FCC CFR 47 PART 90 SUBPART Y
INDUSTRY CANADA RSS-111 ISSUE 2

CERTIFICATION TEST REPORT

FOR

4.9 GHz Radio Module

MODEL: ExtendAir 4.9GHz RF

FCC ID: TTM-104P94N
IC: 6254A-104P94N

REPORT NUMBER: 09U12981-1, Revision B

ISSUE DATE: FEBRUARY 3, 2010

Prepared for
EXALT COMMUNICATIONS
580 DIVISION STREET
CAMPBELL
CA, 95008, USA

Prepared by
COMPLIANCE CERTIFICATION SERVICES
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	1/28/2010	Initial Issue	M. Heckrotte
A	1/29/2010	Revised MPE Calculations, Added preliminary test results	M. Heckrotte
B	2/3/2010	Clarified description and model numbers	M. Heckrotte

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: EXALT COMMUNICATIONS
580 DIVISION STREET
CAMPBELL, CA 95008, USA

EUT DESCRIPTION: 4.9 GHz Radio Module

MODEL: ExtendAir 4.9GHz RF

SERIAL NUMBER: EC46090463

DATE TESTED: January 11-27, 2010

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 90 Subpart Y	Pass
INDUSTRY CANADA RSS-111 ISSUE 2	Pass

Compliance Certification Services, Inc. (CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For CCS By:

MICHAEL HECKROTTE
DIRECTOR OF ENGINEERING
COMPLIANCE CERTIFICATION SERVICES

Tested By:

MONICA HARRISON
SENIOR RF ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA-603-C, FCC CFR 47 Part 2, FCC CFR 47 Part 90, RSS-GEN Issue 2 and RSS-111 Issue 2.

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. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a 4.9 GHz radio module. It is intended for Point-to-Point Fixed Link operation. It may operate with a nominal channel bandwidth of 10 MHz or 20 MHz, with QPSK, 16QAM or 64QAM modulation.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
4945.5-4984.5	10MHz QPSK	24.06	254.74
4950.5-4979.5	20MHz QPSK	24.11	257.87

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes either an integrated or external antenna, with a maximum gain of 26 dBi.

5.4. SOFTWARE AND FIRMWARE

During testing the EUT was running;
Boot Version 1.1.4
Firmware version 1.0.0
RDK Database Version 1.1.0

5.5. WORST-CASE CONFIGURATION AND MODE

Based on preliminary tests over all modulations, QPSK was determined to be the worst-case modulation. For this device the Middle channel with 20MHz Bandwidth and QPSK modulation had the highest conducted power.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Dell	Lattitude	28071776413	DoC
AC Adapter	Dell	LA65NS0-00	CN-0DF263-71615-720-2D21	DoC

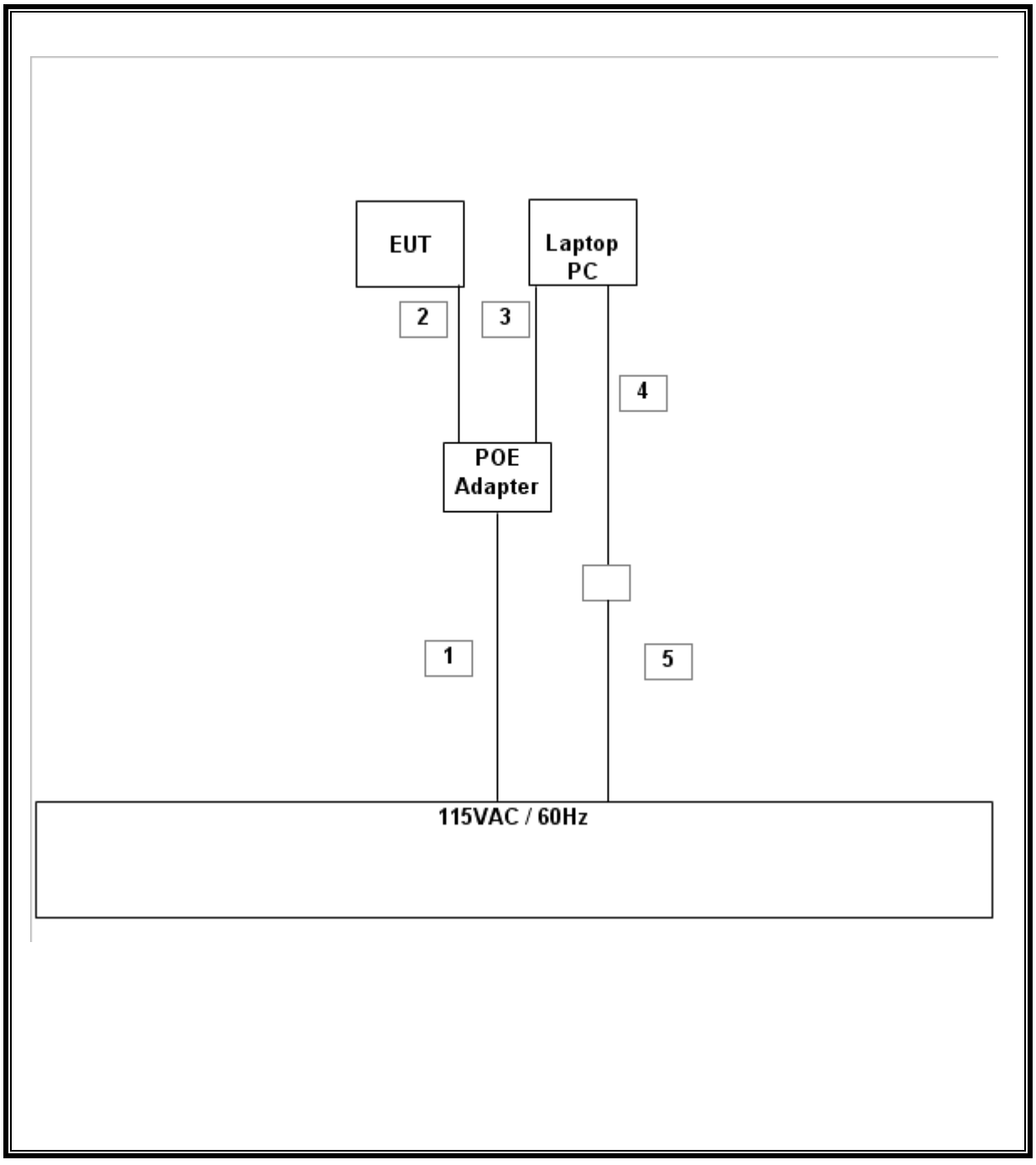
I/O CABLES

TEST SETUP

I/O CABLE LIST						
Cable No.	**Port**	**# of Identica Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	1	AC	unshielded	2.25m	
2	RJ45	1	RJ45	unshielded	1.5m	
3	RJ45	1	RJ45	unshielded	1m	
4	DC	1	DC	unshielded	2m	
5	AC	1	AC	unshielded	1m	

The EUT is a stand alone device, that was controlled using a web based GUI on an external Laptop.

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**
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	6/1/2009	6/1/2010
Power Meter	Agilent / HP	437B	N02778	11/4/2008	8/4/2010
Power Sensor, 18 GHz	Agilent / HP	8481A	N02782	10/28/2009	7/28/2011
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01161	9/9/2009	12/9/2010
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	C00981	5/21/2009	5/21/2010
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	1/29/2009	1/29/2010
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	2/3/2009	2/3/2010
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00558	1/6/2010	1/6/2011
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	2/4/2009	2/4/2010
Temperature Chamber	Thermotron	SE 600-10-10	C00930	4/6/2009	4/6/2010

7. FINAL TEST RESULTS

7.1. CHANNEL TESTS FOR 10MHz BANDWIDTH

7.1.1. EMISSION BANDWIDTH

LIMITS

The emission bandwdith must be less than or equal to the ominal channel bandwidth.

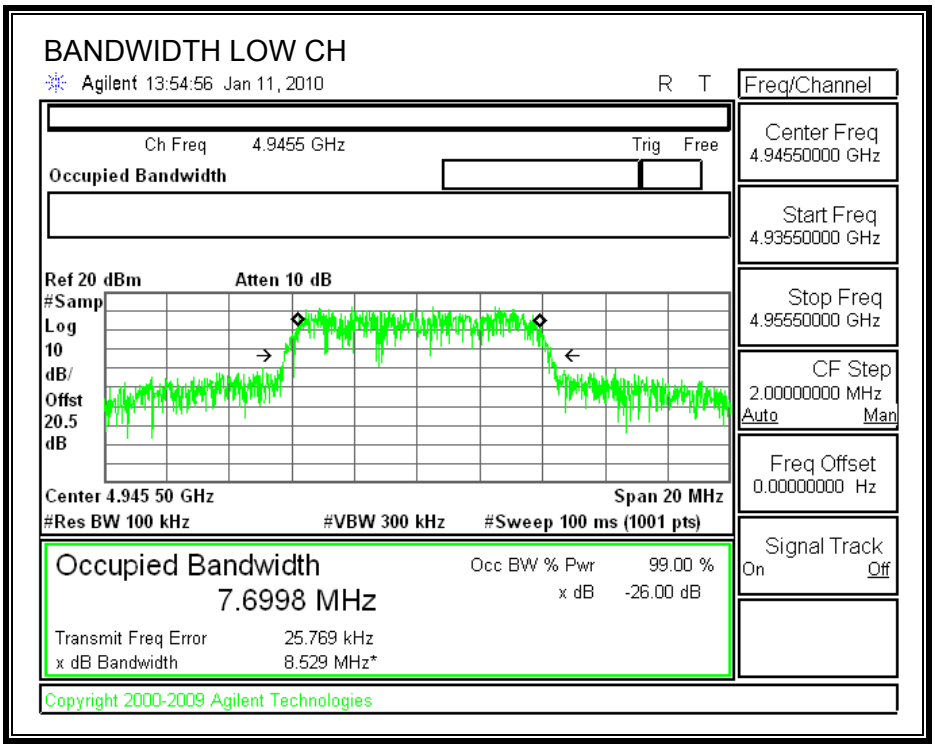
TEST PROCEDURE

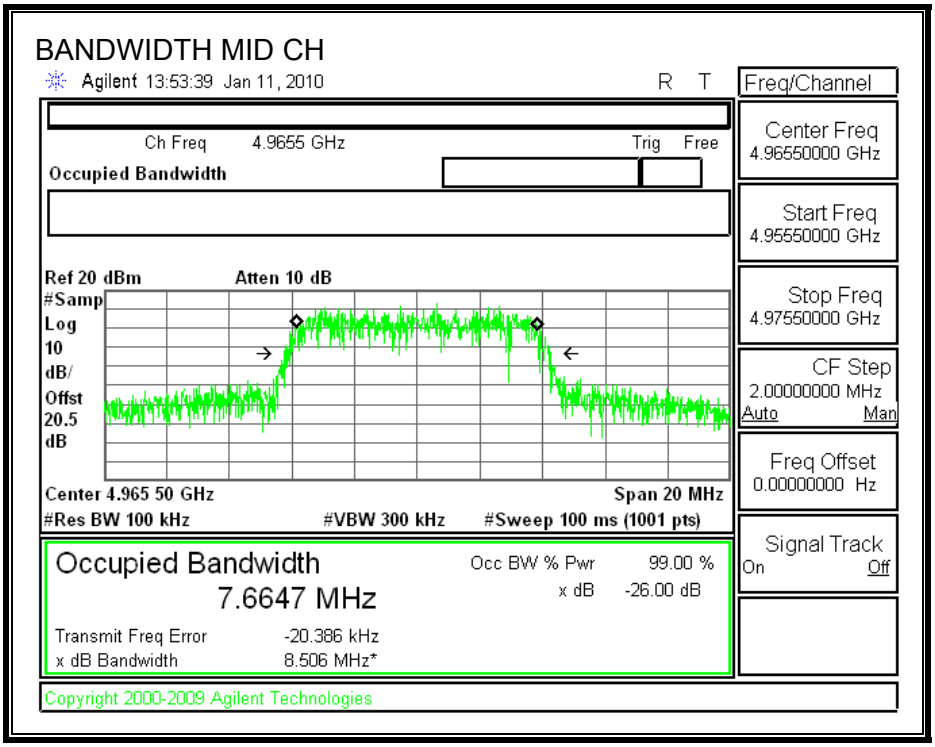
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

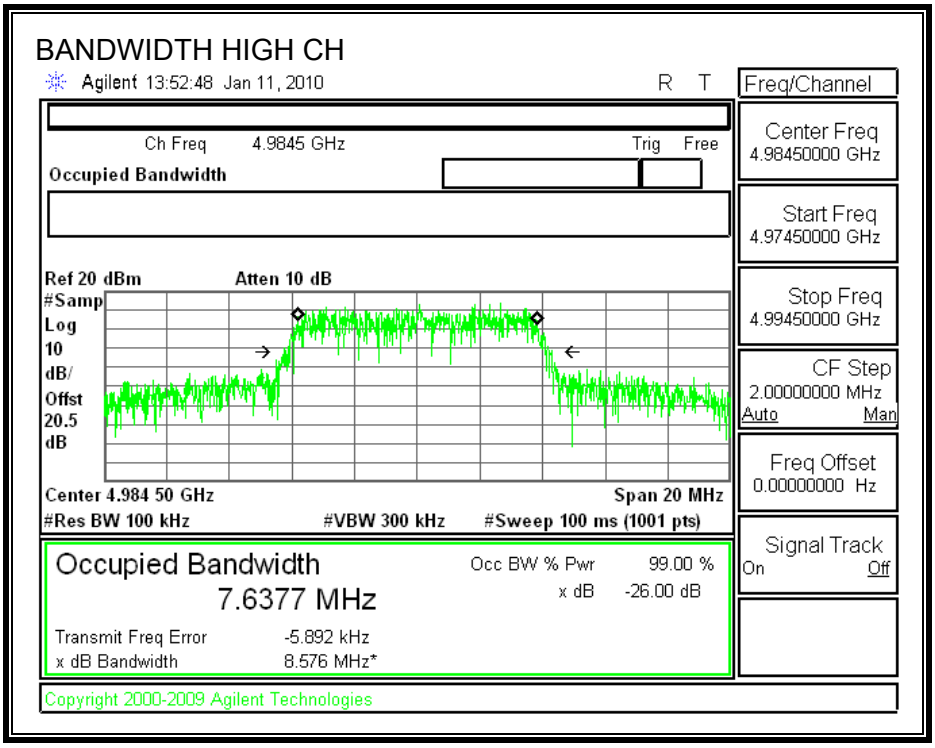
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)	EBW Limit (MHz)
Low	4945.5	7.6998	10
Middle	4965.5	7.6647	10
High	4984.5	7.6377	10

BANDWIDTH







7.1.2. OUTPUT POWER

PEAK POWER LIMIT

§ 90.1215 The transmitting power of stations operating in the 4940–4990 MHz band must not exceed the maximum limits in this section.

(a)(1) The maximum conducted output power should not exceed:

Channel bandwidth (MHz)	Low power Device Peak transmitter Power (dBm)	High power Device Peak transmitter Power (dBm)
1.....	7	20
5.....	14	27
10.....	17	30
15.....	18.8	31.8
20.....	20	33

(2) High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point and point-to-multipoint operations (both fixed and temporaryfixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the maximum conducted output power or spectral density. Corresponding reduction in the maximum conducted output power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

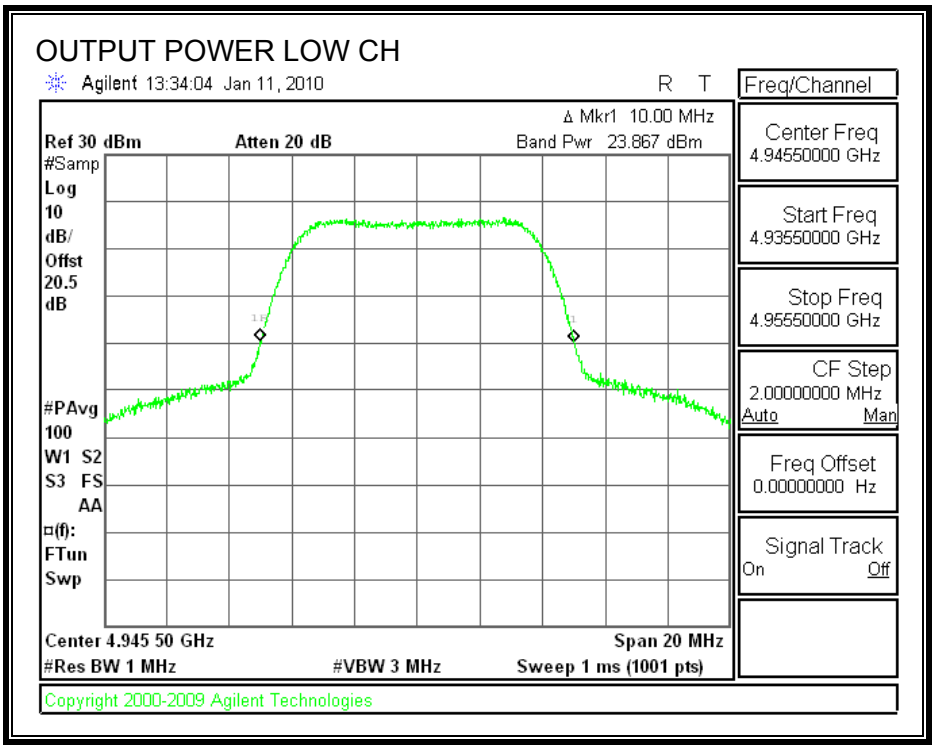
TEST PROCEDURE

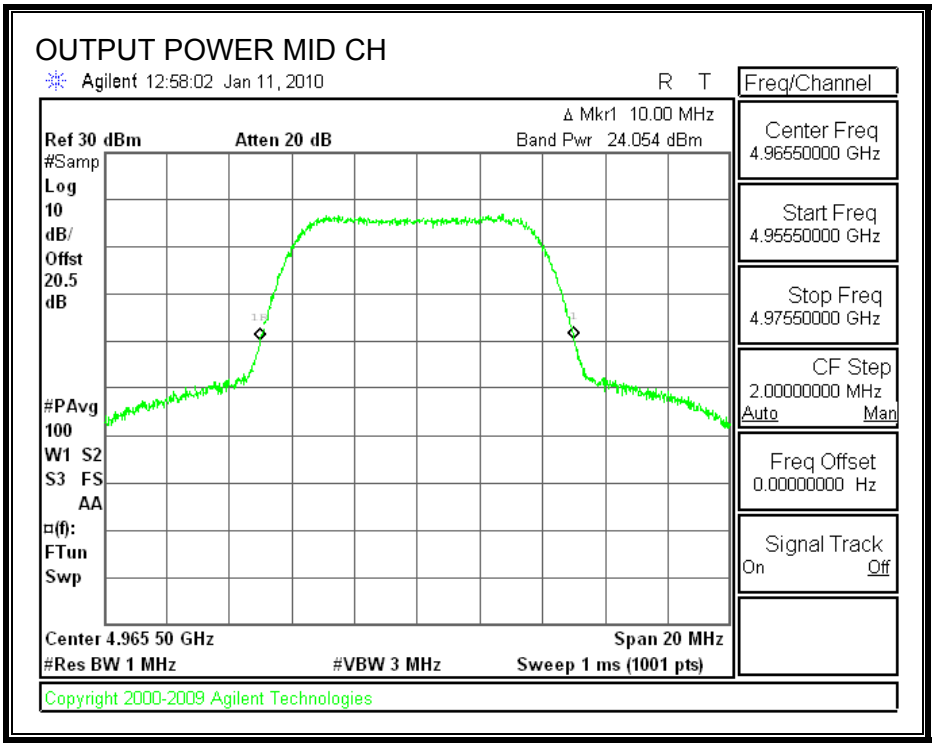
The maximum conducted output power is measured as a conducted emission over an interval of continuous transmission using instrumentation calibrated in terms of an RMS-equivalent voltage.

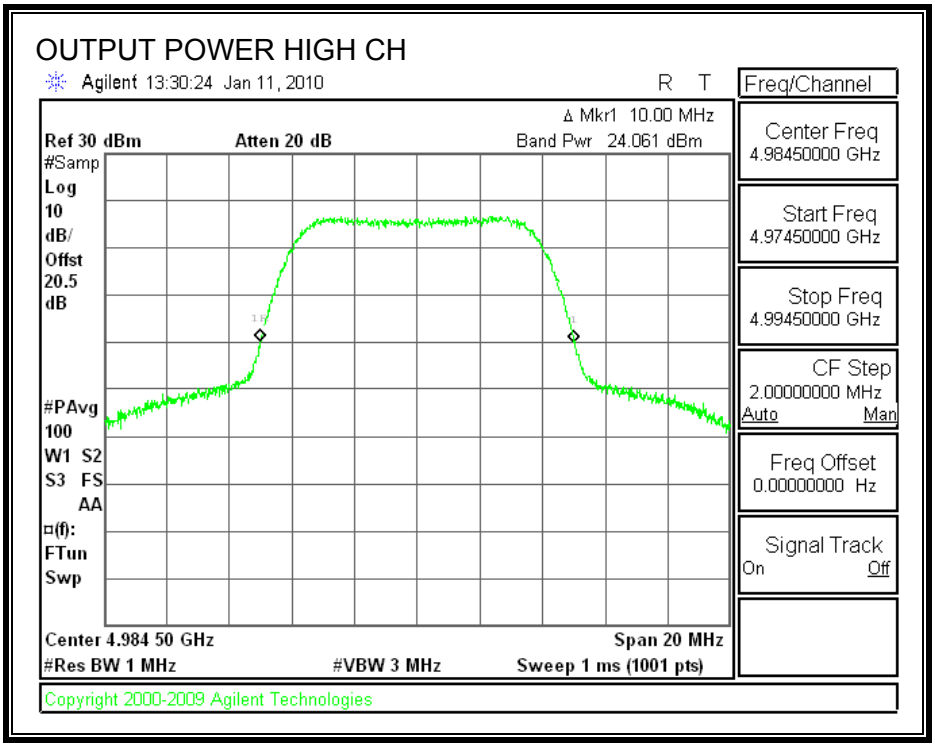
RESULTS

Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	4945.5	23.87	30.00	-6.13
Mid	4965.5	24.05	30.00	-5.95
High	4984.5	24.06	30.00	-5.94

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 21.2 dB (including 20 dB pad and 1.2 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
Low	4945.5	23.91
Middle	4965.5	23.99
High	4984.5	23.95

7.1.4. PEAK POWER SPECTRAL DENSITY

LIMITS

§ 90.1215 (a) High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the peak transmit power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point or point-to-multipoint operation (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the transmitter power or spectral density. Corresponding reduction in the peak transmit power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

(d) The peak power spectral density is measured as conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of one MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

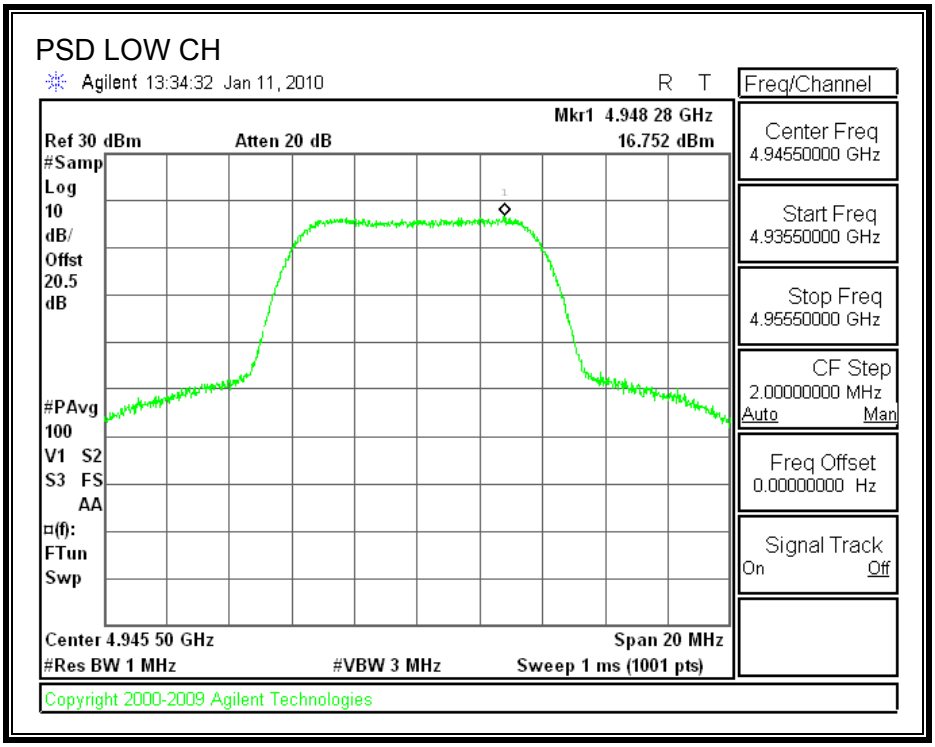
TEST PROCEDURE

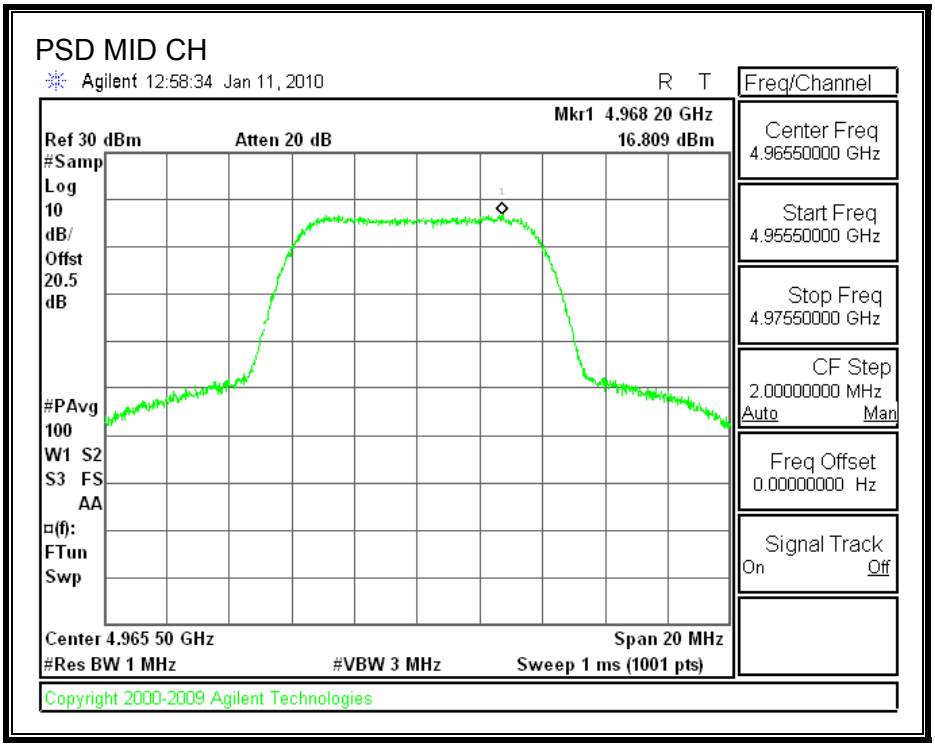
The peak value measured in a 1 MHz measurement bandwidth is corrected for the difference between the measurement bandwidth and the noise bandwidth.

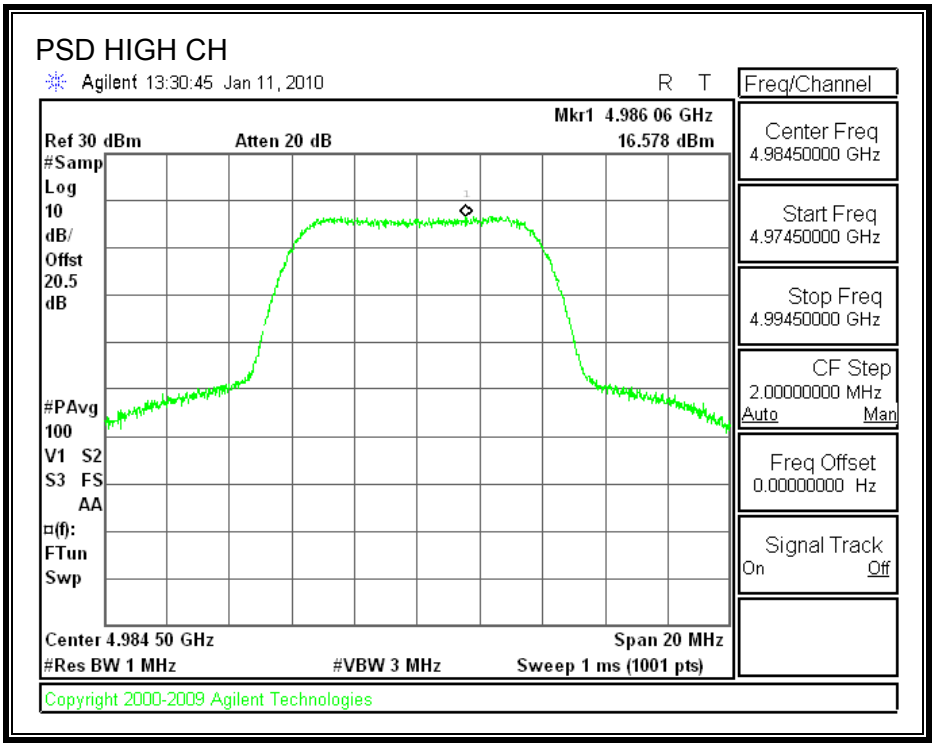
RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Noise BW Factor (dB)	Corrected PPSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
Low	4945.5	16.75	-0.21	16.54	21	-4.46
Middle	4965.5	16.81	-0.21	16.60	21	-4.40
High	4984.5	16.58	-0.21	16.37	21	-4.63

POWER SPECTRAL DENSITY







7.1.5. PEAK EXCURSION

LIMITS

§ 90.1215 (e) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

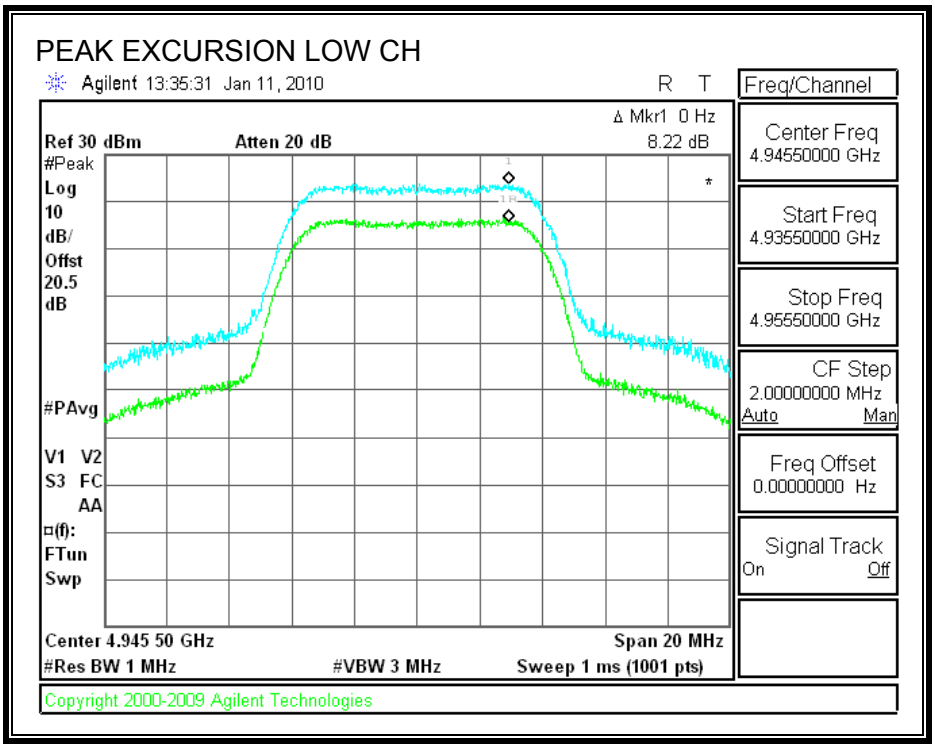
TEST PROCEDURE

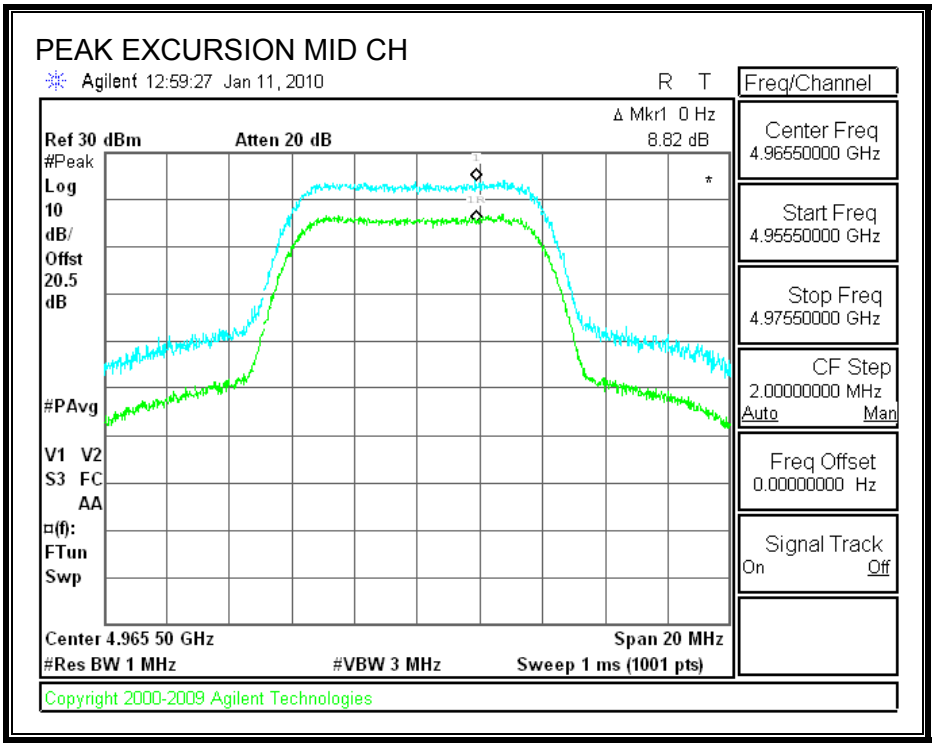
The modulation envelope using peak hold is compared to the conducted output power.

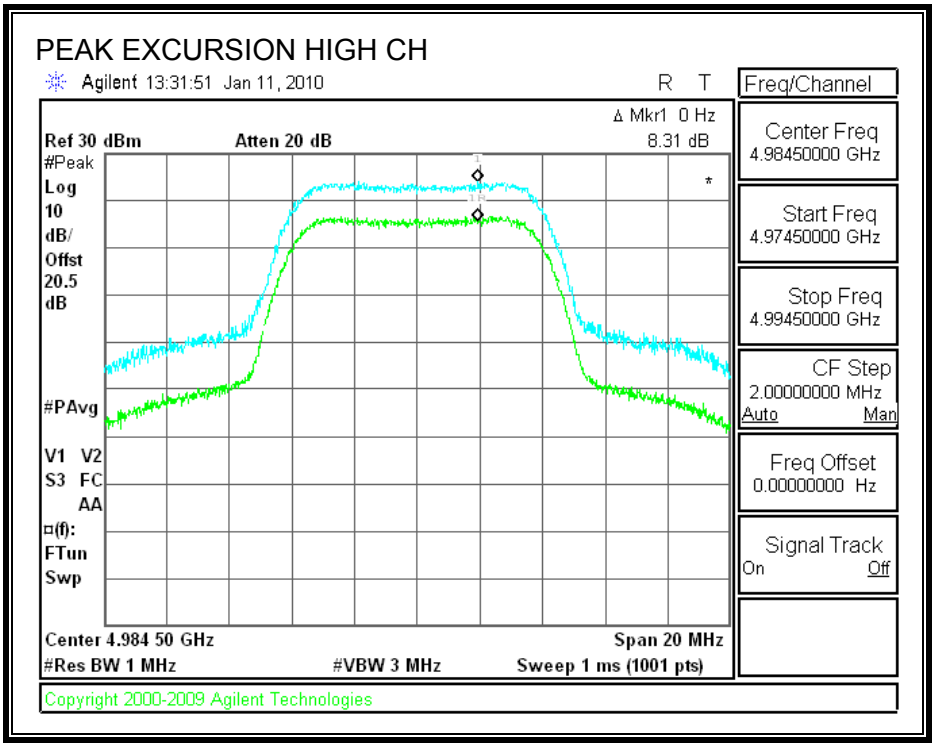
RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	4945.5	8.22	13	-4.78
Middle	4965.5	8.82	13	-4.18
High	4984.5	8.31	13	-4.69

PEAK EXCURSION







7.1.6. EMISSION MASK

§ 90.210 (m) *Emission Mask M.* For high power transmitters (greater that 20 dBm) operating in the 4940–4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0–45% of the authorized bandwidth (BW): 0 dB.

(2) On any frequency removed from the assigned frequency between 45–50% of the authorized bandwidth: 568 log (% of (BW)/45) dB.

(3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: 26 + 145 log (% of BW/50) dB.

(4) On any frequency removed from the assigned frequency between 55–100% of the authorized bandwidth: 32 + 31 log (% of (BW)/55) dB.

(5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: 40 + 57 log (% of (BW)/100) dB.

(6) On any frequency removed from the assigned frequency between above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

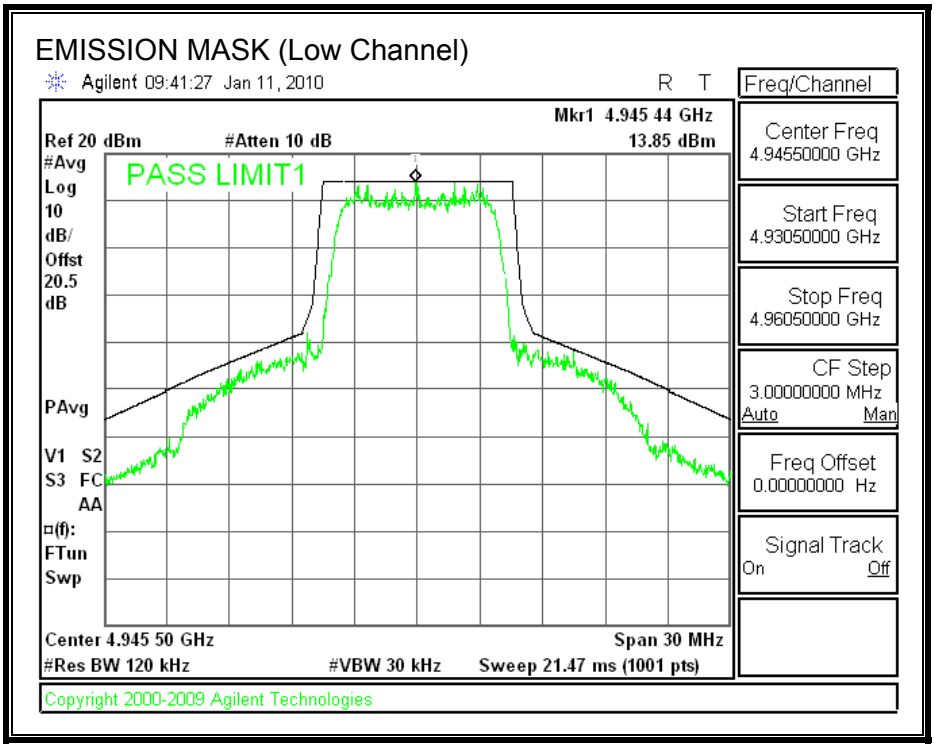
(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

TEST PROCEDURE

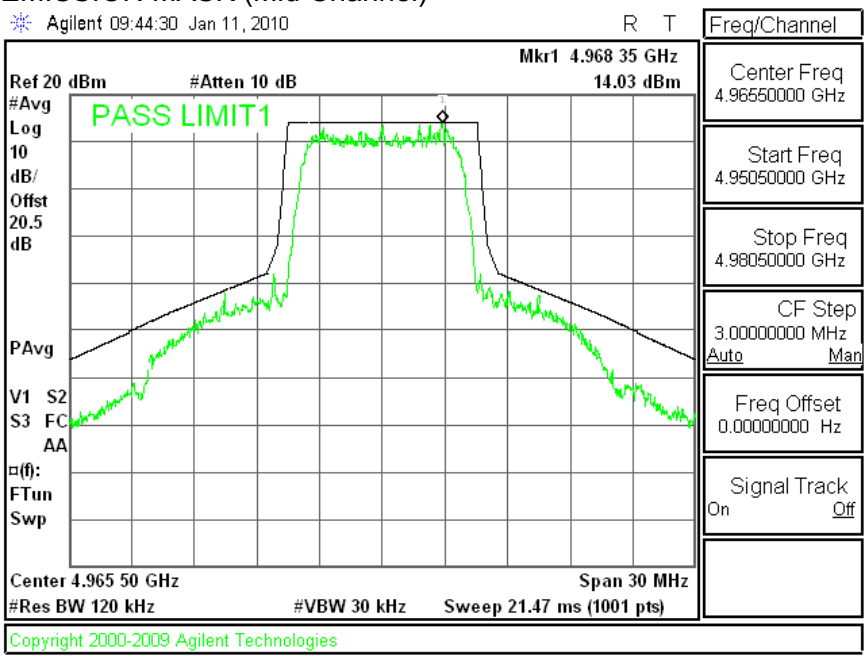
The EUT is connected to the spectrum analyzer, the peak amplitude is used as the 0 dB reference value for the mask, and the trace is compared to the mask.

RESULTS

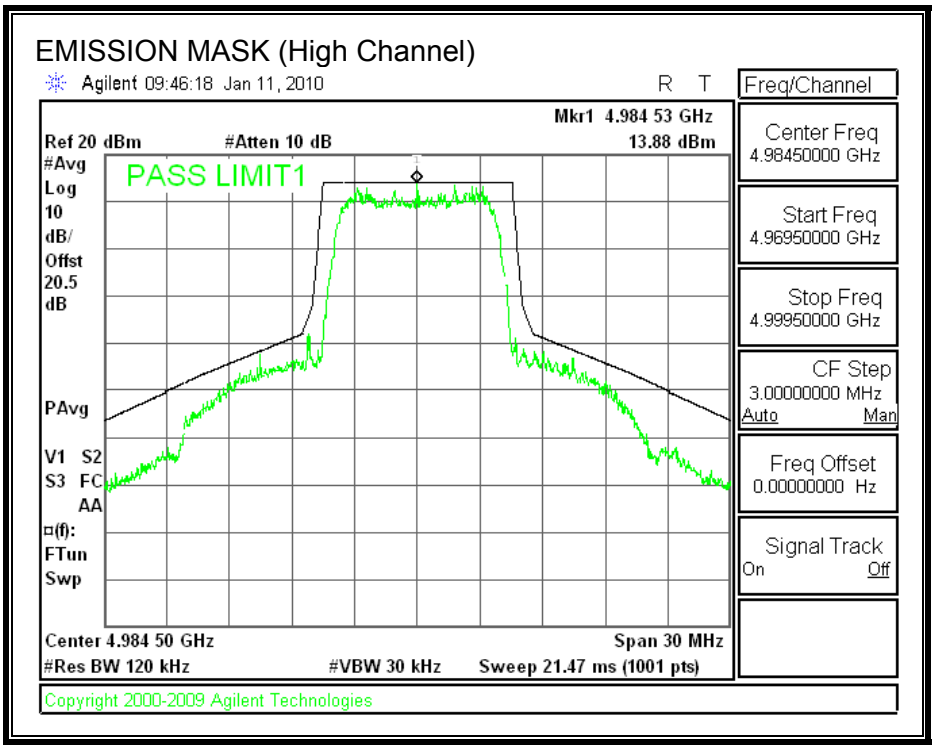
EMISSION MASK



EMISSION MASK (Mid Channel)



EMISSION MASK (High Channel)



7.1.7. CONDUCTED SPURIOUS

§ 90.210 (m) *Emission Mask M.* For high power transmitters (greater that 20 dBm) operating in the 4940–4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(6) On any frequency removed from the assigned frequency between above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

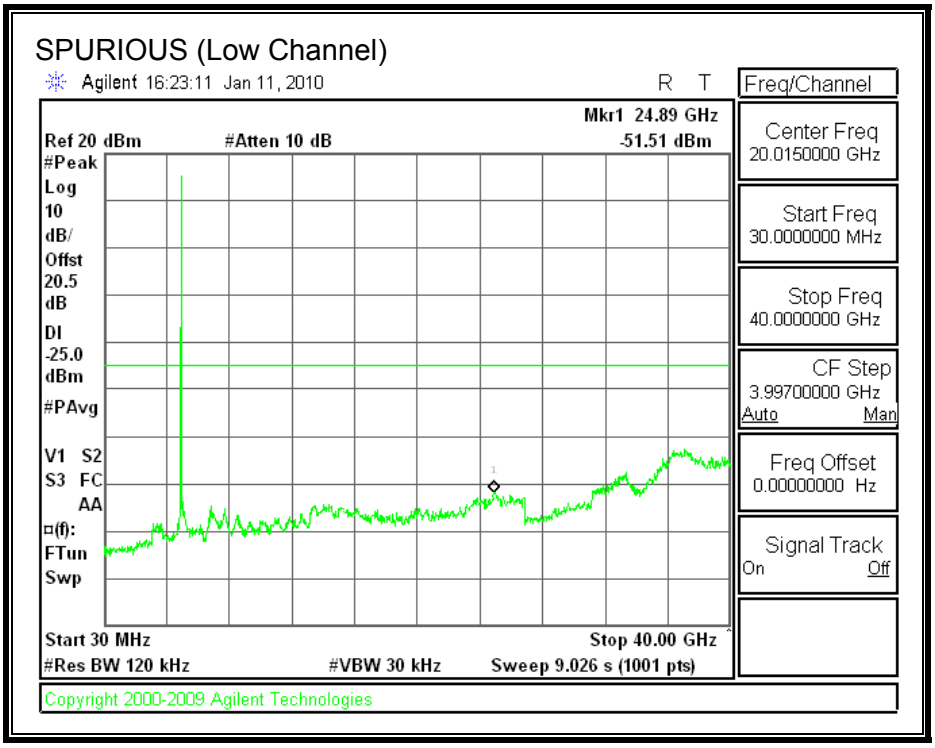
(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

TEST PROCEDURE

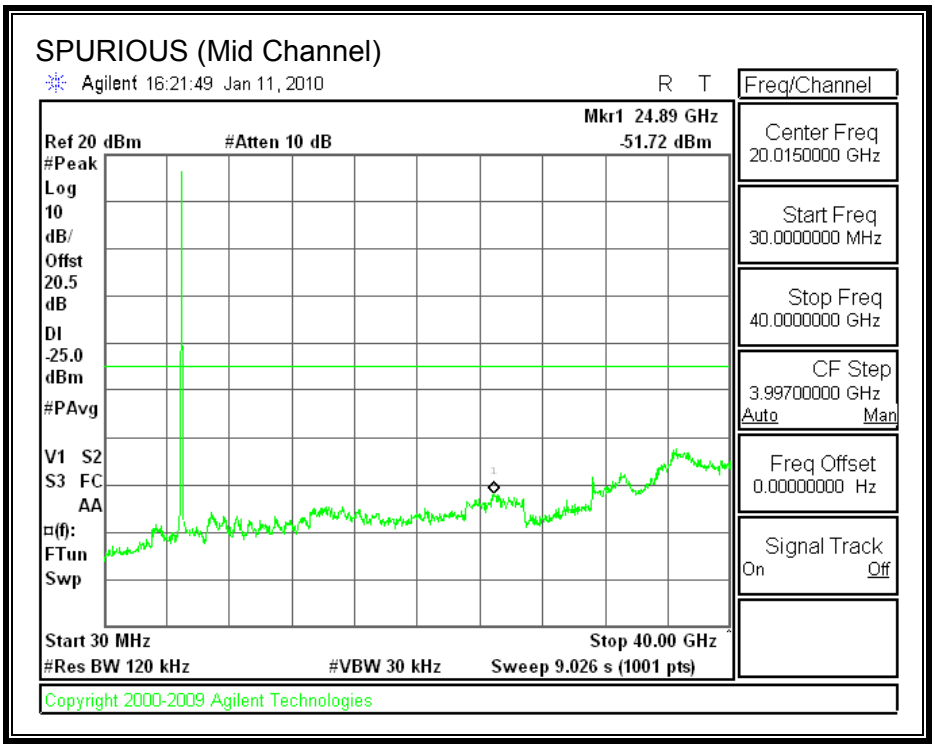
The EUT is connected to the spectrum analyzer. 55 + 10 log (P) dB provides the lesser attenuation therefore the limit is -25 dBm.

RESULTS

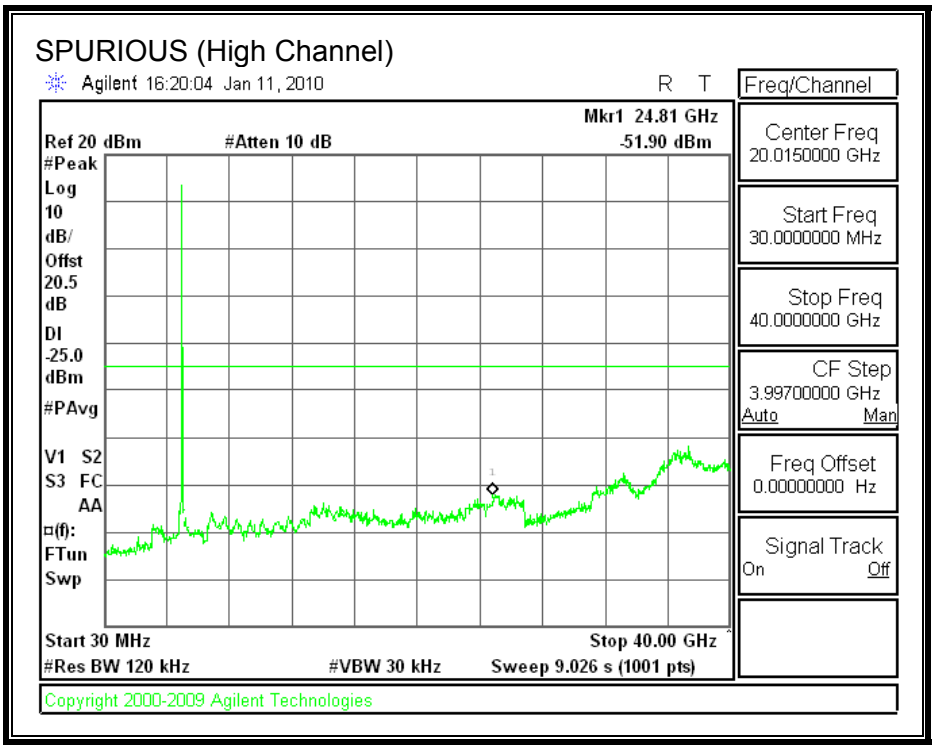
SPURIOUS EMISSIONS



SPURIOUS (Mid Channel)



SPURIOUS (High Channel)



7.1.8. RECEIVER SPURIOUS

IC RSS-GEN Clause 6 The following receiver spurious emission limits shall be complied with:

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 1.

Table 1 - Spurious Emission Limits for Receivers

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

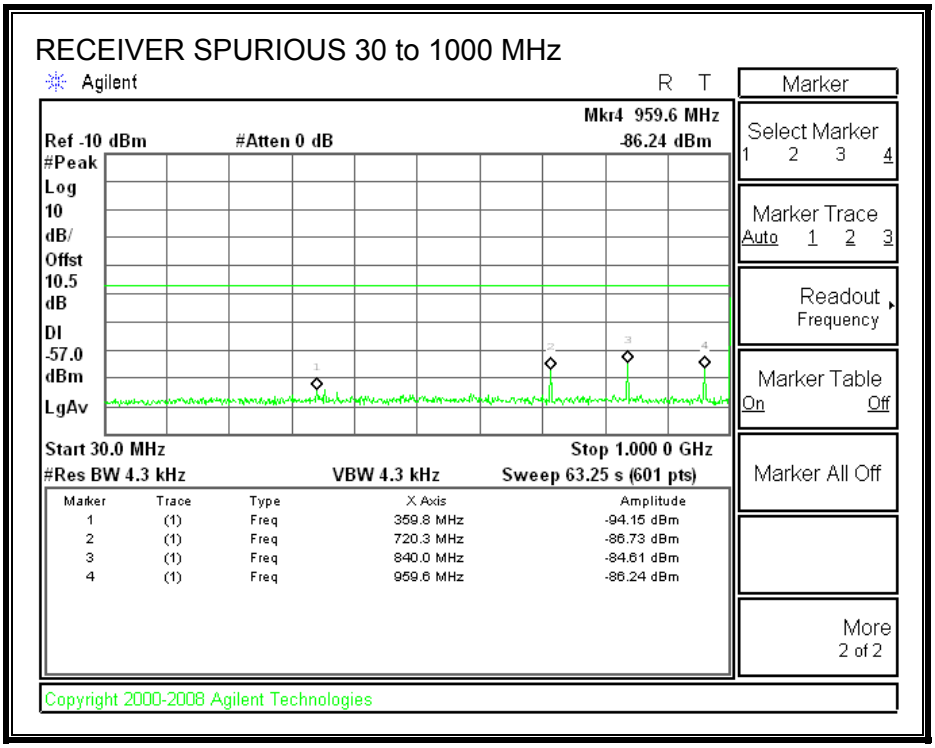
(b) If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

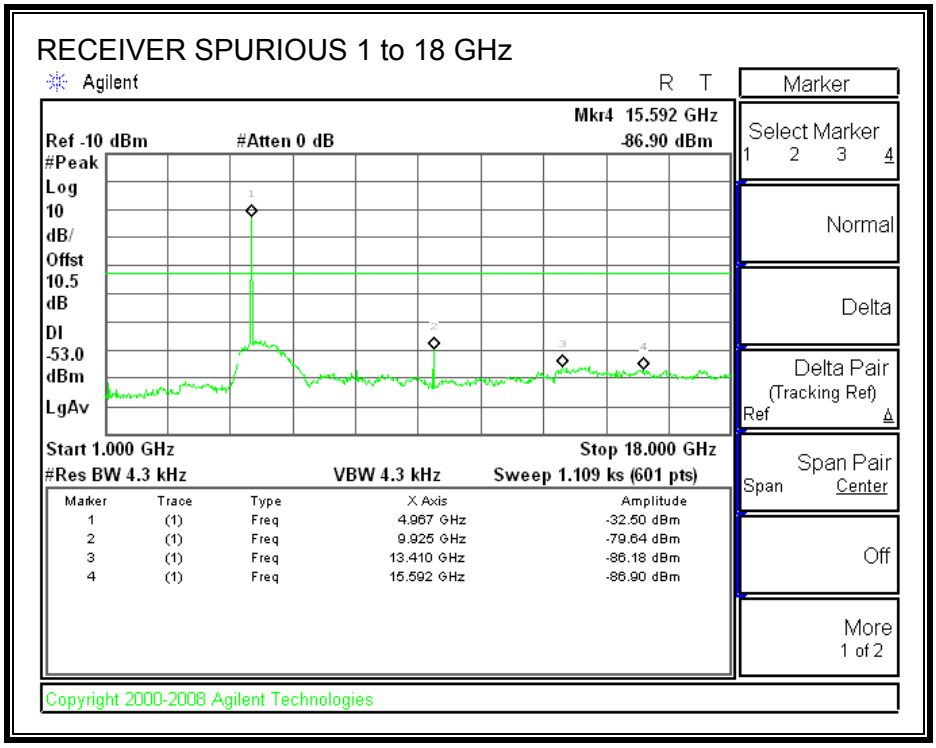
TEST PROCEDURE

The EUT is connected to the spectrum analyzer. Below 1 GHz, 2 nW / 4 kHz is equivalent to -57 dBm / 4 kHz. Above 1 GHz, 5 nW / 4 kHz is equivalent to -53 dBm / 4 kHz. Measurements are made from 30 MHz to 18 GHz.

RESULTS

RECEIVER SPURIOUS





Note: the transmitter and receiver operate simultaneously; the emission over the limit is the fundamental of the transmitter.

7.2. CHANNEL TESTS FOR 20MHz BANDWIDTH

7.2.1. EMISSION BANDWIDTH

LIMITS

The emission bandwdith must be less than or equal to the ominal channel bandwidth.

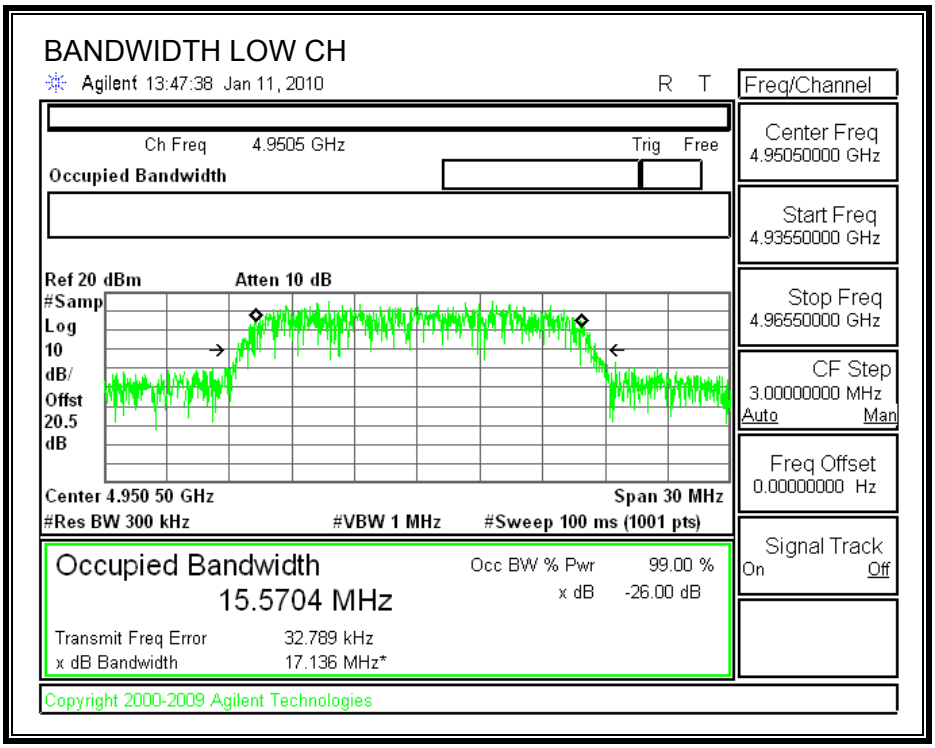
TEST PROCEDURE

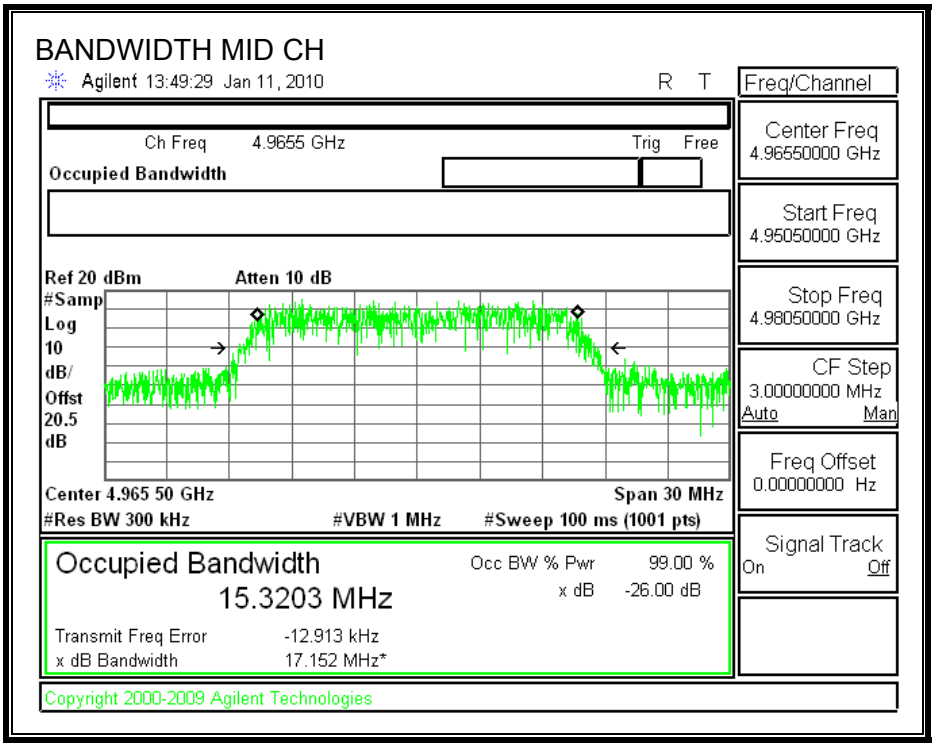
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

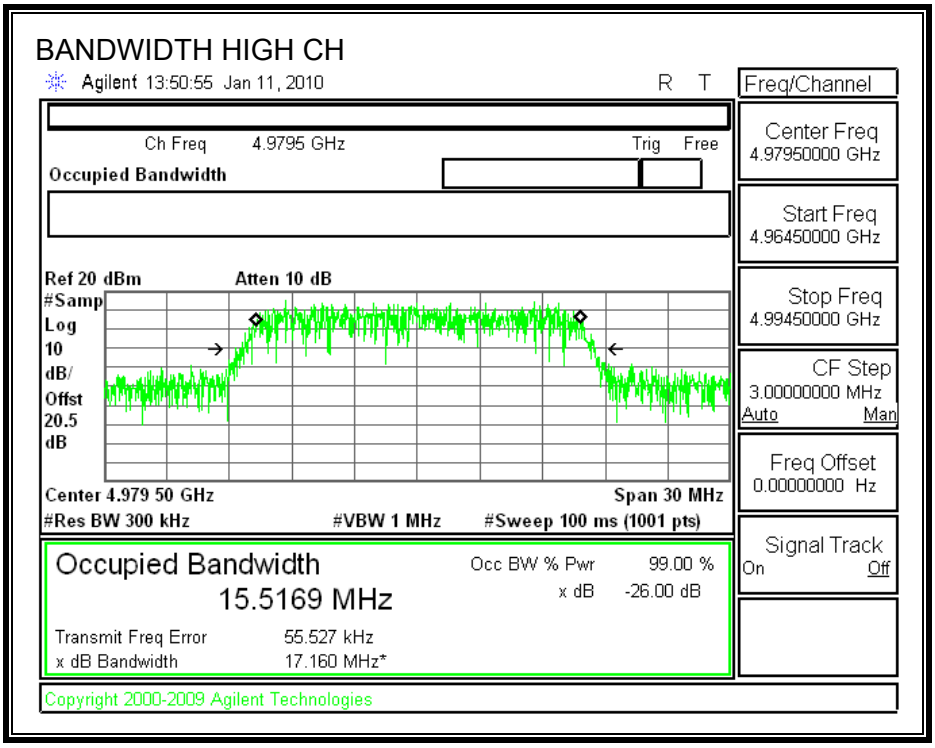
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)	EBW Limit (MHz)
Low	4950.5	15.5704	20
Middle	4965.5	15.3203	20
High	4979.5	15.5169	20

26 dB and 99% BANDWIDTH







7.2.2. OUTPUT POWER

PEAK POWER LIMIT

§ 90.1215 The transmitting power of stations operating in the 4940–4990 MHz band must not exceed the maximum limits in this section.

(a)(1) The maximum conducted output power should not exceed:

Channel bandwidth (MHz)	Low power Device Peak transmitter Power (dBm)	High power Device Peak transmitter Power (dBm)
1.....	7	20
5.....	14	27
10.....	17	30
15.....	18.8	31.8
20.....	20	33

(2) High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point and point-to-multipoint operations (both fixed and temporaryfixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the maximum conducted output power or spectral density. Corresponding reduction in the maximum conducted output power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

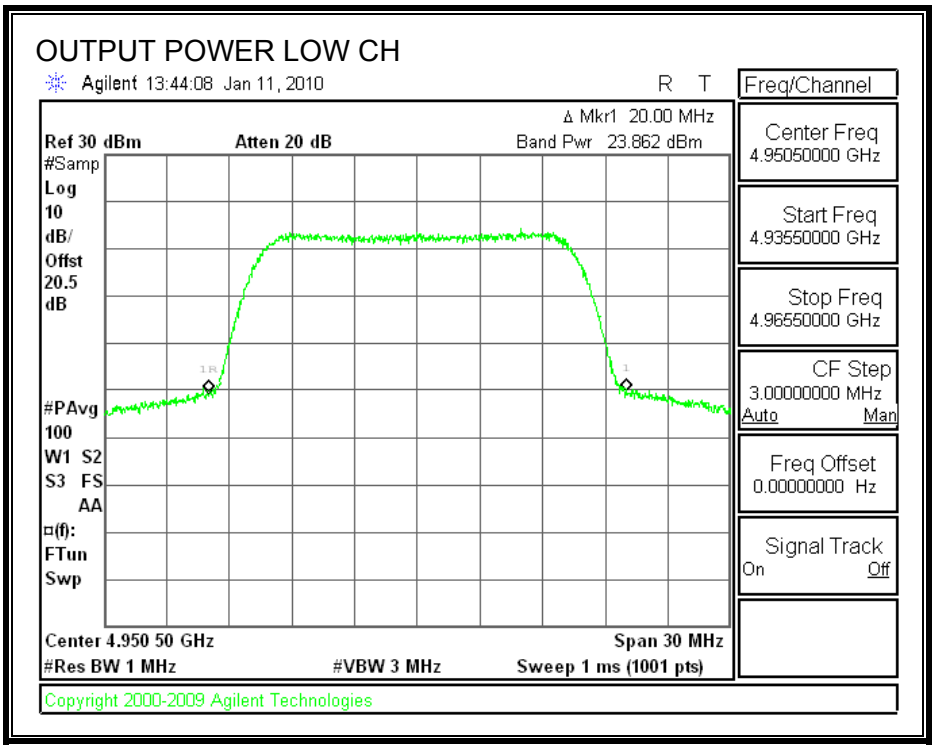
TEST PROCEDURE

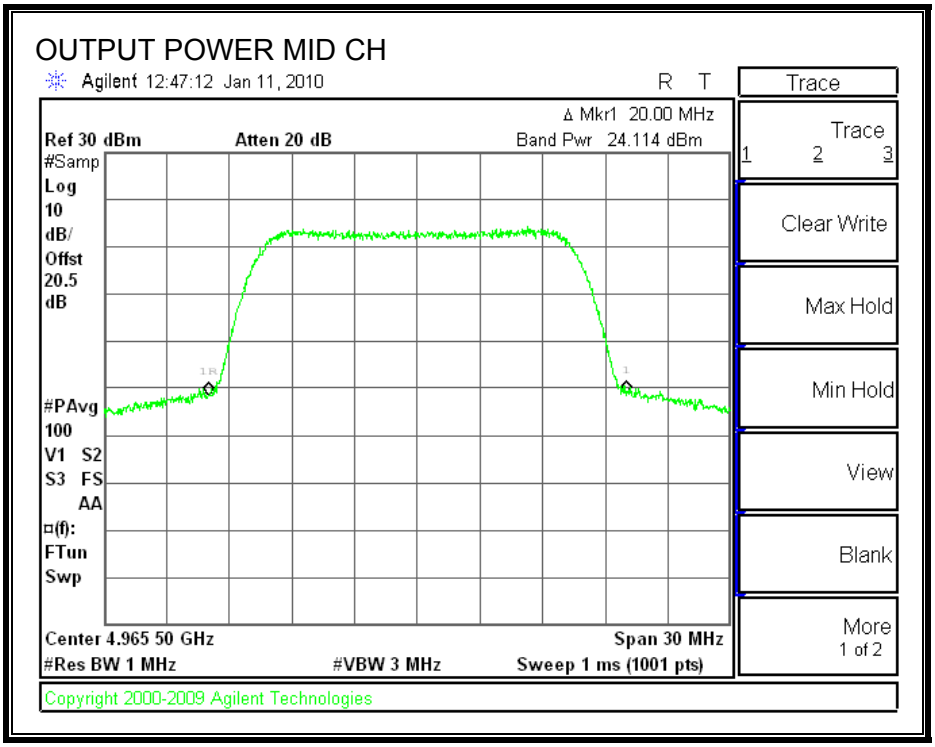
The maximum conducted output power is measured as a conducted emission over an interval of continuous transmission using instrumentation calibrated in terms of an RMS-equivalent voltage.

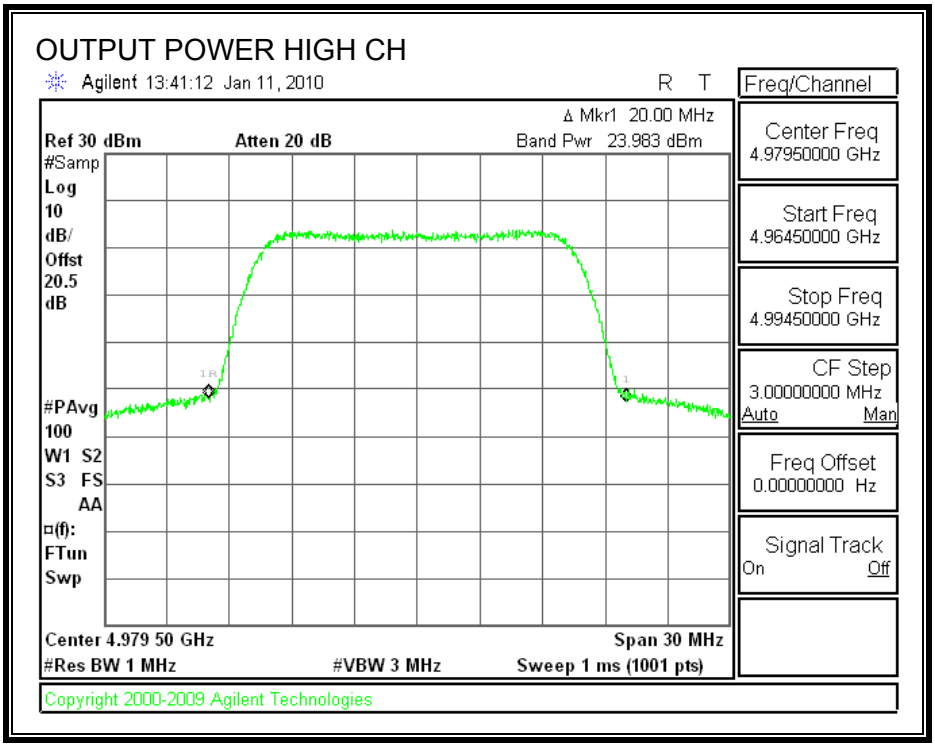
RESULTS

Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	4950.5	23.86	33.00	-9.14
Mid	4965.5	24.11	33.00	-8.89
High	4979.5	23.98	33.00	-9.02

OUTPUT POWER







7.2.3. 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 21.2 dB (including 20dB pad and 1.2dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
Low	4950.5	23.95
Middle	4965.5	23.99
High	4979.5	24.00

7.2.4. PEAK POWER SPECTRAL DENSITY

LIMITS

§ 90.1215 (2) High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point and point-to-multipoint operations (both fixed and temporaryfixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the maximum conducted output power or spectral density. Corresponding reduction in the maximum conducted output power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

(d) The peak power spectral density is measured as conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of one MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

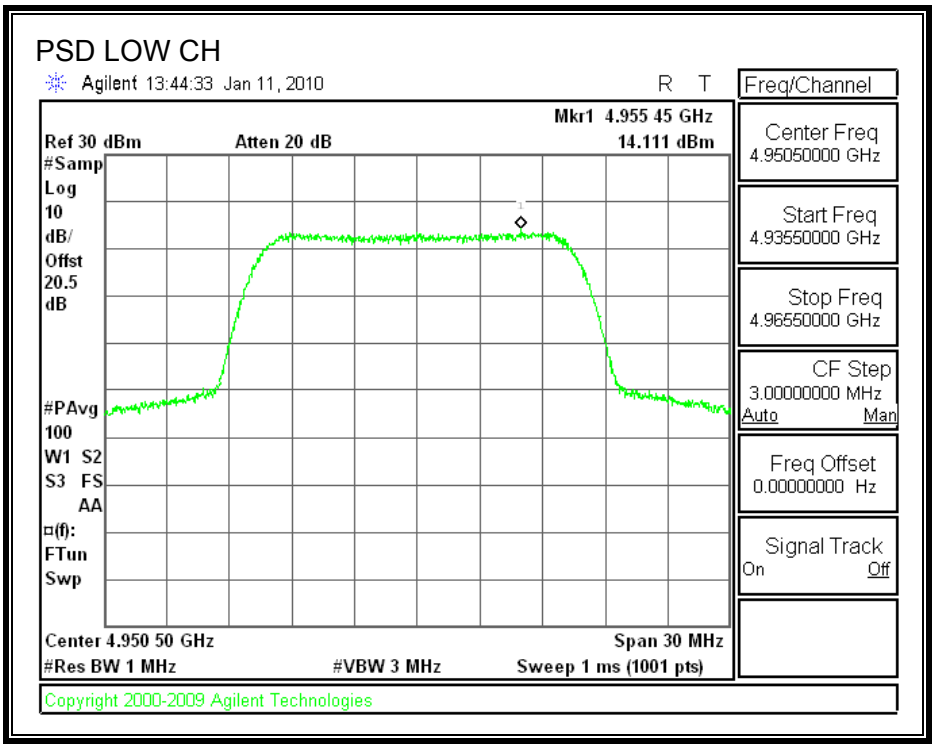
TEST PROCEDURE

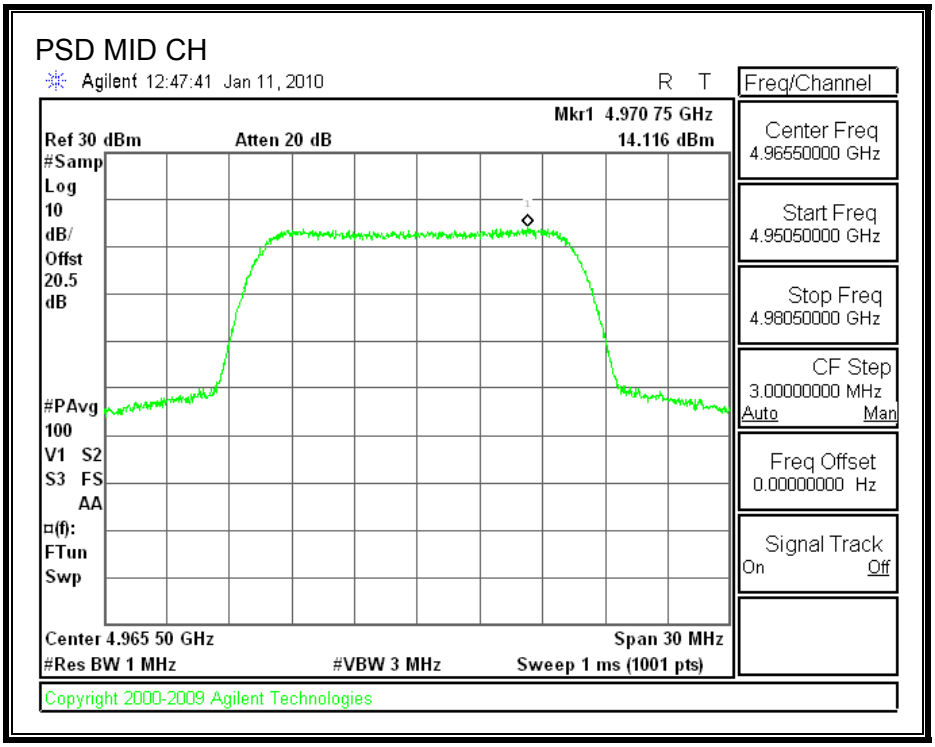
The peak value measured in a 1 MHz measurement bandwidth is corrected for the difference between the measurement bandwidth and the noise bandwidth.

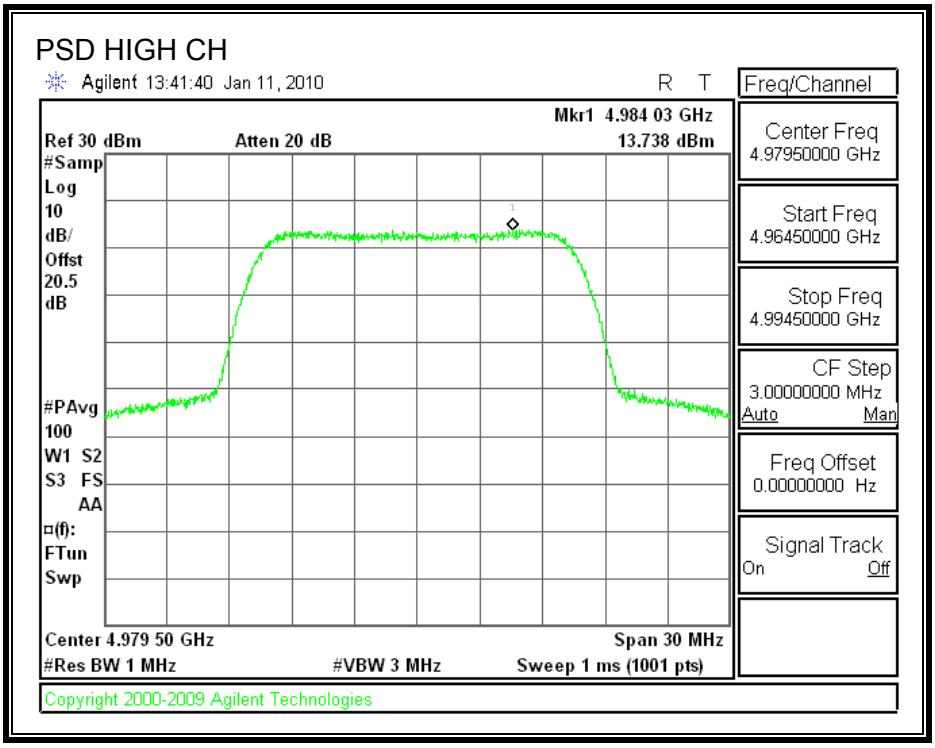
RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Noise BW Factor (dB)	Corrected PPSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
Low	4950.5	14.11	-0.21	13.90	21	-7.10
Middle	4965.5	14.12	-0.21	13.91	21	-7.09
High	4979.5	13.74	-0.21	13.53	21	-7.47

POWER SPECTRAL DENSITY







7.2.5. PEAK EXCURSION

LIMITS

§ 90.1215 (e) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

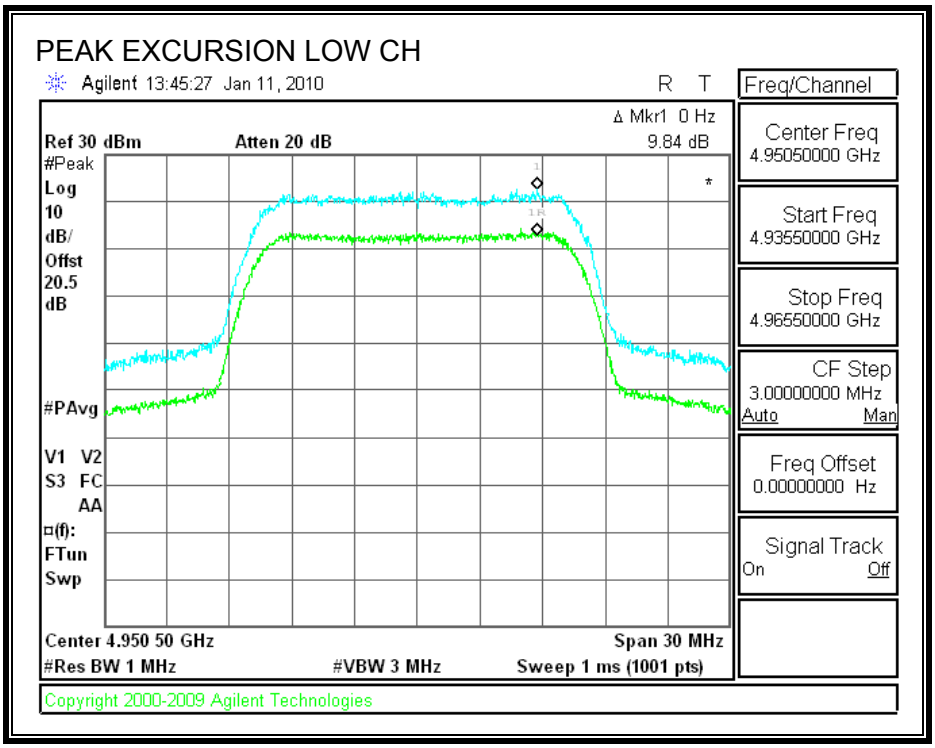
TEST PROCEDURE

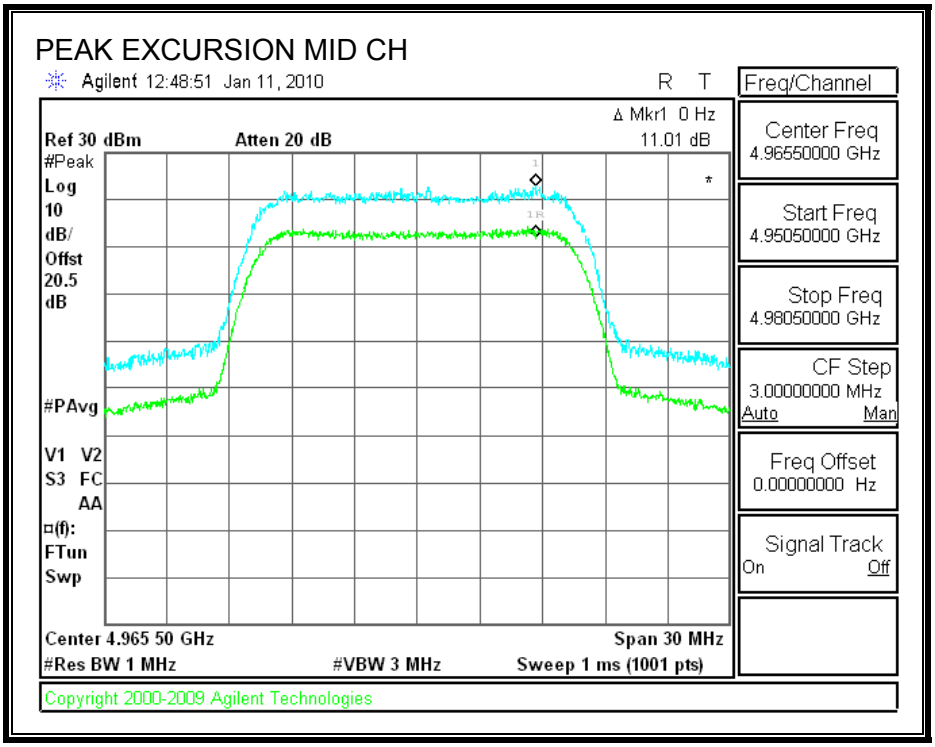
The modulation envelope using peak hold is compared to the conducted output power.

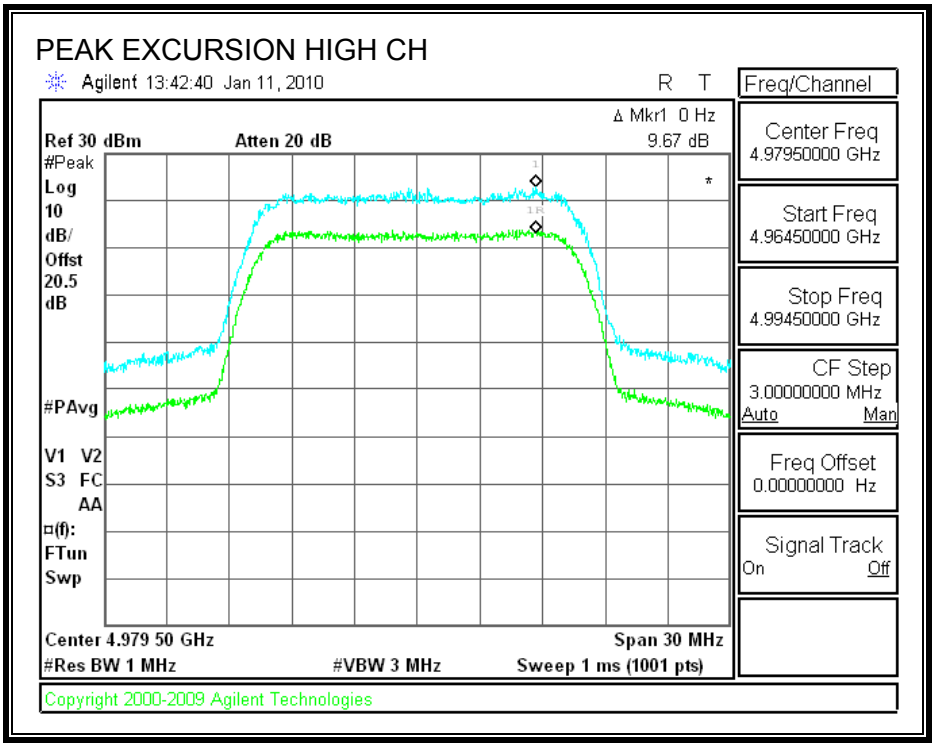
RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	4950.5	9.84	13	-3.16
Middle	4965.5	11.01	13	-1.99
High	4979.5	9.67	13	-3.33

PEAK EXCURSION







7.2.6. EMISSION MASK

§ 90.210 (m) *Emission Mask M.* For high power transmitters (greater that 20 dBm) operating in the 4940–4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0–45% of the authorized bandwidth (BW): 0 dB.

(2) On any frequency removed from the assigned frequency between 45–50% of the authorized bandwidth: 568 log (% of (BW)/45) dB.

(3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: 26 + 145 log (% of BW/50) dB.

(4) On any frequency removed from the assigned frequency between 55–100% of the authorized bandwidth: 32 + 31 log (% of (BW)/55) dB.

(5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: 40 + 57 log (% of (BW)/100) dB.

(6) On any frequency removed from the assigned frequency between above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

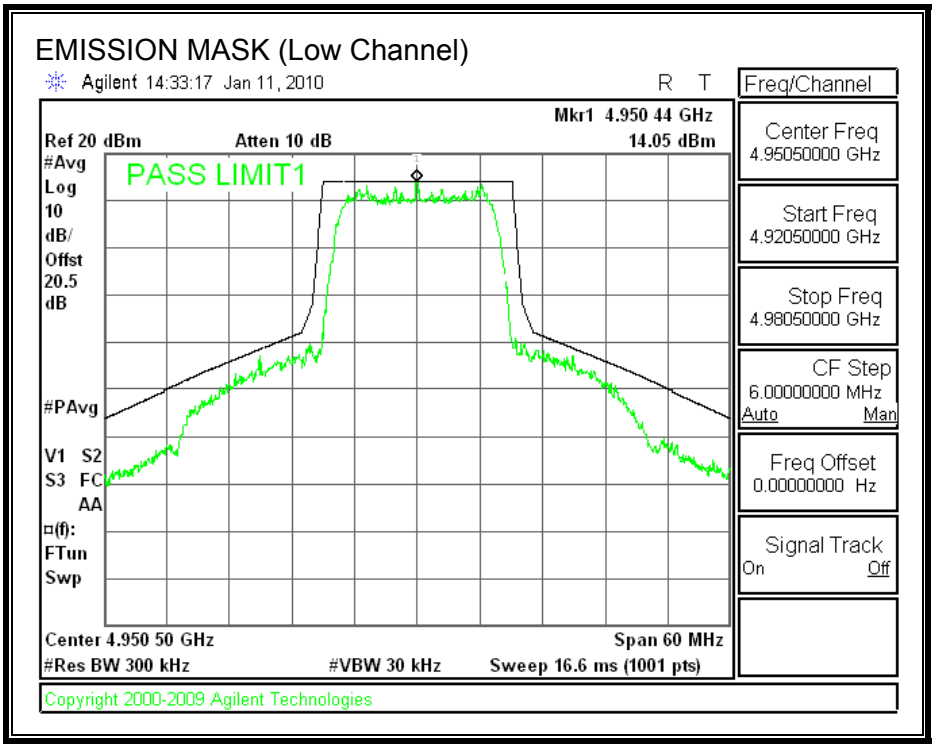
(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

TEST PROCEDURE

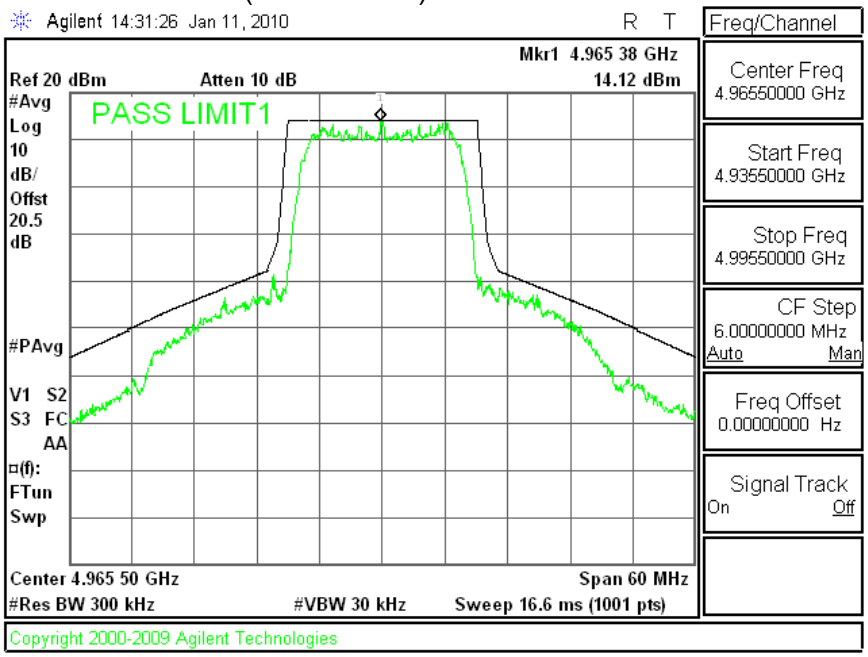
The EUT is connected to the spectrum analyzer, the peak amplitude is used as the 0 dB reference value for the mask, and the trace is compared to the mask.

RESULTS

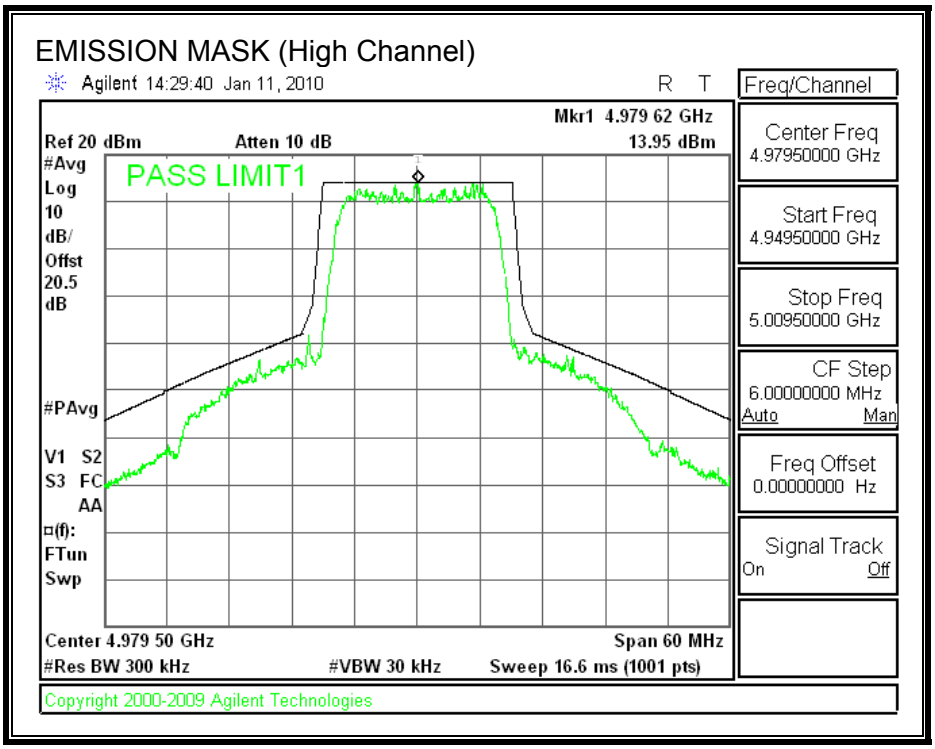
EMISSION MASK



EMISSION MASK (Mid Channel)



EMISSION MASK (High Channel)



7.2.7. CONDUCTED SPURIOUS

§ 90.210 (m) *Emission Mask M.* For high power transmitters (greater that 20 dBm) operating in the 4940–4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(6) On any frequency removed from the assigned frequency between above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

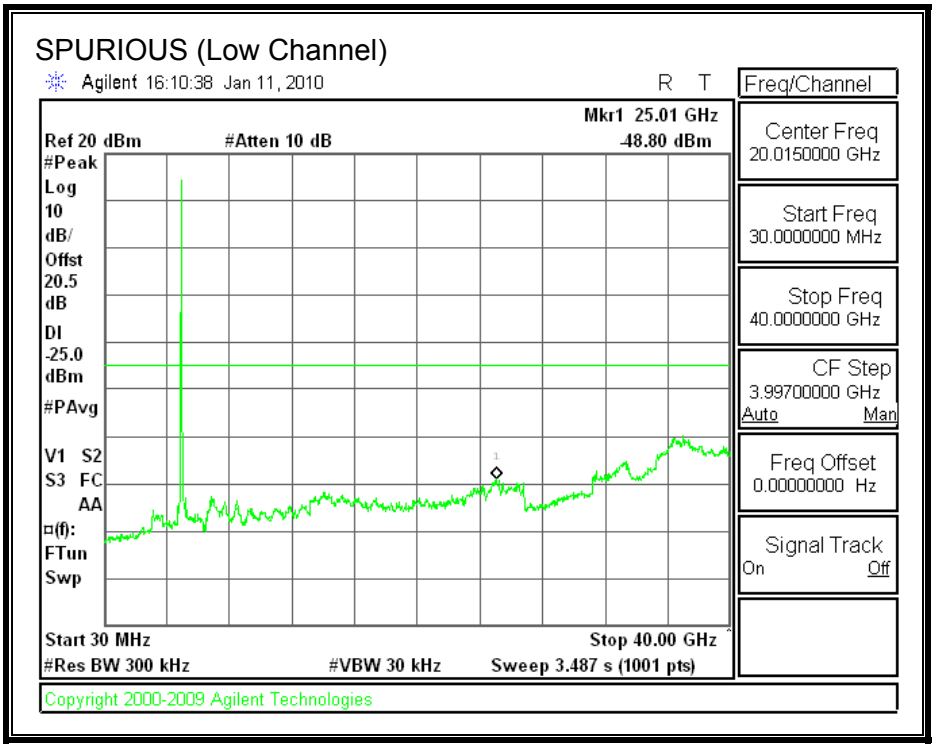
(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

TEST PROCEDURE

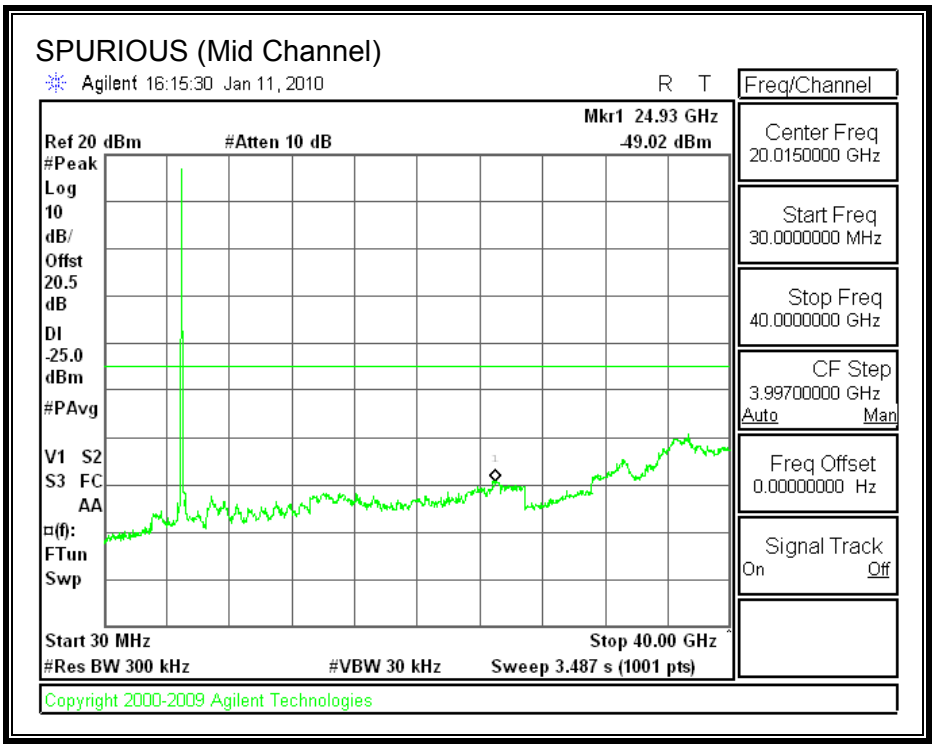
The EUT is connected to the spectrum analyzer. 55 + 10 log (P) dB provides the lesser attenuation therefore the limit is -25 dBm.

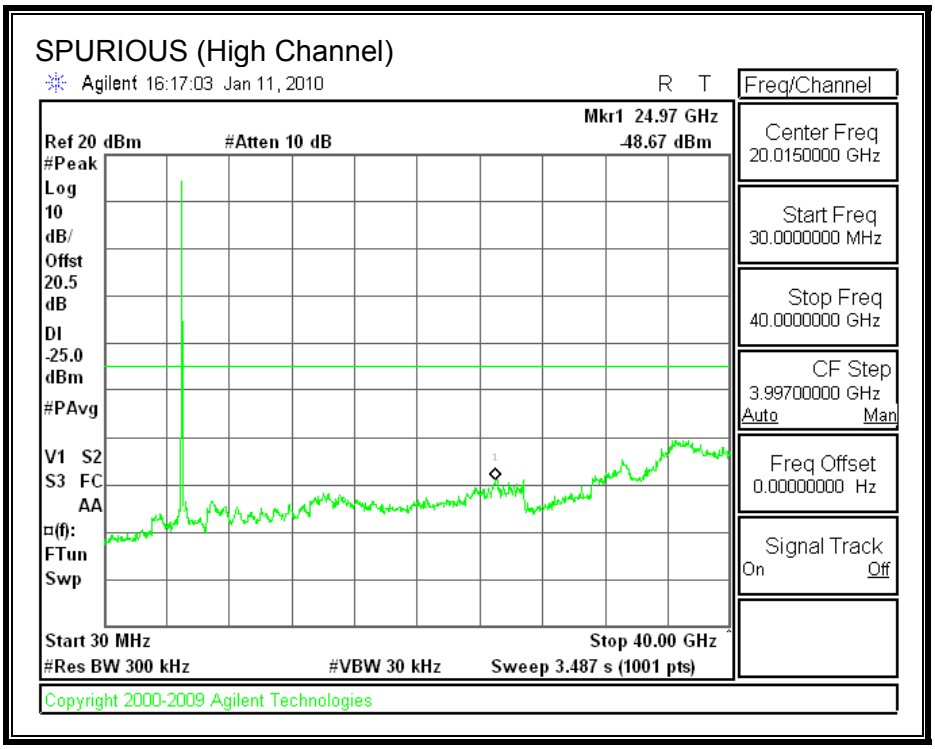
RESULTS

SPURIOUS EMISSIONS



SPURIOUS (Mid Channel)





7.2.8. RECEIVER SPURIOUS

IC RSS-GEN Clause 6 The following receiver spurious emission limits shall be complied with:

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 1.

Table 1 - Spurious Emission Limits for Receivers

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

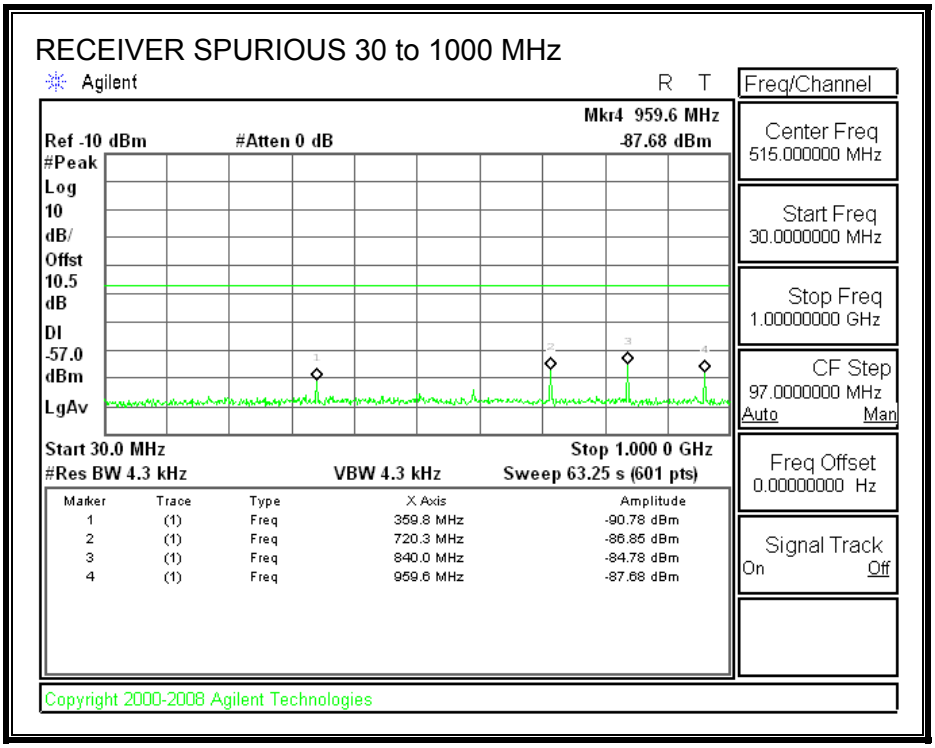
(b) If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

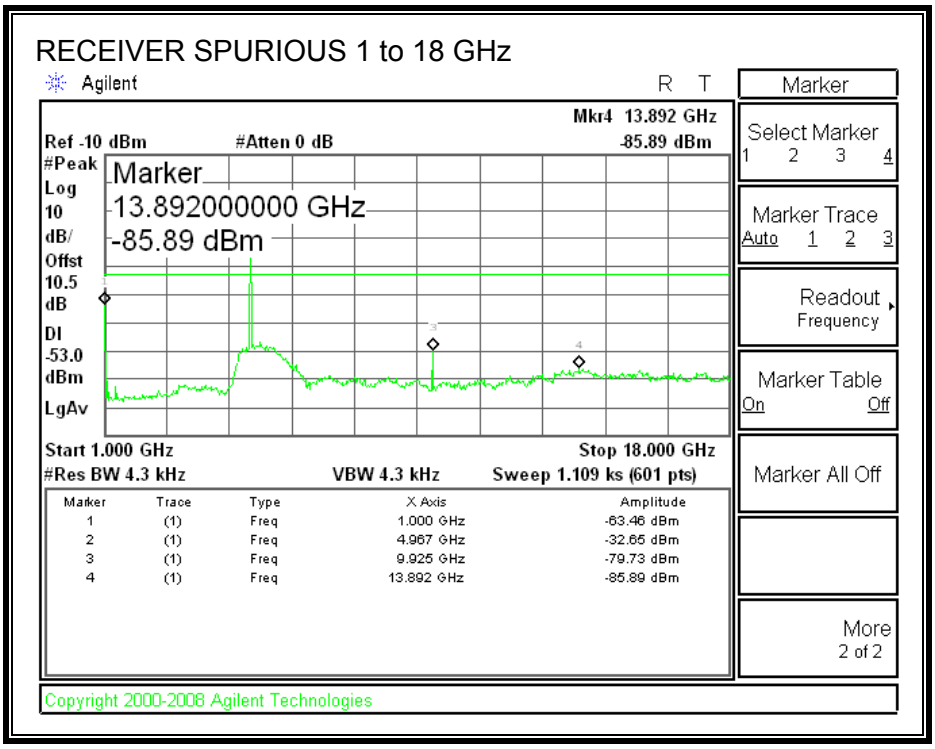
TEST PROCEDURE

The EUT is connected to the spectrum analyzer. Below 1 GHz, 2 nW / 4 kHz is equivalent to -57 dBm / 4 kHz. Above 1 GHz, 5 nW / 4 kHz is equivalent to -53 dBm / 4 kHz. Measurements are made from 30 MHz to 18 GHz.

RESULTS

RECEIVER SPURIOUS





Note: the transmitter and receiver operate simultaneously; the emission over the limit is the fundamental of the transmitter.

7.3. FREQUENCY STABILITY

LIMIT

Regarding Equipment Authorization, for reporting purposes.

§90.213 Frequency stability.

(a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.

Above 2450[10]

[10]Except for DSRCS equipment in the 5850 –5925 MHz band, frequency stability is to be specified in the station authorization.

TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 2.3.1 and 2.3.2

RESULTS

Power Supply (Vac)	Temperature (ºC)	Frequency (MHz)	Deviation (ppm)
115.00	65	4965.494210	-0.659
115.00	60	4965.495380	-0.423
115.00	50	4965.497290	-0.038
115.00	40	4965.498070	0.119
115.00	30	4965.497960	0.097
115.00	**20**	**4965.497480**	**REF**
115.00	10	4965.496390	-0.220
115.00	0	4965.495240	-0.451
115.00	-10	4965.494280	-0.644
115.00	-20	4965.491830	-1.138
115.00	-30	4965.491560	-1.192
115.00	-40	4965.493310	-0.840
97.15	20	4965.498040	0.113
132.25	20	4965.498040	0.113

7.4. RADIATED EMISSIONS

LIMITS

55 + 10 log (P) dB provides the lesser attenuation therefore the limit is -25 dBm ERP/EIRP.

TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 3.2.12

WORST-CASE RADIATED EMISSIONS 30 TO 1000 MHz

Compliance Certification Services
30 - 1000MHz Substitution Measurement

Company: Exalt
Project #: 09U12981
Date: 1/13/10
Test Engi: Monica Harrison
Configura: POE in isolation box
Mode: 20MHz QPSK TX

Chamber	Pre-amplifer	Filter	Limit
3m Chamber	T15 8447D		

f MHz	SA reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Path Loss (dB)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
4950.50										
36.10	-61.4	H	3.0	56.8	28.4		-33.0	-25.0	-8.0	
47.81	-47.3	H	3.0	41.2	28.4		-34.4	-25.0	-9.4	
359.80	-34.0	H	3.0	25.3	27.8		-36.5	-25.0	-11.5	
36.09	-56.0	V	3.0	49.9	28.4		-34.5	-25.0	-9.5	
47.80	-36.6	V	3.0	38.0	28.4		-27.0	-25.0	-2.0	
359.80	-34.5	V	3.0	24.0	27.8		-38.3	-25.0	-13.3	
4965.50										
36.12	-60.7	H	3.0	56.8	28.4		-32.3	-25.0	-7.3	
47.80	-47.9	H	3.0	41.2	28.4		-35.0	-25.0	-10.0	
359.80	-34.0	H	3.0	25.3	27.8		-36.5	-25.0	-11.5	
36.10	-54.5	V	3.0	49.9	28.4		-33.0	-25.0	-8.0	
47.82	-37.3	V	3.0	38.0	28.4		-27.7	-26.0	-1.7	
359.80	-34.7	V	3.0	24.0	27.8		-38.5	-25.0	-13.5	
4979.50										
35.80	-57.3	V	3.0	50.2	28.4		-35.4	-25.0	-10.4	
47.80	-37.5	V	3.0	38.0	28.4		-27.8	-25.0	-2.8	
359.80	-34.6	V	3.0	24.0	27.8		-38.3	-25.0	-13.3	
36.13	-63.1	H	3.0	56.7	28.4		-34.7	-25.0	-9.7	
49.40	-48.0	H	3.0	38.6	28.4		-37.7	-25.0	-12.7	
359.80	-34.1	H	3.0	25.3	27.8		-36.6	-25.0	-11.6	

Rev. 03.03.09

WORST-CASE RADIATED EMISSIONS 1 TO 40 GHz

No emissions measured within 20 dB of the limit.

8. EXCERPT OF PRELIMINARY TEST RESULTS

CONDUCTED OUTPUT POWER AS A FUNCTION OF BANDWIDTH AND MODULATION

The maximum conducted output power is measured as a conducted emission over an interval of continuous transmission using instrumentation calibrated in terms of an RMS-equivalent voltage.

Nominal Bandwidth (MHz)	Mode	Output Power (dBm)
10.0	QPSK	24.061
10.0	16QAM	23.428
10.0	64QAM	23.141
20.0	QPSK	24.114
20.0	16QAM	23.495
20.0	64QAM	23.165

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).

EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

where

D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

In the table below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

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

Separation distance with maximum declared antenna gain:

Band	Mode	IC Limit (W/m^2)	FCC Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	Separation Distance (m)
4.9 GHz	QPSK	10.00	1.000	24.11	26.00	0.90