TEST REPORT

Report Number. : 14008772-E1V2

Applicant	:	ENERGOUS CORPORATION 3590 NORTH FIRST STREET, SUITE 210, SAN JOSE, CA 95134, U.S.A.
Model	:	VN25
Brand	:	ENERGOUS
FCC ID	:	2ADNG-VN25
EUT Description	:	WIRELESS CHARGER
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
November 24, 2021

Prepared by:
UL VERIFICATION SERVICES
47173 Benicia Street
Fremont, CA 94538 U.S.A.
TEL: (510) 319-4000
FAX: (510) 661-0888

ACCREDITED
CERT #0751.05

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	11/22/2021	Initial Issue	--
V2	11/24/2021	Updated Section 6.5 to address TCB's question	Tina Chu

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: ENERGOUS CORPORATION
3590 NORTH FIRST STREET,
SUITE 210,
SAN JOSE, CA 95134, U.S.A.

EUT DESCRIPTION: WIRELESS CHARGER

MODEL: VN25

BRAND: ENERGOUS

SERIAL NUMBER: 2012 (CONDUCTED); 200A (RADIATED)

SAMPLE RECEIPT DATE: SEPTEMBER 23, 2021

DATE TESTED: SEPTEMBER 23, 2021 – OCTOBER 7, 2021

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

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

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 A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.

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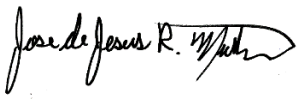
Approved & Released For
UL Verification Services Inc. By:

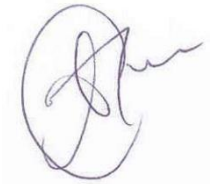
Dan Coronia
Operations Leader
Consumer Technology Division
UL Verification Services Inc.

Prepared By:



Jose Martinez
Test Engineer
Consumer Technology Division
UL Verification Services Inc.

Reviewed By:



Tina Chu
Senior Project Engineer
Consumer Technology Division
UL Verification Services Inc.

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2. TEST RESULTS SUMMARY

This report contains data provided by the customer which can impact the validity of results. UL Verification Services Inc. is only responsible for the validity of results after the integration of the data provided by the customer.

FCC Clause	Requirement	Result	Comment
See Comment	Duty Cycle	Reporting purposes only	Per ANSI C63.10, Section 11.6.
FCC §15.247 (a)(1)(i)	20dB BW/99% OBW	Complies	ANSI C63.10 Sections 6.9.2 and 6.9.3
15.247 (a)(1)	Hopping Frequency Separation	Complies	None.
15.247 (a)(1)(i)	Number of Hopping Channels	Complies	None.
15.247 (a)(1)(i)	Average Time of Occupancy	Complies	None.
15.247 (b)(2)	Output Power	Complies	None.
See Comment	Average Power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (d)	Conducted Spurious Emissions	Complies	None.
15.209, 15.205	Radiated Emissions	Complies	None.
15.207	AC Mains Conducted Emissions	Complies	None.

3. 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, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01.

4. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by A2LA, Certificate Number 0751.05, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
☐	Building 1: 47173 Benicia Street, Fremont, California, USA	US0104	2324A	208313
☐	Building 2: 47266 Benicia Street, Fremont, California, USA	US0104	22541	208313
☒	Building 4: 47658 Kato Rd, Fremont, California, USA	US0104	2324B	208313

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5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	U_{Lab}
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.78 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.84 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.29 dB

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

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a stand-alone wireless charger with BLE and MSK tag mode that is mounted on a ceiling or a wall. The wireless charger transmits power via a frequency hopping signal between 917.2MHz to 918.8MHz and a DTS MSK signal between 2402MHz and 2480MHz, and charges multiple receivers at a time.

This report documents test results of the 900MHz FHSS radio portion of the wireless charger.

6.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
917.2 to 918.8	Normal	29.99	997.70

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) gain and type, as provided by the manufacturer' are as follows:

The radio utilizes two internal PCB cross-polarized dipole antennas, with a maximum gain of 2.5 dBi as total.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 5.0.255.30

The test utility software used during testing was 5.0.255.30

6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Band edge and radiated emissions between 1GHz 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,Z1, and Z2 it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

WPT band and BLE (beaconing mode) or WPT band and 2.4G MSK tag mode transmit simultaneously, there were no new emissions found from 30MHz to 10GHz.

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6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID/ DoC**
AC/DC Switching Adapter	CUI Inc.	SWI5	-	DoC
Laptop	Dell	Latitude E7470	3F94RC2	DoC
Laptop AC/DC adapter	Dell	LA65NM130	CN-03NKWD-72438-38D-0F54-A00	DoC

I/O CABLES (RF CONDUCTED TEST)						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	AC	Un-shielded	1	AC Mains to AC/DC Adapter
2	DC	1	DC	Un-shielded	1.5	AC/DC Adapter to Laptop
3	USB	1	UART	Shielded	1.5	EUT to Laptop
4	Antenna	1	SMA	Un-shielded	0.15	To spectrum analyzer

I/O CABLES (RF RADIATED/AC POWER LINE TEST)						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	USB	1	USB Type C	Shielded	1	N/A

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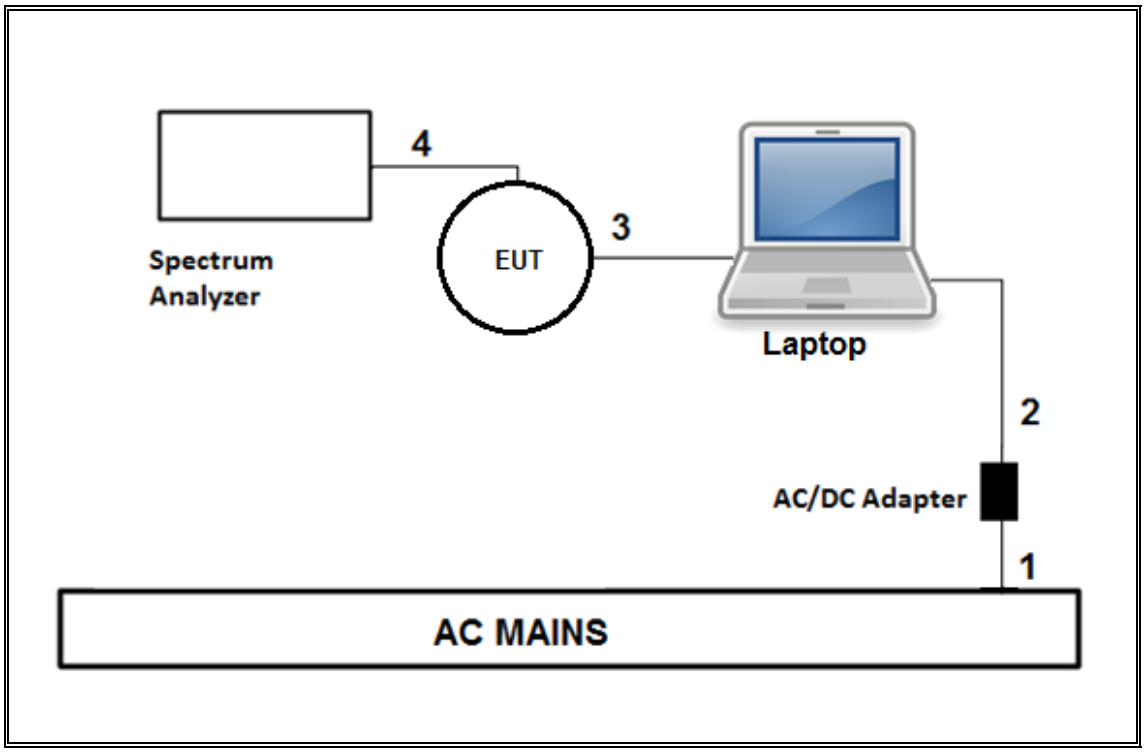
TEST SETUP

The EUT is powered by Laptop via USB cable for conducted test.

SETUP DIAGRAMS



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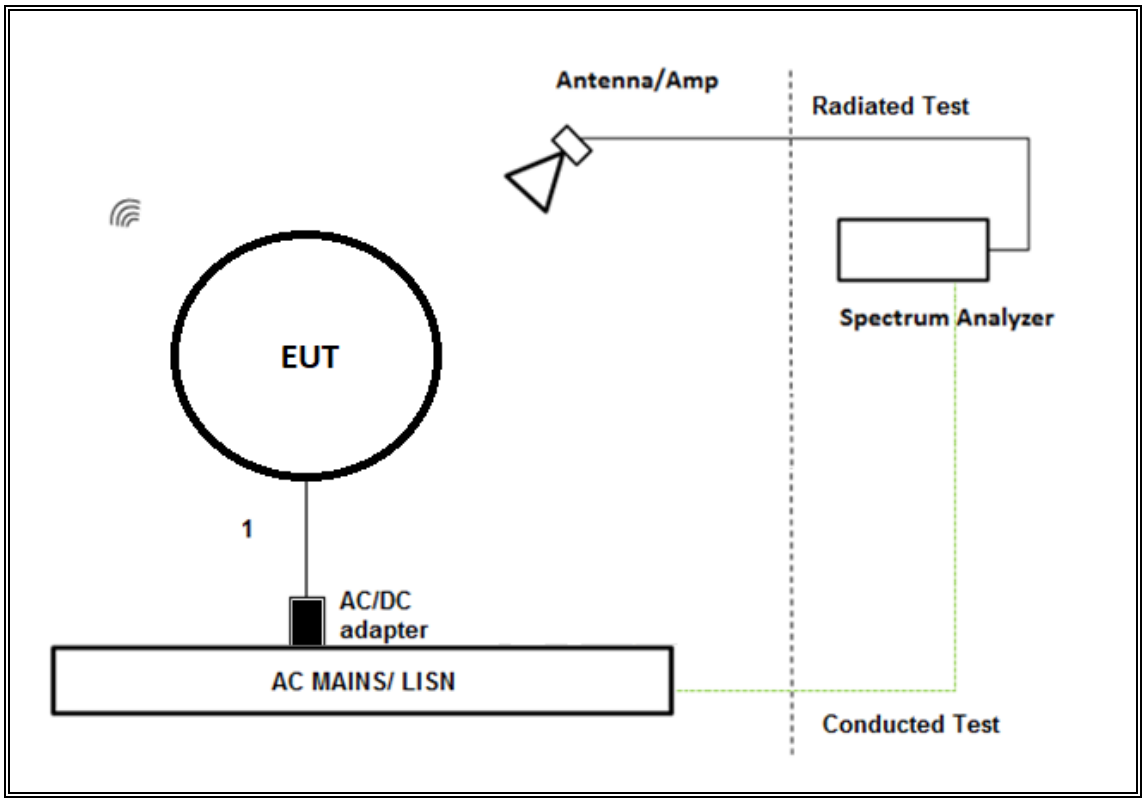
TEST SETUP- RADIATED TEST/AC POWER LINE TEST

The EUT is powered by AC/DC adapter via USB cable.

SETUP DIAGRAM



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7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset**	**Cal Due**
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO METRICS	EM-6871	SC-8015	05/24/2022
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO METRICS	EM-6872	SC-8014	05/24/2022
Antenna, Horn 1-18GHz	ETS-Lindgren (Cedar Park, Texas)	3117	80404	08/04/2022
Amplifier, 100MHz-18GHz	AMPLICAL	AMP0.1G18-47-20	PRE0197319	04/08/2022
Antenna, Broadband Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	202301	10/27/2021
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	175953	01/21/2022
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179367	02/21/2022
Filter, BRF 902 to 928MHz	MICRO-TRONICS	BRC50722	T1847	04/08/2022
Filter, HPF 1.5GHzGHz	MICRO-TRONICS	HPM50114	204786	06/24/2022
Spectrum Analyzer, PSA, 3Hz to 26.5GHz	Keysight Technologies Inc	E4440A	T198	05/13/2022
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	T1272	01/21/2022
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	T1223	06/17/2022
AC Line Conducted				
Description	**Manufacturer**	**Model**	**ID Num**	**Cal Due**
LISN	Fischer Custom Communications, Inc	FCC-LISN-50/250-25-2-01-480V	PRE0186446	01/20/2022
EMI TEST RECEIVER	Rohde & Schwarz	ESR	T1436	02/19/2022
Transient Limiter	TE	TBFL1	207996	06/01/2022
UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Rev 9.5, Jul 29, 2021, Aug 2, 2021	
Antenna Port Software	UL	UL RF	Ver 2021.08.27	
AC Line Conducted Software	UL	UL EMC	Rev 9.5, 07 Jul 2020	

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8. 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

Carrier Frequency Separation: ANSI C63.10-2013 Section 7.8.2

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 Below 30MHz: ANSI C63.10-2013 Section 6.4

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.

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9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
WPT	1.00	1.00	1.000	100.00	0.00	0.010

Test Engineer	19498 ER

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9.2. 20 dB AND 99% BANDWIDTH

LIMITS

FCC §15.247 (a) (1)(i)

(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 RBW is set to 10kHz. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

Note: Because the measured signal is CW or CW-like adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW.

RESULTS

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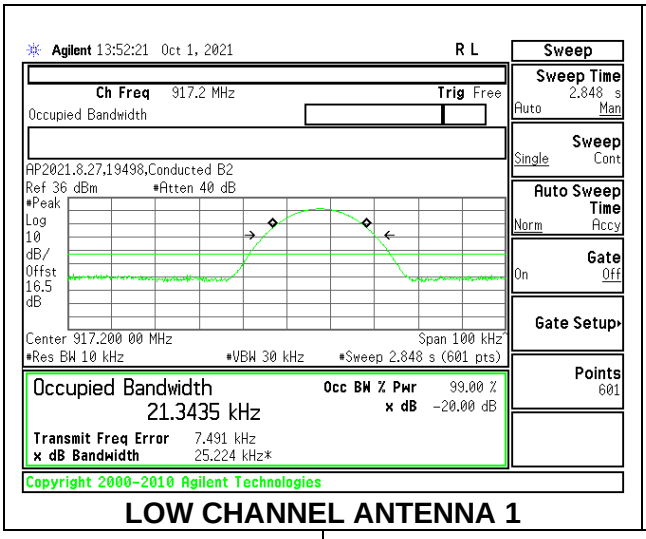
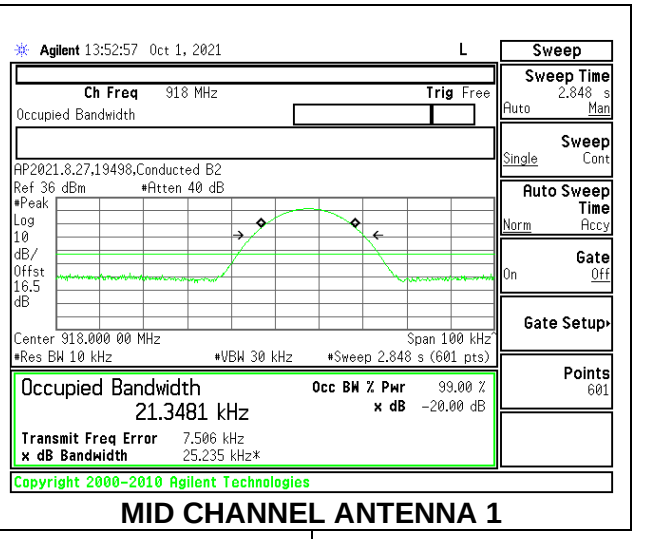
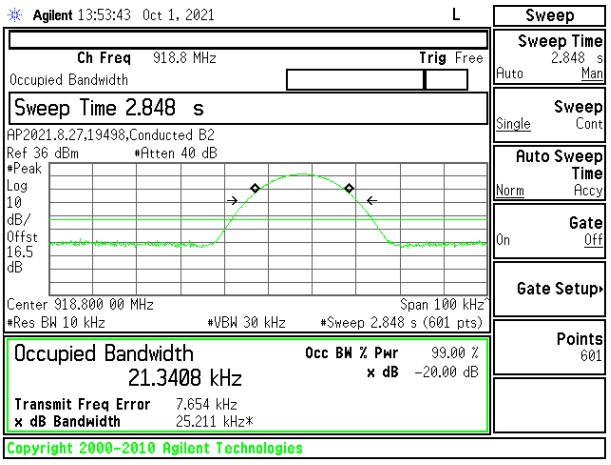
Channel	Frequency (MHz)	20dB Bandwidth Antenna 1 (kHz)	99% Bandwidth Antenna 1 (kHz)	20dB Bandwidth Antenna 2 (kHz)	99% Bandwidth Antenna 2 (kHz)
Low	917.2	25.224	21.3435	25.2255	21.3442
Mid	918	25.235	21.3481	25.219	21.3403
High	918.8	25.211	21.3408	25.229	21.3403



LOW CHANNEL ANTENNA 1



MID CHANNEL ANTENNA 1



HIGH CHANNEL ANTENNA 1

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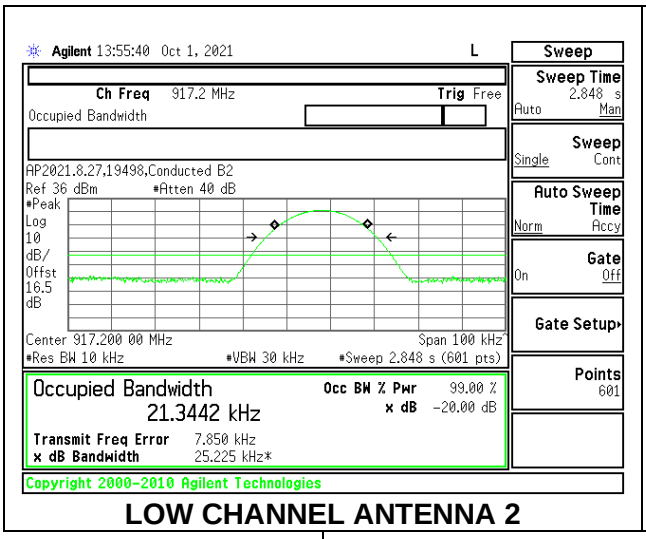
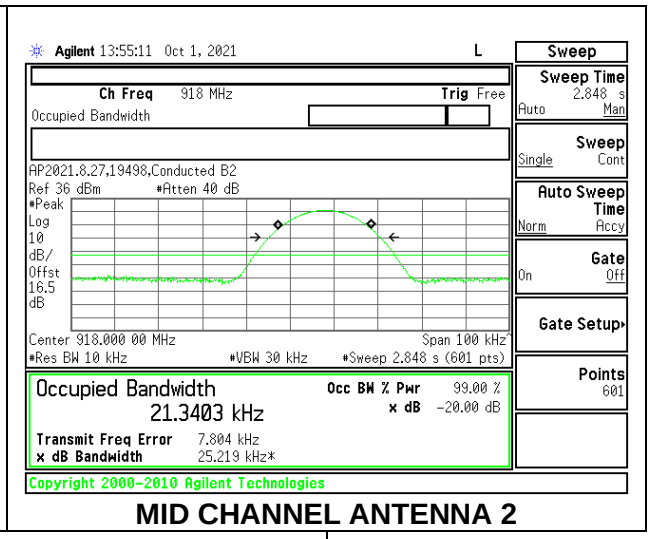
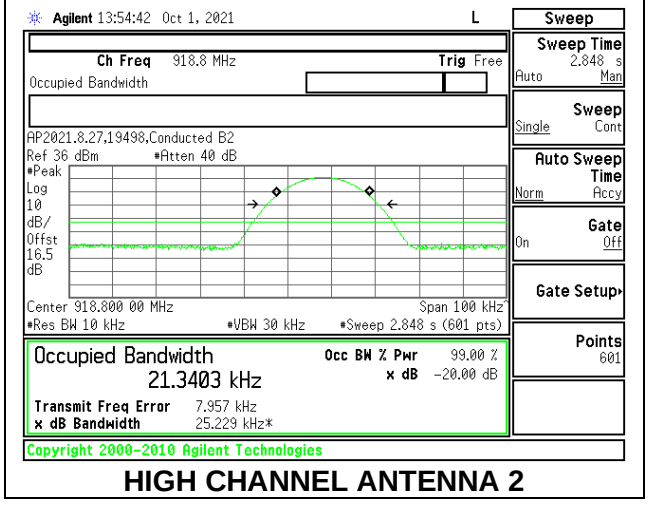


LOW CHANNEL ANTENNA 2



MID CHANNEL ANTENNA 2



HIGH CHANNEL ANTENNA 2

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9.3. HOPPING FREQUENCY SEPARATION

LIMITS

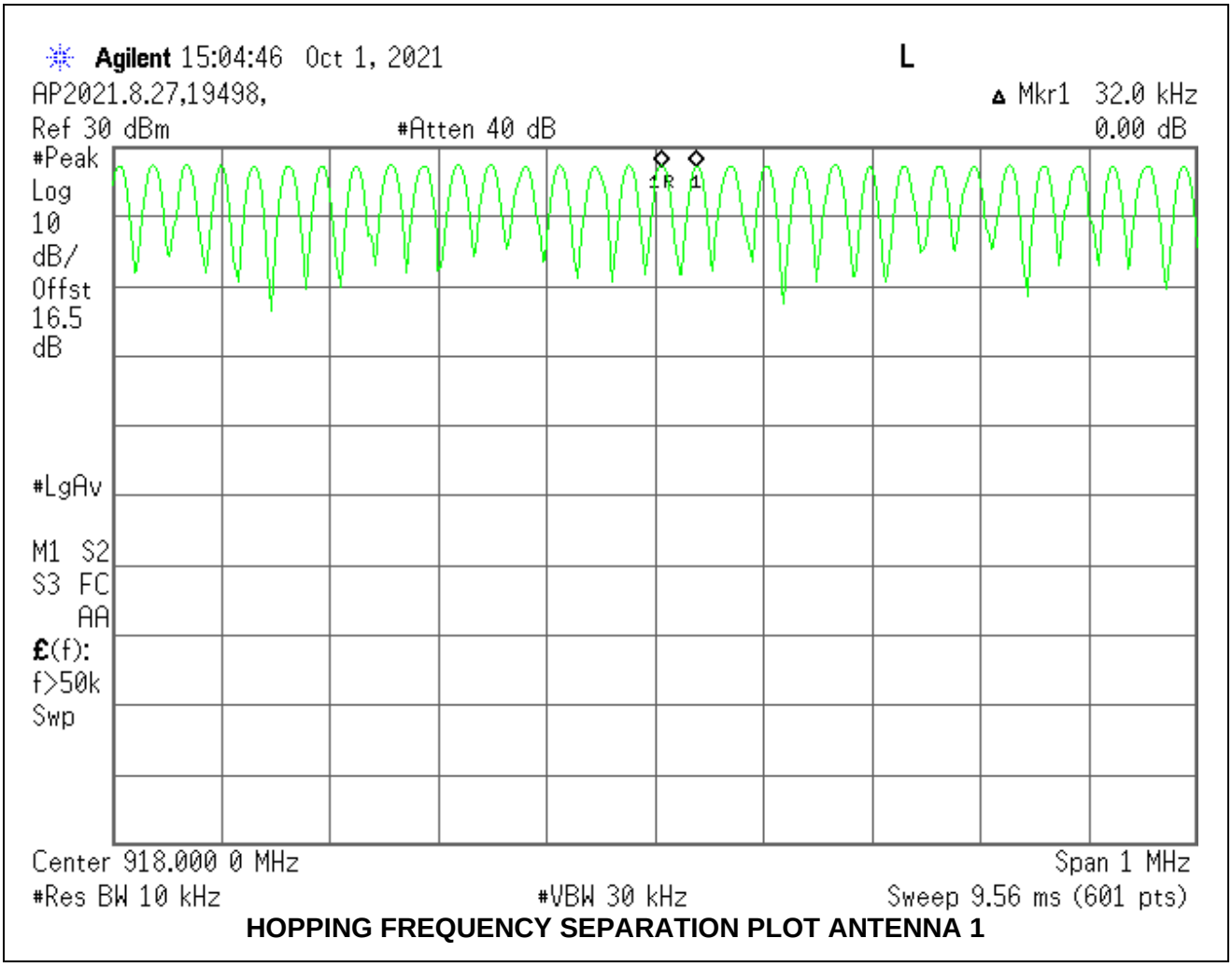
FCC §15.247 (a) (1)

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 10 kHz and the VBW is set to 30 kHz. The sweep time is coupled.

RESULTS



HOPPING FREQUENCY SEPARATION PLOT ANTENNA 1

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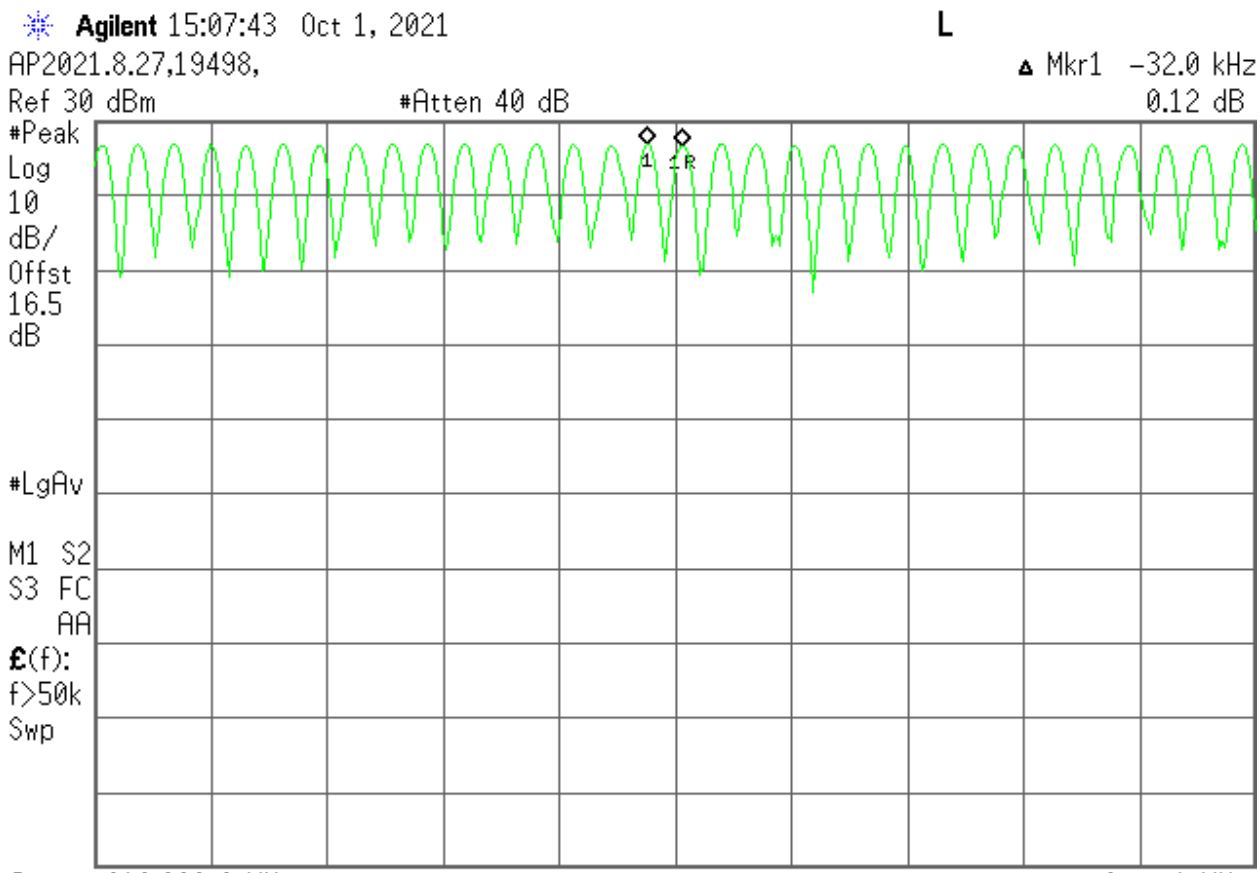

HOPPING FREQUENCY SEPARATION PLOT ANTENNA 2

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9.4. NUMBER OF HOPPING CHANNELS

LIMITS

FCC §15.247 (a) (1) (i)

(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 span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW (set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.)is set to 10 kHz and the VBW is set to > RBW. The analyzer is set to Max Hold.

RESULTS

Normal Mode: 50 Channels Observed

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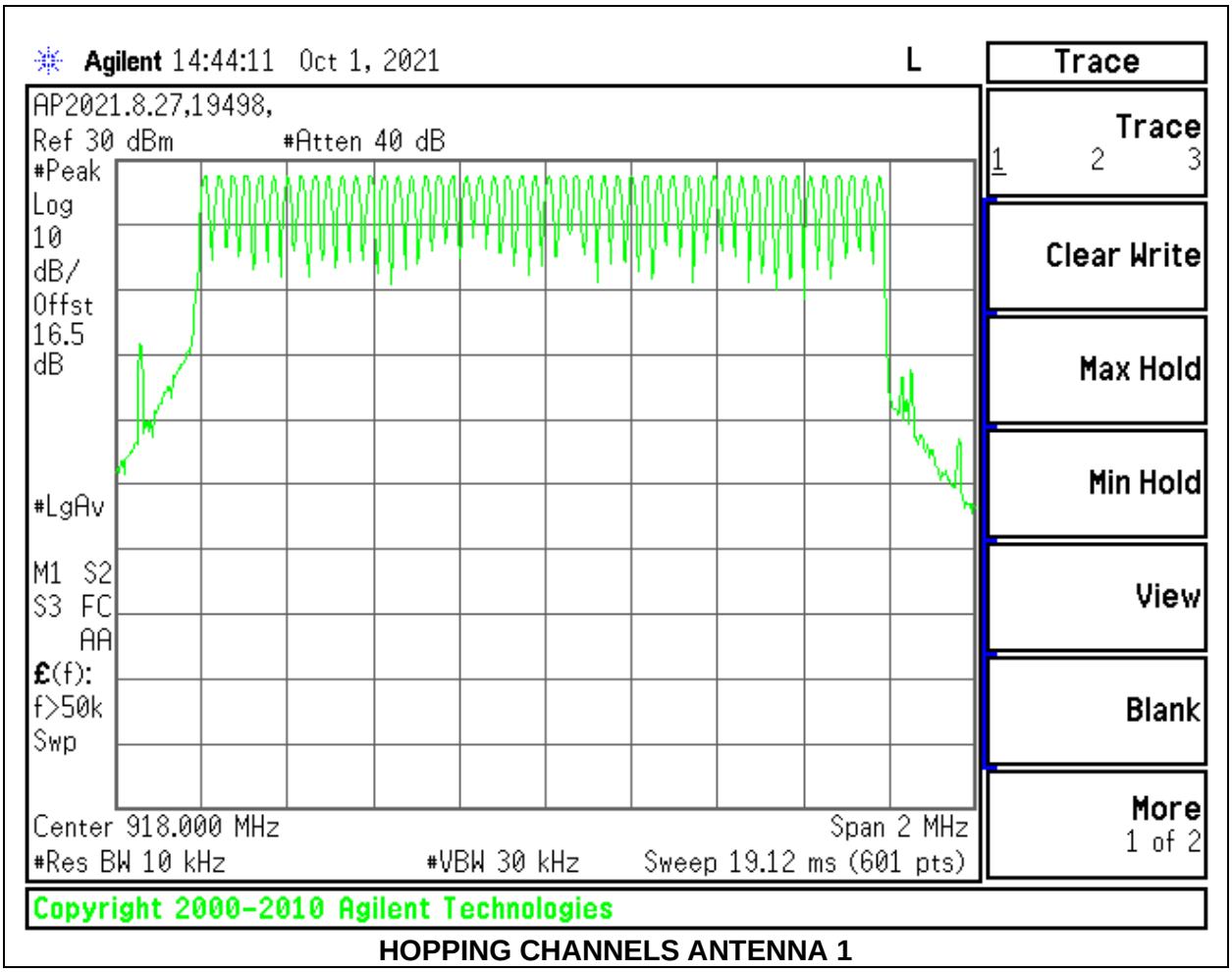

HOPPING CHANNELS ANTENNA 1

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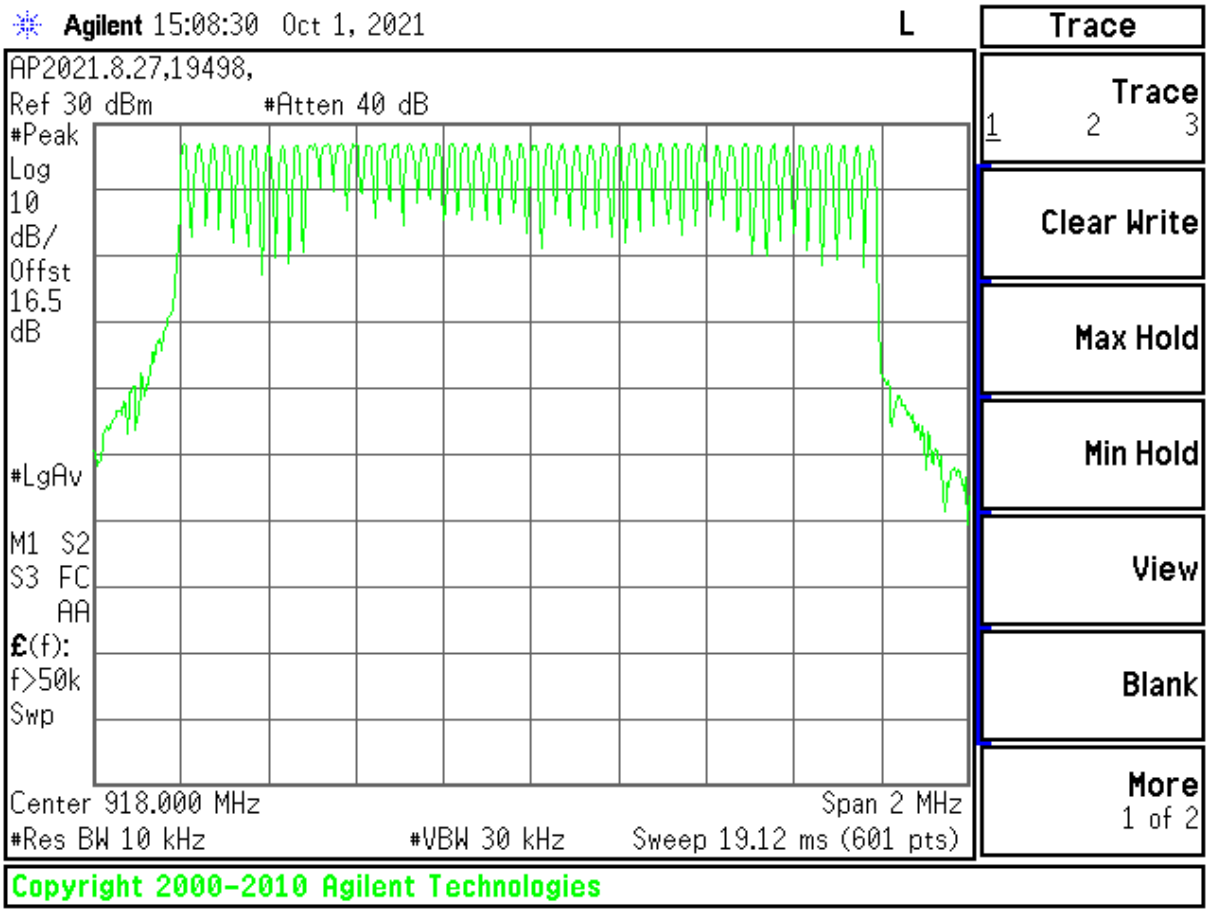

HOPPING CHANNELS ANTENNA 2

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9.5. AVERAGE TIME OF OCCUPANCY

LIMITS

FCC §15.247 (a) (1) (i)

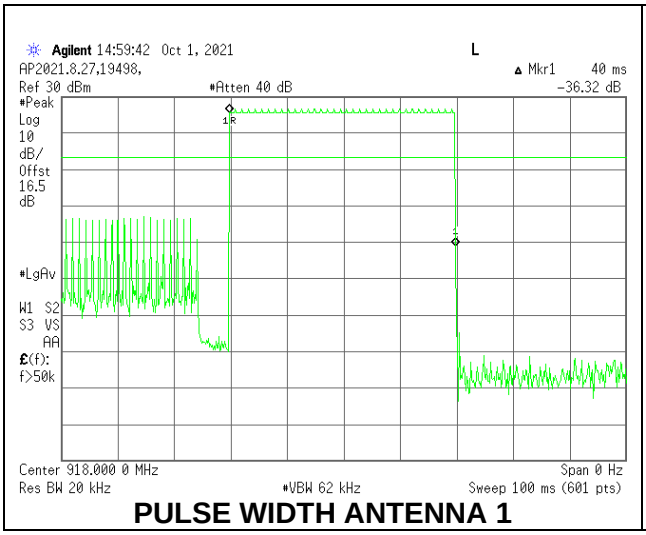
(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period;

TEST PROCEDURE

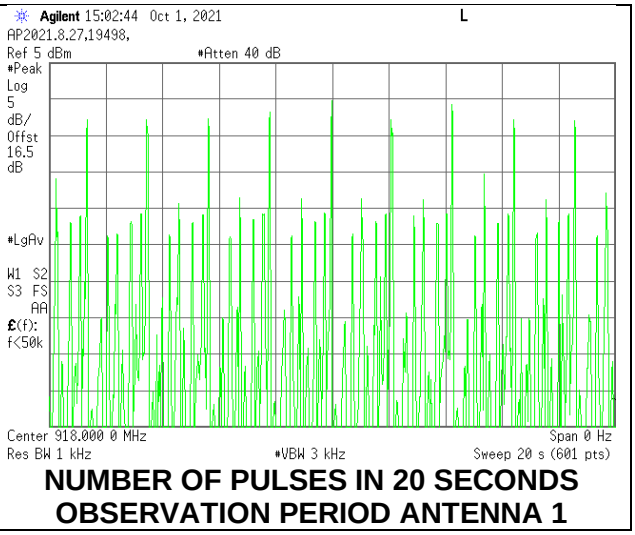
The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 5 second scan, to enable resolution of each occurrence.

RESULTS

Pulse Width (msec)	Number of Pulses in 20 seconds	Average Time of Occupancy in 20 seconds (sec) Antenna 1	Limit (sec)	Margin (sec)
40	9	0.3600	0.4	-0.0400



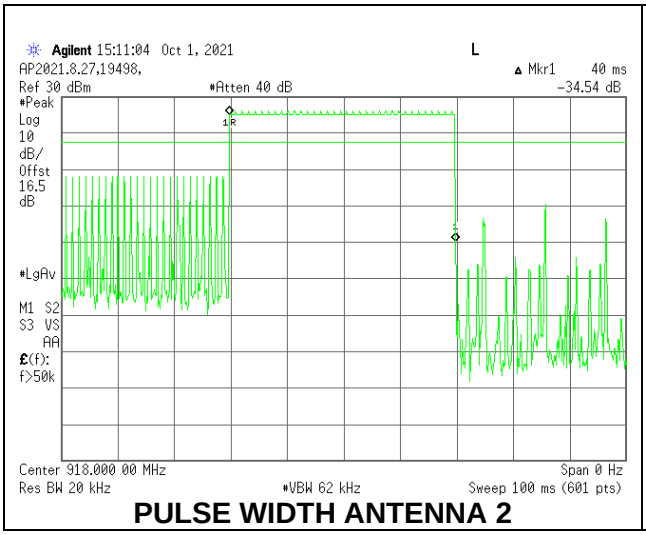
PULSE WIDTH ANTENNA 1



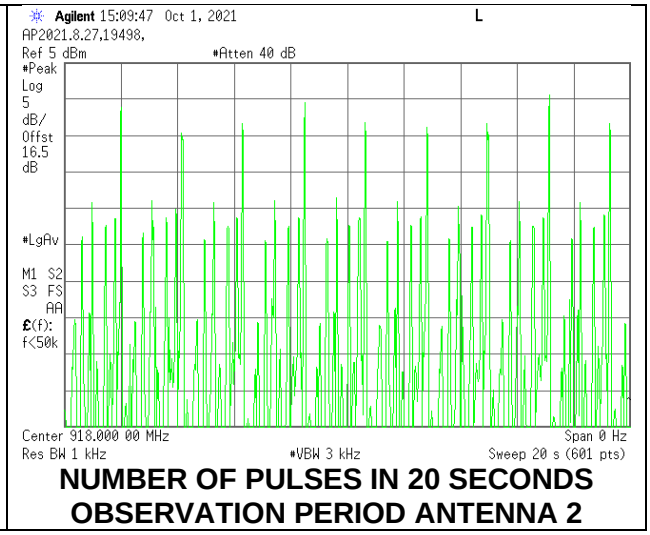
NUMBER OF PULSES IN 20 SECONDS OBSERVATION PERIOD ANTENNA 1

UL VERIFICATION SERVICES
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

Pulse Width (msec)	Number of Pulses in 20 seconds	Average Time of Occupancy in 20 seconds (sec) Antenna 2	Limit (sec)	Margin (sec)
40	9	0.3600	0.4	-0.0400



PULSE WIDTH ANTENNA 2



NUMBER OF PULSES IN 20 SECONDS OBSERVATION PERIOD ANTENNA 2

UL VERIFICATION SERVICES
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9.6. OUTPUT POWER

LIMITS

15.247 (b) (2)

(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 power meter.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband peak power sensor. Peak output power was read directly from power meter.

RESULTS

Tested By:	20756 CW
Date:	10/1/2021

Channel	Frequency (MHz)	Output Power Antenna 1 (dBm)	Output Power Antenna 2 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	917.2	27.26	26.65	29.98	30	-0.02
Middle	918	27.27	26.67	29.99	30	-0.01
High	918.8	27.27	26.67	29.99	30	-0.01

UL VERIFICATION SERVICES
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9.7. AVERAGE POWER

LIMITS

None; for reporting purposes only

TEST PROCEDURE

The transmitter output is connected to a power meter.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband average power sensor. Gated average output power was read directly from power meter.

RESULTS

Tested By:	20756 CW
Date:	10/1/2021

Channel	Frequency (MHz)	Average Power Antenna 1 (dBm)	Average Power Antenna 2 (dBm)	Total Power (dBm)
Low	917.2	26.96	26.5	29.75
Middle	918	26.97	26.38	29.70
High	918.8	26.7	26.39	29.56

UL VERIFICATION SERVICES
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9.8. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

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
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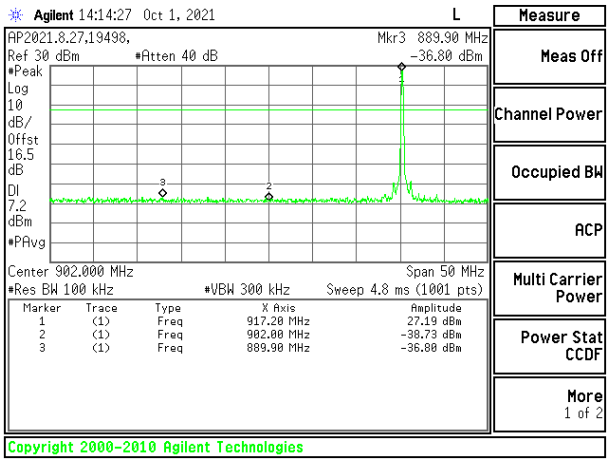
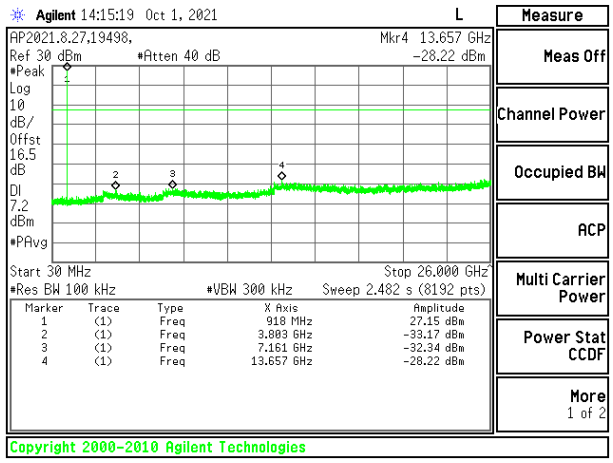
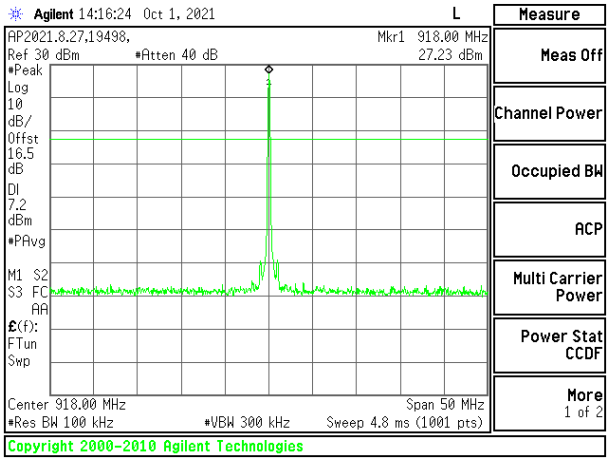
SPURIOUS EMISSIONS, NON-HOPPING



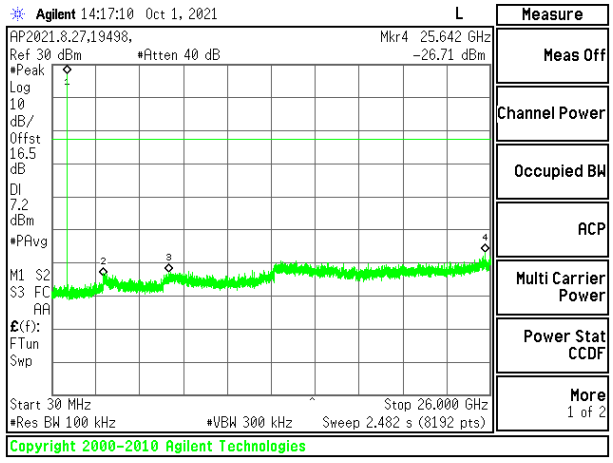
LOW CHANNEL BANDEDGE ANTENNA 1



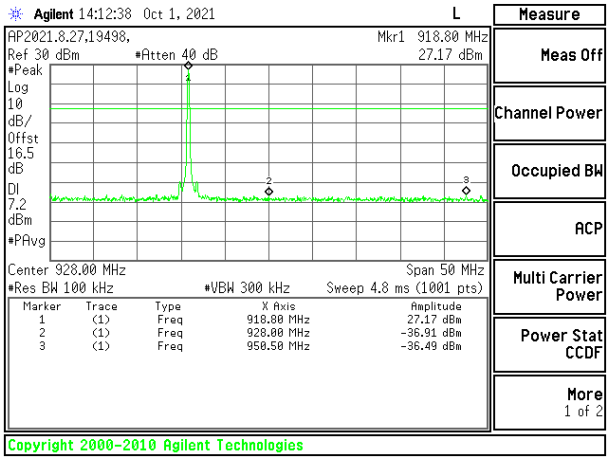
OUT-OF-BAND LOW CHANNEL ANTENNA 1



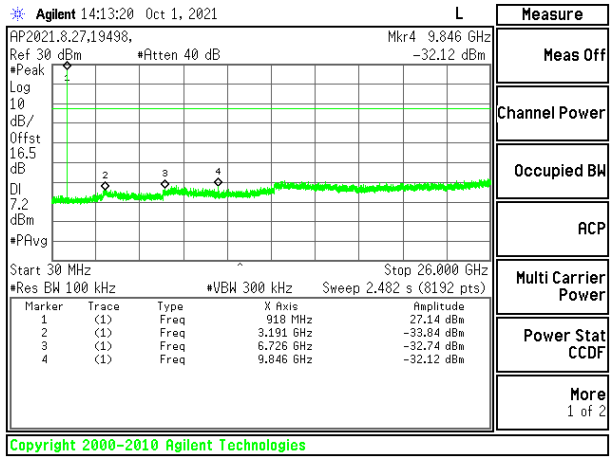
IN-BAND REFERENCE LEVEL ANTENNA 1



OUT-OF-BAND MID CHANNEL ANTENNA 1



HIGH CHANNEL BANDEDGE ANTENNA 1



OUT-OF-BAND HIGH CHANNEL ANTENNA 1

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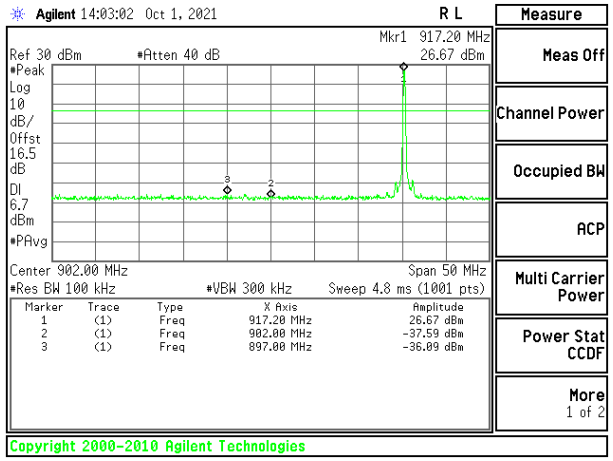
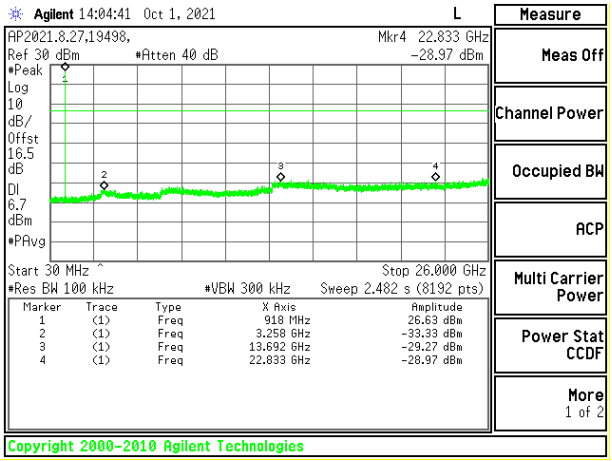
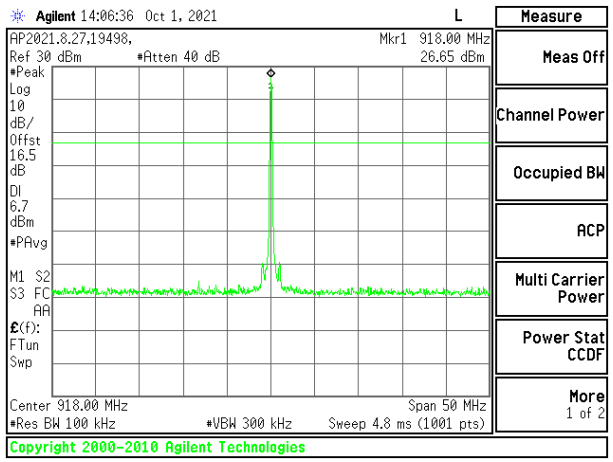


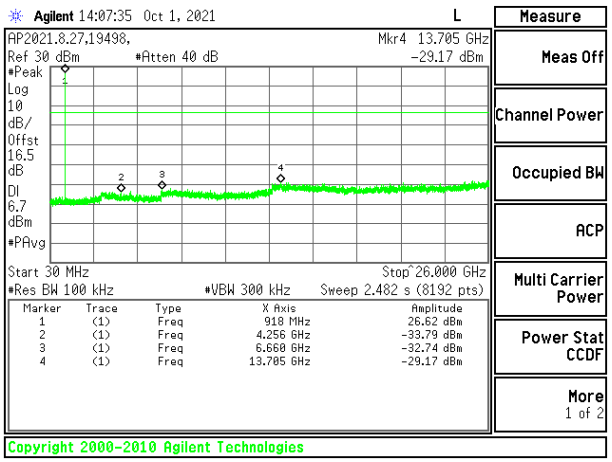
LOW CHANNEL BANDEDGE ANTENNA 2



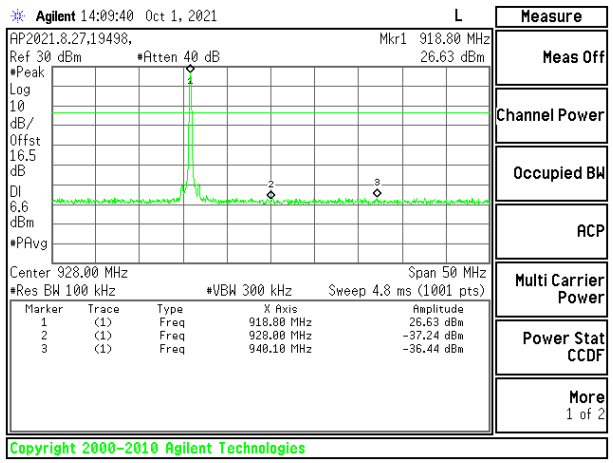
OUT-OF-BAND LOW CHANNEL ANTENNA 2



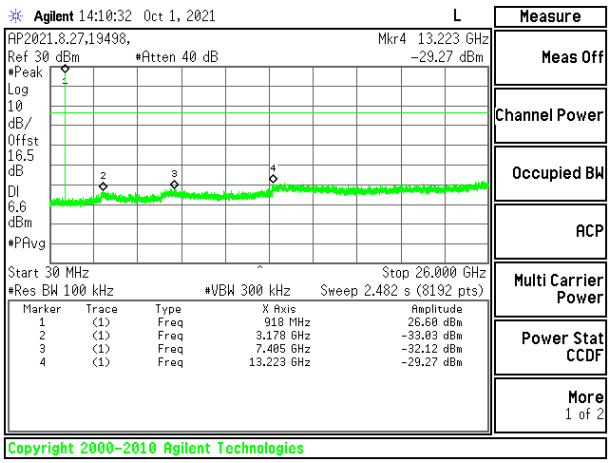
IN-BAND REFERENCE LEVEL ANTENNA 2



OUT-OF-BAND MID CHANNEL ANTENNA 2



HIGH CHANNEL BANDEDGE ANTENNA 2



OUT-OF-BAND HIGH CHANNEL ANTENNA 2

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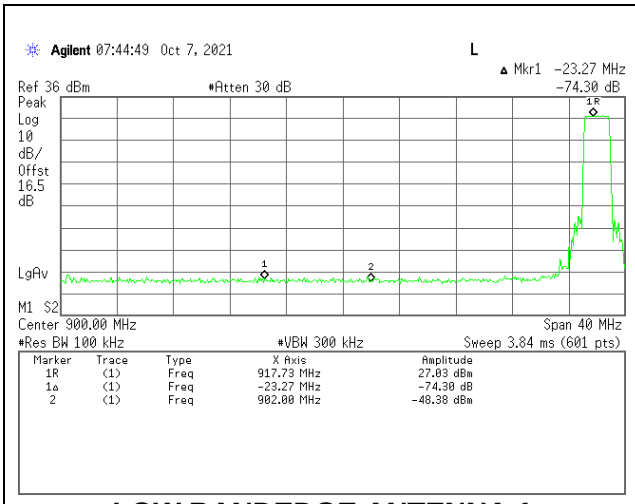
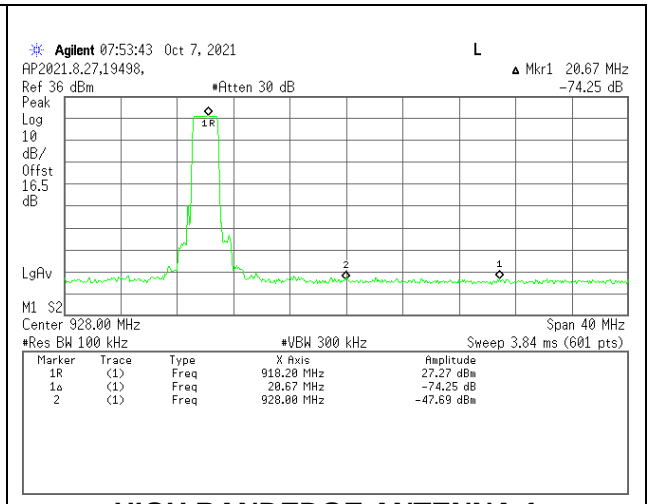
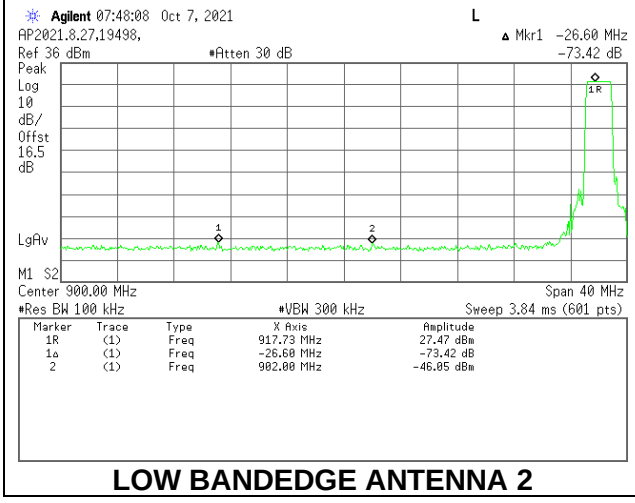
SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



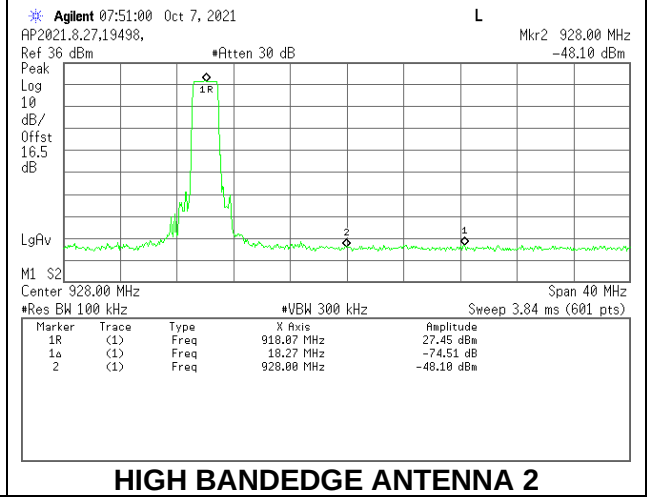
LOW BANDEDGE ANTENNA 1



HIGH BANDEDGE ANTENNA 1



LOW BANDEDGE ANTENNA 2



HIGH BANDEDGE ANTENNA 2

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10. 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 in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. Peak detection is used unless otherwise noted as quasi-peak or average (9-90kHz and 110-490kHz).

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 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector 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.

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For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

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.

KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

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

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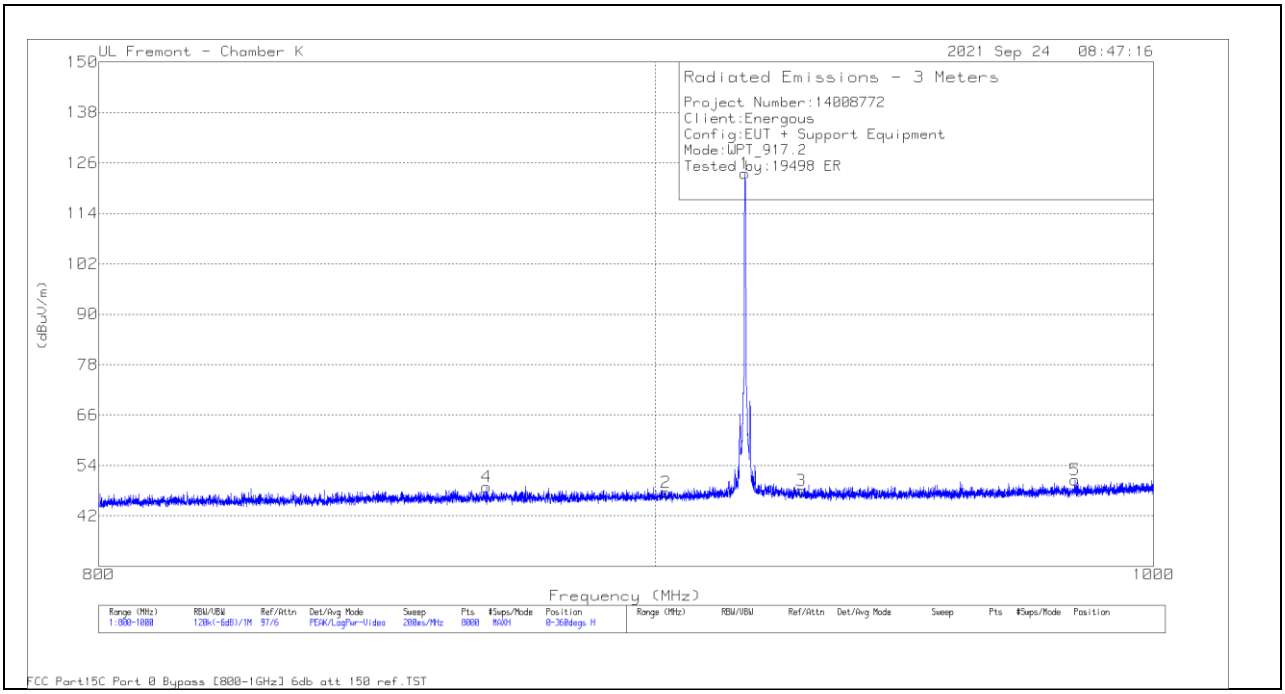
10.1. TRANSMITTER BELOW 1 GHz

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

HORIZONTAL RESULT



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 202301 (dB/m)	Bypass (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	917.2107	92.7	Qp	28.2	4.1	125	-	-	303	146	H
2	901.9872	15.69	Pk	27.9	4	47.59	-	-	0-360	199	H
3	928.1904	15.57	Pk	28.4	4.1	48.07	-	-	0-360	99	H
4	868.4743	1.35	Qp	27.7	3.9	32.95	-	-	34	119	H
5	* 990.0033	1.79	Qp	29	4.2	34.99	54	-19.01	190	198	H

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

M4 is not under restricted bands. With 20dBc from M1 125 dBuV= 105 dBuV as limit, M4 is passing.

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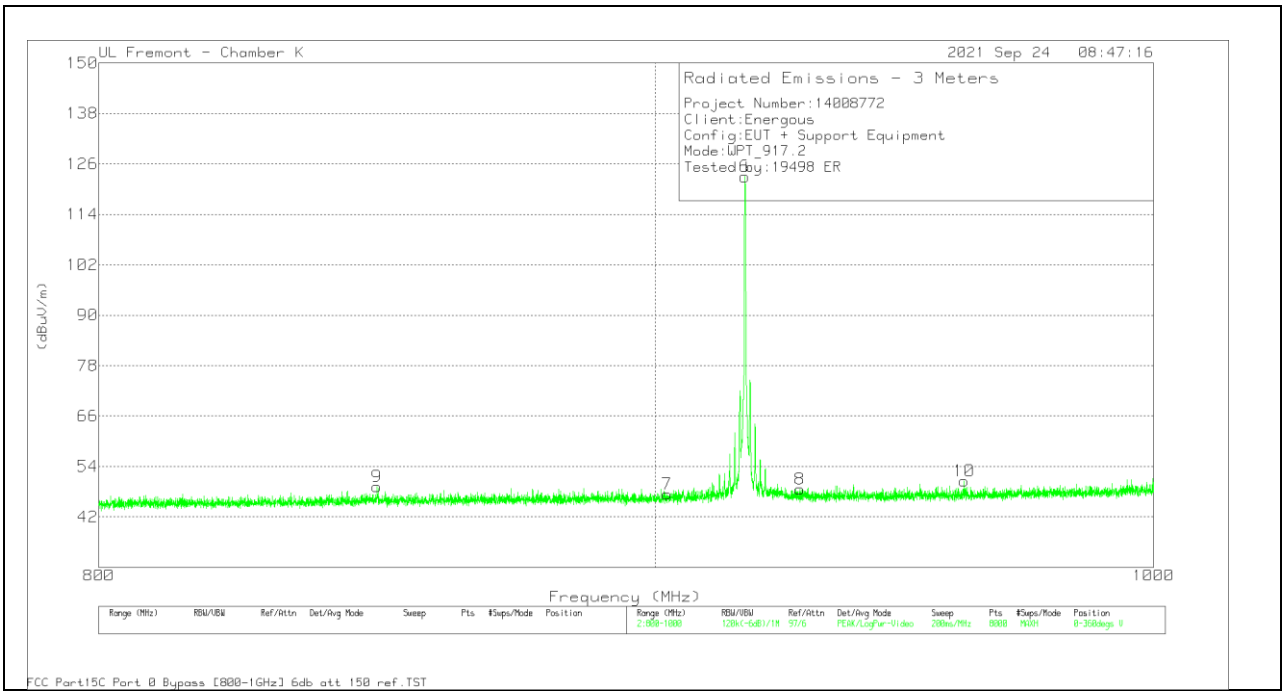
VERTICAL RESULT



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 202301 (dB/m)	Bypass (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
6	917.2107	91.19	Qp	28.2	4.1	123.49	-	-	304	107	V
7	902.1873	15.55	Pk	27.9	4	47.45	-	-	0-360	100	V
8	927.9654	16.12	Pk	28.4	4.1	48.62	-	-	0-360	199	V
9	849.9498	1.5	Qp	27.7	3.9	33.1	-	-	267	322	V
10	* 960.5862	1.22	Qp	28.7	4.1	34.02	54	-19.98	238	332	V

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

M9 is not under restricted bands. With 20dBc from M6 125 dBuV= 105 dBuV as limit, M9 is passing.

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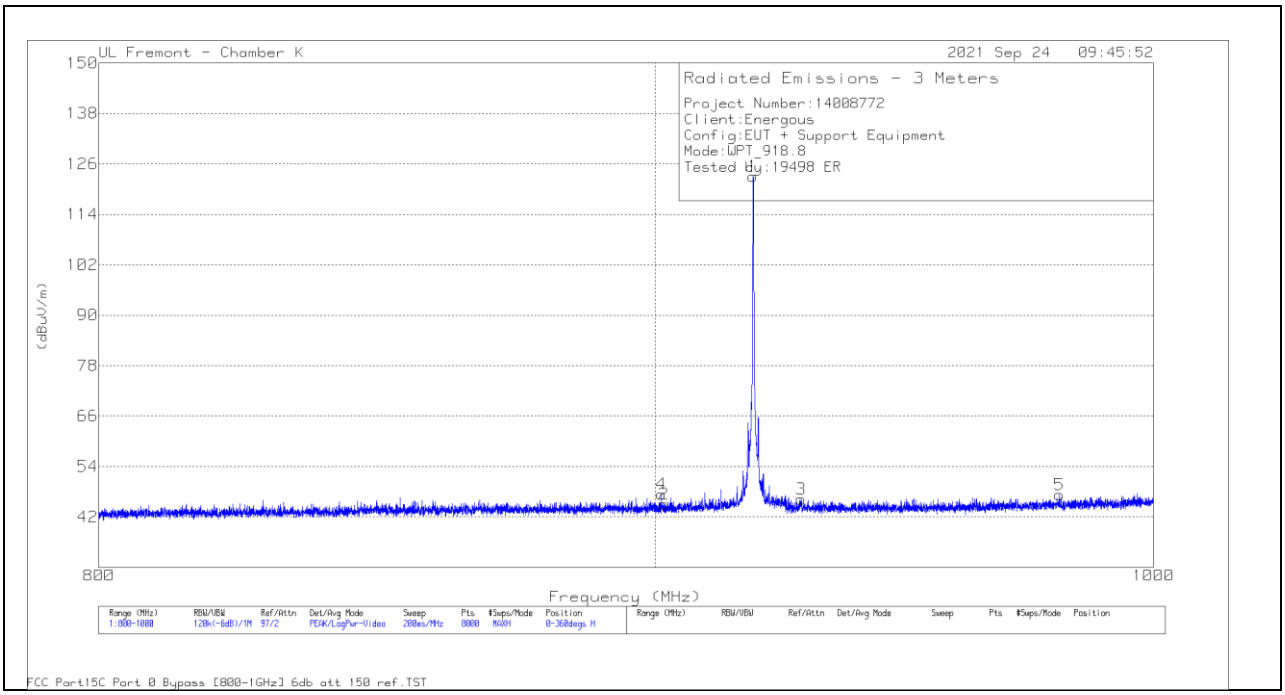
-20 dBc BANDEDGE WITHOUT NOTCH FILTER AND PRE-AMPLIFIER (HIGH CHANNEL)

HORIZONTAL RESULT



Radiated Emissions

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 202301 (dB/m)	Bypass (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	918.8105	92.27	Qp	28.3	4	124.57	-		305	143	H
2	901.6372	13.2	Pk	27.9	4	45.1	-		0-360	98	H
3	928.1654	13.78	Pk	28.4	4.1	46.28	-		0-360	98	H
4	901.1371	15.4	Pk	28	4	47.4	-		0-360	394	H
5	* 980.3216	14.12	Pk	28.9	4.2	47.22	54	-6.78	0-360	394	H

Pk – Peak detector
Qp - Quasi-Peak detector

M4 is not under restricted bands. With 20dBc from M1 124.57 dBuV= 104.57 dBuV as limit, M4 is passing.

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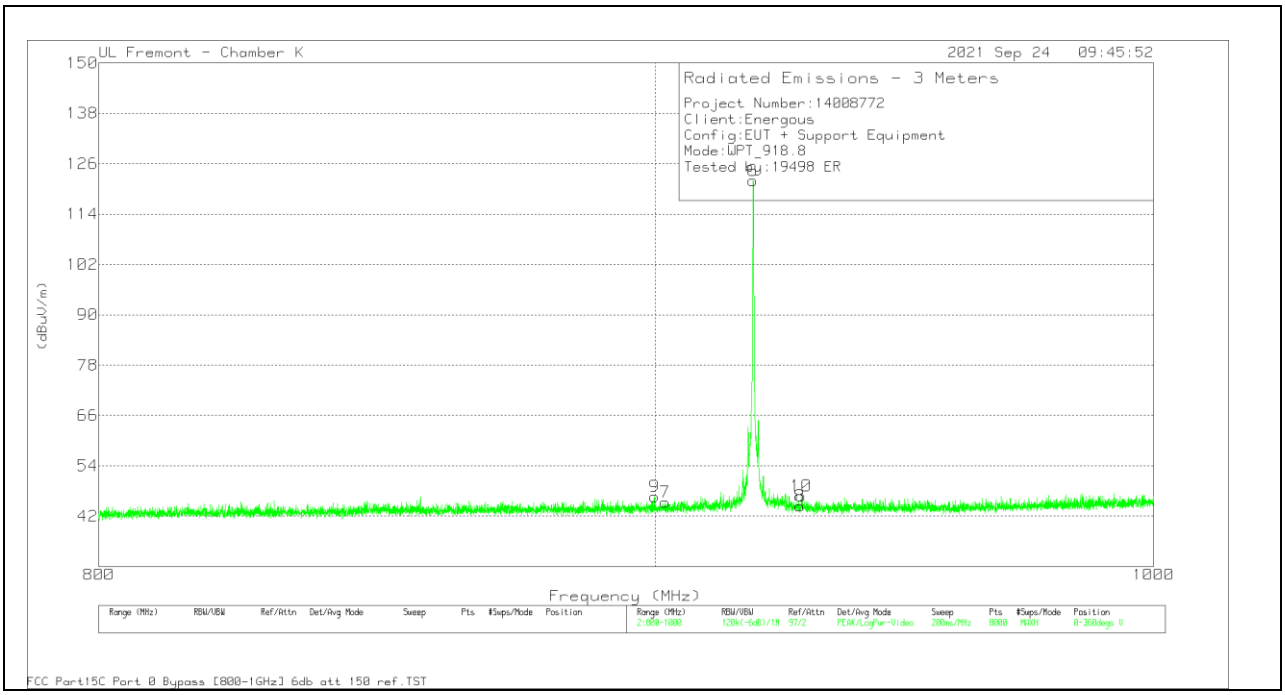
VERTICAL RESULT



Radiated Emissions

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 202301 (dB/m)	Bypass (dB)	Corrected Reading (dBuV/m)	Azimuth (Degs)	Height (cm)	Polarity
6	918.8095	90.92	Qp	28.3	4	123.22	300	107	V
7	901.9122	13.47	Pk	27.9	4	45.37	0-360	199	V
8	927.9654	11.93	Pk	28.4	4.1	44.43	0-360	98	V
9	899.787	14.81	Pk	28	3.9	46.71	0-360	199	V
10	928.1904	14.27	Pk	28.4	4.1	46.77	0-360	98	V

Pk – Peak detector
Qp - Quasi-Peak detector

M9 and M10 are not under restricted bands. With 20dBc from M6 124.57 dBuV= 104.57 dBuV as limit, all of the M9 and M10 are passing.

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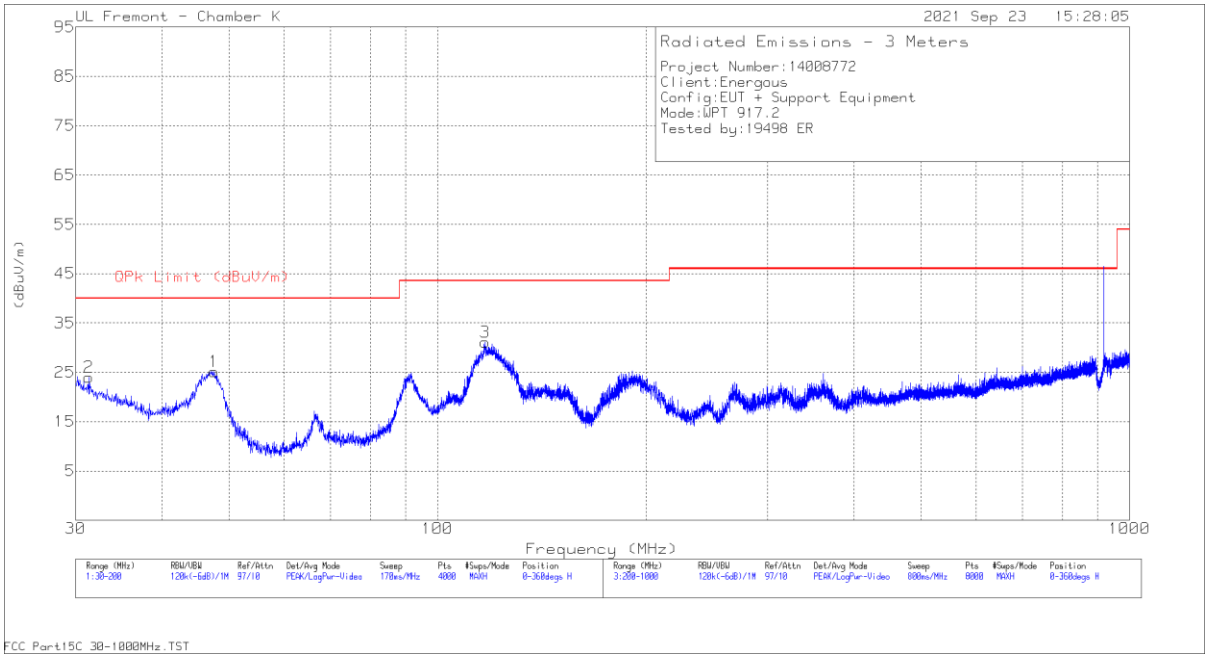
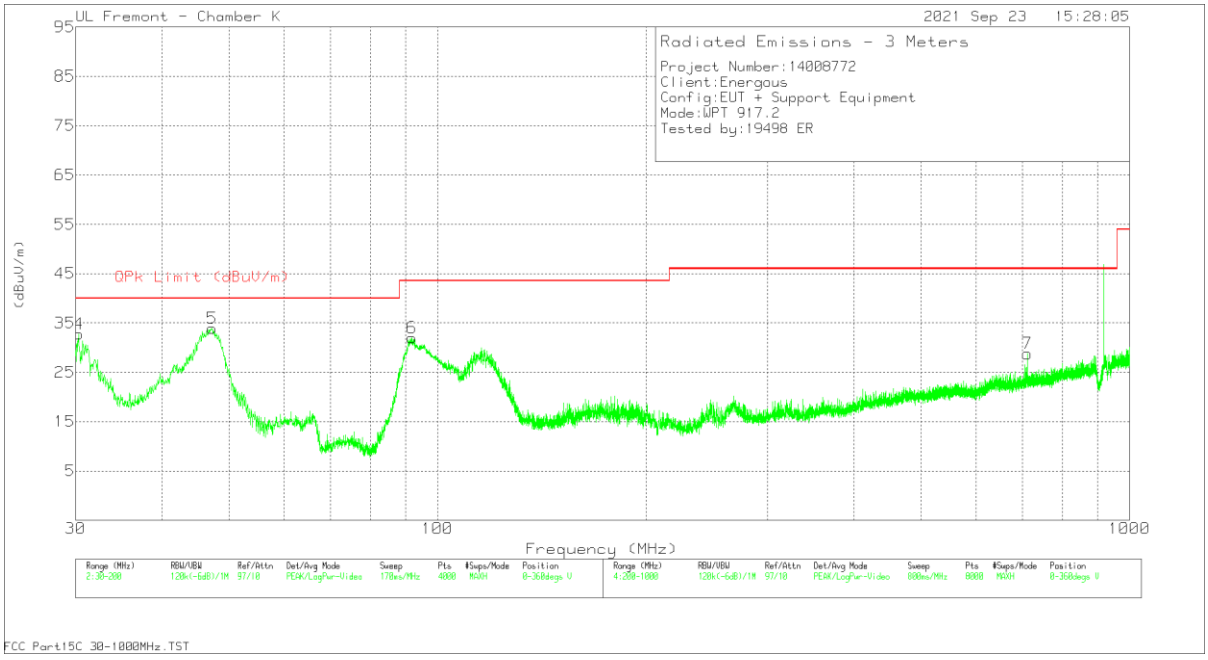
HARMONICS AND SPURIOUS EMISSIONS (WITH NOTCH FILTER)

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

UL VERIFICATION SERVICES
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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 202301 (dB/m)	Amp/Cbl (dB)	T1847 BRF (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	47.267	39.23	Qp	14.8	-31.4	0.05	22.68	40	-17.32	8	383	H
2	35.7727	22.35	Qp	22.7	-31.5	0.04	13.59	40	-26.41	180	311	H
3	* 118.5116	38.64	Qp	19.5	-30.8	0.12	27.46	43.52	-16.06	122	224	H
4	30.3943	32.54	Qp	26.6	-31.6	0.04	27.58	40	-12.42	209	101	V
5	47.2595	48.13	Qp	14.8	-31.4	0.05	31.58	40	-8.42	5	111	V
6	91.7685	46.6	Qp	14	-31	0.11	29.71	43.52	-13.81	193	112	V
7	712.1666	31.17	Pk	26.2	-28.6	0.25	29.02	46.02	-17.00	0-360	101	V

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

UL VERIFICATION SERVICES
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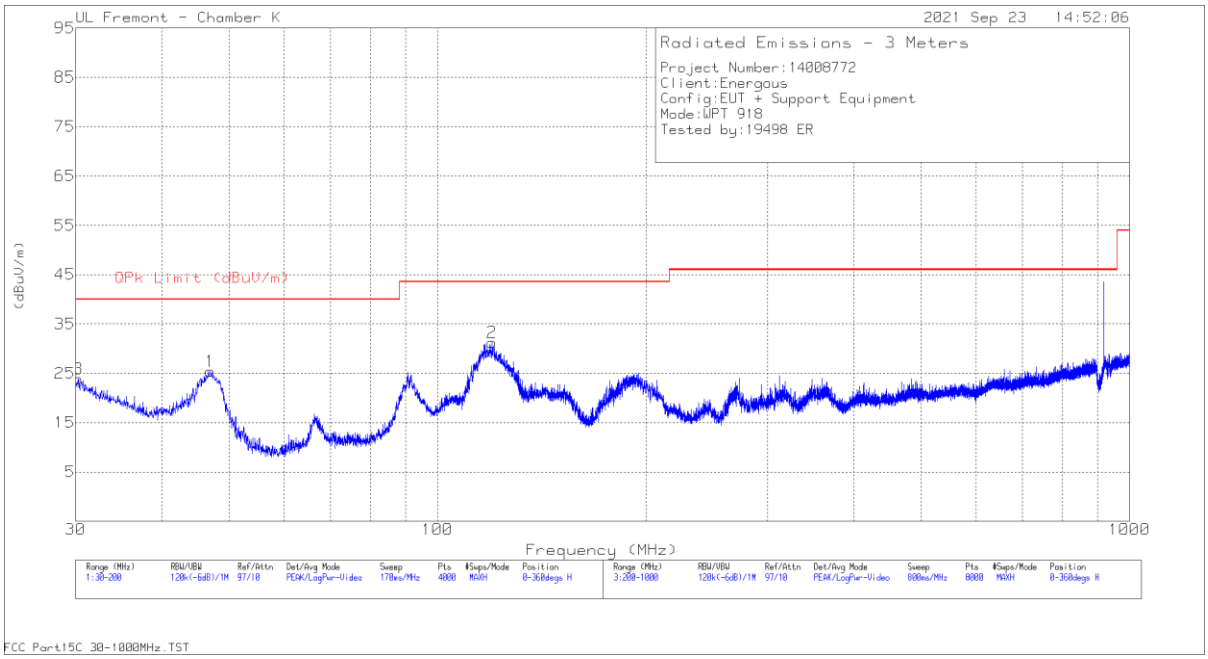
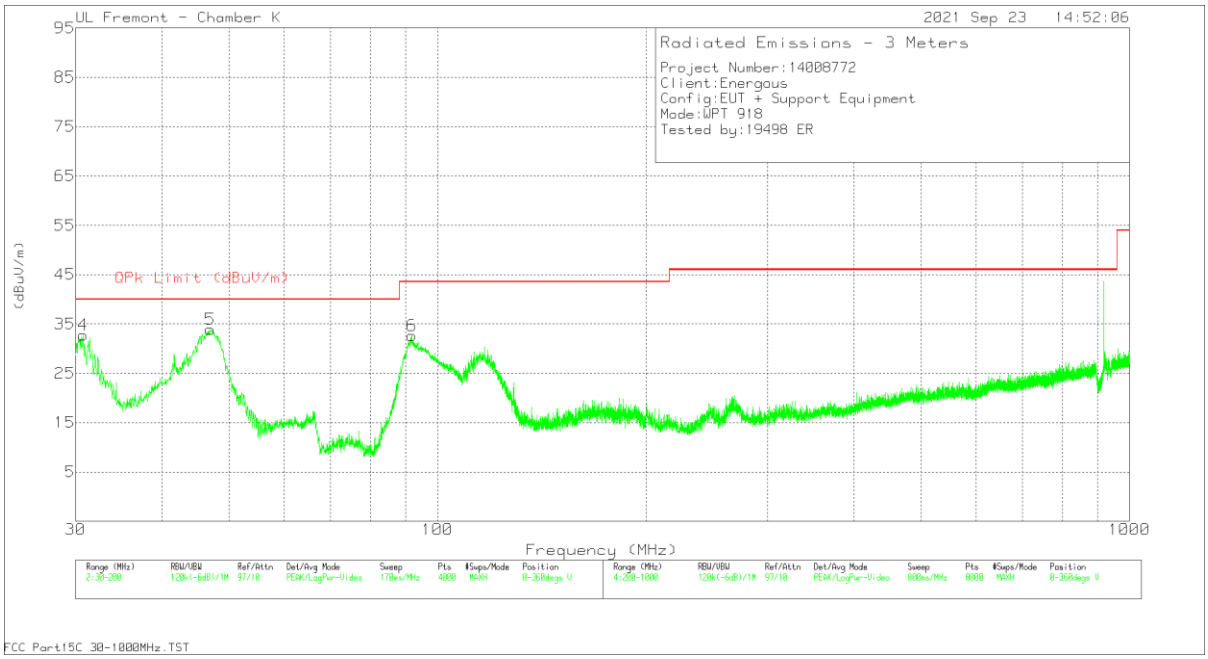
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

UL VERIFICATION SERVICES
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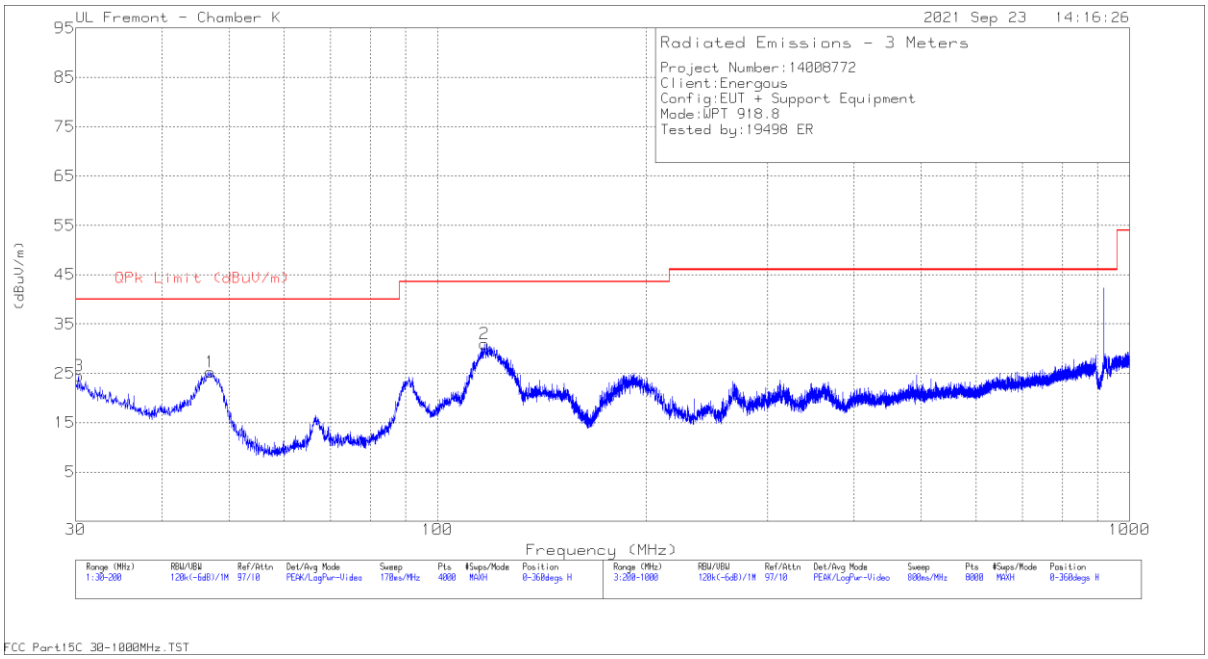
RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 202301 (dB/m)	Amp/Cbl (dB)	T1847 BRF (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	46.9994	39.38	Qp	14.9	-31.4	0.05	22.93	40	-17.07	341	384	H
2	* 118.4943	38.86	Qp	19.4	-30.8	0.12	27.58	43.52	-15.94	134	190	H
3	34.7747	22.15	Qp	23.5	-31.5	0.04	14.19	40	-25.81	67	372	H
4	30.7458	32.31	Qp	26.4	-31.6	0.04	27.15	40	-12.85	270	121	V
5	47.0306	48.26	Qp	14.9	-31.4	0.05	31.81	40	-8.19	72	108	V
6	91.6585	46.1	Qp	13.9	-31	0.11	29.11	43.52	-14.41	171	108	V

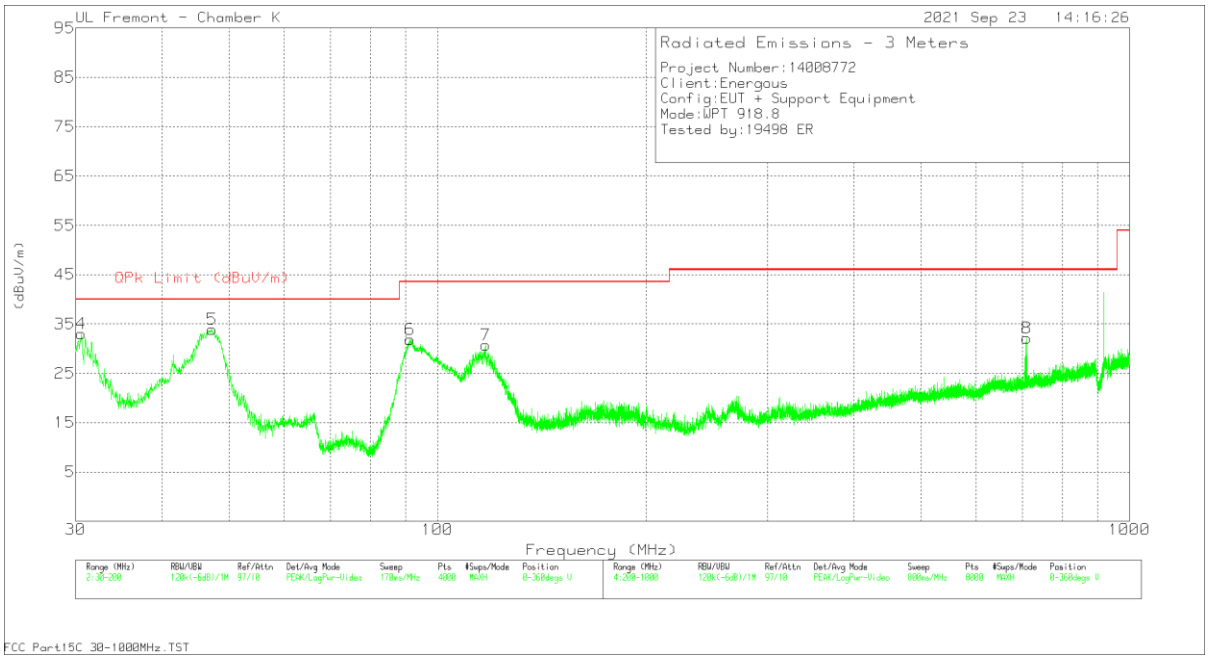
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Qp - Quasi-Peak detector

UL VERIFICATION SERVICES
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

UL VERIFICATION SERVICES
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 202301 (dB/m)	Amp/Cbl (dB)	T1847 BRF (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	46.9619	41.76	Pk	14.9	-31.4	0.05	25.31	40	-14.69	0-360	393	H
2	* 116.9275	38.47	Qp	19.4	-30.8	0.11	27.18	43.52	-16.34	124	179	H
3	30.2976	29.48	Pk	26.6	-31.6	0.04	24.52	40	-15.48	0-360	295	H
5	47.215	48.26	Qp	14.8	-31.4	0.05	31.71	40	-8.29	36	99	V
4	30.7909	31.86	Qp	26.3	-31.6	0.04	26.60	40	-13.40	219	100	V
6	91.3509	46.28	Qp	13.9	-31	0.11	29.29	43.52	-14.23	194	111	V
7	* 117.1426	36.53	Qp	19.4	-30.8	0.11	25.24	43.52	-18.28	120	111	V
8	707.9983	30.86	Qp	26.2	-28.6	0.25	28.71	46.02	-17.31	232	155	V

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

UL VERIFICATION SERVICES
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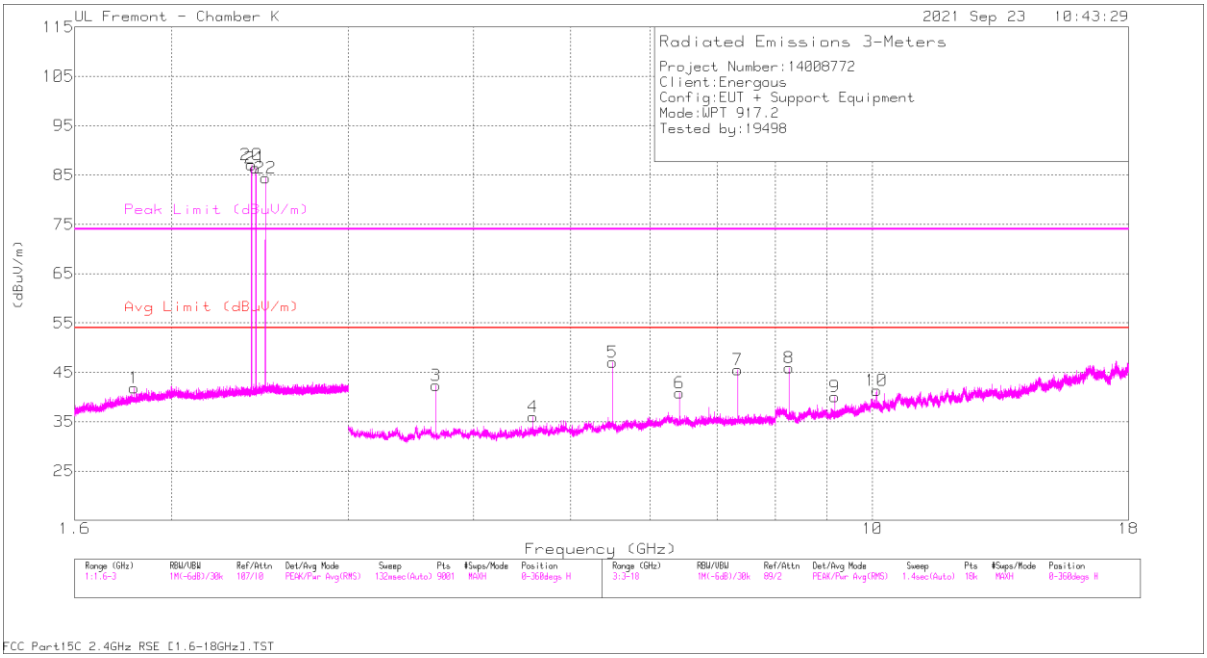
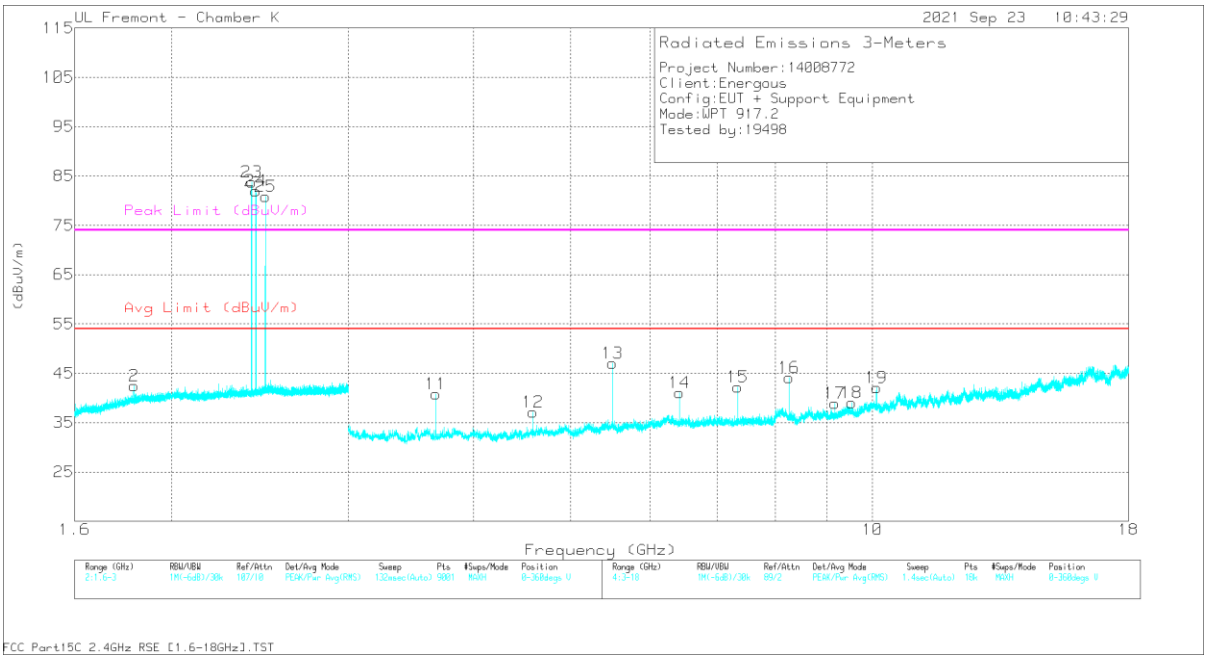
10.2. TRANSMITTER ABOVE 1 GHz

HARMONICS AND SPURIOUS EMISSIONS (WITH HPF 204786)

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

UL VERIFICATION SERVICES
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 80404 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	204786 HPF (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7	* 7.33781	50.66	PKFH	35.8	-37.2	0.8	50.06	-	-	74	-23.94	55	98	H
	* 7.33765	46.16	VA1T	35.8	-37.2	0.8	45.56	54	-8.44	-	-	55	98	H
8	* 8.25484	50.42	PKFH	36	-36.5	0.8	50.72	-	-	74	-23.28	352	193	H
	* 8.25488	46.11	VA1T	36	-36.5	0.8	46.41	54	-7.59	-	-	352	193	H
3	* 3.66885	53.96	PKFH	33.4	-40.7	0.8	47.46	-	-	74	-26.54	358	171	H
	* 3.66883	49.82	VA1T	33.4	-40.7	0.8	43.32	54	-10.68	-	-	358	171	H
16	* 8.2548	48.87	PKFH	36	-36.5	0.8	49.17	-	-	74	-24.83	26	99	V
	* 8.25488	43.06	VA1T	36	-36.5	0.8	43.36	54	-10.64	-	-	26	99	V
15	* 7.33764	49.22	PKFH	35.8	-37.2	0.8	48.62	-	-	74	-25.38	346	99	V
	* 7.33768	42.1	VA1T	35.8	-37.2	0.8	41.5	54	-12.5	-	-	346	99	V
11	* 3.66893	54.57	PKFH	33.4	-40.7	0.8	48.07	-	-	74	-25.93	22	331	V
	* 3.66884	50.55	VA1T	33.4	-40.7	0.8	44.05	54	-9.95	-	-	22	331	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - Markers 20 to 25 are BLE/MSK Signals
NOTE: Worst highest 6 markers frequencies in restricted bands are picked.

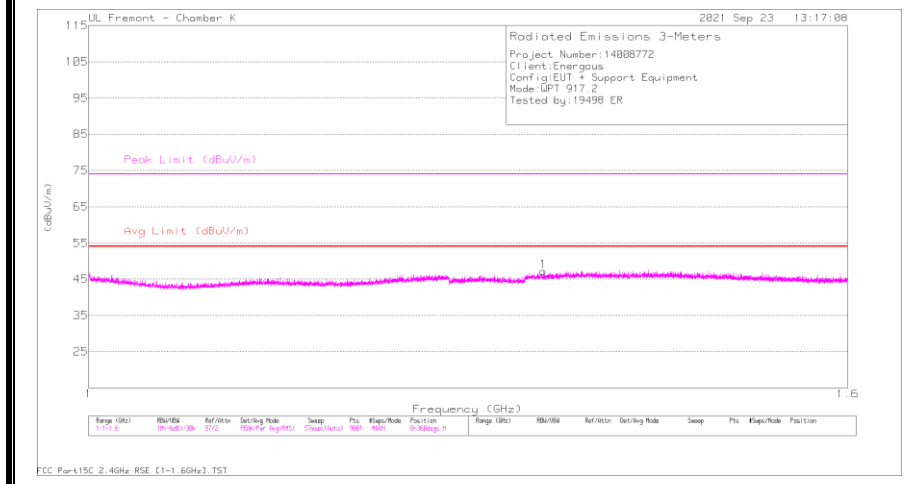
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

UL VERIFICATION SERVICES
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

Spurious Emissions 1GHz – 1.6GHz without a Band Reject Filter, without 1.5 GHz HPF, and without amplifier

Tested by:	19498 ER
Date:	9/23/2021

Horizontal



DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF 80404 (dB/m)	Bypass (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.32466	19.67	PKFH	29	5.3	53.97	-	-	74	-20.03	162	100	H
* 1.32699	6.61	VA1T	28.9	5.3	40.81	54	-13.19	-	-	162	100	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration
Note:

- Test was performed @ 3 meter distance.

UL VERIFICATION SERVICES
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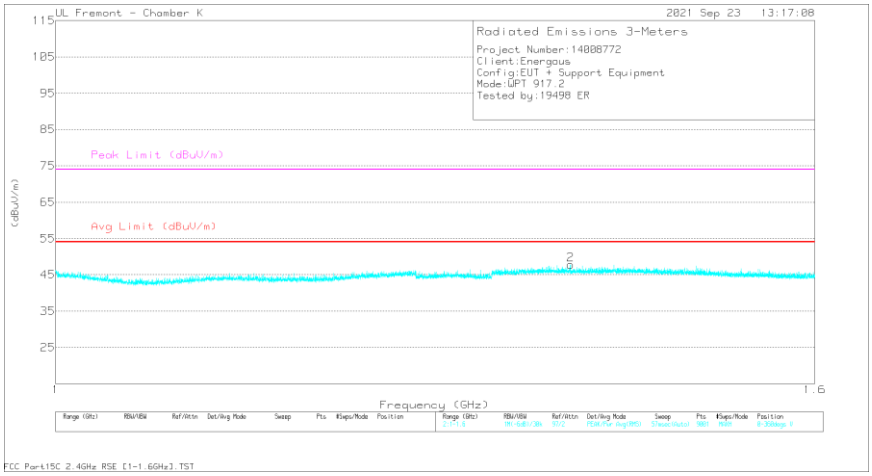
Vertical



DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF 80404 (dB/m)	Bypass (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.37491	19.68	PKFH	29.1	5.4	54.18	-	-	74	-19.82	228	147	V
* 1.37738	6.72	VA1T	29	5.4	41.12	54	-12.88	-	-	228	147	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration
Note:

- Test was performed @ 3 meter distance.

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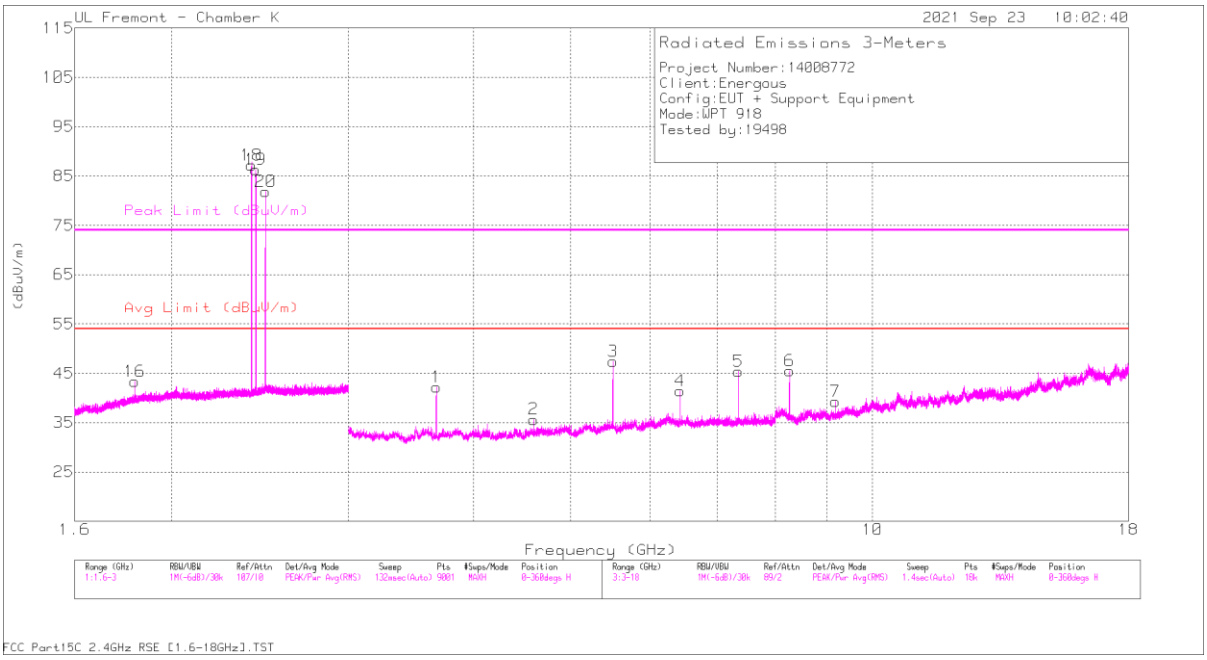
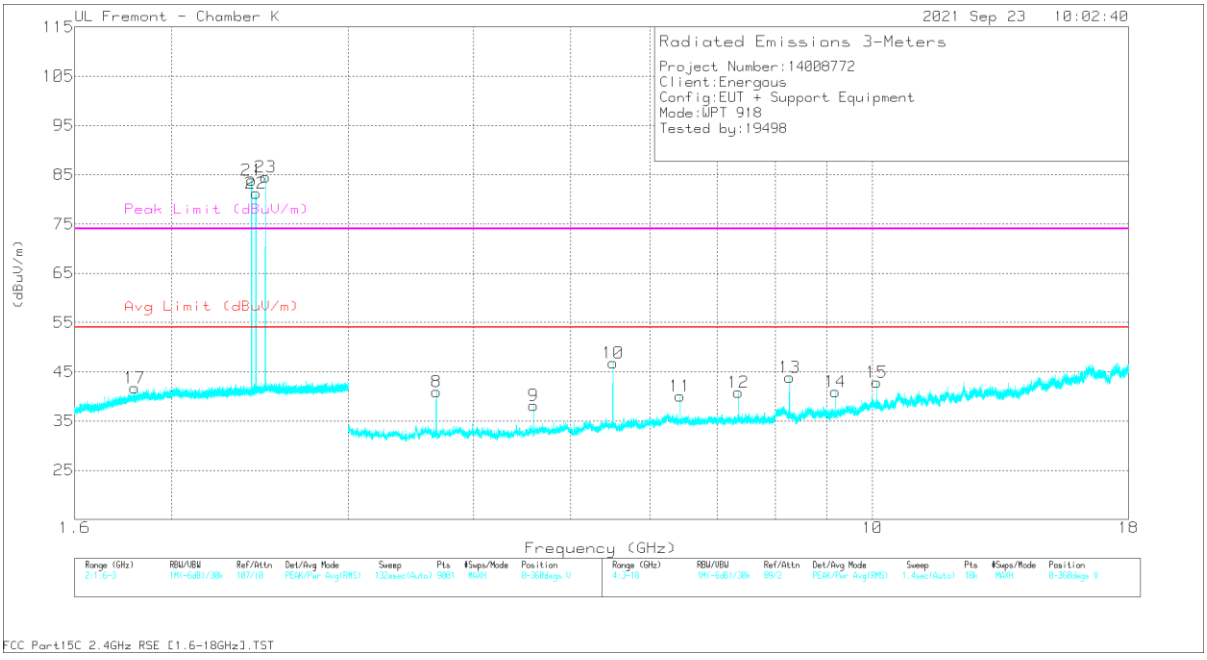
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

UL VERIFICATION SERVICES
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 80404 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	204786 HPF (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	* 7.34419	50.24	PKFH	35.8	-37.2	0.8	49.64	-	-	74	-24.36	55	98	H
	* 7.34408	45.56	VA1T	35.8	-37.2	0.8	44.96	54	-9.04	-	-	55	98	H
6	* 8.26211	51.05	PKFH	36	-36.4	0.8	51.45	-	-	74	-22.55	353	197	H
	* 8.2621	45.63	VA1T	36	-36.4	0.8	46.03	54	-7.97	-	-	353	197	H
1	* 3.67199	52.65	PKFH	33.4	-40.7	0.8	46.15	-	-	74	-27.85	360	104	H
	* 3.67204	46.88	VA1T	33.4	-40.7	0.8	40.38	54	-13.62	-	-	360	104	H
13	* 8.26216	49.12	PKFH	36	-36.4	0.8	49.52	-	-	74	-24.48	24	197	V
	* 8.26208	42.92	VA1T	36	-36.4	0.8	43.32	54	-10.68	-	-	24	197	V
8	* 3.67208	54.51	PKFH	33.4	-40.7	0.8	48.01	-	-	74	-25.99	19	330	V
	* 3.67205	50.51	VA1T	33.4	-40.7	0.8	44.01	54	-9.99	-	-	19	330	V
14	* 9.18036	47.05	PKFH	36.4	-35.8	0.8	48.45	-	-	74	-25.55	21	190	V
	* 9.1801	38.31	VA1T	36.4	-35.9	0.8	39.61	54	-14.39	-	-	21	190	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - Markers 18 to 23 are BLE/MSK Signals
NOTE: Worst highest 6 markers frequencies in restricted bands are picked.

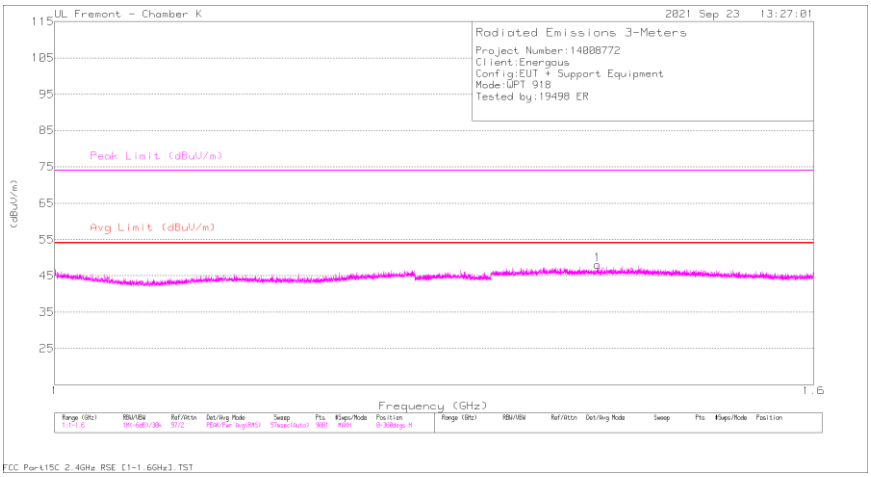
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

UL VERIFICATION SERVICES
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

Spurious Emissions 1GHz – 1.6GHz without a Band Reject Filter, without 1.5 GHz HPF, and without amplifier

Tested by:	19498 ER
Date:	9/23/2021

Horizontal



DATA

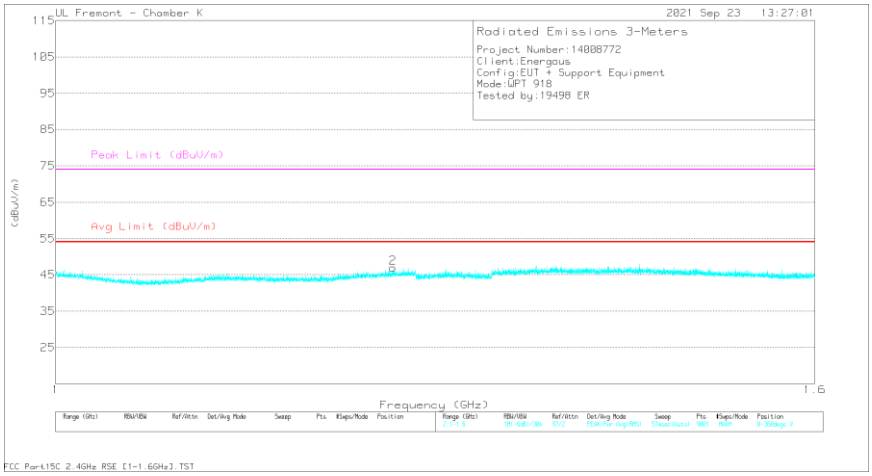
Frequency (GHz)	Meter Reading (dBuV)	Det	AF 80404 (dB/m)	Bypass (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.40067	20.89	PKFH	29	5.4	55.29	-	-	74	-18.71	98	289	H
* 1.40155	6.78	VA1T	29	5.4	41.18	54	-12.82	-	-	98	289	H

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

- Test was performed @ 3 meter distance.

UL VERIFICATION SERVICES
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

Vertical



DATA

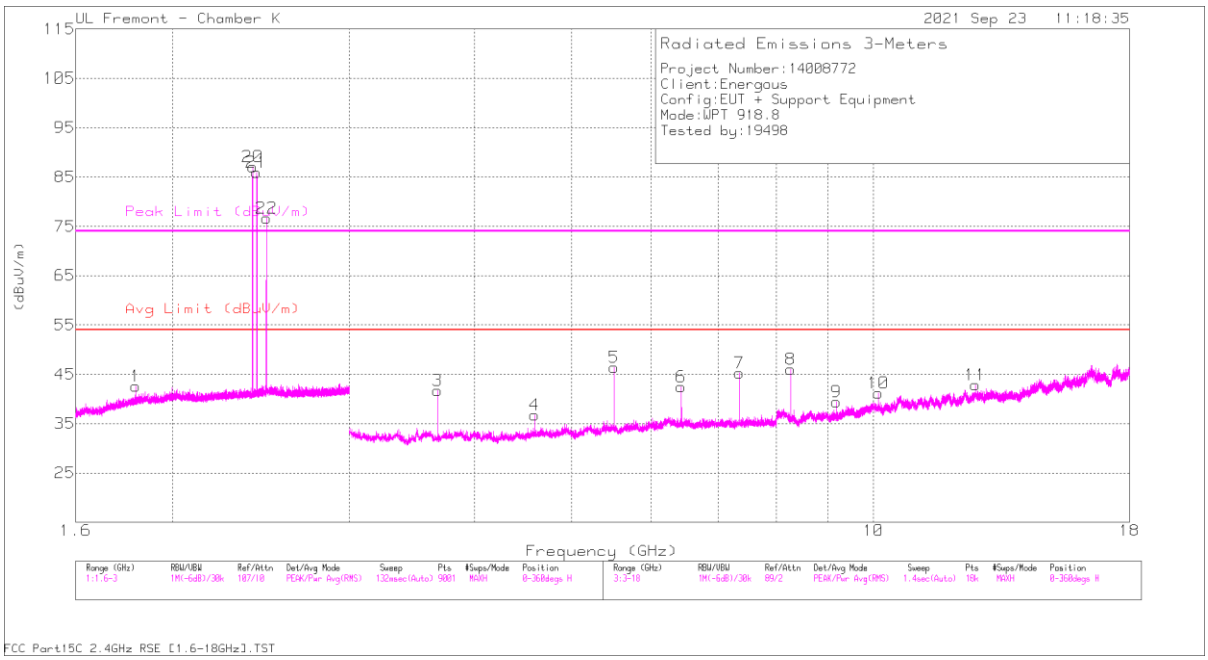
Frequency (GHz)	Meter Reading (dBuV)	Det	AF 80404 (dB/m)	Bypass (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.23315	19.91	PKFH	28.7	5.1	53.71	-	-	74	-20.29	245	211	V
* 1.23429	6.89	VA1T	28.7	5.1	40.69	54	-13.31	-	-	245	211	V

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

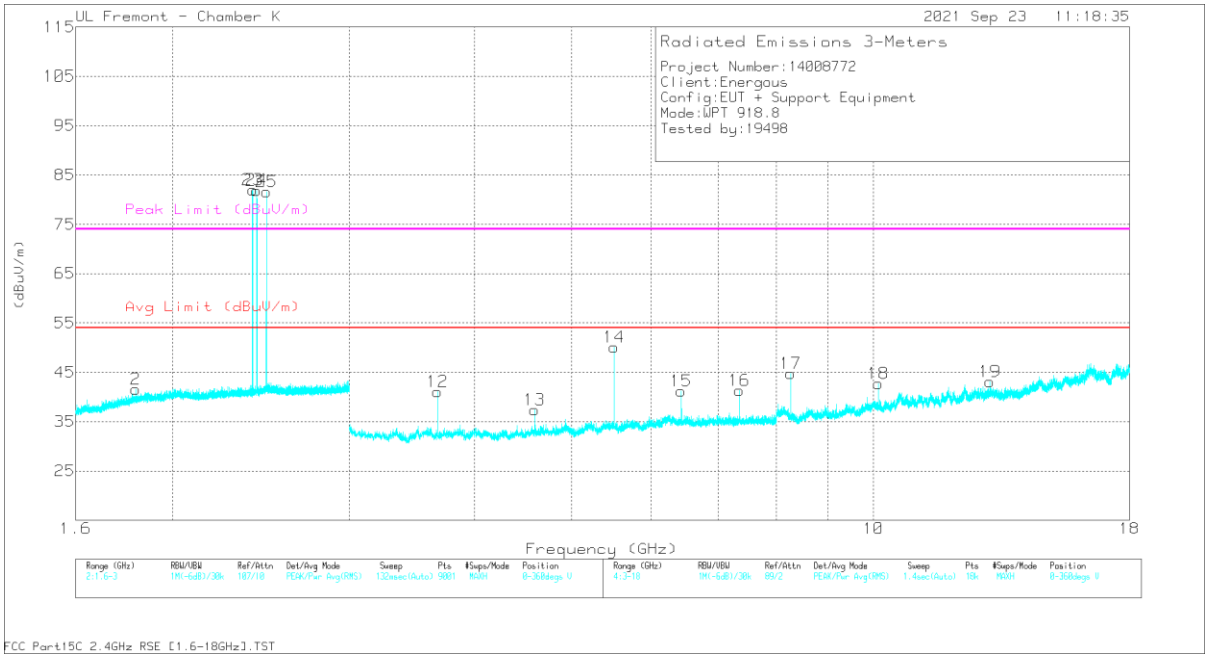
- Test was performed @ 3 meter distance.

UL VERIFICATION SERVICES
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

UL VERIFICATION SERVICES
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RADIATED EMISSIONS

	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 80404 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	204786 HPF (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7	* 7.35055	51.01	PKFH	35.8	-37.1	0.8	50.51	-	-	74	-23.49	354	218	H
	* 7.35048	46.31	VA1T	35.8	-37.1	0.8	45.81	54	-8.19	-	-	354	218	H
8	* 8.26933	50.08	PKFH	36	-36.4	0.8	50.48	-	-	74	-23.52	355	202	H
	* 8.26931	45.35	VA1T	36	-36.4	0.8	45.75	54	-8.25	-	-	355	202	H
3	* 3.67521	53.76	PKFH	33.4	-40.7	0.8	47.26	-	-	74	-26.74	333	241	H
	* 3.67524	49.19	VA1T	33.4	-40.7	0.8	42.69	54	-11.31	-	-	333	241	H
11	* 12.63732	44.34	PKFH	39.2	-32.7	0.8	51.64	-	-	74	-22.36	266	119	H
	* 12.64235	29.86	VA1T	39.2	-32.8	0.8	37.06	54	-16.94	-	-	266	119	H
17	* 8.26926	49.09	PKFH	36	-36.4	0.8	49.49	-	-	74	-24.51	26	98	V
	* 8.26928	43.36	VA1T	36	-36.4	0.8	43.76	54	-10.24	-	-	26	98	V
16	* 7.35047	49.02	PKFH	35.8	-37.1	0.8	48.52	-	-	74	-25.48	20	185	V
	* 7.35048	42.26	VA1T	35.8	-37.1	0.8	41.76	54	-12.24	-	-	20	185	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - Markers 20 to 25 are BLE/MSK Signals
NOTE: Worst highest 6 markers frequencies in restricted bands are picked.

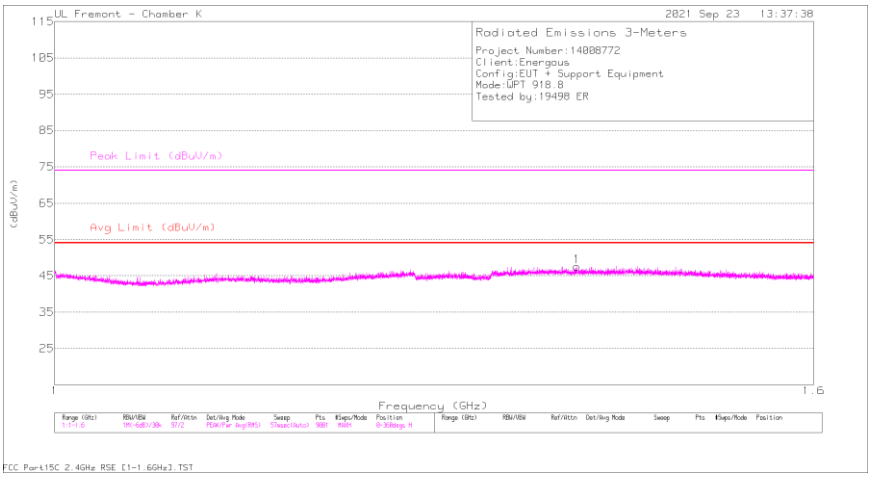
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

UL VERIFICATION SERVICES
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

Spurious Emissions 1GHz – 1.6GHz without a Band Reject Filter, without 1.5 GHz HPF, and without amplifier

Tested by:	19498 ER
Date:	9/23/2021

Horizontal



DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF 80404 (dB/m)	Bypass (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.38344	19.98	PKFH	29.1	5.4	54.48	-	-	74	-19.52	229	156	H
* 1.38351	6.71	VA1T	29.1	5.4	41.21	54	-12.79	-	-	229	156	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration
Note:

- Test was performed @ 3 meter distance.

UL VERIFICATION SERVICES
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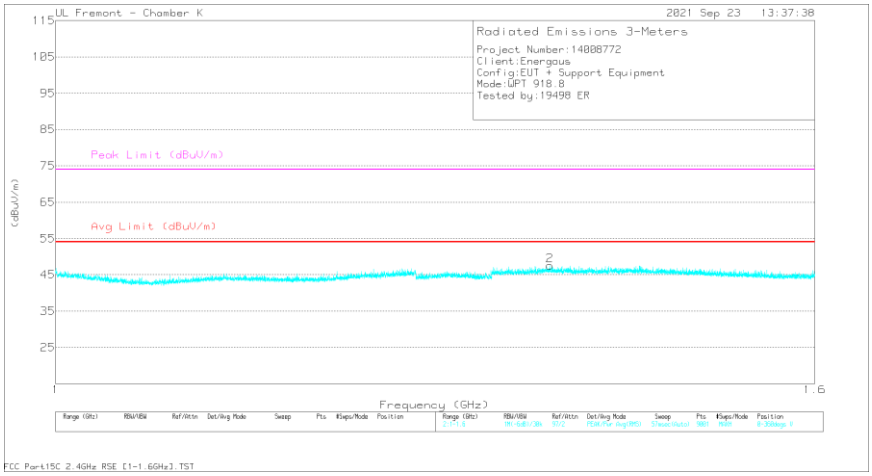
Vertical



DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF 80404 (dB/m)	Bypass (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.35971	20.27	PKFH	29.2	5.4	54.87	-	-	74	-19.13	76	186	V
* 1.35985	6.7	VA1T	29.2	5.4	41.3	54	-12.7	-	-	76	186	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration
Note:

- Test was performed @ 3 meter distance.

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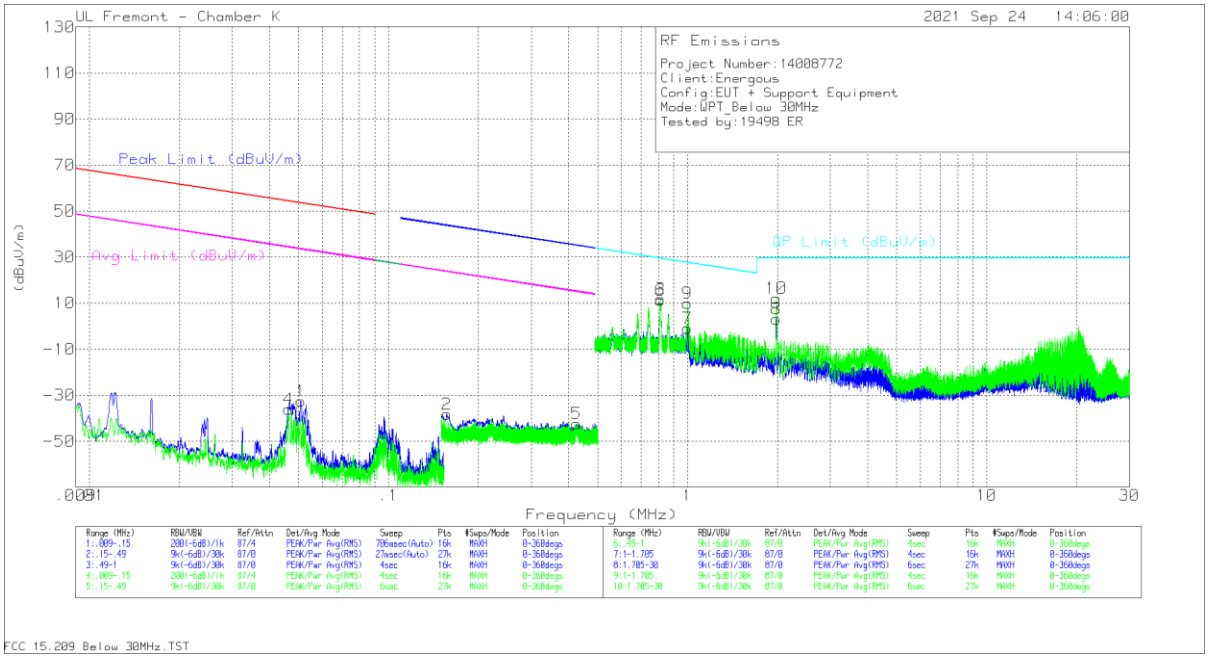
10.3. WORST CASE BELOW 30MHZ

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



ANTENNA- TWO ORIENTATIONS FACE ON/FACE OFF

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (E ACF)	Amp/Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.05091	22.81	Pk	57	-32.3	-80	-32.49	53.45	-85.94	33.45	-65.94	-	-	-	-	0-360
2	.15658	17.99	Pk	55.9	-32.2	-80	-38.31	-	-	-	-	43.73	-82.04	23.73	-62.04	0-360
4	.0463	18.95	Pk	57.1	-32.2	-80	-36.15	54.27	-90.42	34.27	-70.42	-	-	-	-	0-360
5	.42479	13.53	Pk	56.2	-32.2	-80	-42.47	-	-	-	-	35.04	-77.51	15.04	-57.51	0-360

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (E ACF)	Amp/Cbl (dB)	Dist Corr 30m (dB) 40Log	Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.81144	27.74	Pk	56.2	-32.2	-40	11.74	29.43	-17.69	0-360
6	.81054	27.27	Pk	56.2	-32.2	-40	11.27	29.44	-18.17	0-360
7	1.00026	24.41	Pk	46.7	-32.1	-40	-.99	27.62	-28.61	0-360
8	1.97748	33.54	Pk	41.6	-32.1	-40	3.04	29.5	-26.46	0-360
9	1.00009	35.33	Pk	46.7	-32.1	-40	9.93	27.62	-17.69	0-360
10	1.97958	42.63	Pk	41.6	-32.1	-40	12.13	29.5	-17.37	0-360

Pk - Peak detector

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11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

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 C63.4.

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

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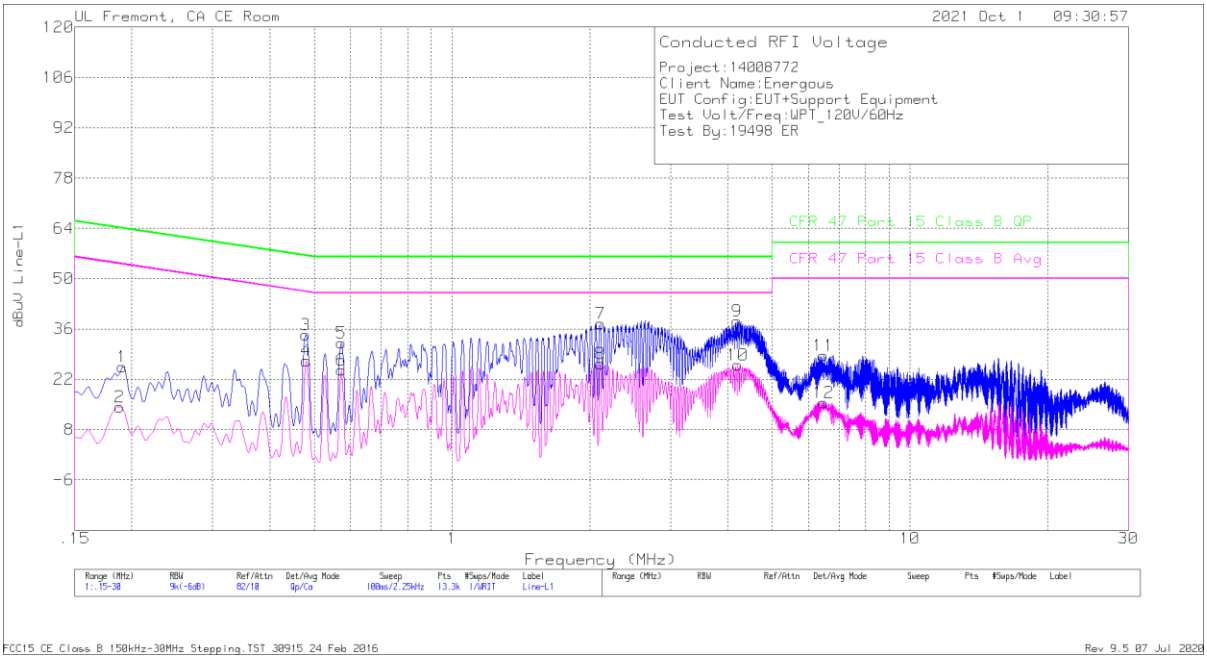
LINE 1 RESULTS



Trace Markers

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE018644 6 L1	LC Cables C1&C3 dB	TekBox Limiter TBFL1 Model 207	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
2	.18825	4.9	Ca	0	0	9.4	14.3	-	-	54.11	-39.81
4	.48075	17.84	Ca	0	0	9.3	27.14	-	-	46.33	-19.19
6	.573	15.36	Ca	0	0	9.3	24.66	-	-	46	-21.34
8	2.1075	16.94	Ca	0	.1	9.3	26.34	-	-	46	-19.66
10	4.209	16.63	Ca	0	.1	9.3	26.03	-	-	46	-19.97
12	6.4725	6.14	Ca	0	.1	9.3	15.54	-	-	50	-34.46
1	.1905	16.2	Qp	0	0	9.3	25.5	64.01	-38.51	-	-
3	.4785	25.14	Qp	0	0	9.3	34.44	56.37	-21.93	-	-
5	.573	22.83	Qp	0	0	9.3	32.13	56	-23.87	-	-
7	2.10975	28.08	Qp	0	.1	9.3	37.48	56	-18.52	-	-
9	4.19775	28.79	Qp	0	.1	9.3	38.19	56	-17.81	-	-
11	6.47475	19.23	Qp	0	.1	9.3	28.63	60	-31.37	-	-

Qp - Quasi-Peak detector
Ca - CISPR average detection

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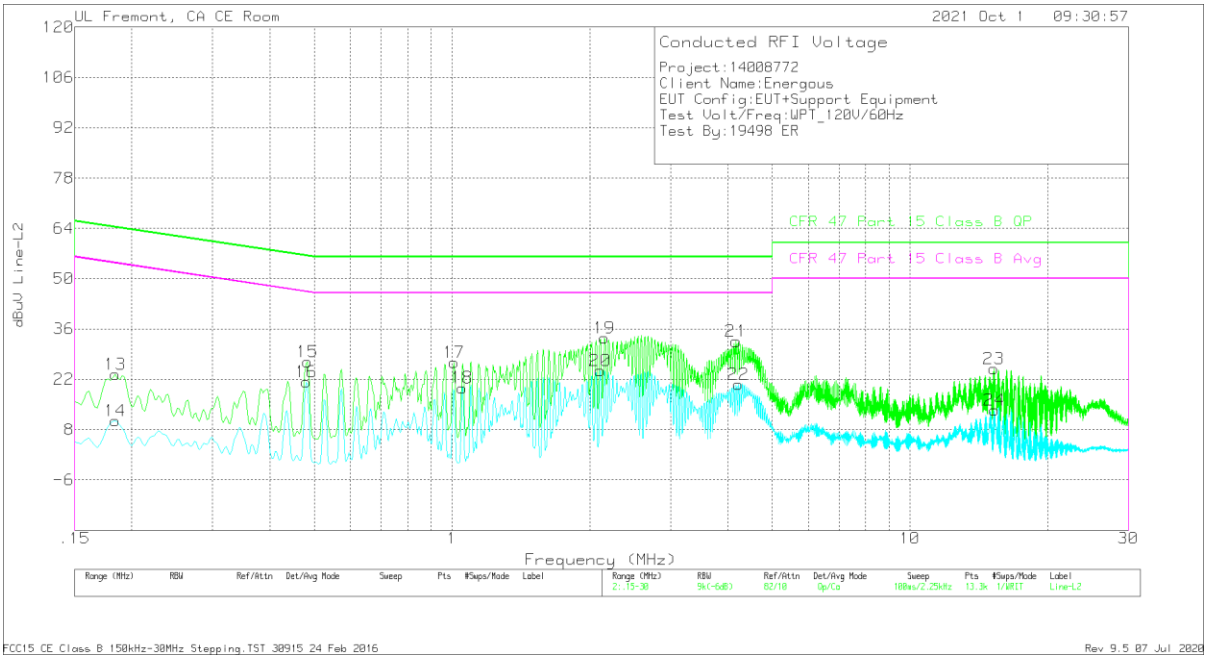
LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE018644 6 L2	LC Cables C2&C3 dB	TekBox Limiter TBFL1 Model 207	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
14	.18375	1.01	Ca	0	0	9.4	10.41	-	-	54.31	-43.9
16	.48075	12.01	Ca	0	0	9.3	21.31	-	-	46.33	-25.02
18	1.05225	10.23	Ca	0	.1	9.3	19.63	-	-	46	-26.37
20	2.1075	15.05	Ca	0	.1	9.3	24.45	-	-	46	-21.55
22	4.218	11.15	Ca	0	.1	9.3	20.55	-	-	46	-25.45
24	15.29025	4.01	Ca	0	.2	9.3	13.51	-	-	50	-36.49
13	.18375	13.93	Qp	0	0	9.4	23.33	64.31	-40.98	-	-
15	.483	17.53	Qp	0	0	9.3	26.83	56.29	-29.46	-	-
17	1.0095	17.37	Qp	0	.1	9.3	26.77	56	-29.23	-	-
19	2.1525	24.1	Qp	0	.1	9.3	33.5	56	-22.5	-	-
21	4.173	23.15	Qp	0	.1	9.3	32.55	56	-23.45	-	-
23	15.243	15.42	Qp	0	.2	9.3	24.92	60	-35.08	-	-

Qp - Quasi-Peak detector
Ca - CISPR average detection

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