



TEST REPORT

Report Number: R13304840-E1

Applicant : ENEL X SRL
Viali Di Tor Di Quinto 45/47
Roma, RM 191
Italy

Model : ST25R3911B

FCC ID : 2A5OV-ST25

IC : 28561-ST25

EUT Description : RFID Module

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
ISED RSS-210 ISSUE 10
ISED RSS-GEN ISSUE 5 + A2

Date Of Issue:
2022-10-19

Prepared by:
UL LLC
12 Laboratory Dr.
Research Triangle Park, NC 27709 U.S.A.
TEL: (919) 549-1400



REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
1	2022-10-11	Initial Issue	Brian Kiewra
2	2022-10-19	Revised model and EUT descriptor	Brian Kiewra

TABLE OF CONTENTS

REVISION HISTORY	2
TABLE OF CONTENTS	3
1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. DECISION RULES AND MEASUREMENT UNCERTAINTY	6
4.1. METROLOGICAL TRACEABILITY	6
4.2. DECISION RULES.....	6
4.3. MEASUREMENT UNCERTAINTY.....	6
4.4. SAMPLE CALCULATION	6
5. EQUIPMENT UNDER TEST	7
5.1. DESCRIPTION OF EUT	7
5.2. SOFTWARE AND FIRMWARE.....	7
5.3. WORST-CASE CONFIGURATION AND MODE.....	7
5.4. DESCRIPTION OF TEST SETUP.....	7
6. TEST AND MEASUREMENT EQUIPMENT	8
7. OCCUPIED BANDWIDTH	10
8. RADIATED EMISSION TEST RESULTS.....	11
8.1. LIMITS AND PROCEDURE.....	11
8.2. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.009 - 30 MHz)	13
8.3. TX SPURIOUS EMISSION 30 TO 1000 MHz	23
9. FREQUENCY STABILITY	27
10. AC MAINS LINE CONDUCTED EMISSIONS	28
11. SETUP PHOTOS	33
END OF TEST REPORT	33

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: ENEL X SRL
Viali Di Tor Di Quinto 45/47
Roma, RM 191
Italy

EUT DESCRIPTION: RFID Module

MODEL: ST25R3911B

SERIAL NUMBER: Non-Serialized

SAMPLE RECEIPT DATE: 2021-12-13

DATE TESTED: 2022-03-23 to 2022-08-08

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	Compliant
ISED RSS-210 Issue 10, Annex B	Compliant
ISED RSS-GEN Issue 5 + A2	Compliant

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.

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 A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released
For UL LLC By:



Michael Antola
Staff Engineer
Consumer Technology Division
UL LLC

Prepared By:



Brian Kiewra
Project Engineer
Consumer Technology Division
UL LLC

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 + A1, and RSS-210 Issue 10.

3. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, certification # 0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
<input type="checkbox"/>	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	825374
<input checked="" type="checkbox"/>	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A		27265	

4. DECISION RULES AND MEASUREMENT UNCERTAINTY

4.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

4.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	U_{Lab}
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	1.22%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	1.94 dB
All emissions, radiated	6.01 dB
Conducted Emissions (0.150-30MHz) - LISN	3.40 dB
Temperature	0.57°C
Humidity	3.39%
DC Supply voltages	1.70%

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

4.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Final Voltage (dBuV)} = \text{Measured Voltage (dBuV)} + \text{Cable Loss (dB)} + \text{Limiter Factor (dB)} + \text{LISN Insertion Loss}$$

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT, Model ST25R3911B, is an RFID Module.

5.2. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was "FCC_scripts_Ver4".

5.3. WORST-CASE CONFIGURATION AND MODE

The EUT is intended to operate in only one orientation. Therefore all final radiated testing was performed with the EUT in this orientation of operation.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788

5.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
None				

I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Mains	1	Hardwired	Non-Shielded	<3m	Connects to AC Mains

SETUP DIAGRAM

Please refer to R13304840-EP1 for setup diagrams

6. 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 – Chamber 1)

Equipment ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
0.009-30MHz					
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2021-08-19	2022-08-19
Gain-Loss Chains					
C1-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2021-07-20	2022-07-20
Receiver & Software					
SA0027	Spectrum Analyzer	Agilent	N9030A	2021-06-25	2022-06-25
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
Additional Equipment used					
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2021-09-27	2022-09-27
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 2)

Equipment ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
0.009-30MHz					
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2021-08-19	2022-08-19
30-1000 MHz					
AT0073	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2021-08-30	2022-08-30
Gain-Loss Chains					
C2-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2021-07-09	2022-07-09
C2-SAC02	Gain-loss string: 25- 1000MHz	Various	Various	2021-07-09	2022-07-09
C2-SAC02	Gain-loss string: 25- 1000MHz	Various	Various	2022-05-10	2023-05-10
Receiver & Software					
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2022-03-08	2023-03-08
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
Additional Equipment used					
s/n 181474409	Environmental Meter	Fisher Scientific	15-077-963	2021-09-27	2022-09-27
PS216	AC Power Source	Elgar	CW2501M (s/n 1045A04231)	NA	NA
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2022-04-05	2023-04-05
HI0091	Environmental Meter	Fisher Scientific	15-077-963	2021-07-12	2022-07-12
HI0091	Environmental Meter	Fisher Scientific	15-077-963	2022-07-20	2023-07-20
LISN003	LISN, 50-ohm/50-uH, 250uH 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50/250-25-2-01	2021-08-16	2022-08-16
LISN003	LISN, 50-ohm/50-uH, 250uH 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50/250-25-2-01	2022-08-01	2023-08-01
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2021-08-17	2022-08-17
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2022-08-03	2023-08-03
ATA222	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2022-04-05	2023-04-05
PS216	AC Power Source	Elgar	CW2501M	NA	NA
PS215	AC Power Source	Elgar	CW2501M	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
72822	Spectrum Analyzer	Keysight Technologies	E4446A	2022-03-03	2023-03-03
207726	Temp/Humid Chamber	Thermotron	SM-32-8200	2022-01-25	2023-01-25
HI0091	Environmental Meter	Fisher Scientific	15-077-963	2021-07-12	2022-07-12
SOFTEMI	Antenna Port Software	UL	Version 2021.11.3 and 2022.2.17		
MM0165 (PRE0126454)	True RMS Multimeter	Agilent	U1232A	2021-08-18	2023-08-18
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
PS216	AC Power Source	Elgar	CW2501M (s/n 1045A04231)	NA	NA

7. OCCUPIED BANDWIDTH

LIMITS

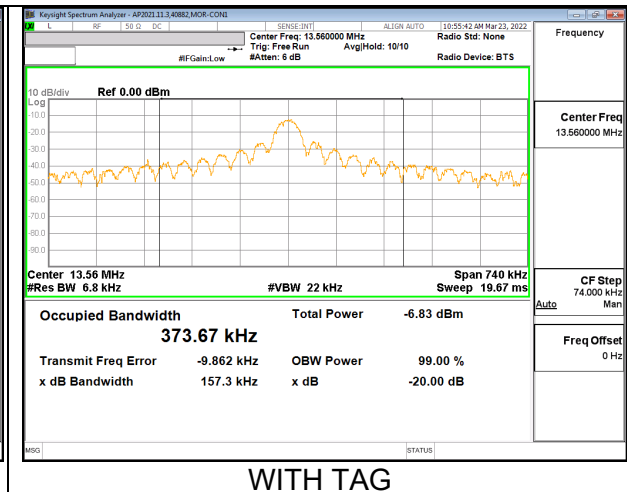
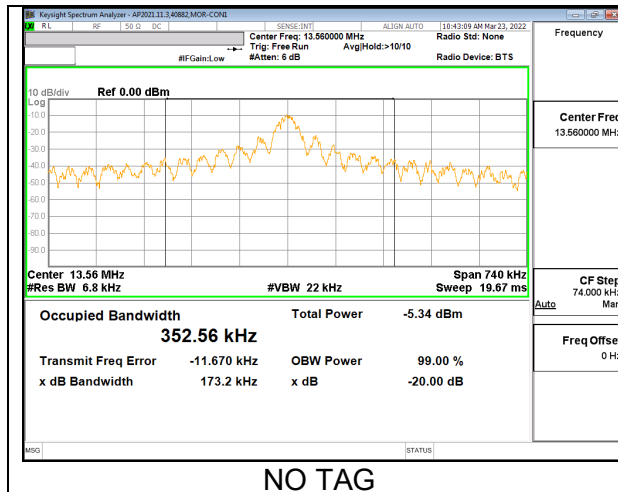
None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1-5% of the 20dB 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% BW (kHz)
13.56 (No Tag)	173.2	352.56
13.56 (With Tag)	157.3	373.67



8. RADIATED EMISSION TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

§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 field strength from uV/m to dBuV/m is:

Limit (dBuV/m) = 20 log limit (uV/m)

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.

TEST PROCEDURE

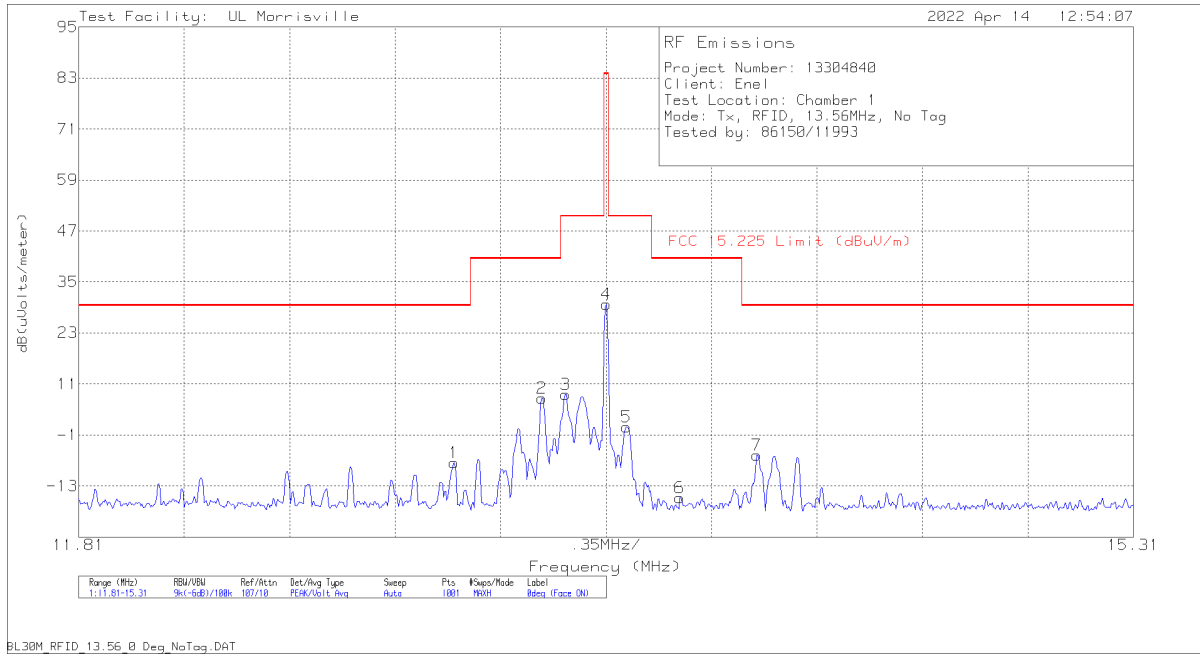
ANSI C63.10, 2013

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 0.009 MHz to the 10th harmonic of the highest fundamental frequency, or 1000 MHz, whichever is greater.

RESULTS

8.2. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.009 - 30 MHz)

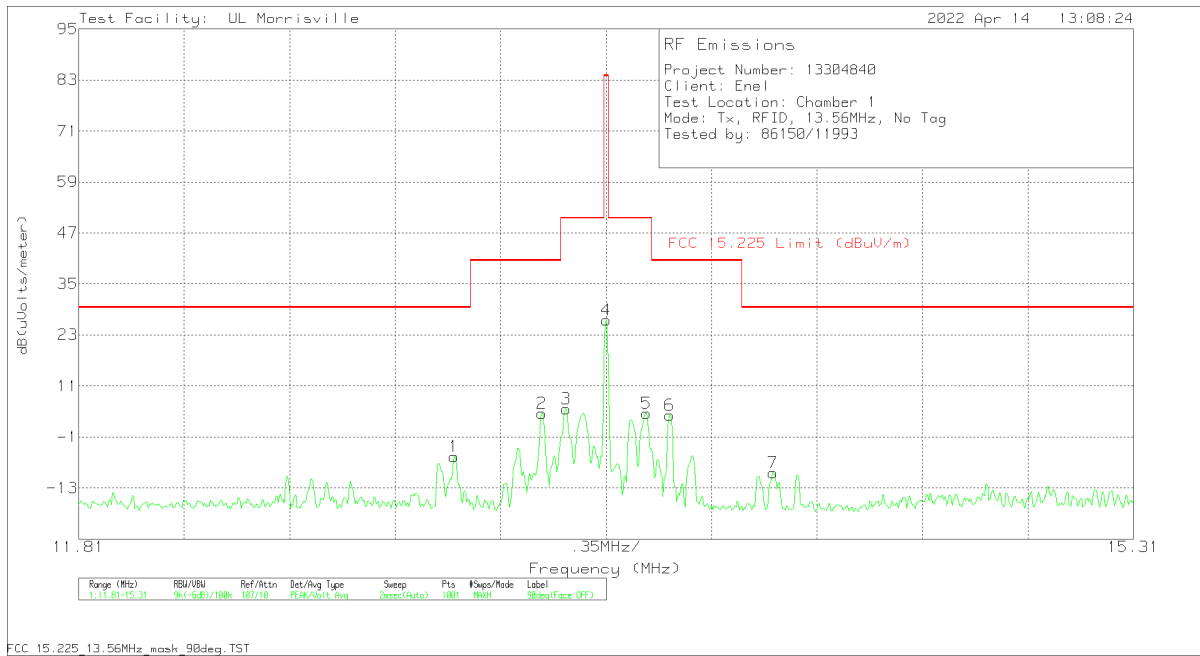
FUNDAMENTAL (NO TAG) – FACE ON, 0°



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Amp/Cbl/Pad (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	13.056	21.52	Pk	10.2	.7	-40	-7.58	29.5	-37.08	180	100	0 degs
2	13.3465	36.67	Pk	10.2	.8	-40	7.67	40.5	-32.83	180	100	0 degs
3	13.42525	37.53	Pk	10.2	.8	-40	8.53	50.5	-41.97	180	100	0 degs
4	13.56	58.74	Pk	10.2	.8	-40	29.74	84	-54.26	180	100	0 degs
5	13.62825	29.85	Pk	10.2	.8	-40	.85	50.5	-49.65	180	100	0 degs
6	13.805	13.26	Pk	10.1	.8	-40	-15.84	40.5	-56.34	180	100	0 degs
7	14.0605	23.37	Pk	10.1	.8	-40	-5.73	29.5	-35.23	180	100	0 degs

Pk - Peak detector

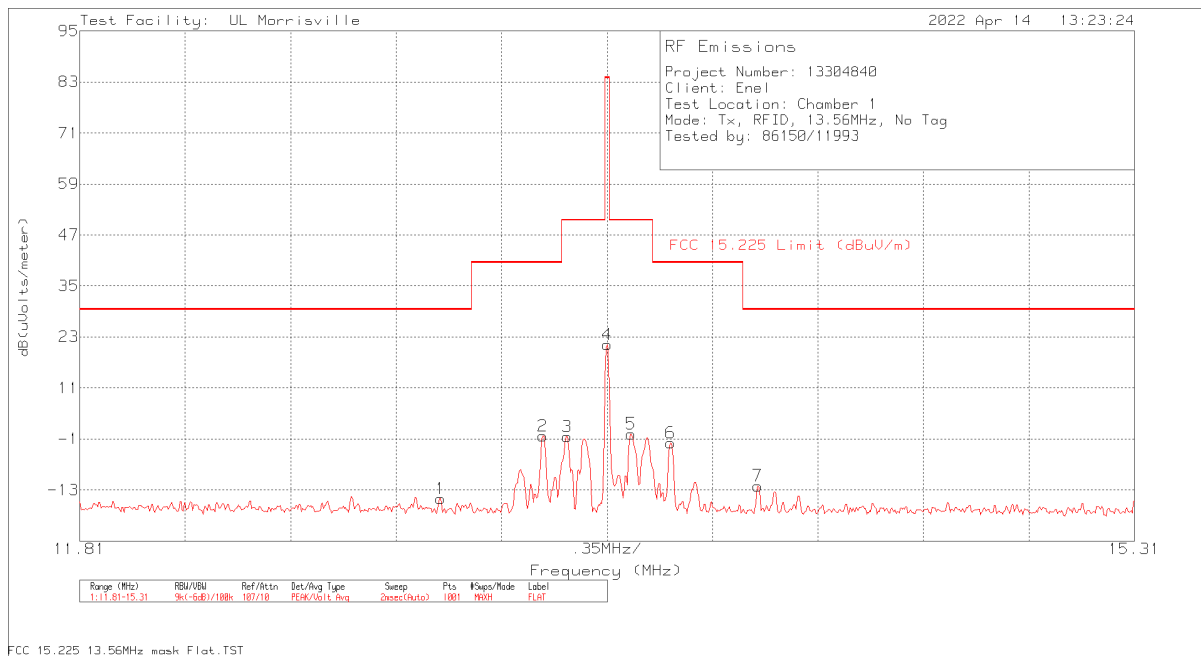
FUNDAMENTAL (NO TAG) – FACE OFF, 90°



Marker	Frequency (MHz)	MeterReading (dBuV)	Det	AT0079 (dB/m)	Amp/Cbl/Pad (dB)	Dist. Corr. Factor (dB)	CorrectedReading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	13.056	23.53	Pk	10.2	.7	-40	-5.57	29.5	-35.07	111	100	90 degs
2	13.3465	33.61	Pk	10.2	.8	-40	4.61	40.5	-35.89	111	100	90 degs
3	13.427	34.61	Pk	10.2	.8	-40	5.61	50.5	-44.89	111	100	90 degs
4	13.56	55.55	Pk	10.2	.8	-40	26.55	84	-57.45	111	100	90 degs
5	13.693	33.55	Pk	10.2	.8	-40	4.55	50.5	-45.95	111	100	90 degs
6	13.77	33.27	Pk	10.1	.8	-40	4.17	40.5	-36.33	111	100	90 degs
7	14.11475	19.61	Pk	10.1	.8	-40	-9.49	29.5	-38.99	111	100	90 degs

Pk - Peak detector

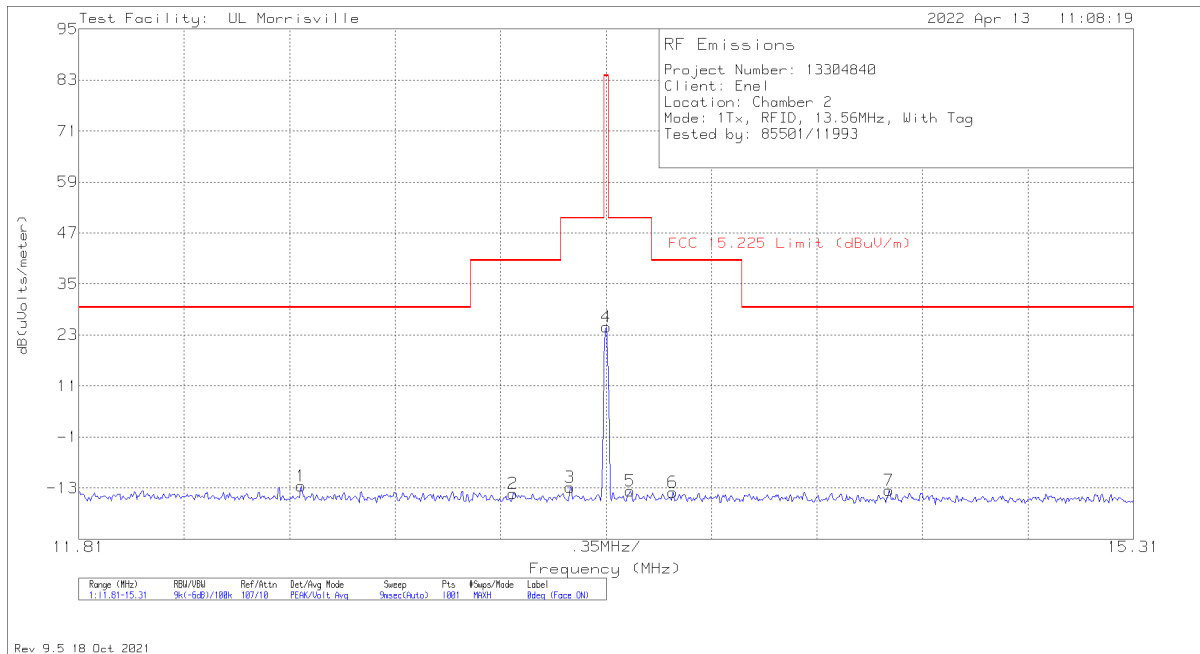
FUNDAMENTAL (NO TAG) - HORIZONTAL, FLAT



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Amp/Cbl/Pad (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	13.007	14.06	Pk	10.2	.7	-40	-15.04	29.5	-44.54	170	100	Flat
2	13.3465	28.69	Pk	10.2	.8	-40	-.31	40.5	-40.81	170	100	Flat
3	13.427	28.54	Pk	10.2	.8	-40	-.46	50.5	-50.96	170	100	Flat
4	13.56	50.2	Pk	10.2	.8	-40	21.2	84	-62.8	170	100	Flat
5	13.6405	29.2	Pk	10.2	.8	-40	.2	50.5	-50.3	170	100	Flat
6	13.77	27.15	Pk	10.1	.8	-40	-1.95	40.5	-42.45	170	100	Flat
7	14.0605	17.07	Pk	10.1	.8	-40	-12.03	29.5	-41.53	170	100	Flat

Pk - Peak detector

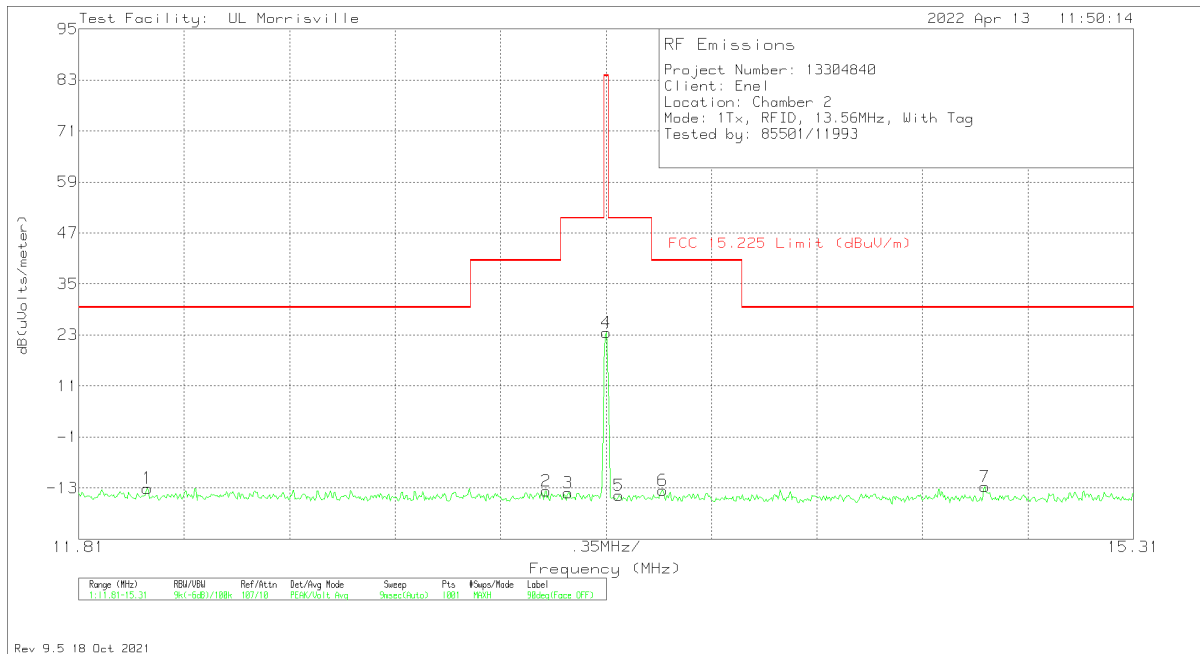
FUNDAMENTAL (WITH TAG) – FACE ON, 0°



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	12.5485	16.41	Pk	10.3	.7	-40	-12.59	29.5	-42.09	170	100	0 degs
2	13.252	14.79	Pk	10.2	.7	-40	-14.31	40.5	-54.81	170	100	0 degs
3	13.441	16.2	Pk	10.2	.7	-40	-12.9	50.5	-63.4	170	100	0 degs
4	13.56	54	Pk	10.2	.7	-40	24.9	84	-59.1	170	100	0 degs
5	13.6405	15.34	Pk	10.2	.7	-40	-13.76	50.5	-64.26	170	100	0 degs
6	13.7805	15.23	Pk	10.1	.7	-40	-13.97	40.5	-54.47	170	100	0 degs
7	14.498	15.5	Pk	10.1	.8	-40	-13.6	29.5	-43.1	170	100	0 degs

Pk - Peak detector

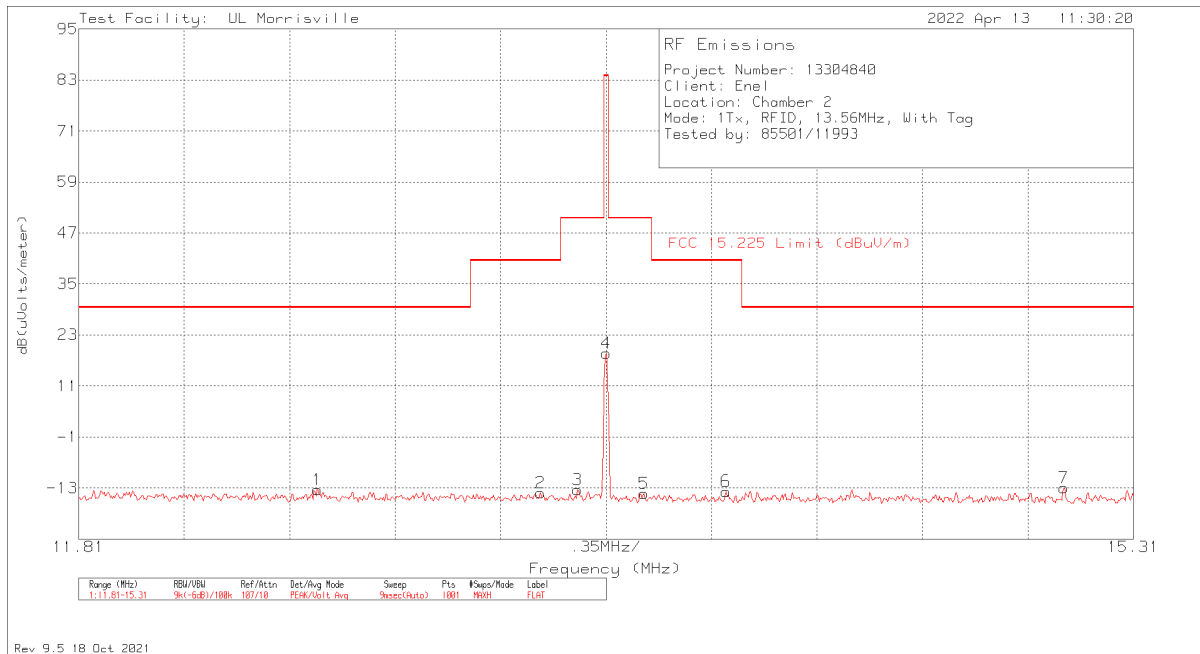
FUNDAMENTAL (WITH TAG) – FACE OFF, 90°



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	12.0375	15.84	Pk	10.4	.7	-40	-13.06	29.5	-42.56	93	100	90 degs
2	13.3605	15.4	Pk	10.2	.7	-40	-13.7	40.5	-54.2	93	100	90 degs
3	13.434	14.96	Pk	10.2	.7	-40	-14.14	50.5	-64.64	93	100	90 degs
4	13.56	52.63	Pk	10.2	.7	-40	23.53	84	-60.47	93	100	90 degs
5	13.602	14.4	Pk	10.2	.7	-40	-14.7	50.5	-65.2	93	100	90 degs
6	13.749	15.49	Pk	10.2	.7	-40	-13.61	40.5	-54.11	93	100	90 degs
7	14.8165	16.48	Pk	10	.8	-40	-12.72	29.5	-42.22	93	100	90 degs

Pk - Peak detector

FUNDAMENTAL (WITH TAG) – HORIZONTAL, FLAT

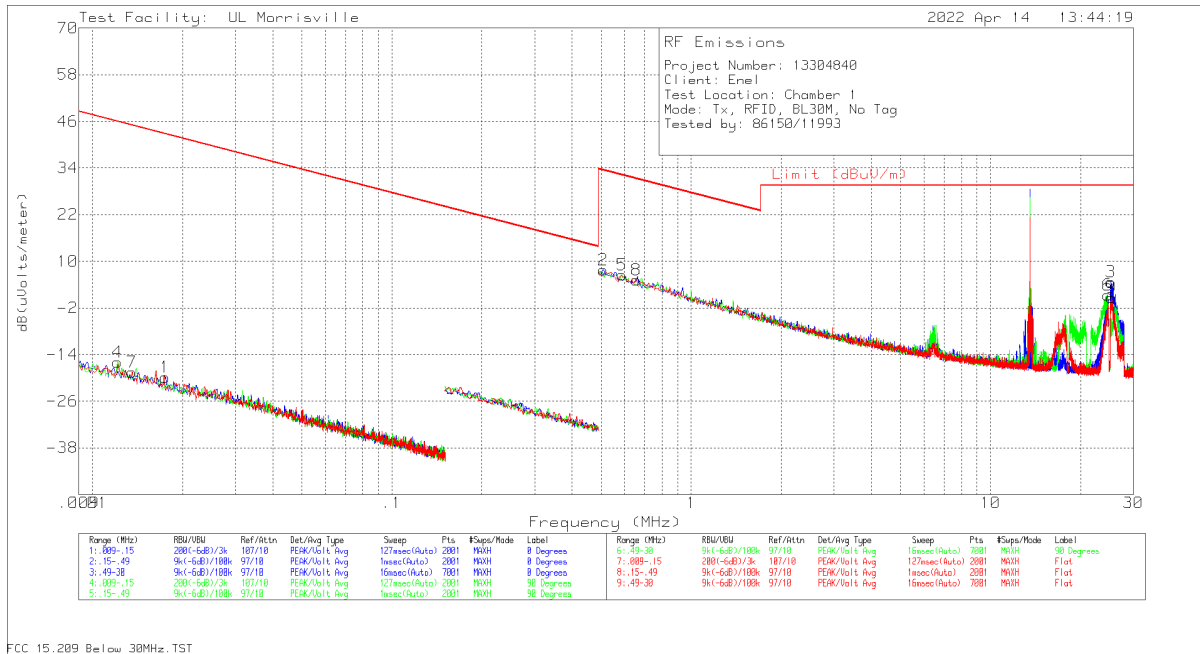


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	12.60275	15.51	Pk	10.3	.7	-40	-13.49	29.5	-42.99	163	100	Flat
2	13.343	14.99	Pk	10.2	.7	-40	-14.11	40.5	-54.61	163	100	Flat
3	13.4655	15.72	Pk	10.2	.7	-40	-13.38	50.5	-63.88	163	100	Flat
4	13.56	47.78	Pk	10.2	.7	-40	18.68	84	-65.32	163	100	Flat
5	13.686	14.79	Pk	10.2	.7	-40	-14.31	50.5	-64.81	163	100	Flat
6	13.959	15.4	Pk	10.1	.7	-40	-13.8	40.5	-54.3	163	100	Flat
7	15.079	16.24	Pk	10	.8	-40	-12.96	29.5	-42.46	163	100	Flat

Pk - Peak detector

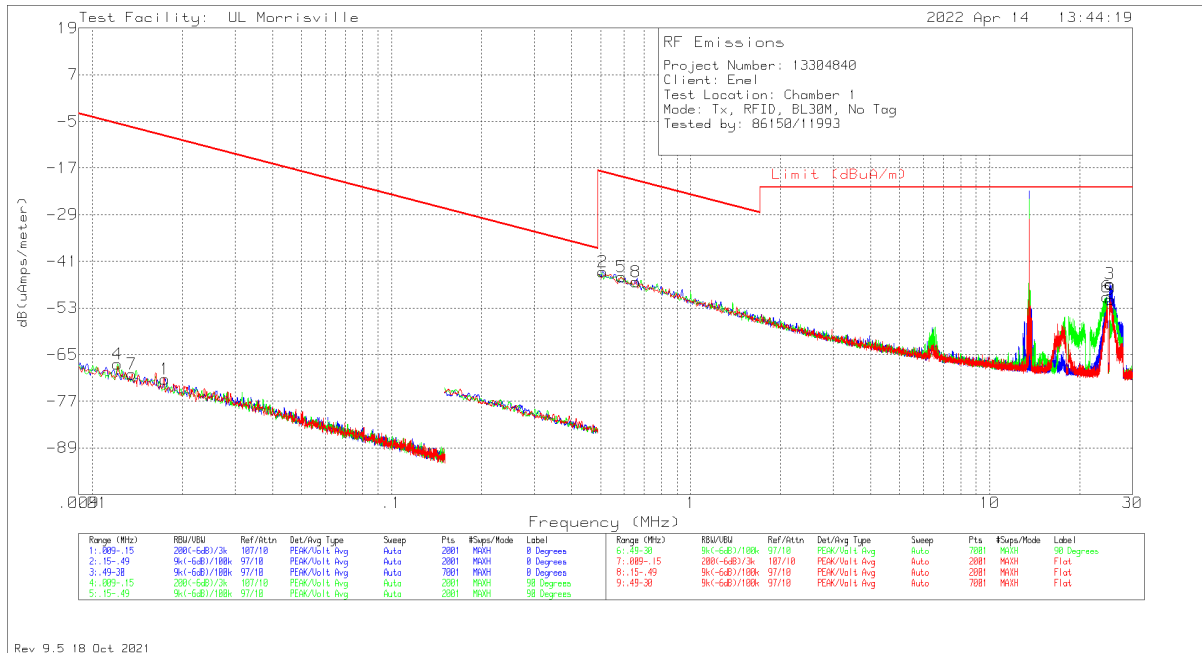
SPURIOUS EMISSIONS – NO TAG

Note: 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).



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Amp/Cbl/Pad (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	QP/AV Limit (dBuV/m)	PK Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
4	.01212	46.39	Pk	17.5	.1	-80	-16.01	45.93	65.93	-61.94	0-360	246	90 degs
7	.01354	44.52	Pk	16.9	.1	-80	-18.48	44.97	64.97	-63.45	0-360	246	Flat
1	.01752	44.93	Pk	15.2	.1	-80	-19.77	42.73	62.73	-62.5	0-360	246	0 degs
2	.50897	36.43	Pk	11.2	.2	-40	7.83	33.47	-	-25.64	0-360	246	0 degs
5	.58697	35.1	Pk	11.2	.2	-40	6.5	32.23	-	-25.73	0-360	246	90 degs
8	.65653	33.74	Pk	11.3	.2	-40	5.24	31.26	-	-26.02	0-360	246	Flat
6	24.60974	31.46	Pk	8.8	1	-40	1.26	29.54	-	-28.28	0-360	246	90 degs
3	25.26743	34.99	Pk	8.6	1.1	-40	4.69	29.54	-	-24.85	0-360	246	0 degs
9	25.36862	30.92	Pk	8.6	1.1	-40	.62	29.54	-	-28.92	0-360	246	Flat

Pk - Peak detector

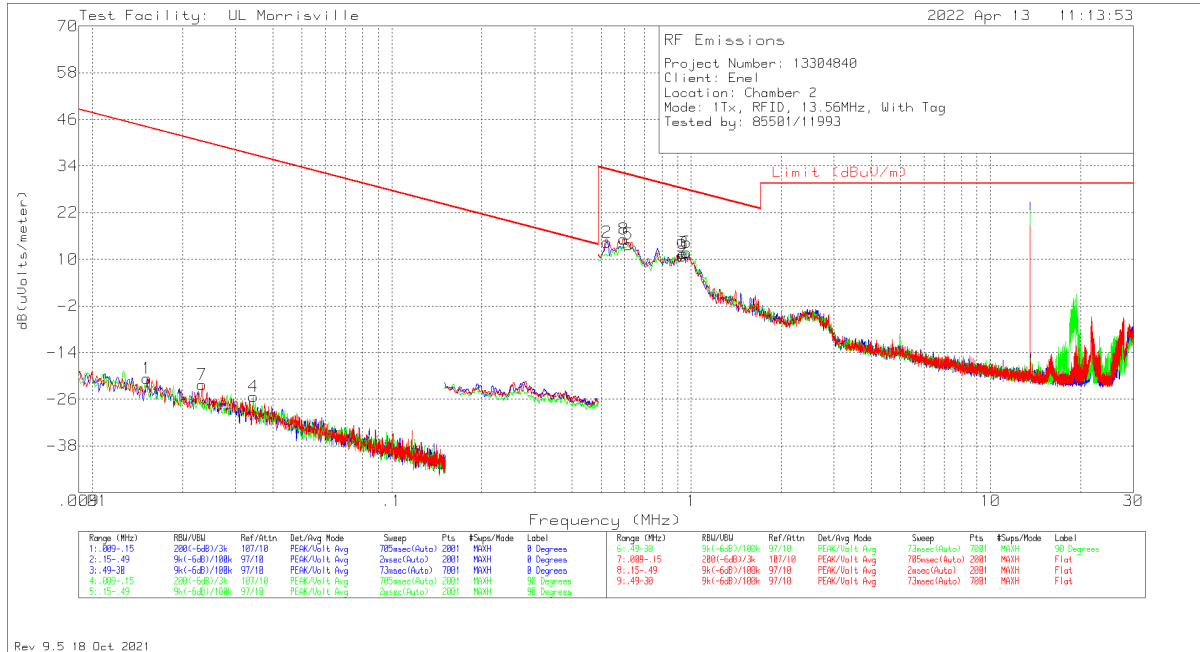


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Amp/Cbl/Pad (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uAmps/meter)	Limit (dBuA/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
4	.01212	46.39	Pk	-34	.1	-80	-67.51	-5.57	-61.94	0-360	246	90 degs
7	.01354	44.52	Pk	-34.6	.1	-80	-69.98	-6.53	-63.45	0-360	246	Flat
1	.01752	44.93	Pk	-36.3	.1	-80	-71.27	-8.77	-62.5	0-360	246	0 degs
2	.50897	36.43	PK	-40.3	.2	-40	-43.67	-18.03	-25.64	0-360	246	0 degs
5	.58697	35.1	PK	-40.3	.2	-40	-45	-19.27	-25.73	0-360	246	90 degs
8	.65653	33.74	PK	-40.2	.2	-40	-46.26	-20.24	-26.02	0-360	246	Flat
6	24.60974	31.46	PK	-42.7	1	-40	-50.24	-21.96	-28.28	0-360	246	90 degs
3	25.26743	34.99	PK	-42.9	1.1	-40	-46.81	-21.96	-24.85	0-360	246	0 degs
9	25.36862	30.92	PK	-42.9	1.1	-40	-50.88	-21.96	-28.92	0-360	246	Flat

Pk - Peak detector

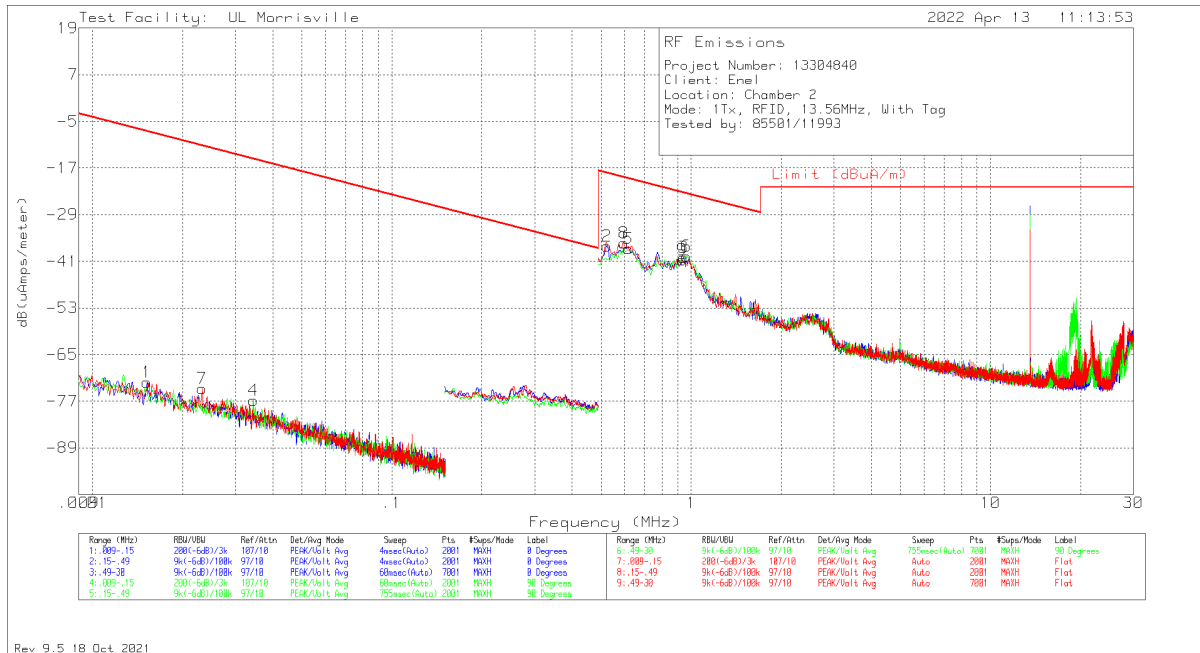
SPURIOUS EMISSIONS – WITH TAG

Note: 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).



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	QP/AV Limit (dBuV/m)	PK Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	.01518	43.12	Pk	16.2	.1	-80	-20.58	43.98	63.98	-64.56	0-360	150	0 degs
7	.02327	43.82	Pk	13.8	.1	-80	-22.28	40.27	60.27	-62.55	0-360	150	Flat
4	.03449	41.57	Pk	13	.1	-80	-25.33	36.85	56.85	-62.18	0-360	150	90 degs
2	.52373	43.14	Pk	11.2	.1	-40	14.44	33.22		-18.78	0-360	150	0 degs
8	.5954	43.8	Pk	11.2	.2	-40	15.2	32.11		-16.91	0-360	150	Flat
5	.61648	42.42	Pk	11.2	.2	-40	13.82	31.81		-17.99	0-360	150	90 degs
9	.93268	39.39	Pk	11.3	.2	-40	10.89	28.21		-17.32	0-360	150	Flat
3	.94111	40.05	Pk	11.3	.2	-40	11.55	28.13		-16.58	0-360	150	0 degs
6	.96641	40.36	Pk	11.3	.2	-40	11.86	27.9		-16.04	0-360	150	90 degs

Pk - Peak detector

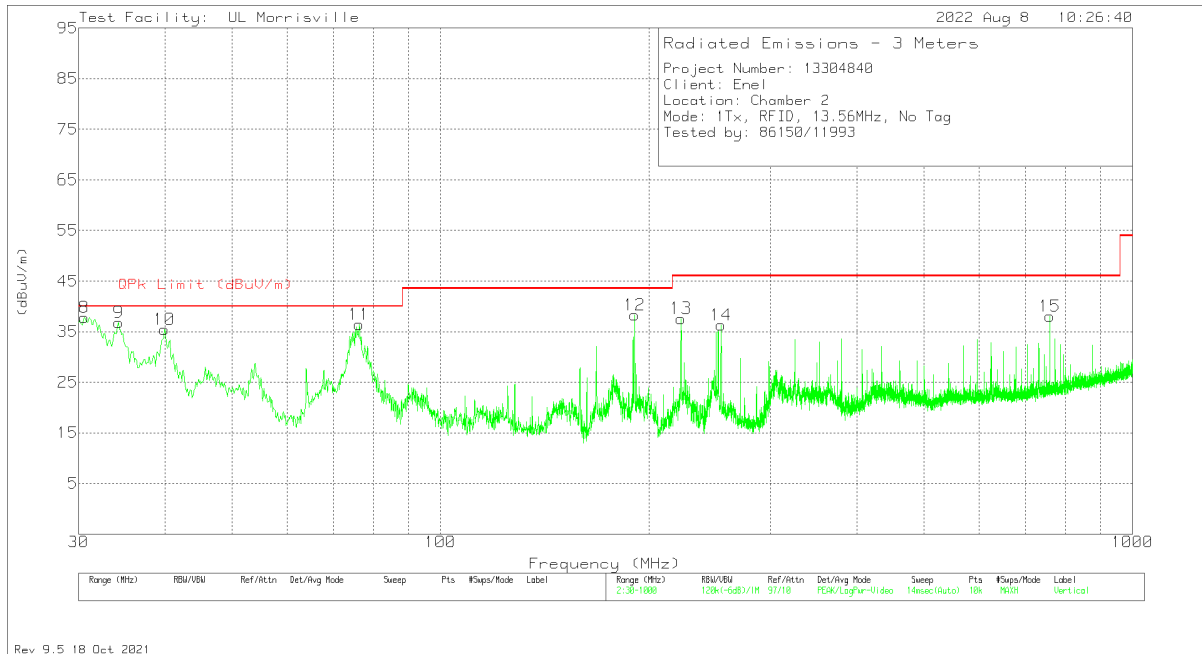
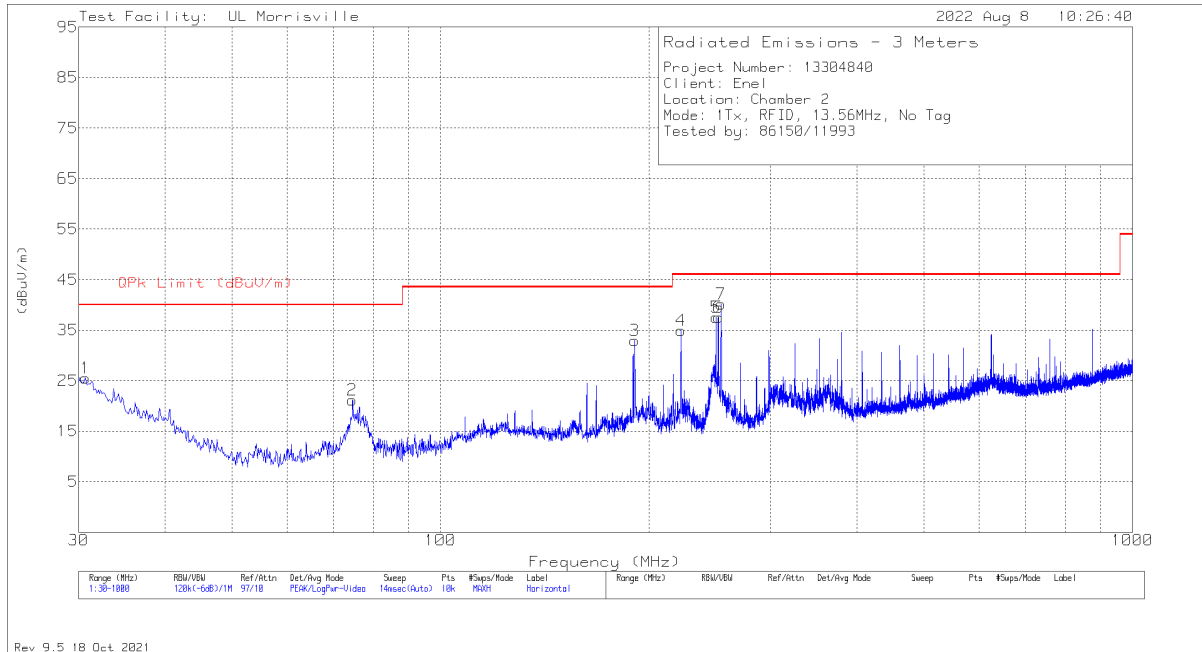


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uAmps/meter)	Limit (dBuA/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	.01518	43.12	Pk	-35.3	.1	-80	-72.08	-7.52	-64.56	0-360	150	0 degs
7	.02327	43.82	Pk	-37.7	.1	-80	-73.78	-11.23	-62.55	0-360	150	Flat
4	.03449	41.57	PK	-38.5	.1	-80	-76.83	-14.65	-62.18	0-360	150	90 degs
2	.52373	43.14	Pk	-40.3	.1	-40	-37.06	-18.28	-18.78	0-360	150	0 degs
8	.5954	43.8	Pk	-40.3	.2	-40	-36.3	-19.39	-16.91	0-360	150	Flat
5	.61648	42.42	Pk	-40.3	.2	-40	-37.68	-19.69	-17.99	0-360	150	90 degs
9	.93268	39.39	Pk	-40.2	.2	-40	-40.61	-23.29	-17.32	0-360	150	Flat
3	.94111	40.05	Pk	-40.2	.2	-40	-39.95	-23.37	-16.58	0-360	150	0 degs
6	.96641	40.36	Pk	-40.2	.2	-40	-39.64	-23.6	-16.04	0-360	150	90 degs

Pk - Peak detector

8.3. TX SPURIOUS EMISSION 30 TO 1000 MHz

NO TAG

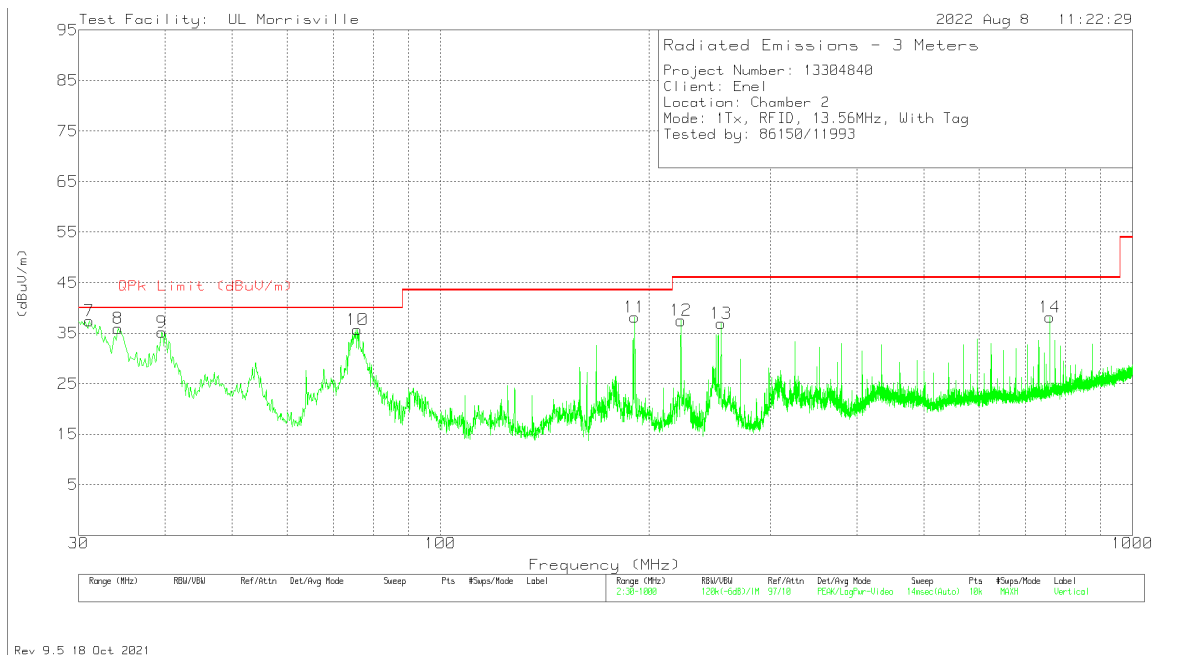
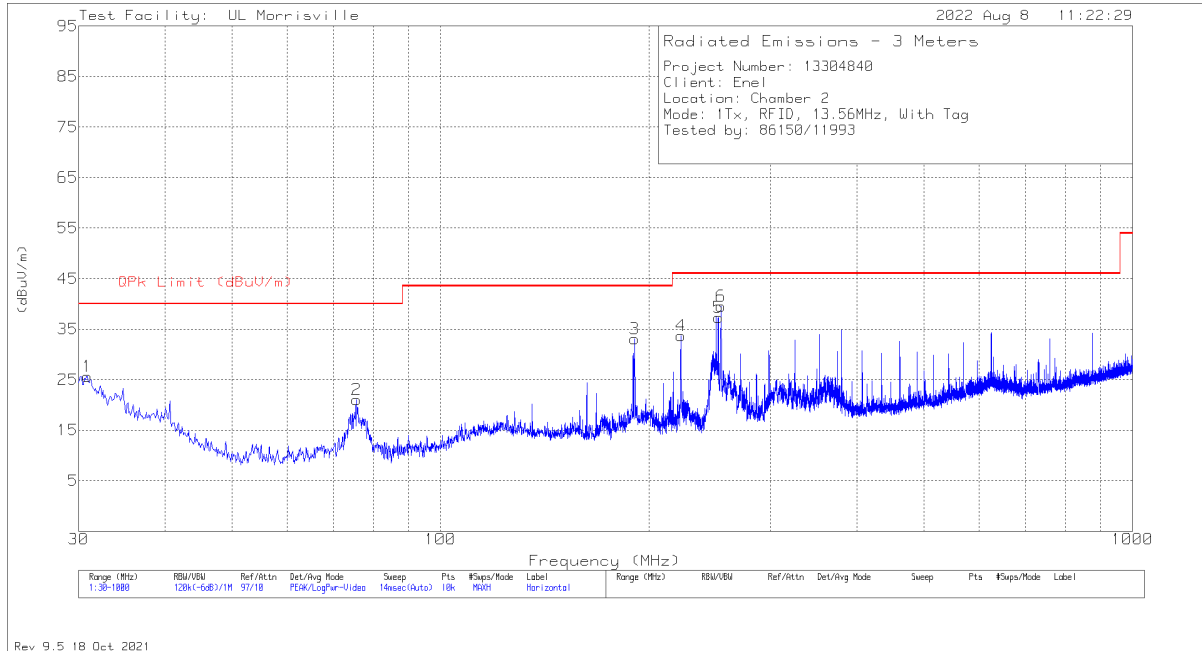


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0073 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
8	30.7009	40.6	Qp	26.4	-31.5	35.5	40	-4.5	188	106	V
1	30.679	30.62	Pk	26.4	-31.5	25.52	40	-14.48	0-360	99	H
9	34.2939	41.72	Qp	24	-31.5	34.22	40	-5.78	141	104	V
10	40.0829	44.59	Qp	19.7	-31.4	32.89	40	-7.11	184	104	V
2	74.62	38.1	Pk	14	-30.9	21.2	40	-18.8	0-360	399	H
11	76.2177	48.36	Qp	13.9	-30.9	31.36	40	-8.64	219	104	V
3	190.826	44.81	Pk	17.6	-29.4	33.01	43.52	-10.51	0-360	99	H
12	190.7526	45.23	Qp	17.6	-29.4	33.43	43.52	-10.09	138	106	V
13	222.545	50.21	Pk	16.8	-29.4	37.61	46.02	-8.41	0-360	101	V
4	222.739	47.57	Pk	16.8	-29.4	34.97	46.02	-11.05	0-360	99	H
5	249.996	49.1	Pk	17.6	-29.2	37.5	46.02	-8.52	0-360	99	H
6	252.033	49.2	Pk	17.6	-29.2	37.6	46.02	-8.42	0-360	99	H
7	254.3992	47.23	Qp	17.6	-29.1	35.73	46.02	-10.29	113	108	H
14	254.361	47.84	Pk	17.6	-29.1	36.34	46.02	-9.68	0-360	199	V
15	759.44	37.77	Pk	27	-26.7	38.07	46.02	-7.95	0-360	101	V

Pk - Peak detector

Qp - Quasi-Peak detector

WITH TAG



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0073 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	30.873	30.74	Pk	26.3	-31.4	25.64	40	-14.36	0-360	299	H
7	31.1706	40.91	Qp	26.1	-31.3	35.71	40	-4.29	226	104	V
8	34.3355	41.58	Qp	24	-31.5	34.08	40	-5.92	178	110	V
9	39.6361	43.2	Qp	20.1	-31.3	32	40	-8	193	139	V
2	75.687	38.08	Pk	13.9	-30.9	21.08	40	-18.92	0-360	399	H
10	75.7223	46.66	Qp	13.9	-30.9	29.66	40	-10.34	194	111	V
3	190.729	44.86	Pk	17.6	-29.4	33.06	43.52	-10.46	0-360	100	H
11	190.7755	45.24	Qp	17.6	-29.4	33.44	43.52	-10.08	146	107	V
4	222.545	46.28	Pk	16.8	-29.4	33.68	46.02	-12.34	0-360	100	H
12	222.545	50.09	Pk	16.8	-29.4	37.49	46.02	-8.53	0-360	101	V
5	252.033	48.91	Pk	17.6	-29.2	37.31	46.02	-8.71	0-360	100	H
6	254.264	51.04	Pk	17.6	-29.1	39.54	46.02	-6.48	0-360	100	H
13	254.361	48.4	Pk	17.6	-29.1	36.9	46.02	-9.12	0-360	199	V
14	759.44	37.92	Pk	27	-26.7	38.22	46.02	-7.8	0-360	101	V

Pk - Peak detector

Qp - Quasi-Peak detector

9. FREQUENCY STABILITY

LIMIT

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ 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 $\pm 0.01\%$ (± 100 ppm).

TEST PROCEDURE

ANSI C63.10-2013 Clause 6.8

RESULTS

No non-compliance noted.

Reference Frequency: EUT Channel 13.56 MHz @ 20°C										
Limit: ± 100 ppm = 1.356 kHz										
Power Supply	Envir. Temp	Frequency Deviation Measured with Time Elapse								
(Vdc)	(°C)	Startup (MHz)	Delta (ppm)	@ 2 mins (MHz)	Delta (ppm)	@ 5 mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
240.00	50	13.5601845	3.203	13.5601845	3.206	13.5601845	3.201	13.5601846	3.197	± 100
240.00	40	13.5601930	2.574	13.5601926	2.607	13.5601982	2.196	13.5601916	2.678	± 100
240.00	30	13.5602428	-1.098	13.5602278	0.010	13.5602211	0.507	13.5602126	1.134	± 100
240.00	20	13.5602279	0.000	13.5602265	0.106	13.5602256	0.172	13.5602245	0.252	± 100
240.00	10	13.5602958	-5.003	13.5602958	-5.005	13.5602953	-4.967	13.5602913	-4.672	± 100
240.00	0	13.5603340	-7.819	13.5603332	-7.760	13.5603314	-7.631	13.5603290	-7.450	± 100
240.00	-10	13.5603613	-9.836	13.5603610	-9.812	13.5603612	-9.828	13.5603608	-9.800	± 100
240.00	-20	13.5603737	-10.747	13.5603741	-10.782	13.5603742	-10.786	13.5603744	-10.805	± 100
204.00	20	13.5602014	1.956	13.5602031	1.828	13.5602029	1.845	13.5602030	1.838	± 100
276	20	13.5601980	2.210	13.5601983	2.189	13.5601983	2.186	13.5601996	2.092	± 100

Test Information

Test Date: 2022-04-12

Tested By: 27465/40882

10. 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 50 μ H/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 (dB μ V)	
	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:

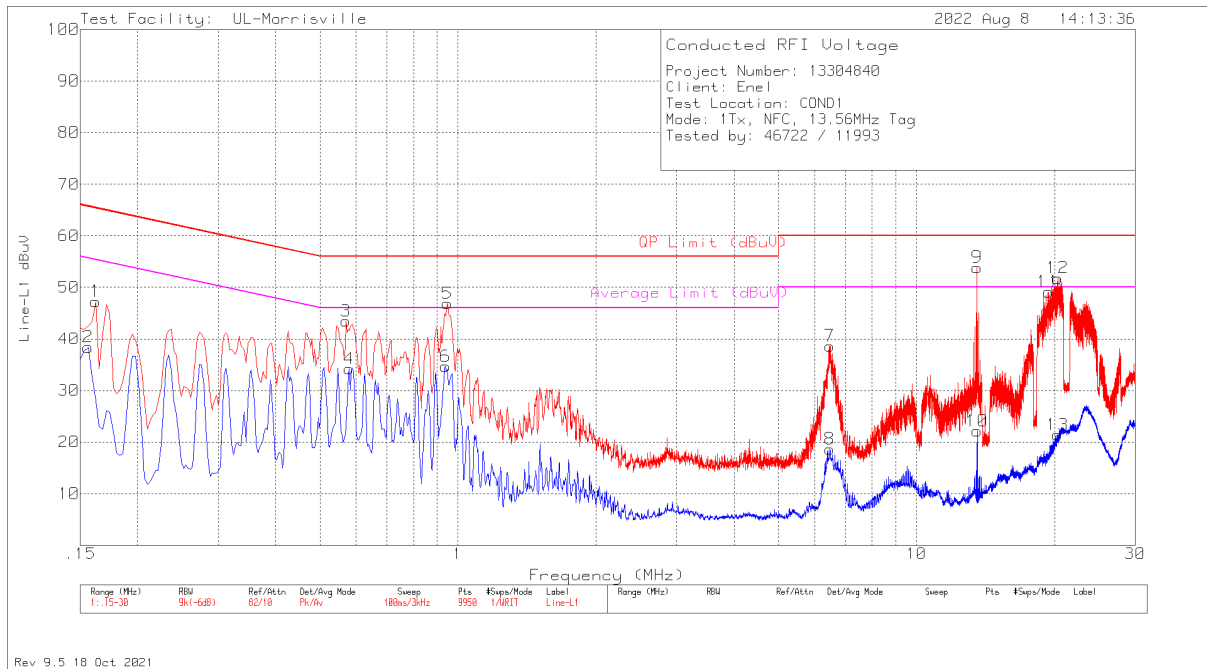
1. The lower limit shall apply at the transition frequencies
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

TEST PROCEDURE

ANSI C63.10:2013

RESULTS

LINE 1 RESULTS – WITH TAG

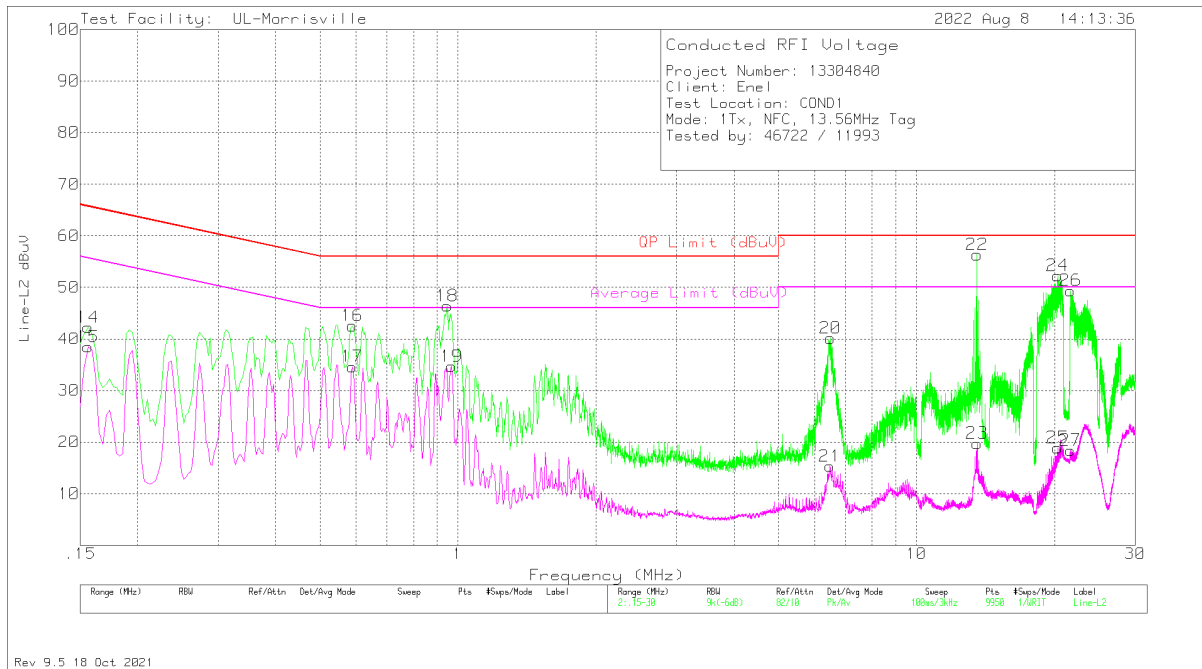


Range 1: Line-L1 .15 - 30MHz

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)
2	.156	28.42	Av	.2	9.8	38.42	-	-	55.67	-17.25
1	.162	37.26	Pk	.2	9.8	47.26	65.36	-18.1	-	-
3	.57	33.67	Pk	0	9.8	43.47	56	-12.53	-	-
4	.579	24.39	Av	0	9.8	34.19	-	-	46	-11.81
6	.939	24.88	Av	0	9.8	34.68	-	-	46	-11.32
5	.948	37.08	Pk	0	9.8	46.88	56	-9.12	-	-
7	6.468	28.62	Pk	.1	9.9	38.62	60	-21.38	-	-
8	6.477	8.64	Av	.1	9.9	18.64	-	-	50	-31.36
9	13.557	43.77	Pk	.1	10	53.87	60	-6.13	-	-
10	13.56	12.04	Av	.1	10	22.14	-	-	50	-27.86
11	19.383	38.84	Pk	.2	10.1	49.14	60	-10.86	-	-
12	20.31	41.51	Pk	.2	10.1	51.81	60	-8.19	-	-
13	20.313	11.12	Av	.2	10.1	21.42	-	-	50	-28.58

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

LINE 2 RESULTS – WITH TAG

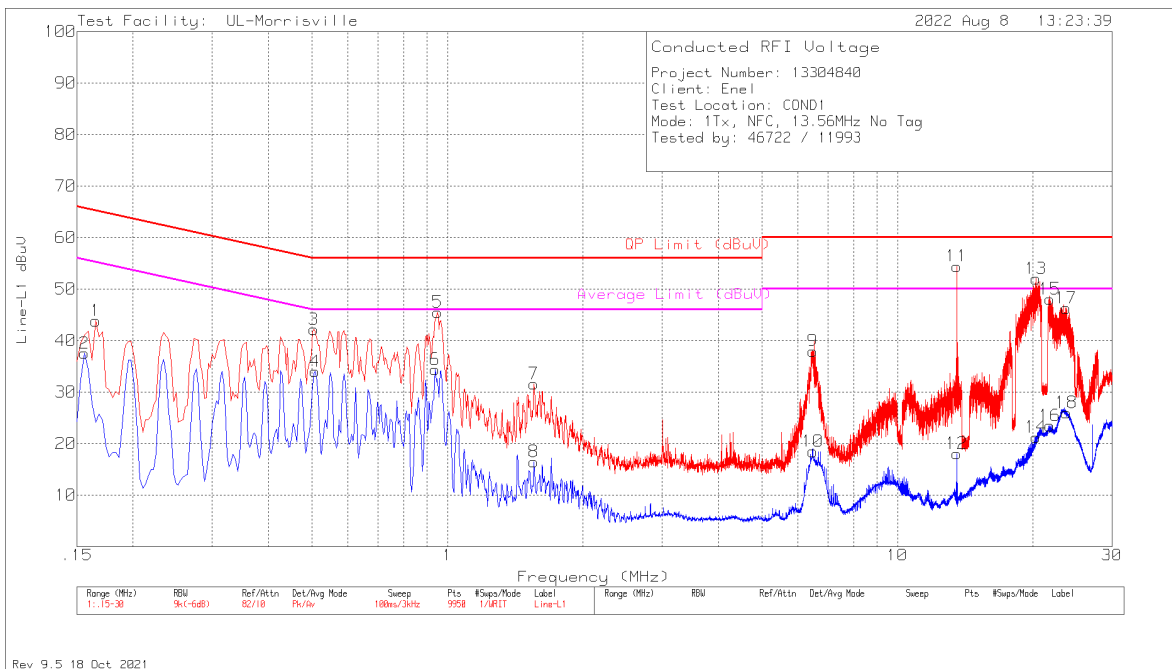


Range 2: Line-L2 .15 - 30MHz

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)
14	.156	32.25	Pk	.2	9.8	42.25	65.67	-23.42	-	-
15	.156	28.46	Av	.2	9.8	38.46	-	-	55.67	-17.21
16	.588	32.76	Pk	0	9.8	42.56	56	-13.44	-	-
17	.588	24.84	Av	0	9.8	34.64	-	-	46	-11.36
18	.948	36.6	Pk	0	9.8	46.4	56	-9.6	-	-
19	.969	24.88	Av	0	9.8	34.68	-	-	46	-11.32
21	6.477	5.31	Av	.1	9.9	15.31	-	-	50	-34.69
20	6.492	30.13	Pk	.1	9.9	40.13	60	-19.87	-	-
22	13.5598	34.9	Qp	.1	10	45	60	-15	-	-
23	13.56	9.65	Av	.1	10	19.75	-	-	50	-30.25
24	20.31	41.98	Pk	.2	10.1	52.28	60	-7.72	-	-
25	20.31	8.59	Av	.2	10.1	18.89	-	-	50	-31.11
27	21.678	8.02	Av	.2	10.2	18.42	-	-	50	-31.58
26	21.681	38.97	Pk	.2	10.2	49.37	60	-10.63	-	-

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

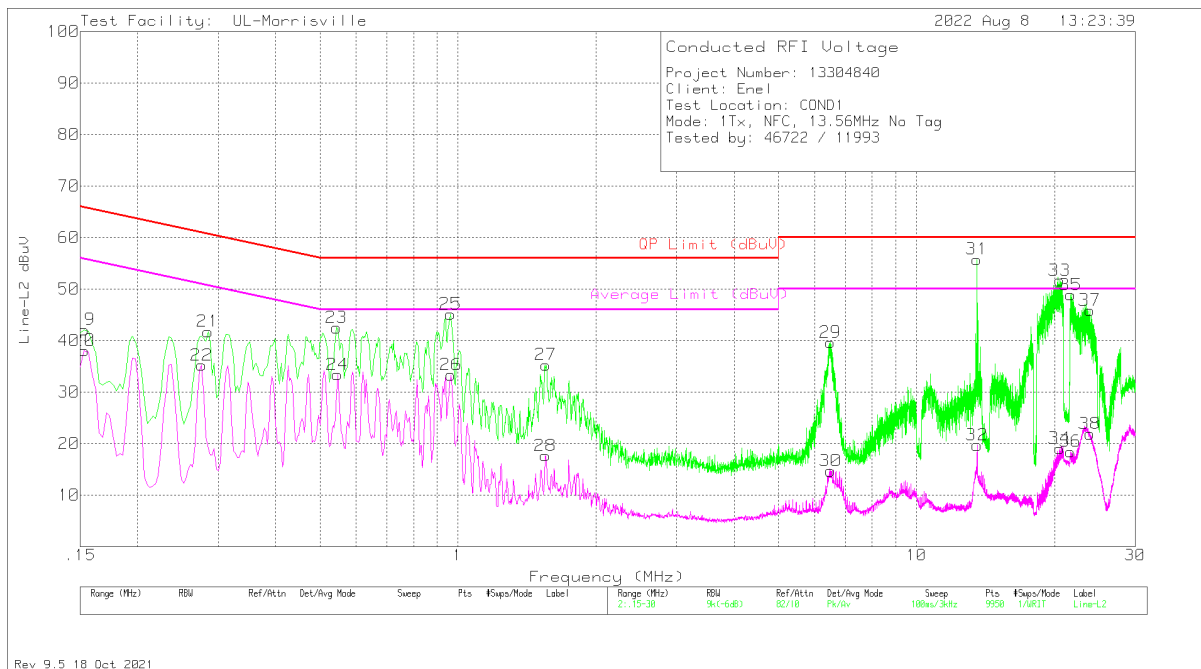
LINE 1 RESULTS – NO TAG



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)
2	.156	27.53	Av	.2	9.8	37.53	-	-	55.67	-18.14
1	.165	33.85	Pk	.2	9.8	43.85	65.21	-21.36	-	-
3	.504	32.39	Pk	0	9.8	42.19	56	-13.81	-	-
4	.507	24.22	Av	0	9.8	34.02	-	-	46	-11.98
6	.939	24.61	Av	0	9.8	34.41	-	-	46	-11.59
5	.951	35.72	Pk	0	9.8	45.52	56	-10.48	-	-
7	1.557	21.83	Pk	0	9.8	31.63	56	-24.37	-	-
8	1.557	6.68	Av	0	9.8	16.48	-	-	46	-29.52
10	6.48	8.49	Av	.1	9.9	18.49	-	-	50	-31.51
9	6.495	27.98	Pk	.1	9.9	37.98	60	-22.02	-	-
11	13.5602	36.77	Qp	.1	10	46.87	60	-13.13	-	-
12	13.56	7.97	Av	.1	10	18.07	-	-	50	-31.93
13	20.31	41.72	Pk	.2	10.1	52.02	60	-7.98	-	-
14	20.31	10.97	Av	.2	10.1	21.27	-	-	50	-28.73
15	21.828	37.66	Pk	.2	10.2	48.06	60	-11.94	-	-
16	21.831	13.09	Av	.2	10.2	23.49	-	-	50	-26.51
17	23.745	35.89	Pk	.2	10.2	46.29	60	-13.71	-	-
18	23.757	15.62	Av	.2	10.2	26.02	-	-	50	-23.98

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

LINE 2 RESULTS – NO TAG



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)
19	.153	32.13	Pk	.2	9.8	42.13	65.84	-23.71	-	-
20	.153	28.09	Av	.2	9.8	38.09	-	-	55.84	-17.75
22	.276	25.34	Av	.1	9.8	35.24	-	-	50.94	-15.7
21	.285	31.87	Pk	.1	9.8	41.77	60.67	-18.9	-	-
23	.543	32.71	Pk	0	9.8	42.51	56	-13.49	-	-
24	.546	23.6	Av	0	9.8	33.4	-	-	46	-12.6
25	.963	35.34	Pk	0	9.8	45.14	56	-10.86	-	-
26	.966	23.56	Av	0	9.8	33.36	-	-	46	-12.64
28	1.551	7.89	Av	0	9.8	17.69	-	-	46	-28.31
27	1.554	25.5	Pk	0	9.8	35.3	56	-20.7	-	-
29	6.492	29.64	Pk	.1	9.9	39.64	60	-20.36	-	-
30	6.495	4.73	Av	.1	9.9	14.73	-	-	50	-35.27
31	13.5601	42.44	Qp	.1	10	52.54	60	-7.46	-	-
32	13.56	9.61	Av	.1	10	19.71	-	-	50	-30.29
33	20.514	41.37	Pk	.2	10.1	51.67	60	-8.33	-	-
34	20.517	8.76	Av	.2	10.1	19.06	-	-	50	-30.94
36	21.678	8.08	Av	.2	10.2	18.48	-	-	50	-31.52
35	21.696	38.48	Pk	.2	10.2	48.88	60	-11.12	-	-
37	23.874	35.47	Pk	.2	10.2	45.87	60	-14.13	-	-
38	23.88	11.52	Av	.2	10.2	21.92	-	-	50	-28.08

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

11. SETUP PHOTOS

Please refer to R13304840-EP1 for setup photos

END OF TEST REPORT