FCC 47 CFR PART 15 SUBPART C
CLASS II PERMISSIVE CHANGE

CERTIFICATION TEST REPORT

FOR

60 GHz WIRELESS HIGH DEFINITION (HD) SINK

MODEL NUMBER: SII-SK63101

FCC ID: UK2-SII-SK63101

REPORT NUMBER: 14U18023-3, REVISION B

ISSUE DATE: OCTORBER 15, 2014

Prepared for
SILICON IMAGE
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SUNNYVALE, CA 94085, U.S.A.

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	09/07/2014	Initial Issue	M. Heckrotte
A	09/22/2014	Editorial update	S. Aguilar
B	10/6/2014	Update section 5.3, 7.1, and 7.3	S. Aguilar
C	10/15/2014	Update Section 7.3	S. Aguilar

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SILICON IMAGE
1140 EAST ARQUES AVE
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EUT DESCRIPTION: 60GHz WIRELESSHD RECEIVER

MODEL: SII-SK63101

SERIAL NUMBER: 2c:39:a7:ce:c4:00
12:05:df:d7:92:00

DATE TESTED: JUNE 10-23, 2014

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass

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

MICHAEL HECKROTTE
DIRECTOR OF ENGINEERING
UL Verification Services Inc.

Tested By:

STEVE AGUILAR
EMC ENGINEER
UL Verification Services Inc.

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 D02 RF Detection Method V01, FCC KDB 200443 Millimeter Wave Test Procedure.

3. FACILITIES AND ACCREDITATION

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

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
☐ Chamber A	☐ Chamber D
☐ Chamber B	☐ Chamber E
☐ Chamber C	☒ Chamber F
	☒ Chamber G

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

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 an adaptive beam-steering array with a maximum gain of 18 dBi.

The EUT 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 18 dBi for each polarization.

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. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The Host control interface is changed from USB to I2C. There is a new board layout (New dimensions and new shield).

5.3. 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 conducted output power is 7 dBm (5 mW).

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**
HDMI TV	Samsung	LT23A350	Z3VEHCRC200971J
HDMI TV	Sony	KDL-32W600A	2122590
Laptop	Lenovo	T400	2767AP1
BD Player	Sony	BDP-S185	2090609
DC Supply	HP	E3632A	KR75303598
Shield Tent	Select Fabricators	600 Series	N/A
Transmitter	Silicon Image	SII-SK63102	f1:ad:50:7b:82:00
Transmitter	Silicon Image	SII-SK63102	d9:9a:5d:a4:91:00

I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identica Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	DC	2	DC,Barrel	Unshielded	1.4M	Ferrite on DC end
2	AC	1	AC,2P	Unshielded	0.5M	N/A
3	DC	1	DC,Barrel	Unshielded	1.3M	N/A
4	HDMI	2	HDMI	Shielded	3.7M	N/A
5	AC	1	AC,2P	Unshielded	1.5M	N/A
6	AC	1	AC,2P	Unshielded	1.6M	N/A
7	AC	1	AC,3P	Unshielded	1.8M	N/A
8	AC	1	AC,2P	Unshielded	1.8M	N/A
9	HDMI	1	DHMI	Shielded	0.9m	Ferrite on each end
10	DC	1	DC,Barrel	Unshielded	3M	Ferrite on Input end

TEST SETUP

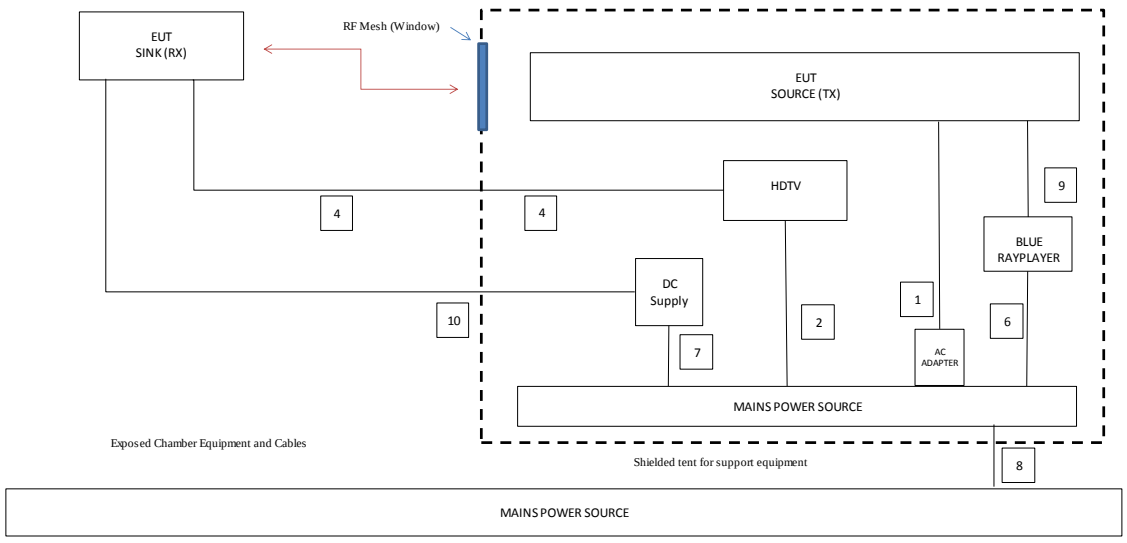
The Blue ray player was placed inside a shielded tent. High Definition Video noise pattern was sent to the Blue Ray player via a conducted HDMI cable connection to the test jig, then sent from the source to the Television via an over-the-air link to the WiHD Sink.

The Television and WiHD Source were placed inside the shielded tent and below the EUT in order to eliminate emissions from the support equipment and to maintain a constant transmission link during all radiated emission tests.

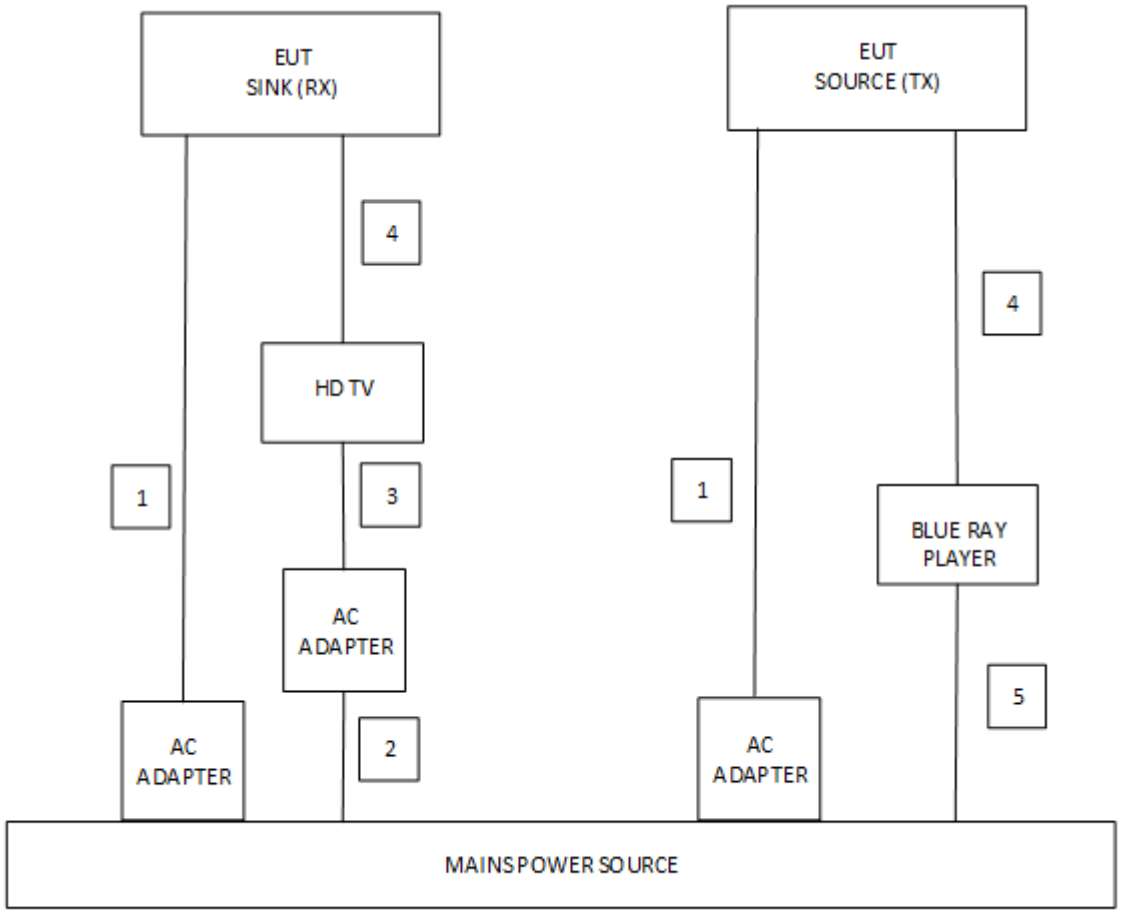
A laptop computer was utilized to adjust the EUT for testing purposes. This computer was not connected during measurements.

SETUP DIAGRAM FOR TESTS

Radiated Emissions 30MHz-40GHz Setup –EUT=RX



All other Radiated 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**	**S/N**	**Cal Due**
N9030A PXA Signal Analyzer	Agilent	N9030A	MY52350427	1/22/2015
Analog Signal Generator, 40 GHz	Agilent	E8257D	MY48050681	9/19/2014
Down Converter, 67 GHz	Agilent	MT-463	12020	CNR
mmWave Source 50 - 75 GHz	OML	S15MS-AG	80708-4	CNR
Mixer Diplexer for HP	OML	DPL.313B	N02429	CNR
Harmonic Mixer, 50 GHz	Agilent	11970Q	3003A03363	9/25/2014
Harmonic Mixer, 75 GHz	Agilent	11970V	2521A01183	2/5/2015
Harmonic Mixer, 110 GHz	Agilent	11970W	2521A01314	2/13/2015
Harmonic Mixer, 90 to 140 GHz	OML	M08HWA	F90519-2	6/17/2015
Harmonic Mixer, 140 to 220 GHz	OML	M05HWA	G90519-1	6/17/2015
Single Average Power Meter	Agilent	N1913A	MY53100006	5/1/2015
Waveguide Power Sensor	Agilent	V8486A	MY52300008	3/22/2014
Power Sensor, 50 to 78 GHz	Agilent	V8486A	MY44420424	12/12/2014
Spectrum Analyzer, 40 GHz	Agilent	8564E	3943A01643	7/29/2014
Horn Antenna, 18 to 26.5GHz	ARA	MWH-1826/B	1049	11/26/2014
PreAmplifier, 1-26.5GHz	Agilent	8449B	3008A04710	3/23/2015
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	924343	8/20/2014
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	1029	6/28/2014
Single Average Power Meter	Agilent	N1913A	MY53100006	4/10/2014
Waveguide Power Sensor	Agilent	V8486A	MY52300008	3/22/2014
Oscilloscope, 2 channel, digital	Tektronox	TDS 3052	B016268	5/22/2014
Spectrum Analyzer, 44 GHz	Agilent	N9030A	MY53311010	5/17/2015
Antenna, Horn, 18 GHz	ETS Lindgren	3117	164318	4/14/2015
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	A051314-2	5/14/2015
RF PreAmplifier, 1-18GHz	Miteq	AFS42-00101800-25-S-42	1818464	6/26/2014
Preamp, 1000MHz	Sonoma	310N	T834	12/30/2014
Spectrum Analyzer, 44 GHz	Agilent	N9030A	MY51380911	2/12/2015
Antenna, Horn, 18 GHz	ETS Lindgren	3117	29310	3/20/2015
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	A022704	8/22/2015
RF PreAmplifier, 1-18GHz	Miteq	AFS42-00101800-25-S-42	T742	8/24/2014
Preamp, 1000MHz	Sonoma	8447D	310N	12/30/2014
Oscilloscope, 2 channel, digital	Tektronox	TDS 3044B	B040298	4/30/2015
Low Pass Filter, 10MHz	Solar Electronics	6623-10	136101	3/26/2015
Low Noise Amplifier	VIVAtech	VTLN-018-FB	51	CNR
Waveguide switch	mi-Wave	530V/387	1332	CNR
MM-Wave Isolator	Millitech	FBI-15-RSES0	1734	CNR
50-75GHZ RF Detector	Millitech	DET-15-RPFWI	41	CNR

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.

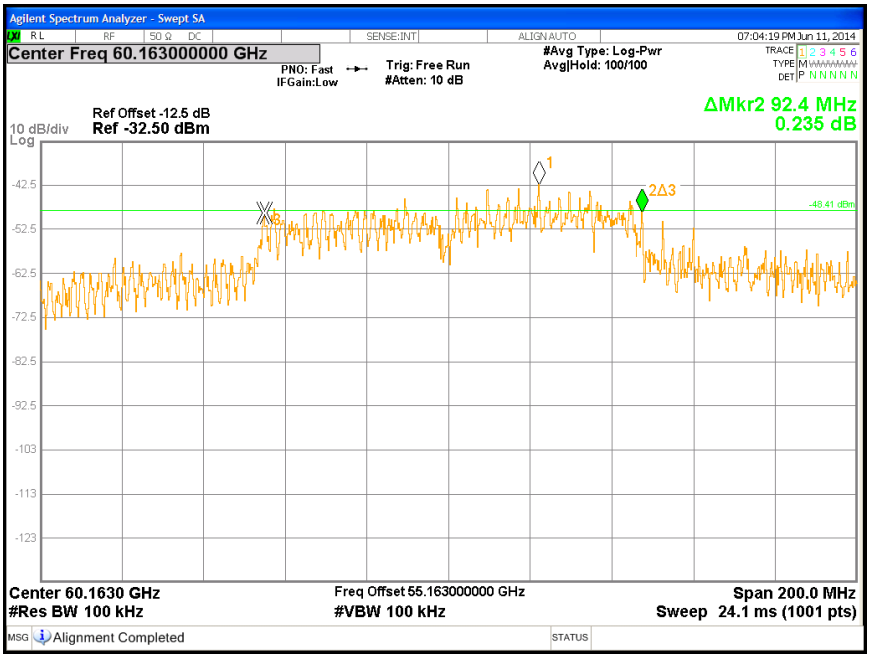
LRP RESULTS

Channel	Frequency (GHz)	6 dB Bandwidth (MHz)
Low	60.163	92.40
Mid	60.797	89.40
High	62.957	89.80

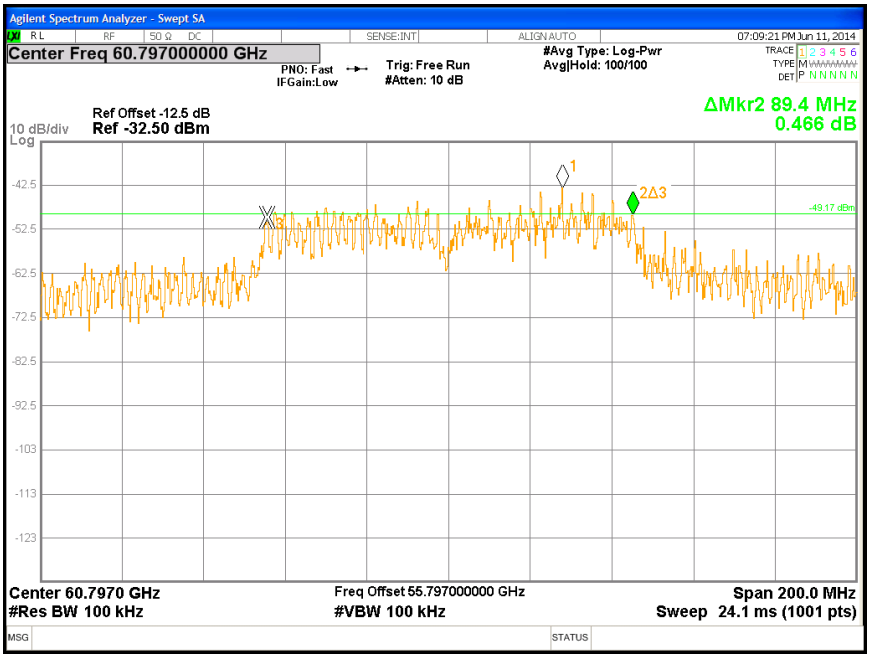
Was:

6 dB BANDWIDTH

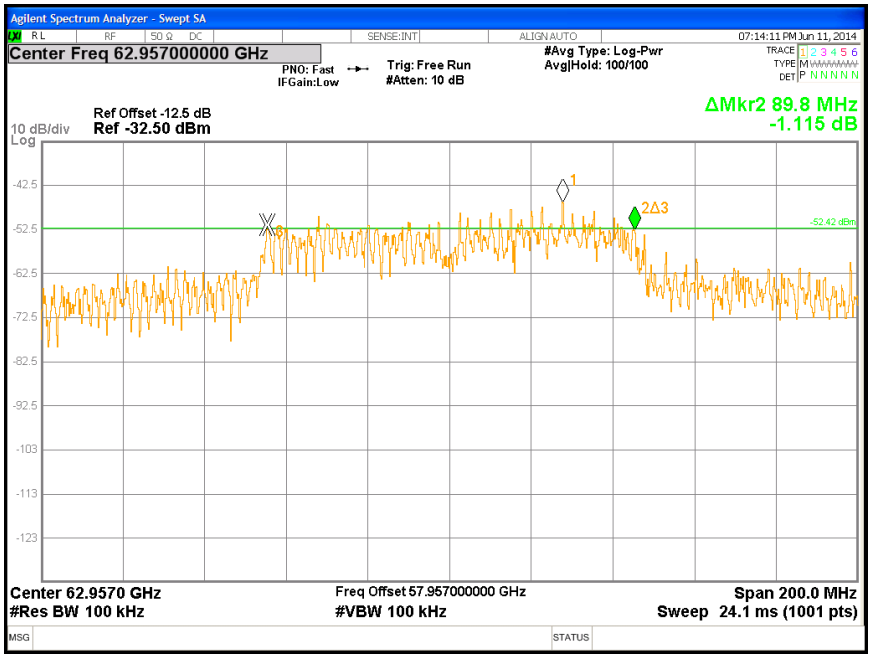
6 dB BANDWIDTH LRP LOW CHANNEL



6 dB BANDWIDTH LRP MID CHANNEL



6 dB BANDWIDTH LRP HIGH CHANNEL



7.2. POWER DENSITY

LIMIT

§15.255 (b) (1) Within the 57-64 GHz band, 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.

TEST PROCEDURE

§15.255 (b) (6) KDB 200443 D02 RF Detection Method V01

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

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

LRP Results

LRP Low Channel

PEAK POWER DENSITY

Frequency (GHz)	Measurement Distance (m)	Measured Peak Voltage (mV)	Raw Measured Power (dBm)	Corrd Measured Power (dBm)	Rx Antenna Gain (dBi)
60.163	1.00	64.00	-20.28	-19.98	23.00
EIRP (dBm)	**EIRP (W)**	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Peak Limit (uW/cm^2)**
25.0	0.319	3.0	0.0028	0.28	18

AVERAGE POWER DENSITY

Frequency (GHz)	Measurement Distance (m)	Measured Average Voltage (mV)	Measured Power (dBm)	Corrd Measured Power (dBm)	Rx Antenna Gain (dBi)
60.163	1.00	2.56	-31.66	-31.36	23.00
EIRP (dBm)	**EIRP (W)**	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Average Limit (uW/cm^2)**
13.7	0.023	3.0	0.0002	0.02	9

LRP Results

LRP Mid Channel

PEAK POWER DENSITY

Frequency (GHz)	Measurement Distance (m)	Measured Peak Voltage (mV)	Raw Measured Power (dBm)	Corrd Measured Power (dBm)	Rx Antenna Gain (dBi)
60.797	1.00	58.00	-20.69	-20.39	23.00
EIRP (dBm)	**EIRP (W)**	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Peak Limit (uW/cm^2)**
24.7	0.297	3.0	0.0026	0.26	18

AVERAGE POWER DENSITY

Frequency (GHz)	Measurement Distance (m)	Measured Average Voltage (mV)	Measured Power (dBm)	Corrd Measured Power (dBm)	Rx Antenna Gain (dBi)
60.797	1.00	2.90	-31.35	-31.05	23.00
EIRP (dBm)	**EIRP (W)**	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Average Limit (uW/cm^2)**
14.1	0.025	3.0	0.0002	0.02	9

LRP Results

LRP High Channel

PEAK POWER DENSITY

Frequency (GHz)	Measurement Distance (m)	Measured Peak Voltage (mV)	Raw Measured Power (dBm)	Corrd Measured Power (dBm)	Rx Antenna Gain (dBi)
62.957	1.00	34.00	-22.69	-22.39	23.00
EIRP (dBm)	**EIRP (W)**	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Peak Limit (uW/cm^2)**
23.0	0.201	3.0	0.0018	0.18	18

AVERAGE POWER DENSITY

Frequency (GHz)	Measurement Distance (m)	Measured Average Voltage (mV)	Measured Power (dBm)	Corrd Measured Power (dBm)	Rx Antenna Gain (dBi)
62.957	1.00	1.06	-31.30	-31.00	23.00
EIRP (dBm)	**EIRP (W)**	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (uW/cm^2)**	**Average Limit (uW/cm^2)**
14.4	0.028	3.0	0.0002	0.02	9

7.3. PEAK OUTPUT POWER

LIMIT

§15.255 (e) Except as specified paragraph (e)(1) of this section, the peak transmitter conducted output power shall not exceed 500 mW. Depending on the gain of the antenna, it may be necessary to operate the intentional radiator using a lower peak transmitter output power in order to comply with the EIRP limits specified in paragraph (b) of this section.

§15.255 (e) (1) Transmitters with an emission bandwidth of less than 100 MHz must limit their peak transmitter conducted output power to the product of 500 mW times their emission bandwidth divided by 100 MHz. For the purposes of this paragraph, 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).

PROCEDURE

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

LRP RESULTS

PEAK OUTPUT POWER

LOW CHANNEL

Frequency (GHz)	EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
60.32	25.0	18.00	7.00	5.0	92.4	462

MID CHANNEL

Frequency (GHz)	EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
60.48	24.7	18.00	6.70	4.7	89.4	447

HIGH CHANNEL

Frequency (GHz)	EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
60.64	23.0	18.00	5.00	3.2	89.8	449

7.4. 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

ANSI C 63.10-2009

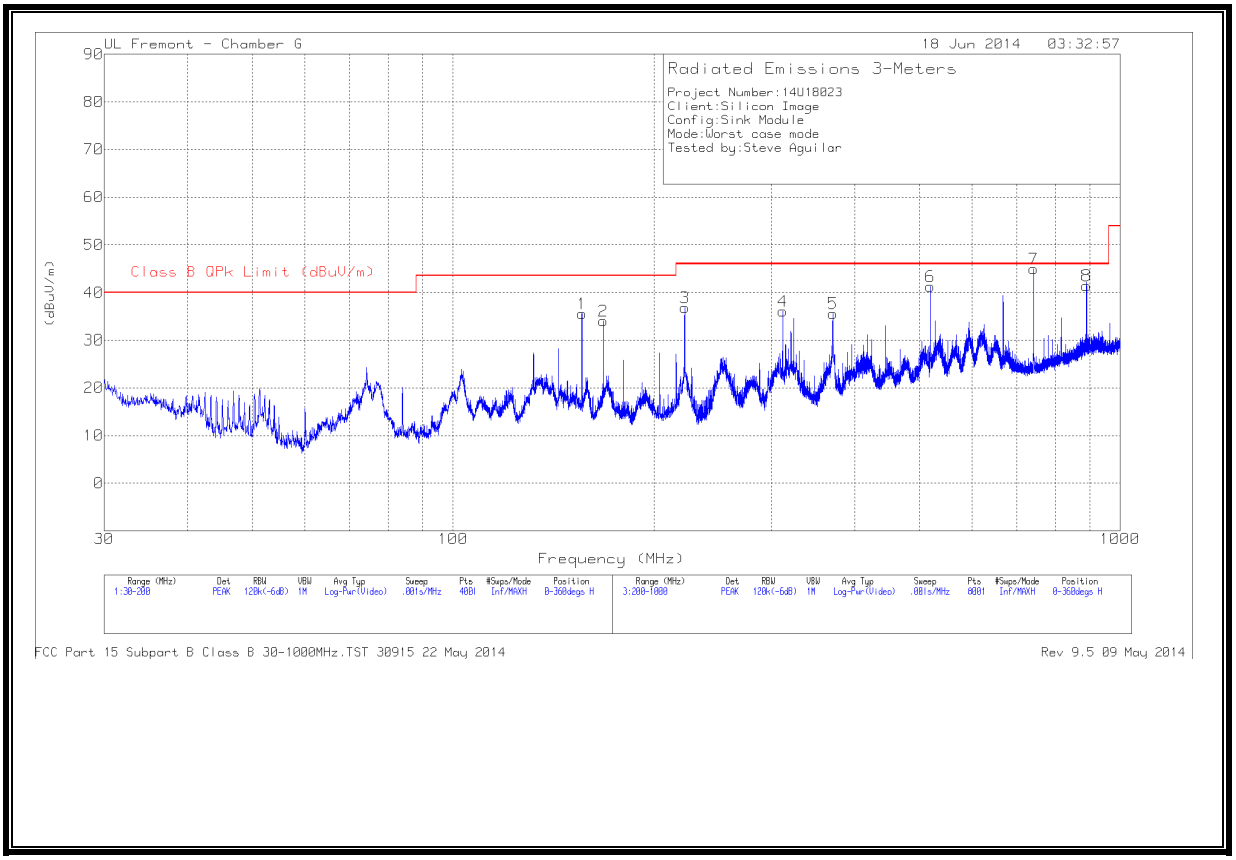
PROCEDURE FOR 40 TO 200 GHz

KDB200443 millimeter wave test procedure.

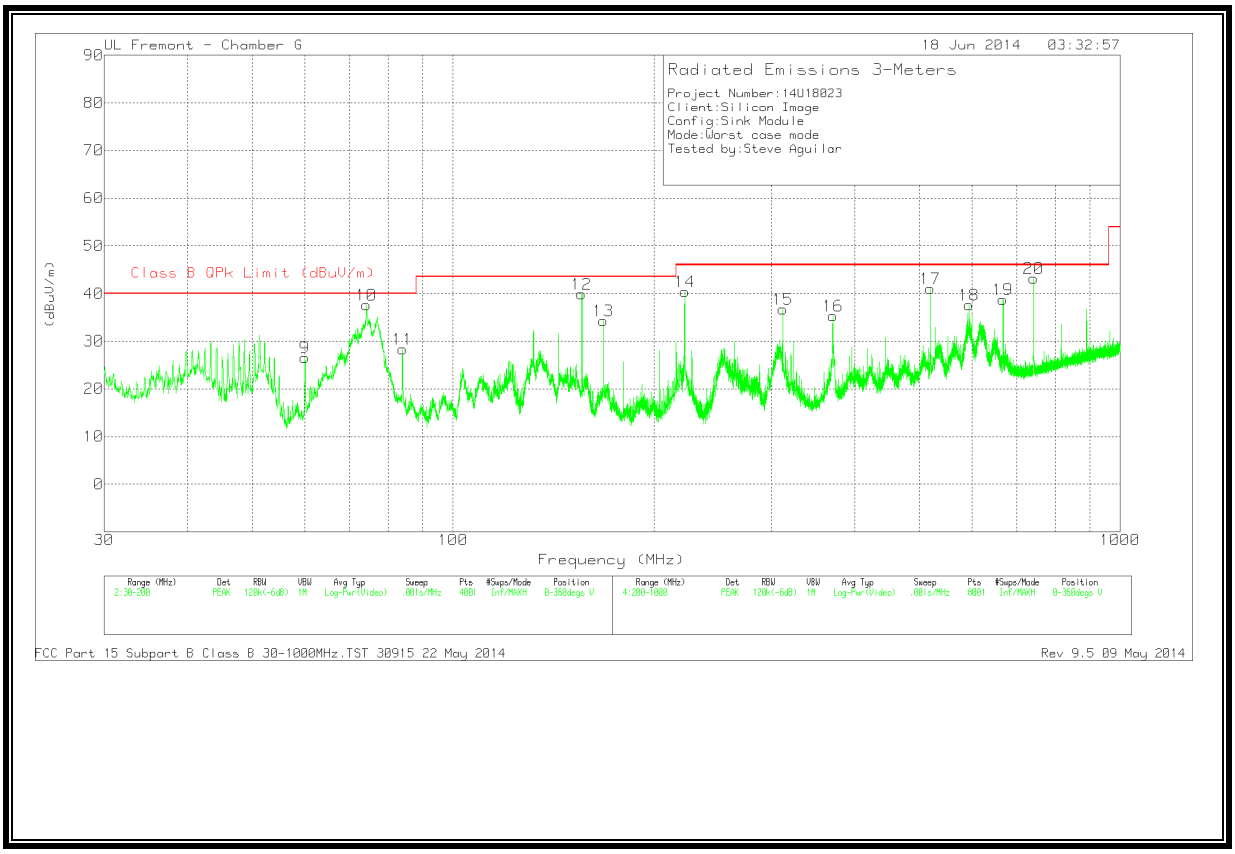
External harmonic mixers are utilized. The EIRP is measured, then the power density at a 3 meter distance is calculated.

7.4.1. Spurious Emission 30 TO 1000 MHz

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

Trace Markers

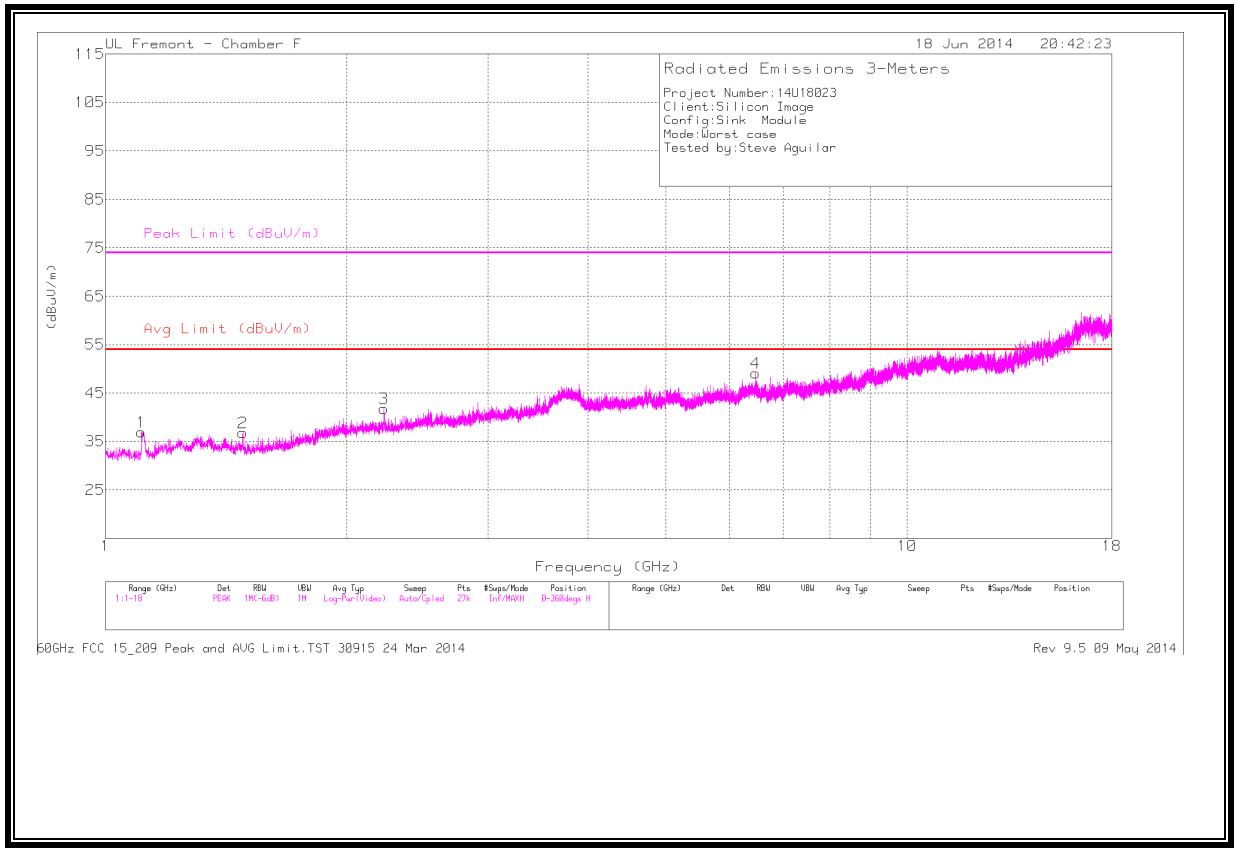
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Hybrid	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Class B QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
9	59.9625	46.45	PK	10.7	-30.6	26.55	40	-13.45	0-360	100	V
10	74.2	57.16	PK	10.9	-30.4	37.66	40	-2.34	0-360	100	V
11	84.0175	48.41	PK	10.2	-30.3	28.31	40	-11.69	0-360	100	V
12	155.97	54.07	PK	15.3	-29.5	39.87	43.52	-3.65	0-360	100	V
1	156.0125	49.81	PK	15.3	-29.5	35.61	43.52	-7.91	0-360	201	H
2	167.9975	48.47	PK	15	-29.4	34.07	43.52	-9.45	0-360	201	H
13	167.9975	48.74	PK	15	-29.4	34.34	43.52	-9.18	0-360	100	V
3	222.5	52.12	PK	13.6	-28.9	36.82	46.02	-9.2	0-360	100	H
14	222.5	55.69	PK	13.6	-28.9	40.39	46.02	-5.63	0-360	101	V
4	312	47.87	PK	16.6	-28.4	36.07	46.02	-9.95	0-360	100	H
15	312	48.57	PK	16.6	-28.4	36.77	46.02	-9.25	0-360	101	V
5	370.8	45.94	PK	17.8	-28.1	35.64	46.02	-10.38	0-360	100	H
16	370.8	45.66	PK	17.8	-28.1	35.36	46.02	-10.66	0-360	200	V
6	519.2	48.12	PK	20.6	-27.4	41.32	46.02	-4.7	0-360	201	H
17	519.3	47.84	PK	20.6	-27.4	41.04	46.02	-4.98	0-360	101	V
18	593.3	43.53	PK	21.3	-27.2	37.63	46.02	-8.39	0-360	101	V
19	667.6	42.98	PK	22.7	-26.9	38.78	46.02	-7.24	0-360	101	V
7	741.8	47.82	PK	23.6	-26.5	44.92	46.02	-1.1	0-360	100	H
20	741.8	46.08	PK	23.6	-26.5	43.18	46.02	-2.84	0-360	101	V
8	890.4	41.98	PK	25	-25.5	41.48	46.02	-4.54	0-360	100	H

PK - Peak detector

Frequency (MHz)	Meter Reading (dBuV)	Det	Hybrid	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Class B QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
74.1763	54.01	QP	11	-30.4	34.61	40	-5.39	73	108	V
155.9972	55.98	QP	15.3	-29.5	41.78	43.52	-1.74	246	102	V
222.5264	54.49	QP	13.6	-28.9	39.19	46.02	-6.83	303	106	V
519.2221	47.1	QP	20.6	-27.4	40.3	46.02	-5.72	187	116	V
519.2472	48.87	QP	20.6	-27.4	42.07	46.02	-3.95	325	198	H
741.7447	46.16	QP	23.6	-26.5	43.26	46.02	-2.76	262	124	H
741.7484	45.15	QP	23.6	-26.5	42.25	46.02	-3.77	203	109	V
890.1365	41.75	QP	25	-25.5	41.25	46.02	-4.77	294	270	H

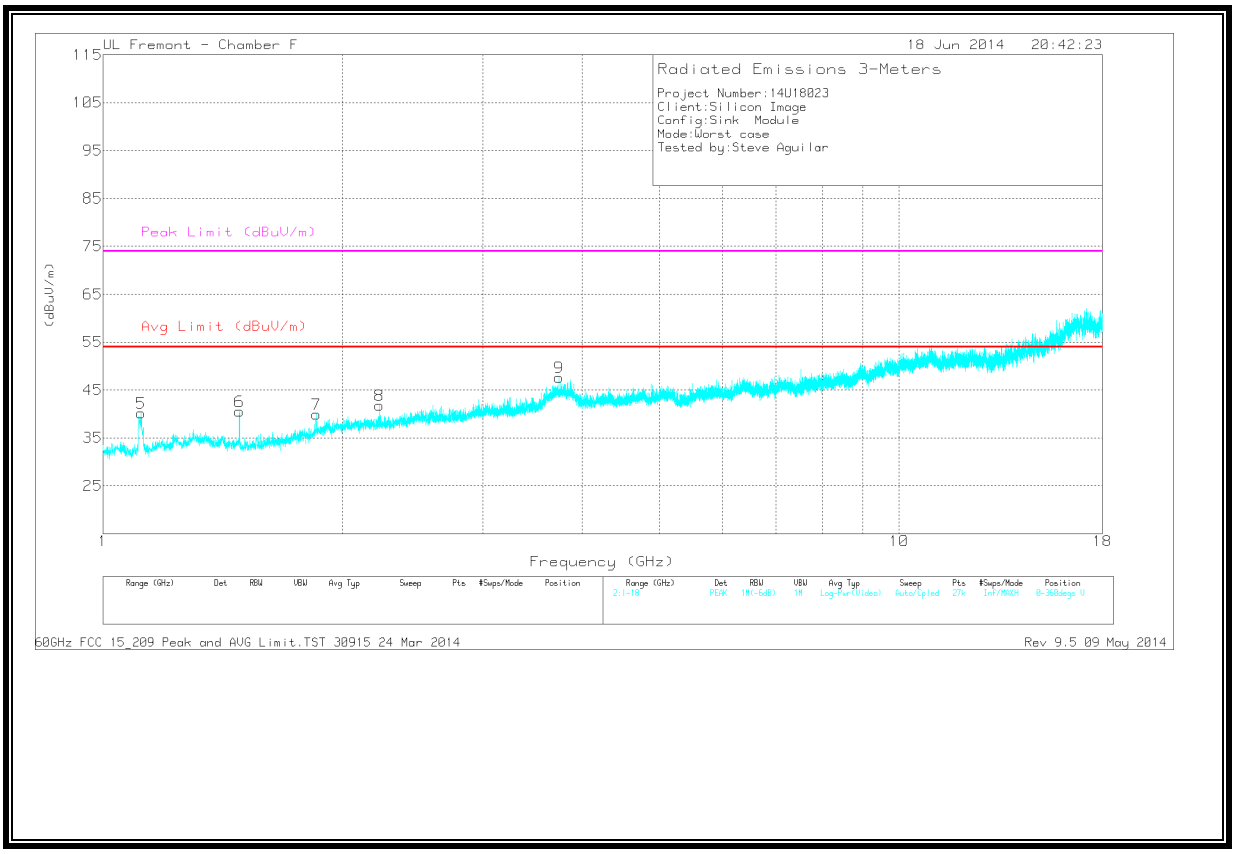
7.4.2. Spurious Emissions 1 TO 18 GHz

SPURIOUS EMISSION 1-18 GHz (HORIZONTAL PLOT)



Note: Average Limit line is for reference only.

TX SPURIOUS EMISSION 1-18 GHz (VERTICAL PLOT)



Note: Average Limit line is for reference only.

SPURIOUS EMISSION 1-18 GHz

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.109	41.98	PK	27.6	-32.6	36.98	54	-	74	-37.02	0-360	98	H
2	1.484	40.39	PK	28.5	-32.1	36.79	54	-	74	-37.21	0-360	199	H
3	2.225	41.01	PK	31.8	-31	41.81	54	-	74	-32.19	0-360	98	H
4	6.473	40.86	PK	35.6	-27.3	49.16	54	-	74	-24.84	0-360	199	H
5	1.116	44.95	PK	27.8	-32.6	40.15	54	-	74	-33.85	0-360	201	V
6	1.484	44.15	PK	28.5	-32.1	40.55	54	-	74	-33.45	0-360	201	V
7	1.855	40.5	PK	30.9	-31.5	39.9	54	-	74	-34.10	0-360	101	V
8	2.225	41.02	PK	31.8	-31	41.82	54	-	74	-32.18	0-360	201	V
9	3.736	42.87	PK	34.7	-30	47.57	54	-	74	-26.43	0-360	201	V

PK - Peak detector

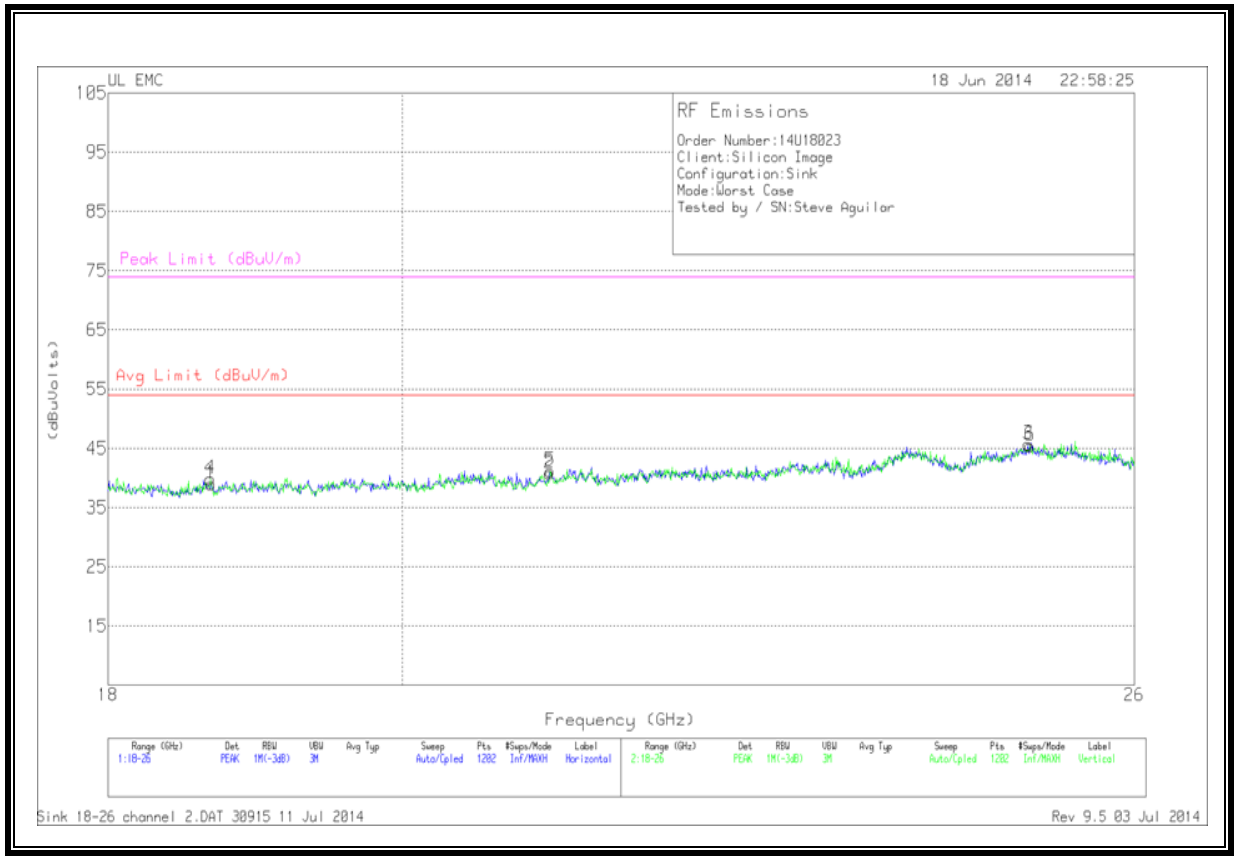
Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.108	42.39	PK	27.6	-32.6	37.39	--	--	74	-36.61	144	130	H
1.111	30.25	Avg	27.7	-32.6	25.35	54	-28.65	-	-	144	130	H
1.111	42.97	PK	27.7	-32.6	38.07	--	--	74	-35.93	144	130	H
2.225	43.98	PK	31.8	-31	44.78	--	--	74	-29.22	237	268	H
2.225	32.84	Avg	31.8	-31	33.64	54	-20.36	-	-	237	268	H
3.376	39.89	PK	33.9	-30.1	43.69	-	-	74	-30.31	121	391	V
3.376	26.57	Avg	33.9	-30.1	30.37	54	-23.63	-	-	121	391	V

PK - Peak detector
Avg - Video bandwidth < Resolution bandwidth

7.4.3. Spurious Emissions 18 to 26 GHz

SPURIOUS EMISSION 18 TO 26 GHz (HORIZONTAL AND VERTICAL PLOT)



SPURIOUS EMISSION 18 TO 26 GHz

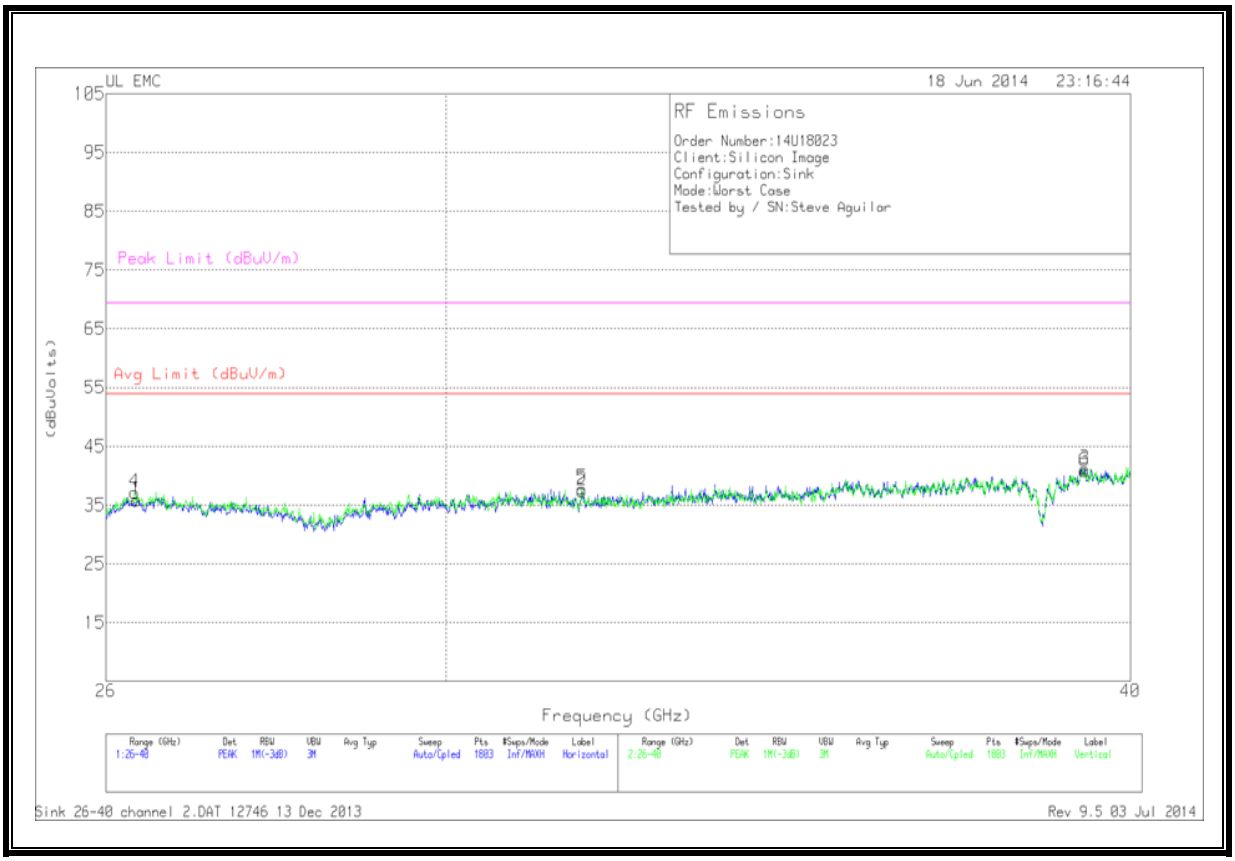
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T89 (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	18.626	40.77	PK	32.5	-24.1	-9.5	39.66	54	-14.34	74	-34.34
2	21.237	41.7	PK	33	-23.7	-9.5	41.5	54	-12.5	74	-32.5
3	25.054	44.1	PK	34	-22.6	-9.5	46	54	-8	74	-28
4	18.673	40.93	PK	32.5	-24.1	-9.5	39.83	54	-14.17	74	-34.17
5	21.217	41.8	PK	33	-23.8	-9.5	41.5	54	-12.5	74	-32.5
6	25.047	43.6	PK	34	-22.6	-9.5	45.5	54	-8.5	74	-28.5

PK - Peak detector
18-26GHz Test 3 to1CF.TST 12746 13 Dec 2013 Rev 9.5 19 Jan 2014

7.4.4. Spurious Emissions 26 TO 40 GHz

SPURIOUS EMISSION 26 TO 40 GHz (HORIZONTAL AND VERTICAL PLOT)



SPURIOUS EMISSION 26 TO 40 GHz

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T90 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	26.334	43.93	PK	35.6	-34.2	-9.5	35.83	54	-18.17	74	-38.17
2	31.765	46.2	PK	36.3	-35.5	-9.5	37.5	54	-16.5	74	-36.5
3	39.239	48.37	PK	38.5	-36.2	-9.5	41.16	54	-12.84	74	-32.84
4	26.319	45.27	PK	35.6	-34.2	-9.5	37.16	54	-16.84	74	-36.84
5	31.765	46.53	PK	36.3	-35.5	-9.5	37.83	54	-16.17	74	-36.17
6	39.235	48.03	PK	38.5	-36.2	-9.5	40.83	54	-13.17	74	-33.17

PK - Peak detector

26-40GHz Test 3 to 1CF.TST 12746 13 Dec 2013 Rev 9.5 19 Jan 2014

7.4.5. Spurious Emissions 40 TO 200 GHz

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

Frequency (GHz)	Measurement Distance (m)	Peak Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
48.384	0.010	-70.92	20.00	-64.8
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (pW/cm^2)**	**Limit (pW/cm^2)**
3.32E-10	3.0	2.94E-12	0.00	90

Frequency (GHz)	Measurement Distance (m)	Peak Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
50.112	0.010	-69.14	20.00	-62.7
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (pW/cm^2)**	**Limit (pW/cm^2)**
5.37E-10	3.0	4.75E-12	0.00	90

7.5. AC MAINS LINE CONDUCTED EMISSIONS

LIMITS

§15.207
IC RSS-GEN, Section 7.2.2

Frequency range (MHz)	Limits (dBµV)	
	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 C63.10-2009

6 WORST EMISSIONS

Line-L1 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
1	.1905	51.34	PK	1	0	52.34	64	-11.66	-	-
2	.1905	28.35	Av	1	0	29.35	-	-	54	-24.65
3	17.196	32.25	PK	.3	.2	32.75	60	-27.25	-	-
4	17.196	14.77	Av	.3	.2	15.27	-	-	50	-34.73
5	27.528	35.42	PK	.3	.3	36.02	60	-23.98	-	-
6	27.528	21.26	Av	.3	.3	21.86	-	-	50	-28.14

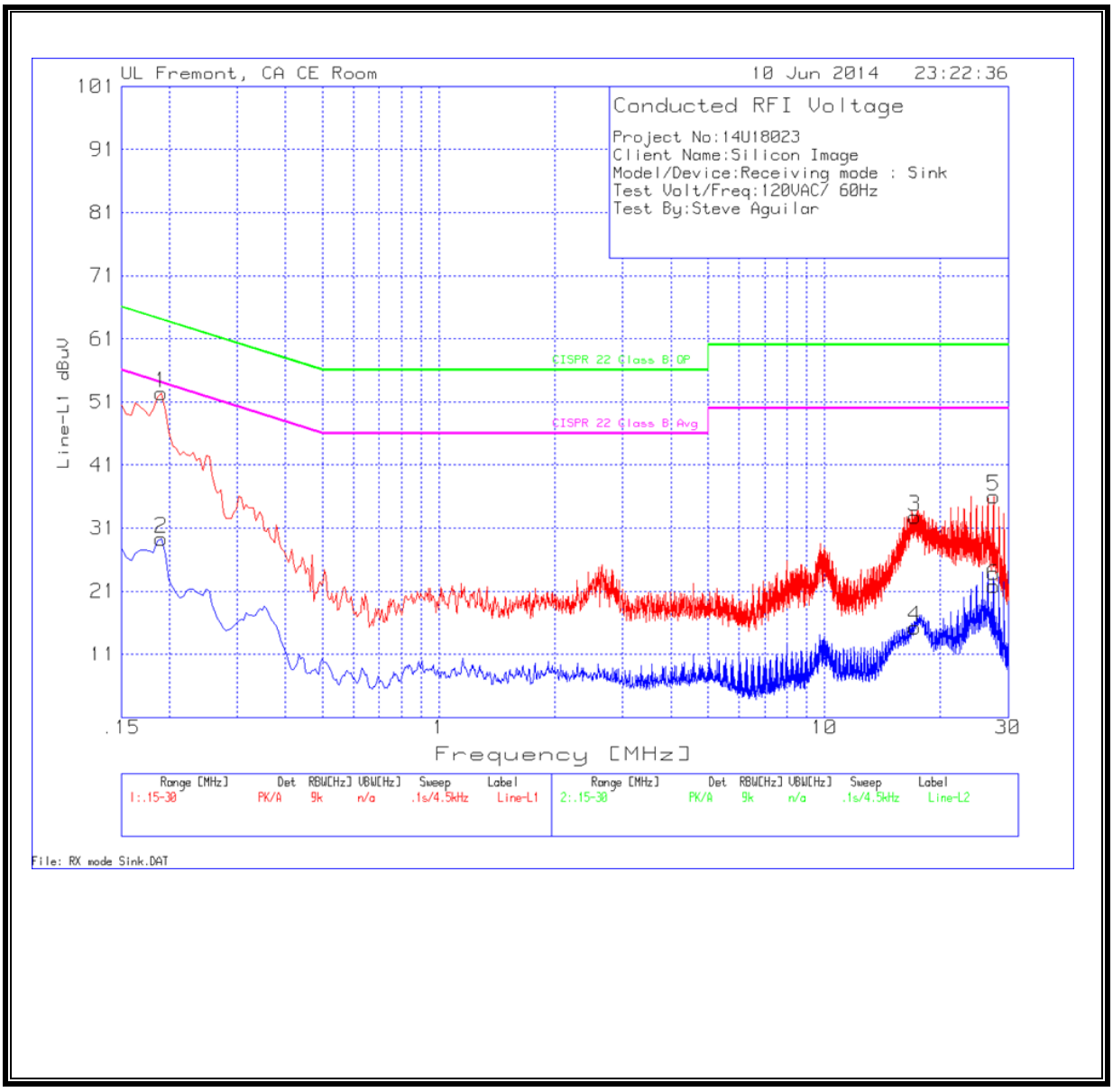
Line-L2 .15 - 30MHz

Trace Markers

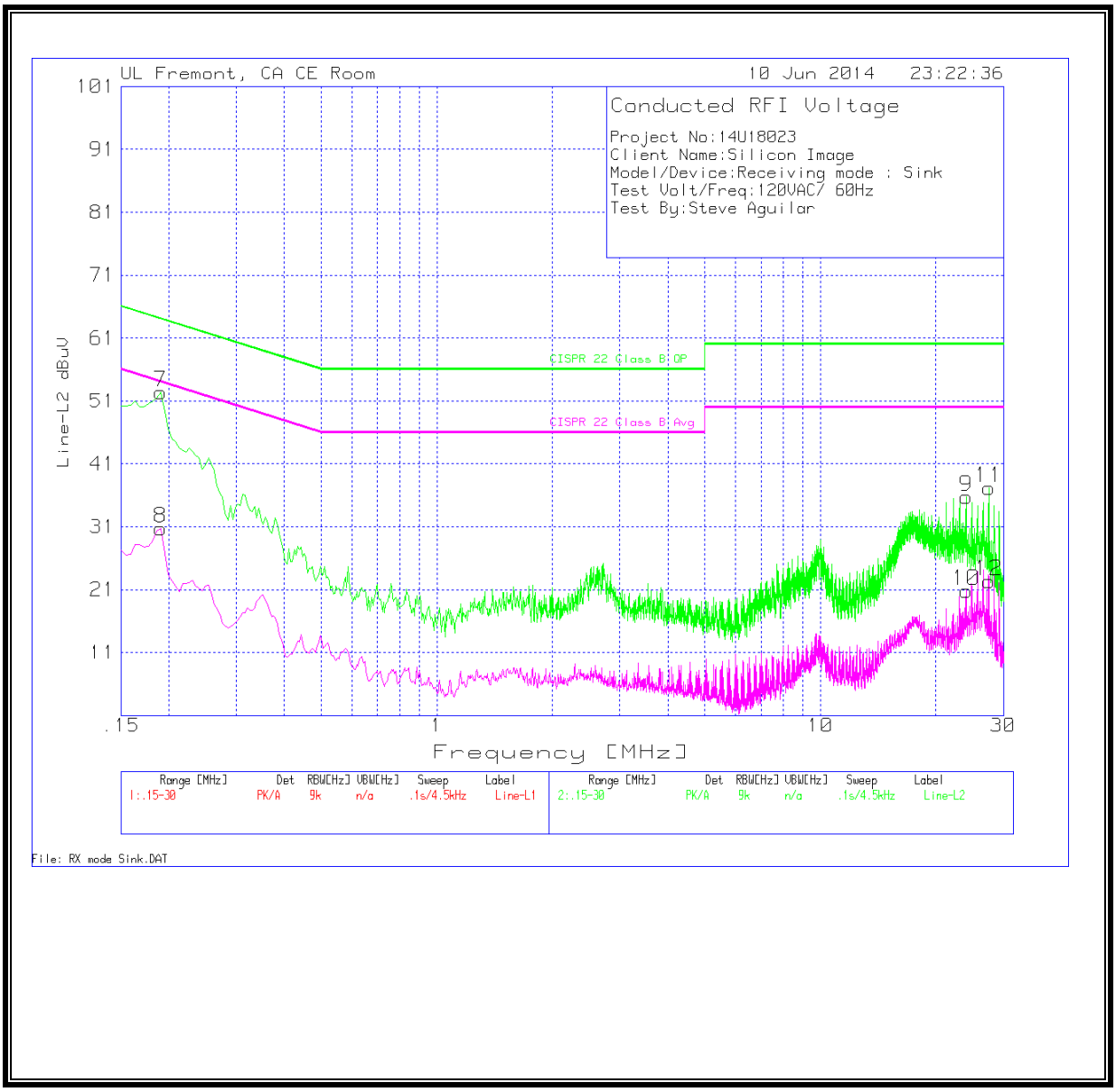
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
7	.1905	51.28	PK	1.1	0	52.38	64	-11.62	-	-
8	.1905	29.6	Av	1.1	0	30.7	-	-	54	-23.3
9	23.9685	35.23	PK	.3	.2	35.73	60	-24.27	-	-
10	23.9685	20.26	Av	.3	.2	20.76	-	-	50	-29.24
11	27.5235	36.55	PK	.3	.3	37.15	60	-22.85	-	-
12	27.5235	21.78	Av	.3	.3	22.38	-	-	50	-27.62

PK - Peak detector
Av - average detection

LINE 1 RESULTS



LINE 2 RESULTS



8. GROUP INSTALLATION

LIMIT

§15.255 (h) Any transmitter that has received the necessary FCC equipment authorization under the rules of this chapter may be mounted in a group installation for simultaneous operation with one or more other transmitter(s) that have received the necessary FCC equipment authorization, without any additional equipment authorization. However, no transmitter operating under the provisions of this section may be equipped with external phase-locking inputs that permit beam-forming arrays to be realized.

RESULTS

The frequency, amplitude and phase of the transmit signal are set within the EUT. There are no external phase-locking inputs or any other means of combining two or more units together to realize a beam-forming array.

9. 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.

CALCULATIONS

EIRP is converted to Power Density using the equation:

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

where:

P_D = power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D_S = separation distance in m

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

RESULTS

Average EIRP (dBm)	Average EIRP (W)	Separation Distance (cm)	Power Density (mW/cm^2)	FCC Limit (mW/cm^2)
14.4	0.028	20	0.01	1