FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 9

CERTIFICATION TEST REPORT

FOR

Electric Vehicle Charger with Near Field Reader

MODEL NUMBER: ELVI

FCC ID: 2ARYO-EB10
IC: 24573-EB10

REPORT NUMBER: 12489879

ISSUE DATE: 2019-01-14

Prepared for
EV-Box B.V.
Fred. Roeskestraat 115
Amsterdam, 1076 EE
The Netherlands

Prepared by
UL LLC
333 Pfingsten Rd.
Northbrook, IL 60062
TEL: (847) 272-8800

NVLAP LAB CODE 100414-0

Revision History

Rev.	Issue Date	Revisions	Revised By
1.0	2019-01-14	Initial Issue	VS

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: **EV-Box B.V.**
Fred. Roeskestraat 115
Amsterdam ,1076 EE
The Netherlands

EUT DESCRIPTION: Electric Vehicle Supply Equipment

MODEL: ELVI

SERIAL NUMBER: non-serialized

DATE TESTED: 2018-11-16 to 2018-11-21

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	Complies
ISED RSS-210 Issue 9, Annex B.6	Complies
ISED RSS-GEN Issue 5	Complies

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL LLC based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC 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 U.S. Government.

Approved & Released For
UL LLC By:

Bartlomiej Mucha(Ext.41216)
Reviewer
Consumer Technology Division

Prepared By:

Vincent Sabalvaro (Ext.42046)
Project Handler
Consumer Technology Division

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 15, RSS-GEN Issue 5, and RSS-210 Issue 9.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 333 Pfingsten Road, Northbrook, IL 60062 USA.

UL NBK is accredited by NVLAP, Laboratory Code 100414-0.
FCC Designation Number: US5269
IC Test Site #: 2180A

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

Sample Calculations
Radiated Field Strength and Conducted Emissions data contained within this report is calculated on the following basis:
Field Strength (dBuV/m) = Meter Reading (dBuV) + AF (dB/m) - Gain (dB) + Cable Loss (dB)
Conducted Voltage (dBuV) = Meter Reading (dBuV) + Cable Loss (dB) + LISN IL (dB)
Conducted Current (dBuA) = Meter Reading (dBuV) + Cable Loss (dB) - Transducer Factor (dBohms)

4.3. MEASUREMENT UNCERTAINTY

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

Test	Range	Equipment	Uncertainty k=2
Radiated Emissions	9k-30MHz	H-Field Loop	3.15dB
Radiated Emissions	30-200MHz	Bicon 10m Horz	4.27dB
Radiated Emissions	30-200MHz	Bicon 10m Vert	4.28dB
Radiated Emissions	200-1000MHz	LogP 10m Horz	3.33dB
Radiated Emissions	200-1000MHz	LogP 10m Vert	3.39dB
Conducted Emissions	150k-30MHz	LISN	3.65dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT, Model ELVI, is an EV charging system equipped with an RFID reader to activate charging functionality.

5.2. MAXIMUM ELECTRIC FIELD STRENGHT

The transmitter has a maximum peak radiated field strength as follows:

Frequency Range (MHz)	Mode	Peak Field Strenght dBuV/m	Measurement Distance meters
13.56	TX	27.09	30.00

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a trace loop antenna.

5.4. SOFTWARE AND FIRMWARE

The device uses a chipset where there is no control over firmware of software related to the radio.

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT is mounted in single orientation only therefore a single position was tested. Preliminary results show worst case measurements occur when the Charging operation mode of the digital device is in Standby (Not-Charging) Mode.

5.6. MODIFICATIONS

No modifications were made during testing.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

None

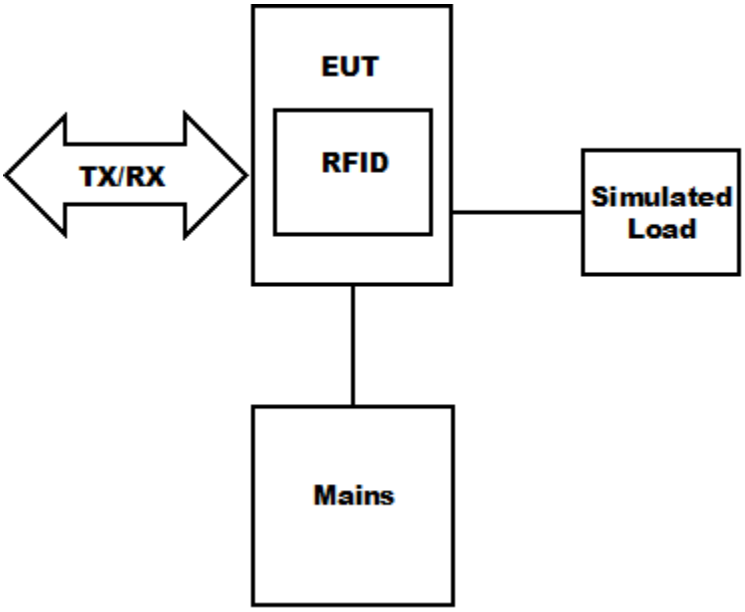
I/O CABLES

Output Charging cable

TEST SETUP

The EUT was placed on 80cm table, with the output cable terminated to a simulated load.

SETUP DIAGRAM FOR TESTS



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 Number**	**Cal Date**	**Cal Due**
Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014		
Conducted Software	UL	UL EMC	Ver 9.5, May 17 2012		
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC4328	12/21/2017	12/31/2018
Bicon Antenna	Chase	VBA6106A	EMC4078	3/28/2018	3/31/2019
Log-P Antenna	Chase	UPA6109	EMC4313	4/9/2018	4/30/2019
Loop Antenna	EMCO	6502/1	EMC4026	1/10/2018	1/31/2019
EMI Test Receiver	Rohde & Schwarz	ESR	EMC4377	12/23/2017	12/31/2018
Transient Limiter	Electro-Metrics	EM7600-2	EMC4224	N/A	N/A
High-Pass Filter	Solar Electronics	2803-150	EMC4327	N/A	N/A
Attenuator	HP	8494B	2831A00838	N/A	N/A
LISN - L1	Solar Electronics	8602-50-TS-50-N	EMC4066	12/29/2017	12/31/2018
LISN - L2	Solar Electronics	8602-50-TS-50-N	EMC4064	12/29/2017	12/31/2018
Signal Analyzer	Aglient	PXA	EMC4360	12/28/2017	12/31/2018

7. 20 dB AND 99% BW

LIMITS

For reference only

TEST PROCEDURE

ANSI C63.10

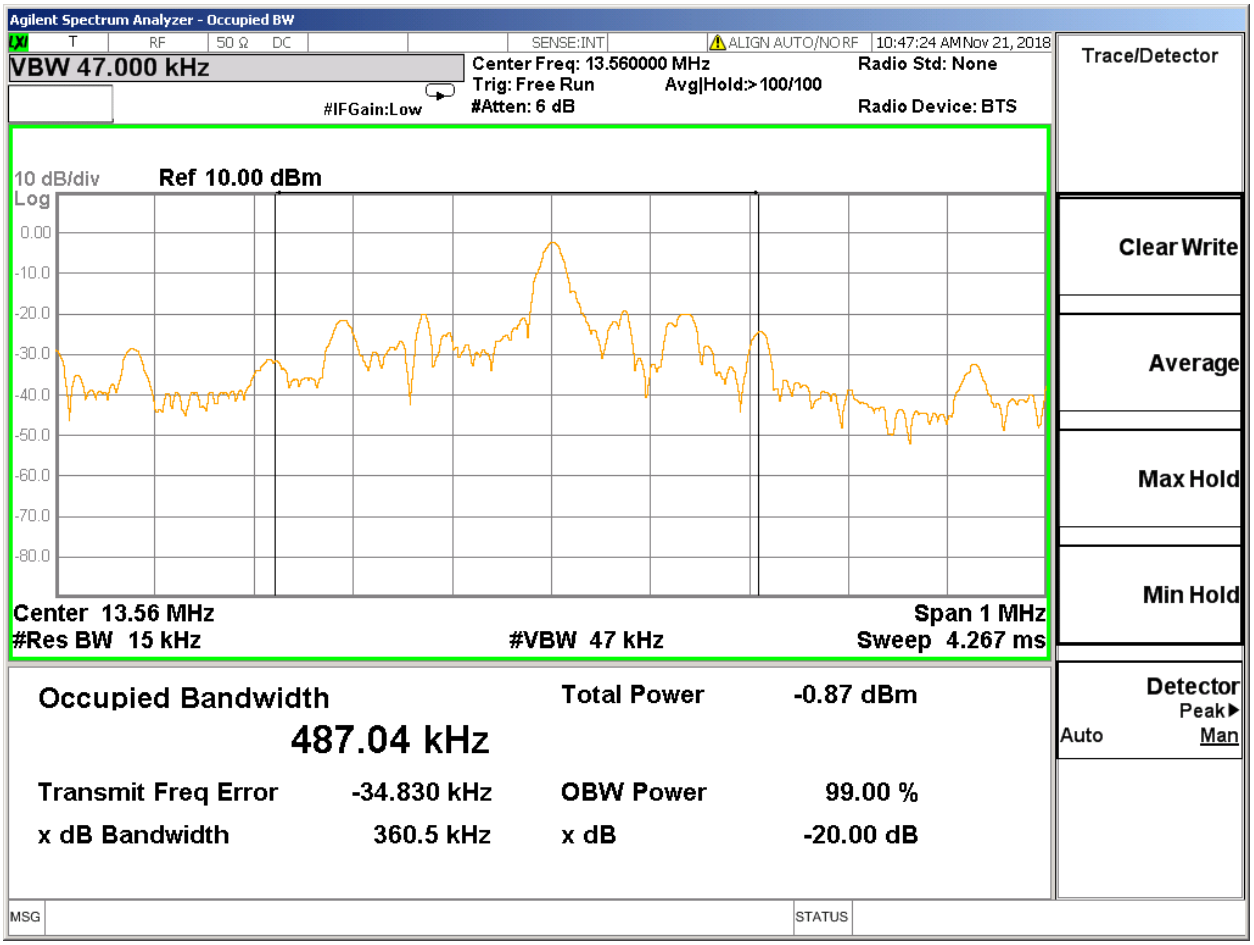
The transmitter output is connected to the spectrum analyzer.

The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

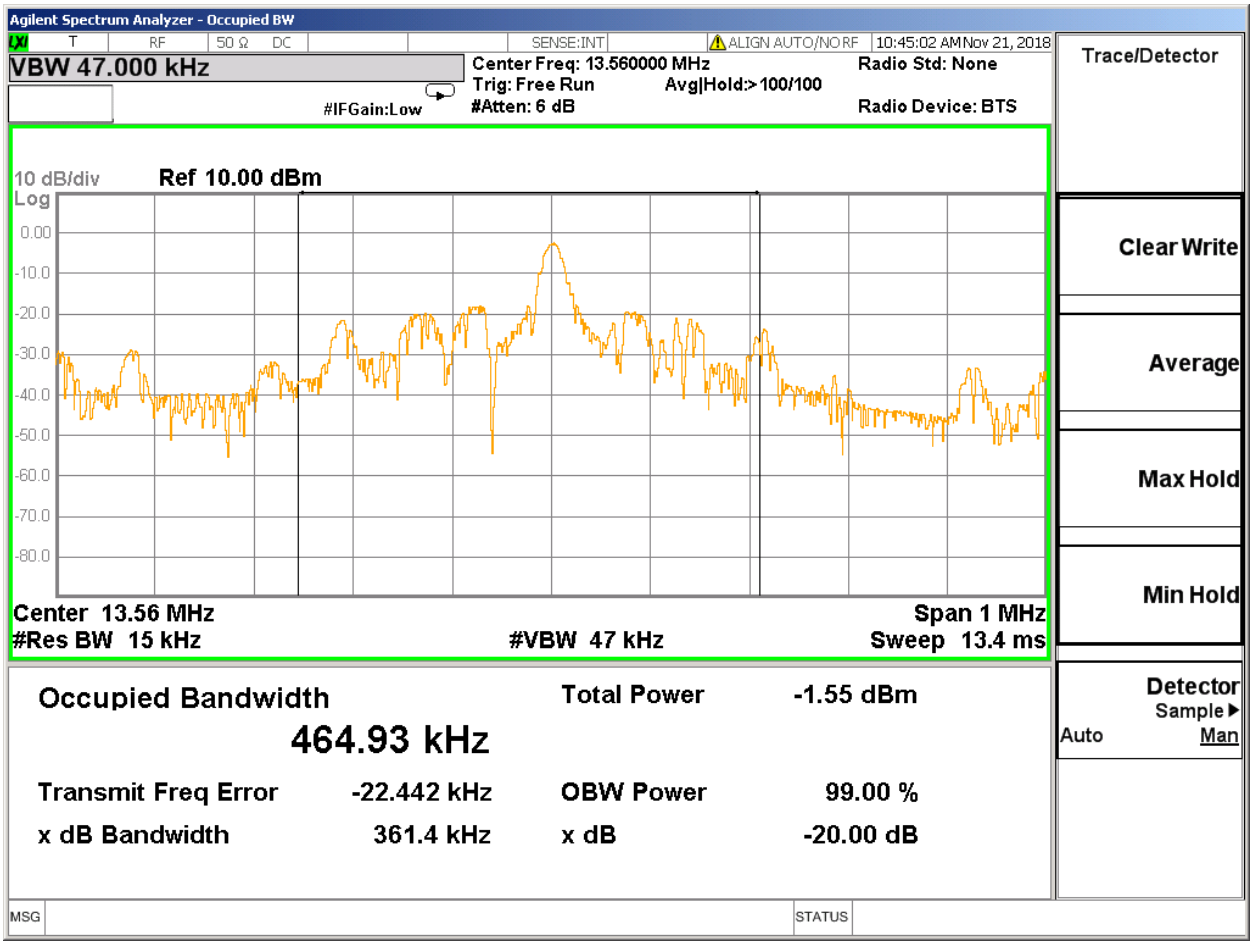
RESULTS

Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
13.56	360.5	464.93

20 dB Bandwidth Measurement



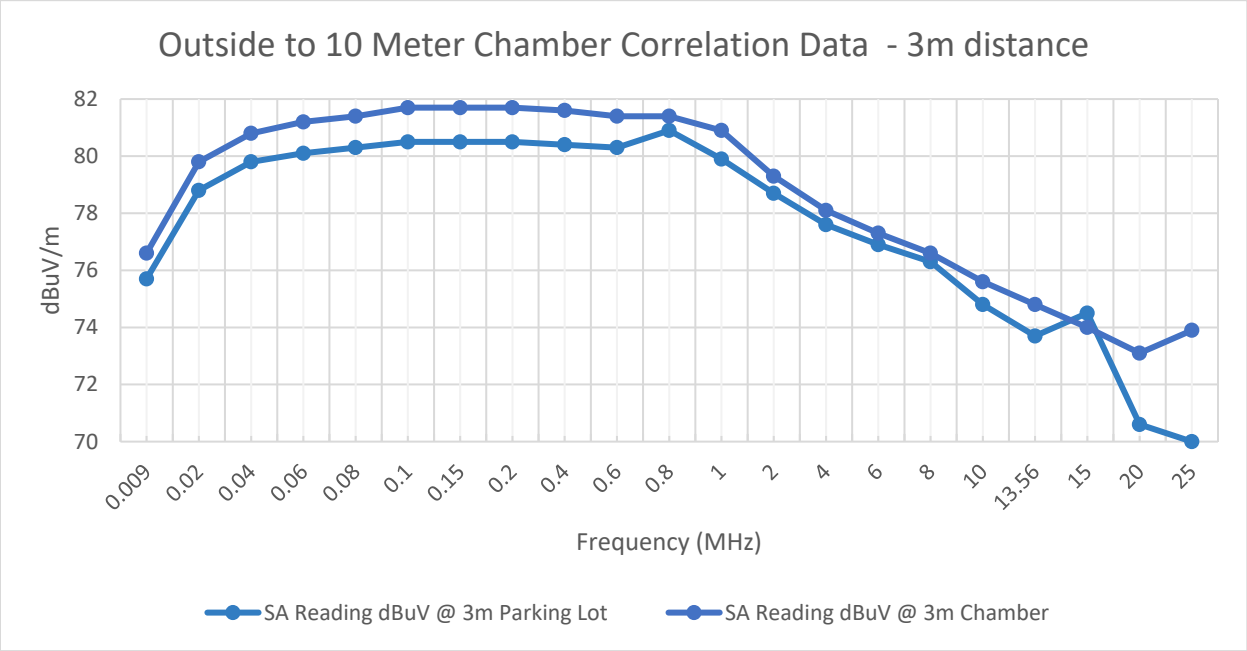
99% OBW Bandwidth Measurement



8. RADIATED EMISSION TEST RESULTS

8.1. Outdoor to 10m SAC Correlation Data

Correlation Data for measurements 9kHz-30MHz between Outside and 10m semi-anechoic chamber at Underwriter Laboratories in Northbrook, IL.



Correlation measurements were conducted using a signal source with an antenna outside in open area (parking lot). Immediately following the measurements the same setup was moved inside the 10 meter semi-anechoic chamber and the measurements were repeated. The above plot shows the difference in levels measured between outside and the 10 meter semi anechoic chamber.

8.2. LIMITS AND PROCEDURE

LIMIT

§15.225
IC RSS-210, Annex B.6 (Transmitter)

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:
§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Limits for radiated disturbance of an intentional radiator		
Frequency range (MHz)	Limits (µV/m)	Measurement Distance (m)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / F (kHz)	30
1.705 – 30.0	30	30
30 – 88	100**	3
88 - 216	150**	3
216 – 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.
§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the filed strength from uV/m to dBuV/m is:
Limit (dBuV/m) = 20 log limit (uV/m)

Masurements between 9kHz-30MHz were conducted at 3m measurement distance and 30MHz-1GHz at 10m distance. The emissions levels were extrapolated to the limit distance using the following factor:

9kHz - 490kHz: 40*log(3/300)
490kHz – 30MHz: 40*log(3/30)
30MHz-1GHz: 20*log(10/3)

In addition:

§15.225 (d) The emission limits shown the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to + 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

RESULTS

8.2.1. FUNDAMENTAL FREQUENCY RADIATED EMISSIONS

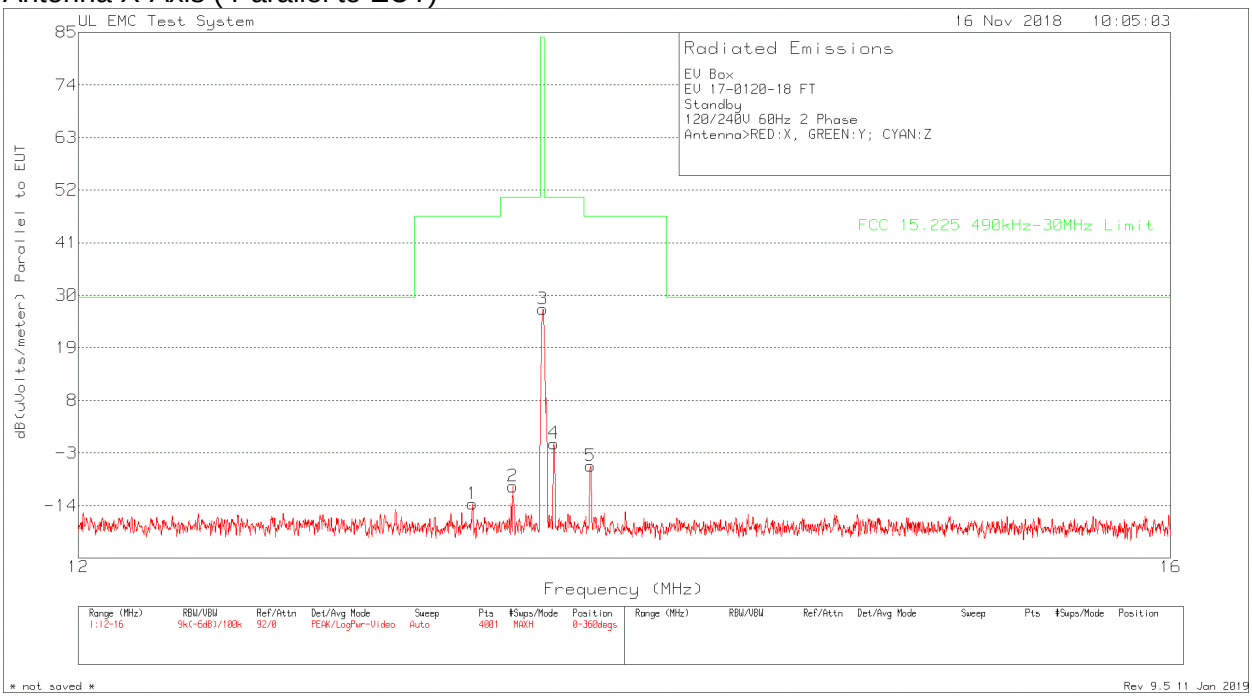
Data

Trace Markers										
Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor (dB/m)	Path (dB)	Distance Factor (dB)	Corrected Reading dB(uVolts/ meter)	AV Limit (dBuV/m)	Margin (dB)	Azimuth [Degs]	Antenna Polarity
13.562	55.29	Pk	11.4	0.4	-40	27.09	84	-56.91	0-360	X
13.563	49.05	Pk	11.4	0.4	-40	20.85	84	-63.15	0-360	Y
13.562	39.64	Pk	11.4	0.4	-40	11.44	84	-72.56	0-360	Z

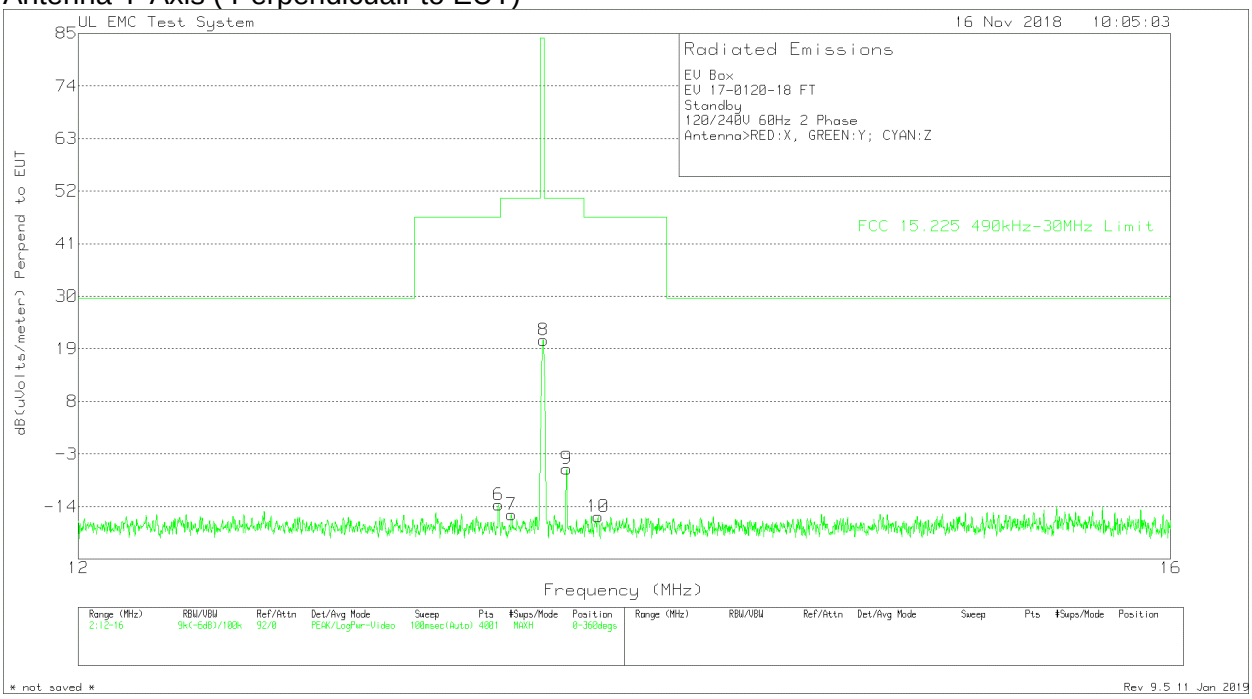
Pk - Peak Detector

8.2.2. SPURIOUS EMISSIONS (0.15 – 30 MHz)

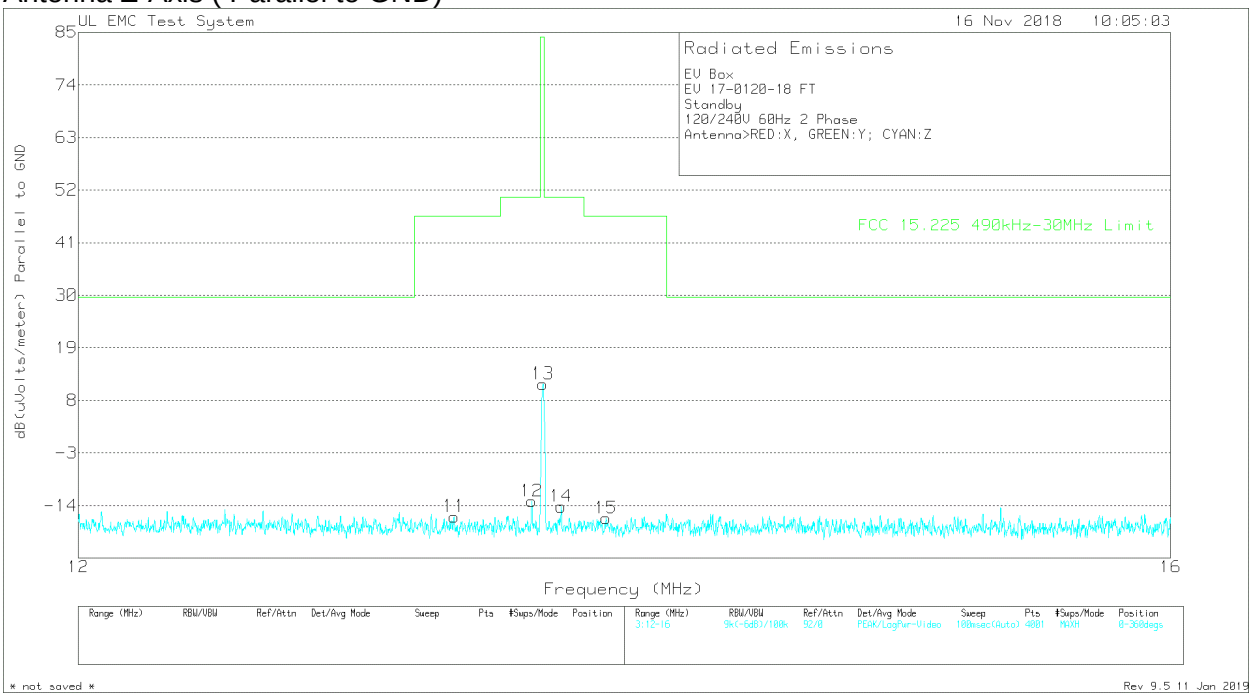
In band Data – Standby
Antenna X-Axis (Parallel to EUT)



Antenna Y-Axis (Perpendicualr to EUT)



Antenna Z-Axis (Parallel to GND)

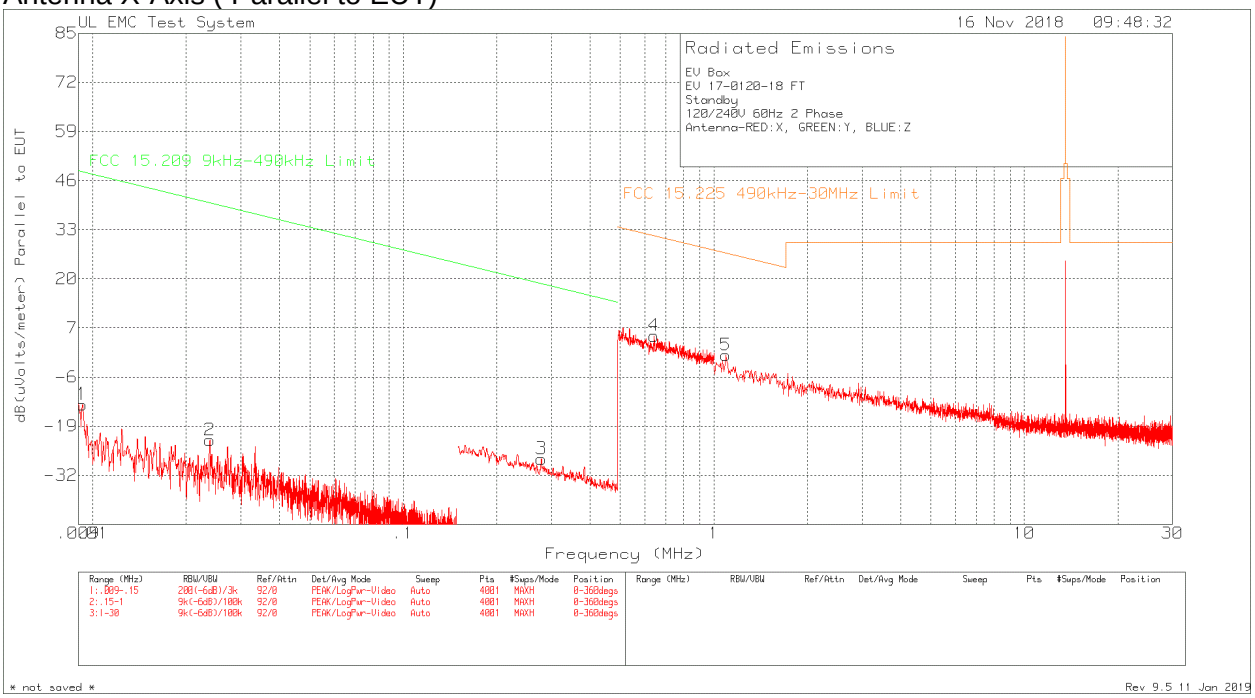


Trace Markers											
Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor (dB/m)	Path (dB)	Distance Factor (dB)	Corrected Reading dB(uVolts/ meter)	AV Limit (dBuV/m)	Margin (dB)	Azimuth [Degs]	Antenna Polarity
1	13.313	14.45	Pk	11.5	0.4	-40	-13.65	46.51	-60.16	0-360	X
2	13.455	18.13	Pk	11.5	0.4	-40	-9.97	50.47	-60.44	0-360	X
3	13.562	55.29	Pk	11.4	0.4	-40	27.09	84	-56.91	0-360	X
4	13.601	27.22	Pk	11.4	0.4	-40	-0.98	50.47	-51.45	0-360	X
5	13.733	22.54	Pk	11.4	0.4	-40	-5.66	46.51	-52.17	0-360	X
6	13.4045	14.51	Pk	11.5	0.4	-40	-13.59	46.51	-60.1	0-360	Y
7	13.45	12.43	Pk	11.5	0.4	-40	-15.67	50.47	-66.14	0-360	Y
8	13.563	49.05	Pk	11.4	0.4	-40	20.85	84	-63.15	0-360	Y
9	13.647	22.15	Pk	11.4	0.4	-40	-6.05	50.47	-56.52	0-360	Y
10	13.761	12.12	Pk	11.4	0.4	-40	-16.08	46.51	-62.59	0-360	Y
11	13.248	11.8	Pk	11.5	0.4	-40	-16.3	46.51	-62.81	0-360	Z
12	13.522	15.15	Pk	11.4	0.4	-40	-13.05	50.47	-63.52	0-360	Z
13	13.562	39.64	Pk	11.4	0.4	-40	11.44	84	-72.56	0-360	Z
14	13.6275	13.99	Pk	11.4	0.4	-40	-14.21	50.47	-64.68	0-360	Z
15	13.79	11.54	Pk	11.4	0.4	-40	-16.66	46.51	-63.17	0-360	Z

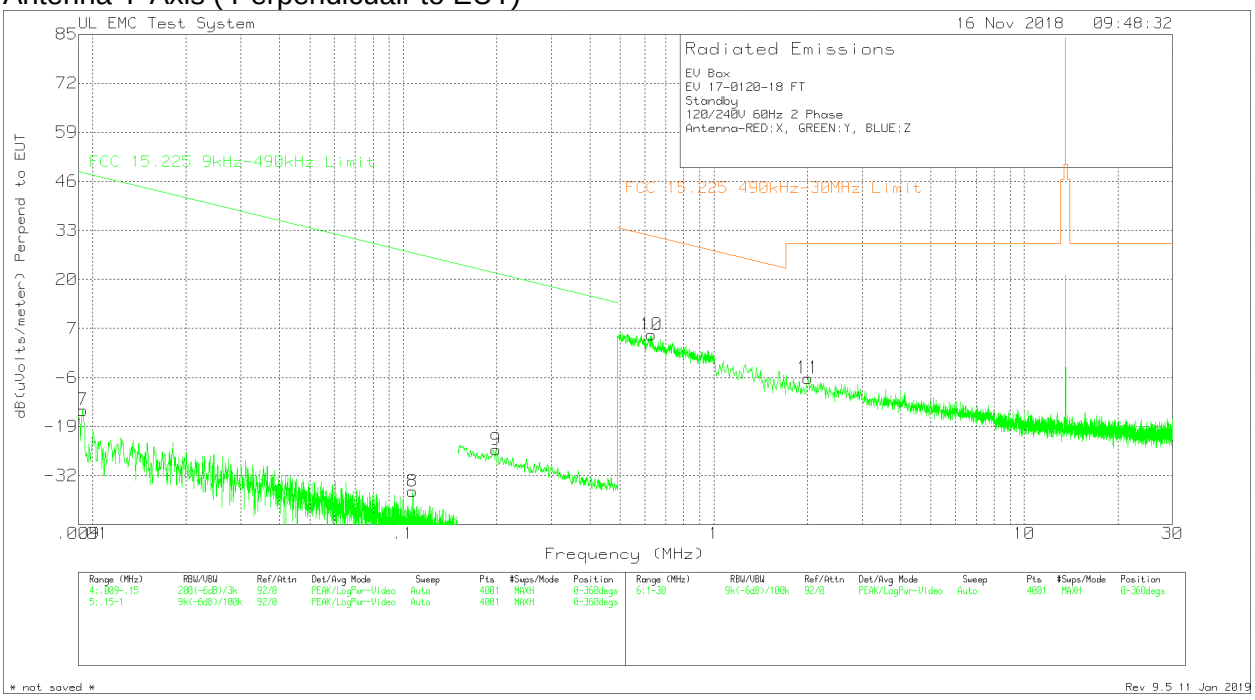
Pk - Peak detector

9kHz-30MHz Data – Standby

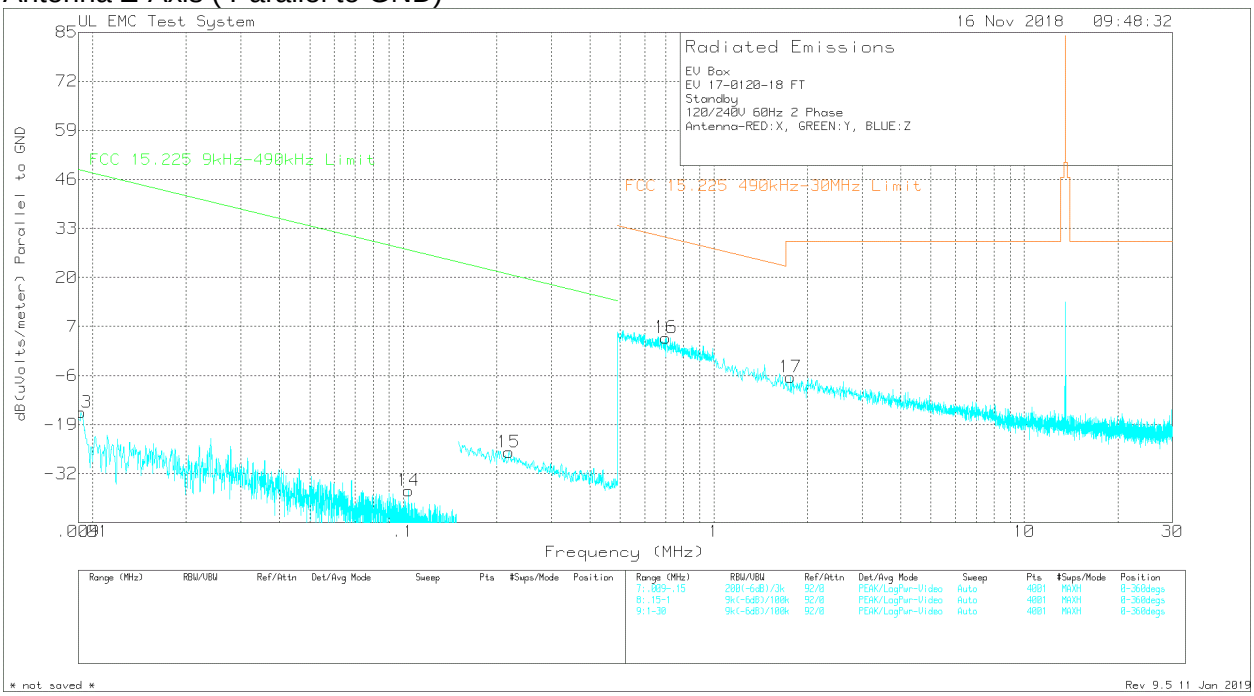
Antenna X-Axis (Parallel to EUT)



Antenna Y-Axis (Perpendicualr to EUT)



Antenna Z-Axis (Parallel to GND)

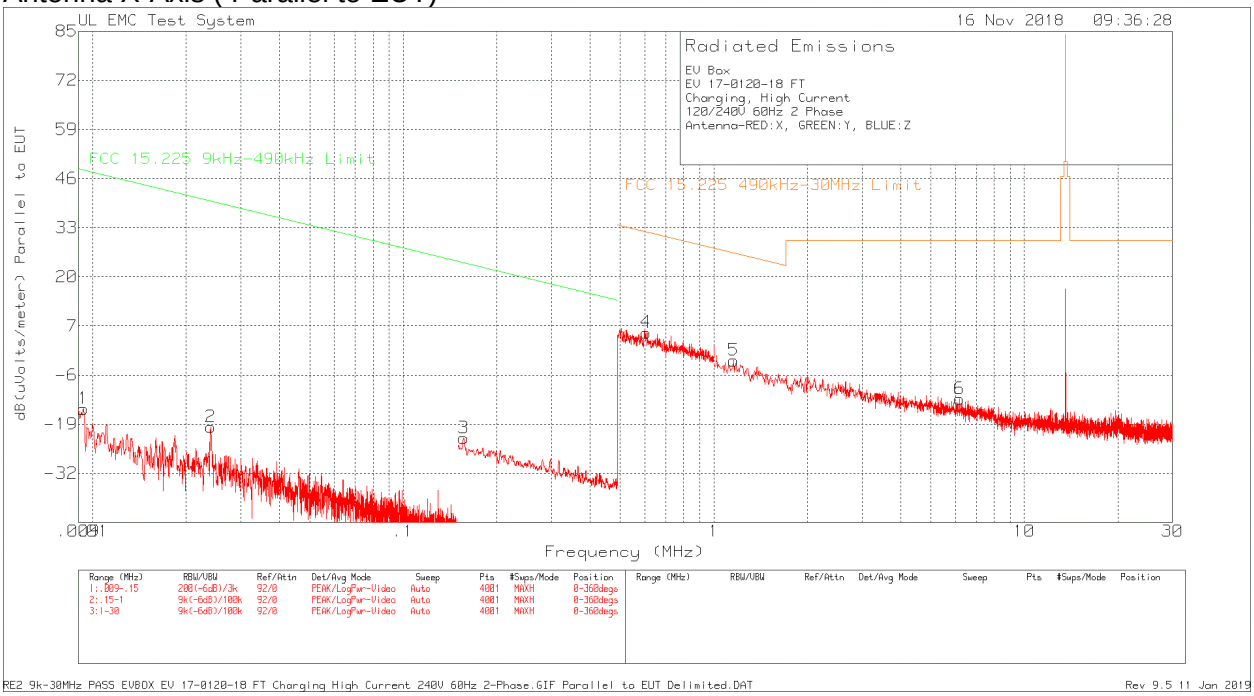


Trace Markers													
Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor (dB/m)	Path (dB)	Distance Factor	Corrected Reading dB(uVolts/ meter)	FCC 15.209 9kHz-490kHz AV Limit (dBuV/m)	AV Margin (dB)	FCC 15.225 490kHz-30MHz AV Limit (dBuV/m)	AV Margin (dB)	Azimuth [Degs]	Antenna Polarity
1	0.009245	43.62	Pk	23.1	0	-80	-13.28	48.29	-61.57	-	-	0-360	X
2	0.02384	39.96	Pk	17.3	0	-80	-22.74	40.06	-62.8	-	-	0-360	X
3	0.27865	40.56	Pk	11.7	0.1	-80	-27.64	18.7	-46.34	-	-	0-360	X
4	0.64246	32.91	Pk	11.9	0.1	-40	4.91	-	-	31.45	-26.54	0-360	X
5	1.09425	27.36	Pk	12.3	0.1	-40	-0.24	-	-	26.82	-27.06	0-360	X
7	0.00928	42.25	Pk	23.1	0	-80	-14.65	48.25	-62.9	-	-	0-360	Y
8	0.10735	31.69	Pk	12.1	0	-80	-36.21	26.99	-63.2	-	-	0-360	Y
9	0.19942	42.87	Pk	11.8	0	-80	-25.33	21.61	-46.94	-	-	0-360	Y
10	0.6301	33.35	Pk	11.9	0.1	-40	5.35	-	-	31.62	-26.27	0-360	Y
11	2.015	21.41	Pk	12.2	0.2	-40	-6.19	-	-	29.54	-35.73	0-360	Y
13	0.009175	41.14	Pk	23.1	0	-80	-15.76	48.35	-64.11	-	-	0-360	Z
14	0.104095	31.39	Pk	12.1	0	-80	-36.51	27.26	-63.77	-	-	0-360	Z
15	0.21923	41.98	Pk	11.8	0.1	-80	-26.12	20.79	-46.91	-	-	0-360	Z
16	0.70167	32.03	Pk	11.9	0.1	-40	4.03	-	-	30.68	-26.65	0-360	Z
17	1.7685	21.31	Pk	12.2	0.1	-40	-6.39	-	-	29.54	-35.93	0-360	Z

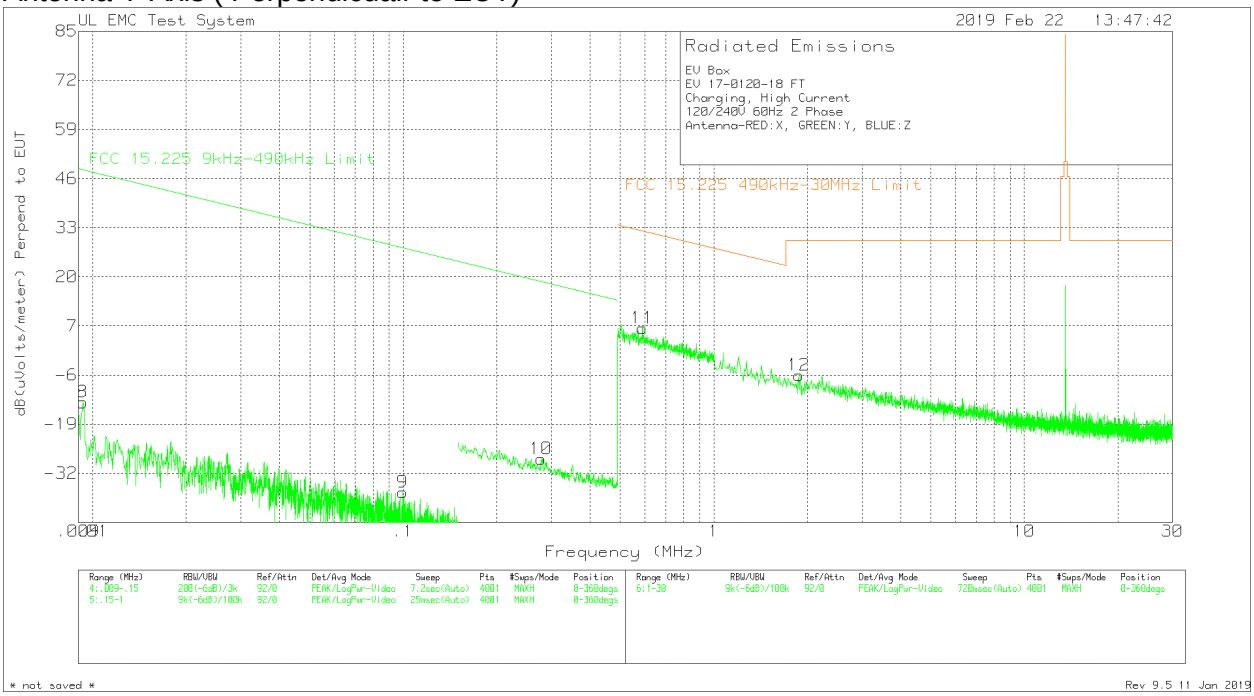
Pk - Peak detector

9kHz-30MHz Data – Charging

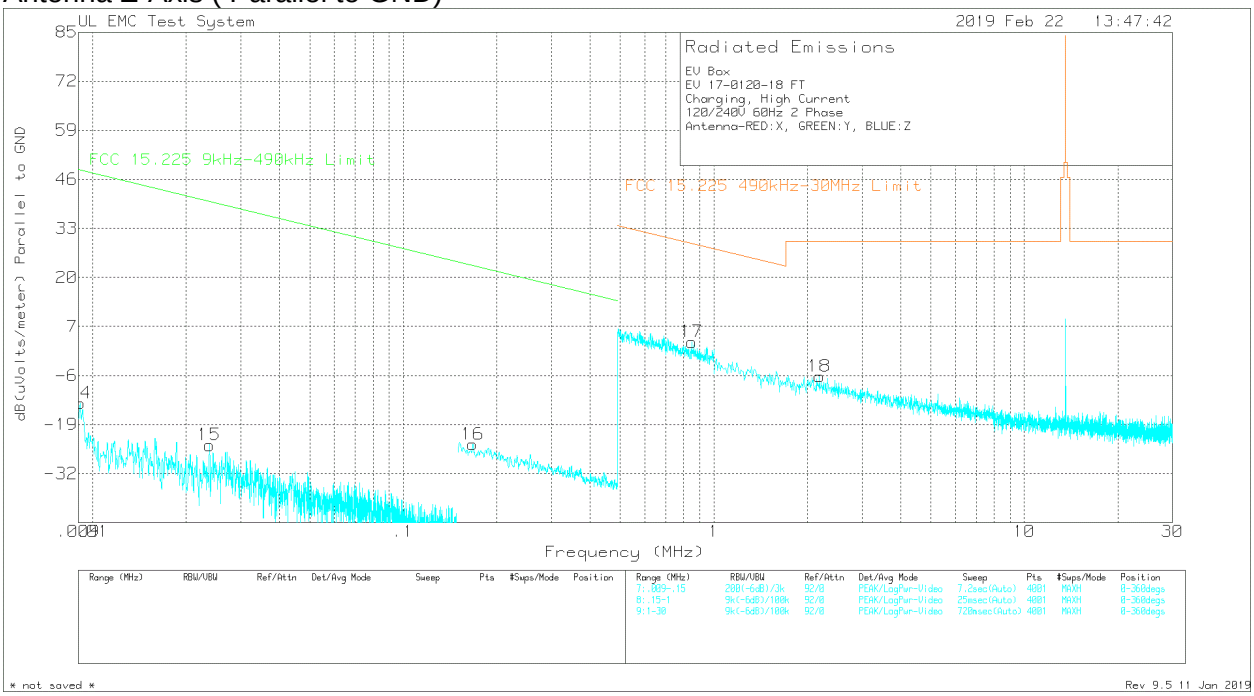
Antenna X-Axis (Parallel to EUT)



Antenna Y-Axis (Perpendicualr to EUT)



Antenna Z-Axis (Parallel to GND)

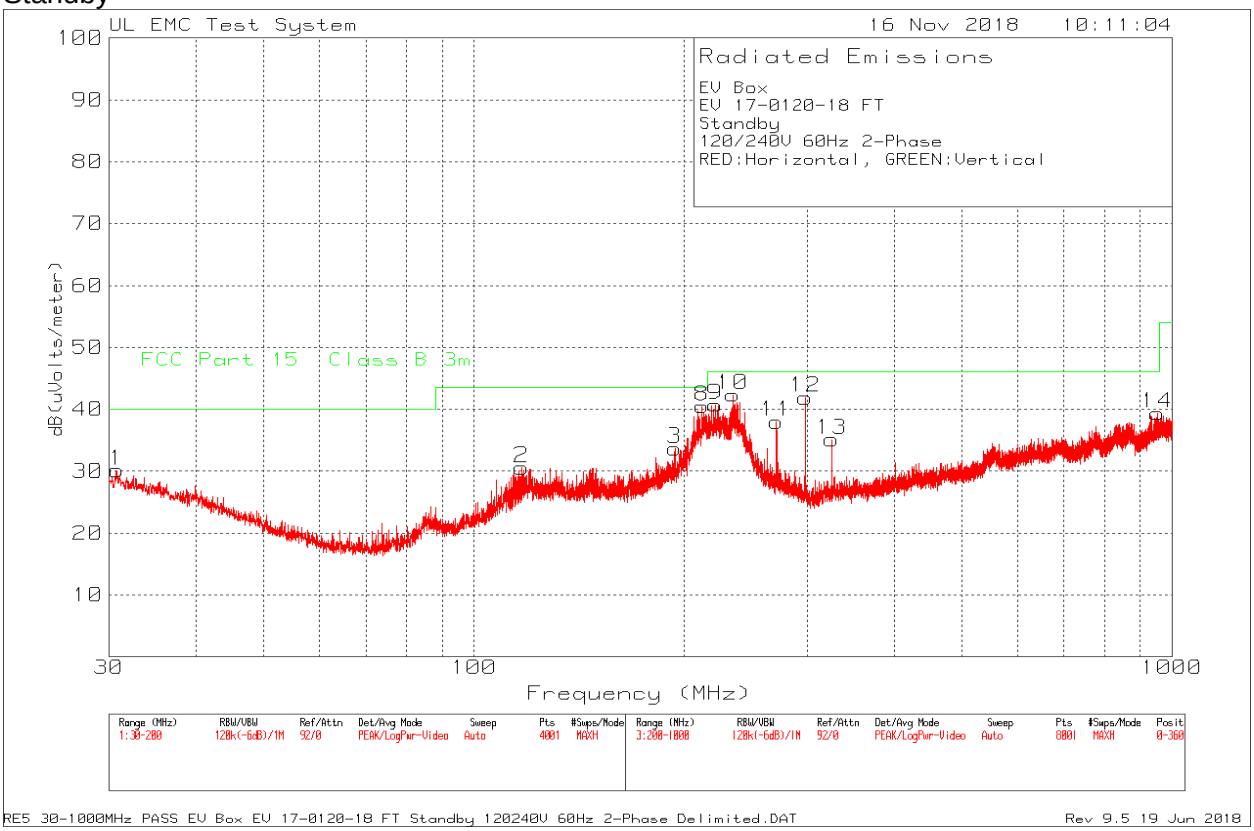


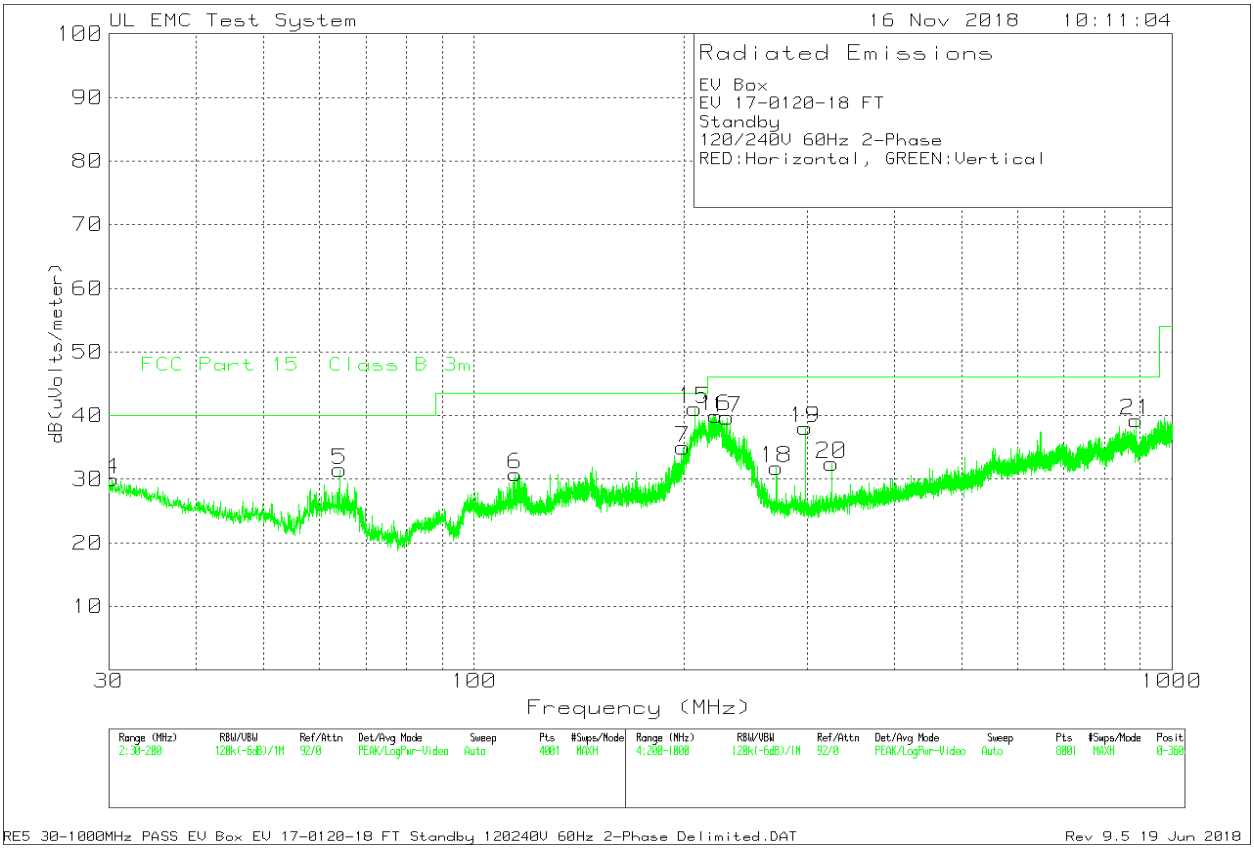
Trace Markers													
Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor (dB/m)	Path (dB)	Distance Factor	Corrected Reading dB(uVolts/ meter)	FCC 15.209 9kHz-490kHz AV Limit (dBuV/m)	AV Margin (dB)	FCC 15.225 490kHz-30MHz AV Limit (dBuV/m)	AV Margin (dB)	Azimuth [Degs]	Antenna Polarity
1	0.00935	41.93	Pk	23.1	0	-80	-14.97	48.19	-63.16	-	-	0-360	X
2	0.02398	42.91	Pk	17.3	0	-80	-19.79	40.01	-59.8	-	-	0-360	X
3	0.1566	45.28	Pk	11.9	0.1	-80	-22.72	23.71	-46.43	-	-	0-360	X
4	0.60539	33.24	Pk	11.9	0.1	-40	5.24	-	-	31.96	-26.72	0-360	X
5	1.1595	25.42	Pk	12.3	0.1	-40	-2.18	-	-	26.32	-28.5	0-360	X
6	6.191	15.26	Pk	12.1	0.3	-40	-12.34	-	-	29.54	-41.88	0-360	X
8	0.009315	43.66	Pk	23.1	0	-80	-13.24	48.22	-61.46	-	-	0-360	Y
9	0.099825	30.82	Pk	12.1	0	-80	-37.08	27.62	-64.7	-	-	0-360	Y
10	0.27801	39.94	Pk	11.7	0.1	-80	-28.26	18.72	-46.98	-	-	0-360	Y
11	0.58963	34.38	Pk	11.9	0.1	-40	6.38	-	-	32.19	-25.81	0-360	Y
12	1.87725	21.65	Pk	12.2	0.1	-40	-6.05	-	-	29.54	-35.59	0-360	Y
14	0.009105	43.51	Pk	23.1	0	-80	-13.39	48.42	-61.81	-	-	0-360	Z
15	0.023735	38.2	Pk	17.3	0	-80	-24.5	40.1	-64.6	-	-	0-360	Z
16	0.16747	43.76	Pk	11.9	0.1	-80	-24.24	23.13	-47.37	-	-	0-360	Z
17	0.84949	30.84	Pk	11.9	0.1	-40	2.84	-	-	29.02	-26.18	0-360	Z
18	2.189	21.33	Pk	12.2	0.2	-40	-6.27	-	-	29.54	-35.81	0-360	Z

Pk - Peak detector

8.2.3. TX SPURIOUS EMISSION 30 TO 1000 MHz

Standby





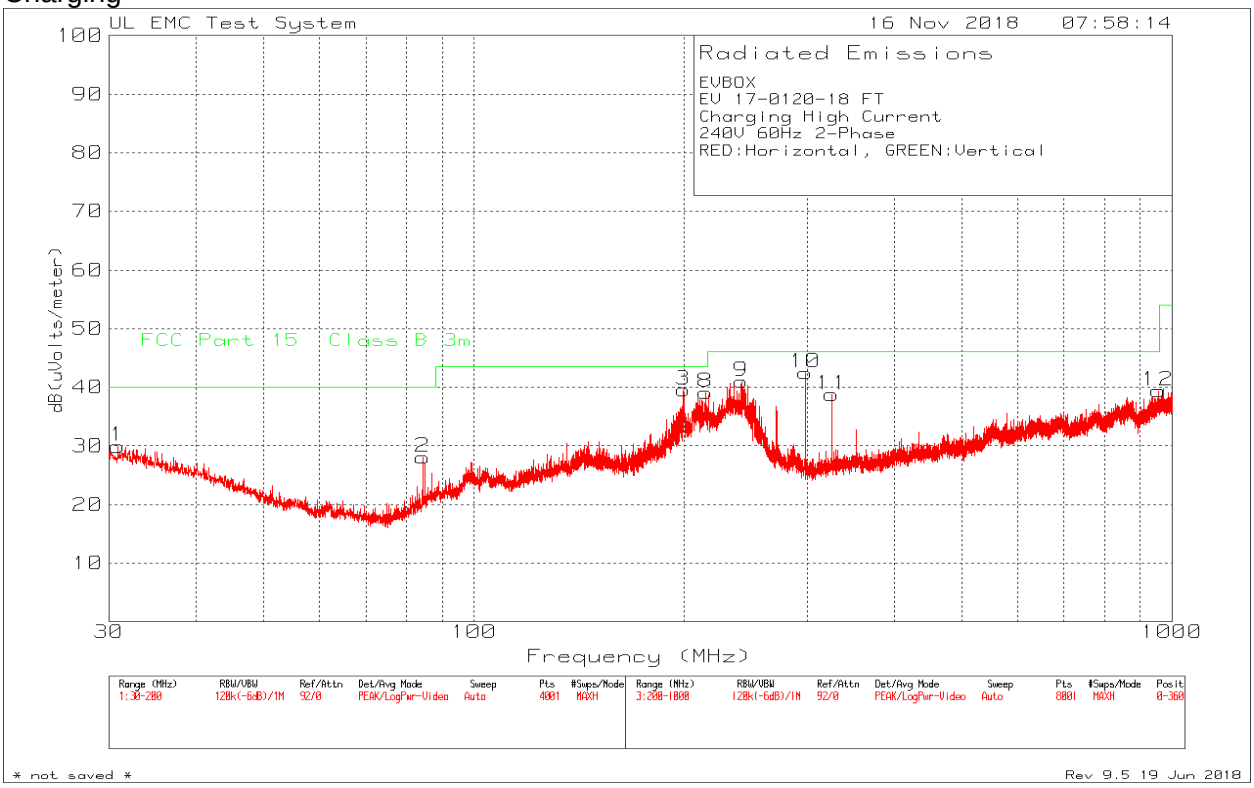
Trace Markers												
Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor (dB/m)	Path (dB)	Distance Factor (dB)	Corrected Reading dB(uVolts/ meter)	FCC 15.209 QP Limit (dBuV/m)	QP Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	30.8075	31.94	Pk	18	-30.3	10.46	30.1	40	-9.9	0-360	248	H
2	116.9975	36.78	Pk	13	-29.7	10.46	30.54	43.52	-12.98	0-360	398	H
3	193.965	35.87	Pk	16.1	-28.8	10.46	33.63	43.52	-9.89	0-360	398	H
4	30.34	31.76	Pk	18.2	-30.5	10.46	29.92	40	-10.08	0-360	101	V
5	64.2125	44.99	Pk	6.3	-30.3	10.46	31.45	40	-8.55	0-360	251	V
6	114.575	37.27	Pk	12.7	-29.7	10.46	30.73	43.52	-12.79	0-360	101	V
7	199.32	36.99	Pk	16.2	-28.7	10.46	34.95	43.52	-8.57	0-360	101	V
8	212.2	48.09	Pk	11.3	-29.4	10.46	40.45	43.52	-3.07	0-360	399	H
9	221.6	48.4	Pk	11	-29.2	10.46	40.66	46.02	-5.36	0-360	399	H
10	234.9	50.13	Pk	11.1	-29.4	10.46	42.29	46.02	-3.73	0-360	399	H
11	271.2	43.9	Pk	12.7	-29.1	10.46	37.96	46.02	-8.06	0-360	299	H
12	298.3	47.2	Pk	13.2	-29	10.46	41.86	46.02	-4.16	0-360	299	H
13	325.5	39.33	Pk	13.9	-28.6	10.46	35.09	46.02	-10.93	0-360	199	H
14	952.6	32.06	Pk	23.7	-26.9	10.46	39.32	46.02	-6.7	0-360	199	H
15	207	48.57	Pk	11.4	-29.4	10.46	41.03	46.02	-4.99	0-360	102	V
16	221.9	47.65	Pk	11	-29.2	10.46	39.91	46.02	-6.11	0-360	102	V
17	230.5	47.41	Pk	11	-29.2	10.46	39.67	46.02	-6.35	0-360	102	V
18	271.2	37.69	Pk	12.7	-29.1	10.46	31.75	46.02	-14.27	0-360	102	V
19	298.4	43.37	Pk	13.2	-29	10.46	38.03	46.02	-7.99	0-360	102	V
20	325.4	36.56	Pk	13.9	-28.5	10.46	32.42	46.02	-13.6	0-360	102	V
21	888	34.35	Pk	21.9	-27.5	10.46	39.21	46.02	-6.81	0-360	299	V

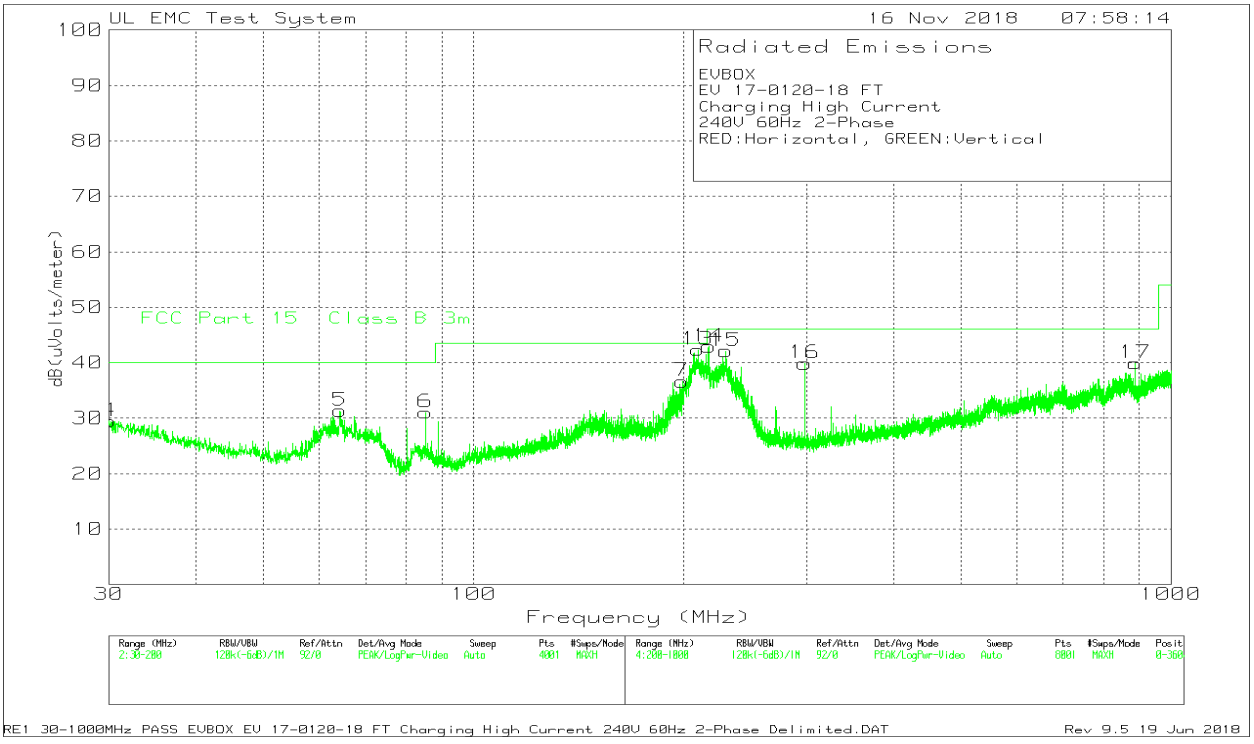
Pk - Peak detector

Radiated Emission Data											
Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor (dB/m)	Path (dB)	Distance Factor (dB)	Corrected Reading dB(uVolts/ meter)	FCC 15.209 QP Limit (dBuV/m)	QP Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
212.871	44.6	Qp	11.3	-29.3	10.46	37.06	43.52	-6.46	245	389	H
221.65075	43	Qp	11	-29.2	10.46	35.26	46.02	-10.76	251	389	H
234.819375	43.94	Qp	11.1	-29.4	10.46	36.1	46.02	-9.92	130	395	H
298.3402	48.44	Qp	13.2	-29	10.46	43.1	46.02	-2.92	225	248	H
207.73475	43.63	Qp	11.4	-29.4	10.46	36.09	43.52	-7.43	292	102	V

Qp - Quasi-Peak detector

Charging





Trace Markers												
Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor (dB/m)	Path (dB)	Distance Factor (dB)	Corrected Reading dB(uVolts/ meter)	QP Limit (dBuV/m)	QP Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	30.8925	31.82	Pk	17.9	-30.3	10.46	29.88	40	-10.12	0-360	399	H
2	84.485	39.56	Pk	7.9	-29.9	10.46	28.02	40	-11.98	0-360	248	H
3	199.575	41.66	Pk	16.2	-28.8	10.46	39.52	43.52	-4	0-360	399	H
4	30.0425	30.99	Pk	18.3	-30.3	10.46	29.45	40	-10.55	0-360	102	V
5	64.34	44.85	Pk	6.3	-30.3	10.46	31.31	40	-8.69	0-360	251	V
6	85.2925	42.45	Pk	8.1	-30	10.46	31.01	40	-8.99	0-360	251	V
7	199.0225	38.74	Pk	16.2	-28.8	10.46	36.6	43.52	-6.92	0-360	102	V
8	214.7	46.91	Pk	11.2	-29.5	10.46	39.07	43.52	-4.45	0-360	399	H
9	241.6	48.4	Pk	11.4	-29.3	10.46	40.96	46.02	-5.06	0-360	399	H
10	298.3	47.79	Pk	13.2	-29	10.46	42.45	46.02	-3.57	0-360	299	H
11	325.5	42.98	Pk	13.9	-28.6	10.46	38.74	46.02	-7.28	0-360	199	H
12	955.1	32.02	Pk	23.8	-26.9	10.46	39.38	46.02	-6.64	0-360	199	H
13	209.6	49.85	Pk	11.4	-29.4	10.46	42.31	46.02	-3.71	0-360	99	V
14	217.4	50.55	Pk	11.1	-29.2	10.46	42.91	46.02	-3.11	0-360	99	V
15	229.8	49.94	Pk	11	-29.3	10.46	42.1	46.02	-3.92	0-360	99	V
16	298.3	45.17	Pk	13.2	-29	10.46	39.83	46.02	-6.19	0-360	99	V
17	888.1	35.04	Pk	21.9	-27.5	10.46	39.9	46.02	-6.12	0-360	298	V

Pk - Peak detector

Radiated Emission Data											
Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor (dB/m)	Path (dB)	Distance Factor (dB)	Corrected Reading dB(uVolts/ meter)	QP Limit (dBuV/m)	QP Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
199.7353	32.99	Qp	16.2	-28.8	10.46	30.85	43.52	-12.67	203	377	H
216.971	46.46	Qp	11.1	-29.6	10.46	38.42	46.02	-7.6	245	395	H
244.13425	45.81	Qp	11.5	-29.4	10.46	38.37	46.02	-7.65	239	298	H
298.35838	48.45	Qp	13.2	-29	10.46	43.11	46.02	-2.91	215	244	H
210.0221	45.88	Qp	11.4	-29.5	10.46	38.24	46.02	-7.78	298	101	V
216.99825	47.78	Qp	11.1	-29.5	10.46	39.84	46.02	-6.18	303	108	V
229.304625	44.91	Qp	11	-29.5	10.46	36.87	46.02	-9.15	116	172	V

Qp - Quasi-Peak detector

9. AC MAINS LINE CONDUCTED EMISSIONS

LIMITS

§15.207
IC RSS-GEN, Section 8.8

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is 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, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency range (MHz)	Limits (dBµV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Notes: 1. The lower limit shall apply at the transition frequencies 2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

TEST PROCEDURE

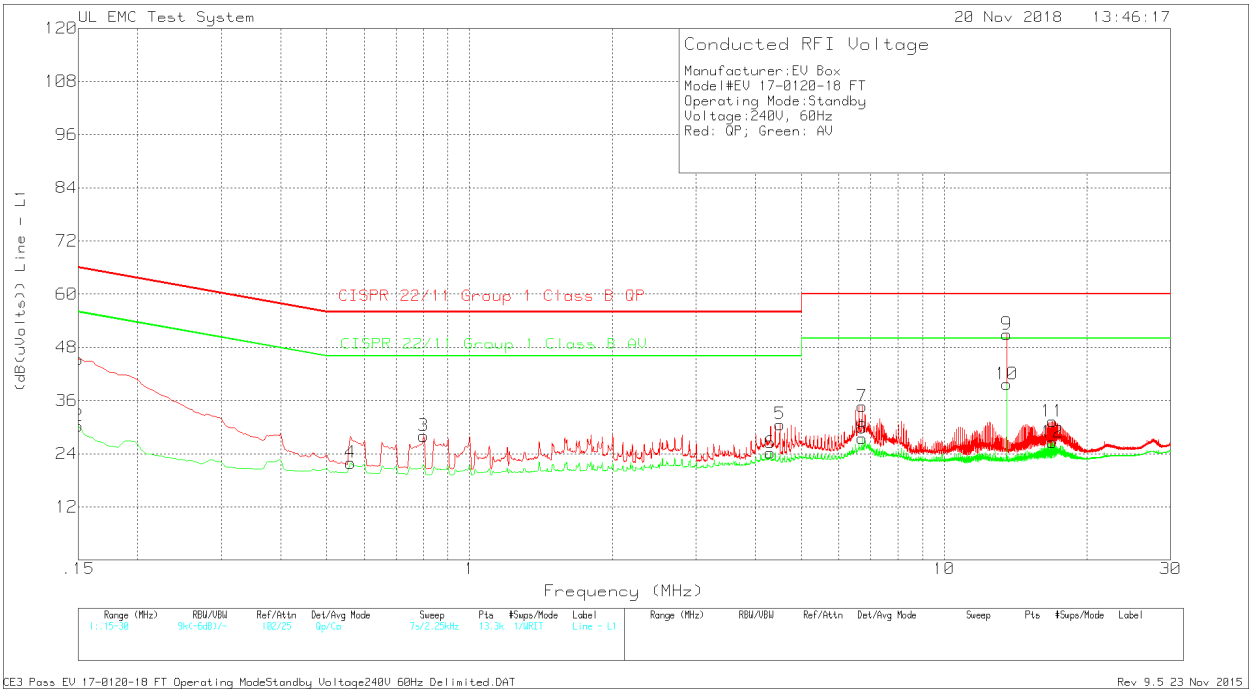
ANSI C63.10

RESULTS

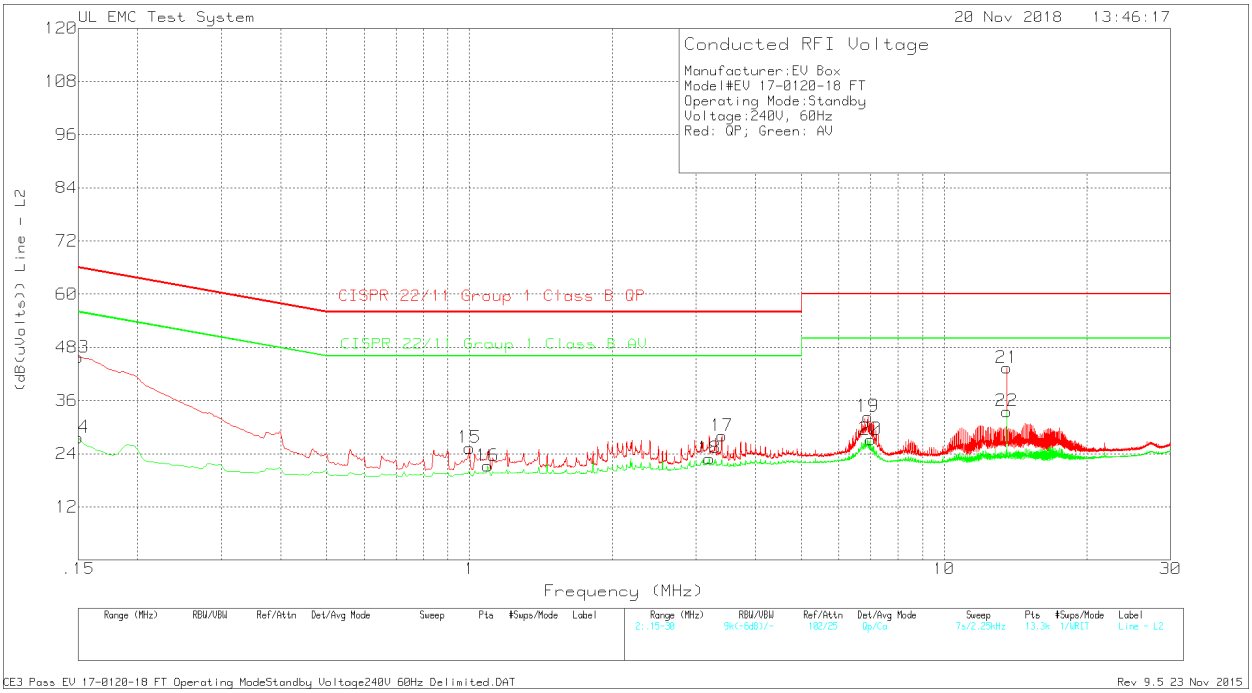
No non-compliance noted:

AC Line Conducted Emissions with normal antenna - Standby

Line 1



Line 2

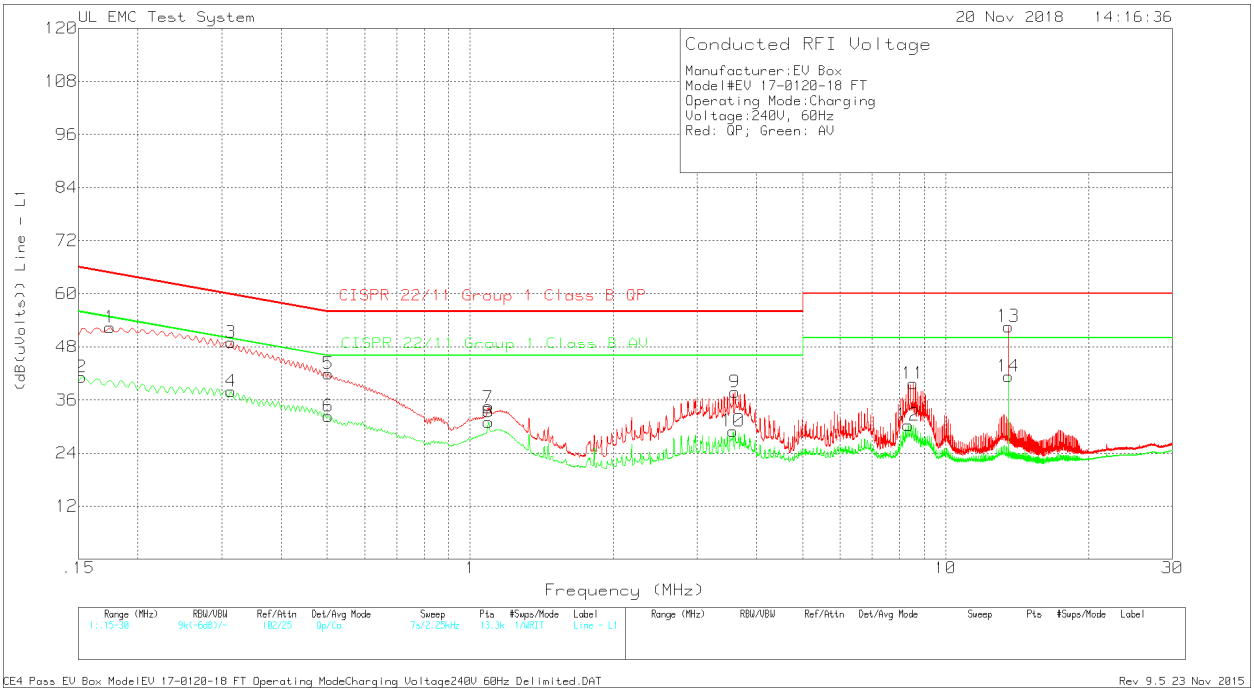


Trace Markers										
Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	LISN Factor (dBm)	Path (dB)	Corrected Reading (dB(uVolts))	QP Limit (dBuV)	QP Margin (dB)	AV Limit (dBuV)	AV Margin (dB)
Range 1: Line - 1 .15 - 30MHz										
1	0.15	30.39	Qp	0.1	14.8	45.29	66	-20.71	-	-
2	0.15	15.33	Ca	0.1	14.8	30.23	-	-	56	-25.77
3	0.80025	17.4	Qp	0	10.6	28	56	-28	-	-
4	0.56175	11.34	Ca	0	10.6	21.94	-	-	46	-24.06
5	4.5105	19.93	Qp	0	10.7	30.63	56	-25.37	-	-
6	4.308	13.55	Ca	0	10.7	24.25	-	-	46	-21.75
7	6.7155	23.91	Qp	0	10.8	34.71	60	-25.29	-	-
8	6.7155	16.67	Ca	0	10.8	27.47	-	-	50	-22.53
9	13.56225	39.86	Qp	0	11.1	50.96	60	-9.04	-	-
10	13.56225	28.6	Ca	0	11.1	39.7	-	-	50	-10.3
11	16.89	19.96	Qp	0	11.3	31.26	60	-28.74	-	-
12	16.89225	15.25	Ca	0	11.3	26.55	-	-	50	-23.45
Range 2: Line - 2 .15 - 30MHz										
13	0.15	30.96	Qp	0.1	14.7	45.76	66	-20.24	-	-
14	0.15	12.85	Ca	0.1	14.7	27.65	-	-	56	-28.35
15	1.0005	14.72	Qp	0	10.6	25.32	56	-30.68	-	-
16	1.09275	10.62	Ca	0	10.6	21.22	-	-	46	-24.78
17	3.40125	17.34	Qp	0	10.7	28.04	56	-27.96	-	-
18	3.201	12.26	Ca	0	10.7	22.96	-	-	46	-23.04
19	6.9045	21.49	Qp	0	10.9	32.39	60	-27.61	-	-
20	7.0035	16.31	Ca	0	10.9	27.21	-	-	50	-22.79
21	13.56225	32.26	Qp	0	11.1	43.36	60	-16.64	-	-
22	13.56225	22.48	Ca	0	11.1	33.58	-	-	50	-16.42

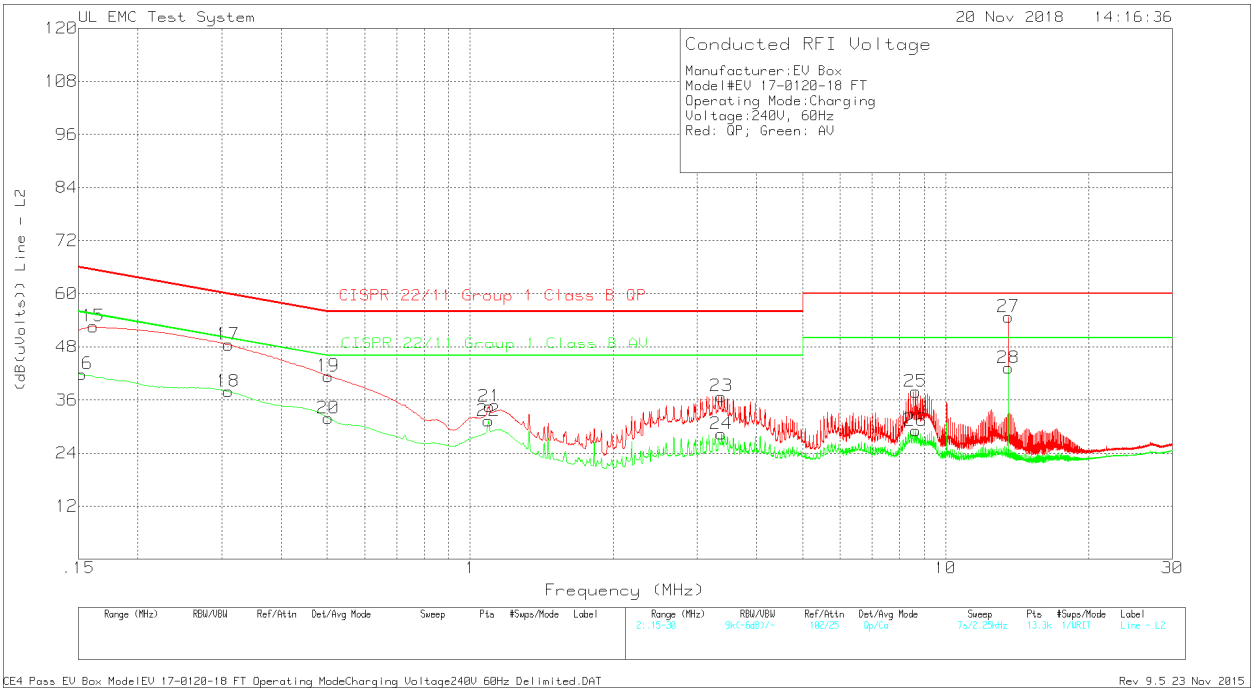
Qp - Quasi-Peak detector
Ca - CISPR Average detection

AC Line Conducted Emissions with normal antenna - Charging

Line 1



Line 2



Trace Markers										
Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	LISN Factor (dBm)	Path (dB)	Corrected Reading (dB(uVolts))	QP Limit (dBuV)	QP Margin (dB)	AV Limit (dBuV)	AV Margin (dB)
Range 1: Line - 1 .15 - 30MHz										
1	0.17475	40.35	Qp	0.1	11.9	52.35	64.73	-12.38	-	-
2	0.15225	27.33	Ca	0.1	13.7	41.13	-	-	55.88	-14.75
3	0.31425	38.15	Qp	0	10.8	48.95	59.86	-10.91	-	-
4	0.31425	27.11	Ca	0	10.8	37.91	-	-	49.86	-11.95
5	0.50325	31.2	Qp	0	10.7	41.9	56	-14.1	-	-
6	0.50325	21.64	Ca	0	10.7	32.34	-	-	46	-13.66
7	1.0905	23.66	Qp	0	10.6	34.26	56	-21.74	-	-
8	1.09275	20.44	Ca	0	10.6	31.04	-	-	46	-14.96
9	3.606	27.07	Qp	0	10.7	37.77	56	-18.23	-	-
10	3.5745	18.3	Ca	0	10.7	29	-	-	46	-17
11	8.5425	28.84	Qp	0	10.9	39.74	60	-20.26	-	-
12	8.34225	19.41	Ca	0	10.9	30.31	-	-	50	-19.69
13	13.56225	41.5	Qp	0	11.1	52.6	60	-7.4	-	-
14	13.56225	30.18	Ca	0	11.1	41.28	-	-	50	-8.72
Range 2: Line - 2 .15 - 30MHz										
15	0.16125	39.92	Qp	0.1	12.6	52.62	65.4	-12.78	-	-
16	0.15225	28.14	Ca	0.1	13.6	41.84	-	-	55.88	-14.04
17	0.30975	37.69	Qp	0	10.8	48.49	59.98	-11.49	-	-
18	0.30975	27.13	Ca	0	10.8	37.93	-	-	49.98	-12.05
19	0.50325	30.68	Qp	0	10.7	41.38	56	-14.62	-	-
20	0.50325	21.14	Ca	0	10.7	31.84	-	-	46	-14.16
21	1.09725	23.94	Qp	0	10.6	34.54	56	-21.46	-	-
22	1.09275	20.66	Ca	0	10.6	31.26	-	-	46	-14.74
23	3.3765	26.13	Qp	0	10.7	36.83	56	-19.17	-	-
24	3.3765	17.67	Ca	0	10.7	28.37	-	-	46	-17.63
25	8.64263	26.97	Qp	0	10.9	37.87	60	-22.13	-	-
26	8.6415	18.23	Ca	0	10.9	29.13	-	-	50	-20.87
27	13.56225	43.7	Qp	0	11.1	54.8	60	-5.2	-	-
28	13.56225	32.16	Ca	0	11.1	43.26	-	-	50	-6.74

Qp - Quasi-Peak detector
Ca - CISPR Average detection

10. FREQUENCY STABILITY

LIMIT

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

RSS-210 Annex B.6: Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

TEST PROCEDURE

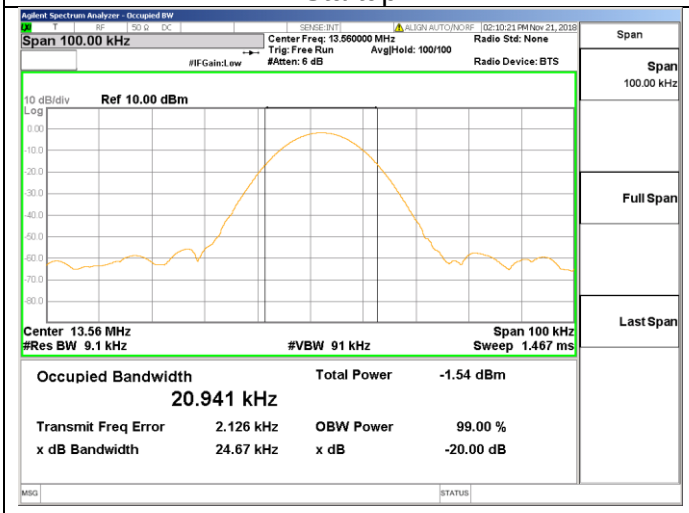
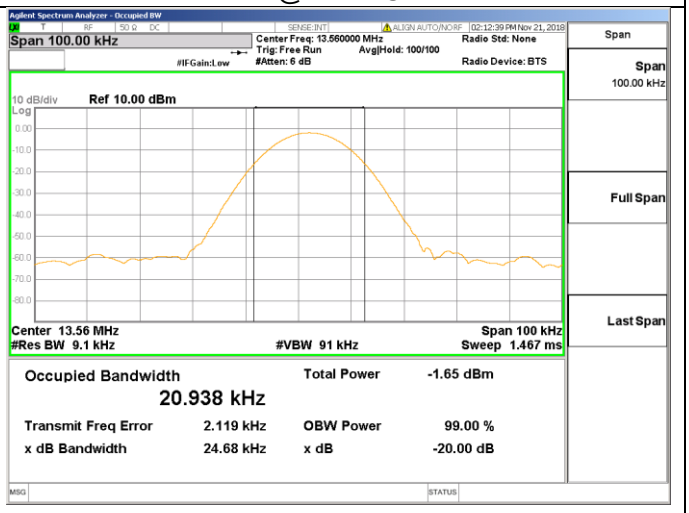
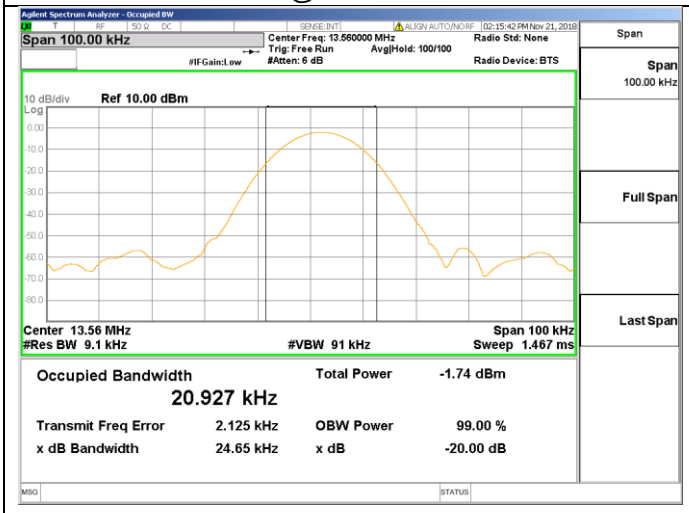
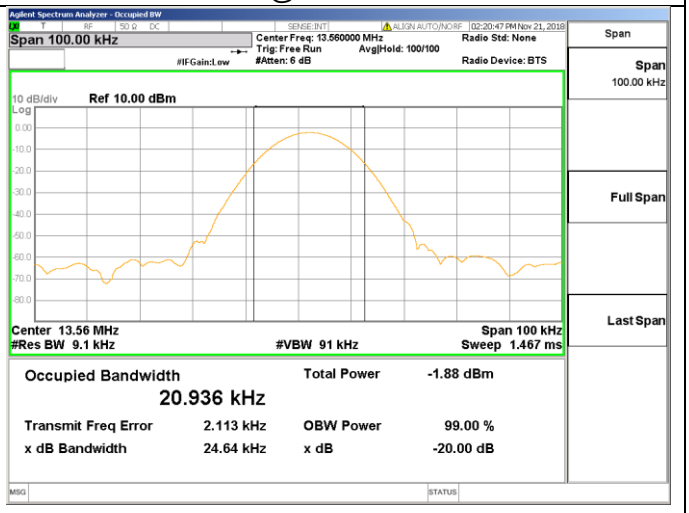
ANSI 63.10:2013 Clause 6.8.1 and 6.8.2

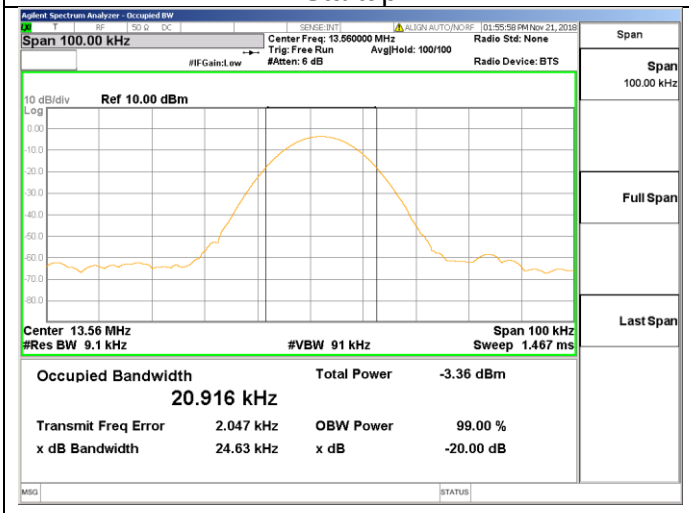
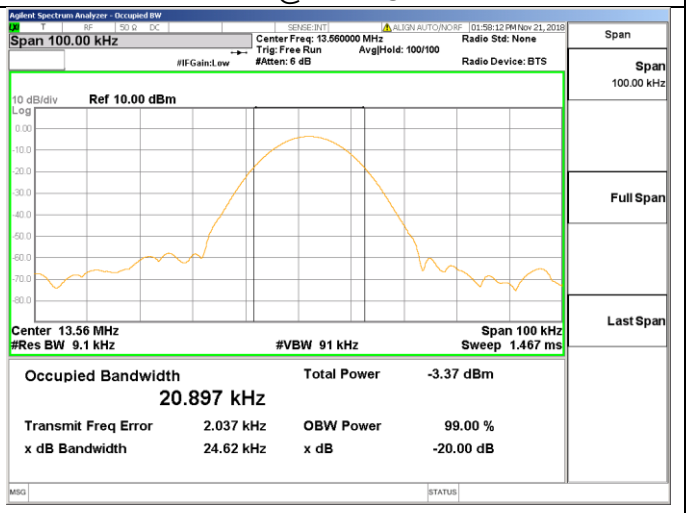
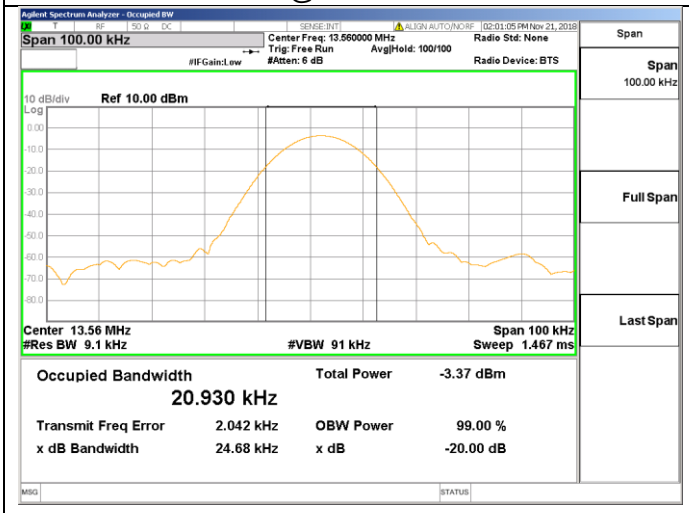
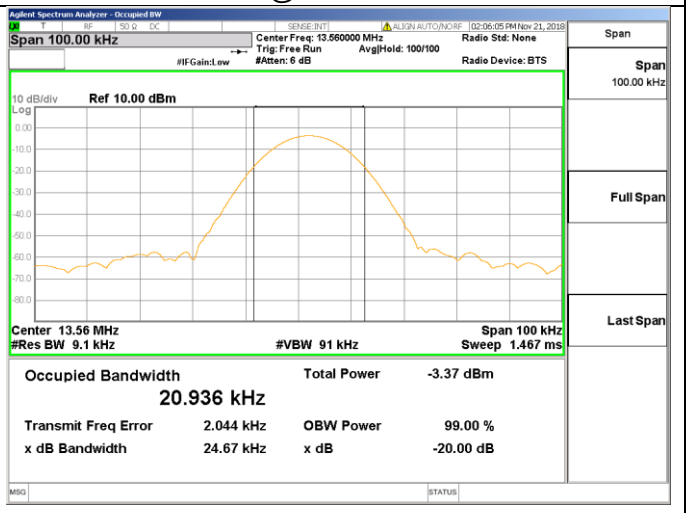
RESULTS

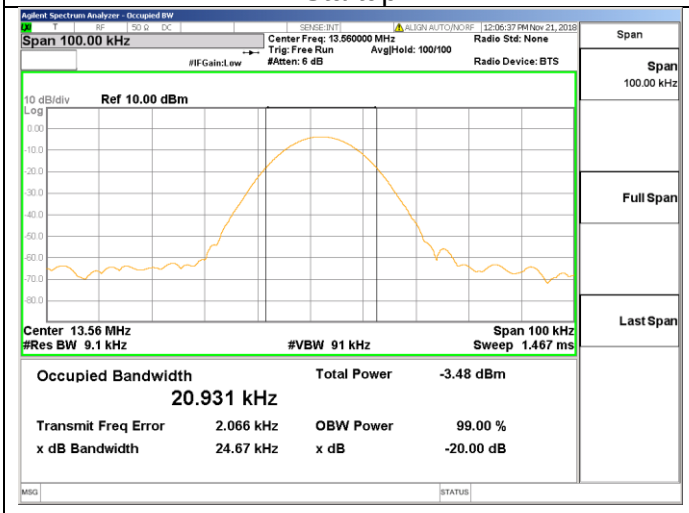
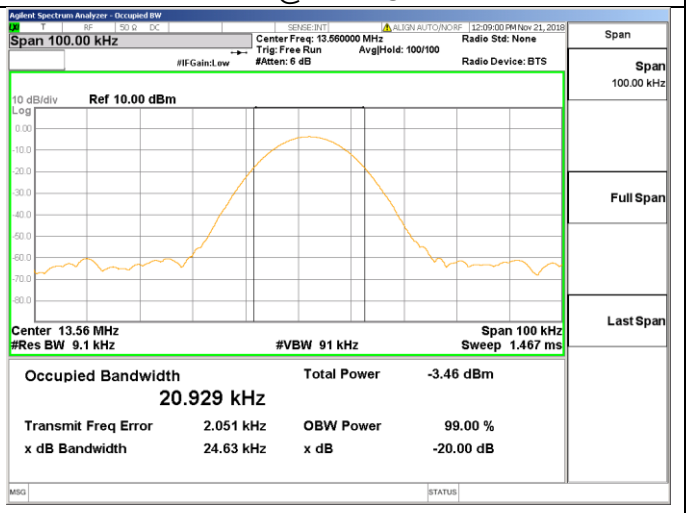
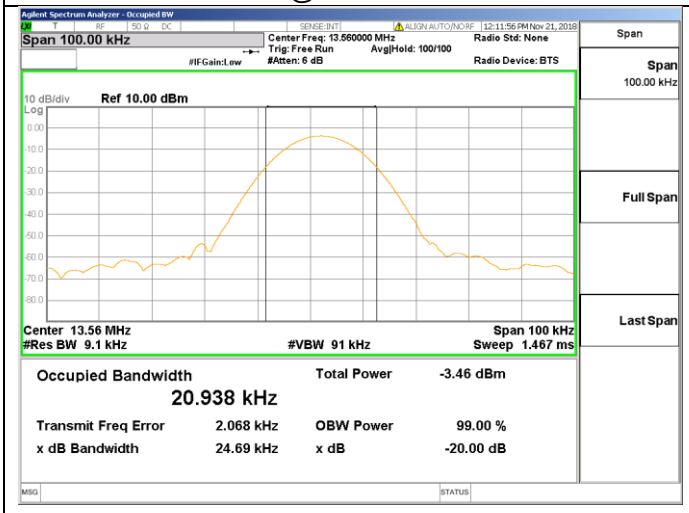
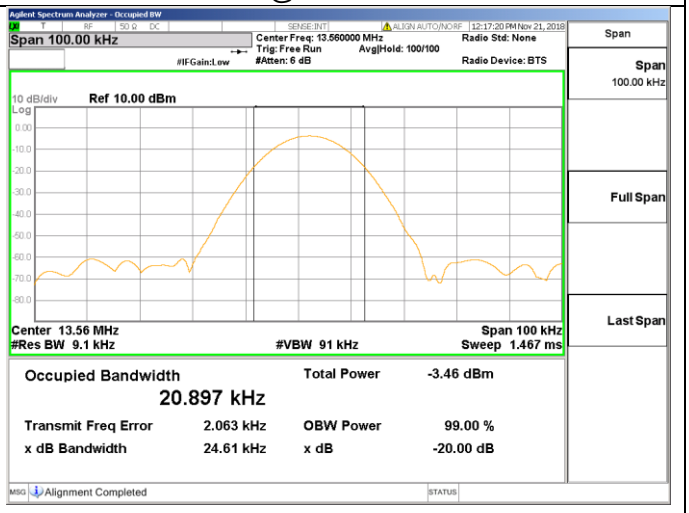
Reference Frequency: EUT Channel 13.56 MHz @ 20ºC Limit: ± 100 ppm = 1.356 kHz										
Power Supply	Envir. Temp	Frequency Deviation Measureed with Time Elapse								
(VDC)	(ºC)	Startup (MHz)	Delta (ppm)	@ 2 mins (MHz)	Delta (ppm)	@ 5 mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
240.00	50	13.5620470	5.826	13.5620370	6.563	13.5620420	6.195	13.5620040	8.997	± 100
240.00	40	13.5620660	4.425	13.5620510	5.531	13.5620680	4.277	13.5620630	4.646	± 100
240.00	30	13.5620960	2.212	13.5620920	2.507	13.5620750	3.761	13.5620890	2.729	± 100
240.00	***20***	***13.5621260***	***0.000***	***13.5621190***	***0.516***	***13.5621250***	***0.074***	***13.5621130***	***0.959***	***± 100***
240.00	10	13.5621510	-1.844	13.5621450	-1.401	13.5621470	-1.549	13.5621460	-1.475	± 100
240.00	0	13.5621590	-2.434	13.5621530	-1.991	13.5621520	-1.917	13.5621590	-2.434	± 100
240.00	-10	13.5621480	-1.622	13.5621450	-1.401	13.5621420	-1.180	13.5621450	-1.401	± 100
240.00	-20	13.5621220	0.295	13.5621110	1.106	13.5621100	1.180	13.5621140	0.885	± 100
204.00	20	13.5621230	0.221	13.5621280	-0.147	13.5621240	0.147	13.5621160	0.737	± 100
276.00	20	13.5621290	-0.221	13.5621220	0.295	13.5621170	0.664	13.5621790	-3.909	± 100

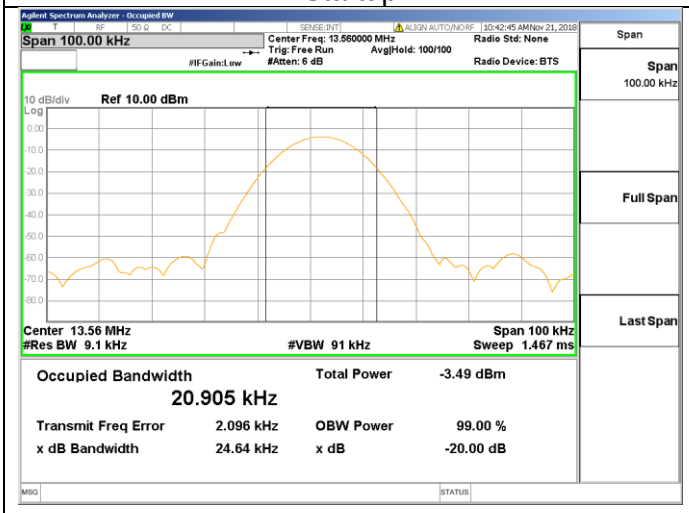
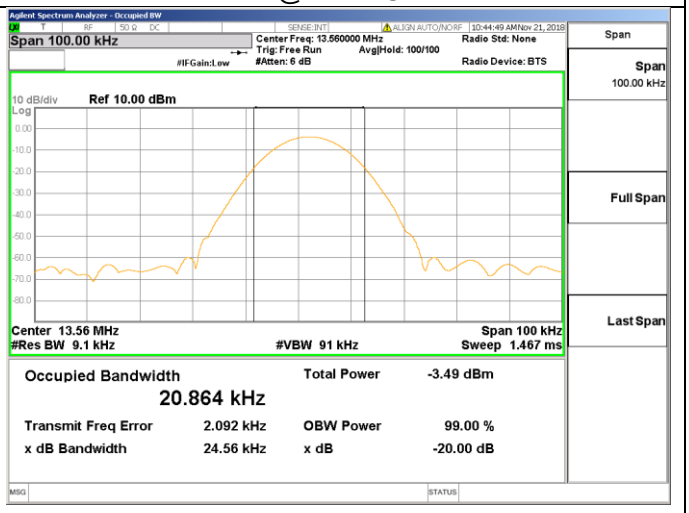
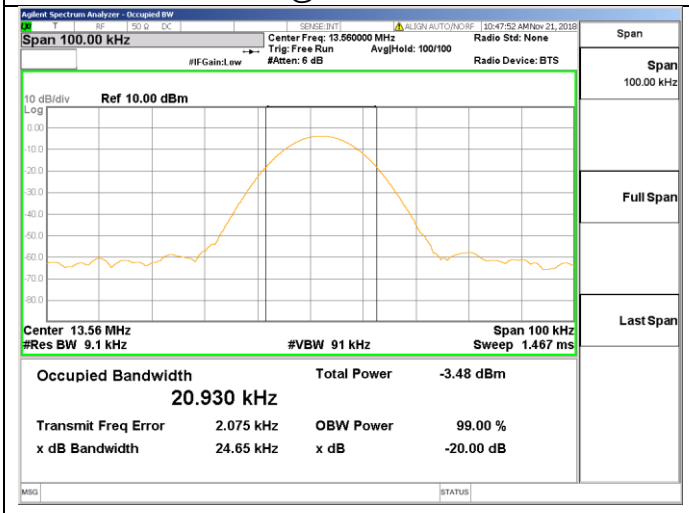
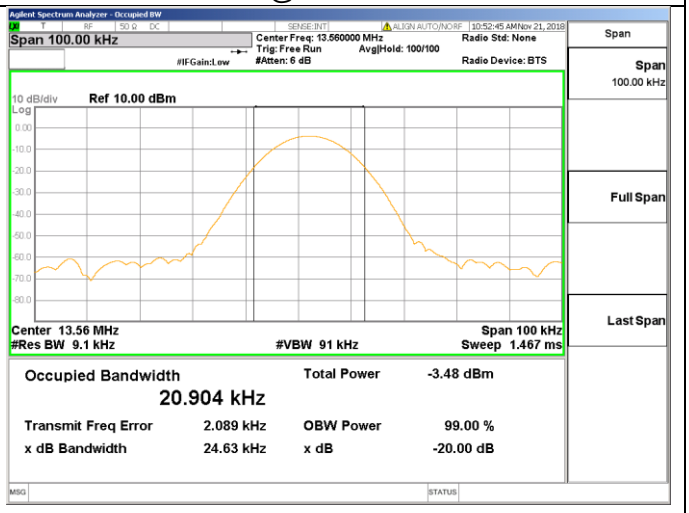
TEST INFORMATION

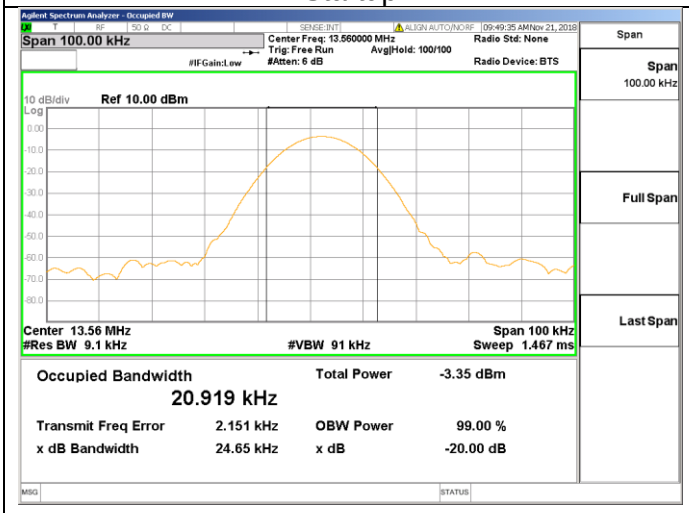
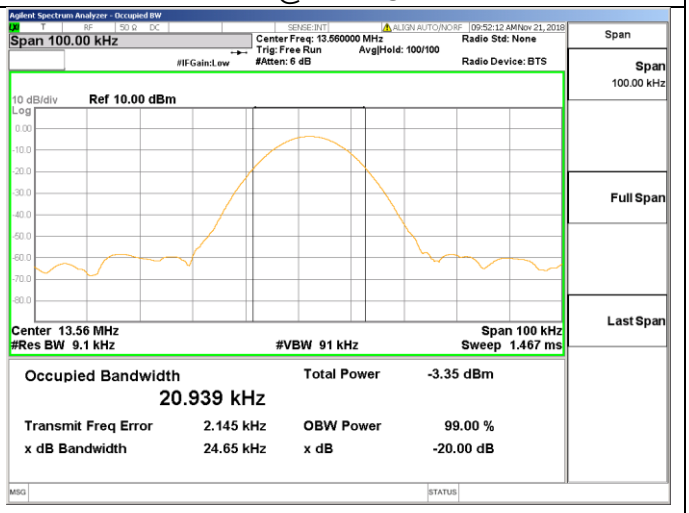
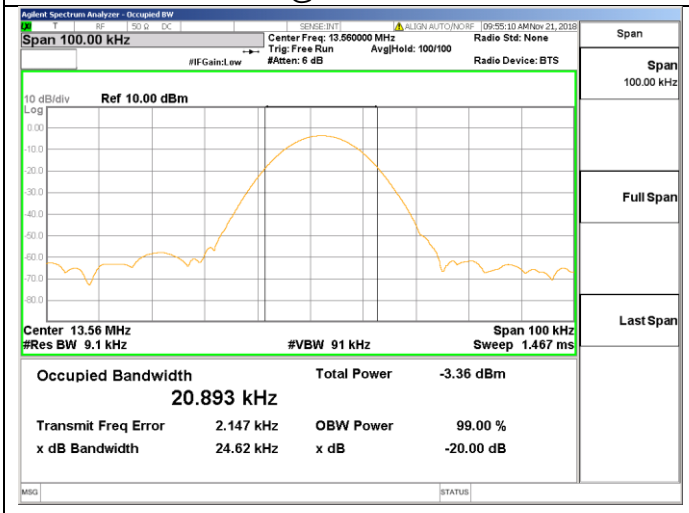
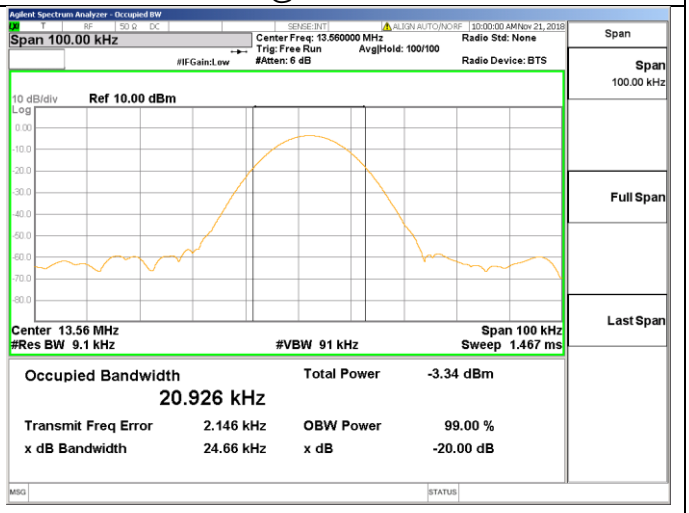
Tester: 31601 VS

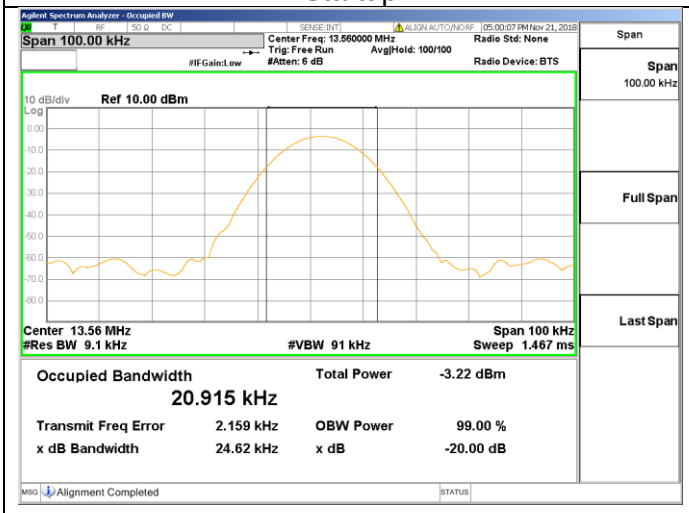
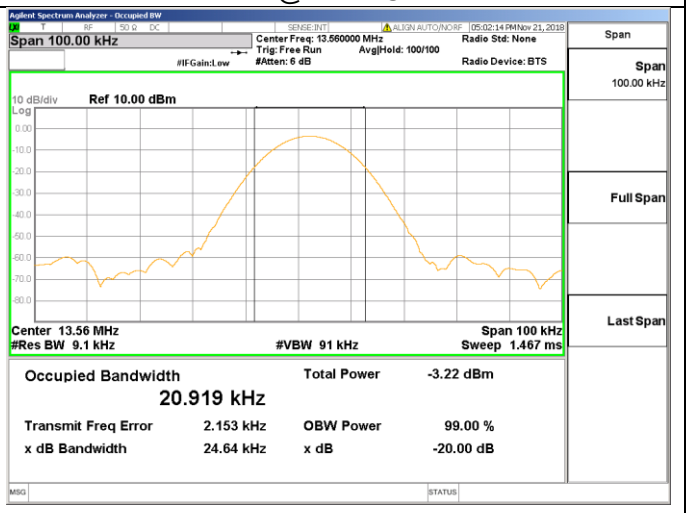
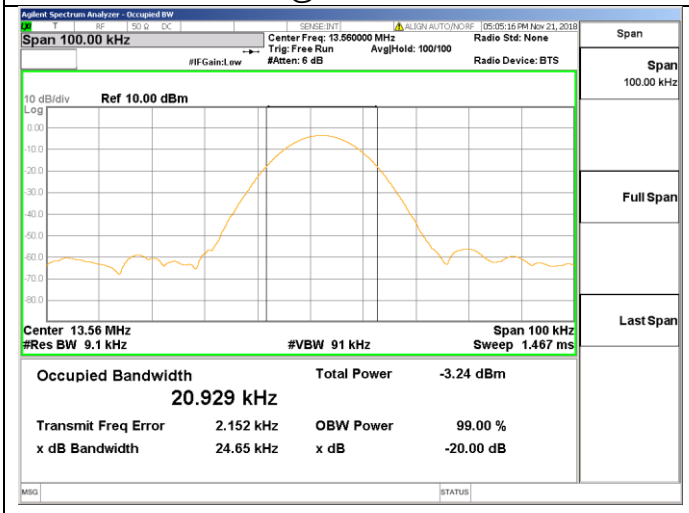
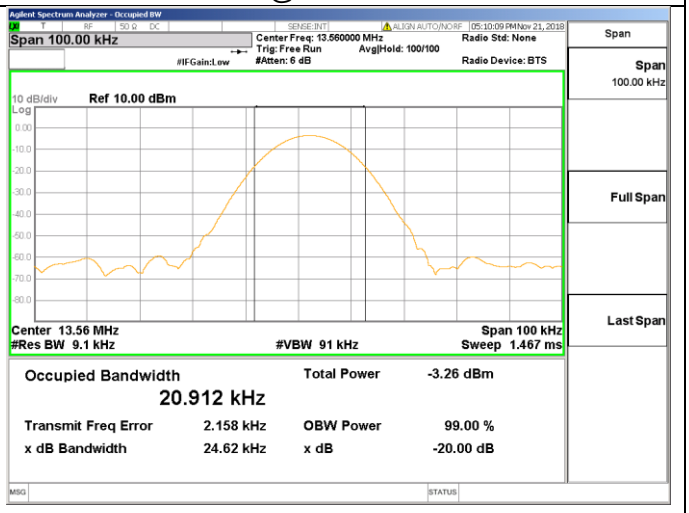
Temperature: 20°Ca	
Startup	@ 2 mins
	
@ 5 mins	@ 10 mins
	

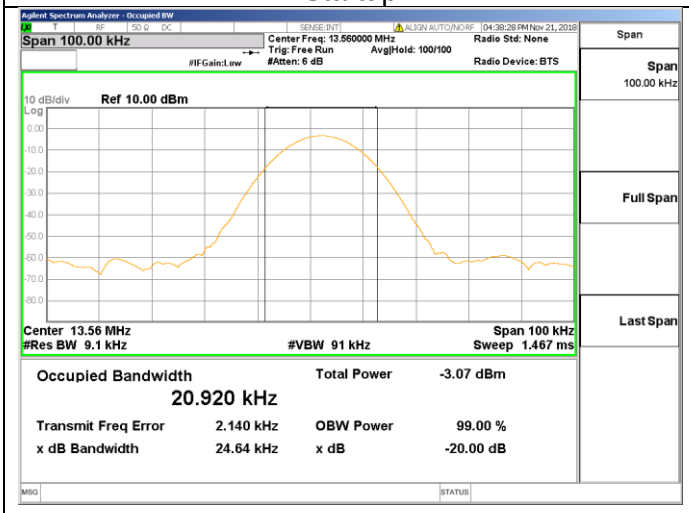
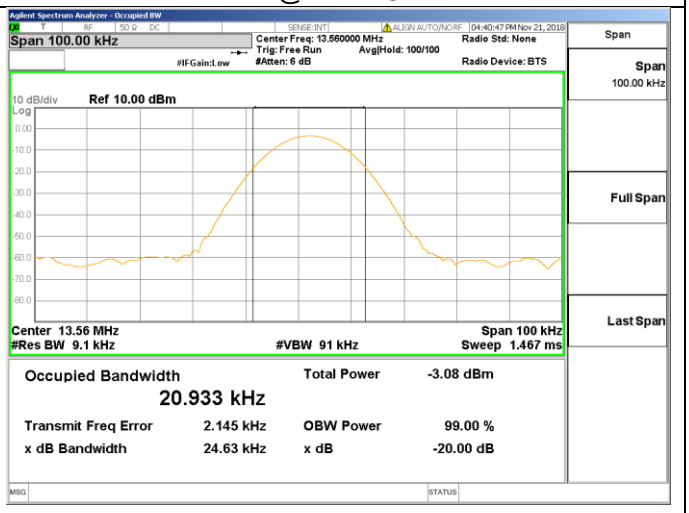
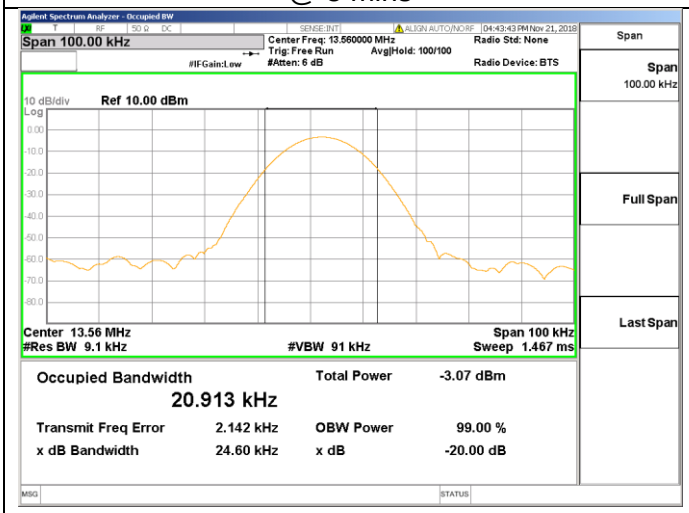
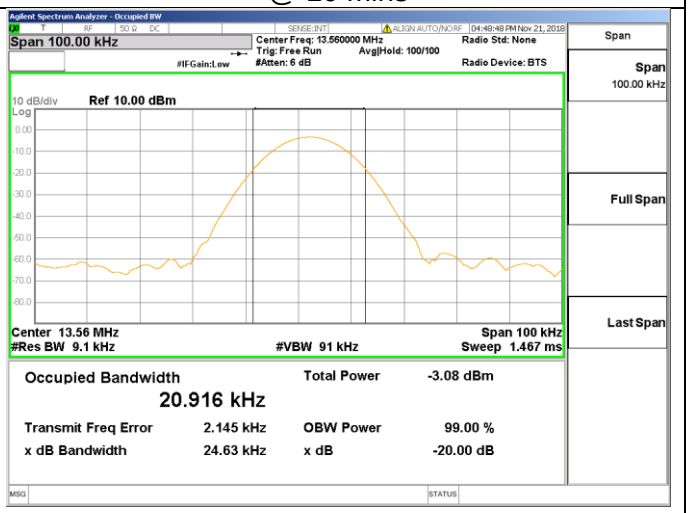
Temperature: 50°C	
Startup	@ 2 mins
	
@ 5 mins	@ 10 mins
	

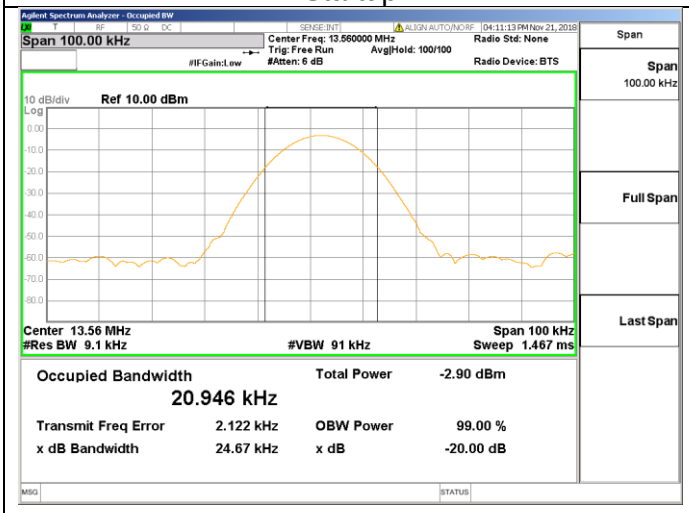
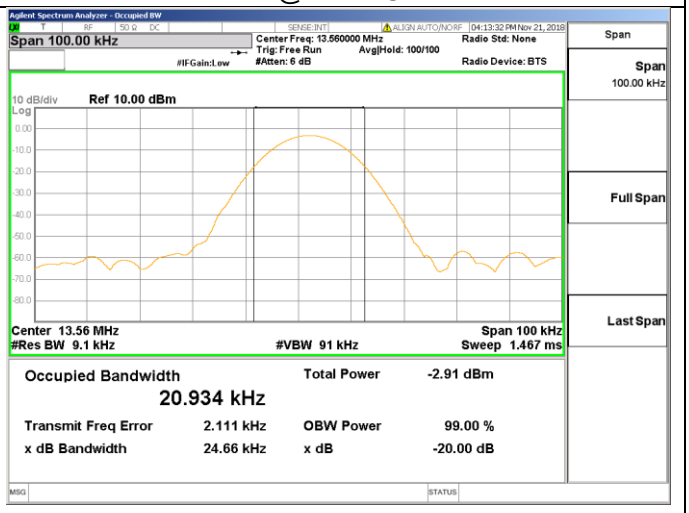
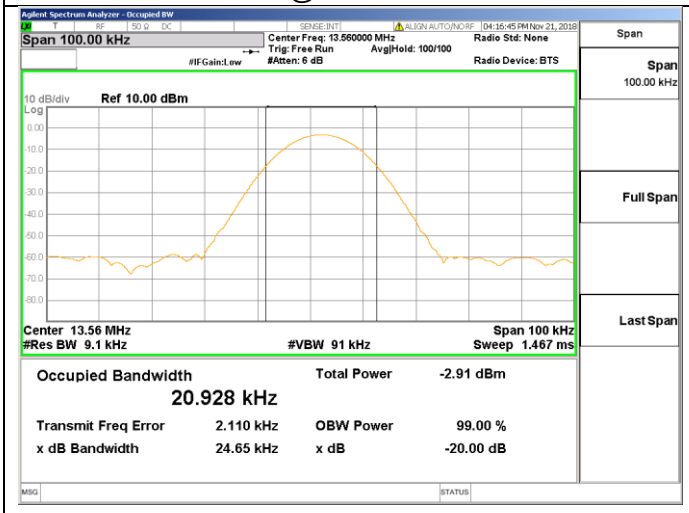
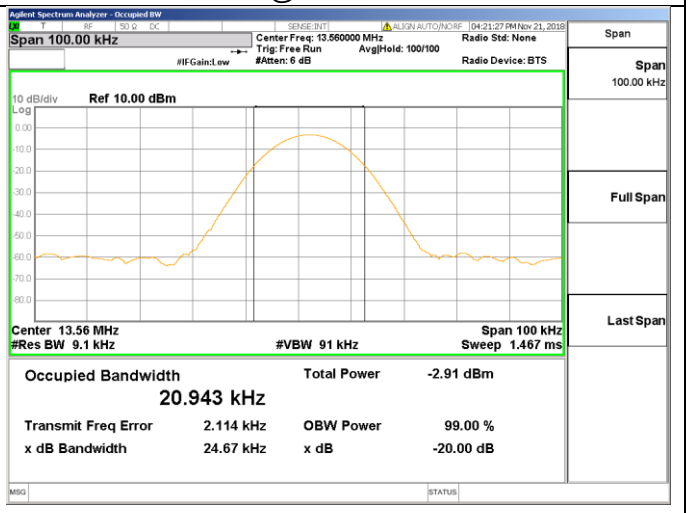
Temperature: 40°C	
Startup	@ 2 mins
	
@ 5 mins	@ 10 mins
	

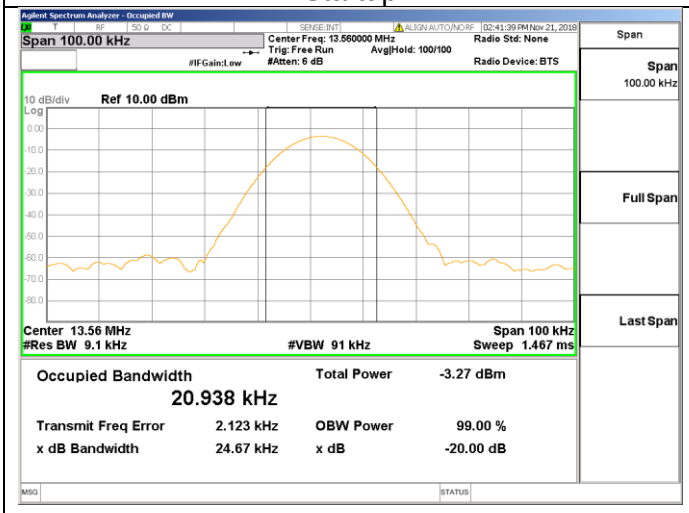
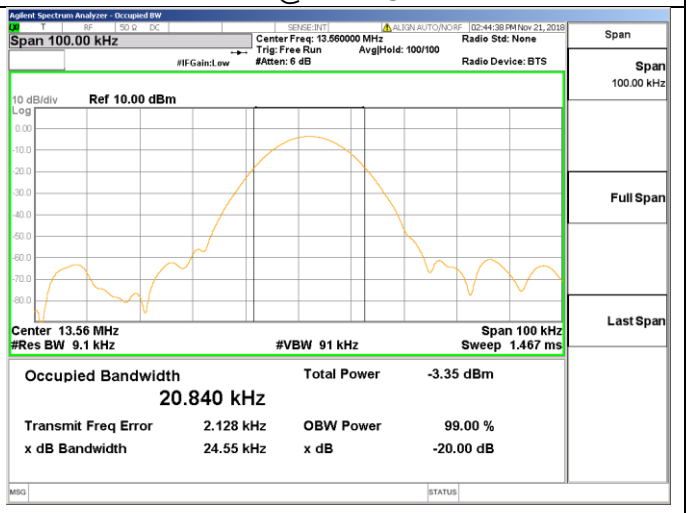
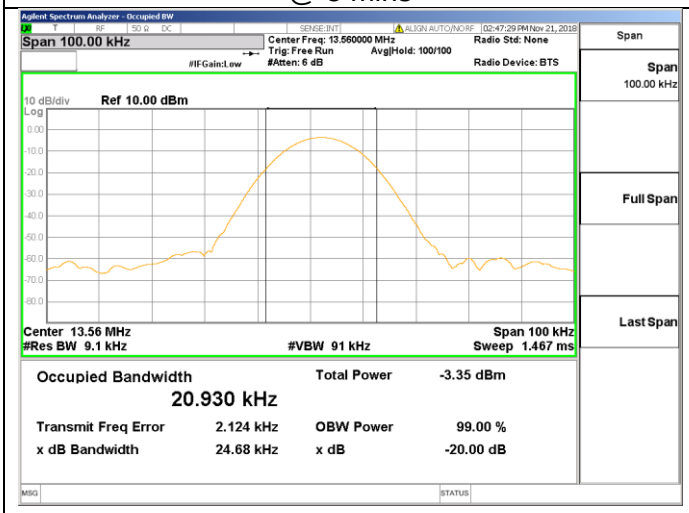
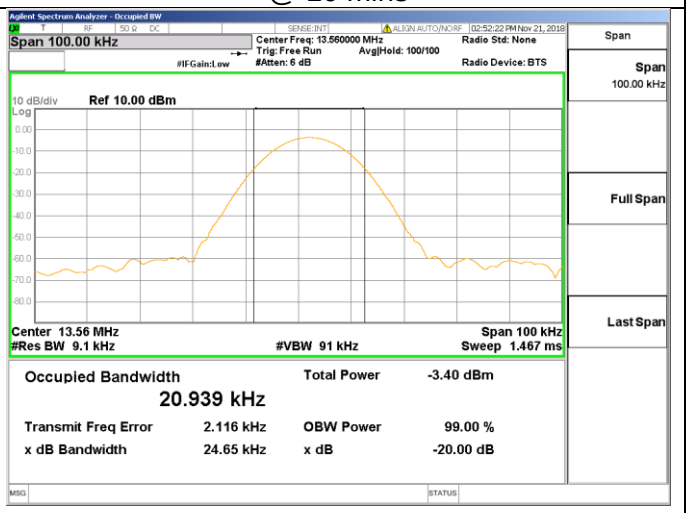
Temperature: 30°C	
Startup	@ 2 mins
	
@ 5 mins	@ 10 mins
	

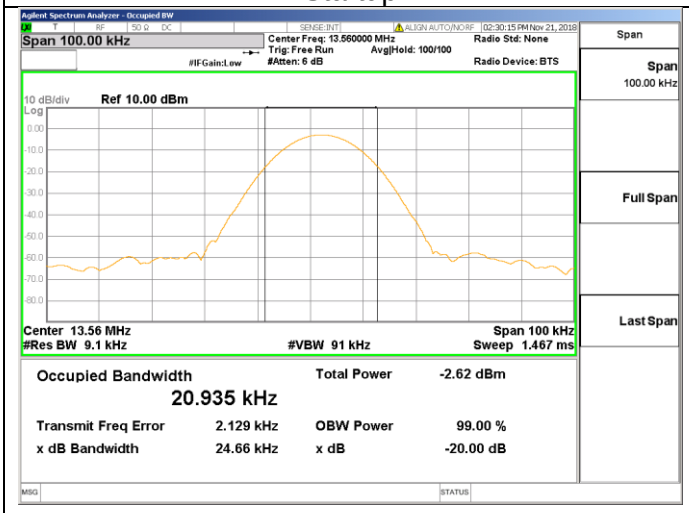
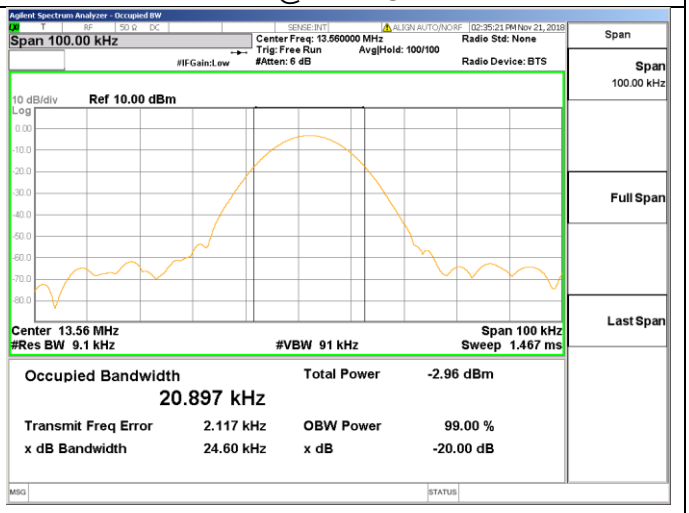
Temperature: 10°C	
Startup	@ 2 mins
	
@ 5 mins	@ 10 mins
	

Temperature: 0°C	
Startup	@ 2 mins
	
@ 5 mins	@ 10 mins
	

Temperature: -10°C	
Startup	@ 2 mins
	
@ 5 mins	@ 10 mins
	

Temperature: -20°C	
Startup	@ 2 mins
	
@ 5 mins	@ 10 mins
	

85% of Rated Supply Voltage (204 V), Temperature: 20°C	
Startup	@ 2 mins
	
@ 5 mins	@ 10 mins
	

115% of Rated Supply Voltage (276 V), Temperature: 20°C	
Startup	@ 2 mins
	
@ 5 mins	@ 10 mins