FCC CFR47 PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac & NFC

FCC ID: PY7-PM0944

REPORT NUMBER: R11139405A-E4

ISSUE DATE: 4/19/2016

Prepared for
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Revision History

Rev.	Issue Date	Revisions	Revised By
V1	4/19/2016	Initial issue	C. OOI

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SONY MOBILE COMMUNICATIONS, INC.

EUT DESCRIPTION: GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac & NFC

SERIAL NUMBER: 245-606926-6

DATE TESTED: April 8 -18, 2016

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass

UL LLC reports apply only to the specific samples tested under stated test conditions. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL LLC shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL LLC issued reports. 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.

This report may contain test results that are not covered by the NVLAP or A2LA accreditation. The scope of accreditation is limited to the specific tests that are listed on the NVLAP and/or A2LA websites referenced at the end of this report..

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, RSS-GEN Issue 4, and RSS-247 Issue 1.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Dr., Research Triangle Park, NC 27709, USA and 2800 Suite B, Perimeter Park Drive, Morrisville, NC 27560.

12 Laboratory Dr., RTP, NC 27709
☐ Chamber A
☐ Chamber C

2800 Suite B Perimeter Park Dr., Morrisville, NC 27560
☐ Chamber NORTH
☒ Chamber SOUTH

The onsite chambers are covered under Industry Canada company address code 2180C with site numbers 2180C -1 through 2180C-4, respectively.

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at http://www.nist.gov/nvlap/

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
Total RF power, conducted	+/-	0.45
RF power density, conducted	+/-	1.50
Spurious emissions, conducted	+/-	2.94
All emissions, radiated up to 26 GHz	+/-	5.36
Temperature	+/-	0.07
Humidity	+/-	2.26
DC and low frequency voltages	+/-	1.27
Conducted Disturbance, 0.15 to 30 MHz	+/-	2.37

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 with BT, DTS/UNII a/b/g/n/ac & NFC.

5.2. MAXIMUM OUTPUT POWER

The testing was performed at 3 meter. The transmitter maximum E-field at 30 meter distance is 21.3 dBuV/m which is converted from the 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.

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 (for sample)	Sony	UCH 20	1215W44500692	N/A
Headphone	Sony			

I/O CABLES

Radiated Emissions above 30 MHz, AC Line Conducted Emissions:

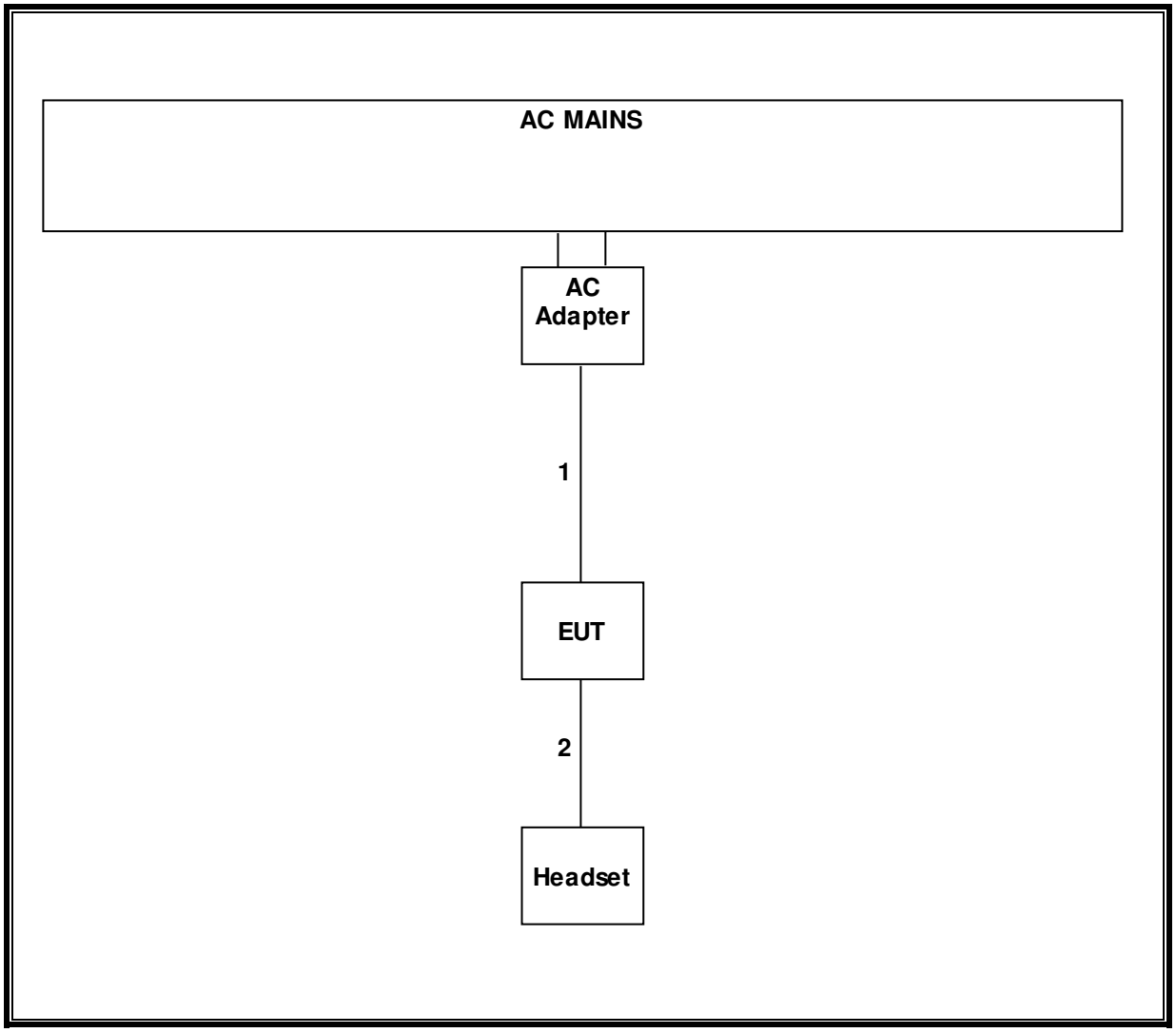
I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	Micro-USB	Shielded	1m	None
2	Audio	1	Mini-Jack	Unshielded	1.5m	None

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:



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	**(Loop Ant.)**			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2015-12-08	2016-12-31
	30-1000 MHz				
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2015-06-10	2016-06-30
	Gain-Loss Chains				
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2015-10-07	2016-10-31
S-SAC02	Gain-loss string: 30-1000MHz	Various	Various	2015-06-09	2016-06-30
	Receiver & Software				
SA0025	Spectrum Analyzer	Agilent	N9030A	2016-03-17	2017-03-31
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
HI0050	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2015-07-01	2016-07-31

Test Equipment Used - Line-Conducted Emissions – Voltage (Morrisville – Conducted 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL077	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3476-240	2015-10-29	2016-10-31
HI0079	Temp/Humid/Pressure Meter	Springfield Precision	PreciseTemp	2015-07-01	2016-07-31
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2015-08-24	2016-08-31
LISN008	LISN, 50-ohm/50-uH, 2-conductor, 25A (For support gear only.)	Solar Electronics	8012-50-R-24-BNC	2015-09-03	2016-09-30
MM0167	Multi-meter	Agilent	U1232A	2015-08-17	2016-08-31
PRE0101521 (75141)	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2015-08-26	2016-08-31
TL001	Transient Limiter, 0.009-30MHz	Com-Power	LIT-930A	2015-05-22	2016-05-31
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Miscellaneous (if needed)				

Test Equipment Used – Frequency Stability and OBW (Morrisville – Conducted 2)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SA0026	Spectrum Analyzer	Agilent Technologies	N9030A	02/24/2016	02/28/2017
1100502	Temp/Humid Chamber	Cincinnati Sub-Zero	ZPH-8-3.5-SCT/AC	2015-05-13	2016-05-31
HI0080	Temp/Humid/Pressure Meter	Springfield	HI0080	7/1/2015	7/31/2016
MM0168	True RMS Multimeter	Agilent	U1232A	2015-08-17	2016-08-31
76021	DC Regulated Power Supply	CircuitSpecialists.Com	CSI3005X5	N/A	N/A
7405	E and B – Field Probes	EMCO	7405	N/A	N/A

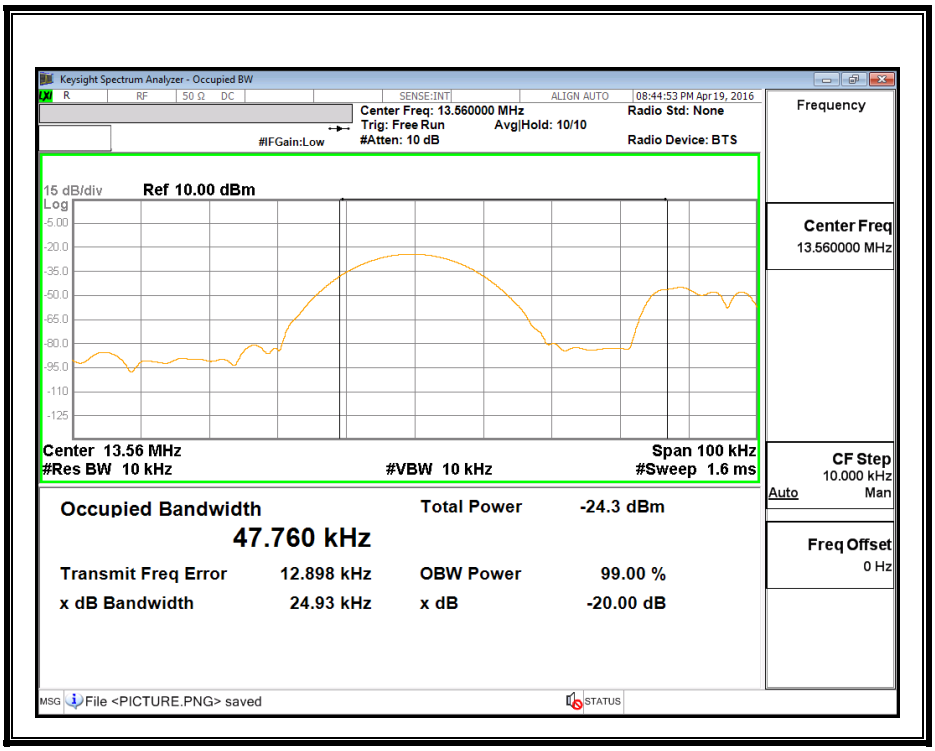
7. OCCUPIED BANDWIDTH

LIMITS

For reporting purposes only

RESULTS

Channel	Frequency (KHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
Low	13.56	47.76	24.93



8. RADIATED EMISSION TEST RESULTS

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 10^{th} harmonic of the highest fundamental frequency, or 1000 MHz, whichever is greater (1000MHz)

RESULTS

No non-compliance noted:

KDB 937606 OATS and Chamber Correlation Justification

- Device is a Smart Phone.

- Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

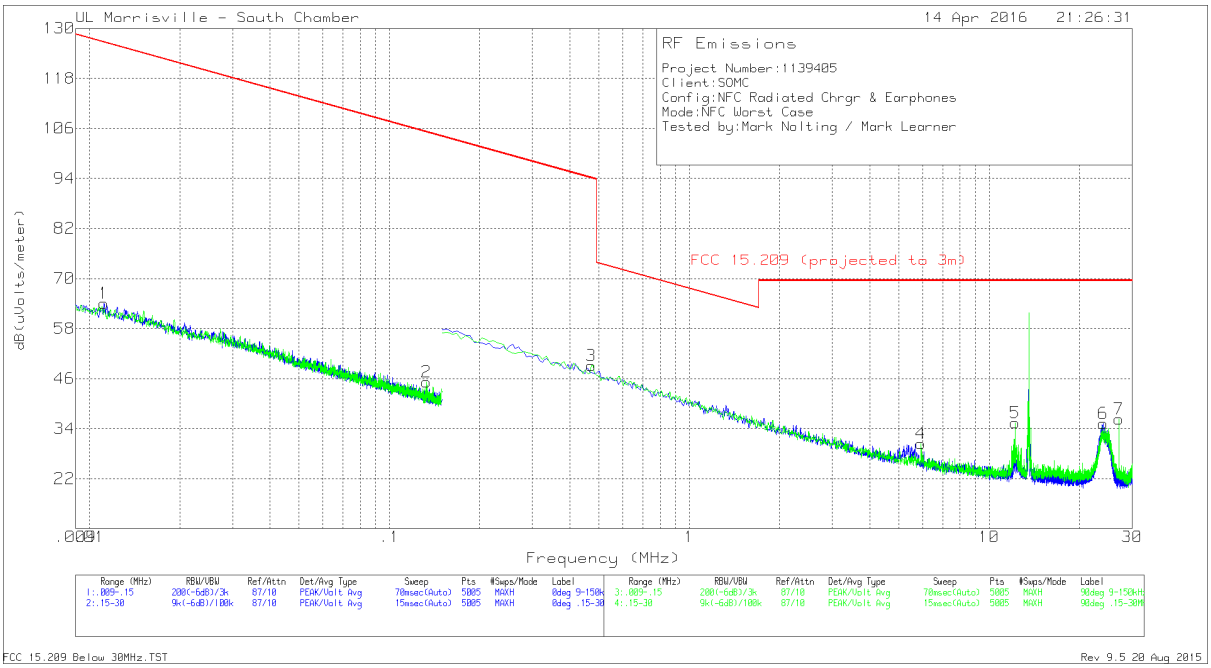
- OATs and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

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

Fundamental

Freq (MHz)	Meter Reading (dBuV)	Detector Type	AF (dB/m)	Gain/Loss (dB)	Test Distance (m)	DCF (dB)	Corrected Reading (dBuV/m)	QP Limit @ 30m (dBuV/m)	Margin (dB)	Loop Orientation	Notes
13.560	48.7	Pk	10.7	0.6	3.0	-40.0	20.0	84.0	-64.0	Face On	Fundamental @ 30m
13.402	19.6	Pk	10.8	0.6	3.0	-40.0	-9.0	40.5	-49.5	Face On	13.110-13.410MHz Band @ 30m
13.553	37.2	Pk	10.7	0.6	3.0	-40.0	8.5	50.5	-42.0	Face On	13.410-13.553MHz Band @ 30m
13.567	30.9	Pk	10.7	0.6	3.0	-40.0	2.2	50.5	-48.3	Face On	13.567-13.710MHz Band @ 30m
13.719	18.8	Pk	10.7	0.6	3.0	-40.0	-9.9	40.5	-50.4	Face On	13.710-14.010MHz Band @ 30m
13.560	50.0	Pk	10.7	0.6	3.0	-40.0	21.3	84.0	-62.7	Face Off	Fundamental @ 30m
13.400	19.4	Pk	10.8	0.6	3.0	-40.0	-9.2	40.5	-49.7	Face Off	13.110-13.410MHz Band @ 30m
13.553	35.9	Pk	10.7	0.6	3.0	-40.0	7.2	50.5	-43.3	Face Off	13.410-13.553MHz Band @ 30m
13.567	34.3	Pk	10.7	0.6	3.0	-40.0	5.6	50.5	-44.9	Face Off	13.567-13.710MHz Band @ 30m
14.061	16.4	Pk	10.7	0.6	3.0	-40.0	-12.3	40.5	-52.8	Face Off	13.710-14.010MHz Band @ 30m
Note:	Emissions at the break points met the lowest applicable limit with -42 dB margin or more										

Spurious Emissions (0.15 – 30 MHz)

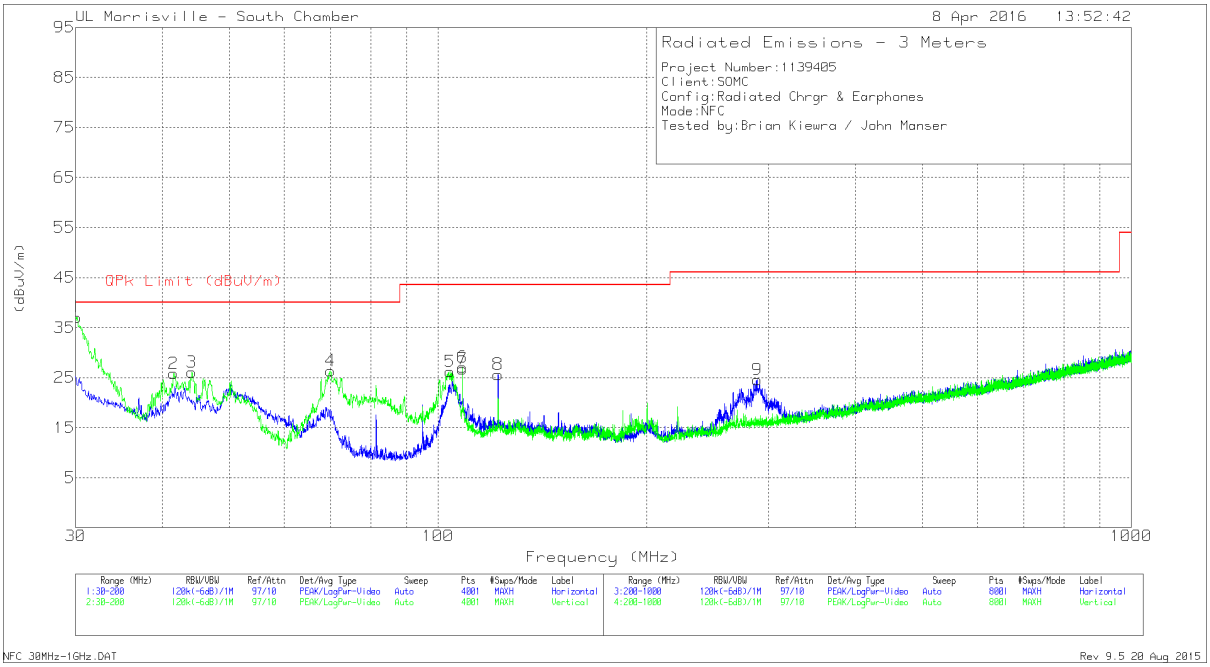


Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 (projected to 3m)	Margin (dB)	Azimuth (Degs)
1	.01118	45.46	Pk	18.5	.1	64.06	126.63	-62.57	0-360
2	.13329	33.21	Pk	11.9	.1	45.21	105.11	-59.9	0-360
3	.47211	37.14	Pk	11.9	.1	49.14	94.12	-44.98	0-360
4	5.93009	18.75	Pk	11.3	.4	30.45	69.54	-39.09	0-360
5	12.1993	23.91	Pk	10.9	.6	35.41	69.54	-34.13	0-360
6	24.05176	25.12	Pk	9.3	.8	35.22	69.54	-34.32	0-360
7	27.11777	26.51	Pk	8.9	.9	36.31	69.54	-33.23	0-360

Pk - Peak detector
FCC 15.209 Below 30MHz.TST
Rev 9.5 20 Aug 2015

8.1.2. TX SPURIOUS EMISSION 30 TO 1000 MHz



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF AT0074 (dB/m)	Port 0 Factors	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	30.1275	42.78	Pk	26.1	-31.8	37.08	40	-2.92	0-360	102	V
	30.0305	37.08	Qp	26.2	-31.8	31.48	40	-8.52	272	102	V
2	41.56	40.23	Pk	17.2	-31.6	25.83	40	-14.17	0-360	102	V
3	44.1525	42.18	Pk	15.5	-31.6	26.08	40	-13.92	0-360	102	V
4	69.9925	45.18	Pk	12.4	-31.2	26.38	40	-13.62	0-360	102	V
5	104.0775	41.4	Pk	15.6	-30.8	26.2	43.52	-17.32	0-360	102	V
7	108.455	40.99	Pk	16.6	-30.9	26.69	43.52	-16.83	0-360	199	H
	108.455	39.02	Qp	16.6	-30.9	24.72	43.52	-18.8	79	143	H
6	108.4975	41.36	Pk	16.6	-30.9	27.06	43.52	-16.46	0-360	102	V
	108.4711	41.23	Qp	16.6	-30.9	26.93	43.52	-16.59	166	104	V
8	122.055	38.33	Pk	18.1	-30.8	25.63	43.52	-17.89	0-360	199	H
	122.055	36.83	Qp	18.1	-30.8	24.13	43.52	-19.39	188	228	H
9	288.5	36.39	Pk	17.9	-29.7	24.59	46.02	-21.43	0-360	102	H

Pk - Peak detector
Qp - Quasi-Peak detector
NFC 30MHz-1GHz.DAT
Rev 9.5 20 Aug 2015

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.

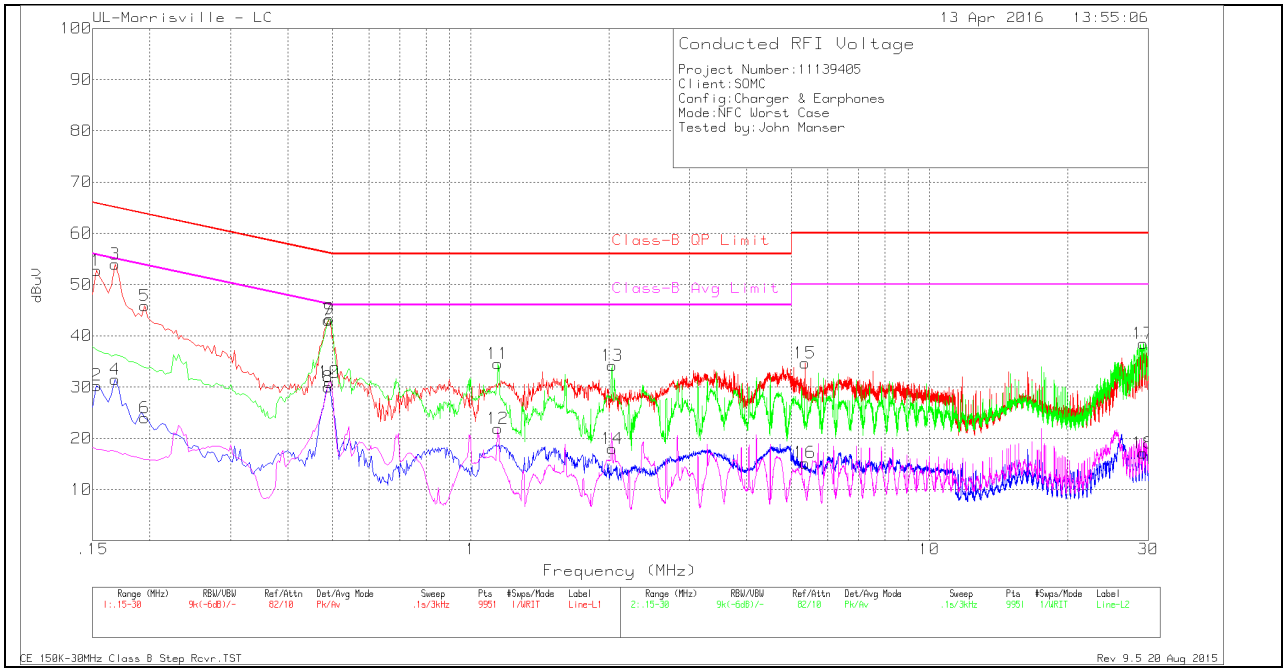
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

No non-compliance noted:

LINE 1 and LINE 2 PLOT



LINE 1 & LINE 2 RESULTS

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF [dB]	Cbl/Limiter (dB)	Corrected Reading dBuV	Class-B QP Limit	Margin (dB)	Class-B Avg Limit	Margin (dB)
Range 1 (Line 1)										
1	.153	42.56	Pk	.2	10	52.76	65.84	-13.08	-	-
2	.153	20.12	Av	.2	10	30.32	-	-	55.84	-25.52
3	.168	43.75	Pk	.2	10	53.95	65.06	-11.11	-	-
4	.168	21.3	Av	.2	10	31.5	-	-	55.06	-23.56
5	.195	35.66	Pk	.2	10	45.86	63.82	-17.96	-	-
6	.195	13.77	Av	.2	10	23.97	-	-	53.82	-29.85
7	.489	32.96	Pk	.1	10	43.06	56.18	-13.12	-	-
8	.489	19.89	Av	.1	10	29.99	-	-	46.18	-16.19
15	5.352	24.37	Pk	.1	10.2	34.67	60	-25.33	-	-
16	5.352	4.9	Av	.1	10.2	15.2	-	-	50	-34.8
Range 2 (Line 2)										
9	.492	33.16	Pk	.1	10	43.26	56.13	-12.87	-	-
10	.492	20.82	Av	.1	10	30.92	-	-	46.13	-15.21
11	1.146	24.57	Pk	0	10	34.57	56	-21.43	-	-
12	1.146	11.86	Av	0	10	21.86	-	-	46	-24.14
13	2.034	24.09	Pk	0	10.1	34.19	56	-21.81	-	-
14	2.034	7.89	Av	0	10.1	17.99	-	-	46	-28.01
17	29.208	27.5	Pk	.3	10.7	38.5	60	-21.5	-	-
18	29.208	6.09	Av	.3	10.7	17.09	-	-	50	-32.91

Pk - Peak detector

Av - Average detection

CE 150K-30MHz Class B Step Rcvr.TST
Rev 9.5 20 Aug 2015

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.

While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized.

TEST PROCEDURE

ANSI C63.10-2013

RESULTS

No non-compliance noted.

Frequency stability versus temperature & apply voltage

Reference Frequency: EUT Channel 13.56 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)**
5.00	50	13.5592446	5.875	± 100
5.00	40	13.5592572	4.946	± 100
5.00	30	13.5593065	1.310	± 100
5.00	***20***	***13.5593243***	***0.000***	***± 100***
5.00	10	13.5593167	0.560	± 100
5.00	0	13.5593519	-2.034	± 100
5.00	-10	13.5593674	-3.182	± 100
5.00	-20	13.5595504	-16.676	± 100
4.25	20	13.5593205	0.278	± 100
5.75	20	13.5593085	1.166	± 100

Note: Frequency stability versus time interval measurements were taken and worst case results are reported in the above table.