# CERTIFICATION TEST REPORT

**Report Number. :** 12380932-E7V4

| | | |
|---|---|---|
| **Applicant** | : | SONY MOBILE COMMUNICATIONS, INC.<br>4-12-3 HIGASHI-SHINAGAWA<br>SHINAGAWA-KU, TOKYO, 140-0002, JAPAN |
| **FCC ID** | : | PY7-12644J |
| **EUT Description** | : | GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac & NFC |
| **Test Standard(s)** | : | FCC 47 CFR PART 15 SUBPART C |

**Date Of Issue:**
August 10, 2018

**Prepared by:**
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NVLAP Lab code: 200065-0

## Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| V1 | 7/20/18 | Initial Issue | |
| V2 | 8/07/18 | Updated Section 5.1 & 5.2. | Kiya Kedida |
| V3 | 8/08/18 | Updated Section 8.2 | Dan Coronia |
| V4 | 8/10/18 | Updated Section 7 | Kiya Kedida |


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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SONY MOBILE COMMUNICATIONS, INC.
4-12-3 HIGASHI-SHINAGAWA,
SHINAGAWA-KU, TOKYO, 140-0002, JAPAN

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

**SERIAL NUMBER:** BH93000ZD8 (With Antenna)
BH93001SD8 (Terminated Antenna)

**DATE TESTED:** July 18 – 19, 2018

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| FCC PART 15 SUBPART C | Complies |

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:

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CONSUMER TECHNOLOGY DIVISION
Operations Leader
UL VERIFICATION SERVICES INC.

Reviewed By:

Kiya Kedida
CONSUMER TECHNOLOGY DIVISION
Project Engineer
UL VERIFICATION SERVICES INC.

# 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, and at 47658 Kato Road, 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 | 47658 Kato Rd. |
|---|---|---|
| ☒ Chamber A (ISED:2324B-1) | ☐ Chamber D (ISED:22541-1) | ☒ Chamber K (ISED: 2324A-1) |
| ☐ Chamber B (ISED:2324B-2) | ☐ Chamber E (ISED:22541-2) | ☐ Chamber L (ISED: 2324A-3) |
| ☐ Chamber C (ISED:2324B-3) | ☐ Chamber F (ISED:22541-3) | |
| | ☐ Chamber G (ISED:22541-4) | |
| | ☐ Chamber H (ISED:22541-5) | |

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through C are covered under ISED company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under ISED company address code 22541 with site numbers 22541 -1 through 22541-5, respectively.

ISED company address codes for chambers K through L are in process, and have yet to be determined.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

# 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 |
|---|---|
| Worst Case Conducted Disturbance, 9KHz to 0.15 MHz | 3.84 dB |
| Worst Case Conducted Disturbance, 0.15 to 30 MHz | 3.65 dB |
| Worst Case Radiated Disturbance, 9KHz to 30 MHz | 3.15 dB |
| Worst Case Radiated Disturbance, 30 to 1000 MHz | 5.36 dB |
| Worst Case Radiated Disturbance, 1000 to 18000 MHz | 4.32 dB |
| Worst Case Radiated Disturbance, 18000 to 26000 MHz | 4.45 dB |
| Worst Case Radiated Disturbance, 26000 to 40000 MHz | 5.24 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 with BT, DTS/UNII a/b/g/n/ac & NFC.

## 5.2. MAXIMUM FIELD STRENGTH

The testing was performed at 3 meters. The transmitter maximum E-field at 30 meter distance was 17.89 dBuV/m, which was converted from the 3 meter data.

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes the loop antenna.

## 5.4. SOFTWARE AND FIRMWARE

The software version installed in the EUT during testing was 2.20.

## 5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission was 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-Axis with AC/DC adapter and headphone was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y-Axis with AC/DC adapter and headphone orientation.

**NOTE:** The EUT pre-scanned in three NFC type A, B & F. The worst type is A, and data rate of 106kbps was recorded to this report.

## 5.6. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| Support Equipment List | | | | |
|---|---|---|---|---|
| Description | Manufacturer | Model | Serial Number | FCC ID |
| AC Adapter | SONY | UCH20 | 3416W45305784 | N/A |
| Headphones | SONY | N/A | N/A | N/A |

**I/O CABLES**

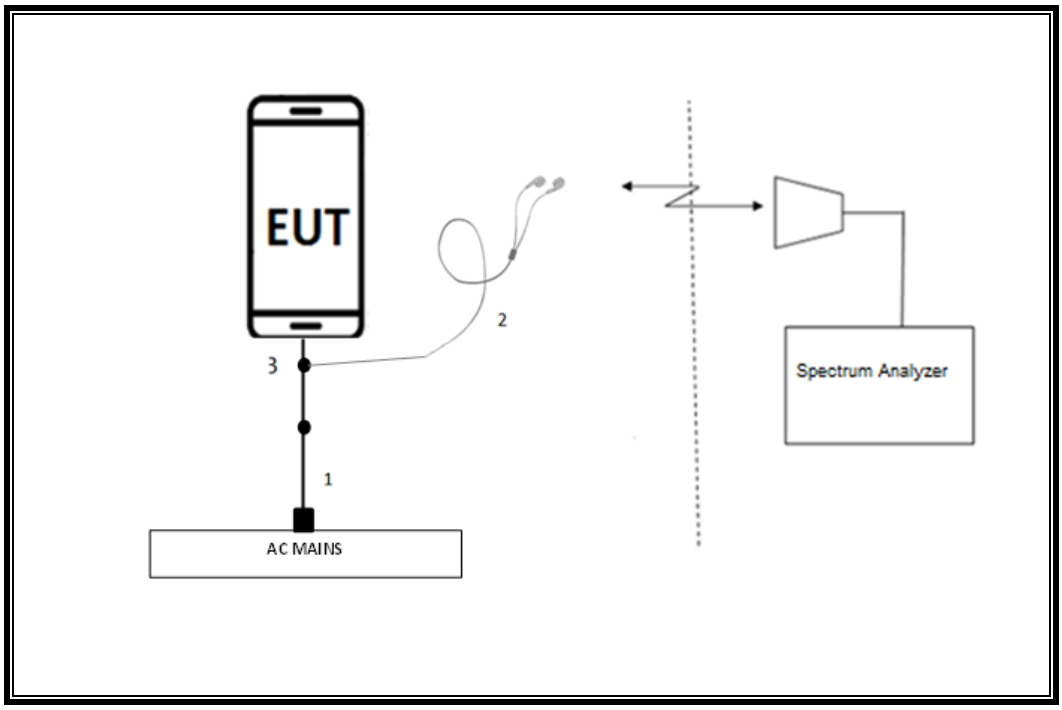
| I/O Cable List | | | | | | |
|---|---|---|---|---|---|---|
| Cable No | Port | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1 | USB | 1 | USB Type-C | Un-Shielded | 1.2 | N/A |
| 2 | Jack | 1 | Headset | Shielded | 1 | N/A |
| 3 | USB/HP Jack | 1 | USB Type-C/Audio | Un-Shielded | 0.11 | Audio & Charger cable |

**TEST SETUP**

The EUT is setup as a standalone device. Test software exercised the radio card.

## SETUP DIAGRAM

## RADIATED AND AC LINE CONDUCTED EMISSIONS SETUP DIAGRAM



# 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** | **ID Num** | **Cal Due** |
| Amplifier, 9KHz to 1GHz, 32dB | Sonoma Instrument | 310 | PRE0180089 | 06/21/2019 |
| Antenna, Broadband Hybrid, 30MHz to 2000MHz w/4dB Pad | Sunol Sciences Corp. | JB3 | T477 | 06/16/2019 |
| EMI TEST RECEIVER | Rohde & Schwarz | ESW44 | PRE0179522 | 05/11/2019 |
| Spectrum Analyzer, PSA, 3Hz to 44GHz | Agilent (Keysight) Technologies | N9030A | T1454 | 01/08/2019 |
| Antenna, Active Loop 9kHz-30MHz | Com-Power Corp. | AL-130R | T1866 | 10/10/2018 |
| EMI Reciever | Rohde & Schwarz | ESR | T1436 | 02/21/2019 |
| L.I.S.N. | FCC INC. | FCC LISN 50/250 | T1310 | 06/15/2019 |
| L.I.S.N. | FCC INC. | FCC LISN 50/250 | T24 | 03/06/2019 |
| Thermometer - Digital | Control Company | 14-650-118 | PRE0177862 | 02/22/2019 |

| UL SOFTWARE | | | |
|---|---|---|---|
| Antenna Port Software | UL | UL EMC | Ver 8.4, June 12, 2018 |
| Radiated Software | UL | UL EMC | Ver 9.5, Dec 01, 2016 |

# 7. OCCUPIED BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to the spectrum analyzer. The RBW is set to 10kHz. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

**Note**: Because the measured signal is CW-like, adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW.

**RESULTS**

**99% and 20dB BW**

**TYPE A**

| Mode Kbps | Frequency (MHz) | 99% Bandwidth (KHz) | 20dB Bandwidth (KHz) |
|---|---|---|---|
| 848 | 13.56 | 21.579 | 25.04 |
| 424 | 13.56 | 21.643 | 24.98 |
| 212 | 13.56 | 21.995 | 24.97 |
| 106 | 13.56 | 27.056 | 25.65 |

**TYPE B**

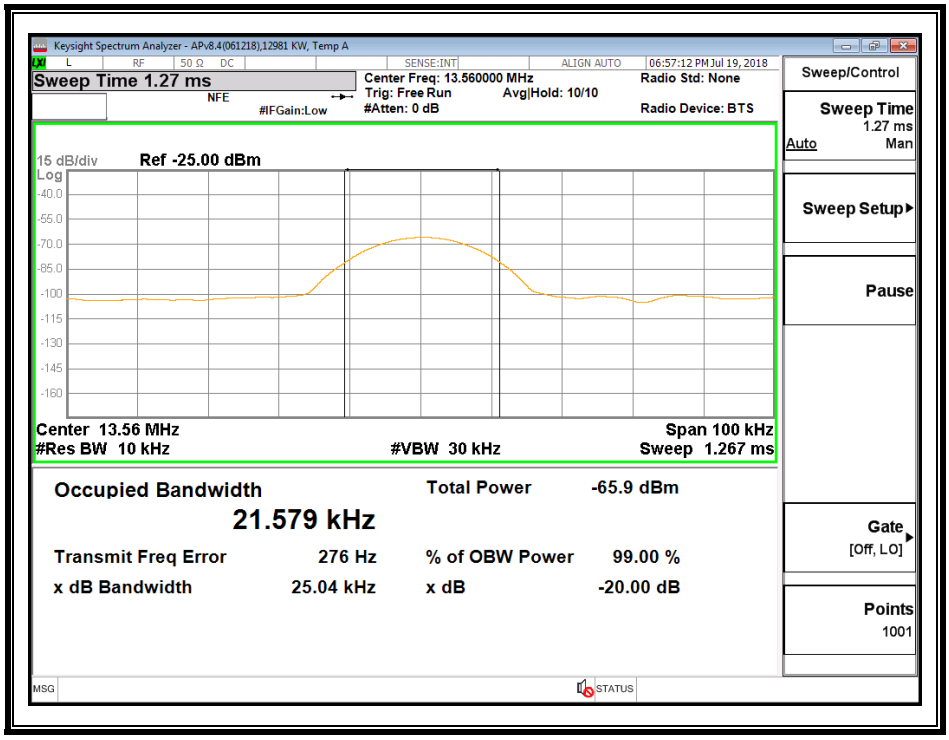
| Mode Kbps | Frequency (MHz) | 99% Bandwidth (KHz) | 20dB Bandwidth (KHz) |
|---|---|---|---|
| 848 | 13.56 | 21.873 | 25.18 |
| 424 | 13.56 | 22.020 | 25.07 |
| 212 | 13.56 | 23.525 | 25.10 |
| 106 | 13.56 | 29.546 | 24.71 |

**TYPE F**

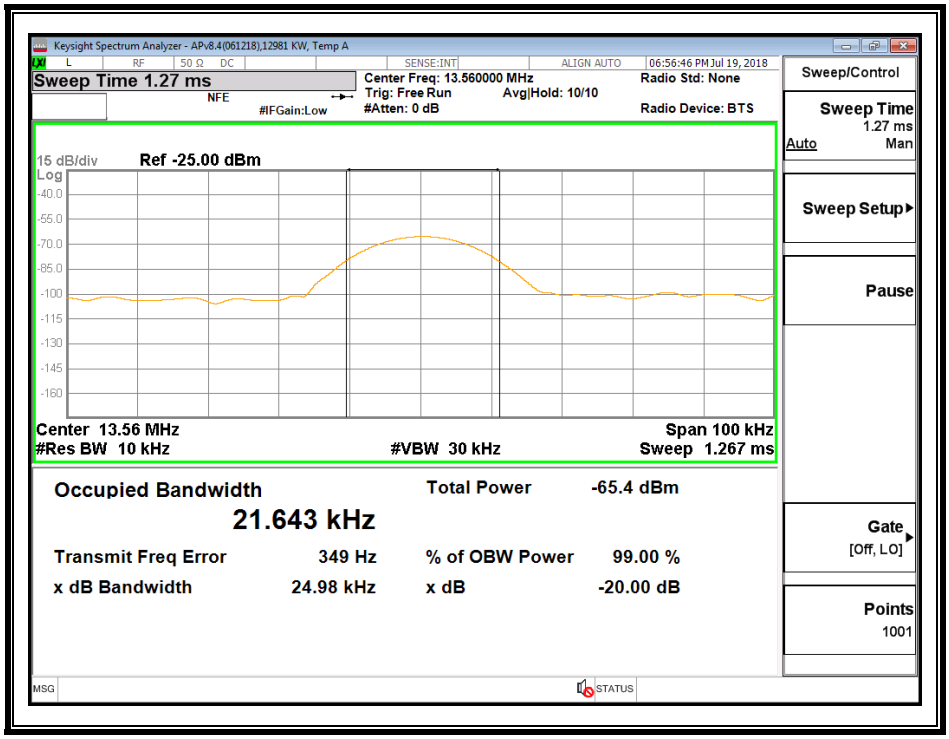
| Mode Kbps | Frequency (MHz) | 99% Bandwidth (KHz) | 20dB Bandwidth (KHz) |
|---|---|---|---|
| 424 | 13.56 | 21.163 | 24.90 |
| 212 | 13.56 | 21.249 | 24.91 |

## 7.1. TYPE A

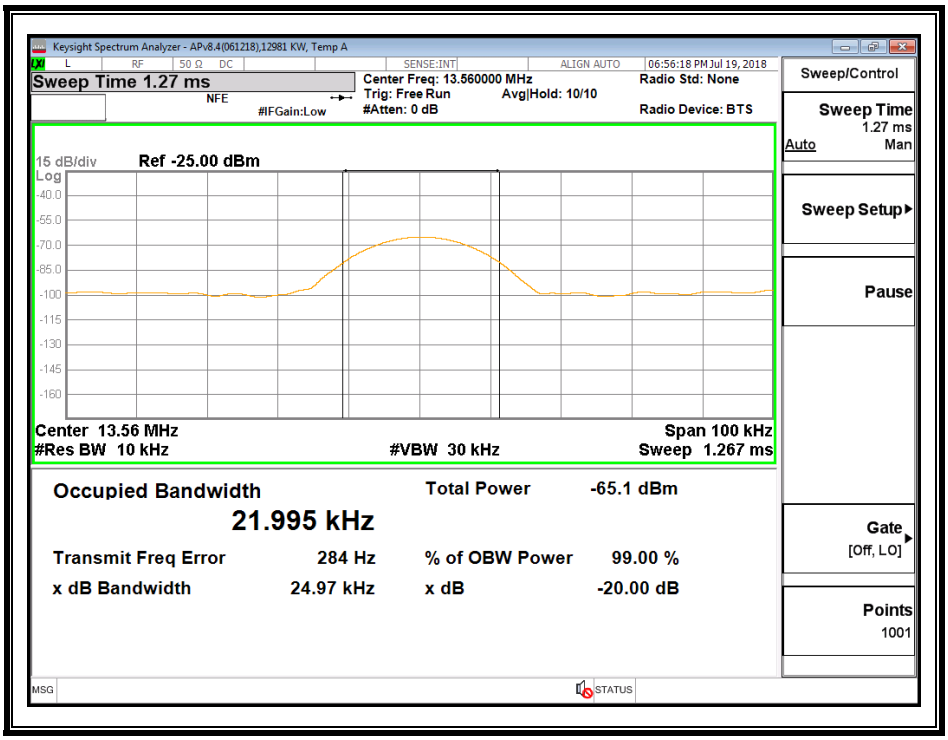
**848Kbps**



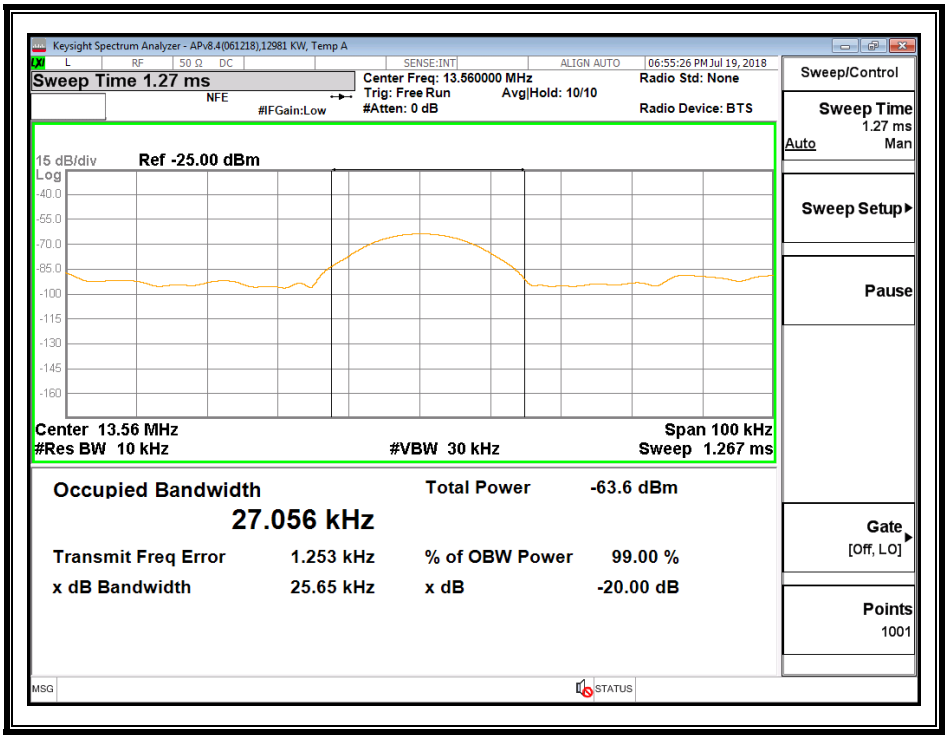

**424Kbps**



**212Kbps**

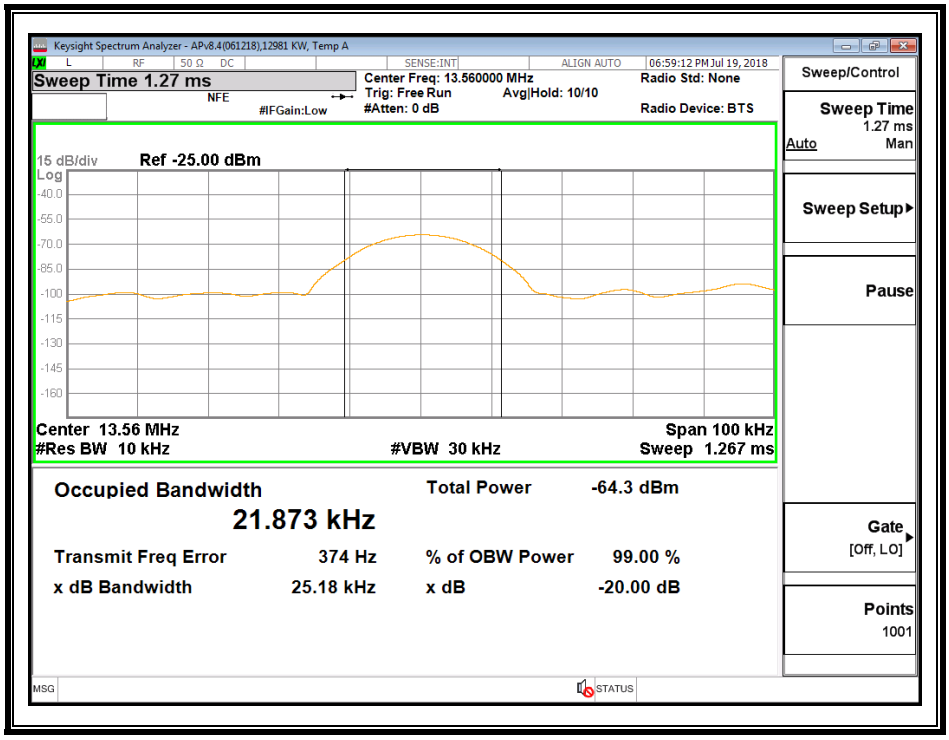



**106Kbps**

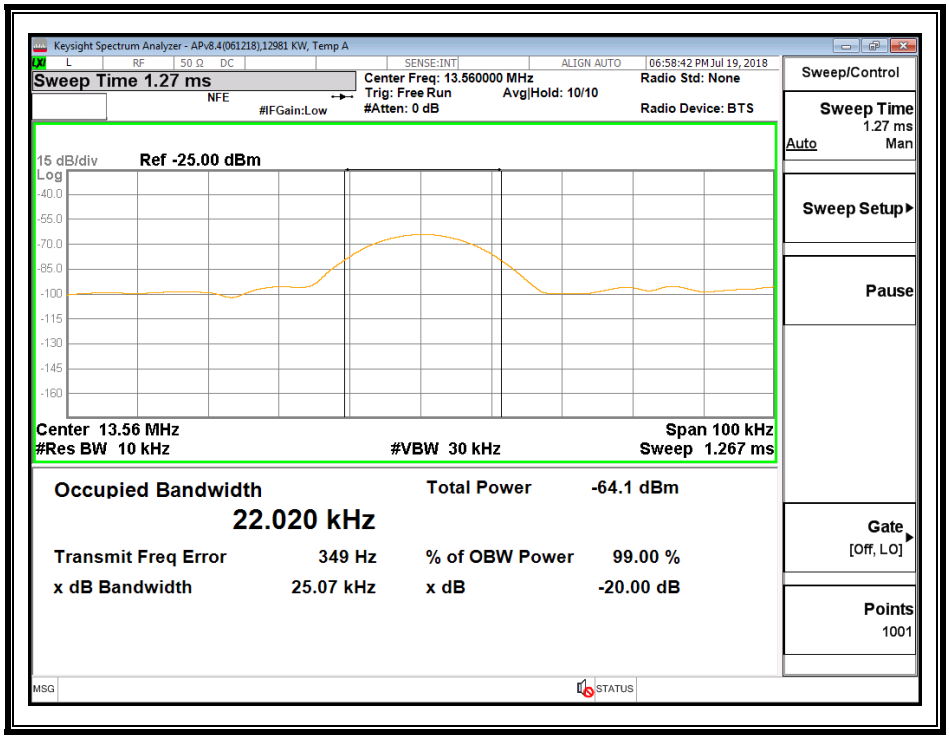


## 7.2. TYPE B

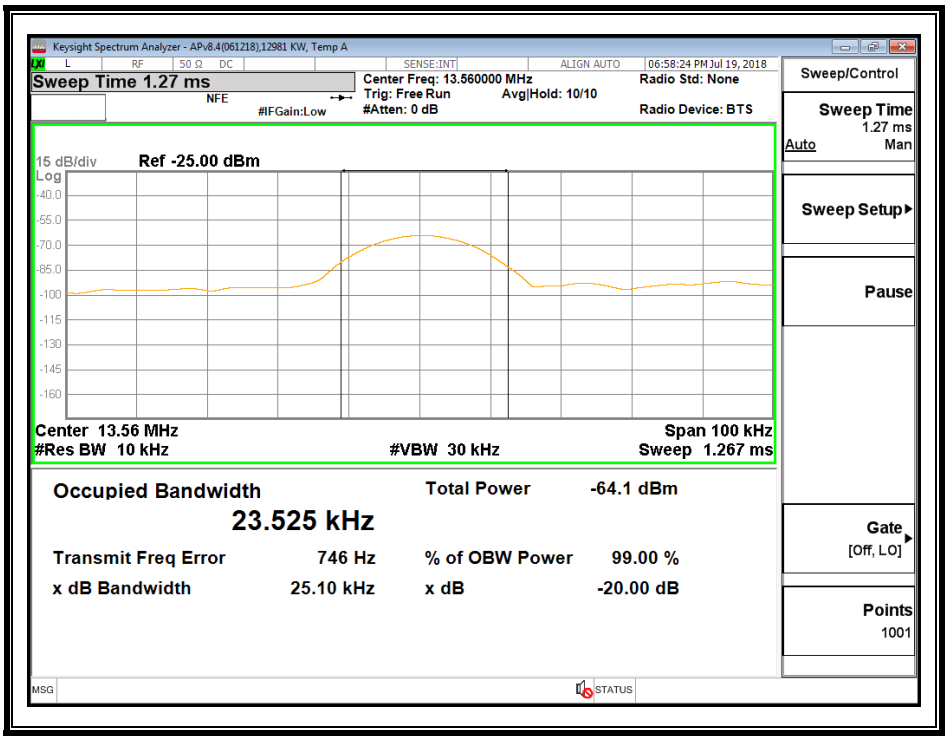
**848Kbps**



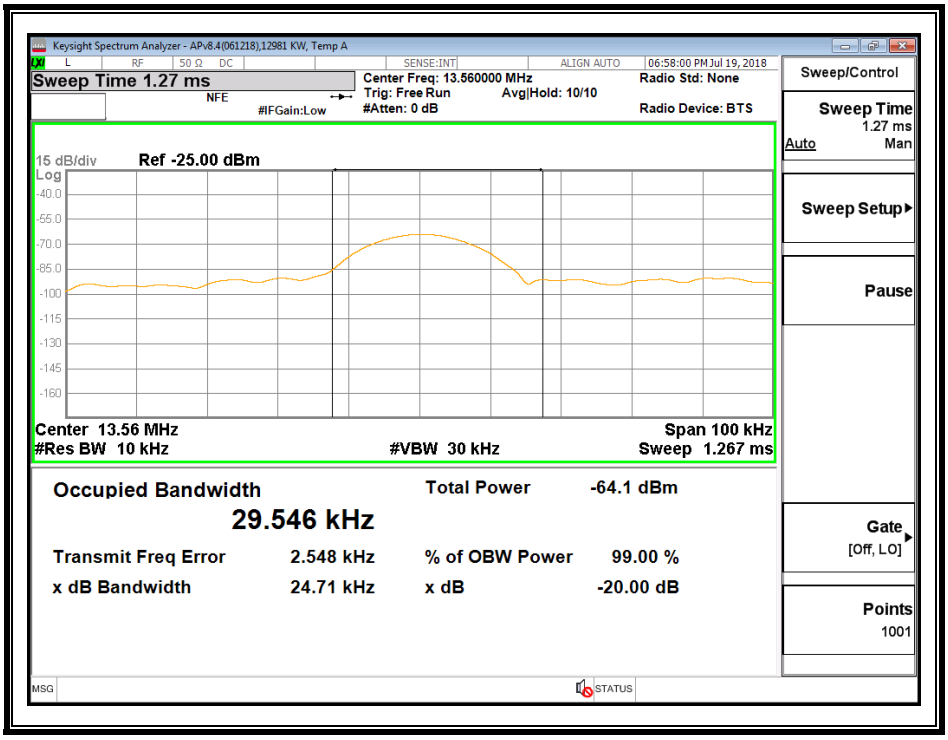

**424Kbps**



**212Kbps**

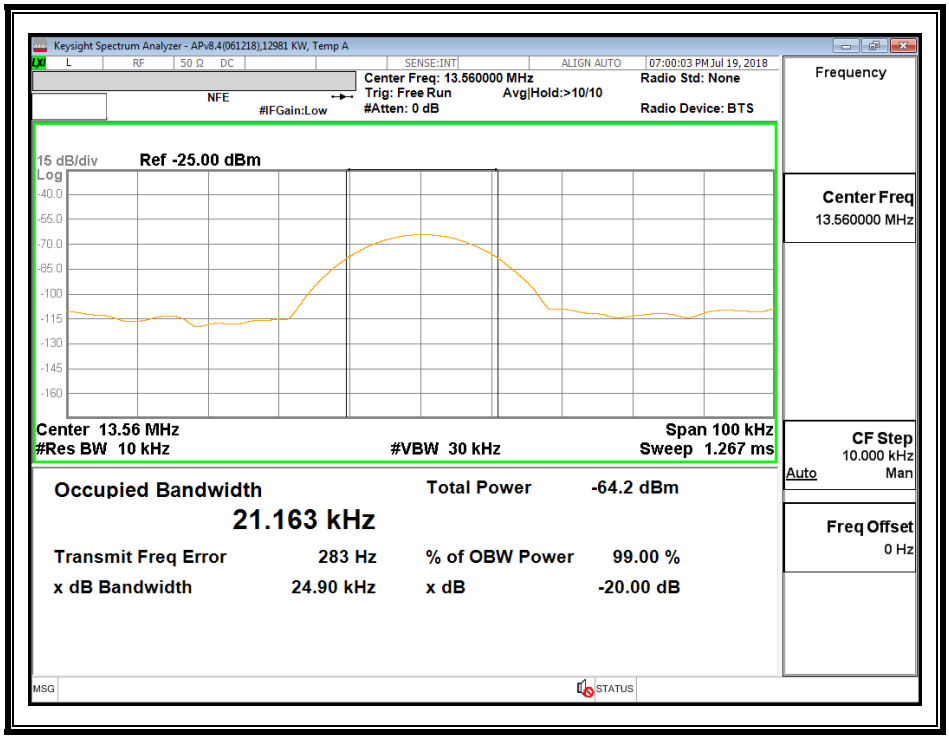



**106Kbps**

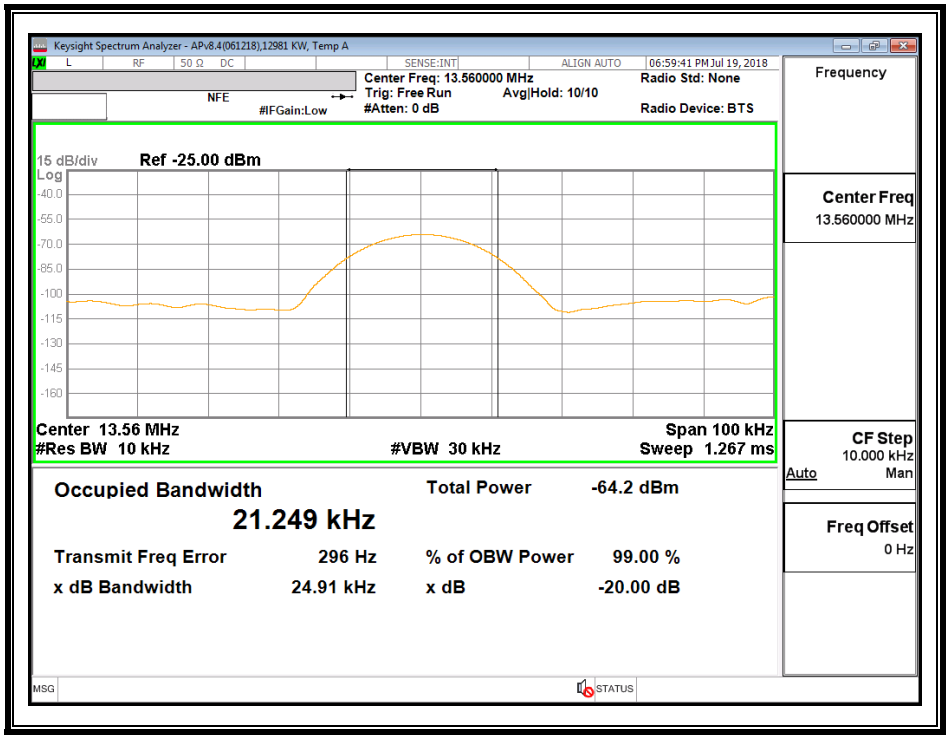


## 7.3. TYPE F

**424Kbps**




**212Kbps**



# 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)

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; therefore, 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.

**RESULTS**

## KDB 414788 OATS and Chamber Correlation Justification

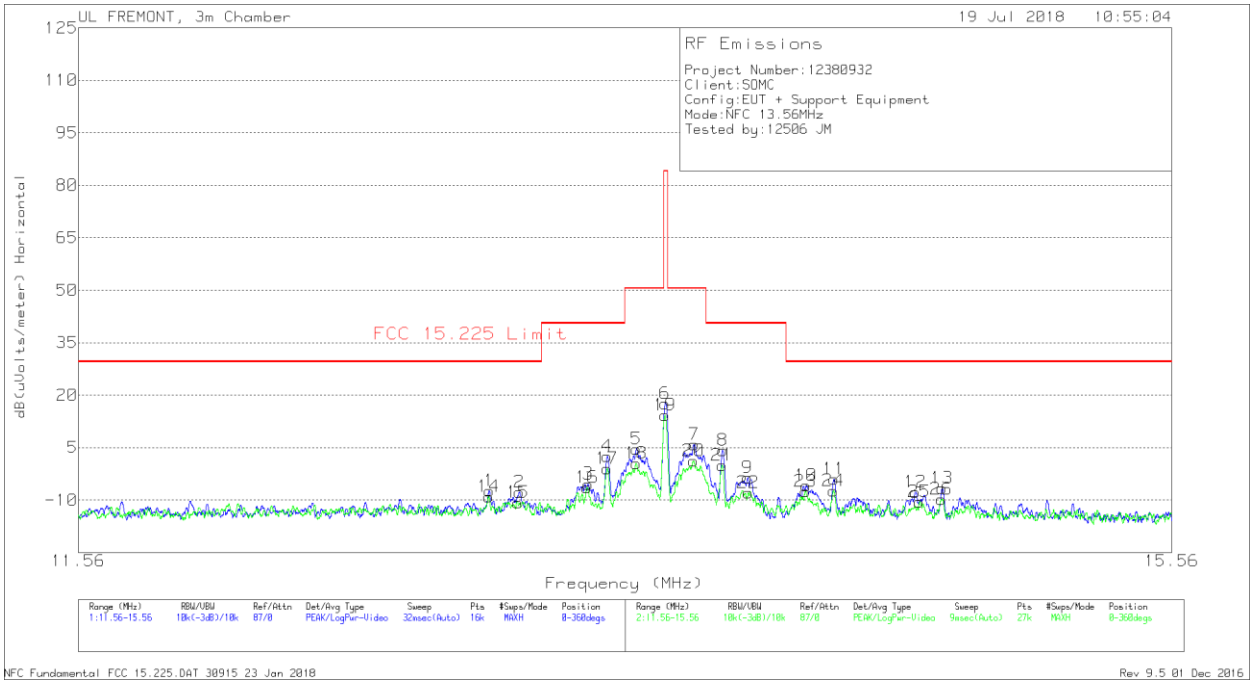
Device is a Smart Phone.

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.

## 8.2. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.09 - 1000 MHz)

**FUNDAMENTAL EMISSION MASK - TYPE A, 106Kbps (11.56 – 15.56 MHz)**




**FACE ON AND FACE OFF**

NOTE: All data rate Field Strength was investigated and Type A, 106k found to have the highest Field Strength results and represents as the worst case data rate.

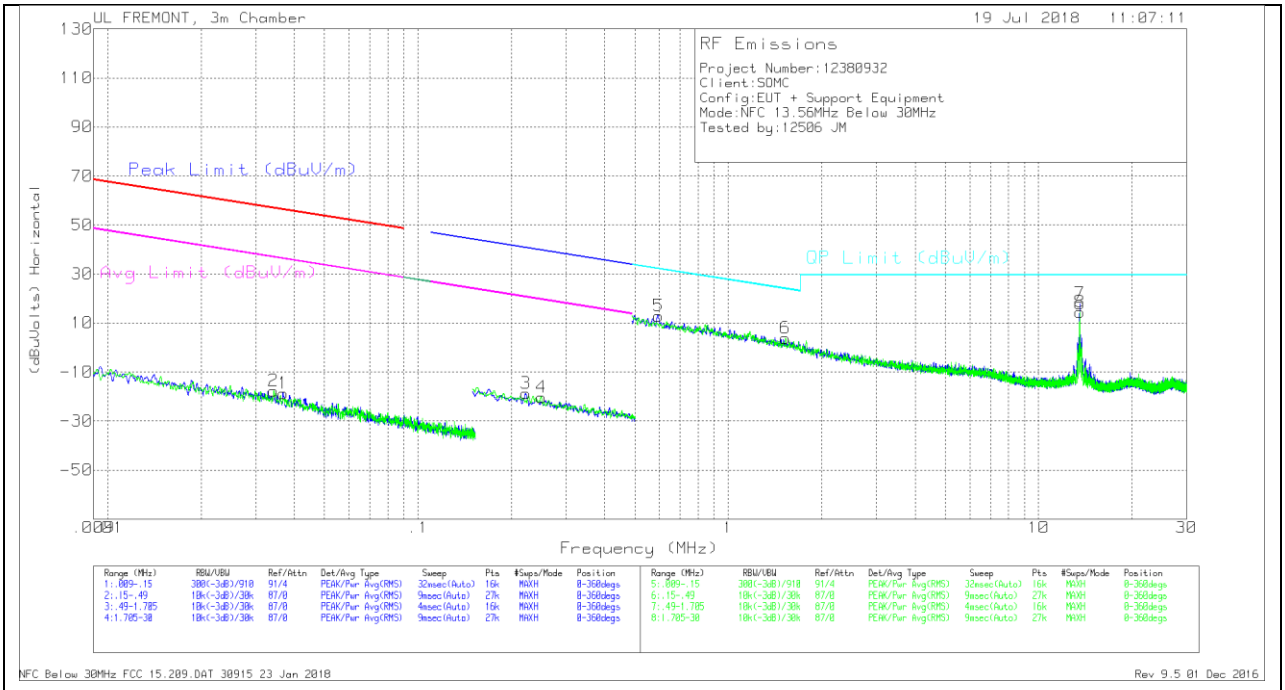
**DATA**

Trace Markers

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | Loop Antenna (dB/m) | Cbl (dB) | Dist Corr 30m | Corrected Reading dB(uVolts/meter) | FCC 15.225 Limit | PK Margin (dB) | Azimuth (Degs) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 12.92315 | 14.88 | Pk | 14.5 | 1.6 | -40 | -9.02 | 29.54 | -38.56 | 0-360 | Face-Off |
| 1 | 12.92525 | 16.53 | Pk | 14.5 | 1.6 | -40 | -7.37 | 29.54 | -36.91 | 0-360 | Face-On |
| 15 | 13.02609 | 13.22 | Pk | 14.5 | 1.6 | -40 | -10.68 | 29.54 | -40.22 | 0-360 | Face-Off |
| 2 | 13.03213 | 16.18 | Pk | 14.5 | 1.6 | -40 | -7.72 | 29.54 | -37.26 | 0-360 | Face-On |
| 16 | 13.27451 | 17.55 | Pk | 14.4 | 1.6 | -40 | -6.45 | 40.51 | -46.96 | 0-360 | Face-Off |
| 3 | 13.27763 | 18.59 | Pk | 14.4 | 1.6 | -40 | -5.41 | 40.51 | -45.92 | 0-360 | Face-On |
| 4 | 13.3465 | 26.49 | Pk | 14.4 | 1.6 | -40 | 2.49 | 40.51 | -38.02 | 0-360 | Face-On |
| 17 | 13.34688 | 23.05 | Pk | 14.4 | 1.6 | -40 | -.95 | 40.51 | -41.46 | 0-360 | Face-Off |
| 18 | 13.45225 | 24.42 | Pk | 14.4 | 1.6 | -40 | .42 | 50.5 | -50.08 | 0-360 | Face-Off |
| 5 | 13.453 | 28.61 | Pk | 14.4 | 1.6 | -40 | 4.61 | 50.5 | -45.89 | 0-360 | Face-On |
| 6 | *13.558 | 41.67 | Pk | 14.4 | 1.6 | -40 | 17.67 | 84 | -66.33 | 0-360 | Face-On |
| 19 | *13.55807 | 38.29 | Pk | 14.4 | 1.6 | -40 | 14.29 | 84 | -69.71 | 0-360 | Face-Off |
| 20 | 13.66389 | 25.22 | Pk | 14.4 | 1.6 | -40 | 1.22 | 50.5 | -49.28 | 0-360 | Face-Off |
| 7 | 13.66588 | 29.82 | Pk | 14.4 | 1.6 | -40 | 5.82 | 50.5 | -44.68 | 0-360 | Face-On |
| 21 | 13.76949 | 24.03 | Pk | 14.3 | 1.6 | -40 | -.07 | 40.51 | -40.58 | 0-360 | Face-Off |
| 8 | 13.77213 | 28.31 | Pk | 14.3 | 1.6 | -40 | 4.21 | 40.51 | -36.3 | 0-360 | Face-On |
| 9 | 13.86663 | 20.45 | Pk | 14.3 | 1.6 | -40 | -3.65 | 40.51 | -44.16 | 0-360 | Face-On |
| 22 | 13.86843 | 16.13 | Pk | 14.3 | 1.6 | -40 | -7.97 | 40.51 | -48.48 | 0-360 | Face-Off |
| 23 | 14.08643 | 16.55 | Pk | 14.3 | 1.6 | -40 | -7.55 | 29.54 | -37.09 | 0-360 | Face-Off |
| 10 | 14.089 | 18.17 | Pk | 14.3 | 1.6 | -40 | -5.93 | 29.54 | -35.47 | 0-360 | Face-On |
| 24 | 14.19396 | 16.67 | Pk | 14.3 | 1.6 | -40 | -7.43 | 29.54 | -36.97 | 0-360 | Face-Off |
| 11 | 14.19538 | 20.05 | Pk | 14.3 | 1.6 | -40 | -4.05 | 29.54 | -33.59 | 0-360 | Face-On |
| 12 | 14.51363 | 16.42 | Pk | 14.3 | 1.6 | -40 | -7.68 | 29.54 | -37.22 | 0-360 | Face-On |
| 25 | 14.52918 | 13.56 | Pk | 14.3 | 1.6 | -40 | -10.54 | 29.54 | -40.08 | 0-360 | Face-Off |
| 26 | 14.61605 | 14.33 | Pk | 14.3 | 1.6 | -40 | -9.77 | 29.54 | -39.31 | 0-360 | Face-Off |
| 13 | 14.61863 | 17.4 | Pk | 14.3 | 1.6 | -40 | -6.7 | 29.54 | -36.24 | 0-360 | Face-On |

* - Indicates fundamental frequency
Pk - Peak detector

## SPURIOUS EMISSIONS - TYPE A, 106kbps (0.09 – 30MHz)




**FACE ON AND FACE OFF**

## DATA

Trace Markers

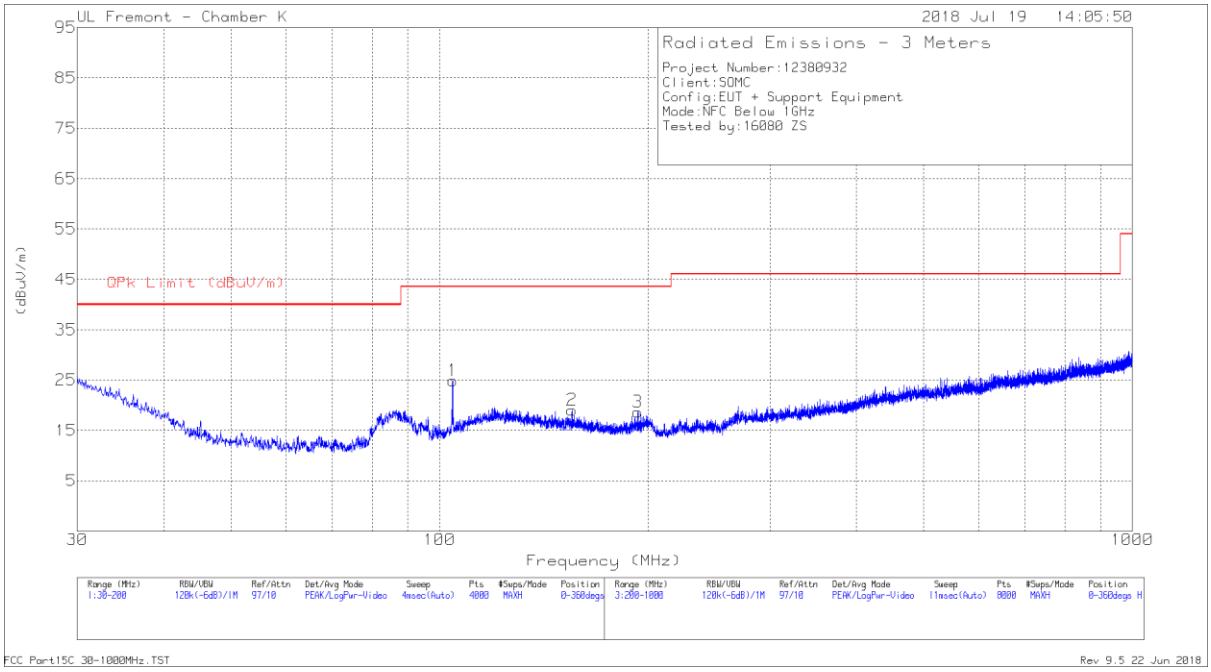
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | Loop Antenna (dB/m) | Cbl (dB) | Dist Corr 300m | Corrected Reading (dBuVolts) | Peak Limit (dBuV/m) | Margin (dB) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Avg Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | .03428 | 45.85 | Pk | 15.1 | 1.4 | -80 | -17.65 | 56.88 | -74.53 | 36.88 | -54.53 | - | - | - | - | 0-360 |
| 1 | .03679 | 44.86 | Pk | 15 | 1.4 | -80 | -18.74 | 56.27 | -75.01 | 36.27 | -55.01 | - | - | - | - | 0-360 |
| 3 | .22225 | 45.85 | Pk | 13.8 | 1.5 | -80 | -18.85 | - | - | - | - | 40.68 | -59.53 | 20.68 | -39.53 | 0-360 |
| 4 | .24998 | 44.38 | Pk | 13.8 | 1.5 | -80 | -20.32 | - | - | - | - | 39.66 | -59.98 | 19.66 | -39.98 | 0-360 |

Pk - Peak detector

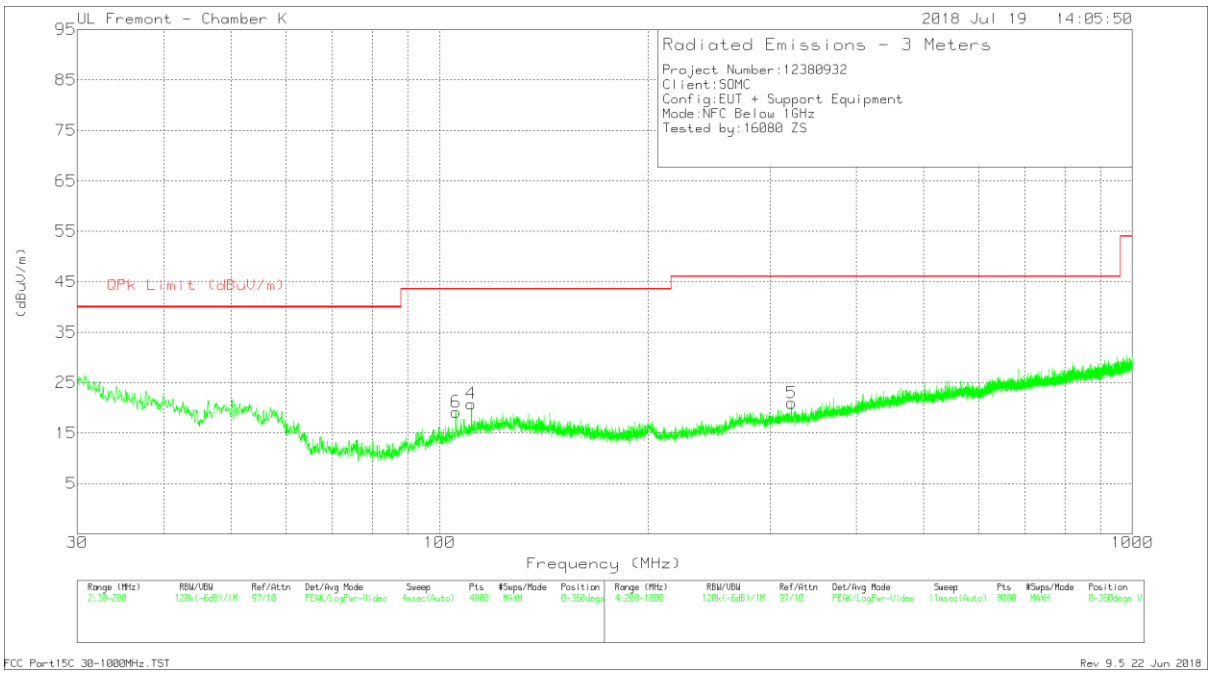
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | Loop Antenna (dB/m) | Cbl (dB) | Dist Corr 30m | Corrected Reading (dBuVolts) | QP Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Avg Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | .59518 | 37.49 | Pk | 13.9 | 1.5 | -40 | 12.89 | 32.12 | -19.23 | - | - | - | - | 0-360 |
| 6 | 1.52801 | 28.2 | Pk | 14.2 | 1.5 | -40 | 3.9 | 23.95 | -20.05 | - | - | - | - | 0-360 |
| 7 | 13.55945 | 41.89 | Pk | 14.4 | 1.6 | -40 | 17.89 | 84 | -66.11 | - | - | - | - | 0-360 |
| 8 | 13.55945 | 38.36 | Pk | 14.4 | 1.6 | -40 | 14.36 | 84 | -69.64 | - | - | - | - | 0-360 |

Pk - Peak detector

**SPURIOUS EMISSIONS - TYPE A, 106kbps (30 – 1000MHz)**




**HORIZONTAL**




**VERTICAL**

**DATA**

Trace Markers

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | AF T407 (dB) | Amp/Cbl (dB) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 104.5218 | 36.32 | Pk | 15.6 | -27 | 24.92 | 43.52 | -18.6 | 0-360 | 299 | H |
| 2 | 155.3649 | 29.36 | Pk | 16.3 | -26.6 | 19.06 | 43.52 | -24.46 | 0-360 | 399 | H |
| 3 | 193.3698 | 29.36 | Pk | 15.6 | -26.3 | 18.66 | 43.52 | -24.86 | 0-360 | 100 | H |
| 4 | * 111.1535 | 30.82 | Pk | 16.9 | -26.9 | 20.82 | 43.52 | -22.7 | 0-360 | 100 | V |
| 6 | 105.5846 | 30.17 | Pk | 15.9 | -26.9 | 19.17 | 43.52 | -24.35 | 0-360 | 100 | V |
| 5 | * 322.1159 | 28.78 | Pk | 17.9 | -25.7 | 20.98 | 46.02 | -25.04 | 0-360 | 100 | V |

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

# 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 C63.10-2013 Clause 6.8

**RESULTS**

| | |
|---|---|
| Tested By: | 16069 OG |
| Date: | 7/18/2018 |

No non-compliance noted.

| Reference Frequency: EUT Channel 13.56 MHz @ 20ºC<br>Limit: ± 100 ppm = 1.356 kHz | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Power Supply | Envir. Temp | Frequency Deviation Measureed with Time Elapse | | | | | | | | |
| (Vdc) | (ºC) | Startup (MHz) | Delta (ppm) | @ 2 mins (MHz) | Delta (ppm) | @ 5 mins (MHz) | Delta (ppm) | @ 10 mins (MHz) | Delta (ppm) | Limit (ppm) |
| 3.80 | 50 | 13.5599539 | 3.245 | 13.5599524 | 3.355 | 13.5599497 | 3.555 | 13.5599468 | 3.768 | ± 100 |
| 3.80 | 40 | 13.5599766 | 1.571 | 13.5599696 | 2.087 | 13.5599660 | 2.353 | 13.5599655 | 2.389 | ± 100 |
| 3.80 | 30 | 13.5600187 | -1.534 | 13.5600133 | -1.136 | 13.5600068 | -0.656 | 13.5599997 | -0.133 | ± 100 |
| ***3.80*** | ***20*** | ***13.5599979*** | ***0.000*** | ***13.5599976*** | ***0.022*** | ***13.5599988*** | ***-0.066*** | ***13.5599989*** | ***-0.074*** | ***± 100*** |
| 3.80 | 10 | 13.5600359 | -2.802 | 13.5600380 | -2.957 | 13.5600404 | -3.134 | 13.5600425 | -3.289 | ± 100 |
| 3.80 | 0 | 13.5600569 | -4.351 | 13.5600581 | -4.440 | 13.5600592 | -4.521 | 13.5600600 | -4.580 | ± 100 |
| 3.80 | -10 | 13.5600619 | -4.720 | 13.5600623 | -4.749 | 13.5600624 | -4.757 | 13.5600615 | -4.688 | ± 100 |
| 3.23 | 20 | 13.5599975 | 0.029 | 13.5599965 | 0.103 | 13.5600001 | -0.162 | 13.5600018 | -0.288 | ± 100 |
| 4.37 | 20 | 13.5599965 | 0.103 | 13.5599986 | -0.052 | 13.5599982 | -0.022 | 13.5599985 | -0.044 | ± 100 |

# 10. 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:<br>1. The lower limit shall apply at the transition frequencies<br>2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. | | |

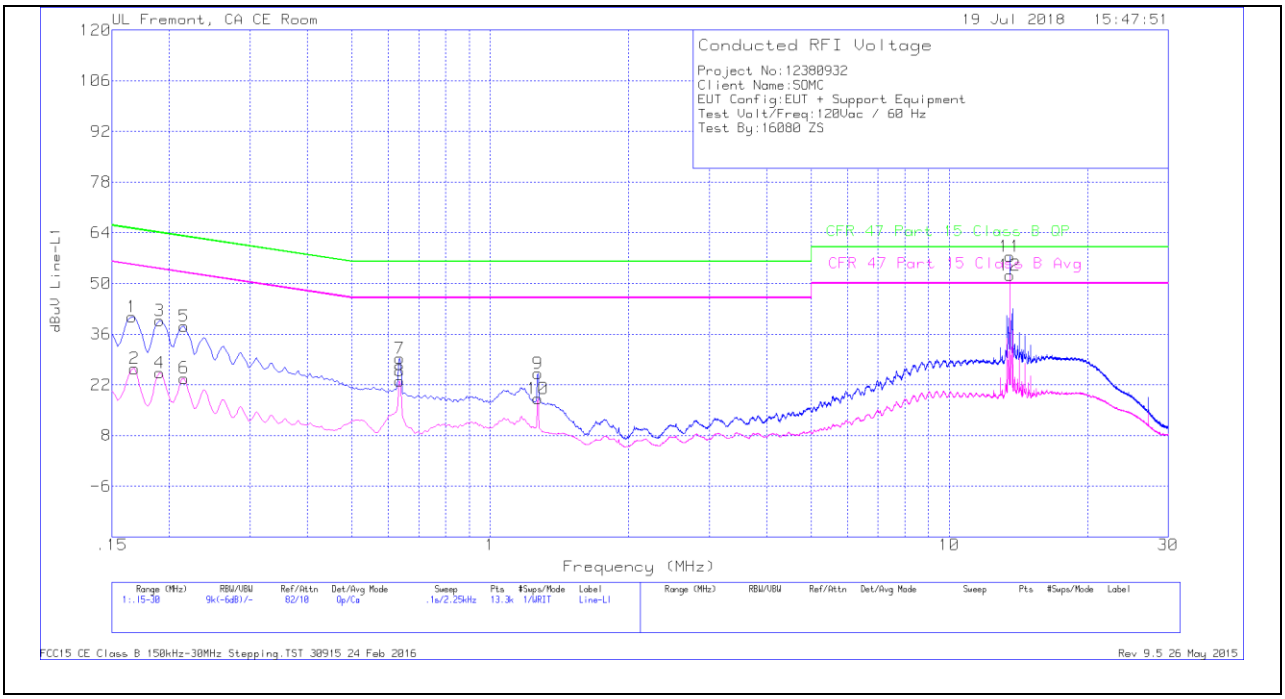
**TEST PROCEDURE**

ANSI C63.10:2013

**RESULTS**

No non-compliance noted:

## EUT WITH ANTENNA – LINE 1 RESULTS



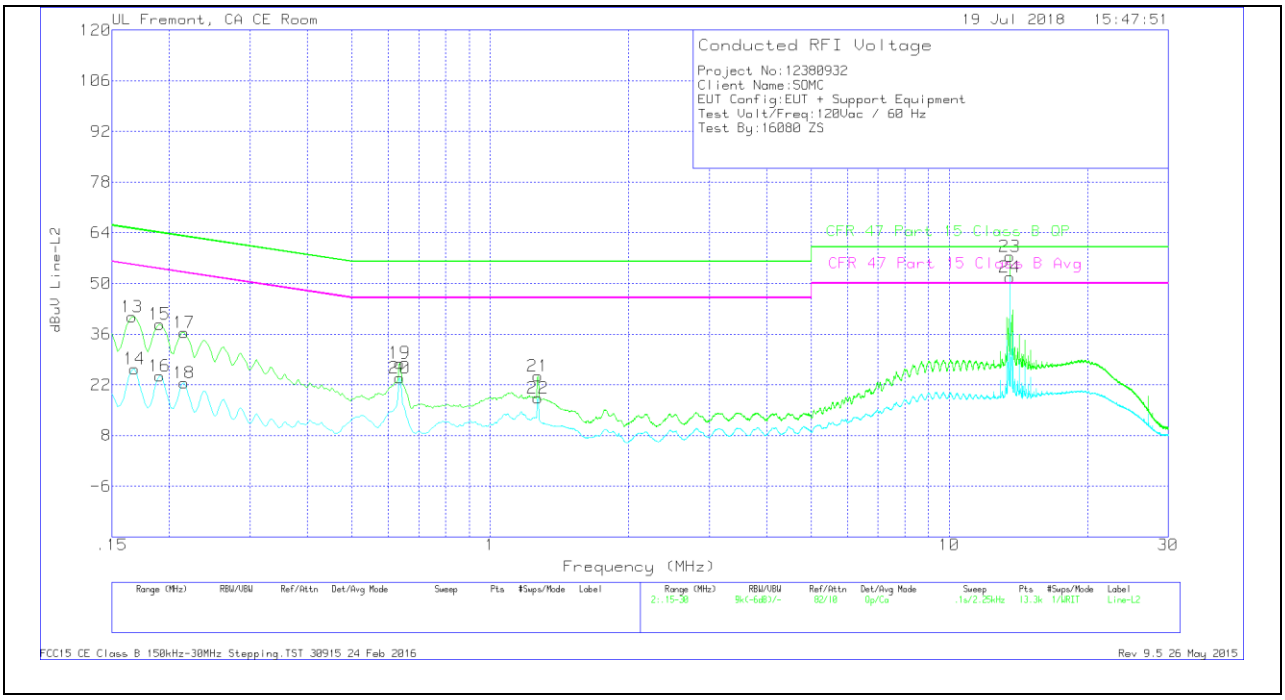

## WORST EMISSIONS

Trace Markers

| Range 1: Line-L1 .15 - 30MHz | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | LISN L1 | LC Cables C1&C3 | Limiter (dB) | Corrected Reading dBuV | CFR 47 Part 15 Class B QP | QP Margin (dB) | CFR 47 Part 15 Class B Avg | Av(CISPR) Margin (dB) |
| 1 | .16575 | 30.64 | Qp | .1 | 0 | 10.1 | 40.84 | 65.17 | -24.33 | - | - |
| 2 | .168 | 16.25 | Ca | .1 | 0 | 10.1 | 26.45 | - | - | 55.06 | -28.61 |
| 3 | .1905 | 29.59 | Qp | 0 | 0 | 10.1 | 39.69 | 64.01 | -24.32 | - | - |
| 4 | .1905 | 15.29 | Ca | 0 | 0 | 10.1 | 25.39 | - | - | 54.01 | -28.62 |
| 5 | .21525 | 28.05 | Qp | 0 | 0 | 10.1 | 38.15 | 63 | -24.85 | - | - |
| 6 | .21525 | 13.74 | Ca | 0 | 0 | 10.1 | 23.84 | - | - | 53 | -29.16 |
| 7 | .636 | 19.21 | Qp | 0 | 0 | 10.1 | 29.31 | 56 | -26.69 | - | - |
| 8 | .636 | 12.92 | Ca | 0 | 0 | 10.1 | 23.02 | - | - | 46 | -22.98 |
| 9 | 1.2705 | 14.92 | Qp | 0 | .1 | 10.1 | 25.12 | 56 | -30.88 | - | - |
| 10 | 1.2705 | 7.94 | Ca | 0 | .1 | 10.1 | 18.14 | - | - | 46 | -27.86 |
| 11 | 13.56 | 47.02 | Qp | .1 | .2 | 10.2 | 57.52 | 60 | -2.48 | - | - |
| 12 | 13.56 | 41.81 | Ca | .1 | .2 | 10.2 | 52.31 | - | - | **50** | **2.31** |

Qp - Quasi-Peak detector
Ca - CISPR average detection
Note: Markers 11 and 12 are the 13.56MHz NFC Fundamental

## EUT WITH ANTENNA – LINE 2 RESULTS



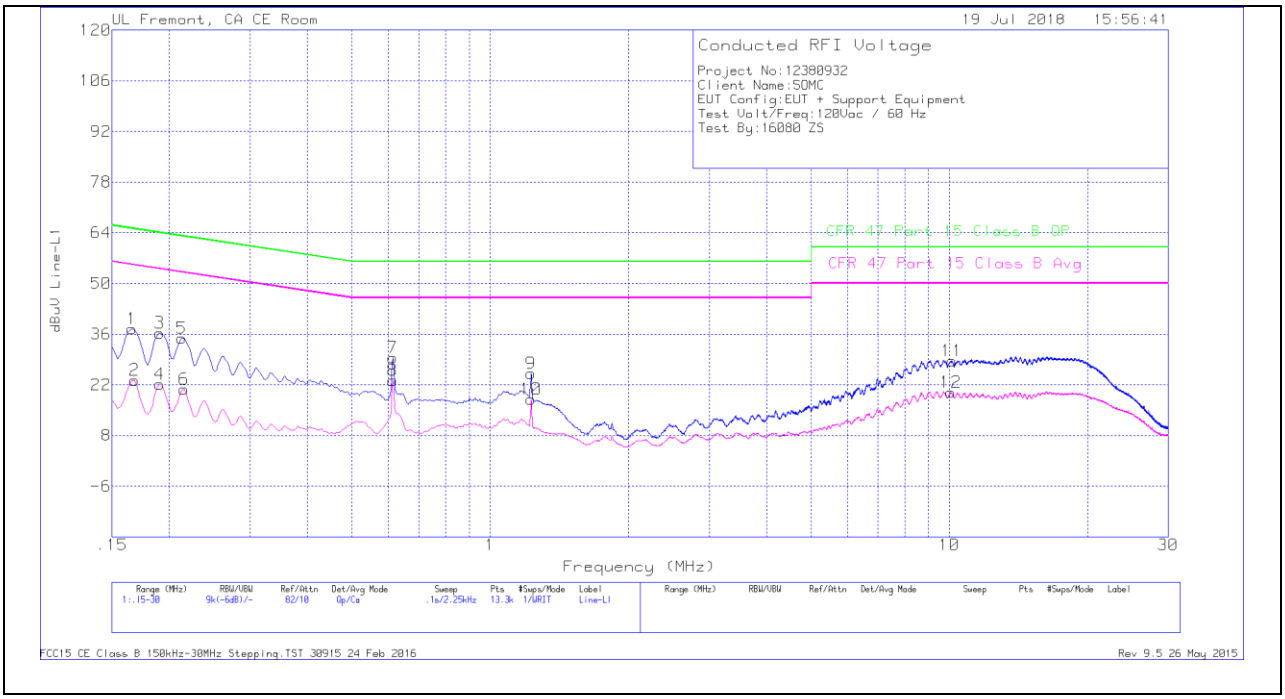

## WORST EMISSIONS

Trace Markers

| Range 2: Line-L2 .15 - 30MHz | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | LISN L2 | LC Cables C2&C3 | Limiter (dB) | Corrected Reading dBuV | CFR 47 Part 15 Class B QP | QP Margin (dB) | CFR 47 Part 15 Class B Avg | Av(CISPR) Margin (dB) |
| 13 | .16575 | 30.58 | Qp | .1 | 0 | 10.1 | 40.78 | 65.17 | -24.39 | - | - |
| 14 | .168 | 16.24 | Ca | .1 | 0 | 10.1 | 26.44 | - | - | 55.06 | -28.62 |
| 15 | .1905 | 28.68 | Qp | 0 | 0 | 10.1 | 38.78 | 64.01 | -25.23 | - | - |
| 16 | .1905 | 14.41 | Ca | 0 | 0 | 10.1 | 24.51 | - | - | 54.01 | -29.5 |
| 17 | .21525 | 26.35 | Qp | 0 | 0 | 10.1 | 36.45 | 63 | -26.55 | - | - |
| 18 | .21525 | 12.38 | Ca | 0 | 0 | 10.1 | 22.48 | - | - | 53 | -30.52 |
| 19 | .636 | 17.91 | Qp | 0 | 0 | 10.1 | 28.01 | 56 | -27.99 | - | - |
| 20 | .636 | 13.79 | Ca | 0 | 0 | 10.1 | 23.89 | - | - | 46 | -22.11 |
| 21 | 1.2705 | 14.18 | Qp | 0 | .1 | 10.1 | 24.38 | 56 | -31.62 | - | - |
| 22 | 1.2705 | 8.21 | Ca | 0 | .1 | 10.1 | 18.41 | - | - | 46 | -27.59 |
| 23 | 13.56 | 47.03 | Qp | .1 | .2 | 10.2 | 57.53 | 60 | -2.47 | - | - |
| 24 | 13.56 | 41.28 | Ca | .1 | .2 | 10.2 | 51.78 | - | - | **50** | **1.78** |

Qp - Quasi-Peak detector
Ca - CISPR average detection
Note: Markers 23 and 24 are the 13.56MHz NFC Fundamental

## EUT WITH ANTENNA PORT TERMINATED – LINE 1 RESULTS



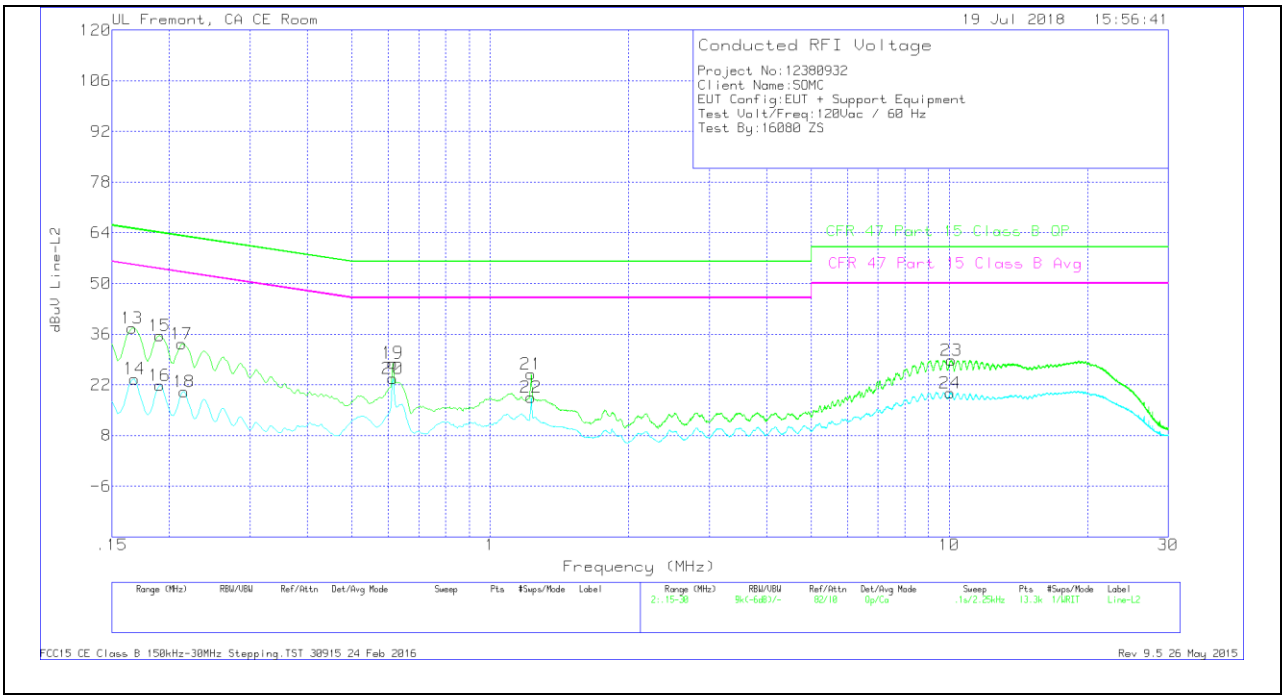

## WORST EMISSIONS

Trace Markers

| Range 1: Line-L1 .15 - 30MHz | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | LISN L1 | LC Cables C1&C3 | Limiter (dB) | Corrected Reading dBuV | CFR 47 Part 15 Class B QP | QP Margin (dB) | CFR 47 Part 15 Class B Avg | Av(CISPR) Margin (dB) |
| 1 | .16575 | 27.3 | Qp | .1 | 0 | 10.1 | 37.5 | 65.17 | -27.67 | - | - |
| 2 | .168 | 13.11 | Ca | .1 | 0 | 10.1 | 23.31 | - | - | 55.06 | -31.75 |
| 3 | .1905 | 26.25 | Qp | 0 | 0 | 10.1 | 36.35 | 64.01 | -27.66 | - | - |
| 4 | .1905 | 12.15 | Ca | 0 | 0 | 10.1 | 22.25 | - | - | 54.01 | -31.76 |
| 5 | .213 | 24.79 | Qp | 0 | 0 | 10.1 | 34.89 | 63.09 | -28.2 | - | - |
| 6 | .21525 | 10.67 | Ca | 0 | 0 | 10.1 | 20.77 | - | - | 53 | -32.23 |
| 7 | .6135 | 19.37 | Qp | 0 | 0 | 10.1 | 29.47 | 56 | -26.53 | - | - |
| 8 | .6135 | 13.07 | Ca | 0 | 0 | 10.1 | 23.17 | - | - | 46 | -22.83 |
| 9 | 1.22775 | 14.96 | Qp | 0 | .1 | 10.1 | 25.16 | 56 | -30.84 | - | - |
| 10 | 1.22775 | 7.85 | Ca | 0 | .1 | 10.1 | 18.05 | - | - | 46 | -27.95 |
| 11 | 10.131 | 18.28 | Qp | 0 | .2 | 10.2 | 28.68 | 60 | -31.32 | - | - |
| 12 | 10.06575 | 9.49 | Ca | 0 | .2 | 10.2 | 19.89 | - | - | 50 | -30.11 |

Qp - Quasi-Peak detector
Ca - CISPR average detection

## EUT WITH ANTENNA PORT TERMINATED – LINE 2 RESULTS




## WORST EMISSIONS

Trace Markers

| Range 2: Line-L2 .15 - 30MHz | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | LISN L2 | LC Cables C2&C3 | Limiter (dB) | Corrected Reading dBuV | CFR 47 Part 15 Class B QP | QP Margin (dB) | CFR 47 Part 15 Class B Avg | Av(CISPR) Margin (dB) |
| 13 | .16575 | 27.51 | Qp | .1 | 0 | 10.1 | 37.71 | 65.17 | -27.46 | - | - |
| 14 | .168 | 13.46 | Ca | .1 | 0 | 10.1 | 23.66 | - | - | 55.06 | -31.4 |
| 15 | .1905 | 25.52 | Qp | 0 | 0 | 10.1 | 35.62 | 64.01 | -28.39 | - | - |
| 16 | .1905 | 11.74 | Ca | 0 | 0 | 10.1 | 21.84 | - | - | 54.01 | -32.17 |
| 17 | .213 | 23.22 | Qp | 0 | 0 | 10.1 | 33.32 | 63.09 | -29.77 | - | - |
| 18 | .21525 | 9.94 | Ca | 0 | 0 | 10.1 | 20.04 | - | - | 53 | -32.96 |
| 19 | .6135 | 17.91 | Qp | 0 | 0 | 10.1 | 28.01 | 56 | -27.99 | - | - |
| 20 | .6135 | 13.72 | Ca | 0 | 0 | 10.1 | 23.82 | - | - | 46 | -22.18 |
| 21 | 1.22775 | 14.72 | Qp | 0 | .1 | 10.1 | 24.92 | 56 | -31.08 | - | - |
| 22 | 1.22775 | 8.37 | Ca | 0 | .1 | 10.1 | 18.57 | - | - | 46 | -27.43 |
| 23 | 10.1175 | 18.42 | Qp | 0 | .2 | 10.2 | 28.82 | 60 | -31.18 | - | - |
| 24 | 10.04438 | 9.34 | Ca | 0 | .2 | 10.2 | 19.74 | - | - | 50 | -30.26 |

Qp - Quasi-Peak detector
Ca - CISPR average detection