

MEASUREMENT REPORT

FCC Part 15B Receiver Spurious Emissions

Applicant Name:
Samsung Electronics Co., Ltd.
129, Samsung-ro,
Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

Date of Testing:
05/13 - 6/1/2021
Test Site/Location:
PCTEST Lab. Yongin-Si, Gyeonggi-do, South Korea
Test Report Serial No.:
1K2105110019-10.A3L

| | |
|-------------------|--------------------------------------|
| FCC ID: | A3LSMA127FN |
| APPLICANT: | Samsung Electronics Co., Ltd. |

Application Type: Certification
Model: SM-A127F/DSN
EUT Type: Portable Handset
Equipment Class: Communications Rcvr for use w/ licensed Tx and CBs (CXX)
FCC Rule Part(s): FCC Part 15 Subpart B
Test Procedure(s): ANSI C63.4-2014

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and has been tested in accordance with the measurement procedures specified in ANSI C63.4-2014 (See Test Report). The results shown herein are also deemed satisfactory evidence of compliance with RSS-Gen. These measurements were performed with no deviation from the standards. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.



Prepared by



Reviewed by

| | | | | |
|--|---|--|---|--|
| FCC ID: A3LSMA127FN |  | MEASUREMENT REPORT (CERTIFICATION) |  | Approved by: Technical Manager |
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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and Innovation, Science and Economic Development Canada.

1.2 PCTEST Test Location

These measurement tests were conducted at the PCTEST facility located at 13, Heungdeok 1-ro, Giheung-gu, Yongin-si, Gyeonggi-do, 16954, South Korea. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

1.3 Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in 13, Heungdeok 1-ro, Giheung-gu, Yongin-si, Gyeonggi-do, 16954 South Korea.

- PCTEST is an ISO 17025-2017 accredited test facility under the National Voluntary Laboratory Accreditation Program (NVLAP) with Certificate number 600143-0 for Specific Absorption Rate (SAR), and Electromagnetic Compatibility (EMC) & Telecommunications testing for FCC and Innovation, Science, and Economic Development Canada (ISED) rules.
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).
- PCTEST facility is a registered (26168) test laboratory with the site description on file with ISED.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMA127FN**. The test data contained in this report pertains only to the emissions due to the digital circuitry of the EUT.

Test Device Serial No.: 2866M

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850 WCDMA/HSPA, Multi-band LTE, WLAN 802.11b/g/n, Bluetooth (1x, EDR, LE), NFC

The device contains receivers which tune and operate between 30MHz – 960MHz in the following bands:

GSM850, WCDMA850, LTE B5

2.3 Test Configuration

The EUT was tested while operating in licensed band Rx mode. All licensed band receivers that tune in the range of 30MHz – 960MHz, as listed in Section 2.2, are investigated. Only the worst case emissions are reported.

All equipment is placed on the test table top and arranged in a typical configuration in accordance with ANSI C63.4-2014 and manipulated to obtain worst case emissions.

For more information please see Section 7.0 for test data and the test setup photos document for the test setup photographs.

2.4 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

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3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedure described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-2014) was used in the measurement of the EUT.

Deviation from measurement procedure.....None

3.2 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Clause 5, Figure 5.7 of ANSI C63.4-2014. A raised turntable is used for radiated measurement. It is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. An 80cm tall test table made of Incco is placed on top of the turn table.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014.

3.3 Environmental Conditions

The temperature is controlled within range of 15°C to 35°C. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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4.0 SAMPLE CALCULATIONS

4.1 Radiated Emission Measurement Sample Calculation

@ 66.7 MHz

| | |
|-----------------------------|---|
| Class B limit | = 100 $\mu\text{V/m}$ = 40.0 dB $\mu\text{V/m}$ |
| Reading | = - 76.0 dBm (calibrated level) |
| Convert to dB μV | = - 76.0 + 107 = 31.0 dB μV |
| Antenna Factor + Cable Loss | = 5.8 dB/m |
| Total | = 36.8 dB $\mu\text{V/m}$ |
| Margin | = 36.8 - 40.0 = - 3.2 dB |
| | = 3.2 dB below limit |

Note:

$$\text{Level [dB}\mu\text{V]} = 20 \log_{10} (\text{Level } [\mu\text{V/m}])$$

$$\text{Level [dB}\mu\text{V]} = \text{Level [dBm]} + 107$$

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5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

| Contribution | Expanded Uncertainty (\pm dB) |
|------------------------------|----------------------------------|
| Radiated Disturbance (<1GHz) | 3.01 |
| Radiated Disturbance (>1GHz) | 5.56 |

| | | | | |
|---|--|---------------------------------------|---|-----------------------------------|
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6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

| Manufacturer | Model | Description | Cal Date | Cal Interval | Cal Due | Serial Number |
|-----------------------|---------------|----------------------------|------------|--------------|------------|---------------|
| Agilent | N9030A | PXA Signal Analyzer | 6/29/2020 | Annual | 6/28/2021 | MY49432391 |
| Anritsu | S820E | Cable and Antenna Analyzer | 6/29/2020 | Annual | 6/28/2021 | 1839097 |
| Anritsu | MA24106A | USB Power Sensor | 6/29/2020 | Annual | 6/28/2021 | 1244512 |
| Com-Power | AL-130R | Active Loop Antenna | 10/29/2020 | Biennial | 10/28/2022 | 10160045 |
| Schwarzbeck | VULB9162 | Broadband TRILOG Antenna | 7/9/2019 | Biennial | 7/8/2021 | 9162-217 |
| Sunol Sciences | DRH-118 | Horn Antenna | 8/9/2019 | Biennial | 8/8/2021 | A102416-1 |
| Keysight Technologies | N9030B | PXA Signal Analyzer | 5/1/2021 | Annual | 4/30/2022 | MY57142018 |
| Mini-Circuits | ZHDC-16-63-S+ | Coupler | 6/29/2020 | Annual | 6/28/2021 | F709401716 |
| Mini-Circuits | ZNDC-18-2G-S+ | Coupler | 6/29/2020 | Annual | 6/28/2021 | F280401542 |
| Mini-Circuits | BW-N10W5+ | Attenuator | 6/29/2020 | Annual | 6/28/2021 | 1607 |
| Mini-Circuits | BW-N10W5+ | Attenuator | 6/29/2020 | Annual | 6/28/2021 | 1607 |
| Rohde & Schwarz | TS-PR18 | Preamplifier | 6/29/2020 | Annual | 6/28/2021 | 102141 |
| Rohde & Schwarz | TS-PR1840 | Preamplifier | 6/29/2020 | Annual | 6/28/2021 | 100049 |
| Rohde & Schwarz | ENV216 | Two-Line V-Network | 5/24/2021 | Annual | 5/23/2022 | 101319 |
| Rohde & Schwarz | FSW43 | Signal & Spectrum Analyzer | 9/17/2020 | Annual | 9/16/2021 | 101250 |
| Rohde & Schwarz | TS-SFUNIT-Rx | Shielded Filter Unit | 2/19/2021 | Annual | 2/18/2022 | 102131 |

Table 6-1. Annual Test Equipment Calibration Schedule

Note:


For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

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7.0 TEST DATA

7.1 Summary

Test Date(s): 05/13 - 6/1/2021

Test Engineer: 

| FCC Part 15 Section | Description | Result |
|---------------------|-----------------------------|--------|
| 15.109 | Radiated Emissions | PASS |
| 15.107 | AC Line Conducted Emissions | PASS |

Table 7-1. Summary of Test Results

| | | | | |
|---|---|---------------------------------------|---|-----------------------------------|
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7.2 Radiated Measurement Data

§15.109

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at maximum power and at the appropriate frequencies. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions must not exceed the limits shown in Table 7-2 per FCC 15.109.

| Frequency [MHz] | Field Strength Limit [$\mu\text{V/m}$] |
|-----------------|--|
| 30 – 88 | 100 |
| 88 – 216 | 150 |
| 216 – 960 | 200 |
| > 960 | 500 |

Table 7-2. 3-Meter Radiated Limits (Section 15.109)

Test Procedures Used

ANSI C63.4-2014

Test Settings

Field Strength Measurements

1. Analyzer frequency set to the frequency of the radiated spurious emission of interest
2. RBW = 100kHz, VBW = 300kHz (for emissions between 30MHz – 1GHz)
3. RBW = 1MHz, VBW = 3MHz (for emissions above 1GHz)
4. Detector = Quasi-peak (for emissions between 30MHz – 1GHz)
5. Detector = Peak (for emissions above 1GHz)
6. Sweep time = auto couple
7. Trace mode = max hold
8. Trace was allowed to stabilize

Test Setup

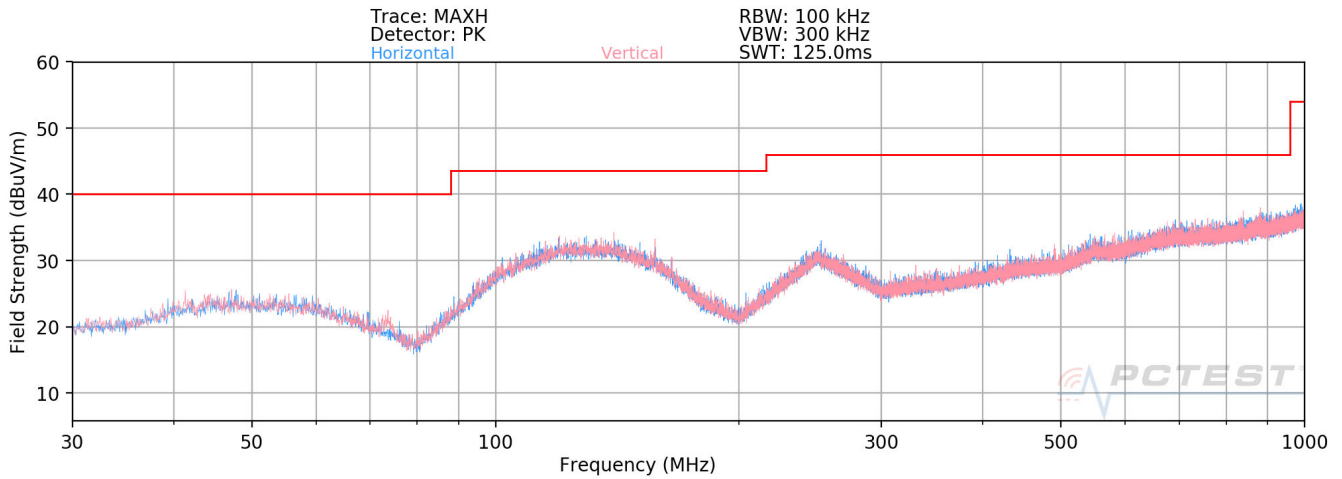
The EUT and measurement equipment were set up as shown test setup photos provided.

| | | | | |
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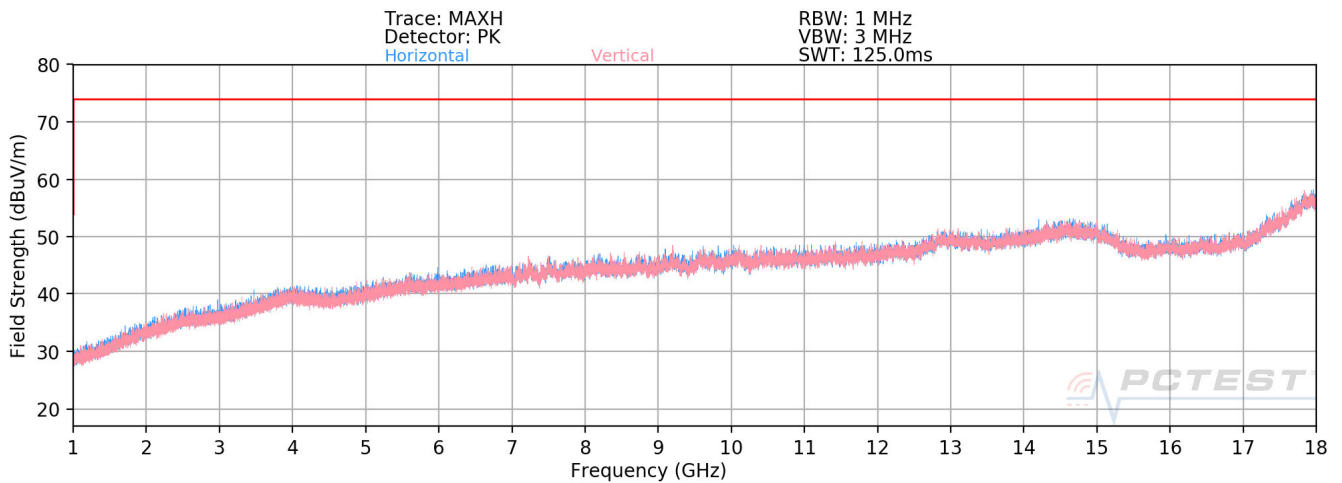
Test Notes

1. All modes of operation were investigated and the worst-case emissions are reported.
2. Radiated emissions were measured from 30MHz – 18GHz to ensure that the provisions of 15.33(b)(1) are satisfied with respect to the upper frequency scanning range.
3. The radiated limits for unintentional radiators at a distance of 3 meters are used in the table above, as specified in 15.109(a).
4. All readings are calibrated by a signal generator with accuracy traceable to the National Institute of Standards and Technology (NIST).
5. AFCL (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB)
6. Level (dB μ V/m) = Analyzer Reading (dBm) + AFCL (dB/m) + 107
7. Margin (dB) = Field strength (dB μ V/m) – Limit (dB μ V/m)
8. Measurements are made using a CISPR quasi-peak detector with a 120kHz resolution bandwidth. Above 1GHz, peak measurements are made using a peak detector with a resolution bandwidth of 1MHz and a video bandwidth of 3MHz and average measurements are made with a RMS detector using a resolution bandwidth of 1MHz and a video bandwidth of 3MHz.
9. Calibrated linearly polarized broadband and horn antennas were used for measurements below and above 1GHz, respectively. For measurements made below 1GHz, the results recorded using the broadband antenna are known to correlate with the results obtained by using a tuned dipole with an acceptable degree of accuracy. The VSWR for the measurement antennas was found to be less than 2:1.
10. Calibrated low-loss microwaves cables and broadband amplifiers are used.

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Plot 7-1. Radiated Spurious Plot below 1GHz



Plot 7-2. Radiated Spurious Plot above 1GHz

| Frequency [MHz] | Detector | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Analyzer Level [dBm] | AFCL [dB/m] | Field Strength [dBuV/m] | Limit [dBuV/m] | Margin [dB] |
|-----------------|------------|-----------------|---------------------|----------------------------|----------------------|-------------|-------------------------|----------------|-------------|
| 47.16 | Quasi-Peak | V | - | - | -108.90 | 14.72 | 12.82 | 40.00 | -27.18 |
| 140.20 | Quasi-Peak | V | - | - | -111.90 | 22.59 | 17.69 | 43.52 | -25.84 |
| 171.30 | Quasi-Peak | V | - | - | -111.40 | 16.86 | 12.46 | 43.52 | -31.06 |
| 496.26 | Quasi-Peak | V | - | - | -111.20 | 19.46 | 15.26 | 46.02 | -30.76 |
| 881.52 | Quasi-Peak | V | - | - | -108.90 | 24.88 | 22.98 | 46.02 | -23.04 |
| 997.50 | Quasi-Peak | V | - | - | -110.00 | 26.21 | 23.21 | 53.98 | -30.77 |

Table 7-3. Radiated Measurements at 3-meters

| | | | | | |
|---|---|---------------------------------------|--|---|-----------------------------------|
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7.3 Line Conducted Measurement Data

§15.107

Test Overview and Limit

All AC line conducted spurious emissions are measured with a receiver connected to a grounded LISN while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.

All conducted emissions must not exceed the limits shown in the table below, per Section 15.207 and RSS-Gen (8.8).

| Frequency of emission (MHz) | Conducted Limit (dB μ V) | |
|-----------------------------|------------------------------|-----------|
| | Quasi-peak | Average |
| 0.15 – 0.5 | 66 to 56* | 56 to 46* |
| 0.5 – 5 | 56 | 46 |
| 5 – 30 | 60 | 50 |

Table 7-4. Conducted Limits

*Decreases with the logarithm of the frequency.

Test Procedures Used

ANSI C63.10-2013, Section 6.2

Test Settings

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = RMS
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

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Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

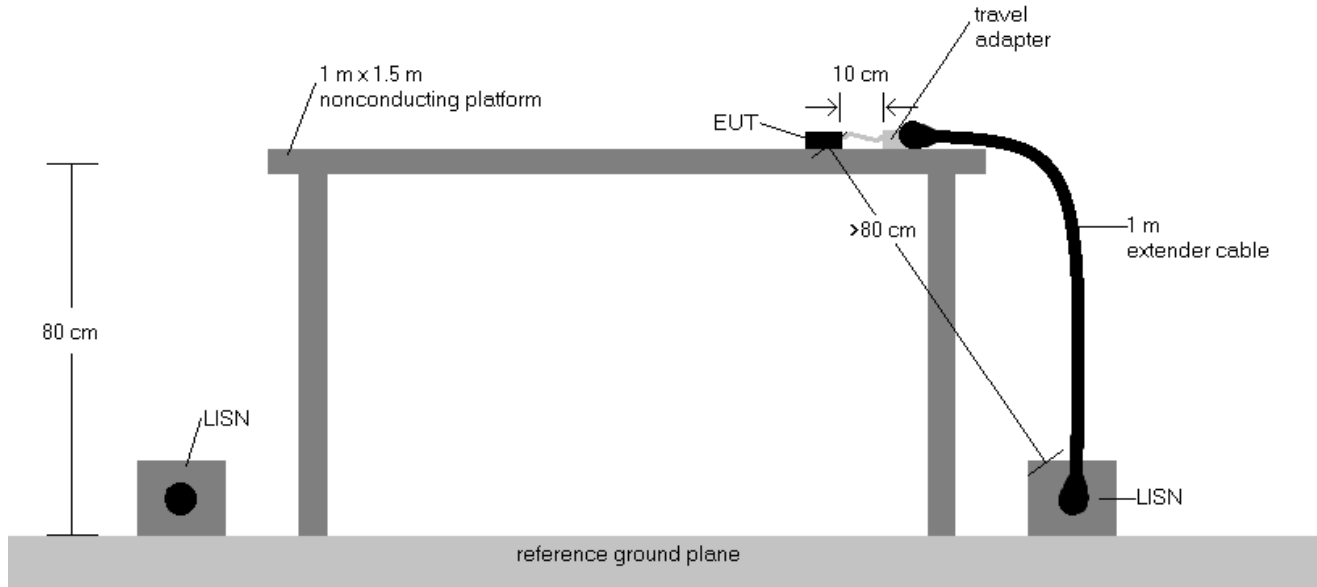
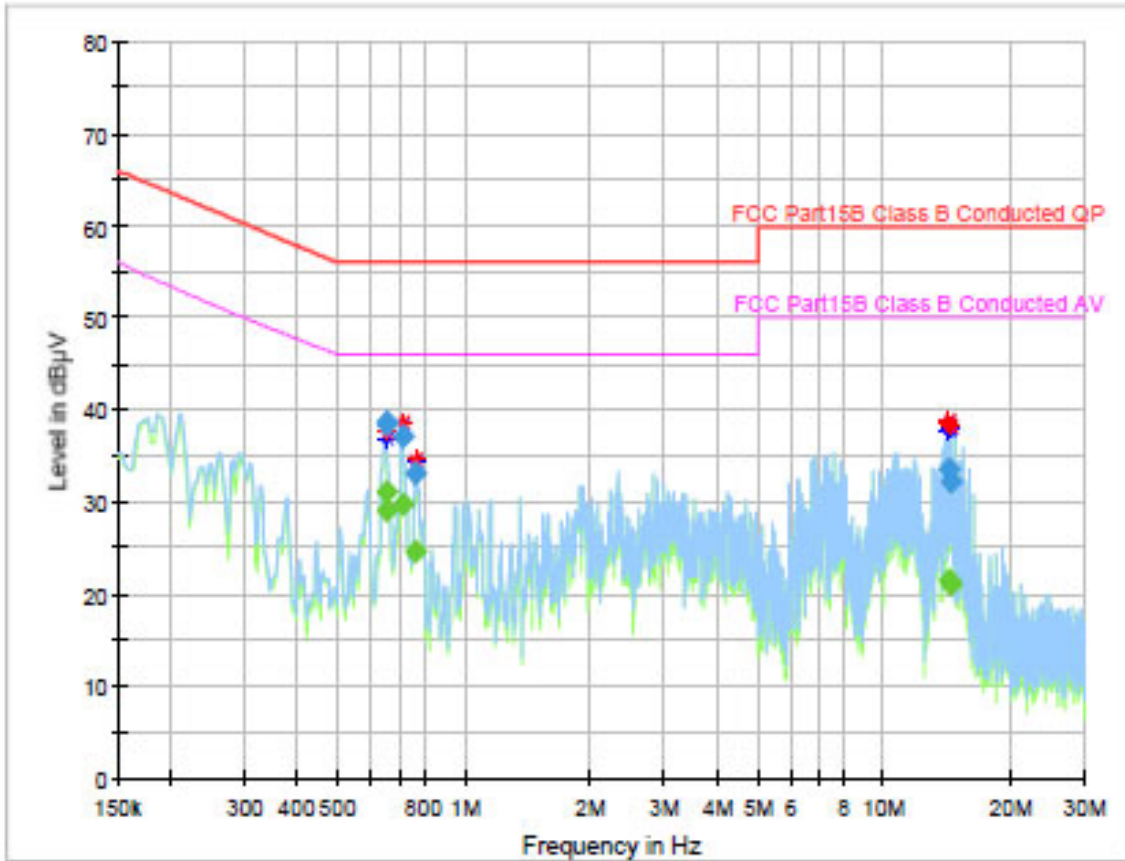


Figure 7-1. Test Instrument & Measurement Setup

Test Notes

- All modes of operation were investigated and the worst-case emissions are reported using mid channel. The emissions found were not affected by the choice of channel used during testing.
- The limit for an intentional radiator from 150kHz to 30MHz are specified in 15.207 and RSS-Gen (8.8).
- Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
- QP/AV Level (dB μ V) = QP/AV Analyzer/Receiver Level (dB μ V) + Corr. (dB)
- Margin (dB) = QP/AV Limit (dB μ V) - QP/AV Level (dB μ V)
- Traces shown in plot are made using a peak detector.
- Deviations to the Specifications: None.

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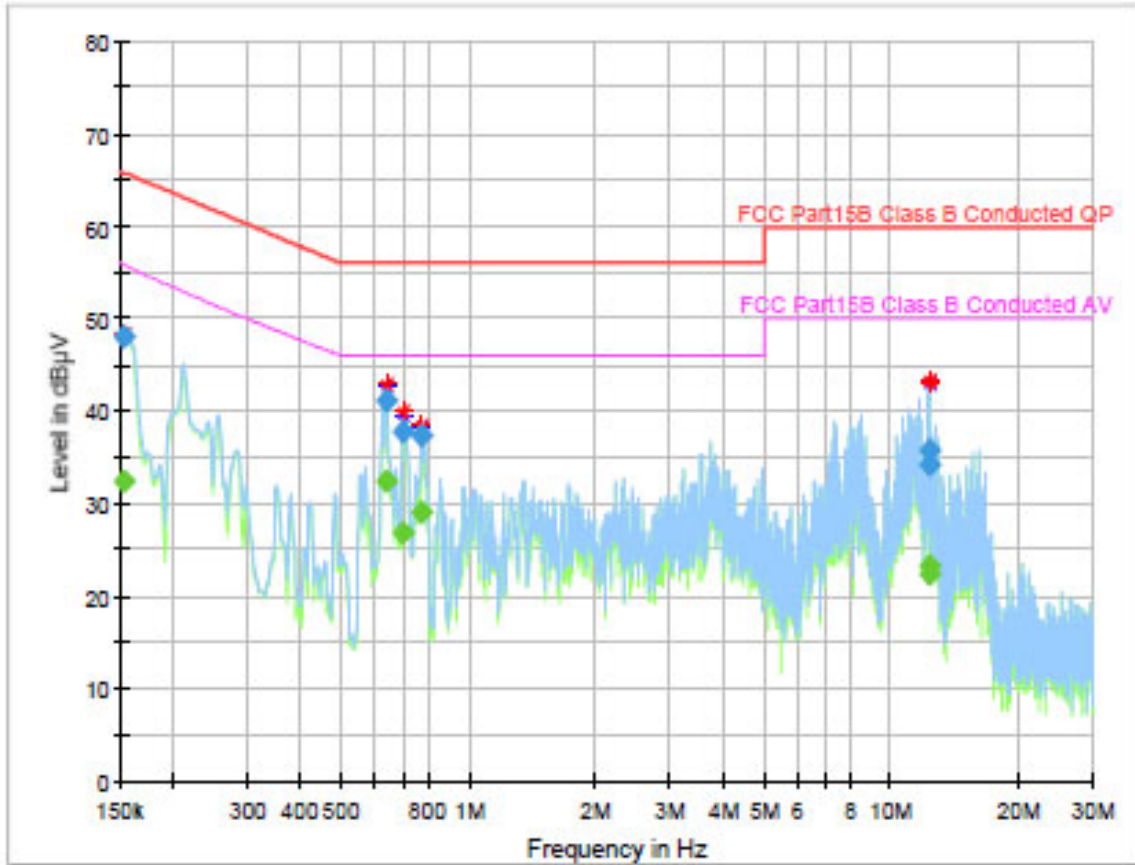
Plot 7-3. Line-Conducted Test Plot (L1)

Final Result

| Frequency (MHz) | QuasiPeak (dBµV) | Average (dBµV) | Limit (dBµV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Corr. (dB) |
|-----------------|------------------|----------------|--------------|-------------|-----------------|-----------------|------|------------|
| 0.651480 | --- | 31.05 | 46.00 | 14.95 | 1000.0 | 9.000 | L1 | 10.0 |
| 0.651480 | 38.68 | --- | 56.00 | 17.32 | 1000.0 | 9.000 | L1 | 10.0 |
| 0.654465 | --- | 29.13 | 46.00 | 16.87 | 1000.0 | 9.000 | L1 | 10.0 |
| 0.654465 | 38.38 | --- | 56.00 | 17.62 | 1000.0 | 9.000 | L1 | 10.0 |
| 0.714165 | --- | 29.63 | 46.00 | 16.37 | 1000.0 | 9.000 | L1 | 9.9 |
| 0.714165 | 37.13 | --- | 56.00 | 18.87 | 1000.0 | 9.000 | L1 | 9.9 |
| 0.767895 | --- | 24.64 | 46.00 | 21.36 | 1000.0 | 9.000 | L1 | 9.9 |
| 0.767895 | 33.02 | --- | 56.00 | 22.98 | 1000.0 | 9.000 | L1 | 9.9 |
| 14.272035 | --- | 21.55 | 50.00 | 28.45 | 1000.0 | 9.000 | L1 | 10.0 |
| 14.272035 | 33.52 | --- | 60.00 | 26.48 | 1000.0 | 9.000 | L1 | 10.0 |
| 14.364570 | --- | 20.96 | 50.00 | 29.04 | 1000.0 | 9.000 | L1 | 10.0 |
| 14.364570 | 32.26 | --- | 60.00 | 27.74 | 1000.0 | 9.000 | L1 | 10.0 |

Table 7-12. Line-Conducted Test Table (L1)

| | | | | | |
|---|--|---------------------------------------|--|----------------|-----------------------------------|
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Plot 7-4. Line-Conducted Test Plot (N)

Final Result

| Frequency (MHz) | QuasiPeak (dBµV) | Average (dBµV) | Limit (dBµV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Corr. (dB) |
|-----------------|------------------|----------------|--------------|-------------|-----------------|-----------------|------|------------|
| 0.152985 | --- | 32.50 | 55.82 | 23.32 | 1000.0 | 9.000 | N | 9.7 |
| 0.152985 | 48.14 | --- | 65.84 | 17.69 | 1000.0 | 9.000 | N | 9.7 |
| 0.639540 | --- | 32.40 | 46.00 | 13.60 | 1000.0 | 9.000 | N | 9.9 |
| 0.639540 | 41.09 | --- | 56.00 | 14.91 | 1000.0 | 9.000 | N | 9.9 |
| 0.702225 | --- | 26.88 | 46.00 | 19.12 | 1000.0 | 9.000 | N | 9.9 |
| 0.702225 | 37.73 | --- | 56.00 | 18.27 | 1000.0 | 9.000 | N | 9.9 |
| 0.773865 | --- | 29.00 | 46.00 | 17.00 | 1000.0 | 9.000 | N | 9.9 |
| 0.773865 | 37.35 | --- | 56.00 | 18.65 | 1000.0 | 9.000 | N | 9.9 |
| 12.269100 | --- | 23.20 | 50.00 | 26.80 | 1000.0 | 9.000 | N | 10.0 |
| 12.269100 | 35.74 | --- | 60.00 | 24.26 | 1000.0 | 9.000 | N | 10.0 |
| 12.334770 | --- | 22.36 | 50.00 | 27.64 | 1000.0 | 9.000 | N | 10.0 |
| 12.334770 | 34.22 | --- | 60.00 | 25.78 | 1000.0 | 9.000 | N | 10.0 |

Table 7-12. Line-Conducted Test Table (N)

| | | | | |
|---|--|---------------------------------------|----------------|-----------------------------------|
| FCC ID: A3LSMA127FN | PCTEST Proud to be part of element | MEASUREMENT REPORT (CERTIFICATION) | SAMSUNG | Approved by: Technical Manager |
| Test Report S/N: 1K2105110019-09.A3L | Test Dates: 05/13 - 6/1/2021 | EUT Type: Portable handset | | Page 16 of 17 |

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Portable Handset FCC ID: A3LSMA127FN** has been tested to comply with the requirements specified in §15.107 and §15.109 of the FCC rules.

| | | | | |
|---|---|---------------------------------------|---|-----------------------------------|
| FCC ID: A3LSMA127FN |  <p>PCTEST[®] Proud to be part of  element</p> | MEASUREMENT REPORT (CERTIFICATION) |  | Approved by: Technical Manager |
| Test Report S/N: 1K2105110019-09.A3L | Test Dates: 05/13 - 6/1/2021 | EUT Type: Portable handset | Page 17 of 17 | |