

MEASUREMENT REPORT

FCC PART 15.249 Bluetooth (Low Energy)

Applicant Name:

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

Date of Testing:

12/27/2017 - 1/26/2018

Test Site/Location:

PCTEST Lab. Columbia, MD, USA

Test Report Serial No.:

1M1712270335-02.A3L

FCC ID:

A3LSFG-D0100

APPLICANT:

Samsung Electronics Co., Ltd.

Application Type:

Certification

Model:

SFG-D0100

EUT Type:

Indoor Customer Premise Equipment (CPE)

Frequency Range:

2402 – 2480MHz

FCC Classification:

Low Power Communications Device Transmitter (DXX)

FCC Rule Part(s):

Part 15 Subpart C (15.249)

Test Procedure(s):

ANSI C63.10-2013

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. 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.


Randy Ortanez
President

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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 the Innovation, Science and Economic Development Canada.

1.2 PCTEST Test Location

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. 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 Columbia, MD 21046, U.S.A.

- PCTEST is an ISO 17025-2005 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada 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 ISSED Standards (RSS).
- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISSED.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Indoor Customer Premise Equipment (CPE) FCC ID: A3LSFG-D0100**. The test data contained in this report pertains only to the emissions due to the EUT's Bluetooth LE transmitter.

Test Device Serial No.: 0053, 0054

2.2 Device Capabilities

This device contains the following capabilities:

5G mmWave, Bluetooth LE

Ch.	Frequency (MHz)
00	2402
:	:
19	2440
:	:
39	2480

Table 2-1. Frequency/ Channel Operations

2.3 Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2013. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Sections 3.2 for AC line conducted emissions test setups, 3.3 for radiated emissions test setups, and 7.2 for antenna port conducted emissions test setups.

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 of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) was used in the measurement of the EUT.

Deviation from measurement procedure.....None

3.2 AC Line Conducted Emissions

The line-conducted facility is located inside a 10'x16'x9' shielded enclosure. The shielded enclosure is manufactured by ETS Lindgren RF Enclosures. The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50μH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. The external power line filter is an ETS Lindgren Model LPRX-4X30 (100dB Attenuation, 14kHz-18GHz) and the two EMI/RFI filters are ETS Lindgren Model LRW-2030-S1 (100dB Minimum Insertion Loss, 14kHz – 10GHz). These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference groundplane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

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 RF output of the LISN was connected to the spectrum analyzer and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions is used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 7.7. The EMI Receiver mode of the Agilent MXE was used to perform AC line conducted emissions testing.

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3.3 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 Figure 5.7 of Clause 5 in ANSI C63.4-2014. 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 Styrodur is placed on top of the turn table. For measurements above 1GHz, an additional Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

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.

3.4 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 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

- The antennas of the EUT are **permanently attached**.
- There are no provisions for connection to an external antenna.

Conclusion:

The EUT complies with the requirement of §15.203.

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5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. 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)
Conducted Bench Top Measurements	1.13
Line Conducted Disturbance	3.09
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

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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
-	RE1	Radiated Emissions Cable Set (UHF/EHF)	6/21/2017	Annual	6/21/2018	RE1
-	WL25-1	Conducted Cable Set (25GHz)	6/14/2017	Annual	6/14/2018	WL25-1
Agilent	N9038A	MXE EMI Receiver	4/26/2017	Annual	4/26/2018	MY51210133
Agilent	N9030A	PXA Signal Analyzer (26.5GHz)	8/28/2017	Annual	8/28/2018	MY49432391
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	10/10/2017	Biennial	10/10/2019	121034
Emco	3115	Horn Antenna (1-18GHz)	3/10/2016	Biennial	3/10/2018	9704-5182
EMCO	3160-09	Small Horn (18 - 26.5GHz)	8/23/2016	Biennial	8/23/2018	135427
EMCO	3160-10	Small Horn (26.5 - 40GHz)	8/23/2016	Biennial	8/23/2018	130993
ETS-Lindgren	3816/2NM	Line Impedance Stabilization Network	12/27/2016	Biennial	12/27/2018	114451
Huber+Suhner	Sucoflex 102A	40GHz Radiated Cable	5/19/2017	Annual	5/19/2018	251425001
Pasternack	NMLC-1	Line Conducted Emissions Cable (NM)	5/31/2017	Annual	5/31/2018	NMLC-1
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	5/11/2017	Annual	5/11/2018	100040
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	7/31/2017	Annual	7/31/2018	100348
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	7/3/2017	Annual	7/3/2018	102135
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/2/2016	Biennial	3/2/2018	N/A
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	3/14/2016	Biennial	3/14/2018	A051107

Table 6-1. Annual Test Equipment Calibration Schedule

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7.0 TEST RESULTS

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.
 FCC ID: A3LSFG-D0100
 Method/System: Low Power Communications Device Transmitter (DXX)
 Number of Channels: 40

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	RSS-Gen [6.6]	Occupied Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
15.249(a)(e)	RSS-210 [B.10]	Fundamental Field Strength Level	< 50 mV/m	RADIATED	PASS	Section 7.3
15.205, 15.209, 15.249(d)(e)	RSS-210 [B.10], RSS-Gen [8.9]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	< 15.209 limits or 50dB below the level of the fundamental (RSS-Gen [8.9])		PASS	Sections 7.4, 7.5, 7.6
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits (RSS-Gen [8.8])	LINE CONDUCTED	PASS	Section 7.7

Table 7-1. Summary of Test Results

Notes:

- 1) All modes of operation were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) For radiated band edge, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "Chamber Automation," Version 1.1.5.
- 3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.

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7.2 Occupied Bandwidth Measurement

§2.1049; RSS-Gen (6.6)

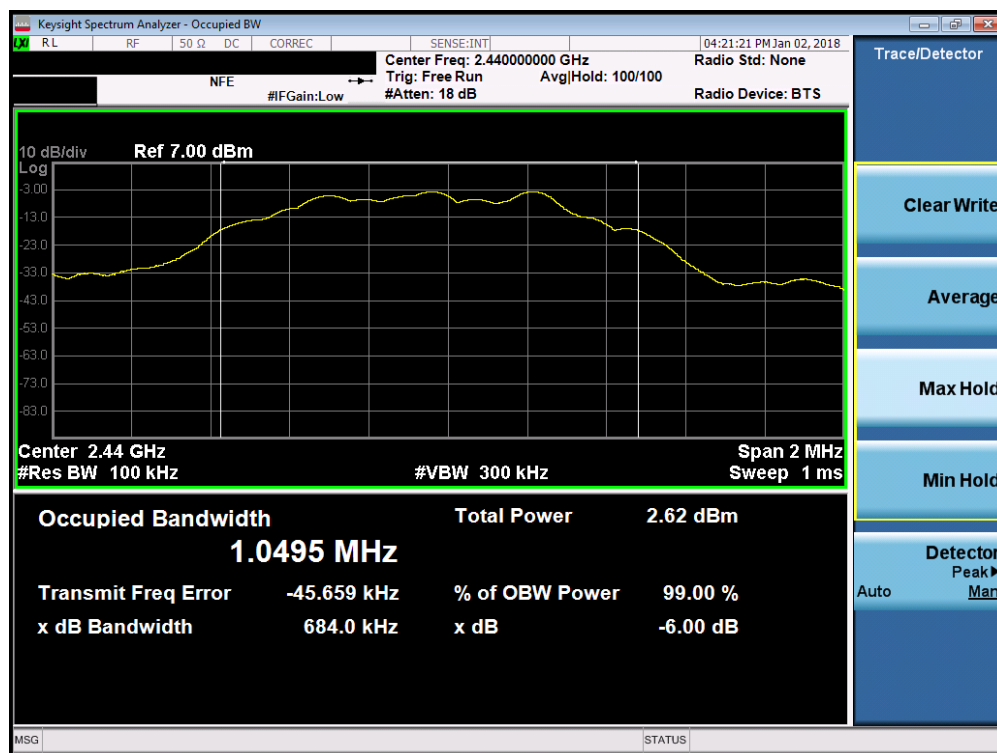
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. The spectrum analyzers' "occupied bandwidth" measurement function was used to record the occupied bandwidth.

Frequency [MHz]	Channel No.	Operating Mode	Measured Bandwidth [kHz]
2440	19	BLE	1049.5

Table 7-2. Occupied Bandwidth Measurement



Figure 7-1. Test Instrument & Measurement Setup



Plot 7-1. Occupied Bandwidth Plot (Bluetooth LE – Ch. 19)

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7.3 Fundamental Field Strength Level Measurement

§15.249(a)(e); RSS-210 (B.10)

Measurement is made while the EUT is operating in non-hopping transmission mode. The field strengths shown below were measured using a spectrum analyzer. Peak field strength measurements are performed in the analyzers' swept spectrum mode using a peak detector with RBW = 3MHz and VBW ≥ RBW. Peak power levels were shown to comply with the average limits so average measurements were not performed.

The maximum permissible average field strength level is 50mV/m (93.98dBμV/m).

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
2402.00	Peak	V	230	320	-38.90	6.45	74.55	93.98	-19.43
2440.00	Peak	V	202	322	-33.67	6.61	79.94	93.98	-14.04
2480.00	Peak	V	140	317	-34.99	6.98	78.99	93.98	-14.99

Table 7-3. Fundamental Field Strength Measurements

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7.4 Radiated Spurious Emission Measurements

§15.205 §15.209 §15.249 (d)(e); RSS-210 (B.10), RSS-Gen (8.9)

Frequency	Field Strength [$\mu\text{V/m}$]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

Table 7-4. Radiated Limits

Test Setup

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

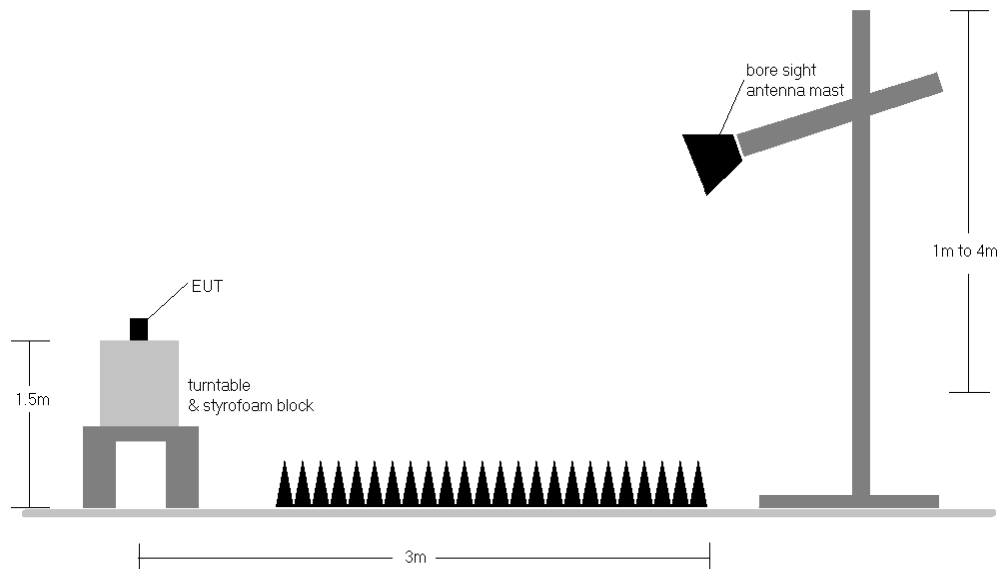


Figure 7-2. Radiated Test Setup

FCC ID: A3LSFG-D0100	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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Sample Calculation

- o Field Strength Level $[\text{dB}\mu\text{V}/\text{m}] = \text{Analyzer Level } [\text{dBm}] + 107 + \text{AFCL } [\text{dB}/\text{m}]$
- o $\text{AFCL } [\text{dB}/\text{m}] = \text{Antenna Factor } [\text{dB}/\text{m}] + \text{Cable Loss } [\text{dB}]$
- o $\text{Margin } [\text{dB}] = \text{Field Strength Level } [\text{dB}\mu\text{V}/\text{m}] - \text{Limit } [\text{dB}\mu\text{V}/\text{m}]$

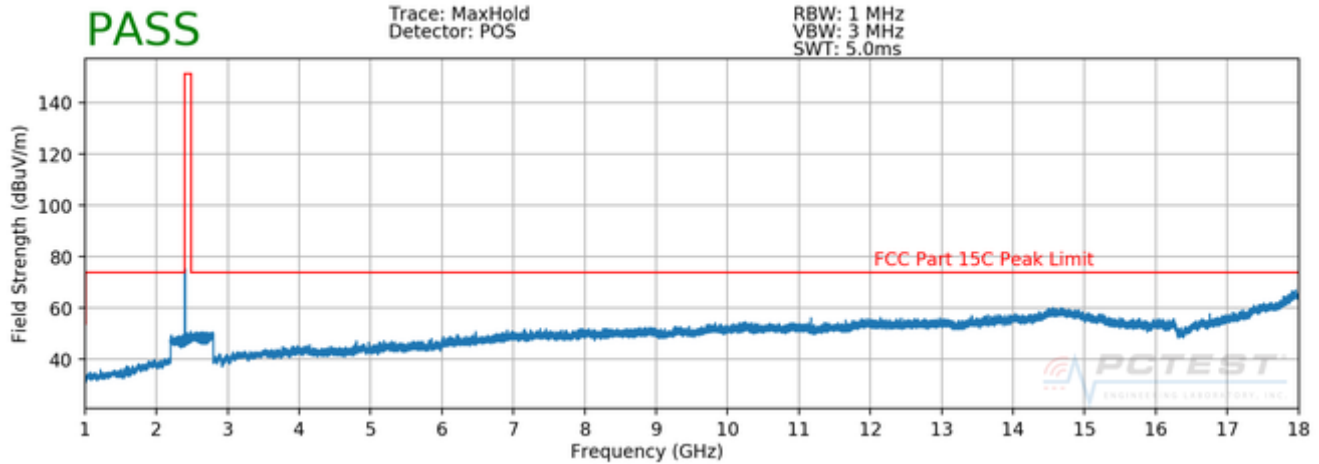
Test Notes

1. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. There were no non-harmonic emissions detected whose levels were within 20dB of the applicable limits so only harmonic emissions data is shown in this section.
2. All emissions lying in restricted bands specified in §15.205 and Section 8.10 of RSS-Gen are below the limit shown in Table 7-4. Per 15.249(d) and RSS-210 (B.10), the radiated emissions limits from 15.209 and RSS-Gen Section 8.10 were used since they were less than the limit of 50dB of attenuation from the measured fundamental field strength level.
3. Peak measurements > 1GHz using RBW = 1MHz and VBW = 3MHz.
4. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
5. This unit was tested while powered by an AC power source.
6. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. Any emissions found to be within 20dB of the limit are fully investigated and the results are shown in this section
7. The "-" shown in the following RSE tables are used to denote a noise floor measurement.
8. The emission found at 22.3GHz in the following plots have been determined to not come from the Bluetooth LE transmitter. Investigations and data for this emission can be found in the appropriate Part 30 test report.

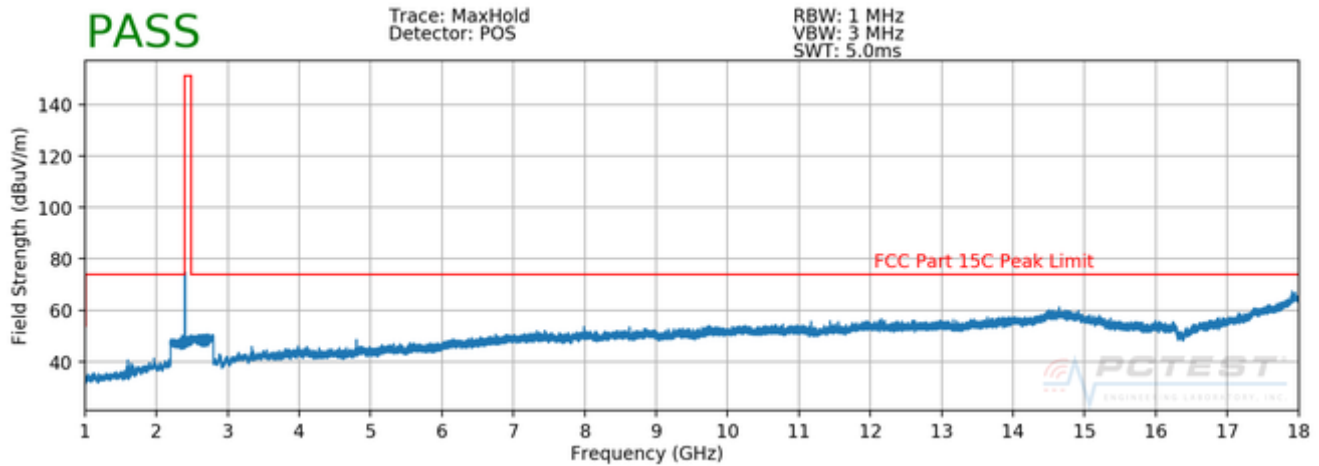
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Radiated Spurious Emission Measurements

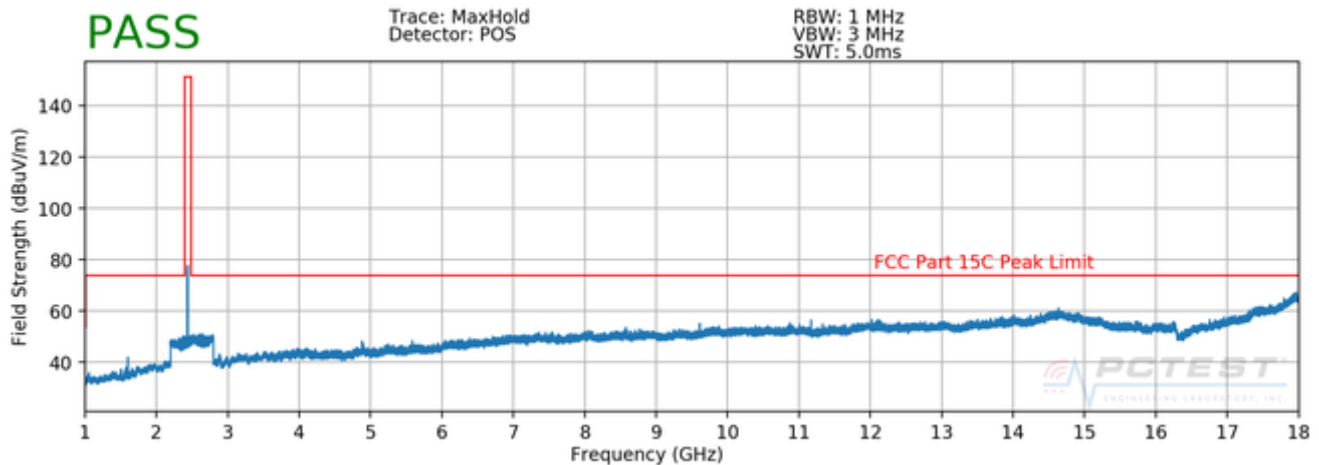
§15.205 §15.209 §15.249 (d)(e); RSS-210 (B.10), RSS-Gen (8.9)



Plot 7-2. Radiated Spurious Plot above 1GHz (BLE – Ch. 0, Ant. Pol. H)

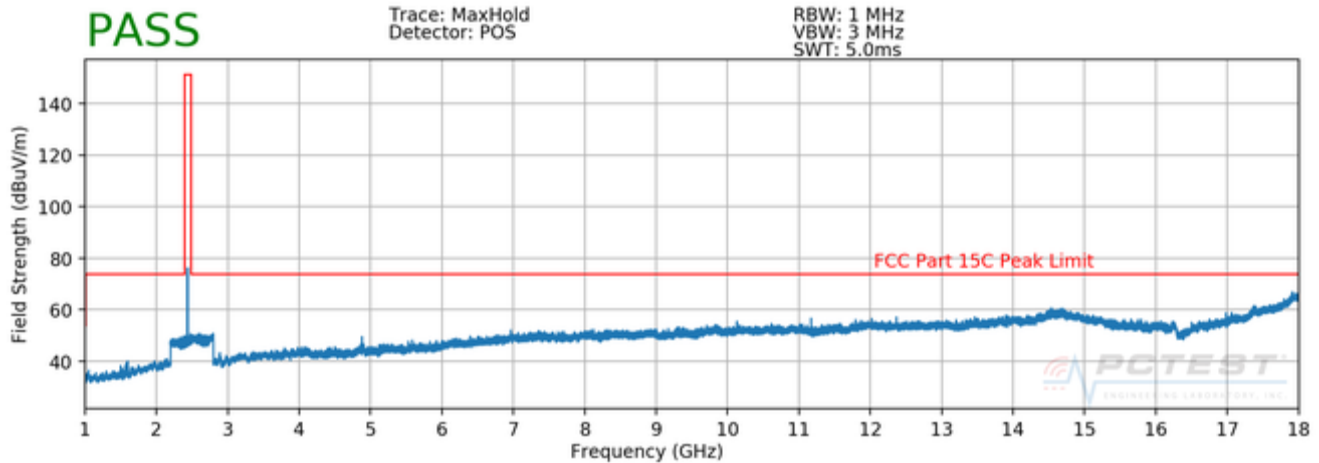


Plot 7-3. Radiated Spurious Plot above 1GHz (BLE – Ch. 0, Ant. Pol. V)

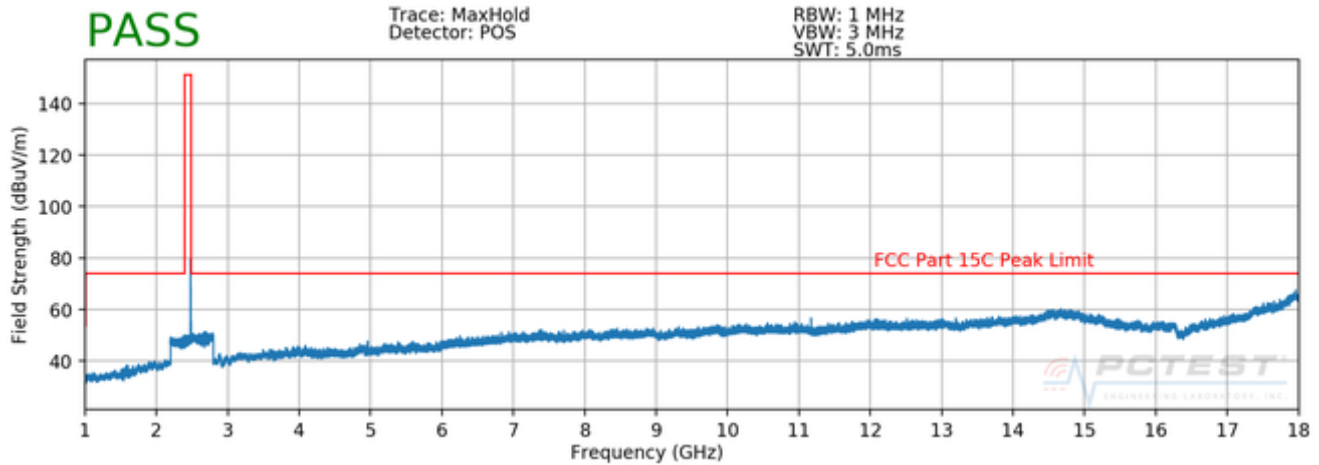


Plot 7-4. Radiated Spurious Plot above 1GHz (BLE – Ch. 19, Ant. Pol. H)

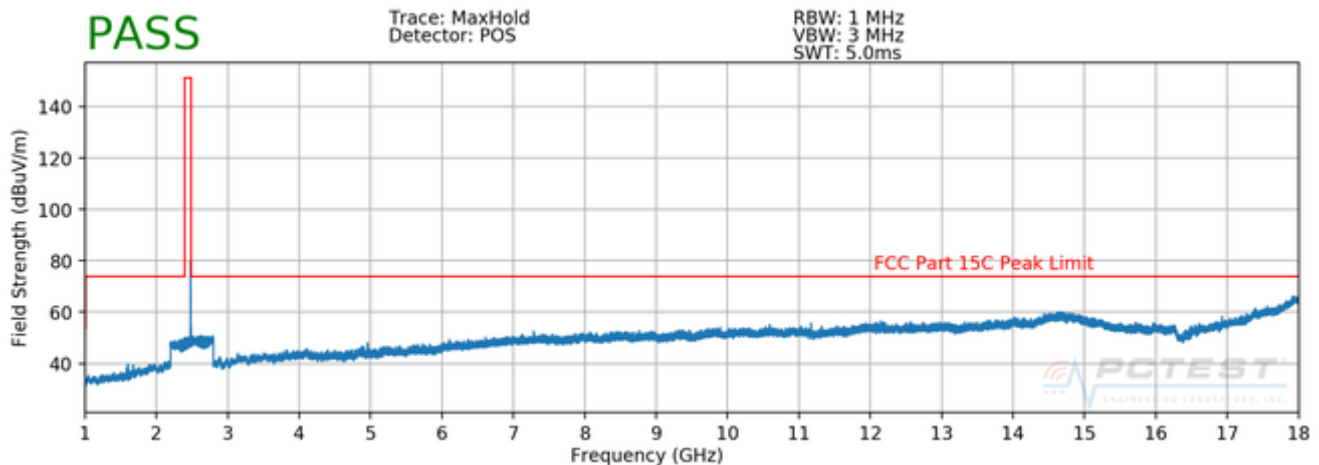
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Plot 7-5. Radiated Spurious Plot above 1GHz (BLE – Ch. 19, Ant. Pol. V)



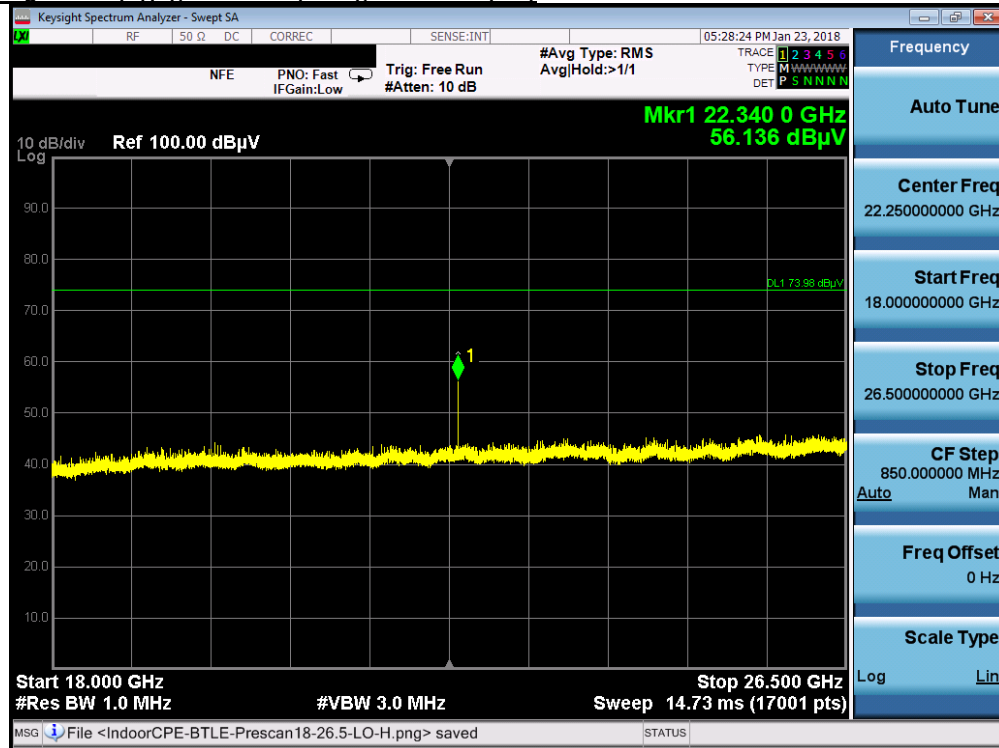
Plot 7-6. Radiated Spurious Plot above 1GHz (BLE – Ch. 39, Ant. Pol. H)



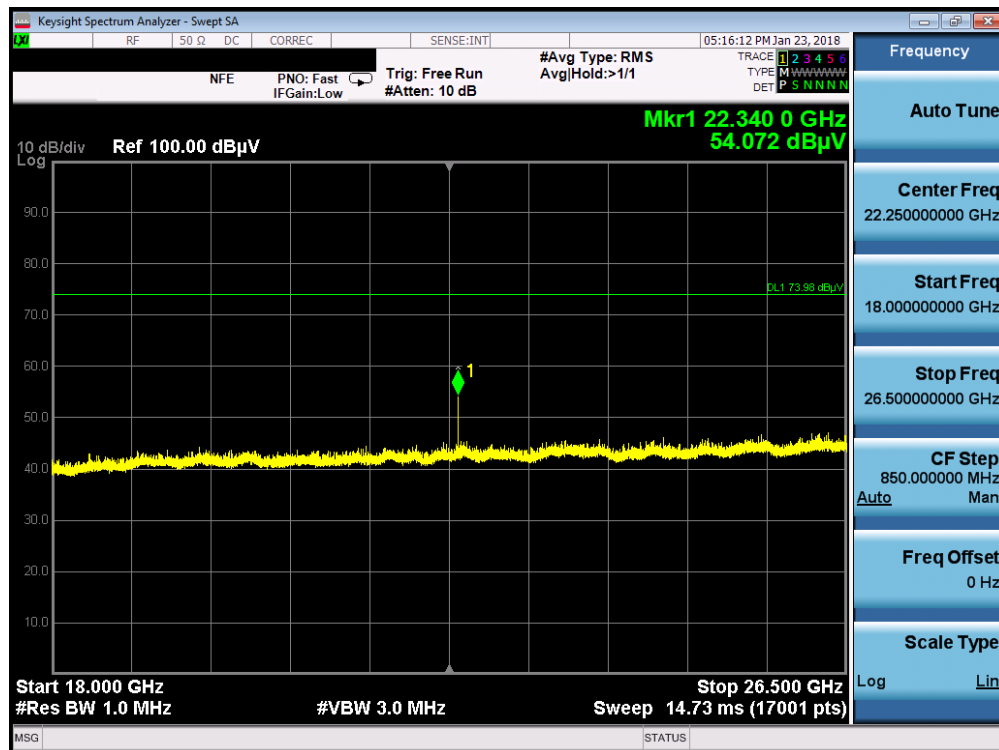
Plot 7-7. Radiated Spurious Plot above 1GHz (BLE – Ch. 39, Ant. Pol. V)

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Radiated Spurious Emission Measurements (Above 18GHz)
\$15.205 \$15.209 \$15.249 (d)(e); RSS-210 (B.10), RSS-Gen (8.9)

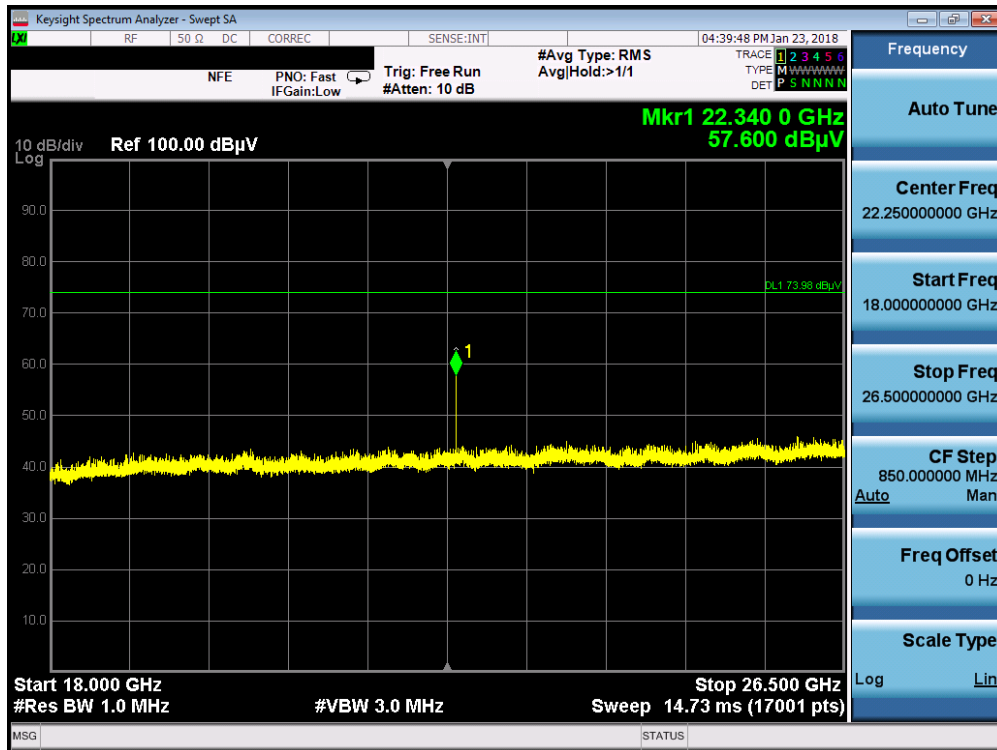


Plot 7-8. Radiated Spurious Plot above 18GHz (BLE – Ch. 0, Ant. Pol. H)

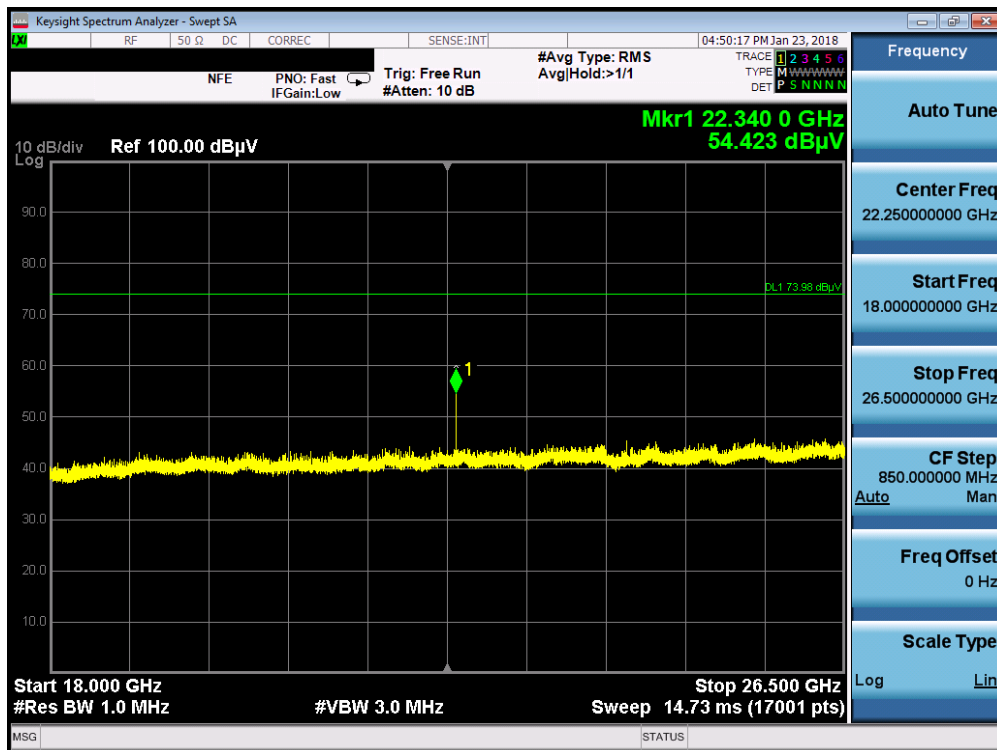


Plot 7-9. Radiated Spurious Plot above 18GHz (BLE – Ch. 0, Ant. Pol. V)

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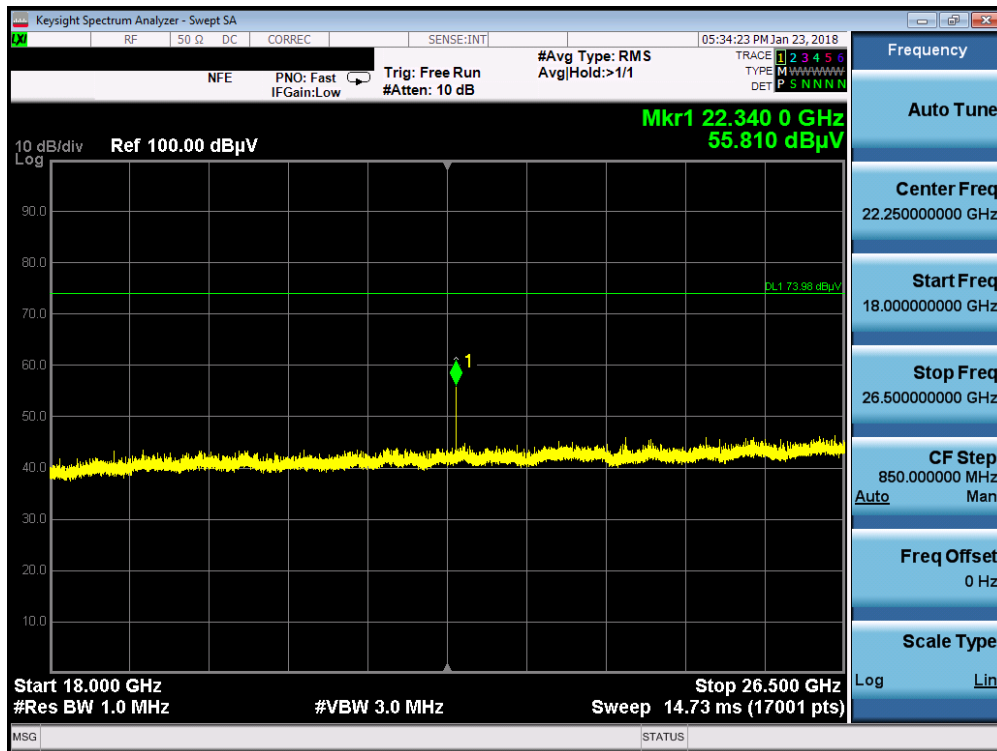


Plot 7-10. Radiated Spurious Plot above 18GHz (BLE – Ch. 19, Ant. Pol. H)

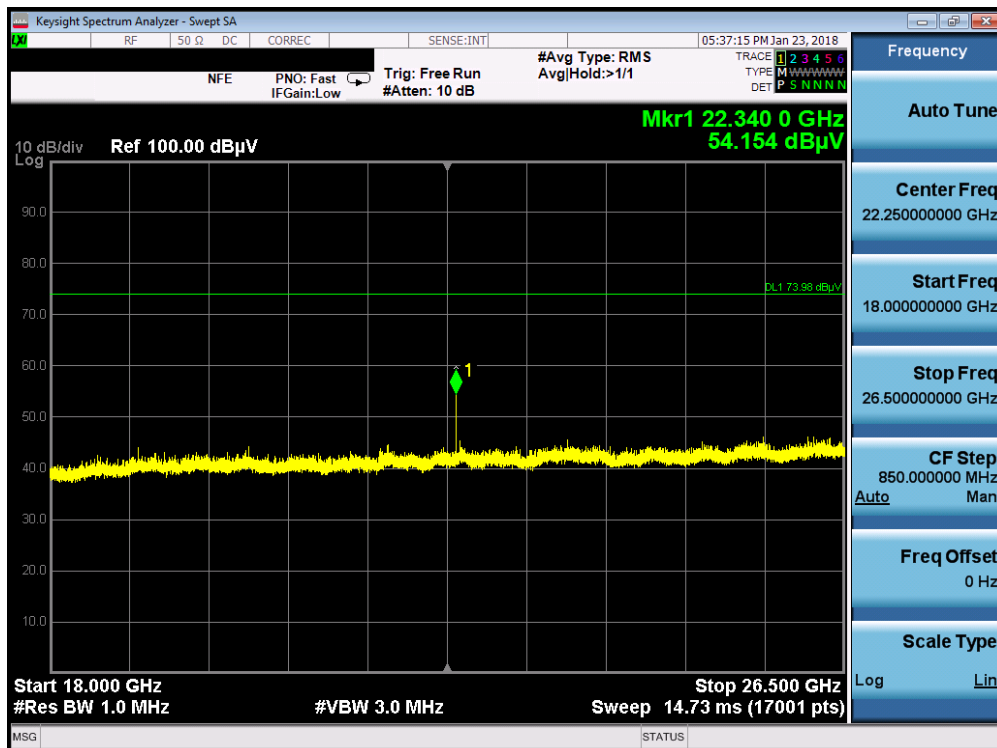


Plot 7-11. Radiated Spurious Plot above 18GHz (BLE – Ch. 19, Ant. Pol. V)

FCC ID: A3LSFG-D0100	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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Plot 7-12. Radiated Spurious Plot above 18GHz (BLE – Ch. 39, Ant. Pol. H)



Plot 7-13. Radiated Spurious Plot above 18GHz (BLE – Ch. 39, Ant. Pol. V)

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Radiated Spurious Emission Measurements

§15.205 §15.209 §15.249 (d)(e); RSS-210 (B.10), RSS-Gen (8.9)

Worst Case Mode: Bluetooth LE (0x04 Payload)
 Measurement Distance: 3 Meters
 Operating Frequency: 2402MHz
 Channel: 0

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4804.00	Avg	H	104	262	-72.41	1.97	36.56	53.98	-17.42
4804.00	Peak	H	104	262	-62.02	1.97	46.95	73.98	-27.03
12010.00	Avg	H	-	-	-75.33	13.14	44.81	53.98	-9.17
12010.00	Peak	H	-	-	-63.68	13.14	56.46	73.98	-17.52

Table 7-5. Radiated Measurements

Worst Case Mode: Bluetooth LE (0x04 Payload)
 Measurement Distance: 3 Meters
 Operating Frequency: 2440MHz
 Channel: 19

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4880.00	Avg	H	343	15	-70.96	2.87	38.91	53.98	-15.07
4880.00	Peak	H	343	15	-61.48	2.87	48.39	73.98	-25.59
7320.00	Avg	H	-	-	-75.77	9.17	40.40	53.98	-13.58
7320.00	Peak	H	-	-	-63.90	9.17	52.27	73.98	-21.71
12200.00	Avg	H	-	-	-75.38	13.65	45.27	53.98	-8.71
12200.00	Peak	H	-	-	-63.91	13.65	56.74	73.98	-17.24

Table 7-6. Radiated Measurements

FCC ID: A3LSFG-D0100		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Radiated Spurious Emission Measurements

§15.205 §15.209 §15.249 (d)(e); RSS-210 (B.10), RSS-Gen (8.9)

Worst Case Mode: Bluetooth LE (0x04 Payload)
 Measurement Distance: 3 Meters
 Operating Frequency: 2480MHz
 Channel: 39

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4960.00	Avg	H	397	15	-67.66	2.39	41.73	53.98	-12.25
4960.00	Peak	H	397	15	-58.24	2.39	51.15	73.98	-22.83
7440.00	Avg	H	-	-	-75.58	9.25	40.67	53.98	-13.31
7440.00	Peak	H	-	-	-63.53	9.25	52.72	73.98	-21.26
12400.00	Avg	H	-	-	-75.61	13.21	44.60	53.98	-9.38
12400.00	Peak	H	-	-	-63.98	13.21	56.23	73.98	-17.75

Table 7-7. Radiated Measurements

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7.5 Radiated Restricted Band Edge Measurements

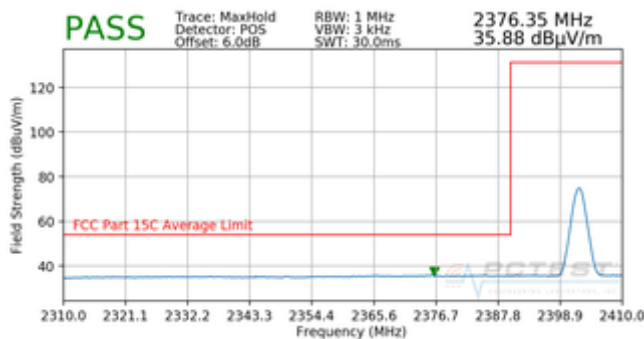
§15.205 §15.209 §15.249 (d); RSS-210 (B.10), RSS-Gen (8.9)

The radiated restricted band edge measurements are measured with an EMI test receiver connected to the receive antenna while the EUT is transmitting.

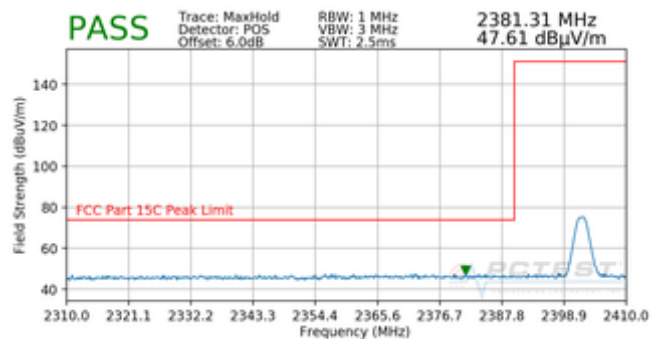
The amplitude offset shown in the following plots was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss) – Preamplifier Gain

Worst Case Mode:	Bluetooth LE (0x04 Payload)
Measurement Distance:	3 Meters
Operating Frequency:	2402MHz
Channel:	0

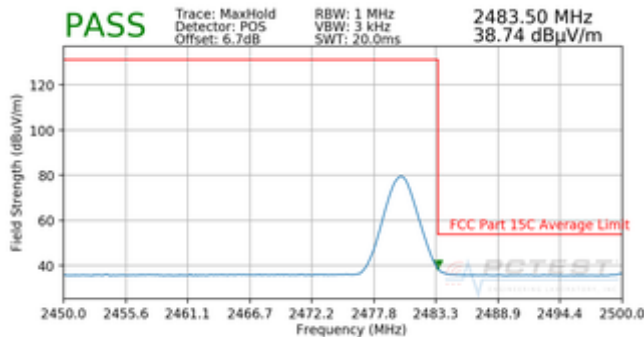


Plot 7-14. Radiated Restricted Upper Band Edge Measurement (Average)

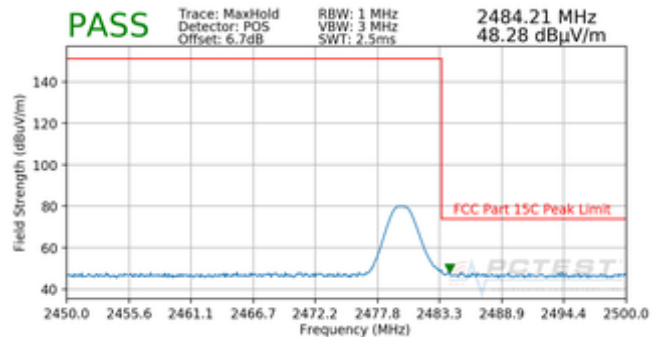


Plot 7-15. Radiated Restricted Upper Band Edge Measurement (Peak)

Worst Case Mode:	Bluetooth LE (0x04 Payload)
Measurement Distance:	3 Meters
Operating Frequency:	2480MHz
Channel:	39



Plot 7-16. Radiated Restricted Upper Band Edge Measurement (Average)



Plot 7-17. Radiated Restricted Upper Band Edge Measurement (Peak)

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7.6 Radiated Spurious Emissions Measurements – Below 1GHz

§15.209; RSS-Gen [8.9]

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 its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR and Table 6 of RSS-Gen (8.10) must not exceed the limits shown in Table 7-8 per Section 15.209 and RSS-Gen (8.9).

Frequency	Field Strength [μV/m]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

Table 7-8. Radiated Limits

Test Procedures Used

ANSI C63.10-2013

Test Settings

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 120kHz (for emissions from 30MHz – 1GHz)
3. Detector = quasi-peak
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 diagrams below.

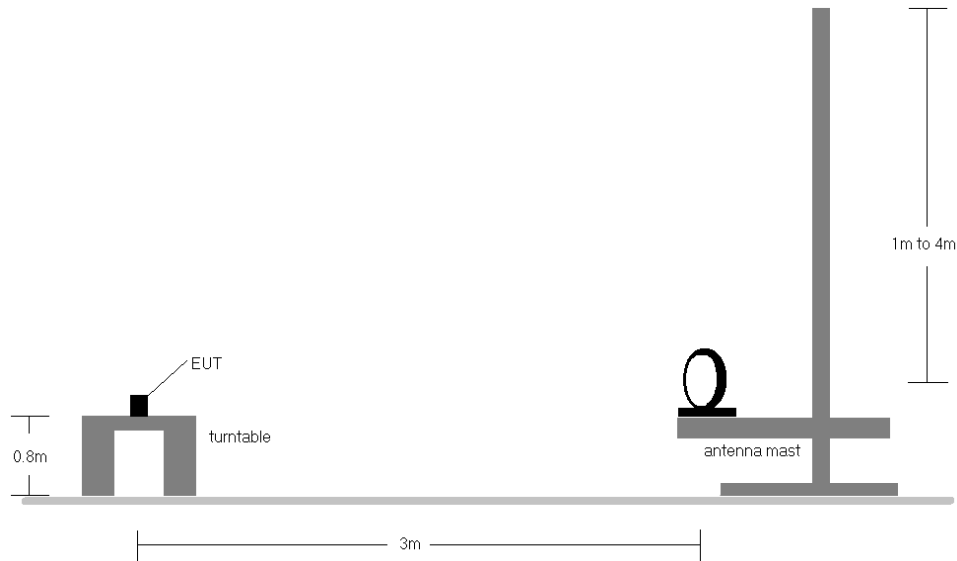


Figure 7-3. Radiated Test Setup < 30Mhz

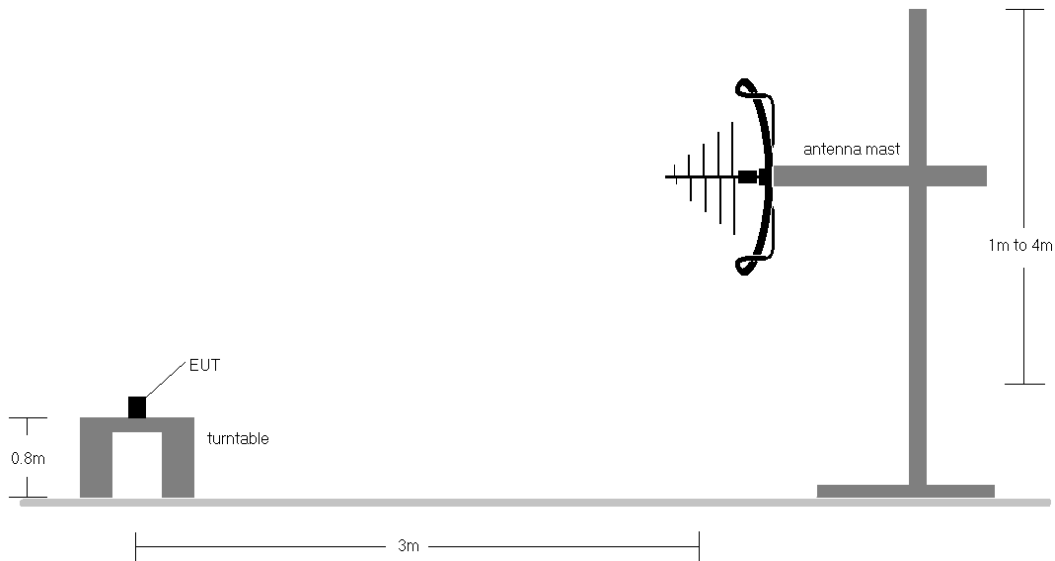


Figure 7-4. Radiated Test Setup < 1GHz

FCC ID: A3LSFG-D0100	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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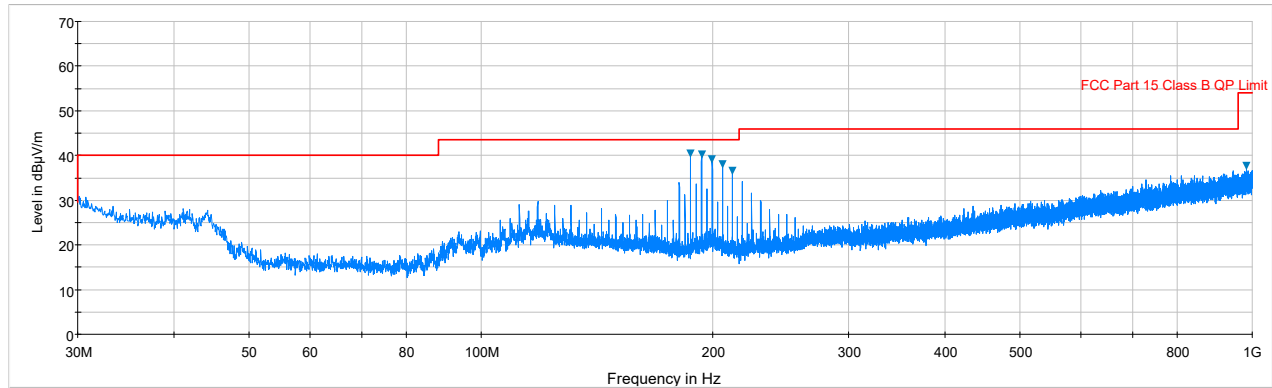
Test Notes

1. All emissions lying in restricted bands specified in §15.205 and RSS-Gen (8.10) are below the limit shown in Table 7-8.
2. The broadband receive antenna is manipulated through vertical and horizontal polarizations during the tests. The EUT is manipulated through three orthogonal planes.
3. This unit was tested while powered by an AC power source.
4. The spectrum is investigated using a peak detector and final measurements are recorded using CISPR quasi peak detector. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
5. Emissions were measured at a 3 meter test distance.
6. Emissions are investigated while operating on the center channel of the mode, band, and modulation that produced the worst case results during the transmitter spurious emissions testing.
7. The results recorded using the broadband antenna is known to correlate with the results obtained by using a tuned dipole with an acceptable degree of accuracy. The VSWR for the measurement antenna was found to be less than 2:1.
8. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification.

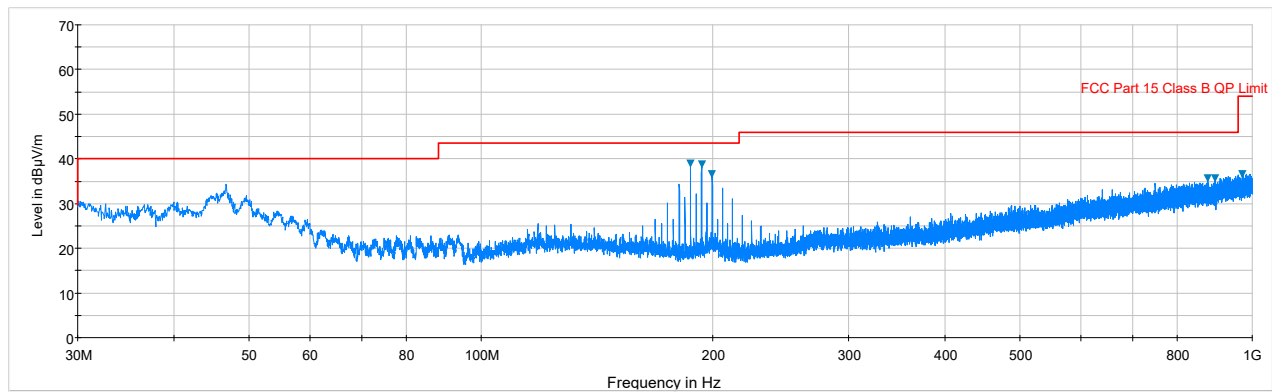
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Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209; RSS-Gen [8.9]



Plot 7-18. Radiated Spurious Plot below 1GHz (Pol. H)



Plot 7-19. Radiated Spurious Plot below 1GHz (Pol. V)

Frequency [MHz]	Detector/T race	Ant. Pol. [H/V]	Antenna Height [cm]	Turn Table Azimuth [degree]	Analyzer Level [dBμV]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
44.38	Max Peak	V	104	185	44.32	-18.67	25.65	40.00	-14.35
93.50	Max Peak	V	113	198	45.42	-20.68	24.74	43.52	-18.78
180.79	Max Peak	V	188	172	54.57	-17.47	37.10	43.52	-6.42
187.02	Max Peak	V	191	180	58.95	-17.64	41.31	43.52	-2.21
193.26	Max Peak	V	176	179	57.88	-17.24	40.64	43.52	-2.88
199.46	Max Peak	H	113	235	54.40	-17.61	36.79	43.52	-6.73

Table 7-9. Radiated Spurious Emissions Below 1GHz

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7.7 Line Conducted Measurement Data

§15.207; RSS-Gen (8.8)

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 §15.207 and RSS-Gen (8.8).

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

Table 7-10. 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

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

Average Field Strength Measurements

- Analyzer center frequency was set to the frequency of the spurious emission of interest
- RBW = 9kHz (for emissions from 150kHz – 30MHz)
- Detector = RMS
- Sweep time = auto couple
- Trace mode = max hold
- 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.

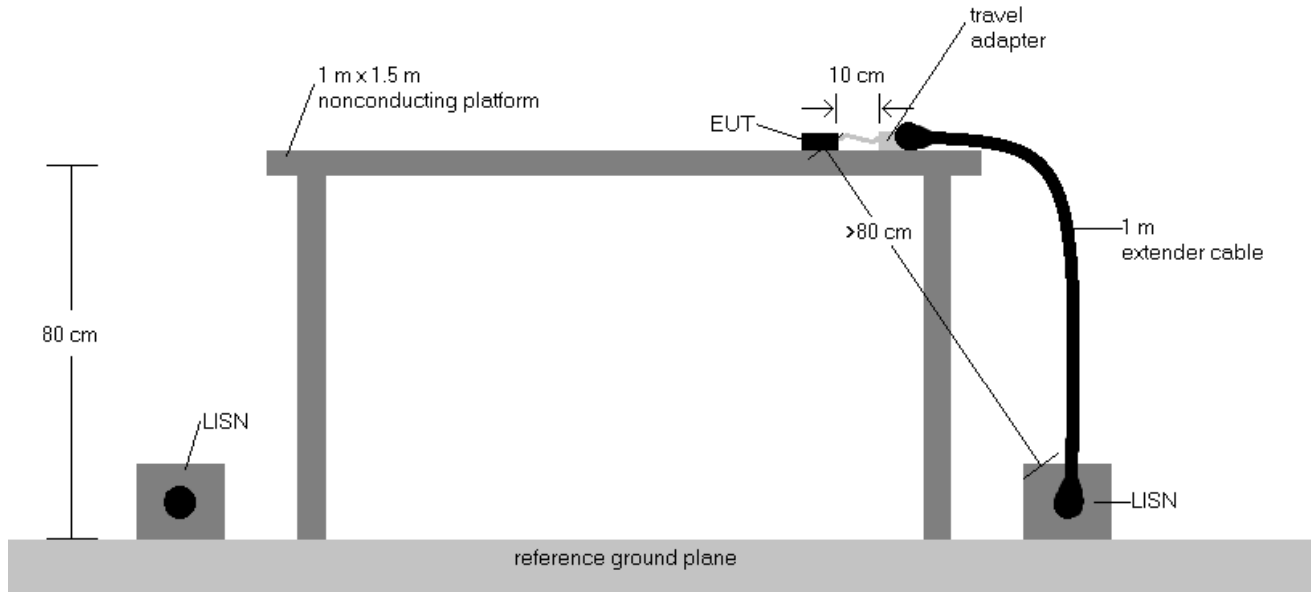
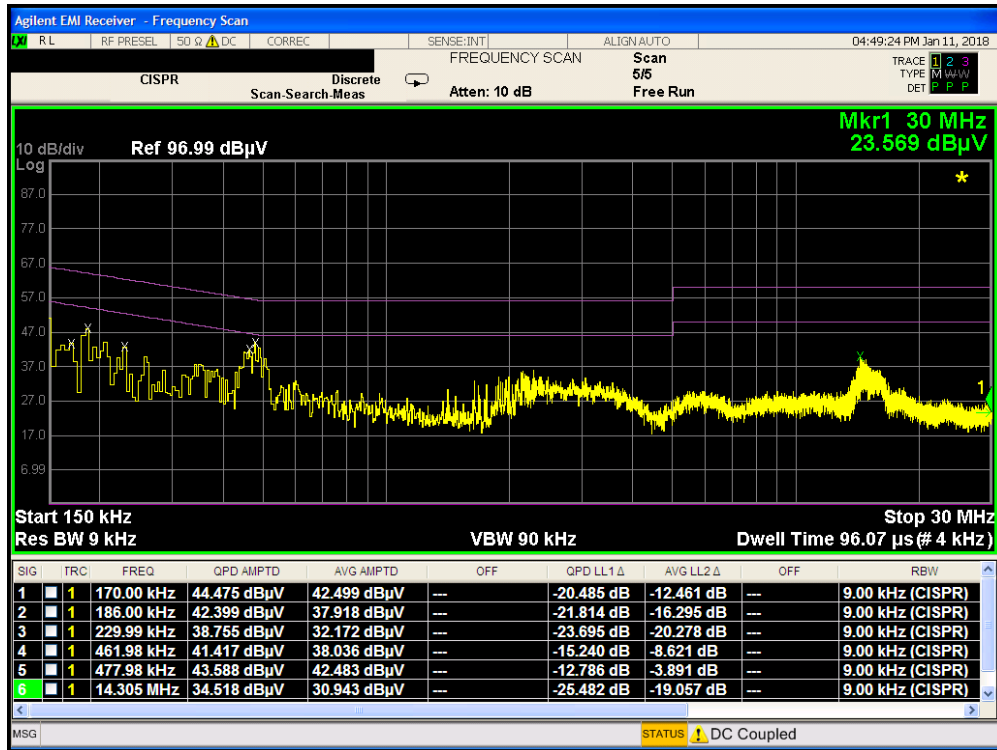


Figure 7-5. Test Instrument & Measurement Setup

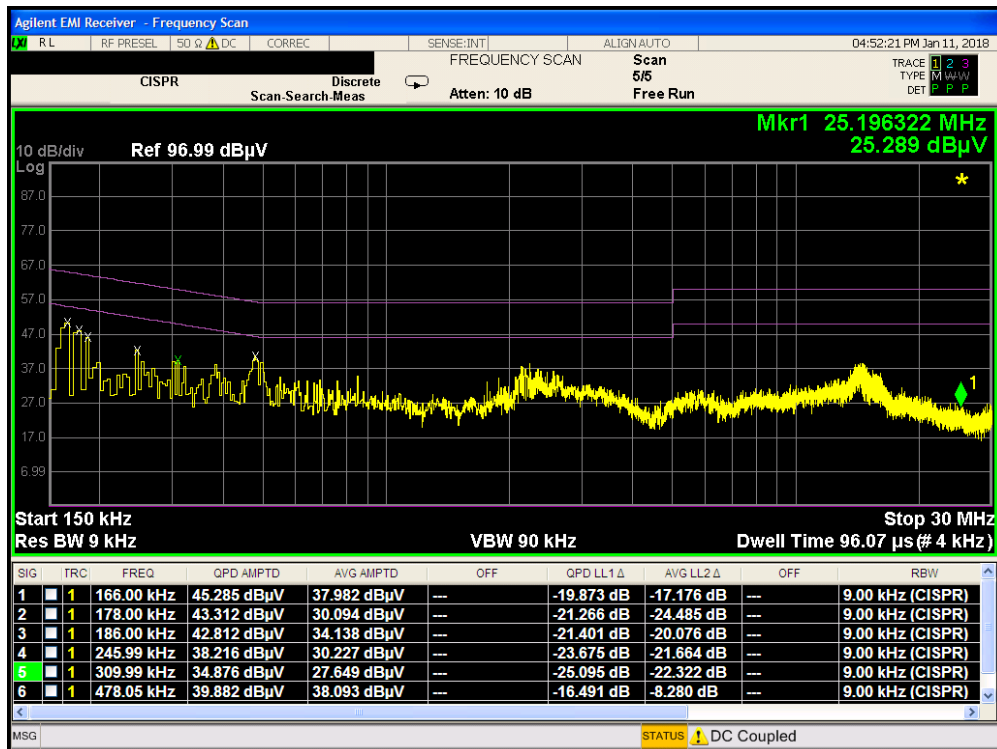
Test Notes

1. 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.
2. The limit for an intentional radiator from 150kHz to 30MHz are specified in 15.207 and RSS-Gen (8.8).
3. $\text{Corr. (dB)} = \text{Cable loss (dB)} + \text{LISN insertion factor (dB)}$
4. $\text{QP/AV Level (dB}\mu\text{V)} = \text{QP/AV Analyzer/Receiver Level (dB}\mu\text{V)} + \text{Corr. (dB)}$
5. $\text{Margin (dB)} = \text{QP/AV Limit (dB}\mu\text{V)} - \text{QP/AV Level (dB}\mu\text{V)}$
6. Traces shown in plot are made using a peak detector.
7. Deviations to the Specifications: None.

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Plot 7-20. Line-Conducted Test Plot (L1)



Plot 7-21. Line-Conducted Test Plot (N)

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8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Indoor Customer Premise Equipment (CPE) FCC ID: A3LSFG-D0100** is in compliance with Part 15 Subpart C (15.249) of the FCC Rules.

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