



Engineering Solutions & Electromagnetic Compatibility Services

FCC Part 15.247 & IC RSS-247 Certification Report

Harris Corporation
221 Jefferson Ridge Parkway
Lynchburg, VA 24501

Harris® Bluetooth® Adapter
Model #: 14002-2015-01

FCC ID: OWDTR-0137-E
IC: 3636B-0137

June 7, 2016

Standards Referenced for this Report	
FCC Classification	DSS – Part 15 Spread Spectrum Transmitter
FCC Rule Part(s)	FCC Rules Part 15.247: Operation within the bands 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Frequency Hopping System (10-01-15)
IC Standard	RSS-247 Issue 1: Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices
Procedure	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Digital Interface Information	Digital Interface was found to be compliant

Frequency Range (MHz)	Rated Transmit Power (W) (Radiated)	Frequency Tolerance (ppm)	Emission Designator
2402 – 2480	0.012	N/A	1M27FXD

Report Prepared By: Dan Baltzell

Document Number: 2014211DSS

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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.

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1 General Information

1.1 Scope

This is an original certification application test report.

Applicable Standards:

- FCC Rules 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.
- RSS-247 Issue 1: Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices

1.2 Description of EUT

Equipment Under Test	Bluetooth attachment for portable radio
Model # / Model Name	14002-2015-01 / Harris Bluetooth Adapter
Power Supply	Internal radio battery operated
Modulation Type	FHSS (GFSK, $\pi/4$ -DQPSK and 8DPSK)
Frequency Range	2402 – 2480 MHz
Antenna Connector Type	N/A
Antenna Type	Internal chip

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.

1.4 Related Submittal(s)/Grant(s)

This is an original certification application for the Harris Bluetooth Adapter, Model # 14002-2015-01, FCC ID: OWDTR-0137-E, IC: 3636B-0137.

1.5 Modifications

None.

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: Channels Tested

Channel	Frequency
Low	2402
Middle	2441
High	2480

2.2 Exercising the EUT

The EUT was supplied with test software to select various transmit/receive modes (for example, high, mid, and low channel, hopping on/off, etc.) for testing, and to continuously transmit during testing. The carrier was also checked to verify that information was being transmitted. There were no deviations from the test standard(s) and/or methods. The test results reported relate only to the item tested. DH5 (SDR) and 3-DH5 (EDR) modes were investigated. Where pertinent, data is presented for the two modes; otherwise, worst-case data is presented. 1Mbps SDR was found to be worst case for radiated measurements which is presented.

2.3 Test Result Summary

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

Test	FCC Reference	IC Reference	Result
AC Power Conducted Emissions	FCC 15.207	RSS-Gen 8.8	N/A
Radiated Emissions	FCC 15.209	RSS-247 5.5; RSS-Gen 6.13/7.1	Pass
Maximum Peak Power Output	FCC 15.247(b)(1)	RSS-247 5.4(2), RSS-Gen 6.12	Pass
Antenna Conducted Spurious Emissions	FCC 15.247(d)	RSS-247 5.5, RSS-Gen 6.13	Pass
Carrier Frequency Separation	FCC 15.247(a)(1)	RSS-247 5.1(2)	Pass
Band Edge Measurement	FCC 15.247(d)	RSS-247 5.5	Pass
20 dB Bandwidth	FCC 15.247(a)(1)(ii)	RSS-247 5.1(1)	Pass
Hopping Characteristics	FCC 15.247(a)(1)(iii)	IC RSS-247 5.1(4)	Pass
Average Time of Occupancy	FCC 15.247(a)(1)(iii)	IC RSS-247 5.1(4)	Pass

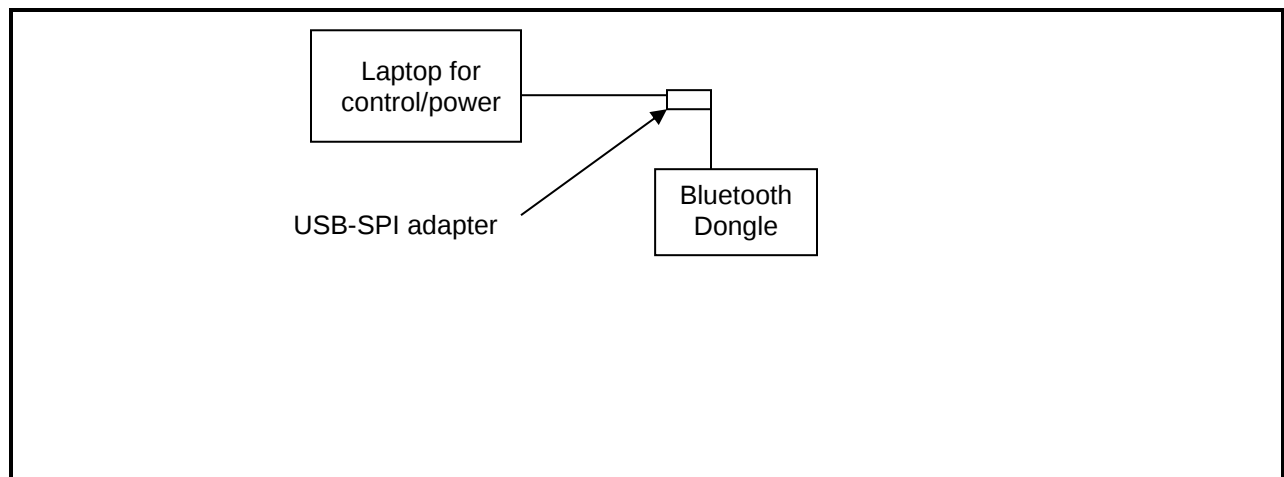
2.4 Tested System Details

The test sample was received on December 16, 2014. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

Table 2-3: Equipment Under Test (EUT)

Part	Manufacturer	Model #	Part Number	FCC ID	RTL Bar Code
Bluetooth Dongle	Harris Corporation	14002-2015-01	14002-2015-01	OWDTR-0137-E	21561
Bluetooth Dongle	Harris Corporation	14002-2015-01	14002-2015-01	OWDTR-0137-E	21562

Figure 2-1: Configuration of Tested System



3 Peak Output Power – FCC 15.247(b)(1), RSS-247 5.4(2), RSS-Gen 6.12

3.1 Power Output Test Procedure

Procedure: C63.10-2013 6.6

No conducted power measurement of the EUT is taken since no conducted port is available. Radiated field strength measurements were taken and converted to power using the following equations:

$$W = \frac{(V/m \cdot d)^2}{30}$$

where:

$$V/m = \text{volts per meter} = 10^{(dBuV/m / 20)} / 1E6$$

d = 3 meters

W = Watts

further: dBm = 10log (W · 1000)

Example: for 97.2 dBuV/m

$$10^{(97.2 \text{ dBuV/m} / 20)} / 1E6 = 0.072 \text{ V/m}$$

$$W = \frac{(0.072 \text{ V/m} \cdot 3)^2}{30} = 0.001574 \quad \therefore \quad \text{dBm} = 10\text{Log}(0.001574 \cdot 1000) = 2.0$$

3.2 Power Output Test Data

Table 3-1: Power Output Test Data

Frequency (MHz)	Peak Analyzer (dBuV)	Site Correction Factor (dB/m)	Corrected Peak (dBuV/m)	Calculated Peak Power (mW)	Calculated Peak Power (dBm)	Limit (dBm)	Margin (dB)
2402	75.2	25.3	100.5	3.4	5.3	30.0	-24.7
2441	78.8	25.4	104.2	7.9	9.0	30.0	-21.0
2480	80.4	25.6	106.0	11.9	10.8	30.0	-19.2

Table 3-2: Power Output Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901592	Insulated Wire Inc.	KPS-1503-3600-KPR	SMK RF Cables 20'	NA	9/3/15
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	11/13/15
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	4/20/15
900886	EMI Shop	WRT000-0003	Turntable OATS	N/A	Not Required

Test Personnel:

Daniel W. Baltzell EMC Test Engineer	 Signature	January 15, 2015 Date of Tests
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4 Antenna Conducted Spurious Emissions – FCC 15.247(d), RSS-247 5.5

Procedure: C63.10-2013 6.7

No conducted antenna port is available so no conducted data is reported.

Test Personnel:

Daniel W. Baltzell EMC Test Engineer	 Signature	January 15, 2015 Date of Test
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5 Band-Edge Compliance of RF Conducted Emissions – FCC 15.247(d), RSS-247 5.5

5.1 Band Edge Test Procedure

Procedure: C63.10-2013 6.10

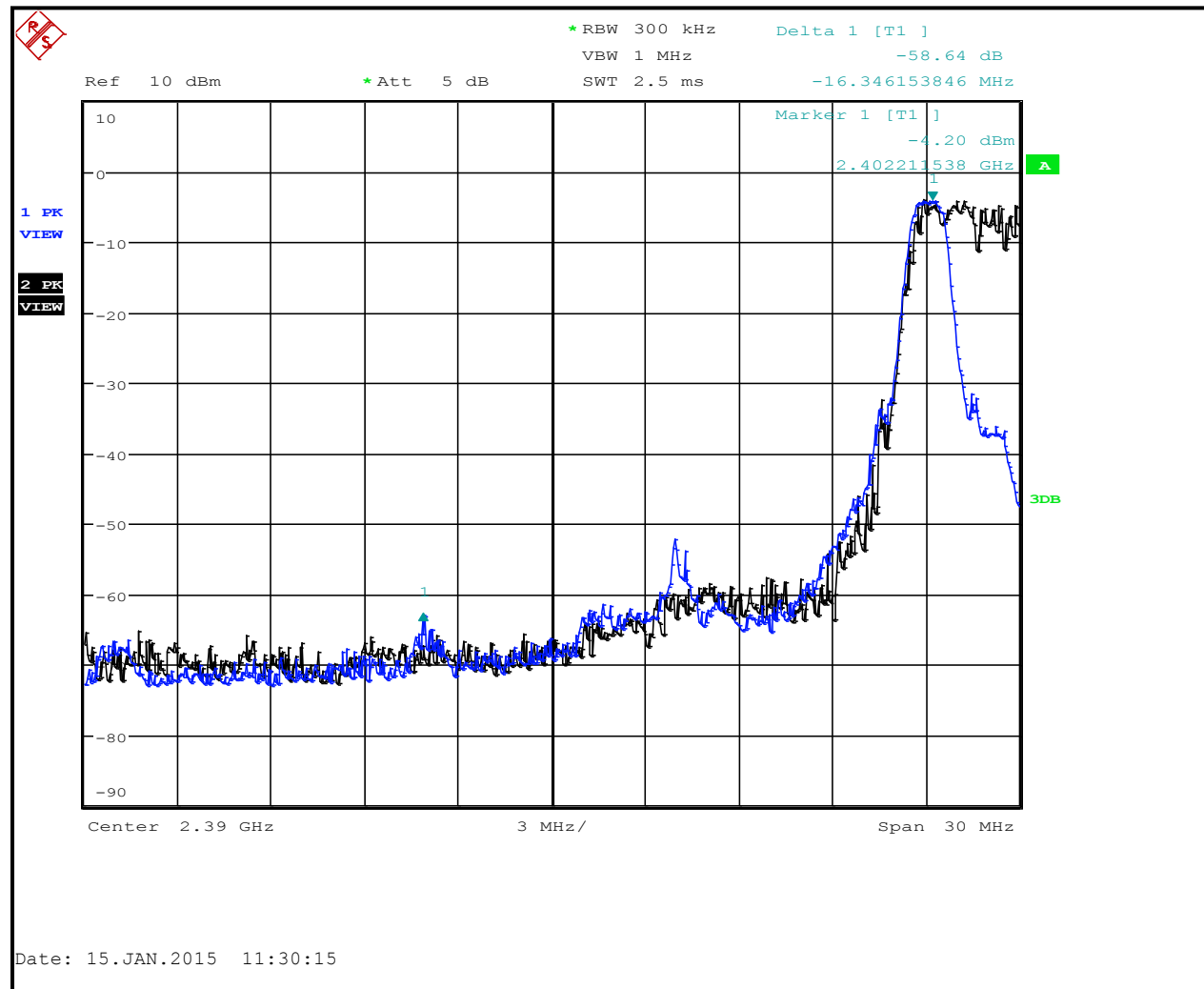
The EUT was connected to the spectrum analyzer through suitable attenuation. The span was set wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation. The spectrum analyzer was set to the following:

RBW $\geq$ 1 % of span
VBW $\geq$ RBW
Sweep = auto
Detector function = peak
Trace = max hold

The trace was allowed to stabilize. The marker was set on the emission at the band edge. The marker-delta was used to show the delta between the maximum in-band emission and the emission at the band edge, and was compared to the 20 dBc requirement of 15.247(d) (when using peak emissions). This measurement was taken in both fixed frequency and hopping modes.

5.2 Test Results

Plot 5-1: Lower Band Edge TX Frequency - 2402 MHz



Plot 5-2: Upper Band Edge TX Frequency - 2480 MHz

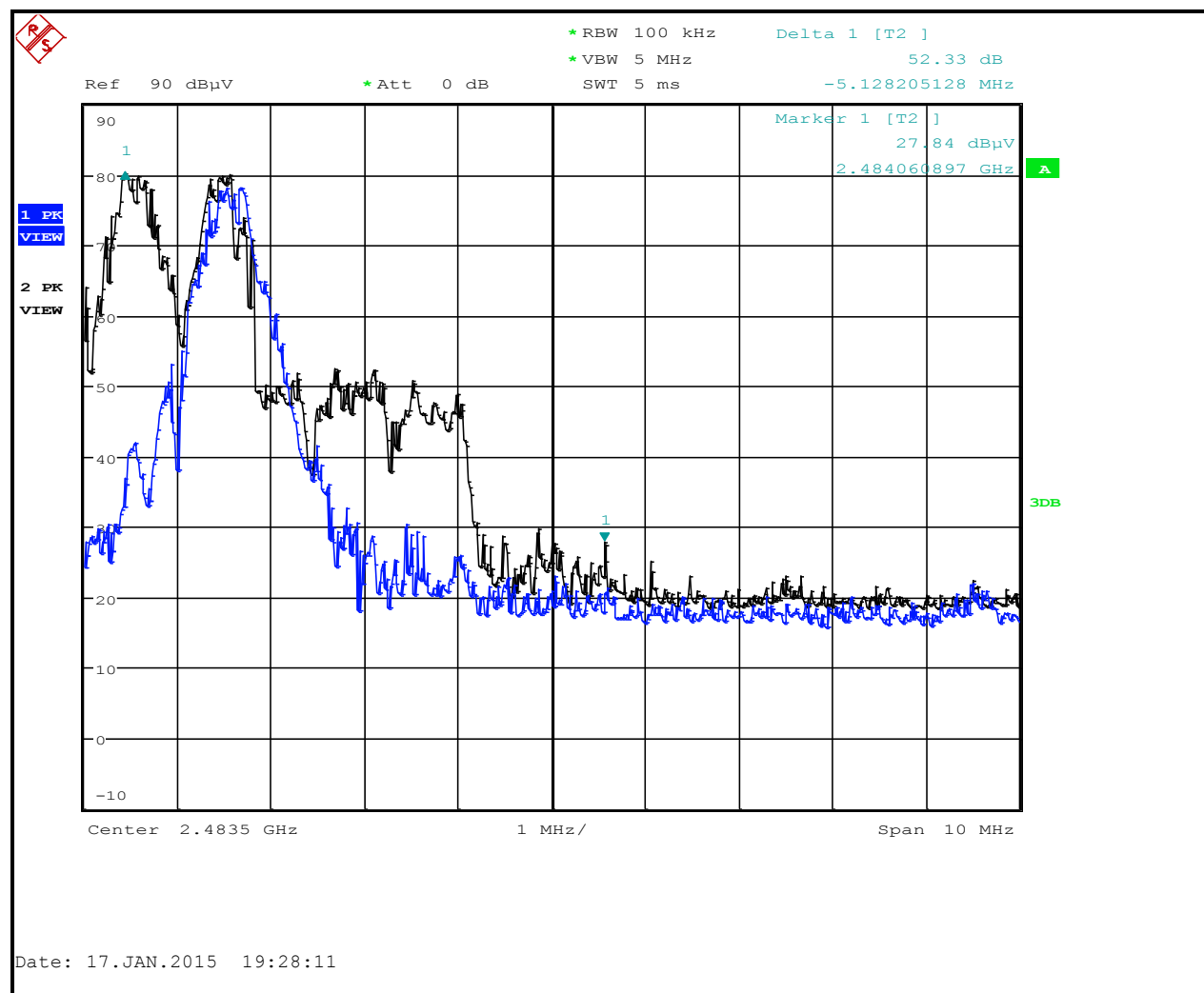


Table 5-1: Band-Edge Compliance of RF Conducted Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	11/13/15

Test Personnel:

Daniel W. Baltzell EMC Test Engineer	 Signature	January 15 & 17, 2015 Dates of Test
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5.3 Radiated Band Edge Emissions

Table 5-2: Radiated Band Edge Emissions Test Data

Frequency (MHz)	Peak Spectrum Analyzer Level (1 MHz RBW/ VBW) (dBuV)	Average Analyzer Detector (1 MHz RBW/ 10 Hz VBW) (dBuV)	Site Correction Factor (dB/m)	Corrected Average Level (dBuV/m)	Delta Measurement from Plots (dB)	Average Limit (dBuV/m)	Margin (dB)
2402.0	75.2	33.7	25.3	59.0	58.6	54.0	-53.6
2480.0	80.4	31.3	25.6	56.9	52.3	54.0	-49.4

Table 5-3: Radiated Band Edge Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901592	Insulated Wire Inc.	KPS-1503-3600-KPR	SMK RF Cables 20'	NA	9/3/15
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	11/13/15
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	4/20/15
900886	EMI Shop	WRT000-0003	Turntable OATS	N/A	Not Required

Test Personnel:

Daniel W. Baltzell
EMC Test Engineer



Signature

January 15, 2015
Date of Test

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

6.1 20 dB Bandwidth Test Procedure

Procedure: C63.10-2013 6.9

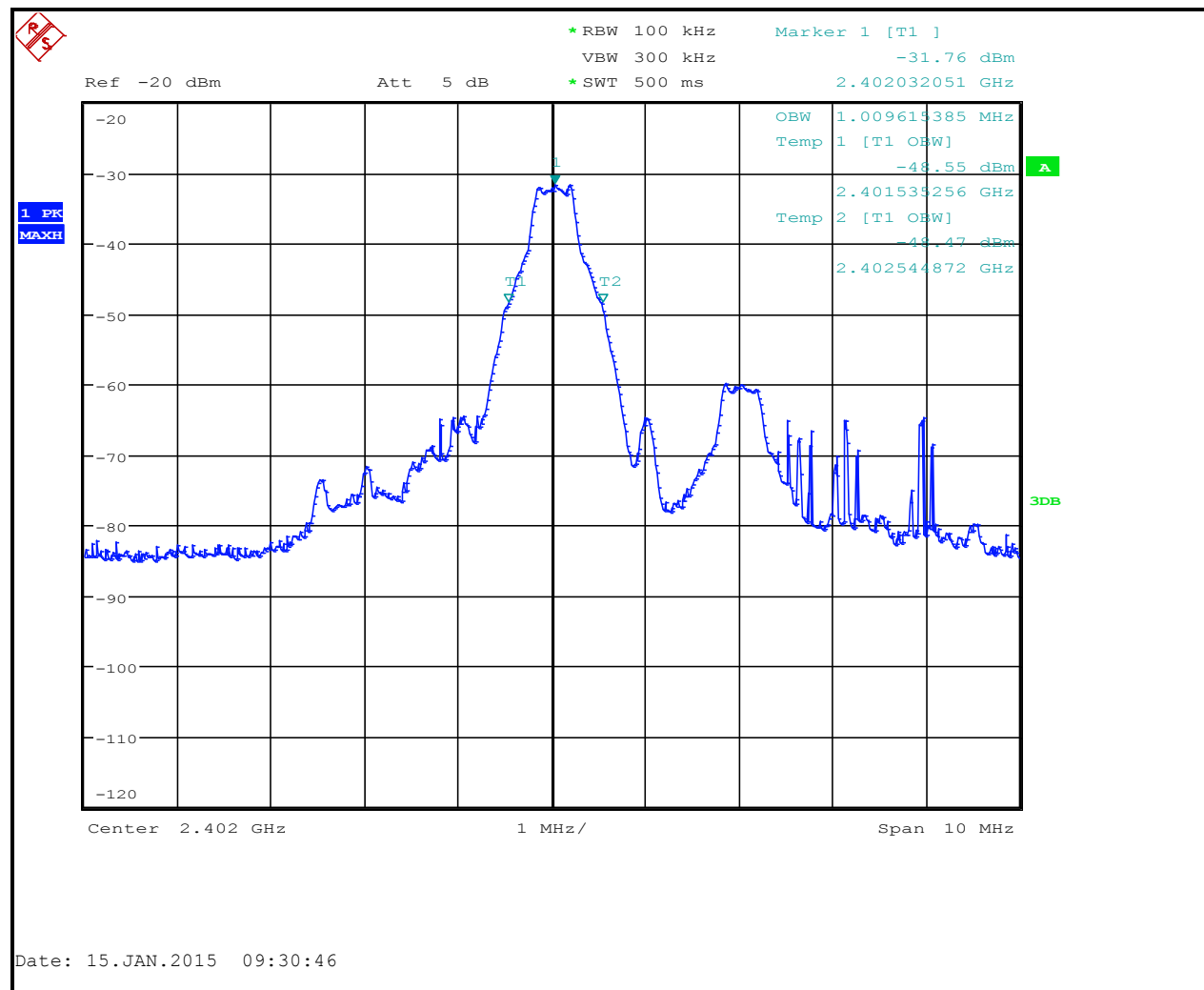
6.2 20 dB Modulated Bandwidth Test Data

Table 6-1: 20 dB Modulated Bandwidth Test Data

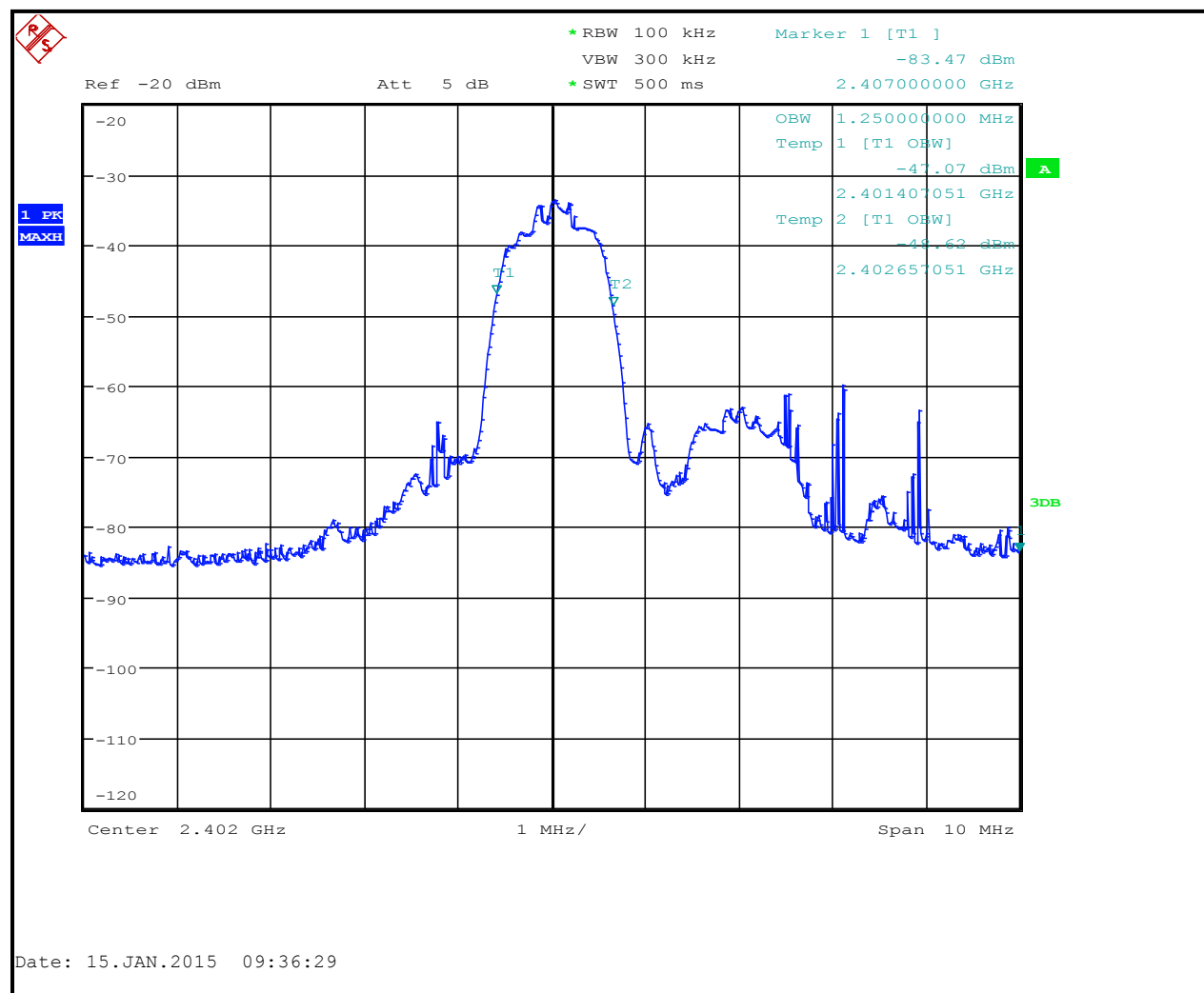
Frequency (MHz)	20 dB Bandwidth (MHz)
2402	1.27
2441	1.27
2480	1.25

6.3 20 dB Bandwidth Plots

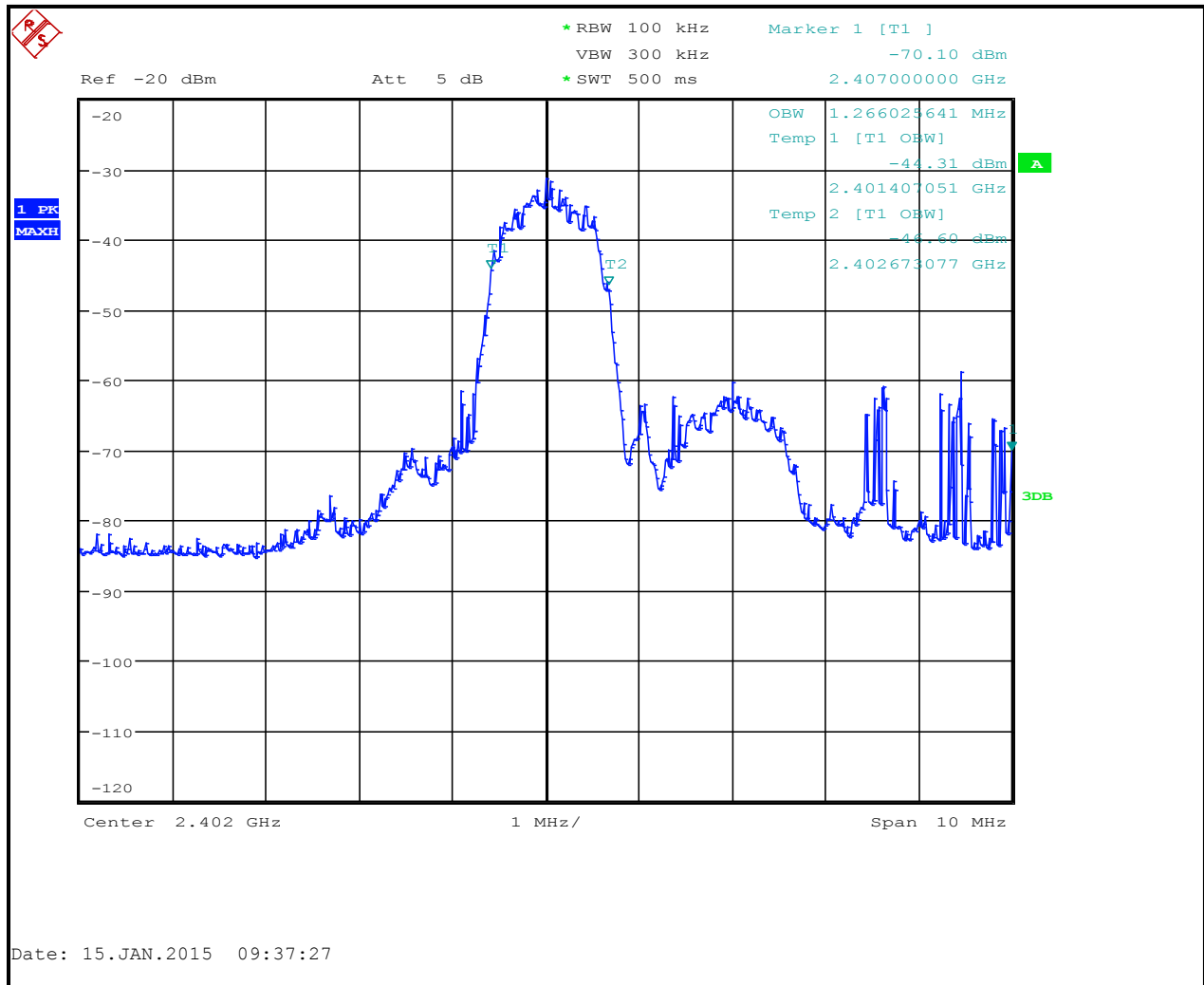
Plot 6-1: 20 dB Bandwidth - 2402 MHz; 1 Mb/s



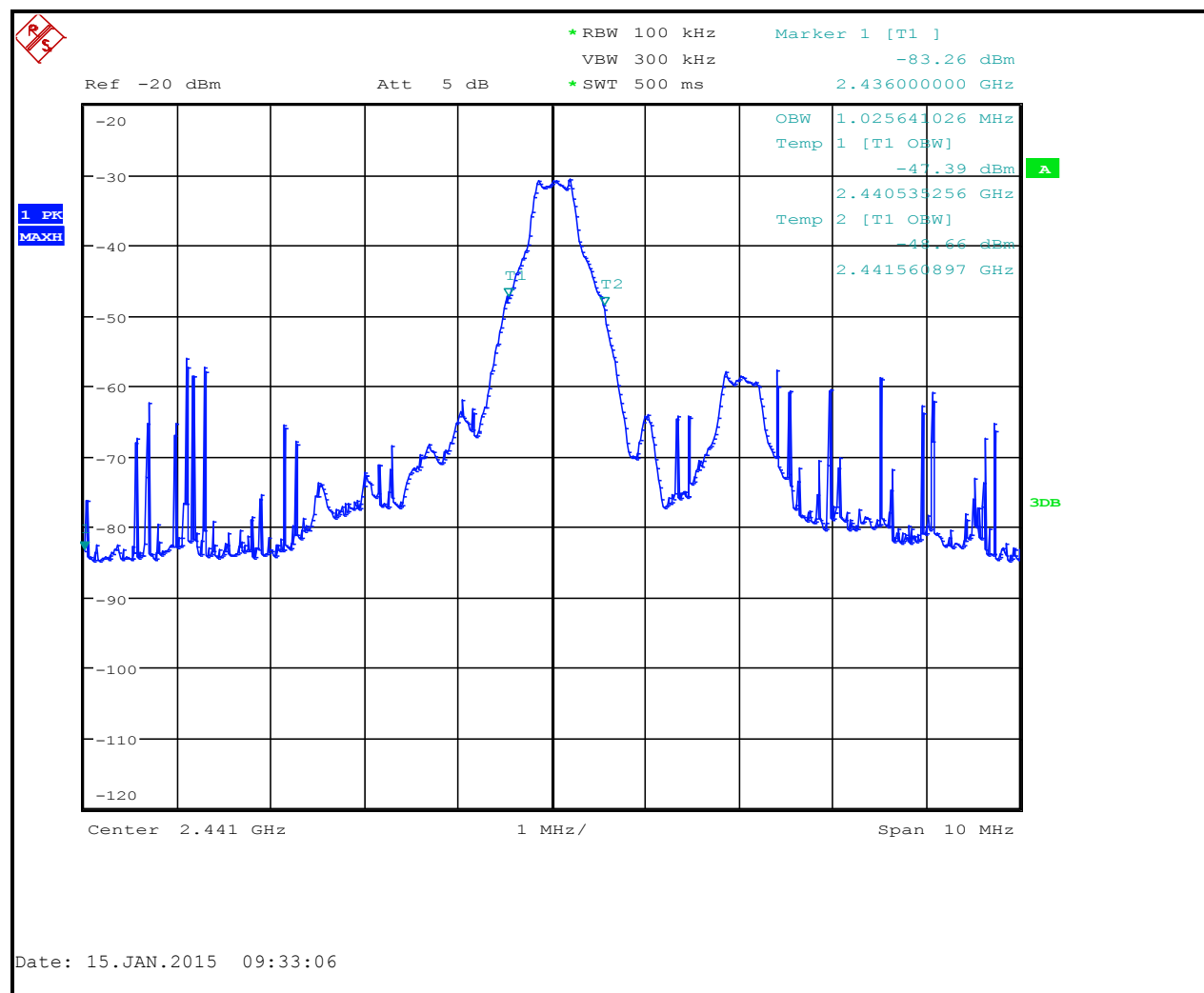
Plot 6-2: 20 dB Bandwidth - 2402 MHz; 2 Mb/s



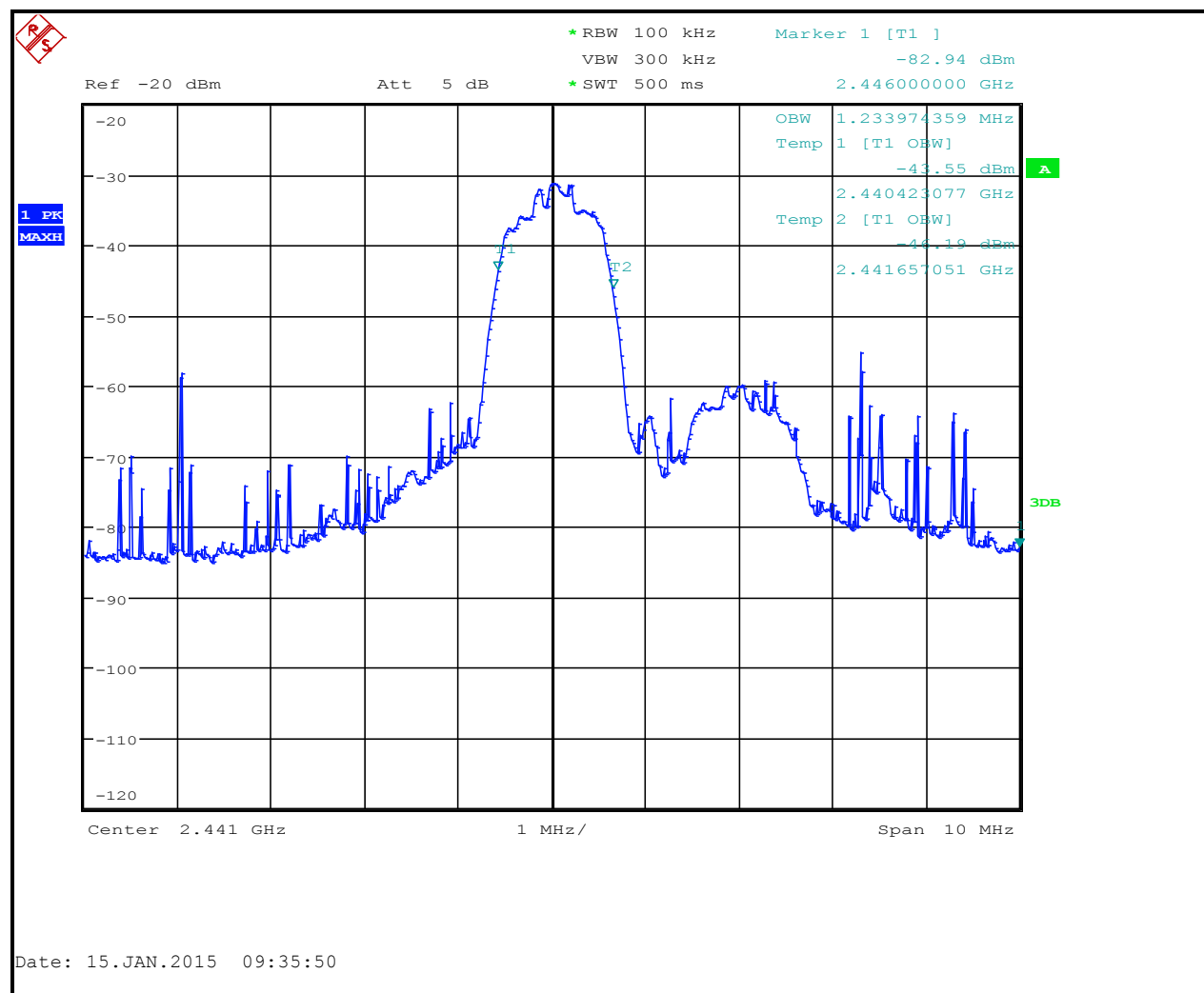
Plot 6-3: 20 dB Bandwidth - 2402 MHz; 3 Mb/s



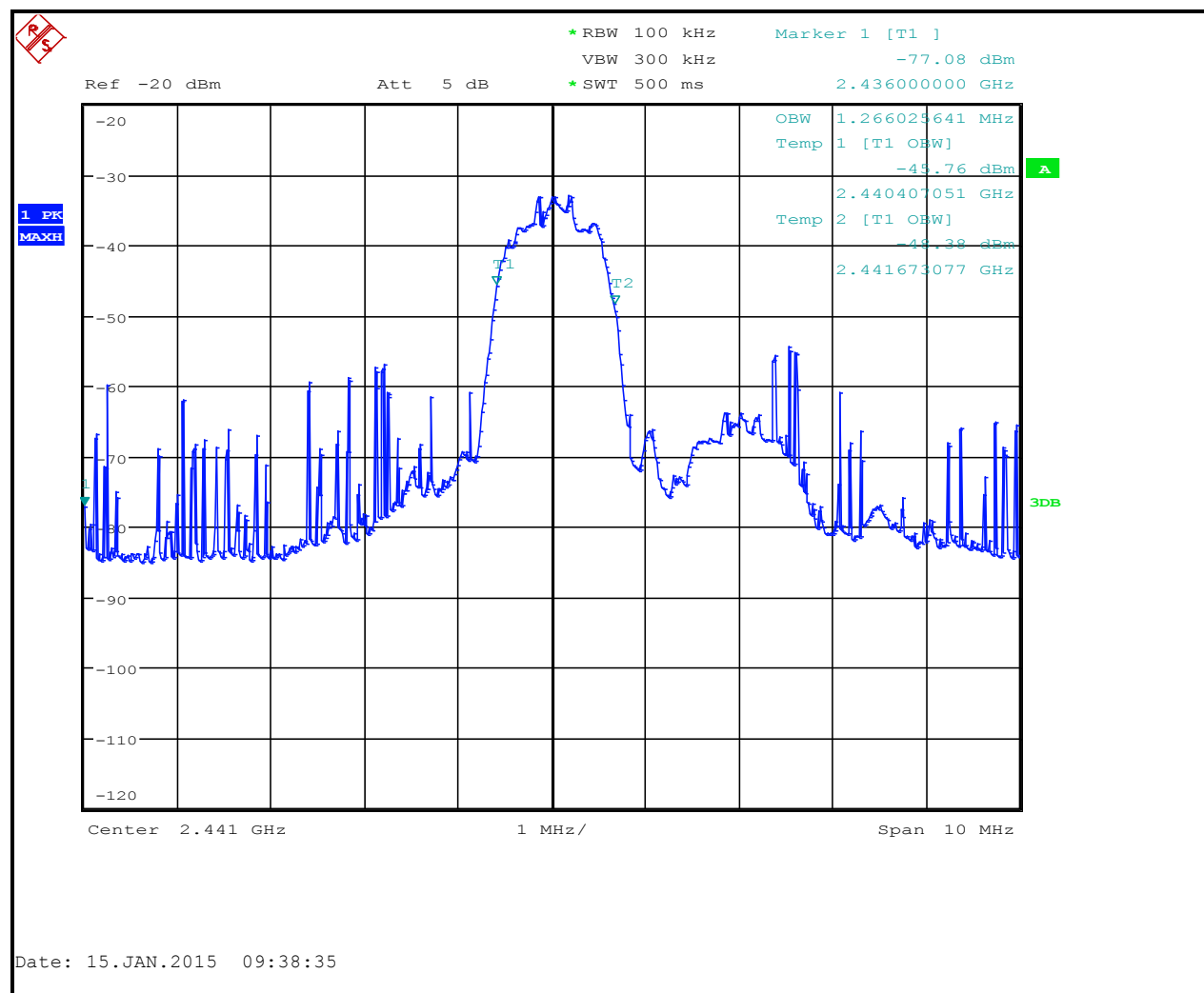
Plot 6-4: 20 dB Bandwidth - 2441 MHz; 1 Mb/s



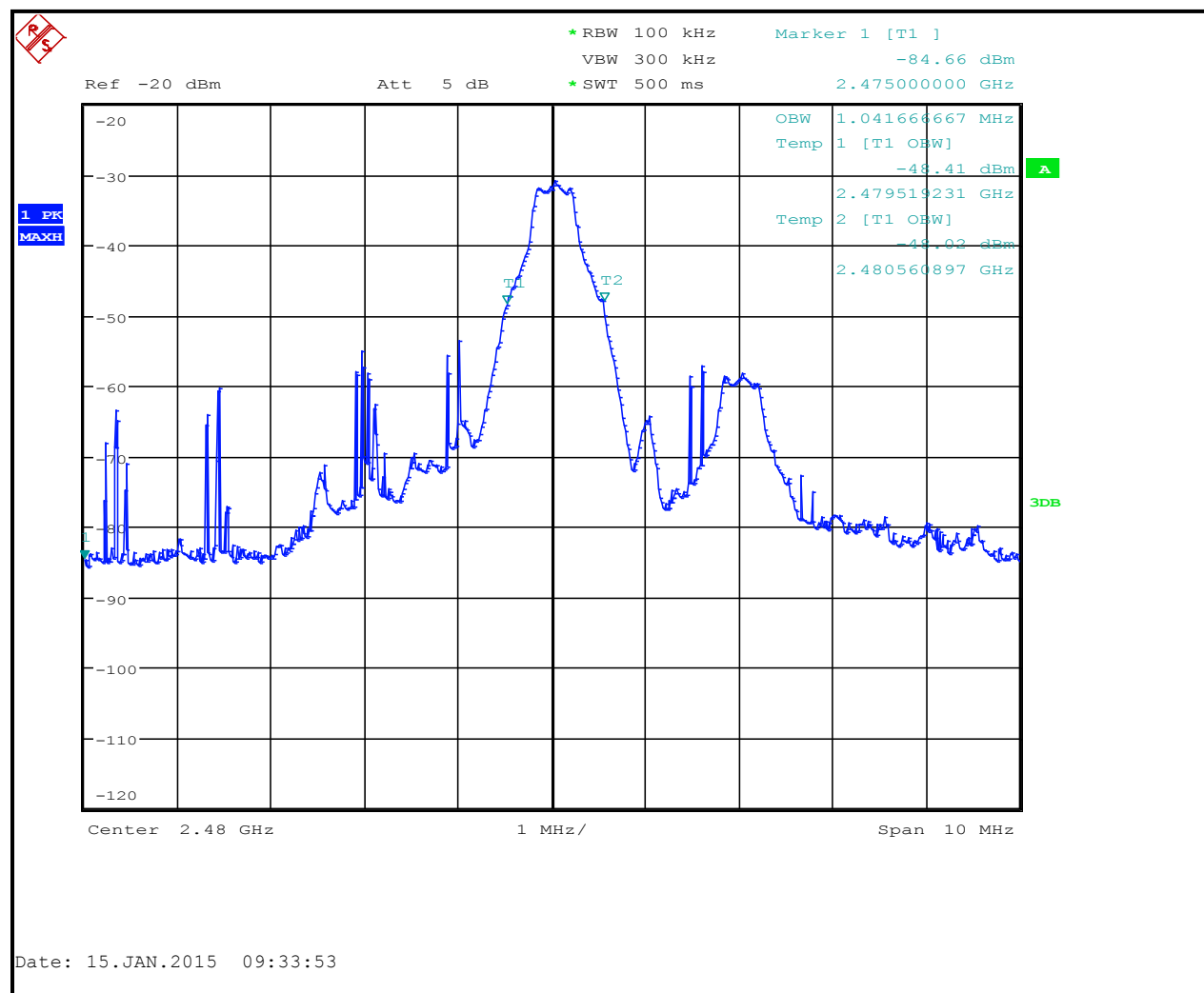
Plot 6-5: 20 dB Bandwidth - 2441 MHz; 2 Mb/s



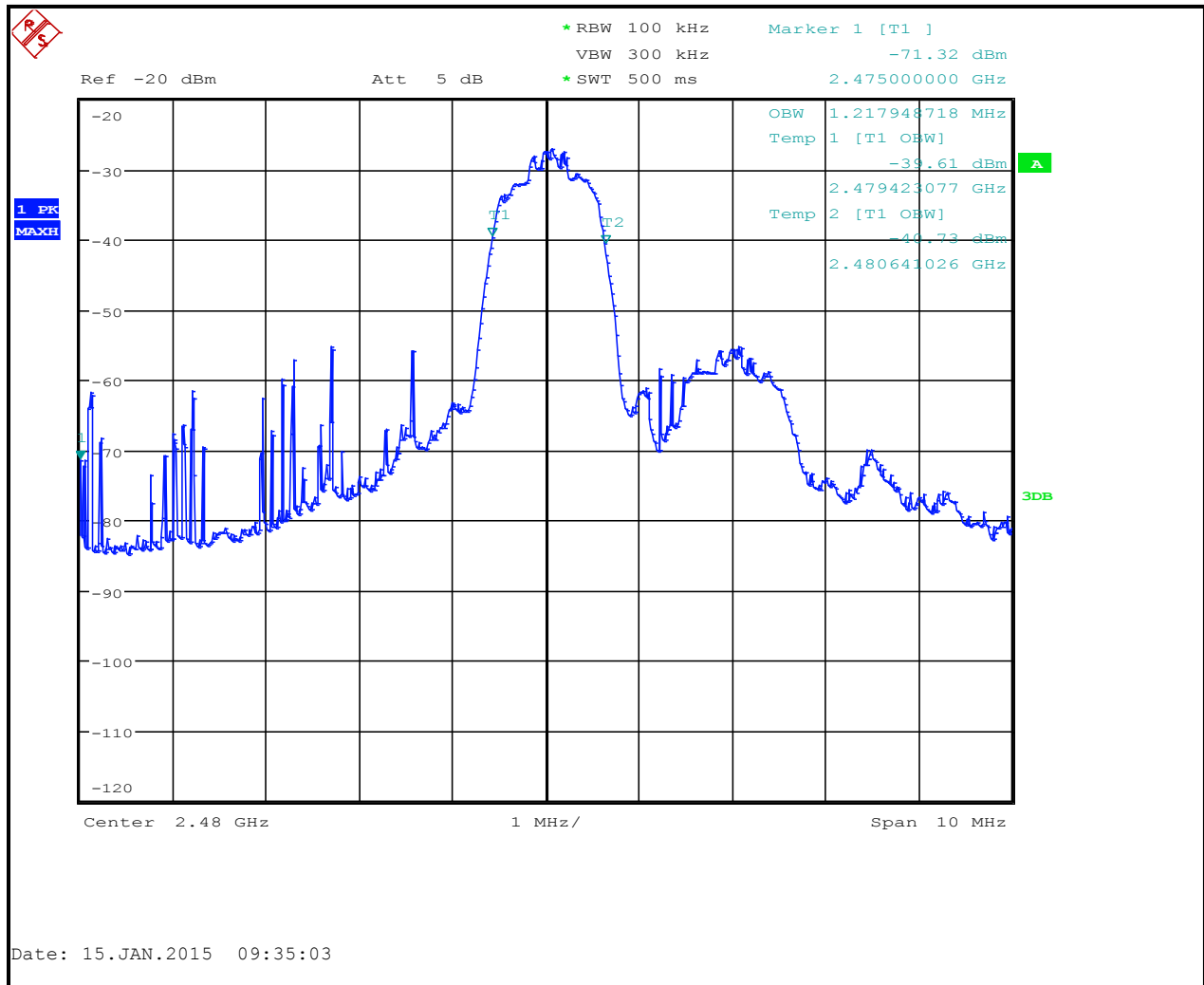
Plot 6-6: 20 dB Bandwidth - 2441 MHz; 3 Mb/s



Plot 6-7: 20 dB Bandwidth - 2480 MHz; 1 Mb/s



Plot 6-8: 20 dB Bandwidth - 2480 MHz; 2 Mb/s



Plot 6-9: 20 dB Bandwidth - 2480 MHz; 3 Mb/s

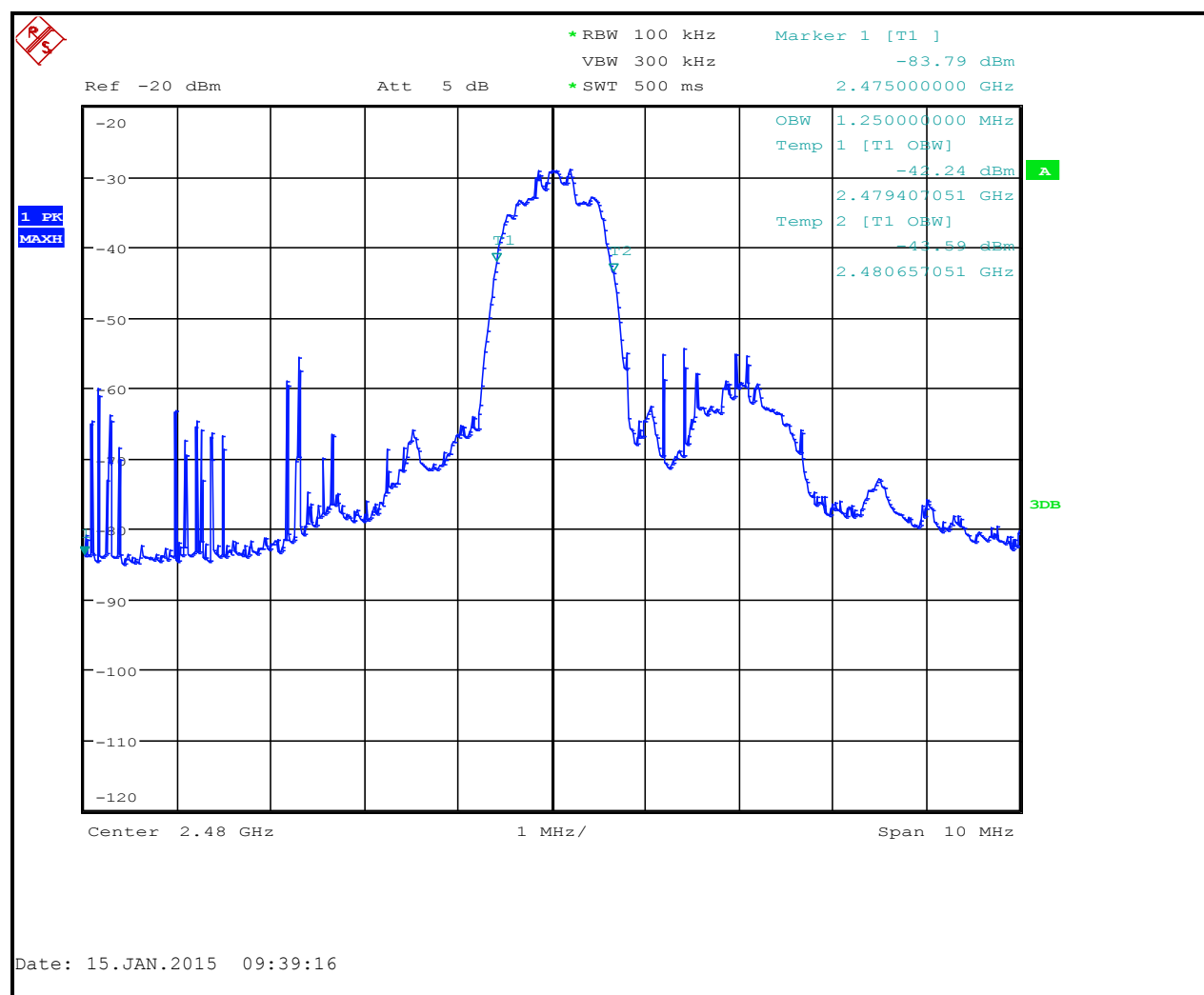


Table 6-2: 20 dB Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	11/13/15

Test Personnel:

Daniel W. Baltzell
EMC Test Engineer

Daniel W. Baltzell

Signature

January 15, 2015
Date of Test

7 Carrier Frequency Separation - 15.247(a)(1), RSS-247 5.1(2)

7.1 Carrier Frequency Separation Test Procedure

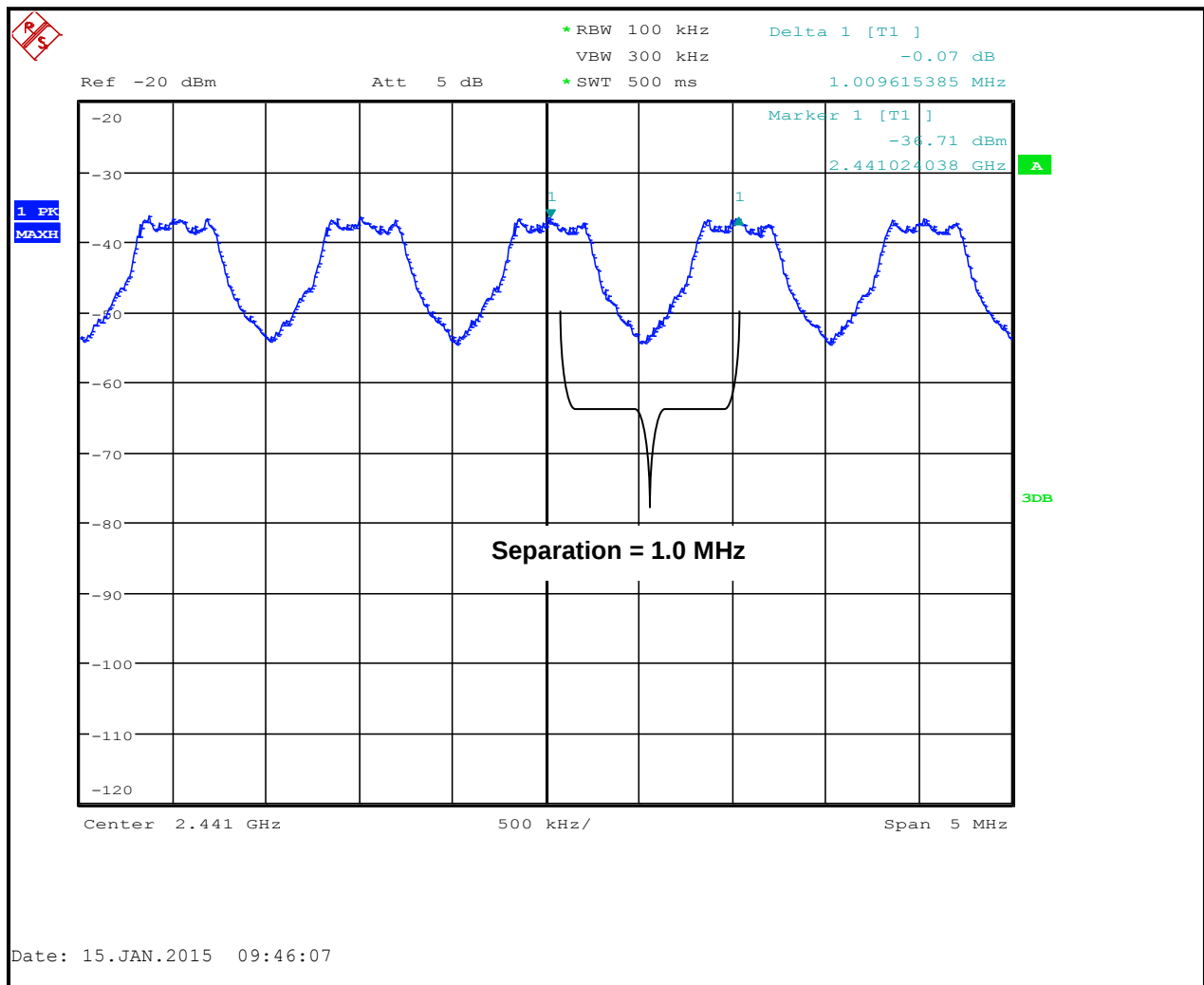
Procedure: C63.10-2013 7.8.2

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. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of greater, provided the systems operate with an output power no greater than 125 mW.

Measured frequency separation = 1.0 MHz

7.2 Carrier Frequency Separation Test Data

Plot 7-1: Carrier Frequency Separation



8 Hopping Characteristics – FCC 15.247(a)(1)(iii), RSS-247 5.1(4)

8.1 Hopping Characteristics Test Procedure

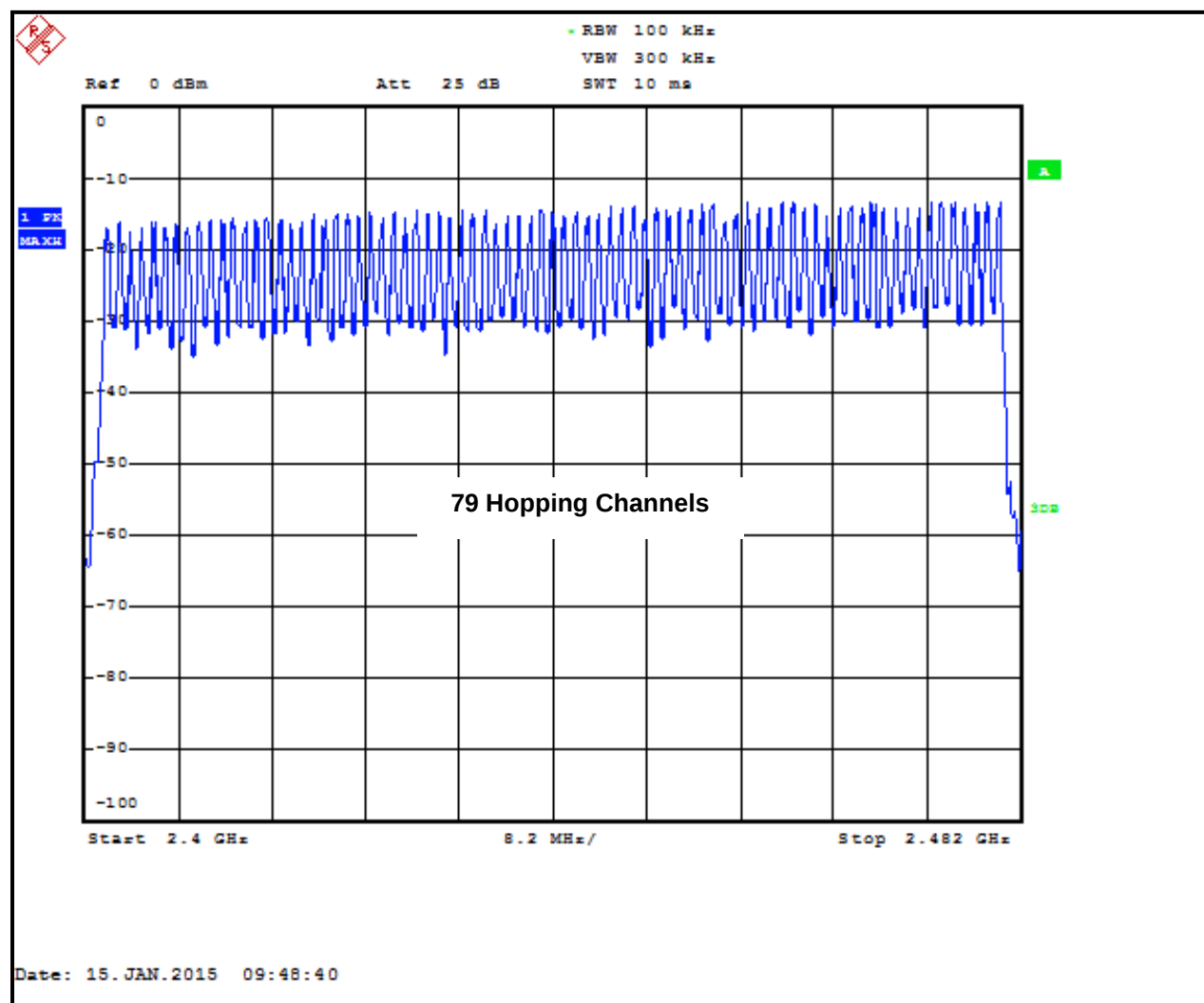
Procedure: C63.10-2013 7.8.3

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 are used.

8.2 Number of Hopping Frequencies

Measured number of hopping frequencies = 79

Plot 8-1: Number of Hopping Frequencies (2402 - 2480 MHz)



8.3 Average Time of Occupancy

Procedure: C63.10-2013 7.8.4

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.

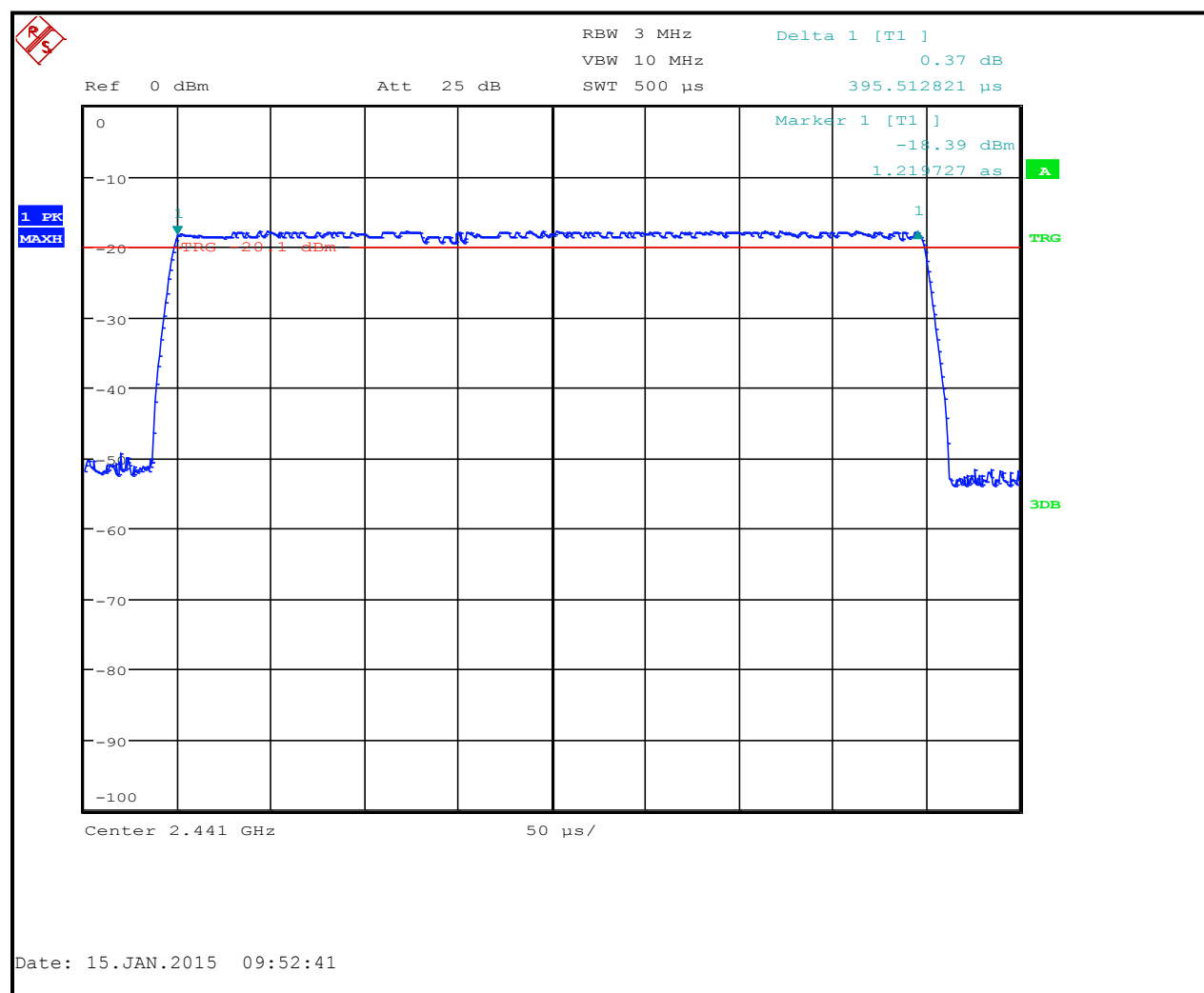
Allowed period = 0.4 s X 79 channels = 31.6 s

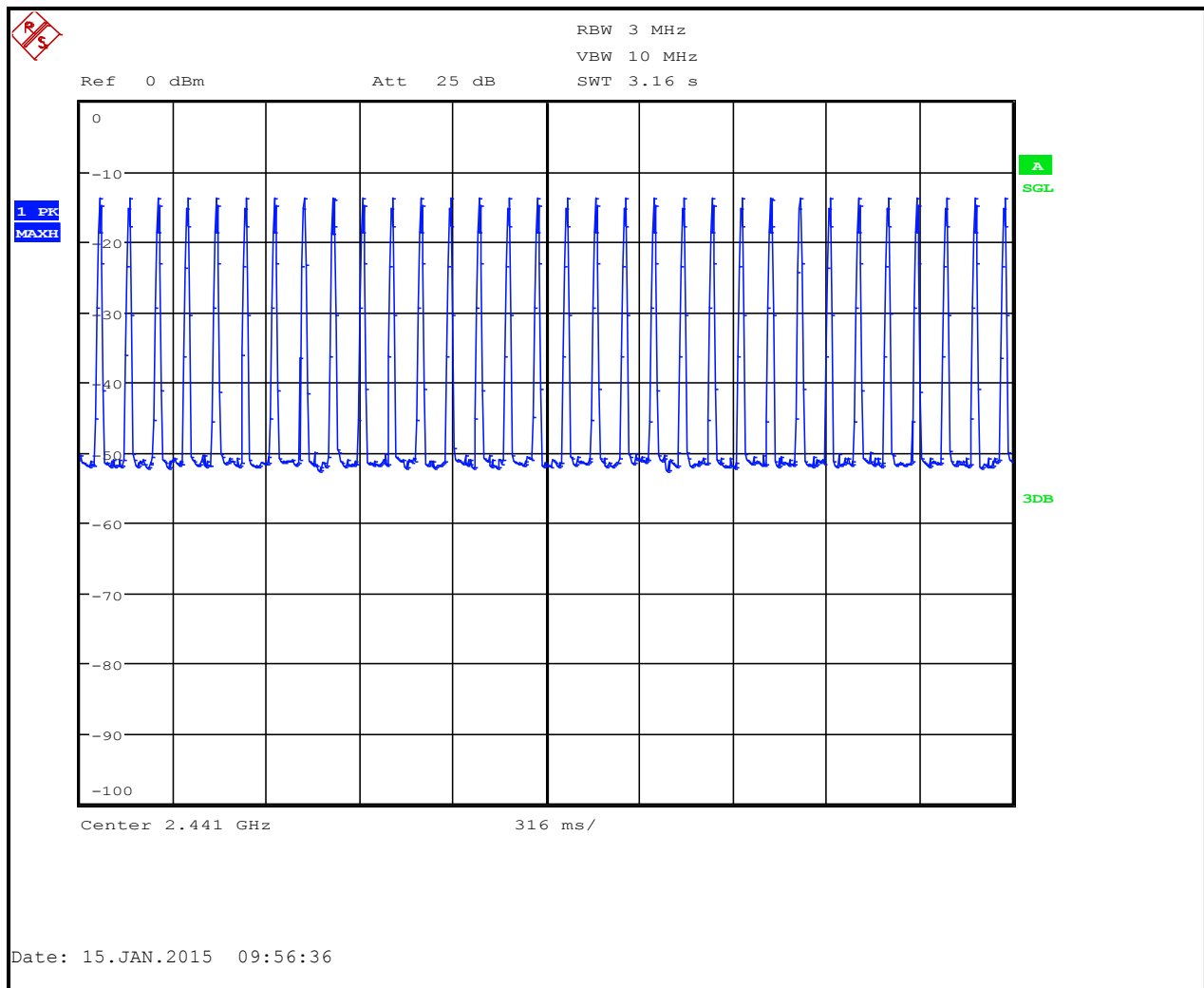
Pulse width = 0.396 ms

Number of pulses within a 31.6 s sweep = $32 \times 10 = 320$

Average time of occupancy in 31.6 s = $0.396 \text{ ms} \times 320 \text{ pulses} = 0.127 \text{ s}$, which meets the limit of 0.4 s

Plot 8-2: Time of Occupancy (Dwell Time)





RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	11/13/15

January 15, 2015
Date of Test

9 Radiated Emissions Test Results - FCC Rules and Regulations Part 15.247(d); RSS-247 2.2

9.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength (uV/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.

9.2 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 10th 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.

9.2.1 Radiated Emissions Harmonics/Spurious Test Data

Table 9-1: Radiated Emissions Harmonics/Spurious - 2402 MHz - Average

Emission Frequency (MHz)	Average Analyzer Reading (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4804.0	4.0	28.5	32.5	54.0	-21.5
12012.0	-11.7	44.0	32.3	54.0	-21.7
19218.0	-11.4	52.9	41.5	54.0	-12.5

Table 9-2: Radiated Emissions Harmonics/Spurious - 2402 MHz - Peak

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Site Correction Factor (dB/m)	Peak Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4804.0	40.3	28.5	68.8	74.0	-5.2
12012.0	-5.5	44.0	38.5	74.0	-35.5
19218.0	0.7	52.9	53.6	74.0	-20.4

Table 9-3: Radiated Emissions Harmonics/Spurious - 2441 MHz - Average

Emission Frequency (MHz)	Average Analyzer Reading (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4882.0	2.0	28.5	30.5	54.0	-23.5
7323.0	-2.8	29.8	27.0	54.0	-27.0
12205.0	-6.8	44.0	37.2	54.0	-16.8
19528.0	-11.2	53.0	41.8	54.0	-12.2

Table 9-4: Radiated Emissions Harmonics/Spurious – 2441 MHz - Peak

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Site Correction Factor (dB/m)	Peak Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4882.0	42.0	28.5	70.5	74.0	-3.5
7323.0	14.2	29.8	44.0	74.0	-30.0
12205.0	1.5	44.0	45.5	74.0	-28.5
19528.0	0.9	53.0	53.9	74.0	-20.1

Table 9-5: Radiated Emissions Harmonics/Spurious - 2480 MHz - Average

Emission Frequency (MHz)	Average Analyzer Reading (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4960.0	4.7	28.6	33.3	54.0	-20.7
7440.1	-1.9	29.9	28.0	54.0	-26.0
12400.0	-15.1	44.0	28.9	54.0	-25.1
19840.0	-10.9	53.2	42.3	54.0	-11.7
22320.0	-30.4	54.2	23.8	54.0	-30.2
24800.0	-29.3	55.3	26.0	54.0	-28.0

Table 9-6: Radiated Emissions Harmonics/Spurious – 2480 MHz - Peak

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Site Correction Factor (dB/m)	Peak Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4960.0	42.8	28.6	71.4	74.0	-2.6
7440.1	17.2	29.9	47.1	74.0	-26.9
12400.0	-3.2	44.0	40.8	74.0	-33.2
19840.0	1.3	53.2	54.5	74.0	-19.5
22320.0	-17.0	54.2	37.2	74.0	-36.8
24800.0	-17.5	55.3	37.8	74.0	-36.2

Table 9-7: Radiated Emissions Harmonics/Spurious – Hopping Mode

Emission Frequency (MHz)	Peak Analyzer Level (dBuV) (1 MHz RBW/VBW)	Average Analyzer Level (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4809.8	36.4	1.1	28.5	29.6	54.0	-24.4
4896.2	39.4	1.7	28.5	30.2	54.0	-23.8
7238.3	10.4	-1.4	29.8	28.4	54.0	-25.6
7314.2	12.2	-1.2	29.8	28.6	54.0	-25.4
7347.4	12.9	-1.1	29.8	28.7	54.0	-25.3
12400.0	-5.7	-15.4	36.9	21.5	54.0	-32.5

Table 9-8: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900151	Rohde and Schwarz	HFH2-Z2	Loop Antenna (9 kHz - 30 MHz)	827525/019	3/4/15
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 - 26.5 GHz)	3008A00505	9/5/15
900878	Rhein Tech Laboratories	AM3-1197-0005	3 meter antenna mast, polarizing	OATS1	N/A
901592	Insulated Wire Inc.	KPS-1503-3600-KPR	SMK RF Cables 20'	NA	9/3/15
901593	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36"	NA	9/3/15
901594	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36"	NA	9/3/15
901242	Rhein Tech Laboratories	WRT-000-0003	Wood rotating table	N/A	N/A
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	11/13/15
900791	Chase	CBL6111B	Bilog Antenna (30 MHz – 2000 MHz)	N/A	6/11/17
900321	EMCO	3161-03	Horn Antennas (4 – 8 GHz)	9508-1020	4/20/15
900323	EMCO	3160-07	Horn Antennas (8.2 – 12 GHz)	9605-1054	4/20/15
900356	EMCO	3160-08	Horn Antennas (12.4 – 18 GHz)	9607-1044	4/20/15
901218	EMCO	3160-09	Horn Antenna (18 - 26 GHz)	960281-003	4/20/15
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	4/20/15

Test Personnel:

Daniel W. Baltzell EMC Test Engineer	 Signature	January 15, 2015 Date of Test
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10 Conclusion

The data in this measurement report shows that the **Harris Bluetooth Adapter, Model # 14002-2015-01** **FCC ID: OWDTR-0137-E, IC: 3636B-0137**, complies with all the applicable requirements of FCC Part 15 and Part 2, and IC RSS-247.