



PCTEST ENGINEERING LABORATORY, INC.

7185 Oakland Mills Road, Columbia, MD 21046 USA

Tel. 410.290.6652 / Fax 410.290.6654

<http://www.pctestlab.com>



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:

5/22-7/18/2017

Test Site/Location:

PCTEST Lab. Columbia, MD, USA

Test Report Serial No.:

1M1705180171-02.A3L

FCC ID:

A3LETWV531

APPLICANT:

Samsung Electronics Co., Ltd.

Application Type:

Certification

Model:

ET-WV531

EUT Type:

Indoor Access Point

Max. RF Output Power:

0.111 mW (-9.53 dBm) Peak Conducted

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



FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 1 of 25

© 2017 PCTEST Engineering Laboratory, Inc.

V 6.5

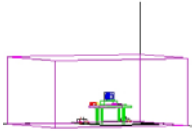
05/19/2017

© 2017 PCTEST Engineering Laboratory, Inc. All rights reserved. Unless otherwise specified, no part of this report may be reproduced or utilized in any part, form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from PCTEST Engineering Laboratory, Inc. If you have any questions about this international copyright or have an enquiry about obtaining additional rights to this report or assembly of contents thereof, please contact INFO@PCTESTLAB.COM.

T A B L E O F C O N T E N T S

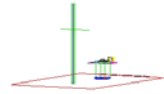
FCC PART 15.249 MEASUREMENT REPORT	3
1.0 INTRODUCTION	4
1.1 Scope	4
1.2 PCTEST Test Location	4
2.0 PRODUCT INFORMATION	5
2.1 Equipment Description	5
2.2 Device Capabilities	5
2.3 Test Configuration	5
2.4 EMI Suppression Device(s)/Modifications	5
3.0 DESCRIPTION OF TESTS	6
3.1 Evaluation Procedure	6
3.2 AC Line Conducted Emissions	6
3.3 Radiated Emissions	7
3.4 Environmental Conditions	7
4.0 ANTENNA REQUIREMENTS	8
5.0 MEASUREMENT UNCERTAINTY	9
6.0 TEST EQUIPMENT CALIBRATION DATA	10
7.0 TEST RESULTS	11
7.1 Summary	11
7.2 Occupied Bandwidth Measurement	12
7.3 Output Power Measurement – Bluetooth (LE)	14
7.4 Fundamental Field Strength Level Measurement	15
7.5 Radiated Spurious Emission Measurements	16
7.6 Radiated Restricted Band Edge Measurements	20
7.7 Line Conducted Measurement Data	22
8.0 CONCLUSION	25

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 2 of 25



MEASUREMENT REPORT

FCC Part 15.249

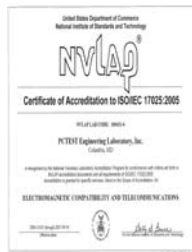


§ 2.1033 General Information

APPLICANT: Samsung Electronics Co., Ltd.
APPLICANT ADDRESS: 129, Samsung-ro,
 Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
TEST SITE: PCTEST ENGINEERING LABORATORY, INC.
TEST SITE ADDRESS: 7185 Oakland Mills Road, Columbia, MD 21046 USA
FCC RULE PART(S): Part 15 Subpart C (15.249)
MODEL: ET-WV531
FCC ID: A3LETWV531
Test Device Serial No.: 26APR-4, 26APR-6 ☐ Production ☒ Pre-Production ☐ Engineering
FCC CLASSIFICATION: Low Power Communications Device Transmitter (DXX)
DATE(S) OF TEST: 5/22-7/18/2017
TEST REPORT S/N: 1M1705180171-02.A3L

Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.



- PCTEST facility is an FCC registered (PCTEST Reg. No. 159966) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (2451B-1).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (2451B-1) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 3 of 25

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 Industry Canada Certification and Engineering Bureau.

1.2 PCTEST Test Location

The map below shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity, the Baltimore-Washington Intern't'l (BWI) airport, the city of Baltimore and the Washington, DC area. (See Figure 1-1).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The site coordinates are 39° 10'23" N latitude and 76° 49'50" W longitude. The facility is 0.4 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2014 on January 22, 2015.

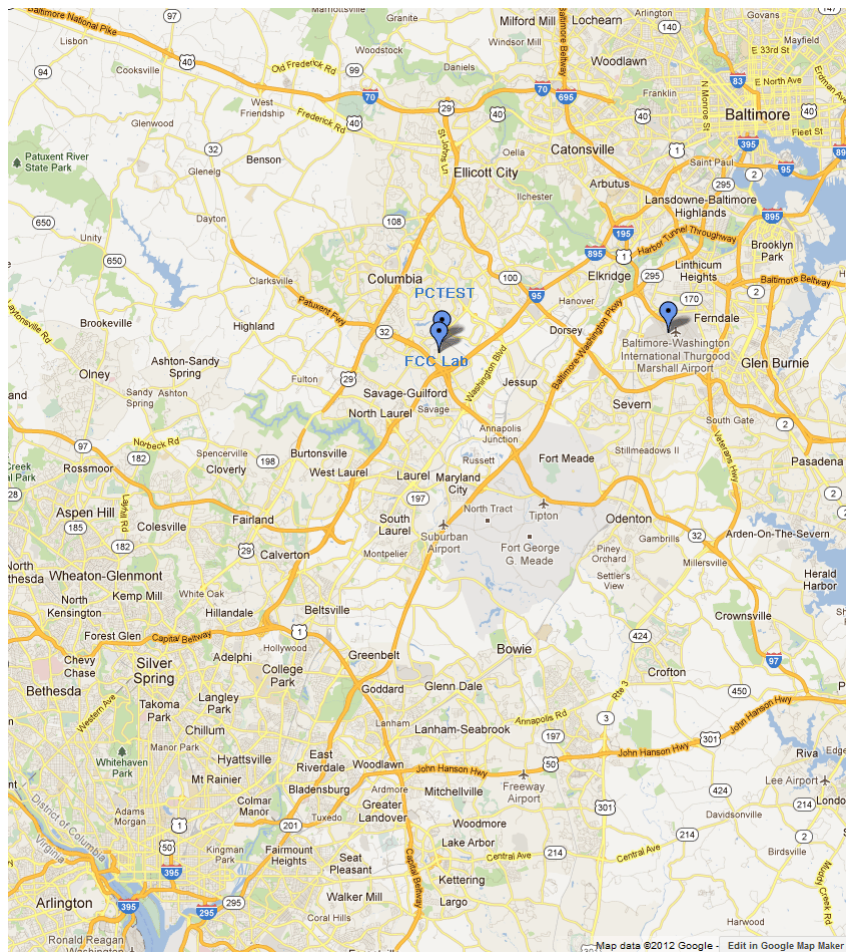


Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

FCC ID: A3LETWV531	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 4 of 25

© 2017 PCTEST Engineering Laboratory, Inc.

V 6.5

05/19/2017

© 2017 PCTEST Engineering Laboratory, Inc. All rights reserved. Unless otherwise specified, no part of this report may be reproduced or utilized in any part, form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from PCTEST Engineering Laboratory, Inc. If you have any questions about this International copyright or have an enquiry about obtaining additional rights to this report or assembly of contents thereof, please contact INFO@PCTESTLAB.COM.

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Indoor Access Point FCC ID: A3LETWV531**. The data found in this test report was taken with the EUT operating in Bluetooth low energy mode. While in low energy mode, the Bluetooth transmitter hops pseudo-randomly between 40 channels. The data found in this report is representative of the device when it transmits on fixed channels with hopping disabled.

2.2 Device Capabilities

This device contains the following capabilities:

802.11b/g/n WLAN, 802.11a/n/ac UNII, BT (LE), Zigbee, Zwave

Ch.	Frequency (MHz)
0	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. See Section 3.3 for radiated emissions test setups.

2.4 EMI Suppression Device(s)/Modifications

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

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 5 of 25

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.

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 6 of 25

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. 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. A 72.4cm high PVC support structure is placed on top of the turntable. A 3" (~7.6cm) sheet of high density polystyrene is used as the table top and is placed on top of the PVC supports to bring the total height of the table to 80cm. For measurements above 1GHz, a high density expanded polystyrene block 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.

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.

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).

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 7 of 25

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.

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 8 of 25

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 data shown herein 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

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 9 of 25

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 C63.5-2006.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	RE1	Radiated Emissions Cable Set (UHF/EHF)	7/11/2016	Annual	7/11/2017	RE1
-	WL25-1	Conducted Cable Set (25GHz)	10/3/2016	Annual	10/3/2017	WL25-1
Agilent	N9020A	MXA Signal Analyzer	10/28/2016	Annual	10/28/2017	US46470561
Agilent	N9038A	MXE EMI Receiver	4/26/2017	Annual	4/26/2018	MY51210133
Agilent	N9030A	PXA Signal Analyzer (26.5GHz)	7/20/2016	Annual	7/20/2017	MY49432391
Agilent	N9030A	PXA Signal Analyzer (44GHz)	3/27/2017	Annual	3/27/2018	MY52350166
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	7/30/2015	Biennial	7/30/2017	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
ETS-Lindgren	3816/2NM	Line Impedance Stabilization Network	12/27/2016	Biennial	12/27/2018	114451
Huber+Suhner	Sucoflex 102A	40GHz Radiated Cable	10/3/2016	Annual	10/3/2017	251425001
K & L	11SH10-3075/U18000	High Pass Filter	7/11/2016	Annual	7/11/2017	11SH10-3075/U18000-2
Pasternack	NMLC-1	Line Conducted Emissions Cable (NM)	10/5/2016	Annual	10/5/2017	NMLC-1
PCTEST	-	EMC Switch System	7/11/2016	Annual	7/11/2017	NM1
Rhode & Schwarz	TS-PR18	Pre-Amplifier	7/6/2016	Annual	7/6/2017	101622
Rohde & Schwarz	TS-PR18	1-18 GHz Pre-Amplifier	7/11/2016	Annual	7/11/2017	100071
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	5/11/2017	Annual	5/11/2018	100040
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	4/19/2017	Annual	4/19/2018	100342
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	7/15/2016	Annual	7/15/2017	100348
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	7/27/2016	Annual	7/27/2017	103200
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

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.

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 10 of 25

7.0 TEST RESULTS

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.
 FCC ID: A3LETWV531
 Method/System: Digital Transmission System (DTS)
 Number of Channels: 40

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	Occupied Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
2.1046	Output Power Measurement	N/A			Section 7.3
15.249(a)(e)	Fundamental Field Strength Level	< 50 mV/m	RADIATED	PASS	Section 7.4
15.205, 15.209, 15.249(d)(e)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	< 15.209 limits or 50dB below the level of the fundamental		PASS	Sections 7.5, 7.6
15.207	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits	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.

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 11 of 25

7.2 Occupied Bandwidth Measurement

\$2.1049

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.	Bluetooth Mode	Measured Bandwidth [kHz]
2402	0	LE	1043.8
2440	19	LE	1040.2
2480	39	LE	1039.2

Table 7-2. Occupied Bandwidth Measurement

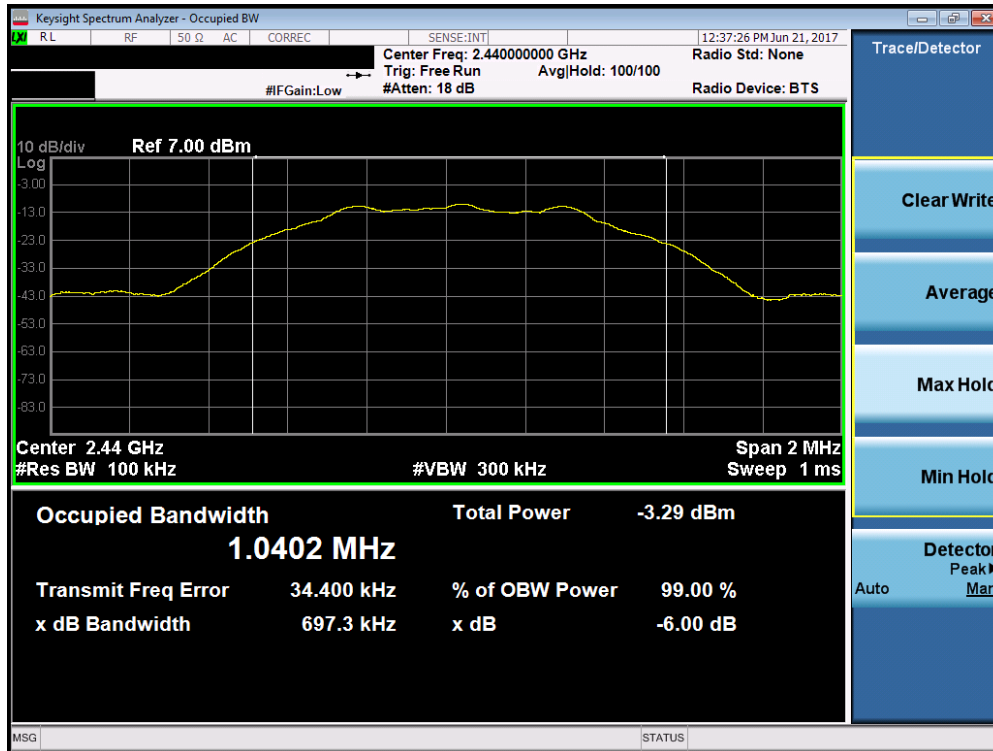


Figure 7-1. Test Instrument & Measurement Setup

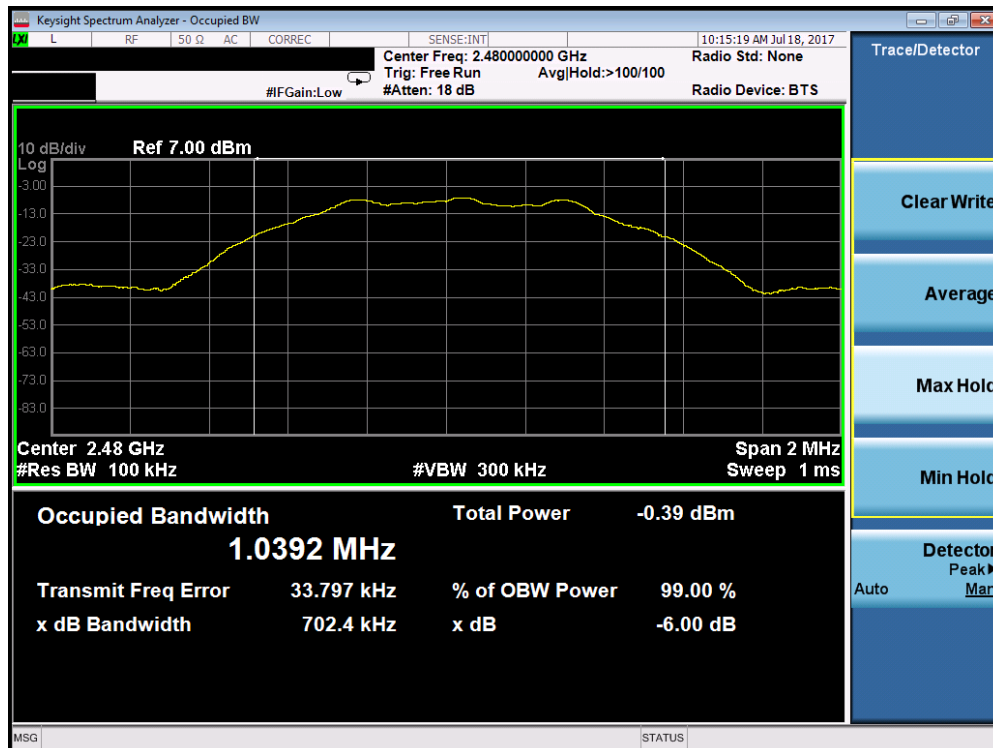


Plot 7-1. 6dB Bandwidth Plot (Bluetooth (LE) – Ch. 0)

FCC ID: A3LETWV531	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 12 of 25



Plot 7-2. 6dB Bandwidth Plot (Bluetooth (LE) – Ch. 19)



Plot 7-3. 6dB Bandwidth Plot (Bluetooth (LE) – Ch. 39)

FCC ID: A3LETWV531	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 13 of 25

7.3 Output Power Measurement – Bluetooth (LE)

\$2.1046

Test Overview and Limits

The transmitter antenna terminal of the EUT is connected to the input of a spectrum analyzer. Measurements are made while the EUT is operating at maximum power and at the appropriate frequencies.

The maximum permissible conducted output power is 1 Watt.

Test Procedure Used

ANSI C63.10-2013

Test Settings

1. RBW = 3MHz
2. VBW = 50MHz
3. Span $\geq 3 \times$ RBW
4. Sweep = auto couple
5. Detector = Peak
6. Trace mode = max hold
7. The trace was allowed to stabilize

Test Setup

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

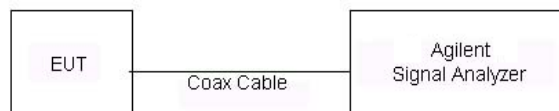


Figure 7-2. Test Instrument & Measurement Setup

Test Notes

None

Frequency [MHz]	Channel No.	Bluetooth Mode	Peak Conducted Power	
			[dBm]	[mW]
2402	0	LE	-11.75	0.067
2440	19	LE	-9.60	0.110
2480	39	LE	-9.53	0.111

Table 7-3. Conducted Output Power Measurements (Bluetooth (LE))

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 14 of 25

7.4 Fundamental Field Strength Level Measurement

§15.249(a)(e)

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.

The maximum permissible average field strength level is 50mV/m (93.98dBμV/m). The maximum permissible peak field strength level is 500mV/m (113.98 dBμV/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	H	100	241	-52.20	33.28	88.08	93.98	-5.90
2441.00	Peak	H	124	264	-52.34	33.55	88.21	93.98	-5.77
2480.00	Peak	H	137	202	-52.27	33.41	88.14	93.98	-5.84

Table 7-4. Field Strength Measurements

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 15 of 25

7.5 Radiated Spurious Emission Measurements

§15.205 §15.209 §15.249 (d)(e)

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 7-5. Radiated Limits

Test Setup

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

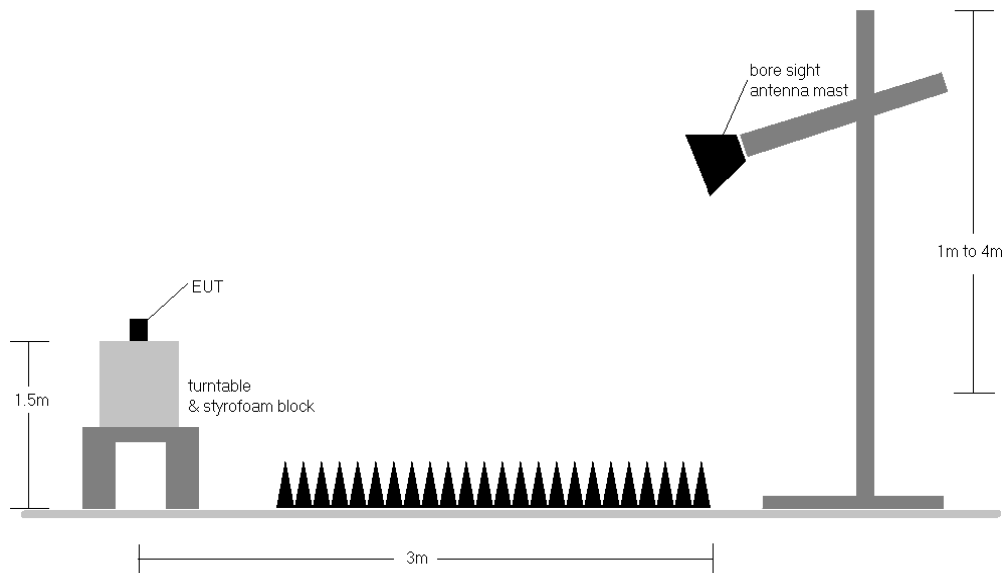


Figure 7-3. Radiated Test Setup

FCC ID: A3LETWV531	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 16 of 25

Sample Calculation

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

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 are below the limit shown in Table 7-5. Per 15.249(d), the radiated emissions limits from 15.209 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 with its standard battery.
6. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 17 of 25

Radiated Spurious Emission Measurements

§15.205 §15.209 §15.249 (d)(e)

Bluetooth Mode: LE
 Distance of Measurements: 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	-	-	-70.30	0.03	36.73	53.98	-17.25
4804.00	Peak	H	-	-	-60.11	0.03	46.92	73.98	-27.06
12010.00	Avg	H	-	-	-70.77	14.14	50.37	53.98	-3.61
12010.00	Peak	H	-	-	-60.39	14.14	60.75	73.98	-13.23

Table 7-6. Radiated Measurements @ 3 meters

Bluetooth Mode: LE
 Distance of Measurements: 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	-	-	-70.33	0.47	37.14	53.98	-16.84
4880.00	Peak	H	-	-	-59.57	0.47	47.90	73.98	-26.08
7320.00	Avg	H	-	-	-70.47	9.92	46.45	53.98	-7.53
7320.00	Peak	H	-	-	-60.26	9.92	56.66	73.98	-17.32
12200.00	Avg	H	-	-	-71.56	14.90	50.34	53.98	-3.64
12200.00	Peak	H	-	-	-60.24	14.90	61.66	73.98	-12.32

Table 7-7. Radiated Measurements @ 3 meters

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 18 of 25

Radiated Spurious Emission Measurements

§15.205 §15.209 §15.247(d)

Bluetooth Mode: LE
 Distance of Measurements: 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	-	-	-70.41	0.73	37.32	53.98	-16.66
4960.00	Peak	H	-	-	-59.81	0.73	47.92	73.98	-26.06
7440.00	Avg	H	-	-	-70.78	10.29	46.51	53.98	-7.46
7440.00	Peak	H	-	-	-60.66	10.29	56.63	73.98	-17.34
12400.00	Avg	H	-	-	-72.26	16.03	50.77	53.98	-3.21
12400.00	Peak	H	-	-	-60.47	16.03	62.57	73.98	-11.41

Table 7-8. Radiated Measurements @ 3 meters

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 19 of 25

7.6 Radiated Restricted Band Edge Measurements

\$15.205 \$15.209 \$15.249 (d)

The radiated restricted band edge measurements are measured with an EMI test receiver connected to the receive antenna while the EUT is transmitting. Two different amplitude offsets were used depending on whether peak or average measurements were measured. The average measurements use a duty cycle correction factor (DCCF).

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

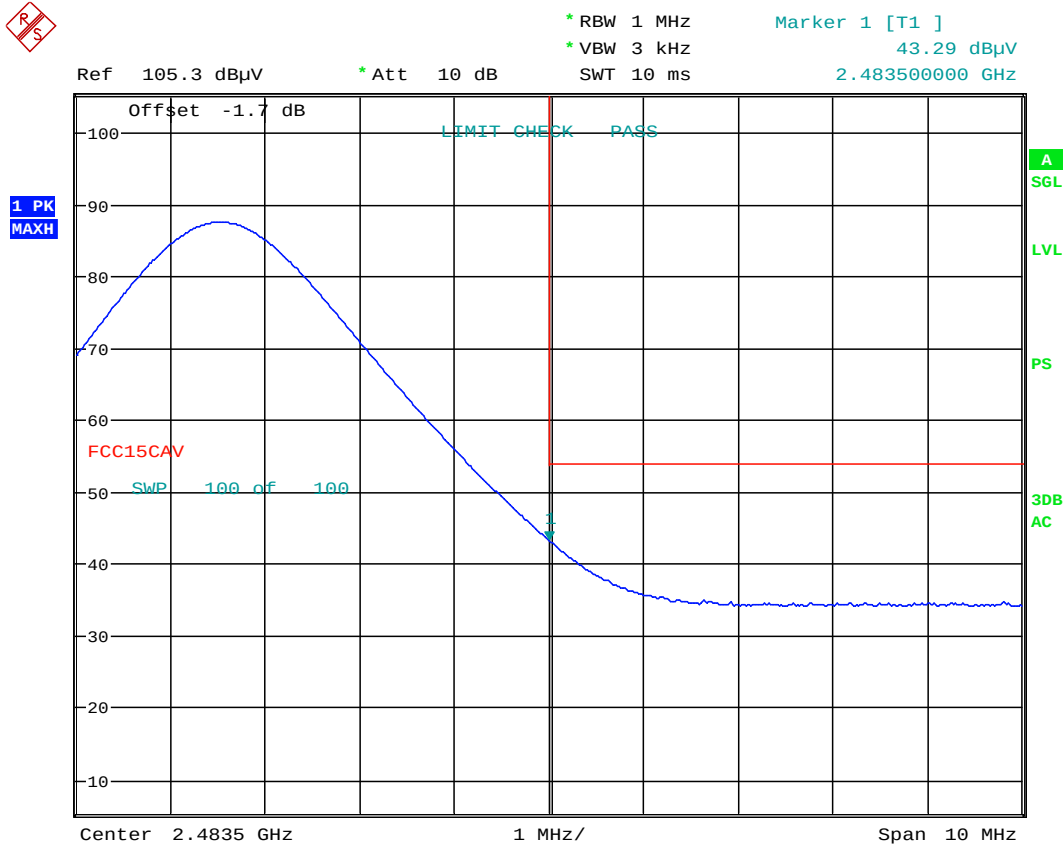
$$\text{Offset (dB)} = (\text{Antenna Factor} + \text{Cable Loss}) - \text{Preamplifier Gain}$$

Bluetooth Mode: LE

Measurement Distance: 3 Meters

Operating Frequency: 2480MHz

Channel: 39



Date: 16.JUN.2017 12:36:48

Plot 7-4. Radiated Restricted Upper Band Edge Measurement (Average)

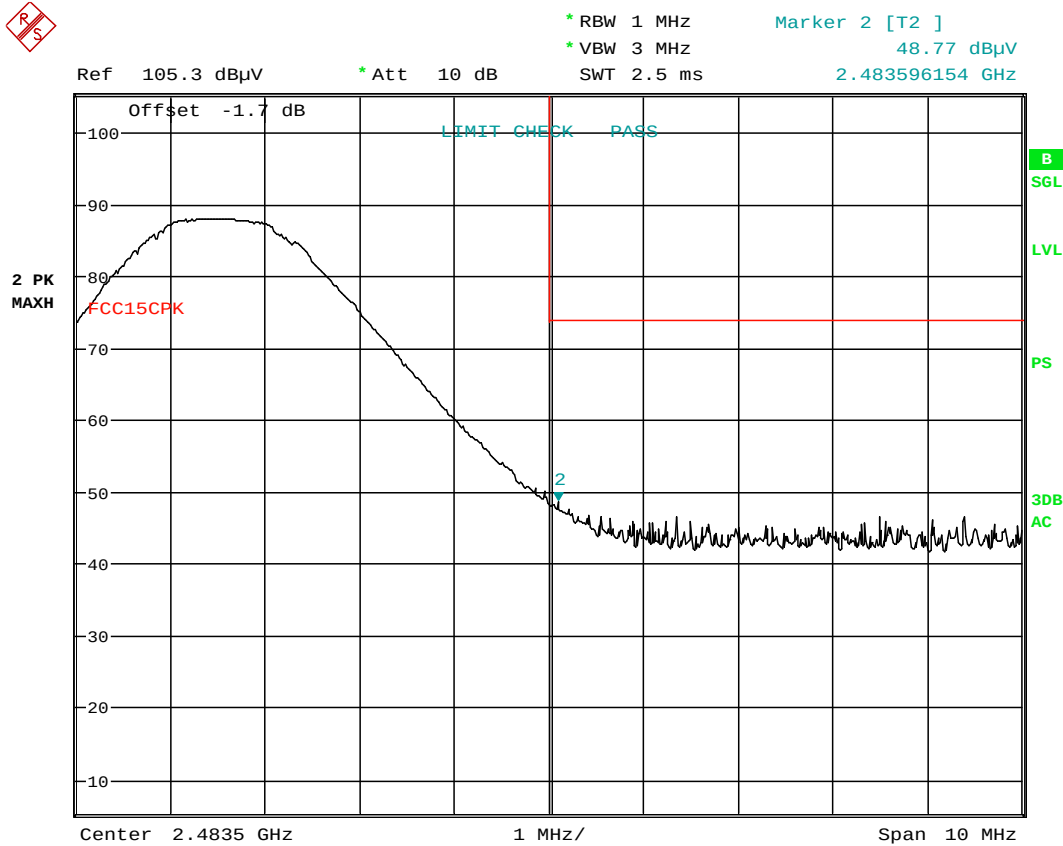
FCC ID: A3LETWV531	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 20 of 25

Radiated Restricted Band Edge Measurements

§15.205 §15.209 §15.249 (d)

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

$$\text{Offset (dB)} = (\text{Antenna Factor} + \text{Cable Loss}) - \text{Preamplifier Gain}$$



Date: 16.JUN.2017 12:36:59

Plot 7-5. Radiated Restricted Upper Band Edge Measurement (Peak)

FCC ID: A3LETWV531	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 21 of 25

7.7 Line Conducted Measurement Data

§15.207

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.

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 7-9. 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

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 22 of 25

Test Setup

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

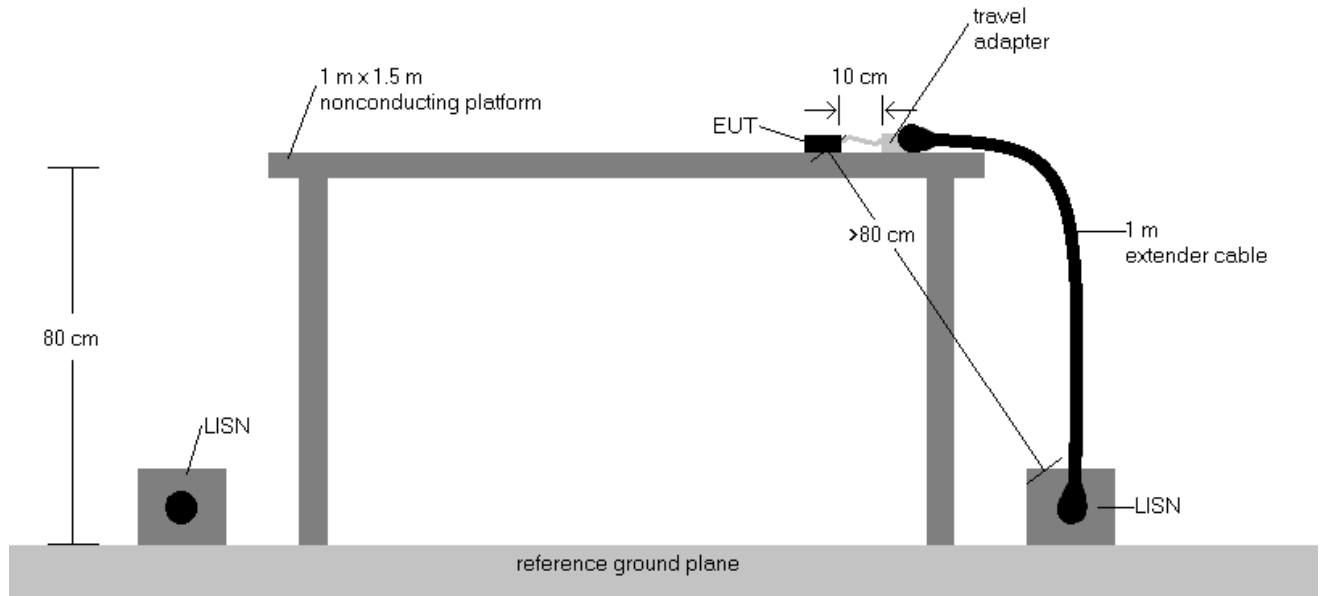


Figure 7-4. Test Instrument & Measurement Setup

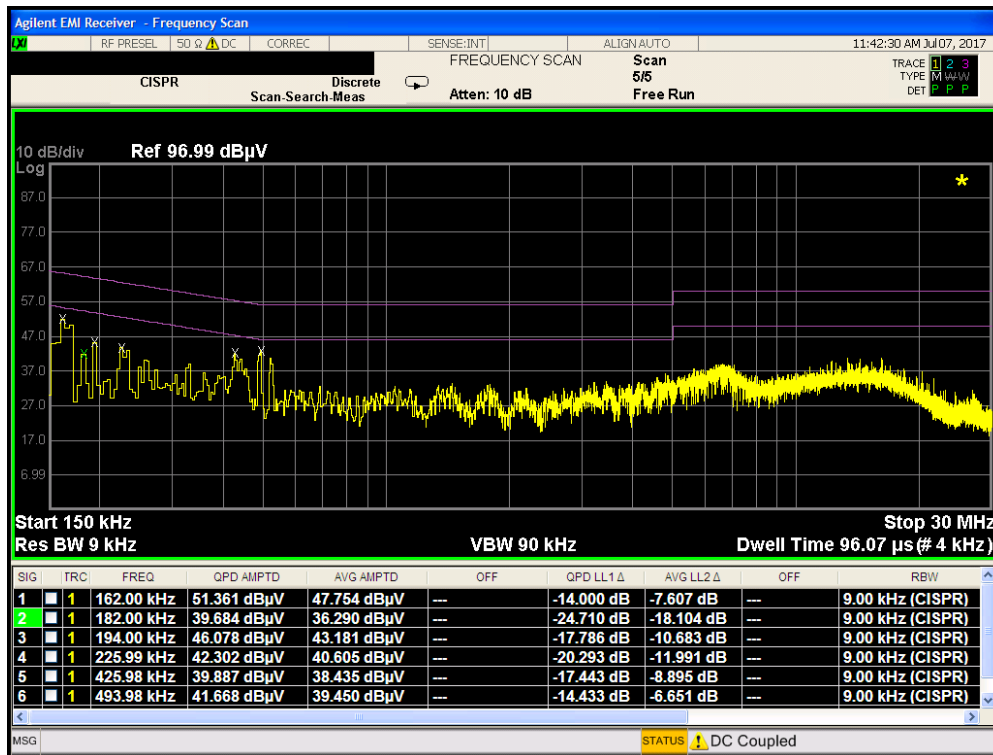
Test Notes

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.
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.

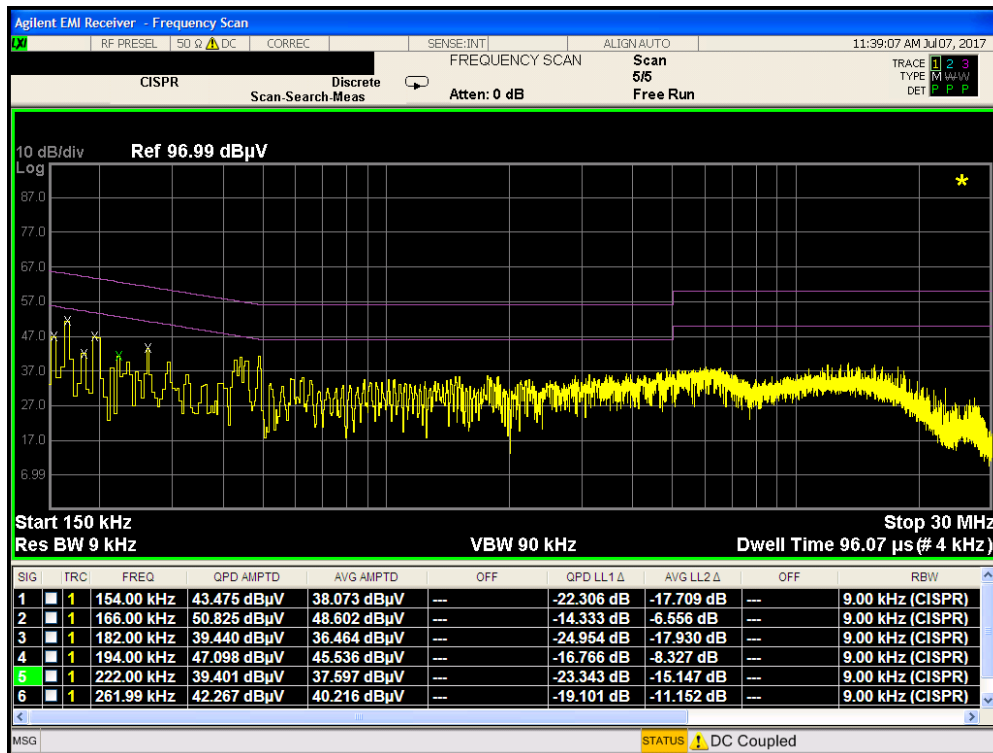
FCC ID: A3LETWV531	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 23 of 25

Line Conducted Measurement Data

\$15.207



Plot 7-6. Line Conducted Plot with Bluetooth LE (L1)



Plot 7-7. Line Conducted Plot with Bluetooth LE (N)

FCC ID: A3LETWV531	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 24 of 25

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Indoor Access Point FCC ID: A3LETWV531** is in compliance with Part 15 Subpart C (15.249) of the FCC Rules.

FCC ID: A3LETWV531		FCC Pt. 15.249 Bluetooth (Low Energy) TEST REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1705180171-02.A3L	Test Dates: 5/22-7/18/2017	EUT Type: Indoor Access Point		Page 25 of 25