ENGINEERING TEST REPORT

Sanuvox Saber Genius II
Model: Saber Pro
FCC ID: 2ADO701721

Applicant:

Sanuvox Technologies Inc.
146 Barr
Saint-Laurent, QC
Canada H4T 1Y4

In Accordance With
Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.231 Periodic Operation

UltraTech's File No.: 15ETR-092_FCC15C231E

This Test report is Issued under the Authority of Tri M. Luu Vice President of Engineering UltraTech Group of Labs Date: April 23, 2015	
Report Prepared by: Dan Huynh Issued Date: April 23, 2015	Tested by: Hung Trinh Test Dates: January 15 & 21, 2015 April 16. 2015

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

UltraTech

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.231
Title:	Code of Federal Regulations (CFR), Title 47, Telecommunication - Part 15
Purpose of Test:	Equipment authorization for section 15.231 - Momentarily Operation at 433.92 MHz.
Test Procedures:	▪ ANSI C63.4 ▪ ANSI C63.10
Environmental Classification:	▪ Residential ▪ Commercial, industrial or business environment

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC 47 CFR 15	2014	Code of Federal Regulations, Title 47 – Telecommunication, Part 15 - Radio Frequency Devices
ANSI C63.4	2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz
ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices
CISPR 22 EN 55022	2008-09, Edition 6.0 2006	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
CISPR 16-1-1 +A1 +A2	2006 2006 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-1-2 +A1 +A2	2003 2004 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Conducted disturbances

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

Applicant	
Name:	Sanuvox Technologies Inc.
Address:	146 Barr Saint-Laurent, QC Canada H4T 1Y4
Contact Person:	Benoit Despatis Phone #: +1 (514) 382-5823 Fax #: +1 (514) 382-6475 Email Address: bdespatis@sanuvox.com

Manufacturer	
Name:	Etratech Inc.
Address:	1047 Cooke Blvd. Burlington, ON Canada L7T 4A8
Contact Person:	Wilson Shedden Phone #: +1 (905) 681-7544 ext. 229 Fax #: +1 (905) 681-7601 Email Address: wshedden@etratech.com

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	Sanuvox Technologies Inc.
Product Name:	Sanuvox Saber Genius II
Model Name or Number:	Saber Pro
Serial Number:	Test sample
Type of Equipment:	Part 15 Security/Remote Control Transmitter
Input Power Supply Type:	24 VAC from AC Adapter
Primary User Functions of EUT:	Ballast Control for a UV Lamp in an Air Purification System.

2.3. EUT'S TECHNICAL SPECIFICATIONS

Transmitter (Ballast)	
Equipment Type:	Mobile
Intended Operating Environment:	Residential Commercial, light industry & heavy industry
Power Supply Requirement:	24 VAC
RF Output Power Rating:	67.64 dBµV/m at 3m distance
Operating Frequency Range:	433.92 MHz
Duty Cycle:	31.41 %
20 dB Bandwidth:	12.55 kHz
Modulation Type:	OOK
Oscillator Frequencies:	4 MHz
Antenna Connector Type:	Integral
Receiver (LCD Display)	
Equipment Type:	Mobile
Power Supply Requirement:	3 VDC (2 x AA Batteries)
Operating Frequency Range:	433.92 MHz
Intermediate Frequency(ies):	N/A
Oscillator Frequency(ies):	4 MHz

2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	UV LAMP	1	4 wires; 18 AWG	1 m non shielded

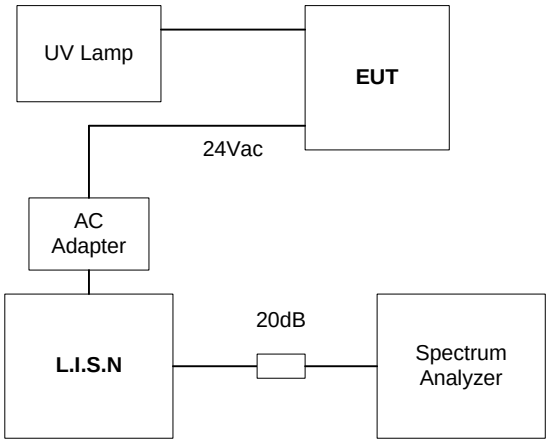
2.5. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	AC Adapter
Brand name:	Maf Technologies
Model Name or Number:	DA-40-24
Connected to EUT's Port:	Power line

2.6. TEST SETUP BLOCK DIAGRAM

Power Line Conducted Emission Test Setup



Radiated Emission Test Setup

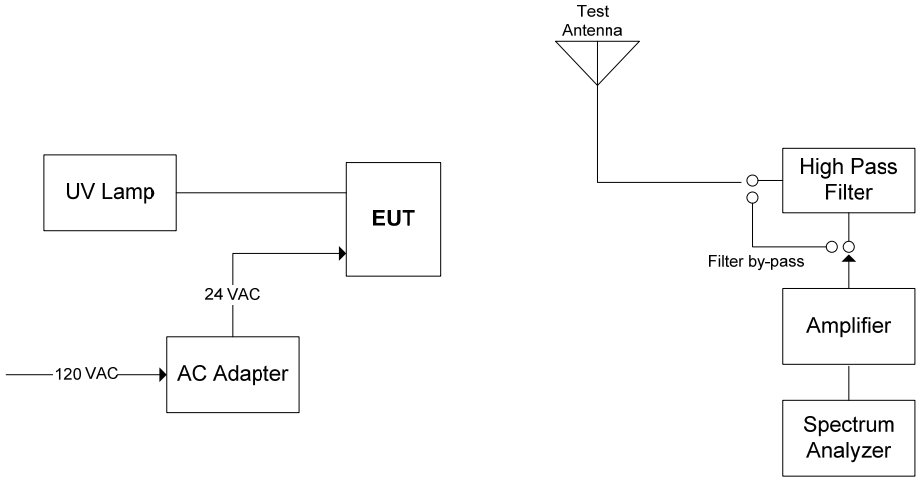


EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	24 VAC via AC Adaptor

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	The EUT was configured for continuous transmission for the duration of testing.
Special Test Software:	N/A
Special Hardware Used:	N/A
Transmitter Test Antenna:	The EUT was tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment.

Transmitter Test Signals	
Frequency Band(s):	433.92 MHz
Test Frequency(ies):	433.92 MHz
RF Power Output:	67.64 dBµV/m at 3m distance
Normal Test Modulation:	OOK
Modulating Signal Source:	Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).

- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2017-04-02.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna Requirement	Yes*
15.207(a)	AC Powerline Conducted Emissions	Yes
15.231(e) 15.209	Transmitter Radiated Emissions - Fundamental, Harmonic and Spurious Emissions	Yes
15.231(c)	20 dB Bandwidth	Yes
15.231(d)	Frequency Tolerance for Devices Operating within the Frequency Band 40.66-40.70 MHz	Not applicable

* The EUT complies with the requirement; it employs an integral antenna.

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. TEST DATA

5.1. POWER LINE CONDUCTED EMISSIONS [§15.207(a)]

5.1.1. Limit(s)

The equipment shall meet the limits of the following table:

Frequency of emission (MHz)	Conducted Limits (dBμV)	
	Quasi-peak	Average
0.15–0.5 .....……..	66 to 56*	56 to 46*
0.5–5 .....……..	56	46
5-30 ……..	60 ..……..	50

*Decreases linearly with the logarithm of the frequency

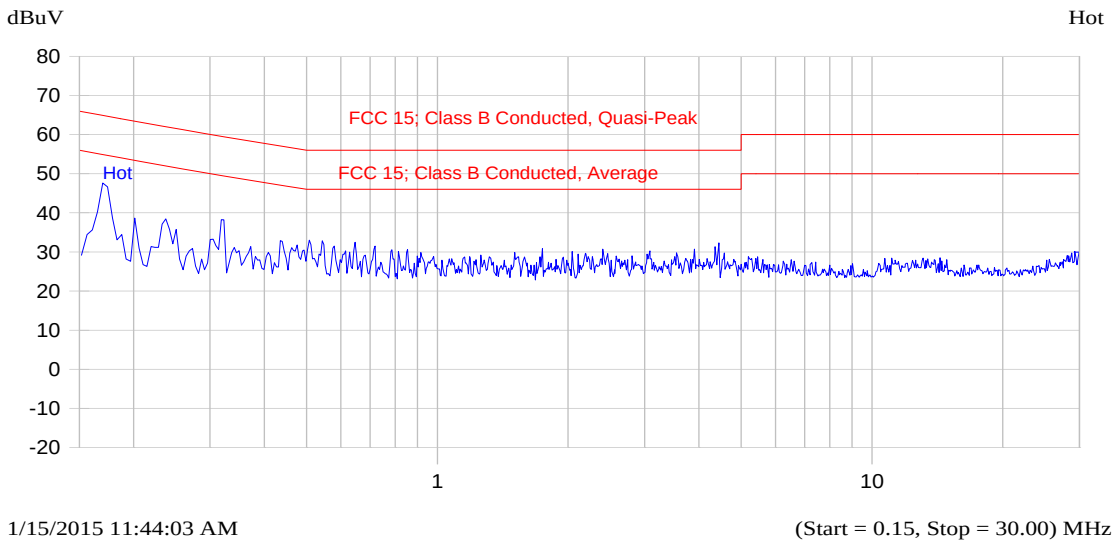
5.1.2. Method of Measurements

ANSI C63.4-2009

5.1.3. Test Data

Plot 5.1.3.1. Power Line Conducted Emissions; Line Voltage: 24 VAC for AC Adapter; Line Tested: Positive

Current Graph

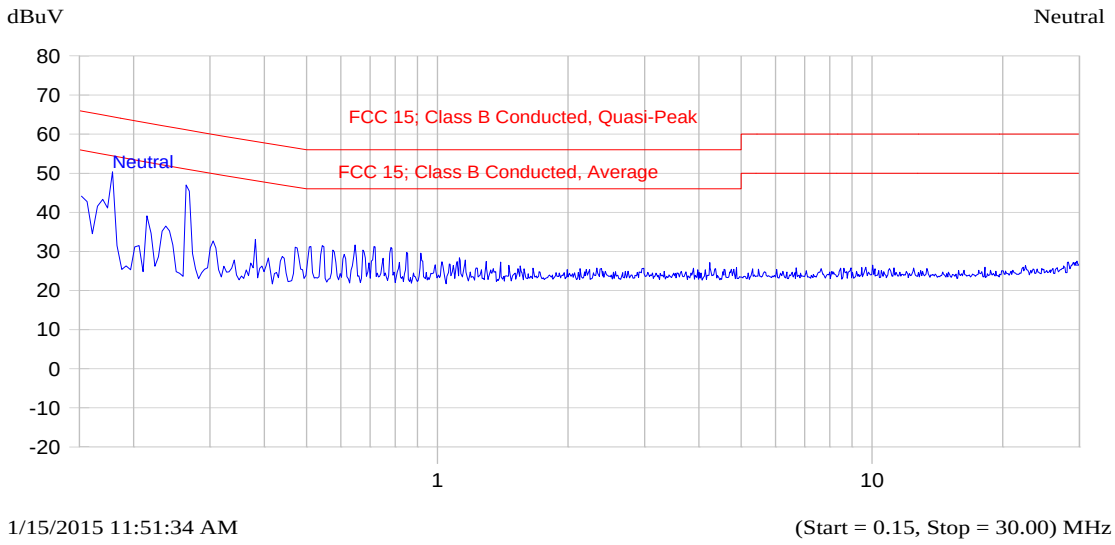


Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.169	53.0	43.9	-21.1	39.0	-16.1	Hot
0.308	43.3	34.9	-25.2	29.4	-20.6	Hot
4.448	34.0	29.3	-26.7	23.8	-22.2	Hot

Plot 5.1.3.2. Power Line Conducted Emissions; Line Voltage: 24 VAC for AC Adapter; Line Tested: Neutral

Current Graph



Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.169	52.8	44.3	-20.7	39.7	-15.3	Neutral
0.246	50.0	41.8	-20.1	25.9	-25.9	Neutral
0.388	36.4	29.7	-28.4	24.1	-24.0	Neutral

5.2. TRANSMITTER RADIATED EMISSIONS [47 CFR §§ 15.231(e), 15.209 & 15.205]

5.2.1. Limit(s)

(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500[1]	50 to 150[1]
174-260	1,500	150
260-470	1,500 to 5,000[1]	150 to 500[1]
Above 470	5,000	500

[1]Linear interpolations.

(b)(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(b)(2) Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(b)(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

47 CFR 15.205(a) Restricted Bands of Operation

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	([2])
13.36–13.41.			

[1] Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.
[2] Above 38.6

47 CFR 15.209(a) General Field Strength Limits

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
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.		

5.2.2. Method of Measurements

ANSI C63.4 and/or ANSI C63.10

5.2.3. Test Data

Remarks:

- The measuring receiver shall be tuned over the frequency range of 30 MHz to the 10th harmonic of the highest fundamental frequency.
- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- For portable transmitter, EUT shall be placed in three different orthogonal positions for searching maximum field strength level.
- In the restricted band per FCC 15.205: § 15.209 (a) limits applied
- Outside the restricted band per FCC 15.205: § 15.231 (e) limits or § 15.209 (a) applied, whichever allows higher field strength emission.
- Section 15.231(e) field strength limit of the fundamental at 433.92 MHz = 20 log [(16.67 x 433.92) – 2833.33] = 72.9 dBµV/m
- Spurious emissions limit is 20 dB below fundamental limit.
- Duty Cycle: measured maximum duty cycle is 18.16 %.
- The peak-average correction factor = -14.82 dB. See Section 5.2.3.1 for details.

Frequency (MHz)	Peak E-Field @ 3m (dBµV/m)	Average E-Field @ 3m (dBµV/m)	Antenna Plane (H/V)	§ 15.231 (e) Limits @ 3m (dBµV/m)	§ 15.209 (a) Limits @ 3m (dBµV/m)	Margin (dB)	Pass/Fail
Field strength of fundamental							
433.92	81.72	66.90	V	72.9	--	-6.0	Pass
433.92	82.46	67.64	H	72.9	--	-5.3	Pass
Field strength of spurious emission							
2169.60	50.51	35.69	V	52.9	54.0	-18.3	Pass
2169.60	48.91	34.09	H	52.9	54.0	-19.9	Pass
2603.52	53.36	38.54	V	52.9	54.0	-15.5	Pass
2603.52	52.05	37.23	H	52.9	54.0	-16.8	Pass
3037.44	56.64	41.82	V	52.9	54.0	-12.2	Pass
3037.44	56.40	41.58	H	52.9	54.0	-12.4	Pass
3471.36	53.32	38.50	V	52.9	54.0	-15.5	Pass
3471.36	56.09	41.27	H	52.9	54.0	-12.7	Pass
3905.28	61.09	46.27	V	52.9	54.0	-7.7	Pass*
3905.28	62.75	47.93	H	52.9	54.0	-6.1	Pass*
4339.20	57.40	42.58	V	52.9	54.0	-11.4	Pass*
4339.20	58.40	43.58	H	52.9	54.0	-10.4	Pass*

* Emissions within the restricted bands, section 15.209(a) limits applied.

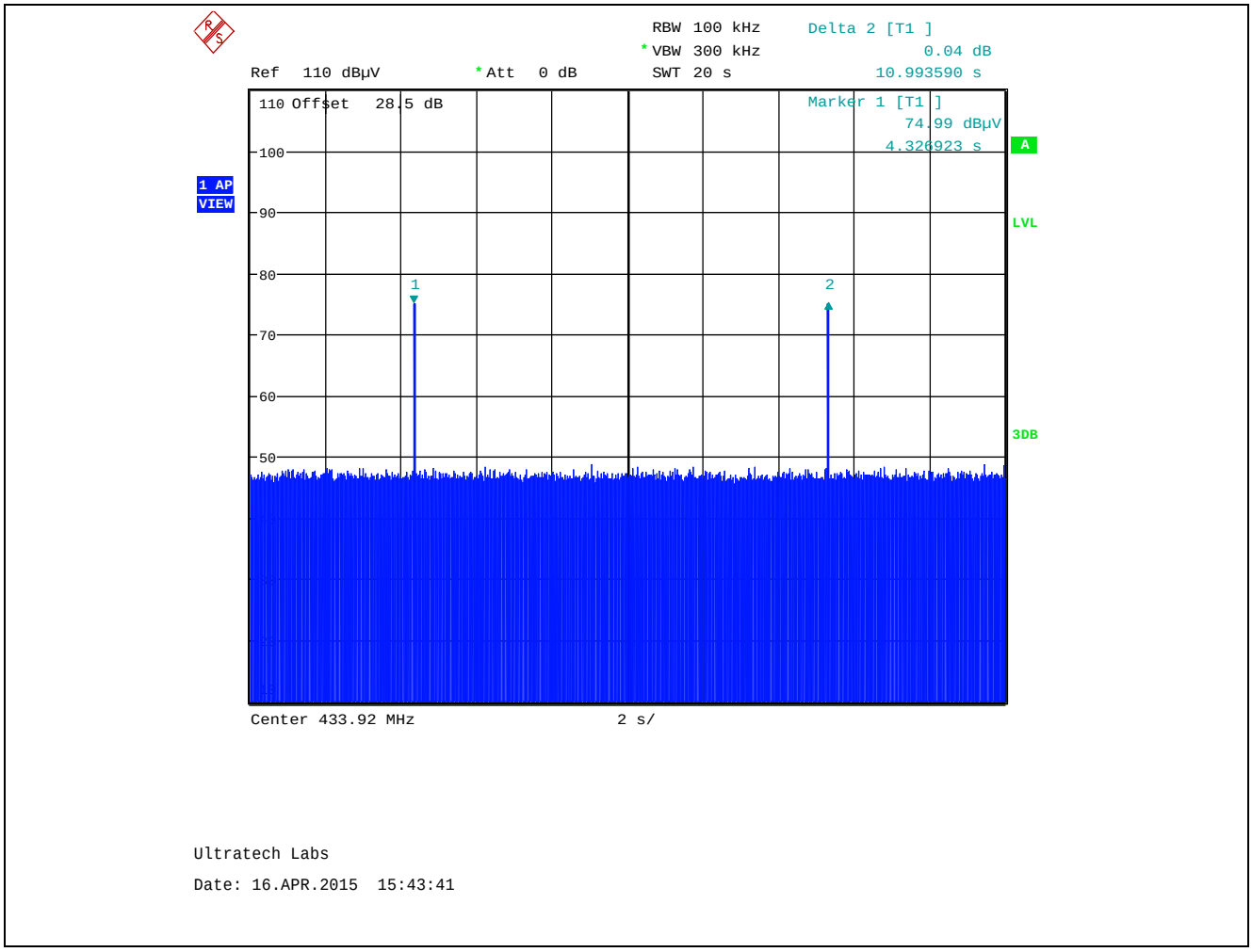
5.2.3.1. Duty-Cycle Correction Factor

The duty cycle correction factor is the total “on time” divided by the period of the pulse train (or 100 ms).

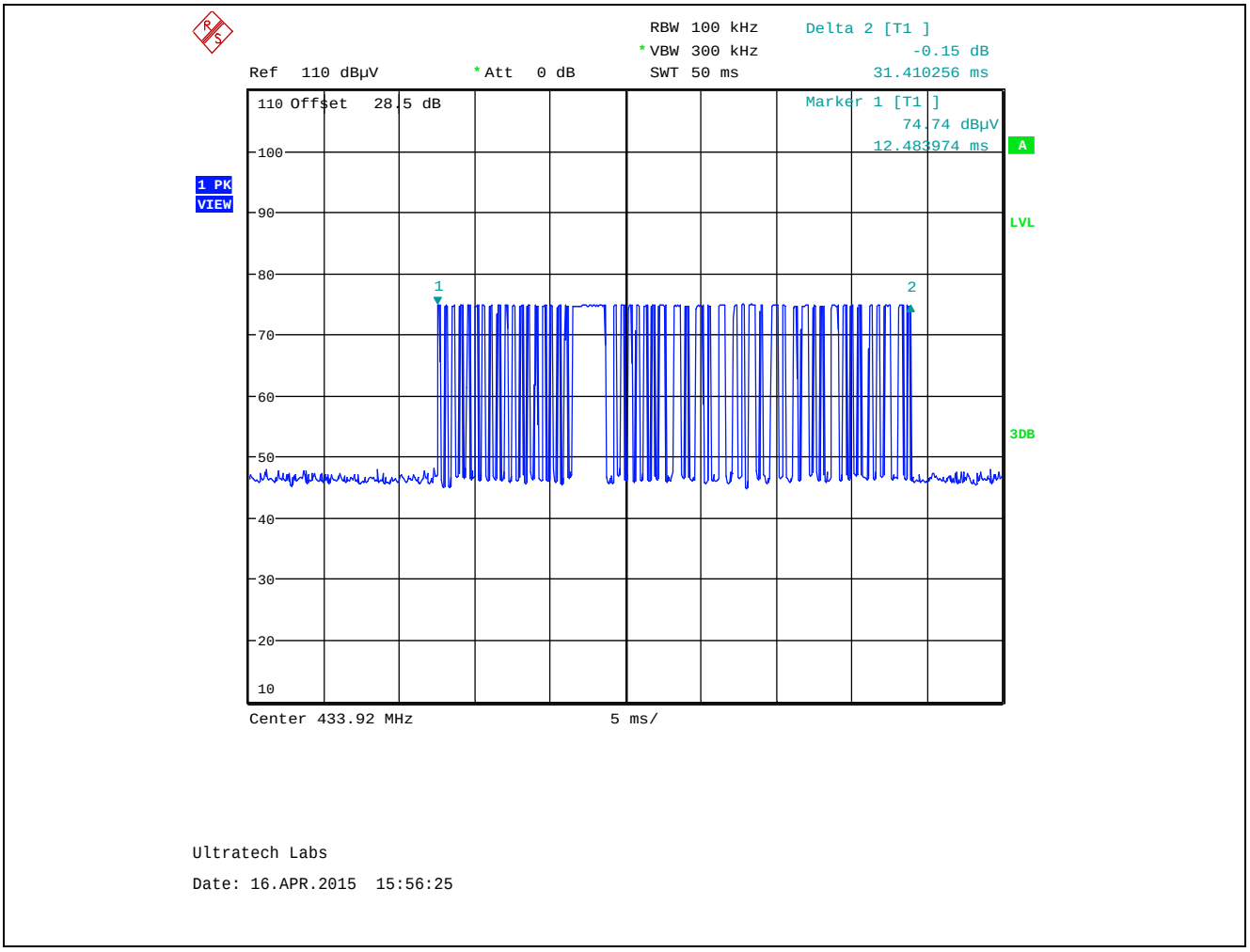
Computation of duty-cycle correction factor

Sub-Pulse	Duration (ms)	Number of pulses	Sub-Pulse “On Time” (ms)
1	2.420	1	2.420
2	0.272	39	10.608
3	0.513	10	5.130
		TOTAL ON TIME:	18.158
Duty cycle correction factor:	20*log (T_{ON}/100 ms) = 20*log (18.158 ms/ 100 ms) = -14.82 dB		

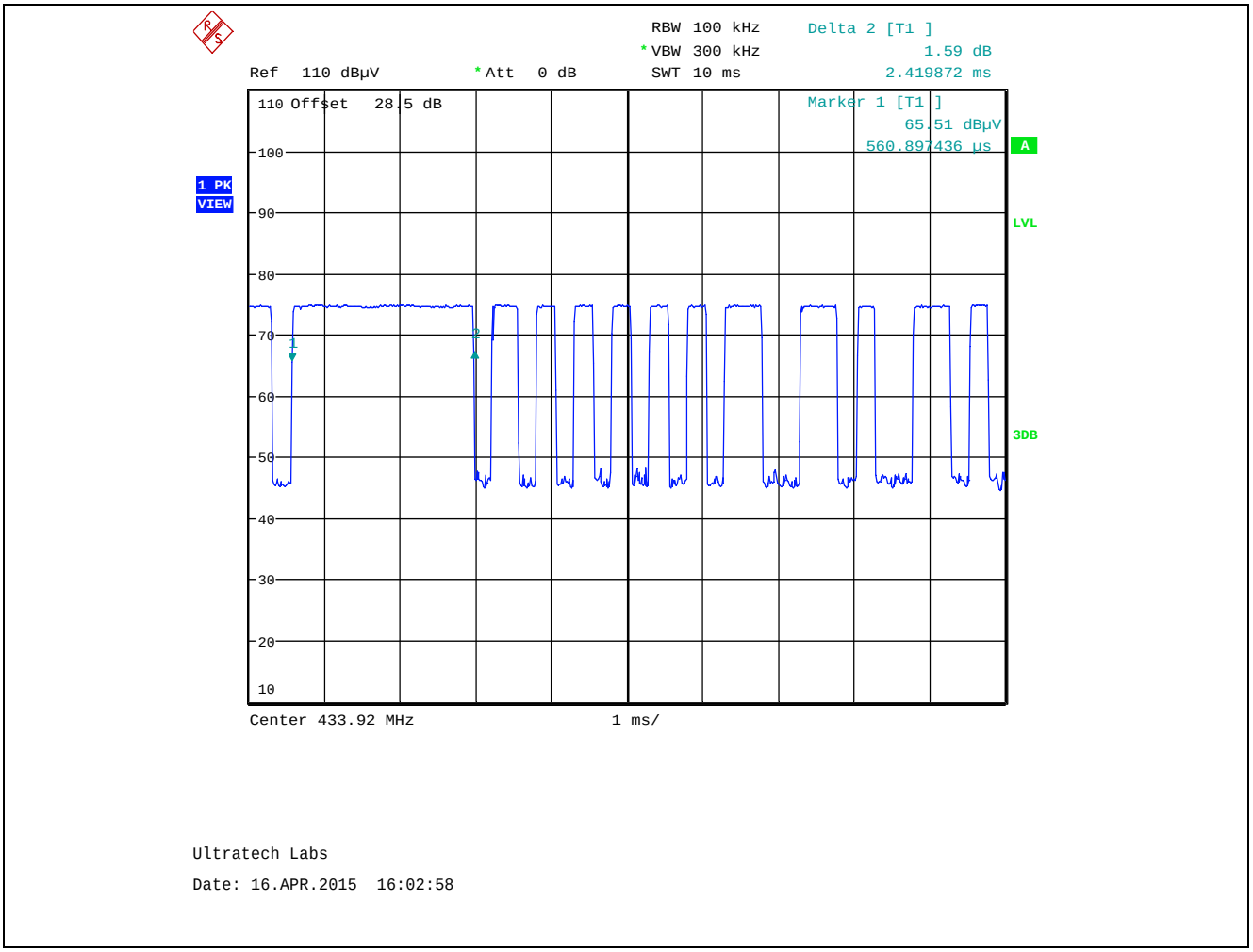
Plot 5.2.3.1.1. Duty Cycle (pulse train)



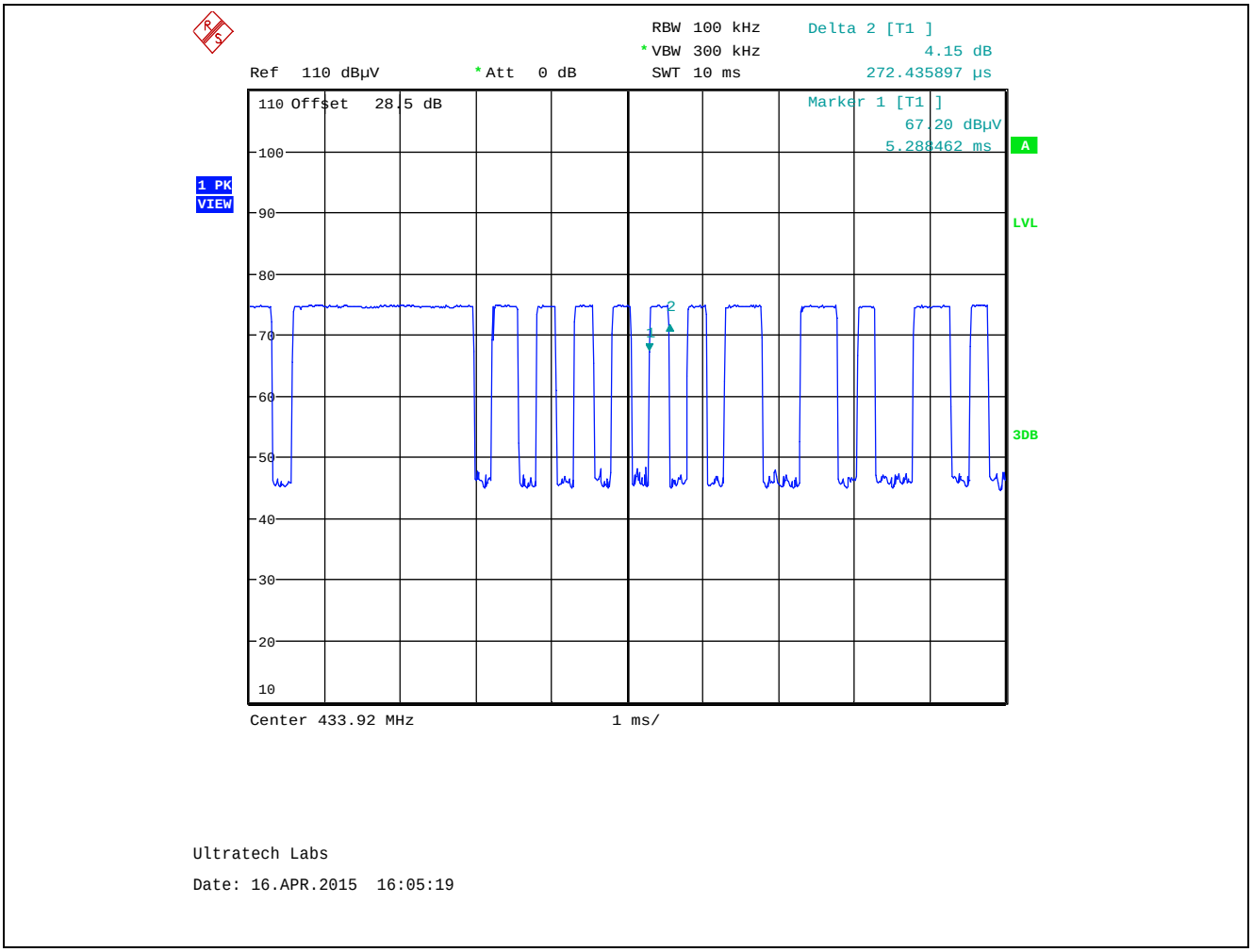
Plot 5.2.3.1.2. Duty Cycle (Zoomed in)



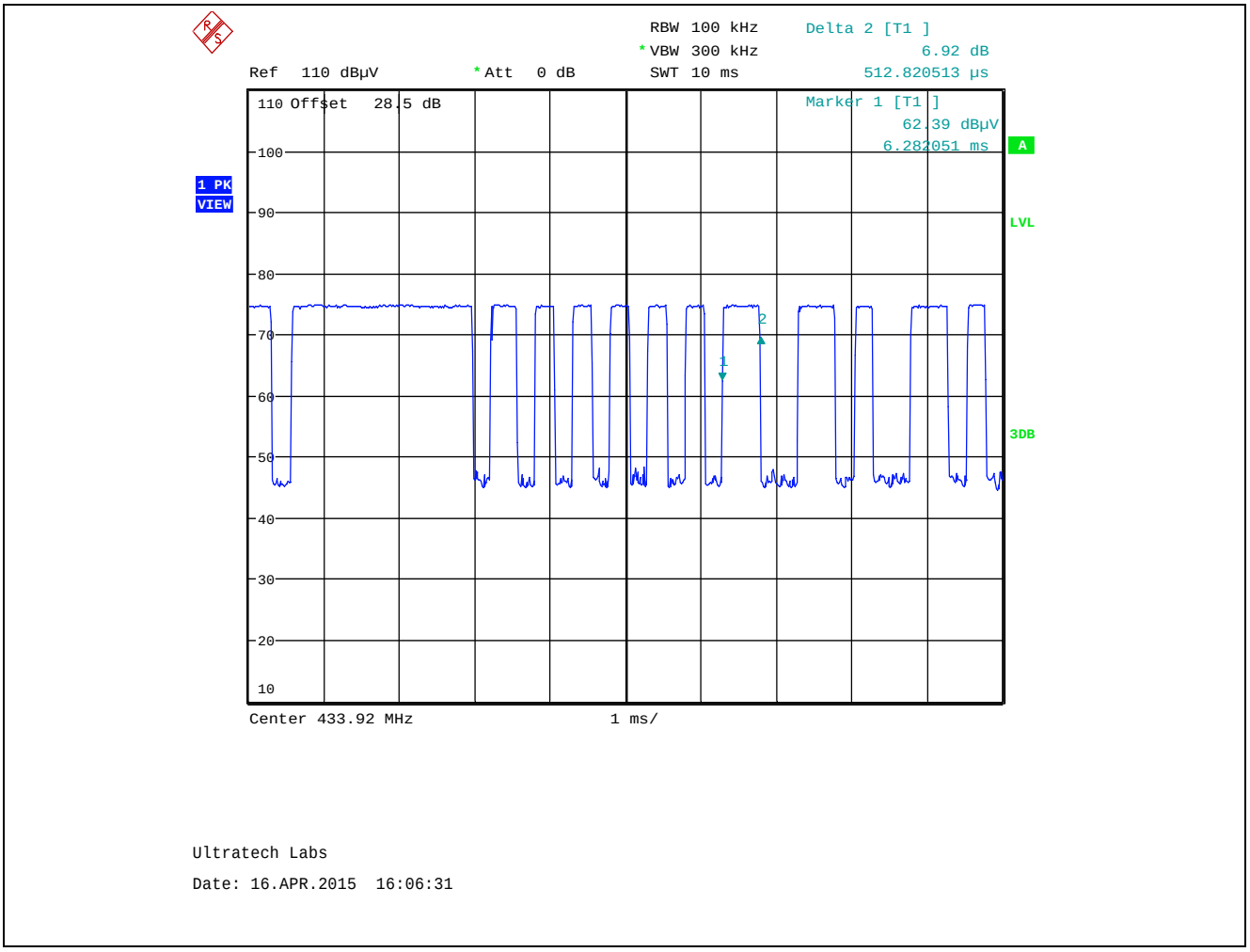
Plot 5.2.3.1.3. Duty Cycle (Sub-Pulse 1)



Plot 5.2.3.1.4. Duty Cycle (Sub-Pulse 2)



Plot 5.2.3.1.5. Duty Cycle (Sub-Pulse 3)



5.3. 20 dB BANDWIDTH [47 CFR 15.231(c)]

5.3.1. Limit(s)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

5.3.2. Method of Measurements

The measurements were performed in accordance with Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4.

5.3.3. Test Data

Channel Frequency (MHz)	20 dB Bandwidth (kHz)	Maximum Bandwidth Limit (kHz)
433.92	12.55	1084.8

Plot 5.3.3.1. 20 dB Bandwidth

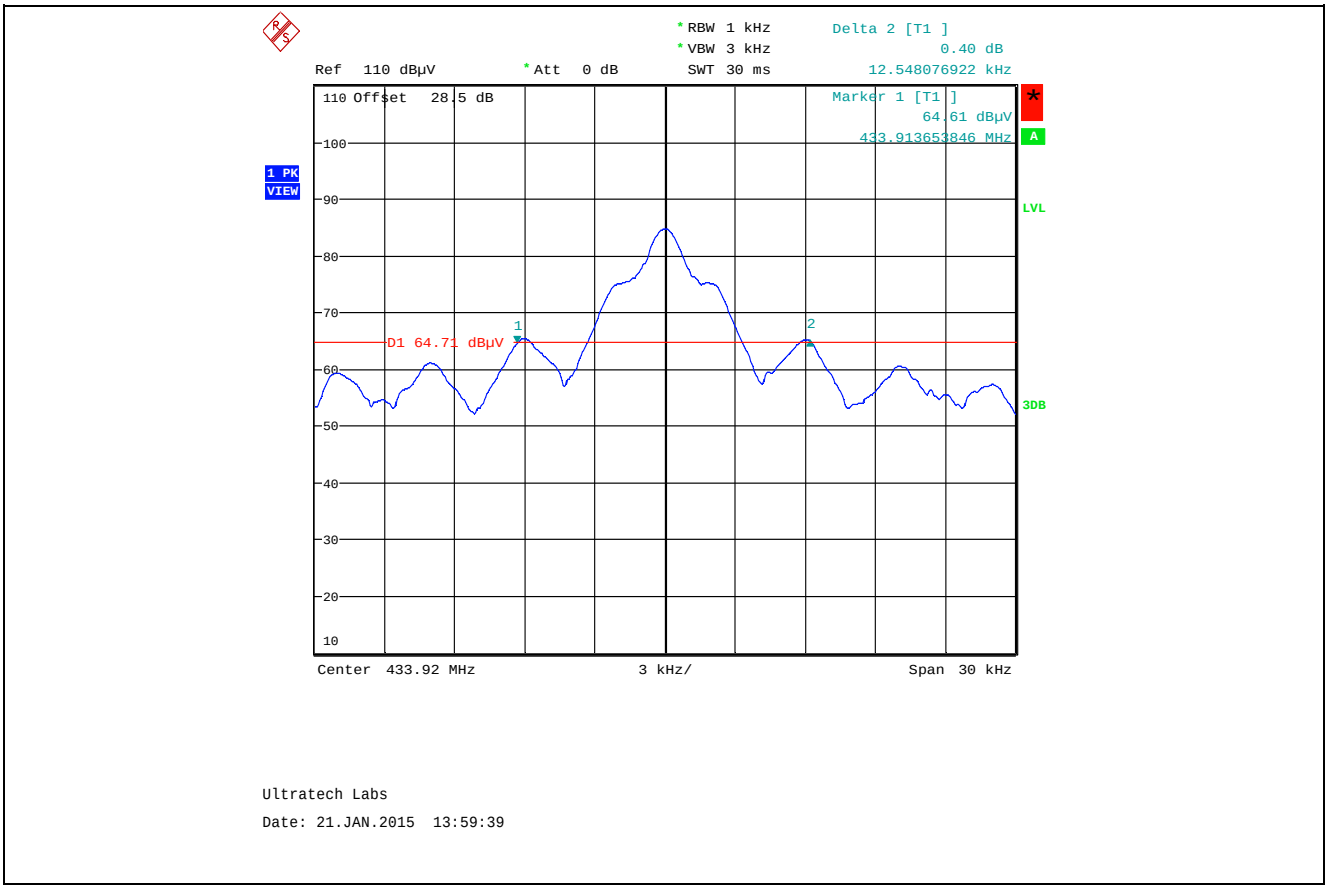


EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Hewlett Packard	HP 8593EM	3412A00103	9 kHz–26.5 GHz	27 Mar 2015*
Attenuator	Pasternack	PE7010-20	-	DC–2 GHz	02 Jan 2016
L.I.S.N	EMCO	3825/2	2209	0.10 -100 MHz	03 Sep 2015
EMI Receiver	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	30 Apr 2015
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	30 Apr 2015
Biconi-Log Antenna	ETS Lindgren	3142C	26873	26 – 3000 MHz	14 Apr 2016
Horn Antenna	ETS Lindgren	3115	5955	1 -18 GHz	26 Mar 2015*
High Pass Filter	Mini-Circuits	SHP-800	10425	Cut off 400 MHz	Cal on use.
Spectrum Analyzer	Rohde & Schwarz	FSU26	200946	20Hz–26.5 GHz	14 July 2015

*Equipment was used on January 15 - 21, 2015

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

	Line Conducted Emission Measurement Uncertainty (9 kHz – 30 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 1.44**	**± 1.8**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 2.89**	**± 3.6**

7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 2.39**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.79**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 2.39**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.78**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 1.87**	**Under consideration**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 3.75**	**Under consideration**