

MEASUREMENT REPORT

FCC PART 15.247 Bluetooth

Applicant Name:
Samsung Electronics Co., Ltd.
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Yeongtong-gu, Suwon-si
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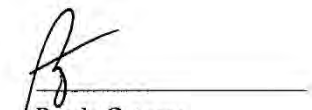
Date of Testing:
1/16 – 1/22/2021
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M2101110003-12.A3L

FCC ID: A3LSMG998JPN
APPLICANT: Samsung Electronics Co., Ltd.

Application Type: Certification
Model: SC-52B
EUT Type: Portable Handset
Max. RF Output Power: 139.32 mW (21.44 dBm) Peak Conducted
Frequency Range: 2402 – 2480MHz
Type of Modulation: GFSK, $\pi/4$ -DQPSK, 8DPSK
FCC Classification: FCC Part 15 Spread Spectrum Transmitter (DSS)
FCC Rule Part(s): Part 15 Subpart C (15.247)
Test Procedure(s): 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: A3LSMG998JPN**. 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:
 - The hopping sequence is pseudorandom
 - All channels are used equally on average
 - The receiver input bandwidth equals the transmit bandwidth
 - 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.: 0280M, 0301M, 0307M

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII (5GHz and 6GHz), 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.

This device is can transmit using Dual BT technology, transmitting 1-stream data using two antennas and receiving using two antennas.


2.3 Antenna Description

Following antenna was used for the testing.

Frequency [GHz]	Antenna 1 Gain (dBi)	Antenna 2 Gain (dBi)
2.4	-6.0	-6.1

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 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, 7.6, 7.7, and 7.8 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) 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 no modifications were made during testing.

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3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

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

Deviation from measurement procedure.....None



3.2 AC Line Conducted Emissions

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

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference groundplane. Power cables for support equipment were routed down to the second LISN while ensuring that 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 (\pm 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	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: A3LSMG998JPN
 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	CONDUCTED	PASS	Section 7.2
15.247(b)(1)	RSS-247 [5.4(2)]	Peak Transmitter Output Power	< 1 Watt if ≥ 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		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

§15.247 (a.1.iii); RSS-247 [5.1(1)]

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

1. 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 ≥ 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.



Figure 7-1. Test Instrument & Measurement Setup

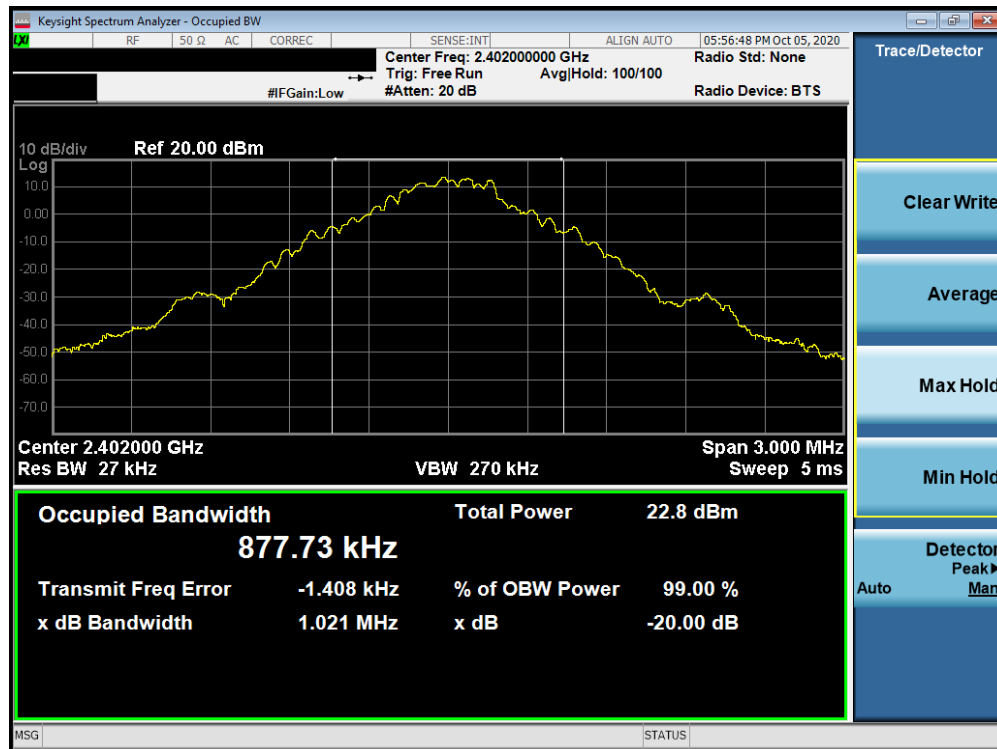
Test Notes

None



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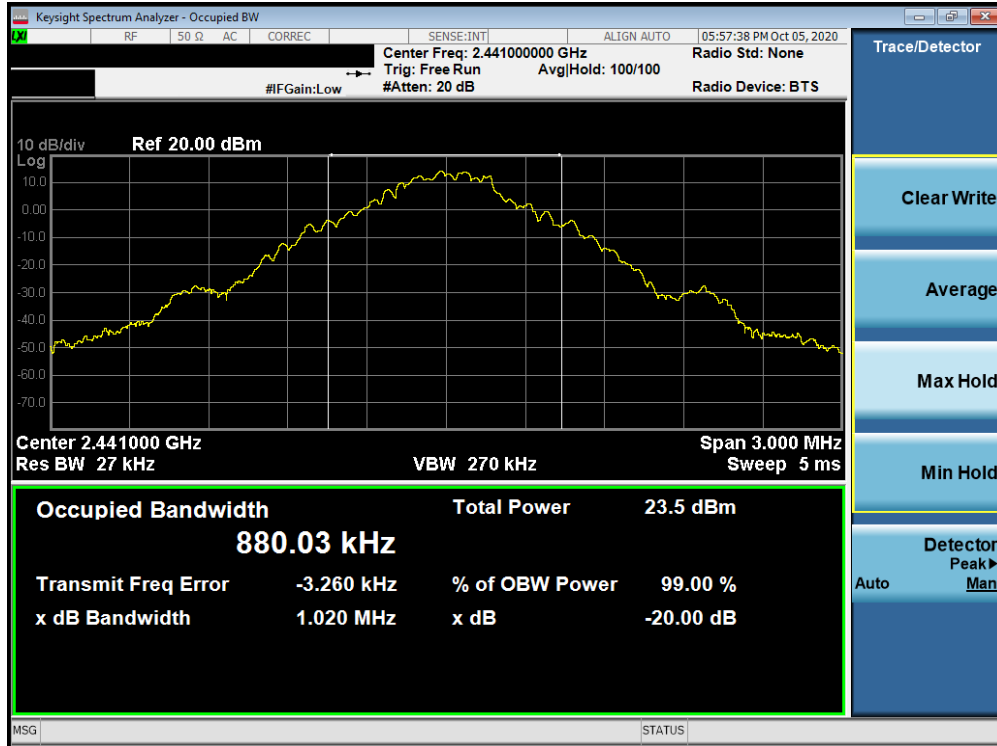
Frequency [MHz]	Data Rate [Mbps]	Channel No.	20dB Bandwidth Test Results [kHz]
2402	1.0	0	1021.00
2441	1.0	39	1020.00
2480	1.0	78	1020.00
2402	2.0	0	1329.00
2441	2.0	39	1327.00
2480	2.0	78	1330.00
2402	3.0	0	1306.00
2441	3.0	39	1296.00
2480	3.0	78	1293.00

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

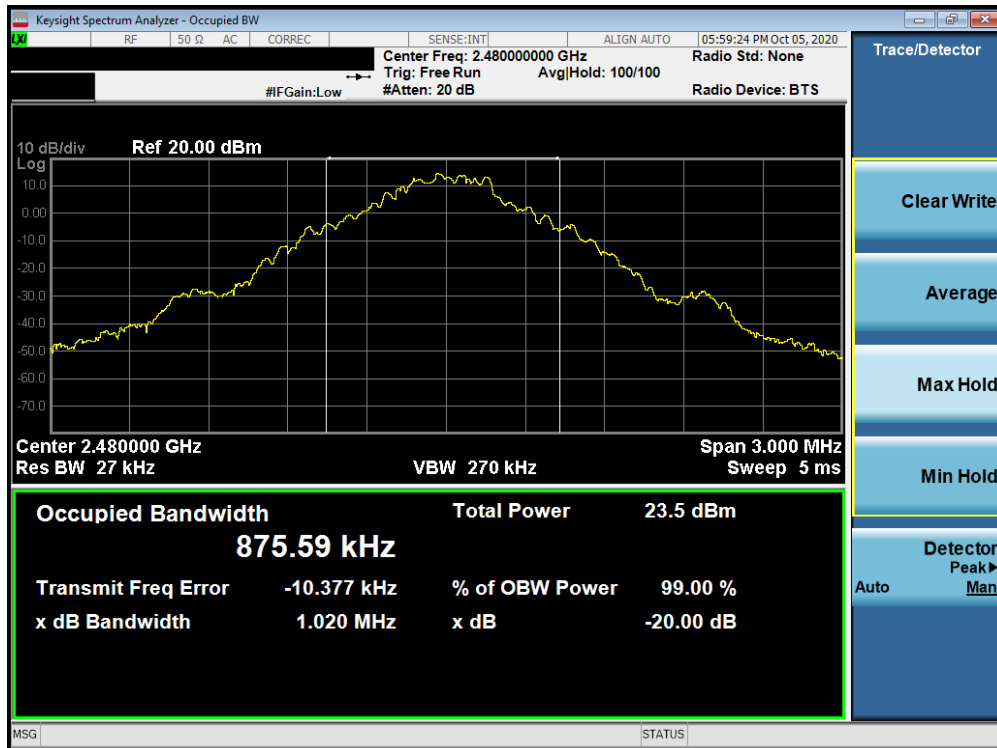


Plot 7-1. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 0) – ANT 1



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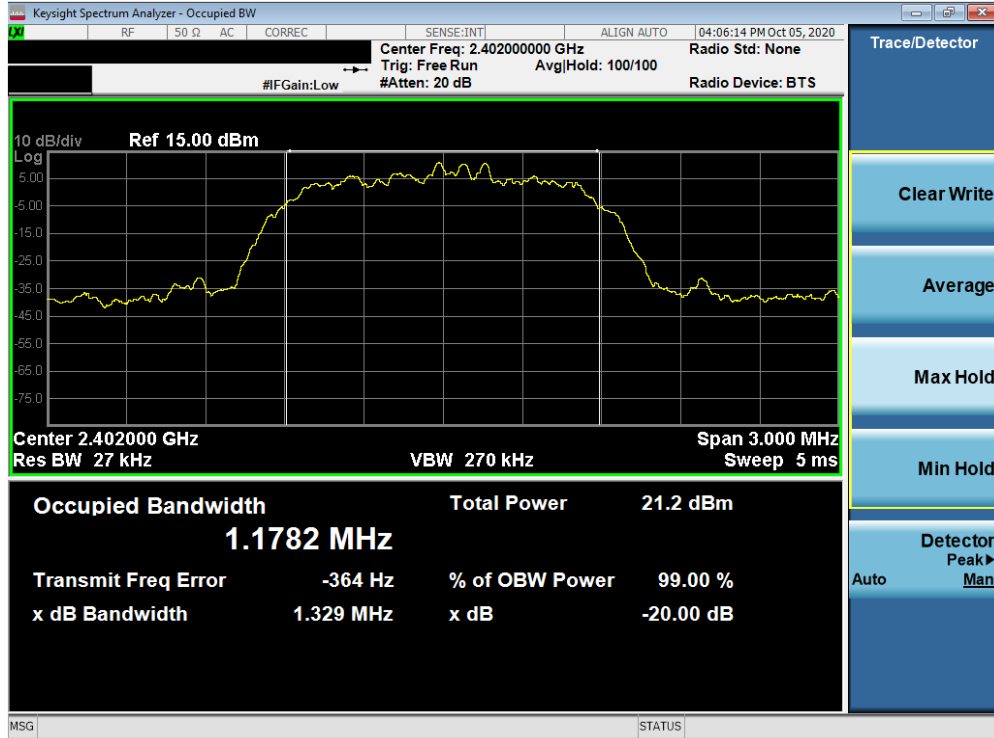


Plot 7-2. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 39) – ANT 1

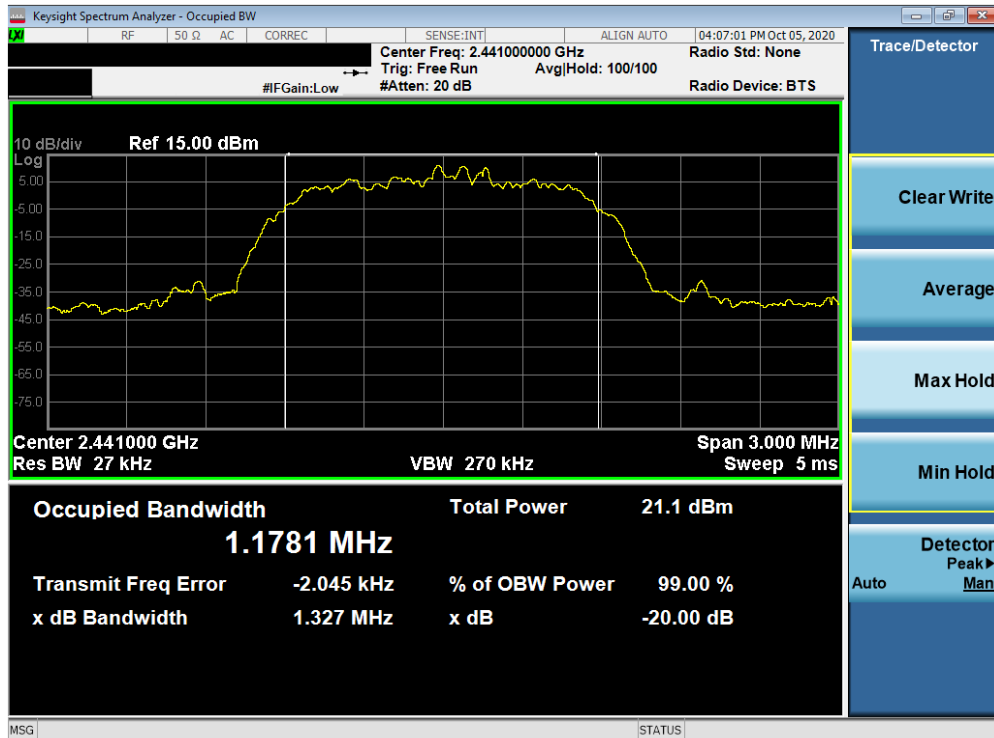


Plot 7-3. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 78) – ANT 1

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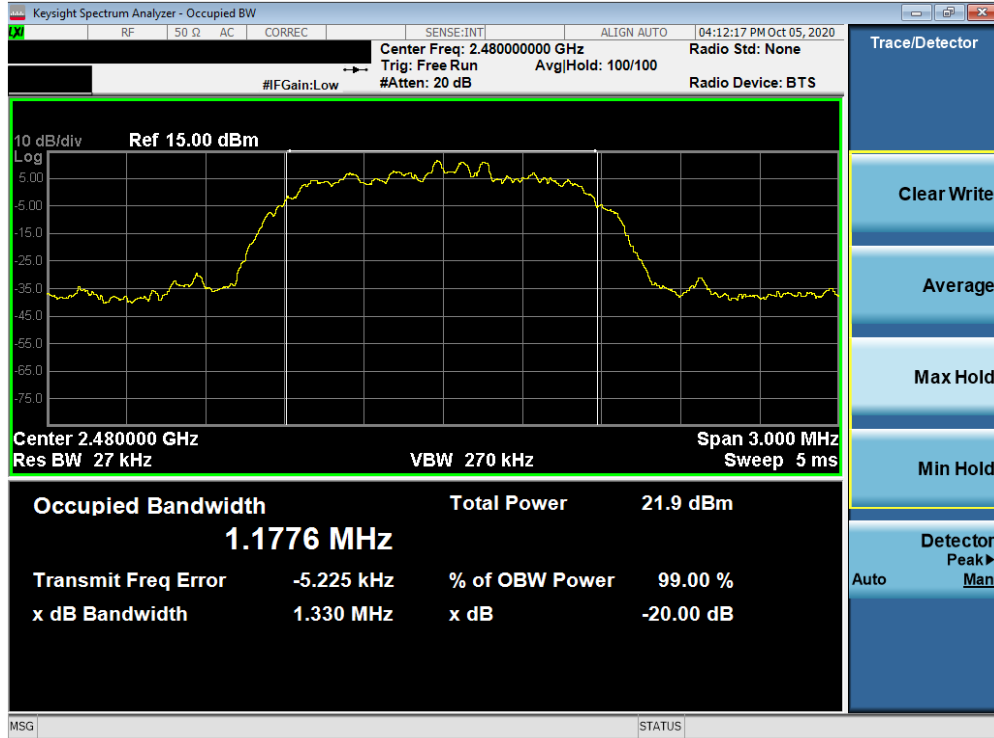


Plot 7-4. 20dB Bandwidth Plot (Bluetooth, 2Mbps – Ch. 0) – ANT 1

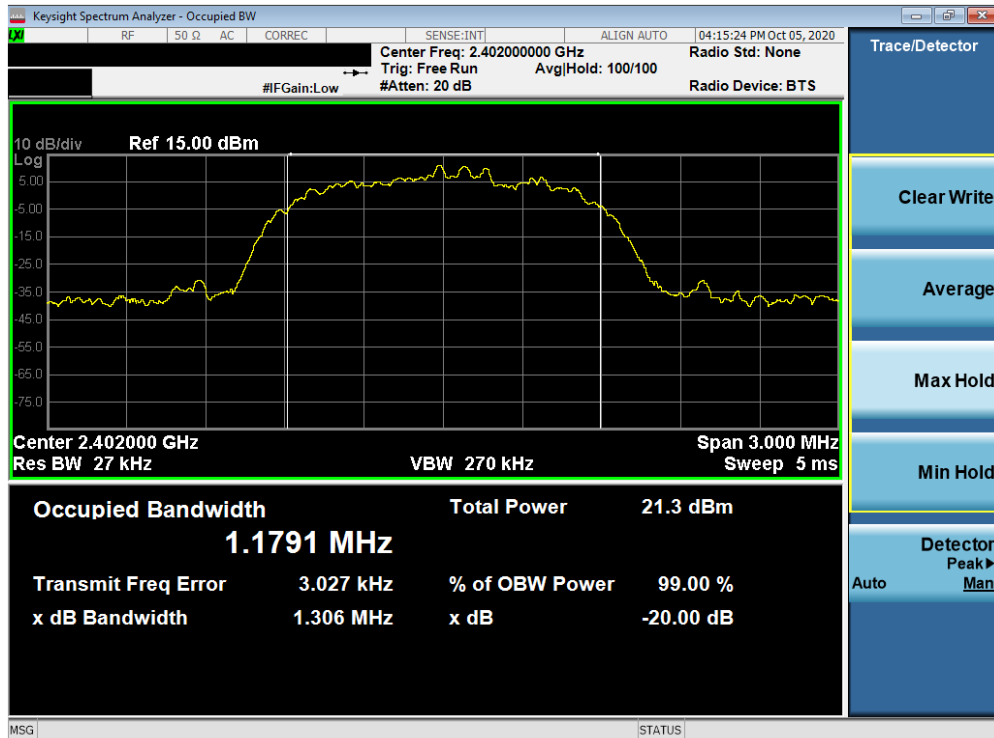


Plot 7-5. 20dB Bandwidth Plot (Bluetooth, 2Mbps – Ch. 39) – ANT 1

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 15 of 107

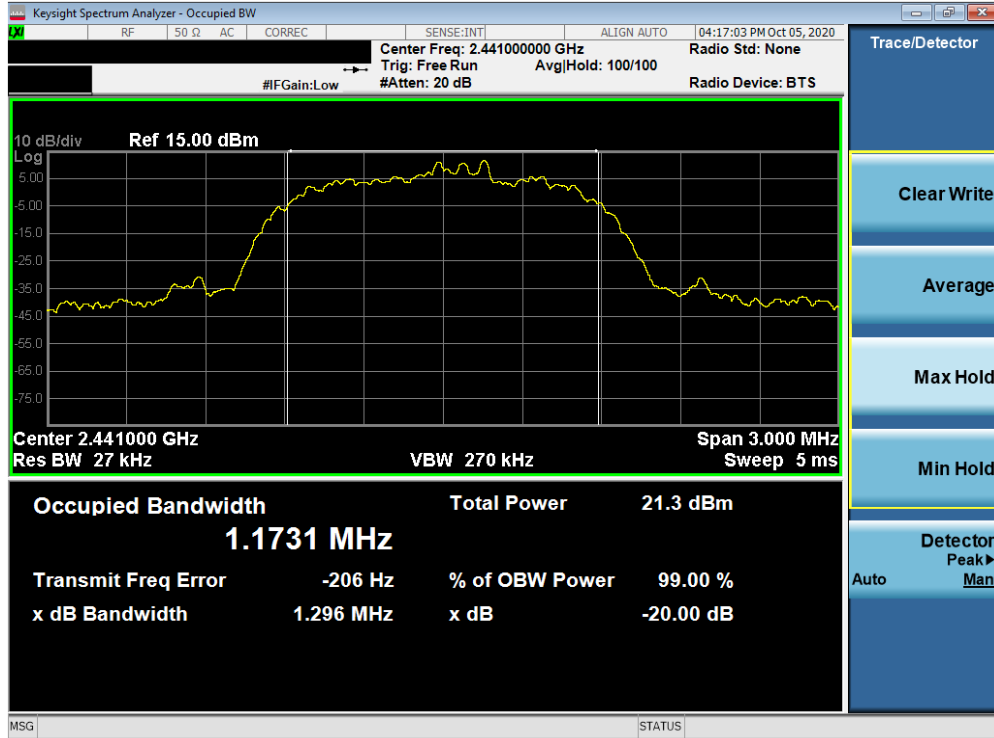


Plot 7-6. 20dB Bandwidth Plot (Bluetooth, 2Mbps – Ch. 78) – ANT 1

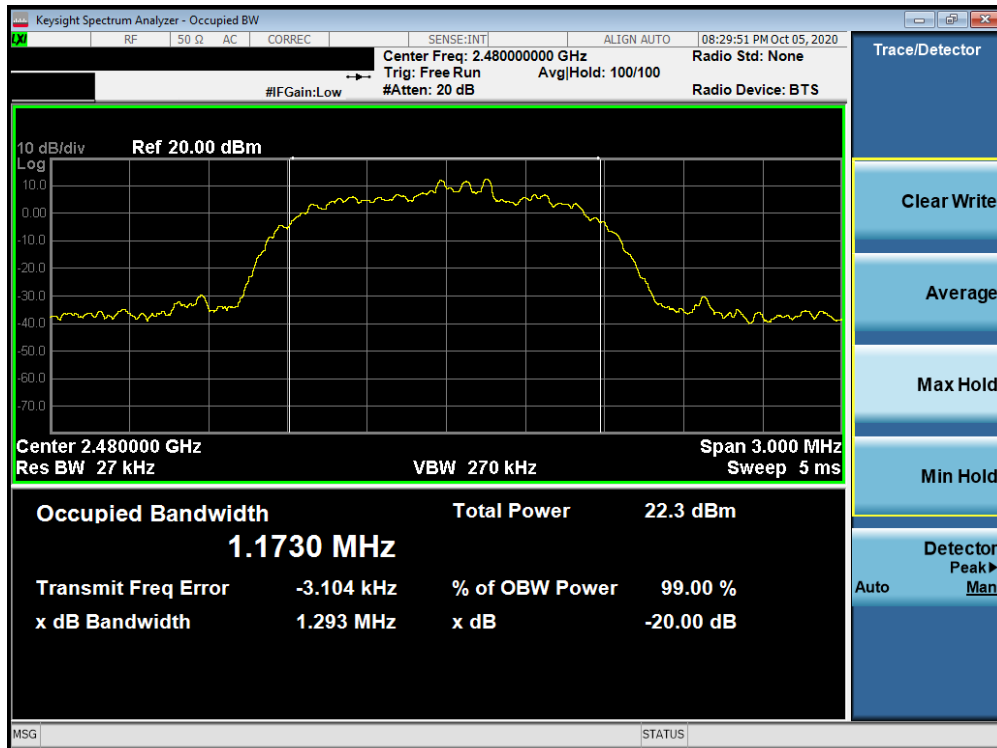


Plot 7-7. 20dB Bandwidth Plot (Bluetooth, 3Mbps – Ch. 0) – ANT 1

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 16 of 107



Plot 7-8. 20dB Bandwidth Plot (Bluetooth, 3Mbps – Ch. 39) – ANT 1

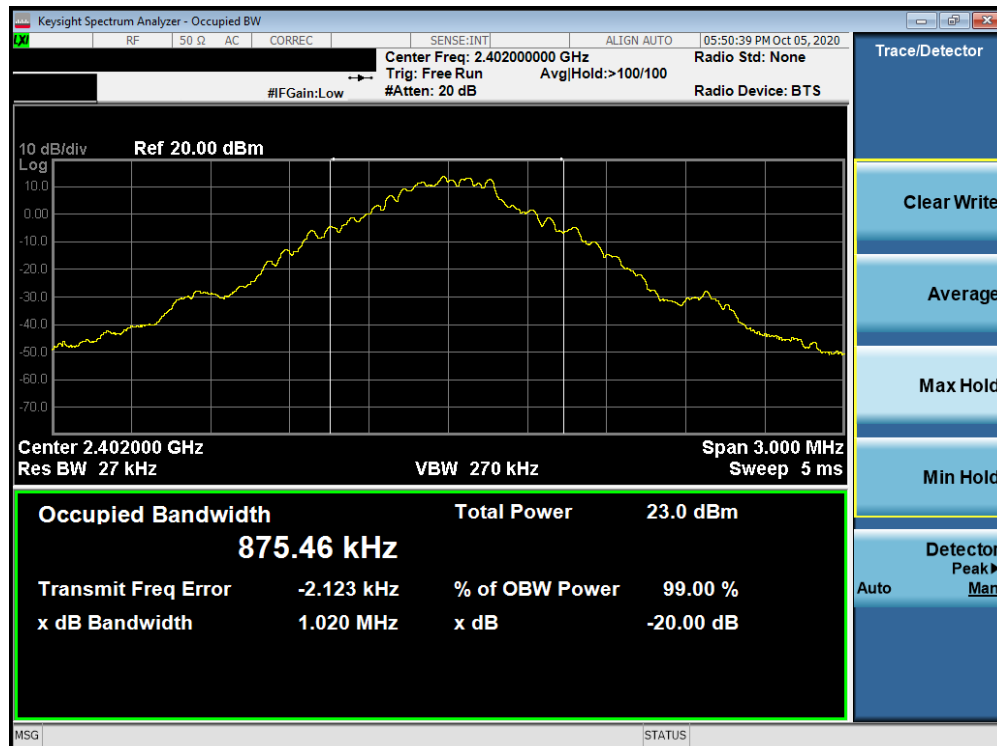


Plot 7-9. 20dB Bandwidth Plot (Bluetooth, 3Mbps – Ch. 78) – ANT 1




FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 17 of 107

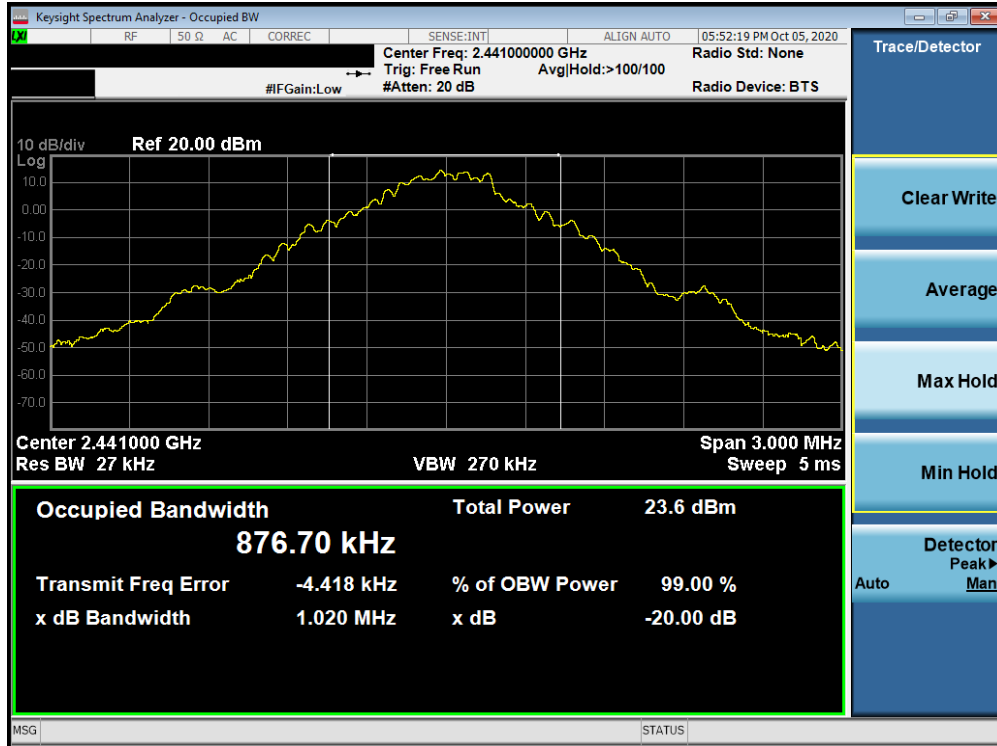
Frequency [MHz]	Data Rate [Mbps]	Channel No.	20dB Bandwidth Test Results
2402	1.0	0	1020.00
2441	1.0	39	1020.00
2480	1.0	78	1022.00
2402	2.0	0	1326.00
2441	2.0	39	1328.00
2480	2.0	78	1325.00
2402	3.0	0	1295.00
2441	3.0	39	1296.00
2480	3.0	78	1298.00

Table 7-3. Conducted 20dB Bandwidth Measurements – ANT 2

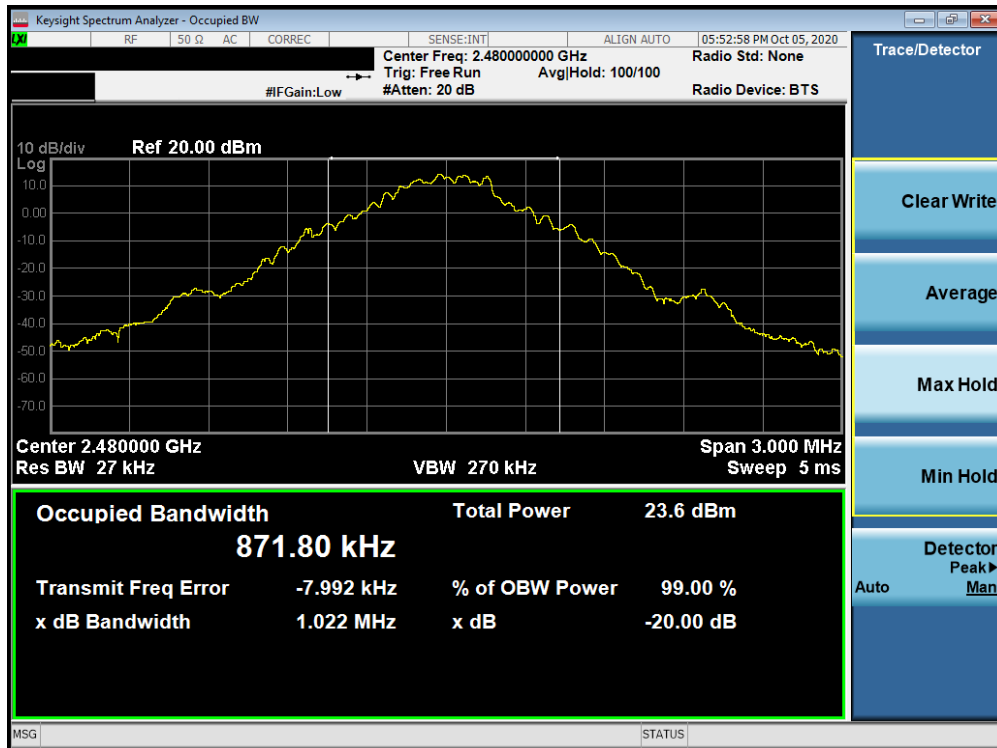


Plot 7-10. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 0) – ANT 2

FCC ID: A3LSMG998JPN	 PCTEST Proud to be part of 	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 18 of 107

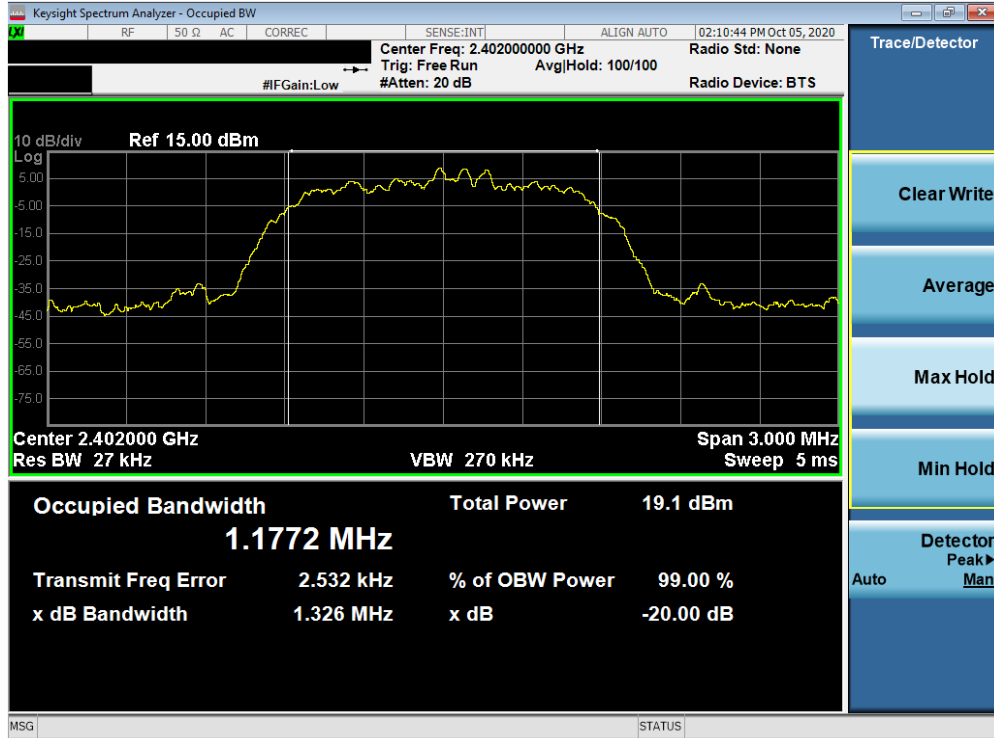


Plot 7-11. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 39) – ANT 2

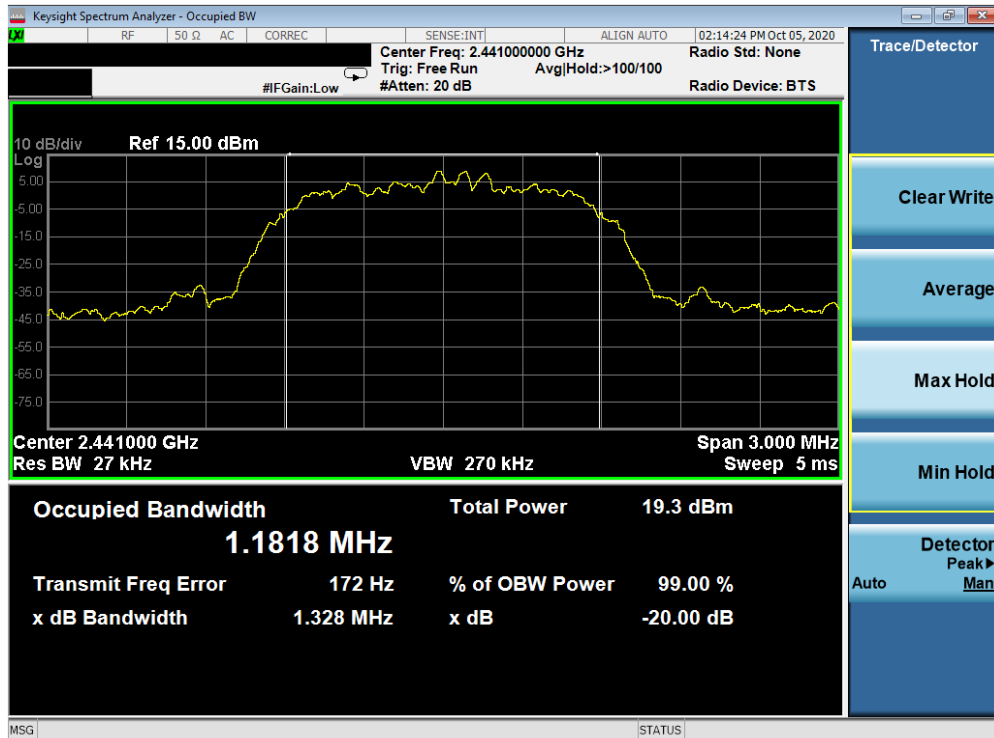


Plot 7-12. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 78) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 19 of 107

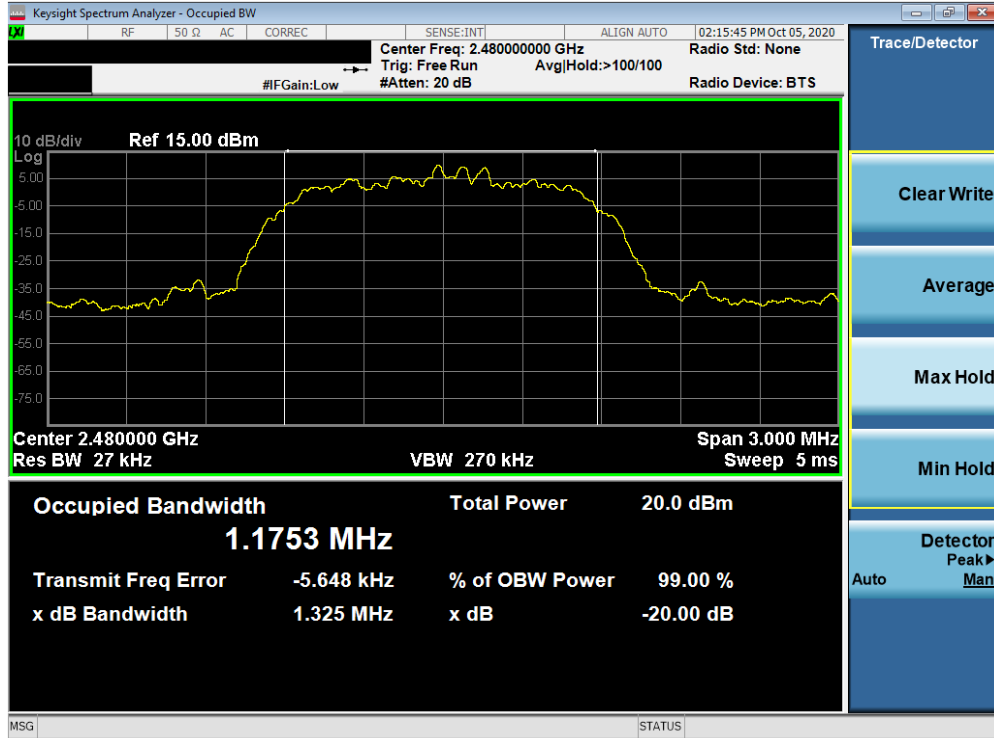


Plot 7-13. 20dB Bandwidth Plot (Bluetooth, 2Mbps – Ch. 0) – ANT 2

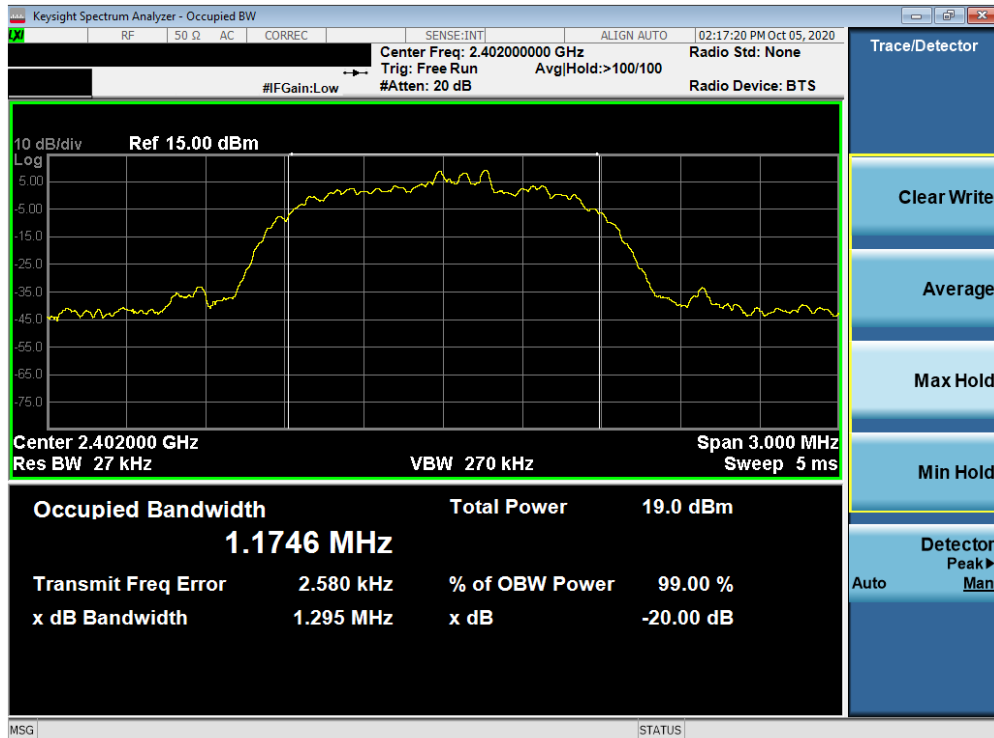


Plot 7-14. 20dB Bandwidth Plot (Bluetooth, 2Mbps – Ch. 39) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 20 of 107

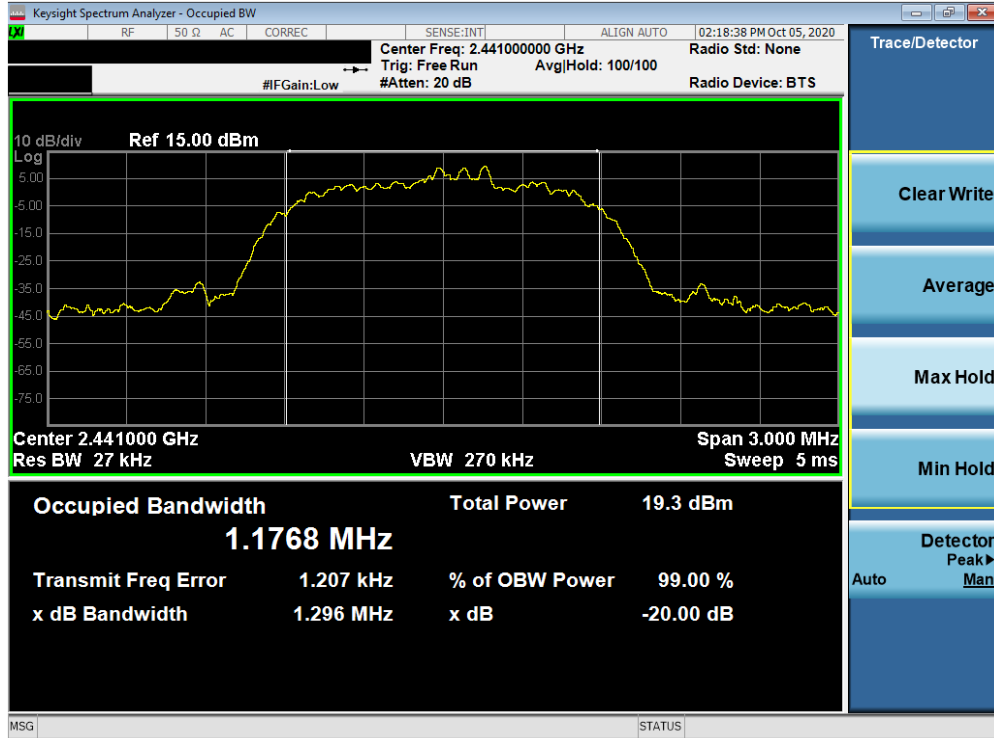


Plot 7-15. 20dB Bandwidth Plot (Bluetooth, 2Mbps – Ch. 78) – ANT 2

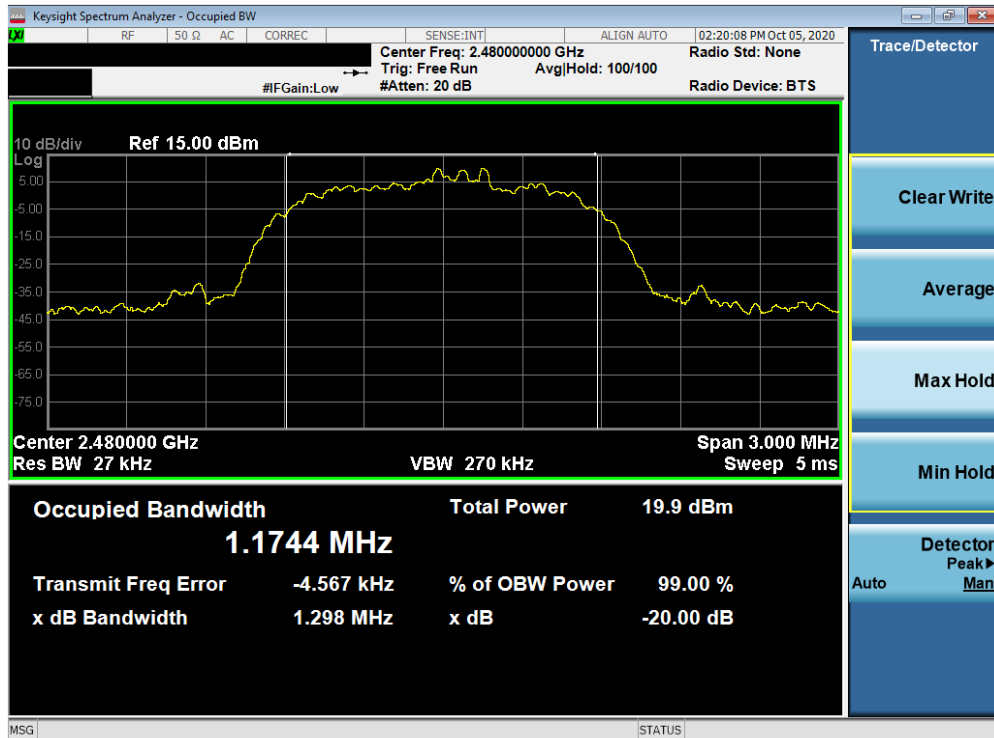


Plot 7-16. 20dB Bandwidth Plot (Bluetooth, 3Mbps – Ch. 0) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 21 of 107



Plot 7-17. 20dB Bandwidth Plot (Bluetooth, 3Mbps – Ch. 39) – ANT 2



Plot 7-18. 20dB Bandwidth Plot (Bluetooth, 3Mbps – Ch. 78) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 22 of 107

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

Note




FCC ID: A3LSMG998JPN	 PCTEST Proud to be part of  element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 23 of 107

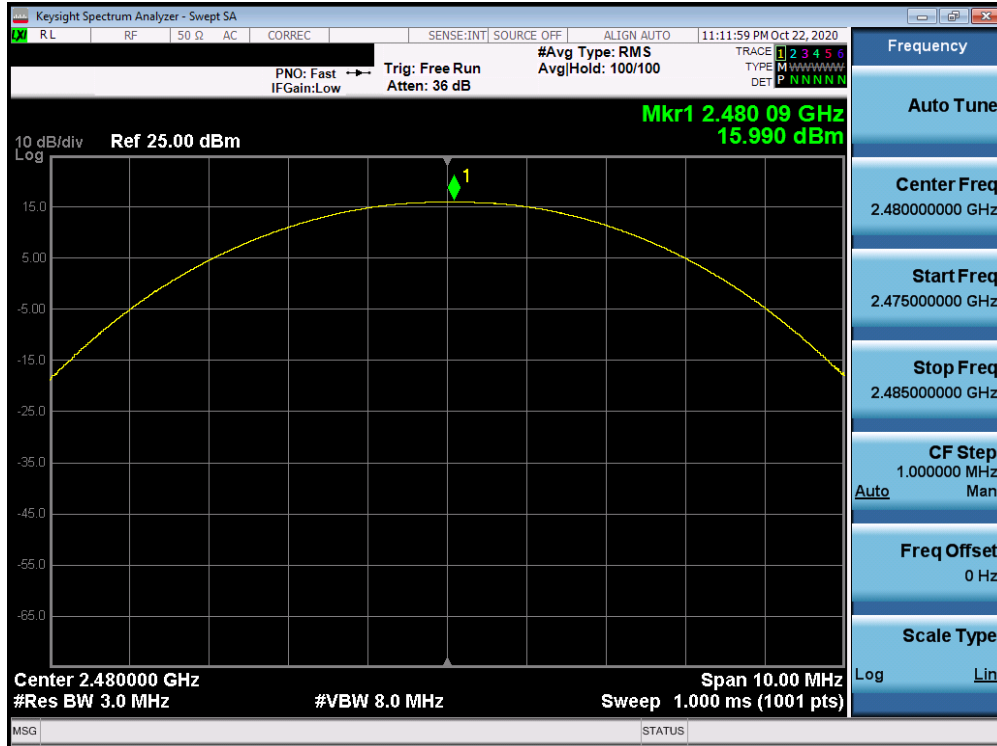
This unit was tested with all possible data rates and the highest peak power is reported with the unit transmitting at 3Mbps. Final results were obtained using calibrated couplers, attenuators and cables. The following formula was used:

$$\text{Output Power (dBm)} = \text{Raw Analyzer Level (dBm)} + \text{Cable Loss (dB)} + \text{Loss in Directional Coupler/Insertion Loss (dB)}$$

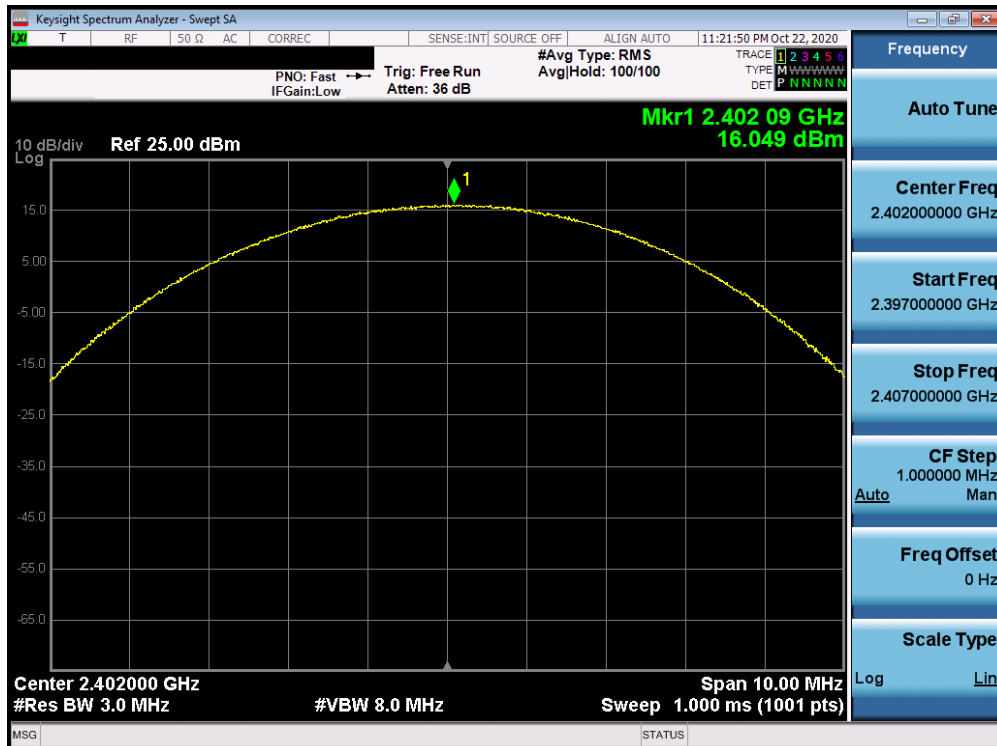
Frequency [MHz]	Data Rate [Mbps]	Channel No.	Peak Conducted Power		Avg Conducted Power	
			[dBm]	[mW]	[dBm]	[mW]
2402	1.0	0	16.74	47.174	16.21	41.774
2441	1.0	39	16.56	45.290	16.29	42.566
2480	1.0	78	15.99	39.719	15.72	37.325
2402	2.0	0	16.05	40.262	12.95	19.713
2441	2.0	39	16.27	42.355	13.40	21.879
2480	2.0	78	16.38	43.491	13.46	22.182
2402	3.0	0	16.98	49.877	13.67	23.292
2441	3.0	39	16.75	47.315	13.48	22.290
2480	3.0	78	16.88	48.708	13.53	22.563

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

FCC ID: A3LSMG998JPN	 PCTEST Proud to be part of  element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 24 of 107

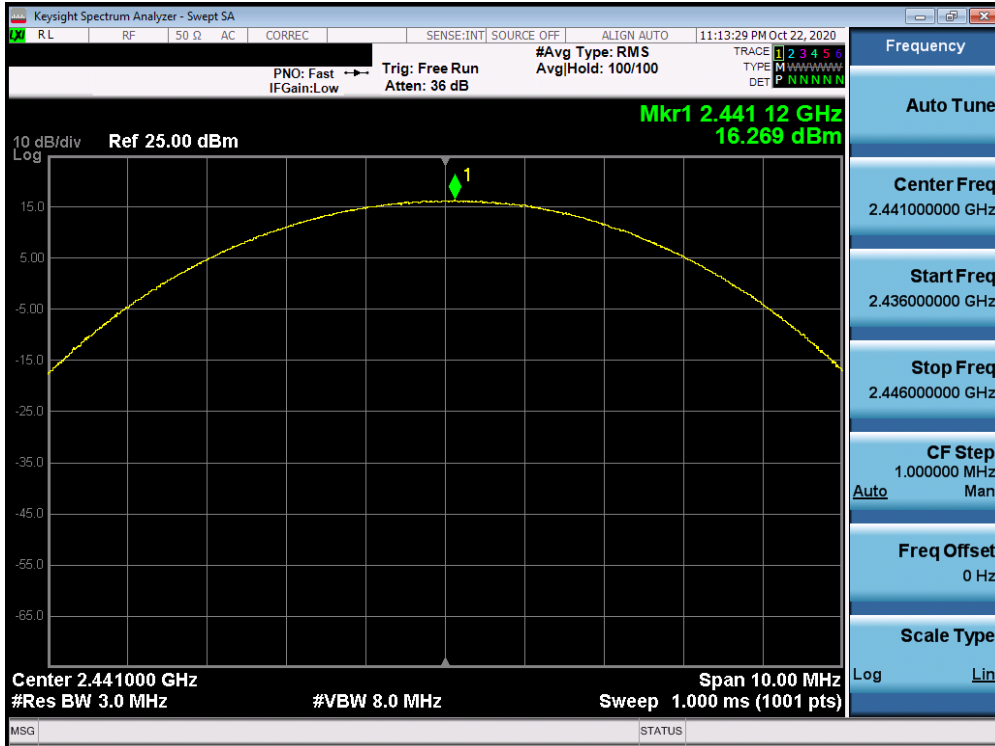


Plot 7-21. Peak Conducted Power (1Mbps – Ch. 78) – ANT 1

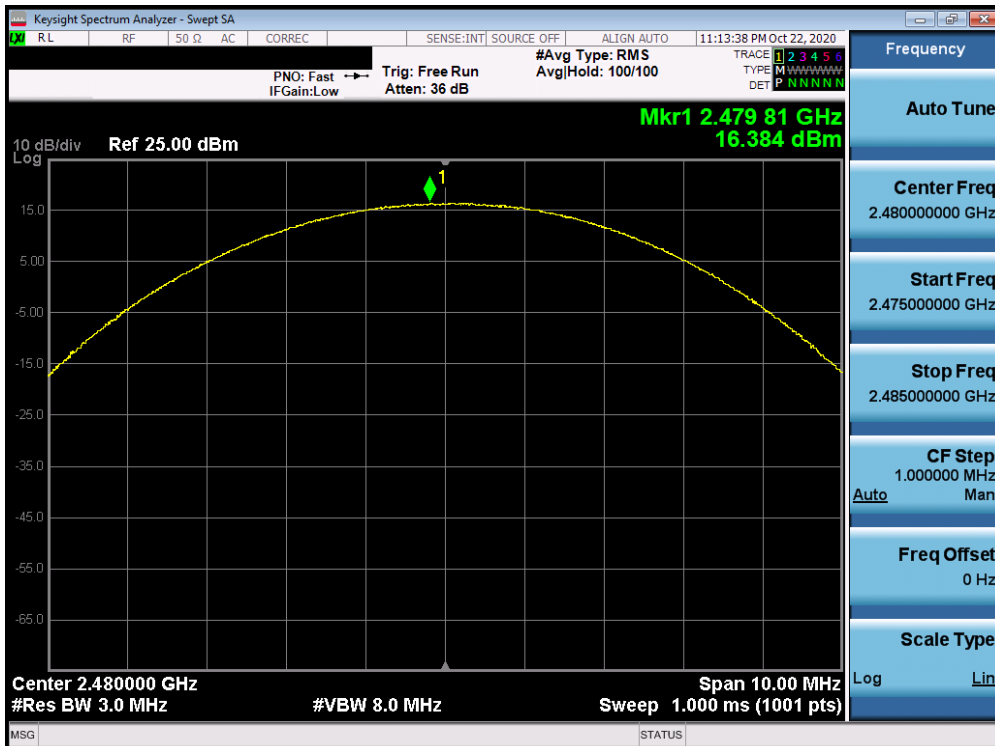


Plot 7-22. Peak Conducted Power (2Mbps – Ch. 0) – ANT 1

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 26 of 107

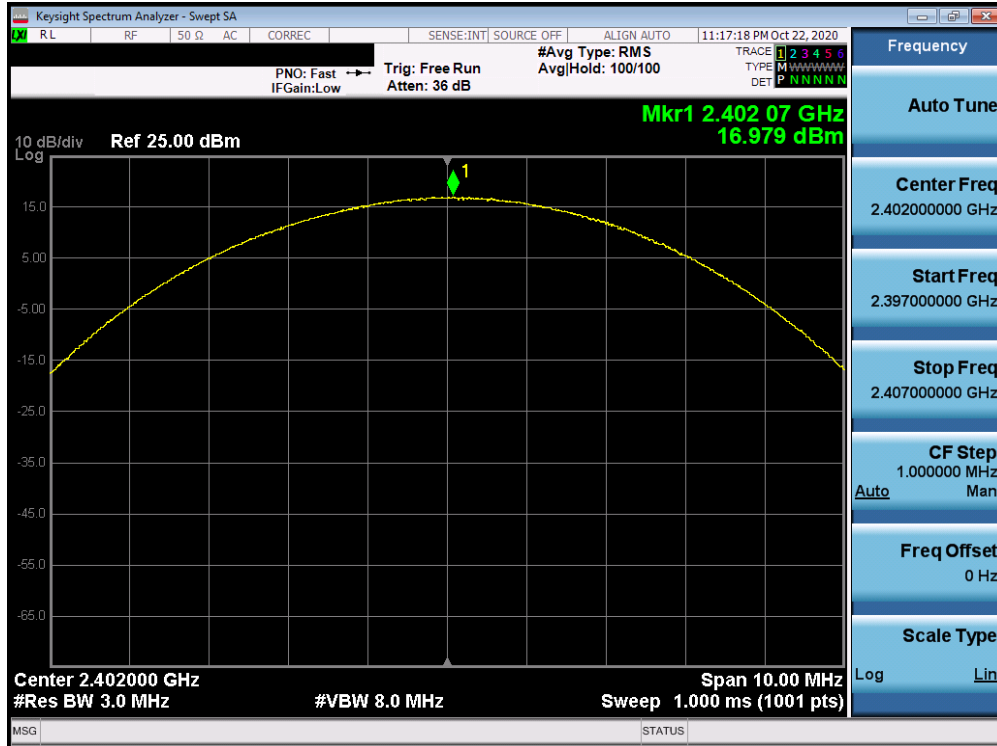


Plot 7-23. Peak Conducted Power (2Mbps – Ch. 39) – ANT 1

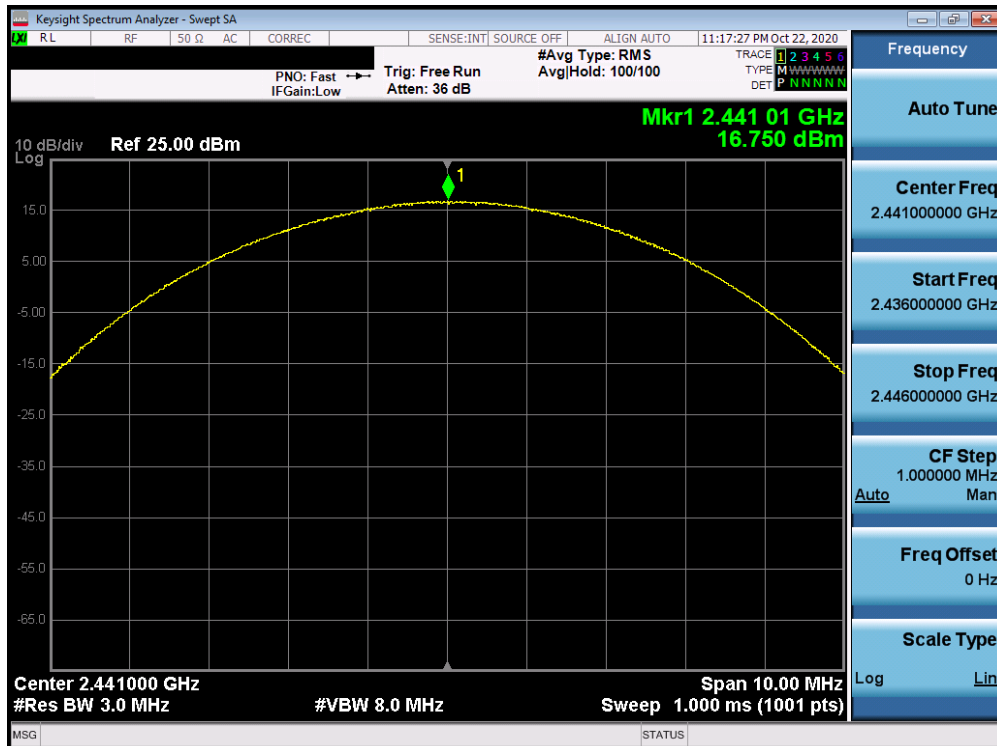


Plot 7-24. Peak Conducted Power (2Mbps – Ch. 78) – ANT 1

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 27 of 107

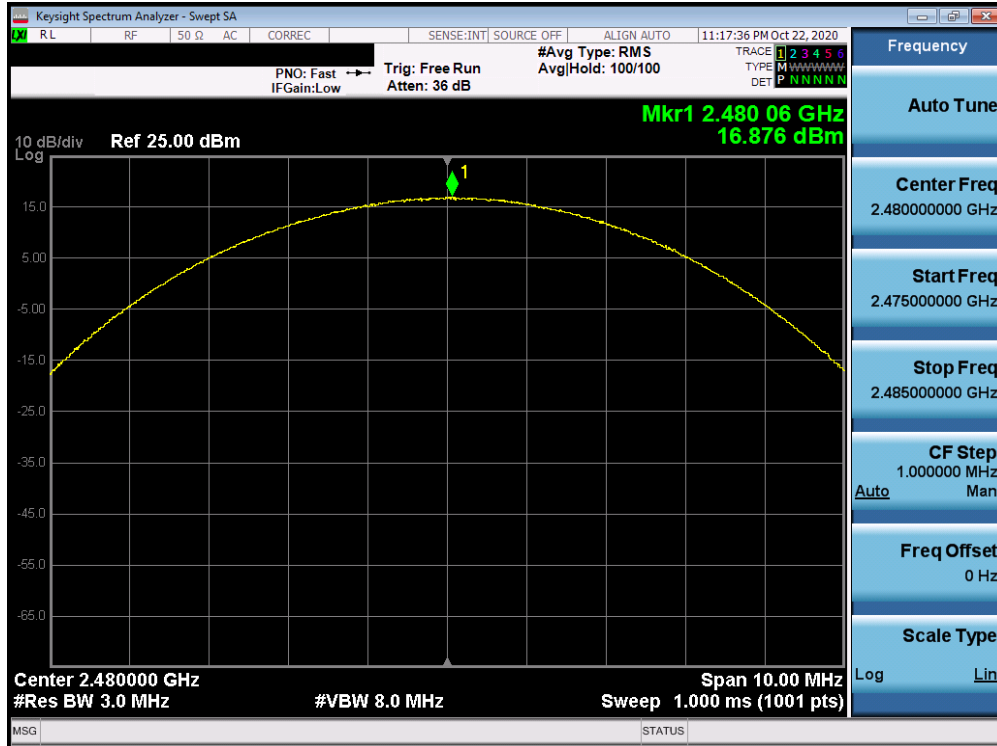


Plot 7-25. Peak Conducted Power (3Mbps – Ch. 0) – ANT 1

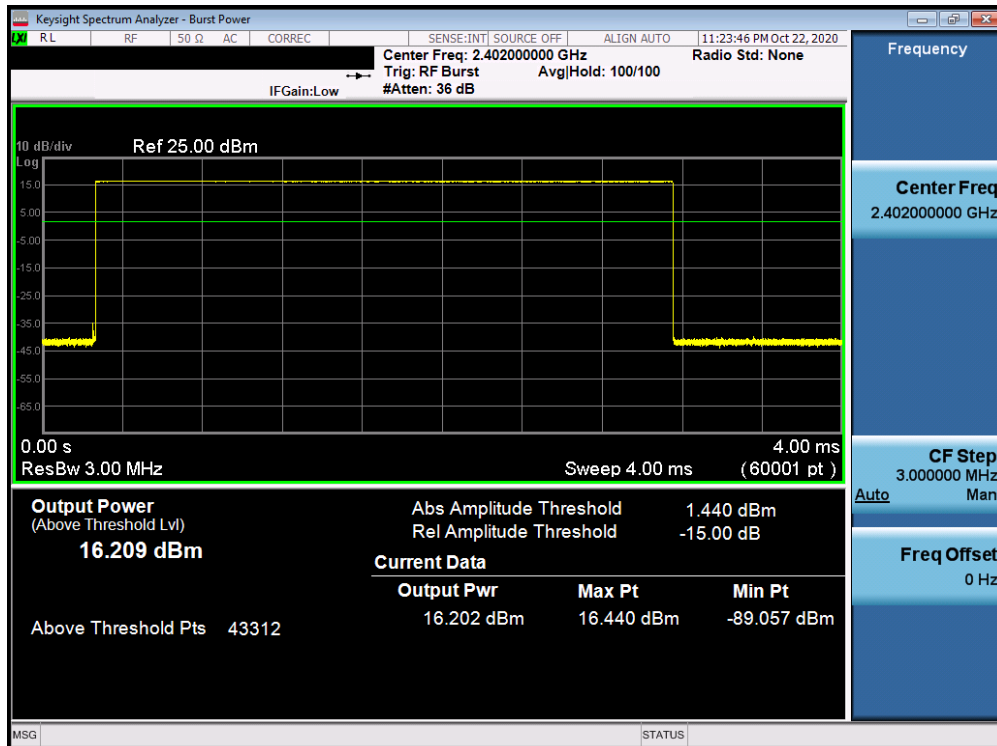


Plot 7-26. Peak Conducted Power (3Mbps – Ch. 39) – ANT 1

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 28 of 107

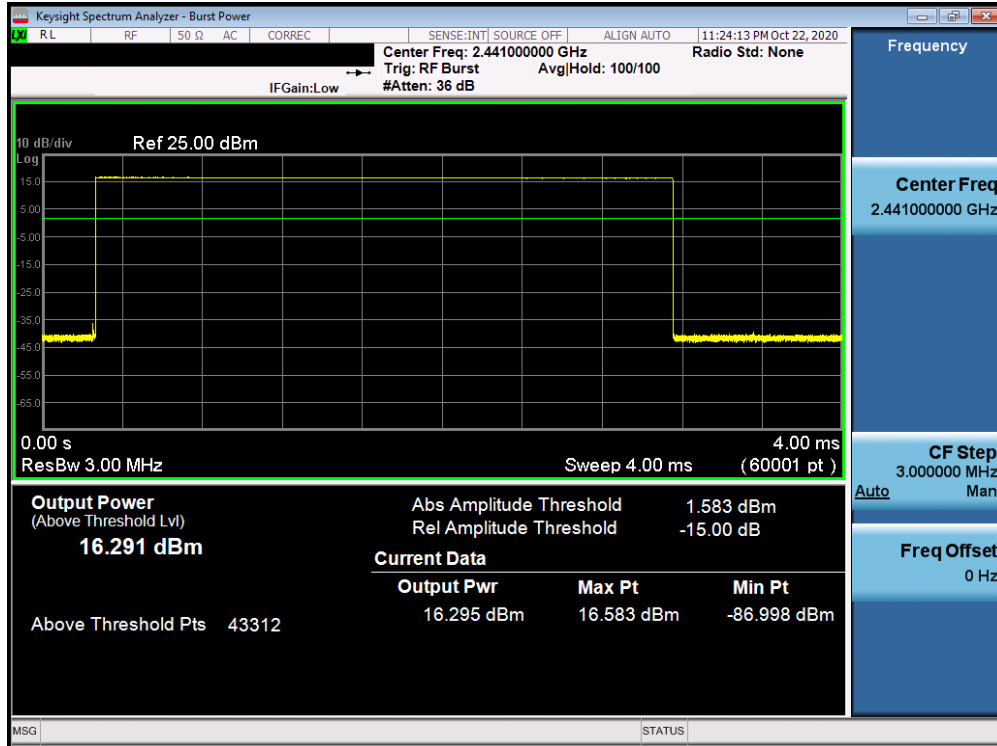


Plot 7-27. Peak Conducted Power (3Mbps – Ch. 78) – ANT 1

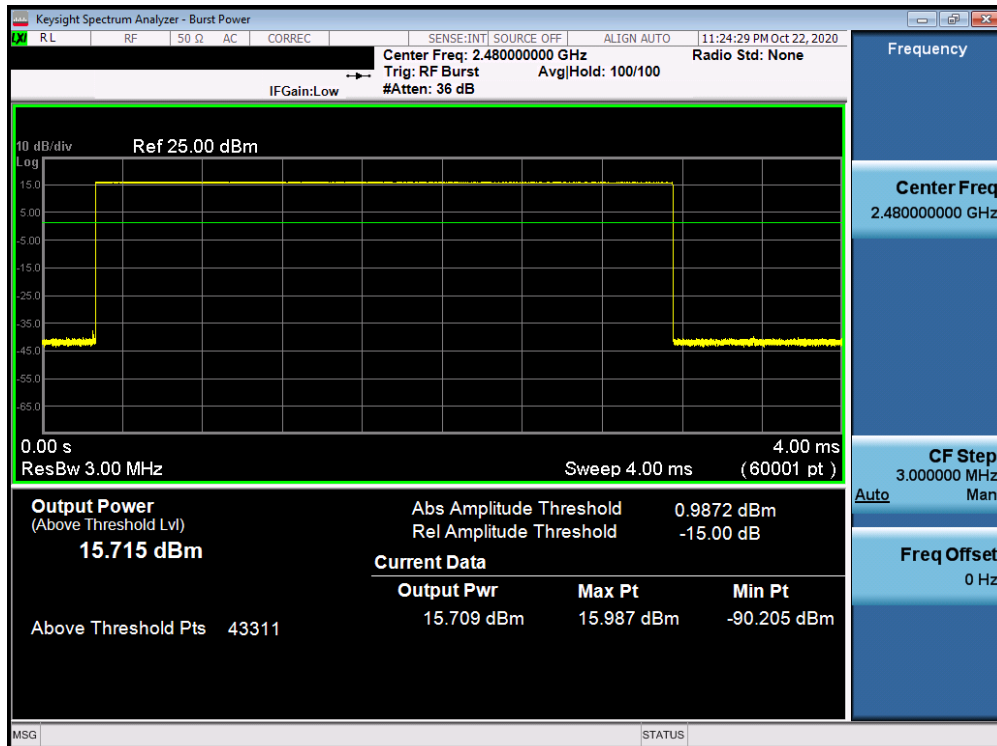


Plot 7-28. Average Conducted Power (1Mbps – Ch. 0) – ANT 1

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 29 of 107

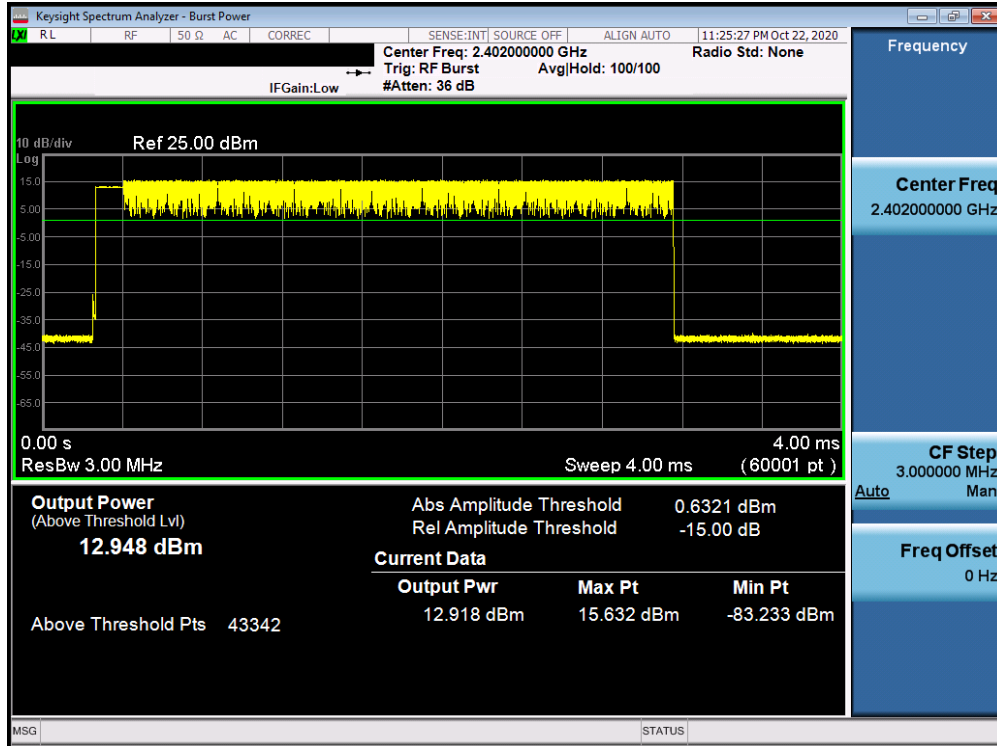


Plot 7-29. Average Conducted Power (1Mbps – Ch. 39) – ANT 1

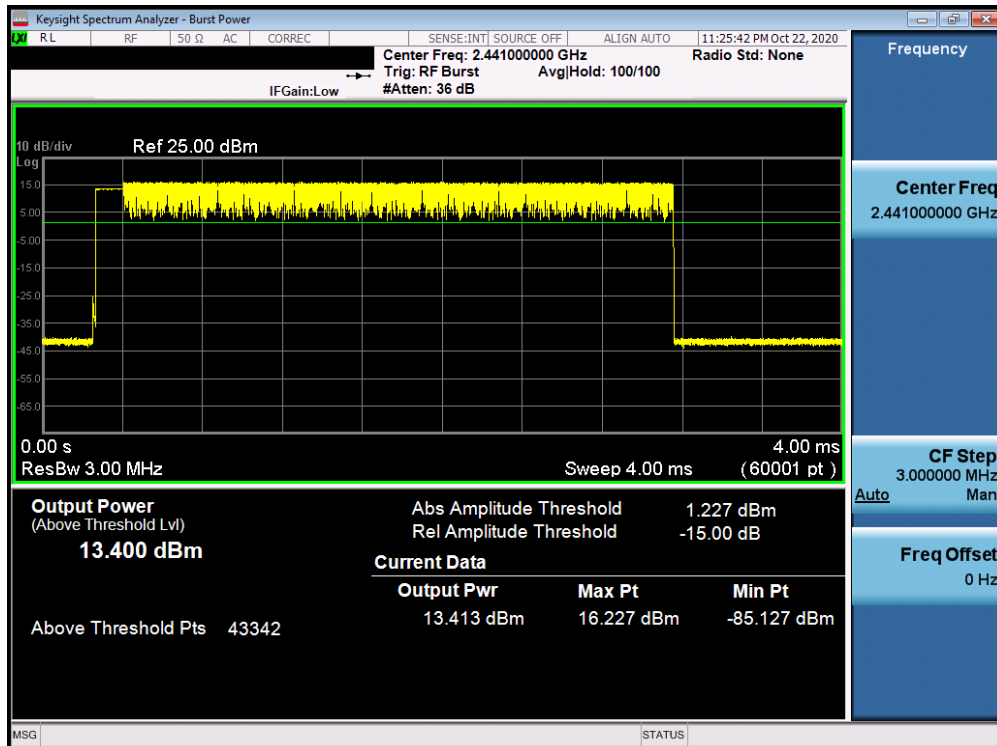


Plot 7-30. Average Conducted Power (1Mbps – Ch. 78) – ANT 1

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 30 of 107

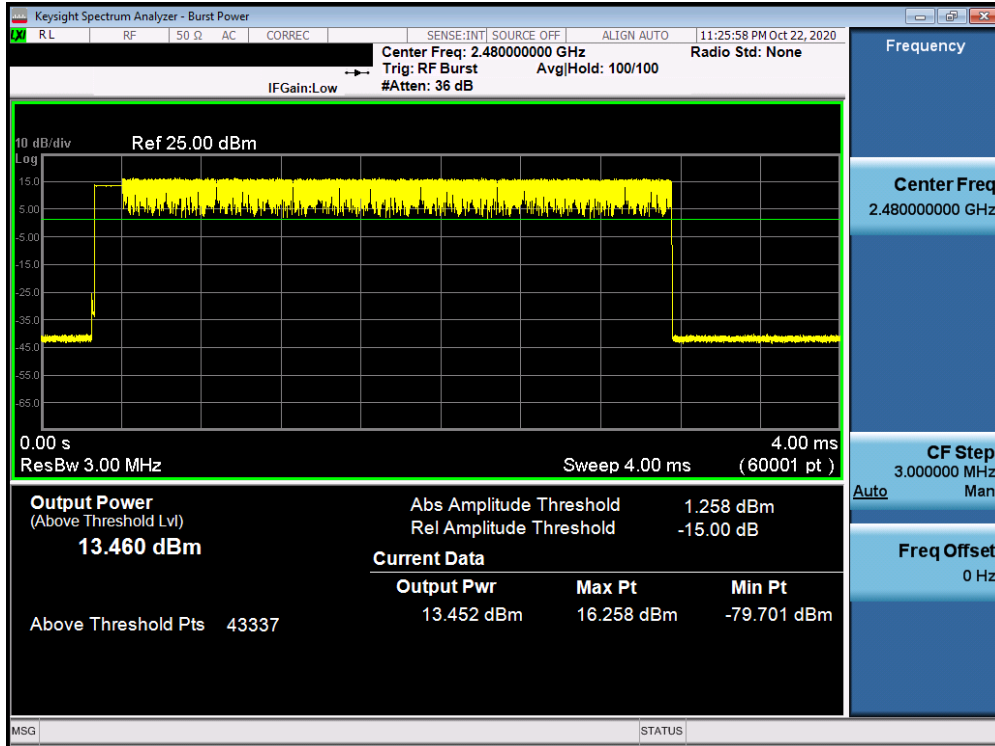


Plot 7-31. Average Conducted Power (2Mbps – Ch. 0) – ANT 1

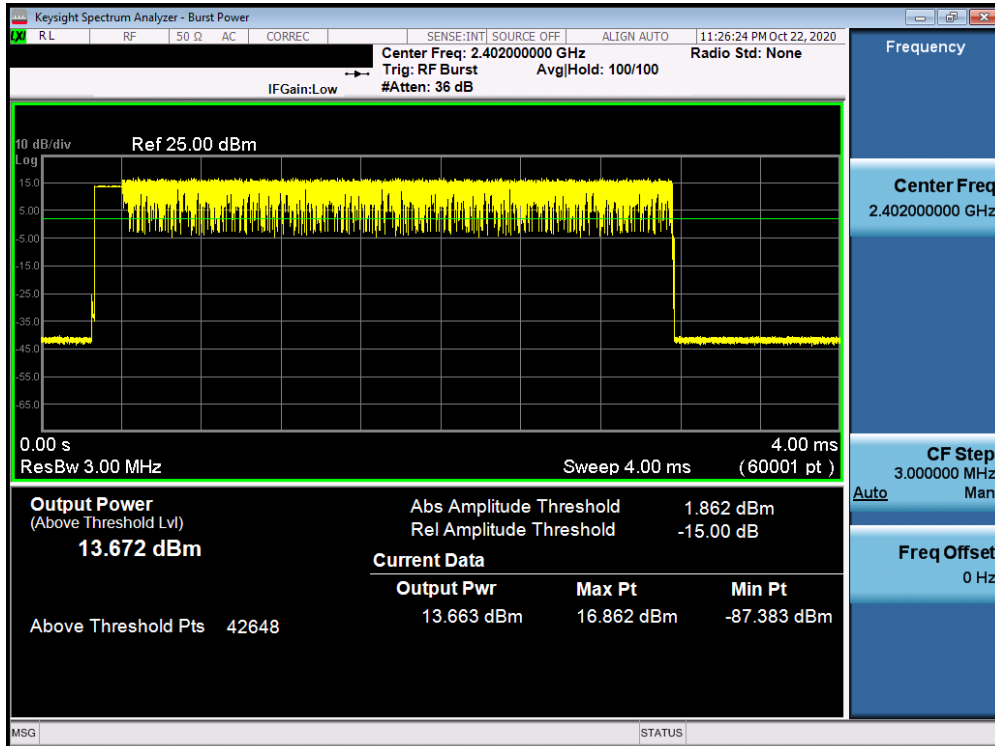


Plot 7-32. Average Conducted Power (2Mbps – Ch. 39) – ANT 1

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 31 of 107

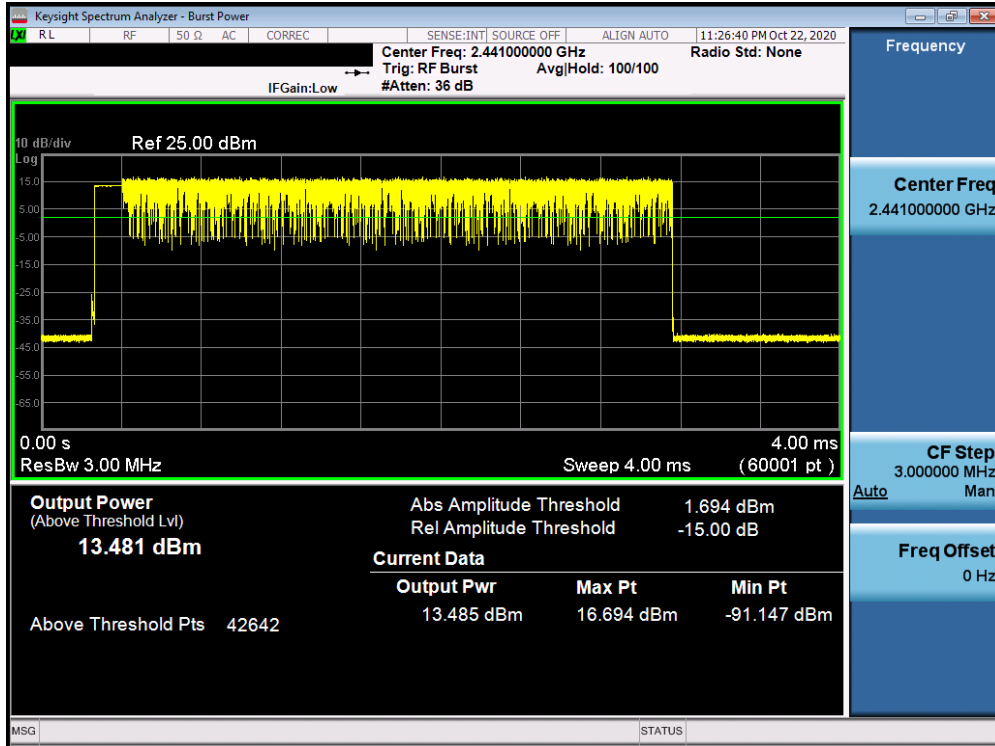


Plot 7-33. Average Conducted Power (2Mbps – Ch. 78) – ANT 1

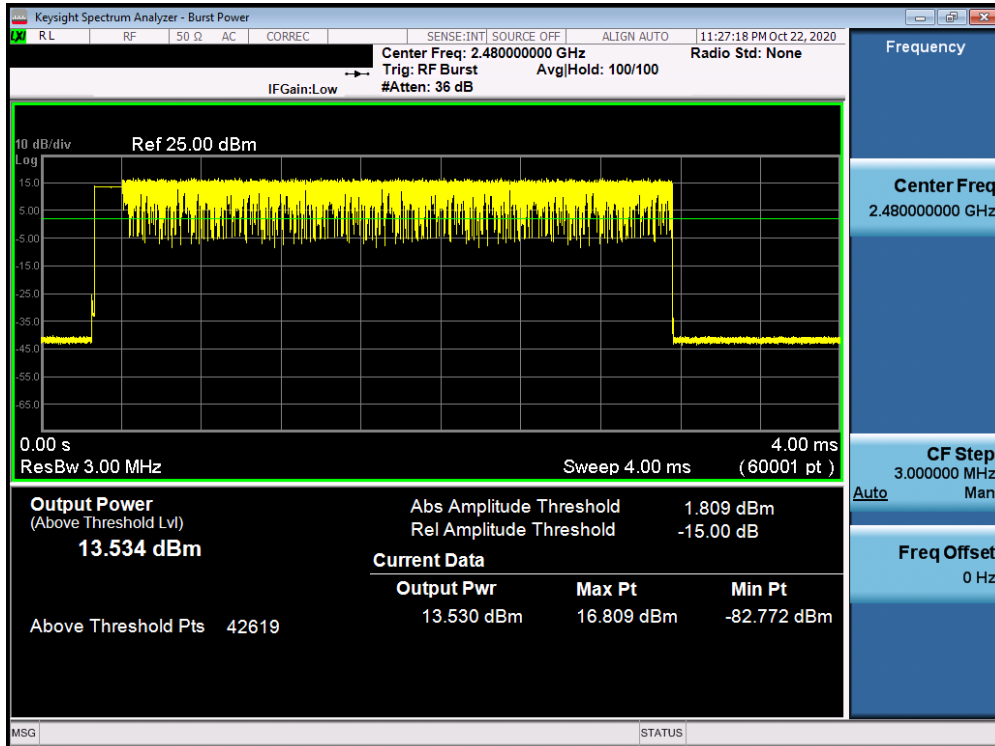


Plot 7-34. Average Conducted Power (3Mbps – Ch. 0) – ANT 1

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 32 of 107



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

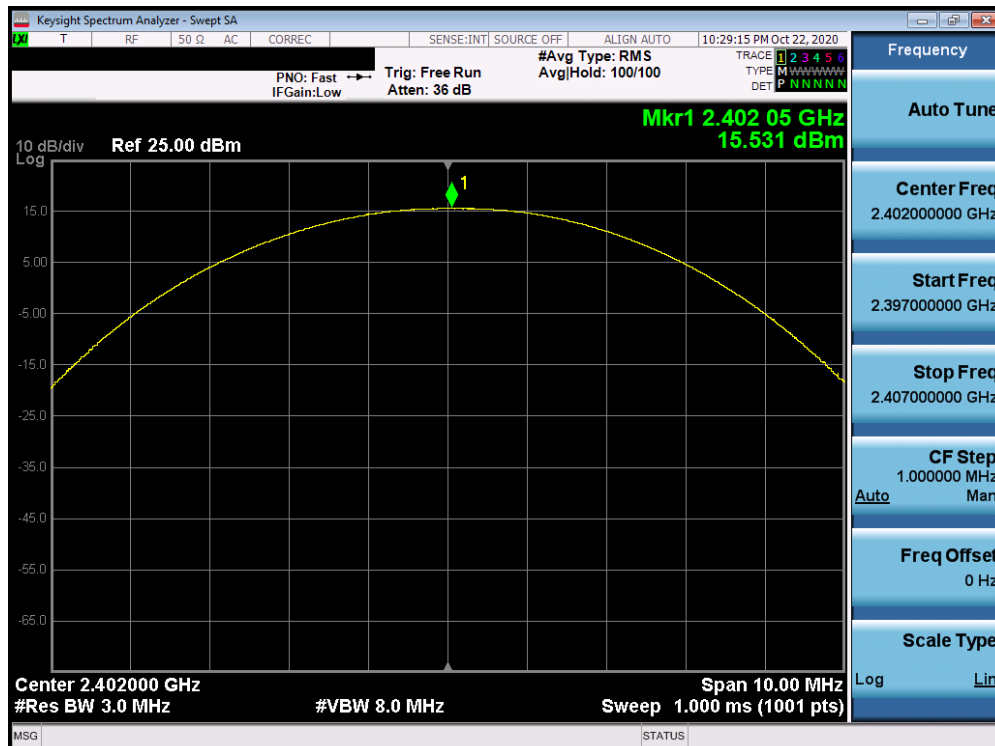


Plot 7-36. Average Conducted Power (3Mbps – Ch. 78) – ANT 1



FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 33 of 107

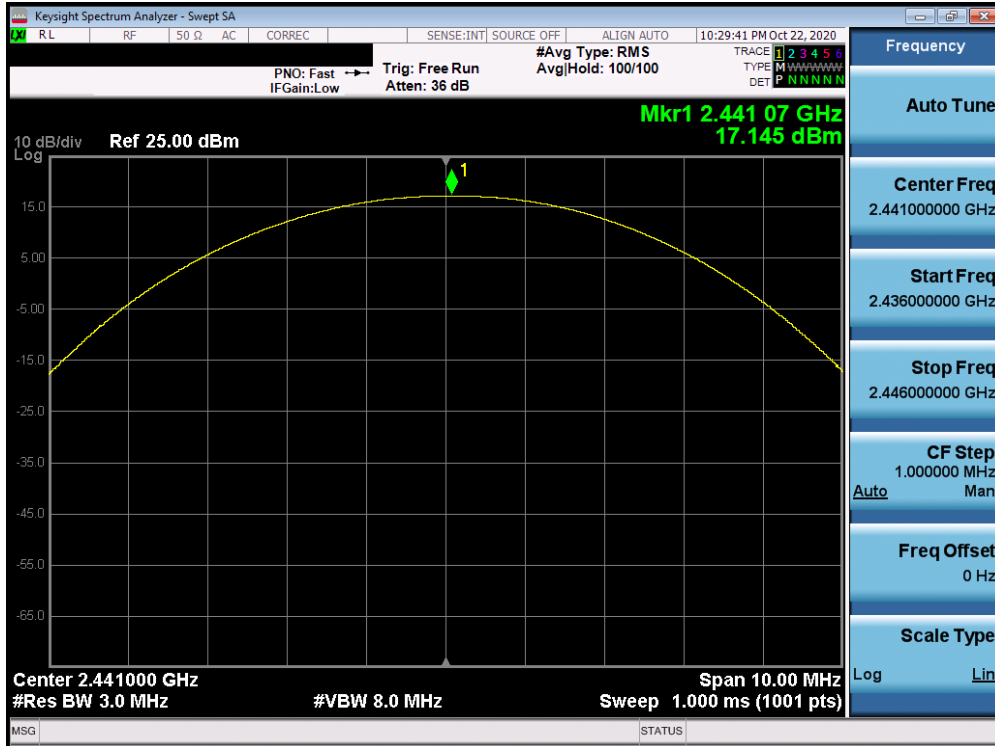
Frequency [MHz]	Data Rate [Mbps]	Channel No.	Peak Conducted Power		Avg Conducted Power	
			[dBm]	[mW]	[dBm]	[mW]
2402	1.0	0	15.53	35.736	14.96	31.354
2441	1.0	39	17.15	51.820	16.76	47.467
2480	1.0	78	16.89	48.865	16.44	44.030
2402	2.0	0	13.14	20.611	10.03	10.074
2441	2.0	39	16.41	43.772	13.28	21.263
2480	2.0	78	16.70	46.730	12.29	16.930
2402	3.0	0	14.60	28.860	11.21	13.208
2441	3.0	39	16.89	48.809	13.53	22.517
2480	3.0	78	17.13	51.677	13.64	23.124

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

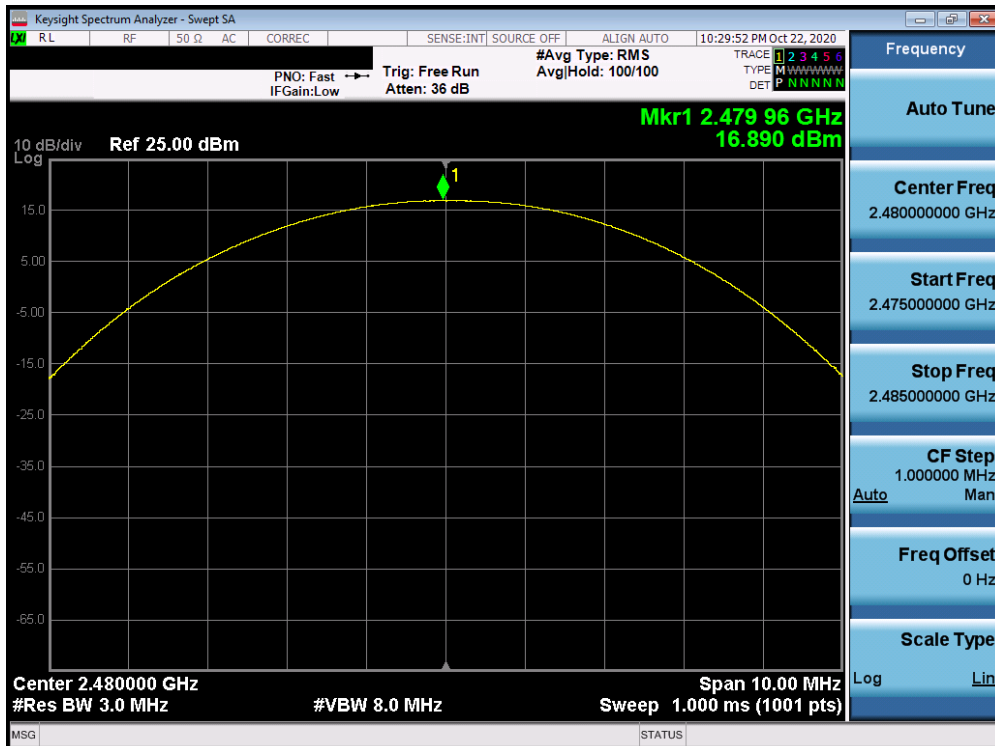


Plot 7-37. Peak Conducted Power (1Mbps – Ch. 0) – ANT 2

FCC ID: A3LSMG998JPN		MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 34 of 107

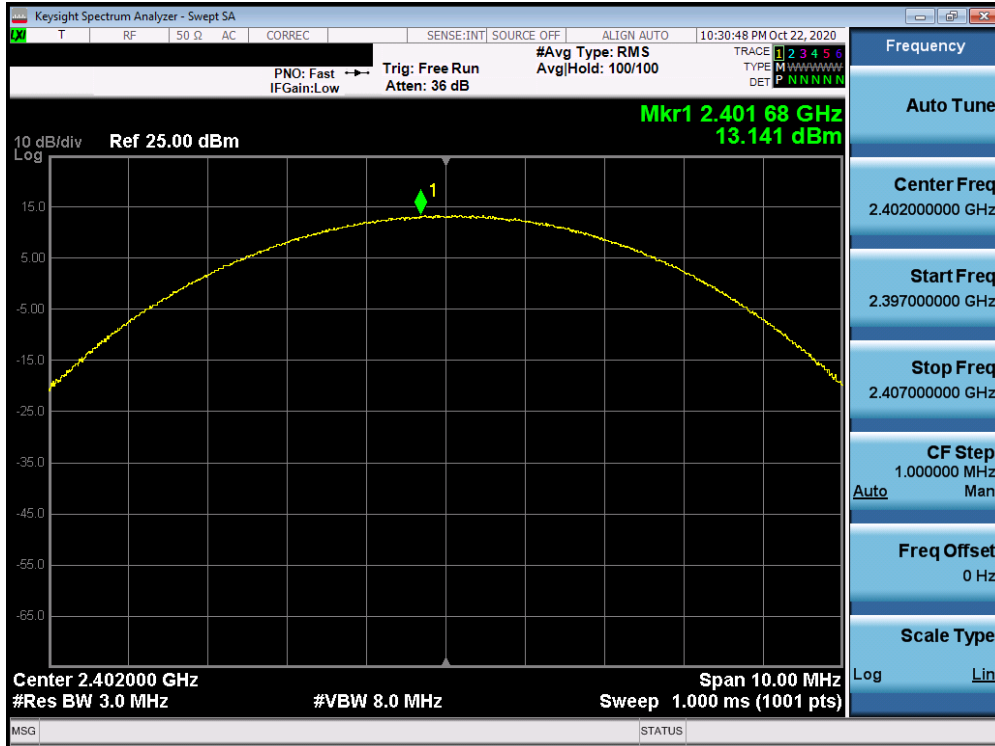


Plot 7-38. Peak Conducted Power (1Mbps – Ch. 39) – ANT 2



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

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 35 of 107

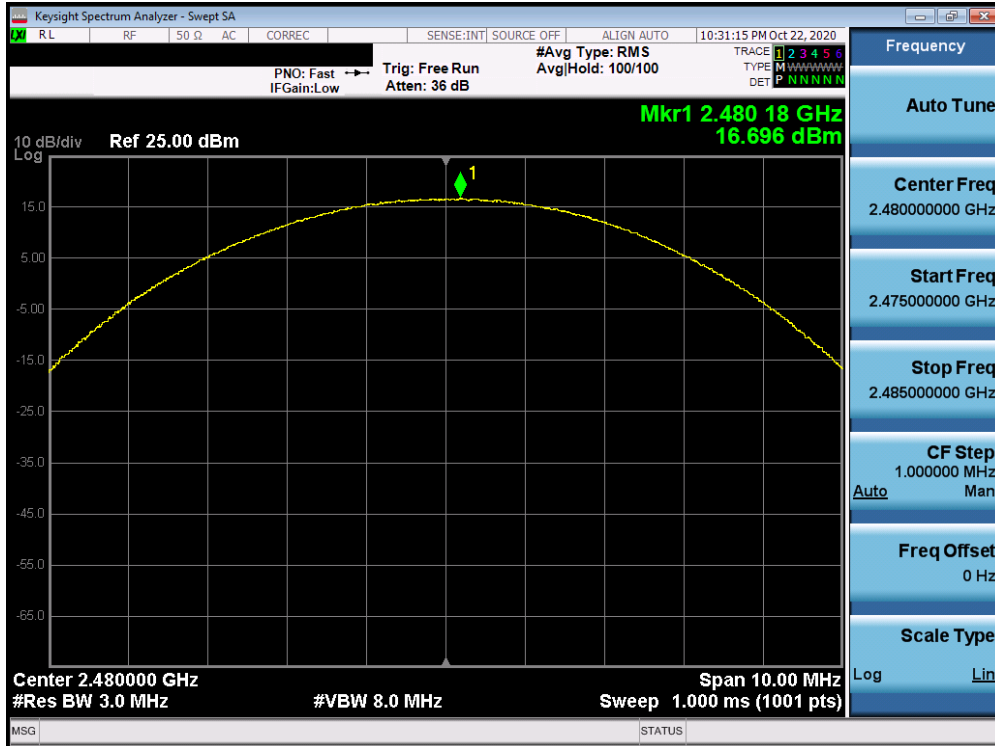


Plot 7-40. Peak Conducted Power (2Mbps – Ch. 0) – ANT 2

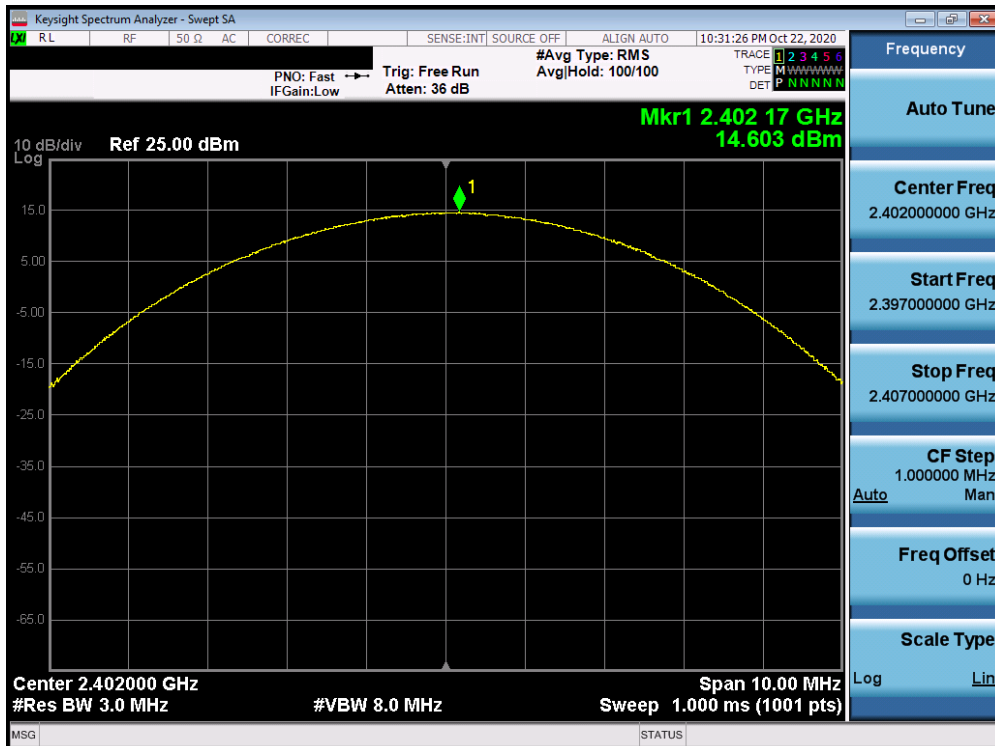


Plot 7-41. Peak Conducted Power (2Mbps – Ch. 39) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 36 of 107

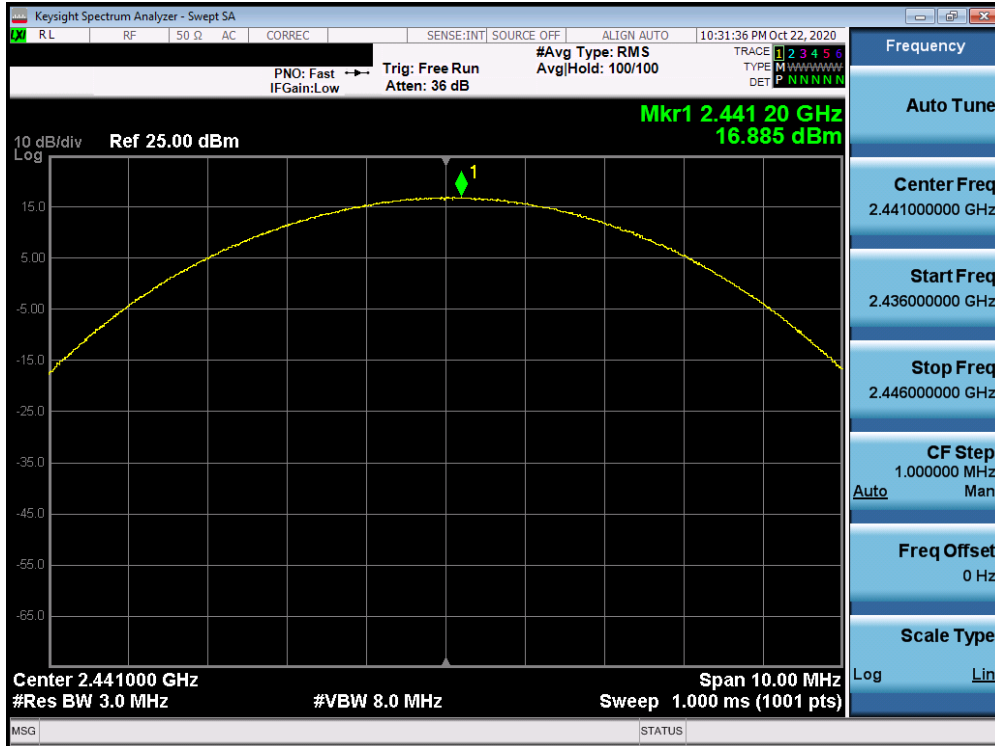


Plot 7-42. Peak Conducted Power (2Mbps – Ch. 78) – ANT 2

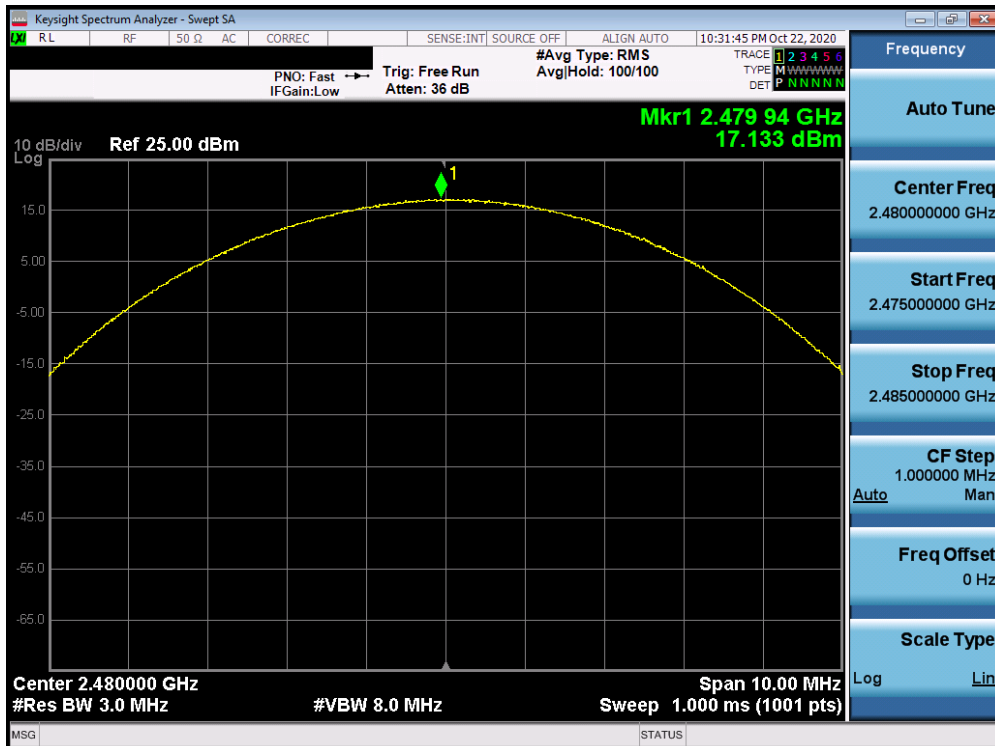


Plot 7-43. Peak Conducted Power (3Mbps – Ch. 0) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 37 of 107

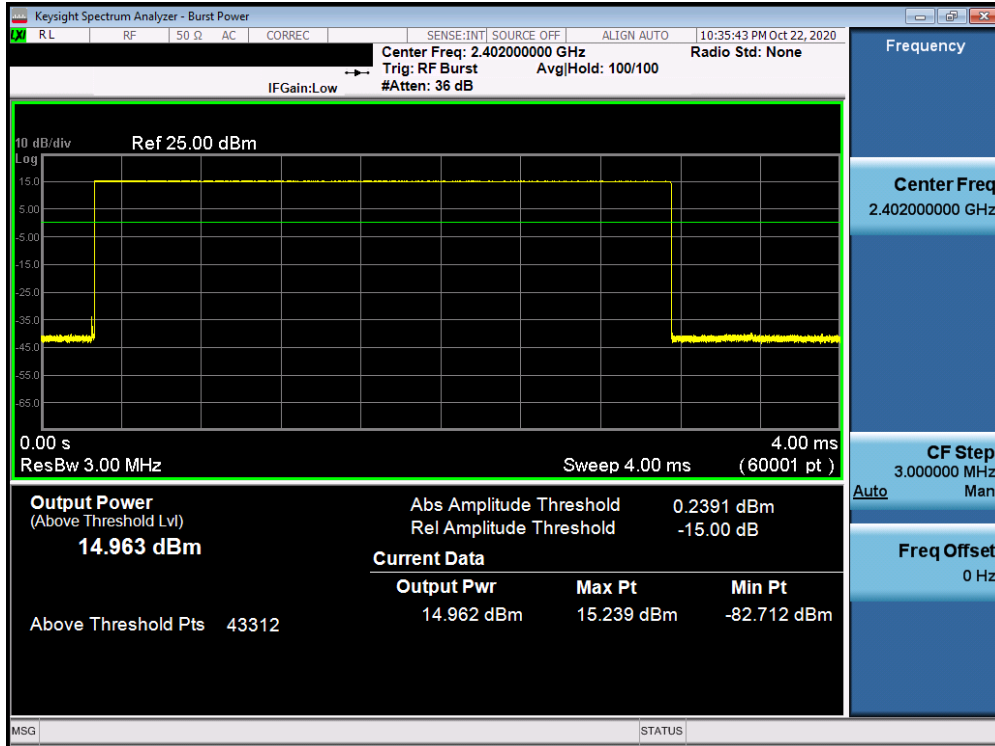


Plot 7-44. Peak Conducted Power (3Mbps – Ch. 39) – ANT 2

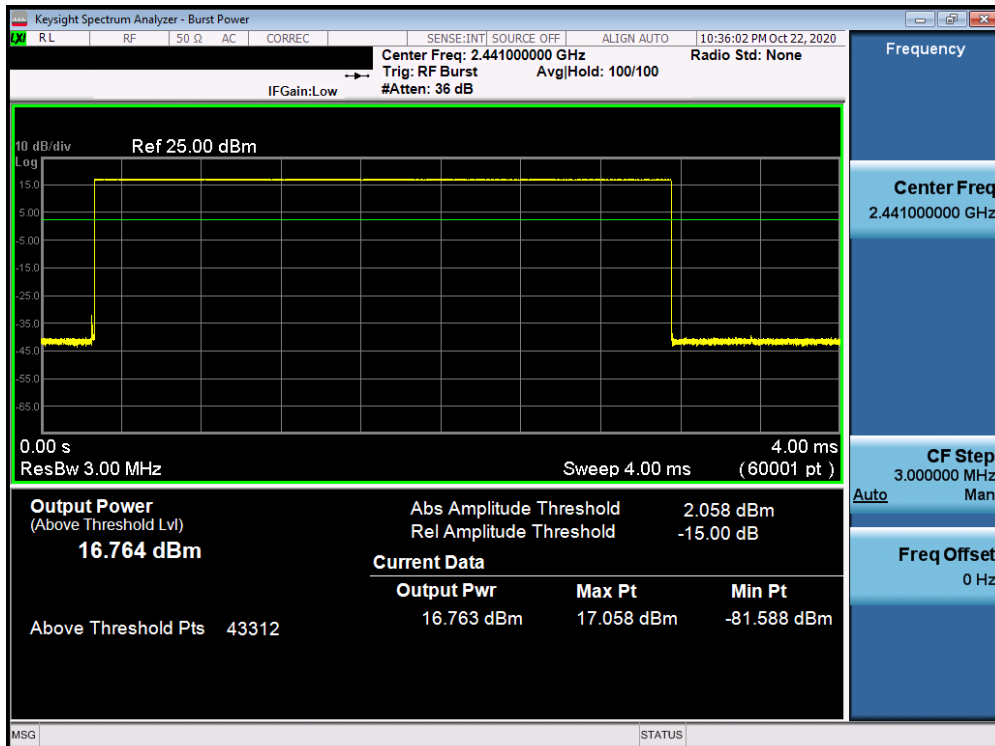


Plot 7-45. Peak Conducted Power (3Mbps – Ch. 78) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of elemental	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 38 of 107

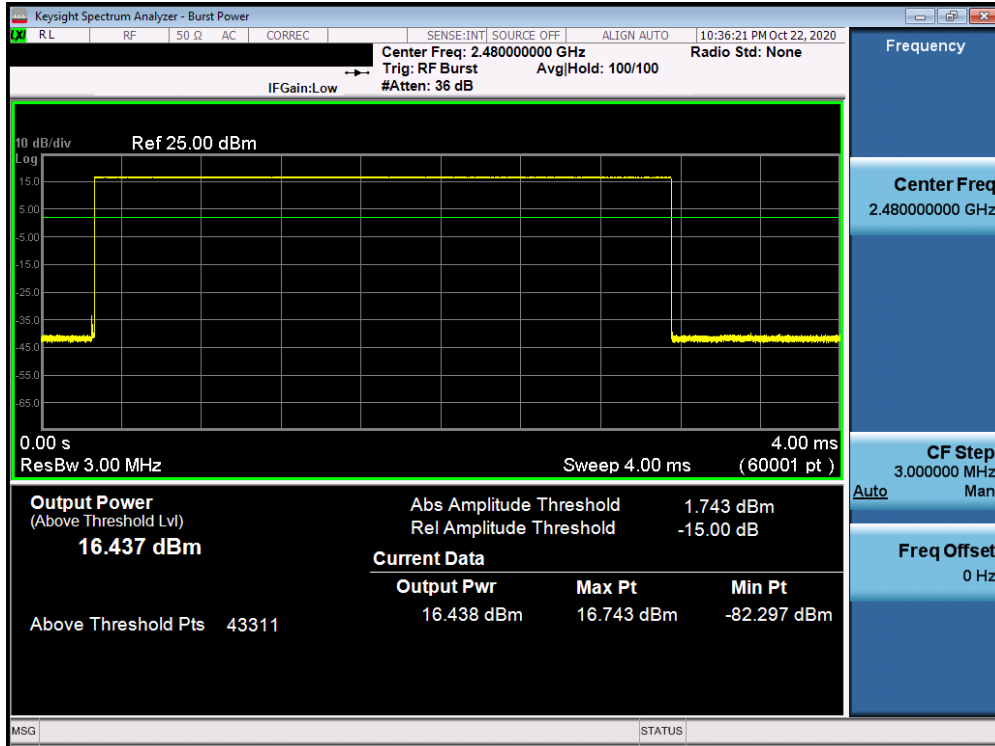


Plot 7-46. Average Conducted Power (1Mbps – Ch. 0) – ANT 2

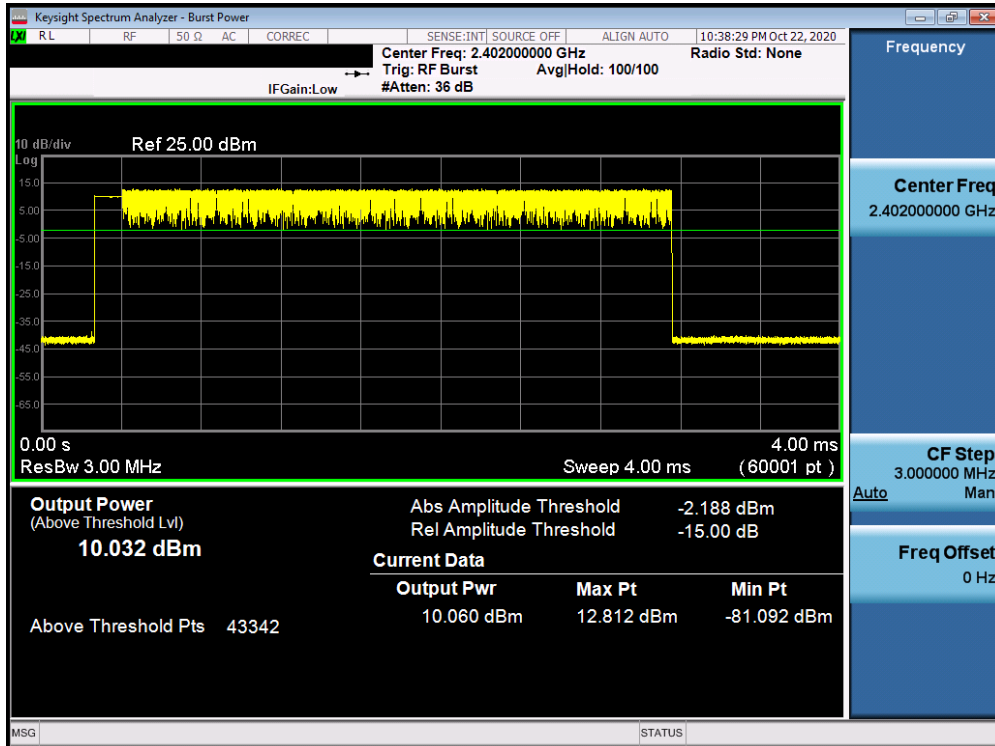


Plot 7-47. Average Conducted Power (1Mbps – Ch. 39) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 39 of 107

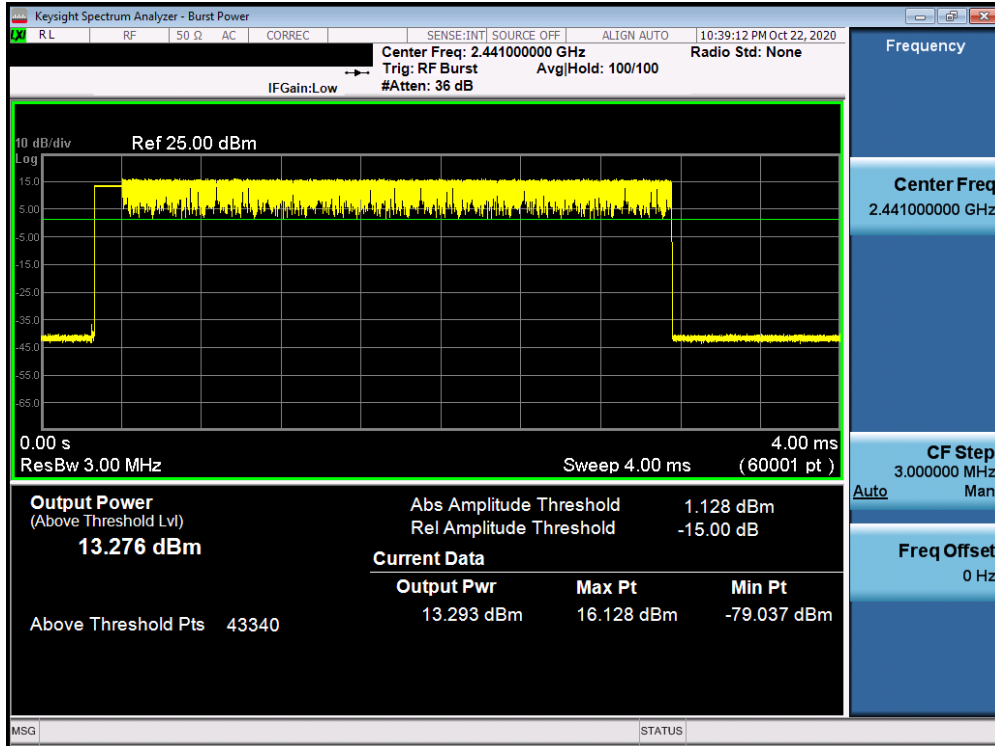


Plot 7-48. Average Conducted Power (1Mbps – Ch. 78) – ANT 2

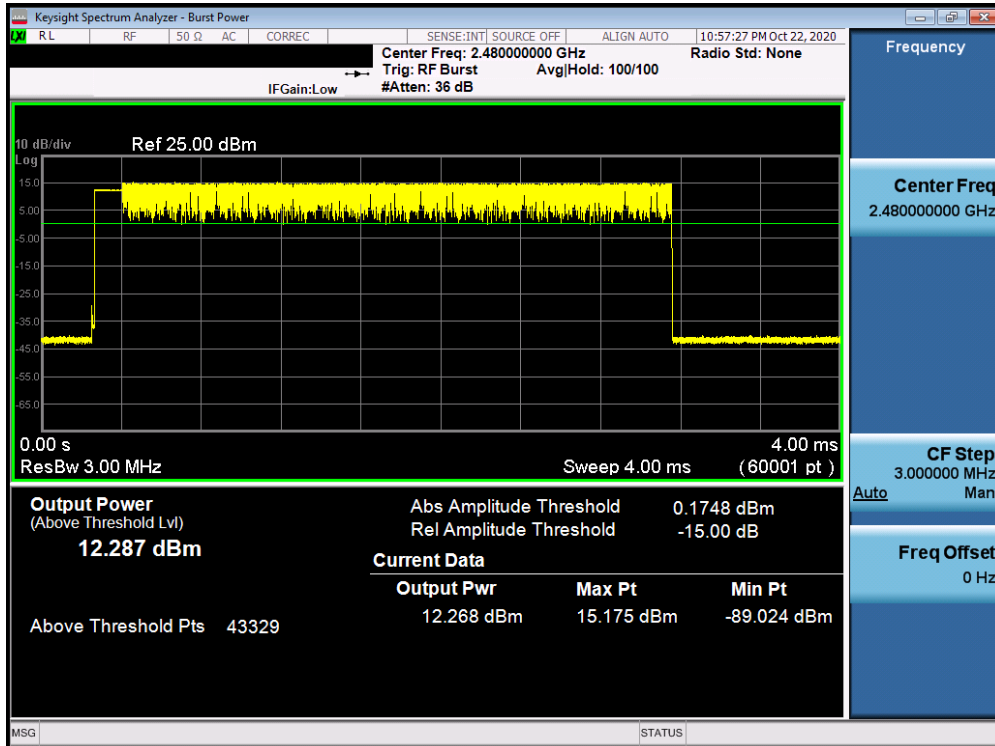


Plot 7-49. Average Conducted Power (2Mbps – Ch. 0) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 40 of 107

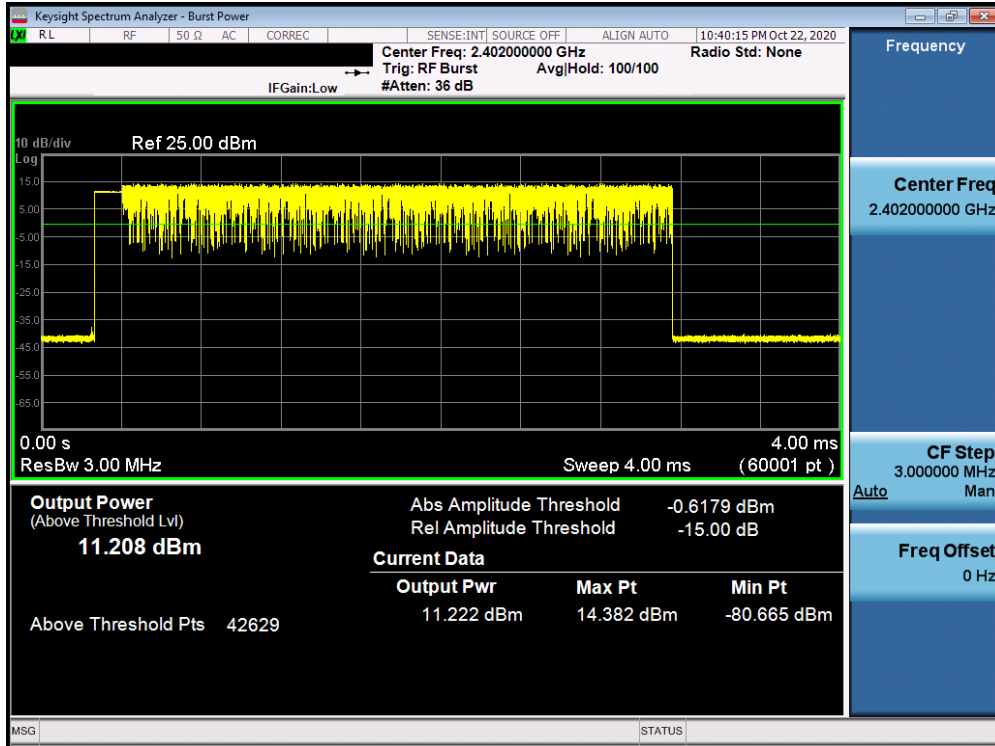


Plot 7-50. Average Conducted Power (2Mbps – Ch. 39) – ANT 2

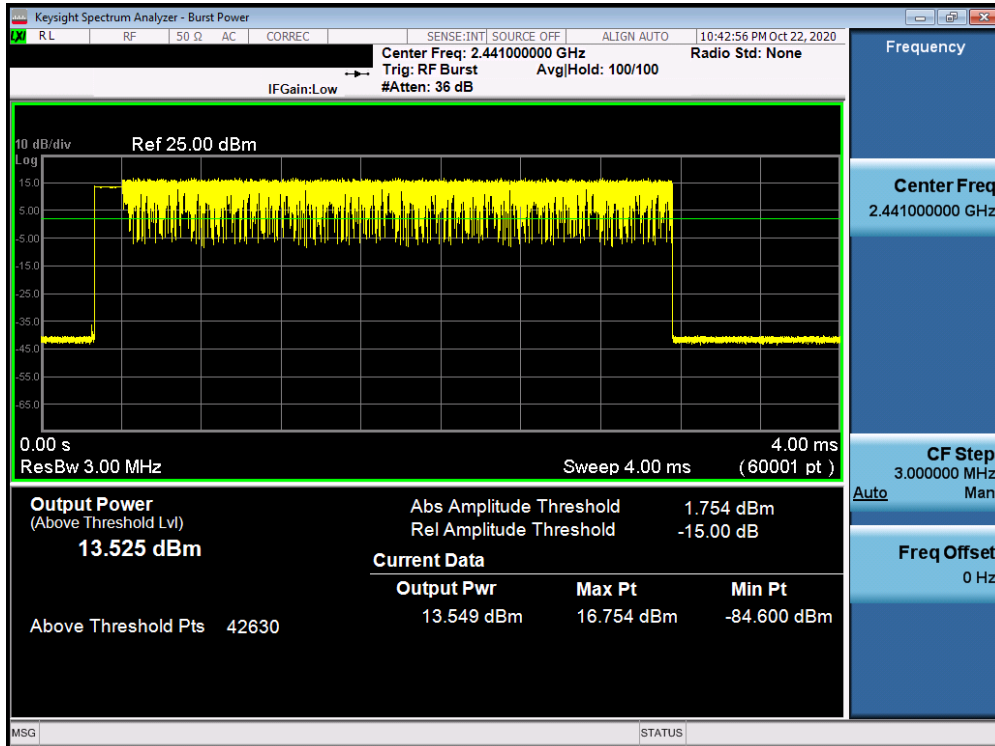


Plot 7-51. Average Conducted Power (2Mbps – Ch. 78) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 41 of 107

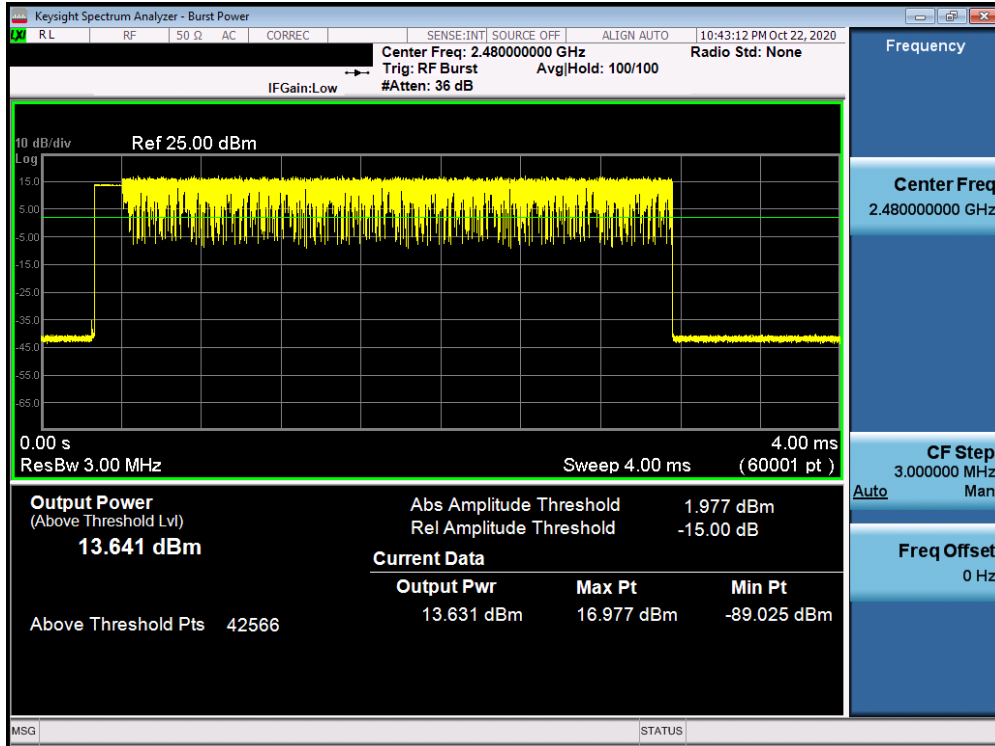


Plot 7-52. Average Conducted Power (3Mbps – Ch. 0) – ANT 2



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

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 42 of 107



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

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 43 of 107



Dual BT

Frequency [MHz]	Data Rate [Mbps]	Channel No.	Avg Conducted Power_ANT1		Avg Conducted Power_ANT2		Avg Conducted Power_DUAL	
			[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]
2402	1.0	0	12.26	16.827	11.59	14.421	14.95	31.261
2441	1.0	39	12.18	16.520	11.93	15.596	15.06	32.063
2480	1.0	78	12.27	16.866	11.44	13.932	14.88	30.761
2402	2.0	0	17.00	50.119	13.70	23.442	18.67	73.621
2441	2.0	39	19.08	80.910	15.89	38.815	20.78	119.674
2480	2.0	78	17.25	53.088	15.68	36.983	19.55	90.157
2402	3.0	0	18.22	66.374	14.19	26.242	19.67	92.683
2441	3.0	39	19.80	95.499	16.42	43.853	21.44	139.316
2480	3.0	78	17.97	62.661	16.29	42.560	20.22	105.196

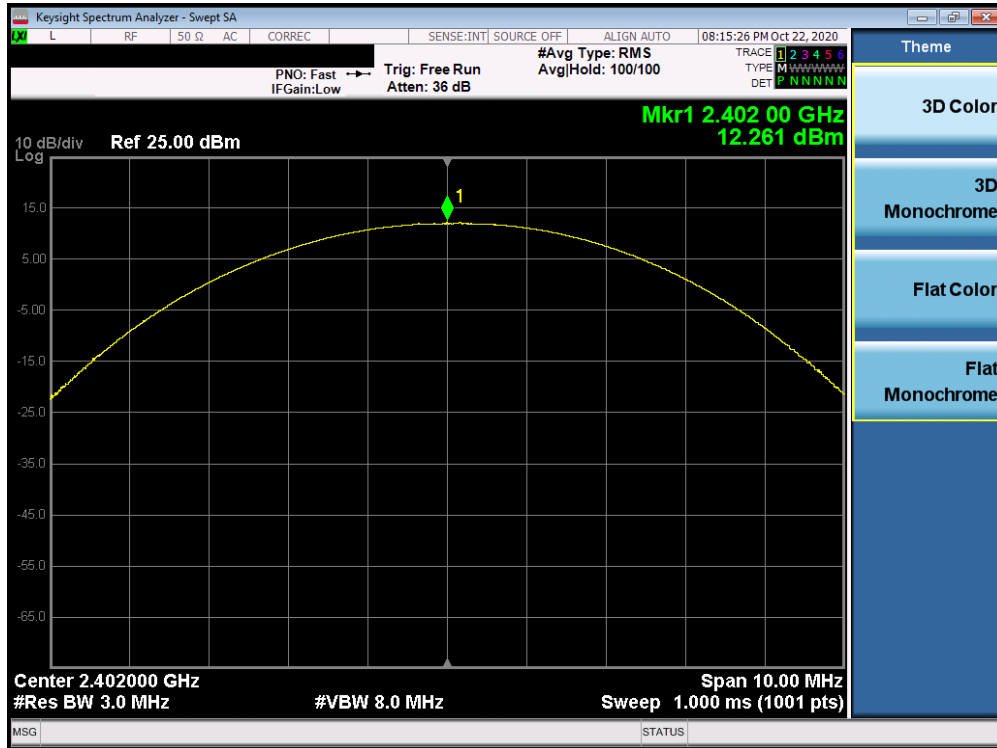
Table 7-6. Dual BT Conducted Powers - Peak Measurements

Frequency [MHz]	Data Rate [Mbps]	Channel No.	Avg Conducted Power_ANT1		Avg Conducted Power_ANT2		Avg Conducted Power_DUAL	
			[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]
2402	1.0	0	11.85	15.318	11.57	14.362	14.72	29.648
2441	1.0	39	12.03	15.970	11.50	14.132	14.79	30.130
2480	1.0	78	11.81	15.157	11.06	12.753	14.46	27.925
2402	2.0	0	14.79	30.151	11.73	14.894	16.54	45.082
2441	2.0	39	15.87	38.619	12.15	16.395	17.40	54.954
2480	2.0	78	13.86	24.333	11.96	15.707	16.02	39.994
2402	3.0	0	14.96	31.326	11.79	15.115	16.67	46.452
2441	3.0	39	15.81	38.142	12.26	16.811	17.40	54.954
2480	3.0	78	13.94	24.757	11.88	15.424	16.04	40.179

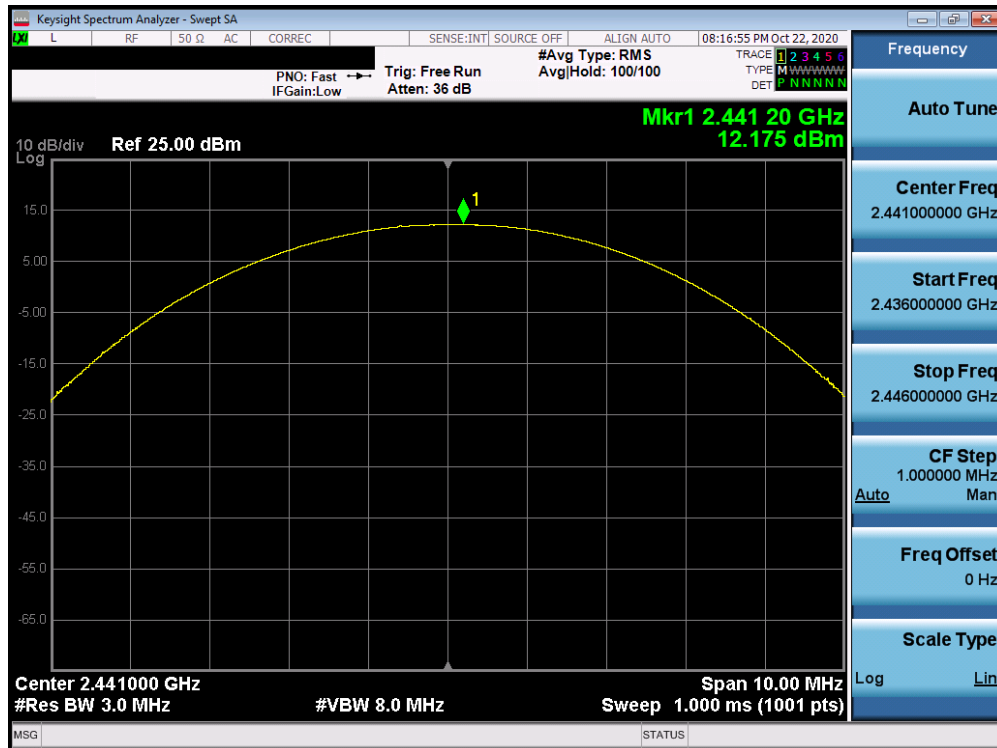
Table 7-7. Dual BT Conducted Powers - Average Measurements

FCC ID: A3LSMG998JPN	 PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset	Page 44 of 107	

Dual BT ANTENNA 1

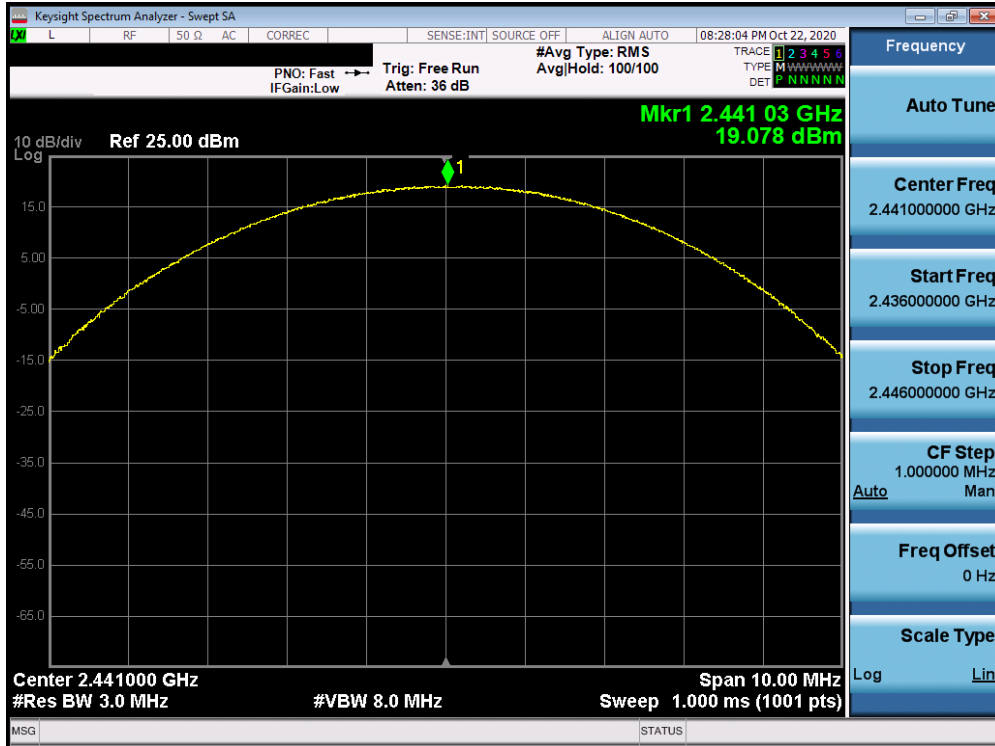


Plot 7-55. Peak Conducted Power (1Mbps – Ch. 0) – ANT 1

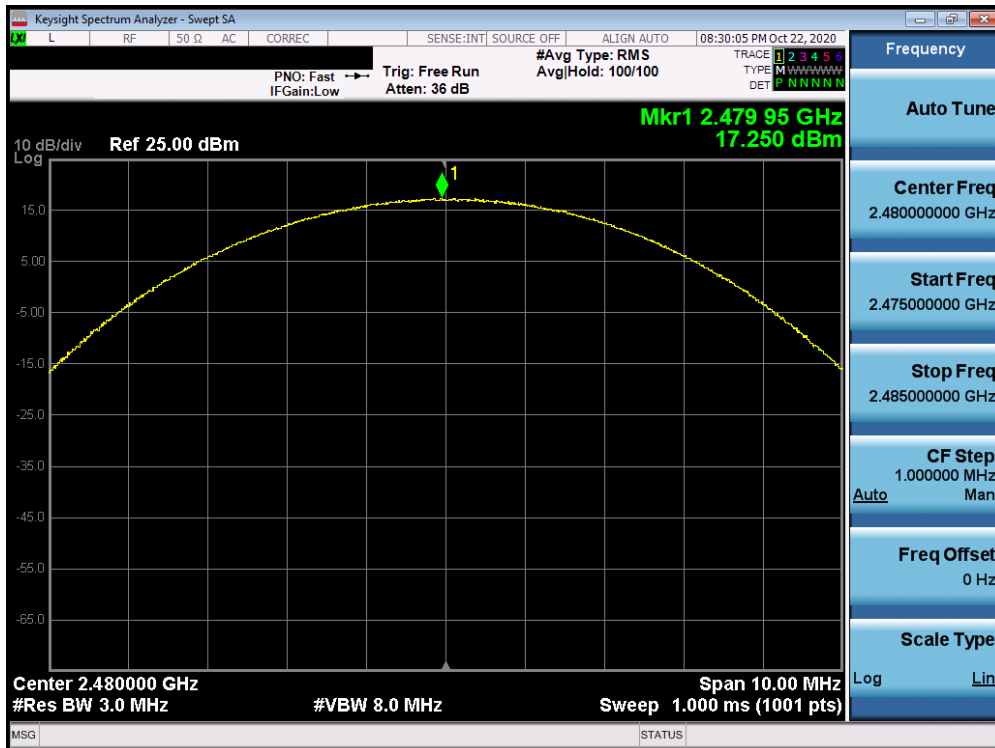


Plot 7-56. Peak Conducted Power (1Mbps – Ch. 39) – ANT 1

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 45 of 107

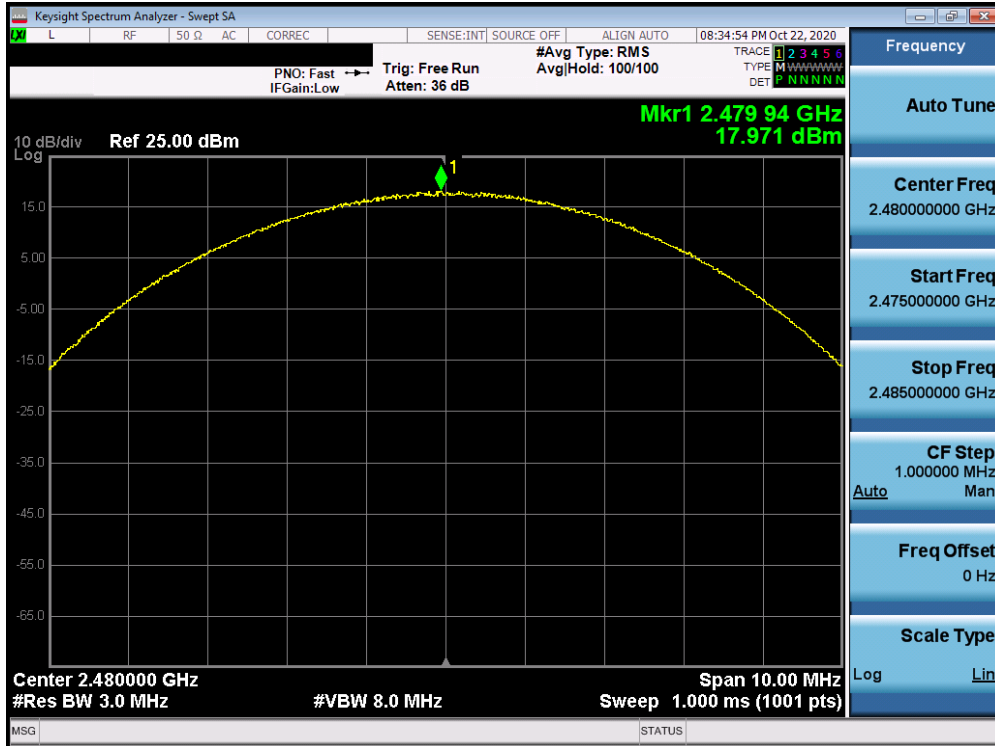


Plot 7-59. Peak Conducted Power (2Mbps – Ch. 39) – ANT 1

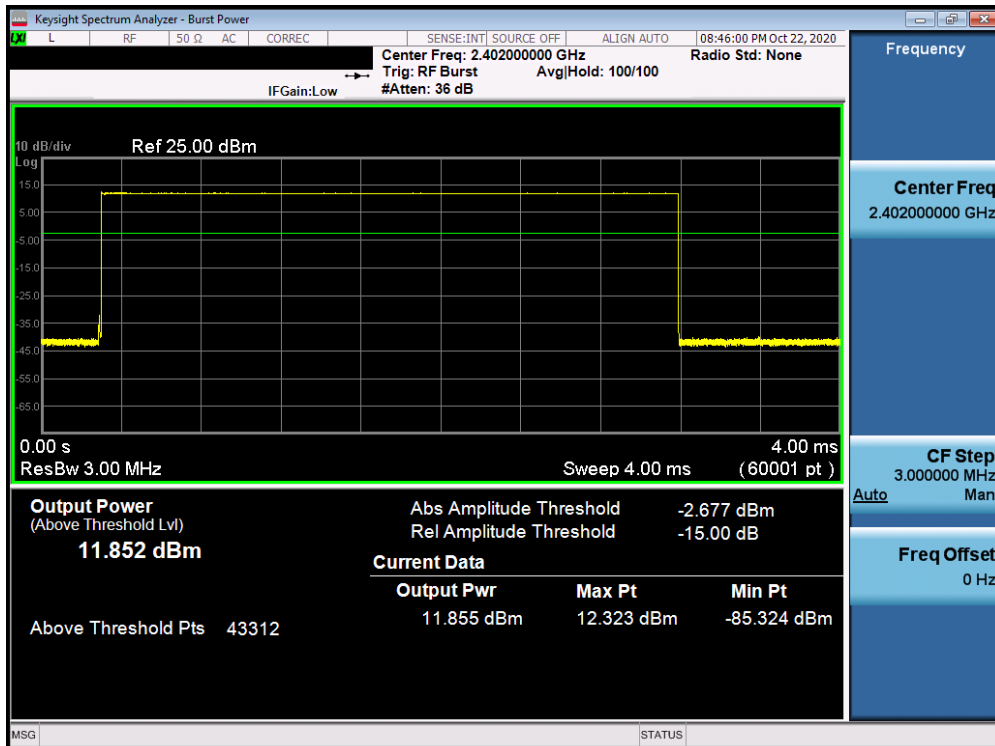


Plot 7-60. Peak Conducted Power (2Mbps – Ch. 78) – ANT 1

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 47 of 107

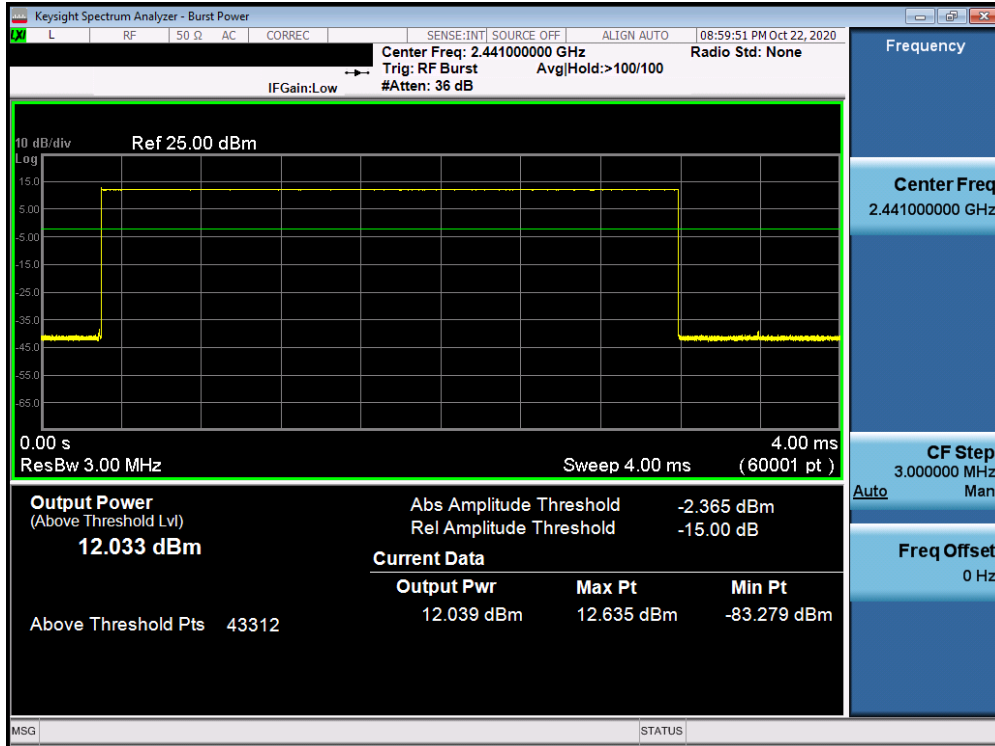


Plot 7-63. Peak Conducted Power (3Mbps – Ch. 78) – ANT 1

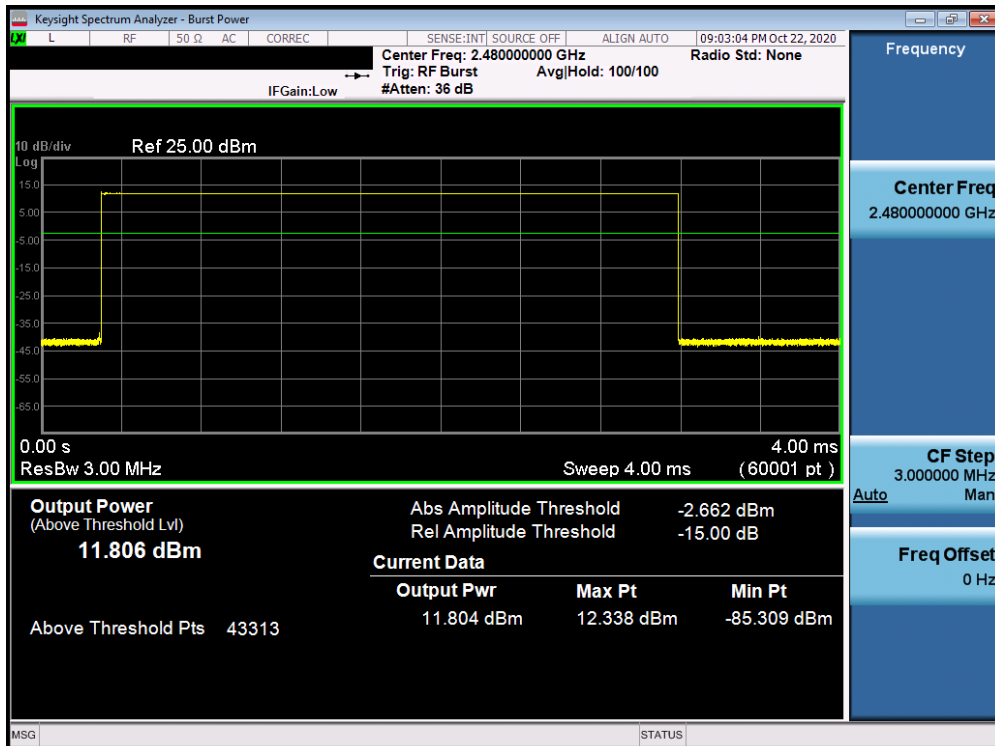


Plot 7-64. Average Conducted Power (1Mbps – Ch. 0) – ANT 1

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 49 of 107

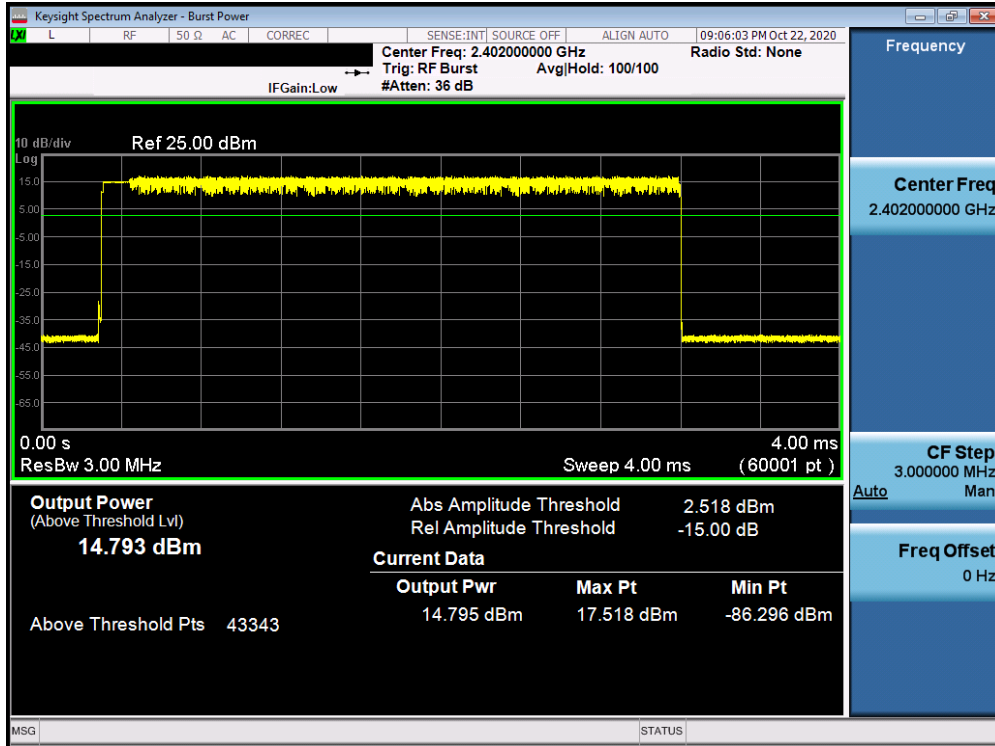


Plot 7-65. Average Conducted Power (1Mbps – Ch. 39) – ANT 1

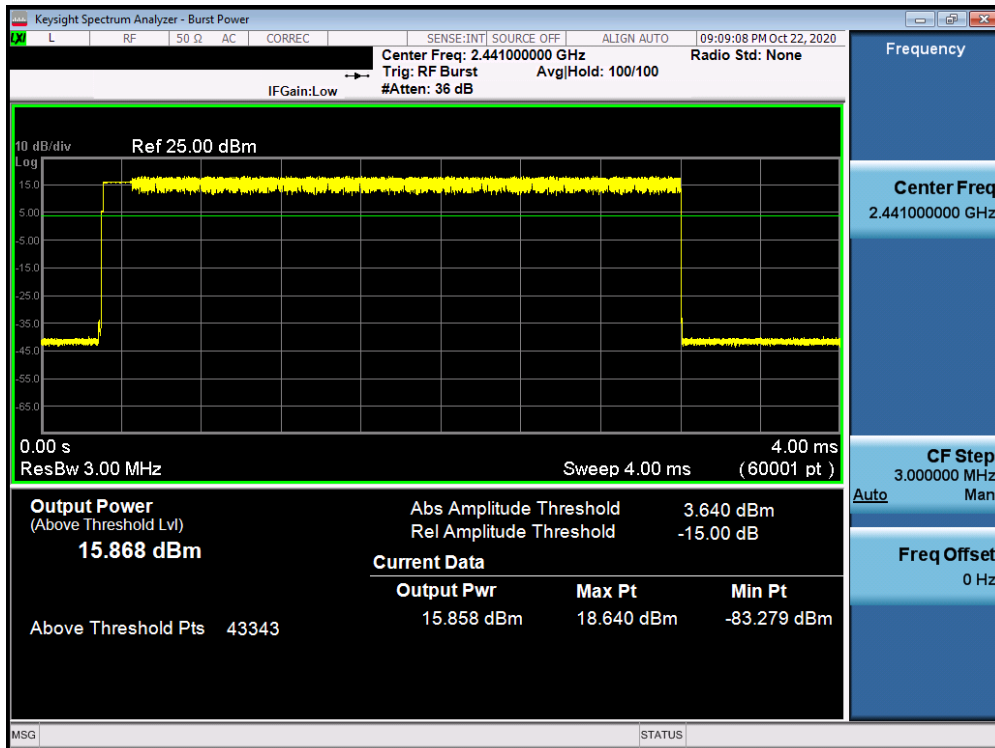


Plot 7-66. Average Conducted Power (1Mbps – Ch. 78) – ANT 1

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 50 of 107

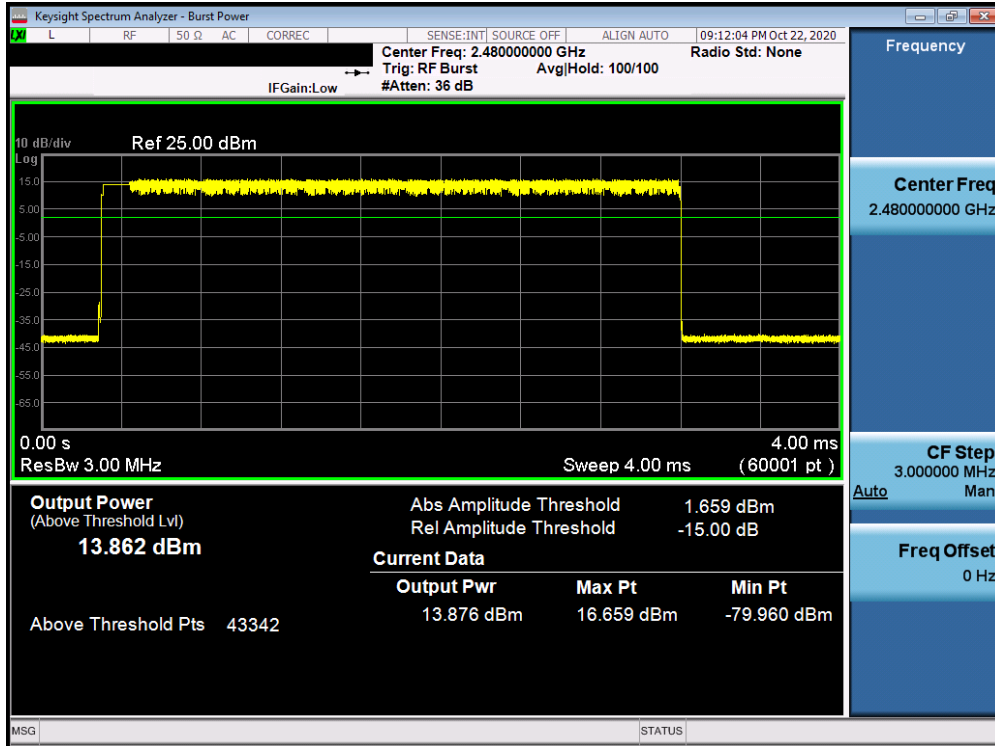


Plot 7-67. Average Conducted Power (2Mbps – Ch. 0) – ANT 1

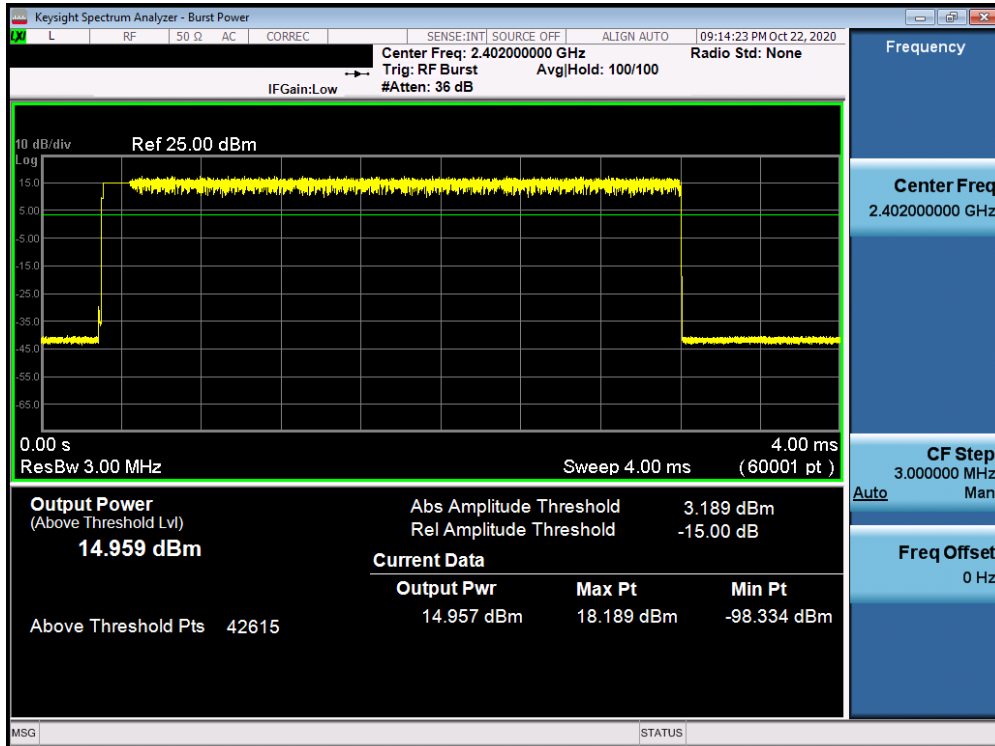


Plot 7-68. Average Conducted Power (2Mbps – Ch. 39) – ANT 1

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 51 of 107

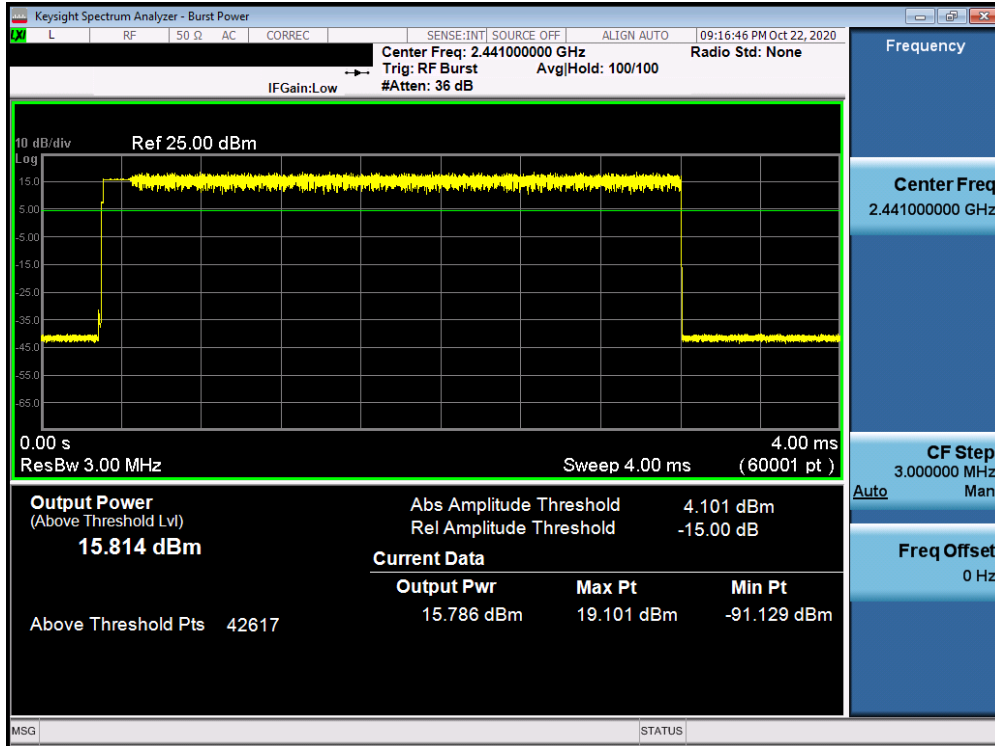


Plot 7-69. Average Conducted Power (2Mbps – Ch. 78) – ANT 1

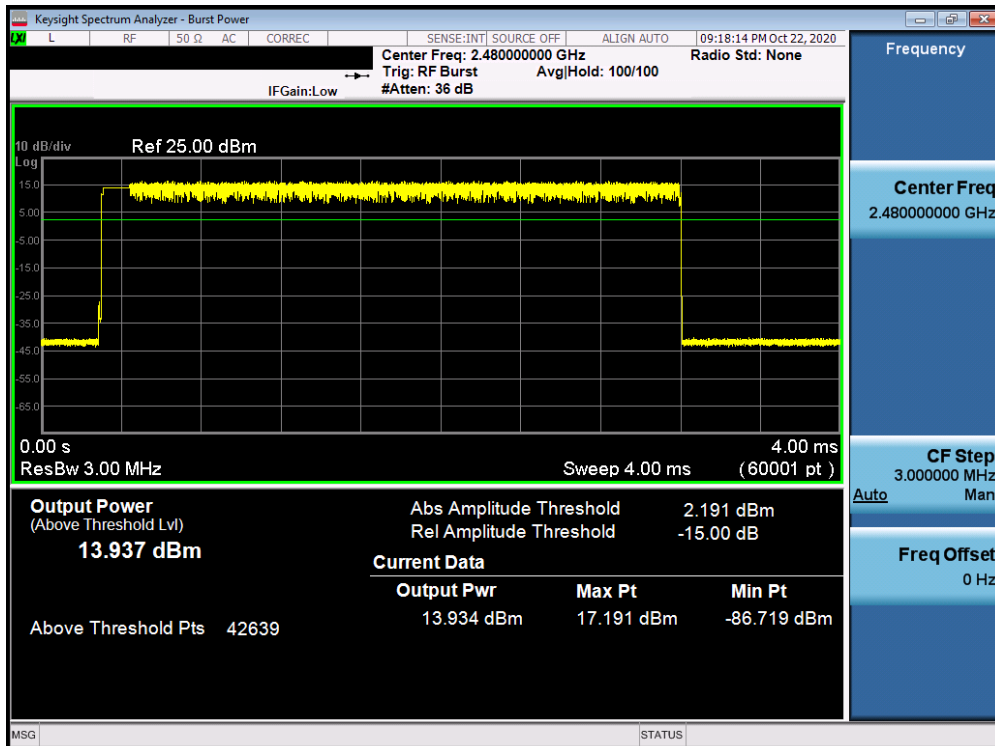


Plot 7-70. Average Conducted Power (3Mbps – Ch. 0) – ANT 1



FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 52 of 107



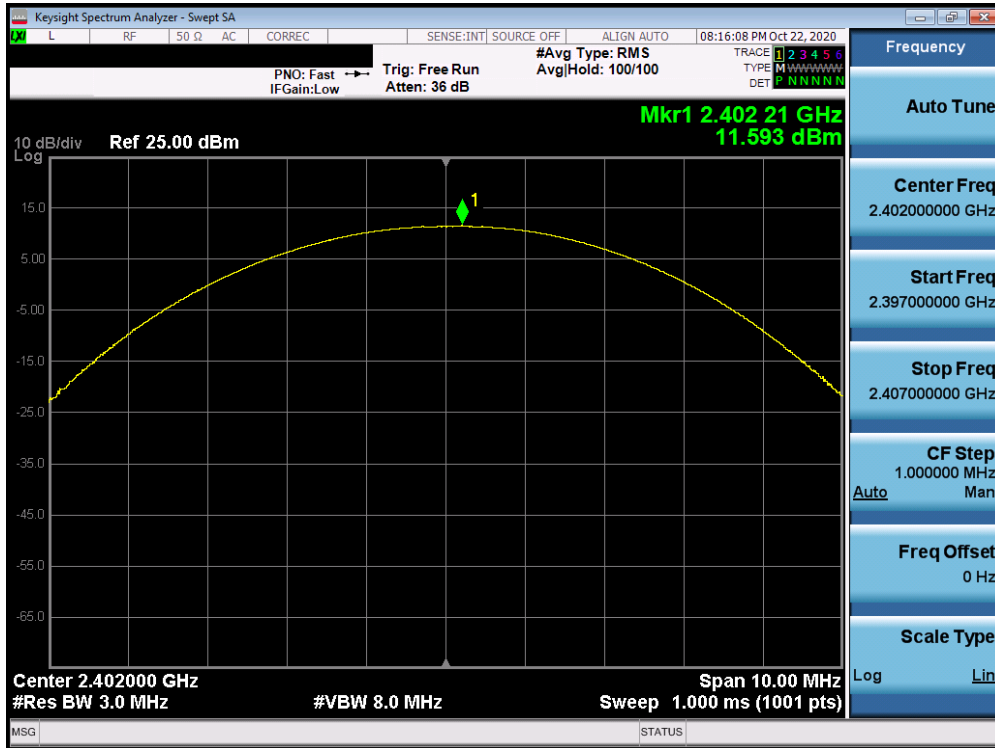
Plot 7-71. Average Conducted Power (3Mbps – Ch. 39) – ANT 1



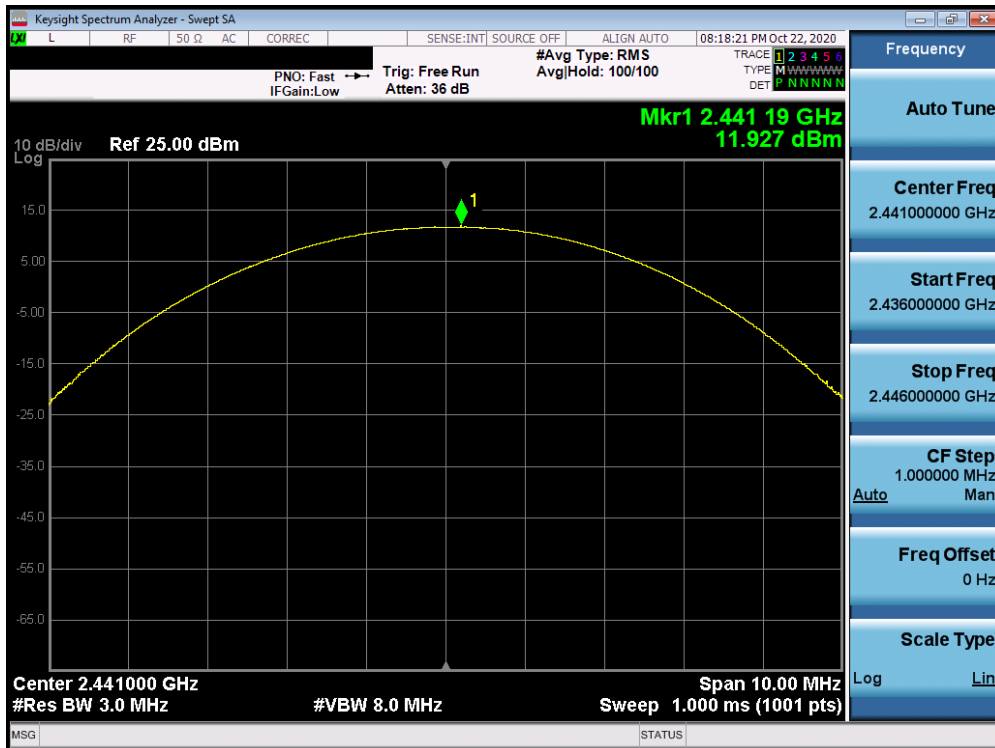
Plot 7-72. Average Conducted Power (3Mbps – Ch. 78) – ANT 1

FCC ID: A3LSMG998JPN		MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 53 of 107

Dual BT ANTENNA 2

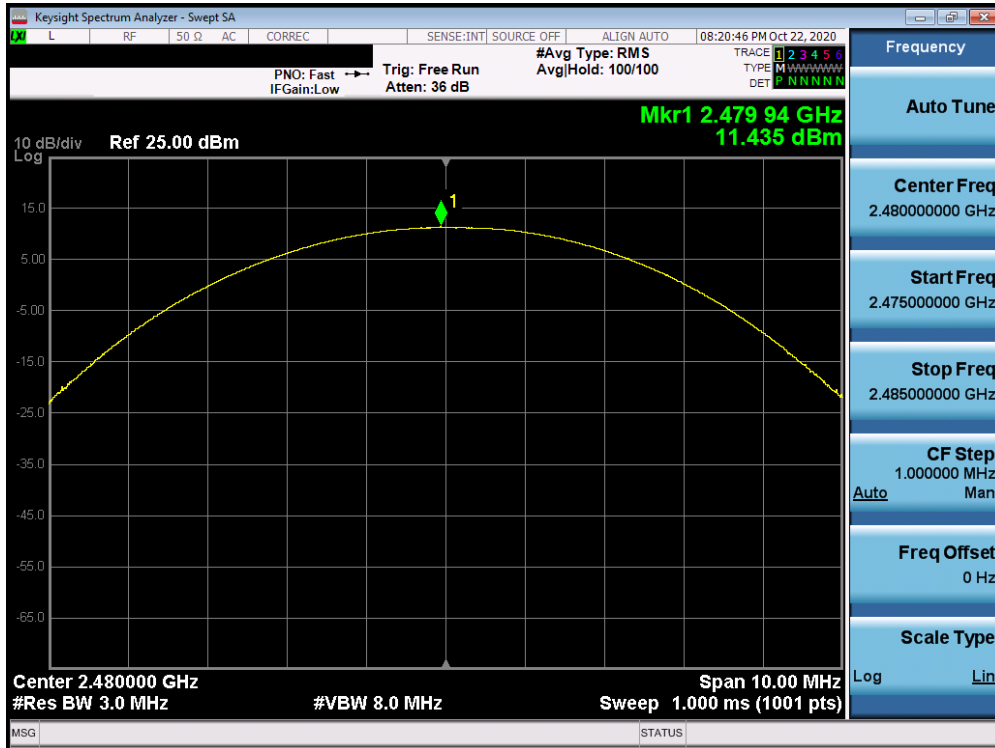


Plot 7-73. Peak Conducted Power (1Mbps – Ch. 0) – ANT 2

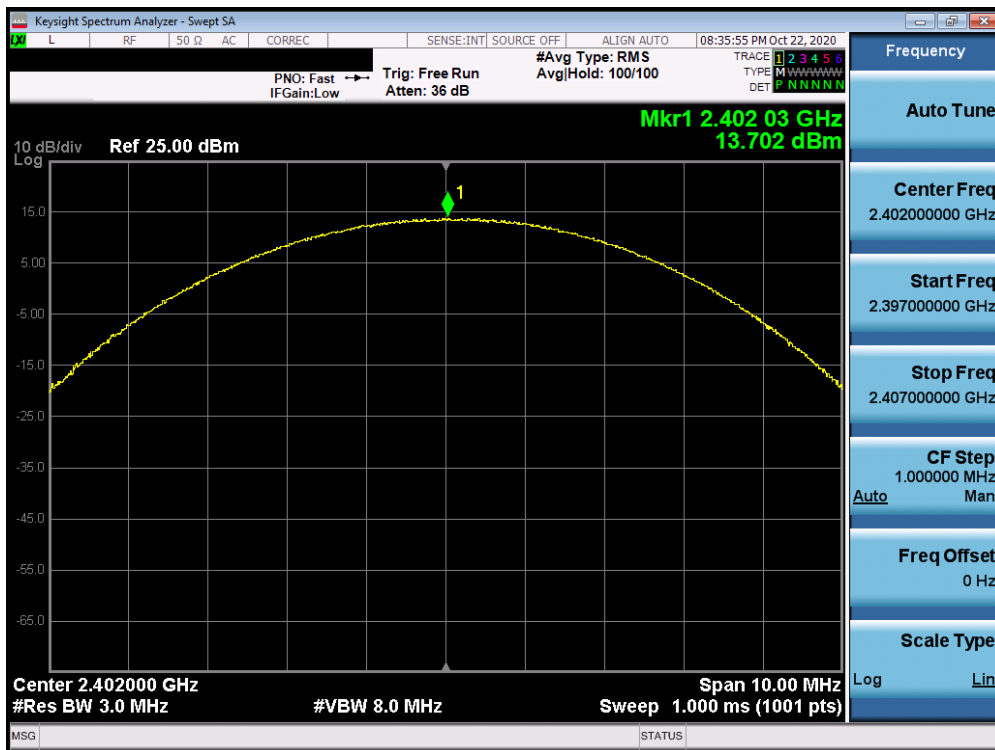


Plot 7-74. Peak Conducted Power (1Mbps – Ch. 39) – ANT 2




FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 54 of 107

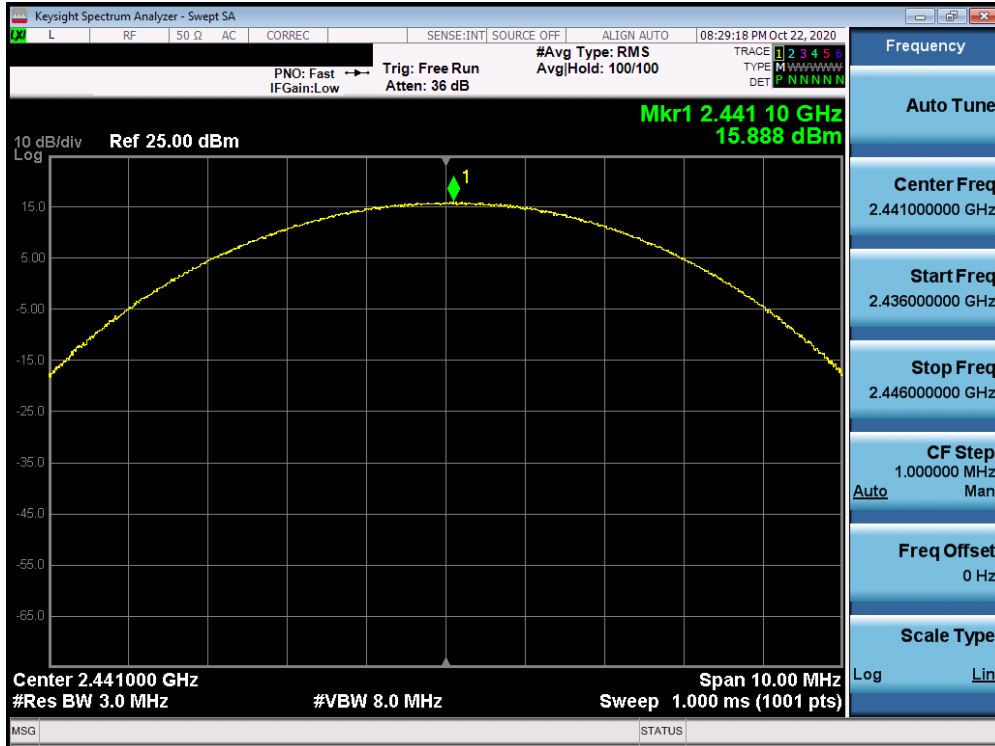


Plot 7-75. Peak Conducted Power (1Mbps – Ch. 78) – ANT 2

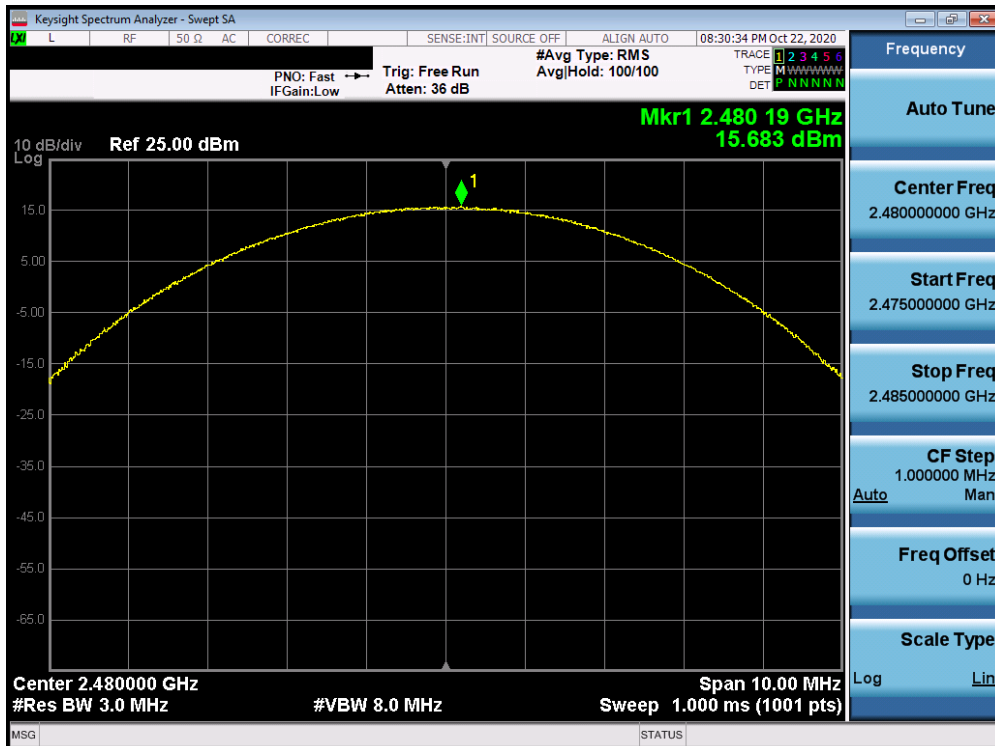


Plot 7-76. Peak Conducted Power (2Mbps – Ch. 0) – ANT 2

FCC ID: A3LSMG998JPN	 Proud to be part of 	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 55 of 107

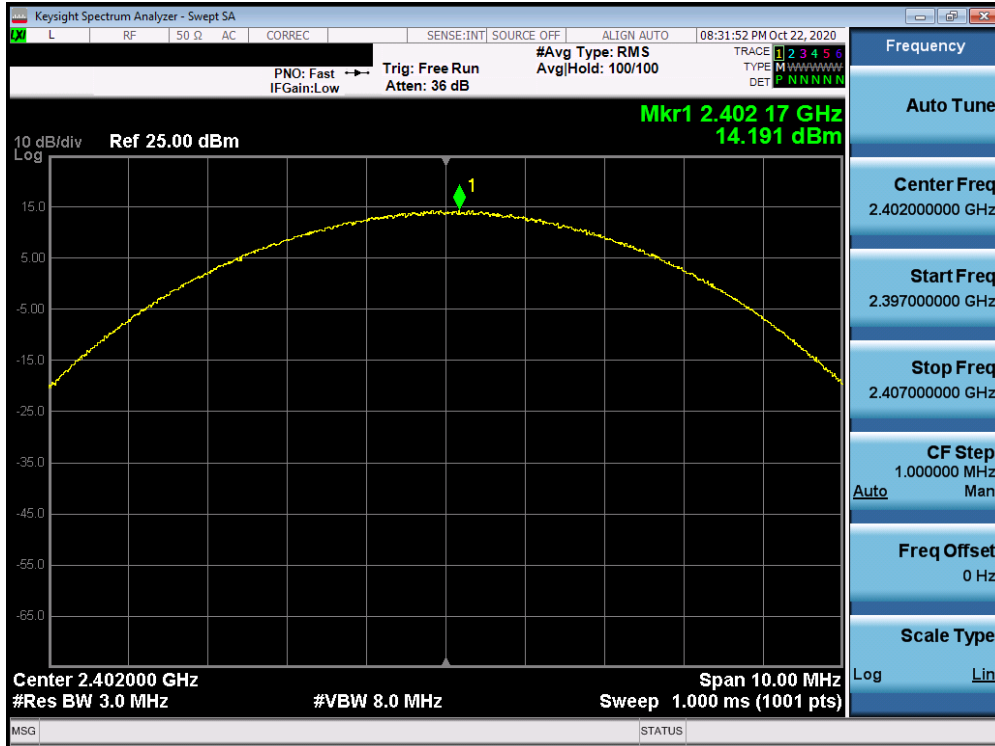


Plot 7-77. Peak Conducted Power (2Mbps – Ch. 39) – ANT 2

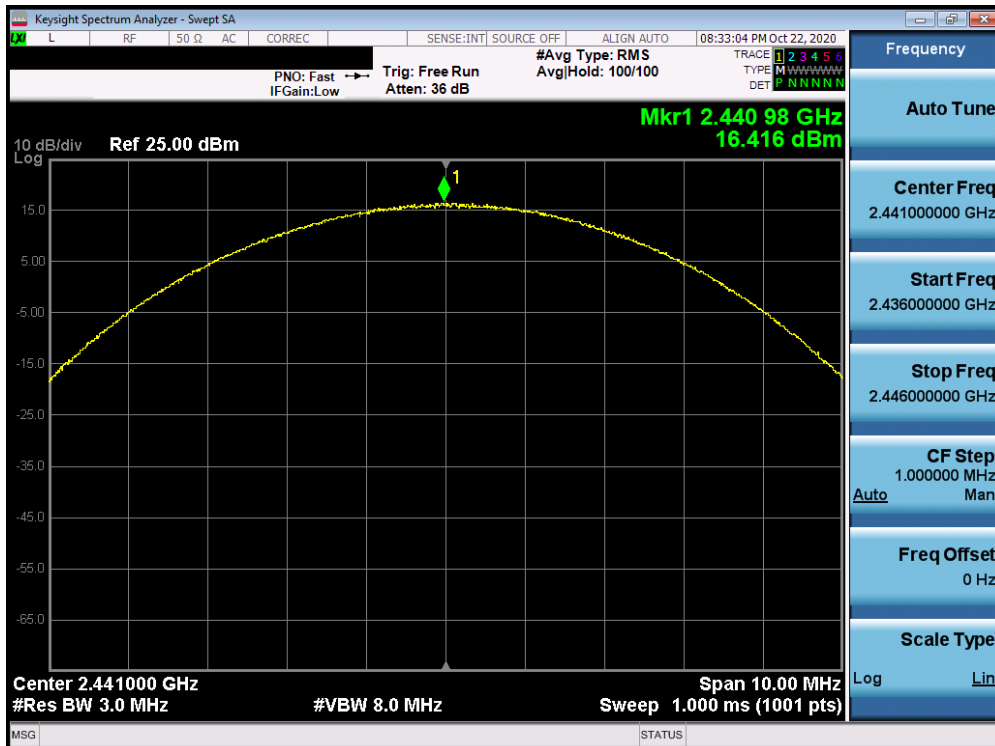


Plot 7-78. Peak Conducted Power (2Mbps – Ch. 78) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 56 of 107

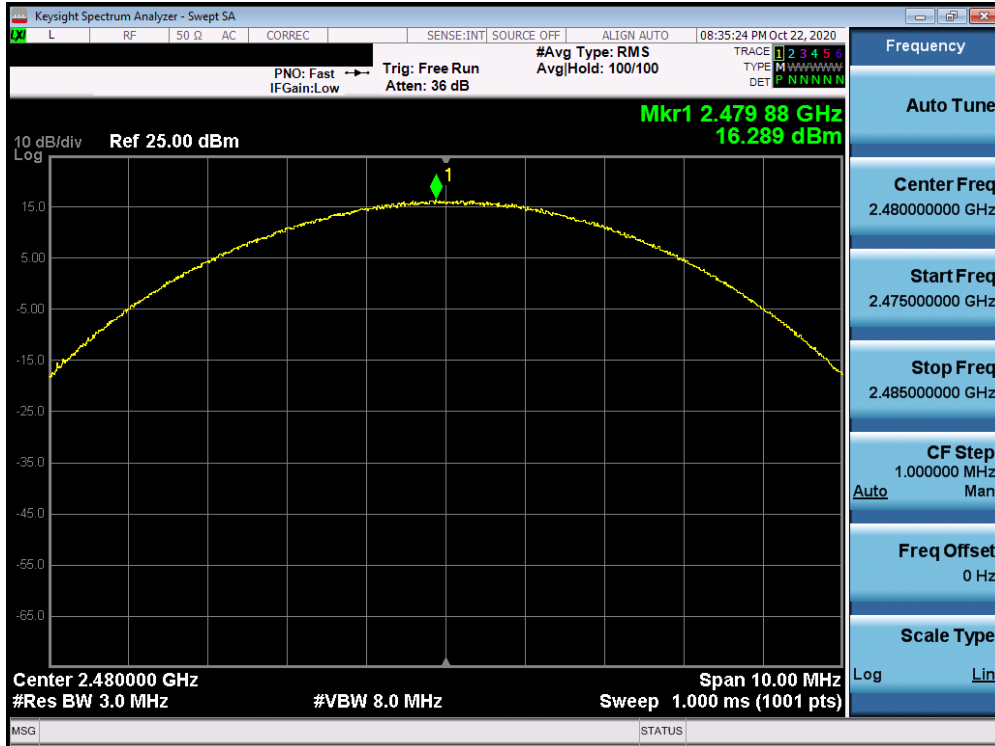


Plot 7-79. Peak Conducted Power (3Mbps – Ch. 0) – ANT 2

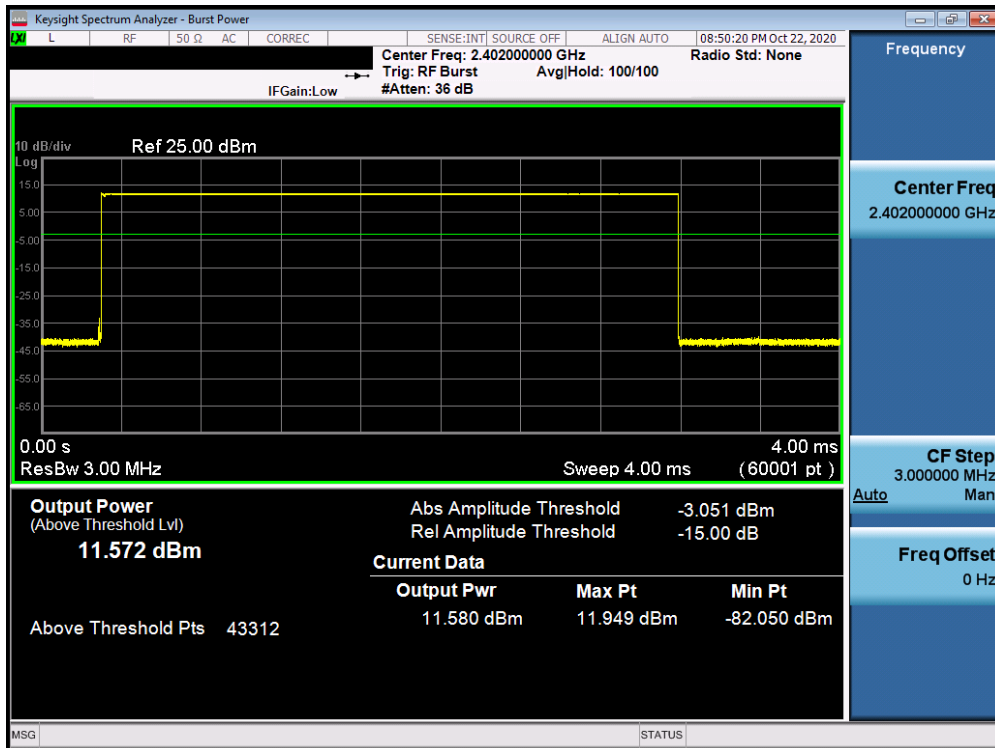


Plot 7-80. Peak Conducted Power (3Mbps – Ch. 39) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 57 of 107

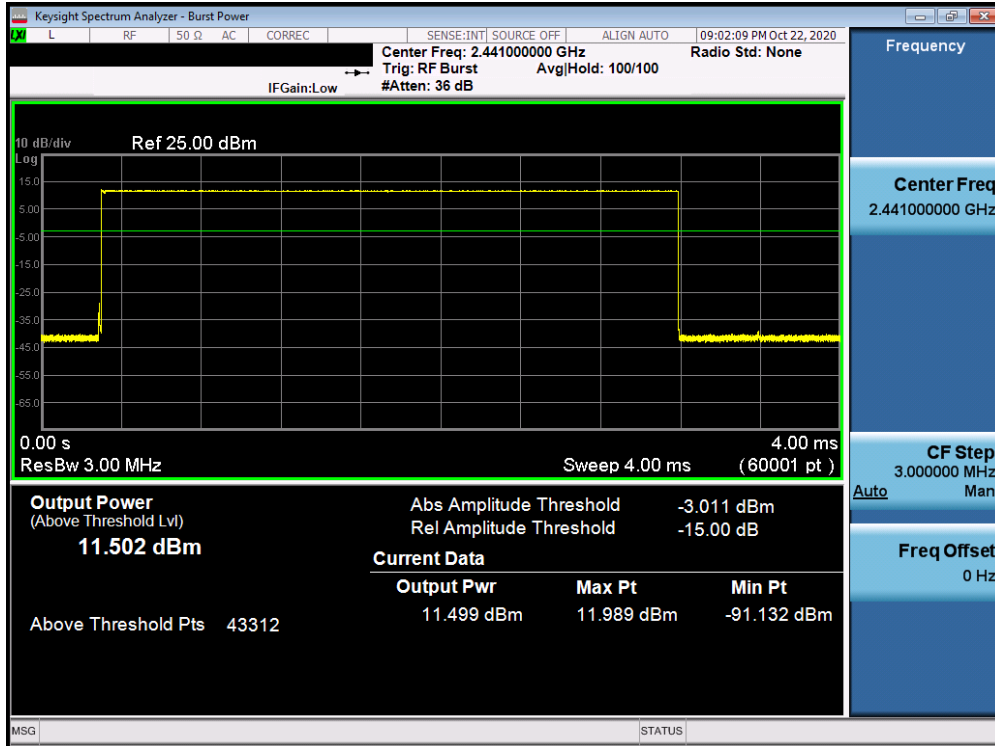


Plot 7-81. Peak Conducted Power (3Mbps – Ch. 78) – ANT 2

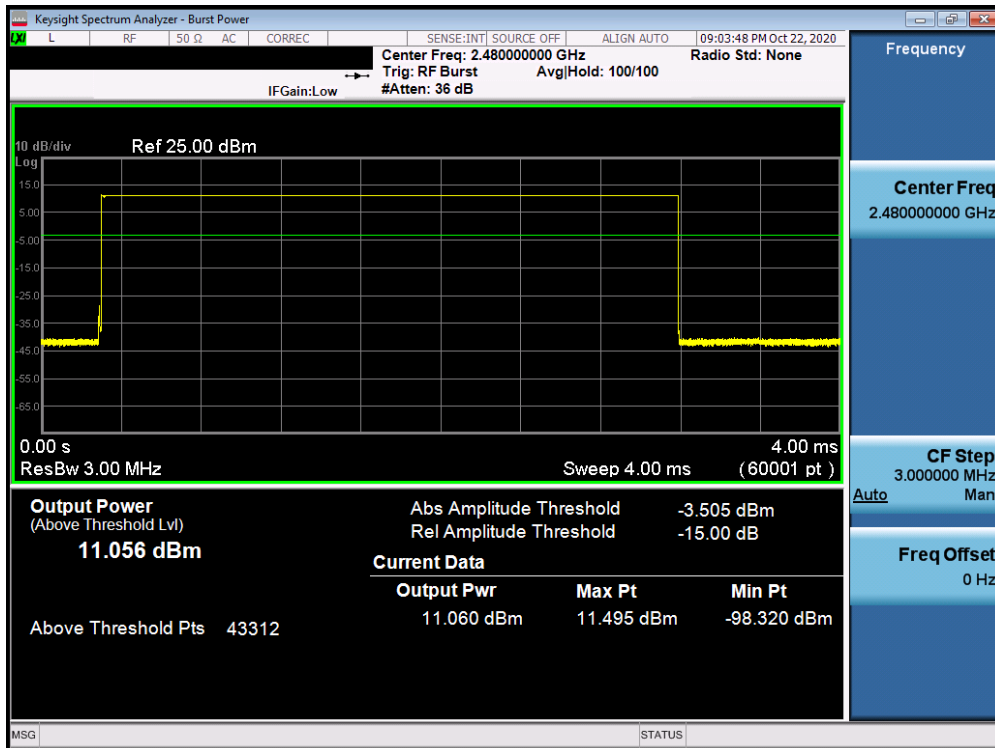


Plot 7-82. Average Conducted Power (1Mbps – Ch. 0) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 58 of 107

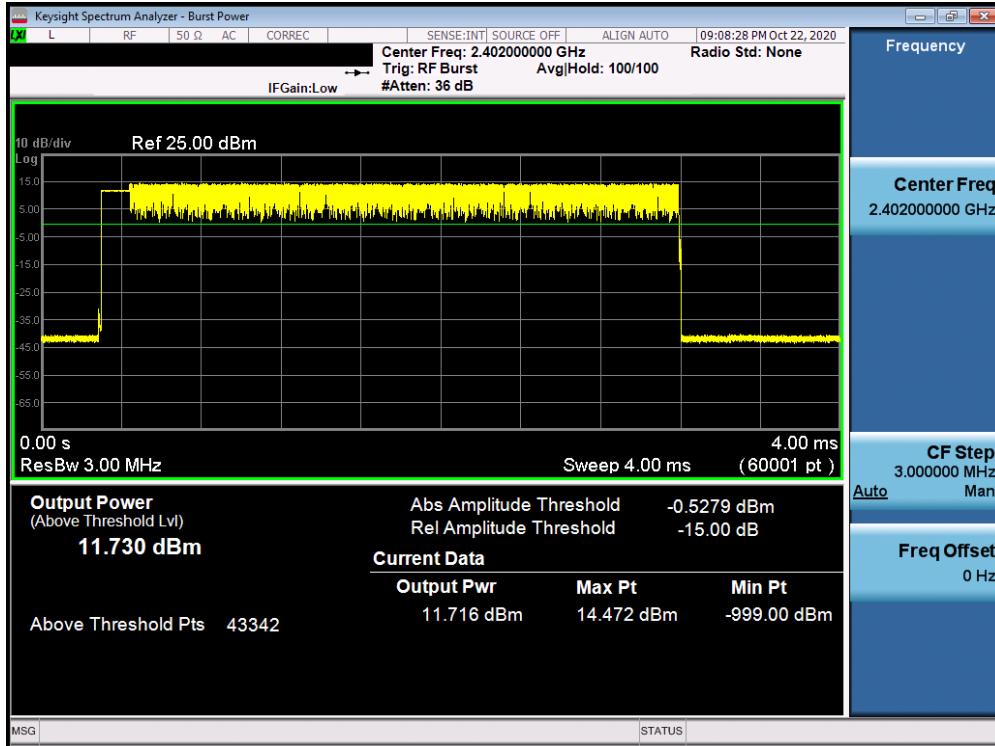


Plot 7-83. Average Conducted Power (1Mbps – Ch. 39) – ANT 2

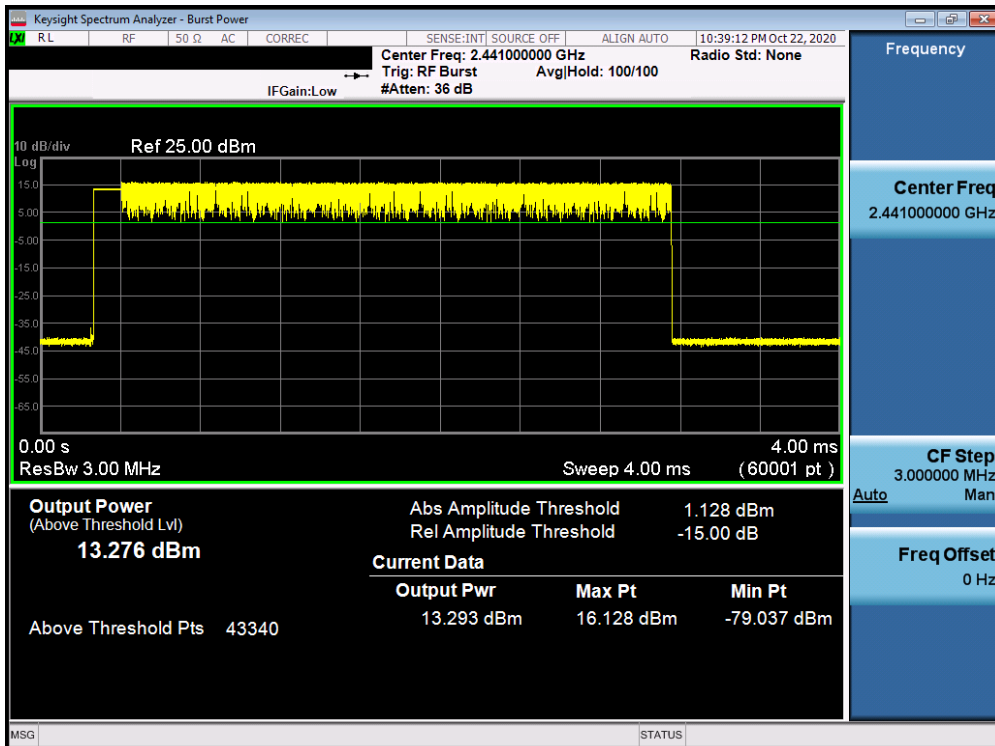


Plot 7-84. Average Conducted Power (1Mbps – Ch. 78) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 59 of 107

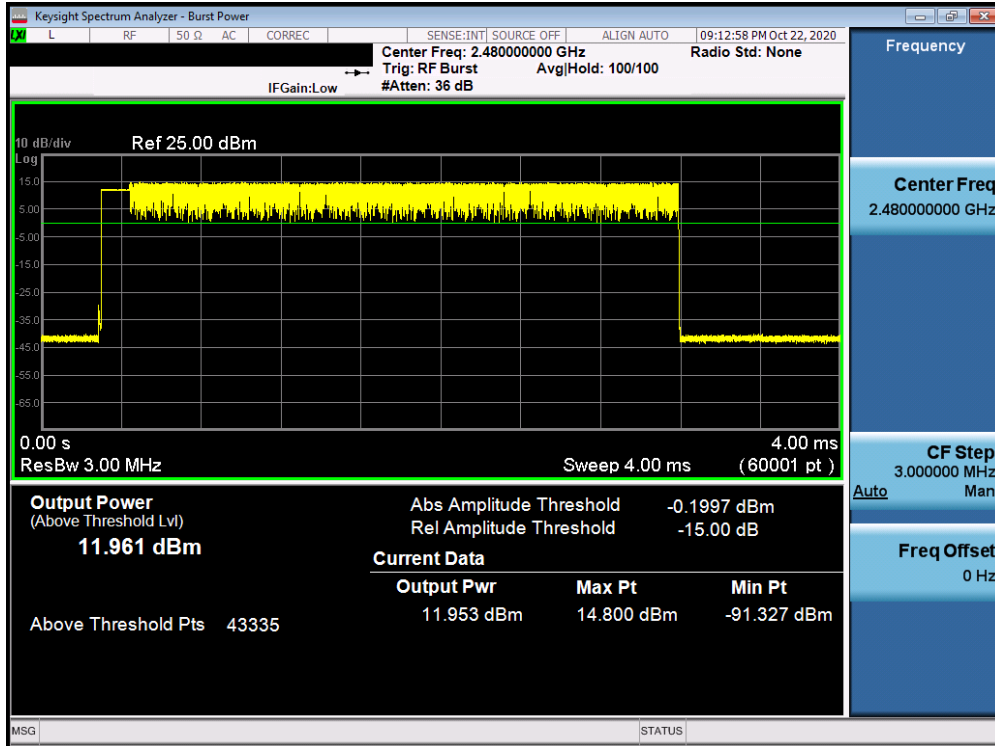


Plot 7-85. Average Conducted Power (2Mbps – Ch. 0) – ANT 2

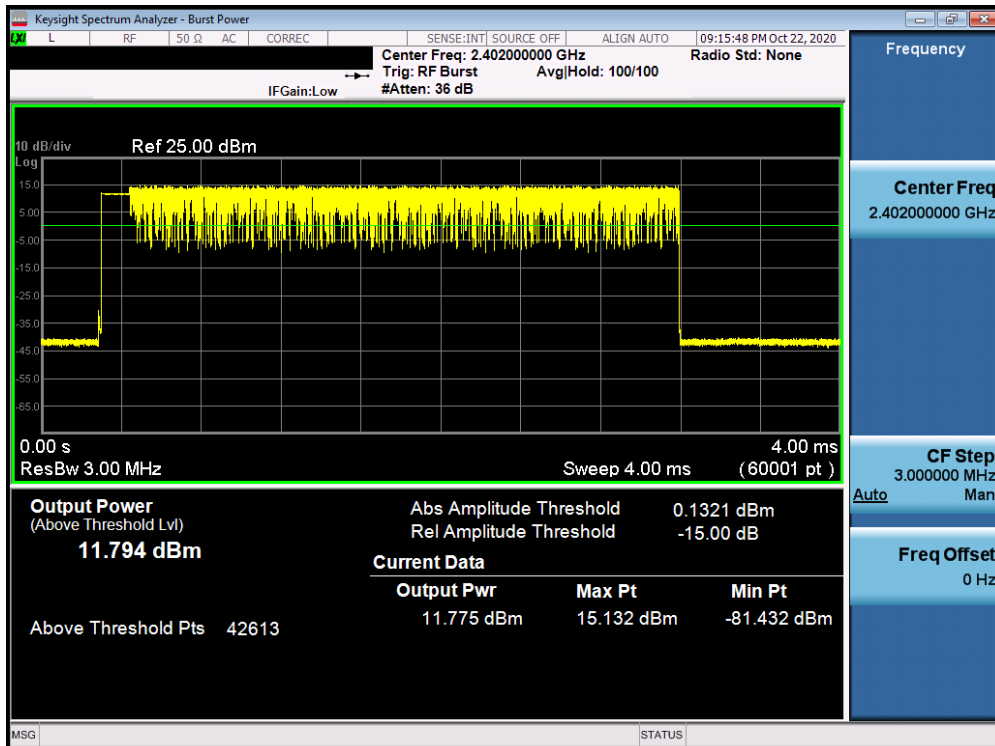


Plot 7-86. Average Conducted Power (2Mbps – Ch. 39) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 60 of 107

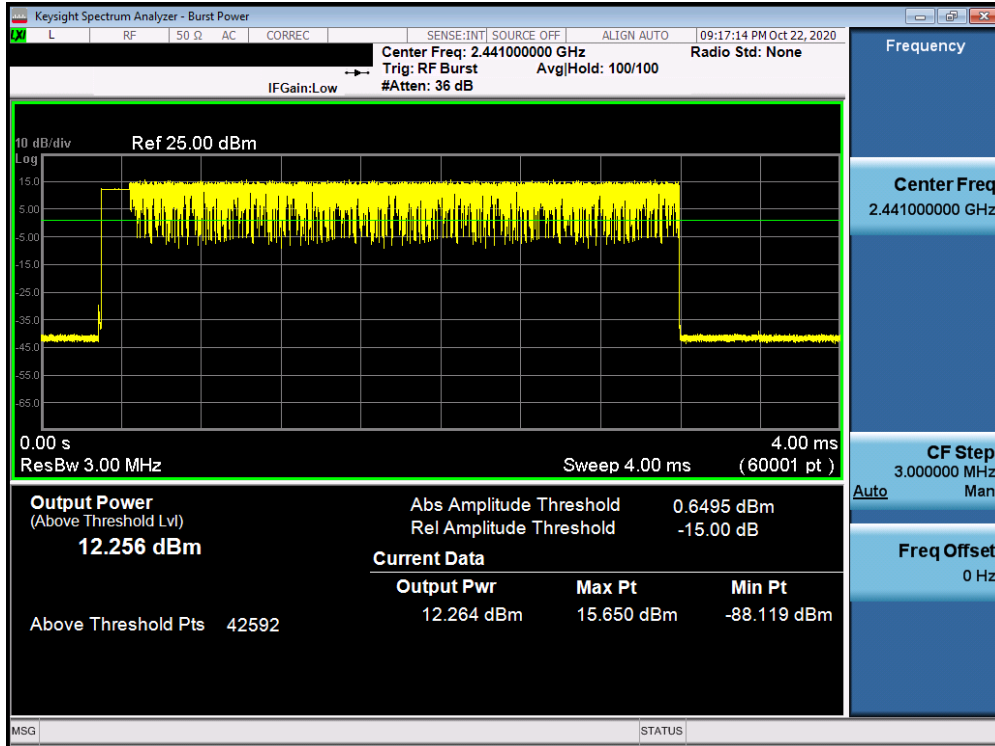


Plot 7-87. Average Conducted Power (2Mbps – Ch. 78) – ANT 2

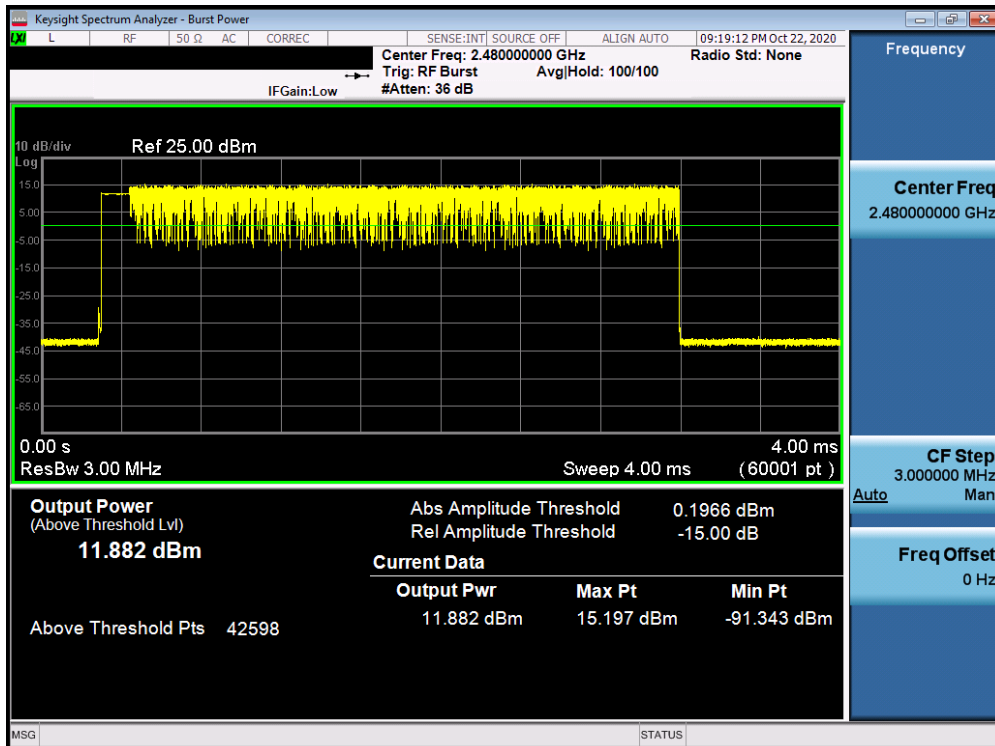


Plot 7-88. Average Conducted Power (3Mbps – Ch. 0) – ANT 2

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 61 of 107



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



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

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 62 of 107

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.



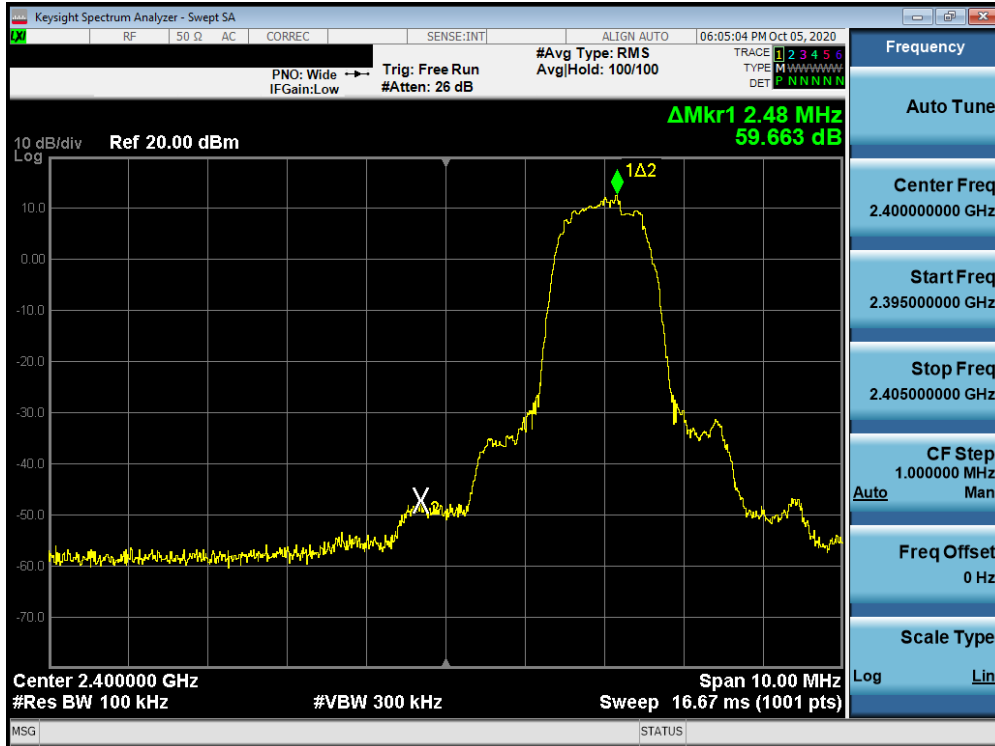
Figure 7-3. Test Instrument & Measurement Setup

Test Notes

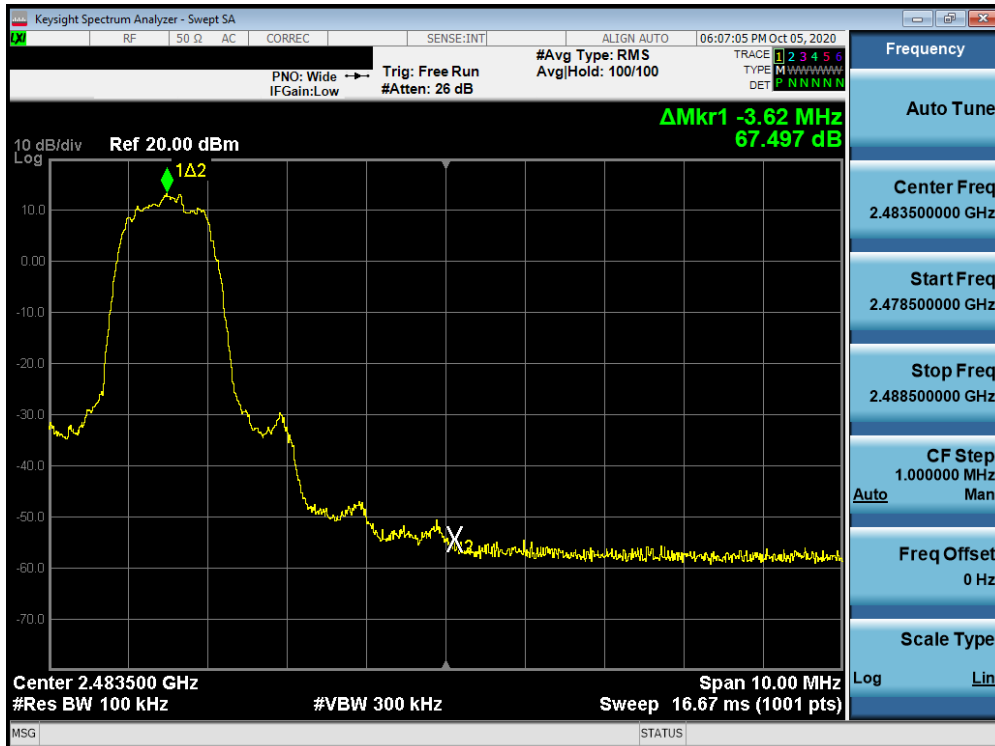
Out of band conducted spurious emissions at the band edge were investigated for all data rates in hopping and non-hopping modes. The worst case emissions were found with the EUT transmitting at 3 Mbps. Band edge emissions were also investigated with the EUT transmitting in all data rates. Plots of the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

FCC ID: A3LSMG998JPN		MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 63 of 107

Antenna 1



Plot 7-91. Band Edge Plot (Bluetooth with Hopping Disabled, ANT1 - 3 Mbps – Ch. 0)



Plot 7-92. Band Edge Plot (Bluetooth with Hopping Disabled, ANT1 - 3 Mbps – Ch. 78)

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 64 of 107



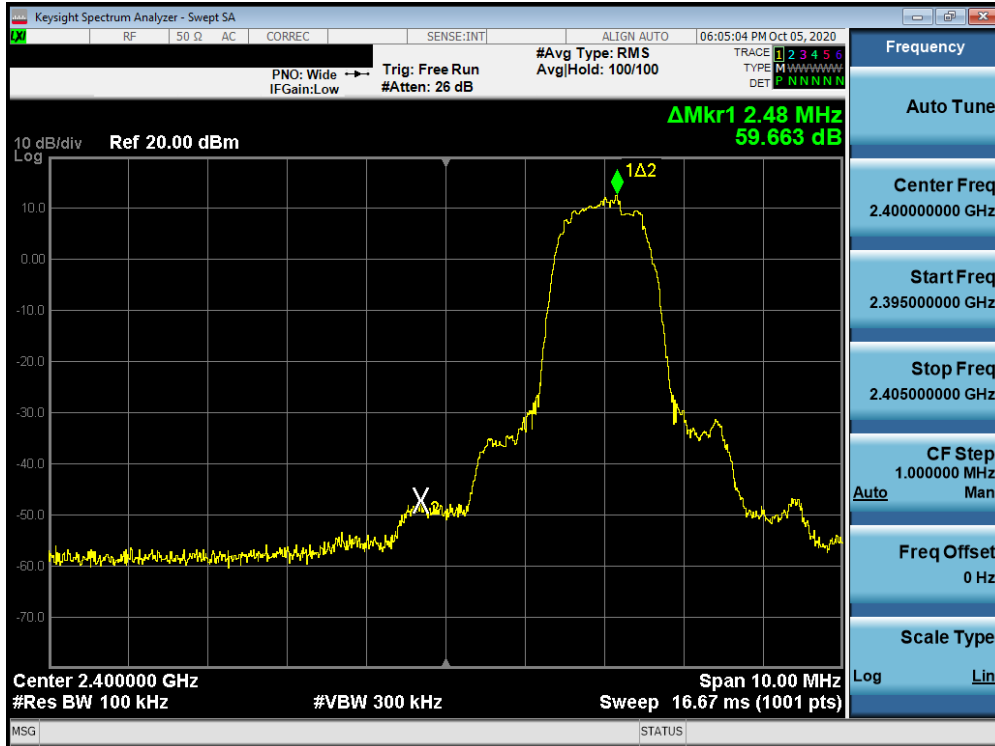
Plot 7-93. Band Edge Plot (Bluetooth with Hopping Enabled, ANT1 - 3 Mbps)



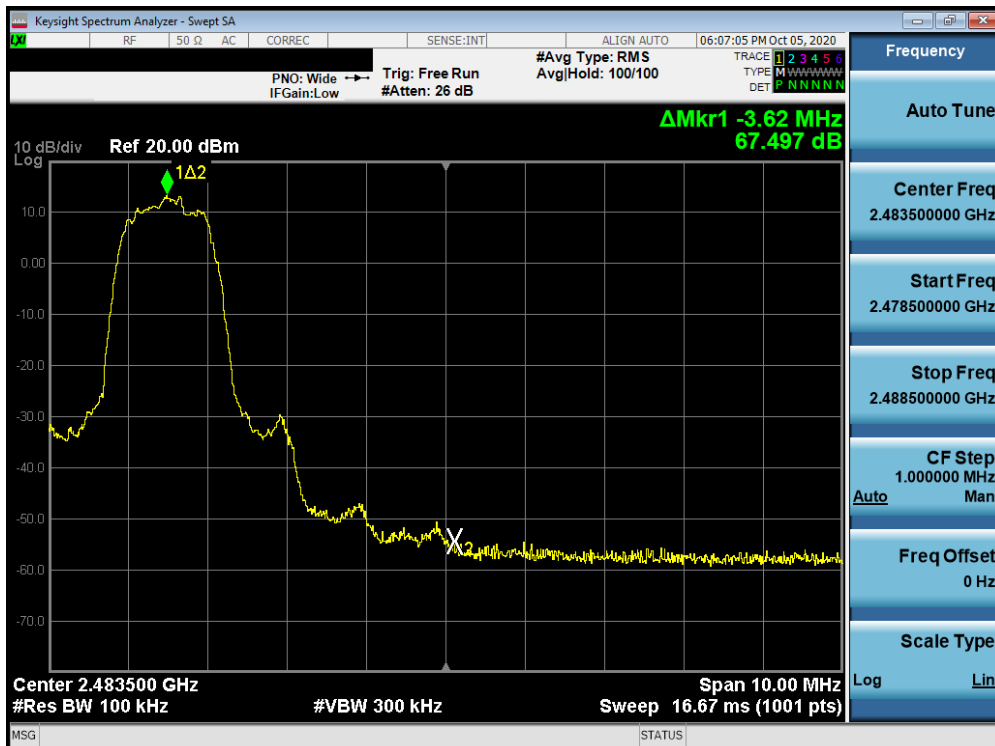
Plot 7-94. Band Edge Plot (Bluetooth with Hopping Enabled, ANT1 - 3 Mbps)

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 65 of 107

Antenna 2

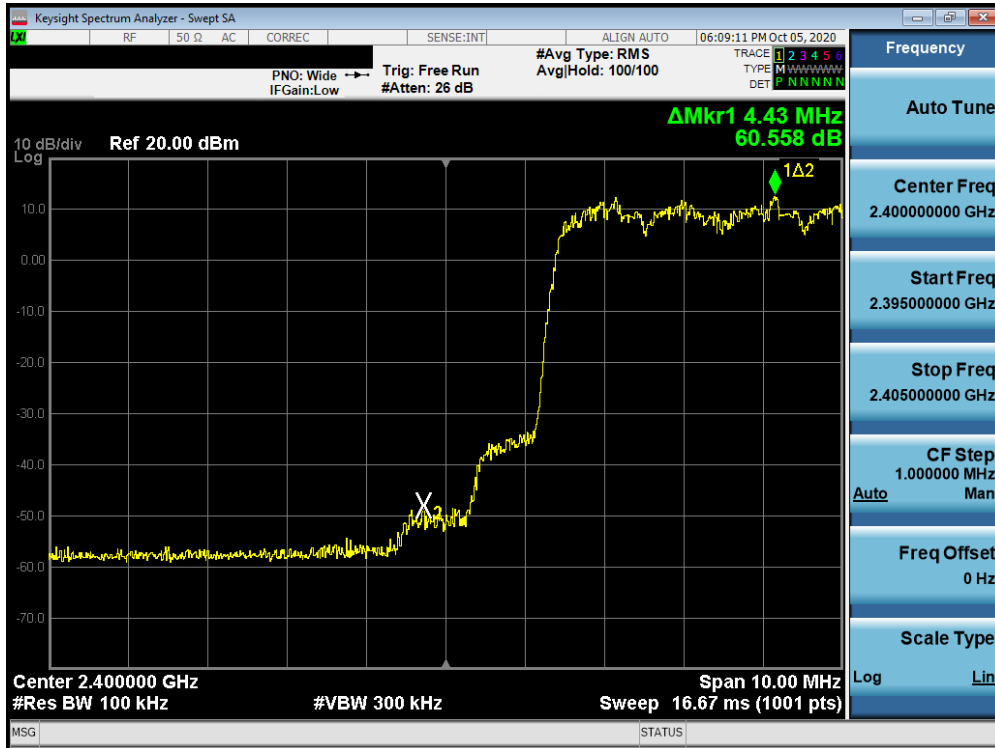


Plot 7-95. Band Edge Plot (Bluetooth with Hopping Disabled, ANT2 - 3 Mbps – Ch. 0)

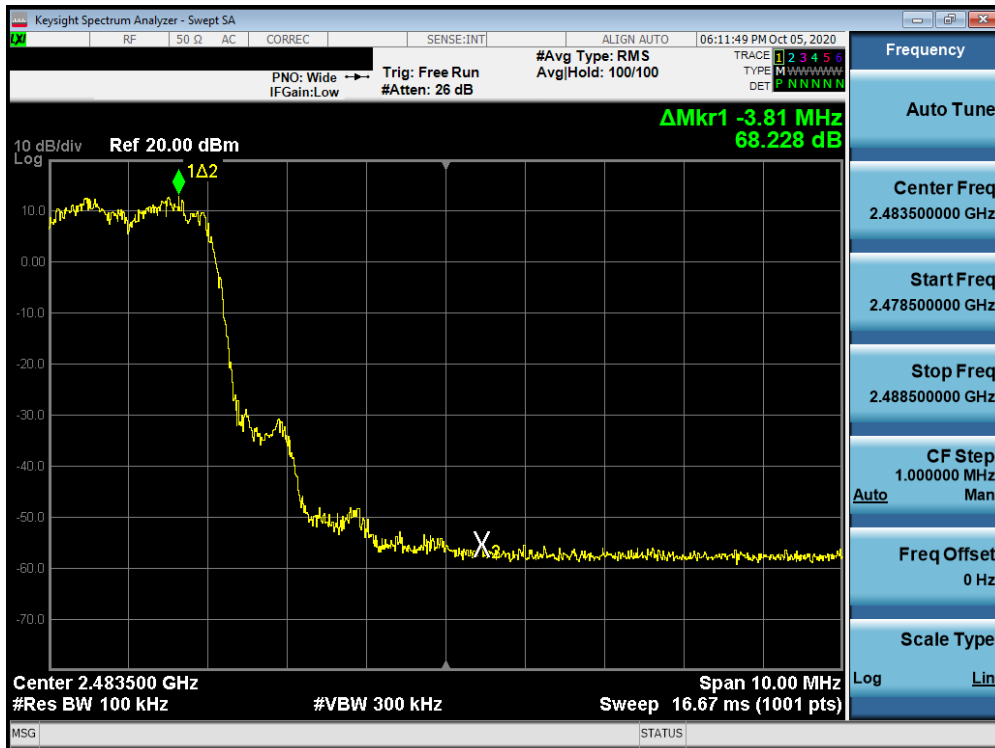


Plot 7-96. Band Edge Plot (Bluetooth with Hopping Disabled, ANT2 - 3 Mbps – Ch. 78)

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
Test Report S/N: 1M2101110003-12.A3L	Test Dates: 1/16 – 1/22/2021	EUT Type: Portable Handset		Page 66 of 107



Plot 7-97. Band Edge Plot (Bluetooth with Hopping Enabled, ANT2 - 3 Mbps)



Plot 7-98. Band Edge Plot (Bluetooth with Hopping Enabled, ANT2 - 3 Mbps)

FCC ID: A3LSMG998JPN	PCTEST Proud to be part of element	MEASUREMENT REPORT (Certification)		Approved by: Quality Manager
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7.5 Carrier Frequency Separation

§15.247 (a.1); RSS-247 [5.1(2)]

Test Overview and Limit

Measurement is made with EUT operating in hopping mode. **The minimum permissible channel separation for this system is 2/3 the value of the 20dB BW.**

Test Procedure Used

ANSI C63.10-2013 – Section 7.8.2

Test Settings

1. Span = Wide enough to capture peaks of two adjacent channels
2. RBW = 30% of channel spacing. Adjust as necessary to best identify center of each individual channel
3. VBW \geq RBW
4. Sweep = Auto
5. Detector = Peak
6. Trace mode = max hold
7. The trace was allowed to stabilize.
8. Marker-delta function used to determine separation between peaks of the adjacent channels

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

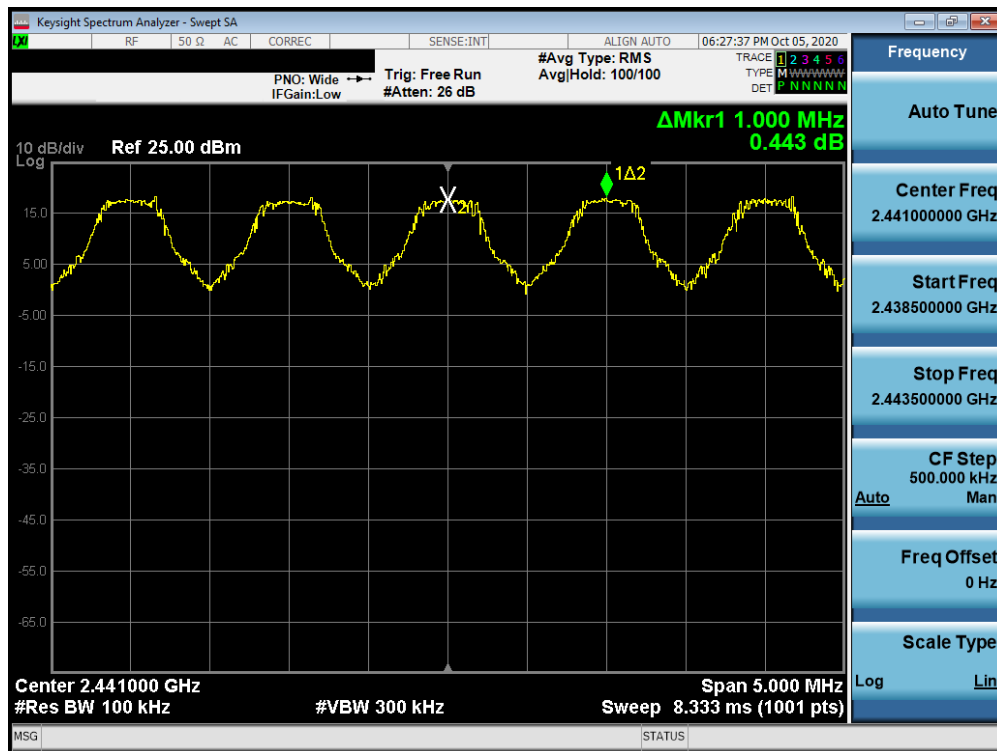
The EUT complies with the minimum channel separation requirement when it is operating in 1x/EDR mode using 79 channels and when operating in AFH mode using 20 channels.

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Antenna 1

Frequency [MHz]	Data Rate [Mbps]	Mod.	Channel No.	Min. Channel Separation [MHz]
2402	1.0	GFSK	0	0.681
2441	1.0	GFSK	39	0.680
2480	1.0	GFSK	78	0.680
2402	2.0	$\pi/4$ -DQPSK	0	0.886
2441	2.0	$\pi/4$ -DQPSK	39	0.885
2480	2.0	$\pi/4$ -DQPSK	78	0.887
2402	3.0	8DPSK	0	0.871
2441	3.0	8DPSK	39	0.864
2480	3.0	8DPSK	78	0.862

Table 7-8. Minimum Channel Separation – ANT1



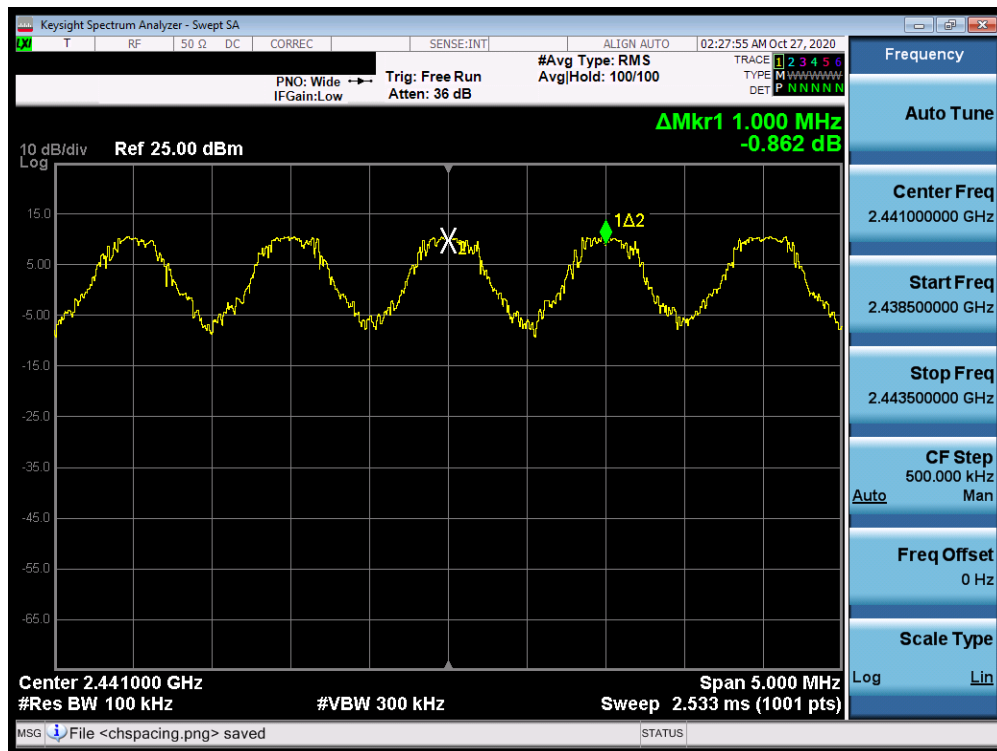
Plot 7-99. Channel Spacing Plot (Bluetooth) – ANT1

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Antenna 2

Frequency [MHz]	Data Rate [Mbps]	Mod.	Channel No.	Min. Channel Separation [MHz]
2402	1.0	GFSK	0	0.680
2441	1.0	GFSK	39	0.680
2480	1.0	GFSK	78	0.681
2402	2.0	$\pi/4$ -DQPSK	0	0.884
2441	2.0	$\pi/4$ -DQPSK	39	0.885
2480	2.0	$\pi/4$ -DQPSK	78	0.883
2402	3.0	8DPSK	0	0.863
2441	3.0	8DPSK	39	0.864
2480	3.0	8DPSK	78	0.865

Table 7-9. Minimum Channel Separation – ANT2



Plot 7-100. Channel Spacing Plot (Bluetooth) – ANT2

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7.6 Time of Occupancy

§15.247 (a.1.iii); RSS-247 [5.1(4)]

Test Overview and Limit

Measurement is made while EUT is operating in hopping mode with the spectrum analyzer set to zero span. **The maximum permissible time of occupancy is 400 ms within a period of 400ms multiplied by the number of hopping channels employed.**

Test Procedure Used

ANSI C63.10-2013 – Section 7.8.4

Test Settings

1. Span = zero span, centered on a hopping channel
2. RBW \leq channel spacing and $\gg 1/T$, where T is expected dwell time per channel
3. Sweep = as necessary to capture entire dwell time. Second plot may be required to demonstrate two successive hops on a channel
4. Trigger is set with appropriate trigger delay to place pulse near the center of the plot
5. Detector = peak
6. Trace mode = max hold
7. Marker-delta function used to determine transmit time per hop

Test Setup



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



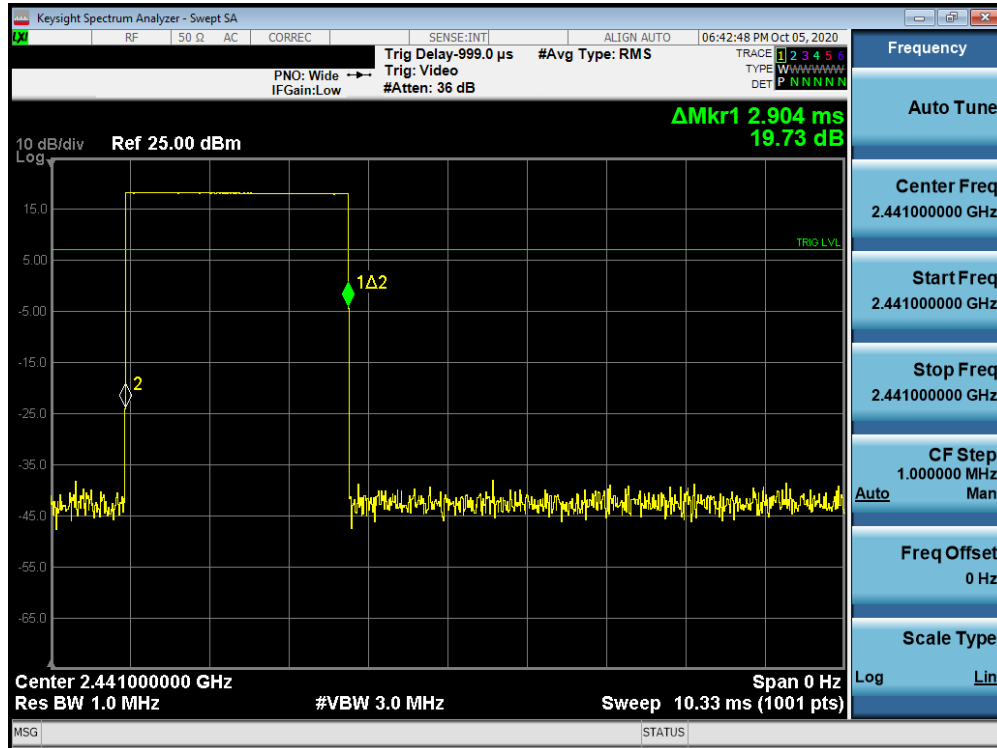
Figure 7-5. Test Instrument & Measurement Setup

Test Notes

None

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Antenna 1



Plot 7-101. Time of Occupancy Plot (Bluetooth) – ANT1



Bluetooth Time of Occupancy Calculation

Typically, Bluetooth 1x/EDR mode has a channel hopping rate of 1600 hops/s. Since 1x/EDR modes use 5 transmit and 1 receive slot, for a total of 6 slots, the Bluetooth transmitter is actually hopping at a rate of $1600 / 6 = 266.67$ hops/s/slot

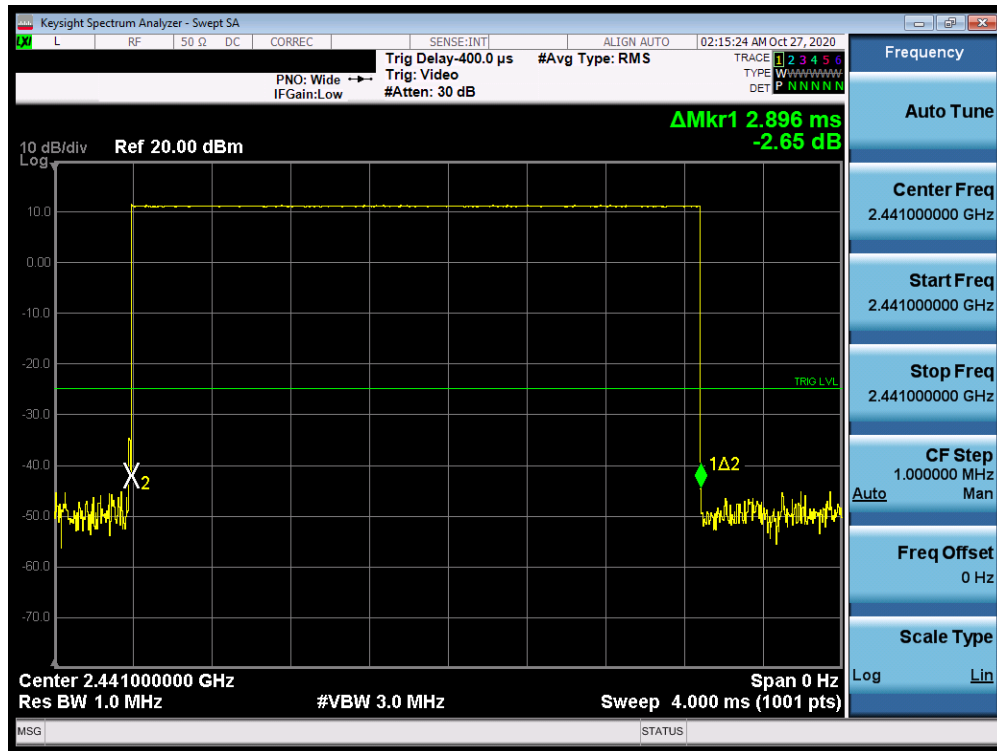
- $400\text{ms} \times 79$ hopping channels = 31.6 sec (Time of Occupancy Limit)
- Worst case BT has 266.67 hops/second (for 1x/EDR modes with DH5 operation)
- 266.67 hops/second / 79 channels = 3.38 hops/second (# of hops/second on one channel)
- 3.38 hops/second/channel \times 31.6 seconds = 106.67 hops (# hops over a 31.6 second period)
- 106.67 hops \times 2.904 ms/channel = 309.77 ms (worst case dwell time for one channel in 1x/EDR modes)

With AFH, the number of channels is reduced to a minimum of 20 channels and the channel hopping rate is reduced by 50% to 800 hops/s. AFH mode also uses 6 total slots so the Bluetooth transmitter hops at a rate of $800 / 6 = 133.3$ hops/s/slot

- $400\text{ms} \times 20$ hopping channels = 8 sec (Time of Occupancy Limit)
- Worst case BT has 133.3 hops/second/slot (for AFH mode with DH5 operation)
- 133.3 hops/s / 20 channels = 6.67 hops/second (# of hops/second on one channel)
- 6.67 hops/s / channel \times 8 seconds = 53.34 hops (# hops over a 8 second period)
- 53.34 hops \times 2.904 ms/channel = 154.90 ms (worst case dwell time for one channel in AFH mode)

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Antenna 2



Plot 7-102. Time of Occupancy Plot (Bluetooth) – ANT2



Bluetooth Time of Occupancy Calculation

Typically, Bluetooth 1x/EDR mode has a channel hopping rate of 1600 hops/s. Since 1x/EDR modes use 5 transmit and 1 receive slot, for a total of 6 slots, the Bluetooth transmitter is actually hopping at a rate of $1600 / 6 = 266.67$ hops/s/slot

- o 400ms x 79 hopping channels = 31.6 sec (Time of Occupancy Limit)
- o Worst case BT has 266.67 hops/second (for 1x/EDR modes with DH5 operation)
- o 266.67 hops/second / 79 channels = 3.38 hops/second (# of hops/second on one channel)
- o 3.38 hops/second/channel x 31.6 seconds = 106.67 hops (# hops over a 31.6 second period)
- o 106.67 hops x 2.896 ms/channel = 308.91 ms (worst case dwell time for one channel in 1x/EDR modes)

With AFH, the number of channels is reduced to a minimum of 20 channels and the channel hopping rate is reduced by 50% to 800 hops/s. AFH mode also uses 6 total slots so the Bluetooth transmitter hops at a rate of $800 / 6 = 133.3$ hops/s/slot

- o 400ms x 20 hopping channels = 8 sec (Time of Occupancy Limit)
- o Worst case BT has 133.3 hops/second/slot (for AFH mode with DH5 operation)
- o 133.3 hops/s / 20 channels = 6.67 hops/second (# of hops/second on one channel)
- o 6.67 hops/s / channel x 8 seconds = 53.34 hops (# hops over a 8 second period)
- o 53.34 hops x 2.896 ms/channel = 154.47 ms (worst case dwell time for one channel in AFH mode)

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7.7 Number of Hopping Channels

§15.247 (a.1.iii); RSS-247 [5.1(4)]

Test Overview and Limit

Measurement is made while EUT is operating in hopping mode. ***This frequency hopping system must employ a minimum of 15 hopping channels.***

Test Procedure Used

ANSI C63.10-2013 – Section 7.8.3

Test Settings

1. Span = frequency of band of operation (divided into two plots)
2. RBW < 30% of channel spacing or 20dB bandwidth, whichever is smaller.
3. VBW ≥ RBW
4. Sweep = auto
5. Detector = peak
6. Trace mode = max hold
7. Trace was allowed to stabilize

Test Setup



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

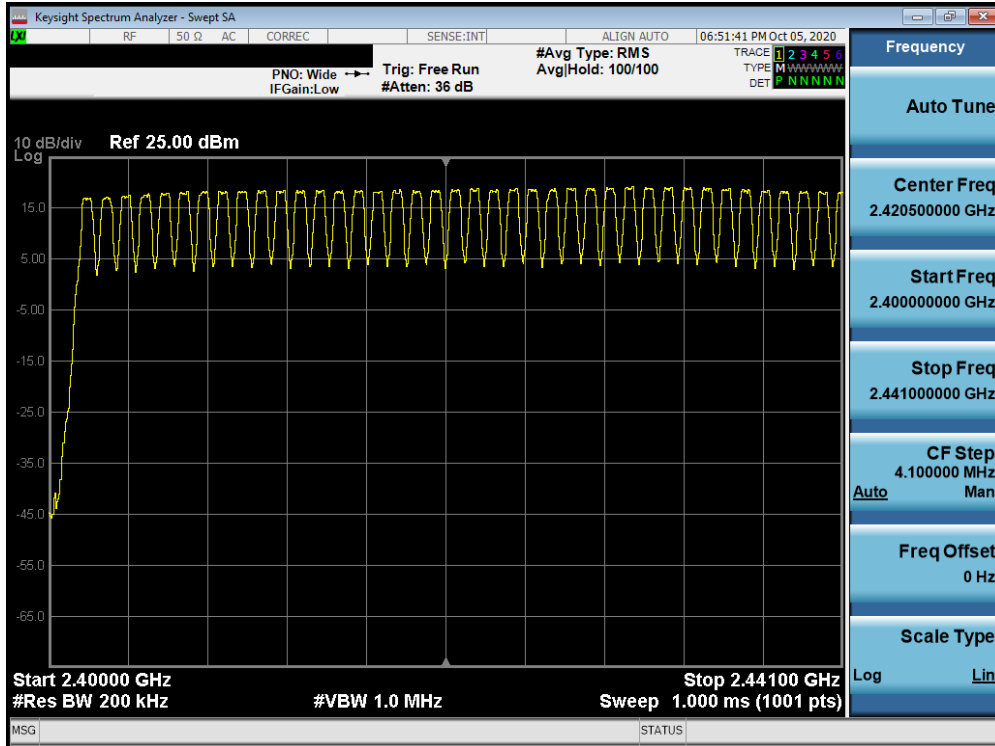


Figure 7-6. Test Instrument & Measurement Setup

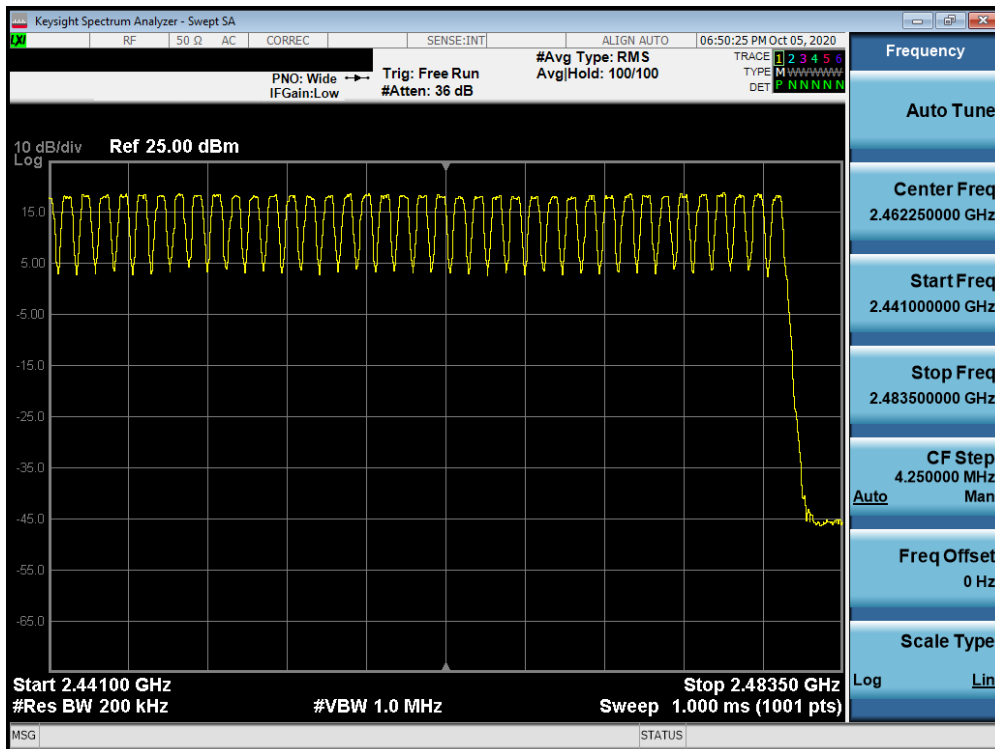
Test Notes

The frequency spectrum was broken up into two sub-ranges to clearly show all of the hopping frequencies. In AFH mode, this device operates using 20 channels so the requirement for minimum number of hopping channels is satisfied.

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Plot 7-103. Low End Spectrum Channel Hopping Plot (Bluetooth) – ANT1



Plot 7-104. High End Spectrum Channel Hopping Plot (Bluetooth) – ANT1

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