



TEST REPORT

Report Number. : 14262501-E1V2

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

Model : VN55

Brand : ENERGOUS

FCC ID : 2ADNG-VN55

IC : 23686-VN55

EUT Description : WIRELESS CHARGER

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
ISED RSS-247 ISSUE 2
ISED RSS-GEN ISSUE 5 + A1 + A2

Date Of Issue:
May 04, 2022

Prepared by:
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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	4/25/2022	Initial Issue	--
V2	5/4/2022	Updated report to address TCB's questions	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: VN55

BRAND: ENERGOUS

SERIAL NUMBER: 5072 (CONDUCTED); AEFEC0B3 (RADIATED)

SAMPLE RECEIPT DATE: MARCH 31, 2022

DATE TESTED: MARCH 31, 2022 – APRIL 14, 2022

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5 + A1 + A2	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.

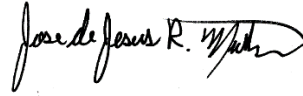
This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This 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.

Approved & Released For
UL Verification Services Inc. By:



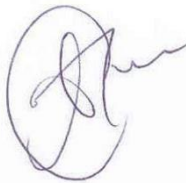
Dan Corona
Operations Leader
Consumer Technology Division
UL Verification Services Inc.

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.

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	ISED Clause	Requirement	Result	Comment
See Comment	See Comment	Duty Cycle	Reporting purposes only	Per ANSI C63.10, Section 11.6.
FCC §15.247 (a) (1)(i)	RSS-GEN 6.7	20dB BW/99% OBW	Complies	ANSI C63.10 Sections 6.9.2 and 6.9.3
15.247 (a)(1)	RSS-247 (5.1) (b)	Hopping Frequency Separation	Complies	None.
15.247 (a)(1)(i)	RSS-247 (5.1) (c)	Number of Hopping Channels	Complies	None.
15.247 (a)(1)(i)	RSS-247 (5.1) (c)	Average Time of Occupancy	Complies	None.
15.247 (b)(2)	RSS-247 (5.4) (a)	Output Power	Complies	None.
See Comment	See Comment	Average Power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (d)	RSS-247 (5.5)	Conducted Spurious Emissions	Complies	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Complies	None.
15.207	RSS-Gen 8.8	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, RSS-GEN Issue 5 + A1 + A2, and RSS-247 Issue 2

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	550739
☐	Building 2: 47266 Benicia Street, Fremont, California, USA	US0104	22541	550739
☒	Building 4: 47658 Kato Rd, Fremont, California, USA	US0104	2324B	550739

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)
 $36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$

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.
 $36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a stand-alone wireless charger with BLE and Zigbee 802.15.4 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 Zigbee 802.15.4 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 3.5.9_FP255

The test utility software used during testing was 3.5.9_FP255

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.

The EUT only supports WPT 2 Tx (MIMO) at the same time, it does not support 1 Tx (SISO). All radiated tests are performed on 2 Tx (MIMO) only.

WPT band and BLE (beaconing mode) or WPT band and 2.4G Zigbee transmit simultaneously, investigation has been performed when WPT band, BLE (beaconing mode) and 2.4G Zigbee transmit simultaneously as worst case, result of 30MHz to 18GHz radiated emissions was recorded in this report.

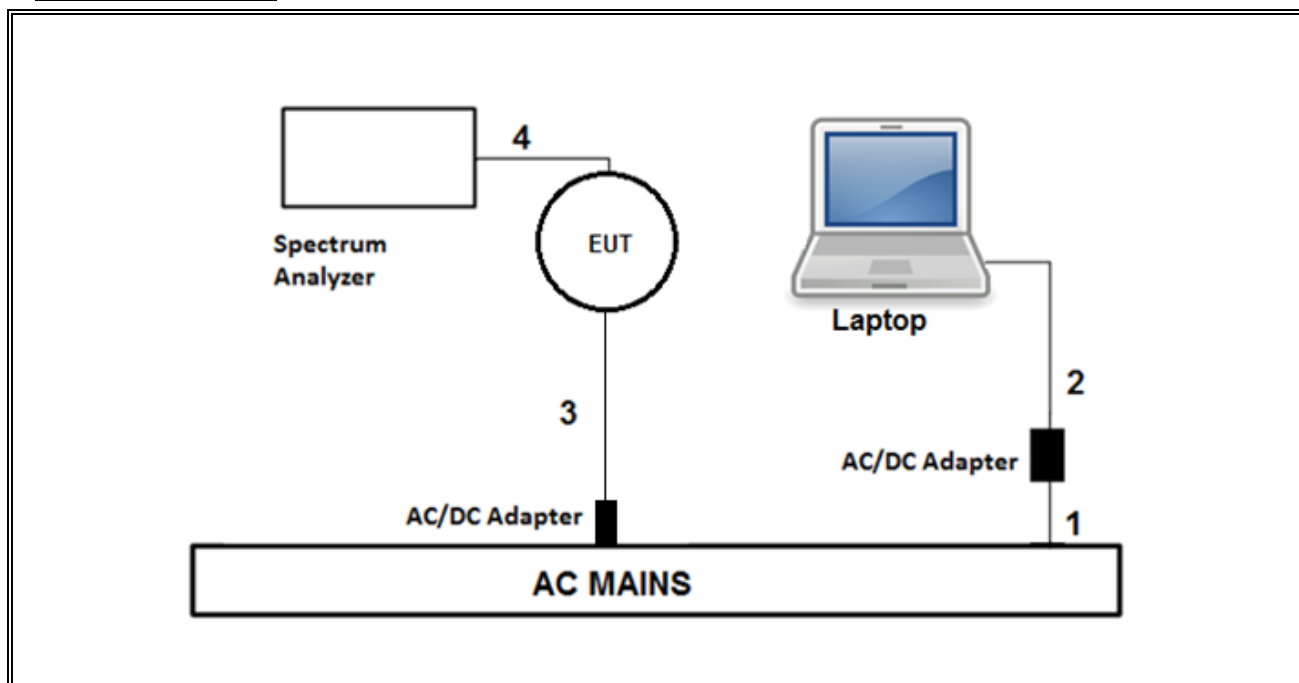
6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description		Manufacturer	Model	Serial Number		FCC ID/ DoC
Laptop		Dell	Precision M3800	1N80562		DoC
Laptop AC/DC adapter		Dell	HA130PM130	CN-0V363H-CH200-732-03L8-A00		DoC
AC/DC Switching Adapter		CUI Inc.	HDP-QB05010U	-		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	USB Type C	Shielded	1	EUT to AC/DC adapter
4	Antenna	1	SMA	Un-shielded	0.3	To spectrum analyzer
I/O CABLES (RF RADIATED TEST/AC LINE CONDUCTED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	USB Type C	Shielded	1	

TEST SETUP-RF CONDUCTED TEST

The EUT was powered by AC/DC adapter via USB cable. Test software exercised the EUT.

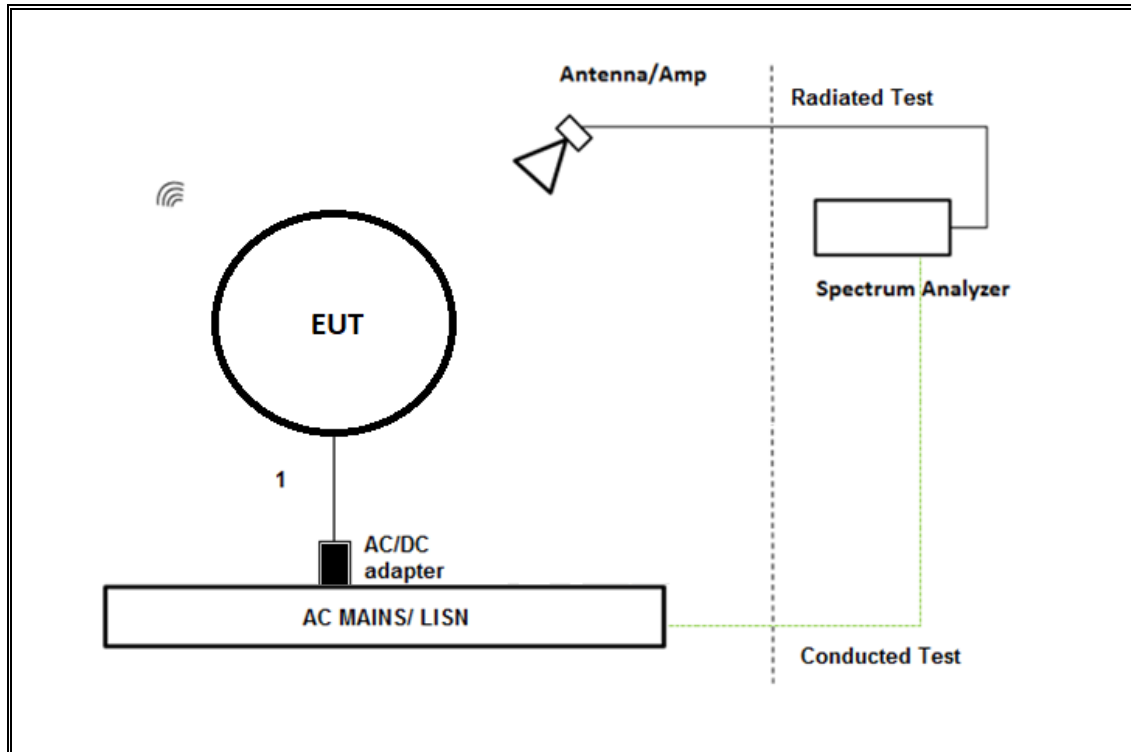
SETUP DIAGRAMS



TEST SETUP- RADIATED TEST / AC LINE CONDUCTED TEST

The EUT was powered by AC/DC adapter via USB cable. Test software exercised the EUT. Laptop was removed after test setup.

SETUP DIAGRAM



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	ID Num	Cal Due	Last Cal
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO METRICS	EM-6871	PRE0179466 (170014)	06/08/2022	06/08/2021
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO METRICS	EM-6872	PRE0179468 (170016)	06/08/2022	06/08/2021
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB1	82258	10/01/2022	10/01/2021
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	175953	02/08/2023	02/08/2022
Antenna, Horn 1-18GHz	ETS-Lindgren (Cedar Park, Texas)	3117	80404	08/04/2022	08/04/2021
Amplifier, 100MHz- 18GHz	AMPLICAL	AMP0.1G18-47- 20	PRE0197319	*04/08/2022	04/08/2021
Thermometer	Control Company	14-650-118	160656	03/30/2023	03/30/2022
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179367	02/16/2023	02/16/2022
Antenna, Horn 1-18GHz	ETS-Lindgren (Cedar Park, Texas)	3117	79834	05/07/2022	05/07/2021
Amplifier, 100MHz- 18GHz	MITEQ	AFS42- 00101800-25-S- 42	150755	03/09/2023	03/09/2022
Thermometer - Digital	Control Company	14-650-118	175731	02/03/2023	02/03/2022
EMI TEST RECEIVER, with B8 option	Rohde & Schwarz	ESW44	169937	02/20/2023	02/20/2022
Filter, BRF 902 to 928MHz	MICRO-TRONICS	BRC50722	T1847	*04/08/2022	04/08/2021
Filter, HPF 1.5GHzGHz	MICRO-TRONICS	HPM50114	204786	06/24/2022	06/24/2021
Spectrum Analyzer, PSA, 3Hz to 26.5GHz	Keysight Technologies Inc	E4440A	81311	02/02/2023	02/02/2022
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	90719	01/24/2023	01/24/2022
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	90391	02/03/2023	02/03/2022
AC Line Conducted					
LISN	Fischer Custom Communications, Inc	FCC-LISN- 50/250-25-2-01- 480V	175765	01/26/2023	01/26/2022
EMI TEST RECEIVER	Rohde & Schwarz	ESR	93091	02/21/2023	02/21/2022
Transient Limiter	TE	TBFL1	207996	06/01/2022	06/01/2021
UL TEST SOFTWARE LIST					
Radiated Software	UL	UL EMC	Rev 9.5, Jan 03, 2020		
Antenna Port Software	UL	UL RF	Ver 2021.08.27		
AC Line Conducted Software	UL	UL EMC	Rev 9.5, 07 Jul 2020		

*testing was completed before calibration expired date.

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.

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

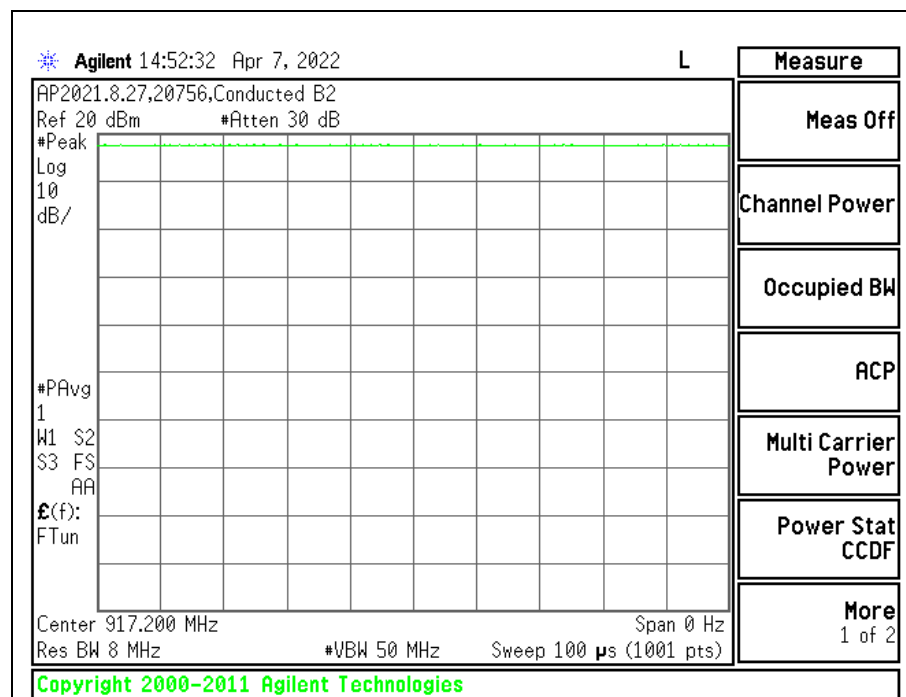
PROCEDURE

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	20756
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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.

RSS-247 (5.1)

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

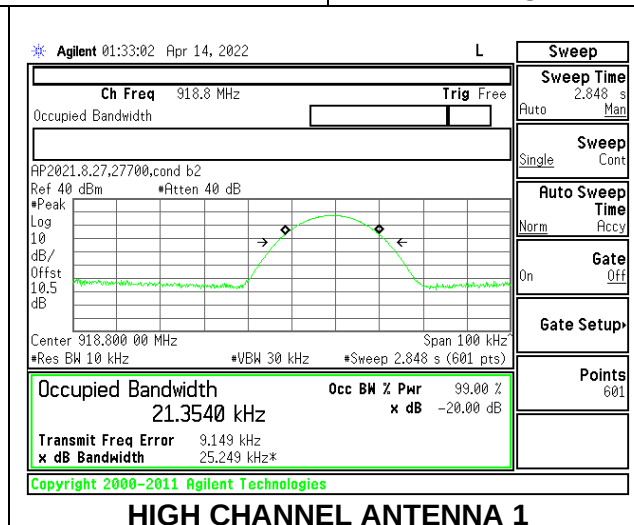
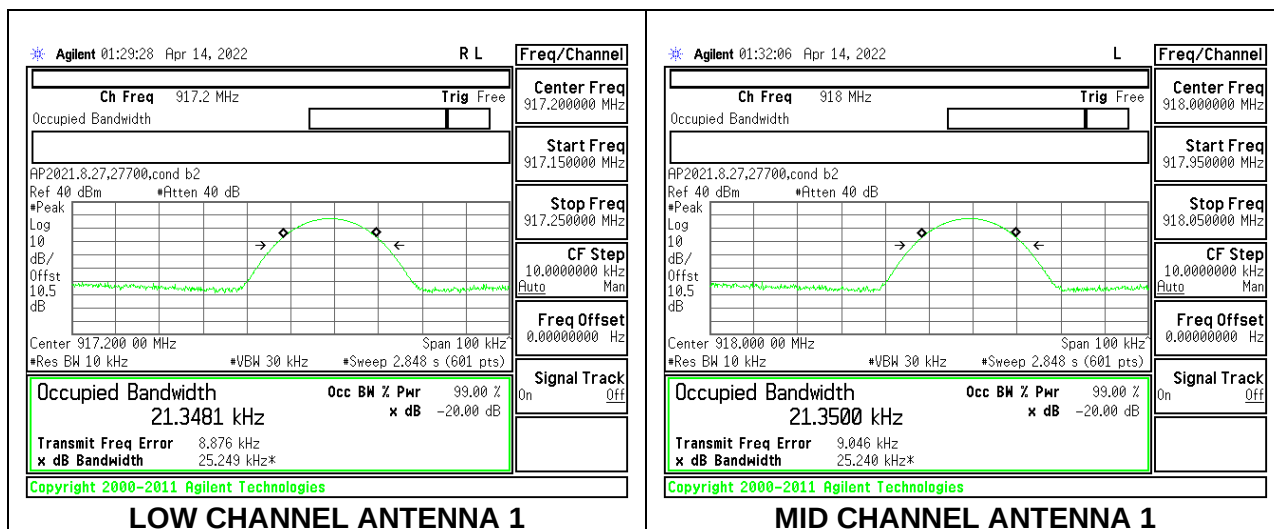
TEST PROCEDURE

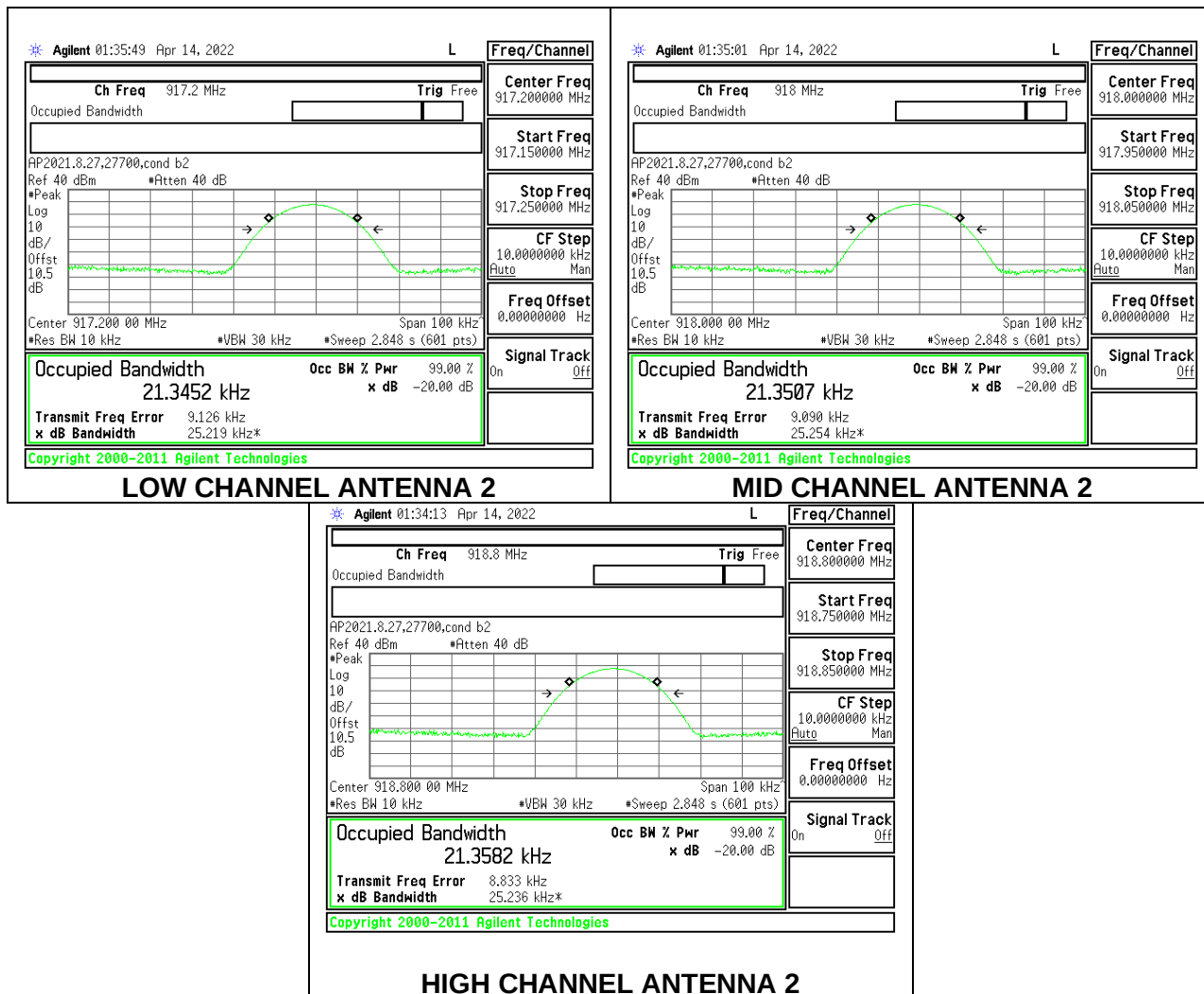
The RBW is set to 10kHz. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

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

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	25.249	21.3481	25.219	21.3452
Mid	918	25.240	21.3500	25.254	21.3507
High	918.8	25.249	21.3540	25.236	21.3582





9.3. HOPPING FREQUENCY SEPARATION

LIMITS

FCC §15.247 (a) (1)

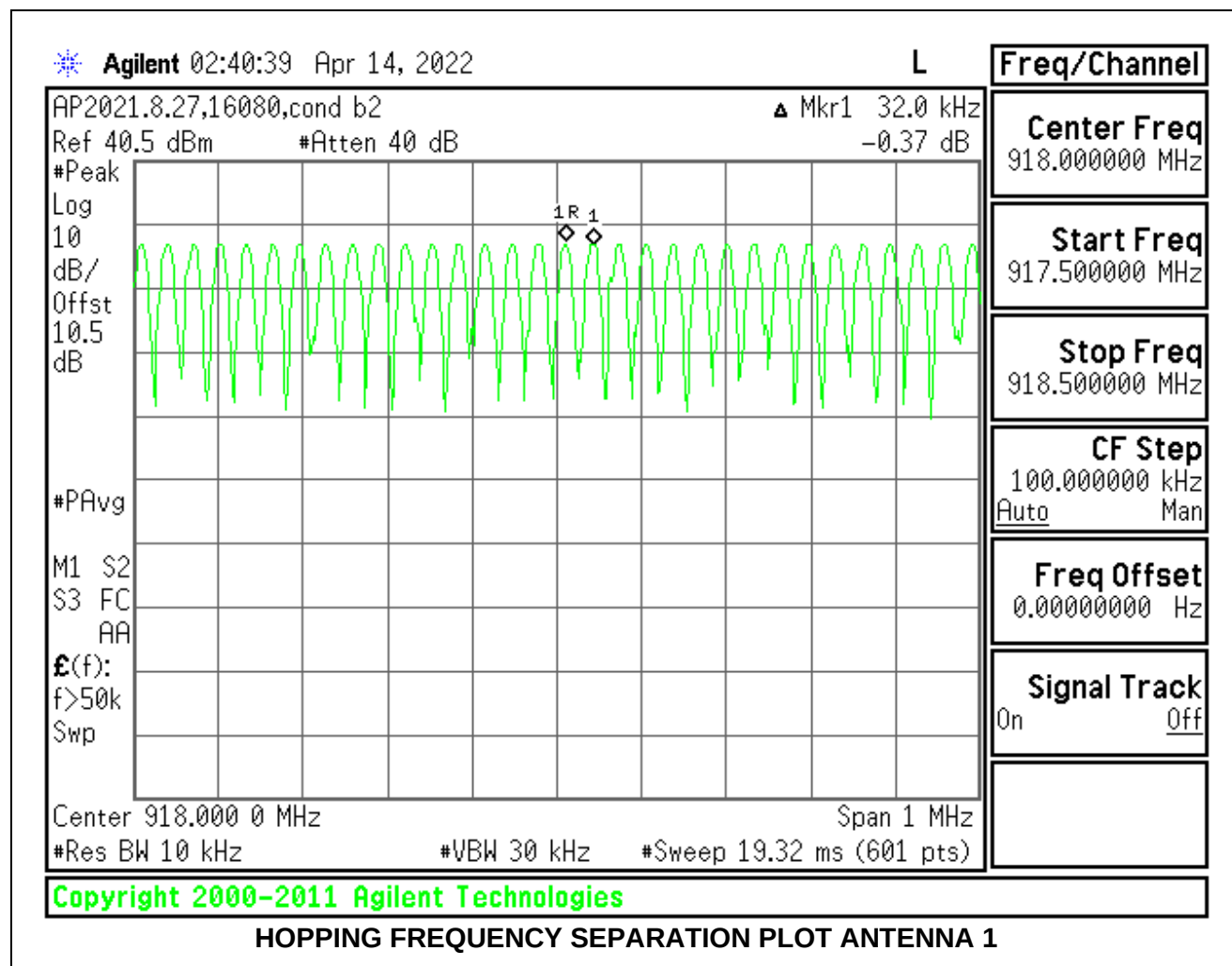
RSS-247 (5.1) (b)

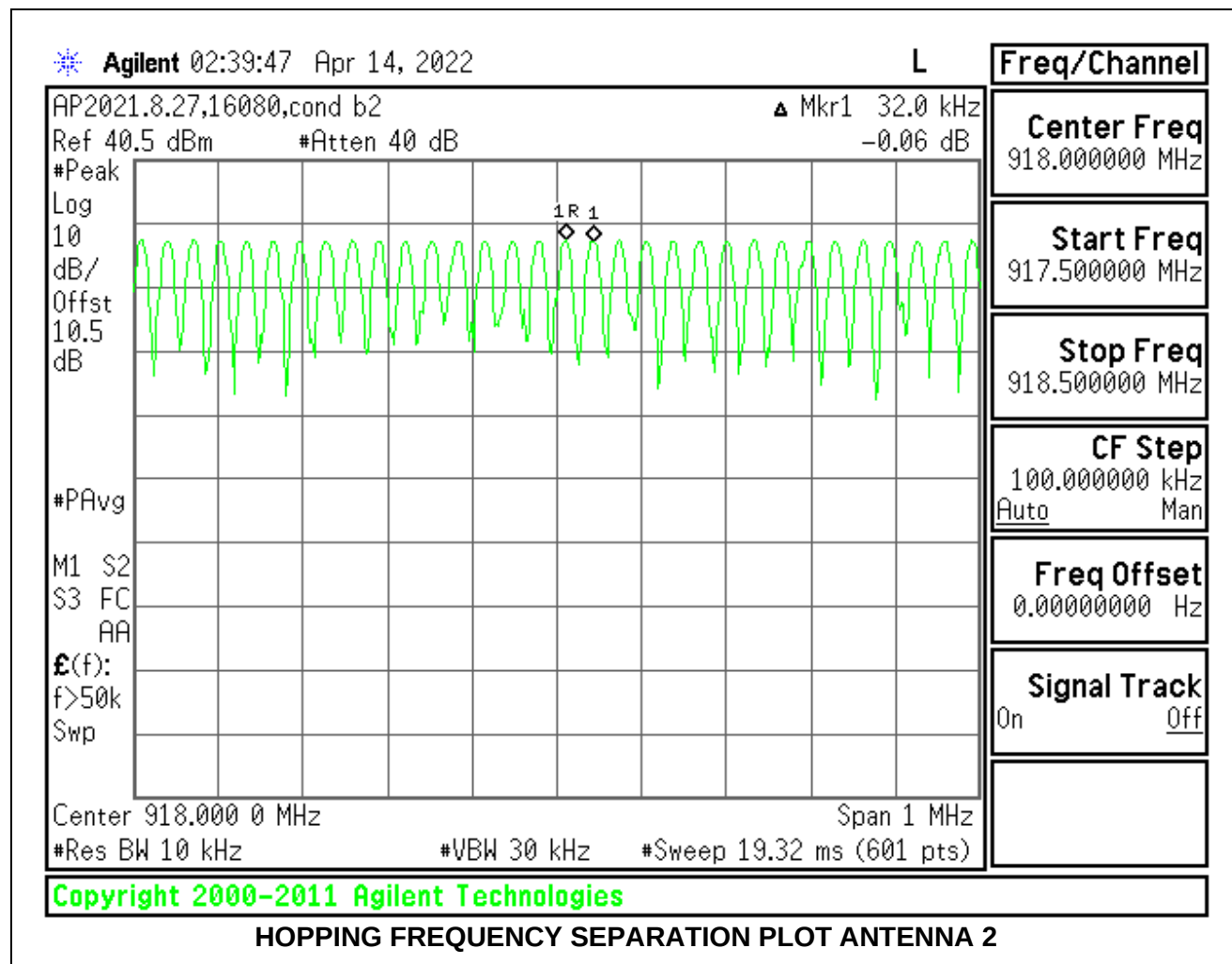
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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





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.

RSS-247 (5.1)

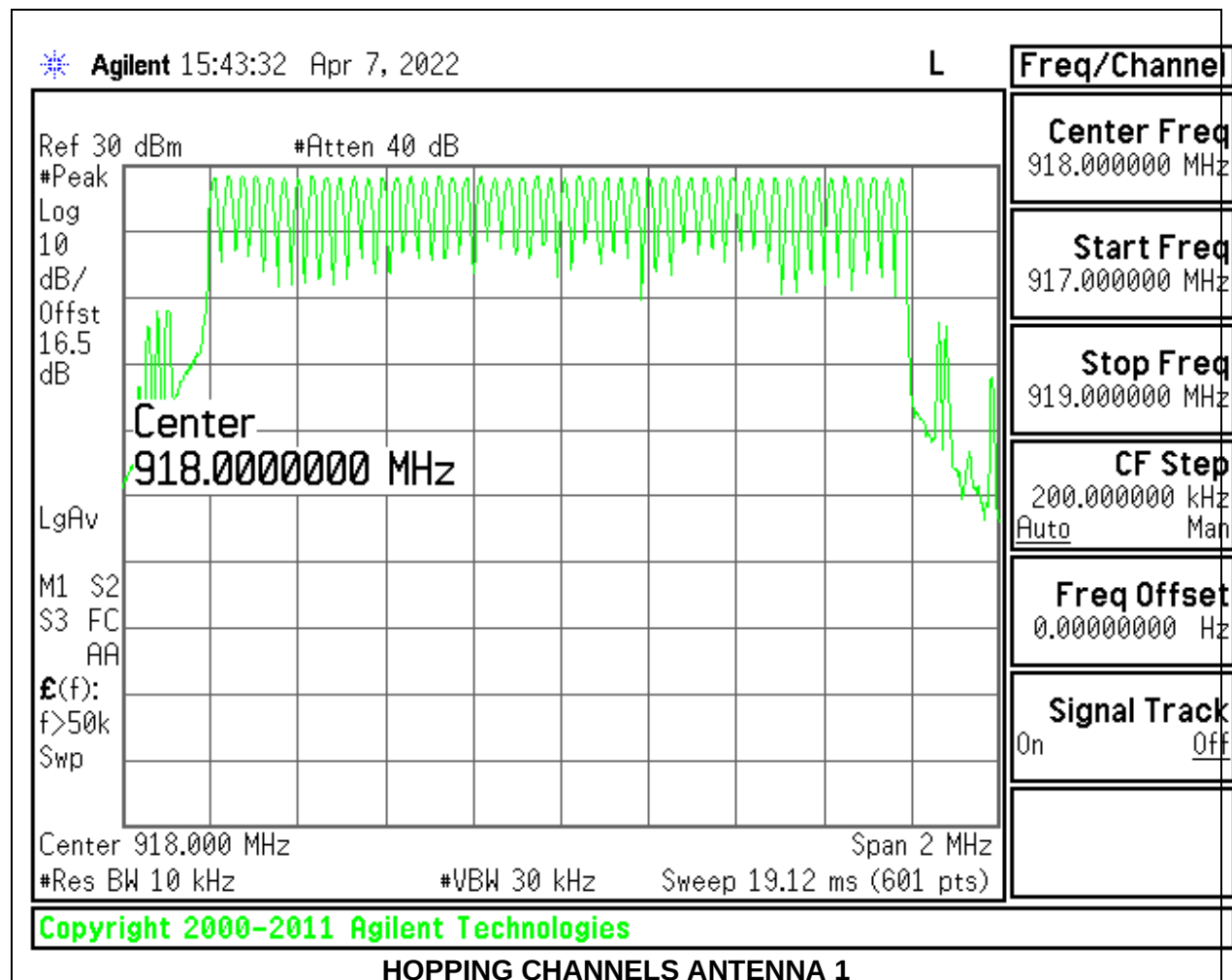
(c) For FHSS in the band 902-928 MHz: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period. If the 20 dB bandwidth of the hopping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

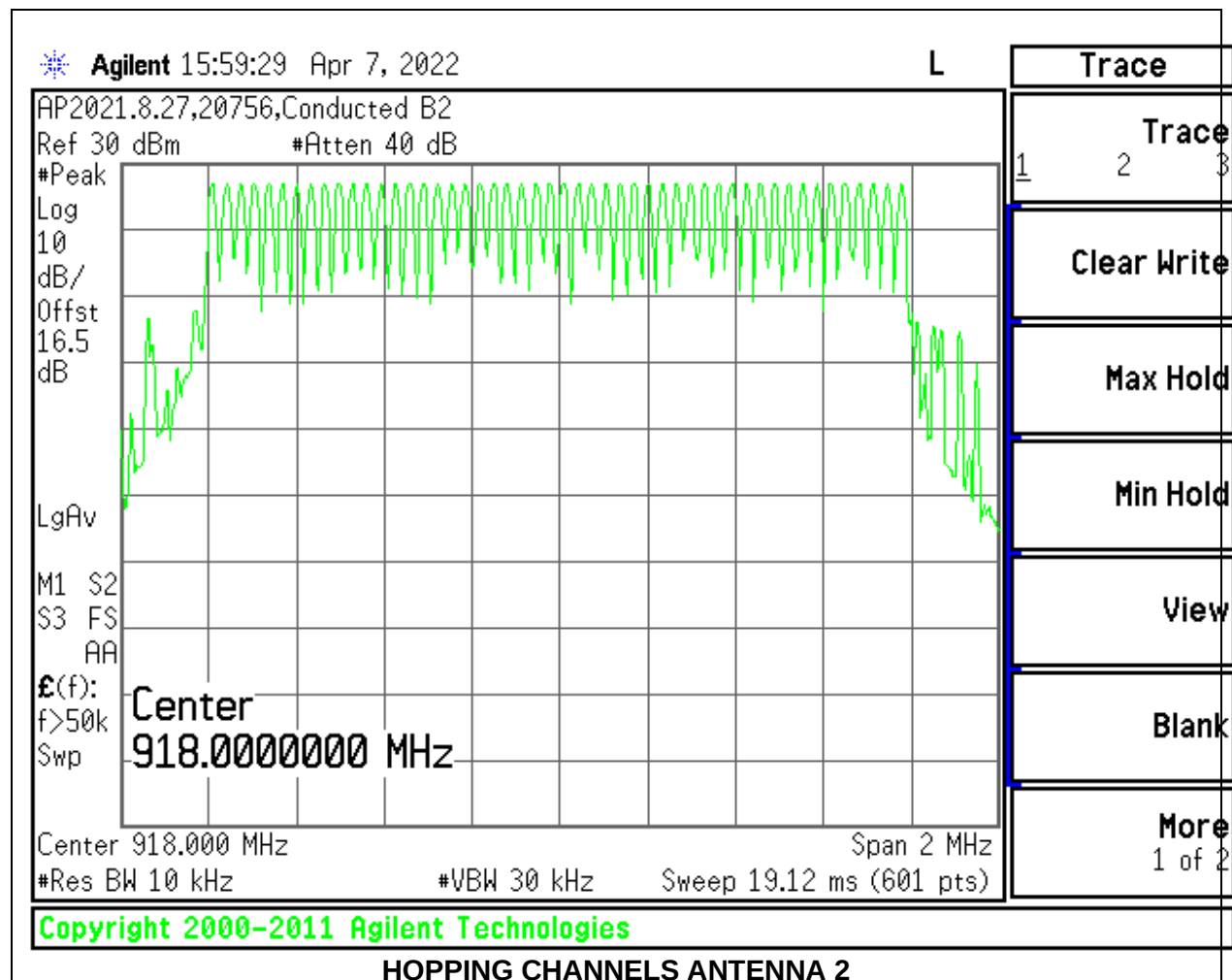
TEST PROCEDURE

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





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;

RSS-247 (5.1)

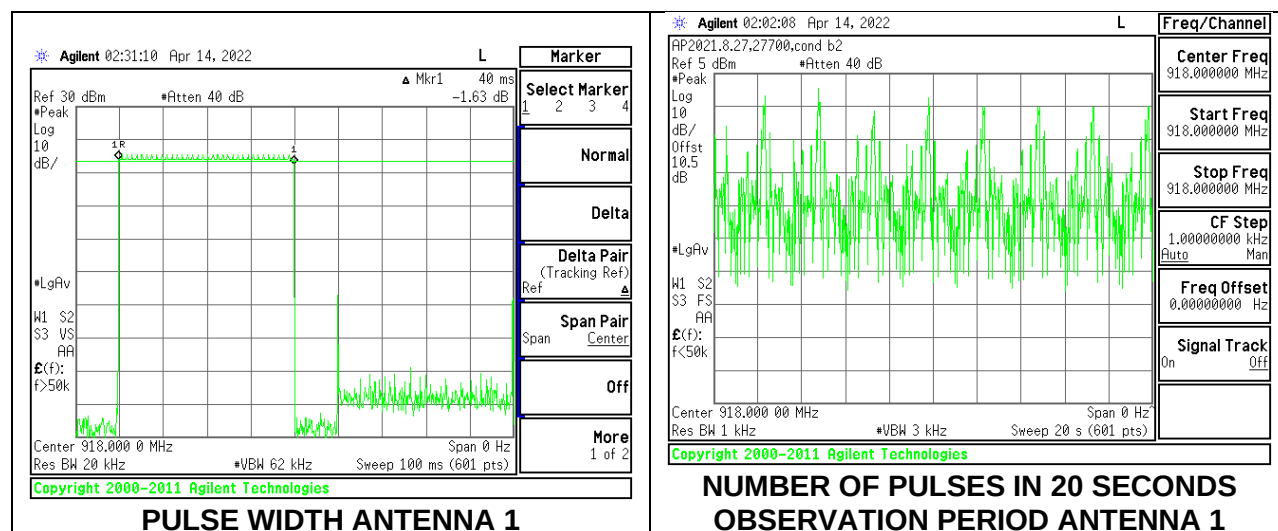
(c) For FHSS in the band 902-928 MHz: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period.

TEST PROCEDURE

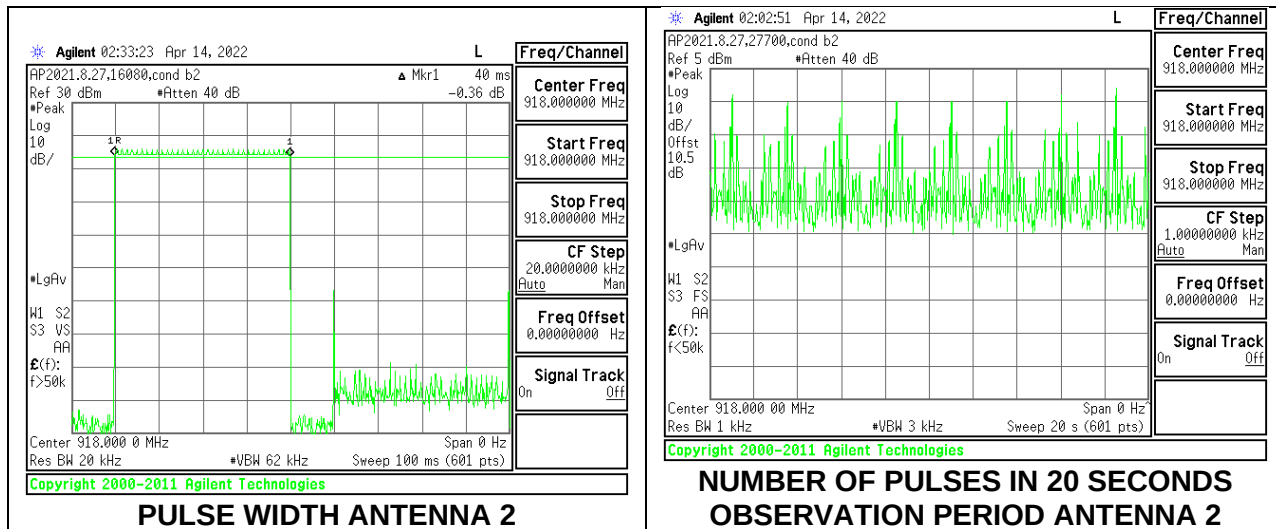
The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 5 second scan, to enable resolution of each occurrence.

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	8	0.3200	0.4	-0.0800



Pulse Width (msec)	Number of Pulses in 20 seconds	Average Time of Occupancy in 20 seconds (sec) Antenna 2	Limit (sec)	Margin (sec)
40	8	0.3200	0.4	-0.0800



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.

RSS-247 (5.4)

(a) For FHSS operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels.

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 power sensor. Peak output power was read directly from power meter.

RESULTS

Tested By:	20756
Date:	4/7/2022

Channel	Frequency (MHz)	Output Power Antenna 1 (dBm)	Output Power Antenna 2 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	917.2	27.49	26.25	29.92	30	-0.08
Middle	918	27.51	26.37	29.99	30	-0.01
High	918.8	26.92	26.85	29.90	30	-0.10

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 power sensor. Gated average output power was read directly from power meter.

RESULTS

Tested By:	20756
Date:	4/7/2022

Channel	Frequency (MHz)	Average Power Antenna 1 (dBm)	Average Power Antenna 2 (dBm)	Total Power (dBm)
Low	917.2	27.44	26.16	29.86
Middle	918	27.46	26.25	29.91
High	918.8	26.85	26.29	29.59

9.8. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 (5.5)

Limit = -20 dBc

TEST PROCEDURE

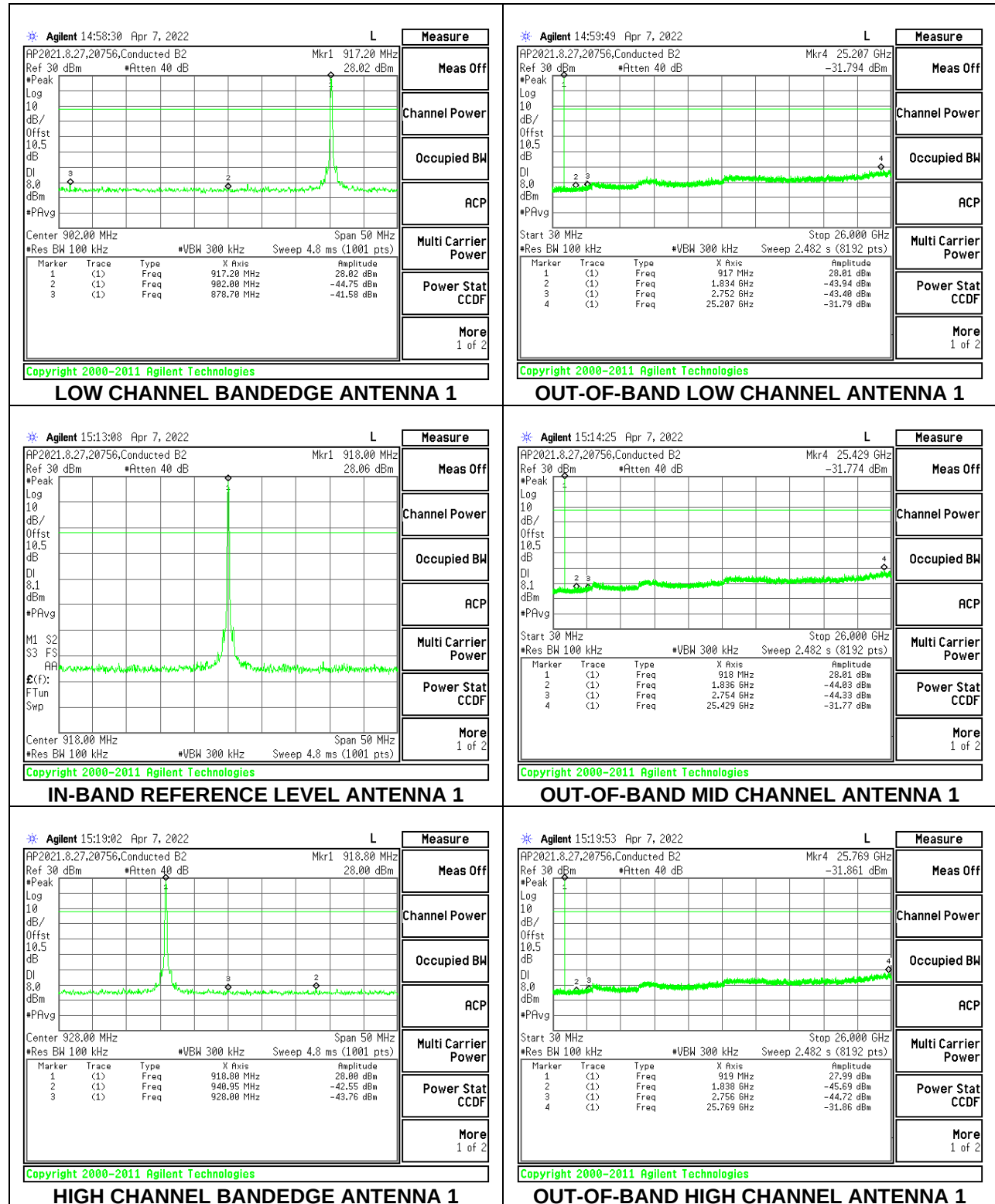
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

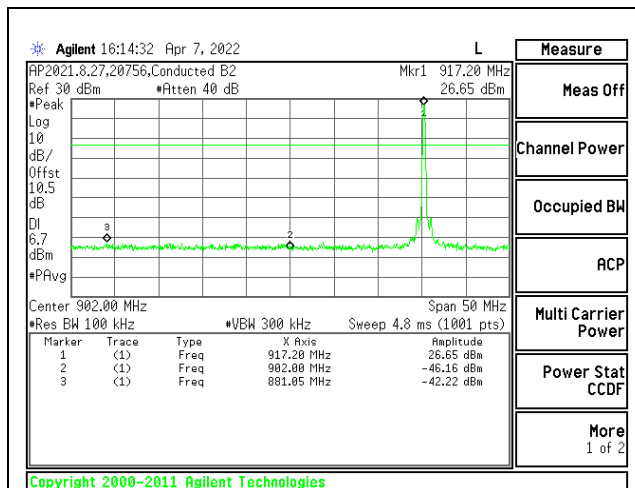
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

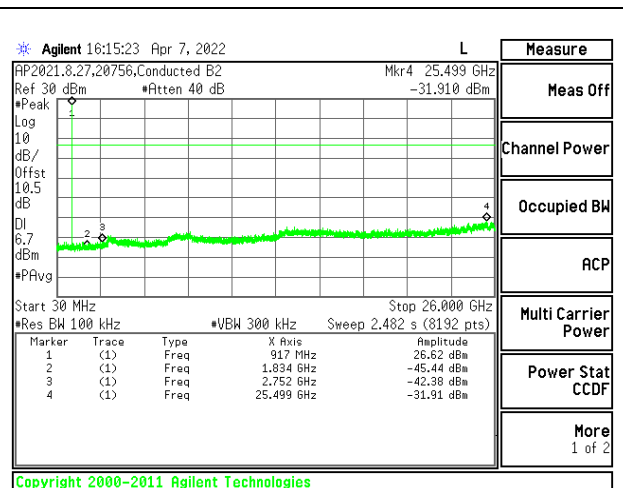
RESULTS

SPURIOUS EMISSIONS, NON-HOPPING

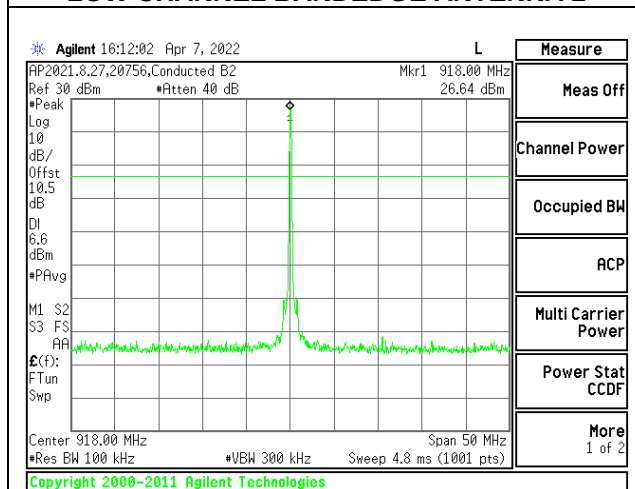




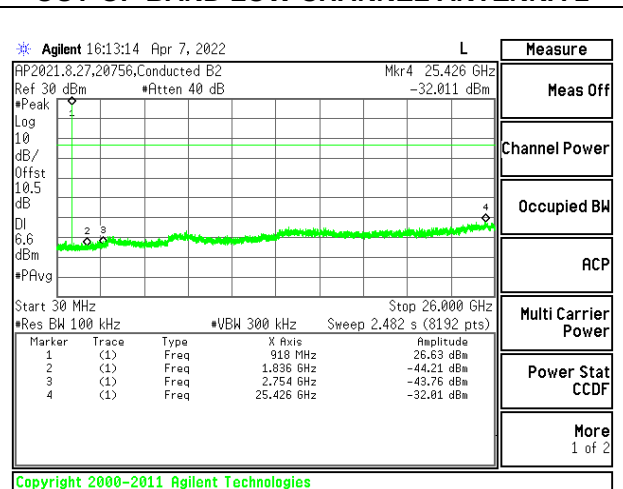
LOW CHANNEL BANDEDGE ANTENNA 2



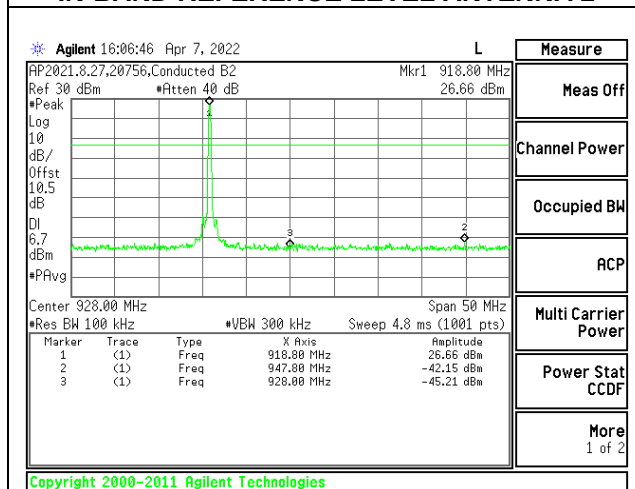
OUT-OF-BAND LOW CHANNEL ANTENNA 2



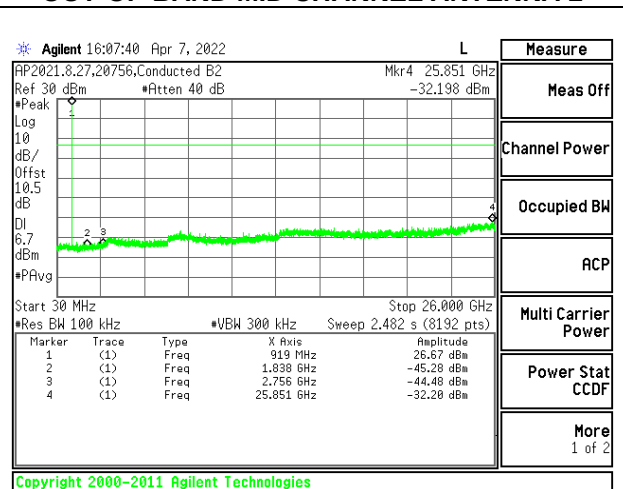
IN-BAND REFERENCE LEVEL ANTENNA 2



OUT-OF-BAND MID CHANNEL ANTENNA 2

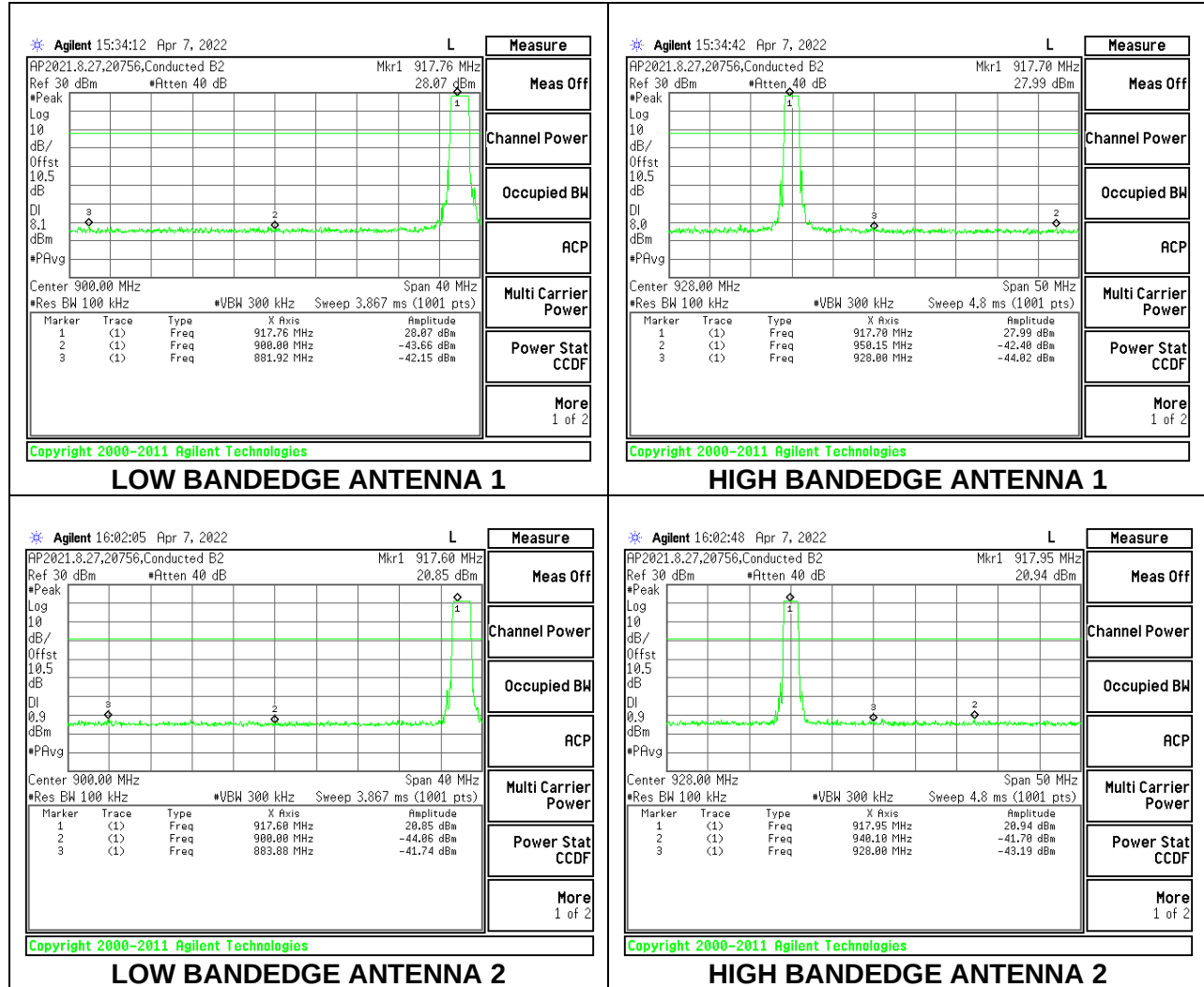


HIGH CHANNEL BANDEDGE ANTENNA 2



OUT-OF-BAND HIGH CHANNEL ANTENNA 2

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



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.

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. Blue color trace on plots: Parallel orientation. Green color trace on plots: Perpendicular orientation.

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

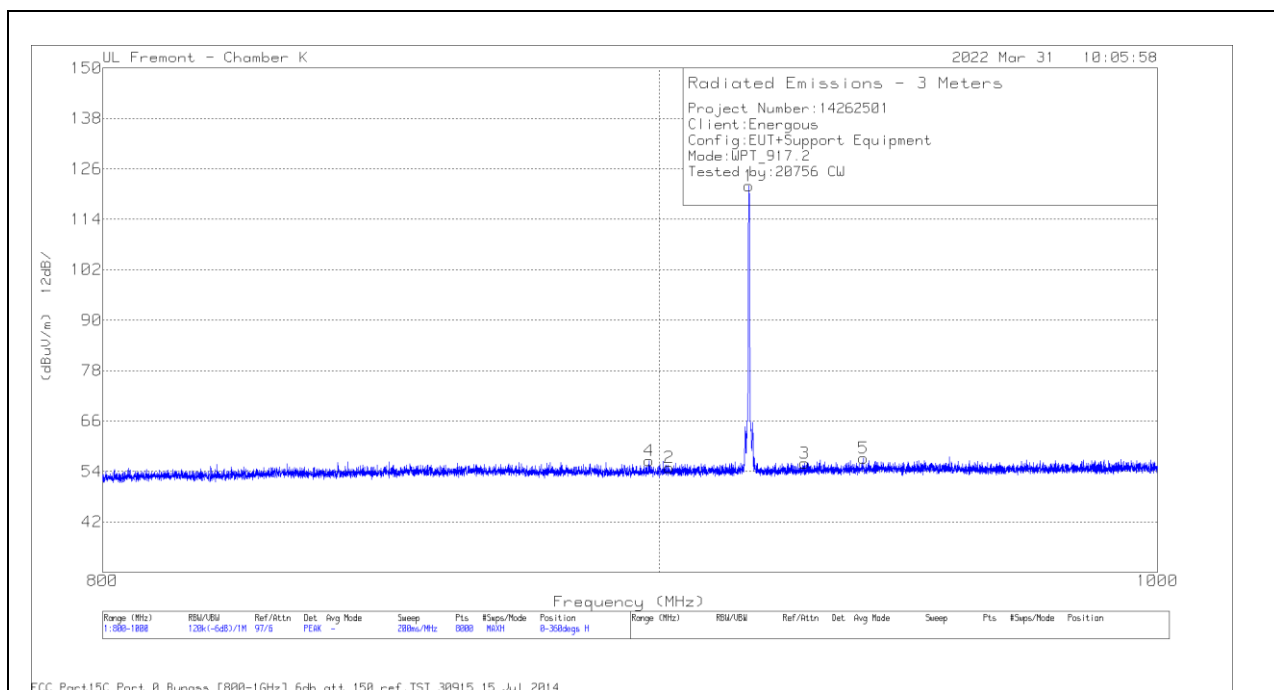
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

NOTE: The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table), using the free space impedance of 377 Ohms. For example the measurement at frequency X kHz resulted in a level of Y dBuV/m, which is equivalent to $Y - 51.5 = Z$ dBuA/m, which has the same margin, W dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

10.1. TRANSMITTER BELOW 1 GHz

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

HORIZONTAL RESULT

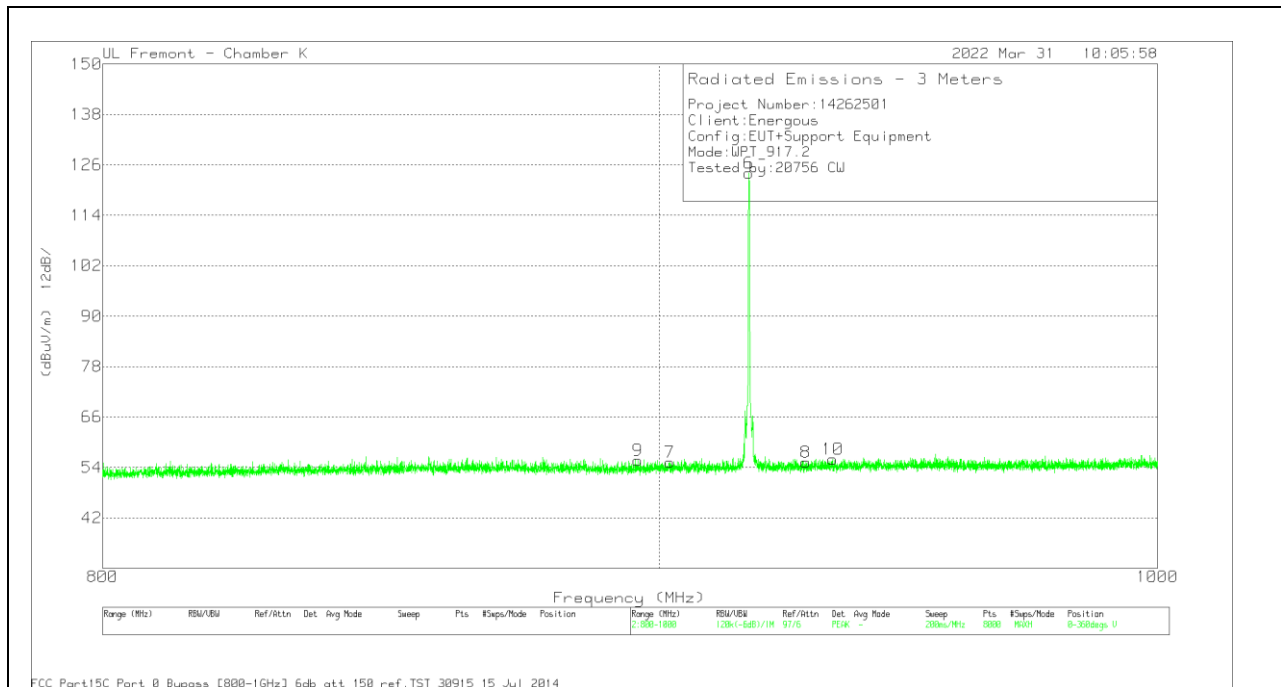


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	82258 ACF (dB)	Bypass (dB)	Corrected Reading (dBuV/m)	Azimuth (Degs)	Height (cm)	Polarity
1	917.214	88.69	Pk	28.8	4.5	121.99	0-360	101	H
2	901.837	21.62	Pk	28.9	4.4	54.92	0-360	101	H
3	928.04	22.35	Pk	29.1	4.5	55.95	0-360	394	H
4	898.012	23.45	Pk	28.7	4.4	56.55	0-360	101	H
5	939.717	23.24	Pk	29.3	4.6	57.14	0-360	101	H

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

M4 and M5 are not under restricted bands. With 20dBc from M1 121.99 dBuV= 101.99 dBuV as limit, M4 and M5 are passing.

VERTICAL RESULT



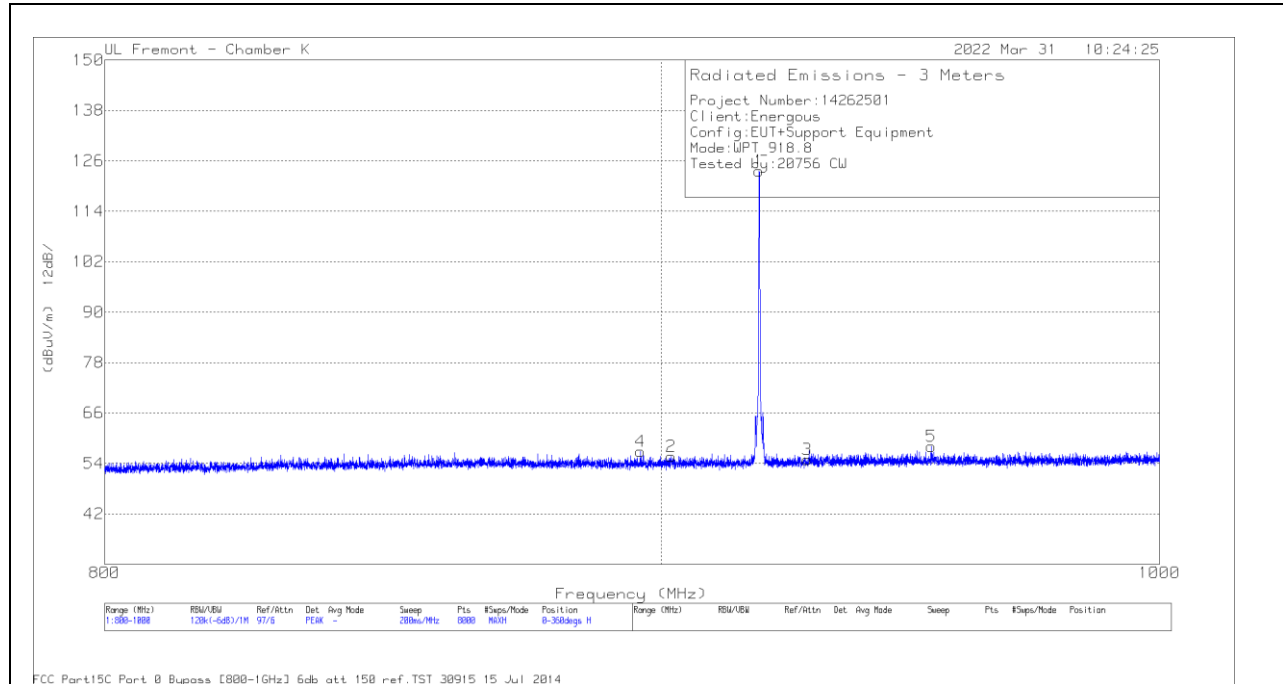
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	82258 ACF (dB)	Bypass (dB)	Corrected Reading (dBuV/m)	Azimuth (Degs)	Height (cm)	Polarity
6	917.214	90.73	Pk	28.8	4.5	124.03	0-360	101	V
7	901.937	22	Pk	28.9	4.4	55.3	0-360	101	V
8	928.365	21.62	Pk	29.1	4.5	55.22	0-360	299	V
9	895.862	22.61	Pk	28.6	4.4	55.61	0-360	299	V
10	933.591	22.31	Pk	29.1	4.5	55.91	0-360	199	V

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

M9 and M10 are not under restricted bands. With 20dBc from M6 124.03 dBuV= 104.03 dBuV as limit, M9 and M10 are passing.

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

HORIZONTAL RESULT



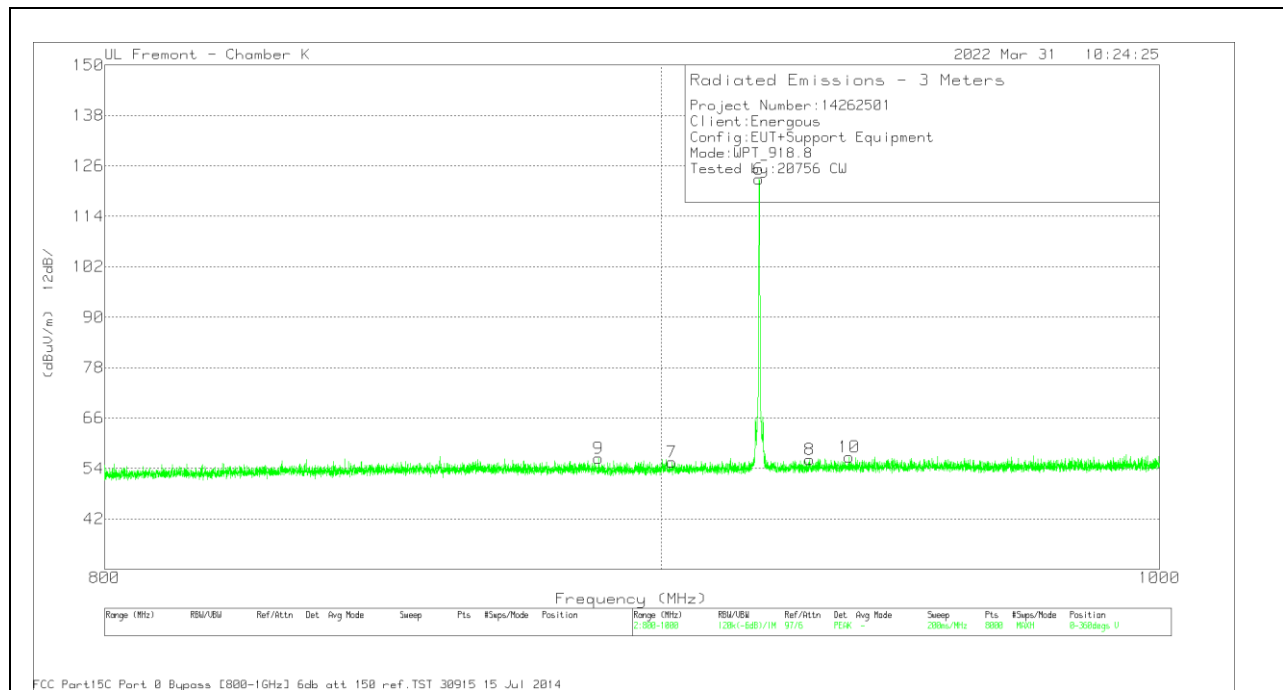
Radiated Emissions

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	82258 ACF (dB)	Bypass (dB)	Corrected Reading (dBuV/m)	Azimuth (Degs)	Height (cm)	Polarity
1	918.814	90.28	Pk	28.8	4.5	123.58	0-360	99	H
2	901.887	22.37	Pk	28.9	4.4	55.67	0-360	394	H
3	928.165	21.27	Pk	29.1	4.5	54.87	0-360	99	H
4	895.987	23.82	Pk	28.6	4.4	56.82	0-360	394	H
5	952.943	23.87	Pk	29.5	4.7	58.07	0-360	299	H

Pk – Peak detector

M4 and M5 are not under restricted bands. With 20dBc from M1 123.58 dBuV= 103.58 dBuV as limit, M4 and M5 are passing.

VERTICAL RESULT



Radiated Emissions

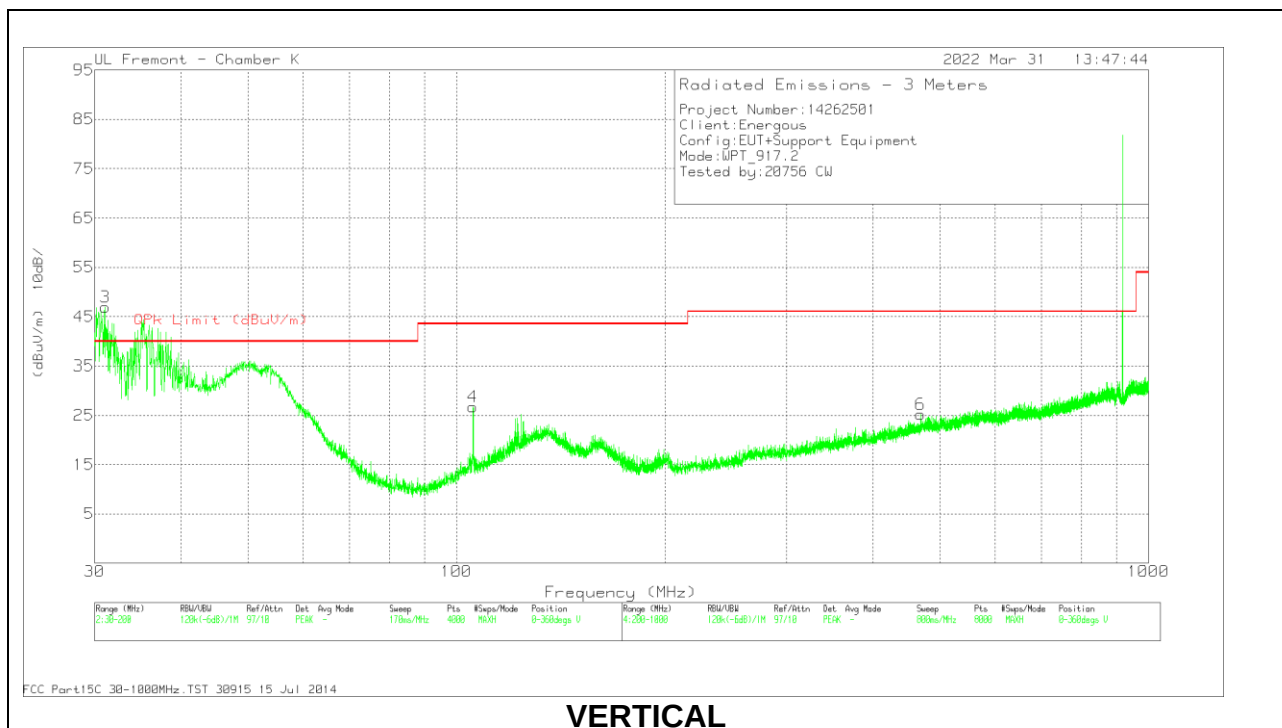
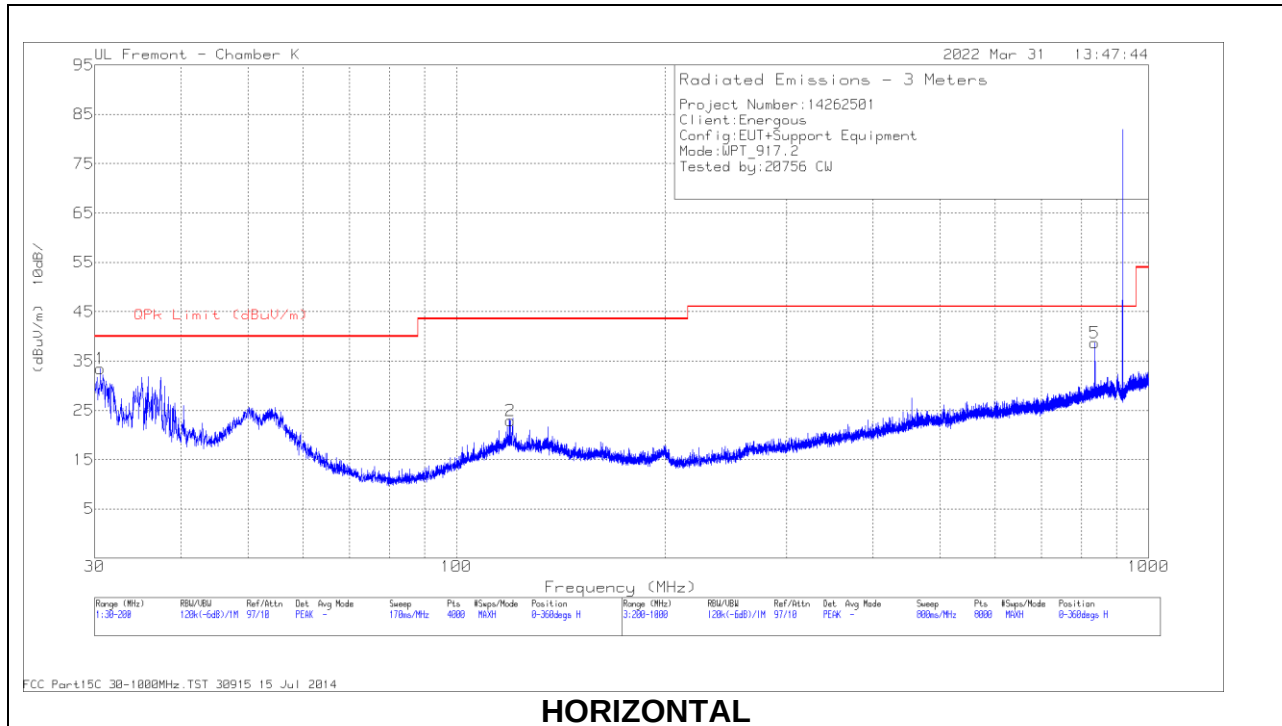
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	82258 ACF (dB)	Bypass (dB)	Corrected Reading (dBuV/m)	Azimuth (Degs)	Height (cm)	Polarity
6	918.814	89.54	Pk	28.8	4.5	122.84	0-360	199	V
7	902.012	22.18	Pk	28.9	4.4	55.48	0-360	299	V
8	928.69	22.41	Pk	29.2	4.5	56.11	0-360	299	V
9	888.161	23.48	Pk	28.5	4.4	56.38	0-360	299	V
10	936.516	22.97	Pk	29.2	4.6	56.77	0-360	101	V

Pk – Peak detector

M9 and M10 are not under restricted bands. With 20dBc from M6 122.84 dBuV= 102.84 dBuV as limit, M9 and M10 are passing.

HARMONICS AND SPURIOUS EMISSIONS (WITH NOTCH FILTER)

LOW CHANNEL RESULTS



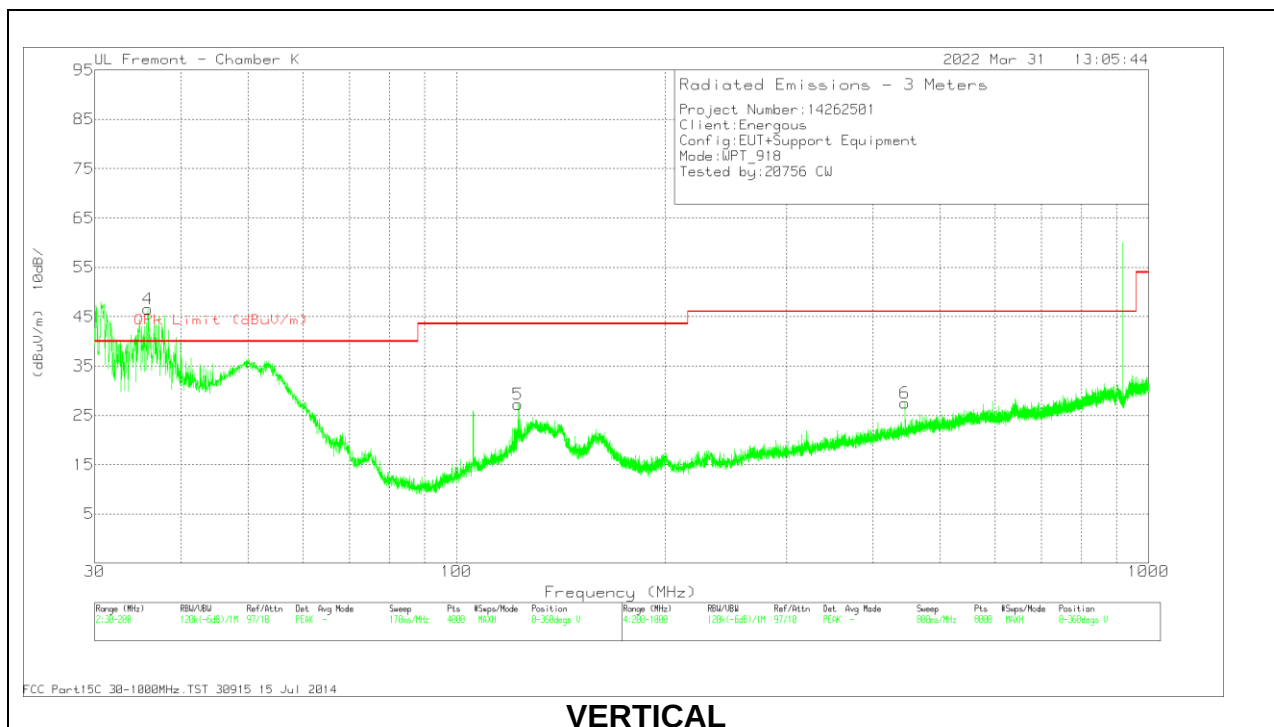
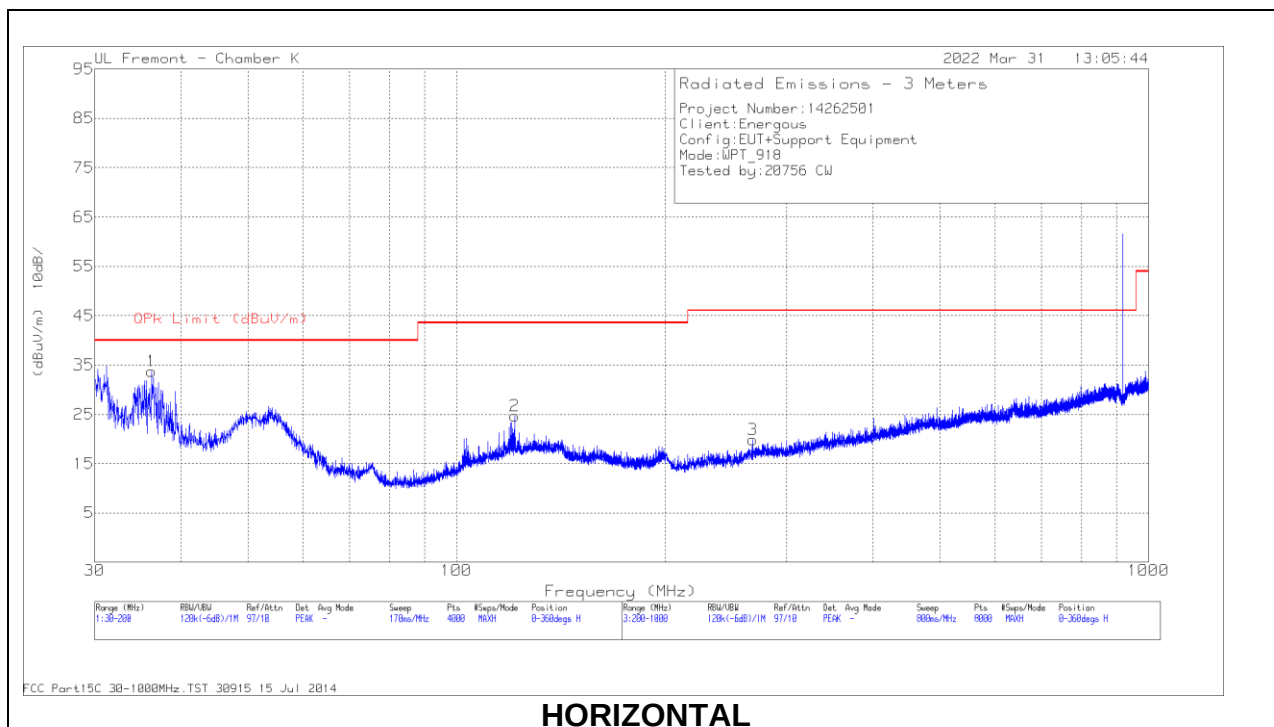
RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	82258 ACF (dB)	Amp/Cbl (dB)	T1847 BRF	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	30.6891	27.42	Qp	27.3	-31.5	0.04	23.26	40	-16.74	27	331	H
2	* 119.678	22.34	Qp	20.1	-30.8	0.12	11.76	43.52	-31.76	275	375	H
3	30.6498	40.74	Qp	27.4	-31.5	0.04	36.68	40	-3.32	255	112	V
4	105.719	36.96	Qp	18.1	-30.9	0.1	24.26	43.52	-19.26	315	109	V
5	836.196	20.11	Qp	28.2	-27.6	0.38	21.09	46.02	-24.93	86	340	H
6	468.866	20.93	Qp	23.6	-29	0.18	15.71	46.02	-30.31	297	143	V

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

Qp - Quasi-Peak detector

MID CHANNEL RESULTS

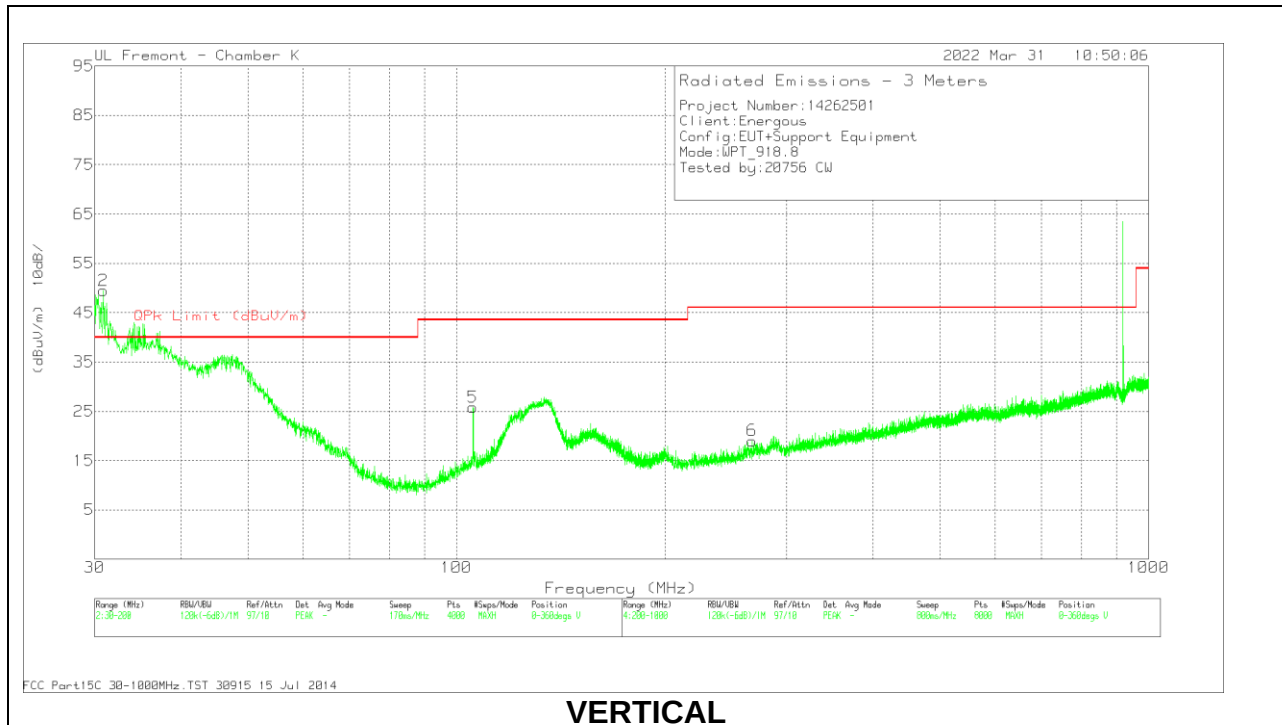
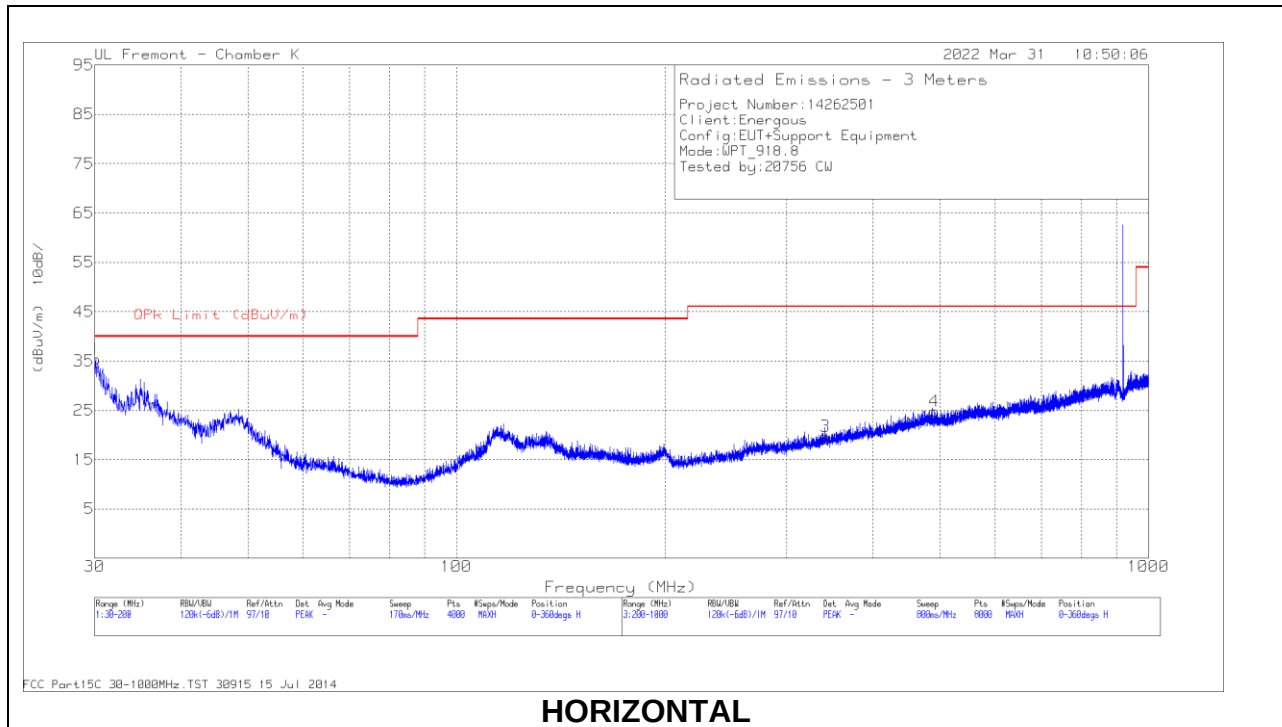


RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	82258 ACF (dB)	Amp/Cbl (dB)	T1847 BRF	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	36.3477	30.18	Qp	23	-31.5	0.04	21.72	40	-18.28	27	285	H
2	* 121.27	23.49	Qp	20.2	-30.7	0.13	13.12	43.52	-30.4	64	306	H
4	* 37.9173	41.89	Qp	21.8	-31.4	0.04	32.33	40	-7.67	110	135	V
5	* 123.027	25.74	Qp	20.3	-30.7	0.13	15.47	43.52	-28.05	92	144	V
3	* 265.791	20.86	Qp	19.4	-29.8	0.13	10.59	46.02	-35.43	100	300	H
6	444.977	30.46	Qp	22.8	-29.2	0.23	24.29	46.02	-21.73	57	105	V

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

HIGH CHANNEL RESULTS



RADIATED EMISSIONS

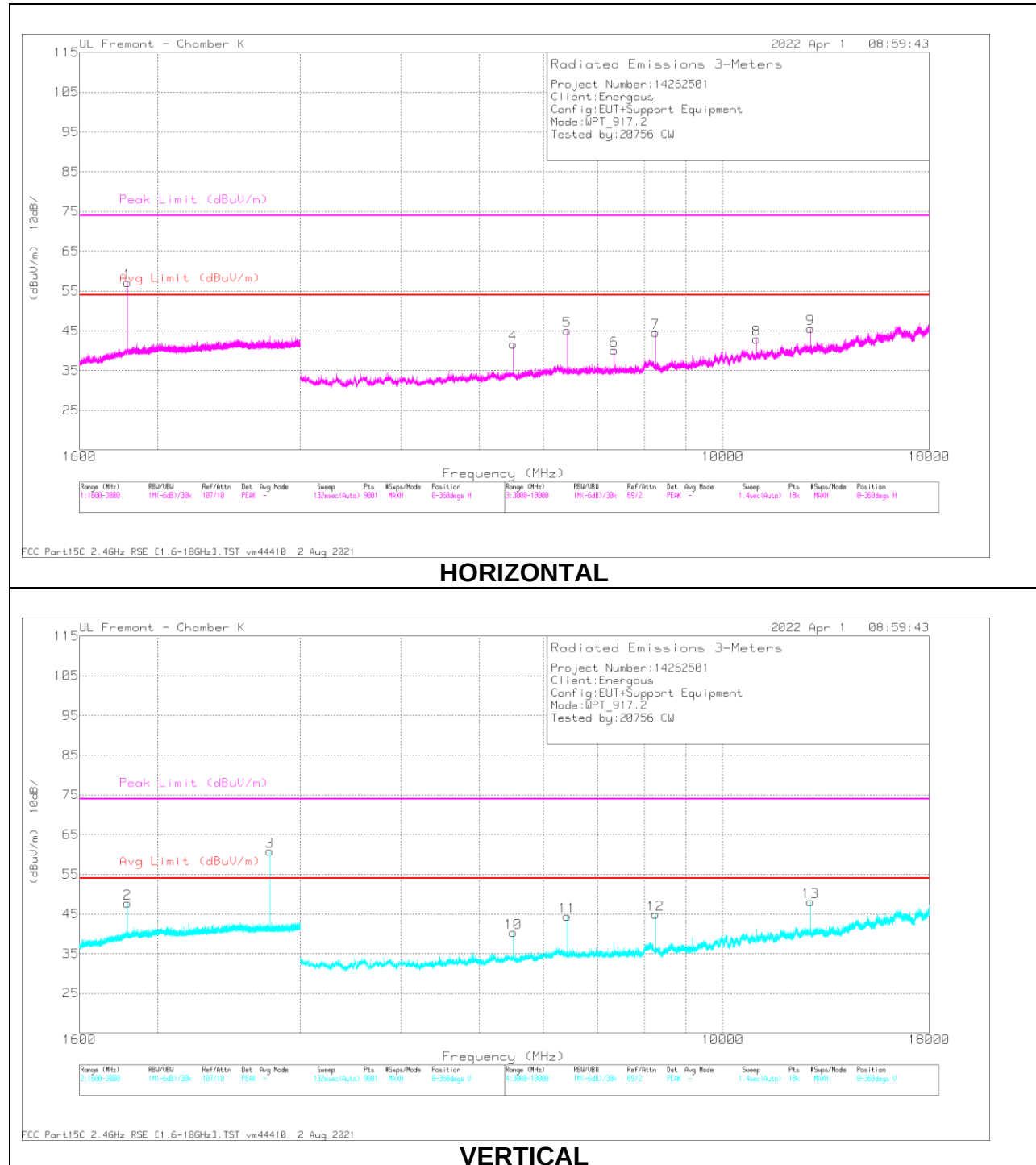
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	82258 ACF (dB)	Amp/Cbl (dB)	T1847 BRF	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	30.0615	30.74	Qp	27.9	-31.5	0.04	27.18	40	-12.82	44	202	H
2	30.8694	43.22	Qp	27.2	-31.5	0.04	38.96	40	-1.04	281	102	V
5	105.7	34.11	Qp	18.1	-30.9	0.01	21.32	43.52	-22.2	255	106	V
3	341.037	21.19	Qp	20.6	-29.6	0.19	12.38	46.02	-33.64	298	289	H
4	490.069	20.69	Qp	24	-29	0.22	15.91	46.02	-30.11	83	311	H
6	* 267.531	20.79	Qp	19.4	-29.9	0.13	10.42	46.02	-35.6	286	362	V

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

10.2. TRANSMITTER ABOVE 1 GHz

HARMONICS AND SPURIOUS EMISSIONS (WITH HPF 204786)

LOW CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 80404 (dB/m)	Amp/Cbl/Filtr/ Pad (dB)	HPF 204786	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1833.972	53.16	PKFH	30.7	-35.8	0.62	48.68	-	-	-	-	188	99	H
	1834.355	40.44	VA1T	30.7	-35.8	0.62	35.96	-	-	-	-	188	99	H
3	* 2751.861	53.02	PKFH	32.5	-33.4	0.5	52.62	-	-	74	-21.38	292	178	V
	* 2751.609	39.93	VA1T	32.5	-33.4	0.5	39.53	54	-14.47	-	-	292	178	V
6	* 7337.563	47.2	PKFH	35.8	-37.2	0.48	46.28	-	-	74	-27.72	39	106	H
	* 7337.695	38.76	VA1T	35.8	-37.2	0.48	37.84	54	-16.16	-	-	39	106	H
7	* 8254.51	44.6	PKFH	36	-36.5	0.49	44.59	-	-	74	-29.41	38	159	H
	* 8254.661	33.35	VA1T	36	-36.5	0.49	33.34	54	-20.66	-	-	38	159	H
8	* 11006.466	45.44	PKFH	38.1	-34.8	0.56	49.3	-	-	74	-24.7	351	148	H
	* 11006.471	36.68	VA1T	38.1	-34.8	0.56	40.54	54	-13.46	-	-	351	148	H
11	6420.463	51.65	PKFH	35.9	-38.4	0.44	49.59	-	-	-	-	62	175	V
	6420.467	46.86	VA1T	35.9	-38.4	0.44	44.8	-	-	-	-	62	175	V
12	* 8254.483	45.43	PKFH	36	-36.5	0.49	45.42	-	-	74	-28.58	70	122	V
	* 8254.659	37.12	VA1T	36	-36.5	0.49	37.11	54	-16.89	-	-	70	122	V

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

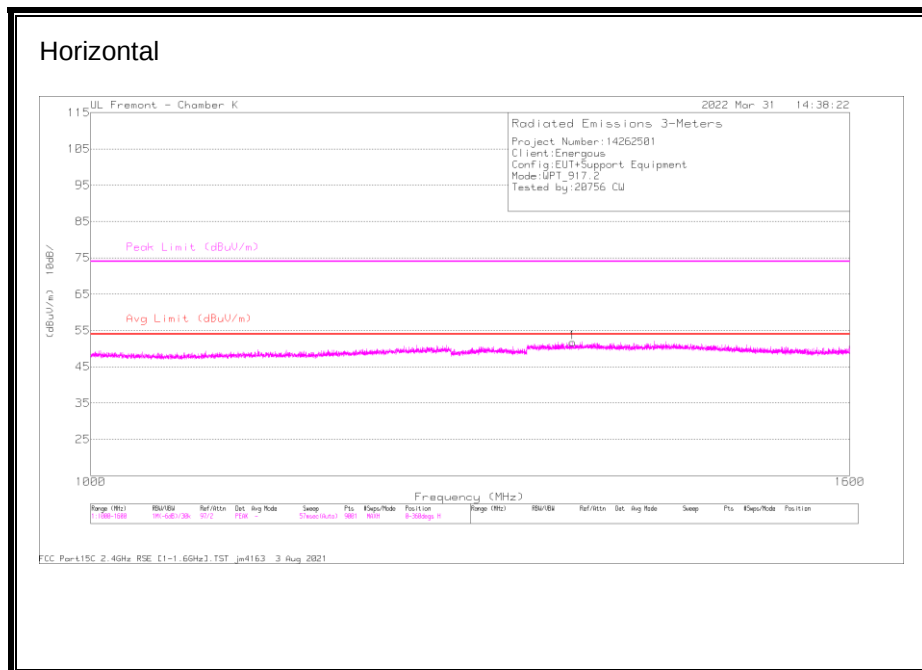
NOTE: Worst highest 5 markers frequencies in restricted bands are picked, the rest of the markers are in non restricted band.

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

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

Tested by:	20756 CW
Date:	3/31/2022



DATA

Frequency (MHz)	Meter Reading (dBuV)	Det	AF 80404 (dBm)	Bypass (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1347.191	24.96	PKFH	29.2	5.3	59.46	-	-	74	-14.54	355	288	H
* 1349.536	11.37	VA1T	29.2	5.3	45.87	54	-8.13	-	-	355	288	H

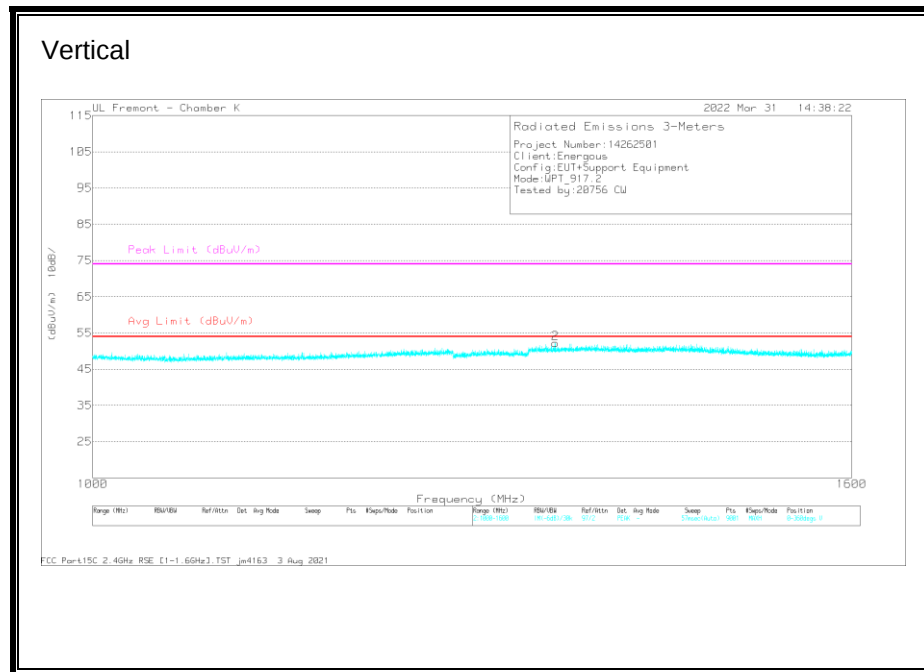
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

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.



DATA

Frequency (MHz)	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
* 1330.192	24.43	PKFH	28.9	5.3	58.63	-	-	74	-15.37	244	198	V
* 1333.685	11.49	VA1T	29.1	5.3	45.89	54	-8.11	-	-	244	198	V

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

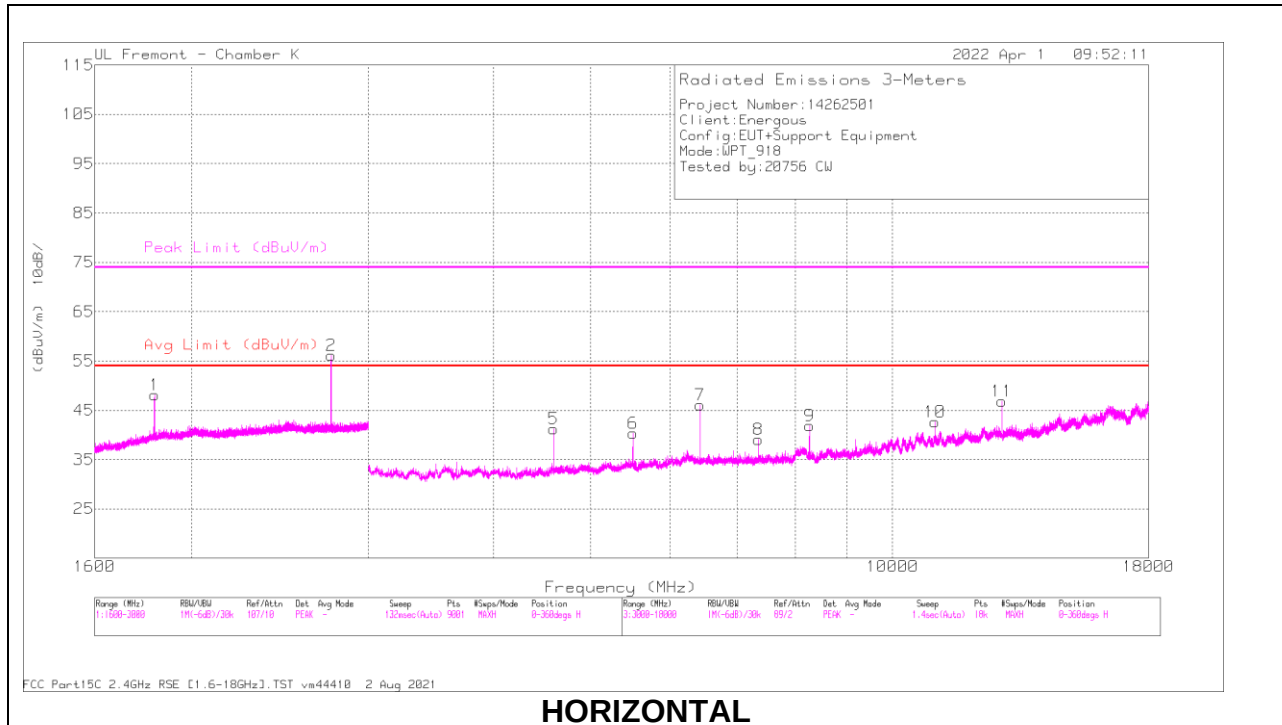
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

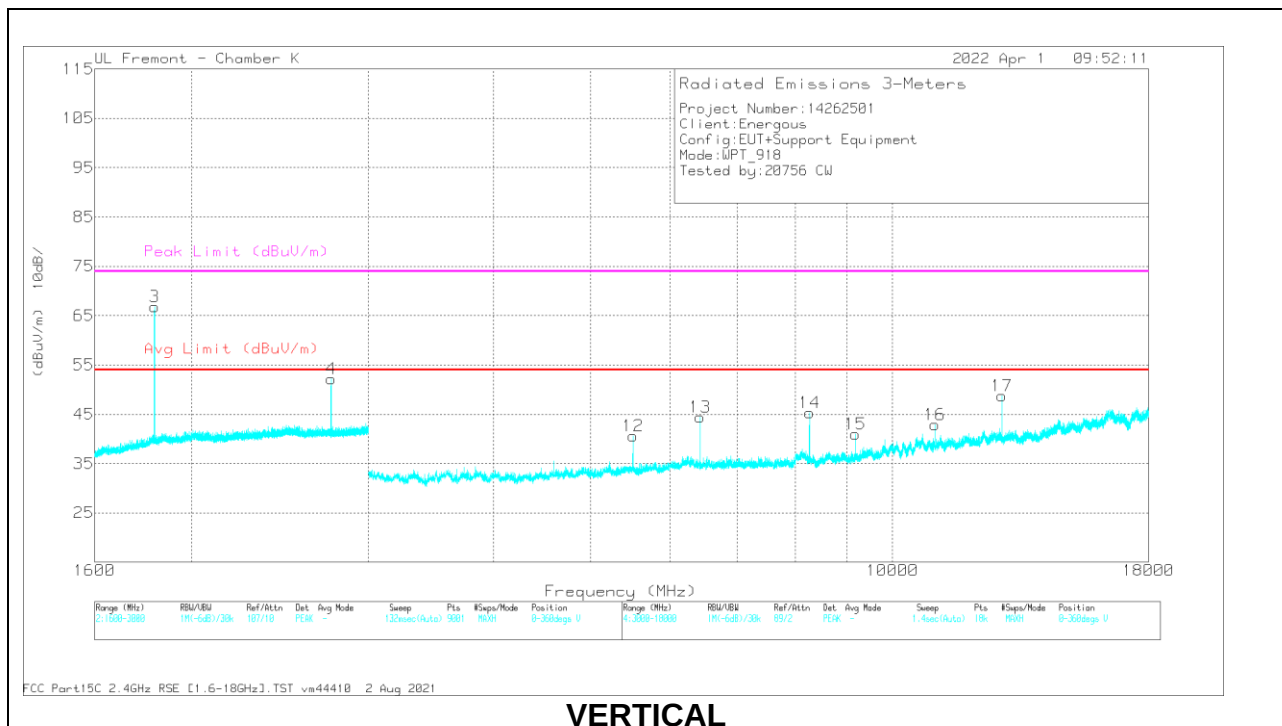
Note:

- Test was performed @ 3 meter distance.

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 80404 (dB/m)	Amp/Cbl/Filtr/ Pad (dB)	HPF 204786	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2753.954	50.72	PKFH	32.5	-33.4	0.5	50.32	-	-	74	-23.68	288	144	H
	* 2754.094	38.27	VA1T	32.5	-33.4	0.5	37.87	54	-16.13	-	-	288	144	H
4	* 2753.614	50.71	PKFH	32.5	-33.4	0.5	50.31	-	-	74	-23.69	305	320	V
	* 2754.178	37.46	VA1T	32.5	-33.4	0.5	37.06	54	-16.94	-	-	305	320	V
9	* 8261.893	46.16	PKFH	36	-36.4	0.49	46.25	-	-	74	-27.75	165	113	H
	* 8262.081	37.6	VA1T	36	-36.4	0.49	37.69	54	-16.31	-	-	165	113	H
10	* 11016.211	46.18	PKFH	38	-34.9	0.59	49.87	-	-	74	-24.13	241	100	H
	* 11016.141	37.95	VA1T	38	-34.9	0.59	41.64	54	-12.36	-	-	241	100	H
14	* 8262.249	48.25	PKFH	36	-36.4	0.49	48.34	-	-	74	-25.66	213	130	V
	* 8262.093	40.23	VA1T	36	-36.4	0.49	40.32	54	-13.68	-	-	213	130	V
16	* 11016.134	46.1	PKFH	38	-34.9	0.59	49.79	-	-	74	-24.21	202	102	V
	* 11016.113	37.59	VA1T	38	-34.9	0.59	41.28	54	-12.72	-	-	202	102	V

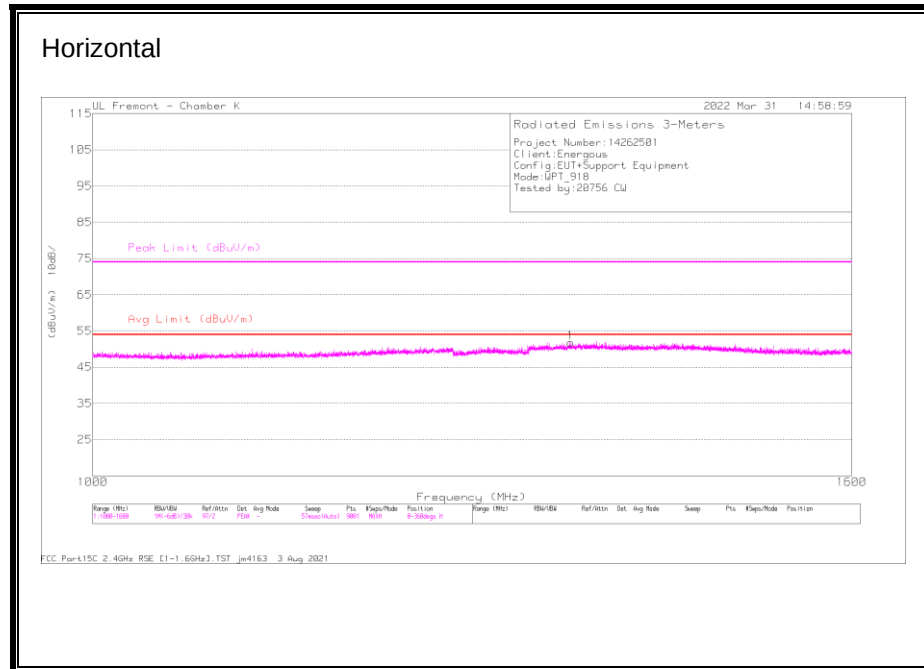
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

NOTE: Worst highest 6 markers frequencies in restricted bands are picked and maximized.

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

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

Tested by:	20756 CW
Date:	3/31/2022



DATA

Frequency (MHz)	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
* 1344.496	23.15	PKFH	29.2	5.3	57.65	-	-	74	-16.35	269	136	H
* 1344.351	11.29	VA1T	29.2	5.3	45.79	54	-8.21	-	-	269	136	H

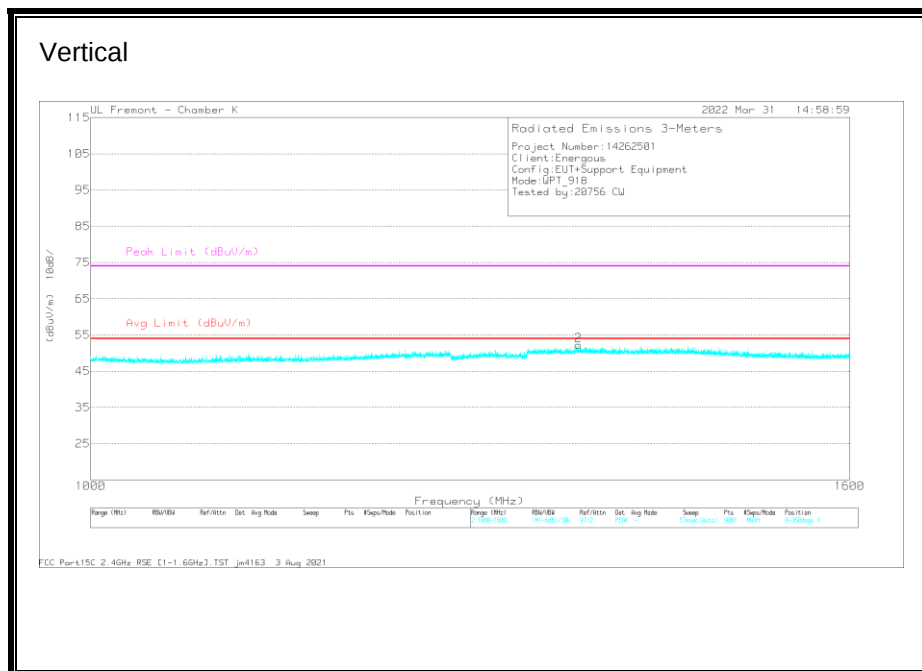
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

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.



DATA

Frequency (MHz)	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
* 1353.168	24.63	PKFH	29.3	5.4	59.33	-	-	74	-14.67	344	275	V
* 1354.635	11.42	VA1T	29.3	5.4	46.12	54	-7.88	-	-	344	275	V

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

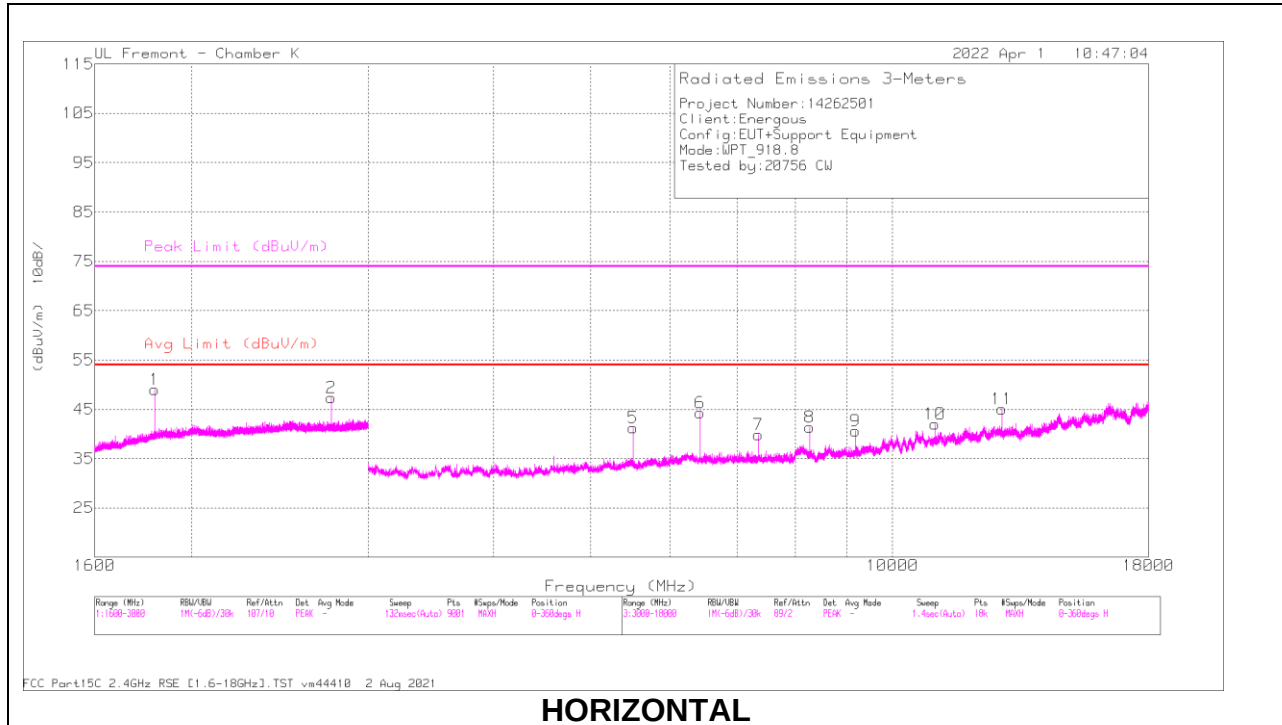
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

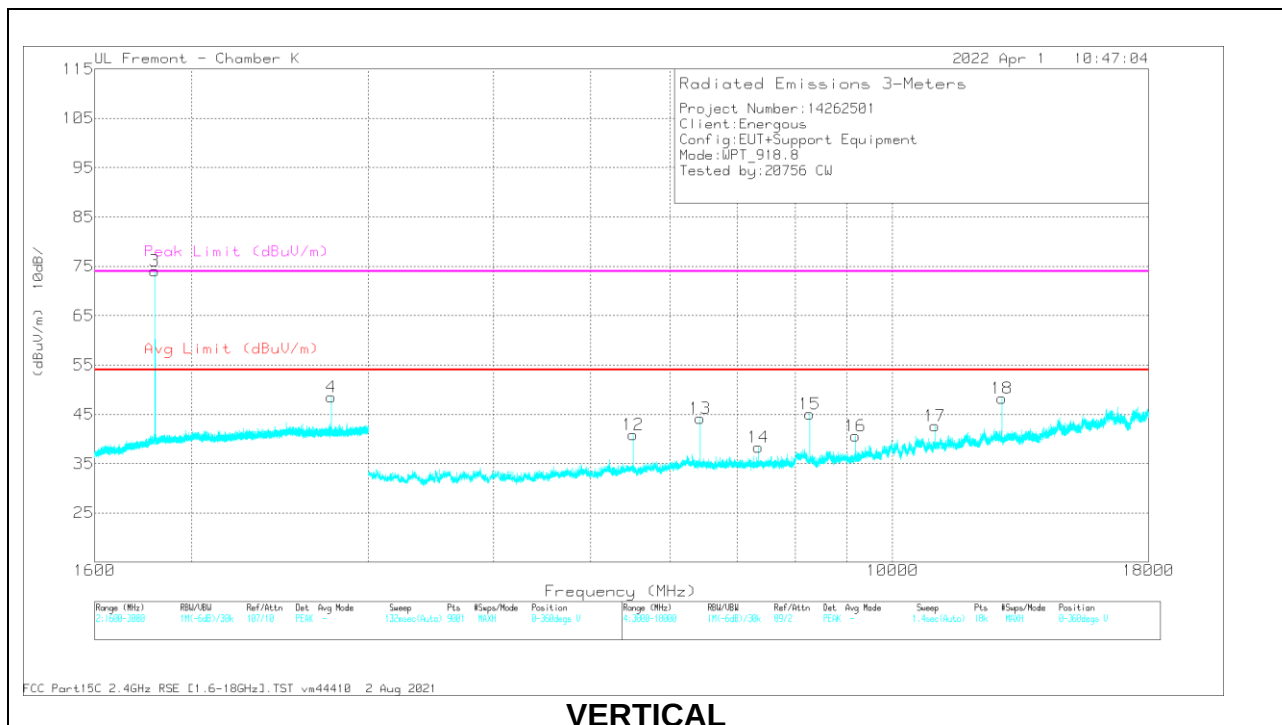
Note:

- Test was performed @ 3 meter distance.

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF 80404 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	HPF 204786	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2757.59	50.38	PKFH	32.5	-33.4	0.51	49.99	-	-	74	-24.01	360	382	H
	* 2756.419	37.4	VA1T	32.5	-33.4	0.51	37.01	54	-16.99	-	-	360	382	H
4	* 2758.106	50.04	PKFH	32.5	-33.4	0.51	49.65	-	-	74	-24.35	155	303	V
	* 2755.229	37.4	VA1T	32.5	-33.4	0.51	37.01	54	-16.99	-	-	155	303	V
8	* 8268.998	48.47	PKFH	36	-36.4	0.48	48.55	-	-	74	-25.45	314	116	H
	* 8269.29	41.07	VA1T	36	-36.4	0.48	41.15	54	-12.85	-	-	314	116	H
10	* 11025.436	46.06	PKFH	38.1	-35.1	0.6	49.66	-	-	74	-24.34	349	307	H
	* 11025.645	38	VA1T	38.1	-35.2	0.6	41.5	54	-12.5	-	-	349	307	H
15	* 8269.322	49.22	PKFH	36	-36.4	0.49	49.31	-	-	74	-24.69	36	168	V
	* 8269.282	44.25	VA1T	36	-36.4	0.49	44.34	54	-9.66	-	-	36	168	V
17	* 11025.553	46.52	PKFH	38.1	-35.1	0.6	50.12	-	-	74	-23.88	353	116	V
	* 11025.645	38.77	VA1T	38.1	-35.2	0.6	42.27	54	-11.73	-	-	353	116	V

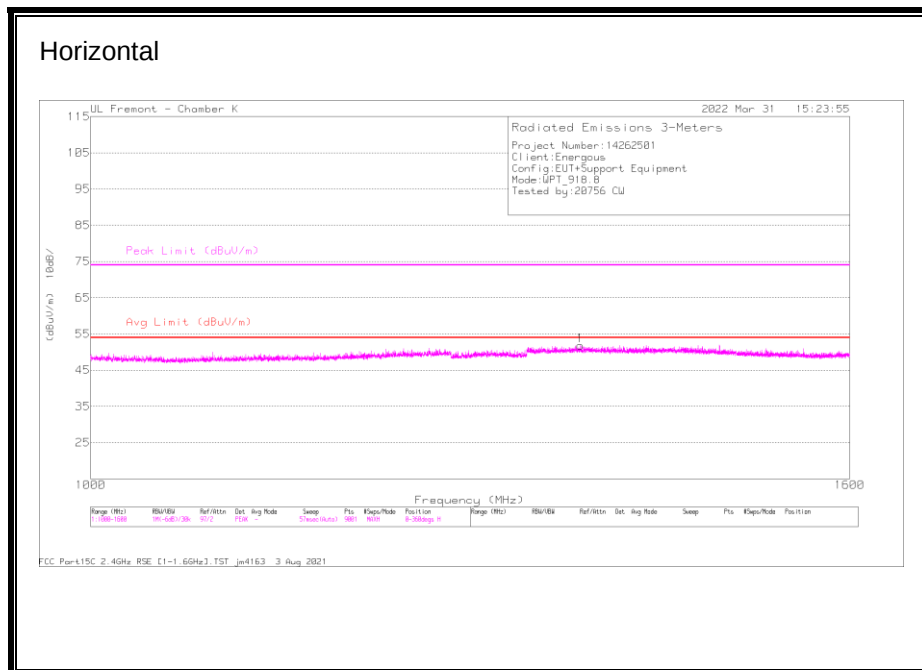
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

NOTE: Worst highest 6 markers frequencies in restricted bands are picked and maximized.

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

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

Tested by:	20756 CW
Date:	3/31/2022



DATA

Frequency (MHz)	Meter Reading (dBuV)	Det	AF 80404 (dBm)	Bypass (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1352.965	24.59	PKFH	29.3	5.4	59.29	-	-	74	-14.71	261	192	H
* 1356.309	11.4	VA1T	29.2	5.4	46	54	-8	-	-	261	192	H

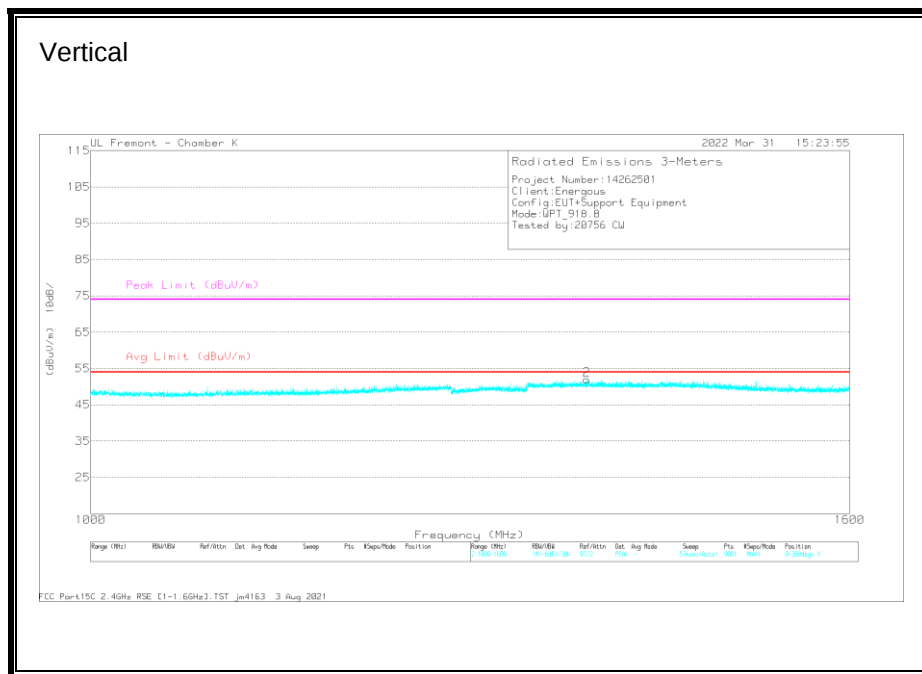
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

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.



DATA

Frequency (MHz)	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
* 1360.591	25.8	PKFH	29.3	5.4	60.5	-	-	74	-13.5	78	335	V
* 1361.415	11.45	VA1T	29.3	5.4	46.15	54	-7.85	-	-	78	335	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

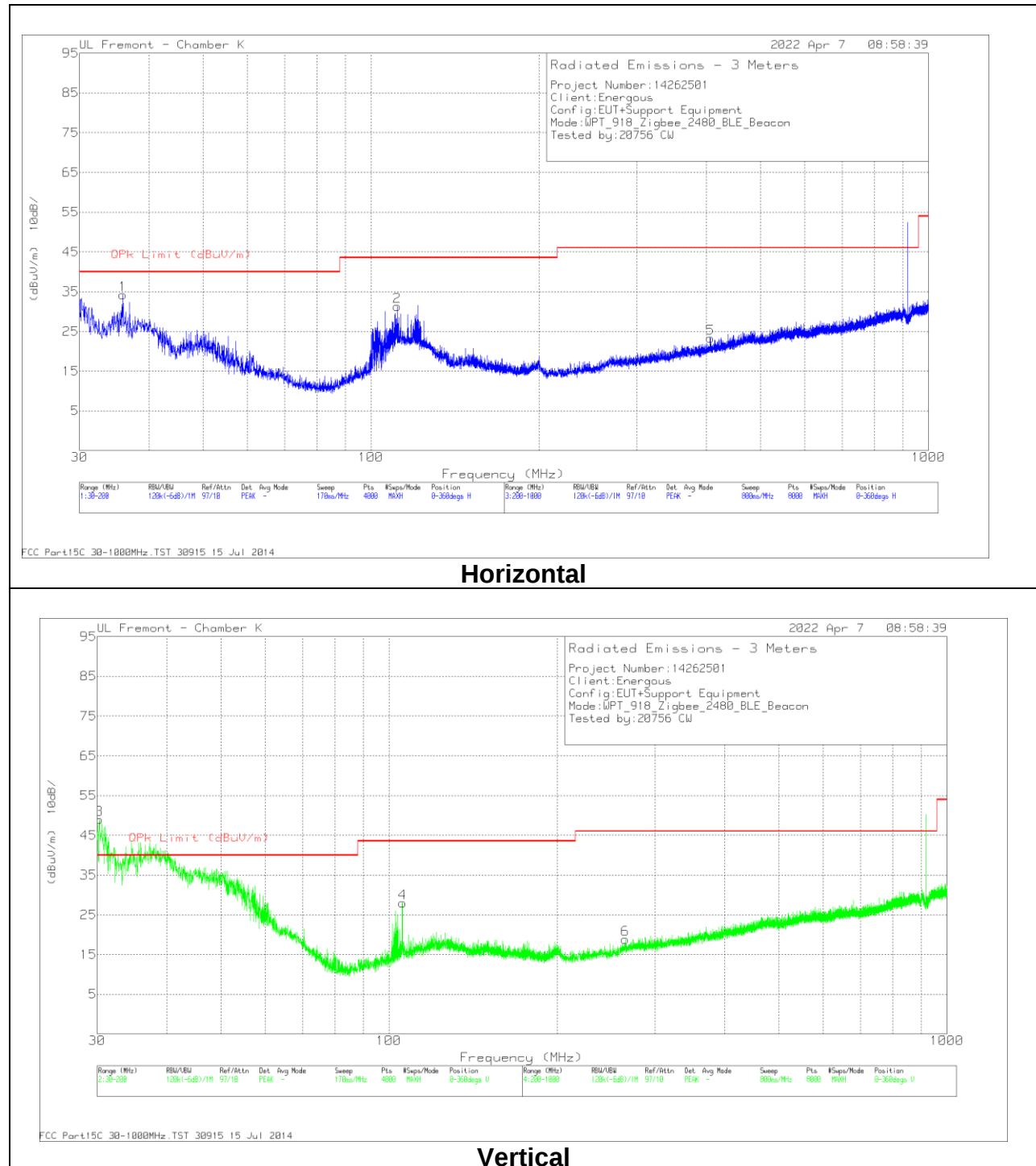
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

Note:

- Test was performed @ 3 meter distance.

10.3. WORST CASE COLACATION BELOW 1G

SPURIOUS EMISSIONS 30 MHz-1000MHz (WORST-CASE CONFIGURATION)



Radiated Emissions

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	82258 ACF (dB)	Amp/Cbl (dB)	BRF	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	35.6933	30.26	Qp	23.5	-31.5	0.04	22.3	40	-17.7	33	310	H
2	* 111.494	42.9	Pk	19.2	-30.8	0.1	31.4	43.52	-12.12	0-360	295	H
3	30.1792	43.42	Qp	27.8	-31.5	0.04	39.76	40	-0.24	279	100	V
4	105.755	40.65	Pk	18.2	-30.9	0.1	28.05	43.52	-15.47	0-360	101	V
5	* 406.927	30.16	Pk	22.4	-29.3	0.23	23.49	46.02	-22.53	0-360	199	H
6	* 265.208	29.35	Pk	19.3	-29.8	0.13	18.98	46.02	-27.04	0-360	299	V

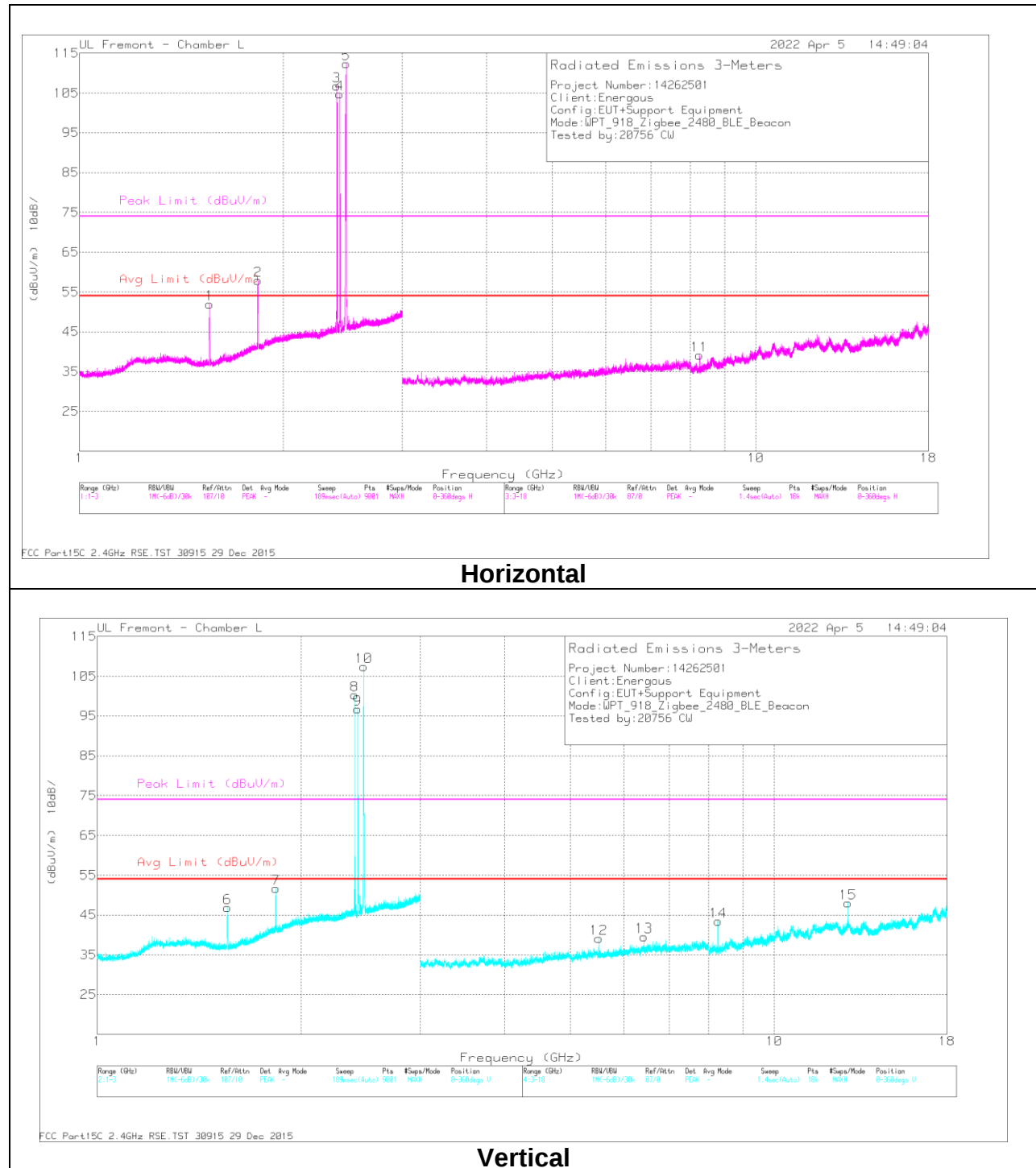
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Qp - Quasi-Peak detector

10.4. WORST CASE COLOCATION ABOVE 1G

SPURIOUS EMISSIONS Above 1GHz (COLOCATION WORST-CASE CONFIGURATION)



Radiated Emissions

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 79834 (dB/m)	Amp/Cbl/Ftr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.556697	36.26	PK2	27.8	-14.9	49.16	-	-	74	-24.84	54	101	H
	* 1.557117	24.13	MAv1	27.8	-14.9	37.03	54	-16.97	-	-	54	101	H
2	1.83511	40.67	Pk	30.8	-13.5	57.97	-	-	-	-	0-360	101	H
11	* 8.254461	22.21	Pk	35.8	-18.9	39.11	-	-	74	-34.89	0-360	101	H
6	* 1.556979	39.92	PK2	27.8	-14.9	52.82	-	-	74	-21.18	43	137	V
	* 1.556807	28.92	MAv1	27.8	-14.9	41.82	54	-12.18	-	-	43	137	V
7	1.835777	34.31	Pk	30.9	-13.5	51.71	-	-	-	-	0-360	200	V
13	6.423525	25.27	Pk	35.7	-21.4	39.57	-	-	-	-	0-360	101	V

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

Markers 3,4,5,8,9,10 are BLE/Zigbee signals, Marker 2,7,11, 12, 13, 14, 15 are WPT FHSS signals. Only Marker 1 & 6 are new emissions signals and maximized.

11. 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

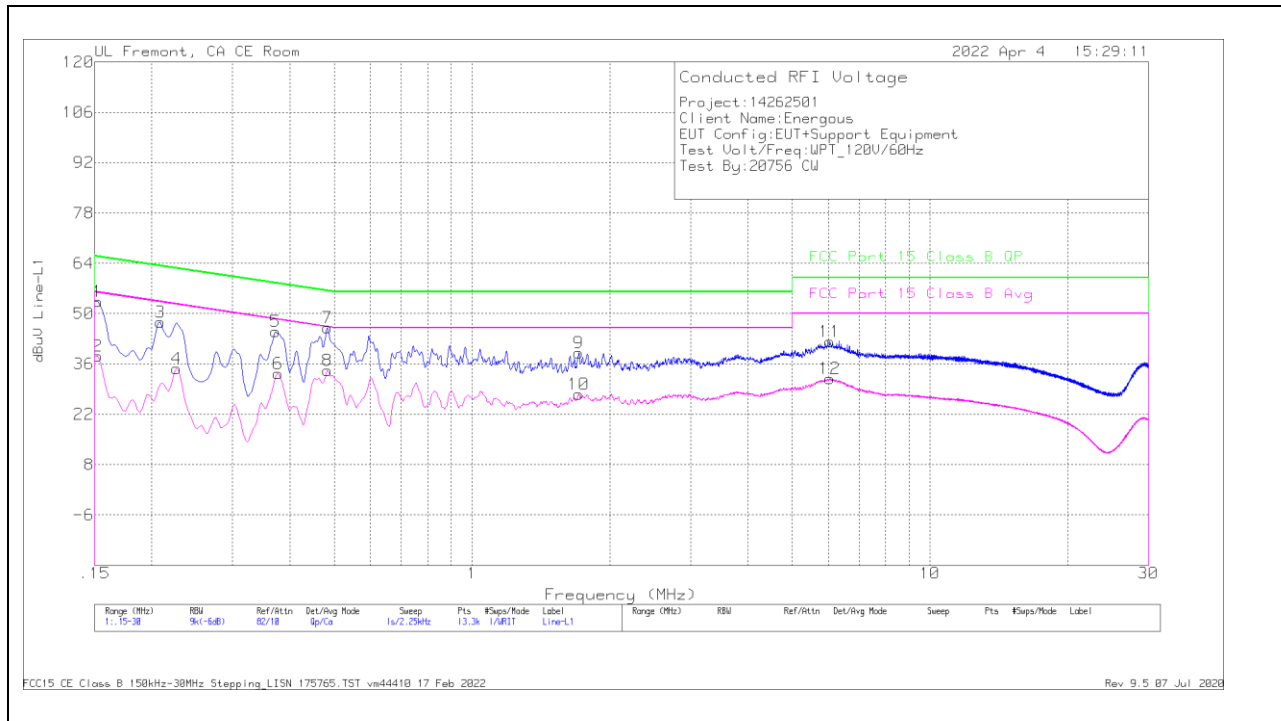
The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

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

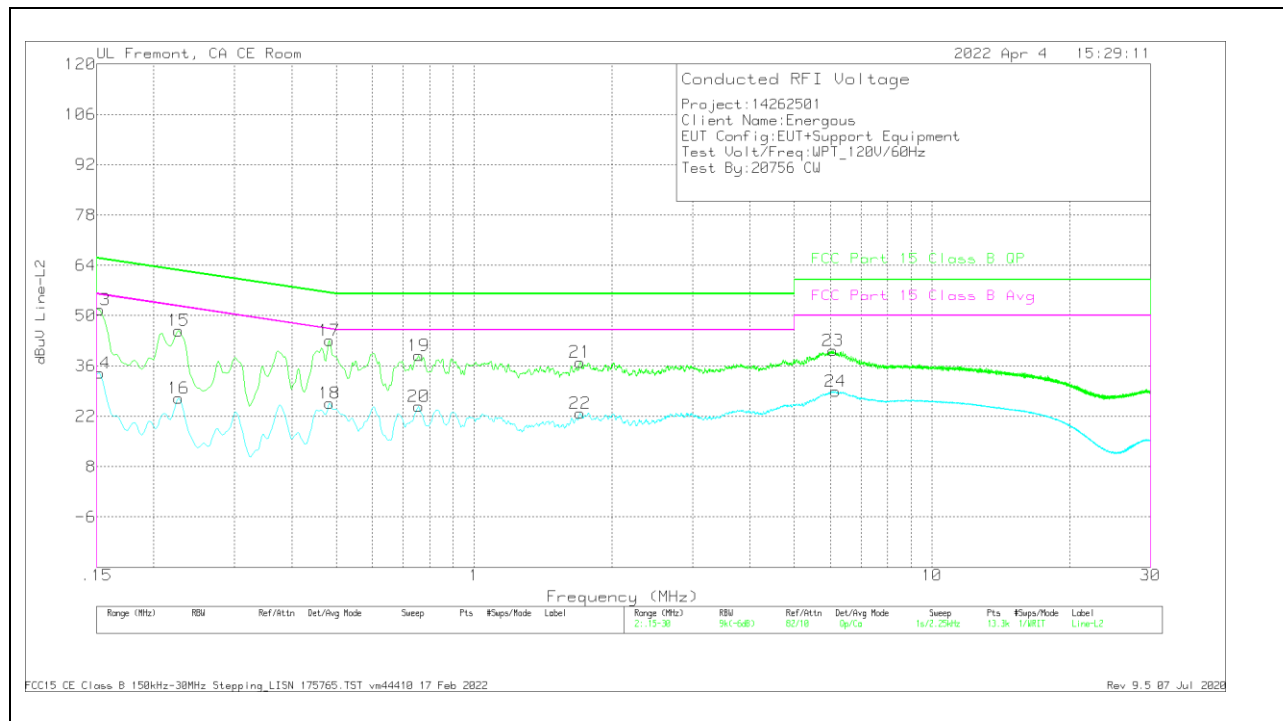
LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	175765 L1SN L1	C1&C3 cable	TekBox Limiter TBFL1 Model 207	Corrected Reading dBuV	FCC Part 15 Class B QP	QP Margin (dB)	FCC Part 15 Class B Avg	Av(CISPR)M argin (dB)
2	.15225	28.77	Ca	.1	0	9.4	38.27	-	-	55.88	-17.61
4	.2265	25.49	Ca	0	0	9.3	34.79	-	-	52.58	-17.79
6	.37725	24.1	Ca	0	0	9.3	33.4	-	-	48.34	-14.94
8	.483	24.83	Ca	0	0	9.3	34.13	-	-	46.29	-12.16
10	1.7115	18.15	Ca	0	.1	9.3	27.55	-	-	46	-18.45
12	6.04725	22.55	Ca	0	.1	9.3	31.95	-	-	50	-18.05
1	.15225	43.91	Qp	.1	0	9.4	53.41	65.88	-12.47	-	-
3	.2085	38.32	Qp	0	0	9.3	47.62	63.26	-15.64	-	-
5	.37275	35.68	Qp	0	0	9.3	44.98	58.44	-13.46	-	-
7	.483	36.73	Qp	0	0	9.3	46.03	56.29	-10.26	-	-
9	1.7115	29.68	Qp	0	.1	9.3	39.08	56	-16.92	-	-
11	6.045	32.77	Qp	0	.1	9.3	42.17	60	-17.83	-	-

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	175765 L1SN L2	C2&C3 cable	TekBox Limiter TBFL1 Model 207	Corrected Reading dBuV	FCC Part 15 Class B QP	QP Margin (dB)	FCC Part 15 Class B Avg	Av(CISPR)M argin (dB)
14	.15225	24.48	Ca	.1	0	9.4	33.98	-	-	55.88	-21.9
16	.2265	17.67	Ca	0	0	9.3	26.97	-	-	52.58	-25.61
18	.483	16.37	Ca	0	0	9.3	25.67	-	-	46.29	-20.62
20	.7575	15.35	Ca	0	.1	9.3	24.75	-	-	46	-21.25
22	1.70475	13.39	Ca	0	.1	9.3	22.79	-	-	46	-23.21
24	6.153	19.62	Ca	0	.1	9.3	29.02	-	-	50	-20.98
13	.15225	42.18	Qp	.1	0	9.4	51.68	65.88	-14.2	-	-
15	.2265	36.51	Qp	0	0	9.3	45.81	62.58	-16.77	-	-
17	.483	33.83	Qp	0	0	9.3	43.13	56.29	-13.16	-	-
19	.7575	29.56	Qp	0	.1	9.3	38.96	56	-17.04	-	-
21	1.7025	27.68	Qp	0	.1	9.3	37.08	56	-18.92	-	-
23	6.0855	30.98	Qp	0	.1	9.3	40.38	60	-19.62	-	-

Qp - Quasi-Peak detector

Ca - CISPR average detection