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INDUSTRY CANADA RSS-210 ISSUE 8
INDUSTRY CANADA RSS-102 ISSUE 4

CERTIFICATION TEST REPORT

FOR

60GHz WIRELESSHD TRANSMITTER

MODEL NUMBER: SII-SK63102

FCC ID: UK2-SII-SK63102
IC: 6705A-SIISK63102

REPORT NUMBER: 12U14407-1, Revision A

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Prepared for
SILICON IMAGE
1140 EAST ARQUES AVE
SUNNYVALE, CA 94085, U.S.A.

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

NVLAP®

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SILICON IMAGE
1140 EAST ARQUES AVE
SUNNYVALE, CA, 94085, U.S.A.

EUT DESCRIPTION: 60GHz WIRELESSHD TRANSMITTER

MODEL: SII-SK63102

SERIAL NUMBER: 96:7d:22:9a:69:00

DATE TESTED: APRIL 18 TO MAY 1, 2012

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 13	Pass
INDUSTRY CANADA RSS-102 Issue 4	Pass

Compliance Certification Services (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.

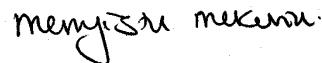
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this 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:



MICHAEL HECKROTTE
DIRECTOR OF ENGINEERING
UL CCS

Tested By:



MENGISTU MEKURIA
EMC ENGINEER
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 15, FCC KDB 200443 Millimeter Wave Test Procedure, FCC Bulletin OET 65, IEEE C95.3-2002, RSS-210 Issue 8, RSS-GEN Issue 3 and RSS-102 Issue 4.

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. 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 WirelessHD Source radio module. It is designed to operate as part of a Wireless Video Audio Network (WVAN) in the 57 to 64 GHz band. The EUT sends High Definition Audio/Video to a WirelessHD Sink radio device.

The EUT transmits High Definition Audio/Video data on a single Medium Rate (MRP) or High Rate (HRP) channel at either 60.48 GHz or 62.64 GHz. The integral MRP/HRP transmit antenna is an adaptive beam-steering array with a maximum gain of 18 dBi.

The EUT transmits and receives control and management signals on one of five Low Rate (LRP) channels for each MRP/HRP channel. LRP channels range from 60.16275 to 60.79725 GHz (for MRP/HRP at 60.48 GHz) or from 62.32275 to 62.95725 GHz (for MRP/HRP at 62.64 GHz). The integral LRP transmit/receive antenna is a scanning beam-steering array with a maximum gain of 16 dBi.

The LRP modulation is BPSK. The MRP modulation is QPSK, at a data rate of 0.476, 0.952, 0.714 or 1.190 Gb/s. The HRP modulation can be either QPSK or 16-QAM. Three system data rates are implemented: QPSK at 0.952 Gb/s (Quarter Rate), QPSK at 1.904 Gb/s (Half Rate) and 16-QAM at 3.807 Gb/s (Full Rate).

5.2. OUTPUT POWER

The antenna is integral thus radiated measurements are made. The EIRP was measured at the worst-case condition, thus the EIRP measurement conditions correspond to the maximum EUT antenna gain. Therefore the maximum antenna gain is used to calculate the Peak Output Power.

The highest peak output power for LRP is 17.5 dBm (56 mW).

The highest peak output power for MRP is 18.6 dBm (72 mW)

The highest peak output power for HRP is 17.7 dBm (59 mW).

5.3. SOFTWARE AND FIRMWARE

The test software used during testing was SWAM3

The test firmware used during testing was 3.0 FS2 Alpha

5.4. WORST-CASE CONFIGURATION AND MODE

The 1080p video mode was determined to be the worst case mode for emissions.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	Serial Number
Test Jig	Silicon Image	N/A	N/A
Power Supply	Agilent	E3632A	MY40012979
Power Supply	Cincon	TR20B033X	20033-0000540
Video Generator	Quantum Data	882E	9040041
WiHD Sink	Silicon Image	Prototype	Prototype
TV	Samsung	P23700HD	EM23HVLZ415106K

I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identic Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	AC	Un-Shielded	2.0 m	N/A
2	DC	1	DC	Un-Shielded	2.0m	N/A
3	I/O	1	HDMI	Shielded	9 m	Excess bundled inside shielded box
4	AC	1	AC	Un-Shielded	1.5 m	N/A

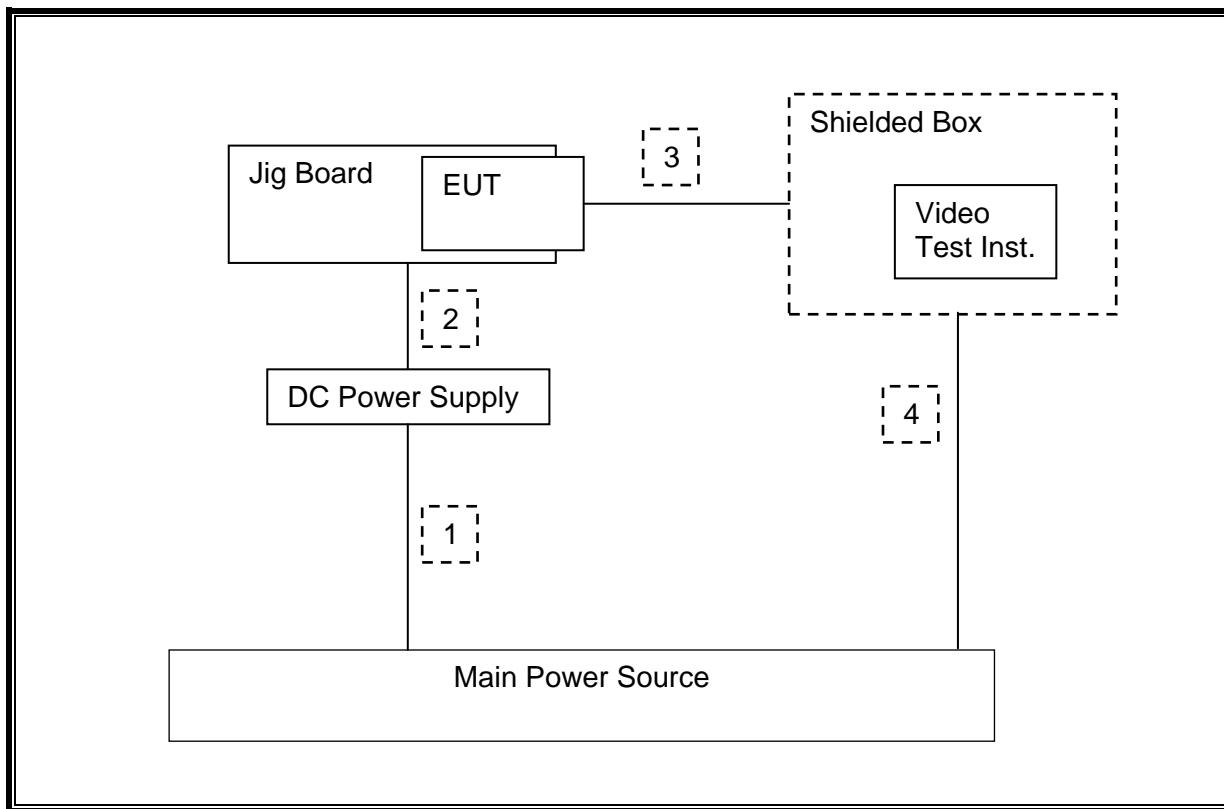
TEST SETUP

The QD generator was placed inside a shielded box. High Definition Audio / Video was sent from the QD generator to the EUT via a conducted HDMI cable connection to the test jig, then sent from the EUT to the Television via an over-the-air link to the WiHD Sink.

The Television and WiHD Sink were placed behind the measuring antenna.

A laptop computer was utilized to adjust the EUT for testing purposes. This computer was not connected during measurements.

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, 44 GHz	Agilent / HP	E4446A	C01012	9/2/2012
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00996	5/4/2012
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00986	3/22/2013
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01176	8/4/2012
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	C01171	1/26/2013
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00558	11/11/2012
Antenna, Horn, 18 GHz	EMCO	3115	C00945	10/6/2012
Antenna, Horn, 18 GHz	EMCO	3115	C00783	6/29/2012
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	7/12/2012
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	7/12/2012
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	7/28/2012
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	C00981	6/14/2012
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
Harmonic Mixer, 110 GHz	Agilent / HP	11970W	C00770	2/9/2014
Harmonic Mixer, 140 GHz	OML	M08HWA	C00868	CNR
Harmonic Mixer, 220 GHz	OML	M05HWA	C00867	CNR
Mixer Diplexer for HP	OML	DPL.313B	N02429	CNR
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	C00930	10/20/2012
LISN, 30 MHz	FCC	50/250-25-2	C00626	12/13/2012
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	12/13/2013

7. APPLICABLE LIMITS AND TEST RESULTS

7.1. 6 dB BANDWIDTH

APPLICABLE RULE

§15.255 (e) (1) For the purposes of this paragraph (e)(1), emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (e.g. for frequency hopping devices).

LIMIT

None; for reporting purposes only.

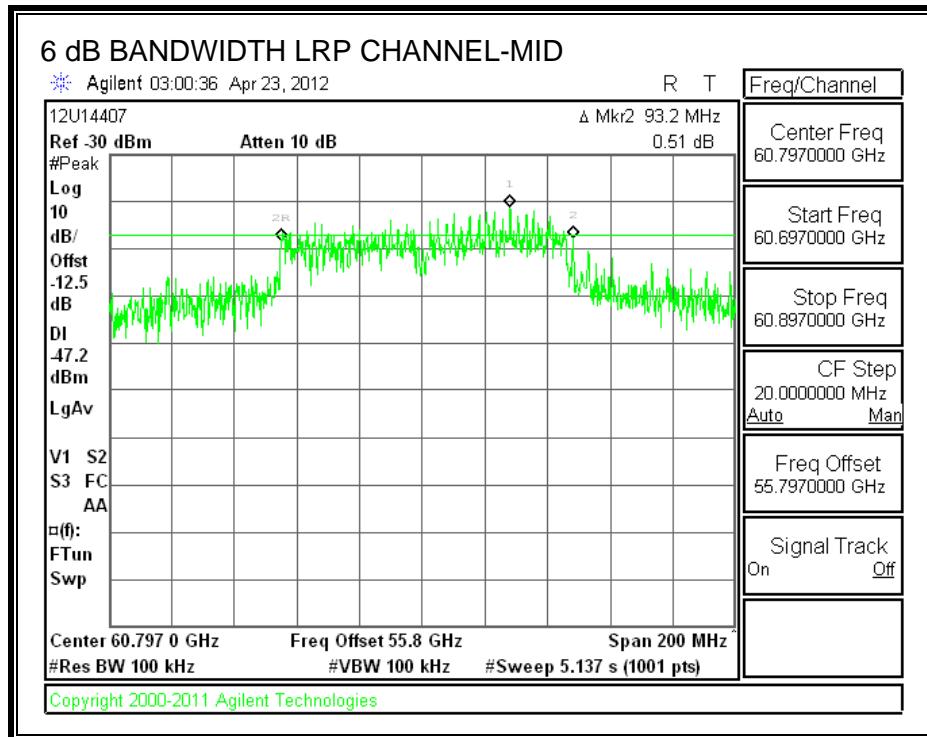
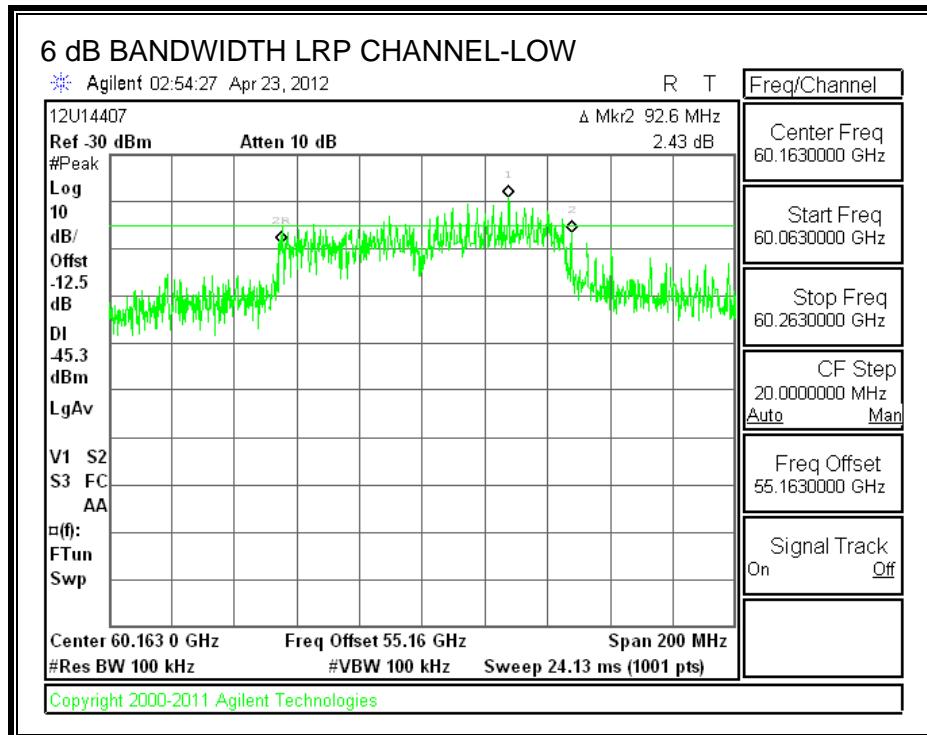
TEST PROCEDURE

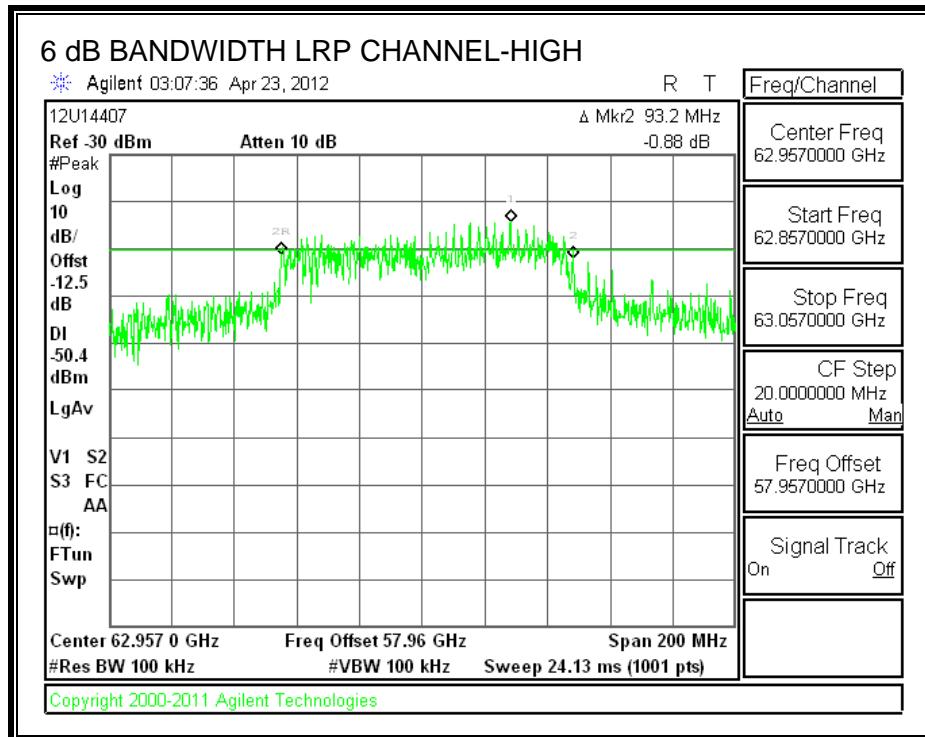
The spectrum analyzer and external mixer are set up to measure the radiated output of the transmitter.

7.1.1. Results for LRP Channels

Channel	Frequency (GHz)	6 dB Bandwidth (MHz)
LOW	60.163	92.60
MID	60.797	93.20
HIGH	62.957	93.20

6 dB BANDWIDTH

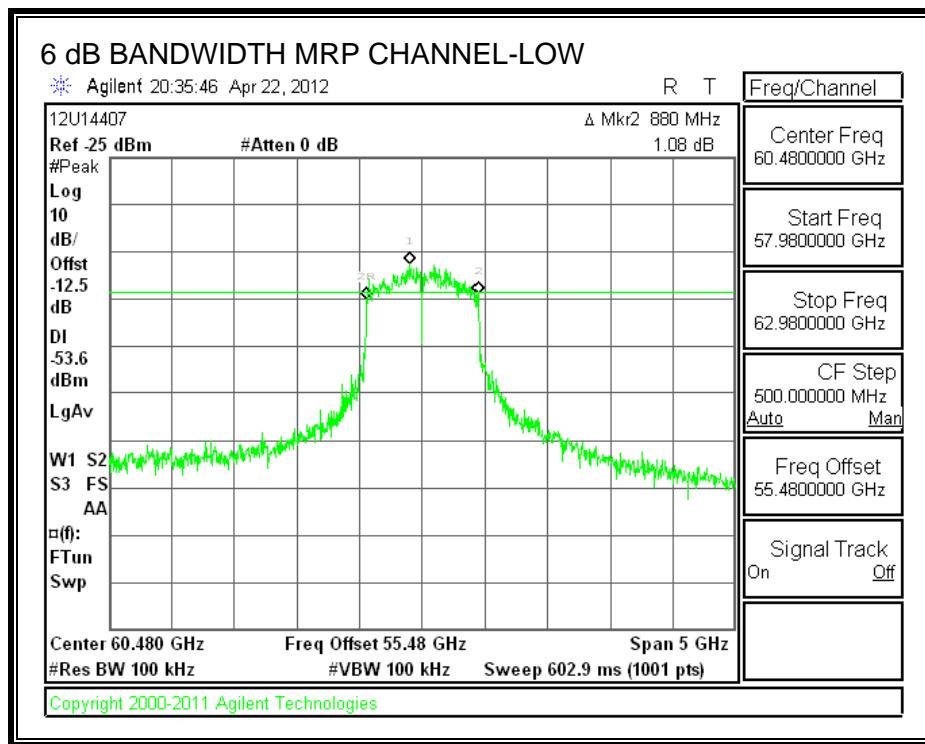


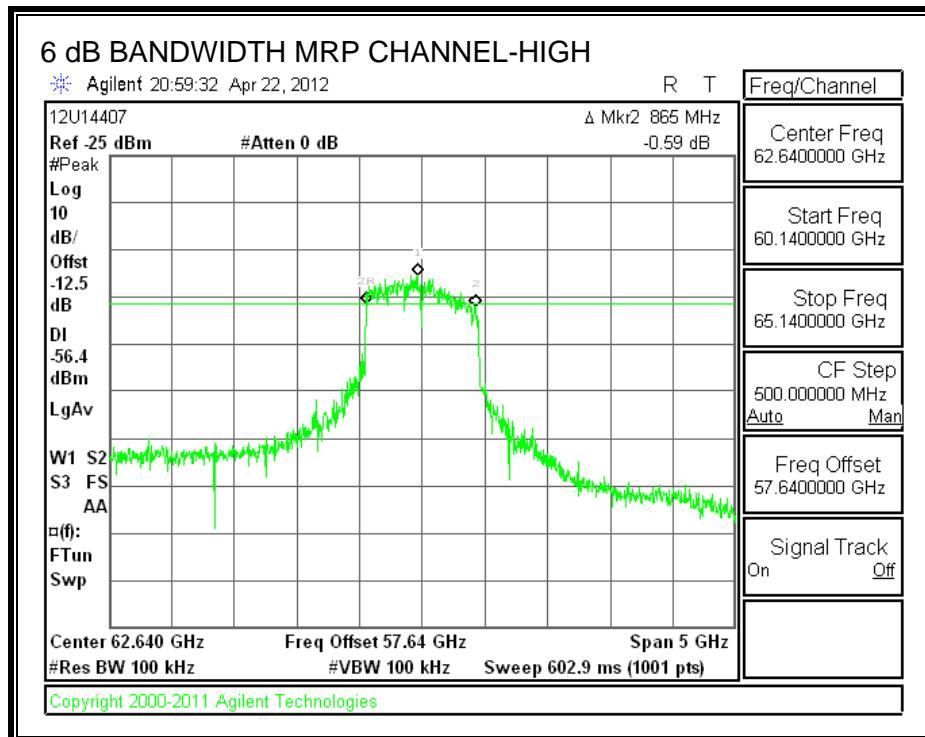


7.1.2. Results for MRP Channels

Channel	Frequency (GHz)	6 dB Bandwidth (GHz)
LOW	60.48	0.880
HIGH	62.64	0.865

6 dB BANDWIDTH

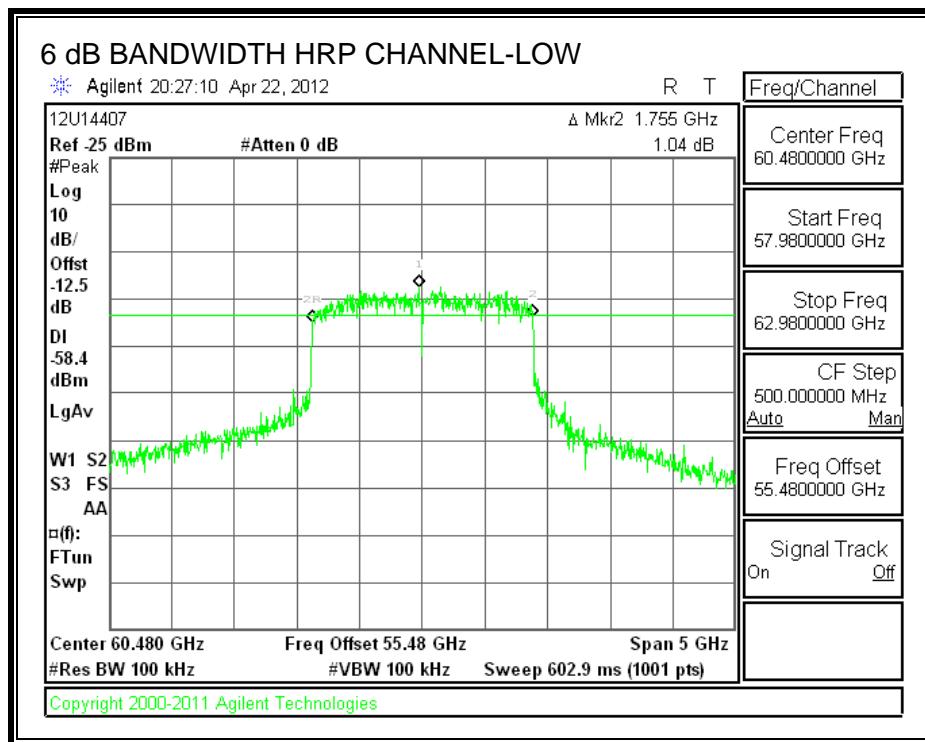


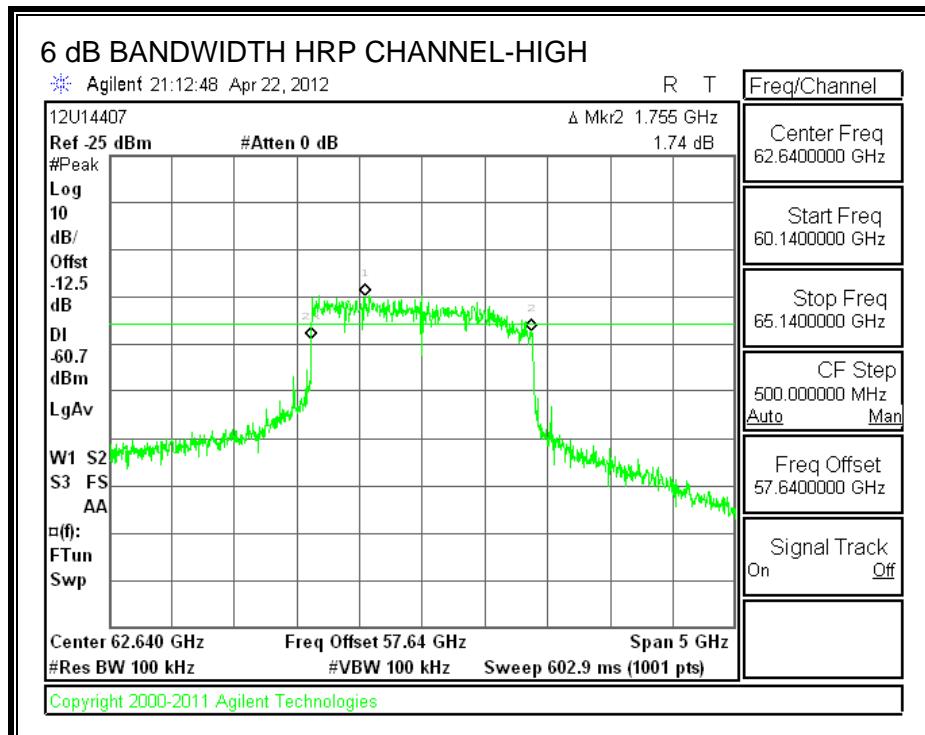


7.1.3. Results for HRP Channels

Channel	Frequency (GHz)	6 dB Bandwidth (GHz)
LOW	60.48	1.755
HIGH	62.64	1.755

6 dB BANDWIDTH





7.2. 99% and 26 dB BANDWIDTH

APPLICABLE RULE

§ 15.403 (c) as referenced by FCC KDB Publication 200443, Millimeter Wave Test Procedures

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

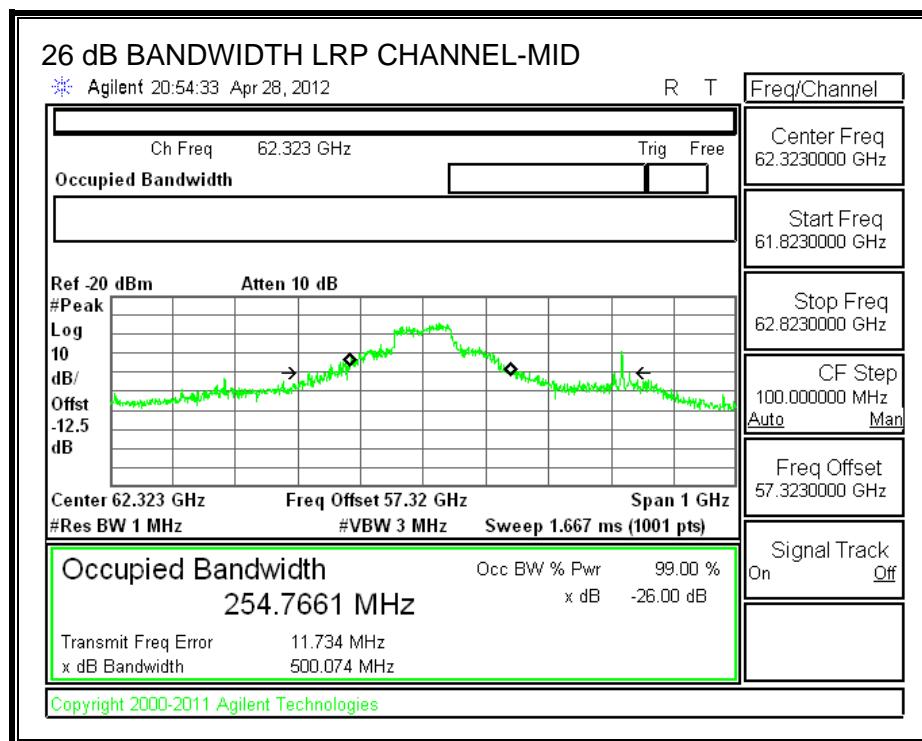
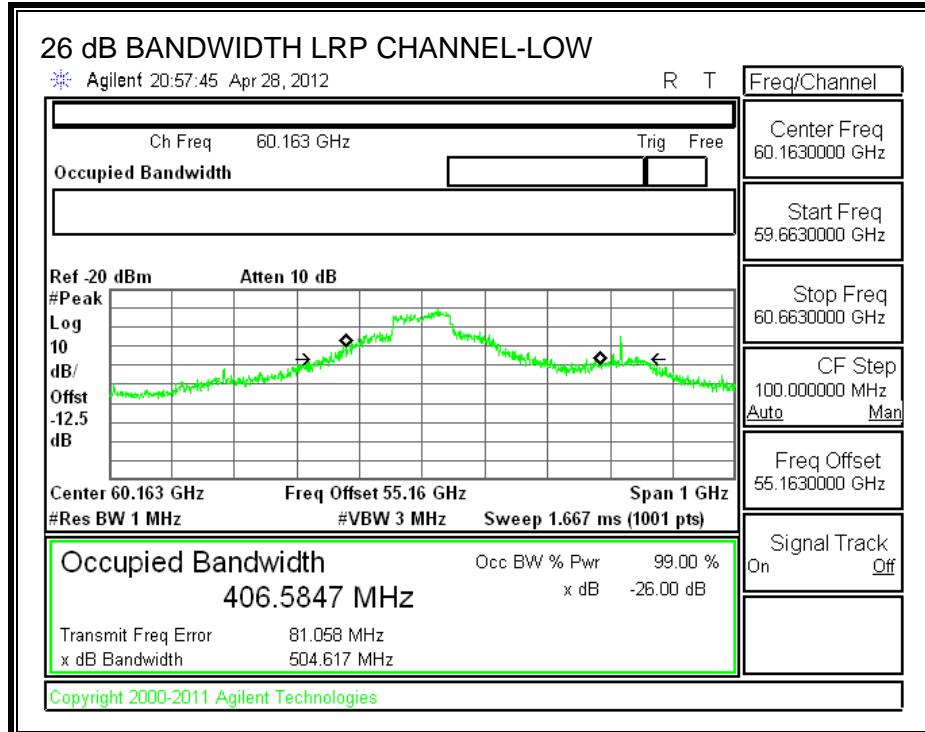
The spectrum analyzer and external mixer are set up to measure the radiated output of the transmitter.

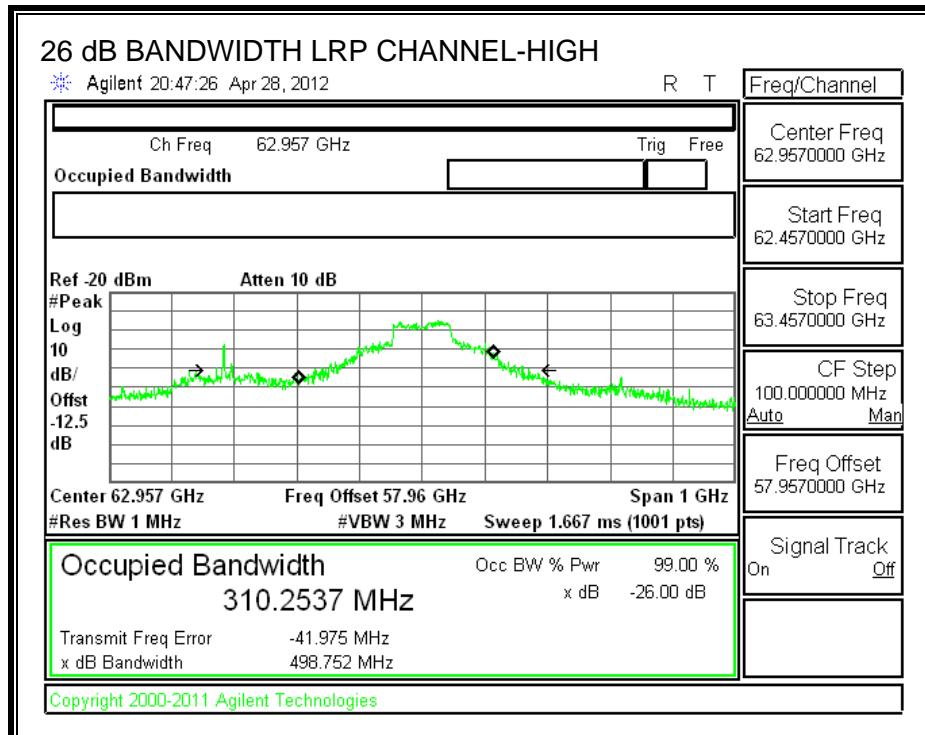
7.2.1. Results for LRP Channels

LRP RESULTS

Channel	Frequency (GHz)	99% Bandwidth (MHz)	26 dB Bandwidth (MHz)
LOW	60.1630	406.5847	504.62
MID	60.7970	254.7662	500.07
HGIH	62.9570	310.2537	498.75

99% and 26 dB BANDWIDTH

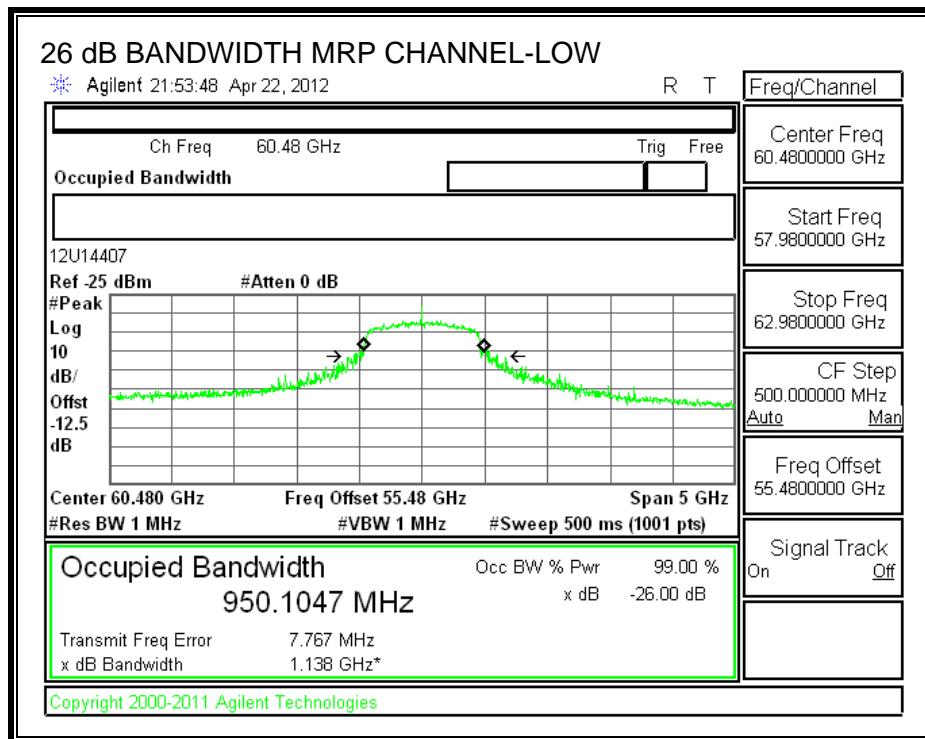


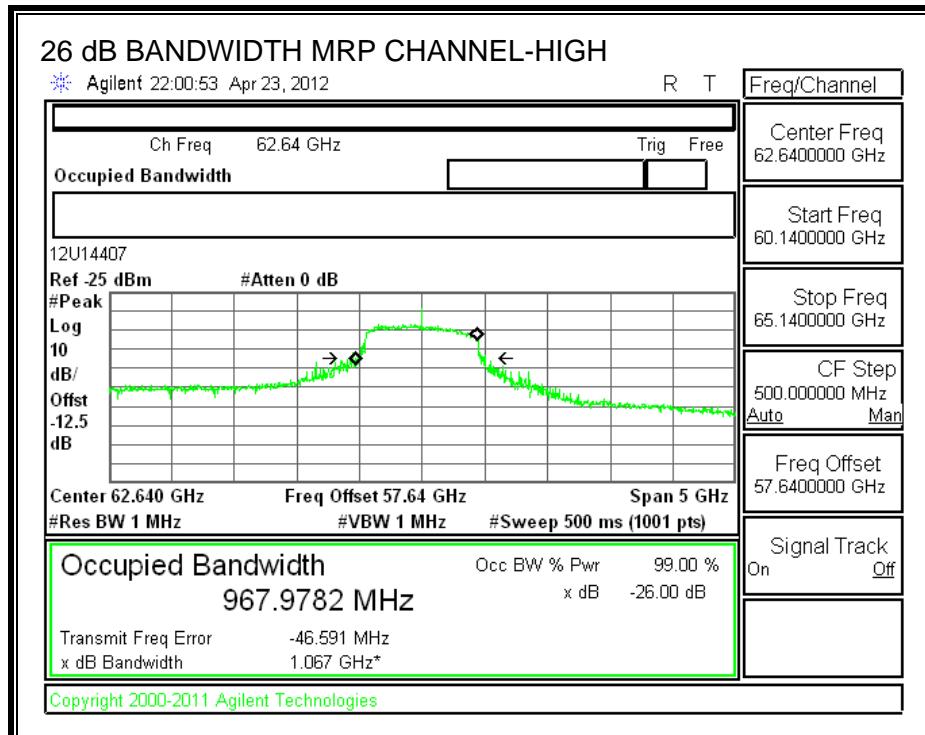


7.2.2. Results for MRP Channels

Channel	Frequency (GHz)	99% Bandwidth (GHz)	26 dB Bandwidth (GHz)
LOW	60.48	950.1047	1.1380
HIGH	62.64	967.9782	1.0670

99% and 26 dB BANDWIDTH

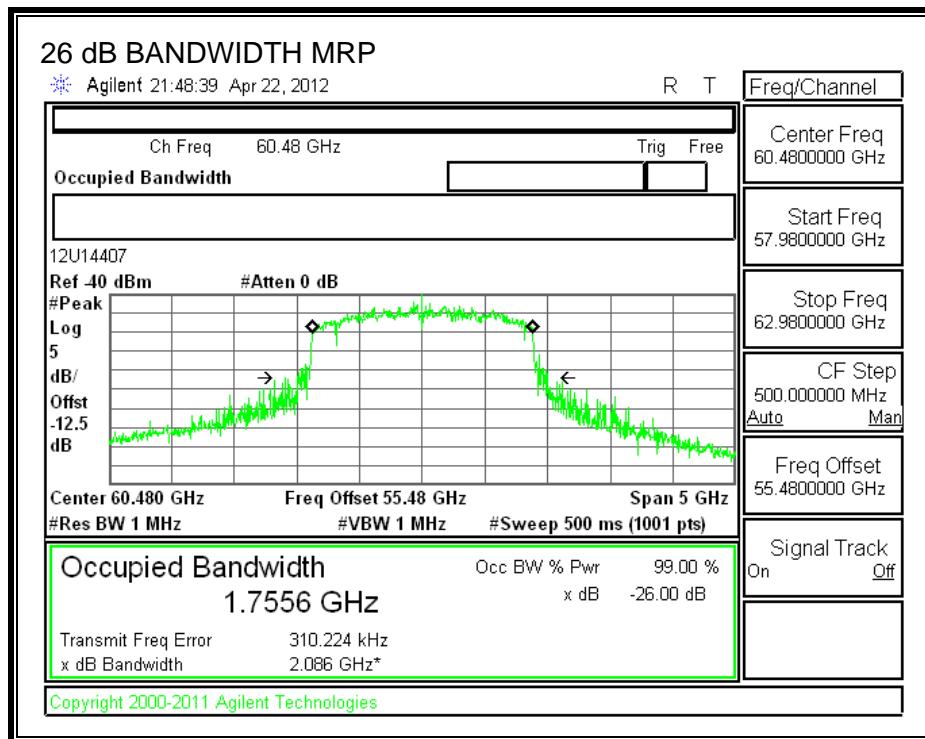


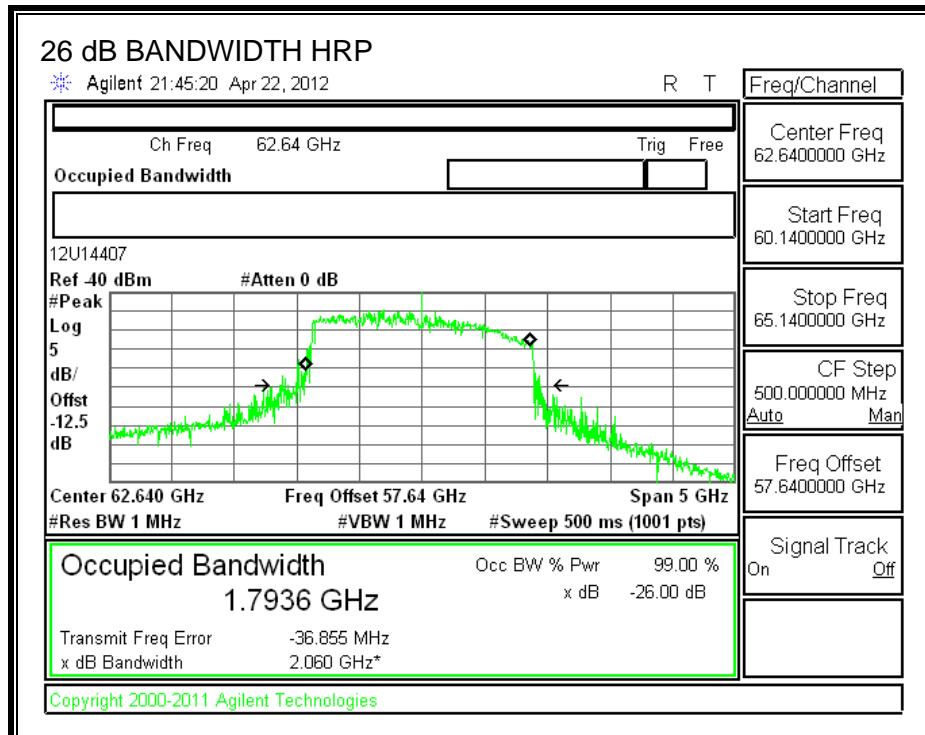


7.2.3. Results for HRP Channels

Channel	Frequency (GHz)	99% Bandwidth (GHz)	26 dB Bandwidth (GHz)
HRP	60.48	1.7556	2.0860
HRP	62.64	1.7936	2.060

99% and 26 dB BANDWIDTH





7.3. POWER DENSITY

LIMIT

§15.255 (b) Within the 57-64 GHz band, emission levels shall not exceed the following:

(1) For products other than fixed field disturbance sensors, the average power density of any emission, measured during the transmit interval, shall not exceed 9 $\mu\text{W}/\text{cm}^2$, as measured 3 meters from the radiating structure, and the peak power density of any emission shall not exceed 18 $\mu\text{W}/\text{cm}^2$, as measured 3 meters from the radiating structure.

(4) Peak power density shall be measured with an RF detector that has a detection bandwidth that encompasses the 57-64 GHz band and has a video bandwidth of at least 10 MHz, or using an equivalent measurement method.

(5) The average emission limits shall be calculated, based on the measured peak levels, over the actual time period during which transmission occurs.

Per FCC KDB Publication 200443, Millimeter Wave Test Procedures, If the emission under investigation is not pulsed, then the average levels may be measured by using a video filtering technique (i.e., VBW << RBW).

TEST PROCEDURE

Measurements are made at a distance greater than or equal to the far field boundary distance.

The peak power is measured by integrating the spectral envelope over the 26 dB EBW.

The measured power level is converted to EIRP using the Friis equation:

$$\text{EIRP} = P_T * G_T = (P_R / G_R) * (4 * \pi * D / \lambda)^2$$

where:

G_R is the gain of the receive measurement antenna

D is the measurement distance

λ is the wavelength

The EIRP is converted to Power Density using the equation:

$$P_D = \text{EIRP} / (4 * \pi * D_s^2)$$

where:

D_s is the specification distance

FAR FIELD BOUNDARY CALCULATIONS

The far-field boundary is given in FCC KDB Publication 200443 as:

$$R_{\text{far field}} = (2 * L^2) / \lambda$$

where:

L = Largest Antenna Dimension, including the reflector, in meters

λ = wavelength in meters

Frequency (GHz)	L (m)	Lambda (m)	R (Far Field) (m)
60.48	0.015	0.0050	0.09
62.64	0.015	0.0048	0.09

7.3.1. Results for LRP Channels

LRP PEAK POWER DENSITY RESULTS

CHANNEL-LOW

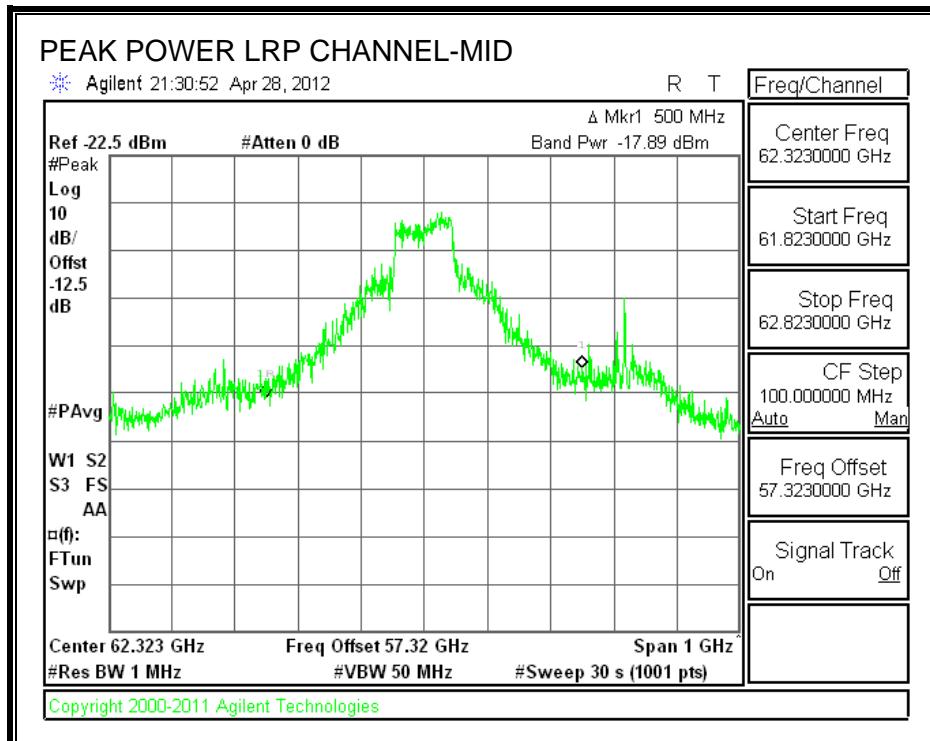
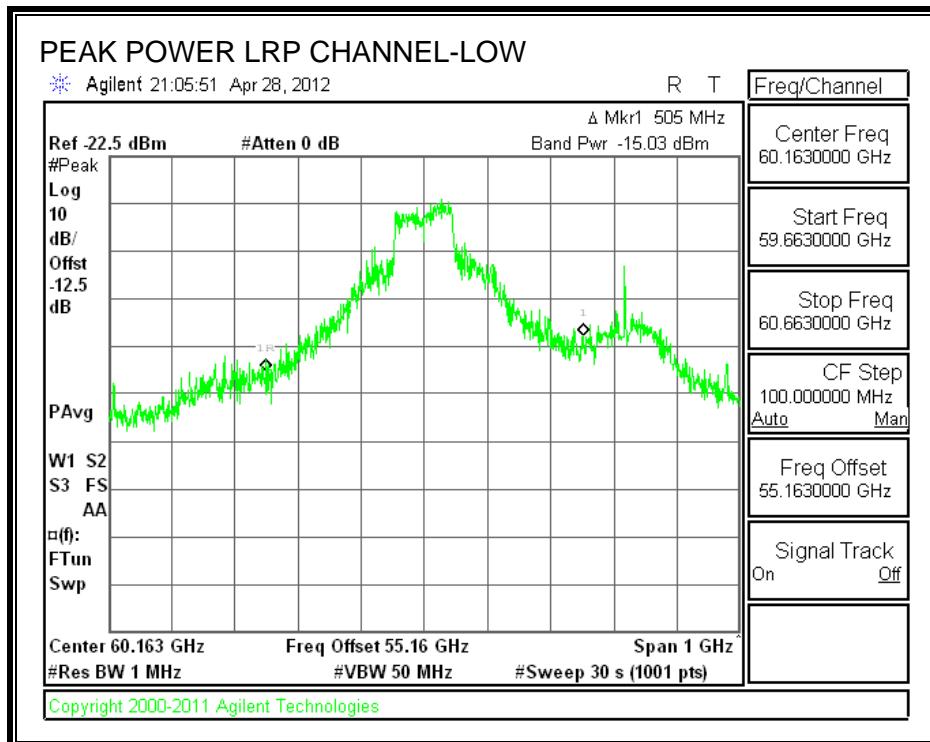
Frequency (GHz)	Measurement Distance (m)	Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
60.163	1.50	-15.03	23.00	33.5
EIRP (W)	Specification Distance (m)	Power Density (W/m^2)	Power Density (uW/cm^2)	Peak Limit (uW/cm^2)
2.247	3.0	0.0199	1.99	18

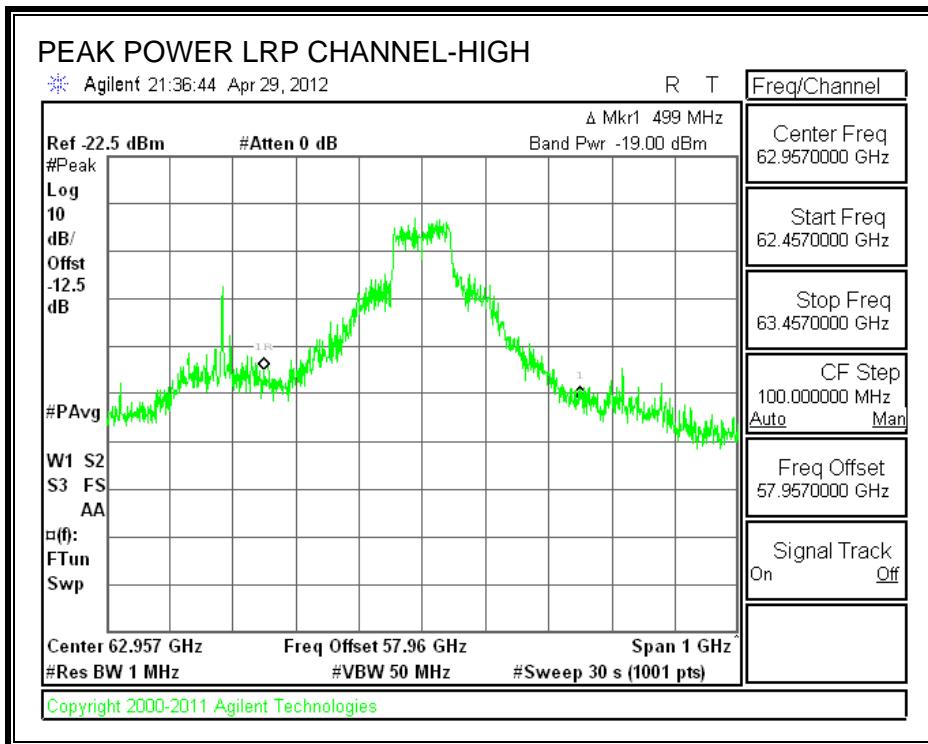
CHANNEL-MID

Frequency (GHz)	Measurement Distance (m)	Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
62.323	1.50	-17.89	23.00	31.0
EIRP (W)	Specification Distance (m)	Power Density 23	3 Density (uW/cm^2)	Peak Limit (uW/cm^2)
1.248	3.0	0.0110	1.10	18

CHANNEL-HIGH

Frequency (GHz)	Measurement Distance (m)	Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
62.957	1.50	-19.00	23.00	29.9
EIRP (W)	Specification Distance (m)	Power Density (W/m^2)	Power Density (uW/cm^2)	Peak Limit (uW/cm^2)
0.986	3.0	0.0087	0.87	18





LRP AVERAGE POWER DENSITY RESULTS

CHANNEL-LOW

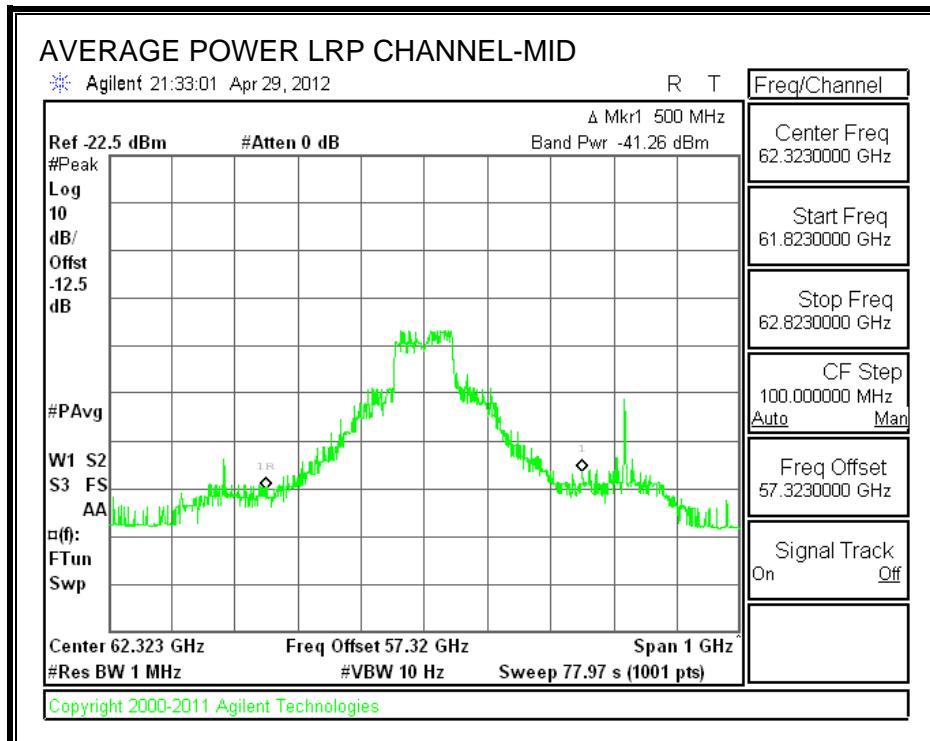
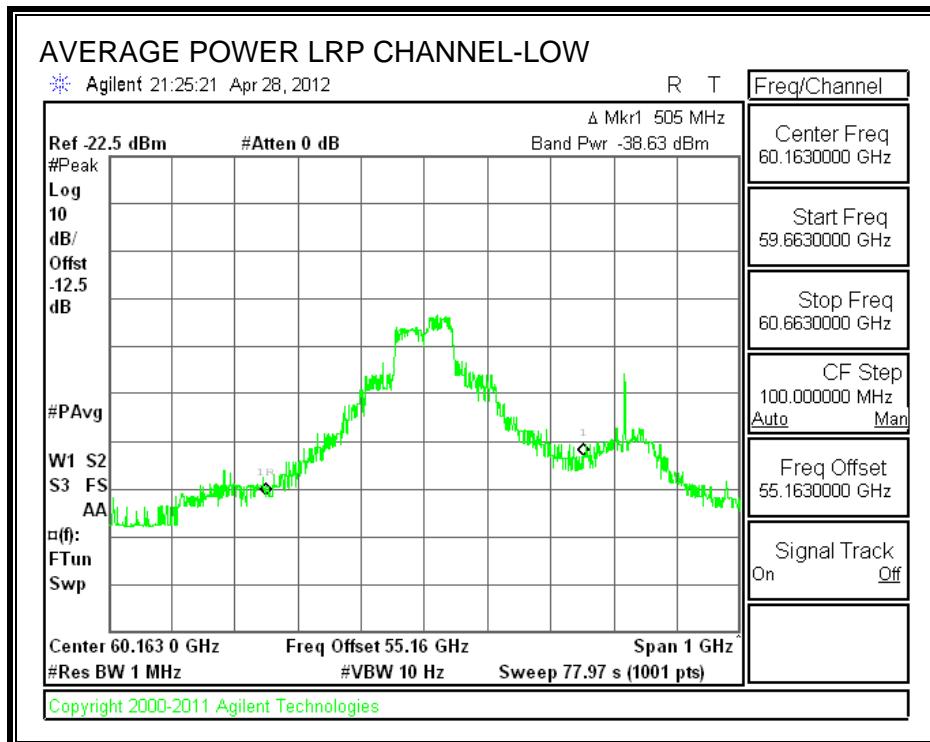
Frequency (GHz)	Measurement Distance (m)	Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
60.163	1.50	-38.63	23.00	9.9
EIRP (W)	Specification Distance (m)	Power Density (W/m ²)	Power Density (uW/cm ²)	Average Limit (uW/cm ²)
0.010	3.0	0.0001	0.009	9

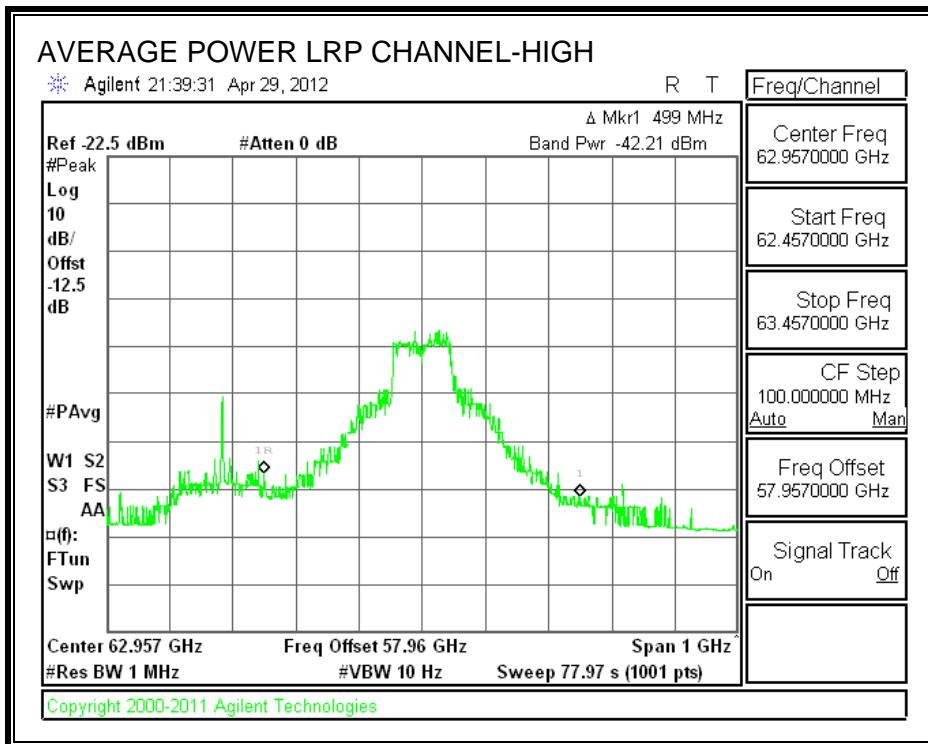
CHANNEL-MID

Frequency (GHz)	Measurement Distance (m)	Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
62.323	1.50	-41.26	23.00	7.6
EIRP (W)	Specification Distance (m)	Power Density 23	3 Density (uW/cm ²)	Average Limit (uW/cm ²)
0.006	3.0	0.0001	0.005	9

CHANNEL-HIGH

Frequency (GHz)	Measurement Distance (m)	Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
62.957	1.50	-42.21	23.00	6.7
EIRP (W)	Specification Distance (m)	Power Density (W/m ²)	Power Density (uW/cm ²)	Average Limit (uW/cm ²)
0.005	3.0	0.0000	0.004	9





7.3.2. Results for MRP Channels

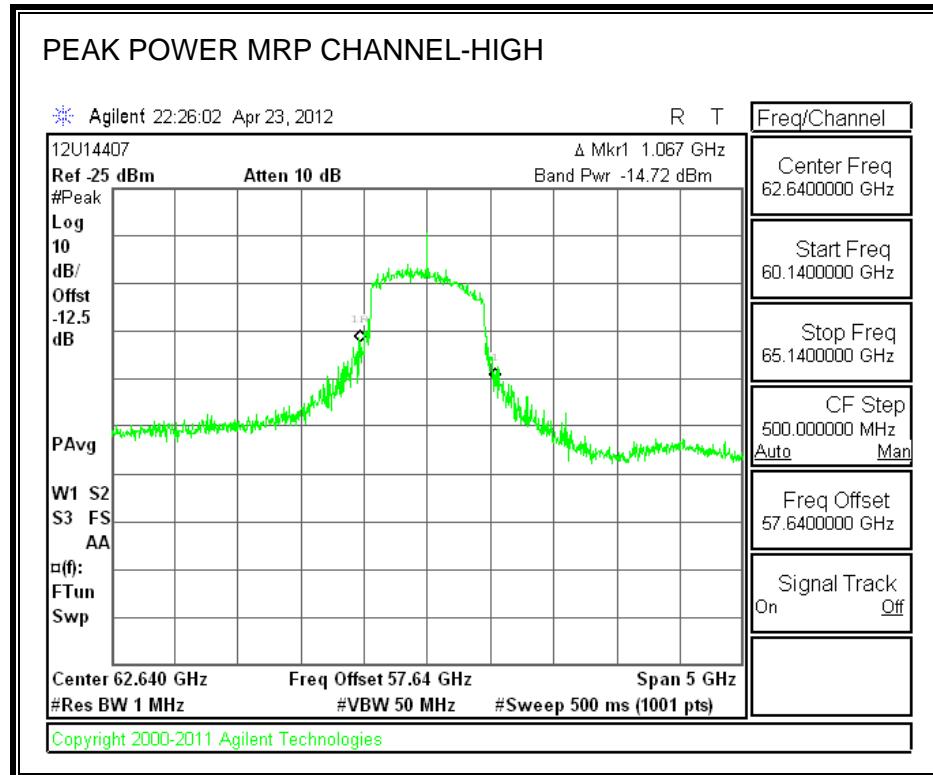
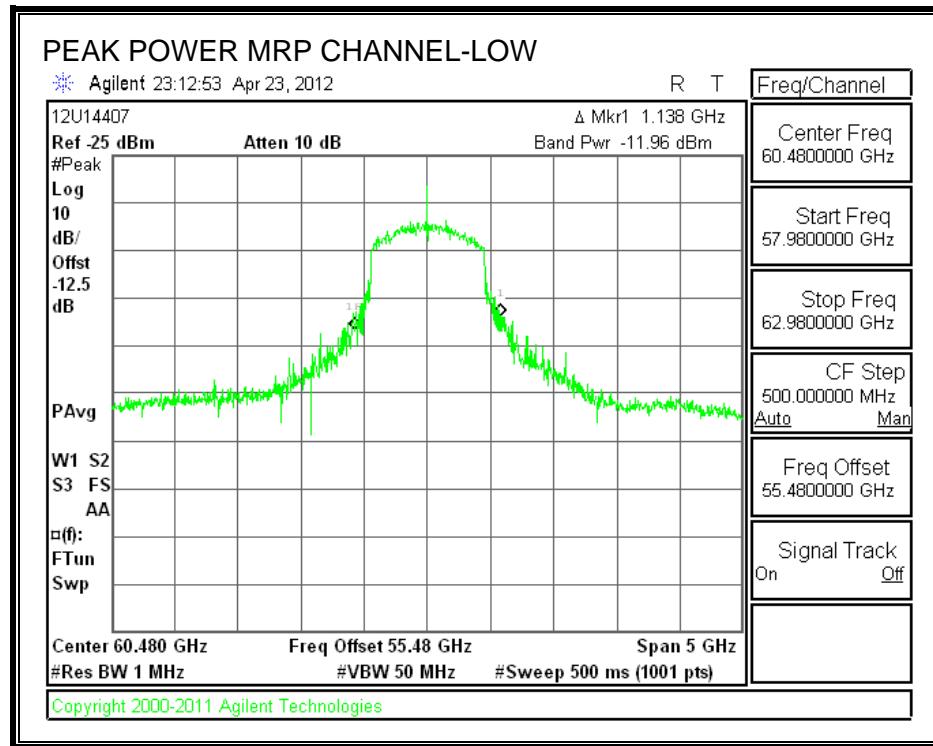
MRP PEAK POWER DENSITY RESULTS

MRP PEAK POWER DENSITY-LOW

Frequency (GHz)	Measurement Distance (m)	Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
60.48	1.50	-11.96	23.00	36.6
EIRP (W)	Specification Distance (m)	Power Density (W/m^2)	Power Density (uW/cm^2)	Peak Limit (uW/cm^2)
4.604	3.0	0.0407	4.07	18

MRP PEAK POWER DENSITY-HIGH

Frequency (GHz)	Measurement Distance (m)	Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
62.64	1.50	-14.72	23.00	34.2
EIRP (W)	Specification Distance (m)	Power Density (W/m^2)	Power Density (uW/cm^2)	Peak Limit (uW/cm^2)
2.616	3.0	0.0231	2.31	18



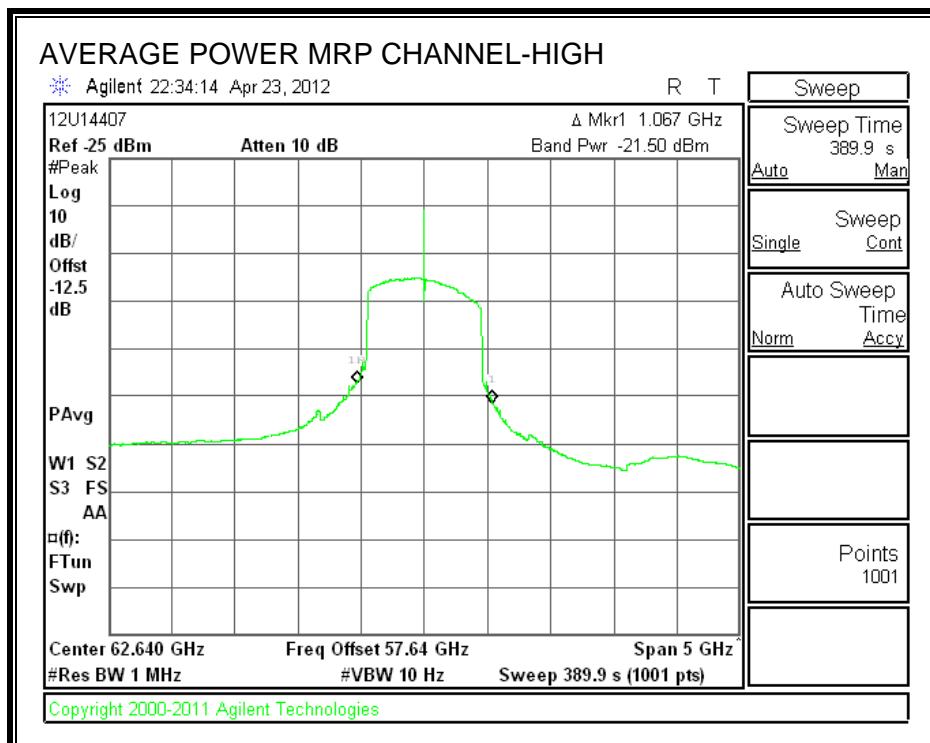
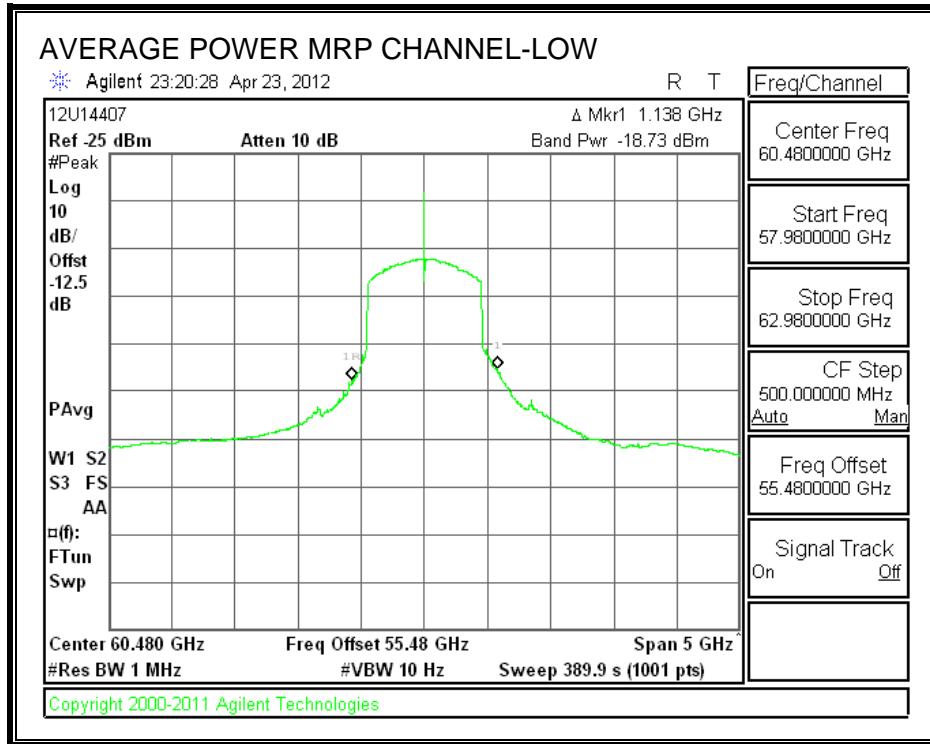
MRP AVERAGE POWER DENSITY RESULTS

MRP AVERAGE POWER DENSITY-LOW

Frequency (GHz)	Measurement Distance (m)	Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
60.48	1.50	-18.73	23.00	29.9
EIRP (W)	Specification Distance (m)	Power Density (W/m^2)	Power Density (uW/cm^2)	Average Limit (uW/cm^2)
0.969	3.0	0.0086	0.86	9

MRP AVERAGE POWER DENSITY-HIGH

Frequency (GHz)	Measurement Distance (m)	Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
62.64	1.50	-21.50	23.00	27.4
EIRP (W)	Specification Distance (m)	Power Density (W/m^2)	Power Density (uW/cm^2)	Average Limit (uW/cm^2)
0.549	3.0	0.0049	0.49	9



7.3.3. Results for HRP Channels

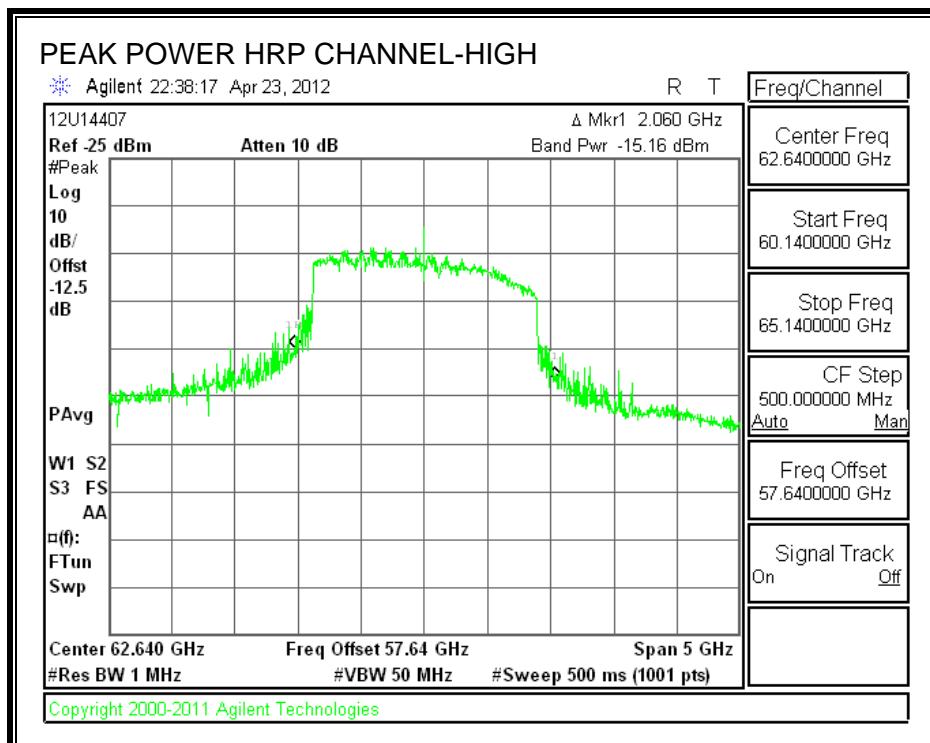
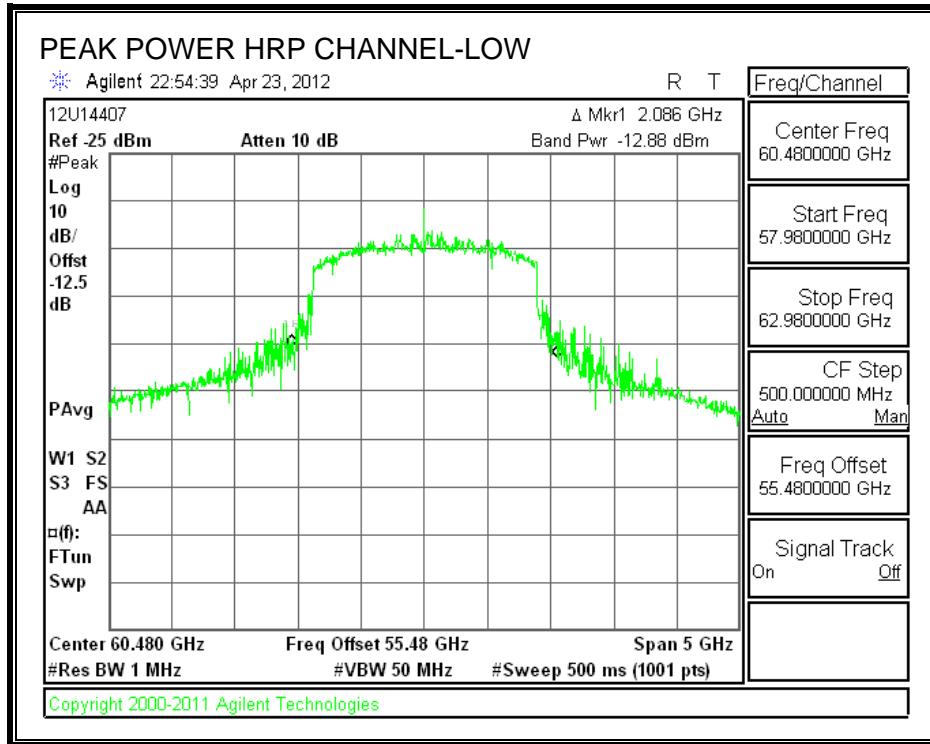
HRP PEAK POWER DENSITY RESULTS

HRP PEAK POWER DENSITY-LOW

Frequency (GHz)	Measurement Distance (m)	Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
60.48	1.50	-12.88	23.00	35.7
EIRP (W)	Specification Distance (m)	Power Density (W/m^2)	Power Density (uW/cm^2)	Peak Limit (uW/cm^2)
3.725	3.0	0.0330	3.30	18

HRP PEAK POWER DENSITY-HIGH

Frequency (GHz)	Measurement Distance (m)	Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
62.64	1.50	-15.16	23.00	33.7
EIRP (W)	Specification Distance (m)	Power Density (W/m^2)	Power Density (uW/cm^2)	Peak Limit (uW/cm^2)
2.364	3.0	0.0209	2.09	18



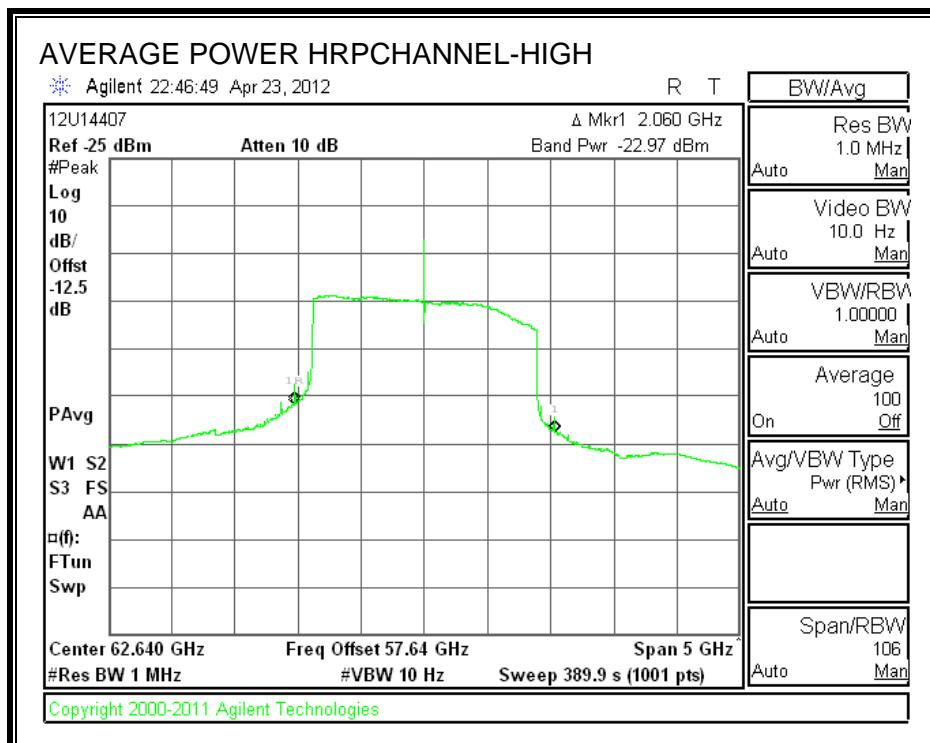
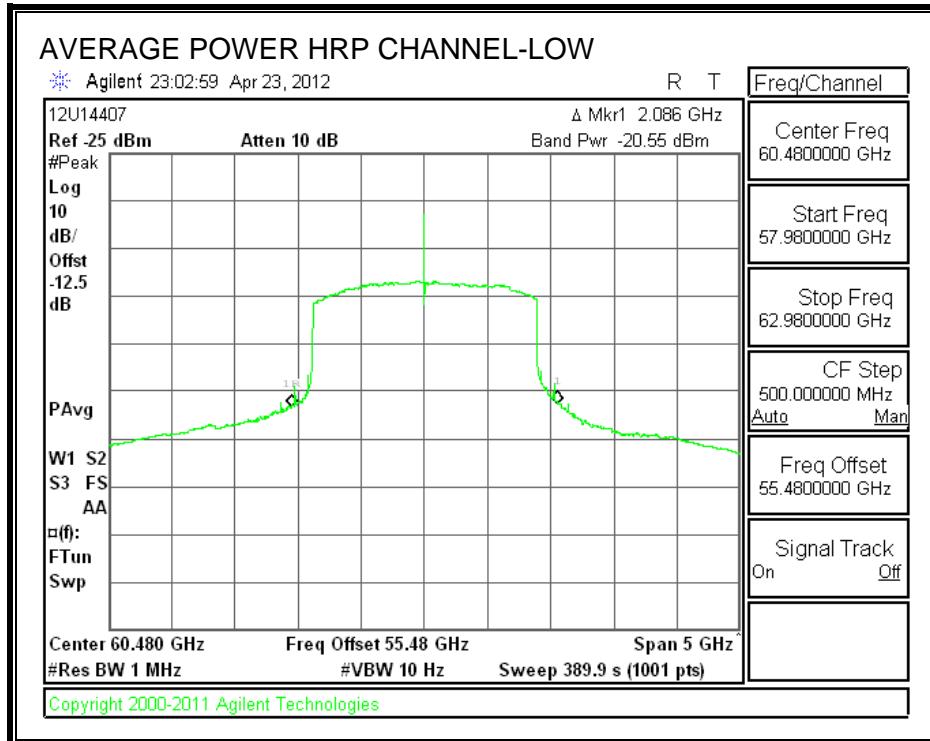
HRP AVERAGE POWER DENSITY RESULTS

HRP AVERAGE POWER DENSITY-LOW

Frequency (GHz)	Measurement Distance (m)	Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
60.48	1.50	-20.55	23.00	28.0
EIRP (W)	Specification Distance (m)	Power Density (W/m^2)	Power Density (uW/cm^2)	Average Limit (uW/cm^2)
0.637	3.0	0.0056	0.56	9

HRP AVERAGE POWER DENSITY-HIGH

Frequency (GHz)	Measurement Distance (m)	Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
62.64	1.50	-22.97	23.00	25.9
EIRP (W)	Specification Distance (m)	Power Density (W/m^2)	Power Density (uW/cm^2)	Average Limit (uW/cm^2)
0.391	3.0	0.0035	0.35	9



7.4. PEAK OUTPUT POWER

LIMIT

§15.255 (e) Except as specified elsewhere in this paragraph (e), the total peak transmitter output power shall not exceed 500 mW.

§15.255 (e) (1) Transmitters with an emission bandwidth of less than 100 MHz must limit their peak transmitter output power to the product of 500 mW times their emission bandwidth divided by 100 MHz. For the purposes of this paragraph (e)(1), emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (e.g. for frequency hopping devices).

§15.255 (e) (2) Peak transmitter output power shall be measured with an RF detector that has a detection bandwidth that encompasses the 57–64 GHz band and that has a video bandwidth of at least 10 MHz, or using an equivalent measurement method.

§15.255 (e) (2) For purposes of demonstrating compliance with this paragraph (e), corrections to the transmitter output power may be made due to the antenna and circuit loss.

PROCEDURE

The maximum EUT antenna gain is subtracted from the Peak EIRP.

7.4.1. Results for LRP Channels

PEAK OUTPUT POWER

CHANNEL-LOW

Frequency (GHz)	EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
60.163	33.5	16.00	17.50	56.2	92.6	463

CHANNEL-MID

Frequency (GHz)	EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
62.323	31.0	16.00	15.00	31.6	93.2	466

CHANNEL-HIGH

Frequency (GHz)	EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
62.957	29.9	16.00	13.90	24.5	93.2	466

7.4.2. Results for MRP Channels

MRP PEAK OUTPUT POWER-LOW

Frequency (GHz)	EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
60.48	36.6	18.00	18.60	72.4	880	500

MRP PEAK OUTPUT POWER-HIGH

Frequency (GHz)	EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
62.64	34.2	18.00	16.20	41.7	865	500

7.4.3. Results for HRP Channels

HRP PEAK OUTPUT POWER-LOW

Frequency (GHz)	EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
60.48	35.7	18.00	17.70	58.9	1775	500

HRP PEAK OUTPUT POWER-HIGH

Frequency (GHz)	EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
62.64	33.7	18.00	15.70	37.2	1775	500

7.5. AVERAGE OUTPUT POWER

LIMIT

For reporting purposes.

PROCEDURE

The maximum EUT antenna gain is subtracted from the Average EIRP.

7.5.1. Results for MRP Channels

MRP AVERAGE OUTPUT POWER

CHANNEL	Frequency (GHz)	EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)
LOW	60.48	29.9	18.00	11.90	15.49
HIGH	62.64	27.4	18.00	9.40	8.71

7.5.2. Results for HRP Channels

HRP AVERAGE OUTPUT POWER

CHANNEL	Frequency (GHz)	EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)
LOW	60.48	28.0	18.00	10.00	10.00
HIGH	62.64	25.9	18.00	7.90	6.17

7.6. SPURIOUS EMISSIONS

LIMITS

§15.255 (c) (1) The power density of any emissions outside the 57–64 GHz band shall consist solely of spurious emissions.

§15.255 (c) (2) Radiated emissions below 40 GHz shall not exceed the general limits in §15.209.

§15.255 (c) (3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm² at a distance of 3 meters.

§15.255 (c) (4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

§15.255 (d) Only spurious emissions and transmissions related to a publicly accessible coordination channel, whose purpose is to coordinate operation between diverse transmitters with a view towards reducing the probability of interference throughout the 57–64 GHz band, are permitted in the 57–57.05 GHz band.

Note to paragraph (d): The 57–57.05 GHz is reserved exclusively for a publicly-accessible coordination channel. The development of standards for this channel shall be performed pursuant to authorizations issued under part 5 of this chapter.

PROCEDURE FOR 30 MHz TO 40 GHz

Measurements are made with the antenna feeding a spectrum analyzer via a preamplifier and cables.

PROCEDURE FOR 40 TO 200 GHz

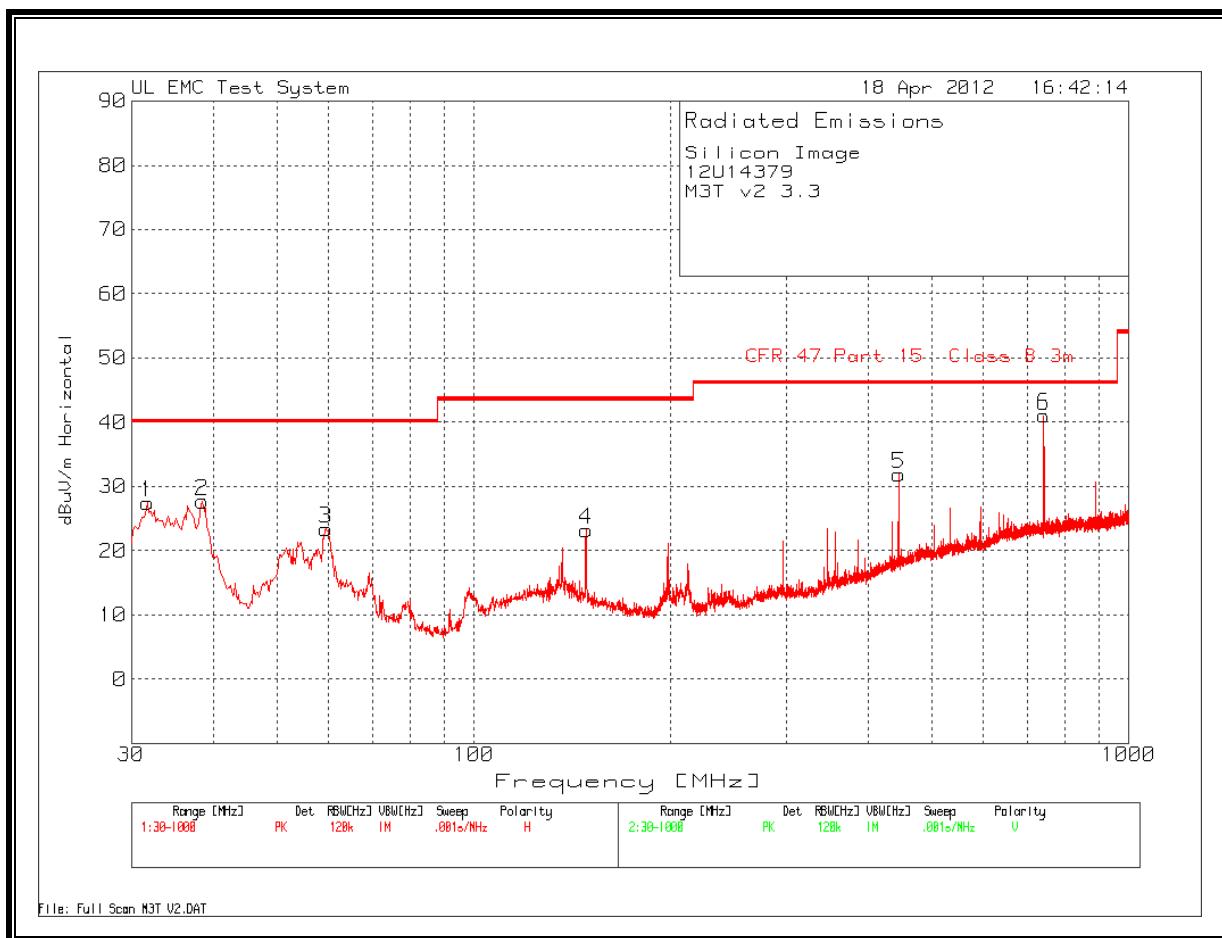
External harmonic mixers are utilized.

The antenna is scanned around the entire perimeter surface of the EUT, in both horizontal and vertical polarizations, at a maximum distance of 5 cm from the EUT.

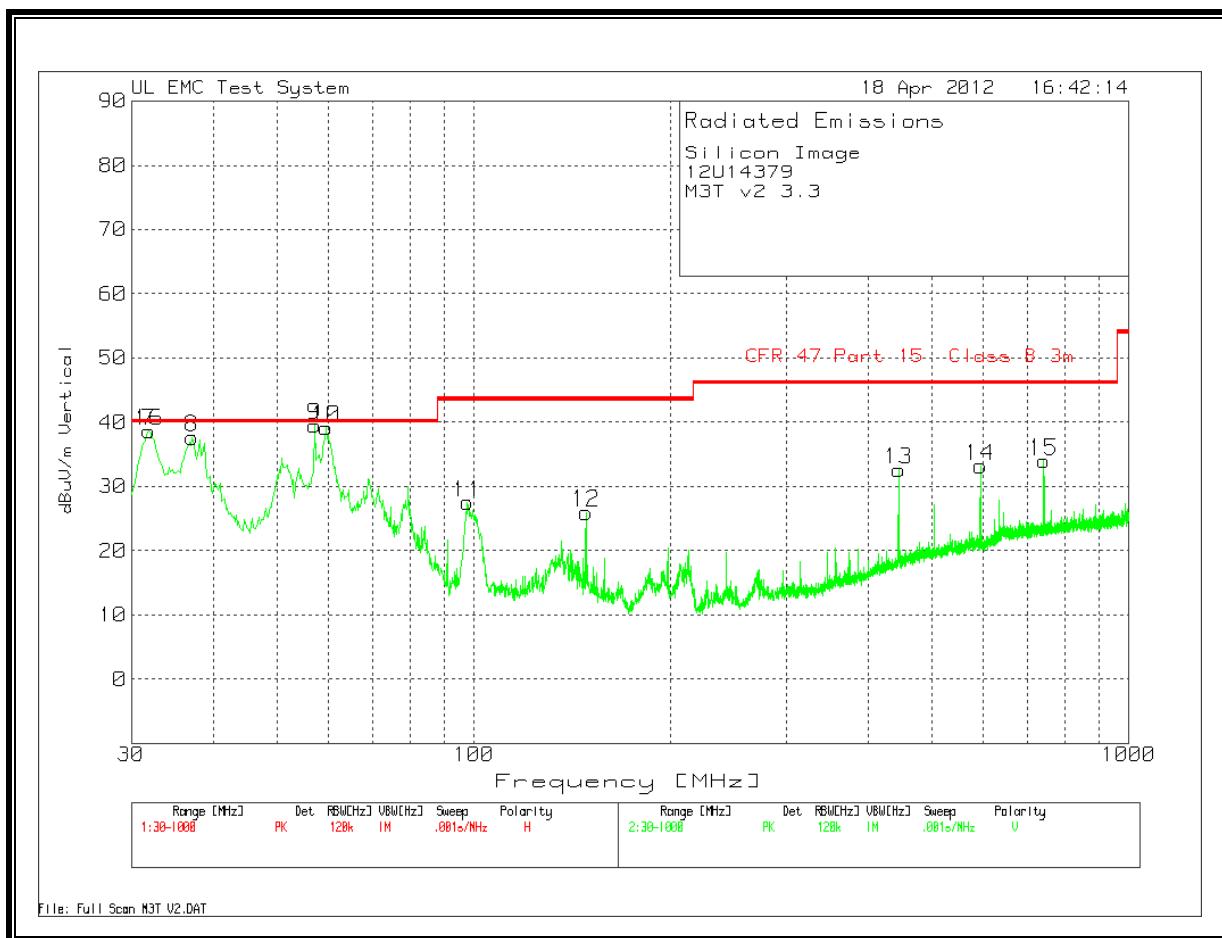
A final test is made at any frequencies at which emissions are found. During this final scan, the antenna is kept no further from the EUT than the maximum distance calculated for each mixer band that yields a minimum system noise floor at least 6 dB below the spurious emissions limit.

The power is measured, the EIRP is calculated, then the extrapolated power density at a 3 meter distance is calculated.

TX AND RX SPURIOUS EMISSION 30 TO 1000 MHz (HORIZONTAL PLOT)



TX AND RX SPURIOUS EMISSION 30 TO 1000 MHz (VERTICAL PLOT)



TX AND RX SPURIOUS EMISSION 30 TO 1000 MHz VERTICAL AND HORIZONTAL DATA

Silicon Image									
12U14379									
M3T v2.3.3									
Horizontal 30 - 1000MHz									
Test Frequency	Meter Reading	Detector	25MHz-1GHz ChmbrA Amplified.TX [dB]	T185 Sunol JB1.TXT [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
31.7446	35	PK	-27.5	20	27.5	40	-12.5	100	Horz
38.5292	40.22	PK	-27.4	14.9	27.72	40	-12.28	301	Horz
59.4644	43.47	PK	-27.2	7.1	23.37	40	-16.63	400	Horz
148.4392	37.41	PK	-26.6	12.4	23.21	43.5	-20.29	201	Horz
445.6035	40.37	PK	-25.2	16.7	31.87	46	-14.13	201	Horz
742.5739	43.95	PK	-23.4	20.5	41.05	46	-4.95	100	Horz
Vertical 30 - 1000MHz									
Test Frequency	Meter Reading	Detector	25MHz-1GHz ChmbrA Amplified.TX [dB]	T185 Sunol JB1.TXT [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
31.602	46.37	PK	-27.5	19.8	38.67	40	-1.33	99	Vert
31.602	37.51	QP	-27.5	20.1	30.11	40	-9.89	267	Vert
37.1723	49.17	PK	-27.4	15.9	37.67	40	-2.33	99	Vert
57.5441	59.81	PK	-27.3	7	39.51	40	-0.49	301	Vert
57.5441	47.8	QP	-27.3	7	27.5	40	-12.5	267	Vert
59.507	59.26	PK	-27.2	7.1	39.16	40	-0.84	99	Vert
59.507	53.77	QP	-27.2	7.2	33.77	40	-6.23	267	Vert
97.8457	45.14	PK	-26.9	9.3	27.54	43.5	-15.96	99	Vert
148.4392	40.19	PK	-26.6	12.4	25.99	43.5	-17.51	99	Vert
445.6035	41.12	PK	-25.2	16.7	32.62	46	-13.38	99	Vert
593.8949	39.01	PK	-24.1	18.3	33.21	46	-12.79	99	Vert
742.5739	36.88	PK	-23.4	20.5	33.98	46	-12.02	99	Vert

The amplitude of the above spurious emissions are independent of mode (MRP/HRP), data rate, and MRP/HRP Channel number.

TX AND RX SPURIOUS EMISSIONS 1 TO 40 GHz VERTICAL AND HORIZONTAL DATA

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber-B															
Company:	Silicon Image														
Project #:	12U14379														
Date:	4/5/2012														
Test Engineer:	S.Aguilar														
Configuration:	Default: Model M3T transmitter														
Mode:	Default														
Test Equipment:															
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit			
T59; S/N: 3245 @3m			T145 Agilent 3008A0056									FCC 15.209			
Hi Frequency Cables															
3' cable 22807700			12' cable 22807600			20' cable 22807500			HPF			Reject Filter			Peak Measurements RBW=VBW=1MHz
3' cable 22807700			12' cable 22807600			20' cable 22807500									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	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
1.117	3.0	43.07	30.84	24.5	2.8	-35.9	0.0	0.0	34.4	22.2	74	54	-39.6	-31.8	H
1.117	3.0	45.19	31.74	24.5	2.8	-35.9	0.0	0.0	36.6	23.1	74	54	-37.4	-30.9	V
1.260	3.0	44.56	32.51	25.0	2.9	-35.8	0.0	0.0	36.7	24.6	74	54	-37.3	-29.4	H
1.260	3.0	46.21	33.32	25.0	2.9	-35.8	0.0	0.0	38.3	25.4	74	54	-35.7	-28.6	V
2.670	3.0	57.92	54.28	29.3	4.5	-35.2	0.0	0.0	56.5	52.8	74	54	-17.5	-1.2	H
2.670	3.0	57.47	52.26	29.3	4.5	-35.2	0.0	0.0	56.0	50.8	74	54	-18.0	-3.2	V
2.818	3.0	49.41	38.58	29.7	4.7	-35.2	0.0	0.0	48.5	37.7	74	54	-25.5	-16.3	H
2.818	3.0	48.30	36.50	29.7	4.7	-35.2	0.0	0.0	47.4	35.6	74	54	-26.6	-18.4	V
2.967	3.0	47.99	42.33	30.1	4.8	-35.2	0.0	0.0	47.7	42.0	74	54	-26.3	-12.0	H
2.967	3.0	53.14	47.96	30.1	4.8	-35.2	0.0	0.0	52.9	47.7	74	54	-21.1	-6.3	V
4.481	3.0	37.59	25.60	32.8	6.0	-34.8	0.0	0.0	41.6	29.6	74	54	-32.4	-24.4	H
4.481	3.0	38.40	25.59	32.8	6.0	-34.8	0.0	0.0	42.4	29.6	74	54	-31.6	-24.4	V

Rev. 11.10.11

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 3m Chamber															
Company:	SILICON IMAGE														
Project #:	12U14407														
Date:	4/30/2012														
Test Engineer:	MENGISTU MEKURIA														
Configuration:	EUT AND SUPPORT EQUIPMENT														
Mode:	VIDEO AND AUDIO TX/RX														
<u>Test Equipment:</u>															
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit			
T73; S/N: 6717 @3m			T144 Miteq 3008A00931			T88 Miteq 26-40GHz			T89; ARA 18-26GHz; S/N:1049			FCC 15.209			
Hi Frequency Cables															
3' cable 22807700			12' cable 22807600			20' cable 22807500			HPF			Reject Filter			Peak Measurements RBW=VBW=1MHz
3' cable 22807700			12' cable 22807600			20' cable 22807500									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)
24.192	3.0	37.3	26.1	33.9	17.2	-34.1	0.0	0.0	54.3	43.0	74	54	-19.7	-11.0	V
25.056	3.0	40.4	31.9	33.9	18.6	-32.7	0.0	0.0	60.3	51.7	74	54	-13.7	-2.3	V
24.192	3.0	36.6	24.1	33.9	17.2	-34.1	0.0	0.0	53.6	41.1	74	54	-20.4	-12.9	H
25.056	3.0	38.5	25.2	33.9	18.6	-32.7	0.0	0.0	58.3	45.1	74	54	-15.7	-8.9	H
Rev. 07.08.11															
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										

The amplitude of the above spurious emissions are independent of mode (LRP/MRP/HRP) and data rate. The emission at 24.192 GHz corresponds to MRP/HRP Channel 2 and the emission at 25.056 GHz corresponds to MRP/HRP Channel 3.

TX AND RX SPURIOUS EMISSIONS 40 TO 200 GHz

PEAK MEASUREMENT

Note: The peak density is less than the average limit

MRP/HRP Channel 2 (Low)

Frequency (GHz)	Measurement Distance (m)	Peak Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
48.384	0.400	-77.41	20.00	-39.2
EIRP (W)	Specification Distance (m)	Power Density (W/m^2)	Power Density (pW/cm^2)	Limit (pW/cm^2)
1.19E-07	3.0	1.05E-09	0.11	90

MRP/HRP Channel 3 (High)

Frequency (GHz)	Measurement Distance (m)	Peak Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
50.112	0.400	-74.41	20.00	-35.9
EIRP (W)	Specification Distance (m)	Power Density (W/m^2)	Power Density (pW/cm^2)	Limit (pW/cm^2)
2.55E-07	3.0	2.26E-09	0.23	90

The amplitude of the above spurious emissions are independent of mode (LRP/MRP/HRP) and data rate.

7.7. AC MAINS LINE CONDUCTED EMISSIONS

LIMITS

§15.207
IC RSS-GEN, Section 7.2.2

Frequency range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Notes:

1. The lower limit shall apply at the transition frequencies
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

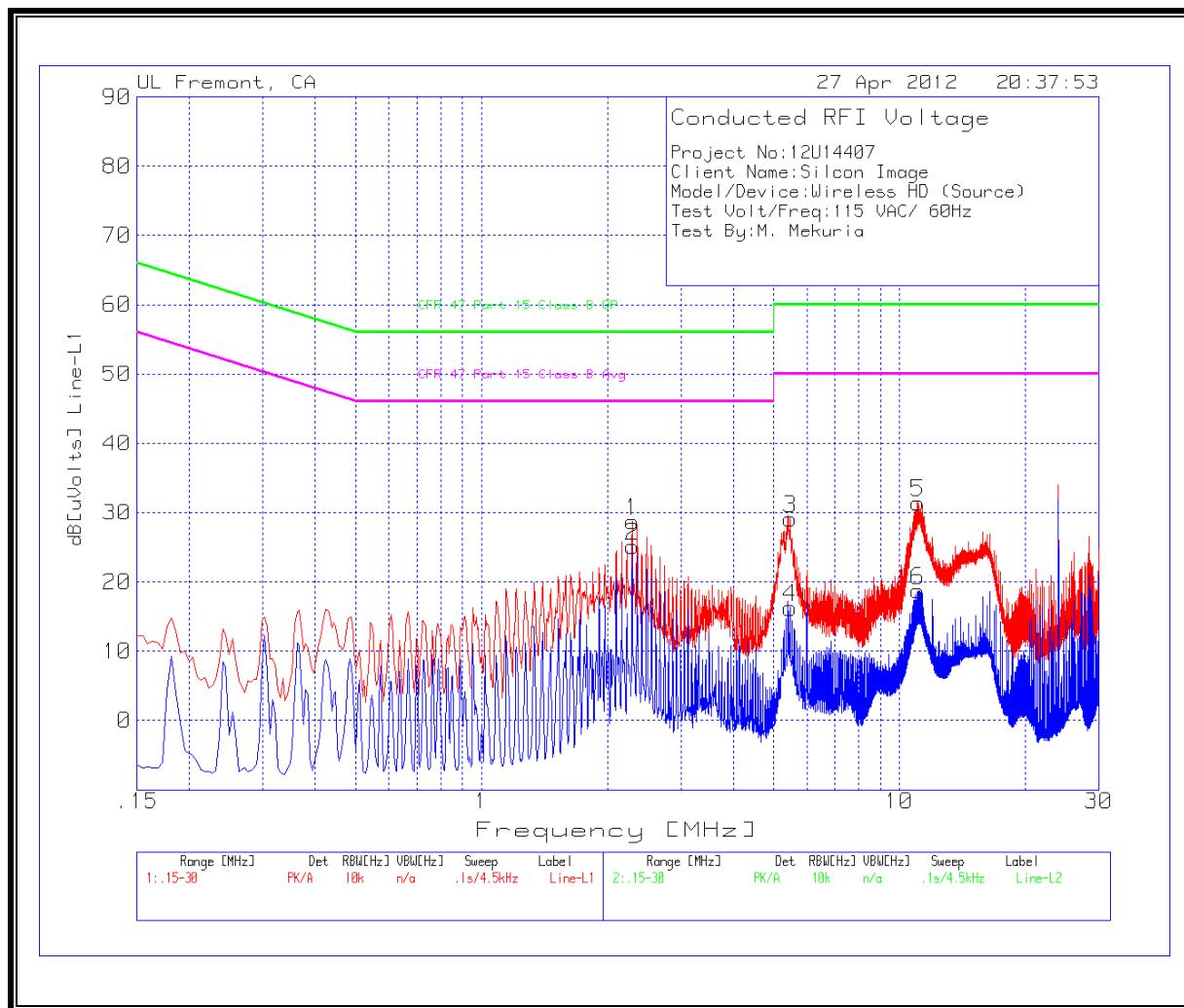
TEST PROCEDURE

ANSI C63.4

6 WORST EMISSIONS

Project No:12U14407									
Client Name:Silcon Image									
Model/Device:Wireless HD (Source)									
Test Volt/Freq:115 VAC/ 60Hz									
Test By:M. Mekuria									
Line-L1.15 - 30MHz									
Test Frequency	Meter Reading	Detector	T24 IL L1.TXT [dB]	LC Cables 1&3.TXT [dB]	dB[uVolts]	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
2.292	28.5	PK	0.1	0.1	28.7	56	-27.3	-	-
2.292	24.94	Av	0.1	0.1	25.14	-	-	46	-20.86
5.4735	28.92	PK	0.1	0.1	29.12	60	-30.88	-	-
5.4735	16.05	Av	0.1	0.1	16.25	-	-	50	-33.75
11.0715	31.13	PK	0.1	0.2	31.43	60	-28.57	-	-
11.0715	18.44	Av	0.1	0.2	18.74	-	-	50	-31.26
Line-L2.15 - 30MHz									
Test Frequency	Meter Reading	Detector	T24 IL L2.TXT [dB]	LC Cables 2&3.TXT [dB]	dB[uVolts]	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
5.397	29.79	PK	0.1	0.1	29.99	60	-30.01	-	-
5.397	15.44	Av	0.1	0.1	15.64	-	-	50	-34.36
11.265	30.85	PK	0.2	0.2	31.25	60	-28.75	-	-
11.265	17.48	Av	0.2	0.2	17.88	-	-	50	-32.12
24	33.48	PK	0.4	0.2	34.08	60	-25.92	-	-
24	27.66	Av	0.4	0.2	28.26	-	-	50	-21.74

LINE 1 RESULTS



LINE 2 RESULTS

