FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8
INDUSTRY CANADA RSS-102 ISSUE 4
CLASS II PERMISSIVE CHANGE

CERTIFICATION TEST REPORT

FOR

60GHz WIRELESSHD RECEIVER

MODEL NUMBER: SII-SK63101

FCC ID: UK2-SII-SK63101
IC: 6705A-SIISK63101

REPORT NUMBER: 12U14665-1, Revision A

ISSUE DATE: MARCH 7, 2013

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 LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	2/6/2013	As Issued	M. Heckrotte
A	3/7/2013	Added section to clarify RSS-102 Exemption	M. Heckrotte

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: 60GHz WIRELESSHD RECEIVER

MODEL: SII-SK63101

SERIAL NUMBER: a2:ef:a1:8a:53:50

DATE TESTED: DECEMBER 18 TO 22, 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 KDB 662911 d02 MIMO with Cross-Polarized Antenna, 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 Sink 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 receives High Definition Audio/Video from a WirelessHD Source radio device.

The EUT receives 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 receive antenna is a dual-polarized adaptive beam-steering array with a maximum gain of 15 dBi for each polarization.

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 dual-polarized scanning beam-steering array with a maximum gain of 13 dBi for each polarization.

The LRP modulation is BPSK.

5.1. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The antenna design is changed from a single-polarized antenna to a dual-polarized antenna by rotating half of the antenna elements by 90 degrees.

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.

Radiated measurements are utilized to show compliance with conducted power limits in accordance with KDB 662911. The highest measured peak output power is 19.7 dBm (93.2 mW), and is within 0.5 dB of the originally reported peak output power.

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	Cincon	TR20B033X	20033-0000853
Blu-ray Player	Sony	BDP-BX58	1192217
WiHD Source	Silicon Image	Prototype	Prototype
TV	Samsung	P23700HD	EM23HVLZ415106K

I/O CABLES

Horiz Average EIRP (dBm)	Horiz Average EIRP (W)	Vert Average EIRP (dBm)	Vert Average EIRP (W)	Total Average EIRP (W)	Total Average EIRP (dBm)
7.1	0.005	5.6	0.004	0.009	9.4

Separation Distance (cm)	Power Density (W/m^2)	IC Limit (W/m^2)	Power Density (mW/cm^2)	FCC Limit (mW/cm^2)
20	0.02	10	0.002	1

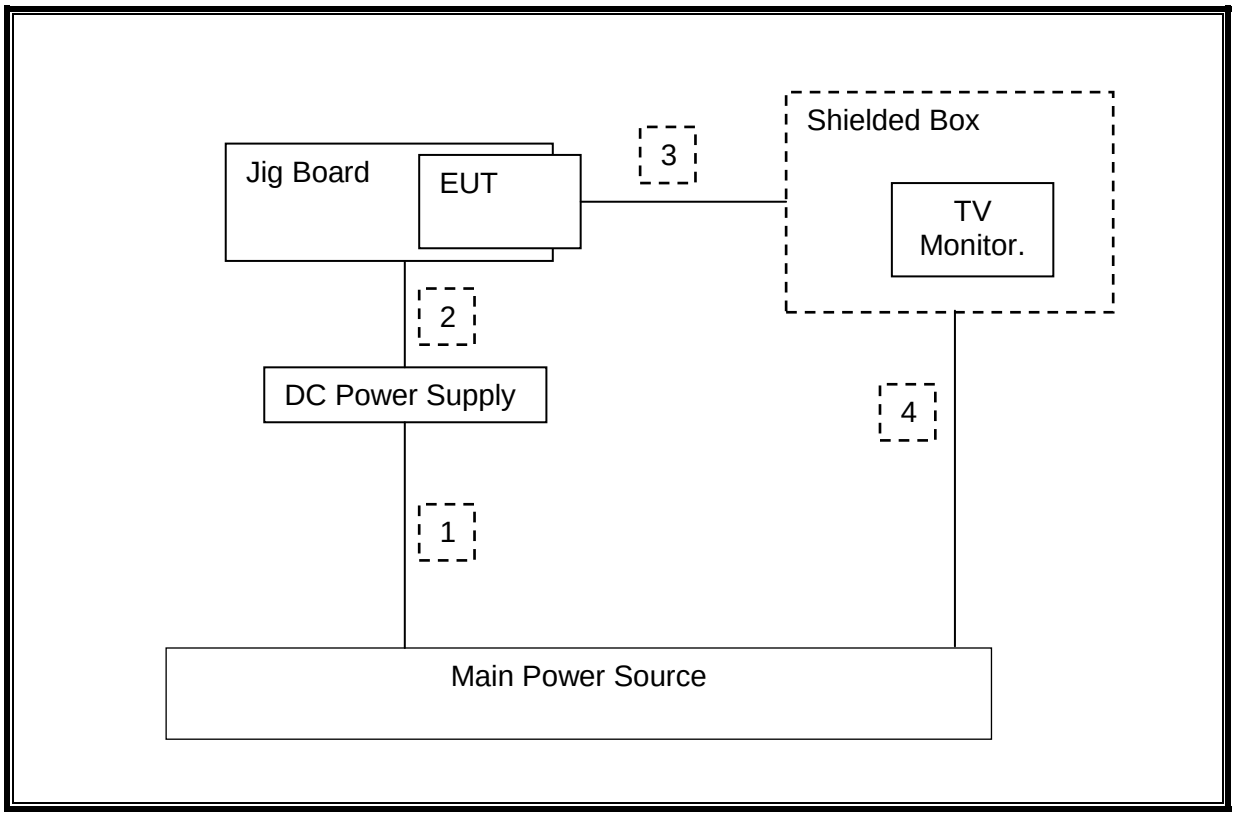
TEST SETUP

The Blu-ray player 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	10/21/2013
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01179	2/16/2013
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00996	5/11/2013
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	C01171	1/26/2013
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00558	2/21/2013
Antenna, Horn, 18 GHz	EMCO	3115	C00945	11/12/2013
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	10/22/2013
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	11/14/2013
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	C00981	6/14/2013
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	8/2/2013
Antenna, Horn, 75 GHz	CMI	HO15R	107	CNR
Downconverter, 67 GHz	Agilent	MT-463	12020	12/21/2013
Analog Signal Generator, 40 GHz	Agilent / HP	E8257D	C01177	9/9/2013
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

7. APPLICABLE LIMITS AND TEST RESULTS

7.1. 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

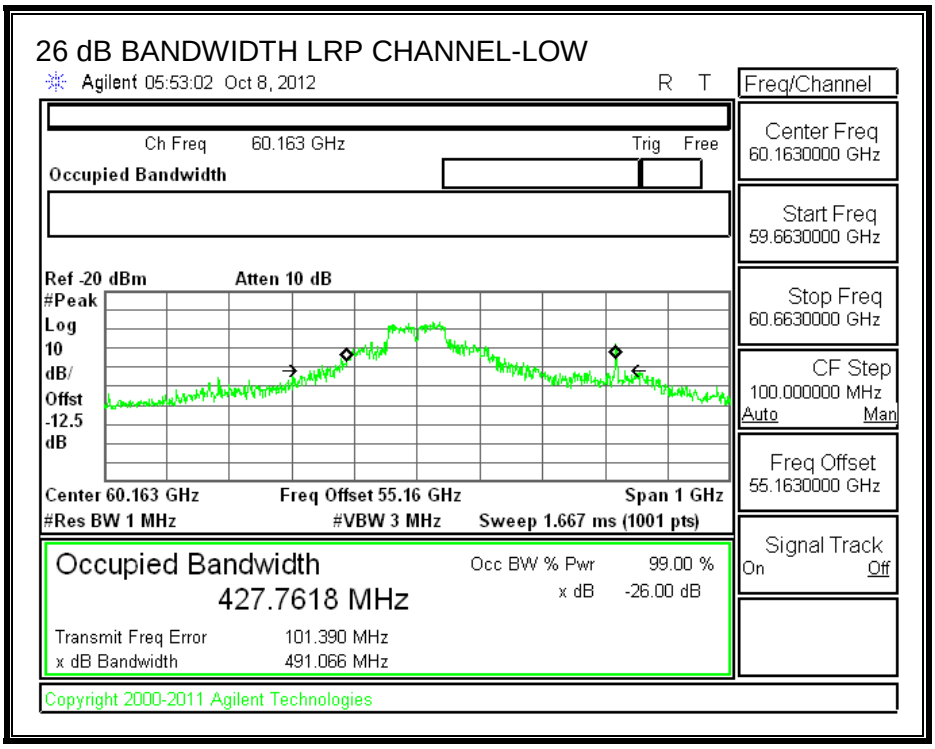
The spectrum analyzer and external mixer are set up to measure the radiated output of the transmitter.

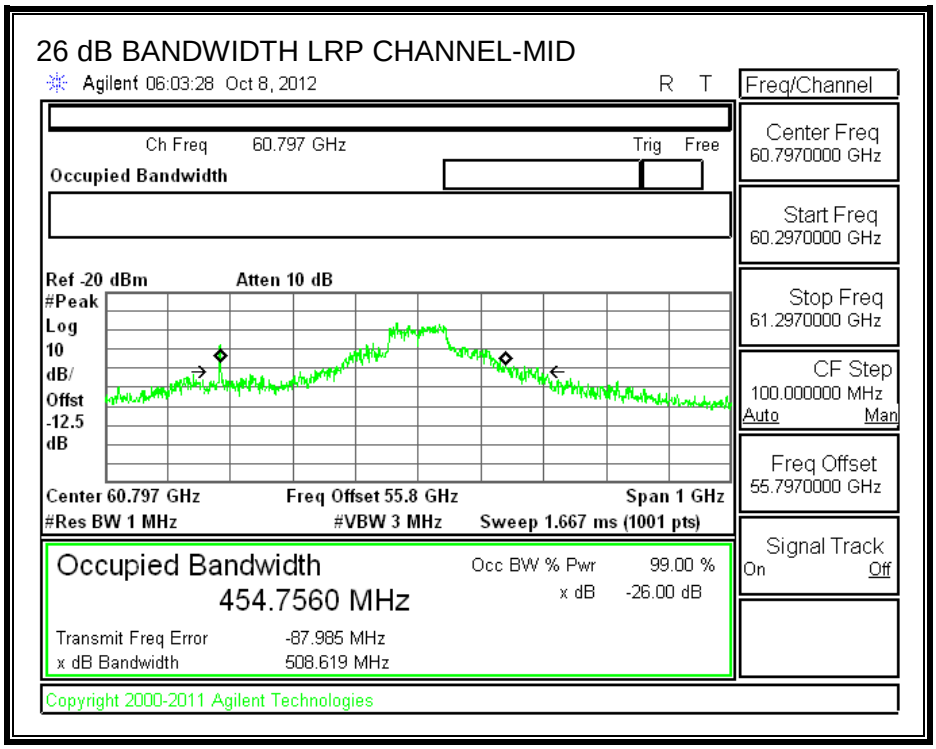
7.1.1. Results for LRP Channels

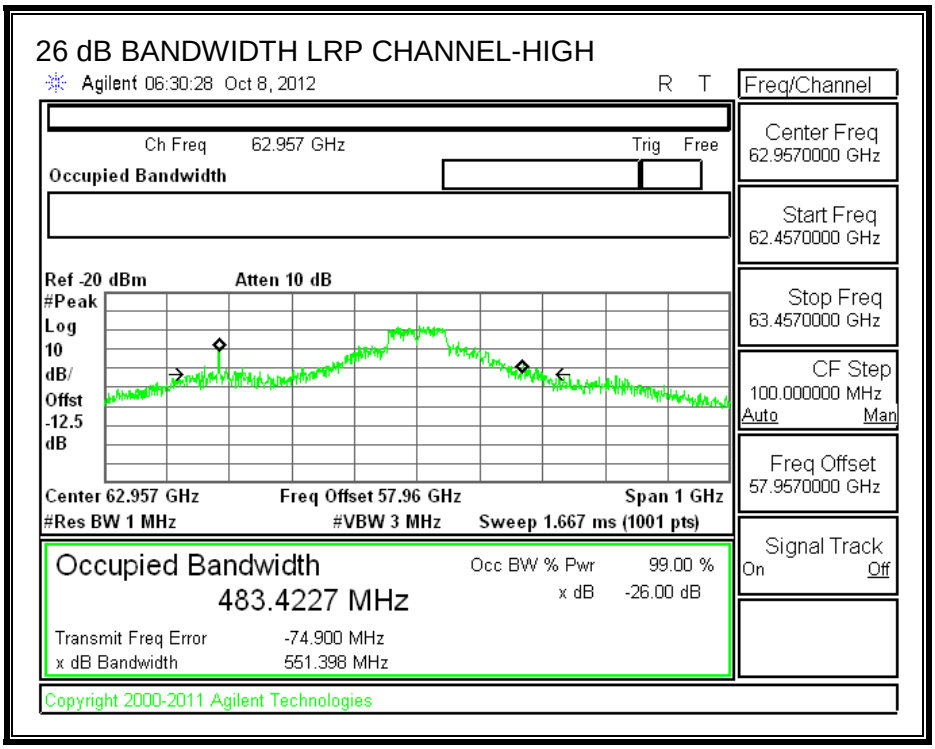
LRP RESULTS

Channel	Frequency (GHz)	99% Bandwidth (MHz)	26 dB Bandwidth (MHz)
LOW	60.1630	427.7618	491.07
MID	60.7970	454.7560	508.62
HGIH	62.9570	483.4227	551.40

99% and 26 dB BANDWIDTH







7.2. 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 uW/cm^2, as measured 3 meters from the radiating structure, and the peak power density of any emission shall not exceed 18 uW/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:

$$EIRP = P_T * G_T = (P_R / G_R) * (4 * Pi * D / \lambda)^2$$

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:

$$P_D = EIRP / (4 * Pi * D_S^2)$$

where:

D_S is the specification distance

FAR FIELD BOUNDARY CALCULATIONS

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

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

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

7.2.1. PEAK POWER DENSITY RESULTS

LRP PEAK POWER DENSITY RESULTS LOW CHANNEL

CHANNEL-LOW-HORIZ

Frequency (GHz)	Measurement Distance (m)	Horizontal Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
60.163	1.50	-18.32	23.00	30.2
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Peak Limit (uW/cm^2)**
1.053	3.0	0.0093	0.93	18

CHANNEL-LOW-VERT

Frequency (GHz)	Measurement Distance (m)	Vertical Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
60.163	1.50	-19.49	23.00	29.1
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Peak Limit (uW/cm^2)**
0.805	3.0	0.0071	0.71	18

LRP PEAK POWER DENSITY RESULTS MID CHANNEL

CHANNEL-MID-HORIZ

Frequency (GHz)	Measurement Distance (m)	Horizontal Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
60.797	1.50	-19.55	23.00	29.1
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Peak Limit (uW/cm^2)**
0.810	3.0	0.0072	0.72	18

CHANNEL-MID-VERT

Frequency (GHz)	Measurement Distance (m)	Vertical Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
60.797	1.50	-20.58	23.00	28.1
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Peak Limit (uW/cm^2)**
0.639	3.0	0.0057	0.57	18

LRP PEAK POWER DENSITY RESULTS HIGH CHANNEL

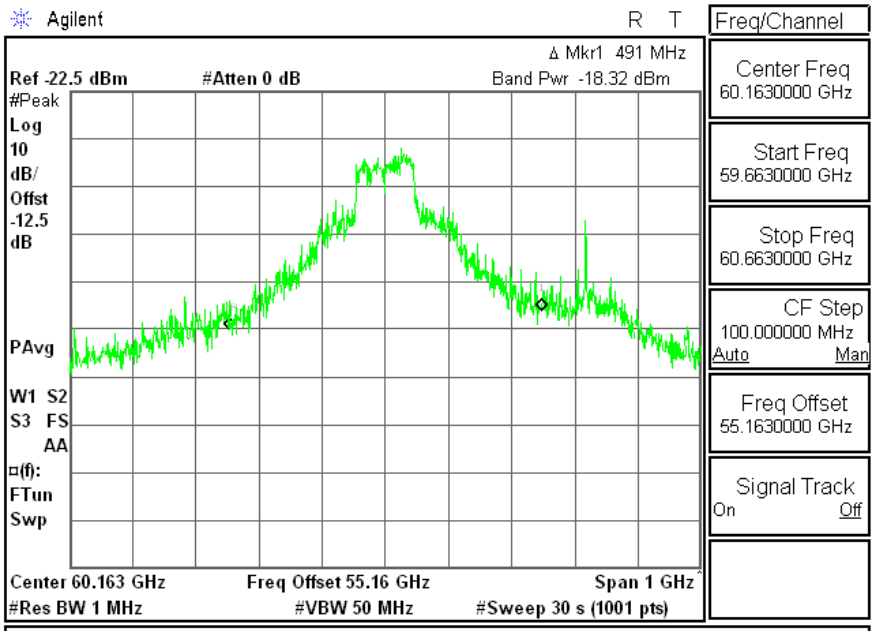
CHANNEL-HIGH-HORIZ

Frequency (GHz)	Measurement Distance (m)	Horizontal Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
62.957	1.50	-20.82	23.00	28.1
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Peak Limit (uW/cm^2)**
0.649	3.0	0.0057	0.57	18

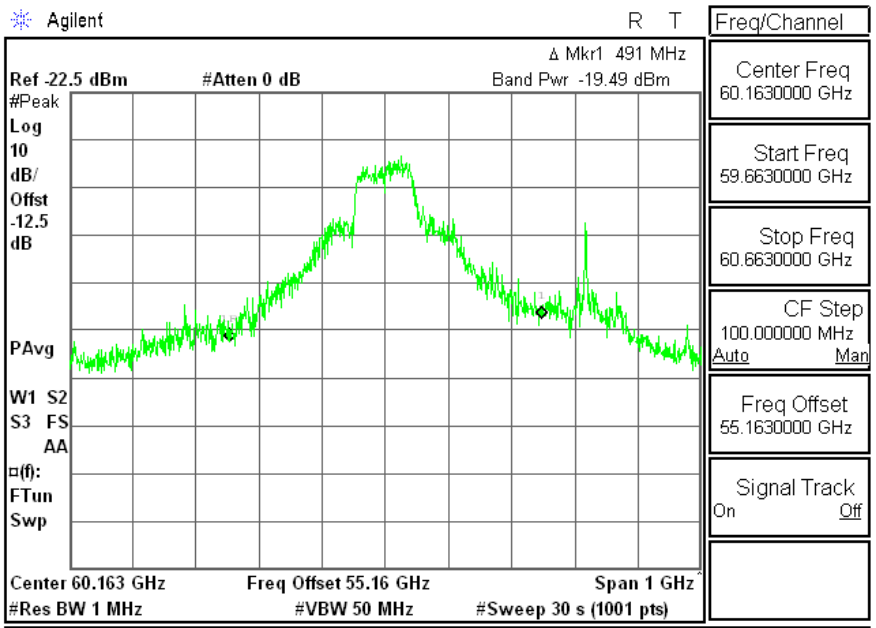
CHANNEL-HIGH-VERT

Frequency (GHz)	Measurement Distance (m)	Vertical Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
62.957	1.50	-21.49	23.00	27.5
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Peak Limit (uW/cm^2)**
0.556	3.0	0.0049	0.49	18

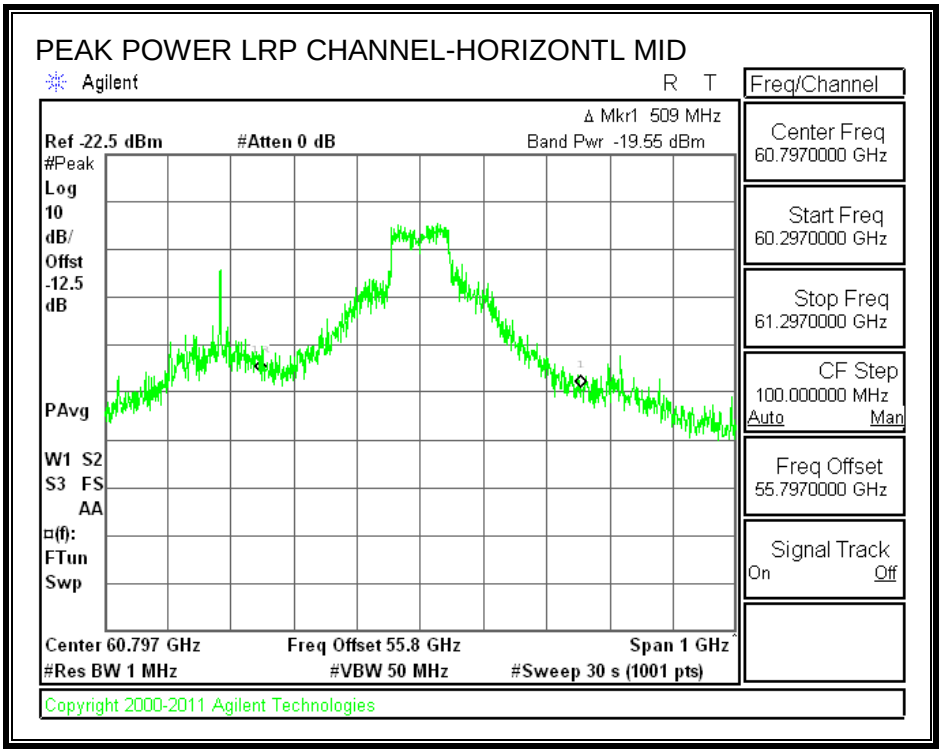
PEAK POWER LRP CHANNEL-HORIZONTAL LOW



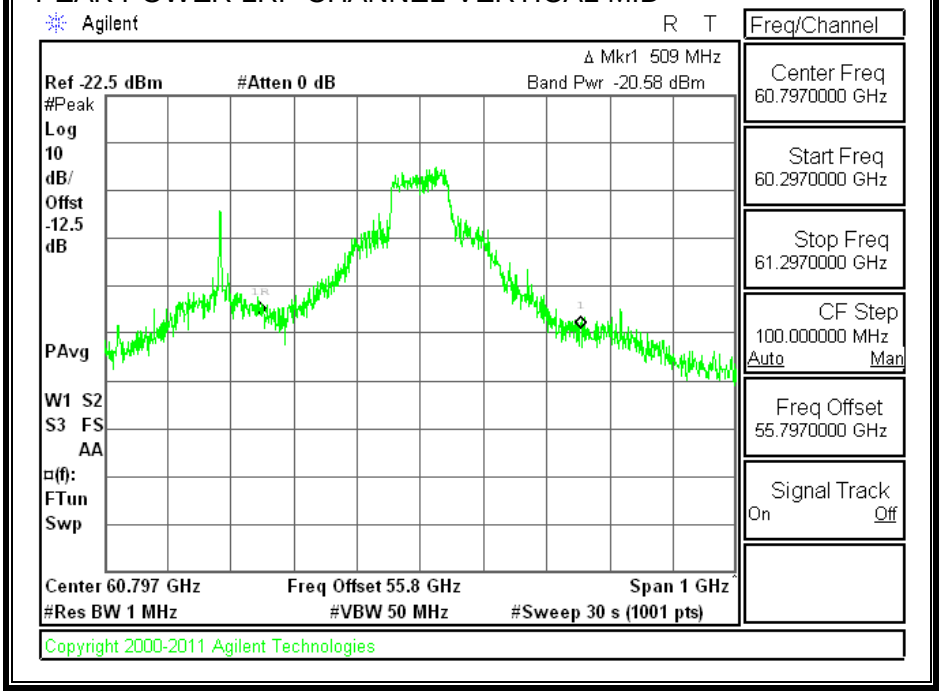
PEAK POWER LRP CHANNEL-VERTICAL LOW



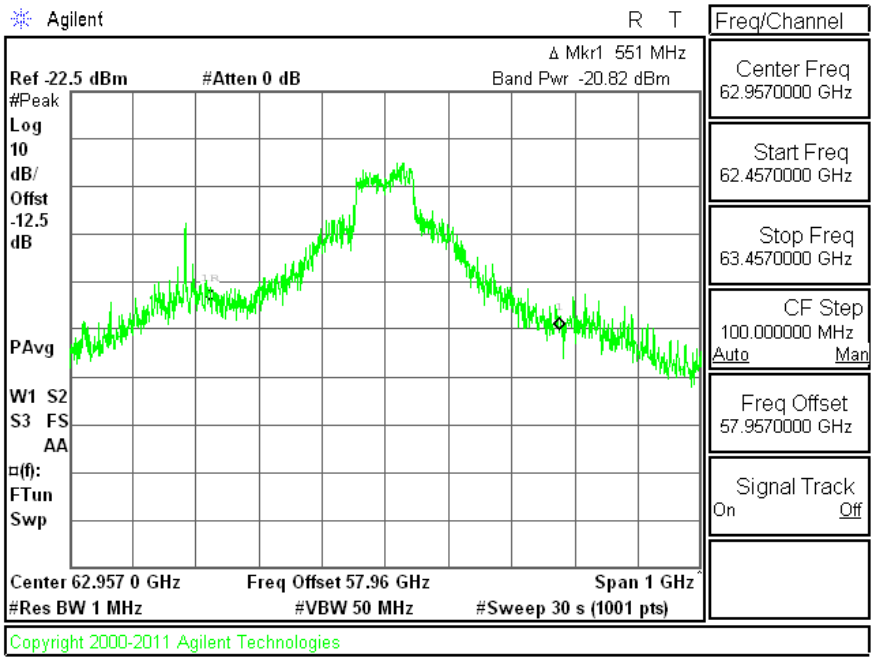
PEAK POWER LRP CHANNEL-HORIZONTL MID



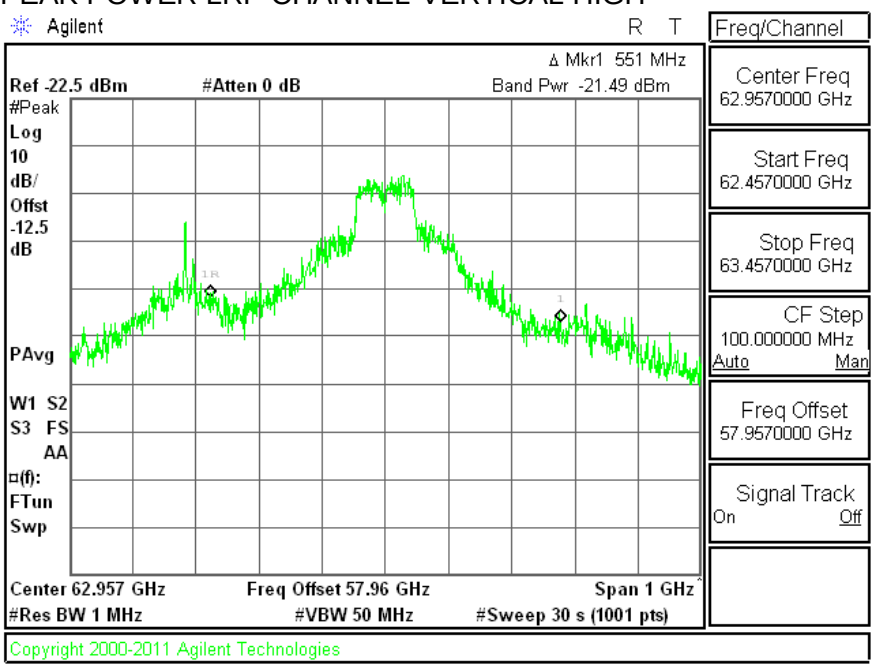
PEAK POWER LRP CHANNEL-VERTICAL MID



PEAK POWER LRP CHANNEL-HORIZONTAL HIGH



PEAK POWER LRP CHANNEL-VERTICAL HIGH



7.2.2. AVERAGE POWER DENSITY RESULTS

LRP AVERAGE POWER DENSITY RESULTS LOW CHANNEL

CHANNEL-LOW-HORIZ

Frequency (GHz)	Measurement Distance (m)	Horizontal Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
60.163	1.50	-41.43	23.00	7.1
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Peak Limit (uW/cm^2)**
0.005	3.0	0.000046	0.005	9

CHANNEL-LOW-VERT

Frequency (GHz)	Measurement Distance (m)	Vertical Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
60.163	1.50	-42.94	23.00	5.6
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Peak Limit (uW/cm^2)**
0.004	3.0	0.000032	0.003	9

LRP AVERAGE POWER DENSITY RESULTS MID CHANNEL

CHANNEL-MID-HORIZ

Frequency (GHz)	Measurement Distance (m)	Horizontal Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
60.797	1.50	-42.58	23.00	6.1
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Peak Limit (uW/cm^2)**
0.004	3.0	0.000036	0.004	9

CHANNEL-MID-VERT

Frequency (GHz)	Measurement Distance (m)	Vertical Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
60.797	1.50	-43.70	23.00	4.9
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Peak Limit (uW/cm^2)**
0.003	3.0	0.000028	0.003	9

LRP AVERAGE POWER DENSITY RESULTS HIGH CHANNEL

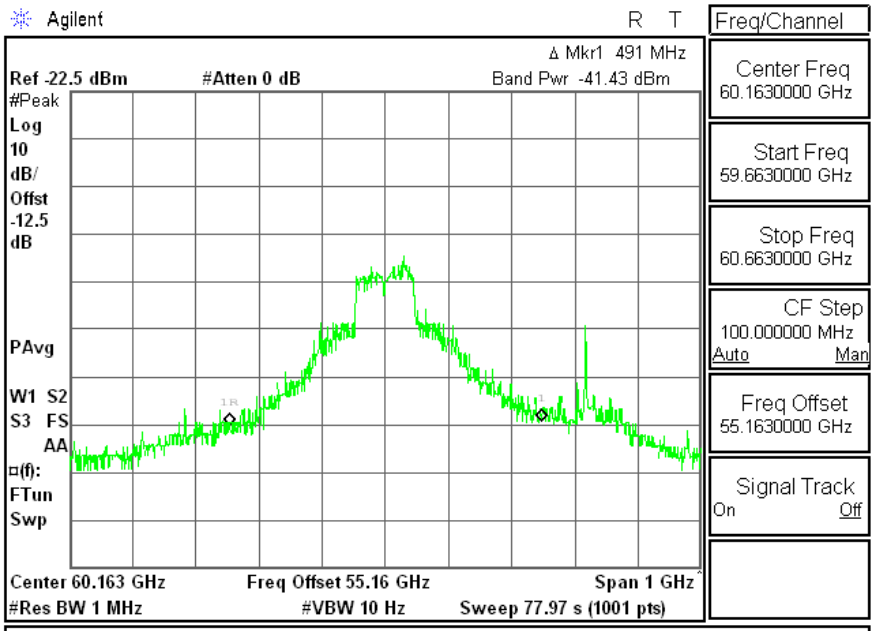
CHANNEL-HIGH-HORIZ

Frequency (GHz)	Measurement Distance (m)	Horizontal Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
62.957	1.50	-43.95	23.00	5.0
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Peak Limit (uW/cm^2)**
0.003	3.0	0.000028	0.003	9

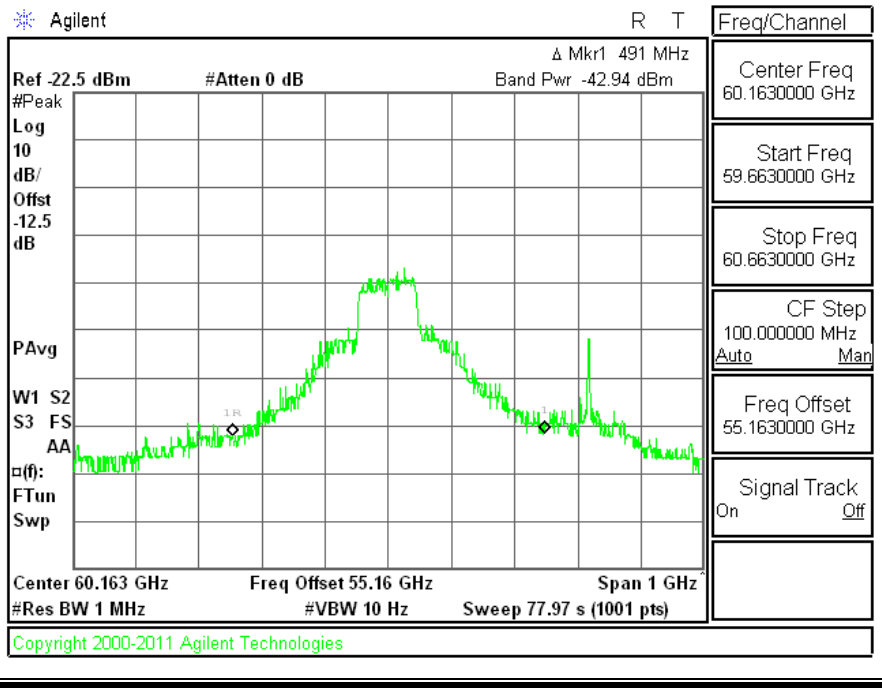
CHANNEL-HIGH-VERT

Frequency (GHz)	Measurement Distance (m)	Vertical Measured Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
62.957	1.50	-46.03	23.00	2.9
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Peak Limit (uW/cm^2)**
0.002	3.0	0.000017	0.002	9

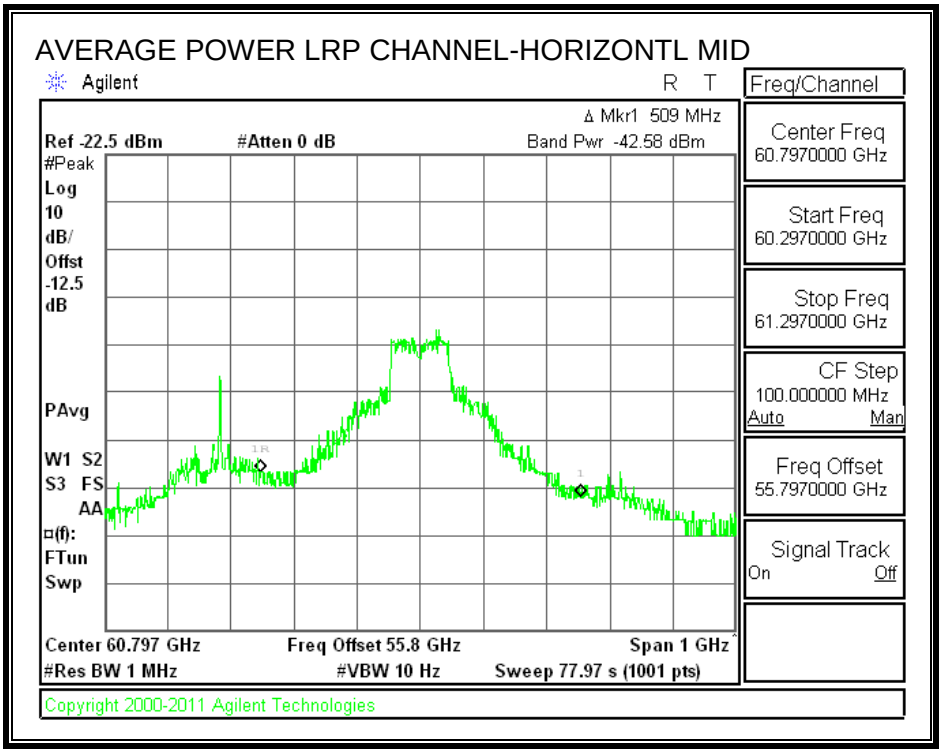
AVERAGE POWER LRP CHANNEL- HORIZONTAL LOW



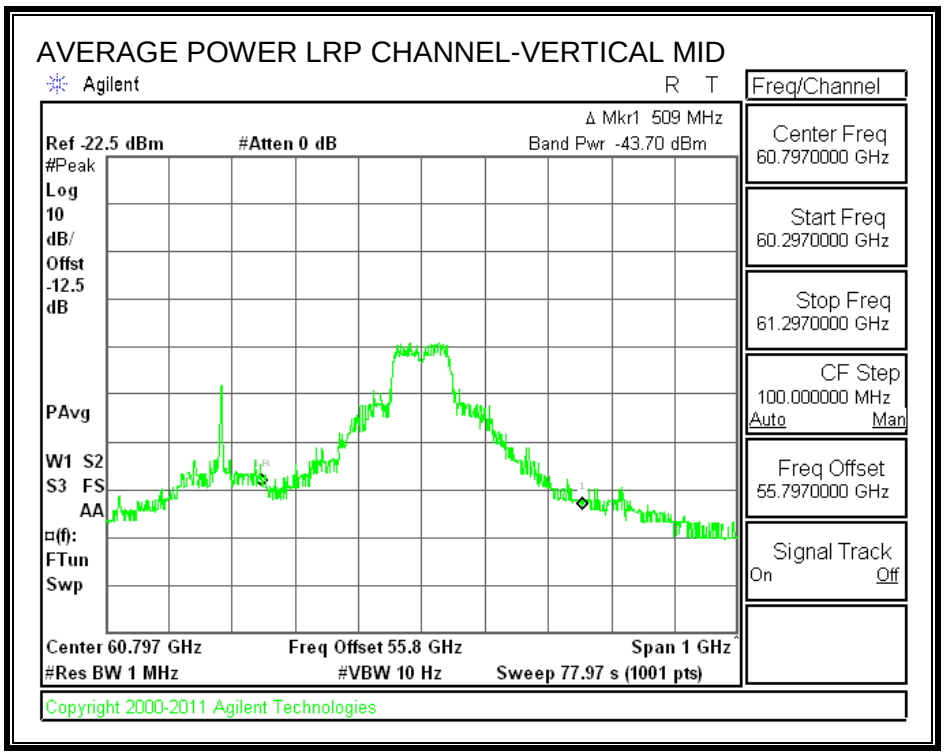
AVERAGE POWER LRP CHANNEL-VERTICAL LOW



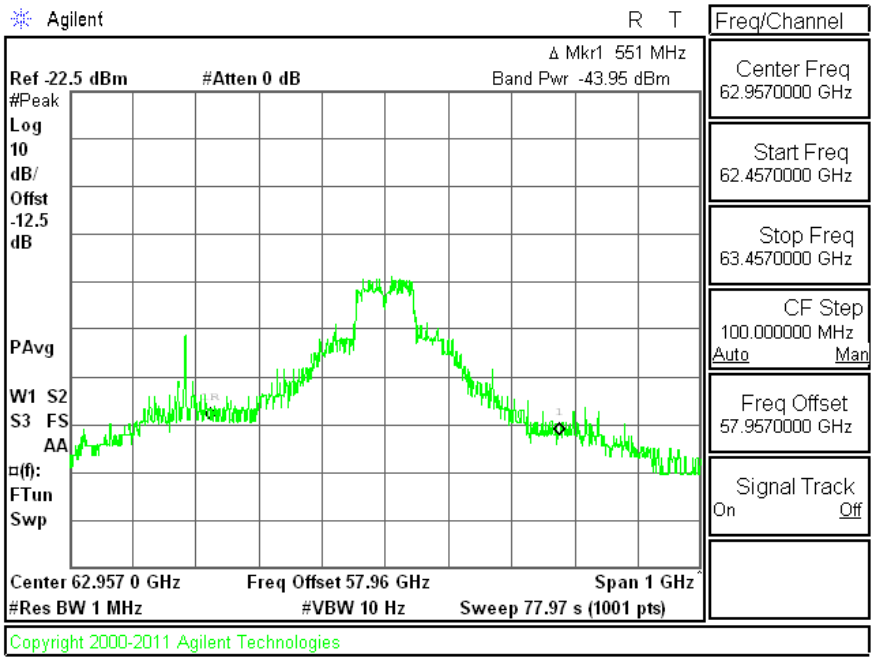
AVERAGE POWER LRP CHANNEL-HORIZONTL MID



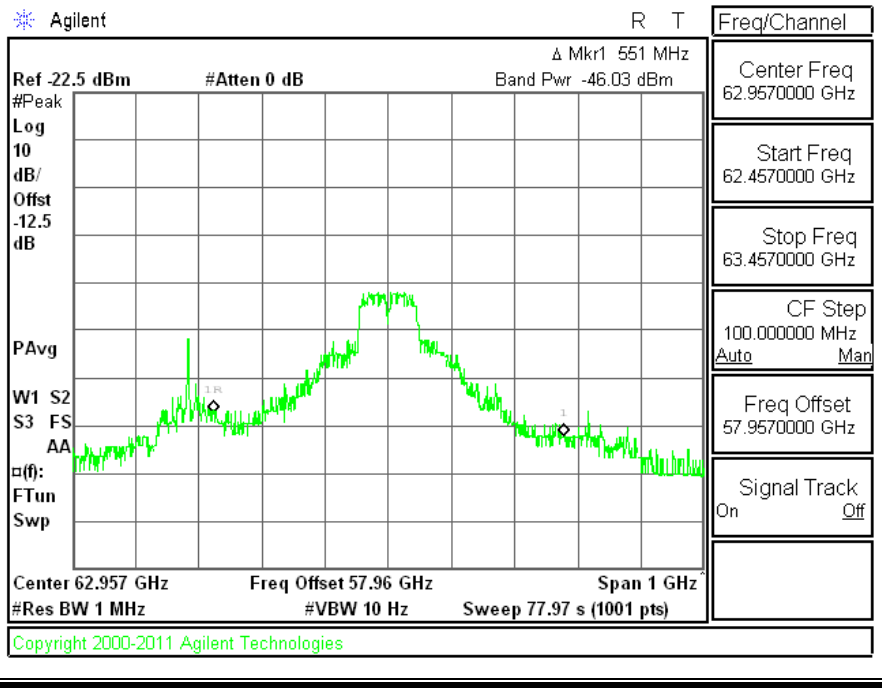
AVERAGE POWER LRP CHANNEL-VERTICAL MID



AVERAGE POWER LRP CHANNEL-HORIZONTAL HIGH



AVERAGE POWER LRP CHANNEL-VERTICAL HIGH



7.1. 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

Calculations are performed in accordance with KDB 662911.The maximum EUT antenna gain is subtracted from the Peak EIRP for each polarization to yield the conducted power for each polarization, then the sum of these two powers are calculated to yield the total conducted power.

7.1.1. OUTPUT POWER RESULTS

PEAK OUTPUT POWER – LOW CHANNEL

CHANNEL-LOW

Frequency (GHz)	Horiz EIRP (dBm)	Horiz EUT Ant Gain (dBi)	Horiz Output Power (dBm)	Vert EIRP (dBm)	Vert EUT Ant Gain (dBi)	Vert Output Power (dBm)
60.163	30.2	13.00	17.20	29.1	13.00	16.10

Horiz Output Power (mW)	Vert Output Power (mW)	Total Output Power (mW)	Total Output Power (dBm)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
52.48	40.7	93.2	19.7	90.8	454

PEAK OUTPUT POWER – MID CHANNEL

CHANNEL-MID

Frequency (GHz)	Horiz EIRP (dBm)	Horiz EUT Ant Gain (dBi)	Horiz Output Power (dBm)	Vert EIRP (dBm)	Vert EUT Ant Gain (dBi)	Vert Output Power (dBm)
60.797	29.1	13.00	16.10	28.1	13.00	15.10

Horiz Output Power (mW)	Vert Output Power (mW)	Total Output Power (mW)	Total Output Power (dBm)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
40.74	32.4	73.1	18.6	90.8	454

PEAK OUTPUT POWER – HIGH CHANNEL

CHANNEL-HIGH

Frequency (GHz)	Horiz EIRP (dBm)	Horiz EUT Ant Gain (dBi)	Horiz Output Power (dBm)	Vert EIRP (dBm)	Vert EUT Ant Gain (dBi)	Vert Output Power (dBm)
60.163	28.1	13.00	15.10	27.5	13.00	14.50

Horiz Output Power (mW)	Vert Output Power (mW)	Total Output Power (mW)	Total Output Power (dBm)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
32.36	28.2	60.5	17.8	90.8	454

7.2. 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/cm^2 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

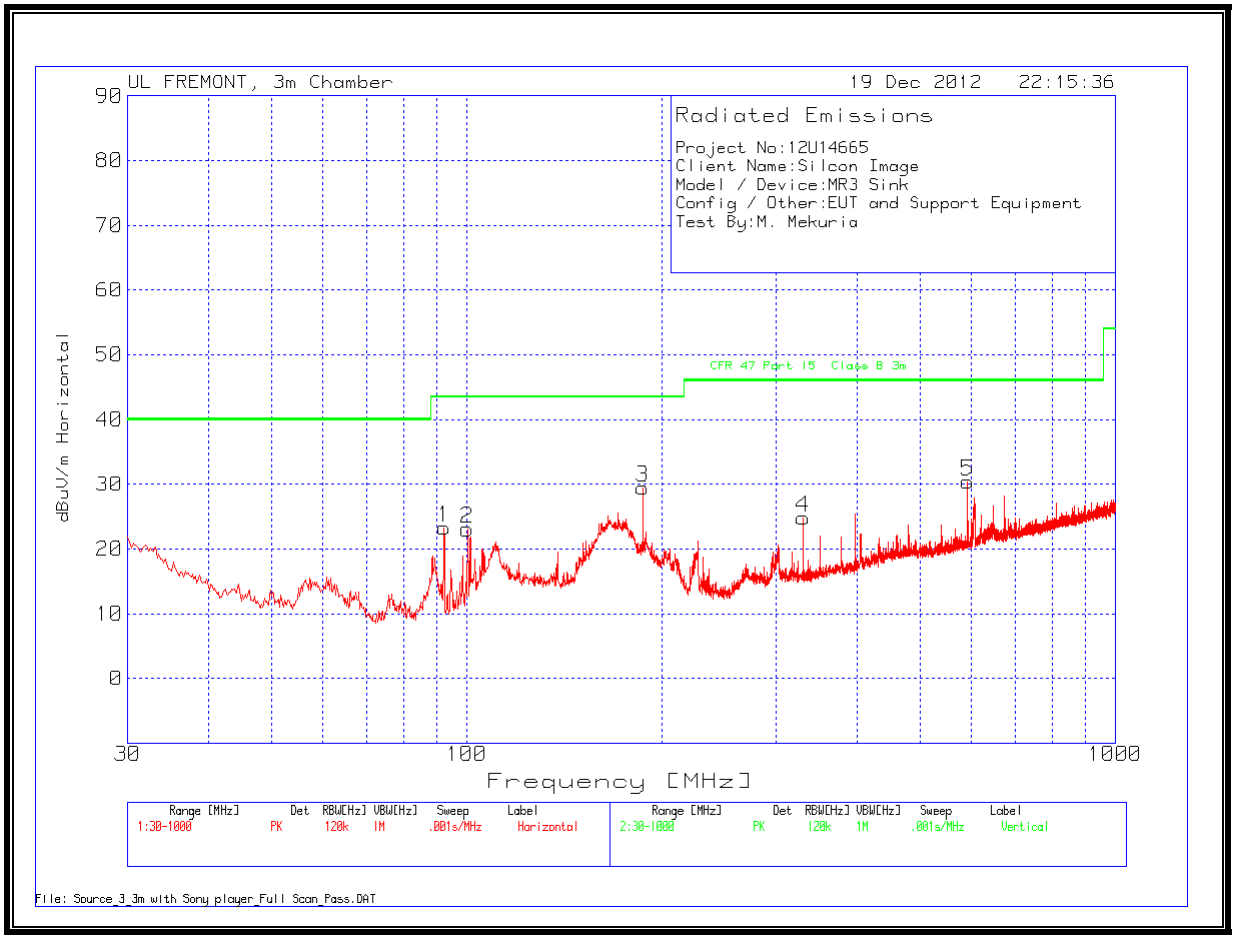
External harmonic mixers are utilized.

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.

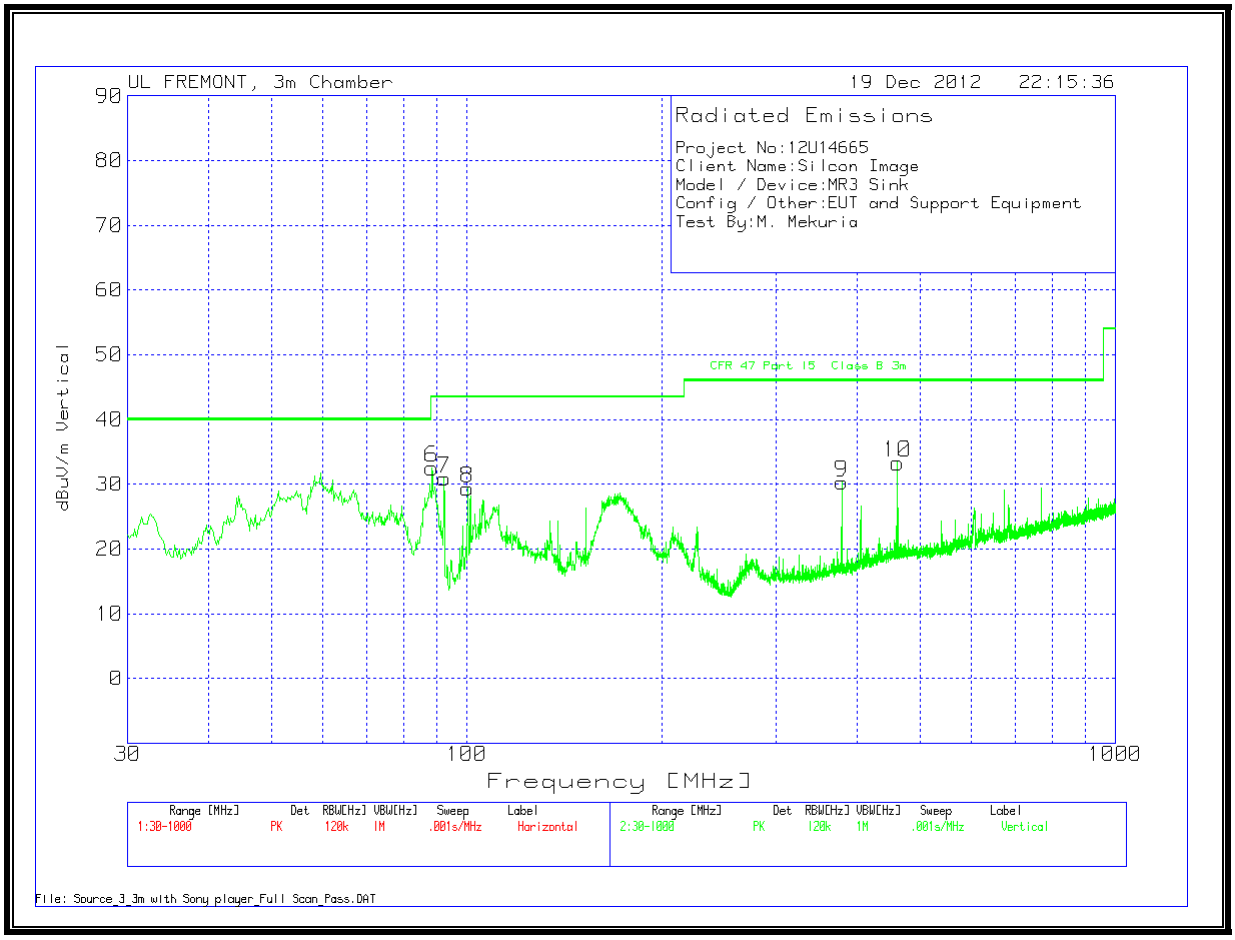
A final test is made at any frequencies at which emissions are found. During this final scan, the antenna is kept no further from the EUT than the maximum distance calculated for each mixer band that yields a minimum system noise floor at least 6 dB below the spurious emissions limit.

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

Project No:12U14665										
Client Name:Silcon Image										
Model / Device:MR3 Sink										
Config / Other:EUT and Support Equipment										
Test By:M. Mekuria										
Horizontal 30 - 1000MHz										
Marker No.	Test Frequency	Meter Reading	Detector	25MHz-1GHz Chambr 3m Amplified (dB)	Antenna T185 (dB)	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
1	92.2242	42.28	PK	-26.9	7.9	23.28	43.5	-20.22	200	Horz
2	100.1719	39.86	PK	-26.8	10	23.06	43.5	-20.44	200	Horz
3	186.8205	44.47	PK	-25.9	10.9	29.47	43.5	-14.03	400	Horz
4	330.2658	36.23	PK	-25.3	13.9	24.83	46	-21.17	99	Horz
5	591.7626	37.7	PK	-25.7	18.4	30.4	46	-15.6	200	Horz
Vertical 30 - 1000MHz										
Marker No.	Test Frequency	Meter Reading	Detector	25MHz-1GHz Chambr 3m Amplified (dB)	Antenna T185 (dB)	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
6	88.3473	52.11	PK	-27	7.4	32.51	43.5	-10.99	99	Vert
7	92.2242	49.9	PK	-26.9	7.9	30.9	43.5	-12.6	99	Vert
8	100.1719	46.15	PK	-26.8	10	29.35	43.5	-14.15	99	Vert
9	378.5332	40.8	PK	-25.5	15	30.3	46	-15.7	301	Vert
10	461.6926	42	PK	-25.8	17.1	33.3	46	-12.7	99	Vert

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

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

Company: SILCON IMAGE
Project #: 12U14665
Date: 12/20/2012
Test Engineer: MENGISTU MEKURIA
Configuration: ETU AND SUPPORT EQUIPMENT
Mode: AUDIO/VIDEO RECEIVE M0DE

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	FCC Class B

Hi Frequency Cables

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

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)
1.045	3.0	54.1	34.7	24.0	2.8	-38.8	0.0	0.0	42.2	22.7	74	54	-31.8	-31.3	V
1.576	3.0	52.5	32.6	25.9	3.4	-38.0	0.0	0.0	43.8	23.9	74	54	-30.2	-30.1	V
1.956	3.0	53.9	32.3	27.2	3.8	-37.5	0.0	0.0	47.4	25.8	74	54	-26.6	-28.2	V
2.538	3.0	46.5	39.2	29.0	4.5	-36.9	0.0	0.0	43.2	35.8	74	54	-30.8	-18.2	V
3.236	3.0	45.0	28.7	31.0	5.1	-36.4	0.0	0.0	44.6	28.3	74	54	-29.4	-25.7	V
24.192	3.0	34.9	22.9	33.9	16.5	-34.1	0.0	0.0	51.2	39.2	74	54	-22.8	-14.8	V
25.056	3.0	35.6	24.1	33.9	17.5	-32.7	0.0	0.0	54.3	42.8	74	54	-19.7	-11.2	V
1.032	3.0	56.7	35.6	24.0	2.7	-38.8	0.0	0.0	44.6	23.5	74	54	-29.4	-30.5	H
1.404	3.0	53.5	33.8	25.3	3.2	-38.3	0.0	0.0	43.8	24.0	74	54	-30.2	-30.0	H
1.567	3.0	53.5	32.3	25.9	3.4	-38.1	0.0	0.0	44.7	23.5	74	54	-29.3	-30.5	H
1.620	3.0	55.3	44.3	26.1	3.5	-38.0	0.0	0.0	46.8	35.8	74	54	-27.2	-18.2	H
1.936	3.0	50.0	31.7	27.2	3.8	-37.6	0.0	0.0	43.4	25.1	74	54	-30.6	-28.9	H
2.536	3.0	49.2	41.6	29.0	4.5	-36.9	0.0	0.0	45.9	38.2	74	54	-28.1	-15.8	H
2.700	3.0	46.4	32.9	29.5	4.6	-36.8	0.0	0.0	43.7	30.3	74	54	-30.3	-23.7	H
3.225	3.0	47.1	28.1	31.0	5.0	-36.4	0.0	0.0	46.7	27.7	74	54	-27.3	-26.3	H
24.192	3.0	36.6	24.9	33.9	16.5	-34.1	0.0	0.0	52.9	41.1	74	54	-21.1	-12.9	H
25.056	3.0	35.9	24.2	33.9	17.5	-32.7	0.0	0.0	54.6	42.9	74	54	-19.4	-11.1	H

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		

The emission at 24.192 GHz corresponds to all LRP channels associated with MRP/HRP Channel 2 and the emission at 25.056 GHz corresponds to all LRP channels associated with MRP/HRP Channel 3. The amplitude of the above spurious emissions are independent of the LRP channel.

TX AND RX SPURIOUS EMISSIONS 40 TO 200 GHz

PEAK MEASUREMENT
Note: The peak density is less than the average limit

Emission corresponding to all LRP Channels associated with MRP/HRP Channel 2

Frequency (GHz)	Measurement Distance (m)	Horizontal Peak Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
48.384	0.400	-74.06	20.00	-35.9
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (pW/cm^2)**	**Limit (pW/cm^2)**
2.58E-07	3.0	2.28E-09	0.23	90

Frequency (GHz)	Measurement Distance (m)	Vertical Peak Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
48.384	0.400	-76.96	20.00	-38.8
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (pW/cm^2)**	**Limit (pW/cm^2)**
1.32E-07	3.0	1.17E-09	0.12	90

PEAK MEASUREMENT
Note: The peak density is less than the average limit

Emission corresponding to all LRP Channels associated with MRP/HRP
Channel 3

Frequency (GHz)	Measurement Distance (m)	Horizontal Peak Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
50.112	0.400	-72.58	20.00	-34.1
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (pW/cm^2)**	**Limit (pW/cm^2)**
3.89E-07	3.0	3.44E-09	0.34	90

Frequency (GHz)	Measurement Distance (m)	Vertical Peak Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
50.112	0.400	-74.55	20.00	-36.1
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (pW/cm^2)**	**Limit (pW/cm^2)**
2.47E-07	3.0	2.19E-09	0.22	90

The amplitude of the above spurious emissions are independent of the LRP channel.

8. RF EXPOSURE

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

CALCULATIONS

EIRP is converted to Power Density using the equation:

$P_D = EIRP / (4 * Pi * D_S^2)$
where:
D_S is the separation distance

RESULTS

Horiz Average EIRP (dBm)	Horiz Average EIRP (W)	Vert Average EIRP (dBm)	Vert Average EIRP (W)	Total Average EIRP (W)	Total Average EIRP (dBm)
7.1	0.005	5.6	0.004	0.009	9.4

Separation Distance (cm)	Power Density (W/m^2)	IC Limit (W/m^2)	Power Density (mW/cm^2)	FCC Limit (mW/cm^2)
20	0.02	10	0.002	1

8.1. EXEMPTION FROM RSS-102 ROUTINE EVALUATION LIMITS

The total average output power is 0.009 Watts EIRP, the separation distance is greater than 20 cm and the device operates at or above 1.5 GHz. In accordance with Clause 2.5.2 of RSS-102, the device is exempt from RF Exposure Evaluation.