CERTIFICATION TEST REPORT

Report Number. : 12193631-E1V4

Applicant	:	PSIKICK 2348 WALSH AVE, SANTA CLARA, CA 95051
Model	:	IPN-100-1007
FCC ID	:	2AO7CIPN-100-1007
ISED ID	:	23743-IPN1001007
EUT Description	:	CONTROL NODE TRANSMITTER MODULE
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 4

Date Of Issue:
May 23, 2018

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	03/12/2018	Initial Issue	---
V2	04/17/2018	Revised ISED ID and antenna gain	Grace Rincand
V3	05/9/2018	Updated section 10	Francisco de Anda
V4	05/23/2018	Updated cover page, added section 8.3	Francisco de Anda

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

TABLE OF CONTENTS

REVISION HISTORY **2**

TABLE OF CONTENTS **3**

1. ATTESTATION OF TEST RESULTS **5**

2. TEST METHODOLOGY **6**

3. FACILITIES AND ACCREDITATION **6**

4. CALIBRATION AND UNCERTAINTY **7**

4.1. MEASURING INSTRUMENT CALIBRATION *7*

4.2. SAMPLE CALCULATION *7*

4.3. MEASUREMENT UNCERTAINTY *7*

5. EQUIPMENT UNDER TEST **8**

5.1. EUT DESCRIPTION *8*

5.2. MAXIMUM OUTPUT POWER *8*

5.3. DESCRIPTION OF AVAILABLE ANTENNAS *8*

5.4. SOFTWARE AND FIRMWARE *8*

5.5. WORST-CASE CONFIGURATION AND MODE *8*

5.6. DESCRIPTION OF TEST SETUP *9*

6. TEST AND MEASUREMENT EQUIPMENT **12**

7. MEASUREMENT METHODS **13**

8. ANTENNA PORT TEST RESULTS **14**

8.1. ON TIME AND DUTY CYCLE *14*

8.2. 20 dB AND 99% BANDWIDTH *15*

8.2.1. 99% OCCUPIED BANDWIDTH 16

8.2.2. 20dB BANDWIDTH 17

8.3. HOPPING FREQUENCY SEPARATION *18*

8.4. NUMBER OF HOPPING CHANNELS *19*

8.5. AVERAGE TIME OF OCCUPANCY *20*

8.5.1. OOK MODULATION 21

8.6. OUTPUT POWER *22*

8.7. CONDUCTED SPURIOUS EMISSIONS *24*

8.7.1. OOK MODULATION 25

9. RADIATED TEST RESULTS **27**

9.1. TRANSMITTER ABOVE 1 GHz *29*

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

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.1.1. OOK MODULATION 29

9.2. TRANSMITTER BELOW 1 GHz.....35

9.2.1. OOK MODULATION 35

9.3. WORST CASE BELOW 30 MHz.....45

9.3.1. SPURIOUS EMISSIONS 9 kHz TO 30 MHz (WORST-CASE CONFIGURATION) 45

10. AC POWER LINE CONDUCTED EMISSIONS 46

11. SETUP PHOTOS 49

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

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: PSIKICK

EUT DESCRIPTION: CONTROL NODE TRANSMITTER MODULE

MODEL: IPN-100-1007

SERIAL NUMBER: 28

DATE TESTED: MARCH 01 - 02, 2018

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
ISED RSS-247 Issue 2	Pass
ISED RSS-GEN Issue 4	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 the U.S. government.

Approved & Released For
UL Verification Services Inc. By:

Francisco de Anda
CONSUMER TECHNOLOGY DIVISION
Operations Leader
UL Verification Services Inc.

Prepared By:

Jason Qian
CONSUMER TECHNOLOGY DIVISION
Test Engineer
UL Verification Services Inc.

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, RSS-GEN Issue 4, and RSS-247 Issue 2.

3. FACILITIES AND ACCREDITATION

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 (ISED:2324B-1)	☐ Chamber D (ISED:22541-1)
☐ Chamber B (ISED:2324B-2)	☐ Chamber E (ISED:22541-2)
☐ Chamber C (ISED:2324B-3)	☐ Chamber F (ISED:22541-3)
	☐ Chamber G (ISED:22541-4)
	☐ Chamber H (ISED:22541-5)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through C are covered under ISED company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under ISED Canada company address code 22541 with site numbers 22541 -1 through 22541-5, respectively.

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.

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

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. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is a control node transmitter module that operates in the 902-928 MHz band.
Device uses hopping technology and is categorized as an Frequency Hopping System(FHS).

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
902-928	Normal	26.04	401.79

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a dipole antenna, with a maximum gain of 2.19 dBi.

5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was WakeupDevice_0000004.

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 30MHz and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Radiated emissions from 30MHz to 1GHz were performed with the EUT set to transmit at low middle and high channels.

Band edge and radiated emissions between 30MHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	X1 Carbon	W1KS72210YY	PD98260NG
Laptop Adapter	Lenovo	ADLX65NCC2A	45N0263	-

I/O CABLES

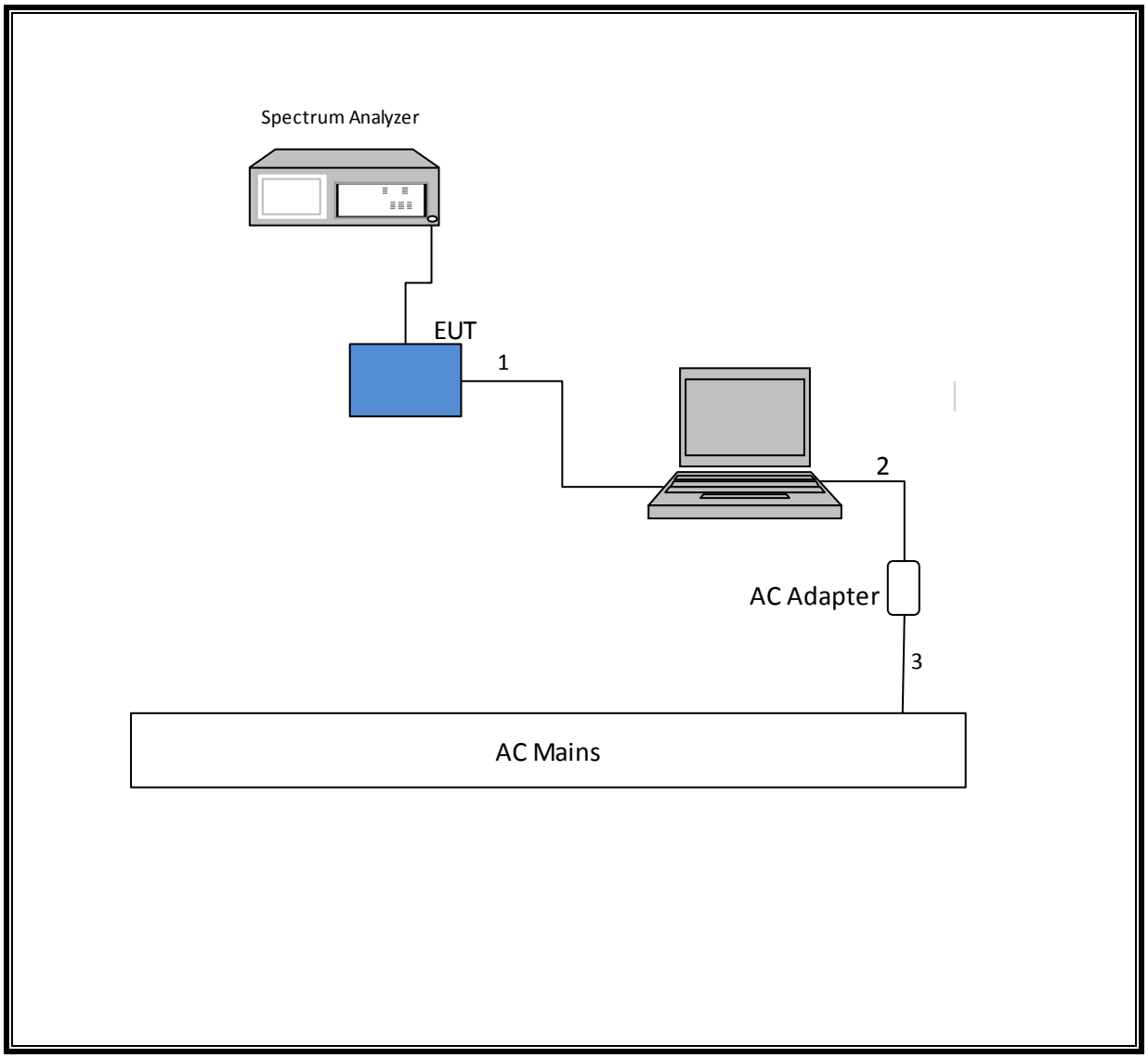
I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	USB	1	USB	Shielded	1	
2	DC	1	DC	Shielded	1	
3	AC	1	3-Prong	Unshielded	0.8	

TEST SETUP

The EUT is connected to a test laptop during the tests. Test software exercised the radio card.

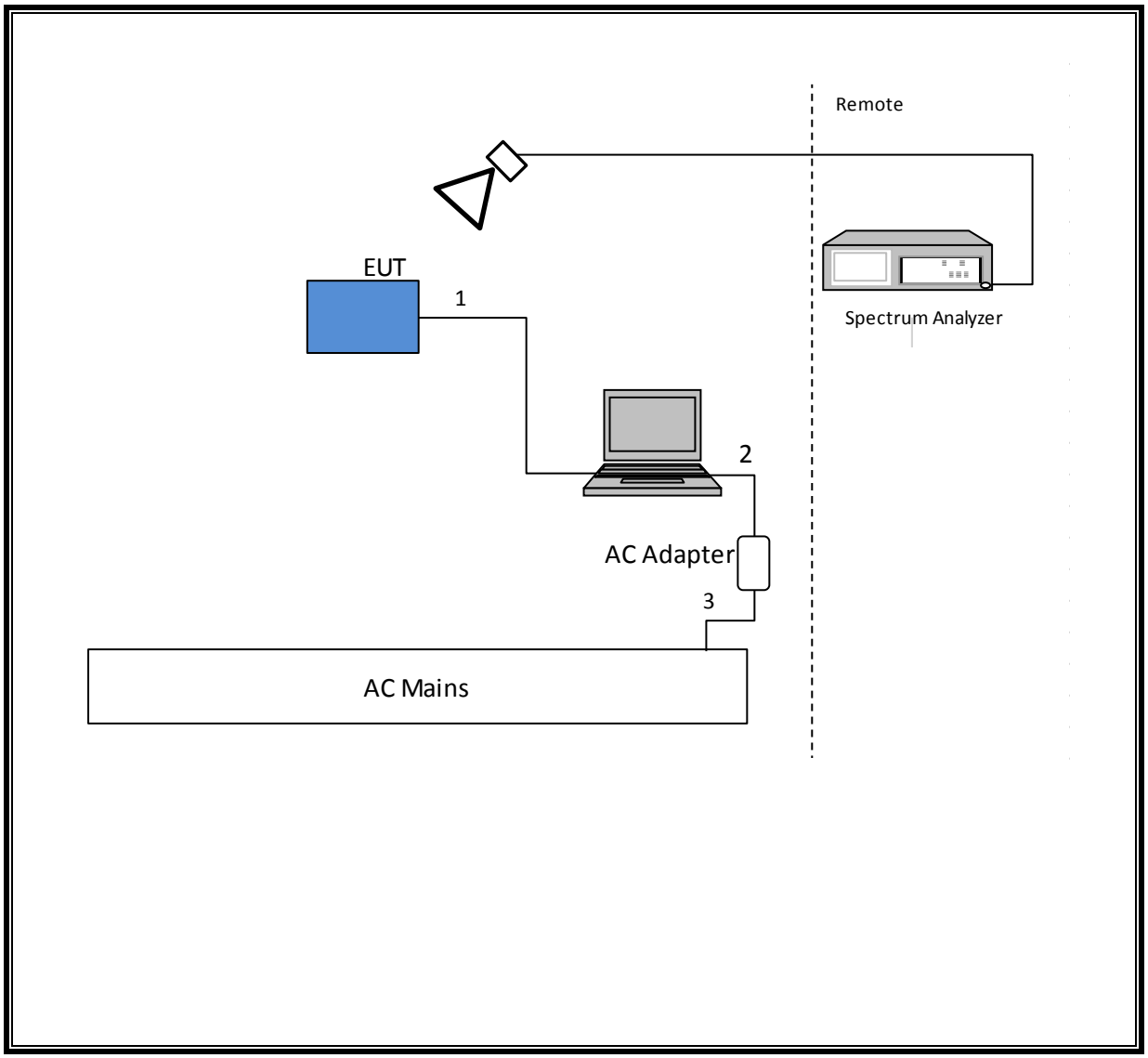
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

SETUP DIAGRAM FOR CONDUCTED TESTS



UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

SETUP DIAGRAM FOR RADIATED TESTS



UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

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**	**ID Num**	**Cal Due**	**Last Cal**
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB1	T130	10/16/2018	10/16/2017
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T862	06/09/2018	06/09/2017
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T1269	03/29/2018	03/29/2017
Amplifier, 1 - 18GHz	MITEQ	AFS42-00101800-25-S-42	T931	09/20/2018	09/20/2017
Amplifier, 1-8GHz	MITEQ	AMF-4D-01000800-30-29P	T1156	06/24/2018	06/24/2017
Power Sensor, P - series, 50MHz to 18GHz, Wideband	All	N1921A	T1224	03/29/2018	03/29/2017
Amplifier, 10KHz to 1GHz, 32dB	Agilent (Keysight) Technologies	8447D	T10	02/14/2019	02/14/2018
Spectrum Analyzer PSA	Agilent (Keysight) Technologies	E4446A	T146	03/21/2018	03/21/2017
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1466	04/11/2018	04/11/2017
Antenna, Active Loop 9kHz-30MHz	Com-Power Corp.	AL-130R	T1866	10/10/2018	10/10/2017
Test Receiver, EMI, 10Hz-7GHz	Rhode&Schwarz	ESR	T1436	01/06/2019	01/06/2018
LISN	FISCHER	FCC-LISN-50/250-25-2-01	T1310	01/17/2019	01/17/2018

Test Software List			
Description	**Manufacturer**	**Model**	**Version**
Radiated Software	UL	UL EMC	Ver 9.5, December 1, 2016
Antenna Port Software	UL	UL RF	Ver 9.1, January 25, 2018

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

7. MEASUREMENT METHODS

On Time and Duty Cycle: ANSI C63.10-2013 Section 11.6

Occupied BW (20dB): ANSI C63.10-2013 Section 6.9.2

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Number of Hopping Frequencies: ANSI C63.10-2013 Section 7.8.3

Time of Occupancy (Dwell Time): ANSI C63.10-2013 Section 7.8.4

Peak Output Power: ANSI C63.10-2013 Section 7.8.5

Conducted Spurious Emissions: ANSI C63.10-2013 Section 7.8.8

Conducted Band-Edge: ANSI C63.10-2013 Section 6.10.4

Radiated Spurious Emissions 30-1000MHz: ANSI C63.10-2013 Section 6.3 and 6.5

Radiated Spurious Emissions above 1GHz: ANSI C63.10-2013 Section 6.3 and 6.6

Radiated Band-edge: ANSI C63.10-2013 Section 6.10.5

AC Power-line conducted emissions: ANSI C63.10-2013, Section 6.2.

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

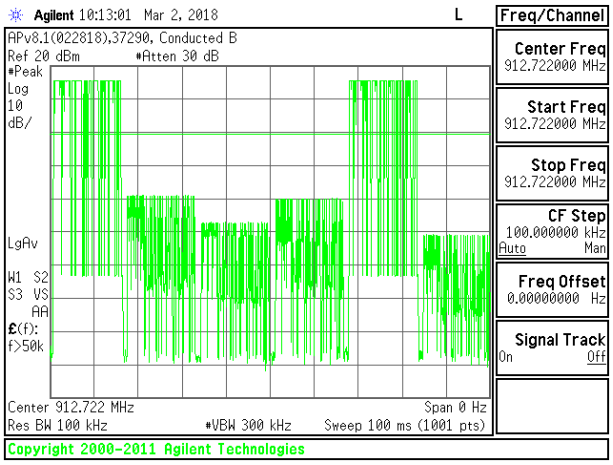
None; for reporting purposes only.

ON TIME AND DUTY CYCLE RESULTS

One Period (ms)	Pulse Numbers in 100ms	Long Pulse Width (ms)	# of Long Pulses	Medium Pulse 1 Width (ms)	# of Medium 1 Pulses	Medium Pulse 2 Width (ms)	# of Medium 2 Pulses	Short Pulse Width (ms)	# of Short Pulses	Duty Cycle	20*Log Duty Cycle (dB)
100	2	0.610	3	0.38	3	0.24	6	0.120	28	0.155	-16.17

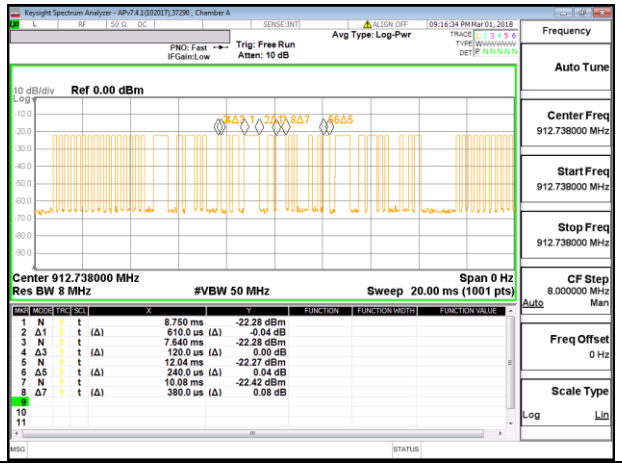
DUTY CYCLE PLOTS

PULSE NUMBER IN 100ms



PULSE NUMBER ZOOM IN

PULSE WIDTHS



UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.2. 20 dB AND 99% BANDWIDTH

LIMITS

FCC §15.247 (a) (1)(i)

RSS-247 (5.1) (c)

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

TEST PROCEDURE

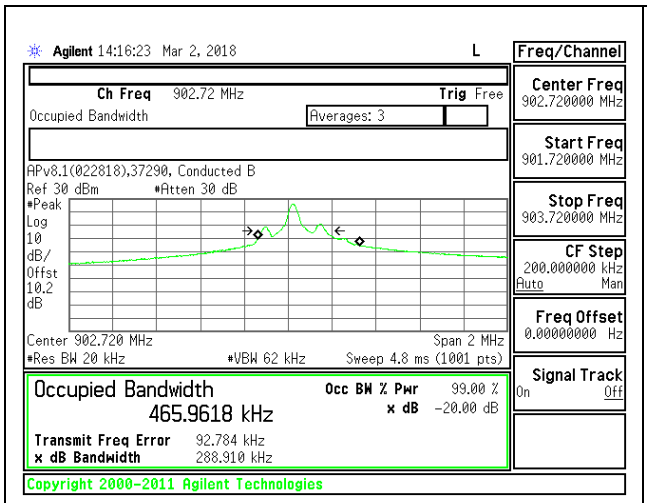
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

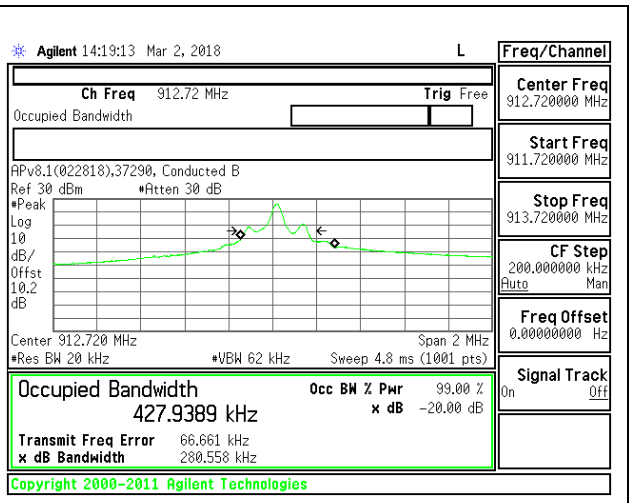
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.2.1. 99% OCCUPIED BANDWIDTH

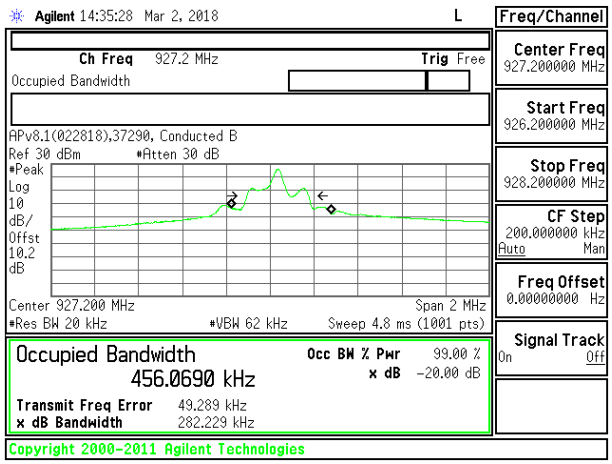
Channel	Frequency (MHz)	99% Bandwidth (kHz)
Low	902.72	465.96
Mid	912.72	427.94
High	927.20	456.07



LOW CHANNEL



MID CHANNEL

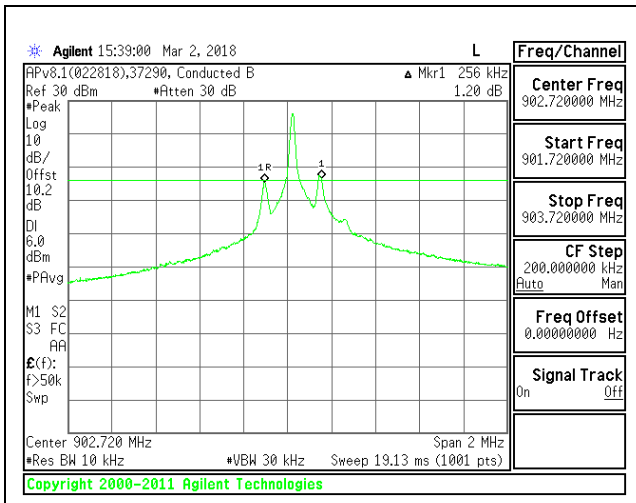


HIGH CHANNEL

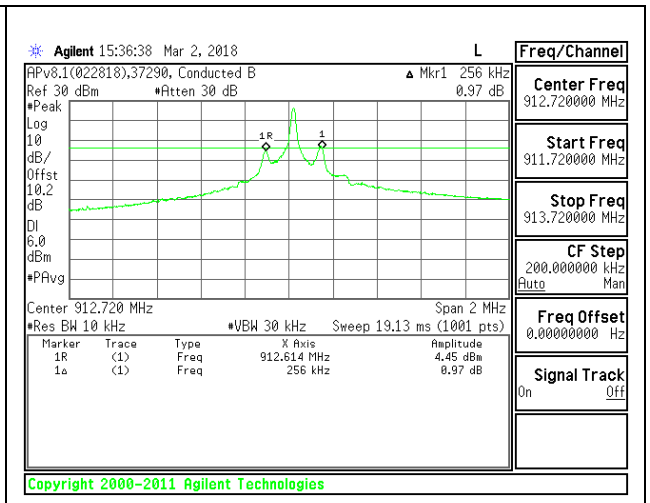
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.2.2. 20dB BANDWIDTH

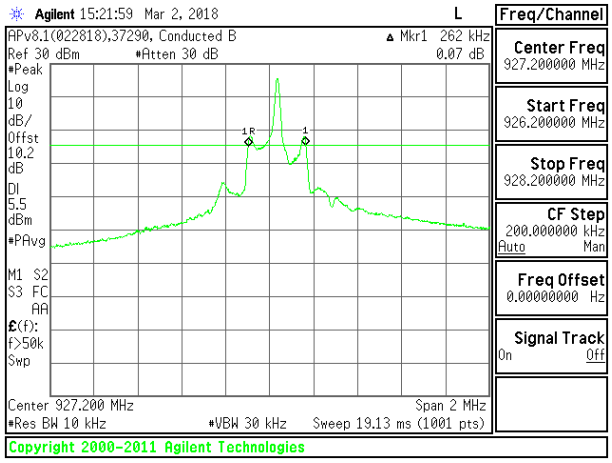
Channel	Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)
Low	902.72	256	500
Mid	912.72	256	500
High	927.20	262	500



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.3. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

RSS-247 (5.1) (c)

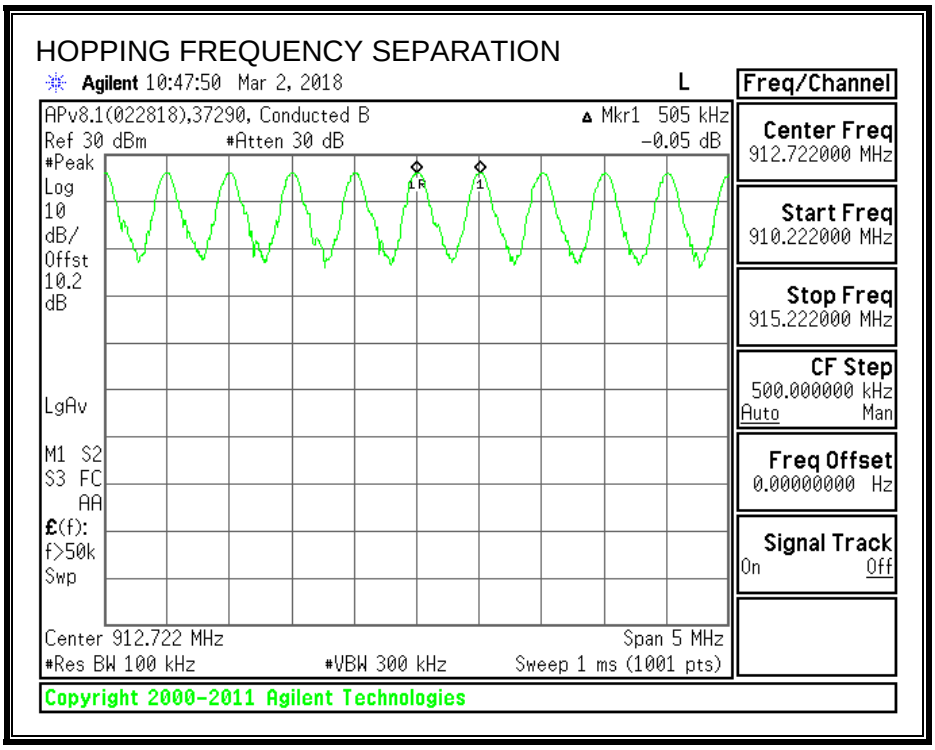
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION



UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.4. NUMBER OF HOPPING CHANNELS

LIMITS

FCC §15.247 (a) (1) (i)

RSS-247 (5.1) (c)

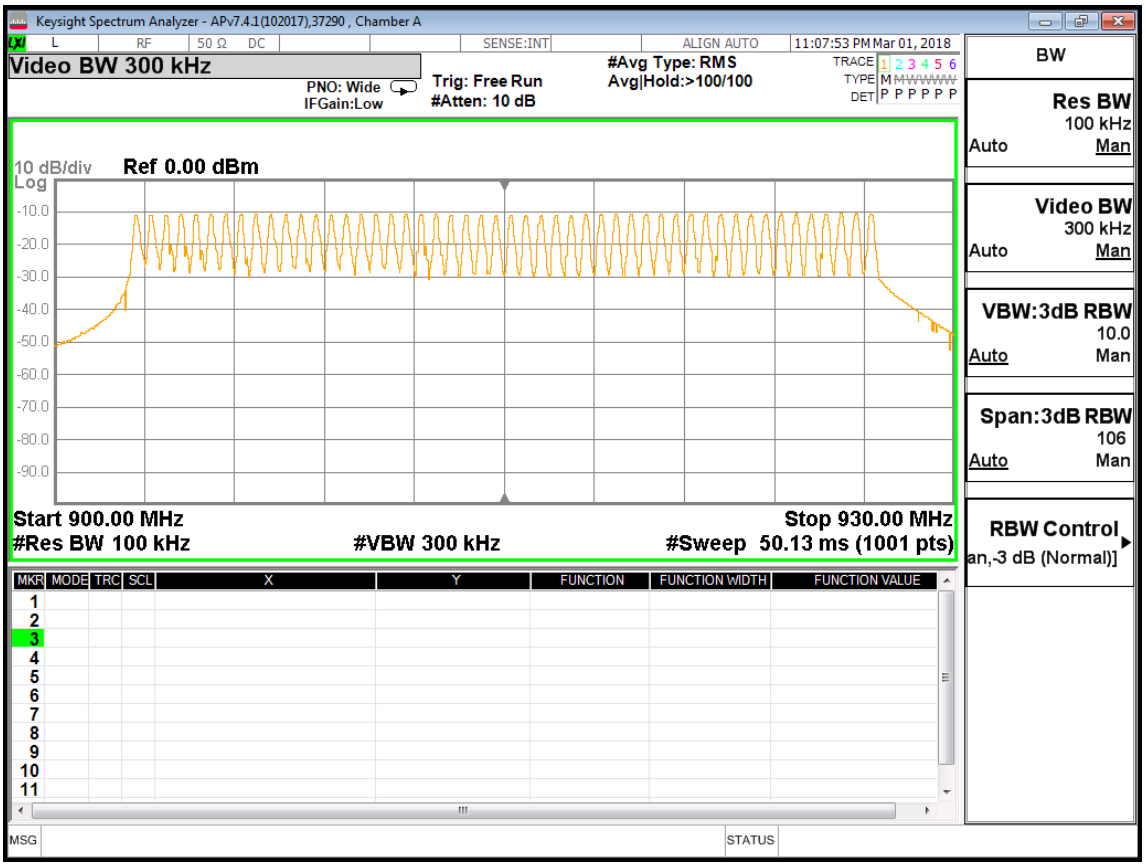
For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

Normal Mode: 50 Channels observed.



UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.5. AVERAGE TIME OF OCCUPANCY

LIMITS

FCC §15.247 (a) (1) (i)

RSS-247 (5.1) (c)

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

TEST PROCEDURE

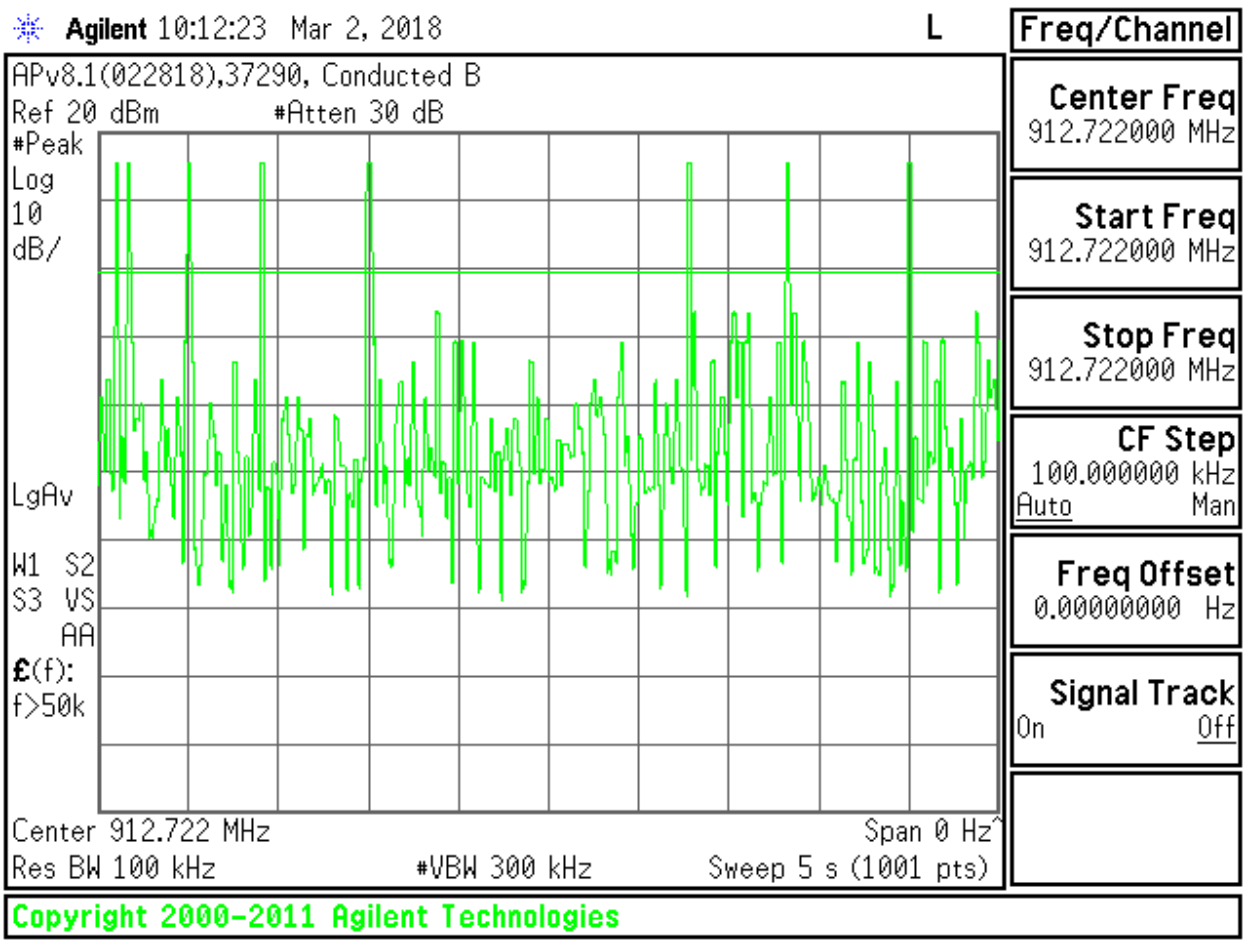
The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 5 second scan, to enable resolution of each occurrence.

RESULTS

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.5.1. OOK MODULATION

DH Packet	Pulse Width (msec)	Number of Pulses in 5 seconds	Average Time of Occupancy in 10 seconds (sec)	Limit (sec)	Margin (sec)
Normal	7.75	8	0.1240	0.4	-0.2760



5 Seconds

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.6. OUTPUT POWER

LIMITS

§15.247 (b) (2)

RSS-247 (5.4) (a)

(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels as permitted under paragraph (a)(1)(i) of this section.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1 MHz, and the VBW is set to 3 MHz. The detector is peak and max hold.

The cable assembly insertion loss of 10.2 dB (including 10 dB pad and 0.2 dB cable) was entered as an offset in the spectrum analyzer to allow for a peak reading of power.

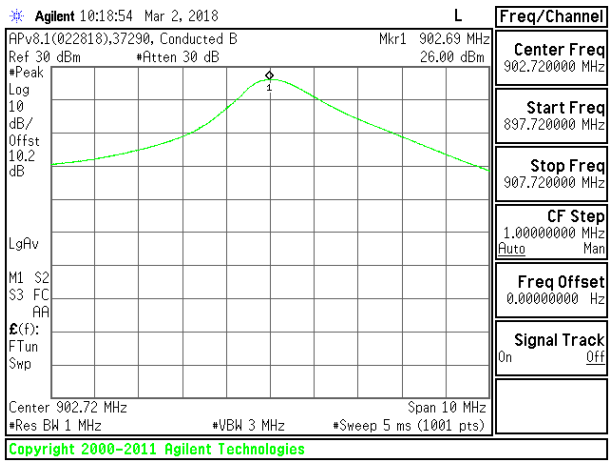
RESULTS

OOK MODULATION

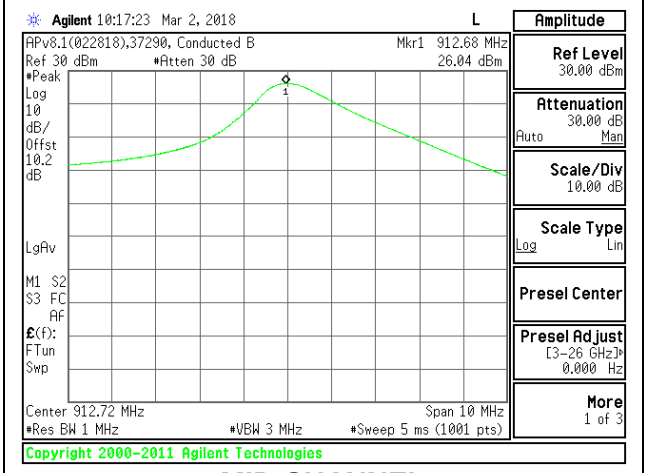
Tested By:	37290 RZ
Date:	3/2/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	902.72	26	30	-4
Middle	912.72	26.04	30	-3.96
High	927.20	25.68	30	-4.32

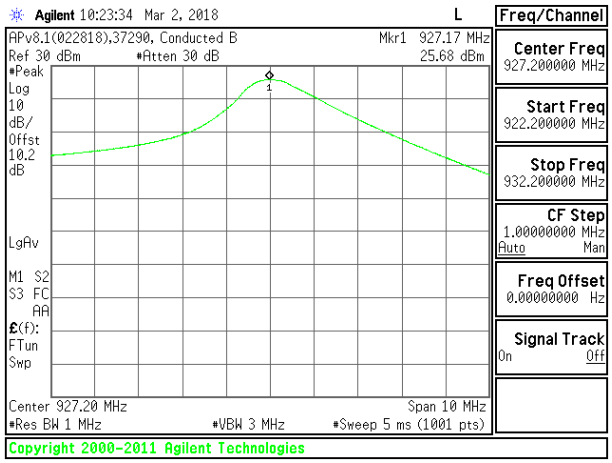
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-247 5.5

Limit = -20 dBc

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

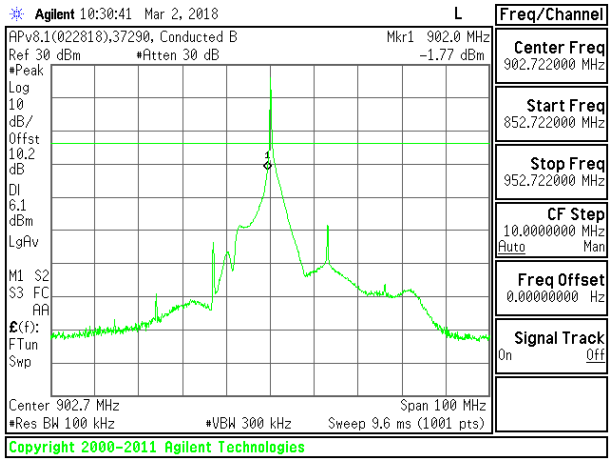
The bandedges at 902MHz and 928MHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

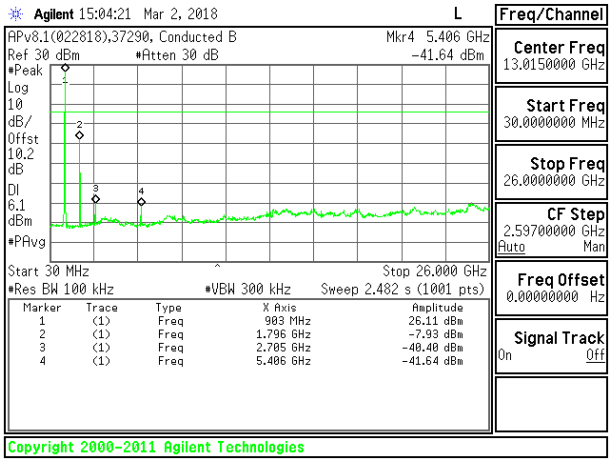
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.7.1. OOK MODULATION

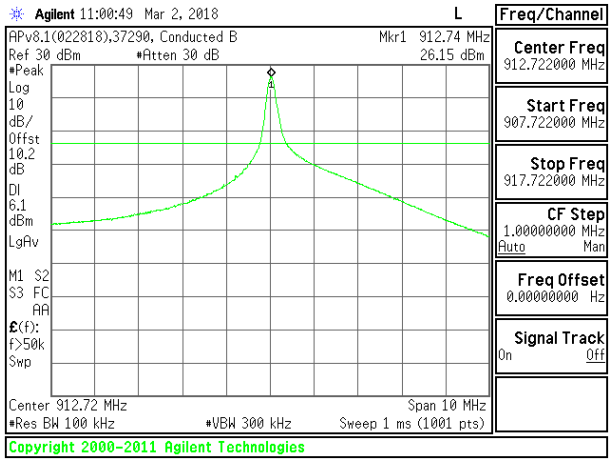
SPURIOUS EMISSIONS, NON-HOPPING



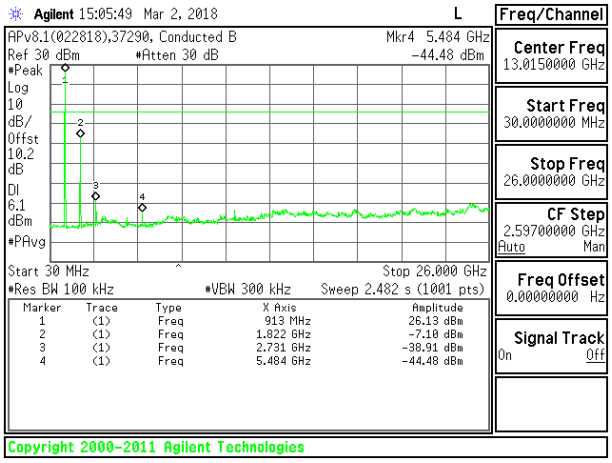
LOW CHANNEL BANDEDGE



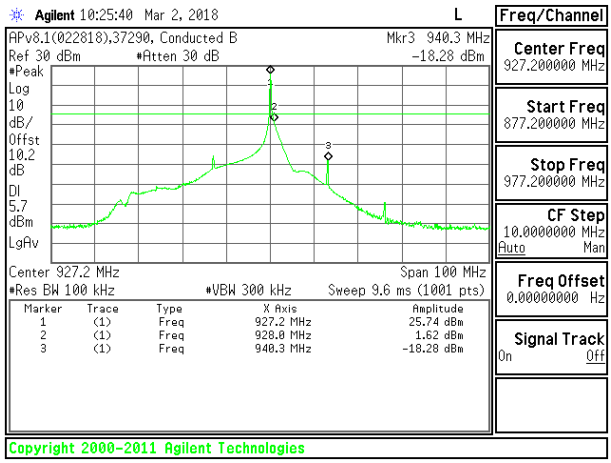
LOW CHANNEL BANDEDGE



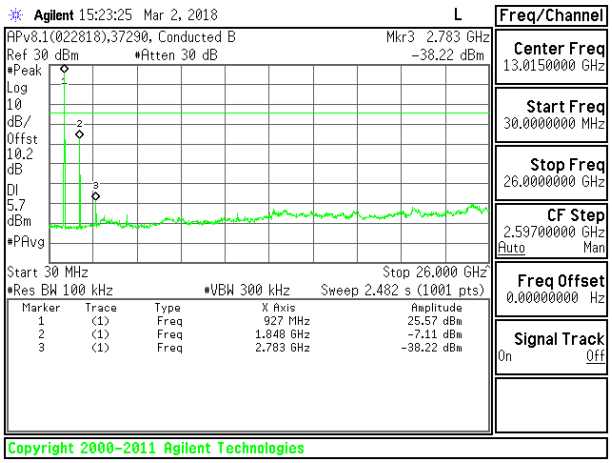
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE

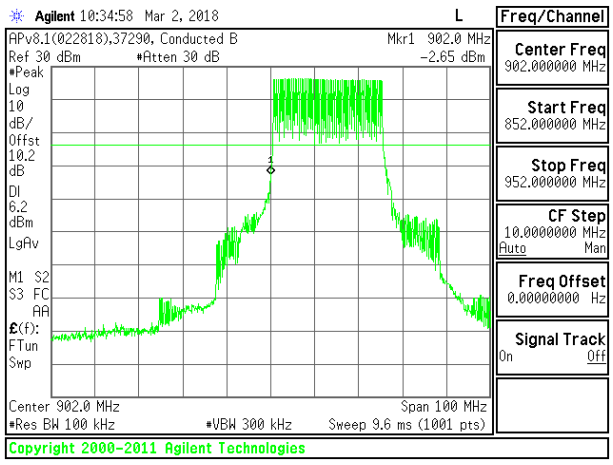


HIGH CHANNEL BANDEDGE

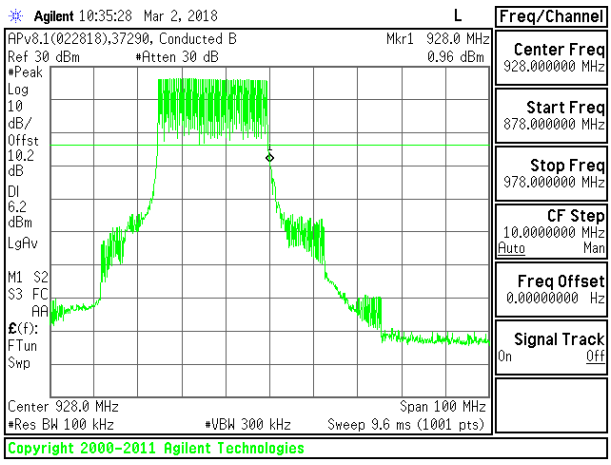
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



LOW BANDEDGE



HIGH BANDEDGE

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209

RSS-GEN, Section 8.9 and 8.10.

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

KDB 414788 OATS and Chamber Correlation Justification

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

OATs and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

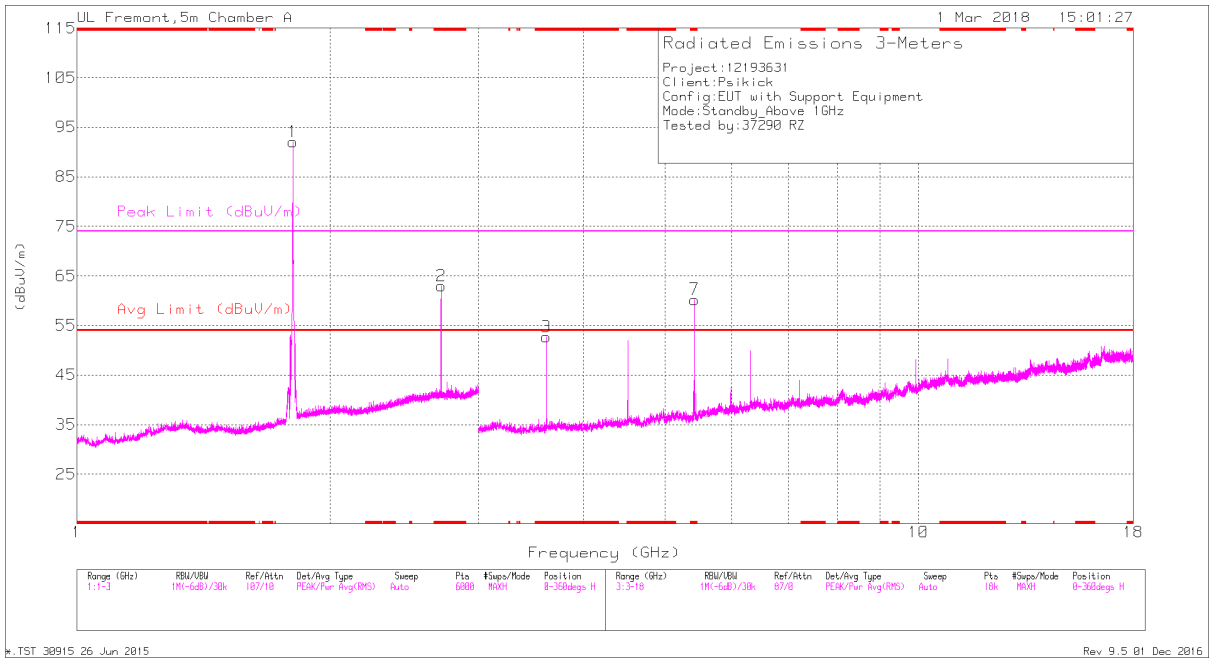
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.1. TRANSMITTER ABOVE 1 GHz

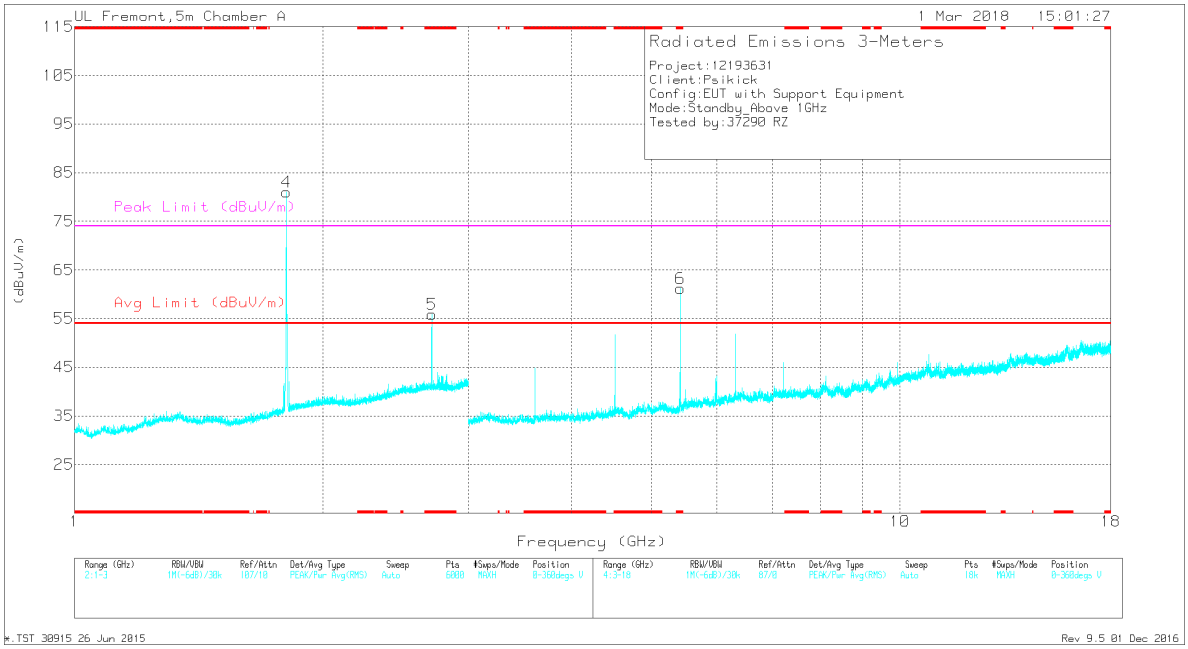
9.1.1. OOK MODULATION

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZTONAL



VERTICAL

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RADIATED EMISSIONS

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.708	53.26	Pk	32.5	-22.8	62.96	-	-	74	-11.04	0-360	101	H
5	* 2.708	46.22	Pk	32.5	-22.8	55.92	-	-	74	-18.08	0-360	200	V
3	* 3.611	49.02	Pk	33	-29.3	52.72	-	-	74	-21.28	0-360	101	H
7	* 5.416	52.36	Pk	34.7	-26.8	60.26	-	-	74	-13.74	0-360	101	H
6	* 5.416	53.26	Pk	34.7	-26.8	61.16	-	-	74	-12.84	0-360	101	V
1	1.805	85.19	Pk	30.3	-23.4	92.09	-	-	-	-	0-360	101	H
4	1.805	74.08	Pk	30.3	-23.4	80.98	-	-	-	-	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	1GHz HPF Loss (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.708	53.97	PK2	32.5	-22.8	0.40	64.07	-	-	74	-10.33	18	102	H
		Avg				47.90	54	-6.1					
* 2.708	49.26	PK2	32.5	-22.8	0.40	59.36	-	-	74	-15.04	333	242	V
		Avg				43.19	54	-10.81					
* 3.611	47.56	PK2	33	-29.3	0.35	51.61	-	-	74	-22.74	359	127	H
		Avg				35.44	54	-18.56					
* 5.416	53.38	PK2	34.7	-26.8	0.32	61.6	-	-	74	-12.72	6	104	H
		Avg				45.43	54	-8.57					
* 5.416	54.06	PK2	34.7	-26.8	0.32	62.28	-	-	74	-12.04	39	107	V
		Avg				46.11	54	-7.89					

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Avg – Average detector

* Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is -16.17dB

Pulse number in 100ms * ((# of long pulses * long pulse width) + (# of medium pulses 1 * medium pulse width) + (# of medium pulses 2* medium pulse width) + (# of short pulses * short pulse width)) / 100 or T

Refer to section 8.1 for duty cycle factor calculation (-16.17dB)

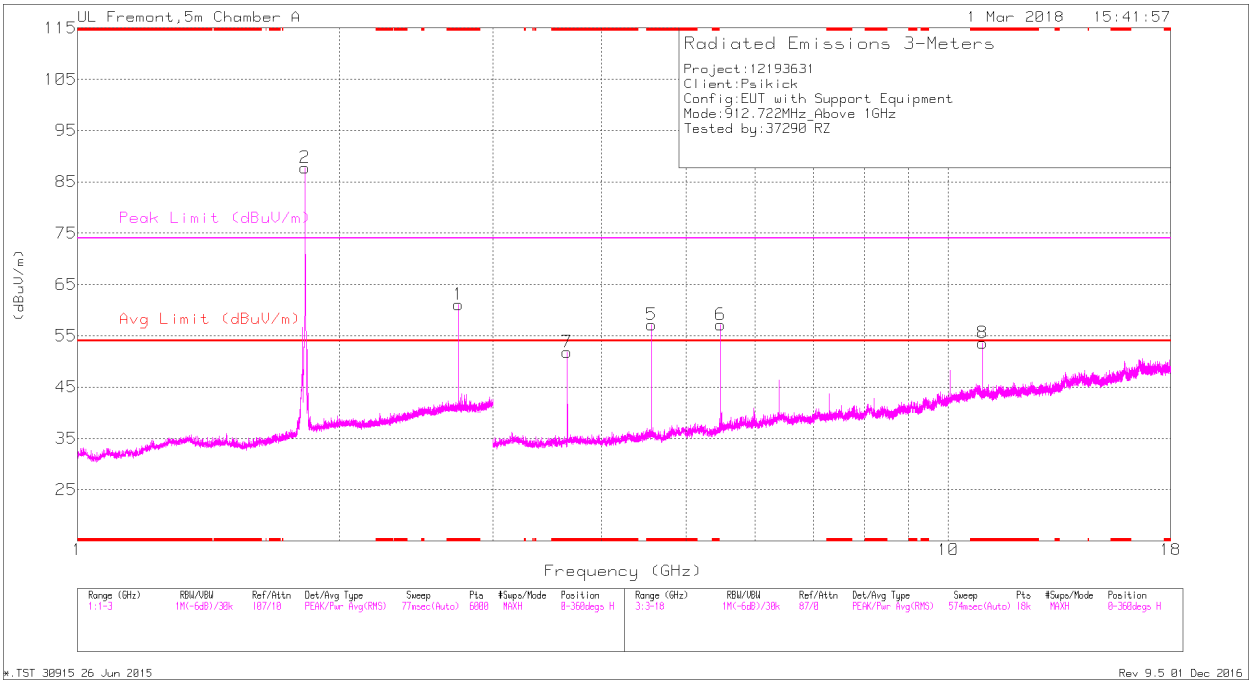
Note: Radiated peak result is based on 100% duty cycle sample; average reading = peak reading + DCCF

** Harmonics of fundamental 902.72MHz

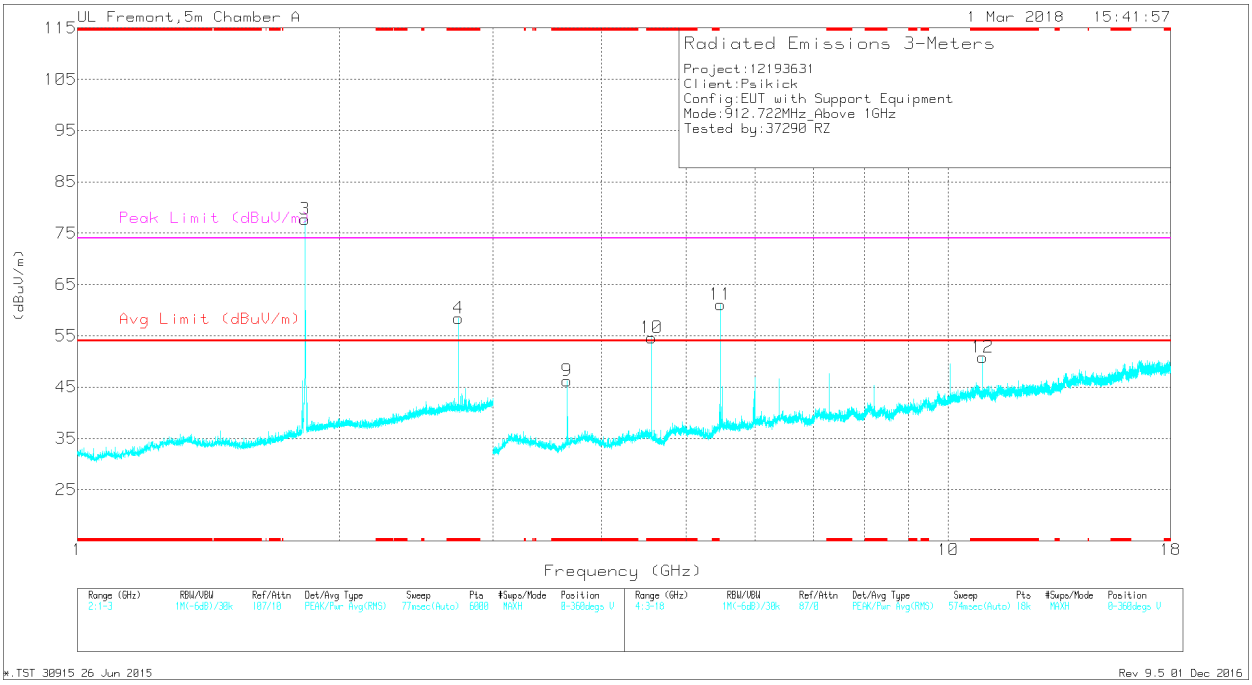
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

MID CHANNEL RESULTS



HORIZTONAL



VERTICAL

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RADIATED EMISSIONS

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1**	* 2.738	51.34	Pk	32.4	-22.7	61.04	-	-	74	-12.96	0-360	102	H
4**	* 2.738	48.68	Pk	32.4	-22.7	58.38	-	-	74	-15.62	0-360	101	V
5	* 4.563	50.94	Pk	34	-27.8	57.14	-	-	74	-16.86	0-360	101	H
7	* 3.651	47.77	Pk	32.9	-28.8	51.87	-	-	74	-22.13	0-360	101	H
8	* 10.954	34.96	Pk	37.9	-19.3	53.56	-	-	74	-20.44	0-360	101	H
9**	* 3.651	42.19	Pk	32.9	-28.8	46.29	-	-	74	-27.71	0-360	200	V
10**	* 4.563	48.42	Pk	34	-27.8	54.62	-	-	74	-19.38	0-360	101	V
12**	* 10.953	32.24	Pk	37.9	-19.3	50.84	-	-	74	-23.16	0-360	200	V
2**	1.825	80.7	Pk	30.6	-23.5	87.8	-	-	-	-	0-360	102	H
3**	1.825	70.67	Pk	30.6	-23.5	77.77	-	-	-	-	0-360	200	V
6	5.476	48.3	Pk	34.8	-26	57.1	-	-	-	-	0-360	101	H
11	5.476	52.24	Pk	34.8	-26	61.04	-	-	-	-	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector

Radiated Emissions

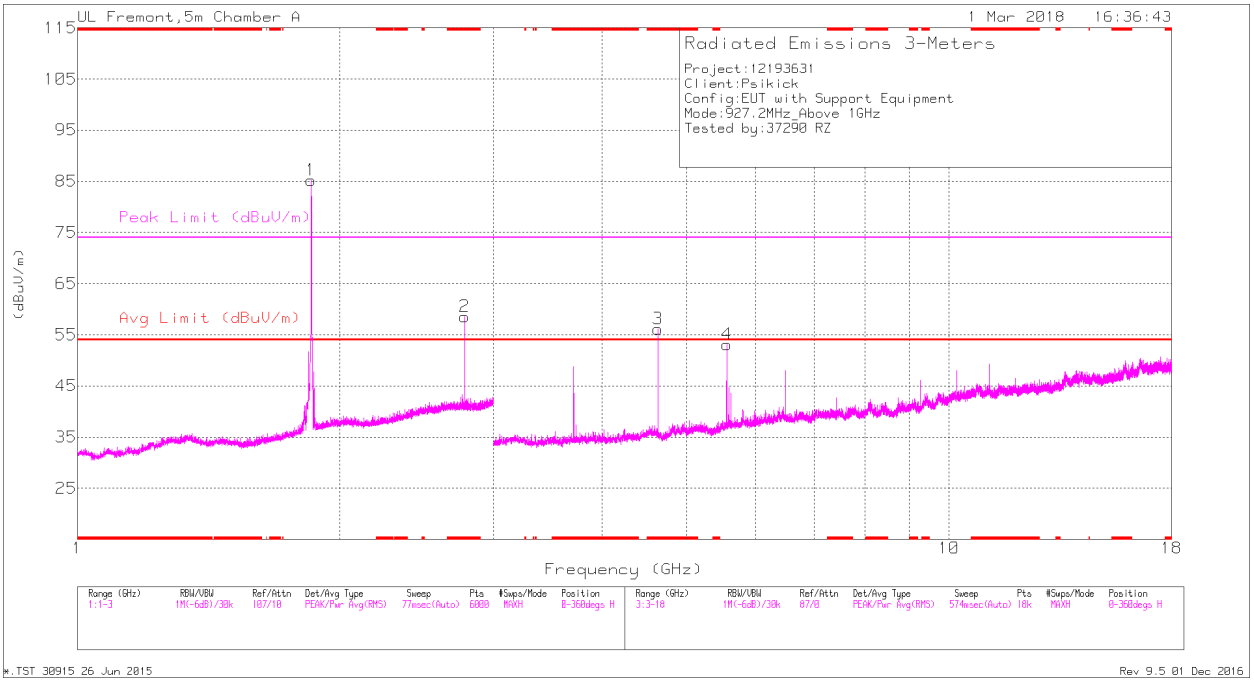
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	1GHz HPF Loss (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.738	52.47	PK2	32.4	-22.7	0.44	62.61	-	-	74	-11.83	99	134	H
		Avg				46.00	54	-8	-	-			
* 2.738	50.03	PK2	32.4	-22.7	0.44	60.17	-	-	74	-14.27	270	101	V
		Avg				43.56	54	-10.44	-	-			
* 4.564	52.57	PK2	34	-27.8	0.26	59.03	-	-	74	-15.23	181	101	H
		Avg				42.60	54	-11.4	-	-			
* 3.651	48.84	PK2	32.9	-28.8	0.34	53.28	-	-	74	-21.06	0	108	H
		Avg				36.77	54	-17.23	-	-			
* 10.953	39.05	PK2	37.9	-19.3	0.30	57.95	-	-	74	-16.35	164	120	H
		Avg				41.48	54	-12.52	-	-			
* 3.651	44.91	PK2	32.9	-28.8	0.34	49.35	-	-	74	-24.99	326	224	V
		Avg				32.84	54	-21.16	-	-			
* 4.564	50.52	PK2	34	-27.8	0.26	56.98	-	-	74	-17.28	168	111	V
		Avg				40.55	54	-13.45	-	-			
* 10.953	38.99	PK2	37.9	-19.3	0.30	57.89	-	-	74	-16.41	124	238	V
		Avg				41.42	54	-12.58	-	-			

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Avg – Average detector

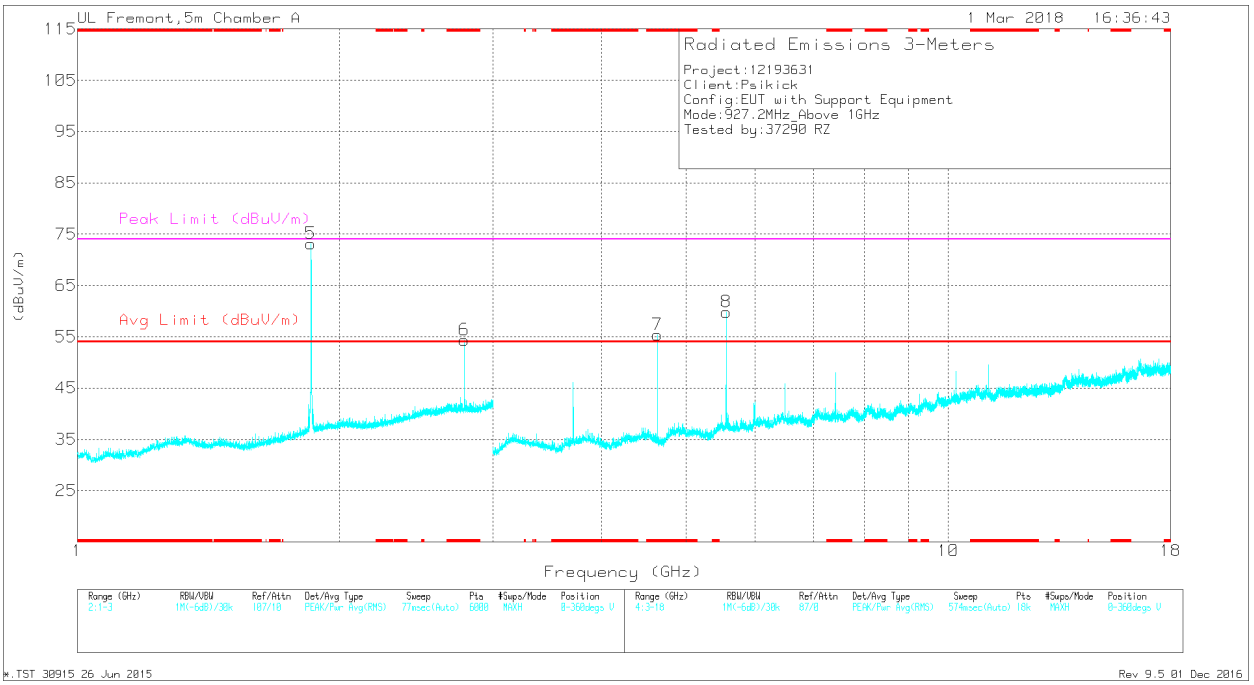
* Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is -16.17dB
Pulse number in 100ms * ((# of long pulses * long pulse width) + (# of medium pulses 1 * medium pulse width) + (# of medium pulses 2* medium pulse width) + (# of short pulses * short pulse width)) / 100 or T
Refer to section 8.1 for duty cycle factor calculation (-16.17dB)
Note: Radiated peak result is based on 100% duty cycle sample; average reading = peak reading + DCCF
** Harmonics of fundamental 912.72MHz

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HIGH CHANNEL RESULTS



HORIZTONAL



VERTICAL

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RADIATED EMISSIONS

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2**	* 2.782	48.72	Pk	32.3	-22.5	58.52	-	-	74	-15.48	0-360	199	H
6**	* 2.782	44.55	Pk	32.3	-22.5	54.35	-	-	74	-19.65	0-360	101	V
3	* 4.636	50.21	Pk	34	-28.1	56.11	-	-	74	-17.89	0-360	199	H
7**	* 4.636	49.42	Pk	34	-28.1	55.32	-	-	74	-18.68	0-360	200	V
1**	1.854	77.7	Pk	30.9	-23.4	85.2	-	-	-	-	0-360	101	H
5**	1.854	65.64	Pk	30.9	-23.4	73.14	-	-	-	-	0-360	101	V
4	5.563	44.59	Pk	35	-26.5	53.09	-	-	-	-	0-360	199	H
8**	5.563	51.33	Pk	35	-26.5	59.83	-	-	-	-	0-360	200	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	1GHz HPF Loss (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.782	50.42	PK2	32.3	-22.5	0.36	60.58	-	60.58	74	-13.78	106	198	H
		Avg				44.05	54	44.05					
* 2.782	47.34	PK2	32.3	-22.5	0.36	57.50	-	57.50	74	-16.86	272	107	V
		Avg				40.97	54	40.97					
* 4.636	51.85	PK2	34	-28.1	0.32	58.07	-	58.07	74	-16.25	178	254	H
		Avg				41.58	54	41.58					
* 4.636	50.84	PK2	34	-28.1	0.32	57.06	-	57.06	74	-17.26	262	202	V
		Avg				40.57	54	40.57					

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Avg – Average detector

* Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is -16.17dB
Pulse number in 100ms * ((# of long pulses * long pulse width) + (# of medium pulses 1 * medium pulse width) + (# of medium pulses 2* medium pulse width) + (# of short pulses * short pulse width)) / 100 or T
Refer to section 8.1 for duty cycle factor calculation (-16.17dB)
Note: Radiated peak result is based on 100% duty cycle sample; average reading = peak reading + DCCF
** Harmonics of fundamental 927.2MHz

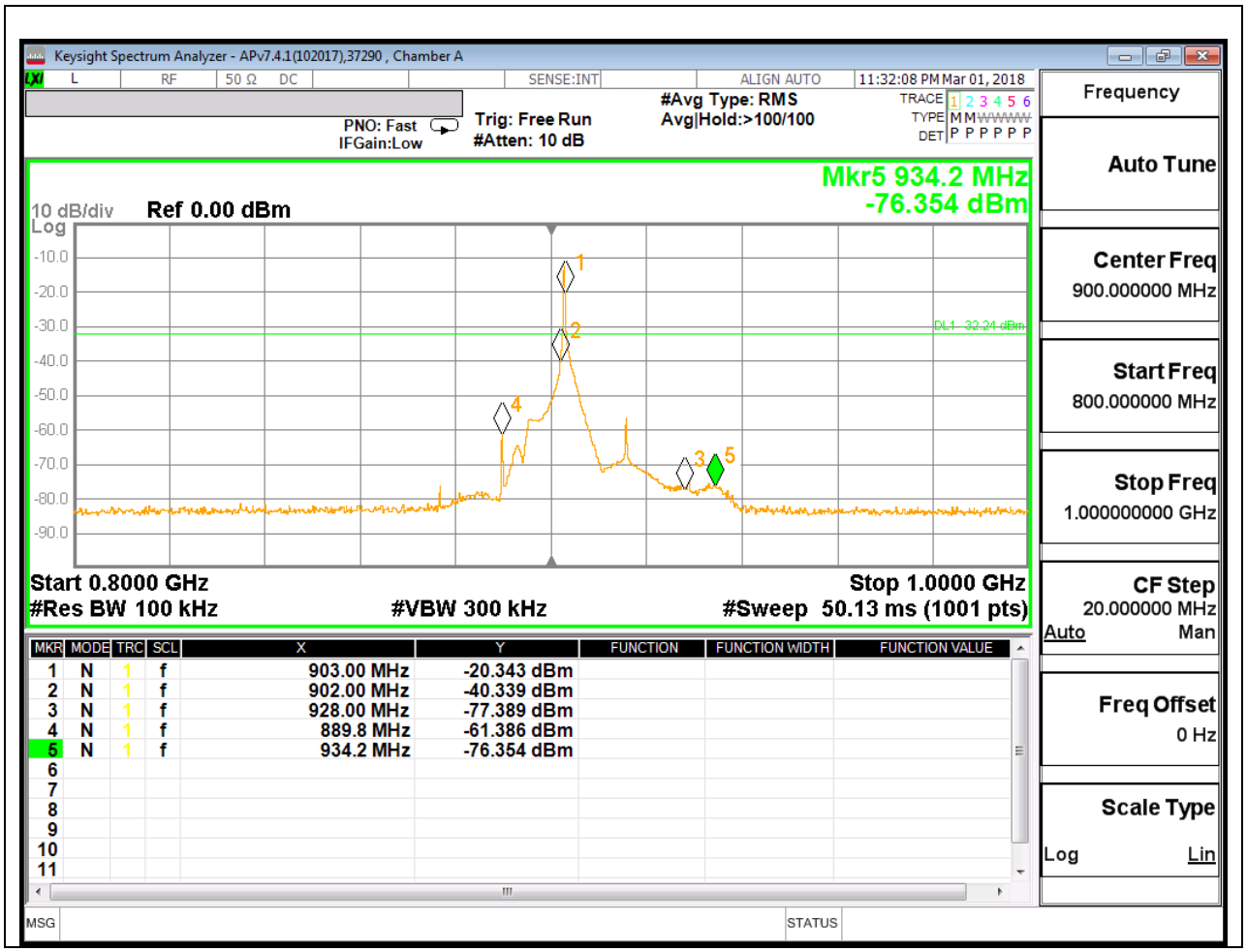
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.2. TRANSMITTER BELOW 1 GHz

9.2.1. OOK MODULATION

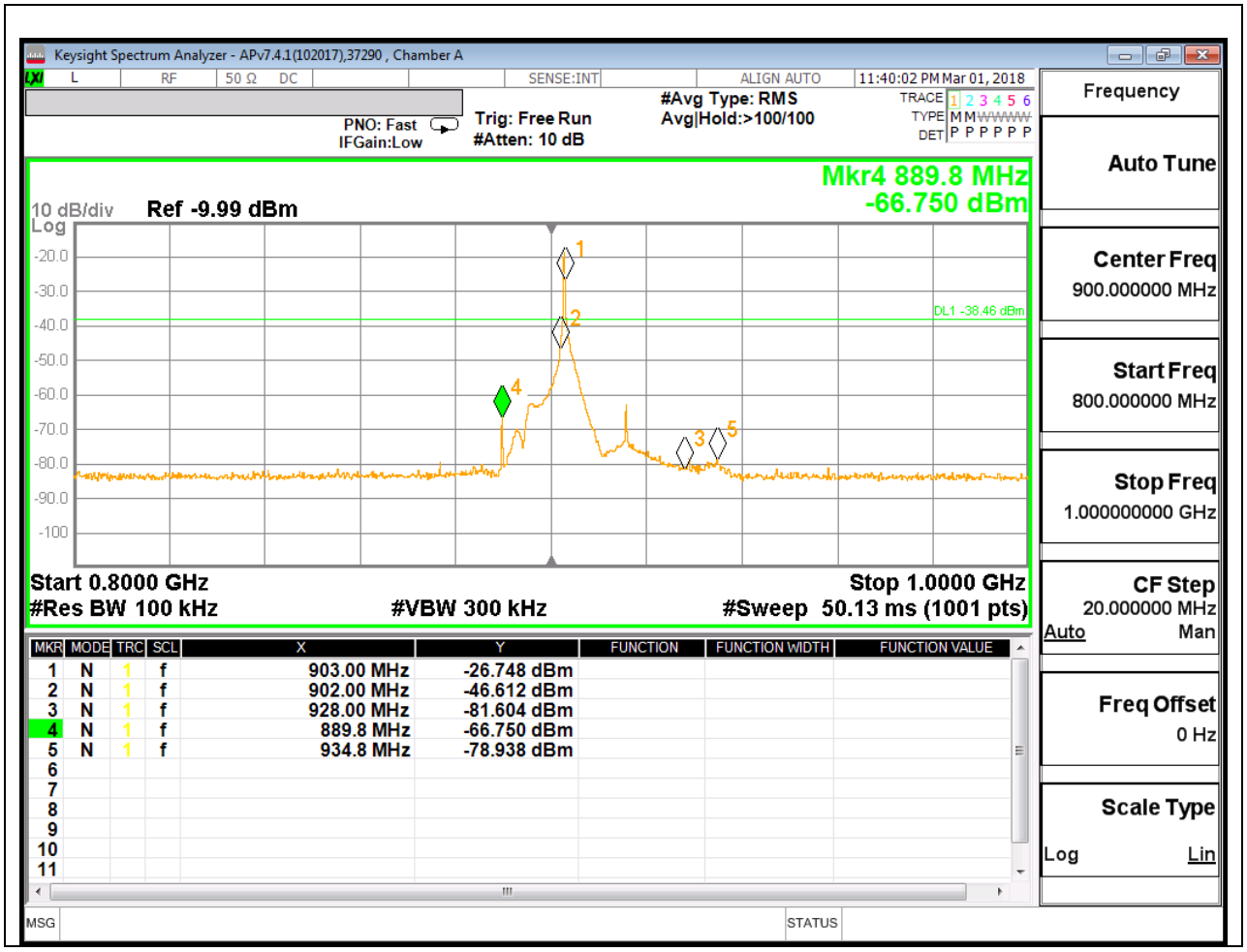
-20 dBc BANDEDGE WITHOUT NOTCH FILTER AND PRE-AMPLIFIER (LOW CHANNEL)

HORIZONTAL RESULT



UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

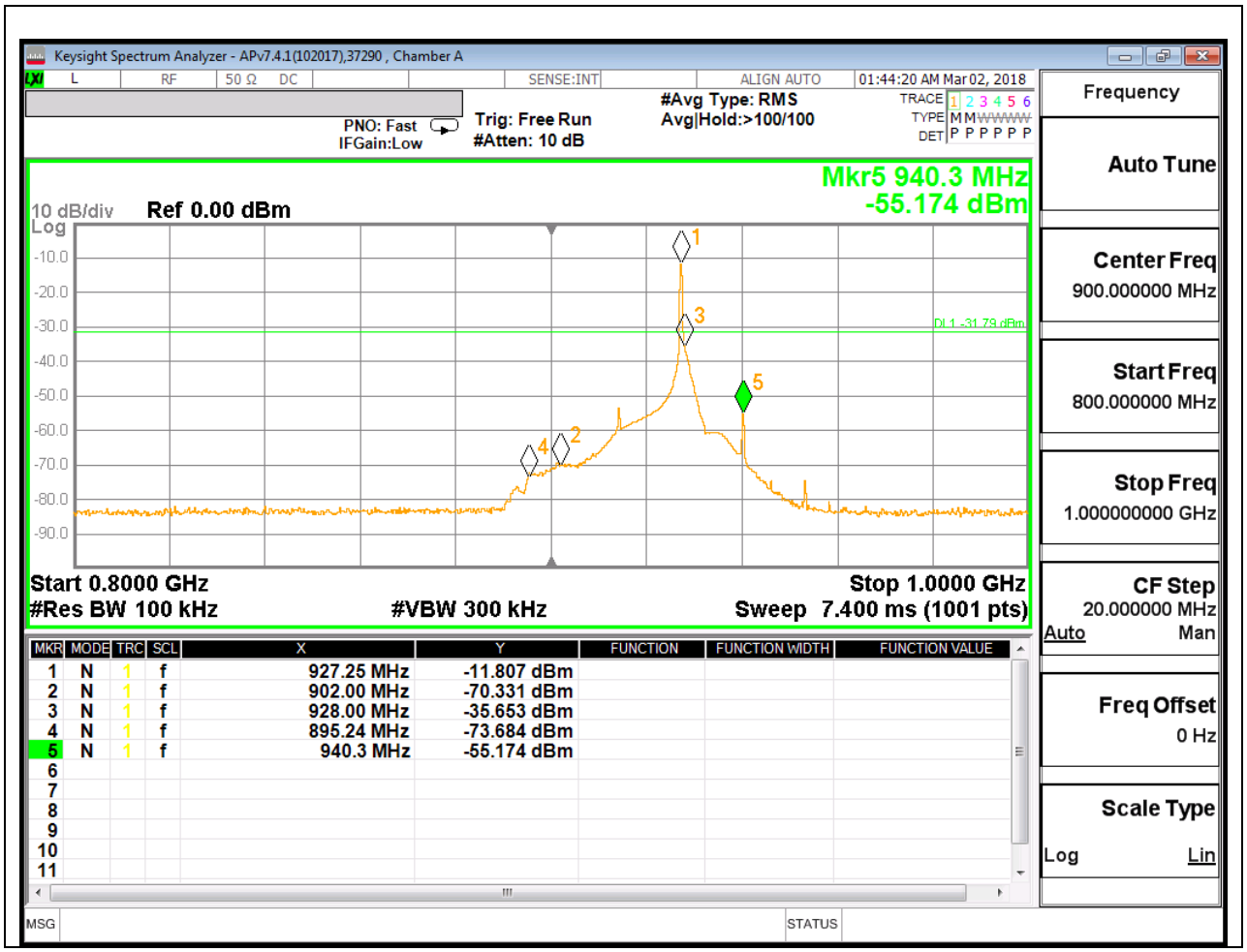
VERTICAL RESULT



UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

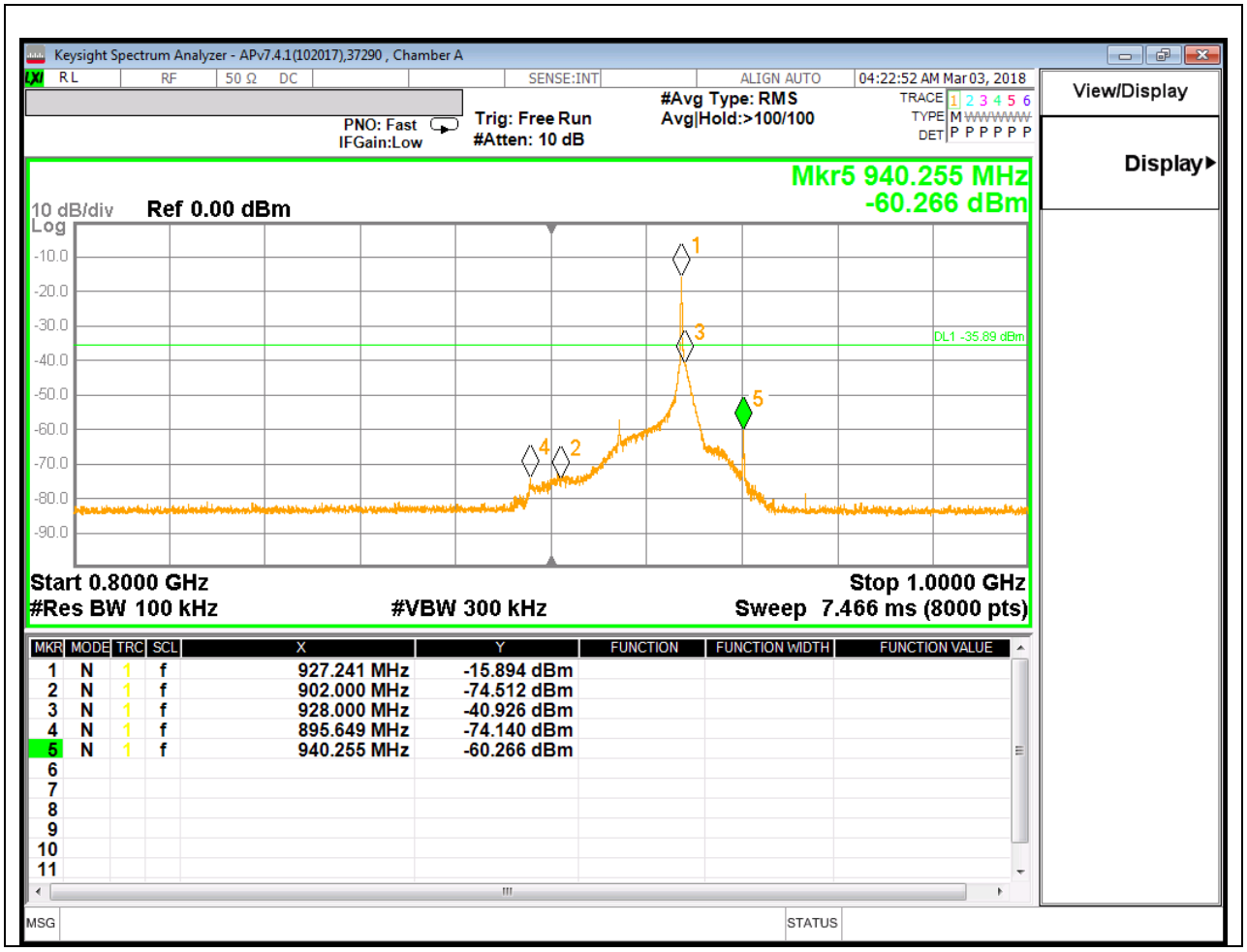
-20 dBc BANDEDGE WITHOUT NOTCH FILTER AND PRE-AMPLIFIER (HIGH CHANNEL)

HORIZONTAL RESULT



UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

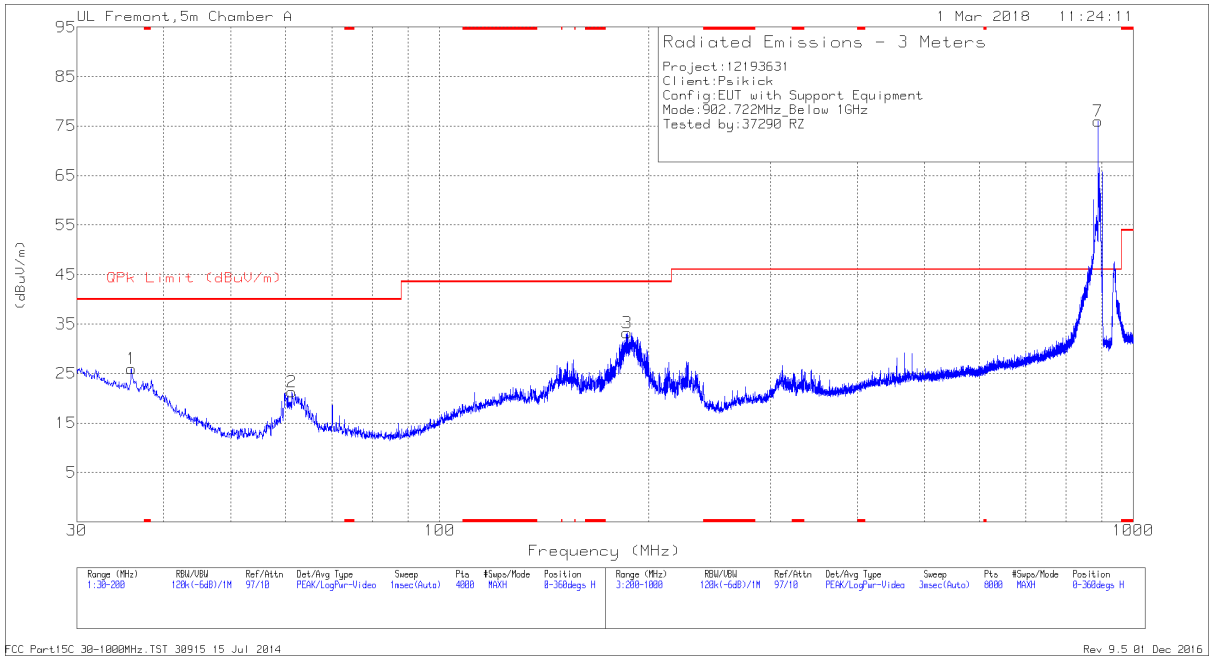
VERTICAL RESULT



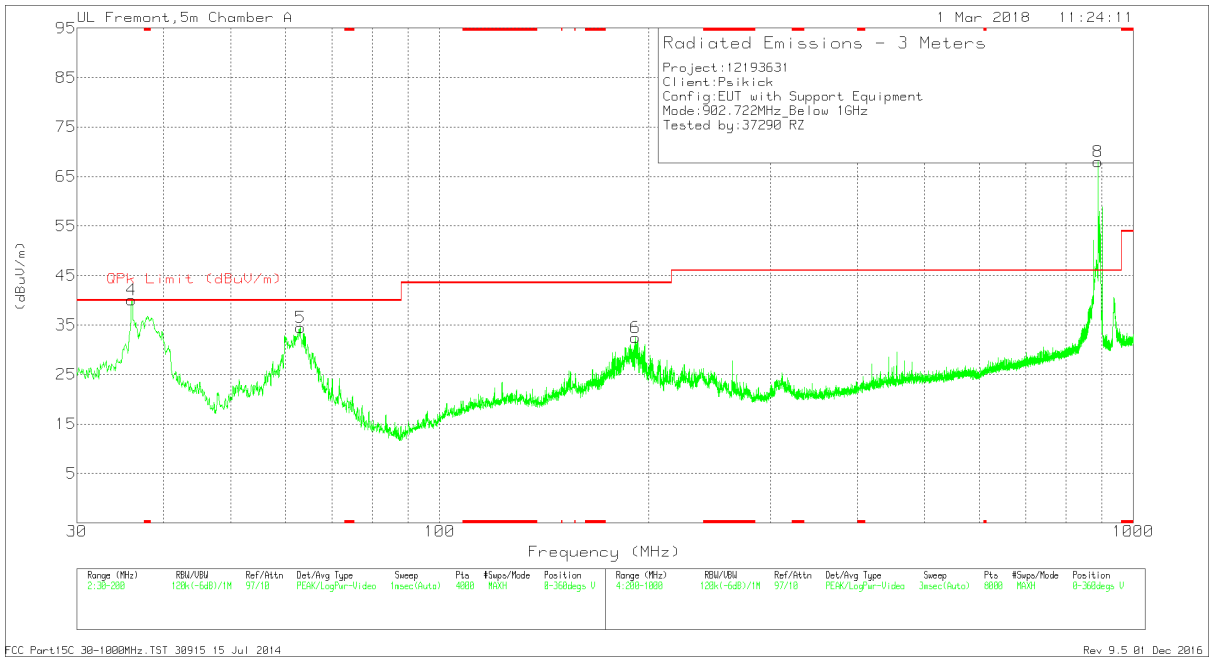
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS WITH A NOTCH FILTER

LOW CHANNEL RESULTS



HORIZTONAL



VERTICAL

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

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RADIATED EMISSIONS

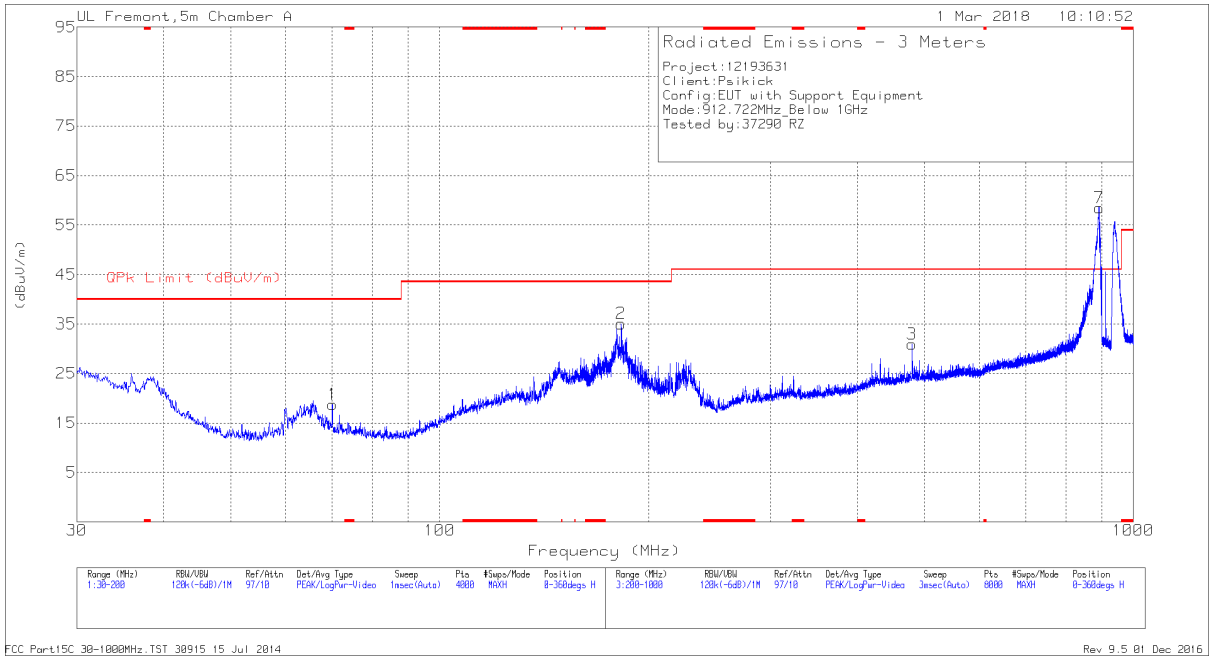
Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB/m)	Notch Filter loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	35.9515	32.26	Pk	20.9	-27.2	0.04	26.00	40	-14.00	0-360	200	H
4	35.9941	46.41	Pk	20.9	-27.2	0.04	40.15	40	0.15	0-360	100	V
	36.0321	39.13	Qp	20.9	-27.2	0.04	32.87	40	-7.13	317	119	V
2	61.2456	36.44	Pk	11.7	-26.9	0.15	21.39	40	-18.61	0-360	400	H
5	62.9885	49.43	Pk	11.9	-26.8	0.16	34.69	40	-5.31	0-360	100	V
	61.4735	43.73	Qp	11.7	-26.9	0.15	28.68	40	-11.32	221	105	V
3	186.2704	43.47	Pk	15.2	-25.5	0.21	33.38	43.52	-10.14	0-360	200	H
6	191.6693	42.37	Pk	15.5	-25.4	0.22	32.69	43.52	-10.83	0-360	100	V
*7	889.6896	72.72	Pk	26.3	-23	1.96	77.98	-	-	0-360	101	H
*8	889.6896	64.64	Pk	26.3	-23	1.96	69.90	-	-	0-360	101	V

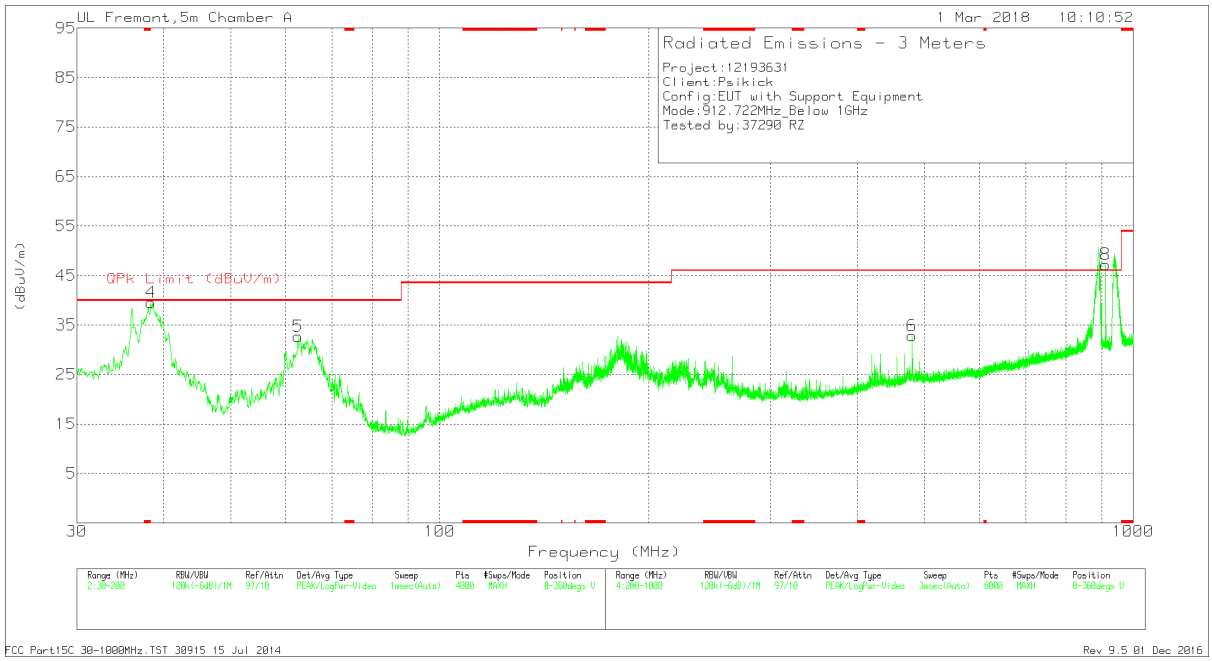
Pk - Peak detector
Qp - Quasi-Peak detector
* Harmonics of fundamental 902.72MHz

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

MID CHANNEL RESULTS



HORIZTONAL



VERTICAL

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RADIATED EMISSIONS

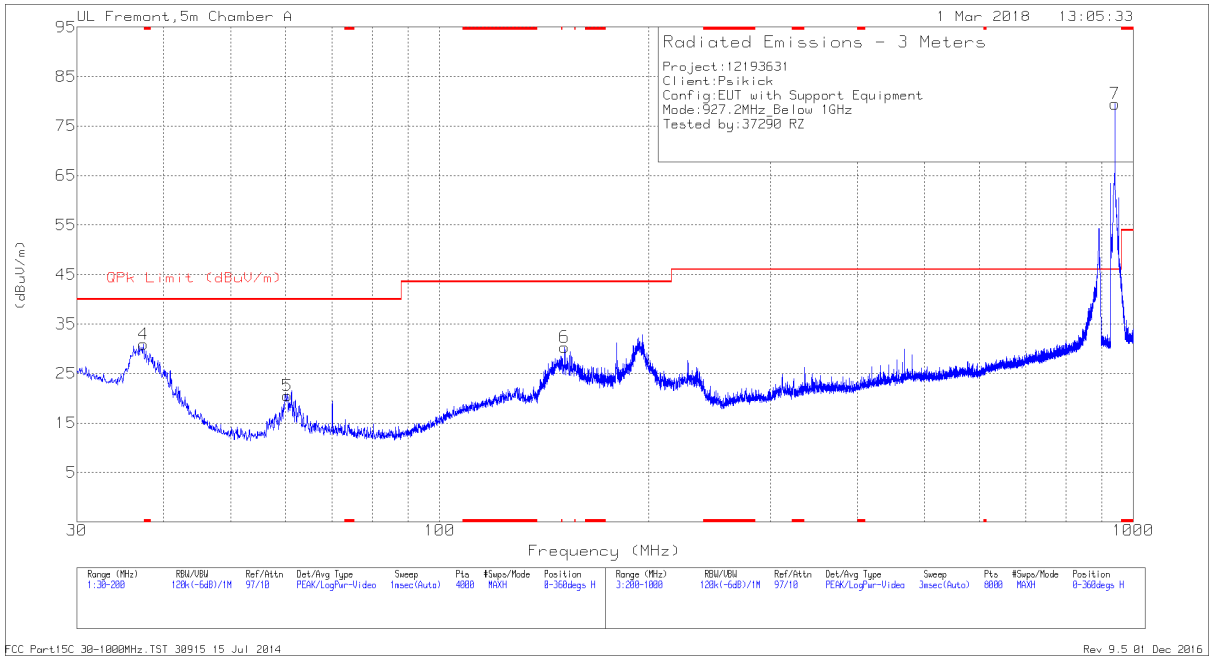
Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB/m)	Notch Filter loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	38.3322	47.54	Pk	19.2	-27.2	0.05	39.59	40	-0.41	0-360	100	V
	38.3742	42.97	Qp	19.1	-27.2	0.05	34.92	40	-5.08	334	102	V
5	62.5209	47.63	Pk	11.9	-26.8	0.16	32.89	40	-7.11	0-360	100	V
1	70.0454	33.35	Pk	12.1	-26.7	0.16	18.91	40	-21.09	0-360	101	H
2	182.7845	45.36	Pk	15.2	-25.5	0.19	35.25	43.52	-8.27	0-360	200	H
3	479.9364	34.64	Pk	21.6	-25.3	0.23	31.17	46.02	-14.85	0-360	200	H
6	480.0364	36.54	Pk	21.6	-25.3	0.23	33.07	46.02	-12.95	0-360	200	V
*7	892.49	55.18	Pk	26.4	-23.1	2.70	61.18	-	-	0-360	101	H
*8	912.6926	43.64	Pk	26.6	-23	2.64	49.88	-	-	0-360	200	V

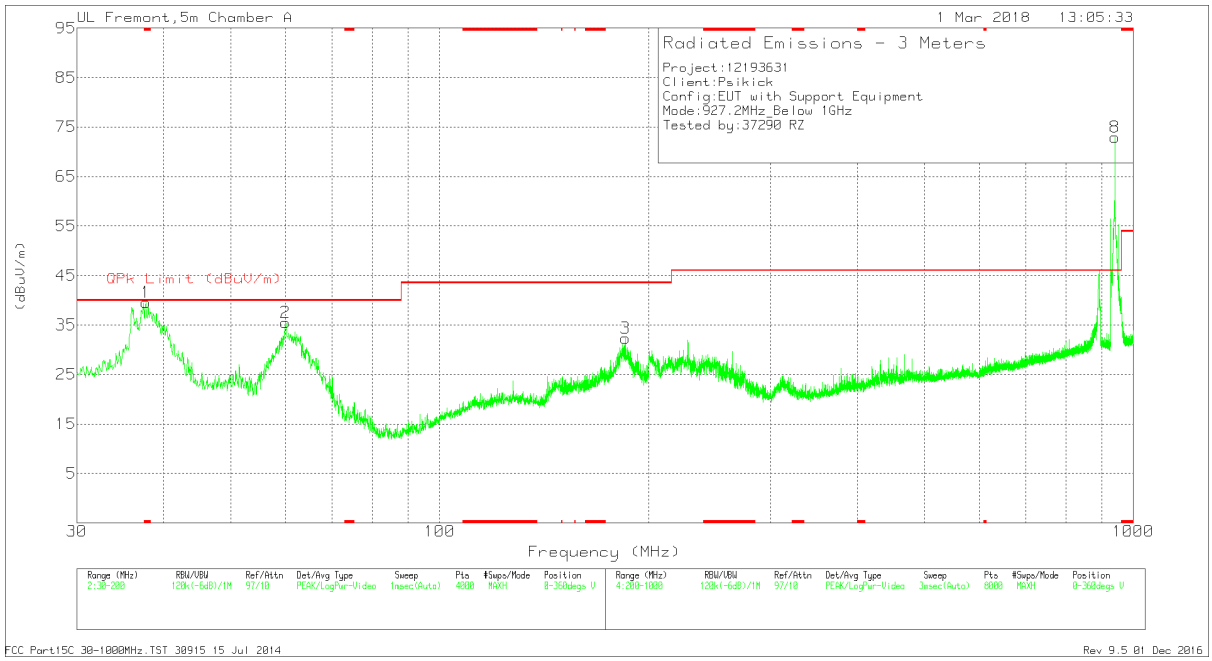
Pk - Peak detector
Qp - Quasi-Peak detector
* Harmonics of fundamental 912.72MHz

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HIGH CHANNEL RESULTS



HORIZTONAL



VERTICAL

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RADIATED EMISSIONS

Trace Markers

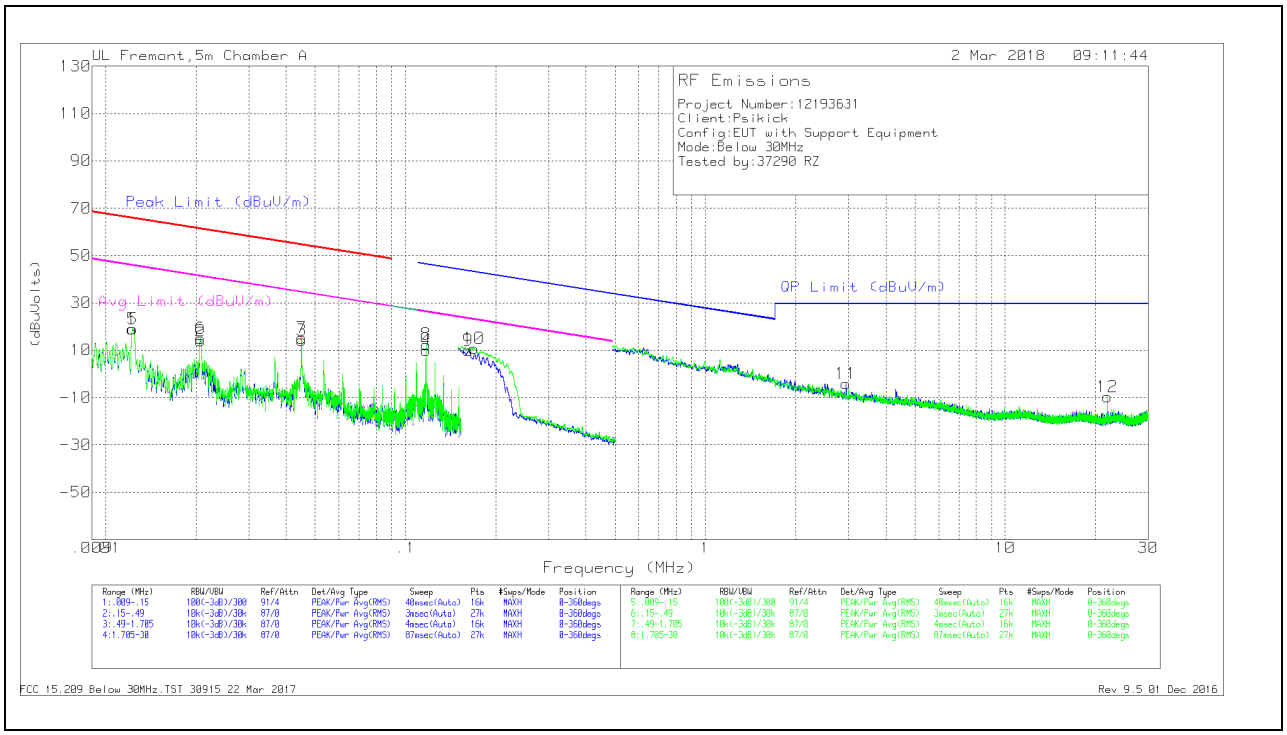
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB/m)	Notch Filter loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	37.6945	47.13	Pk	19.6	-27.2	0.05	39.58	40	-0.42	0-360	100	V
	38.4765	39.43	Qp	19.1	-27.2	0.05	31.38	40	-8.62	152	111	V
4	37.3969	38.33	Pk	19.8	-27.2	0.05	30.98	40	-9.02	0-360	300	H
2	59.9703	50.77	Pk	11.6	-26.9	0.15	35.62	40	-4.38	0-360	100	V
	59.7543	44.43	Qp	11.6	-26.9	0.15	29.28	40	-10.72	108	110	V
5	60.3529	35.88	Pk	11.6	-26.9	0.15	20.73	40	-19.27	0-360	400	H
6	151.4964	39.76	Pk	16.4	-25.8	0.21	30.57	43.52	-12.95	0-360	200	H
3	185.2502	42.72	Pk	15.1	-25.5	0.20	32.52	43.52	-11.00	0-360	100	V
*7	940.1962	75.69	Pk	26.5	-22.7	1.38	80.87	-	-	0-360	101	H
*8	940.1962	69.15	Pk	26.5	-22.7	1.38	74.33	-	-	0-360	101	V

Pk - Peak detector
Qp - Quasi-Peak detector
* Harmonics of fundamental 927.2MHz

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.3. WORST CASE BELOW 30 MHz

9.3.1. SPURIOUS EMISSIONS 9 kHz TO 30 MHz (WORST-CASE CONFIGURATION)



Below 30MHz Data

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.01228	81.08	Pk	17.7	.1	-80	18.88	65.8	-46.92	45.8	-26.92	0-360
5	.01229	81.12	Pk	17.7	.1	-80	18.92	65.79	-46.87	45.79	-26.87	0-360
2	.02073	79.74	Pk	14.2	.1	-80	14.04	61.25	-47.21	41.25	-27.21	0-360
6	.02073	80.68	Pk	14.2	.1	-80	14.98	61.25	-46.27	41.25	-26.27	0-360
7	.04499	82.74	Pk	12.3	.1	-80	15.14	54.52	-39.38	34.52	-19.38	0-360
3	.045	81.81	Pk	12.3	.1	-80	14.21	54.52	-40.31	34.52	-20.31	0-360
4	.11696	78.78	Pk	11.1	.1	-80	9.98	46.27	-36.29	26.27	-16.29	0-360
8	.11698	81.27	Pk	11.1	.1	-80	12.47	46.26	-33.79	26.26	-13.79	0-360
9	.16199	78.84	Pk	11	.1	-80	9.94	43.43	-33.49	23.43	-13.49	0-360
10	.16906	79.67	Pk	11	.1	-80	10.77	43.06	-32.29	23.06	-12.29	0-360

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 30m	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
11	2.94426	24.34	Pk	11.3	.3	-40	-4.06	29.5	-33.56	0-360
12	21.91987	18.72	Pk	10.8	.7	-40	-9.78	29.5	-39.28	0-360

Pk - Peak detector

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

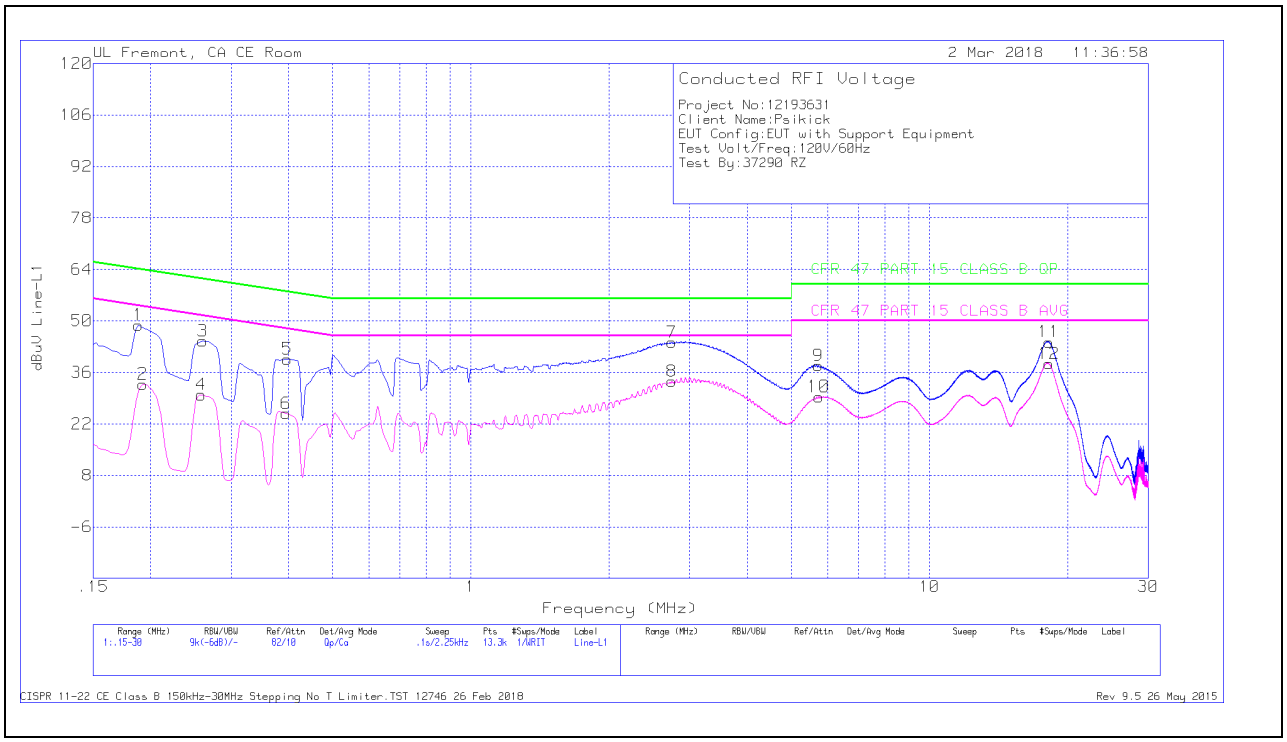
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

LINE 1 RESULTS



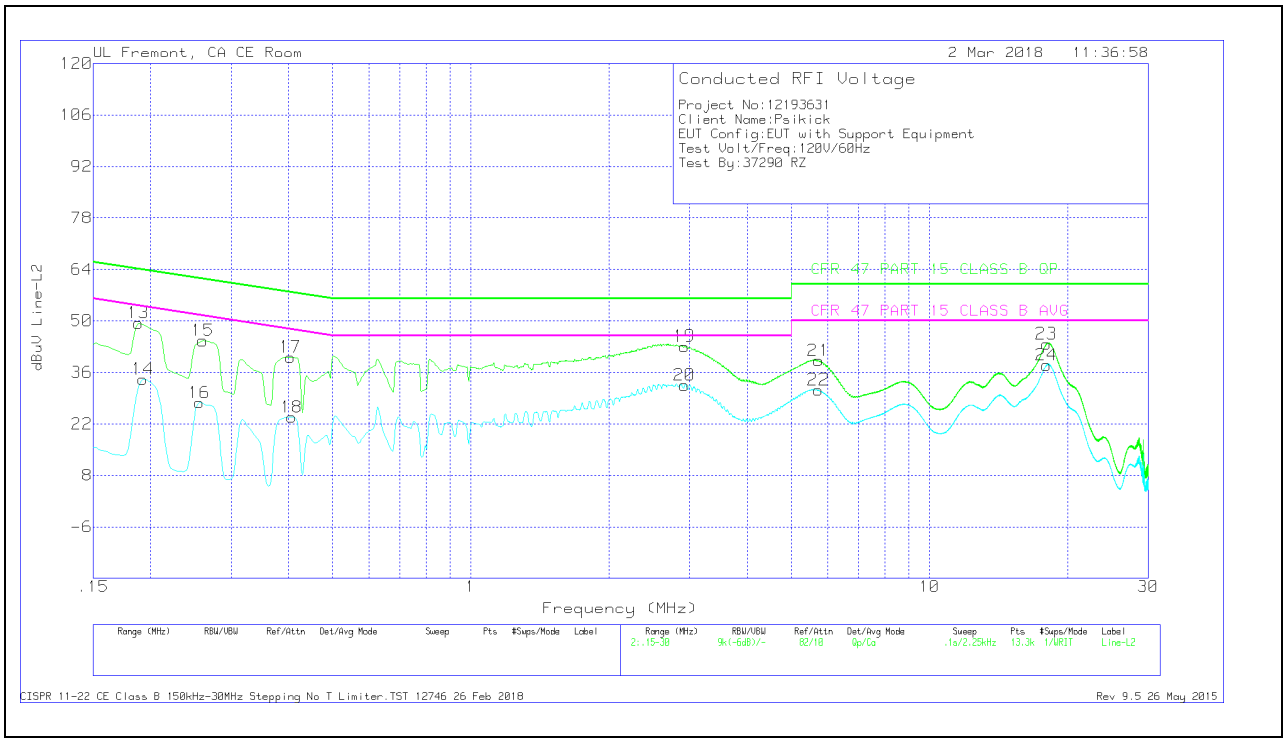
Trace Markers

Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Corrected Reading dBuV	CFR 47 PART 15 CLASS B QP	Margin (dB)	CFR 47 PART 15 CLASS B AVG	Margin (dB)
1	.18825	48.88	Qp	0	0	48.88	64.11	-15.23	-	-
2	.19275	32.78	Ca	0	0	32.78	-	-	53.92	-21.14
3	.26025	44.5	Qp	0	0	44.5	61.42	-16.92	-	-
4	.258	29.92	Ca	0	0	29.92	-	-	51.5	-21.58
5	.3975	39.64	Qp	0	0	39.64	57.91	-18.27	-	-
6	.39525	24.82	Ca	0	0	24.82	-	-	47.95	-23.13
7	2.742	44.09	Qp	0	.1	44.19	56	-11.81	-	-
8	2.742	33.45	Ca	0	.1	33.55	-	-	46	-12.45
9	5.72775	37.63	Qp	0	.2	37.83	60	-22.17	-	-
10	5.7345	29.18	Ca	0	.2	29.38	-	-	50	-20.62
11	18.2265	43.97	Qp	0	.3	44.27	60	-15.73	-	-
12	18.20513	38.07	Ca	0	.3	38.37	-	-	50	-11.63

Qp - Quasi-Peak detector
Ca - CISPR average detection

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

LINE 2 RESULTS



Trace Markers

Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Corrected Reading dBuV	CFR 47 PART 15 CLASS B QP	Margin (dB)	CFR 47 PART 15 CLASS B AVG	Margin (dB)
13	.18825	49.42	Qp	0	0	49.42	64.11	-14.69	-	-
14	.19275	34.14	Ca	0	0	34.14	-	-	53.92	-19.78
15	.26025	44.64	Qp	0	0	44.64	61.42	-16.78	-	-
16	.25575	27.76	Ca	0	0	27.76	-	-	51.57	-23.81
17	.40425	40.14	Qp	0	0	40.14	57.77	-17.63	-	-
18	.4065	23.81	Ca	0	0	23.81	-	-	47.72	-23.91
19	2.92425	42.95	Qp	0	.1	43.05	56	-12.95	-	-
20	2.92425	32.39	Ca	0	.1	32.49	-	-	46	-13.51
21	5.73	39	Qp	0	.2	39.2	60	-20.8	-	-
22	5.72888	31.02	Ca	0	.2	31.22	-	-	50	-18.78
23	17.9835	43.44	Qp	0	.3	43.74	60	-16.26	-	-
24	17.98575	37.66	Ca	0	.3	37.96	-	-	50	-12.04

Qp - Quasi-Peak detector
Ca - CISPR average detection

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.