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MEASUREMENT REPORT FCC PART 15.247 Bluetooth

Applicant Name:

Samsung Electronics Co., Ltd. 129, Samsung-ro, Yeongtong-gu, Suwon-si Gyeonggi-do, 16677, Korea Date of Testing: 9/28/2020-12/07/2020 Test Site/Location: PCTEST Lab. Columbia, MD, USA Test Report Serial No.: 1M2009280154-13.A3L

FCC ID:

A3LSMG998B

Certification

APPLICANT:

Samsung Electronics Co., Ltd.

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

SM-G998B/DS SM-G998B Portable Handset 123.310 mW (20.91 dBm) Peak Conducted 2402 – 2480MHz GFSK, π /4-DQPSK, 8DPSK FCC Part 15 Spread Spectrum Transmitter (DSS) Part 15 Subpart C (15.247) 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. 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: A3LSMG998B**. The test data contained in this report pertains only to the emissions due to the EUT's Bluetooth transmitter.

- This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following:
 - A) The hopping sequence is pseudorandom
 - B) All channels are used equally on average
 - C) The receiver input bandwidth equals the transmit bandwidth
 - D) The receiver hops in sequence with the transmit signal
- 15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.
- 15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate its channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.
- 15.247(h): The EUT employs Adaptive Frequency Hopping (AFH) which identifies sources of interference namely devices
 operating in 802.11 WLAN and excludes them from the list of available channels. The process of re-mapping reduces the
 number of test channels from 79 channels to a minimum number of 20 channels.

Test Device Serial No.: 0198M, 0107M, 0198R

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 5G NR (n5, n66), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax(6E) UNII, Bluetooth (1x, EDR, LE), NFC, Wireless Power Transfer, UWB

Ch.	Frequency (MHz)	
00	2402	
:	:	
39	2441	
:	:	
78	2480	

Table 2-1. Frequency/ Channel Operations

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.

2.3 Antenna Description

Following antenna was used for the testing.

Frequency [GHz]	ANT 1 Gain [dBi]	ANT 2 Gain [dBi]
2.4	-3.5	-4.2

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. ANSI C63.10-2013 was also used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Sections AC Line Conducted Emissions for AC line conducted emissions test setups, 3.3 for radiated emissions test setups, and 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, and 7.8 for antenna port conducted emissions test setups. The worst case radiated emissions data is shown in this report.

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 Software and Firmware

The test was conducted with firmware version G998BXXE0ATKA installed on the EUT.

2.6 EMI Suppression Device(s)/Modifications

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

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3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedure described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) was used in the measurement of the EUT.

Deviation from measurement procedure.....None

3.2 AC Line Conducted Emissions

The line-conducted facility is located inside a 10'x16'x9' shielded enclosure. The shielded enclosure is manufactured by ETS Lindgren RF 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 the 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 7.12. 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 antennas of the EUT are permanently attached.
- There are no provisions for connection to an external antenna.

Conclusion:

The EUT complies with the requirement of §15.203.

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5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.13
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
~	BT1	Bluetooth Cable Set	9/16/2020	Annual	9/16/2021	BT1
Agilent	N4010A	Wireless Connectivity Test Set	12	N/A		GB46170464
Anritsu	ML2495A	Power Meter	12/17/2019	Annual	12/17/2020	941001
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
Emco	3116	Horn Antenna (18 - 40GHz)	8/7/2018	Triennial	8/7/2021	9203-2178
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	2/14/2019	Biennial	2/14/2021	125518
ETS-Lindgren	3816/2NM	LISN	7/9/2020	Biennial	7/9/2022	114451
ETS-Lindgren	3115	Double Ridged Guide Horn 750MHz - 18GHz	3/12/2020	Biennial	3/12/2022	150693
Keysight Technologies	N9020A	MXA Signal Analyzer	8/14/2020	Annual	8/14/2021	US46470561
Keysight Technologies	N9038A	MXE EMI Receiver	8/11/2020	Annual	8/11/2021	MY51210133
Keysight Technologies	N9030A	PXA Signal Analyzer (44GHz)	8/17/2020	Annual	8/17/2021	MY52350166
Keysight Technologies	N9020A	MXA Signal Analyzer	9/22/2020	Annual	9/22/2021	MY54500644
Pasternack	NMLC-2	Line Conducted Emissions Cable (NM)	1/9/2020	Annual	1/9/2021	NMLC-2
Rohde & Schwarz	CMU200	Base Station Simulator		N/A		107826
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	7/15/2020	Annual	7/15/2021	100342
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	9/9/2020	Annual	9/9/2021	100348
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	8/10/2020	Annual	8/10/2021	103200
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	2/10/2020	Annual	2/10/2021	102134
Solar Electronics	8012-50-R-24-BNC	Line Impedance Stabilization Network	10/1/2019	Biennial	10/1/2021	310233
Sunol	DRH-118	Horn Antenna (1-18GHz)	10/3/2019	Biennial	10/3/2021	A050307
Sunol Science	JB5	Bi-Log Antenna (30M - 5GHz)	7/27/2020	Biennial	7/27/2022	A051107

Table 6-1. Annual Test Equipment Calibration Schedule

Notes:

- 1. 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.
- 2. Equipment with a calibration date of "N/A" shown in this list was not used to make direct calibrated measurements.

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7.0 TEST RESULTS

7.1 Summary

Company Name:	Samsung Electronics Co., Ltd.
FCC ID:	A3LSMG998B
Method/System:	Frequency Hopping Spread Spectrum (FHSS)
Number of Channels:	79

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(1)(iii)	RSS-247 [5.1(1)]	20dB Bandwidth	N/A		PASS	Section 7.2
15.247(b)(1)	RSS-247 [5.4(2)]	Peak Transmitter Output Power	< 1 Watt if <u>></u> 75 non- overlapping channels used		PASS	Section 7.3
15.247(a)(1)	RSS-247 [5.1(2)]	Channel Separation	> 2/3 of 20 dB BW for systems with Output Power < 125mW	CONDUCTED	PASS	Section 7.5
15.247(a)(1)(iii)	RSS-247 [5.1(4)]	Number of Channels	> 15 Channels		PASS	Section 7.7
15.247(a)(1)(iii)	RSS-247 [5.1(4)]	Time of Occupancy	< 0.4 sec in 31.6 sec period		PASS	Section 7.6
15.247(d)	RSS-247 [5.5]	Band Edge / Out-of-Band Emissions	Conducted > 20dBc		PASS	Section 7.4, Section 7.8
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-247 limits)	RADIATED	PASS	Section 7.9, Section 7.10, Section 7.11
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits (RSS-Gen [8.8] limits)	LINE CONDUCTED	PASS	Section 7.12

Table 7-1. Summary of Test Results

Notes:

- 1) All modes of operation and data rates 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, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT 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, attenuators, and couplers.
- 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 "BT Auto," Version 3.5.
- 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 20dB Bandwidth Measurement

<u>§15.247 (a.1.iii); RSS-247 [5.1(1)]</u>

Test Overview and Limit

The bandwidth at 20dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

Test Procedure Used

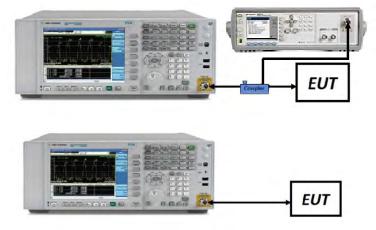
ANSI C63.10-2013 – Section 6.9.2

Test Settings

- The signal analyzers' automatic bandwidth measurement capability of the spectrum analyzer was used to perform the 20dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 20. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
- 2. RBW = 1 5% OBW
- 3. VBW \geq 3 x RBW
- 4. Reference level set to keep signal from exceeding maximum input mixer level for linear operation.
- 5. Detector = Peak
- 6. Trace mode = max hold
- 7. Sweep = auto couple
- 8. The trace was allowed to stabilize

Test Setup

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





Test Note None

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Frequency [MHz]	Data Rate [Mbps]	Channel No.	20dB Bandwidth Test Results [kHz]
2402	1.0	0	1021.00
2441	1.0	39	1009.00
2480	1.0	78	993.80
2402	2.0	0	1334.00
2441	2.0	39	1328.00
2480	2.0	78	1317.00
2402	3.0	0	1279.00
2441	3.0	39	1308.00
2480	3.0	78	1326.00

Table 7-2. Conducted 20dB Bandwidth Measurements-ANT 1



Plot 7-1. 20dB Bandwidth Plot (Bluetooth, 1Mbps - Ch. 0) -ANT 1

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Plot 7-2. 20dB Bandwidth Plot (Bluetooth, 1Mbps - Ch. 39) -ANT 1



Plot 7-3. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 78) -ANT 1

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Plot 7-4. 20dB Bandwidth Plot (Bluetooth, 2Mbps - Ch. 0) -ANT 1



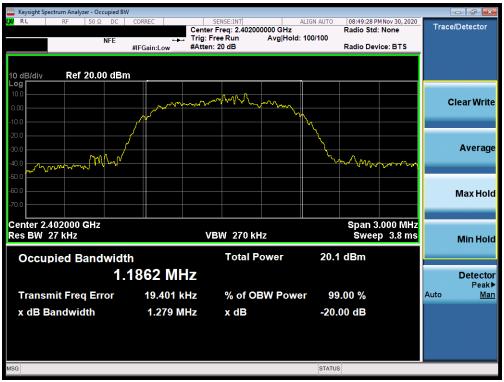
Plot 7-5. 20dB Bandwidth Plot (Bluetooth, 2Mbps - Ch. 39) -ANT 1

FCC ID: A3LSMG998B	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dogo 15 of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset		Page 15 of 109
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Plot 7-6. 20dB Bandwidth Plot (Bluetooth, 2Mbps - Ch. 78) -ANT 1



Plot 7-7. 20dB Bandwidth Plot (Bluetooth, 3Mbps - Ch. 0) -ANT 1

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dega 16 of 100
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Plot 7-9. 20dB Bandwidth Plot (Bluetooth, 3Mbps – Ch. 78) -ANT 1

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 17 of 100
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Frequency [MHz]	Data Rate [Mbps]	Channel No.	20dB Bandwidth Test Results
2402	1.0	0	1021.00
2441	1.0	39	918.40
2480	1.0	78	913.30
2402	2.0	0	1327.00
2441	2.0	39	1332.00
2480	2.0	78	1347.00
2402	3.0	0	1295.00
2441	3.0	39	1292.00
2480	3.0	78	1328.00





Plot 7-10. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 0) -ANT 2

FCC ID: A3LSMG998B	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dega 19 of 100
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Plot 7-11. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 39) -ANT 2



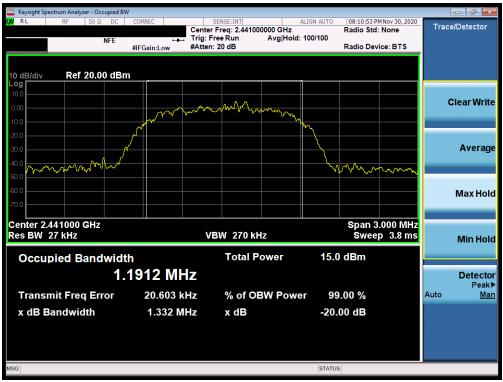
Plot 7-12. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 78) -ANT 2

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 10 of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset		Page 19 of 109
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Plot 7-13. 20dB Bandwidth Plot (Bluetooth, 2Mbps - Ch. 0) -ANT 2



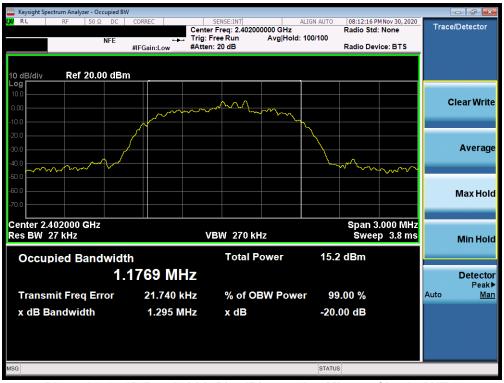
Plot 7-14. 20dB Bandwidth Plot (Bluetooth, 2Mbps – Ch. 39) -ANT 2

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dega 20 of 100
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Plot 7-15. 20dB Bandwidth Plot (Bluetooth, 2Mbps - Ch. 78) -ANT 2



Plot 7-16. 20dB Bandwidth Plot (Bluetooth, 3Mbps – Ch. 0) -ANT 2

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Daga 21 of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset		Page 21 of 109
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Test Report S/N:	Test Dates:	EUT Type:		Dage 22 of 100
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7.3 Output Power Measurement §15.247 (b.1); RSS-247 [5.4(2)]

Test Overview and Limits

Measurement is made while the EUT is operating in non-hopping transmission mode. The powers shown below were measured using a spectrum analyzer with a Bluetooth signaling test set (Agilent Model: N4010A) used only to maintain a Bluetooth link with the EUT. Average power measurements are performed using the analyzer's "burst power" function with RBW = 3MHz. The burst power function triggers on a single set burst set to maximum power and measures the maximum average power on the on-time.

The maximum permissible output power is 1 Watt.

Test Procedure Used

ANSI C63.10-2013 – Section 7.8.5 ANSI C63.10-2013 – Section 11.9.2.3.2 method AVGPM-G

Test Settings

Peak Power Measurement

- 1. Span = approximately 5x 20dB bandwidth, centered on hopping channel
- 2. RBW > 20dB bandwidth of emission being measured
- 3. VBW ≥ RBW
- 4. Sweep = auto
- 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

<u>Note</u>

This unit was tested with all possible data rates and the highest peak power is reported with the unit transmitting at 1Mbps. The EUT was tested for the average power with a broadband power meter for reporting purposes only. Final results were obtained using calibrated couplers, attenuators and cables. The following formula was used:

Output Power (dBm) = Raw Analyzer Level (dBm) + Cable Loss (dB) + Loss in Directional Coupler/Insertion Loss (dB)

FCC ID: A3LSMG998B	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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	Data					nducted wer	-	nducted wer
Frequency [MHz]	Rate [Mbps]	Mod.	Power Scheme	Channel No.	[dBm]	[mW]	[dBm]	[mW]
2402	1.0	GFSK	ePA	0	17.78	60.007	17.22	52.684
2441	1.0	GFSK	ePA	39	16.06	40.327	15.70	37.166
2480	1.0	GFSK	ePA	78	16.26	42.306	15.85	38.443
2402	2.0	π/4-DQPSK	ePA	0	15.90	38.922	13.03	20.093
2441	2.0	π/4-DQPSK	ePA	39	16.23	41.957	13.32	21.465
2480	2.0	π/4-DQPSK	ePA	78	17.09	51.145	14.07	25.515
2402	3.0	8DPSK	ePA	0	17.05	50.687	13.77	23.827
2441	3.0	8DPSK	ePA	39	16.79	47.797	13.50	22.371
2480	3.0	8DPSK	ePA	78	17.69	58.749	14.19	26.242

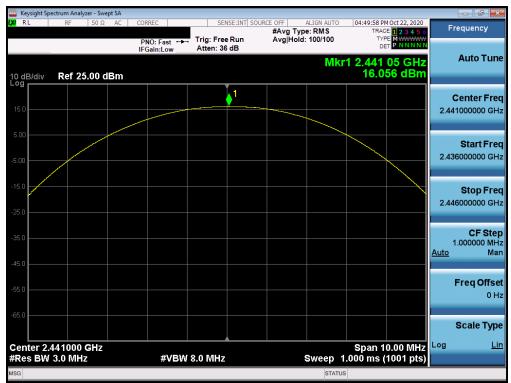
Table 7-4. Conducted Output Power Measurements-ANT 1



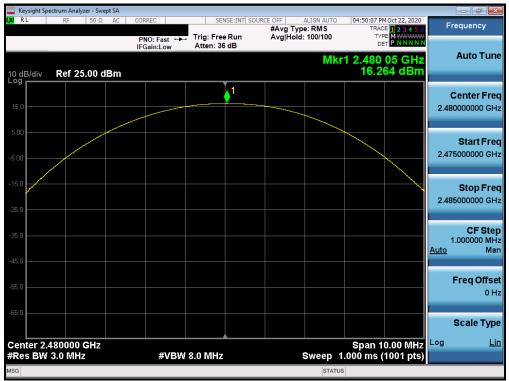
Plot 7-19. Peak Conducted Power (1Mbps – Ch. 0) -ANT 1

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
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Plot 7-20. Peak Conducted Power (1Mbps - Ch. 39) -ANT 1



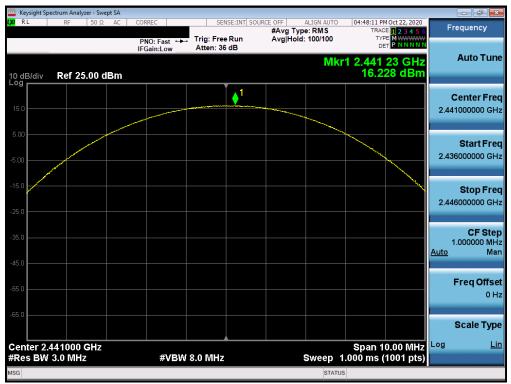
Plot 7-21. Peak Conducted Power (1Mbps – Ch. 78) -ANT 1

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 25 of 100
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Plot 7-22. Peak Conducted Power (2Mbps - Ch. 0) -ANT 1



Plot 7-23. Peak Conducted Power (2Mbps – Ch. 39) -ANT

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dega 26 of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset		Page 26 of 109
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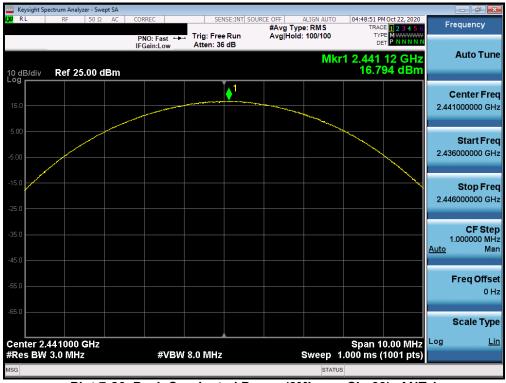
Plot 7-24. Peak Conducted Power (2Mbps - Ch. 78) -ANT 1



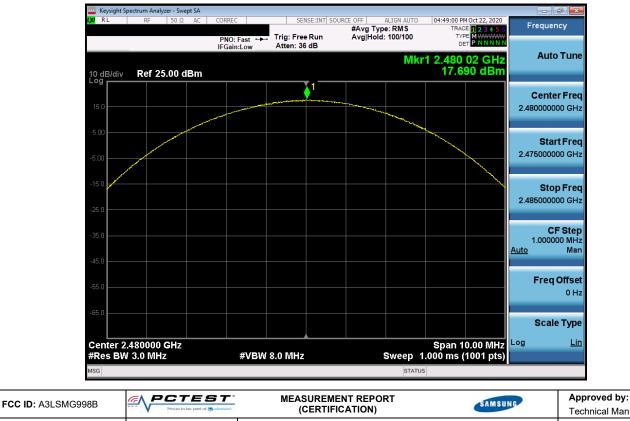
Plot 7-25. Peak Conducted Power (3Mbps - Ch. 0) -ANT 1

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 07 of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset		Page 27 of 109
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Plot 7-26. Peak Conducted Power (3Mbps – Ch. 39) -ANT 1



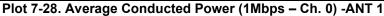
FCC ID: ASESING998B	Proud to be part of @ eloment	(CERTIFICATION)	Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Page 28 of 109
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset	Fage 20 01 109
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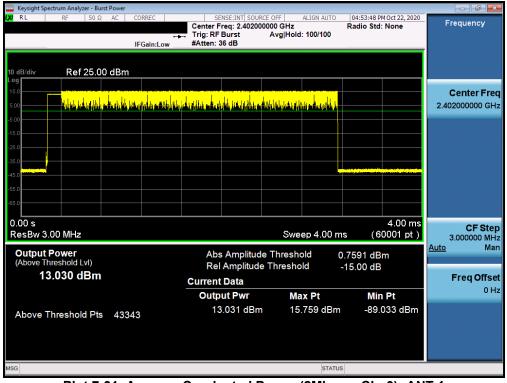


FCC ID: A3LSMG998B	Provid to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 20 of 100
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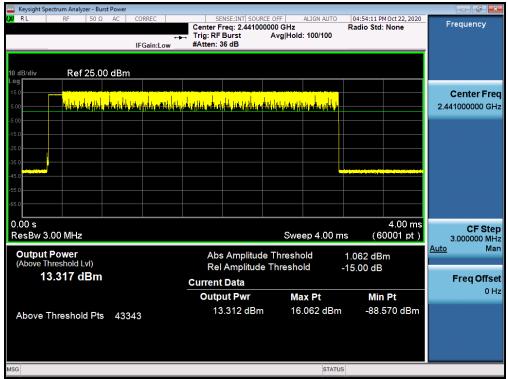




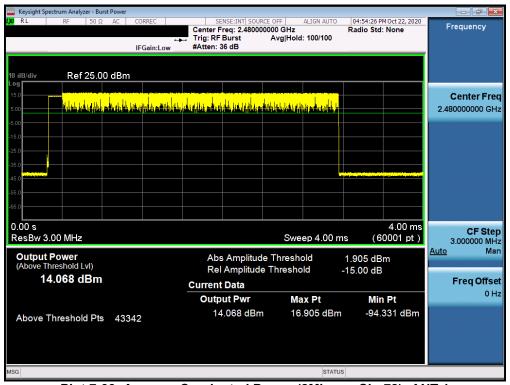


FCC ID: A3LSMG998B	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 20 of 100
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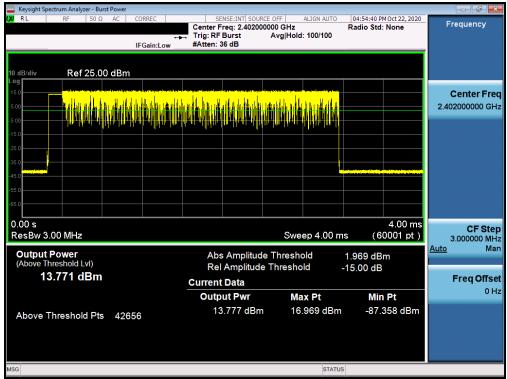
Plot 7-32. Average Conducted Power (2Mbps - Ch. 39) -ANT 1



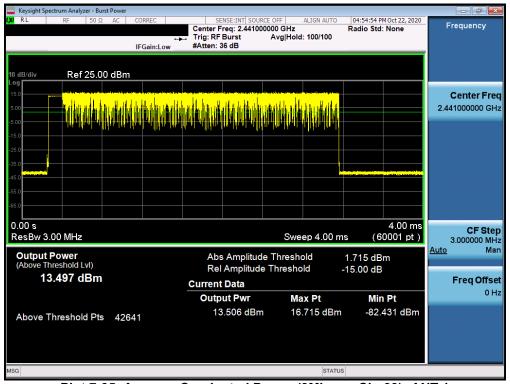
Plot 7-33. Average Conducted Power (2Mbps – Ch. 78) -ANT 1

FCC ID: A3LSMG998B	Provid to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 21 of 100
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Plot 7-34. Average Conducted Power (3Mbps - Ch. 0) -ANT 1



Plot 7-35. Average Conducted Power (3Mbps - Ch. 39) -ANT 1

FCC ID: A3LSMG998B			SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dega 22 of 100
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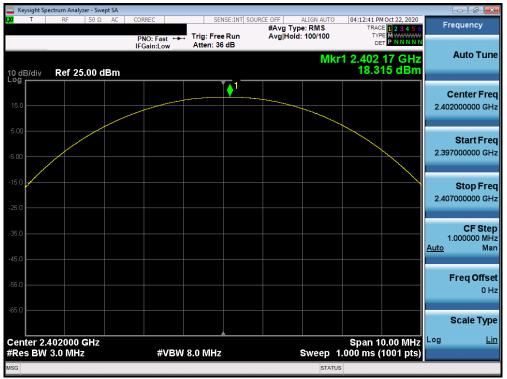
Plot 7-36. Average Conducted Power (3Mbps – Ch. 78)-ANT 1

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dega 22 of 100
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Frequency	Data Rate	Mod.	Power Channel			nducted wer	-	nducted wer
[MHz]	[Mbps]	widd.	Scheme	No.	[dBm]	[mW]	[dBm]	[mW]
2402	1.0	GFSK	ePA	0	18.32	67.842	17.87	61.222
2441	1.0	GFSK	ePA	39	18.09	64.432	17.79	60.069
2480	1.0	GFSK	ePA	78	17.78	60.021	17.40	55.013
2402	2.0	π/4-DQPSK	ePA	0	16.72	46.957	14.22	26.446
2441	2.0	π/4-DQPSK	ePA	39	17.48	56.014	14.64	29.139
2480	2.0	π/4-DQPSK	ePA	78	17.97	62.647	14.93	31.104
2402	3.0	8DPSK	ePA	0	18.15	65.298	14.92	31.073
2441	3.0	8DPSK	ePA	39	18.06	64.003	14.71	29.564
2480	3.0	8DPSK	ePA	78	18.50	70.713	14.98	31.487

Table 7-5. Conducted Output Power Measurements-ANT 2



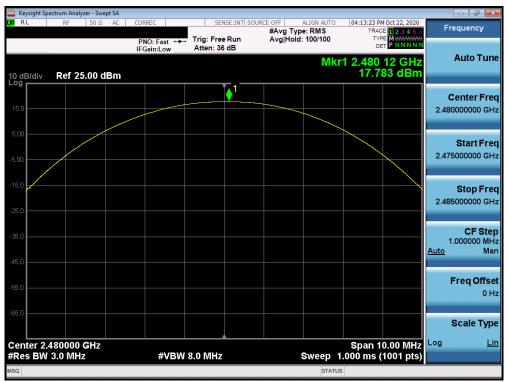
Plot 7-37. Peak Conducted Power (1Mbps – Ch. 0) -ANT 2

FCC ID: A3LSMG998B	Proud to be part of element		SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 24 of 100
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	ectrum Analyzer - S						
XI RL	RF 50	Ω AC	CORREC	SENSE:INT S	OURCE OFF ALIGN AUTO #Avg Type: RMS	04:13:04 PM Oct 22, 2020 TRACE 1 2 3 4 5 6	Frequency
			PNO: Fast ↔ IFGain:Low	Trig: Free Run Atten: 36 dB	Avg Hold: 100/100	TYPE MWWWWW DET PNNNN	
10 dB/div	Ref 25.00	dBm			Mkı	1 2.441 16 GHz 18.091 dBm	Auto Tune
15.0							Center Freq 2.441000000 GHz
5.00							
-5.00							Start Fred 2.436000000 GHz
15.0							Stop Fred
-25.0							2.446000000 GH:
45.0							CF Step 1.000000 MH <u>Auto</u> Mar
55.0							Freq Offse 0 H
65.0							Scale Type
Center 2.4 #Res BW	441000 GH: 3.0 MHz	z	#VBW	8.0 MHz	Sweep 1	Span 10.00 MHz 1.000 ms (1001 pts)	Log <u>Lir</u>
ISG					STATU		

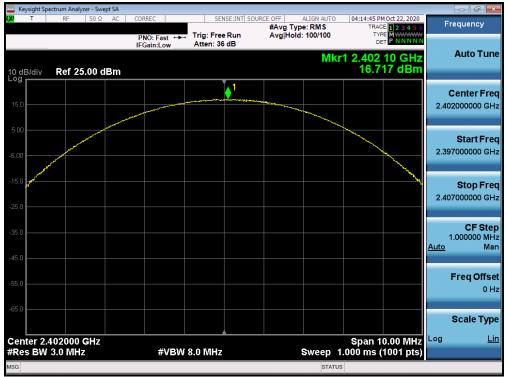
Plot 7-38. Peak Conducted Power (1Mbps - Ch. 39) -ANT 2



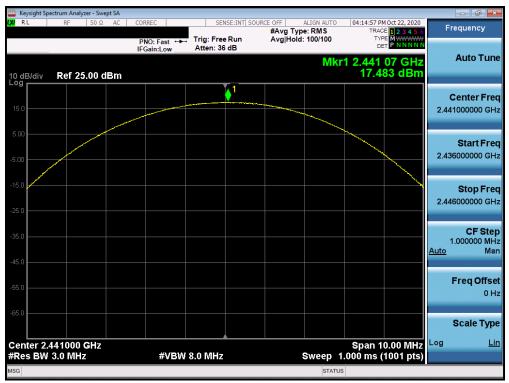
Plot 7-39. Peak Conducted Power (1Mbps – Ch. 78) -ANT 2

FCC ID: A3LSMG998B	Provid to be part of () element		SAMSUNG	Approved by: Technical Manager
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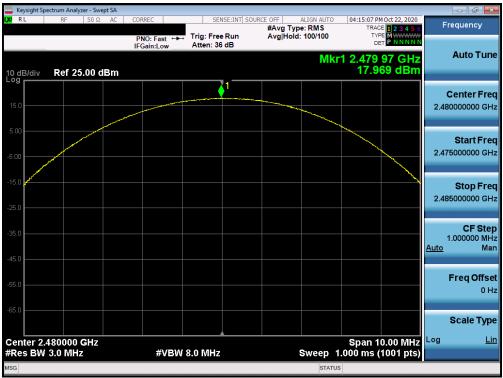
Plot 7-40. Peak Conducted Power (2Mbps – Ch. 0) -ANT 2



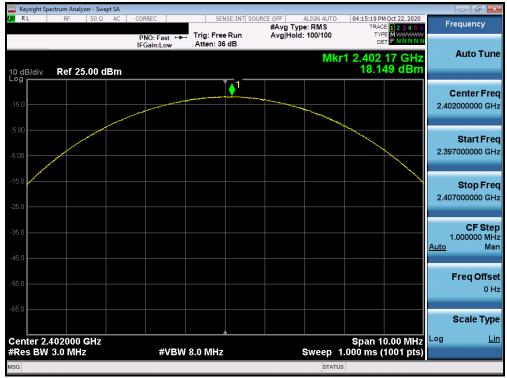
Plot 7-41. Peak Conducted Power (2Mbps - Ch. 39) -ANT 2

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 26 of 100
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Plot 7-42. Peak Conducted Power (2Mbps - Ch. 78) -ANT 2



Plot 7-43. Peak Conducted Power (3Mbps – Ch. 0-ANT 2

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dega 27 of 100
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	pectrum Analyz	er - Swept SA	A									
X RL	RF	50 Ω AC	C CORRE	C	SEN	SE:INT SOURC	E OFF AVG TVF	ALIGN AUTO		M Oct 22, 2020 CE 1 2 3 4 5 6	F	requency
	_): Fast ↔ in:Low	Trig: Free Atten: 36		Avg Hold		TY			
10 dB/div Log	Ref 25.	.00 dBn	ń					Mk	r1 2.441 18.0	12 GHz 62 dBm		Auto Tune
15.0						♦ 1						Center Freq 1000000 GHz
-5.00											2.43	Start Freq 86000000 GHz
-15.0											2.44	Stop Freq 16000000 GHz
-35.0											<u>Auto</u>	CF Step 1.000000 MH Mar
55.0												Freq Offse 0 Hi
-65.0												Scale Type
Center 2 #Res BV	.441000 ¢ / 3.0 MHz	GHz		#VBW	8.0 MHz			Sweep	Span 1 1.000 ms (0.00 MHz (1001 pts)	Log	Lin
MSG								STATU	JS			

Plot 7-44. Peak Conducted Power (3Mbps - Ch. 39) -ANT 2



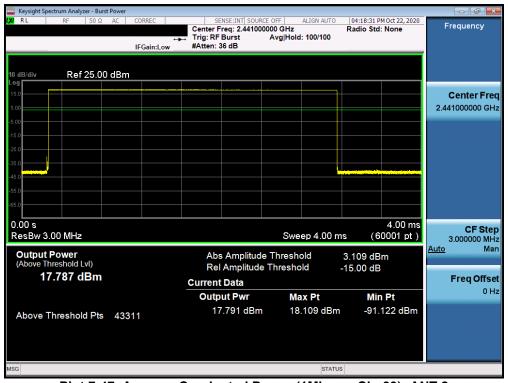
Plot 7-45. Peak Conducted Power (3Mbps - Ch. 78) -ANT 2

FCC ID: A3LSMG998B	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dega 29 of 100
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🔤 Keysight Spe		er - Bur	st Power									- 5
LXV RL	RF	50 Ω	AC	CORREC	Low	Trig: I	SENSE:INT SOUR r Freq: 2.40200 RF Burst h: 36 dB	0000 GHz	ALIGN AUTO	04:18:06 P Radio Std	M Oct 22, 2020 : None	Frequency
10 dB/div Log	Ref	25.00) dBm									
15.0 5.00												Center Fre 2.402000000 GH
-5.00 -15.0 -25.0												
-35.0												
-65.0												
0.00 s ResBw 3.0	00 MHz							Swe	ep 4.00 m	1s (6	4.00 ms 0001 pt)	CF Ste 3.000000 MH
(Above Th	Output Power (Above Threshold Lvl) 17.869 dBm				R	bs Amplitud el Amplitude nt Data			3.107 dBm -15.00 dB		Auto Ma Freq Offse	
Above T	hreshold	d Pts	433	12		Ou	tput Pwr 17.880 dBm		ax Pt .107 dBm	Min -80.0	ı Pt 655 dBm	он
ISG									STATU	s		

Plot 7-46. Average Conducted Power (1Mbps - Ch. 0) -ANT 2



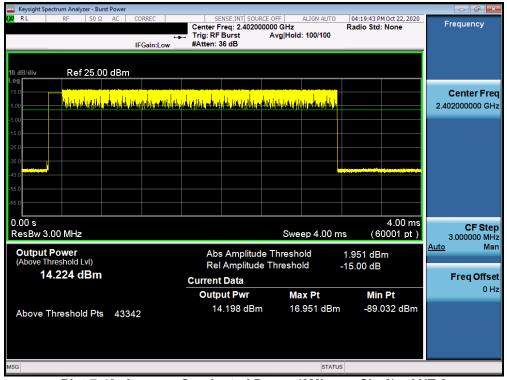
Plot 7-47. Average Conducted Power (1Mbps – Ch. 39) -ANT 2

FCC ID: A3LSMG998B	Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 20 of 100
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Keysight Spec													×
X/RL	RF	50 Ω	AC	CORREC IFGain:	Low	Center		0000 GHz	ALIGN AUTO	04:18:47 F Radio Std	PM Oct 22, 2020 I: None	Frequency	
10 dB/div Log	Ref 2	25.00) dBm										
5.00												Center Fr 2.480000000 G	
-15.0													
-35.0													
-65.0													
0.00 s ResBw 3.0	00 MHz							Swe	ep 4.00 n	ns (6	4.00 ms 30001 pt)	CF St 3.000000 M	
(Above Thr	Output Power (Above Threshold Lvi) 17.405 dBm				Abs Amplitude Threshold 2.752 d Rel Amplitude Threshold -15.00 d Current Data					dBm			
					out Pwr	Ma	ax Pt	Mii	n Pt	0	н		
Above Tł	hreshold	Pts	433	11			7.398 dBm	ı 17	.752 dBm	n -85.	.637 dBm		
ISG									STATU	JS			





Plot 7-49. Average Conducted Power (2Mbps – Ch. 0) --ANT 2

FCC ID: A3LSMG998B	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 40 of 100
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Keysight Spectrum Analyzer - Burst Power				
X RL RF 50Ω AC CORREC IFGain:Low	SENSE:INT SOURCE OFF Center Freq: 2.441000000 GH Trig: RF Burst Avg H #Atten: 36 dB	ALIGN AUTO	04:19:58 PM Oct 22, 2020 Radio Std: None	Frequency
10 dB/div Ref 25.00 dBm				
15.0 5.00	<mark> </mark>	<mark>st af dig sig and the age with t</mark>		Center Freq 2.441000000 GHz
-5.00				
-45.0				
-55.0				
0.00 s ResBw 3.00 MHz	S	weep 4.00 m	4.00 ms is (60001 pt)	CF Step 3.000000 MHz
Output Power (Above Threshold Lvi) 14.645 dBm	Abs Amplitude Three Rel Amplitude Thres		2.448 dBm -15.00 dB	Auto Man Freg Offset
	Current Data Output Pwr	Max Pt	Min Pt	0 Hz
Above Threshold Pts 43342	14.648 dBm	17.448 dBm	-86.972 dBm	
MSG		STATUS	3	

Plot 7-50. Average Conducted Power (2Mbps – Ch. 39) -ANT 2



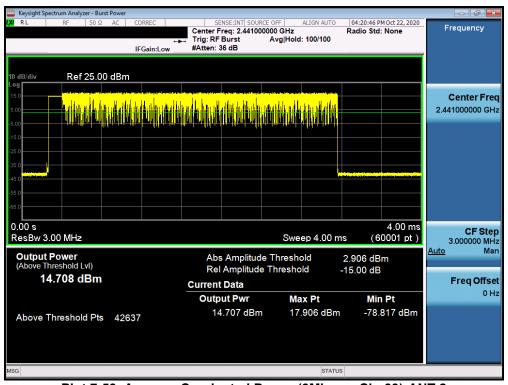
Plot 7-51. Average Conducted Power (2Mbps – Ch. 78) -ANT 2

FCC ID: A3LSMG998B	Provid to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dogo 11 of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset	Page 41 of 109
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Keysight Spectrum An												
IXI RL RF	50 Ω	AC C	ORREC		Center F	NSE:INT SOU	00000 GHz	ALIGN AUTO	04:20:29 Radio Sto	PM Oct 22, 2020 d: None	Fre	quency
			FGain:L	• • -	Trig: RF #Atten: 3		Avg Hold	i: 100/100				
			r Gain.L									
10 dB/div R	ef 25.0() dBm										
Log			a di kara san									
15.0	ha addada	الما والكر الأربي	histo	والليف	all break	din tahu ta						enter Freq
5.00											2.4020	000000 GHz
-5.00		1 1 -1-141-142				ал нистрания П						
-15.0												
-25.0												
-35.0												
-45.0												
-65.0												
0.00 s							-	1.00		4.00 ms		CF Step
ResBw 3.00 MH	1Z						Swe	ep 4.00 n	ns (t	60001 pt)	3.0 Auto	000000 MHz Man
Output Powe (Above Threshold	r						le Thresh		3.084 dE		Auto	Ivian
14.924							e Thresho	old	-15.00 dE	3	-	05-1
14.524	UDIII				Current	Data					F	r eq Offset 0 Hz
					Outp	ut Pwr	Ma	ax Pt	Mi	n Pt		0 H2
Above Thresh	Above Threshold Pts 42647					14.913 dBm 18.084 d			1 -92	.306 dBm		
MSG								STATU	JS			

Plot 7-52. Average Conducted Power (3Mbps – Ch. 0) -ANT 2



Plot 7-53. Average Conducted Power (3Mbps – Ch. 39)-ANT 2

FCC ID: A3LSMG998B	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 42 of 100
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Keysight Spectrum Analyzer - Burst Power				
(X) RL RF 50Ω AC CORREC → IFGain:Low	SENSE:INT SOUR Center Freq: 2.48000 Trig: RF Burst #Atten: 36 dB		04:21:04 PM Oct 22, 2020 Radio Std: None	Frequency
10 dB/div Ref 25.00 dBm				
		na da na hana kata		Center Freq 2.480000000 GHz
-25.0				
-35.0				
.65.0			4.00 ms	CF Step
ResBw 3.00 MHz		Sweep 4.00 m		3.000000 MHz Auto Man
Output Power (Above Threshold Lvi) 14.981 dBm	Abs Amplitud Rel Amplitude Current Data		3.330 dBm -15.00 dB	Freq Offset
Above Threshold Pts 42588	Output Pwr 14.982 dBm	Max Pt 18.330 dBm	Min Pt -80.675 dBm	0 Hz
MSG		STATUS	3	

Plot 7-54. Average Conducted Power (3Mbps – Ch. 78)-ANT 2

FCC ID: A3LSMG998B			SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dega 42 of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset		Page 43 of 109
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Dual BT

Frequency	Data		Power	Channel	Peak Co Power	nducted ANT1	Peak Co Power	nducted ANT2	Peak Conducted Power DUAL		
[MHz]	Rate [Mbps]	Mod.	Scheme	No.	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	
2402	1.0	GFSK	iPA	0	11.17	13.101	11.40	13.810	14.30	26.915	
2441	1.0	GFSK	iPA	39	10.86	12.187	11.16	13.068	14.02	25.235	
2480	1.0	GFSK	iPA	78	11.37	13.706	11.16	13.071	14.28	26.792	
2402	2.0	π/4-DQPSK	ePA	0	18.07	64.047	16.32	42.806	20.29	106.905	
2441	2.0	π/4-DQPSK	ePA	39	16.20	41.639	16.44	44.025	19.33	85.704	
2480	2.0	π/4-DQPSK	ePA	78	16.43	43.985	16.14	41.124	19.30	85.114	
2402	3.0	8DPSK	ePA	0	18.64	73.114	17.02	50.315	20.91	123.310	
2441	3.0	8DPSK	ePA	39	16.85	48.373	16.83	48.161	19.85	96.605	
2480	3.0	8DPSK	ePA	78	16.99	49.980	16.66	46.355	19.84	96.383	

Table 7-6. Dual BT Conducted Powers-Peak Measurements

Frequency	Data		Power	Channel	Avg Cor Power	nducted • ANT1	•	nducted • ANT2	-	nducted DUAL
[MHz]	Rate [Mbps]	Mod.	Scheme	No.	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]
2402	1.0	GFSK	iPA	0	10.97	12.514	10.96	12.477	13.98	25.003
2441	1.0	GFSK	iPA	39	10.57	11.389	11.13	12.981	13.87	24.378
2480	1.0	GFSK	iPA	78	10.73	11.841	10.66	11.641	13.71	23.496
2402	2.0	π/4-DQPSK	ePA	0	15.49	35.375	13.57	22.725	17.64	58.076
2441	2.0	π/4-DQPSK	ePA	39	13.62	23.036	13.30	21.399	16.48	44.463
2480	2.0	π/4-DQPSK	ePA	78	13.72	23.556	13.15	20.640	16.45	44.157
2402	3.0	8DPSK	ePA	0	13.24	35.571	13.51	22.423	16.38	43.451
2441	3.0	8DPSK	ePA	39	13.67	23.297	13.31	21.419	16.50	44.668
2480	3.0	8DPSK	ePA	78	13.57	22.756	13.08	20.310	16.34	43.053

Table 7-7. Dual BT Conducted Powers-Average Measurement

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 14 of 100
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Dual BT-Antenna 1



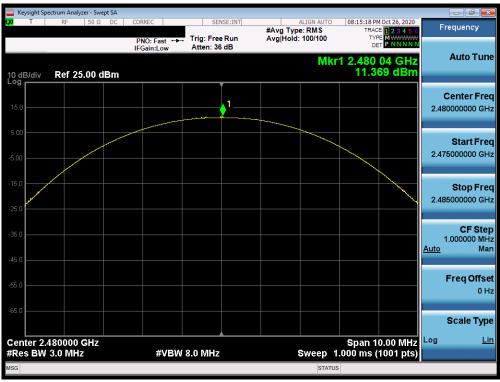
Plot 7-55. Peak Conducted Power (1Mbps – Ch. 0) -ANT 1



Plot 7-56. Peak Conducted Power (1Mbps – Ch. 39) -ANT 1

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 45 of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset		Page 45 of 109
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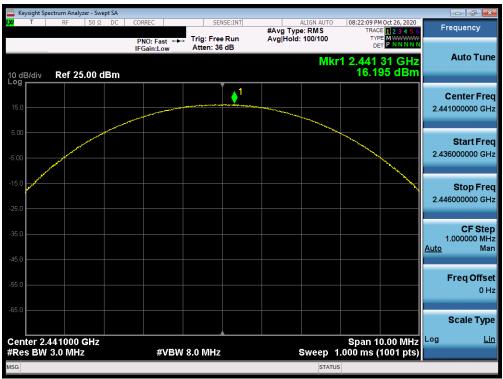
Plot 7-57. Peak Conducted Power (1Mbps - Ch. 78) -ANT 1



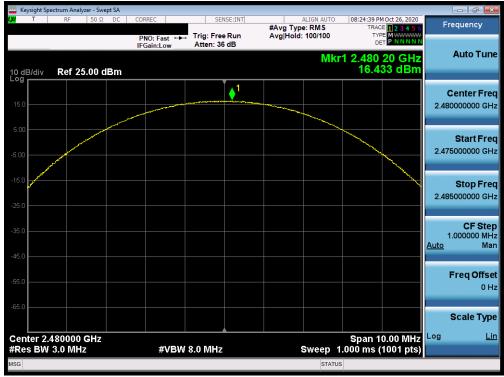
Plot 7-58. Peak Conducted Power (2Mbps – Ch. 0) -ANT 1

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dega 46 of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset		Page 46 of 109
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Plot 7-59. Peak Conducted Power (2Mbps - Ch. 39) -ANT 1



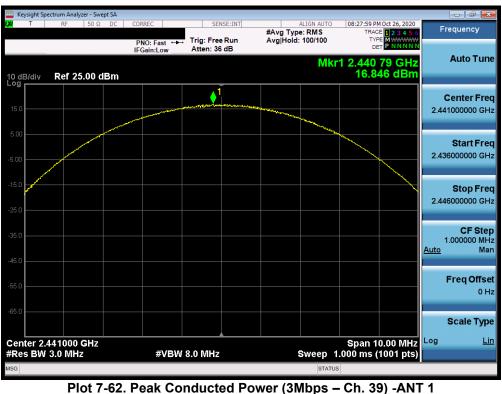
Plot 7-60. Peak Conducted Power (2Mbps - Ch. 78) -ANT 1

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dego 47 of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset		Page 47 of 109
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Plot 7-61. Peak Conducted Power (3Mbps - Ch. 0-ANT 1



FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dega 49 of 100
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Plot 7-63. Peak Conducted Power (3Mbps - Ch. 78) -ANT 1



Plot 7-64. Average Conducted Power (1Mbps – Ch. 0) -ANT 1

FCC ID: A3LSMG998B	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 40 of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset		Page 49 of 109
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Keysight Spect	rum Analyze RF	r - Burs 50 Ω	st Power DC	CORREC	⊷ Low	Center F		0000 GHz Avg Hold	ALIGN AUTO	09:37:00 F Radio Std	2M Oct 26, 2020 I: None	Frequency
10 dB/div Log 15.0	Ref 2	25.00) dBm									Center Fre 2.441000000 GH
-5.00 -15.0 -25.0 -35.0												
-45.0 -55.0 -65.0												
0.00 s ResBw 3.0							A 1% 1		ep 4.00 m		4.00 ms 60001 pt)	CF Ste 3.000000 MH <u>Auto</u> Ma
Output P (Above Thre 10.	ower eshold Lv 565 dE						s Amplitud Amplitude Data			-3.956 dE -15.00 dE		Freq Offse
Above Th	reshold	Pts	433	11			ut Pwr).569 dBm		ix Pt .044 dBm		n Pt 000 dBm	0 Н
IISG									STATU	s		

Plot 7-65. Average Conducted Power (1Mbps - Ch. 39) -ANT 1



Plot 7-66. Average Conducted Power (1Mbps – Ch. 78) -ANT 1

FCC ID: A3LSMG998B	Proved to be part of the element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dama 50 of 100
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Keysight Spectrum Analyzer - Burst Power K L L RF 50 Ω DC CORREC	SENSE:INT		3:29 PM Oct 26, 2020	
IFGain:Low	Center Freq: 2.402000000 GHz		5:29 PM Oct 26, 2020 o Std: None	Frequency
10 dB/div Ref 25.00 dBm				
15.0 5.00	$\frac{(\Delta_{1} \theta _{2})}{(\Delta_{1} \theta _{2})} = \frac{1}{(\Delta_{1} \theta _{2})} \frac{1}{(\Delta_{1} \theta$	date and de la faite and the second		Center Freq 2.402000000 GHz
-5.0				
-35.0				
-55.0				
0.00 s ResBw 3.00 MHz		ep 4.00 ms	4.00 ms (60001 pt)	CF Step 3.000000 MHz Auto Man
Output Power (Above Threshold Lvl) 15.487 dBm	Abs Amplitude Thresh Rel Amplitude Thresho Current Data		5 dBm	Freq Offset
		ax Pt	Min Pt	0 Hz
Above Threshold Pts 43342		.175 dBm	-83.680 dBm	
MSG		STATUS		

Plot 7-67. Average Conducted Power (2Mbps - Ch. 0) --ANT 1



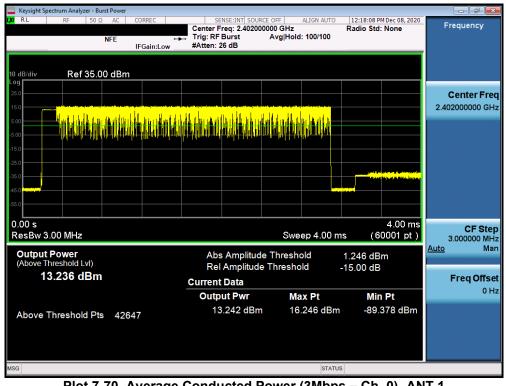
Plot 7-68. Average Conducted Power (2Mbps – Ch. 39) -ANT 1

FCC ID: A3LSMG998B	Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 51 of 100
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Keysight Spectrum Analyzer - Burst Power			
UM L RF 50Ω DC CORREC → IFGain:Low	SENSE:INT Center Freq: 2.480000000 GHz Trig: RF Burst Avg Holo #Atten: 36 dB	ALIGN AUTO 09:46:13 Radio Sto I: 100/100	PMOct 26, 2020 1: None Frequency
10 dB/div Ref 25.00 dBm			
15.0 5.00	<mark>18.18412112-8011-1412114114114114114114114114114114114114</mark>	un a funde a n	Center Freq 2.480000000 GHz
-5.00			
-25.0			
-65.0			
0.00 s ResBw 3.00 MHz	Swe	ep 4.00 ms (6	4.00 ms 50001 pt) 3.000000 MHz Auto Man
Output Power (Above Threshold Lvl) 13.721 dBm	Abs Amplitude Thresh Rel Amplitude Thresho		Bm
	Current Data Output Pwr Ma	ax Pt Mi	n Pt
Above Threshold Pts 43342	13.719 dBm 16	.513 dBm -84	.685 dBm
MSG		STATUS	

Plot 7-69. Average Conducted Power (2Mbps - Ch. 78) -ANT 1



Plot 7-70. Average Conducted Power (3Mbps - Ch. 0) -ANT 1

FCC ID: A3LSMG998B	PCTEST Proud to be part of @ eloment	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 52 of 100
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Keysight Spectrum Analyzer - Burst Power K L R F 50 Ω DC CORREC	SENSE:INT	ALIGN AUTO	09:48:51 PM Oct 26, 2020	
IFGain:Low	Center Freq: 2.4410000		Radio Std: None	Frequency
10 dB/div Ref 25.00 dBm				
				Center Freq 2.441000000 GHz
-15.0				
-35.0				
-65.0			4.00 ms	
ResBw 3.00 MHz Output Power	A I A	Sweep 4.00 m	s (60001 pt)	CF Step 3.000000 MHz <u>Auto</u> Mar
(Above Threshold Lvl) 13.673 dBm	Abs Amplitude Rel Amplitude T Current Data		2.013 dBm 15.00 dB	Freq Offse
	Output Pwr 13.672 dBm	Max Pt 17.013 dBm	Min Pt -83,239 dBm	0 Hz
Above Threshold Pts 42616	13.072 dBM	17.013 dBm	-65.259 dBM	
MSG		STATUS		

Plot 7-71. Average Conducted Power (3Mbps - Ch. 39)-ANT 1

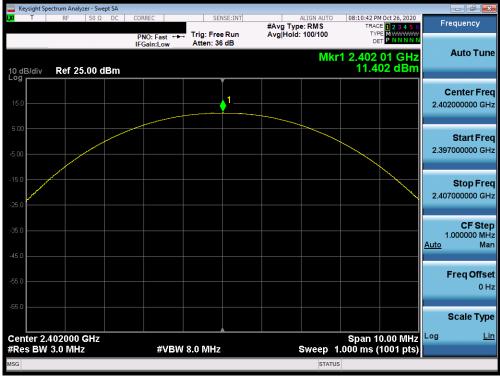


Plot 7-72. Average Conducted Power (3Mbps – Ch. 78)-ANT 1

FCC ID: A3LSMG998B	Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:		Dage 52 of 100	
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Dual BT-Antenna 2



Plot 7-73. Peak Conducted Power (1Mbps – Ch. 0) -ANT 2



Plot 7-74. Peak Conducted Power (1Mbps – Ch. 39) -ANT 2

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Daga 54 of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset		Page 54 of 109
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Plot 7-75. Peak Conducted Power (1Mbps - Ch. 78) -ANT 2



Plot 7-76. Peak Conducted Power (2Mbps – Ch. 0) - ANT 2

FCC ID: A3LSMG998B		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dege EE of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset		Page 55 of 109
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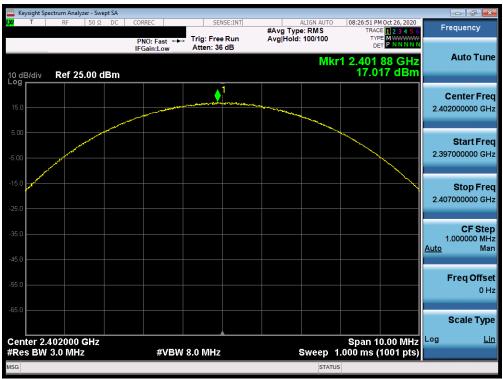
Plot 7-77. Peak Conducted Power (2Mbps - Ch. 39) - ANT 2



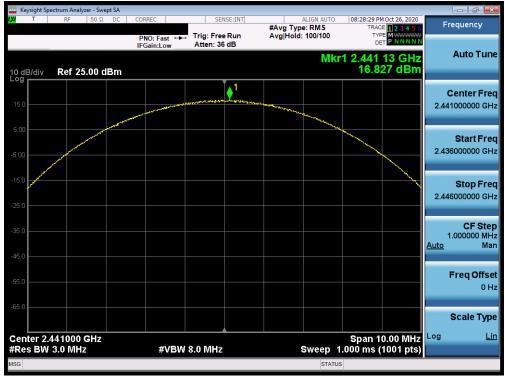
Plot 7-78. Peak Conducted Power (2Mbps – Ch. 78) - ANT 2

FCC ID: A3LSMG998B Protect E S T Protect to be part of @ determent		MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dege EC of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset		Page 56 of 109
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Plot 7-79. Peak Conducted Power (3Mbps - Ch. 0- ANT 2



Plot 7-80. Peak Conducted Power (3Mbps - Ch. 39) - ANT 2

FCC ID: A3LSMG998B			SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dave 57 of 100
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Plot 7-81. Peak Conducted Power (3Mbps - Ch. 78) - ANT 2



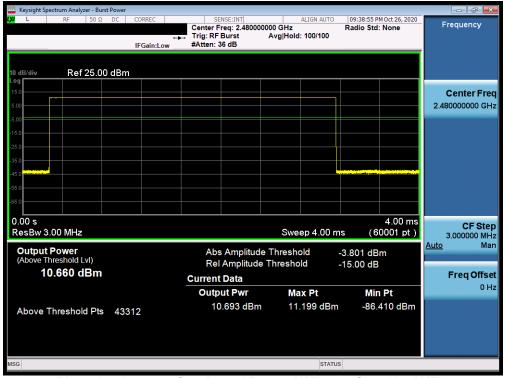
Plot 7-82. Average Conducted Power (1Mbps – Ch. 0) - ANT 2

FCC ID: A3LSMG998B	PCTEST Proud to be part of @ elivment	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Daga 59 of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset	Page 58 of 109
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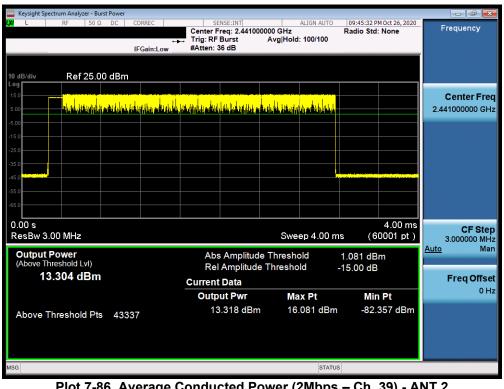
Plot 7-84. Average Conducted Power (1Mbps – Ch. 78) - ANT 2

FCC ID: A3LSMG998B	Proved to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	ISUNG	Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:		Dage 50 of 100	
1M2009280154-13.A3L	9/28/2020-12/07/2020	ortable Handset		Page 59 of 109	
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Keysight Spectri		r - Burst 50 Ω	DC	CORREC		Center F	NSE:INT		ALIGN AUTO	09:43:54 P	PM Oct 26, 2020 I: None	Frequency	×
				IFGain	Low	#Atten: 3		Avg Hold	: 100/100				
10 dB/div	Ref 2	5.00	dBm										
15.0												Center F	rec
5.00	where the second se	inder of the second	dilatik,	<mark>u la place</mark>	dit she ha	النائد الأرزارية		and the second second	ulter fielder bet			2.402000000	GHz
-5.00													
-15.0													
-35.0													
-45.0													
-55.0													
-65.0													
0.00 s ResBw 3.00) MHz							Swe	ep 4.00 n	ns (6	4.00 ms 60001 pt)	CF S 3.000000 M	мні
Output Po (Above Thre	wer	N						le Thresh		1.308 dE		<u>Auto</u> I	Mai
	565 dE							e Thresho	old	-15.00 dE	3	Freq Off	fea
		Current	ut Pwr	M	x Pt		n Pt		0 H				
							3.564 dBm		.308 dBm		701 dBm		
Above Thr	eshold	Pts	433	42									
IISG									STATU	s			_

Plot 7-85. Average Conducted Power (2Mbps - Ch. 0) -- ANT 2



Plot 7-86. Average Conducted Power (2Mbps - Ch. 39) - ANT 2

FCC ID: A3LSMG998B	Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:		Dage 60 of 100
1M2009280154-13.A3L	9/28/2020-12/07/2020	Portable Handset		Page 60 of 109
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Keysight Spectrum Analyzer - Burst Power				_ d <mark>×</mark>
Dog L RF 50Ω DC CORREC → IFGain:Low	SENSE:INT Center Freq: 2.480000000 GH Trig: RF Burst Avg H #Atten: 36 dB		09:46:33 PM Oct 26, 2020 adio Std: None	Frequency
10 dB/div Ref 25.00 dBm				
5.00	<mark>ra oppelas a deutsta la deutsta a d</mark> uces, de su	<mark>a ng nang sa katala kata</mark>		Center Freq 2.48000000 GHz
-5.00 -15.0 -25.0				
-35.0				
-65.0				
0.00 s ResBw 3.00 MHz		weep 4.00 ms	4.00 ms (60001 pt)	CF Step 3.000000 MHz Auto Man
Output Power (Above Threshold Lvl) 13.147 dBm	Abs Amplitude Thre Rel Amplitude Thres		014 dBm 5.00 dB	Freq Offset
	Current Data Output Pwr	Max Pt	Min Pt	0 Hz
Above Threshold Pts 43337	13.152 dBm	16.014 dBm	-88.389 dBm	
MSG		STATUS		

Plot 7-87. Average Conducted Power (2Mbps – Ch. 78) - ANT 2



Plot 7-88. Average Conducted Power (3Mbps - Ch. 0) - ANT 2

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Keysight Spectrum Analyzer - Burst Power			
UM2 L RF 50Ω DC CORREC IFGain:Low	Center Freq: 2.441000000 GHz		requency
10 dB/div Ref 25.00 dBm			
	aliterin varian it har state it here		Center Freq 1000000 GHz
-150 -250	and a diffusion of the state of		
-35.0			
		4.00 ms	
ResBw 3.00 MHz Output Power	Sweep 4 Abs Amplitude Threshold		CF Step 3.000000 MHz Man
(Above Threshold Lvl) 13.308 dBm	Rel Amplitude Threshold Current Data	-15.00 dB	Freq Offset
Above Threshold Pts 42643	Output Pwr Max P 13.302 dBm 16.624		0 Hz
MSG		STATUS	

Plot 7-89. Average Conducted Power (3Mbps - Ch. 39)- ANT 2



Plot 7-90. Average Conducted Power (3Mbps – Ch. 78)- ANT 2

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7.4 Band Edge Compliance §15.247 (d); RSS-247 [5.5]

Test Overview and Limits

EUT operates in hopping and non-hopping transmission mode. Measurement is taken at the highest point located outside of the emission bandwidth. *The maximum permissible out-of-band emission level is 20 dBc.*

Test Procedure Used

ANSI C63.10-2013 - Section 6.10.4

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 7-3. Test Instrument & Measurement Setup

Test Notes

Out of band conducted spurious emissions at the band edge were investigated for all data rates in hopping and non-hopping modes. The worst case emissions were found with the EUT transmitting at 3 Mbps. Band edge emissions were also investigated with the EUT transmitting in all data rates. Plots of the worst case emissions are shown below.

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Antenna 1



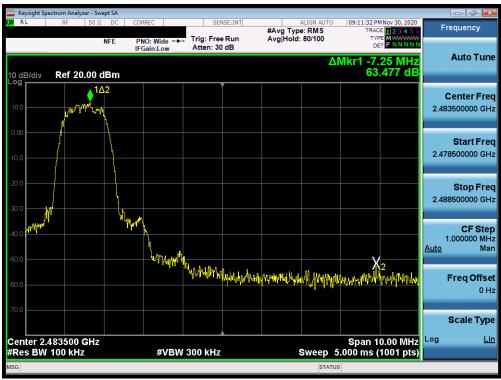
Plot 7-91. Band Edge Plot (Bluetooth with Hopping Disabled, ANT 1-3 Mbps - Ch. 0)



Plot 7-92. Band Edge Plot (Bluetooth with Hopping Disabled, ANT 1-3 Mbps – Ch. 78)

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Plot 7-93. Band Edge Plot (Bluetooth with Hopping Enabled, ANT 1-3 Mbps)

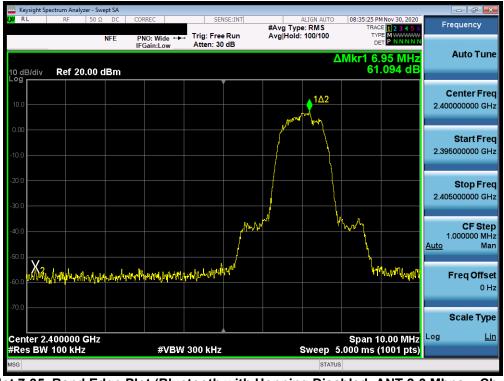


Plot 7-94. Band Edge Plot (Bluetooth with Hopping Enabled, ANT 1-3 Mbps)

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Antenna 2



Plot 7-95. Band Edge Plot (Bluetooth with Hopping Disabled, ANT 2-3 Mbps – Ch. 0)



Plot 7-96. Band Edge Plot (Bluetooth with Hopping Disabled, ANT 2-3 Mbps – Ch. 78)

FCC ID: A3LSMG998B	Proud to be part of () element	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
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