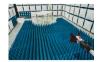


PCTEST

7185 Oakland Mills Road, Columbia, MD 21046 USA Tel. 410.290.6652 / Fax 410.290.6654 http://www.pctest.com



MEASUREMENT REPORT FCC PART 15.247 / ISED RSS-247 Bluetooth (Low Energy)

Applicant Name:

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

Date of Testing: 4/17 - 6/22/2020 Test Site/Location: PCTEST Lab. Columbia, MD, USA Test Report Serial No.: 1M2004170066-09.A3L

FCC ID:

A3LSMN986W

IC:

649E-SMN986W

Samsung Electronics Co., Ltd.

APPLICANT:

Application Type:

Frequency Range:

FCC Rule Part(s):

FCC Classification:

ISED Specification:

Test Procedure(s):

Max. RF Output Power:

Model/HVIN:

EUT Type:

Certification SM-N986W Portable Handset 7.876 mW (8.96 dBm) Peak Conducted 2402 – 2480MHz Digital Transmission System (DTS) Part 15 Subpart C (15.247) RSS-247 Issue 2 ANSI C63.10-2013, KDB 558074 D01 v05r02, KDB 648474 D03 v01r04

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 and KDB 558074 D01 v05r02. 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 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 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 ISED Standards (RSS).
- PCTEST facility is a registered (2451B) 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: A3LSMN986W**. 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, three of which are "advertising channels". When the transmitter is hopping only between the three advertising channels, the EUT does not fall under the category of a "hopper" as defined in 15.247(a)(iii) which states that a "frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels." As operation on only the advertising channels does not qualify the EUT as a hopper, the EUT is certified as a DTS device in this mode. The data found in this report is representative of the device when it transmits on its advertising channels. Typical Bluetooth operation is covered under the DSS report found with this application.

Test Device Serial No.: 0702M, 0713M, 1245M, 1251M, 1250M, 1242M

2.2 Device Capabilities

This device contains the following capabilities:

850 CDMA/EvDO Rev0/A, 1x Advanced (BC0), 850/1900 GSM/GPRS/EDGE, 850/1700/1900, WCDMA/HSPA, Multi-band LTE, 5G NR (n71, n41, n66), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII, Bluetooth (1x, EDR, LE), NFC, Wireless Power Transfer, UWB

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 and KDB 558074 D01 v05r02. 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, 7.3, 7.4, 7.5, and 7.6 for antenna port conducted emissions test setups.

This device supports wireless charging capability and, thus, is subject to the test requirements of KDB 648474 D03 v01r04. Additional radiated spurious emission measurements were performed with the EUT lying flat on an authorized wireless charging pad (WCP) Model: EP-N5100 while operating under normal conditions in a simulated call or data transmission configuration. The worst case radiated emissions data is shown in this report.

2.4 EMI Suppression Device(s)/Modifications

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

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3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 558074 D01 v05r02 were 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, $50\Omega/50\mu$ H 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 quasipeak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 7.10. 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 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. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 474788 D01.

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 antenna(s) 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 (±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
-	WL25-1	Conducted Cable Set (25GHz)	10/30/2019	Annual	10/30/2020	WL25-1
-	WL40-1	Conducted Cable Set (40GHz)	10/30/2019	Annual	10/30/2020	WL40-1
Agilent	N9038A	MXE EMI Receiver	7/17/2019	Annual	7/17/2020	MY51210133
Agilent	N9030A	PXA Signal Analyzer (44GHz)	6/12/2019	Annual	6/12/2020	MY52350166
Anritsu	MA2411B	Pulse Power Sensor	8/14/2019	Annual	8/14/2020	1315051
Anritsu	ML2496A	Power Meter	11/6/2019	Annual	11/6/2020	1405003
Anritsu	MA2411B	Pulse Power Sensor	10/15/2019	Annual	10/15/2020	1339026
Anritsu	MA2411B	Pulse Power Sensor	8/27/2019	Annual	8/27/2020	1339027
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	10/10/2019	Biennial	10/10/2021	121034
Emco	3116	Horn Antenna (18 - 40GHz)	6/7/2018	Triennial	6/7/2021	9203-2178
Emco	3160-09	Small Horn (18 - 26.5GHz)	8/9/2018	Biennial	8/9/2020	00135427
ETS-Lindgren	3816/2NM	Line Impedance Stabilization Network	6/18/2018	Biennial	6/18/2020	114451
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	9/23/2019	Annual	9/23/2020	100348
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	7/8/2019	Annual	7/8/2020	102133
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	7/11/2019	Annual	7/11/2020	102134
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	5/6/2019	Annual	5/6/2020	103200
Solar Electronics	8012-50-R-24-BNC	Line Impedance Stabilization Network	10/1/2019	Biennial	10/1/2021	310233
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	4/19/2018	Biennial	4/19/2020	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.

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7.0 TEST RESULTS

7.1 Summary

Company Name:	Samsung Electronics Co., Ltd.
FCC ID:	A3LSMN986W
FCC Classification:	Digital Transmission System (DTS)
Number of Channels:	<u>40</u>

FCC Part Test Test RSS Section(s) **Test Description Test Limit** Reference Condition Section(s) Result 15.247(a)(2) RSS-247 [5.2] 6dB Bandwidth > 500kHz PASS Section 7.2 RSS-247 [5.4(4)] PASS Sections 7.3 15.247(b)(3) Transmitter Output Power < 1 Watt CONDUCTED Transmitter Power 15.247(e) RSS-247 [5.2] < 8dBm / 3kHz Band PASS Section 7.4 Spectral Density Band Edge / Sections 7.5, 15.247(d) RSS-247 [5.5] ≥ 20dBc PASS Out-of-Band Emissions 76 General Field Strength Emissions in restricted 15.205 Limits (Restricted Bands bands must meet the Sections 7.7, RADIATED RSS-Gen [8.9] PASS 15.209 and Radiated Emission radiated limits detailed in 78 15.209 (RSS-Gen [8.9]) Limits) AC Conducted Emissions < FCC 15.207 limits LINE RSS-Gen [8.8] PASS 15.207 Section 7.10 150kHz – 30MHz (RSS-Gen[8.8]) CONDUCTED

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. The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to Naccount for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 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 and attenuators.
- 4. For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "Bluetooth LE Automation," Version 3.6.
- 5. 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 1.3.1.

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7.2 6dB Bandwidth Measurement – Bluetooth (LE) §15.247(a.2); RSS-247 [5.2]

Test Overview and Limit

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the transmitter antenna terminal of the EUT while the EUT is operating at maximum power and at the appropriate frequencies. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible 6dB bandwidth is 500 kHz.

Test Procedure Used

ANSI C63.10-2013 – Section 11.8.2 Option 2 KDB 558074 D01 v05r02 – Section 8.2

Test Settings

- The signal analyzers' automatic bandwidth measurement capability of the spectrum analyzer was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 6. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
- 2. RBW = 100kHz
- 3. VBW \geq 3 x RBW
- 4. Detector = Peak
- 5. Trace mode = max hold
- 6. Sweep = auto couple
- 7. The trace was allowed to stabilize

Test Setup

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



Figure 7-1. Test Instrument & Measurement Setup

Test Notes

None

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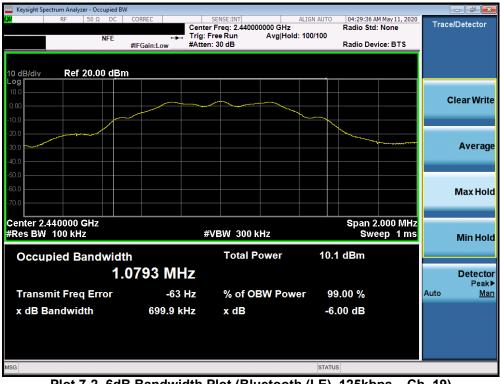
Frequency [MHz]	Data Rate	Channel No.	Bluetooth Mode	Measured Bandwidth [kHz]	Minimum Bandwidth [kHz]	Pass / Fail
2402	125 kbps	0	LE	701.7	500	Pass
2440	125 kbps	19	LE	699.9	500	Pass
2480	125 kbps	39	LE	703.8	500	Pass
2402	500 kbps	0	LE	669.5	500	Pass
2440	500 kbps	19	LE	669.0	500	Pass
2480	500 kbps	39	LE	668.9	500	Pass
2402	1 Mbps	0	LE	696.7	500	Pass
2440	1 Mbps	19	LE	695.4	500	Pass
2480	1 Mbps	39	LE	702.0	500	Pass
2402	2 Mbps	0	LE	1270.0	500	Pass
2440	2 Mbps	19	LE	1269.0	500	Pass
2480	2 Mbps	39	LE	1272.0	500	Pass

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Keysight Spectrum Analyzer - Occupied BW					
C RF 50 Ω DC		SENSE:INT er Freq: 2.402000000 GHz Free Run Avg Hold	R	04:28:58 AM May 11, 2020 adio Std: None	Trace/Detector
NE		en: 30 dB		adio Device: BTS	
10 dB/div Ref 20.00 dBm					
10.0					Clear Writ
0.00					Clear With
10.0					
20.0				~~~	_
30.0				- marganetter	Averaç
40.0					
50.0					
60.0					Max Ho
-70.0					
Center 2.402000 GHz				Span 2.000 MHz	
Res BW 100 kHz		#VBW 300 kHz		Sweep 1 ms	Min Ho
Occupied Bandwidth	1	Total Power	7.65 d	Bm	
)774 MHz				Detecto
1.\					Peak
Transmit Freq Error	7.828 kHz	% of OBW Pow	er 99.0	0 %	Auto <u>Ma</u>
x dB Bandwidth	701.7 kHz	x dB	-6.00	dB	
SG			STATUS		

Plot 7-1. 6dB Bandwidth Plot (Bluetooth (LE), 125kbps - Ch. 0)



Plot 7-2. 6dB Bandwidth Plot (Bluetooth (LE), 125kbps - Ch. 19)

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Keysight Spectrum Analyzer - Occupied BW					
RF 50 Ω DC	CORREC	SENSE:INT er Freq: 2.480000000 GHz	ALIGN AUTO	04:31:11 AM May 11, 2020 Radio Std: None	Trace/Detector
NFE	Trig:	Free Run Avg Ho	ld: 100/100		
	#IFGain:Low #Atte	en: 30 dB		Radio Device: BTS	-
10 dB/div Ref 20.00 dBm					
Log					
					Clear Write
10.0					
-20.0					Averag
-30.0					Average
-40.0					
-50.0					
-60.0					Max Hold
-70.0					
Center 2.480000 GHz				Span 2.000 MHz	
#Res BW 100 kHz		#VBW 300 kHz		Sweep 1 ms	
					WIIITIOK
Occupied Bandwidt	ו	Total Power	10.4	dBm	
1.0)823 MHz				Detecto
					Peak
Transmit Freq Error	-5.422 kHz	% of OBW Pov	ver 99	.00 %	Auto <u>Mar</u>
x dB Bandwidth	703.8 kHz	x dB	-6.	00 dB	
ISG			STATUS		





Plot 7-4. 6dB Bandwidth Plot (Bluetooth (LE), 500kbps - Ch. 0)

FCC ID: A3LSMN986W	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 14 of 50
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Keysight Spectrum Analyzer - Occupied BW	CORREC	CENCEJINT		04-27-02 AM May 11, 2022	
NFE	Trig:	sense:INT Freq: 2.440000000 GHz Free Run Avg Holo n: 30 dB	I: 100/100	04:37:03 AM May 11, 2020 Radio Std: None Radio Device: BTS	Trace/Detector
10 dB/div Ref 20.00 dBm					
10.0 0.00 -10.0					Clear Write
-20.0					Averag
-50.0					Max Hol
Center 2.440000 GHz #Res BW 100 kHz		VBW 300 kHz		Span 2.000 MHz Sweep 1 ms	Min Hol
Occupied Bandwidth 1.0	681 MHz	Total Power	13.2	iBm	Detecto Peak
Transmit Freq Error x dB Bandwidth	4.742 kHz 669.0 kHz	% of OBW Pow x dB		00 % 0 dB	Auto <u>Ma</u>
MSG			STATUS		

Plot 7-5. 6dB Bandwidth Plot (Bluetooth (LE), 500kbps - Ch. 19)



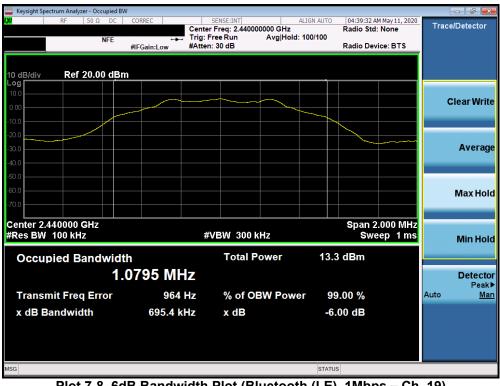
Plot 7-6. 6dB Bandwidth Plot (Bluetooth (LE), 500kbps - Ch. 39)

FCC ID: A3LSMN986W	PCTEST Proud to be part of @ element		SAMSUNG	Approved by: Quality Manager
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Keysight Spectrum Analyzer - Occupied BV					
RF 50 Ω DC		sense:INT nter Freq: 2.402000000 GHz g: Free Run Avg Ho	ALIGN AUTO	04:38:54 AM May 11, 2020 Radio Std: None	Trace/Detector
NFE		ten: 30 dB	10.100/100	Radio Device: BTS	
10 dB/div Ref 20.00 dBn	n				
10.0					Clear Writ
0.00					Clear Will
10.0					
20.0					Averag
40.0					Arcrug
50.0					
60.0					Max Hol
-70.0					
Center 2.402000 GHz				Span 2.000 MHz	
#Res BW 100 kHz		#VBW 300 kHz		Sweep 1 ms	Min Hole
Occupied Bandwidt	th	Total Power	11.0	dBm	
	0799 MHz				Detecto
					Peak
Transmit Freq Error	9.311 kHz	% of OBW Pov		.00 %	Auto <u>Ma</u>
x dB Bandwidth	696.7 kHz	x dB	-6.	00 dB	
SG			STATUS		
3			STATUS		

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

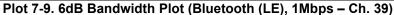


Plot 7-8. 6dB Bandwidth Plot (Bluetooth (LE), 1Mbps – Ch. 19)

FCC ID: A3LSMN986W	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:		De
1M2004170066-09.A3L	4/17 - 6/22/2020	Portable Handset		Page 16 of 59
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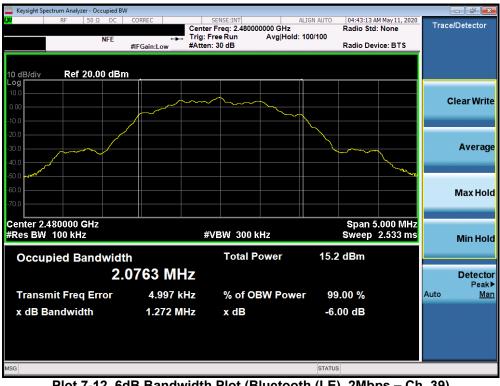
Plot 7-10. 6dB Bandwidth Plot (Bluetooth (LE), 2Mbps - Ch. 0)

FCC ID: A3LSMN986W	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:	Dage 17 of 50
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Plot 7-11. 6dB Bandwidth Plot (Bluetooth (LE), 2Mbps - Ch. 19)



Plot 7-12. 6dB Bandwidth Plot (Bluetooth (LE), 2Mbps – Ch. 39)

FCC ID: A3LSMN986W	PCTEST [®] Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:	Dage 19 of 50
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7.3 Output Power Measurement – Bluetooth (LE) §15.247(b.3); RSS-247 [5.4(4)]

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 – Section 11.9.1.1 KDB 558074 D01 v05r02 – Section 8.3.1.1

Test Settings

- 1. RBW = 3MHz
- 2. VBW = 50MHz
- 3. Span \ge 3 x 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

FCC ID: A3LSMN986W	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 10 of 50
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Frequency	Data Rate	Channel	Bluetooth	Peak Conducted Power Ant. Ga		Ant. Gain	EIRP	Limit	Morgin
[MHz]	[Mbps]	No.	Mode	[dBm]	[mW]	[dBi]	LIKP	LIIIIL	Margin
2402	125 kbps	0	LE	3.31	3.092	-3.54	-0.23	36.02	-36.25
2440	125 kbps	19	LE	7.15	5.193	-3.54	3.61	36.02	-32.41
2480	125 kbps	39	LE	6.15	4.121	-3.54	2.61	36.02	-33.41
2402	500 kbps	0	LE	3.12	3.088	-3.54	-0.42	36.02	-36.44
2440	500 kbps	19	LE	7.15	5.188	-3.54	3.61	36.02	-32.41
2480	500 kbps	39	LE	6.35	4.315	-3.54	2.81	36.02	-33.21
2402	1 Mbps	0	LE	3.31	3.235	-3.54	-0.23	36.02	-36.25
2440	1 Mbps	19	LE	7.29	5.355	-3.54	3.75	36.02	-32.27
2480	1 Mbps	39	LE	6.47	4.432	-3.54	2.93	36.02	-33.09
2402	2 Mbps	0	LE	4.74	2.976	-3.54	1.20	36.02	-34.82
2440	2 Mbps	19	LE	8.63	7.300	-3.54	5.09	36.02	-30.93
2480	2 Mbps	39	LE	8.96	7.876	-3.54	5.42	36.02	-30.60

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

FCC ID: A3LSMN986W	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:	Dage 20 of 50
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Keysight Spectrum Analyzer - Swept SA					
RF 50 Ω DC	CORREC SEN	ISE:INT #Avg Ty	pe: RMS TF	AM May 11, 2020	Frequency
NFE	PNO: Fast +++ Trig: Free IFGain:Low Atten: 26				A
10 dB/div Ref 15.00 dBm			Mkr1 2.40 3.	2 11 GHz 307 dBm	Auto Tune
5.00		▶1			Center Freq 2.402000000 GHz
-5.00					Start Freq 2.397000000 GHz
-25.0					Stop Freq 2.407000000 GHz
-45.0					CF Step 1.000000 MHz <u>Auto</u> Man
-65.0					Freq Offset 0 Hz
-75.0					Scale Type
Center 2.402000 GHz #Res BW 3.0 MHz	VBW 3.0 MHz		Span Sweep 1.000 ms		Log <u>Lin</u>
MSG			STATUS		

Plot 7-13. Peak Power Plot (Bluetooth (LE), 125kbps - Ch. 0)



Plot 7-14. Peak Power Plot (Bluetooth (LE), 125kbps - Ch. 19)

FCC ID: A3LSMN986W	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 21 of 50
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Keysight Spectrum Analyzer - Swept SA					- 0 ×
XI RF 50Ω DC		#Avg Type	ERMS TRACE	MWWWW	equency
10 dB/div Ref 15.00 dBm	PNO: Fast Trig: Free IFGain:Low Atten: 26 o		DE Mkr1 2.402 3.12		Auto Tune
5.00		↓ 1			enter Fred 000000 GH
-5.00					Start Fre
-25.0				2.407	Stop Fre 000000 GH
-45.0				1. <u>Auto</u>	CF Ste 000000 MH Ma
65.0				F	F req Offs o 0 ⊦
-75.0				5	Scale Typ
Center 2.402000 GHz #Res BW 3.0 MHz	VBW 3.0 MHz		Span 10 Sweep 1.000 ms (1	0.00 MHz 1001 pts)	Li
MSG			STATUS		

Plot 7-16. Peak Power Plot (Bluetooth (LE), 500kbps - Ch. 0)

FCC ID: A3LSMN986W	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:		Page 22 of 59
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🔤 Keysight Sp	ectrum Analyzer -									_	
LXI	RF 50	DΩ DC	CORREC	SE	NSE:INT	#Avg Typ	ALIGN AUTO		M May 11, 2020	F	requency
10 dB/div	Ref 15.00	NFE 0 dBm	PNO: Fast IFGain:Low	⊷ Trig: Fre Atten: 2				TYF DE 1 2.439			Auto Tune
5.00				↓ ¹							Center Freq 0000000 GHz
-5.00										2.43	Start Freq 5000000 GHz
-25.0										2.44	Stop Freq 5000000 GHz
-45.0										<u>Auto</u>	CF Step 1.000000 MHz Man
-65.0											Freq Offset 0 Hz
-75.0 Center 2.	440000 GH	z						Span 1		Log	Scale Type Lin
#Res BW			VB	W 3.0 MHz				.000 ms (1001 pts)		
MSG							STATU	5			

Plot 7-17. Peak Power Plot (Bluetooth (LE), 500kbps - Ch. 19)



Plot 7-18. Peak Power Plot (Bluetooth (LE), 500kbps - Ch. 39)

FCC ID: A3LSMN986W	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager		
Test Report S/N:	Test Dates:	EUT Type:		Dage 22 of 50		
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🔤 Keysight Spe	ctrum Analyzer - Sv									_	
L <mark>XI</mark>	RF 50 \$	DC DC	CORREC	SENS	SE:INT	#Avg Typ	ALIGN AUTO		May 11, 2020	F	requency
		NFE	PNO: Fast ++ IFGain:Low	Trig: Free Atten: 26		#A18 19P		TYP DE			Auto Tune
10 dB/div Log	Ref 15.00	dBm					Mkr	1 2.402 3.3	11 GHz 07 dBm		Auto Tune
5.00					1						Center Freq 02000000 GHz
										2.40	J2000000 GH2
-5.00										2.30	Start Freq
-15.0										2.55	700000 GH2
-25.0										2.40	Stop Freq
-35.0										2.40	7000000 GH2
-45.0											CF Step 1.000000 MHz
-55.0										<u>Auto</u>	Man
-65.0											Freq Offset
-75.0											0 Hz
											Scale Type
Center 2.4 #Res BW ∶	02000 GHz 3.0 MHz		VBW	3.0 MHz			Sweep 1	Span 1 .000 m <u>s (</u>		Log	<u>Lin</u>
MSG							STATUS				

Plot 7-19. Peak Power Plot (Bluetooth (LE), 1Mbps - Ch. 0)



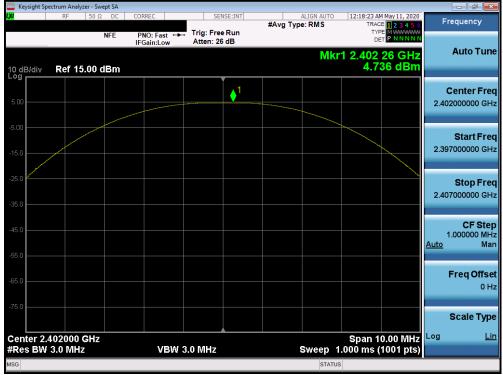
Plot 7-20. Peak Power Plot (Bluetooth (LE), 1Mbps - Ch. 19)

FCC ID: A3LSMN986W	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 24 of 50
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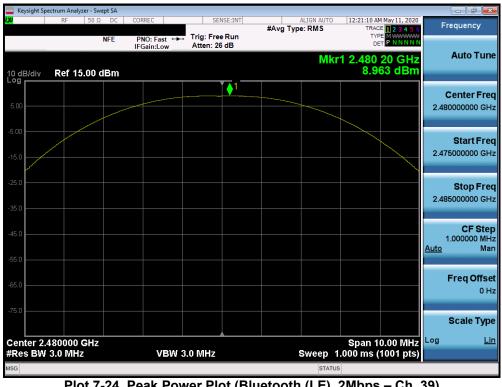
Plot 7-22. Peak Power Plot (Bluetooth (LE), 2Mbps – Ch. 0)

FCC ID: A3LSMN986W	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager	
Test Report S/N:	Test Dates:	EUT Type:		Dage 25 of 50	
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🔤 Keysight Sp	ectrum Analyze									_	X
LXI	RF	50 Ω DC	CORREC	SENSE	#	Avg Type	ALIGN AUTO e: RMS	TRAC	May 11, 2020	Fr	equency
		NFE	PNO: Fast ↔ IFGain:Low	Trig: Free R Atten: 26 d			Mkr	DE			Auto Tune
10 dB/div Log	Ref 15.	00 dBm						8.6	33 dBm		
											Center Freq
5.00			and the second se							2.44	0000000 GHz
-5.00										0.42	Start Freq
-15.0										2.43	5000000 GHZ
-25.0											Stop Freq
-35.0										2.44	5000000 GHz
-45.0										1	CF Step .000000 MHz
-55.0										<u>Auto</u>	Man
											Freq Offset
-65.0											0 Hz
-75.0											Scale Type
Center 2.4 #Res BW			MBM 2	.0 MHz			Swoon 1	Span 1	0.00 MHz 1001 pts)	Log	Lin
	5.0 WHZ			SO WINZ			sweep 1.	oou ins (roo r pts)		

Plot 7-23. Peak Power Plot (Bluetooth (LE), 2Mbps - Ch. 19)



Plot 7-24. Peak Power Plot (Bluetooth (LE), 2Mbps - Ch. 39)

FCC ID: A3LSMN986W	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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7.4 Power Spectral Density – Bluetooth (LE) §15.247(e); RSS-247 [5.2]

Test Overview and Limit

The peak power density is measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power and at the appropriate frequencies.

The maximum permissible power spectral density is 8 dBm in any 3 kHz band.

Test Procedure Used

ANSI C63.10-2013 – Section 11.10.2 Method PKPSD KDB 558074 D01 v05r02 – Section 8.4 DTS Maximum Power Spectral Density level in the fundamental emission

Test Settings

- 1. Analyzer was set to the center frequency of the DTS channel under investigation
- 2. Span = 1.5 times the DTS channel bandwidth
- 3. RBW = 3kHz
- 4. VBW = 1MHz
- 5. Detector = peak
- 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 in the diagram below.



Figure 7-3. Test Instrument & Measurement Setup

Test Notes

None

FCC ID: A3LSMN986W	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager	
Test Report S/N:	Test Dates:	EUT Type:		Dogo 07 of 50	
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Frequency [MHz]	Data Rate [Mbps]	Channel No.	Bluetooth Mode	Measured Power Spectral Density [dBm]	Maximum Permissible Power Density [dBm / 3kHz]	Margin [dB]
2402	125 kbps	0	LE	-1.75	8.0	-9.75
2440	125 kbps	19	LE	0.52	8.0	-7.48
2480	125 kbps	39	LE	0.83	8.0	-7.17
2402	500 kbps	0	LE	-2.01	8.0	-10.01
2440	500 kbps	19	LE	0.37	8.0	-7.63
2480	500 kbps	39	LE	0.69	8.0	-7.32
2402	1 Mbps	0	LE	-11.07	8.0	-19.07
2440	1 Mbps	19	LE	-8.73	8.0	-16.73
2480	1 Mbps	39	LE	-8.41	8.0	-16.41
2402	2 Mbps	0	LE	-12.27	8.0	-20.27
2440	2 Mbps	19	LE	-9.97	8.0	-17.97
2480	2 Mbps	39	LE	-9.69	8.0	-17.69

Table 7-4. Conducted Power Density Measurements

FCC ID: A3LSMN986W	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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Plot 7-25. Power Spectral Density Plot (Bluetooth (LE), 125kbps - Ch. 0)



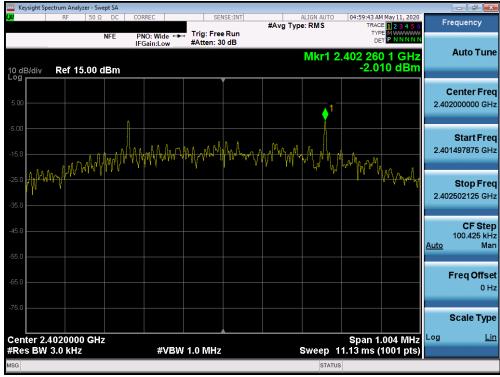
Plot 7-26. Power Spectral Density Plot (Bluetooth (LE), 125kbps – Ch. 19)

FCC ID: A3LSMN986W	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager	
Test Report S/N:	Test Dates:	EUT Type:		Dage 20 of 50	
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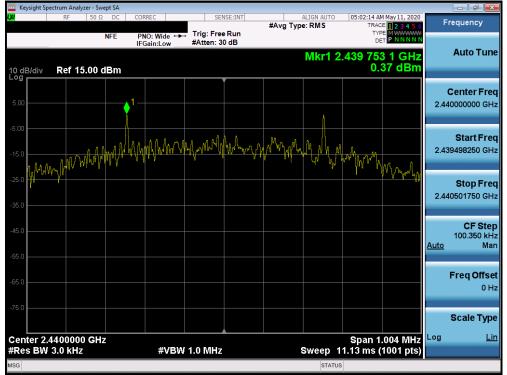




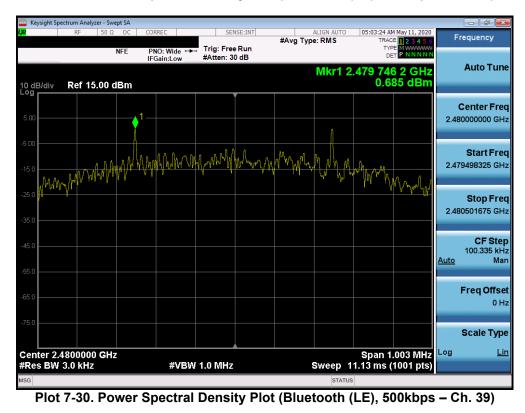
Plot 7-28. Power Spectral Density Plot (Bluetooth (LE), 500kbps - Ch. 0)

FCC ID: A3LSMN986W	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager	
Test Report S/N:	Test Dates:	EUT Type:		Dage 20 of 50	
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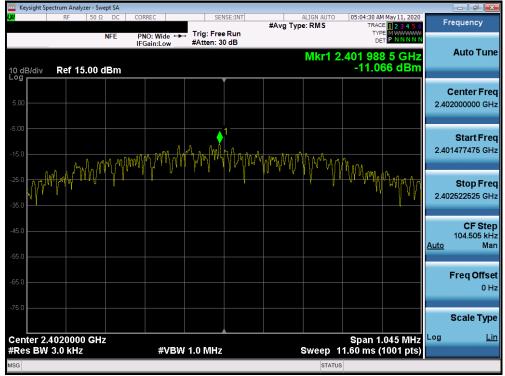


Plot 7-29. Power Spectral Density Plot (Bluetooth (LE), 500kbps – Ch. 19)

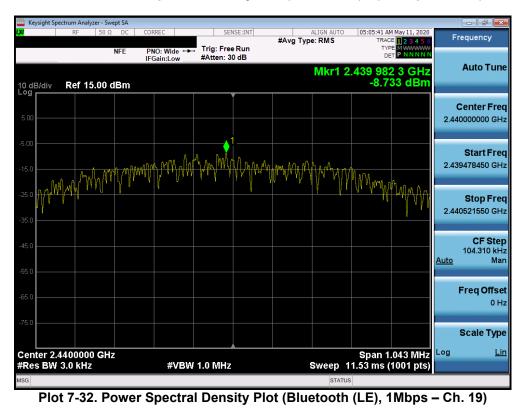


Approved by: PCTEST MEASUREMENT REPORT SAMSUNG FCC ID: A3LSMN986W (CERTIFICATION) Proud to be part of Quality Manager Test Report S/N: Test Dates: EUT Type: Page 31 of 59 1M2004170066-09.A3L 4/17 - 6/22/2020 Portable Handset © 2020 PCTEST V 9.0 02/01/2019



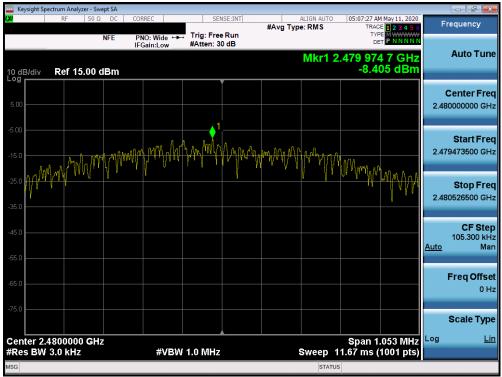


Plot 7-31. Power Spectral Density Plot (Bluetooth (LE), 1Mbps – Ch. 0)

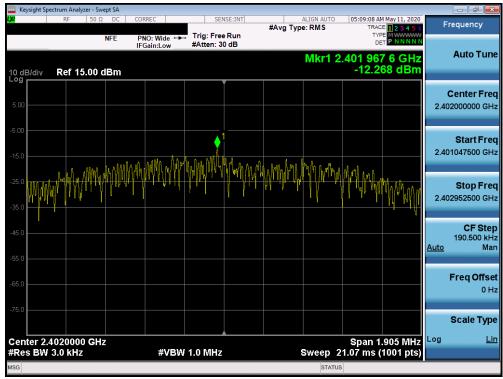


FCC ID: A3LSMN986W	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:	Dage 22 of 50
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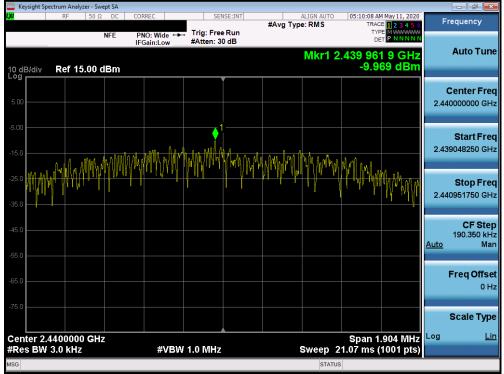
Plot 7-33. Power Spectral Density Plot (Bluetooth (LE), 1Mbps - Ch. 39)



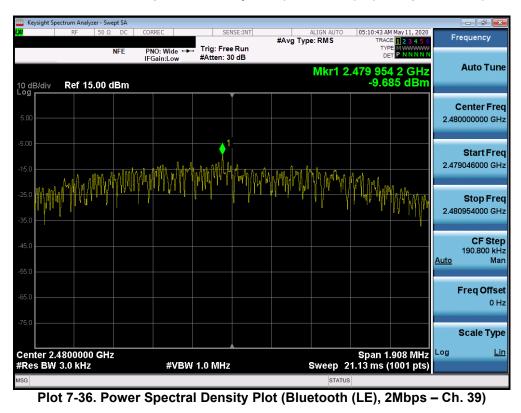
Plot 7-34. Power Spectral Density Plot (Bluetooth (LE), 2Mbps - Ch. 0)

FCC ID: A3LSMN986W	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager	
Test Report S/N:	Test Dates:	EUT Type:		Dega 22 of 50	
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Plot 7-35. Power Spectral Density Plot (Bluetooth (LE), 2Mbps – Ch. 19)



Approved by: PCTEST MEASUREMENT REPORT SAMSUNG FCC ID: A3LSMN986W (CERTIFICATION) Proud to be part of Quality Manager Test Report S/N: Test Dates: EUT Type: Page 34 of 59 1M2004170066-09.A3L 4/17 - 6/22/2020 Portable Handset © 2020 PCTEST V 9.0 02/01/2019



7.5 Conducted Emissions at the Band Edge §15.247(d); RSS-247 [5.5]

Test Overview and Limit

For the following out of band conducted spurious emissions plots at the band edge, the EUT was set to transmit at maximum power with the largest packet size available. These settings produced the worst-case emissions.

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100kHz bandwidth.

Test Procedure Used

ANSI C63.10-2013 – Section 11.11.3 KDB 558074 D01 v05r02 – Section 8.7.2

Test Settings

- 1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
- 2. Span was set large enough so as to capture all out of band emissions near the band edge
- 3. RBW = 100kHz
- 4. VBW = 300kHz
- 5. Detector = Peak
- 6. Number of sweep points $\geq 2 \times \text{Span/RBW}$
- 7. Trace mode = max hold
- 8. Sweep time = auto couple
- 9. The trace was allowed to stabilize

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

None

FCC ID: A3LSMN986W	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager	
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🔤 Keysight Spectrum Ana										
RF RF	50 Ω DC	CORREC		E:INT	#Avg Type	ERMS	TRAC	May 17, 2020	F	requency
	NFE 20.00 dBm	PNO: Wide IFGain:Low	Trig: Free Atten: 30 d			ΔΝ	DE /kr1 3.3	56 MHz 388 dB		Auto Tune
10.0						<u>_</u> 1∆2				Center Freq 0000000 GHz
-10.0					ſ	M	4		2.39	Start Freq 6000000 GHz
-20.0							M		2.40	Stop Freq 4000000 GHz
-40.0	um a derdinder lik datut			whether War	<u> </u>			With the second second	<u>Auto</u>	CF Step 800.000 kHz Mar
.60.0										Freq Offse 0 H
-70.0 Center 2.400000) GHz						Span 8	.000 MHz	Log	Scale Type
#Res BW 100 kl		#VBW	300 kHz			Sweep 4	.000 ms (2001 pts)		
MSG						STATUS				

Plot 7-37. Band Edge Plot (Bluetooth (LE), 125kbps - Ch. 0)



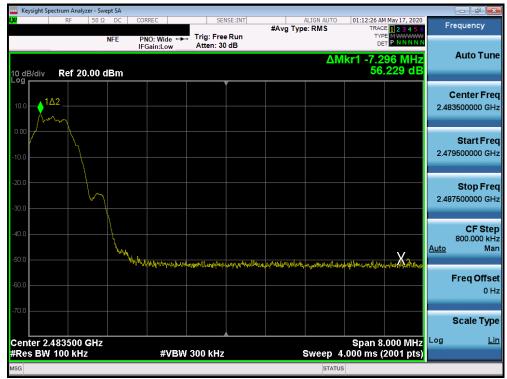
Plot 7-38. Band Edge Plot (Bluetooth (LE), 125kbps – Ch. 39)

FCC ID: A3LSMN986W	PCTEST Proud to be part of @ element			Approved by: Quality Manager	
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NFE PNO: Wide Trig: Free Run Atten: 30 dB #Avg Type: RMS Trace D 2 3 4 5 Trace D 2 3 4 5 Det P NNNNN Frequence 0 dB/div Ref 20.00 dBm 0 <th>Keysight Spectrum Analyzer - Sv RF 50 S</th> <th></th> <th>cruce with</th> <th></th> <th>01 10 10 10 10 10 17 0000</th> <th></th>	Keysight Spectrum Analyzer - Sv RF 50 S		cruce with		01 10 10 10 10 10 17 0000	
Log ΔMkr1 3.124 MHz 51.550 dB Auto 00 1Δ2 1 1 2.40000000 00 1Δ2 1 1 2.40000000 00 1Δ2 1 1 2.40000000 00 1 1 1 1 2.40000000 00 1	KF 50 3	NFE PNO: Wid	e 🛶 Trig: Free Run		TRACE 1 2 3 4 5 6 TYPE M WWWW	Frequency
Center 2.40000000 Start 2.39600000 2.40400000 C C C C C C C C C C C C C C C C	dB/div Ref 20.00		W Atten: 30 dB	Δ	Mkr1 3.124 MHz	Auto Tui
Start 2.39600000 2.404000000 2.404000000 2.40400000 2.404000000 2.404000000 2.404000000 2.404000000 2.404000000 2.404000000 2.404000000 2.404000000 2.404000000 2.404000000 2.404000000 2.404000000 2.404000000 2.404000000 2.404000000 2.404000000 2.4040000000 2.404000000 2.4040000000 2.404000000 2.4040000000000				1∆2		Center Fr 2.400000000 Gi
Stop 2.404000000 2.404000000 C CF 800.00 Freq O C Scale Scale C Scale C Scale C Scale C Scale C Scale C Scale C Scale C Scale C Scale C Scale C Scale C Scale C Scale C Scale C Scale C Scale Scale C Scale C Scale C Scale C Scale C Scale C Scale C Scale C Scale C Scale Scale C Scale C Scale Sc				- Am		Start Fr 2.396000000 G
Auto 800.00 Auto 800.00 Freq O Control Control Cont						Stop Fr 2.404000000 G
Freq O Freq O Scale Log		X	I was a be dedation			CF Sto 800.000 k <u>Auto</u> M
enter 2.400000 GHz Span 8.000 MHz	.0		needen alfreddin yn gregol yn g Dreffyl gregol yn greg			Freq Offs 0
					Span 8.000 MHz	Scale Ty
Res BW 100 kHz #VBW 300 kHz Sweep 4.000 ms (2001 pts)	Res BW 100 kHz		/BW 300 kHz		.000 ms (2001 pts)	

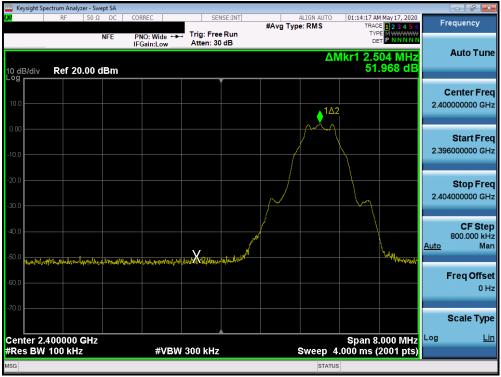
Plot 7-39. Band Edge Plot (Bluetooth (LE), 500kbps – Ch. 0)



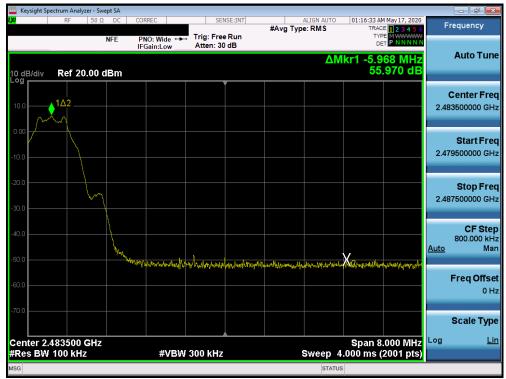
Plot 7-40. Band Edge Plot (Bluetooth (LE), 500kbps - Ch. 39)

FCC ID: A3LSMN986W	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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Plot 7-41. Band Edge Plot (Bluetooth (LE), 1Mbps - Ch. 0)



Plot 7-42. Band Edge Plot (Bluetooth (LE), 1Mbps - Ch. 39)

FCC ID: A3LSMN986W	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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🔤 Keysight Spe	ectrum Analyzer - S										
L <mark>XI</mark>	RF 50	ΩDC	CORREC	SEN	ISE:INT	#Avg Typ	ALIGN AUTO e: RMS		May 17, 2020	F	requency
10 dB/div	Ref 20.00	NFE) dBm	PNO: Wide	↓ Trig: Free Atten: 30			ΔΝ	TYF DE /kr1 2.0	08 MHz .210 dB		Auto Tune
10.0							1∆2				Center Freq 0000000 GHz
-10.0								- A		2.39	Start Freq 6000000 GHz
-20.0					/					2.40	Stop Freq 4000000 GHz
-40.0				$ \rightarrow $	(z~~				\sim	<u>Auto</u>	CF Step 800.000 kHz Man
-60.0	halan yang darika karang darikan karang darikan karang darikan karang darikan karang darikan karang darikan kar	hthroddyddyd	hum annahahunah	nooden, Londoll							Freq Offsel 0 Hz
-70.0	400000 GH	7						Snan 8	.000 MHz	Log	Scale Type
#Res BW		2	#VBW	/ 300 kHz			Sweep 4	.000 ms (2001 pts)		
MSG							STATUS				

Plot 7-43. Band Edge Plot (Bluetooth (LE), 2Mbps - Ch. 0)



Plot 7-44. Band Edge Plot (Bluetooth (LE), 2Mbps - Ch. 39)

FCC ID: A3LSMN986W	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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7.6 Conducted Spurious Emissions §15.247(d); RSS-247 [5.5]

Test Overview and Limit

For the following out of band conducted spurious emissions plots, the EUT was set to transmit at maximum power with the largest packet size available. The worst case spurious emissions were found in this configuration.

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100kHz bandwidth per the procedure in Section 8.5 of KDB 558074 D01 v05r02 and Section 11.11.3 of ANSI C63.10-2013.

Test Procedure Used

ANSI C63.10-2013 – Section 11.11.3 KDB 558074 D01 v05r02 – Section 8.5

Test Settings

- 1. Start frequency was set to 30MHz and stop frequency was set to 25GHz (separated into two plots per channel)
- 2. RBW = 1MHz
- 3. VBW = 3MHz
- 4. Detector = Peak
- 5. Trace mode = max hold
- 6. Sweep time = auto couple
- 7. The trace was allowed to stabilize

Test Setup

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



Figure 7-5. Test Instrument & Measurement Setup

FCC ID: A3LSMN986W	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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Test Notes

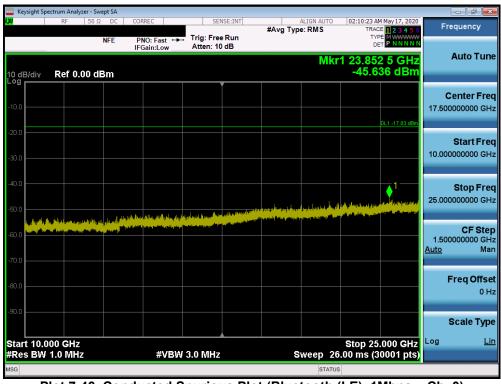
- 1. RBW was set to 1MHz rather than 100kHz in order to increase the measurement speed.
- 2. The display line shown in the following plots denotes the limit at 20dB below the fundamental emission level measured in a 100kHz bandwidth. However, since the traces in the following plots are measured with a 1MHz RBW, the display line may not necessarily appear to be 20dB below the level of the fundamental in a 1MHz bandwidth.
- 3. For plots showing conducted spurious emissions near the limit, the frequencies were investigated with a reduced RBW to ensure that no emissions were present.

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Keysight Spe		zer - Swept SA									_	
XI	RF	50 Ω DC	CORREC		SEI	ISE:INT	#Avg Typ	ALIGN AUTO	01:55:12 A	M May 17, 2020	Freque	ency
		NFE	PNO: F IFGain:	ast ⊶⊶ Low	Trig: Free Atten: 30				TYI Di			
10 dB/div	Ref 20).00 dBm						Mk	r1 3.82 -33.4	8 6 GHz 19 dBm	Aut	to Tun
- °g											Cent 5.015000	er Fre 000 GH
0.00												
												art Fre
10.0										DL1 -17.83 dBm	30.000	000 MH
20.0											Sto 10.000000	op Fre
30.0						tada ak da	المراجع والمراجع	, _{press} angelikke	ala bullar attacciati	ta bila kardana bilari		
									Constant of Constant of Constant		997.000 <u>Auto</u>	CF Ste 000 MH Ma
50.0											Free	qOffse
												0 H
70.0											Sca	le Typ
start 30 N Res BW		Z		#VBW	3.0 MHz		S	weep 18	Stop 10 .00 ms (3	.000 GHz 0001 pts)	Log	Li
SG								STATUS				

Plot 7-45. Conducted Spurious Plot (Bluetooth (LE), 1Mbps - Ch. 0)



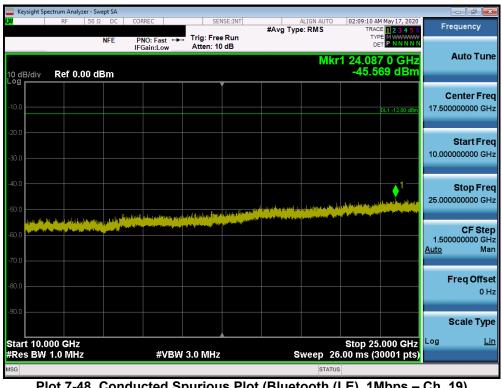
Plot 7-46. Conducted Spurious Plot (Bluetooth (LE), 1Mbps - Ch. 0)

FCC ID: A3LSMN986W	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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🔤 Keysight Sp	ectrum Analyz											
X	RF	50 Ω DC	CORR	EC	SEI	NSE:INT	#Avg Typ	ALIGN AUTO		M May 17, 2020	Fre	quency
		NFE		D:Fast ↔ ain:Low	. Trig: Free Atten: 30				TY D			Auto Tune
10 dB/div Log	Ref 20	.00 dBm							-33.3	68 dBm		
											с	enter Freq
10.0											5.015	000000 GHz
0.00												
-10.0											30.	Start Freq 000000 MHz
-10.0										DL1 -12.80 dBm		
-20.0												Stop Freq
-30.0									1		10.000	000000 GHz
			القريب والم		and the second	a train a site	alay and a support		and we will pr			CF Step
يعليون ا	a production dest				and the second se		میں _{میں بل} ین میں اور میں اور				997. <u>Auto</u>	000000 MHz Man
-50.0											_	
-60.0											-	req Offset 0 Hz
-70.0												
											5	Scale Type
Start 30 N									Stop 10		Log	Lin
#Res BW	1.0 MHz			#VBW	3.0 MHz		s			30001 pts)		
150								STATU	15			

Plot 7-47. Conducted Spurious Plot (Bluetooth (LE), 1Mbps - Ch. 19)



Plot 7-48. Conducted Spurious Plot (Bluetooth (LE), 1Mbps – Ch. 19)

FCC ID: A3LSMN986W	PCTEST°	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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🔤 Keysight Sp	ectrum Analyz	er - Swept SA										
L <mark>XI</mark>	RF	50 Ω DC	CORRE	C	SEN	ISE:INT	#Avg Typ	ALIGN AUTO		M May 17, 2020	Fr	equency
		NFE	PNO: IFGai	Fast ↔⊷ n:Low	Trig: Free Atten: 30				TYF DE			Auto Tune
10 dB/div Log	Ref 20	.00 dBm			,				-33.9	92 dBm		
10.0												enter Freq 5000000 GHz
0.00												04
-10.0										DL1 -13.87 dBm	30	Start Freq .000000 MHz
-20.0												Stop Freq
-30.0				و منافد	d	ا يعا	Danskopilitari	I can rai cuin	للغبر مايرينا المعروبة		10.000	0000000 GHz
-40.0							din anter constants		andra and a subscription of the	and a second filling	997 Auto	CF Step .000000 MHz Man
-50.0	n: "											=req Offset
-60.0												0 Hz
-70.0												Scale Type
Start 30 N #Res BW				#VBW	3.0 MHz		s	weep 18	Stop 10 3.00 ms (3	.000 GHz 0001 pts)	Log	Lin
MSG								STATU				

Plot 7-49. Conducted Spurious Plot (Bluetooth (LE), 1Mbps - Ch. 39)



Plot 7-50. Conducted Spurious Plot (Bluetooth (LE), 1Mbps - Ch. 39)

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7.7 Radiated Spurious Emission Measurements §15.205 §15.209 §15.247(d); 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 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 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 7-5 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 7-5. Radiated Limits

Test Procedures Used

ANSI C63.10-2013 – Section 6.6.4.3

KDB 558074 D01 v05r02 - Section 8.6, 8.7

Test Settings

Average Field Strength Measurements

- 1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
- 2. RBW = 1MHz
- 3. VBW = 3kHz > 1/T
- 4. Averaging type was set to RMS to ensure that video filtering was applied in the power domain
- 5. Detector = peak
- 6. Sweep time = auto
- 7. Trace mode = max hold
- 8. Trace was allowed to run for at least 50 times (1/duty cycle) traces

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Peak Field Strength Measurements

- 1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
- 2. RBW is set depending on measurement frequency, as specified in Table 7-6 below
- 3. VBW = 3MHz
- 4. Detector = peak
- 5. Sweep time = auto couple
- 6. Trace mode = max hold
- 7. Trace was allowed to stabilize

Frequency	RBW
9 – 150kHz	200 – 300Hz
0.15 – 30MHz	9 – 10kHz
30 – 1000MHz	100 – 120kHz
> 1000MHz	1MHz

Table 7-6. RBW as a Function of Frequency

Test Setup

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

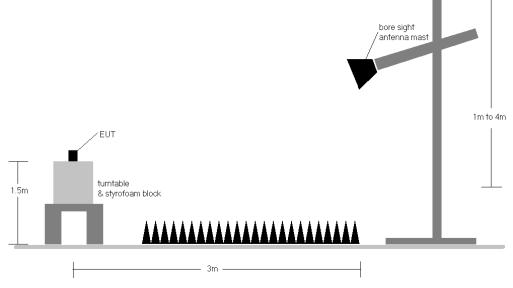


Figure 7-6. Radiated Test Setup >1GHz

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Test Notes

- The optional test procedures for antenna port conducted measurements of unwanted emissions per the guidance of KDB 558074 D01 v05r02 were not used to evaluate this device for compliance to radiated limits. All radiated spurious emissions levels were measured in a radiated test setup.
- 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 7-5.
- 3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
- 4. This unit was tested with its standard battery.
- 5. The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. Above 1 GHz, average and peak measurements were taken using linearly polarized horn antennas. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
- 6. Average measurements were recorded using a VBW of 3kHz, per Section 4.1.4.2.3 of ANSI C63.10-2013, since 1/T is equal to just under 3kHz. This method was used because the EUT could not be configured to operate with a duty cycle > 98%. Both average and peak measurements were made using a peak detector
- 7. Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
- 8. No significant radiated band edge emissions were found in the 2310 2390MHz restricted band.
- 9. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

Sample Calculations

Determining Spurious Emissions Levels

- Field Strength Level [dBμV/m] = Analyzer Level [dBm] + 107 + AFCL [dB/m]
- AFCL [dB/m] = Antenna Factor [dB/m] + Cable Loss [dB]
- \circ Margin [dB] = Field Strength Level [dBµV/m] Limit [dBµV/m]

Radiated Band Edge Measurement Offset

• The amplitude offset shown in the radiated restricted band edge plots in Section 7.8 was calculated using the formula:

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

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Radiated Spurious Emission Measurements §15.205 §15.209 §15.247(d); RSS-Gen [8.9]

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	V	-	-	-78.83	3.63	31.80	53.98	-22.18
4804.00	Peak	V	-	-	-66.35	3.63	44.28	73.98	-29.70
12010.00	Avg	V	-	-	-81.96	15.60	40.64	53.98	-13.34
12010.00	Peak	V	-	-	-69.32	15.60	53.28	73.98	-20.70

Table 7-7. Radiated Measurements @ 3 meters

Bluetooth Mode: Distance of Measurements: Operating Frequency: Channel:

LE 3 Meters 2440MHz

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	V	-	-	-78.94	3.85	31.91	53.98	-22.07
4880.00	Peak	V	-	-	-66.57	3.85	44.28	73.98	-29.70
7320.00	Avg	V	-	-	-80.43	7.91	34.48	53.98	-19.50
7320.00	Peak	V	-	-	-67.37	7.91	47.54	73.98	-26.44
12200.00	Avg	V	-	-	-81.95	14.55	39.60	53.98	-14.38
12200.00	Peak	V	-	-	-69.67	14.55	51.88	73.98	-22.10

Table 7-8. Radiated Measurements @ 3 meters

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Radiated Spurious Emission Measurements §15.205 §15.209 §15.247(d); RSS-Gen [8.9]

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	V	-	-	-79.09	3.71	31.62	53.98	-22.36
4960.00	Peak	V	-	-	-66.25	3.71	44.46	73.98	-29.52
7440.00	Avg	V	-	-	-80.25	9.08	35.83	53.98	-18.15
7440.00	Peak	V	-	-	-68.35	9.08	47.73	73.98	-26.25
12400.00	Avg	V	-	-	-81.87	14.24	39.37	53.98	-14.61
12400.00	Peak	V	-	-	-69.55	14.24	51.69	73.98	-22.29

Table 7-9. 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	V	-	-	-78.99	3.85	31.86	53.98	-22.12
4880.00	Peak	V	-	-	-66.31	3.85	44.54	73.98	-29.44
7320.00	Avg	V	-	-	-81.01	7.91	33.90	53.98	-20.08
7320.00	Peak	V	-	-	-69.00	7.91	45.91	73.98	-28.07
12200.00	Avg	V	-	-	-81.97	14.55	39.58	53.98	-14.40
12200.00	Peak	V	-	-	-70.01	14.55	51.54	73.98	-22.44

Table 7-10. Radiated Measurements with WCP @ 3 meters

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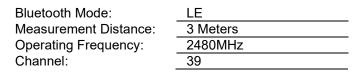


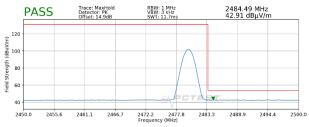
7.8 Radiated Restricted Band Edge Measurements §15.209; RSS-Gen [8.9]

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

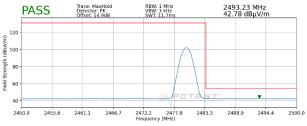
The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

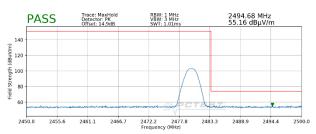




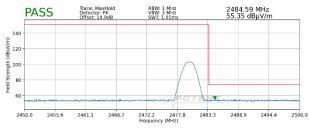
Plot 7-51. Radiated Restricted Upper Band Edge Measurement (Average)



Plot 7-53. Radiated Restricted Upper Band Edge Measurement with WCP (Average)



Plot 7-52. Radiated Restricted Upper Band Edge Measurement (Peak)



Plot 7-54. Radiated Restricted Upper Band Edge Measurement with WCP (Peak)

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7.9 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 7-11 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 7-11. 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.

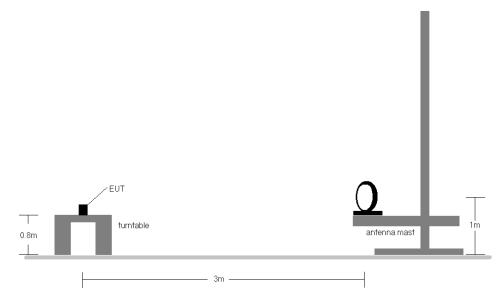
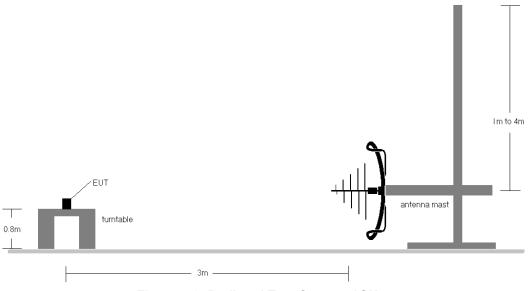
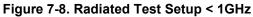


Figure 7-7. Radiated Test Setup < 30Mhz





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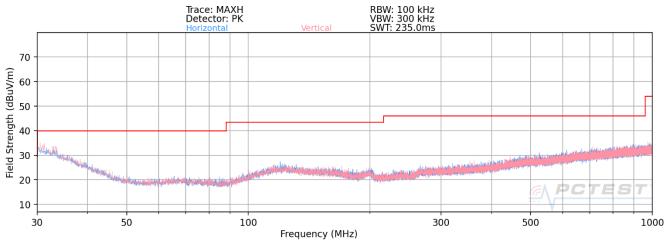
Test Notes

- 1. All emissions lying in restricted bands specified in §15.205 and RSS-Gen(8.10) are below the limit shown in Table 7-11.
- 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 with its standard battery.
- 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. No spurious emissions were detected within 20dB of the limit below 30MHz.
- 8. 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.
- The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. There were no emissions detected in the 30MHz – 1GHz frequency range, as shown in the subsequent plots.

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Radiated Spurious Emissions Measurements (Below 1GHz) §15.209; RSS-Gen [8.9]



Plot 7-55. Radiated Spurious Plot below 1GHz

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7.10 Line-Conducted Test 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 Section 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 7-12. 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.

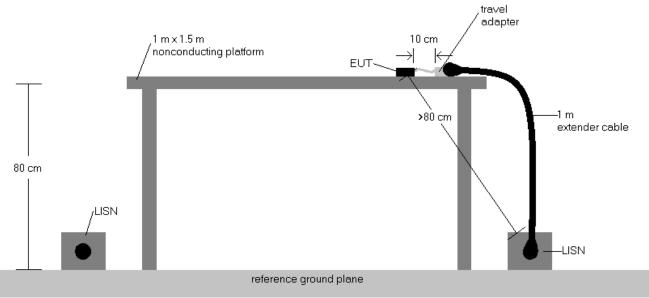


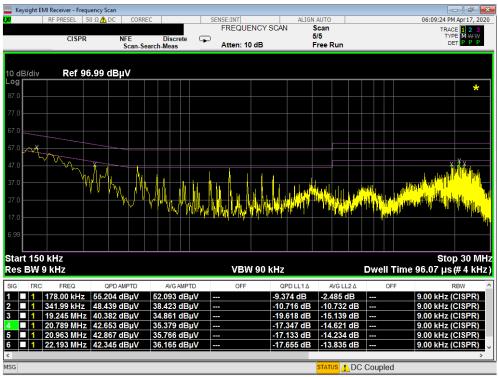
Figure 7-9. Test Instrument & Measurement Setup

Test Notes

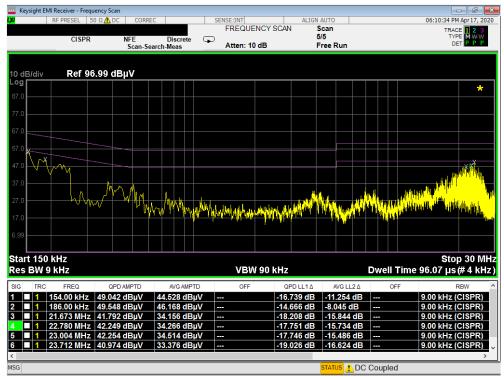
- 1. All modes of operation were investigated and the worst-case emissions are reported using mid channel. The emissions found were not affected by the choice of channel used during testing.
- 2. The limit for an intentional radiator from 150kHz to 30MHz are specified in Part 15.207 and RSS-Gen (8.8).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

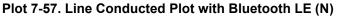
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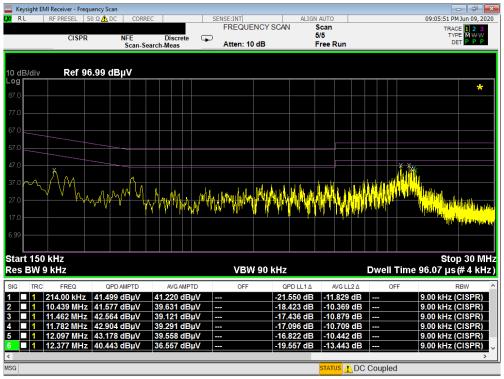




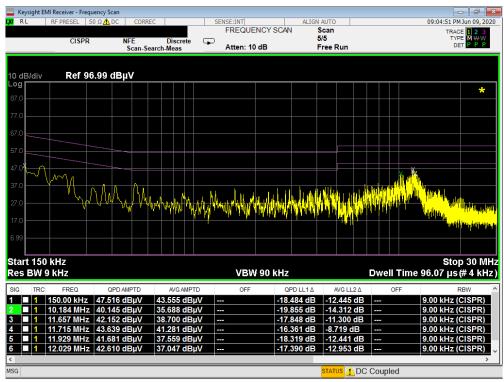


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Plot 7-58. Line Conducted Plot with Bluetooth LE (L1) with WCP



Plot 7-59. Line Conducted Plot with Bluetooth LE (N) with WCP

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8.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **Samsung Portable Handset FCC ID: A3LSMN986W** is in compliance with Part 15 Subpart C (15.247) of the FCC Rules and RSS-247 of the Innovation, Science and Economic Development Canada Rules.

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