Certification Application Report
FCC Part 15.247 & ISED RSS-247

Test Lab:		Applicant:	
Rhein Tech Laboratories, Inc. Phone: 703-689 0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 www.rheintech.com Herndon, VA 20170 E-Mail: atcbinfo@rheintech.com		Honeywell International Inc. 9680 Old Bailes Road Fort Mill, SC 29707	
FCC ID/ IC	HD5-HBT1500-01/ 1693B-HBT150001	**Test Report Date**	August 13, 2019
Platform	N/A	**RTL Work Order #**	2019050
Model **Model #/HVINs**	SRX3 HBT1500-01	**RTL Quote Number**	QRTL19-050A

American National Standard Institute	ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
FCC Classification	DSS – Part 15 Spread Spectrum Transmitter
FCC Rule Part(s)	FCC Rules Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz (10-01-18)
ISED Standards	RSS-247 Issue 2: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices RSS-Gen Issue 5: General Requirements for Compliance of Radio Apparatus
Digital Interface Information	Digital Interface was found to be compliant

Frequency Range (MHz)	Output Power (mW) Peak Conducted	Frequency Tolerance	Emission Designator
2402 – 2480	2.5	N/A	1M18FXD

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, ANSI C63.10, and ISED RSS-247 and RSS-Gen.

Signature:  Date: August 13, 2019

Typed/Printed Name: Desmond A. Fraser Position: President

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANAB.
Refer to certificate and scope of accreditation AT-1445.
This replaces DRAFT R0.2.

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1 General Information

1.1 Scope

Applicable Standards:

- FCC Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.
- ISED RSS-247: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices
- ISED RSS-Gen Issue 5: General Requirements for Compliance of Radio Apparatus

1.2 Description of EUT

Equipment Under Test	Body-worn transmitter
Model	SRX3
Power Supply	Internal rechargeable 3.6 VDC Li-Ion Battery
Modulation Type	FHSS
Frequency Range	2402–2480 MHz
Antenna	Internal +1.47 dBi

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.10-2013).

1.4 Related Submittal(s)/Grant(s)

This is an original certification application for Honeywell International Inc. SRX3 Model# HBT1500-01, FCC ID: HD5-HBT1500-01, IC: 1693B-HBT150001.

1.5 Modifications

No modifications were required for compliance.

2 Test Information

2.1 Description of Test Modes

In accordance with FCC 15.31(m), and because the EUT utilizes an operating band greater than 10 MHz, the following frequencies were tested:

Table 2-1: Test Frequencies

Channel	FHSS Frequency (MHz)
0	2402
40	2441
79	2480

2.2 Exercising the EUT

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with software to continuously transmit during testing. The carrier was also checked to verify that information was being transmitted; all modes were investigated and the worst-case mode was used for final testing. There were no deviations from the test standard(s) and/or methods. The test results reported relate only to the item tested.

2.3 Test Result Summary

Table 2-2: Test Result Summary – FCC Part 15, Subpart C (Section 15.247); ISED RSS-247, RSS-Gen

Test	FCC Reference	ISED Reference	Result
AC Power Conducted Emissions	15.207	RSS-Gen 8.8	Not Tested
Radiated Emissions	15.209	RSS-247 5.5; RSS-Gen 8.9, 8.10	Pass
Maximum Peak Power Output	15.247(b)(1)	RSS-247 5.4(b), RSS-Gen 6.12	Pass
Antenna Conducted Spurious Emissions	15.247(d)	RSS-247 5.5, RSS-Gen 6.13	Pass
Carrier Frequency Separation	15.247(a)(1)	RSS-247 5.1(b)	Pass
Band Edge Measurement	15.247(d)	RSS-247 5.5	Pass
20 dB Bandwidth	15.247(a)(1)	RSS-247 5.1(a)	Pass
Hopping Characteristics	15.247(a)(1)(iii)	RSS-247 5.1(d)	Pass
Average Time of Occupancy	15.247(a)(1)(iii)	RSS-247 5.1(d)	Pass
99% Bandwidth	N/A	RSS-Gen 6.7/ TRC-43	N/A

2.4 Test System Details

The test samples were received on August 2, 2019. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following tables. The BT transceiver models are electrically identical.

Table 2-3: Equipment Under Test (EUT)

Part	Manufacturer	Model #/ HVIN	Serial Number	FCC ID	Cable Description	RTL Bar Code
BT Transceiver (Conducted)	Honeywell International Inc.	HBT1500-01	7819280238	HD5-HBT1500-01	N/A	23325
BT Transceiver (Conducted)	Honeywell International Inc.	HBT1500-01	7819280193	HD5-HBT1500-01	N/A	23328
BT Transceiver (Radiated)	Honeywell International Inc.	HBT1500-01	7819280033	HD5-HBT1500-01	N/A	23326
3.6 V Li-Ion Battery	Honeywell International Inc.	HBA1000-02	351740040412	N/A	N/A	23321
3.6 V Li-Ion Battery	Honeywell International Inc.	HBA1000-02	351526007410	N/A	N/A	23324

Table 2-4: Support Equipment

Part	Manufacturer	Model #	Serial Number	FCC ID	Cable Description	RTL Bar Code
Laptop	ASUS	N550J	F2N0CY33003607G	N/A	N/A	N/A

2.5 Configuration of Tested System

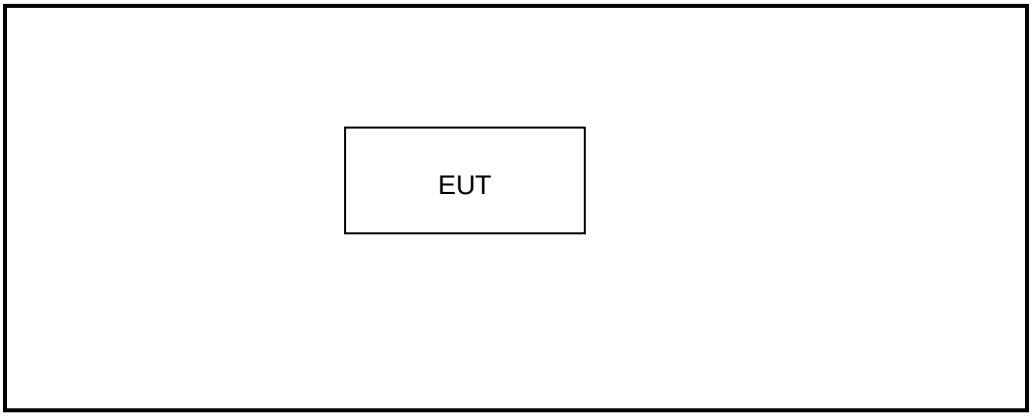


Figure 2-1: Configuration of System Under Test

3 Peak Output Power – FCC 15.247(b)(1); ISED RSS-247 5.4(b), RSS-Gen 6.12

3.1 Power Output Test Procedure

A conducted power measurement of the EUT was taken using an Agilent Technologies Analyzer. The following settings were used:

1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel (4 MHz used)
2) RBW >20 dB bandwidth of the emission being measured (1 MHz used)
3) VBW ≥RBW (3 MHz used)
4) Sweep: Auto
5) Detector function: Peak
6) Trace: Max hold. The trace was allowed to stabilize, and the marker-to-peak function was used to set the marker to the peak of the emission.

Table 3-1: Power Output Test Equipment

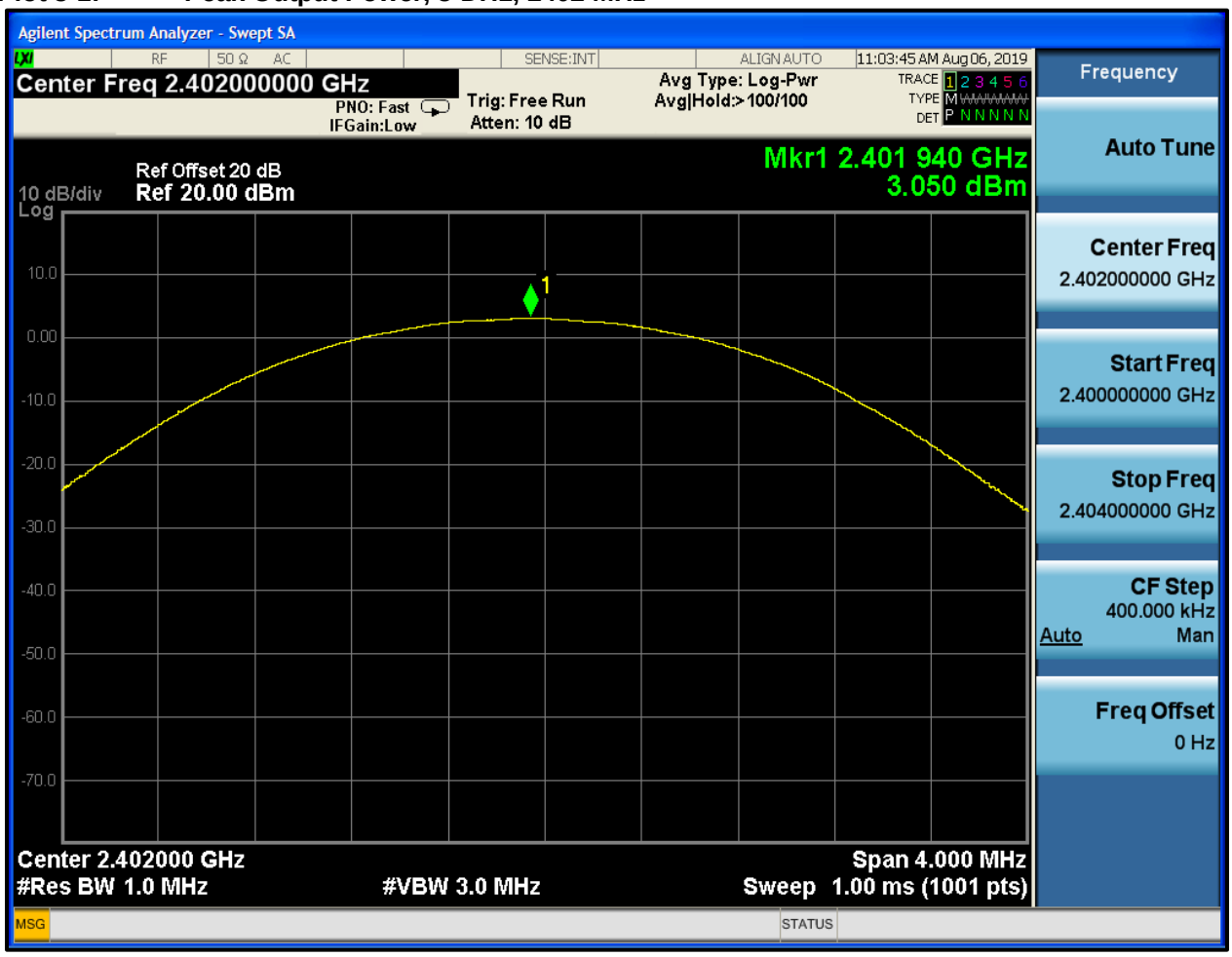
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901521	MA/COM	2082-6174-20	Attenuator, 20 dB 2 W, DC – 4 GHz	N/A	08/07/20
901583	Agilent Technologies	EXA N9010A	Signal Analyzer	MY51250846	02/06/20

3.2 Power Output Test Results

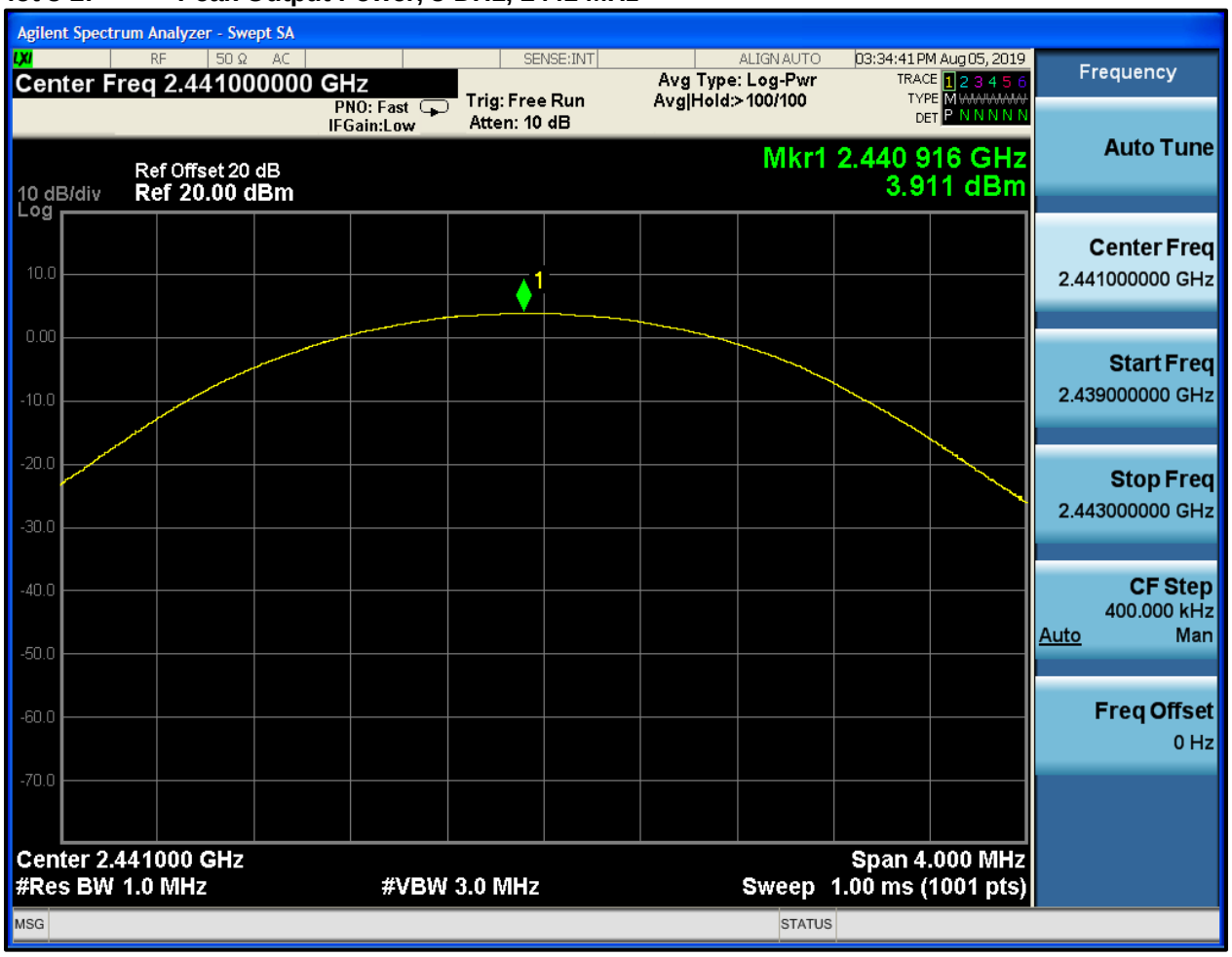
Table 3-2: Power Output Test Data

Modulation Type	Level Measured 2402 MHz (dBm)	Level Measured 2441 MHz (dBm)	Level Measured 2480 MHz (dBm)
DM1	1.12	2.41	1.91
DH1	1.10	2.39	1.89
HV1	1.14	2.40	1.89
HV2	1.12	2.41	1.89
HV3	1.14	2.39	1.89
DM3	1.07	2.38	1.88
DH3	1.06	2.38	1.87
EV4	1.08	2.36	1.85
EV5	1.05	2.38	1.85
DM5	1.06	2.36	1.88
DH5	1.04	2.37	1.86
2-DH1	2.57	3.53	3.30
2-EV3	2.63	3.57	3.23
3-EV3	2.95	3.87	3.55
3-DH1	**3.05**	**3.91**	**3.62**
2-DH3	3.01	3.66	3.33
3-DH3	2.94	3.86	3.56
2-EV5	2.70	3.61	3.30
3-EV5	2.91	3.87	3.55
2-DH5	2.65	3.60	3.33
3-DH5	2.92	3.85	3.55

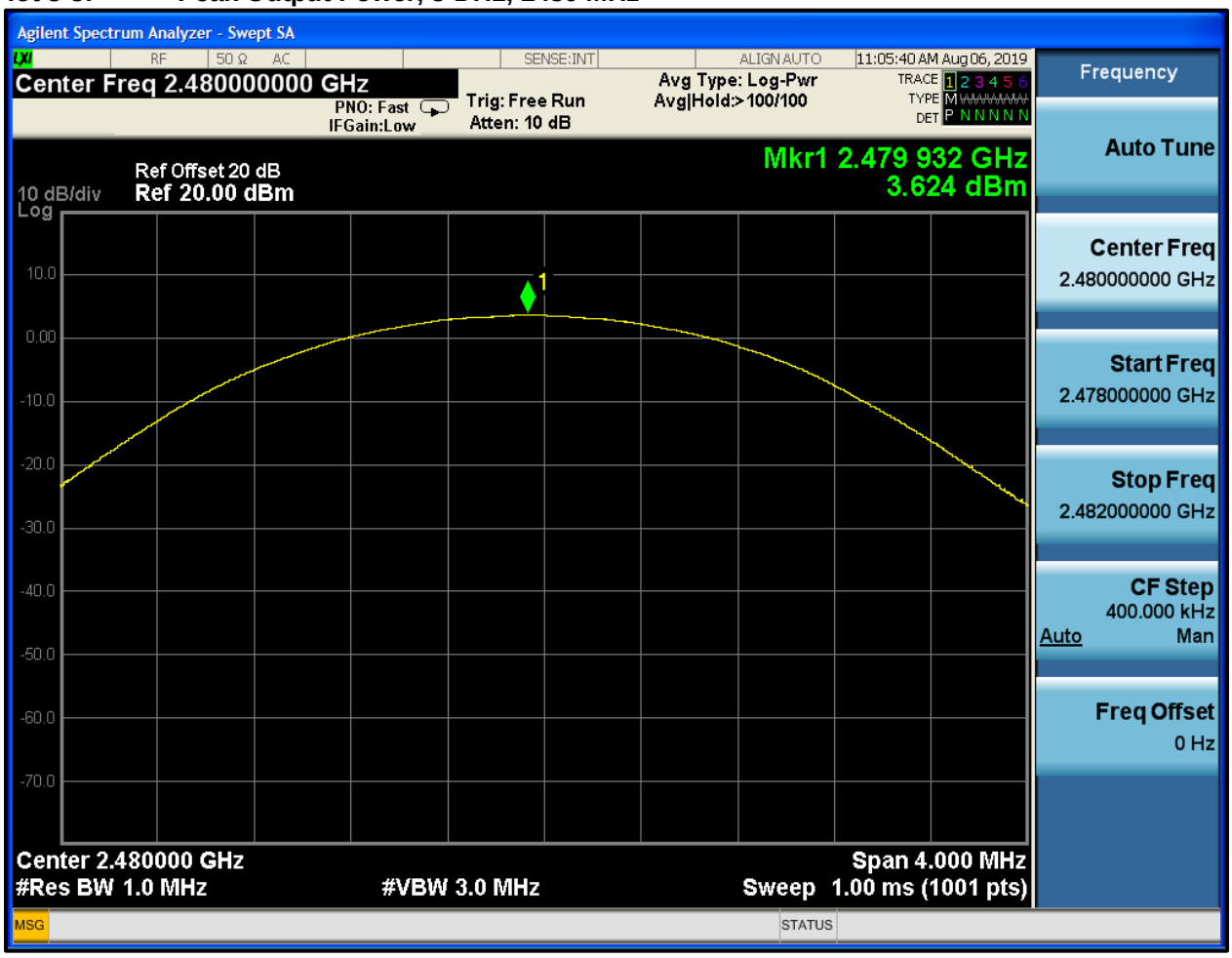
Plot 3-1: Peak Output Power, 3-DH1, 2402 MHz



Plot 3-2: Peak Output Power, 3-DH1, 2441 MHz



Plot 3-3: Peak Output Power, 3-DH1, 2480 MHz



Measurement uncertainty: ±0.8 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Test Personnel:

Khue Do		August 5 & 6, 2019
Test Engineer	Signature	Dates of Test

4 Compliance with the Band Edge – FCC 15.247(d); ISED RSS-247 5.5

4.1 Band Edge Test Procedure

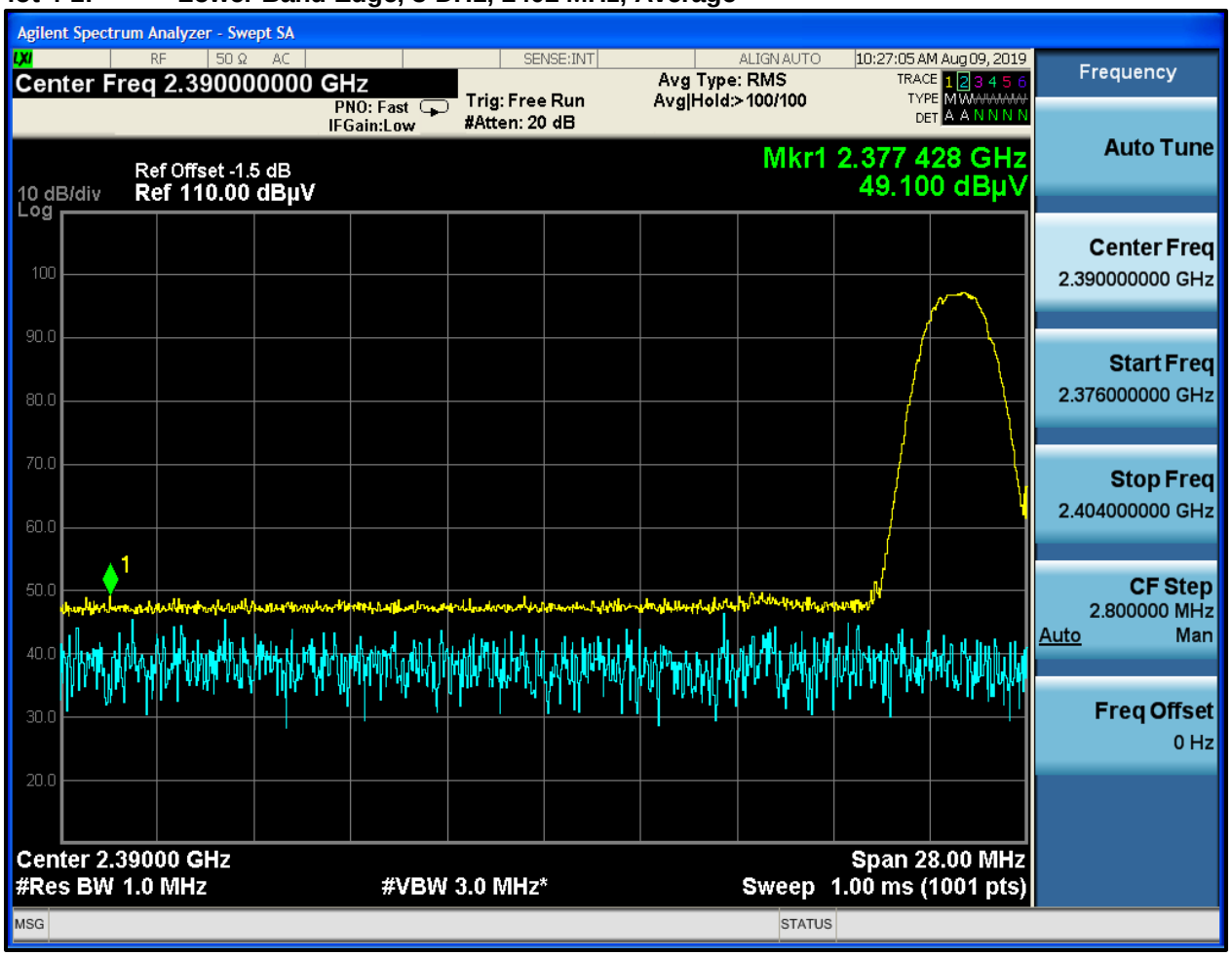
The transmitter output was connected to the spectrum analyzer. Peak and average detector conducted plots were taken with a suitable span to encompass the peak of the fundamental, and traces to stop hopping and non-hopping modes. The measurement was performed from the highest peak in the restricted band (within 2 MHz), and the result was compared to the restricted band limit (54 dBµV/m).
An offset was used to reference the fundamental power to a radiated field strength measurement.

Table 4-1: Band Edge Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900772	EMCO	3161-02	Horn Antenna (2 – 4 GHz)	9804-1044	05/17/21
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 – 26.5 GHz)	3008A00505	10/01/19
901583	Agilent Technologies	EXA N9010A	Signal Analyzer	MY51250846	02/06/20

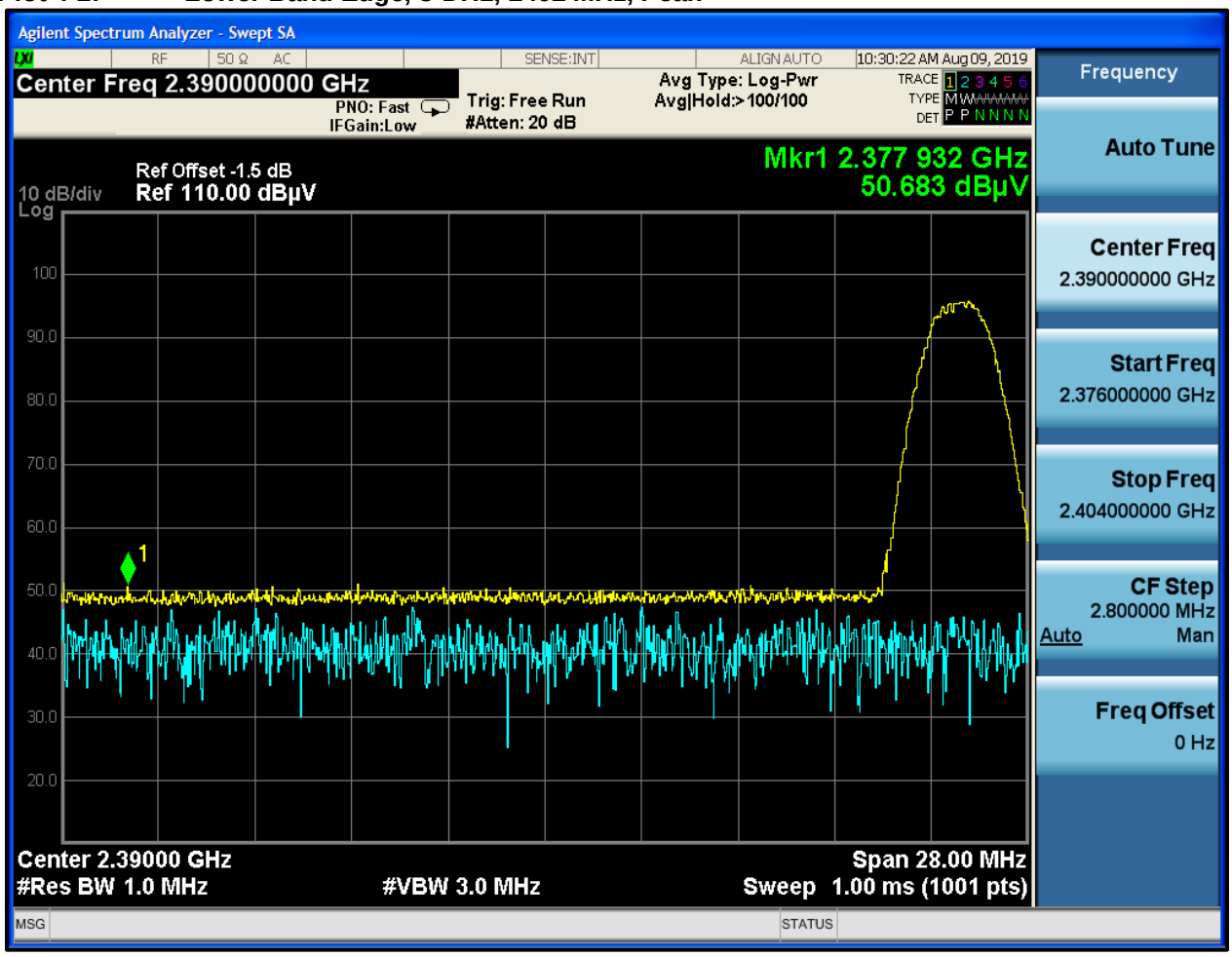
4.2 Restricted Band Edge Test Results

Plot 4-1: Lower Band Edge, 3-DH1, 2402 MHz, Average



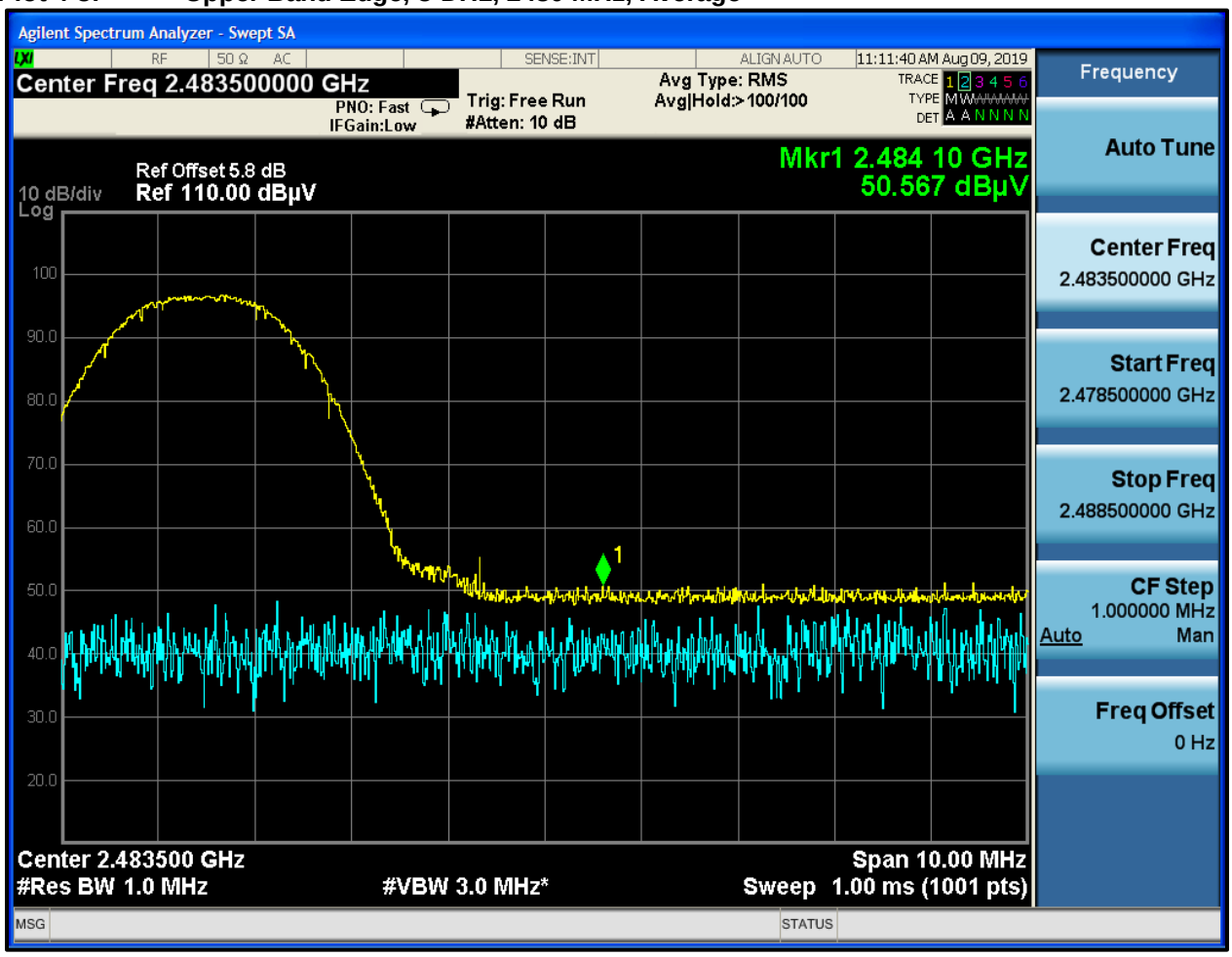
Measured = 49.1 dBµV/m Limit = 54.0 dBµV/m Margin = -4.9 dB Result: Pass

Plot 4-2: Lower Band Edge, 3-DH1, 2402 MHz, Peak



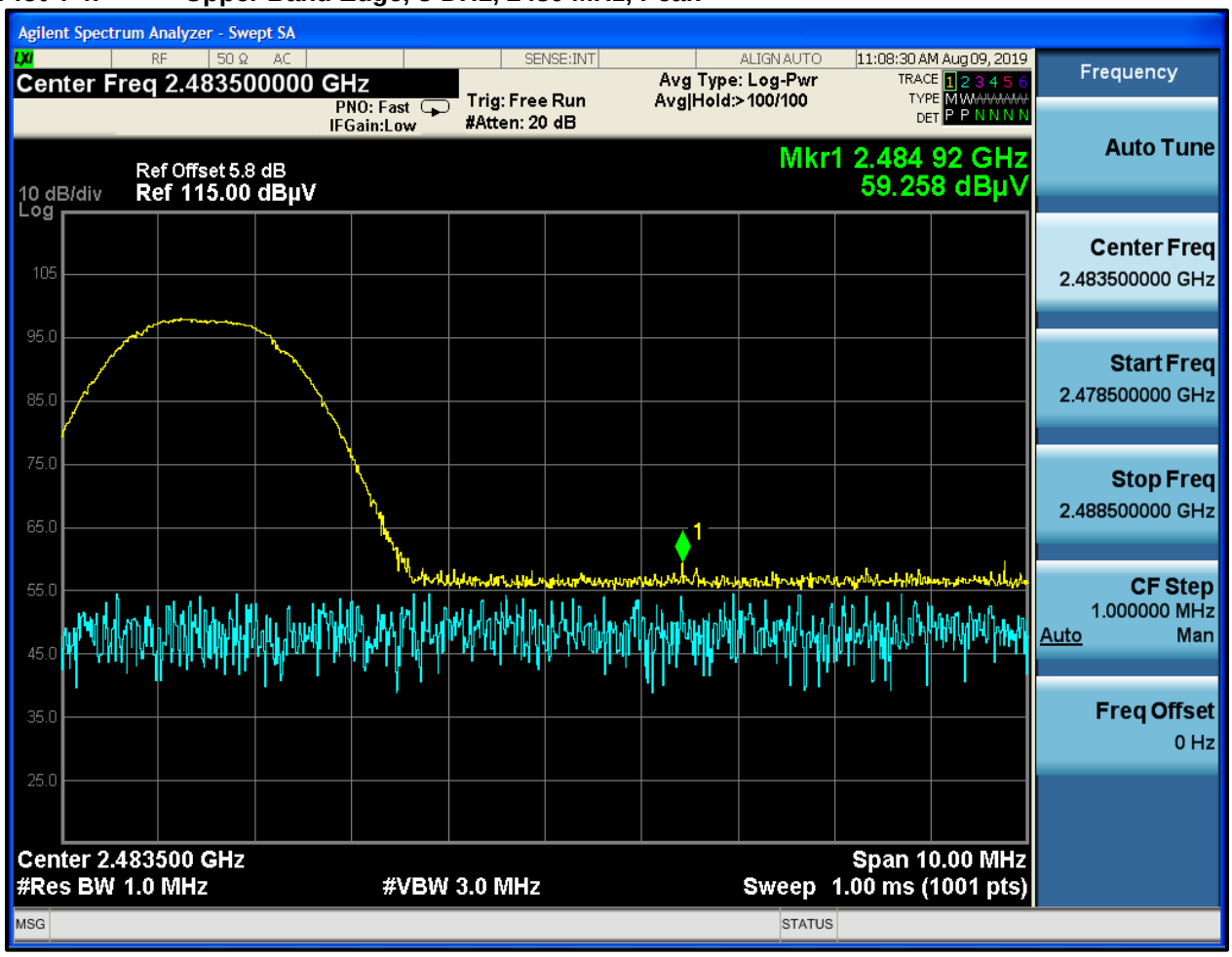
Measured = 50.7 dBµV/m Limit = 74.0 dBµV/m Margin = -23.3 dB Result: Pass

Plot 4-3: Upper Band Edge, 3-DH1, 2480 MHz, Average



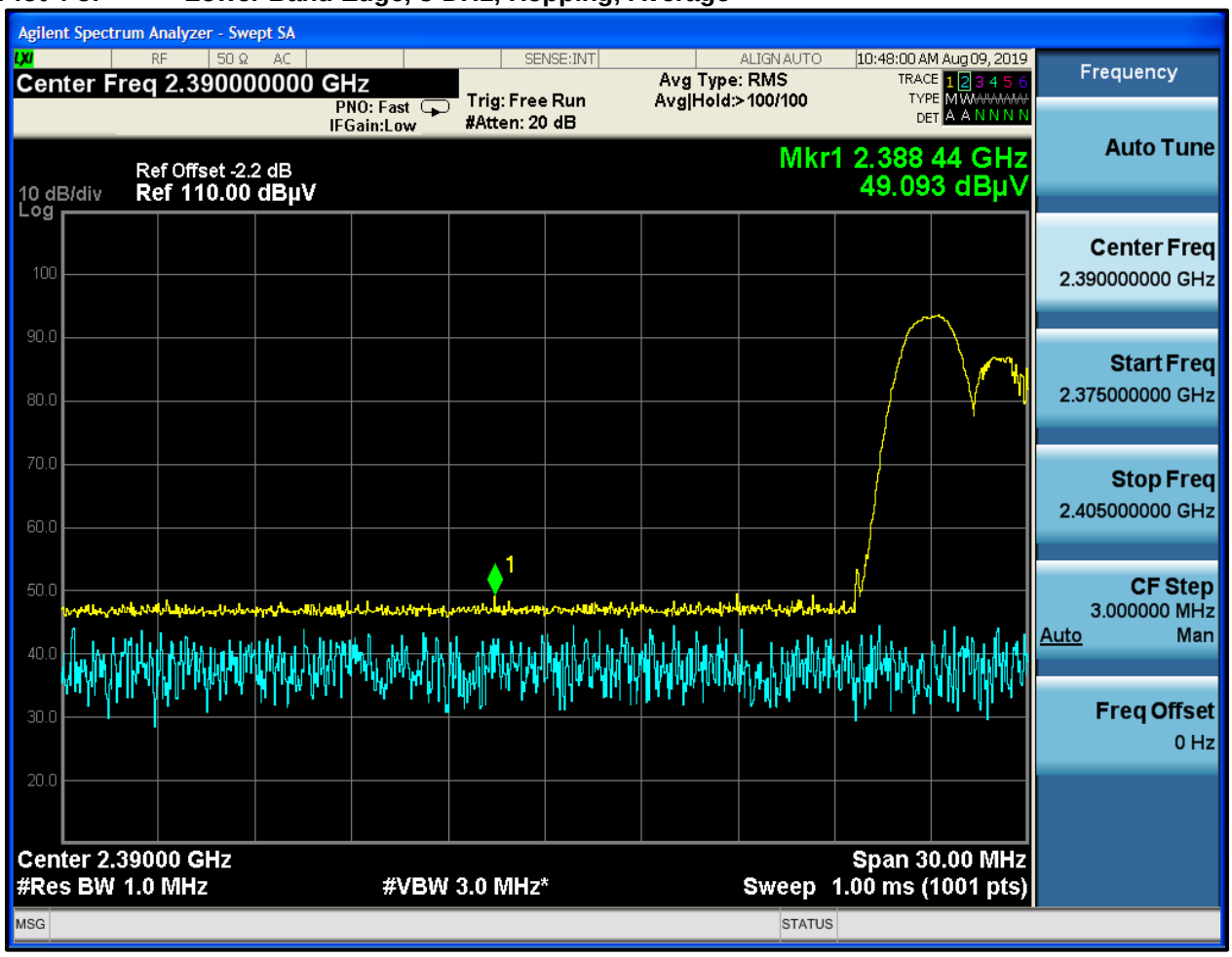
Measured = 50.6 dBµV/m Limit = 54.0 dBµV/m Margin = -3.4 dB Result: Pass

Plot 4-4: Upper Band Edge, 3-DH1, 2480 MHz, Peak



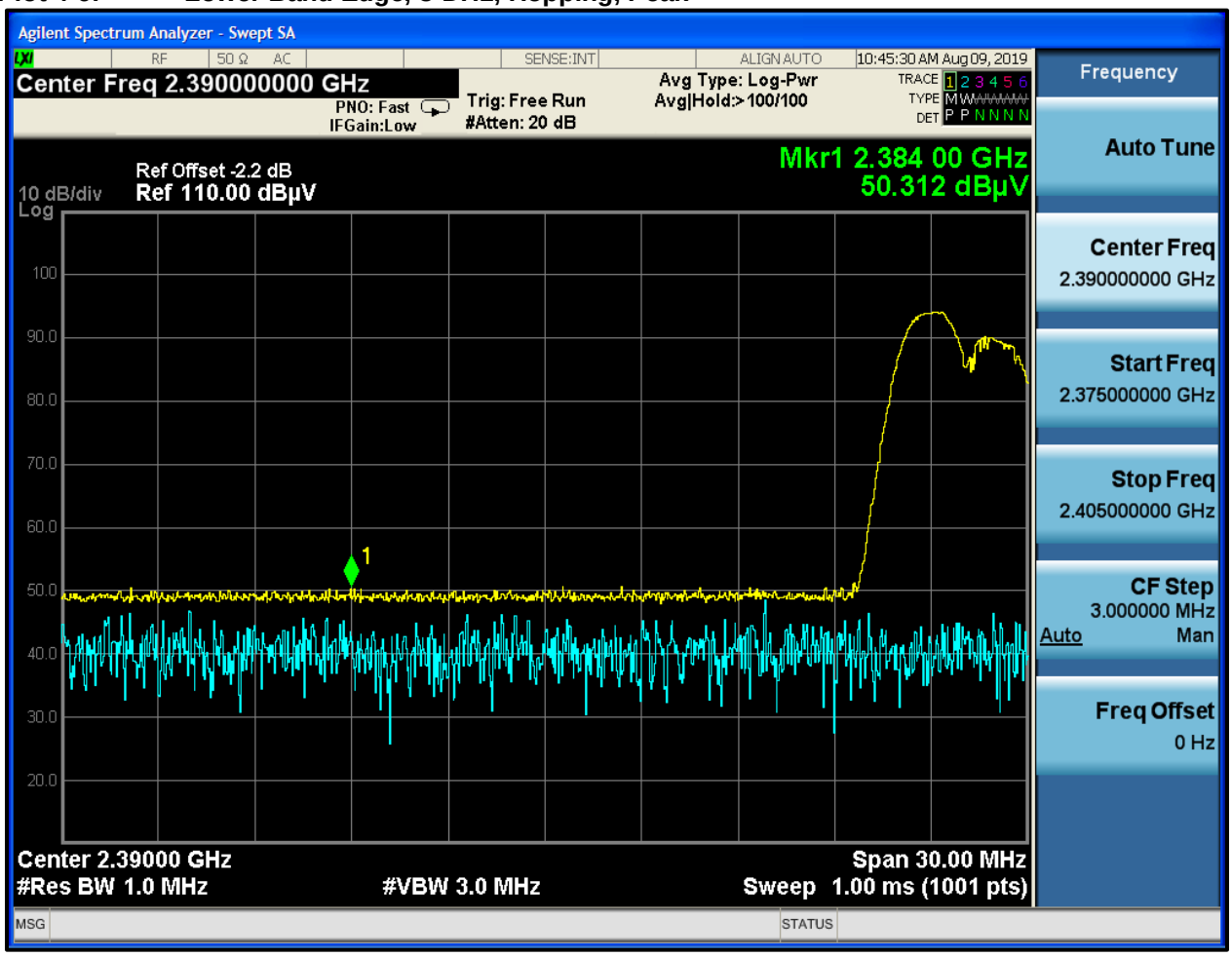
Measured = 59.3 dBµV/m Limit = 74.0 dBµV/m Margin = -14.7 dB Result: Pass

Plot 4-5: Lower Band Edge, 3-DH1, Hopping, Average



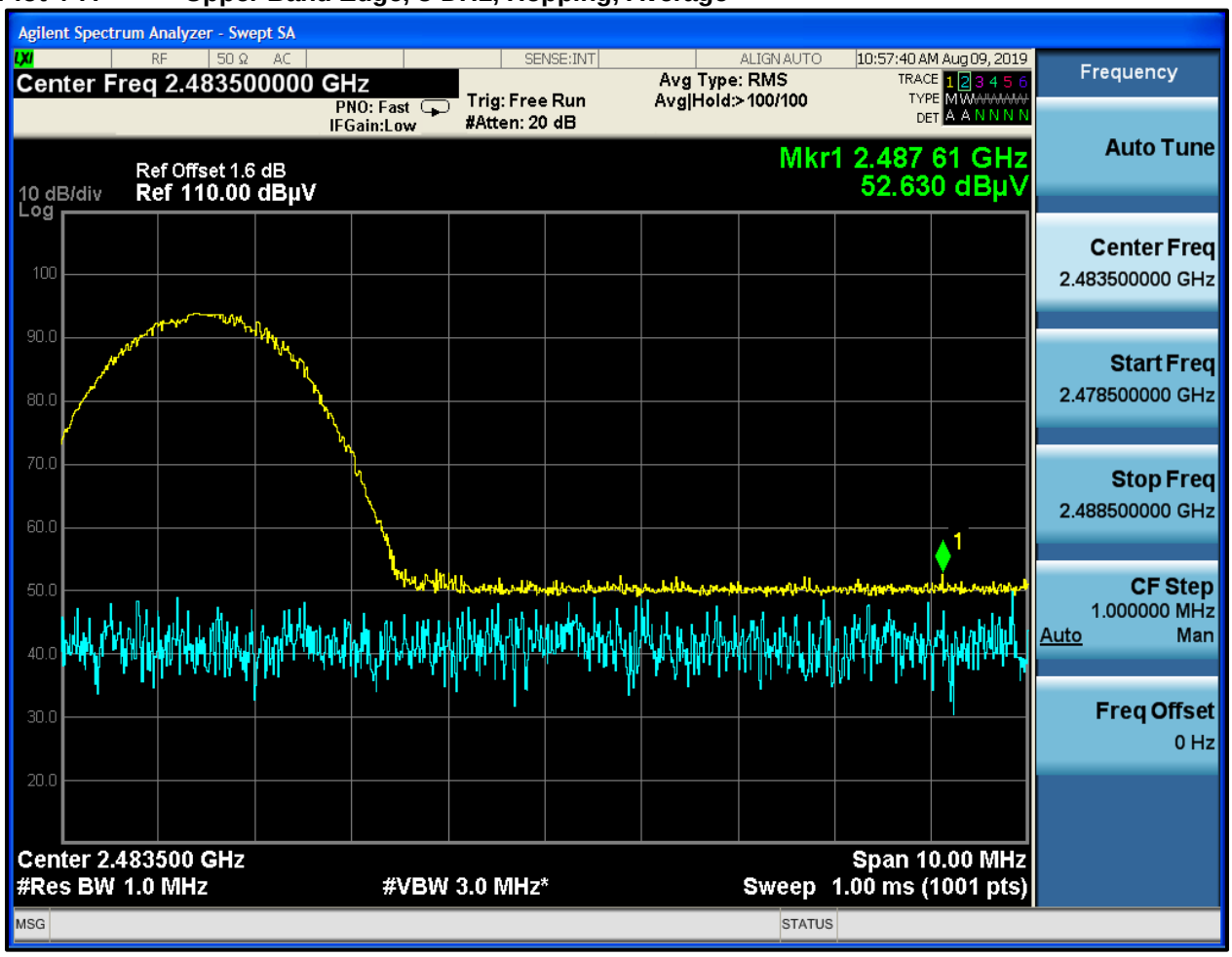
Measured = 49.1 dBµV/m Limit = 54.0 dBµV/m Margin = -4.9 dB Result: Pass

Plot 4-6: Lower Band Edge, 3-DH1, Hopping, Peak



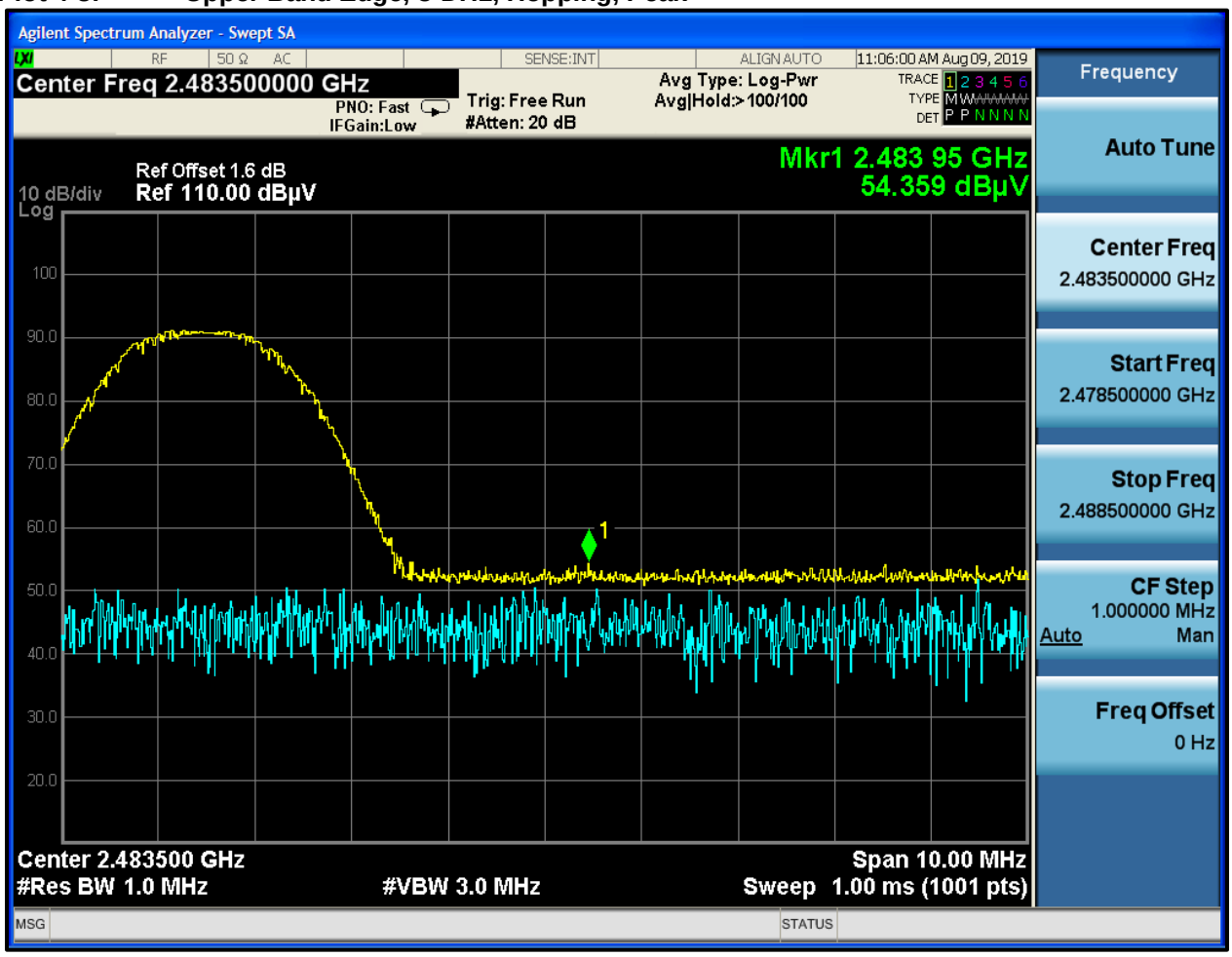
Measured = 50.3 dBµV/m Limit = 54.0 dBµV/m Margin = -3.7 dB Result: Pass

Plot 4-7: Upper Band Edge, 3-DH1, Hopping, Average



Measured = 52.6 dBµV/m Limit = 54.0 dBµV/m Margin = -1.4 dB Result: Pass

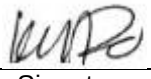
Plot 4-8: Upper Band Edge, 3-DH1, Hopping, Peak



Measured = 54.4 dBµV/m Limit = 74.0 dBµV/m Margin = -19.6 dB Result: Pass

Measurement uncertainty: ±0.8 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Test Personnel:

Khue Do		August 9, 2018
Test Engineer	Signature	Date of Test

5 Antenna Conducted Spurious Emissions – FCC 15.247(d); ISED RSS-247 5.5, RSS-Gen 6.13

5.1 Antenna Conducted Spurious Emissions Test Procedures

Antenna spurious emissions per FCC 15.247(d) were measured from the EUT antenna port using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 100 kHz. The modulated carrier was identified at the following frequencies: 2402 MHz, 2441 MHz and 2480 MHz.

Table 5-1: Antenna Conducted Spurious Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901521	MA/COM	2082-6174-20	Attenuator, 20 dB 2 W, DC – 4 GHz	N/A	08/07/20
901583	Agilent Technologies	EXA N9010A	Signal Analyzer	MY51250846	02/06/20

5.2 Antenna Conducted Spurious Emissions Test Results

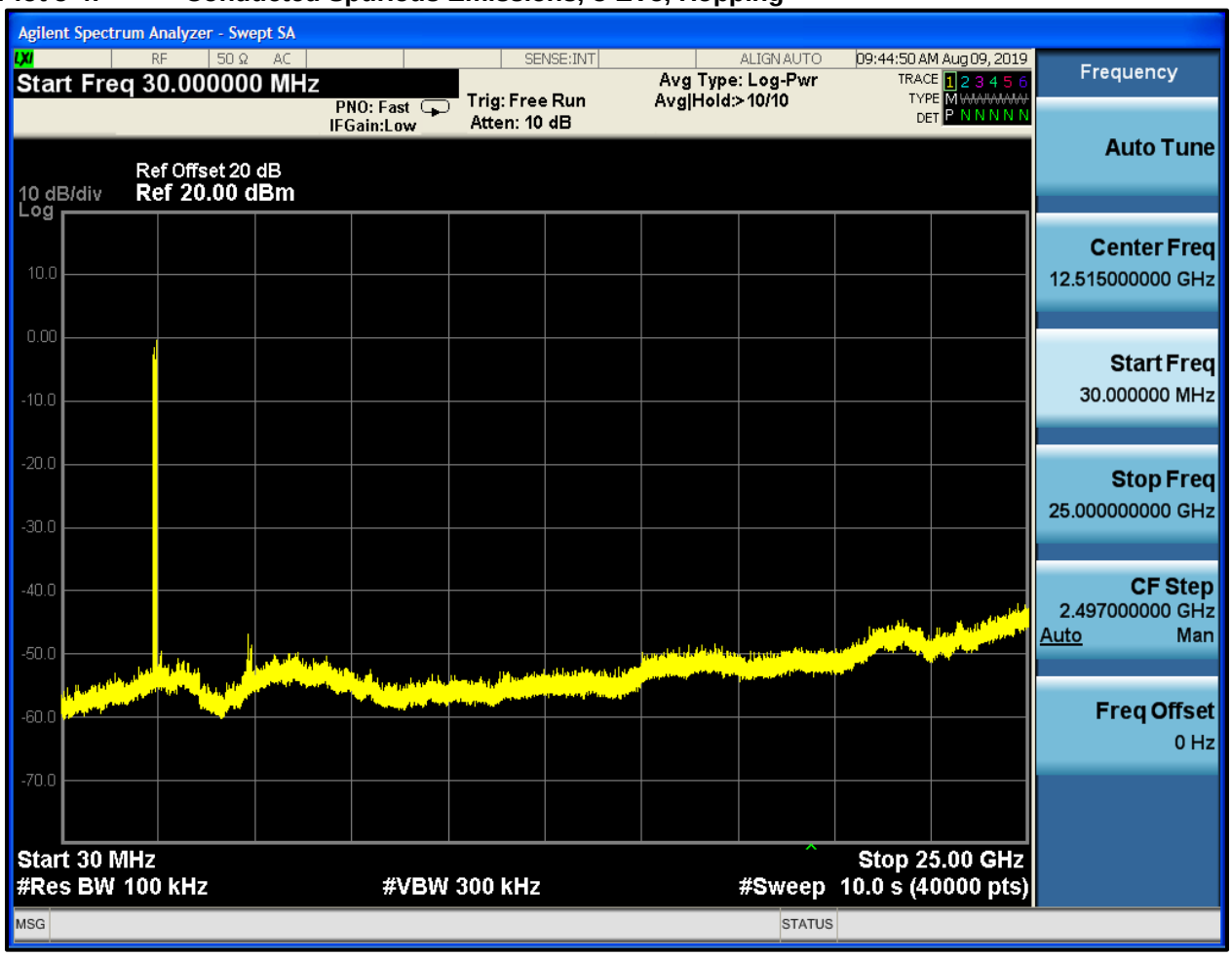
No harmonics or spurs were found within 20 dB (note that we are reporting power as peak) of the carrier level from the carrier to the 10th harmonic of the carrier frequency.

Plot 5-1: Conducted Spurious Emissions, 3-DH1, 2441 MHz

Plot 5-2: Conducted Spurious Emissions, 3-DH1, Hopping

Plot 5-3: Conducted Spurious Emissions, 3-EV5, 2441 MHz

Plot 5-4: Conducted Spurious Emissions, 3-EV5, Hopping



Plot 5-5: Conducted Spurious Emissions, 3-DH5, 2441 MHz

Plot 5-6: Conducted Spurious Emissions, 3-DH5, Hopping

Measurement uncertainty: ±0.8 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Test Personnel:

Khue Do		August 6 & 9, 2019
Test Engineer	Signature	Dates of Test

6 20 dB Bandwidth – FCC 15.247(a)(1)); ISED RSS-247 5.1(a)

6.1 20 dB Bandwidth Test Procedure

The minimum 20 dB bandwidths per FCC 15.247 were measured using a 50-ohm spectrum analyzer. The carrier was adjusted on the analyzer so that it was displayed entirely on the spectrum analyzer. The sweep time was set to auto and allowed through several sweeps with the max hold function used in peak detector mode. The resolution bandwidth was set to 100 kHz, and the video bandwidth set at 300 kHz. The minimum 20 dB bandwidths were measured using the spectrum analyzer delta marker set 20 dB down from the peak of the carrier.

The table below contains the bandwidth measurement results. DH5 and 3-DH5 are shown as representative worst case for basic and EDR modulations.

Table 6-1: 20 dB Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901521	MA/COM	2082-6174-20	Attenuator, 20 dB 2 W, DC – 4 GHz	N/A	08/07/20
901583	Agilent Technologies	EXA N9010A	Signal Analyzer	MY51250846	02/06/20

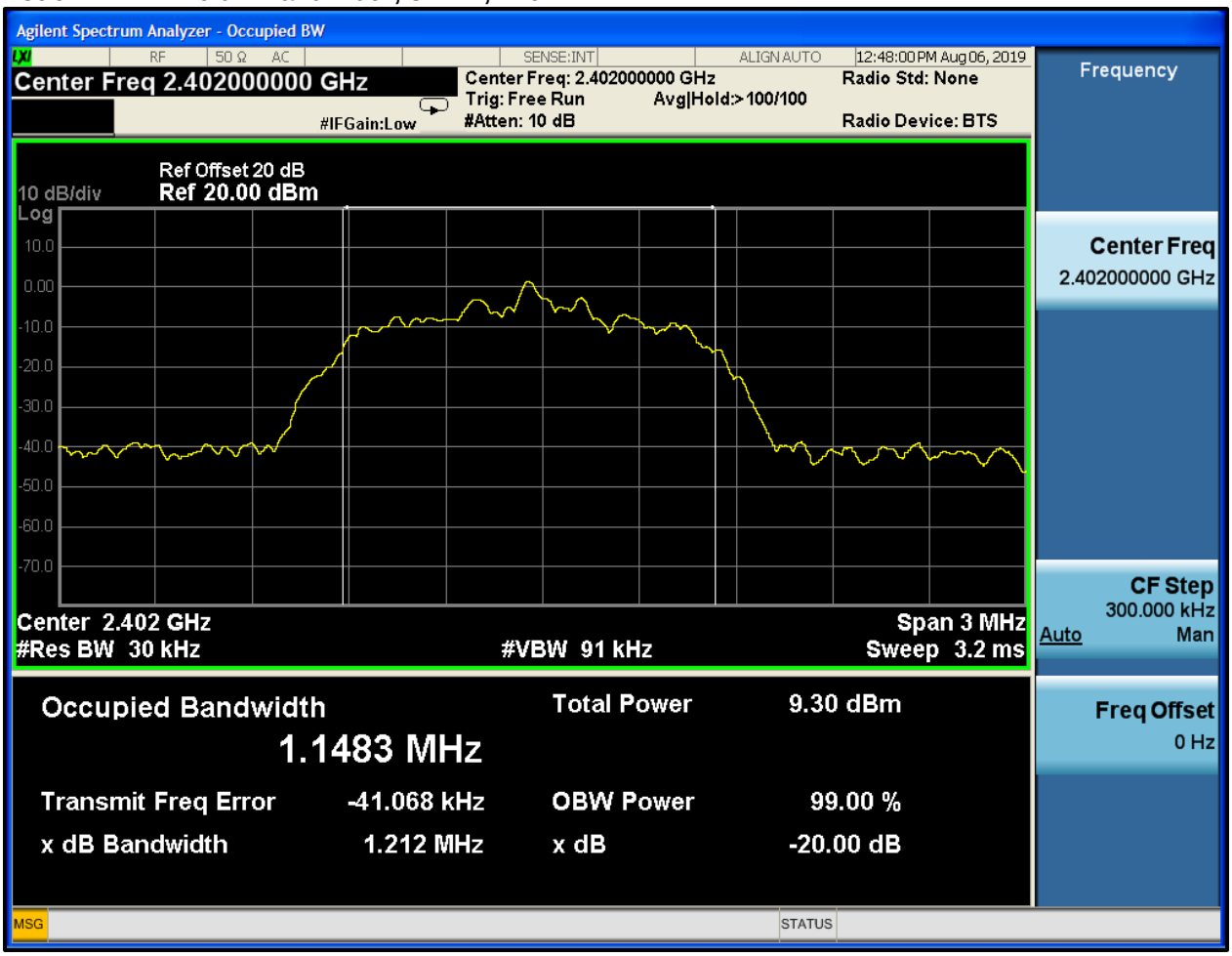
6.2 20 dB Modulated Bandwidth Test Results

Table 6-2: 20 dB Modulated Bandwidth Test Data

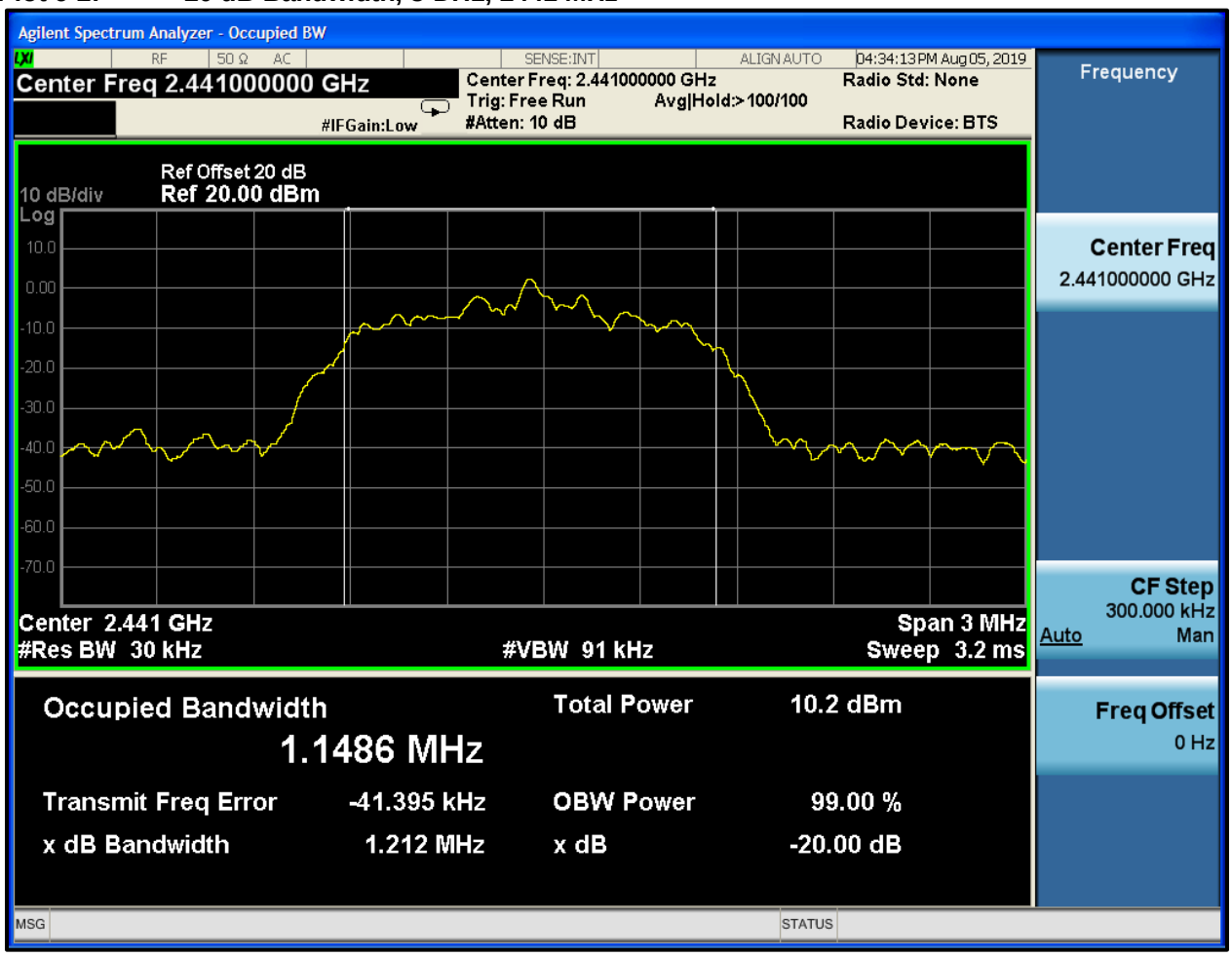
Packet Type	Frequency (MHz)	20 dB Bandwidth (MHz)
3-DH1	2402	1.212
3-DH1	2441	1.212
3-DH1	2480	1.213
3-EV5	2402	1.267
3-EV5	2441	1.265
3-EV5	2480	1.263
3-DH5	2402	1.264
3-DH5	2441	1.266
3-DH5	2480	1.266

6.3 20 dB Bandwidth Plots

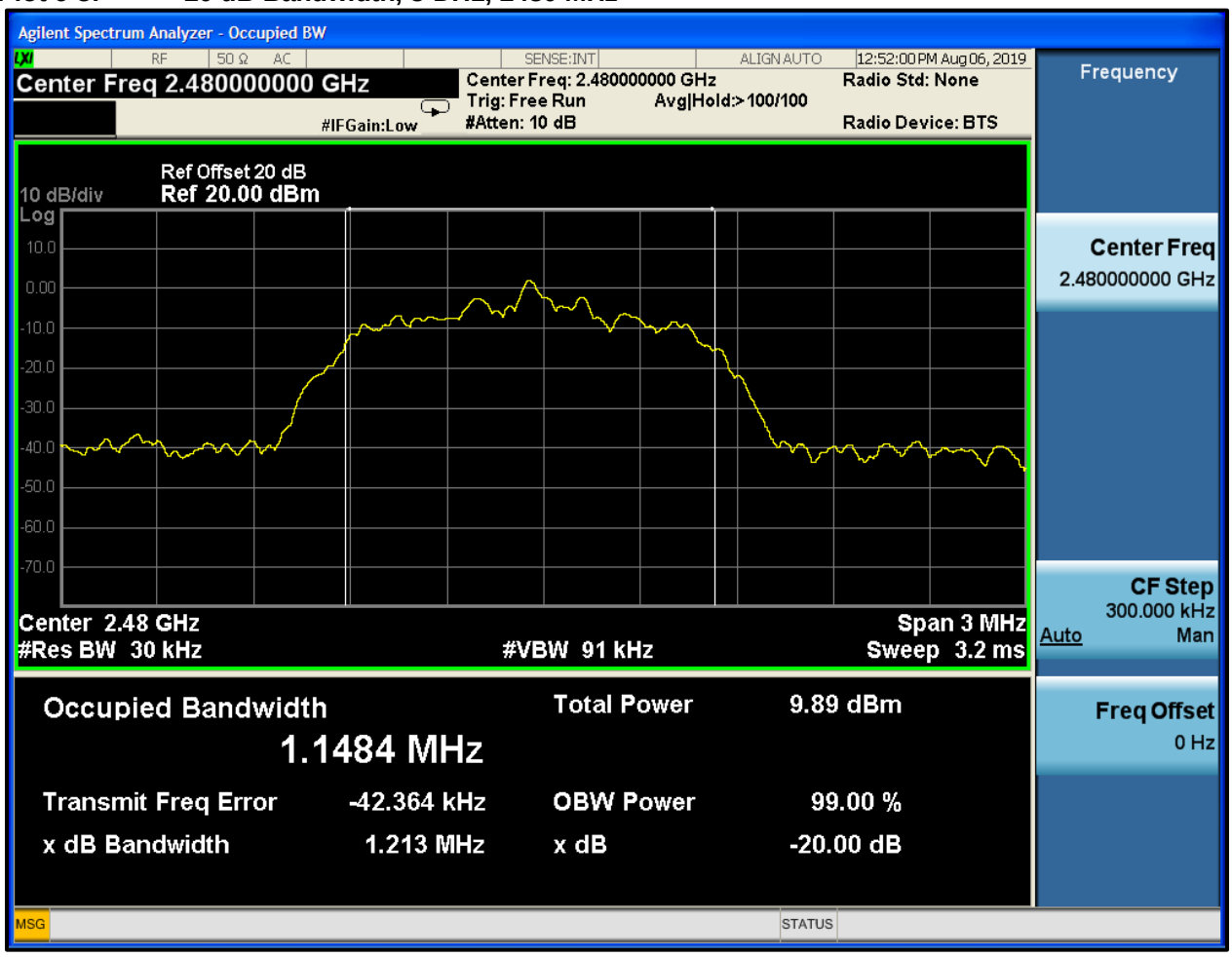
Plot 6-1: 20 dB Bandwidth, 3-DH1, 2402 MHz



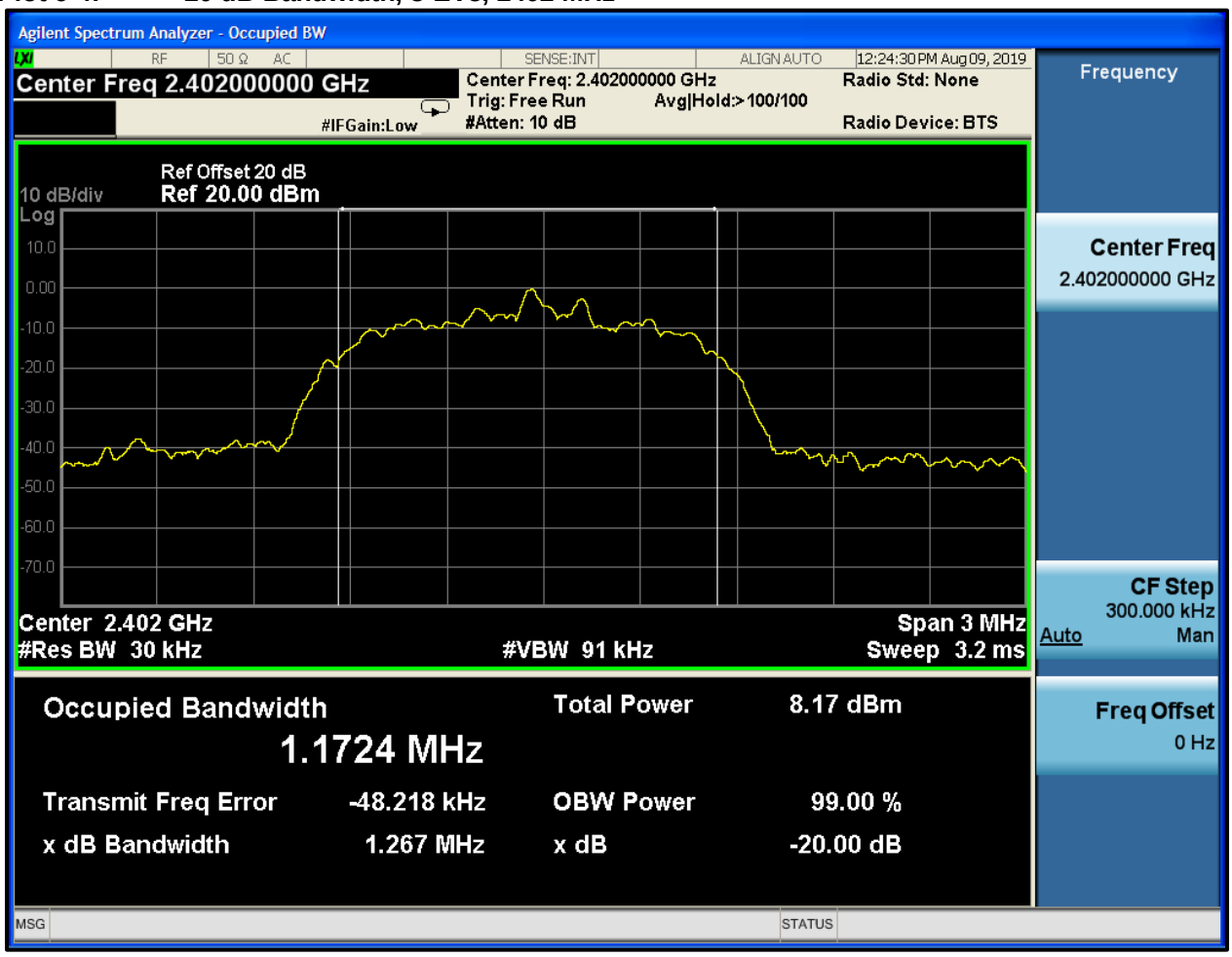
Plot 6-2: 20 dB Bandwidth, 3-DH1, 2441 MHz



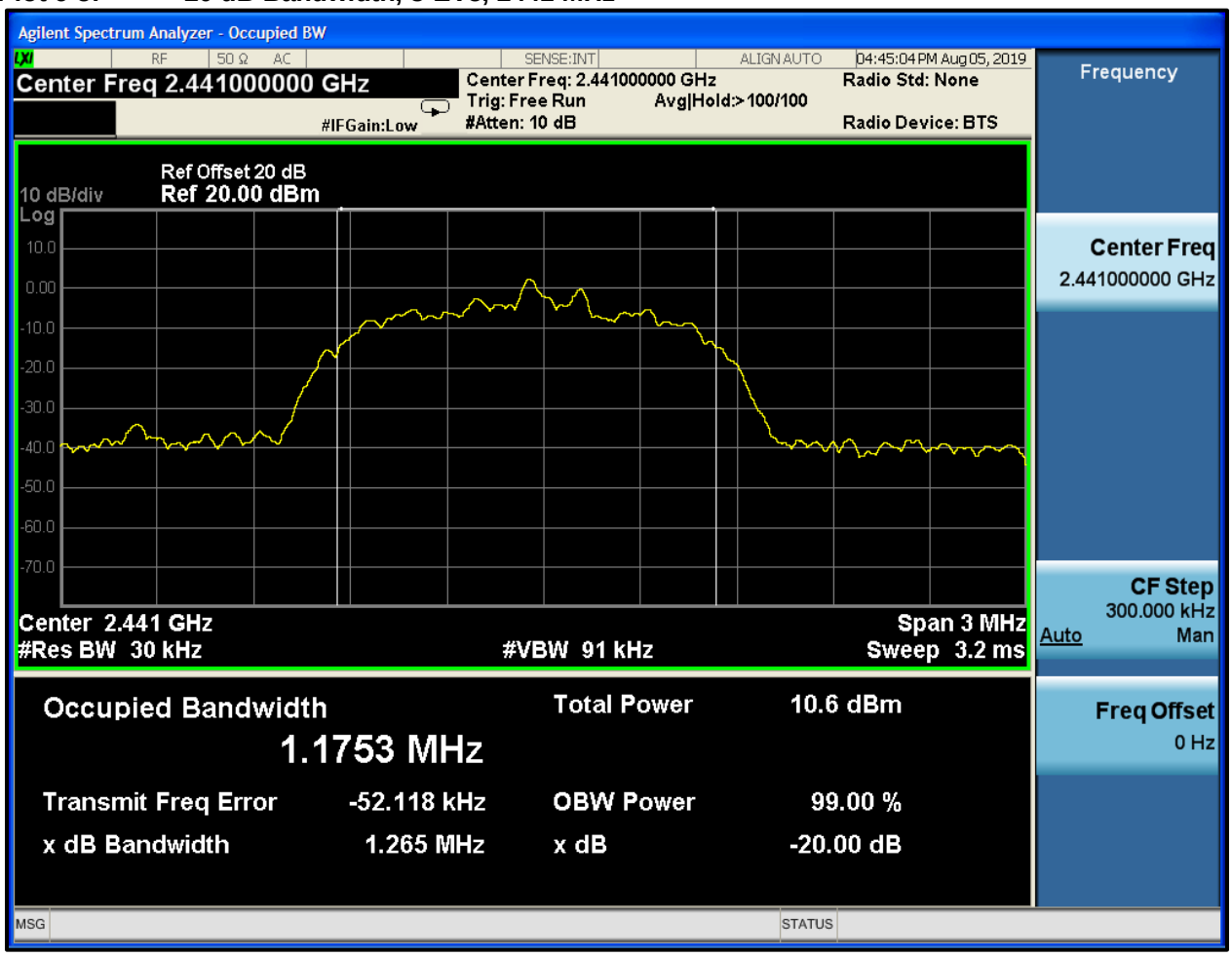
Plot 6-3: 20 dB Bandwidth, 3-DH1, 2480 MHz



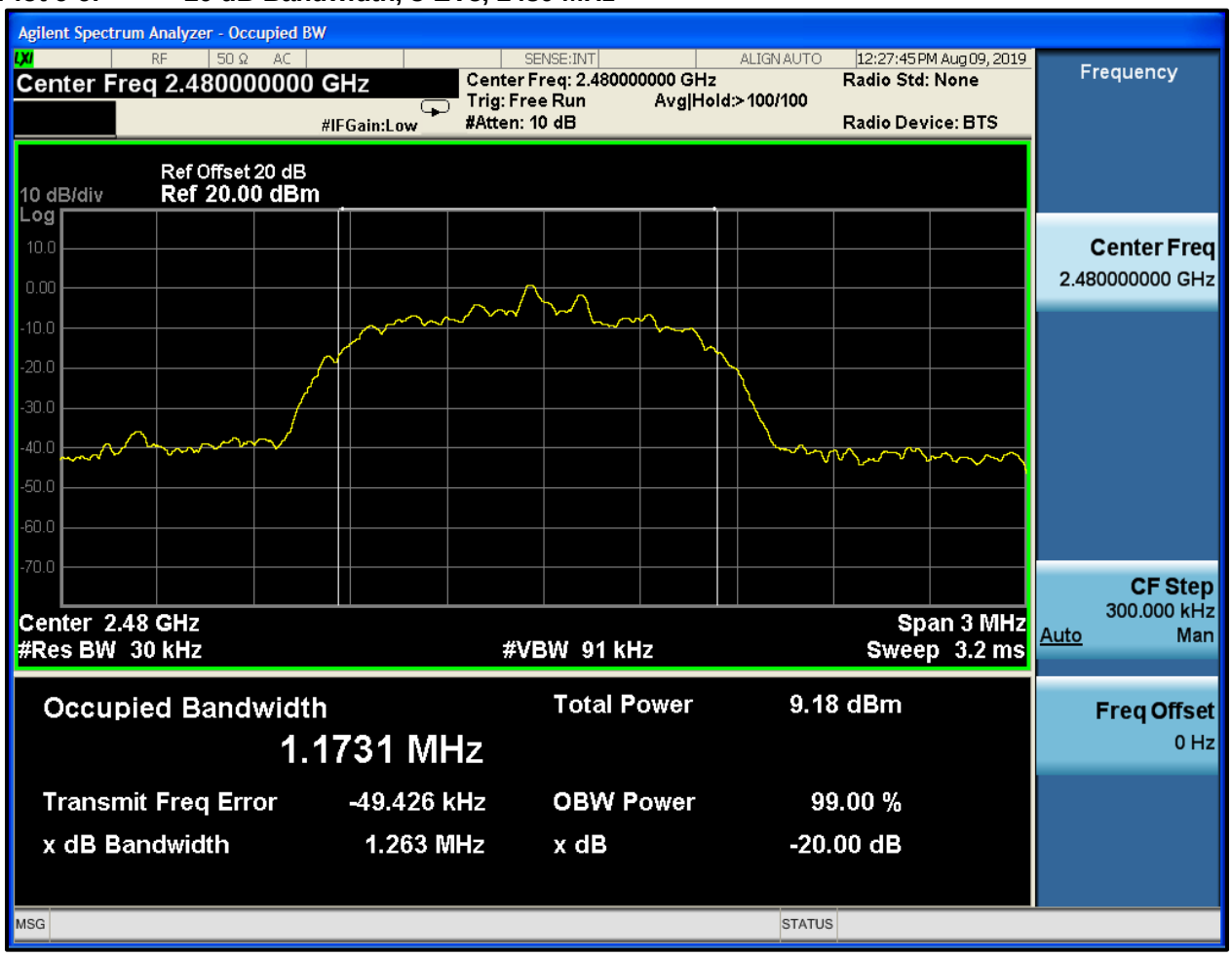
Plot 6-4: 20 dB Bandwidth, 3-EV5, 2402 MHz



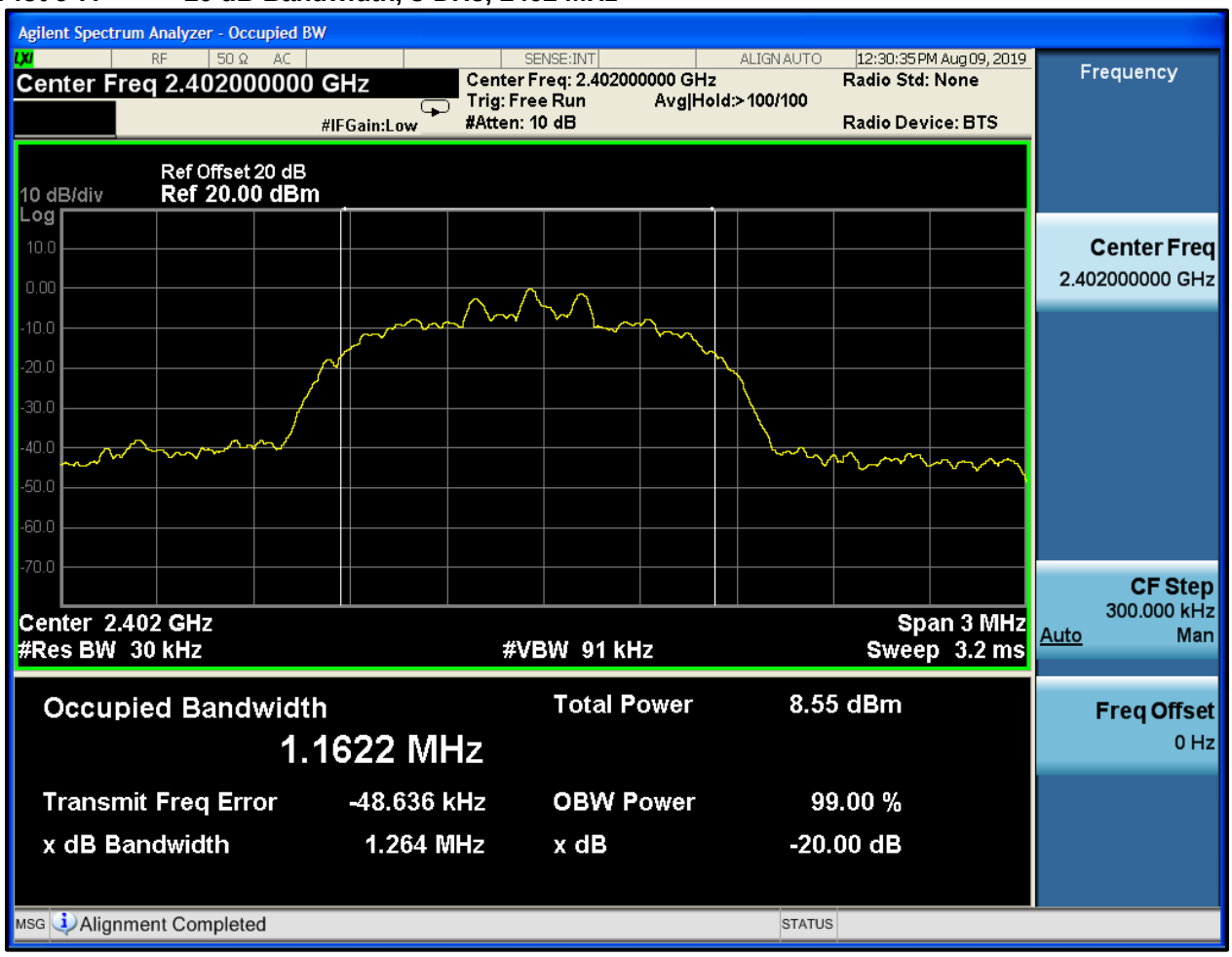
Plot 6-5: 20 dB Bandwidth, 3-EV5, 2441 MHz



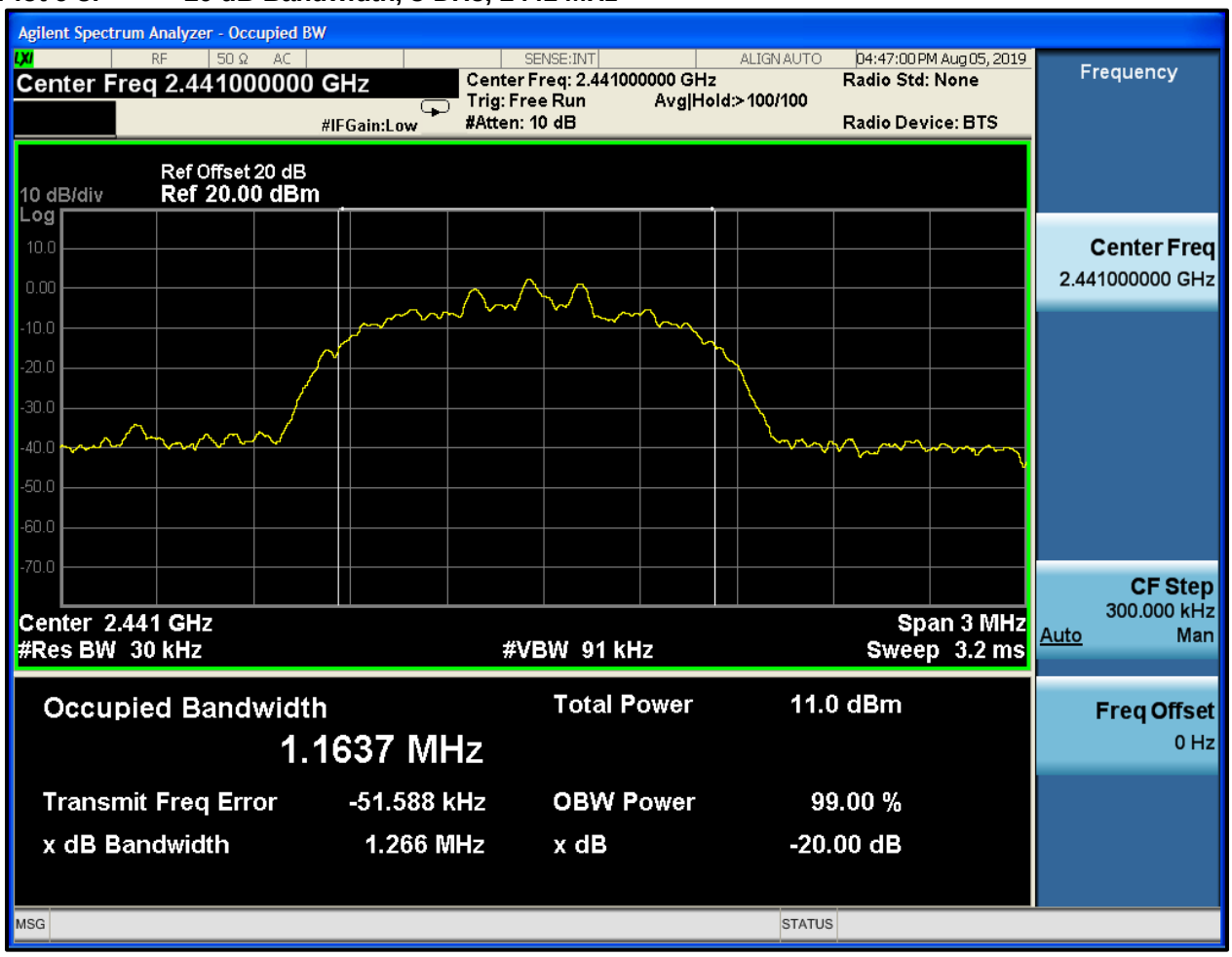
Plot 6-6: 20 dB Bandwidth, 3-EV5, 2480 MHz



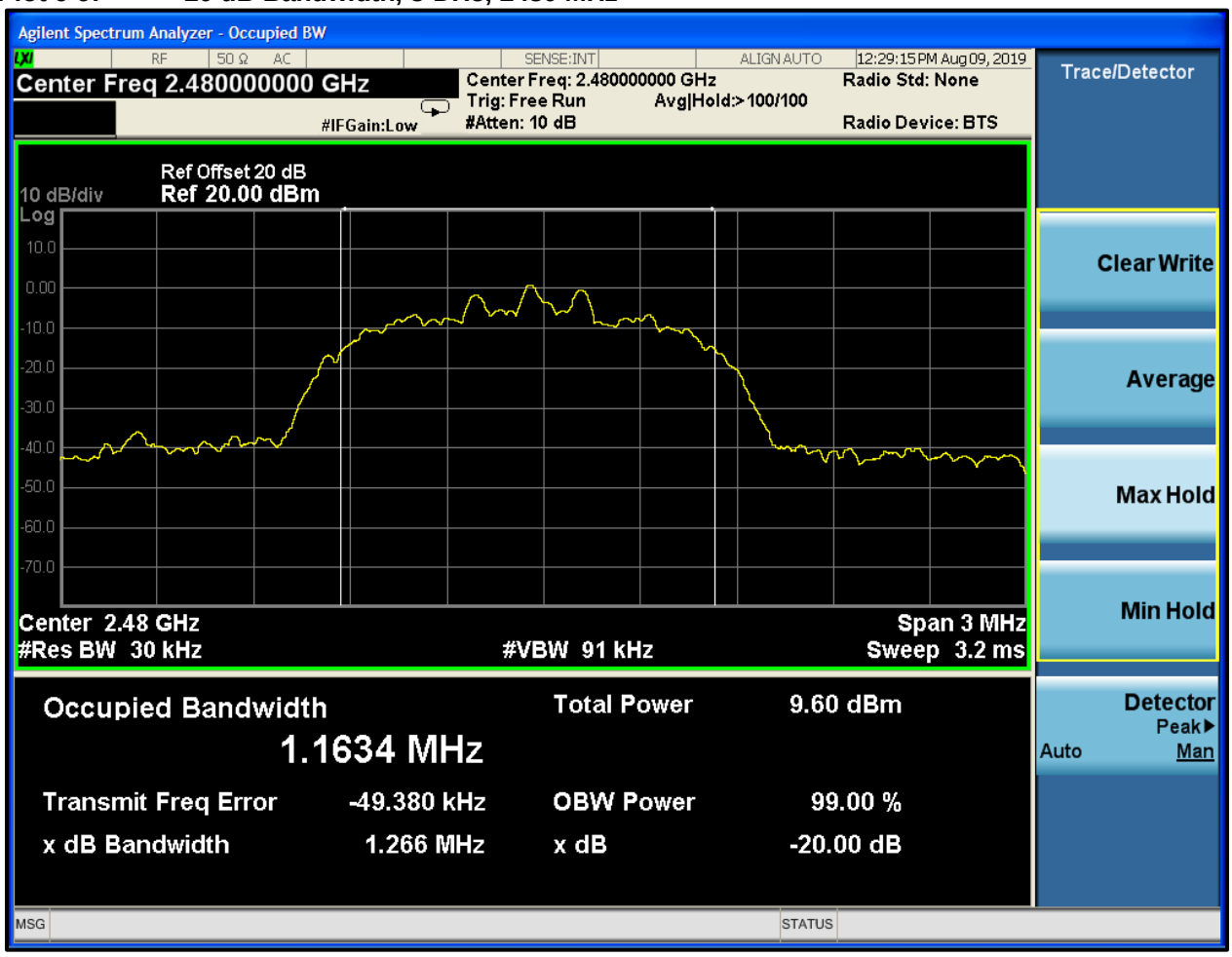
Plot 6-7: 20 dB Bandwidth, 3-DH5, 2402 MHz



Plot 6-8: 20 dB Bandwidth, 3-DH5, 2441 MHz



Plot 6-9: 20 dB Bandwidth, 3-DH5, 2480 MHz



Frequency uncertainty: ±1 x 10^{-6} Hz. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Test Personnel:

Khue Do		August 5, 6 & 9, 2019
Test Engineer	Signature	Dates of Test

7 Occupied Bandwidth – ISED RSS-Gen 6.7

7.1 99% Bandwidth Test Procedure

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

• The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

• The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.

• The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

Table 7-1: 99% Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901521	MA/COM	2082-6174-20	Attenuator, 20 dB 2 W, DC – 4 GHz	N/A	08/07/20
901583	Agilent Technologies	EXA N9010A	Signal Analyzer	MY51250846	02/06/20

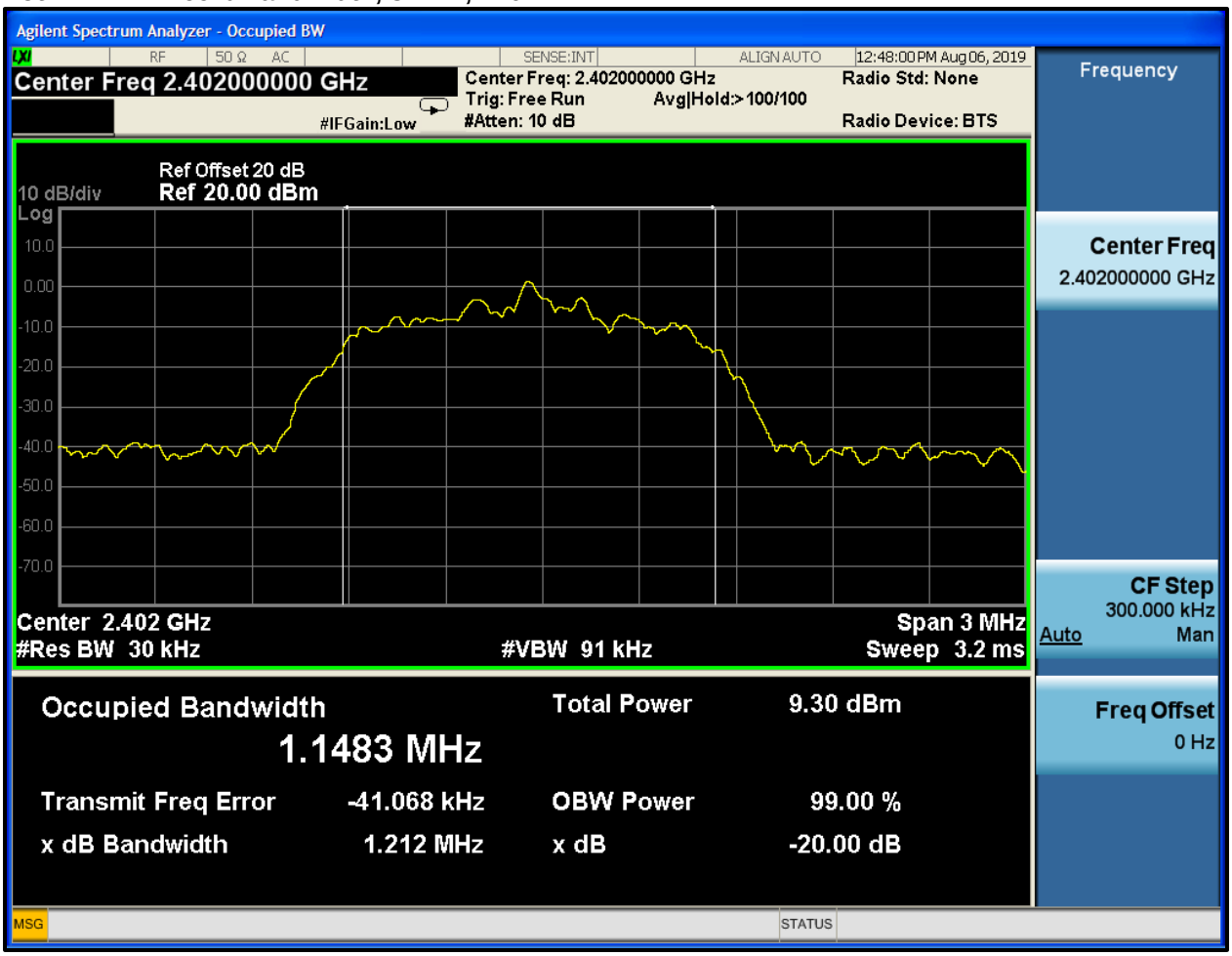
7.2 99% Bandwidth Test Results

Table 7-2: 99% Bandwidth Test Data

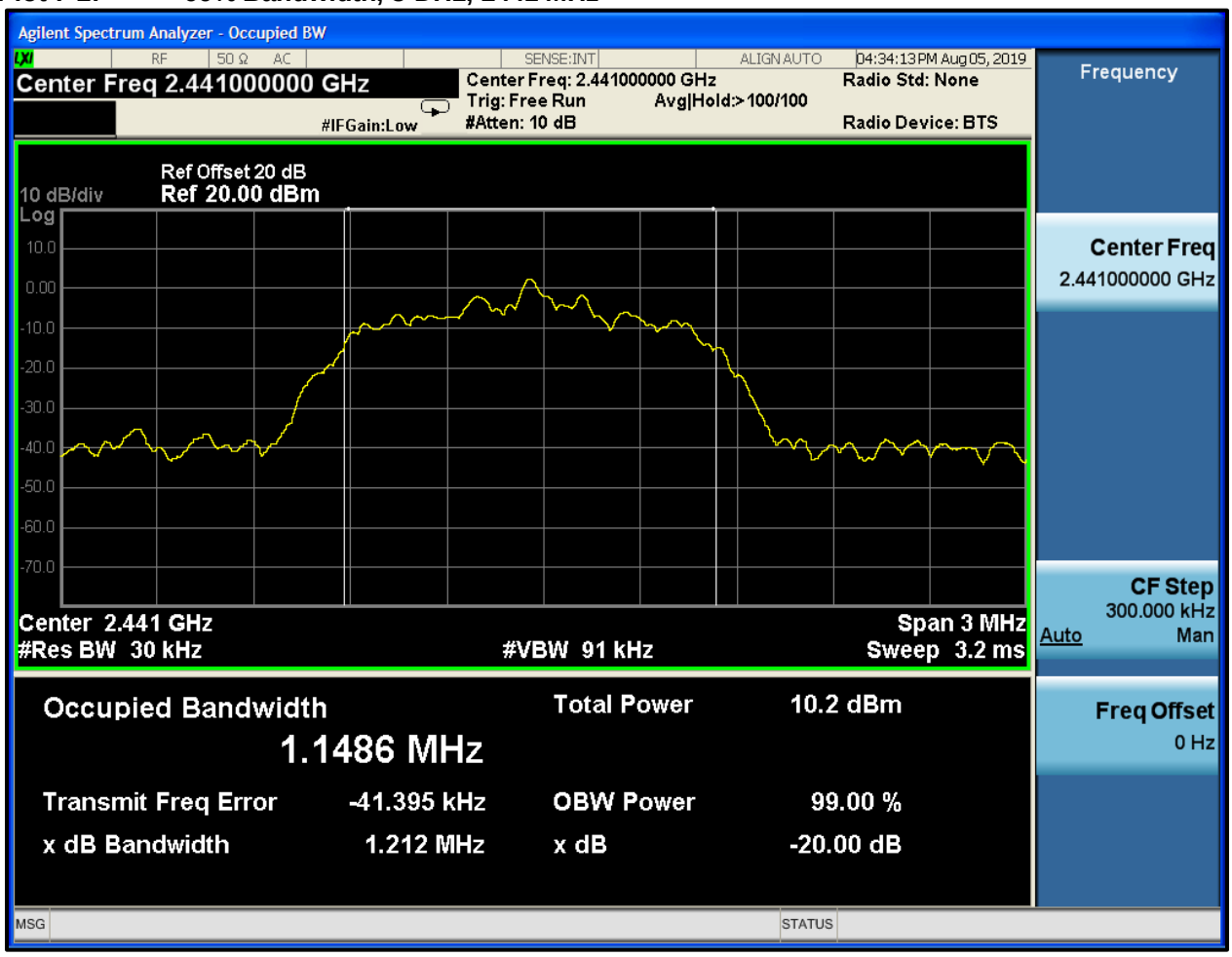
Packet Type	Frequency (MHz)	99% Bandwidth (MHz)
3-DH1	2402	1.148
3-DH1	2441	1.149
3-DH1	2480	1.148
3-EV5	2402	1.172
3-EV5	2441	1.175
3-EV5	2480	1.173
3-DH5	2402	1.162
3-DH5	2441	1.164
3-DH5	2480	1.163

7.3 99% Bandwidth Plots

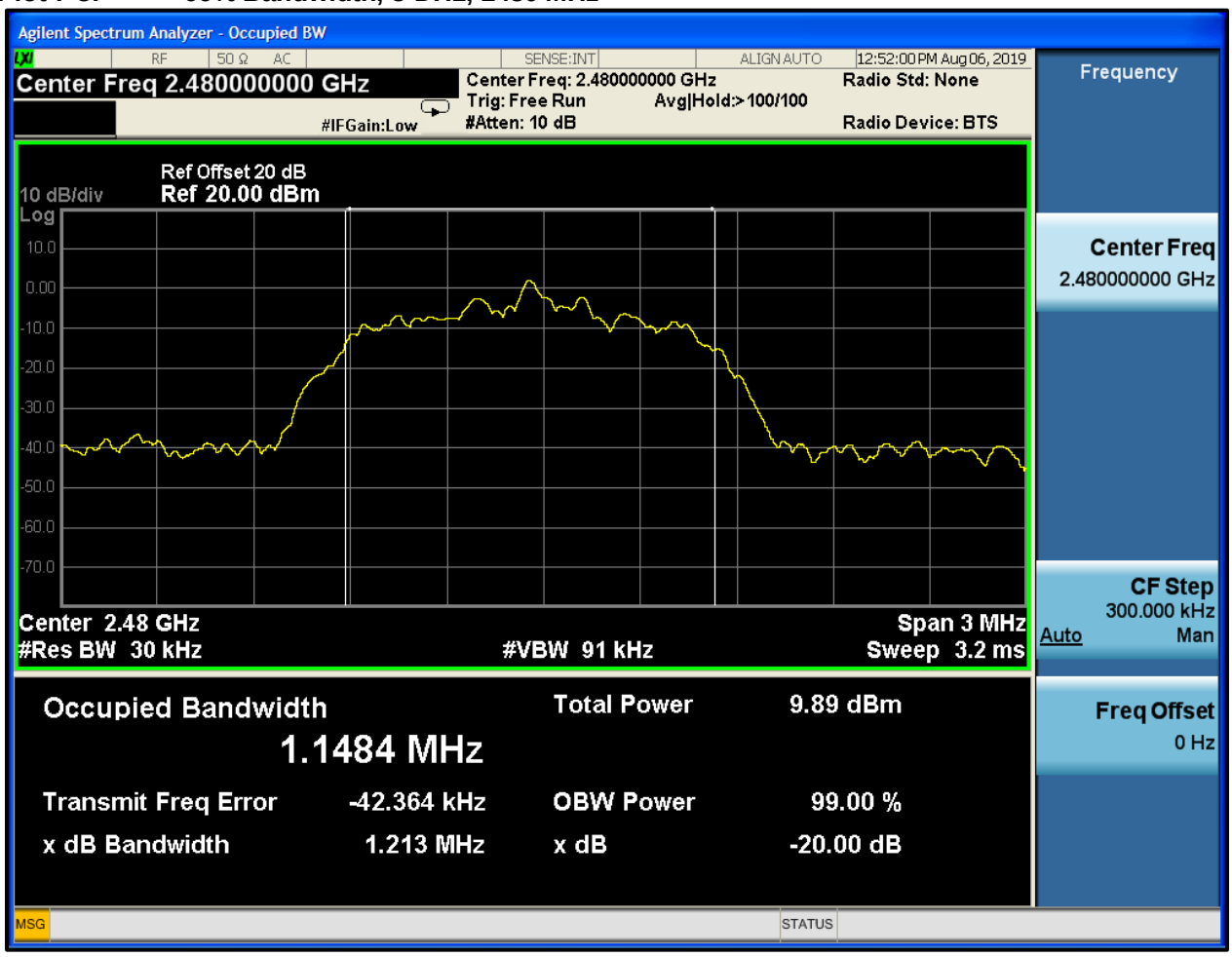
Plot 7-1: 99% Bandwidth, 3-DH1, 2402 MHz



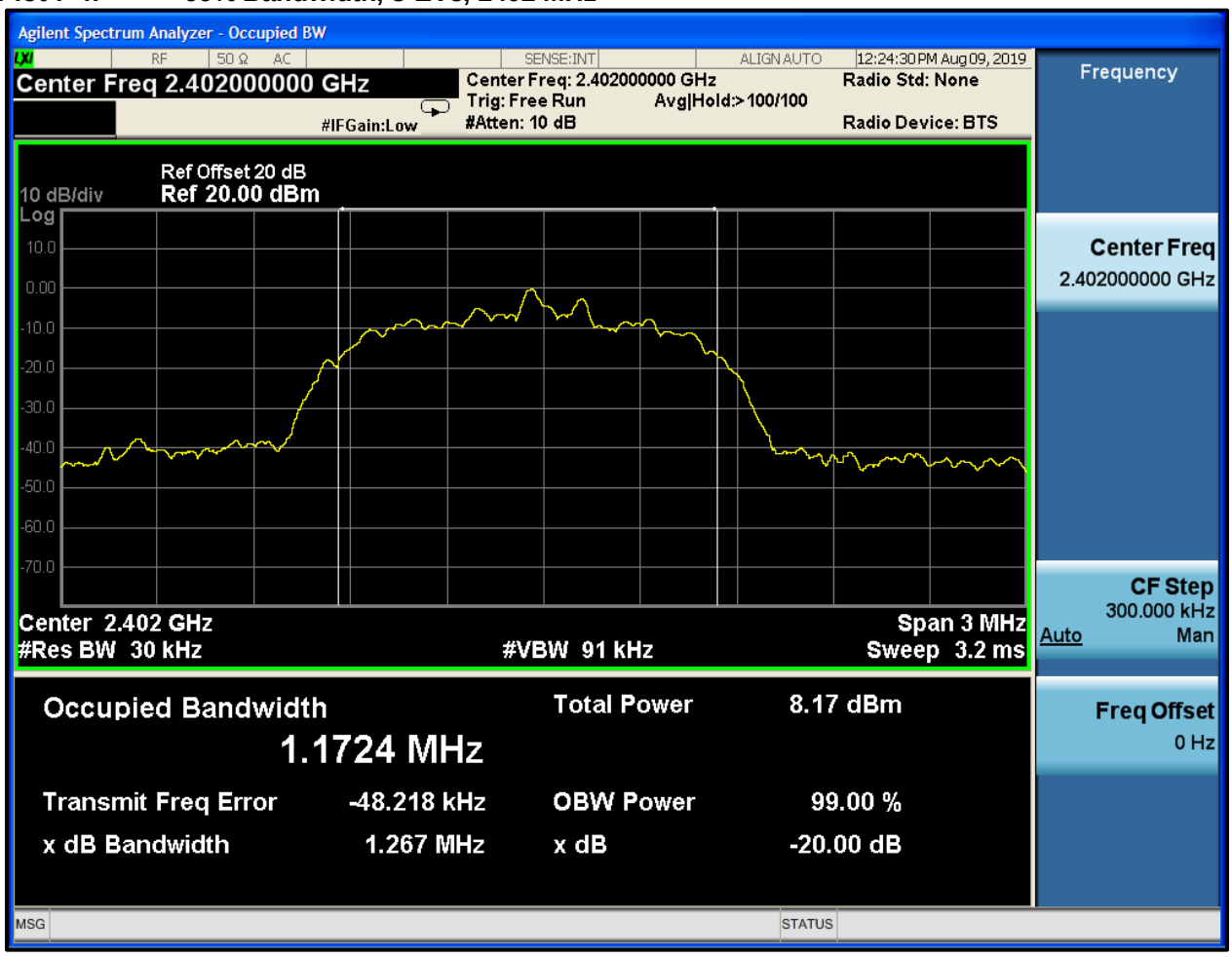
Plot 7-2: 99% Bandwidth, 3-DH1, 2441 MHz



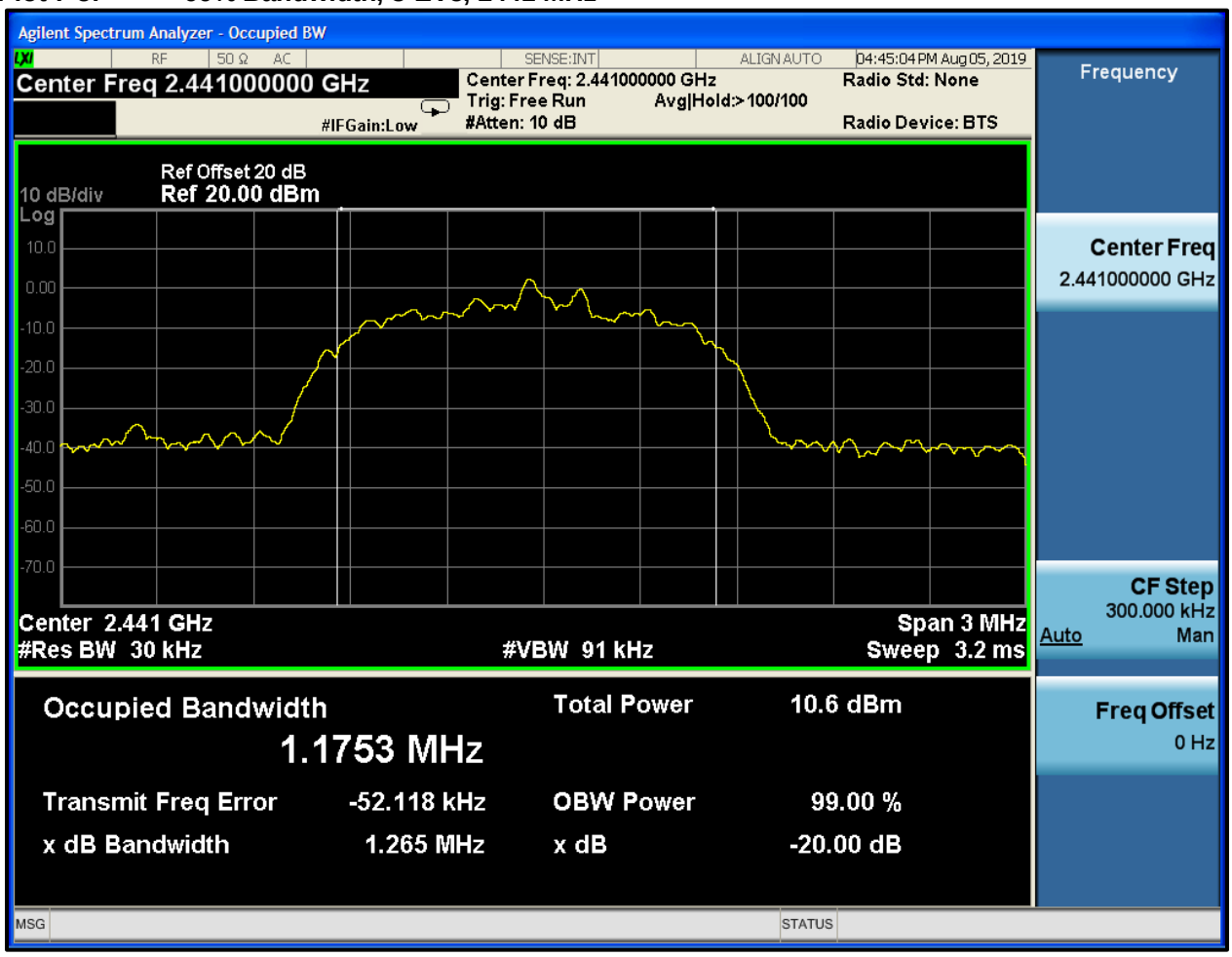
Plot 7-3: 99% Bandwidth, 3-DH1, 2480 MHz



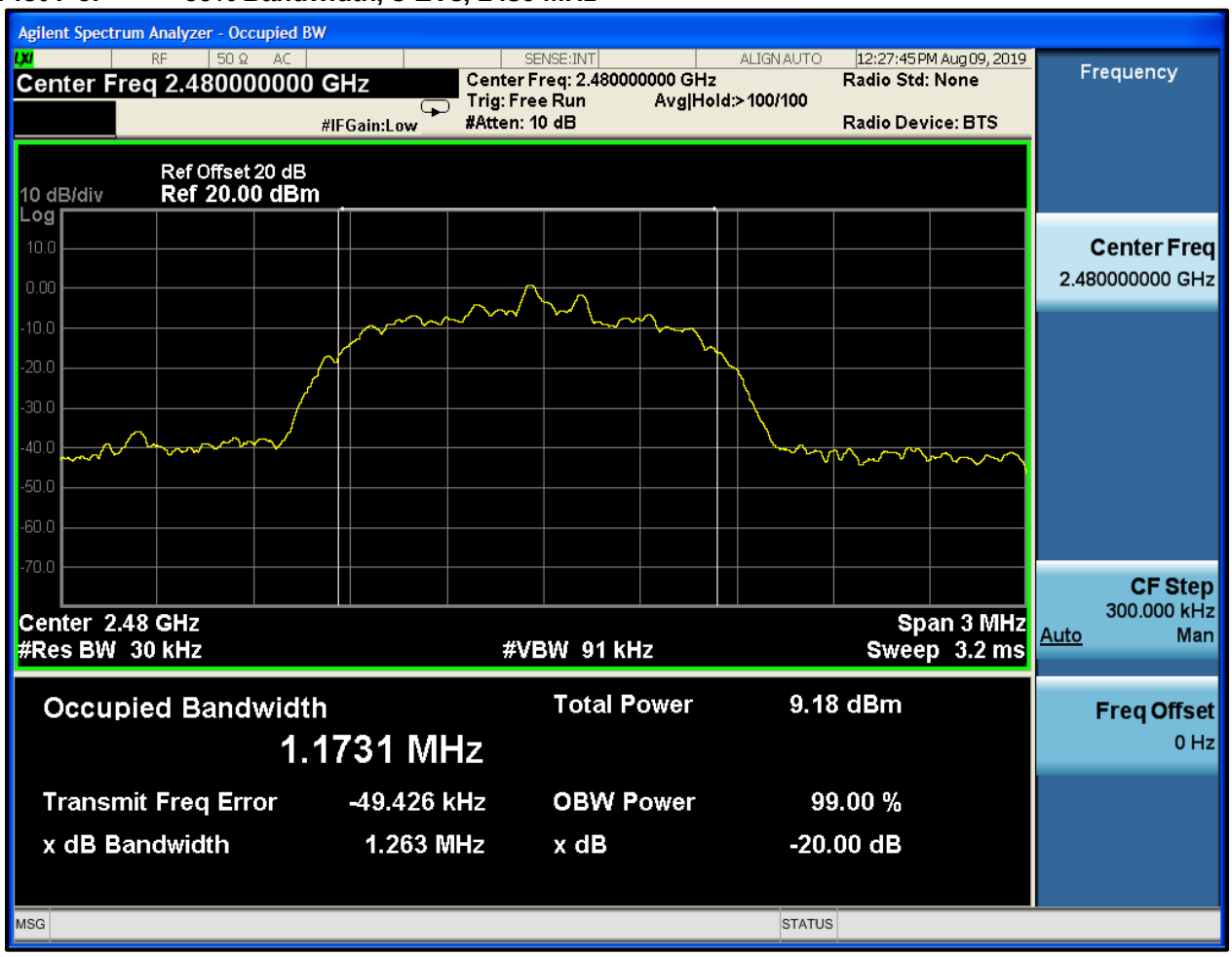
Plot 7-4: 99% Bandwidth, 3-EV5, 2402 MHz



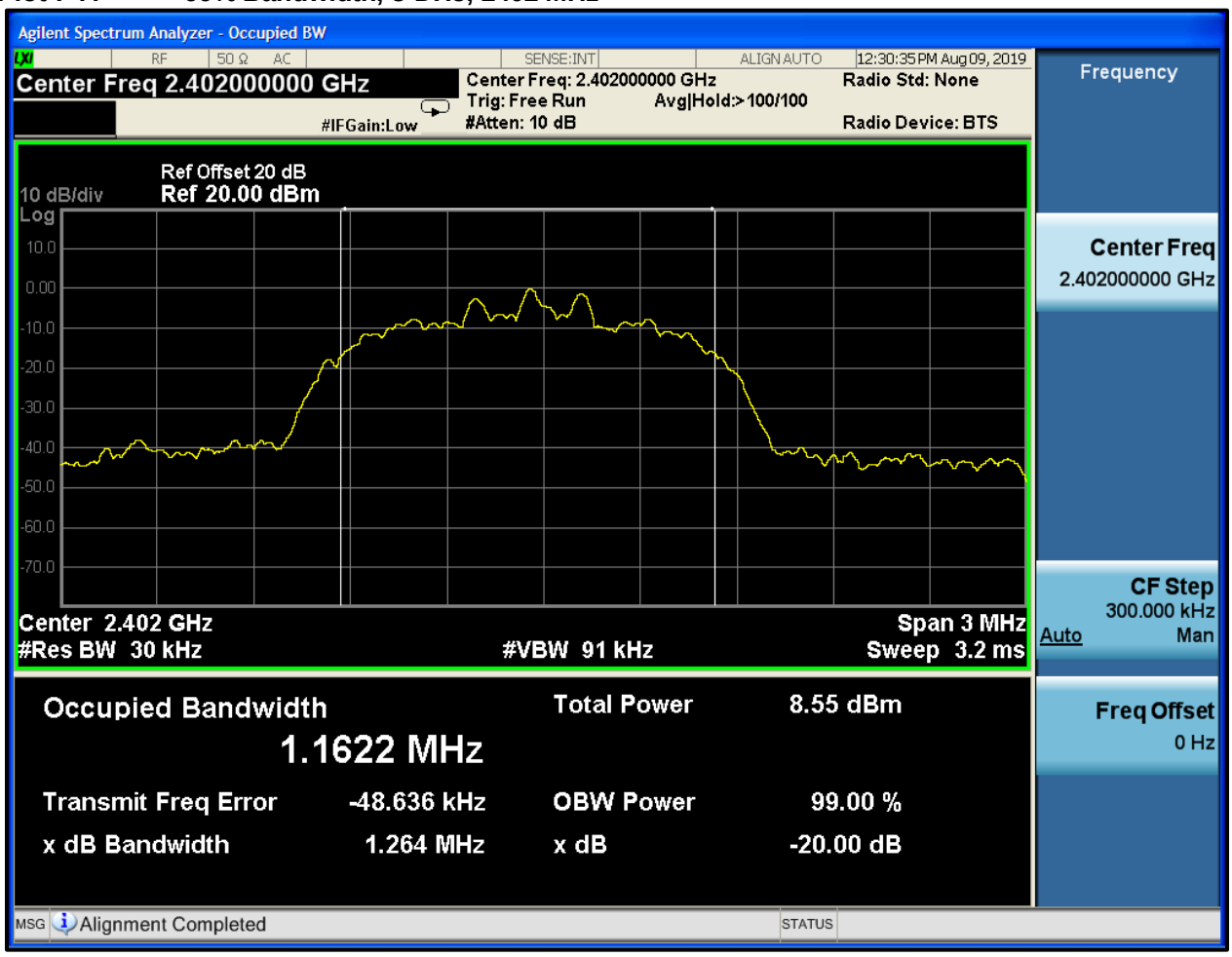
Plot 7-5: 99% Bandwidth, 3-EV5, 2441 MHz



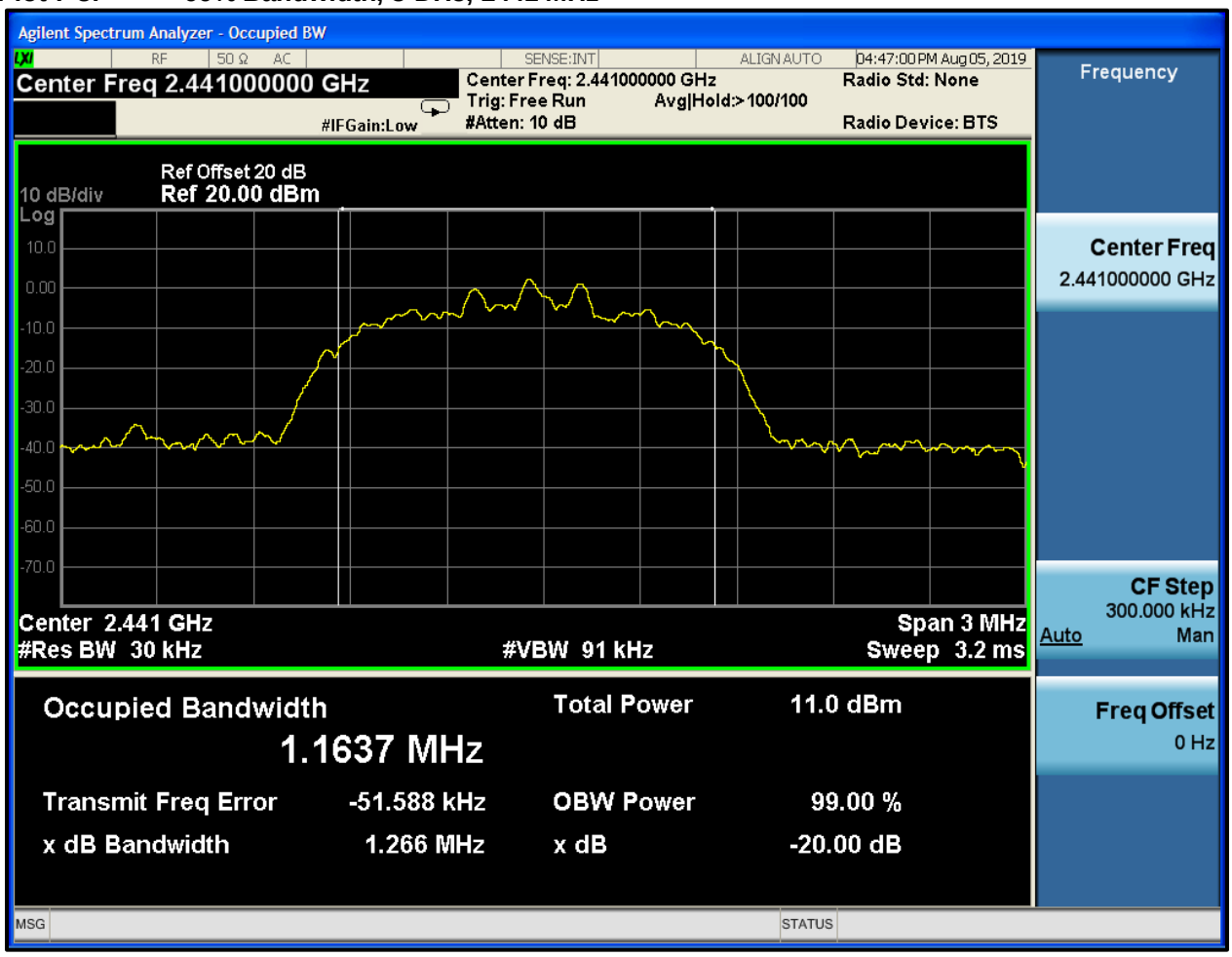
Plot 7-6: 99% Bandwidth, 3-EV5, 2480 MHz



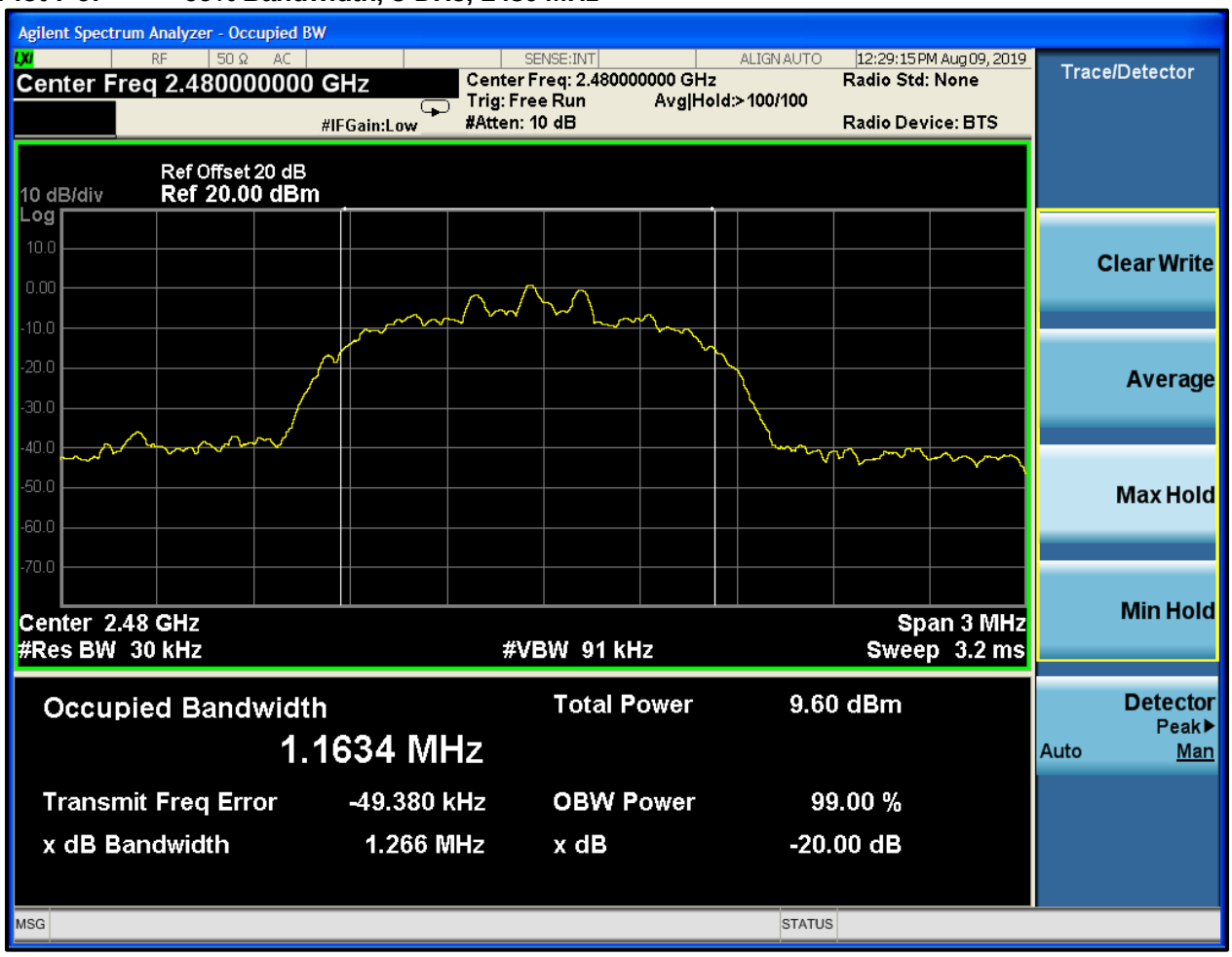
Plot 7-7: 99% Bandwidth, 3-DH5, 2402 MHz



Plot 7-8: 99% Bandwidth, 3-DH5, 2441 MHz

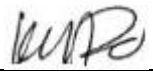


Plot 7-9: 99% Bandwidth, 3-DH5, 2480 MHz



Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty = ±2 dB.

Test Personnel:

Khue Do		August 5, 6 & 9, 2019
Test Engineer	Signature	Dates of Test

8 Carrier Frequency Separation – FCC 15.247(a)(1); ISED RSS-247 5.1(b)

8.1 Carrier Frequency Separation Test Procedure

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

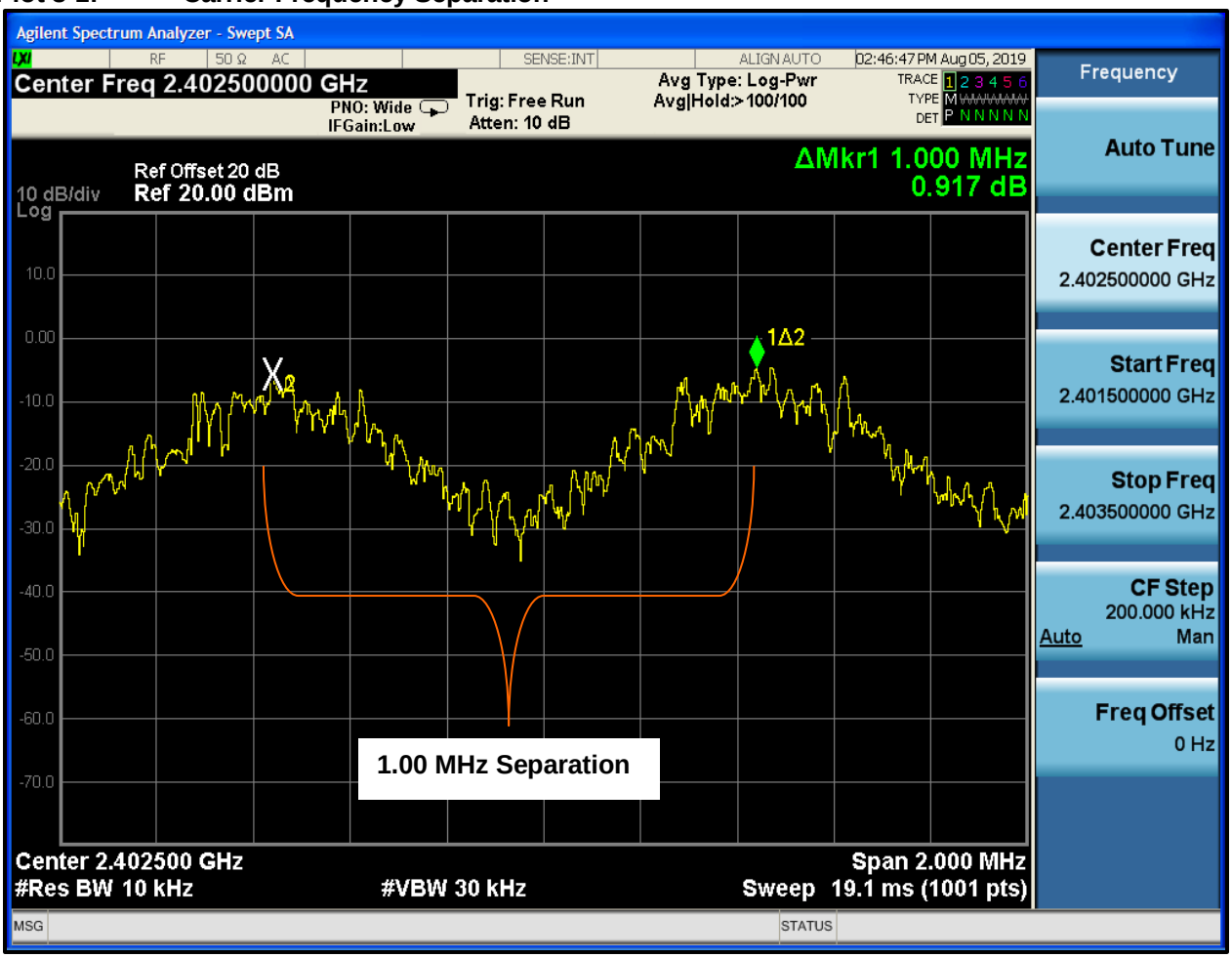
Measured frequency separation = 1.00 MHz

Table 8-1: Carrier Frequency Separation Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901521	MA/COM	2082-6174-20	Attenuator, 20 dB 2 W, DC – 4 GHz	N/A	08/07/20
901583	Agilent Technologies	EXA N9010A	Signal Analyzer	MY51250846	02/06/20

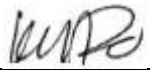
8.2 Carrier Frequency Separation Test Results

Plot 8-1: Carrier Frequency Separation



Frequency uncertainty: ±1 x 10^{-6} Hz. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Test Personnel:

Khue Do		August 5, 2019
Test Engineer	Signature	Date of Test

9 Hopping Characteristics – FCC 15.247(a)(1)(iii); ISED RSS-247 5.1(d)

9.1 Hopping Characteristics Test Procedure

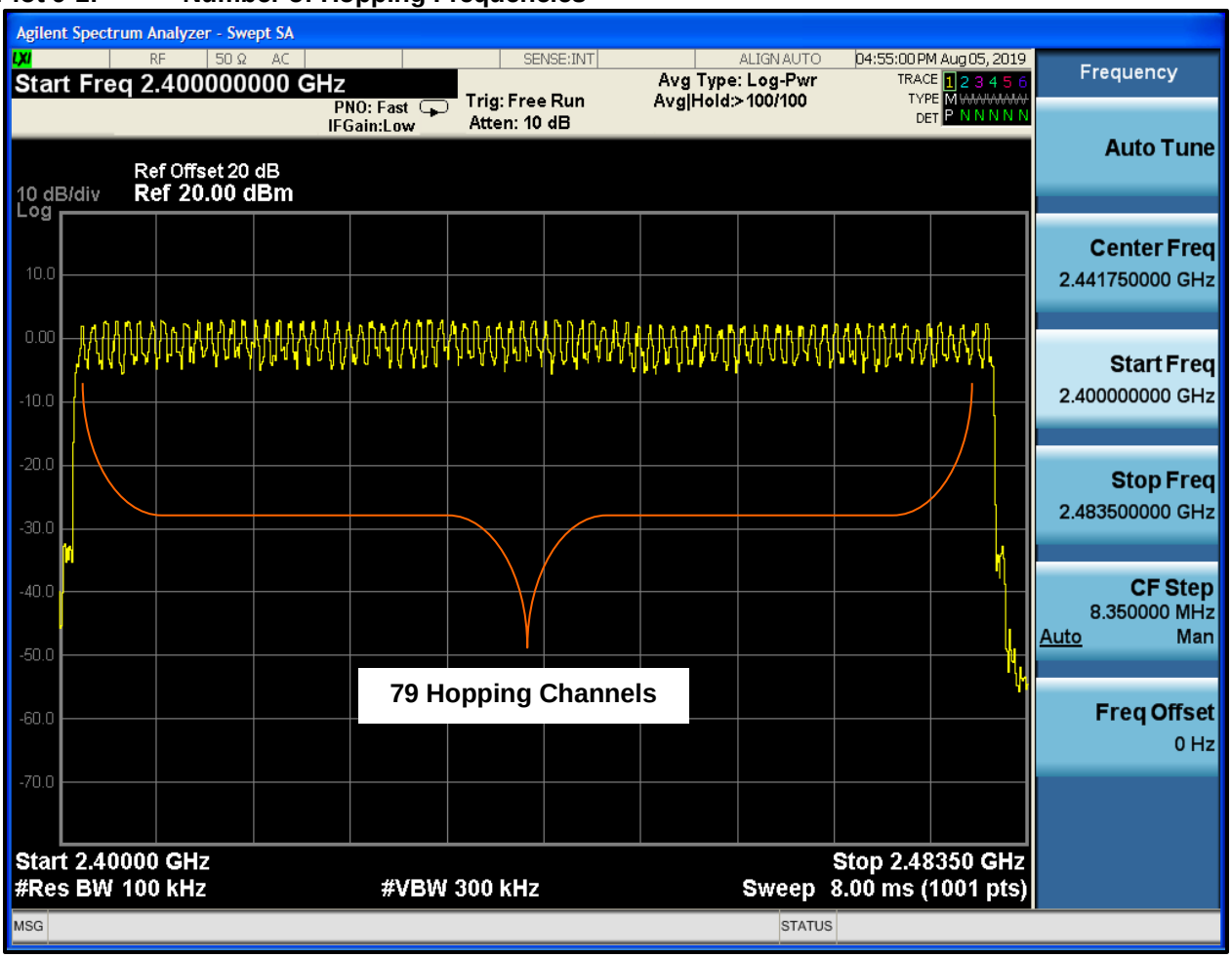
Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels is used.

Table 9-1: Hopping Characteristics Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901521	MA/COM	2082-6174-20	Attenuator, 20 dB 2 W, DC – 4 GHz	N/A	08/07/20
901583	Agilent Technologies	EXA N9010A	Signal Analyzer	MY51250846	02/06/20

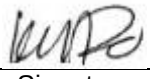
9.2 Number of Hopping Frequencies Test Results

Plot 9-1: Number of Hopping Frequencies



Frequency uncertainty: ±1 x 10^{-6} Hz. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Test Personnel:

Khue Do		August 5, 2019
Test Engineer	Signature	Date of Test

9.3 Average Time of Occupancy

The spectrum analyzer gate function was used to determine the pulse width using the gate start and stop times, with a zero span at 2441 MHz to capture a pulse from the device under test. The delta response was used to measure the dwell time for this pulse. The sweep was then set to single sweep for 31.6 s.

The number of pulses in 31.6 s varied depending on the packet type.

The average time of occupancy in the above period (31.6 s) is equal to the number of pulses multiplied by the dwell time, which meets the limit as defined by 15.247(a)(1)(iii) of 0.4 seconds.

Table 9-2: Average Time of Occupancy Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901521	MA/COM	2082-6174-20	Attenuator, 20 dB 2 W, DC – 4 GHz	N/A	08/07/20
901583	Agilent Technologies	EXA N9010A	Signal Analyzer	MY51250846	02/06/20

9.4 Average Time of Occupancy Test Results

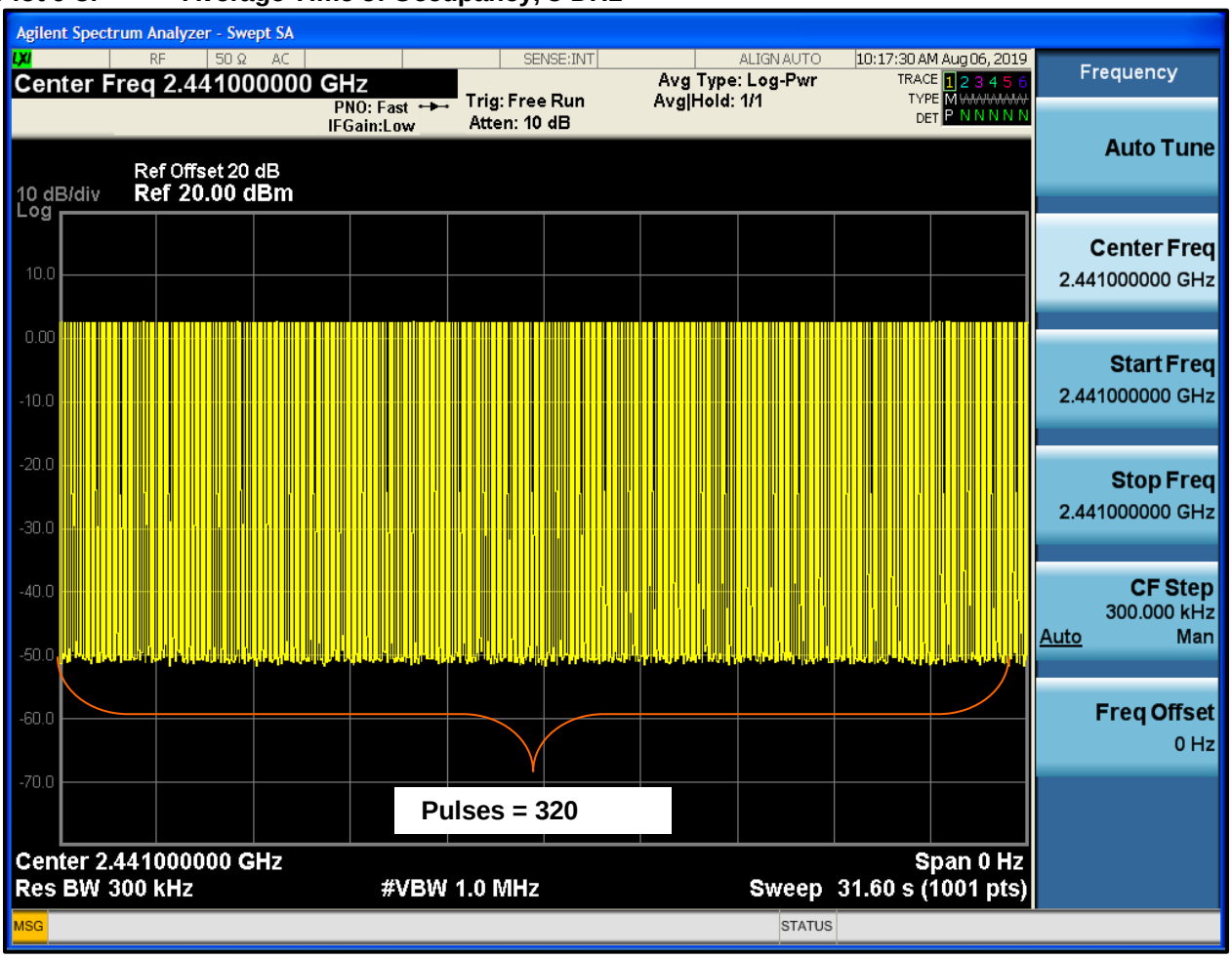
Table 9-3: Average Time of Occupancy Test Data

Packet Type	Dwell (µs)	# of Pulses (N)	ATO (ms)	Limit (ms)	Result (Pass / Fail)
DM1	396.0	320	126.7	400.0	PASS
DH1	396.0	320	126.7	400.0	PASS
HV1	389.0	320	124.5	400.0	PASS
HV2	389.0	320	124.5	400.0	PASS
HV3	389.0	320	124.5	400.0	PASS
DM3	1641.0	160	262.6	400.0	PASS
DH3	1641.0	160	262.6	400.0	PASS
EV4	1611.0	160	257.8	400.0	PASS
EV5	1593.0	160	254.9	400.0	PASS
DM5	2885.0	110	317.4	400.0	PASS
DH5	2880.0	110	316.8	400.0	PASS
2-DH1	400.0	320	128.0	400.0	PASS
2-EV3	416.0	320	133.1	400.0	PASS
3-EV3	412.8	320	132.1	400.0	PASS
3-DH1*	400.8	320	128.3	400.0	PASS
2-DH3	1650.0	160	264.0	400.0	PASS
3-DH3	1650.0	160	264.0	400.0	PASS
2-EV5	1614.0	160	258.2	400.0	PASS
3-EV5*	1611.0	160	257.8	400.0	PASS
2-DH5	2890.0	110	317.9	400.0	PASS
3-DH5*	2890.0	110	317.9	400.0	PASS

Note*: Data presentation narrowed down to these packet types due to their variation in transmit time and high output power.

Plot 9-2: Dwell Time, 3-DH1

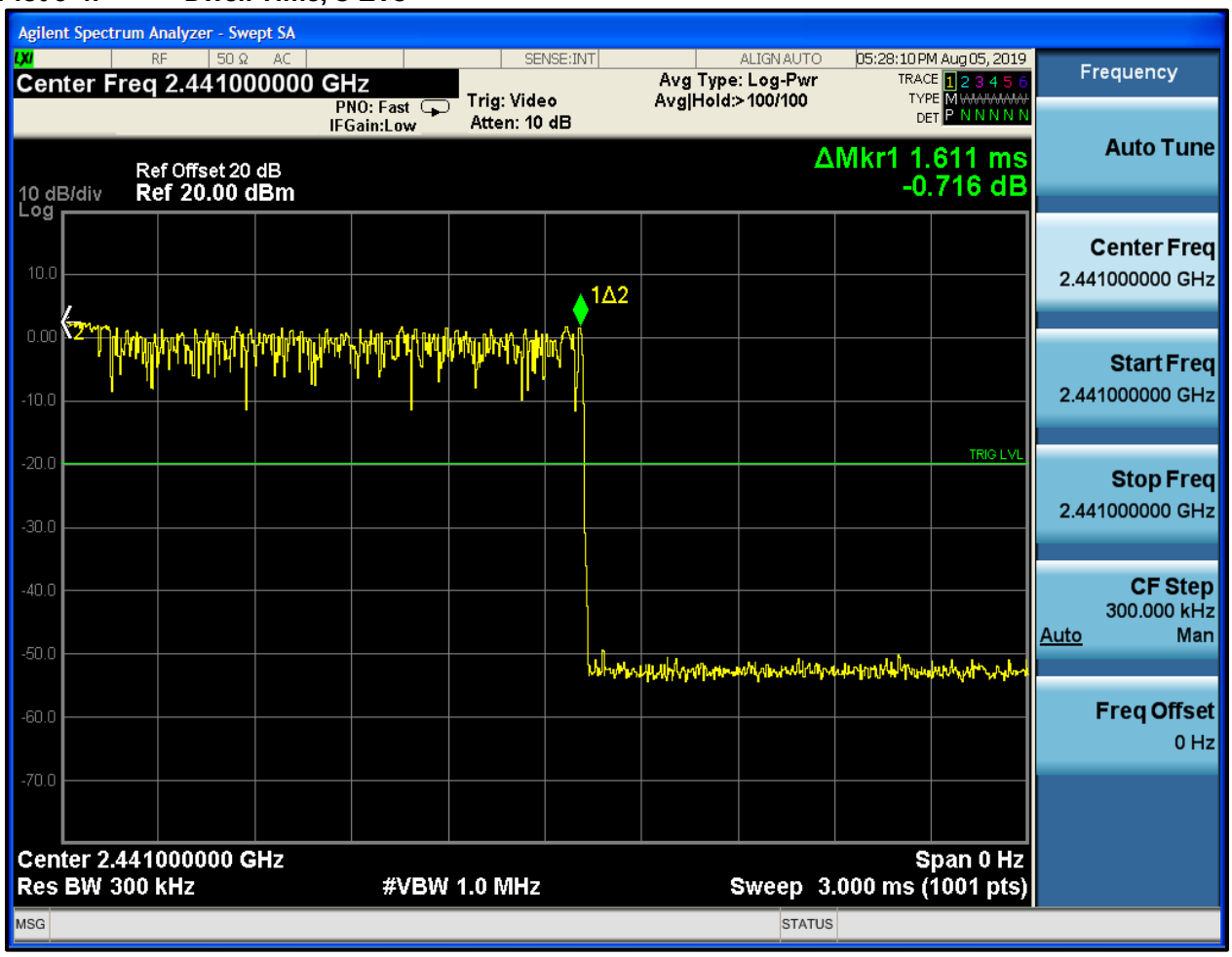
Plot 9-3: Average Time of Occupancy, 3-DH1



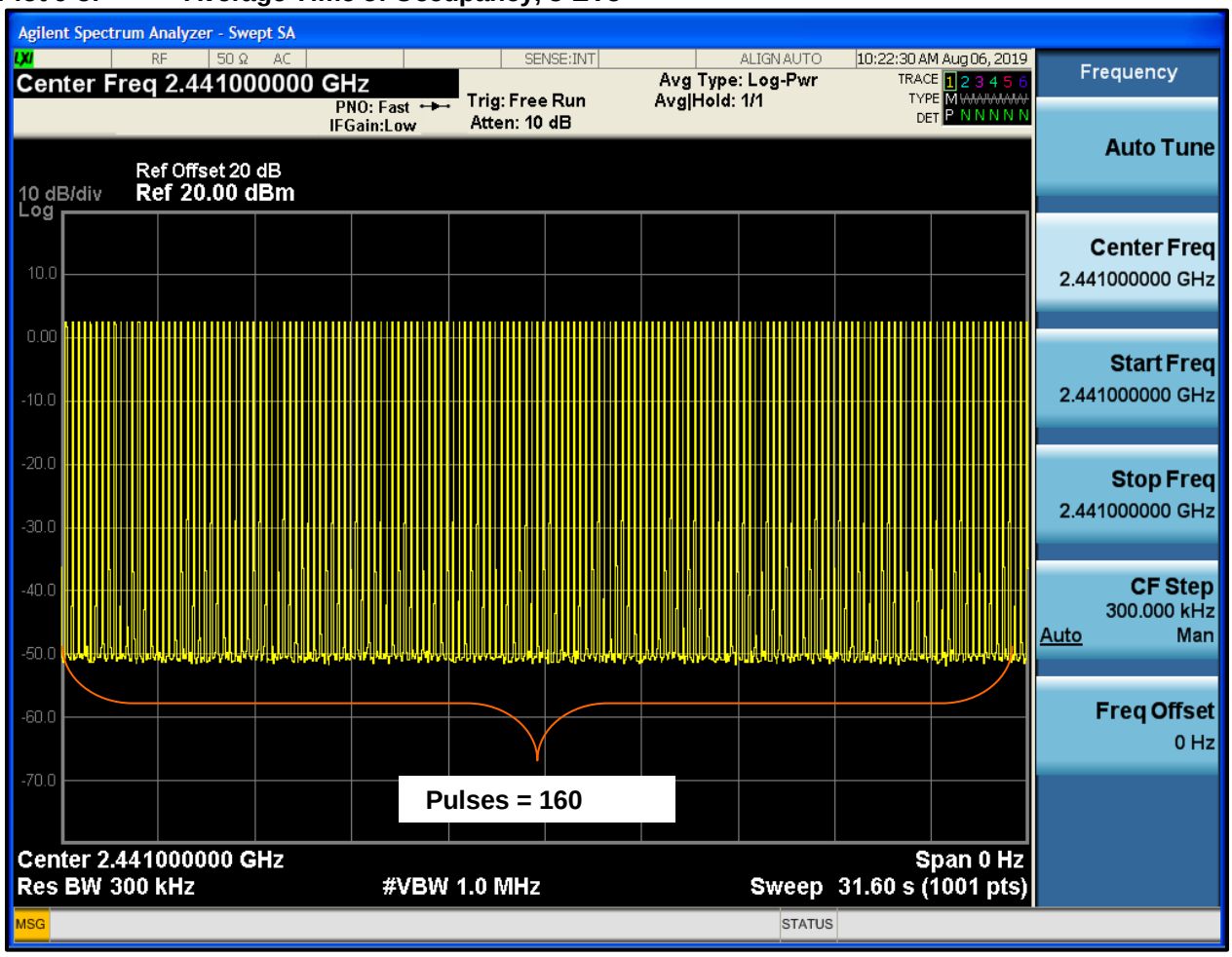
Number of pulses in 31.6 seconds: 320

The pulse width of 0.401 ms x 320 = 128.3 ms, less than the limit of 400.0 ms.

Plot 9-4: Dwell Time, 3-EV5



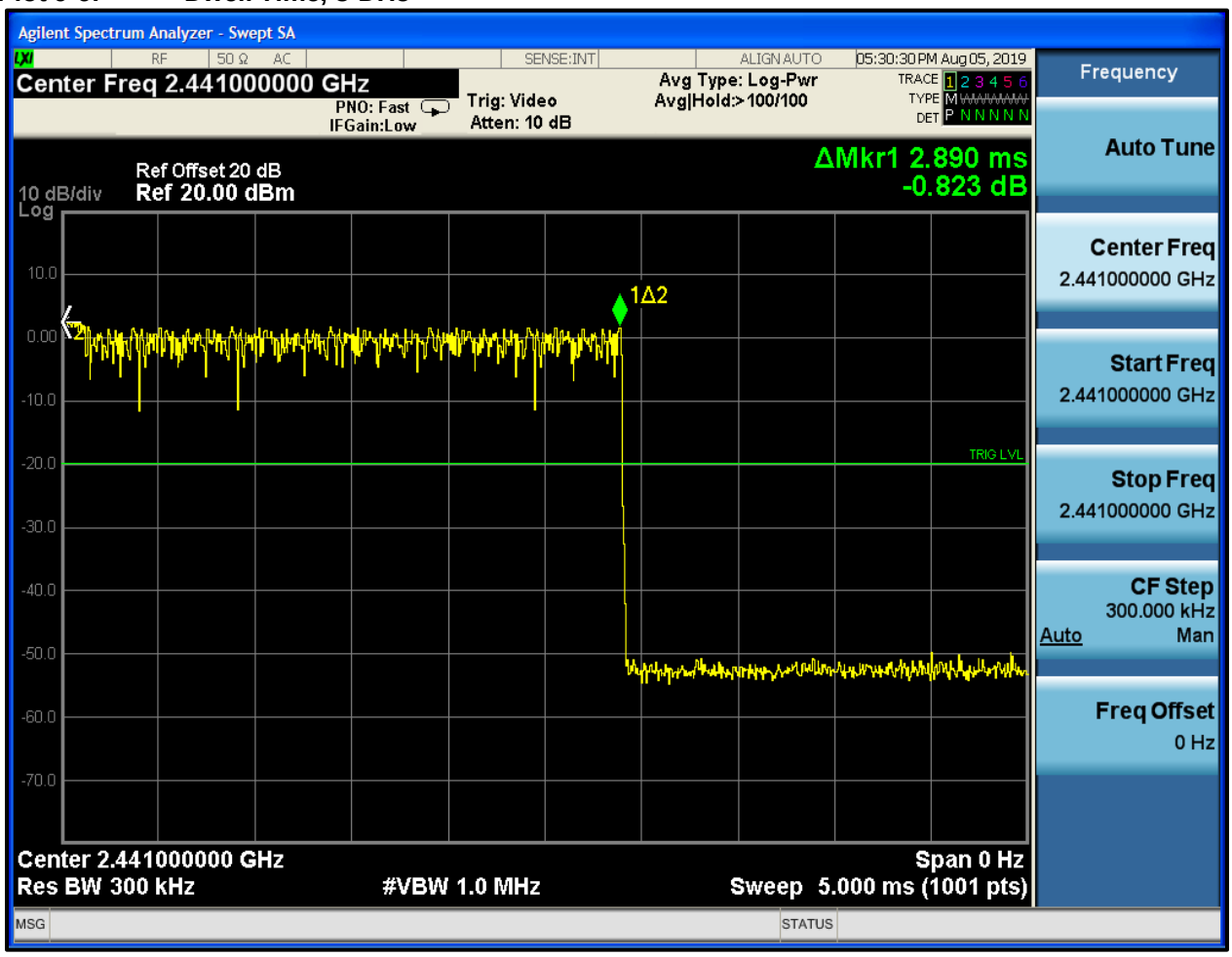
Plot 9-5: Average Time of Occupancy, 3-EV5



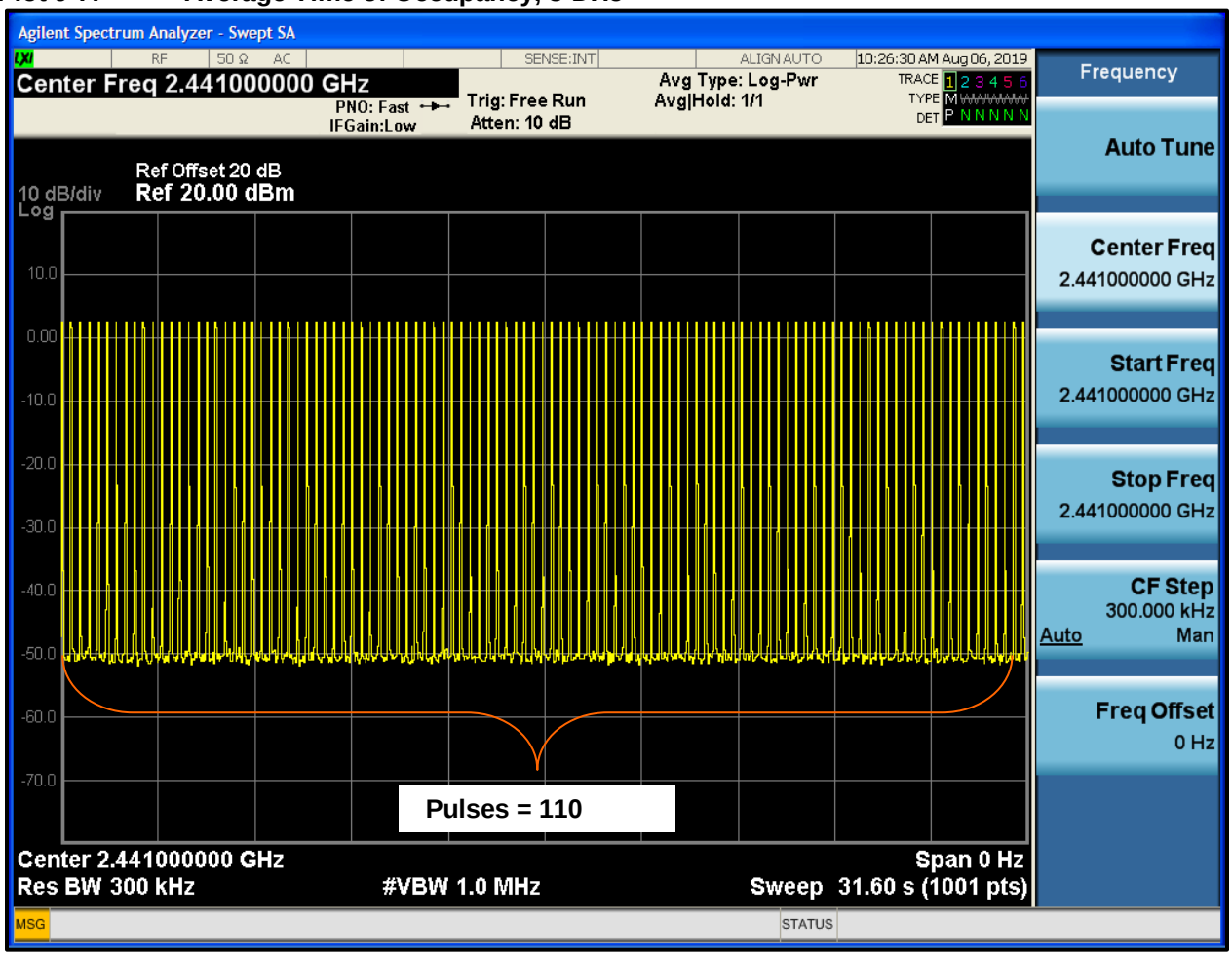
Number of pulses in 31.6 seconds: 160

The pulse width of 1.611 ms x 160 = 257.8 ms, less than the limit of 400.0 ms.

Plot 9-6: Dwell Time, 3-DH5



Plot 9-7: Average Time of Occupancy, 3-DH5



Number of pulses in 31.6 seconds: 110

The pulse width of 2.890 ms x 110 = 317.9 ms, less than the limit of 400.0 ms.

Frequency uncertainty: ±1 x 10^{-6} Hz. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Test Personnel:

Khue Do		August 5 & 6, 2019
Test Engineer	Signature	Dates of Test

10 Duty Cycle

The EUT was set to hopping mode for normal use operation. The spectrum analyzer gate function was used to determine the pulse width using the gate start and stop times, with a zero span to capture a pulse from the device under test. The sweep was then set to single sweep for 100 ms.

The Duty Cycle in the above period (100 ms) is equal to the number of pulses multiplied by the dwell time, then divided by 100 ms. Please refer to Section 9 for dwell time.

Table 10-1: Duty Cycle Test Equipment

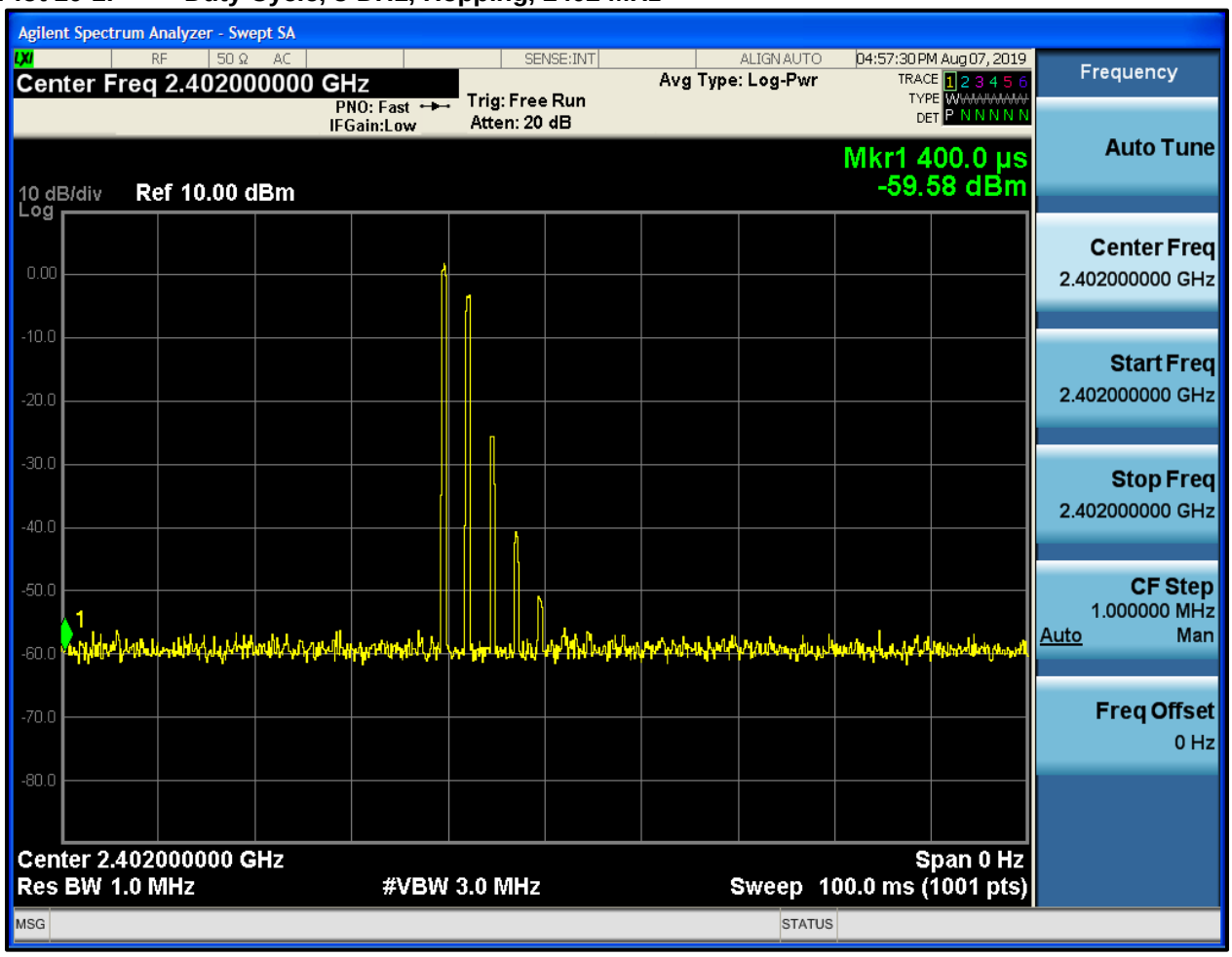
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901521	MA/COM	2082-6174-20	Attenuator, 20 dB 2 W, DC – 4 GHz	N/A	08/07/20
901583	Agilent Technologies	EXA N9010A	Signal Analyzer	MY51250846	02/06/20

10.1 Duty Cycle Test Results

Table 10-2: Duty Cycle Data

Packet Type	Frequency (MHz)	Duty Cycle (%)
3-DH1	2402	2.0
3-DH1	2441	3.6
3-DH1	2480	2.0

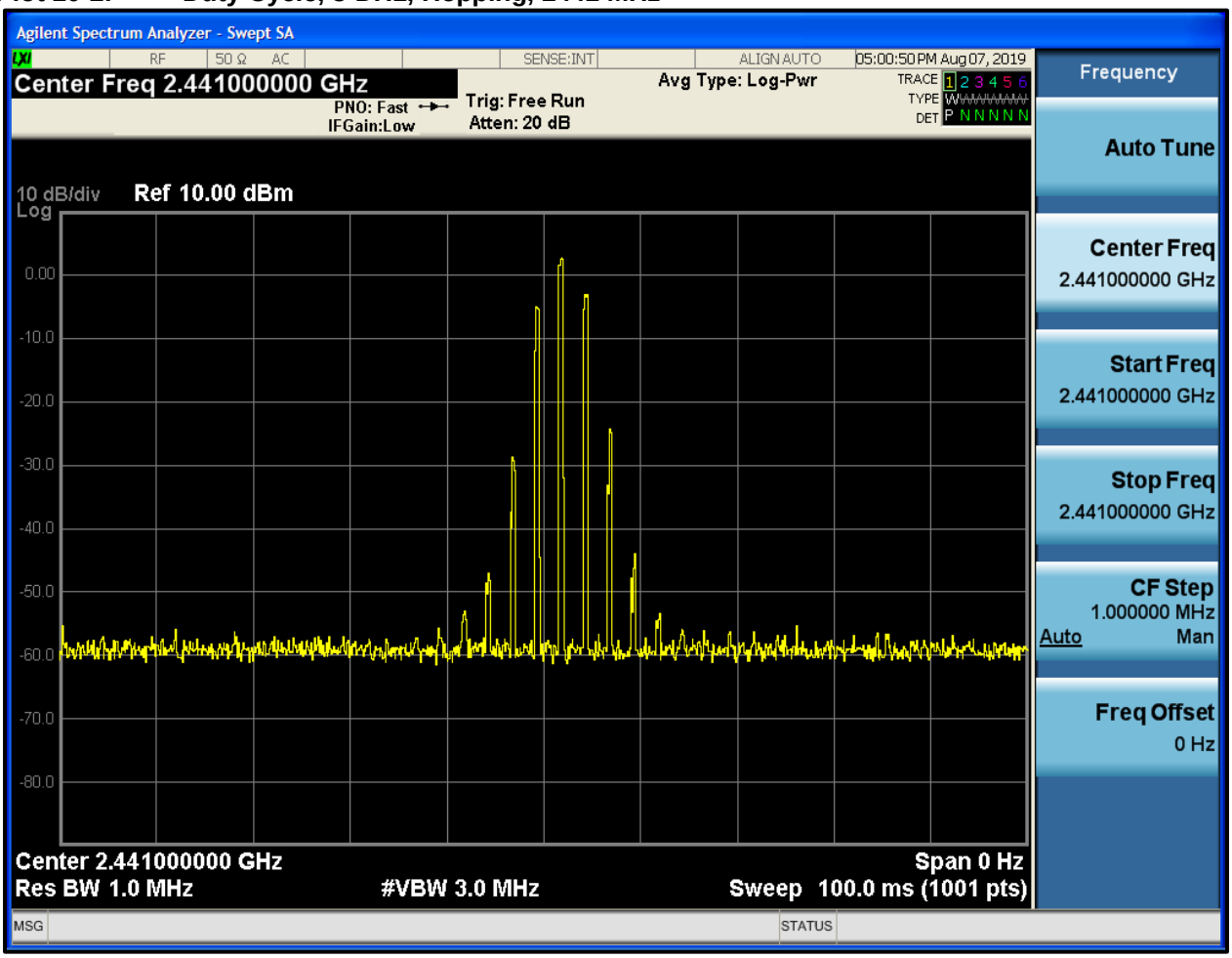
Plot 10-1: Duty Cycle, 3-DH1, Hopping, 2402 MHz



Number of Pulse = 5

DC (%) = (0.401 ms * 5) / 100 ms = 2.0 %

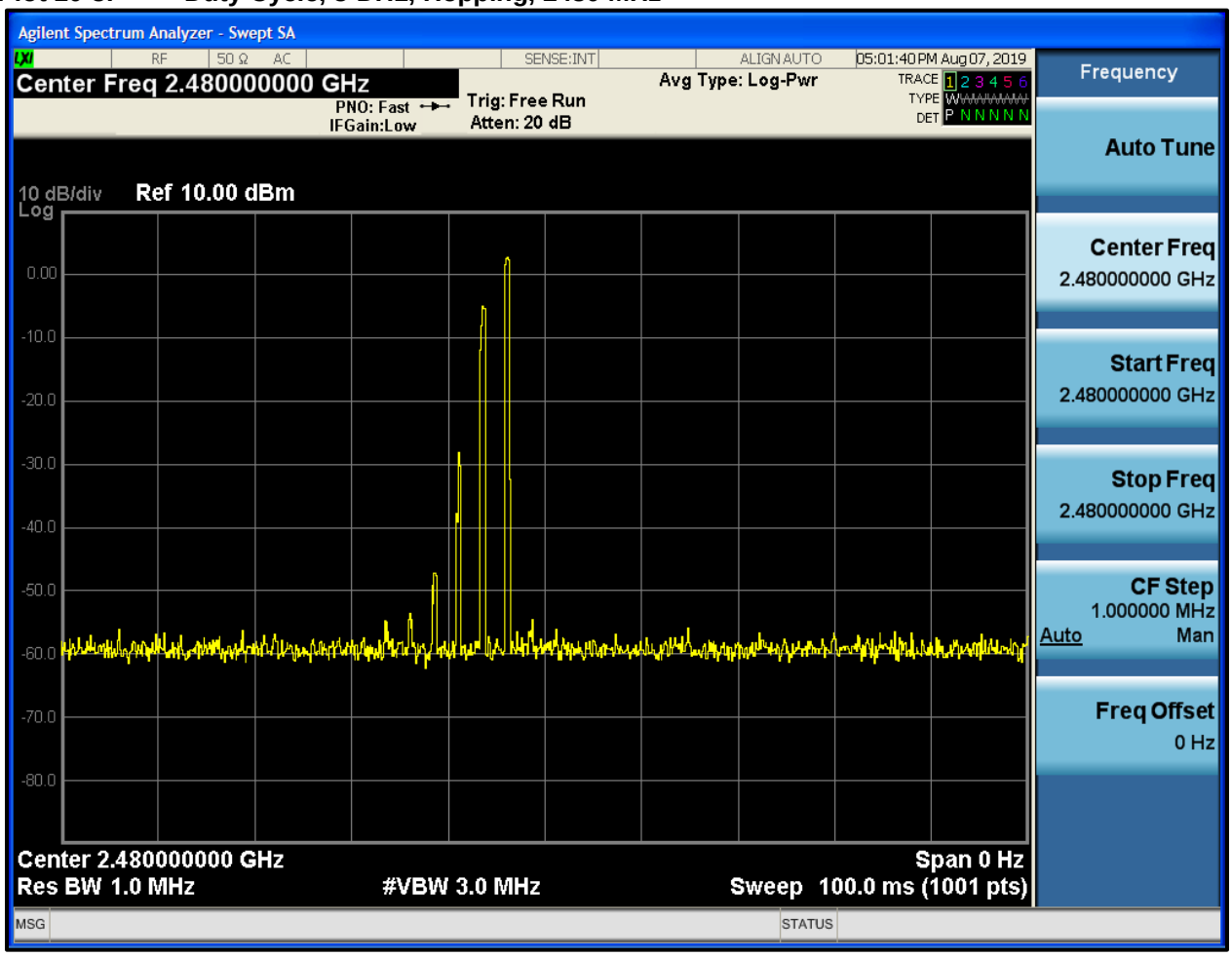
Plot 10-2: Duty Cycle, 3-DH1, Hopping, 2441 MHz



Number of Pulse = 9

DC (%) = (0.401 ms * 9) / 100 ms = 3.6 %

Plot 10-3: Duty Cycle, 3-DH1, Hopping, 2480 MHz



Number of Pulse = 5

DC (%) = (0.401 ms * 5) / 100 ms = 2.0 %

Test Personnel:

Khue Do		August 7, 2019
Test Engineer	Signature	Date of Test

11 AC Conducted Emissions – FCC 15.207; ISED RSS-Gen 8.8

Device is battery operated; AC line conducted emissions measurements are not required.

12 Radiated Emissions – FCC 15.209; ISED RSS-247 5.5; RSS-Gen 8.9, 8.10

12.1 Limits of Radiated Emissions Measurement

Table 12-1: Radiated Emissions Limits

Frequency (MHz)	Field Strength (µV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/f (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any circumstances of modulation.

12.2 Radiated Emissions Measurement Test Procedure

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 10^{th} harmonic of the highest fundamental transmitter frequency (24.8 GHz).

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Table 12-2: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900321	EMCO	3161-03	Horn Antennas (4 – 8.2 GHz)	9508-1020	05/17/21
900323	EMCO	3160-7	Horn Antennas (8.2 – 12.4 GHz)	9605-1054	05/17/21
900356	EMCO	3160-08	Horn Antenna (12.4 – 18 GHz)	9607-1044	05/17/21
900772	EMCO	3161-02	Horn Antenna (2 – 4 GHz)	9804-1044	05/17/21
900791	Chase	CBL6111B	Bilog Antenna (30 – 2000 MHz)	N/A	10/04/20
900905	Rhein Tech Laboratories	PR-1040	Preamplifier (10 – 2000 MHz)	1006	08/20/19
900913	Hewlett Packard	85462A	RF Filter Section (100 kHz – 6.5 GHz)	3325A00159	05/14/21
900914	Hewlett Packard	85460A	EMI Receiver Section (9 kHz – 6.5 GHz)	3330A00107	05/14/21
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 – 26.5 GHz)	3008A00505	10/01/19
901218	EMCO	3160-09	Horn Antenna (18 – 26.5 GHz)	960281-003	05/05/21
901583	Agilent Technologies	EXA N9010A	Signal Analyzer	MY51250846	02/06/20

12.3 Radiated Emissions Test Results

Table 12-3: Radiated Emissions Harmonics/Spurious – 2402 MHz, Peak Detector

Frequency (MHz)	Peak Analyzer (dBµV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)
4804	58.1	0.2	58.3	74.0	-15.7
12010	47.2	-19.5	27.7	74.0	-46.3
19216	50.3	-9.6	40.7	74.0	-33.3

Table 12-4: Radiated Emissions Harmonics/Spurious – 2402 MHz, Average Detector

Frequency (MHz)	Peak Analyzer (dBµV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)
4804*	24.1	0.2	24.3	54.0	-29.7
12010	45.0	-19.5	25.5	54.0	-28.5
19216	48.0	-9.6	38.4	54.0	-15.6

Table 12-5: Radiated Emissions Harmonics/Spurious – 2441 MHz, Peak Detector

Frequency (MHz)	Peak Analyzer (dBµV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)
4882	60.9	0.1	61.0	74.0	-13.0
7323	50.3	3.1	53.4	74.0	-20.6
12205	46.1	-19.5	26.6	74.0	-47.4
19528	50.5	-9.7	40.8	74.0	-33.2

Table 12-6: Radiated Emissions Harmonics/Spurious – 2441 MHz, Average Detector

Frequency (MHz)	Peak Analyzer (dBµV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)
4882*	32.0	0.1	32.1	54.0	-21.9
7323*	21.4	3.1	24.5	54.0	-29.5
12205	44.0	-19.5	24.5	54.0	-29.5
19528	48.0	-9.7	38.3	54.0	-15.7

Table 12-7: Radiated Emissions Harmonics/Spurious – 2480 MHz, Peak Detector

Frequency (MHz)	Peak Analyzer (dBµV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)
4960	62.0	0.3	62.3	74.0	-11.7
7440	52.8	3.1	55.9	74.0	-18.1
12400	46.2	-19.2	27.0	74.0	-47.0
19840	48.9	-9.4	39.5	74.0	-34.5
22320	51.0	-6.0	45.0	74.0	-29.0

Table 12-8: Radiated Emissions Harmonics/Spurious – 2480 MHz, Average Detector

Frequency (MHz)	Peak Analyzer (dBµV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)
4960*	28.0	0.3	28.3	54.0	-25.7
7440*	18.8	3.1	21.9	54.0	-32.1
12400	44.2	-19.2	25.0	54.0	-29.0
19840	46.7	-9.4	37.3	54.0	-16.7
22320	48.0	-6.0	42.0	54.0	-12.0

Note*: Average calculations were used to obtain Average levels at:

Average (dBµV/m) = Peak (dBµV/m) + 20 * LOG(Duty Cycle)

Please refer to Section 10 for the Duty Cycle.

Table 12-9: Unintentional Emissions Test Data

Temperature: 82°F Humidity: 55%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (°)**	**Antenna Height (m)**	**Analyzer Reading (dBµV)**	**Site Correction Factor (dB/m)**	**Emission Level (dBµV/m)**	**Limit (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
54.388	AVG	V	0.0	1.0	35.6	-21.0	14.7	40.0	-25.3	Pass
289.600	AVG	V	90.0	1.0	32.7	-12.2	20.6	46.0	-25.4	Pass
315.000	AVG	H	270.0	1.0	32.8	-11.5	21.3	46.0	-24.7	Pass
410.437	AVG	V	135.0	1.0	36.1	-7.8	28.3	46.0	-17.7	Pass
474.615	AVG	H	90.0	1.0	35.8	-6.7	29.1	46.0	-16.9	Pass
662.312	AVG	V	180.0	1.0	41.9	-3.2	38.7	46.0	-7.3	Pass

Measurement uncertainty: ±4.6 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Test Personnel:

Khue N. Do		August 7 & 8, 2019
Test Engineer	Signature	Dates of Test

13 Conclusion

The data in this measurement report shows that the EUT as tested, Honeywell International Inc. SRX3 Model # HBT1500-01, FCC ID: HD5-HBT1500-01, IC: 1693B-HBT150001, complies with the applicable requirements of FCC Parts 2 and 15 and ISED RSS-247 and RSS-Gen.