

# PCTEST

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# 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: 09/15 - 11/10/2020 Test Site/Location: PCTEST Lab. Columbia, MD Test Report Serial No.: 1M2009140143-12.A3L

# FCC ID:

# A3LSMG996U

Certification

# APPLICANT:

# Samsung Electronics Co., Ltd.

Application Type: Model: Additional Models: EUT Type: Max. RF Output Power: Frequency Range: FCC Classification: FCC Rule Part(s): ISED Specification: Test Procedure(s):

SM-G996U SM-G996U1 Portable Handset 9.665 mW (9.85 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 17025-2017 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: A3LSMG996U**. 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.: 0501M, 0517M, 0561M

# 2.2 Device Capabilities

This device contains the following capabilities:

800/850/1900 CDMA/EVDO Rev. 0/A (BC0, BC1, BC10), 850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 5G NR (FR1/FR2), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII, Bluetooth (1x, EDR, LE), NFC, UWB, Wireless Power Transfer

Ch.	Frequency (MHz)
0	2402
:	:
19	2440
:	:
39	2480

Table 2-1. Frequency / Channel Operations

## 2.3 Antenna Description

Following antenna was used for the testing.

Frequency [GHz]	Antenna Gain (dBi)
2.4	-1.78

### Table 2-2. Antenna Peak Gain

**Note:** This device is capable of operating in hopping and non-hopping mode. The EUT can hop between 79 different channels in the 2400 – 2483.5MHz band.

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# 2.4 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.

# 2.5 EMI Suppression Device(s)/Modifications

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

## 2.6 Software and Firmware

The test was conducted with firmware version G996USWU0ATI9 installed on the EUT.

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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 EnclosuresThe line-conducted facility is located inside a 7m x 3.66m x 2.7m shielded enclosure. The shielded enclosure is manufactured by AP Americas. 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 quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 7.9. 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)	7/2/2020	Annual	7/2/2021	WL25-1
Keysight Technologies	N9038A	MXE EMI Receiver	8/11/2020	Annual	8/11/2021	MY51210133
Agilent	N9020A	MXA Signal Analyzer	8/4/2020	Annual	8/4/2021	US46470561
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	10/10/2019	Biennial	10/10/2021	121034
Emco	3115	Horn Antenna (1-18GHz)	6/18/2020	Biennial	6/18/2022	9704-5182
ETS-Lindgren	3816/2NM	Line Impedance Stabilization Network	7/9/2020	Biennial	7/9/2022	114451
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	11/1/2019	Annual	11/1/2020	100040
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	7/15/2020	Annual	7/15/2021	100342
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	2/10/2020	Annual	2/10/2021	102134
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	2/21/2020	Annual	2/21/2021	102133
Sunol	DRH-118	Horn Antenna (1-18GHz)	10/3/2019	Biennial	10/3/2021	A050307
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	7/27/2020	Biennial	7/27/2022	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:	A3LSMG996U
FCC Classification:	Digital Transmission System (DTS)
Number of Channels:	<u>40</u>

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	RSS-247 [5.2]	6dB Bandwidth	> 500kHz		PASS	Section 7.2
15.247(b)(3)	RSS-247 [5.4(4)]	Transmitter Output Power	Transmitter Power < 8dBm / 3kHz Band		PASS	Sections 7.3
15.247(e)	RSS-247 [5.2]	Transmitter Power Spectral Density			PASS	Section 7.4
15.247(d)	RSS-247 [5.5]	Band Edge / Out-of-Band Emissions	≥ 20dBc		PASS	Sections 7.5, 7.6
15.205 15.209	RSS-Gen [8.9]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-Gen [8.9])	RADIATED	PASS	Sections 7.7, 7.8
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits (RSS-Gen[8.8])	LINE CONDUCTED	PASS	Section 7.9

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 account 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.





### 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	700.6	500	Pass
2440	125 kbps	19	LE	695.3	500	Pass
2480	125 kbps	39	LE	697.2	500	Pass
2402	500 kbps	0	LE	667.6	500	Pass
2440	500 kbps	19	LE	666.4	500	Pass
2480	500 kbps	39	LE	664.8	500	Pass
2402	1 Mbps	0	LE	699.2	500	Pass
2440	1 Mbps	19	LE	706.5	500	Pass
2480	1 Mbps	39	LE	713.6	500	Pass
2402	2 Mbps	0	LE	1246.0	500	Pass
2440	2 Mbps	19	LE	1251.0	500	Pass
2480	2 Mbps	39	LE	1252.0	500	Pass

Table 7-2. Conducted Bandwidth Measurements

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www.common.common.common.common.common.common.common.common.common.common.common.common.common.common.common.com						
<b>LX/ R L</b> RF 50 Ω AC	CORREC	SENSE:INT ter Freg: 2.402000000	ALIGN AUTO	04:44:13 PM Radio Std:	Sep 28, 2020	Trace/Detector
NFE	🛶 Trig	: Free Run Ave	Hold: 100/100	Radio Stu.	None	
	#IFGain:Low #At	ten: 30 dB		Radio Devi	ce: BTS	
10 dB/div Ref 20.00 dBm						
Log 10.0						
						Clear Write
0.00						
-10.0						
-20.0						
-30.0						Average
-40.0						
-50.0						
-60.0						Max Hold
-70.0						muxitoru
Center 2.402000 GHz #Res BW 100 kHz		#VBW 300 kHz		Span 2. Sweep	000 MHz	
#Res BW TOURHZ				sweep .	5.333 IIIS	Min Hold
Occupied Bandwidt	1	Total Powe	r 14.	9 dBm		
	)758 MHz					
1.0						Detector Peak►
Transmit Freq Error	-5.002 kHz	% of OBW I	Power 9	9.00 %		Auto <u>Man</u>
x dB Bandwidth	700.6 kHz	x dB	_6	.00 dB		
	700.0 KHZ	A ub	-0	.00 UB		
MSG			STATU	IS		

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 B	W					
LXI RE 50Ω AC	CORREC	SENSE:INT Center Freg: 2.4800		N AUTO 04:45:18 Radio St	PM Sep 28, 2020	Trace/Detector
NFE		Trig: Free Run	Avg Hold: 100	/100		
	#IFGain:Low #	Atten: 30 dB		Radio D	evice: BTS	
10 dB/div Ref 20.00 dB	m					
Log 10.0						
0.00						Clear Write
-10.0						
-20.0						
				سسيل	hh	Average
-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	3.333 ms	Min Hold
		<b>T</b> - 4 - 1 I		11.4 dBm		
Occupied Bandwid		Total	Power	11.4 dBm		
1.	.0815 MHz					Detector
Transmit Freq Error	-19.914 kH	7 % of O	BW Power	99.00 %		Peak▶ Auto Man
			BWFOwer			
x dB Bandwidth	697.2 kH	z xdB		-6.00 dB		
MSG				STATUS		

Plot 7-3. 6dB Bandwidth Plot (Bluetooth (LE), 125kbps - Ch. 39)



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

FCC ID: A3LSMG996U	Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager	
Test Report S/N:	Test Dates:	EUT Type:		Dage 15 of 50	
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🔤 Keysight Spectrum Analyzer - Occupied BW						
LXI RE 50 Ω AC	CORREC	SENSE:INT	ALIGN AUTO	04:49:40 PM Radio Std:	1 Sep 28, 2020	Trace/Detector
NFE	🛶 Trig	g: Free Run A	vg Hold: 100/100	Raulo Stu.	None	
	#IFGain:Low #At	ten: 30 dB		Radio Devi	ce: BTS	
10 dB/div Ref 20.00 dBm						
Log 10.0						
						Clear Write
0.00						
-10.0						
-20.0						
-30.0						Average
-40.0						
-50.0						
-60.0						Max Hold
-70.0						
Center 2.440000 GHz #Res BW 100 kHz		#VBW 300 kHz			.000 MHz 3.333 ms	
#Res BW TOO KHZ		#VEW JUUKH2		sweep	3.333 IIIS	Min Hold
Occupied Bandwidth	1	Total Pov	ver 14.	9 dBm		
	)675 MHz					
1.0						Detector Peak▶
Transmit Freq Error	-8.907 kHz	% of OBW	Power 9	9.00 %		Auto <u>Man</u>
x dB Bandwidth	666.4 kHz	x dB	-6	.00 dB		
	000.4 KHZ	A UD	-0	.00 00		
MSG			STATU	JS		

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



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

FCC ID: A3LSMG996U	Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 16 of 56
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🧱 Keysight Spectrum Analyzer - Occupied BW						
<b>LXI RE 50 Ω AC</b>	CORREC	SENSE:INT ter Freg: 2.402000000 0	ALIGN AUTO	04:46:58 PN Radio Std:	1 Sep 28, 2020	Trace/Detector
NFE	🛶 Trig	: Free Run Avg	Hold: 100/100	Raulo Stu.	None	
	#IFGain:Low #At	ten: 30 dB		Radio Devi	ice: BTS	
10 dB/div Ref 20.00 dBm						
Log 10.0						
						Clear Write
0.00						
-10.0						
-20.0				- ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~		
-30.0						Average
-40.0						
-50.0						
-60.0						Max Hold
-70.0						
				0		
Center 2.402000 GHz #Res BW 100 kHz		#VBW 300 kHz			.000 MHz 3.333 ms	
WICE DW TOO RITZ		#4044 300 KHZ		Oweep	5.555 ms	Min Hold
Occupied Bandwidth	า	Total Powe	r 14.	7 dBm		
1 (	0757 MHz					Detector
						Peak►
Transmit Freq Error	-5.161 kHz	% of OBW F	ower 99	9.00 %		Auto <u>Man</u>
x dB Bandwidth	699.2 kHz	x dB	-6	.00 dB		
			CTAT	10		
MSG			STATU	15		

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



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

FCC ID: A3LSMG996U	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:		Dege 17 of 50
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🔤 Keysight Spectrum Analyze	er - Occupied B	W							
LXI RL RF	50 Ω AC	CORREC	SENSE:	NT 2.480000000 GH	ALIGN AUTO	04:54:29 Radio Ste	PM Sep 28, 2020	Trace	/Detector
	NFE		📑 Trig: Free Ru	in Avg H	lold: 100/100				
		#IFGain:Low	#Atten: 30 dE	3		Radio De	vice: BTS		
10 dB/div Ref 2	20.00 dBi	m						-	
10.0									
0.00					~			c	lear Write
-10.0									
-20.0									
-30.0									Average
-40.0									, in the second s
-50.0									
-60.0									Max Hold
-70.0									
Center 2.480000 G				000 1-11-		Span	2.000 MHz		
#Res BW 100 kHz			#VBW	300 kHz		Sweep	3.333 ms		Min Hold
Occupied Ba	ndwid	th	Т	otal Power	15.	0 dBm			
		0769 M	47						Detector
									Peak ►
Transmit Freq	Error	-19.639	kHz %	of OBW Po	ower 9	9.00 %		Auto	<u>Man</u>
x dB Bandwid	th	713.6	kHz x	dB	-6	.00 dB			
MSG					STATU	JS			

Plot 7-9. 6dB Bandwidth Plot (Bluetooth (LE), 1Mbps - Ch. 39)



Plot 7-10. 6dB Bandwidth Plot (Bluetooth (LE), 2Mbps - Ch. 0)

FCC ID: A3LSMG996U	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:		Dogo 19 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: A3LSMG996U	Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:		Dogo 10 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  $\geq$  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: A3LSMG996U	Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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Frequency	Data	Channel	Bluetooth	Peak Condu	icted Power
[MHz]	Rate [Mbps]	No.	Mode	[dBm]	[mW]
2402	125 kbps	0	LE	6.28	4.242
2440	125 kbps	19	LE	9.53	8.970
2480	125 kbps	39	LE	7.78	6.002
2402	500 kbps	0	LE	6.35	4.313
2440	500 kbps	19	LE	9.78	9.497
2480	500 kbps	39	LE	8.14	6.521
2402	1 Mbps	0	LE	6.50	4.468
2440	1 Mbps	19	LE	9.85	9.665
2480	1 Mbps	39	LE	8.35	6.833
2402	2 Mbps	0	LE	6.88	4.875
2440	2 Mbps	19	LE	9.73	9.402
2480	2 Mbps	39	LE	8.61	7.264

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

FCC ID: A3LSMG996U	Proud to be part of (e) element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager	
Test Report S/N:	Test Dates:	EUT Type:		Dage 24 of 56	
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Keysight Spectrum Analyzer - Swept SA					
			ALIGN AUTO	10:31:52 PM Sep 22, 2020 TRACE 1 2 3 4 5 6 TYPE M WWWWW	Frequency
NFE 0 dB/div Ref 20.00 dBm	PNO: Fast Trig: Free IFGain:Low Atten: 30		Mkr1	2.402 09 GHz 6.28 dBm	Auto Tune
10.0		<b>↓</b> 1			Center Freq 2.402000000 GHz
0.00					Start Fred 2.397000000 GHz
30.0					Stop Fred 2.407000000 GHz
40.0					<b>CF Stej</b> 1.000000 MH <u>Auto</u> Mar
60.0					<b>Freq Offse</b> 0 H
Center 2.402000 GHz				Span 10.00 MHz	Scale Type
Res BW 3.0 MHz	#VBW 50 MHz		Sweep 1.0	000 ms (1001 pts)	

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



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

FCC ID: A3LSMG996U	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:		Daga 22 of 56
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	ectrum Analyze									d X
X/RL	RF	50 Ω DC	CORREC	SENSE:I		ALIGN AUTO g Type: RMS	TRAC	E 1 2 3 4 5 6	Frequer	ncy
		NFE	PNO: Fast 📮 IFGain:Low	Trig: Free Ru Atten: 30 dB	n		DE		Auto	o Tune
10 dB/div Log	Ref 20.	.00 dBm					1 2.479 7.	57 GHZ 78 dBm		
				<b>1</b>					Cente	er Fred
10.0			-			~~~~			2.4800000	00 GH:
0.00		and the second s							Sta	rtFree
10.0									2.4750000	00 GH:
20.0	and the second sec									_
-30.0									2.4850000	pFred 00 GH:
									C	F Ster
50.0									1.0000 <u>Auto</u>	
50.0									Freq	Offer
60.0									ireq	0 H
70.0										
									Scale	е Тур
Center 2.			-#\/D\M	50 MHz		Curron 1	Span 1	0.00 MHz	Log	Lii
Res BW	3.0 WHZ		#VBW	<b>SU MHZ</b>		Sweep	-	1001 pts)		

Plot 7-15. Peak Power Plot (Bluetooth (LE), 125kbps - Ch. 39)



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

FCC ID: A3LSMG996U	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 56
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NFE       PNO: Fast       Trig: Free Run       #Avg Type: RMS       Trace       2 3 4 5 00000         Mkr1 2.439 75 GHz       9.78 dBm       9.78 dBm       9.78 dBm       0.000000       0.000000       0.000000       0.000000       0.000000       0.000000       0.000000       0.000000       0.0000000000       0.0000000000000       0.00000000000000000000000000000000000		ectrum Analyze									
NFE       PNO: Fast       Trig: Free Run Atten: 30 dB       Trig: Free Run Atten: 30 dB       Trig: Free Run DFT       Auto T         dB/div       Ref 20.00 dBm       9.78 dBm       9.78 dBm       2.440000000         00       0       0       0       0       0       0       0         00       0	RL	RF	50 Ω DC	CORREC	SEI	SE:INT	ALIGN AUTO e: RMS			Free	quency
Mixing 2.435 / 35 GH2         9.78 dBm         9.78 dBm         00         01         02         03         04         05         06         07         08         09         010         02         03         04         05         06         07         08         09         09         010			NFE					TYF DE			
Center 2.44000000 Start 1 2.43500000 Start 1 2.435000000 Start 1 2.435000000 Start 1 2.43500000 Start 1 2.435000000 Start 1 2.435000000 Start 1 2.43500000 Start 1 2.4350000 Start 1 2.43500000 Start 1 2.43500000 Start 1 2.4350000 Start 1 2.43500000 Start 1 2.43500000 Start 1 2.43500000 Start 1 2.43500000 Start 1 2.43500000 Start 1 2.4350000 Start 1 2.43500000 Start 1 2.43500000 Start 1 2.43500000 Start 1 2.43500000 Start 1 2.43500000 Start 1 2.4350000 Start 1 2.43500000 Start 1 2.4350000 Start 1 2.43500000 Start 1 2.4350000 Start 1 2.43500000 Start 1 2.43500000 Start 1 2.4350000 Start 1 2.43500000 Start 1 2.4350000000000 Start 1 2.435000000000000000000000000000000000000	0 dB/div	Ref 20.	00 dBm				Mkr	1 2.439 9.	75 GHz 78 dBm	-	uto i un
2.440000000 2.440000000 3.4000 3.40000000 3.40000000 3.40000000 3.40000000 3.40000000 3.40000000 3.40000000 3.4000000 3.4000000 3.4000 3.4000000 3.4000000 3.4000000 3.4000 3.4000000 3.4000 3.4000000 3.4000000 3.4000 3.400000 3.4000000 3.4000 3.4000000 3.4000 3.400000 3.40000 3.4000 3.4000 3.40000 3.40000 3.40000 3.40000 3.40000 3.40000 3.40000 3.40000 3.40000 3.40000 3.40000 3.40000 3.40000 3.40000 3.40000 3.40000 3.400000 3.4000000 3.40000000 3.4000000000000000000000000000000000000					<b>1</b>					Ce	enter Fre
10         Start I           10         Start I </td <td>0.0</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td> </td> <td></td> <td></td> <td></td> <td></td>	0.0						 				
2.43500000 3.0 3.0 3.0 3.0 3.0 3.0 3.0	.00										
00         Stop 1           00         Stop 1           00         CF 5           1.000000         Auto           00         Freq 0           00         Scale 1           00         Span 10.00 MHz											Start Fre
00         2.445000000           00         CF 3           00         00           00         00           00         Freq O           00         Span 10.00 MHz	0.0									2.4350	100000 GF
00	0.0										Stop Fre
Auto       1.000000         Auto       1.000000         Auto       Freq O         Auto       Span 10.00 MHz	0.0									2.4450	00000 GI
Auto       1.000000         Auto       1.000000         Auto       Freq O         Auto       Span 10.00 MHz											CF Ste
Freq O	).0										
enter 2.440000 GHz Span 10.00 MHz	D.O 0.C									Auto	IVI
enter 2.440000 GHz Span 10.00 MHz										F	req Offs
enter 2.440000 GHz Span 10.00 MHz											0
enter 2.440000 GHz Span 10.00 MHz Log	0.0										
enter 2.440000 GHz Span 10.00 MHz Log										S	cale Typ
Res BMC1 0 MHz #VBM 50 MHz Sween 1 000 ms (1001 nts)								Span 1	0.00 MHz	Log	L
	kes BW	3.0 MHz		#VBW	50 MHz		Sweep 1	.000 ms (	1001 pts)		

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



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

FCC ID: A3LSMG996U	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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	ectrum Analy											_	- 6
RL	RF	50 Ω	DC	CORREC		SEI	SE:INT	#Avg Typ	ALIGN AUTO		M Sep 22, 2020	Fr	equency
		N	IFE	PNO: F IFGain:	ast 🖵 Low	Trig: Free Atten: 30				TYF DE			Auto Tun
) dB/div	Ref 2	0.00 dl	Bm						Mkı	1 2.402 6.	00 GHz 50 dBm		Auto Tui
<sup>a</sup>												0	enter Fre
D.O							1						2000000 GI
.00													
													Start Fre
).0 <b> </b>												2.39	7000000 GI
0.0												2.40	<b>Stop Fr</b> 7000000 GI
0.0													
													CF Ste
).0													.000000 M
0.0												<u>Auto</u>	М
).0													Freq Offs
													0
).0													
													Scale Ty
enter 2.4	402000	GHz								Span 1	0.00 MHz	Log	L
les BW					#VBW	50 MHz			Sweep 1	1.000 ms (	1001 pts)		
3									STATU	s			

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



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

FCC ID: A3LSMG996U	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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	ctrum Analyzer -										
XI RL	RF 50	DΩ DC	CORREC		E:INT	#Avg Typ	ALIGN AUTO e: RMS	TRAC	E 1 2 3 4 5 6	Fr	equency
10 dB/div	Ref 20.0	NFE 0 dBm	PNO: Fast 🖵 IFGain:Low	Trig: Free Atten: 30			Mkr	DE 1 2.479	85 GHz 35 dBm		Auto Tune
- <b>og</b>				1		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~					enter Free
0.00										2.475	Start Free
20.0 <b></b> 30.0 <b></b>										2.48	<b>Stop Fre</b> 5000000 GH
40.0										1 <u>Auto</u>	CF Ste .000000 MH Ma
60.0										i	F <b>req Offs</b> e 0 H
70.0	180000 GH							Snan 1	0.00 MHz		Scale Typ
Res BW		2	#VBW	50 MHz			Sweep 1	.000 ms (	0.00 MH2 1001 pts)		
SG							STATUS				

Plot 7-21. Peak Power Plot (Bluetooth (LE), 1Mbps - Ch. 39)



Plot 7-22. Peak Power Plot (Bluetooth (LE), 2Mbps - Ch. 0)

FCC ID: A3LSMG996U	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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🔤 Keysight Spectrur											
IX/RL I	RF 50 Ω		ORREC		NSE:INT	#Avg Typ	ALIGN AUTO	TRAC	4 Sep 28, 2020 E 1 2 3 4 5 6 E M WWWW	Free	quency
		NFE	PNO: Fast 📮 IFGain:Low	Trig: Free Atten: 30				DE			uto Tune
10 dB/div Ro	ef 20.00 d	Bm					MKr	1 2.440 9.	14 GHz 73 dBm		
					<b>1</b>						enter Freq
10.0										2.4400	00000 GHz
0.00											Start Freq
-10.0										2.4350	00000 GHz
-20.0											Stop Freq
-30.0										2.4450	00000 GHz
-40.0										1.0	CF Step
-50.0										<u>Auto</u>	Man
-60.0										F	req Offset
											0 Hz
-70.0										S	cale Type
Center 2.440 #Res BW 3.0			#\/B\A	/ 50 MHz			Sween_1	Span 1	0.00 MHz 1001 pts)	Log	<u>Lin</u>
MSG	191112		#000	50 WIN2			STATUS		roor 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: A3LSMG996U	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 KDB 558074 D01 v05r02 – Section 8.3.1.3

#### **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: A3LSMG996U	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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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	-0.52	8.0	-8.52
2440	125 kbps	19	LE	2.87	8.0	-5.13
2480	125 kbps	39	LE	1.21	8.0	-6.79
2402	500 kbps	0	LE	-0.70	8.0	-8.70
2440	500 kbps	19	LE	2.99	8.0	-5.01
2480	500 kbps	39	LE	1.37	8.0	-6.63
2402	1 Mbps	0	LE	-9.70	8.0	-17.70
2440	1 Mbps	19	LE	-6.16	8.0	-14.16
2480	1 Mbps	39	LE	-7.72	8.0	-15.72
2402	2 Mbps	0	LE	-11.96	8.0	-19.96
2440	2 Mbps	19	LE	-8.43	8.0	-16.43
2480	2 Mbps	39	LE	-10.04	8.0	-18.04

Table 7-4. Conducted Power Density Measurements

FCC ID: A3LSMG996U	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)



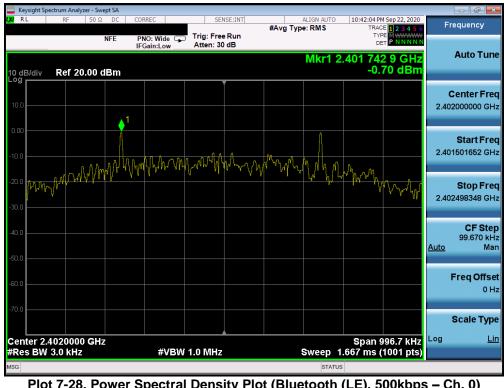
Plot 7-26. Power Spectral Density Plot (Bluetooth (LE), 125kbps - Ch. 19)

FCC ID: A3LSMG996U	PCTEST 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 56
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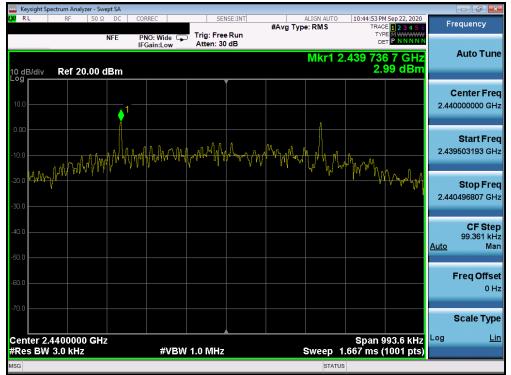
Plot 7-27. Power Spectral Density Plot (Bluetooth (LE), 125kbps - Ch. 39)



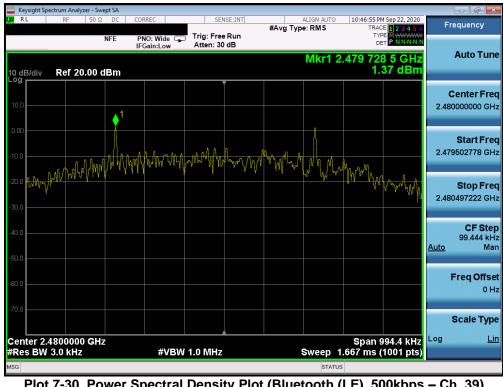
Plot 7-28. Power Spectral Density Plot (Bluetooth (LE), 500kbps - Ch. 0)

FCC ID: A3LSMG996U	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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Plot 7-29. Power Spectral Density Plot (Bluetooth (LE), 500kbps - Ch. 19)



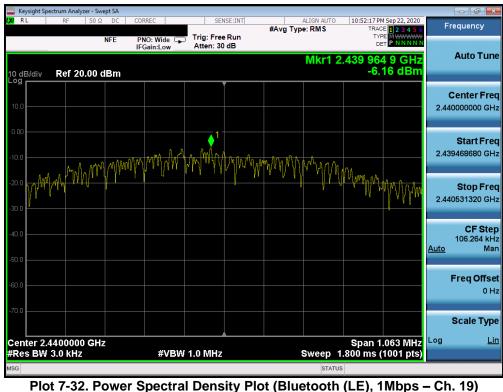
Plot 7-30. Power Spectral Density Plot (Bluetooth (LE), 500kbps - Ch. 39)

FCC ID: A3LSMG996U	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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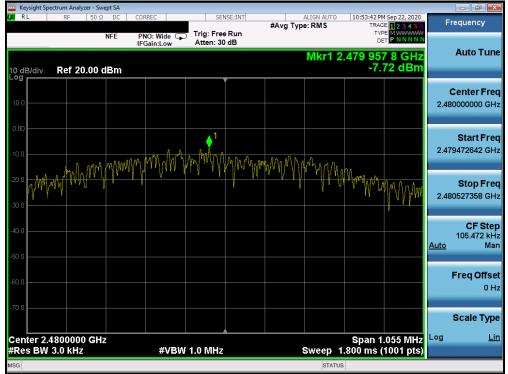
🔤 Keysight Spectrum Analyzer - Swept SA 👘				
IXI RE S0Ω DC	CORREC SENS	#Avg Type: RMS	0 10:50:14 PM Sep 22, 2020 TRACE 1 2 3 4 5 6	Frequency
10 dB/div Ref 20.00 dBm	PNO: Wide Trig: Free I IFGain:Low Atten: 30 d	lВ	2.401 972 6 GHz -9.70 dBm	Auto Tune
10.0				Center Freq 2.402000000 GHz
-10.0	1 1000 MM MM MM MM	Mr. Mar. Mar M. A. Mar and a real and a	<u>л Ль</u>	Start Freq 2.401473128 GHz
-20.0 -30.0			HANNA WAA	<b>Stop Freq</b> 2.402526872 GHz
-40.0				CF Step 105.374 kH: <u>Auto</u> Mar
60.0				Freq Offse 0 H:
Center 2.4020000 GHz #Res BW 3.0 kHz	#VBW 1.0 MHz	Sween	Span 1.054 MHz 1.800 ms (1001 pts)	Scale Type Log <u>Lir</u>
MSG		STA		

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

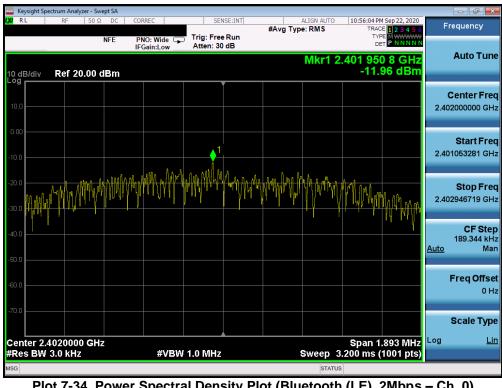


FCC ID: A3LSMG996U	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 22 of 56
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Plot 7-33. Power Spectral Density Plot (Bluetooth (LE), 1Mbps - Ch. 39)



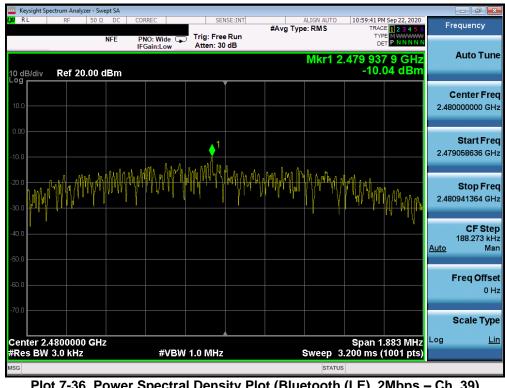
Plot 7-34. Power Spectral Density Plot (Bluetooth (LE), 2Mbps - Ch. 0)

FCC ID: A3LSMG996U	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 56
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Keysight Spectrum Analyzer - Swept SA				
🗶 RE S0Ω DC		#Avg Type		123456 Frequency
10 dB/div <b>Ref 20.00 dBm</b>	PNO: Wide Trig: Fre IFGain:Low Atten: 3	0 dB	DET Mkr1 2.439 943	3 GHz Auto Tune 3 dBm
10.0				Center Fred 2.440000000 GHz
-10.0	1 1	h an an an line la	Anna	Start Free 2.439055033 GH:
		<u>a ma b' tra strattara dina</u> A ma b' tra strattara dina		<b>Stop Fred</b> 2.440944967 GH:
40.0				CF Stej 188.993 kH <u>Auto</u> Ma
60.0				Freq Offse 0 H
-70.0 Center 2.4400000 GHz #Res BW 3.0 KHz	#VBW 1.0 MHz		Span 1.3 Sweep 3.200 ms (1	Scale Type 890 MHz <sup>Log <u>Lir</u> 001 pto)</sup>
	#VBW 1.0 MHz		status	

Plot 7-35. Power Spectral Density Plot (Bluetooth (LE), 2Mbps - Ch. 19)



Plot 7-36. Power Spectral Density Plot (Bluetooth (LE), 2Mbps - Ch. 39)

FCC ID: A3LSMG996U	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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## 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: A3LSMG996U	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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	sight Spe																			
l <mark>X/</mark> RL		RF		50 Ω	DC	COR	REC			SEN	SE:INT	#	Avg Typ	ALIGN AUTO e: RMS	) 1		PM Sep 22, 2 ACE 1 2 3 4		F	requency
10 dE	3/div	Ref	20.0		IFE Bm	PN IFG	O: Wi ain:Lo	de 🖵 ow		: Free en: 30				Δ	Mk	r1 3.	992 M			Auto Tune
Log -														~ <sup>1</sup> /	<b>\2</b> — Դ					Center Freq 00000000 GHz
0.00 · -10.0 ·																			2.3	Start Freq 96000000 GHz
-20.0 + -30.0 +													$\checkmark$			h	,		2.4	Stop Freq 04000000 GHz
-40.0 +					X	,					- Held Comment	4							<u>Auto</u>	CF Step 800.000 kH: Mar
-60.0	<b>hi</b> nterfacente	ud (minis	hill ar an bi	(halin)	HIMMA	Waldy	United a	4	<b>6  ,  ,  </b> 0,   ,	uurikiji								A de la		Freq Offse 0 H:
	ter 2.4			Hz												Span :	8.000 M	Hz	Log	Scale Type
_	s BW	100	٢Hz				#	VBW	300	kHz					13.3	3 ms	(2001 p	ots)		
//SG														STAT	US					

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



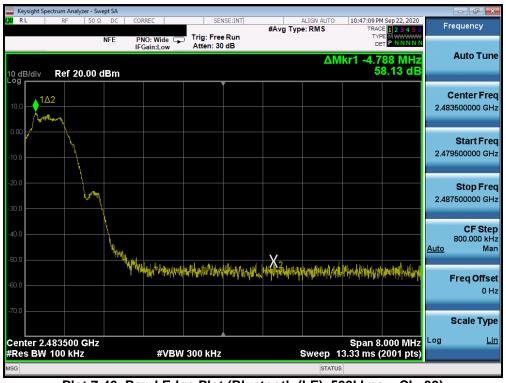
Plot 7-38. Band Edge Plot (Bluetooth (LE), 125kbps – Ch. 39)

FCC ID: A3LSMG996U	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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Keysight Spectrum Analyzer - Swept SA				
X/RL RF 50Ω DC	CORREC SENSE:IN	#Avg Type: RMS	TRACE 1 2 3 4 5 6	Frequency
NFE 10 dB/div Ref 20.00 dBm	PNO: Wide 🖵 Trig: Free Run IFGain:Low Atten: 30 dB		Mkr1 2.152 MHz 56.20 dB	Auto Tune
10.0		1Δ2 - /w#/hw-		Center Freq 2.400000000 GHz
-10.0				Start Freq 2.396000000 GHz
-30.0		And the		<b>Stop Freq</b> 2.404000000 GHz
-40.0				CF Step 800.000 kHz <u>Auto</u> Man
-60.0	ndelaftarlandikanya japanya Minar Addibil	d.	"m <sub>e</sub> hhu	Freq Offset 0 Hz
Center 2.400000 GHz			Span 8.000 MHz	Scale Type
#Res BW 100 kHz	#VBW 300 kHz	Sweep	13.33 ms (2001 pts)	

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



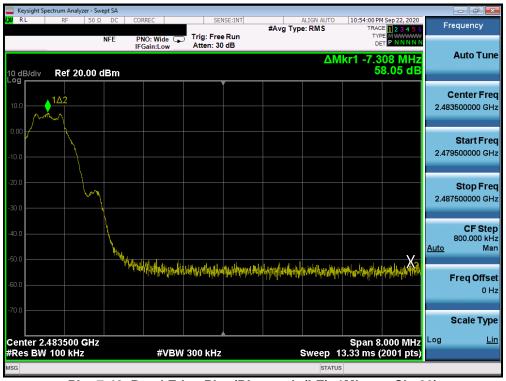
Plot 7-40. Band Edge Plot (Bluetooth (LE), 500kbps – Ch. 39)

FCC ID: A3LSMG996U	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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Keysight Spectrum A										
🗶 RL RF	50 Ω DC	CORREC	SEN	ISE:INT	#Avg Typ	ALIGN AUTO e: RMS		M Sep 22, 2020	Fi	equency
10 dB/div Ref	NFE 20.00 dBm	PNO: Wide G	Trig: Free Atten: 30			ΔΝ	DE //kr1 2.0	32 MHz 5.57 dB		Auto Tune
10.0						1Δ2				Center Fred 0000000 GHz
-10.0						/ \			2.39	<b>Start Fred</b> 6000000 GH;
-20.0							h		2.40	<b>Stop Fred</b> 4000000 GH:
-40.0			×	aw				Maria and	<u>Auto</u>	CF Stej 800.000 kH Mai
-60.0	ndrija je kaji de konstrukcije de konstrukcije de konstrukcije de konstrukcije de konstrukcije de konstrukcije Na na	nternet en televiseten det	hiyikaryon VoyVM	¥¶" '				healaffa		Freq Offse 0 H
-70.0 Center 2.4000							Span 8	.000 MHz	Log	Scale Type Lir
#Res BW 100	KHZ	#VBW	/ 300 kHz			sweep 1	3.33 ms (	2001 pts)		

Plot 7-41. Band Edge Plot (Bluetooth (LE), 1Mbps - Ch. 0)



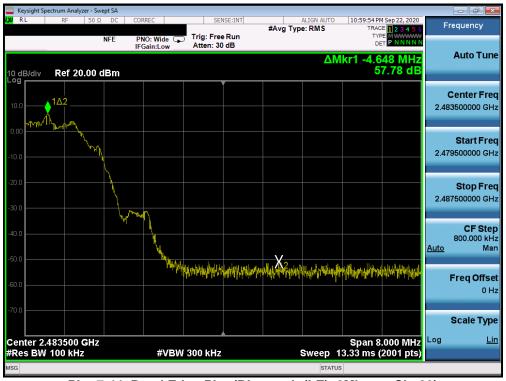
Plot 7-42. Band Edge Plot (Bluetooth (LE), 1Mbps – Ch. 39)

FCC ID: A3LSMG996U	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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Plot 7-43. Band Edge Plot (Bluetooth (LE), 2Mbps - Ch. 0)



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

FCC ID: A3LSMG996U	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: A3LSMG996U	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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#### Test Notes

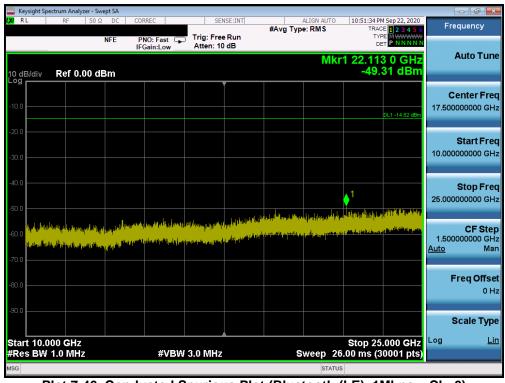
- 1. RBW was set to 1MHz rather than 100kHz in order to increase the measurement speed.
- 2. The display line shown in the following plots denotes the limit at 20dB below the fundamental emission level measured in a 100kHz bandwidth. However, since the traces in the following plots are measured with 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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		/zer - Swept SA										
XI RL	RF	50 Ω DC	CORREC		SEN	NSE:INT	#Avg Typ	ALIGN AUTO e: RMS		M Sep 22, 2020 CE 1 2 3 4 5 6	Frequ	ency
		NFE	PNO: IFGair	Fast 🖵 n:Low	Trig: Free Atten: 30				TY D		_	
10 dB/div Log	Ref 20	0.00 dBm	1					Μ	lkr1 4.96 -34.	6 5 GHz 21 dBm	Au	to Tune
10.0											Cent 5.015000	t <b>er Frec</b> 1000 GH2
-10.0										DL1 -14.82 dBm		art Fred 1000 MH:
-20.0						1					St 10.000000	op Fred 1000 GH:
-40.0 الارابيون -50.0 -50.0	non alter av tere Maria av tere	New York of the State State	alaanaa art						an a	a alatha galay ditar Taribu a ditar ditar	997.000 <u>Auto</u>	CF Stej 1000 MH Mai
60.0											Fre	q Offse 0 H
-70.0 Start 30	MHz _								Stop_10	.000 GHz	Sca Log	ile Type <u>Lir</u>
#Res BW	/ 1.0 MH	Z		#VBW	3.0 MHz		s		8.00 ms (:	80001 pts)		
ISG								STAT	US			

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



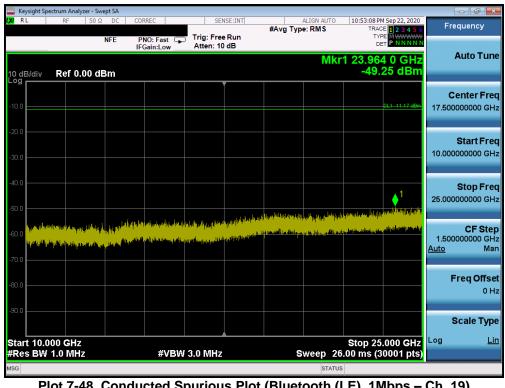
Plot 7-46. Conducted Spurious Plot (Bluetooth (LE), 1Mbps - Ch. 0)

FCC ID: A3LSMG996U	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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		alyzer - Swe											di X
KN RL	RF	50 Ω	DC	CORR	EC		SENSE:INT	#Avg 1	ALIGN AUT		PM Sep 22, 2020	Frequer	ncy
10 dB/div	Ref	20.00 d	NFE	PN0 IFGa	0:Fast ( ain:Low		Free Run n: 30 dB		N	/kr1 5.26		Auto	Tune
		20.00 4										Cente 5.0150000	
-10.0											DL111.17 dBm	Stai 30.0000	<b>t Freq</b> 00 MHz
-20.0							1-					<b>Sto</b> 10.0000000	p Freq 00 GHz
-40.0	լույններին Անդիններին	ten gar tepesikî Şan skiholdatî	n jarii Marii	(nin pype) Mitting of	lord tana an sa ang ta	An Bashion Markath		ante d'Annata de Altra Regestare	din print dist.	hdi an de la gran de se de la deserva de Na deserva de la deserva de	the childrane treat the Physicilary of the children of the contract of the con	CI 997.0000 <u>Auto</u>	F Step 00 MHz Man
-50.0												Freq	Offsel 0 Hz
-70.0	Dalla.									Oton 4		Scale	e Type Lin
Start 30 #Res BW		Hz			#VB	W 3.0 N	IHz		Sweep	500 1 18.00 ms (	0.000 GHz 30001 pts)		
MSG									STA	TUS			

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



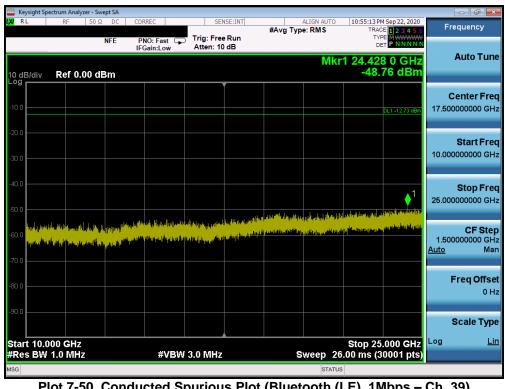
Plot 7-48. Conducted Spurious Plot (Bluetooth (LE), 1Mbps - Ch. 19)

FCC ID: A3LSMG996U	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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	n Analyzer - Swept SA					
X/RL R	RF 50 Ω DC	CORREC	SENSE:INT	ALIGN #Avg Type: RM		2 3 4 5 6 Frequency
10 dB/div Re	NFE ef 20.00 dBm	PNO: Fast 🕞	Trig: Free Run Atten: 30 dB		Mkr1 3.854 5 -34.84	GHZ Auto Tune
10.0						<b>Center Freq</b> 5.015000000 GHz
-10.0					0L1 -	Start Freq 30.000000 MHz
-20.0						<b>Stop Freq</b> 10.000000000 GHz
-40.0		dythene segret af det hinne and it.			gin yang ditentek petergalan di a	CF Step 997.000000 MHz <u>Auto</u> Man
-60.0						Freq Offsel 0 Hz
-70.0 Start 30 MHz					Stop 10.00	Scale Type
#Res BW 1.0		#VBW	3.0 MHz	Swee	p 18.00 ms (3000	o Giliz
MSG					STATUS	

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.

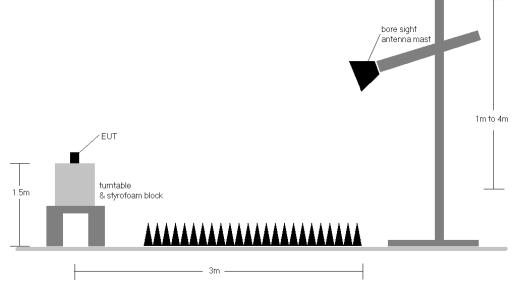


Figure 7-6. Radiated Test Setup >1GHz

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

#### 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

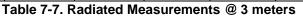
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# Radiated Spurious Emission Measurements §15.205 §15.209 §15.247(d); RSS-Gen [8.9]

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	Н	-	-	-78.61	5.84	34.23	53.98	-19.75
4804.00	Peak	Н	-	-	-66.61	5.84	46.23	73.98	-27.75
12010.00	Avg	н	-	-	-81.34	17.74	43.40	53.98	-10.58
12010.00	Peak	н	-	-	-69.49	17.74	55.25	73.98	-18.73



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	н	-	-	-78.78	6.09	34.31	53.98	-19.67
4880.00	Peak	н	-	-	-67.11	6.09	45.98	73.98	-28.00
7320.00	Avg	н	-	-	-80.40	12.06	38.66	53.98	-15.32
7320.00	Peak	н	-	-	-68.62	12.06	50.44	73.98	-23.54
12200.00	Avg	н	-	-	-81.56	16.86	42.30	53.98	-11.68
12200.00	Peak	н	-	-	-69.94	16.86	53.92	73.98	-20.06

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	Н	-	-	-78.84	6.60	34.76	53.98	-19.22
4960.00	Peak	н	-	-	-67.01	6.60	46.59	73.98	-27.39
7440.00	Avg	н	-	-	-80.31	11.54	38.23	53.98	-15.75
7440.00	Peak	Н	-	-	-68.66	11.54	49.88	73.98	-24.10
12400.00	Avg	н	-	-	-81.36	17.21	42.85	53.98	-11.13
12400.00	Peak	Н	-	-	-69.39	17.21	54.82	73.98	-19.16

Table 7-9. Radiated Measurements @ 3 meters

FCC ID: A3LSMG996U	Proud to be part of (e) element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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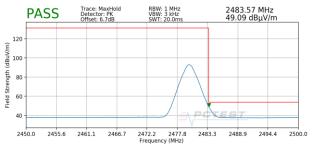
## 7.8 Radiated Restricted Band Edge Measurements §15.209; RSS-Gen [8.9]

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

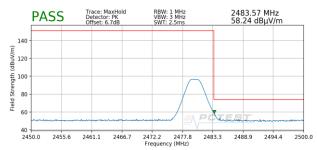
The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	LE
Measurement Distance:	3 Meters
Operating Frequency:	2480MHz
Channel:	39



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



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

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#### 7.9 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 7-10. Conducted Limits

\*Decreases with the logarithm of the frequency.

#### **Test Procedures Used**

ANSI C63.10-2013, Section 6.2

#### Test Settings

#### **Quasi-Peak Field Strength Measurements**

- 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

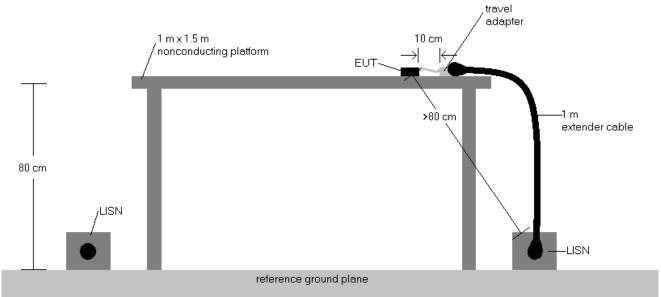
- 1. Analyzer center frequency was set to the frequency of the spurious emission of interest
- 2. RBW = 9kHz (for emissions from 150kHz 30MHz)
- 3. Detector = RMS
- 4. Sweep time = auto couple
- 5. Trace mode = max hold
- 6. Trace was allowed to stabilize

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#### Test Setup

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



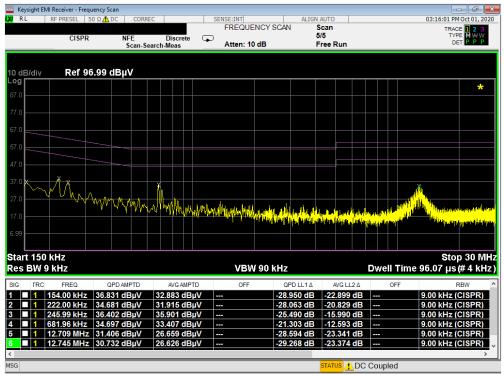


#### Test Notes

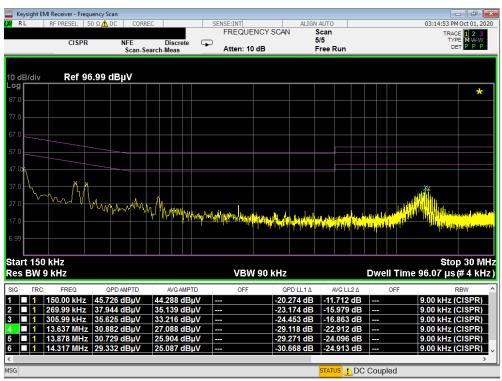
- All modes of operation were investigated and the worst-case emissions are reported using mid channel. The emissions found were not affected by the choice of channel used during testing.
- 2. The limit for an intentional radiator from 150kHz to 30MHz are specified in Part 15.207 and RSS-Gen (8.8).
-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

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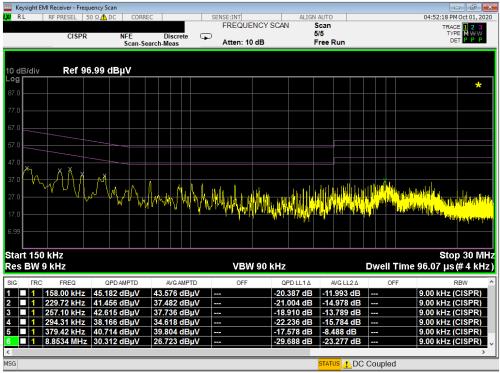
Plot 7-53. Line Conducted Plot with Bluetooth LE (L1)



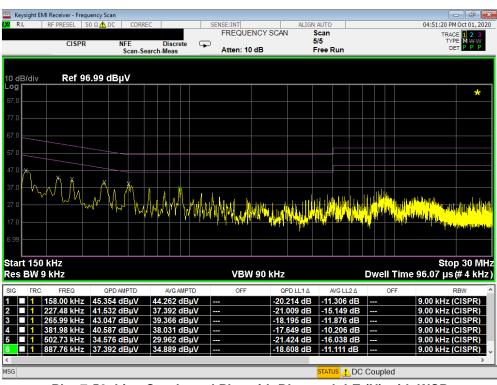
Plot 7-54. Line Conducted Plot with Bluetooth LE (N)

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Plot 7-55. Line Conducted Plot with Bluetooth LE (L1) with WCP



Plot 7-56. 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: A3LSMG996U** 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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