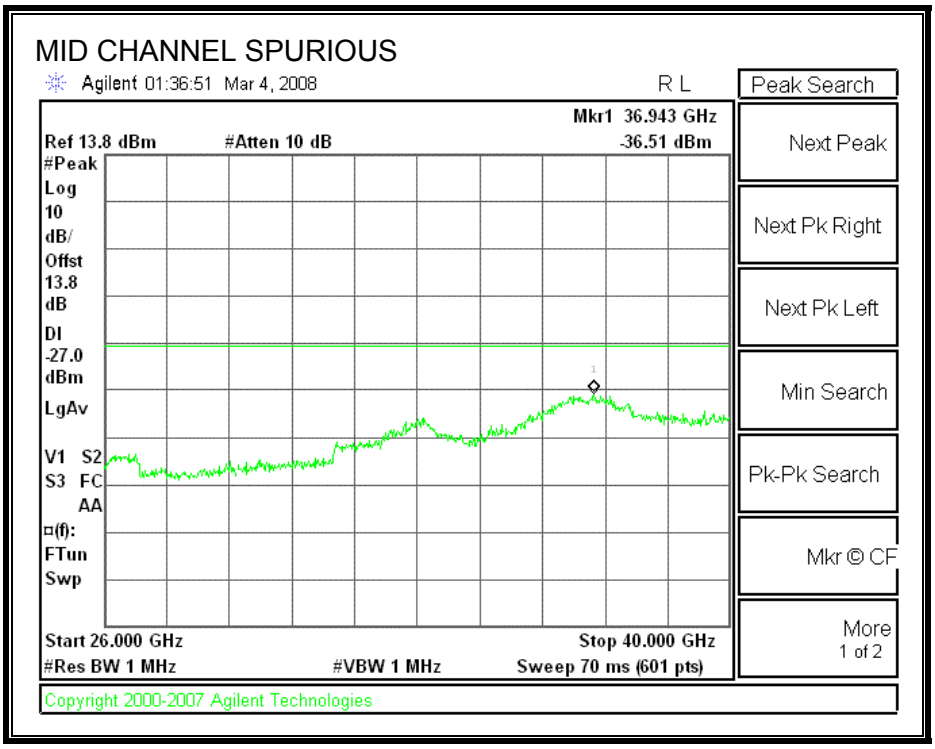
LOW CHANNEL SPURIOUS



MID CHANNEL SPURIOUS



MID CHANNEL SPURIOUS



7.4. 802.11a THREE CHAINS LEGACY MODE IN THE 5.5 GHz BAND

7.4.1. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

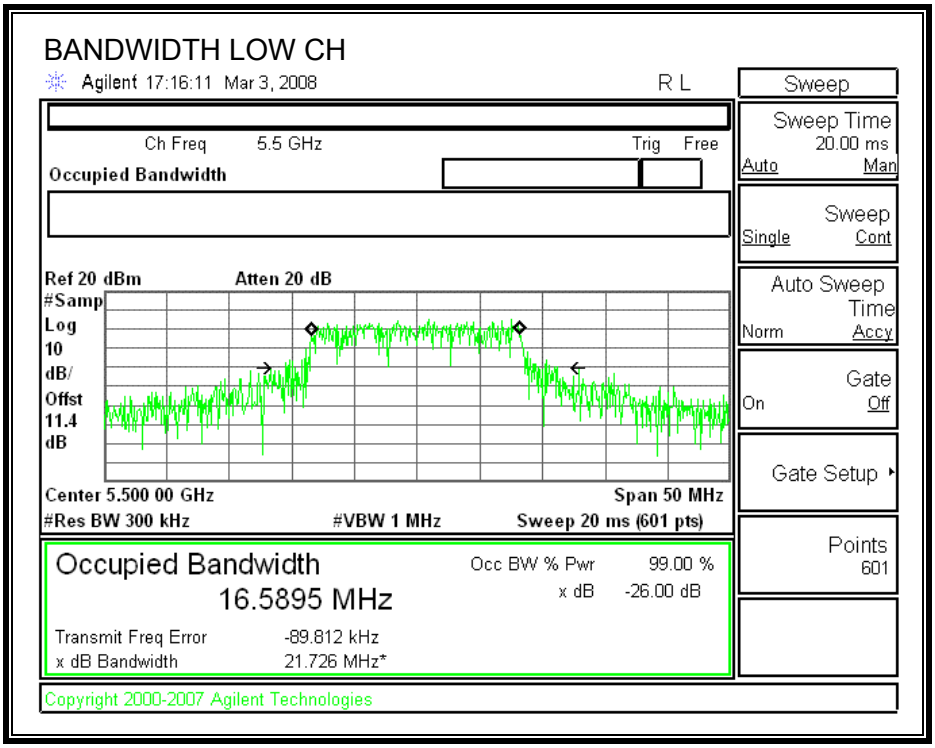
TEST PROCEDURE

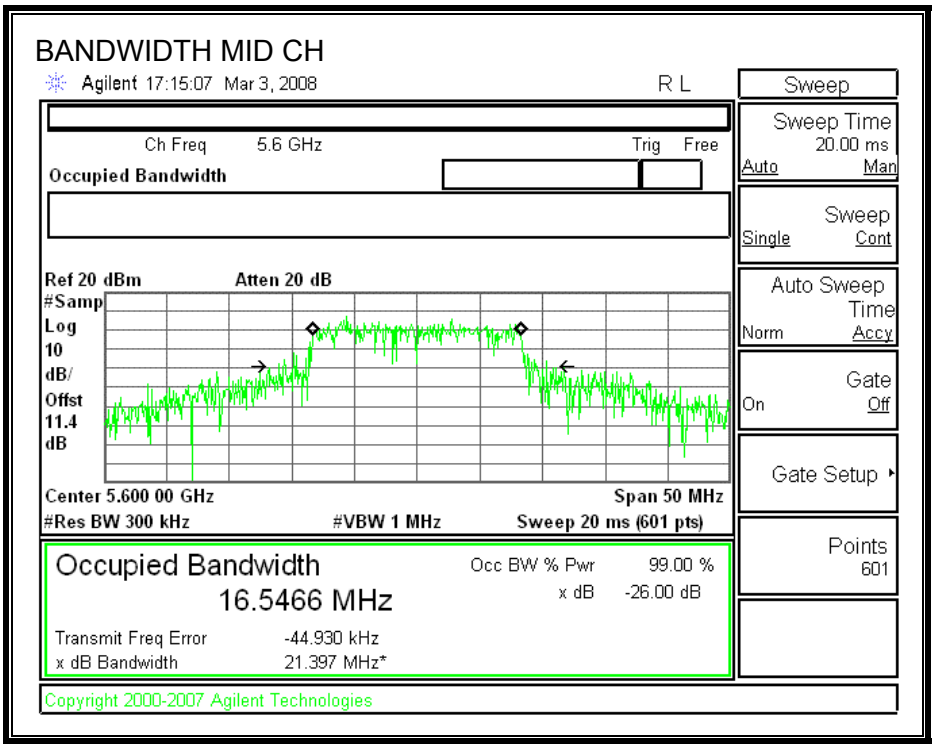
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

RESULTS

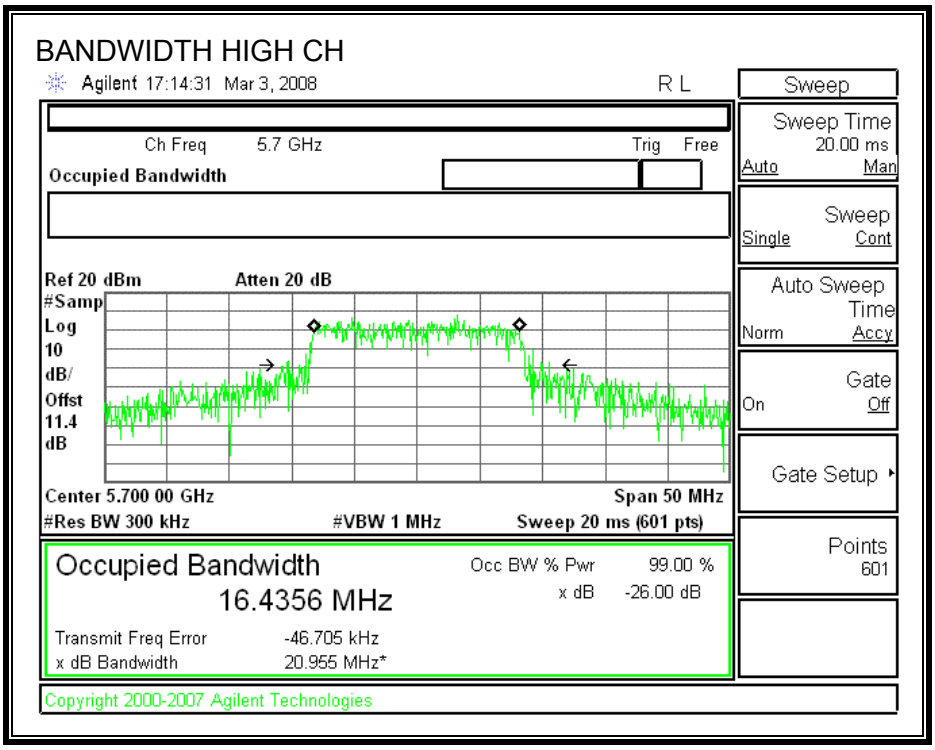
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5500	21.7260	16.5895
Middle	5600	21.3970	16.5466
High	5700	20.9550	16.4356

26 dB and 99% BANDWIDTH





BANDWIDTH HIGH CH



7.4.2. OUTPUT POWER

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

Antenna Gain (dBi)	10 Log (# Tx Chains) (dB)	Effective Legacy Gain (dBi)
5	4.77	9.77

For the 5.47-5.725 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

Limit

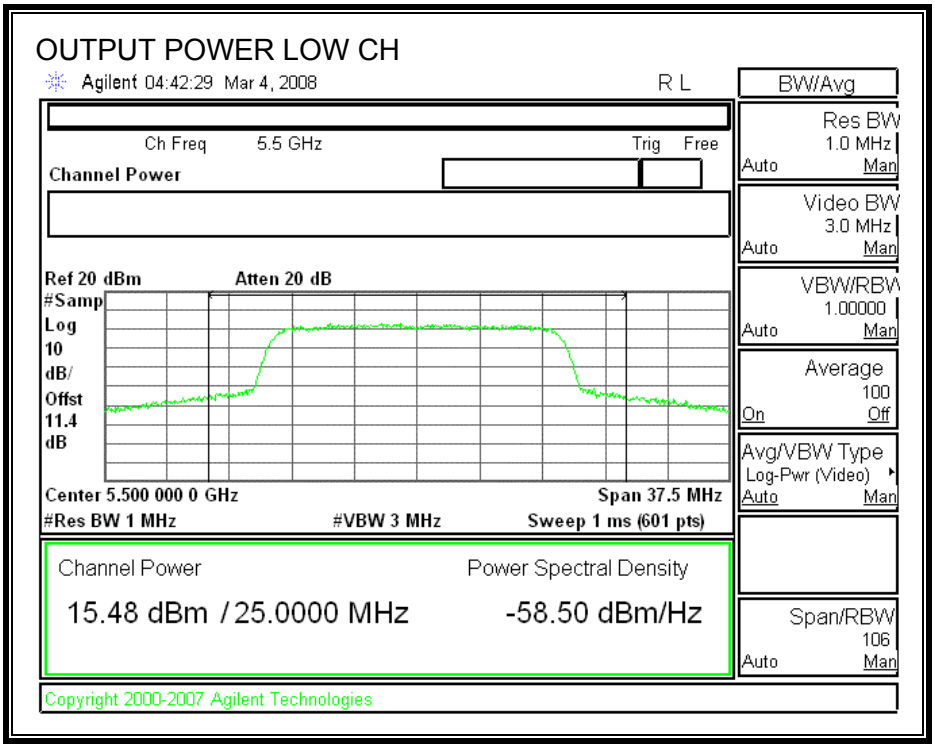
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Effective Ant. Gain (dBi)	Limit (dBm)
Low	5500	23.98	21.705	24.37	9.77	20.21
Mid	5600	23.98	21.791	24.38	9.77	20.21
High	5700	23.98	21.965	24.42	9.77	20.21

Individual Chain Results

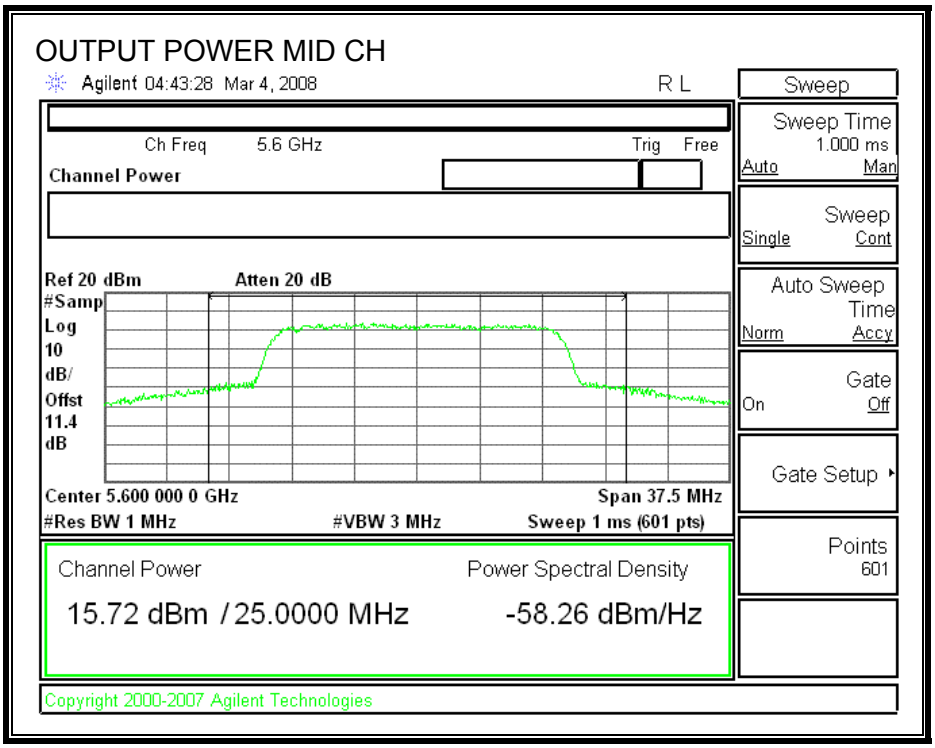
Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5500	15.48	15.33	15.88	20.34	20.21	-4.73
Mid	5600	15.72	14.87	15.8	20.25	20.21	-4.49
High	5700	15.67	15.12	15.36	20.16	20.21	-4.54

OUTPUT POWER

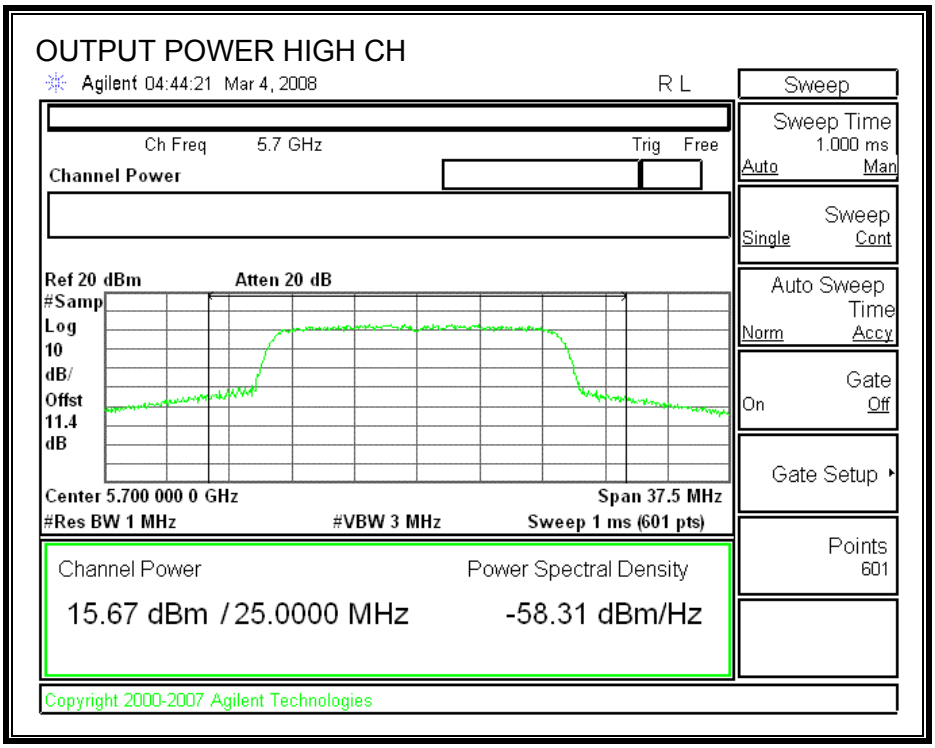
CH 0



CH 0

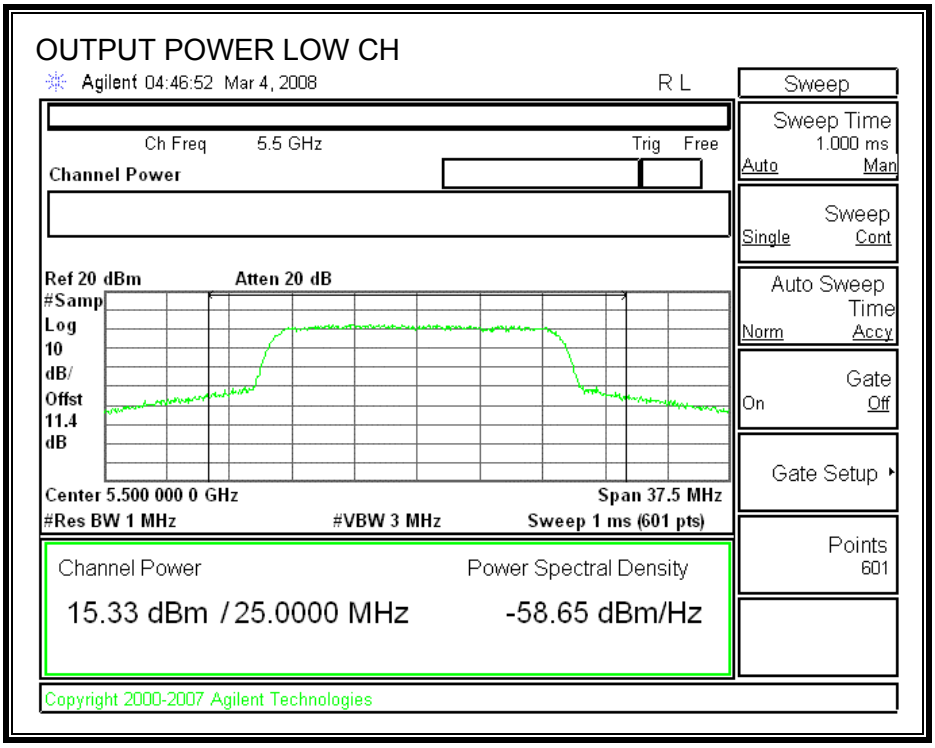


CH 0

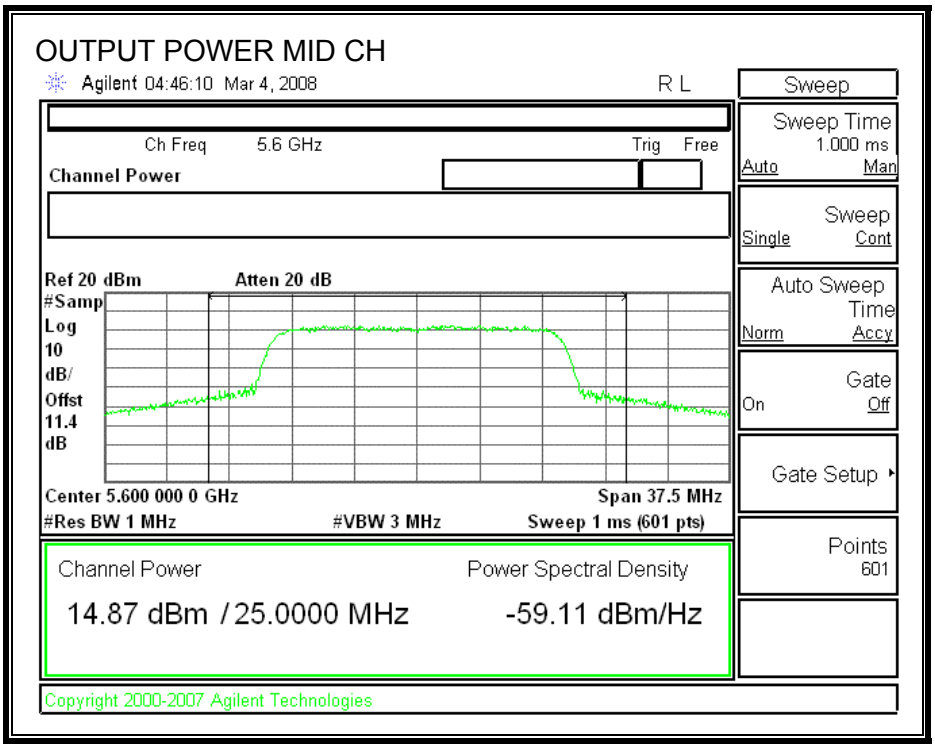


OUTPUT POWER

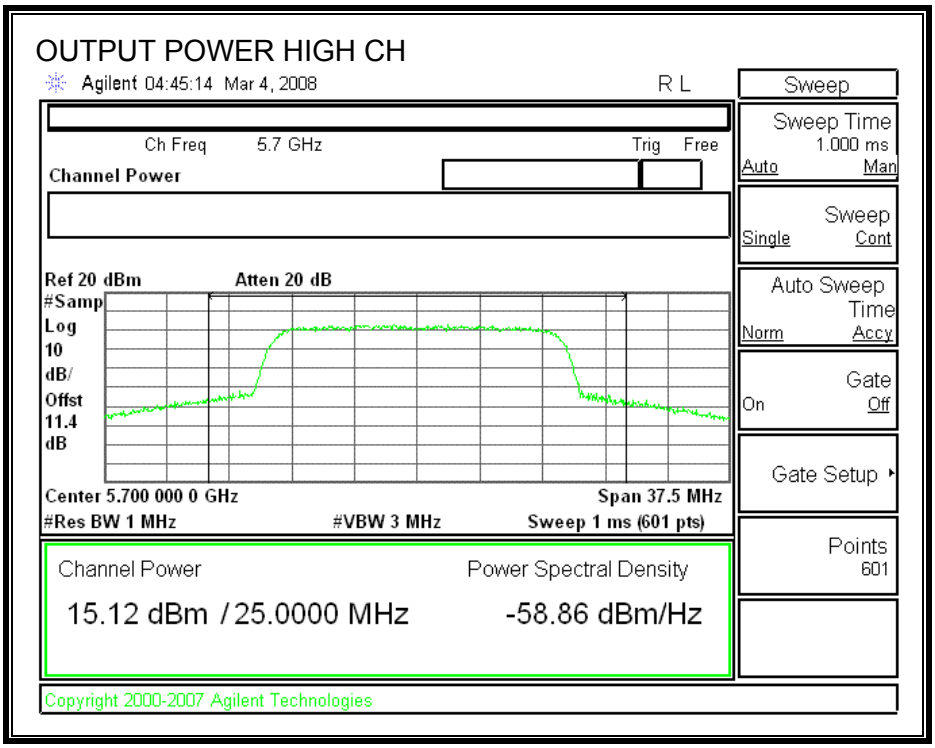
CH 1



CH 1

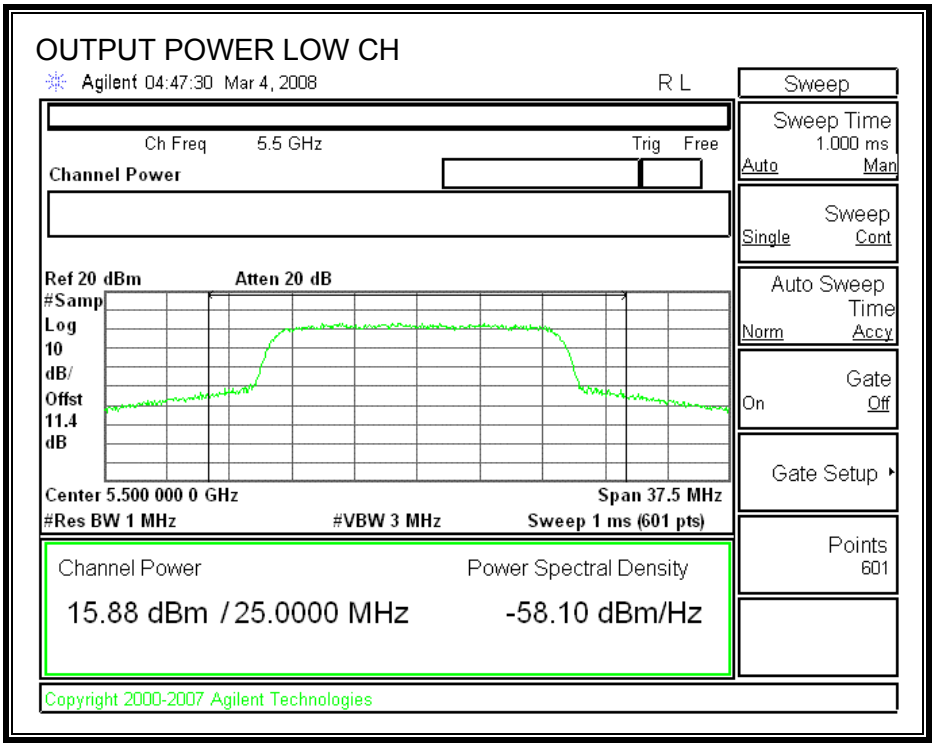


CH 1

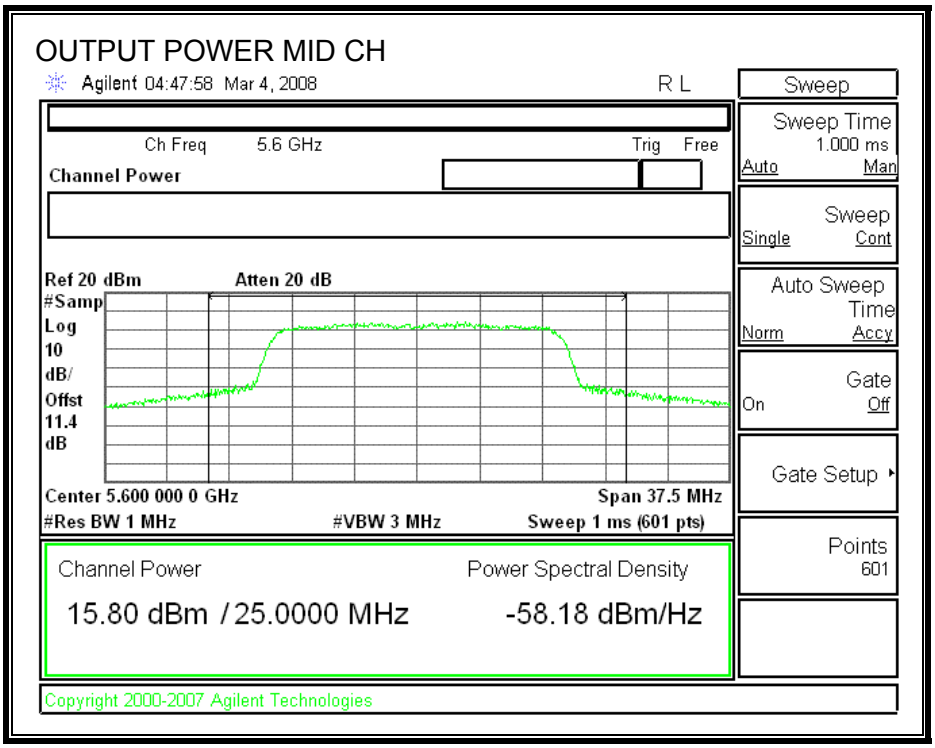


OUTPUT POWER

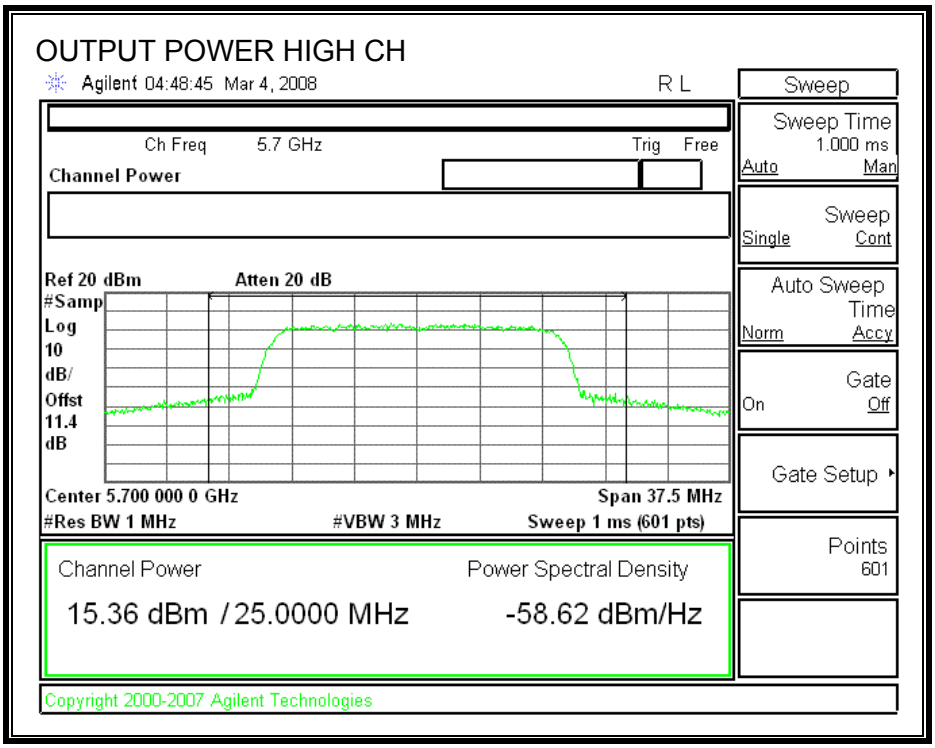
CH 2



CH 2



CH 2



7.4.3. AVERAGE POWER FOR LEGACY MODES (5.6GHz)

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	5500	15.48	15.25	15.90	20.32
Middle	5600	15.86	14.90	16.00	20.38
High	5700	15.60	15.25	15.50	20.22

7.4.4. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

Antenna Gain (dBi)	10 Log (# Tx Chains) (dB)	Effective Legacy Gain (dBi)
5	4.77	9.77

For the 5.47-5.725 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum effective antenna gain is 9.77 dBi, therefore the limit is 7.23 dBm.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

RESULTS

Channel	Frequency (MHz)	PPSD With Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	5500	5.573	7.23	-1.657
Middle	5600	6.056	7.23	-1.174
High	5700	5.534	7.23	-1.696

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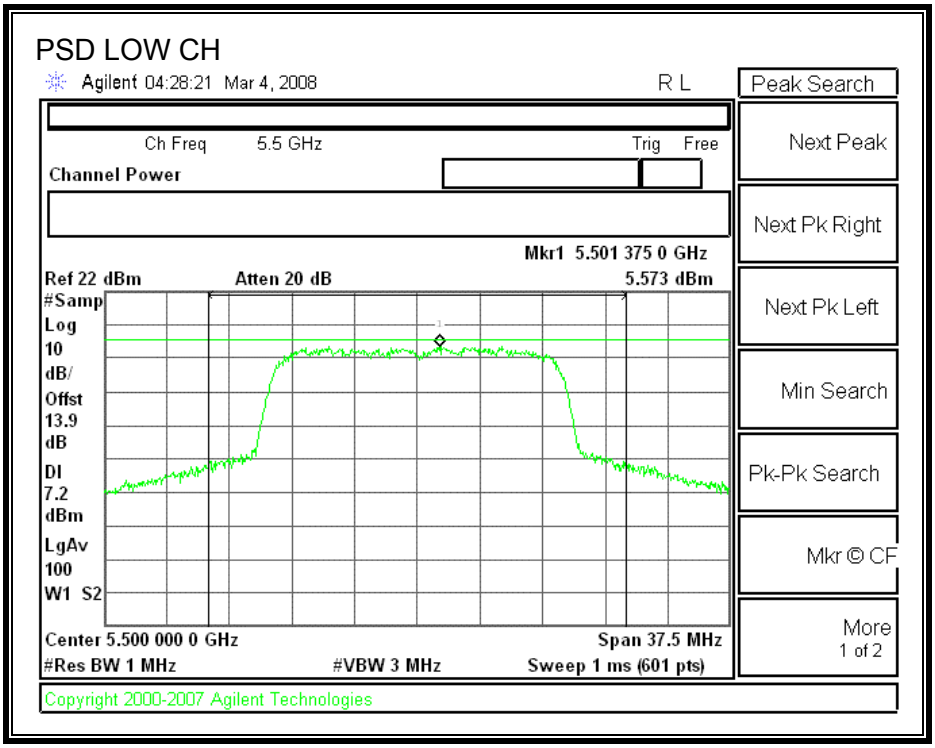
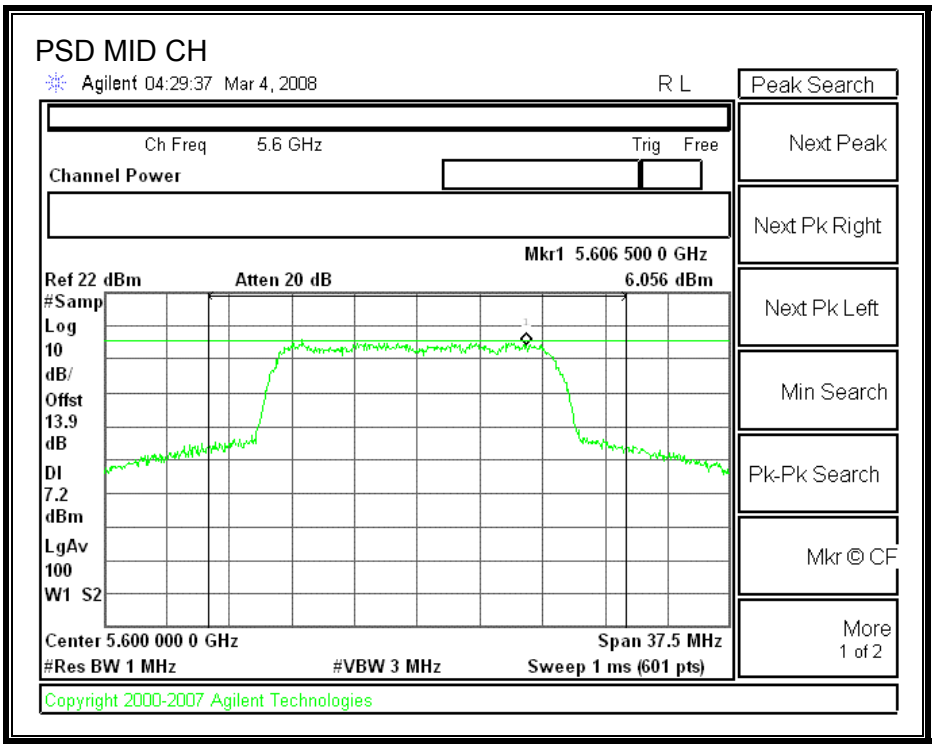
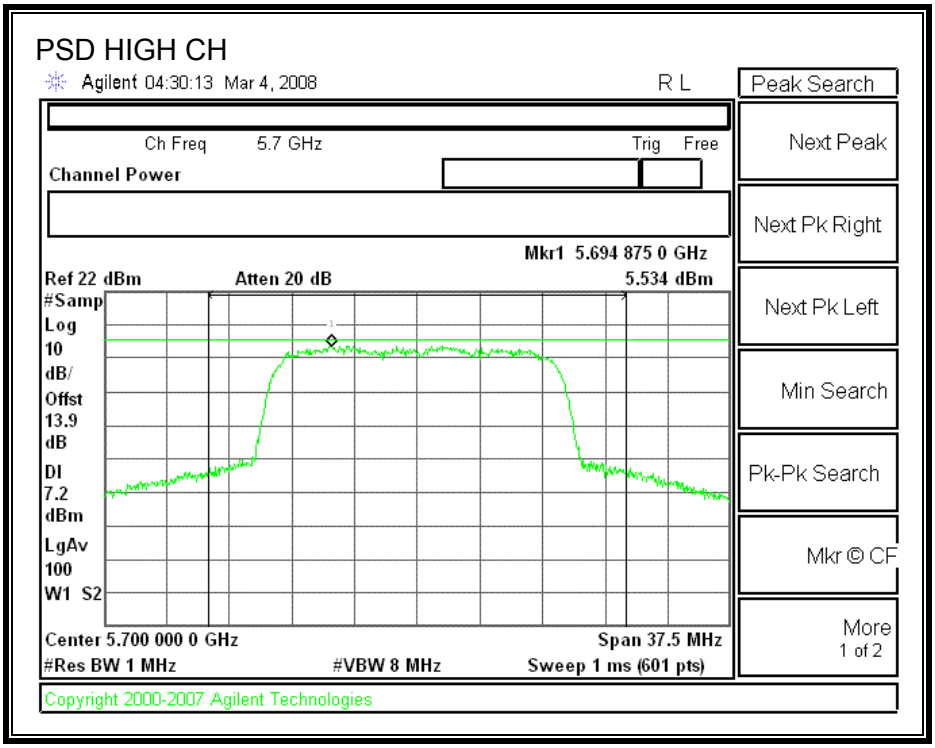
POWER SPECTRAL DENSITY (WITH COMBINER)



PSD MID CH



PSD HIGH CH



7.4.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (3)

IC RSS-210 A9.3 (3)

For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm / MHz.

TEST PROCEDURE

Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

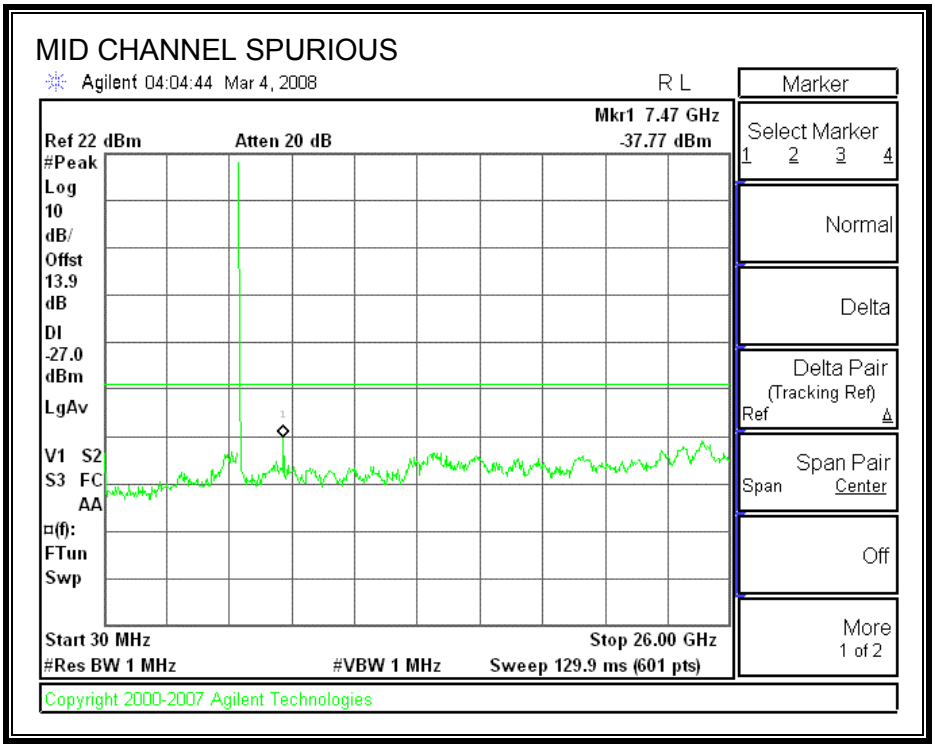
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements are made.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

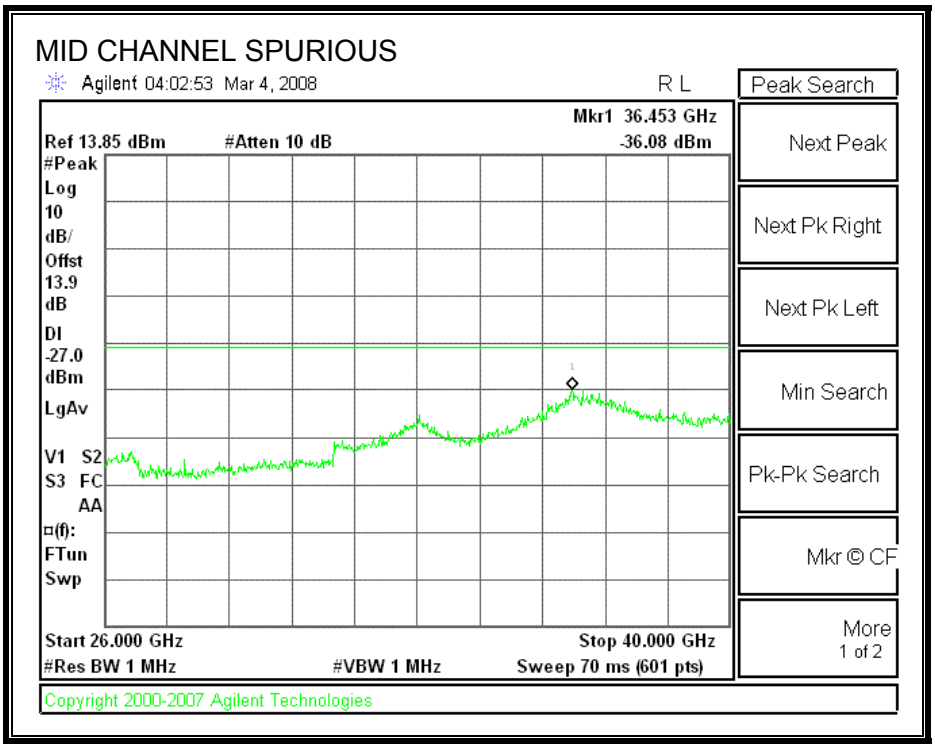
Offset Value = Cable Loss + Attenuation + Antenna Gain + Combiner Loss

RESULTS

SPURIOUS EMISSIONS (WITH COMBINER)



MID CHANNEL SPURIOUS



7.5. 802.11n THREE CHAINS HT20 MODE IN THE 5.6 GHz BAND

7.5.1. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

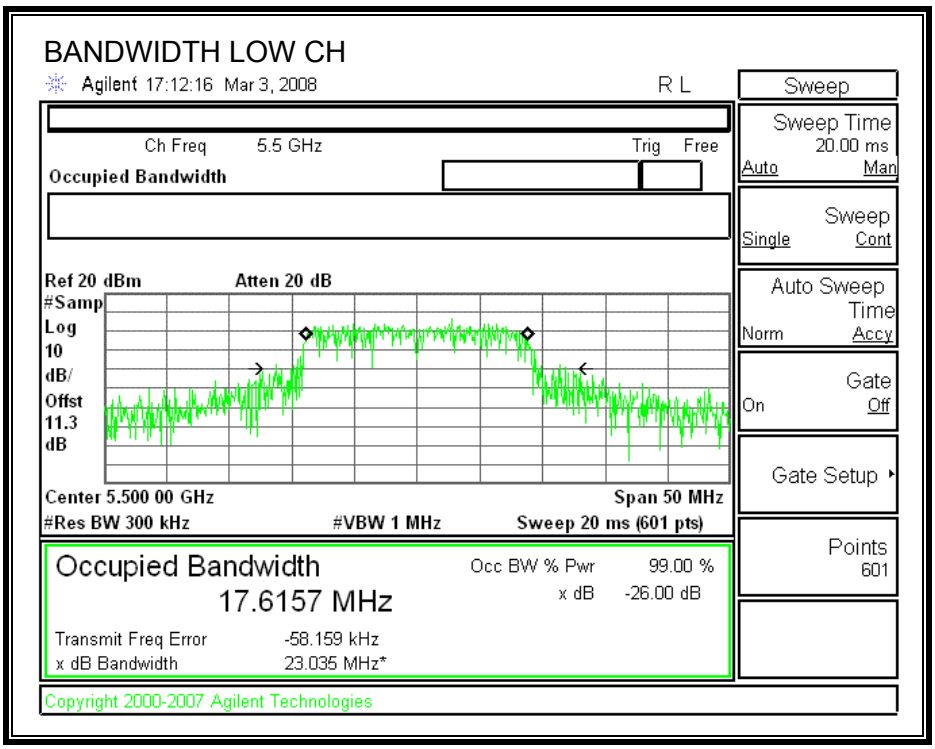
TEST PROCEDURE

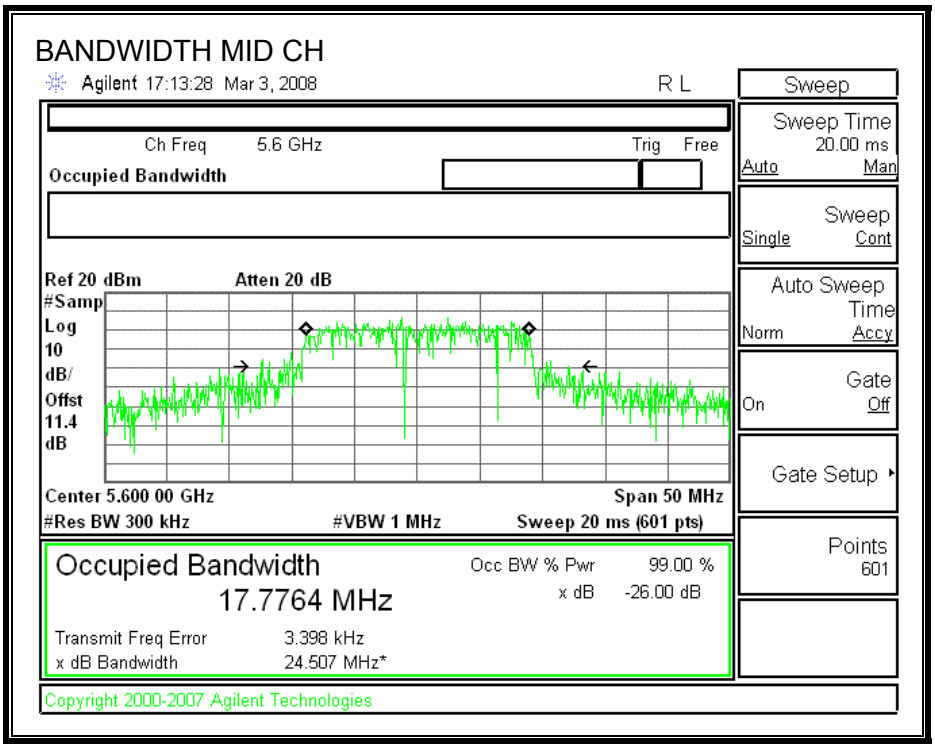
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

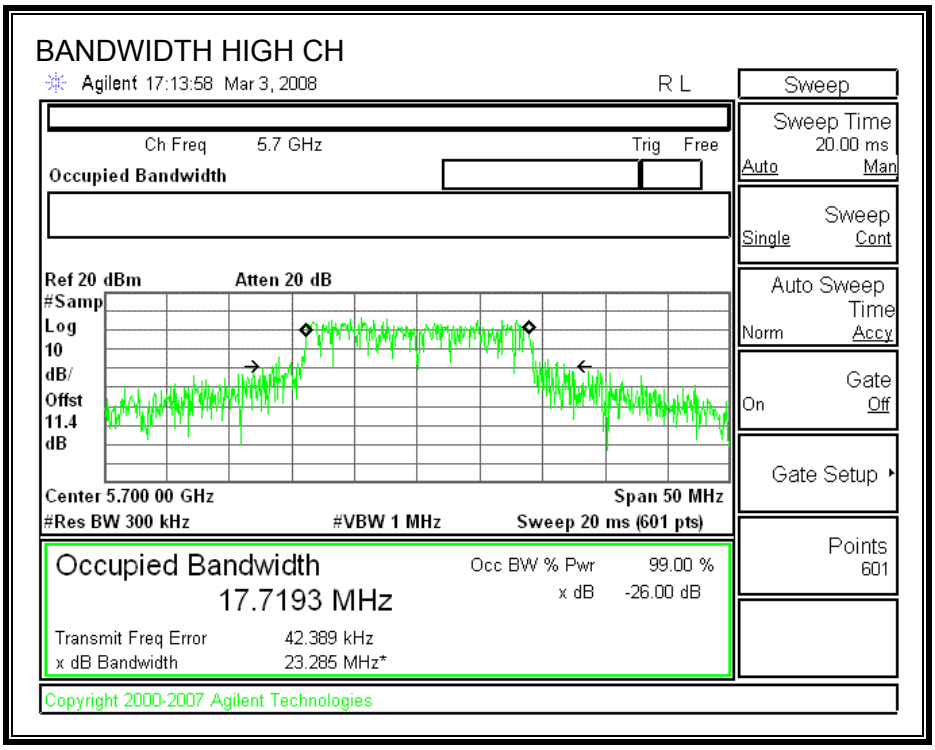
RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5500	23.0350	17.6157
Middle	5600	24.5070	17.7764
High	5700	23.2850	17.7193

26 dB and 99% BANDWIDTH







7.5.2. OUTPUT POWER

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.47-5.725 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

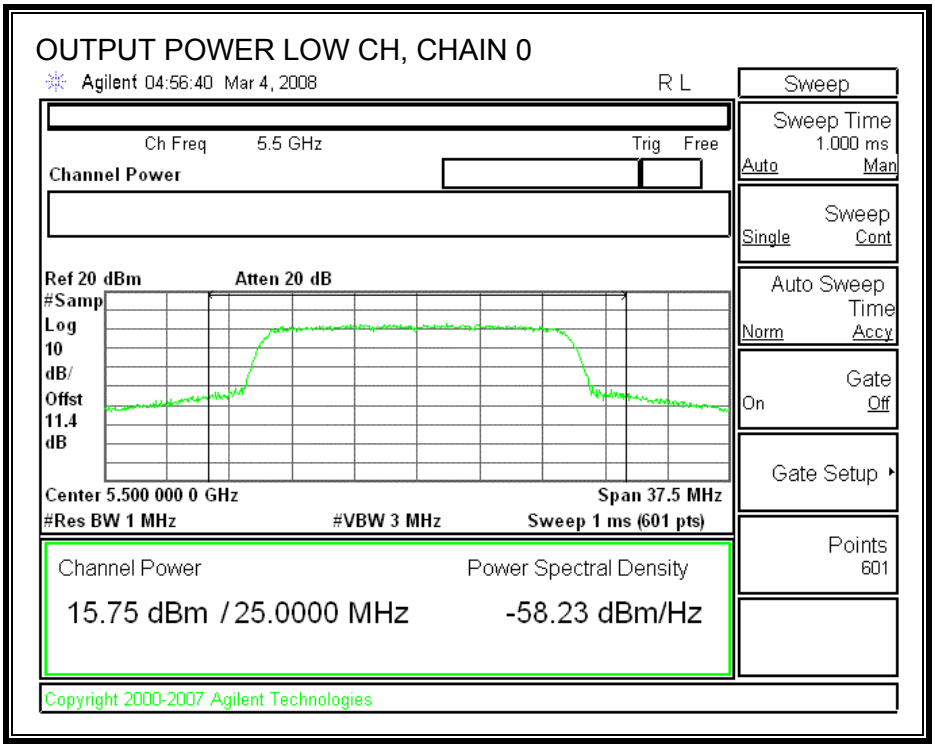
Limit

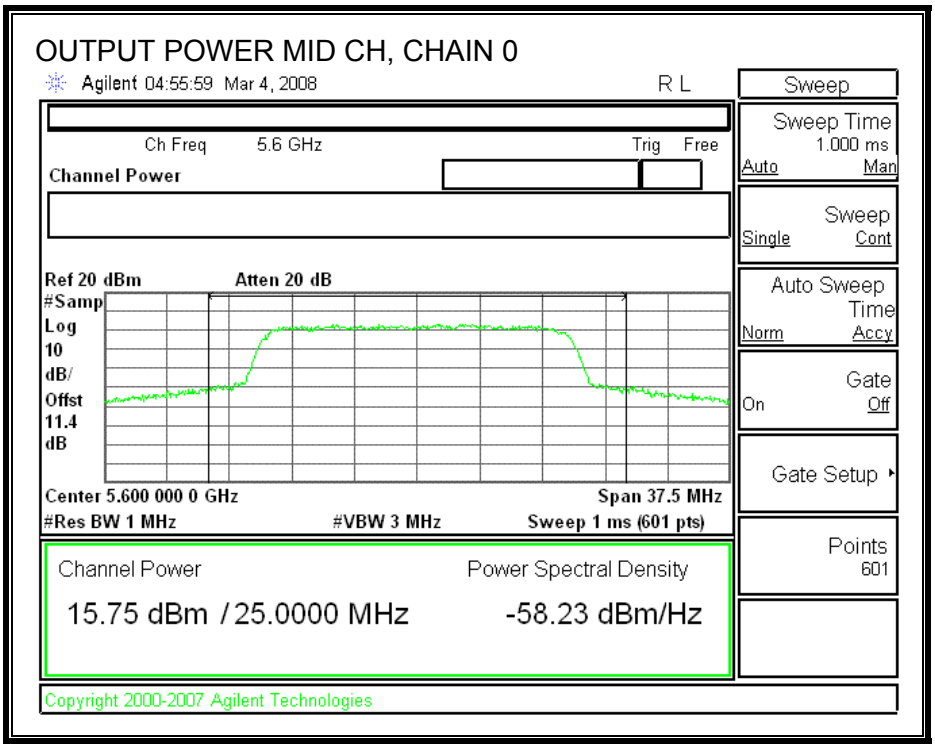
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Effective Ant. Gain (dBi)	Limit (dBm)
Low	5500	24	22.305	24.48	5.00	24.00
Mid	5600	24	22.741	24.57	5.00	24.00
High	5700	24	22.812	24.58	5.00	24.00

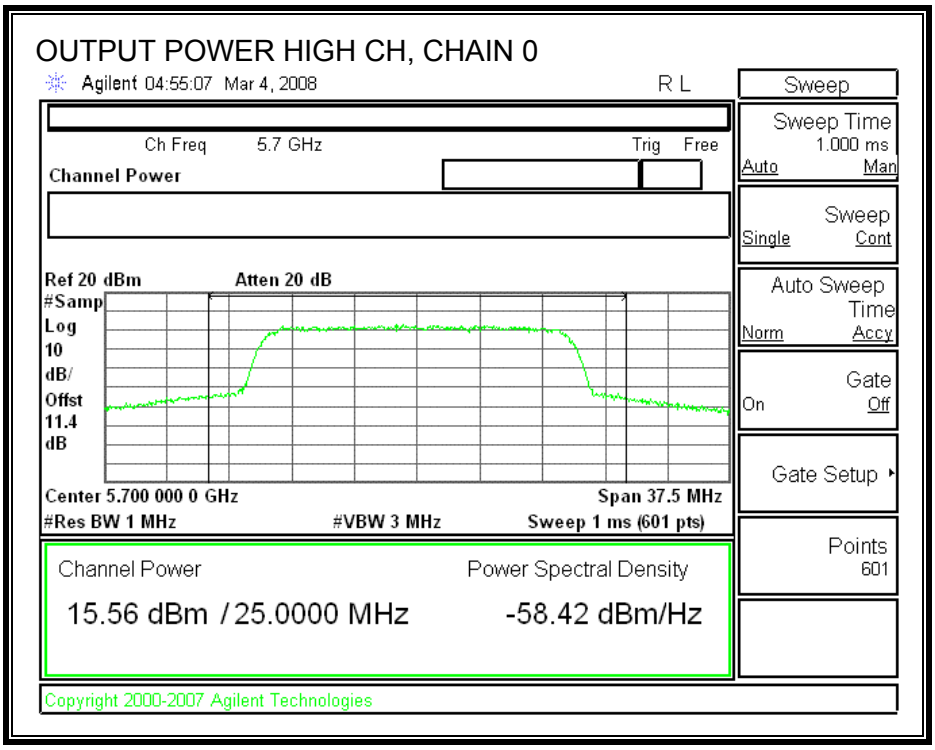
Individual Chain Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5500	15.75	15.44	15.87	20.46	24.00	-8.25
Mid	5600	15.75	14.80	15.97	20.31	24.00	-8.25
High	5700	15.56	15.24	15.35	20.16	24.00	-8.44

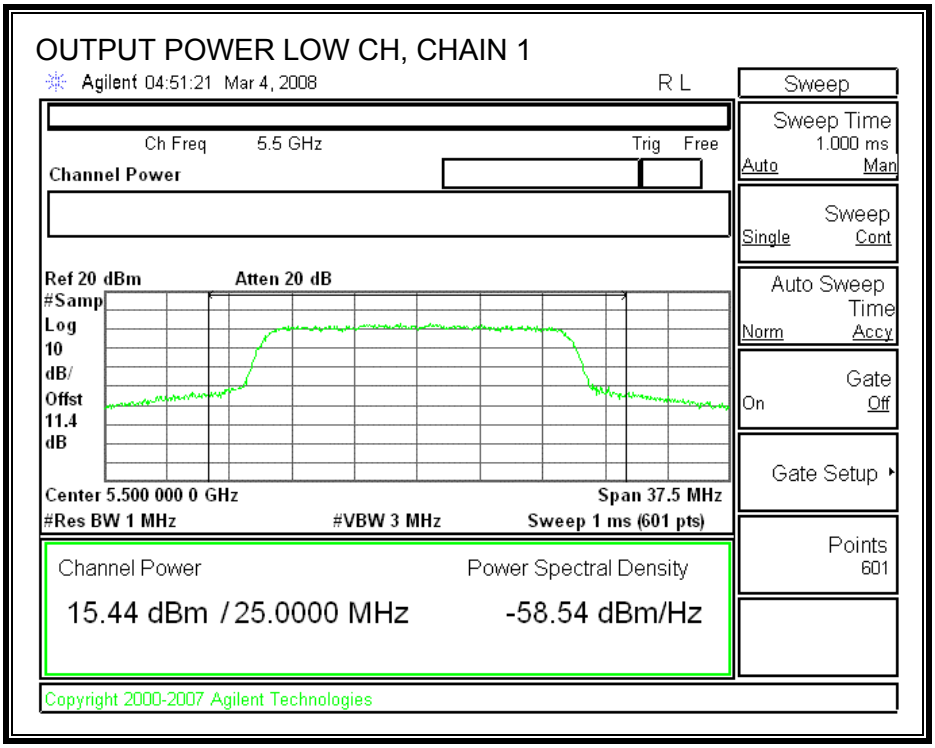
CHAIN 0 OUTPUT POWER

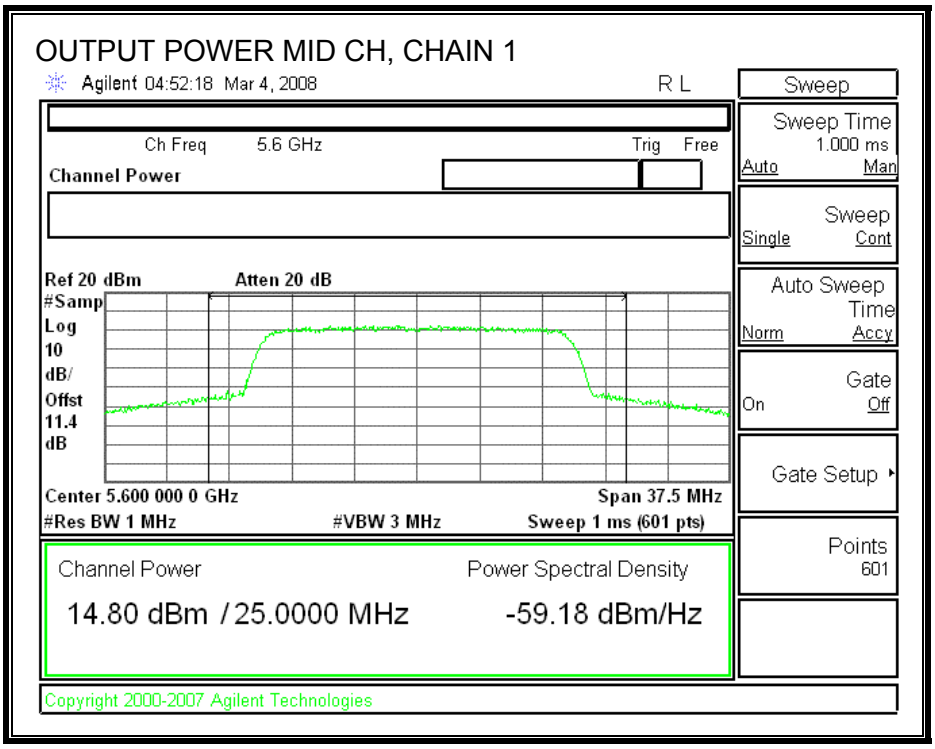


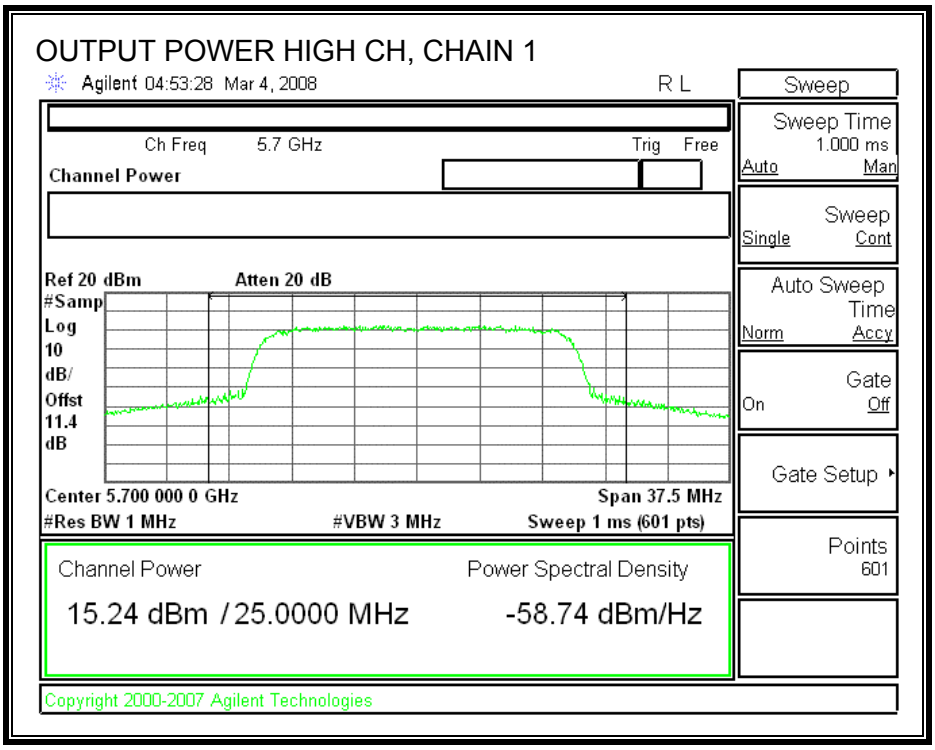




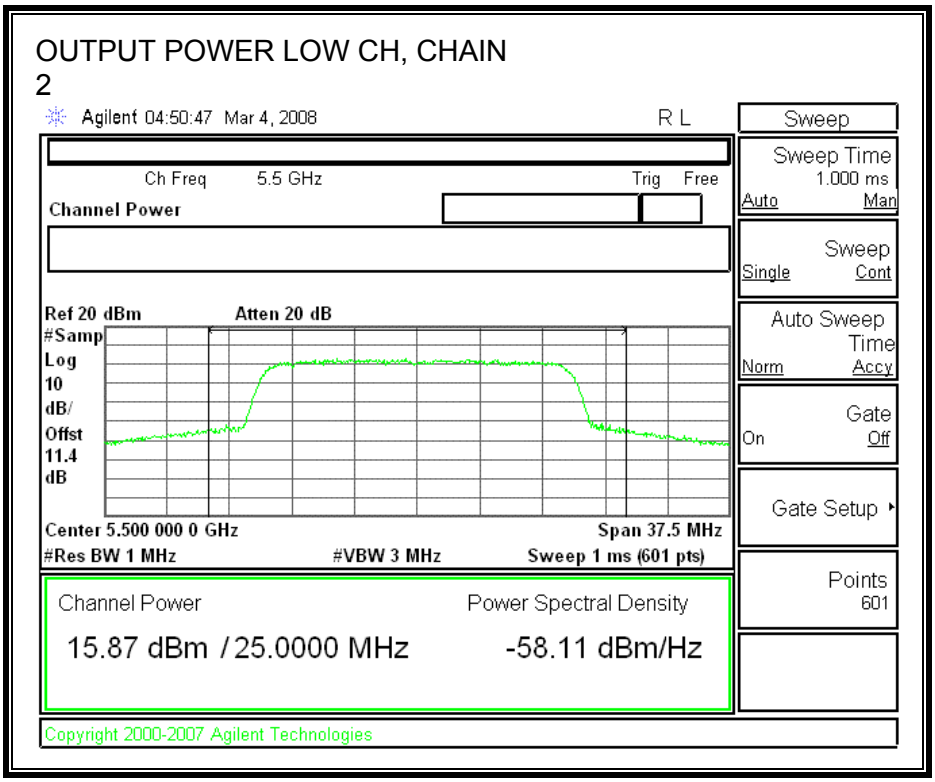
CHAIN 1 OUTPUT POWER

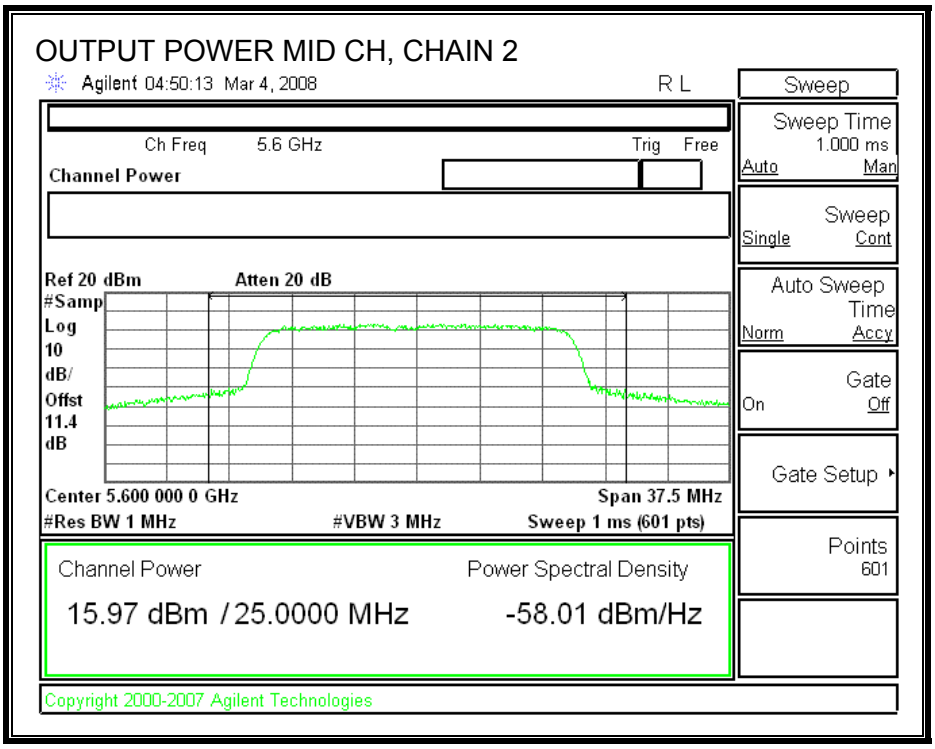




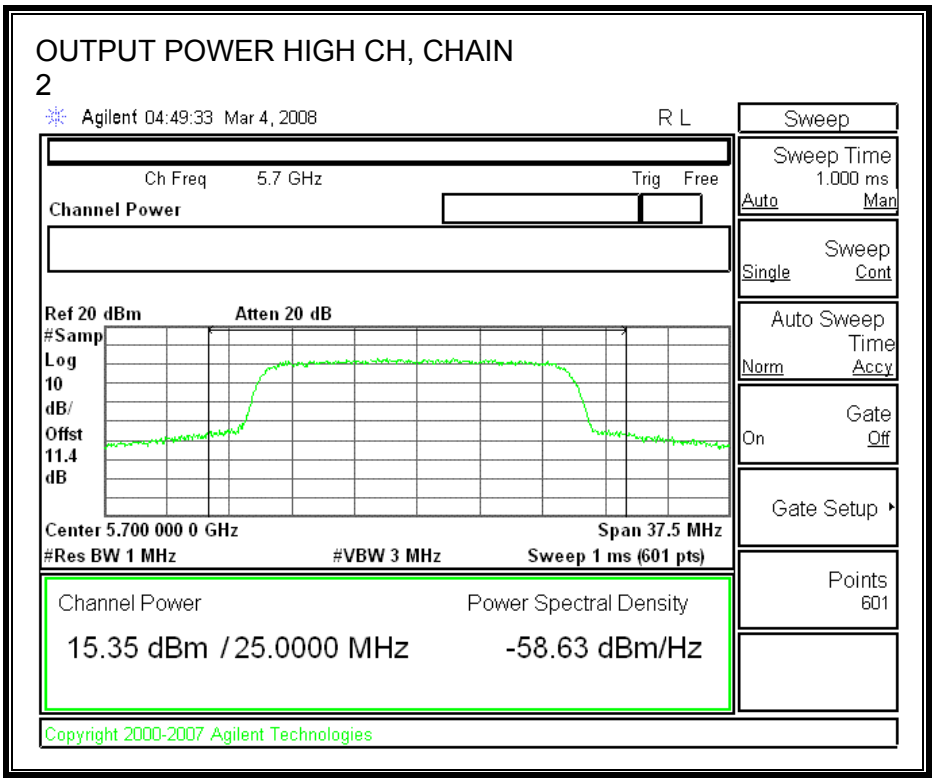


CHAIN 2 OUTPUT POWER





OUTPUT POWER HIGH CH, CHAIN 2



7.5.3. AVERAGE POWER FOR HT20 MODES (5.6GHz)

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	5500	15.60	15.35	15.76	20.34
Middle	5600	16.15	14.80	16.00	20.46
High	5700	15.90	15.33	15.24	20.27

7.5.4. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.47-5.725 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 11 dBm.

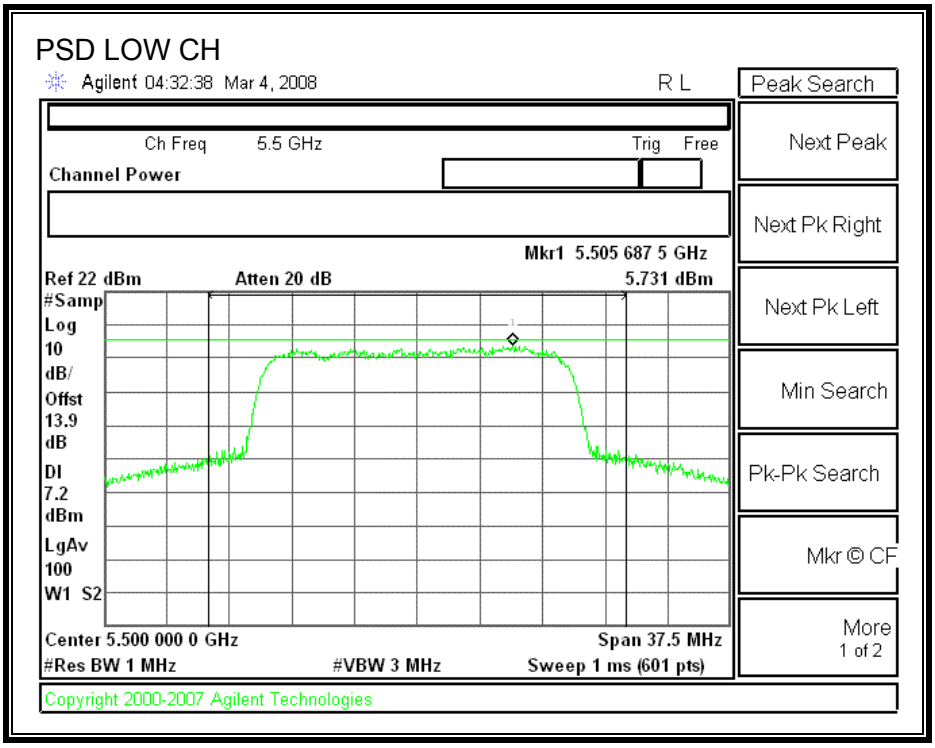
TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

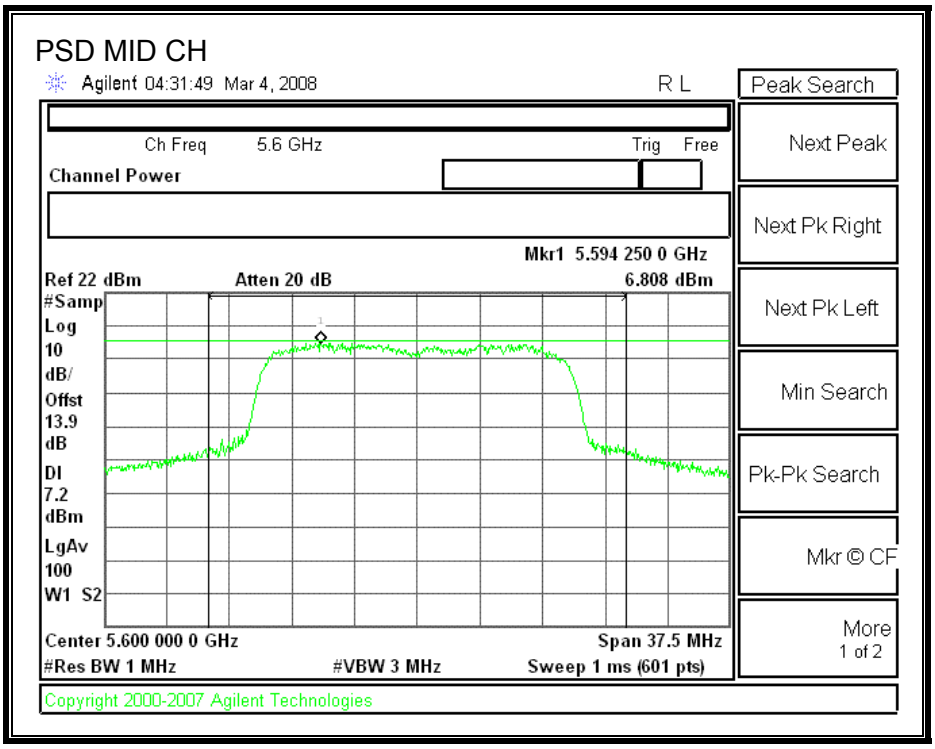
RESULTS

Channel	Frequency (MHz)	PPSD With Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	5500	5.731	11	-5.269
Middle	5600	6.808	11	-4.192
High	5700	6.572	11	-4.428

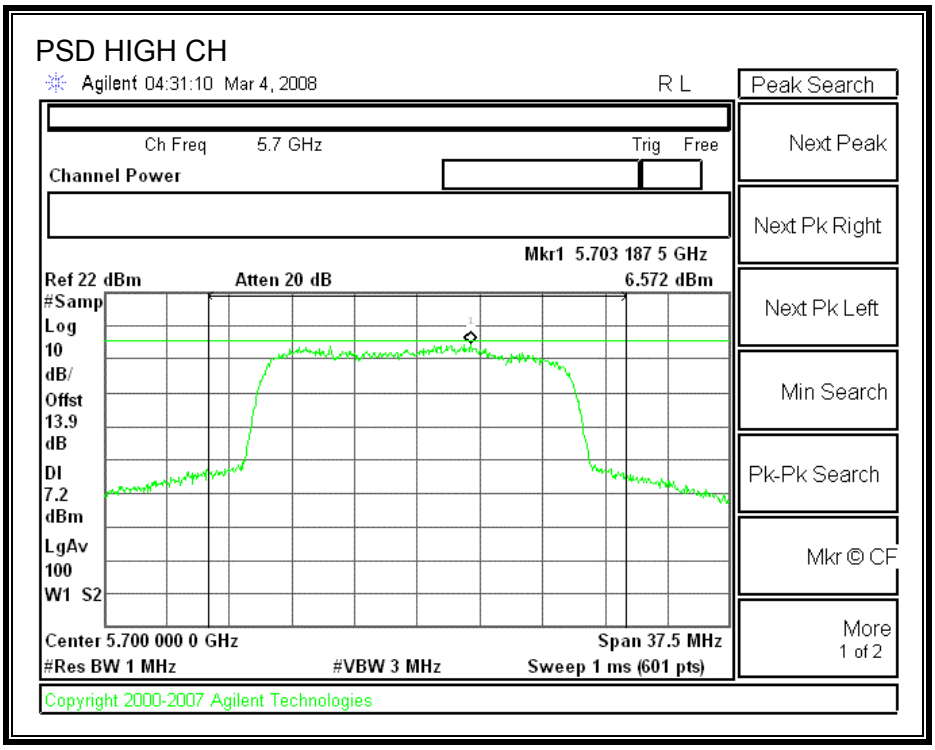
POWER SPECTRAL DENSITY (WITH COMBINER)



PSD MID CH



PSD HIGH CH



7.5.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (3)

IC RSS-210 A9.3 (3)

For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm / MHz.

TEST PROCEDURE

Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

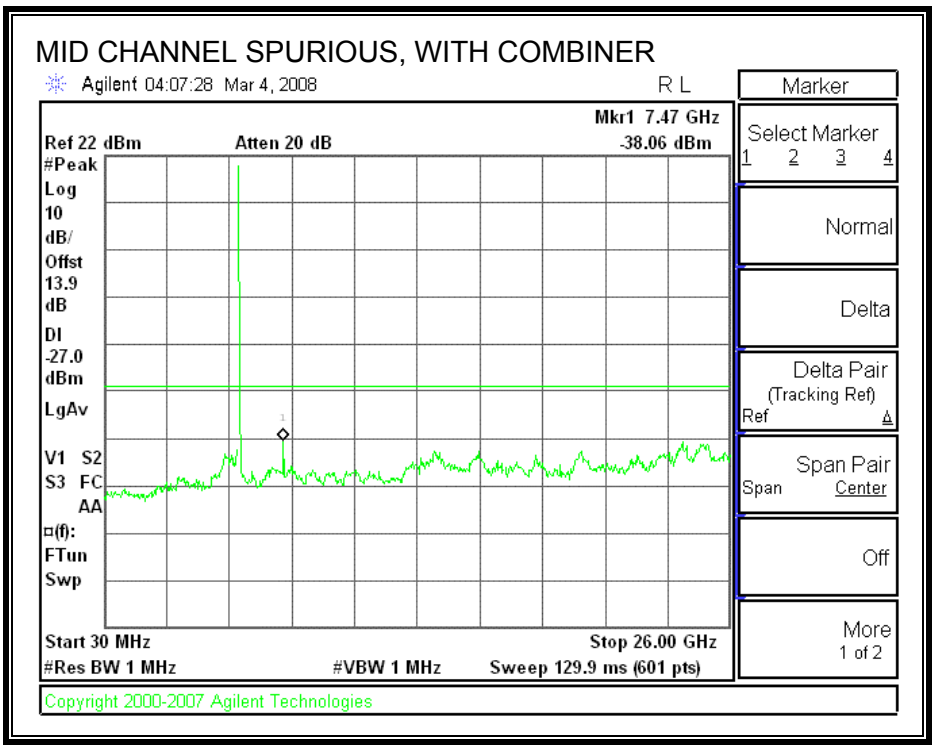
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements are made.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

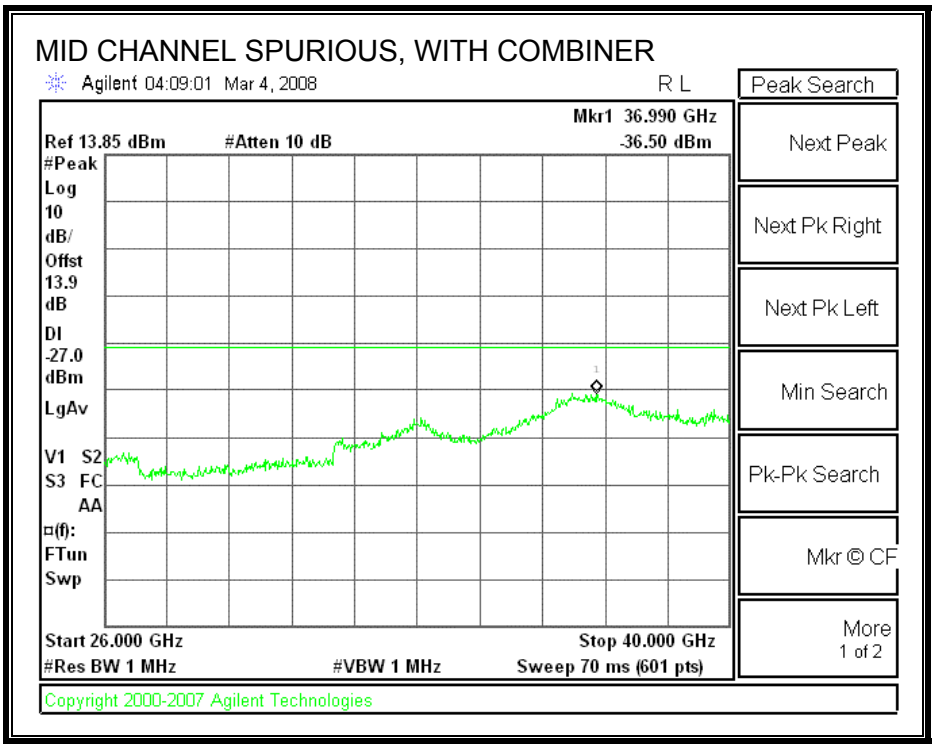
Offset Value = Cable Loss + Attenuation + Antenna Gain + Combiner Loss

RESULTS

SPURIOUS EMISSIONS (WITH COMBINER)



MID CHANNEL SPURIOUS, WITH COMBINER



7.6. 802.11n THREE CHAINS HT40 MODE IN THE 5.6 GHz BAND

7.6.1. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

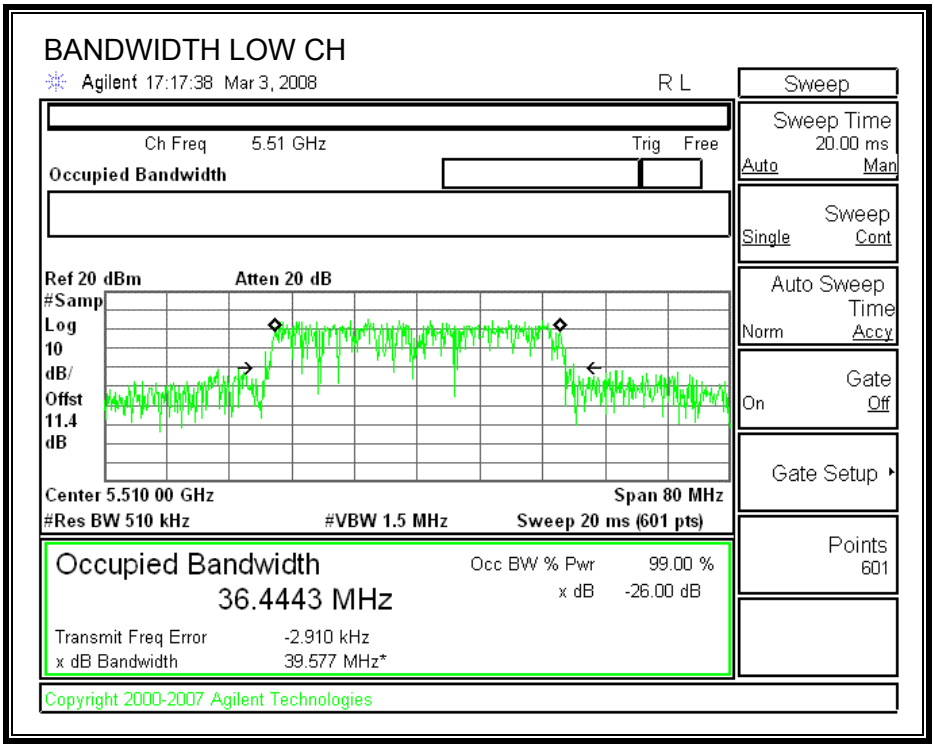
TEST PROCEDURE

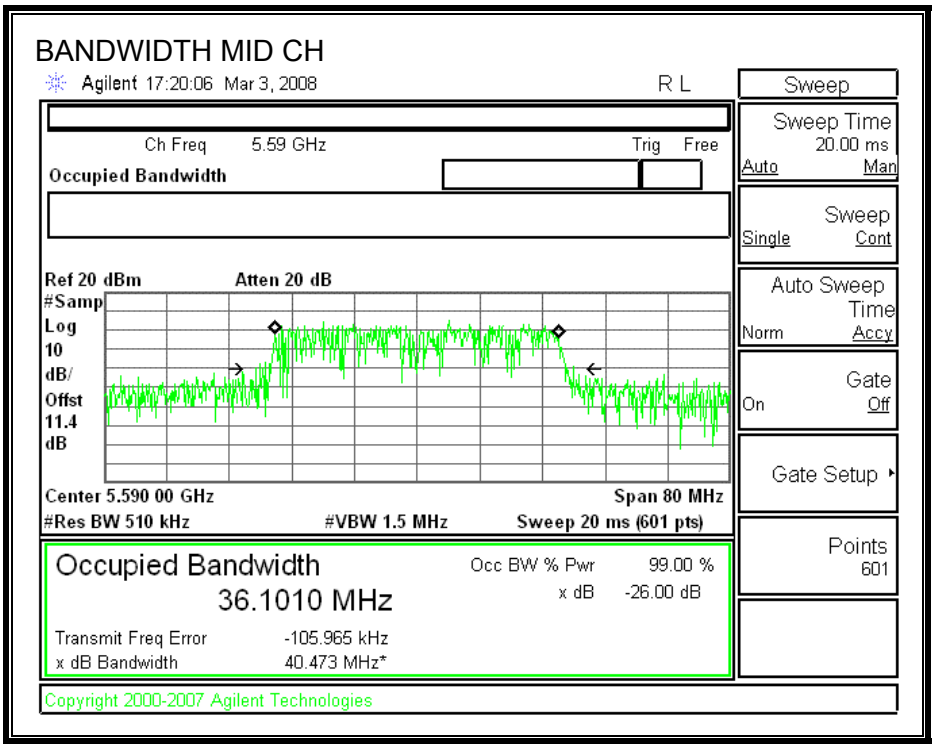
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

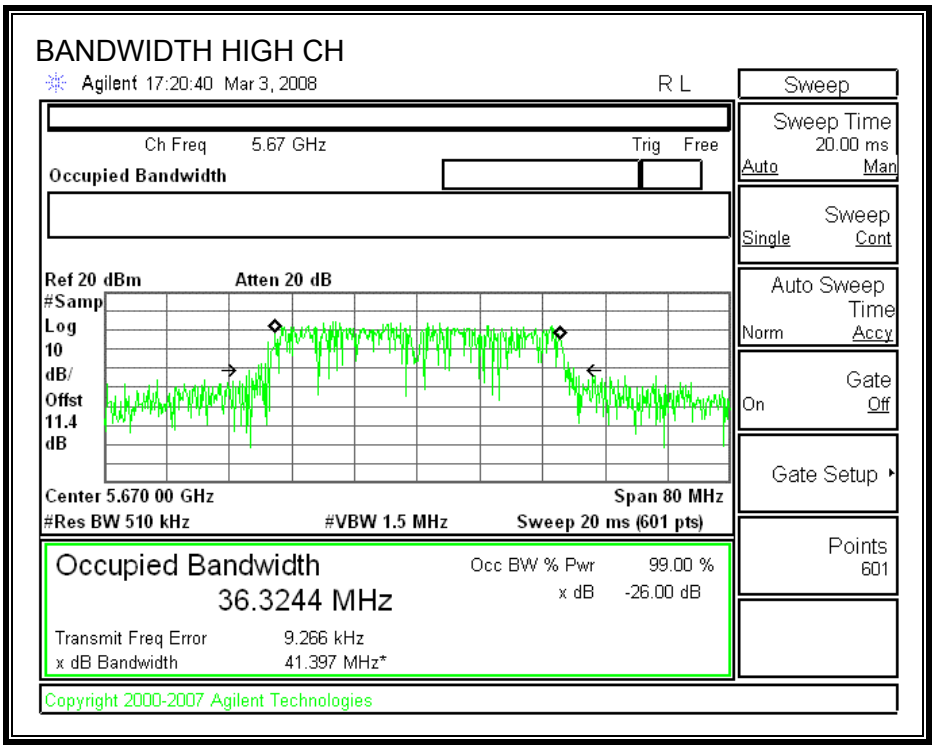
RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5510	39.5770	36.4447
Middle	5590	40.4730	36.1010
High	5670	41.3970	36.3244

26 dB and 99% BANDWIDTH







7.6.2. OUTPUT POWER

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.47-5.725 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

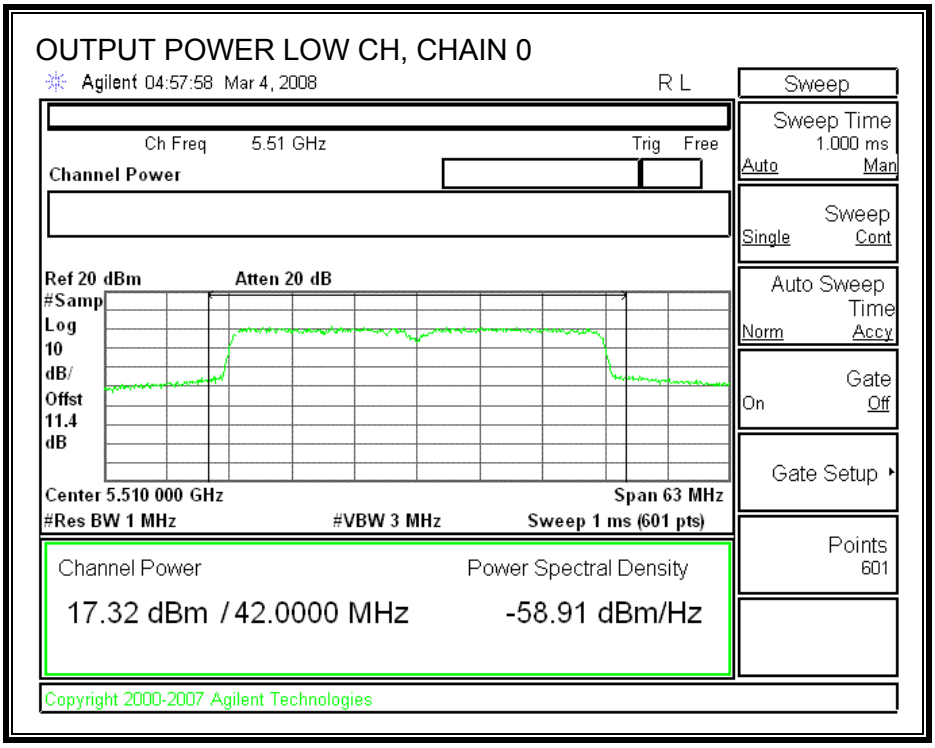
Limit

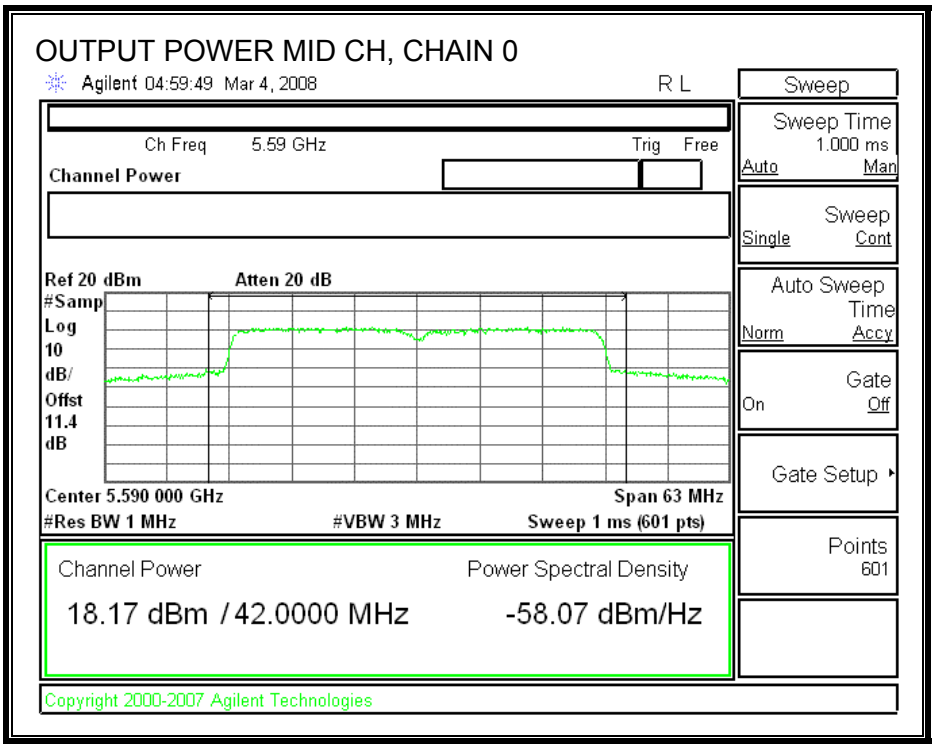
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Effective Ant. Gain (dBi)	Limit (dBm)
Low	5510	23.98	48.0700	27.82	5.00	23.98
Mid	5590	23.98	56.7120	28.54	5.00	23.98
High	5670	23.98	55.8740	28.47	5.00	23.98

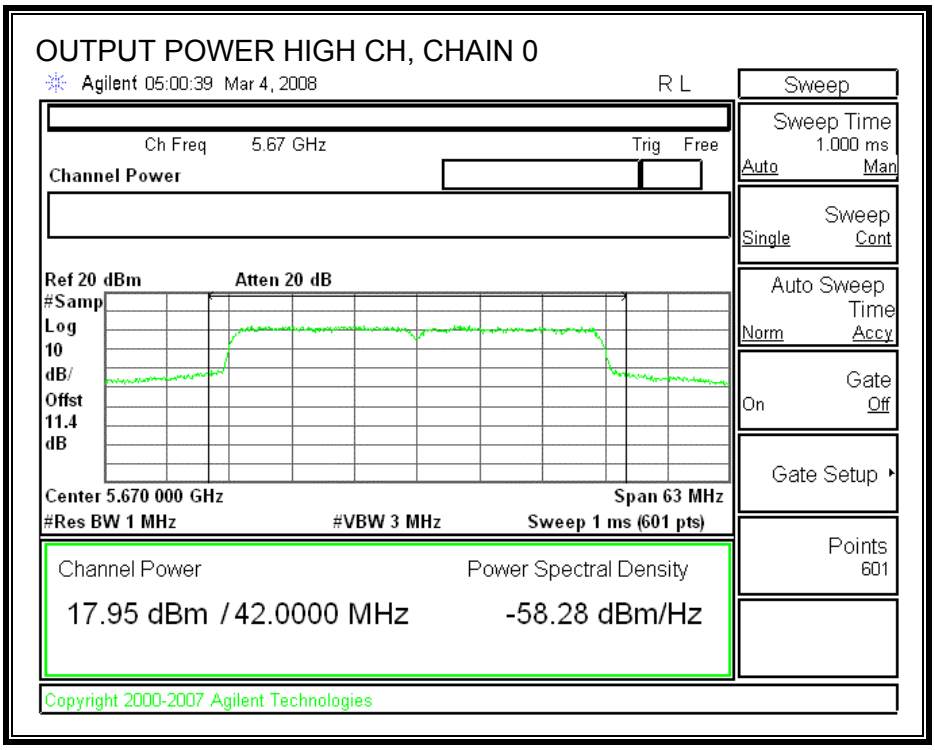
Individual Chain Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5510	17.32	17.27	15.74	21.61	23.98	-6.66
Mid	5590	18.17	17.43	18.46	22.81	23.98	-5.81
High	5670	17.95	17.44	17.89	22.54	23.98	-6.03

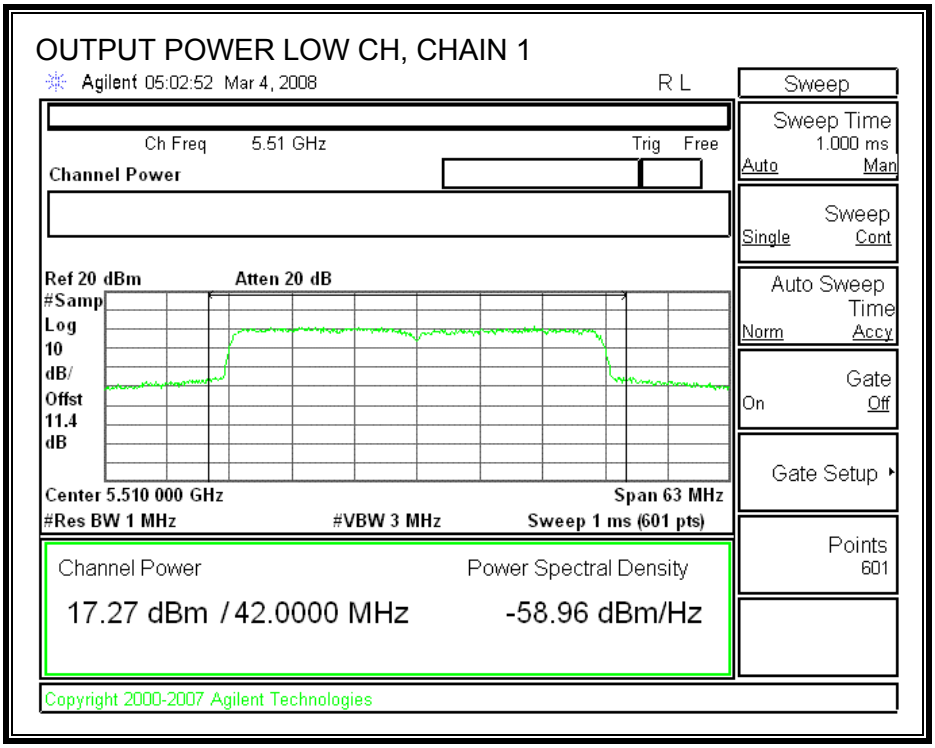
CHAIN 0 OUTPUT POWER

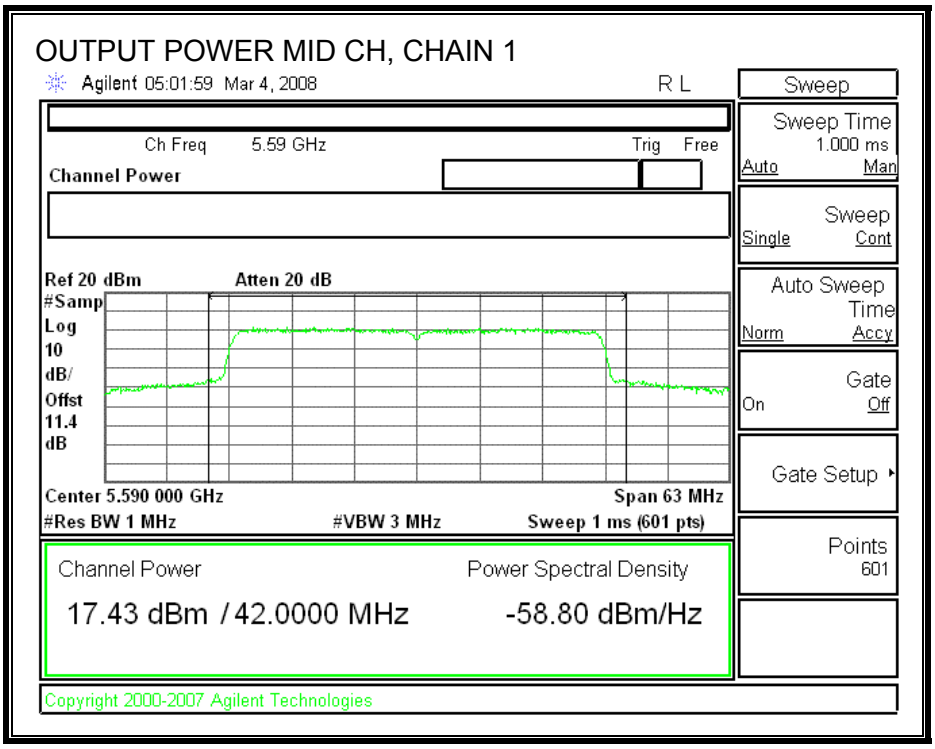


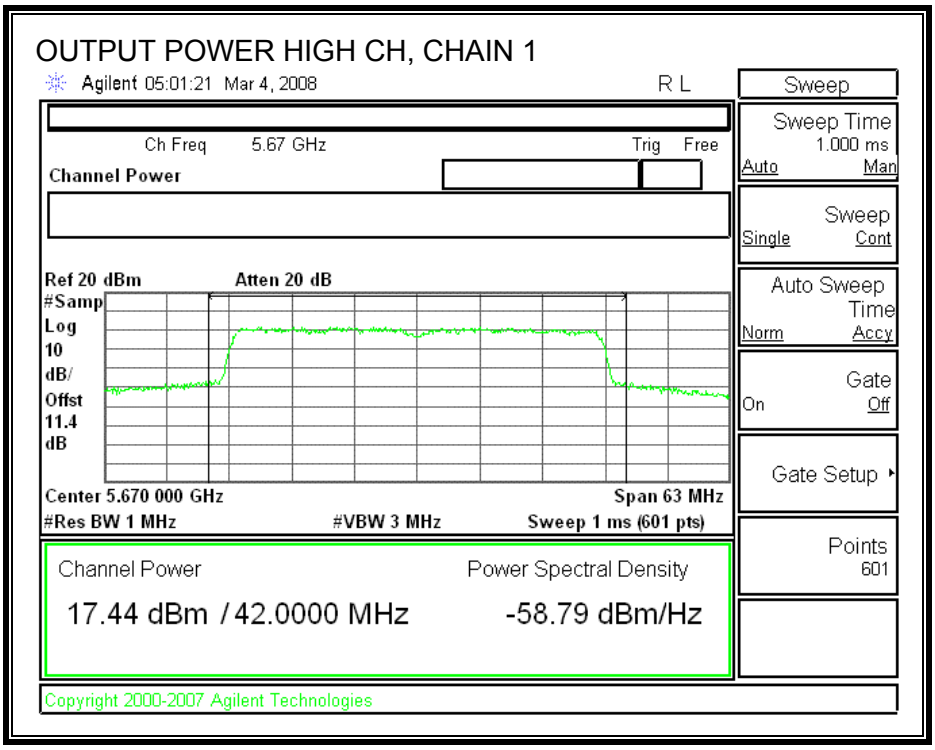




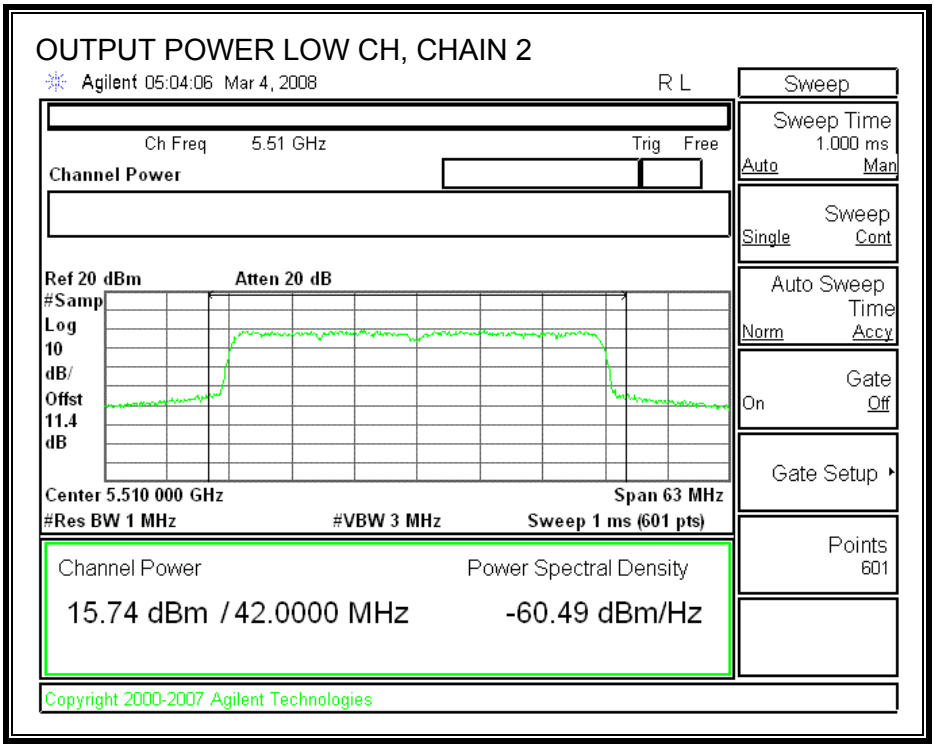
CHAIN 1 OUTPUT POWER

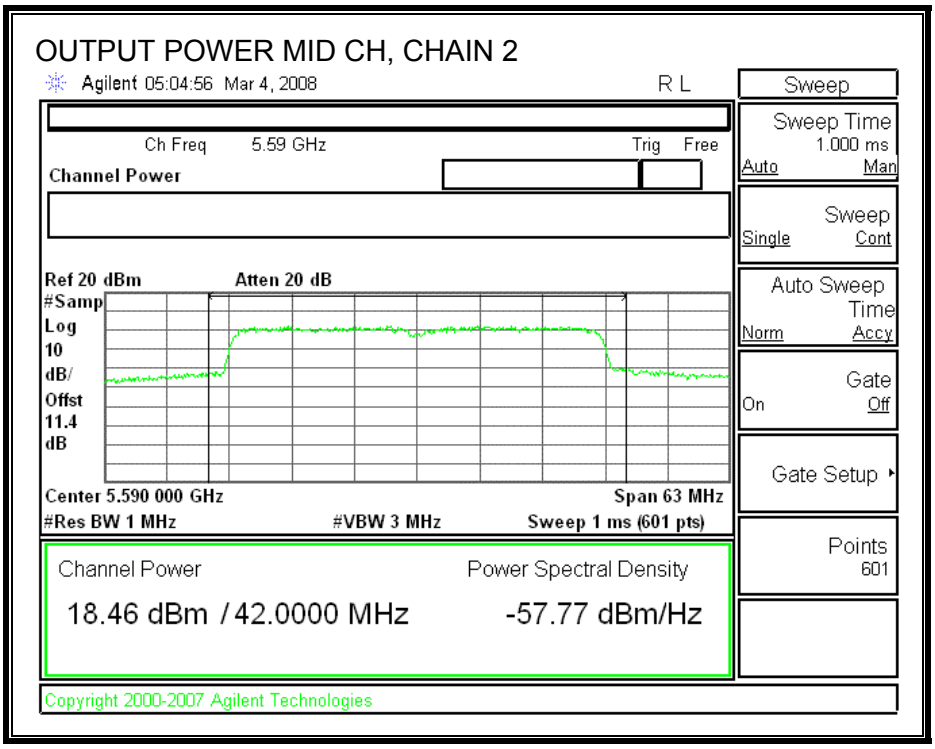


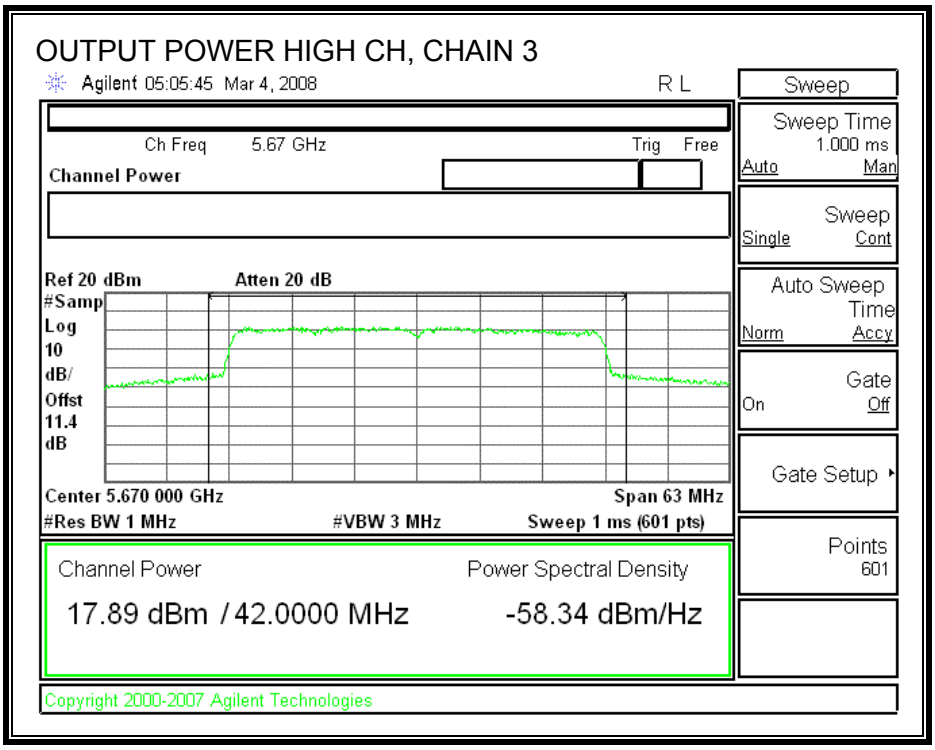




CHAIN 2 OUTPUT POWER







7.6.3. AVERAGE POWER FOR HT40 MODES (5.6GHz)

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	5510	17.10	17.30	15.75	21.54
Middle	5590	17.90	17.20	18.25	22.58
High	5670	17.93	17.22	17.53	22.34

7.6.4. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

Antenna Gain (dBi)	10 Log (# Tx Chains) (dB)	Effective Legacy Gain (dBi)
5	4.77	9.77

For the 5.47-5.725 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 11 dBm.

TEST PROCEDURE

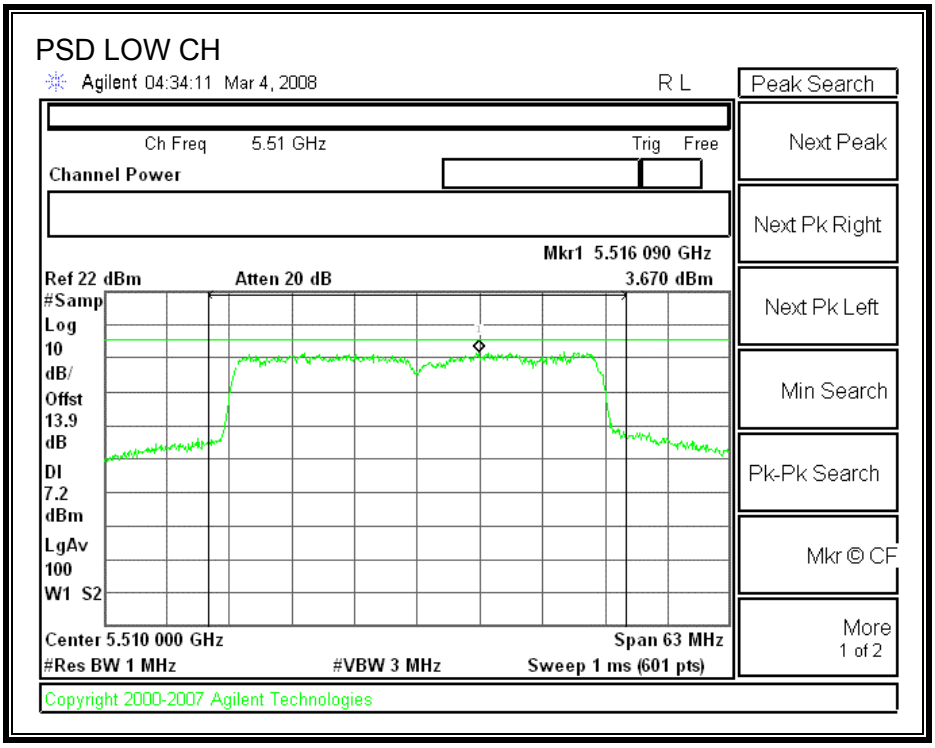
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

RESULTS

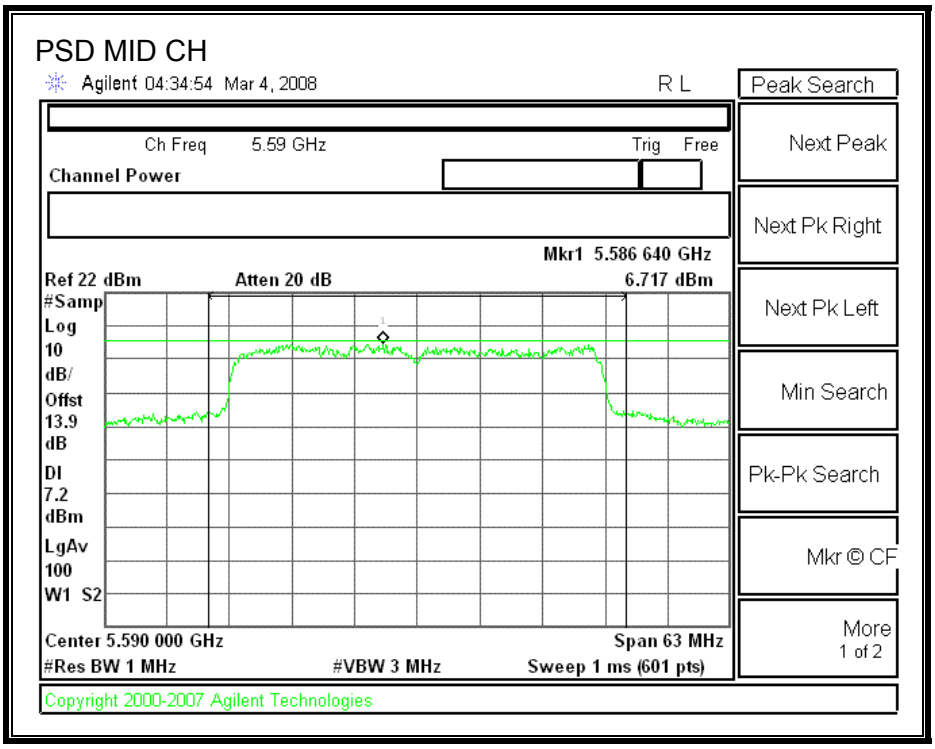
Low channel plots are included hereafter.

Channel	Frequency (MHz)	PPSD With Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	5510	3.670	11	-7.330
Middle	5590	6.717	11	-4.283
High	5670	6.061	11	-4.939

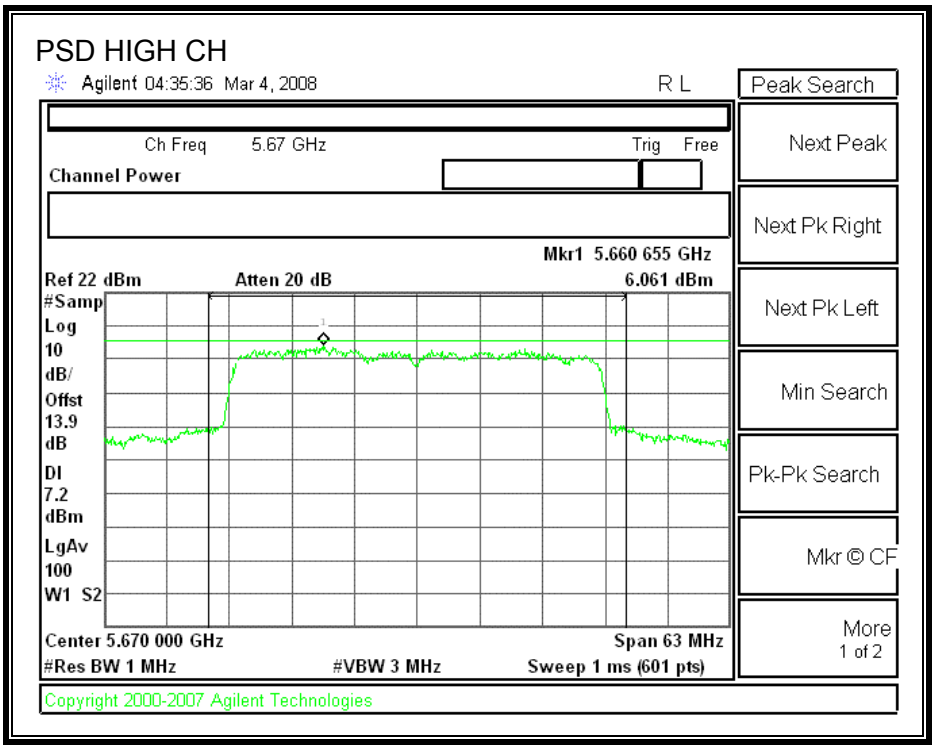
POWER SPECTRAL DENSITY (WITH COMBINER)



PSD MID CH



PSD HIGH CH



7.6.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (3)

IC RSS-210 A9.3 (3)

For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm / MHz.

TEST PROCEDURE

Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

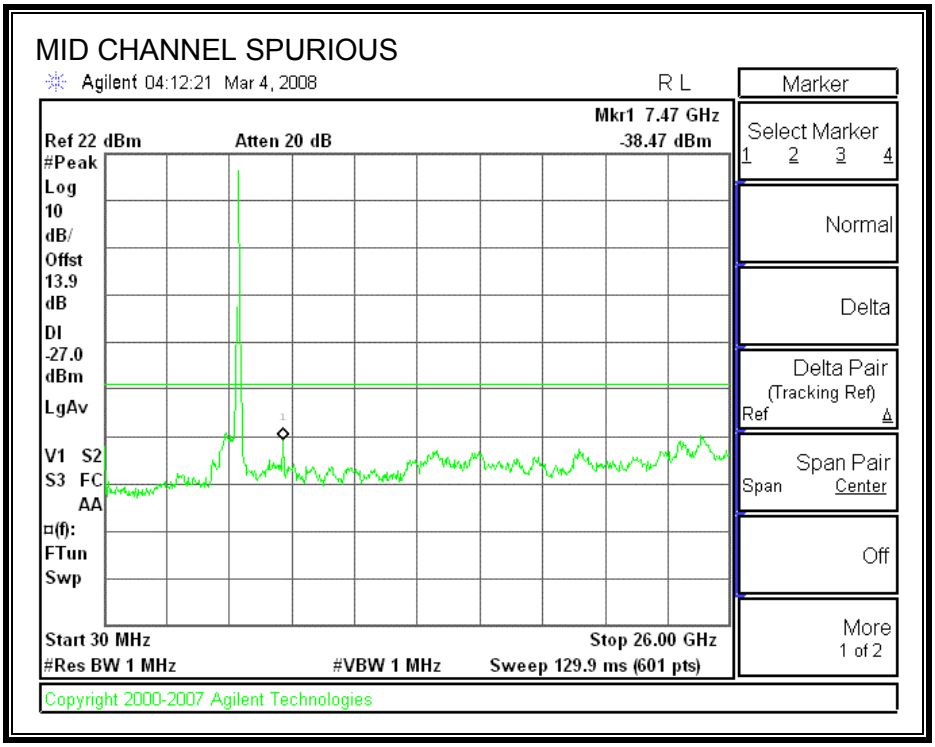
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements are made.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

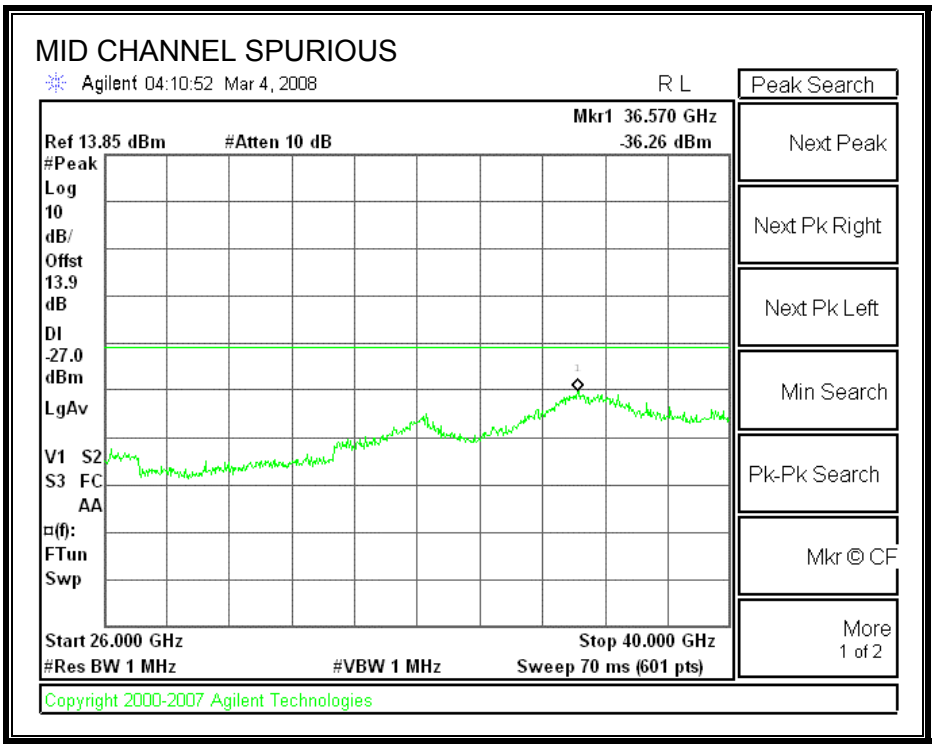
Offset Value = Cable Loss + Attenuation + Antenna Gain + Combiner Loss

RESULTS

SPURIOUS EMISSIONS (WITH COMBINER)



MID CHANNEL SPURIOUS



8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. ABOVE 1 GHz, 802.11a LEGACY MODE, 5.2 GHz

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Atheros Communications
Project #: 08U11627
Date: 3/4/2008
Test Engineer: Chin Pang
Configuration: EUT/3 Antennas/Laptop
Mode: a mode, 5.2GHz Band, TX

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T119; S/N: 29301 @3m	T145 Agilent 3008A005(	T88 Miteq 26-40GHz	T89; ARA 18-26GHz; S/N:1049	FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
Chin 177079003		C-5m Chamber	HPF_7.6GHz	

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Ch 5180MHz															
15.540	3.0	47.0	33.7	35.5	5.2	-32.3	0.0	0.7	56.2	42.9	74	54	-17.8	-11.1	V
15.540	3.0	45.5	32.5	35.5	5.2	-32.3	0.0	0.7	54.7	41.7	74	54	-19.3	-12.3	H
Mid Ch 5260MHz															
15.780	3.0	53.5	37.6	36.5	5.3	-32.2	0.0	0.7	63.8	47.9	74	54	-10.2	-6.1	V
15.780	3.0	50.6	36.1	36.5	5.3	-32.2	0.0	0.7	60.9	46.4	74	54	-13.1	-7.6	H

Rev. 4.12.7
Note: No other emissions were detected above the system noise floor.

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

8.2.2. ABOVE 1 GHz, 802.11n HT20 MODE, 5.2 GHz

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Atheros Communications
Project #: 08U11627
Date: 3/3/2008
Test Engineer: Chin Pang
Configuration: EUT/3 Antennas/Laptop
Mode: HT20, TX

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T119; S/N: 29301 @3m	T145 Agilent 3008A005(	T88 Miteq 26-40GHz	T89; ARA 18-26GHz; S/N:1049	FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
Chin 177079003		C-5m Chamber	HPF_7.6GHz	

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Ch 5180MHz															
15.540	3.0	60.5	40.4	35.5	5.2	-32.3	0.0	0.7	69.7	49.6	74	54	-4.3	-4.4	V
15.540	3.0	57.2	36.8	35.5	5.2	-32.3	0.0	0.7	66.4	46.0	74	54	-7.6	-8.0	H
Mid Ch 5260MHz															
15.780	3.0	56.0	39.0	36.5	5.3	-32.2	0.0	0.7	66.3	49.3	74	54	-7.7	-4.7	V
15.780	3.0	51.0	36.5	36.5	5.3	-32.2	0.0	0.7	61.3	46.8	74	54	-12.7	-7.2	H

Rev. 4.12.7
Note: No other emissions were detected above the system noise floor.

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

8.2.3. TX ABOVE 1 GHz, 802.11n HT40 MODE, 5.2 GHz

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Atheros Communications
Project #: 08U11627
Date: 3/3/2008
Test Engineer: Chin Pang
Configuration: EUT/3 Antennas/Laptop
Mode: HT40, TX

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T119; S/N: 29301 @3m	T145 Agilent 3008A005(	T88 Miteq 26-40GHz	T89; ARA 18-26GHz; S/N:1049	FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
Chin 177079003		C-5m Chamber	HPF_7.6GHz	

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Mid Ch 5270MHz															
15.810	3.0	49.5	36.2	36.7	5.3	-32.2	0.0	0.7	60.0	46.7	74	54	-14.0	-7.3	V
15.810	3.0	48.0	35.0	36.7	5.3	-32.2	0.0	0.7	58.5	45.5	74	54	-15.5	-8.5	H

Rev. 4.12.7
Note: No other emissions were detected above the system noise floor.

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

8.2.4. TX ABOVE 1 GHz, 802.11a LEGACY MODE, 5.6 GHz

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Atheros Communications
Project #: 08U11627
Date: 3/4/2008
Test Engineer: Chin Pang
Configuration: EUT/3 Antennas/Laptop
Mode: TX, 5.5GHz Band, a mode

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T120; S/N: 29310 @3m	T145 Agilent 3008A005(	T88 Miteq 26-40GHz	T89; ARA 18-26GHz; S/N:1049	FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
Chin 177079003		C-5m Chamber	HPF_7.6GHz	

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Mid Ch 5600MHz															
11.200	3.0	52.0	40.8	36.4	4.5	-33.5	0.0	0.7	60.0	48.8	74	54	-14.0	-5.2	V
11.200	3.0	46.8	34.7	36.4	4.5	-33.5	0.0	0.7	54.8	42.7	74	54	-19.2	-11.3	H

Rev. 4.12.7
Note: No other emissions were detected above the system noise floor.

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

8.2.5. TX ABOVE 1 GHz, 802.11n HT20 MODE, 5.6 GHz

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Atheros Communications
Project #: 08U11627
Date: 3/3/2008
Test Engineer: Chin Pang
Configuration: EUT/3 Antennas/Laptop
Mode: 5.5GHz Band, HT20, TX

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T119; S/N: 29301 @3m	T145 Agilent 3008A005(	T88 Miteq 26-40GHz	T89; ARA 18-26GHz; S/N:1049	FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
Chin 177079003		C-5m Chamber	HPF_7.6GHz	

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Mid Ch 5600MHz															
11.200	3.0	46.0	33.0	36.2	4.5	-33.5	0.0	0.7	53.9	40.9	74	54	-20.1	-13.1	V
11.200	3.0	44.6	31.8	36.2	4.5	-33.5	0.0	0.7	52.5	39.7	74	54	-21.5	-14.3	H

Rev. 4.12.7
Note: No other emissions were detected above the system noise floor.

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

8.2.6. TX ABOVE 1 GHz, 802.11n HT40 MODE, 5.6 GHz

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Atheros Communications
Project #: 08U11627
Date: 3/3/2008
Test Engineer: Chin Pang
Configuration: EUT/3 Antennas/Laptop
Mode: 5.5GHz Band, HT40, TX

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T119; S/N: 29301 @3m	T145 Agilent 3008A005(	T88 Miteq 26-40GHz	T89; ARA 18-26GHz; S/N:1049	FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
Chin 177079003		C-5m Chamber	HPF_7.6GHz	

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Mid Ch 5590MHz															
11.180	3.0	48.0	34.3	36.2	4.4	-33.5	0.0	0.7	55.8	42.1	74	54	-18.2	-11.9	V
11.200	3.0	47.5	33.8	36.2	4.5	-33.5	0.0	0.7	55.4	41.7	74	54	-18.6	-12.3	H

Rev. 4.12.7
Note: No other emissions were detected above the system noise floor.

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

8.3. RECEIVER ABOVE 1 GHz

8.3.1. RX ABOVE 1 GHz, 5.2 GHz

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Atheros Communications
Project #: 08U11627
Date: 3/3/2008
Test Engineer: Chin Pang
Configuration: EUT/3 Antennas/Laptop
Mode: 5.2GHz, RX, HT40 (Mid Ch)

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T119; S/N: 29301 @3m	T145 Agilent 3008A005(			FCC 15.209

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
Chin 177079003		C-5m Chamber		

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Mid Ch															
1.093	3.0	55.0	35.2	28.3	1.7	-36.1	0.0	0.0	48.9	29.1	74	54	-25.1	-24.9	V
1.330	3.0	57.8	37.5	29.0	1.8	-35.9	0.0	0.0	52.8	32.5	74	54	-21.2	-21.5	V
1.195	3.0	53.8	34.2	28.6	1.8	-36.0	0.0	0.0	48.2	28.6	74	54	-25.8	-25.4	H
1.593	3.0	52.6	33.8	29.9	2.0	-35.7	0.0	0.0	48.8	30.0	74	54	-25.2	-24.0	H

Rev. 4.12.7
Note: No other emissions were detected above the system noise floor.

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

8.3.2. RX ABOVE 1 GHz, 5.6 GHz

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Atheros Communications
Project #: 08U11627
Date: 3/3/2008
Test Engineer: Chin Pang
Configuration: EUT/3 Antennas/Laptop
Mode: 5.5GHz RX, HT40 (Mid Ch)

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T119; S/N: 29301 @3m	T145 Agilent 3008A005(			FCC 15.209

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
Chin 177079003		C-5m Chamber		

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Mid Ch															
1.093	3.0	57.2	35.2	28.3	1.7	-36.1	0.0	0.0	51.1	29.1	74	54	-22.9	-24.9	V
1.598	3.0	55.2	34.1	29.9	2.0	-35.7	0.0	0.0	51.4	30.3	74	54	-22.6	-23.7	V
1.093	3.0	53.6	34.0	28.3	1.7	-36.1	0.0	0.0	47.5	27.9	74	54	-26.5	-26.1	H
1.598	3.0	53.5	33.6	29.9	2.0	-35.7	0.0	0.0	49.7	29.8	74	54	-24.3	-24.2	H

Rev. 4.12.7
Note: No other emissions were detected above the system noise floor.

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

9. DYNAMIC FREQUENCY SELECTION

9.1. OVERVIEW

9.1.1. LIMITS

FCC

§15.407 (h) and FCC MO&O 06-96 APPENDIX "COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVCIES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION".

INDUSTRY CANADA

IC RSS-210 is closely harmonized with FCC Part 15 DFS rules. The deviations are as follows:

RSS-210 Issue 7 A9.4 (b) (ii) **Channel Availability Check Time:** …

Additional requirements for the band 5600-5650 MHz: Until further notice, devices subject to this Section shall not be capable of transmitting in the band 5600-5650 MHz, so that Environment Canada weather radars operating in this band are protected.

RSS-210 Issue 7 A9.4 (b) (iv) **Channel closing time:** the maximum channel closing time is 260 ms.

REQUIREMENTS AND LIMITS

Table 1: Applicability of DFS requirements prior to use of a channel

Requirement	Operational Mode		
	Master	Client (without radar detection)	Client (with radar detection)
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
Uniform Spreading	Yes	Not required	Not required

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode		
	Master	Client **(without DFS)**	Client **(with DFS)**
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes

Table 3: Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value (see note)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.	

Table 4: DFS Response requirement values

Parameter	Value
Non-occupancy period	30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds
Channel Closing Transmission Time	200 milliseconds + approx. 60 milliseconds over remaining 10 second period
The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows: For the Short pulse radar Test Signals this instant is the end of the *Burst*. For the Frequency Hopping radar Test Signal, this instant is the end of the last radar burst generated. For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission. The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate channel changes (an aggregate of approximately 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.	

Table 5 – Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (Microseconds)	PRI (Microseconds)	Pulses	Minimum Percentage of Successful Detection	Minimum Trials
1	1	1428	18	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120

Table 6 – Long Pulse Radar Test Signal

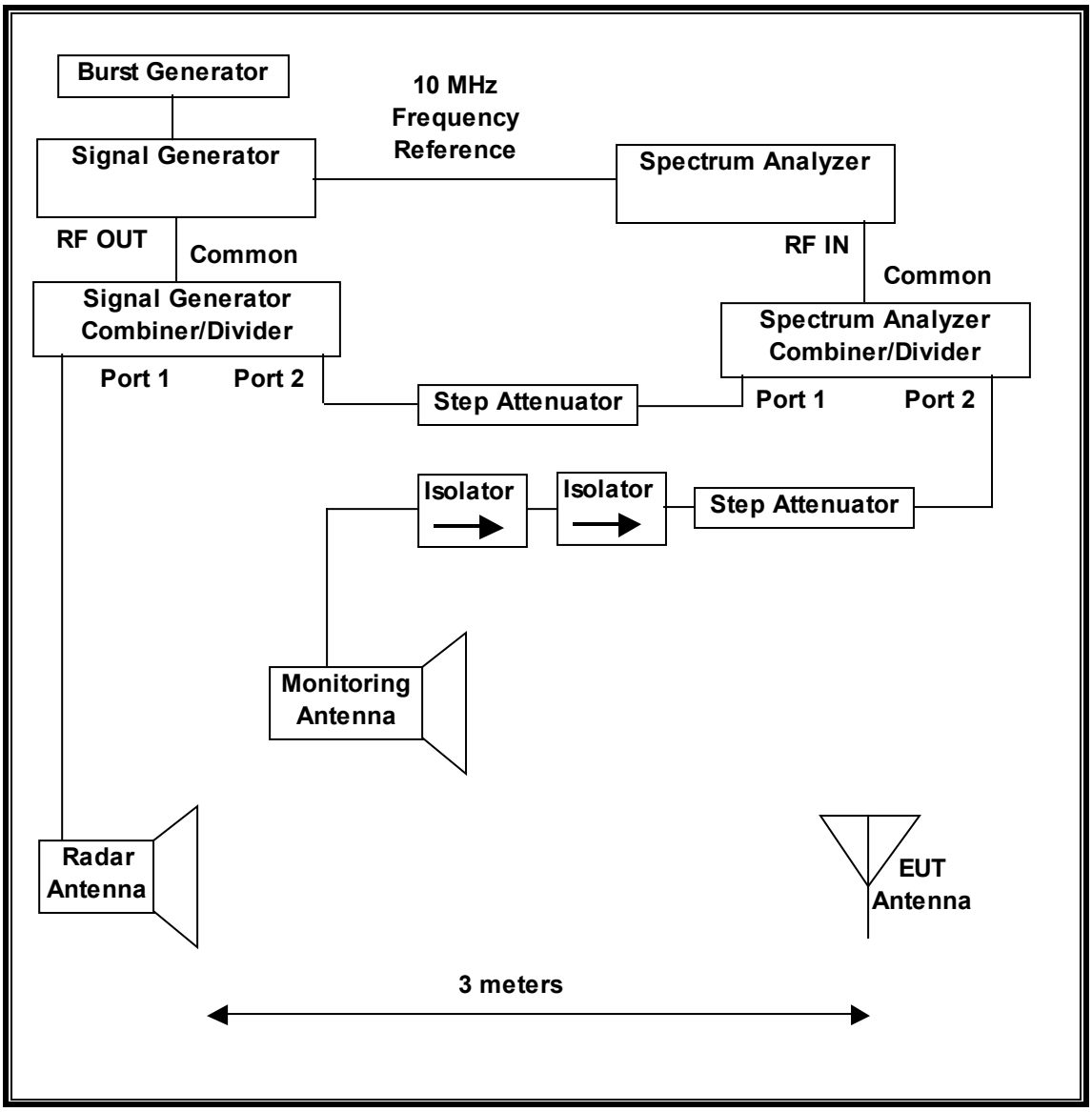
Radar Waveform	Bursts	Pulses per Burst	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Minimum Percentage of Successful Detection	Minimum Trials
5	8-20	1-3	50-100	5-20	1000-2000	80%	30

Table 7 – Frequency Hopping Radar Test Signal

Radar Waveform	Pulse Width (µsec)	PRI (µsec)	Burst Length (ms)	Pulses per Hop	Hopping Rate (kHz)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	300	9	.333	70%	30

9.1.2. TEST AND MEASUREMENT SYSTEM

RADIATED METHOD SYSTEM BLOCK DIAGRAM



SYSTEM OVERVIEW

The short pulse and long pulse signal generating system utilizes the NTIA software. The Vector Signal Generator has been validated by the NTIA. The hopping signal generating system utilizes the CCS simulated hopping method and system, which has been validated by the DoD, FCC and NTIA. The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution.

The short pulse types 2, 3 and 4, and the long pulse type 5 parameters are randomized at run-time.

The hopping type 6 pulse parameters are fixed while the hopping sequence is based on the August 2005 NTIA Hopping Frequency List. The initial starting point randomized at run-time and each subsequent starting point is incremented by 475. Each frequency in the 100-length segment is compared to the boundaries of the EUT Detection Bandwidth and the software creates a hopping burst pattern in accordance with Section 7.4.1.3 Method #2 Simulated Freqeuncy Hopping Radar Waveform Generating Subsystem of FCC 06-96 APPENDIX. The frequency of the signal generator is incremented in 1 MHz steps from F_L to F_H for each successive trial. This incremental sequence is repeated as required to generate a minimum of 30 total trials and to maintain a uniform frequency distribution over the entire Detection Bandwidth.

The signal monitoring equipment consists of a spectrum analyzer set to display 8001 bins on the horizontal axis. The time-domain resolution is 2 msec / bin with a 16 second sweep time, meeting the 10 second short pulse reporting criteria. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection and max hold.

SYSTEM CALIBRATION

A horn antenna is set up with its main beam oriented directly toward the radar test generator antenna at a 3-meter distance (this is the same location at which the EUT will be placed during the test). The spectrum analyzer is connected to this horn antenna via a coaxial cable, with the reference level offset set equal to the horn antenna assembly gain (horn antenna gain – coaxial cable loss). A 50-ohm load is connected to each unused port of the test system. The signal generator is set to CW mode. The amplitude of the signal generator is adjusted to yield a level of –64 dBm as measured on the spectrum analyzer.

Without changing any of the instrument settings, the spectrum analyer is reconnected to the Common port of the Spectrum Analyzer Combiner/Divider. The amplitude is measured and the difference from –64 dBm is calculated. The Reference Level Offset of the spectrum analyzer is adjusted to this difference.

The spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device. The interference detection threshold may be varied from the calibrated value of –64 dBm and the spectrum analyzer will still indicate the level as received by the Master Device.

The signal generator is set to produce a radar waveform, a burst is triggered manually and the level on the spectrum analyzer is observed. The amplitude of the signal generator is adjusted as required so that the peak level of the waveform is at a displayed level equal to specified interference detection threshold. Separate signal generator amplitude settings are determined as required for each radar type.

ADJUSTMENT OF DISPLAYED TRAFFIC LEVEL

A link is established between the Master and Slave, adjusting the distance between the units as needed to provide a suitable received level at the Master and Slave devices. The video test file is streamed to generate WLAN traffic. The WLAN traffic, as displayed on the spectrum analyzer, is confirmed to be at a lower amplitude than the radar detection threshold, and the displayed traffic is confirmed to be only from the EUT and not from the support device associated with the EUT.

If different settings of the Step Attenuators are required to meet the above conditions, a new System Calibration is performed for the new Step Attenuator settings.

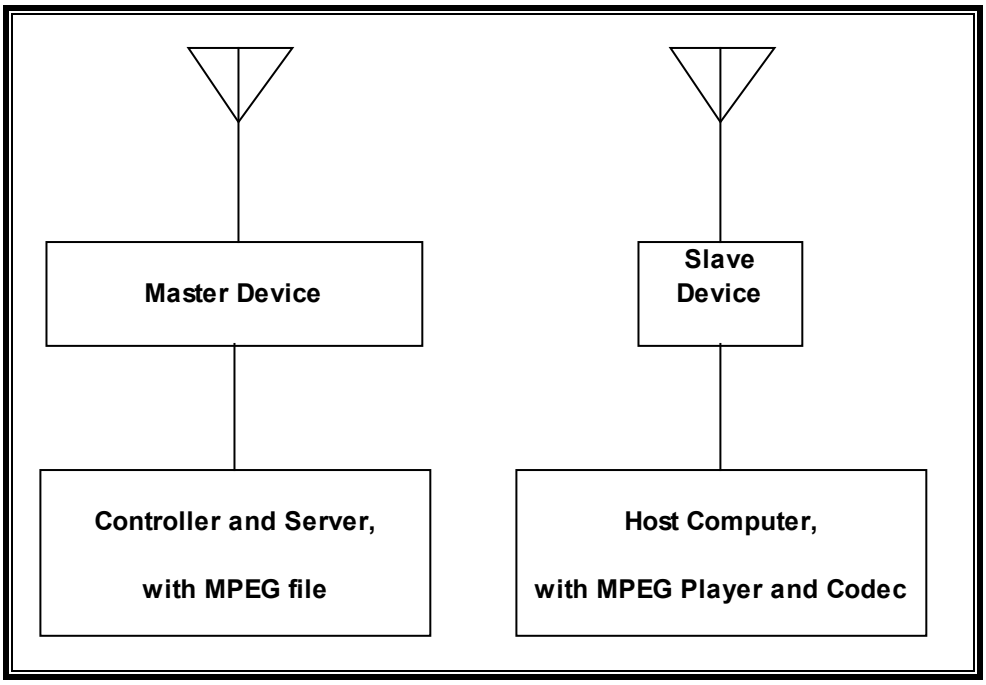
TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the DFS tests documented in this report:

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**Cal Due**
Spectrum Analyzer, 44 GHz	**Agilent / HP**	**E4446A**	**MY45300064**	**5/11/2009**
Vector Signal Generator 250kHz-20GHz	**Agilent / HP**	**E8267C**	**US43320336**	**11/16/2009**
High Speed Digital I/O Card	**National Instruments**	**PCI-6534**	**HA1612845**	**1/16/2009**

9.1.3. SETUP OF EUT

RADIATED METHOD EUT TEST SETUP



SUPPORT EQUIPMENT

The following support equipment was utilized for the DFS tests documented in this report:

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Notebook PC (Console)	IBM	SIT Rome-4 2668-11U	ZZ-27004	DoC
AC Adapter (Console)	IBM	92P1016	11S92P1016Z1ZAC66AJ1C2	DoC
Notebook PC (Client)	IBM	SIT Rome-4 2668-G2U	ZZ-27259	DoC
AC Adapter (Client)	IBM	08K8208	11S08K8208Z1Z9MA4BF6MY	DoC

9.1.4. DESCRIPTION OF EUT

The EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges.

The EUT is a Master Device.

The highest conducted power level within these bands is 21.93 dBm in the 5250-5350 MHz band and 20.32 dBm in the 5470-5725 MHz band, for 20 MHz bandwidth operation, and 22.01 dBm in the 5250-5350 MHz band and 22.80 dBm in the 5470-5725 MHz band, for 40 MHz bandwidth operation.

The highest gain antenna assembly utilized with the EUT has a gain of 5 dBi. The lowest gain antenna assembly utilized with the EUT has a gain of 0 dBi.

The highest radiated power level within these bands is 27.8 dBm EIRP.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is –64 dBm.

The calibrated radiated DFS Detection Threshold level is set to –64 dBm.

The EUT uses three transmitters connected to three 50-ohm coaxial antenna ports to satisfy MIMO operational requirements.

The Slave device associated with the EUT during these tests does not have radar detection capability.

WLAN traffic is generated by streaming the video file TestFile.mp2 “6 ½ Magic Hours” from the Master to the Slave in full motion video mode using the media player with the V2.61 Codec package.

TPC is required since the maximum EIRP is greater than 500 mW (27 dBm).

The EUT utilizes the 802.11a/n architecture. Two nominal channel bandwidths are implemented: 20 MHz and 40 MHz.

The software installed in the access point is revision AP7.0.0.353.

Test results show that the EUT requires 46.3 seconds to complete its initial power-up cycle in the 20 MHz bandwidth mode and 46.63 seconds in the 40 MHz bandwidth mode.

DESCRIPTION OF TPC FUNCTION

The power is adjustable over a range of approximately 12 dB, therefore the EUT is capable of the required 6 dB TPC reduction.

MANUFACTURER'S DESCRIPTION OF UNIFORM CHANNEL SPREADING FUNCTION

This is in a separate document.

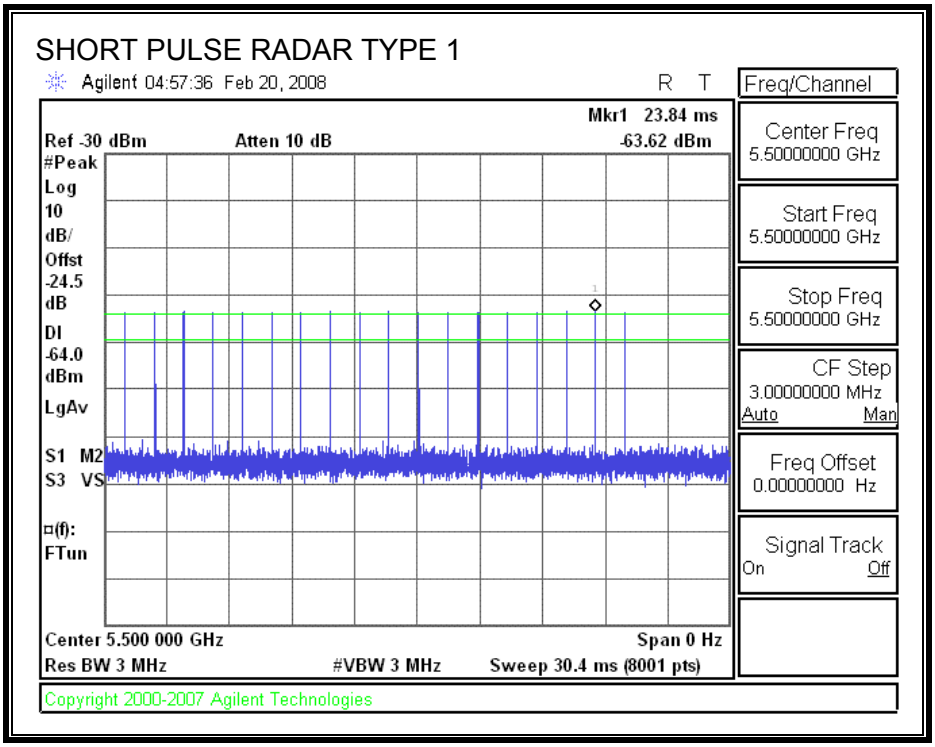
9.2. RESULTS FOR 20 MHz BANDWIDTH MODE

9.2.1. TEST CHANNEL

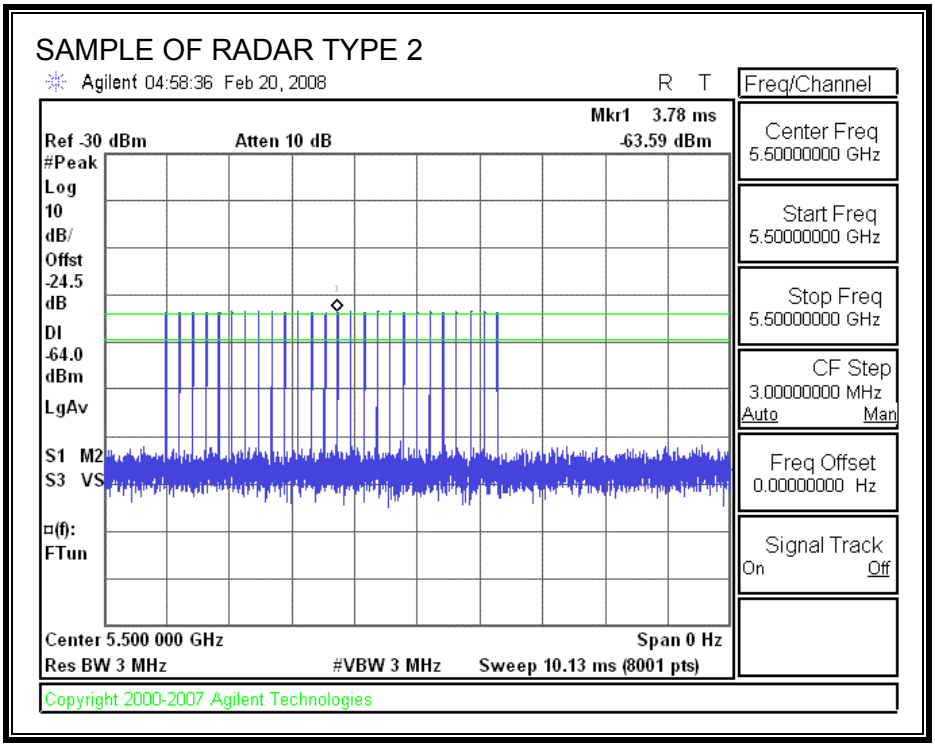
All tests were performed at a channel center frequency of 5500 MHz. Measurements were performed using radiated test methods.

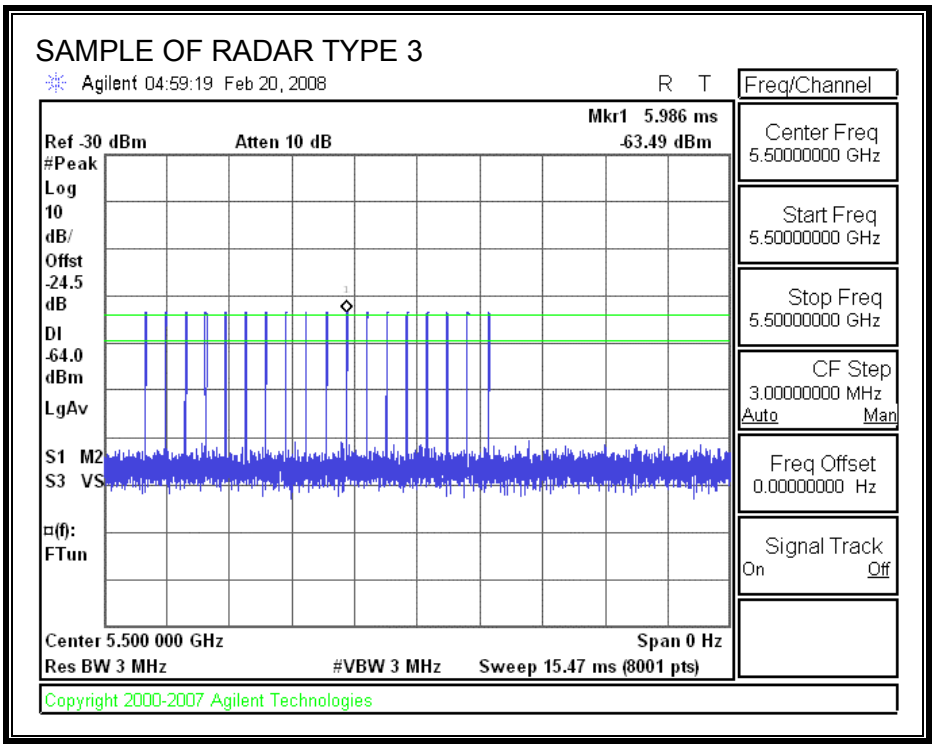
9.2.2. PLOTS OF RADAR WAVEFORMS AND WLAN TRAFFIC

PLOTS OF RADAR WAVEFORMS

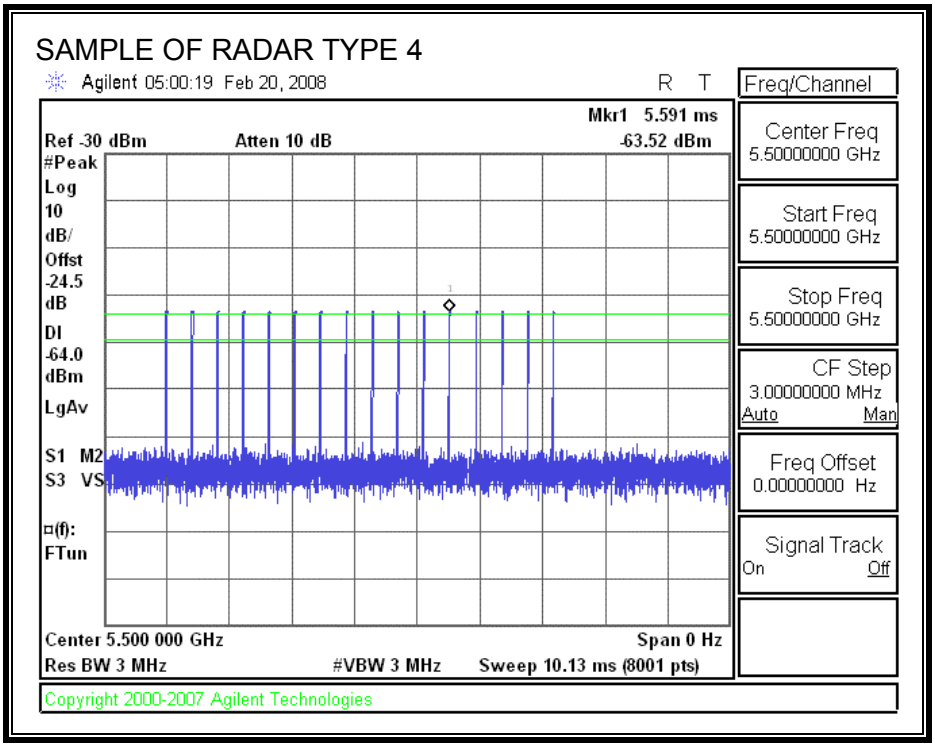


SAMPLE OF RADAR TYPE 2

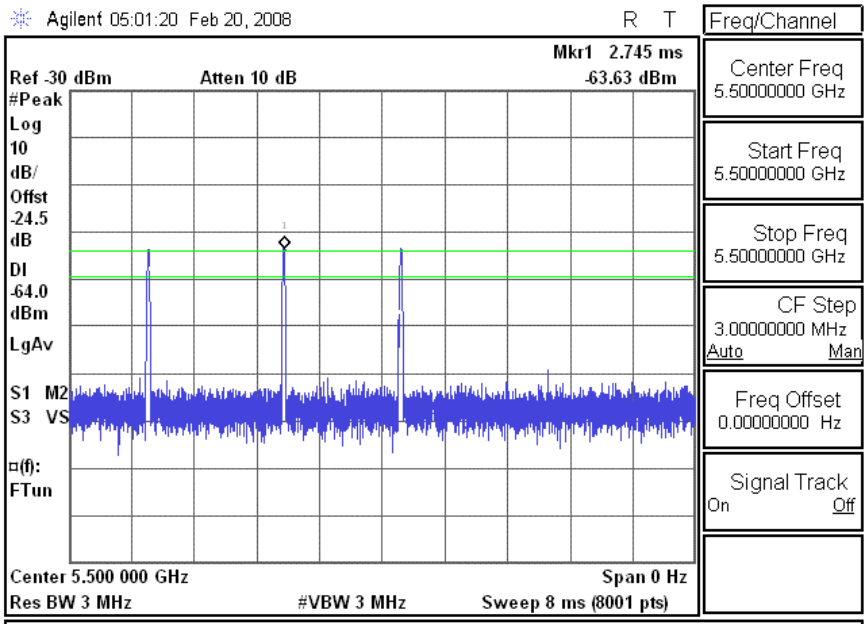




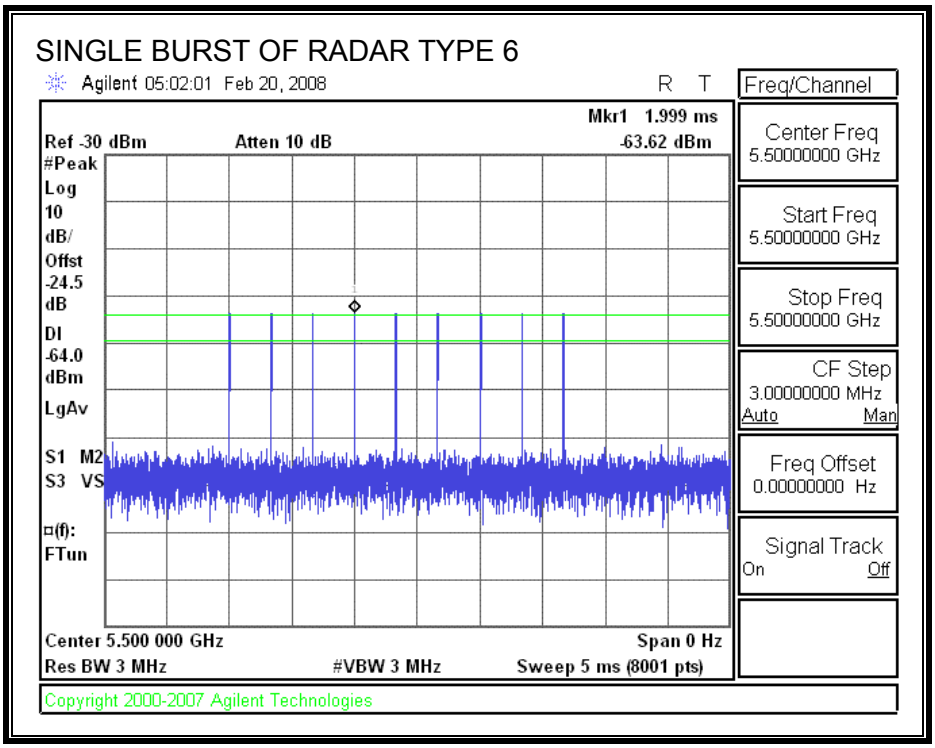
SAMPLE OF RADAR TYPE 4



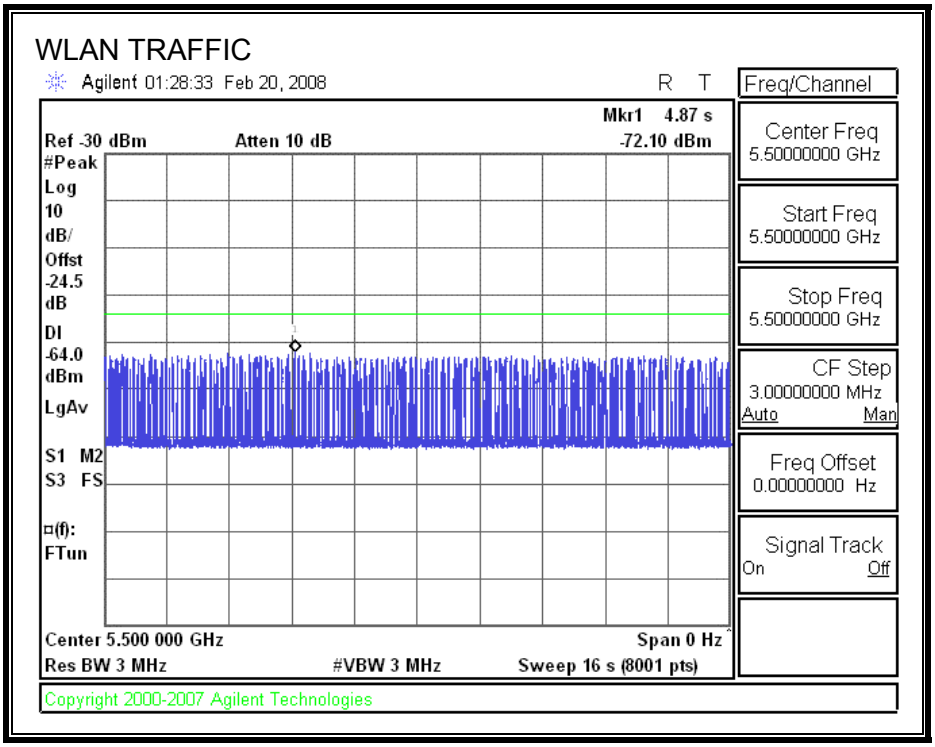
SAMPLE OF SINGLE BURST OF RADAR TYPE 5



SINGLE BURST OF RADAR TYPE 6



PLOT OF WLAN TRAFFIC FROM MASTER



9.2.3. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

A link was established on channel, then the EUT was rebooted. The time from the cessation of traffic to the re-initialization of traffic was measured as the time required for the EUT to complete the total power-up cycle. The time to complete the initial power-up period is 60 seconds less than this total power-up time.

PROCEDURE FOR TIMING OF RADAR BURST

With a link established on channel, the EUT was rebooted. A radar signal was triggered within 0 to 6 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

The Non-Occupancy list was cleared. With a link established on channel, the EUT was rebooted. A radar signal was triggered within 54 to 60 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

RESULTS

No Radar Triggered

Timing of Reboot (sec)	Timing of Start of Traffic (sec)	Total Power-up Cycle Time (sec)	Initial Power-up Cycle Time (sec)
21.49	127.8	106.3	46.3

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
24.16	74.5	50.3	4.0

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
22.09	125.5	103.4	57.1

If a radar signal is detected during the channel availability check then the PC controlling the EUT displays a message stating that radar was detected.

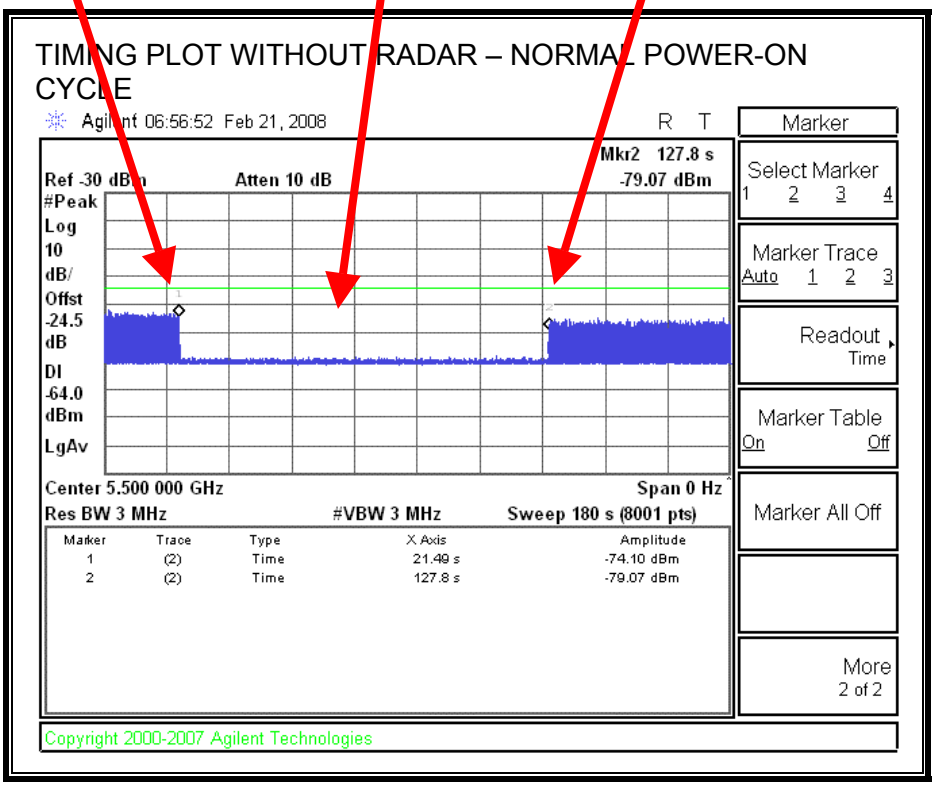
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected EUT does not display any radar parameter values	No transmissions on channel
Within 54 to 60 second window	EUT indicates radar detected EUT does not display any radar parameter values	No transmissions on channel

TIMING PLOT WITHOUT RADAR DURING CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

End of CAC
Traffic is Initiated



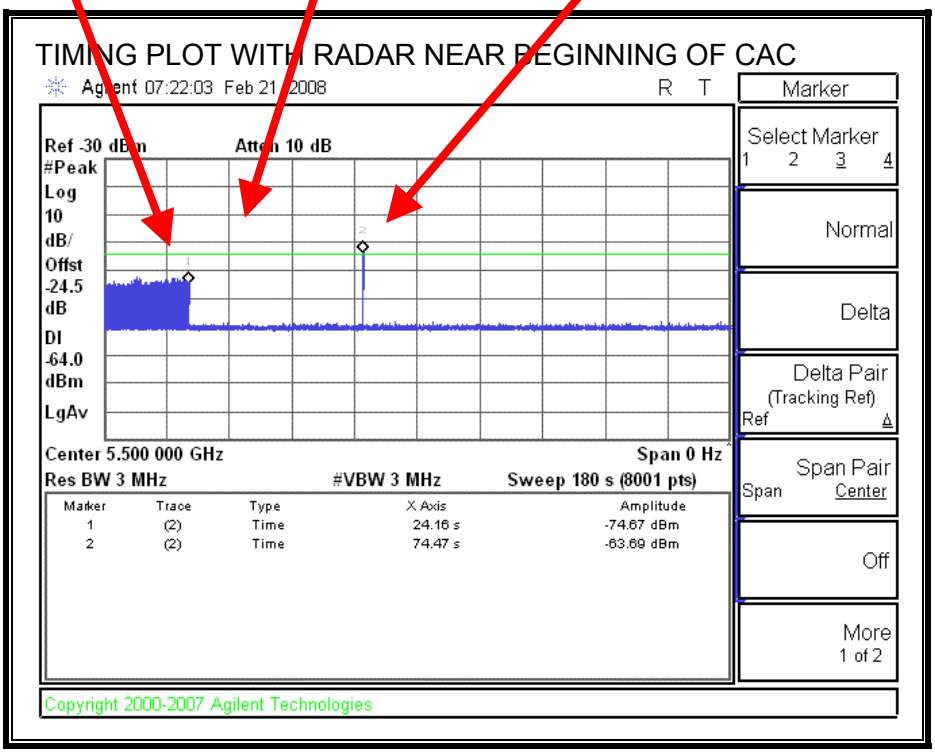
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

TIMING PLOT WITH RADAR NEAR BEGINNING OF CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



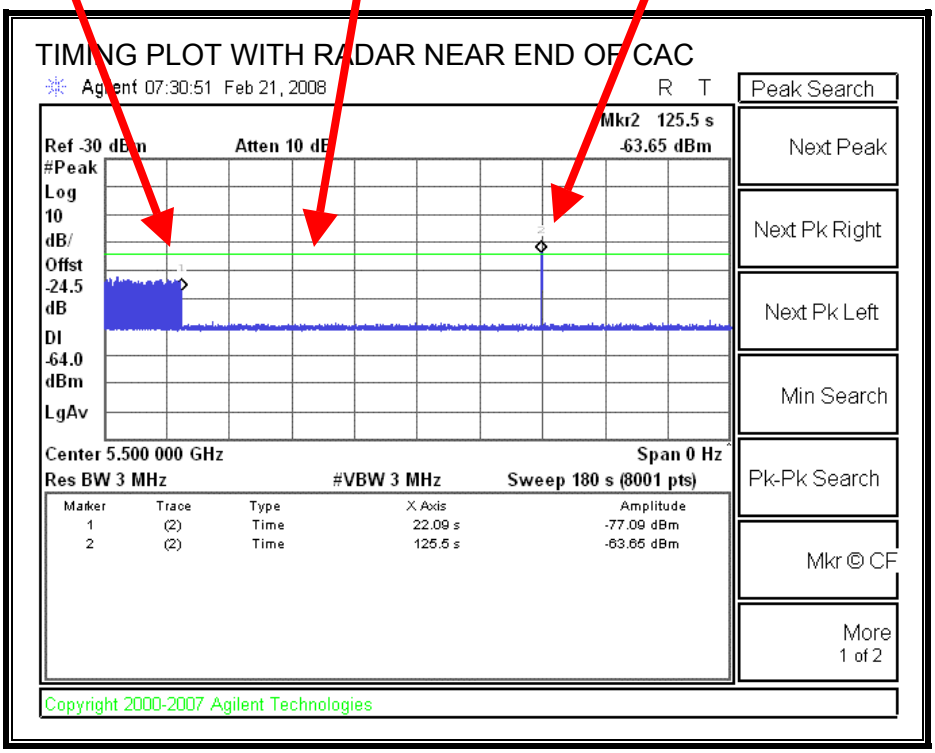
No EUT transmissions were observed after the radar signal.

TIMING PLOT WITH RADAR NEAR END OF CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

9.2.4. MOVE AND CLOSING TIME

REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =
(Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

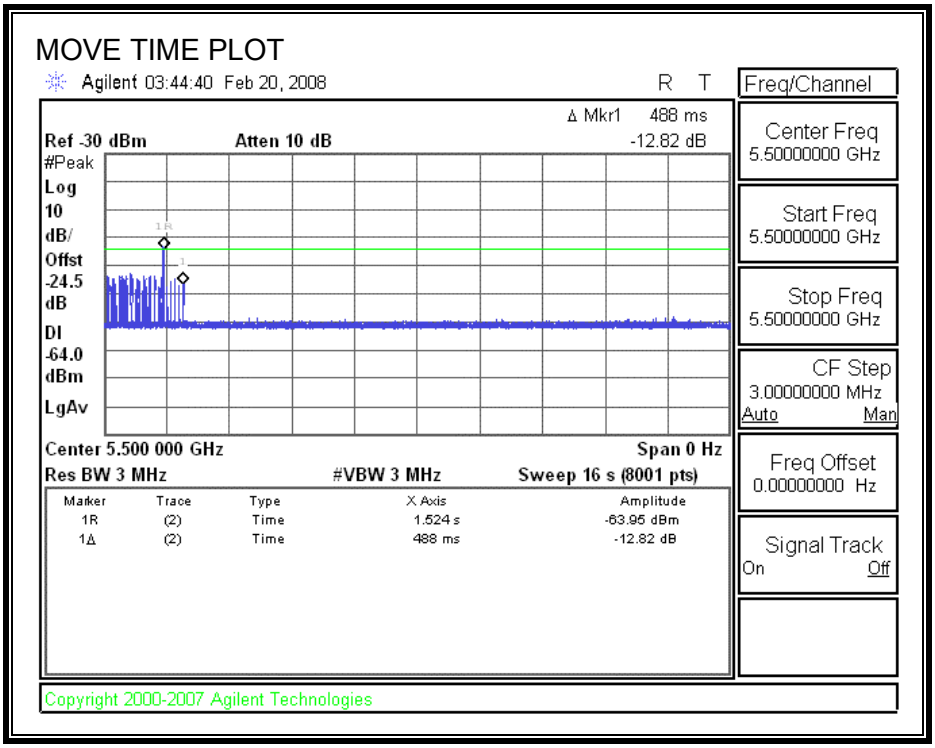
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

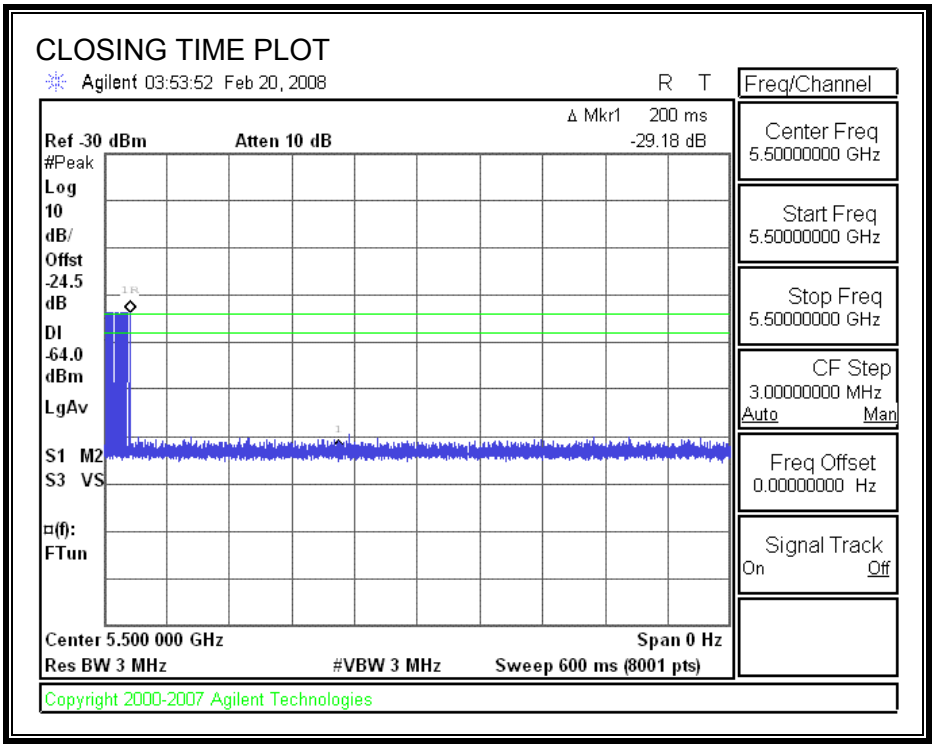
Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.488	10

Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	8.0	60
IC	12.0	260

MOVE TIME



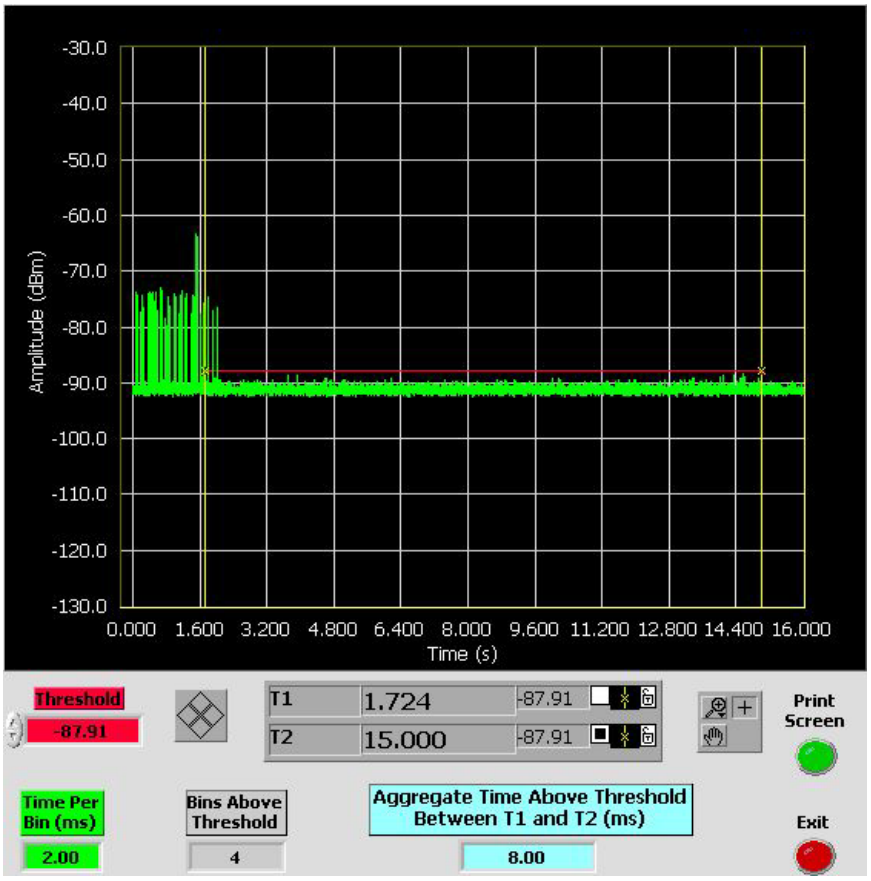
CHANNEL CLOSING TIME



FCC AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the monitoring period.

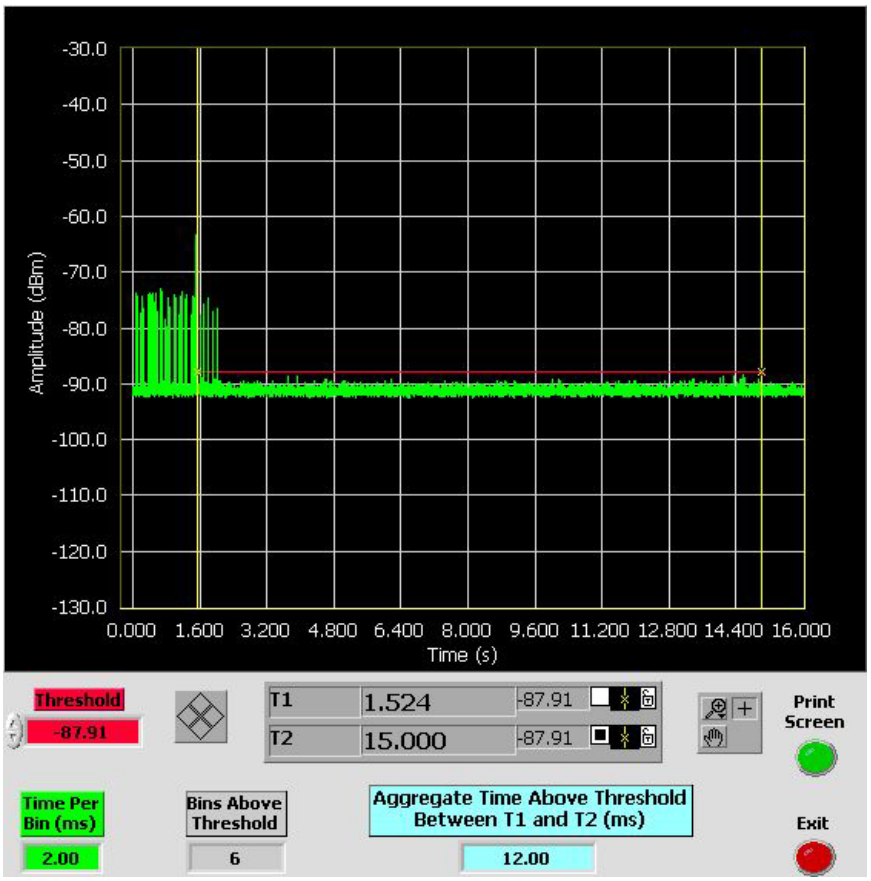
FCC AGGREGATE CLOSING TIME PLOT



IC AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

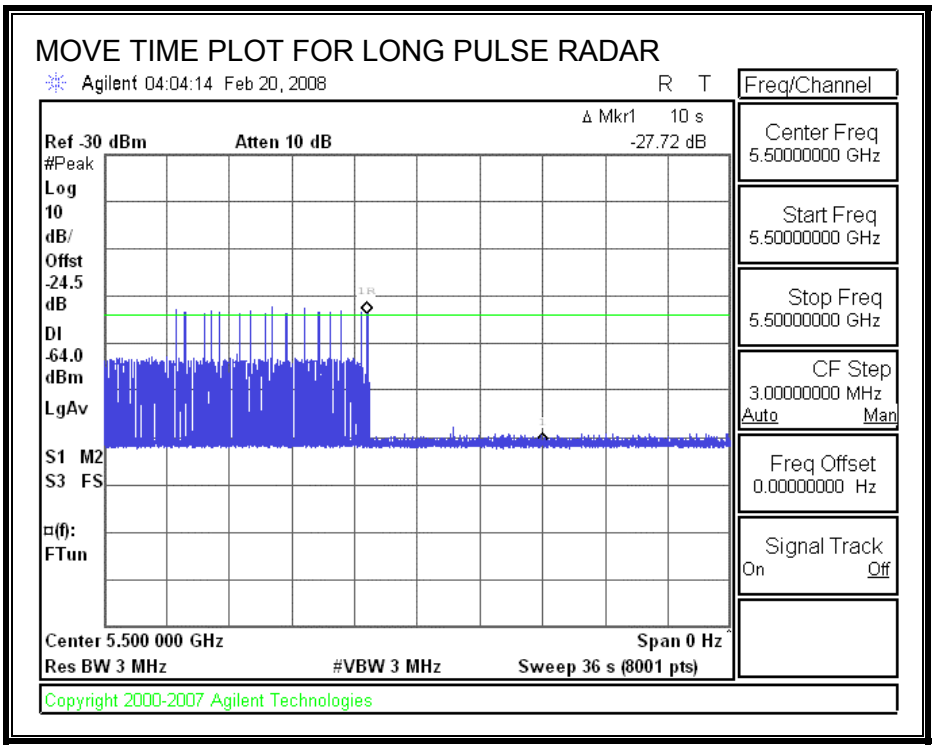
Only intermittent transmissions are observed during the monitoring period.

IC AGGREGATE CLOSING TIME PLOT



LONG PULSE CHANNEL MOVE TIME

The traffic ceases prior to 10 seconds after the end of the radar waveform.

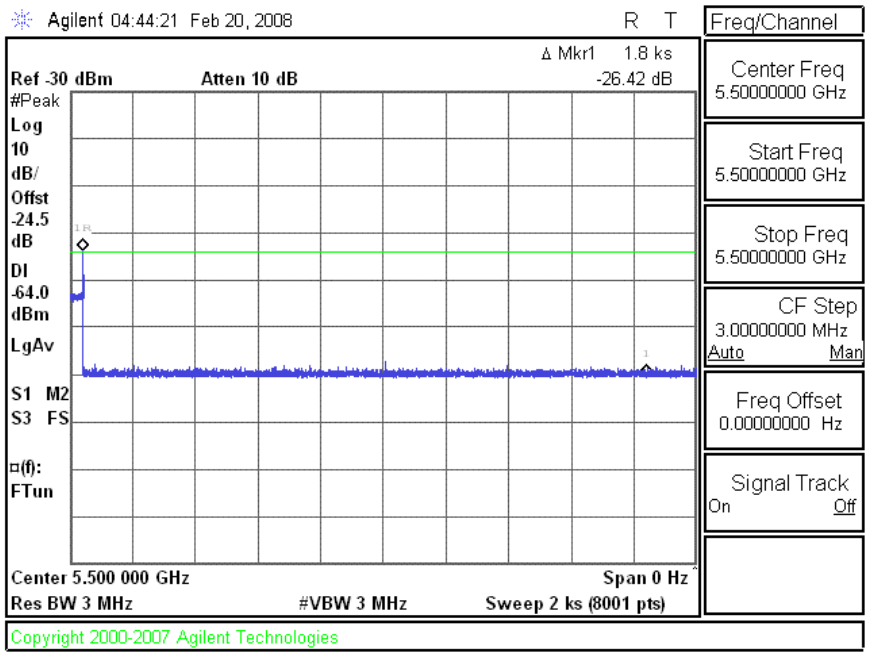


9.2.5. NON-OCCUPANCY PERIOD

RESULTS

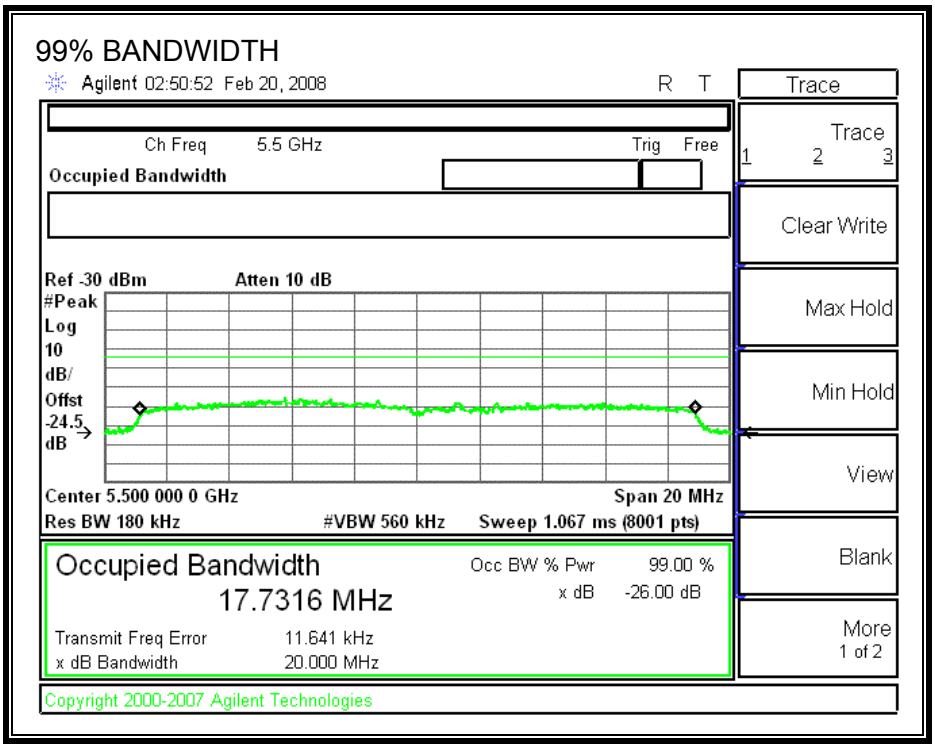
No EUT transmissions were observed on the test channel during the 30-minute observation time.

NON-OCCUPANCY PERIOD PLOT



9.2.6. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER BANDWIDTH



RESULTS

FL (MHz)	FH (MHz)	Detection Bandwidth (MHz)	99% Power Bandwidth (MHz)	Ratio of Detection BW to 99% Power BW (%)	Minimum Limit (%)
5490	5510	20	17.732	112.8	80

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results				
FCC Type 1 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst				
Frequency (MHz)	Number of Trials	Number Detected	Detection (%)	Mark
5489	10	3	30	
5490	10	10	100	FL
5491	10	10	100	
5492	10	10	100	
5493	10	10	100	
5494	10	10	100	
5495	10	10	100	
5496	10	10	100	
5497	10	10	100	
5498	10	10	100	
5499	10	10	100	
5500	10	10	100	
5501	10	10	100	
5502	10	10	100	
5503	10	10	100	
5504	10	10	100	
5505	10	10	100	
5506	10	10	100	
5507	10	10	100	
5508	10	10	100	
5509	10	10	100	
5510	10	10	100	FH
5511	10	0	0	

9.2.7. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary				
Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail
FCC TYPE 1	30	93.33	60	Pass
FCC TYPE 2	30	93.33	60	Pass
FCC TYPE 3	30	86.67	60	Pass
FCC TYPE 4	30	83.33	60	Pass
Aggregate		89.17	80	Pass
FCC TYPE 5	30	96.67	80	Pass
FCC TYPE 6	42	100.00	70	Pass

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Fixed Radar Type 1	
1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst	
Trial	Successful Detection (Yes/No)
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	Yes
8	No
9	Yes
10	Yes
11	Yes
12	Yes
13	Yes
14	Yes
15	Yes
16	Yes
17	Yes
18	Yes
19	Yes
20	Yes
21	Yes
22	Yes
23	Yes
24	Yes
25	Yes
26	Yes
27	Yes
28	No
29	Yes
30	Yes

TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
2001	3.2	214.00	26	Yes
2002	1.4	169.00	26	Yes
2003	4.7	161.00	24	Yes
2004	2.7	227.00	28	Yes
2005	4.7	219.00	28	Yes
2006	3.8	212.00	28	Yes
2007	4.5	229.00	24	Yes
2008	1.9	222.00	28	Yes
2009	2.3	175.00	29	Yes
2010	2	158.00	29	Yes
2011	4.8	198.00	28	Yes
2012	3.6	201.00	29	Yes
2013	4.9	204.00	24	Yes
2014	2.4	217.00	26	Yes
2015	3.3	196.00	24	Yes
2016	3.1	218.00	25	Yes
2017	4.6	200.00	25	Yes
2018	1.1	162.00	23	Yes
2019	2.1	208.00	25	Yes
2020	3.5	182.00	28	Yes
2021	1.8	157.00	26	Yes
2022	1.7	179.00	28	Yes
2023	1.4	195.00	29	Yes
2024	1.4	205.00	25	Yes
2025	2.9	163.00	24	Yes
2026	4.5	171.00	27	Yes
2027	1.1	203.00	24	Yes
2028	3.2	156.00	23	No
2029	3.2	202.00	28	Yes
2030	2.6	180.00	23	No

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
3001	8.4	499.00	18	Yes
3002	8.1	266.00	16	Yes
3003	9.5	284.00	16	No
3004	9.6	271.00	18	Yes
3005	6.9	289.00	17	Yes
3006	6.4	346.00	18	Yes
3007	8.4	307.00	16	Yes
3008	7	299.00	17	Yes
3009	8.6	469.00	18	Yes
3010	8.9	391.00	17	Yes
3011	7.1	255.00	17	Yes
3012	8	451.00	16	Yes
3013	9.4	427.00	16	Yes
3014	5.9	486.00	17	Yes
3015	8.1	471.00	18	Yes
3016	7.6	377.00	17	Yes
3017	7.7	457.00	17	Yes
3018	6.6	427.00	18	Yes
3019	6.4	272.00	17	Yes
3020	8.3	390.00	17	Yes
3021	8.6	446.00	18	Yes
3022	6.9	431.00	17	No
3023	5.6	497.00	18	Yes
3024	9.6	250.00	17	Yes
3025	8	435.00	18	Yes
3026	8.9	325.00	18	Yes
3027	8.3	440.00	17	Yes
3028	6.5	445.00	16	Yes
3029	7.1	269	17	No
3030	9.3	447	16	No

TYPE 4 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 4				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
4001	12.9	417.00	16	Yes
4002	13.8	363.00	16	No
4003	19.4	273.00	14	Yes
4004	16.2	424.00	14	Yes
4005	20	348.00	12	Yes
4006	20	396.00	13	Yes
4007	13.3	290.00	14	Yes
4008	15.2	442.00	16	Yes
4009	15.4	418.00	12	Yes
4010	11.9	480.00	13	Yes
4011	10	417.00	16	Yes
4012	15.5	414.00	12	Yes
4013	18.7	381.00	16	Yes
4014	16.8	320.00	14	No
4015	13.5	268.00	16	Yes
4016	19.3	417.00	16	No
4017	14.6	472.00	16	Yes
4018	17.1	496.00	14	Yes
4019	12.6	366.00	12	Yes
4020	20	417.00	15	No
4021	14.7	358.00	14	Yes
4022	16.6	253.00	14	Yes
4023	16.4	499.00	16	Yes
4024	12.2	379.00	13	Yes
4025	19	390.00	16	Yes
4026	13.5	259.00	16	Yes
4027	10.8	258.00	13	No
4028	15.3	320.00	12	Yes
4029	12.9	492.00	14	Yes
4030	16.6	477.00	14	Yes

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5	
Trial	Successful Detection (Yes/No)
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	Yes
8	Yes
9	Yes
10	Yes
11	Yes
12	Yes
13	Yes
14	Yes
15	Yes
16	Yes
17	Yes
18	Yes
19	No
20	Yes
21	Yes
22	Yes
23	Yes
24	Yes
25	Yes
26	Yes
27	Yes
28	Yes
29	Yes
30	Yes

Note: The Type 5 randomized parameters are shown in a separate document.

TYPE 6 DETECTION PROBABILITY

Data Sheet for FCC Hopping Radar Type 6				
1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop				
NTIA August 2005 Hopping Sequence				
Trial	Starting Index Within Sequence (Base 1)	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	116	5490	1	Yes
2	591	5491	6	Yes
3	1066	5492	3	Yes
4	1541	5493	2	Yes
5	2016	5494	5	Yes
6	2491	5495	6	Yes
7	2966	5496	5	Yes
8	3441	5497	3	Yes
9	3916	5498	2	Yes
10	4391	5499	4	Yes
11	4866	5500	7	Yes
12	5341	5501	5	Yes
13	5816	5502	4	Yes
14	6291	5503	5	Yes
15	6766	5504	5	Yes
16	7241	5505	2	Yes
17	7716	5506	5	Yes
18	8191	5507	5	Yes
19	8666	5508	3	Yes
20	9141	5509	6	Yes
21	9616	5510	7	Yes
22	10091	5490	3	Yes
23	10566	5491	3	Yes
24	11041	5492	7	Yes
25	11516	5493	6	Yes
26	11991	5494	9	Yes
27	12466	5495	6	Yes
28	12941	5496	8	Yes
29	13416	5497	9	Yes
30	13891	5498	3	Yes
31	14366	5499	5	Yes
32	14841	5500	3	Yes
33	15316	5501	3	Yes
34	15791	5502	3	Yes
35	16266	5503	5	Yes
36	17216	5504	4	Yes
37	17691	5505	5	Yes
38	18166	5506	7	Yes
39	18641	5507	4	Yes
40	19116	5508	6	Yes
41	19591	5509	2	Yes
42	20066	5510	7	Yes

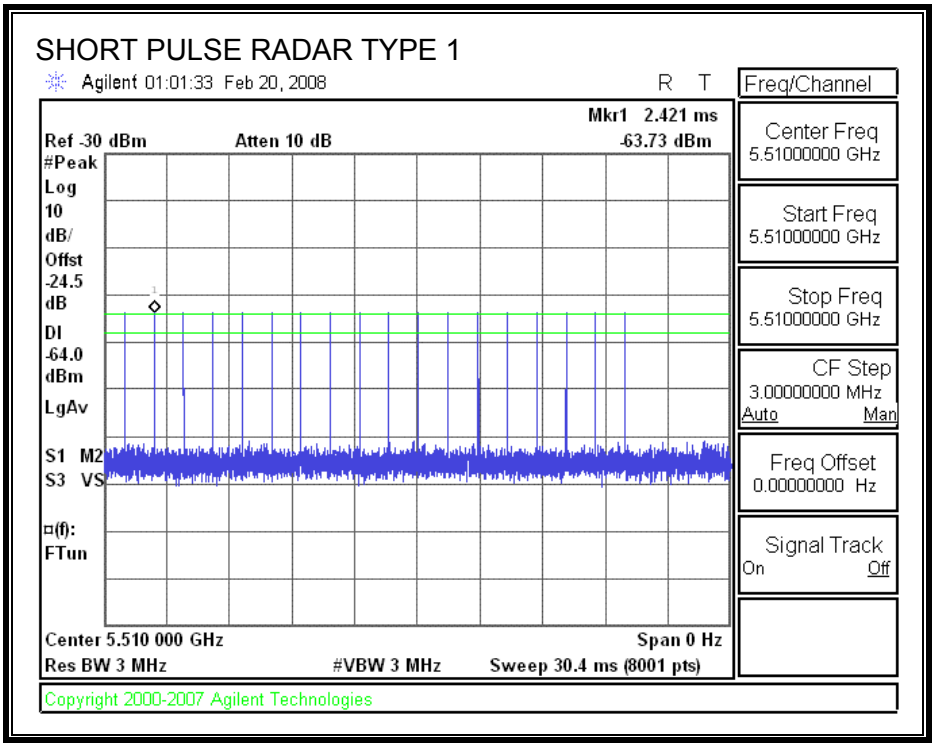
9.3. RESULTS FOR 40 MHz BANDWIDTH MODE

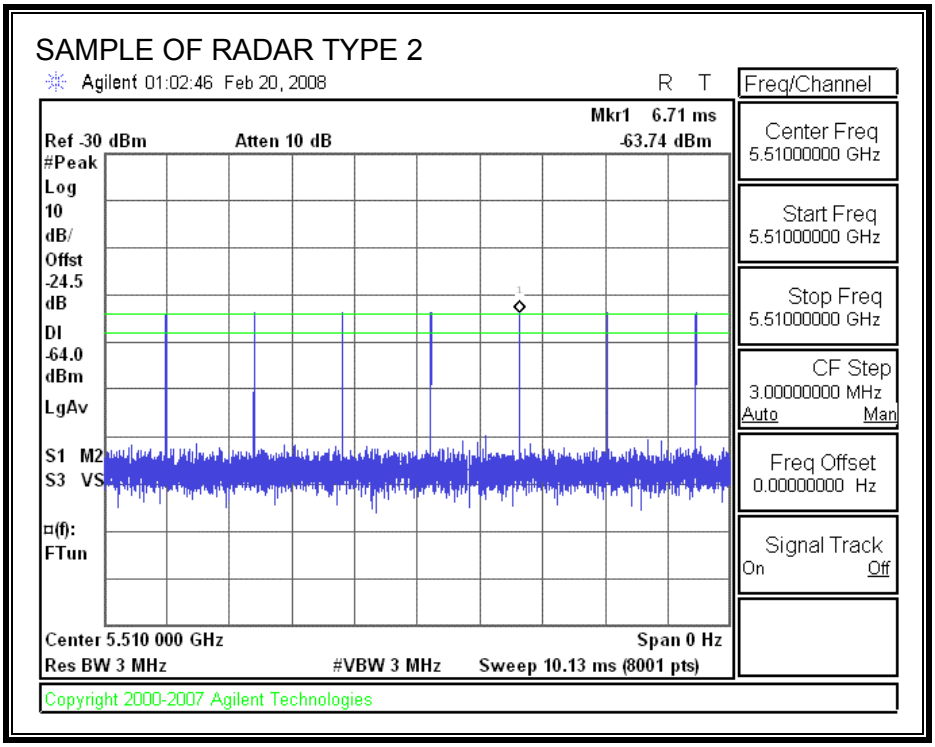
9.3.1. TEST CHANNEL

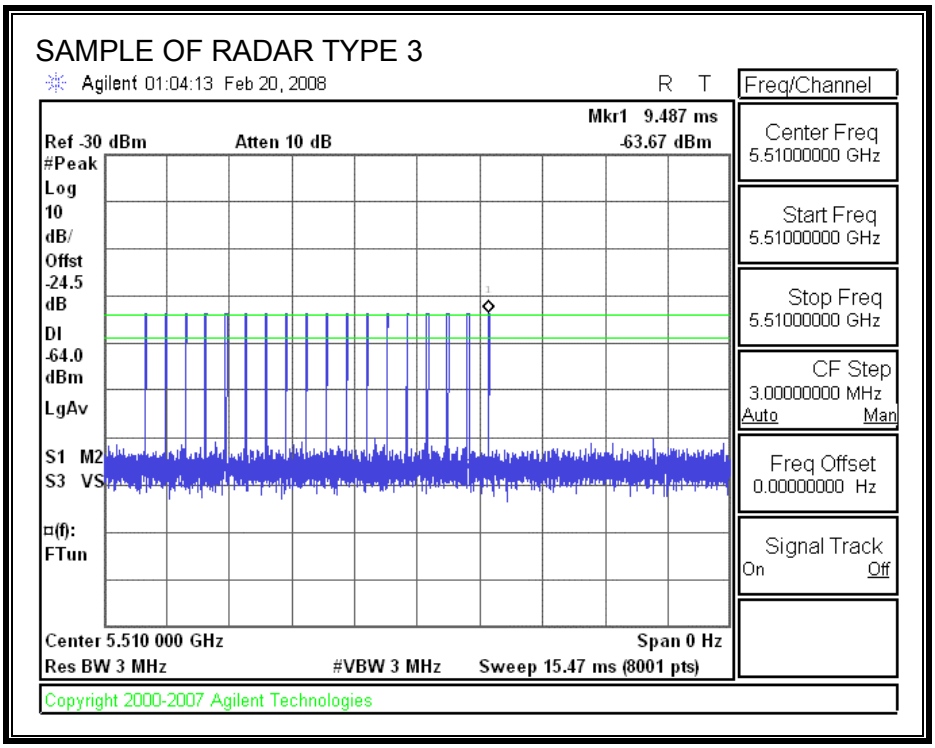
All tests were performed at a channel center frequency of 5510 MHz. Measurements were performed using radiated test methods.

9.3.2. PLOTS OF RADAR WAVEFORMS AND WLAN TRAFFIC

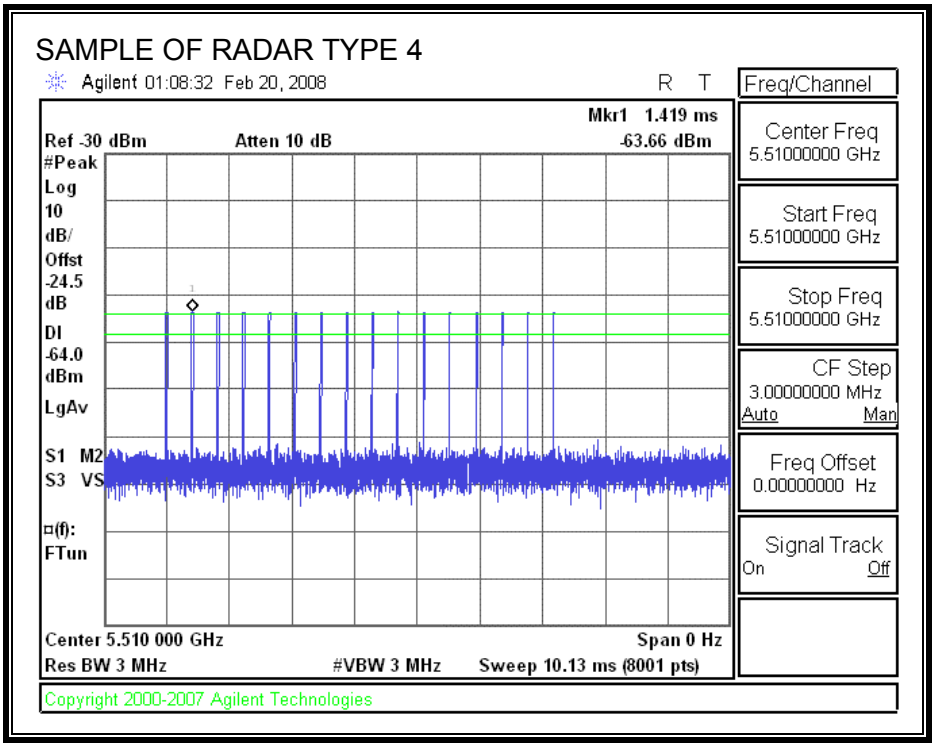
PLOTS OF RADAR WAVEFORMS



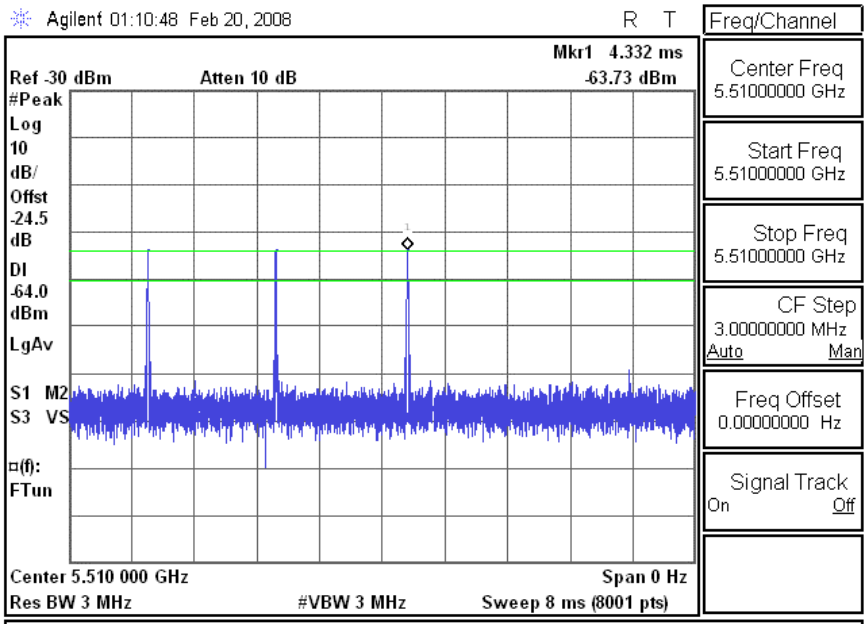


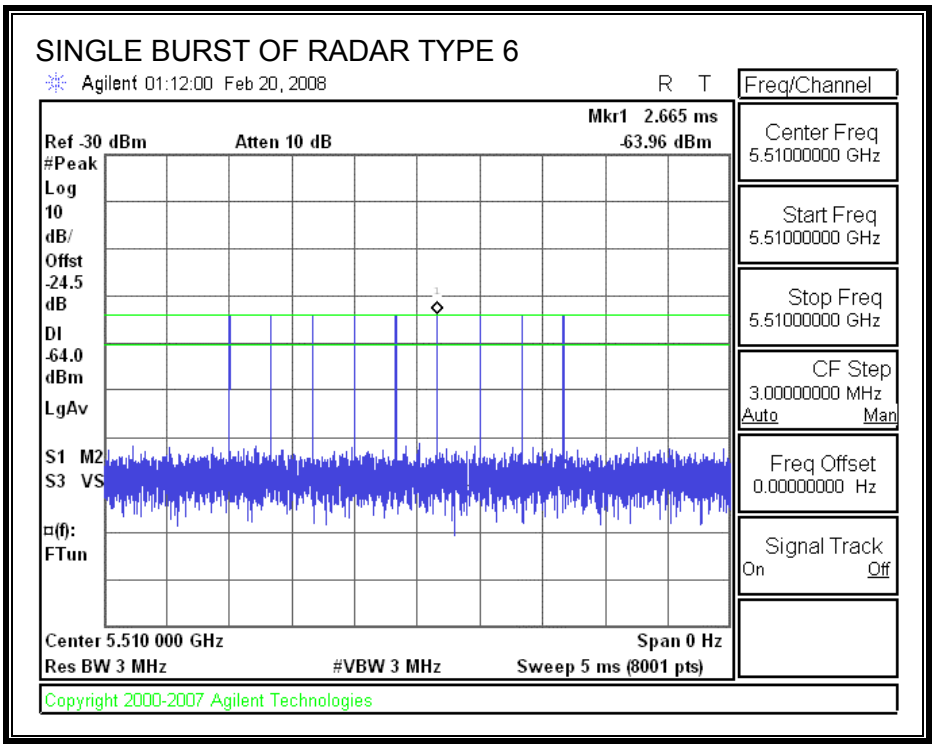


SAMPLE OF RADAR TYPE 4

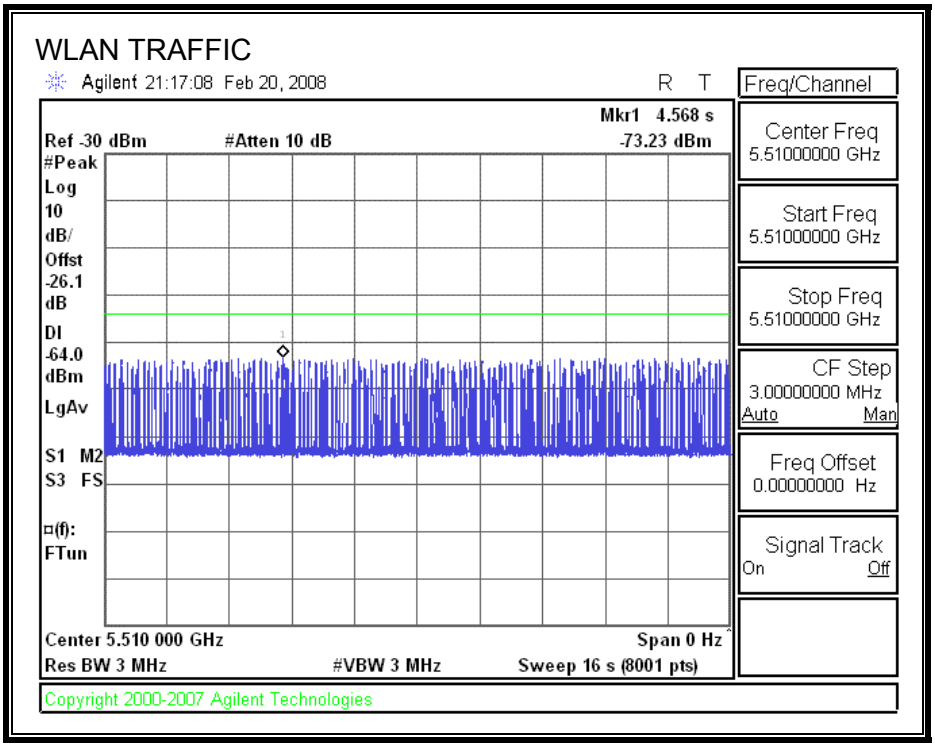


SAMPLE OF SINGLE BURST OF RADAR TYPE 5





PLOT OF WLAN TRAFFIC FROM MASTER



9.3.3. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

A link was established on channel then a software reboot command was issued to the EUT. The time from the cessation of traffic to the re-initialization of traffic was measured as the time required for the EUT to complete the total power-up cycle. The time to complete the initial power-up period is 60 seconds less than this total power-up time.

PROCEDURE FOR TIMING OF RADAR BURST

With a link established on channel, the EUT was rebooted. A radar signal was triggered within 0 to 6 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

The Non-Occupancy list was cleared. With a link established on channel, the EUT was rebooted. A radar signal was triggered within 54 to 60 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

QUANTITATIVE RESULTS

No Radar Triggered

Timing of Reboot (sec)	Timing of Start of Traffic (sec)	Total Power-up Cycle Time (sec)	Initial Power-up Cycle Time (sec)
22.97	129.60	106.63	46.63

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
24.95	74.75	49.80	3.17

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
25	128.70	103.70	57.07

QUALITATIVE RESULTS

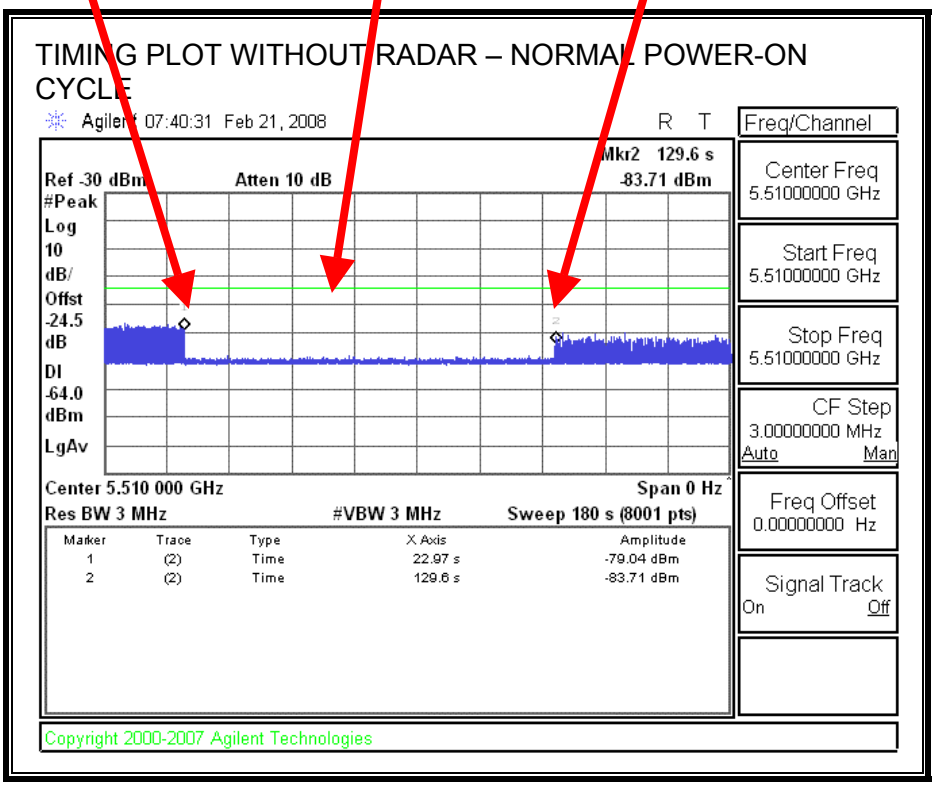
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected EUT does not display any radar parameter values	No transmissions on channel
Within 54 to 60 second window	EUT indicates radar detected EUT does not display any radar parameter values	No transmissions on channel

TIMING PLOT WITHOUT RADAR DURING CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

End of CAC
Traffic is Initiated



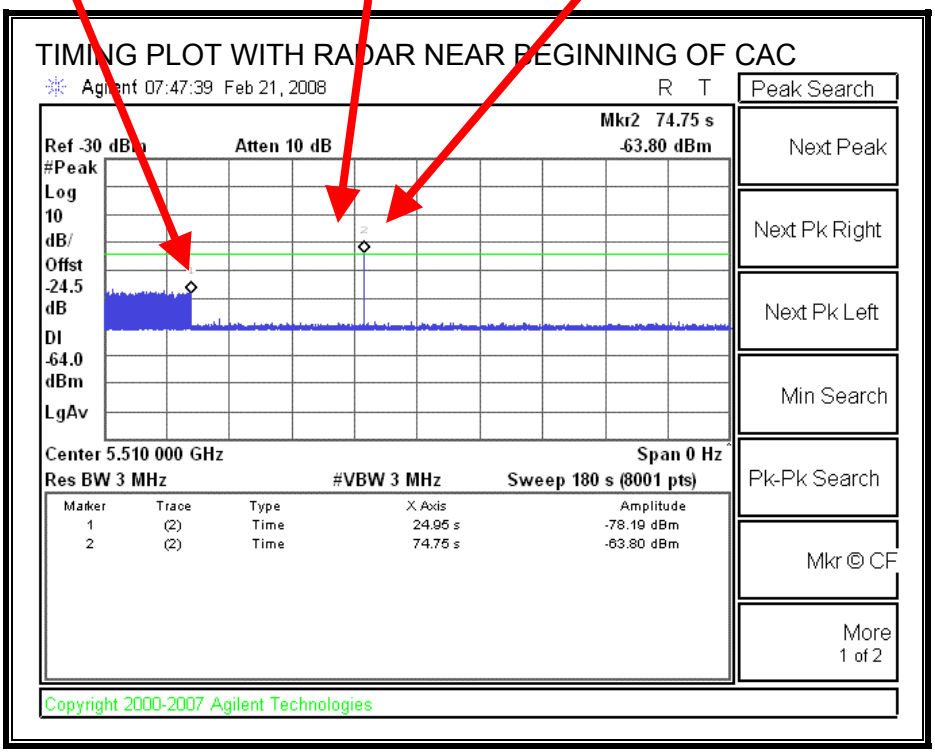
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

TIMING PLOT WITH RADAR NEAR BEGINNING OF CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



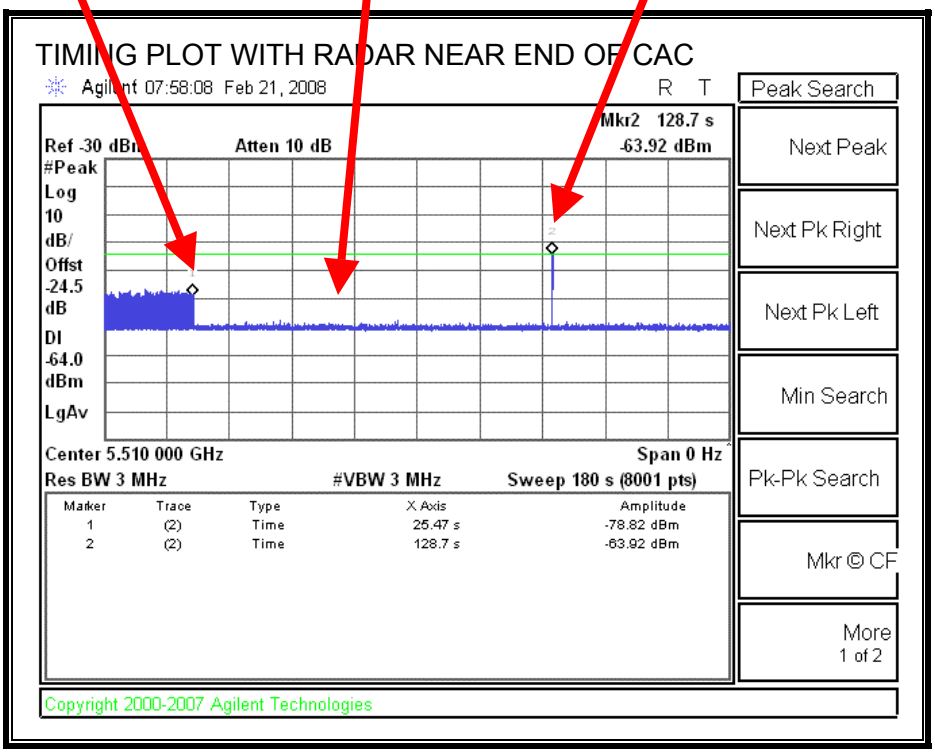
No EUT transmissions were observed after the radar signal.

TIMING PLOT WITH RADAR NEAR END OF CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

9.3.4. MOVE AND CLOSING TIME

REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =
(Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

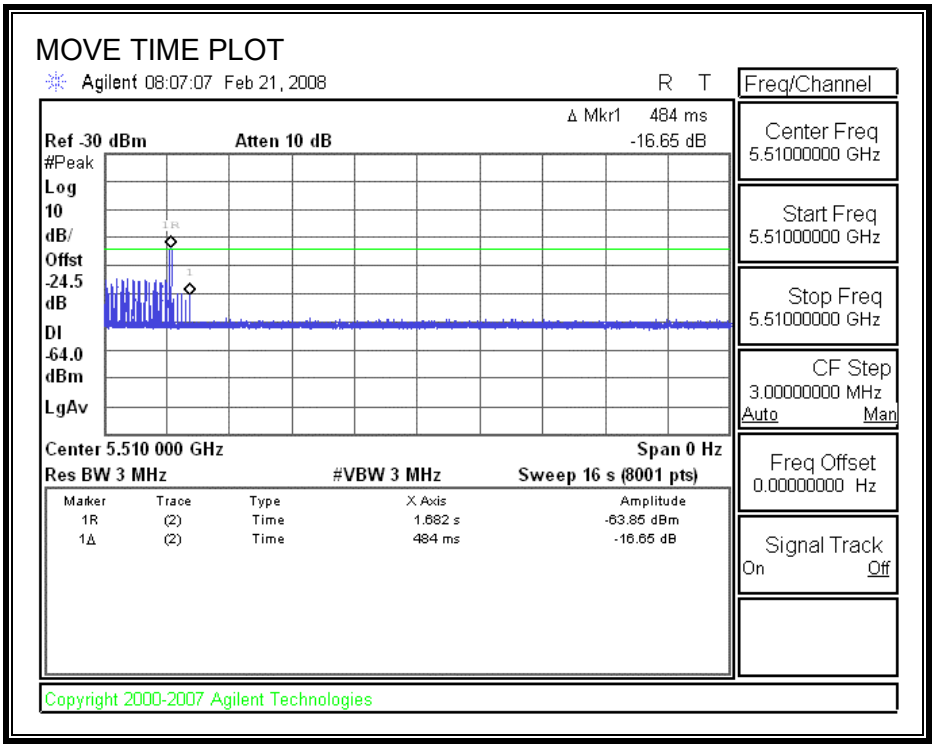
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

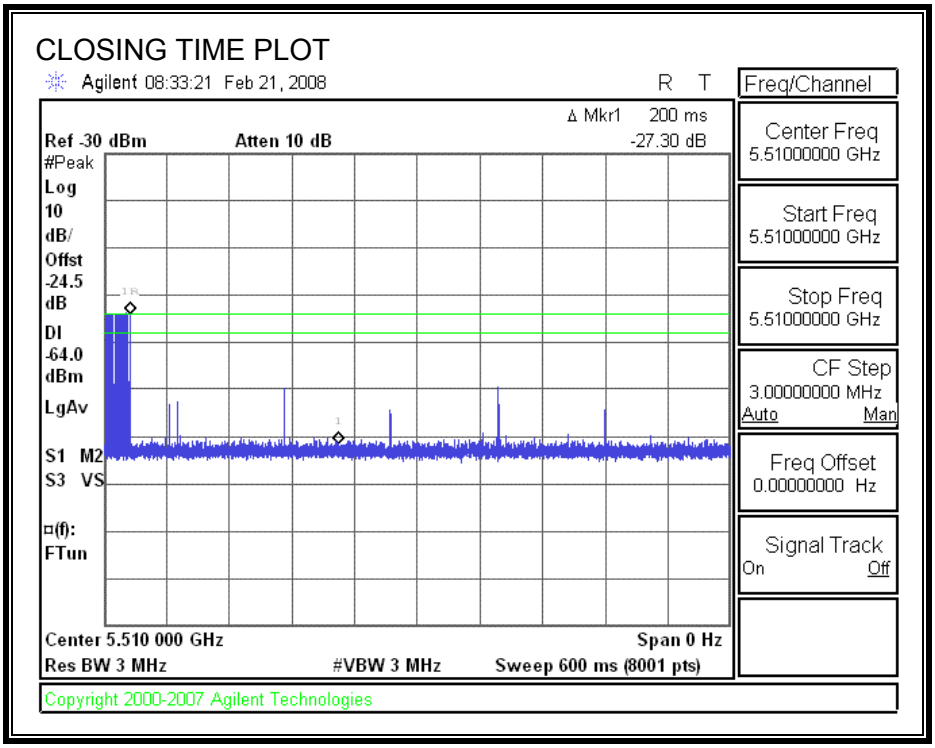
Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.484	10

Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	6.0	60
IC	24.0	260

MOVE TIME



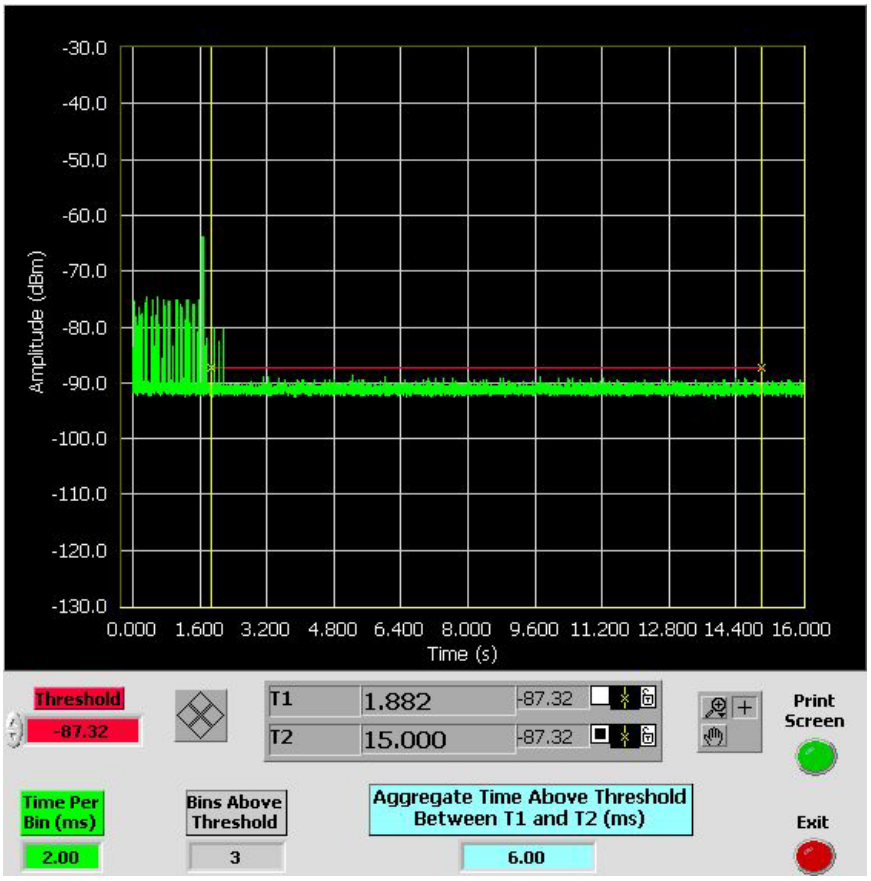
CHANNEL CLOSING TIME



FCC AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

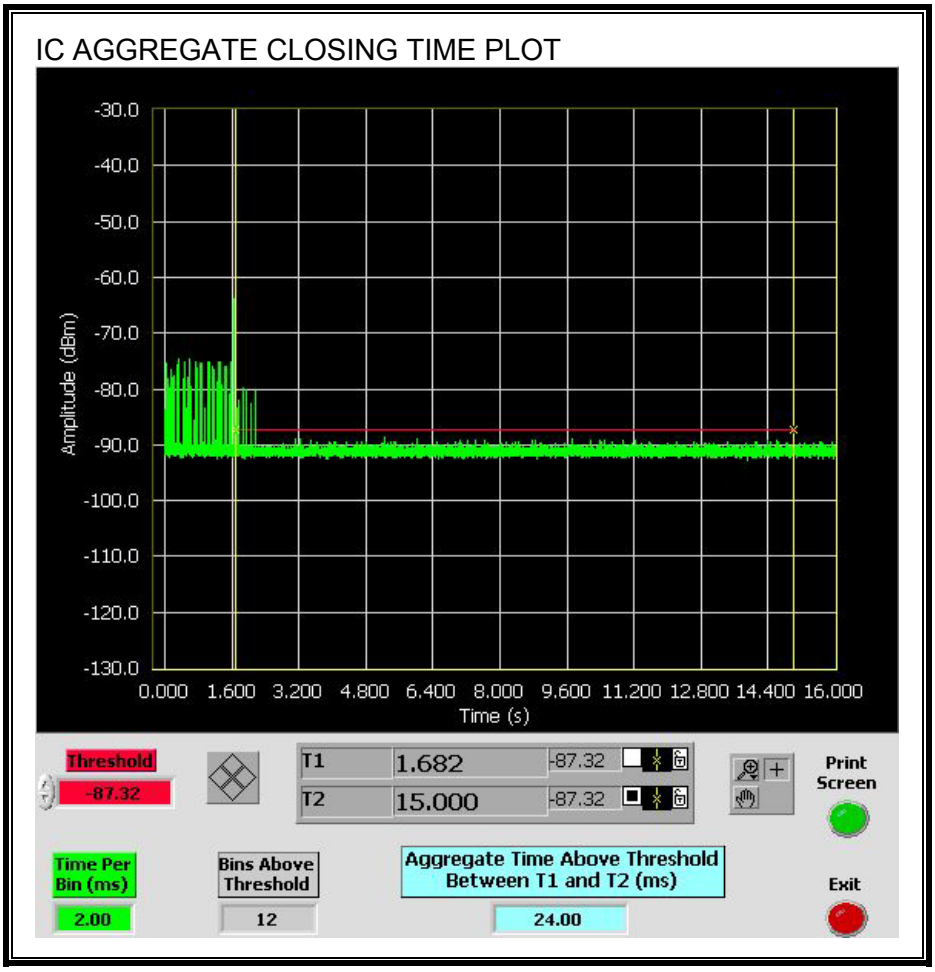
Only intermittent transmissions are observed during the aggregate monitoring period.

FCC AGGREGATE CLOSING TIME PLOT



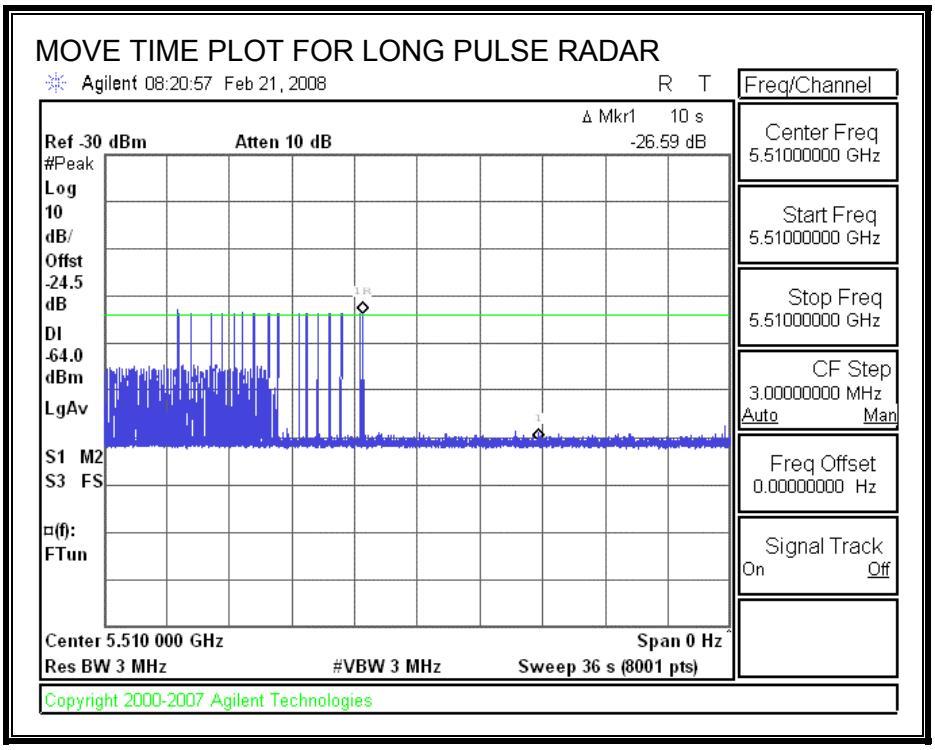
IC AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

The traffic ceases prior to 10 seconds after the end of the radar waveform.

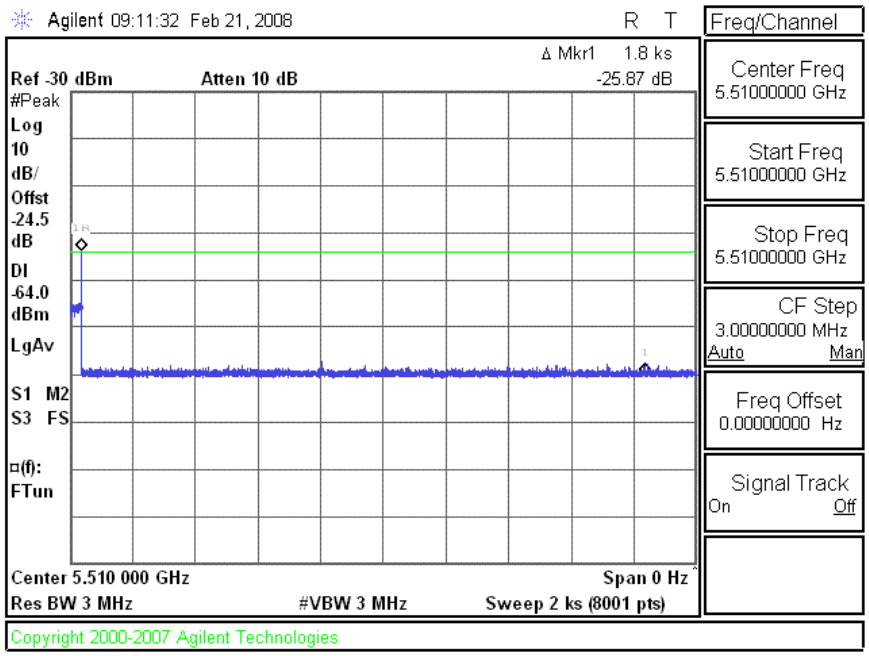


9.3.5. NON-OCCUPANCY PERIOD

RESULTS

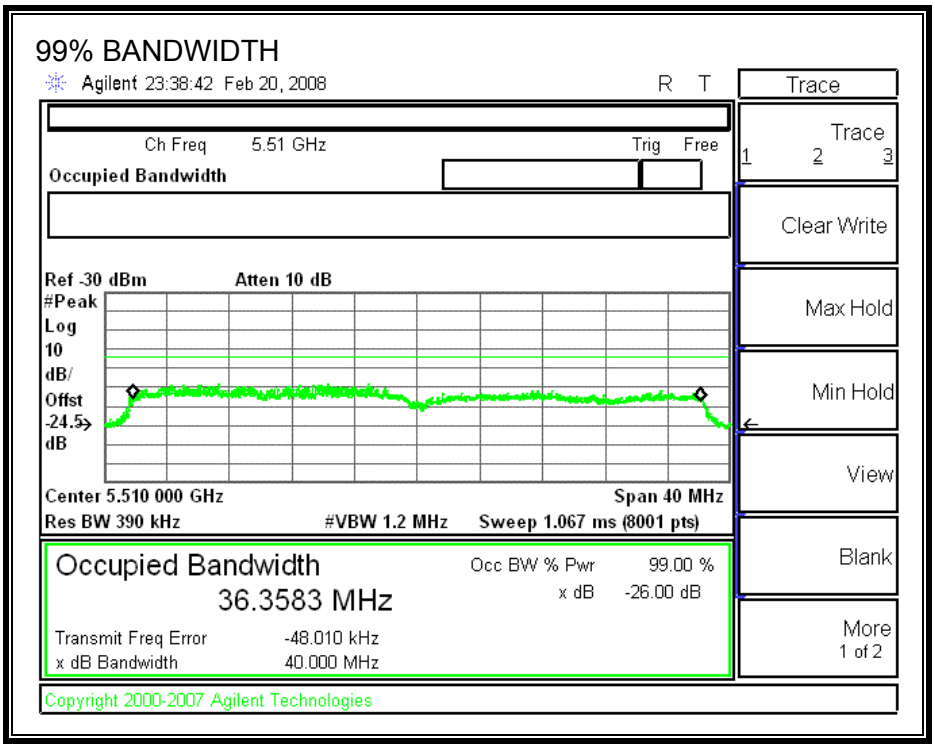
No EUT transmissions were observed on the test channel during the 30-minute observation time.

NON-OCCUPANCY PERIOD PLOT



9.3.6. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER BANDWIDTH



RESULTS

FL (MHz)	FH (MHz)	Detection Bandwidth (MHz)	99% Power Bandwidth (MHz)	Ratio of Detection BW to 99% Power BW (%)	Minimum Limit (%)
5490	5530	40	36.358	110.0	80

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

FCC Type 1 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst

Frequency (MHz)	Number of Trials	Number Detected	Detection (%)	Mark
5490	10	10	100	FL
5491	10	10	100	
5492	10	10	100	
5493	10	10	100	
5494	10	10	100	
5495	10	10	100	
5496	10	10	100	
5497	10	10	100	
5498	10	10	100	
5499	10	10	100	
5500	10	10	100	
5501	10	10	100	
5502	10	10	100	
5503	10	10	100	
5504	10	10	100	
5505	10	10	100	
5506	10	10	100	
5507	10	10	100	
5508	10	10	100	
5509	10	10	100	
5510	10	10	100	
5511	10	10	100	
5512	10	10	100	
5513	10	10	100	
5514	10	10	100	
5515	10	10	100	
5516	10	10	100	
5517	10	10	100	
5518	10	10	100	
5519	10	10	100	
5520	10	10	100	
5521	10	10	100	
5522	10	10	100	
5523	10	10	100	
5524	10	10	100	
5525	10	10	100	
5526	10	10	100	
5527	10	10	100	
5528	10	10	100	
5529	10	10	100	
5530	10	10	100	FH

9.3.7. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary				
Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail
FCC TYPE 1	30	93.33	60	Pass
FCC TYPE 2	30	100.00	60	Pass
FCC TYPE 3	30	86.67	60	Pass
FCC TYPE 4	30	80.00	60	Pass
Aggregate		90.00	80	Pass
FCC TYPE 5	30	96.67	80	Pass
FCC TYPE 6	41	100.00	70	Pass

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Fixed Radar Type 1	
1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst	
Trial	Successful Detection (Yes/No)
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	No
8	Yes
9	Yes
10	Yes
11	Yes
12	Yes
13	Yes
14	Yes
15	Yes
16	Yes
17	No
18	Yes
19	Yes
20	Yes
21	Yes
22	Yes
23	Yes
24	Yes
25	Yes
26	Yes
27	Yes
28	Yes
29	Yes
30	Yes

TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
2001	3.2	214.00	26	Yes
2002	1.4	169.00	26	Yes
2003	4.7	161.00	24	Yes
2004	2.7	227.00	28	Yes
2005	4.7	219.00	28	Yes
2006	3.8	212.00	28	Yes
2007	4.5	229.00	24	Yes
2008	1.9	222.00	28	Yes
2009	2.3	175.00	29	Yes
2010	2	158.00	29	Yes
2011	4.8	198.00	28	Yes
2012	3.6	201.00	29	Yes
2013	4.9	204.00	24	Yes
2014	2.4	217.00	26	Yes
2015	3.3	196.00	24	Yes
2016	3.1	218.00	25	Yes
2017	4.6	200.00	25	Yes
2018	1.1	162.00	23	Yes
2019	2.1	208.00	25	Yes
2020	3.5	182.00	28	Yes
2021	1.8	157.00	26	Yes
2022	1.7	179.00	28	Yes
2023	1.4	195.00	29	Yes
2024	1.4	205.00	25	Yes
2025	2.9	163.00	24	Yes
2026	4.5	171.00	27	Yes
2027	1.1	203.00	24	Yes
2028	3.2	156.00	23	Yes
2029	3.2	202.00	28	Yes
2030	2.6	180.00	23	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
3001	8.4	499.00	18	Yes
3002	8.1	266.00	16	No
3003	9.5	284.00	16	Yes
3004	9.6	271.00	18	Yes
3005	6.9	289.00	17	No
3006	6.4	346.00	18	Yes
3007	8.4	307.00	16	No
3008	7	299.00	17	No
3009	8.6	469.00	18	Yes
3010	8.9	391.00	17	Yes
3011	7.1	255.00	17	Yes
3012	8	451.00	16	Yes
3013	9.4	427.00	16	Yes
3014	5.9	486.00	17	Yes
3015	8.1	471.00	18	Yes
3016	7.6	377.00	17	Yes
3017	7.7	457.00	17	Yes
3018	6.6	427.00	18	Yes
3019	6.4	272.00	17	Yes
3020	8.3	390.00	17	Yes
3021	8.6	446.00	18	Yes
3022	6.9	431.00	17	Yes
3023	5.6	497.00	18	Yes
3024	9.6	250.00	17	Yes
3025	8	435.00	18	Yes
3026	8.9	325.00	18	Yes
3027	8.3	440.00	17	Yes
3028	6.5	445.00	16	Yes
3029	7.1	269	17	Yes
3030	9.3	447	16	Yes

TYPE 4 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 4				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
4001	12.9	417.00	16	Yes
4002	13.8	363.00	16	Yes
4003	19.4	273.00	14	Yes
4004	16.2	424.00	14	Yes
4005	20	348.00	12	Yes
4006	20	396.00	13	Yes
4007	13.3	290.00	14	Yes
4008	15.2	442.00	16	Yes
4009	15.4	418.00	12	No
4010	11.9	480.00	13	Yes
4011	10	417.00	16	Yes
4012	15.5	414.00	12	Yes
4013	18.7	381.00	16	Yes
4014	16.8	320.00	14	Yes
4015	13.5	268.00	16	Yes
4016	19.3	417.00	16	No
4017	14.6	472.00	16	No
4018	17.1	496.00	14	Yes
4019	12.6	366.00	12	Yes
4020	20	417.00	15	No
4021	14.7	358.00	14	Yes
4022	16.6	253.00	14	No
4023	16.4	499.00	16	Yes
4024	12.2	379.00	13	No
4025	19	390.00	16	Yes
4026	13.5	259.00	16	Yes
4027	10.8	258.00	13	Yes
4028	15.3	320.00	12	Yes
4029	12.9	492.00	14	Yes
4030	16.6	477.00	14	Yes

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5	
Trial	Successful Detection (Yes/No)
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	Yes
8	Yes
9	Yes
10	Yes
11	Yes
12	Yes
13	Yes
14	Yes
15	Yes
16	Yes
17	Yes
18	Yes
19	No
20	Yes
21	Yes
22	Yes
23	Yes
24	Yes
25	Yes
26	Yes
27	Yes
28	Yes
29	Yes
30	Yes

Note: The Type 5 randomized parameters are shown in a separate document.

TYPE 6 DETECTION PROBABILITY

Data Sheet for FCC Hopping Radar Type 6				
1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop				
NTIA August 2005 Hopping Sequence				
Trial	Starting Index Within Sequence (Base 1)	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	186	5490	8	Yes
2	661	5491	7	Yes
3	1136	5492	8	Yes
4	1611	5493	6	Yes
5	2086	5494	9	Yes
6	2561	5495	7	Yes
7	3036	5496	7	Yes
8	3511	5497	11	Yes
9	3986	5498	6	Yes
10	4461	5499	12	Yes
11	4936	5500	11	Yes
12	5411	5501	9	Yes
13	5886	5502	8	Yes
14	6361	5503	6	Yes
15	6836	5504	8	Yes
16	7311	5505	11	Yes
17	7786	5506	11	Yes
18	8261	5507	8	Yes
19	8736	5508	8	Yes
20	9211	5509	8	Yes
21	9686	5510	9	Yes
22	10161	5511	6	Yes
23	10636	5512	8	Yes
24	11111	5513	10	Yes
25	11586	5514	13	Yes
26	12061	5515	4	Yes
27	12536	5516	8	Yes
28	13011	5517	10	Yes
29	13486	5518	6	Yes
30	13961	5519	9	Yes
31	14436	5520	9	Yes
32	14911	5521	10	Yes
33	15386	5522	8	Yes
34	15861	5523	7	Yes
35	16336	5524	7	Yes
36	16811	5525	8	Yes
37	17286	5526	5	Yes
38	17761	5527	8	Yes
39	18236	5528	9	Yes
40	18711	5529	11	Yes
41	19186	5530	13	Yes

10. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f^2)	6
30–300	61.4	0.163	1.0	6
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f^2)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

CALCULATIONS

Given

$E = \sqrt{(30 * P * G)} / d$

and

$S = E ^ 2 / 3770$

where

E = Field Strength in Volts/meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power Density in milliwatts/square centimeter

Combining equations, rearranging the terms to express the distance as a function of the remaining variables, changing to units of Power to mW and Distance to cm, and substituting the logarithmic form of power and gain yields:

$d = 0.282 * 10 ^ ((P + G) / 20) / \sqrt{S}$

where

d = MPE distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW/cm^2

Rearranging terms to calculate the power density at a specific distance yields

$S = 0.0795 * 10 ^ ((P + G) / 10) / (d^2)$

The power density in units of mW/cm^2 is converted to units of W/m^2 by multiplying by a factor of 10.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

RESULTS

(MPE distance equals 20 cm)

Mode	Band	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	FCC Power Density (mW/cm^2)	IC Power Density (W/m^2)
802.11a	5.2 GHz	20.0	18.04	9.77	0.12	1.20
802.11n H20	5.2 GHz	20.0	21.69	5.00	0.09	0.93
802.11n H40	5.2 GHz	20.0	22.02	5.00	0.10	1.00

Mode	Band	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	FCC Power Density (mW/cm^2)	IC Power Density (W/m^2)
802.11a	5.6 GHz	20.0	20.34	9.77	0.20	2.04
802.11n H20	5.6 GHz	20.0	20.46	5.00	0.07	0.70
802.11n H40	5.6 GHz	20.0	22.81	5.00	0.12	1.20

The power level used for MPE calculations is the sum of the power of all transmitter chains. Since the antennas are identical for each transmitter this is equivalent to summing the power density of all transmitters. All three antennas are assumed to be at the same location to give a worst-case estimate of the total power density at a distance of 20 cm from this point. For 802.11abg transmissions the effective legacy mode antenna gain is used (this effective gain assumes that the legacy signals are coherent thus add in voltage). For 802.11n transmissions the signals are not coherent therefore they add in power and the normal antenna gain is applicable.