CERTIFICATION TEST REPORT

Report Number. : R13105073-E2

Applicant	:	SONIQUENCE LLC 2477 GRAND AVE BALDWIN, NY 11510-3556
Model	:	Soniquence Generator
FCC ID	:	2AV4P-0270412
EUT Description	:	MEDICAL DEVICE WITH RFID RADIO
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED CANADA RSS-210 ISSUE 10

Date Of Issue:
June 12, 2020

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2020-05-29	Initial Issue	Cristian Melara
V2	2020-06-03	- Added calibration notes - Revised model name - Revised applicant address	Cristian Melara
V3	2020-06-12	- Revised test methodology and references	Cristian Melara

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SONIQUENCE LLC
2477 GRAND AVE
BALDWIN, NY 11510-3556

EUT DESCRIPTION: MEDICAL DEVICE WITH RFID RADIO

MODEL: Soniquence Generator

SERIAL NUMBER: 1S130001
1S1300025

DATE TESTED: 2020-03-04 to 2020-05-20

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Complies
ISED CANADA RSS-210 Issue 10, Annex B.6	Complies
ISED CANADA RSS-GEN Issue 5	Complies

UL LLC 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.

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Approved & Released For
UL LLC By:

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Operations Leader
Consumer Technology Division
UL LLC

Prepared By:

Cristian Melara
Engineer
Consumer Technology Division
UL LLC

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 5 and RSS-210 Issue 10 Annex B.6.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Drive, Research Triangle Park, North Carolina, USA and 2800 Perimeter Park Dr., Suite B, Morrisville, North Carolina, USA. 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.

12 Laboratory Dr.	**2800 Perimeter Park Dr.**
ISED Site Code: 2180C	
☐ Chamber A RTP	☐ North Chamber
☐ Chamber C RTP	☒ South Chamber

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4. DECISION RULES AND MEASUREMENT 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. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	2.00%
Unwanted Emissions, conducted	3.05 dB
All emissions, radiated	4.88 dB
Temperature	2.26°C
Humidity	6.79%
DC Supply voltages	1.70%
Time	3.39%

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

4.3. SAMPLE CALCULATION

RADIATED EMISSIONS
Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

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

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5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT, Soniquence Generator, is a medical device that generates high radiofrequency energy for surgical applications. The EUT employs a 13.56 MHz RFID radio for the detection of the type of tool connected to the instrument.

5.2. MAXIMUM FIELD STENGTH

The maximum E-field reading with tags at 30m is 22.53 dBuV/m.

The maximum E-field reading without tags at 30m is 9.74 dBuV/m.

5.3. SOFTWARE AND FIRMWARE

The test utility software used during testing was V6-08.

5.4. WORST-CASE CONFIGURATION AND MODE

The EUT is intended to be installed in only one orientation therefore all radiated testing was performed in its intended orientation (X-Axis). The EUT was tested with both RFIDs transmitting simultaneously for worst case emissions.

Worst case emissions were found to be with the tags (tools) in place. Occupied bandwidth, frequency tolerance, and AC mains emissions testing were performed with tags.

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5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Triple footswitch	Soniquence	TF-FSCB	00014	N/A
3-Button Fingerswitch Handpiece	Soniquence	N/A	N/A	N/A
Resistor	N/A	N/A	N/A	N/A
Neutral Plate	Soniquence	N/A	N/A	N/A

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC pwr	1	C14	AC	0.2 m	None
2	Monopolar	1	3-pin	I/O	0.3 m	Cable integrated with 3-Button Fingerswitch Handpiece
3	Bipolar	1	2-pin	I/O	0.3 m	Connected to resistor
4	Neutral	1	3-pin	I/O	0.3 m	Cable integrated with neutral plate
5	Footswitch	1	Multi pin	I/O	4 m	Cable integrate with footswitch

TEST SETUP

The EUT is installed as a standalone device.

SETUP DIAGRAMS

Please refer to R13105073-EP2 for setup diagram.

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6. MEASUREMENT METHOD

Occupied BW (20dB): ANSI C63.10-2013 Section 6.9.2

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Frequency Stability : ANSI C63.10-2013 Clause 6.8

General Radiated emissions: ANSI C63.10 Section 6.3 to 6.5

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2 and KDB 174176 D01 Line Conducted FAQ v01r01, Q5.

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7. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - North Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	**(Loop Ant.)**			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2019-08-08	2020-08-08
	30-1000 MHz				
AT0073	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2019-08-08	2020-08-08
	Gain-Loss Chains				
N-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2019-05-02	2020-05-02
N-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2019-05-02, 2020-04-24	2020-05-02, 2021-04-24
	Receiver & Software				
SA0026	Spectrum Analyzer	Agilent	N9030A	2019-03-19	2020-03-19
SA0025	Spectrum Analyzer	Agilent	N9030A	2020-03-17	2021-03-17
SOFTEMI	EMI Software	UL	Version 9.5 June 15, 2019	NA	NA
	Additional Equipment used				
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27

NOTES:
1. For equipment listed above that was calibrated during the testing period, please note the equipment was used for testing after calibration.
2. For equipment listed above that has a calibration due date during the testing period, the testing was completed before the equipment expiration date.

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Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	**(Loop Ant.)**			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2019-08-08	2020-08-08
	30-1000 MHz				
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2019-07-16	2020-07-16
	Gain-Loss Chains				
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2019-05-02	2020-05-02
S-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2019-05-02, 2020-04-23	2020-05-02, 2021-04-23
	Receiver & Software				
SA0027	Spectrum Analyzer	Agilent	N9030A	2019-05-15	2020-05-31
SOFTEMI	EMI Software	UL	Version 9.5 June 15, 2019	NA	NA
	Additional Equipment used				
s/n 181474409	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27

NOTES:

1. For equipment listed above that was calibrated during the testing period, please note the equipment was used for testing after calibration.
2. For equipment listed above that has a calibration due date during the testing period, the testing was completed before the equipment expiration date.

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Test Equipment Used - Wireless Conducted Measurement Equipment

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Conducted Room 2				
T177 (PRE0079253)	Spectrum Analyzer	Agilent Technologies	E4446A	2019-04-22	2020-04-22
76023 (EC0225)	Temp/Humid Chamber	Cincinnati Sub-Zero	ZPH-8-3.5-SCT/AC	2019-06-14	2020-06-14
SN 181474341	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27
76021	DC Regulated Power Supply	CircuitSpecialists.Com	CSI3005X5	N/A	N/A
SOFTEMI	EMC Software	UL	Version 2020.03.11	NA	NA
	Additional Equipment used				
MM0167	Multi-Meter	Agilent	U1232A	2019-08-23	2020-08-23

NOTES:

1. For equipment listed above that was calibrated during the testing period, please note the equipment was used for testing after calibration.
2. For equipment listed above that has a calibration due date during the testing period, the testing was completed before the equipment expiration date.

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Test Equipment Used - Line-Conducted Emissions – Voltage (Morrisville – Conducted 1)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2019-05-29	2020-05-29
s/n 181562858	Environmental Meter	Fisher Scientific	14-650-118	2018-09-04	2020-09-04
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2019-08-19	2020-08-19
75141 (PRE0101521)	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2019-08-20	2020-08-20
TL001	Transient Limiter, 0.009-30MHz	Com-Power	LIT-930A	2019-05-29	2020-05-29
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 June 15, 2019	NA	NA
	Miscellaneous (if needed)				
LISN008	LISN, 50-ohm/50-uH, 2-conductor, 25A (For support gear only.)	Solar Electronics	8012-50-R-24-BNC	2019-07-10	2020-07-10

NOTES:

1. For equipment listed above that was calibrated during the testing period, please note the equipment was used for testing after calibration.
2. For equipment listed above that has a calibration due date during the testing period, the testing was completed before the equipment expiration date.

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8. OCCUPIED BANDWIDTH AND 20dB BANDWIDTH

LIMITS

None; for reporting purposes only.

FCC §15.215 (c) and RSS-GEN, ANSI C63.10 Sections 6.9.2 and 6.9.3 were used for the measurement procedure.

RESULTS

Occupied Bandwidth & 20 dB Bandwidth Results

Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
13.56	436.5815	55.63

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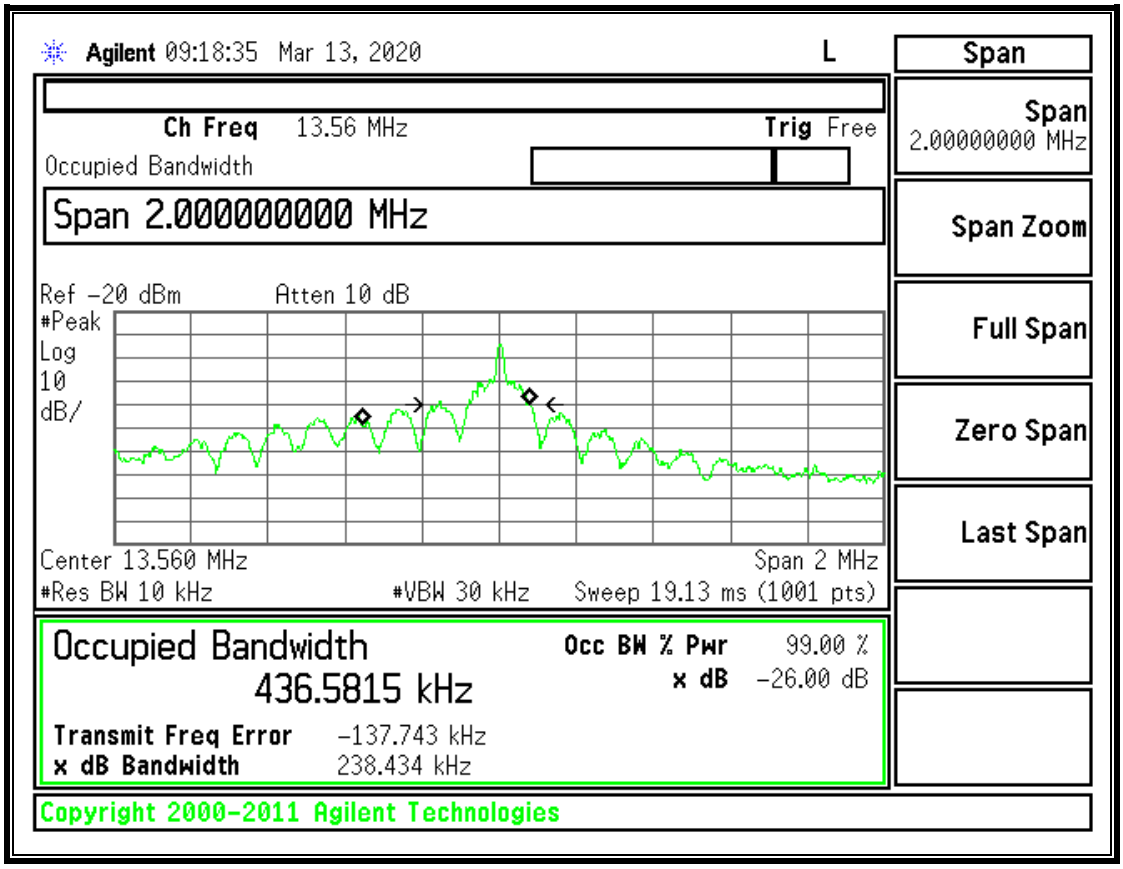
8.1. 99% BANDWIDTH PLOT



TEST INFORMATION

Test Date: 2020-03-13
Tested By: 40882

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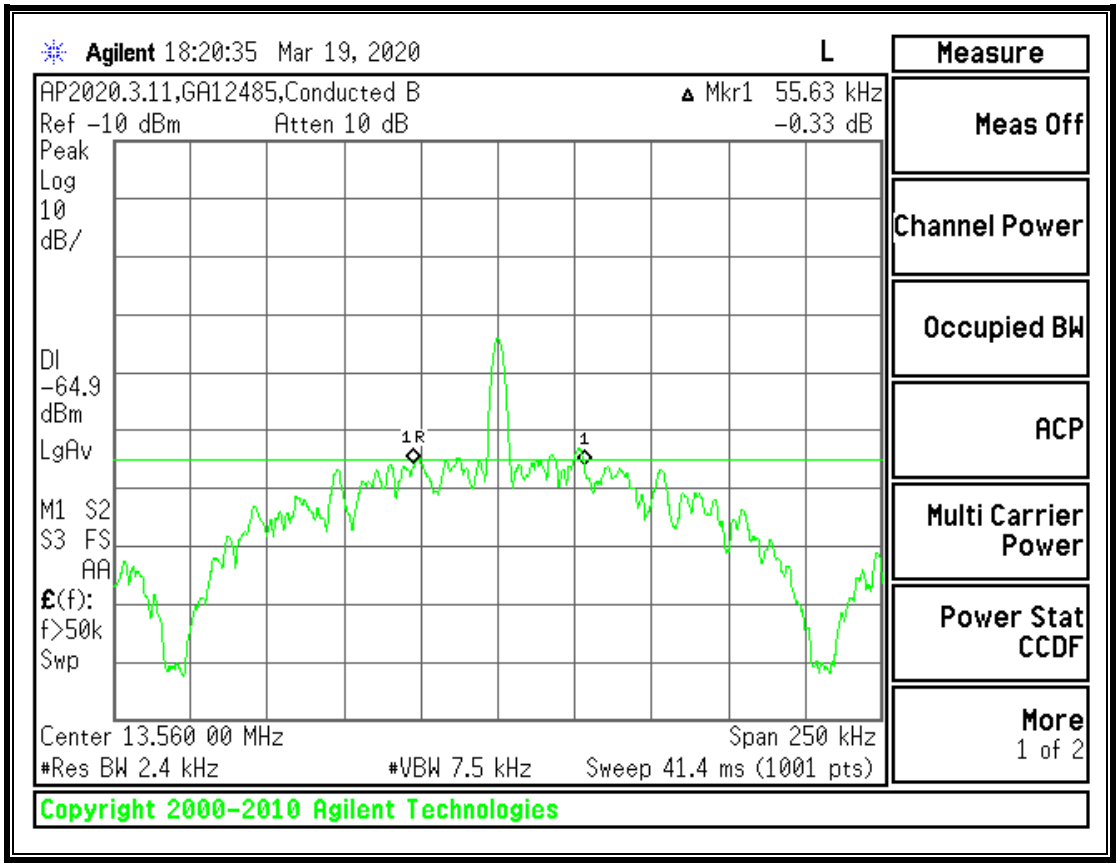
8.2. 20dB BANDWIDTH PLOT



TEST INFORMATION

Test Date: 2020-03-13
Tested By: 40882

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9. 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.

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

TEST PROCEDURE

ANSI C63.10-2013 Clause 6.8.1 and 6.8.2

RESULTS

No non-compliance noted.

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)
120.00	50	13.5598370	4.277	13.5598270	5.015	13.5598270	5.015	13.5598270	5.015	± 100
120.00	40	13.5598480	3.466	13.5598440	3.761	13.5598430	3.835	13.5598420	3.909	± 100
120.00	30	13.5598730	1.622	13.5598720	1.696	13.5598680	1.991	13.5598670	2.065	± 100
120.00	**20**	**13.5598950**	**0.000**	**13.5598940**	**0.074**	**13.5598940**	**0.074**	**13.5598940**	**0.074**	**± 100**
120.00	10	13.5599190	-1.770	13.5599180	-1.696	13.5599180	-1.696	13.5599170	-1.622	± 100
120.00	0	13.5599290	-2.507	13.5599290	-2.507	13.5599290	-2.507	13.5599290	-2.507	± 100
120.00	-10	13.5599170	-1.622	13.5599190	-1.770	13.5599200	-1.844	13.5599210	-1.917	± 100
120.00	-20	13.5598910	0.295	13.5598910	0.295	13.5598900	0.369	13.5598890	0.442	± 100
138.00	20	13.5598520	3.171	13.5598510	3.245	13.5598510	3.245	13.5598500	3.319	± 100
102.00	20	13.5598750	1.475	13.5598610	2.507	13.5598530	3.097	13.5598520	3.171	± 100

TEST INFORMATION
Date: 2020-03-13
Project No: 13105073
Tester: 40882

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10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

LIMIT

§15.225
IC RSS-210, Annex B.6
IC RSS-GEN, Section 8.9 (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)

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In addition:

§15.209 (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.

§15.209 (d) The provisions in §§ 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

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.

TEST PROCEDURE

ANSI C63.10, 2013
The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 0.15 MHz to the 10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower.

Since the EUT contains a digital device operating at 13.56 MHz, the frequency range was expanded to 1 GHz, as specified in the following table.

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30.
1.705-108	1000.
108-500	2000.
500-1000	5000.
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

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10.1. TRANSMISSION SPURIOUS EMISSIONS

Note for below 30 MHz scans: All measurements were made at a test distance of 3 m. The measured data was extrapolated from the test distance (3m) to the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were 40*Log (test distance / specification distance).

The below 30 MHz 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 377Ω. For example, the measurement frequency 12.2 kHz resulted in a level of -16.67 dBuV/m, which is equivalent to -16.67-51.5 = -68.17 dBuA/m, which has the same margin, -62.55 dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

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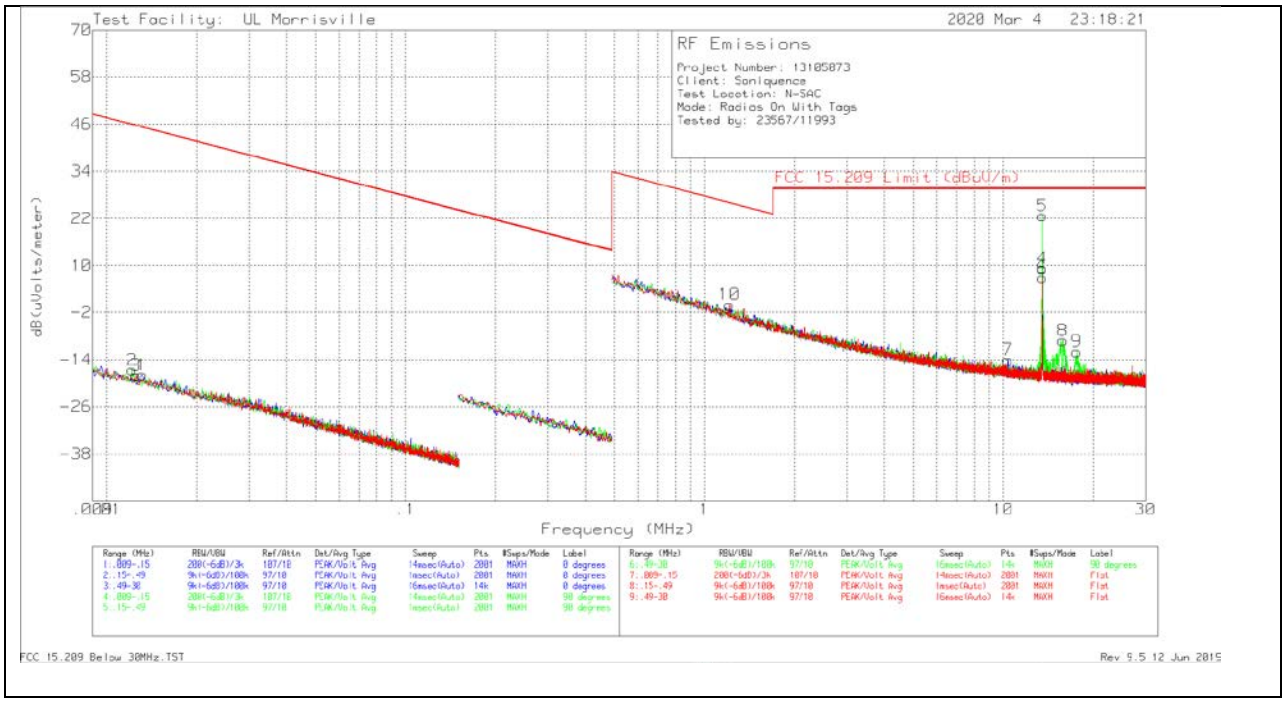
10.1.1. TAG

SPURIOUS AND HARMONICS EMISSIONS 9 kHz TO 30 MHZ



RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 QP/AV Limit (dBuV/m)	FCC 15.209 PK Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
2	.0122	45.93	Pk	17.3	.1	-80	-16.67	45.88	65.88	-62.55	0-360
3	.01255	44.78	Pk	17.1	.1	-80	-18.02	45.63	65.63	-63.65	0-360
1	.01319	45.18	Pk	16.8	.1	-80	-17.92	45.2	65.2	-63.12	0-360
10	1.21515	28.76	Pk	11.1	.2	-40	.06	25.91	-	-25.85	0-360
7	10.35755	15.19	Pk	10.3	.5	-40	-14.01	29.54	-	-43.55	0-360
4	13.5596	38.64	Pk	10	.6	-40	9.24	29.54	-	-20.3	0-360
5	13.5596	52.01	Pk	10	.6	-40	22.61	29.54	-	-6.93	0-360
6	13.5596	36.29	Pk	10	.6	-40	6.89	29.54	-	-22.65	0-360
8	15.82992	20.43	Pk	9.7	.7	-40	-9.17	29.54	-	-38.71	0-360
9	17.67863	17.76	Pk	9.6	.7	-40	-11.94	29.54	-	-41.48	0-360

Pk- Peak Detector

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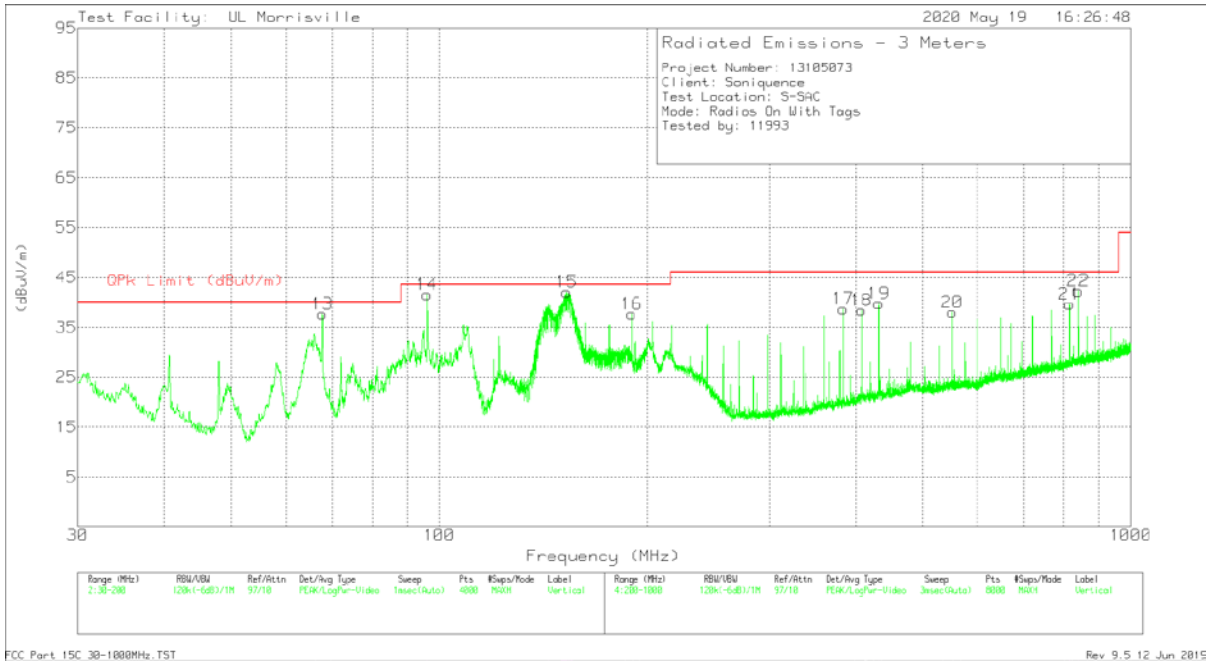
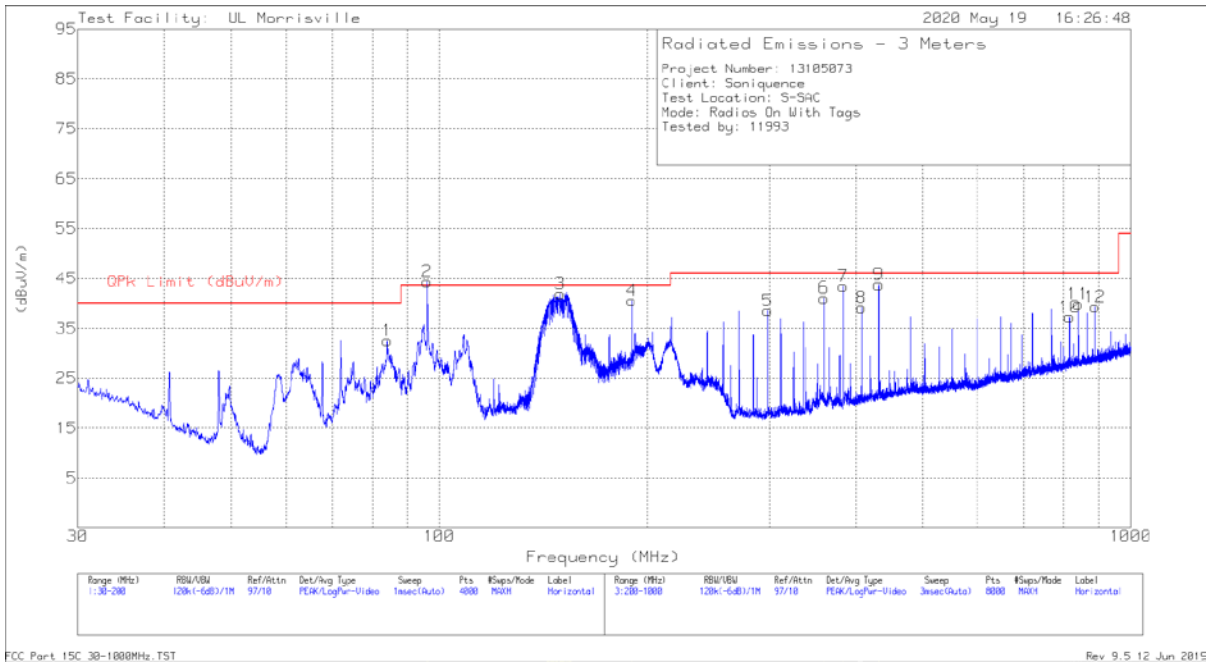
SPURIOUS AND HARMONIC EMISSIONS 30MHz to 1000MHz

VERTICAL RESULT



HORIZONTAL RESULT



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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 AF (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	84.1165	50.35	Pk	13.3	-31.1	32.55	40	-7.45	0-360	299	H
2	96.0165	57	Qp	15.2	-31	41.2	43.52	-2.32	328	310	H
3	149.4993	51.55	Qp	18.6	-30.6	39.55	43.52	-3.97	17	249	H
4	189.8398	53.22	Qp	17.5	-30.2	40.52	43.52	-3	296	112	H
5	298.3128	48.73	Pk	19.4	-29.6	38.53	46.02	-7.49	0-360	101	H
6	359.9995	49.05	Qp	20.8	-29.4	40.45	46.02	-5.57	115	104	H
7	384.0058	52.97	Qp	21.1	-29.3	44.77	46.02	-1.25	275	101	H
8	408.027	46.21	Pk	22	-29.1	39.11	46.02	-6.91	0-360	101	H
9	432.0091	49.42	Qp	22.6	-28.9	43.12	46.02	-2.9	331	102	H
10	815.9801	37.23	Pk	27.7	-27.7	37.23	46.02	-8.79	0-360	101	H
11	839.9832	39.56	Pk	27.9	-27.6	39.86	46.02	-6.16	0-360	101	H
12	887.9894	38.2	Pk	28.3	-27.2	39.3	46.02	-6.72	0-360	101	H
13	67.7985	52.99	Qp	14.1	-31.3	35.79	40	-4.21	257	107	V
14	96.0196	55.24	Qp	15.2	-31	39.44	43.52	-4.08	68	104	V
15	152.8251	51.54	Qp	18.6	-30.5	39.64	43.52	-3.88	250	102	V
16	189.8524	48.96	Qp	17.5	-30.2	36.26	43.52	-7.26	207	117	V
17	384.0239	46.91	Pk	21.1	-29.3	38.71	46.02	-7.31	0-360	198	V
18	408.027	45.46	Pk	22	-29.1	38.36	46.02	-7.66	0-360	101	V
19	432.0302	46.05	Pk	22.6	-28.9	39.75	46.02	-6.27	0-360	101	V
20	552.0458	42.32	Pk	24.3	-28.6	38.02	46.02	-8	0-360	101	V
21	815.9801	39.63	Pk	27.7	-27.7	39.63	46.02	-6.39	0-360	101	V
22	840.012	41.95	Qp	27.9	-27.6	42.25	46.02	-3.77	34	101	V

Pk - Peak detector
Qp - Quasi-Peak detector

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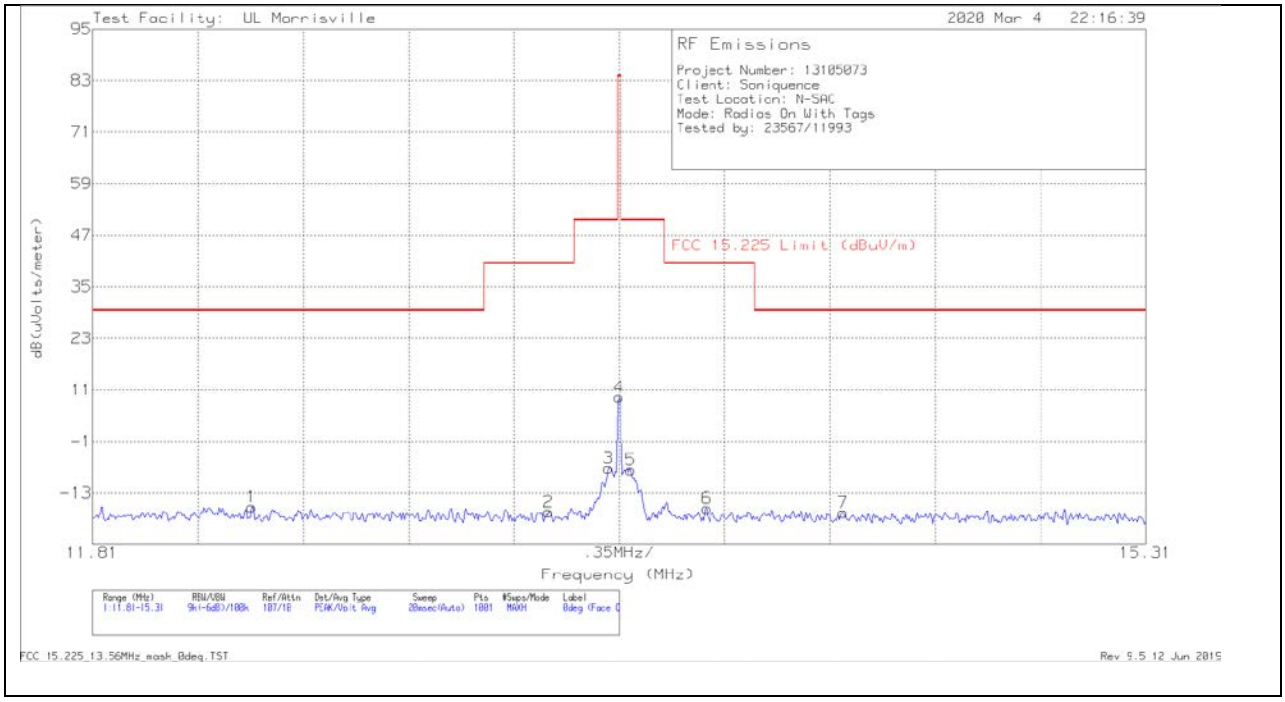
Fundamental 0 Degrees



RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	12.3385	13.04	Pk	10.1	.6	-40	-16.26	29.5	-45.76	253
2	13.3255	12.01	Pk	10	.6	-40	-17.39	40.5	-57.89	253
3	13.525	22.21	Pk	10	.6	-40	-7.19	50.5	-57.69	253
4	13.56	38.71	Pk	10	.6	-40	9.31	84	-74.69	253
5	13.5985	21.73	Pk	10	.6	-40	-7.67	50.5	-58.17	253
6	13.8505	12.91	Pk	9.9	.6	-40	-16.59	40.5	-57.09	253
7	14.3055	11.97	Pk	9.9	.6	-40	-17.53	29.5	-47.03	253

Pk - Peak detector

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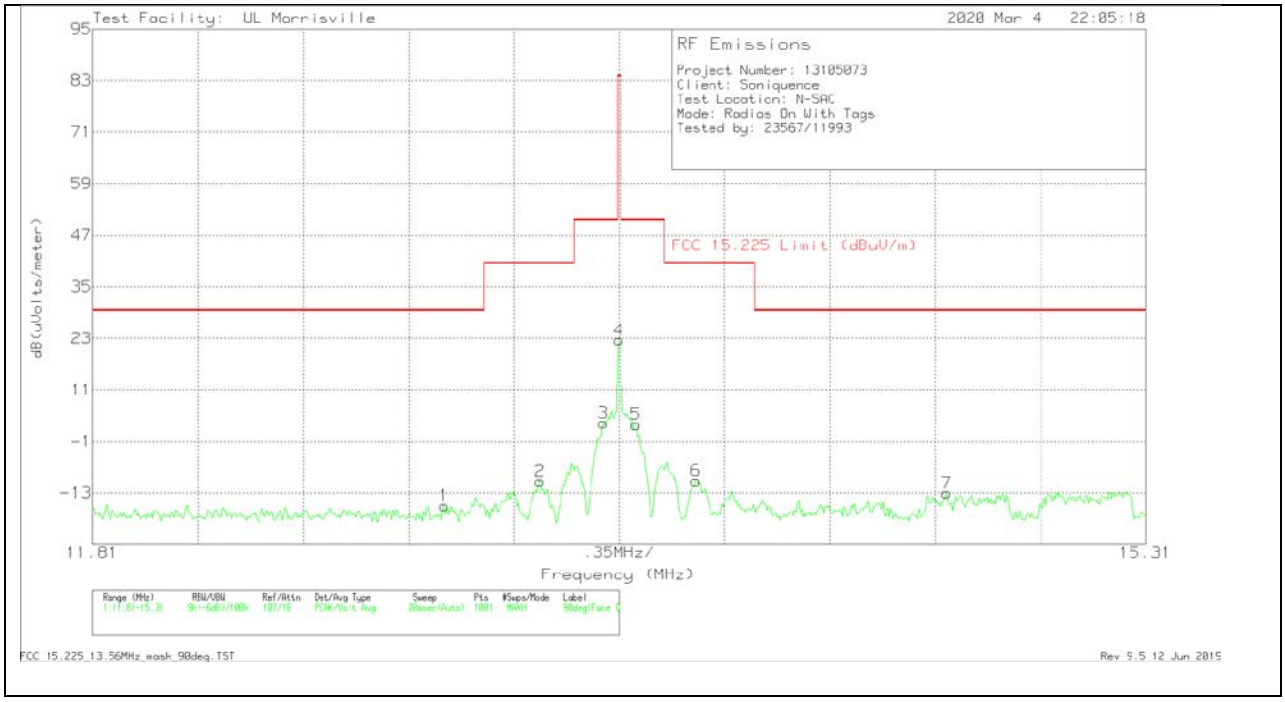
Fundamental 90 Degrees



RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	12.979	13.42	Pk	10	.6	-40	-15.98	29.5	-45.48	204
2	13.2975	19.13	Pk	10	.6	-40	-10.27	40.5	-50.77	204
3	13.5075	32.68	Pk	10	.6	-40	3.28	50.5	-47.22	204
4	13.56	51.93	Pk	10	.6	-40	22.53	84	-61.47	204
5	13.616	32.47	Pk	9.9	.6	-40	2.97	50.5	-47.53	204
6	13.8155	19.34	Pk	9.9	.6	-40	-10.16	40.5	-50.66	204
7	14.6485	16.59	Pk	9.8	.6	-40	-13.01	29.5	-42.51	204

Pk - Peak detector

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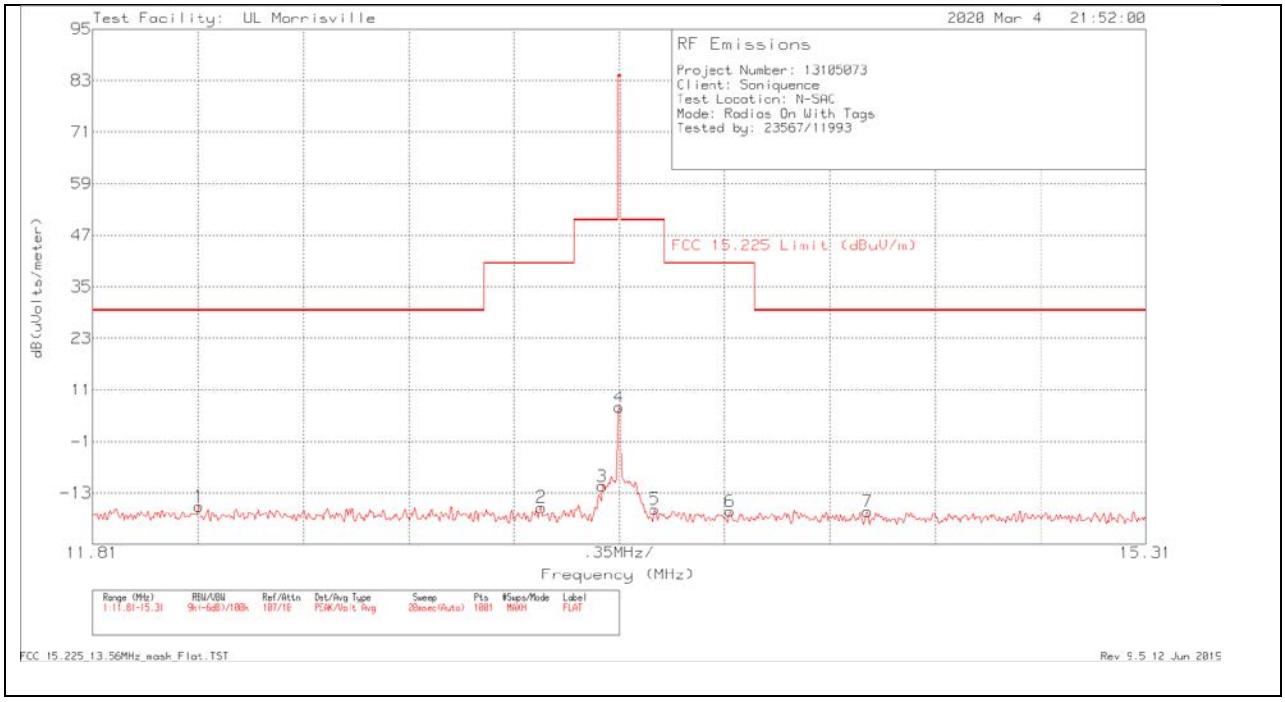
Fundamental Parallel to GRP



RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	12.1635	13.24	Pk	10.1	.6	-40	-16.06	29.5	-45.56	229
2	13.301	13.06	Pk	10	.6	-40	-16.34	40.5	-56.84	229
3	13.504	18	Pk	10	.6	-40	-11.4	50.5	-61.9	229
4	13.56	36.36	Pk	10	.6	-40	6.96	84	-77.04	229
5	13.679	12.74	Pk	9.9	.6	-40	-16.76	50.5	-67.26	229
6	13.9275	12.2	Pk	9.9	.6	-40	-17.3	40.5	-57.8	229
7	14.386	12.18	Pk	9.9	.6	-40	-17.32	29.5	-46.82	229

Pk - Peak detector

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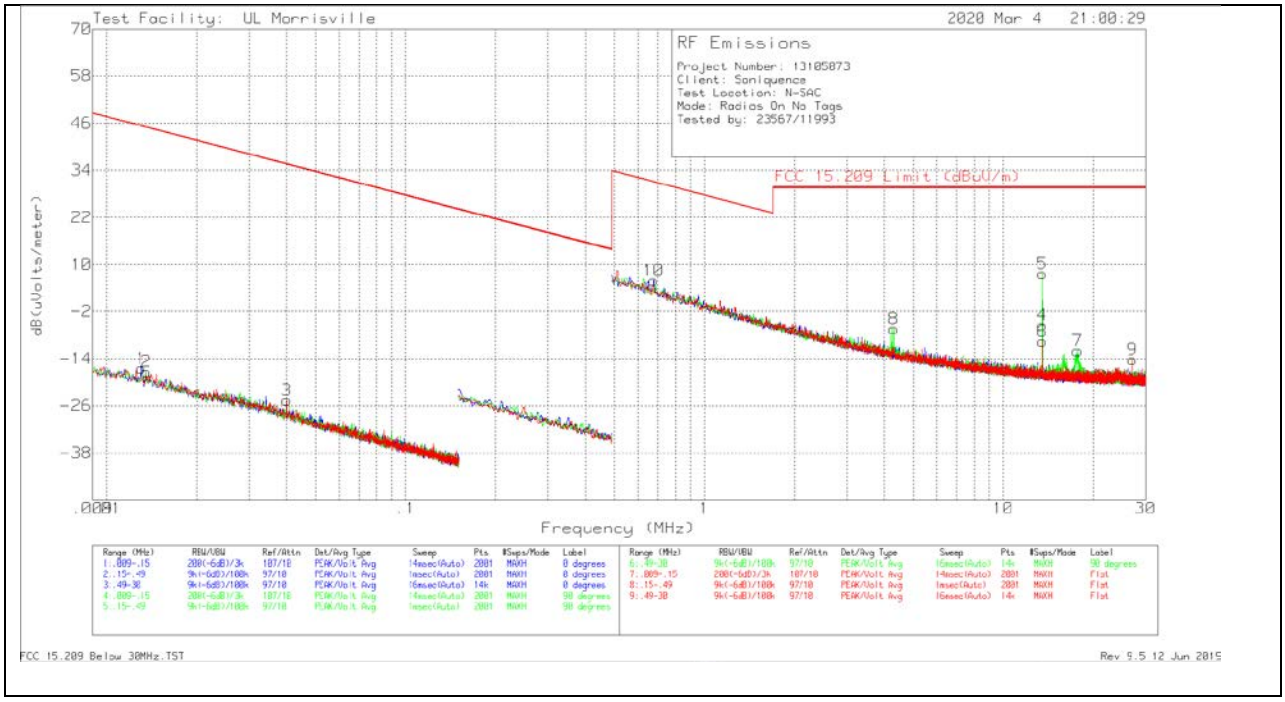
10.1.2. WITHOUT TAG

SPURIOUS AND HARMONICS EMISSIONS .09MHz TO 30 MHZ



RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 QP/AV Limit (dBuV/m)	FCC 15.209 PK Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.01312	46.52	Pk	16.9	.1	-80	-16.48	45.25	65.25	-61.73	0-360
2	.01362	45.85	Pk	16.7	.1	-80	-17.35	44.92	64.92	-62.27	0-360
3	.04003	42.95	Pk	12.3	.1	-80	-24.65	35.56	55.56	-60.21	0-360
10	.67761	34.81	Pk	11	.1	-40	5.91	30.98	-	-25.07	0-360
8	4.30548	22.11	Pk	11.1	.4	-40	-6.39	29.54	-	-35.93	0-360
4	13.5596	23.93	Pk	10	.6	-40	-5.47	29.54	-	-35.01	0-360
5	13.5596	37.06	Pk	10	.6	-40	7.66	29.54	-	-21.88	0-360
6	13.5596	19.78	Pk	10	.6	-40	-9.62	29.54	-	-39.16	0-360
7	17.77982	17.71	Pk	9.6	.7	-40	-11.99	29.54	-	-41.53	0-360
9	27.12247	16.38	Pk	8.5	.9	-40	-14.22	29.54	-	-43.76	0-360

Pk- Peak Detector

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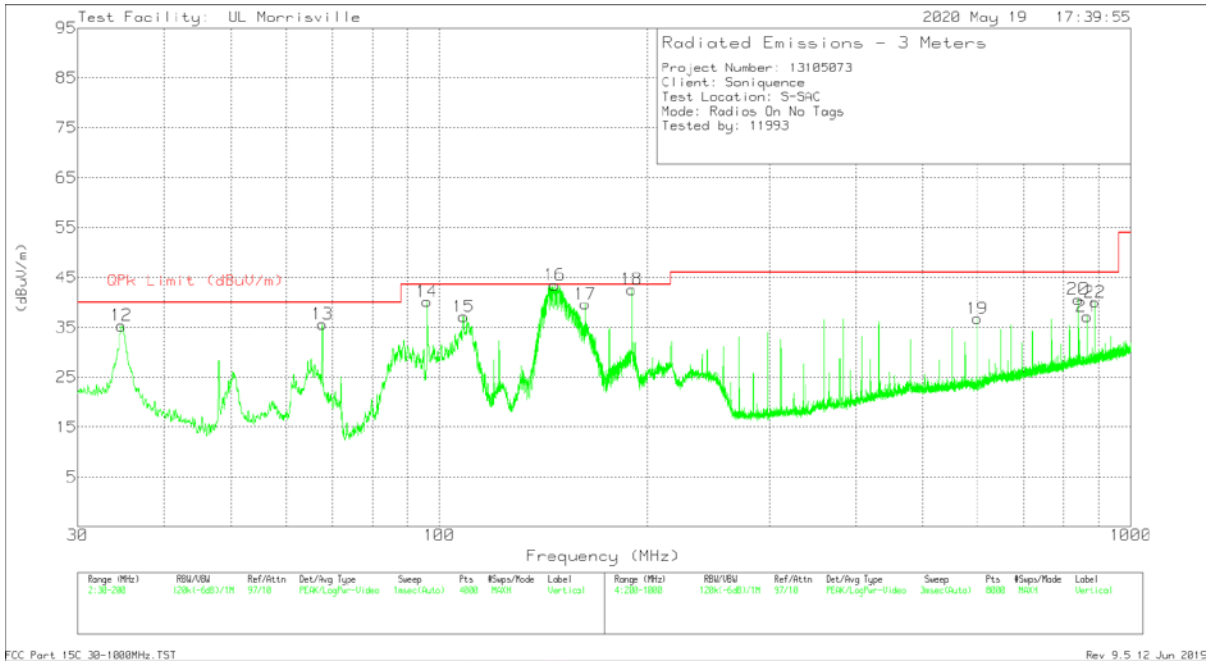
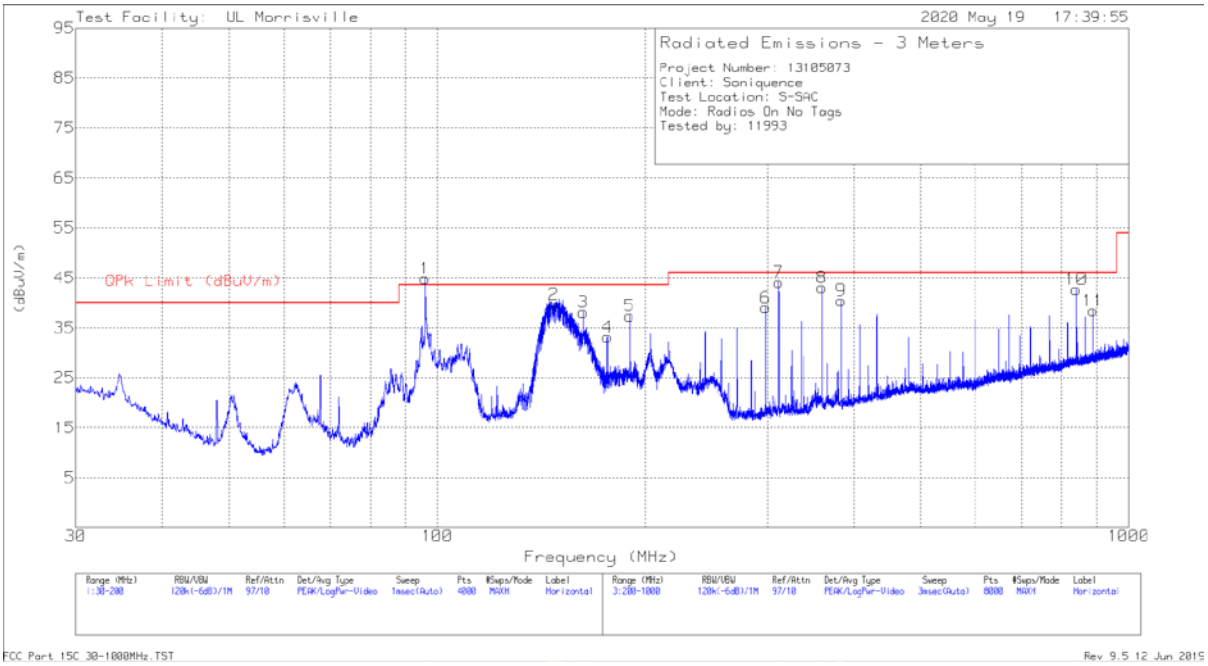
SPURIOUS AND HARMONIC EMISSIONS 30MHz to 1000MHz

VERTICAL RESULT



HORIZONTAL RESULT



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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 AF (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	96.0023	58.36	Qp	15.2	-31	42.56	43.52	-.96	327	294	H
2	147.4874	50.07	Qp	18.7	-30.6	38.17	43.52	-5.35	227	194	H
3	162.7044	49.27	Qp	18.4	-30.5	37.17	43.52	-6.35	82	161	H
4	176.2804	45.9	Pk	17.6	-30.4	33.1	43.52	-10.42	0-360	198	H
5	189.8414	50.05	Pk	17.5	-30.2	37.35	43.52	-6.17	0-360	101	H
6	298.3128	49.22	Pk	19.4	-29.6	39.02	46.02	-7	0-360	101	H
7	311.9988	53.65	Qp	19.8	-29.5	43.95	46.02	-2.07	256	102	H
8	360.0016	51.63	Qp	20.8	-29.4	43.03	46.02	-2.99	25	104	H
9	384.0031	47.22	Qp	21.1	-29.3	39.02	46.02	-7	354	101	H
10	840.0221	41.3	Qp	27.9	-27.6	41.6	46.02	-4.42	334	103	H
11	887.9894	37.27	Pk	28.3	-27.2	38.37	46.02	-7.65	0-360	198	H
12	34.8178	39.89	Qp	23.5	-31.7	31.69	40	-8.31	21	109	V
13	67.8	51.47	Qp	14.1	-31.3	34.27	40	-5.73	237	110	V
14	96.0009	49.96	Qp	15.2	-31	34.16	43.52	-9.36	336	129	V
15	108.4541	49.53	Pk	18.5	-30.9	37.13	43.52	-6.39	0-360	101	V
16	146.7681	53.43	Qp	18.7	-30.6	41.53	43.52	-1.99	293	101	V
17	162.7131	50.74	Qp	18.4	-30.5	38.64	43.52	-4.88	329	105	V
18	189.8385	55.08	Qp	17.5	-30.2	42.38	43.52	-1.14	24	101	V
19	600.052	40.96	Pk	24.4	-28.6	36.76	46.02	-9.26	0-360	101	V
20	840.0157	38.78	Qp	27.9	-27.6	39.08	46.02	-6.94	336	113	V
21	863.9863	36.51	Pk	28	-27.4	37.11	46.02	-8.91	0-360	101	V
22	888.0004	37.82	Qp	28.3	-27.2	38.92	46.02	-7.1	175	103	V

Pk - Peak detector
Qp - Quasi-Peak detector

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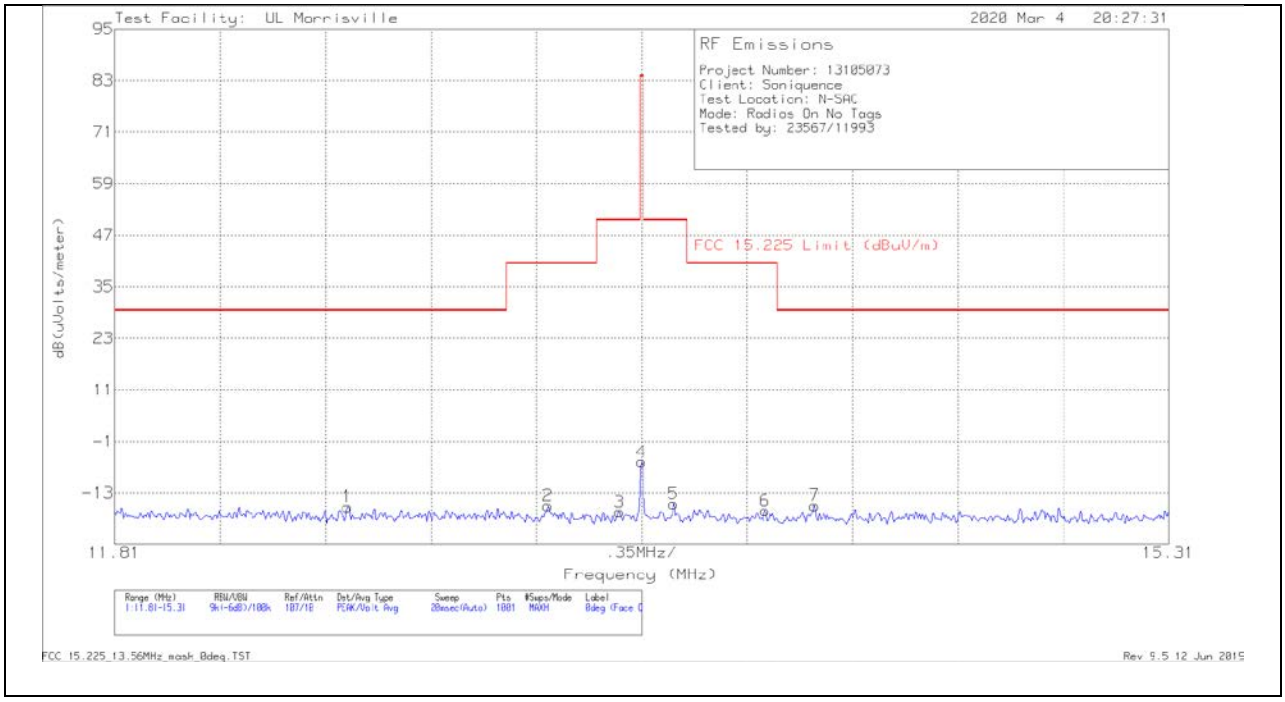
Fundamental 0 Degrees



RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	12.5835	13.12	Pk	10.1	.6	-40	-16.18	29.5	-45.68	253
2	13.2485	13.48	Pk	10	.6	-40	-15.92	40.5	-56.42	253
3	13.4865	12.01	Pk	10	.6	-40	-17.39	50.5	-67.89	253
4	13.56	23.66	Pk	10	.6	-40	-5.74	84	-89.74	253
5	13.66675	13.98	Pk	9.9	.6	-40	-15.52	50.5	-66.02	253
6	13.9695	12.42	Pk	9.9	.6	-40	-17.08	40.5	-57.58	253
7	14.134	13.6	Pk	9.9	.6	-40	-15.9	29.5	-45.4	253

Pk - Peak detector

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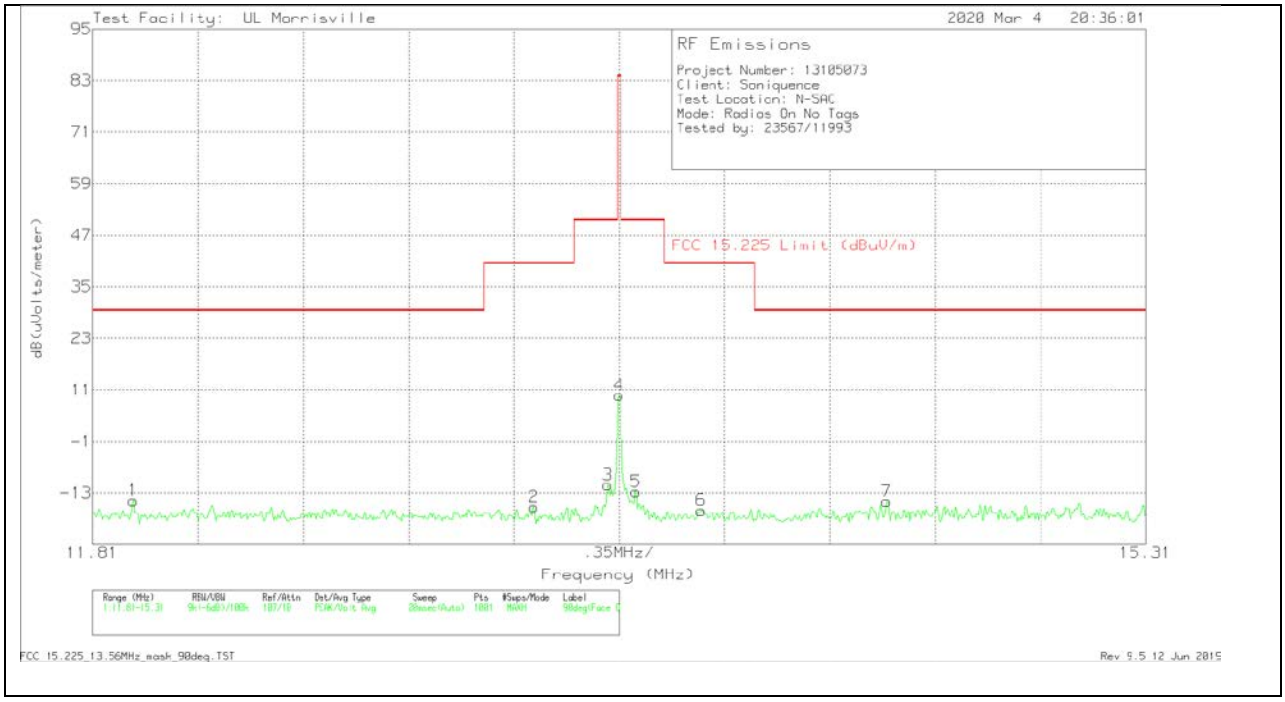
Fundamental 90 Degrees



RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	11.94475	14.57	Pk	10.1	.6	-40	-14.73	29.5	-44.23	110
2	13.2765	13.13	Pk	10	.6	-40	-16.27	40.5	-56.77	110
3	13.5215	18.32	Pk	10	.6	-40	-11.08	50.5	-61.58	110
4	13.56	39.14	Pk	10	.6	-40	9.74	84	-74.26	110
5	13.616	16.83	Pk	9.9	.6	-40	-12.67	50.5	-63.17	110
6	13.833	12.46	Pk	9.9	.6	-40	-17.04	40.5	-57.54	110
7	14.449	14.59	Pk	9.9	.6	-40	-14.91	29.5	-44.41	110

Pk - Peak detector

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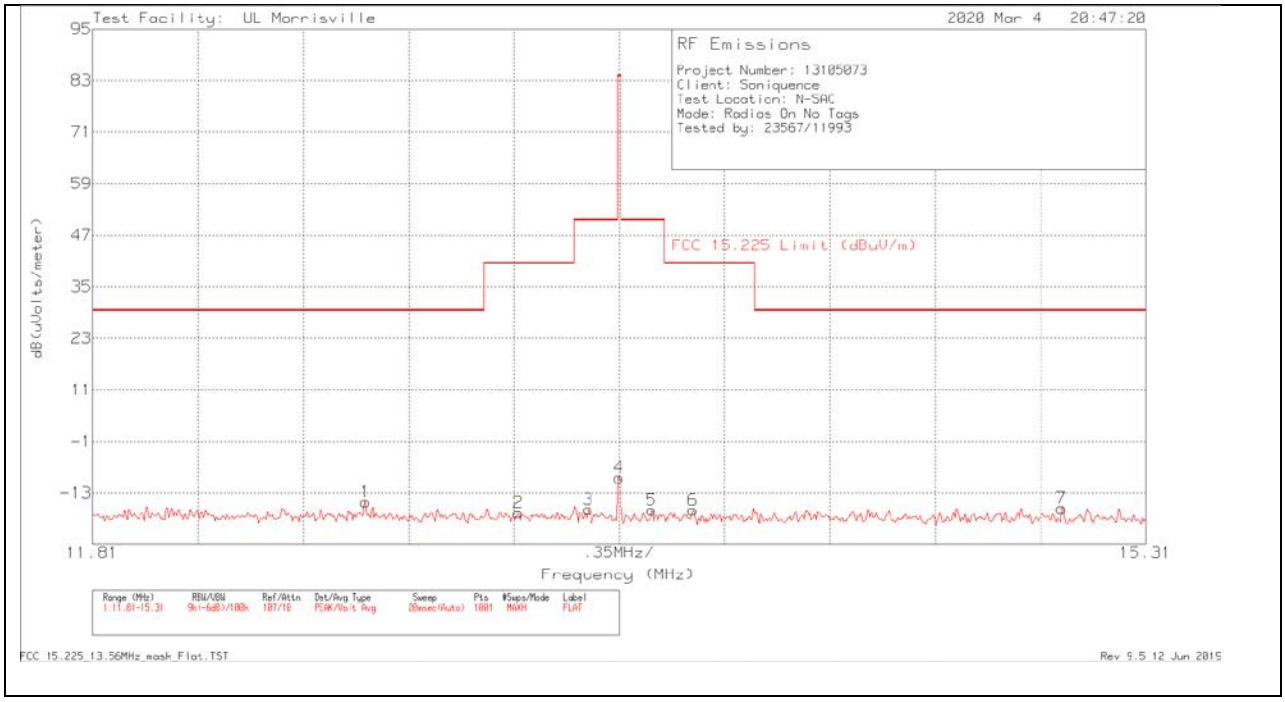
Fundamental Parallel to GRP



RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	12.7165	14.35	Pk	10	.6	-40	-15.05	29.5	-44.55	14
2	13.224	11.87	Pk	10	.6	-40	-17.53	40.5	-58.03	14
3	13.4585	12.54	Pk	10	.6	-40	-16.86	50.5	-67.36	14
4	13.56	19.97	Pk	10	.6	-40	-9.43	84	-93.43	14
5	13.6685	12.49	Pk	9.9	.6	-40	-17.01	50.5	-67.51	14
6	13.805	12.52	Pk	9.9	.6	-40	-16.98	40.5	-57.48	14
7	15.03	13.01	Pk	9.8	.6	-40	-16.59	29.5	-46.09	14

Pk - Peak detector

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11. AC POWER LINE CONDUCTED EMISSIONS

§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 C63.10:2013 and KDB 174176 D01 Line Conducted FAQ v01r01, Q5.

RESULTS

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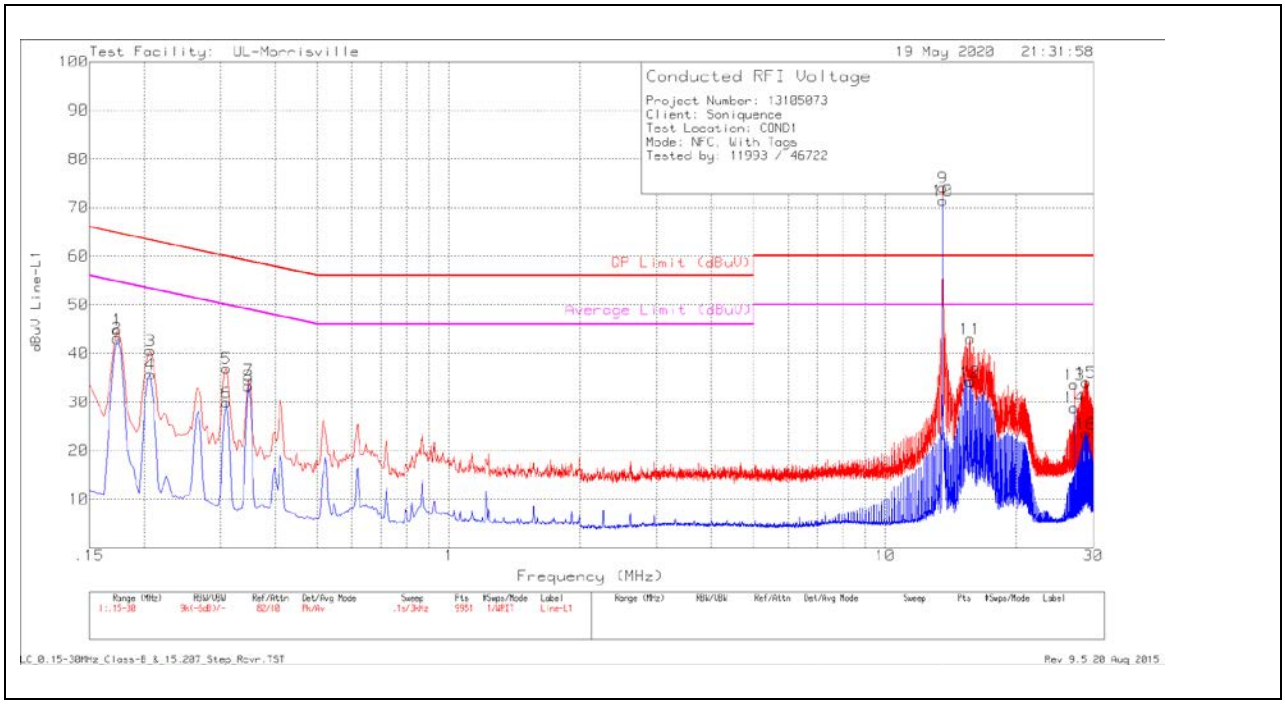
11.1. RFID

11.1.1. NORMAL OPERATION WITH TAGS

LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz										
Marker	**Frequency (MHz)**	**Meter Reading (dBuV)**	**Det**	**LISN VCF (dB)**	**Cbl/Limiter (dB)**	**Corrected Reading dBuV**	**QP Limit (dBuV)**	**Margin (dB)**	**Average Limit (dBuV)**	**Margin (dB)**
1	.174	35.04	Pk	.2	9.7	44.94	64.77	-19.83	-	-
2	.174	33.21	Av	.2	9.7	43.11	-	-	54.77	-11.66
3	.207	30.78	Pk	.1	9.7	40.58	63.32	-22.74	-	-
4	.207	25.9	Av	.1	9.7	35.7	-	-	53.32	-17.62
5	.309	27.11	Pk	.1	9.7	36.91	60	-23.09	-	-
6	.309	20.06	Av	.1	9.7	29.86	-	-	50	-20.14
7	.348	24.78	Pk	.1	9.7	34.58	59.01	-24.43	-	-
8	.348	23.48	Av	.1	9.7	33.28	-	-	49.01	-15.73
9	13.5599	63.3	Qp	.1	10	73.4	**60**	**13.4**	-	-
10	13.56	61.36	Av	.1	10	71.46	-	-	**50**	**21.46**
11	15.657	32.81	Pk	.1	10.1	43.01	60	-16.99	-	-
12	15.663	23.96	Av	.1	10.1	34.16	-	-	50	-15.84
13	27.12	23.07	Pk	.3	10.2	33.57	60	-26.43	-	-
14	27.12	18.35	Av	.3	10.2	28.85	-	-	50	-21.15
15	28.881	23.6	Pk	.3	10.2	34.1	60	-25.9	-	-
16	28.881	12.98	Av	.3	10.2	23.48	-	-	50	-26.52

Note – Refer to Terminated plots for final compliance data, per KDB 174176 D01 Line Conducted FAQ v01r01, Q5.

Pk - Peak detector
Qp - Quasi-Peak detector
Av - Average detection

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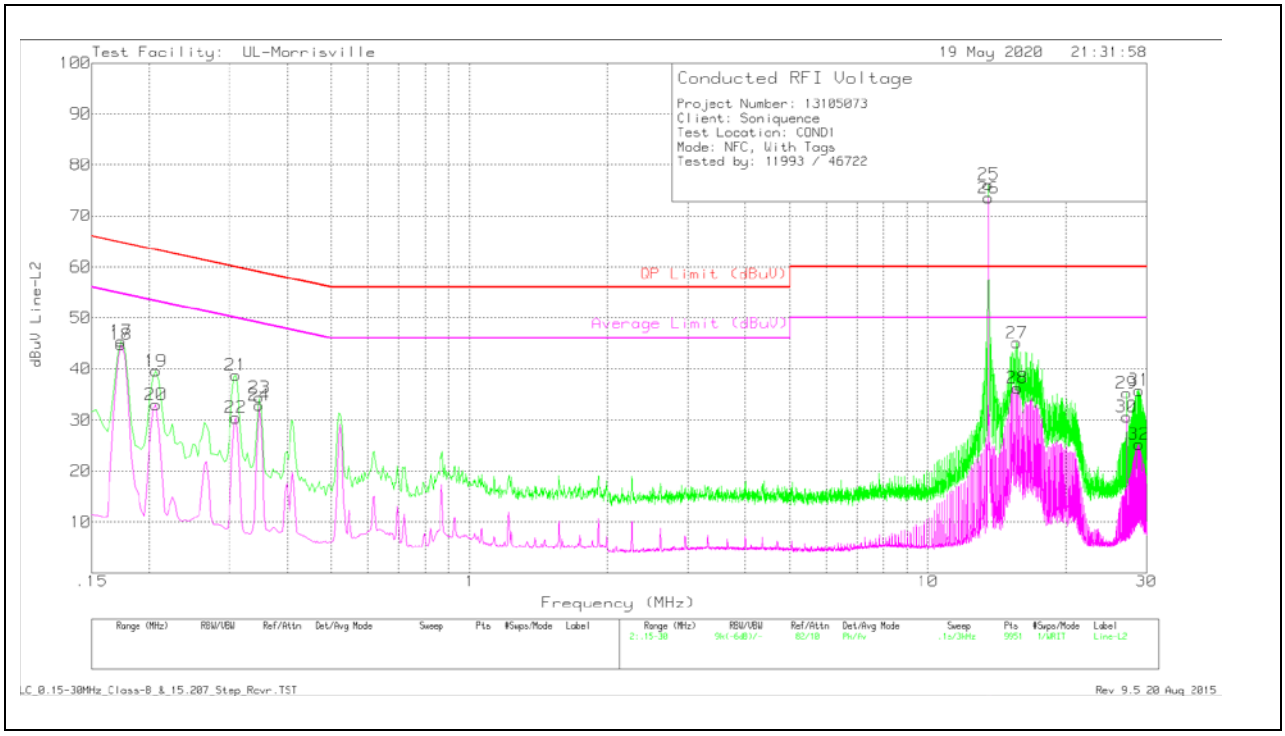
LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
17	.174	35.52	Pk	.2	9.7	45.42	64.77	-19.35	-	-
18	.174	34.88	Av	.2	9.7	44.78	-	-	54.77	-9.99
19	.207	29.82	Pk	.1	9.7	39.62	63.32	-23.7	-	-
20	.207	23.2	Av	.1	9.7	33	-	-	53.32	-20.32
21	.309	28.98	Pk	.1	9.7	38.78	60	-21.22	-	-
22	.309	20.66	Av	.1	9.7	30.46	-	-	50	-19.54
23	.348	24.63	Pk	.1	9.7	34.43	59.01	-24.58	-	-
24	.348	23.09	Av	.1	9.7	32.89	-	-	49.01	-16.12
25	13.56	65.38	Qp	.1	10	75.48	**60**	**15.48**	-	-
26	13.56	63.57	Av	.1	10	73.67	-	-	**50**	**23.67**
27	15.645	34.9	Pk	.1	10.1	45.1	60	-14.9	-	-
28	15.663	26.1	Av	.1	10.1	36.3	-	-	50	-13.7
29	27.12	24.91	Pk	.2	10.2	35.31	60	-24.69	-	-
30	27.12	20.24	Av	.2	10.2	30.64	-	-	50	-19.36
31	28.881	25.33	Pk	.3	10.2	35.83	60	-24.17	-	-
32	28.881	14.72	Av	.3	10.2	25.22	-	-	50	-24.78

Note – Refer to Terminated plots for final compliance data, per KDB 174176 D01 Line Conducted FAQ v01r01, Q5.

Pk - Peak detector
Qp - Quasi-Peak detector
Av - Average detection

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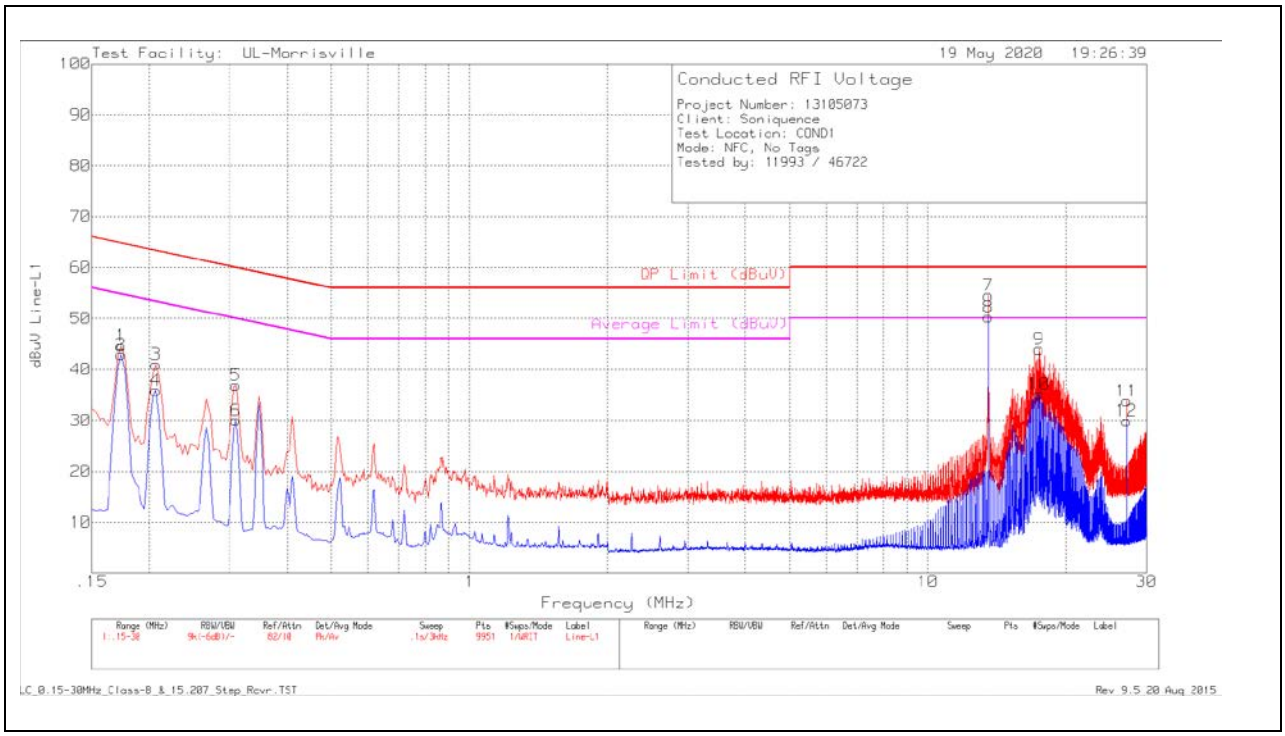
11.1.2. NORMAL OPERATION WITHOUT TAGS

LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.174	34.78	Pk	.2	9.7	44.68	64.77	-20.09	-	-
2	.174	33.03	Av	.2	9.7	42.93	-	-	54.77	-11.84
3	.207	31.2	Pk	.1	9.7	41	63.32	-22.32	-	-
4	.207	26.11	Av	.1	9.7	35.91	-	-	53.32	-17.41
5	.309	27.07	Pk	.1	9.7	36.87	60	-23.13	-	-
6	.309	20.19	Av	.1	9.7	29.99	-	-	50	-20.01
7	13.5597	43.26	Qp	.1	10	53.36	60	-6.64	-	-
8	13.56	40.24	Av	.1	10	50.34	-	-	**50**	**.34**
9	17.475	33.78	Pk	.1	10.1	43.98	60	-16.02	-	-
10	17.475	25	Av	.1	10.1	35.2	-	-	50	-14.8
11	27.12	23.33	Pk	.3	10.2	33.83	60	-26.17	-	-
12	27.12	19.43	Av	.3	10.2	29.93	-	-	50	-20.07

Note – Refer to Terminated plots for final compliance data, per KDB 174176 D01 Line Conducted FAQ v01r01, Q5.

Pk - Peak detector
Qp - Quasi-Peak detector
Av - Average detection

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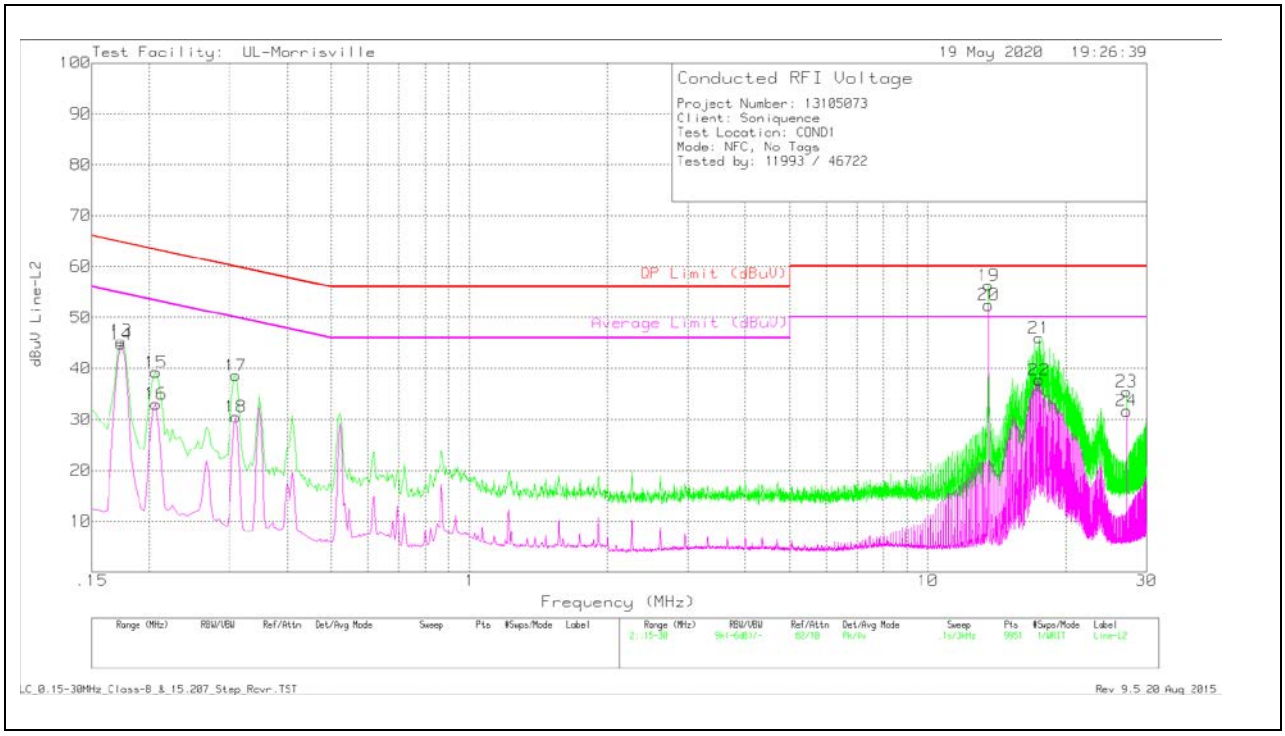
LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
13	.174	35.51	Pk	.2	9.7	45.41	64.77	-19.36	-	-
14	.174	34.84	Av	.2	9.7	44.74	-	-	54.77	-10.03
15	.207	29.4	Pk	.1	9.7	39.2	63.32	-24.12	-	-
16	.207	23.21	Av	.1	9.7	33.01	-	-	53.32	-20.31
17	.309	28.81	Pk	.1	9.7	38.61	60	-21.39	-	-
18	.309	20.67	Av	.1	9.7	30.47	-	-	50	-19.53
19	13.5601	45.34	Qp	.1	10	55.44	60	-4.56	-	-
20	13.56	42.19	Av	.1	10	52.29	-	-	50	2.29
21	17.475	35.76	Pk	.1	10.1	45.96	60	-14.04	-	-
22	17.475	27.53	Av	.1	10.1	37.73	-	-	50	-12.27
23	27.12	25.06	Pk	.2	10.2	35.46	60	-24.54	-	-
24	27.12	21.28	Av	.2	10.2	31.68	-	-	50	-18.32

Note – Refer to Terminated plots for final compliance data, per KDB 174176 D01 Line Conducted FAQ v01r01, Q5.

Pk - Peak detector
Qp - Quasi-Peak detector
Av - Average detection

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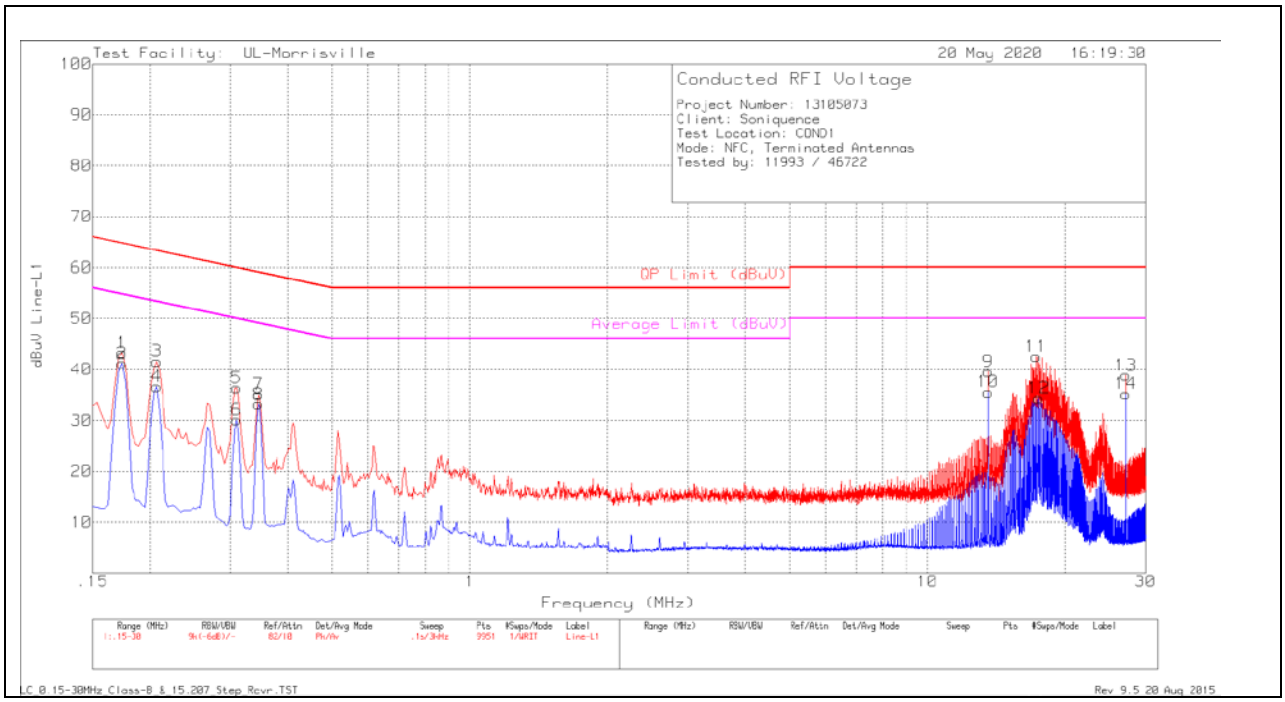
11.1.3. NORMAL OPERATION WITH ANTENNAS TERMINATED

LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.174	33.42	Pk	.2	9.7	43.32	64.77	-21.45	-	-
2	.174	31.29	Av	.2	9.7	41.19	-	-	54.77	-13.58
3	.207	31.83	Pk	.1	9.7	41.63	63.32	-21.69	-	-
4	.207	26.83	Av	.1	9.7	36.63	-	-	53.32	-16.69
5	.309	26.6	Pk	.1	9.7	36.4	60	-23.6	-	-
6	.309	20.3	Av	.1	9.7	30.1	-	-	50	-19.9
7	.345	25.29	Pk	.1	9.7	35.09	59.08	-23.99	-	-
8	.345	23.39	Av	.1	9.7	33.19	-	-	49.08	-15.89
9	13.56	29.51	Pk	.1	10	39.61	60	-20.39	-	-
10	13.56	25.51	Av	.1	10	35.61	-	-	50	-14.39
11	17.271	32.32	Pk	.1	10.1	42.52	60	-17.48	-	-
12	17.523	24.19	Av	.1	10.1	34.39	-	-	50	-15.61
13	27.12	28.36	Pk	.3	10.2	38.86	60	-21.14	-	-
14	27.12	24.74	Av	.3	10.2	35.24	-	-	50	-14.76

Pk - Peak detector
Qp - Quasi-Peak detector
Av - Average detection
Ca - CISPR average detection

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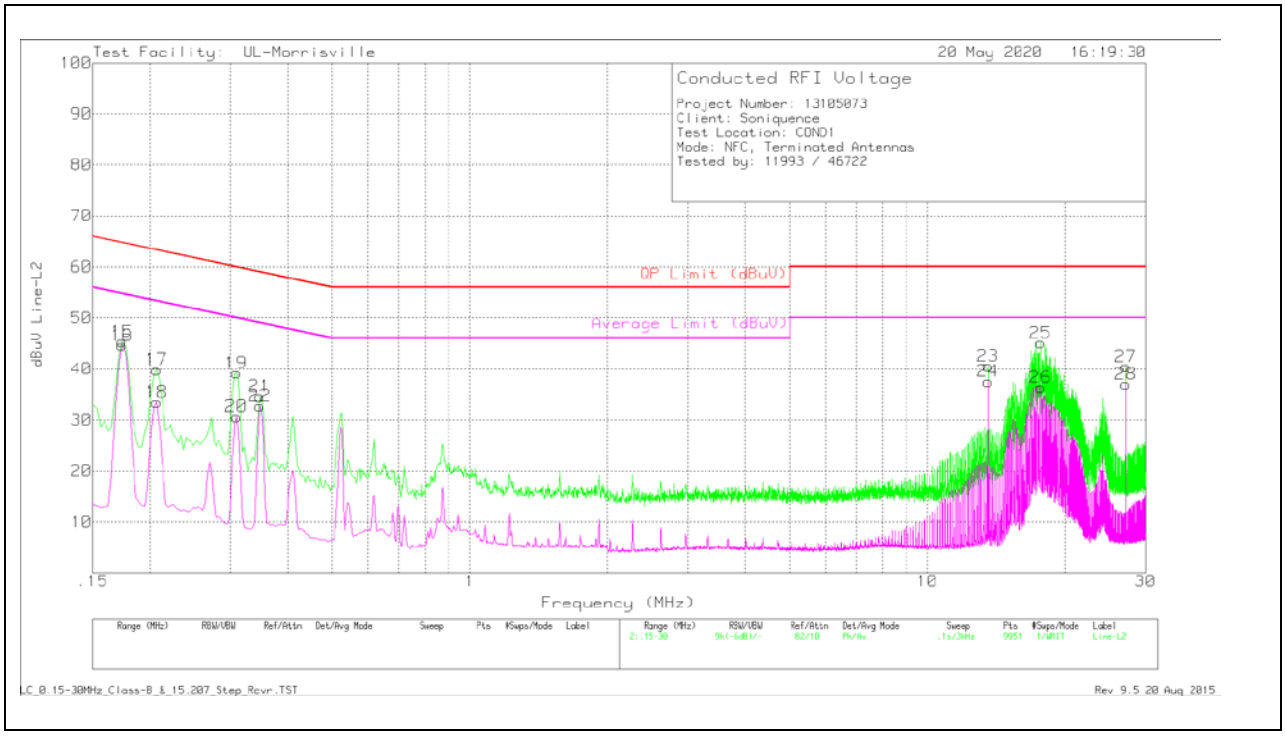
LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
15	.174	35.45	Pk	.2	9.7	45.35	64.77	-19.42	-	-
16	.174	34.73	Av	.2	9.7	44.63	-	-	54.77	-10.14
17	.207	30.09	Pk	.1	9.7	39.89	63.32	-23.43	-	-
18	.207	23.7	Av	.1	9.7	33.5	-	-	53.32	-19.82
19	.309	29.43	Pk	.1	9.7	39.23	60	-20.77	-	-
20	.309	20.88	Av	.1	9.7	30.68	-	-	50	-19.32
21	.348	24.83	Pk	.1	9.7	34.63	59.01	-24.38	-	-
22	.348	22.97	Av	.1	9.7	32.77	-	-	49.01	-16.24
23	13.56	30.49	Pk	.1	10	40.59	60	-19.41	-	-
24	13.56	27.47	Av	.1	10	37.57	-	-	50	-12.43
25	17.679	34.94	Pk	.1	10.1	45.14	60	-14.86	-	-
26	17.679	26.19	Av	.1	10.1	36.39	-	-	50	-13.61
27	27.12	30.08	Pk	.2	10.2	40.48	60	-19.52	-	-
28	27.12	26.66	Av	.2	10.2	37.06	-	-	50	-12.94

Pk - Peak detector
Qp - Quasi-Peak detector
Av - Average detection
Ca - CISPR average detection

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12. SETUP PHOTOS

Please refer to R13105073-EP2 for setup photos.

END OF TEST REPORT

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