



FCC CFR47 PART 15 SUBPART C

NFC

CERTIFICATION TEST REPORT

FOR

GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n, ANT+ and NFC

MODEL NUMBER : SM-A510F/DS, SM-A510F

FCC ID: A3LSMA510F

REPORT NUMBER: 15K22047-E4

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Prepared for
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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	11/26/15	Initial issue	SungGil Park

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. CALIBRATION AND UNCERTAINTY	5
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i>	5
4.2. <i>SAMPLE CALCULATION</i>	5
4.3. <i>MEASUREMENT UNCERTAINTY</i>	5
5. EQUIPMENT UNDER TEST	6
5.1. <i>DESCRIPTION OF EUT</i>	6
5.2. <i>MAXIMUM OUTPUT POWER</i>	6
5.3. <i>WORST-CASE CONFIGURATION AND MODE</i>	6
5.4. <i>MODIFICATIONS</i>	6
5.5. <i>DESCRIPTION OF TEST SETUP</i>	7
6. TEST AND MEASUREMENT EQUIPMENT	10
7. RADIATED EMISSION TEST RESULTS	11
7.1. <i>LIMITS AND PROCEDURE</i>	11
7.1.1. <i>FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz)</i>	13
7.1.2. <i>TX SPURIOUS EMISSION 30 TO 1000 MHz</i>	14
8. AC MAINS LINE CONDUCTED EMISSIONS	16
9. FREQUENCY STABILITY	21
10. SETUP PHOTOS	22

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, ANT+ and NFC
MODEL NUMBER: SM-A510F/DS
SERIAL NUMBER: R38FA0JNM9W/ 330091e6a336920d (RADIATED);
3300228292a67257 (CONDUCTED)
DATE TESTED: OCT 19, 2015 - NOV 26, 2015

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.

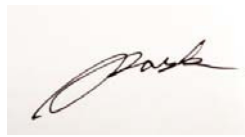
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration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



CY Choi
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:



SungGil Park
Suwon Lab Engineer
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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

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 checked="" type="checkbox"/>	Chamber 1
<input checked="" type="checkbox"/>	Chamber 2

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <http://www.iasonline.org/PDF/TL/TL-637.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:

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

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	2.32 dB
Radiated Disturbance, Below 1GHz	4.14 dB

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

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, ANT+ and NFC. This test report addresses the DXX (NFC) operational mode.

5.2. MAXIMUM OUTPUT POWER

The testing was performed at 1 meter. The transmitter maximum E-field at 30m distance is 14.50 dBuV/m which convert from 1 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 Z-orientation was the worst-case orientation; therefore all final radiated testing was performed with the EUT in the Z-orientation while generating continuous emissions.

5.4. MODIFICATIONS

No modifications were made during testing.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA20UWE	R37G9EN04S1DK3	N/A
Data Cable	SAMSUNG	ECB-DU4AWE	N/A	N/A
Earphone	SAMSUNG	GH59-11720H	N/A	N/A

I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	Mini-USB	Shielded	0.8m	N/A
2	Audio	1	Mini-Jack	Unshielded	1.0m	N/A

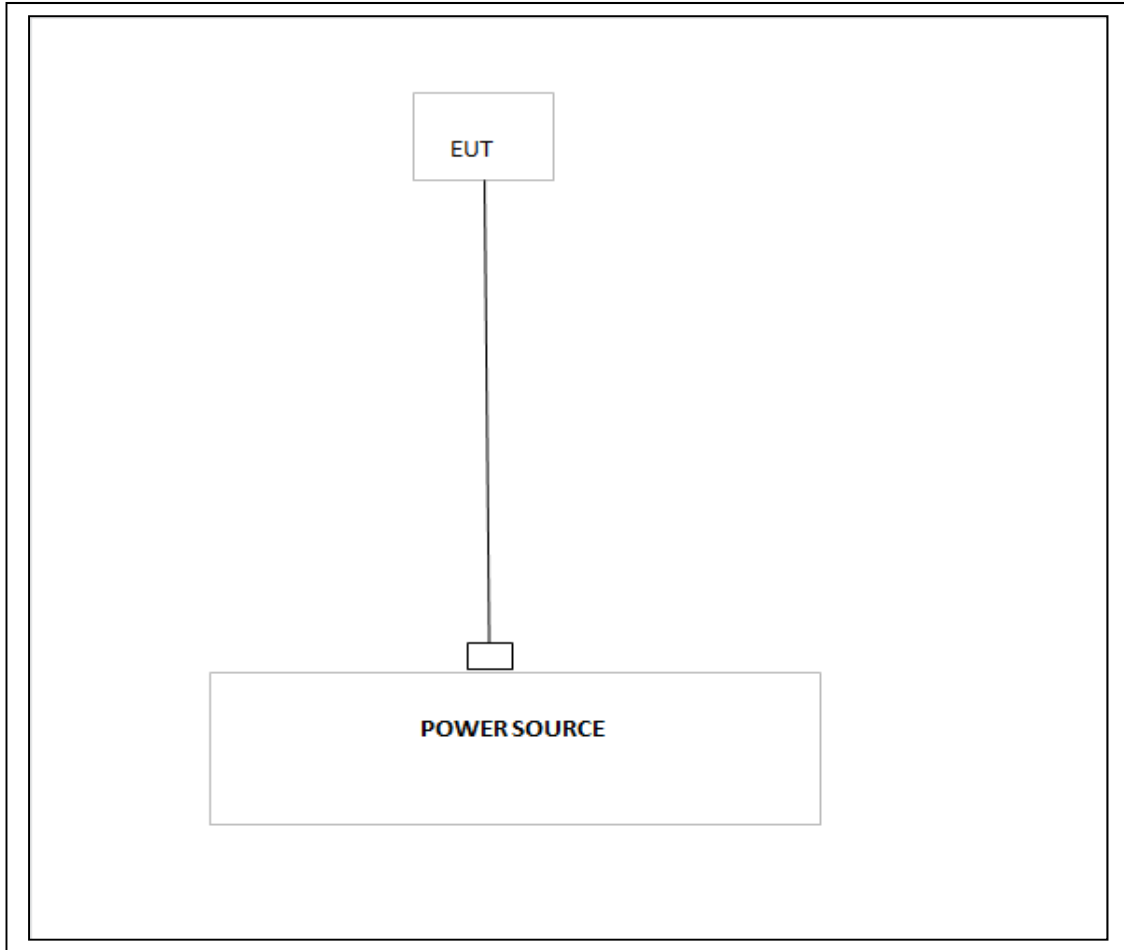
TEST SETUP

The EUT is a stand-alone device configured and tested in a worst-case setup.

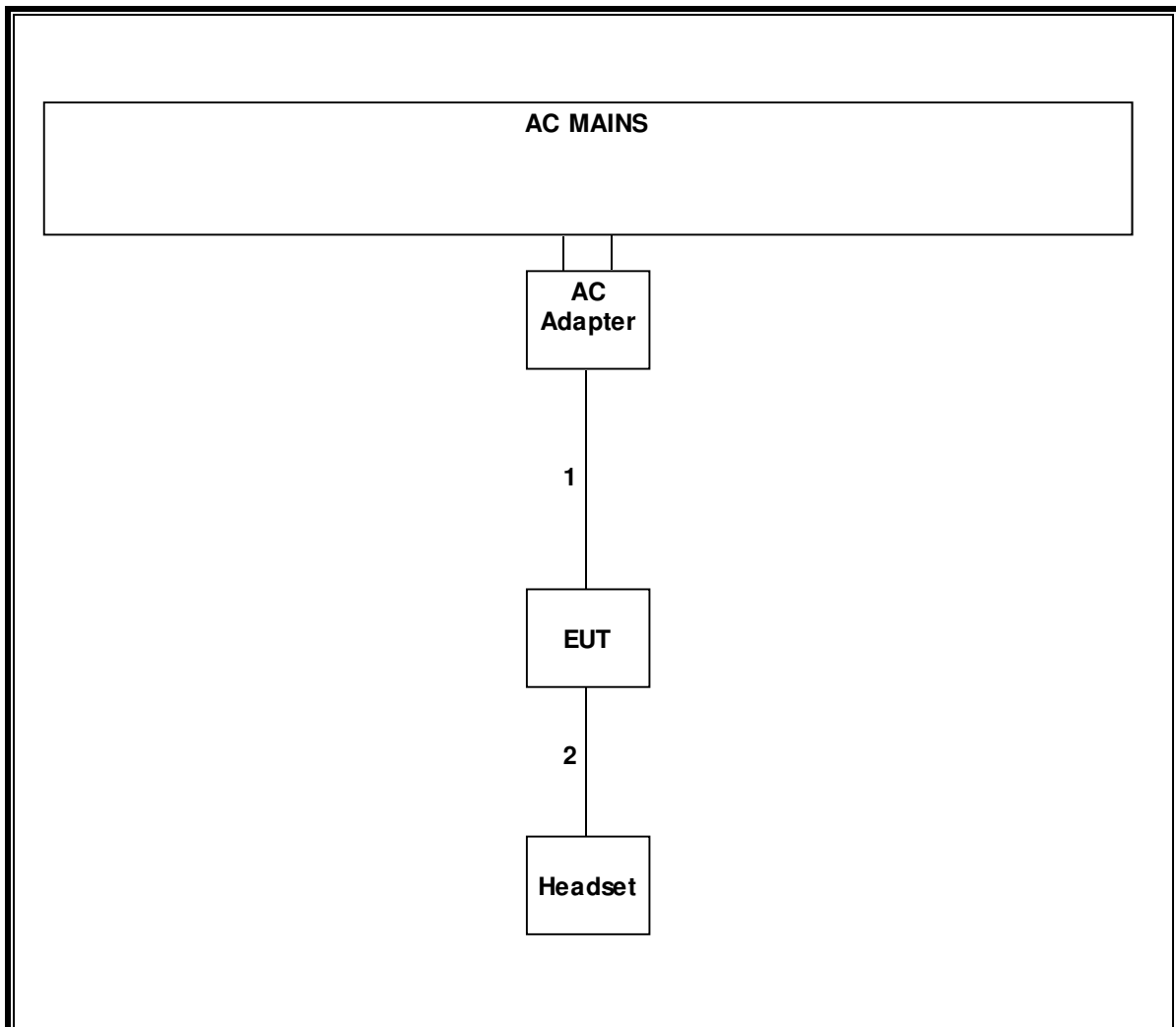
Note: worst case is using worst case orientation with AC charger and headset attached to the EUT with NFC signal continuously transmitting.

SETUP DIAGRAM FOR TESTS

Radiated Emissions Below 30 MHz:



Radiated Emissions Above 30 MHz, AC Line Conducted Emissions:



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	749	04-25-16
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	11-18-15
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-18-16
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-19-16
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-19-16
DC Power Supply	Agilent / HP	E3640A	MY54226395	08-18-16
Temperature Chamber	ESPEC	SH-642	93001109	08-18-16
LISN	R&S	ENV216	101836	08-19-16
LISN	R&S	ENV216	101837	08-19-16

7. RADIATED EMISSION TEST RESULTS

7.1. 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 C63.10-2009

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)

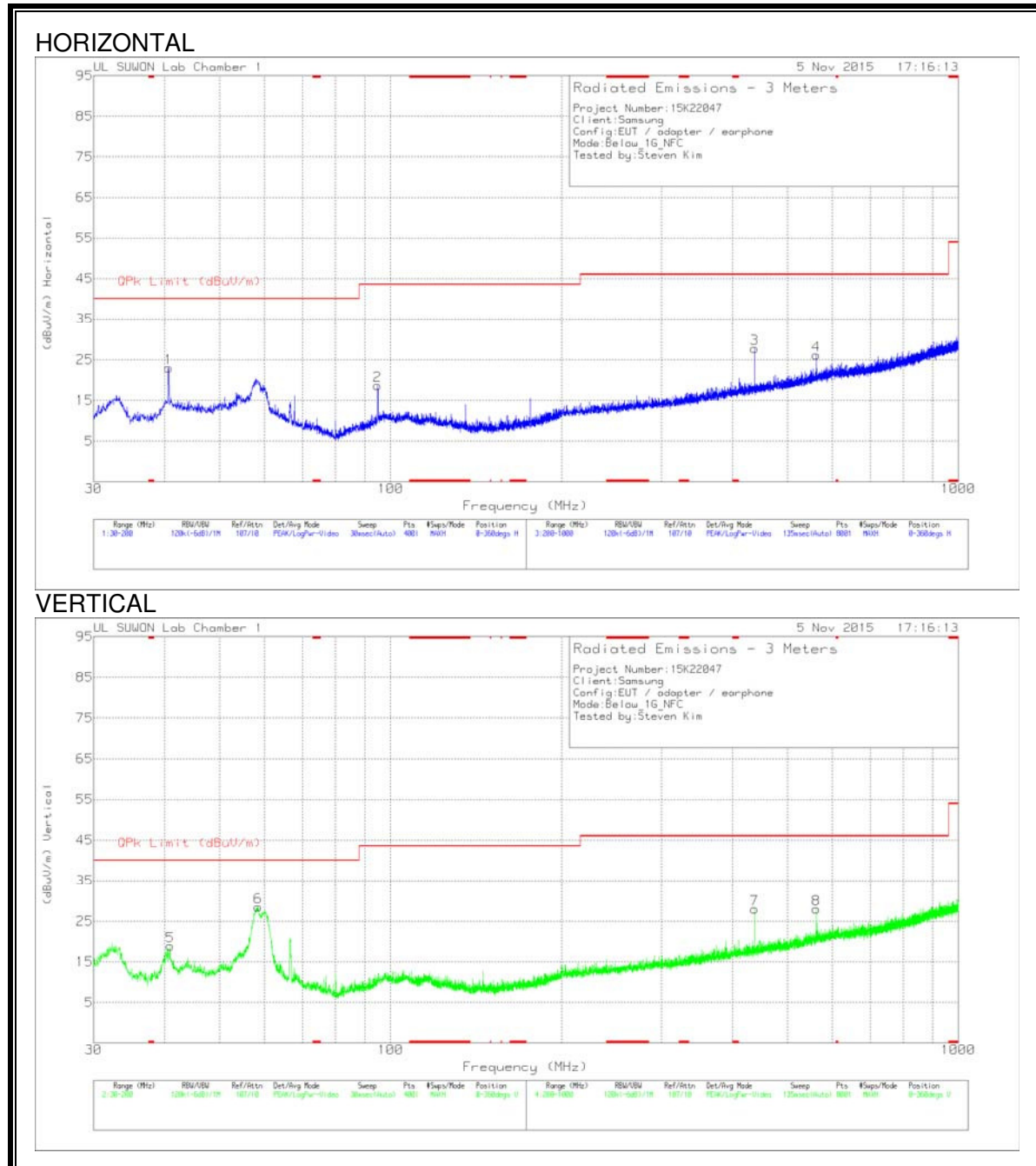
RESULTS

No non-compliance noted:

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

FCC Part 15, Subpart B & C													1 Meter Distance Measurement At Chamber 1	
Company: Samsung														
Project #: 15K														
Model #: SM-A510F/DS														
Tester: Steven.Kim														
Date: 2015-10-22														
Frequency (MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	AF (dB/m)	Distance Correction (dB)	PK Corrected Reading (dBuV/m)	AV Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	PK Margin (dB)	AV Margin (dB)	Notes		
Loop Antenna Face on: Z position worst														
13.56	53.73		N/A	19.86	-59.08	14.50	N/A	84.00	N/A	-69.5	N/A	Fundamental @ 1m Dist		
13.55	42.4		N/A	19.86	-59.08	3.17	N/A	50.48	N/A	-47.3	N/A	13.41MHz-13.553MHz		
13.57	41.9		N/A	19.86	-59.08	2.67	N/A	50.48	N/A	-47.8	N/A	13.567MHz-13.71MHz		
13.35	36.82		N/A	19.87	-59.08	-2.40	N/A	40.51	N/A	-42.9	N/A	13.110-13.410MHz		
13.77	35.19		N/A	19.85	-59.08	-4.05	N/A	41.51	N/A	-45.6	N/A	13.71-14.01MHz		
6.68	18.73		N/A	19.8	-59.08	-20.55	N/A	29.54	N/A	-50.1	N/A	9k-13.11MHz		
14.53	13.19		N/A	19.92	-59.08	-26.08	N/A	29.54	N/A	-55.6	N/A	14.01MHz-30MHz		
Loop Antenna Face off: Z position														
13.56	45.5		N/A	19.86	-59.08	6.27	N/A	84.00	N/A	-77.7	N/A	Fundamental @ 1m Dist		
13.55	35.15		N/A	19.86	-59.08	-4.08	N/A	50.48	N/A	-54.6	N/A	13.41MHz-13.553MHz		
13.57	33.62		N/A	19.86	-59.08	-5.61	N/A	50.48	N/A	-56.1	N/A	13.567MHz-13.71MHz		
13.35	28.35		N/A	19.87	-59.08	-10.87	N/A	40.51	N/A	-51.4	N/A	13.110-13.410MHz		
13.77	26.32		N/A	19.85	-59.08	-12.92	N/A	40.51	N/A	-53.4	N/A	13.71-14.01MHz		
9.00	20.22		N/A	19.94	-59.08	-18.93	N/A	29.54	N/A	-48.5	N/A	9k-13.11MHz		
21.41	12.91		N/A	19.92	-59.08	-26.26	N/A	29.54	N/A	-55.8	N/A	14.01MHz-30MHz		
* No more emissions were found up to 30MHz														
Note: The emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.														
P.K. = Peak														
Q.P. = Quasi Peak Reading														
A.F. = Antenna factor														
Rev. 10.23.09														

7.1.2. TX SPURIOUS EMISSION 30 TO 1000 MHz



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-750 (dB/m)	Amp/Cbl/Fltr/ Pad (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	40.6675	40.66	Pk	12.6	-30.3	22.96	40	-17.04	0-360	100	H
2	94.94	37.41	Pk	10.5	-29.3	18.61	43.52	-24.91	0-360	100	H
5	40.9225	36.55	Pk	12.7	-30.3	18.95	40	-21.05	0-360	100	V
6	58.475	45.78	Pk	12.8	-30	28.58	40	-11.42	0-360	100	V
3	437.5	38.29	Pk	16.1	-26.6	27.79	46.02	-18.23	0-360	300	H
4	562.5	33.83	Pk	18.3	-26	26.13	46.02	-19.89	0-360	200	H
7	437.5	38.53	Pk	16.1	-26.6	28.03	46.02	-17.99	0-360	100	V
8	562.6	35.67	Pk	18.4	-26	28.07	46.02	-17.95	0-360	100	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

8. 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

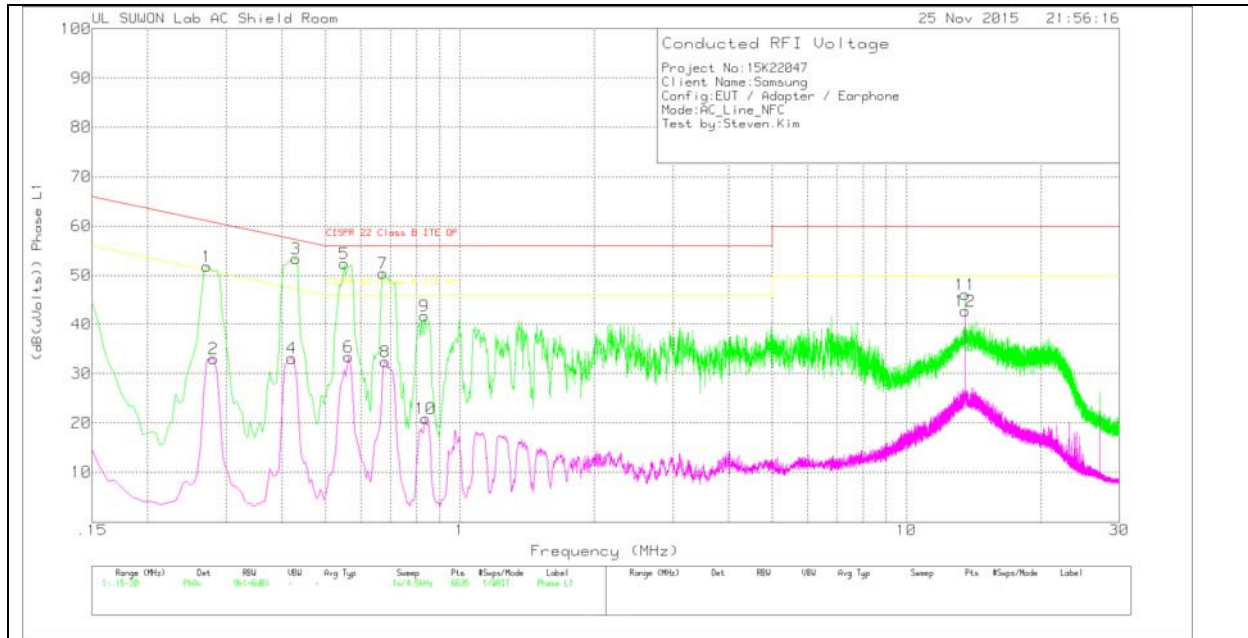
ANSI C63.10-2009

RESULTS

No non-compliance noted:

WORST EMISSIONS

LINE 1 PLOT



LINE 1 RESULTS

Trace Markers

Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_w ith ex- cord_L1	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
1	.2715	41.99	Pk	9.8	0	51.79	61.07	-9.28	-	-
2	.2805	23.14	Av	9.8	0	32.94	-	-	50.8	-17.86
3	.429	43.33	Pk	10.1	0	53.43	57.27	-3.84	-	-
4	.42	22.96	Av	10.1	0	33.06	-	-	47.45	-14.39
5	.5505	42.28	Pk	10.1	0	52.38	56	-3.62	-	-
6	.564	23.31	Av	10.1	0	33.41	-	-	46	-12.59
7	.672	40.34	Pk	10.1	0	50.44	56	-5.56	-	-
8	.681	22.27	Av	10.1	0	32.37	-	-	46	-13.63
9	.834	31.9	Pk	9.9	0	41.8	56	-14.2	-	-
10	.8385	10.92	Av	9.9	0	20.82	-	-	46	-25.18
11	13.56	35.76	Pk	10.1	.2	46.06	60	-13.94	-	-
12	13.56	32.52	Av	10.1	.2	42.82	-	-	50	-7.18
1	.2715	41.99	Pk	9.8	0	51.79	61.07	-9.28	-	-
2	.2805	23.14	Av	9.8	0	32.94	-	-	50.8	-17.86
3	.429	43.33	Pk	10.1	0	53.43	57.27	-3.84	-	-
4	.42	22.96	Av	10.1	0	33.06	-	-	47.45	-14.39

Pk - Peak detector

Av - Average detection

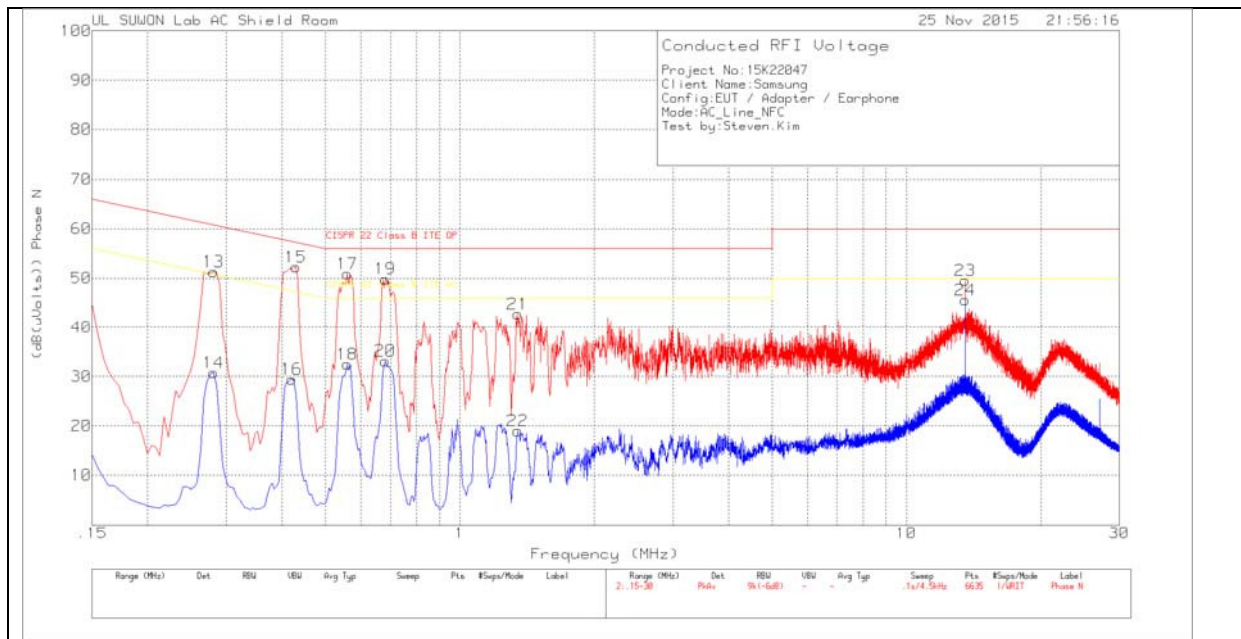
Quasi-Peak Emissions

Phase L1 .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	101837_wit h ex-cord_L1	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
.2751	38.3	Qp	9.8	0	48.1	60.96	-12.86	-	-
.4254	39.75	Qp	10.1	0	49.85	57.34	-7.49	-	-
.5523	35.43	Qp	10.1	0	45.53	56	-10.47	-	-
.6729	35.85	Qp	10.1	0	45.95	56	-10.05	-	-
.8358	17.84	Qp	9.9	0	27.74	56	-28.26	-	-
13.56	33.94	Qp	10.1	.2	44.24	60	-15.76	-	-

Qp - Quasi-Peak detector

LINE 2 PLOT



LINE 2 RESULTS

Trace Markers

Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_w ith ex- cord_N	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
13	.2805	41.56	Pk	9.8	0	51.36	60.8	-9.44	-	-
14	.2805	20.98	Av	9.8	0	30.78	-	-	50.8	-20.02
15	.429	42.23	Pk	10.1	0	52.33	57.27	-4.94	-	-
16	.42	19.37	Av	10.1	0	29.47	-	-	47.45	-17.98
17	.5595	40.81	Pk	10.1	0	50.91	56	-5.09	-	-
18	.5595	22.44	Av	10.1	0	32.54	-	-	46	-13.46
19	.681	39.88	Pk	10	0	49.88	56	-6.12	-	-
20	.681	23.18	Av	10	0	33.18	-	-	46	-12.82
21	1.347	32.86	Pk	9.8	.1	42.76	56	-13.24	-	-
22	1.347	9.06	Av	9.8	.1	18.96	-	-	46	-27.04
23	13.56	39.12	Pk	10.2	.2	49.52	60	-10.48	-	-
24	13.56	35.25	Av	10.2	.2	45.65	-	-	50	-4.35

Pk - Peak detector

Av - Average detection

Quasi-Peak Emissions

Phase N .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	101837_wit h ex-cord_N	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
.2823	38.99	Qp	9.8	0	48.79	60.75	-11.96	-	-
.4254	38.45	Qp	10.1	0	48.55	57.34	-8.79	-	-
.564	37.37	Qp	10.1	0	47.47	56	-8.53	-	-
.6765	35.18	Qp	10	0	45.18	56	-10.82	-	-
1.3488	24.09	Qp	9.8	.1	33.99	56	-22.01	-	-
13.56	36.52	Qp	10.2	.2	46.92	60	-13.08	-	-

Qp - Quasi-Peak detector

9. FREQUENCY STABILITY

LIMIT

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

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)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	13.559868411	-1.054	100
3.80	40	13.559874024	-1.468	100
3.80	30	13.559853917	0.015	100
3.80	20	13.559854122	0	100
3.80	10	13.559853906	0.016	100
3.80	0	13.559854409	-0.021	100
3.80	-10	13.559900355	-3.410	100
3.80	-20	13.559853721	0.030	100
3.80	-30	13.559901303	-3.479	100

Reference Frequency: EUT Channel 13.56 MHz @ 20°C				
Limit: ± 100 ppm = 1.356 kHz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	20	13.559854122	0	100
4.20	20	13.559899683	-3.360	100
3.40	20	13.559854769	-0.048	100

No non-compliance noted.