



FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

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

MODEL NUMBER: SCV32

FCC ID: A3LSCV32

REPORT NUMBER: 15I21858-E7V3

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NVLAP LAB CODE 200065-0

Revision History

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--	11/11/15	Initial Issue	P. Zhang
V2	11/13/15	Updated Section 6, Section 1, Section 7.1.1 and Setup photo	C. Vergonio
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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, NFC and ANT+
MODEL: SCV32
SERIAL NUMBER: 2215406 (Radiated), 2215407 (Conducted)
DATE TESTED: SEPTEMBER 28 – NOVEMBER 13, 2015

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	Pass

UL Verification Services Inc. 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 Verification Services Inc. 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 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 NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 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.

47173 Benicia Street	47266 Benicia Street
<input type="checkbox"/> Chamber A	<input type="checkbox"/> Chamber D
<input checked="" type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

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	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

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

5.2. MAXIMUM OUTPUT POWER

The testing was performed at 1 meter. The transmitter maximum E-field at 30m distance is 10.76dBuV/m which convert from the 1 meters 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(upward) 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

Radiated Emissions Above 30 MHz, AC Line Conducted Emissions and Frequency Stability:

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	Samsung			N/A
Earphone	Samsung	N/A	N/A	N/A

I/O CABLES

Radiated Emissions above 30 MHz, AC Line Conducted Emissions :

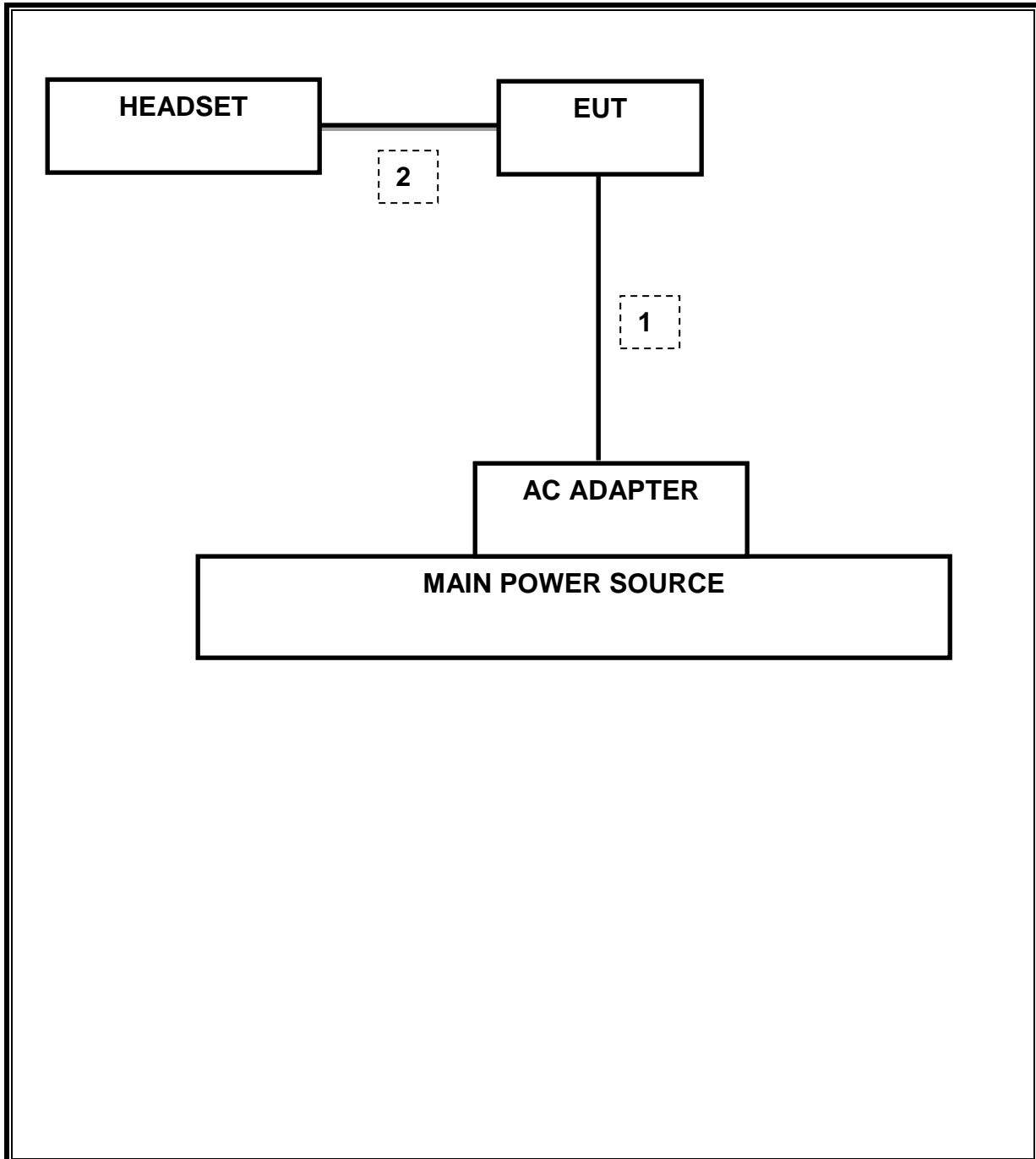
I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	Micro-USB	Shielded	1 m	None
2	Audio	1	Mini-Jack	Un-Shielded	1 m	None

TEST SETUP

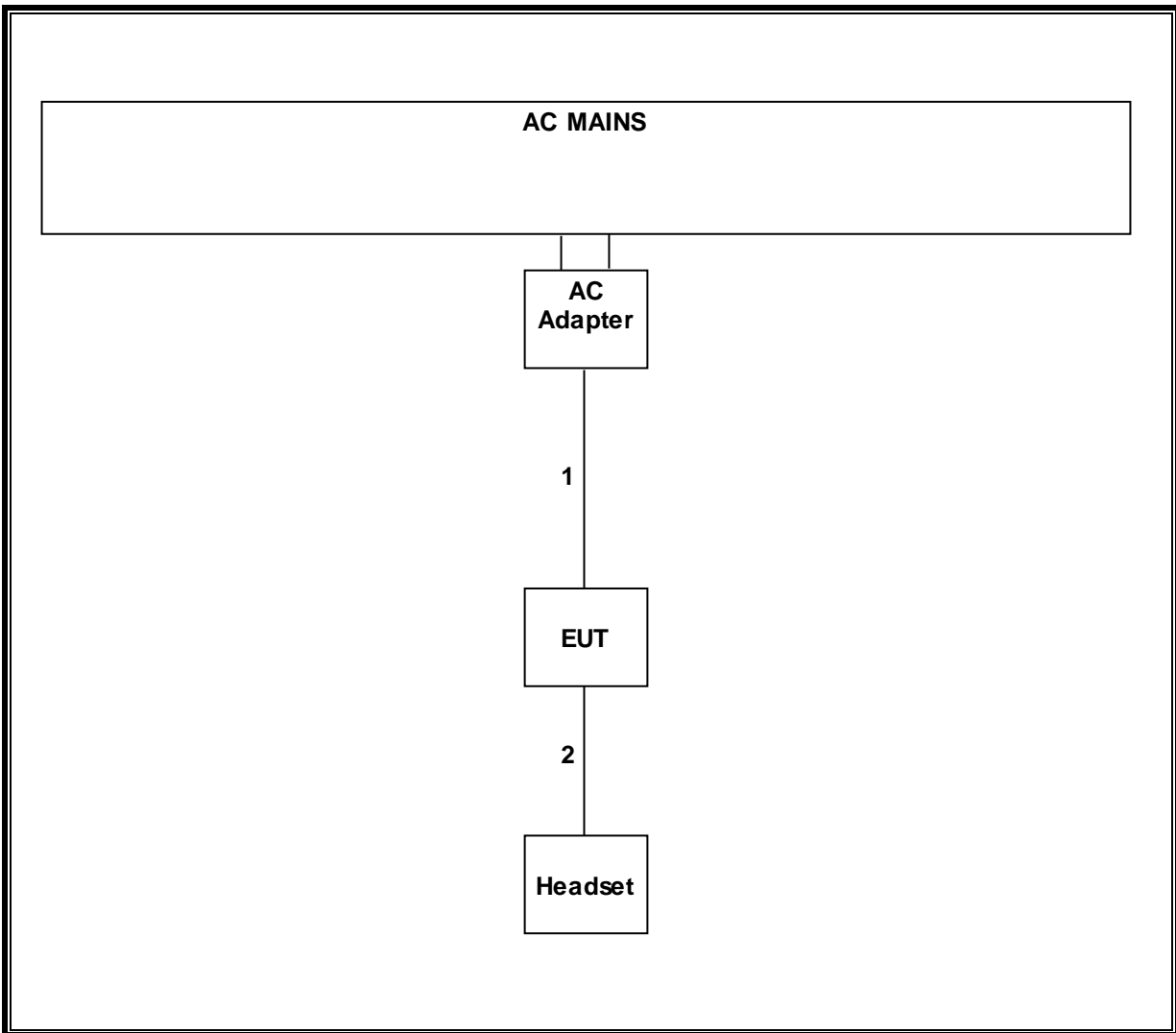
The EUT is a stand-alone device configured and tested in a worst-case setup.

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	Asset	Cal Due
ESA-E Spectrum Analyzer, 9kHz-26.5 GHz	Agilent / HP	E4407B	C01098	04/04/16
Antenna, Loop, 30 MHz	EMCO	6502	C00593	02/20/16
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	T243	12/08/15
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	01/21/16
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/08/16
LISN, 30 MHz	FCC	50/250-25-2	C00626	01/14/16
DMM	Fluke	77-11	N02303	10/31/16
Digital Thermometer	Tektronix	DTM920	None	10/21/16
Temperature Chamber	CSZ	2PHS-8-3	T267	03/04/16

Test Software List			
Description	Manufacturer	Model	Version
Radiated Software	UL	UL EMC	Version 9.5, 07/22/14
Conducted Software	UL	UL EMC	Version 9.5, 05/17/14
CLT Software	UL	UL RF	Version 1.0, 02/02/15
Antenna Port Software	UL	UL RF	Version 2.1.1.1, 1/20/15

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 C63.10-2013

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:

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

FCC Part 15, Subpart B & C 1 Meter Distance Measurement At Emissions Chamber

Company: LIONS
 Project #: 15I21858 SAMPLE: 2215406
 Model #: SCV32
 Tester: J. Ko
 Date: 11/13/2015

Frequency (MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	AF (dB/m)	Distance (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													
Fundamental Field Strength & Within Bands:													
13.56	70.54	--	10.56	1	-59.08		22.01	--	84.00	--	-62.0	--	Fundamental @ 30m Dist
13.454	30.08	--	10.55	1	-59.08		-18.46	--	50.48	--	-68.9	--	13.41-13.553MHz Spurious @ 30m
13.553	42.85	--	10.56	1	-59.08		-5.68	--	50.48	--	-56.2	--	13.41-13.553MHz Spurious @ 30m
13.567	53.34	--	10.56	1	-59.08		4.81	--	50.48	--	-45.7	--	13.567-13.710MHz Spurious @ 30m
13.667	30.69	--	10.57	1	-59.08		-17.83	--	40.51	--	-58.3	--	13.567-13.710MHz Spurious @ 30m
13.348	40.53	--	10.53	1	-59.08		-8.02	--	40.51	--	-48.5	--	13.110-13.410MHz Spurious @ 30m
13.772	40.40	--	10.58	1	-59.08		-8.11	--	29.54	--	-37.6	--	13.710-14.010MHz Spurious @ 30m

Loop Antenna Face Off: Z-Position													
Fundamental Field Strength & Within Bands:													
13.56	61.21	--	10.56	1	-59.08		12.68	--	84.00	--	-71.3	--	Fundamental @ 30m Dist
13.453	25.30	--	10.55	1	-59.08		-23.24	--	50.48	--	-73.7	--	13.41-13.553MHz Spurious @ 30m
13.553	37.90	--	10.56	1	-59.08		-10.63	--	50.48	--	-61.1	--	13.41-13.553MHz Spurious @ 30m
13.567	38.10	--	10.56	1	-59.08		-10.43	--	50.48	--	-60.9	--	13.567-13.710MHz Spurious @ 30m
13.665	27.57	--	10.57	1	-59.08		-20.95	--	40.51	--	-61.5	--	13.567-13.710MHz Spurious @ 30m
13.348	27.64	--	10.53	1	-59.08		-20.91	--	40.51	--	-61.4	--	13.110-13.410MHz Spurious @ 30m
13.772	38.93	--	10.58	1	-59.08		-9.58	--	29.54	--	-39.1	--	13.710-14.010MHz Spurious @ 30m

Spurious Emissions 9kHz - 490kHz:													
0.01	63.40	--		18.7	1	-99.08	-16.98	-16.98	67.60	47.60	-84.6	-64.6	9kHz-10kHz Spurious @ 30m
0.1	50.83	--		10.5	1	-99.08	-37.75	-37.75	47.60	27.60	-85.4	-65.4	10kHz-100kHz Spurious @ 30m
0.489	36.34	--		10.21	1	-99.08	-52.54	-52.54	33.82	13.82	-86.4	-66.4	100kHz-489kHz Spurious @ 30m

Spurious Emissions 490kHz - 30MHz:													
0.49	36.13	--		10.21	1	-59.08	-12.75	--	33.80		-46.5	--	489kHz-490kHz Spurious @ 30m
1	30.20	--		10.3	1	-59.08	-18.58	--	27.60		-46.2	--	490kHz-1MHz Spurious @ 30m
1.499	27.05	--		10.28	1	-59.08	-21.76	--	24.09		-45.8	--	1MHz-1.705MHz Spurious @ 30 m
2.611	22.07	--		10.22	1	-59.08	-26.80	--	29.54		-56.3	--	1.705MHz-5MHz Spurious @ 30m
6.275	20.59	--		10.2	1	-59.08	-28.29	--	29.54		-57.8	--	5-10MHz Spurious @ 30m
24.05	37.92	--		9.49	1	-59.08	-11.67	--	29.54		-41.2	--	20-30MHz Spurious @ 30m

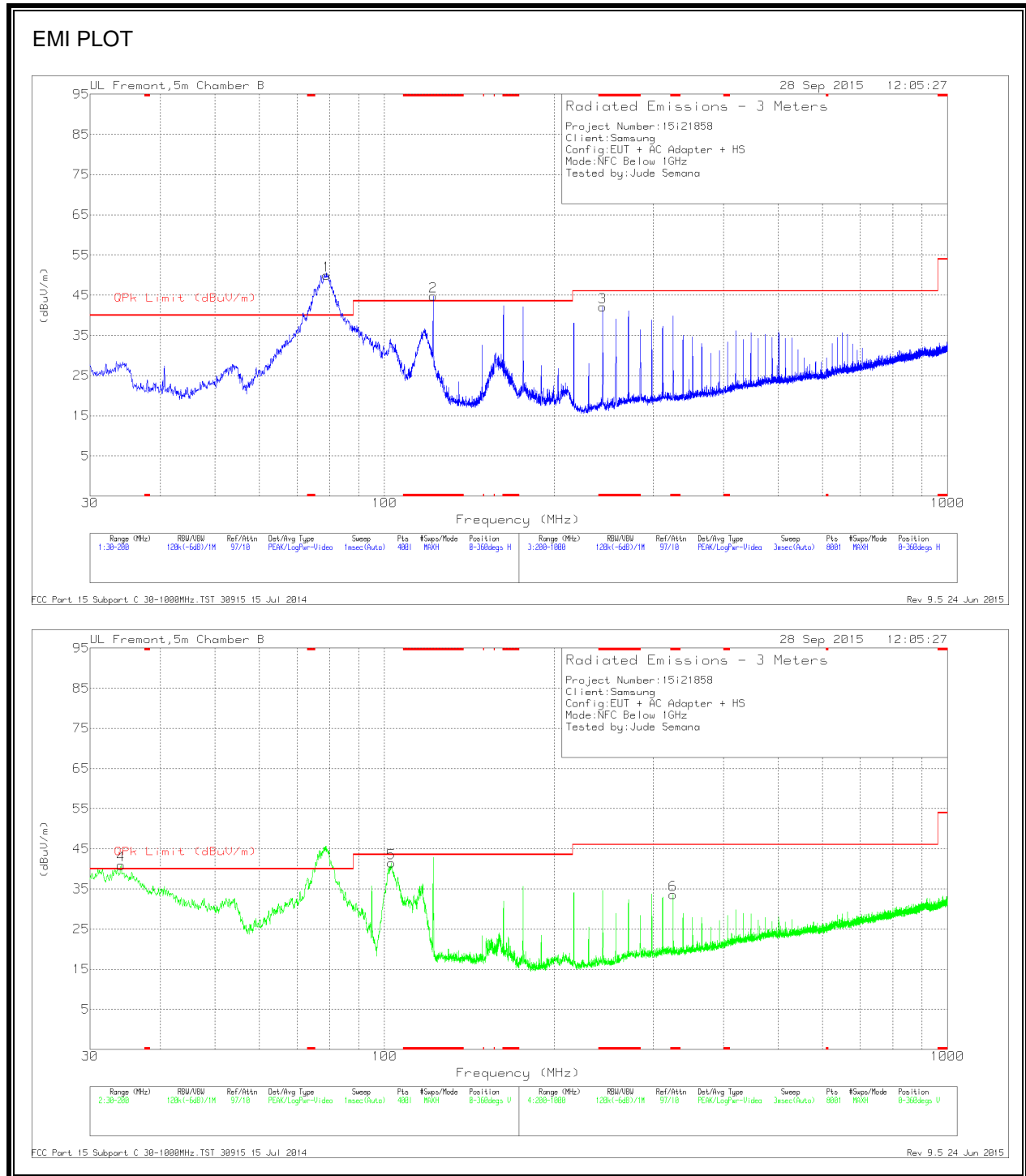
* No more emissions were found up to 30MHz

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 10000MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

P.K. = Peak
 Q.P. = Quasi Peak Readings
 A.F. = Antenna factor

Rev. 11.21.14

7.1.2. TX SPURIOUS EMISSION 30 TO 1000 MHz



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AFT130 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 122.055	54.82	Pk	17.8	-27.9	44.72			0-360	199	H
3	* 244.1	53.19	Pk	15.5	-26.6	42.09	46.02	-3.93	0-360	101	H
6	* 325.4	41.83	Pk	17.9	-26.1	33.63	46.02	-12.39	0-360	299	V
4	34.0375	47.4	Pk	22.3	-28.8	40.9			0-360	101	V
1	78.9175	66.93	Pk	11.5	-28.4	50.03			0-360	199	H
5	102.8875	54.29	Pk	15.2	-28	41.49	43.52	-2.03	0-360	101	V

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

Pk - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 122.0375	50.64	Qp	17.8	-27.9	40.54	43.52	-2.98	360	100	H
34.235	38.22	Qp	22.1	-28.8	31.52	40	-8.48	360	100	V
76.6413	49.43	Qp	11.7	-28.3	32.83	40	-7.17	360	100	H

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

Qp - Quasi-Peak detector

FCC Part 15 Subpart C 30-100MHz.TST 30915 15 Jul 2014

Rev 9.5 24 Jun 2015

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

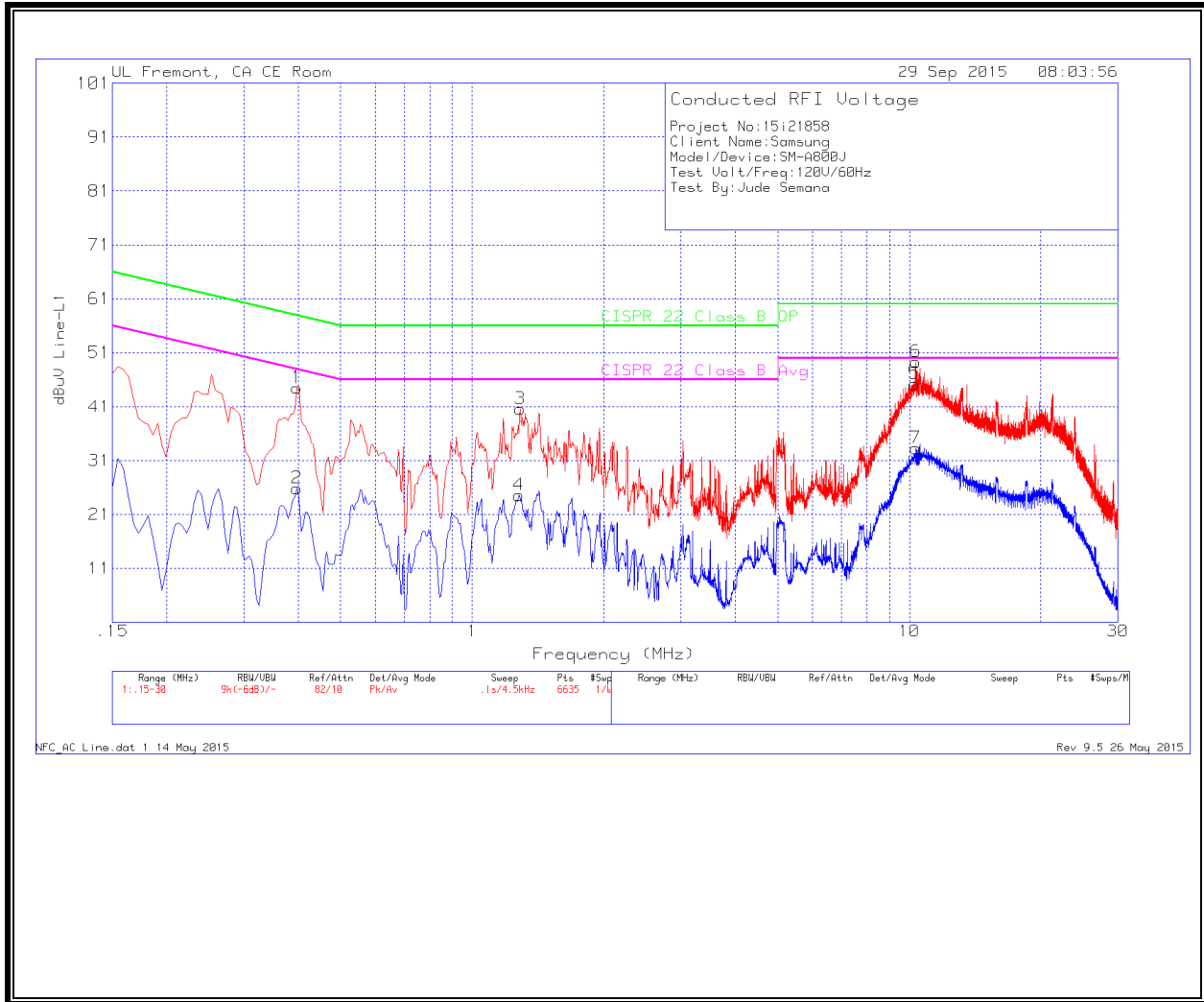
ANSI C63.10-2013

RESULTS

No non-compliance noted:

6 WORST EMISSIONS

LINE 1 RESULTS



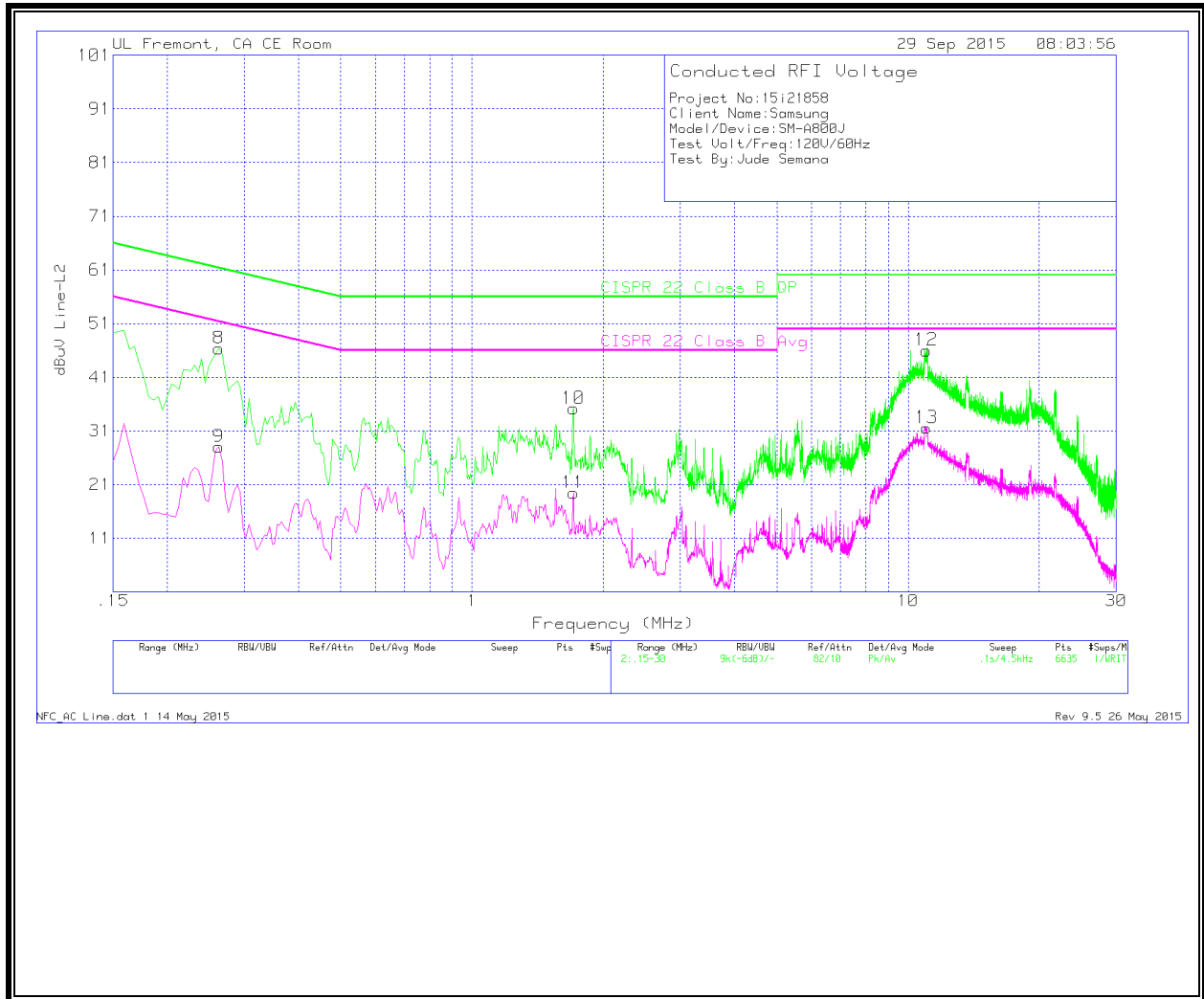
Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
1	.3975	44.08	Pk	.4	0	44.48	57.91	-13.43		
2	.3975	25.43	Av	.4	0	25.83	-	-	47.91	-22.08
3	1.2885	40.26	Pk	.2	.1	40.56	56	-15.44		
4	1.2795	24.25	Av	.2	.1	24.55	-	-	46	-21.45
5	10.284	44.81	Pk	.2	.2	45.21	60	-14.79		
6	10.3605	48.9	Pk	.2	.2	49.3	60	-10.7		
7	10.3425	32.86	Av	.2	.2	33.26	-	-	50	-16.74

Pk - Peak detector

Av - Average detection

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
8	.2625	45.67	Pk	.7	0	46.37	61.35	-14.98		
9	.2625	27.33	Av	.7	0	28.03	-	-	51.35	-23.32
10	1.707	34.87	Pk	.2	.1	35.17	56	-20.83		
11	1.707	19.14	Av	.2	.1	19.44	-	-	46	-26.56
12	11.004	45.6	Pk	.2	.2	46	60	-14		
13	11.022	31.14	Av	.2	.2	31.54	-	-	50	-18.46

Pk - Peak detector

Av - Average detection

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 Section 6

RESULTS

No non-compliance noted.

Results

Reference Frequency: EUT Channel 13.560000 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)
5.00	50	13.5594960	35.612	± 100
5.00	40	13.5607796	-59.049	± 100
5.00	30	13.5612490	-93.665	± 100
5.00	20	13.5599789	0.000	± 100
5.00	10	13.5602982	-23.547	± 100
5.00	0	13.5602611	-20.811	± 100
5.00	-10	13.5592980	50.214	± 100
5.00	-20	13.5609851	-74.204	± 100
5.00	-30	13.5612981	-97.286	± 100
5.35	20	13.5609861	-74.277	± 100
4.85	20	13.5608773	-66.254	± 100