FCC § 15.255 RF TEST REPORT

(CLASS 2 PERMISSIVE CHANGE)

FOR

WirelessHD SOURCE MODULE INTEGRATED IN ENDOSCOPE

MODEL: XpressView Wireless Camera

FCC ID: 2AFNQ63102

REPORT NUMBER: 11501984-E1V2

ISSUE DATE: DECEMBER 20, 2016

Prepared for

TERADAK LLC
8 MASON
IRVINE, CA 92618 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

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	12/06/2016	Initial Issue	M. Heckrotte
V2	12/20/2016	Revised 15.255 citations in accordance with new Rules	M. Heckrotte

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	TERADAK LLC. 8 MASON IRVINE, CA 92618 U.S.A.
EUT DESCRIPTION:	WirelessHD SOURCE MODULE INTEGRATED IN ENDOSCOPE
MODEL:	XpressView Wireless Camera
SERIAL NUMBER:	00:D0:BD:A0:25:6A:00
DATE TESTED:	NOVEMBER 18-21, 2016

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
§15.255	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
PRINCIPAL ENGINEER
UL Verification Services Inc.

Tested By:

STEVE AGUILAR
WiSE ENGINEER
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013.

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
Radiated Power	±0.55 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF CLASS 2 PERMISSIVE CHANGE

The EUT is a WirelessHD Source radio module integrated into a portable end product Endoscope, operating at a source-based duty cycle of 22.6%.

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

The EUT transmits and receives control and management signals on one of five Low Rate (LRP) channels for each HRP channel. The integral LRP transmit/receive antenna is a scanning beam-steering array with a maximum gain of 16 dBi.

Operation in the MRP mode is not implemented.

5.2. OUTPUT POWER

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

The peak conducted output power for LRP is 25.7 mW (14.1 dBm).

The peak conducted output power for HRP is 17.0 mW (12.3 dBm).

5.3. SOFTWARE AND FIRMWARE

The test software used during testing was SWAM3

The test firmware used during testing was
SiliconImage SiI63XX_0.3, SOURCE-0.3, RF-SiI6310-A4, Pkg: SDK_3.4.12,
Ver.: 3_4_12_2015-10-29a_trunk_SVN54125_External_base_source,
Built: Oct 29 2015 23:48:29.

5.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	Thinkpad	L3-DBW6W	
Laptop Adapter	Lenovo	42T4426	11S42T4426Z1ZF3F0 7G0UG	
HDMI LED Monitor + Adapter	Upstar	M240A2	ZH157E000M00318	
Debug Board	Paralinx	PXASR	--	
WirelessHD Sink Receiver	Silicon Image	SII-SK63101	00:D0:BD:B0:22:33:00	UK2-SII-SK63101
Receiver 12 VDC Adapter	V-Infinity	EMSA 120050-PSP-SZ	--	
12 VDC Adapter	V-Infinity	EMSA120150-PSP-SZ	--	

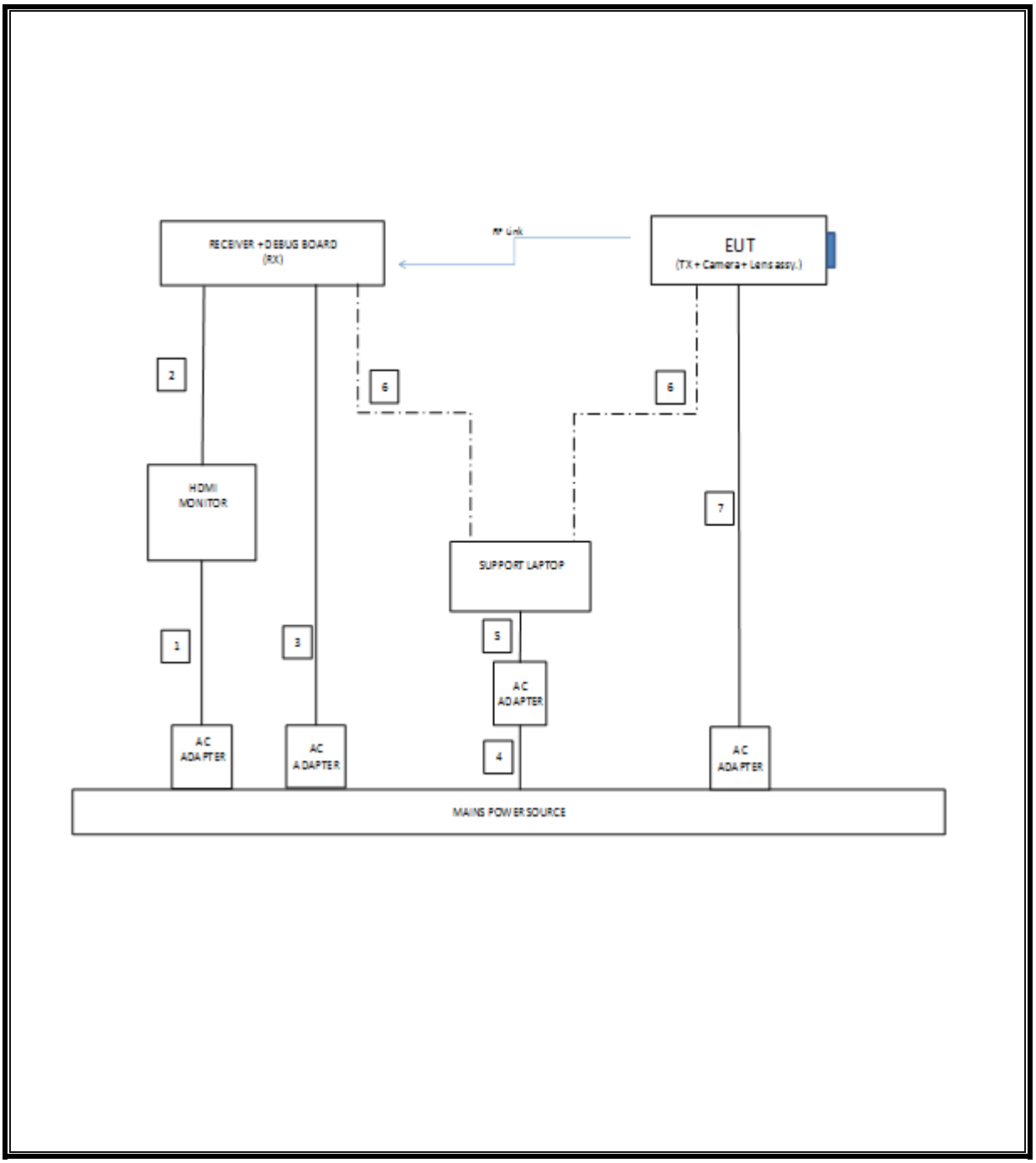
I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC	1	Barrel	Unshielded	1.5	HDMI Monitor adapter
2	VIDEO	1	HDMI	Shielded	1.8 - 5	--
3	DC	1	Barrel	Unshielded	1.5	Receiver Adapter
4	AC	1	3-Prong	Unshielded	0.8	Support Laptop
5	DC	1	Barrel	Shielded	1.8	Support Laptop
6	USB	2	USB	Shielded	3 - 6	For setting test mode only
7	DC	1	Barrel	Unshielded	1	EUT 12VDC Power

TEST SETUP

A laptop computer was utilized to adjust the EUT for testing purposes. The EUT was set up in an operating link with a WirelessHD Sink support device, and continuously transmitting images.

SETUP DIAGRAM FOR TEST



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**
50-75 GHz RF Detector	Millitech	DET-15-RPFWI	41	CNR
50-75 GHz Isolator	Millitech	FBI-15-RSES0	1734	CNR
50-75 GHz Low Noise Amplifier	VIVAtech	VTLN-018-FB	51	9/13/2017
57-66 GHz Low Noise Amplifier	Spacek	SL607-30-5W	14JC4	9/13/2017
50-75 GHz 10 dB Attenuator	MiWave	521V-10/385	1321	1/19/2017
50-75 GHz Horn Antenna	CMI	HO15R	N/A	9/26/2017
Low Pass Filter, 10MHz	Solar Electronics	6623-10	136101	10/7/2017
Oscilloscope 8 GHz 4 Ch DSO	Agilent	DSA90804A	MY51420139	9/6/2017
Analog Signal Generator, 40 GHz	Agilent	E8257D	MY48050681	9/19/2017
mmWave Source 50 - 75 GHz	OML	S15MS-AG	80708-4	CNR
Single Average Power Meter	Agilent	N1913A	MY53100006	8/8/2017
50-75 GHz Waveguide Power Sensor	Agilent	V8486A-H02	MY52300008	8/25/2017
Spectrum Analyzer, 50 GHz	Agilent	N9030A	MY52350427	8/31/2017
Downconverter, 67 GHz	Agilent	MT463	12020	9/21/2017

7. APPLICABLE LIMITS AND TEST RESULTS

7.1. DUTY CYCLE

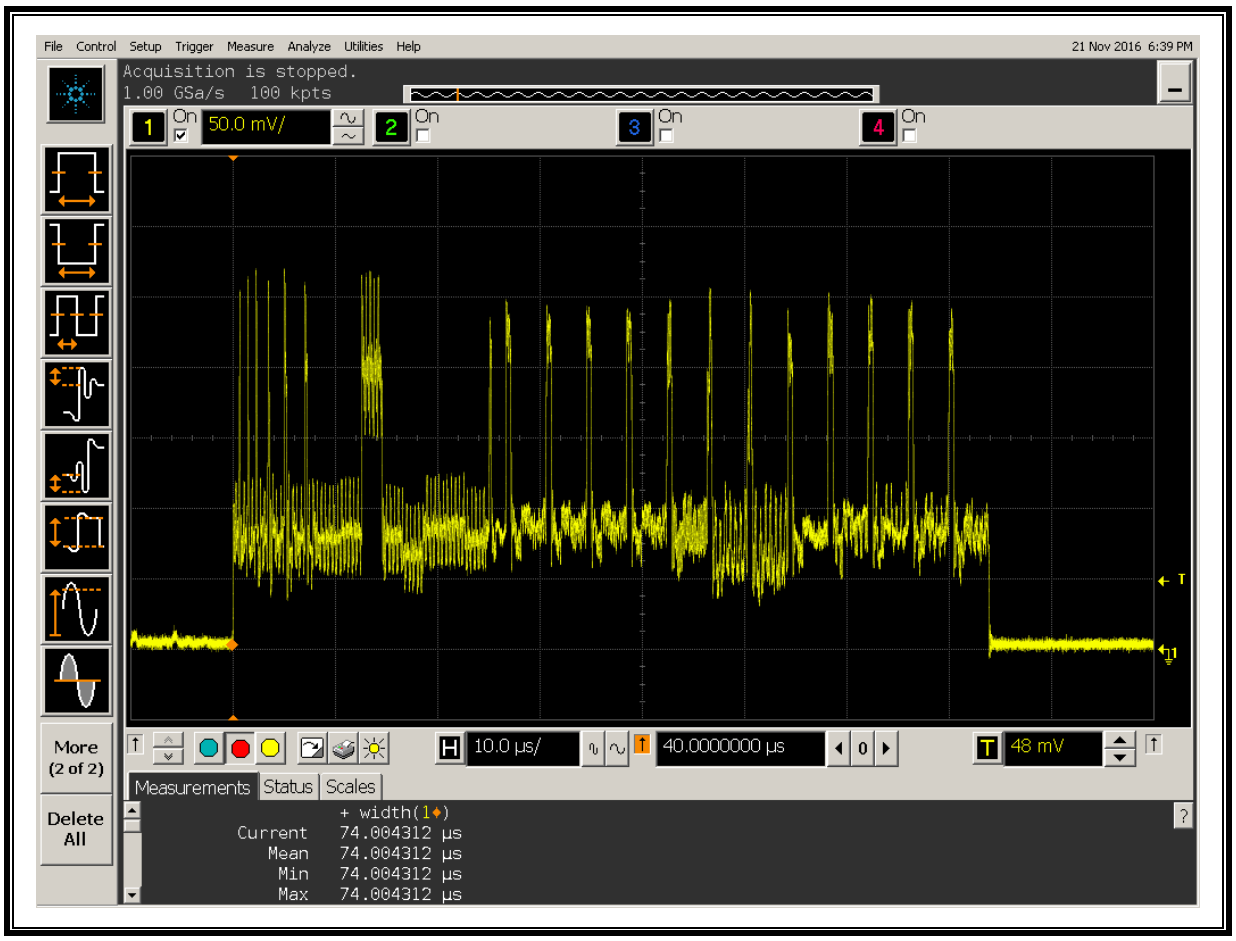
7.1.1. LRP DUTY CYCLE

LIMIT

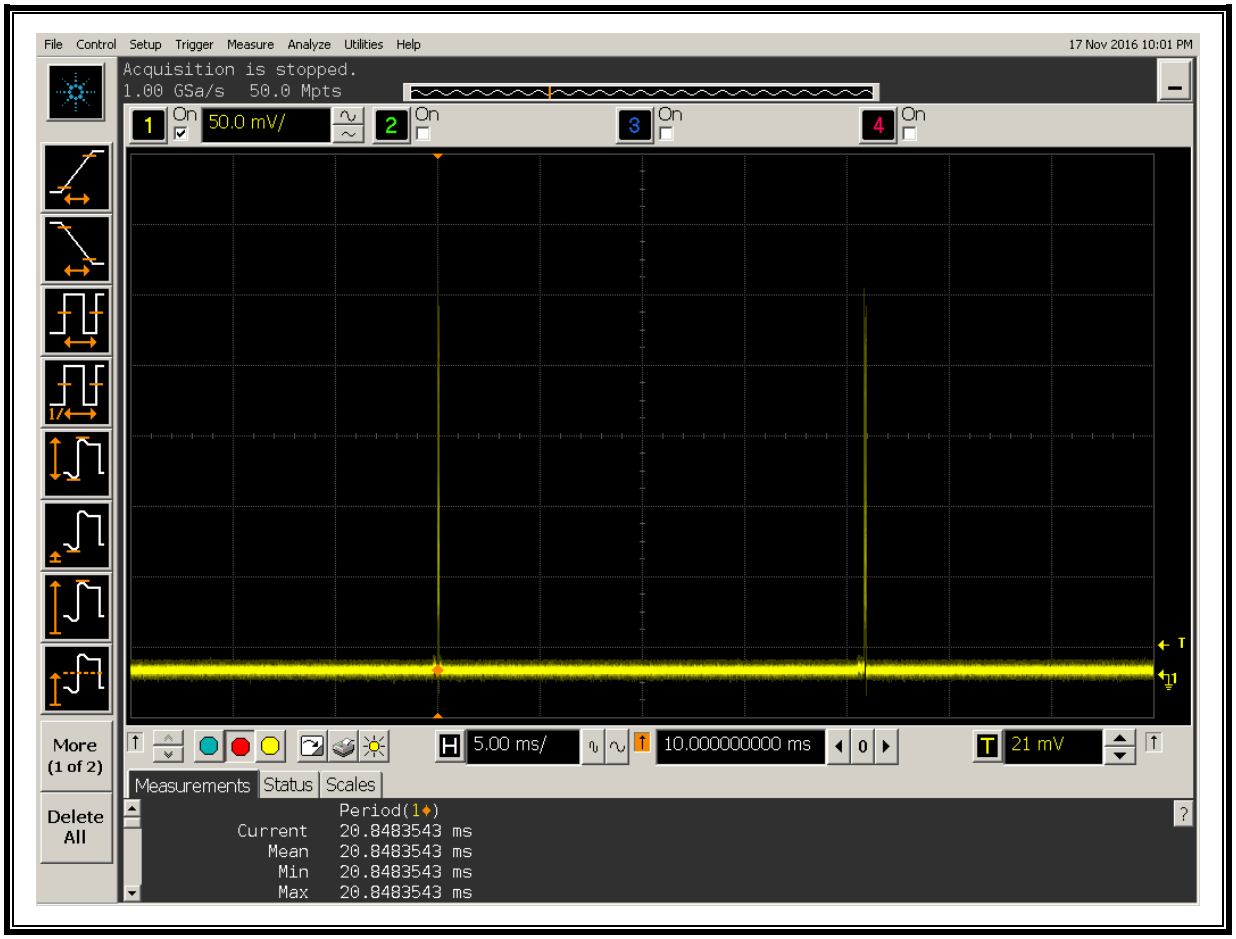
Reporting requirement only.

RESULTS

Duration of LRP Burst



Period between LRP Bursts



LRP Duty Cycle = Burst Width / Period = (74 us) / (20.85 ms) = 0.00355

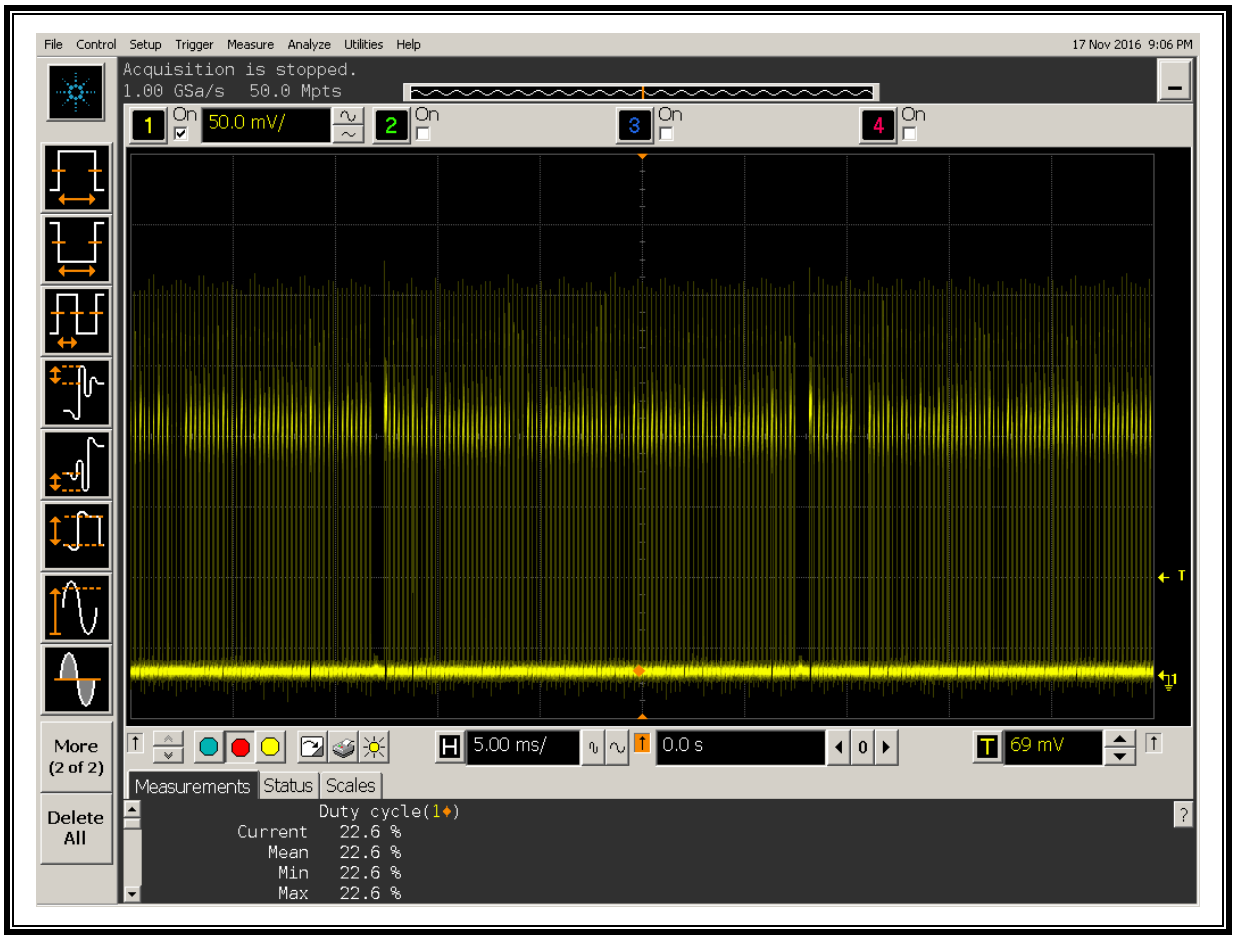
Duty Cycle Correction Factor = 10 * Log (Duty Cycle) = -24.5 dB

7.1.2. HRP DUTY CYCLE

LIMIT

Reporting requirement only.

RESULTS



7.2. 6 dB BANDWIDTH

APPLICABLE RULE

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

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

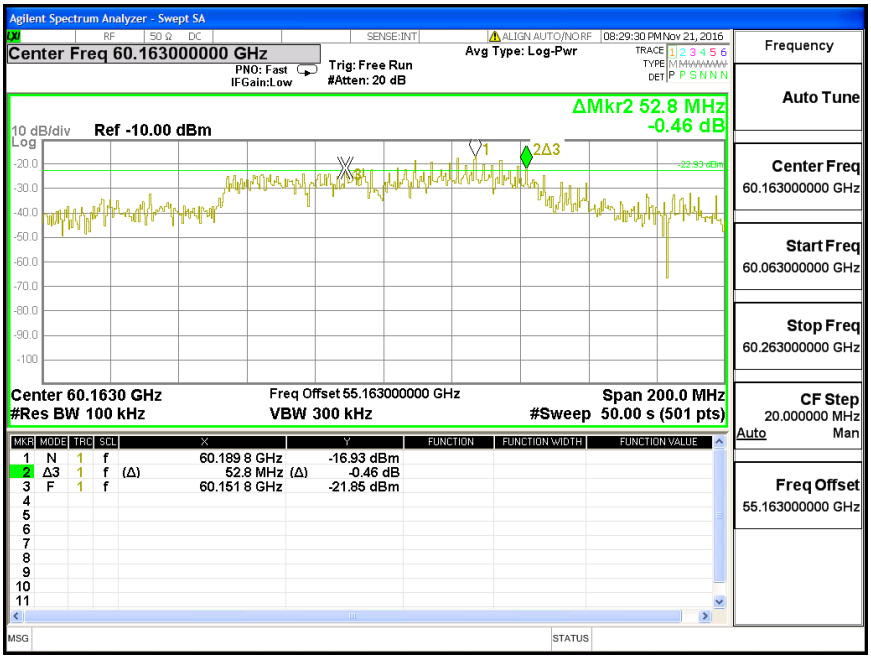
The spectrum analyzer and external mixer are set up to measure the radiated output of the transmitter.

7.2.1. Results for LRP Channels

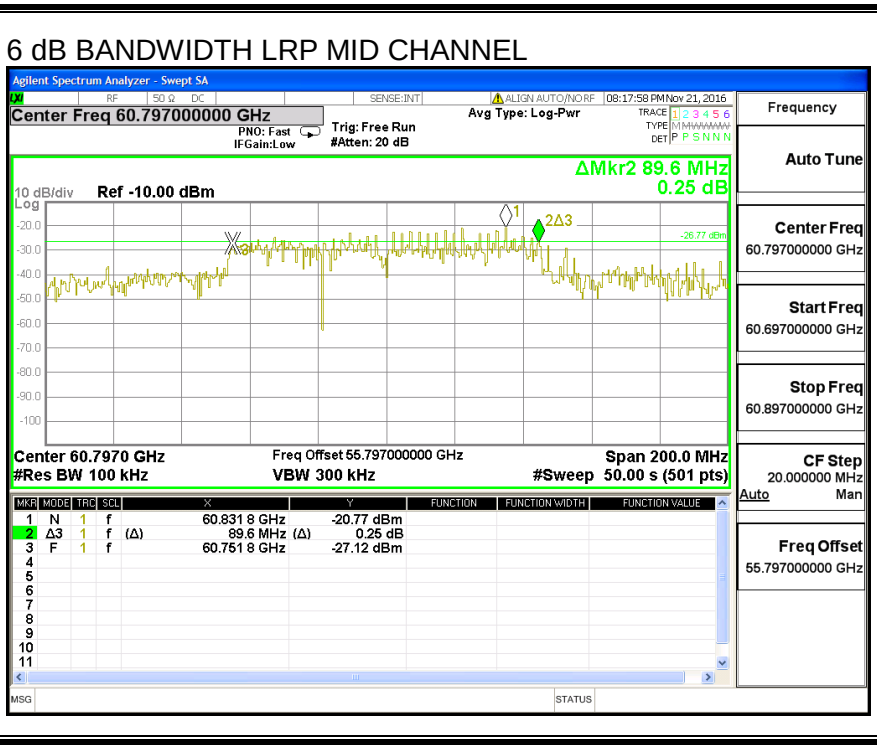
Channel	Frequency (GHz)	6 dB Bandwidth (MHz)
LOW	60.163	52.8
MID	60.797	89.6
HIGH	62.957	84.4

6 dB BANDWIDTH

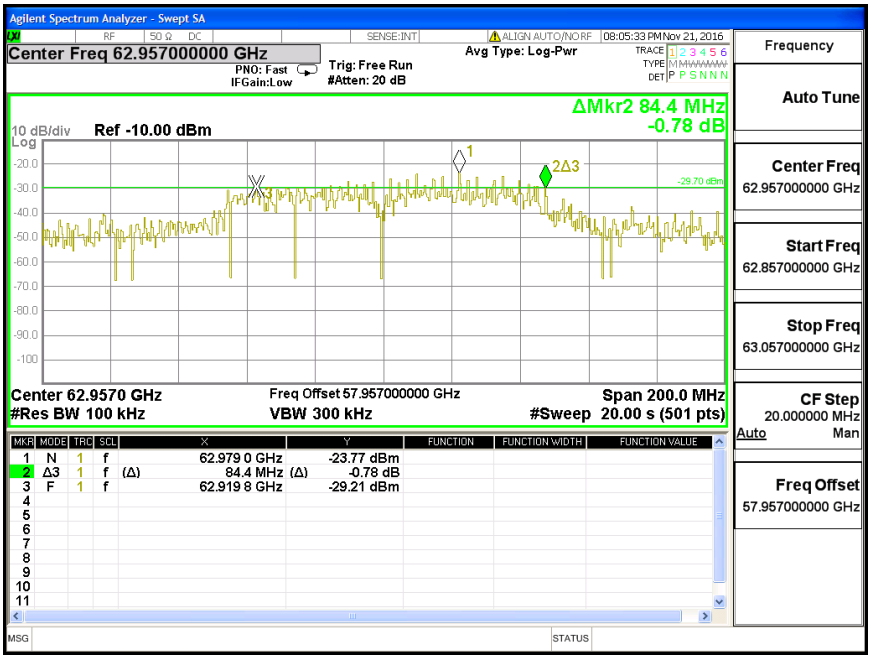
6 dB BANDWIDTH LRP LOW CHANNEL



6 dB BANDWIDTH LRP MID CHANNEL



6 dB BANDWIDTH LRP HIGH CHANNEL

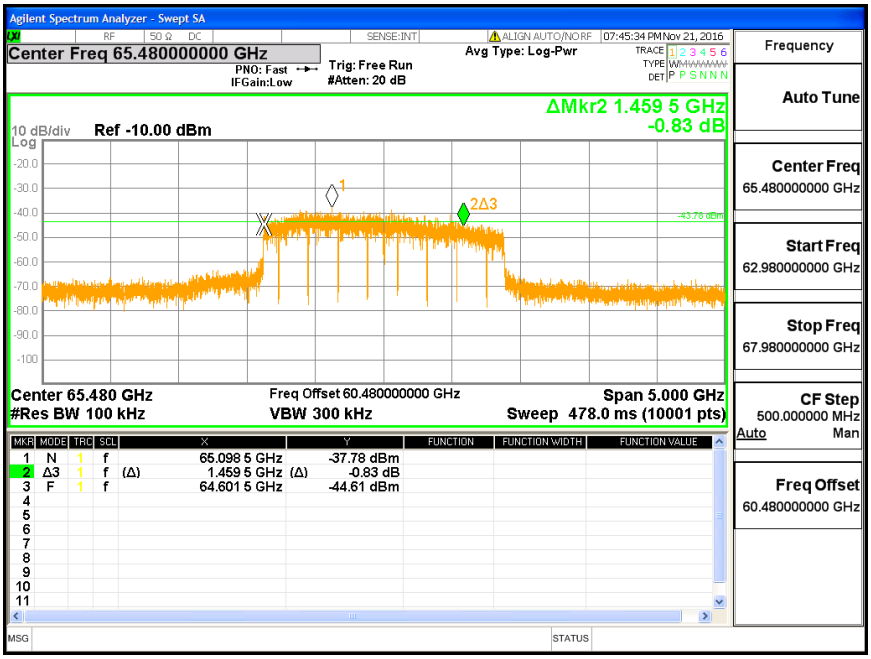


7.2.2. Results for HRP Channels

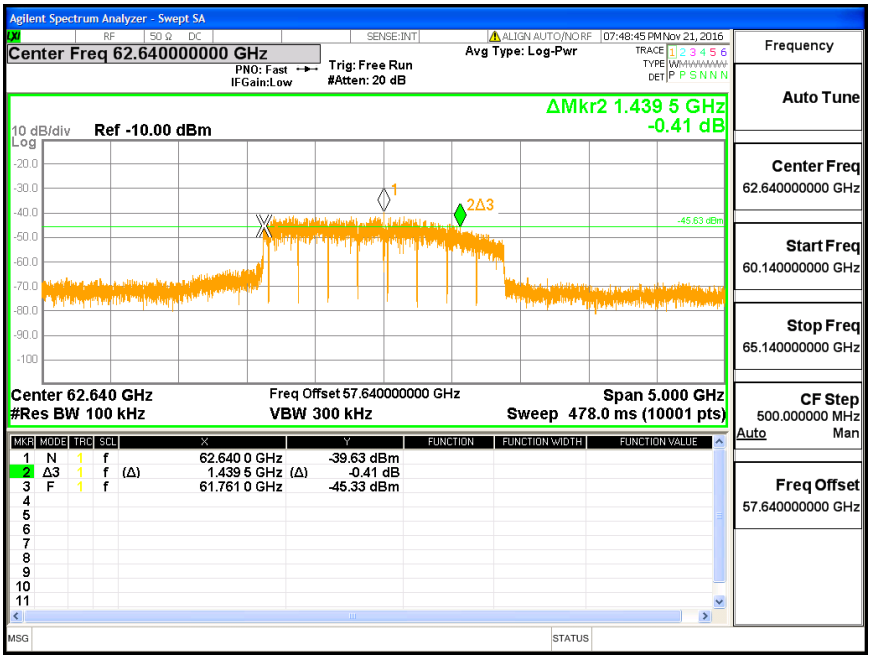
Channel	Frequency (GHz)	6 dB Bandwidth (mHz)
LOW	60.48	1459.5
HIGH	62.64	1439.5

6 dB BANDWIDTH

6 dB BANDWIDTH HRP LOW CHANNEL



6 dB BANDWIDTH HRP HIGH CHANNEL



7.3. POWER DENSITY

LIMIT

§15.255 (b) (1) (i) Within the 57-71 GHz band, emission levels shall not exceed the following equivalent isotropically radiated power (EIRP): … Products other than fixed field disturbance sensors and short-range devices for interactive motion sensing shall comply with … the following emission limits, as measured during the transmit interval: … 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

C63.10
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 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	0.01924	0.0050	0.15
62.64	0.01924	0.0048	0.15

LRP DUTY FACTOR FOR AVERAGE EIRP

Average voltage measurements are made across the entire 100 us scope time sweep, which encompasses a single LRP burst. The measured average voltage is corrected to yield the average voltage during the LRP ON time as follows:

Average Voltage Within the Burst
= (Measured Average Voltage over Entire Sweep) * ((Sweep time) / (Burst Width))

Substitution CW power measurements are based on the Average Voltage Within the Burst, then corrected for the LRP duty factor of 0.00355 (24.5 dB correction factor) to yield the average LRP power over the entire LRP period.

HRP DUTY FACTOR FOR AVERAGE EIRP

The 22.6% duty factor is included in the test signal. Average voltage measurements are made across multiple cycles of ON and OFF times.

Substitution CW power measurements were based on the Average voltage across multiple bursts, thus no correction for duty factor is made.

7.3.1. LRP Peak and Average Power Density

RESULTS

PEAK POWER - LRP Low Channel

Frequency (GHz)	Measurement Distance (m)	Measured Peak Voltage (mV)	Measured Power (dBm)	Waveguide Loss (dB)	Received Power (dBm)
60.163	3.0	276.60	-35.34	0.30	-35.04
Rx Antenna Gain (dBi)	**EIRP (dBm)**	**Limit (dBm)**	**Margin (dBm)**		
13.00	29.5	43.0	-13.5		

AVERAGE POWER - LRP Low Channel

Frequency (GHz)	Measurement Distance (m)	Measured Average Voltage (mV)	Measured Power (dBm)	Waveguide Loss (dB)	Received Power (dBm)
60.163	3.0	100.50	-46.05	0.30	-45.75
Rx Antenna Gain (dBi)	**EIRP Within Burst (dBm)**	**Duty Cycle Corr. Fact. (dB)**	**EIRP**	**Limit (dBm)**	**Margin (dBm)**
13.00	18.8	-24.5	-5.7	40.0	-45.7

PEAK POWER - LRP Mid Channel

Frequency (GHz)	Measurement Distance (m)	Measured Peak Voltage (mV)	Measured Power (dBm)	Waveguide Loss (dB)	Received Power (dBm)
60.797	3.0	297.80	-34.85	0.30	-34.55
Rx Antenna Gain (dBi)	**EIRP (dBm)**	**Limit (dBm)**	**Margin (dBm)**		
13.00	30.1	43.0	-12.9		

AVERAGE POWER - LRP Mid Channel

Frequency (GHz)	Measurement Distance (m)	Measured Average Voltage (mV)	Measured Power (dBm)	Waveguide Loss (dB)	Received Power (dBm)
60.797	3.0	115.70	-45.58	0.30	-45.28
Rx Antenna Gain (dBi)	**EIRP Within Burst (dBm)**	**Duty Cycle Corr. Fact. (dB)**	**EIRP**	**Limit (dBm)**	**Margin (dBm)**
13.00	19.4	-24.5	-5.1	40.0	-45.1

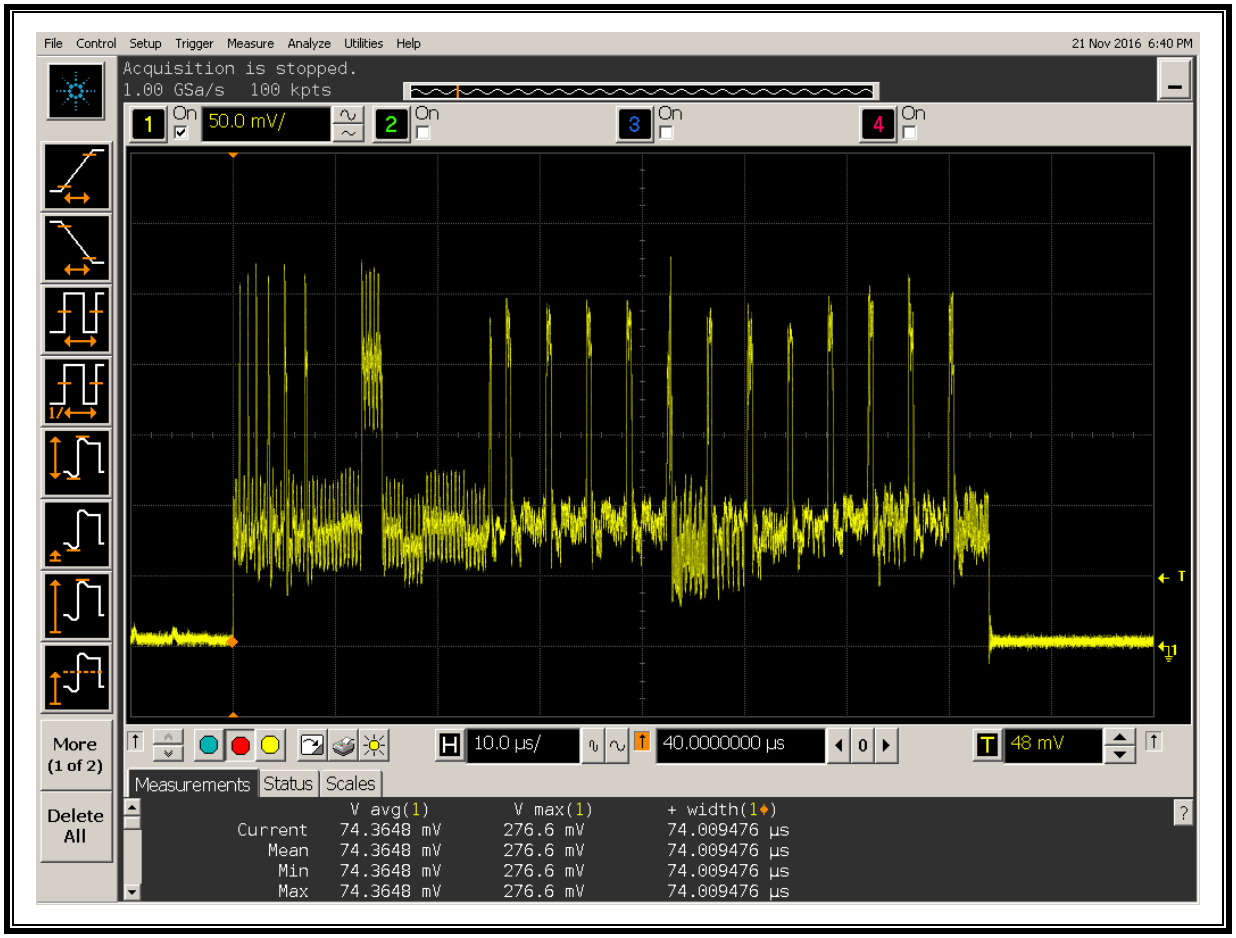
PEAK POWER - LRP HIgh Channel

Frequency (GHz)	Measurement Distance (m)	Measured Peak Voltage (mV)	Measured Power (dBm)	Waveguide Loss (dB)	Received Power (dBm)
62.957	3.0	192.60	-41.19	0.30	-40.89
Rx Antenna Gain (dBi)	**EIRP (dBm)**	**Limit (dBm)**	**Margin (dBm)**		
13.00	24.1	43.0	-18.9		

AVERAGE POWER - LRP High Channel

Frequency (GHz)	Measurement Distance (m)	Measured Average Voltage (mV)	Measured Power (dBm)	Waveguide Loss (dB)	Received Power (dBm)
62.957	3.0	53.16	-47.85	0.30	-47.55
Rx Antenna Gain (dBi)	**EIRP Within Burst (dBm)**	**Duty Cycle Corr. Fact. (dB)**	**EIRP**	**Limit (dBm)**	**Margin (dBm)**
13.00	17.4	-24.5	-7.1	40.0	-47.1

LRP Low Channel Peak and Average Voltages



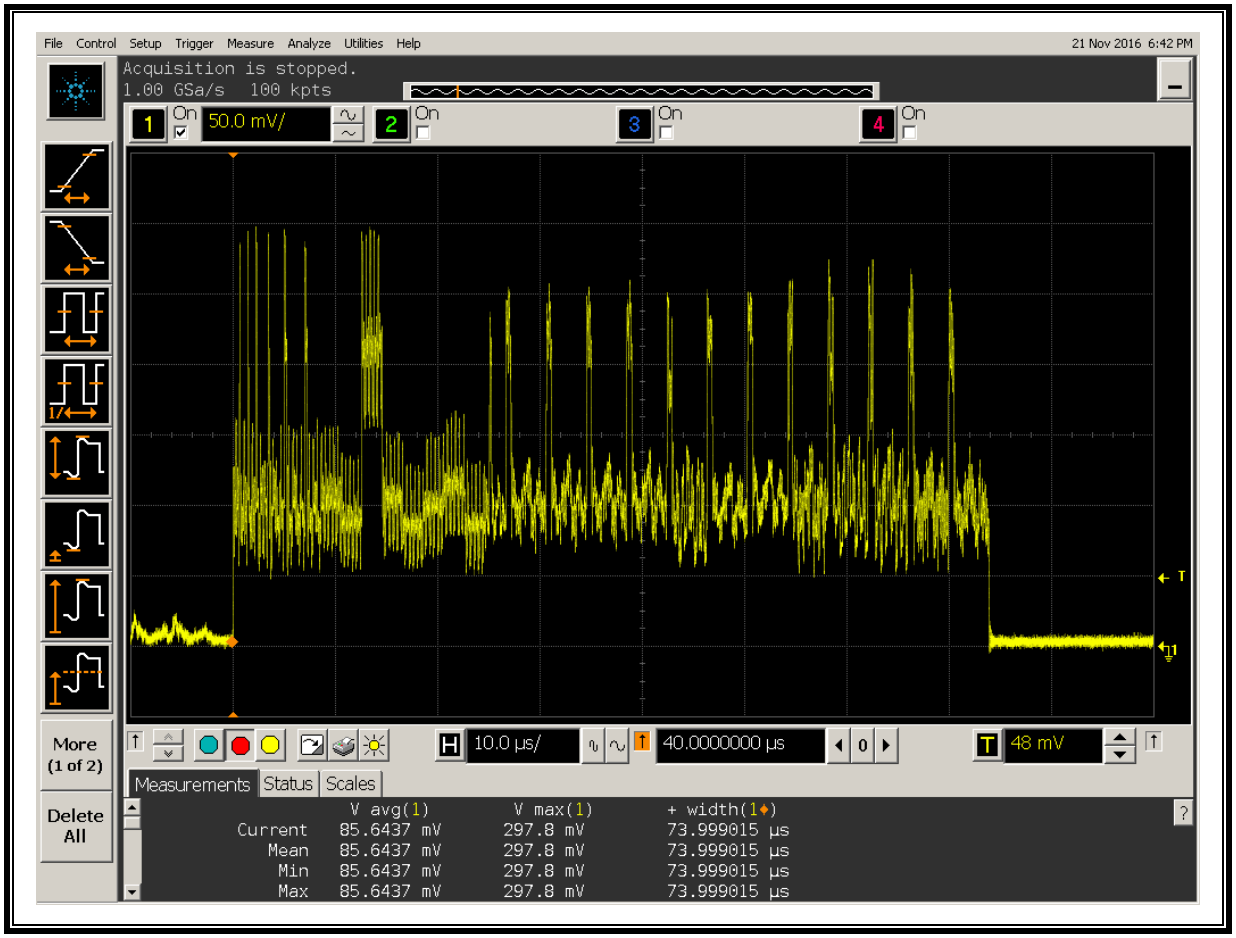
Average Voltage Within the Burst

= (Measured Average Voltage over Entire Sweep) * ((Sweep time) / (Burst Width))

=74.36* (100 / 74)

=100.5 mV

LRP Mid Channel Peak and Average Voltages



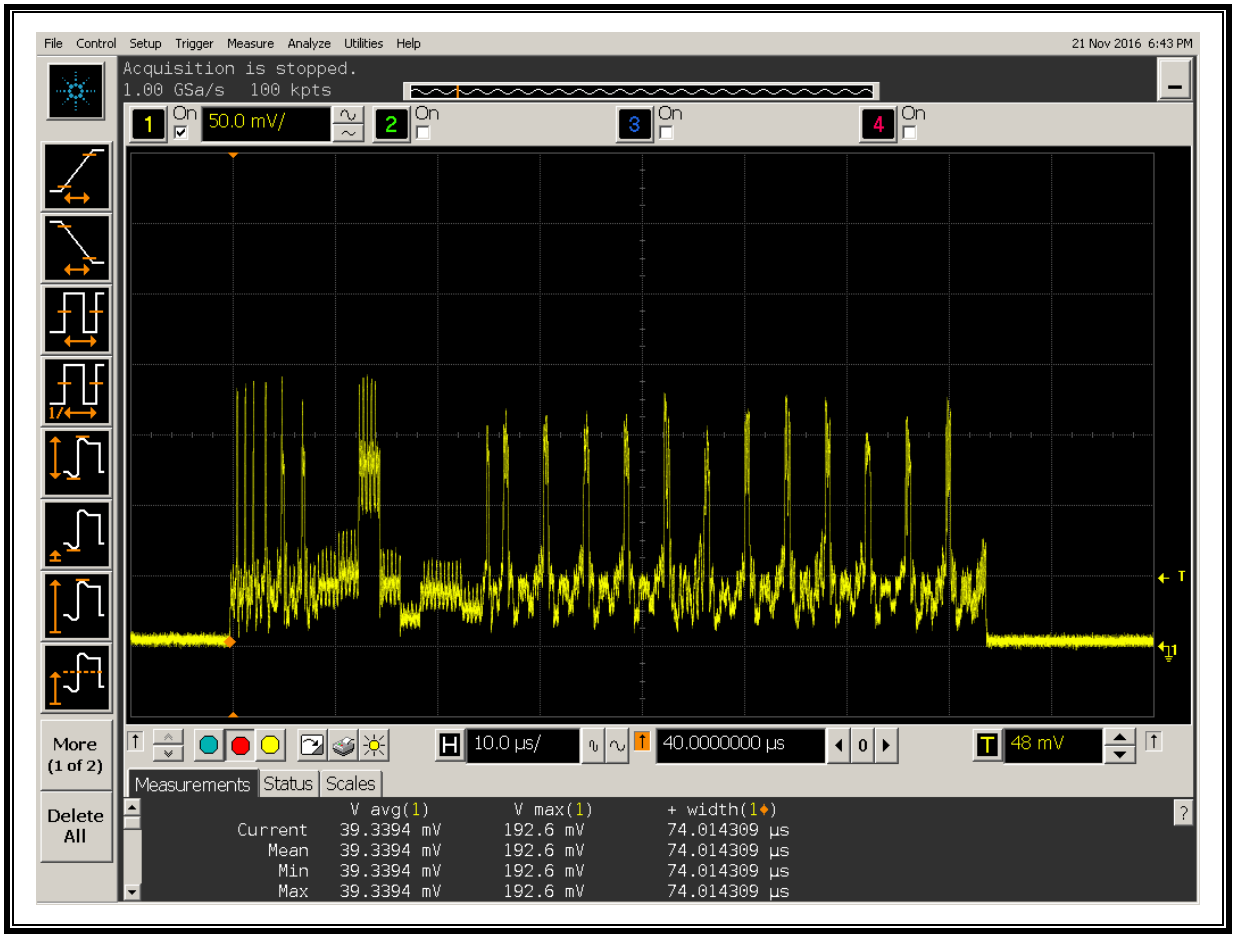
Average Voltage Within the Burst

= (Measured Average Voltage over Entire Sweep) * ((Sweep time) / (Burst Width))

=85.64 * (100 / 74)

=115.7 mV

LRP High Channel Peak and Average Voltages



Average Voltage Within the Burst

= (Measured Average Voltage over Entire Sweep) * ((Sweep time) / (Burst Width))

=39.34 * (100 / 74)

=53.16 mV

7.3.2. HRP Peak and Average Power Density

RESULTS

PEAK POWER - HRP Low Channel 2

Frequency (GHz)	Measurement Distance (m)	Measured Peak Voltage (mV)	Measured Power (dBm)	Waveguide Loss (dB)	Received Power (dBm)
60.48	3.0	299.40	-34.60	0.30	-34.30
Rx Antenna Gain (dBi)	**EIRP (dBm)**	**Limit (dBm)**	**Margin (dBm)**		
13.00	30.3	43.0	-12.7		

AVERAGE POWER - HRP Low Channel 2

Frequency (GHz)	Measurement Distance (m)	Measured Average Voltage (mV)	Measured Power (dBm)	Waveguide Loss (dB)	Received Power (dBm)
60.48	3.0	35.37	-50.00	0.30	-49.70
Rx Antenna Gain (dBi)	**EIRP (dBm)**	**Limit (dBm)**	**Margin (dBm)**		
13.00	14.9	40.0	-25.1		

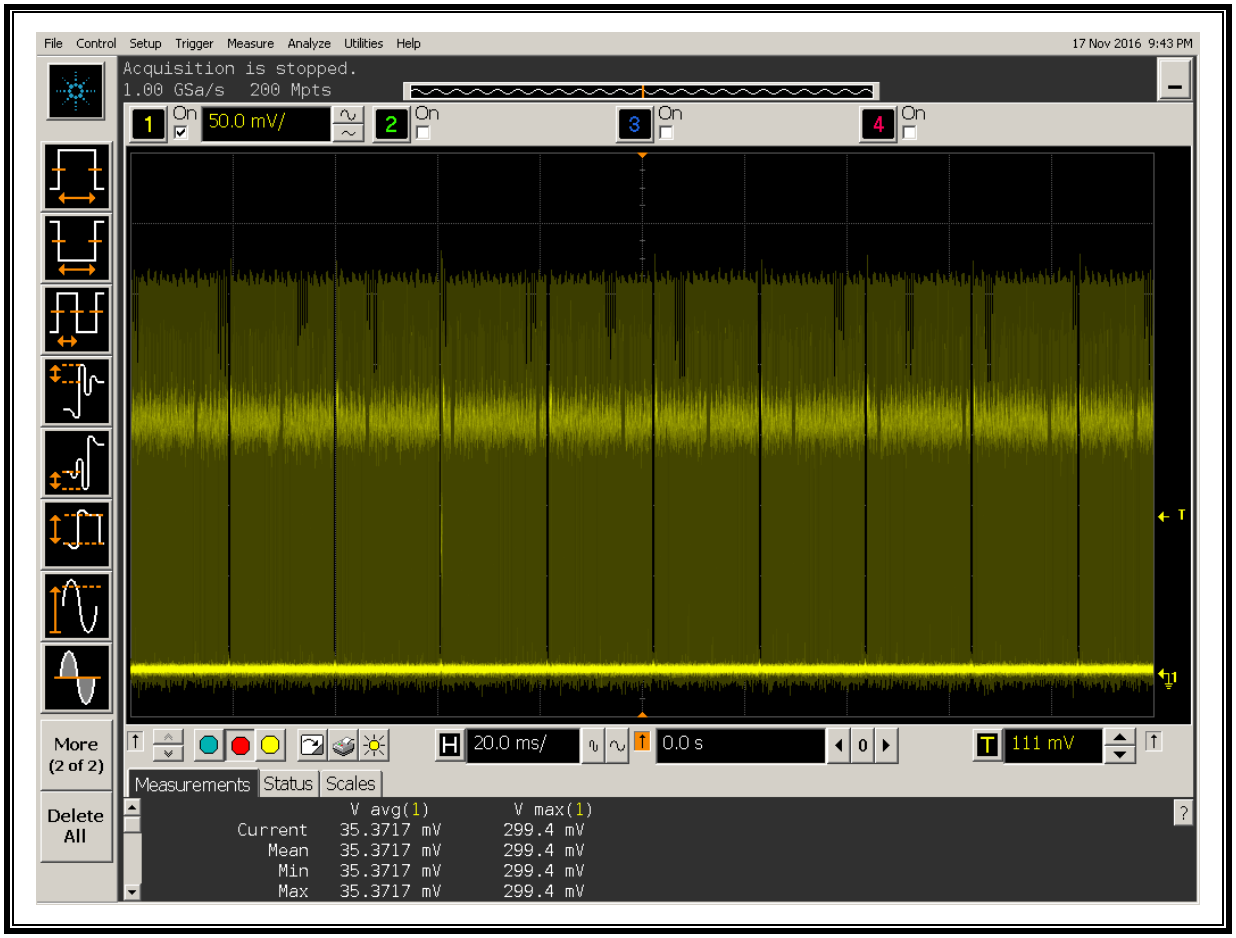
PEAK POWER - HRP HIgh Channel 3

Frequency (GHz)	Measurement Distance (m)	Measured Peak Voltage (mV)	Measured Power (dBm)	Waveguide Loss (dB)	Received Power (dBm)
62.64	3.0	284.70	-35.40	0.30	-35.10
Rx Antenna Gain (dBi)	**EIRP (dBm)**	**Limit (dBm)**	**Margin (dBm)**		
13.00	29.8	43.0	-13.2		

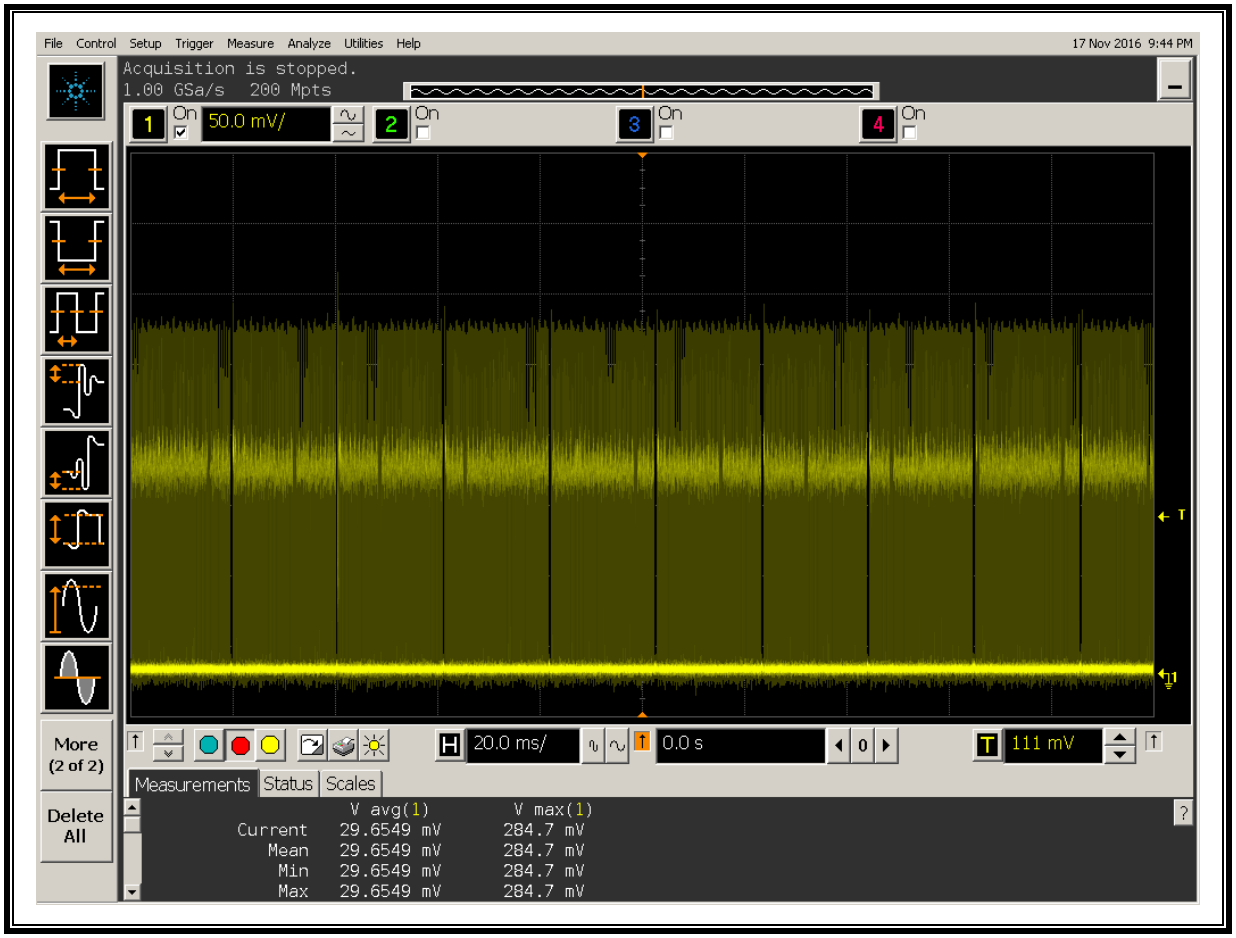
AVERAGE POWER - HRP HIgh Channel 3

Frequency (GHz)	Measurement Distance (m)	Measured Average Voltage (mV)	Measured Power (dBm)	Waveguide Loss (dB)	Received Power (dBm)
62.64	3.0	29.65	-50.50	0.30	-50.20
Rx Antenna Gain (dBi)	**EIRP (dBm)**	**Limit (dBm)**	**Margin (dBm)**		
13.00	14.7	40.0	-25.3		

HRP Low Channel 2 Peak and Average Voltages



HRP High Channel 3 Peak and Average Voltages



7.4. PEAK OUTPUT POWER

LIMIT

§15.255 (d) Except as specified paragraph (d)(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 (d) (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.

RESULTS

Mode	Frequency (GHz)	Peak EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)	6 dB Bandwidth (MHz)	Output Power Limit (mW)
LRP	60.163	29.5	16.00	13.50	22.4	52.8	264
LRP	60.797	30.1	16.00	14.10	25.7	89.6	448
LRP	62.957	24.1	16.00	8.10	6.5	84.4	422
HRP	60.48	30.3	18.00	12.30	17.0	1459.5	500
HRP	62.64	29.8	18.00	11.80	15.1	1439.5	500