

MEASUREMENT REPORT
FCC PART 15.247 / ISED RSS-247 Bluetooth

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

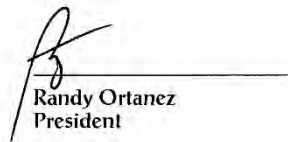
Date of Testing:
05/04 - 07/06/2020
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M2005040080-12.A3L

FCC ID:	A3LSMF707U
IC:	649E-SMF707U
APPLICANT:	Samsung Electronics Co., Ltd.

Application Type: Certification
Model: SM-F707U
Additional Model(s): SM-F707U1, SM-F707W
HVIN : SM-F707W
EUT Type: Portable Handset
Max. RF Output Power: 71.879 mW (18.57 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)
ISED Specification: RSS-247 Issue 2
Test Procedure(s): ANSI C63.10-2013, KDB 558074 D01 v05r02

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 17025-2005 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).
- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISED.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMF707U**. 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.

This device can operate in one of two physical configurations – “open” and “closed”. All emissions are investigated in both modes for compliance.

Test Device Serial No.: 0025H, 0023H, 0009H, 0036H, 0038H, 1064M, 1049M

2.2 Device Capabilities

This device contains the following capabilities:

800/850/1900 CDMA/EvDO Rev0/A, 1x Advanced (BC0, BC1, BC10), 850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 5G NR (n71, n5, n66, n25, n2, n41), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII, Bluetooth (1x, EDR, LE), NFC, Wireless Power Transfer

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

Table 2-1. Frequency/ Channel Operations

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2.3 Antenna Description

Following antenna was used for the testing.

Frequency [GHz]	Antenna Gain (dBi)
2.4	-5.8

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.

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.

2.5 Software and Firmware

The test was conducted with software version F707USQE0ATEJ 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 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 7.13. 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	8/3/2019	Annual	8/3/2020	BT1
Agilent	N4010A	Wireless Connectivity Test Set	N/A			GB46170464
Agilent	N9038A	MXE EMI Receiver	7/17/2019	Annual	7/17/2020	MY51210133
Agilent	N9030A	PXA Signal Analyzer (44GHz)	7/12/2019	Annual	7/12/2020	MY52350166
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	10/10/2019	Biennial	10/10/2021	121034
Emco	3116	Horn Antenna (18 - 40GHz)	6/7/2018	Triennial	6/7/2021	9203-2178
Rohde & Schwarz	CMU200	Base Station Simulator	N/A			836536/0005
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	11/1/2019	Annual	11/1/2020	100040
Rohde & Schwarz	TS-PR40	26.5-40 GHz Pre-Amplifier	11/1/2019	Annual	11/1/2020	100037
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	8/5/2019	Annual	8/5/2020	100342
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	9/23/2019	Annual	9/23/2020	100348
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	7/11/2019	Annual	7/11/2020	102134
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	7/8/2019	Annual	7/8/2020	102133
Solar Electronics	8012-50-R-24-BNC	Line Impedance Stabilization Network	10/1/2019	Biennial	10/1/2021	310233
Sunol	DRH-118	Horn Antenna (1-18 GHz)	8/27/2019	Biennial	8/27/2021	A042511
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	7/19/2018	Biennial	7/19/2020	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: A3LSMF707U
 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 7.12
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits (RSS-Gen [8.8] limits)	LINE CONDUCTED	PASS	Section 7.13

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

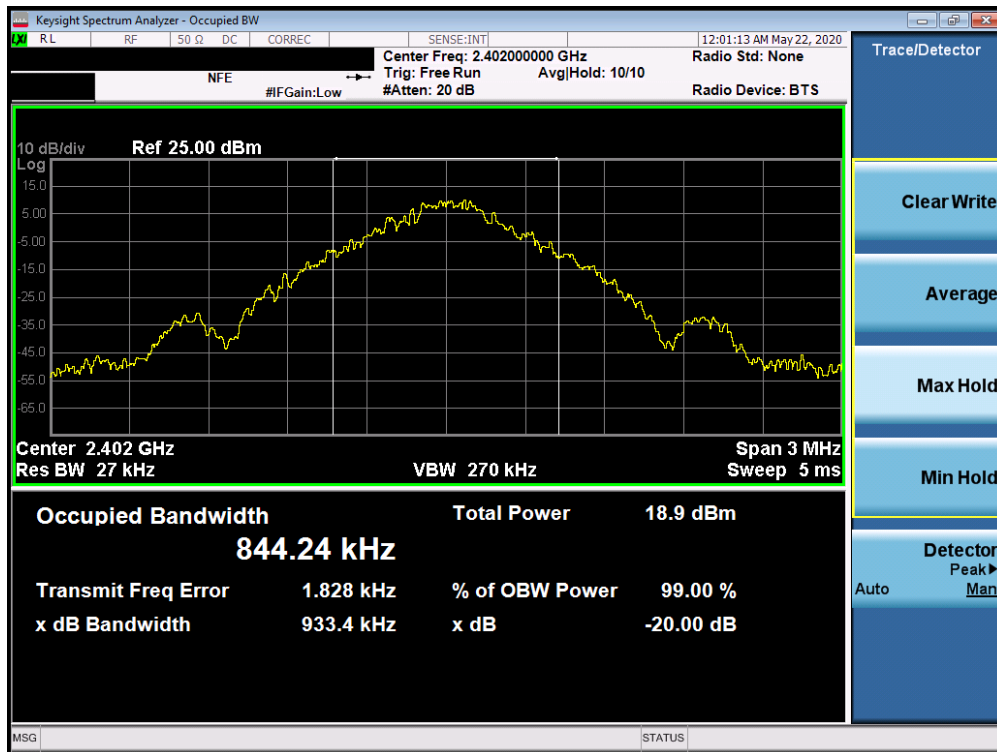
Test Notes

None

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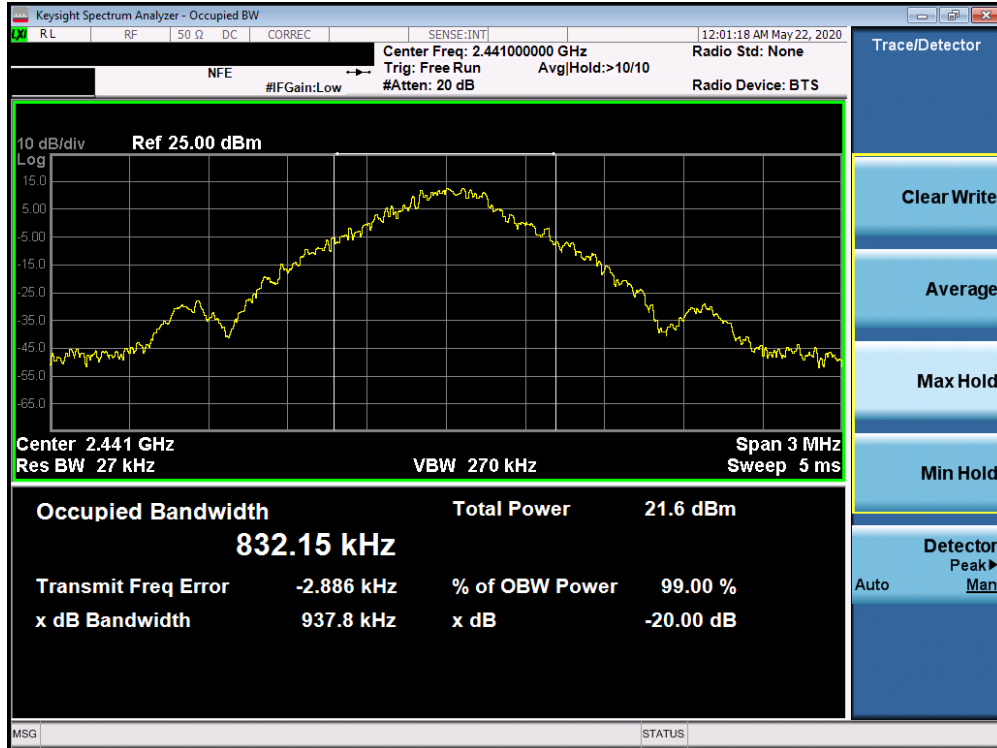
Frequency [MHz]	Data Rate [Mbps]	Channel No.	20dB Bandwidth Test Results [kHz]
2402	1.0	0	933.40
2441	1.0	39	937.80
2480	1.0	78	922.20
2402	2.0	0	1360.00
2441	2.0	39	1253.00
2480	2.0	78	1334.00
2402	3.0	0	1278.00
2441	3.0	39	1320.00
2480	3.0	78	1226.00

Table 7-2. Conducted 20dB Bandwidth Measurements-ANT0

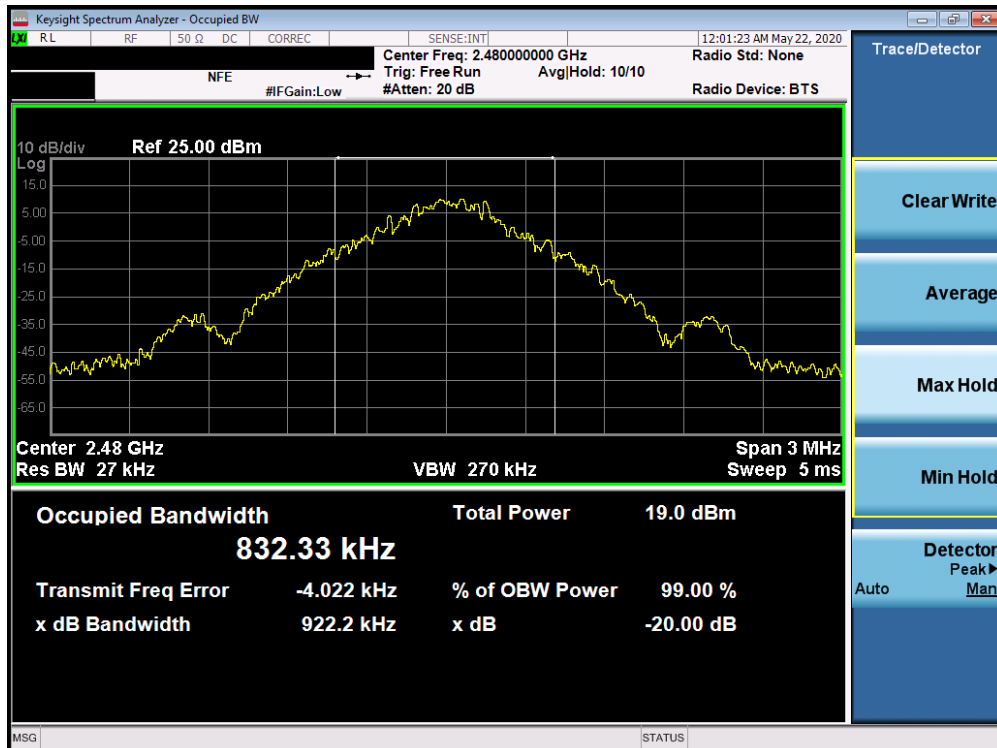


Plot 7-1. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 0)

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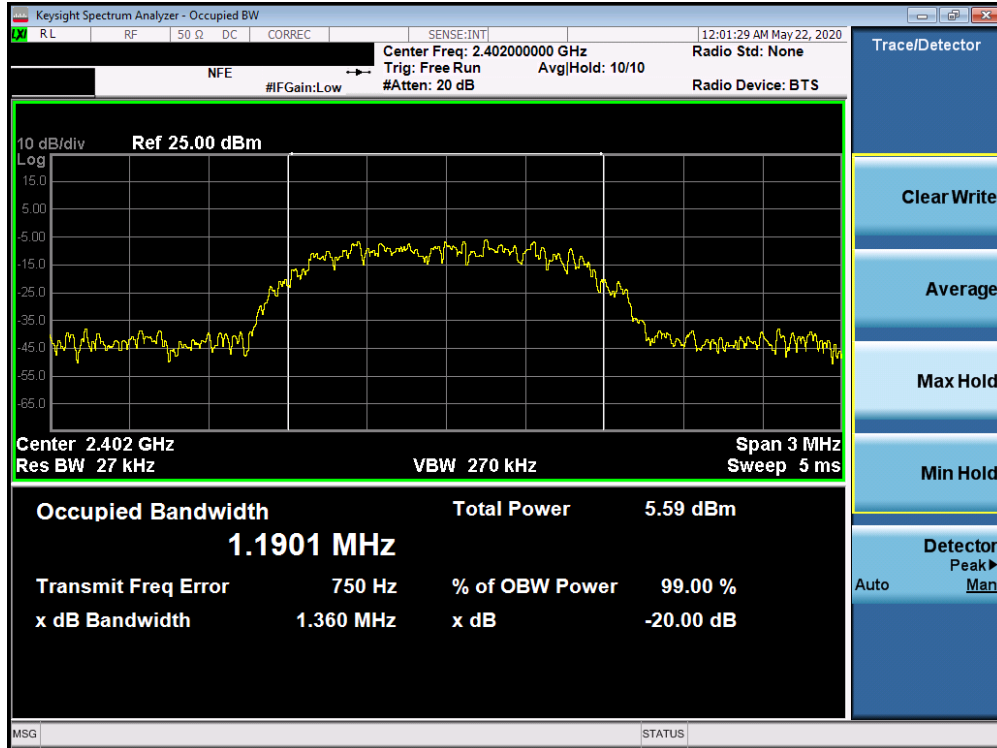


Plot 7-2. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 39)

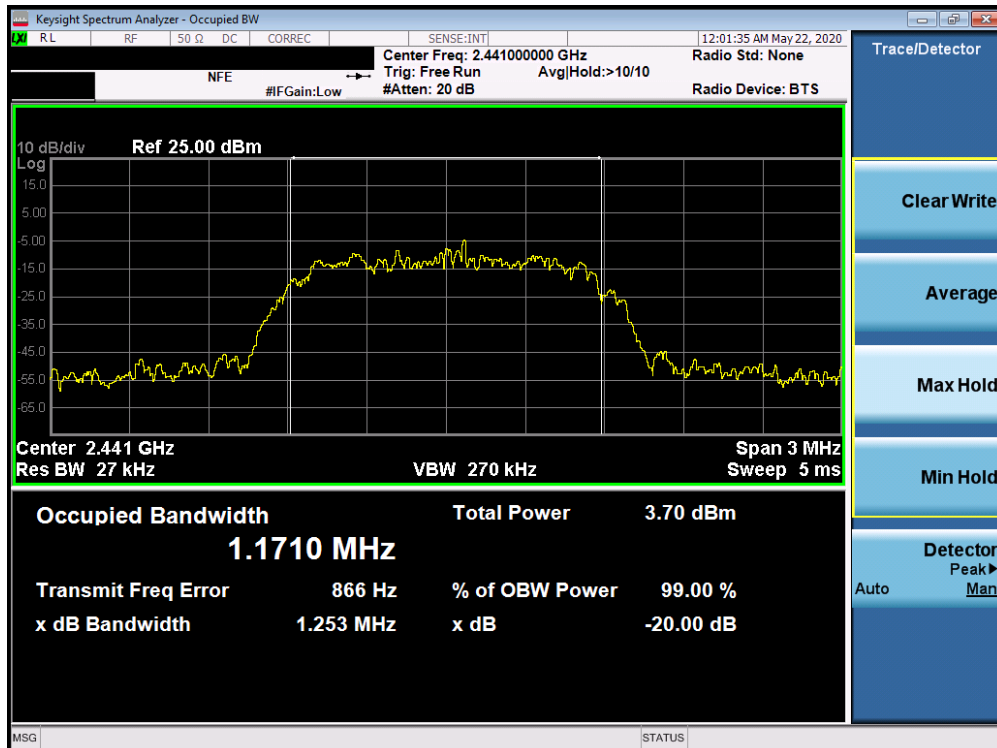


Plot 7-3. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 78)

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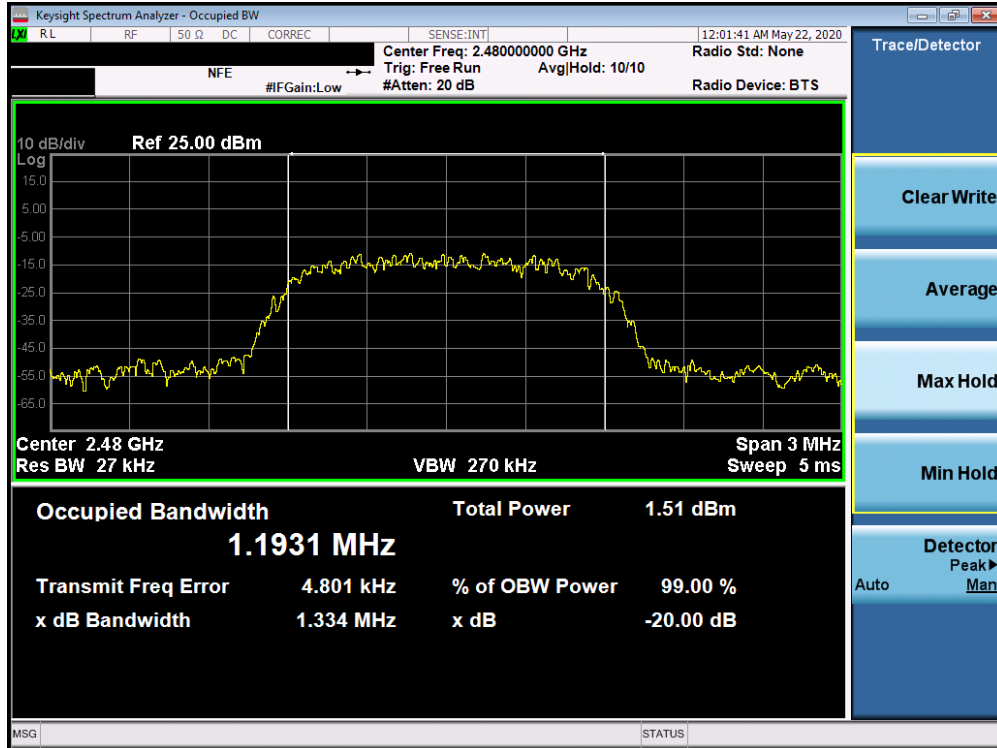


Plot 7-4. 20dB Bandwidth Plot (Bluetooth, 2Mbps – Ch. 0)

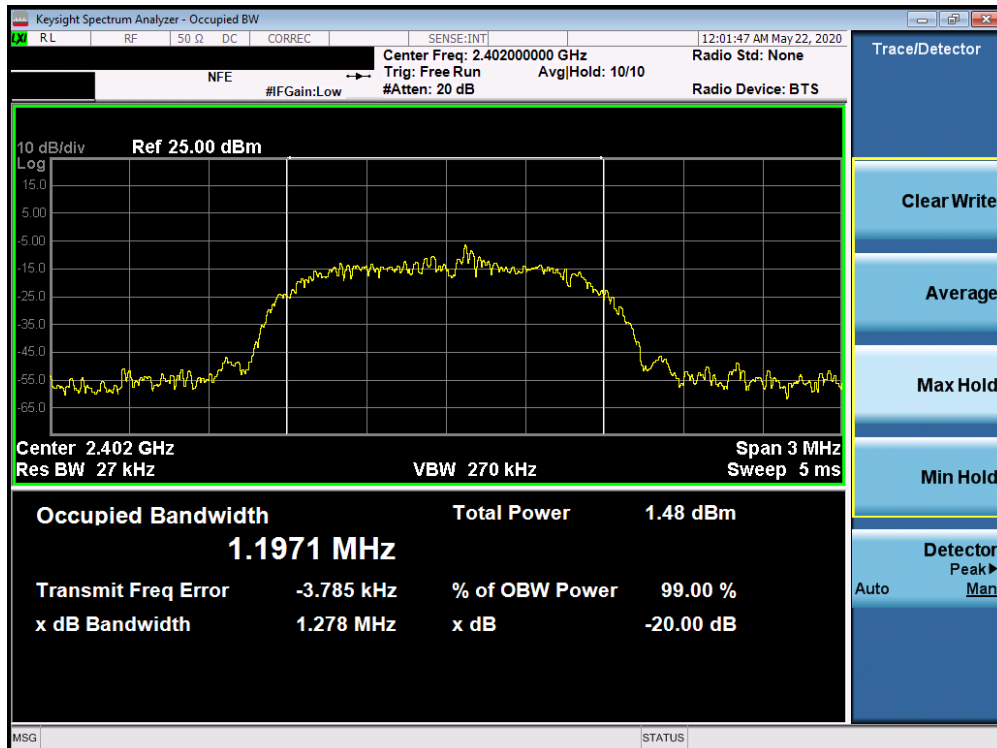


Plot 7-5. 20dB Bandwidth Plot (Bluetooth, 2Mbps – Ch. 39)

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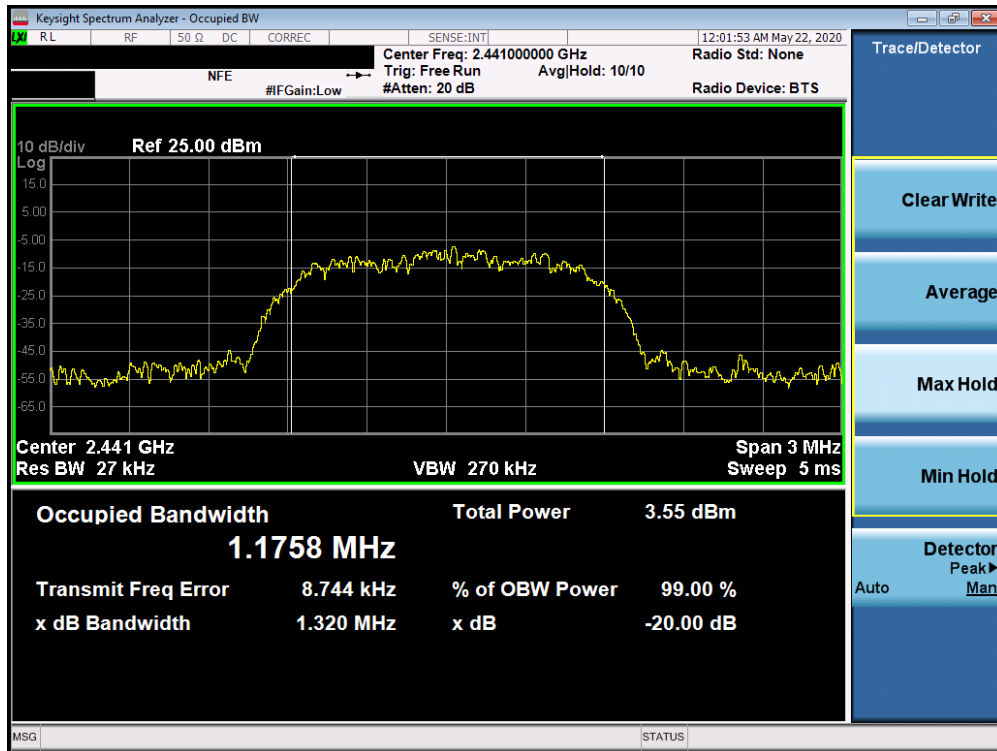


Plot 7-6. 20dB Bandwidth Plot (Bluetooth, 2Mbps – Ch. 78)

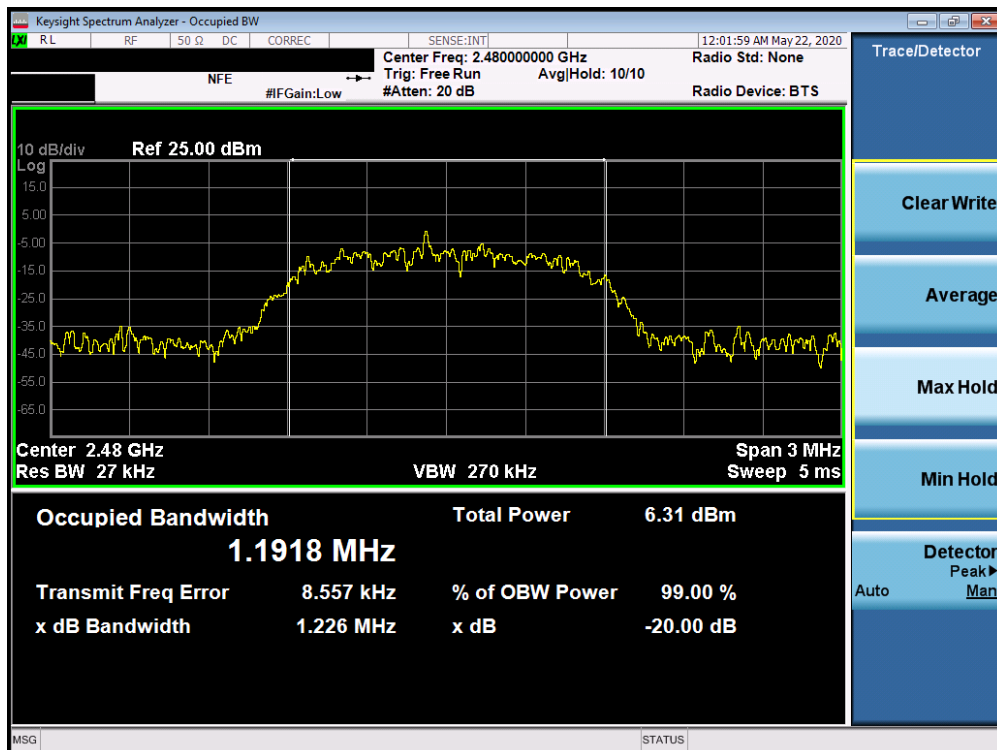


Plot 7-7. 20dB Bandwidth Plot (Bluetooth, 3Mbps – Ch. 0)

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Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 16 of 94



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

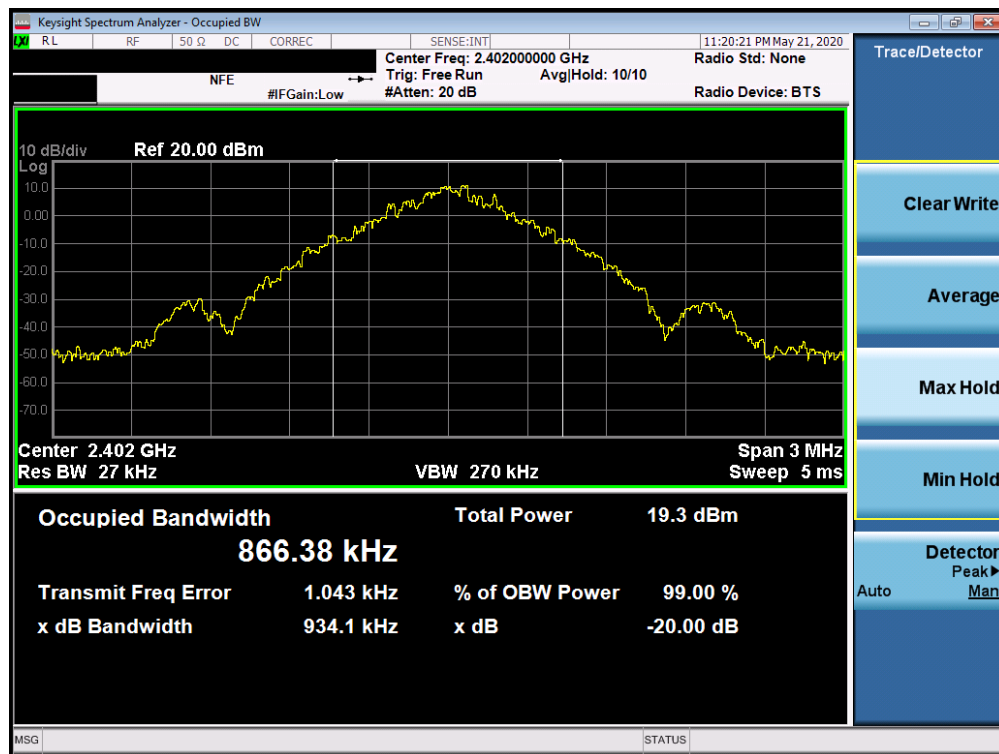


Plot 7-9. 20dB Bandwidth Plot (Bluetooth, 3Mbps – Ch. 78)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 17 of 94

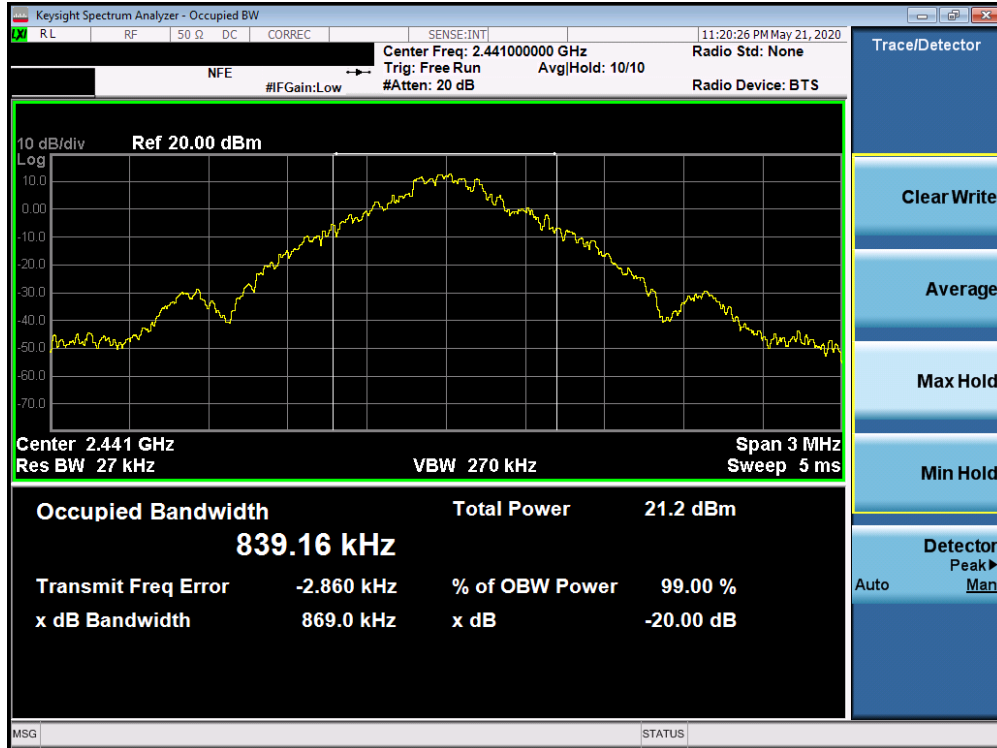
Frequency [MHz]	Data Rate [Mbps]	Channel No.	20dB Bandwidth Test Results [kHz]
2402	1.0	0	934.10
2441	1.0	39	869.00
2480	1.0	78	924.80
2402	2.0	0	1355.00
2441	2.0	39	1321.00
2480	2.0	78	1353.00
2402	3.0	0	1302.00
2441	3.0	39	1261.00
2480	3.0	78	1262.00

Table 7-3. Conducted 20dB Bandwidth Measurements-ANT1

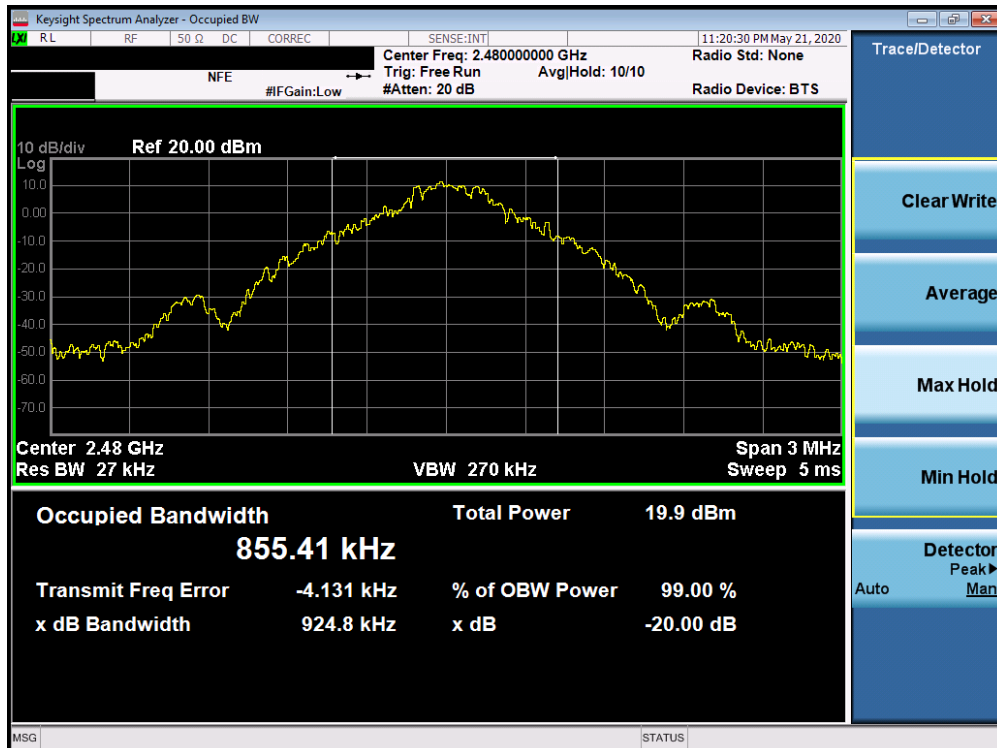


Plot 7-10. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 0)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 18 of 94

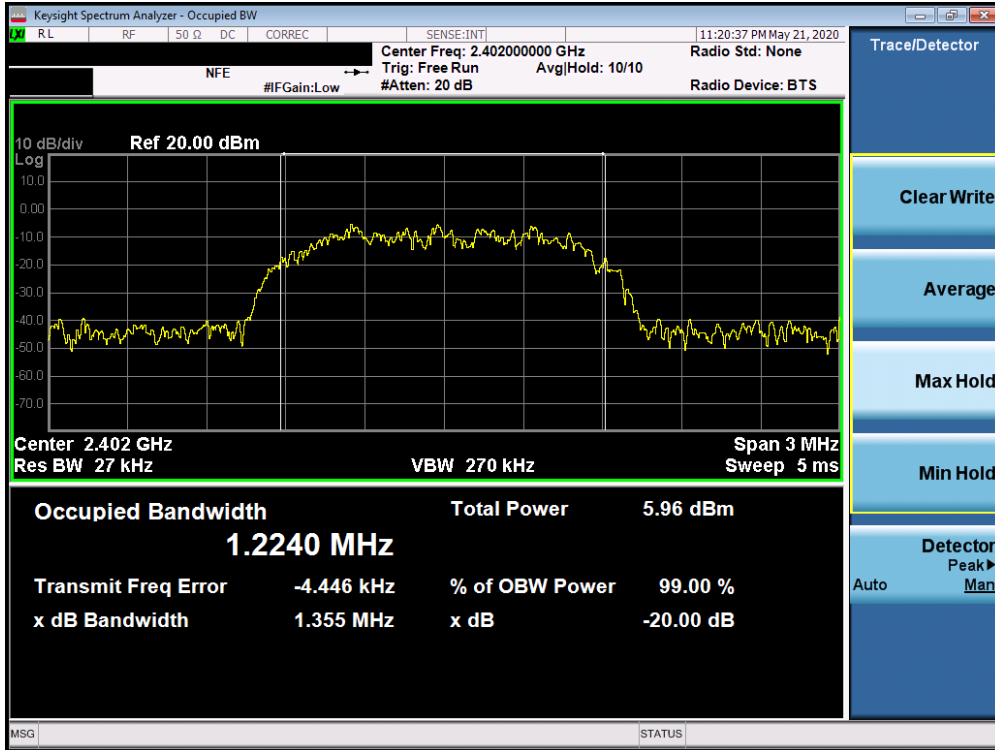


Plot 7-11. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 39)

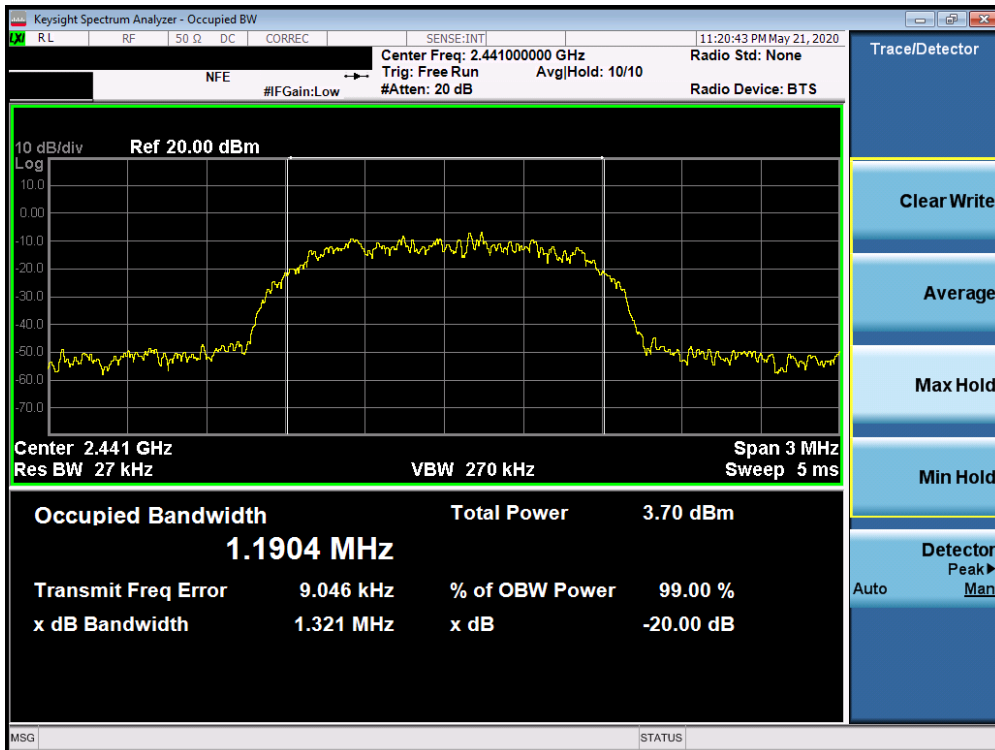


Plot 7-12. 20dB Bandwidth Plot (Bluetooth, 1Mbps – Ch. 78)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 19 of 94

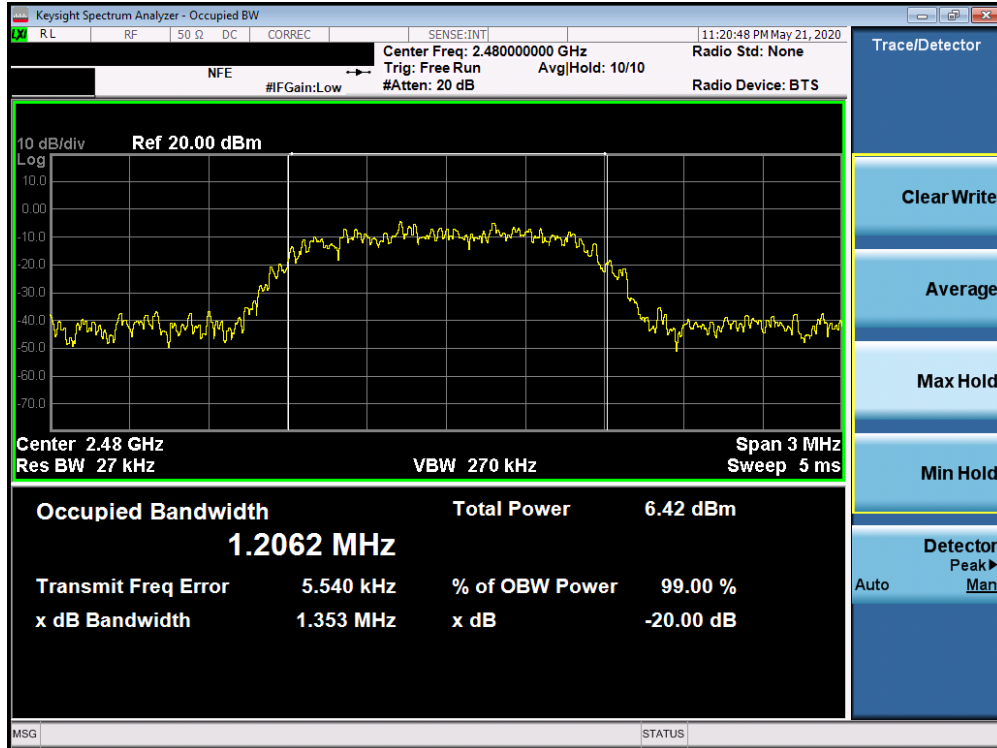


Plot 7-13. 20dB Bandwidth Plot (Bluetooth, 2Mbps – Ch. 0)

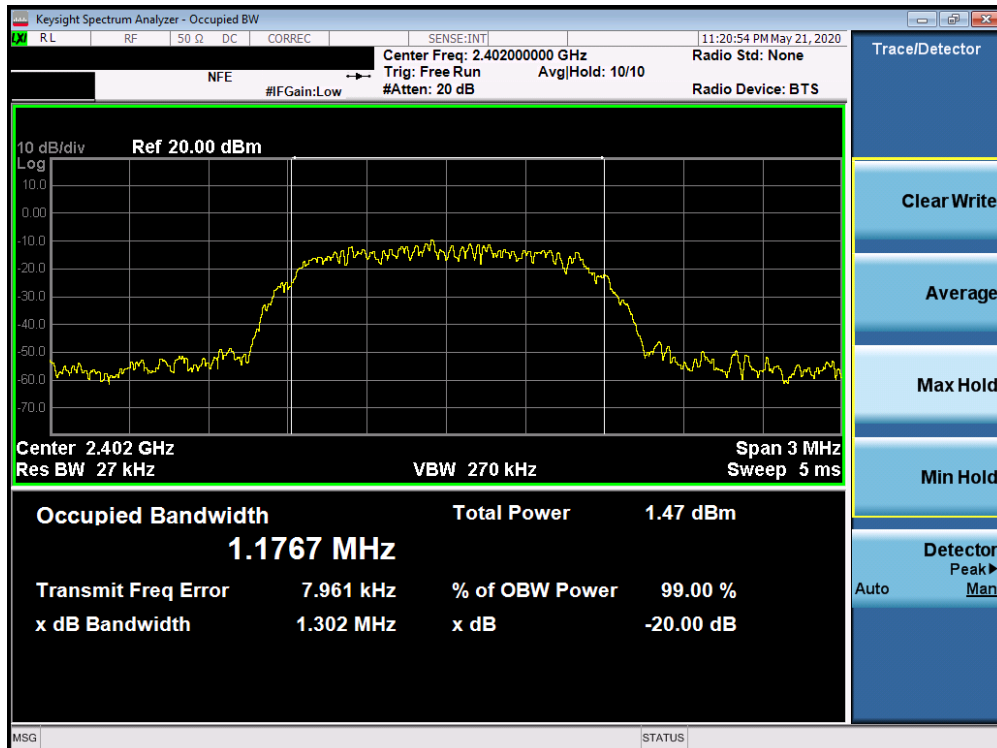


Plot 7-14. 20dB Bandwidth Plot (Bluetooth, 2Mbps – Ch. 39)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 20 of 94

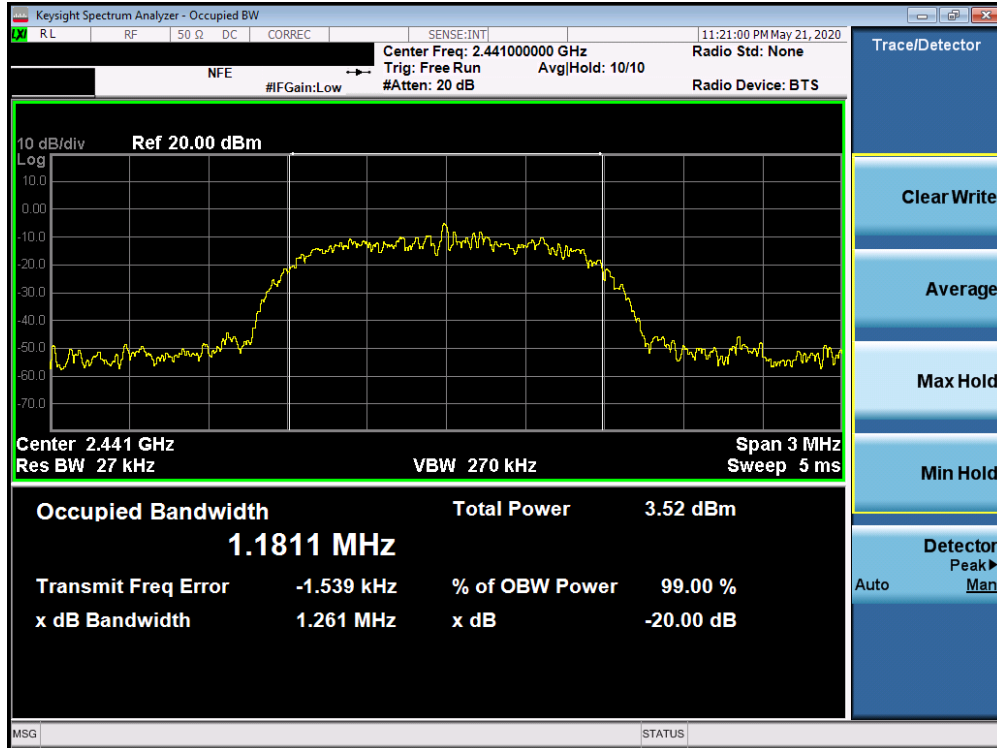


Plot 7-15. 20dB Bandwidth Plot (Bluetooth, 2Mbps – Ch. 78)

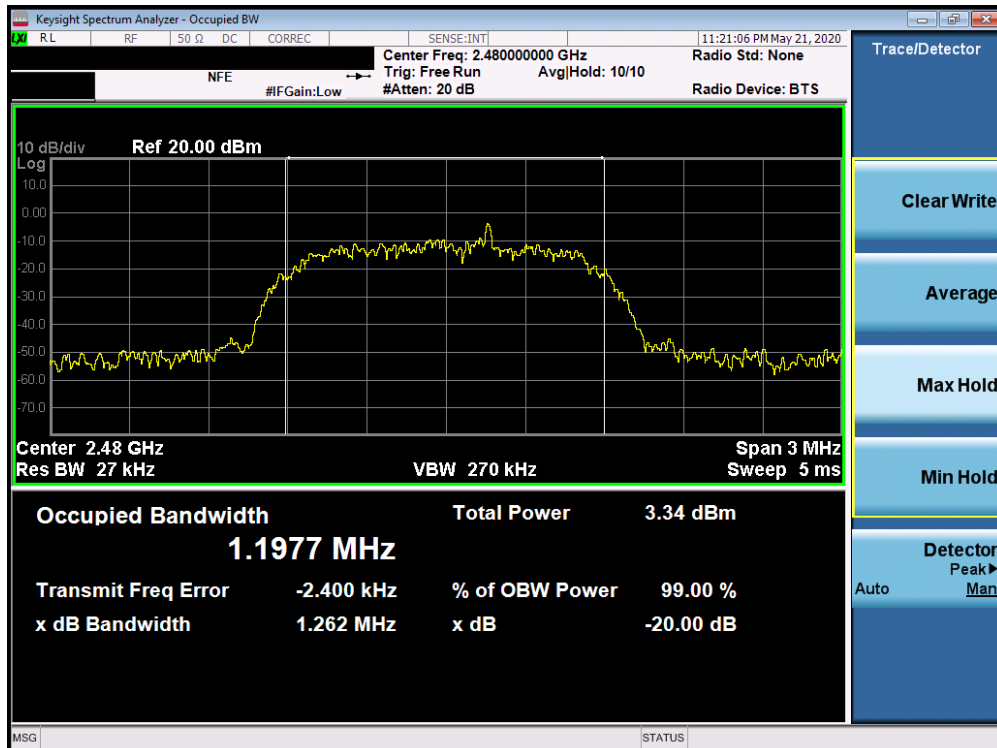


Plot 7-16. 20dB Bandwidth Plot (Bluetooth, 3Mbps – Ch. 0)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 21 of 94



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



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

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 22 of 94

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

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

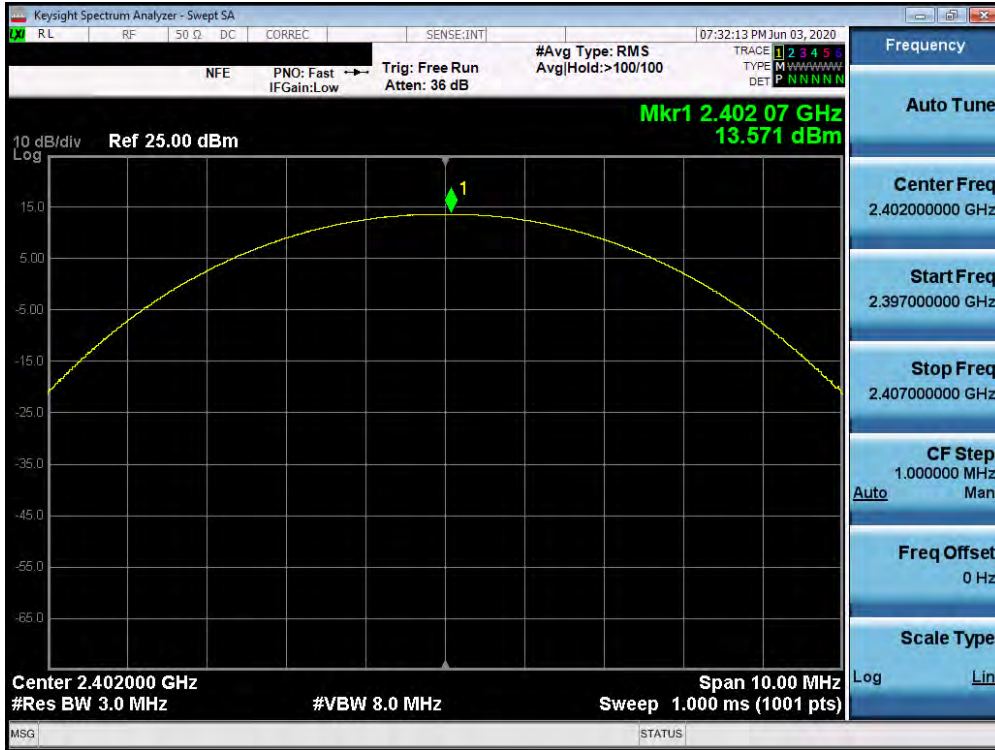
$$\text{Output Power (dBm)} = \text{Raw Analyzer Level (dBm)} + \text{Cable Loss (dB)} + \text{Loss in Directional Coupler/Insertion Loss (dB)}$$

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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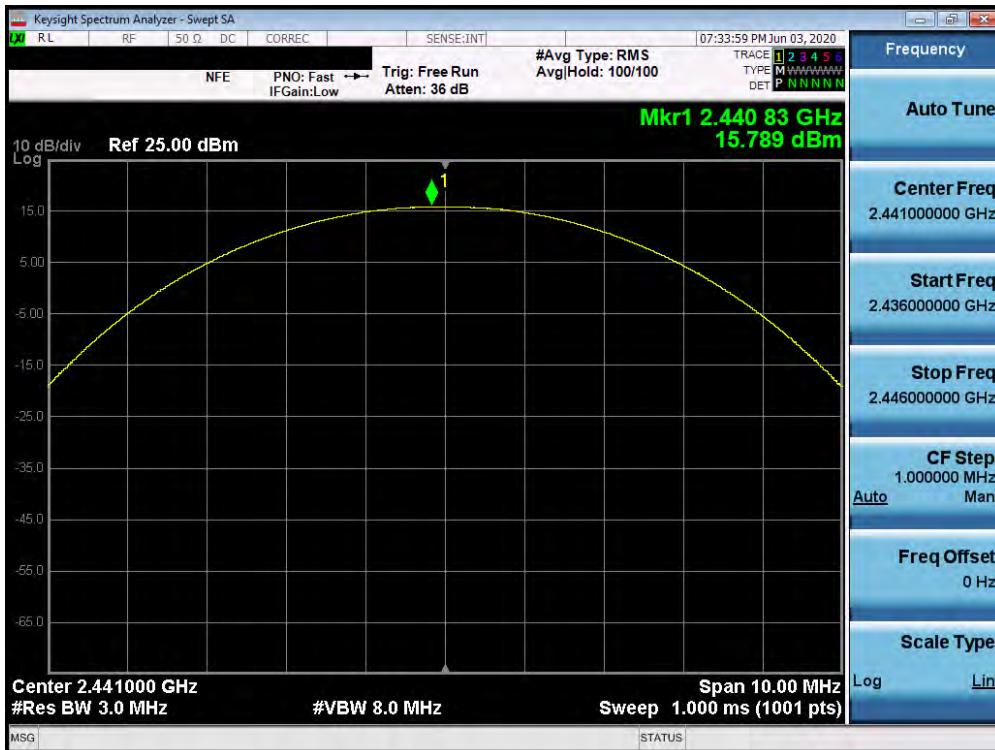
Frequency [MHz]	Data Rate [Mbps]	Mod.	Channel No.	Peak Conducted Power		Avg Conducted Power	
				[dBm]	[mW]	[dBm]	[mW]
2402	1.0	GFSK	0	13.57	22.756	12.58	18.093
2441	1.0	GFSK	39	15.79	37.923	14.94	31.210
2479	1.0	GFSK	77	13.27	21.208	12.39	17.346
2480	1.0	GFSK	78	13.00	19.943	12.16	16.459
2402	2.0	$\pi/4$ -DQPSK	0	15.82	38.221	12.55	17.985
2441	2.0	$\pi/4$ -DQPSK	39	18.15	65.313	14.89	30.818
2479	2.0	$\pi/4$ -DQPSK	77	15.14	32.644	12.31	17.037
2480	2.0	$\pi/4$ -DQPSK	78	15.23	33.373	12.09	16.162
2402	3.0	8DPSK	0	16.02	40.013	12.58	18.130
2441	3.0	8DPSK	39	18.57	71.879	14.94	31.182
2479	3.0	8DPSK	77	15.76	37.636	12.42	17.454
2480	3.0	8DPSK	78	15.52	35.653	12.14	16.353

Table 7-4. Conducted Output Power Measurements - ANT0

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 24 of 94

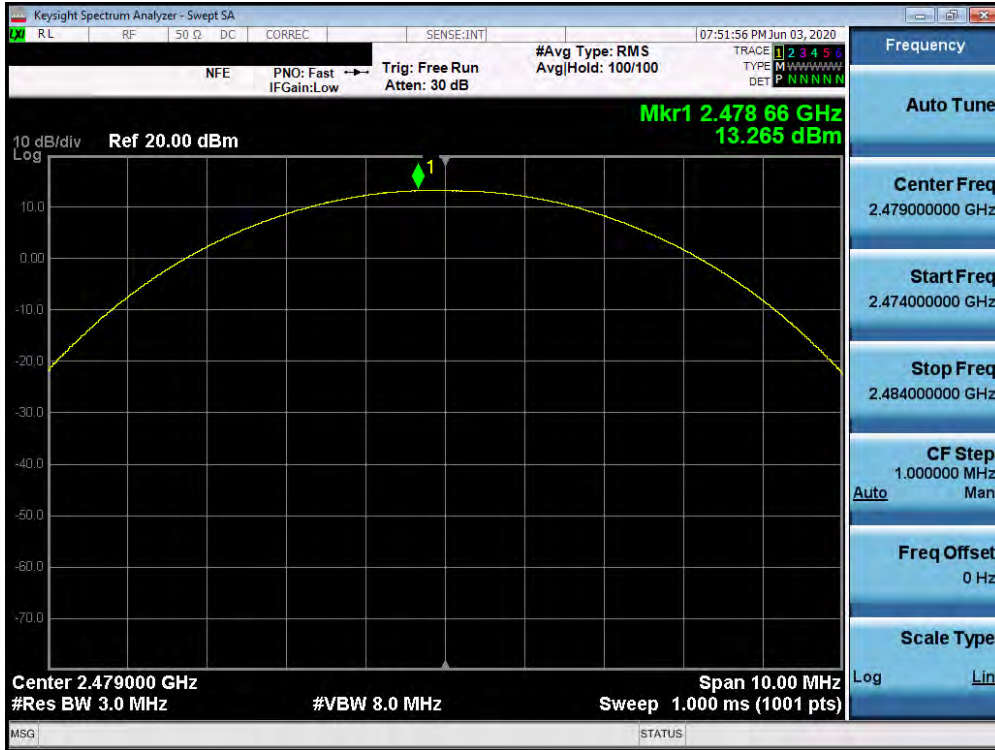


Plot 7-19. Peak Conducted Power (1Mbps – Ch. 0)

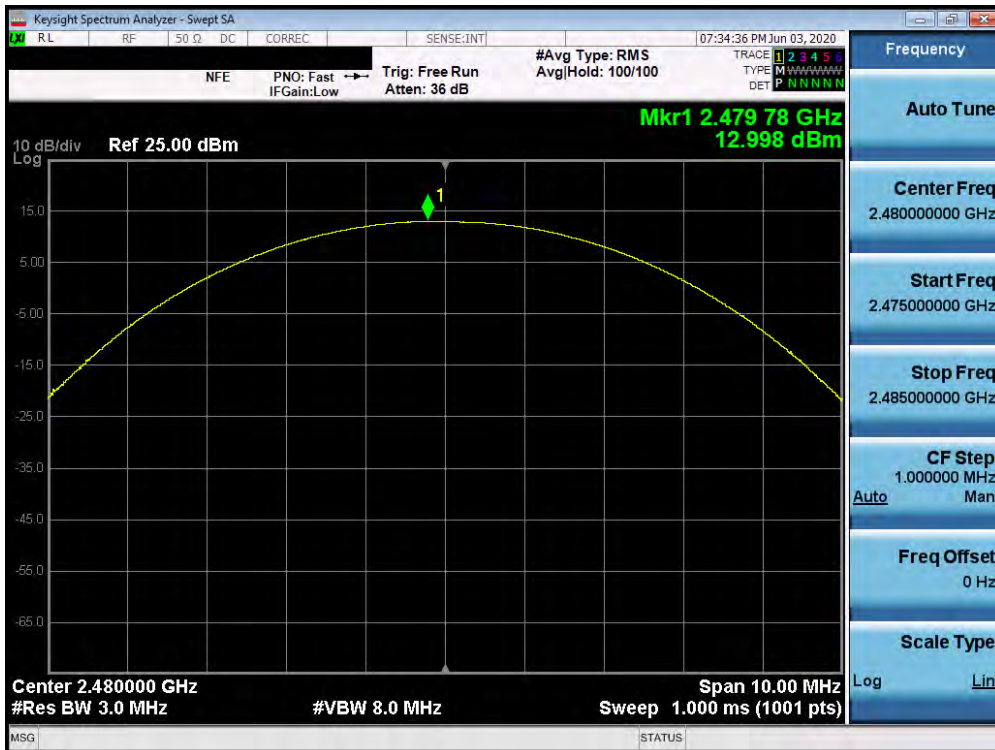


Plot 7-20. Peak Conducted Power (1Mbps – Ch. 39)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 25 of 94

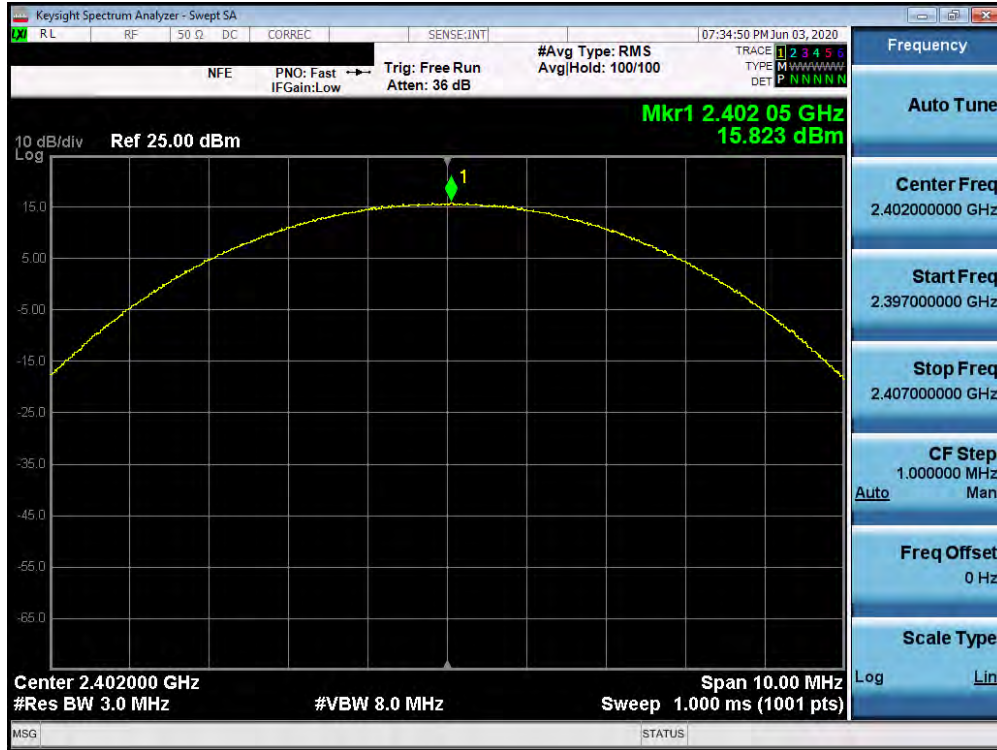


Plot 7-21. Peak Conducted Power (1Mbps – Ch. 77)

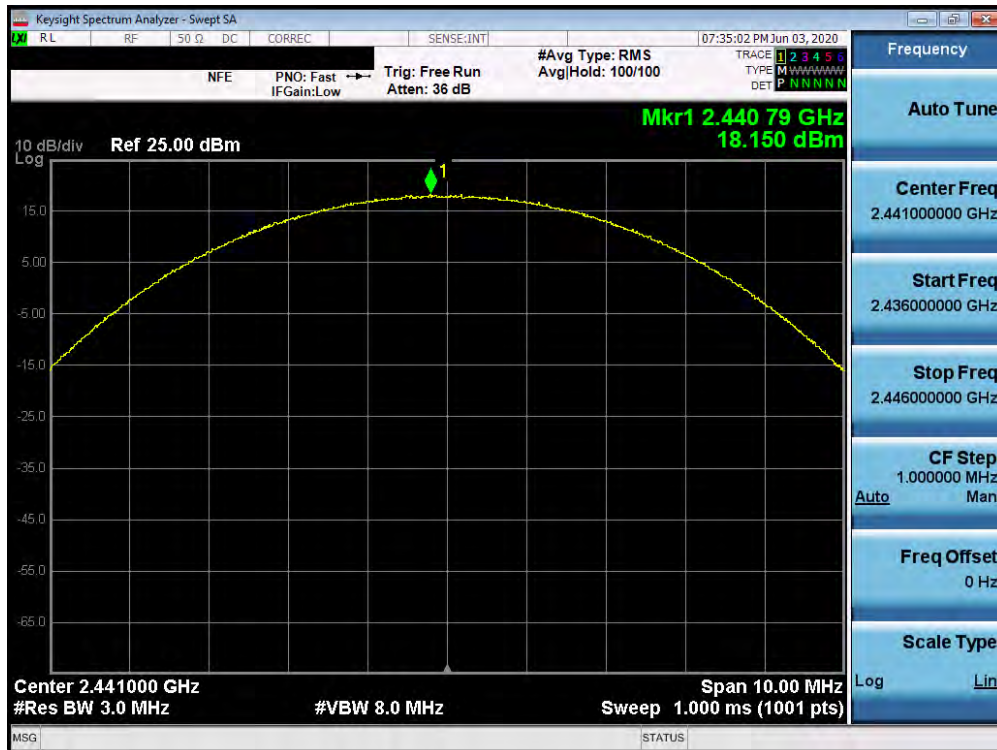


Plot 7-22. Peak Conducted Power (1Mbps – Ch. 78)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 26 of 94

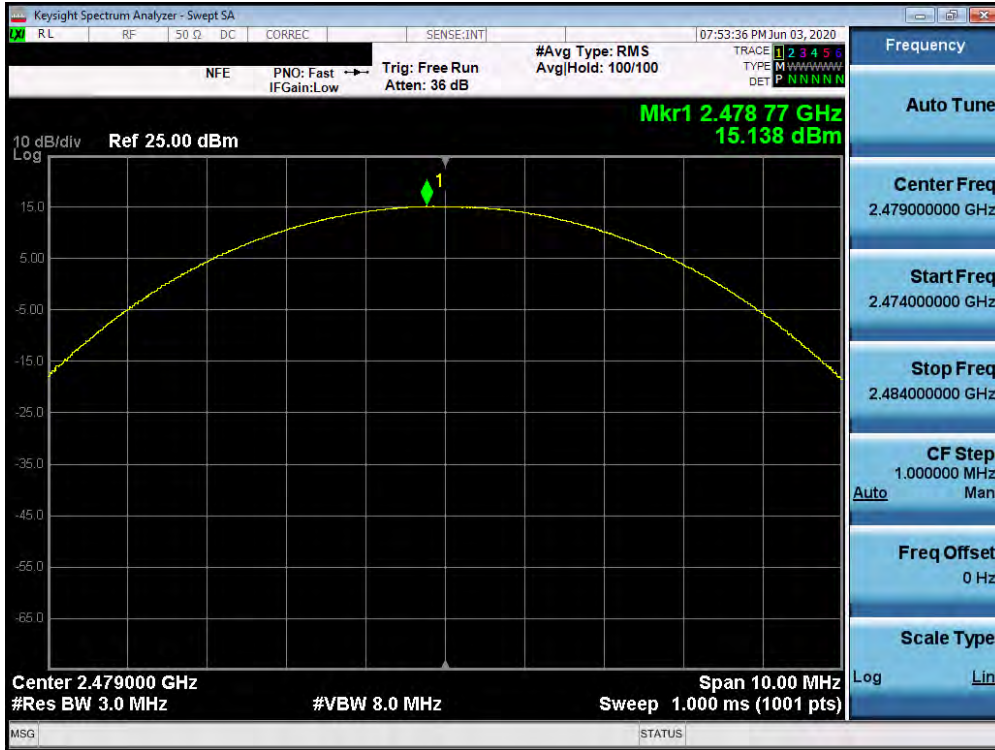


Plot 7-23. Peak Conducted Power (2Mbps – Ch. 0)

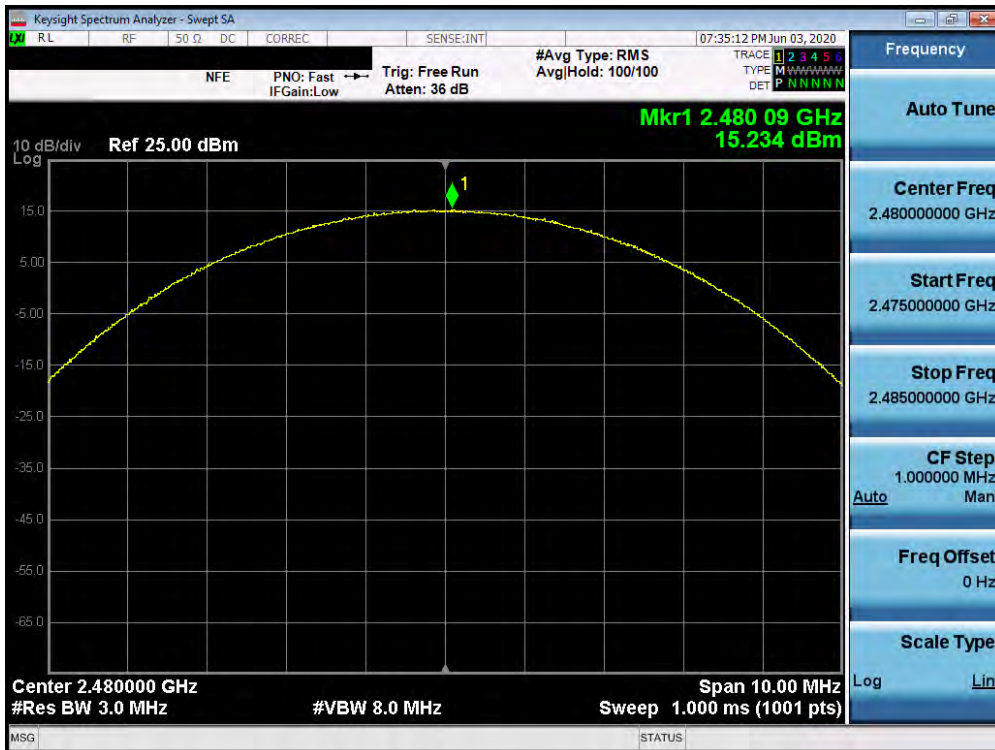


Plot 7-24. Peak Conducted Power (2Mbps – Ch. 39)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 27 of 94

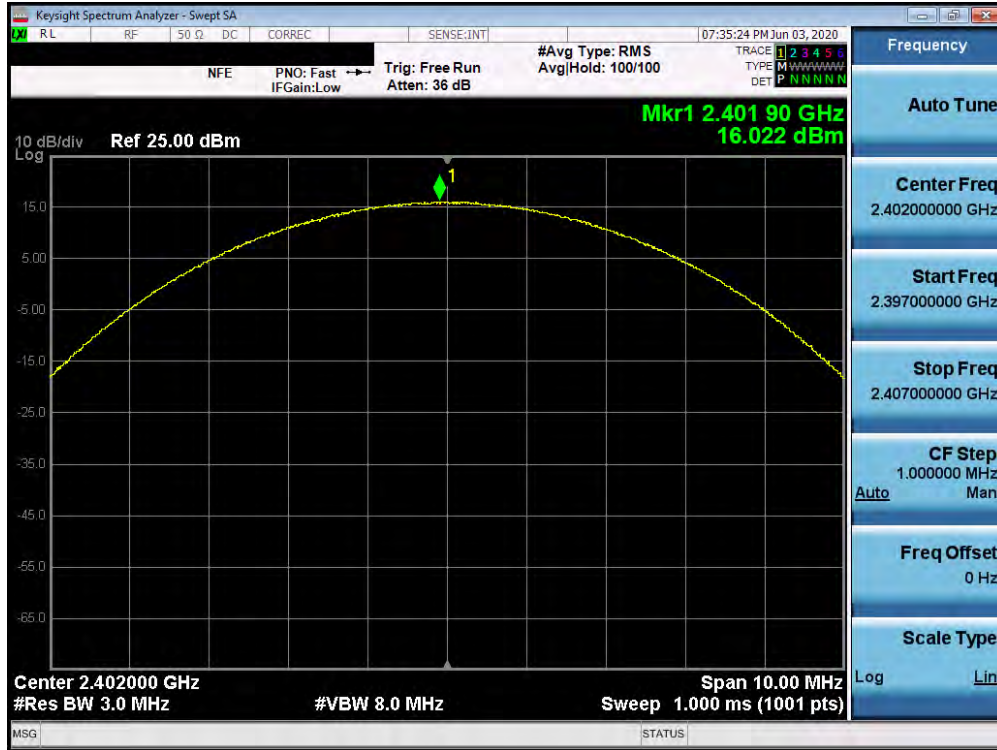


Plot 7-25. Peak Conducted Power (2Mbps – Ch. 77)

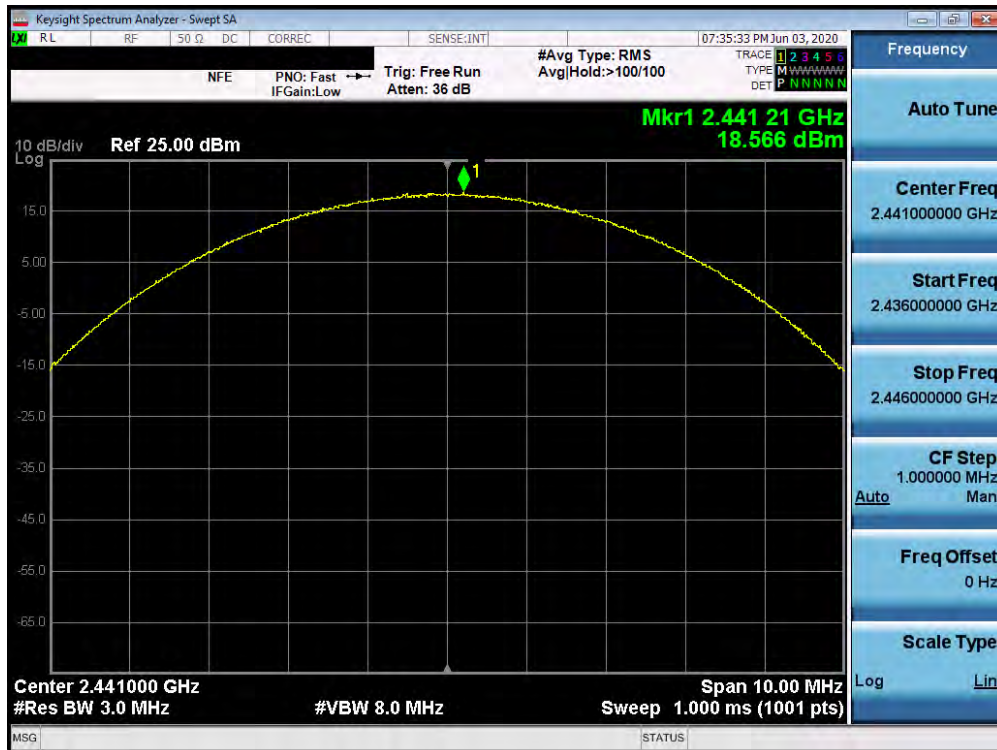


Plot 7-26. Peak Conducted Power (2Mbps – Ch. 78)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 28 of 94

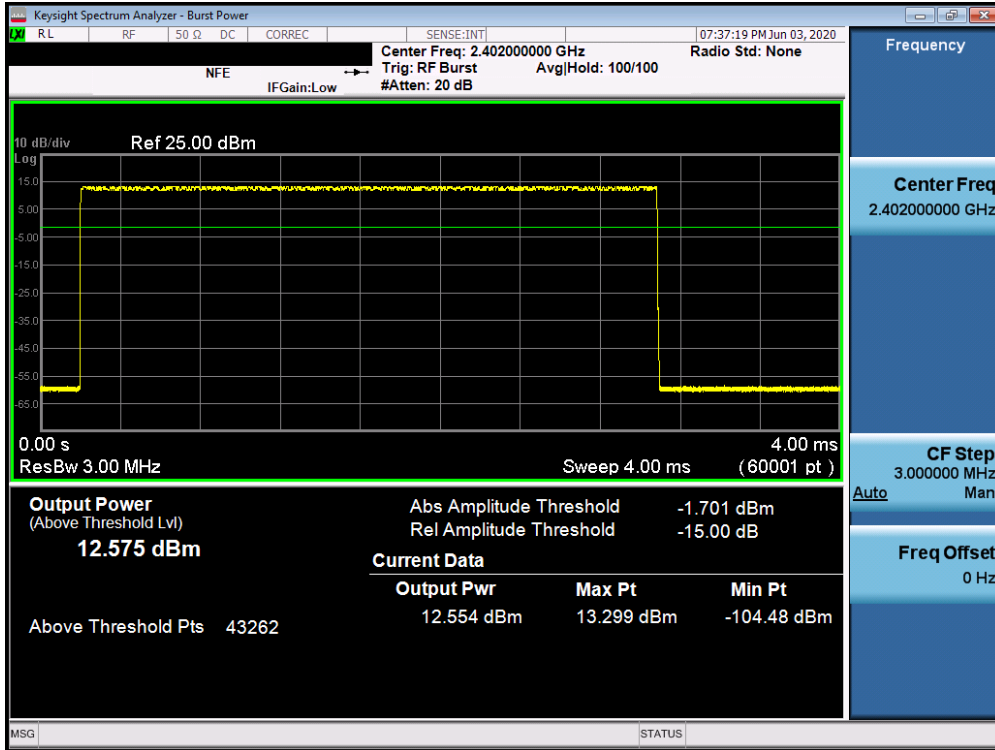


Plot 7-27. Peak Conducted Power (3Mbps – Ch. 0)

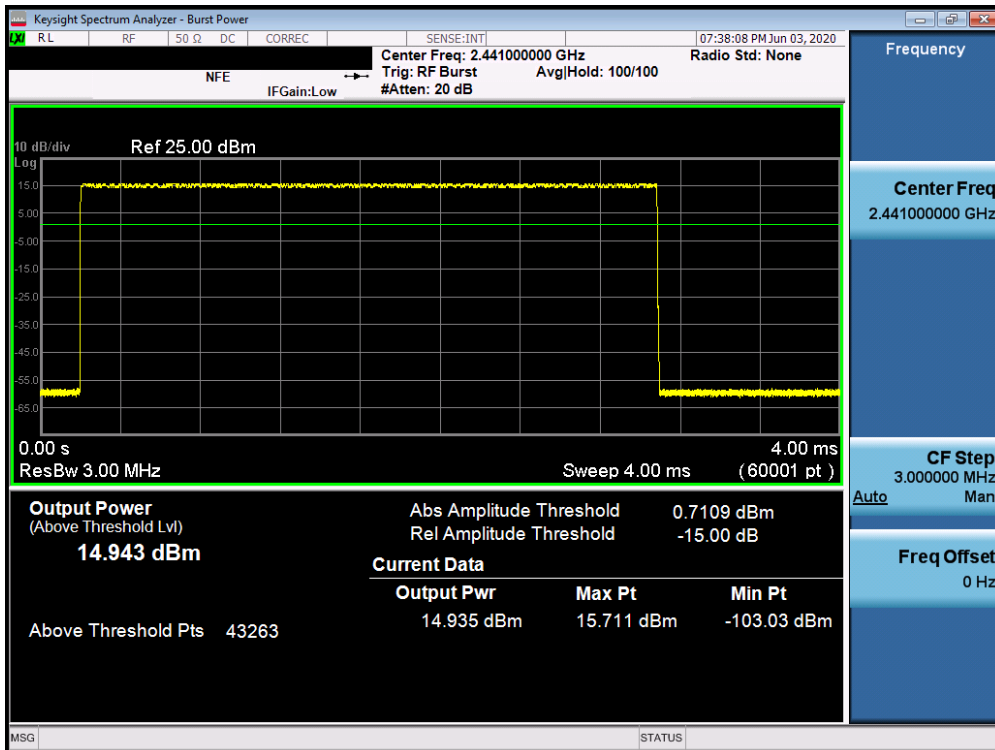


Plot 7-28. Peak Conducted Power (3Mbps – Ch. 39)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 29 of 94

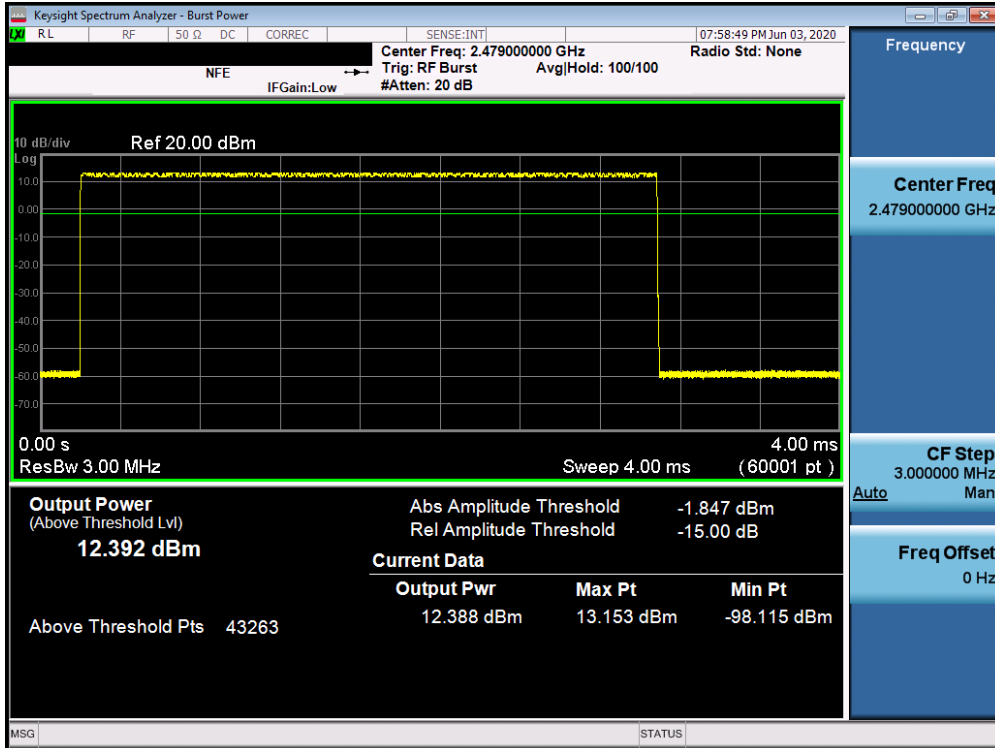


Plot 7-31. Average Conducted Power (1Mbps – Ch. 0)

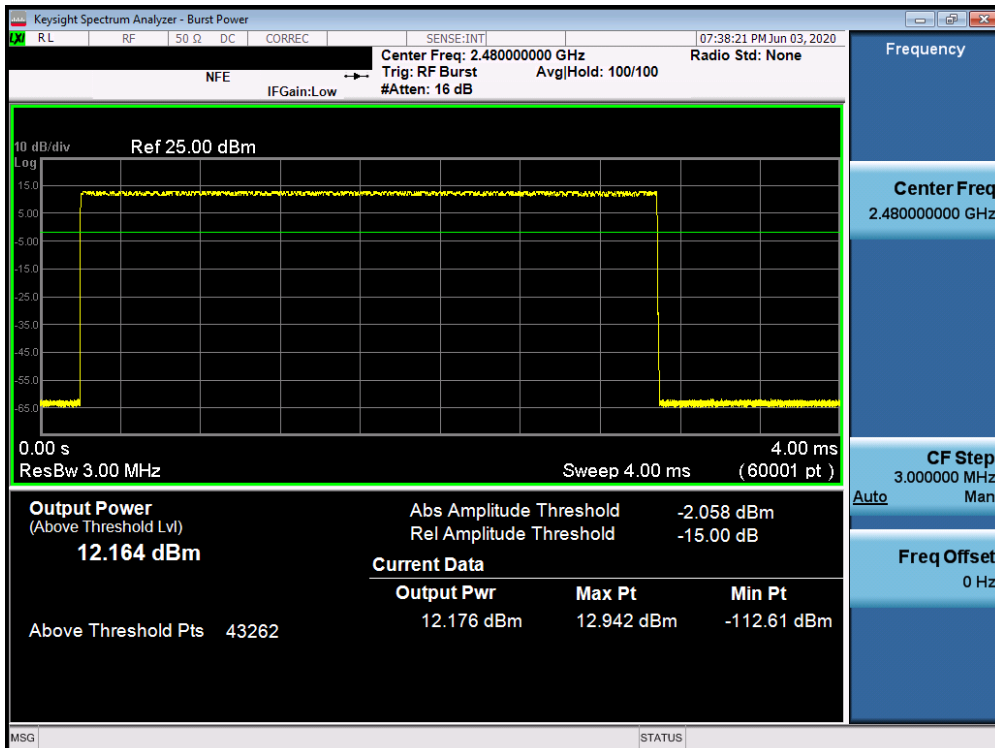


Plot 7-32. Average Conducted Power (1Mbps – Ch. 39)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 31 of 94

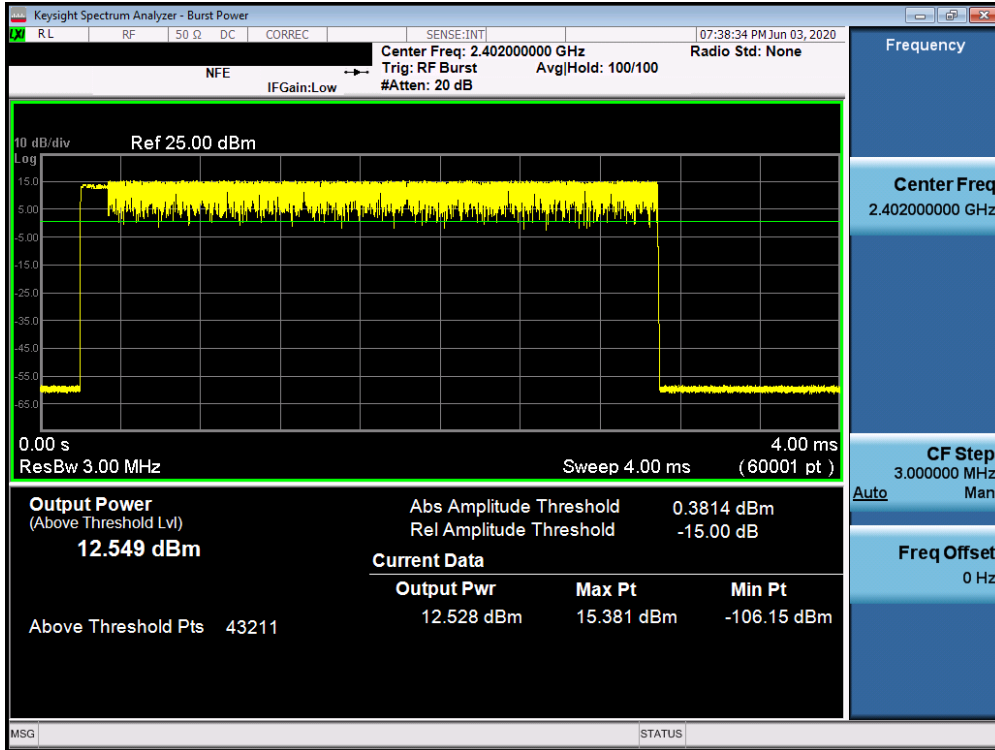


Plot 7-33. Average Conducted Power (1Mbps – Ch. 77)

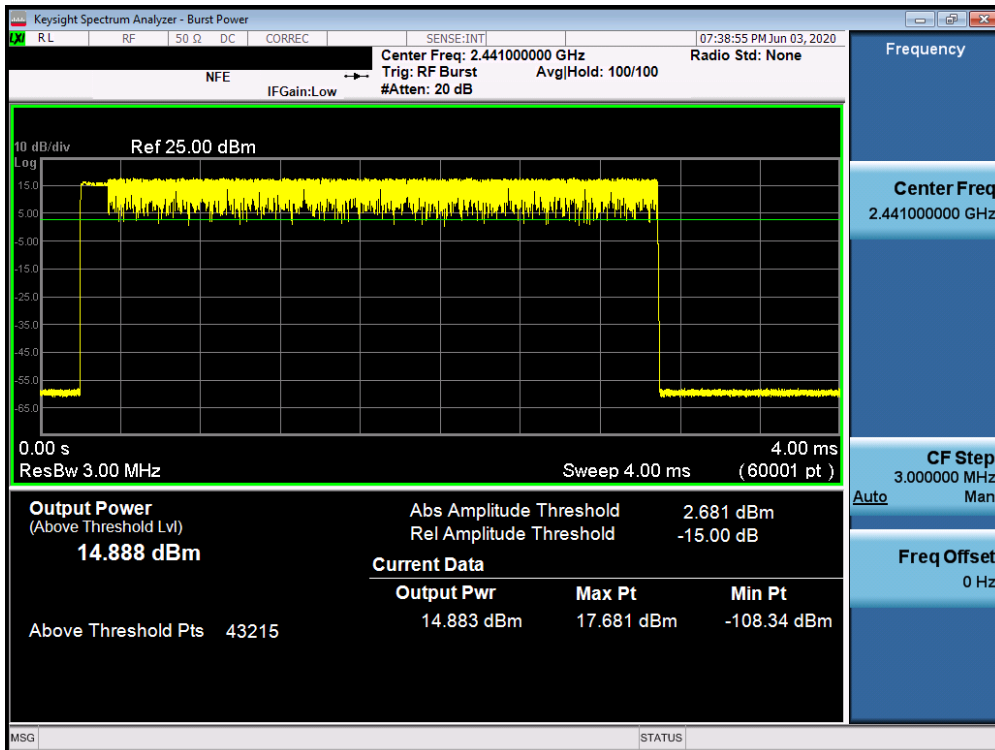


Plot 7-34. Average Conducted Power (1Mbps – Ch. 78)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 32 of 94

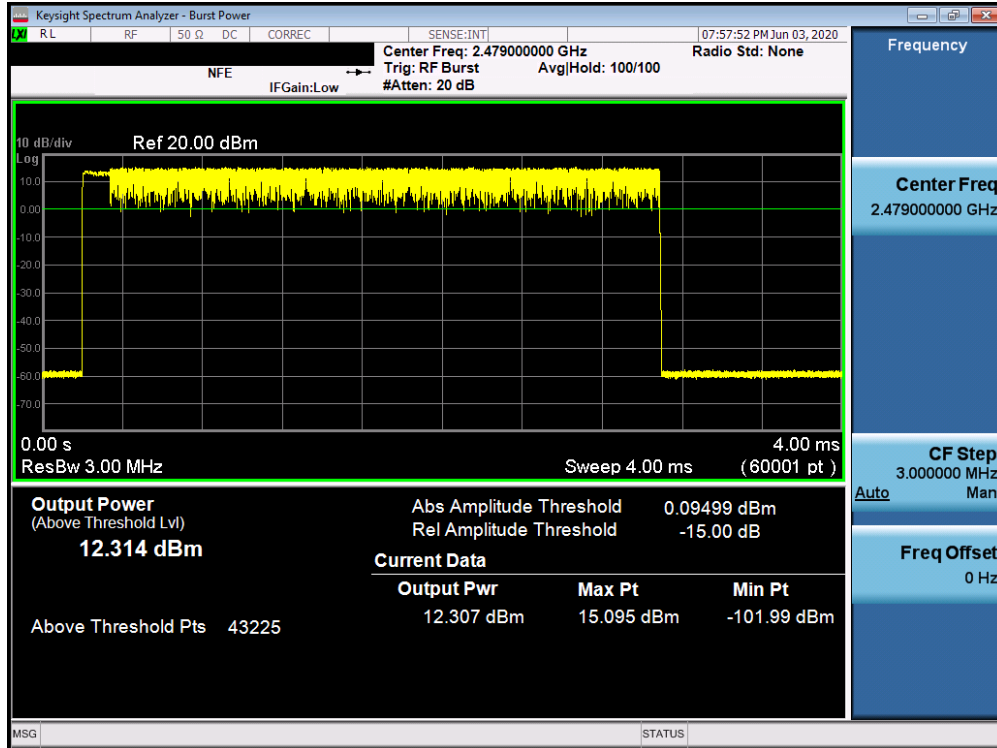


Plot 7-35. Average Conducted Power (2Mbps – Ch. 0)

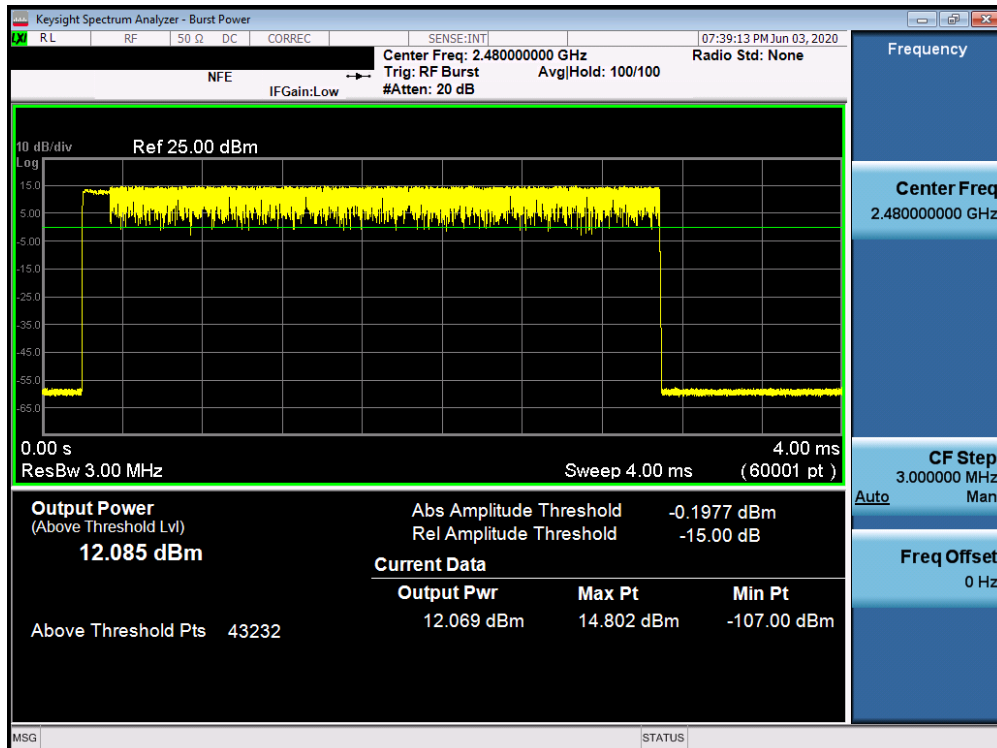


Plot 7-36. Average Conducted Power (2Mbps – Ch. 39)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 33 of 94

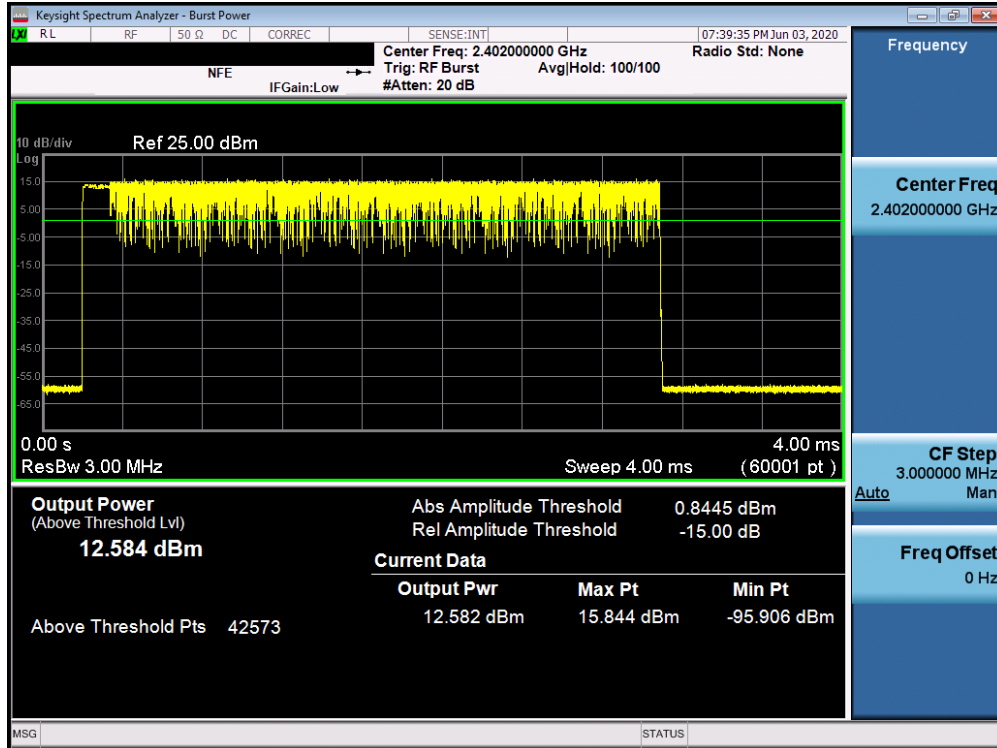


Plot 7-37. Average Conducted Power (2Mbps – Ch. 77)

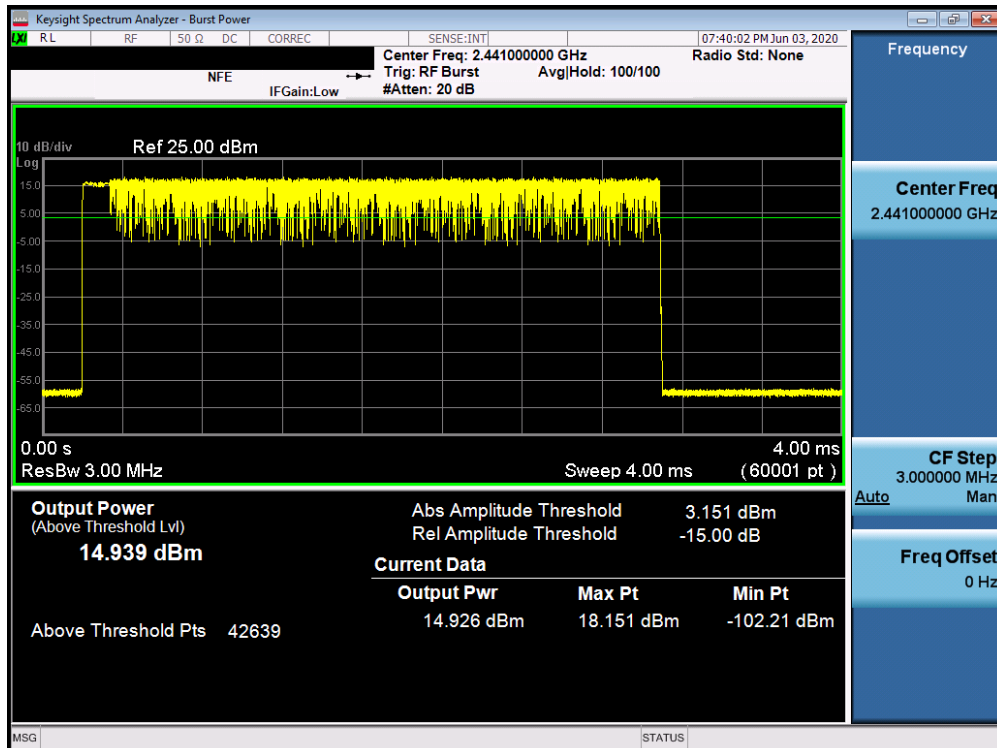


Plot 7-38. Average Conducted Power (2Mbps – Ch. 78)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 34 of 94

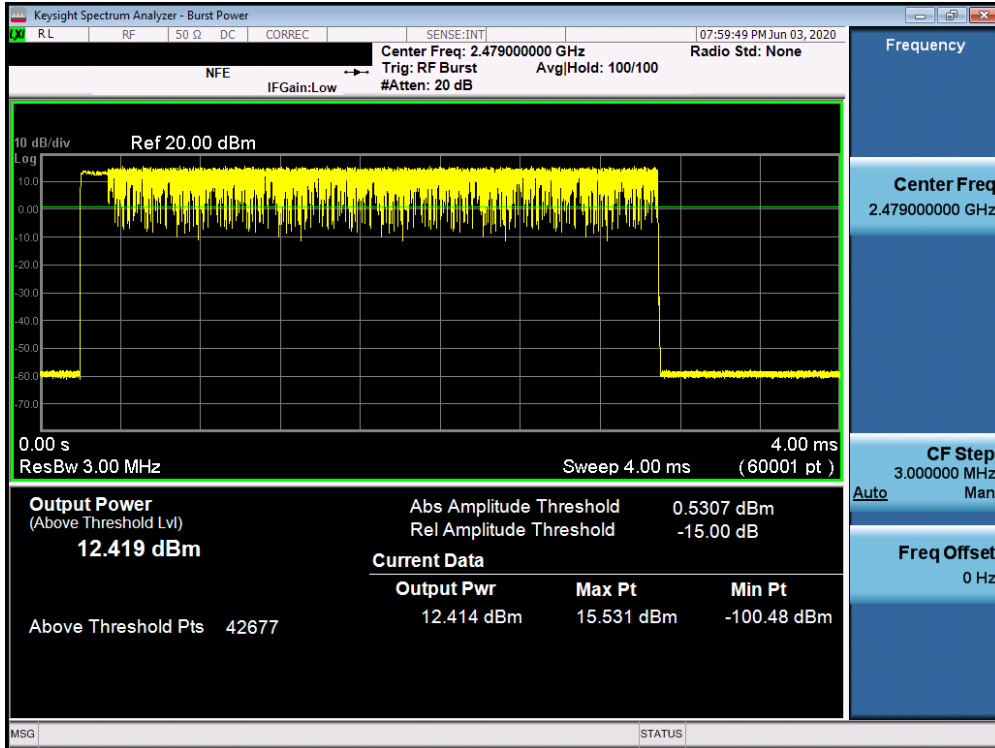


Plot 7-39. Average Conducted Power (3Mbps – Ch. 0)

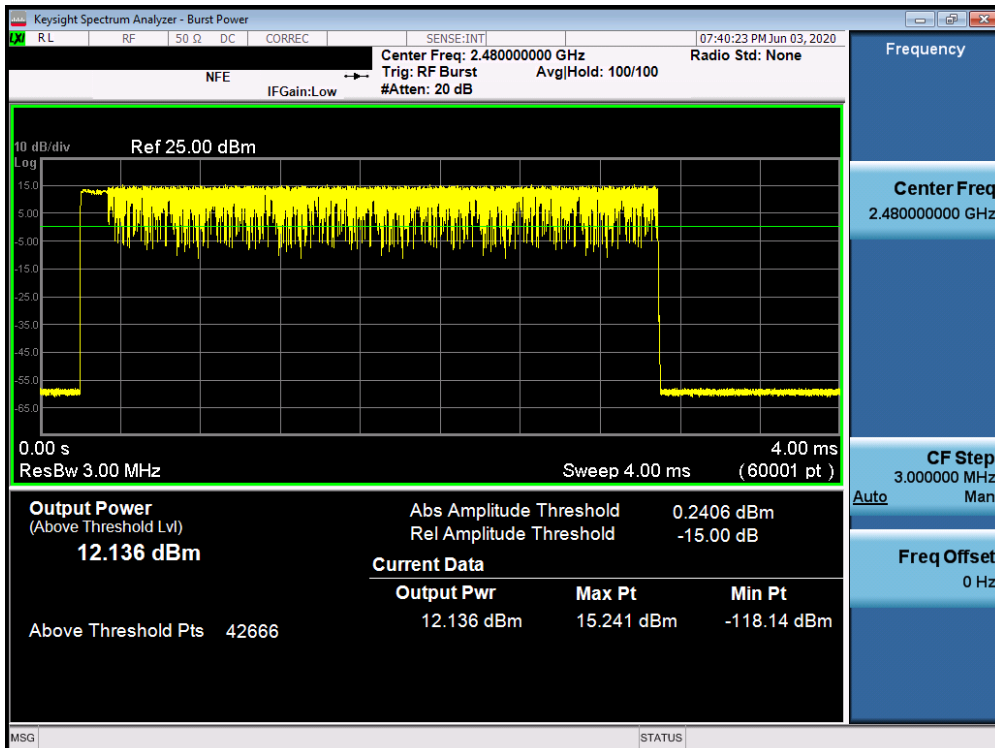


Plot 7-40. Average Conducted Power (3Mbps – Ch. 39)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Plot 7-41. Average Conducted Power (3Mbps – Ch. 77)



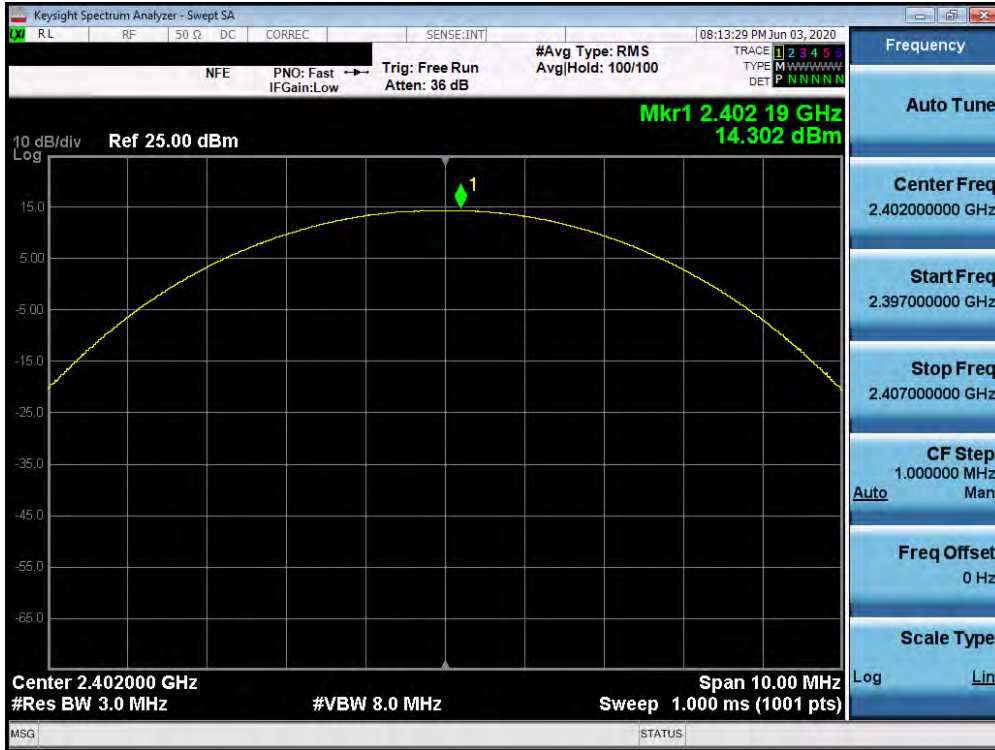
Plot 7-42. Average Conducted Power (3Mbps – Ch. 78)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 36 of 94

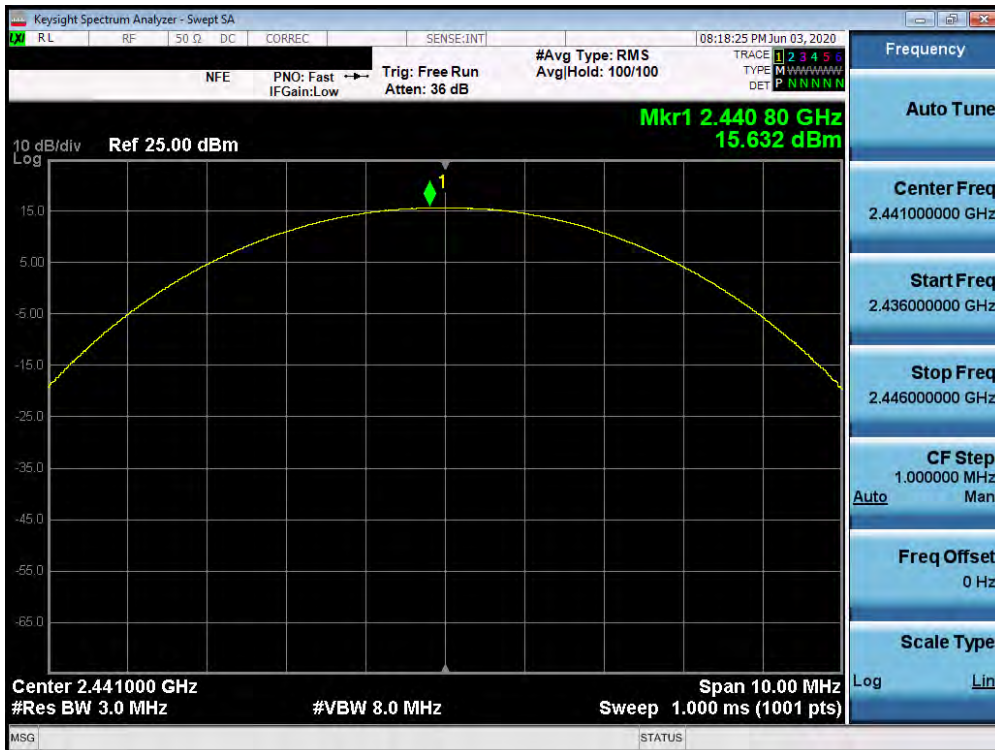
Frequency [MHz]	Data Rate [Mbps]	Mod.	Channel No.	Peak Conducted Power		Avg Conducted Power	
				[dBm]	[mW]	[dBm]	[mW]
2402	1.0	GFSK	0	14.30	26.928	13.18	20.816
2441	1.0	GFSK	39	15.63	36.576	14.78	30.046
2479	1.0	GFSK	77	14.53	28.392	13.68	23.324
2480	1.0	GFSK	78	14.50	28.203	13.62	23.039
2402	2.0	$\pi/4$ -DQPSK	0	16.25	42.121	13.10	20.394
2441	2.0	$\pi/4$ -DQPSK	39	17.74	59.416	14.70	29.512
2479	2.0	$\pi/4$ -DQPSK	77	16.68	46.580	13.65	23.158
2480	2.0	$\pi/4$ -DQPSK	78	16.64	46.079	13.50	22.361
2402	3.0	8DPSK	0	16.69	46.677	13.20	20.903
2441	3.0	8DPSK	39	18.24	66.619	14.77	29.971
2479	3.0	8DPSK	77	17.17	52.167	13.74	23.659
2480	3.0	8DPSK	78	17.07	50.945	13.56	22.699

Table 7-5. Conducted Output Power Measurements - ANT1

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 37 of 94

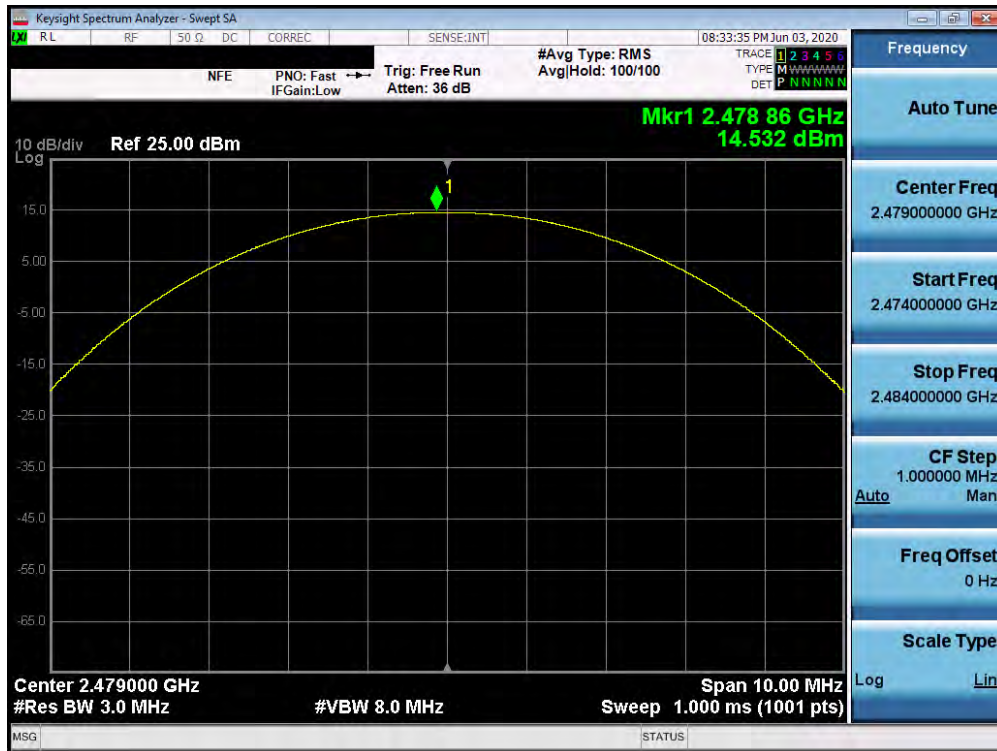


Plot 7-43. Peak Conducted Power (1Mbps – Ch. 0)

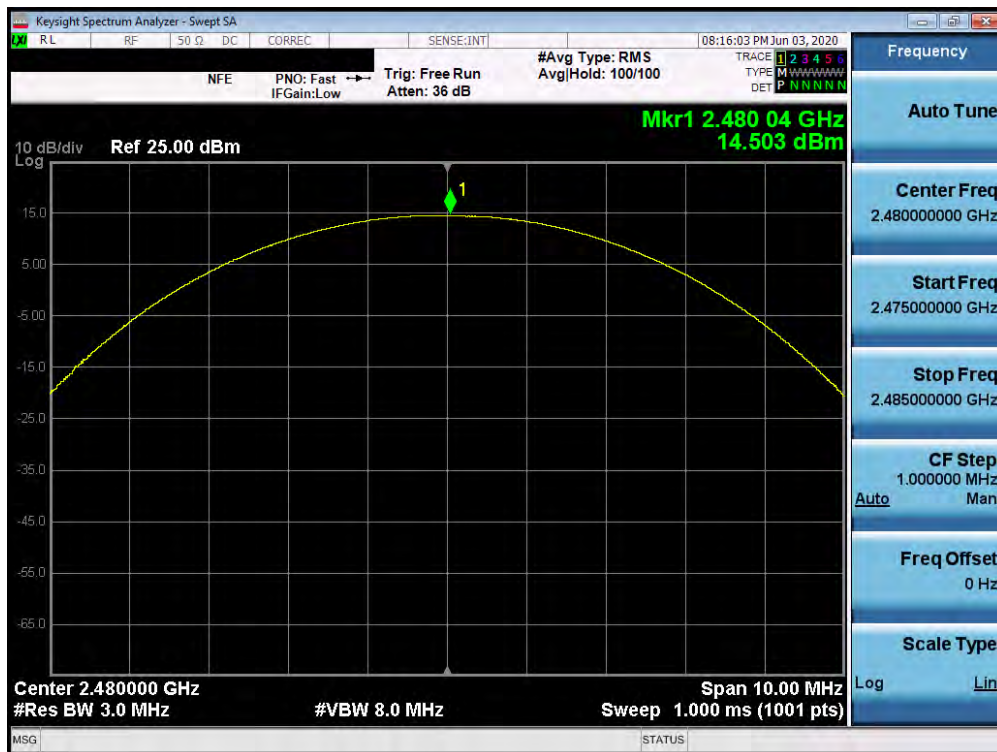


Plot 7-44. Peak Conducted Power (1Mbps – Ch. 39)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 38 of 94

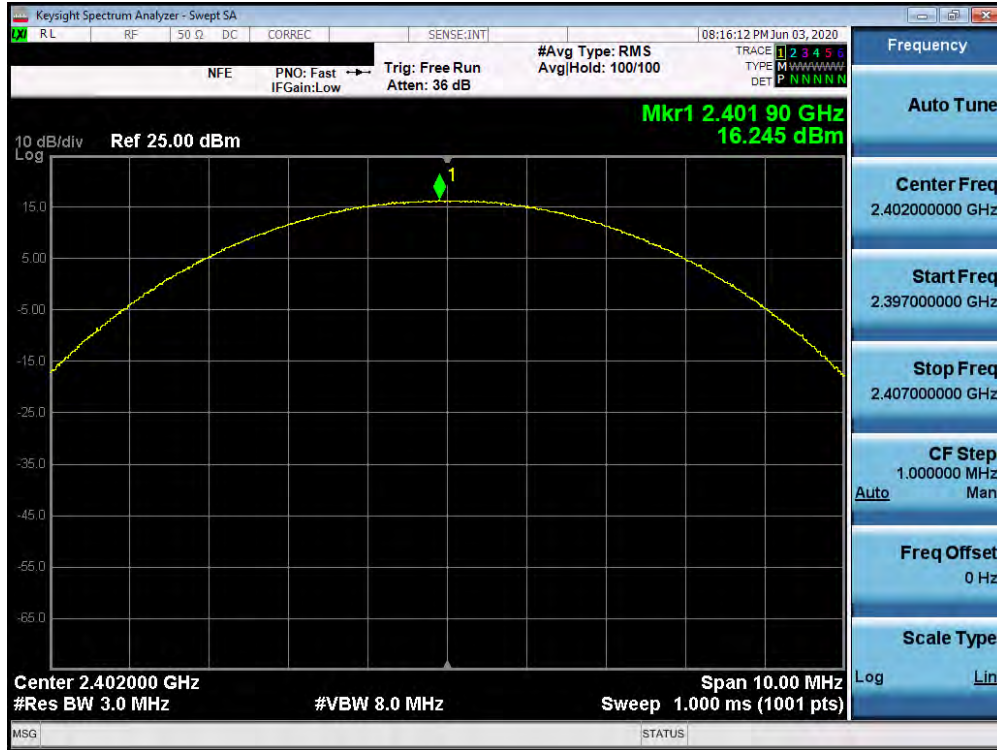


Plot 7-45. Peak Conducted Power (1Mbps – Ch. 77)

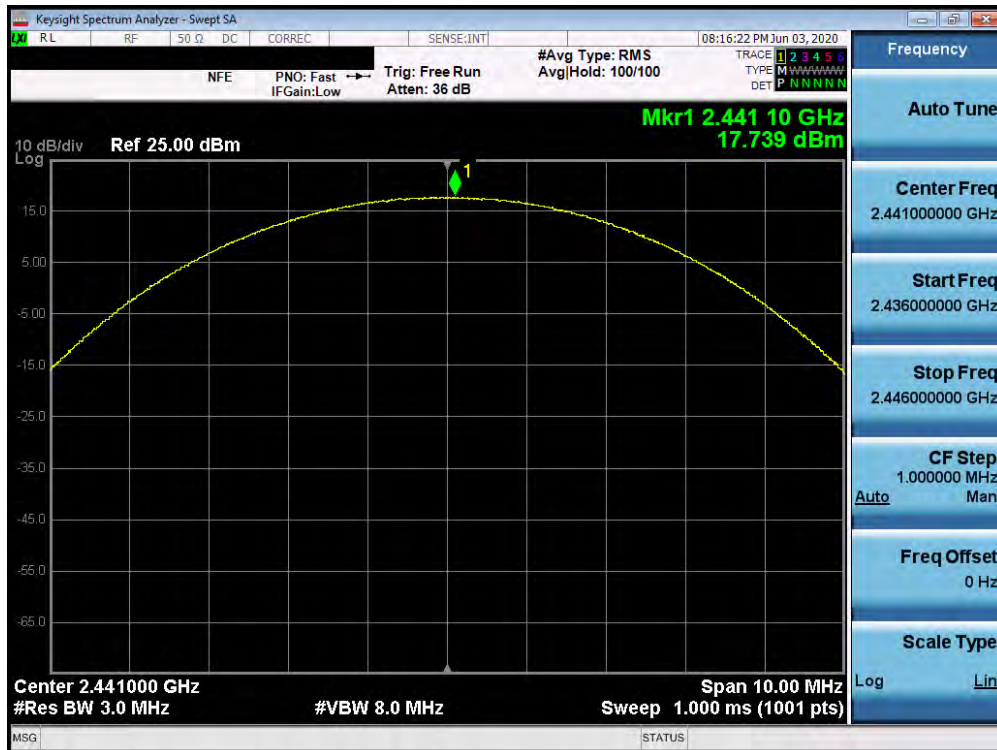


Plot 7-46. Peak Conducted Power (1Mbps – Ch. 78)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 39 of 94

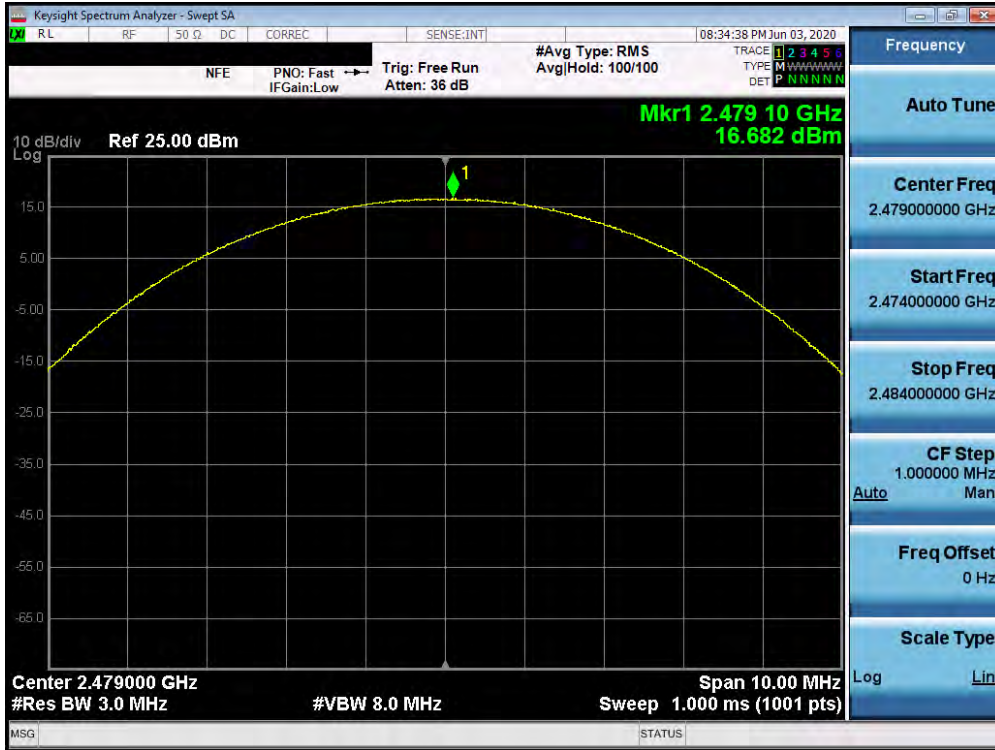


Plot 7-47. Peak Conducted Power (2Mbps – Ch. 0)

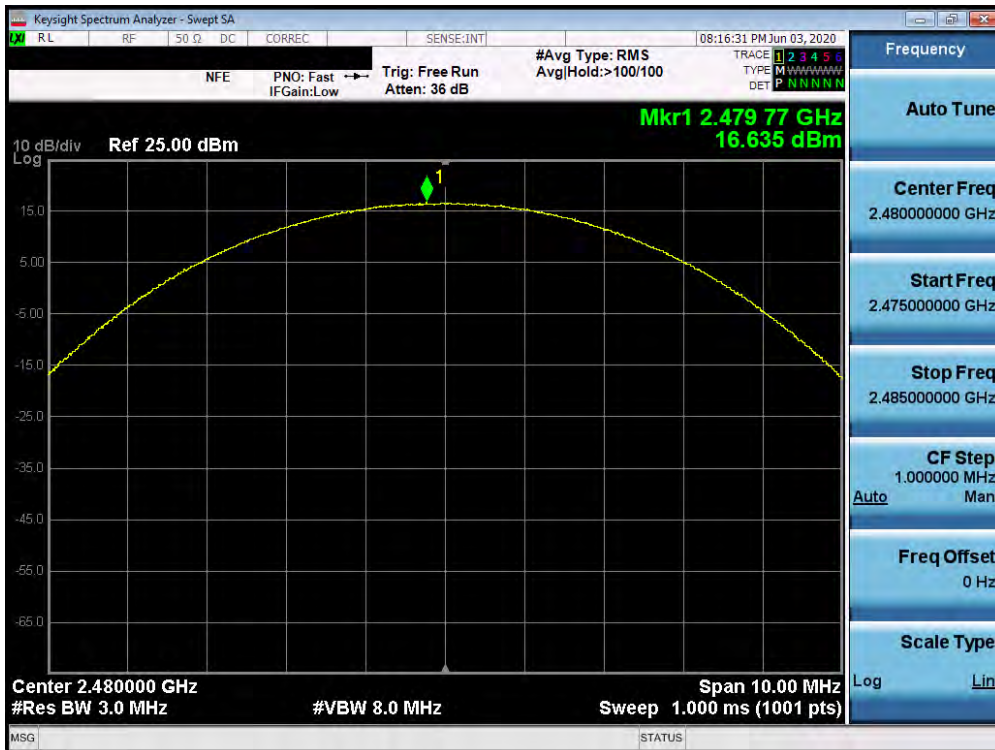


Plot 7-48. Peak Conducted Power (2Mbps – Ch. 39)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 40 of 94

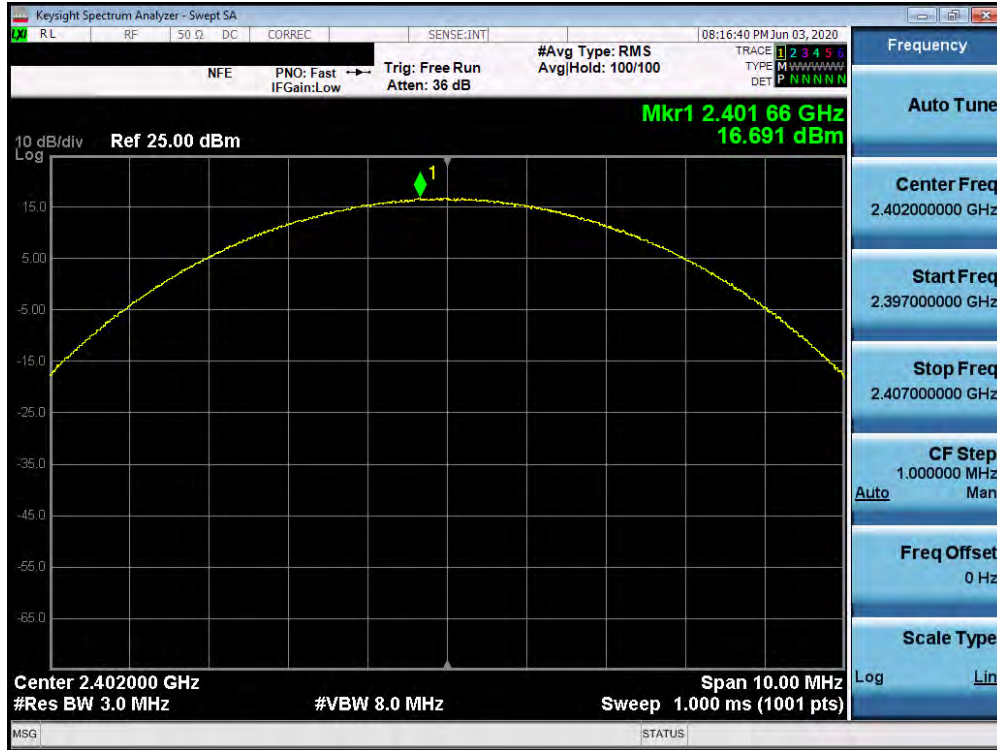


Plot 7-49. Peak Conducted Power (2Mbps – Ch. 77)

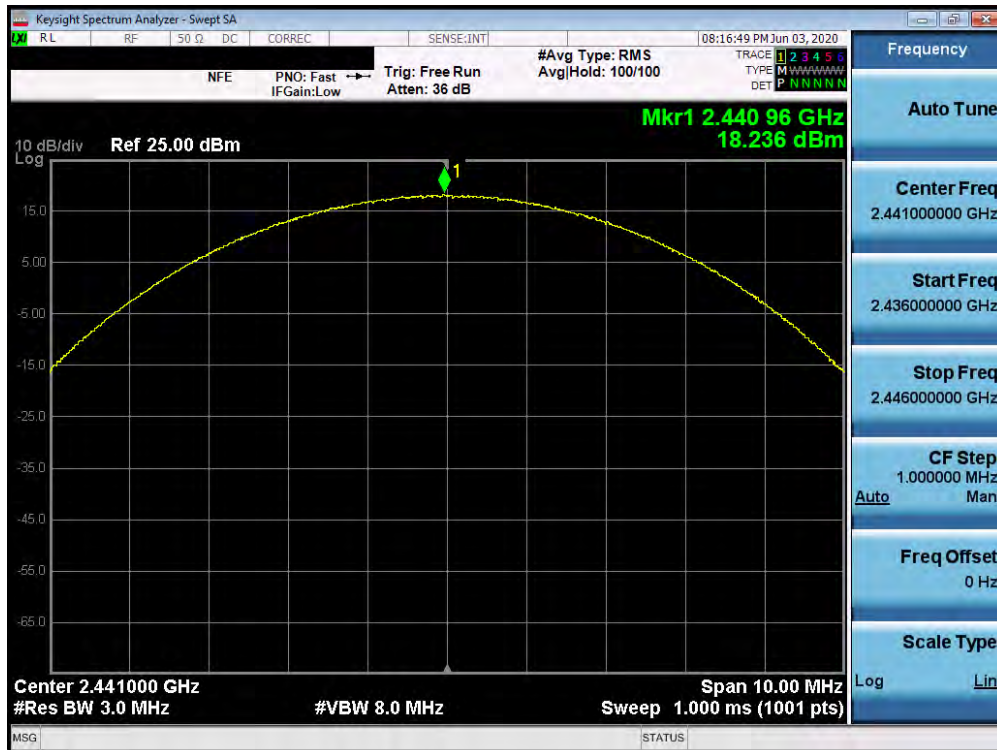


Plot 7-50. Peak Conducted Power (2Mbps – Ch. 78)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 41 of 94

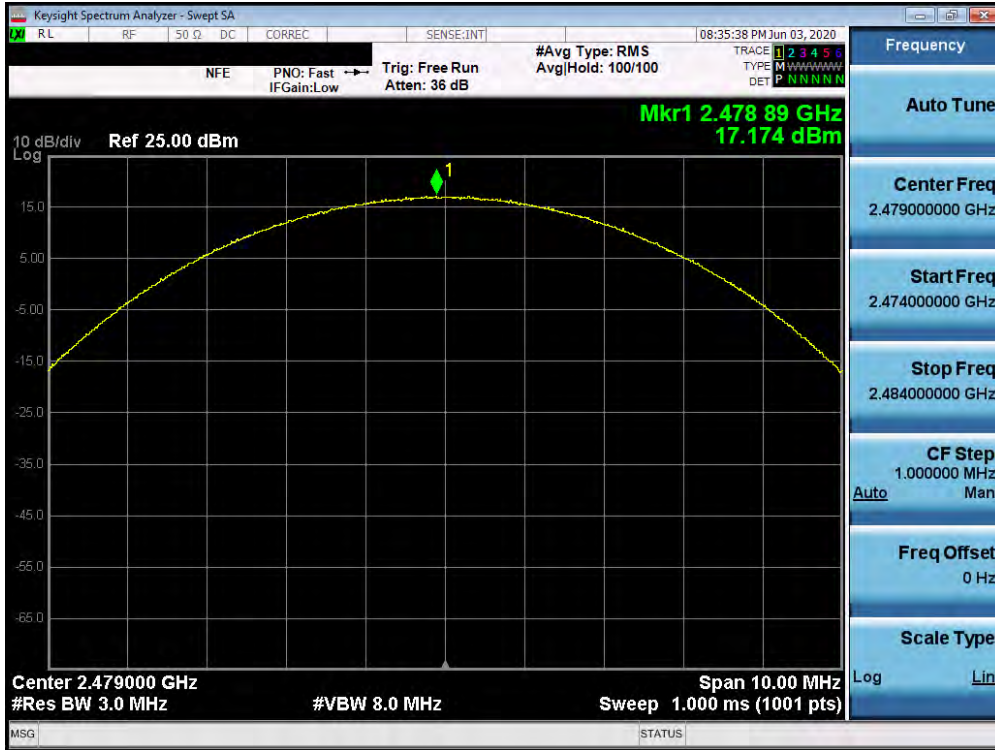


Plot 7-51. Peak Conducted Power (3Mbps – Ch. 0)

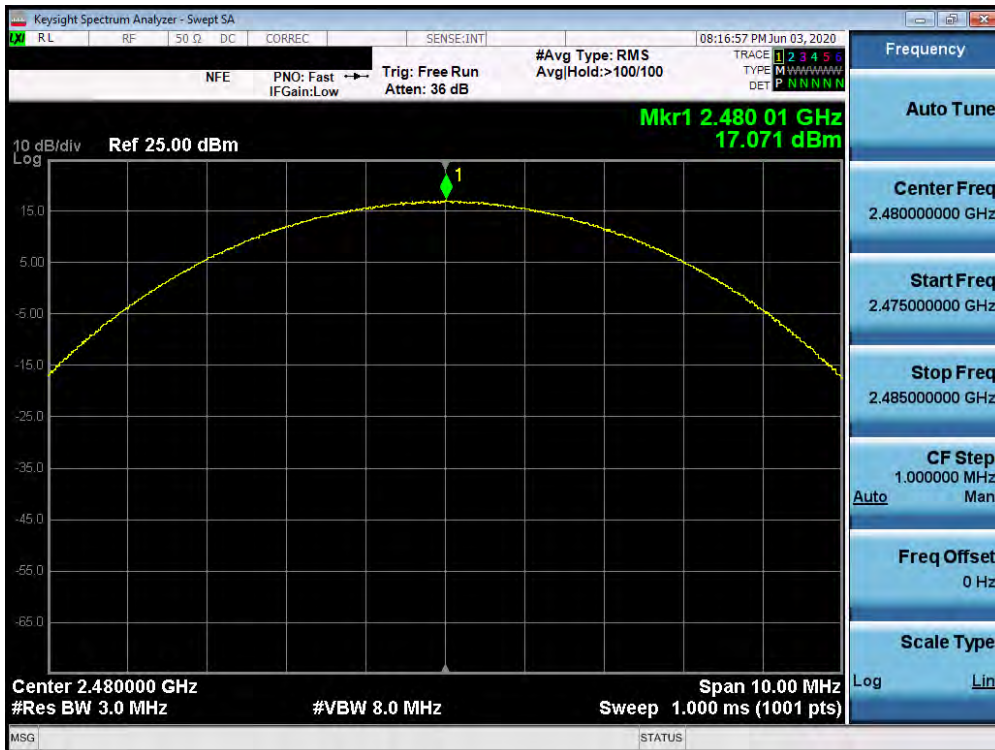


Plot 7-52. Peak Conducted Power (3Mbps – Ch. 39)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 42 of 94

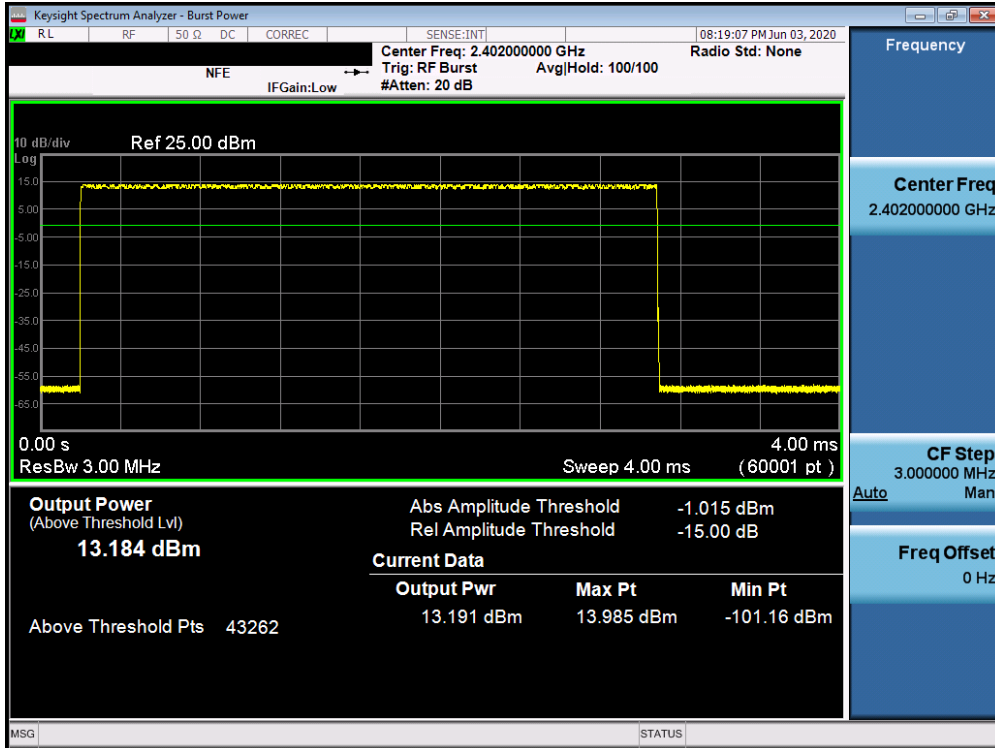


Plot 7-53. Peak Conducted Power (3Mbps – Ch. 77)

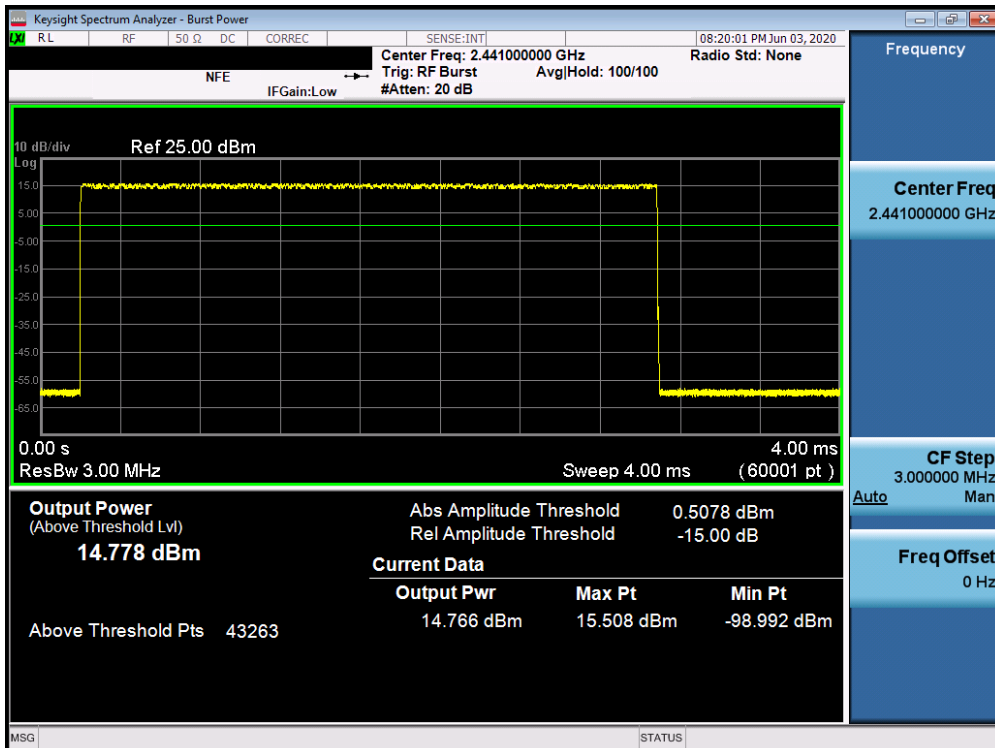


Plot 7-54. Peak Conducted Power (3Mbps – Ch. 78)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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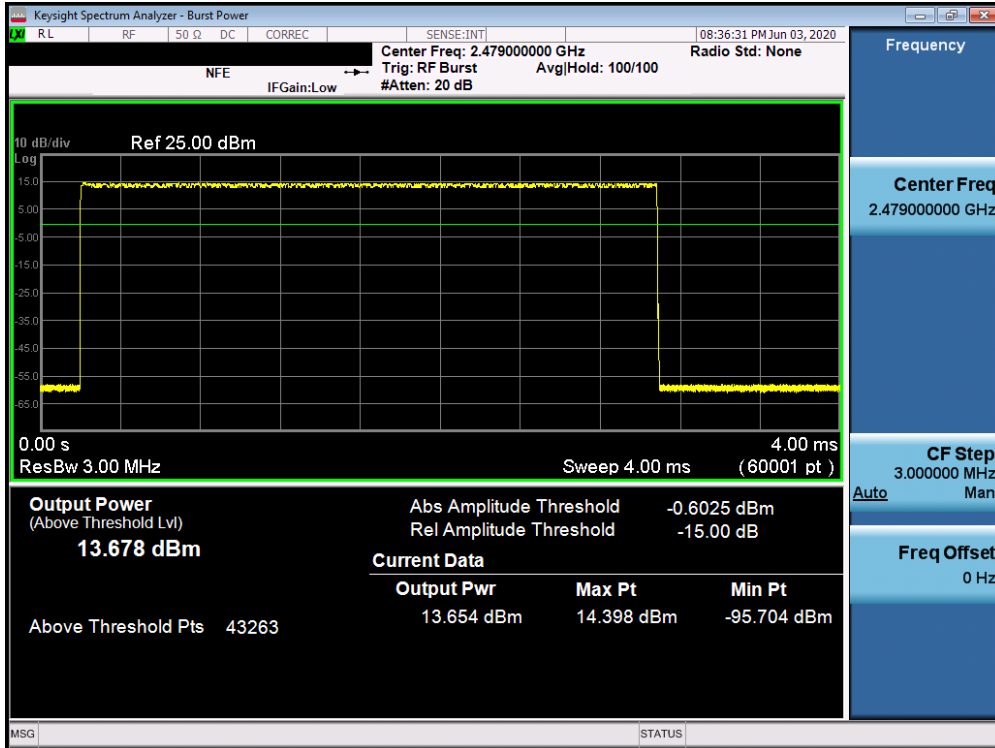


Plot 7-55. Average Conducted Power (1Mbps – Ch. 0)

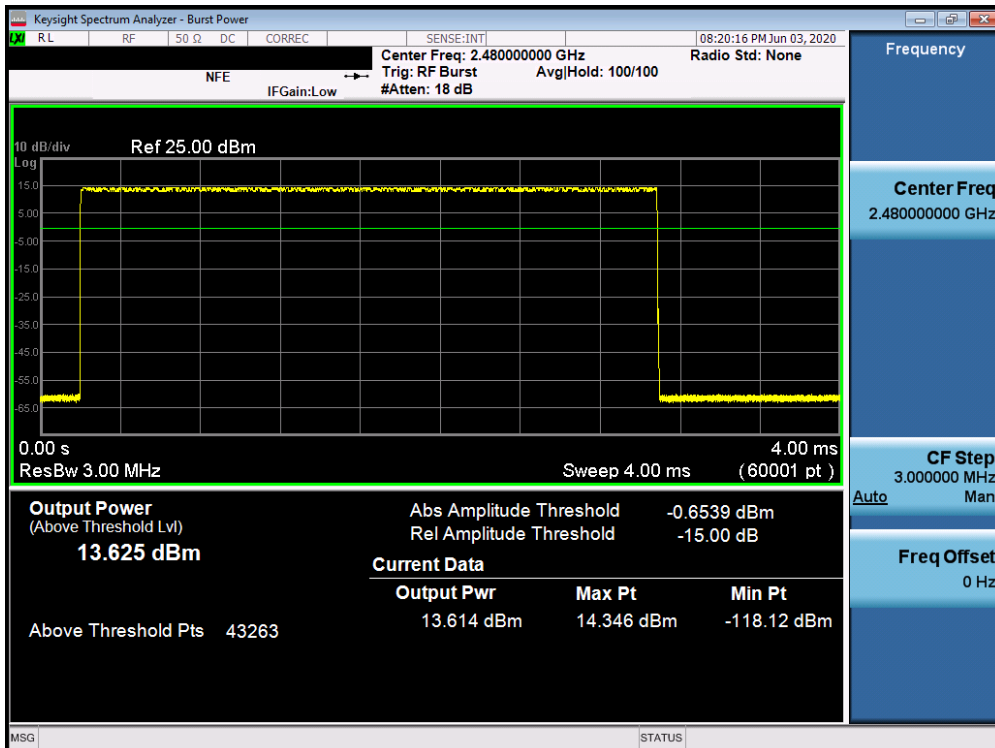


Plot 7-56. Average Conducted Power (1Mbps – Ch. 39)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 44 of 94

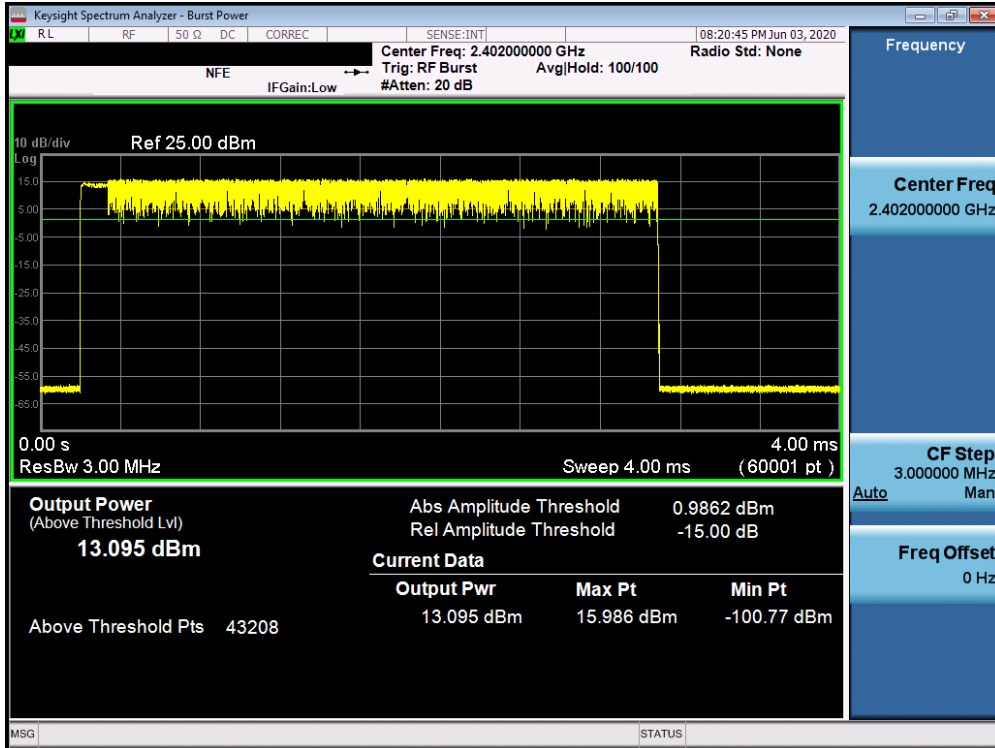


Plot 7-57. Average Conducted Power (1Mbps – Ch. 77)

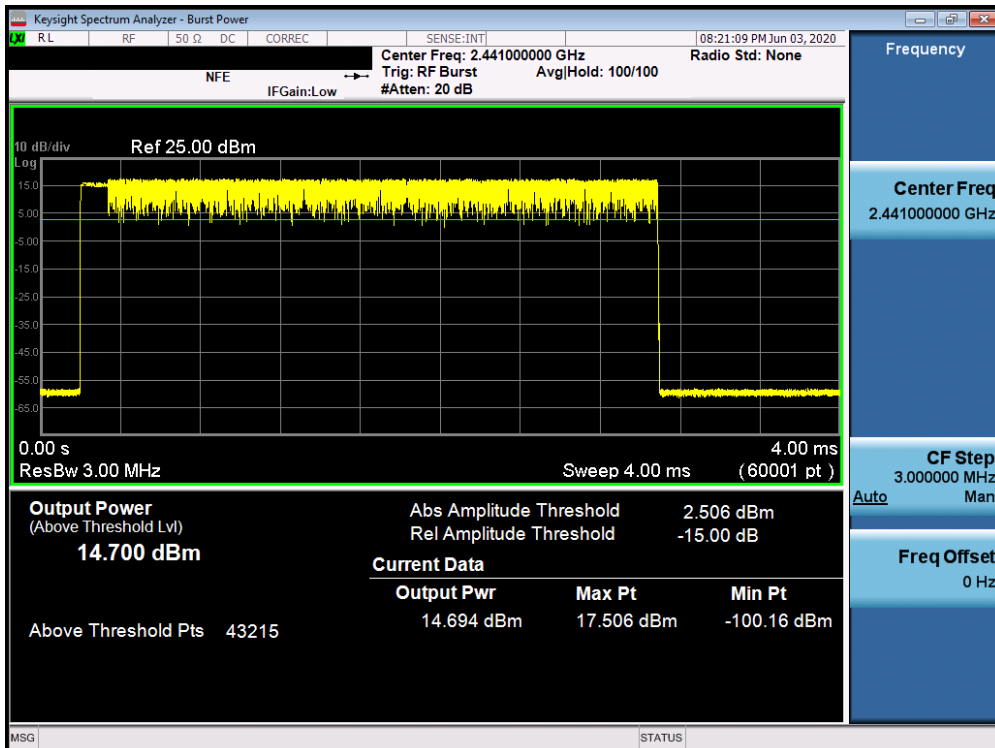


Plot 7-58. Average Conducted Power (1Mbps – Ch. 78)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 45 of 94

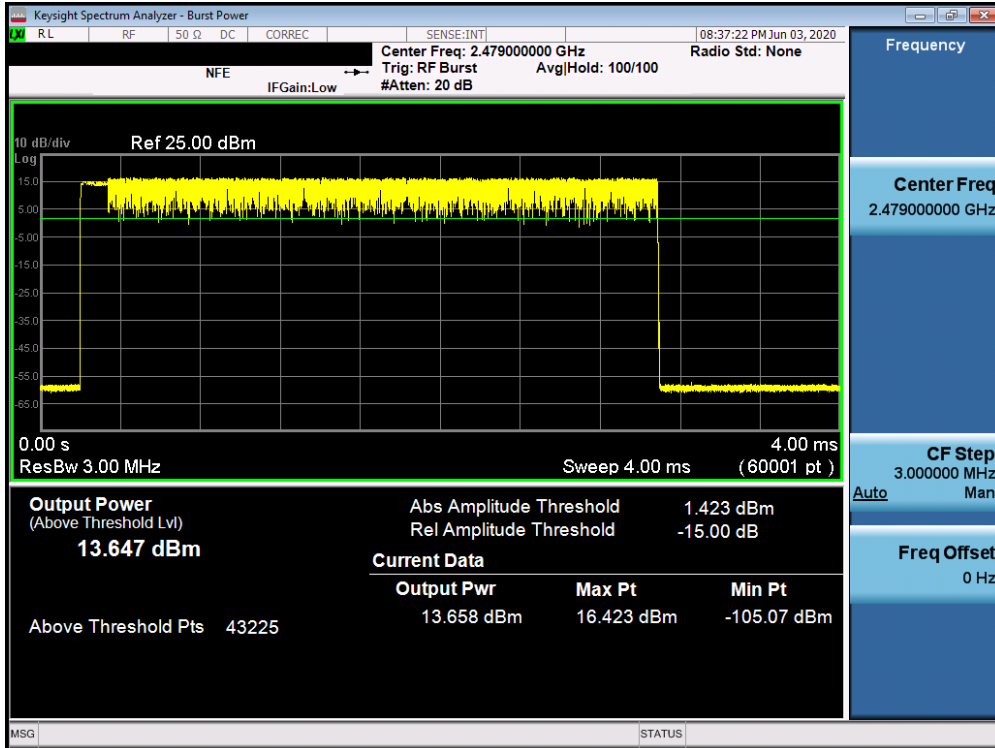


Plot 7-59. Average Conducted Power (2Mbps – Ch. 0)

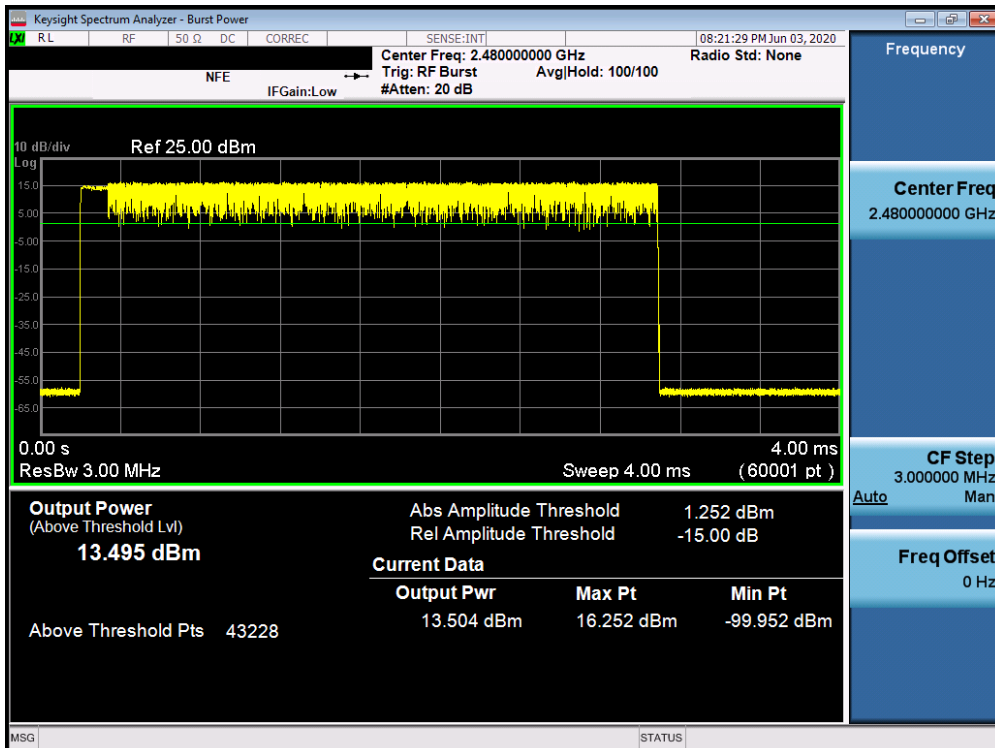


Plot 7-60. Average Conducted Power (2Mbps – Ch. 39)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 46 of 94

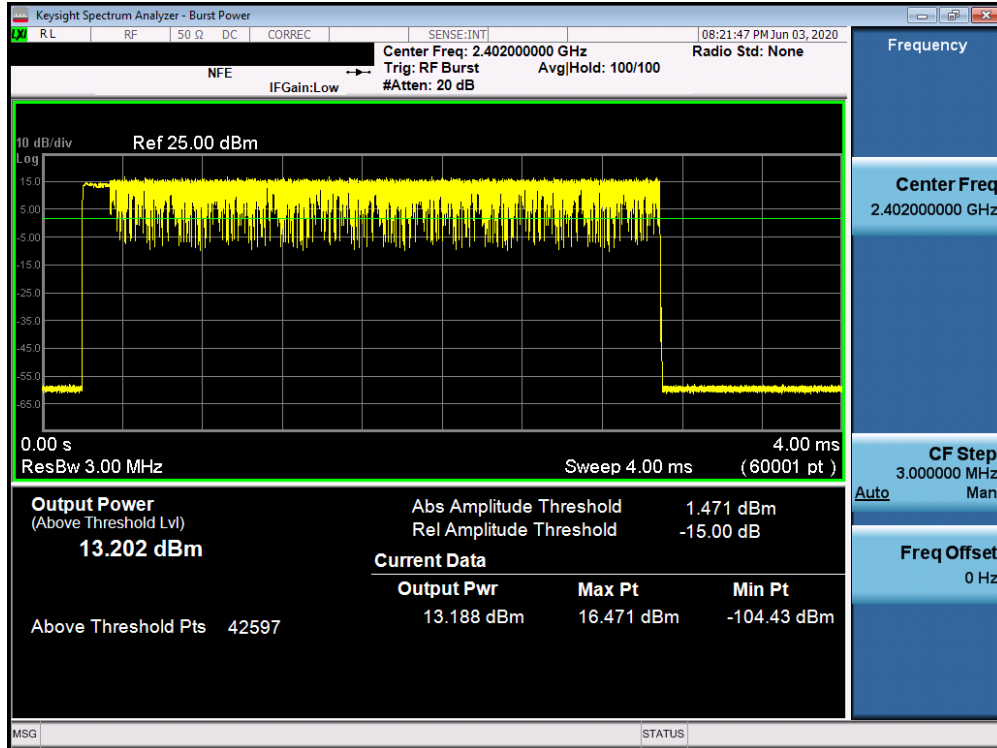


Plot 7-61. Average Conducted Power (2Mbps – Ch. 77)

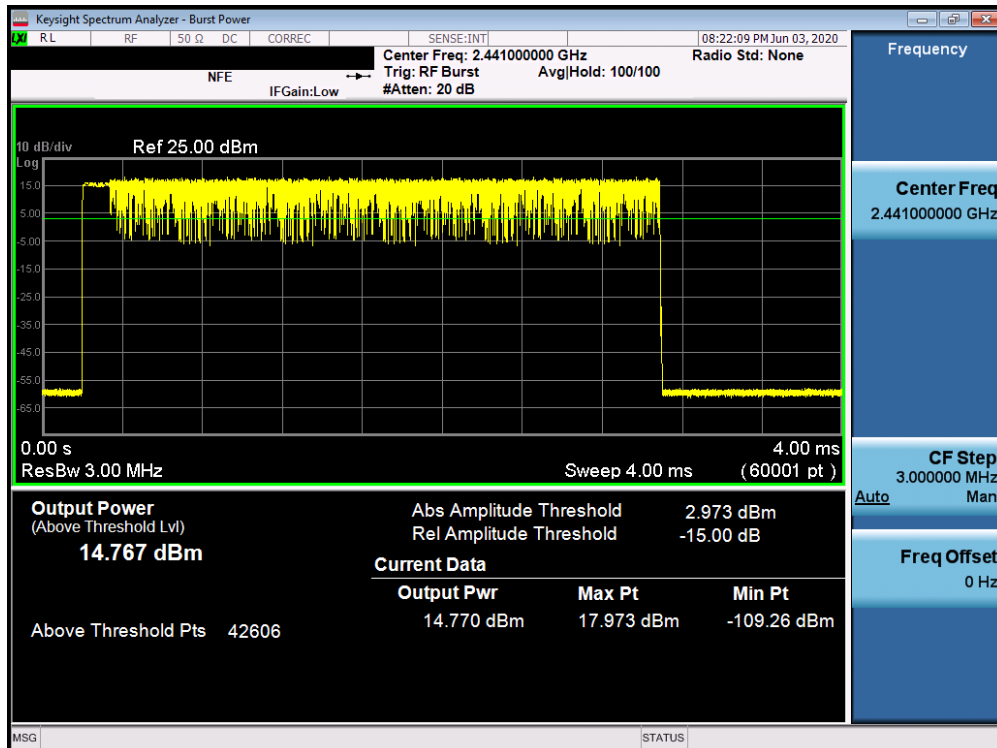


Plot 7-62. Average Conducted Power (2Mbps – Ch. 78)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 47 of 94

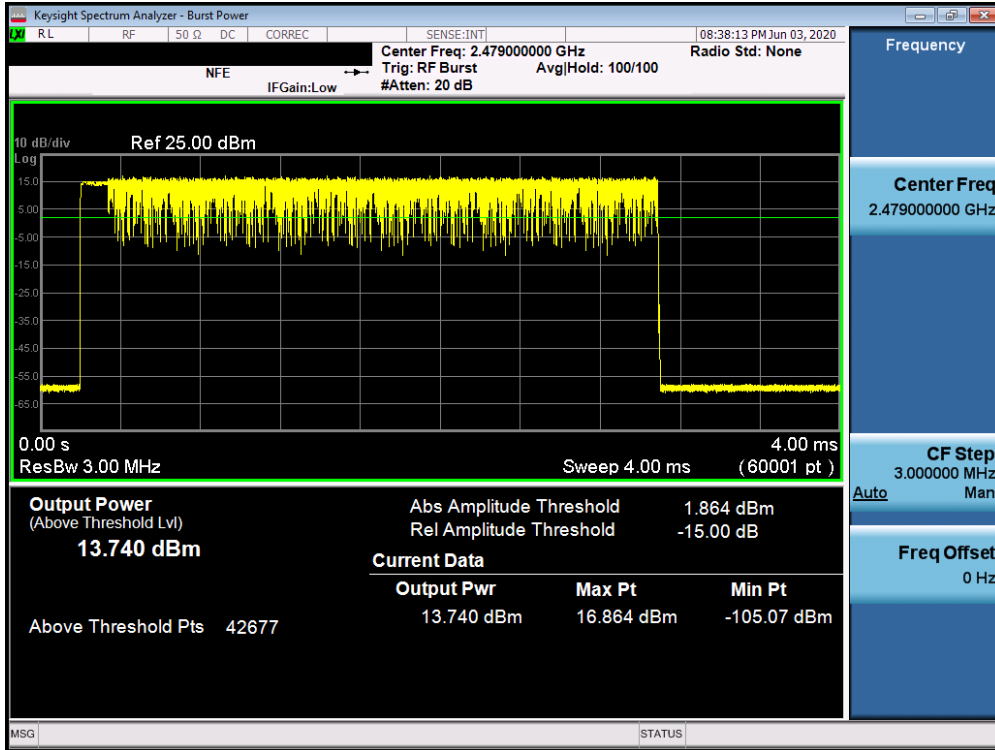


Plot 7-63. Average Conducted Power (3Mbps – Ch. 0)

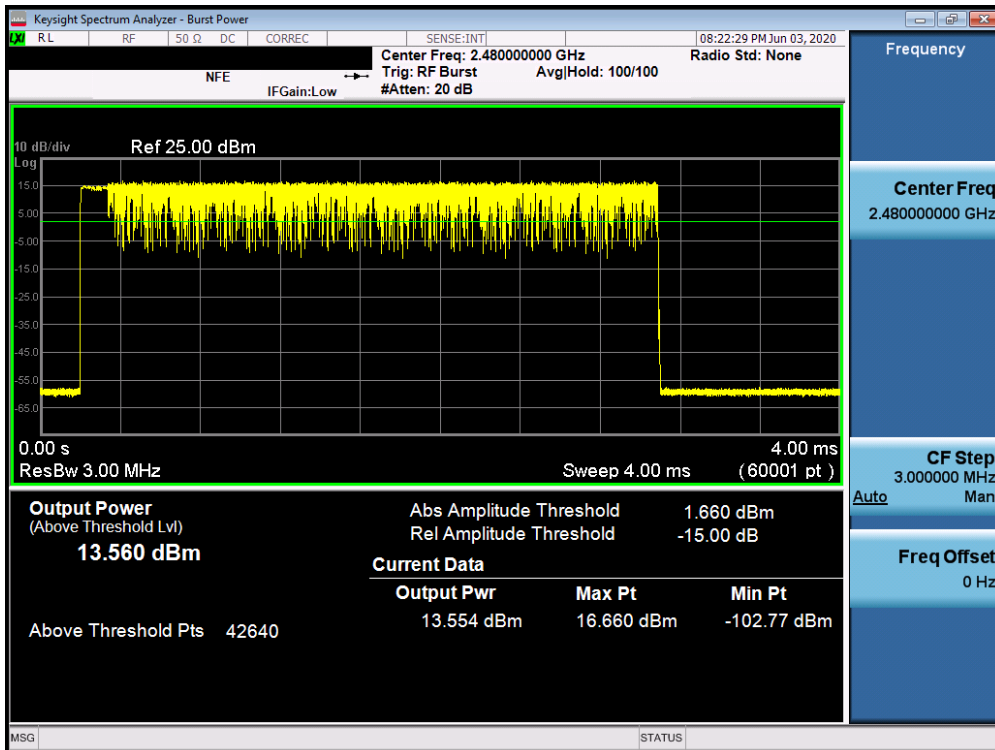


Plot 7-64. Average Conducted Power (3Mbps – Ch. 39)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 48 of 94



Plot 7-65. Average Conducted Power (3Mbps – Ch. 77)



Plot 7-66. Average Conducted Power (3Mbps – Ch. 78)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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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.



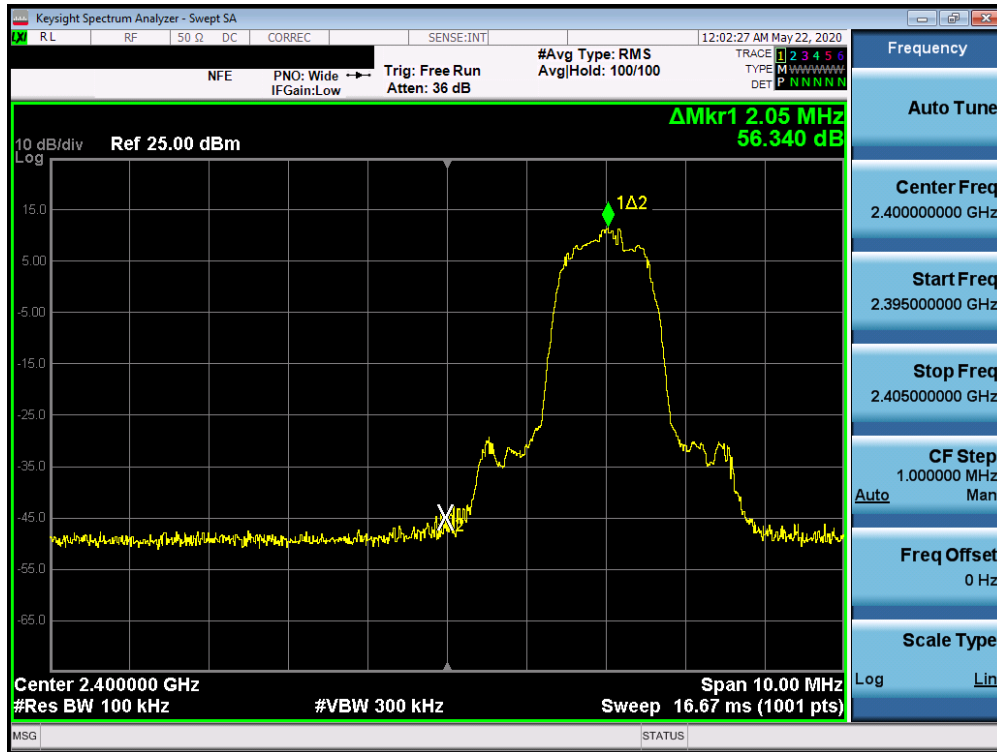
Figure 7-3. Test Instrument & Measurement Setup

Test Notes

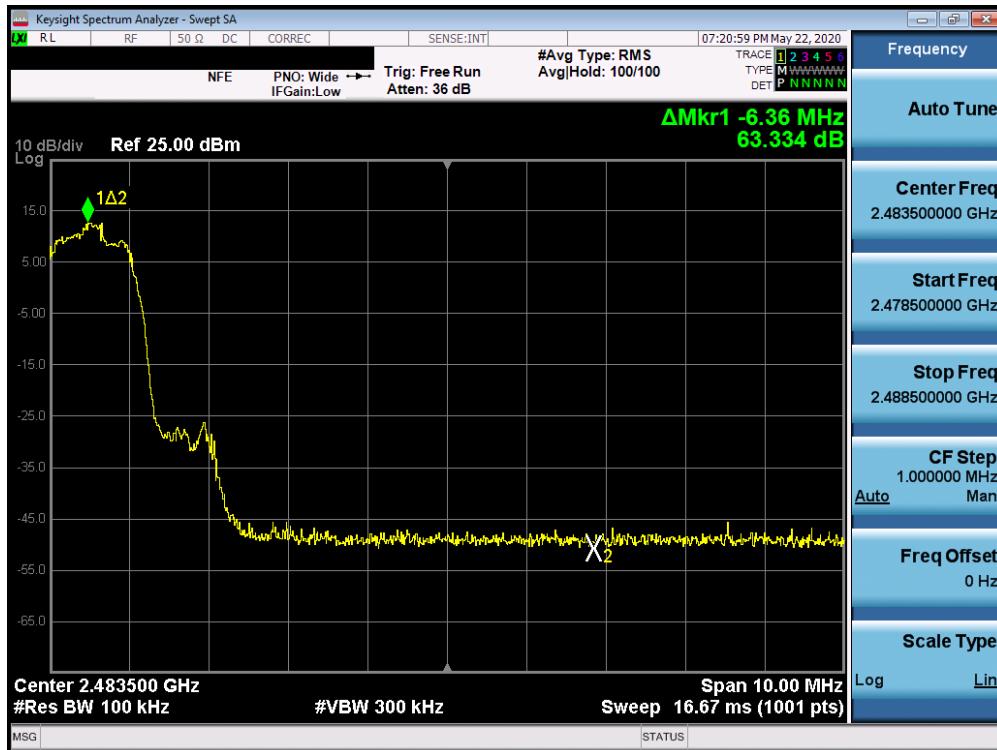
Out of band conducted spurious emissions at the band edge were investigated for all data rates in hopping and non-hopping modes. The worst case emissions were found with the EUT transmitting at 3 Mbps. Band edge emissions were also investigated with the EUT transmitting in all data rates. Plots of the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

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Bluetooth ANT0

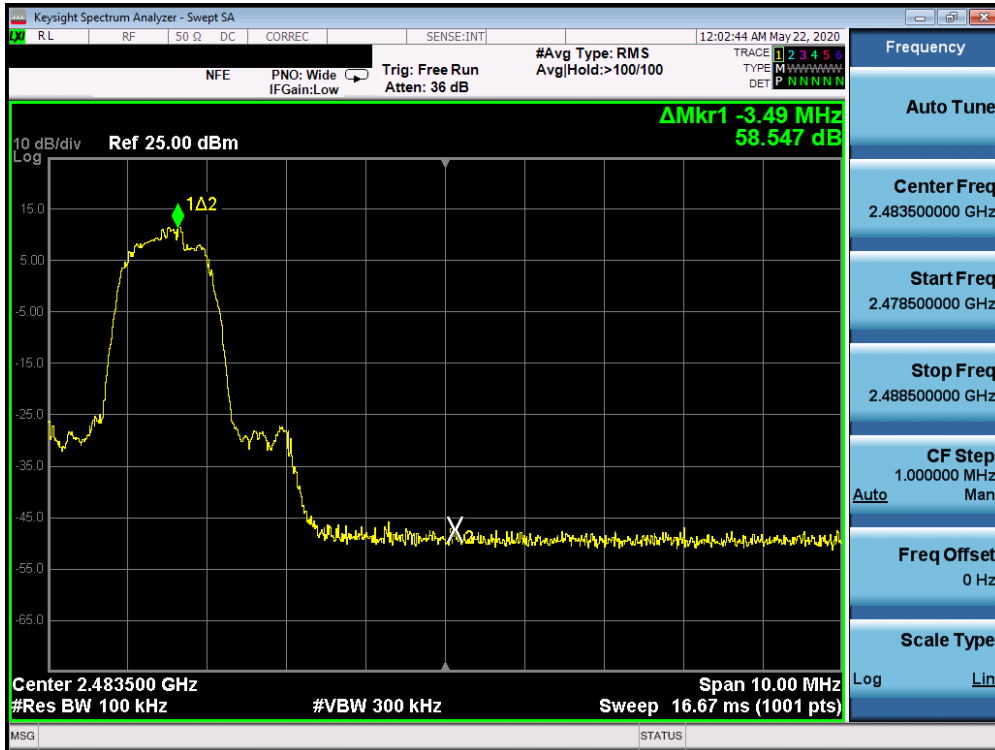


Plot 7-67. Band Edge Plot (Bluetooth with Hopping Disabled, 3 Mbps – Ch. 0)



Plot 7-68. Band Edge Plot (Bluetooth with Hopping Disabled, 3 Mbps – Ch. 77)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Plot 7-69. Band Edge Plot (Bluetooth with Hopping Disabled, 3 Mbps – Ch. 78)



Plot 7-70. Band Edge Plot (Bluetooth with Hopping Enabled, 3 Mbps)

FCC ID: A3LSMF707U	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 52 of 94



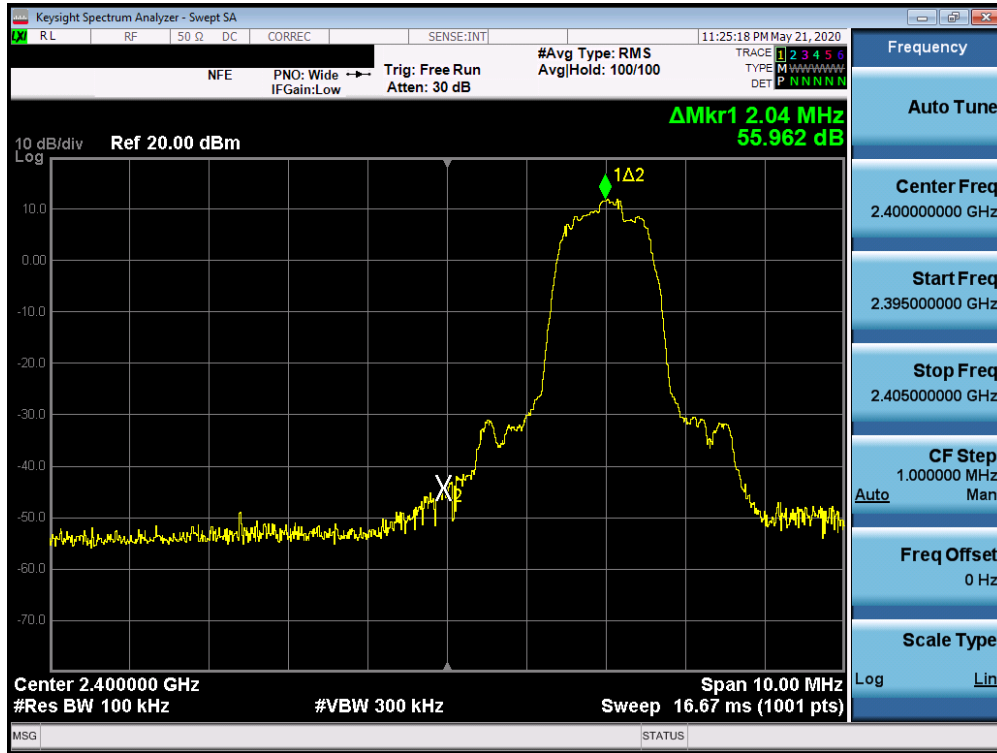
Plot 7-71. Band Edge Plot (Bluetooth with Hopping Enabled, 3 Mbps)



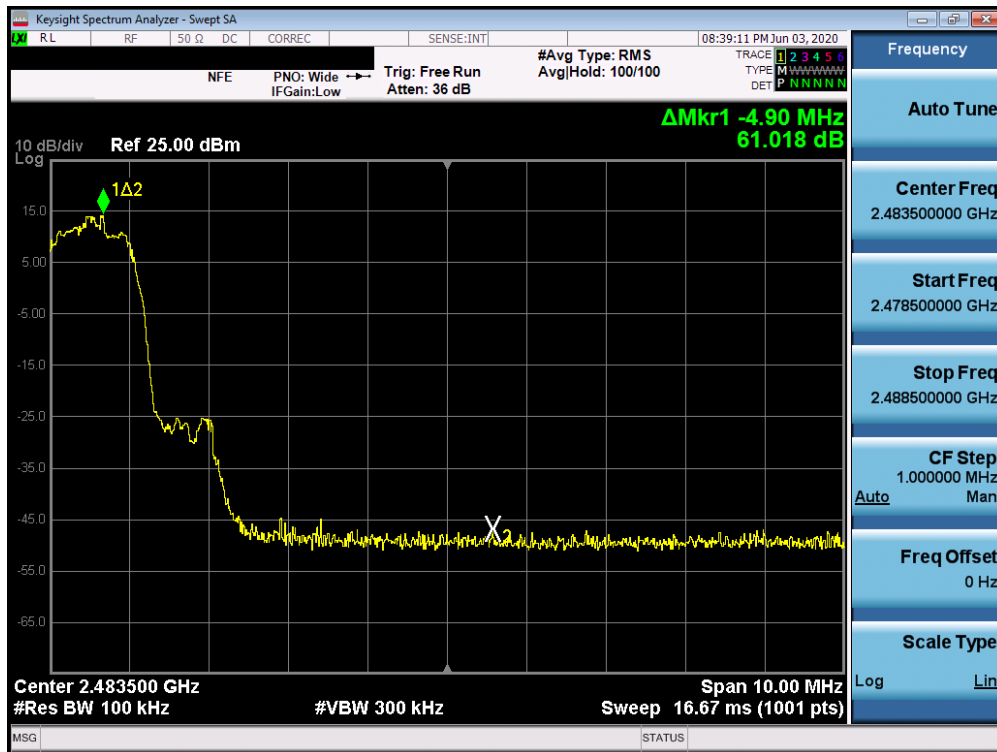
Plot 7-72. Band Edge Plot (Bluetooth with Hopping Enabled, 3 Mbps)

FCC ID: A3LSMF707U	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 53 of 94

Bluetooth ANT1

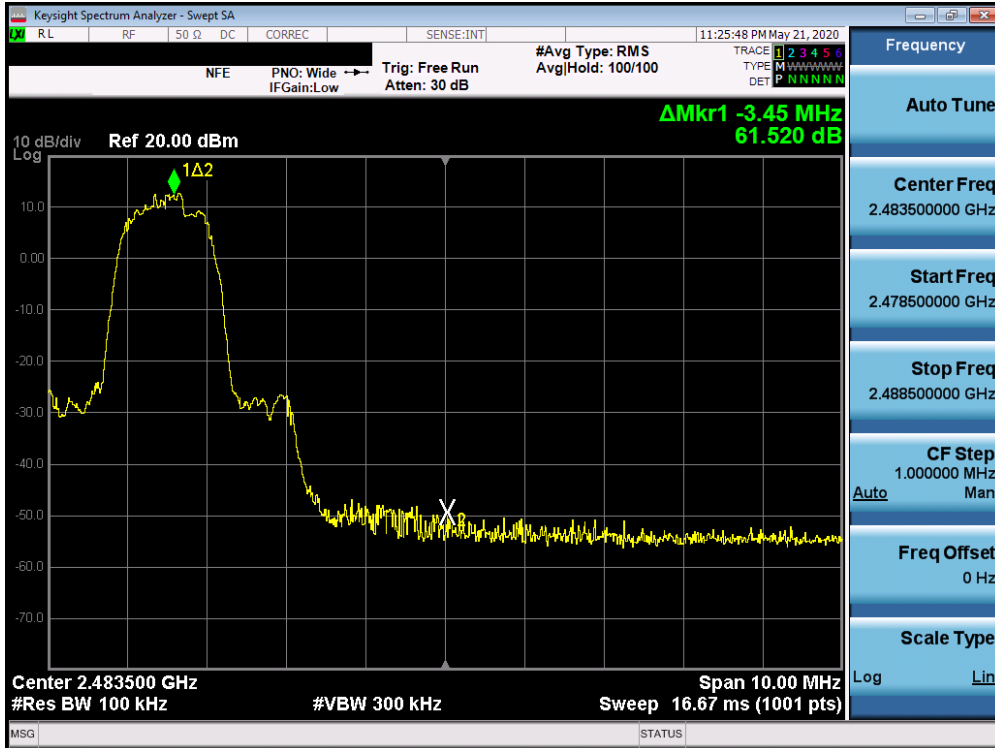


Plot 7-73. Band Edge Plot (Bluetooth with Hopping Disabled, 3 Mbps – Ch. 0)

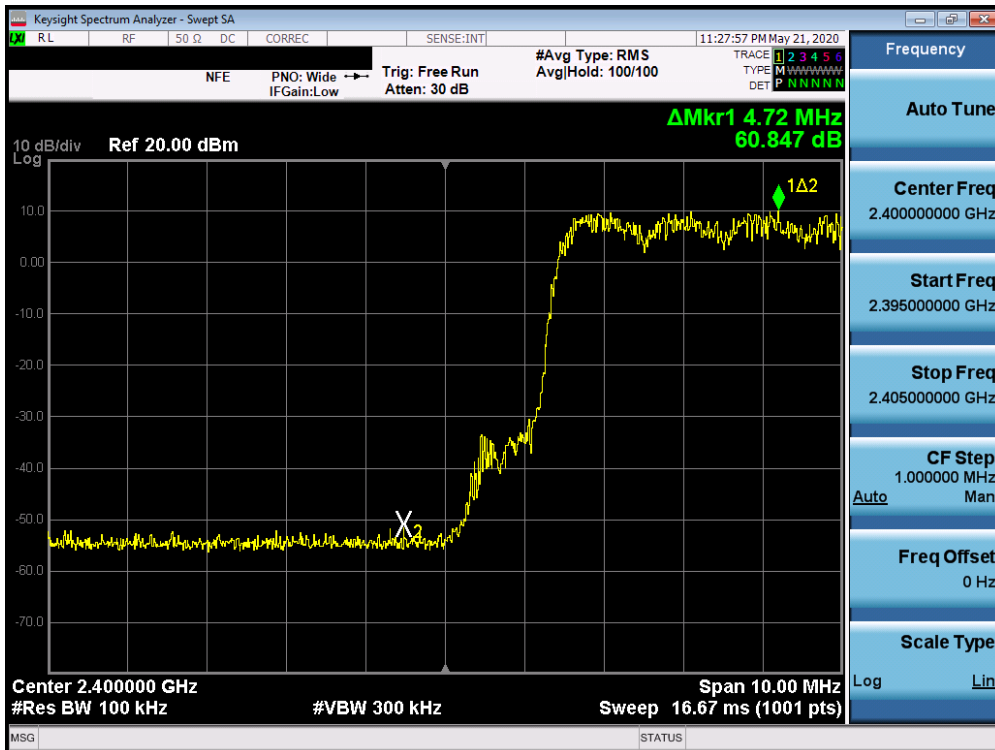


Plot 7-74. Band Edge Plot (Bluetooth with Hopping Disabled, 3 Mbps – Ch. 77)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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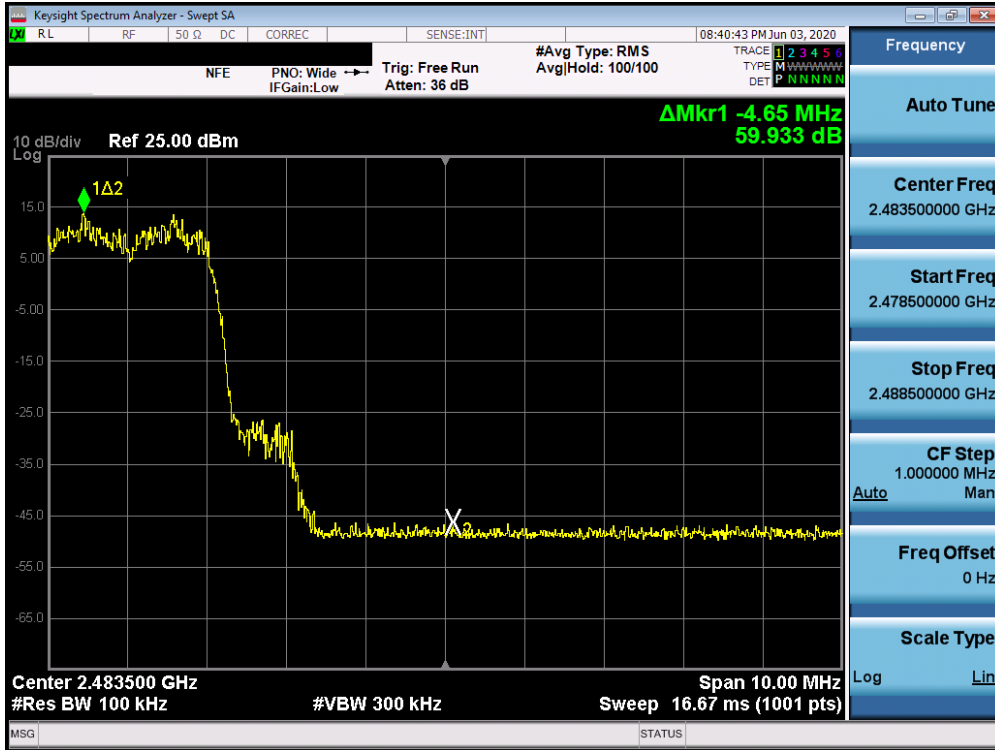


Plot 7-75. Band Edge Plot (Bluetooth with Hopping Disabled, 3 Mbps – Ch. 78)

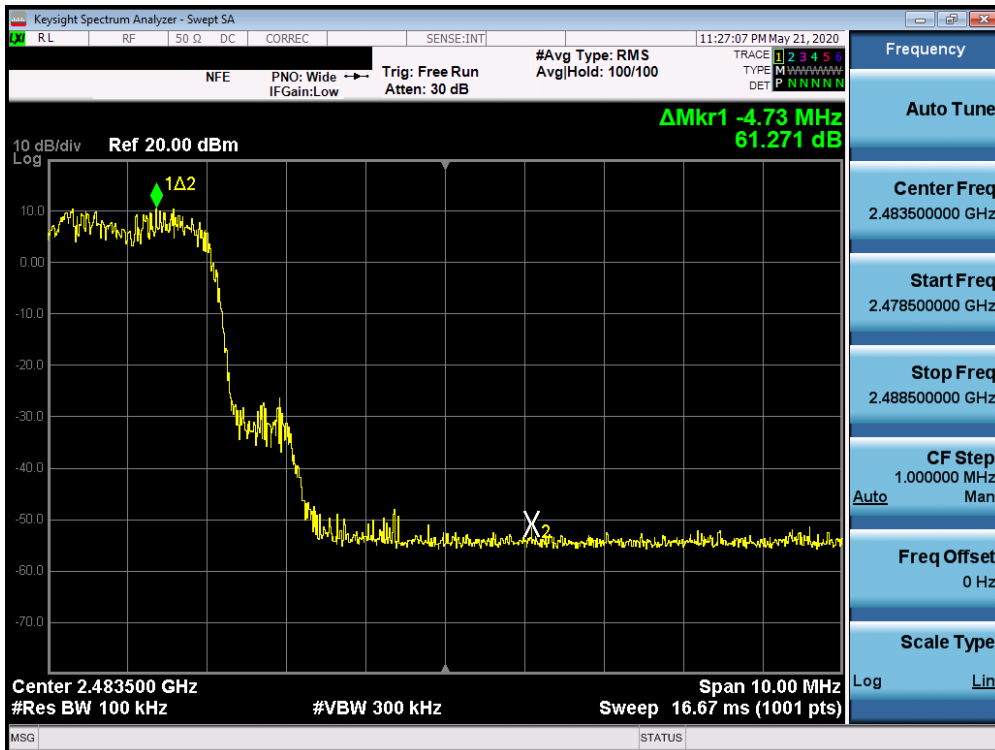


Plot 7-76. Band Edge Plot (Bluetooth with Hopping Enabled, 3 Mbps)

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Plot 7-77. Band Edge Plot (Bluetooth with Hopping Enabled, 3 Mbps)



Plot 7-78. Band Edge Plot (Bluetooth with Hopping Enabled, 3 Mbps)

FCC ID: A3LSMF707U		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.

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Frequency [MHz]	Data Rate [Mbps]	Mod.	Channel No.	Min. Channel Separation [MHz]
2402	1.0	GFSK	0	0.622
2441	1.0	GFSK	39	0.625
2480	1.0	GFSK	78	0.615
2402	2.0	$\pi/4$ -DQPSK	0	0.907
2441	2.0	$\pi/4$ -DQPSK	39	0.835
2480	2.0	$\pi/4$ -DQPSK	78	0.889
2402	3.0	8DPSK	0	0.852
2441	3.0	8DPSK	39	0.880
2480	3.0	8DPSK	78	0.817

Table 7-6. Minimum Channel Separation – ANT0

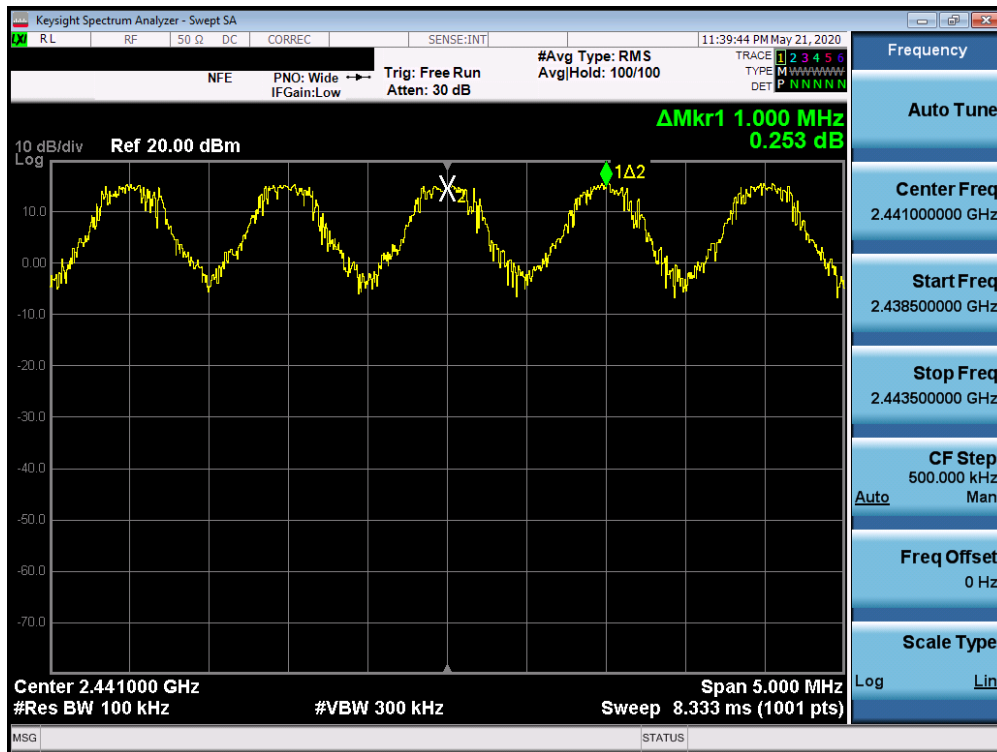


Plot 7-79. Channel Spacing Plot (Bluetooth)- ANT0

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M2005040080-12.A3L	Test Dates: 05/04 - 07/06/2020	EUT Type: Portable Handset		Page 58 of 94

Frequency [MHz]	Data Rate [Mbps]	Mod.	Channel No.	Min. Channel Separation [MHz]
2402	1.0	GFSK	0	0.623
2441	1.0	GFSK	39	0.579
2480	1.0	GFSK	78	0.617
2402	2.0	$\pi/4$ -DQPSK	0	0.903
2441	2.0	$\pi/4$ -DQPSK	39	0.881
2480	2.0	$\pi/4$ -DQPSK	78	0.902
2402	3.0	8DPSK	0	0.868
2441	3.0	8DPSK	39	0.841
2480	3.0	8DPSK	78	0.841

Table 7-7. Minimum Channel Separation – ANT1



Plot 7-80. Channel Spacing Plot (Bluetooth)- ANT1

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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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

FCC ID: A3LSMF707U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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