FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

ZeroWire G2 Receiver

MODEL NUMBER: WR-P42-11

FCC ID: UEZ-WR-P42-11

REPORT NUMBER: 14U19063-E2, Revision C

ISSUE DATE: MARCH 25, 2015

Prepared for

NDS SURGICAL IMAGING, LLC
5750 HELLYER AVENUE
SAN JOSE, CA 95138, U.S.A.

Prepared by

UL VERIFICATION SERVICES INC
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

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Revision History

Rev.	Issue Date	Revisions	Revised By
--	02/26/2015	Initial Issue	M. Heckrotte
A	03/05/2015	Editorial update Section 5	S. Aguilar
B	03/25/2015	Restated power density results as radiated power	M. Heckrotte
C	03/30/2015	Corrected the FCC ID number to FCC ID: UEZ-***WR***-P42-11	S. Kuwatani

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: NDS SURGICAL IMAGING, LLC
5750 HELLYER AVENUE
SAN JOSE, CA 94138, U.S.A.

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EUT DESCRIPTION: ZeroWire G2 Receiver

MODEL: WR-P42-11

SERIAL NUMBER: ENG10006, ENG10007, RX107

DATE TESTED: NOV. 19th ,2014 to JAN.28th, 2015

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
PRINICIPAL ENGINEER
UL Verification Services Inc.

Tested By:

STEVE AGUILAR
LAB ENGINEER
UL Verification Services Inc.

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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

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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
Radiated Disturbance, 1 to 6 GHz	±3.86 dB
Radiated Disturbance, 6 to 18 GHz	±4.23 dB
Radiated Disturbance, 18 to 26 GHz	±5.30 dB
Radiated Disturbance, 26 to 40 GHz	±3.23 dB
Radiated Disturbance, 4 GHz above	±3.50dB

Uncertainty figures are valid to a confidence level of 95%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The WR-P42-11 is a Generation 2 Wireless HD sink operating in the 57-64 GHz band for Wireless Video Audio Network (WVAN). The EUT receives High Definition Audio/Video from a WirelessHD source (UEZ-WT-P42-13).

The EUT receives High Definition Audio/Video data on a single High Rate (HRP) channel at either 60.48 GHz or 62.64 GHz. The integral HRP receive antenna is an adaptive beam-steering array with a maximum gain of 22 dBi.

The EUT transmits and receives control and management signals on one of three Low Rate (LRP) channels per HRP channel. LRP channels range from 60.321375 to 60.638625 GHz (for HRP at 60.48 GHz) or from 62.481375 to 62.798625 GHz (for HRP at 62.64 GHz). The integral LRP transmit/receive antenna is a scanning beam-steering array with a maximum gain of 16 dBi for each polarization.

The LRP modulation is BPSK. 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. CONDUCTED 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 1.02 mW (0.10 dBm).

5.3. WORST-CASE CONFIGURATION AND MODE

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

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5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an integral phased-array antenna, with a maximum gain of 16 dBi.

5.5. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was Gemtek Version 1.3.01

The test utility software used during testing was SBAM2 NB 2011.11.28.0 and RS232.exe version 11-13-2014

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	**Manufacturer**	**Model**	**Serial Number**
HD Digital Media Player	GFEN	EXT-HD-DSMP	AB1403770171
DC Power Adepter	GFEN	3A-401WP12	--
HD Monitor	NDSSI	Radiance G2 HB	ENG0722
HD Monitor Power supply	SL Power Elec.	MW155RA2400F 02	B36-07029
Interface Board	SiBeam	Cyclops	-
Interface Board	SiBeam	Cyclops	-
Laptop	Dell	E6330	3819856385
Laptop Power supply	Dell	1XRN1	CN-01XRN1-48661-398-CS HT-A01

I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**No. of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC	2	Barrel	Unshielded	3	Ferrite on DC cord
2	AC	1	AC,3P	Unshielded	1.8	N/A
3	DC	1	Barrel	Unshielded	2.4	N/A
4	DVI	1	DVI	Shielded	2	N/A
5	DC	1	Barrel	Unshielded	1.5	N/A
6	DVI	1	HDMI-to-DVI	Shielded	1.8	N/A

TEST SETUP

Laptop using USB to Mini-USB was used to set EUT into an operational mode and was not used as part of the test.

The SiBeam Cyclops interface board was used to directly interface the RF module in order to set the EUT in the proper modes for RF Tests.

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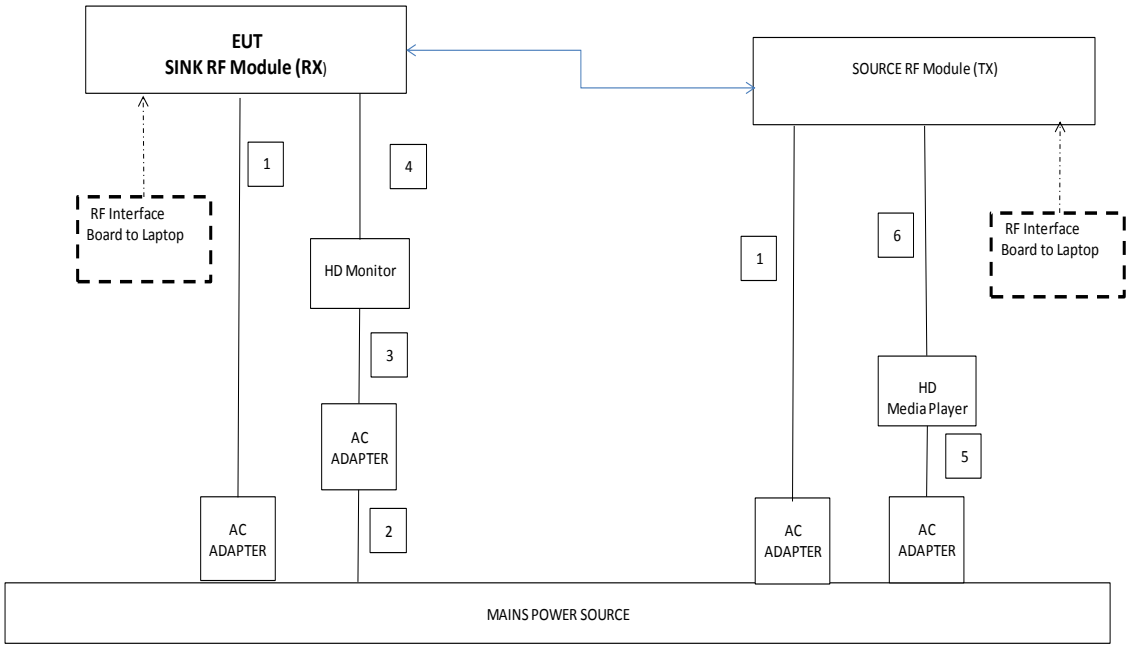
SETUP DIAGRAM FOR TESTS

RF Tests



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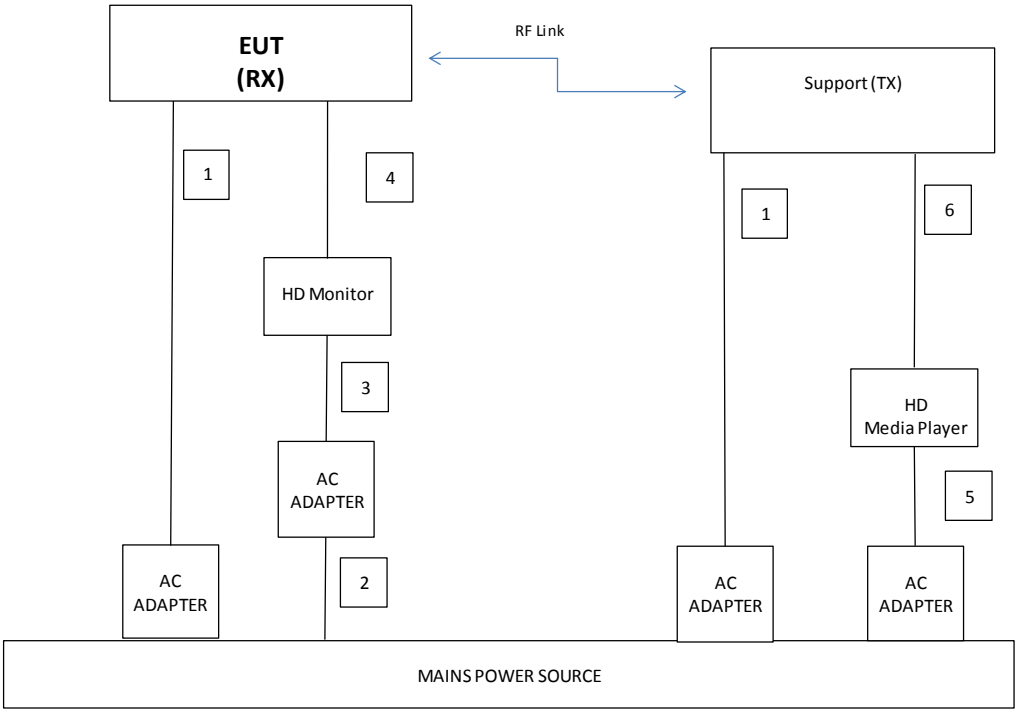
SETUP DIAGRAM FOR TESTS

Radiated Emissions Tests



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6. TEST AND MEASUREMENT EQUIPMENT

Test Equipment List				
Description	**Manufacturer**	**Model**	**S/N**	**Cal Due**
N9030A PXA Signal Analyzer	Agilent	N9030A	MY52350427	9/13/2015
Analog Signal Generator, 40 GHz	Agilent	E8257D	MY48050681	9/26/2015
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	M1970U-002	MY5139	11/1/2015
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	5/6/2015
Harmonic Mixer, 50-80 GHz	Keysight	M1970V-002	MY51390830	6/18/2015
Low Pass Filter	Spacek	LPF 5-60-8-15	14L21	CNR
Low Noise Amplifier, 40-50 GHz	Spacek	SL4510-33-4W	14J05	9/4/2015
Low Pass Filter	Spacek	LPF-5-50-8-22	14L20	CNR
Spectrum Analyzer	Agilent	8564E	3943A01643	8/6/2015
Horn Antenna, 18 to 26.5GHz	ARA	MWH-1826/B	1049	12/17/2015
PreAmplifier, 1-26.5GHz	Agilent	8449B	3008A04710	3/23/2015
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	924343	9/3/2015
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	1029	7/15/2015
Oscilloscope 1GHz 4 Ch DSO	Agilent	DSO9104A	MY51420139	6/11/2015
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
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	A051314-2	1/28/215
RF PreAmplifier, 1-18GHz *	Miteq	AFS42-00101800-25-S-42	T742	1/20/2015
Preamp, 1000MHz*	Sonoma	310N	185623	6/7/2015
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	JB3	A051314-2	4/27/2015
RF PreAmplifier, 1-18GHz	Miteq	AFS42-00101800-25-S-42	1818464	6/5/2015
Preamp, 1000MHz	Sonoma	310N	325188	6/5/2015
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	100935	9/16/2015
LISN, 30 MHz	FCC	50/250-25-2	114	1/17/2015
Chamber, Environmental	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	ZP131613	4/10/2015
Power supply AC	Elgar-Ametek	CW2501M	1307A03505	CNR
DMM	Fluke	87V	23310087	3/21/2015
Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014	
Conducted Software	UL	UL EMC	Ver 9.5, May 17, 2012	

*Used before due date.

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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.

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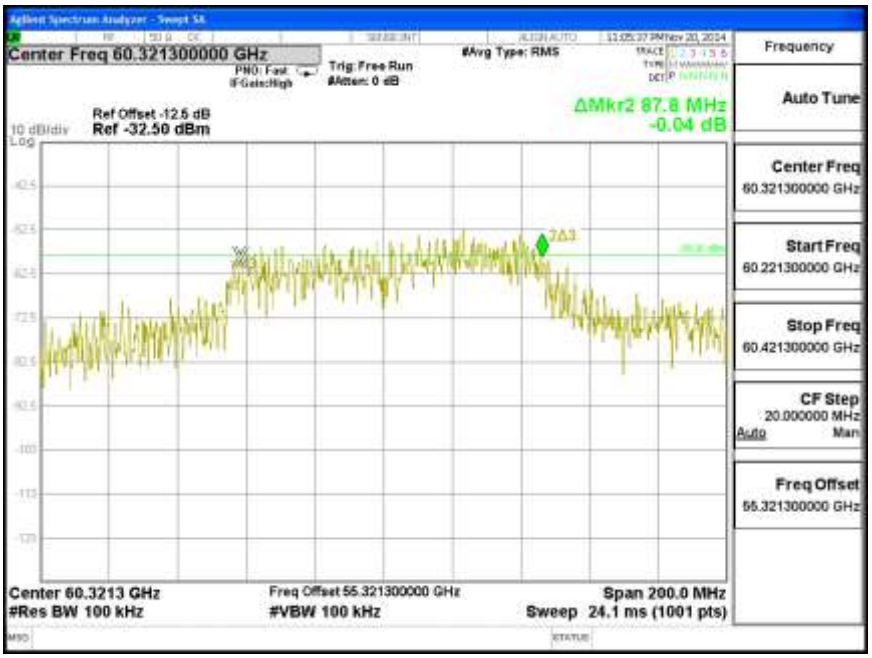
RESULTS

Channel	Frequency (GHz)	6 dB Bandwidth (MHz)
Low	60.32	87.80
Mid	60.64	90.40
High	62.79	91.40

6dB BANDWIDTH

6 dB BANDWIDTH LRP LOW CHANNEL



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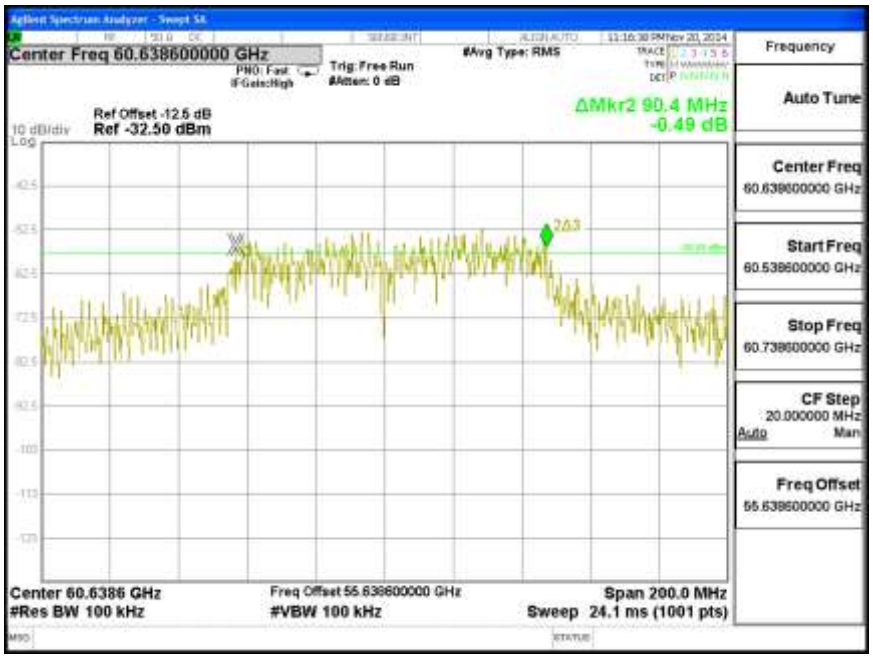
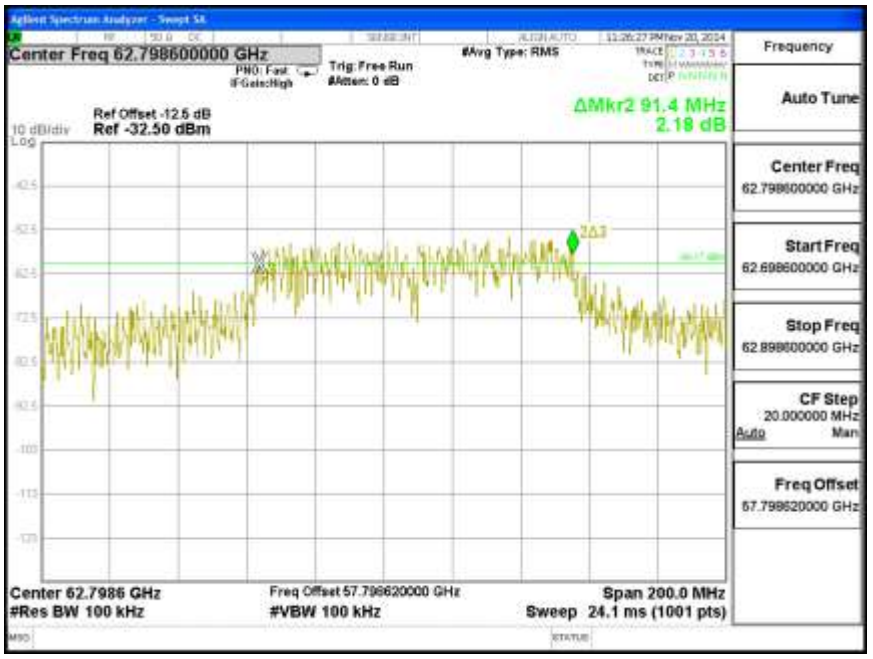
6dB BANDWIDTH

6 dB BANDWIDTH LRP MID CHANNEL



6 dB BANDWIDTH LRP HIGH CHANNEL



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7.2. RADIATED POWER

LIMIT

§15.255 (b) (1) (i) Within the 57-64 GHz band, the average power of any emission shall not exceed 40 dBm and the peak power of any emission shall not exceed 43 dBm.

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

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	0.020	0.0050	0.16
62.64	0.020	0.0048	0.17

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Low Channel

PEAK RADIATED POWER

Frequency (GHz)	Measurement Distance (m)	Measured Peak Voltage (mV)	Raw Measured Power (dBm)	Corrd Power (dBm)	Rx Antenna Gain (dBi)
60.32	1.50	6.30	-32.77	-32.47	23.00
EIRP (dBm)	**EIRP Limit (dBm)**	**Margin (dB)**			
16.1	43.0	-26.9			

AVERAGE RADIATED POWER

Frequency (GHz)	Measurement Distance (m)	Measured Average Voltage (mV)	Measured Power (dBm)	Corrd Measured Power (dBm)	Rx Antenna Gain (dBi)
60.32	1.50	0.90	-37.34	-37.04	23.00
EIRP (dBm)	**EIRP Limit (dBm)**	**Margin (dB)**			
11.5	40.0	-28.5			

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Mid Channel

PEAK RADIATED POWER

Frequency (GHz)	Measurement Distance (m)	Measured Peak Voltage (mV)	Raw Measured Power (dBm)	Corrd Power (dBm)	Rx Antenna Gain (dBi)
60.64	1.50	6.35	-33.16	-32.86	23.00
EIRP (dBm)	**EIRP Limit (dBm)**	**Margin (dB)**			
15.8	43.0	-27.2			

AVERAGE RADIATED POWER

Frequency (GHz)	Measurement Distance (m)	Measured Average Voltage (mV)	Measured Power (dBm)	Corrd Measured Power (dBm)	Rx Antenna Gain (dBi)
60.64	1.50	0.88	-38.02	-37.72	23.00
EIRP (dBm)	**EIRP Limit (dBm)**	**Margin (dB)**			
10.9	40.0	-29.1			

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High Channel

PEAK RADIATED POWER

Frequency (GHz)	Measurement Distance (m)	Measured Peak Voltage (mV)	Raw Measured Power (dBm)	Corrd Power (dBm)	Rx Antenna Gain (dBi)
62.79	1.50	6.35	-33.16	-32.86	23.00

EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
16.1	43.0	-26.9

AVERAGE RADIATED POWER

Frequency (GHz)	Measurement Distance (m)	Measured Average Voltage (mV)	Measured Power (dBm)	Corrd Measured Power (dBm)	Rx Antenna Gain (dBi)
62.79	1.50	0.88	-38.02	-37.72	23.00

EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
11.2	40.0	-28.8

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7.3. PEAK CONDUCTED 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.

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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)
60.32	16.1	16.00	0.10	1.02	87.8	439

CHANNEL-MID

Frequency (GHz)	EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
60.64	15.8	16.00	-0.20	0.95	90.4	452

CHANNEL-HIGH

Frequency (GHz)	EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
62.79	16.1	16.00	0.10	1.02	91.4	457

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7.4. FREQUENCY STABILITY

LIMIT

§15.255 (f) Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range - 20 to +50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

TEST PROCEDURE

The radio module is placed in an environmental chamber, with power furnished by an adjustable source.

RESULTS

Reference Conditions: 120VAC @ 20ºC			Mid LRP 60.63
Power Supply (VAC)	**Environment Temperature (ºC)**	**Frequency (MHz)**	**Delta (kHz)**
120.00	50	60641.4855000	2130.000
120.00	40	60641.5755000	2220.000
120.00	30	60640.6755000	1320.000
120.00	***20***	***60639.3555000***	***Reference***
120.00	10	60638.3155000	-1040.000
120.00	0	60638.5155000	-840.000
120.00	-10	60639.0050000	-350.500
120.00	-20	60638.0050000	-1350.500
102.00	20	60639.3855000	30.000
138.00	20	60639.7955000	440.000

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7.5. 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.

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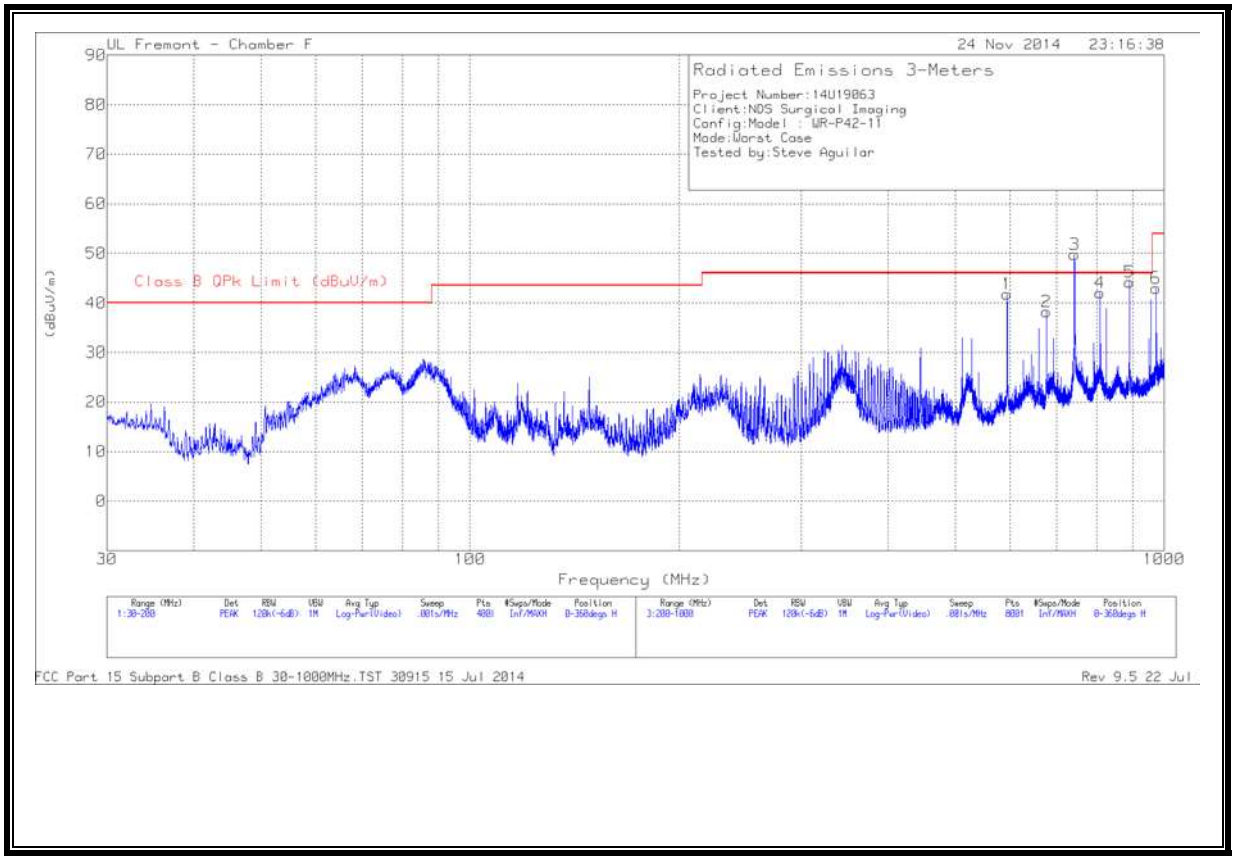
7.5.1. Spurious Emissions 30MHz TO 1 GHz

TX SPURIOUS EMISSION 30 TO 1000 MHz (HORIZONTAL PLOT)



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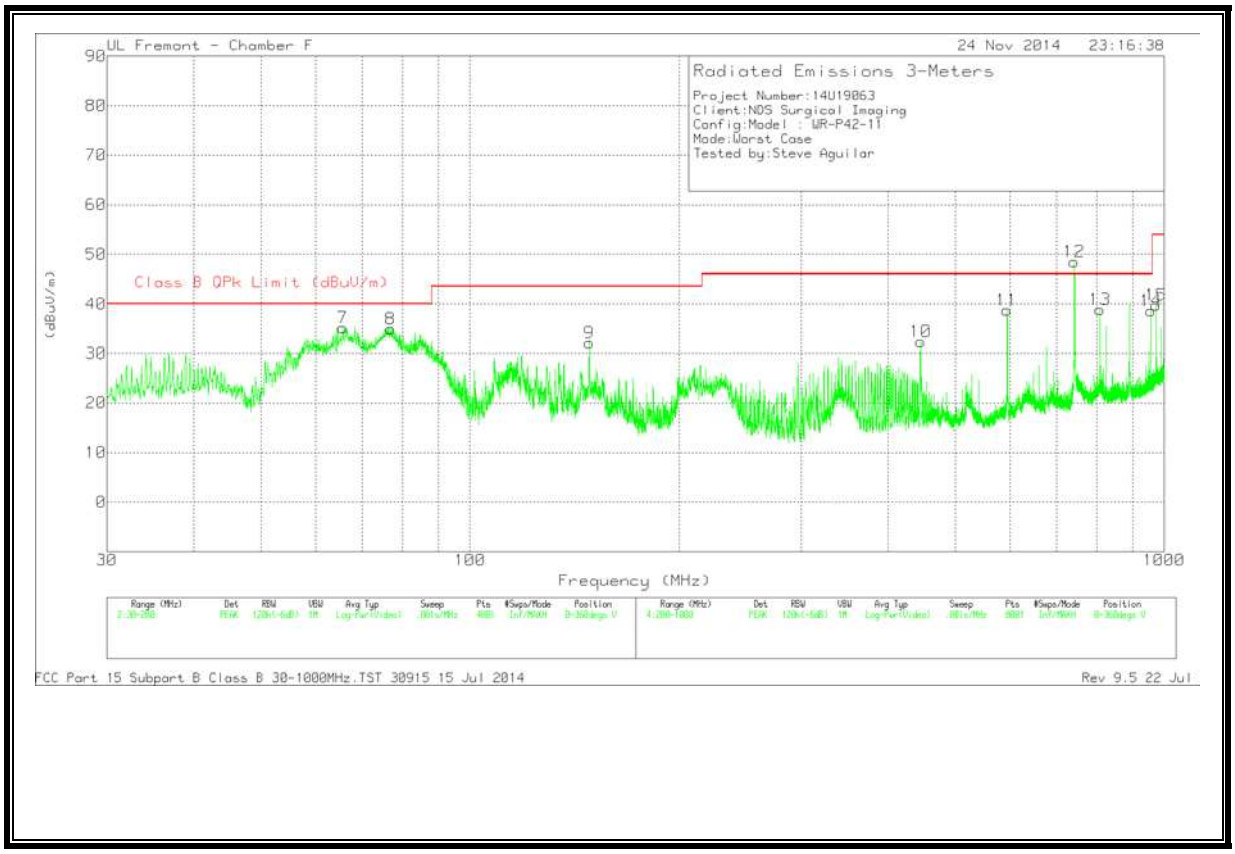
TX SPURIOUS EMISSION 30 TO 1000 MHz (VERTICAL PLOT)



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TX SPURIOUS EMISSION 30MHz-1GHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T122 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Class B QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7	65.5725	59.01	PK	7.9	-31.7	35.21	40	-4.79	0-360	100	V
8	76.8775	58.61	PK	7.9	-31.6	34.91	40	-5.09	0-360	100	V
9	148.4475	50.76	PK	12.7	-31.3	32.16	43.52	-11.36	0-360	100	V
1	594	53.34	PK	18.5	-30	41.84	46.02	-4.18	0-360	100	H
2	676.5	48.29	PK	19.9	-29.9	38.29	46.02	-7.73	0-360	201	H
3	742.6	58.59	PK	20.7	-29.5	49.79	**46.02**	**3.77**	0-360	201	H
4	808.5	49.75	PK	21.6	-29.3	42.05	46.02	-3.97	0-360	201	H
5	891	50.28	PK	22.5	-28.6	44.18	46.02	-1.84	0-360	401	H
6	973.5	47.7	PK	23.1	-27.8	43	53.97	-10.97	0-360	100	H
10	445.5	45.86	PK	16.8	-30.2	32.46	46.02	-13.56	0-360	100	V
11	594	50.28	PK	18.5	-30	38.78	46.02	-7.24	0-360	301	V
12	742.3	57.48	PK	20.6	-29.6	48.48	**46.02**	**2.46**	0-360	301	V
13	808.5	46.62	PK	21.6	-29.3	38.92	46.02	-7.1	0-360	301	V
14	957	43.63	PK	23	-28	38.63	46.02	-7.39	0-360	201	V
15	973.5	44.5	PK	23.1	-27.8	39.8	53.97	-14.17	0-360	201	V

PK - Peak detector

Radiated Emissions

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T122 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Class B QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Pol.
7	63.85	55.96	QP	7.8	-31.7	32.06	40	-7.94	228	100	V
8	75.77	56.61	QP	8	-31.7	32.91	40	-7.09	167	161	V
1	593.99	40.65	QP	18.5	-30	29.15	46.02	-16.87	273	277	H
3	742.85	50.47	QP	20.7	-29.5	41.67	46.02	-4.35	50	308	H
4	807.93	28.1	QP	21.6	-29.3	20.4	46.02	-25.62	76	221	H
5	890.99	50	QP	22.5	-28.6	43.9	46.02	-2.12	116	232	H
12	742.66	51.24	QP	20.7	-29.5	42.44	46.02	-3.58	352	164	V

QP - Quasi-Peak detector

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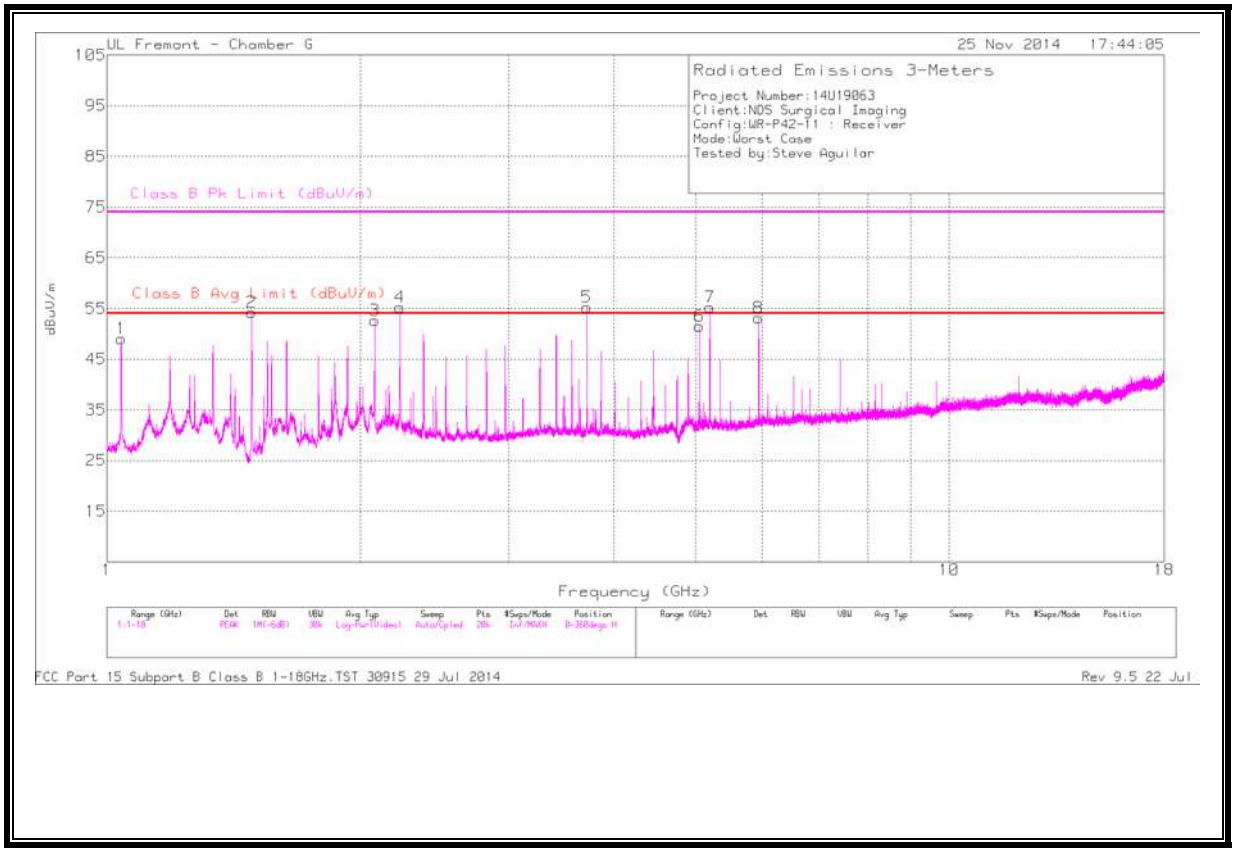
7.5.2. Spurious Emissions 1 TO 18 GHz

TX SPURIOUS EMISSION 1-18 GHz (HORIZONTAL PLOT)



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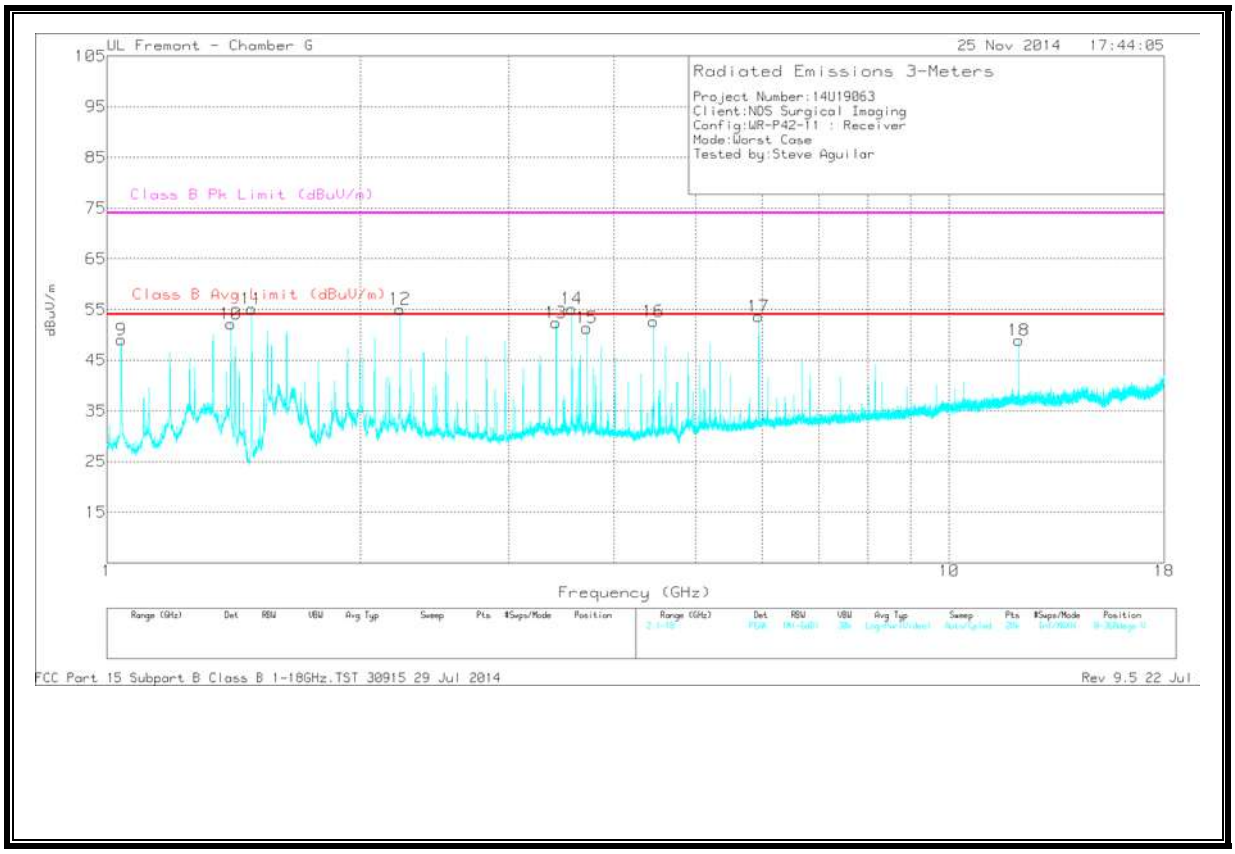
TX SPURIOUS EMISSION 1-18 GHz (VERTICAL PLOT)



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TX SPURIOUS EMISSION 1-18 GHz

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Corrected Reading dBuV/m	Avg Limit (dBuV/m)	Av(CISPR)Margin (dB)	Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.039	56.79	PK	28.2	-35.9	49.09	54	-	74	-24.91	0-360	201	H
9	1.039	56.75	PK	28.2	-35.9	49.05	54	-	74	-24.95	0-360	201	V
10	1.402	59.29	PK	28.4	-35.5	52.19	54	-	74	-21.81	0-360	201	V
2	1.485	61.86	PK	28	-35.6	54.26	54	-	74	-19.74	0-360	201	H
11	1.485	62.68	PK	28	-35.6	55.08	54	-	74	-18.92	0-360	201	V
3	2.079	56.22	PK	31.4	-35	52.62	54	-	74	-21.38	0-360	201	H
12	2.227	58.56	PK	31.5	-35	55.06	54	-	74	-18.94	0-360	201	V
4	2.228	58.69	PK	31.5	-35	55.19	54	-	74	-18.81	0-360	201	H
13	3.415	53.66	PK	32.9	-34.2	52.36	54	-	74	-21.64	0-360	201	V
14	3.564	56.48	PK	32.8	-34.1	55.18	54	-	74	-18.82	0-360	201	V
5	3.712	56.29	PK	32.9	-33.9	55.29	54	-	74	-18.71	0-360	201	H
15	3.712	52.34	PK	32.9	-33.9	51.34	54	-	74	-22.66	0-360	101	V
16	4.454	52.59	PK	33.6	-33.6	52.59	54	-	74	-21.41	0-360	201	V
6	5.049	50.81	PK	34.2	-33.5	51.51	54	-	74	-22.49	0-360	98	H
7	5.197	54.5	PK	34.4	-33.6	55.3	54	-	74	-18.7	0-360	201	H
8	5.94	51.35	PK	35.1	-33.3	53.15	54	-	74	-20.85	0-360	201	H
17	5.941	51.87	PK	35.1	-33.3	53.67	54	-	74	-20.33	0-360	201	V
18	12.096	37.56	PK	38.8	-27.4	48.96	54	-	74	-25.04	0-360	101	V

PK - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Corrected Reading dBuV/m	Class B Avg Limit (dBuV/m)	Av(CISPR)Margin (dB)	Class B Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.485	66.66	PK	28	-35.6	59.06	-	-	74	-14.94	244	244	H
1.485	57.4	Avg	28	-35.6	49.8	54	-4.2	-	-	244	244	H
1.485	68.27	PK	28	-35.6	60.67	-	-	74	-13.33	232	184	V
1.485	58.67	Avg	28	-35.6	51.07	54	-2.93	-	-	232	184	V
2.227	62.64	PK	31.5	-35	59.14	-	-	74	-14.86	263	202	H
2.228	46.91	Avg	31.5	-35	43.41	54	-10.59	-	-	263	202	H
2.277	46.81	PK	31.6	-34.8	43.61	-	-	74	-30.39	124	342	V
2.277	33	Avg	31.6	-34.8	29.8	54	-24.2	-	-	124	342	V
3.564	60.36	PK	32.8	-34.1	59.06	-	-	74	-14.94	213	305	V
3.564	43.44	Avg	32.8	-34.1	42.14	54	-11.86	-	-	213	305	V
3.712	57.89	PK	32.9	-33.9	56.89	-	-	74	-17.11	223	206	H
3.712	39.88	Avg	32.9	-33.9	38.88	54	-15.12	-	-	223	206	H
5.197	55.83	PK	34.4	-33.6	56.63	-	-	74	-17.37	191	378	H
5.198	40.4	Avg	34.4	-33.6	41.2	54	-12.8	-	-	191	378	H
12.096	39.91	PK	38.8	-27.4	51.31	-	-	74	-22.69	72	106	V
12.096	26.38	Avg	38.8	-27.4	37.78	54	-16.22	-	-	72	106	V

PK - Peak detector
Avg - Video bandwidth < Resolution bandwidth

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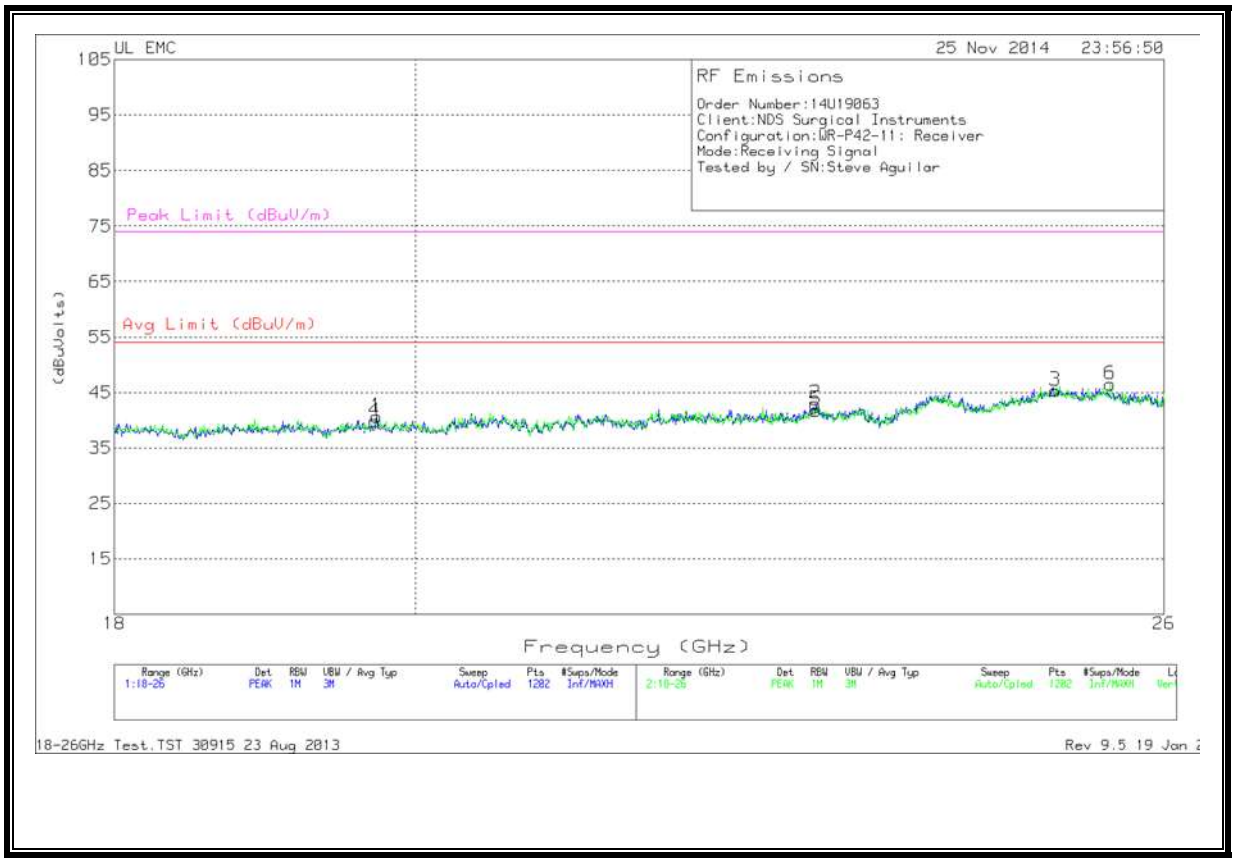
7.5.3. Spurious Emissions 18 to 26 GHz

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



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TX 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	19.732	41.37	PK	32.7	-23.9	-9.5	40.66	54	-13.33	74	-33.33
2	23.009	42.2	PK	33.6	-23.3	-9.5	43	54	-11	74	-31
3	25.027	43.73	PK	34	-22.9	-9.5	45.33	54	-8.66	74	-28.66
4	19.719	40.53	PK	32.7	-23.9	-9.5	39.83	54	-14.16	74	-34.16
5	23.016	41.13	PK	33.6	-23.4	-9.5	41.83	54	-12.16	74	-32.16
6	25.514	44.9	PK	34.1	-23	-9.5	46.5	54	-7.5	74	-27.5

PK - Peak detector

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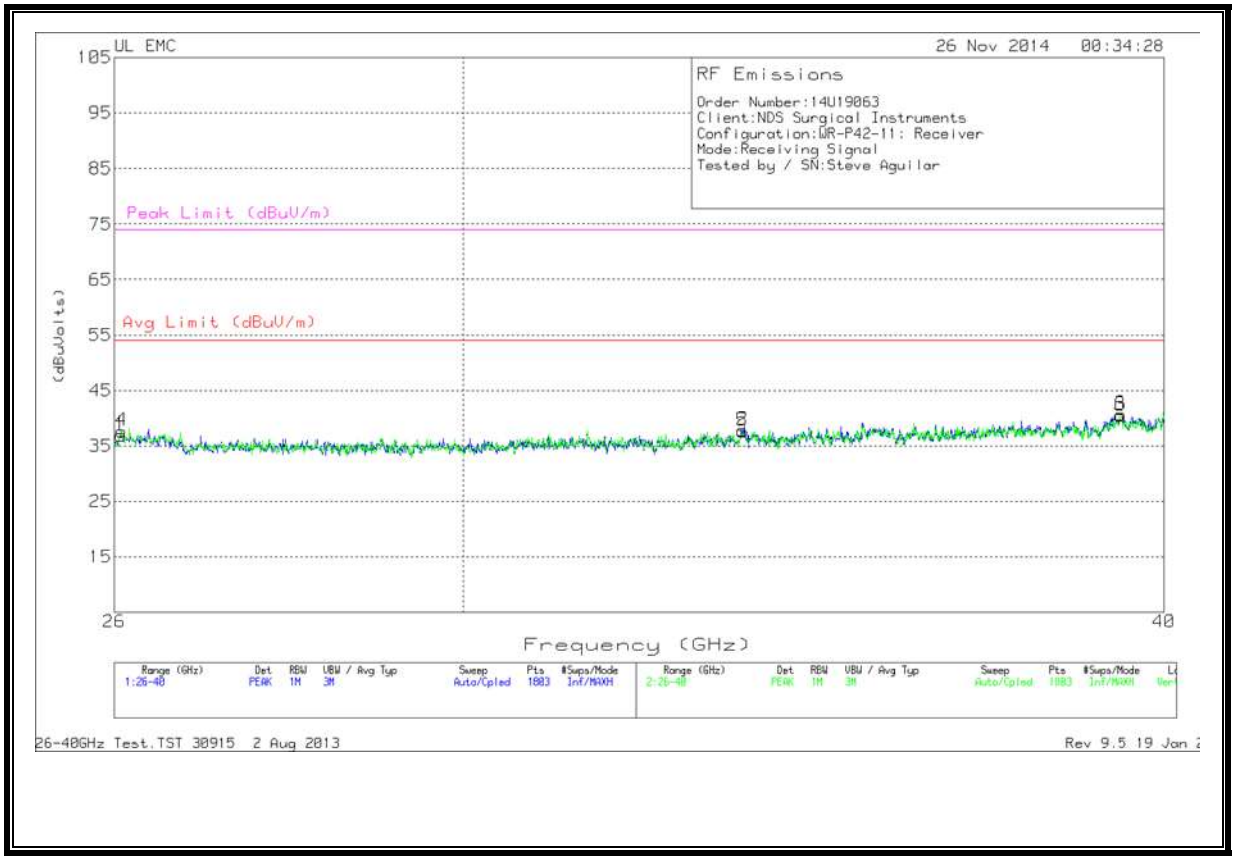
7.5.4. Spurious Emissions 26 TO 40 GHz

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



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TX 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	26.07	43.9	PK	35.6	-33	-9.5	37	54	-17	74	-37
2	33.64	47.23	PK	36.9	-36.8	-9.5	37.83	54	-16.16	74	-36.16
3	39.28	47.7	PK	38.4	-36.1	-9.5	40.5	54	-13.5	74	-33.5
4	26.07	44.67	PK	35.6	-33.1	-9.5	37.66	54	-16.33	74	-36.33
5	33.64	47.07	PK	36.9	-36.8	-9.5	37.66	54	-16.33	74	-36.33
6	39.29	47.57	PK	38.4	-35.8	-9.5	40.66	54	-13.33	74	-33.33

PK - Peak detector

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7.5.5. Spurious Emissions 40 TO 200 GHz

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

CH2

Frequency (GHz)	Measurement Distance (m)	Peak Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
48.309	1.500	-56.58	48.00	-34.9
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (pW/cm^2)**	**Limit (pW/cm^2)**
3.21E-07	3.0	2.84E-09	0.28	90

CH3

Frequency (GHz)	Measurement Distance (m)	Peak Power (dBm)	Rx Antenna Gain (dBi)	EIRP (dBm)
50.111	1.500	-70.39	23.00	-23.4
EIRP (W)	**Specification Distance (m)**	**Power Density (W/m^2)**	**Power Density (pW/cm^2)**	**Limit (pW/cm^2)**
4.54E-06	3.0	4.02E-08	4.02	90

No other spurious or harmonic emissions to 200 GHz detected above the noise floor.

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7.6. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

§15.207

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

ADAPTERS TESTED

DESIGNATION	MANUFACTURER	MODEL NUMBER
Adapter 1	Bridge Power	MW172KB2400B02
Adapter 2	GlobTek, Inc.	GTM91120-3024-T3A

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RESULTS-Adapter 1

6 WORST EMISSIONS

Line-L1 .15 - 30MHz

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	.1995	50.19	PK	.9	0	51.09	63.6	-12.51	-	-
2	.1995	39.45	Av	.9	0	40.35	-	-	53.6	-13.25
3	.402	46.04	PK	.4	0	46.44	57.8	-11.36	-	-
4	.402	44.32	Av	.4	0	44.72	-	-	47.8	-3.08
5	3.264	48.33	PK	.2	.1	48.63	56	-7.37	-	-
6	3.264	45.06	Av	.2	.1	45.36	-	-	46	-.64

Line-L2 .15 - 30MHz

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	.1995	49.79	PK	1	0	50.79	63.6	-12.81	-	-
8	.1995	36.38	Av	1	0	37.38	-	-	53.6	-16.22
9	.3975	45.4	PK	.4	0	45.8	57.9	-12.1	-	-
10	.3975	43.65	Av	.4	0	44.05	-	-	47.9	-3.85
11	3.2595	47.22	PK	.2	.1	47.52	56	-8.48	-	-
12	3.2595	43.18	Av	.2	.1	43.48	-	-	46	-2.52

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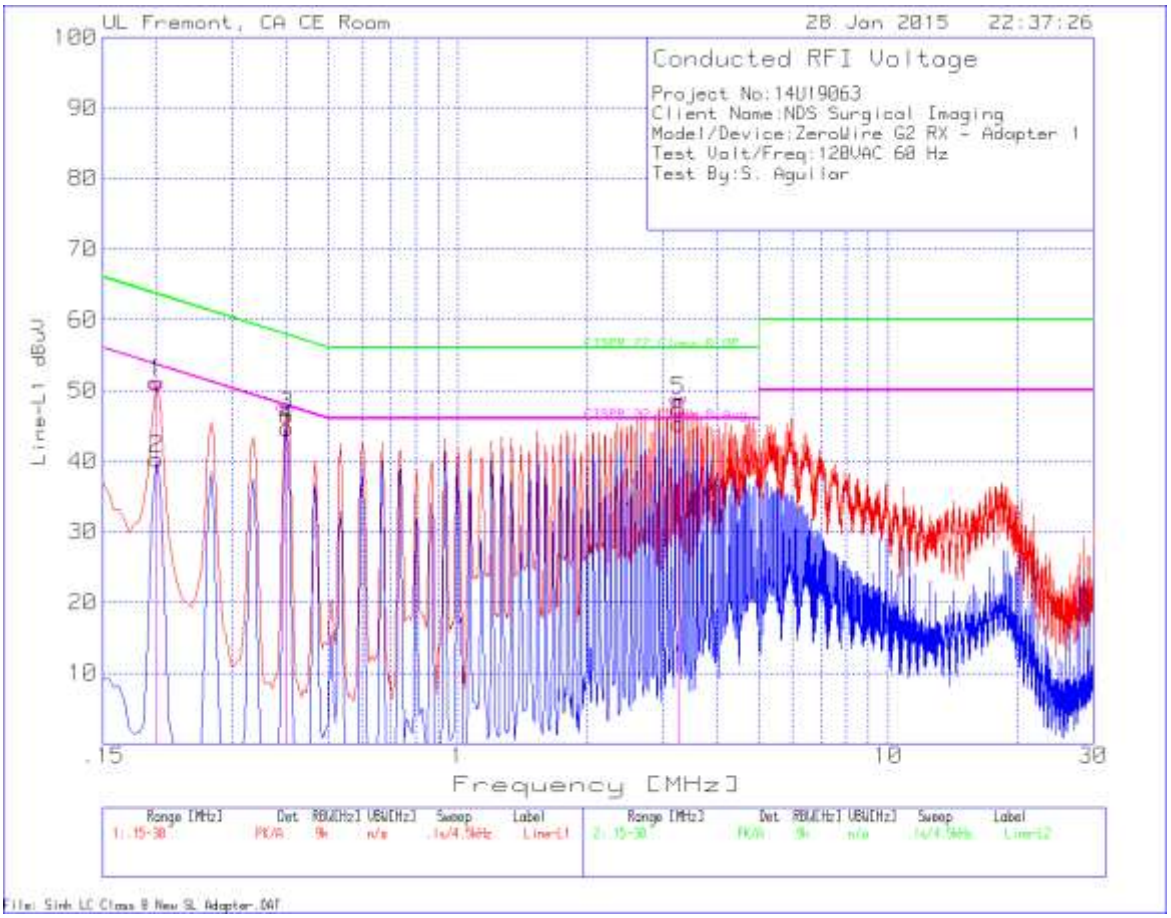
LINE 1 RESULTS-Adapter 1



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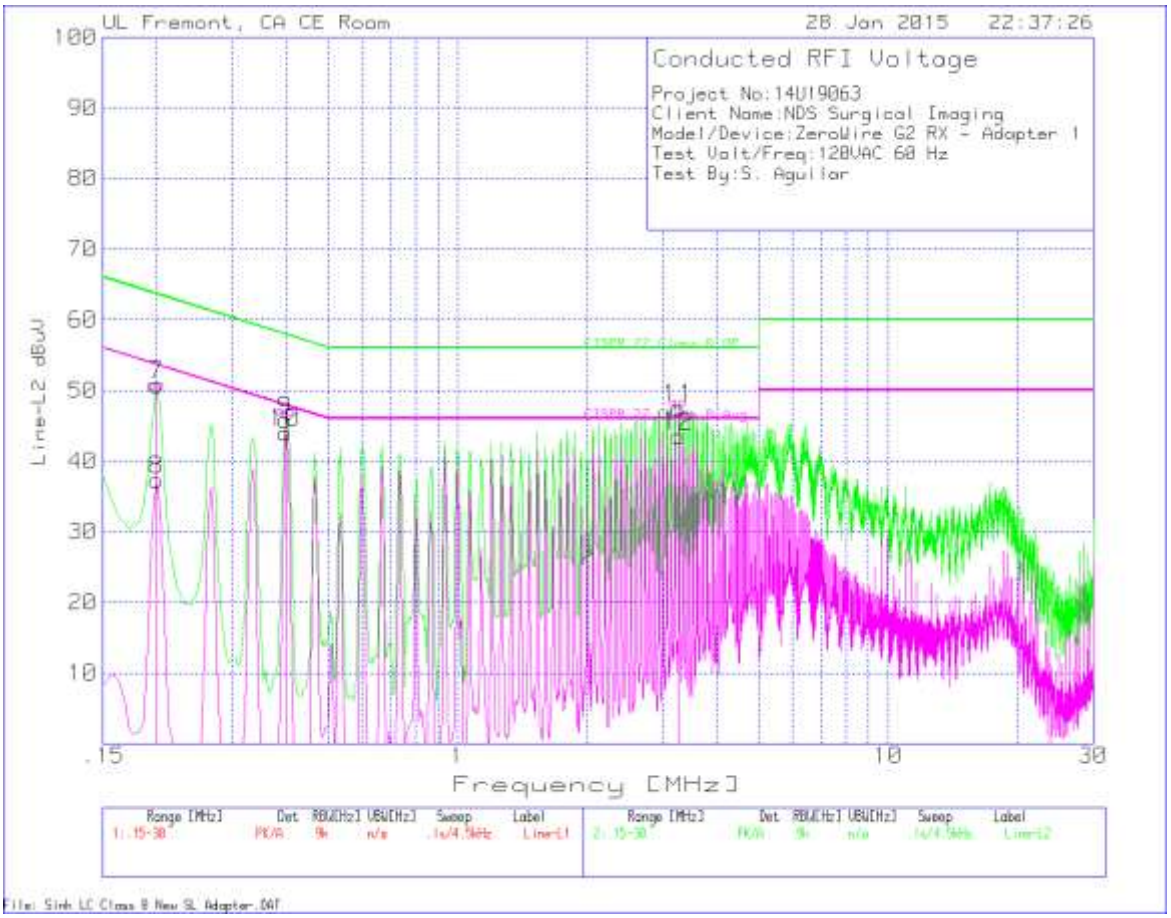
LINE 2 RESULTS-Adapter 1



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RESULTS-Adapter 2

6 WORST EMISSIONS

Line-L1 .15 - 30MHz

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	.15	49.78	PK	1.4	0	51.18	66	-14.82	-	-
2	.15	23.65	Av	1.4	0	25.05	-	-	56	-30.95
3	.186	47.52	PK	1	0	48.52	64.2	-15.68	-	-
4	.186	29.55	Av	1	0	30.55	-	-	54.2	-23.65
5	4.668	38.87	PK	.2	.1	39.17	56	-16.83	-	-
6	4.668	25.43	Av	.2	.1	25.73	-	-	46	-20.27

Line-L2 .15 - 30MHz

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	.15	48.99	PK	1.5	0	50.49	66	-15.51	-	-
8	.15	23.63	Av	1.5	0	25.13	-	-	56	-30.87
9	.186	47.47	PK	1.1	0	48.57	64.2	-15.63	-	-
10	.186	31.24	Av	1.1	0	32.34	-	-	54.2	-21.86
11	4.614	38.05	PK	.2	.1	38.35	56	-17.65	-	-
12	4.614	25.44	Av	.2	.1	25.74	-	-	46	-20.26

PK - Peak detector
Av - average detection

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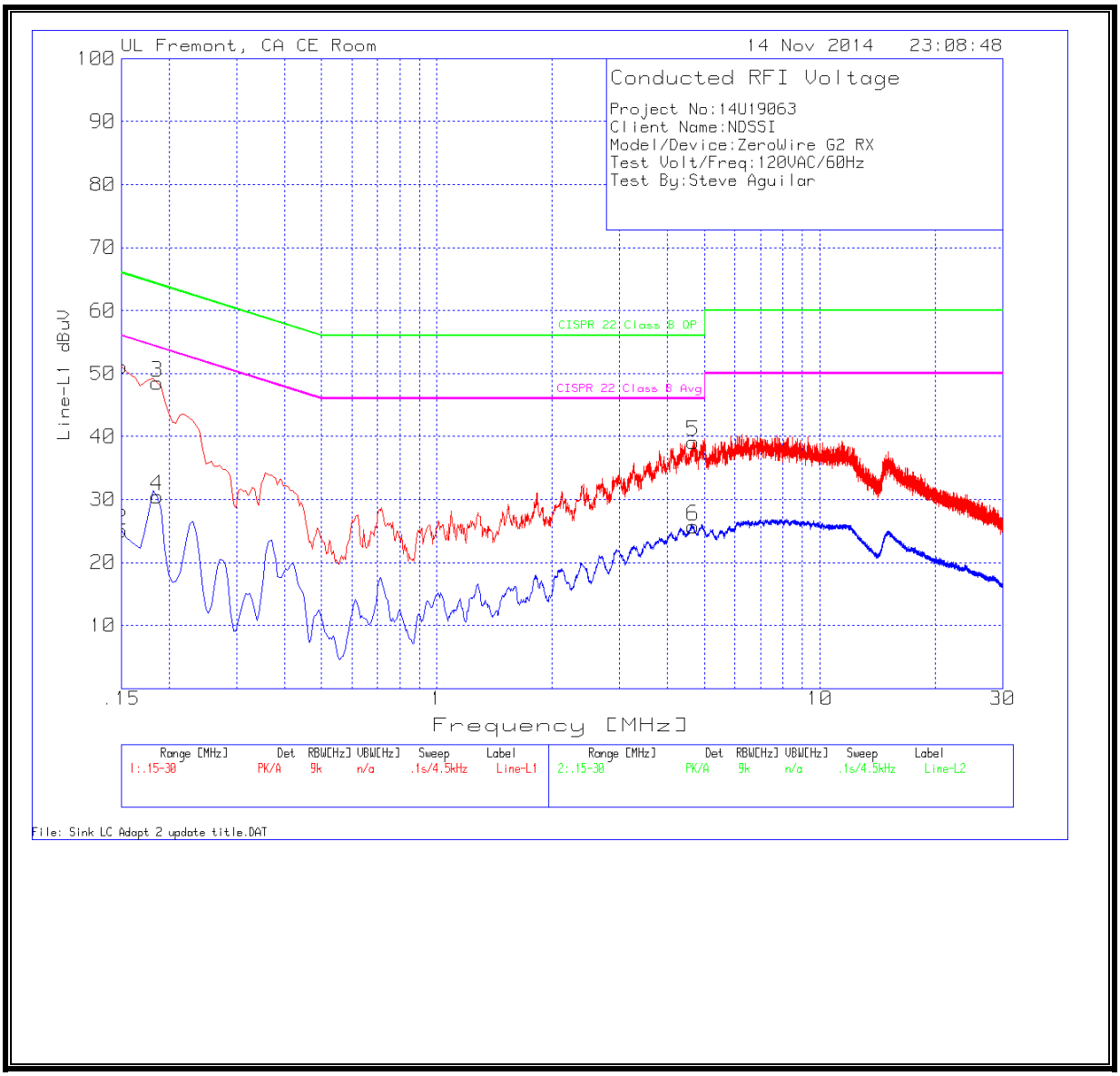
LINE 1 RESULTS-Adapter 2



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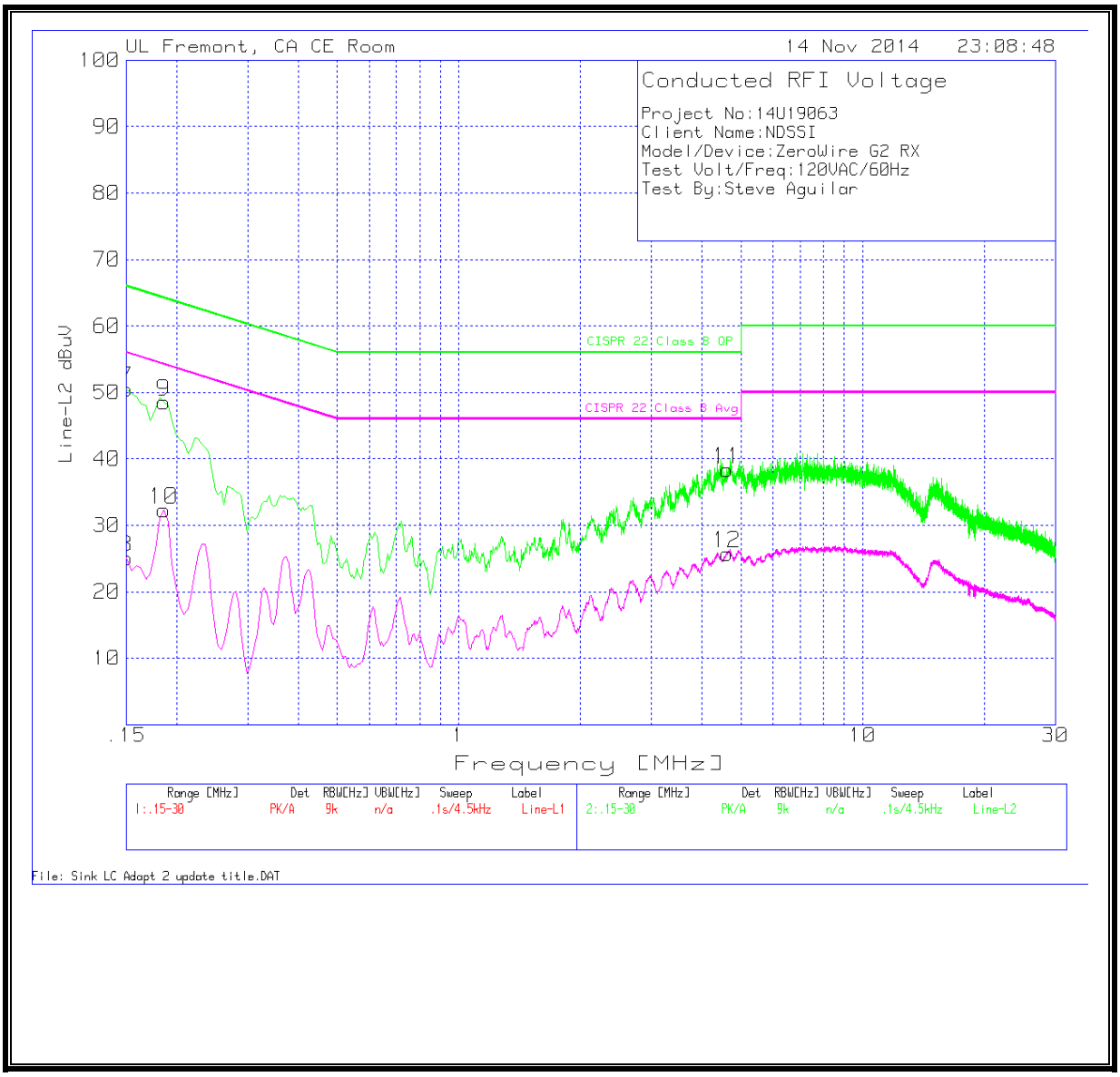
LINE 2 RESULTS- Adapter 2



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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.

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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.

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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)
11.5	0.014	20	0.003	1

UL VERIFICATION SERVICES INC FORM NO: CCSUP4701I
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
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