

CERTIFICATION TEST REPORT

Report Number. : 4790748041-E13V3

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

Model : SM-F946U, SM-F946U1

FCC ID : A3LSMF946U

EUT Description : GSM/WCDMA/LTE 5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax,
NFC, WPT and UWB

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

Date Of Issue:

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Prepared by:

UL KOREA LTD.

26th floor, 152, Teheran-ro, Gangnam-gu Seoul, 06236, Korea

Suwon Test Site: UL KOREA LTD. Suwon Laboratory

218 Maeyeong-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16675, Korea

TEL: (031) 337-9902

FAX: (031) 213-5433

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	2023-05-12	Initial issue	Dexter(Hyunsik) Yun
V2	2023-05-22	Updated to address TCB's question	Dexter(Hyunsik) Yun
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION: GSM/WCDMA/LTE 5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, NFC, WPT and UWB
MODEL NUMBER: SM-F946U, SM-F946U1
SERIAL NUMBER: R3CW30K682H (Radiated),
DATE TESTED: 2023-03-22 ~ 2023-05-12;

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies

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

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

Approved & Released For
UL KOREA LTD. By:



Seokhwan Hong
Suwon Lab Engineer
UL KOREA LTD.

Tested By:



Dexter(Hyunsik) Yun
Suwon Lab Engineer
UL KOREA LTD.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

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

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. 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.

218 Maeyeong-ro	
<input type="checkbox"/>	Chamber 1(3m semi-anechoic chamber)
<input checked="" type="checkbox"/>	Chamber 2(3m semi-anechoic chamber)
<input type="checkbox"/>	Chamber 3(3m semi-anechoic chamber)
<input type="checkbox"/>	Chamber 4(3m Full-anechoic chamber)
<input type="checkbox"/>	Chamber 5(3m Full-anechoic chamber)

UL KOREA LTD. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

$$\begin{aligned} \text{Corrected Reading (dBuV)} &= \text{Meter Reading (dBuV)} + \text{External Cable (dB)} + \\ &\text{Cableloss (dB)} \\ 46.62 \text{ dBuV} + 9.8 \text{ dB} + 0.1 \text{ dB} &= 56.52 \text{ dBuV} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.80 dB
Radiated Disturbance, 9 kHz to 30 MHz	1.69 dB
Radiated Disturbance, 30 MHz to 1 GHz	3.92 dB

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

4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 2, Clause 4.4.3 in IEC Guide 115:2021.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE 5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, NFC, WPT and UWB. This test report addresses the DXX (NFC) operational mode.

Representative model	Difference	Derivative model
		SM-F946U1
SM-F946U	Hardware	Same as SM-F946U
	Software	Different UI

Thus, SM-F946U was set for final test.

5.2. MAXIMUM E-FIELD STRENGTH

The testing was performed at 3 meter. The transmitter maximum E-field at 30m distance is 15.28 dBuV/m which convert from 3 meter data.

Foldable conditions	NFC with tag mode [dBuV/m]	NFC without tag mode [dBuV/m]
Open	13.76	14.13
Half-folded	14.58	14.86
Full-folded	15.14	15.28

5.3. WORST-CASE CONFIGURATION AND MODE

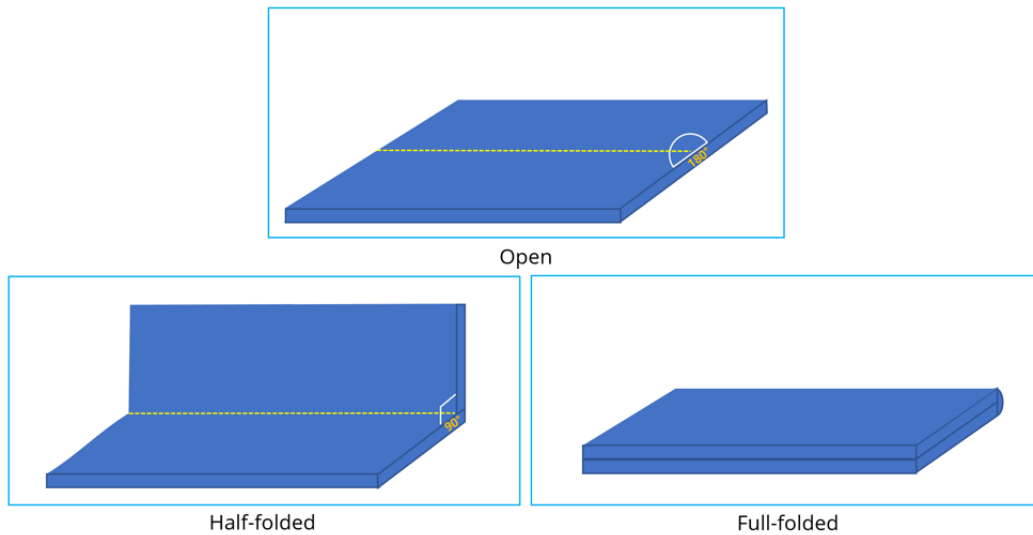
The NFC function was tested at its' fundamental and only operational frequency of 13.56 MHz.

- i. Worst case of antenna axis:

NFC with tag mode	NFC without tag mode
Y	

- ii. Foldable condition

NFC with tag mode	NFC without tag mode
Full-folded	



The fundamental level of the EUT was investigated each type and bitrate. All test was performed worst case condition(type A and bit rate 106 kbps).

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

5.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA800	R37N9QP4SL9DK3	N/A
Data Cable	SAMSUNG	WBR0062M	GH39-02112A	N/A

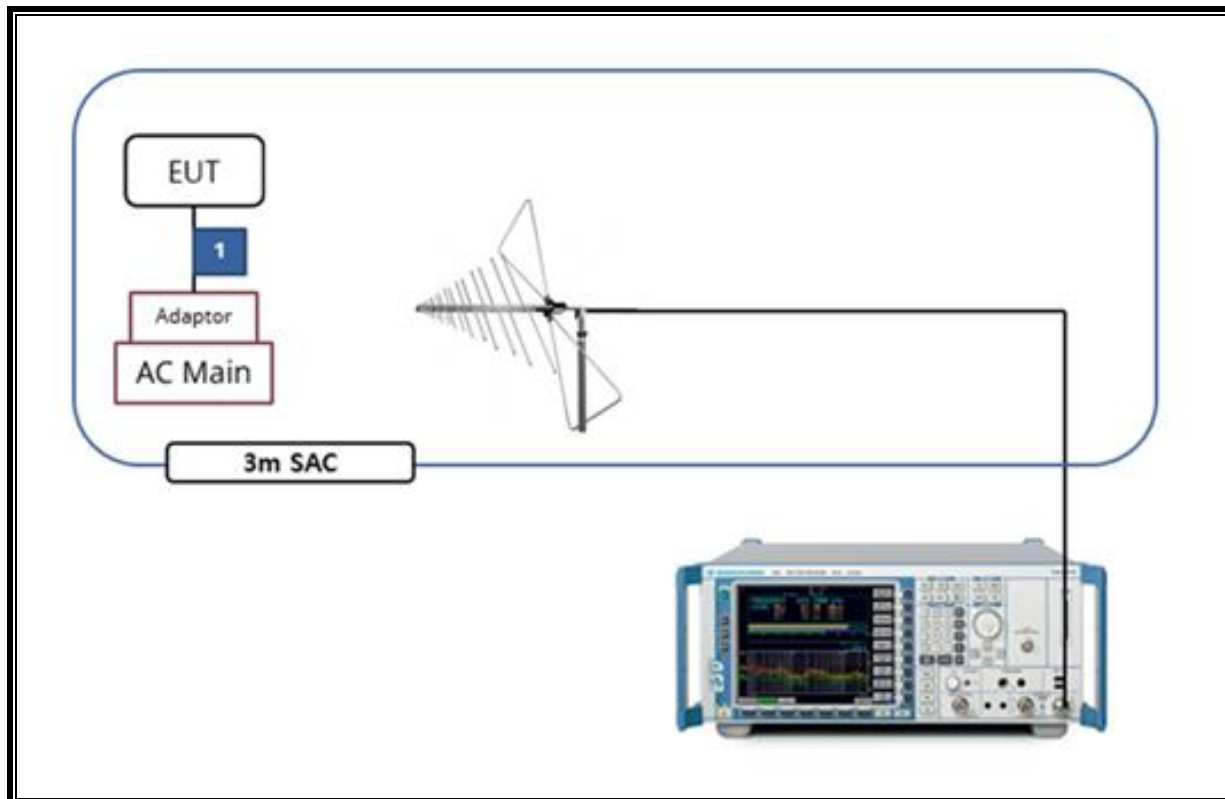
I/O CABLE

I/O Cable List						
Cable No.	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	C Type	Shielded	1.0 m	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)



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	Manufacturer	Model	S/N	Cal Due
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	2024-08-15
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	2024-08-15
Preamplifier, 1000 MHz	Sonoma	310N	341282	2023-08-02
Preamplifier, 1000 MHz	Sonoma	310N	351741	2023-08-02
Spectrum Analyzer, 7 GHz	Agilent / HP	N9010A	MY54200580	2023-08-01
EMI Test Receive, 3 GHz	R&S	ESR3	101832	2023-08-01
DC Power Supply	Agilent / HP	E3640A	MY54226395	2023-08-02
Temperature Chamber	ESPEC	SH-642	93001109	2023-08-01
LISN	R&S	ENV216	101837	2023-08-04
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	2023-10-06
UL Software				
Description	Manufacturer	Model	Version	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

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

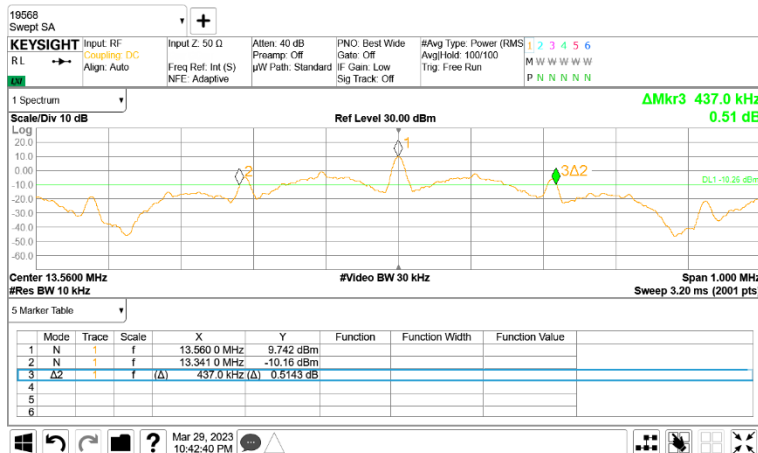
TEST PROCEDURE

The spectrum analyzer connected receive antenna and the EUT placed on near the receive antenna. The RBW is set to 10kHz. The VBW is set to 3 times the RBW. The sweep time is coupled.

RESULTS

Frequency [MHz]	20 dB Bandwidth [kHz]
13.56	437

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

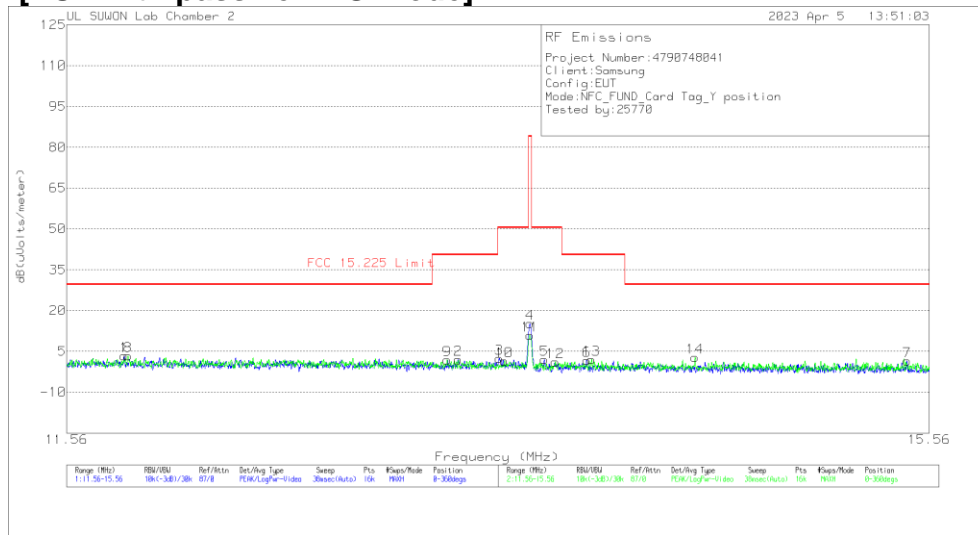
The EUT is an intentional radiator that incorporates a digital device. The highest fundamental frequency generated or used in the device is 13.56 MHz. The frequency range was investigated from 0.15 MHz to the 10th harmonic of the highest fundamental frequency, or 1000 MHz, whichever is greater (1000MHz)

RESULTS

No non-compliance noted:

8.1.1. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz)

[EUT with passive TAG mode]



Trace Markers Face on

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	HFH2-Z2_Loop Antenna	Dist Corr 30m	Cable Loss	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	Margin (dB)	Azimuth (Degs)
1	11.79088	22.6	Pk	20.2	-40	.5	3.3	29.54	-26.24	0-360
2	13.22913	21.35	Pk	20.1	-40	.5	1.95	40.51	-38.56	0-360
3	13.4185	21.78	Pk	20.1	-40	.5	2.38	50.5	-48.12	0-360
**4	13.56025	34.54	Pk	20.1	-40	.5	15.14	84	-68.86	0-360
5	13.62775	21.29	Pk	20.1	-40	.6	1.99	50.5	-48.51	0-360
6	13.82813	21.04	Pk	20.1	-40	.6	1.74	40.51	-38.77	0-360
7	15.4415	20.7	Pk	20.1	-40	.6	1.4	29.54	-28.14	0-360

Face off

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	HFH2-Z2_Loop Antenna	Dist Corr 30m	Cable Loss	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	Margin (dB)	Azimuth (Degs)
8	11.80713	22.58	Pk	20.2	-40	.5	3.28	29.54	-26.26	0-360
9	13.17913	21.3	Pk	20.1	-40	.5	1.9	40.51	-38.61	0-360
10	13.44213	20.92	Pk	20.1	-40	.5	1.52	50.5	-48.98	0-360
**11	13.55988	30.35	Pk	20.1	-40	.5	10.95	84	-73.05	0-360
12	13.67938	20.45	Pk	20.1	-40	.6	1.15	50.5	-49.35	0-360
13	13.85138	21.37	Pk	20.1	-40	.6	2.07	40.51	-38.44	0-360
14	14.35413	22.07	Pk	20.1	-40	.6	2.77	29.54	-26.77	0-360

Pk - Peak detector

**Fundamental

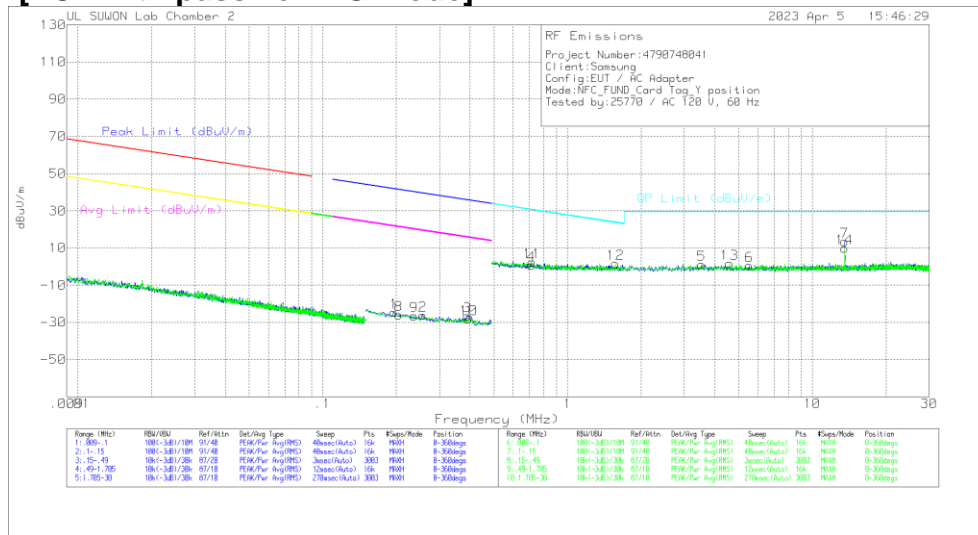
Note 1 : Although these tests were performed other than open filed test site, adequate comparison measurements were confirmed against 30 m open are test site.

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.

8.1.2. SPURIOUS EMISSION 0.009 TO 30 MHz

[EUT with passive TAG mode]



Trace Markers

Face on

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	HFH2-Z2_Loop Antenna	Cable Loss	Dist Corr 300m	Corrected Reading dBuV/m	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.19537	35.27	Pk	20	.1	-80	-24.63	41.8	-66.43	21.8	-46.43	0-360
2	.25645	33.87	Pk	19.9	.1	-80	-26.13	39.43	-65.56	19.43	-45.56	0-360
3	.38916	33.65	Pk	19.9	.1	-80	-26.35	35.81	-62.16	15.81	-42.16	0-360

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	HFH2-Z2_Loop Antenna	Cable Loss	Dist Corr 30m	Corrected Reading dBuV/m	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
4	.71215	20.63	Pk	20	.1	-40	.73	30.56	-29.83	0-360
5	3.53345	20.68	Pk	20.2	.3	-40	1.18	29.5	-28.32	0-360
6	5.52213	19.91	Pk	20.2	.4	-40	.51	29.5	-28.99	0-360
**7	13.56165	33.02	Pk	20.1	.5	-40	13.62	29.5	-15.88	0-360

Face off

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	HFH2-Z2_Loop Antenna	Cable Loss	Dist Corr 300m	Corrected Reading dBuV/m	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
8	.20452	33.97	Pk	19.9	.1	-80	-26.03	41.4	-67.43	21.4	-47.43	0-360
9	.23661	33.43	Pk	19.9	.1	-80	-26.57	40.13	-66.7	20.13	-46.7	0-360
10	.39459	31.9	Pk	19.9	.1	-80	-28.1	35.68	-63.78	15.68	-43.78	0-360

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	HFH2-Z2_Loop Antenna	Cable Loss	Dist Corr 30m	Corrected Reading dBuV/m	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
11	.71568	22.26	Pk	20	.1	-40	2.36	30.52	-28.16	0-360
12	1.57091	21.43	Pk	20.1	.2	-40	1.73	23.71	-21.98	0-360
13	4.58905	21.27	Pk	20.2	.3	-40	1.77	29.5	-27.73	0-360
**14	13.56165	29.42	Pk	20.1	.5	-40	10.02	29.5	-19.48	0-360

Pk - Peak detector

**Fundamental

Note 1: The data for marker number 7 and 14 are the fundamental signal.

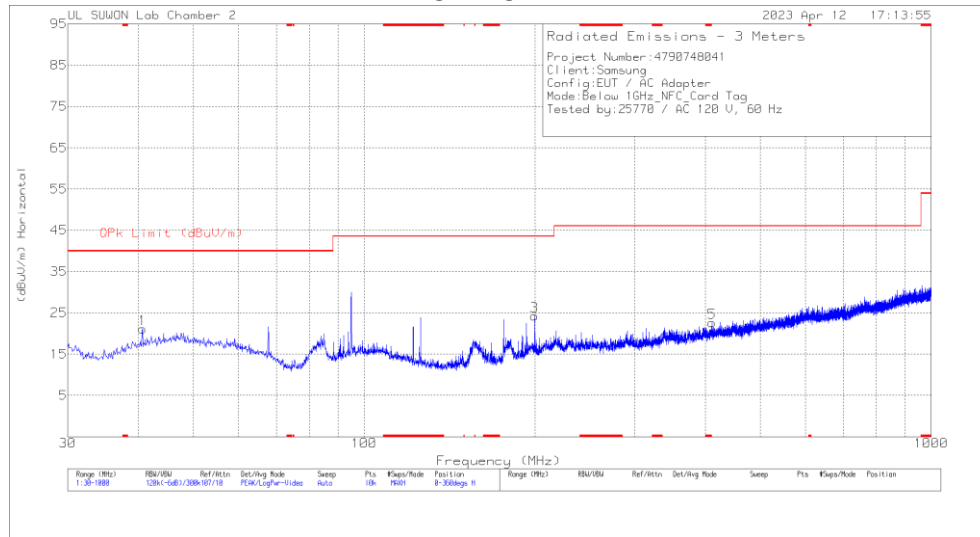
Please refer to section 8.1.1 about the fundamental level.

Frequency range 0.009MHz ~ 0.490MHz, only noise floor level and more than 20dB margin.

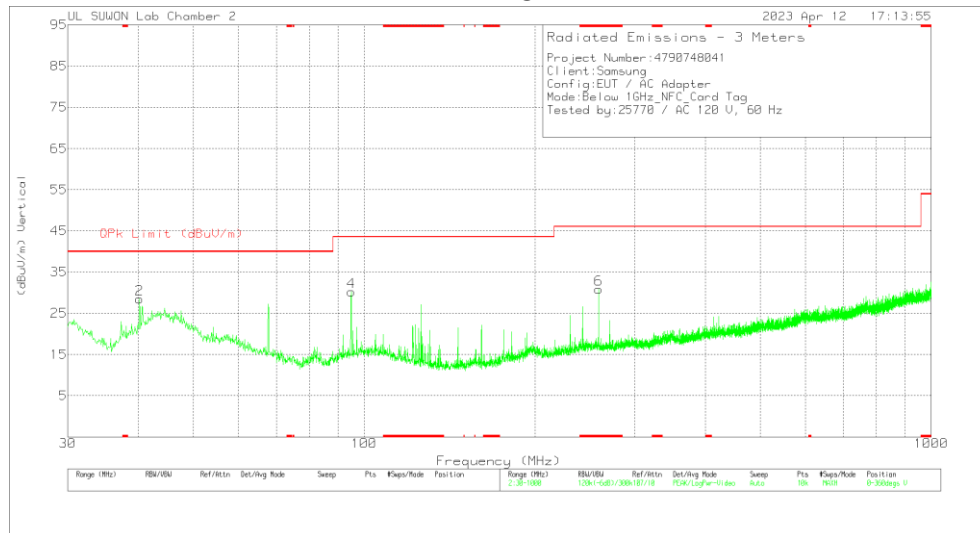
Note 2: Radiated test were investigated with three receiving antenna axes: Face-on, Face-off and horizontal (parallel to the ground plane) and the worse orientations of Face-on and Face-off were set for final test.

8.1.3. TX SPURIOUS EMISSION 30 TO 1000 MHz [EUT with passive TAG mode]

HORIZONTAL



VERTICAL

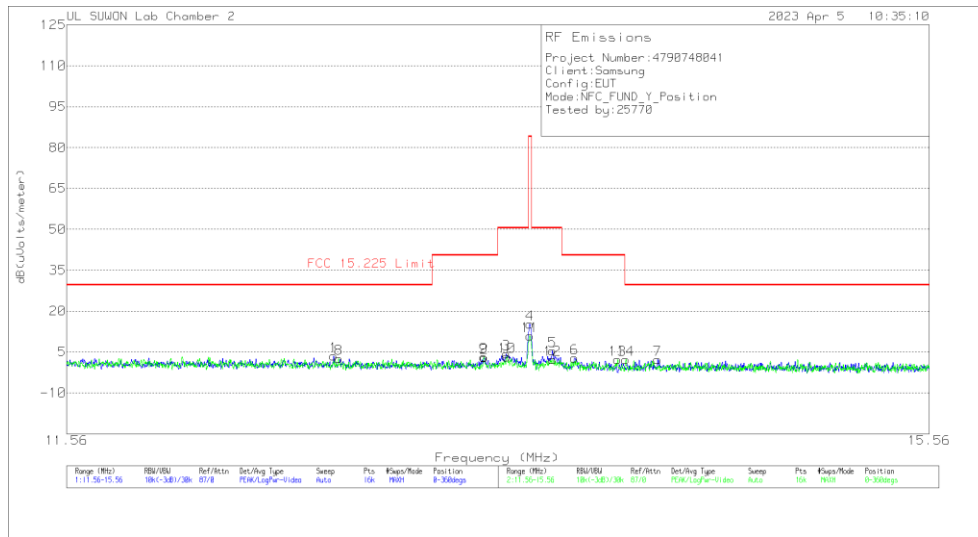


Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163_749	Below_1G(dB)	Corrected Reading (dBuV/m)	QPK Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	40.67	33.89	Pk	18.9	-31.7	21.09	40	-18.91	0-360	300	H
3	199.944	37.27	Pk	17.6	-30.6	24.27	43.52	-19.25	0-360	100	H
5	410.725	31.25	Pk	21.4	-30	22.65	46.02	-23.37	0-360	100	H
2	40.185	41.37	Pk	18.8	-31.7	28.47	40	-11.53	0-360	100	V
4	94.893	44.98	Pk	16.6	-31.3	30.28	43.52	-13.24	0-360	100	V
6	* 259.211	42.85	Pk	18.5	-30.5	30.85	46.02	-15.17	0-360	100	V

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

8.1.4. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz) [EUT without passive TAG mode]



Trace Markers Face on

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	HFH2-Z2_Loop Antenna	Dist Corr 30m	Cable Loss	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	Margin (dB)	Azimuth (Degs)
1	12.67363	22.88	Pk	20.1	-40	.5	3.48	29.54	-26.06	0-360
2	13.34813	22.41	Pk	20.1	-40	.5	3.01	40.51	-37.5	0-360
3	13.45013	23.67	Pk	20.1	-40	.5	4.27	50.5	-46.23	0-360
**4	13.55938	34.68	Pk	20.1	-40	.5	15.28	84	-68.72	0-360
5	13.66575	24.68	Pk	20.1	-40	.6	5.38	50.5	-45.12	0-360
6	13.77113	22.15	Pk	20.1	-40	.6	2.85	40.51	-37.66	0-360
7	14.17088	21.54	Pk	20.1	-40	.6	2.24	29.54	-27.3	0-360

Face off

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	HFH2-Z2_Loop Antenna	Dist Corr 30m	Cable Loss	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	Margin (dB)	Azimuth (Degs)
8	12.69538	21.96	Pk	20.1	-40	.5	2.56	29.54	-26.98	0-360
9	13.34688	22.51	Pk	20.1	-40	.5	3.11	40.51	-37.4	0-360
10	13.45325	22.67	Pk	20.1	-40	.5	3.27	50.5	-47.23	0-360
**11	13.55963	30.22	Pk	20.1	-40	.5	10.82	84	-73.18	0-360
12	13.66688	21.45	Pk	20.1	-40	.6	2.15	50.5	-48.35	0-360
13	13.97675	21.44	Pk	20.1	-40	.6	2.14	40.51	-38.37	0-360
14	14.01613	21.61	Pk	20.1	-40	.6	2.31	29.54	-27.23	0-360

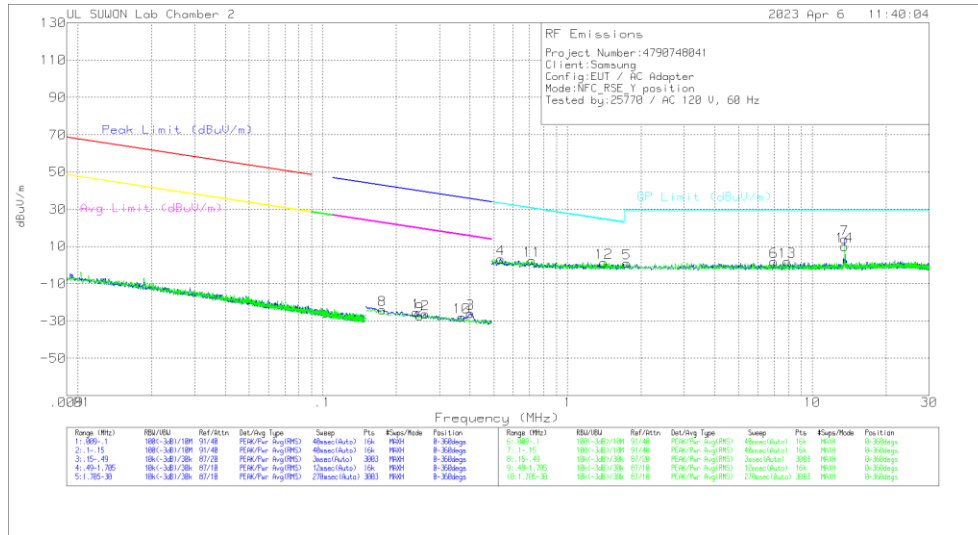
Pk - Peak detector

**Fundamental

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.

8.1.5. SPURIOUS EMISSION 0.09 TO 30 MHz [EUT without passive TAG mode]



Trace Markers Face on

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	HFH2-Z2_Loop Antenna	Cable Loss	Dist Corr 300m	Corrected Reading dBuV/m	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.24034	34.55	Pk	19.9	.1	-80	-25.45	40	-65.45	20	-45.45	0-360
2	.26215	33.72	Pk	19.9	.1	-80	-26.28	39.24	-65.52	19.24	-45.52	0-360
3	.40193	33.93	Pk	20	.1	-80	-25.97	35.52	-61.49	15.52	-41.49	0-360

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	HFH2-Z2_Loop Antenna	Cable Loss	Dist Corr 30m	Corrected Reading dBuV/m	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
4	.53222	23.31	Pk	20	.1	-40	3.41	33.08	-29.67	0-360
5	1.7427	20.88	Pk	20.1	.2	-40	1.18	29.5	-28.32	0-360
6	6.95473	21.21	Pk	20.2	.4	-40	1.81	29.5	-27.69	0-360
**7	13.56165	33.46	Pk	20.1	.5	-40	14.06	29.5	-15.44	0-360

Face off

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	HFH2-Z2_Loop Antenna	Cable Loss	Dist Corr 300m	Corrected Reading dBuV/m	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
8	.17514	35.82	Pk	20	.1	-80	-24.08	42.75	-66.83	22.75	-46.83	0-360
9	.24944	32.69	Pk	19.9	.1	-80	-27.31	39.68	-66.99	19.68	-46.99	0-360
10	.36905	32.28	Pk	19.9	.1	-80	-27.72	36.27	-63.99	16.27	-43.99	0-360

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	HFH2-Z2_Loop Antenna	Cable Loss	Dist Corr 30m	Corrected Reading dBuV/m	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
11	.71416	22.5	Pk	20	.1	-40	2.6	30.54	-27.94	0-360
12	1.40857	21.19	Pk	20	.2	-40	1.39	24.65	-23.26	0-360
13	7.90665	21.39	Pk	20.2	.4	-40	1.99	29.5	-27.51	0-360
**14	13.56165	29.47	Pk	20.1	.5	-40	10.07	29.5	-19.43	0-360

Pk - Peak detector
 **Fundamental

Note 1: The data for marker number 7 and 14 are the fundamental signal.

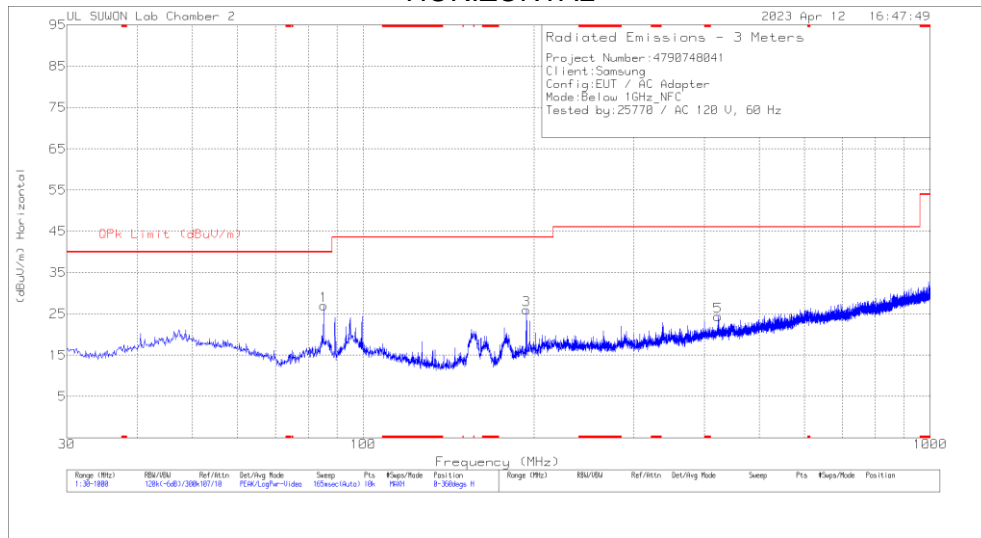
Please refer to section 8.1.4 about the fundamental level.

Frequency range 0.009MHz ~ 0.490MHz, only noise floor level and more than 20dB margin.

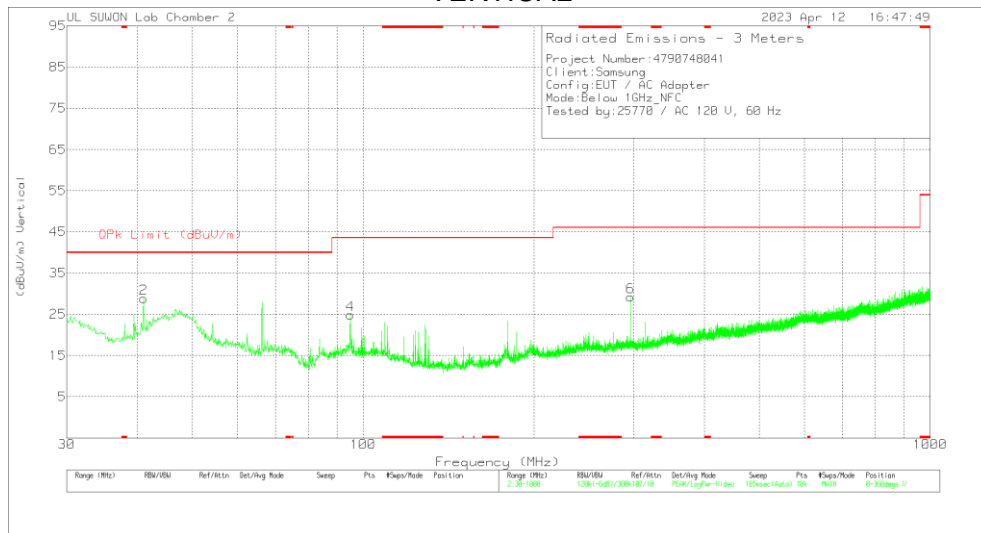
Note 2: Radiated test were investigated with three receiving antenna axes: Face-on, Face-off and horizontal (parallel to the ground plane) and the worse orientations of Face-on and Face-off were set for final test.

8.1.6. TX SPURIOUS EMISSION 30 TO 1000 MHz [EUT without passive TAG mode]

HORIZONTAL



VERTICAL



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163_749	Below_1G(dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	85.193	44.15	Pk	14.2	-31.4	26.95	40	-13.05	0-360	300	H
3	193.833	39.64	Pk	17.1	-30.8	25.94	43.52	-17.58	0-360	100	H
5	422.462	32.54	Pk	21.7	-29.9	24.34	46.02	-21.68	0-360	100	H
2	40.961	41.52	Pk	19	-31.7	28.82	40	-11.18	0-360	100	V
4	94.893	39.52	Pk	16.6	-31.3	24.82	43.52	-18.7	0-360	100	V
6	296.265	40.39	Pk	19.1	-30.3	29.19	46.02	-16.83	0-360	100	V

Pk - Peak detector

9. 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 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

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.

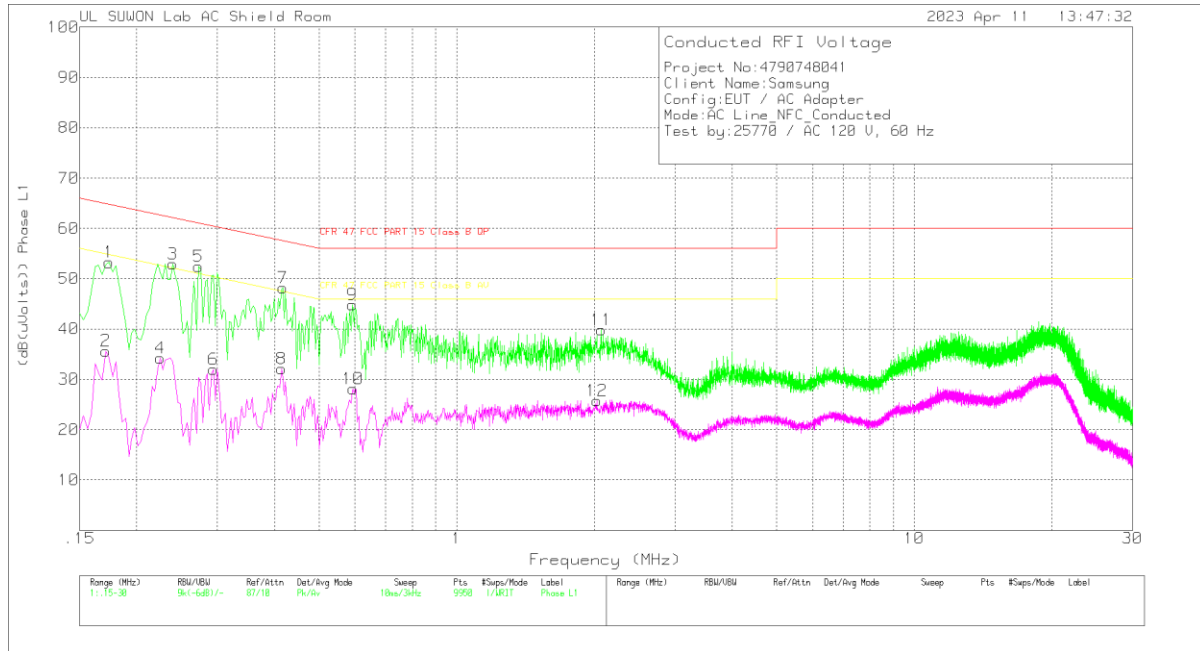
Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

No non-compliance noted:

WORST EMISSIONS(Terminated)

LINE 1 PLOT



LINE 1 RESULTS

Trace Markers

Range 1: Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101836_Wit h EX_L1[dB]	CABLELOS S(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
1	.174	43.04	Pk	10	.2	53.24	64.77	-11.53	-	-
2	.171	25.46	Av	10	.2	35.66	-	-	54.91	-19.25
3	.24	43.02	Pk	9.7	.2	52.92	62.1	-9.18	-	-
4	.225	24.38	Av	9.7	.2	34.28	-	-	52.63	-18.35
5	.273	42.68	Pk	9.6	.2	52.48	61.03	-8.55	-	-
6	.294	22.11	Av	9.7	.2	32.01	-	-	50.41	-18.4
7	.417	38.22	Pk	9.8	.2	48.22	57.51	-9.29	-	-
8	.414	22.12	Av	9.8	.2	32.12	-	-	47.57	-15.45
9	.591	34.84	Pk	9.8	.2	44.84	56	-11.16	-	-
10	.594	18.11	Av	9.8	.2	28.11	-	-	46	-17.89
11	2.07	29.84	Pk	9.7	.3	39.84	56	-16.16	-	-
12	2.025	15.7	Av	9.7	.3	25.7	-	-	46	-20.3

Pk - Peak detector

Av - Average detection

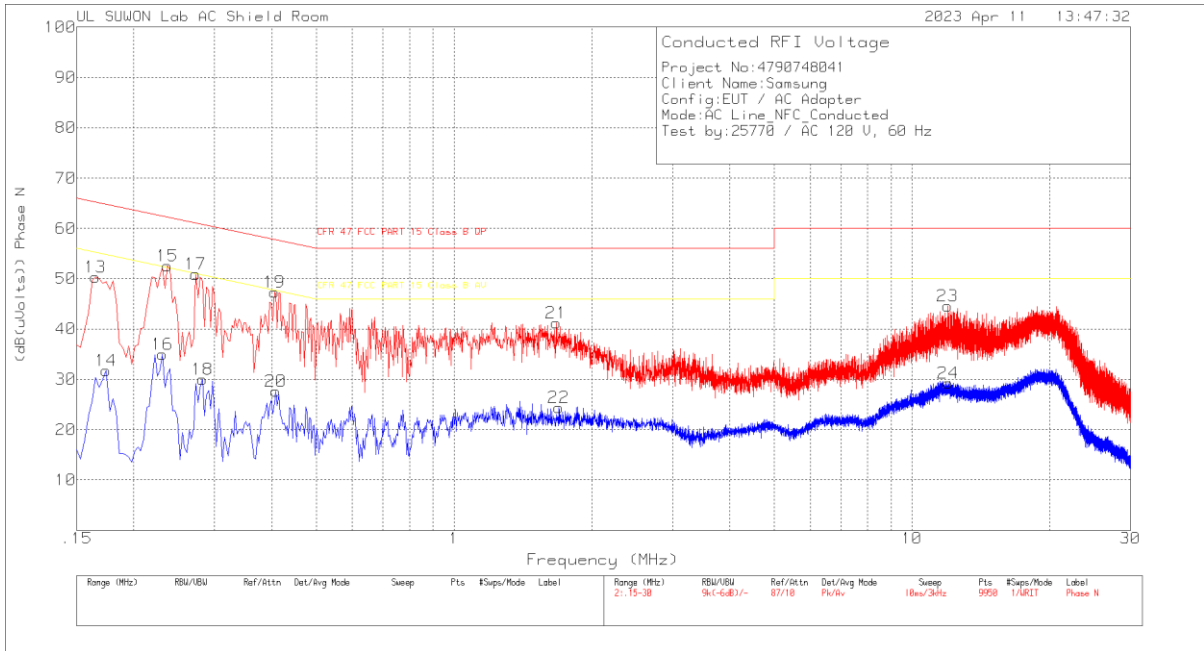
Quasi-Peak Emissions

Range 1: Phase L1 .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	101836_With EX_L1[dB]	CABLELOS S(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
.24075	40.47	Qp	9.7	.2	50.37	62.07	-11.7	-	-
.27225	22.6	Qp	9.6	.2	32.4	61.05	-28.65	-	-
.41625	18.26	Qp	9.8	.2	28.26	57.52	-29.26	-	-

Qp - Quasi-Peak detector

LINE 2 PLOT



LINE 2 RESULTS

Trace Markers

Range 2: Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101836_With EX_N[dB]	CABLELOS S(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
13	.165	40.25	Pk	9.9	.1	50.25	65.21	-14.96	-	-
14	.174	21.53	Av	10	.2	31.73	-	-	54.77	-23.04
15	.237	42.63	Pk	9.7	.2	52.53	62.2	-9.67	-	-
16	.231	25.11	Av	9.7	.2	35.01	-	-	52.41	-17.4
17	.273	41.07	Pk	9.6	.2	50.87	61.03	-10.16	-	-
18	.282	20.07	Av	9.7	.2	29.97	-	-	50.76	-20.79
19	.405	37.29	Pk	9.8	.2	47.29	57.75	-10.46	-	-
20	.408	17.65	Av	9.8	.2	27.65	-	-	47.69	-20.04
21	1.674	31.22	Pk	9.7	.3	41.22	56	-14.78	-	-
22	1.692	14.44	Av	9.7	.3	24.44	-	-	46	-21.56
23	11.958	34.22	Pk	10	.3	44.52	60	-15.48	-	-
24	12.009	18.9	Av	10	.3	29.2	-	-	50	-20.8

Pk - Peak detector

Av - Average detection

Quasi-Peak Emissions

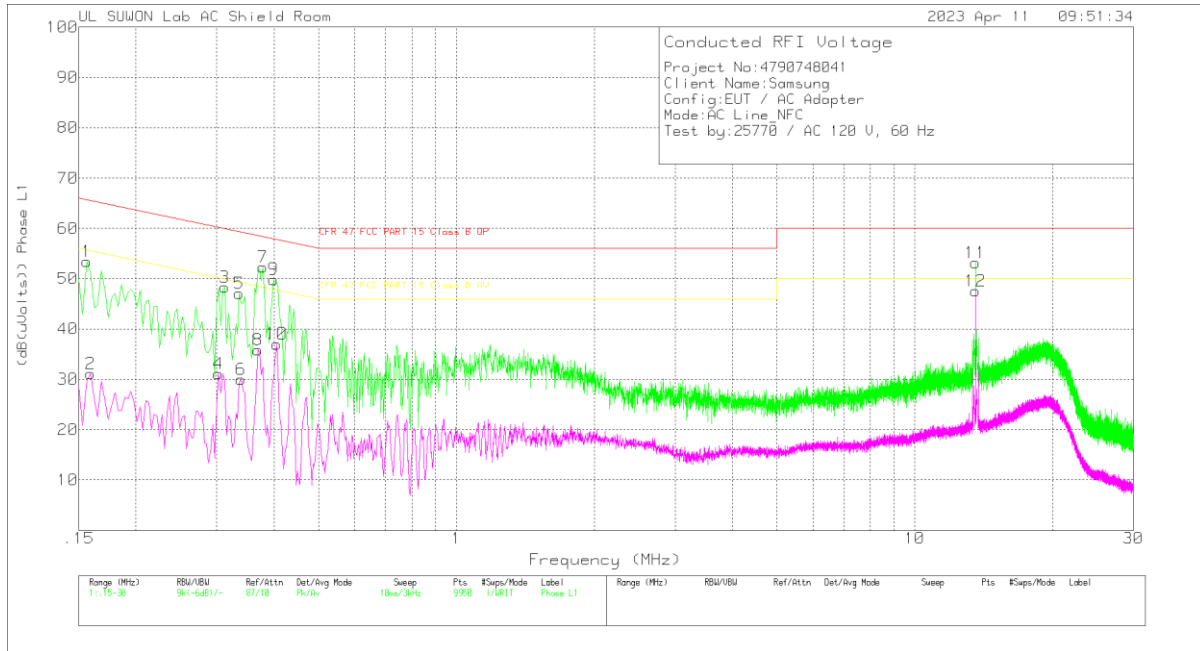
Range 2: Phase N .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	101836_With EX_N[dB]	CABLELOS S(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
.23775	38.74	Qp	9.7	.2	48.64	62.17	-13.53	-	-

Qp - Quasi-Peak detector

WORST EMISSIONS(non-Terminated)

LINE 1 PLOT



LINE 1 RESULTS

Trace Markers

Range 1: Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101836_Wit h EX_L1[dB]	CABLELOS S(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
1	.156	43.53	Pk	9.8	.1	53.43	65.67	-12.24	-	-
2	.159	21.17	Av	9.8	.1	31.07	-	-	55.52	-24.45
3	.312	38.45	Pk	9.7	.2	48.35	59.92	-11.57	-	-
4	.303	21.23	Av	9.7	.2	31.13	-	-	50.16	-19.03
5	.336	37.12	Pk	9.8	.2	47.12	59.3	-12.18	-	-
6	.339	20.04	Av	9.8	.2	30.04	-	-	49.23	-19.19
7	.378	42.25	Pk	9.8	.2	52.25	58.32	-6.07	-	-
8	.369	25.86	Av	9.8	.2	35.86	-	-	48.52	-12.66
9	.399	39.87	Pk	9.8	.2	49.87	57.87	-8	-	-
10	.405	27.03	Av	9.8	.2	37.03	-	-	47.75	-10.72
11	13.56	42.77	Pk	10	.4	53.17	60	-6.83	-	-
12	13.56	37.19	Av	10	.4	47.59	-	-	50	-2.41

Pk - Peak detector

Av - Average detection

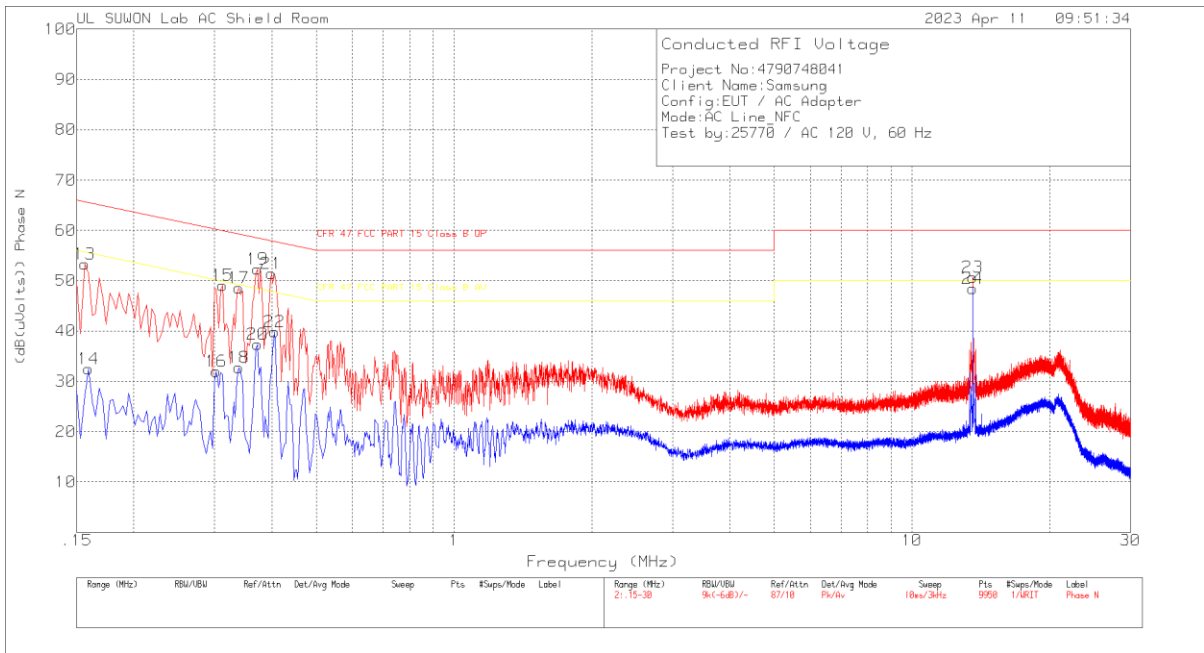
Quasi-Peak Emissions

Range 1: Phase L1 .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	101836_Wit h EX_L1[dB]	CABLELOS S(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
.37875	33.38	Qp	9.8	.2	43.38	58.31	-14.93	-	-
.39825	35.47	Qp	9.8	.2	45.47	57.89	-12.42	-	-
13.5602	41.47	Qp	10	.4	51.87	60	-8.13	-	-

Qp - Quasi-Peak detector

LINE 2 PLOT



LINE 2 RESULTS

Trace Markers

Range 2: Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101836_Wit h EX_N[dB]	CABLELOS S(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
13	.156	43.35	Pk	9.8	.1	53.25	65.67	-12.42	-	-
14	.159	22.59	Av	9.8	.1	32.49	-	-	55.52	-23.03
15	.312	39.2	Pk	9.7	.2	49.1	59.92	-10.82	-	-
16	.303	22.11	Av	9.7	.2	32.01	-	-	50.16	-18.15
17	.339	38.53	Pk	9.8	.2	48.53	59.23	-10.7	-	-
18	.339	22.79	Av	9.8	.2	32.79	-	-	49.23	-16.44
19	.372	42.28	Pk	9.8	.2	52.28	58.46	-6.18	-	-
20	.372	27.35	Av	9.8	.2	37.35	-	-	48.46	-11.11
21	.399	41.48	Pk	9.8	.2	51.48	57.87	-6.39	-	-
22	.405	29.85	Av	9.8	.2	39.85	-	-	47.75	-7.9
23	13.56	40.31	Pk	10	.4	50.71	60	-9.29	-	-
24	13.56	37.99	Av	10	.4	48.39	-	-	50	-1.61

Pk - Peak detector

Av - Average detection

Quasi-Peak Emissions

Range 2: Phase N .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	101836_Wit h EX_N[dB]	CABLELOS S(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
.37275	22.35	Qp	9.8	.2	32.35	58.44	-26.09	-	-
.39825	37.06	Qp	9.8	.2	47.06	57.89	-10.83	-	-
.40425	31.2	Qp	9.8	.2	41.2	57.77	-16.57	-	-
13.5602	39.24	Qp	10	.4	49.64	60	-10.36	-	-

Qp - Quasi-Peak detector

10. 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.

TEST PROCEDURE

ANSI C63.10 §6.8

RESULTS

No non-compliance noted.

Test Date	2023-3-29
Test Engineer	19568

Reference Frequency: EUT Channel 13.56 MHz @ 20°C Limit: ± 100 ppm = 1.356 kHz										
Power Supply (Vdc)	Envir. Temp (°C)	Frequency Deviation Measured with Time Elapse								
		Start up (MHz)	Delta (ppm)	@ 2mins (MHz)	Delta (ppm)	@ 5mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
3.88	50	13.559980538	-2.286	13.559973573	-2.800	13.559965117	-3.423	13.559956221	-4.079	100
3.88	40	13.560005516	-0.444	13.559994329	-1.269	13.559989943	0.000	13.559987955	-1.739	100
3.88	30	13.560025220	1.009	13.560019834	0.612	13.560013939	0.177	13.560012817	0.094	100
3.88	20	13.560011536	0	13.560019657	0.599	13.560023996	0.919	13.560028325	1.238	100
3.88	10	13.559991847	-1.452	13.559998028	-0.996	13.560022123	0.781	13.560038143	1.962	100
3.88	0	13.560055940	3.275	13.560059564	3.542	13.560068437	4.196	13.560075965	4.751	100
3.88	-10	13.560080455	5.083	13.560080678	5.099	13.560082890	5.262	13.560083924	5.338	100
3.88	-20	13.560081205	5.138	13.560077555	4.869	13.560072293	4.481	13.560066427	4.048	100
3.88	-30	13.560041448	2.206	15.560030945	147493.931	13.560019946	0.620	13.560009927	-0.119	100

Reference Frequency: EUT Channel 13.56 MHz @ 20°C Limit: ± 100 ppm = 1.356 kHz										
Power Supply (Vdc)	Envir. Temp (°C)	Frequency Deviation Measured with Time Elapse								
		Start up (MHz)	Delta (ppm)	@ 2mins (MHz)	Delta (ppm)	@ 5mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
3.70	20	13.560035473	0	13.560040497	0.371	13.560047478	0.885	13.560045719	0.756	100
3.88	20	13.560204361	12.455	13.560024103	-0.838	13.560026207	-0.683	13.560028808	-0.492	100
4.45	20	13.560018097	-1.281	13.560009115	-1.944	13.560012067	-1.726	13.560016599	-1.392	100

END OF TEST REPORT