



FCC CFR47 PART 15 SUBPART C

**ANT+
CERTIFICATION TEST REPORT**

FOR

GSM/WCDMA Phone + Bluetooth, DTS/UNII a/b/g/n/ac, NFC & ANT+

MODEL NUMBER: SM-N7507

FCC ID: A3LSMN7507

REPORT NUMBER: 14U17208-8

ISSUE DATE: March 17, 2014

**Prepared for
SAMSUNG ELECTRONICS CO., LTD.
416, MAETAN 3-DONG, YEONGTONG-GU
SUWON-CITY
GYEONGGI-DO, 443-742, SOUTH KOREA**

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	3/17/14	Initial Issue	P. Kim

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.
416, MAETAN 3-DONG, YEONGTONG-GU
SUWON-CITY, GYEONGGI-DO, 443-742, SOUTH KOREA

EUT DESCRIPTION: GSM/WCDMA Phone + Bluetooth, DTS/UNII a/b/g/n/ac, NFC & ANT+

MODEL: SM-N7507

SERIAL NUMBER: R31DB1SV13P

DATE TESTED: DECEMBER 9, 2013 – JANUARY 5, 2014

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 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
UL Verification Services Inc. By:



PHILIP KIM
PROGRAM MANAGER
CONSUMER TECHNOLOGIES DIVISION
UL Verification Services Inc.

Tested By:



STEVEN TRAN
TEST TECHNICIAN
CONSUMER TECHNOLOGIES DIVISION
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2009, 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 47173 Benicia Street, Fremont, California, USA.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

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 18000 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 Phone + Bluetooth, DTS/UNII a/b/g/n/ac, NFC & ANT.

The model FCC ID: A3LSMN7507 shares the same enclosure and circuit board as mode FCC ID: A3LSMN7505. The WWAN/WLAN/Bluetooth/ANT+ circuitry and layout, including antenna, are identical between the two units. The WWAN/WLAN/Bluetooth/ANT+ antenna and surrounding circuitry is the same between these two units.

After confirming through preliminary radiated emissions that the performance of the A3LSMN7505 remains representative of this model (FCC ID A3LSMN7507). Test data for FCC ID: A3LSMN7505 is being submitted for this application.

Radiated emissions were fully re-evaluated against 15B requirements for digital devices and results indicated no significant differences between the two versions. Other differences between the two FCC IDs are in the WWAN LTE band being removed for US region.

5.2. MAXIMUM OUTPUT FUNDAMENTAL FIELD STRENGTH

The ANT+ mode has maximum output fundamental field strength as follows:

Frequency Range (MHz)	Mode	Peak E-field Strength (dBuV/m)	Avg E-field Strength (dBuV/m)	Distance (m)
2402 - 2480	ANT +	57.20	9.24	3.00

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an FPCB antenna, with a maximum gain of -1.51 dBi.

5.4. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	Samsung	SM-N7505	FK-383-A	N/A
Earphone	Samsung	Samsung	N/A	N/A

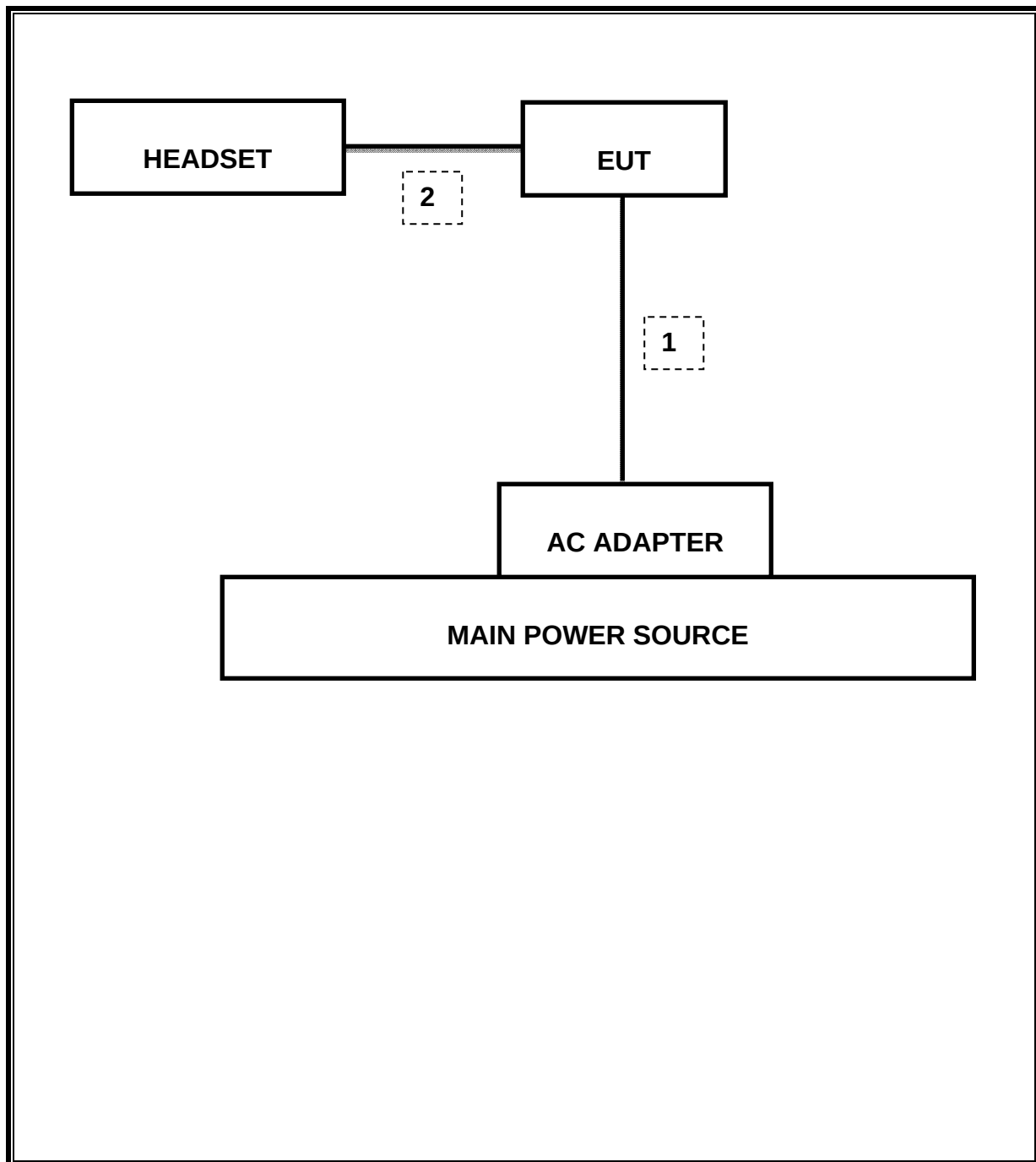
I/O CABLES

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	1.2m	N/A
2	Audio	1	Mini-Jack	Unshielded	1m	N/A

TEST SETUP

The EUT is set to continuously transmit in ANT + test mode

SETUP DIAGRAM FOR TESTS



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 Date	Cal Due
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	C01171	03/23/13	02/13/14
Antenna, Horn, 18GHz	EMCO	3115	C00783	10/25/13	10/25/14
Antenna, Horn, 25.5 GHz	ARA	MWH-1826/B	C00980	11/14/13	11/14/14
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	01/28/13	01/28/14
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	10/22/13	10/22/14
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	12/20/13	12/20/14
CBT Bluetooth Tester	R & S	CBT	None	07/12/13	07/12/14
Peak Power Meter	Agilent / HP	E4416A	C00963	12/13/13	12/13/14
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/13/13	12/13/14
LISN, 30 MHz	FCC	50/250-25-2	C00626	01/14/13	01/14/14
Reject Filter, 2.4GHz	Micro-Tronics	BRM50702	N02684	CNR	CNR

7. LIMITS AND RESULTS

7.1. 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

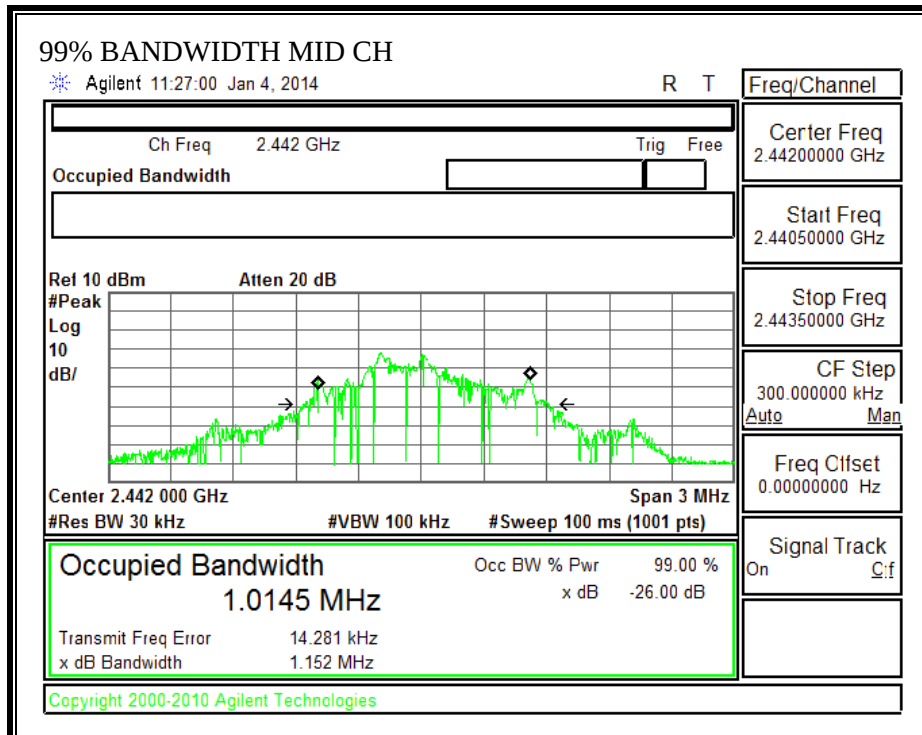
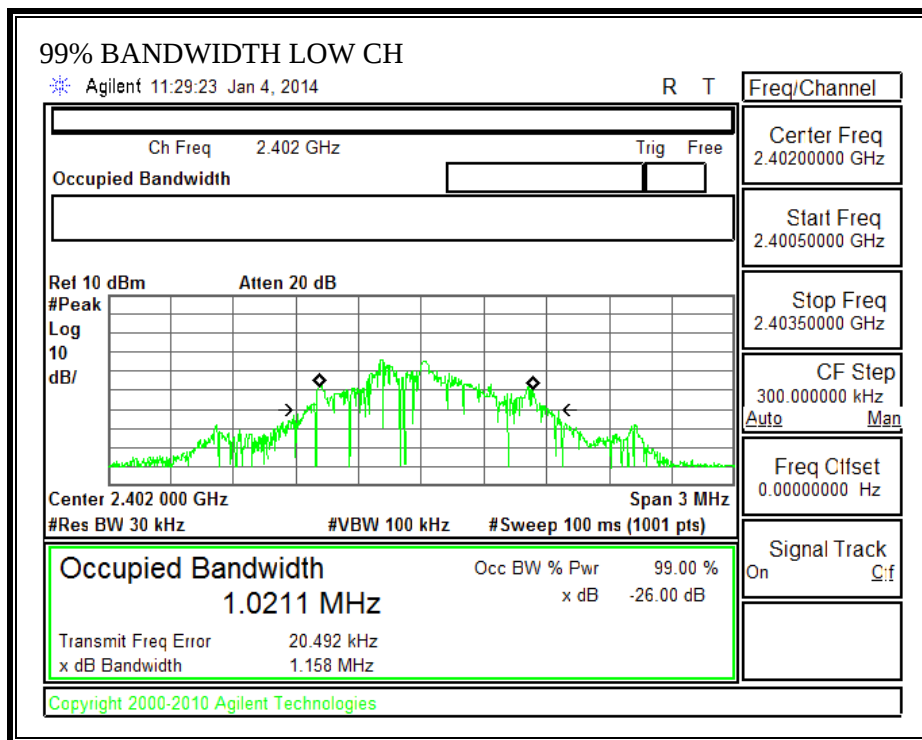
TEST PROCEDURE

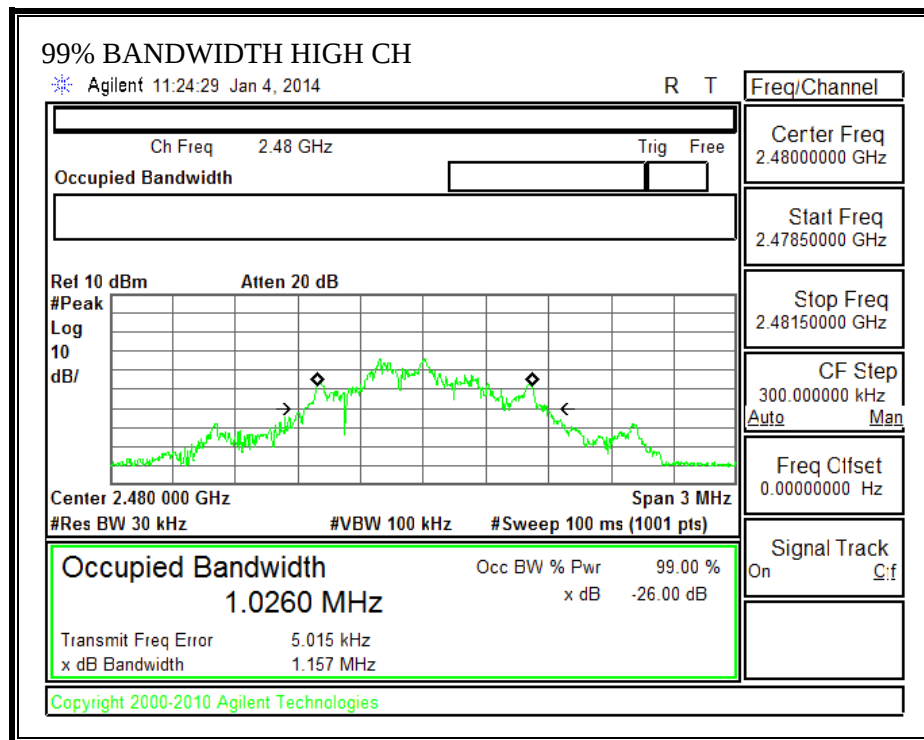
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0211
Middle	2442	1.0145
High	2480	1.026

99% BANDWIDTH





7.2. TRANSMITTER RADIATED EMISSIONS

TEST PROCEDURE

ANSI C63.4

LIMIT

IC RSS-210, A2.9
FCC 15.249

Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz, and 24.0–24.25 GHz.

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/ meter)	Field strength of harmonics (microvolts/ meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

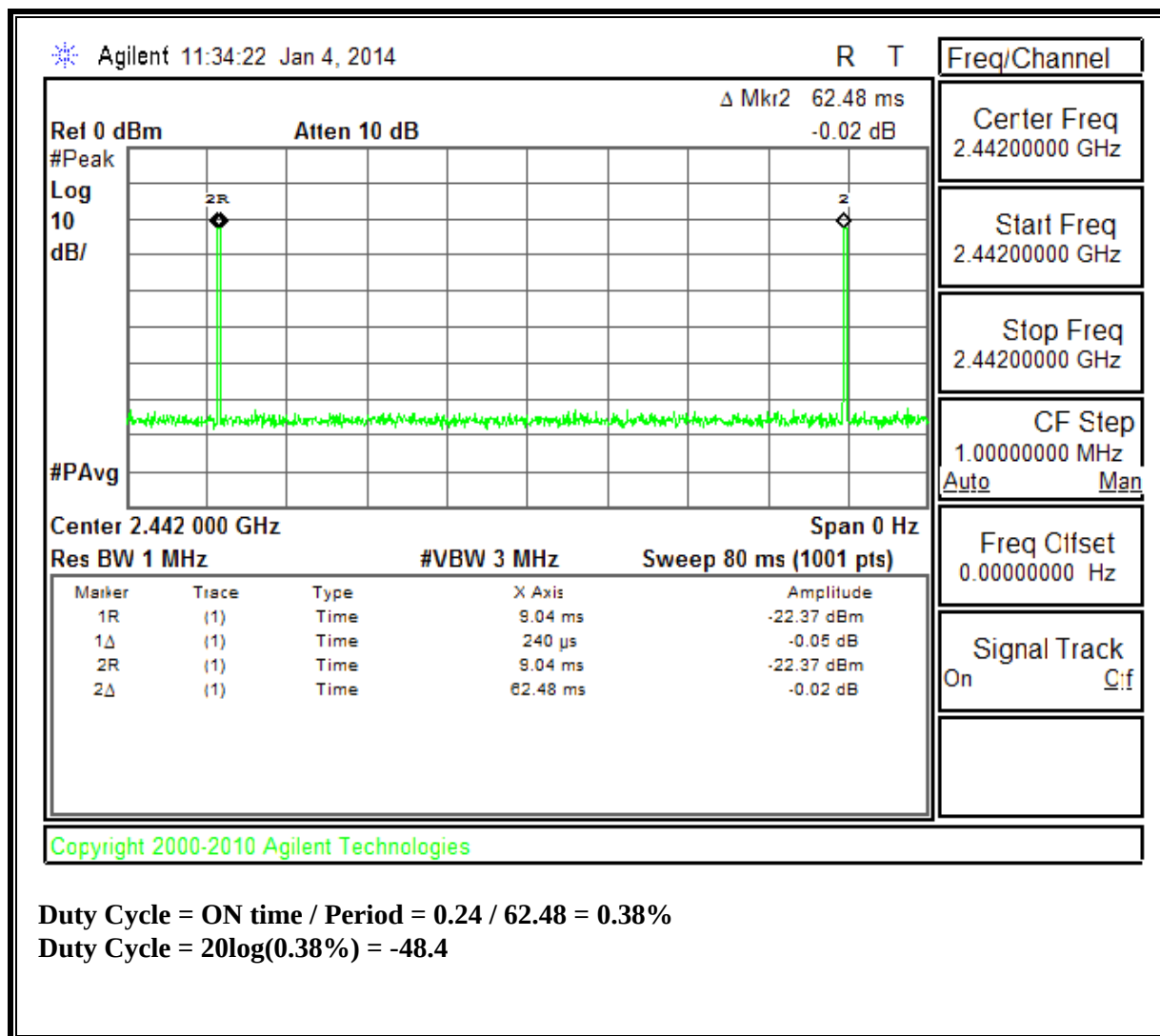
(e) As shown in Sec. 15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

Frequency (MHz)	Field strength (microvolts/meter)	Measure- ment dis- tance (meters)
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.

RESULTS

7.2.1. DUTY CYCLE

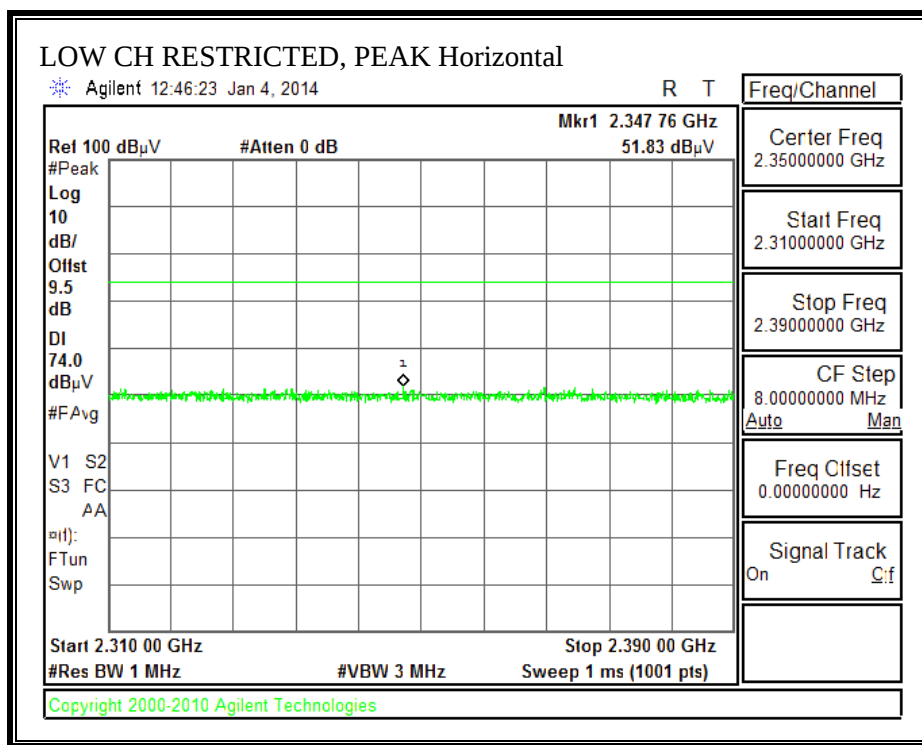


7.2.2. FUNDAMENTAL FREQUENCY RADIATED EMISSION

 FCC, VCCI, CISPR, CE, AUSTEL, NZ UL, CSA, TUV, BSMI, DHHS, NVLAP 47173 BENICIA STREET, FREMONT, CA 94538, USA		Project #: 13U16698 Report #: 13U16698 Date & Time: 01/04/14 Test Engr: Charles Vergonio												
Company: Samsung EUT Description: GSM/WCDMA Phone + Bluetooth & WLAN (2.4GHz & 5GHz) and NFC BAR PHONE Test Configuration: Y-Position (EUT Standup) Type of Test: FCC /IC Mode of Operation: Transmitting : ANT+ mode														
$M\% = ((t1+t2+t3+...)/T) * 66.83\% = 0.38\%$		$Av \text{ Reading} = Pk \text{ Reading} + 20 * \log(M\%)$ $20 * \log(M\%) = -48.40$												
Freq. (MHz)	Pk Rdg (dBuV)	Av Rdg (dBuV)	AF (dB)	Closs (dB)	Pre-amp (dB)	Pk Level (dBuV/m)	Av Level (dBuV/m)	Pk Limit FCC_B	Av Limit FCC_B	Pk Margin (dB)	Avg Margin (dB)	Pol (H/V)	Az (Deg)	Height (Meter)
Low channel														
2402.00	53.99	5.59	32.10	-22.80	0.00	63.29	14.89	114.00	94.00	-50.71	-79.11	3mV	0.00	1.00
2402.00	56.76	8.36	32.10	-22.80	0.00	66.06	17.66	114.00	94.00	-47.94	-76.34	3mH	0.00	2.00
Mid channel														
2442.00	55.73	7.33	32.10	-22.80	0.00	65.03	16.63	114.00	94.00	-48.97	-77.37	3mV	0.00	1.00
2442.00	57.20	8.80	32.10	-22.80	0.00	66.50	18.10	114.00	94.00	-47.50	-75.90	3mH	0.00	2.00
High channel														
2480.00	55.13	6.73	32.10	-22.80	0.00	64.43	16.03	114.00	94.00	-49.57	-77.97	3mV	0.00	1.00
2480.00	55.11	6.71	32.10	-22.80	0.00	64.41	16.01	114.00	94.00	-49.59	-77.99	3mH	0.00	2.00

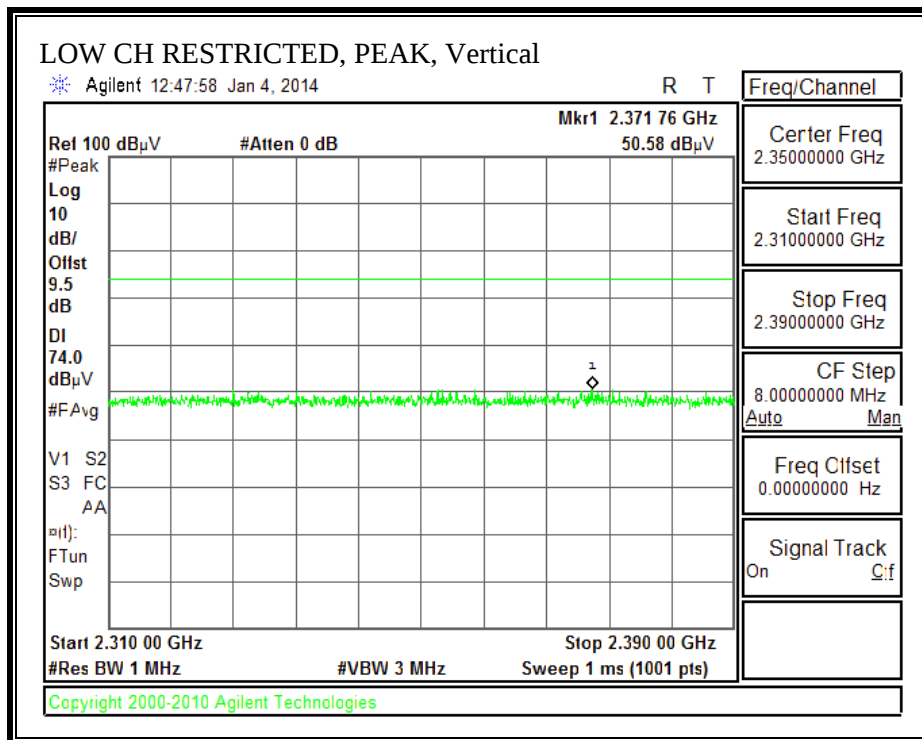
7.2.3. TRANSMITTER RESTRICTED BAND EDGES

RESTRICTED BANEDGE (LOW CHANNEL, HORIZONTAL)



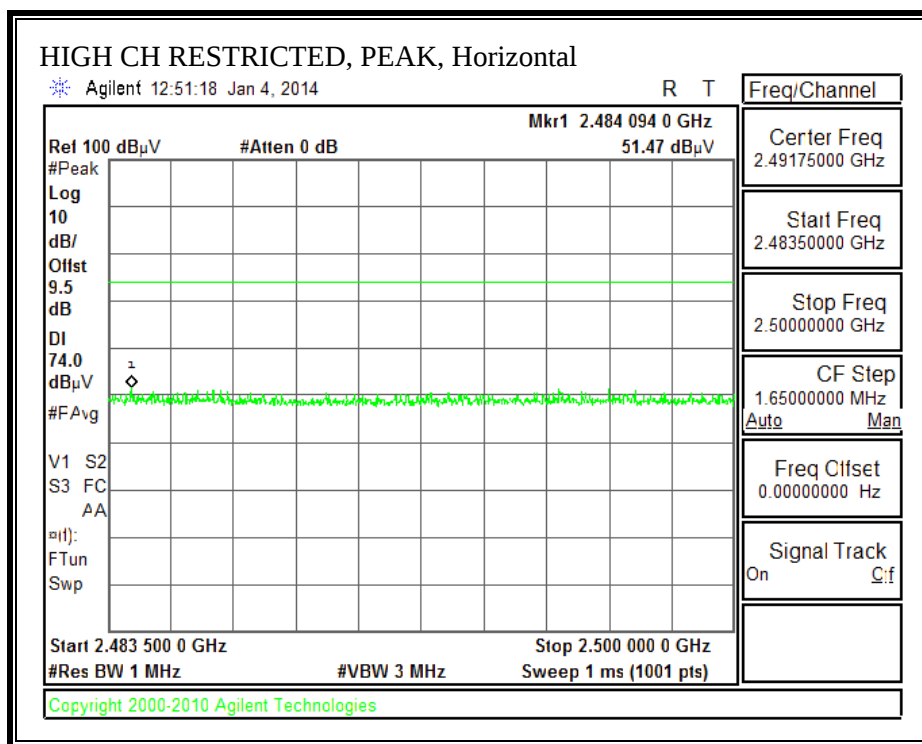
Note: Corrected Average Reading = $51.83 - 48.4 = 3.43$
 Passing Margin = $3.43 - 54 = -50.57$ dB

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



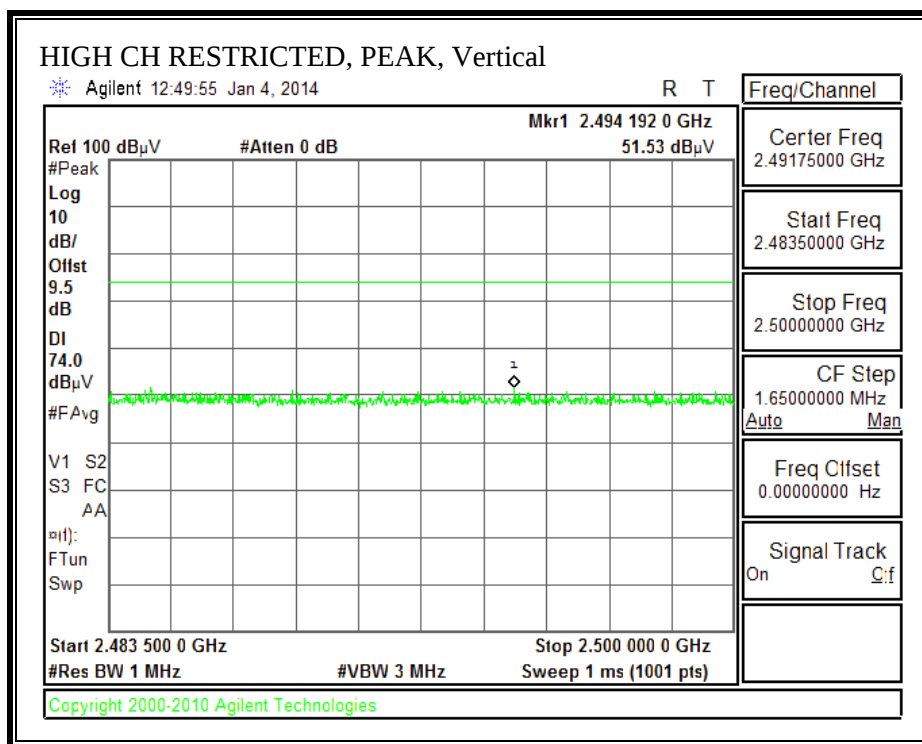
Note: Corrected Average Reading = 50.58 – 48.4 = 2.18
Passing Margin = 2.18 – 54 = -51.82 dB

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Note: Corrected Average Reading = 51.47 – 48.4 = 3.07
Passing Margin = 3.07 – 54 = -50.93 dB

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



Note: Corrected Average Reading = 51.53 – 48.4 = 3.13
Passing Margin = 3.13 – 54 = -50.87 dB

HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz



FCC, VCCI, CISPR, CE, AUSTEL, NZ
UL, CSA, TUV, BSMI, DHHS, NVLAP
47173 BENICIA STREET, FREMONT, CA 94538, USA

Project #: 13U16698
Report #: 13U16698
Date & Time: 01/04/14
Test Engr: Charles Vergonio

Company: Samsung
EUT Description: GSM/WCDMA Phone + Bluetooth & WLAN (2.4GHz & 5GHz) and NFC BAR PHONE
Test Configuration: Y-Position (EUT Standup)
Type of Test: FCC /IC Harmonics
Mode of Operation: Transmitting : ANT+ mode

M% = ((t1+t2+t3+...)/T) * 66.83% = 0.38%

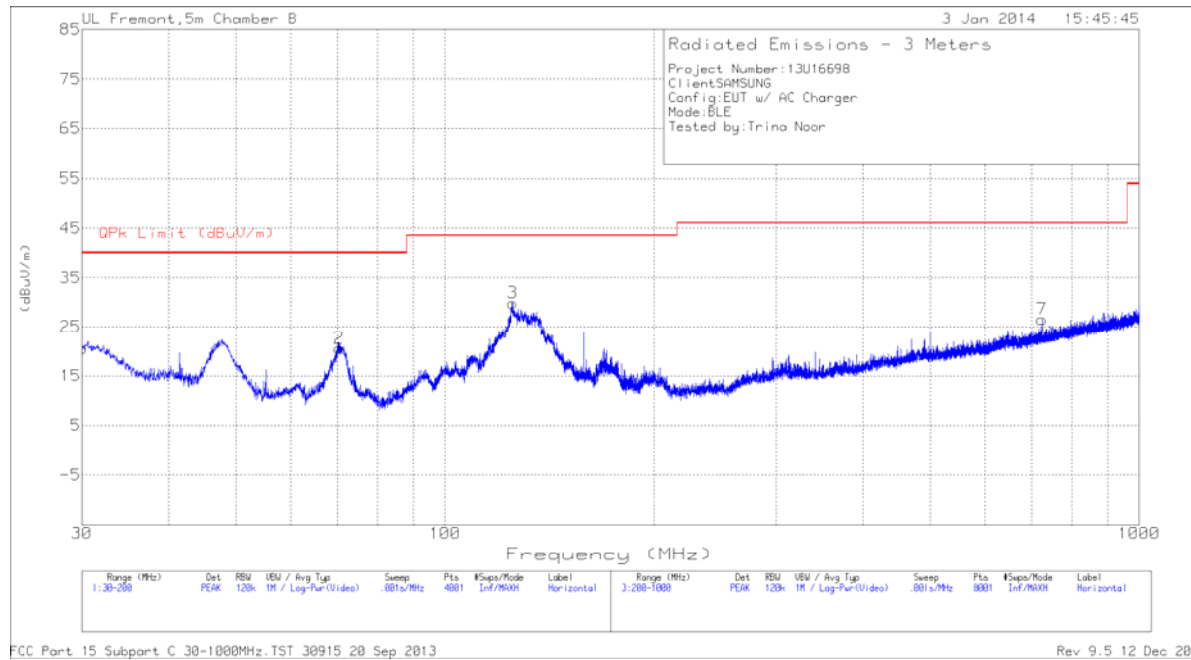
Av Reading = Pk Reading + 20*log(M%)
20 * log (M%) = -48.40

Freq. (MHz)	Pk Rdg (dBuV)	Av Rdg (dBuV)	AF (dB)	Closs (dB)	Pre-amp (dB)	Pk Level (dBuV/m)	Av Level (dBuV/m)	Pk Limit FCC_B	Av Limit FCC_B	Pk Margin (dB)	Avg Margin (dB)	Pol (H/V)	Az (Deg)	Height (Meter)
Low channel														
4804.00	26.17	15.39	32.10	-22.80	0.00	35.47	24.69	74.00	54.00	-38.53	-29.31	3mV	0.00	1.00
4804.00	26.16	15.51	32.10	-22.80	0.00	35.46	24.81	74.00	54.00	-38.54	-29.19	3mH	0.00	2.00
Mid channel														
4884.00	25.99	15.45	32.10	-22.80	0.00	35.29	24.75	74.00	54.00	-38.71	-29.25	3mV	0.00	1.00
4884.00	25.89	15.49	32.10	-22.80	0.00	35.19	24.79	74.00	54.00	-38.81	-29.21	3mH	0.00	2.00
High channel														
4960.00	25.82	15.25	32.10	-22.80	0.00	35.12	24.55	74.00	54.00	-38.88	-29.45	3mV	0.00	1.00
4960.00	25.95	15.51	32.10	-22.80	0.00	35.25	24.81	74.00	54.00	-38.75	-29.19	3mH	0.00	2.00

7.2.4. SPURIOUS BELOW 1 GHz

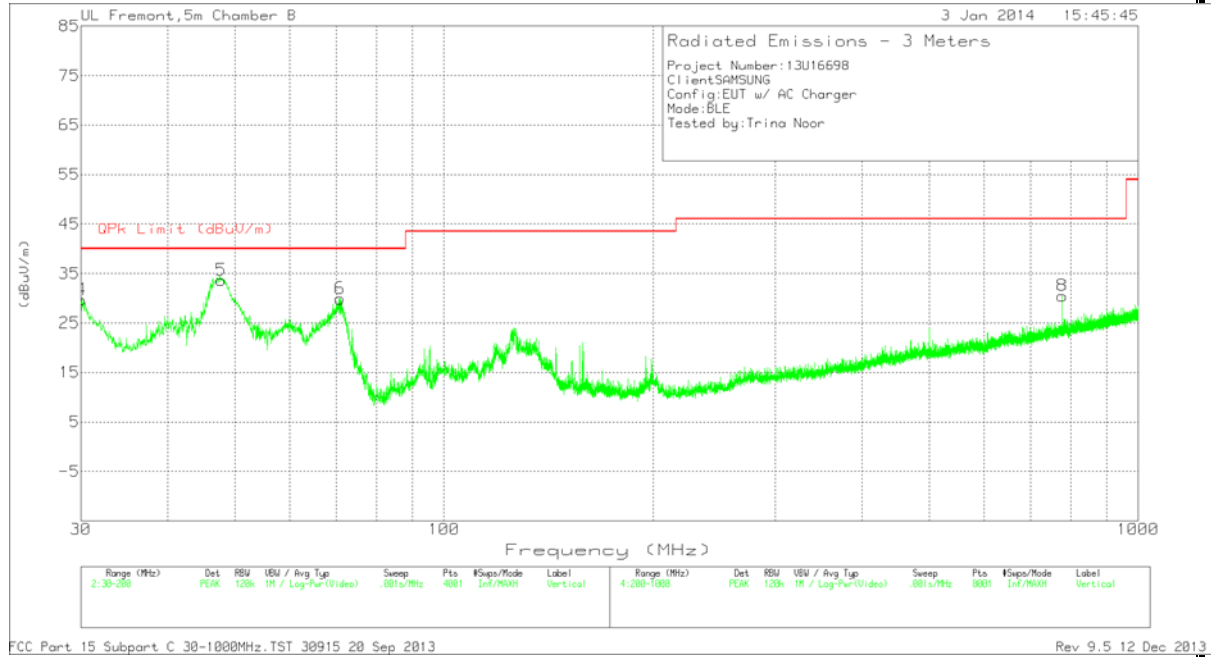
SPURIOUS EMISSIONS 30 TO 1000 MHz (HORIZONTAL)

HORIZONTAL PLOT



SPURIOUS EMISSIONS 30 TO 1000 MHz (VERTICAL)

VERTICAL PLOT



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T243 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	30.0425	28.65	PK	20.9	-28.9	20.65	40	-19.35	0-360	200	H
4	30.0425	37.68	PK	20.9	-28.9	29.68	40	-10.32	0-360	101	V
5	47.765	53.63	PK	8.6	-28.6	33.63	40	-6.37	0-360	101	V
2	70.4175	41.06	PK	7.9	-28.4	20.56	40	-19.44	0-360	200	H
6	70.8425	50.42	PK	7.9	-28.4	29.92	40	-10.08	0-360	101	V
3	125.2	43.55	PK	14.1	-27.8	29.85	43.52	-13.67	0-360	200	H
7	724.5	30.65	PK	20.4	-24.5	26.55	46.02	-19.47	0-360	300	H
8	777.3	33.5	PK	21.1	-24.1	30.5	46.02	-15.52	0-360	101	V

PK - Peak detector

FCC Part 15 Subpart C 30-1000MHz.TST 30915 20 Sep 2013 Rev 9.5 12 Dec 2013

7.3. RECEIVER RADIATED EMISSION

TEST PROCEDURE

ANSI C63.4

LIMIT

IC RSS-210
FCC 15.249

Frequency (MHz)	Field strength (microvolts/meter)	Measure- ment dis- tance (meters)
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.

RESULTS

The EUT is set to continuously transmit in ANT + test mode only,. Skip receiver mode

8. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

ANSI C63.4 - 2009

RESULTS

6 WORST EMISSIONS

Line-L1 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dB(uVolts)	CISPR 11/22 Class B Quasi-peak	Margin to Limit (dB)	CISPR 11/22 Class B Average	Margin to Limit (dB)
1	.15	47.33	PK	.1	0	47.43	66	-18.57	-	-
2	.15	27.32	Av	.1	0	27.42	-	-	56	-28.58
3	.2715	48.19	PK	.1	0	48.29	61.1	-12.81	-	-
4	.2715	30.28	Av	.1	0	30.38	-	-	51.1	-20.72
5	4.5285	43.94	PK	.1	.1	44.14	56	-11.86	-	-
6	4.5285	20.17	Av	.1	.1	20.37	-	-	46	-25.63
7	13.5555	30.39	PK	.2	.2	30.79	60	-29.21	-	-
8	13.5555	20.65	Av	.2	.2	21.05	-	-	50	-28.95
9	27.123	27.49	PK	.5	.3	28.29	60	-31.71	-	-
10	27.123	1.61	Av	.5	.3	2.41	-	-	50	-47.59

Line-L2 .15 - 30MHz

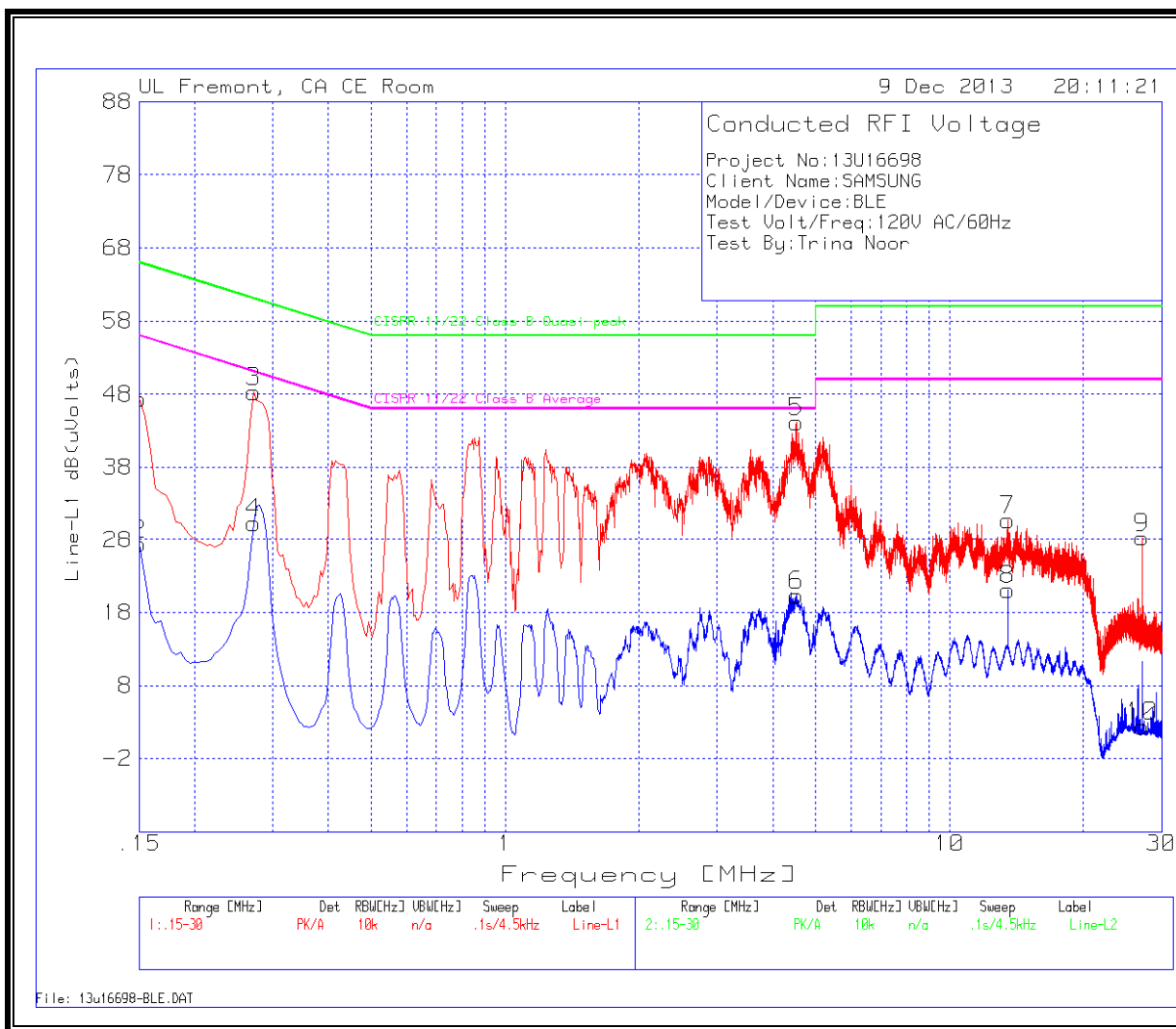
Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dB(uVolts)	CISPR 11/22 Class B Quasi-peak	Margin to Limit (dB)	CISPR 11/22 Class B Average	Margin to Limit (dB)
11	.15	47.51	PK	.1	0	47.61	66	-18.39	-	-
12	.15	23.77	Av	.1	0	23.87	-	-	56	-32.13
13	.2715	47.72	PK	.1	0	47.82	61.1	-13.28	-	-
14	.2715	28.02	Av	.1	0	28.12	-	-	51.1	-22.98
15	5.181	40.19	PK	.1	.1	40.39	60	-19.61	-	-
16	5.181	18.51	Av	.1	.1	18.71	-	-	50	-31.29
17	13.6545	27	PK	.2	.2	27.4	60	-32.6	-	-
18	13.6545	12.29	Av	.2	.2	12.69	-	-	50	-37.31

PK - Peak detector

Av - average detection

LINE 1 RESULTS



LINE 2 RESULTS

