FCC CFR47 PART 90 SUBPART Z

Test Report

3.65 GHz Fixed Wireless Base Station Transceiver

Model Number: PM-BSR-365

FCC ID: PS6PM365-BS

Report Number: 08PR008

Issue Date: 7 May 2008

Prepared for

Aperto Networks
598 Gibraltar Drive
Milpitas CA 95035

Prepared by

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P.O. Box 1086
El Granada CA 94018

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1. TEST AND TEST LOCATION INFORMATION

COMPANY NAME: APERTO NETWORKS
598 GIBRALTAR DRIVE
MILPITAS CA 95035

EUT DESCRIPTION: 3.65 GHz Base Station Radio

FCC ID: **PS6PM365-BS**
MODEL: PM-BSR-365

DATE TESTED: 21 April – 4 May 2008

All radiated and AC line conducted tests were performed by

Compliance Certification Services
47173 Benicia Street
Fremont, CA 94538

All antenna port output conducted test were performed by

Aperto Networks
598 Gibraltar Drive
Milpitas CA 95035

7 May 2008

T.N. Cokenias
Agent for Aperto Networks

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with EIA/TIA 603, FCC CFR 47 Part 2 and FCC CFR 47 Part 90 Subpart Z.

3. EQUIPMENT UNDER TEST

3.1. DESCRIPTION OF EUT

The EUT is a WiMAX base station radio operating in the 3650-3675 MHz portion of the 3650-3700 MHz band regulated in Part 90, Subpart Z of the Rules. The radio employs a restricted contention protocol. Modulation is 802.16d/e in 3.5 MHz and 7 MHz channel bandwidths.

3.2. MAXIMUM OUTPUT POWER

3.5 MHz EBW

	(MHz)	(dBm)	(mW)
Low	3652	19.41	87.3
Middle	3675	19.96	99.1
High	3698	19.61	91.4

7 MHz EBW

	(MHz)	(dBm)	(mW)
Low	3653.5	21.84	152.8
Middle	3675	21.11	129.1
High	3696.5	21.62	145.2

3.3. DESCRIPTION OF AVAILABLE ANTENNAS

The user/installer manual for the EUT contains a list of antennas available for use with the product. It is the responsibility of the licensee to adjust transmitter output power such that the eirp limits specified in section 90.1321 (a) of the Rules are not exceeded.

Limit for 3.5 MHz channels = 25 watts/25 MHz = 3.16 watts/3.16 MHz eirp
Limit for 7.0 MHz channels = 25 watts/25 MHz = 6.32 watts/6.32 MHz eirp

Table D-24 Antenna Specifications

Part Numbers	Parameter	Specification
PWA3500V-90 (sector 90°)	Frequency range	3.3-3.8 GHz
	Nominal Gain	16dBI
	Beamwidth: Azimuth Elevation	 90° 7 °
	Polarization	Vertical
PWA3300D-60 (sector60°)	Frequency range	3.3-3.8 GHz
	Nominal Gain	16 dBI
	Beamwidth: Azimuth Elevation	 60° 8°
	Polarization	Dual
PWA3300D-90 (sector 90°)	Frequency range	3.3-3.8 GHz
	Nominal Gain	15.5 dBI
	Beamwidth: Azimuth Elevation	 90° 8°
	Polarization	Dual
	Country	US
PWA3500V-120 (sector 120°)	Frequency range	3.3-3.8 GHz
	Nominal Gain	13 dBI
	Beamwidth: Azimuth Elevation	 120° 7°
	Polarization	Vertical
PWA3500V-360 (sector 360°)	Frequency range	3.4-3.7 GHz
	Nominal Gain	10 dBI
	Beamwidth: Azimuth Elevation	 360° 9°
	Polarization	Vertical
PWA3300V-360 (sector 360°)	Frequency range	3.3-3.6 GHz
	Nominal Gain	10 dBI
	Beamwidth: Azimuth Elevation	 360° 9°
	Polarization	Vertical

3.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was PM 2.3

3.5. WORST-CASE CONFIGURATION AND MODE

Radiated and conducted emissions tests were performed for both 3.5 MHz and 7 MHz emission bandwidth channels. Worst-case emissions for both conditions are reported.

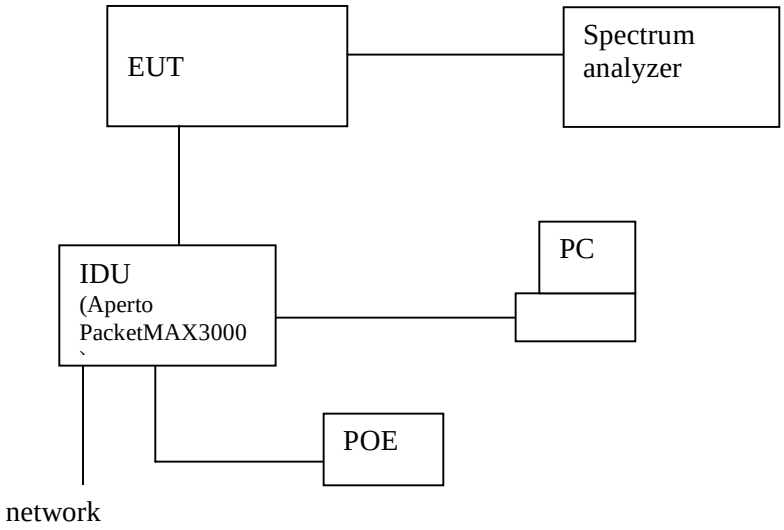
3.6. DESCRIPTION OF TEST SETUP

TEST SETUP

The EUT is an outdoor radio (ODR) which obtains DC power and modulated IF signal from an indoor unit (IDU). The IDU obtains DC power from a power over Ethernet (POE) powered by the AC mains. The IDU connects to the network via CAT5 Ethernet cable.

The laptop sets the channels and power levels of the radio via the IDU.

SETUP DIAGRAM FOR TESTS



3.7 Modifications to EUT

NONE.

TEST AND MEASUREMENT EQUIPMENT

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

CCS Test Equipment: Radiated and Line Conducted Tests

TEST EQUIPMENT LIST					
Description	**Manufacturer**	**Model**	**Asset**	**Cal Date**	**Cal Due**
EMI Receiver, 2.9 GHz	Agilent / HP	8542E	C00957	2/6/07	6/12/08
RF Filter Section, 2.9 GHz	Agilent / HP	85420E	C00958	2/6/07	6/12/08
Bilog Antenna	Sunol Sciences	JB1	C01016	9/28/07	9/28/08
Antenna, Horn, 18 GHz	EMCO	3115	C00872	4/15/07	4/15/08
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	8/3/07	9/27/08
Preamplifier, 9Khz-1GHz	Sonoma	310N	N02891	1/20/07	1/20/08
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/25/07	10/25/08
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	10/25/07	10/25/08
Reject Filter, 5.725-5.825 GHz	Micro-Tronics	BRC13192	N02677	CNR	CNR

Aperto Networks Test Equipment: Antenna Port Conducted Tests

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**Cal Due**
Spectrum Analyzer	Agilent	E4440A	MY46186111	8/21/08
Directional Coupler	KYRTAR	1850	-	-

LIMITS AND RESULTS

3.7. ANTENNA PORT CHANNEL TESTS

3.7.1. 99% OCCUPIED BANDWIDTH

REQUIREMENT

2.1049 Measurements required: Occupied bandwidth.
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 99% bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

RESULTS

No non-compliance noted:

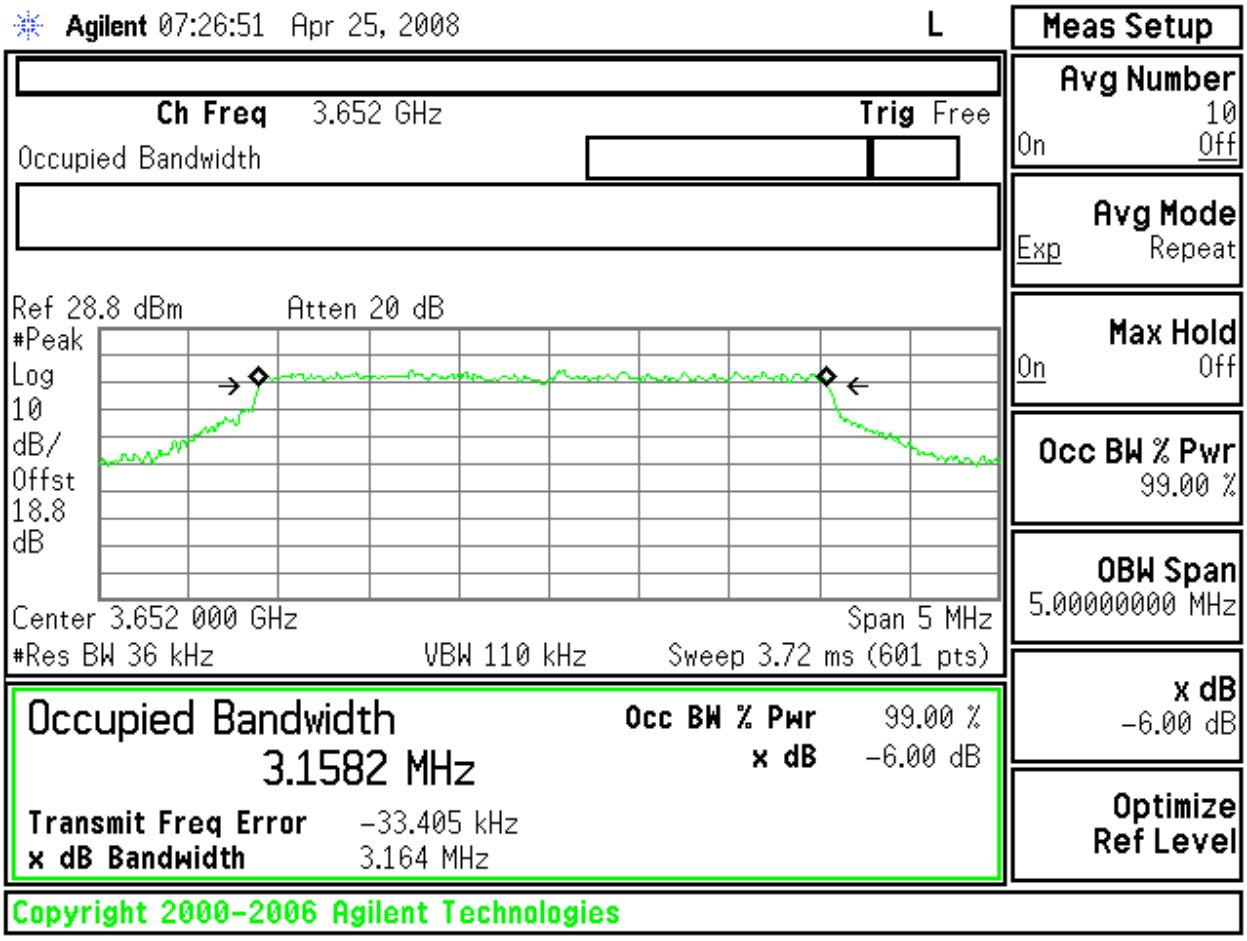
3.5 MHz EBW

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
Low	3652	3.16
Middle	3675	3.16
High	3698	3.14

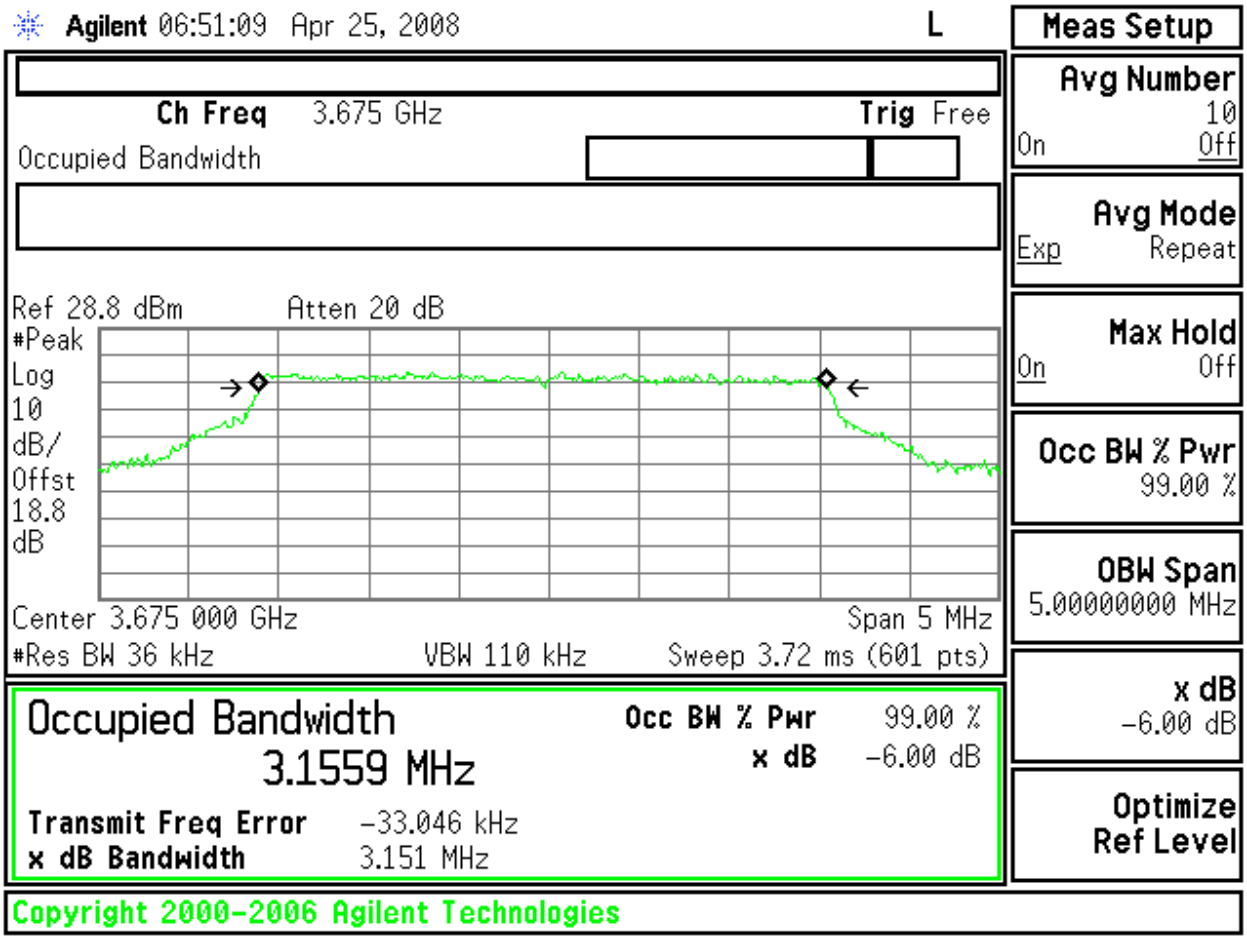
7 MHz EBW

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
Low	3653.5	6.29
Middle	3675	6.28
High	3696.5	6.32

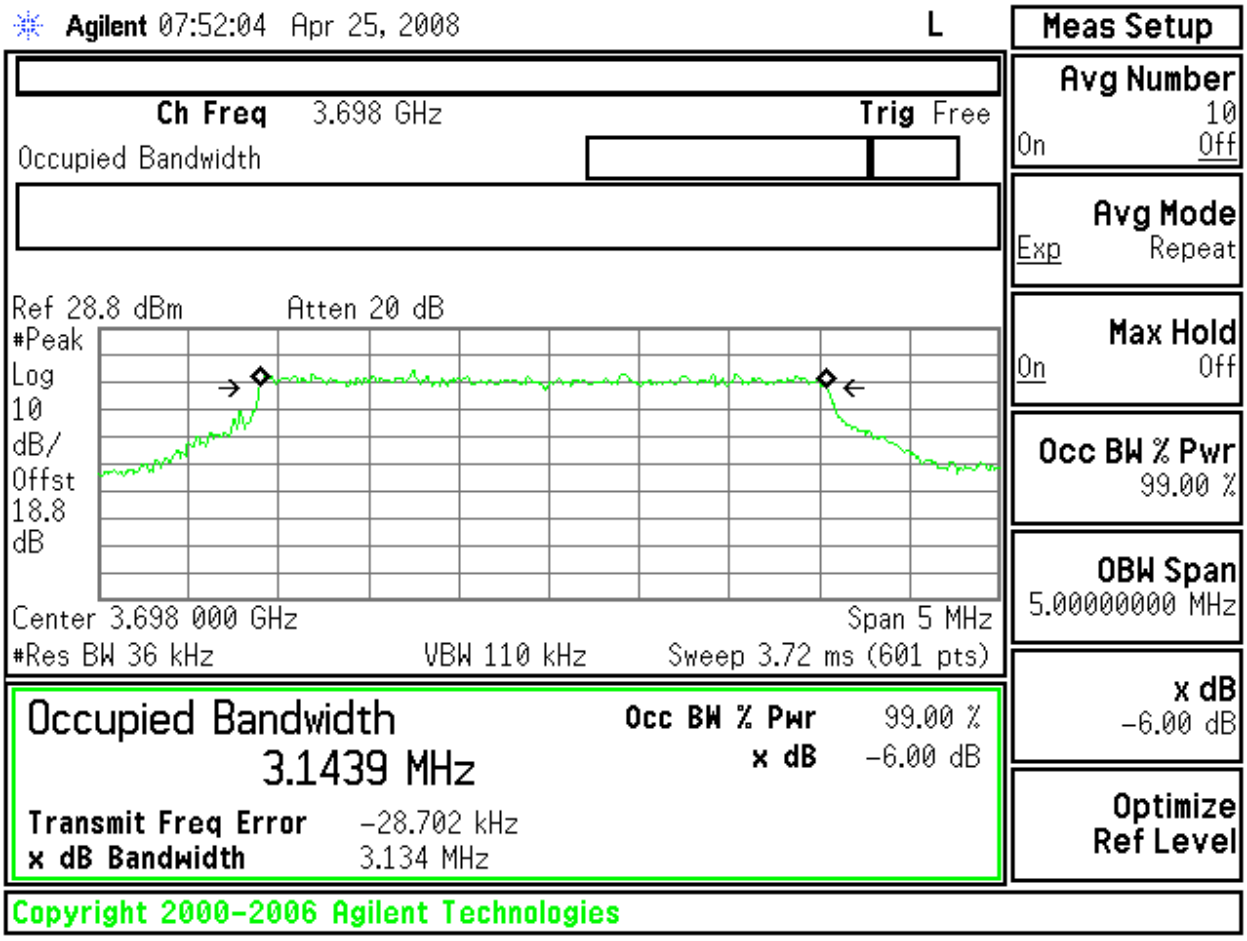
99% Occ BANDWIDTH LOW CHANNEL 3.5 MHz EBW



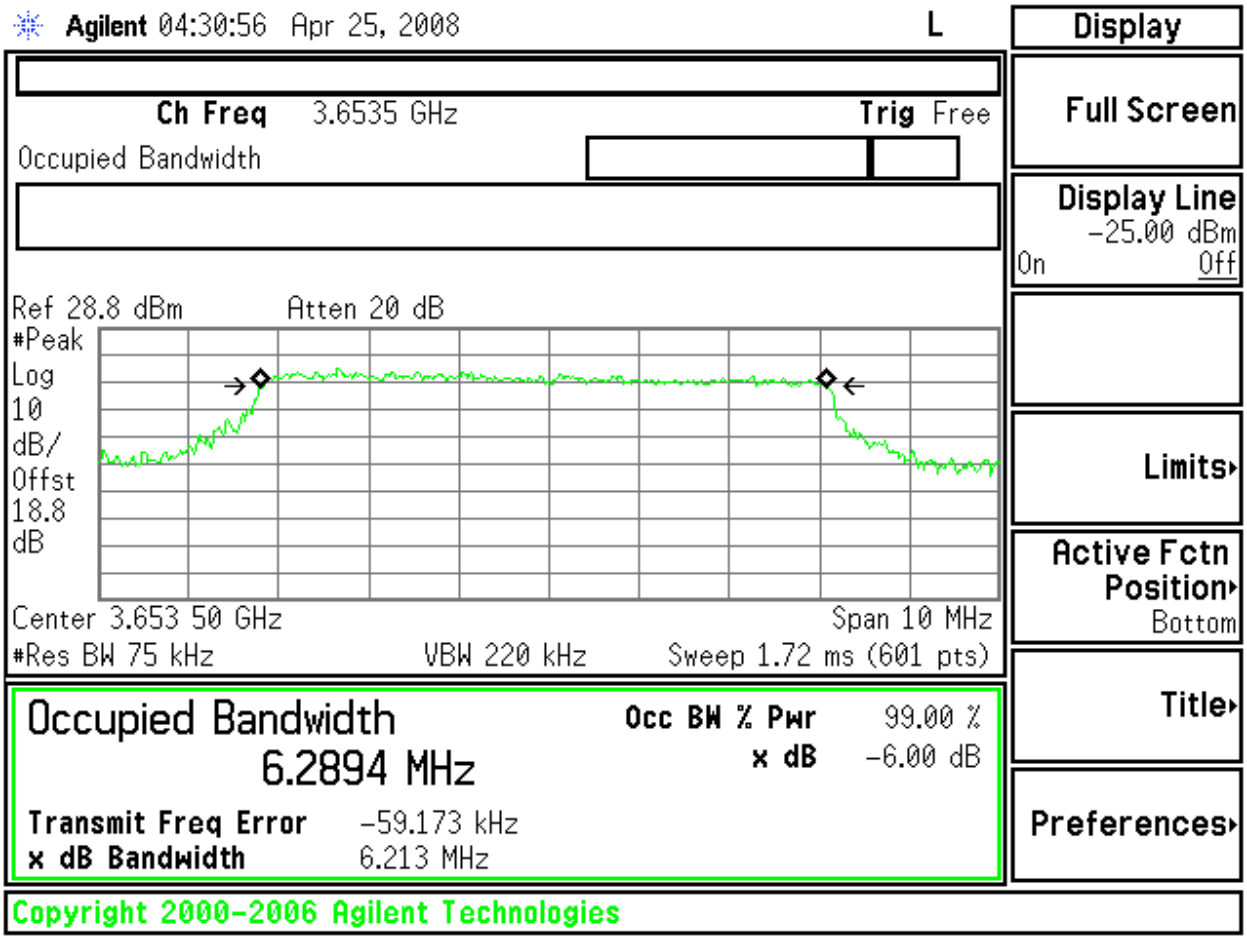
99% Occupied BANDWIDTH MID CHANNEL 3.5 MHz EBW



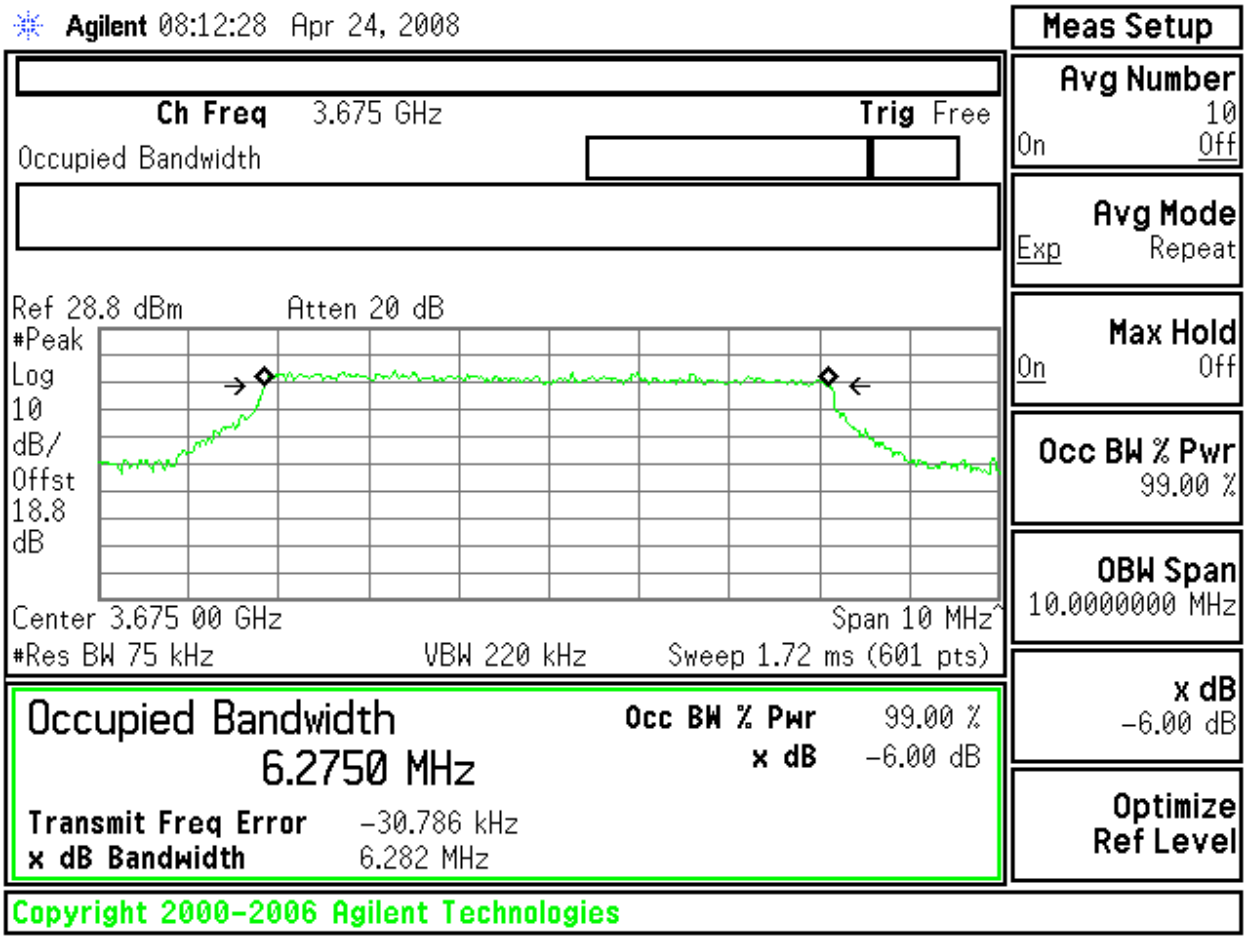
99% Occupied BANDWIDTH HIGH CHANNEL 3.5 MHz EBW



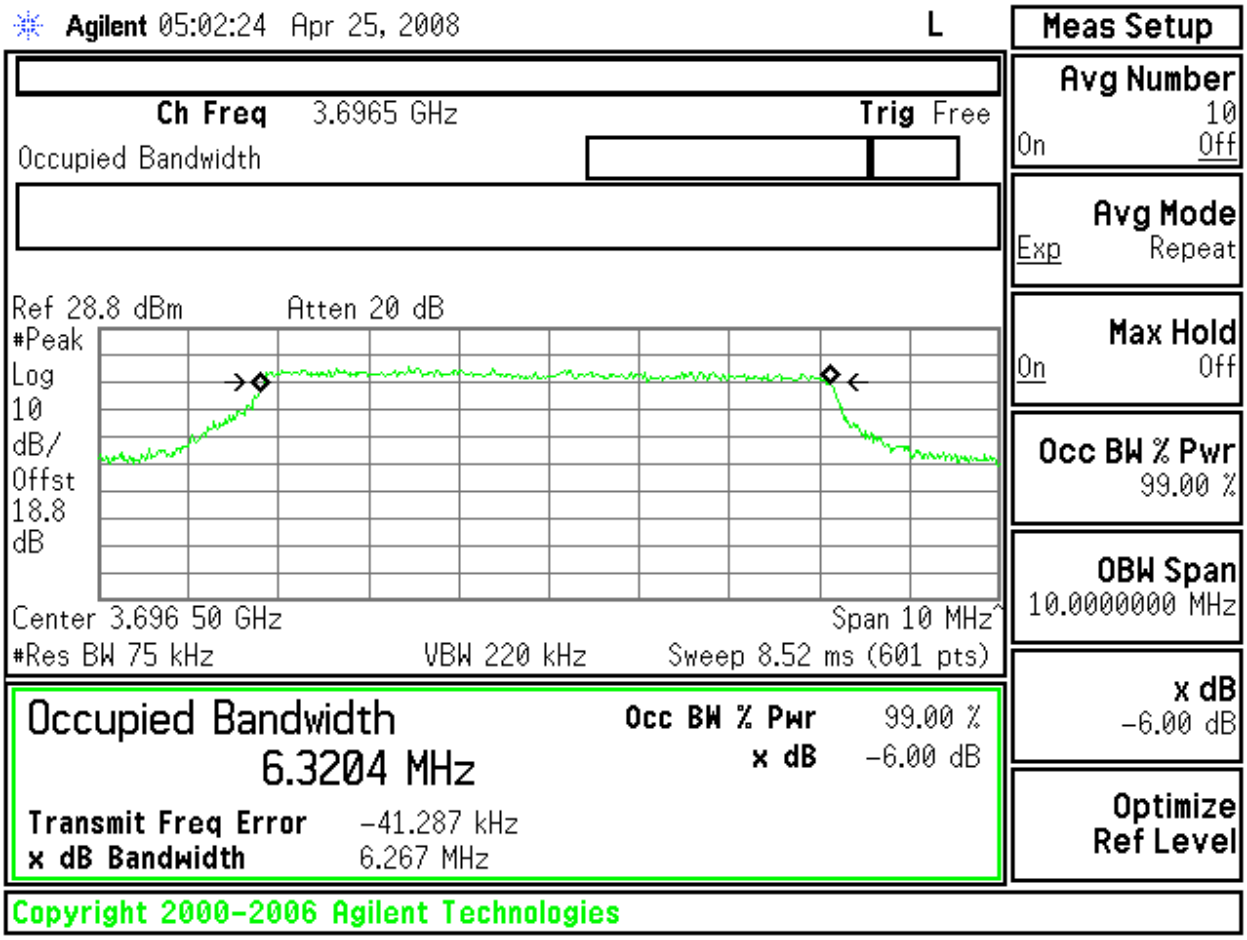
99% Occupied BANDWIDTH LOW CHANNEL 7 MHz EBW



99% Occupied BANDWIDTH MID CHANNEL 7 MHz EBW



99% Occupied BANDWIDTH HIGH CHANNEL 7 MHz EBW



3.7.2. POWER SPECTRAL DENSITY

REQUIREMENT

90.1321 Power and antenna limits.

(a) Base and fixed stations are limited to 25 watts/25 MHz equivalent isotropically radiated power (EIRP). In any event, the peak EIRP power density shall not exceed 1 Watt in any one-megahertz slice of spectrum.

TEST PROCEDURE

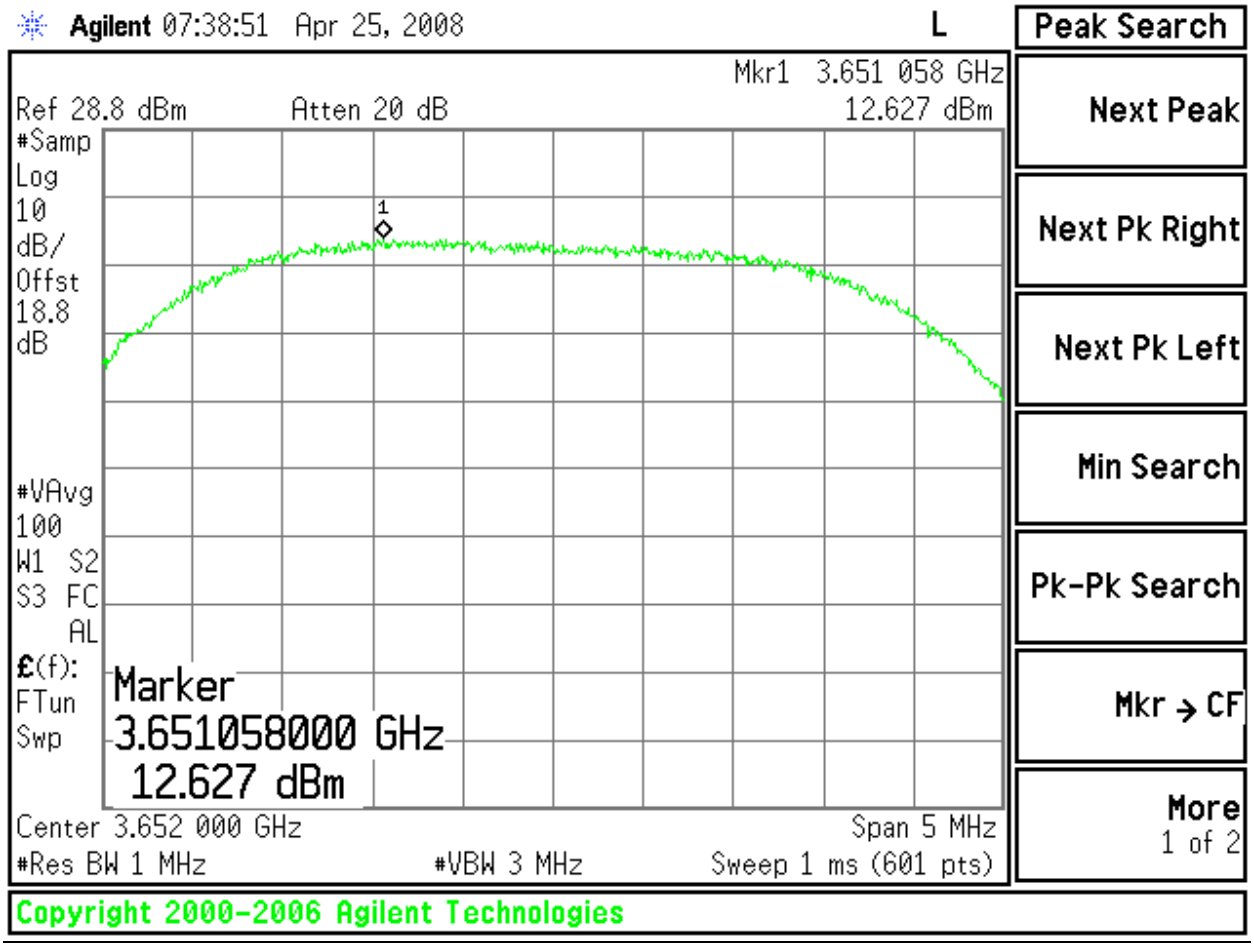
Spectrum analyzer settings:

SPAN = approximately 1.5 EBW
RBW = 1 MHz
VBW = 3 MHz
Sweep time: Auto couple

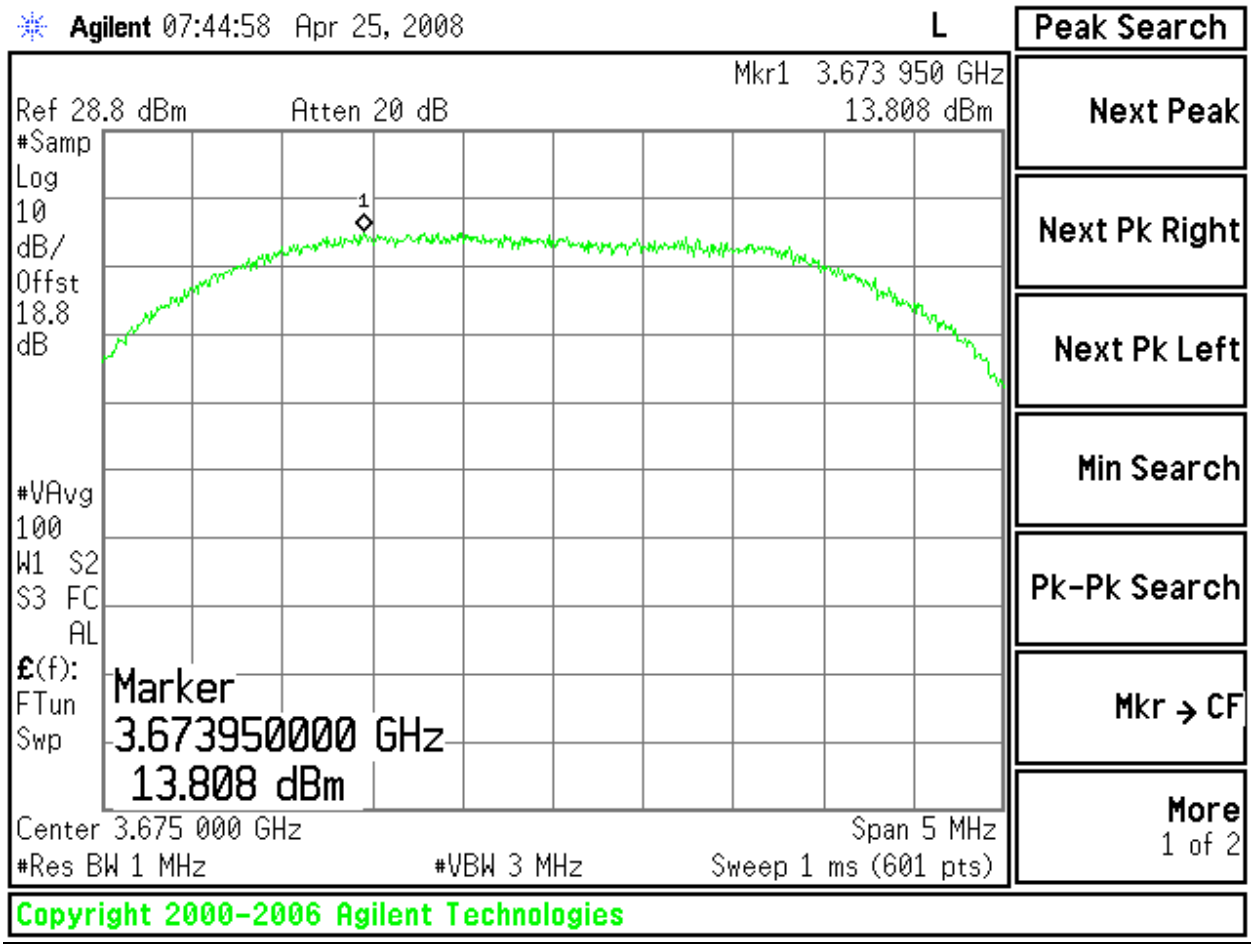
RESULTS

Refer to following plots. The licensee is responsible for determining that the eirp does not exceed the 1watt/MHz power density limit.

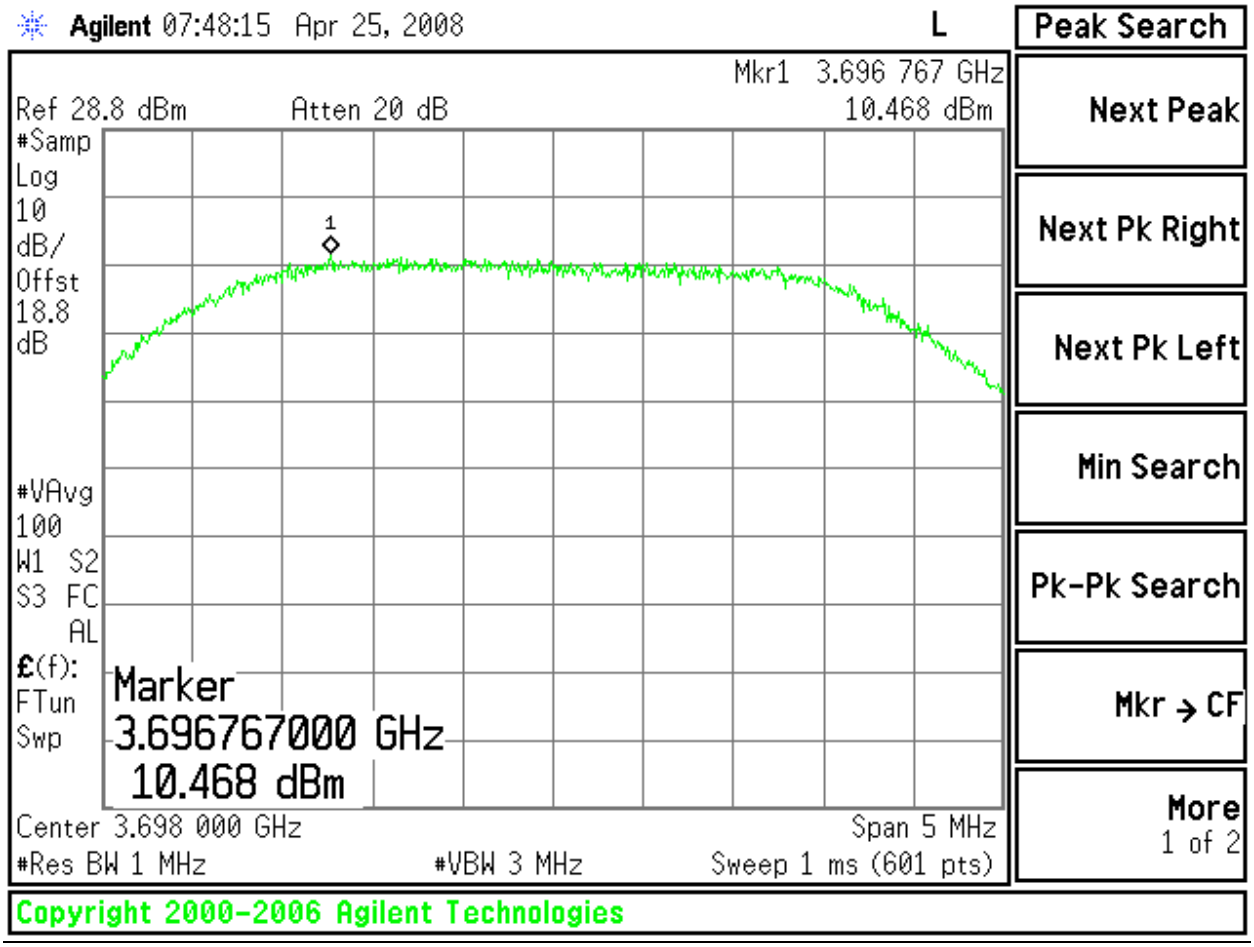
PSD LOW CHANNEL 3.5 MHZ EBW



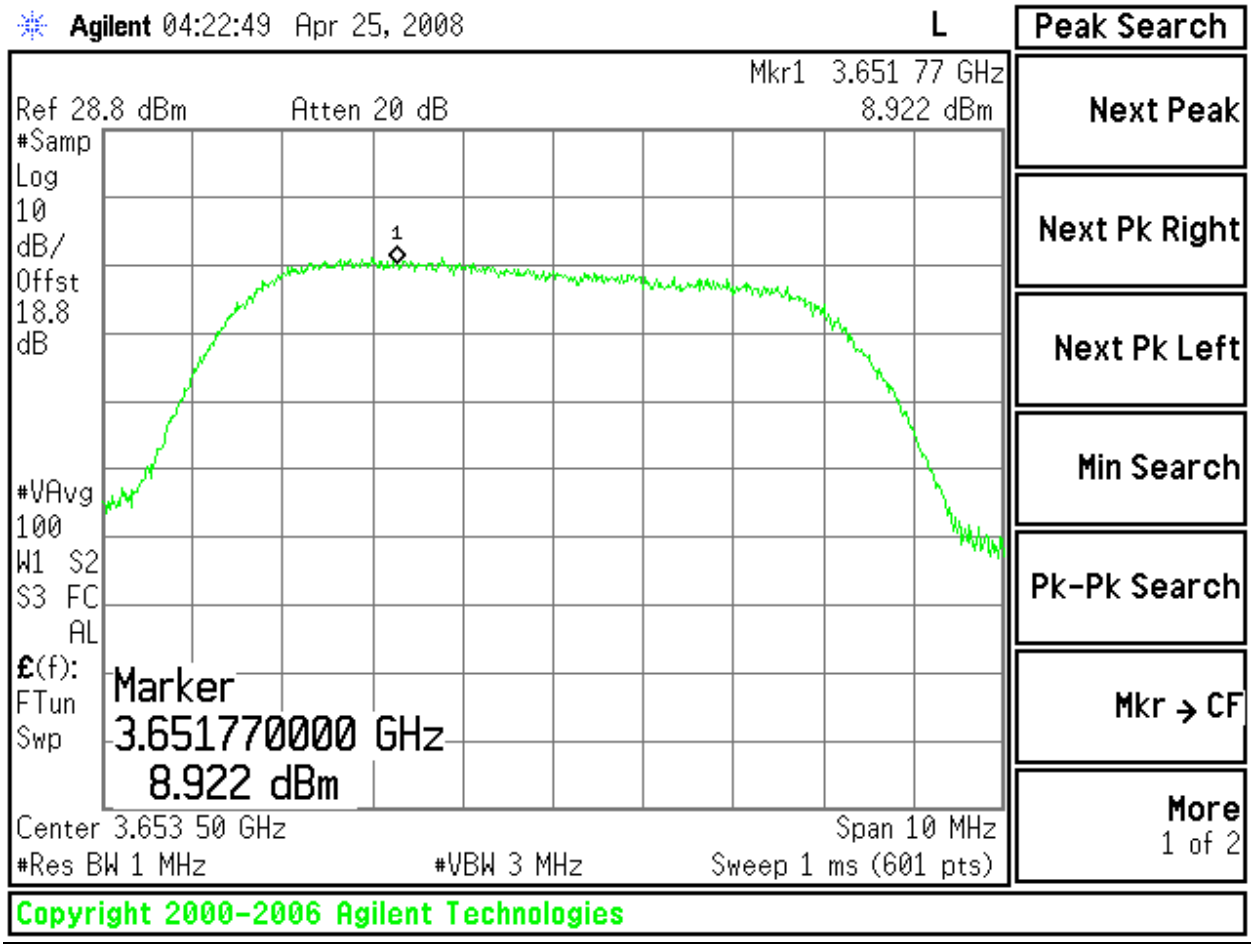
PSD MID CHANNEL 3.5 MHZ EBW



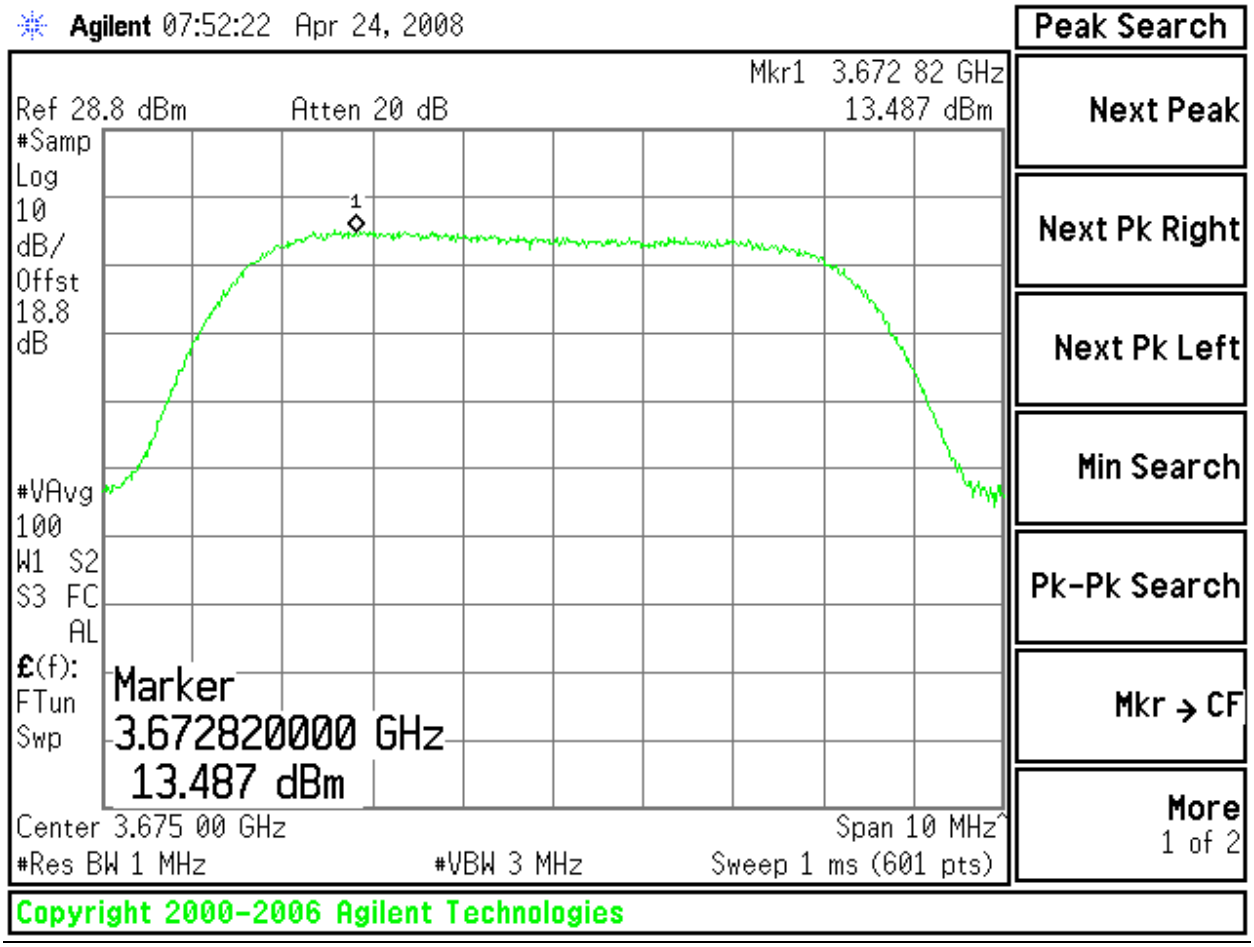
PSD HIGH CHANNEL 3.5 MHZ EBW



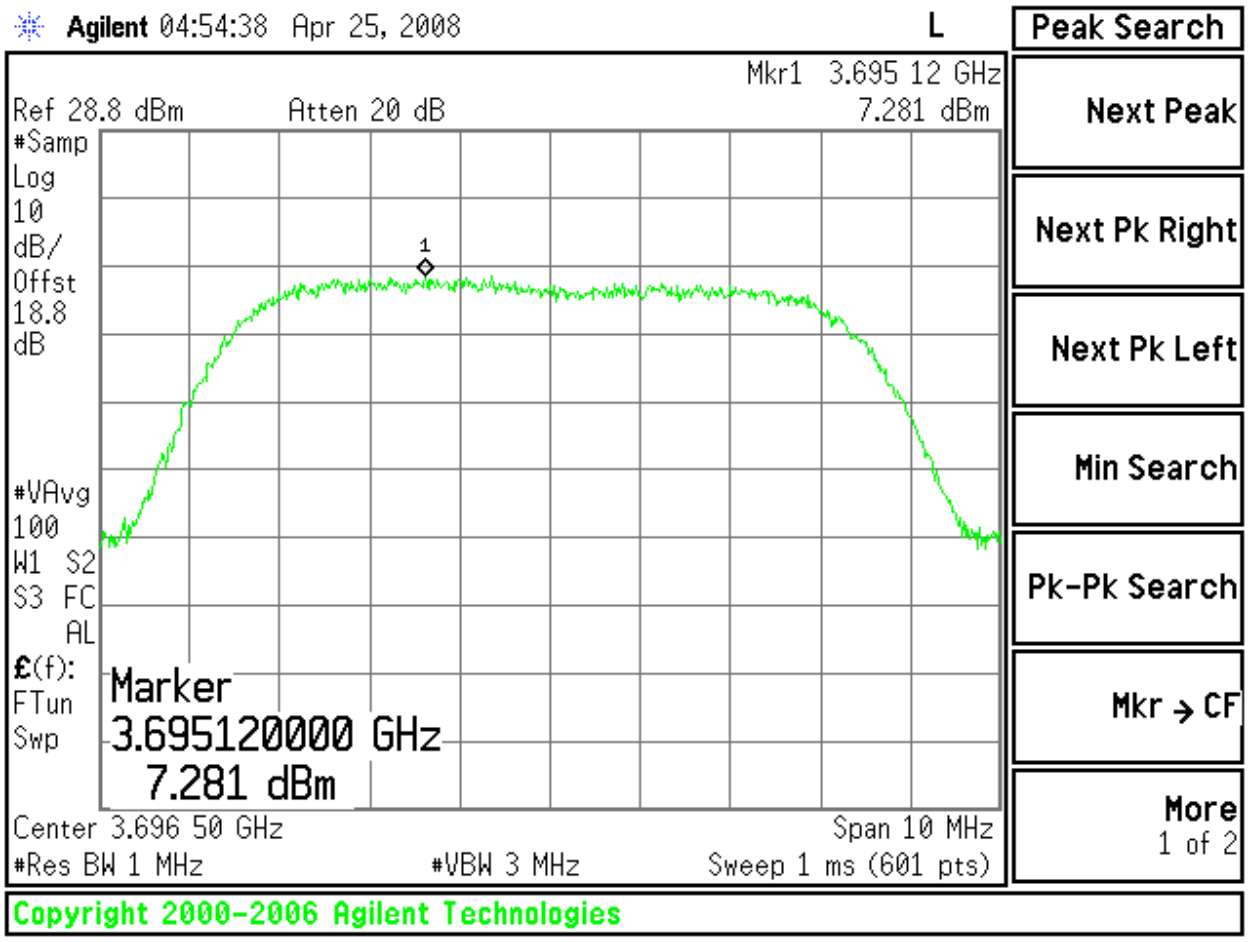
PSD LOW CHANNEL 7 MHZ EBW



PSD MID CHANNEL 7 MHZ EBW



PSD HIGH CHANNEL 7 MHZ EBW



PEAK OUTPUT POWER

PEAK POWER LIMIT

§ 90.1321 Power and antenna limits.

(a) Base and fixed stations are limited to 25 watts/25 MHz equivalent isotropically radiated power (EIRP). In any event, the peak EIRP power density shall not exceed 1 Watt in any one-megahertz slice of spectrum.

The user/installer manual for the EUT contains a list of antennas available for use with the product. It is the responsibility of the licensee to adjust transmitter output power such that the eirp limits specified in section 90.1321 (a) of the Rules are not exceeded.

Limit for 3.5 MHz channels = 25 watts/25 MHz = 3.16 watts/3.16 MHz eirp = 35 dBm eirp
Limit for 7.0 MHz channels = 25 watts/25 MHz = 6.32 watts/6.32 MHz eirp = 38 dBm eirp

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The built-in Channel Power function was used to measure peak output power.

RESULTS

No non-compliance noted:

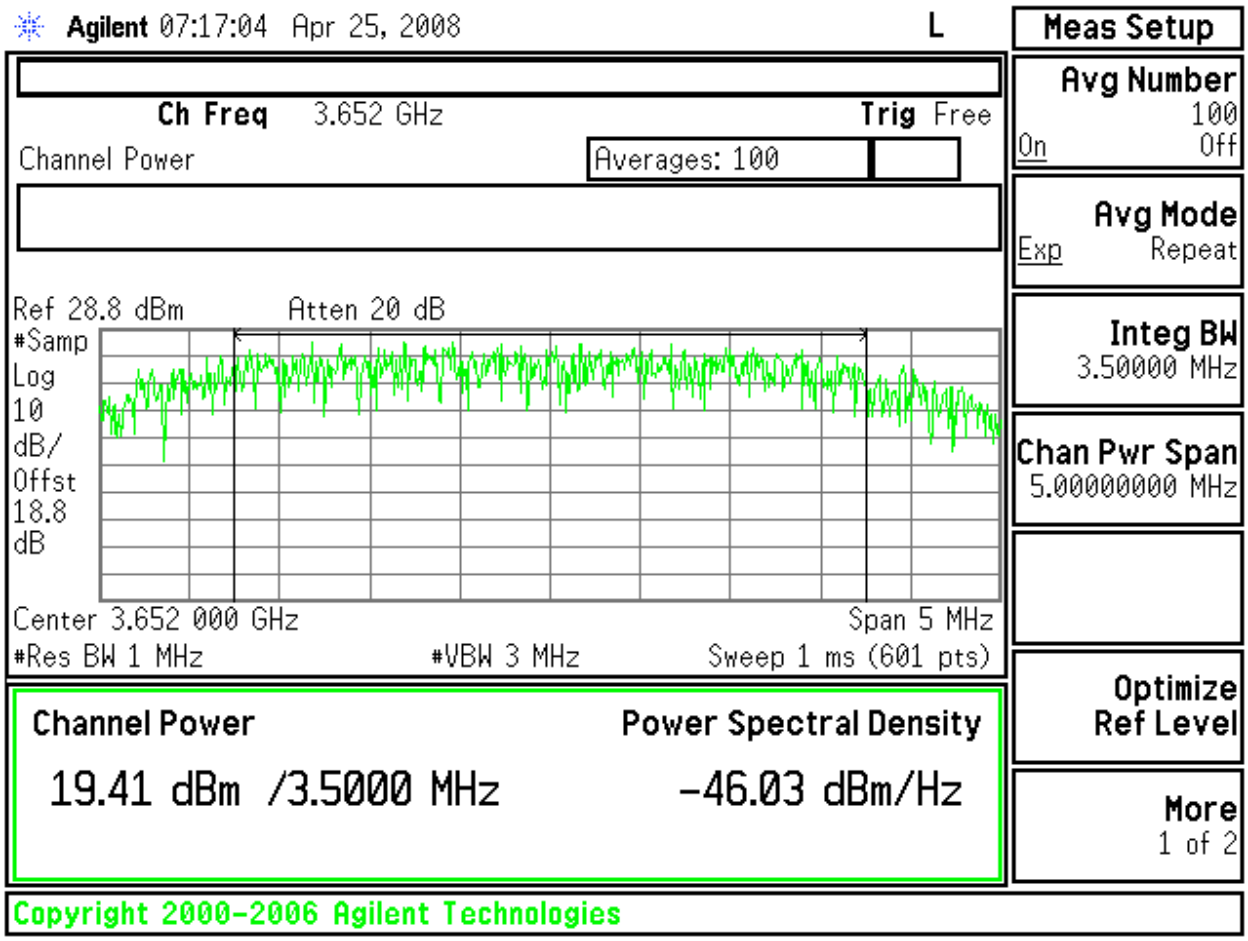
3.5 MHz EBW

	(MHz)	(dBm)	(mW)
Low	3652	19.41	87.3
Middle	3675	19.96	99.1
High	3698	19.61	91.4

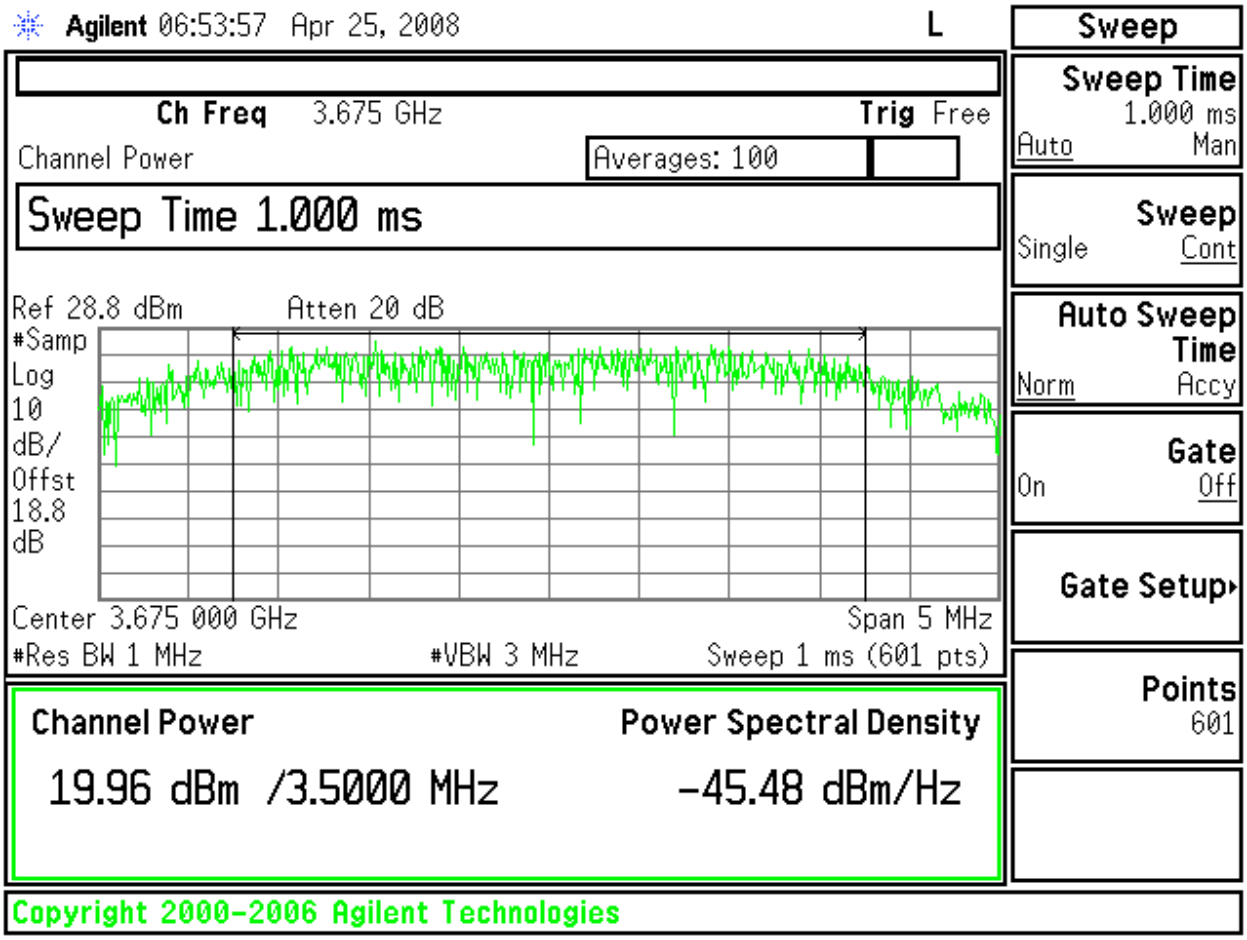
7 MHz EBW

	(MHz)	(dBm)	(mW)
Low	3653.5	21.84	152.8
Middle	3675	21.11	129.1
High	3696.5	21.62	145.2

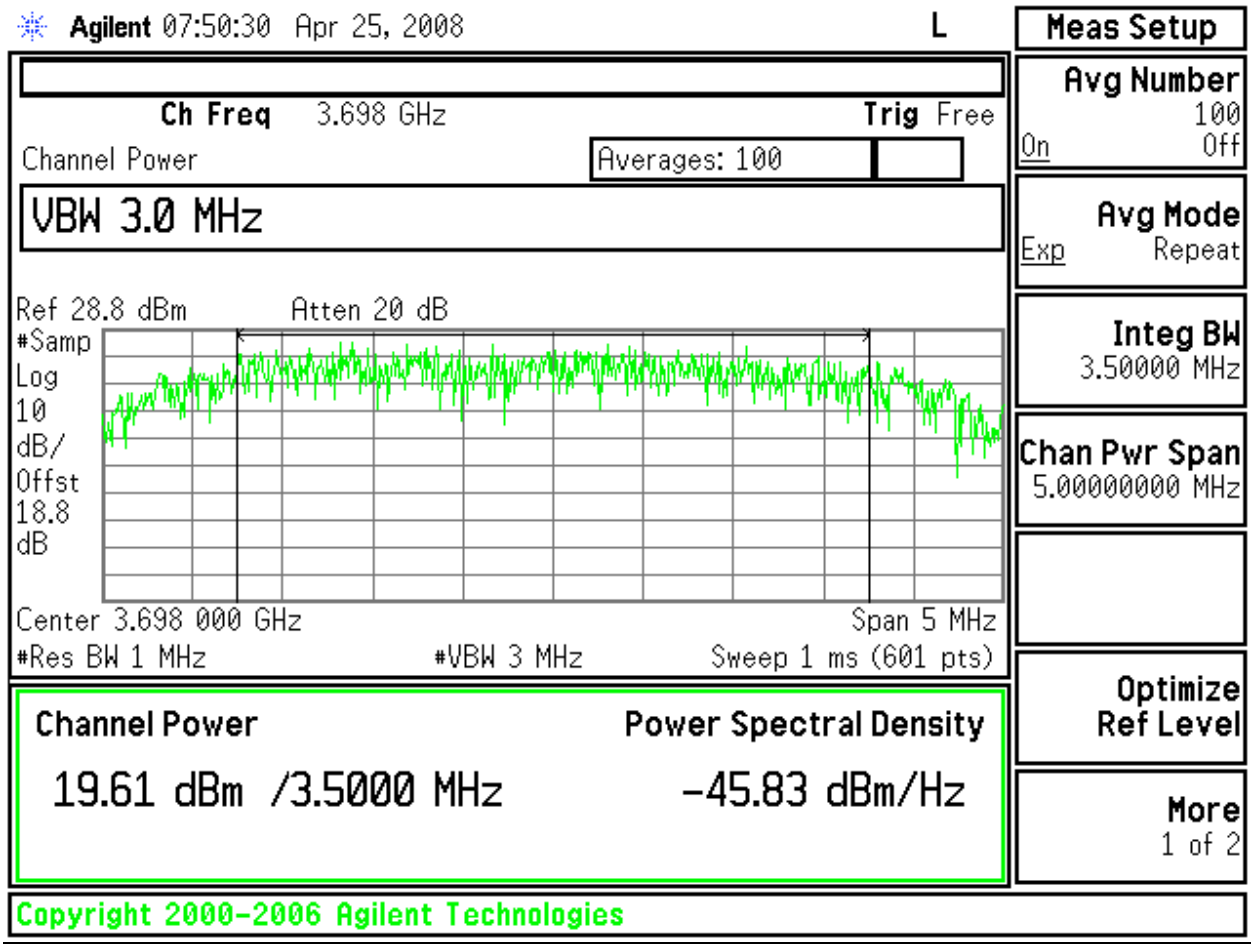
OUTPUT POWER LOW CHANNEL 3.5 MHZ EBW



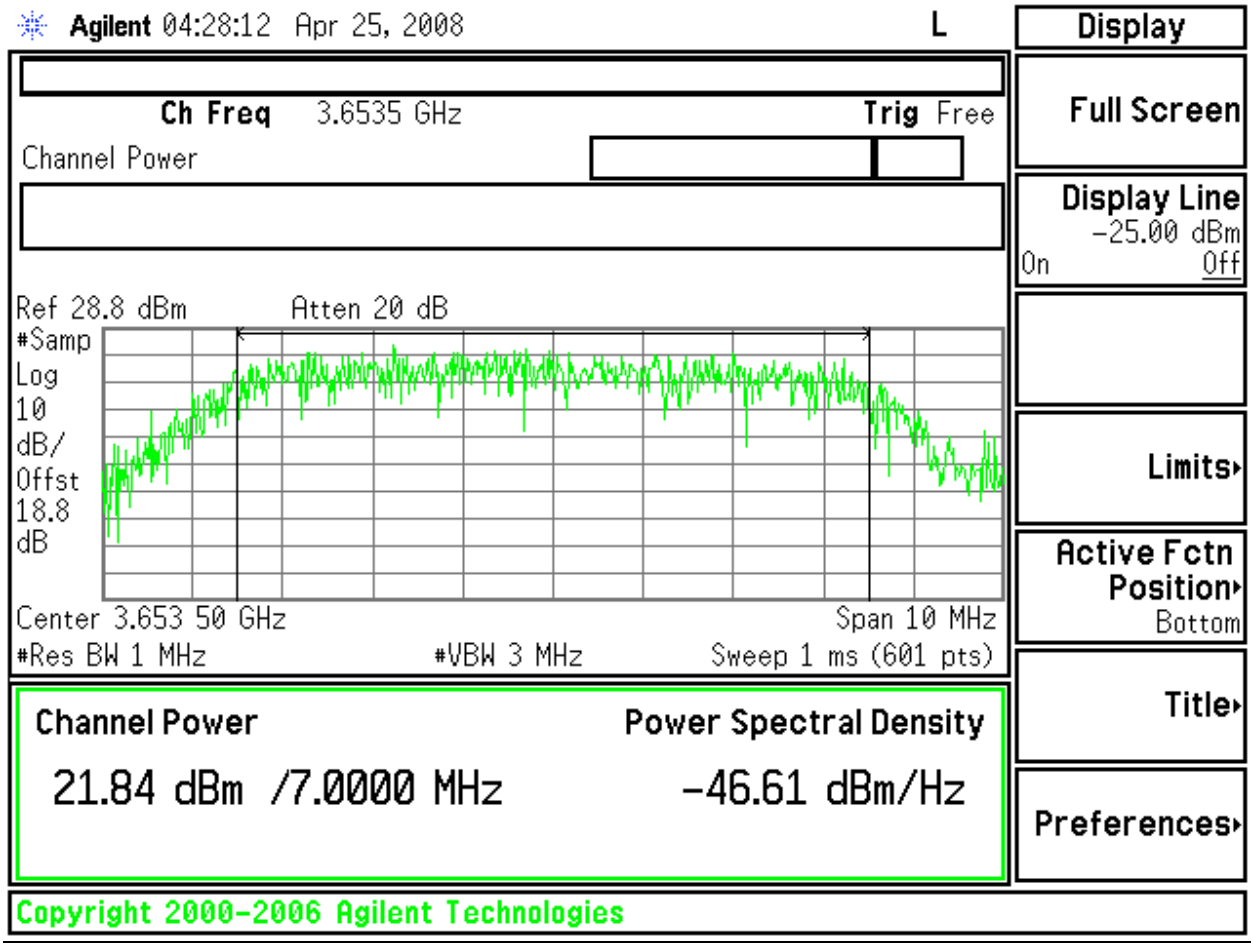
OUTPUT POWER MID CHANNEL 5 MHZ EBW



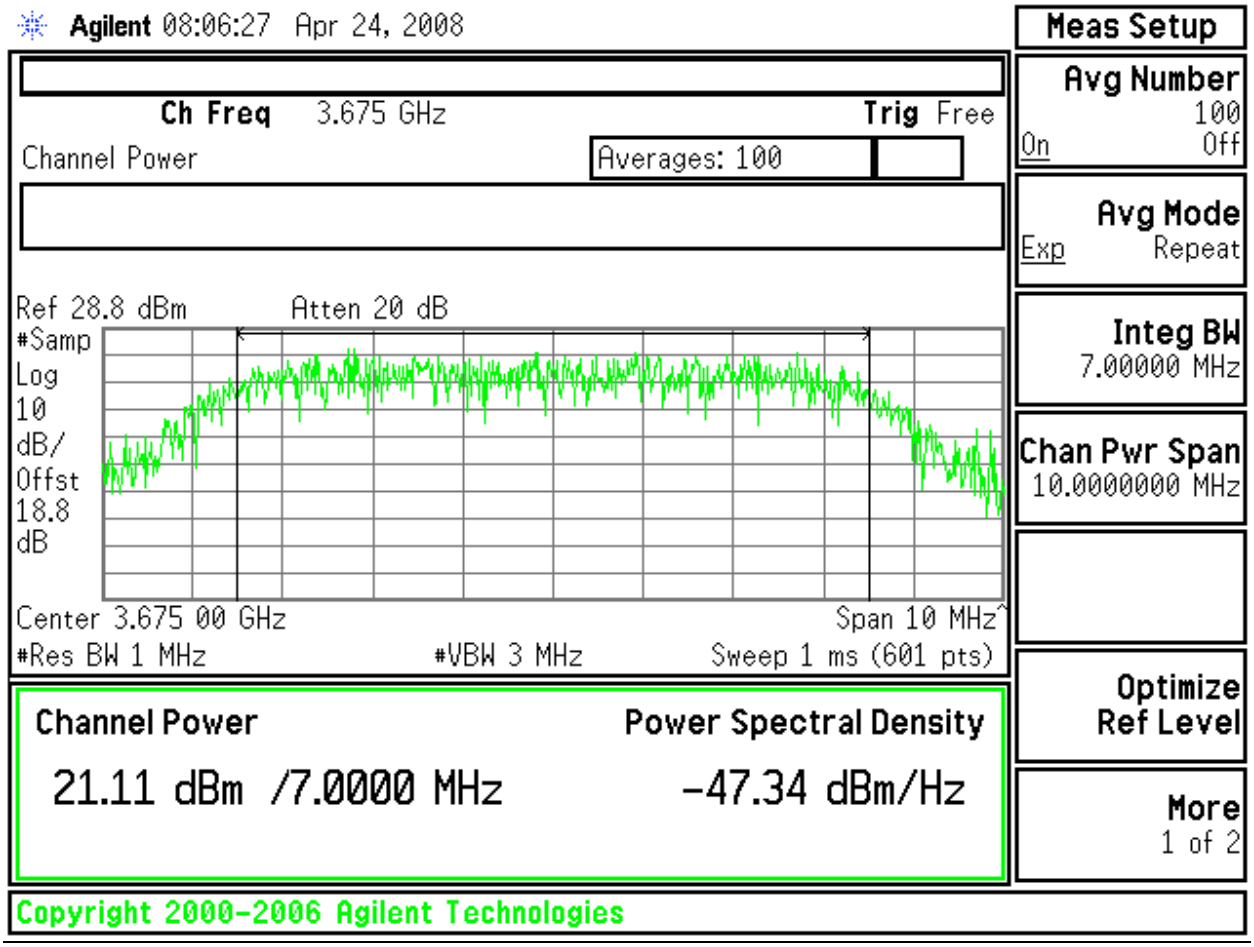
OUTPUT POWER HIGH CHANNEL 3.5 MHZ EBW



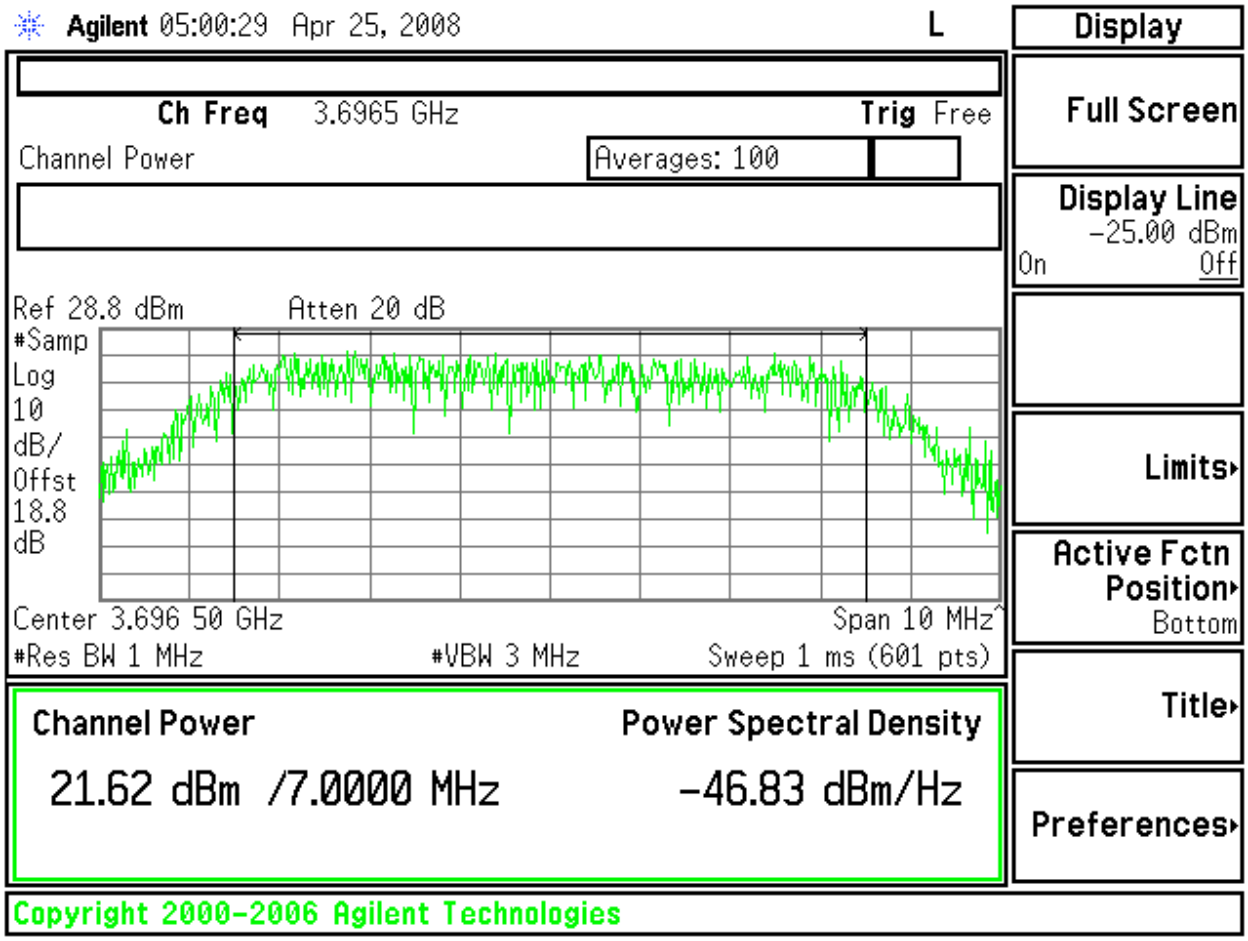
OUTPUT POWER LOW CHANNEL 7 MHZ EBW



OUTPUT POWER MID CHANNEL 7 MHZ EBW



OUTPUT POWER HIGH CHANNEL 7 MHZ EBW



3.7.3. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

§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 consequenoe of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

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 and rearranging the terms to express the distance as a function of the remaining variables yields:

$d = \sqrt{((30 * P * G) / (3770 * S))}$

Changing to units of Power to mW and Distance to cm, using:

P (mW) = P (W) / 1000 and
d (cm) =100 * d (m)

yields

$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$
$d = 0.282 * \sqrt{(P * G / S)}$

where

d = distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power Density in mW/cm^2

Substituting the logarithmic form of power and gain using:

P (mW) = 10 ^ (P (dBm) / 10) and
G (numeric) = 10 ^ (G (dBi) / 10)

yields

$d = 0.282 * 10 ^ ((P + G) / 20) / \sqrt{S}$ Equation (1)

where

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

Equation (1) and the measured peak power is used to calculate the MPE distance.

LIMITS

From §1.1310 Table 1 (B), S = 0.6 mW/cm^2

RESULTS

No non-compliance noted:

Power Density Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
1.0	19.96	17.00	19.87

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.

3.7.4. CONDUCTED SPURIOUS EMISSIONS

REQUIREMENT

90.1323 Emission limits.

(a) The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or less, but at least one percent of the emission bandwidth of the fundamental emission of the transmitter, provided the measured energy is integrated over a 1 MHz bandwidth.

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

TEST PROCEDURE

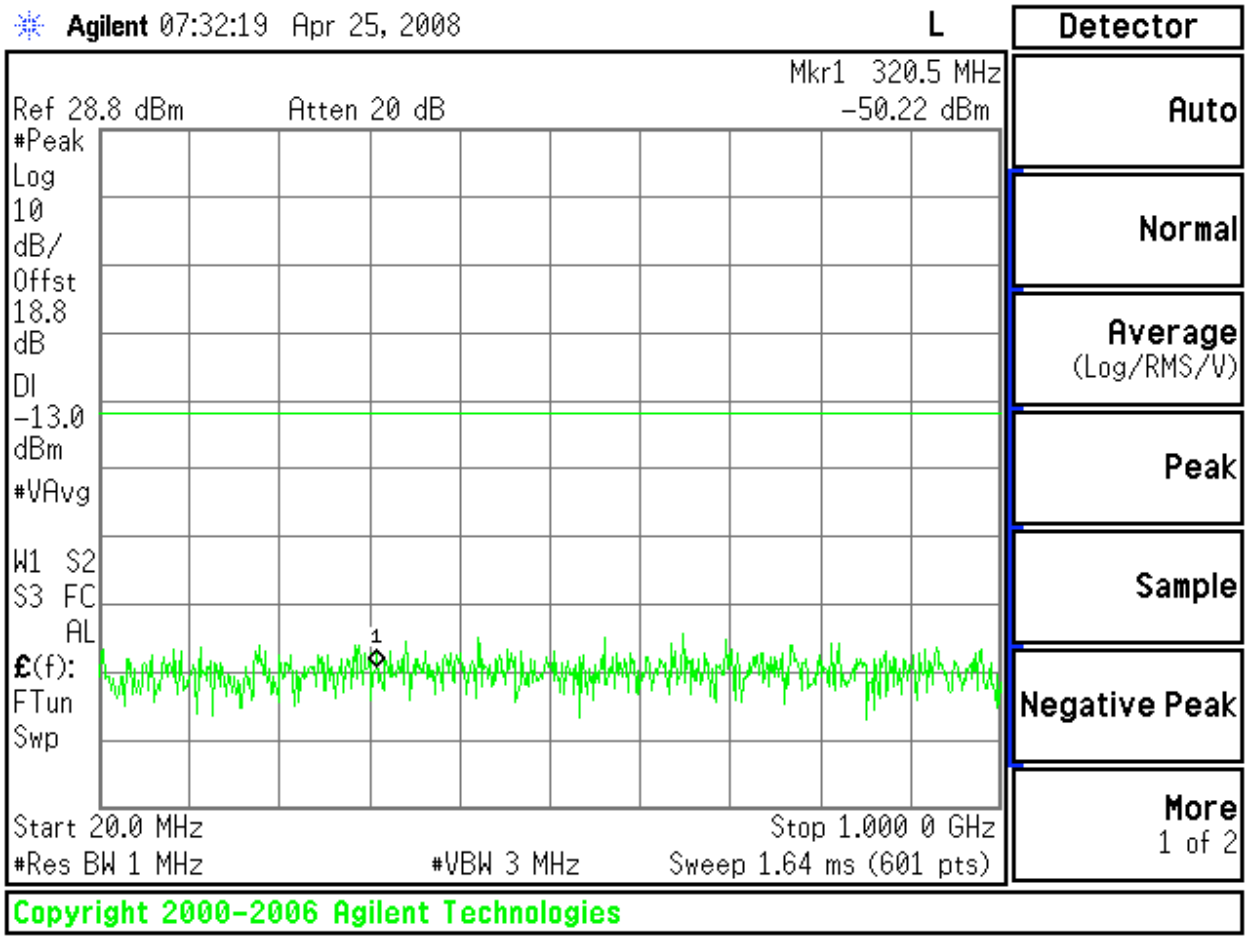
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 1MHz. The video bandwidth is set to 3MHz.

The spectrum from 30 MHz to 10 GHz is investigated with the transmitter set to the lowest, middle, and highest channels. The emissions are compared to -13 dBm, equivalent to the 43 + 10log(P) dB requirement.

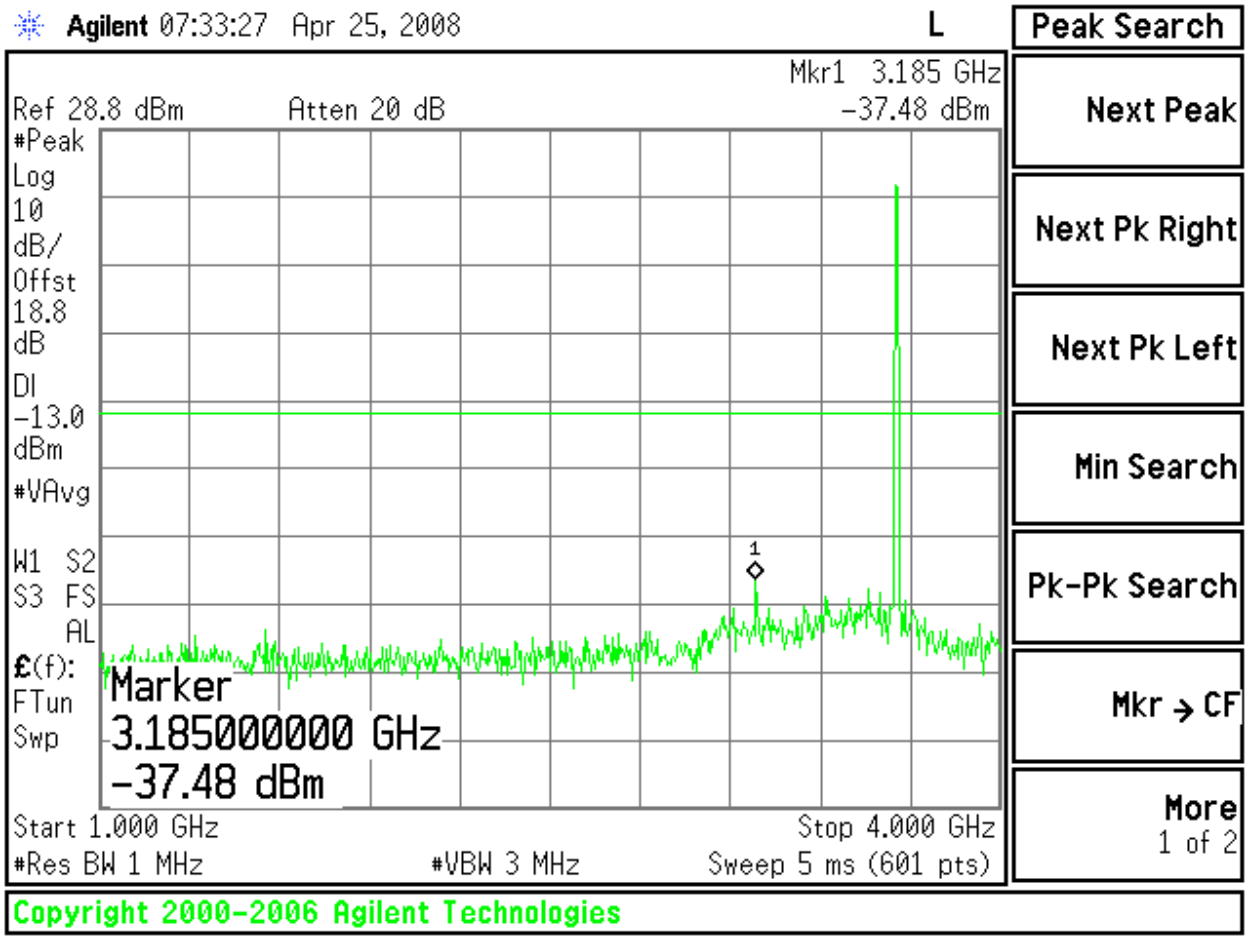
RESULTS

No non-compliance noted:

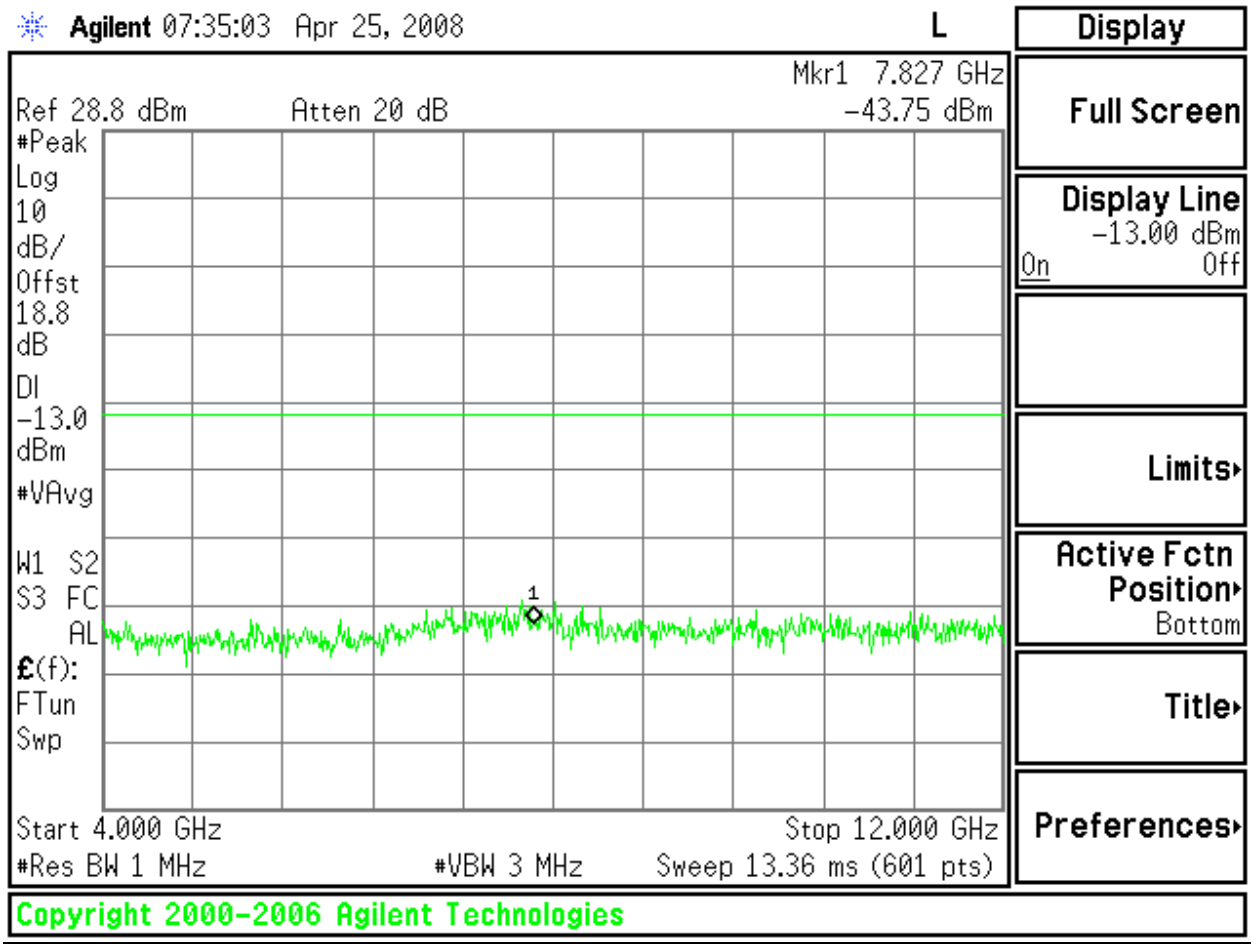
SPURIOUS EMISSIONS, LOW CHANNEL 3.5 MHZ EBW 1/4



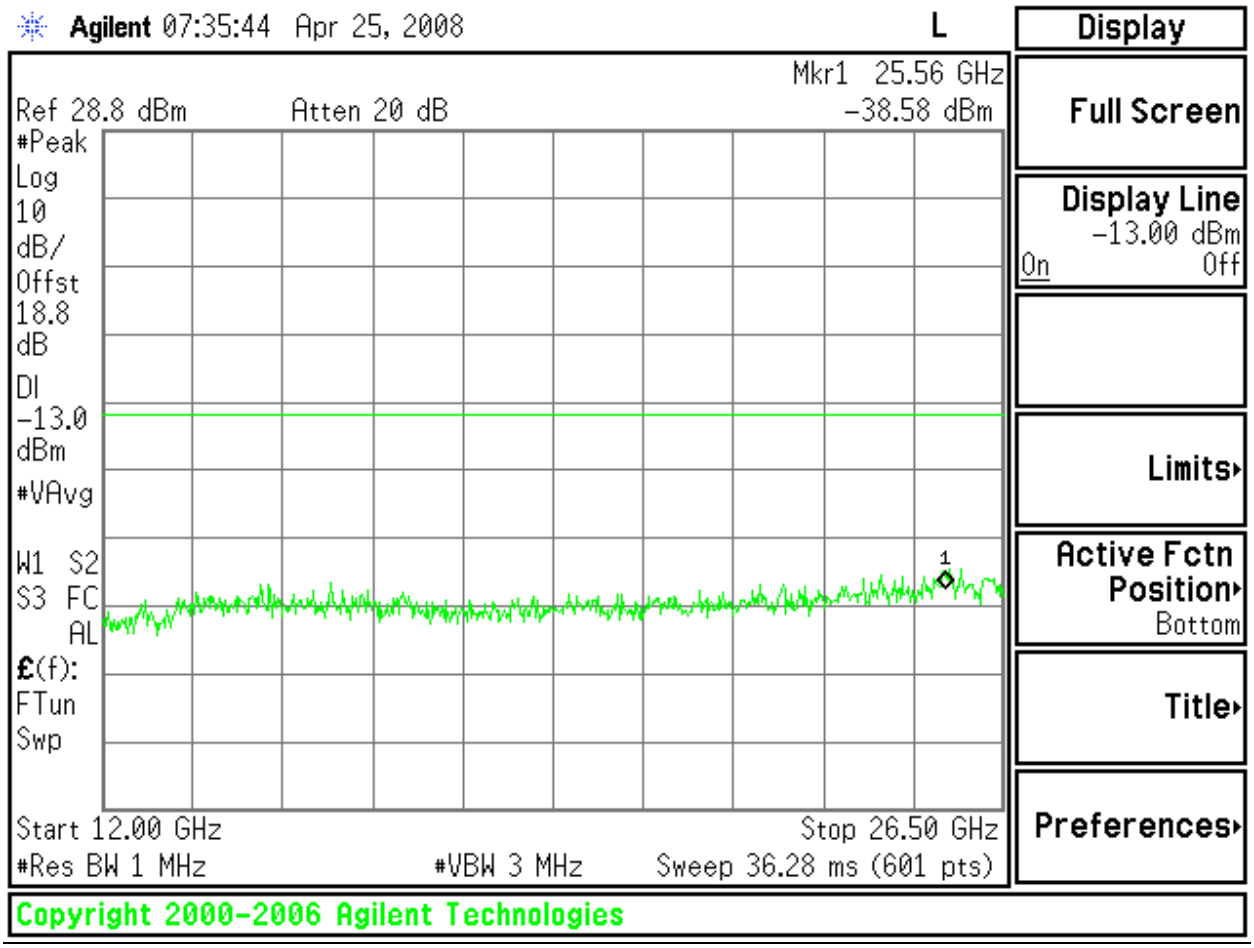
SPURIOUS EMISSIONS, LOW CHANNEL 3.5 MHZ EBW 2/4



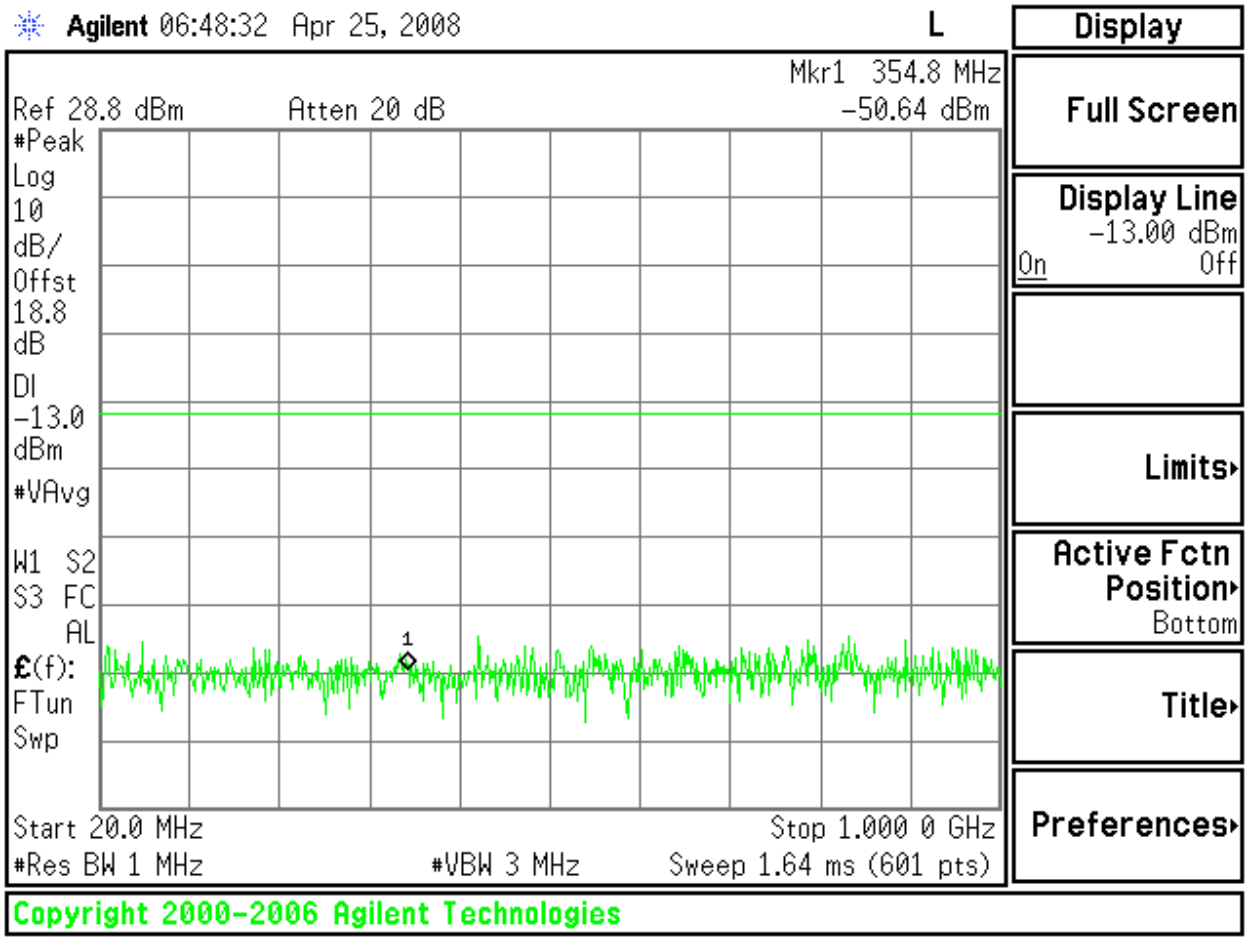
SPURIOUS EMISSIONS, LOW CHANNEL EBW 3.5 MHZ 3/4



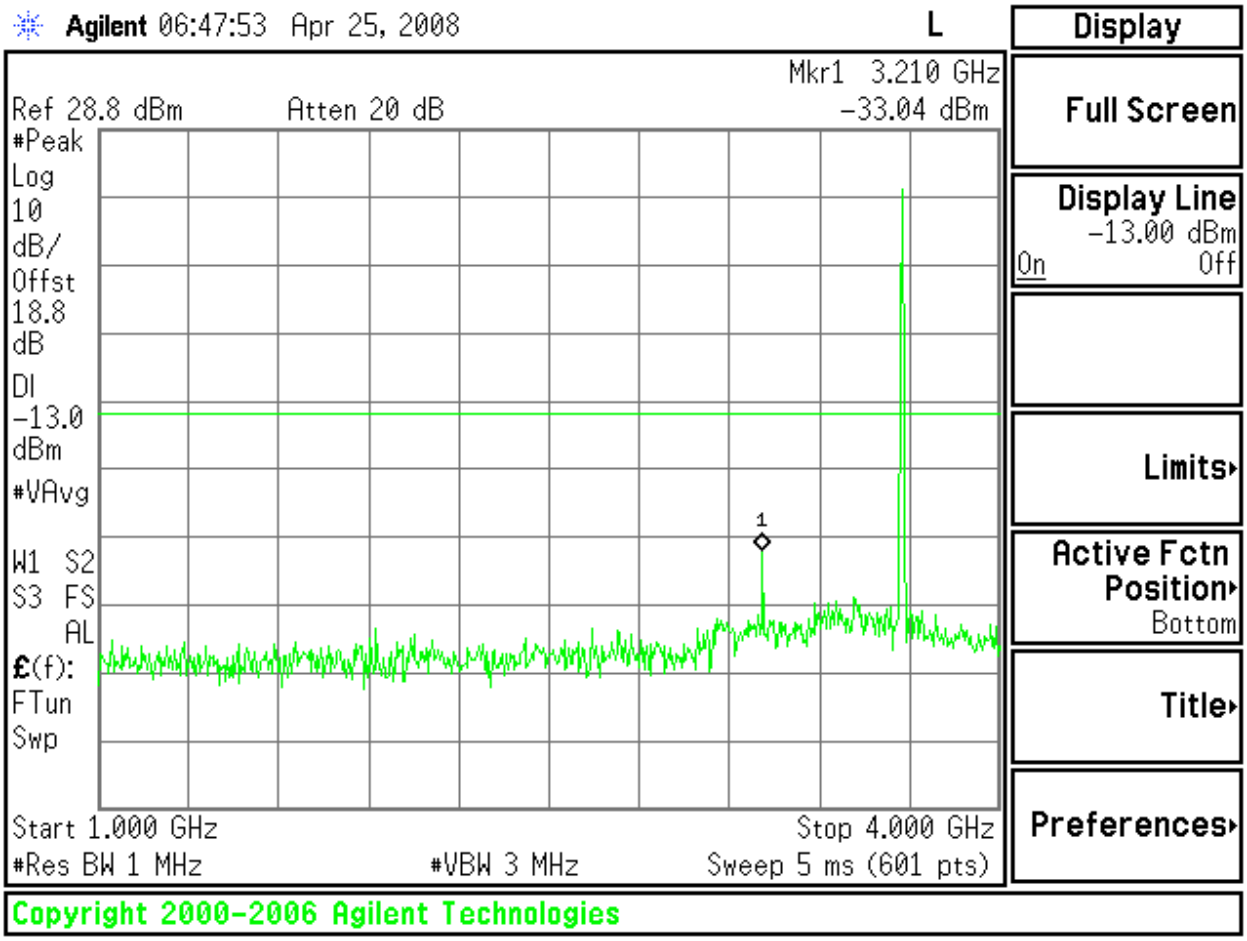
SPURIOUS EMISSIONS, LOW CHANNEL EBW 3.5 MHZ 4/4



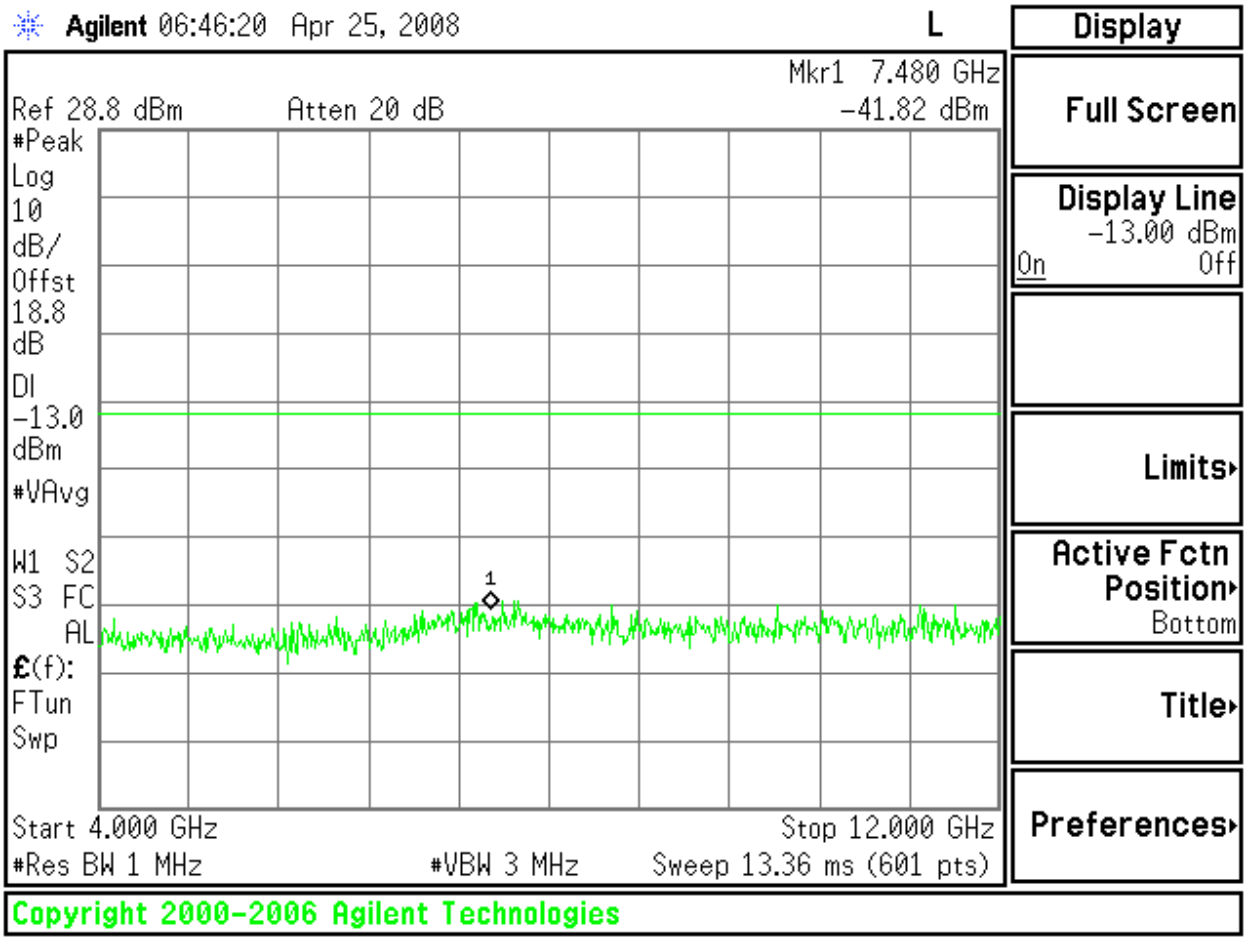
SPURIOUS EMISSIONS, MID CHANNEL3.5 MHZ EBW 1/4



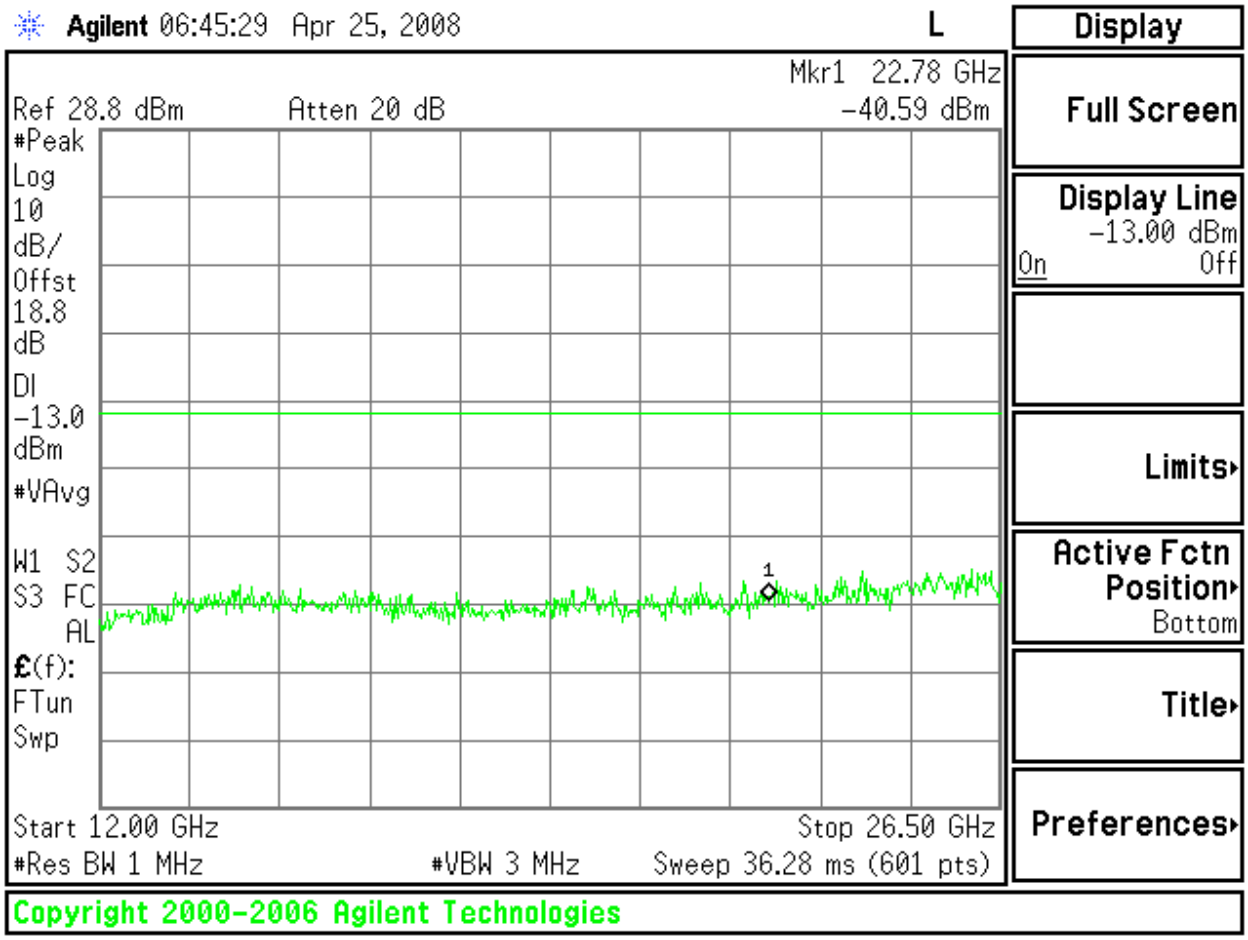
SPURIOUS EMISSIONS, MID CHANNEL 3.5 MHZ EBW 2/4



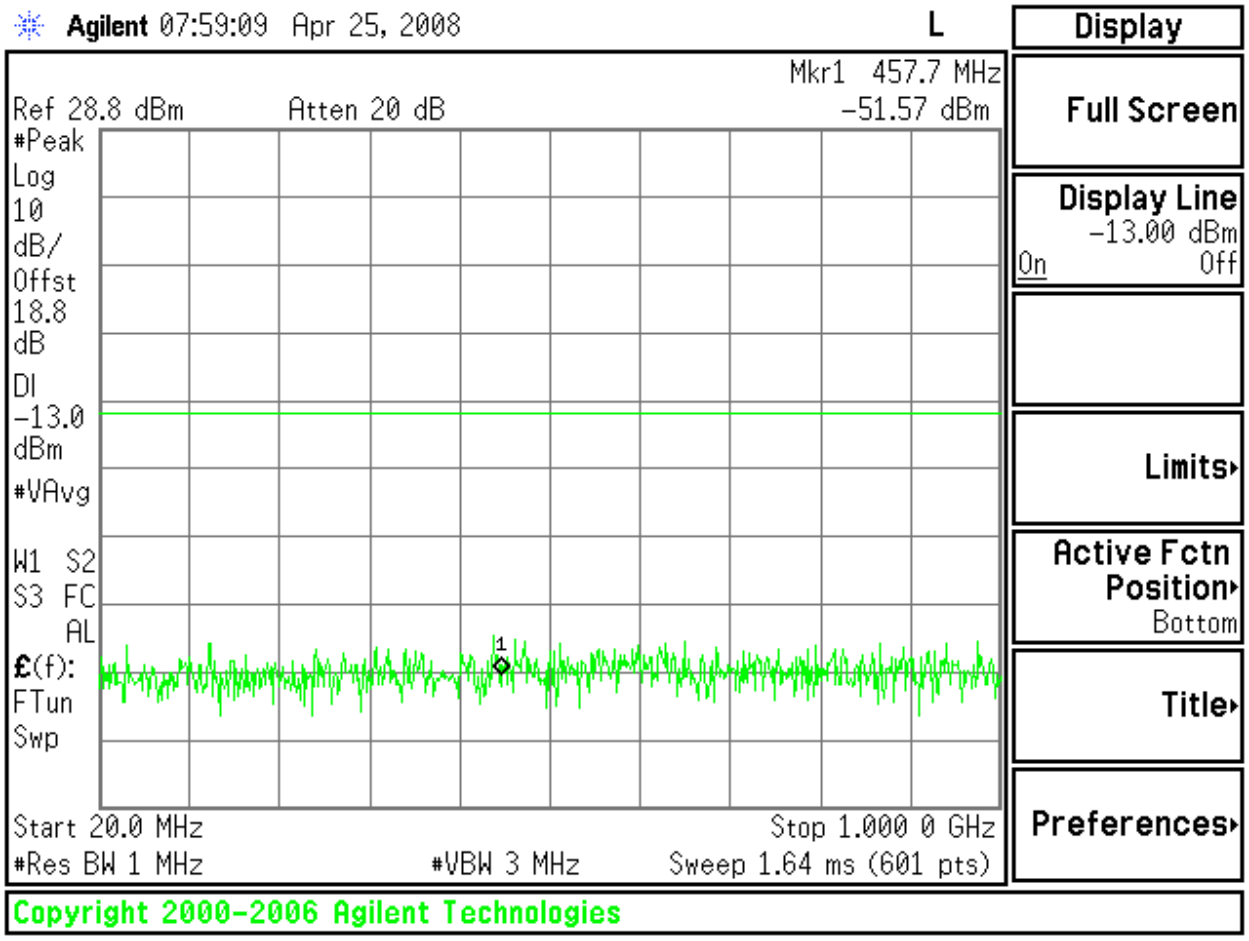
SPURIOUS EMISSIONS, MID CHANNEL 3.5 MHZ EBW 3/4



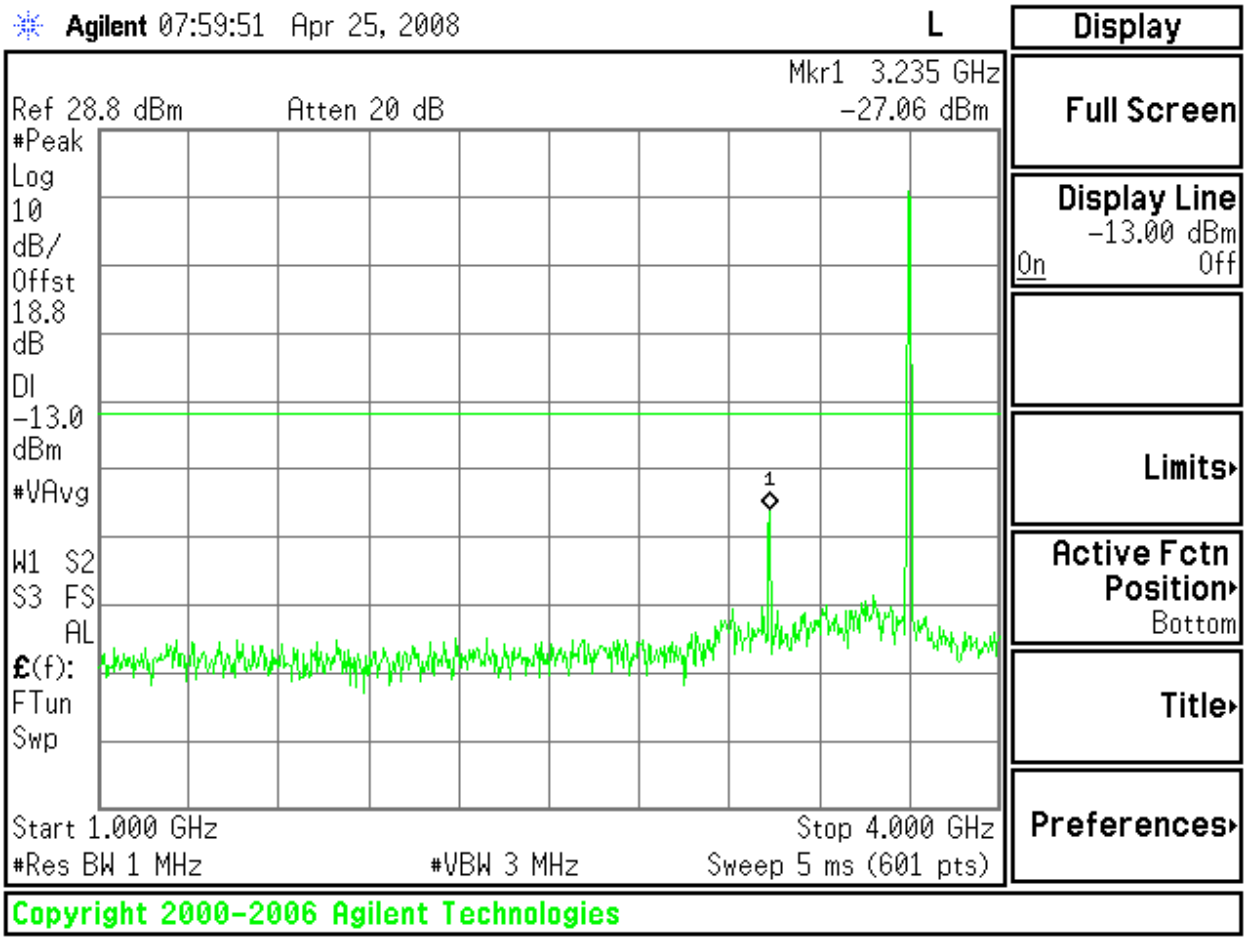
SPURIOUS EMISSIONS, MID CHANNEL EBW 3.5 MHZ 4/4



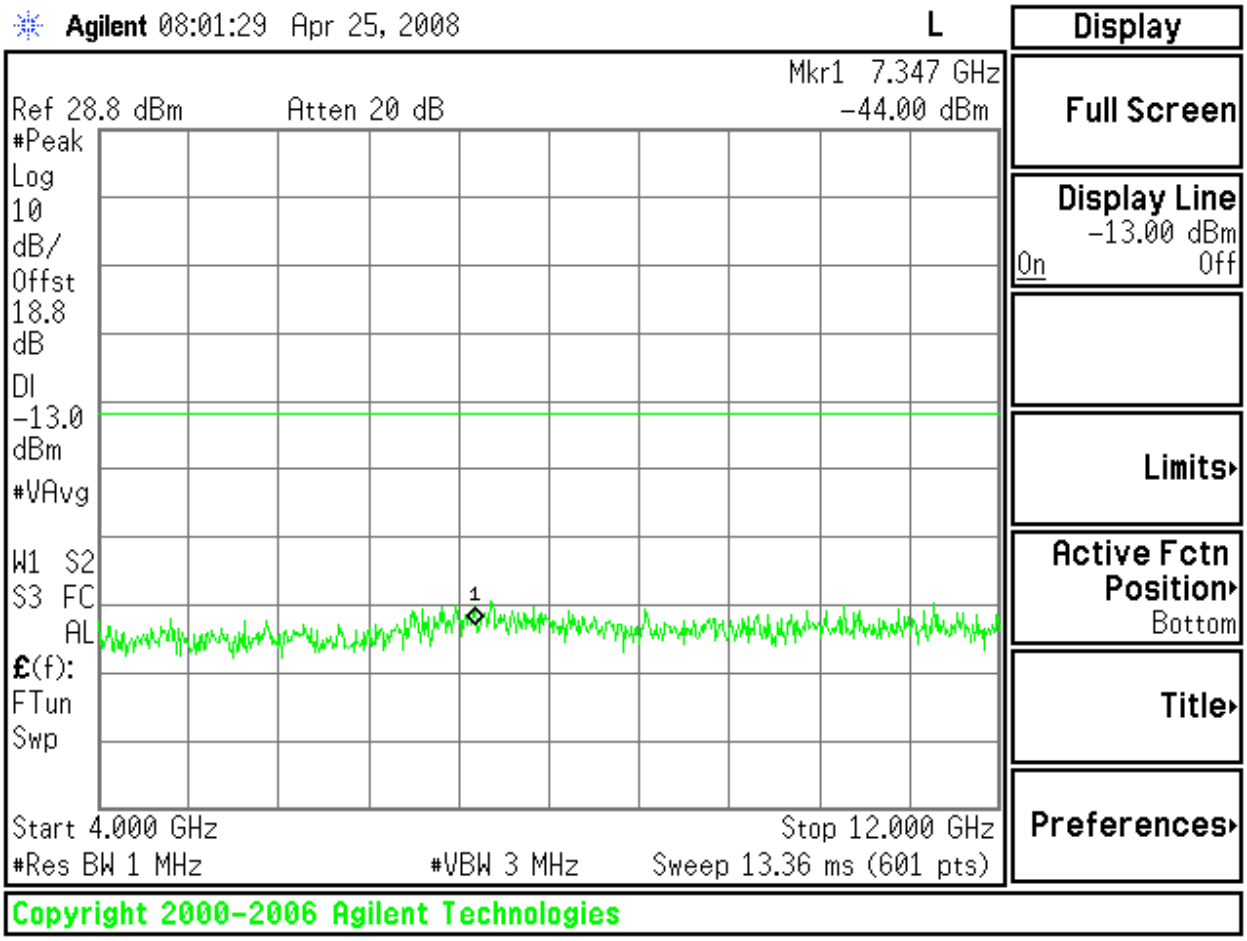
SPURIOUS EMISSIONS, HIGH CHANNEL 3.5 MHZ EBW 1/4



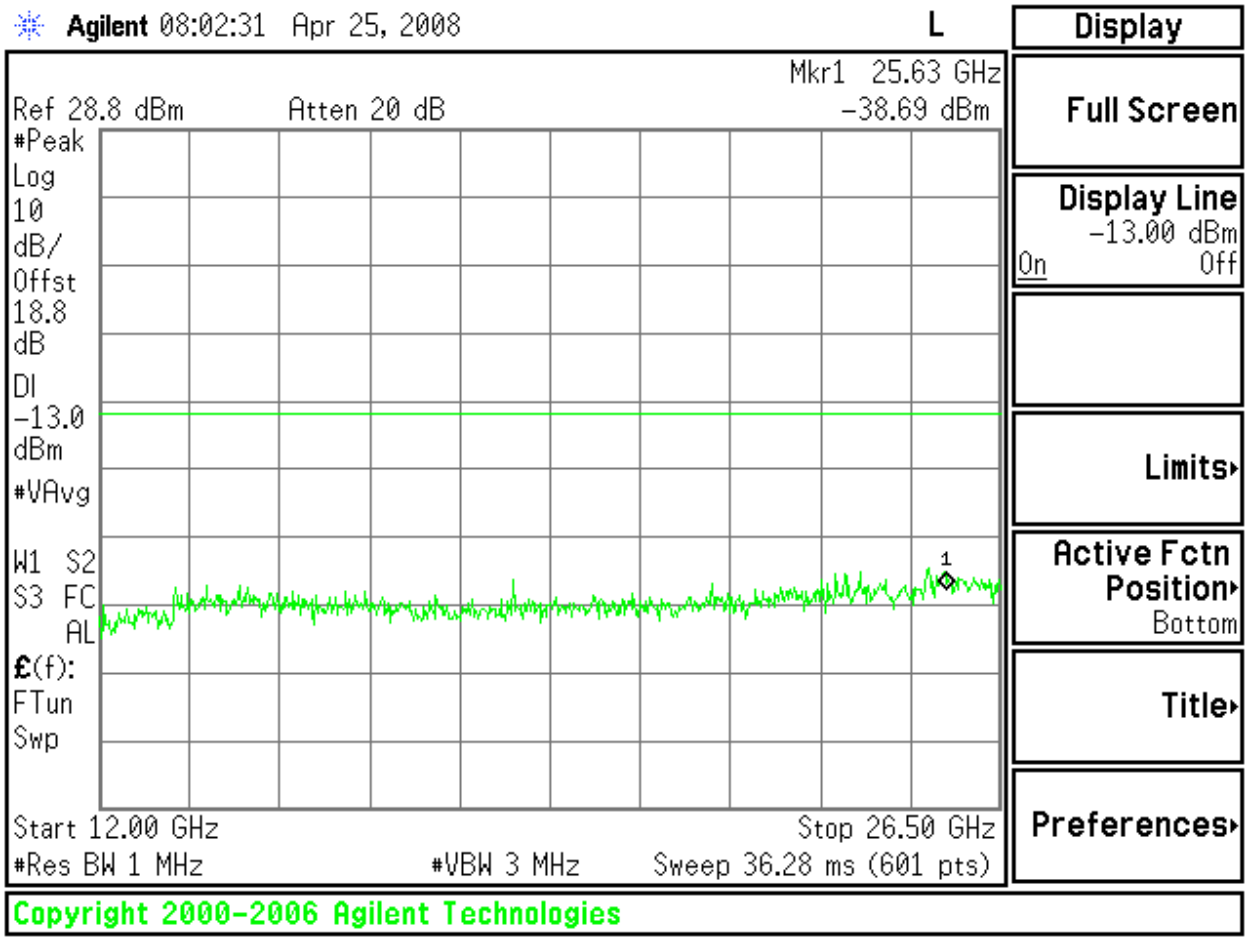
SPURIOUS EMISSIONS, HIGH CHANNEL 3.5 MHZ EBW 2/4



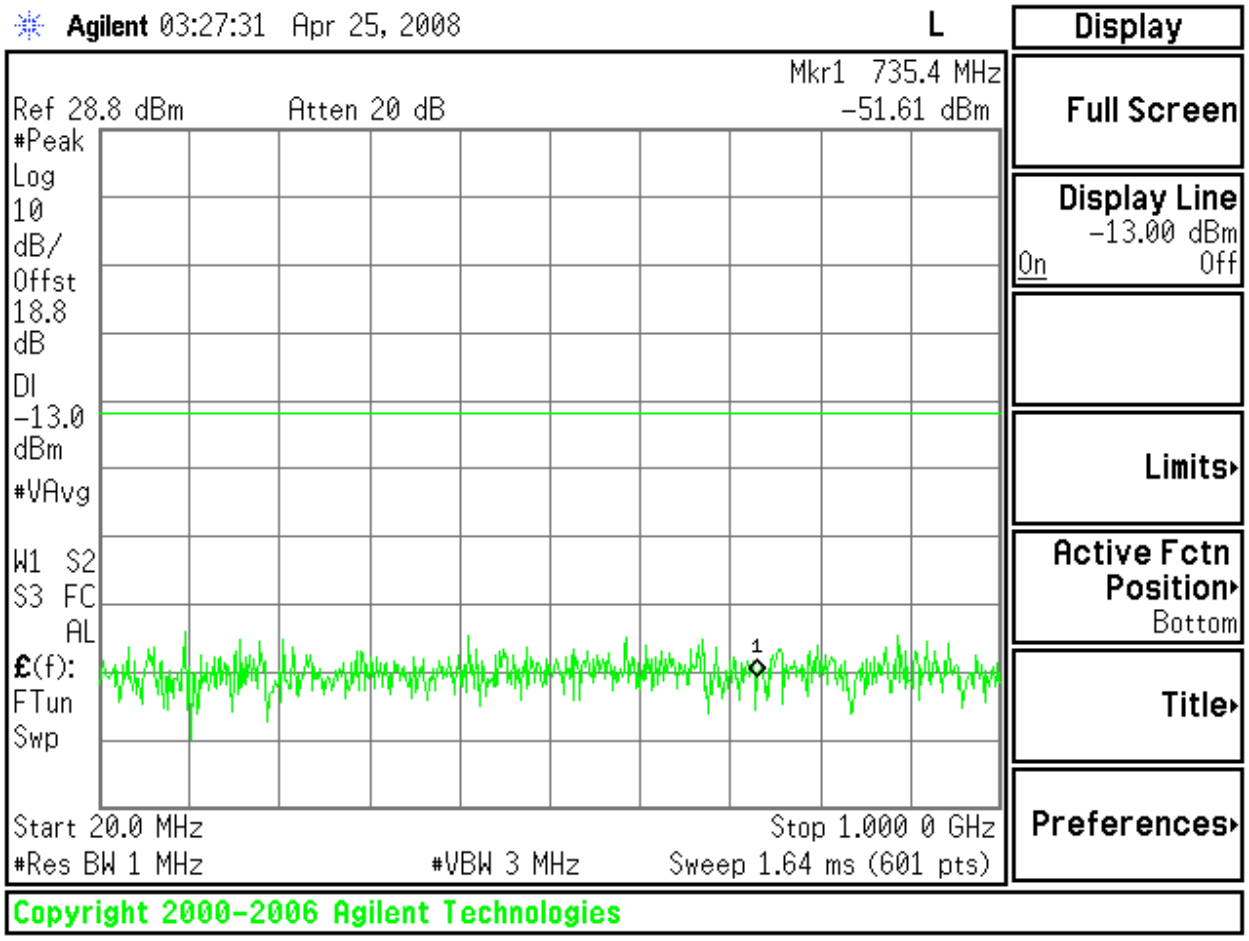
SPURIOUS EMISSIONS, HIGH CHANNEL 3.5 MHZ EBW ¾



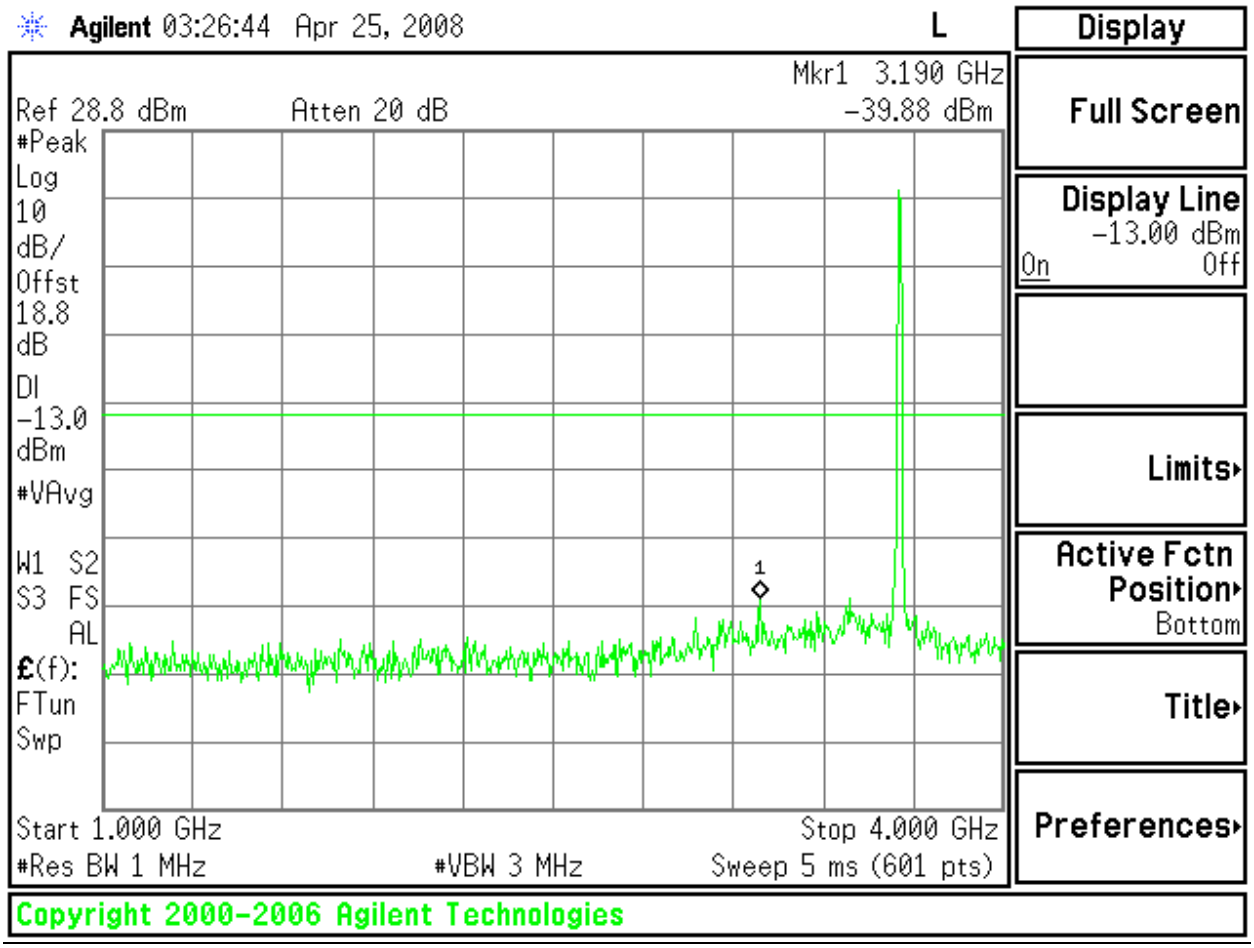
SPURIOUS EMISSIONS, HIGH CHANNEL 3.5 MHZ EBW 4/4



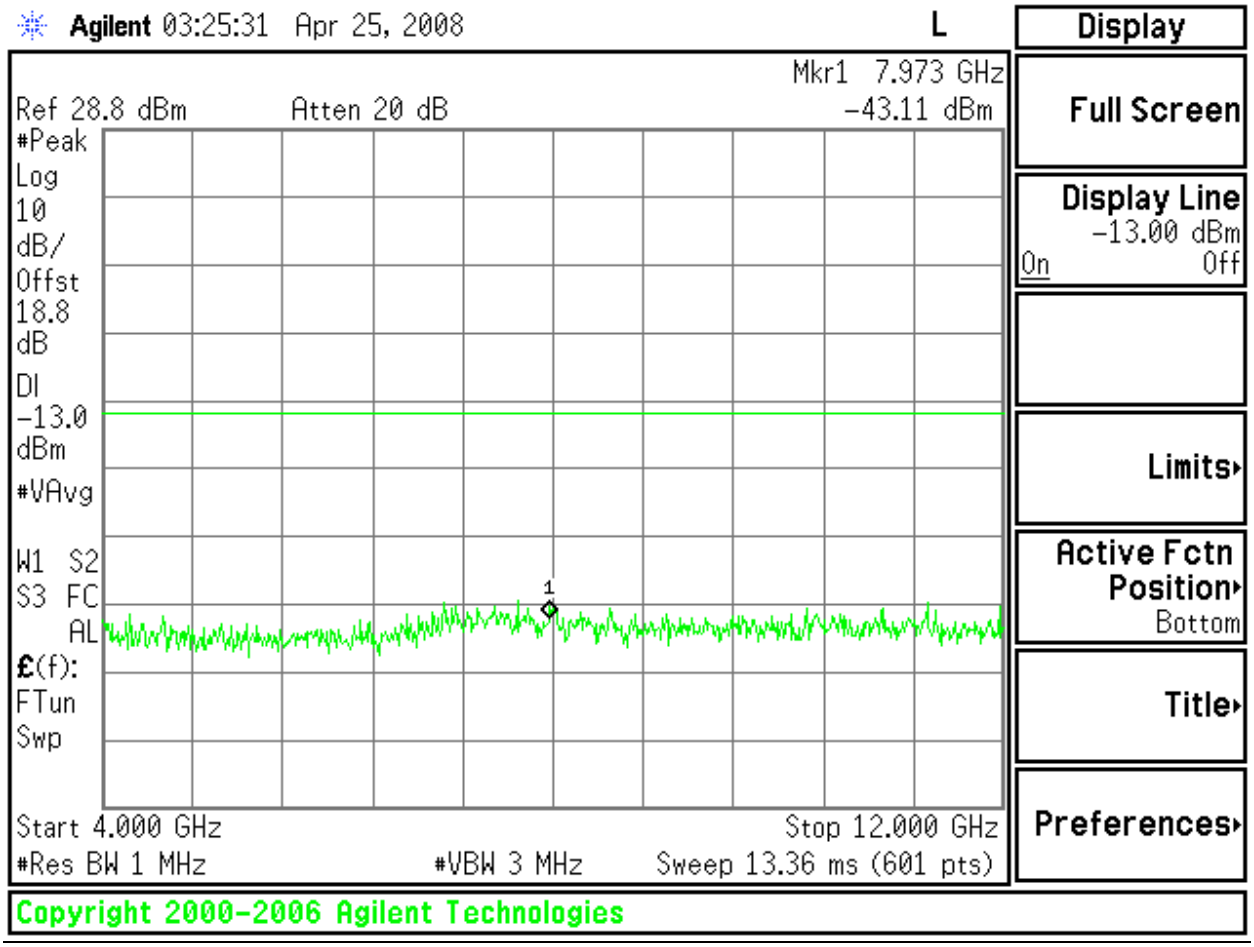
SPURIOUS EMISSIONS, LOW CHANNEL 7 MHZ EBW 1/4



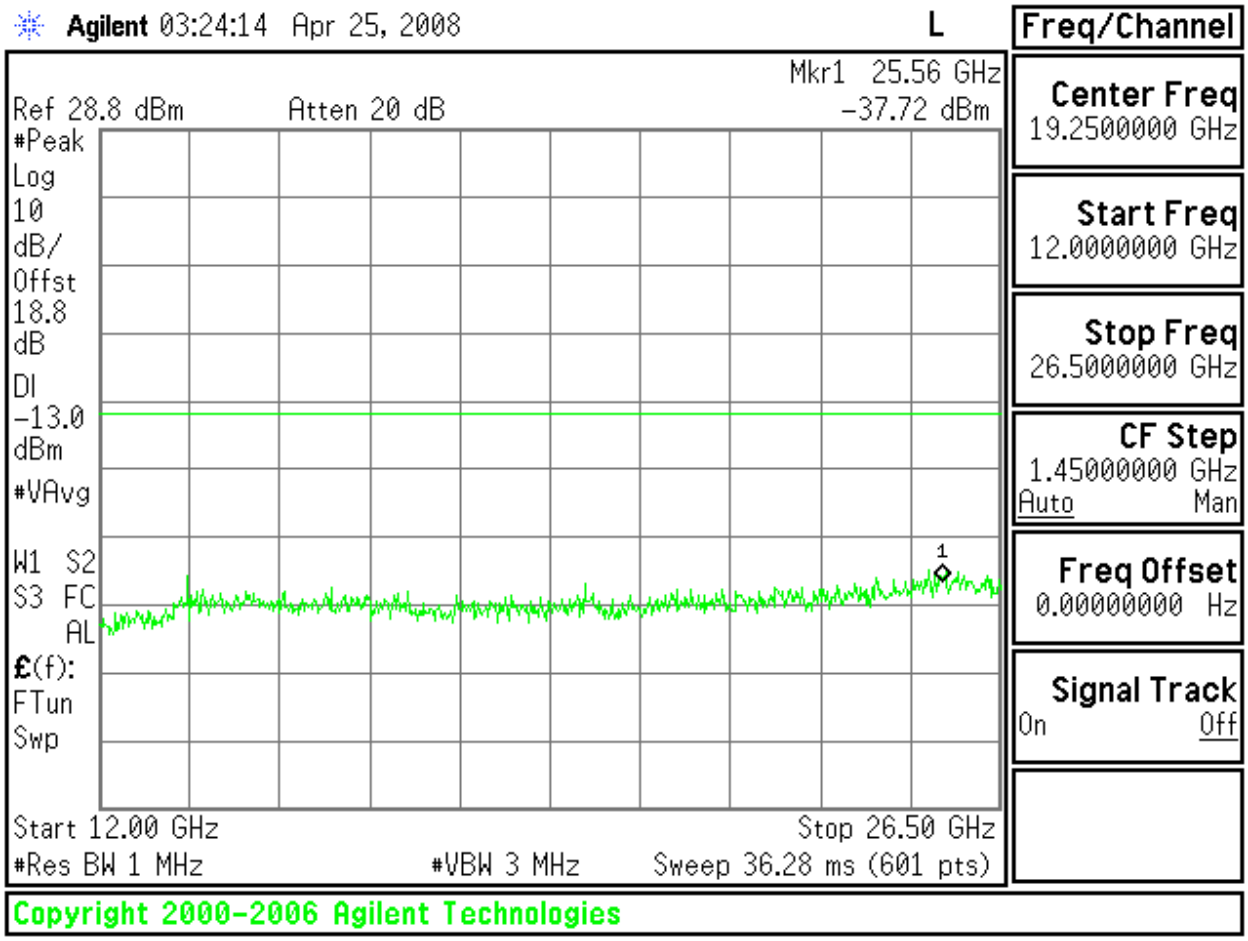
SPURIOUS EMISSIONS, LOW CHANNEL 7 MHZ EBW 2/4



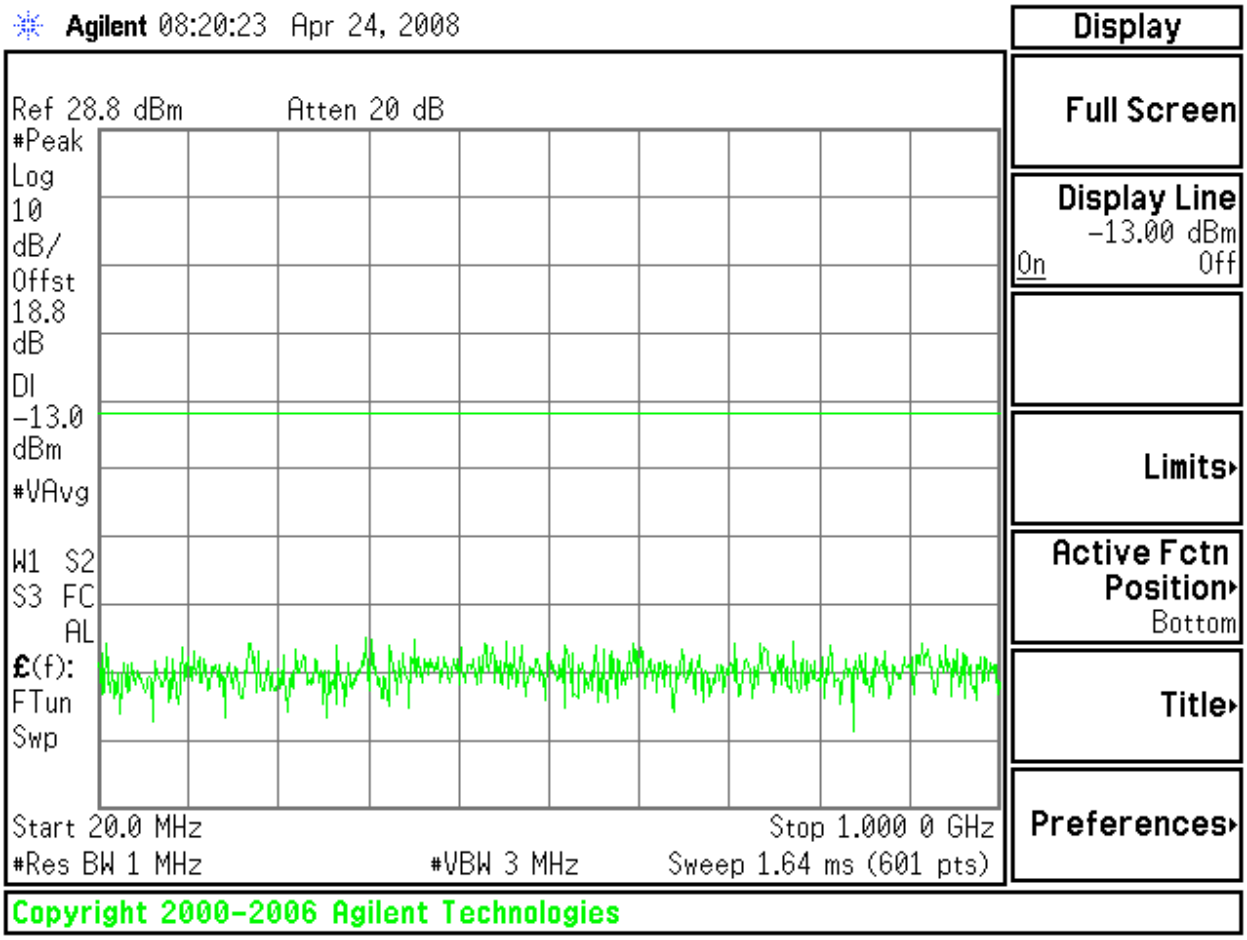
SPURIOUS EMISSIONS, LOW CHANNEL 7 MHZ EBW 3/4



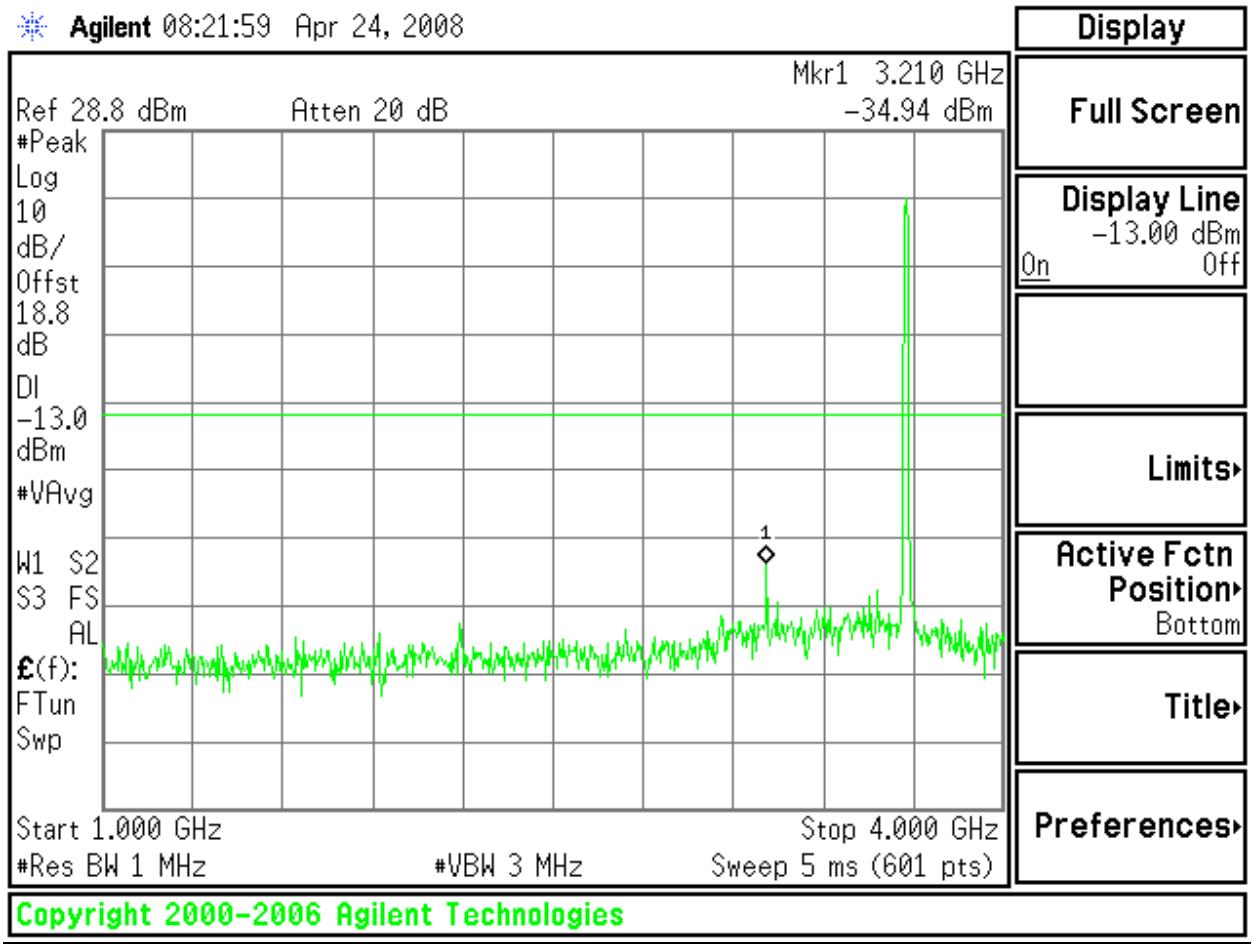
SPURIOUS EMISSIONS, LOW CHANNEL 7 MHZ EBW 4/4



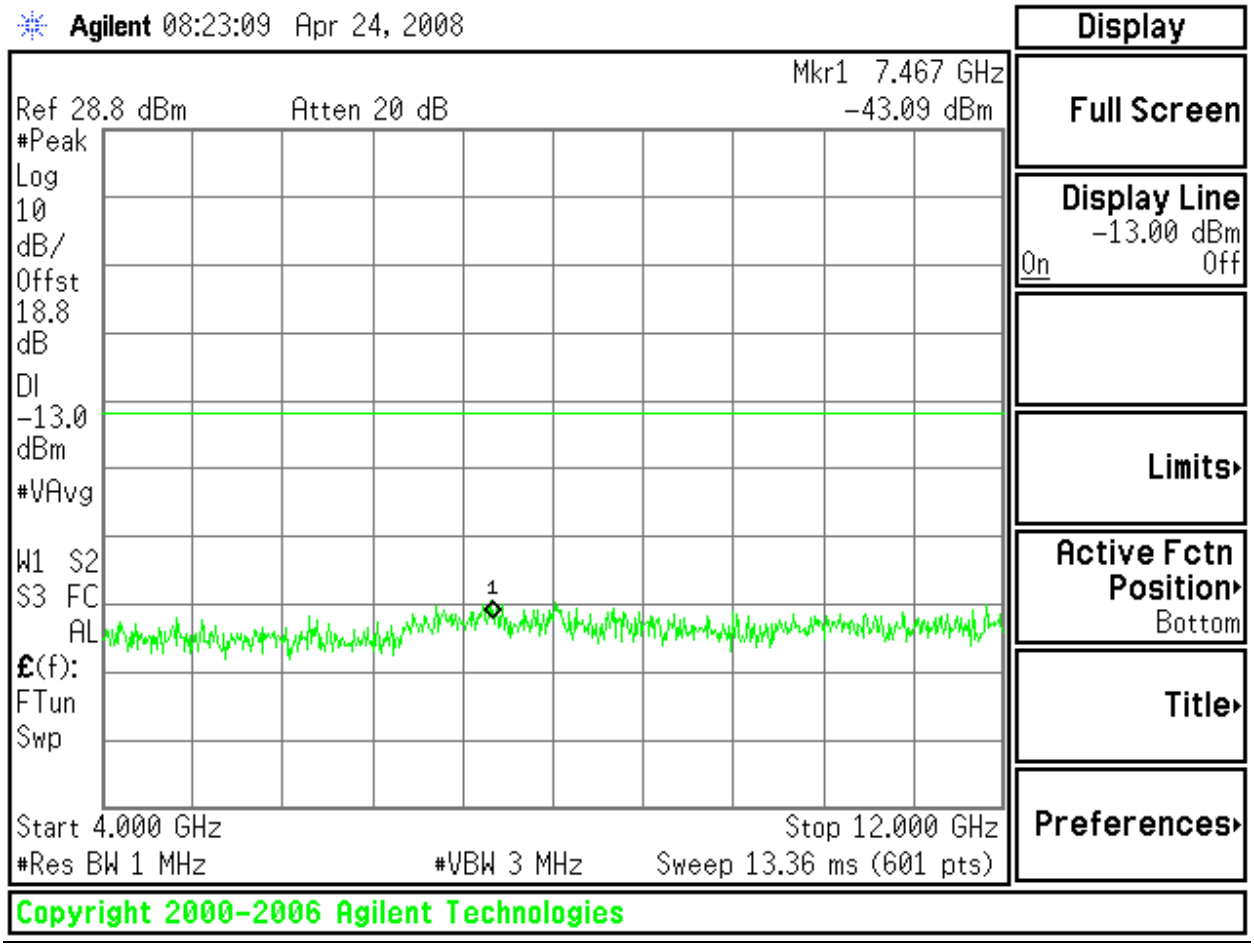
SPURIOUS EMISSIONS, MID CHANNEL 7 MHZ EBW 1/4



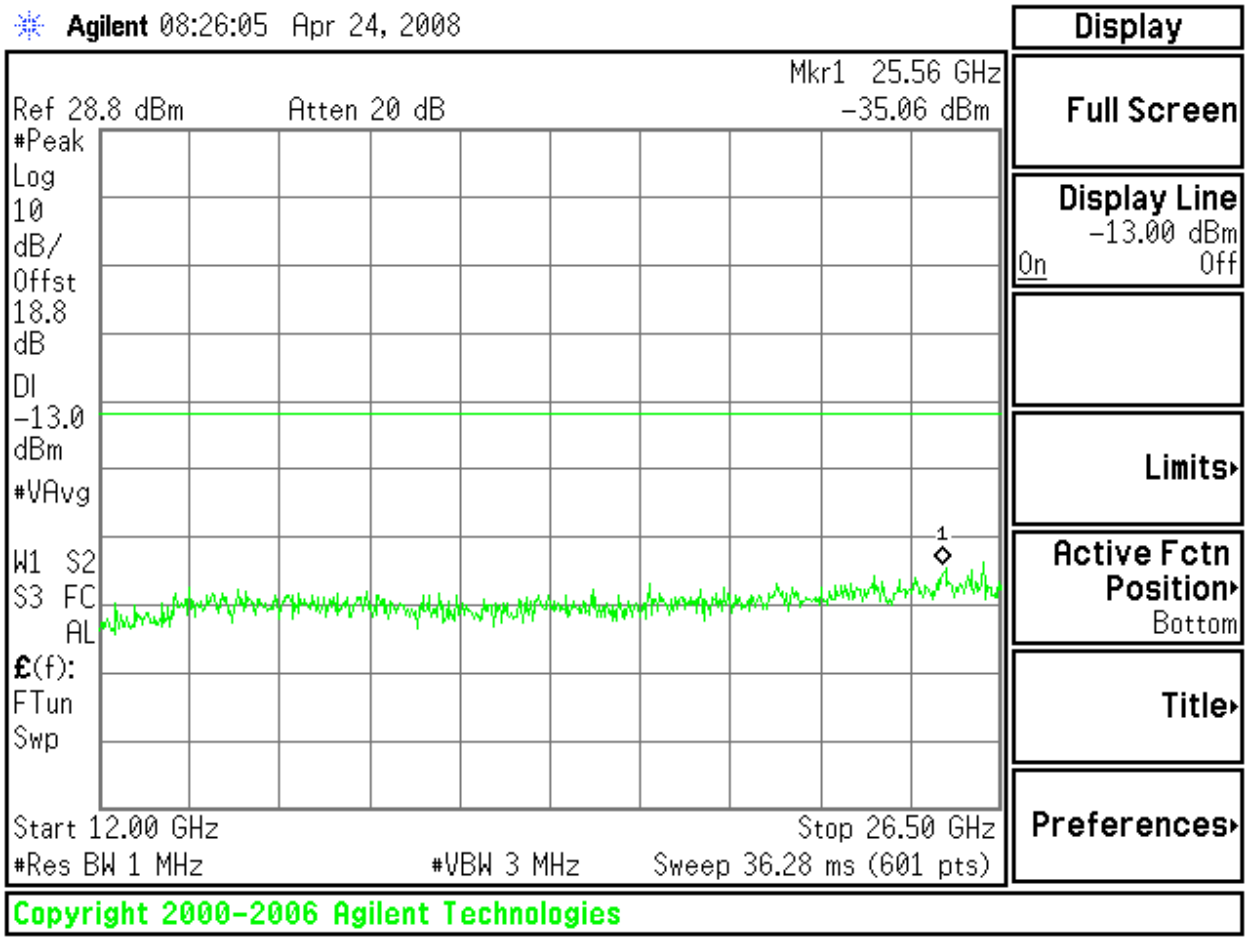
SPURIOUS EMISSIONS, MID CHANNEL 7 MHZ EBW 2/4



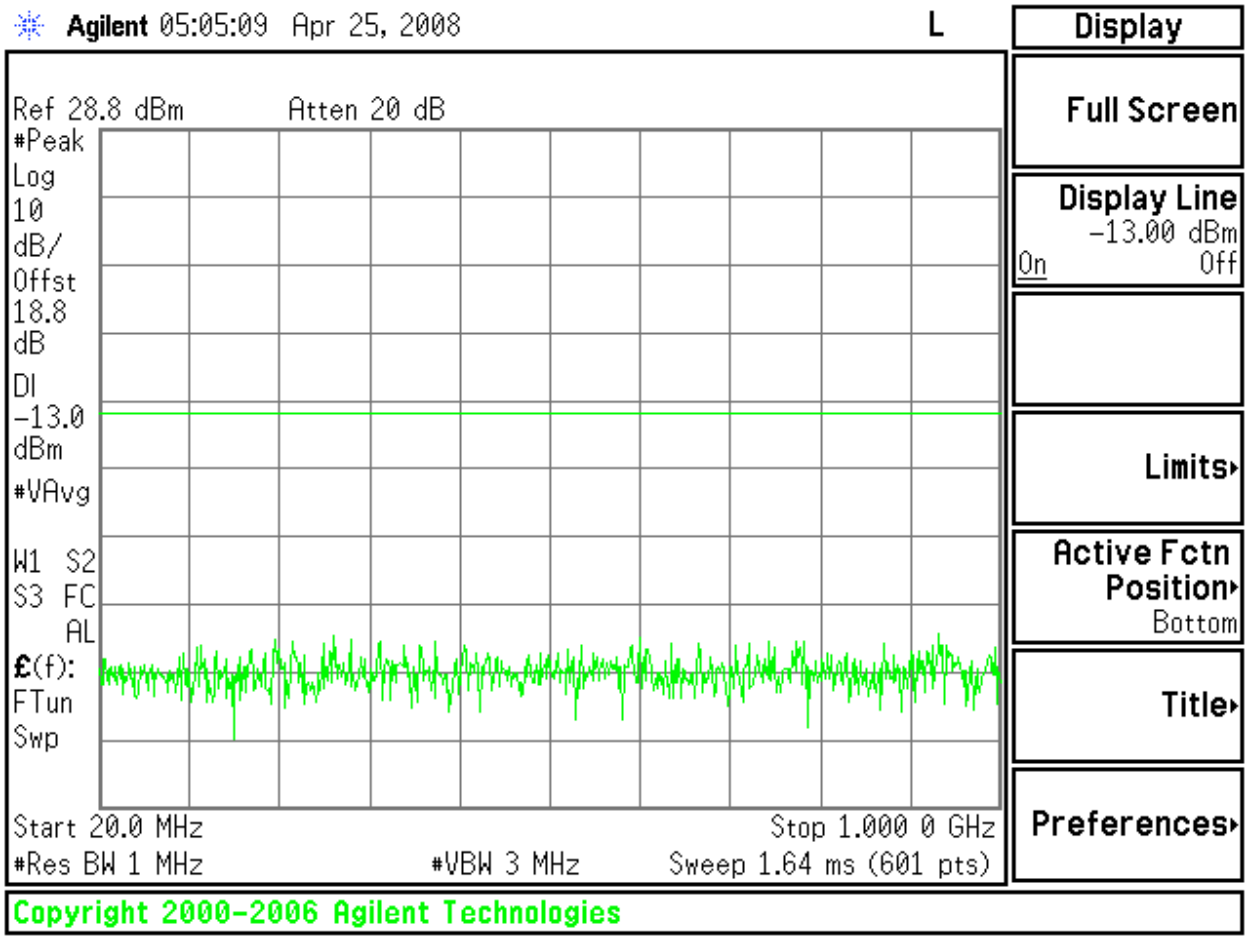
SPURIOUS EMISSIONS, MID CHANNEL 7 MHZ EBW 3/4



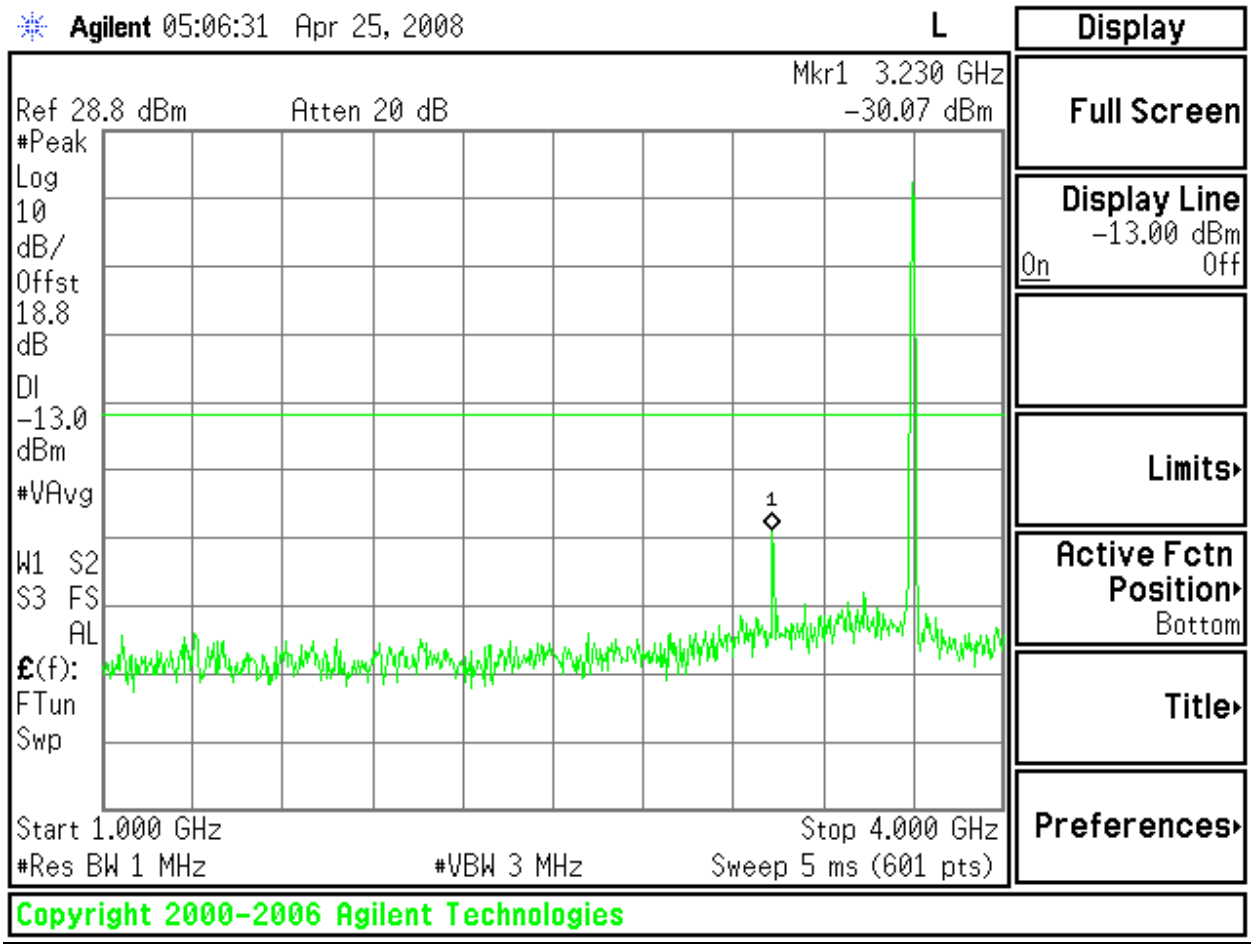
SPURIOUS EMISSIONS, MID CHANNEL 7 MHZ EBW 4/4



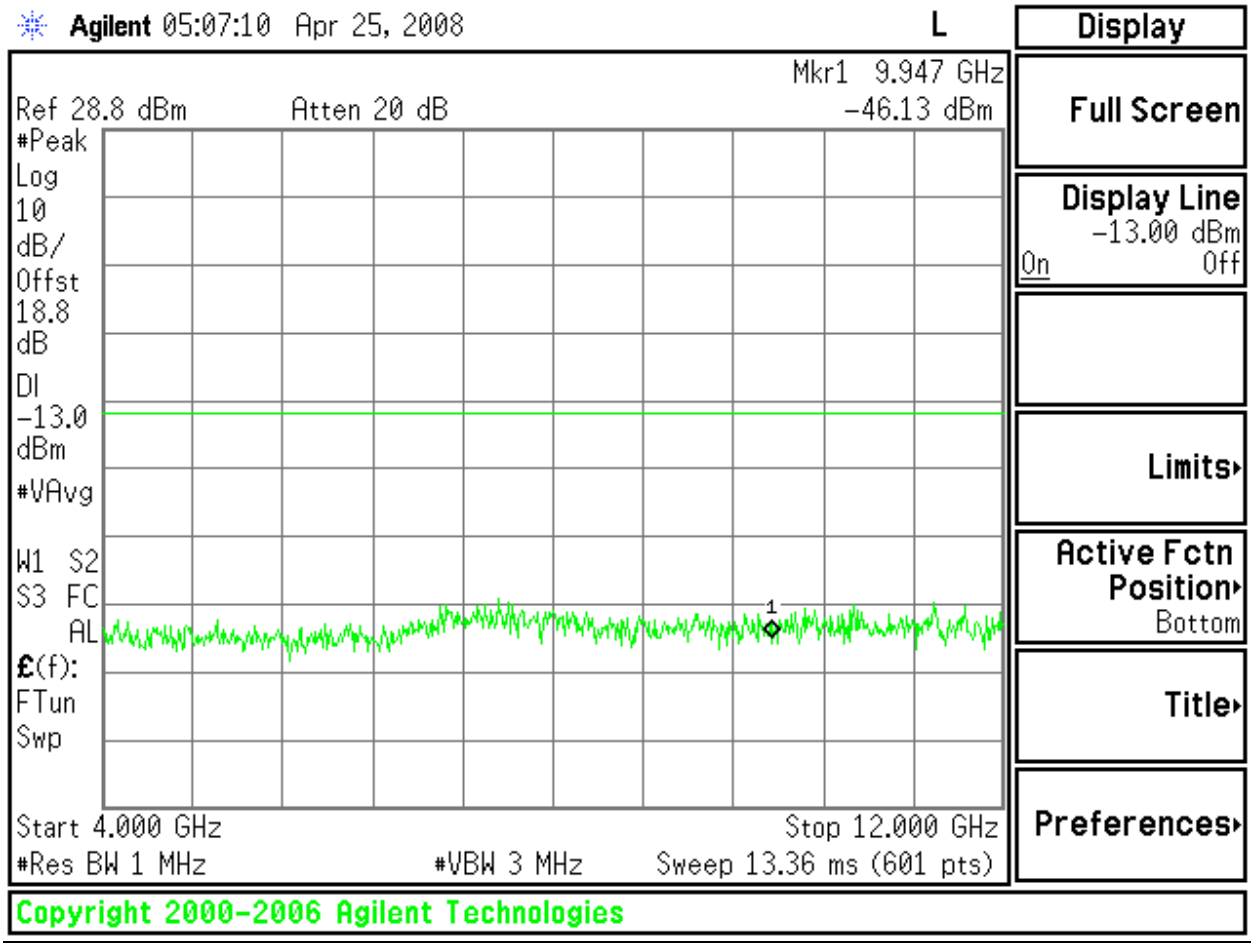
SPURIOUS EMISSIONS, HIGH CHANNEL 7 MHZ EBW 1/4



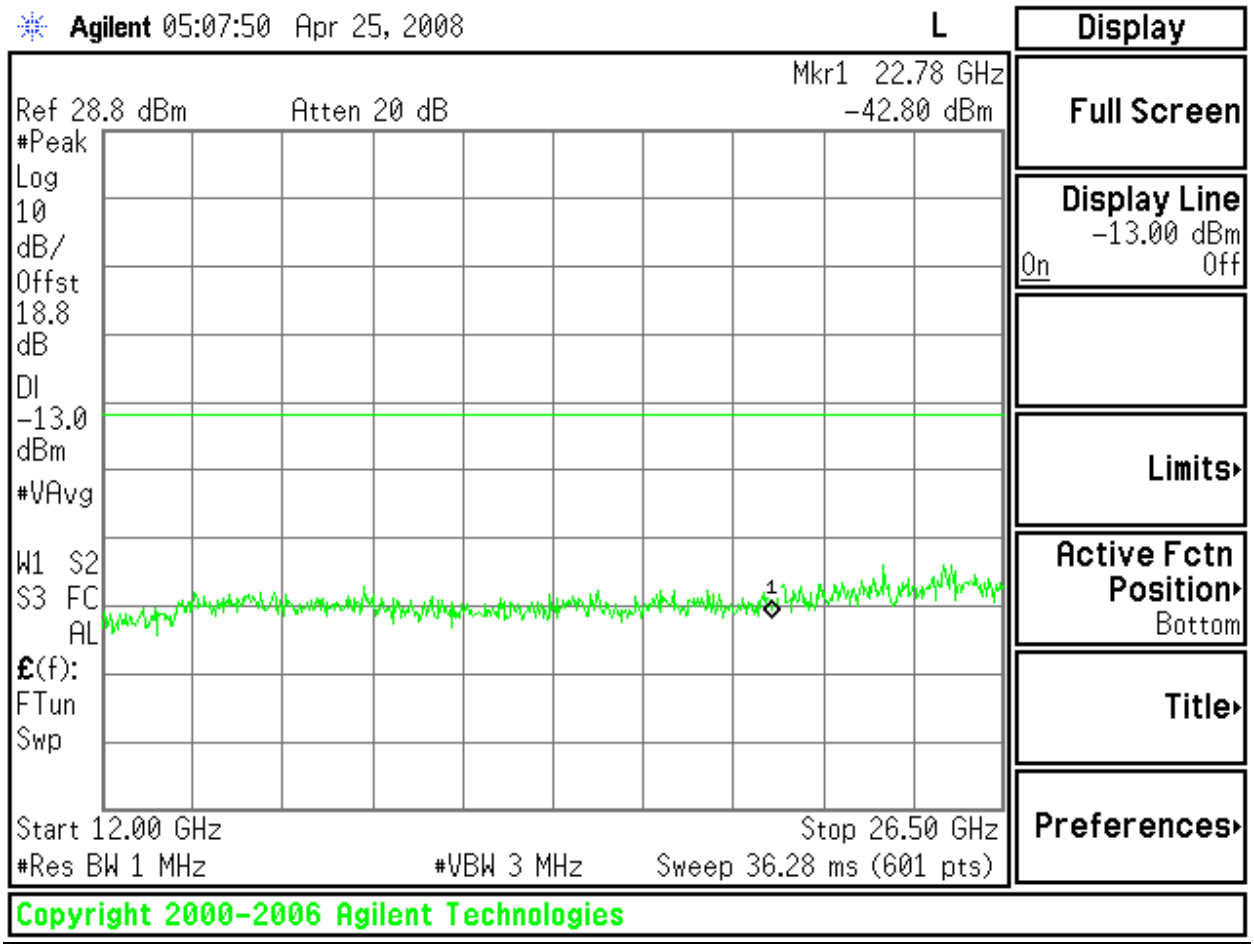
SPURIOUS EMISSIONS, HIGH CHANNEL 7 MHZ EBW 2/4



SPURIOUS EMISSIONS, HIGH CHANNEL 7 MHZ EBW 3/4



SPURIOUS EMISSIONS, HIGH CHANNEL 7 MHZ EBW 4/4



3.8. RADIATED EMISSIONS

3.8.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

REQUIREMENT

2.1053 Measurements required: Field strength of spurious radiation

Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half wave dipole antennas.

90.1323 Emission limits.

(a) The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or less, but at least one percent of the emission bandwidth of the fundamental emission of the transmitter, provided the measured energy is integrated over a 1 MHz bandwidth.

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

TEST PROCEDURE

Testing was performed using the substitution method.

1. The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna port was terminated with a resistive non-radiating 50 ohm termination.

2. The spectrum from 30 MHz to 37 GHz was investigated with the transmitter set to the lowest, middle, and highest channels in each 5 GHz band.

3. The frequency range of interest was 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.

4. The EUT was replaced by a signal generator and antenna. The signal generator was set to produce field strengths matching the levels obtained in step 3 above. The equivalent eirp was calculated from the signal generator output and antenna gain with respect to isotropic.

3.8.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Aperto Networks
Project #: 08U11764
Date: April 21, 2008
Test Engineer: Thanh Nguyen
Configuration: EUT and 50ohms load
Mode: Transmit

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz
T73; S/N: 6717 @3m	T34 HP 8449B		

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)
Transmit 5MHz Channel width															
Low Channel 3651.75MHz , 16QAM Modulation															
1.066	3.0	49.6	43.2	24.0	3.3	-38.2	0.0	0.0	38.8	32.4	74	54	-35.2	-21.6	V
1.333	3.0	49.9	45.4	25.0	3.7	-37.8	0.0	0.0	40.8	36.2	74	54	-33.2	-17.8	V
3.697	3.0	53.4	38.2	31.8	6.2	-35.3	0.0	0.0	56.1	40.9	74	54	-17.9	-13.1	V
1.066	3.0	49.0	41.4	24.0	3.3	-38.2	0.0	0.0	38.2	30.6	74	54	-35.8	-23.4	H
1.333	3.0	52.5	48.9	25.0	3.7	-37.8	0.0	0.0	43.4	39.8	74	54	-30.6	-14.2	H
3.651	3.0	46.2	30.9	31.7	6.1	-35.3	0.0	0.0	48.7	33.3	74	54	-25.3	-20.7	H
Mid Channel 3675MHz , 16QAM Modulation															
1.333	3.0	54.6	51.5	25.0	3.7	-37.8	0.0	0.0	45.5	42.4	74	54	-28.5	-11.6	V
3.673	3.0	49.5	33.8	31.7	6.1	-35.3	0.0	0.0	52.1	36.4	74	54	-21.9	-17.6	V
1.333	3.0	52.5	48.9	25.0	3.7	-37.8	0.0	0.0	43.4	39.8	74	54	-30.6	-14.2	H
3.675	3.0	51.9	32.0	31.7	6.1	-35.3	0.0	0.0	54.4	34.6	74	54	-19.6	-19.4	H
High Channel 3698.25MHz , 16QAM Modulation															
1.333	3.0	51.0	47.1	25.0	3.7	-37.8	0.0	0.0	41.9	38.0	74	54	-32.1	-16.0	V
3.697	3.0	53.4	38.2	31.8	6.2	-35.3	0.0	0.0	56.1	40.9	74	54	-17.9	-13.1	V
1.066	3.0	49.4	41.3	24.0	3.3	-38.2	0.0	0.0	38.6	30.5	74	54	-35.4	-23.5	H
1.333	3.0	47.1	39.9	25.0	3.7	-37.8	0.0	0.0	38.0	30.8	74	54	-36.0	-23.2	V
3.697	3.0	52.3	37.2	31.8	6.2	-35.3	0.0	0.0	55.0	39.8	74	54	-19.0	-14.2	H
No other spurious emissions above noise floor															

Rev. 4.12.7

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		

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Aperto Networks
Project #: 08U11764
Date: April 21, 2008
Test Engineer: Thanh Nguyen
Configuration: EUT and 50ohms load
Mode: Transmit

Test Equipment:

Horn 1-18GHz: T73; S/N: 6717 @3m
Pre-amplifer 1-26GHz: T34 HP 8449B
Pre-amplifer 26-40GHz:
Horn > 18GHz:
Hi Frequency Cables
2 foot cable:
3 foot cable:
12 foot cable: B-5m Chamber
HPF:
Reject Filter:

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)
Transmit 7MHz Channel width															
Mid Channel 3650MHz , 64QAM Modulation															
1.078	3.0	52.4	41.8	24.1	3.3	-38.2	0.0	0.0	41.6	31.1	74	54	-32.4	-22.9	V
3.067	3.0	43.4	32.2	30.1	5.6	-35.8	0.0	0.0	43.3	32.1	74	54	-30.7	-21.9	V
3.340	3.0	41.0	29.6	30.9	5.8	-35.6	0.0	0.0	42.1	30.8	74	54	-31.9	-23.2	V
3.890	3.0	40.4	30.1	32.3	6.3	-35.1	0.0	0.0	43.9	33.7	74	54	-30.1	-20.3	V
6.950	3.0	37.0	26.4	34.8	8.5	-34.3	0.0	0.0	46.0	35.4	74	54	-28.0	-18.6	V
1.330	3.0	47.3	33.8	25.0	3.7	-37.8	0.0	0.0	38.1	24.6	74	54	-35.9	-29.4	H
1.467	3.0	46.1	33.5	25.5	3.8	-37.6	0.0	0.0	37.8	25.2	74	54	-36.2	-28.8	H
2.520	3.0	43.9	31.0	28.6	5.2	-36.2	0.0	0.0	41.4	28.6	74	54	-32.6	-25.4	H
3.400	3.0	40.8	30.5	31.0	5.9	-35.5	0.0	0.0	42.2	31.8	74	54	-31.8	-22.2	H
Mid Channel 3675MHz , 16QAM Modulation															
1.333	3.0	53.0	49.2	25.0	3.7	-37.8	0.0	0.0	43.9	40.1	74	54	-30.1	-13.9	H
3.673	3.0	46.0	30.1	31.7	6.1	-35.3	0.0	0.0	48.6	32.7	74	54	-25.4	-21.3	H
1.333	3.0	52.5	48.9	25.0	3.7	-37.8	0.0	0.0	43.4	39.8	74	54	-30.6	-14.2	V
3.675	3.0	50.3	31.8	31.7	6.1	-35.3	0.0	0.0	52.9	34.4	74	54	-21.1	-19.6	V
Mid Channel 3700MHz , QPSK Modulation															
1.333	3.0	52.6	49.2	25.0	3.7	-37.8	0.0	0.0	43.4	40.0	74	54	-30.6	-14.0	V
3.674	3.0	48.8	31.9	31.7	6.1	-35.3	0.0	0.0	51.4	34.4	74	54	-22.6	-19.6	V
1.333	3.0	53.2	49.9	25.0	3.7	-37.8	0.0	0.0	44.1	40.7	74	54	-29.9	-13.3	H
3.757	3.0	40.2	30.5	31.9	6.2	-35.2	0.0	0.0	43.2	33.4	74	54	-30.8	-20.6	H
No other spurious emissions above noise floor															

Rev. 4.12.7

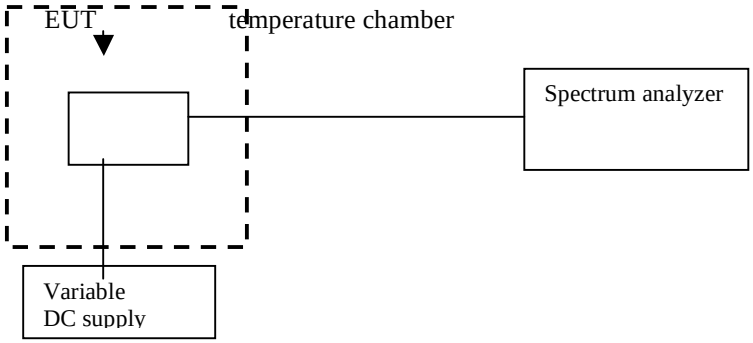
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field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

4. FREQUENCY STABILITY TEST

REQUIREMENT

2.1055 Measurements required: Frequency stability

Test Set-up



Test Procedures

1. Spectrum analyzer center frequency was set to 3675 MHZ operating frequency. Frequency was measured at +25C using spectrum analyzer marker function.
2. The transmitter was allowed to stabilize at every 10 degrees C from –30C to +50C and measurements were recorded at each temperature.

Test Results

Refer to table below. Frequency remains within 712 Hz (0.2ppm) throughout all required temperature and supply voltage variations.

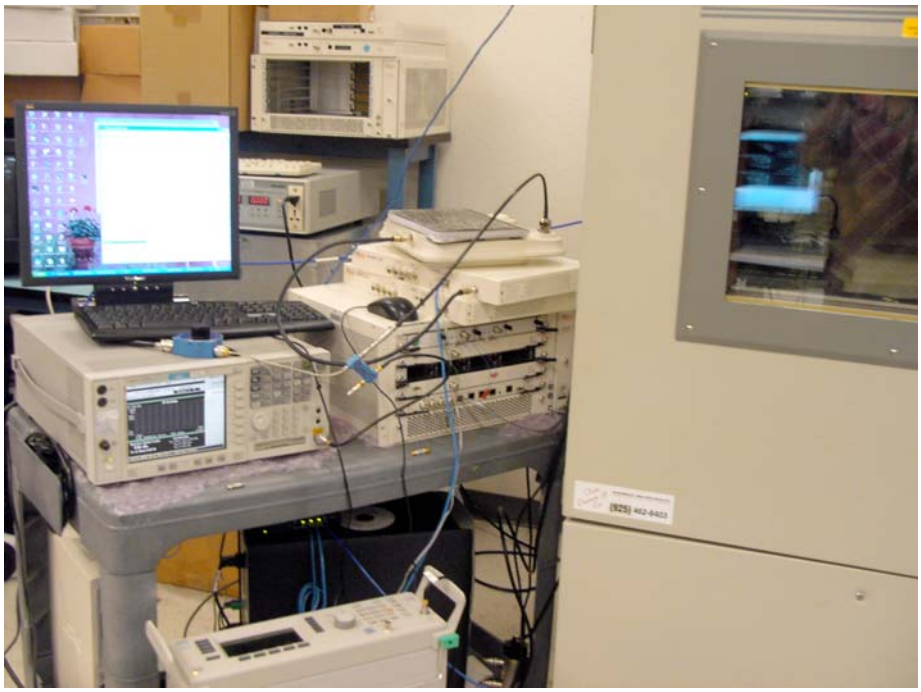
Frequency Stability Test for 3.65BSR

BSR Tuned to 3675 MHz

Temperature (Degree C)	AC Voltage (Volts)	Frequency Meas (Hz)	Frequency Error (Hz)
25	110	3674999303.297	-696.703
25	93.5	3674999330.961	-669.039
25	126.5	3674999323.132	-676.868
-35	110	3674999308.075	-691.925
-25	110	3674999311.678	-688.322
-10	110	3674999295.764	-704.236
10	110	3674999290.330	-709.670
25	110	3674999303.279	-696.721
40	110	3674999287.798	-712.202
60	110	3674999308.011	-691.989

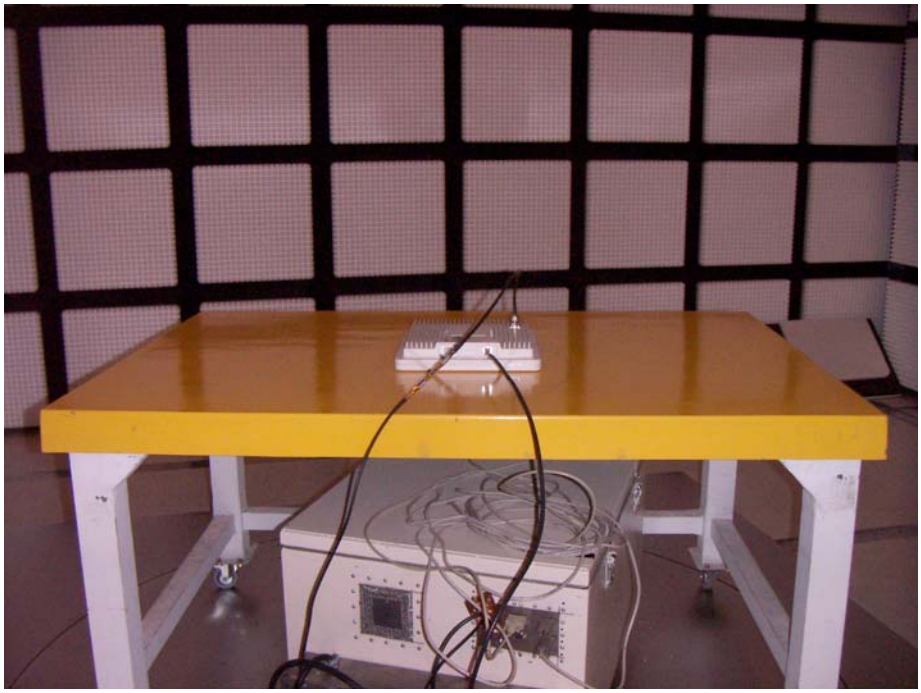
5. SETUP PHOTOS

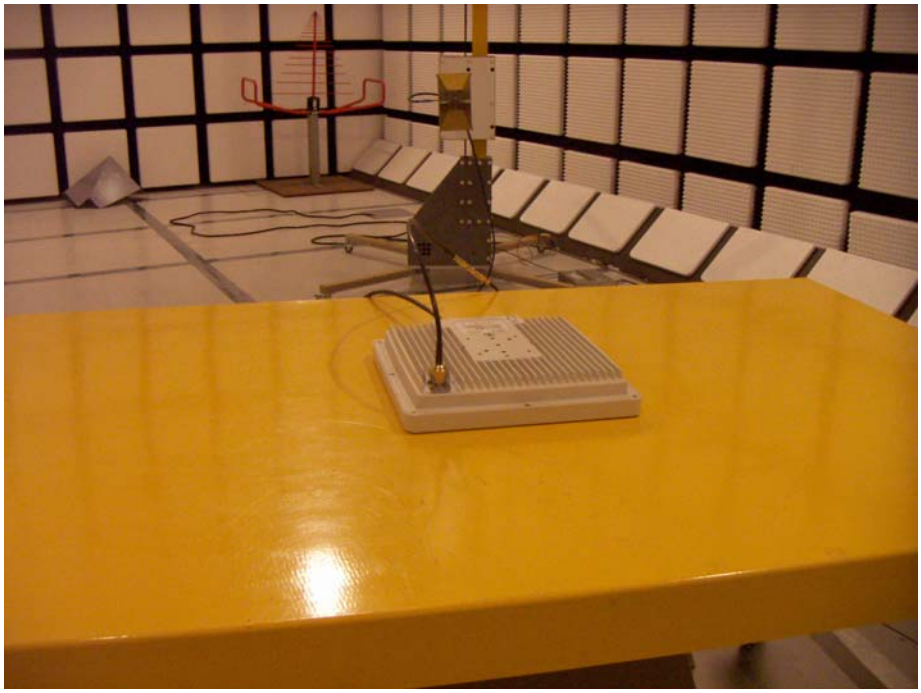
ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP



FREQUENCY STABILITY TEST SETUP

RADIATED RF MEASUREMENT SETUP





END OF REPORT