FCC CFR47 PART 90

CERTIFICATION TEST REPORT

FOR

COMPACT SURVEILLANCE RADAR

MODEL NUMBER: M600C

FCC ID: CO6-M600C

REPORT NUMBER: 12U14355-1, Revision A

ISSUE DATE: SEPTEMBER 5, 2012

Prepared for
SPOTTER RF LLC
709 E. TECHNOLOGY AVE. BLDG E 3100
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	07/20/2012	Initial Issue	T. LEE
A	09/05/20012	Corrected FCC ID	A. Zaffar

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SPOTTERRF LLC 709 E. TECHNOLOGY AVE. BLDG E 3100 OREM, UTAH 84097 USA
EUT DESCRIPTION:	COMPACT SURVEILLANCE RADAR
MODEL:	M600C
SERIAL NUMBER:	SP0169 (CONDUCTED), SP0210 (RADIATED)
DATE TESTED:	MAY 22ND - JULY 18TH, 2012

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 90	Pass

UL 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 UL 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 UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL 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 UL CCS By:

TIMOTHY K. LEE
STAFF ENGINEER
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Tested By:

STEVE AGUILAR
EMC TECHNICIAN
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 90, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL 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 10 GHz medium range Compact Surveillance Radar (CSR). The unit operates only between channel 3 through 7 (10.125 GHz to 10.325 GHz)

The radio module is manufactured by SpotterRF LLC.

5.2. MAXIMUM OUTPUT POWER

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

Frequency (MHz)	Channel	Output Power (dBm)	Output Power (mW)
10125	3	25.88	387.26
10225	5	26.02	399.94
10325	7	26.26	422.67

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a patch antenna, with a maximum gain of 14 dBi.

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was ElusiveElephant_v3.0.0-beta.00115_2012-02-20.bin and greater.

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission was performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

All final radiated testing was performed with the EUT in upright orientation as indicated by the installation instructions.

Based on the baseline scan, the worst-case channel for radiated emissions was channel 7.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Toshiba	PT324U03900R	2C165037H	DoC
AC Adapter	Toshiba	PA3714U-1ACA	T0412032003150A	DoC
Power **O**ver **E**thernet Adapter	APC	AP9302-WM	--	--
AC Adapter	V-infinity	ETSA200200UD	--	--

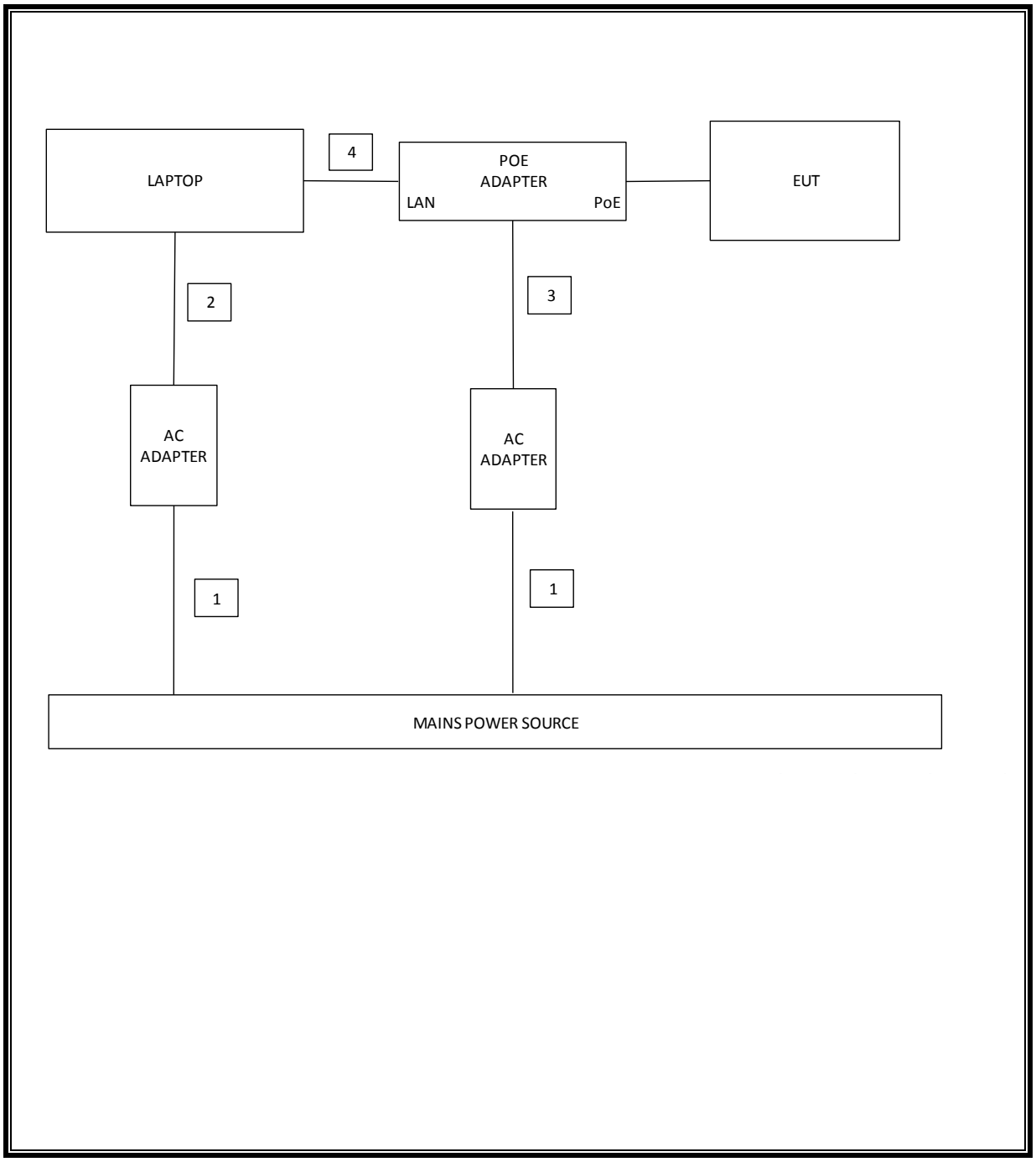
I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	2	AC 2P	Unshielded	1.8m	None
2	DC	1	DC	Shielded	1.8m	Ferrite on Laptop end
3	DC	1	DC	Unshielded	1.8m	Ferrite on Adapter end
4	LAN	1	CAT5	Unshielded	2m	None
5	LAN	1	CAT5	Shielded	7.5m	Screw on weatherproof connector for EUT side

TEST SETUP

The EUT is powered via the POE adapter. Test software exercised using the Laptop controlled through the Ethernet cables.

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 Due**
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01161	12/16/2012
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	11/11/2012
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	--	2/7/2013
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	11/11/2012
Antenna, Horn, 18 GHz	EMCO	3115	C00945	10/6/2012
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	12/15/2012
P-Series single channel Power	Agilent / HP	N1911A	1260847C	8/4/2012
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01176	8/4/2012
Temperature / Humidity Chamb	Thermotron	SE 600-10-10	C00930	10/20/2012
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	8/2/2012
Downconverter, 67 GHz	Agilent	MT-463	12020	10/10/2012
Analog Signal Generator, 40 GHz	Agilent / HP	E8257D	C01177	8/18/2012
Harmonic Mixer, 50 GHz	Agilent / HP	11970Q	C00769	5/11/2013
Harmonic Mixer, 75 GHz	Agilent / HP	11970V	C00768	1/31/2014

7. ANTENNA PORT TEST RESULTS

7.1. 10 GHz BAND

7.1.1. 99% BANDWIDTH

LIMITS

FCC § 90.209(b)(5)

None; for reporting purposes only. Bandwidth for radiolocation stations will be reviewed and authorized on a case-by-case basic.

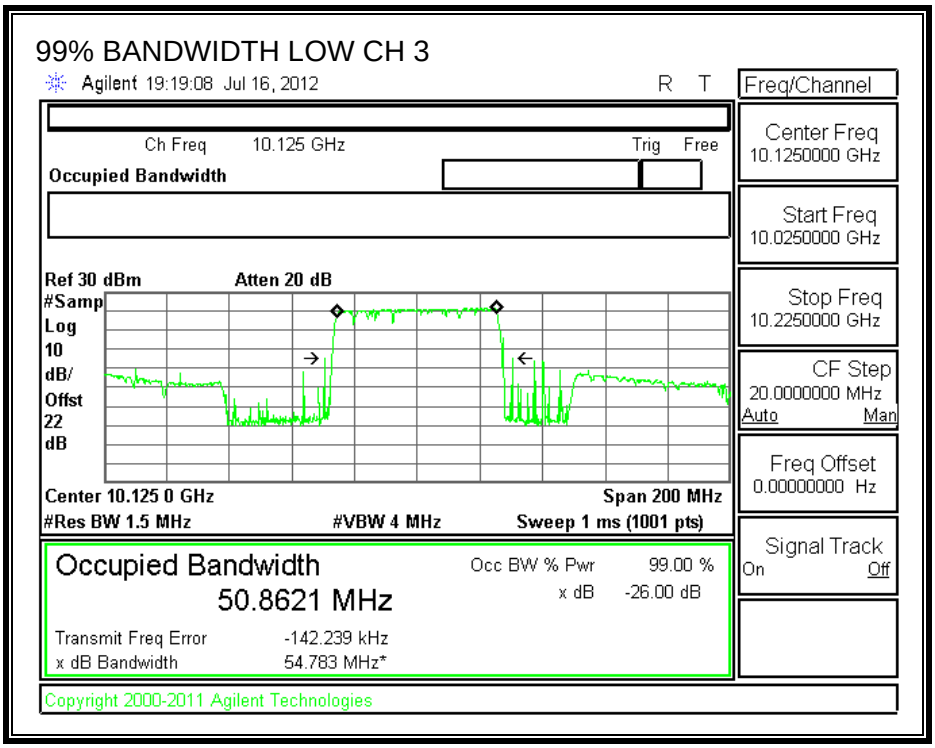
TEST PROCEDURE

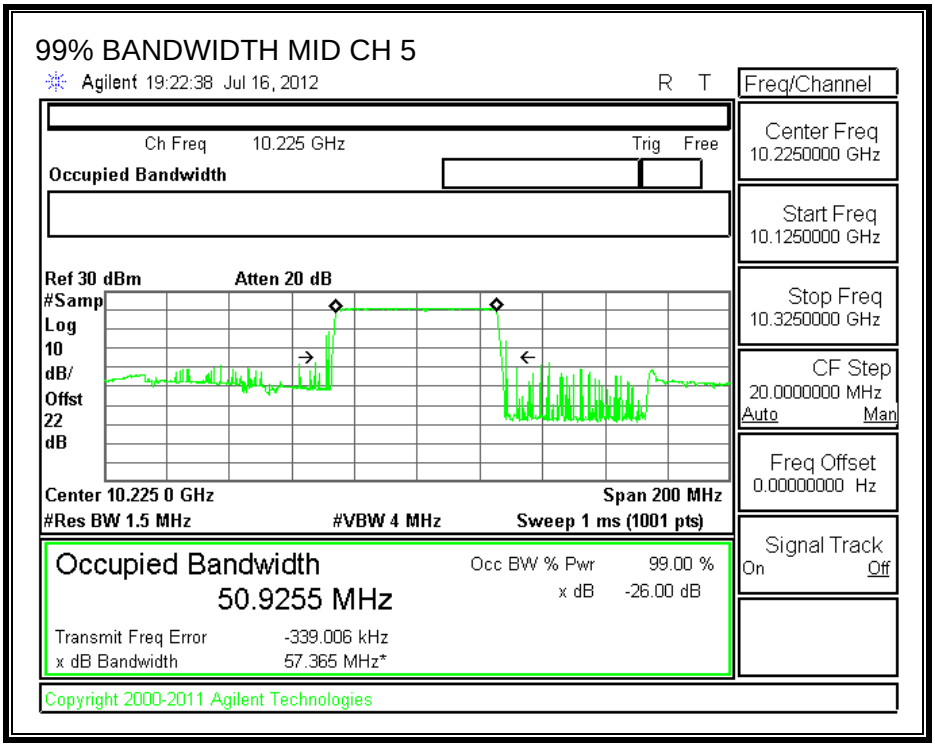
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

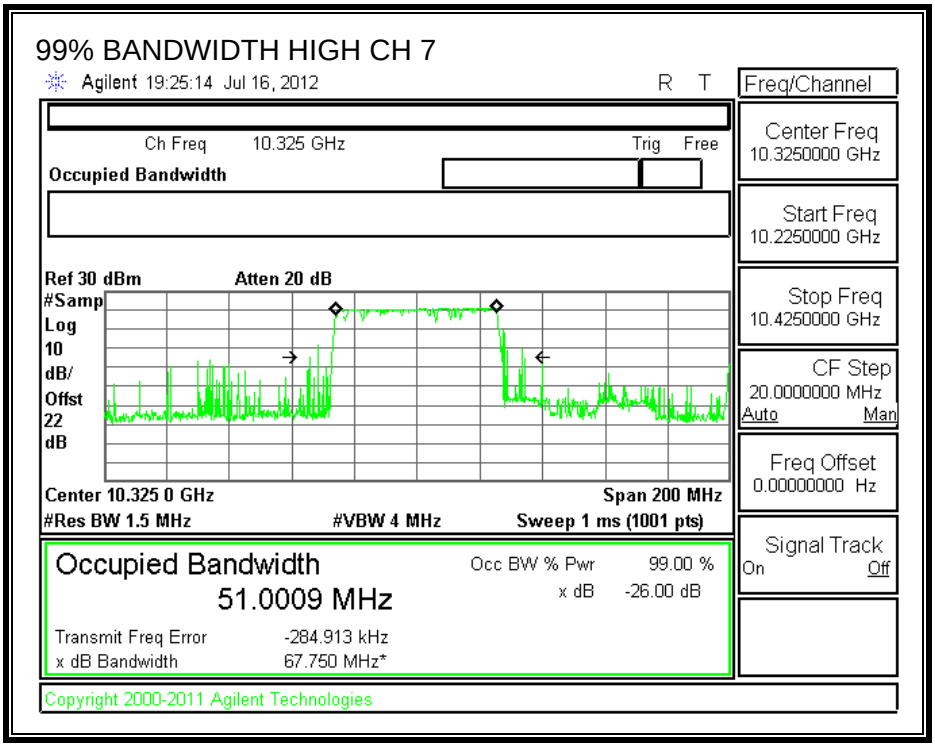
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
3	10125	50.8621
5	10225	50.9255
7	10325	51.0009

99% BANDWIDTH







7.1.2. OUTPUT POWER

LIMITS

FCC §90.103(c) (13)

The maximum power into the antenna port shall be less than 5 W.

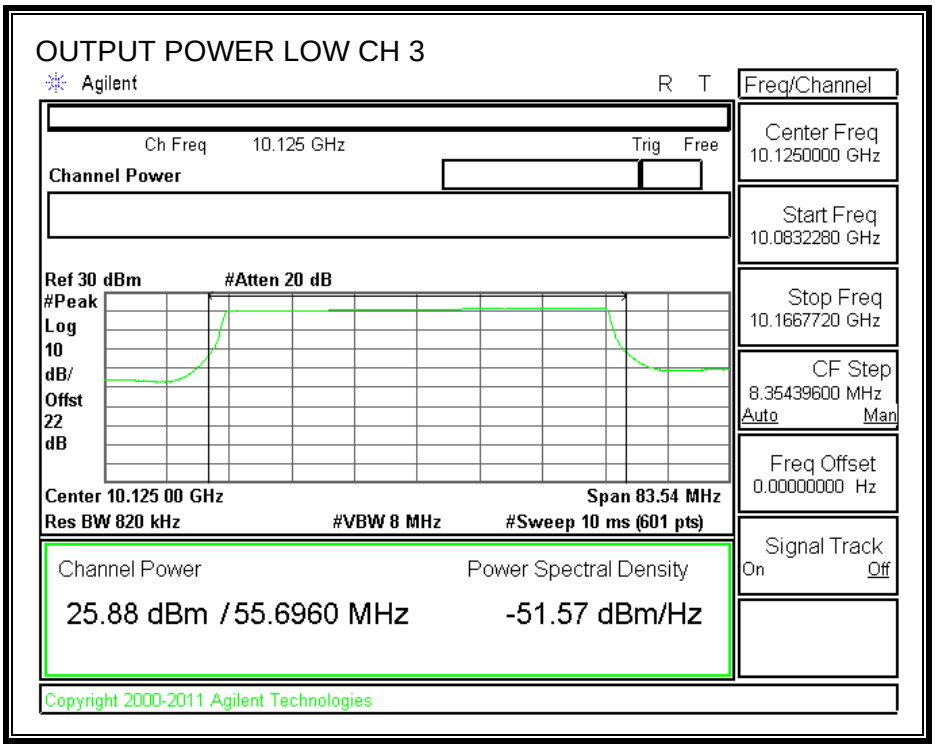
TEST PROCEDURE

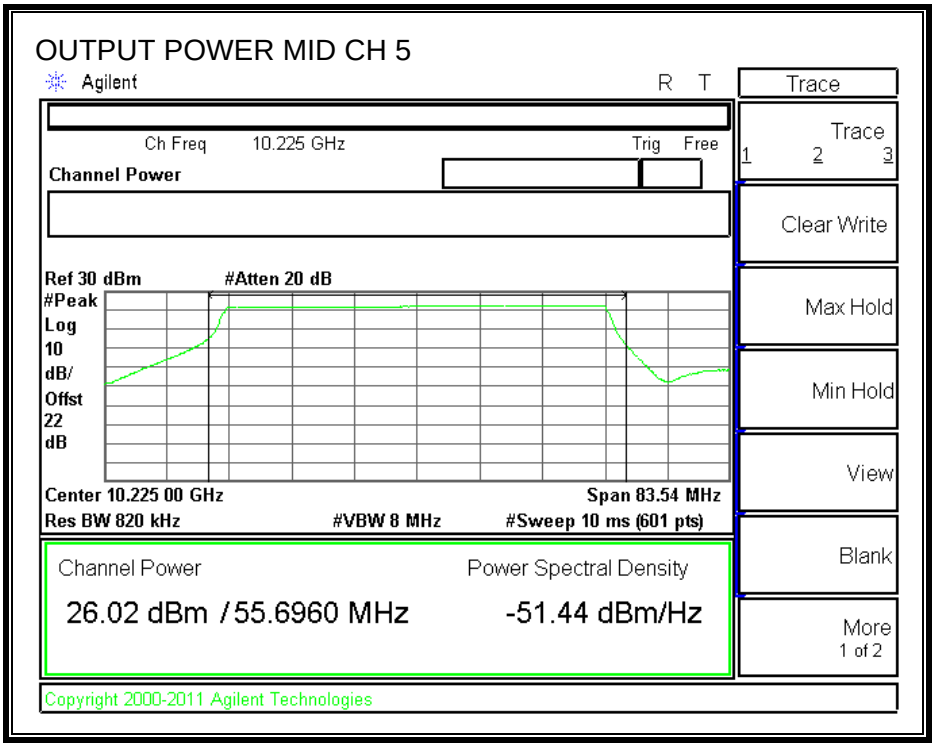
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

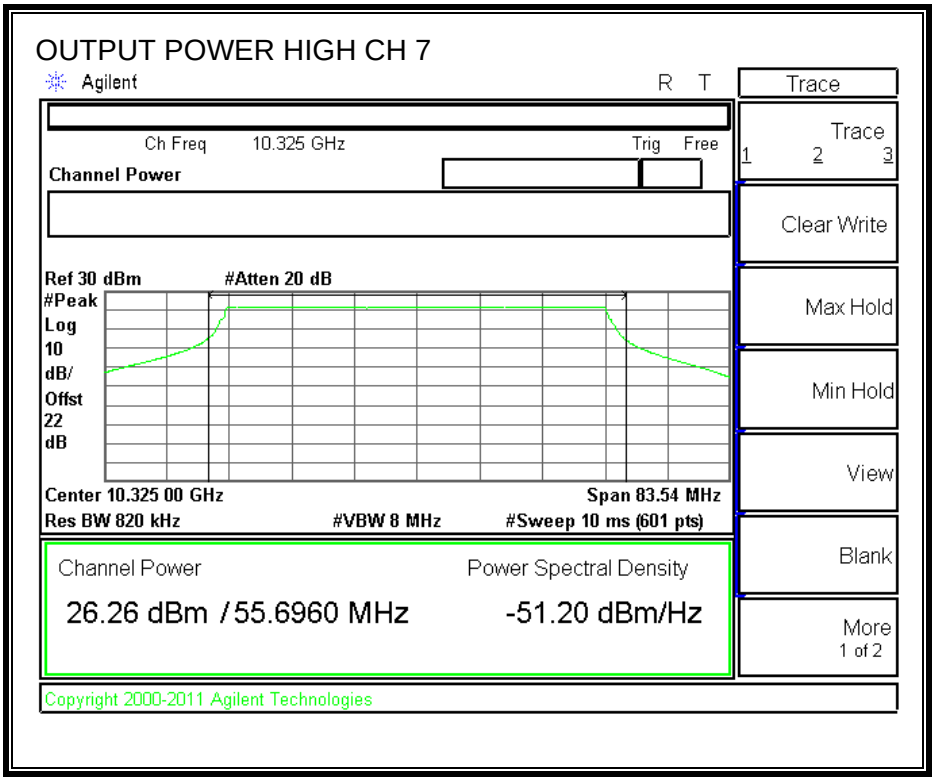
RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
3	10125	25.880	37	-11.120
5	10225	26.020	37	-10.980
7	10325	26.260	37	-10.740

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 22 dB (including 20dB pad and 2 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	AV power (dBm)
3	10125	20.88
5	10225	21.81
7	10325	20.96

7.1.4. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §90.210

Attenuation below carrier of 43 + 10 log (P) dB or -13dBm

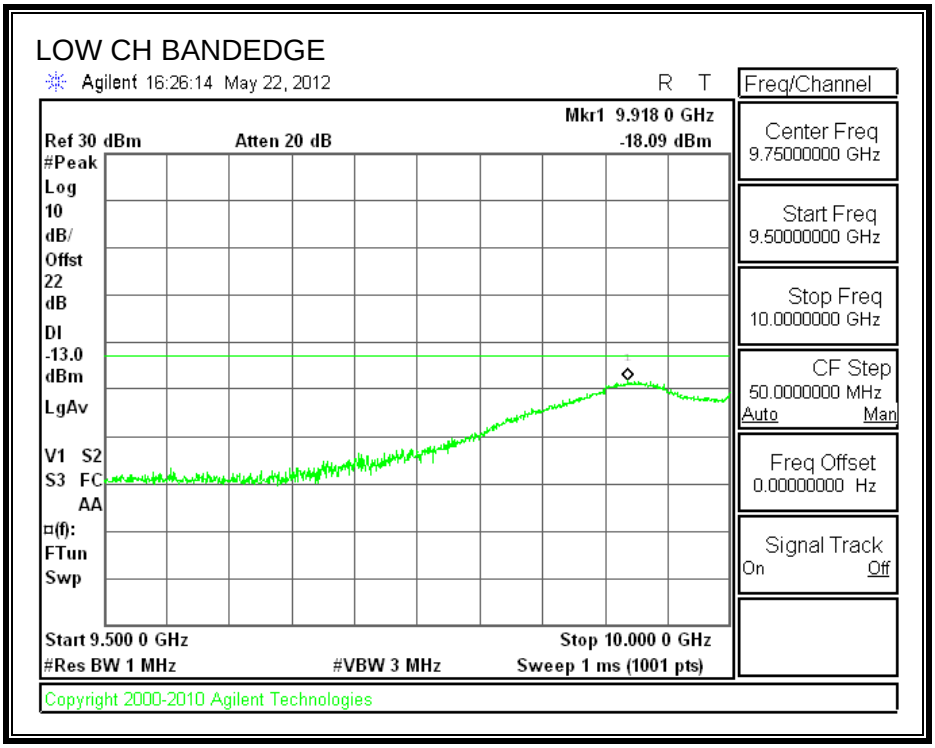
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

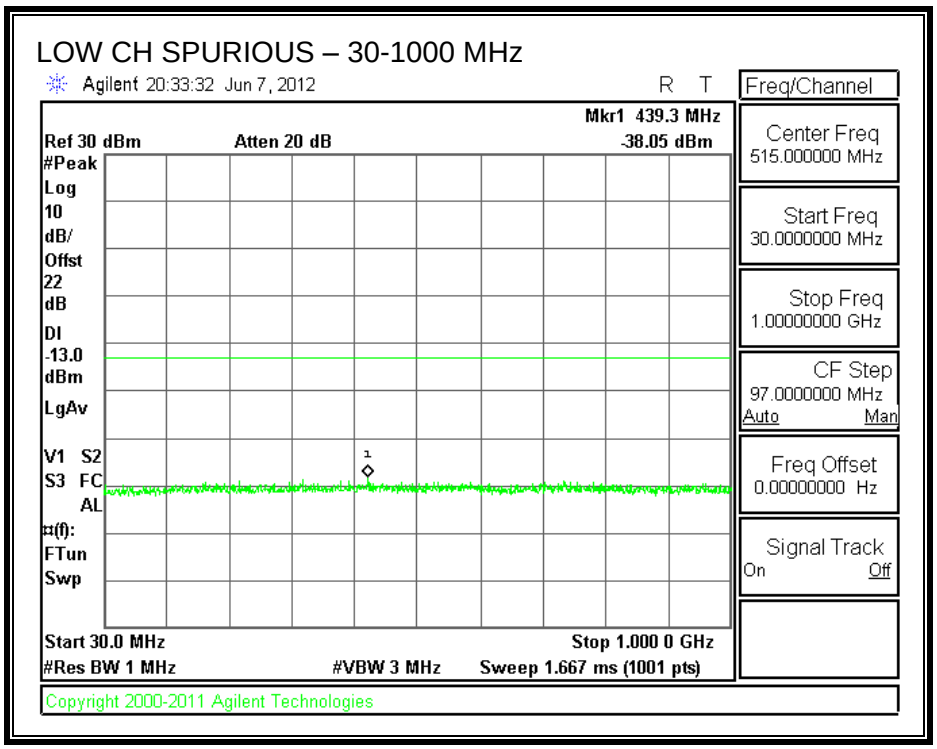
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULT

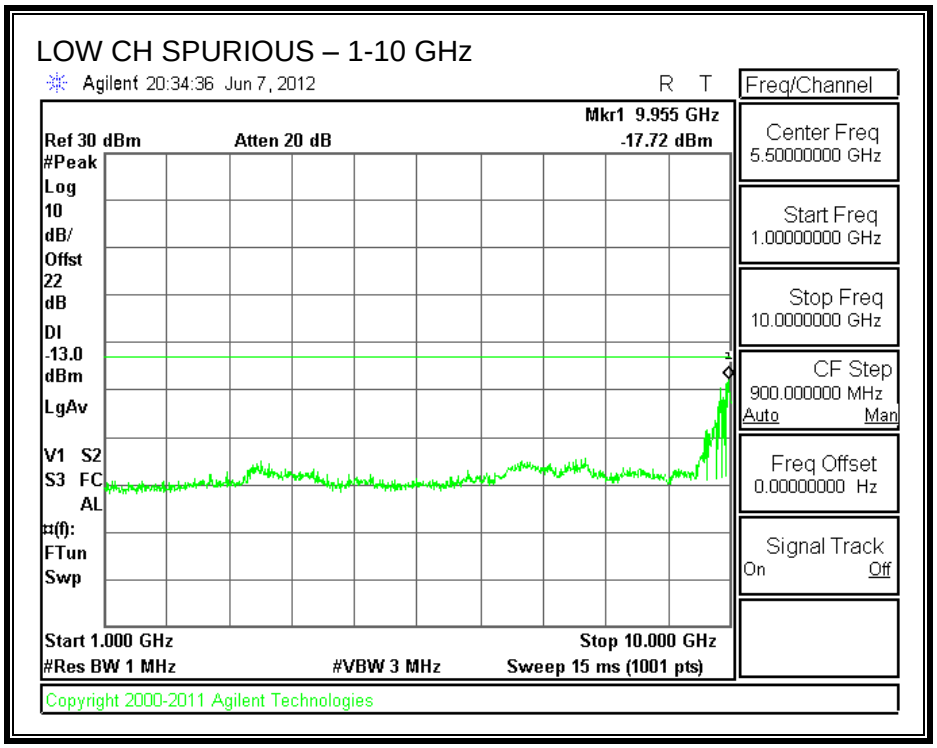
SPURIOUS EMISSIONS, LOW CHANNEL



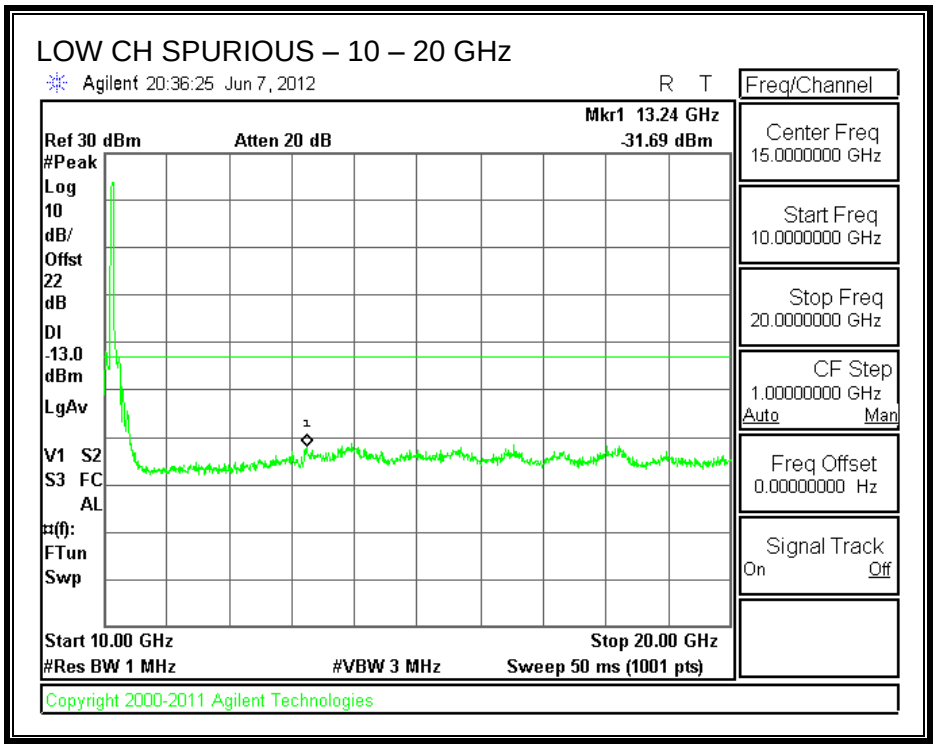
LOW CH SPURIOUS – 30-1000 MHz



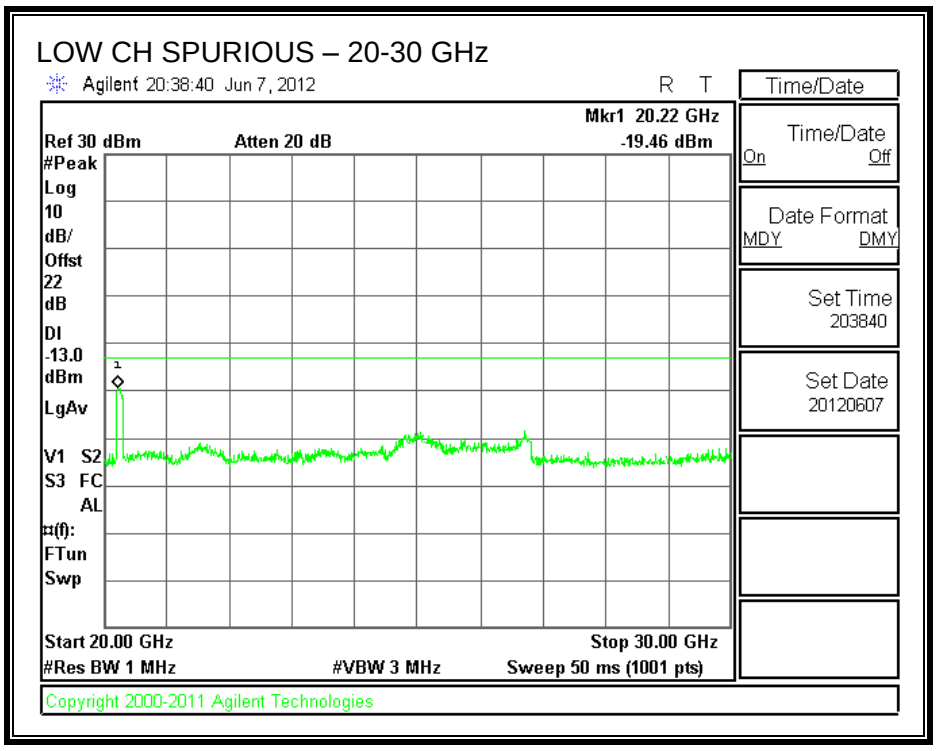
LOW CH SPURIOUS – 1-10 GHz



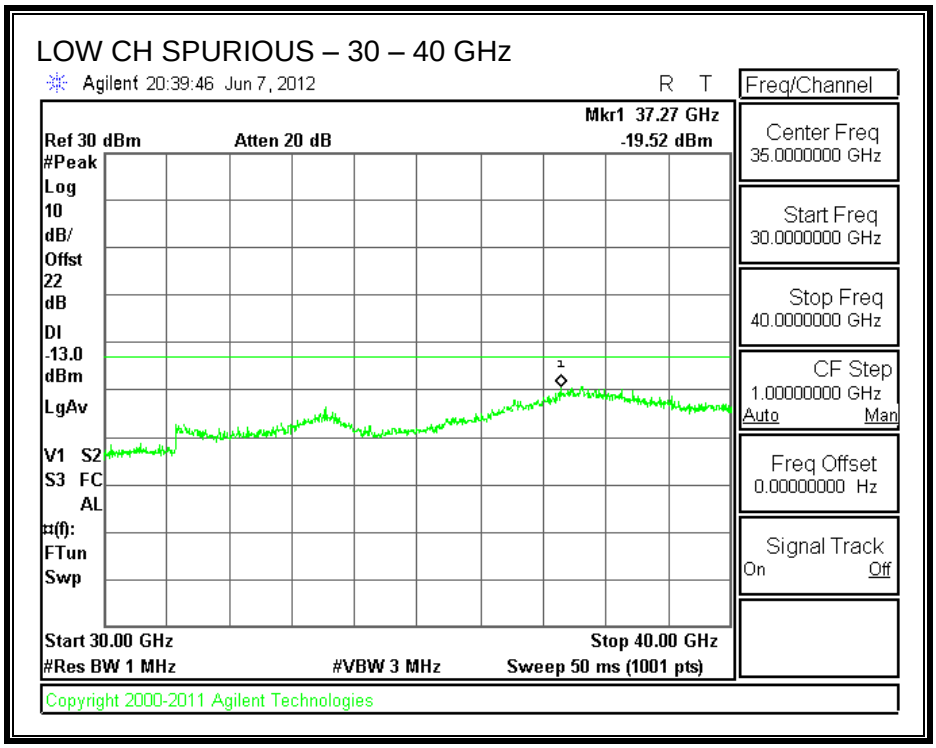
LOW CH SPURIOUS – 10 – 20 GHz



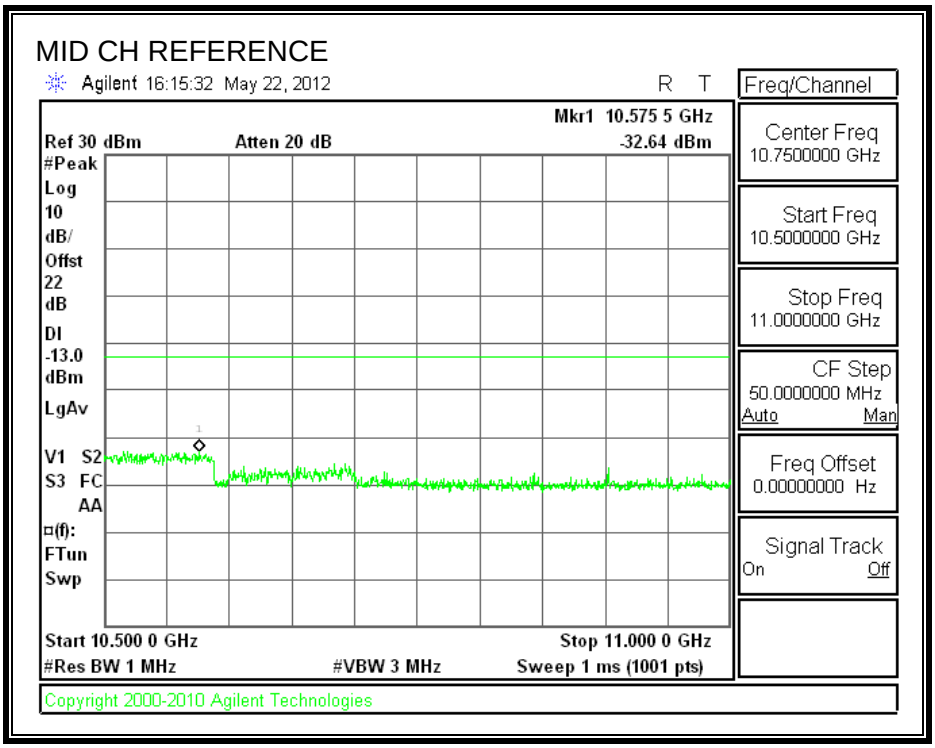
LOW CH SPURIOUS – 20-30 GHz



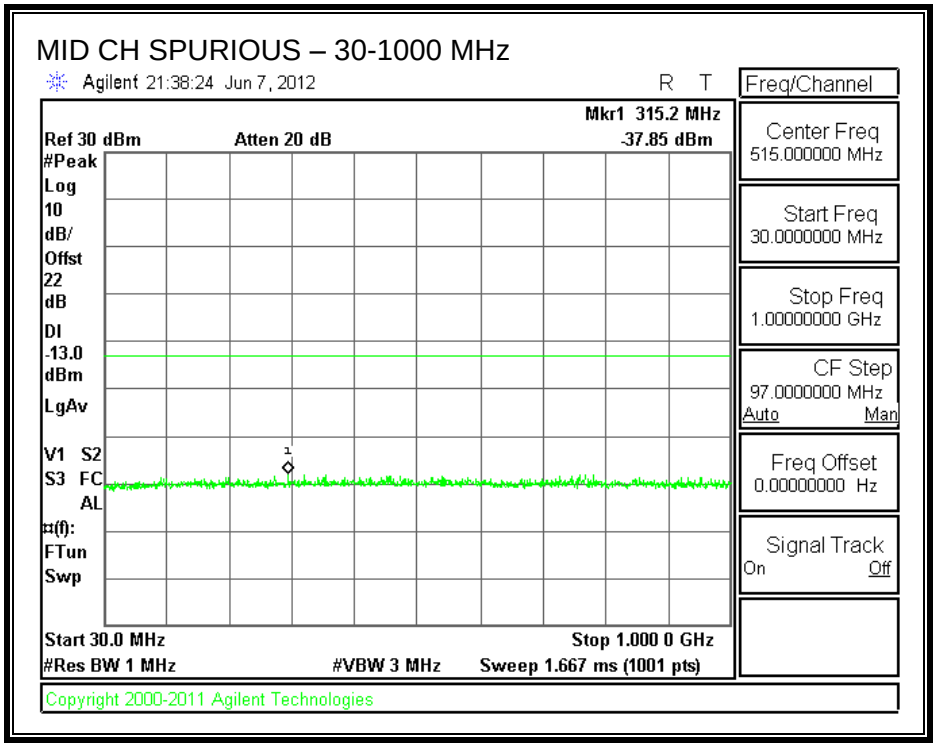
LOW CH SPURIOUS – 30 – 40 GHz



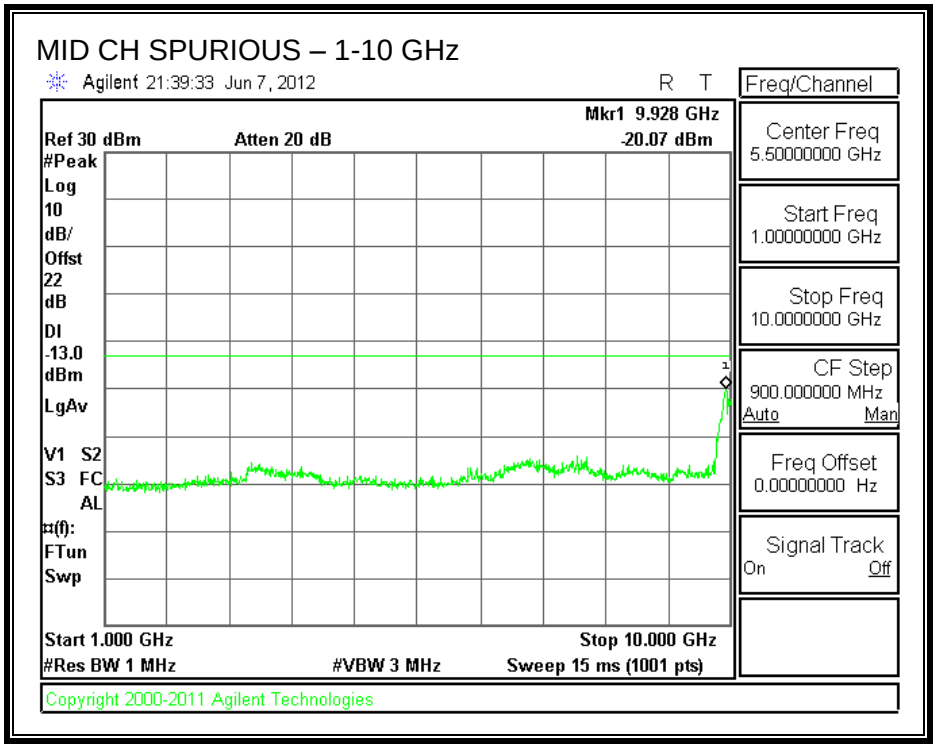
SPURIOUS EMISSIONS, MID CHANNEL



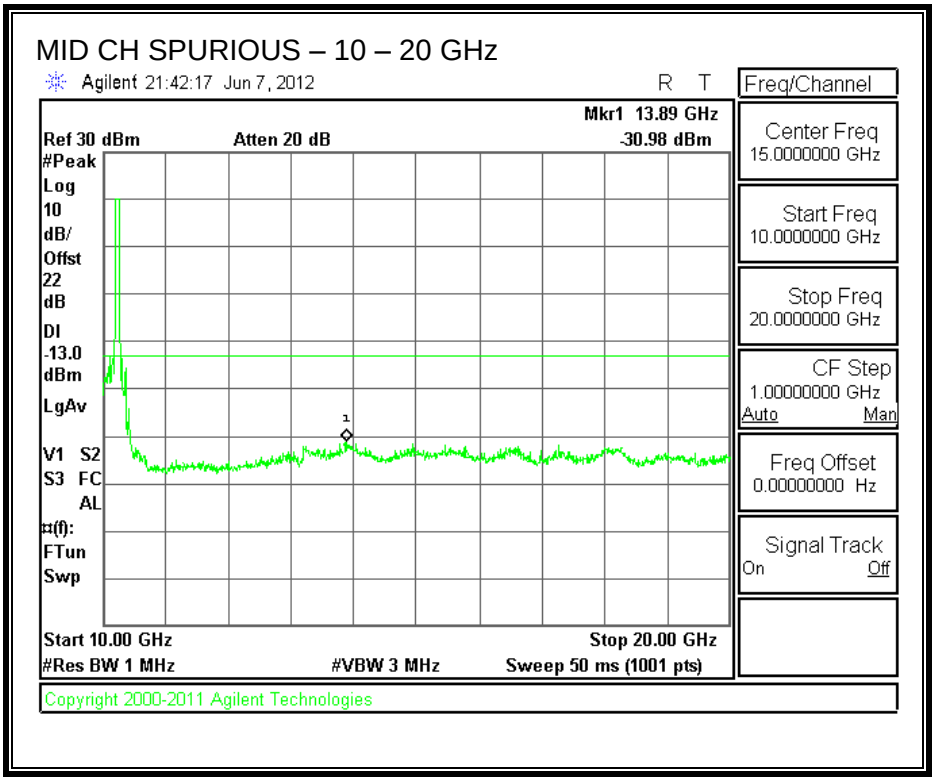
MID CH SPURIOUS – 30-1000 MHz



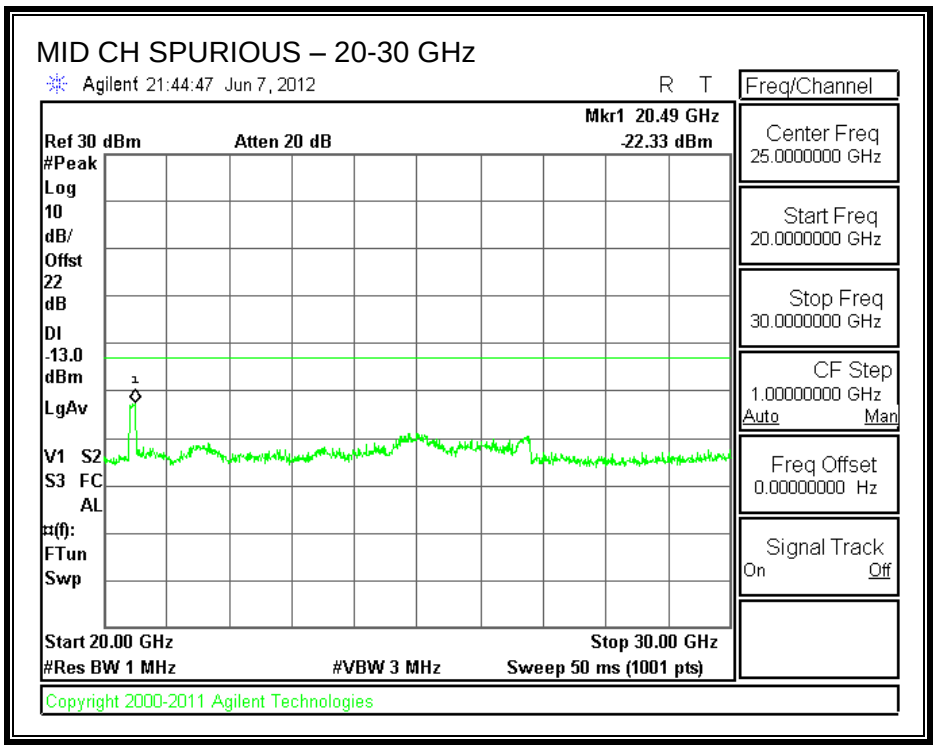
MID CH SPURIOUS – 1-10 GHz



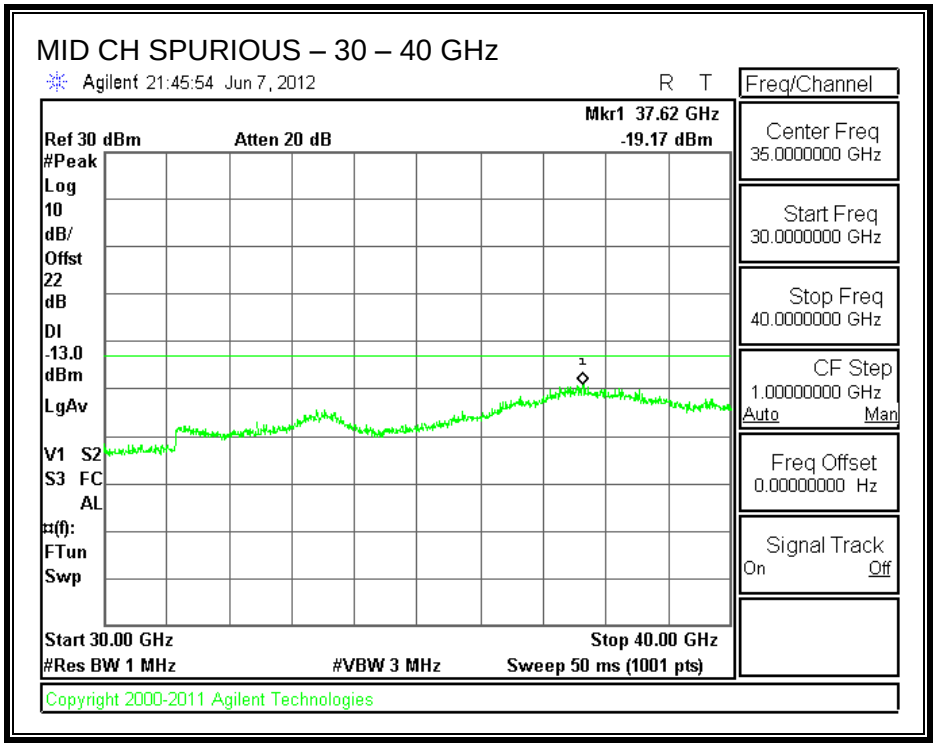
MID CH SPURIOUS – 10 – 20 GHz



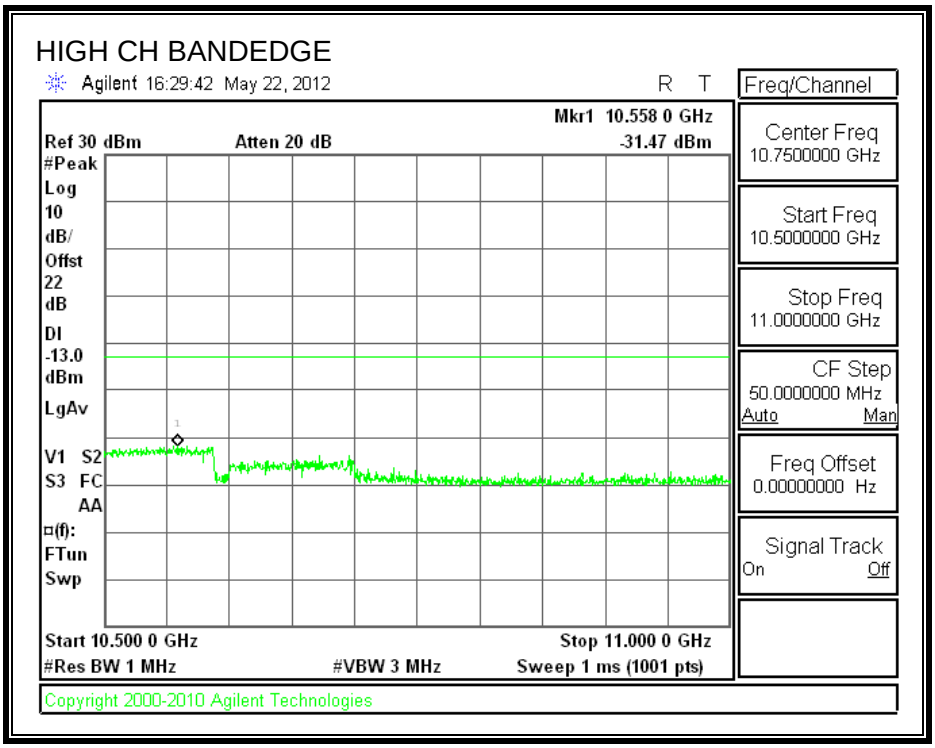
MID CH SPURIOUS – 20-30 GHz



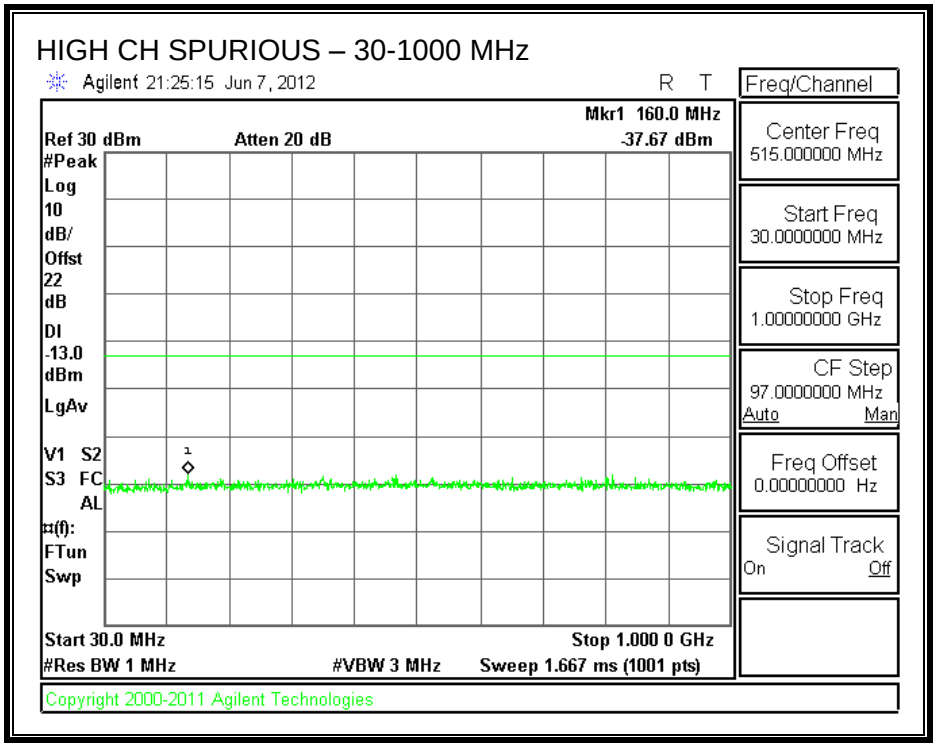
MID CH SPURIOUS – 30 – 40 GHz



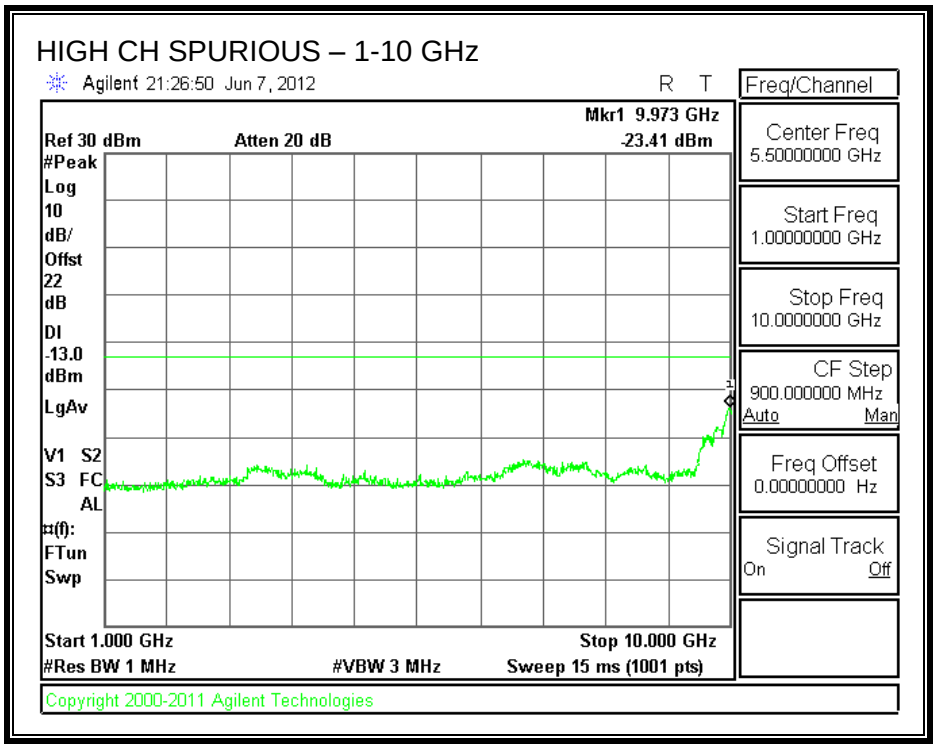
SPURIOUS EMISSIONS, HIGH CHANNEL



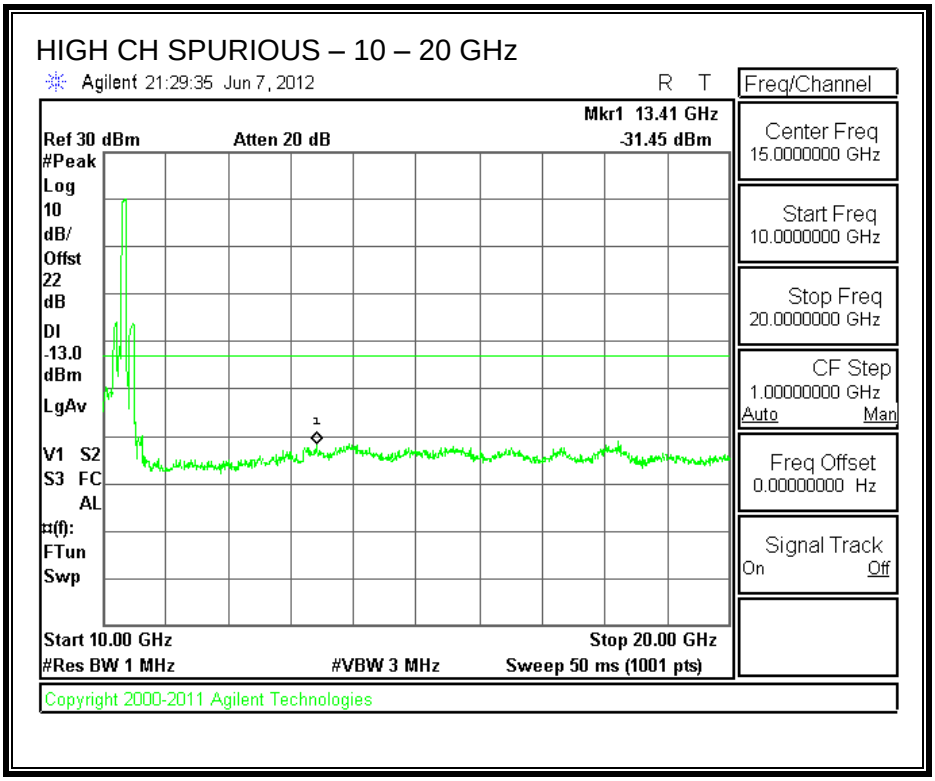
HIGH CH SPURIOUS – 30-1000 MHz



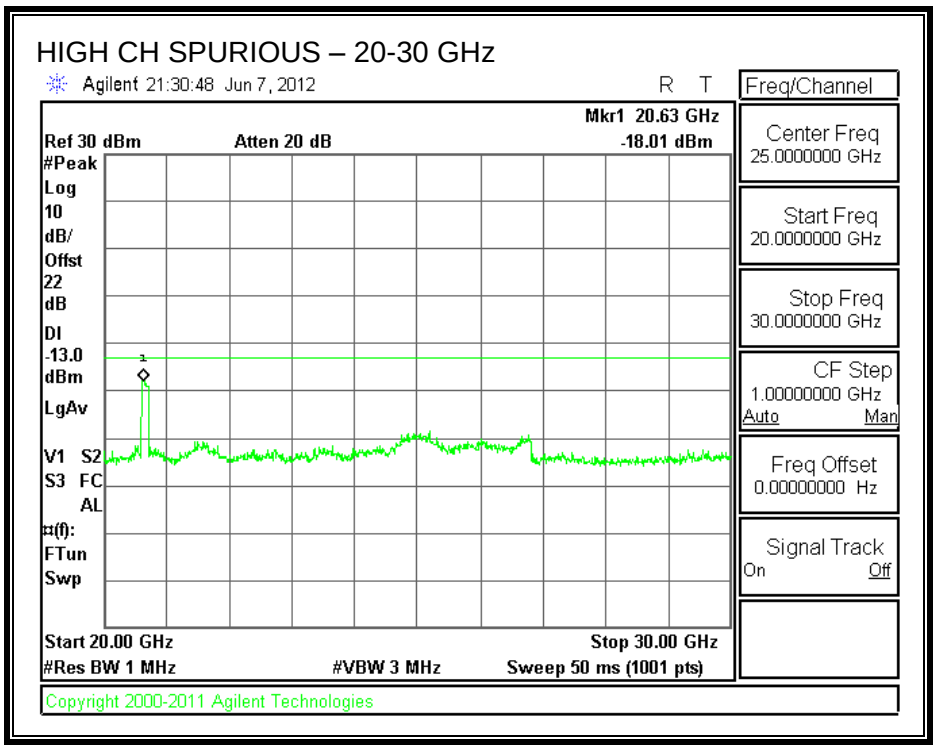
HIGH CH SPURIOUS – 1-10 GHz



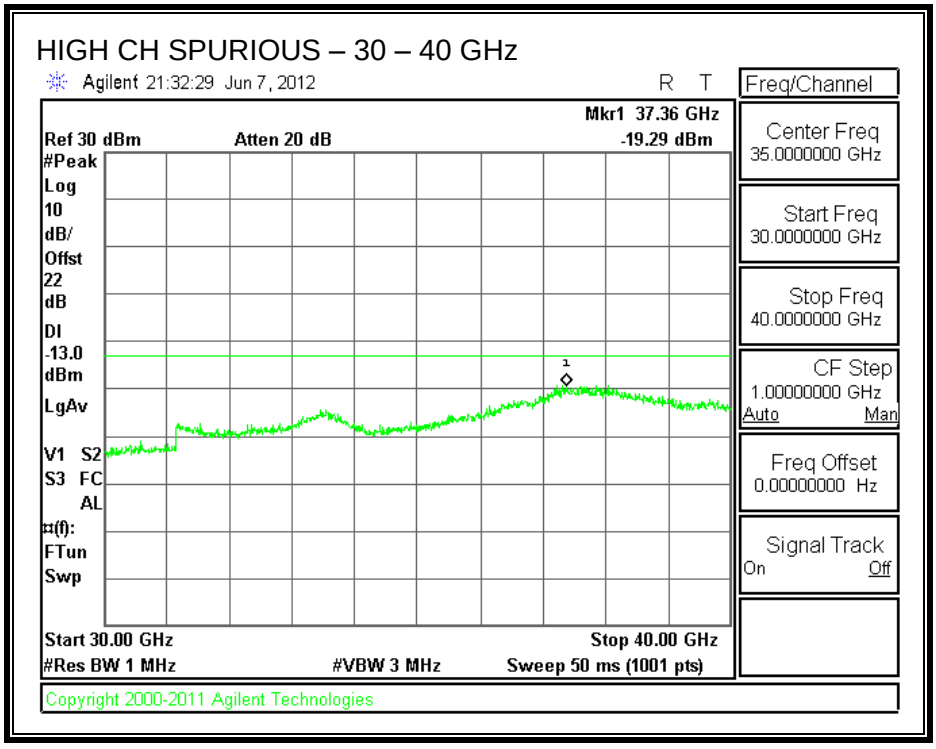
HIGH CH SPURIOUS – 10 – 20 GHz



HIGH CH SPURIOUS – 20-30 GHz



HIGH CH SPURIOUS – 30 – 40 GHz



7.1.5. FREQUENCY STABILITY

LIMIT

§90.213 (a) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 2.3.1 and 2.3.2

RESULTS

Reference Frequency: EUT Channel 5 @ 20ºC Limit: ± 100 ppm = 101447.224 kHz				
Power Supply (Vac)	**Environment Temperature (ºC)**	**Frequency Deviation Measureed with Time Elapse**		
		(MHz)	**Delta (ppm)**	**Limit (ppm)**
115.00	60	10144.6208900	0.100	± 100
115.00	50	10144.6726100	0.049	± 100
115.00	40	10144.7233100	-0.001	± 100
115.00	30	10144.7224000	0.000	± 100
115.00	***20***	***10144.7223700***	***0.000***	***± 100***
115.00	10	10144.8198200	-0.096	± 100
115.00	0	10144.7943800	-0.071	± 100
115.00	-10	10144.7696400	-0.047	± 100
115.00	-20	10144.7707100	-0.048	± 100

8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §90.210

13dBm (~ 82dBuV/m)

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 55 GHz is investigated with the transmitter set at the worst case channel.

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

8.2. TRANSMITTER ABOVE 1 GHz

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber-A

Company:	Spotter RF
Project #:	12U14355
Date:	7/17/2012
Test Engineer:	S. Aguilar
Configuration:	EUT + POE module + laptop
Mode:	TX Mode Worst Case. EUT normal op. orientation

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T73; S/N: 6717 @3m	T144 Miteq 3008A00931	T88 Miteq 26-40GHz	T89; ARA 18-26GHz; S/N:1049	

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter
3' cable 22807700	12' cable 22807600	20' cable 22807500		R_001

Peak Measurements
RBW=VBW=1MHz

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)
1.544	3.0	46.08	32.73	25.8	3.4	-38.1	0.0	0.0	37.2	23.8	82.0		-44.8		H
13.614	3.0	35.03	21.91	40.6	11.6	-34.8	0.0	0.0	52.5	39.3	82.0		-29.5		H
13.614	3.0	35.03	21.91	40.6	11.6	-34.8	0.0	0.0	52.5	39.3	82.0		-29.5		H
20.650	3.0	59.47	22.01	33.3	14.7	-34.1	0.0	0.0	73.4	35.9	82.0		-8.6		H
30.975	3.0	43.06	30.68	39.0	12.7	-41.4	0.0	0.0	53.4	41.0	82.0		-28.6		H
											82.0				
1.579	3.0	45.44	32.92	25.9	3.4	-38.0	0.0	0.0	36.7	24.2	82.0		-45.3		V
13.619	3.0	35.01	21.92	40.6	11.6	-34.8	0.0	0.0	52.5	39.4	82.0		-29.5		V
20.650	3.0	60.43	21.95	33.3	14.7	-34.1	0.0	0.0	74.3	35.8	82.0		-7.7		V
30.975	3.0	44.54	30.74	39.0	12.7	-41.4	0.0	0.0	54.9	41.1	82.0		-27.1		V

Rev. 11.10.11

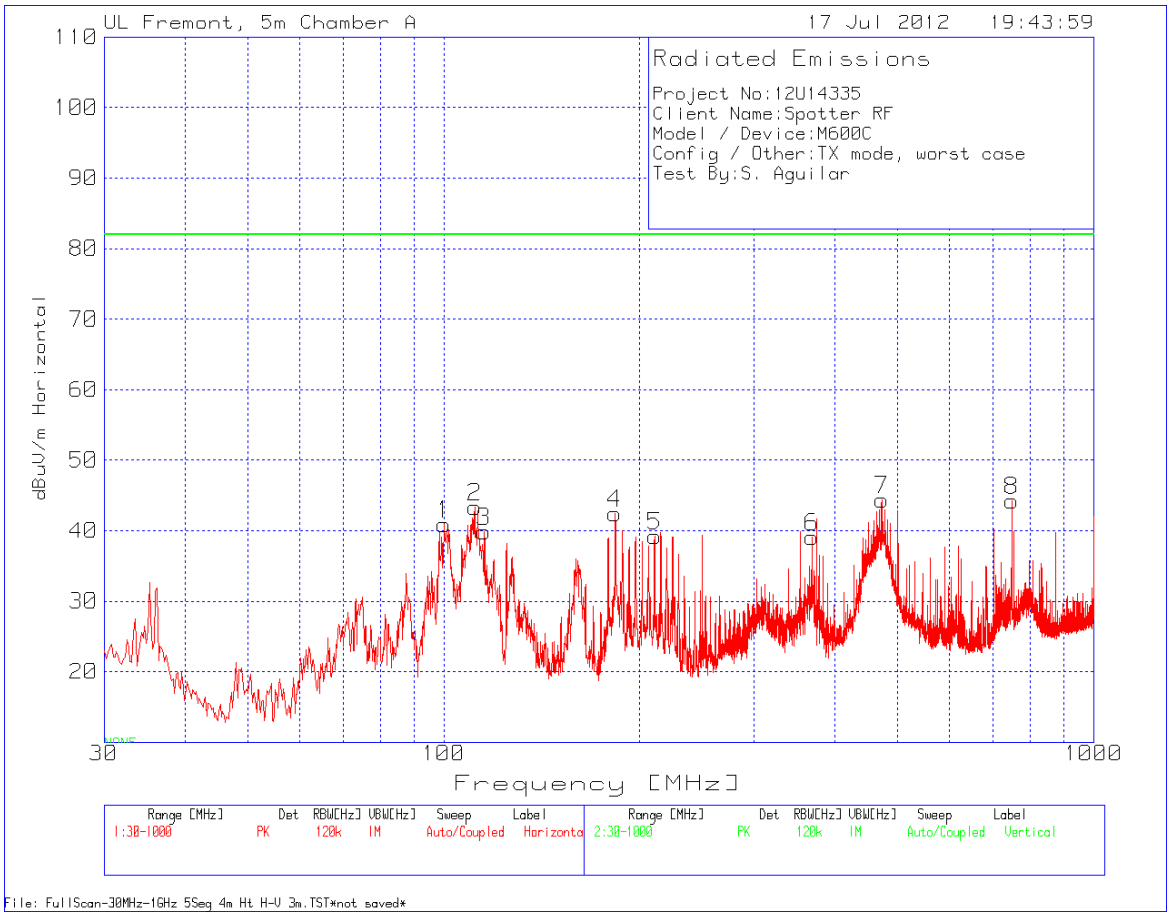
No other emmissions above the noise floor detected up to 55 GHz.

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

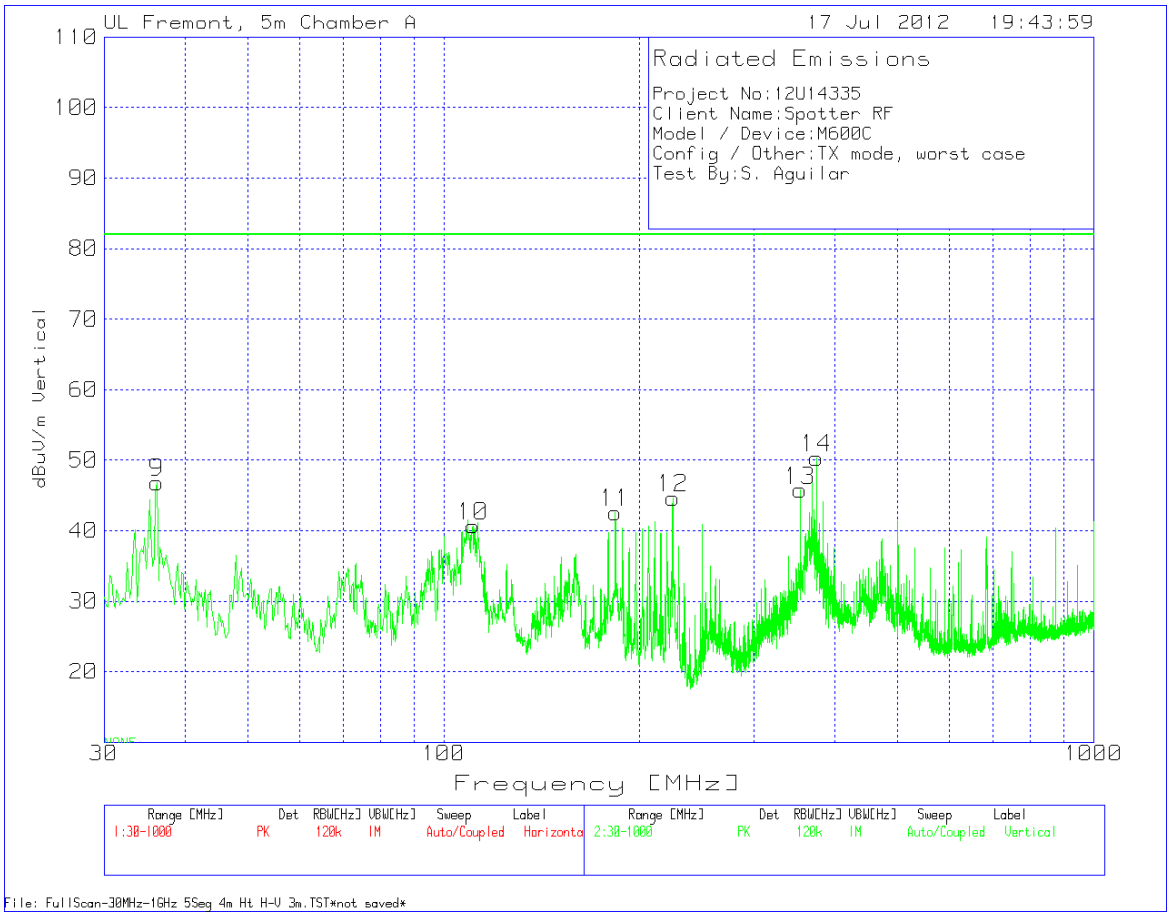
8.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Company Name: Spotter RF
Project: 12U14335
Date: 7/17/2012
Configuraiton: EUT + POE adapter + EUT
Mode: TX, worst case
Tested by: S.Aguilar

Test Frequency [MHz]	Meter Reading [dB(μV)]	Detector	Pre Amp Factor [dB]	Antenna Factor [dB/m]	Corrected [dB(μV/m)]	Class B PK limit [dB(μV/m)]	QP Margin [dB]	Height [cm]	Polarity
Range 1 30 - 1000MHz									
100.1719	57.45	PK	-26.9	10.3	40.85	82	-41.15	300	Horz
111.6087	57.01	PK	-26.7	13	43.31	82	-38.69	300	Horz
115.4856	53.18	PK	-26.8	13.5	39.88	82	-42.12	300	Horz
183.5252	57.69	PK	-26.4	11.1	42.39	82	-39.61	100	Horz
211.245	54.99	PK	-26.1	10.3	39.19	82	-42.81	100	Horz
368.6471	49.4	PK	-25.5	15.2	39.1	82	-42.9	300	Horz
471.9664	52.17	PK	-25	17.2	44.37	82	-37.63	200	Horz
749.94	46.88	PK	-23.3	20.7	44.28	82	-37.72	100	Horz
Range 2 30 - 1000MHz									
36.203	57.5	PK	-27.5	16.8	46.8	82	-35.2	100	Vert
110.8333	54.5	PK	-26.7	12.9	40.7	82	-41.3	100	Vert
183.719	57.86	PK	-26.4	11.1	42.56	82	-39.44	100	Vert
225.2018	60.07	PK	-26	10.6	44.67	82	-37.33	100	Vert
353.9149	56.63	PK	-25.6	14.7	45.73	82	-36.27	100	Vert
374.8501	60.5	PK	-25.4	15.2	50.3	82	-31.7	100	Vert

PK - Peak detector
QP - Quasi-peak detector

9. 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

ANSI C63.4

RESULTS

Test not required as EUT is powered using the Ethernet connection.