FCC CFR47 PART 15 SUBPART E

INDUSTRY CANADA RSS-210 ISSUE 7

CERTIFICATION TEST REPORT
FOR

CANOPY 5400 OFDM ACCESS POINT AND SUBSCRIBER MODULE

MODEL NUMBER: 5440

FCC ID: ANZ89FT7629

IC: 109W-5400

REPORT NUMBER: 07U11448-1

ISSUE DATE: NOVEMBER 09, 2007

Prepared for

MOTOROLA-SCHAUMBURG
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Prepared by

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	11/09/07	Initial Issue	M. Heckrotte

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: MOTOROLA
1299 E. ALGONQUIN RD
SCHAUMBURG, IL 60156, U.S.A

EUT DESCRIPTION: CANOPY 5400 OFDM ACCESS POINT/SUBSCRIBER MODULE

MODEL: 5440

SERIAL NUMBER: 2069 AND 2071

DATE TESTED: NOVEMBER 05-08, 2007

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart E	No Non-Compliance Noted
RSS-210 Issue 7 Annex 9 and RSS-GEN Issue 2	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: Tested By:

MICHAEL HECKROTTE
ENGINEERING MANAGER
COMPLIANCE CERTIFICATION SERVICES

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 OFDM transceiver operating in the 5470 - 5725 MHz band with a 10 MHz nominal channel bandwidth. The EUT can be configured as an Access Point or a Subscriber Module.

Three data rates are available: 7 Mb/s with QPSK, 14 Mb/s with 16QAM, and 21 Mb/s with 64QAM.

The radio module is manufactured by Motorola.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Output Power (dBm)	Output Power (mW)
5476-5719	9.92	9.82

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The Access Point utilizes a Dipole antenna and the Subscriber Module utilizes a Patch antenna. Each antenna has a gain of 18 dBi and a 1 dB cable loss, therefore the antenna assembly gain for either version is 17 dBi.

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was Telnet.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case data rate was determined to be 7 Mb/s with QPSK modulation, based on preliminary test results of all data rates.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Dell	PP20L	NA	DoC
AC Adapter	Dell	CA65N30-00	DF263-71615-720-	DoC
AC Adapter with POE	Phihong	PSA15R-290	E27260700830010	NA

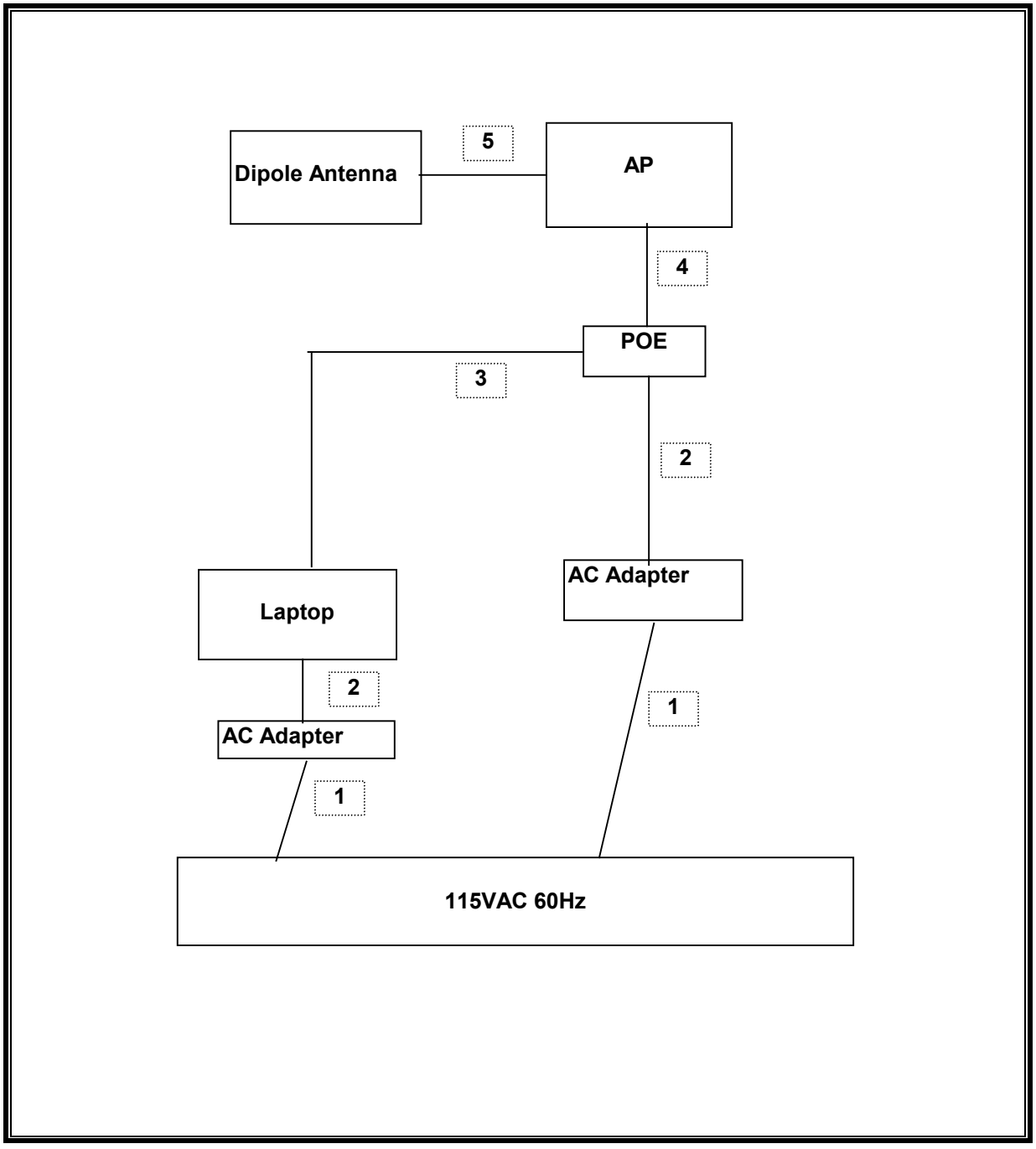
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identica Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	2	US 115V	Un-shielded	2m	No
2	DC	2	DC	Un-shielded	2m	One ferrite on POE End
3	Ethernet	1	RJ45	Un-shielded	5m	Yes
4	RJ45	1	Ethernet	Un-shielded	0.1m	Yes
5	SMA	1	Dipole Antenna	Un-shielded	0.1m	Yes

TEST SETUP

The EUT is connected to a laptop computer during the tests via a POE adapter. Test software exercised the AP.

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**	**Asset**	**Cal Date**	**Cal Due**
Antenna, Horn, 18 GHz	EMCO	3115	C00872	04/15/07	04/15/08
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	09/28/07	09/28/08
Preamplifier 26-30GHz	Miteq	NSP4000-SP2	C00990		08/24/08
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	10/03/06	09/27/08
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	05/02/06	08/07/08
Antenna, Horn, 18 GHz	ETS	3117	C01005	04/15/07	04/15/08
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/25/07	10/25/08
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	10/16/06	01/27/08
Preamplifier, 1300 MHz	Agilent / HP	8447D		05/09/07	05/09/08
SA Display Section	Agilent / HP	85662A	N02480	05/04/06	04/07/08
SA RF Section, 1.5 GHz	Agilent / HP	85680B	N02455	04/04/06	01/07/08
Quasi-Peak Adaptor	Agilent / HP	85650A	C00779	04/13/06	01/21/08
Power Meter	Agilent / HP	438A	C01068	11/29/06	09/12/08
Power Sensor, 18 GHz	Agilent / HP	8481A	N02781	01/24/07	04/30/08
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	C00981	4/11/2007	4/11/2008

7. TEST RESULTS

7.1. ANTENNA PORT TEST RESULTS

7.1.1. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

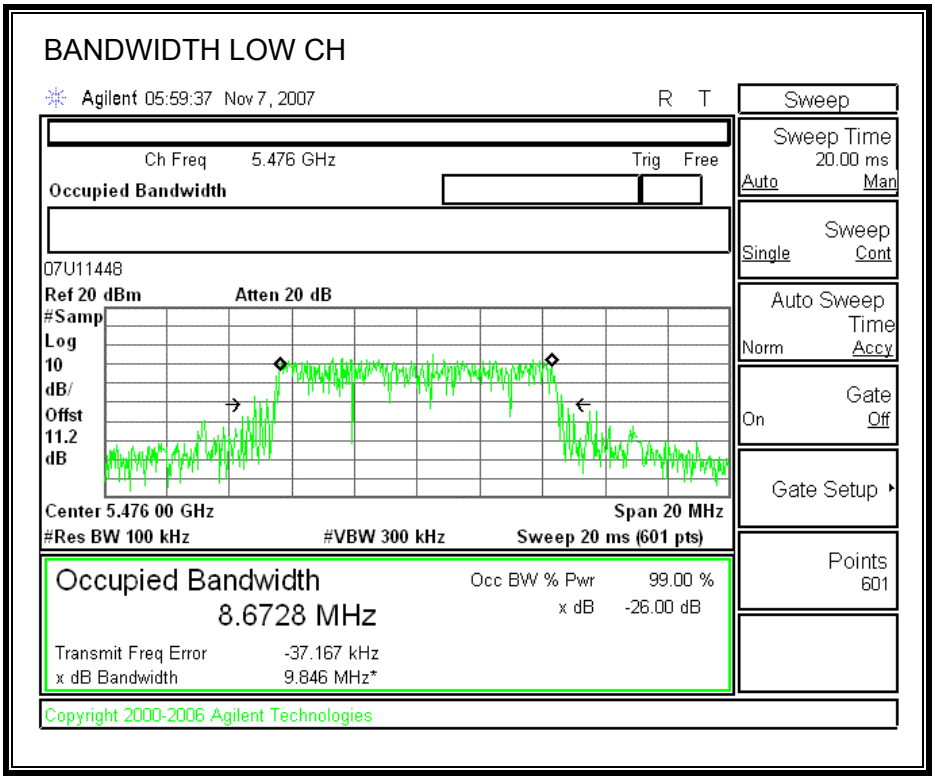
TEST PROCEDURE

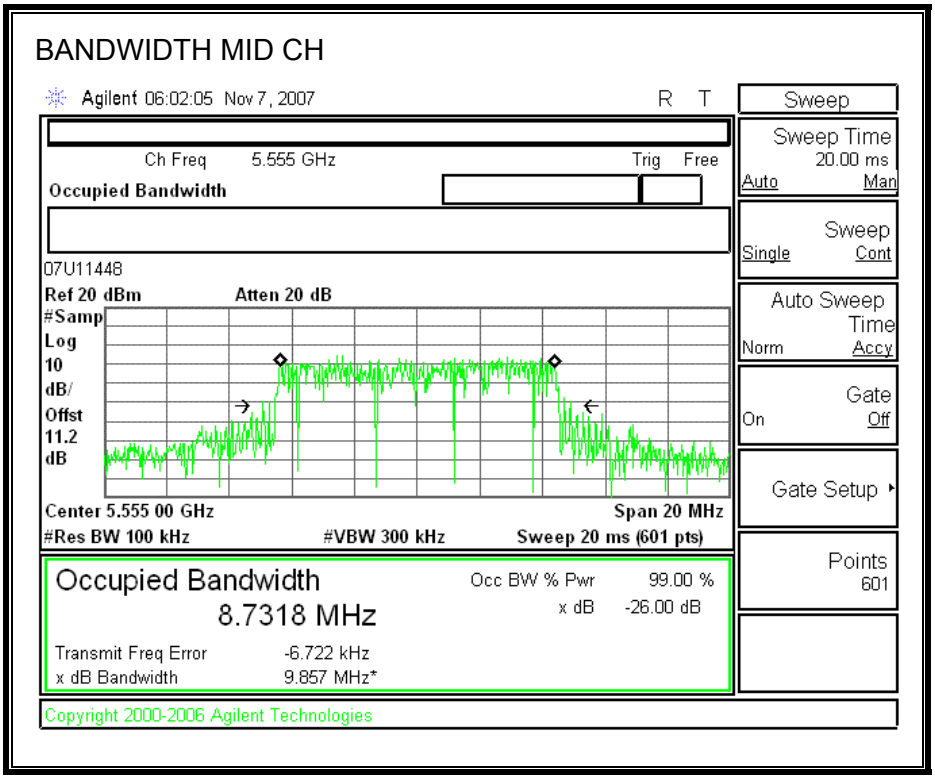
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

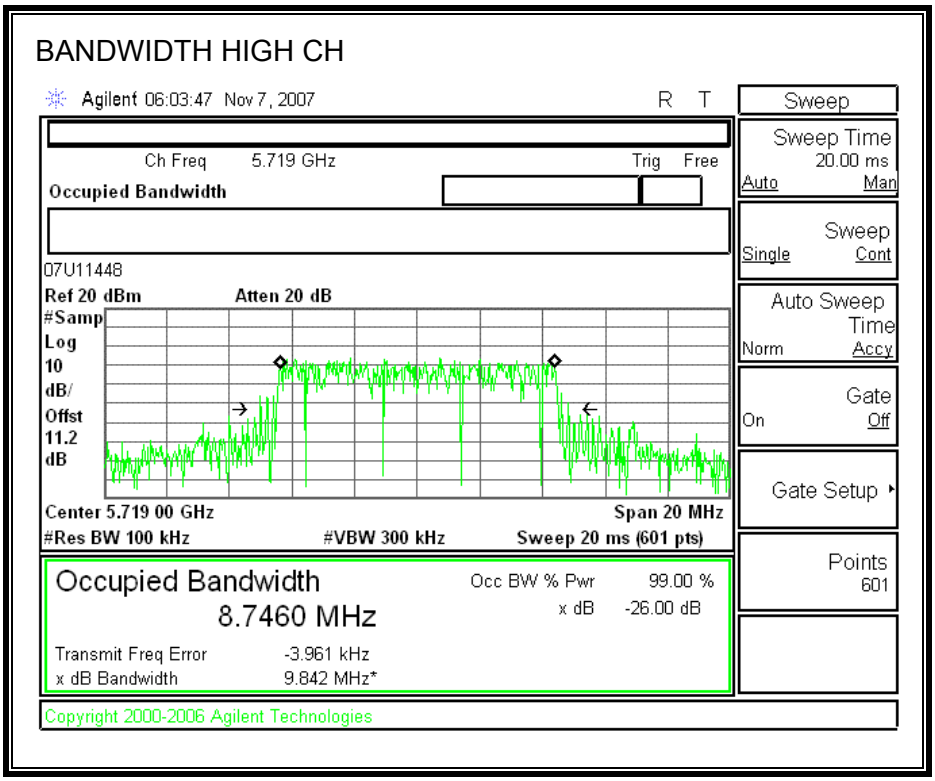
RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5476	9.846	8.6728
Middle	5555	9.857	8.7318
High	5719	9.842	8.746

26 dB and 99% BANDWIDTH







7.1.2. 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

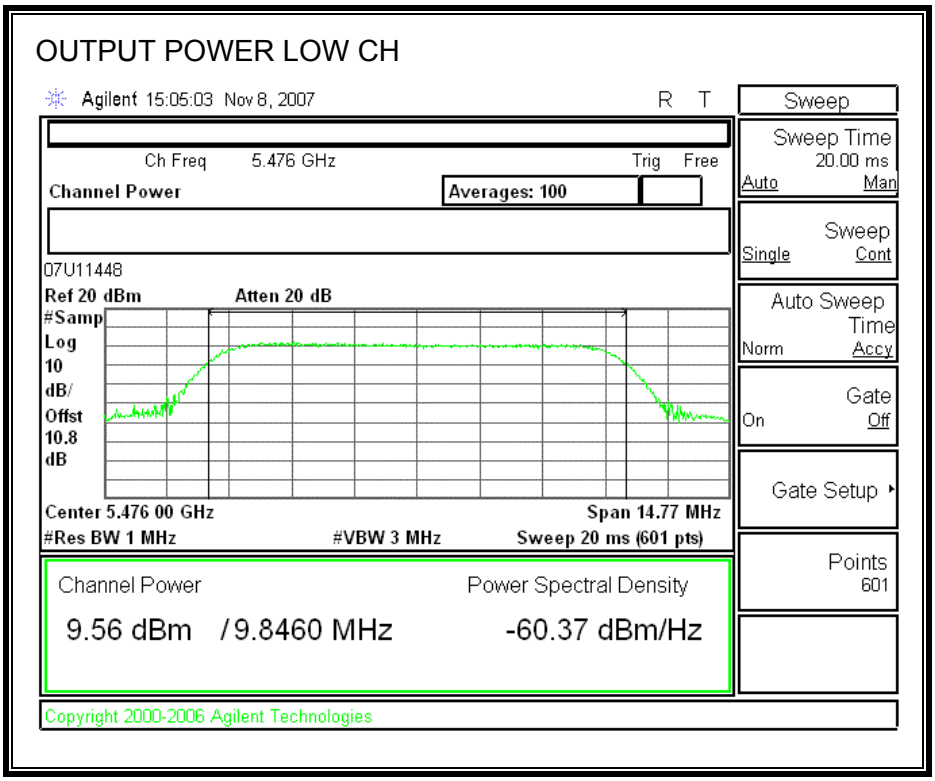
Limit

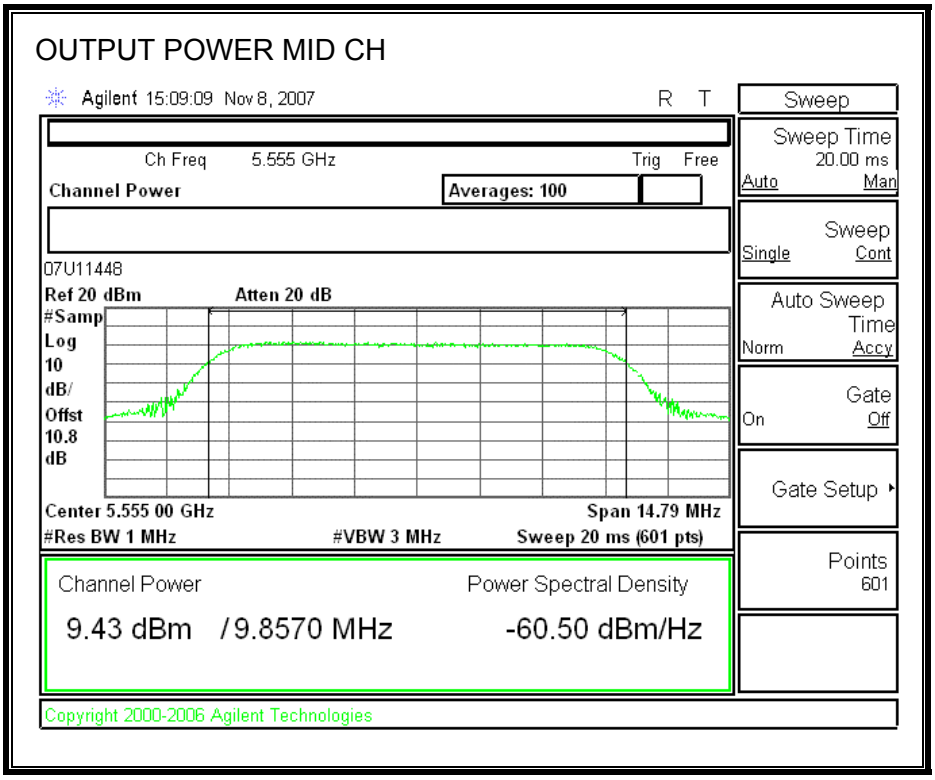
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5476	24	9.846	20.93	17.00	9.93
Mid	5555	24	9.857	20.94	17.00	9.94
High	5719	24	9.842	20.93	17.00	9.93

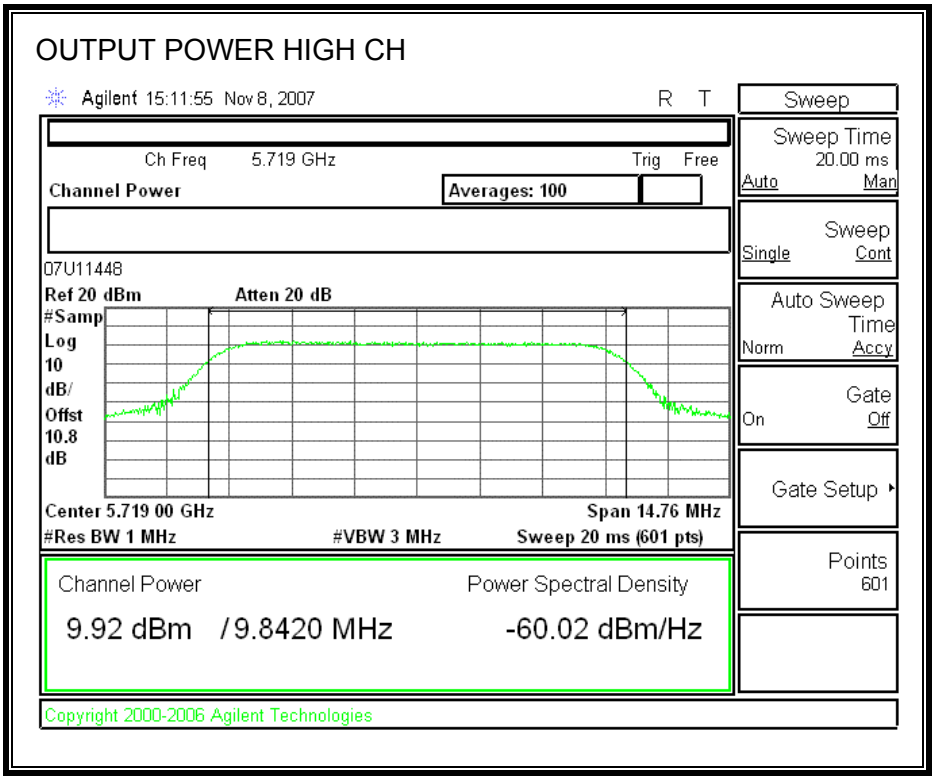
Results

Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	5476	9.56	9.93	-0.37
Mid	5555	9.43	9.94	-0.51
High	5719	9.92	9.93	-0.01

OUTPUT POWER







7.1.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
Low	5476	9.54
Middle	5555	9.41
High	5719	9.90

7.1.4. 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 antenna assembly gain is 17 dBi, the excess gain is 11 dB, therefore the limit is 0 dBm.

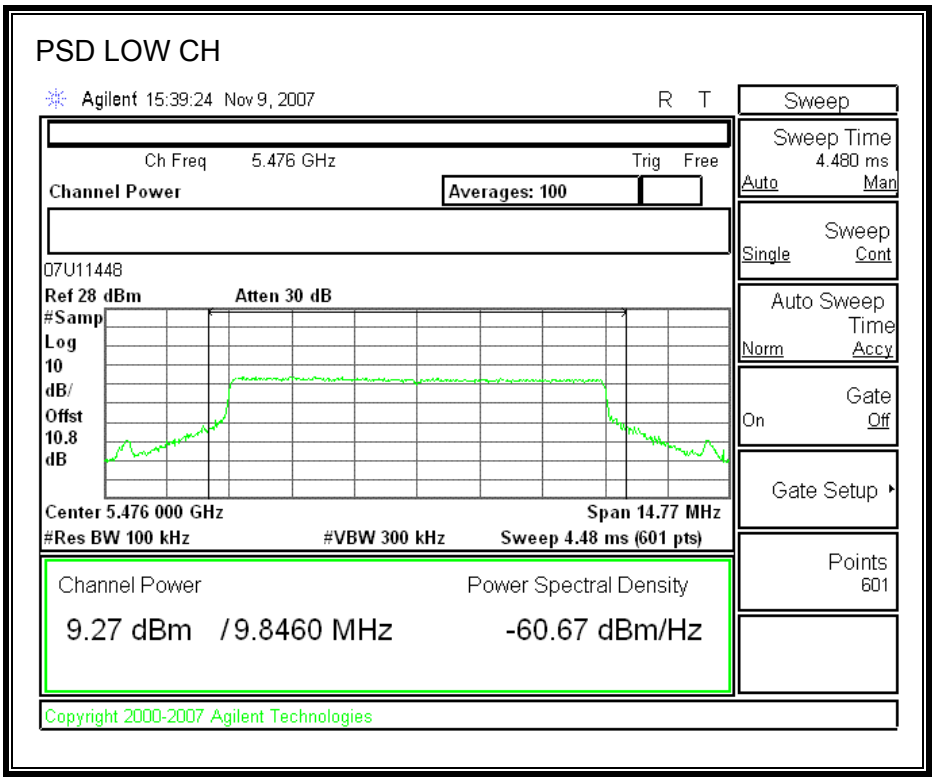
TEST PROCEDURE

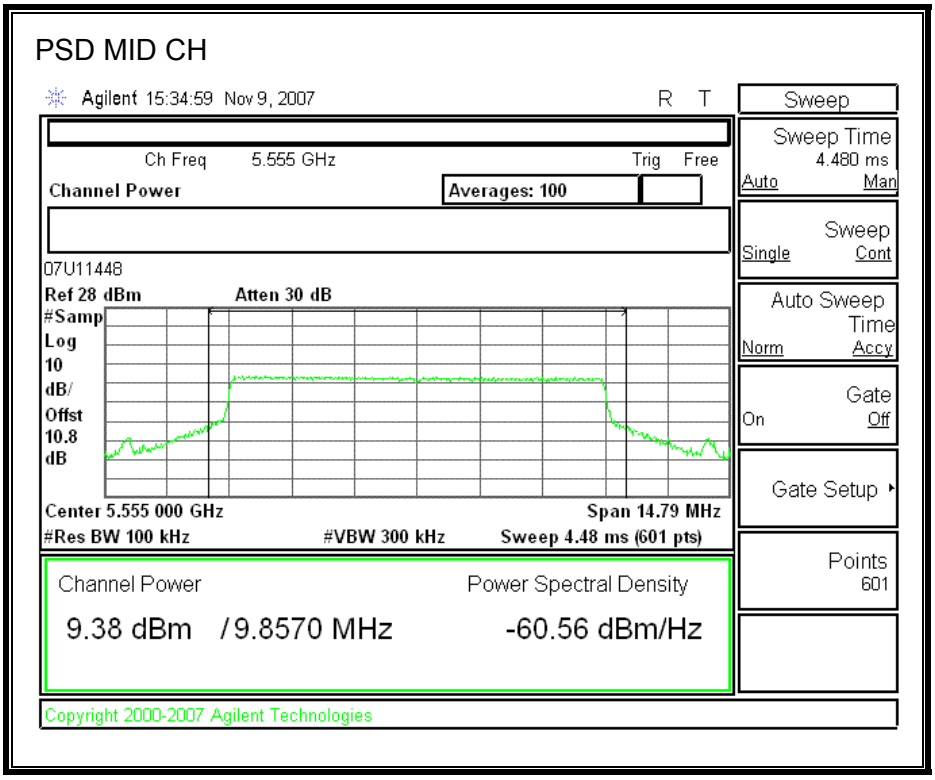
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

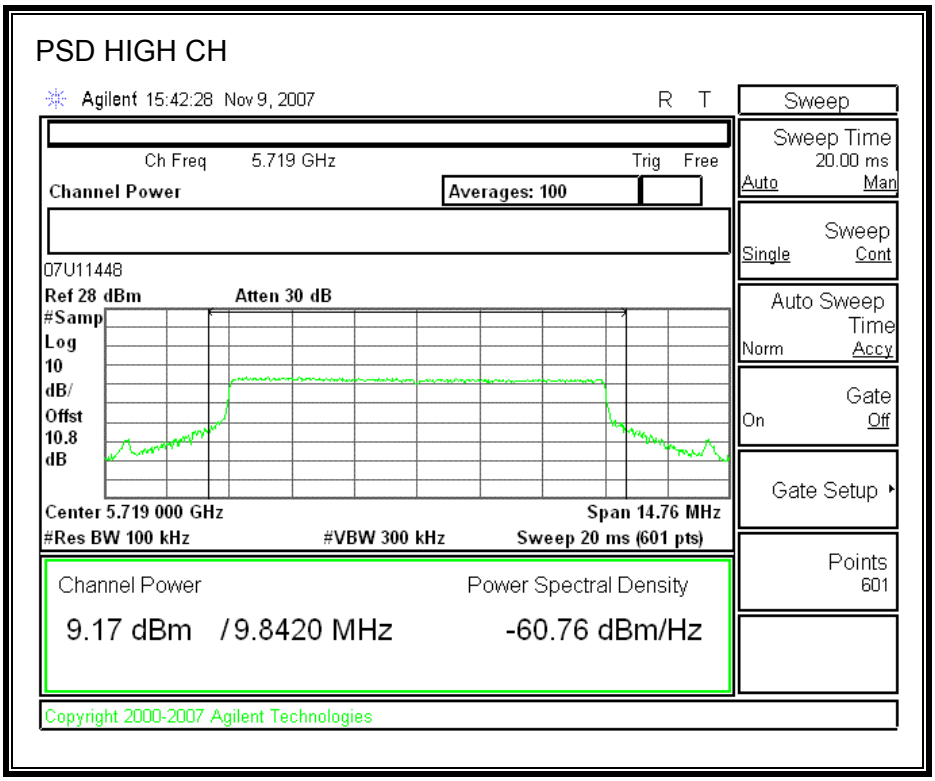
RESULTS

Channel	Frequency (MHz)	PPSD (dBm/Hz)	PPSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
Low	5476	-60.67	-0.67	0	-0.67
Middle	5555	-60.56	-0.56	0	-0.56
High	5719	-60.76	-0.76	0	-0.76

POWER SPECTRAL DENSITY







7.1.5. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST PROCEDURE

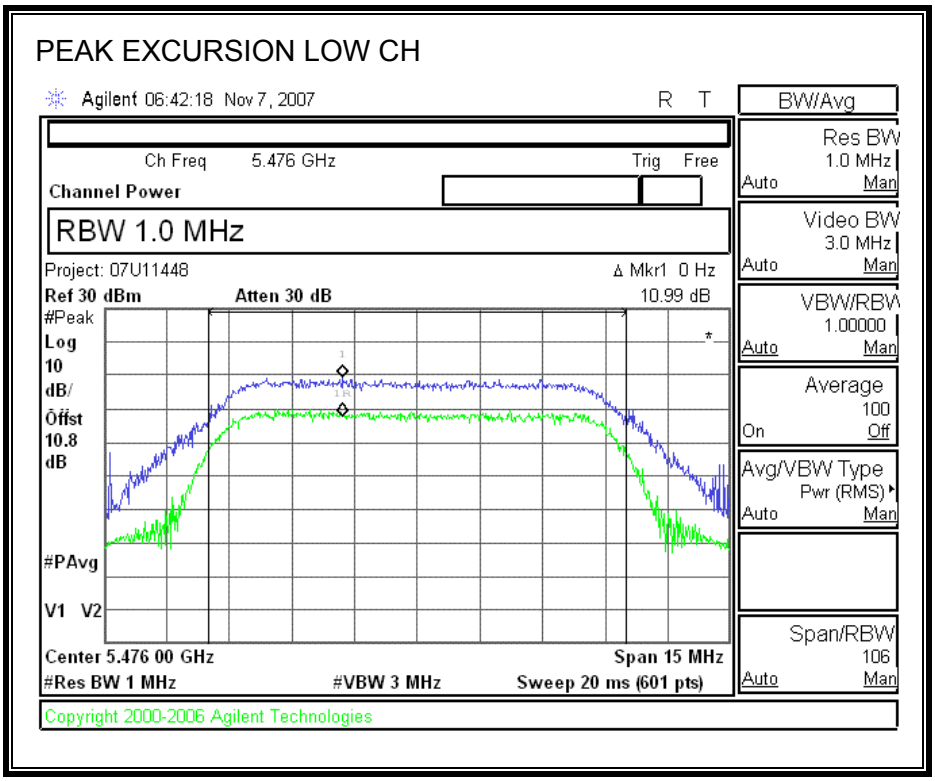
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

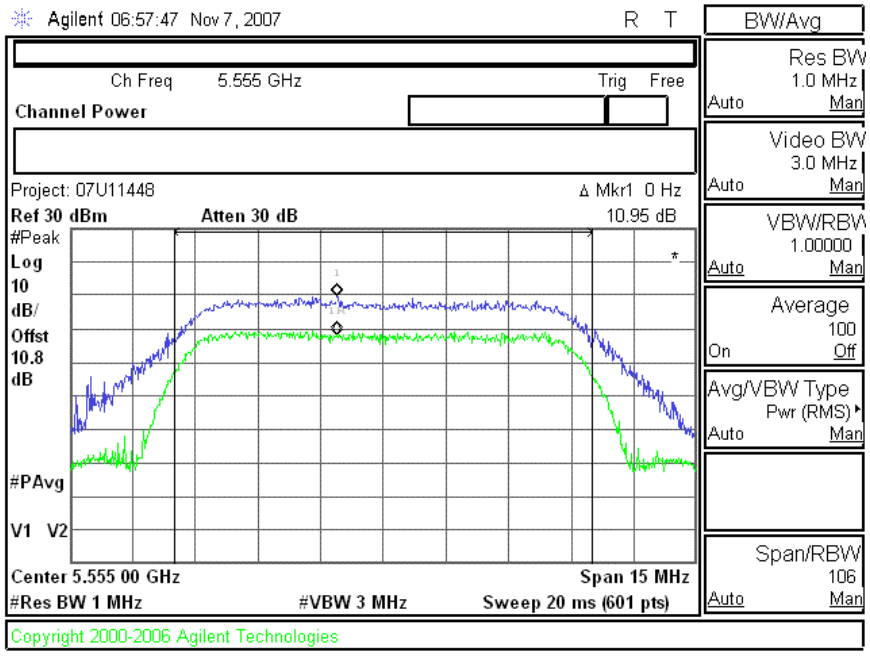
RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5476	10.99	13	-2.01
Middle	5555	10.95	13	-2.05
High	5719	9.87	13	-3.13

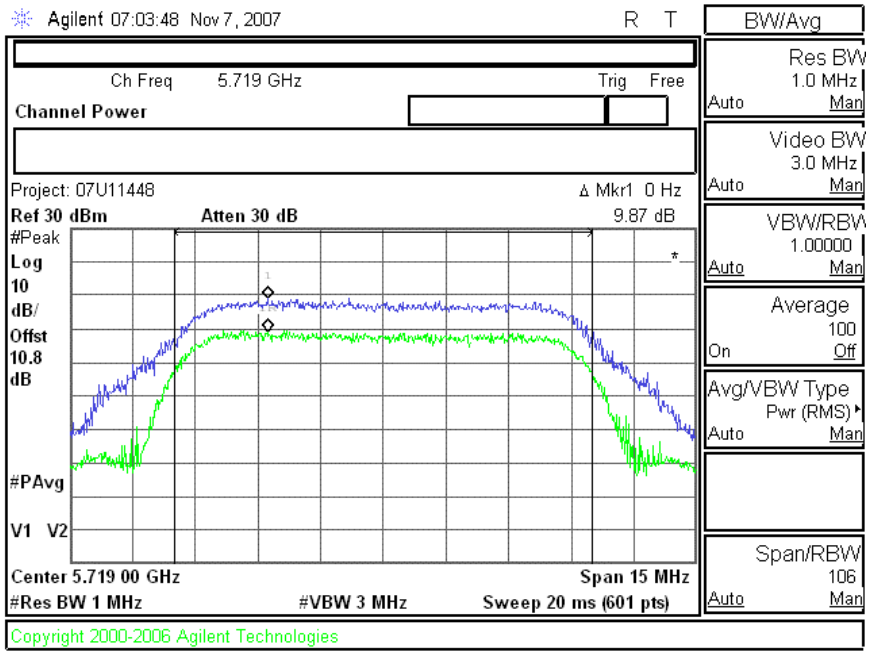
PEAK EXCURSION



PEAK EXCURSION MID CH



PEAK EXCURSION HIGH CH



7.1.6. 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.

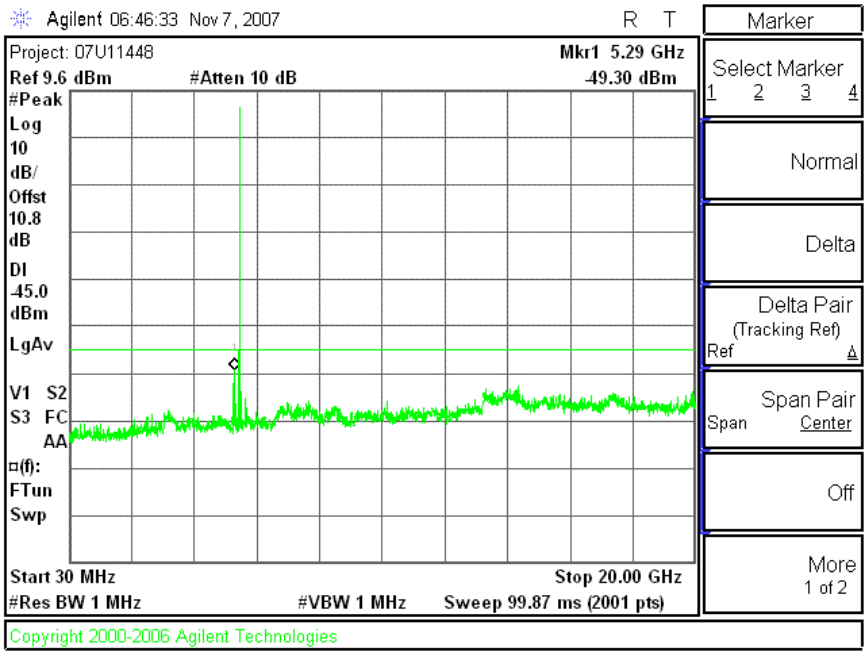
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements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

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

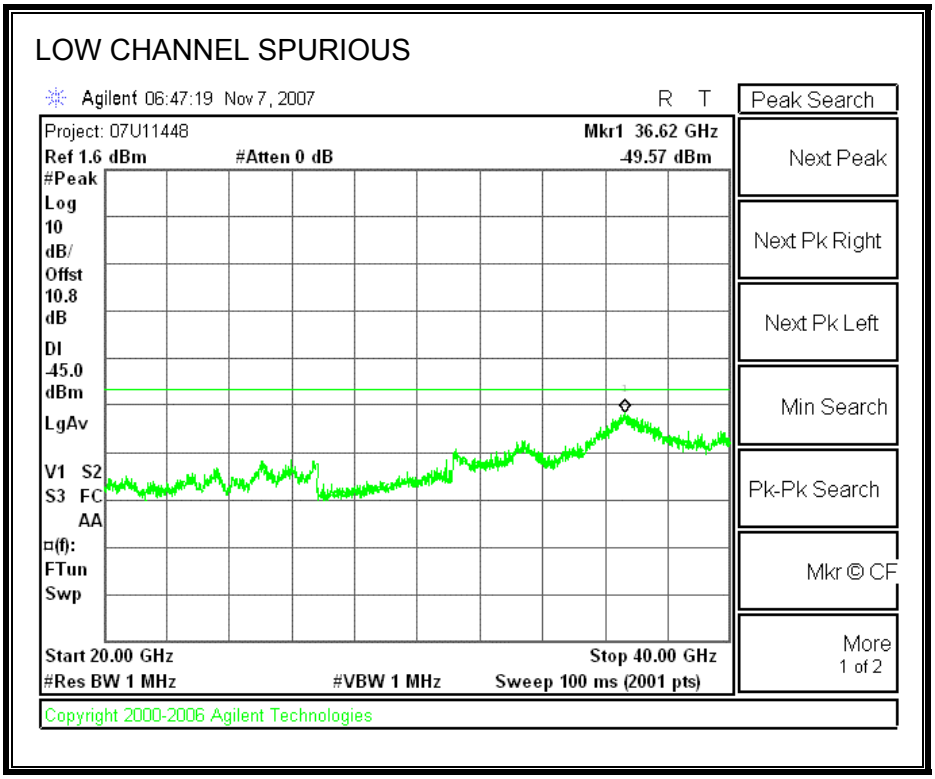
RESULTS

SPURIOUS EMISSIONS

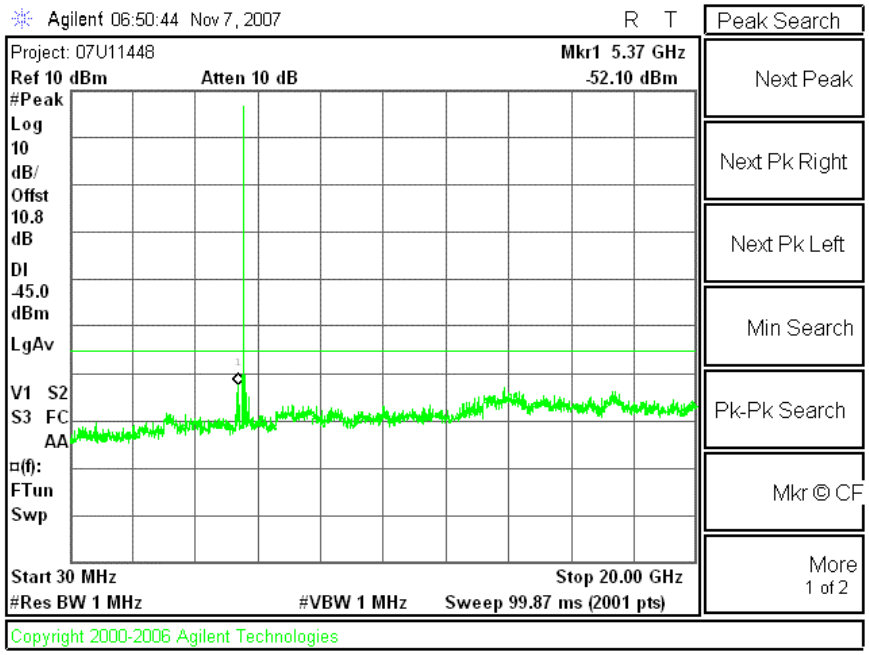
LOW CHANNEL SPURIOUS



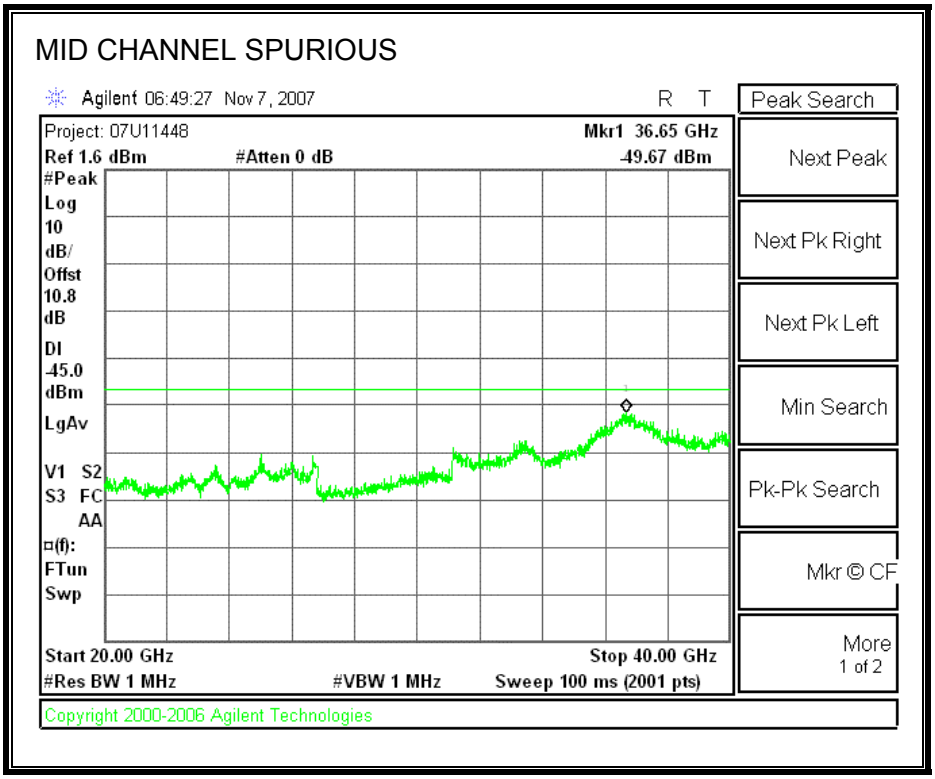
LOW CHANNEL SPURIOUS



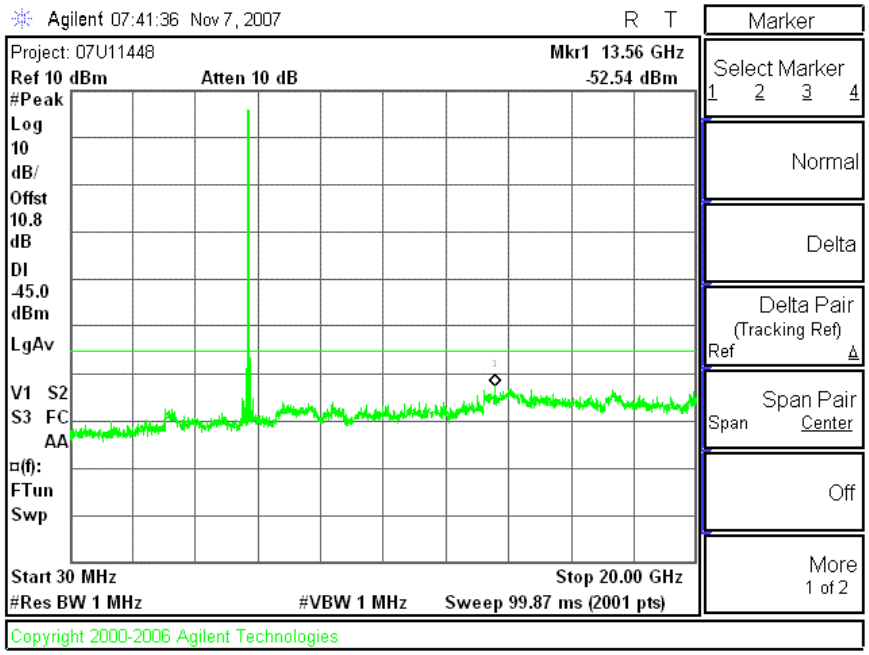
MID CHANNEL SPURIOUS



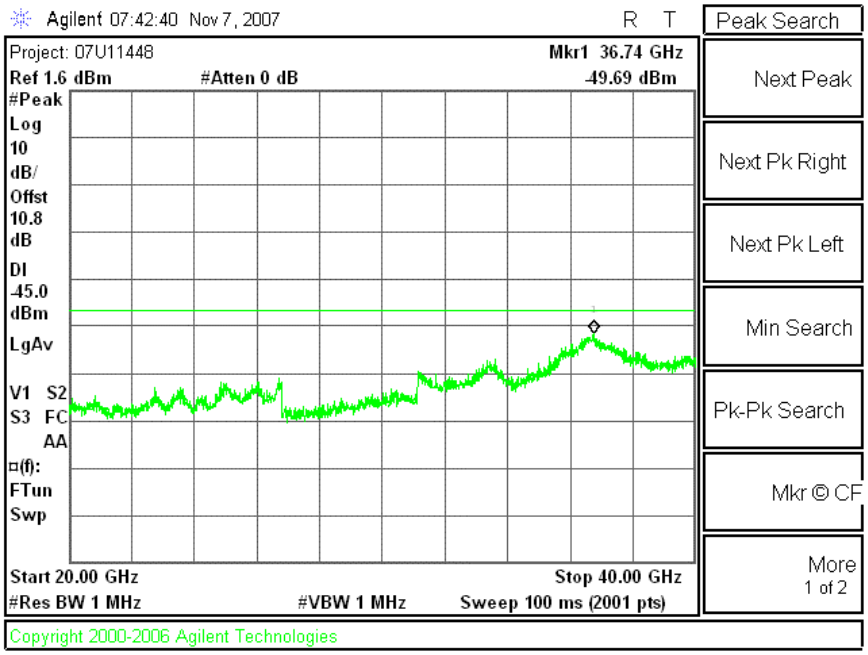
MID CHANNEL SPURIOUS



HIGH CHANNEL SPURIOUS



HIGH CHANNEL SPURIOUS



7.2. RADIATED TEST RESULTS

7.2.1. 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.

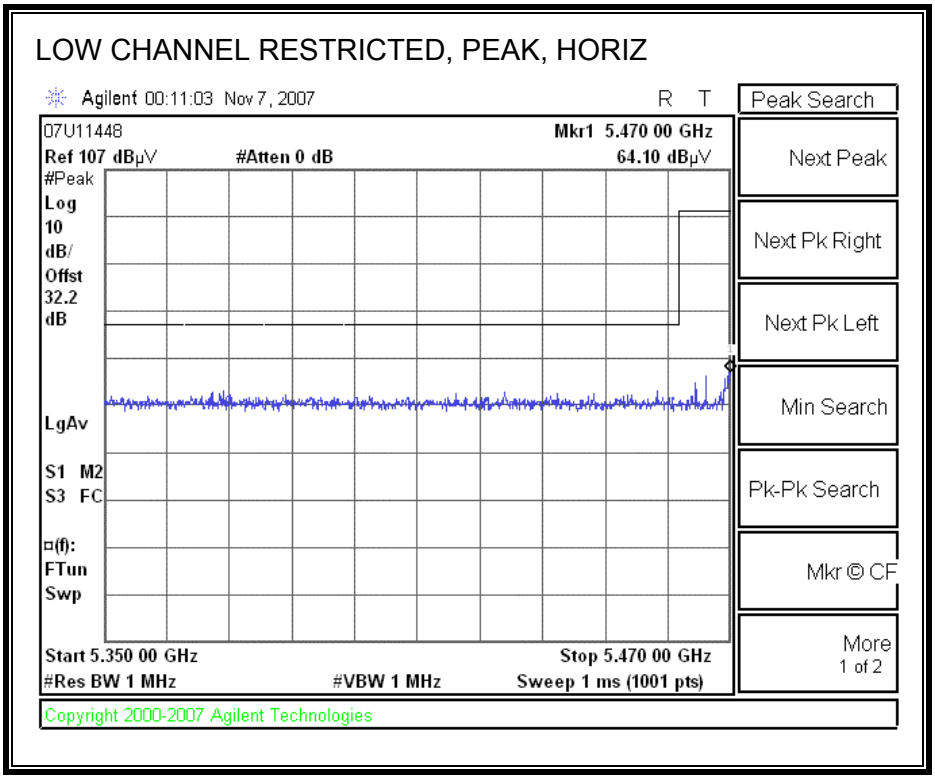
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

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.

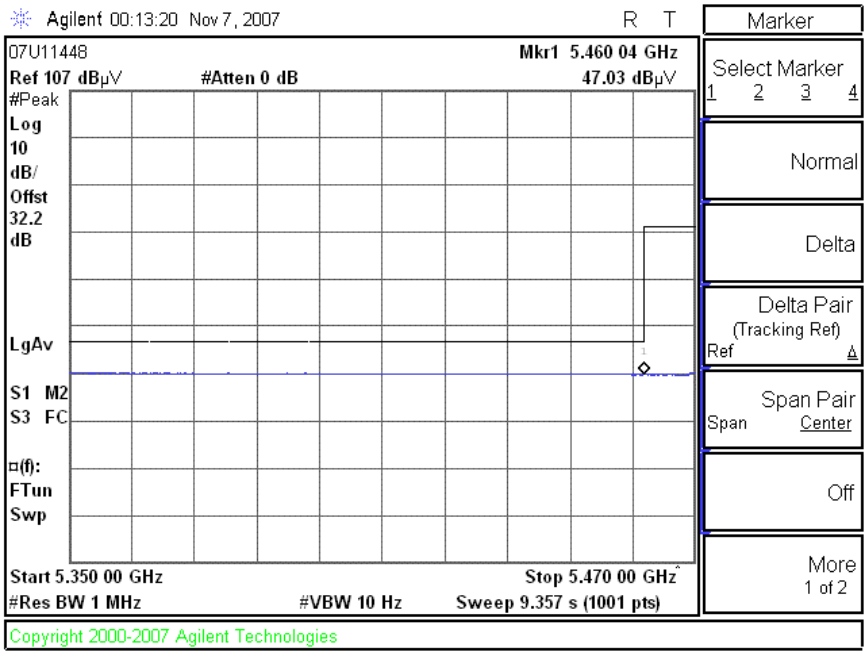
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

7.2.2. TRANSMITTER ABOVE 1 GHz WITH DIPOLE ANTENNA

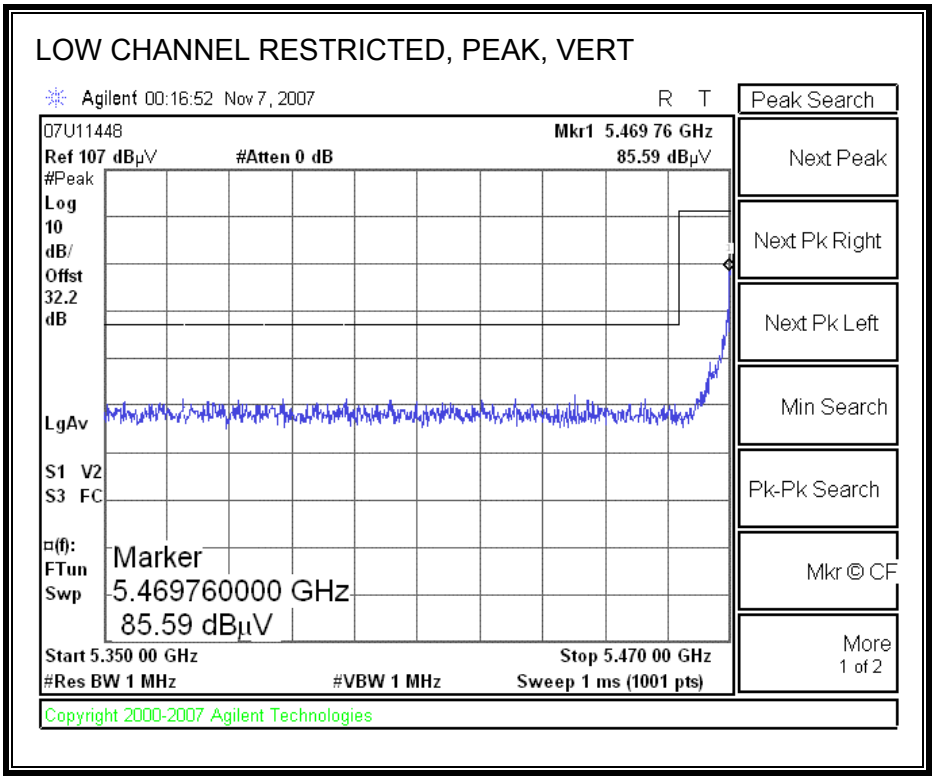
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



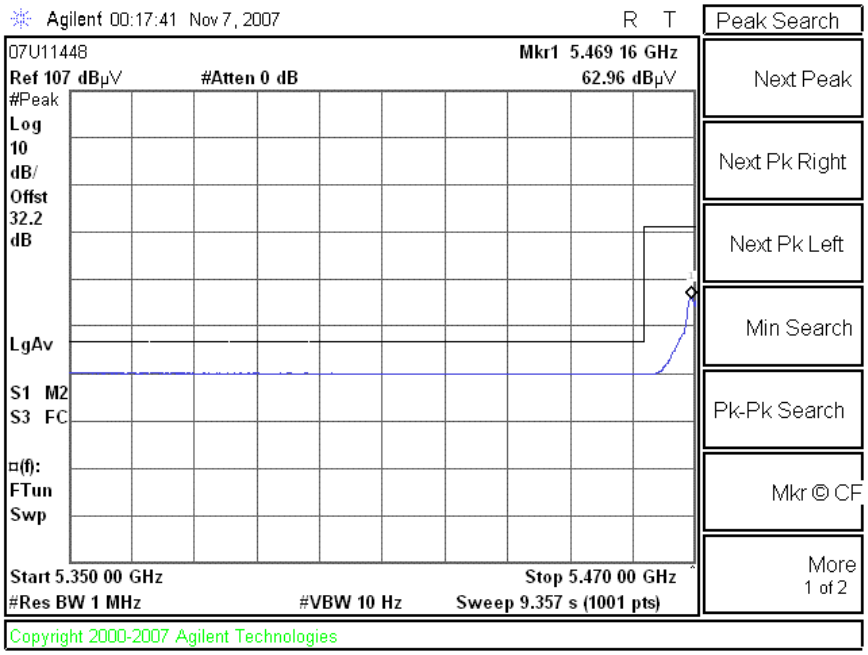
LOW CHANNEL RESTRICTED, AVG, HORIZ



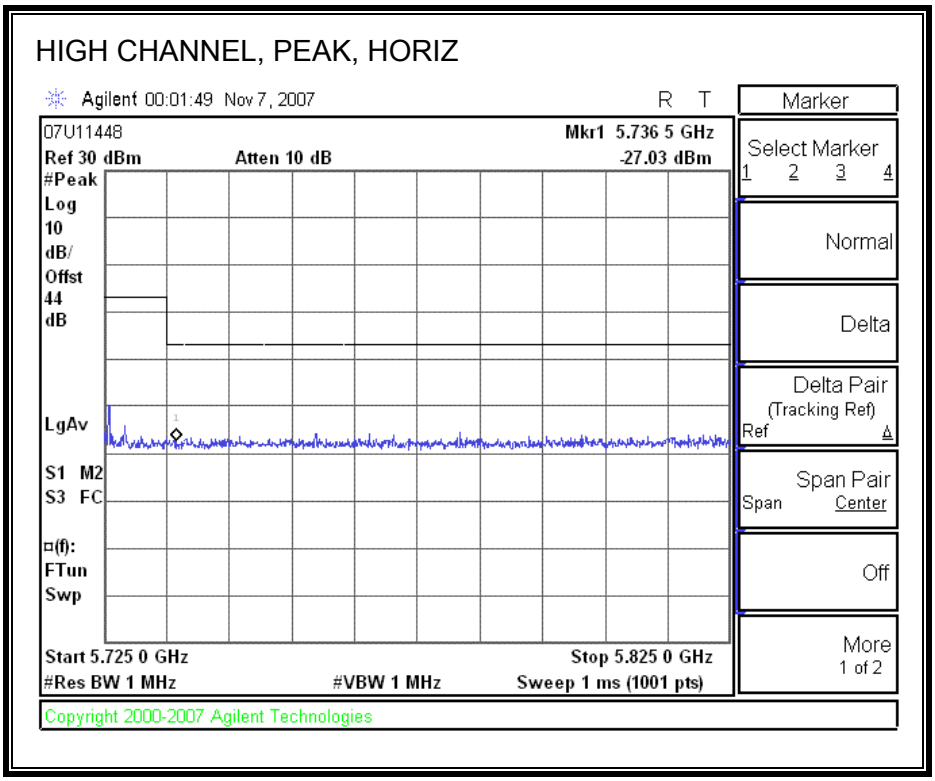
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



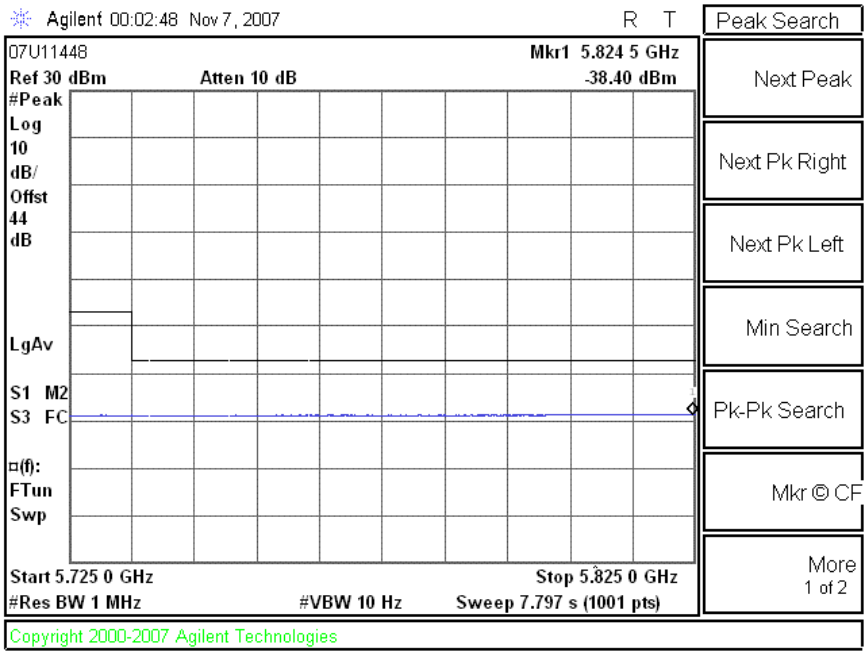
LOW CHANNEL RESTRICTED, AVG, VERT



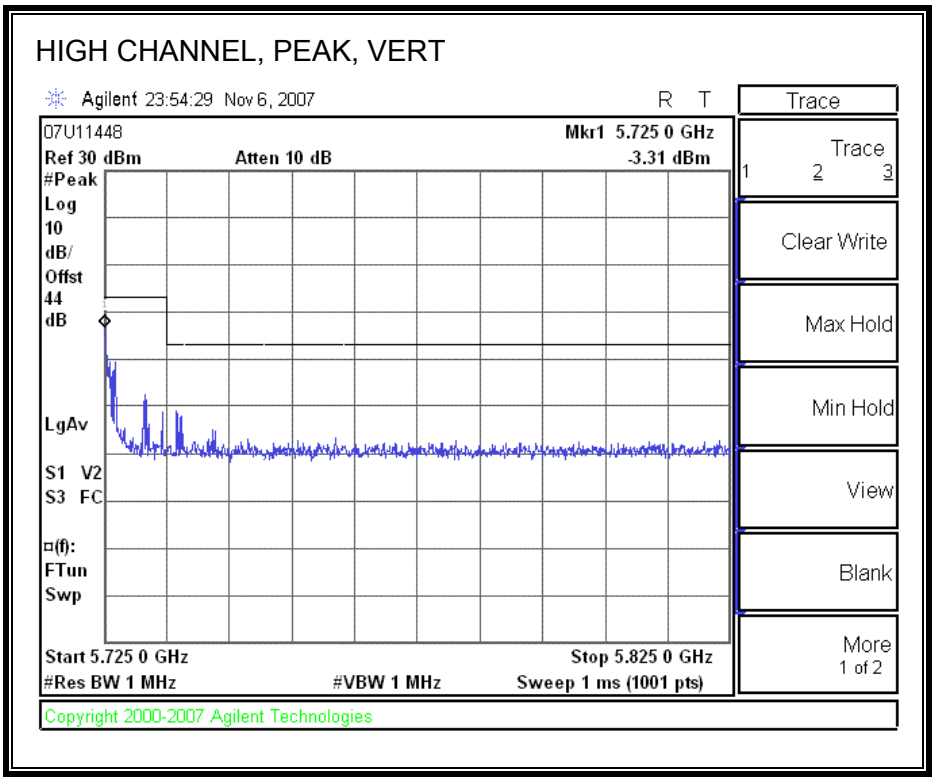
AUTHORIZED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



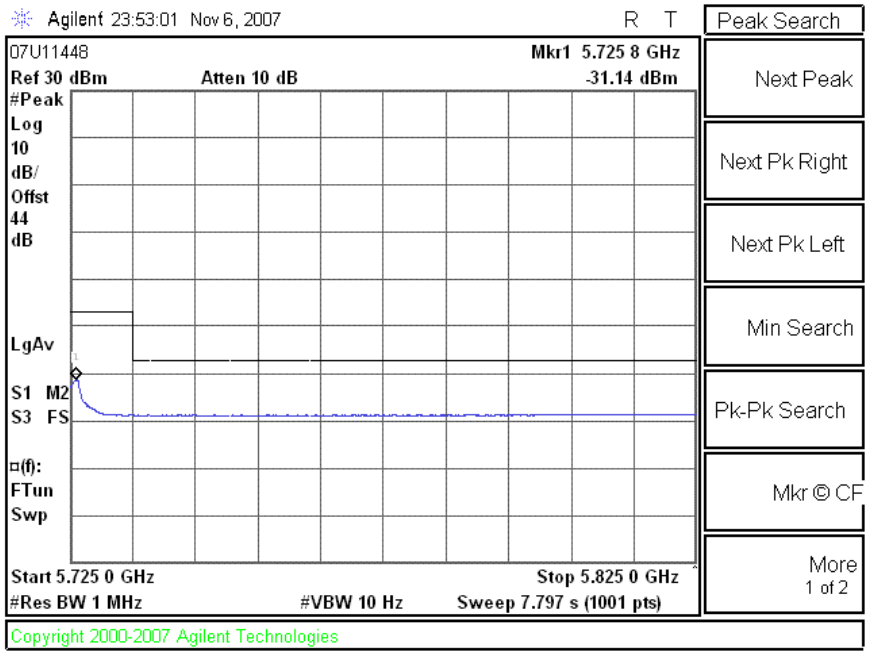
HIGH CHANNEL, AVG, HORIZ



AUTHORIZED BANDEDGE (HIGH CHANNEL, VERTICAL)



HIGH CHANNEL, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Motorola
Project #: 07U11448
Date: 11-6-2007
Test Engineer: Chin Pang
Configuration: EUT/Dipole Antenna (18dBi)
Mode: TX

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T144 Miteq 3008A00931			FCC 15.209

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
		B-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)
Low Ch, 5476MHz															
1.066	3.0	52.6	45.9	25.6	3.3	-39.4	0.0	0.0	42.1	35.4	74	54	-31.9	-18.6	V
9.438	3.0	42.7	33.5	37.0	9.7	-36.9	0.0	0.0	52.5	43.3	74	54	-21.5	-10.7	V
10.952	3.0	40.3	28.0	37.3	11.3	-36.3	0.0	0.0	52.6	40.3	74	54	-21.4	-13.7	V
16.952	3.0	43.1	29.1	40.7	13.4	-33.7	0.0	0.0	63.5	49.5	74	54	-10.5	-4.5	V
1.066	3.0	52.0	44.7	25.6	3.3	-39.4	0.0	0.0	41.5	34.2	74	54	-32.5	-19.8	H
9.438	3.0	41.3	28.5	37.0	9.7	-36.9	0.0	0.0	51.1	38.3	74	54	-22.9	-15.7	H
10.952	3.0	40.5	27.6	37.3	11.3	-36.3	0.0	0.0	52.8	39.9	74	54	-21.2	-14.1	H
16.952	3.0	41.9	29.1	40.7	13.4	-33.7	0.0	0.0	62.4	49.5	74	54	-11.6	-4.5	H
Mid Ch 5555MHz															
1.066	3.0			25.6	3.3	-39.4	0.0	0.0	-10.5	-10.5	74	54	-84.5	-64.5	V
11.110	3.0	41.2	28.0	37.3	11.4	-36.2	0.0	0.0	53.8	40.6	74	54	-20.2	-13.4	V
16.665	3.0	41.6	28.4	39.8	13.3	-33.9	0.0	0.0	60.8	47.6	74	54	-13.2	-6.4	V
11.110	3.0	41.3	28.1	37.3	11.4	-36.2	0.0	0.0	53.9	40.7	74	54	-20.1	-13.3	H
16.665	3.0	42.0	28.4	39.8	13.3	-33.9	0.0	0.0	61.2	47.6	74	54	-12.8	-6.4	H
High Ch, 5719MHz															
11.438	3.0	40.3	27.4	37.4	11.8	-35.9	0.0	0.0	53.5	40.7	74	54	-20.5	-13.3	V
17.157	3.0	43.3	30.2	41.4	13.5	-33.7	0.0	0.0	64.5	51.4	74	54	-9.5	-2.6	V
11.438	3.0	40.2	27.3	37.4	11.8	-35.9	0.0	0.0	53.5	40.6	74	54	-20.5	-13.4	H
17.157	3.0	43.5	30.1	41.4	13.5	-33.7	0.0	0.0	64.7	51.3	74	54	-9.3	-2.7	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		

7.2.3. RECEIVER ABOVE 1 GHz WITH DIPOLE ANTENNA

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Motorola
Project #: 07U11448
Date: 11-7-2007
Test Engineer: Chin Pang
Configuration: EUT/ Dipole Antenna (18dBi)
Mode: RX

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T34 HP 8449B			FCC 15.209

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
	Chin 197538001	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 5555MHz															
1.330	3.0	53.0	33.7	26.3	0.4	-37.8	0.0	0.0	41.8	22.5	74	54	-32.2	-31.5	V
1.592	3.0	51.7	32.6	26.9	0.4	-37.4	0.0	0.0	41.6	22.5	74	54	-32.4	-31.5	V
1.330	3.0	55.6	39.0	26.3	0.4	-37.8	0.0	0.0	44.4	27.8	74	54	-29.6	-26.2	H
1.592	3.0	55.3	38.3	26.9	0.4	-37.4	0.0	0.0	45.2	28.2	74	54	-28.8	-25.8	H

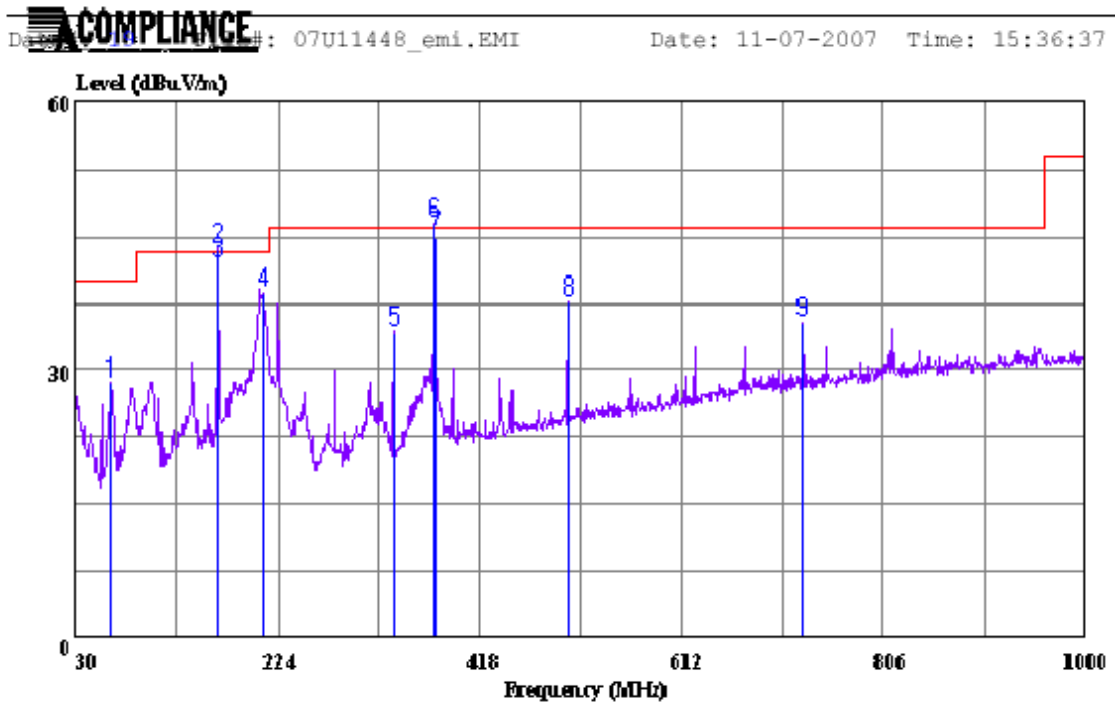
Rev. 4.12.7
Note: No other emissions were detected above the system noise floor.

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		

7.2.4. WORST-CASE BELOW 1 GHz WITH DIPOLE ANTENNA

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



Trace: 16 Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Engineer: : Chin Pang
Company: : Motorola
Project #: : 07U11448
Test Configuration:: EUT/Dipole Antenna/POE/Support Equipment
Mode of operation: : Normal Tx
Test Target: : FCC Class B

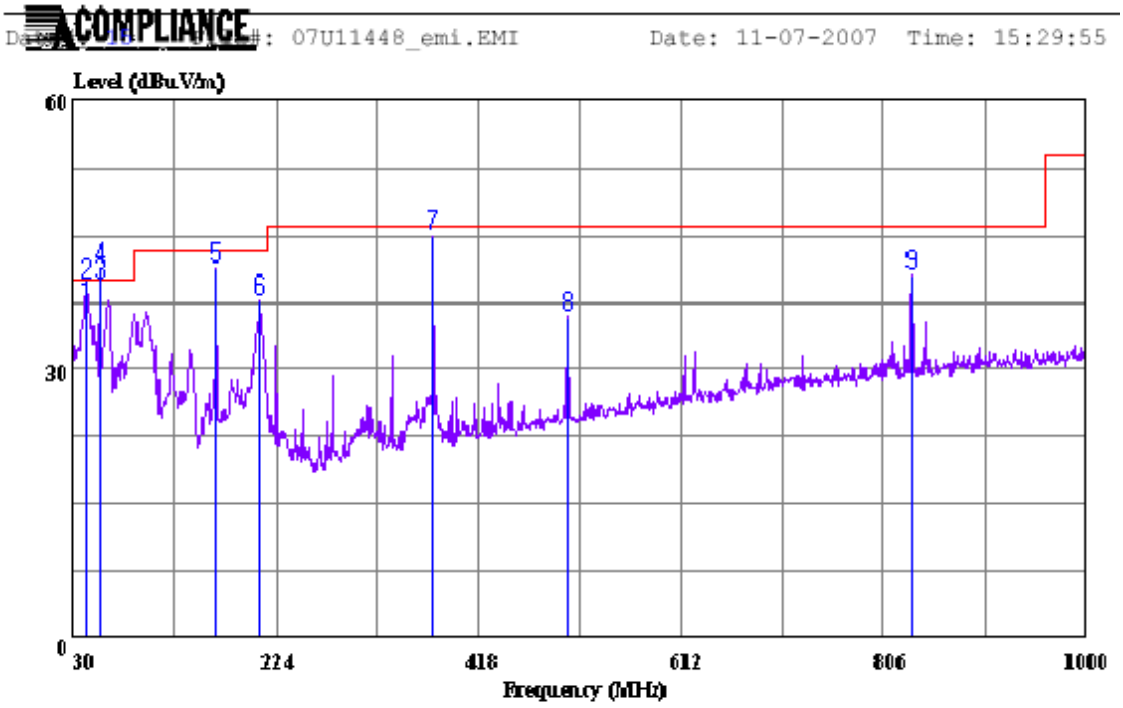
HORIZONTAL DATA

Page: 1

		Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1		63.950	47.90	-19.45	28.45	40.00	-11.55	Peak
2	*	166.770	58.10	-14.50	43.60	43.50	0.10	Peak
3		166.770	56.50	-14.50	42.00	43.50	-1.50	QP
4		209.450	53.50	-14.91	38.59	43.50	-4.91	Peak
5		335.550	45.70	-11.37	34.33	46.00	-11.67	Peak
6	*	374.350	56.90	-10.46	46.44	46.00	0.44	Peak
7		375.350	55.26	-10.43	44.83	46.00	-1.17	QP
8		503.360	45.10	-7.32	37.78	46.00	-8.22	Peak
9		728.400	38.30	-3.08	35.22	46.00	-10.78	Peak

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

VERTICAL PLOT



Trace: 12 Ref Trace:

Condition: FCC CLASS-B VERTICAL
Engineer: : Chin Pang
Company: : Motorola
Project #: : 07U11448
Test Configuration:: EUT/Dipole Antenna/POE/Support Equipment
Mode of operation: : Normal Tx
Test Target: : FCC Class B

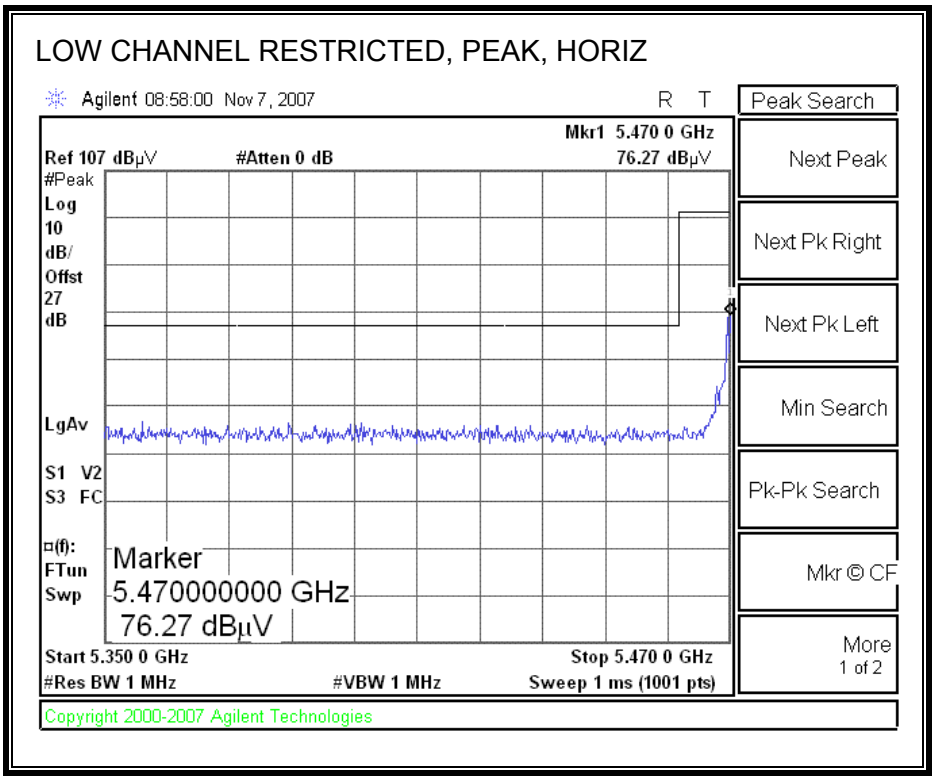
VERTICAL DATA

Page: 1

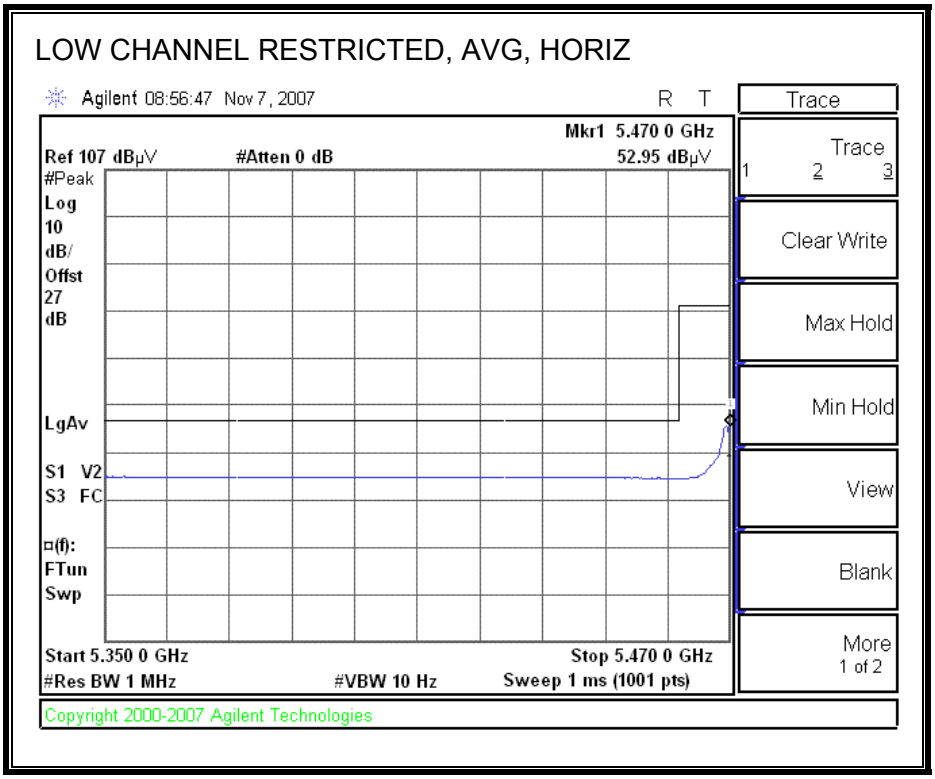
		Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1		43.580	51.20	-14.27	36.93	40.00	-3.07	QP
2		43.580	54.40	-14.89	39.51	40.00	-0.49	Peak
3		54.250	58.84	-19.34	39.50	40.00	-0.50	QP
4	*	54.250	60.60	-19.34	41.26	40.00	1.26	Peak
5		166.770	55.80	-14.50	41.30	43.50	-2.20	Peak
6		208.480	52.40	-14.79	37.61	43.50	-5.89	Peak
7		374.350	55.50	-10.46	45.04	46.00	-0.96	Peak
8		503.360	43.10	-7.32	35.78	46.00	-10.22	Peak
9		833.160	42.20	-1.73	40.47	46.00	-5.53	Peak

7.2.5. TRANSMITTER ABOVE 1 GHz WITH PATCH ANTENNA

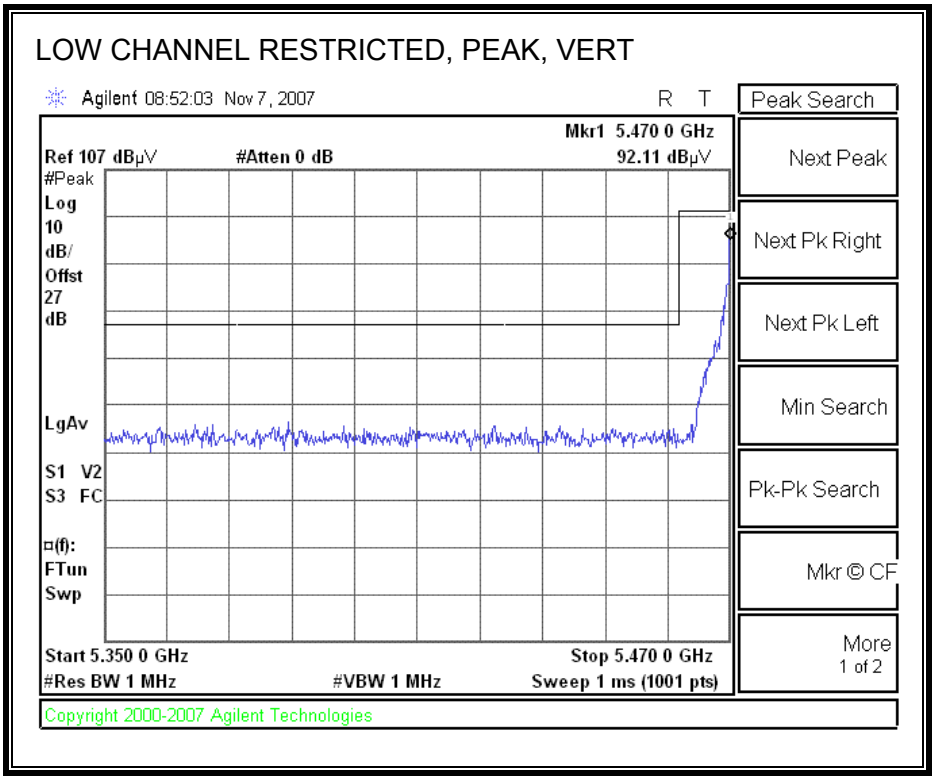
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



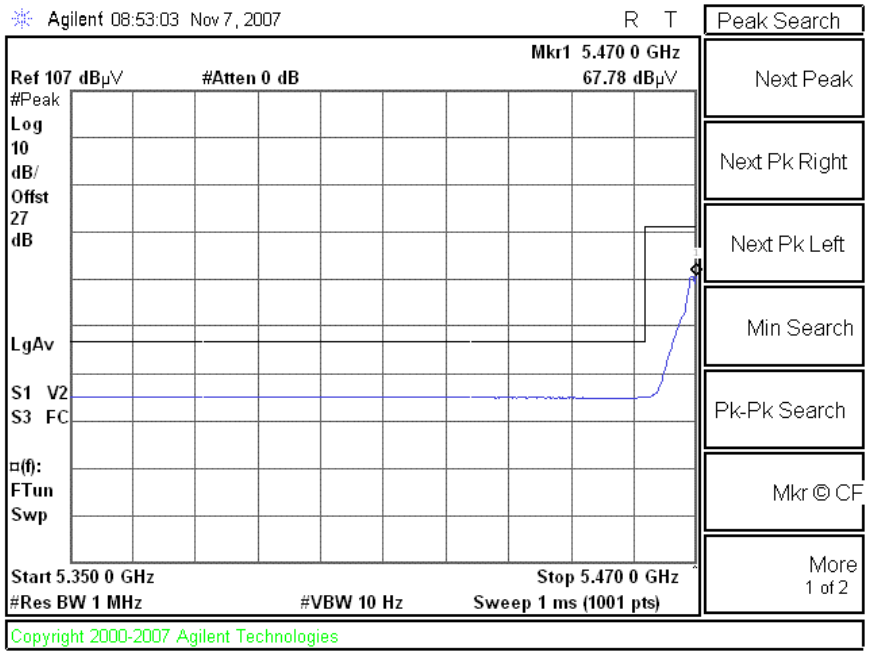
LOW CHANNEL RESTRICTED, AVG, HORIZ



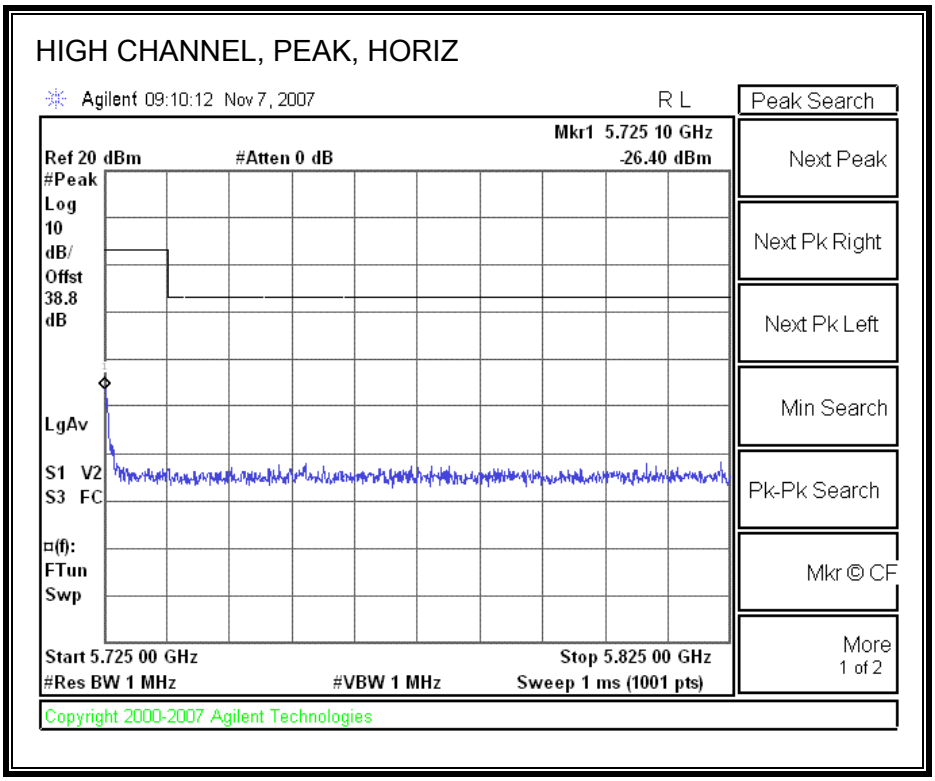
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



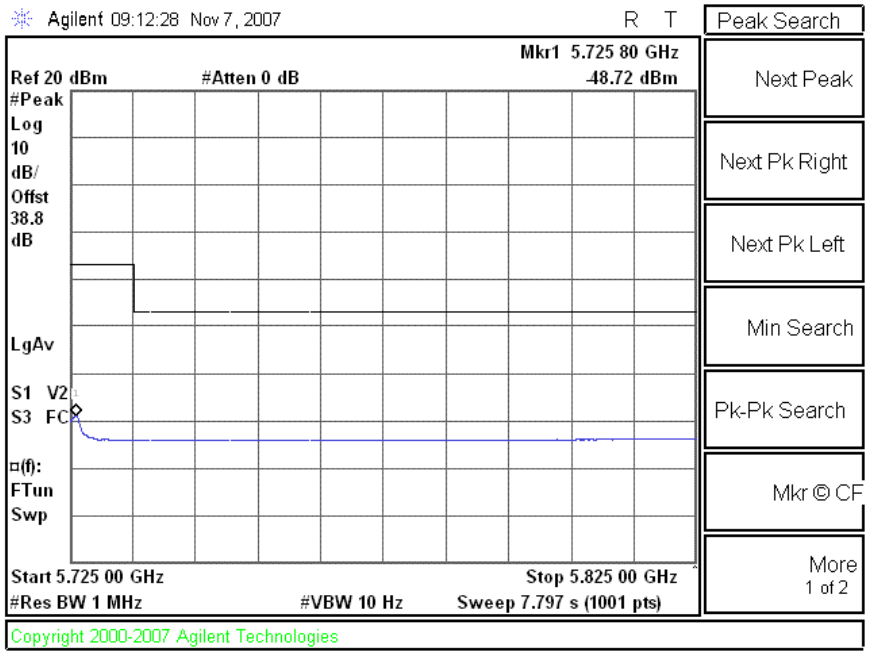
LOW CHANNEL RESTRICTED, AVG, VERT



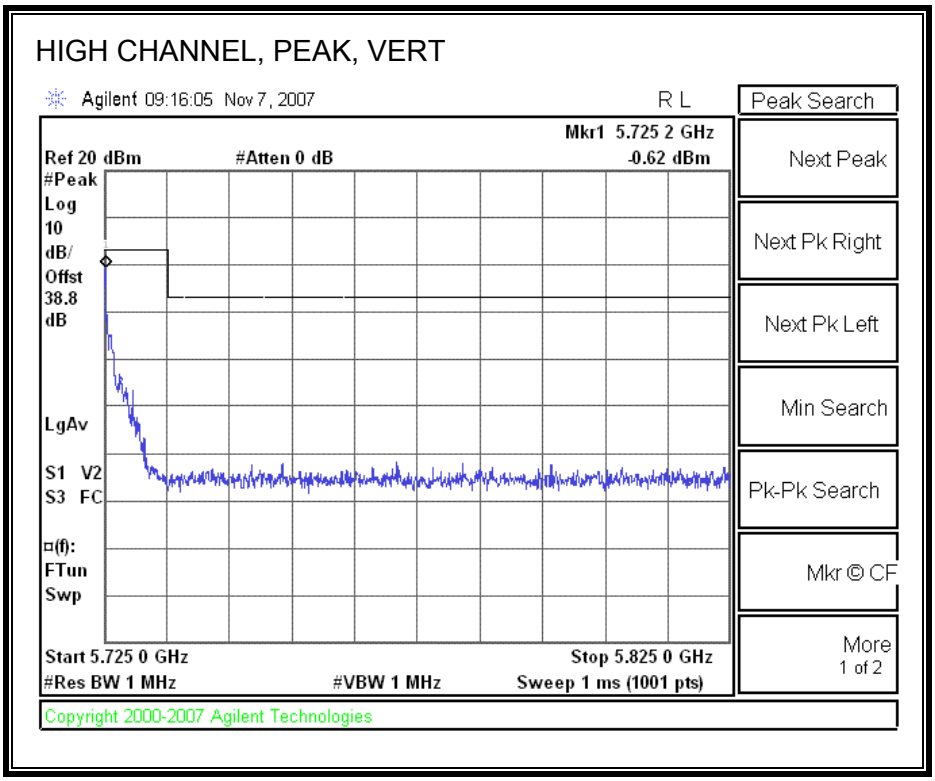
AUTHORIZED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



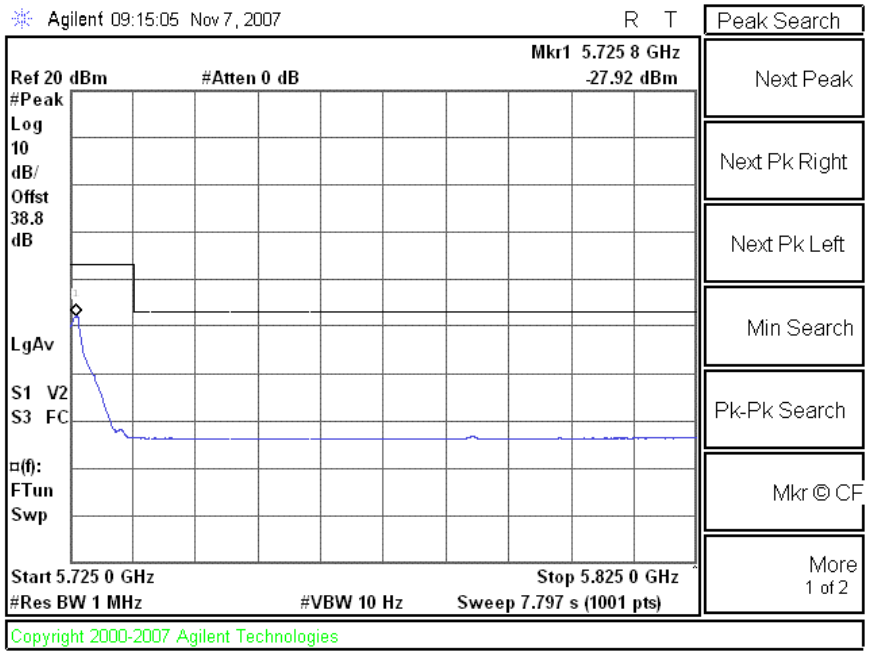
HIGH CHANNEL, AVG, HORIZ



AUTHORIZED BANDEDGE (HIGH CHANNEL, VERTICAL)



HIGH CHANNEL, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Motorola
Project #: 07U11448
Date: 11-7-2007
Test Engineer: Chin Pang
Configuration: EUT/Patch Antenna (18dBi)
Mode: TX

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T34 HP 8449B	T88 Miteq 26-40GHz	T39; ARA 18-26GHz; S/N:1013	FCC 15.209

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
	Chin 197538001	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, 5476MHz															
1.332	3.0	54.0	40.1	26.3	0.4	-37.8	0.0	0.0	42.8	28.9	74	54	-31.2	-25.1	V
10.952	3.0	43.5	30.7	37.3	0.8	-32.6	0.0	0.7	49.8	37.0	74	54	-24.2	-17.0	V
16.428	3.0	45.1	32.0	39.1	1.3	-32.1	0.0	0.7	54.1	41.0	74	54	-19.9	-13.0	V
1.332	3.0	54.4	40.3	26.3	0.4	-37.8	0.0	0.0	43.2	29.1	74	54	-30.8	-24.9	H
10.952	3.0	43.7	30.8	37.3	0.8	-32.6	0.0	0.7	50.0	37.1	74	54	-24.0	-16.9	H
16.428	3.0	45.3	32.0	39.1	1.3	-32.1	0.0	0.7	54.3	41.0	74	54	-19.7	-13.0	H
Mid Ch 5555MHz															
1.332	3.0	53.7	40.0	26.3	0.4	-37.8	0.0	0.0	42.5	28.8	74	54	-31.5	-25.2	V
11.110	3.0	43.0	30.7	37.3	0.8	-32.6	0.0	0.7	49.3	37.0	74	54	-24.7	-17.0	V
16.665	3.0	43.8	31.4	39.8	1.3	-32.0	0.0	0.7	53.6	41.2	74	54	-20.4	-12.8	V
1.332	3.0	55.4	40.5	26.3	0.4	-37.8	0.0	0.0	44.2	29.3	74	54	-29.8	-24.7	H
11.110	3.0	43.7	30.8	37.3	0.8	-32.6	0.0	0.7	50.0	37.1	74	54	-24.0	-16.9	H
16.665	3.0	45.0	31.9	39.8	1.3	-32.0	0.0	0.7	54.8	41.7	74	54	-19.2	-12.3	H
High Ch, 5719MHz															
1.332	3.0	53.3	38.0	26.3	0.4	-37.8	0.0	0.0	42.1	26.8	74	54	-31.9	-27.2	V
11.438	3.0	43.4	30.6	37.4	0.8	-32.5	0.0	0.7	49.7	36.9	74	54	-24.3	-17.1	V
17.157	3.0	44.5	31.9	41.4	1.4	-32.0	0.0	0.7	55.9	43.3	74	54	-18.1	-10.7	V
1.332	3.0	55.2	39.7	26.3	0.4	-37.8	0.0	0.0	44.0	28.5	74	54	-30.0	-25.5	H
11.438	3.0	44.6	31.4	37.4	0.8	-32.5	0.0	0.7	50.9	37.7	74	54	-23.1	-16.3	H
17.157	3.0	45.3	32.0	41.4	1.4	-32.0	0.0	0.7	56.7	43.4	74	54	-17.3	-10.6	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		

7.2.6. RECEIVER ABOVE 1 GHz WITH PATCH ANTENNA

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Motorola
Project #: 07U11448
Date: 11-7-2007
Test Engineer: Chin Pang
Configuration: EUT/Patch Antenna (18dBi)
Mode: RX

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T34 HP 8449B			FCC 15.209

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
	Chin 197538001	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 5555MHz															
1.330	3.0	55.0	41.4	26.3	0.4	-37.8	0.0	0.0	43.8	30.2	74	54	-30.2	-23.8	V
1.592	3.0	52.5	36.6	26.9	0.4	-37.4	0.0	0.0	42.4	26.5	74	54	-31.6	-27.5	V
1.330	3.0	52.0	37.0	26.3	0.4	-37.8	0.0	0.0	40.8	25.8	74	54	-33.2	-28.2	H
1.592	3.0	51.7	35.6	26.9	0.4	-37.4	0.0	0.0	41.6	25.5	74	54	-32.4	-28.5	H

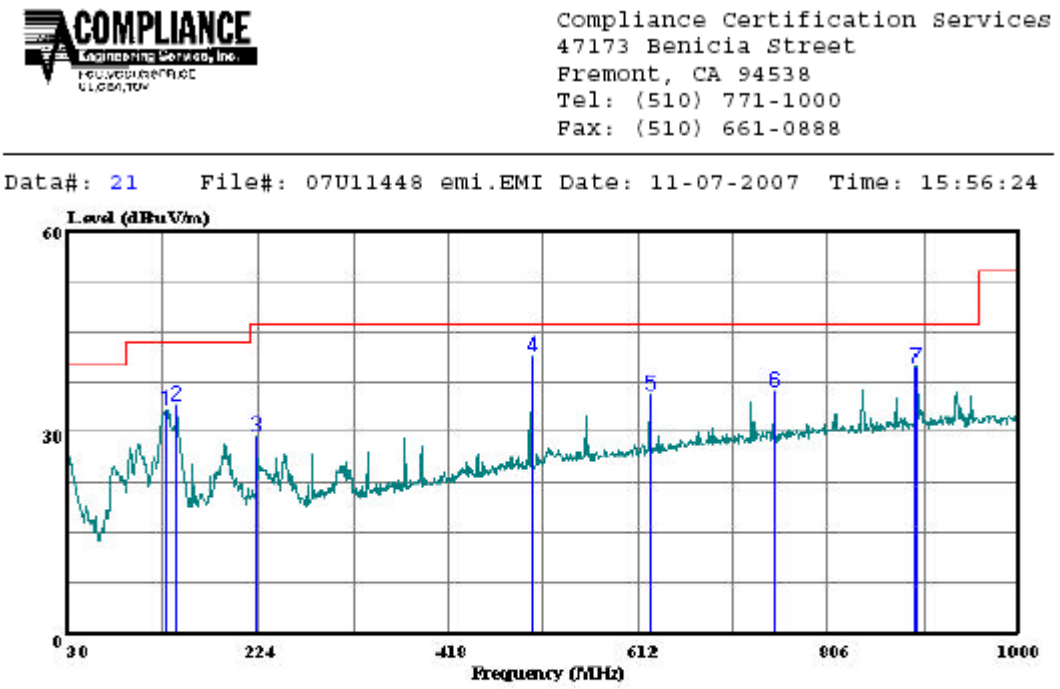
Rev. 4.12.7
Note: No other emissions were detected above the system noise floor.

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		

7.2.7. WORST-CASE BELOW 1 GHz WITH PATCH ANTENNA

WITH PATCH ANTENNA

HORIZONTAL PLOT



HORIZONTAL DATA

Page: 1

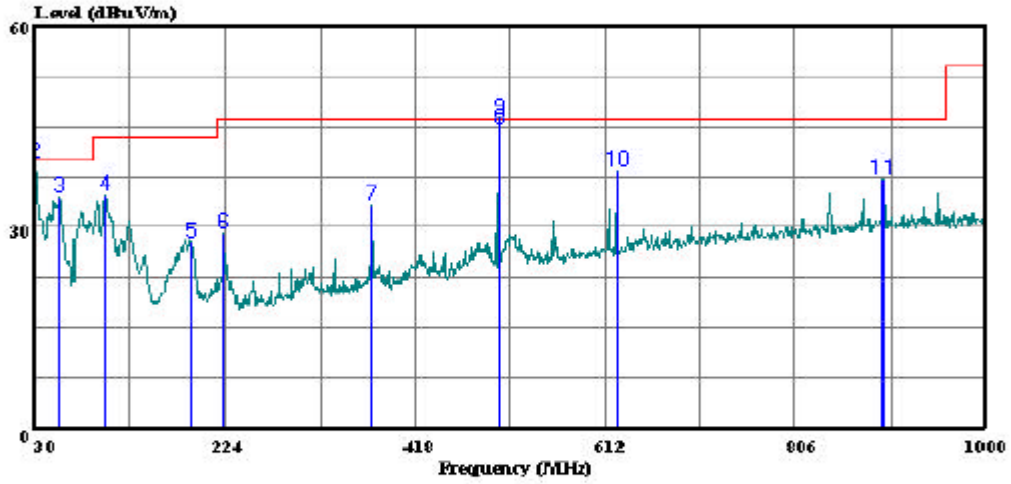
	Freq	Level	Limit Line	Over Limit	Remark
	MHz	dBuV/m	dBuV/m	dB	
1	130.880	33.20	43.50	-10.30	Peak
2	141.550	34.15	43.50	-9.35	Peak
3	223.030	29.42	46.00	-16.58	Peak
4	503.360	41.18	46.00	-4.82	Peak
5	624.610	35.56	46.00	-10.44	Peak
6	750.710	36.03	46.00	-9.97	Peak
7	896.210	39.74	46.00	-6.26	Peak

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

VERTICAL PLOT

Compliance Certification Services
47173 Benicia Street
Fremont, CA 94538
Tel: (510) 771-1000
Fax: (510) 661-0888

Data#: 25 File#: 07U11448 emi.EMI Date: 11-07-2007 Time: 16:10:41



Trace: 22 Ref Trace:

Condition: FCC CLASS-B VERTICAL
Engineer: : Chin Pang
Company: : Motorola
Project #: : 07U11448
Test Configuration:: EUT/Patch Antenna/POE/Support Equip
Mode of operation: : Normal Tx
Test Target: : FCC Class B

VERTICAL DATA

Page: 1

		Freq	Level	Limit Line	Over Limit	Remark
		MHz	dBuV/m	dBuV/m	dB	
1		30.000	37.36	40.00	-2.64	QP
2		30.000	39.64	40.00	-0.36	Peak
3		55.220	34.58	40.00	-5.42	Peak
4		101.780	34.88	43.50	-8.62	Peak
5		190.050	27.88	43.50	-15.62	Peak
6		223.030	29.02	46.00	-16.98	Peak
7		374.350	33.24	46.00	-12.76	Peak
8		503.360	44.68	46.00	-1.32	QP
9	*	503.360	46.18	46.00	0.18	Peak
10		624.610	38.46	46.00	-7.54	Peak
11		896.210	37.04	46.00	-8.96	Peak

7.3. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

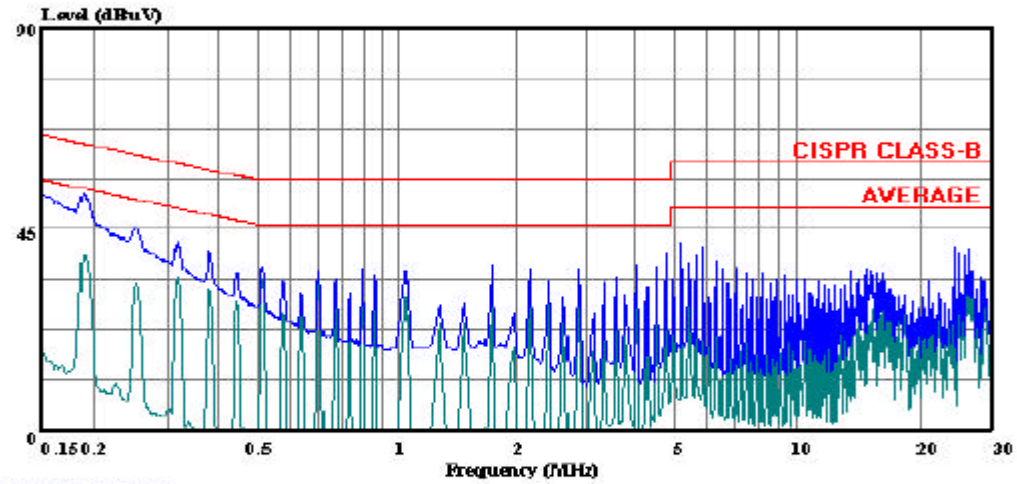
6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.19	52.62	--	38.78	0.00	64.04	54.04	-11.42	-15.26	L1
4.85	39.55	--	33.45	0.00	56.00	46.00	-16.45	-12.55	L1
24.40	40.83	--	37.74	0.00	60.00	50.00	-19.17	-12.26	L1
0.19	51.66	--	38.81	0.00	64.12	54.12	-12.46	-15.31	L2
4.85	39.35	--	34.08	0.00	56.00	46.00	-16.65	-11.92	L2
24.40	40.21	--	37.16	0.00	60.00	50.00	-19.79	-12.84	L2
6 Worst Data AC Adapter with Patch Antenna									

LINE 1 RESULTS

Compliance Certification Services
47173 Benicia Street
Fremont, CA 94538
Tel: (510) 771-1000
Fax: (510) 661-0888

Data#: 14 File#: 07U11448LC.EMI Date: 11-08-2007 Time: 07:07:14

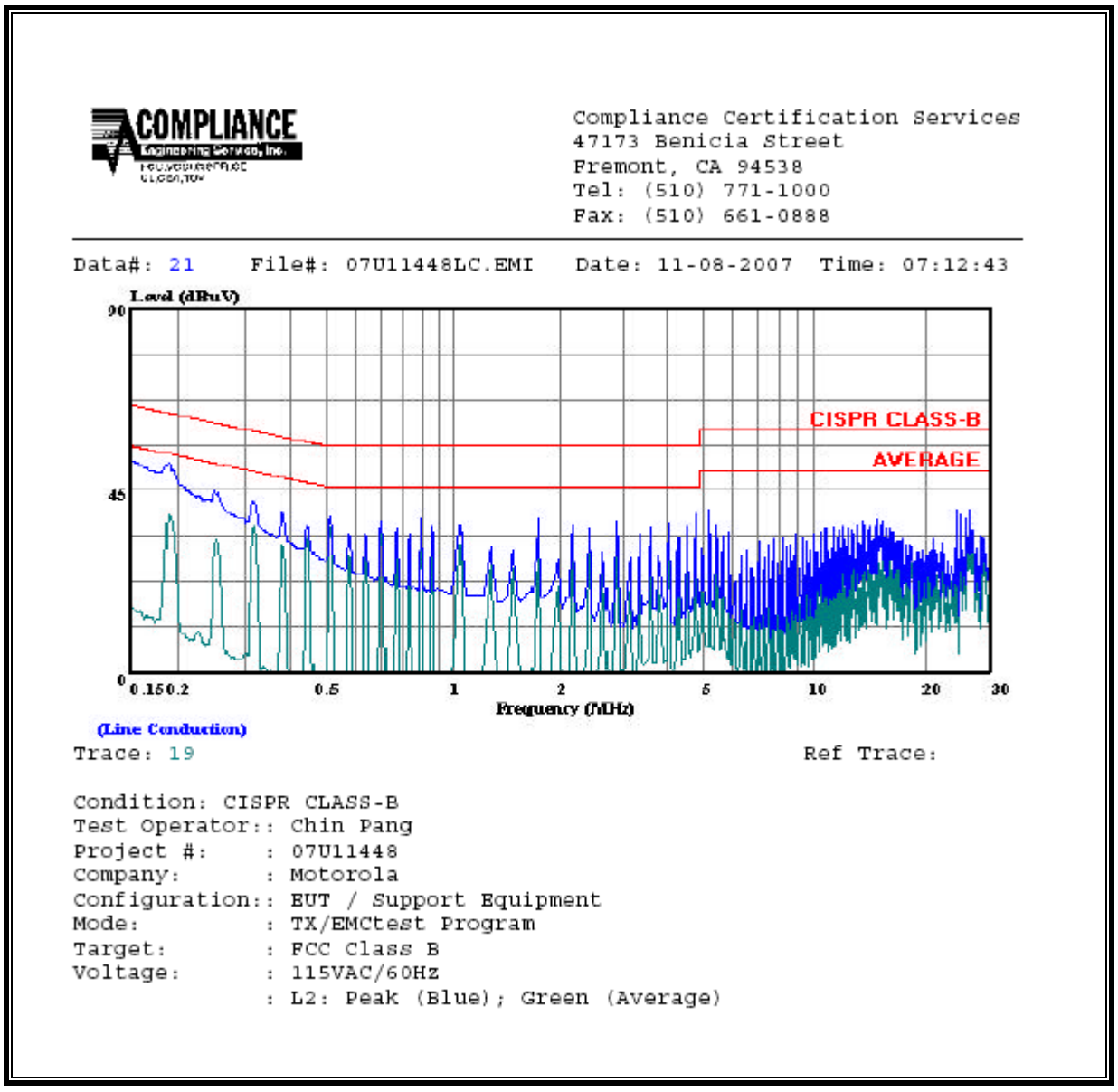


(Line Conduction)

Trace: 12 Ref Trace:

Condition: CISPR CLASS-B
Test Operator:: Chin Pang
Project #: : 07U11448
Company: : Motorola
Configuration:: EUT / Support Equipment
Mode: : TX/EMCtest Program
Target: : FCC Class B
Voltage: : 115VAC/60Hz
: L1: Peak (Blue); Green (Average)

LINE 2 RESULTS



8. DYNAMIC FREQUENCY SELECTION

8.1. OVERVIEW

8.1.1. LIMITS

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.

FCC

§15.407 (h) and FCC 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”.

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

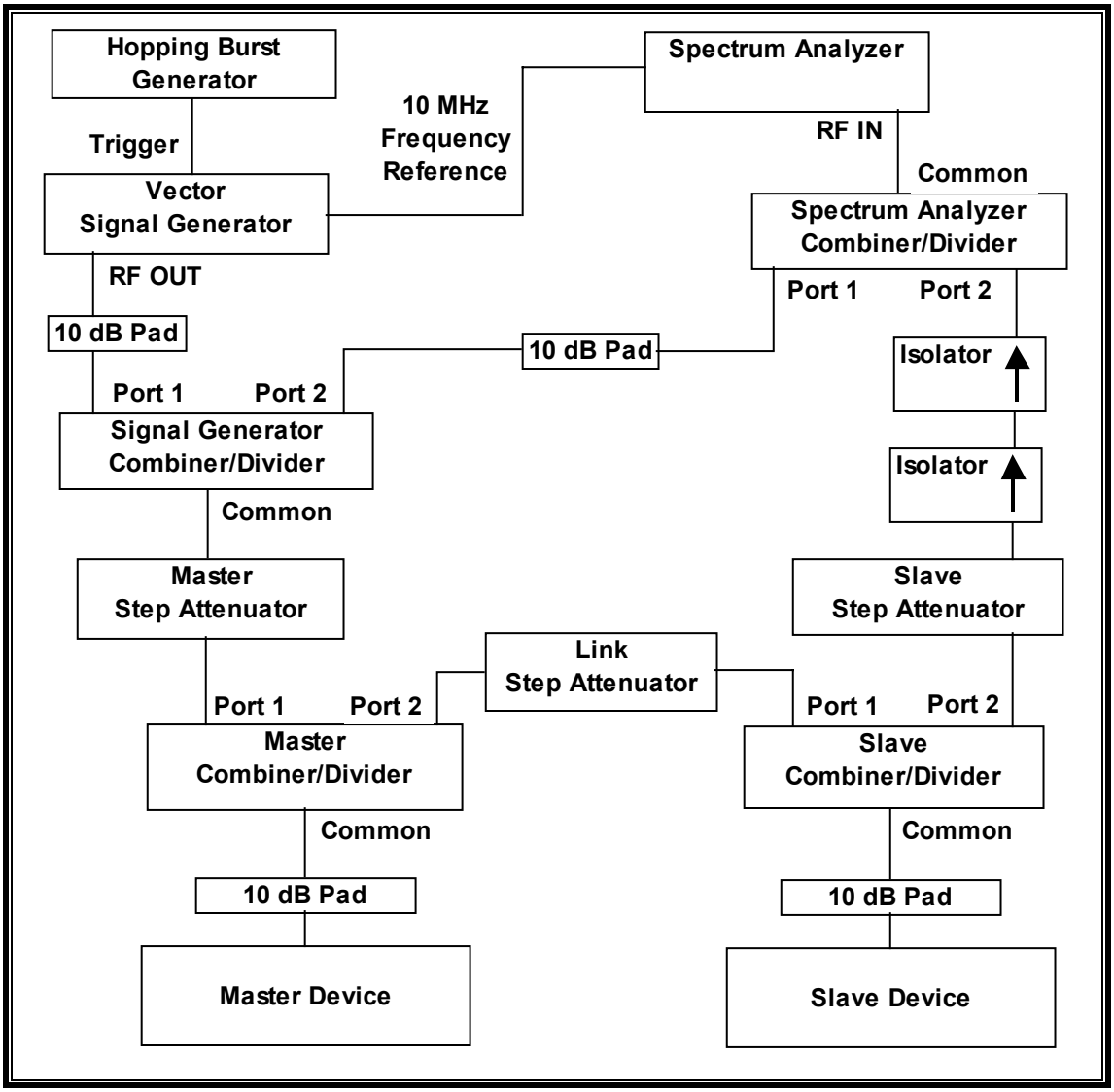
Radar Waveform	Bursts	Pulses per Burst	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Minimum Percentage of Successful Detection	Minimum Trials
5	8-20	1-3	50-100	5-20	1000-2000	80%	30

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

8.1.2. TEST AND MEASUREMENT SYSTEM

CONDUCTED 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.

Should multiple RF ports be utilized for the Master and/or Slave devices (for example, for diversity or MIMO implementations), additional combiner/dividers are inserted between the Master Combiner/Divider and the pad connected to the Master Device (and/or between the Slave Combiner/Divider and the pad connected to the Slave Device). Additional pads are utilized such that there is one pad at each RF port on each EUT.

SYSTEM CALIBRATION

A 50-ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected in place of the master device and 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. Measure the amplitude and calculate the difference from –64 dBm. Adjust the Reference Level Offset of the spectrum analyzer 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.

Set the signal generator to produce a radar waveform, trigger a burst manually and measure the level on the spectrum analyzer. Readjust the amplitude of the signal generator as required so

that the peak level of the waveform is at a displayed level equal to the required or desired interference detection threshold. Separate signal generator amplitude settings are determined as required for each radar type.

ADJUSTMENT OF DISPLAYED TRAFFIC LEVEL

Establish a link between the Master and Slave, adjusting the Link Step Attenuator as needed to provide a suitable received level at the Master and Slave devices. Stream the video test file to generate WLAN traffic. Confirm that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold. For Master Device testing confirm that the displayed traffic does not include Slave Device traffic. For Slave Device testing confirm that the displayed traffic does not include Master Device traffic.

If a different setting of the Master Step Attenuator is required to meet the above conditions, perform a new System Calibration for the new Master Step Attenuator setting.

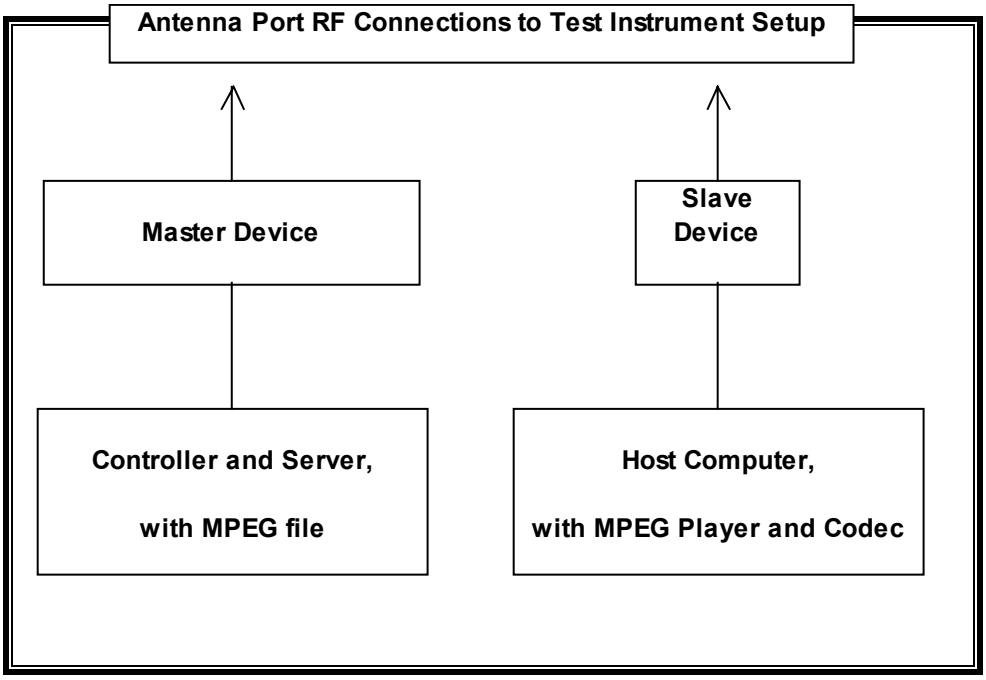
TEST AND MEASUREMENT EQUIPMENT

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 9 kHz ~ 26.5 GHz	**Agilent / HP**	**E4407B**	**US41444322**	**11/9/2008**
Vector Signal Generator 250kHz-20GHz	**Agilent / HP**	**E8267C**	**US43320336**	**11/2/2007**
High Speed Digital I/O Card	**National Instruments**	**PCI-6534**	**HA1612845**	**1/16/2008**

8.1.3. SETUP OF EUT

CONDUCTED METHOD EUT TEST SETUP



SUPPORT EQUIPMENT

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

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	DELL	HP-OQ065B83	CN-05U092-47890-39H-0482	DoC
Laptop	DELL	Precision/M20	CN-OC4708-48643-63B-0267	DoC
AC Adapter	Compaq	PPP012L	565BC0ALL0J1BE	DoC
Laptop	Compaq	Presario 3000	CNN327025L	DoC

8.1.4. DESCRIPTION OF EUT

The EUT operates over the 5470-5725 MHz range.

The EUT can be configured either as a Master Device or as a Slave Device without Radar Detection.

The highest conducted power level is 9.92 dBm.

The antenna plus cable assembly utilized with the EUT has an assembly gain of 17 dBi.

The highest radiated power level is 26.92 dBm EIRP.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is –64 dBm. After correction for antenna gain and procedural adjustments, the required conducted threshold at the antenna port is –64 + 1 + 17 = -46 dBm.

The calibrated conducted DFS Detection Threshold level is set to –46 dBm.

The EUT uses one transmitter connected to a 50-ohm coaxial antenna port to perform conducted tests.

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 not required since the maximum EIRP is less than 500 mW (27 dBm).

The EUT utilizes a frame-based architecture with a 10 MHz nominal channel bandwidth and minimum of 10 MHz channel spacing.

The software installed in the access point is CANOPY. (BUILD) APAS-DES with Software Boot Version CANOPYBOOT 1.0.

The software installed in the slave device is CANOPY. (BUILD) SM-DES with Software Boot Version CANOPYBOOT 1.0.

Test results show that the EUT requires 101 seconds to complete its initial power-up cycle.

MANUFACTURER’S DESCRIPTION OF UNIFORM CHANNEL SPREADING FUNCTION

This is in a separate document.

8.2. RESULTS FOR MASTER DEVICE CONFIGURATION

8.2.1. TEST CHANNEL

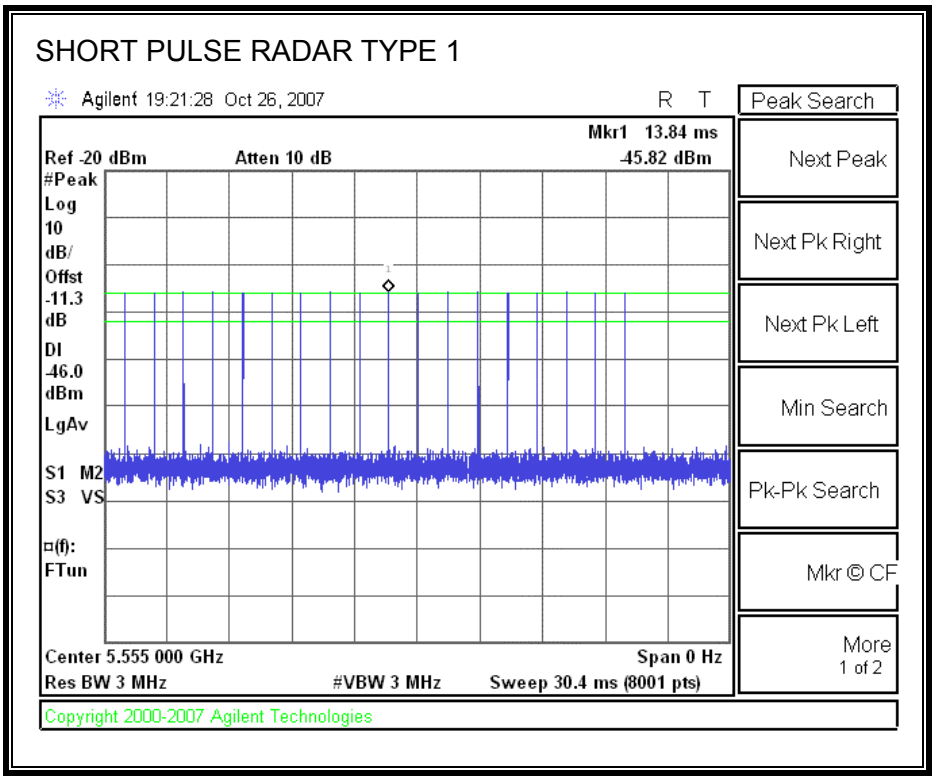
All tests were performed at a channel center frequency of 5555 MHz. Measurements were performed using conducted test methods.

8.2.2. TALK / LISTEN RATIO

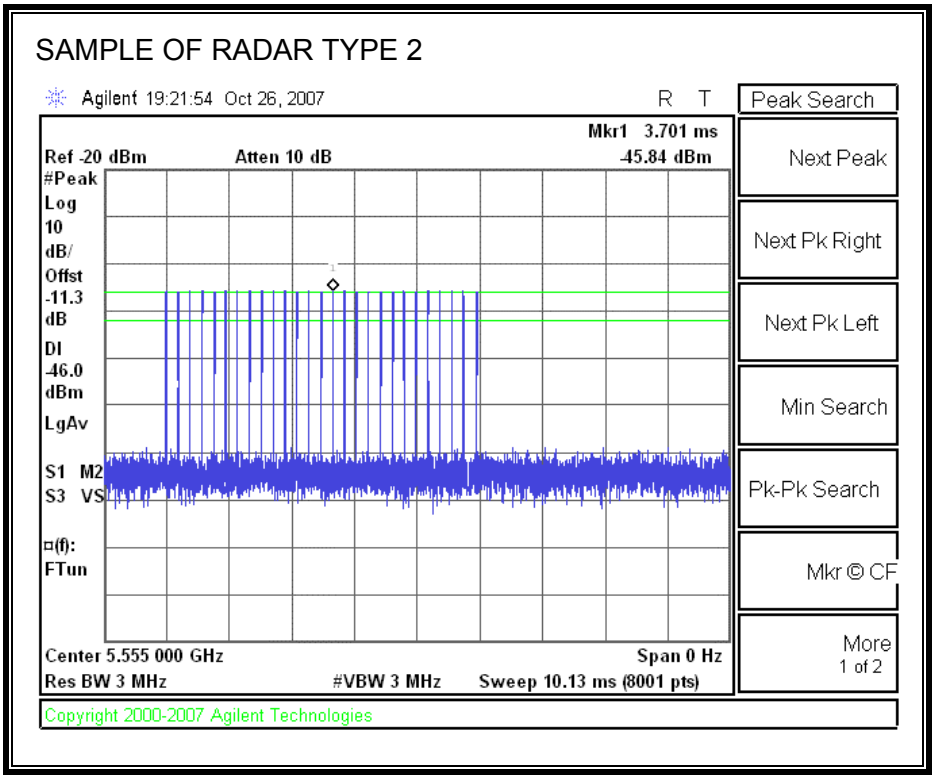
The Frame parameters were set to a Talk / Listen ratio of 45 % / 55 %. This is as close to 40% / 60% that the EUT is capable of being set.

8.2.3. PLOTS OF RADAR WAVEFORMS AND WLAN TRAFFIC

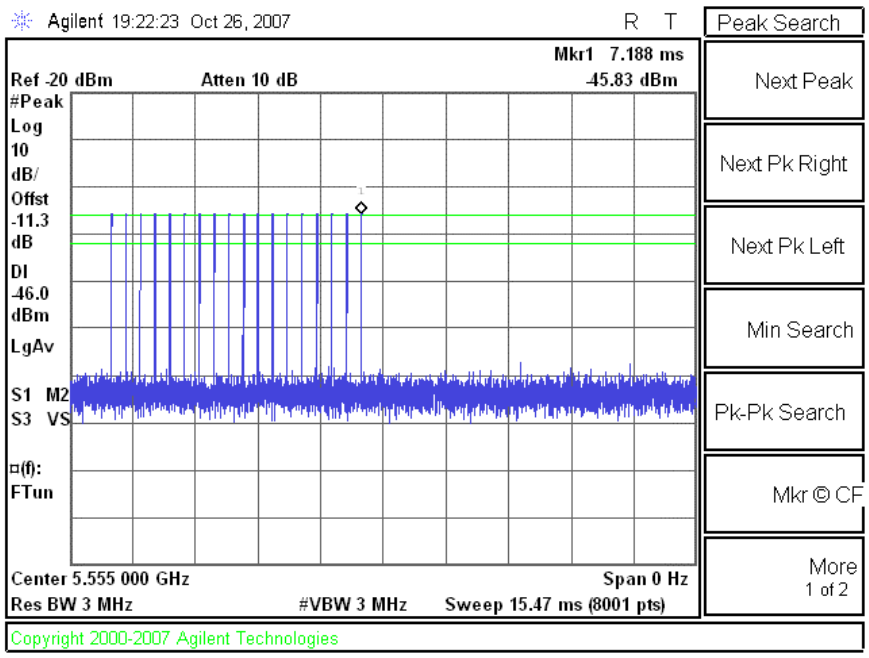
PLOTS OF RADAR WAVEFORMS



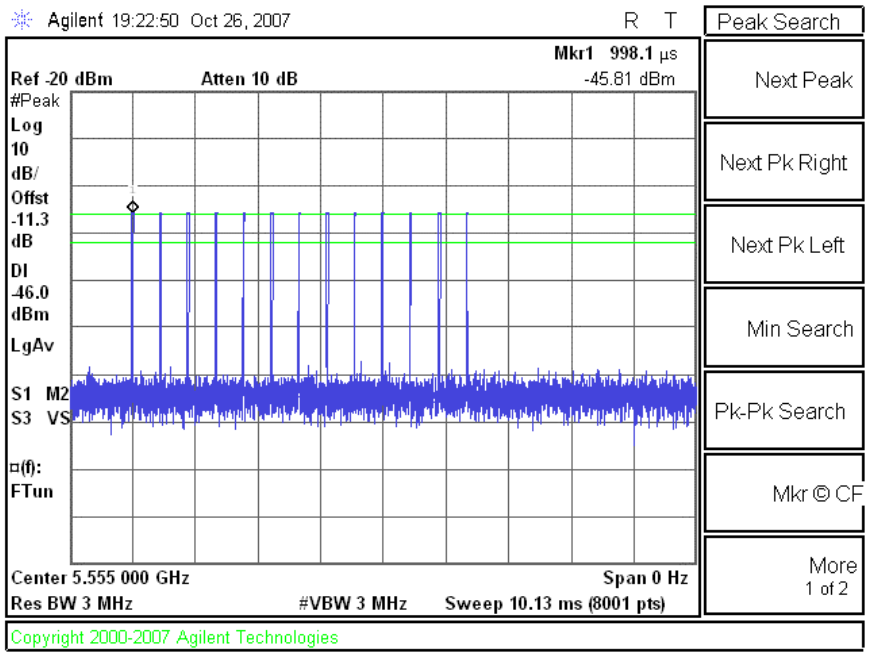
SAMPLE OF RADAR TYPE 2



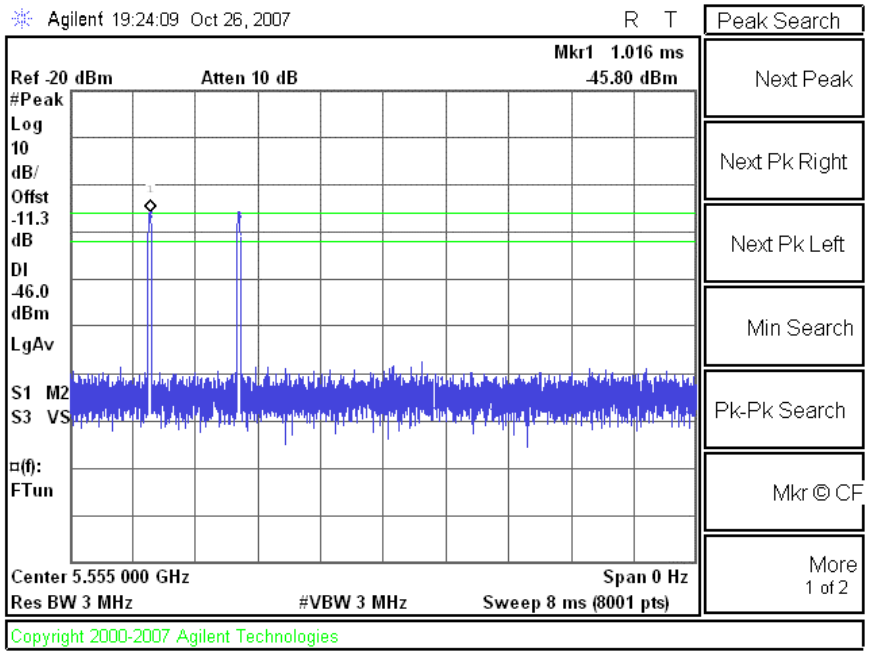
SAMPLE OF RADAR TYPE 3



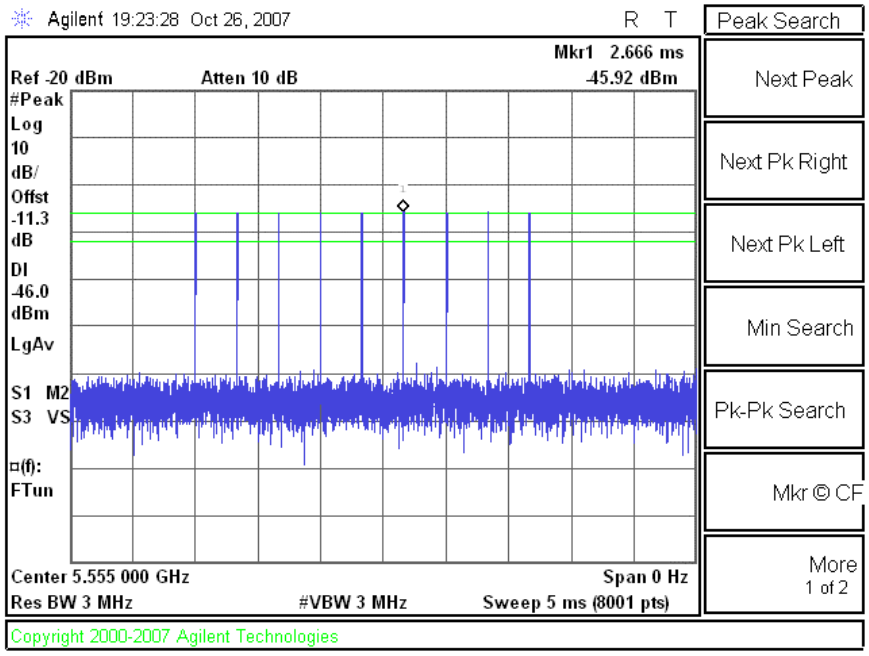
SAMPLE OF RADAR TYPE 4



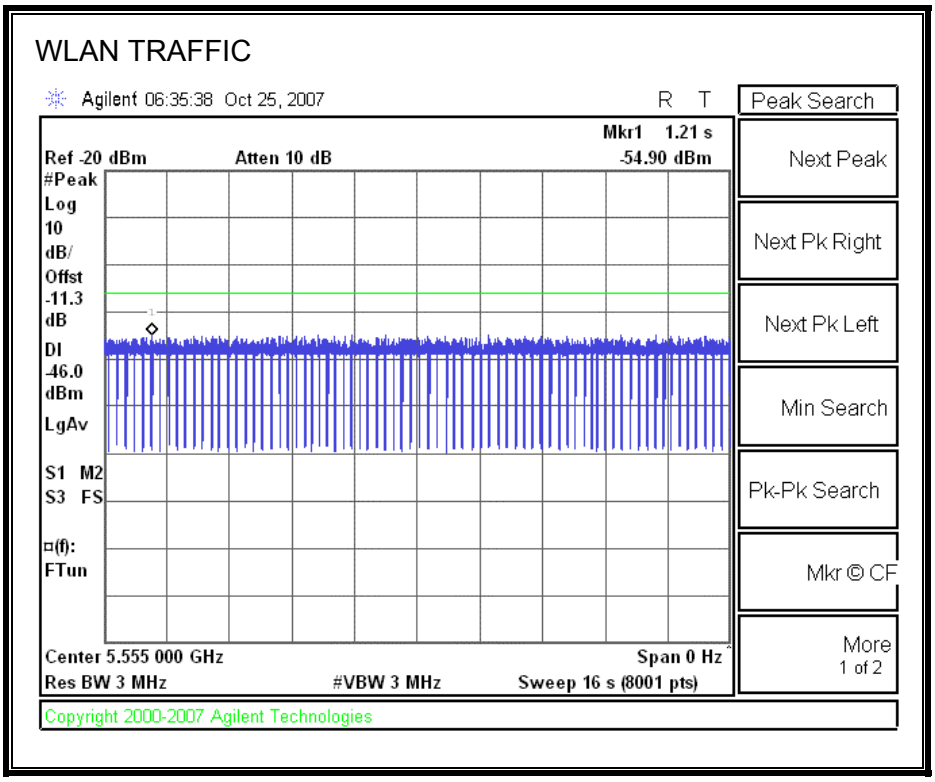
SAMPLE OF SINGLE BURST OF RADAR TYPE 5



SINGLE BURST OF RADAR TYPE 6



PLOT OF WLAN TRAFFIC FROM MASTER



8.2.4. 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.

Transmissions commence 10 seconds after the end of the Channel Availability Check, therefore the time to complete the initial power-up period is 70 seconds less than this total power-up time.

PROCEDURE FOR TIMING OF RADAR BURST

With a link established on channel, a software reboot command was issued to the EUT. 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, a software reboot command was issued to the EUT. 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)
43.56	144.6	101.0	31.0

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)
44.37	80.5	36.1	5.1

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)
44.19	133.3	89.1	58.1

QUALITATIVE RESULTS

Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT indicates Normal Transmit	Transmissions begin on channel after completion of the initial power-up cycle, the CAC, and the final power-up cycle.
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

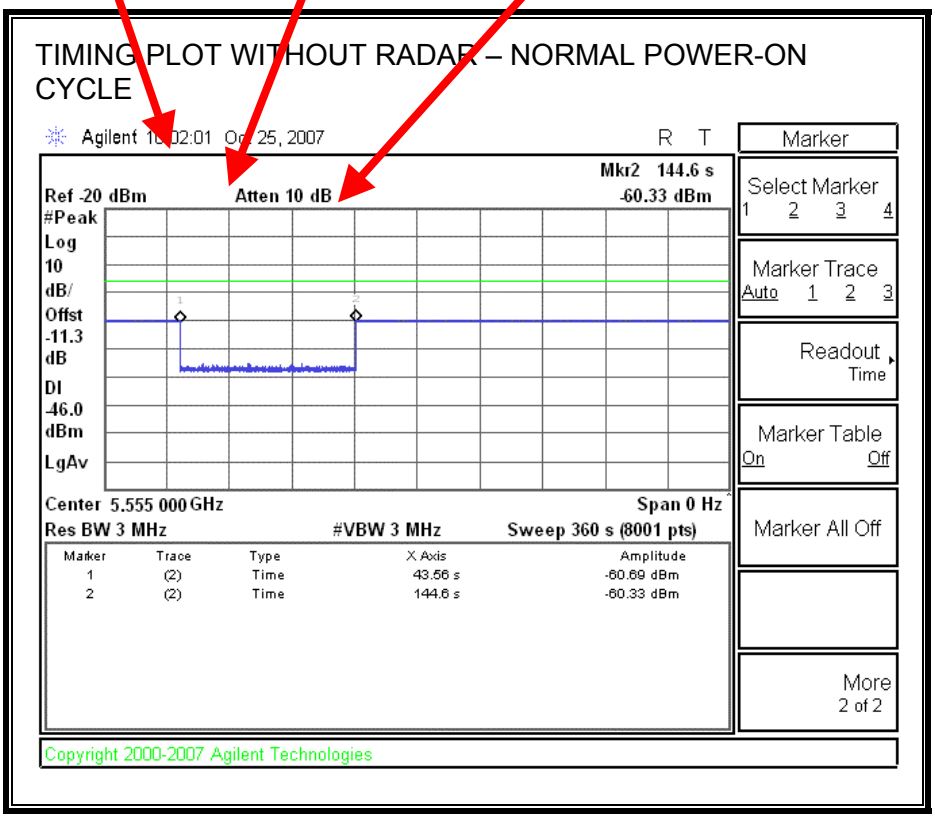
Start of Initial Power-up cycle

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

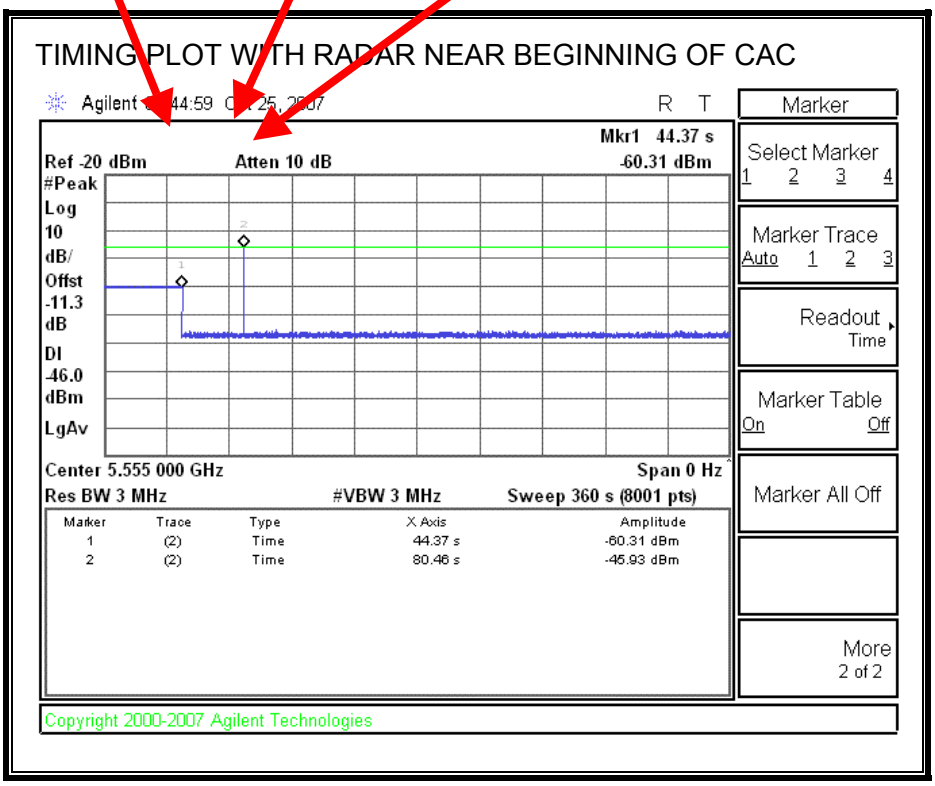
Traffic ceases

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

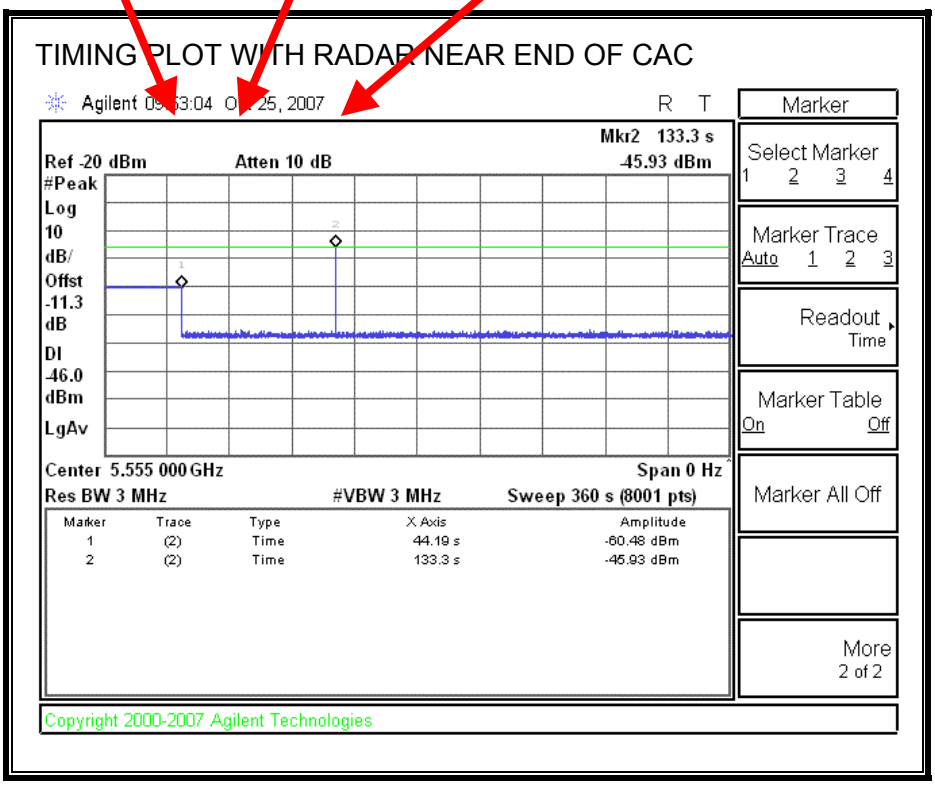
Traffic ceases

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.

8.2.5. OVERLAPPING CHANNEL TESTS

RESULTS

The channel spacing is greater than or equal to the channel bandwidth therefore the EUT does not have an overlapping channel plan.

These tests are not applicable.

8.2.6. 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).

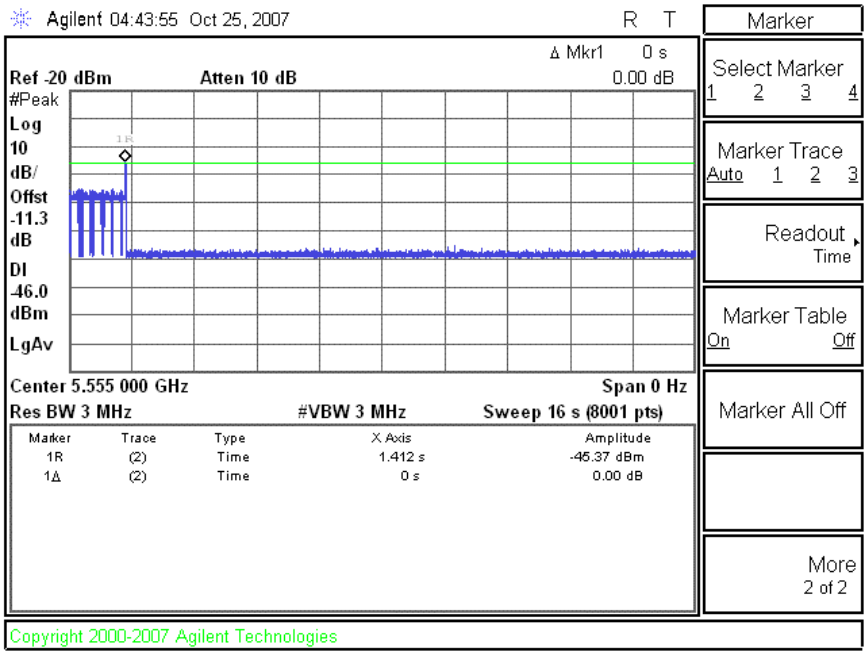
RESULTS

Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.0	10

Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	0.0	60
IC	24.0	260

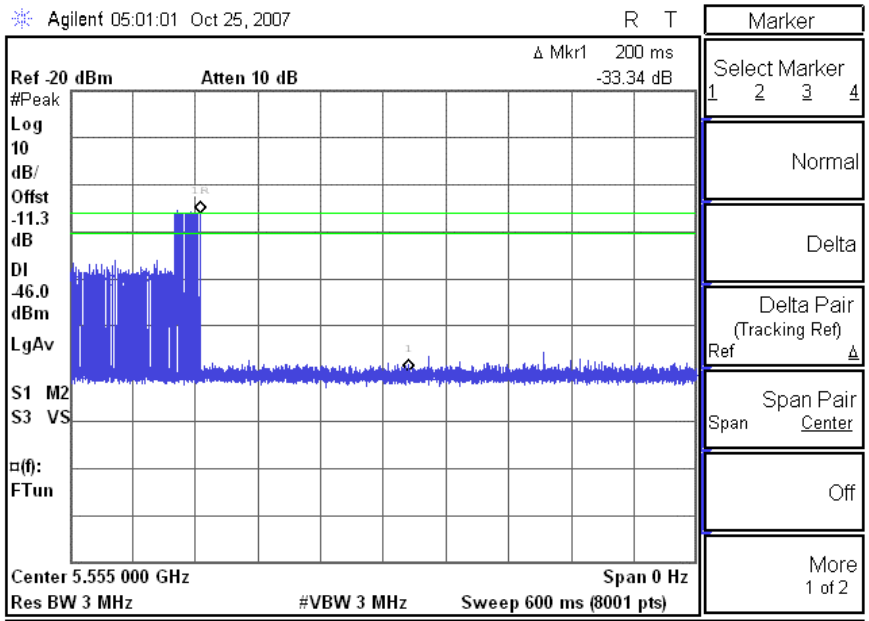
MOVE TIME

MOVE TIME PLOT



CHANNEL CLOSING TIME

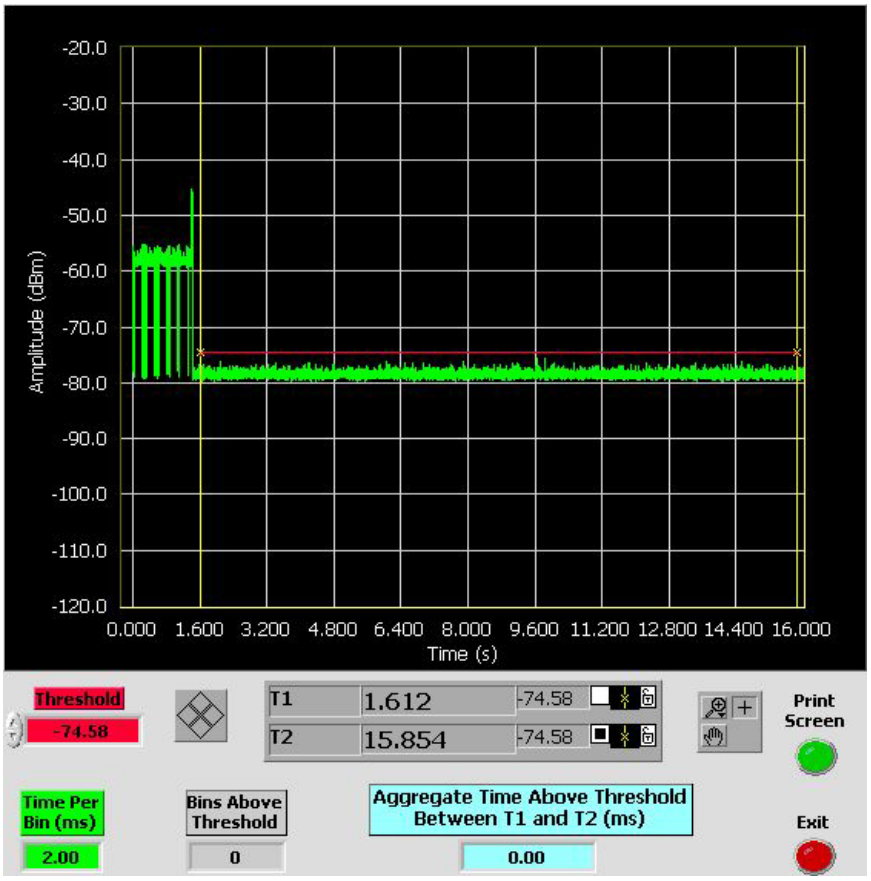
CLOSING TIME PLOT



FCC AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the aggregate monitoring period.

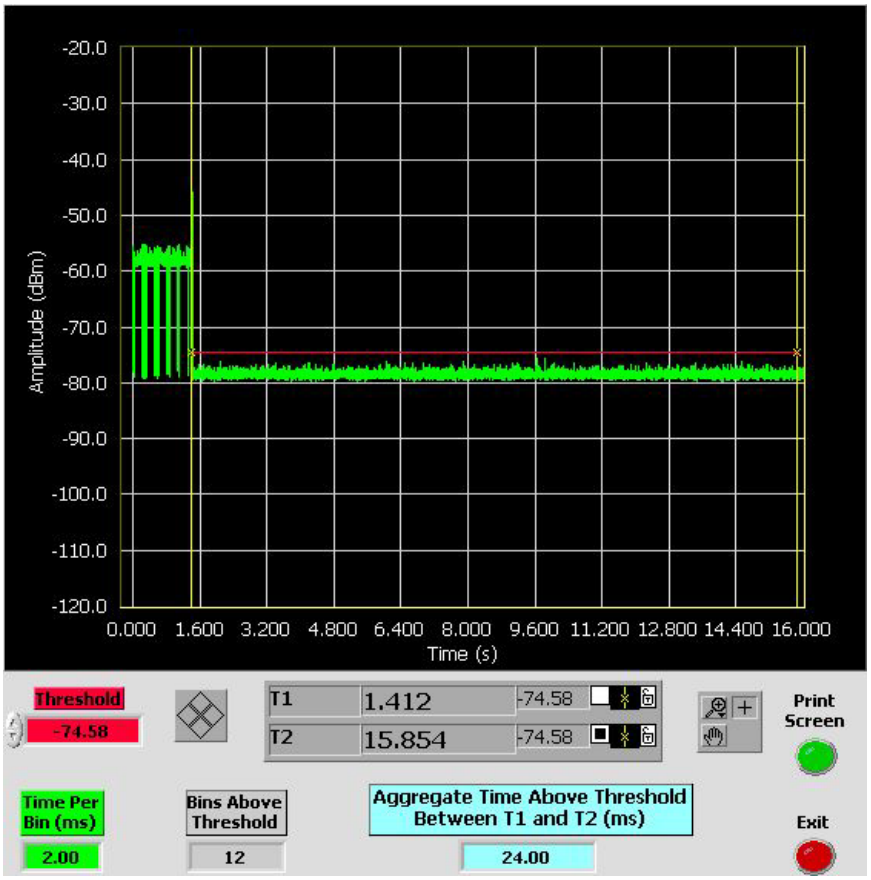
FCC AGGREGATE CLOSING TIME PLOT



IC AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

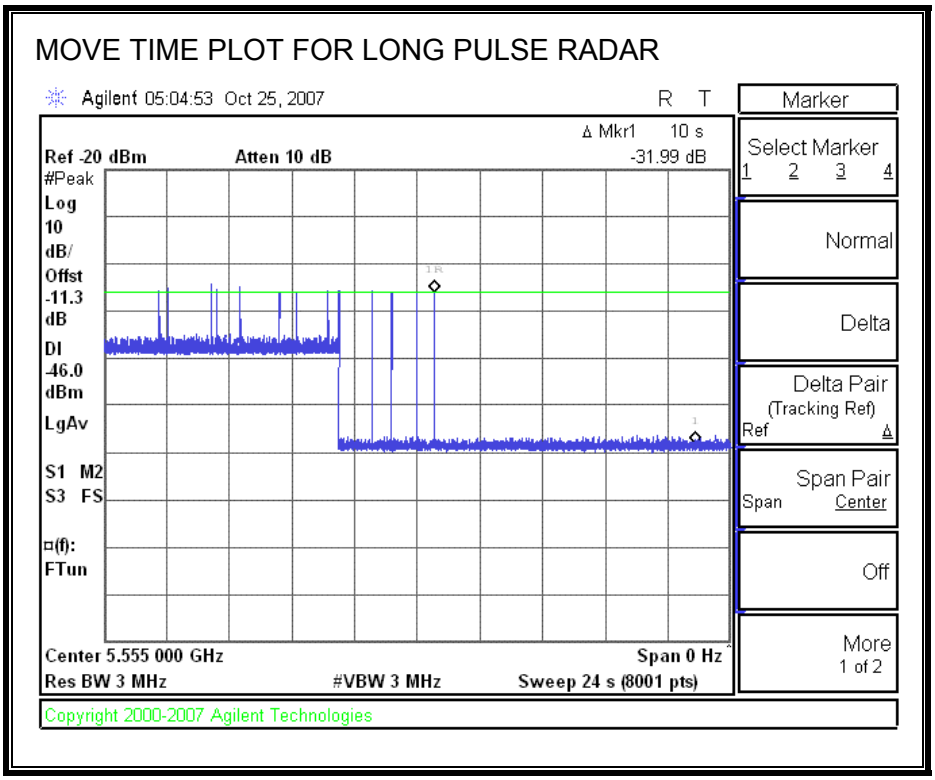
Only intermittent transmissions are observed during the aggregate monitoring period.

IC AGGREGATE CLOSING TIME PLOT



LONG PULSE CHANNEL MOVE TIME

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



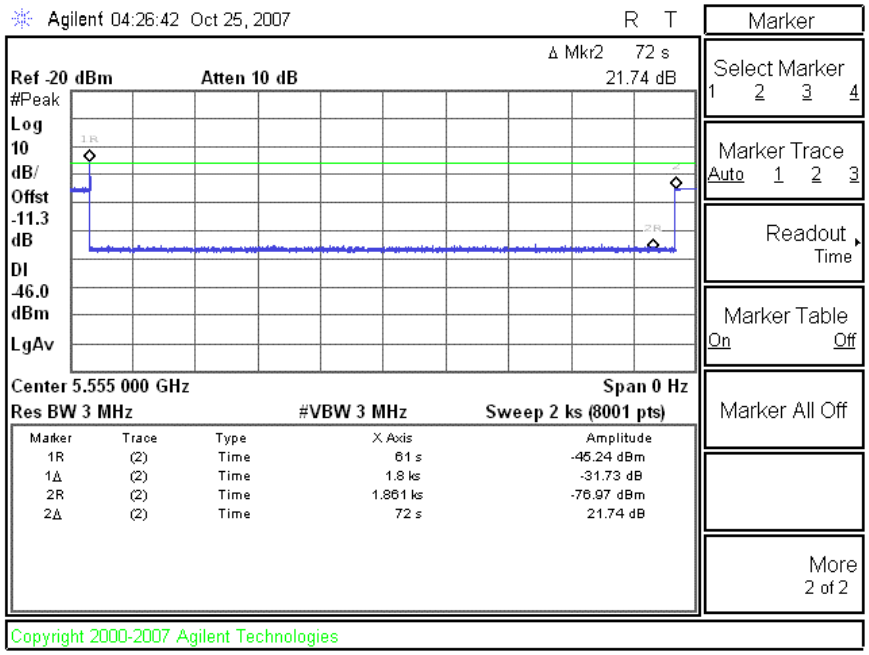
8.2.7. NON-OCCUPANCY PERIOD

RESULTS

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

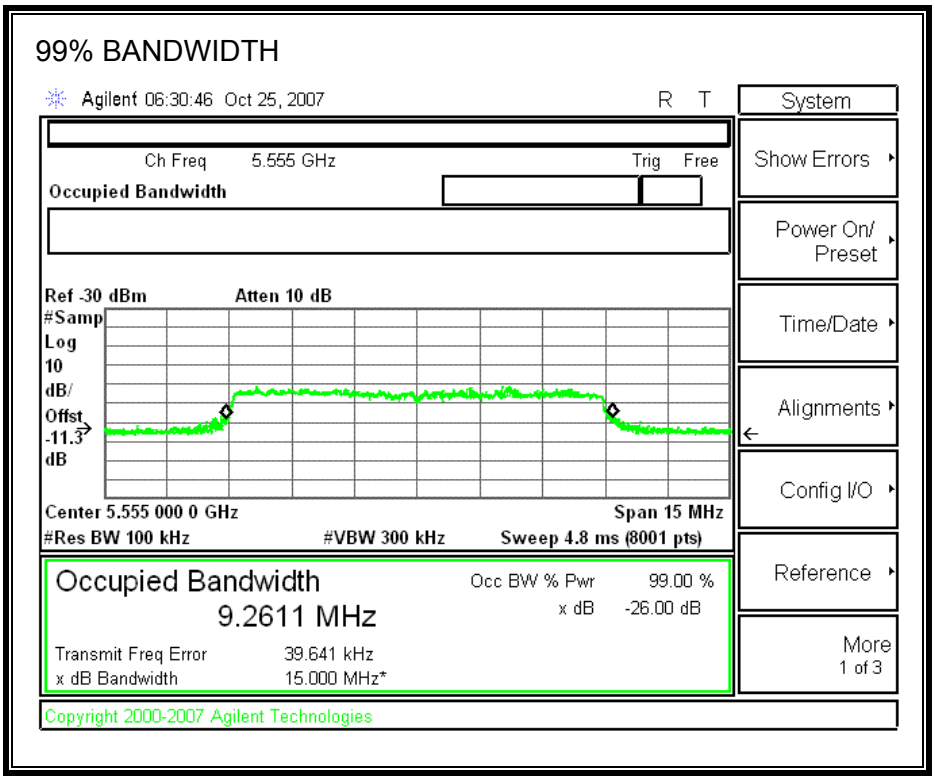
For test purposes, only one channel was enabled. Therefore at the conclusion of the Non-occupancy period, the EUT performed another CAC test, and traffic initiated 72 seconds after the end of the Non-occupancy period.

NON-OCCUPANCY PERIOD PLOT



8.2.8. 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 (%)
5551	5559	8	9.261	86.4	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
5550	10	0	0	
5551	10	10	100	FL
5552	10	10	100	
5553	10	10	100	
5554	10	10	100	
5555	10	10	100	
5556	10	10	100	
5557	10	10	100	
5558	10	10	100	
5559	10	10	100	FH
5560	10	0	0	

8.2.9. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary				
Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail
FCC TYPE 1	30	100.00	60	Pass
FCC TYPE 2	30	100.00	60	Pass
FCC TYPE 3	30	100.00	60	Pass
FCC TYPE 4	30	96.67	60	Pass
Aggregate		99.17	80	Pass
FCC TYPE 5	30	80.00	80	Pass
FCC TYPE 6	36	100.00	80	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	Yes
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	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	2.3	193.00	27	Yes
2002	3.5	193.00	27	Yes
2003	1.2	196.00	24	Yes
2004	1	166.00	29	Yes
2005	4.5	207.00	27	Yes
2006	1	208.00	29	Yes
2007	4.8	173.00	29	Yes
2008	3.2	228.00	29	Yes
2009	4.3	174.00	29	Yes
2010	4.8	227.00	29	Yes
2011	3.8	208.00	26	Yes
2012	4.8	221.00	27	Yes
2013	4.3	166.00	23	Yes
2014	4.8	219.00	28	Yes
2015	4.2	159.00	23	Yes
2016	4	178.00	23	Yes
2017	2.4	190.00	25	Yes
2018	4.2	182.00	24	Yes
2019	1.9	177.00	24	Yes
2020	1.9	193.00	25	Yes
2021	3.6	191.00	27	Yes
2022	3.1	163.00	23	Yes
2023	3.8	200.00	25	Yes
2024	2.6	207.00	24	Yes
2025	4.4	168.00	29	Yes
2026	2.1	192.00	28	Yes
2027	1.4	224.00	23	Yes
2028	1.6	161.00	27	Yes
2029	3.1	179.00	28	Yes
2030	4.7	169.00	29	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	6.7	364.00	18	Yes
3002	7	349.00	17	Yes
3003	6	436.00	16	Yes
3004	9.9	488.00	18	Yes
3005	9.8	452.00	17	Yes
3006	6.9	376.00	18	Yes
3007	5.3	321.00	16	Yes
3008	7	383.00	16	Yes
3009	6	459.00	17	Yes
3010	7.5	318.00	17	Yes
3011	7.9	257.00	17	Yes
3012	5.5	260.00	18	Yes
3013	5.9	491.00	17	Yes
3014	5	391.00	16	Yes
3015	6.5	308.00	16	Yes
3016	5	472.00	18	Yes
3017	8.4	454.00	16	Yes
3018	8.6	260.00	18	Yes
3019	7.1	402.00	17	Yes
3020	7.2	477.00	17	Yes
3021	7.6	435.00	17	Yes
3022	8	361.00	16	Yes
3023	7.4	353.00	16	Yes
3024	5.1	364.00	18	Yes
3025	9.1	282.00	18	Yes
3026	8.1	369.00	18	Yes
3027	9.7	307.00	18	Yes
3028	9.9	442.00	16	Yes
3029	6.3	383	18	Yes
3030	9.7	396	17	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	17.4	450.00	13	Yes
4002	13.7	339.00	15	Yes
4003	14.7	269.00	13	Yes
4004	12.2	321.00	13	Yes
4005	12.5	366.00	15	Yes
4006	19.1	264.00	14	Yes
4007	17.1	474.00	12	Yes
4008	17.8	483.00	13	Yes
4009	12.4	382.00	13	Yes
4010	17.2	319.00	15	Yes
4011	14.3	352.00	13	Yes
4012	14.2	379.00	12	Yes
4013	15.9	333.00	16	Yes
4014	15.5	477.00	12	Yes
4015	16.3	312.00	15	Yes
4016	18.2	282.00	12	Yes
4017	12	334.00	13	Yes
4018	19.2	315.00	15	Yes
4019	18.1	441.00	12	Yes
4020	12	463.00	15	Yes
4021	17.6	391.00	13	Yes
4022	16.6	261.00	15	Yes
4023	12.3	475.00	15	Yes
4024	13.7	419.00	15	No
4025	11.2	350.00	13	Yes
4026	13.3	408.00	14	Yes
4027	16.4	412.00	12	Yes
4028	16.9	483.00	16	Yes
4029	18.8	372.00	16	Yes
4030	17.2	274.00	15	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	No
7	Yes
8	No
9	Yes
10	Yes
11	No
12	No
13	Yes
14	Yes
15	Yes
16	Yes
17	Yes
18	Yes
19	Yes
20	No
21	Yes
22	Yes
23	Yes
24	Yes
25	Yes
26	Yes
27	Yes
28	No
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	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	161	5551	1	Yes
2	636	5552	3	Yes
3	1111	5553	1	Yes
4	1586	5554	2	Yes
5	2536	5555	1	Yes
6	3011	5556	1	Yes
7	3486	5557	4	Yes
8	3961	5558	3	Yes
9	4436	5559	4	Yes
10	4911	5551	1	Yes
11	5386	5552	1	Yes
12	5861	5553	1	Yes
13	6336	5554	5	Yes
14	6811	5555	2	Yes
15	7286	5556	3	Yes
16	8236	5557	3	Yes
17	9186	5558	4	Yes
18	9661	5559	2	Yes
19	10136	5551	2	Yes
20	10611	5552	2	Yes
21	11086	5553	1	Yes
22	11561	5554	3	Yes
23	12036	5555	1	Yes
24	12511	5556	2	Yes
25	12986	5557	2	Yes
26	13461	5558	3	Yes
27	13936	5559	1	Yes
28	14411	5551	2	Yes
29	15361	5552	1	Yes
30	15836	5553	4	Yes
31	16786	5554	1	Yes
32	17261	5555	3	Yes
33	17736	5556	1	Yes
34	18211	5557	1	Yes
35	18686	5558	1	Yes
36	19161	5559	2	Yes

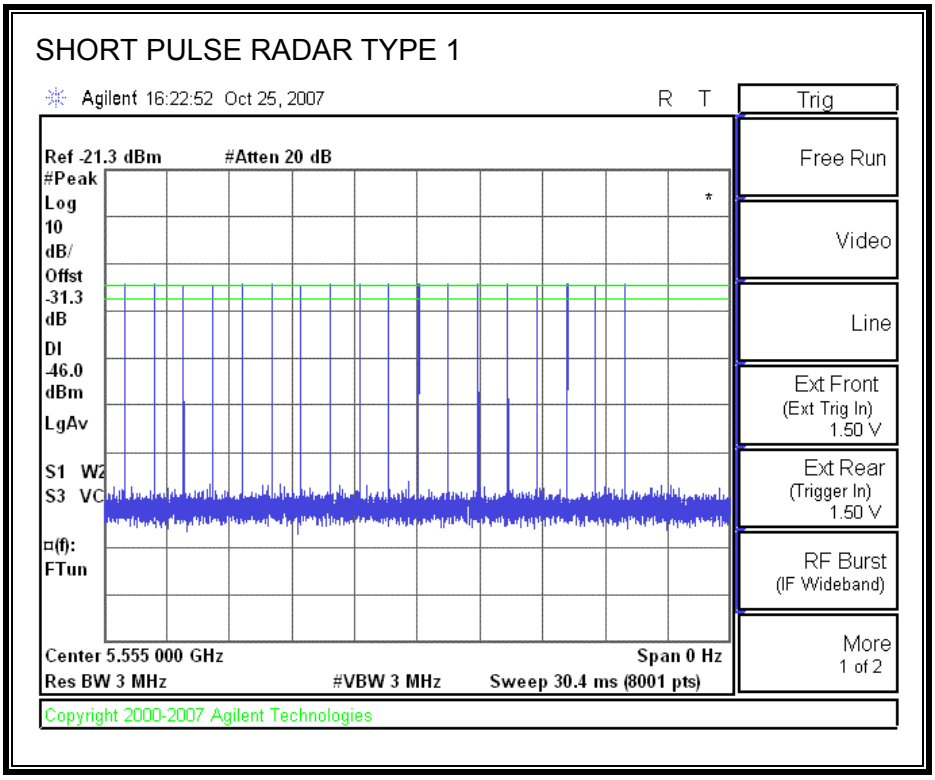
8.3. RESULTS FOR SLAVE DEVICE CONFIGURATION

8.3.1. TEST CHANNEL

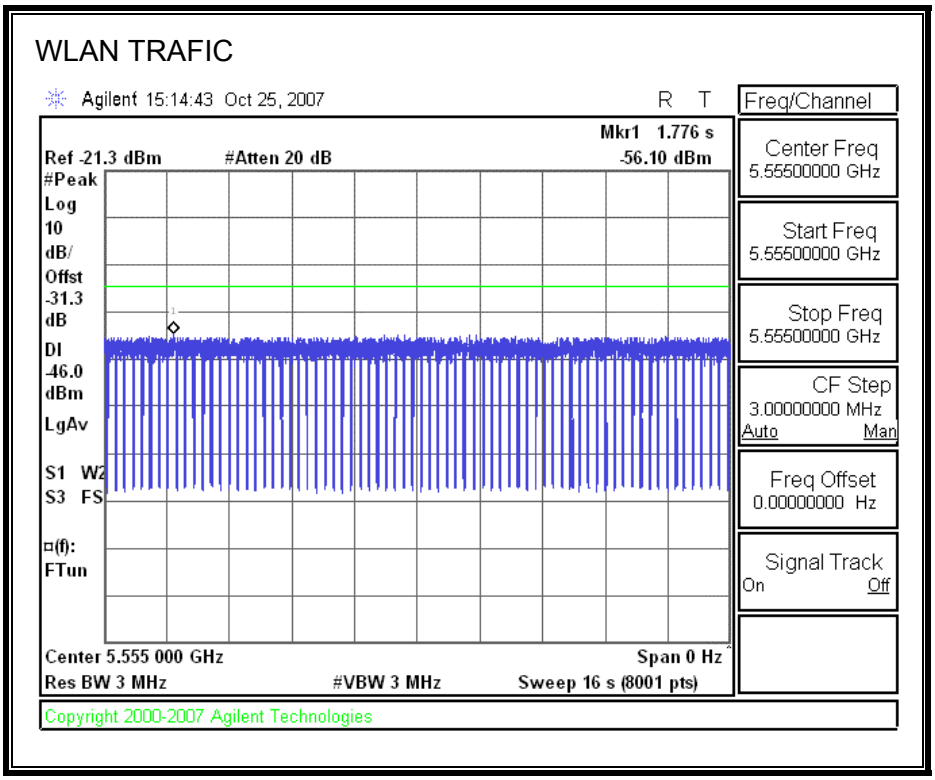
All tests were performed at a channel center frequency of 5555 MHz. Measurements were performed using conducted test methods.

8.3.2. PLOTS OF RADAR WAVEFORM AND WLAN TRAFFIC

PLOTS OF RADAR WAVEFORM



PLOT OF WLAN TRAFFIC



8.3.3. 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).

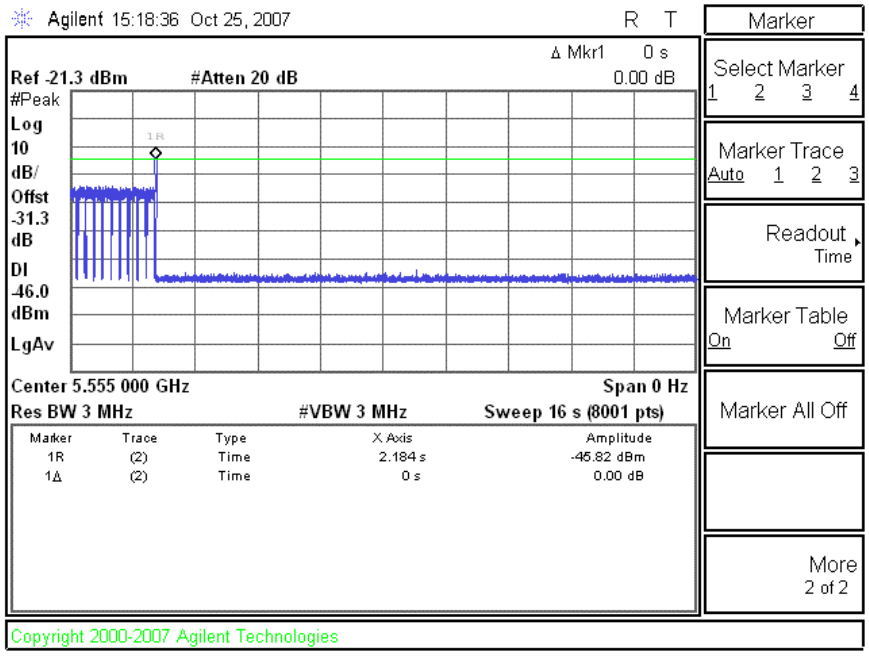
RESULTS

Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.0	10

Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	0.0	60
IC	0.0	260

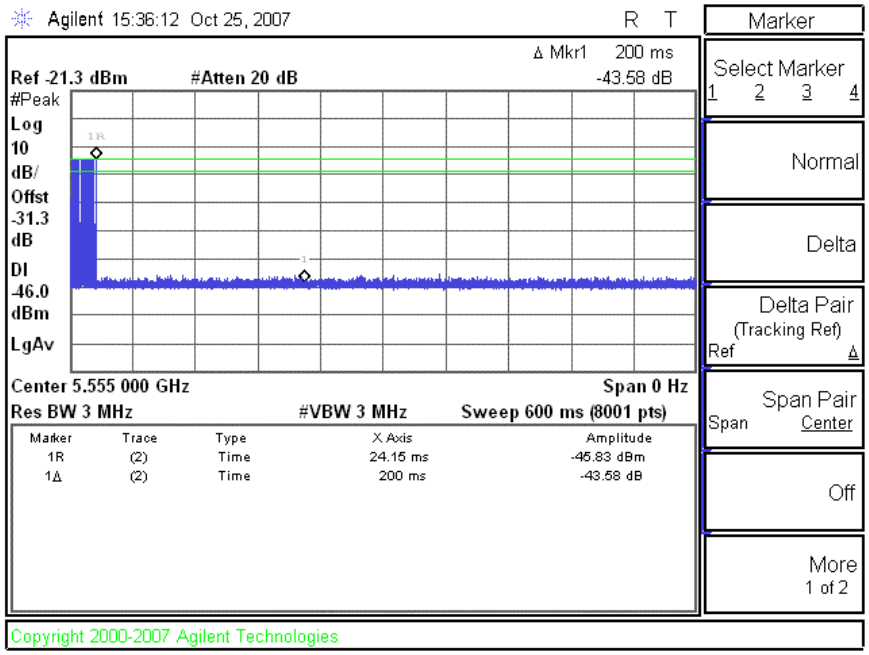
MOVE TIME

MOVE TIME PLOT



CHANNEL CLOSING TIME

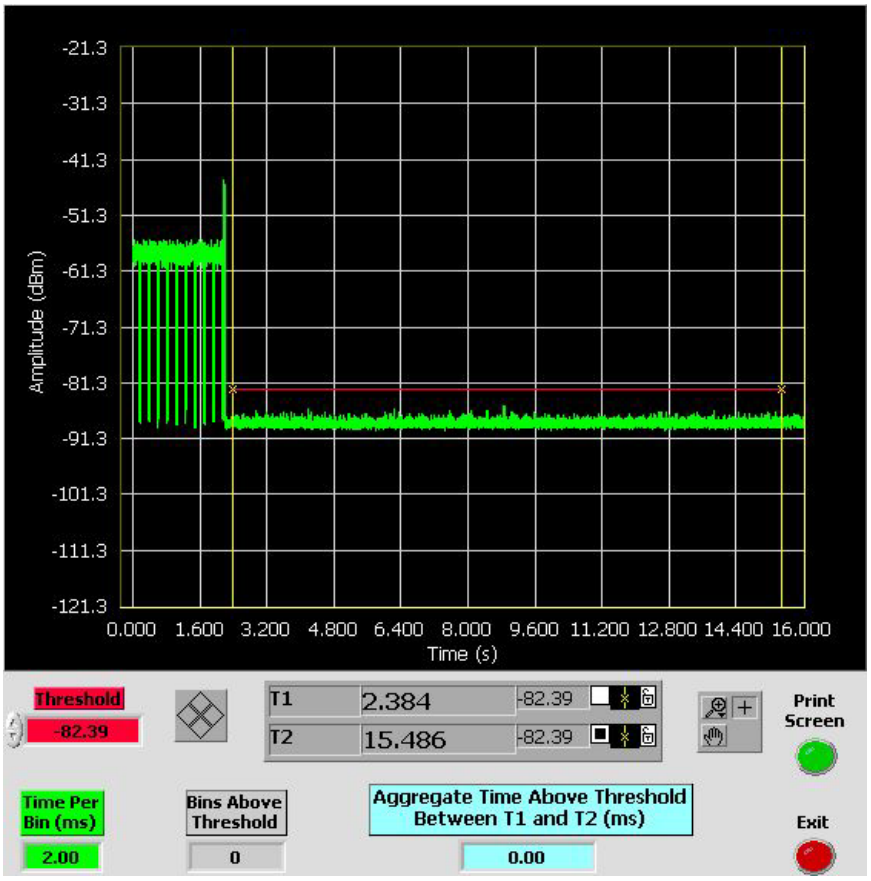
CLOSING TIME PLOT



FCC AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the aggregate monitoring period.

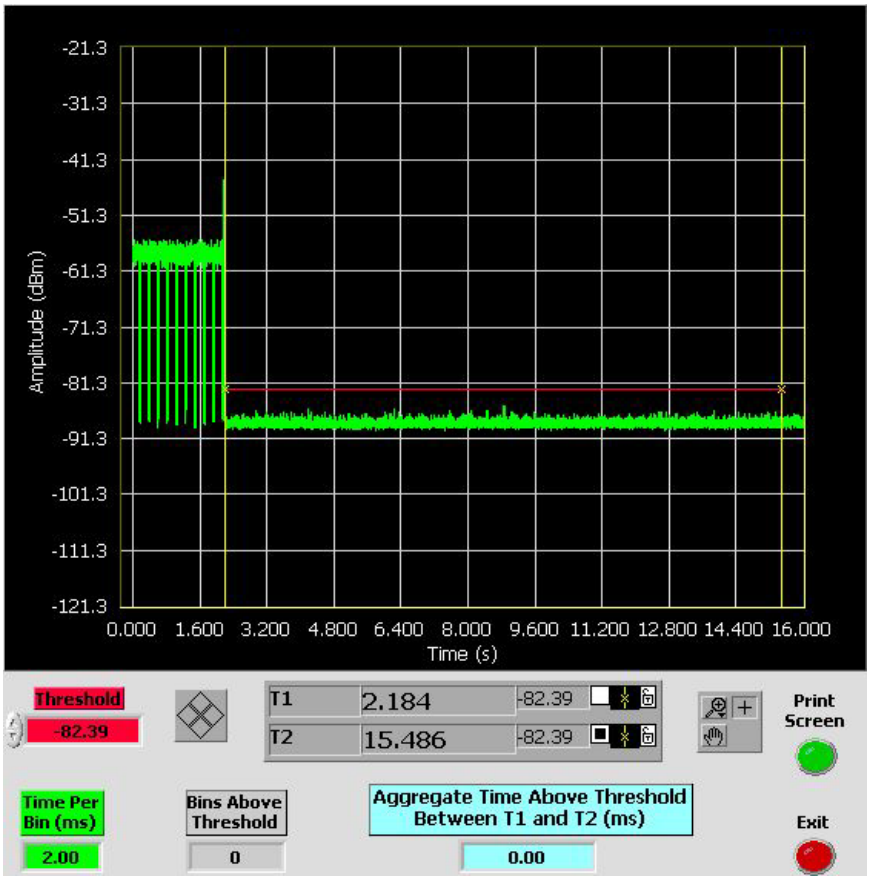
FCC AGGREGATE CLOSING TIME PLOT



IC AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the aggregate monitoring period.

IC AGGREGATE CLOSING TIME PLOT

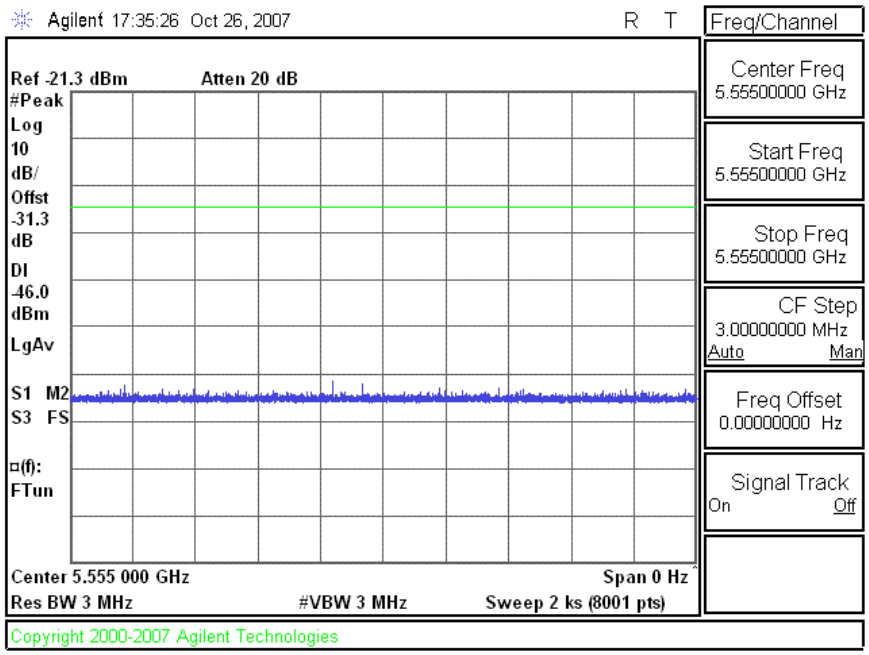


8.3.4. SLAVE NON-OCCUPANCY

NON-ASSOCIATED TEST RESULTS

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

NON-OCCUPANCY PERIOD, NON-ASSOCIATED PLOT

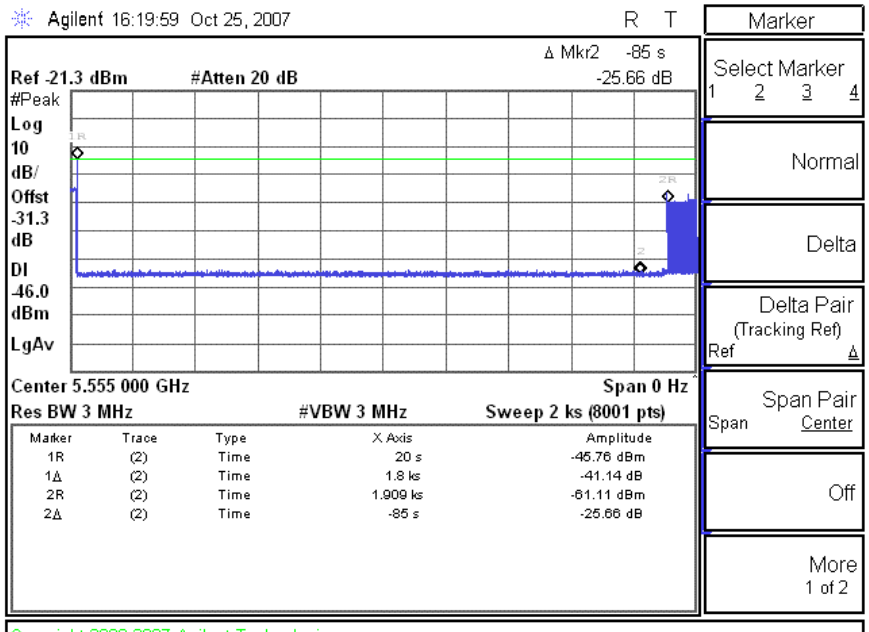


ASSOCIATED TEST RESULTS

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

For test purposes, only one channel of ther Master Device was enabled. Therefore at the conclusion of the Non-occupancy period, the Master Device performed another CAC test, and the Slave linked to the Master 85 seconds after the end of the Non-occupancy period.

NON-OCCUPANCY PERIOD, ASSOCIATED PLOT



9. 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

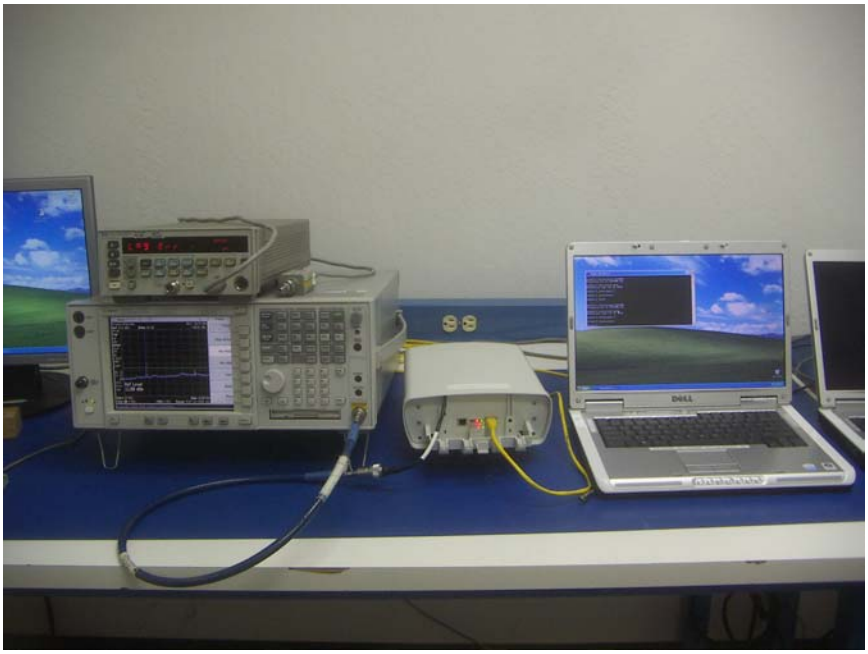
MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	FCC Power Density (mW/cm^2)	IC Power Density (W/m^2)
20.0	9.92	17.00	0.10	0.98

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

10. SETUP PHOTOS

ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP

ANTENNA PORT CONDUCTED PHOTO



RADIATED RF MEASUREMENT SETUP WITH DIPOLE ANTENNA

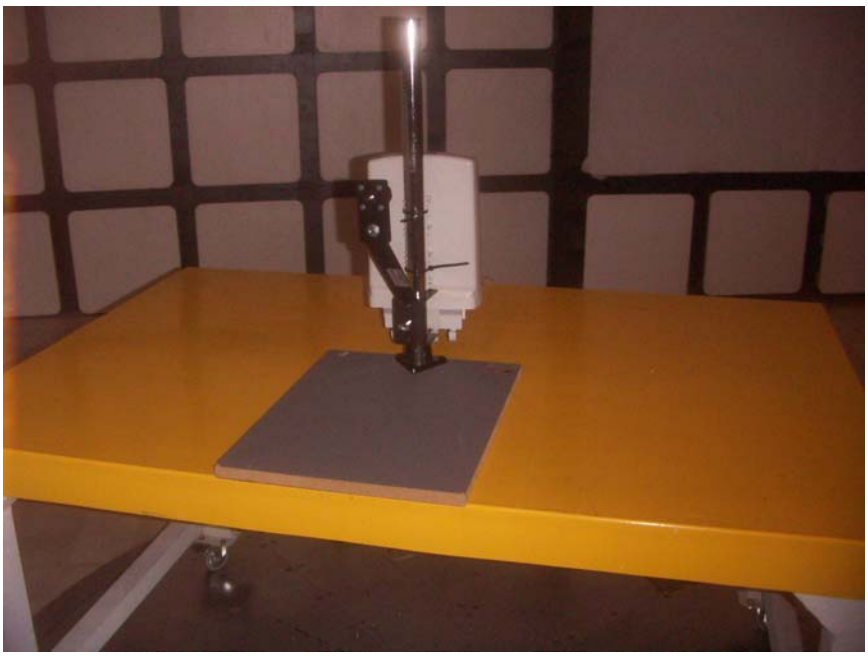
RADIATED FRONT PHOTO

RADIATED BACK PHOTO

RADIATED RF MEASUREMENT SETUP WITH PATCH ANTENNA

RADIATED FRONT PHOTO

RADIATED BACK PHOTO



DIGITAL DEVICE RADIATED EMISSIONS SETUP WITH DIPOLE ANTENNA

DIGITAL DEVICE FRONT PHOTO

DIGITAL DEVICE BACK PHOTO

DIGITAL DEVICE RADIATED EMISSIONS SETUP WITH PATCH ANTENNA

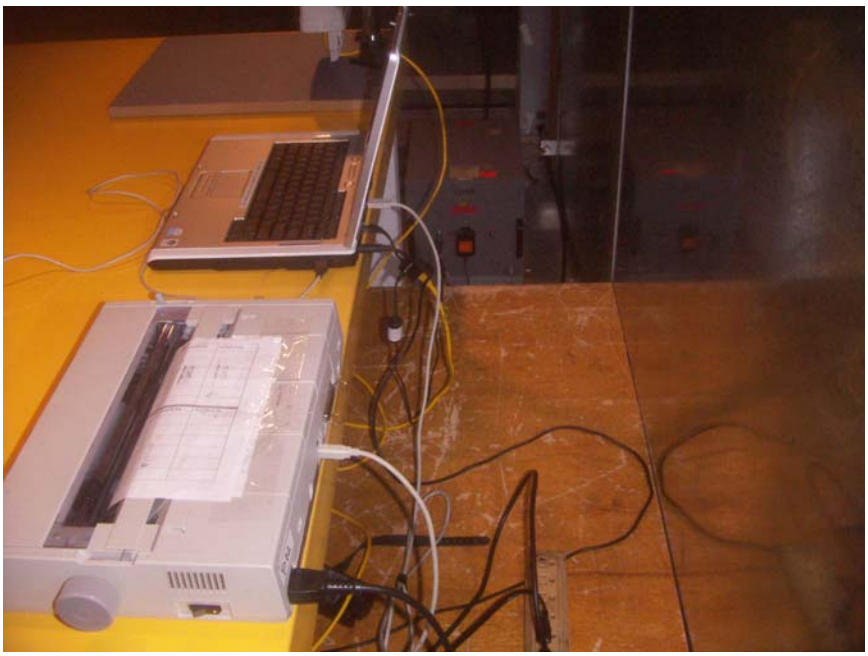
DIGITAL DEVICE FRONT PHOTO

DIGITAL DEVICE BACK PHOTO

POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP

LINE CONDUCTED FRONT PHOTO

LINE CONDUCTED BACK PHOTO



DYNAMIC FREQUENCY SELECTION MEASUREMENT SETUP

DFS SETUP PHOTO

END OF REPORT