FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

GSM/WCDMA/LTE PHONE + BLUETOOTH + DTS b/g/n + NFC

MODEL NUMBER: SM-G531F & SM-G531F/DD

FCC ID: A3LSMG531F

REPORT NUMBER: 15I20736-E5, Revision B

ISSUE DATE: Jun 11, 2015

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	05/27/15	Initial Issue	P. Zhang
A	6/9/15	Updated setup diagram	P. Zhang
B	6/10/15	Added Another Model	AAumentado

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	Samsung Electronics Co., LTD. 129 Samsung-ro, Yeongtong-Gu, Suwon City, Gyeonggi-Do, Korea 443-742
EUT DESCRIPTION:	GSM/WCDMA/LTE PHONE + BLUETOOTH + DTS b/g/n + NFC
MODEL:	SM-G531F and SM-G531F/DD
SERIAL NUMBER:	R38G40TQMVX (Conducted), R38G40TQM9X (Radiated)
DATE TESTED:	MAY 18 – 27, 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.

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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 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
☒ Chamber A(IC: 2324B-1)	☐ Chamber D(IC: 2324B-4)
☐ Chamber B(IC: 2324B-2)	☐ Chamber E(IC: 2324B-5)
☐ Chamber C(IC: 2324B-3)	☐ Chamber F(IC: 2324B-6)
	☐ Chamber G(IC: 2324B-7)
	☐ Chamber H(IC: 2324B-8)

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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

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

The EUT is a GSM/WCDMA/LTE PHONE + BLUETOOTH + DTS b/g/n + NFC.

5.2. MAXIMUM OUTPUT POWER

The testing was performed at 1 meter. The transmitter maximum E-field at 30m distance is 23.89 dBuV/m which convert from the 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(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	N/A	N/A
Earphone	Samsung	N/A	N/A	N/A

I/O CABLES

Radiated Emissions above 30 MHz, AC Line Conducted Emissions :

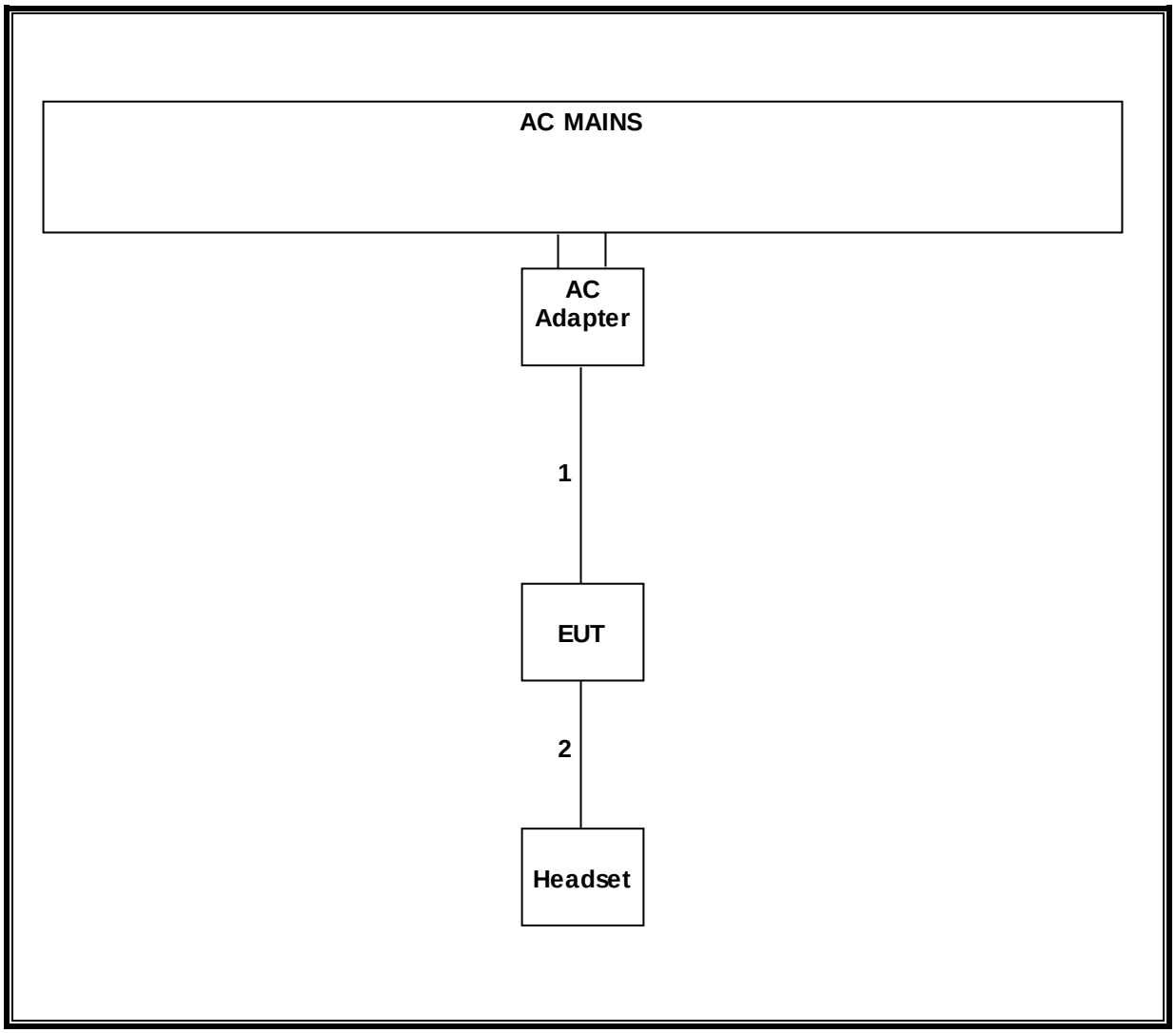
I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	Micro-USB	Shielded	1 m	None
2	Audio	1	Mini-Jack	Un-Shielded	1 m	None

TEST SETUP

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

SETUP DIAGRAM FOR TESTS

Radiated Emissions, 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	08/08/15
LISN, 30 MHz	FCC	50/250-25-2	C00626	01/14/16
DMM	Fluke	77-11	N02303	10/31/15
Digital Thermometer	Tektronix	DTM920	None	10/21/15
Temperature Chamber	CSZ	2PHS-8-3	T267	03/04/16

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 10^{th} 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: Samsung
Project #: 15I20736
Model #: SM-G531F
Tester: David Mun
Date: 05/27/15

Frequency (MHz)	PK (dBu/V)	QP (dBu/V)	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	68.29		--	10.64	1	-59.08	19.85	--	84.00	--	-64.2	--	Fundamental @ 30m Dist
13.454	27.66		--	10.65	1	-59.08	-20.77	--	50.48	--	-71.3	--	13.41-13.553MHz Sprious @ 30m
13.553	26.78		--	10.64	1	-59.08	-21.66	--	50.48	--	-72.1	--	13.41-13.553MHz Sprious @ 30m
13.567	27.42		--	10.64	1	-59.08	-21.02	--	50.48	--	-71.5	--	13.567-13.710MHz Spurious @ 30m
13.666	26.9		--	10.63	1	-59.08	-21.55	--	40.51	--	-62.1	--	13.567-13.710MHz Spurious @ 30m
13.137	26.98		--	10.69	1	-59.08	-21.42	--	40.51	--	-61.9	--	13.110-13.410MHz Spurious @ 30m
13.408	27.24		--	10.66	1	-59.08	-21.19	--	40.51	--	-61.7	--	13.110-13.410MHz Spurious @ 30m
13.772	29.49		--	10.62	1	-59.08	-18.97	--	40.51	--	-59.5	--	13.710-14.010MHz Spurious @ 30m
13.984	27.26		--	10.6	1	-59.08	-21.22	--	29.54	--	-50.8	--	13.710-14.010MHz Spurious @ 30m
Loop Antenna Face Off: Z Position													
Fundamental Field Strength & Within Bands:													
13.56	72.33		--	10.64	1	-59.08	23.89	--	84.00	--	-60.1	--	Fundamental @ 30m Dist
13.454	28.75		--	10.65	1	-59.08	-19.68	--	50.48	--	-70.2	--	13.41-13.553MHz Sprious @ 30m
13.553	29.36		--	10.64	1	-59.08	-19.08	--	50.48	--	-69.6	--	13.41-13.553MHz Sprious @ 30m
13.567	43.67		--	10.64	1	-59.08	-4.77	--	50.48	--	-55.3	--	13.567-13.710MHz Spurious @ 30m
13.665	29.14		--	10.63	1	-59.08	-19.31	--	40.51	--	-59.8	--	13.567-13.710MHz Spurious @ 30m
13.138	29.04		--	10.69	1	-59.08	-19.36	--	40.51	--	-59.9	--	13.110-13.410MHz Spurious @ 30m
13.408	28.58		--	10.66	1	-59.08	-19.85	--	40.51	--	-60.4	--	13.110-13.410MHz Spurious @ 30m
13.772	27.74		--	10.62	1	-59.08	-20.72	--	40.51	--	-61.2	--	13.710-14.010MHz Spurious @ 30m
13.983	28.7		--	10.6	1	-59.08	-19.78	--	29.54	--	-49.3	--	13.710-14.010MHz Spurious @ 30m
Loop Antenna Face On: Z Position													
Spurious Emissions 9kHz - 490kHz:													
0.01	73.26	--		18.9	1	-99.08	-6.92	-6.92	67.60	47.60	-74.5	-54.5	9kHz-10kHz Spurious @ 30m
0.1	47.54	--		11.8	1	-99.08	-39.74	-39.74	47.60	27.60	-87.3	-67.3	10kHz-100kHz Spurious @ 30m
0.109	46.77	--		11.8	1	-99.08	-40.52	-40.52	46.86	26.86	-87.4	-67.4	100kHz-489kHz Spurious @ 30m
Spurious Emissions 490kHz - 30MHz:													
0.49	36.81		--	11.7	1	-59.08	-10.57	--	33.80		-44.4	--	489kHz-490kHz Spurious @ 30m
1	32.19		--	11.8	1	-59.08	-15.09	--	27.60		-42.7	--	490kHz-1MHz Spurious @ 30m
1.366	28.98		--	11.8	1	-59.08	-18.30	--	24.90		-43.2	--	1MHz-1.705MHz Spurious @ 30 m
4.133	28.3		--	11.63	1	-59.08	-19.15	--	29.54		-48.7	--	1.705MHz-5MHz Spurious @ 30m
6.27	27.48		--	11.37	1	-59.08	-20.23	--	29.54		-49.8	--	5-10MHz Spurious @ 30m
24.05	28.4		--	9.233	1	-59.08	-21.45	--	29.54		-51.0	--	20-30MHz Spurious @ 30m

* No more emissions were found up to 30MHz

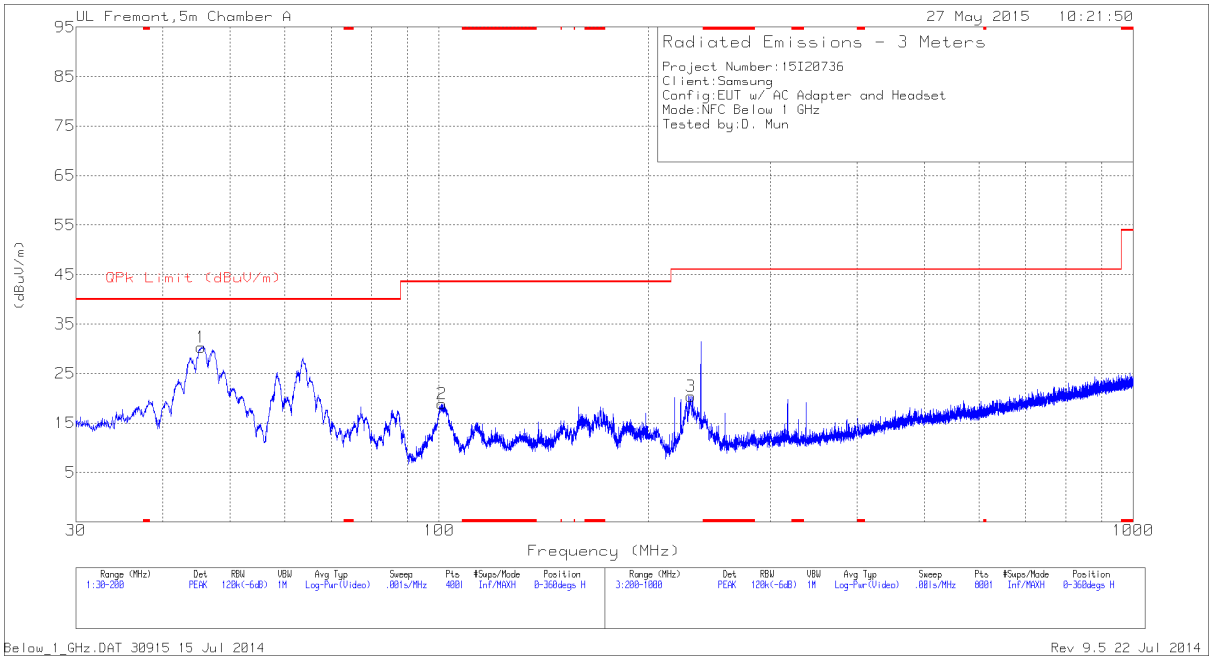
Note: The emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 10000Mhz. Radiated emission limits in these three bands are based on measurements employing an average detector.

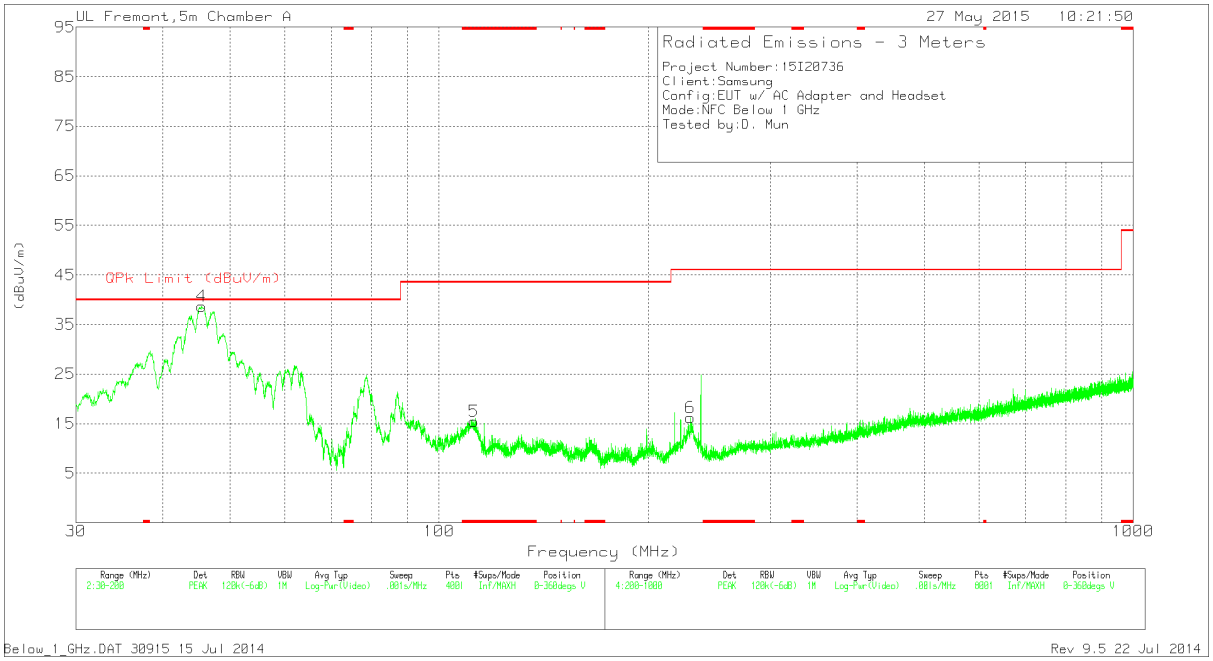
P.K. = Peak
Q.P. = Quasi Peak Readings
A.F. = Antenna factor

Rev. 05.27.15

7.1.2. TX SPURIOUS EMISSION 30 TO 1000 MHz

EMI PLOT





Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	* 112.365	32.99	PK	12.9	-30.5	15.39	43.52	-28.13	0-360	101	V
1	45.4275	51.12	PK	10.3	-31.1	30.32	40	-9.68	0-360	300	H
4	45.5125	59.44	PK	10.3	-31.1	38.64	40	-1.36	0-360	101	V
2	101.06	39.69	PK	9.8	-30.6	18.89	43.52	-24.63	0-360	300	H
6	230.2	34.87	PK	11.1	-29.8	16.17	46.02	-29.85	0-360	200	V
3	230.7	39.09	PK	11.1	-29.8	20.39	46.02	-25.63	0-360	101	H

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 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

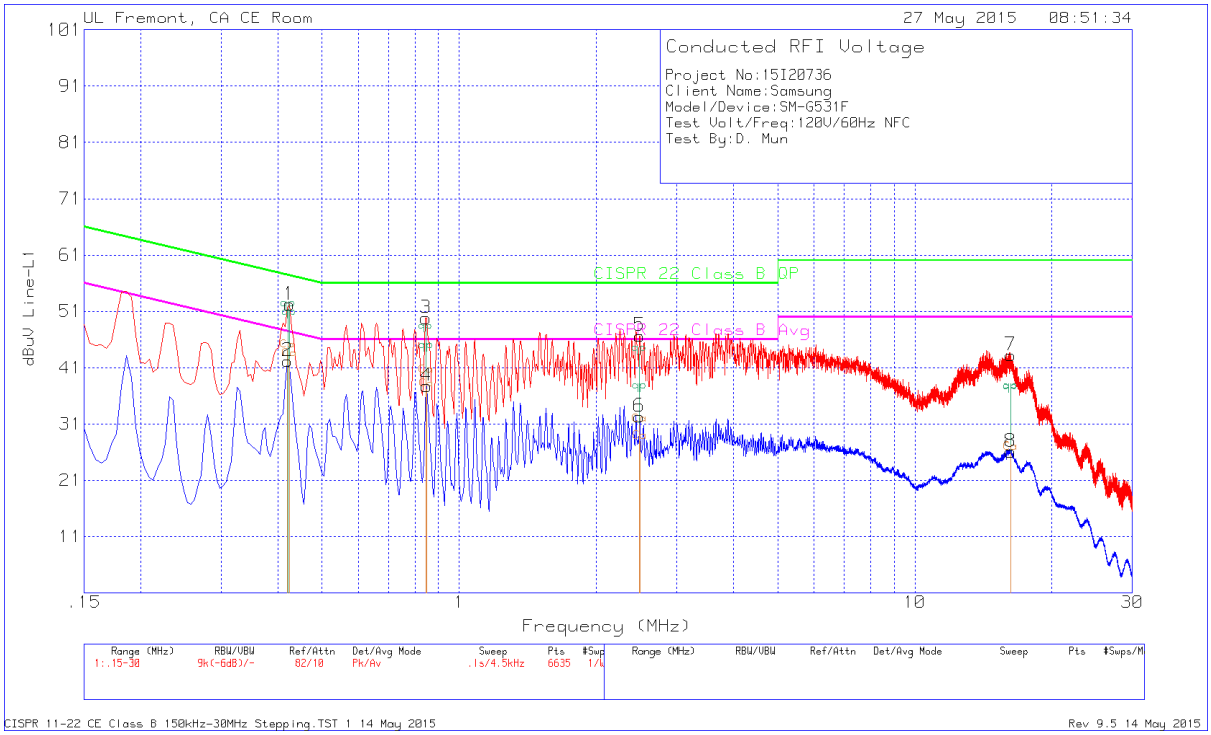
ANSI C63.10-2009

RESULTS

No non-compliance noted:

6 WORST EMISSIONS

LINE 1 RESULTS



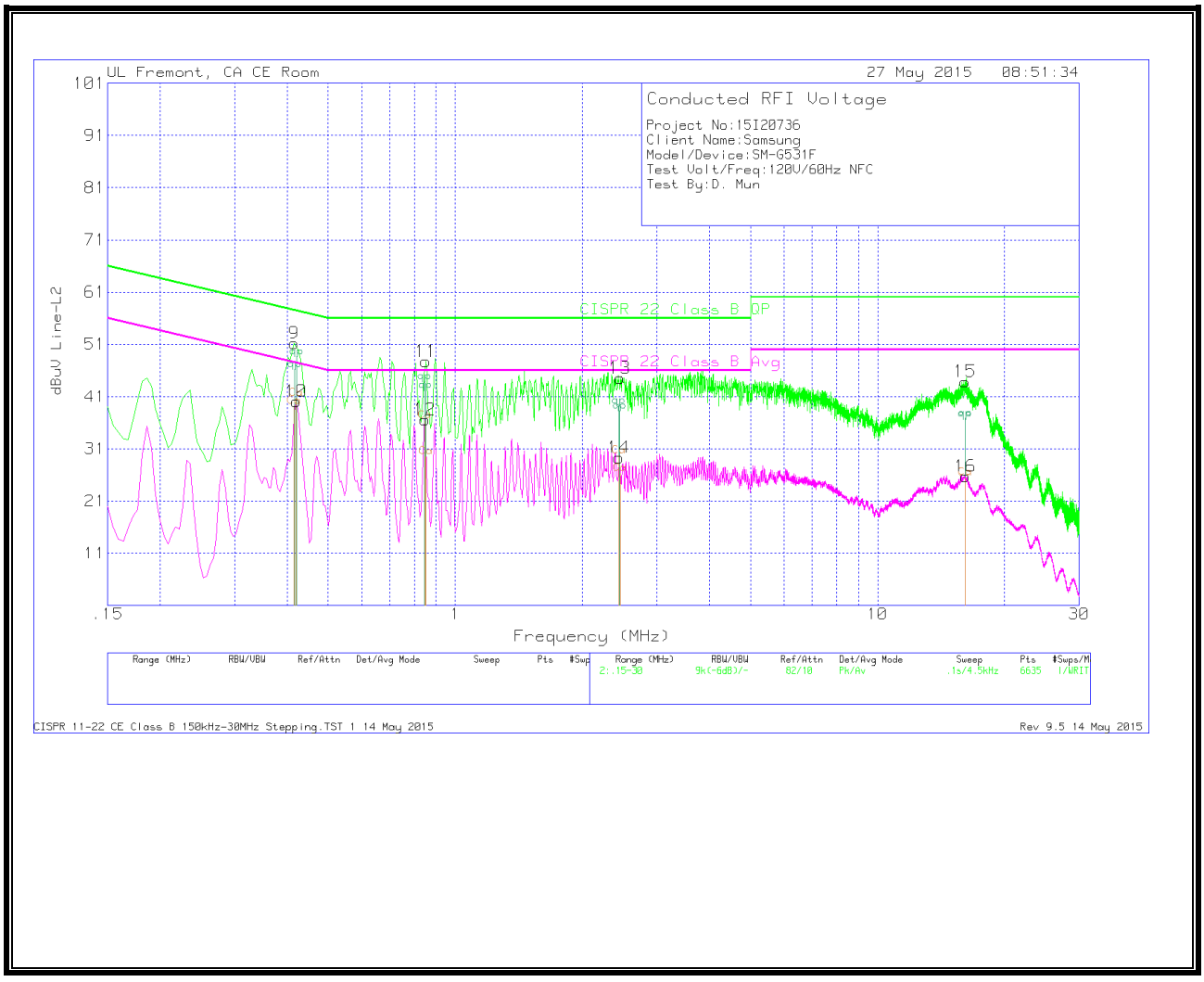
Trace Markers

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	.4245	51.8	Pk	.4	0	52.2	57.36	-5.16		
2	.42	41.77	Av	.4	0	42.17	-	-	47.45	-5.28
3	.84525	49.5	Pk	.3	0	49.8	56	-6.2		
4	.8475	37.45	Av	.3	0	37.75	-	-	46	-8.25
5	2.49	46.35	Pk	.2	.1	46.65	56	-9.35		
6	2.4855	32.02	Av	.2	.1	32.32	-	-	46	-13.68
7	16.215	42.71	Pk	.3	.2	43.21	60	-16.79		
8	16.2195	25.57	Av	.3	.2	26.07	-	-	50	-23.93

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)
9	.4155	50.79	Pk	.4	0	51.19	57.54	-6.35		
10	.42	39.66	Av	.4	0	40.06	-	-	47.45	-7.39
11	.852	47.41	Pk	.3	0	47.71	56	-8.29		
12	.8475	36.26	Av	.3	0	36.56	-	-	46	-9.44
13	2.454	44.22	Pk	.2	.1	44.52	56	-11.48		
14	2.4405	29	Av	.2	.1	29.3	-	-	46	-16.7
15	16.1205	43.35	Pk	.3	.2	43.85	60	-16.15		
16	16.1385	25.2	Av	.3	.2	25.7	-	-	50	-24.3

Pk - Peak detector
Av - Average detection

9. FREQUENCY STABILITY

LIMIT

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

TEST PROCEDURE

ANSI C63.10 Section 6

RESULTS

No non-compliance noted.

Results

Reference Frequency: EUT Channel 13.5600000 MHz @ 20ºC Limit: ± 100 ppm = 1.356 kHz				
Power Supply (Vdc)	Environment Temperature (ºC)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	13.5613800	9.586	± 100
3.80	40	13.5614100	7.374	± 100
3.80	30	13.5615900	-5.899	± 100
3.80	***20***	13.5615100	***0.000***	***± 100***
3.80	10	13.5614300	5.899	± 100
3.80	0	13.5613400	12.535	± 100
3.80	-10	13.5617400	-16.960	± 100
3.80	-20	13.5616900	-13.273	± 100
3.23	20	13.5615200	-0.737	± 100
4.37	20	13.5615310	-1.549	± 100

Note: Test was done for more than 10 mins at each temperature and worst case result is recorded.