TEST REPORT

Report Number: 14938215-E8V4

Applicant: SAMSUNG ELECTRONICS CO., LTD.
129, SAMSUNG-RO, YEONGTONG-GU,
SUWON-SI, GYEONGGI-DO, 16677, KOREA

Model: SM-A256E/DSN and SM-A256E/N

FCC ID: A3LSMA256E

EUT Description: GSM/WCDMA/LTE/5G Phone with BT/BLE, DTS/UNII a/b/g/n/ac, NFC

Test Standard(s): FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
2023-11-03

Prepared by:
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ACCREDITED
CERT #0751.05

REPORT REVISION HISTORY

Rev.		Issue Date		Revisions			Revised By
V1		2023-10-18		Initial Issue			
V2		2023-10-24		Updated Sections 5.6, 11			Benjamin D.
V3		2023-10-31		Updated Sections 5.3, 7, 8.3			Chris Xiong
V4		2023-11-03		Updated Section 8.3 and 8.4			Steven Tran

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD. 129, SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
EUT DESCRIPTION:	GSM/WCDMA/LTE/5G Phone with BT/BLE, DTS/UNII a/b/g/n/ac, NFC
MODEL:	SM-A256E/DSN and SM-A256E/N
SERIAL NUMBER:	Conducted: R3CW50B1BPM Radiated: R3CW50B1C2V, R3CW50B1C0J
DATE TESTED:	2023-09-27 –2023-10-10

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For
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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with:

- FCC CFR 47 Part 2
- FCC CFR 47 Part 15
- ANSI C63.10-2013
- KDB 414788 D01 Radiated Test Site v01r01

3. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by A2LA, certification #0751.05, 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
☐	Building 1: 47173 Benicia Street, Fremont, CA 94538, USA	US0104	2324A	550739
☒	Building 2: 47266 Benicia Street, Fremont, CA 94538, USA			
☐	Building 3: 843 Auburn Court, Fremont, CA 94538 USA			
☒	Building 4: 47658 Kato Rd, Fremont, CA 94538 USA			
☐	Building 5: 47670 Kato Rd, Fremont, CA 94538 USA			

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)	141.16 Hz
Occupied Bandwidth	1.2%
Temperature	±0.57 %
Relative Humidity	3.39 %
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.78 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.87 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB

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

4.4. 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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE/5G Phone with BT/BLE, DTS/UNII a/b/g/n/ac and NFC.

The model SM-A256E/DSN was used for final testing and is representative of the test results in this report.

5.2. MAXIMUM E-FIELD STRENGTH

The testing was performed at 3 meters. The transmitter maximum E-field at 30 meter distance was 18.98 dBuV/m, which was converted from the 3 meter data.

NFC with Tag Mode [dBuV/m]	NFC without Tag Mode [dBuV/m]
18.98	13.94

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a FPCB antenna.

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was A256E.001.

5.5. WORST-CASE CONFIGURATION AND MODE

The NFC function was tested at its' fundamental and only operational frequency of 13.56 MHz.

The fundamental of the EUT was investigated under three orthogonal orientations X (Flatbed), Y (Landscape), and Z (Portrait). The Y (Landscape) orientation was determined to be the worst-case orientation.

The fundamental level of the EUT was investigated with each Type (A,B,F) and bitrate (106/212/424 Kbps).
All tests were performed with the worst case condition (Type A and bitrate 106 Kbps).

Radiated (fundamental level and spurious emissions) tests were performed without reading a passive tag condition [test mode] and with reading a passive tag condition.

5.6. DESCRIPTION OF TEST SETUP

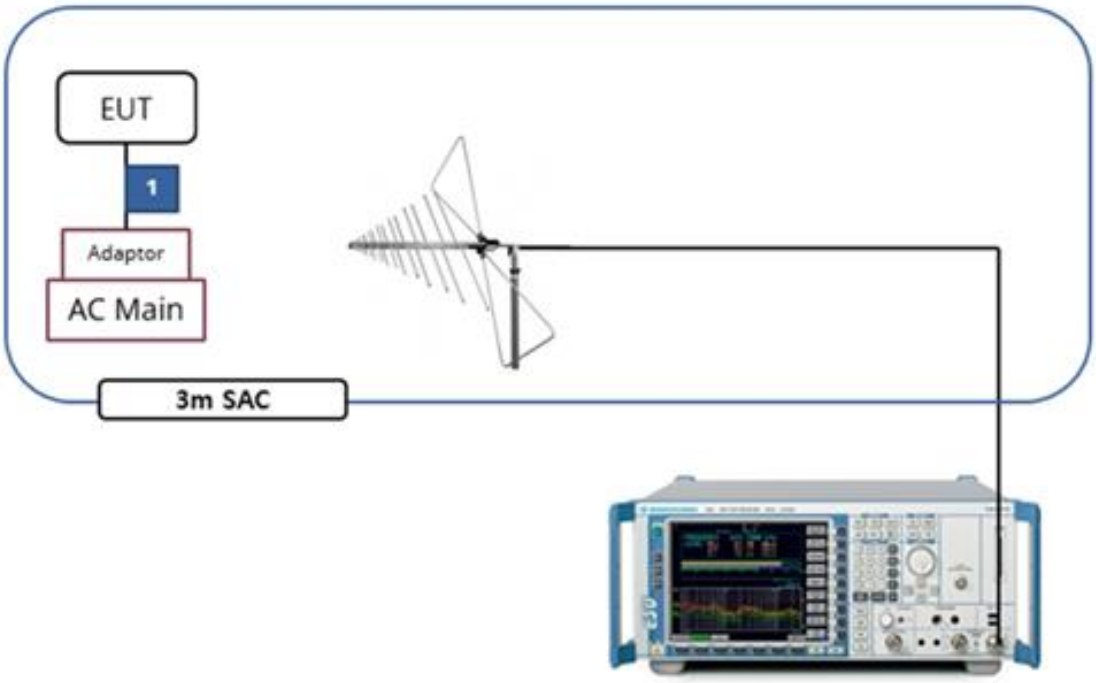
SUPPORT TEST EQUIPMENT				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID/ DoC**
AC Adapter	Samsung	EP-TA800	R37TC7A00EBDKA	N/A
Data Cable	Samsung	WBR0062M		

I/O CABLES (RF RADIATED and AC LINE CONDUCTED TEST)						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	USB-C	Shielded	1.0	N/A

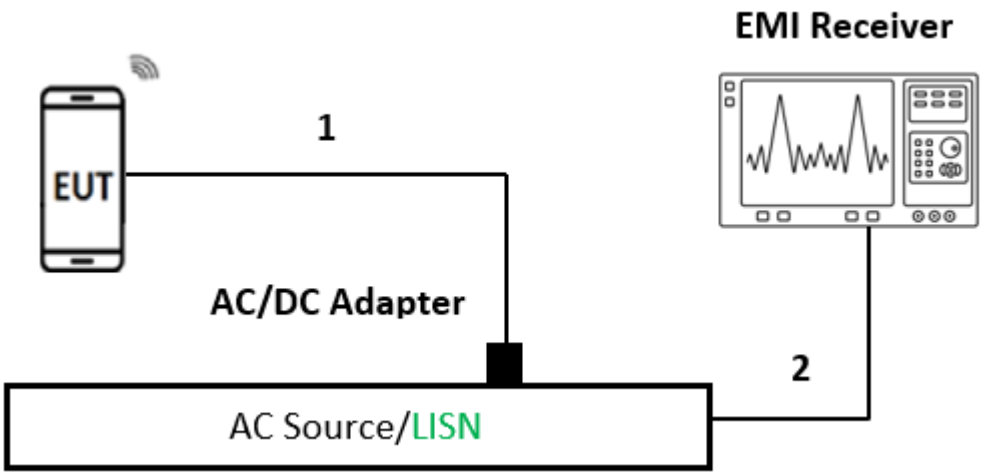
The EUT is a stand-alone device configured and tested in a worst-case setup.
Note: Worst case is using worst case orientation with AC charger attached to the EUT with NFC signal continuously transmitting.

SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)

Radiated Configuration



AC Line Conducted Configuration



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST					
Description	**Manufacturer**	**Model**	**ID Num**	**Cal Due**	**Last Cal**
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	85214	02/29/2024	02/06/2023
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	235266	03/31/2024	03/30/2023
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	235670	04/30/2024	04/06/2023
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO-METRICS	EM-6871	170013	07/31/2024	07/28/2022
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO-METRICS	EM-6872	170015	07/31/2024	07/28/2022
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	191428	02/29/2024	02/15/2023
Antenna, BroadBand Hybrid 30 MHz - 3 GHz	SUNOL SCIENCES CORP.	JB3	230635	01/31/2024	01/23/2023
Amplifier 9 KHz - 1 GHz	SONOMA INSTRUMENT	310N	230310	02/02/2024	02/02/2023
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	85212	02/29/2024	02/01/2023
Environmental Chamber	Cincinnati Sub Zero - division of Weiss Tecknik	ZPHS-8-3.5-SCT/WC	89097	12/31/2023	06/08/2023

AC Line Conducted					
Description	**Manufacturer**	**Model**	**ID Num**	**Cal Due**	**Last Cal**
EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESR	93091	02/29/2024	02/29/2023
LISN for Conducted Emissions CISPR-16	FISCHER CUSTOM COMMUNICATIONS	FCC-LISN-50/250-25-2-01-480V	175764	01/31/2024	01/31/2023
Transient Limiter	TE	TBFL1	207996	08/31/2024	08/10/2023

UL AUTOMATION SOFTWARE			
Radiated Software	UL	UL EMC	Ver 9.5, May 1, 2023
Conducted Software	UL	UL EMC	2020.8.16
AC Line Conducted Software	UL	UL EMC	Ver 9.5, Mar 3, 2023

7. 20dB BANDWIDTH

LIMITS

§15.215

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated

§15.225

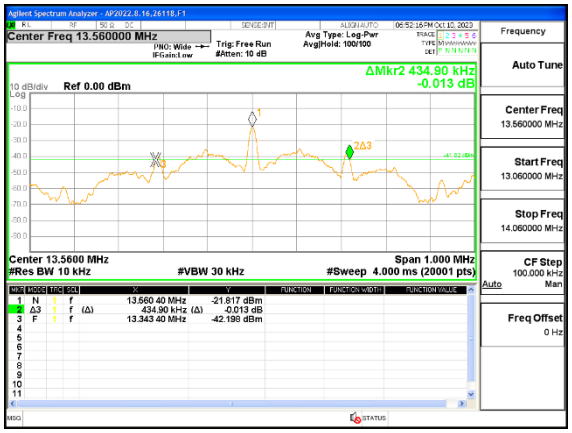
Operation within the band 13.110 – 14.010MHz

TEST PROCEDURE

The spectrum analyzer connected receive antenna and the EUT placed on near the receive antenna. The RBW is set to 1-5% of bandwidth per C63.10. The VBW is set to 3 times the RBW. The sweep time is coupled.

RESULTS

Frequency [MHz]	20 dB Bandwidth [kHz]
13.56	434.90



20dB Bandwidth Plot

8. RADIATED EMISSION TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMIT

§15.225

(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)

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

2D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

KDB 414788 OFS and Chamber Correlation Justification

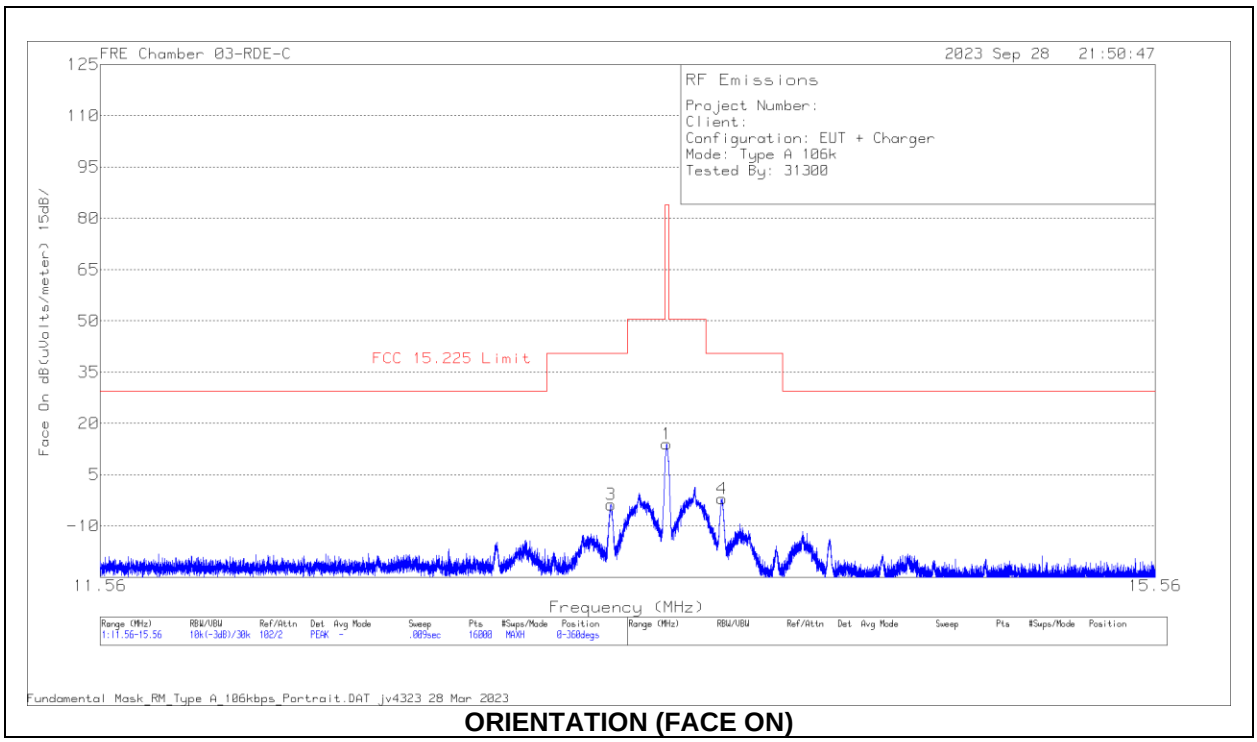
Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

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

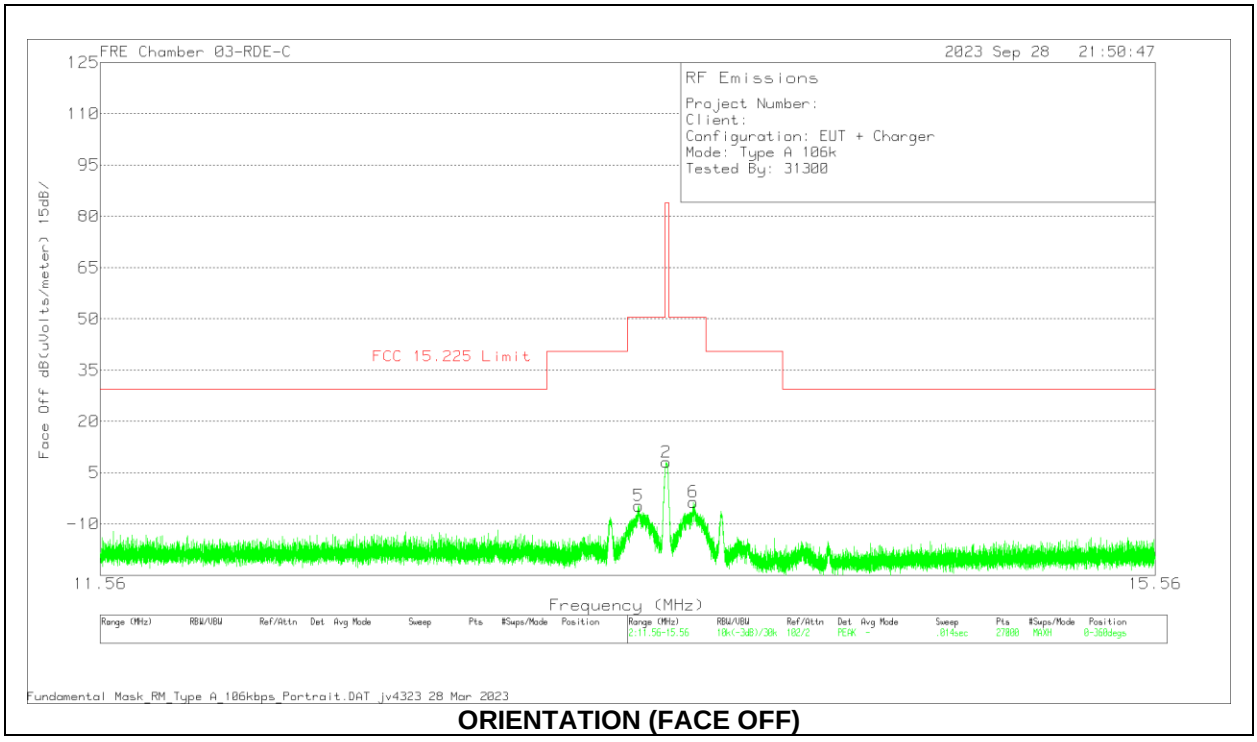
RESULTS

8.2. FUNDAMENTAL EMISSION MASK

8.2.1. EUT without Passive Tag Mode



ORIENTATION (FACE ON)



ORIENTATION (FACE OFF)

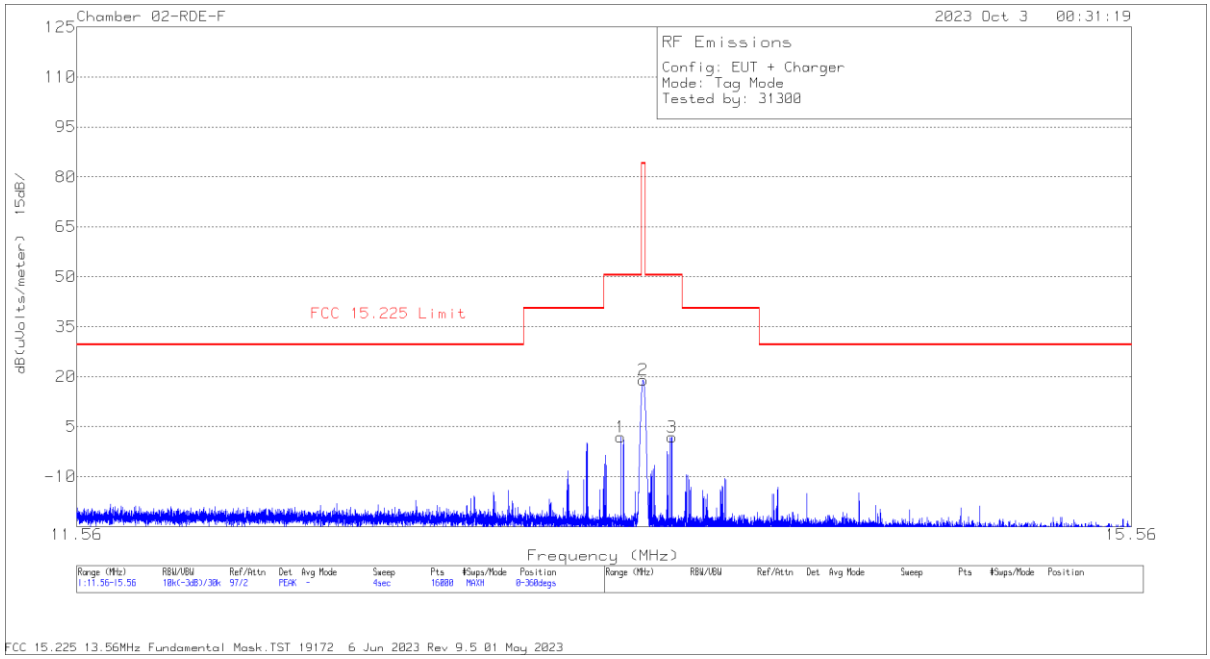
DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna E(ACF)	Cbl (dB)	Dist Corr 30m (dB) 40Log	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
3	13.3493	34.03	Pk	34.3	-32.1	-40	-3.77	40.51	-44.28	0-360
5	13.4538	33.23	Pk	34.3	-32.2	-40	-4.67	50.5	-55.17	0-360
2	13.559	45.86	Pk	34.3	-32.1	-40	8.06	84	-75.94	0-360
1	13.5595	51.74	Pk	34.3	-32.1	-40	13.94	84	-70.06	0-360
6	13.6622	34.31	Pk	34.2	-32.1	-40	-3.59	50.5	-54.09	0-360
4	13.7725	35.76	Pk	34.2	-32	-40	-2.04	40.51	-42.55	0-360

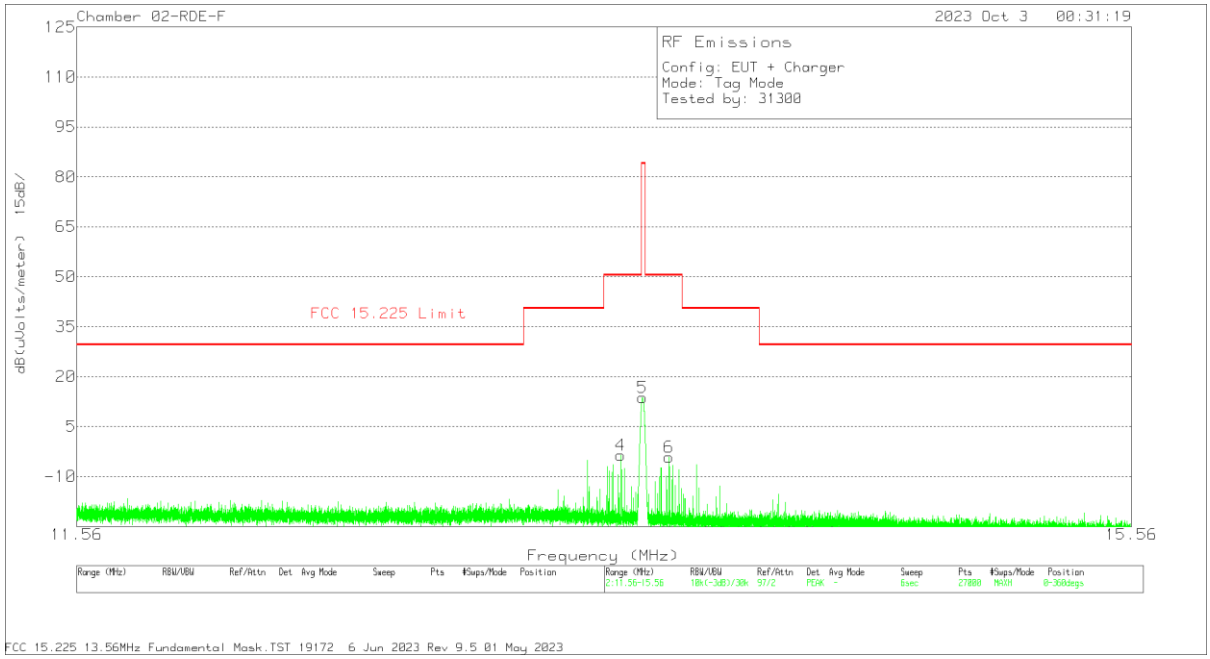
Pk - Peak detector

Note 1: Although these tests were performed other than open filed 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.
Note 2: Radiated test were investigated with three receiving antenna axes: Face-on, Face-off and Horizontal (parallel to the ground plane) and the worse orientations of Face-on and Face-off were set for final test.

8.2.2. EUT with Passive Tag Mode



ORIENTATION (FACE ON)



ORIENTATION (FACE OFF)

DATA

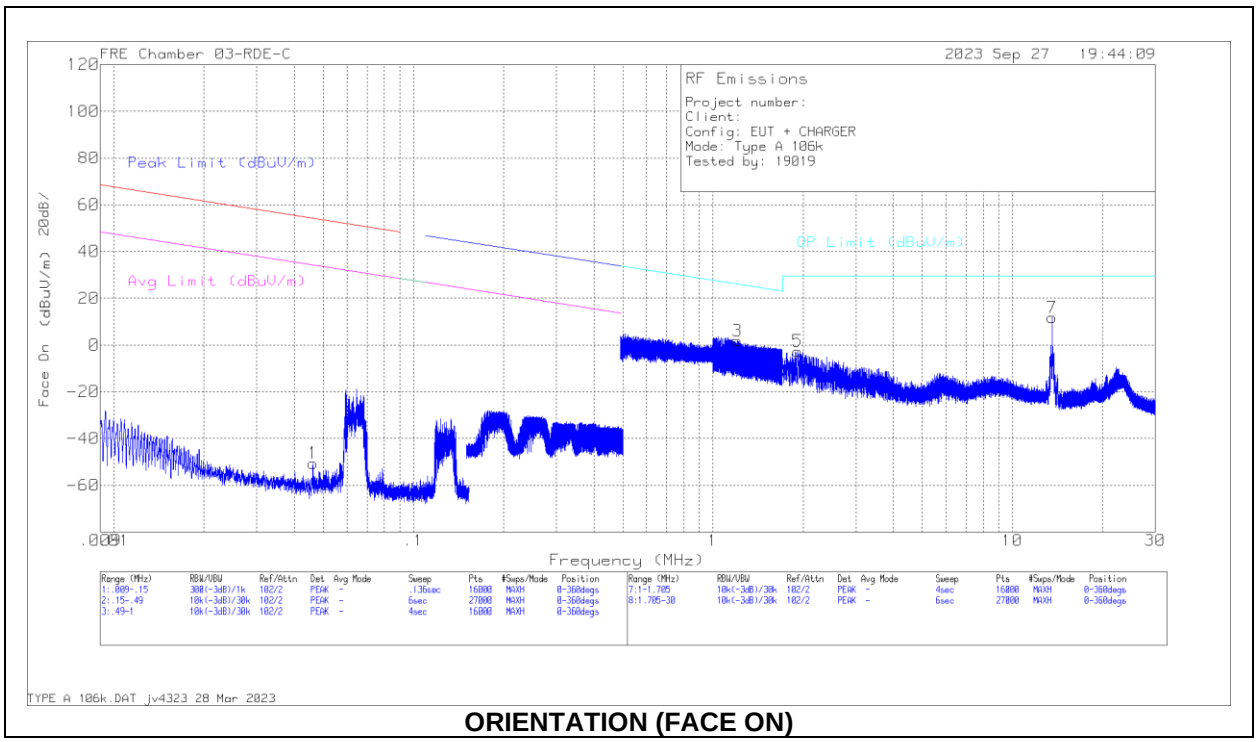
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna E(ACF)	Cbl (dB)	Dist Corr (dB) 40Log	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
1	13.474	39.73	Pk	34.3	-32.1	-40	1.93	50.5	-48.57	0-360
2	13.5595	56.68	Pk	34.3	-32	-40	18.98	84	-65.02	0-360
3	13.6705	39.6	Pk	34.2	-32	-40	1.8	50.5	-48.7	0-360
4	13.475	34.17	Pk	34.3	-32.1	-40	-3.63	50.5	-54.13	0-360
5	13.5579	51.37	Pk	34.3	-32	-40	13.67	84	-70.33	0-360
6	13.6581	33.68	Pk	34.2	-32	-40	-4.12	50.5	-54.62	0-360

Pk - Peak detector

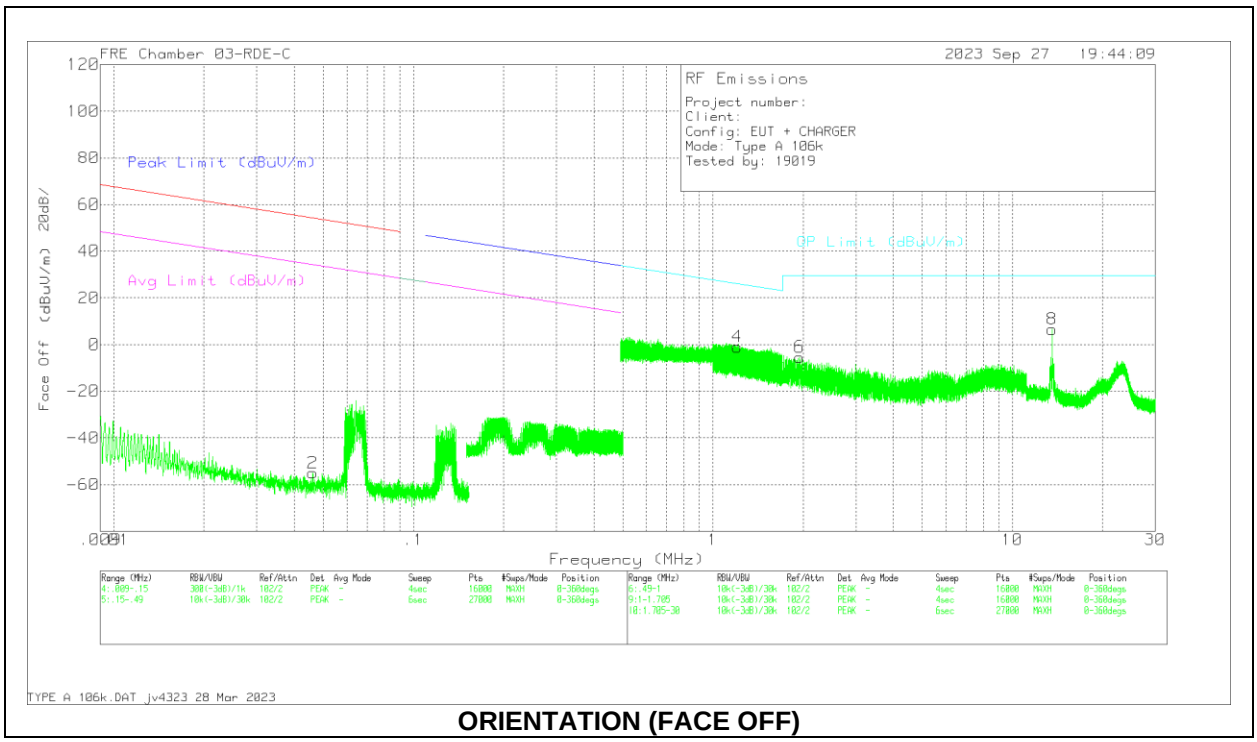
Note 1: Although these tests were performed other than open filed test site, adequate comparison measurements were confirmed against 30 m open are test site.
Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.
Note 2: Radiated test were investigated with three receiving antenna axes: Face-on, Face-off and Horizontal (parallel to the ground plane) and the worse orientations of Face-on and Face-off were set for final test.

8.3. SPURIOUS EMISSION 0.15-30 MHz

8.3.1. EUT without Passive Tag Mode



ORIENTATION (FACE ON)



ORIENTATION (FACE OFF)

DATA

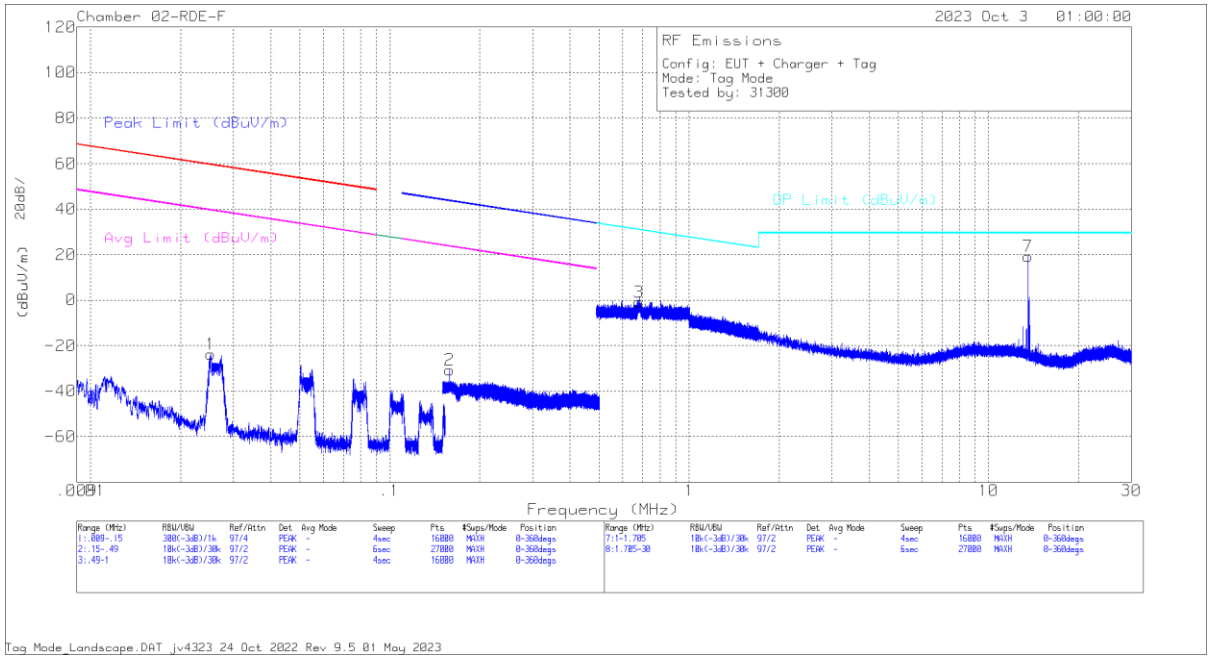
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna E(ACF)	Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
2	.0461	.5	Pk	57.2	-32.7	-80	-55	54.31	-109.31	34.31	-89.31	0-360
1	.0463	4.93	Pk	57.2	-32.7	-80	-50.57	54.28	-104.85	34.28	-84.85	0-360

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna E(ACF)	Cbl (dB)	Dist Corr 30m (dB) 40Log	Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
4	1.2054	25.94	Pk	45.7	-32.6	-40	-.96	26	-26.96	0-360
3	1.2068	28.66	Pk	45.7	-32.6	-40	1.76	25.99	-24.23	0-360
	1.0125	20.05	Qp	46.8	-32.7	-40	-5.85	27.51	-33.36	89
5	1.9167	27.74	Pk	42	-32.4	-40	-2.66	29.5	-32.16	0-360
6	1.9439	25.21	Pk	41.9	-32.5	-40	-5.39	29.5	-34.89	0-360
7	13.5589	49.55	Pk	34.3	-32.1	-40	11.75	29.5	-17.75	0-360
8	13.561	44.35	Pk	34.3	-32.1	-40	6.55	29.5	-22.95	0-360

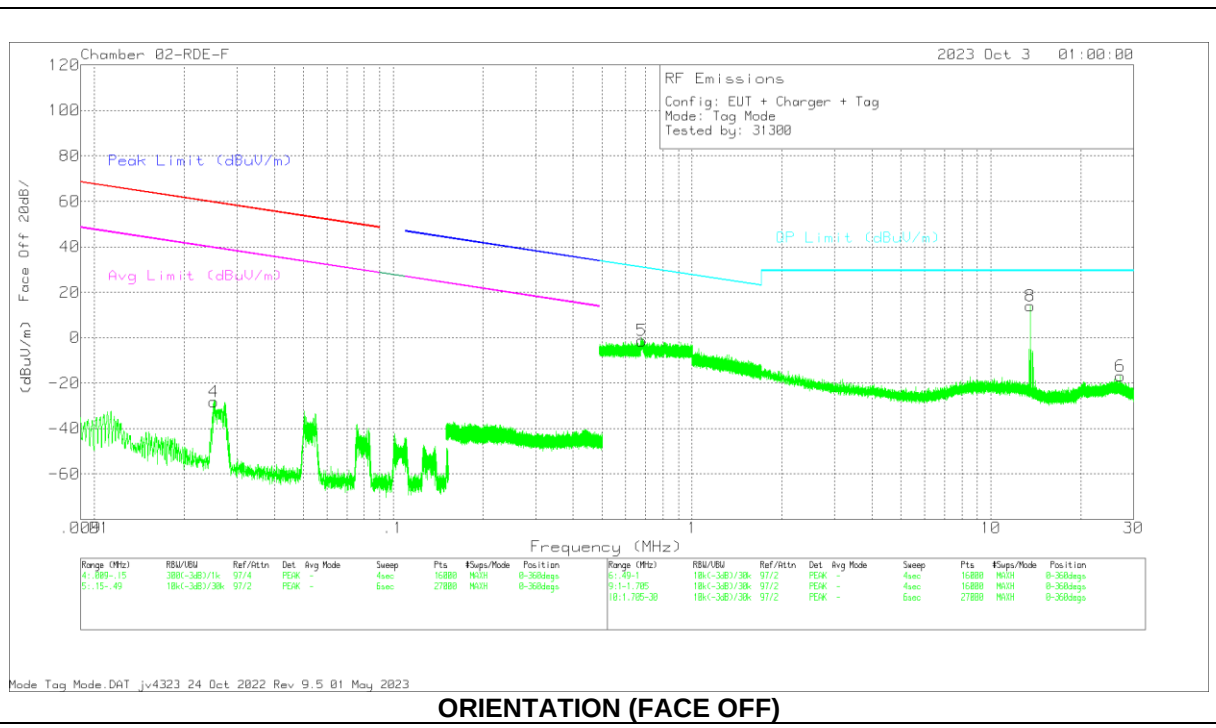
Pk - Peak detector
Qp - Quasi-Peak detector

Note 1: The data for markers number 7 and 8 are the fundamental signal. Please refer to 8.2.1 about Fundamental level.
Note 2: Radiated test were investigated with three receiving antenna axes: Face-on, Face-off and Horizontal (parallel to the ground plane) and the worse orientations of Face-on and Face-off were set for final test.

8.3.2. EUT with Passive Tag Mode



ORIENTATION (FACE ON)



ORIENTATION (FACE OFF)

DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna E(ACF)	Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.0252	29.63	Pk	58.6	-32	-80	-23.77	59.56	-83.33	39.56	-63.33	-	-	-	-	0-360
2	.1585	25.8	Pk	56.1	-32.6	-80	-30.7	-	-	-	-	43.62	-74.32	23.62	-54.32	0-360
4	.0251	25.32	Pk	58.6	-32	-80	-28.08	59.59	-87.67	39.59	-67.67	-	-	-	-	0-360

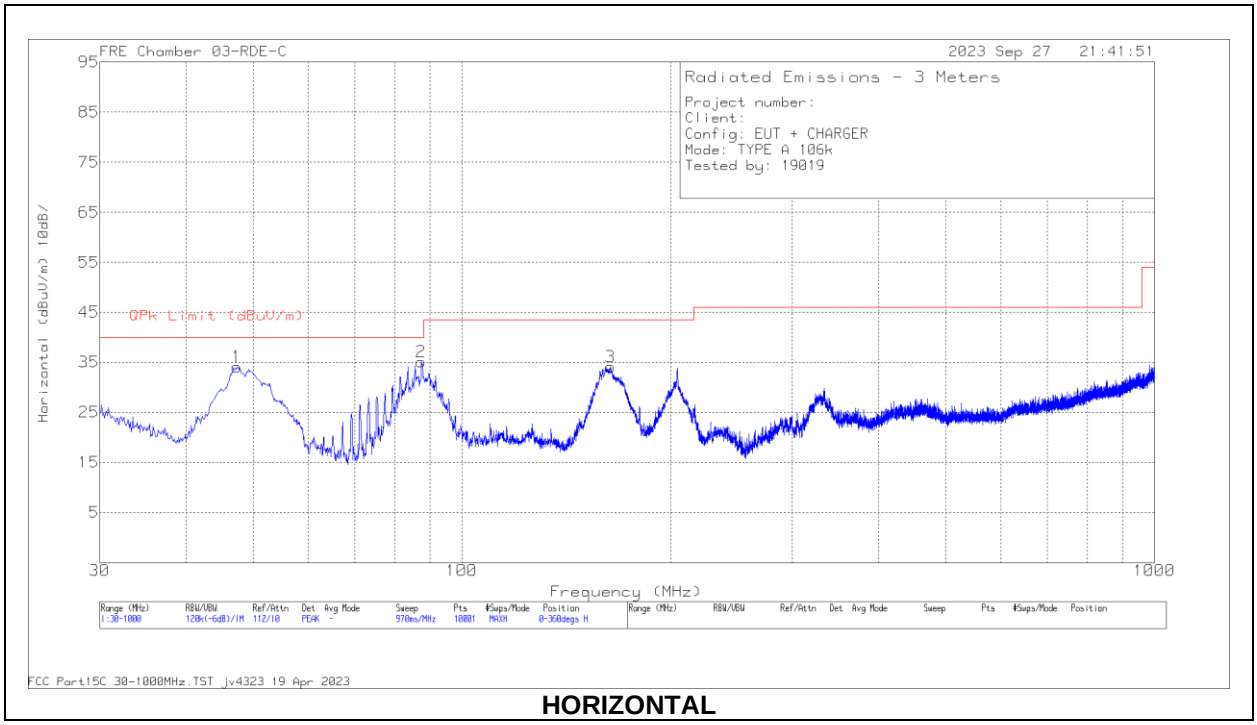
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna E(ACF)	Cbl (dB)	Dist Corr (dB) 40Log	Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.6785	15.2	Pk	56.3	-32.5	-40	-1	30.98	-31.98	0-360
	.6774	8.96	Qp	56.3	-32.5	-40	-7.24	31	-38.24	112
5	.679	14.89	Pk	56.3	-32.5	-40	-1.31	30.98	-32.29	0-360
6	27.1201	21.29	Pk	33.5	-31.8	-40	-17.01	29.5	-46.51	0-360
7	13.56	57.02	Pk	34.3	-32	-40	19.32	29.5	-10.18	0-360
8	13.5595	51.8	Pk	34.3	-32	-40	14.1	29.5	-15.4	0-360

Pk - Peak detector
Qp - Quasi-Peak detector

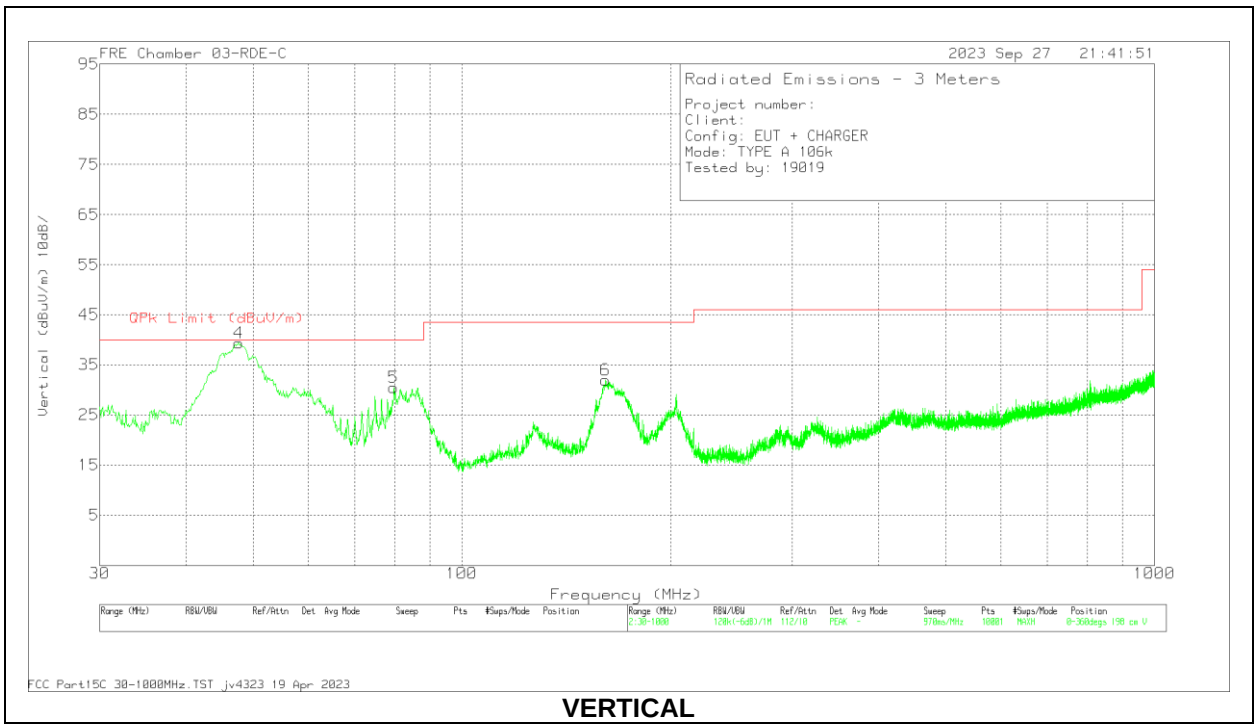
Note 1: The data for markers number 7 and 8 are the fundamental signal. Please refer to 8.2.2 about Fundamental level.
Note 2: Radiated test were investigated with three receiving antenna axes: Face-on, Face-off and Horizontal (parallel to the ground plane) and the worse orientations of Face-on and Face-off were set for final test.

8.4. SPURIOUS EMISSION 30-1000 MHz

8.4.1. EUT without Passive Tag Mode



HORIZONTAL



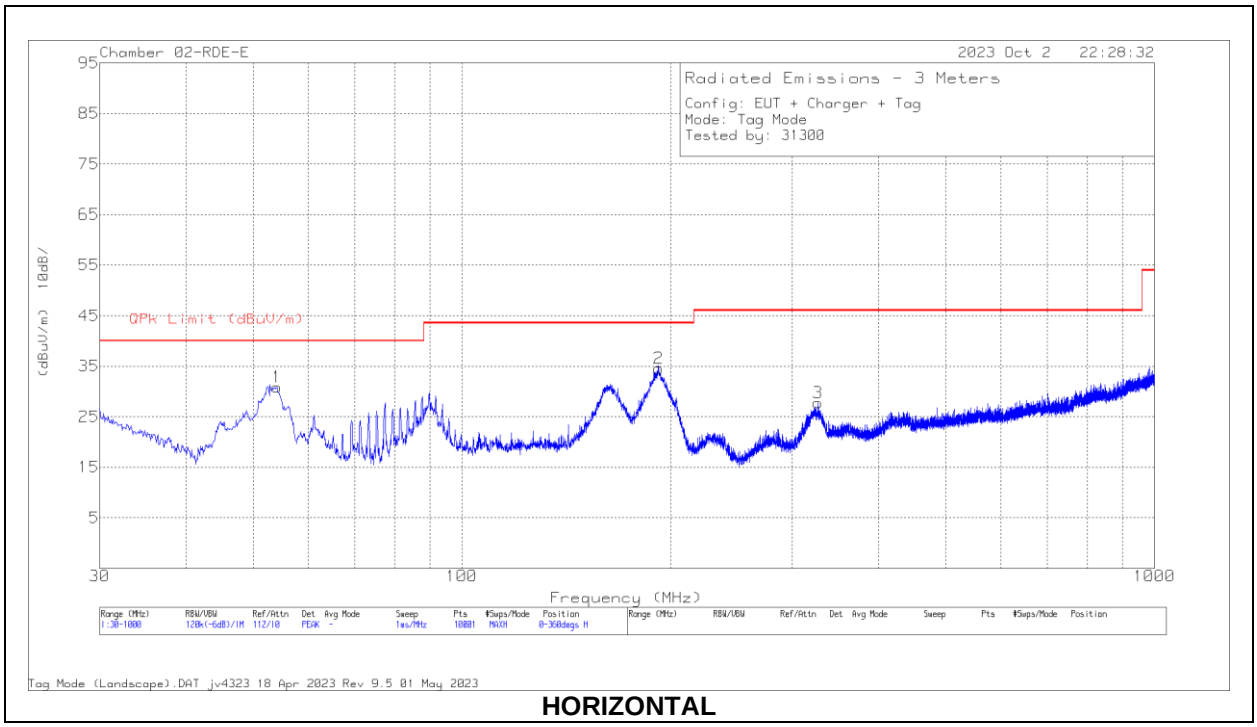
VERTICAL

DATA

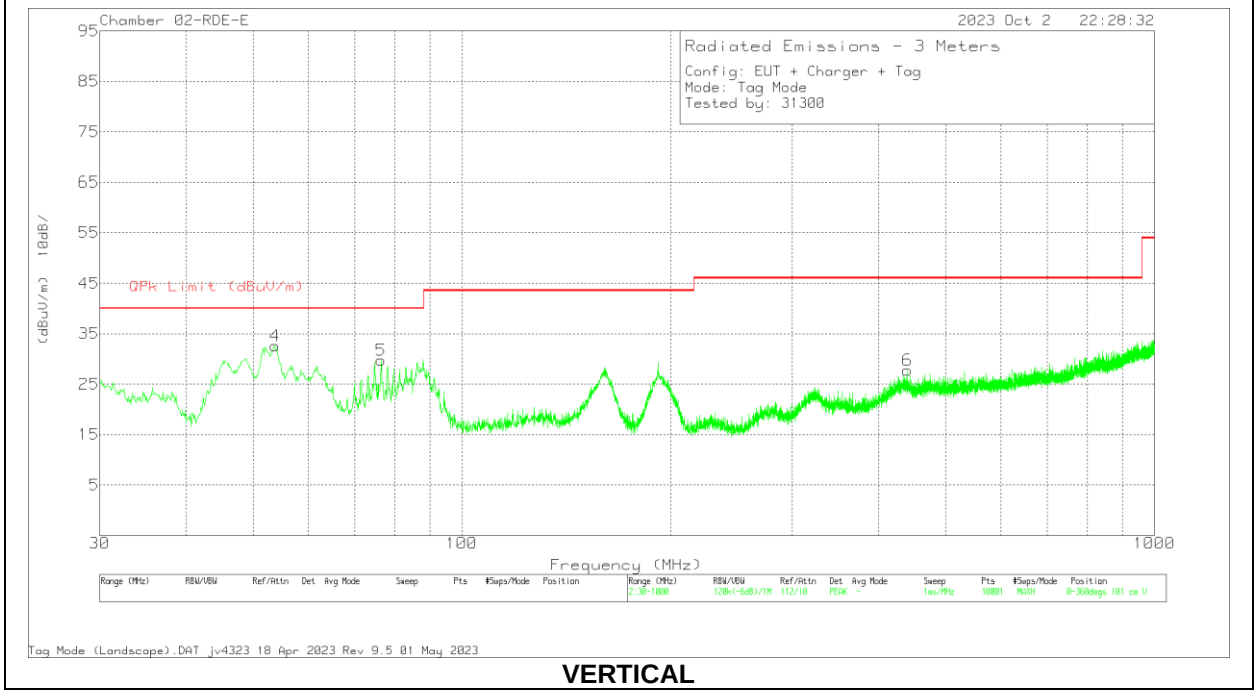
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	235174 ACF (dB) 10m H	Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 163.86	46.35	Pk	18.1	-30.4	34.05	43.52	-9.47	0-360	198	H
1	47.363	50.48	Pk	14.9	-31.3	34.08	40	-5.92	0-360	398	H
	47.6586	46.67	Qp	14.7	-31.3	30.07	40	-9.93	218	378	H
4	47.654	55.93	Pk	14.7	-31.3	39.33	40	-.67	0-360	103	V
	48.2541	54.03	Qp	14.5	-31.3	37.23	40	-2.77	134	117	V
5	79.761	47.95	Pk	13.4	-30.9	30.45	40	-9.55	0-360	103	V
2	87.424	52.48	Pk	13.5	-30.9	35.08	40	-4.92	0-360	398	H
	86.2166	46.94	Qp	13.4	-30.9	29.44	40	-10.56	37	274	H
6	161.241	44.3	Pk	18.2	-30.5	32	43.52	-11.52	0-360	198	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Qp - Quasi-Peak detector

8.4.1. EUT with Passive Tag Mode



HORIZONTAL



VERTICAL

DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	230635 ACF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 326.917	37.27	Pk	19.7	-29.2	27.77	46.02	-18.25	0-360	101	H
4	53.765	50.6	Pk	13.2	-31.2	32.6	40	-7.4	0-360	101	V
1	54.056	48.83	Pk	13.2	-31.2	30.83	40	-9.17	0-360	399	H
5	76.463	46.92	Pk	13.8	-31	29.72	40	-10.28	0-360	101	V
2	192.281	46.96	Pk	17.6	-30	34.56	43.52	-8.96	0-360	101	H
6	439.922	33.87	Pk	22.5	-28.6	27.77	46.02	-18.25	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector

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.

TEST PROCEDURE

ANSI C63.10-2013 Clause 6.8

RESULTS

No non-compliance noted.

ID:	31300	**Date:**	2023-09-27

9.1. EUT without Passive Tag Mode

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)
3.80	50	13.5600043	0.305	13.5600043	0.305	13.5600043	0.307	13.5600042	0.309	± 100
3.80	40	13.5600054	0.225	13.5600053	0.226	13.5600053	0.227	13.5600053	0.227	± 100
3.80	30	13.5600068	0.121	13.5600067	0.127	13.5600066	0.130	13.5600066	0.134	± 100
3.80	***20***	***13.5600084***	***0.000***	***13.5600085***	***-0.003***	***13.5600085***	***-0.007***	***13.5600085***	***-0.009***	***± 100***
3.80	10	13.5600097	-0.098	13.5600098	-0.101	13.5600098	-0.103	13.5600098	-0.104	± 100
3.80	0	13.5600098	-0.101	13.5600098	-0.102	13.5600098	-0.101	13.5600098	-0.101	± 100
3.80	-10	13.5600095	-0.080	13.5600095	-0.083	13.5600096	-0.085	13.5600096	-0.085	± 100
3.65	20	13.5600027	0.421	13.5600025	0.440	13.5600024	0.446	13.5600024	0.446	± 100
4.47	20	13.5600023	0.449	13.5600022	0.456	13.5600023	0.452	13.5600034	0.370	± 100

9.2. EUT with Passive Tag Mode

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)
3.80	50	13.5600072	0.156	13.5600072	0.160	13.5600071	0.163	13.5600071	0.168	± 100
3.80	40	13.5600085	0.063	13.5600084	0.068	13.5600084	0.072	13.5600083	0.074	± 100
3.80	30	13.5600092	0.008	13.5600091	0.014	13.5600091	0.019	13.5600090	0.025	± 100
3.80	***20***	***13.5600093***	***0.000***	***13.5600093***	***0.000***	***13.5600093***	***-0.001***	***13.5600093***	***-0.001***	***± 100***
3.80	10	13.5600096	-0.019	13.5600096	-0.023	13.5600097	-0.027	13.5600098	-0.032	± 100
3.80	0	13.5600097	-0.031	13.5600097	-0.029	13.5600097	-0.027	13.5600097	-0.024	± 100
3.80	-10	13.5600086	0.052	13.5600086	0.052	13.5600086	0.053	13.5600086	0.053	± 100
3.65	20	13.5600026	0.495	13.5600027	0.492	13.5600027	0.492	13.5600027	0.488	± 100
4.47	20	13.5600025	0.506	13.5600024	0.508	13.5600024	0.509	13.5600024	0.509	± 100

10. AC MAINS LINE CONDUCTED EMISSIONS

LIMITS

§15.207

(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

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

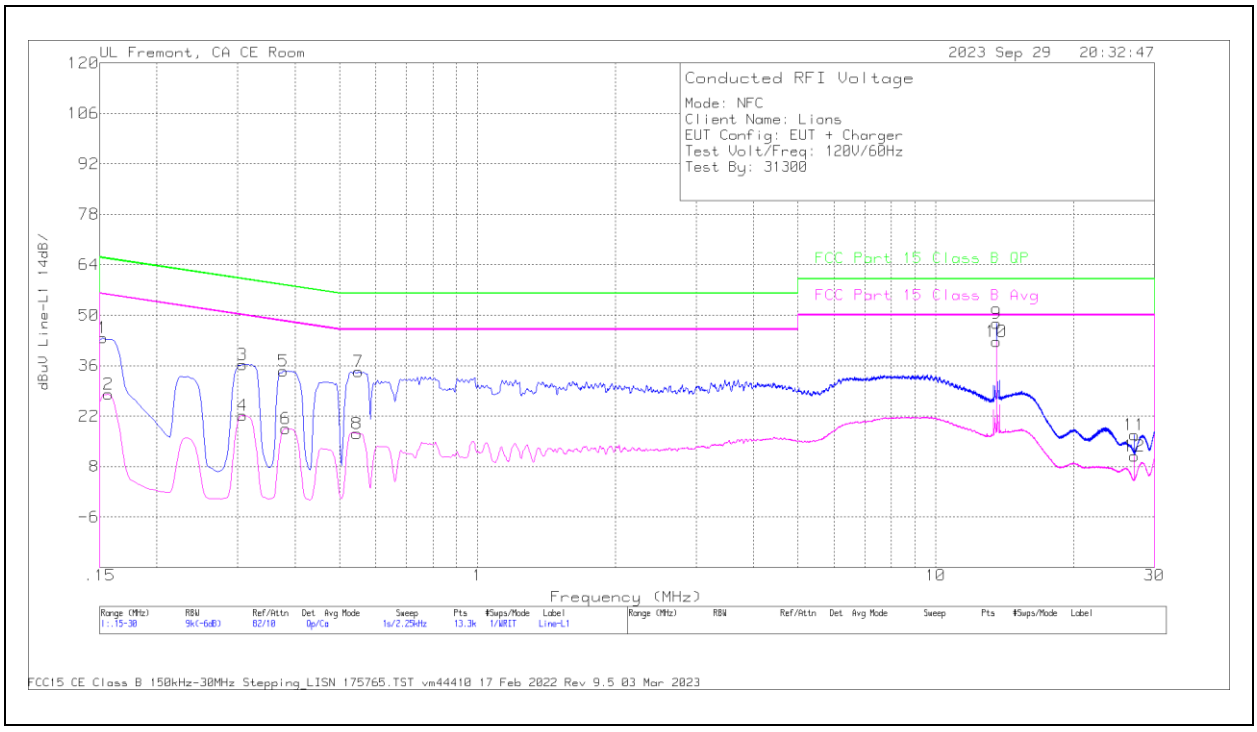
Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

No non-compliance noted:

10.1. EUT without Passive Tag Mode (Non-Terminated)

LINE 1 RESULTS

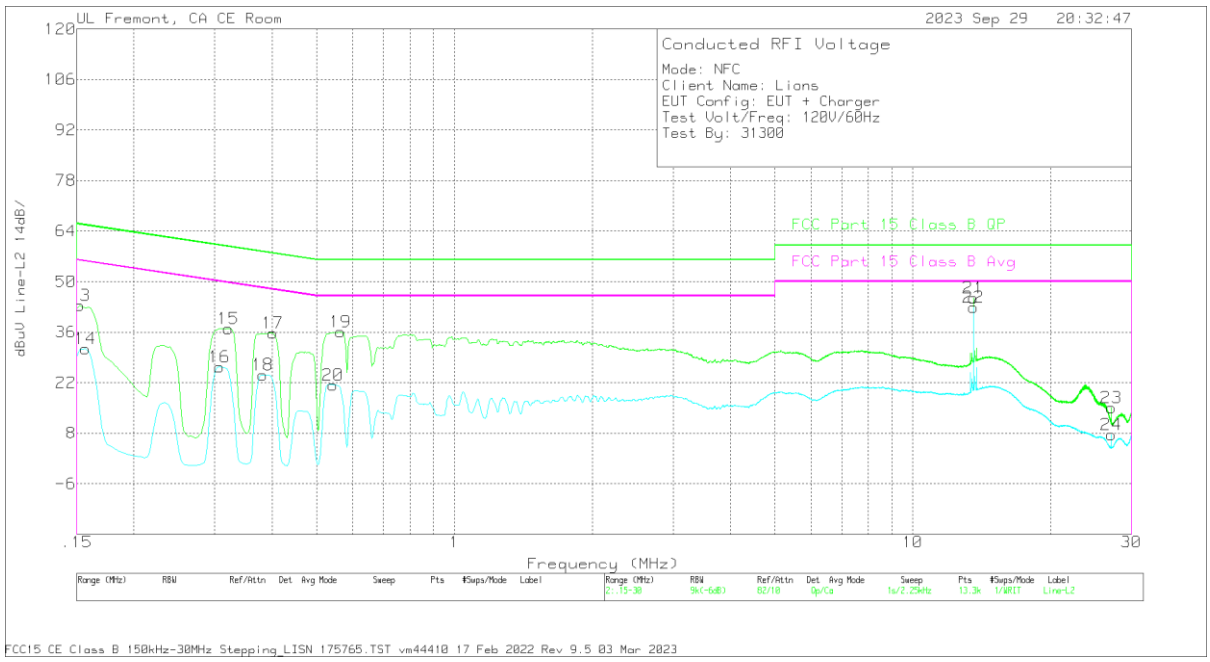


DATA

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN (dB)	Cbl (dB)	Trns Limiter (dB)	Corrected Reading dBuV	FCC Part 15 Class B QP (dBuV)	QP Margin (dB)	FCC Part 15 Class B Avg (dBuV)	Av(CISPR)Margin (dB)
2	.1568	18.54	Ca	0	0	9.5	28.04	-	-	55.63	-27.59
4	.3075	12.67	Ca	0	.1	9.4	22.17	-	-	50.04	-27.87
6	.3818	9.09	Ca	0	0	9.4	18.49	-	-	48.24	-29.75
8	.546	7.81	Ca	0	.1	9.3	17.21	-	-	46	-28.79
10	13.56	32.84	Ca	.1	.3	9.5	42.74	-	-	50	-7.26
12	27.1208	.85	Ca	.3	.3	9.4	10.85	-	-	50	-39.15
1	.1523	34.22	Qp	0	0	9.5	43.72	65.88	-22.16	-	-
3	.3075	26.82	Qp	0	.1	9.4	36.32	60.04	-23.72	-	-
5	.3773	25.18	Qp	0	0	9.4	34.58	58.34	-23.76	-	-
7	.5505	24.92	Qp	0	.1	9.3	34.32	56	-21.68	-	-
9	13.56	37.82	Qp	.1	.3	9.5	47.72	60	-12.28	-	-
11	27.1208	6.84	Qp	.3	.3	9.4	16.84	60	-43.16	-	-

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS



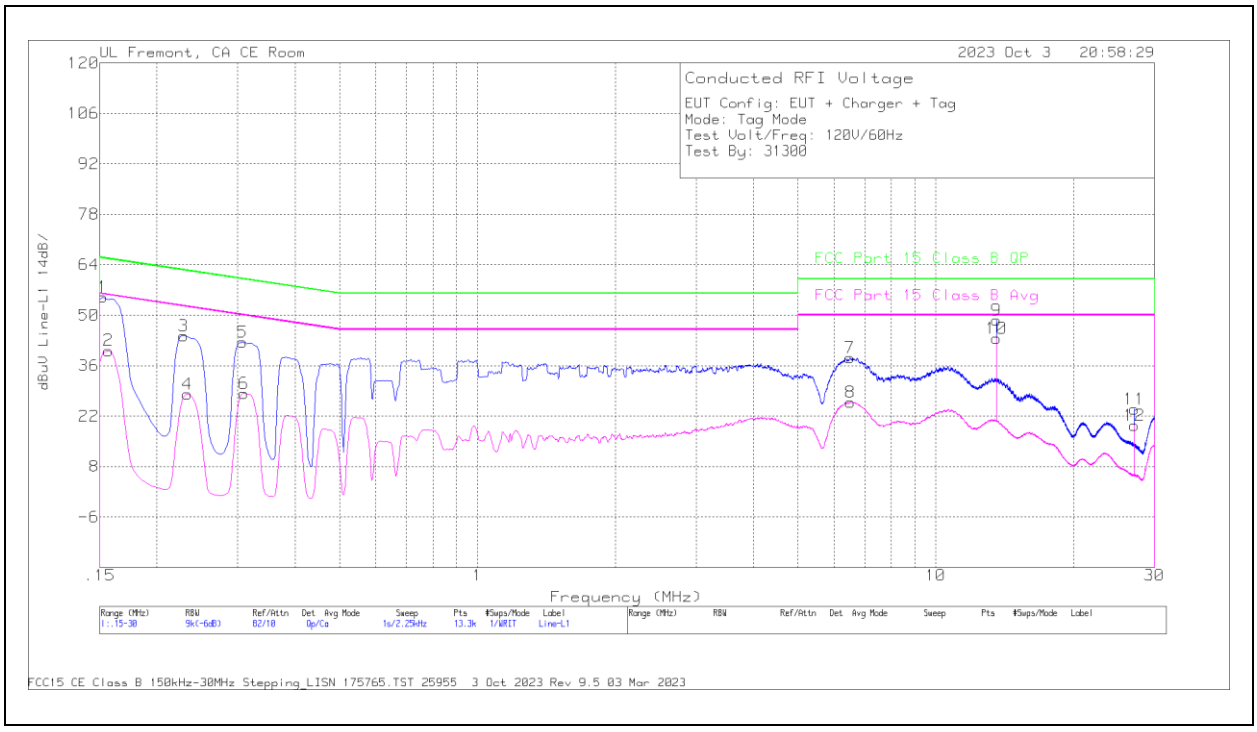
DATA

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN (dB)	Cbl (dB)	Trns Limiter (dB)	Corrected Reading dBuV	FCC Part 15 Class B QP (dBuV)	QP Margin (dB)	FCC Part 15 Class B Avg (dBuV)	Av(CISPR)Margin (dB)
14	.1568	21.87	Ca	0	0	9.5	31.37	-	-	55.63	-24.26
16	.3075	16.83	Ca	0	.1	9.4	26.33	-	-	50.04	-23.71
18	.3818	14.68	Ca	0	.1	9.4	24.18	-	-	48.24	-24.06
20	.5438	12.06	Ca	0	0	9.3	21.36	-	-	46	-24.64
22	13.56	33.1	Ca	.1	.2	9.5	42.9	-	-	50	-7.1
24	27.1208	-2.46	Ca	.3	.3	9.4	7.54	-	-	50	-42.46
13	.1523	33.89	Qp	0	0	9.5	43.39	65.88	-22.49	-	-
15	.321	27.49	Qp	0	.1	9.4	36.99	59.68	-22.69	-	-
17	.402	26.27	Qp	0	.1	9.4	35.77	57.81	-22.04	-	-
19	.564	26.77	Qp	0	0	9.3	36.07	56	-19.93	-	-
21	13.56	35.69	Qp	.1	.2	9.5	45.49	60	-14.51	-	-
23	27.1208	5.06	Qp	.3	.3	9.4	15.06	60	-44.94	-	-

Qp - Quasi-Peak detector
Ca - CISPR average detection

10.2. EUT with Passive Tag Mode (Non-Terminated)

LINE 1 RESULTS

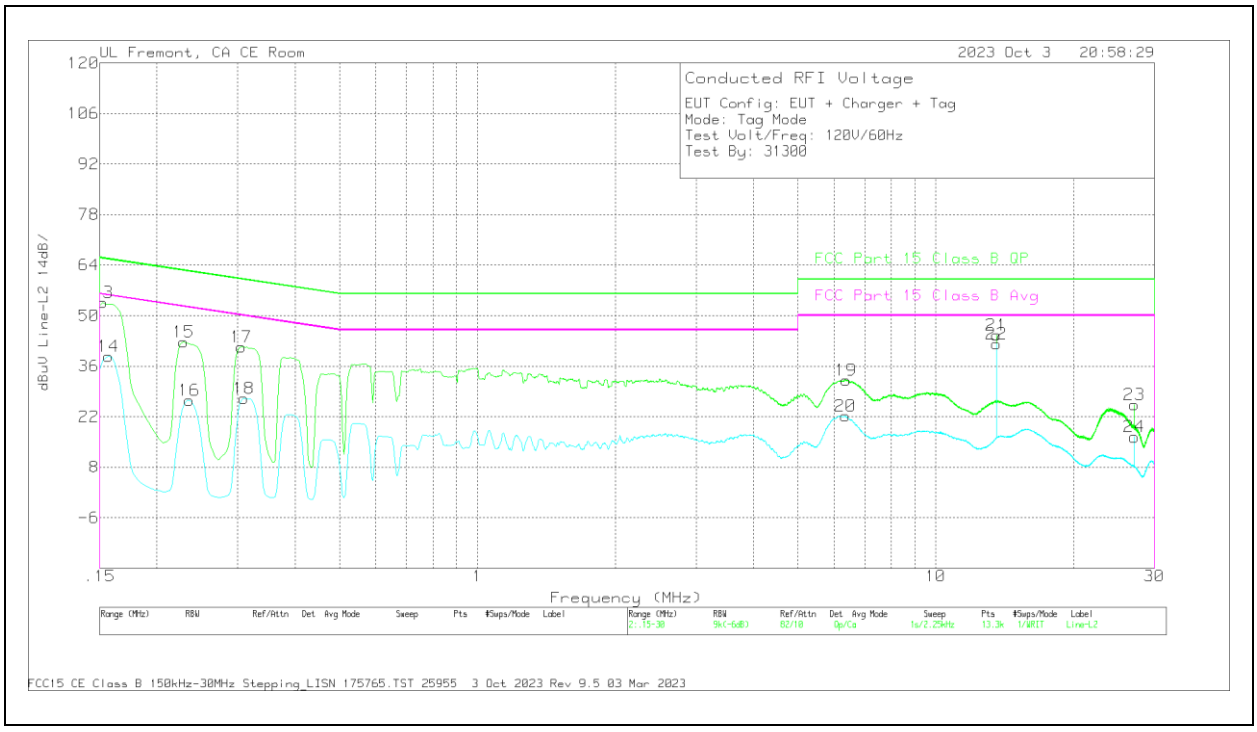


DATA

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN (dB)	Cbl (dB)	Trns Limiter (dB)	Corrected Reading dBuV	FCC Part 15 Class B QP (dBuV)	QP Margin (dB)	FCC Part 15 Class B Avg (dBuV)	Av(CISPR)Margin (dB)
2	.1568	30.68	Ca	0	0	9.5	40.18	-	-	55.63	-15.45
4	.2333	18.73	Ca	0	0	9.4	28.13	-	-	52.33	-24.2
6	.3098	18.82	Ca	0	.1	9.4	28.32	-	-	49.98	-21.66
8	6.5108	16.37	Ca	0	.2	9.3	25.87	-	-	50	-24.13
10	13.56	33.59	Ca	.1	.3	9.5	43.49	-	-	50	-6.51
12	27.1208	9.38	Ca	.3	.3	9.4	19.38	-	-	50	-30.62
1	.1523	45.61	Qp	0	0	9.5	55.11	65.88	-10.77	-	-
3	.2288	34.91	Qp	0	0	9.4	44.31	62.49	-18.18	-	-
5	.3075	32.97	Qp	0	.1	9.4	42.47	60.04	-17.57	-	-
7	6.4928	28.75	Qp	0	.2	9.3	38.25	60	-21.75	-	-
9	13.56	38.74	Qp	.1	.3	9.5	48.64	60	-11.36	-	-
11	27.1208	14	Qp	.3	.3	9.4	24	60	-36	-	-

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS



DATA

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN (dB)	Cbl (dB)	Trns Limiter (dB)	Corrected Reading dBuV	FCC Part 15 Class B QP (dBuV)	QP Margin (dB)	FCC Part 15 Class B Avg (dBuV)	Av(CISPR)Margin (dB)
14	.1568	29.25	Ca	0	0	9.5	38.75	-	-	55.63	-16.88
16	.2355	17.16	Ca	0	0	9.4	26.56	-	-	52.25	-25.69
18	.3098	17.55	Ca	0	.1	9.4	27.05	-	-	49.98	-22.93
20	6.3533	12.5	Ca	0	.2	9.5	22.2	-	-	50	-27.8
22	13.56	32.38	Ca	.1	.2	9.5	42.18	-	-	50	-7.82
24	27.1208	6.37	Ca	.3	.3	9.4	16.37	-	-	50	-33.63
13	.1523	44.15	Qp	0	0	9.5	53.65	65.88	-12.23	-	-
15	.2288	33.25	Qp	0	0	9.4	42.65	62.49	-19.84	-	-
17	.3053	31.81	Qp	0	.1	9.4	41.31	60.1	-18.79	-	-
19	6.3758	22.62	Qp	0	.1	9.4	32.12	60	-27.88	-	-
21	13.56	34.76	Qp	.1	.2	9.5	44.56	60	-15.44	-	-
23	27.1208	15.28	Qp	.3	.3	9.4	25.28	60	-34.72	-	-

Qp - Quasi-Peak detector
Ca - CISPR average detection

11. SETUP PHOTOS

Please refer to 14938215 – E10V1 for setup photos.

END OF TEST REPORT