FCC CFR47 PART 15 SUBPART C

NFC

CERTIFICATION TEST REPORT

FOR

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

MODEL NUMBER : SM-G611S, SM-G611K, SM-G611L

FCC ID: A3LSMG611KOR

REPORT NUMBER: 4788269334-E4V2

ISSUE DATE: JAN 05, 2018

Prepared for
SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
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ACCREDITED
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	01/04/18	Initial issue	Junwhan Lee
V2	01/05/18	Revised to address TCB's question	Junwhan Lee

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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. MEASURING INSTRUMENT CALIBRATION 5

4.2. SAMPLE CALCULATION 5

4.3. MEASUREMENT UNCERTAINTY 5

5. EQUIPMENT UNDER TEST 6

5.1. DESCRIPTION OF EUT 6

5.2. MAXIMUM E-FIELD STRENGTH 6

5.3. WORST-CASE CONFIGURATION AND MODE 6

5.4. DESCRIPTION OF TEST SETUP 7

6. TEST AND MEASUREMENT EQUIPMENT 10

7. 20dB BANDWIDTH 11

8. RADIATED EMISSION TEST RESULTS 12

8.1. LIMITS AND PROCEDURE 12

8.1.1. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz) 14

8.1.2. SPURIOUS EMISSION 0.09 TO 30 MHz 16

8.1.3. TX SPURIOUS EMISSION 30 TO 1000 MHz 18

9. AC MAINS LINE CONDUCTED EMISSIONS 20

10. FREQUENCY STABILITY 25

11. SETUP PHOTOS 26

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	GSM/WCDMA/LTE Phone + BT/BLE, DTS b/g/n, ANT+ and NFC
MODEL NUMBER:	SM-G611S, SM-G611K, SM-G611L
SERIAL NUMBER:	R39JB04JBD, R39JB04JBP (RADIATED,CONDUCTED);
DATE TESTED:	DEC 20, 2017 - DEC 28, 2017

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:

SungGil Park
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

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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.

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

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:

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	2.32 dB
Radiated Disturbance, Below 1GHz	3.86 dB

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

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

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

SM-G611S and SM-G611K/SM-G611L are same hardware and only difference is S/W user interface for different network operator. SM-G611S was used for the tests.

5.2. MAXIMUM E-FIELD STRENGTH

The testing was performed at 3 meter. The transmitter maximum E-field at 30m distance is 21.97 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 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.

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).

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5.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA50KWK	DW2J609DS/A -E	N/A
Data Cable	SAMSUNG	ECB-DU68WE	N/A	N/A
Earphone	SAMSUNG	EHS64AVFWE	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	2	Mini-Jack	Unshielded	1.2m	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 attached to the EUT with NFC signal continuously transmitting.

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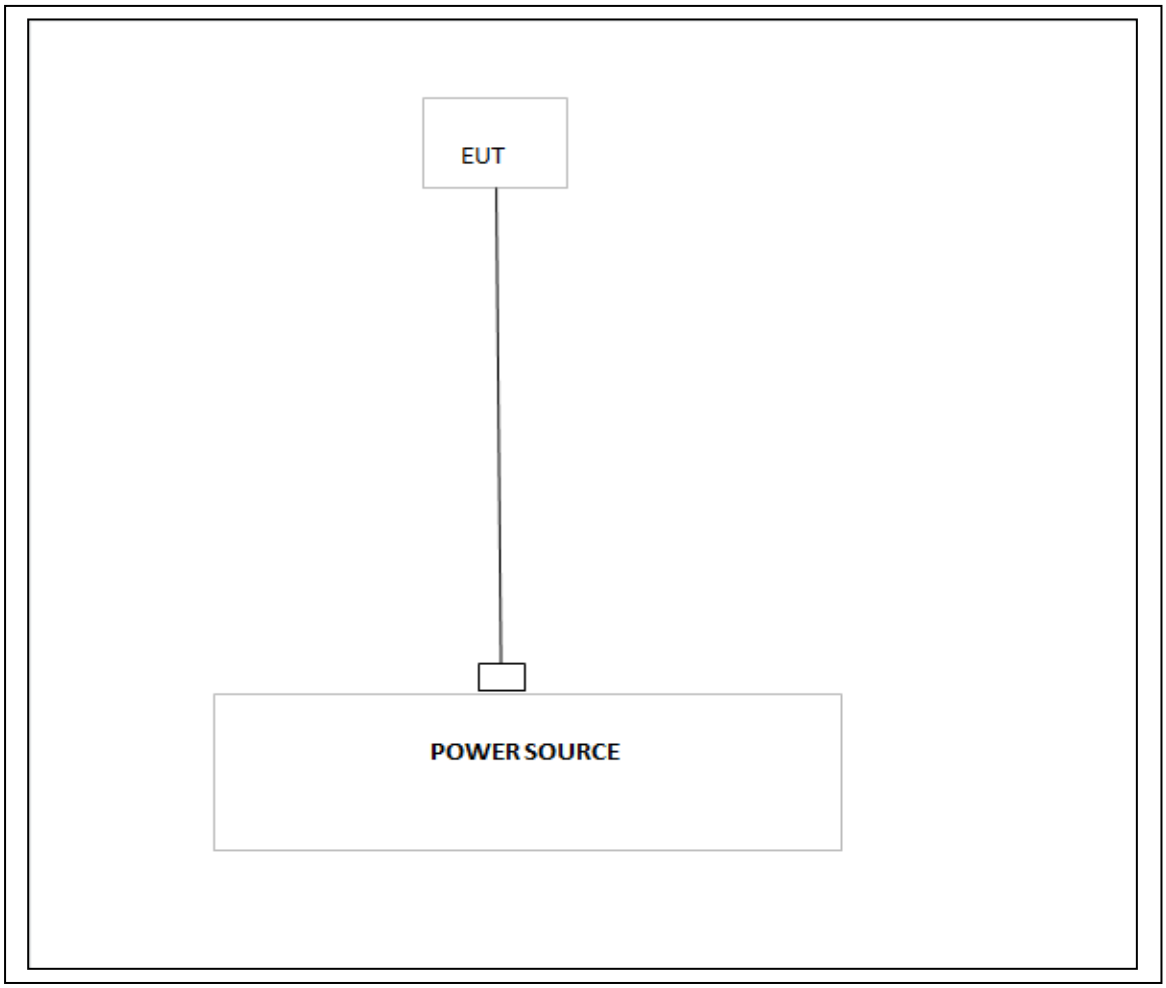
SETUP DIAGRAM FOR TESTS

Radiated Emissions Below 30 MHz:



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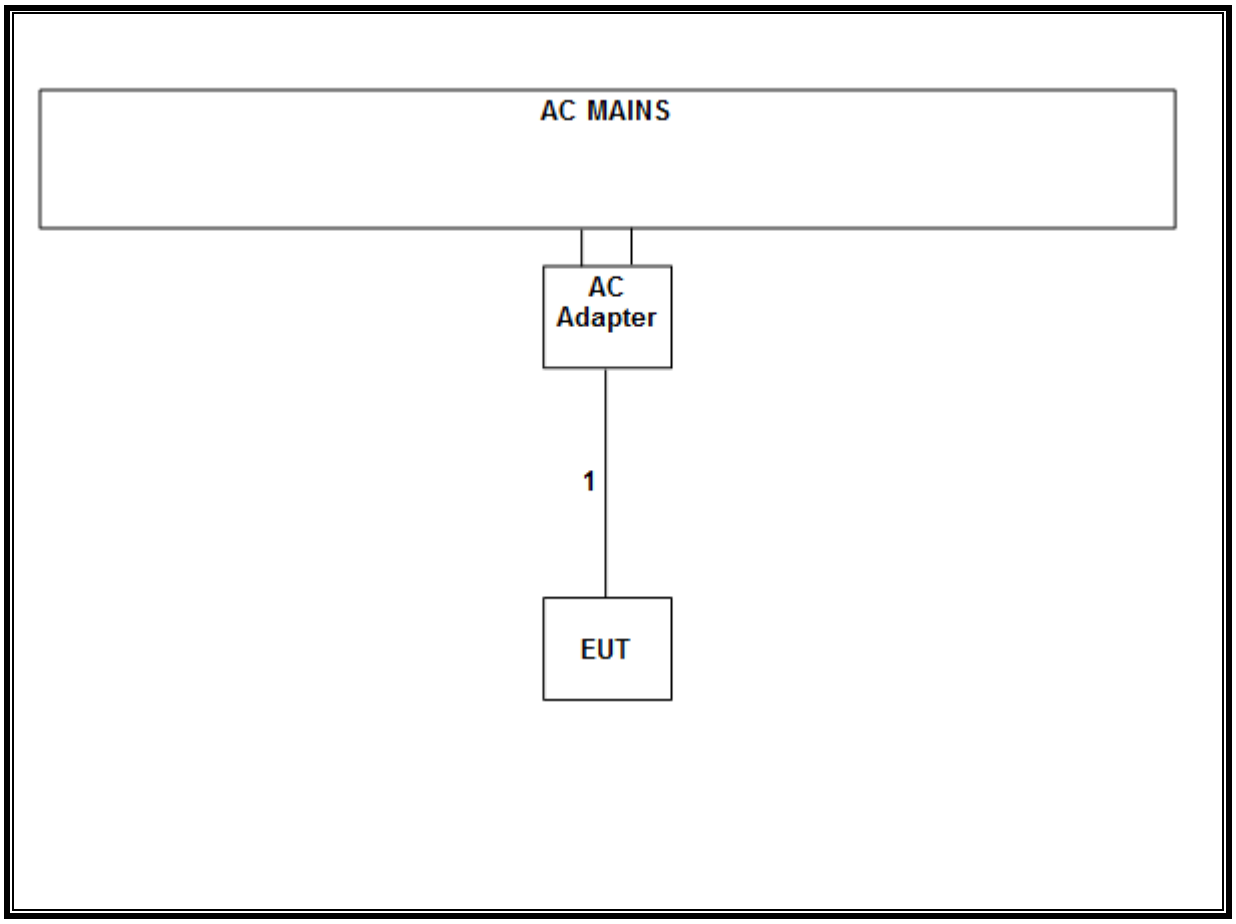
Radiated Emissions Above 30 MHz, AC Line Conducted Emissions:



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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	750	08-31-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	04-14-19
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	10-26-19
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-09-18
Preamplifier, 1000 MHz	Sonoma	310N	251741	08-07-18
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-08-18
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-08-18
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-08-18
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-08-18
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-07-18
DC Power Supply	Agilent / HP	E3640A	MY54226395	08-07-18
Temperature Chamber	ESPEC	SH-642	93001109	08-08-18
LISN	R&S	ENV216	101837	08-09-18
UL Software				
Description	**Manufacturer**	**Model**	**Version**	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

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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]	20dB Bandwidth [KHz]
13.56	432.95

20dB Bandwidth Plot

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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 filed strength from uV/m to dBuV/m is:
Limit (dBuV/m) = 20 log limit (uV/m)

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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:

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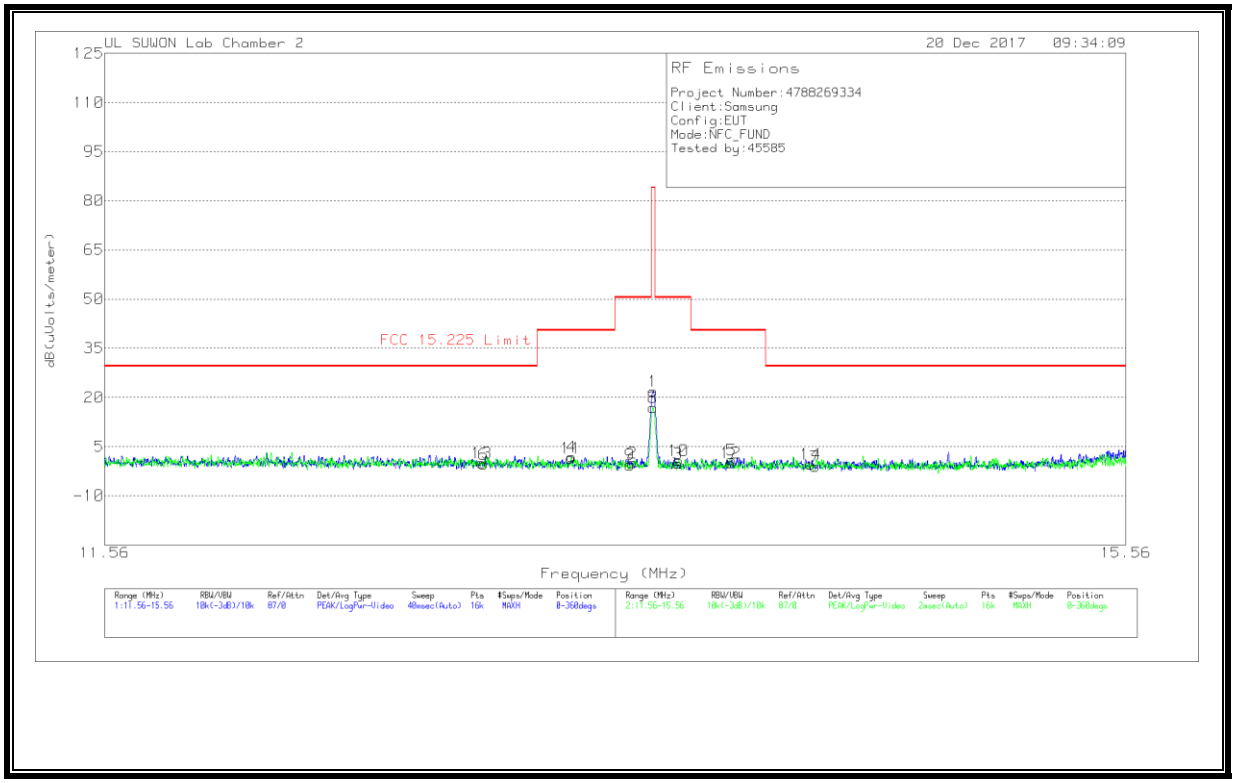
8.1.1. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz)



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Trace Markers

Range 1: Face On 11.56 - 15.56MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna	Dist Corr 30m	Cable Loss	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
1	13.56088	41.57	Pk	19.9	-40	.5	21.97	84	-62.03	0-360
2	13.47813	19.62	Pk	19.9	-40	.5	.02	50.5	-50.48	0-360
3	13.65863	19.33	Pk	19.9	-40	.6	-.17	50.5	-50.67	0-360
4	13.24188	21.39	Pk	19.9	-40	.5	1.79	40.51	-38.72	0-360
5	13.87388	20.56	Pk	19.8	-40	.6	.96	40.51	-39.55	0-360
6	12.90788	19.2	Pk	19.9	-40	.5	-.4	29.54	-29.94	0-360
7	14.21488	18.55	Pk	19.8	-40	.6	-1.05	29.54	-30.59	0-360

Pk - Peak detector

Range 2: Face Off 11.56 - 15.56MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna	Dist Corr 30m	Cable Loss	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
8	13.55988	36.56	Pk	19.9	-40	.5	16.96	84	-67.04	0-360
9	13.46863	18.96	Pk	19.9	-40	.5	-.64	50.5	-51.14	0-360
10	13.66175	20.31	Pk	19.9	-40	.6	.81	50.5	-49.69	0-360
11	13.24025	21.08	Pk	19.9	-40	.5	1.48	40.51	-39.03	0-360
12	13.87138	19.66	Pk	19.8	-40	.6	.06	40.51	-40.45	0-360
13	12.90125	19.63	Pk	19.9	-40	.5	.03	29.54	-29.51	0-360
14	14.19688	19.29	Pk	19.8	-40	.6	-.31	29.54	-29.85	0-360

Pk - Peak detector

Note : Although these tests were performed other than open area 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.

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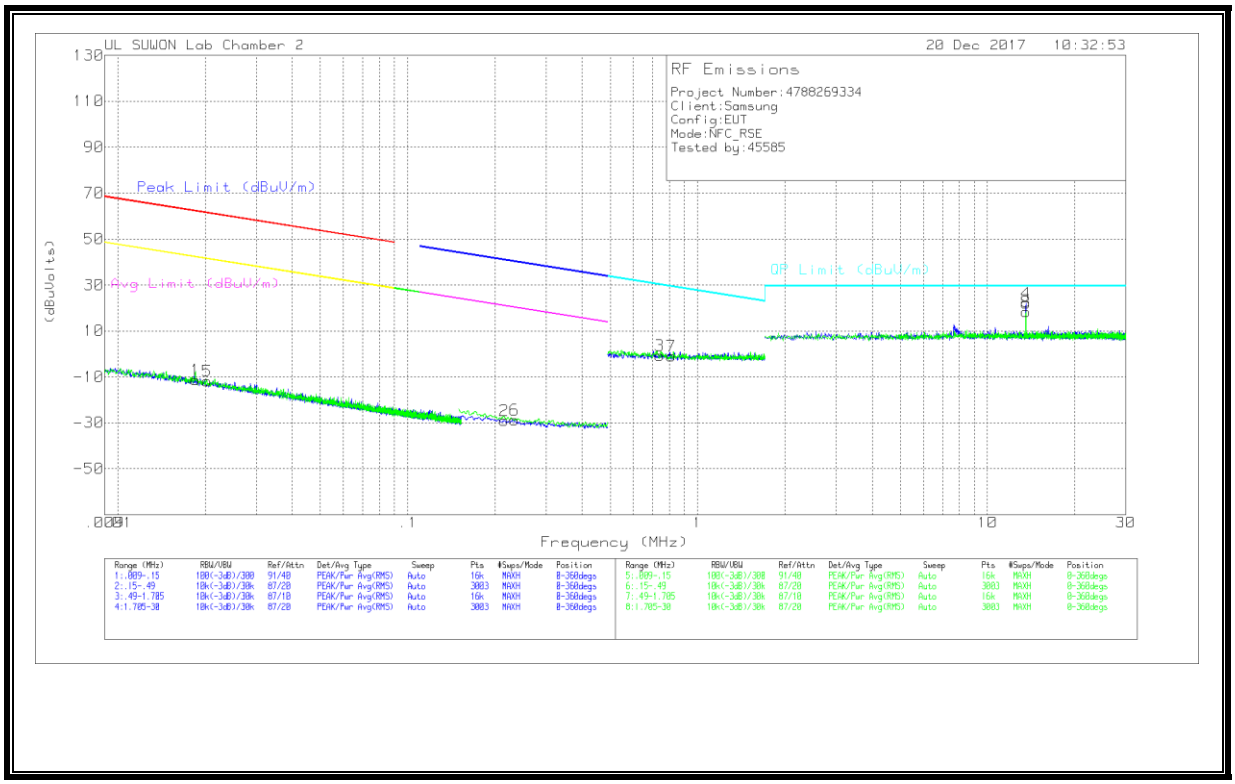
8.1.2. SPURIOUS EMISSION 0.09 TO 30 MHz



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Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna	Cable Loss	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QP Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.01858	48.64	Pk	20	.1	-80	-11.26	62.21	-73.47	42.21	-53.47	-	-	-	-	-	-	0-360
5	.02029	48.01	Pk	20	.1	-80	-11.89	61.44	-73.33	41.44	-53.33	-	-	-	-	-	-	0-360
2	.21475	31.28	Pk	19.6	.1	-80	-29.02	-	-	-	-	-	-	40.98	-70	20.98	-50	0-360
6	.23317	31.51	Pk	19.6	.1	-80	-28.79	-	-	-	-	-	-	40.26	-69.05	20.26	-49.05	0-360

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna	Cable Loss	Dist Corr 30m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.74	19.44	Pk	19.7	.1	-40	-.76	-	-	-	-	30.23	-30.99	0-360
7	.81186	19.1	Pk	19.7	.2	-40	-1	-	-	-	-	29.43	-30.43	0-360
4	13.56165	41.57	Pk	19.9	.5	-40	21.97	-	-	-	-	29.5	-7.53	0-360
8	13.56165	37.87	Pk	19.9	.5	-40	18.27	-	-	-	-	29.5	-11.23	0-360

Pk - Peak detector

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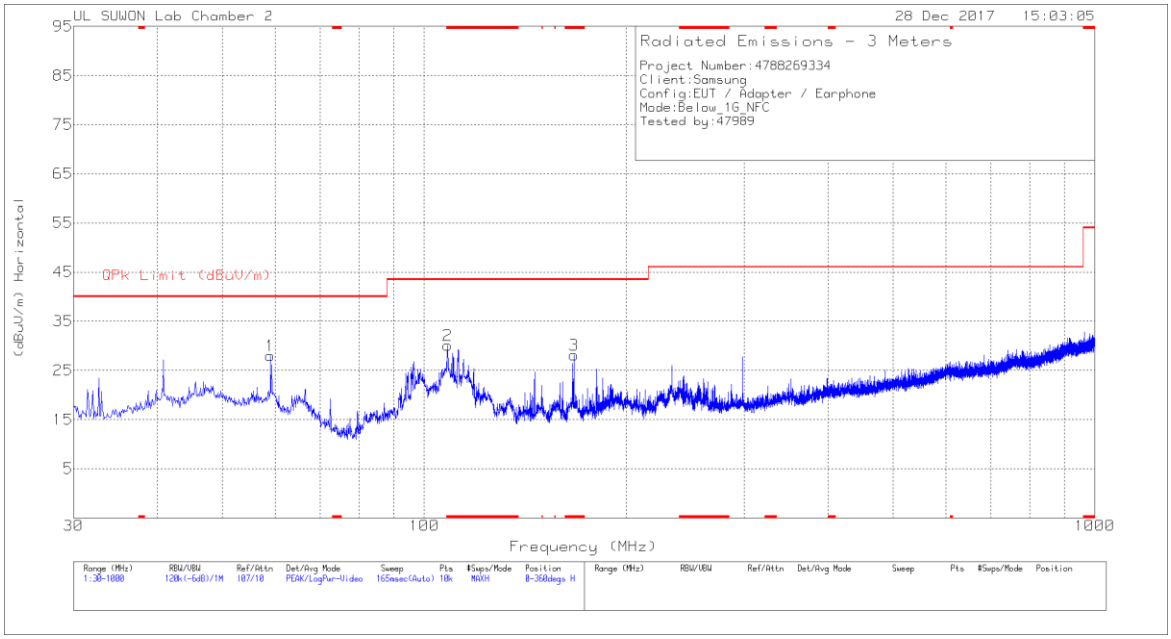
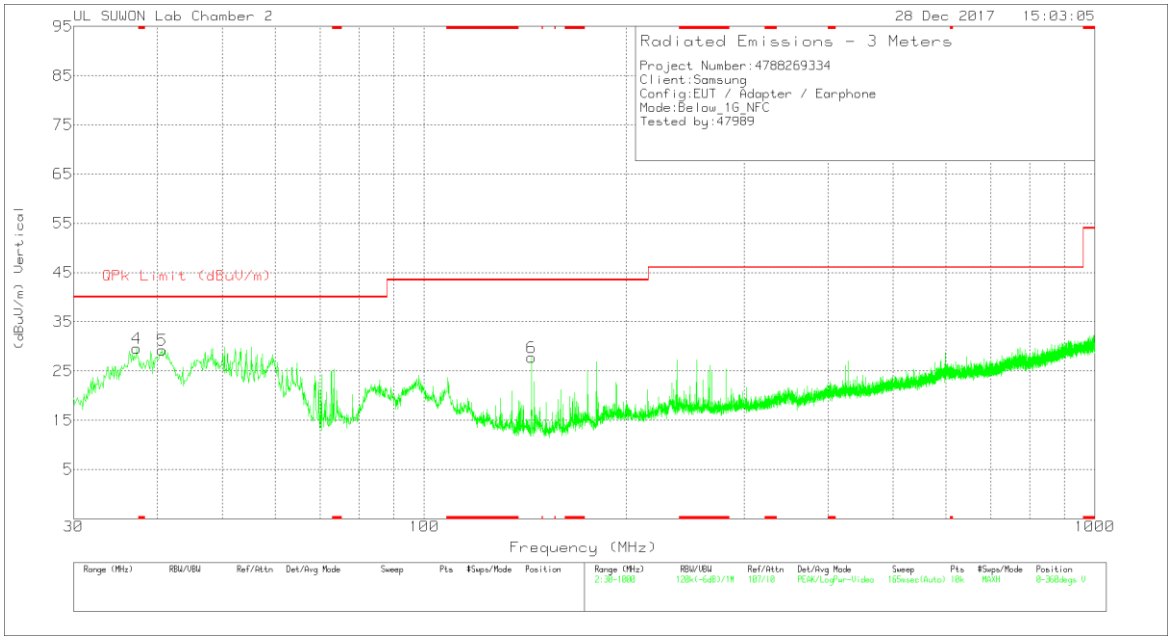
8.1.3. TX SPURIOUS EMISSION 30 TO 1000 MHz

HORIZONTAL



VERTICAL



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Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-749	30-1000MHz[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	59.003	40.74	Pk	18.5	-31.3	27.94	40	-12.06	0-360	400	H
2	* 108.473	43.88	Pk	17.2	-31	30.08	43.52	-13.44	0-360	300	H
3	* 167.158	44.27	Pk	14.6	-30.7	28.17	43.52	-15.35	0-360	300	H
4	37.275	43.18	Pk	18	-31.6	29.58	40	-10.42	0-360	100	V
5	40.67	41.68	Pk	19.1	-31.5	29.28	40	-10.72	0-360	100	V
6	144.557	45	Pk	13.5	-30.8	27.7	43.52	-15.82	0-360	200	V

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

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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:

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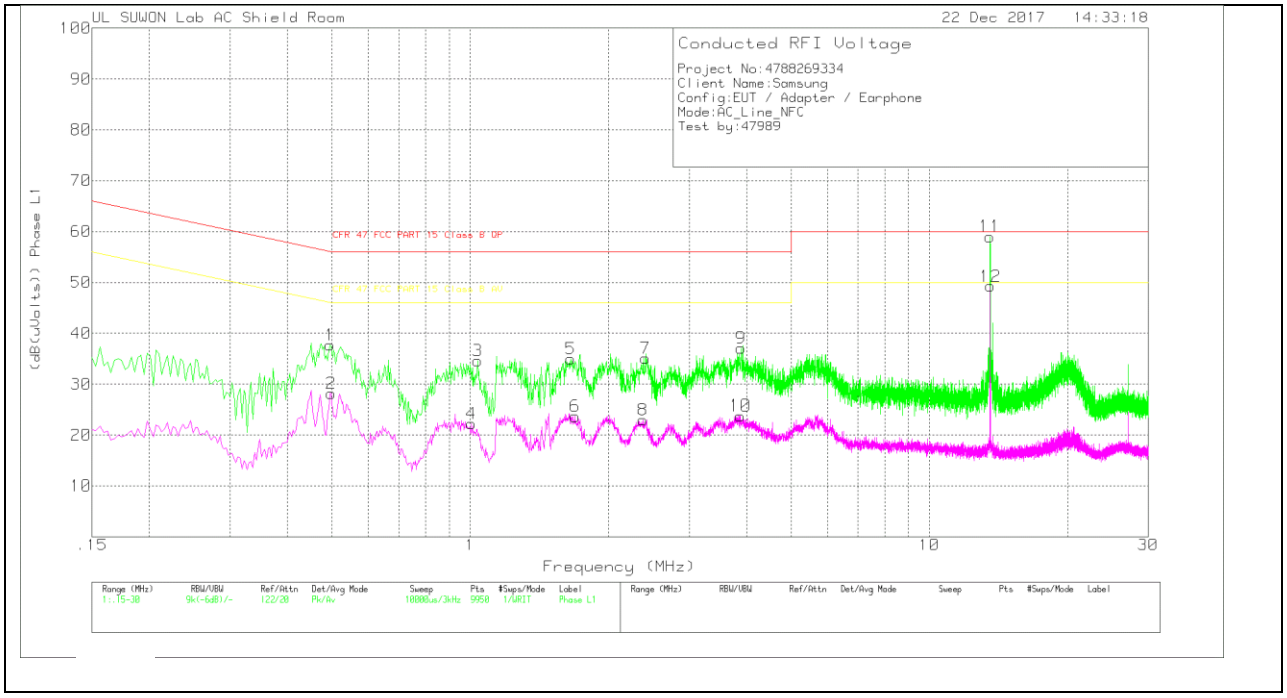
WORST EMISSIONS

LINE 1 PLOT



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LINE 1 RESULTS

Trace Markers

Range 1: Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_L1_with extension	CABLELOSS(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	.495	27.76	Pk	9.7	.2	37.66	56.08	-18.42	-	-
2	.498	18.32	Av	9.7	.2	28.22	-	-	46.03	-17.81
3	1.038	24.54	Pk	9.8	.3	34.64	56	-21.36	-	-
4	1.005	12.19	Av	9.8	.3	22.29	-	-	46	-23.71
5	1.656	24.72	Pk	9.9	.3	34.92	56	-21.08	-	-
6	1.695	13.46	Av	9.9	.3	23.66	-	-	46	-22.34
7	2.406	25.03	Pk	9.8	.3	35.13	56	-20.87	-	-
8	2.376	12.93	Av	9.8	.3	23.03	-	-	46	-22.97
9	3.885	27.01	Pk	9.8	.3	37.11	56	-18.89	-	-
10	3.873	13.68	Av	9.8	.3	23.78	-	-	46	-22.22
11	13.56	45.87	Pk	9.8	.4	56.07	60	-3.93	-	-
12	13.56	32.9	Av	9.8	.4	43.1	-	-	50	-6.9

Pk - Peak detector
Av - Average detection

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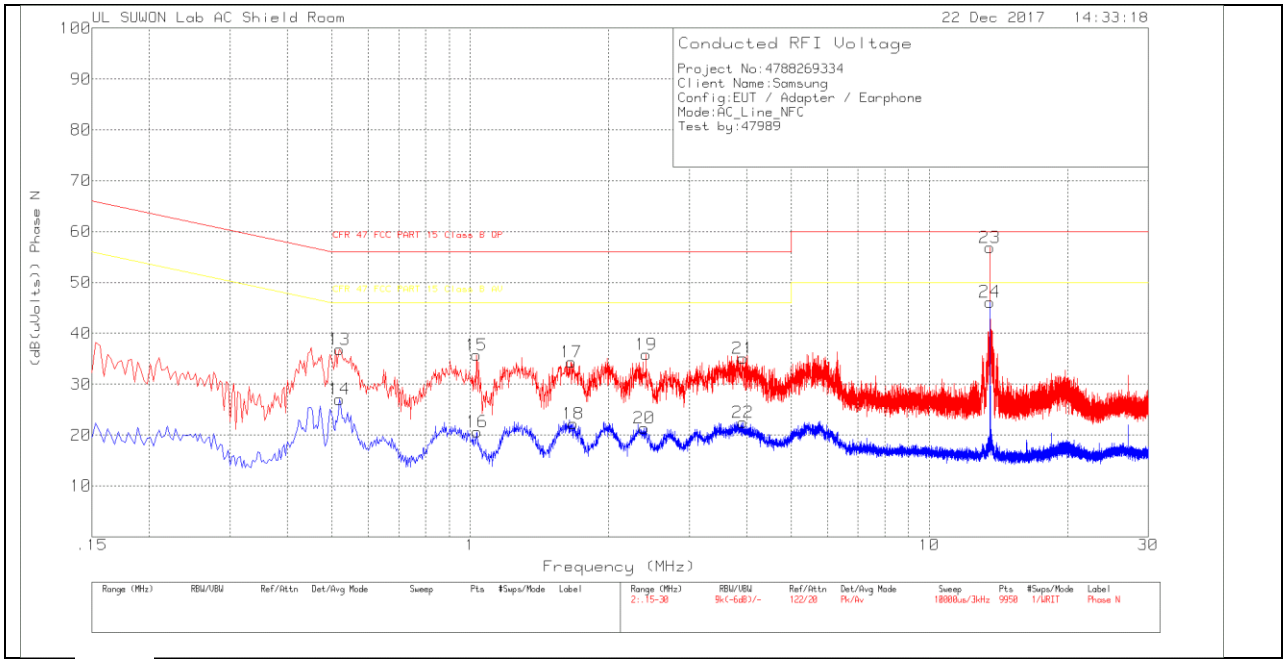
LINE 2 PLOT



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LINE 2 RESULTS

Trace Markers

Range 2: Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_N_with extension	CABLELOSS(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	.519	26.85	Pk	9.8	.2	36.85	56	-19.15	-	-
14	.519	17	Av	9.8	.2	27	-	-	46	-19
15	1.032	25.55	Pk	9.9	.3	35.75	56	-20.25	-	-
16	1.035	10.46	Av	9.9	.3	20.66	-	-	46	-25.34
17	1.659	24.13	Pk	9.9	.3	34.33	56	-21.67	-	-
18	1.677	12	Av	9.9	.3	22.2	-	-	46	-23.8
19	2.418	25.59	Pk	9.9	.3	35.79	56	-20.21	-	-
20	2.397	11.13	Av	9.9	.3	21.33	-	-	46	-24.67
21	3.921	24.95	Pk	9.8	.3	35.05	56	-20.95	-	-
22	3.924	12.4	Av	9.8	.3	22.5	-	-	46	-23.5
23	13.56	42	Pk	9.8	.4	52.2	60	-7.8	-	-
24	13.56	31.8	Av	9.8	.4	42	-	-	50	-8

Pk - Peak detector
Av - Average detection

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10. 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 §6.8

RESULTS

Reference Frequency: EUT Channel 13.56 MHz @ 20ºC Limit: ± 100 ppm = 1.356 kHz										
Power Supply	Envir.	Frequency Deviation Measureed with Time Elapse								
(Vdc)	Temp (°C)	Start up (MHz)	Delta (ppm)	@ 2mins (MHz)	Delta (ppm)	@ 5mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
3.85	50	13.559856003	0.443	13.559855083	0.511	13.559854885	0.526	13.559854569	0.549	100
3.85	40	13.559857958	0.299	13.559857502	0.333	13.559856898	0.377	13.559856618	0.398	100
3.85	30	13.559860425	0.117	13.559859563	0.181	13.559858973	0.224	13.559858622	0.250	100
3.85	***20***	***13.559862013***	***0***	***13.559861967***	0.003	***13.559861698***	0.023	***13.559861433***	0.043	***100***
3.85	10	13.559862286	-0.020	13.559862290	-0.020	13.559862271	-0.019	13.559862232	-0.016	100
3.85	0	13.559861230	0.058	13.559861724	0.021	13.559861938	0.006	13.559861923	0.007	100
3.85	-10	13.559857910	0.303	13.559858853	0.233	13.559859351	0.196	13.559859678	0.172	100
3.85	-20	13.559854374	0.563	13.559854882	0.526	13.559855204	0.502	13.559855379	0.489	100
3.85	-30	13.559853000	0.665	13.559852298	0.716	13.559851131	0.803	13.559850086	0.880	100

Reference Frequency: EUT Channel 13.56 MHz @ 20ºC Limit: ± 100 ppm = 1.356 kHz										
Power Supply	Envir.	Frequency Deviation Measureed with Time Elapse								
(Vdc)	Temp (°C)	Start up (MHz)	Delta (ppm)	@ 2mins (MHz)	Delta (ppm)	@ 5mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
3.85	***20***	***13.559862013***	***0***	***13.559861967***	0.003	***13.559861698***	0.023	***13.559861433***	0.043	***100***
4.30	20	13.559861994	0.001	***13.559861858***	0.011	***13.559740449***	8.942	***13.559861316***	0.051	100
3.60	20	13.559862112	-0.007	***13.559862117***	-0.008	***13.559825659***	2.658	***13.559861515***	0.037	100

No non-compliance noted.

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