



CERTIFICATION TEST REPORT

Report Number. : 4789497455-E7V2

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

Model : SM-N985F/DS, SM-N985F

FCC ID : A3LSMN985F

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

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

Date Of Issue:

July 08, 2020

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



ACCREDITED

Testing Laboratory

TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	07/02/20	Initial issue	Hyunsik Yun
V2	07/08/20	Updated to address TCB's question	Hyunsik Yun

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
1.1. INTRODUCTION OF TEST DATA REUSE	5
1.2. DIFFERENCE	5
1.3. SPOT CHECK VERIFICATION DATA.....	5
1.4. REFERENCE DETAIL.....	6
2. TEST METHODOLOGY	7
3. FACILITIES AND ACCREDITATION	7
4. CALIBRATION AND UNCERTAINTY	8
4.1. MEASURING INSTRUMENT CALIBRATION.....	8
4.2. SAMPLE CALCULATION.....	8
4.3. MEASUREMENT UNCERTAINTY	8
4.4. DECISION RULE	8
5. EQUIPMENT UNDER TEST	9
5.1. DESCRIPTION OF EUT.....	9
5.2. MAXIMUM E-FIELD STRENGTH.....	9
5.3. WORST-CASE CONFIGURATION AND MODE	9
5.4. DESCRIPTION OF TEST SETUP.....	10
6. TEST AND MEASUREMENT EQUIPMENT	12
7. 20dB BANDWIDTH	13
8. RADIATED EMISSION TEST RESULTS.....	14
8.1. LIMITS AND PROCEDURE	14
8.1.1. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz)	16
8.1.2. SPURIOUS EMISSION 0.009 TO 30 MHz	18
8.1.3. TX SPURIOUS EMISSION 30 TO 1000 MHz	20
8.1.4. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz) [EUT with passive TAG mode]	22
8.1.5. SPURIOUS EMISSION 0.09 TO 30 MHz [EUT with passive TAG mode].....	24
8.1.6. TX SPURIOUS EMISSION 30 TO 1000 MHz [EUT with passive TAG mode]	26
9. AC MAINS LINE CONDUCTED EMISSIONS	28
10. FREQUENCY STABILITY	31

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

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

MODEL NUMBER: SM-N985F/DS, SM-N985F

SERIAL NUMBER: R3CN40CD5BN, R3CN40CD4FP, R3CN40FXTJZ (RADIATED, Original); R38N406WLZB, R38N406WJAW(Spot-Check);

DATE TESTED: MAY 18, 2020 – JUN 15, 2020(Original); JUN 02, 2020 – JUN 26, 2020(Spot-Check);

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

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:



Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:



Hyunsik Yun
Suwon Lab Engineer
UL Korea, Ltd.

1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMN986B DXX NFC(FCC CFR 47 Part 15C). And the applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID.

1.2. DIFFERENCE

The FCC ID: A3LSMN985F shares the same enclosure and circuit board as FCC ID: A3LSMN986B. The NFC antennas and surrounding circuitry and layout are identical between these two units.

After confirming through preliminary radiated emissions that the performance of the FCC ID: A3LSMN986B remains representative of FCC ID: A3LSMN985F. The test data of FCC ID: A3LSMN986B being submitted for this application to cover NFC features.

1.3. SPOT CHECK VERIFICATION DATA

(Worst case of the radiated band-edge and radiated spurious emissions)

Band	Test Item	Mode	Frequency	Test Limit	Original model	Spot-check model	Deviation	Remark
					SM-N986B/DS Results	SM-N985F/DS Results		
					FCC ID : A3LSMN986B	FCC ID : A3LSMN985F		
NFC (13.56MHz)	FUND.	Tag Y position	13.56 MHz	84 dBuV/m	17.23 dBuV/m	18.14 dBuV/m	0.91 dB	-
	RSE	Tag Y position	2.60 MHz	29.5 dBuV/m	9.76 dBuV/m	9.67 dBuV/m	-0.09 dB	-

Comparison of two models, upper deviation is within 3 dB range and all test results are under FCC Technical Limits.

1.4. REFERENCE DETAIL

Reference application that contains the reused reference data in the individual test reports:

Equipment Class	Reference FCC ID (Parent)	Application Type	Reference Test report number	Exhibit Type	Variant Test Report Number	Data Re-used
PCE	A3LSMN986B	Original Grant	4789468331-E2	Test Report	4789497455-E2	All
DTS	A3LSMN986B	Original Grant	4789468331-E3 (802.11b/g/n/ax)	Test Report	4789497455-E3 (802.11b/g/n/ax)	All
			4789468331-E4 Bluetooth LE	Test Report	4789497455-E4 Bluetooth LE	All
DSS	A3LSMN986B	Original Grant	4789468331-E5 (Bluetooth)	Test Report	4789497455-E5 (Bluetooth)	All
NII	A3LSMN986B	Original Grant	4789468331-E6 (802.11a/n/ac/ax)	Test Report	4789497455-E6 (802.11a/n/ac/ax)	All
DXX	A3LSMN986B	Original Grant	4789468331-E7 (NFC)	Test Report	4789497455-E7 (NFC)	All
DCD	A3LSMN986B	Original Grant	4789468331-E8 (WPT)	Test Report	4789497455-E8 (WPT)	All

For this application the data reuse is summarized below for each equipment class:

Equipment Class	Reference FCC ID (Parent)	Application Type	Test Item	Data Re-used
PCE	A3LSMN986B	Original Grant	WWAN	All except SAR (full test), HAC (full test)
DTS	A3LSMN986B	Original Grant	BLE	All
			WLAN	All except SAR (full test), HAC (full test)
			WLAN 802.11ax	All except HAC (full test)
DSS	A3LSMN986B	Original Grant	BT	All except SAR (full test)
NII	A3LSMN986B	Original Grant	WLAN	All except SAR (full test), HAC (full test)
			WLAN 802.11ax	All except HAC (full test)
DXX	A3LSMN986B	Original Grant	NFC	All
DCD	A3LSMN986B	Original Grant	WPT	All except RF exposure

2. TEST METHODOLOGY

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

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. ANSI C63.10-2013.
4. 414788 D01 Radiated Test Site v01r01
5. KDB 484596 D01 Referencing Test Data v01

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	
☐	Chamber 1
☒	Chamber 2
☐	Chamber 3

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:

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

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

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	2.35 dB
Radiated Disturbance, 9 kHz to 30 MHz	1.72 dB
Radiated Disturbance, 30 MHz to 1 GHz	3.49 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 1, Clause 4.4.2 in IEC Guide 115:2007.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

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

This report covers the Samsung models SM-N986B/DS and SM-N986B. These models are identical in hardware except SM-N986B has single SIM tray. With some pre-scan, model SM-N986B/DS 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 17.23 dBuV/m which convert from 3 meter data.

5.3. 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 in three orthogonal orientations X, Y and Z. It was determined that the Y orientation was the worst-case orientation; therefore all final radiated testing was performed with the EUT in the Y orientation while generating continuous emissions.

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	R37N39301T8SE3	N/A
Data Cable	SAMSUNG	EP-DG980	N/A	N/A

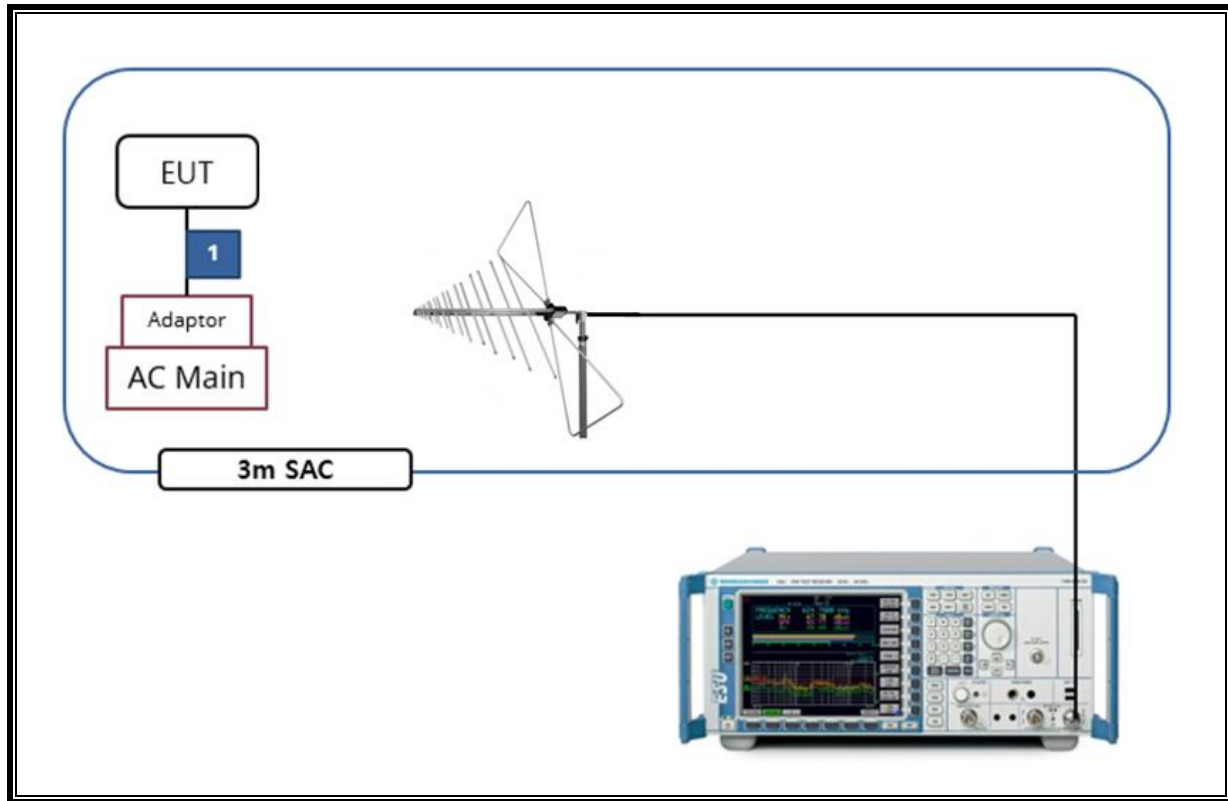
I/O CABLE

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	1.1m	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	New Cal Due
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00167211	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00161451	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168724	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168717	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00205959	08-04-20
Antenna, Horn, 40 GHz	ETS	3116C	00166155	08-14-20
Antenna, Horn, 40 GHz	ETS	3116C	00168645	10-02-21
Preamplifier	ETS	3116C-PA	00168841	08-08-20
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-05-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-06-20
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-06-20
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-06-20
Spectrum Analyzer, 43.5 GHz	R&S	FSW43	104089	08-06-20
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-09-20
Attenuator	PASTERNAK	PE7087-10	A001	08-08-20
Attenuator	PASTERNAK	PE7087-10	A008	08-08-20
Attenuator	PASTERNAK	PE7004-10	2	08-06-20
Attenuator	PASTERNAK	PE7087-10	A009	08-08-20
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-06-20
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-06-20
EMI Test Receive, 44 GHz	R&S	ESW44	101590	08-05-20
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-05-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-06-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-06-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	020	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	08-06-20
LISN	R&S	ENV-216	101837	08-09-20
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	10-02-21
Antenna, Loop, 9kHz-30MHz				
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	437.20

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 field strength from µV/m to dBµV/m is:

Limit (dBµV/m) = 20 log limit (µV/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

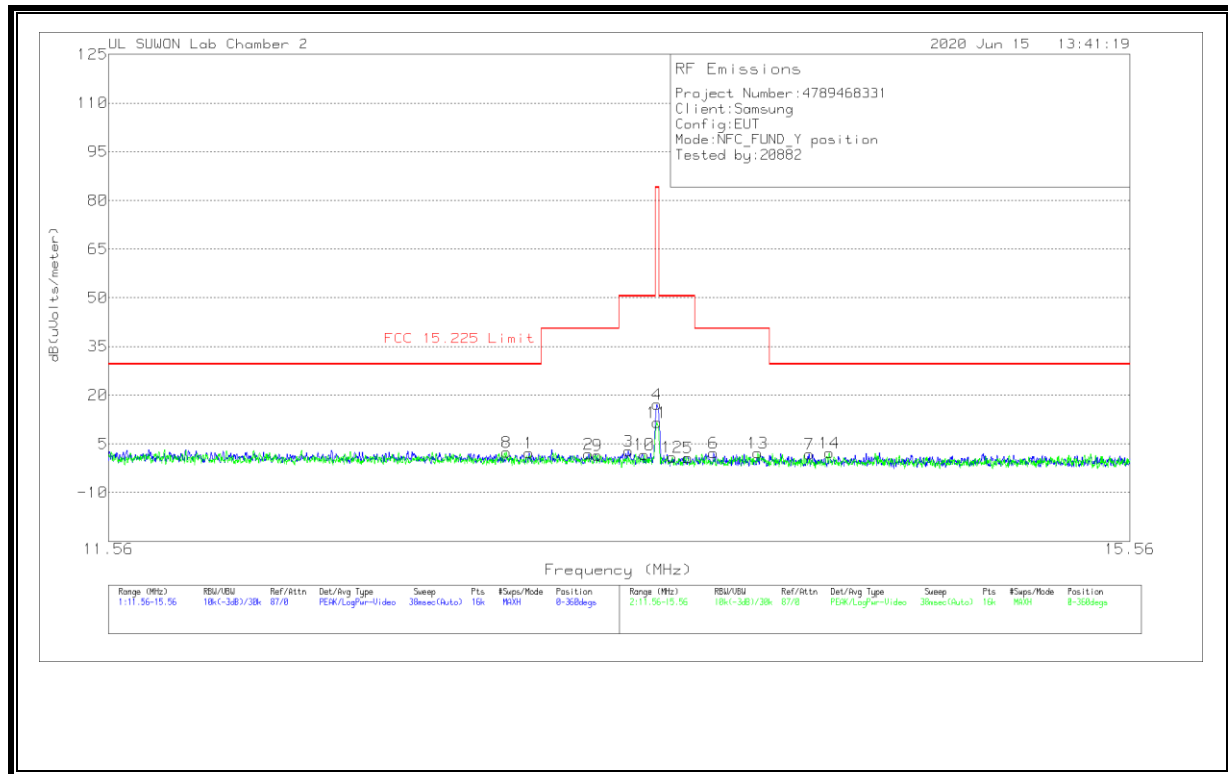
ANSI C63.10-2013

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)



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	13.06488	21.69	Pk	20	-40	.5	2.19	29.54	-27.35	0-360
2	13.29338	21.35	Pk	20	-40	.5	1.85	40.51	-38.66	0-360
3	13.4475	22.29	Pk	20	-40	.5	2.79	50.5	-47.71	0-360
**4	13.56	36.68	Pk	20	-40	.5	17.18	84	-66.82	0-360
5	13.684	20.18	Pk	20	-40	.6	.78	50.5	-49.72	0-360
6	13.78525	21.55	Pk	20	-40	.6	2.15	40.51	-38.36	0-360
7	14.17388	21.3	Pk	20	-40	.6	1.9	29.54	-27.64	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	12.97838	21.97	Pk	20	-40	.5	2.47	29.54	-27.07	0-360
9	13.32838	21.05	Pk	20	-40	.5	1.55	40.51	-38.96	0-360
10	13.51063	21.26	Pk	20	-40	.5	1.76	50.5	-48.74	0-360
**11	13.55988	31.13	Pk	20	-40	.5	11.63	84	-72.37	0-360
12	13.62088	20.28	Pk	20	-40	.6	.88	50.5	-49.62	0-360
13	13.96388	21.61	Pk	20	-40	.6	2.21	40.51	-38.3	0-360
14	14.25688	21.57	Pk	20	-40	.6	2.17	29.54	-27.37	0-360

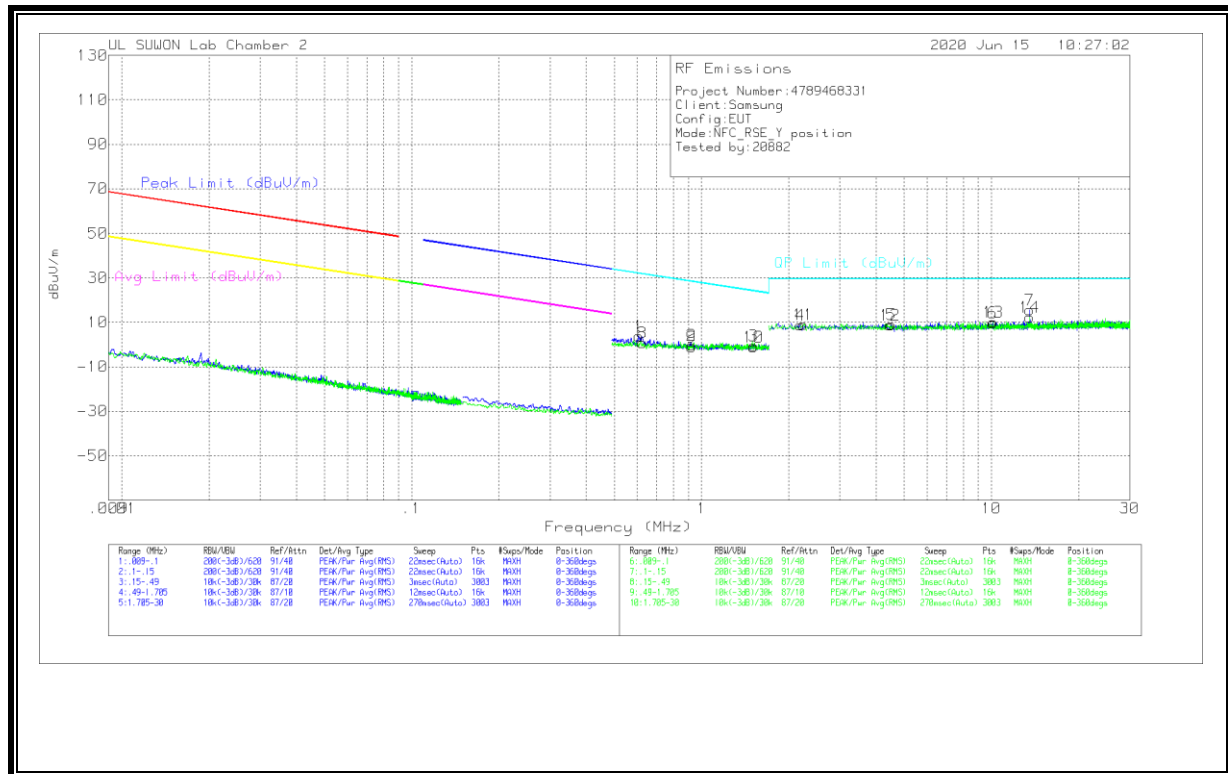
Pk - Peak detector

** 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



Trace Markers

[Face On]

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)
1	.60734	23.96	Pk	19.7	.1	-40	3.76	31.94	-28.18	0-360
2	.92339	19.75	Pk	19.8	.2	-40	-.25	28.31	-28.56	0-360
3	1.50916	19.5	Pk	19.8	.2	-40	-.5	24.06	-24.56	0-360
4	2.18568	28.72	Pk	19.9	.2	-40	8.82	29.5	-20.68	0-360
5	4.50423	28.98	Pk	19.8	.3	-40	9.08	29.5	-20.42	0-360
6	10.09325	29.36	Pk	20	.5	-40	9.86	29.5	-19.64	0-360
**7	13.56165	35.14	Pk	20	.5	-40	15.64	29.5	-13.86	0-360

[Face Off]

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)
8	.62577	20.95	Pk	19.7	.1	-40	.75	31.68	-30.93	0-360
9	.92499	19.01	Pk	19.8	.2	-40	-.99	28.3	-29.29	0-360
10	1.51304	18.78	Pk	19.8	.2	-40	-1.22	24.03	-25.25	0-360
11	2.24223	28.96	Pk	19.9	.2	-40	9.06	29.5	-20.44	0-360
12	4.46653	28.63	Pk	19.8	.3	-40	8.73	29.5	-20.77	0-360
13	10.13095	29.53	Pk	20	.5	-40	10.03	29.5	-19.47	0-360
**14	13.56165	31.72	Pk	20	.5	-40	12.22	29.5	-17.28	0-360

Pk - Peak detector

** Fundamental

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

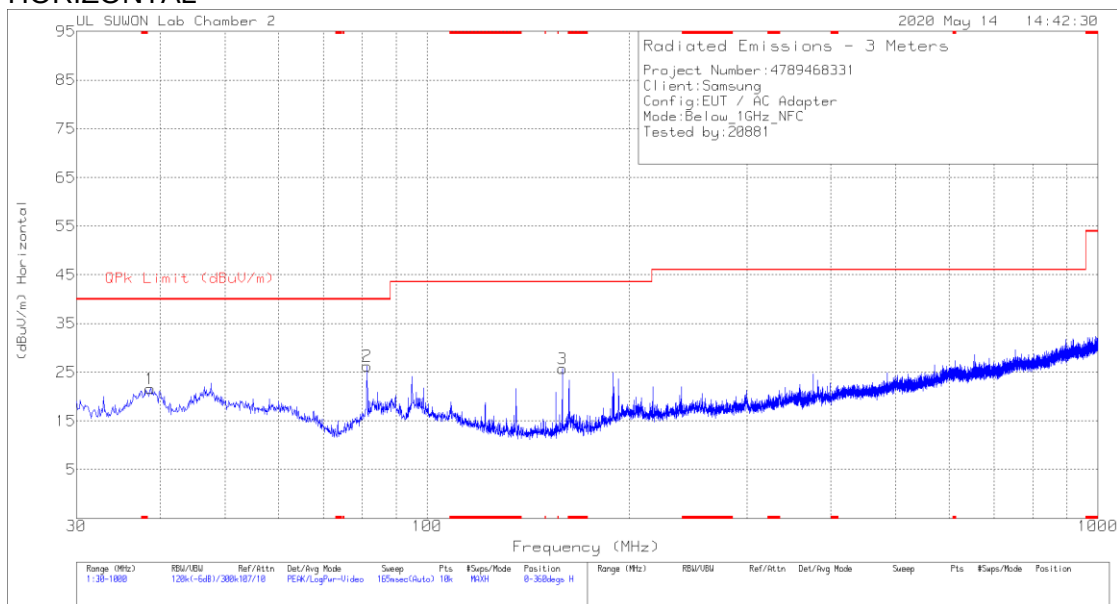
Please refer to section 8.1.1 about the fundamental level.

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

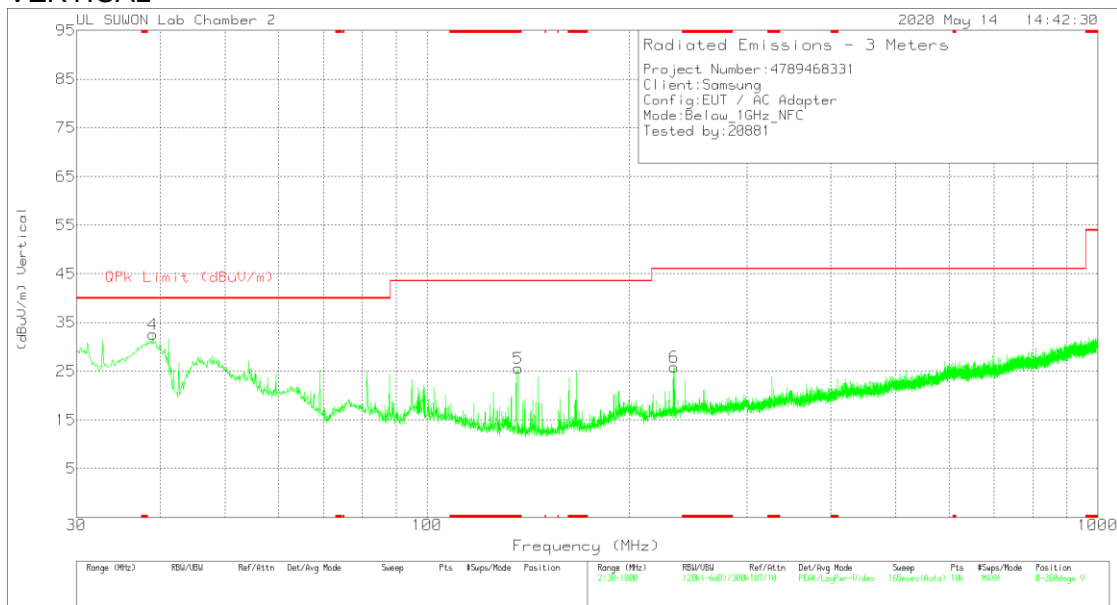
Note 2: Radiated test were investigated with three receiving antenna axes: Face-on, Face-off and horizontal (parallel to the ground plane) and the worse orientations of Face-on and Face-off were set for final test.

8.1.3. TX SPURIOUS EMISSION 30 TO 1000 MHz

HORIZONTAL



VERTICAL



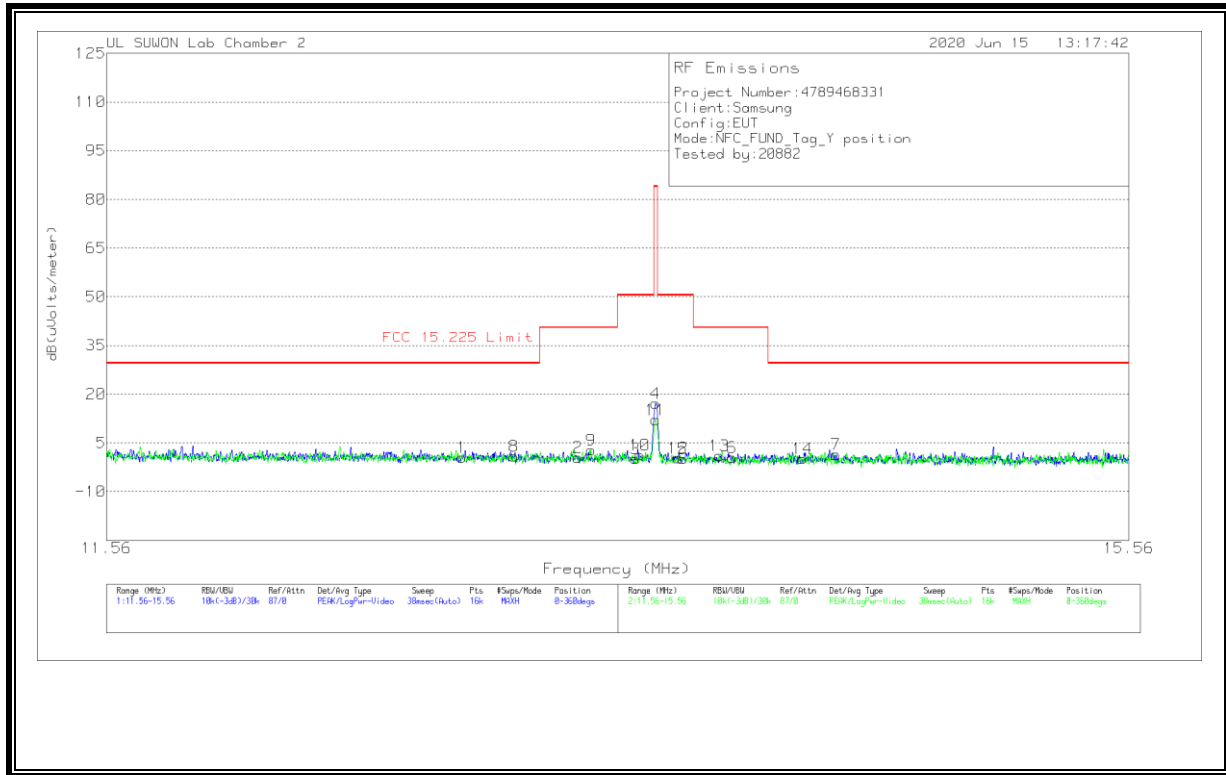
Trace Markers

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	38.633	35.35	Pk	18.2	-31.9	21.65	40	-18.35	0-360	300	H
2	81.313	45	Pk	12.7	-31.4	26.3	40	-13.7	0-360	400	H
3	159.01	42.27	Pk	14.5	-31	25.77	43.52	-17.75	0-360	200	H
4	39.021	46.17	Pk	18.4	-32	32.57	40	-7.43	0-360	100	V
5	* 136.7	42.75	Pk	14.1	-31.2	25.65	43.52	-17.87	0-360	100	V
6	233.7	38.51	Pk	18.2	-30.8	25.91	46.02	-20.11	0-360	200	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 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	12.817	20.07	Pk	20	-40	.5	.57	29.54	-28.97	0-360
2	13.25838	20.01	Pk	20	-40	.5	.51	40.51	-40	0-360
3	13.48213	19.73	Pk	20	-40	.5	.23	50.5	-50.27	0-360
**4	13.56113	36.73	Pk	20	-40	.5	17.23	84	-66.77	0-360
5	13.66938	19.65	Pk	20	-40	.6	.25	50.5	-50.25	0-360
6	13.86638	20.02	Pk	20	-40	.6	.62	40.51	-39.89	0-360
7	14.29138	20.79	Pk	20	-40	.6	1.39	29.54	-28.15	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	13.01288	20.34	Pk	20	-40	.5	.84	29.54	-28.7	0-360
9	13.30788	22.22	Pk	20	-40	.5	2.72	40.51	-37.79	0-360
10	13.49725	20.81	Pk	20	-40	.5	1.31	50.5	-49.19	0-360
**11	13.56	31.71	Pk	20	-40	.5	12.21	84	-71.79	0-360
12	13.65013	19.83	Pk	20	-40	.6	.43	50.5	-50.07	0-360
13	13.813	20.51	Pk	20	-40	.6	1.11	40.51	-39.4	0-360
14	14.15188	19.49	Pk	20	-40	.6	.09	29.54	-29.45	0-360

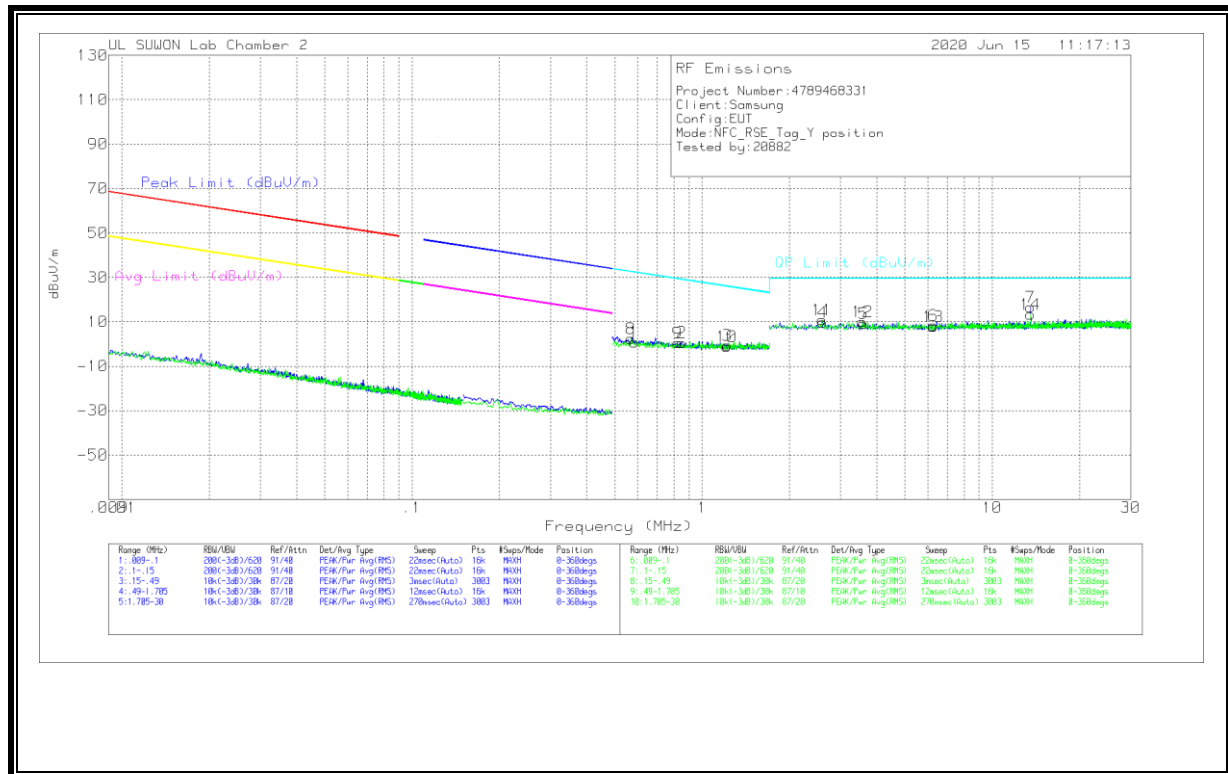
Pk - Peak detector

** 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 with passive TAG mode]



Trace Markers

[Face On]

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)
1	.58451	20.89	Pk	19.7	.1	-40	.69	32.27	-31.58	0-360
2	.85047	20.67	Pk	19.8	.2	-40	.67	29.02	-28.35	0-360
3	1.22488	19.33	Pk	19.8	.2	-40	-.67	25.86	-26.53	0-360
4	2.60038	29.56	Pk	19.9	.3	-40	9.76	29.5	-19.74	0-360
5	3.59	29.09	Pk	19.9	.3	-40	9.29	29.5	-20.21	0-360
6	6.2667	28.04	Pk	19.9	.4	-40	8.34	29.5	-21.16	0-360
**7	13.56165	36.16	Pk	20	.5	-40	16.66	29.5	-12.84	0-360

[Face Off]

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)
8	.56885	22.65	Pk	19.7	.1	-40	2.45	32.51	-30.06	0-360
9	.82269	20.53	Pk	19.8	.2	-40	.53	29.31	-28.78	0-360
10	1.218	18.83	Pk	19.8	.2	-40	-1.17	25.91	-27.08	0-360
11	2.59095	30.67	Pk	19.9	.3	-40	10.87	29.5	-18.63	0-360
12	3.57115	29.8	Pk	19.9	.3	-40	10	29.5	-19.5	0-360
13	6.24785	27.64	Pk	19.8	.4	-40	7.84	29.5	-21.66	0-360
**14	13.56165	32.76	Pk	20	.5	-40	13.26	29.5	-16.24	0-360

Pk - Peak detector

** Fundamental

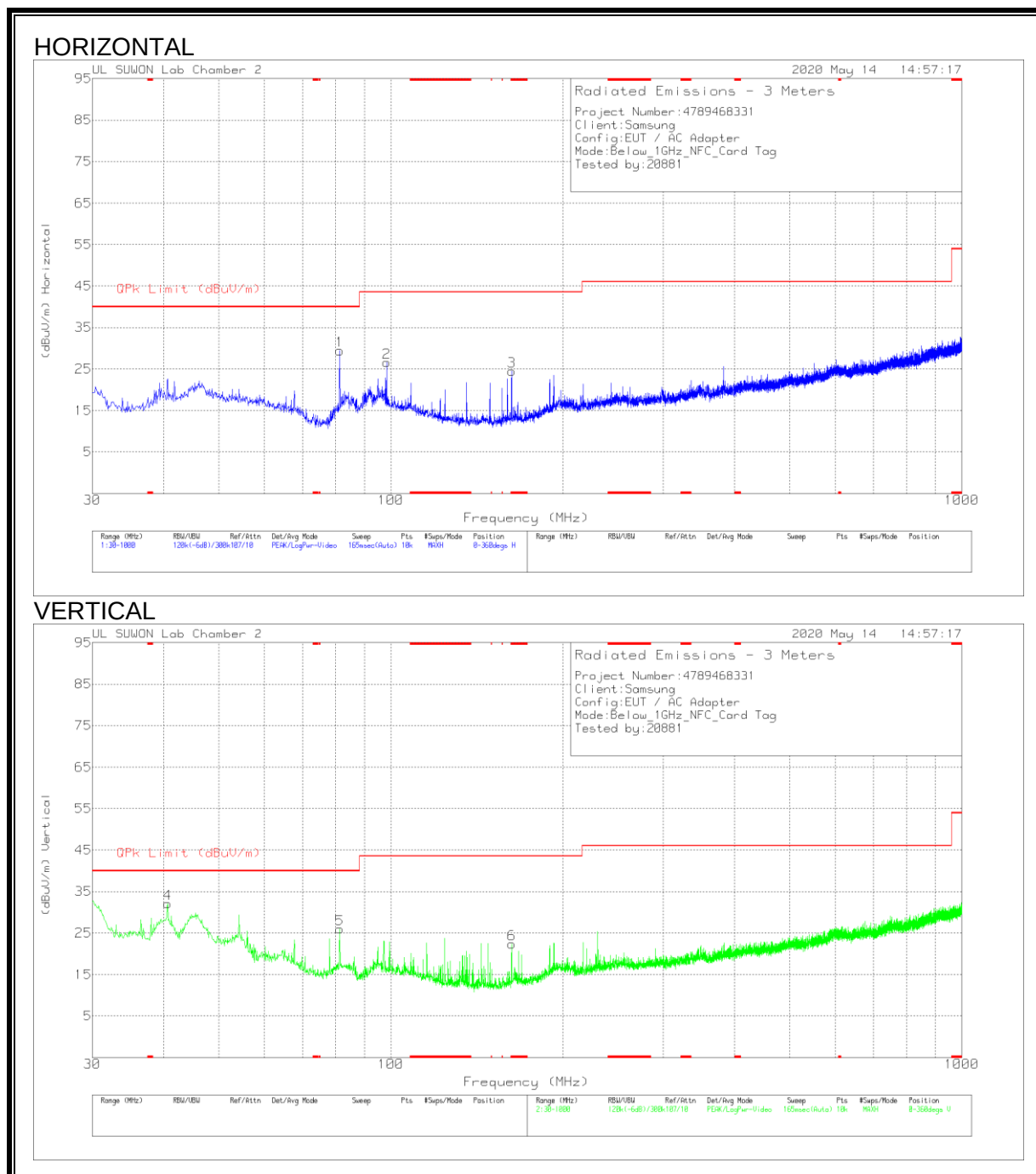
Note 1: The data for marker number 7 and 14 are the fundamental signal.

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 with passive TAG mode]**



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	81.313	48.12	Pk	12.7	-31.4	29.42	40	-10.58	0-360	400	H
2	98.288	40.42	Pk	17.6	-31.4	26.62	43.52	-16.9	0-360	300	H
3	* 162.696	40.74	Pk	14.7	-31	24.44	43.52	-19.08	0-360	200	H
4	40.67	45.04	Pk	18.9	-31.8	32.14	40	-7.86	0-360	100	V
5	81.313	44.73	Pk	12.7	-31.4	26.03	40	-13.97	0-360	100	V
6	* 162.696	38.67	Pk	14.7	-31	22.37	43.52	-21.15	0-360	200	V

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

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 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.

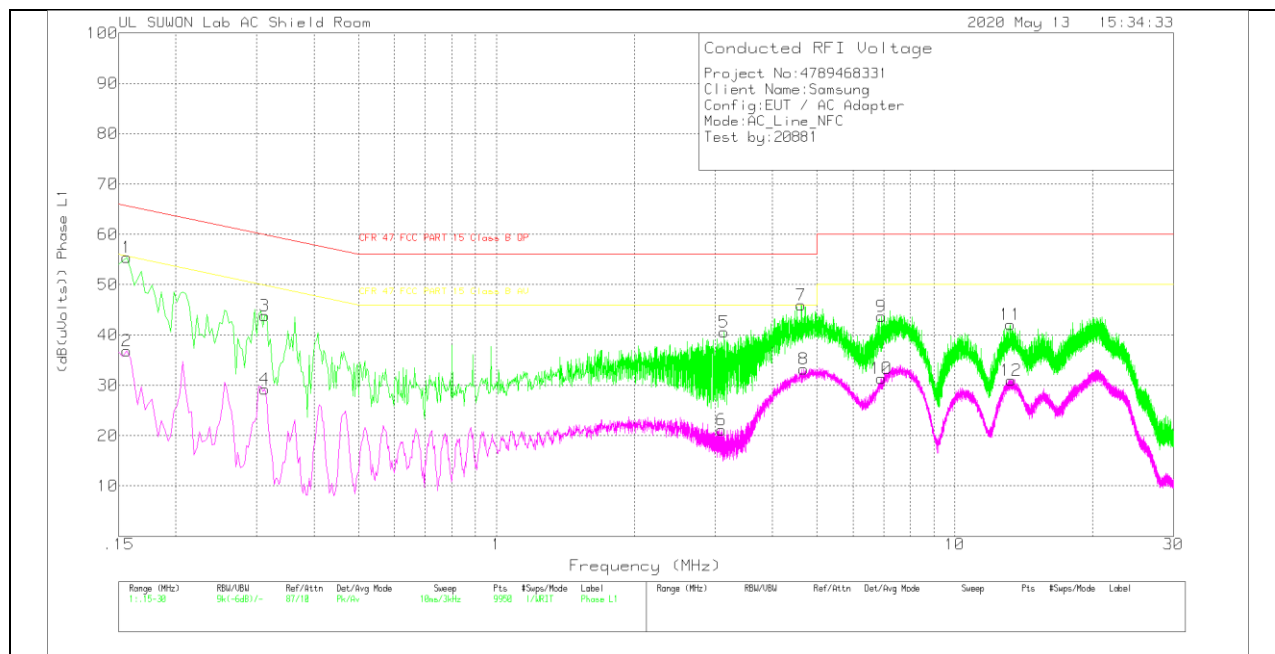
Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

No non-compliance noted:

WORST EMISSIONS

LINE 1 PLOT



LINE 1 RESULTS

Trace Markers

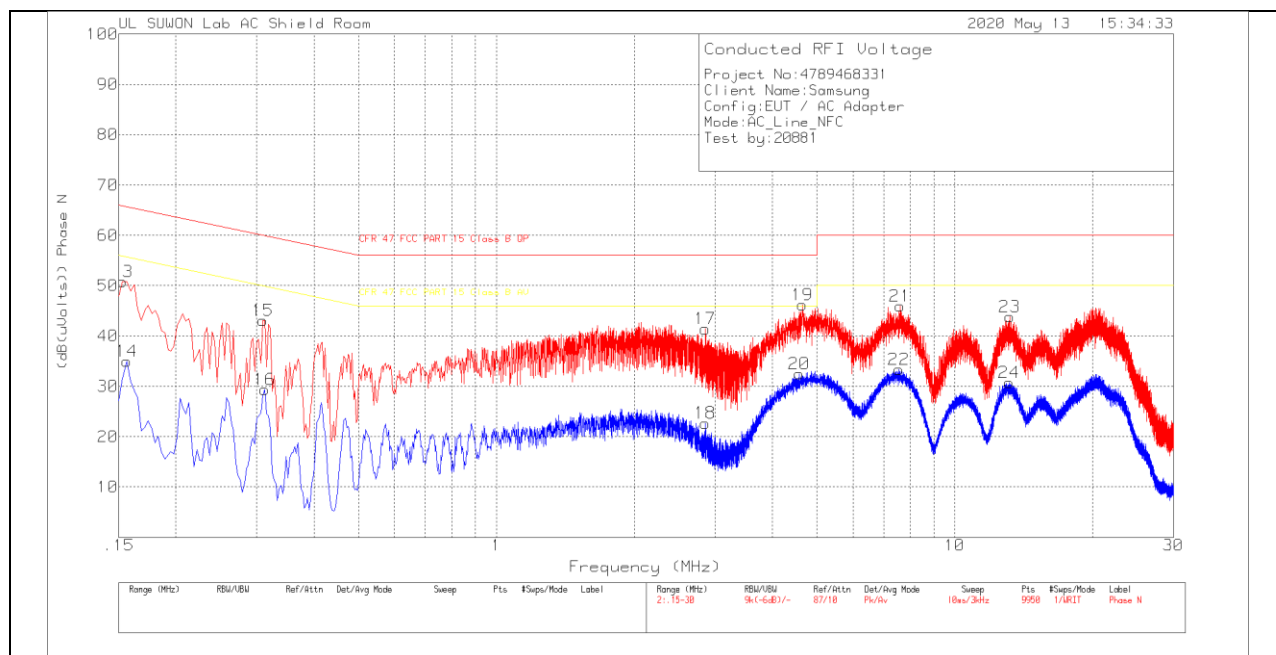
Range 1: Phase L1 .15 - 30MHz

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	45.43	Pk	9.9	.1	55.43	65.67	-10.24	-	-
2	.156	26.84	Av	9.9	.1	36.84	-	-	55.67	-18.83
3	.312	33.82	Pk	9.8	.2	43.82	59.92	-16.1	-	-
4	.312	19.22	Av	9.8	.2	29.22	-	-	49.92	-20.7
5	3.141	30.5	Pk	9.8	.3	40.6	56	-15.4	-	-
6	3.102	11.04	Av	9.8	.3	21.14	-	-	46	-24.86
7	4.623	35.9	Pk	9.8	.3	46	56	-10	-	-
8	4.686	23.18	Av	9.8	.3	33.28	-	-	46	-12.72
9	6.924	33.49	Pk	9.9	.3	43.69	60	-16.31	-	-
10	6.915	21.21	Av	9.9	.3	31.41	-	-	50	-18.59
11	13.239	31.59	Pk	10.1	.4	42.09	60	-17.91	-	-
12	13.287	20.52	Av	10.1	.4	31.02	-	-	50	-18.98

Pk - Peak detector

Av - Average detection

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	.153	40.9	Pk	9.8	.1	50.8	65.84	-15.04	-	-
14	.156	25.01	Av	9.9	.1	35.01	-	-	55.67	-20.66
15	.309	33.13	Pk	9.8	.2	43.13	60	-16.87	-	-
16	.312	19.34	Av	9.8	.2	29.34	-	-	49.92	-20.58
17	2.856	31.3	Pk	9.8	.3	41.4	56	-14.6	-	-
18	2.856	12.6	Av	9.8	.3	22.7	-	-	46	-23.3
19	4.65	36.05	Pk	9.8	.3	46.15	56	-9.85	-	-
20	4.578	22.42	Av	9.8	.3	32.52	-	-	46	-13.48
21	7.608	35.71	Pk	9.9	.3	45.91	60	-14.09	-	-
22	7.554	23.1	Av	9.9	.3	33.3	-	-	50	-16.7
23	13.173	33.34	Pk	10.1	.4	43.84	60	-16.16	-	-
24	13.152	20.28	Av	10.1	.4	30.78	-	-	50	-19.22

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)
4.64925	29.49	Qp	9.8	.3	39.59	56	-16.41	-	-

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

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	13.560630180	-0.117	13.560630520	-0.142	13.560630642	-0.151	13.560630627	-0.150	100
3.88	40	13.560629072	-0.035	13.560629159	-0.042	13.560629369	-0.057	13.560629595	-0.074	100
3.88	30	13.560628677	-0.006	13.560628718	-0.009	13.560628734	-0.010	13.560628771	-0.013	100
3.88	20	13.560628596	0	13.560628601	0.000	13.560628618	-0.002	13.560628618	-0.002	100
3.88	10	13.560628468	0.009	13.560628543	0.004	13.560628766	-0.013	13.560628995	-0.029	100
3.88	0	13.560629133	-0.040	13.560629156	-0.041	13.560629295	-0.052	13.560629472	-0.065	100
3.88	-10	13.560630228	-0.120	13.560630505	-0.141	13.560630614	-0.149	13.560630804	-0.163	100
3.88	-20	13.560630769	-0.160	13.560630625	-0.150	13.560630401	-0.133	13.560630171	-0.116	100
3.88	-30	13.560629779	-0.087	13.560629716	-0.083	13.560629781	-0.087	13.560629772	-0.087	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)
3.88	20	13.560628596	0	13.560628601	0.000	13.560628618	-0.002	13.560628618	-0.002	100
4.47	20	13.560628622	-0.002	13.560628653	-0.004	13.560628673	-0.004	13.560628670	-0.005	100
3.60	20	13.560628655	-0.004	13.560628676	-0.006	13.560628699	-0.006	13.560628694	-0.007	100

No non-compliance noted.

END OF TEST REPORT