CERTIFICATION TEST REPORT

Report Number. : 12889029-E1V2

Applicant	:	ENERGOUS CORPORATION 3590 NORTH FIRST STREET SAN JOSE, CA 95134 U.S.A.
Model	:	NF-330
FCC ID	:	2ADNG-NF330
EUT Description	:	WIRELESS CHARGER
Test Standard(s)	:	FCC 47 CFR PART 18 SUBPART C

Date Of Issue:
July 08, 2019

Prepared by:
UL Verification Services Inc.
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NVLAP Lab code: 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	6/26/2019	Initial Issue	--
V2	7/8/2019	Updated Section 7.1.1to address TCB's question	Tina Chu

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: WIRELESS CHARGER

MODEL NUMBER: NF-330

SERIAL NUMBER: R100A

DATE TESTED: JUNE 4, 2019 – JUNE 20, 2019

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 18 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.

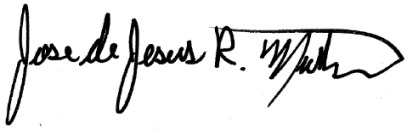
The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. 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 NVLAP, NIST, or any agency of the Federal Government.

Approved & Released For
UL Verification Services Inc. By:

THU CHAN
OPERATIONS LEAD
UL Verification Services Inc.

Prepared By:



JOSE MARTINEZ
TEST ENGINEER
UL Verification Services Inc.

Reviewed By:

TINA CHU
SENIOR PROJECT ENGINEER
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC / OST MP-5, "FCC Methods of Measurements of Radio Noise Emissions from Industrial, Scientific, and Medical Equipment."

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street	47658 Kato Road
☐ Chamber A	☐ Chamber D	☐ Chamber I
☐ Chamber B	☐ Chamber E	☐ Chamber J
☐ Chamber C	☐ Chamber F	☒ Chamber K
	☐ Chamber G	☐ Chamber L
	☐ Chamber H	☐ Chamber M

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code: 2324A.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

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

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a RF near-field, contact charger. Wireless power transfer is only transmitting a continuous carrier wave signal at 918 MHz frequency single channel when both receiving devices are placed upon the top surface of the EUT. The charger pad uses BLE to pair with the receiving devices.

This report documents test results of the Wireless Power Transfer ISM portion of the wireless charger.

5.2. OPERATING FREQUENCY AND POWER

The EUT operates at 918 MHz.

The highest maximum measured conducted average power is 36.01dBm.

Mode	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Total Power (dBm)
CW	918	33.00	33.00	36.01

5.3. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was Version: 3.0.1.255

The software installed in the EUT during testing was WattUp app Version 3.0.52

5.4. CONFIGURATION

The EUT is a tabletop device and it has two ports, one is the USB type C port for power only, second port is for command line interface control, end user will not have access to it. Therefore, all final radiated testing was performed with the EUT in tabletop orientation powered by AC/DC adapter via USB cable.

The EUT supports two WPT PIFA antennas with antenna peak gain 1.2 dBi each. The antennas are identical. Both of the antennas are active at the same time for all the charging mode testing.

Configuration	Description
Standby mode	EUT is powered by AC/DC adapter via USB cable. WPT in standby mode, BLE is in normal operating mode as the worst case.
Charging mode	EUT is powered by AC/DC adapter via USB cable and receiving devices are placed on the surface of the EUT and receives maximum 918 MHz RF energy from EUT. BLE and WPT can transmit simultaneously, BLE is in normal operating mode as the worst case.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID/DoC
2 Receivers	Energous	N/A	M310C & M3103	N/A
AC/DC Adapter	Aukey	PA-Y18	100A	N/A

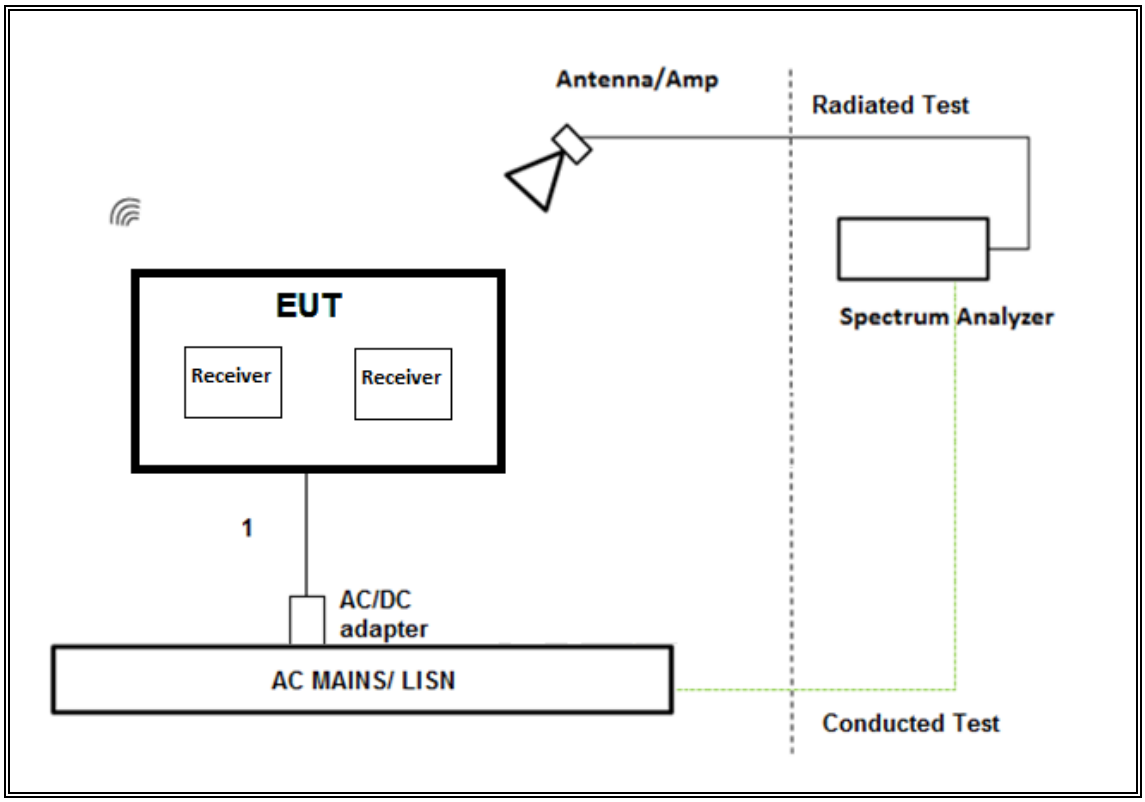
CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	USB Type C	Shielded	1	EUT to AC/DC adapter

TEST SETUP- RADIATED TEST

The EUT is powered by AC/DC adapter via USB cable, 2 receiving devices are placed on the EUT surface for wireless charging purpose at maximum power.

SETUP DIAGRAM



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset**	**Cal Due**
Antenna, Active Loop 9KHz to 30MHz	COM-POWER	AL-130R	PRE0165308	04/11/2020
Antenna, Double Ridge Guide Horn Antenna 700MHz to 18GHz	A.H. SYSTEMS, INC.	SAS-571	PRE0190811	07/12/2019
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	T1569	05/04/2020
Amplifier, 100kHz to 1GHz, 32 dB	Agilent (Keysight) Technologies	8447D	PRE0186650	12/13/2019
Antenna,Broadband Hybrid, 30MHz to 3GHz	SunAR rf motion	JB3	PRE0184052	10/24/2019
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179372	02/16/2020
Filter, BRF 902 to 928MHz	MICRO-TRONICS	BRC50722	T1846	08/16/2019
Filter, HPF 1.5 to 18GHz	MICRO-TRONICS	HPM50114	T1852	07/31/2019
AC Line Conducted				
EMI Receiver	Rohde & Schwarz	ESR	T1436	02/14/2020
LISN for Conducted Emissions CISPR-16	FCC INC.	FCC LISN 50/250	T1310	01/24/2020
Power Cable, Line Conducted Emissions	UL	PR1	T861	10/19/2019
UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Ver 9.5, Jan 11, 2019	
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015	

7. APPLICABLE LIMITS AND TEST RESULTS

7.1. RADIATED EMISSIONS

LIMIT

§18.301 Operating frequencies

The EUT operates at 918 MHz, within the tolerance of the ISM Frequency of 915 +/- 13MHz.

§18.305 Field Strength Limits
(b) The field strength levels of emissions which lie outside the bands specified in §18.301, unless otherwise indicated, shall not exceed the following:

Equipment	Operating frequency	RF Power generated by equipment (watts)	Field strength limit (μV/m)	Distance (meters)
Any type unless otherwise specified (miscellaneous)	Any ISM frequency	Below 500 500 or more	25 25 × SQRT(power/500)	300 [1]300

[1]Field strength may not exceed 10μV/m at 1600 meters. Consumer equipment operating below 1000 MHz is not permitted the increase in field strength otherwise permitted here for power over 500 watts.

The RF Power generated by the equipment is below 500 W therefore the field strength limit is 25uV/m at 300 m, equivalent to 28 dBuV/m at 300 m.

TEST PROCEDURE

Tested in accordance with FCC / OST MP-5

The frequency range was investigated from 9 kHz to 10 GHz.

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

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

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

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

For below 30MHz testing, based on KDB 414788, Clause 2, for Part 18 equipment, Section 2.1 of FCC Measurement Procedure MP-5 also permits the use of test sites other than an open-field test site only if it can be shown that the results obtained at such a location are correlated with those made at an open-field test site.

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

Distance Correction Factor

Based on FCC 18.305, note 2. Testing for compliance with these limits may be made at closer distances, provided a sufficient number of measurements are taken to plot the radiation pattern, to determine the major lobes of radiation, and to determine the expected field strength level at 30, 300, or 1600 meters. Alternatively, if measurements are made at only one closer fixed distance, then the permissible field strength limits shall be adjusted using 1/d as an attenuation factor.

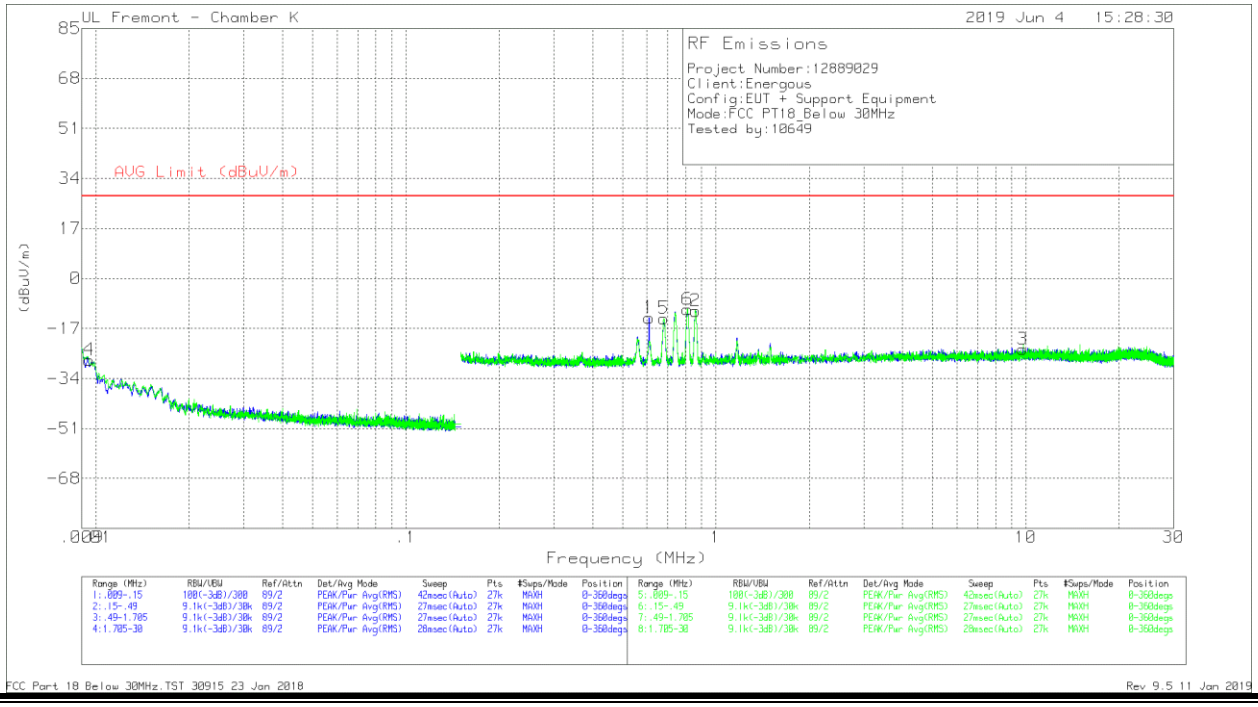
- Distance factor from 3m to 300m = 20log (3/300) = -40dB

RESULTS

7.1.1. SPURIOUS EMISSIONS 9 kHz TO 30 MHz

STANDBY MODE

ANTENNA LOOP FACE ON AND FACE OFF



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuV/m)	Part 18 Limit 300m (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.60894	12.47	Pk	14.1	.1	-40	-13.33	28	-41.33	0-360
2	.85941	14.66	Pk	14.2	.1	-40	-11.04	28	-39.04	0-360
3	9.75888	.52	Pk	15	.4	-40	-24.08	28	-52.08	0-360
4	.00951	-3.34	Pk	15.6	0	-40	-27.74	28	-55.74	0-360
5	.67844	12.18	Pk	14.1	.1	-40	-13.62	28	-41.62	0-360
6	.80984	15.22	Pk	14.1	.1	-40	-10.58	28	-38.58	0-360

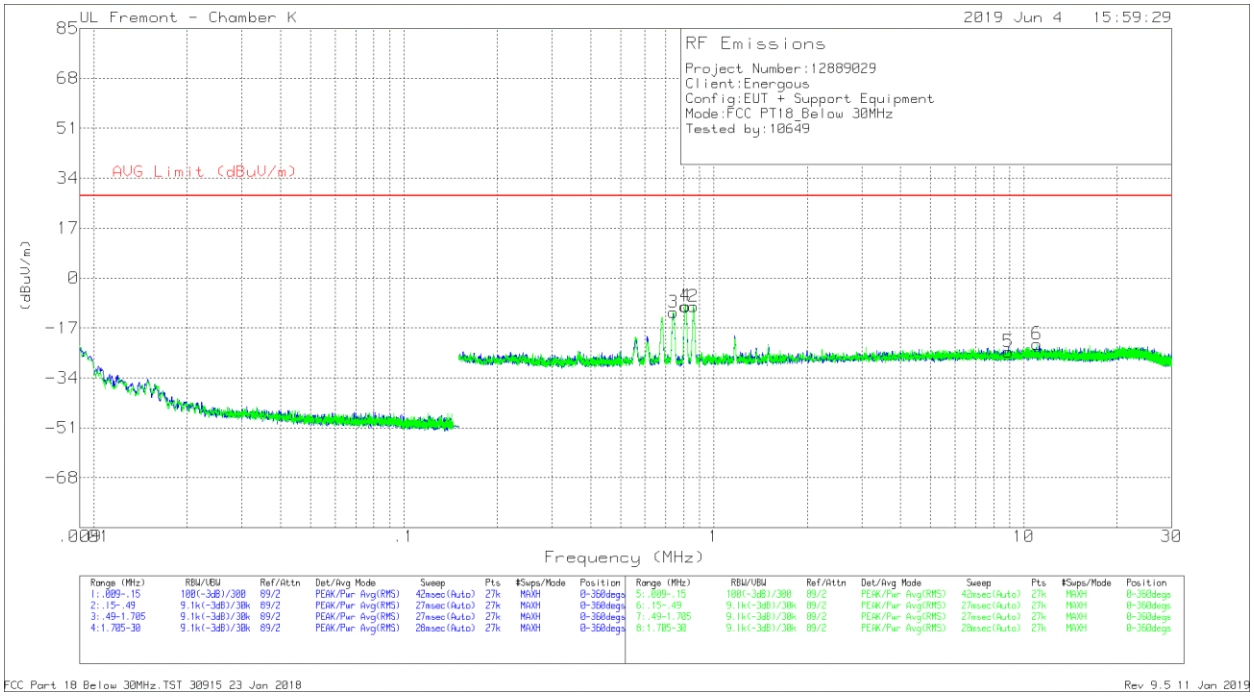
Pk - Peak detector

Note:

- Test was performed @ 3 meter distance.
- Distance factor from 3m to 300m = 20log (3/300) = -40dB

CHARGING MODE

ANTENNA LOOP FACE ON AND FACE OFF



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuV/m)	AVG Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.80804	16.2	Pk	14.1	.1	-40	-9.6	28	-37.6	0-360
2	.86044	16.04	Pk	14.2	.1	-40	-9.66	28	-37.66	0-360
5	8.93096	-.23	Pk	14.7	.4	-40	-25.13	28	-53.13	0-360
3	.73959	14.1	Pk	14.1	.1	-40	-11.7	28	-39.7	0-360
4	.81081	16.24	Pk	14.1	.1	-40	-9.56	28	-37.56	0-360
6	11.04792	2.01	Pk	15.1	.4	-40	-22.49	28	-50.49	0-360

Pk - Peak detector

Note:

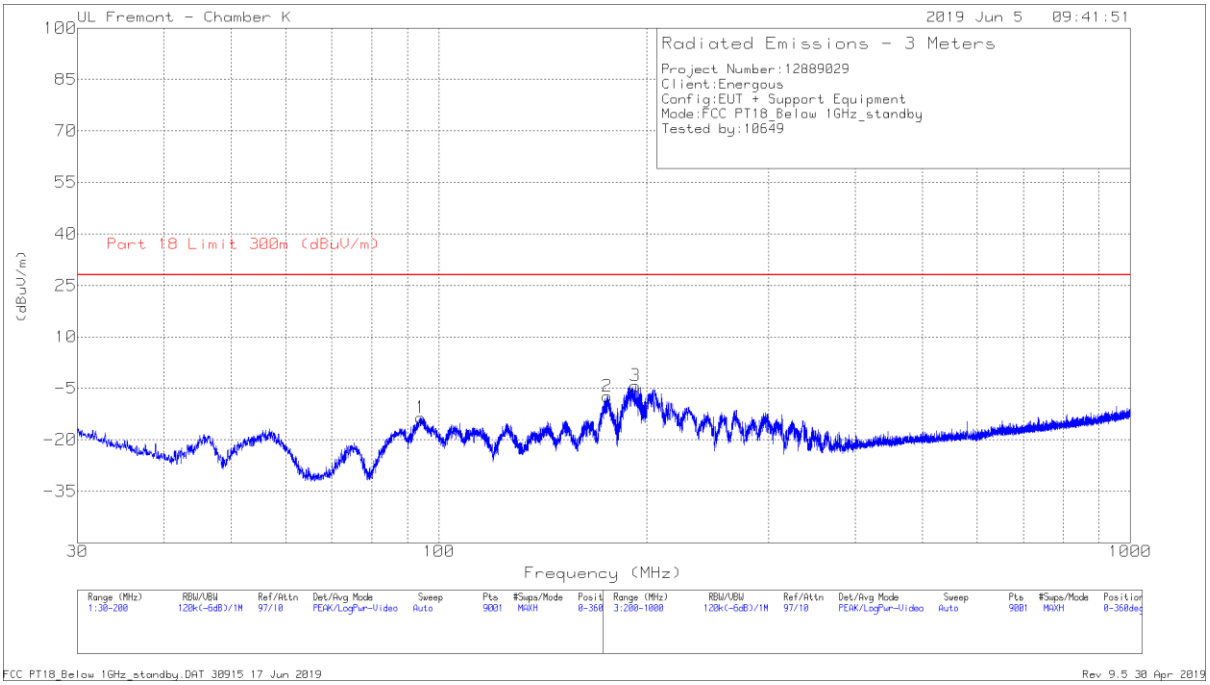
- Test was performed @ 3 meter distance.
- Distance factor from 3m to 300m = 20log (3/300) = -40dB

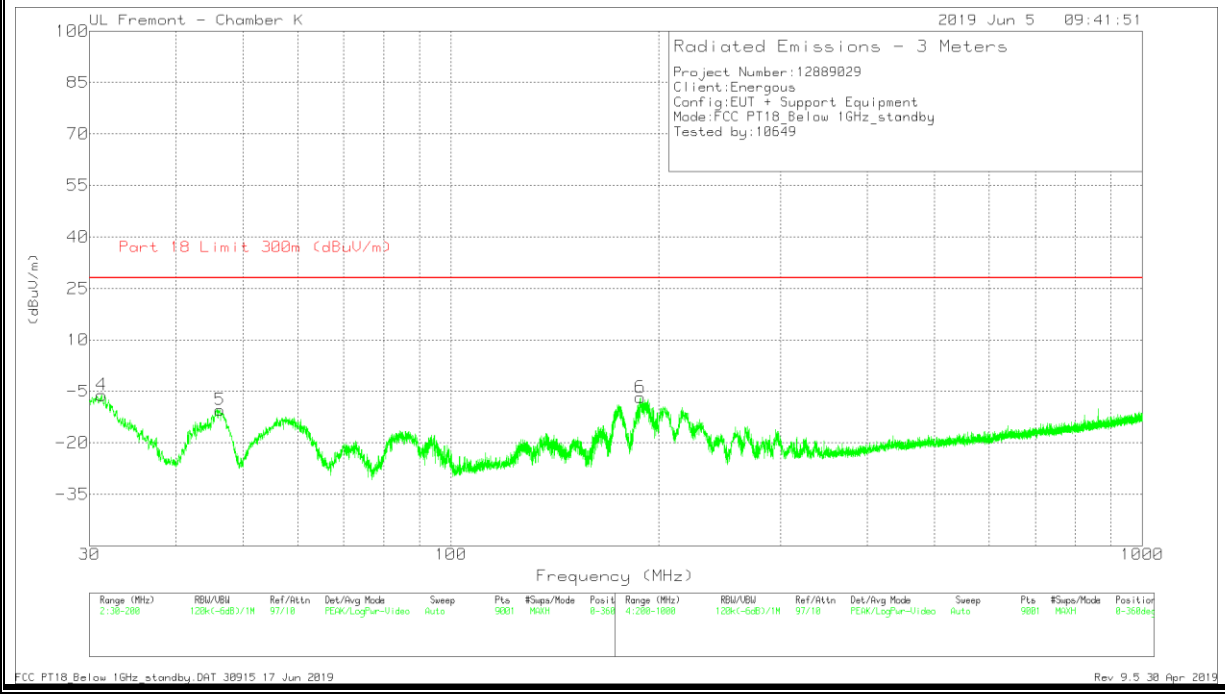
7.1.2. SPURIOUS EMISSIONS 30 MHz TO 1000 MHz

STANDBY MODE

Spurious Emissions 30 – 1000 MHz

30MHz – 902MHz HORIZONTAL & VERTICAL





DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0184052 (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuV/m)	Part 18 Limit 300m (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	94.147	43.06	Pk	14.4	-31	-40	-13.54	28	-41.54	0-360	299	H
2	175.162	45.79	Pk	17.3	-30.4	-40	-7.31	28	-35.31	0-360	99	H
3	192.3132	48.82	Pk	17.3	-30.4	-40	-4.28	28	-32.28	0-360	99	H
	192.3386	45.34	Qp	17.3	-30.4	-40	-7.76	28	-35.76	240	113	H
4	31.2467	39.69	Pk	25.8	-31.6	-40	-6.11	28	-34.11	0-360	100	V
5	46.339	45.64	Pk	15.3	-31.3	-40	-10.36	28	-38.36	0-360	100	V
6	187.8648	46.43	Pk	17.1	-30.3	-40	-6.77	28	-34.77	0-360	100	V

Pk - Peak detector
Qp - Quasi-Peak detector

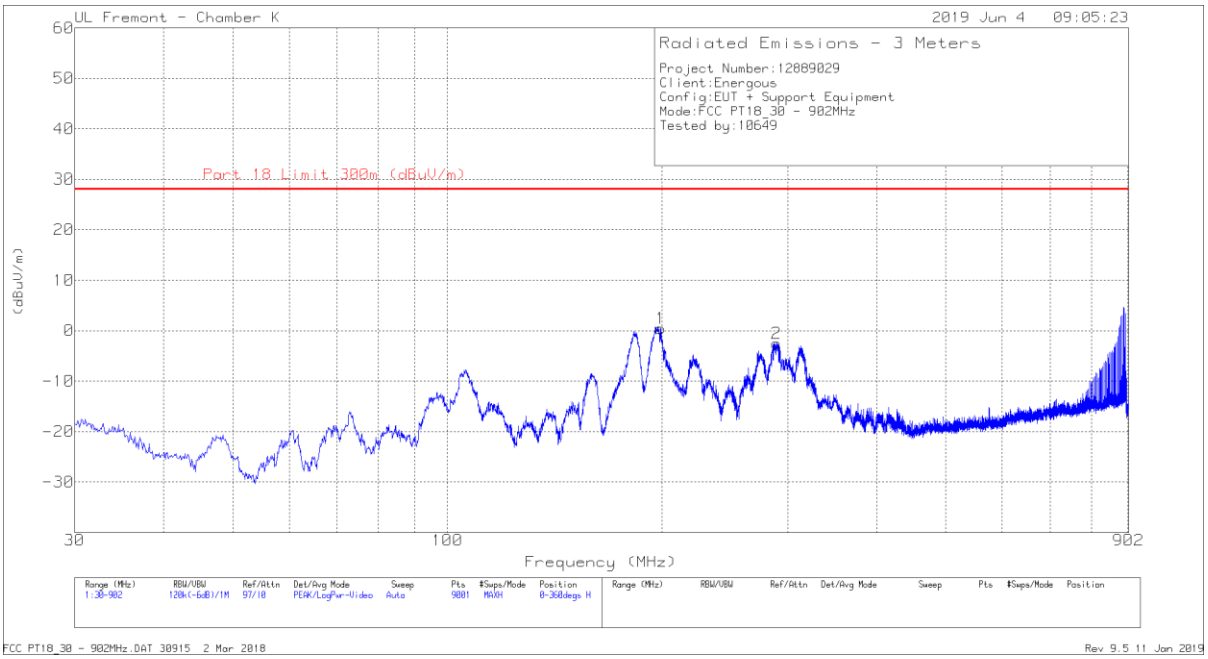
Note:

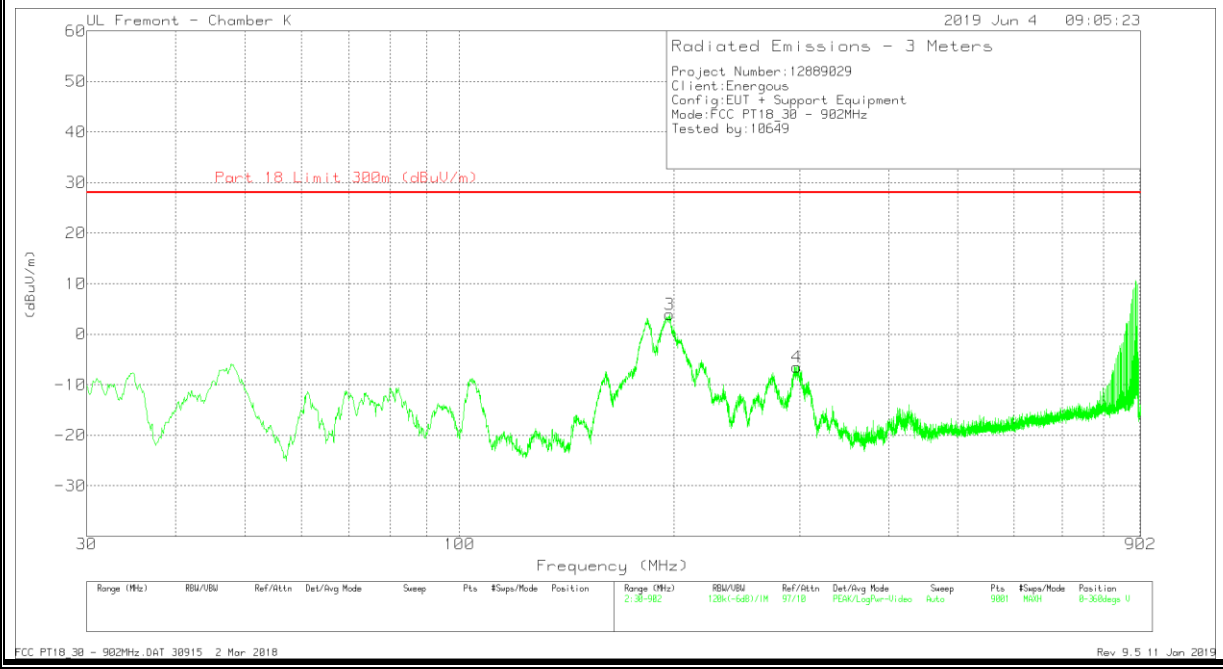
- Test was performed @ 3 meter distance.
- Distance factor from 3m to 300m = 20log (3/300) = -40dB

CHARGING MODE

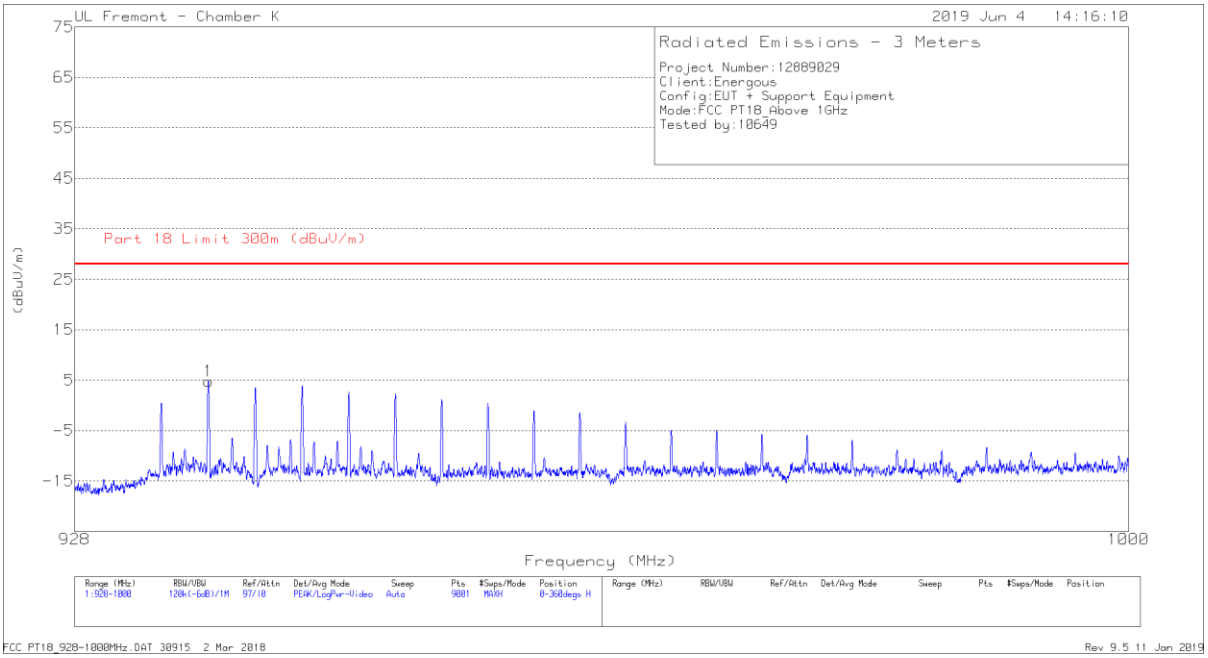
Spurious Emissions 30 – 1000 MHz with a Notch Filter

30MHz – 902MHz HORIZONTAL & VERTICAL





928MHz – 1000MHz HORIZONTAL & VERTICAL



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0184052 (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	T1846 BRF (dB)	Corrected Reading (dBuV/m)	Part 18 Limit 300m (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	198.9744	51.85	Pk	18.4	-30.3	-40	.5	.45	28	-27.55	0-360	99	H
2	289.3719	47.69	Pk	19.2	-29.9	-40	.5	-2.51	28	-30.51	0-360	99	H
3	196.9397	55.57	Pk	18	-30.2	-40	.5	3.87	28	-24.13	0-360	99	V
4	297.2199	43.44	Pk	19.3	-29.8	-40	.5	-6.56	28	-34.56	0-360	99	V

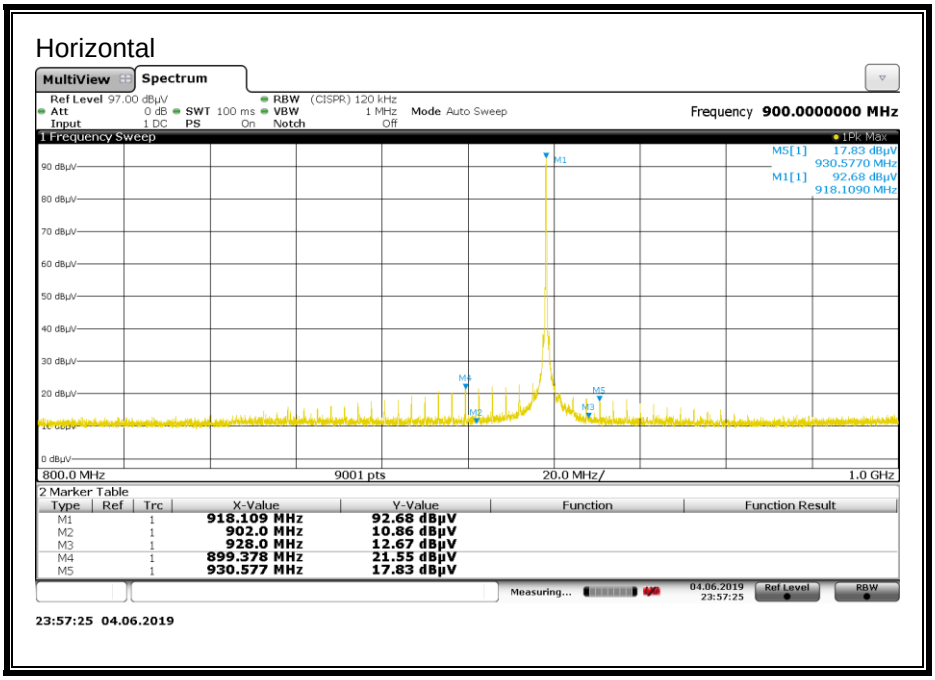
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0184052 (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	T1846 BRF (dB)	Corrected Reading (dBuV/m)	Part 18 Limit 300m (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	936.84	42.47	Pk	28.5	-26.7	-40	.5	4.77	28	-23.23	0-360	199	H
2	936.84	51.06	Pk	28.5	-26.7	-40	.5	13.36	28	-14.64	0-360	100	V
	936.8414	50.09	Qp	28.5	-26.7	-40	.5	12.39	28	-15.61	258	101	V

Pk - Peak detector

Note:

- Test was performed @ 3 meter distance.
- Distance factor from 3m to 300m = 20log (3/300) = -40dB
- **Notch filter was used to prevent system overloading.**

Spurious Emissions 800 – 1000 MHz without a Notch Filter and without amplifier



DATA

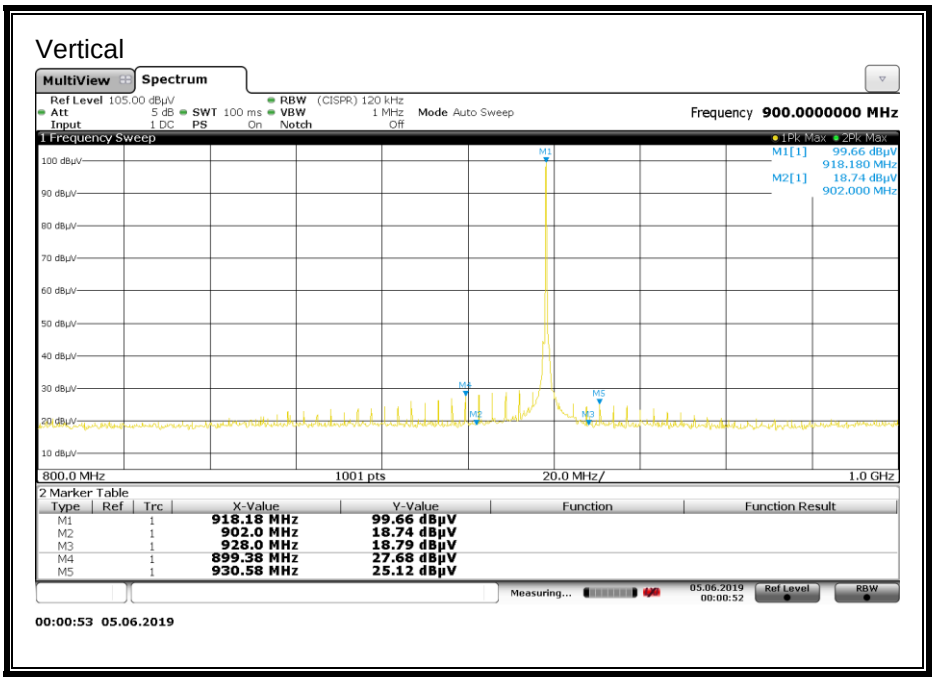
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0184052 (dB/m)	Cable (dB)	Dist Corr (dB)	Corrected Reading (dBuV/m)	FCC PART18 300m LIMIT (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	899.378	21.55	Pk	28.1	3.95	-40	13.6	28	-14.4	101	129	H
5	930.577	17.83	Pk	28.5	4.04	-40	10.37	28	-17.63	100	129	H

Pk - Peak detector

Note:

- Test was performed @ 3 meter distance.
- Distance factor from 3m to 300m = 20log (3/300) = -40dB

Vertical



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0184052 (dB/m)	Cable (dB)	Dist Corr (dB)	Corrected Reading (dBuV/m)	FCC PART18 300m LIMIT (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	899.38	27.68	Pk	28.1	3.95	-40	19.73	28	-8.27	246	105	V
5	930.58	25.12	Pk	28.5	4.04	-40	17.66	28	-10.34	45	100	V

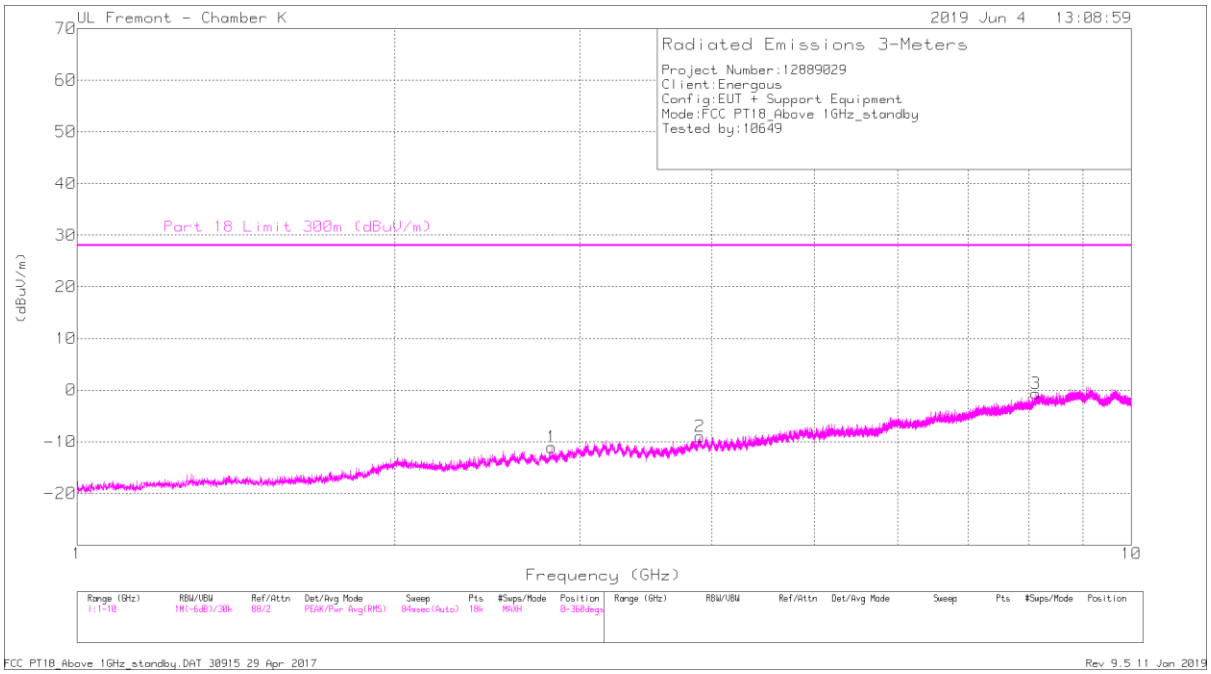
Pk - Peak detector
Note:

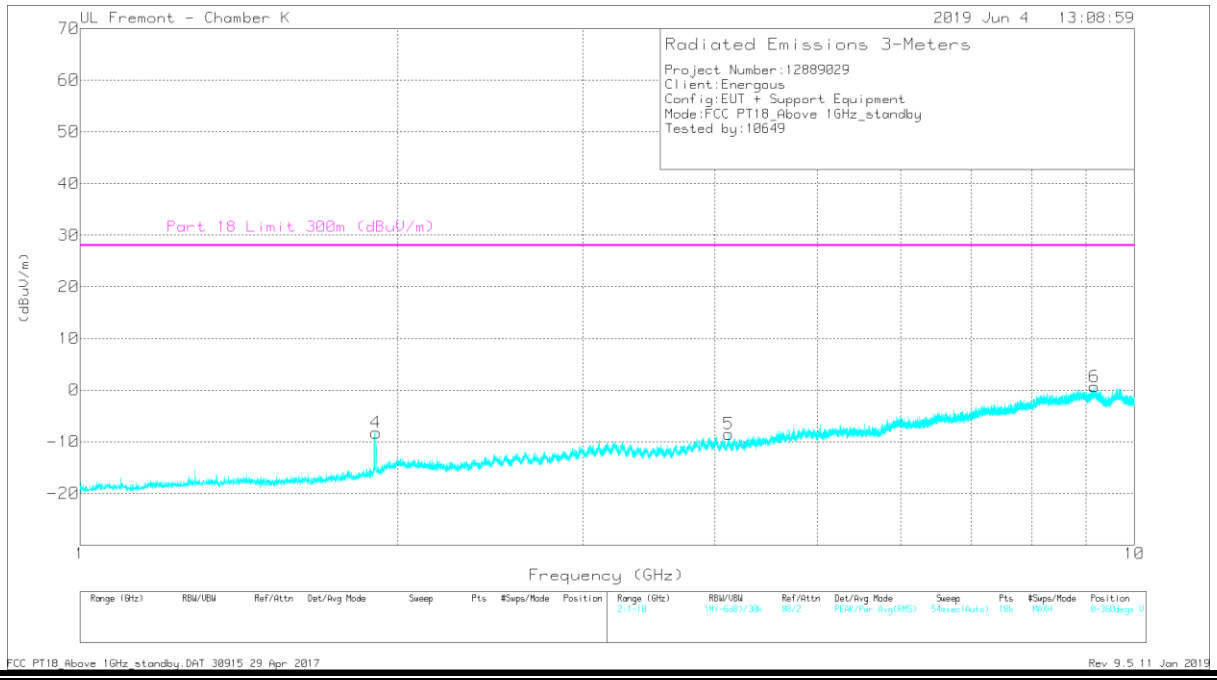
- Test was performed @ 3 meter distance.
- Distance factor from 3m to 300m = 20log (3/300) = -40dB

7.1.3. SPURIOUS EMISSIONS 1 GHz TO 10 GHz

STANDBY MODE

HORIZONTAL & VERTICAL





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Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0190811 (dB/m)	Amp/Cbl (dB)	T1852 HP Fltr (dB)	Dist Corr (dB)	Corrected Reading (dBuV/m)	Part 18 Limit 300m (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	3.89858	28.37	ADR	31.4	-32.2	.7	-40	-11.73	28	-39.73	46	132	H
3	8.11784	22.45	ADR	37.9	-25.9	.7	-40	-4.85	28	-32.85	176	219	H
1	2.82016	30.63	ADR	29	-34.9	.7	-40	-14.57	28	-42.57	296	203	H
4	1.90828	31.5	ADR	26.6	-35.4	.7	-40	-16.6	28	-44.6	55	181	V
5	4.12409	27.47	ADR	31.2	-31.9	.7	-40	-12.53	28	-40.53	311	394	V
6	9.16628	21.83	ADR	38.6	-24	.7	-40	-2.87	28	-30.87	315	362	V

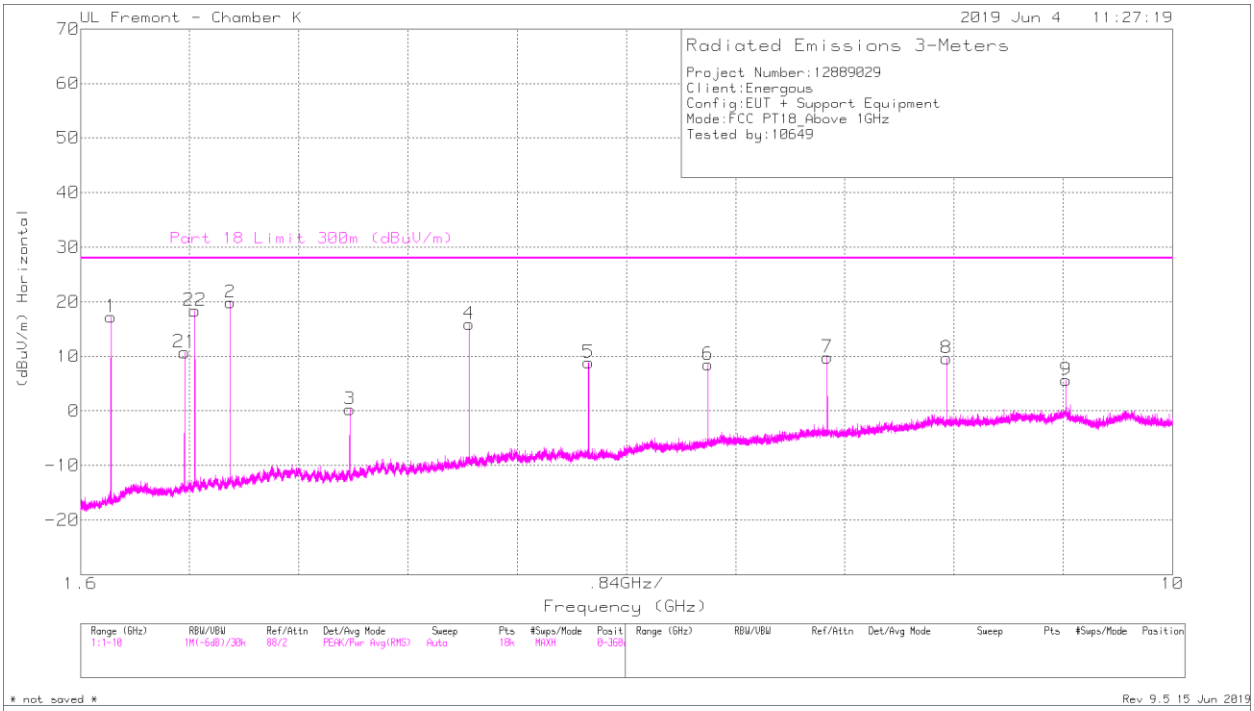
ADR - AD primary method, RMS average

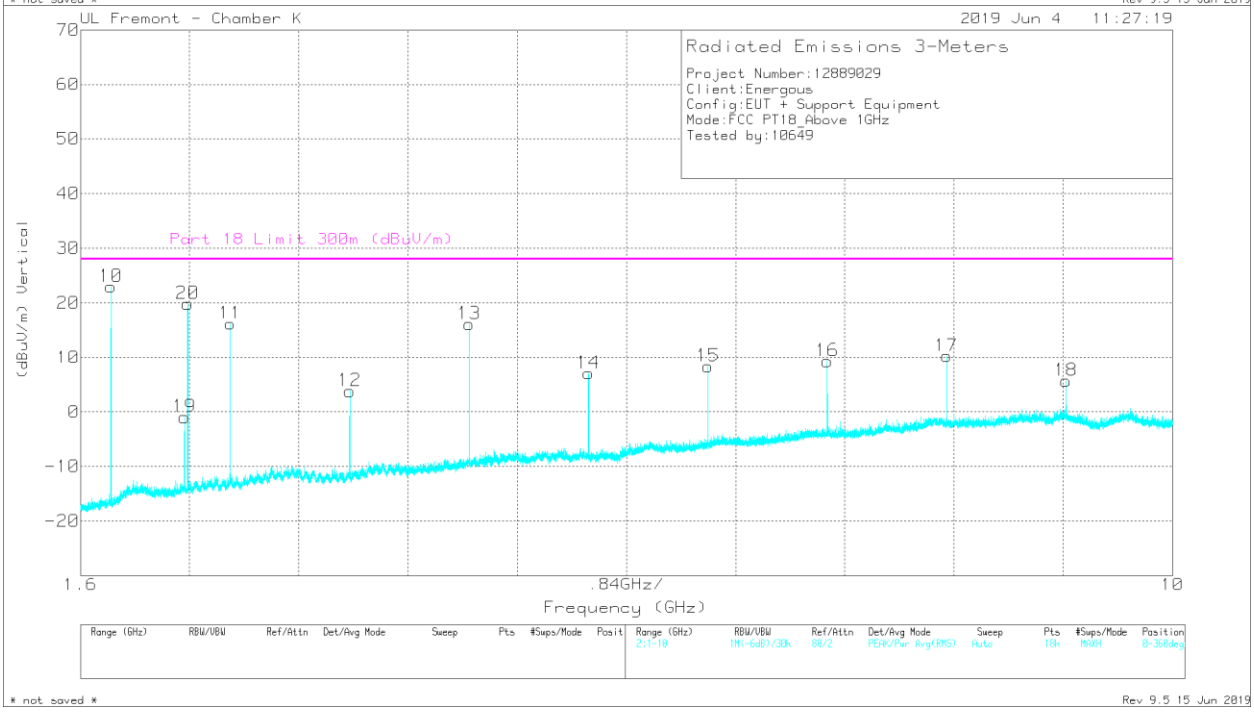
Note:

- Test was performed @ 3 meter distance.
- Distance factor from 3m to 300m = 20log (3/300) = -40dB

CHARGING MODE

HORIZONTAL & VERTICAL





DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0190811 (dB/m)	Amp/Cbl (dB)	T1852 HP Fltr (dB)	Dist Corr (dB)	Corrected Reading (dBuV/m)	Part 18 Limit 300m (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.836	66.34	Pk	25.8	-35.4	.7	-40	17.44	28	-10.56	0-360	200	H
2	2.754	65.4	Pk	28.9	-34.9	.7	-40	20.1	28	-7.9	0-360	100	H
3	3.672	42.32	Pk	30.1	-32.6	.7	-40	0.52	28	-27.48	0-360	100	H
4	4.59	54.23	Pk	32.3	-31.1	.7	-40	16.13	28	-11.87	0-360	200	H
5	5.508	44.87	Pk	33.5	-30	.7	-40	9.07	28	-18.93	0-360	100	H
6	6.427	40.53	Pk	35.4	-27.9	.7	-40	8.73	28	-19.27	0-360	200	H
7	7.345	39.21	Pk	37.1	-27	.7	-40	10.01	28	-17.99	0-360	100	H
8	8.263	36.75	Pk	38	-25.6	.7	-40	9.85	28	-18.15	0-360	100	H
9	9.181	30.78	Pk	38.6	-24.2	.7	-40	5.88	28	-22.12	0-360	100	H
21	2.402	57.34	Pk	28.2	-35.3	.7	-40	10.94	28	-17.06	0-360	100	H
22	2.48	64.78	Pk	28.5	-35.4	.7	-40	18.58	28	-9.42	0-360	200	H
10	1.836	72.07	Pk	25.8	-35.4	.7	-40	23.17	28	-4.83	0-360	101	V
11	2.754	61.68	Pk	28.9	-34.9	.7	-40	16.38	28	-11.62	0-360	101	V
12	3.672	45.84	Pk	30.1	-32.6	.7	-40	4.04	28	-23.96	0-360	101	V
13	4.59	54.39	Pk	32.3	-31.1	.7	-40	16.29	28	-11.71	0-360	101	V
14	5.508	43.1	Pk	33.5	-30	.7	-40	7.3	28	-20.7	0-360	101	V
15	6.427	40.35	Pk	35.4	-27.9	.7	-40	8.55	28	-19.45	0-360	200	V
16	7.345	38.7	Pk	37.1	-27	.7	-40	9.5	28	-18.5	0-360	200	V
17	8.263	37.34	Pk	38	-25.6	.7	-40	10.44	28	-17.56	0-360	200	V
18	9.181	30.81	Pk	38.6	-24.2	.7	-40	5.91	28	-22.09	0-360	200	V
19	2.401	45.65	Pk	28.2	-35.3	.7	-40	-0.75	28	-28.75	0-360	101	V
20	2.426	66.31	Pk	28.3	-35.3	.7	-40	20.01	28	-7.99	0-360	101	V

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0190811 (dB/m)	Amp/Cbl (dB)	T1852 HP Fltr (dB)	Dist Corr (dB)	Corrected Reading (dBuV/m)	Part 18 Limit 300m (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.836	66.72	ADR	25.8	-35.4	.7	-40	17.82	28	-10.18	213	157	H
2	2.754	58.1	ADR	28.9	-34.9	.7	-40	12.8	28	-15.2	26	103	H
4	4.59	53.5	ADR	32.3	-31.1	.7	-40	15.4	28	-12.6	319	173	H
10	1.836	71.4	ADR	25.8	-35.4	.7	-40	22.5	28	-5.5	310	117	V
11	2.754	58.42	ADR	28.9	-34.9	.7	-40	13.12	28	-14.88	174	166	V
13	4.591	52.07	ADR	32.3	-31.1	.7	-40	13.97	28	-14.03	84	101	V

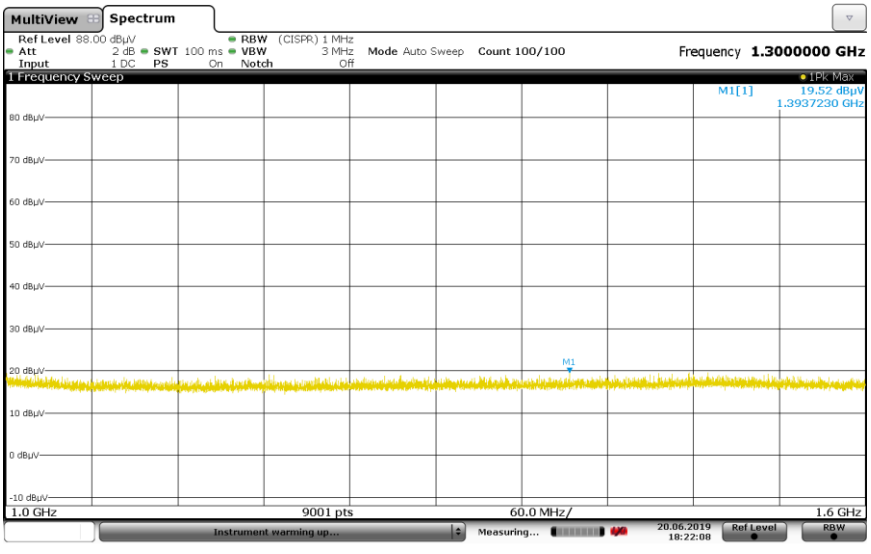
Pk - Peak detector
ADR - AD primary method, RMS average

Note:

- Test was performed @ 3 meter distance.
- Distance factor from 3m to 300m = 20log (3/300) = -40dB
- Markers 21, 22, 20 are BLE signals.
- Frequency Range 1G – 1.6GHz were investigation using due to High pass filter 1.5G was used. See the following test result of frequency range 1G-1.6GHz.

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

Horizontal



DATA

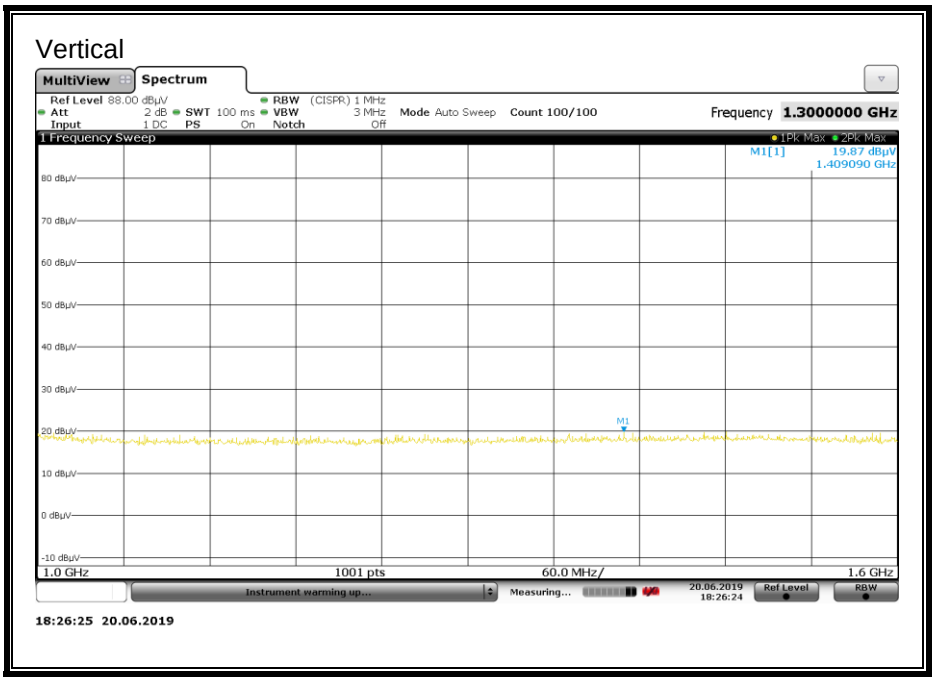
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0190811 (dB/m)	Cable (dB)	Dist Corr (dB)	Corrected Reading (dBuV/m)	FCC PART18 300m LIMIT (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.3937	19.52	Pk	24.82	5.5	-40	9.84	28	-18.16	0-360	200	H
	1.3922	6.62	ADR	24.82	5.5	-40	-3.06	28	-31.06	221.8	335.7	H

Pk - Peak detector

Note:

- Test was performed @ 3 meter distance.
- Distance factor from 3m to 300m = 20log (3/300) = -40dB

Vertical



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0190811 (dB/m)	Cable (dB)	Dist Corr (dB)	Corrected Reading (dBuV/m)	FCC PART18 300m LIMIT (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.4091	19.87	Pk	24.82	5.61	-40	10.3	28	-17.7	0-360	200	V
	1.4096	7.53	ADR	24.82	5.61	-40	-2.04	28	-30.04	338.5	144.8	V

Pk - Peak detector
Note:

- Test was performed @ 3 meter distance.
- Distance factor from 3m to 300m = 20log (3/300) = -40dB

7.2. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

§ 18.307 For the following equipment, when designed to be connected to the public utility (AC) power line the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies shall not exceed the limits in the following table. Compliance with the provisions of this paragraph shall be based on the measurements of the radio frequency voltage between each power line and ground at the power terminal using a 50 µH/50 ohms line impedance stabilization network (LISN).

§ 18.307 (b) All other Part 18 consumer devices:

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.

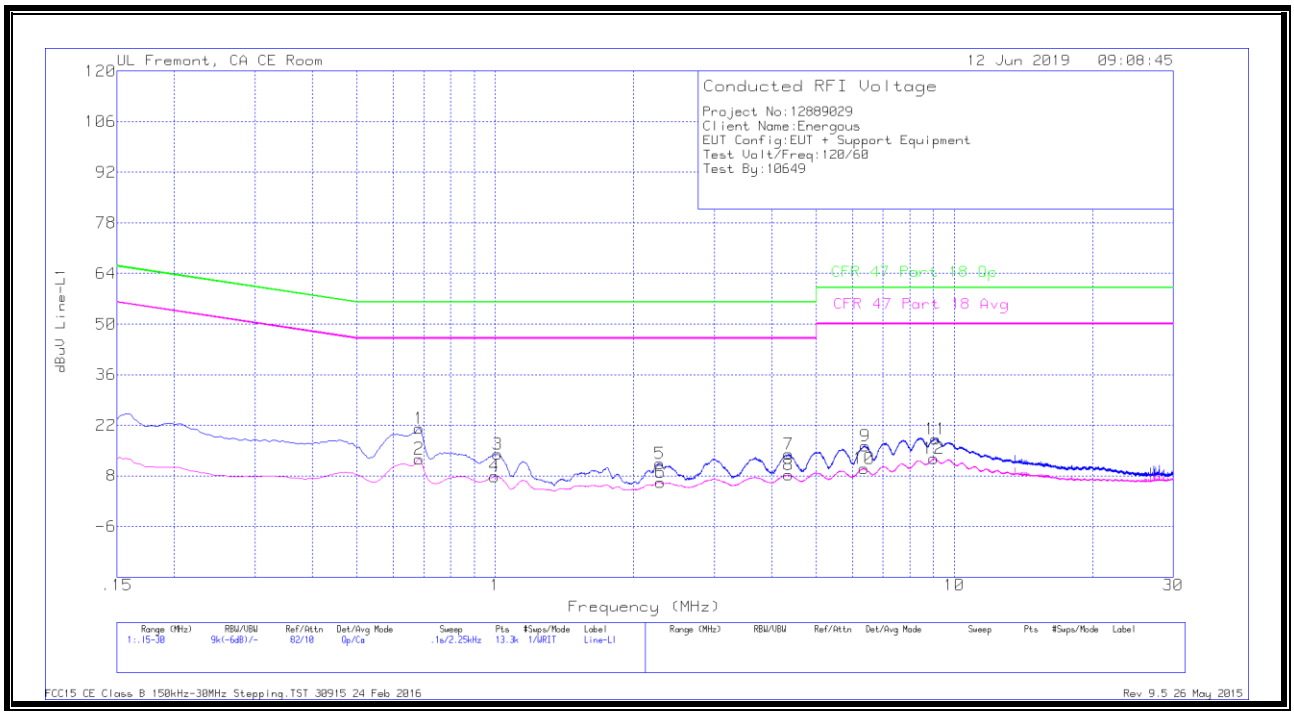
TEST PROCEDURE

Tested in accordance with FCC / OST MP-5

RESULTS

7.2.1. STANDBY MODE

LINE 1 RESULTS

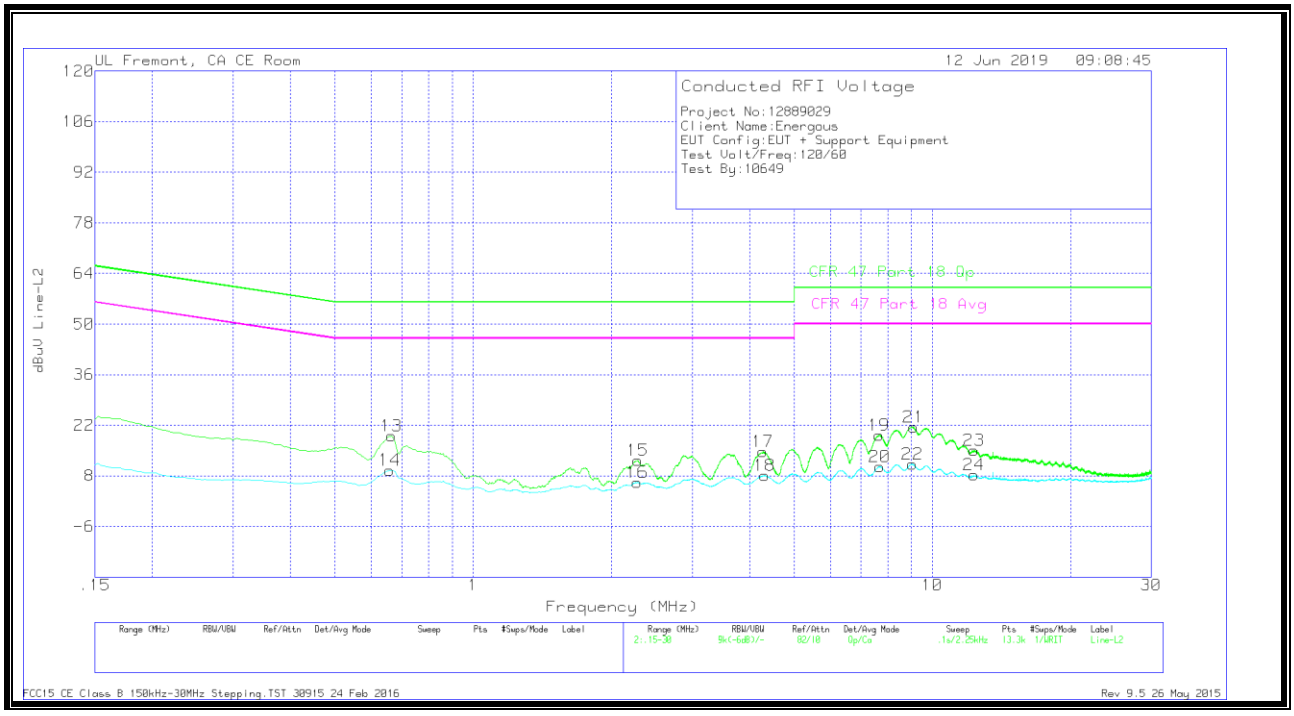


WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 18 QP	QP Margin (dB)	CFR 47 Part 18 Avg	Av(CISPR)Margin (dB)
1	.68325	11.01	Qp	0	0	10.1	21.11	56	-34.89	-	-
2	.68325	2.61	Ca	0	0	10.1	12.71	-	-	46	-33.29
3	1.014	3.88	Qp	0	.1	10.1	14.08	56	-41.92	-	-
4	.99825	-2.35	Ca	0	.1	10.1	7.85	-	-	46	-38.15
5	2.28525	1.22	Qp	0	.1	10.1	11.42	56	-44.58	-	-
6	2.292	-3.92	Ca	0	.1	10.1	6.28	-	-	46	-39.72
7	4.353	3.77	Qp	0	.1	10.1	13.97	56	-42.03	-	-
8	4.35075	-1.97	Ca	0	.1	10.1	8.23	-	-	46	-37.77
9	6.3915	5.91	Qp	0	.2	10.2	16.31	60	-43.69	-	-
10	6.36	-.4	Ca	0	.2	10.2	10	-	-	50	-40
11	9.09825	7.86	Qp	0	.2	10.2	18.26	60	-41.74	-	-
12	9.03413	2.38	Ca	0	.2	10.2	12.78	-	-	50	-37.22

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS



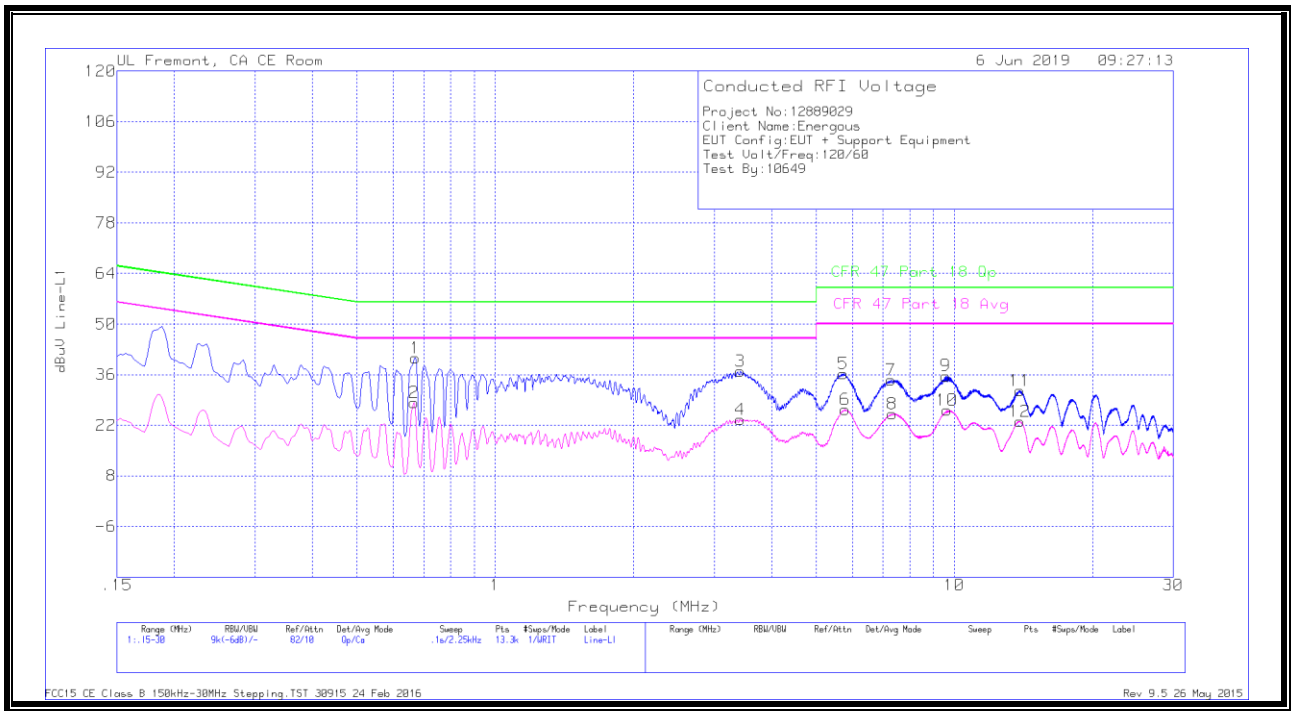
WORST EMISSIONS

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 18 QP	QP Margin (dB)	CFR 47 Part 18 Avg	Av(CISPR)Margin (dB)
13	.663	8.9	Qp	0	0	10.1	19	56	-37	-	-
14	.6585	-.52	Ca	0	0	10.1	9.58	-	-	46	-36.42
15	2.28525	2.03	Qp	0	.1	10.1	12.23	56	-43.77	-	-
16	2.27963	-3.96	Ca	0	.1	10.1	6.24	-	-	46	-39.76
17	4.281	4.57	Qp	0	.1	10.1	14.77	56	-41.23	-	-
18	4.3215	-2.14	Ca	0	.1	10.1	8.06	-	-	46	-37.94
19	7.665	8.87	Qp	0	.2	10.2	19.27	60	-40.73	-	-
20	7.68975	.1	Ca	0	.2	10.2	10.5	-	-	50	-39.5
21	9.11175	11.05	Qp	0	.2	10.2	21.45	60	-38.55	-	-
22	9.042	.82	Ca	0	.2	10.2	11.22	-	-	50	-38.78
23	12.33375	4.6	Qp	.1	.2	10.2	15.1	60	-44.9	-	-
24	12.32925	-2.24	Ca	.1	.2	10.2	8.26	-	-	50	-41.74

Qp - Quasi-Peak detector
Ca - CISPR average detection

7.2.2. CHARGING MODE

LINE 1 RESULTS

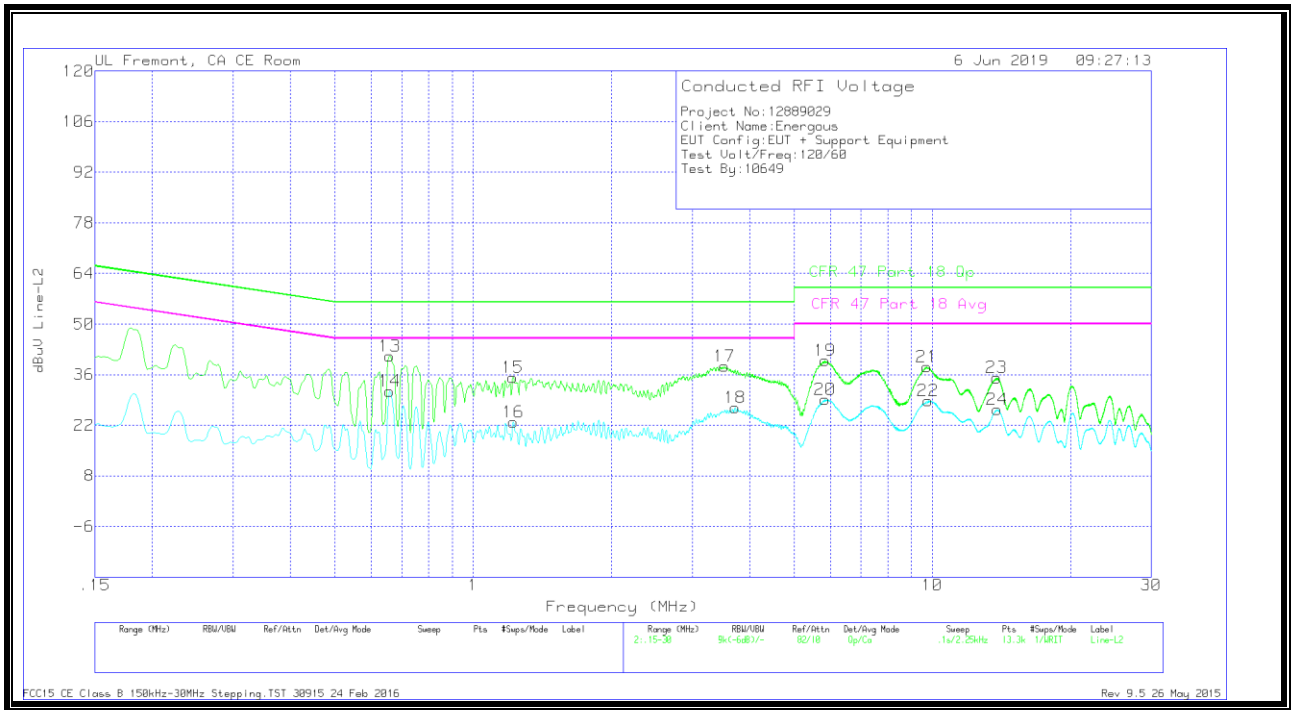


WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 18 QP	QP Margin (dB)	CFR 47 Part 18 Avg	Av(CISPR)Margin (dB)
1	.66975	30.59	Qp	0	0	10.1	40.69	56	-15.31	-	-
2	.66525	18.18	Ca	0	0	10.1	28.28	-	-	46	-17.72
3	3.4215	26.75	Qp	0	.1	10.1	36.95	56	-19.05	-	-
4	3.42038	13.37	Ca	0	.1	10.1	23.57	-	-	46	-22.43
5	5.72775	25.89	Qp	0	.2	10.2	36.29	60	-23.71	-	-
6	5.77838	15.93	Ca	0	.2	10.2	26.33	-	-	50	-23.67
7	7.2825	24.15	Qp	0	.2	10.2	34.55	60	-25.45	-	-
8	7.3275	14.72	Ca	0	.2	10.2	25.12	-	-	50	-24.88
9	9.58425	25.26	Qp	0	.2	10.2	35.66	60	-24.34	-	-
10	9.63375	15.73	Ca	0	.2	10.2	26.13	-	-	50	-23.87
11	13.9155	21	Qp	.1	.3	10.2	31.6	60	-28.4	-	-
12	13.89525	12.49	Ca	.1	.3	10.2	23.09	-	-	50	-26.91

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS



WORST EMISSIONS

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 18 QP	QP Margin (dB)	CFR 47 Part 18 Avg	Av(CISPR)Margin (dB)
13	.6585	31.08	Qp	0	0	10.1	41.18	56	-14.82	-	-
14	.6585	21.38	Ca	0	0	10.1	31.48	-	-	46	-14.52
15	1.221	25.03	Qp	0	.1	10.1	35.23	56	-20.77	-	-
16	1.22325	12.61	Ca	0	.1	10.1	22.81	-	-	46	-23.19
17	3.52725	28.1	Qp	0	.1	10.1	38.3	56	-17.7	-	-
18	3.7185	16.63	Ca	0	.1	10.1	26.83	-	-	46	-19.17
19	5.83575	29.47	Qp	0	.2	10.2	39.87	60	-20.13	-	-
20	5.8335	18.67	Ca	0	.2	10.2	29.07	-	-	50	-20.93
21	9.71925	27.7	Qp	0	.2	10.2	38.1	60	-21.9	-	-
22	9.789	18.34	Ca	0	.2	10.2	28.74	-	-	50	-21.26
23	13.82325	24.64	Qp	.1	.2	10.2	35.14	60	-24.86	-	-
24	13.83563	15.79	Ca	.1	.2	10.2	26.29	-	-	50	-23.71

Qp - Quasi-Peak detector
Ca - CISPR average detection