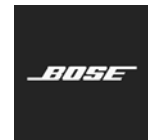




PRODUCT ASSURANCE ENGINEERING  
Wireless Transceiver DSS Test Report



FCC ID: A94BMD0011 IC: 3232A-BMD0011

Test Type: Emissions  Immunity

Product Type: Wireless Headphones

Product Name/Number: *Model Number(s): BMD0011*  
*FCC ID: A94BMD0011*  
*IC: 3232A-BMD0011*

Prepared For: *Product Assurance Engineering Department,*  
*Bose Corporation*

Test Results: Pass  Fail

Applicable Standards: FCC CFR 47 Part 15 Subpart C  
Industry Canada RSS-247 Issue 2  
Industry Canada RSS-GEN Issue 5

Report Number: *EMC. 433948.20.174.1*

General Comments/Special Test Conditions:

This report relates only to the items tested. This report covers EMC marking requirements for model BMD0011

	Print Name	Signature	Date
Prepared By:	Karl Klemm		6/26/2020
Electrical Engineer Review* By:	Bryan Cerqua		6/24/2020

\* Since every test result is separately reviewed after its completion, the electrical engineer review indicated above represents a higher level review to ensure this report lists and contains all applicable and appropriate requirements.

If the report carries the "accredited" logo, the reviewer must verify all the tests in this report are covered under the current ISO17025 accreditation. The A2LA-accredited logo must be removed if any of the tests in the report are not performed under the current scope of accreditation. It is the responsibility of the reviewer to ensure the A2LA advertising policy is followed.



PRODUCT ASSURANCE ENGINEERING  
Wireless Transceiver DSS Test Report



FCC ID: A94BMD0011 IC: 3232A-BMD0011

**Table of Contents**

**Tests Performed (Table of Contents):**

Test Report Summary ..... 3

20dB and 99% Bandwidth ..... 6

Conducted Output Power ..... 18

Hopping Frequency Separation..... 25

Conducted Spurious Emissions ..... 28

Average Time of Occupancy ..... 64

Number of Hopping Channels ..... 75



# Test Report Summary

Product Information:

Description

*The EUT is a wireless headphone that contains DSS/DTS transceivers, manufactured by Qualcomm Technologies, QCC5127. The EUT uses Adaptive Frequency Hopping (AFH) mode, using a reduced hop set if interference is detected in band, however a minimum of 20 channels is always maintained.*

*There are two frame styles (Soprano and Tenor) which use identical electronics and are differentiated only by cosmetic differences in the enclosure. The differences in the enclosures have no impact on the transmitter function or characteristics. The Soprano frame style was used for testing.*

Setup (Cables and Accessories)

*For radio tests the radio was configured with Qualcomm Blue Suite software (details provided in SOFTWARE AND FIRMWARE section).*

EUT Antenna Description

*The antenna is an internal PIF variant with antenna gain of 2.8 dBi formed by printed circuit board etch.*

SOFTWARE AND FIRMWARE

*The firmware installed in the EUT during testing was version 0.3.103*

*The test utility software used during testing was Polycomm, version 2.6.0 and Blue Suite version 3.2.3.*

Scope:

*This report covers EMC requirements. FCC CFR 47 PART 15 SUBPART C, Industry Canada RSS-247 Issue 2, and Industry Canada RSS-GEN Issue 5.*

*All measurements in this report were made with a direct connection to the antenna terminal, with the antenna disconnected.*

Test Objective:

*Verify product meets all applicable EMC requirements.*

Measurement Method:

*ANSI C63.10 (2013).*

Results:

*Product complies with all applicable EMC requirements. All final results represent worst-case emissions and/or immunity.*


Conclusions:

The device under test (D.U.T.):

meets all test standards selected in section 2 of this report.

does not meet all test standards selected in section 2 of this report.

Affirmation of Test Results:

	Print Name	Signature	Date
Testing Engineer/Technician	Karl Klemm		6/26/2020



PRODUCT ASSURANCE ENGINEERING  
**Wireless Transceiver DSS Test Report**  
FCC ID: A94BMD0011 IC: 3232A-BMD0011





# Test Standards

## Emissions:

- Standard
- FCC Part 15C
- Canada RSS-247
- Canada RSS-GEN

# Environmental Conditions

## Ambient:

- Temperature: 22±4 °C
- Humidity: 30-60 %RH
- Mains Voltage:  5 Vdc

# FCC Test Site Accreditation.

Firm Name	Location	Accreditation	MRA	Designation Number	Expiration Date	Contact	Contact Title
<a href="#">Bose Corporation</a>	1 New York Avenue, Framingham, MA	American Association for Laboratory Accreditation	N/A	US1088	09/30/2020	Carole Park	Quality Manager

# Canadian Test Site Registration.

Organization	CAB identifier	Scope / Recognition Date (yyyy-mm-dd)	Expiration (yyyy-mm-dd)
BOSE CORPORATION  1 New York Avenue Framingham, MA 01701 UNITED STATES  Website: <a href="https://www.bose.com/en_us/index.html">https://www.bose.com/en_us/index.html</a>  <b>ISED#: 3232A</b>  Contact: Benjamin Cerretani <a href="mailto:benjamin_cerretani@bose.com">benjamin_cerretani@bose.com</a>	US0210	RSS-GEN (2019-02-11)  RSS-210 (2019-02-11) RSS-247 (2019-02-11)	<b>RECOGNIZED UNTIL: 2020-07-31</b>  A2LA ISO/IEC 17025:2005 Expires: 2020-07-31

# 20dB and 99% Bandwidth

## Requirement:

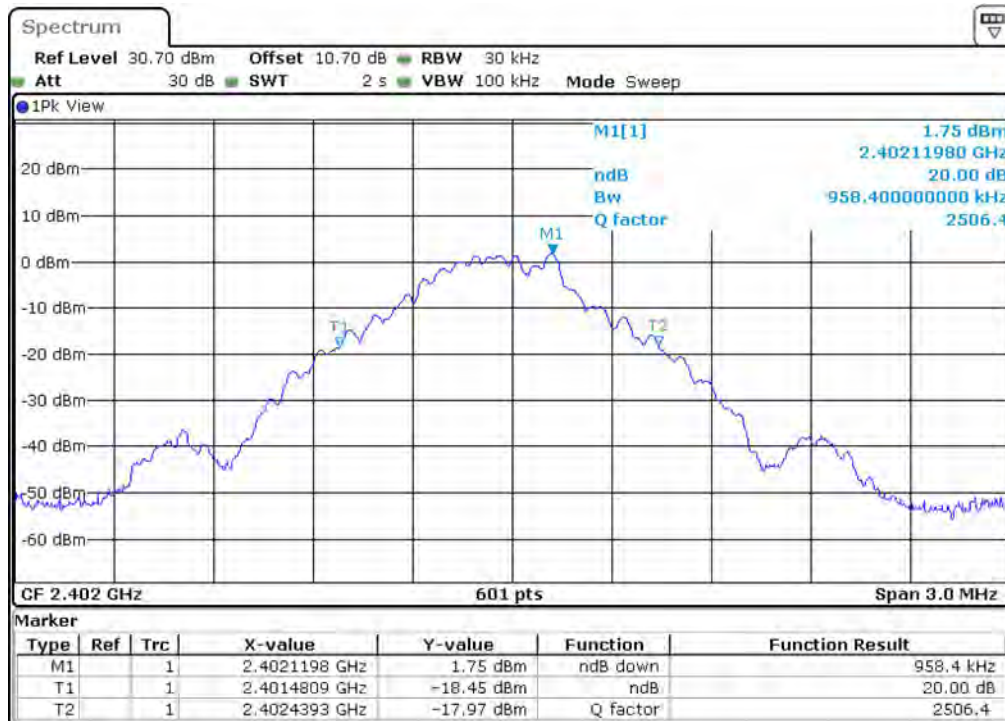
None; for reporting purposes only. Test per FCC 15.247(a)(1); IC RSS-247 5.1 (1), RSS-Gen 6.6.

## Test Procedure:

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1-5% of the 20 dB bandwidth and 99% Occupied Bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

# 20dB Occupied Bandwidth

20 dB OBW Summary Table (Basic Rate: 1 Mbps)				
Channel	Frequency (MHz)	Mode	20 dB OBW (MHz)	Limit NA
Low	2402	DH5	0.958	-
Middle	2441	DH5	0.958	-
High	2480	DH5	0.958	-

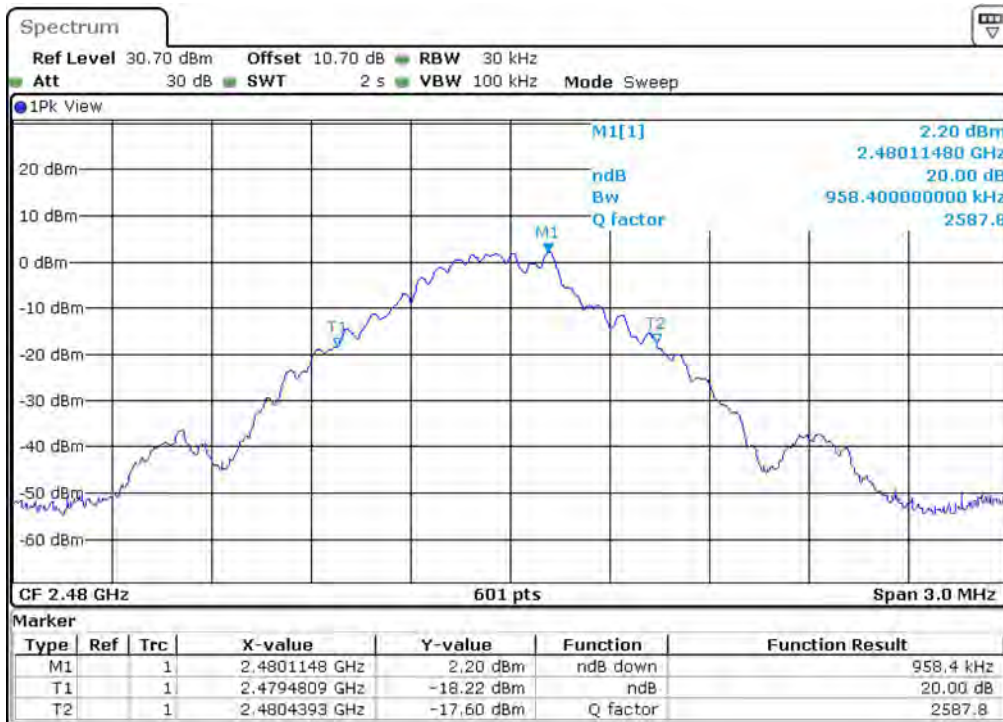
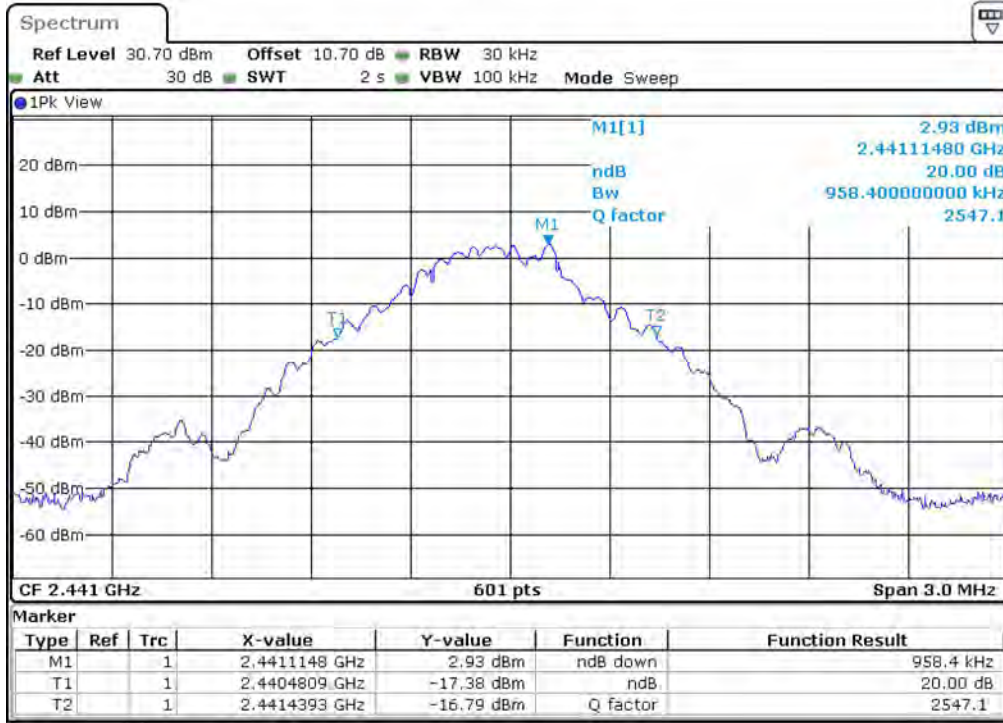




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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

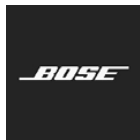
FCC ID: A94BMD0011 IC: 3232A-BMD0011





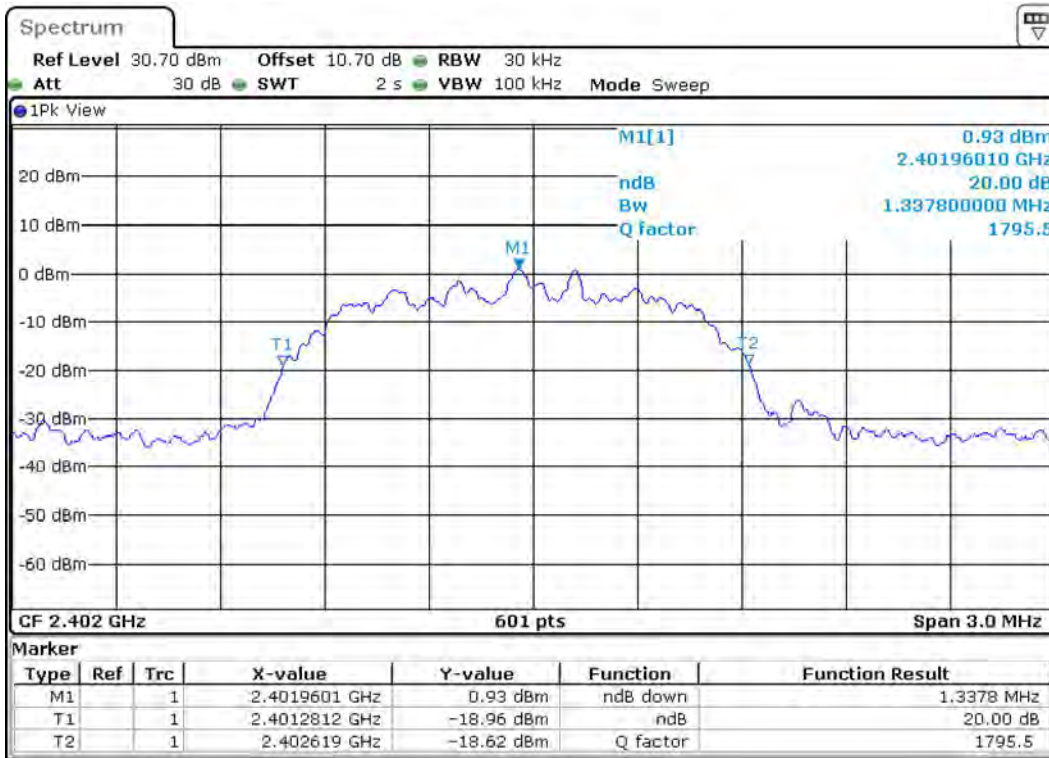
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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report



FCC ID: A94BMD0011 IC: 3232A-BMD0011

20 dB OBW Summary Table (Enhanced Rate: 2 Mbps)				
Channel	Frequency (MHz)	Mode	20 dB OBW (MHz)	Limit NA
Low	2402	2-DH5	1.338	-
Middle	2441	2-DH5	1.338	-
High	2480	2-DH5	1.343	-



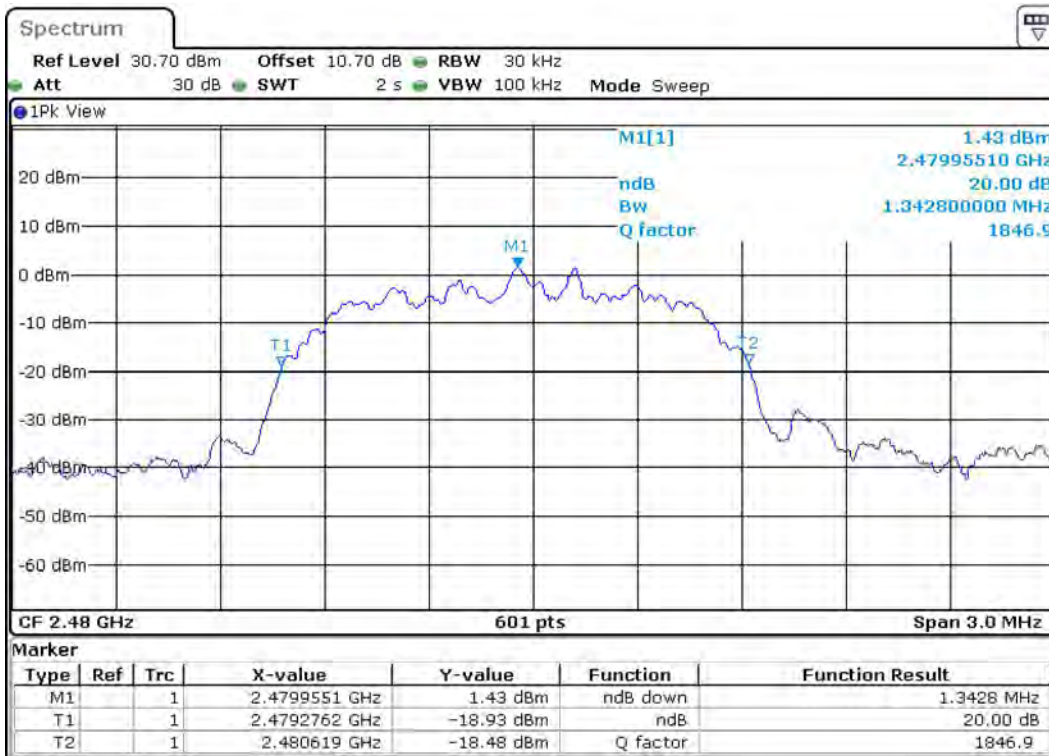
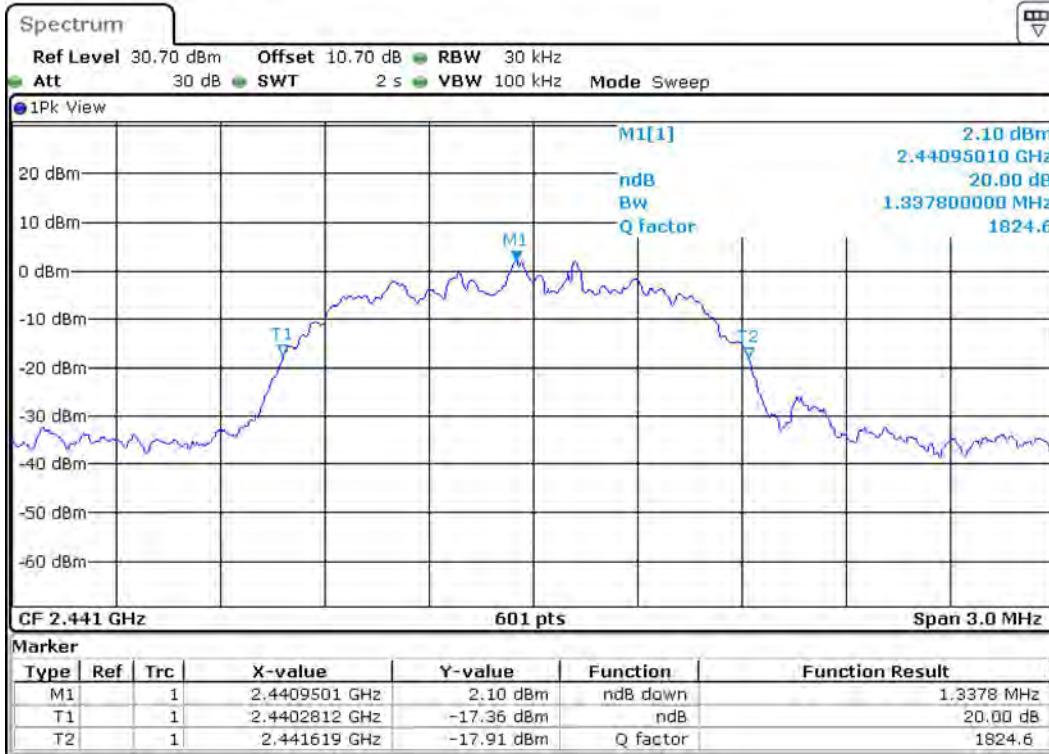




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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

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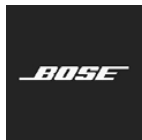




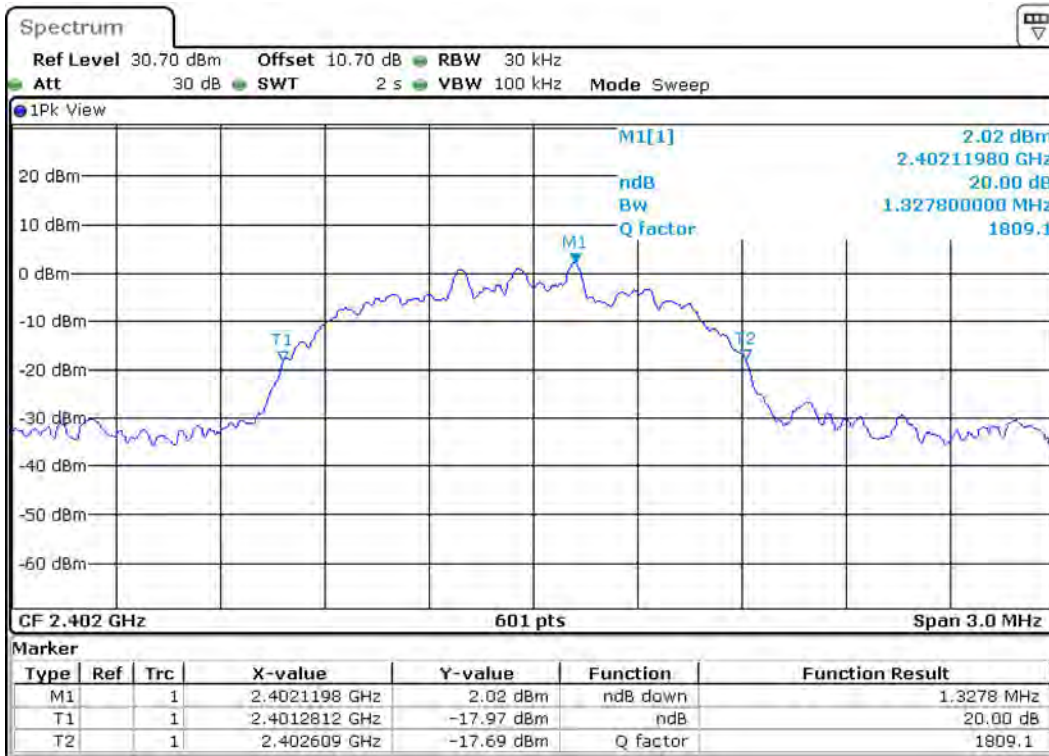
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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



20 dB OBW Summary Table (Enhanced Rate: 3 Mbps)				
Channel	Frequency (MHz)	Mode	20 dB OBW (MHz)	Limit NA
Low	2402	3-DH5	1.328	-
Middle	2441	3-DH5	1.323	-
High	2480	3-DH5	1.303	-

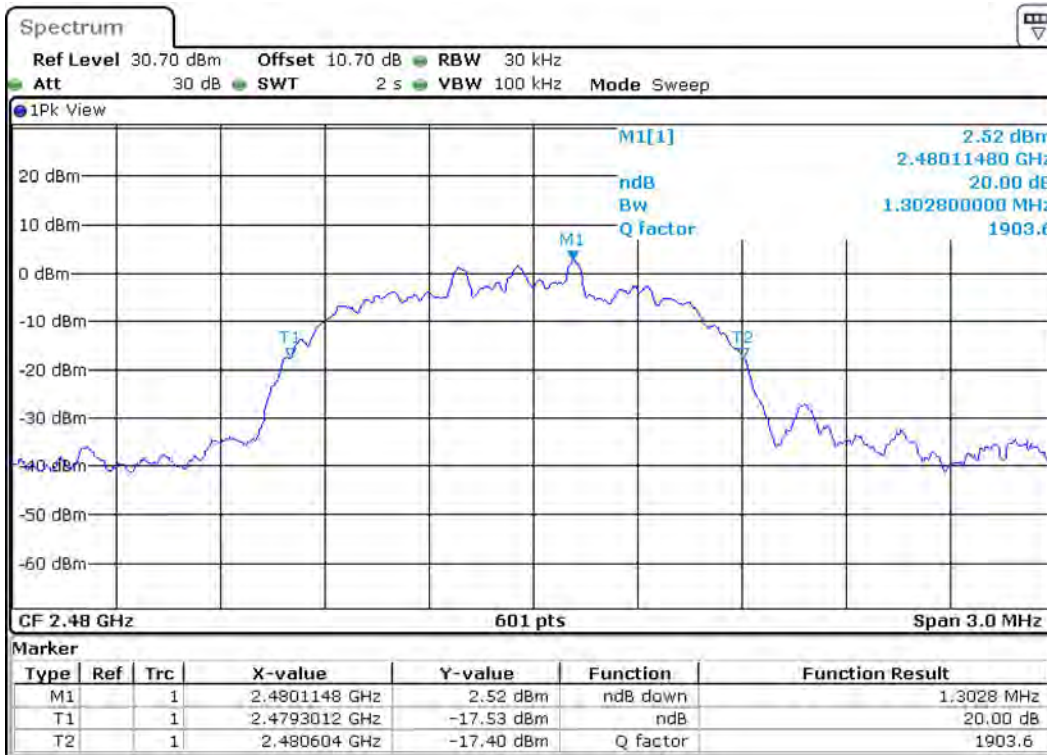
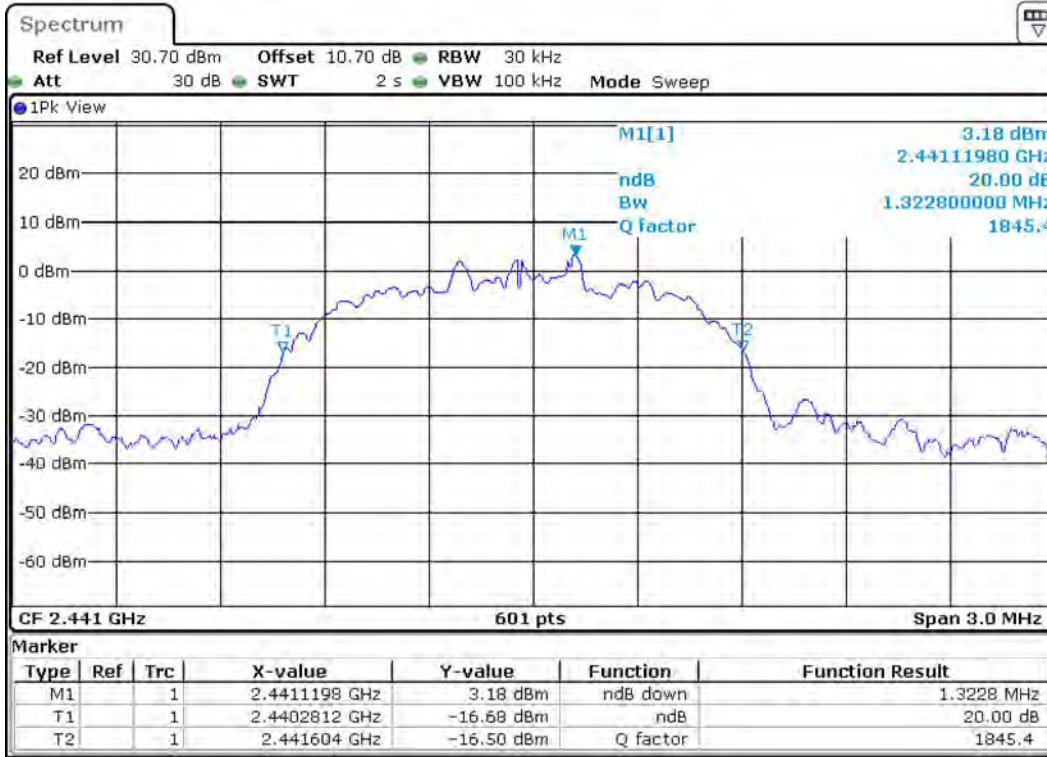




Certificate # 1514.1

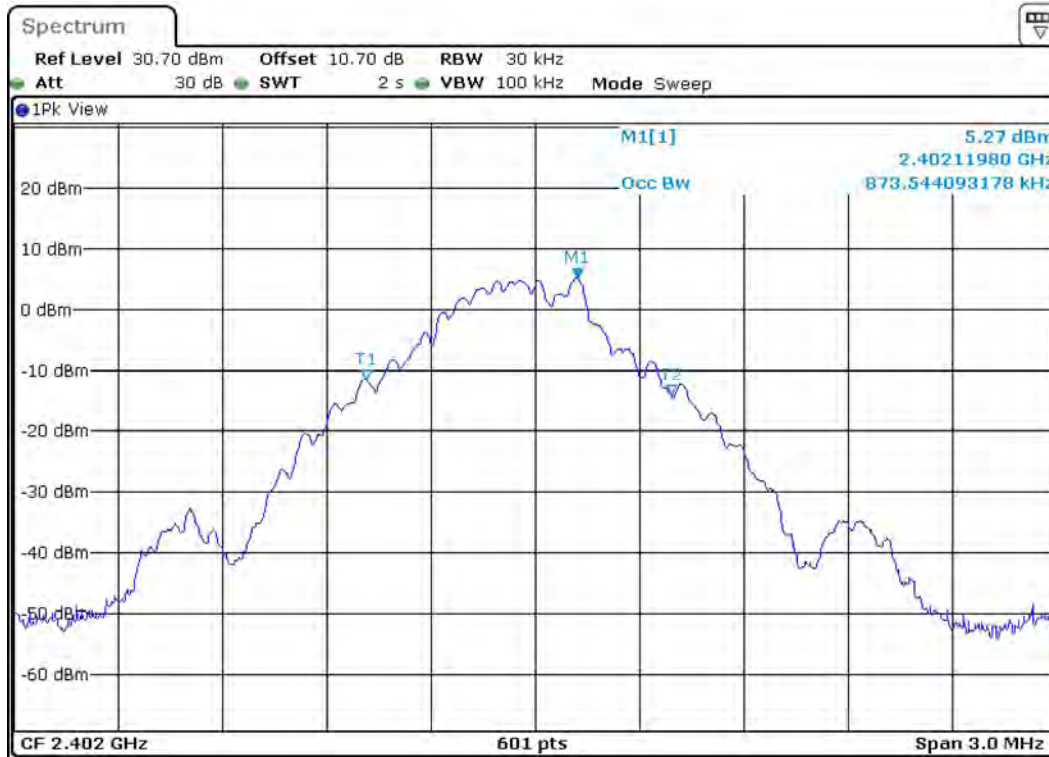
# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



# 99% Occupied Bandwidth

99% OBW Summary Table (Basic Rate: 1 Mbps)				
Channel	Frequency (MHz)	Mode	99% OBW (MHz)	Limit NA
Low	2402	DH5	0.874	-
Middle	2441	DH5	0.879	-
High	2480	DH5	0.874	-

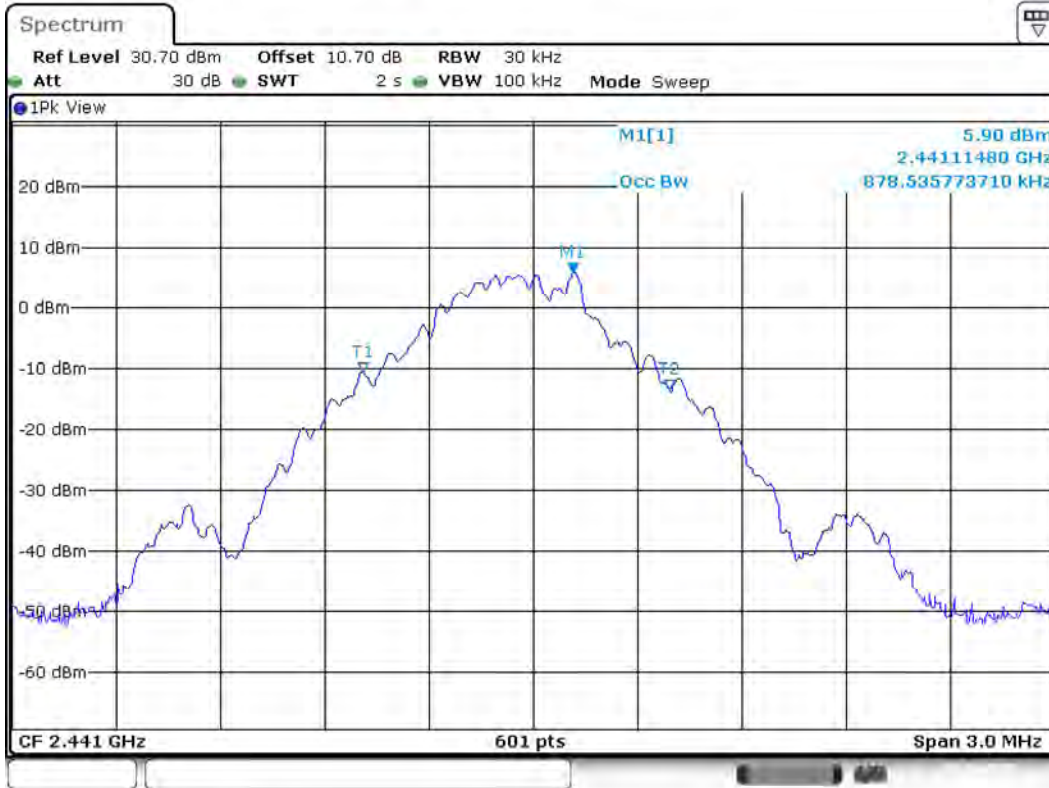




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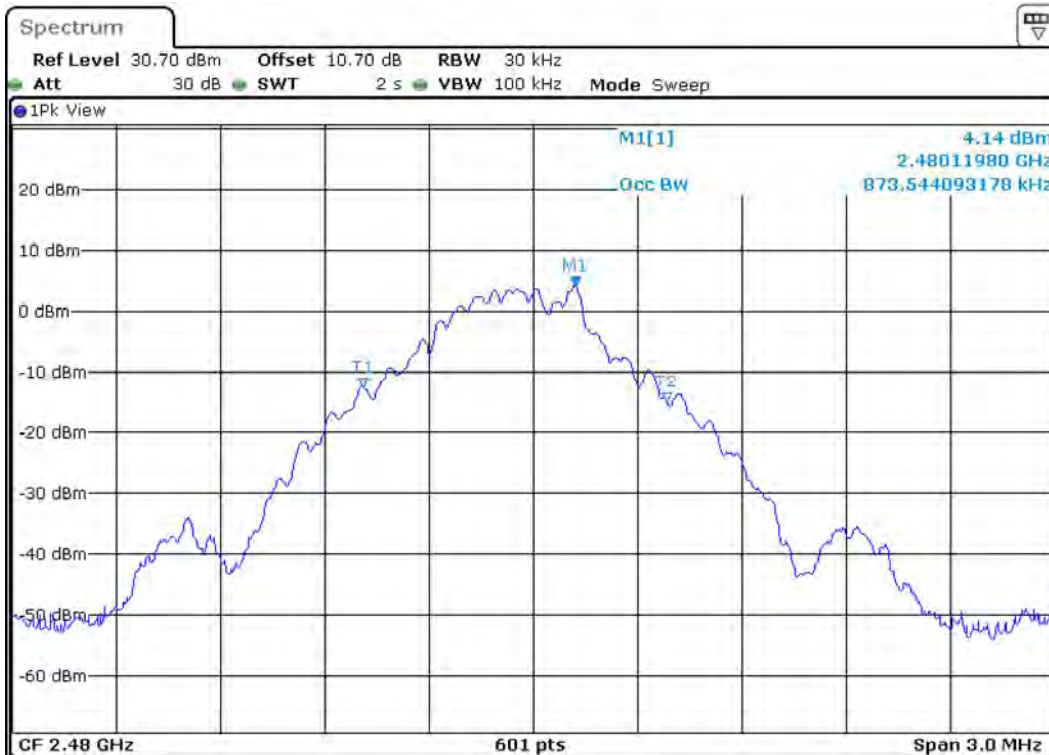
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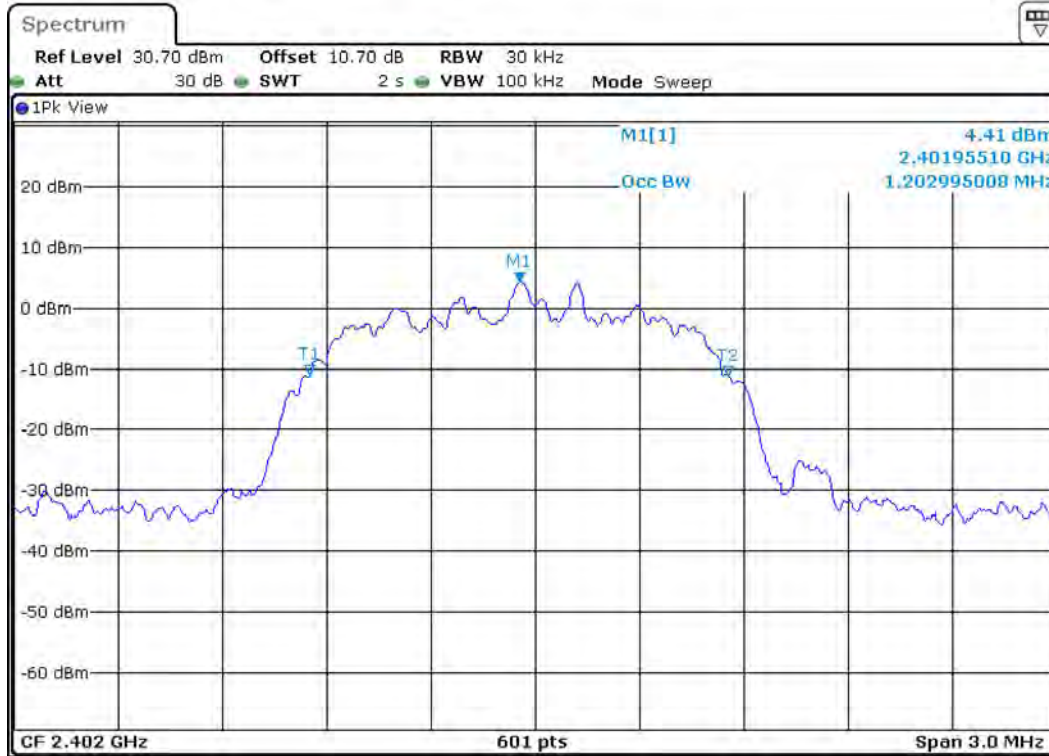


Plot2 99P OBW DH5 2441 MHz

Date: 2 JUN.2020 17:20:19



99% OBW Summary Table (Enhanced Rate: 2 Mbps)				
Channel	Frequency (MHz)	Mode	99% OBW (MHz)	Limit NA
Low	2402	2-DH5	1.203	-
Middle	2441	2-DH5	1.208	-
High	2480	2-DH5	1.198	-





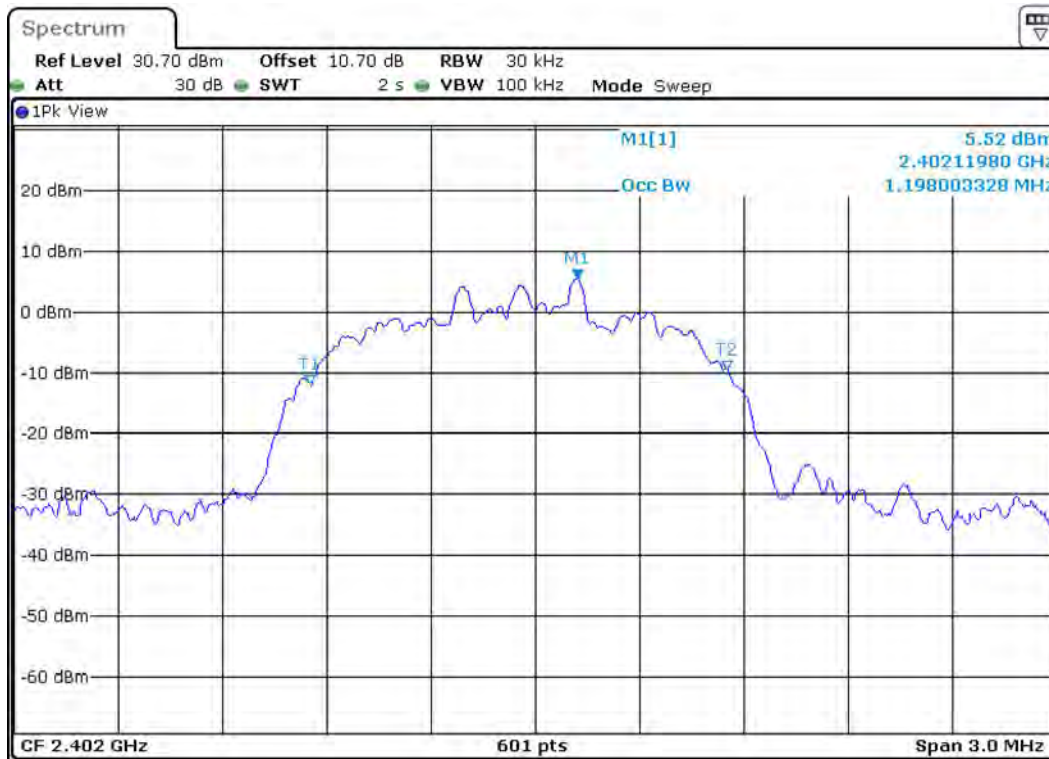
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



99% OBW Summary Table (Enhanced Rate: 3 Mbps)				
Channel	Frequency (MHz)	Mode	99% OBW (MHz)	Limit NA
Low	2402	3-DH5	1.198	-
Middle	2441	3-DH5	1.203	-
High	2480	3-DH5	1.188	-



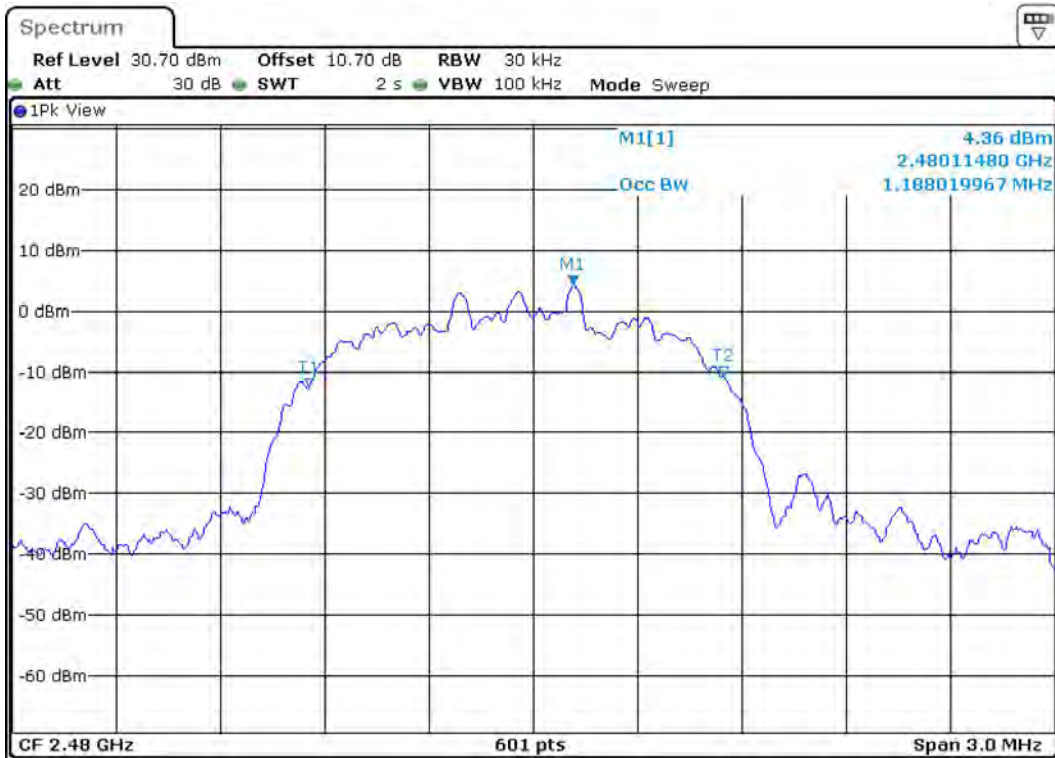




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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011





# Conducted Output Power Requirements:

## FCC 15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

## RSS-247 5.4 (2)

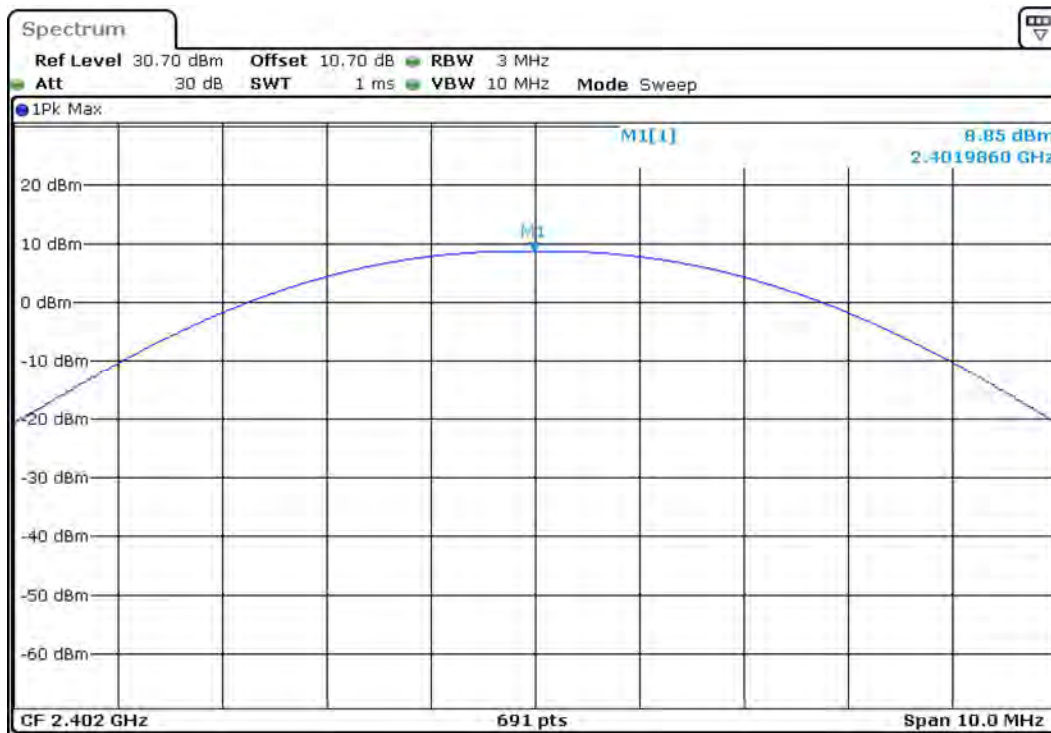
For frequency hopping systems operating in the band 2400-2483.5 MHz and employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W.

# Test setup details:

The EUT is controlled via the USB port with Blue Suite software which is used to set the test modes of the Bluetooth device. The EUT antenna is disconnected. A temporary test connector is mounted to the PCB. An 8 inch SMA adapter cable with 0.7 dB loss was used for all conducted measurements. To compensate for the cable loss, the reference level offset feature of the spectrum analyzer was used. The EUT is programmed to operate on fixed frequencies at the low, middle, and high end of the authorized frequency band. The spectrum analyzer resolution bandwidth is set to 3 MHz (higher than the occupied bandwidth), peak detector and max hold. The maximum output power is recorded for each of the three frequencies in both basic and enhanced data rates.

# Test Results:

Output Power Summary Table (Basic Rate: 1 Mbps)							
Channel	Frequency (MHz)	Mode	Output Power (dBm)	Directional Gain (dBi)	Limit (dB)	Margin (dB)	Result
Low	2402	DH5	8.90	0	21	12.10	Pass
Middle	2441	DH5	10.10	0	21	10.90	Pass
High	2480	DH5	8.90	0	21	12.10	Pass

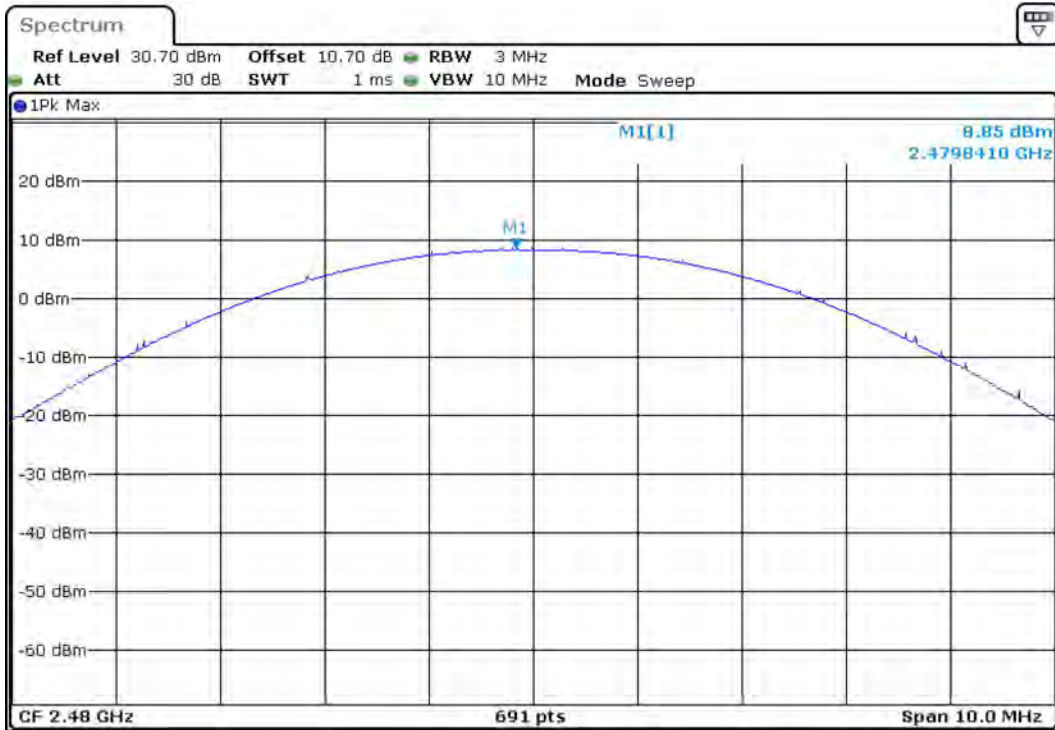
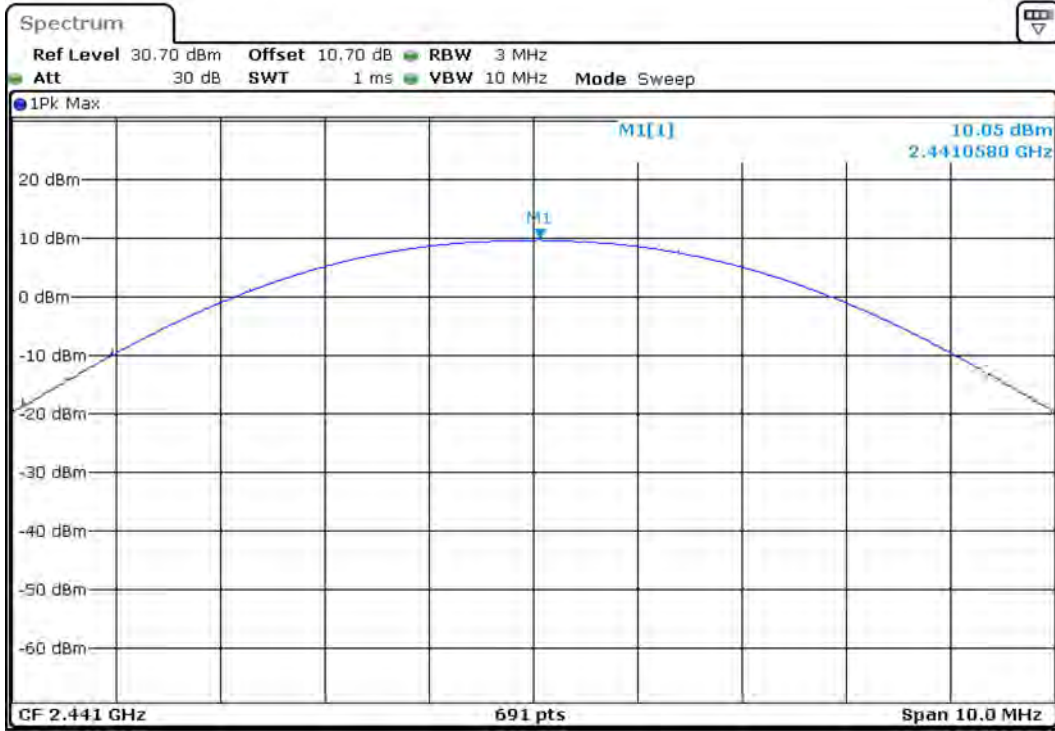




Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011





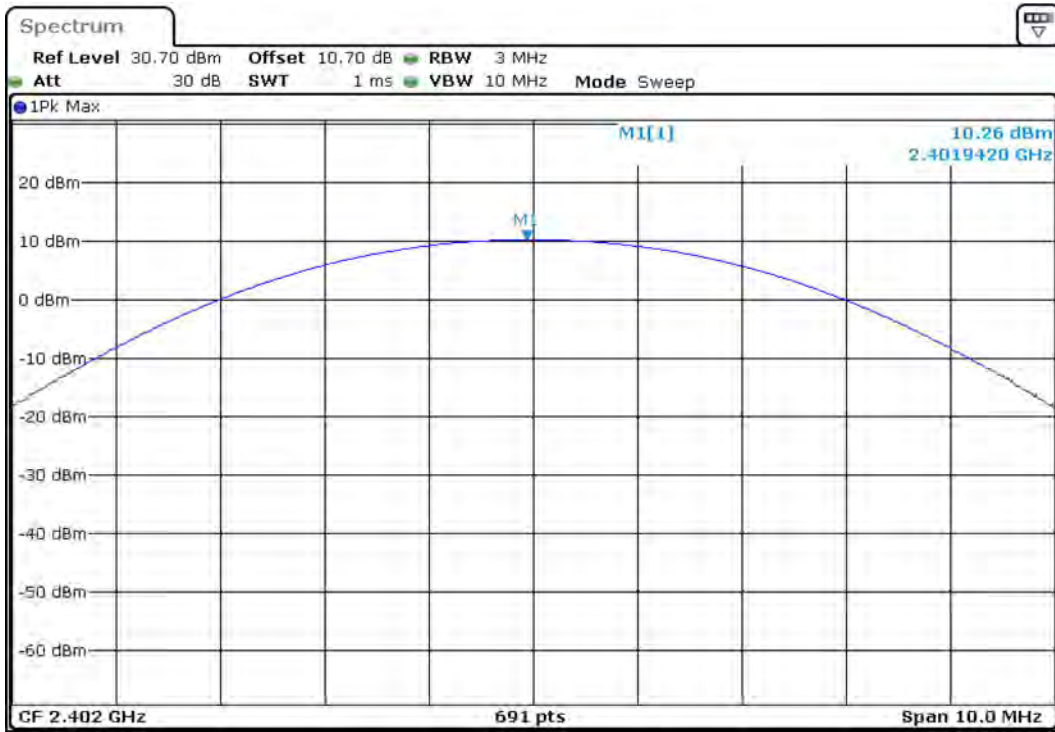
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Output Power Summary Table (Enhanced Rate: 2 Mbps)							
Channel	Frequency (MHz)	Mode	Output Power (dBm)	Directional Gain (dBi)	Limit (dB)	Margin (dB)	Result
Low	2402	2-DH5	10.30	0	21	10.70	Pass
Middle	2441	2-DH5	11.00	0	21	10.00	Pass
High	2480	2-DH5	9.90	0	21	11.10	Pass

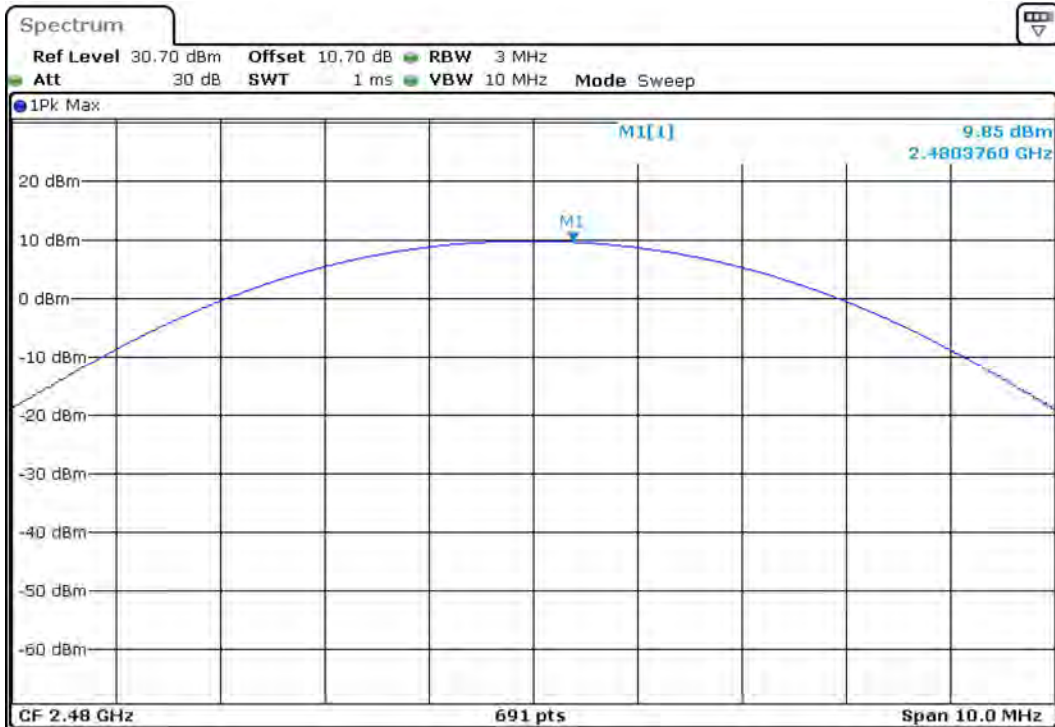
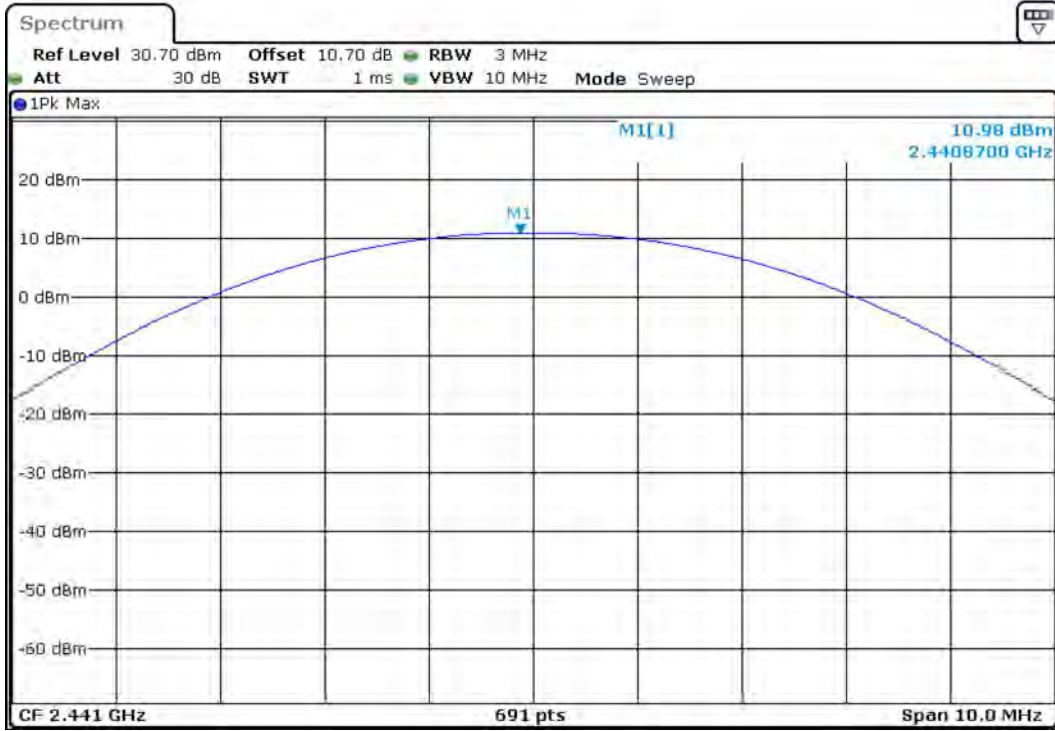




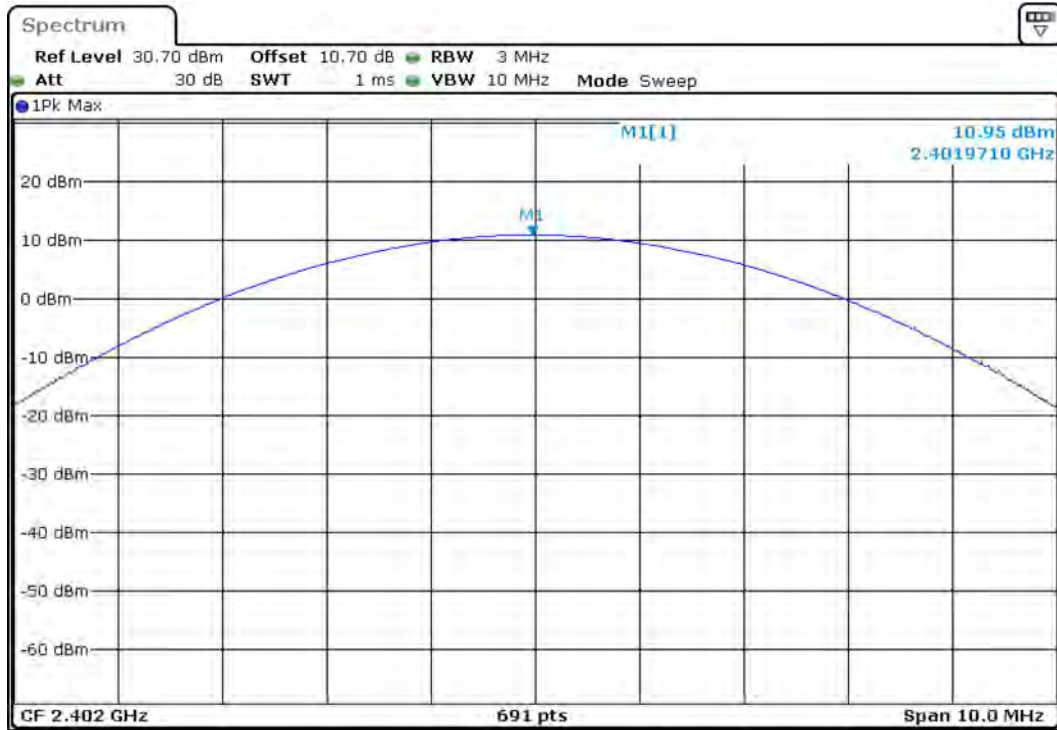
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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Output Power Summary Table (Enhanced Rate: 3 Mbps)							
Channel	Frequency (MHz)	Mode	Output Power (dBm)	Directional Gain (dBi)	Limit (dB)	Margin (dB)	Result
Low	2402	3-DH5	11.00	0	21	10.00	Pass
Middle	2441	3-DH5	11.70	0	21	9.30	Pass
High	2480	3-DH5	10.50	0	21	10.50	Pass

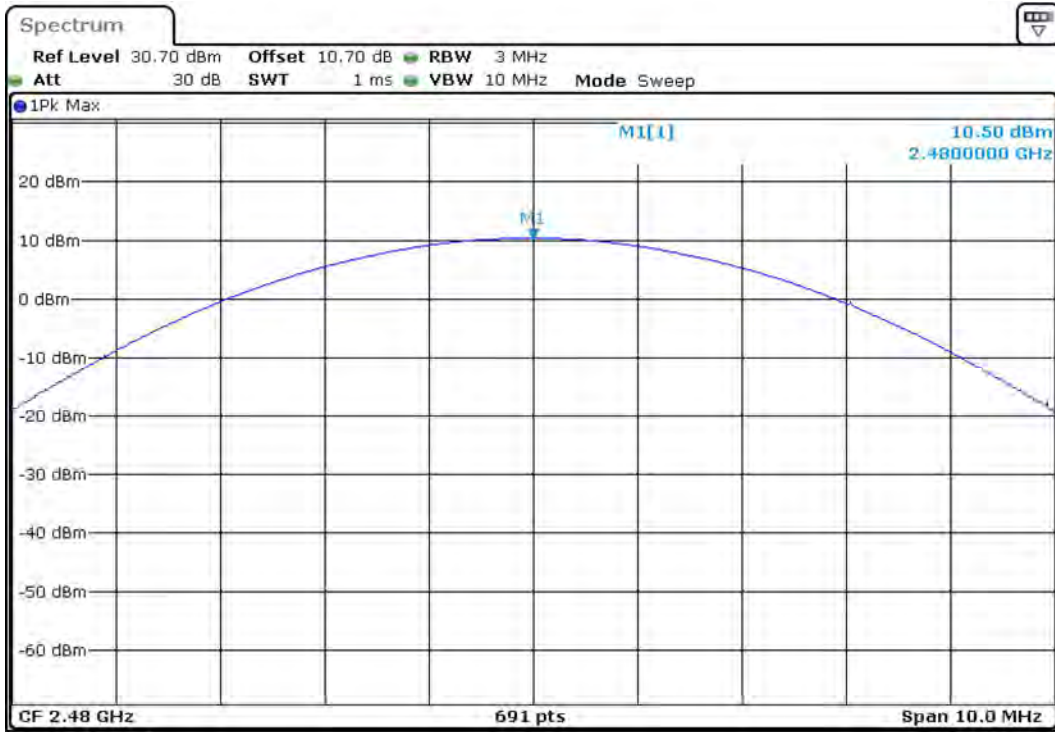
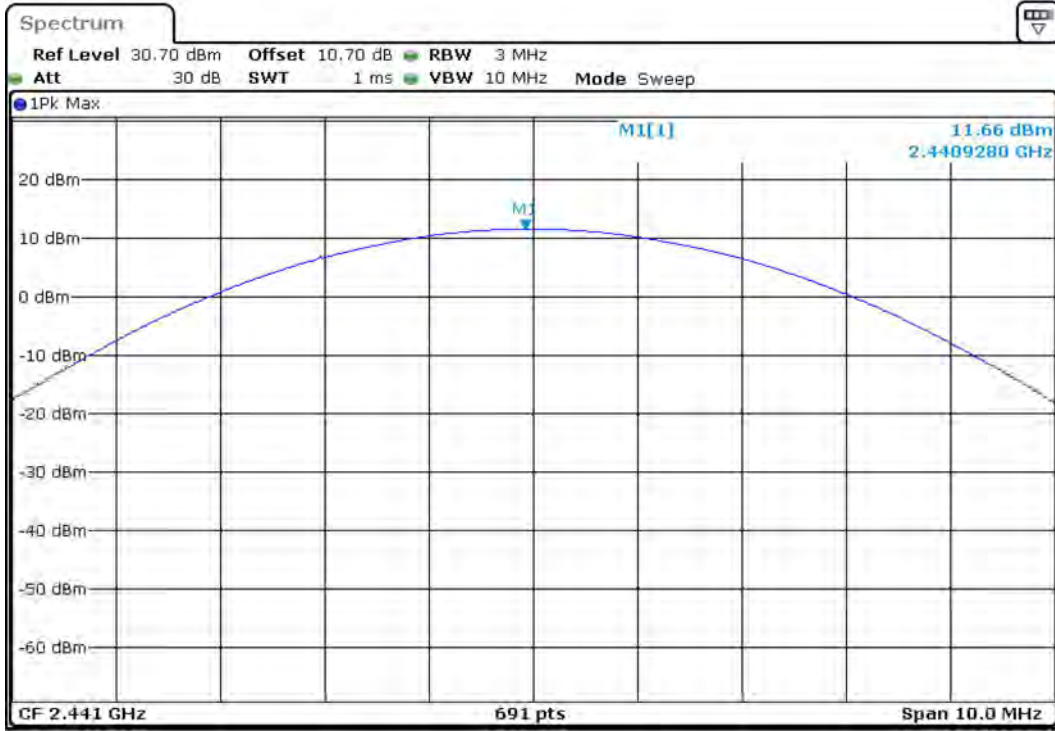




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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011





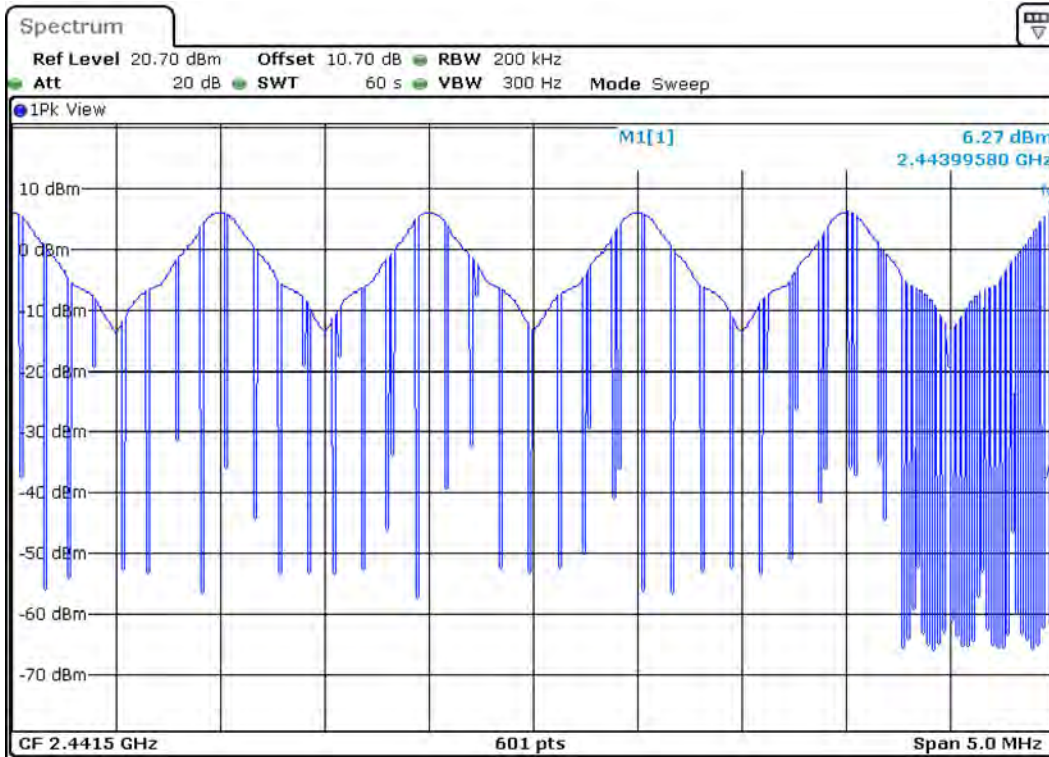


# Hopping Frequency Separation Requirements:

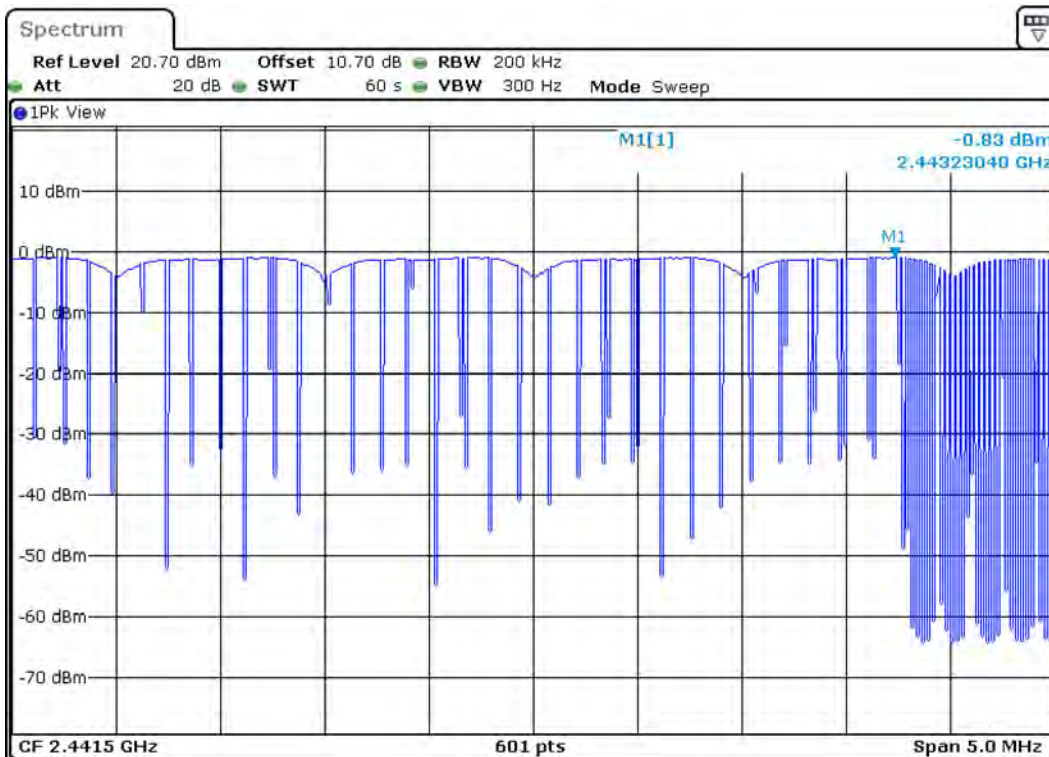
FCC 15.247 (a) (1), IC RSS-247 5.1 (2)

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 the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

# Test Results:



Hopping frequencies are separated by 1 MHz, which is greater than the required minimum of the 20 dB bandwidth; 958 kHz for DH5.



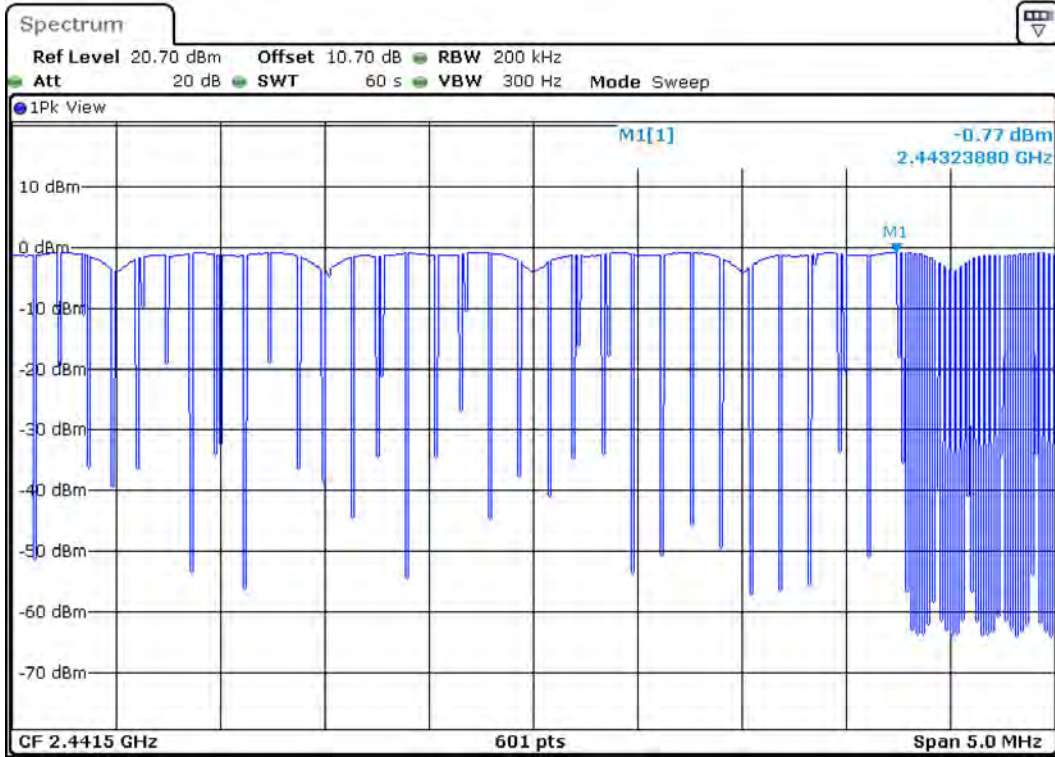
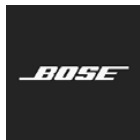
Hopping frequencies are separated by 1 MHz which is greater than the required minimum of 2/3 of the 20 dB bandwidth of the hopping channel, which would be 895 kHz for 2-DH5; the output power in 2-DH5 mode is less than 125 mW



Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Hopping frequencies are separated by 1 MHz which is greater than the required minimum of 2/3 of the 20 dB bandwidth of the hopping channel, which would be 885 kHz for 3-DH5; the output power in 3-DH5 mode is less than 125 mW



# Conducted Spurious Emissions Requirements:

## FCC 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see 15.205(c)).

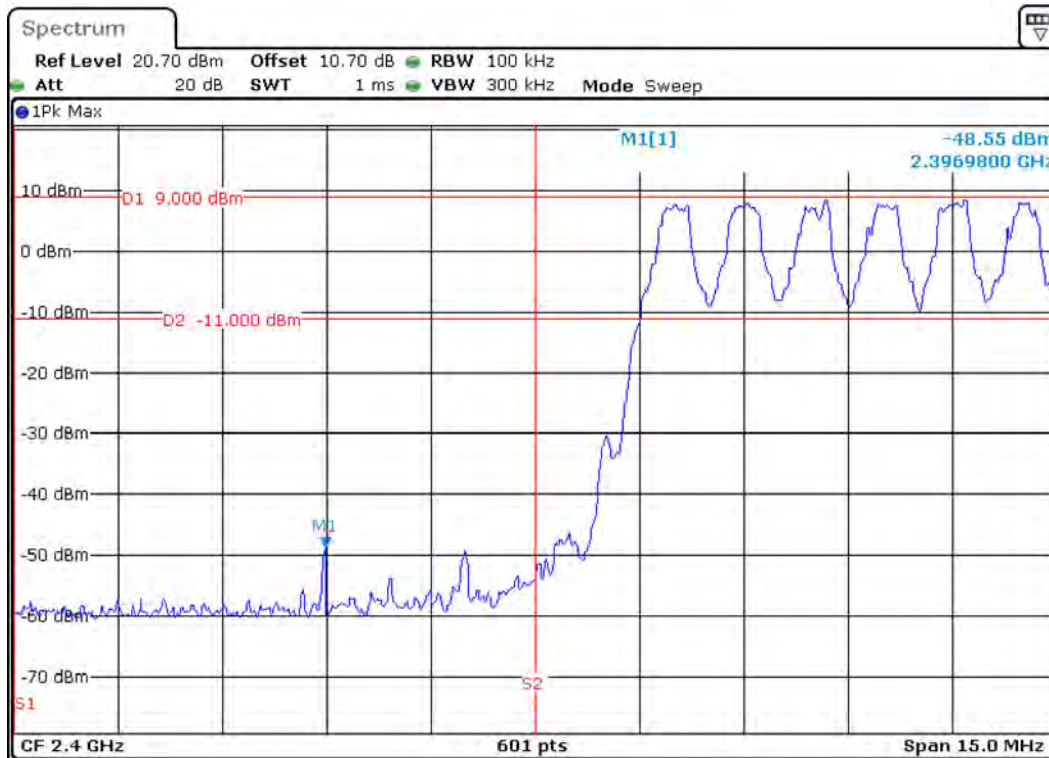
## IC RSS-247 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Note: Antenna gain outside of the wanted band was assumed to be zero. The conducted spurious readings are for additional information as the radiated readings take precedence.

# Spurious Band-edge Emissions

Lower Band Edge (Basic Rate: 1 Mbps) (Hopping Mode)						
Mode	Frequency (MHz)	Mode	Worst Case (dBc)	Limit (dBc)	Margin (dB)	Result
Hopping	All	DH5	57.55	20	37.55	Pass
Hopping	All	2-DH5	53.38	20	33.38	Pass
Hopping	All	3-DH5	52.01	20	32.01	Pass



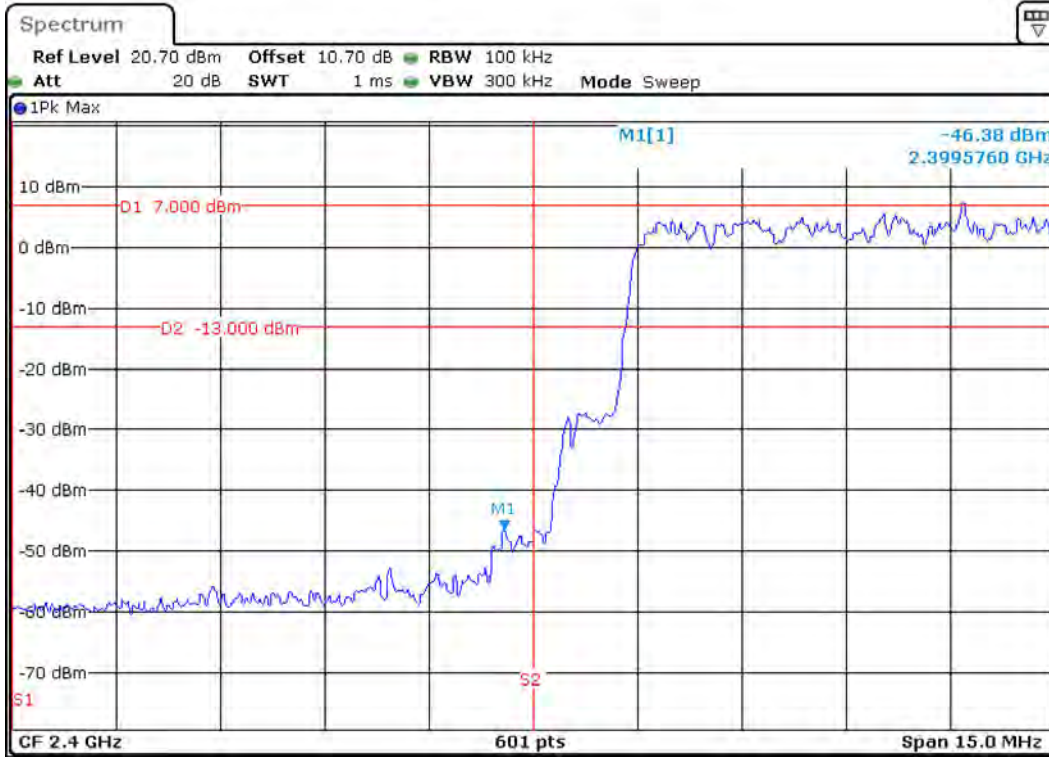
DH5, hopping on all channels



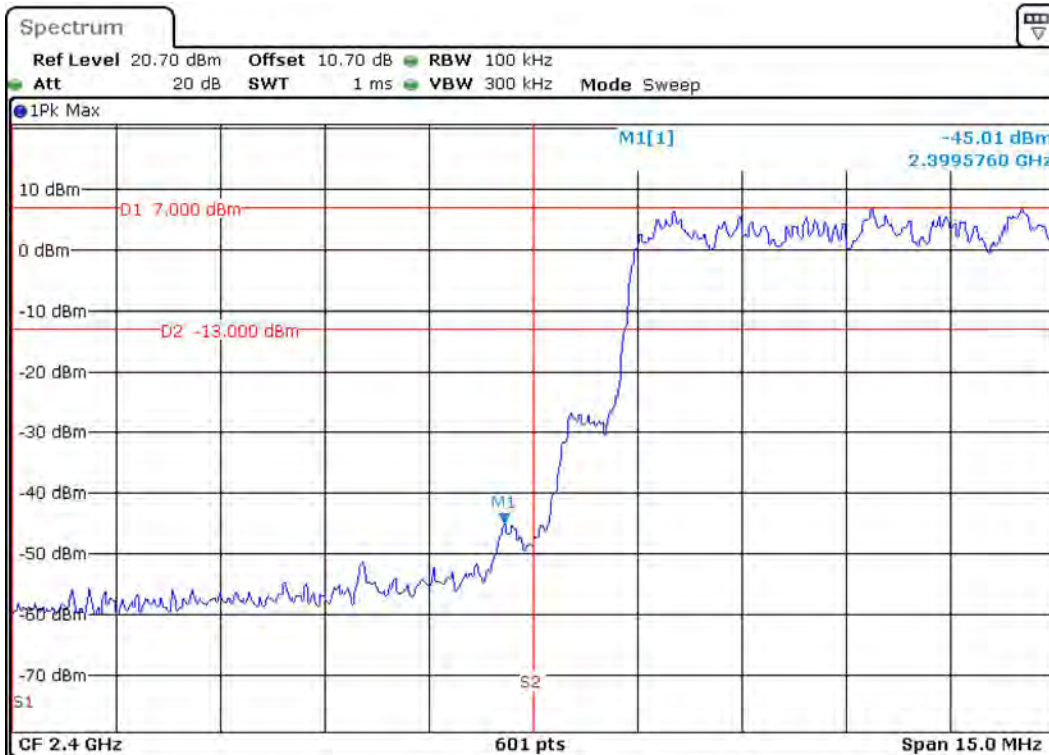
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011

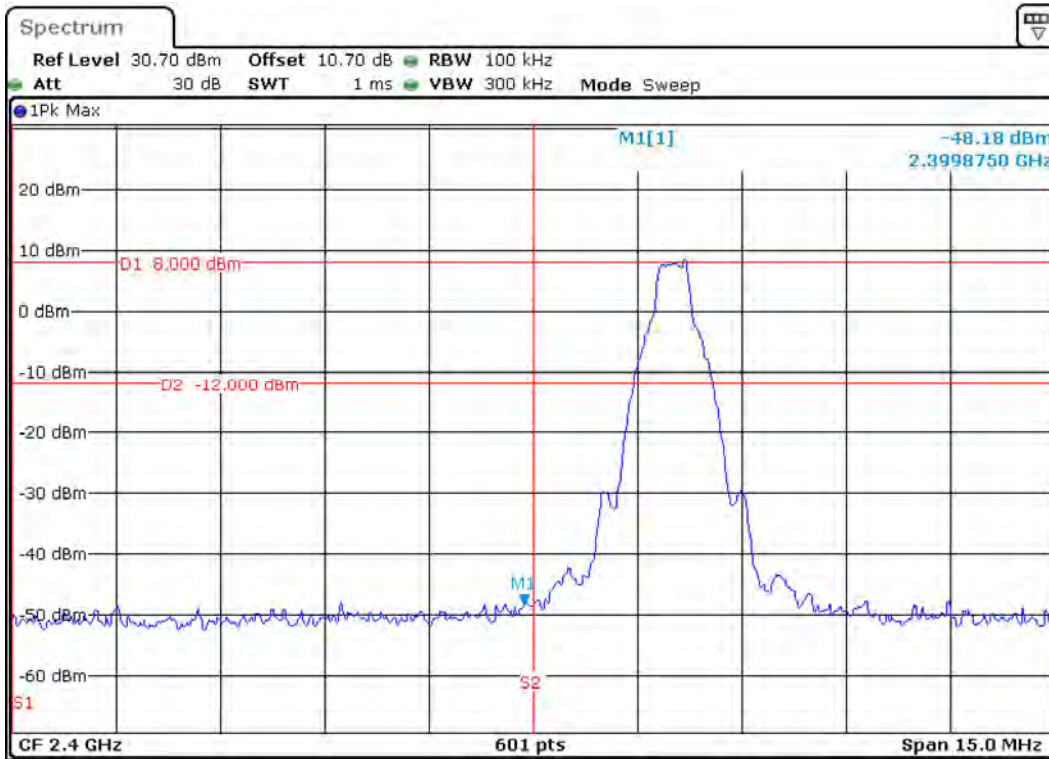


2DH5, hopping on all channels



3DH5, hopping on all channels

Lower Band Edge (Basic Rate: 1 Mbps) (Non-Hopping Mode)						
Channel	Frequency (MHz)	Mode	Worst Case (dBc)	Limit (dBc)	Margin (dB)	Result
Low	2402	DH5	56.18	20	36.18	Pass
Low	2402	2-DH5	51.15	20	31.15	Pass
Low	2402	3-DH5	50.87	20	30.87	Pass



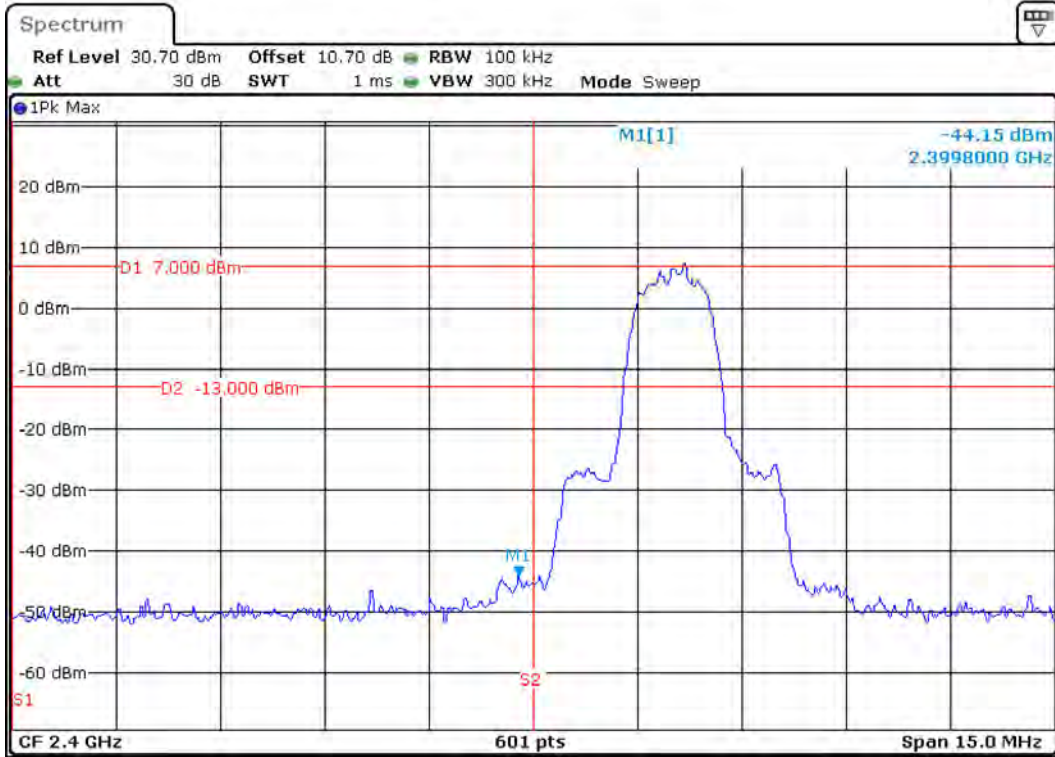
DH5, non-hopping



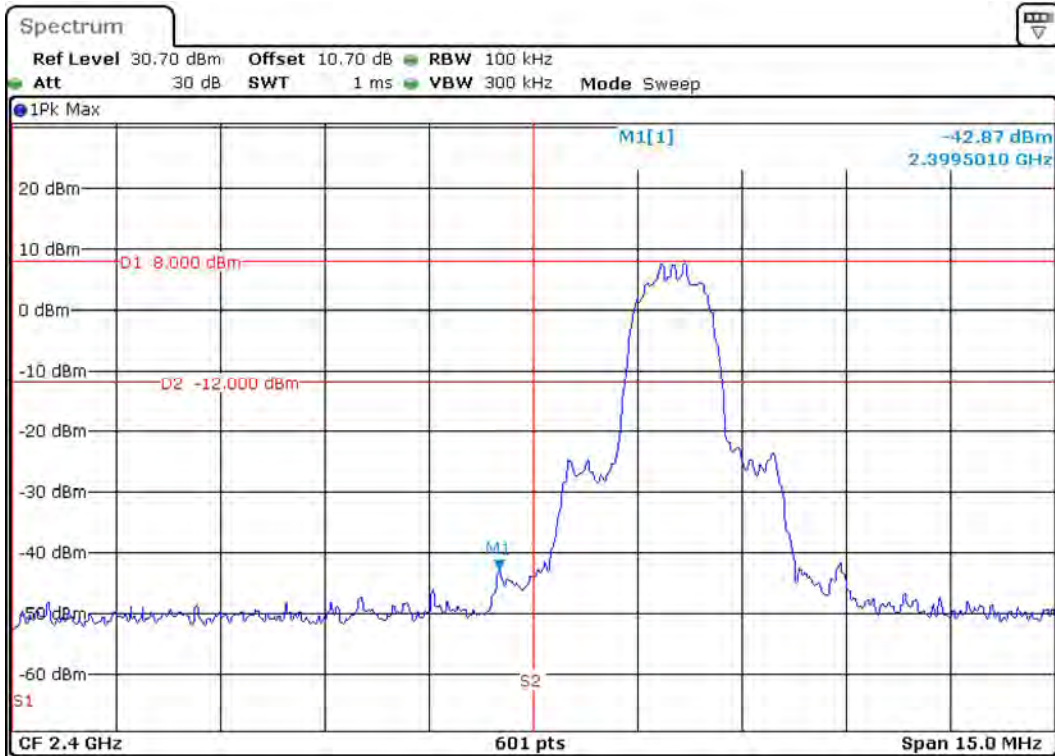
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



2DH5, non-hopping



3DH5, non-hopping





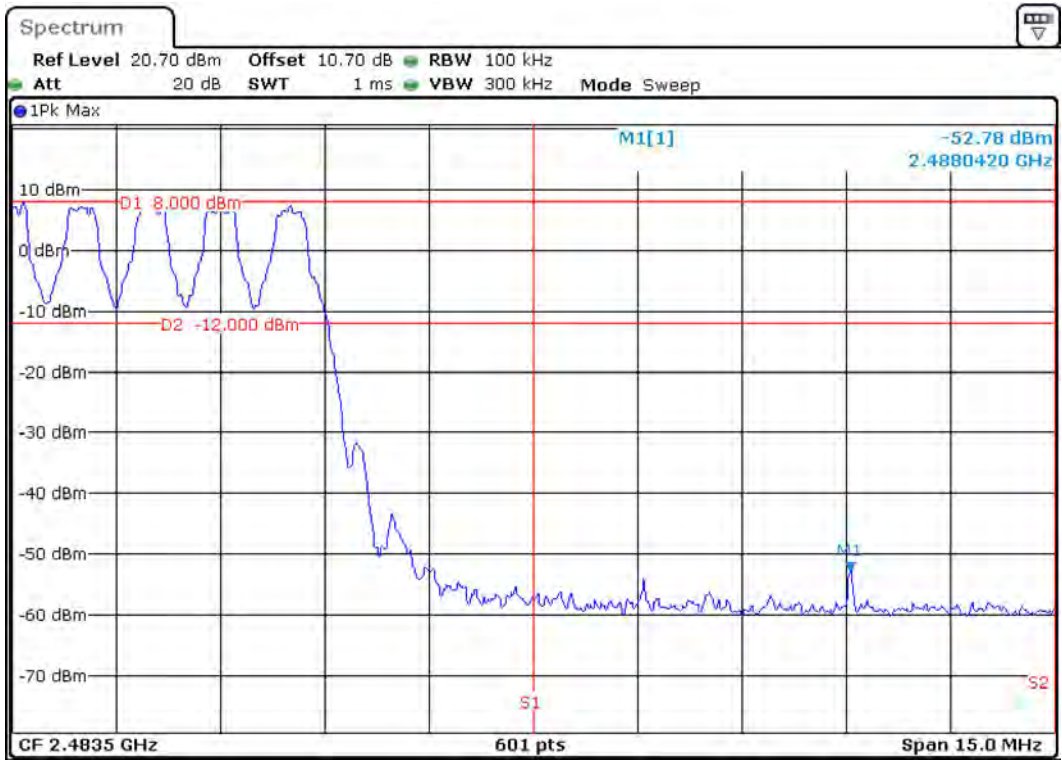
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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Upper Band Edge (Basic Rate: 1 Mbps) (Hopping Mode)						
Mode	Frequency (MHz)	Mode	Worst Case (dBc)	Limit (dBc)	Margin (dB)	Result
Hopping	All	DH5	60.78	20	40.78	Pass
Hopping	All	2-DH5	60.43	20	40.43	Pass
Hopping	All	3-DH5	61.33	20	41.33	Pass



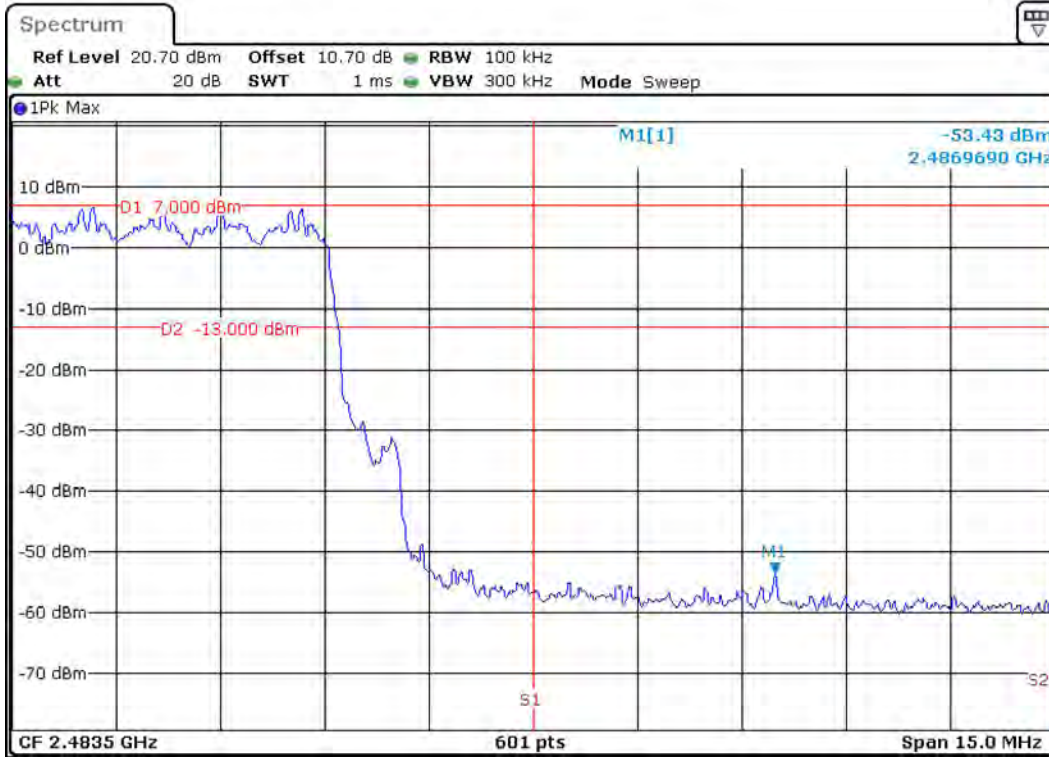
DH5, hopping on all channels



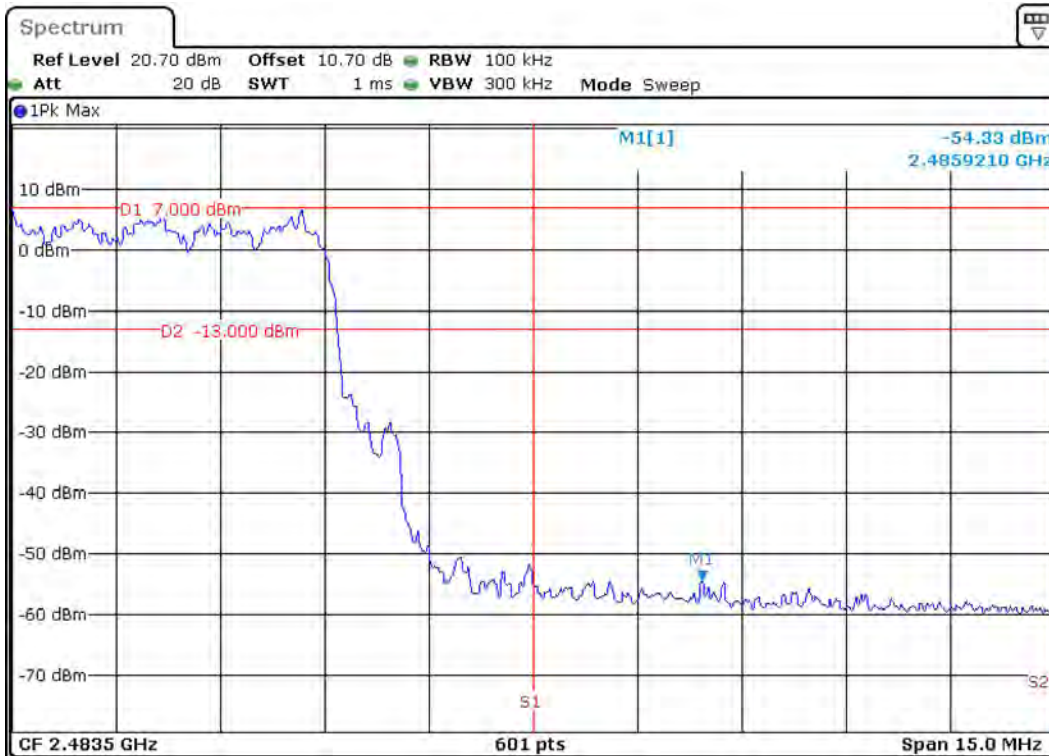
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



2DH5, hopping on all channels



3DH5, hopping on all channels



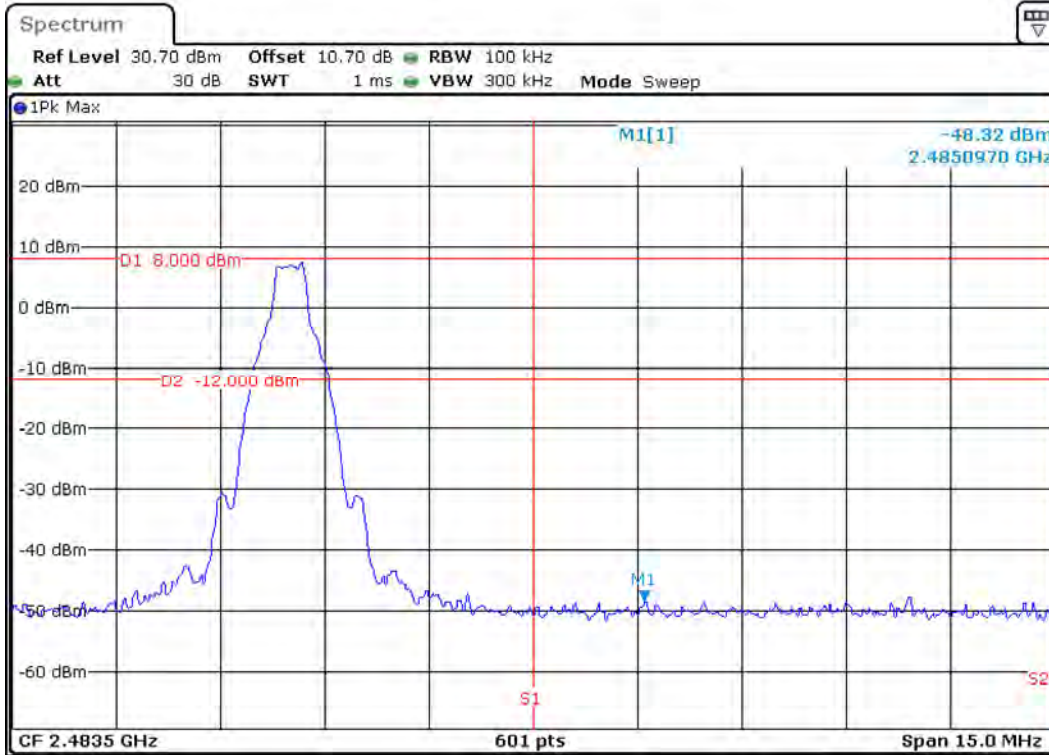
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Upper Band Edge (Basic Rate: 1 Mbps) (Non-Hopping Mode)						
Channel	Frequency (MHz)	Mode	Worst Case (dBc)	Limit (dBc)	Margin (dB)	Result
High	2480	DH5	56.32	20	36.32	Pass
High	2480	2-DH5	54.91	20	34.91	Pass
High	2480	3-DH5	54.46	20	34.46	Pass



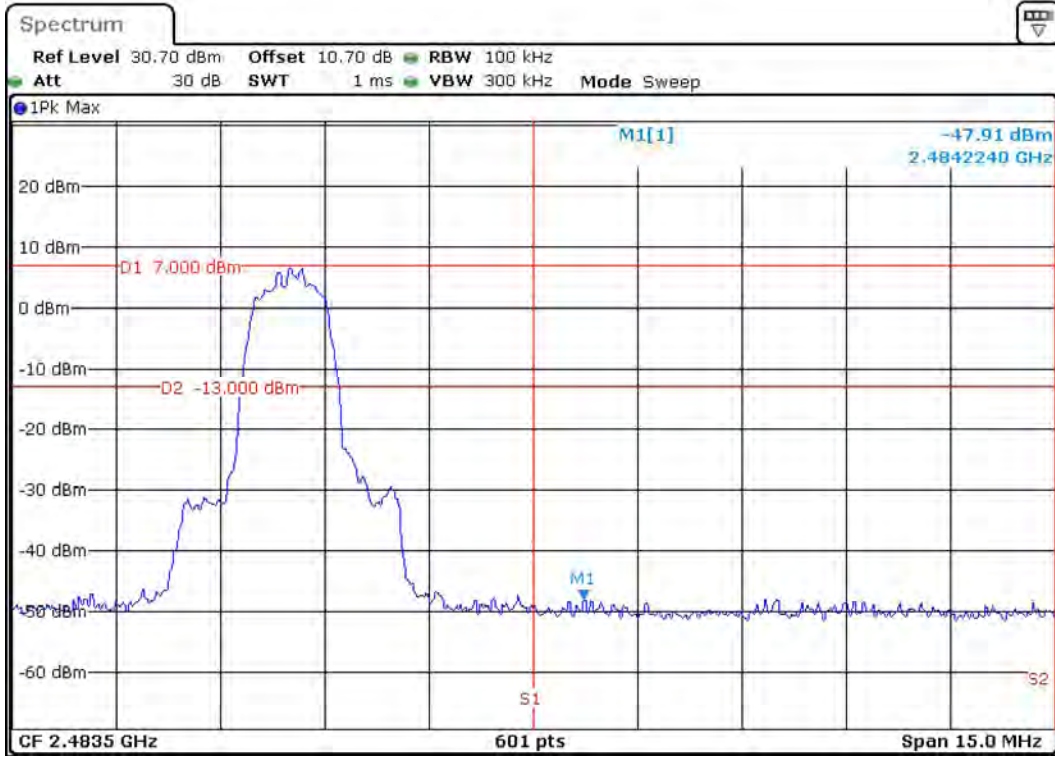
DH5 on 2480 MHz, non-hopping



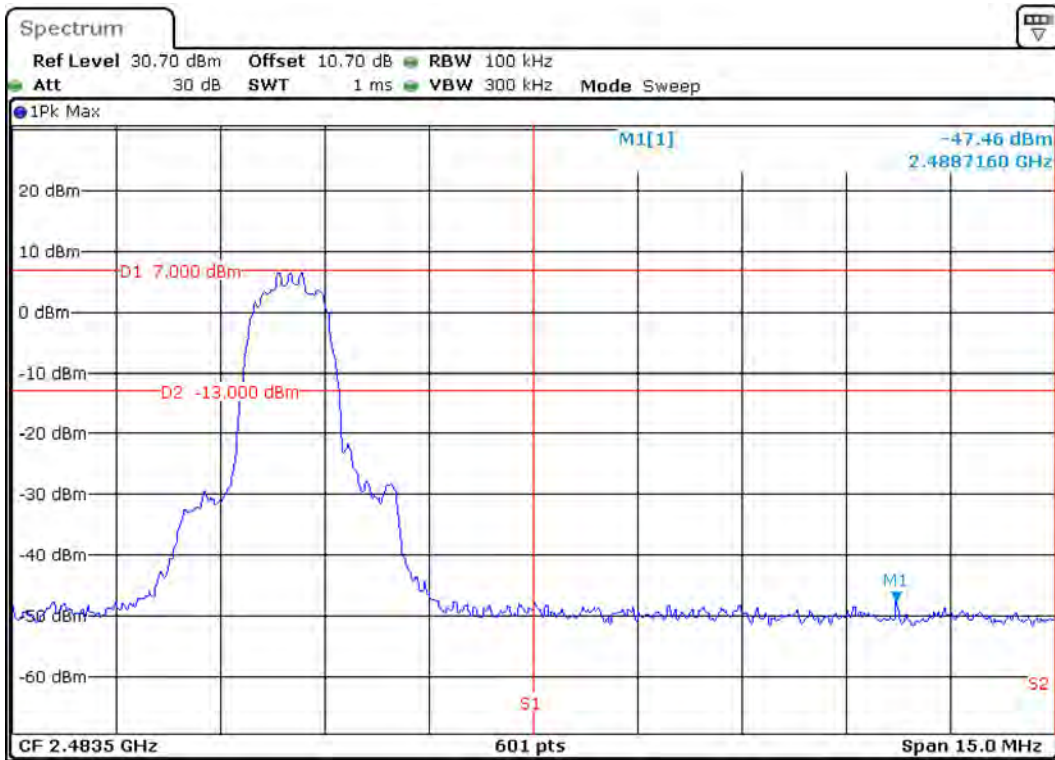
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



2DH5 on 2480 MHz, non-hopping



3DH5 on 2480 MHz, non-hopping



# Spurious Emissions

For these readings, a notch filter was used to protect the EMI receiver from overload. A correction factor was applied to account for the effect of the notch filter.

Spurious Summary Table (Basic Rate: 1 Mbps)											
Channel	Band Range (MHz)	Mode	Raw Measurement (dBm)	Test Cable Loss (dB)	Pad ATTN (dB)	EUT Antenna Gain At Harmonic Frequency (dBi)	Corrected Reading (dBm)	Convert to E-Field at 3 meters (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Result
Low	30 To 1000	DH5	-75.4	0.7	10.0	0.0	-64.7	30.50	74	43.50	Pass
Low	2483.5 To 25000	DH5	-69.5	0.7	10.0	0.0	-58.8	36.43	74	37.57	Pass
Mid	30 To 1000	DH5	-74.8	0.7	10.0	0.0	-64.1	31.17	74	42.83	Pass
Mid	2483.5 To 25000	DH5	-72.4	0.7	10.0	0.0	-61.7	33.52	74	40.48	Pass
High	30 To 1000	DH5	-75.3	0.7	10.0	0.0	-64.6	30.62	74	43.38	Pass
High	2483.5 To 25000	DH5	-69.2	0.7	10.0	0.0	-58.5	36.77	74	37.23	Pass
Hopping	30 To 1000	DH5	-74.4	0.7	10.0	0.0	-63.7	31.50	74	42.50	Pass
Hopping	2483.5 To 25000	DH5	-66.3	0.7	10.0	0.0	-55.6	39.65	74	34.35	Pass

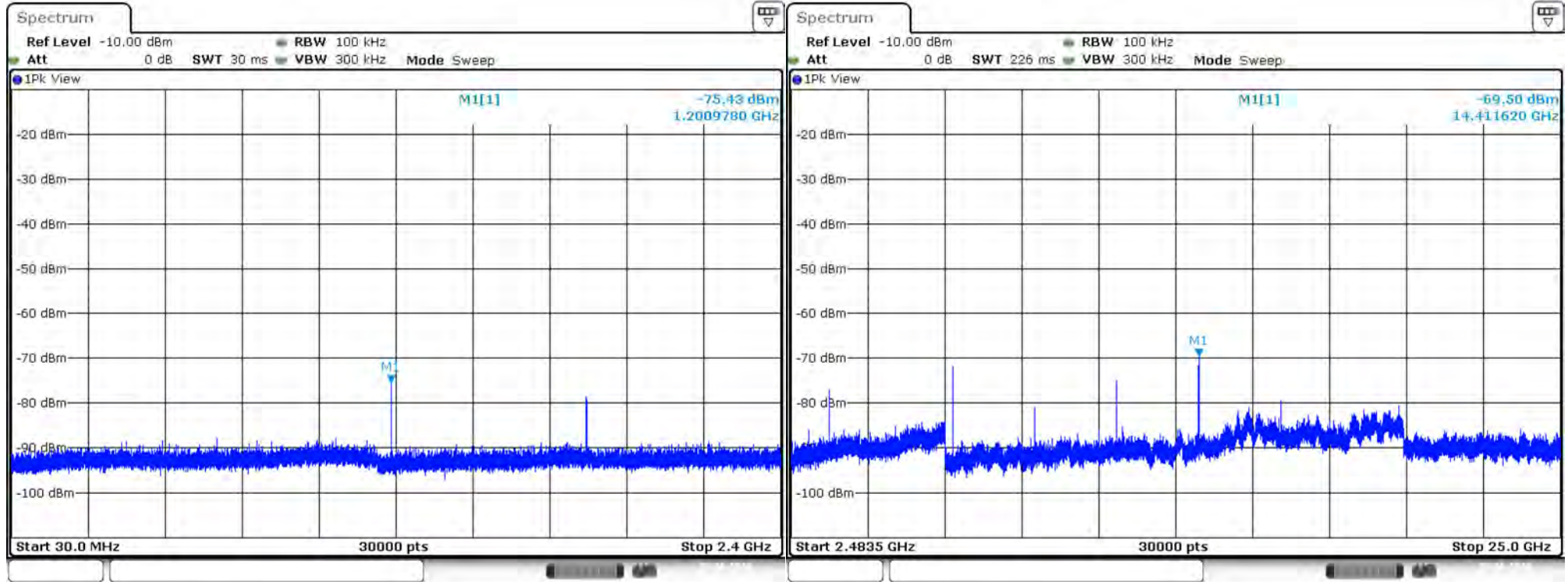
Spurious Summary Table (Basic Rate: 1 Mbps)											
Channel	Band Range (MHz)	Mode	Raw Measurement (dBm)	Test Cable Loss (dB)	Pad ATTN (dB)	EUT Antenna Gain At Harmonic Frequency (dBi)	Corrected Reading (dBm)	Convert to E-Field at 3 meters (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Result
Low	30 To 1000	DH5	-77.6	0.7	10.0	0.0	-66.9	28.36	54	25.64	Pass
Low	2483.5 To 25000	DH5	-80.0	0.7	10.0	0.0	-69.3	25.95	54	28.05	Pass
Mid	30 To 1000	DH5	-76.8	0.7	10.0	0.0	-66.1	29.11	54	24.89	Pass
Mid	2483.5 To 25000	DH5	-75.9	0.7	10.0	0.0	-65.2	30.03	54	23.97	Pass
High	30 To 1000	DH5	-77.8	0.7	10.0	0.0	-67.1	28.14	54	25.86	Pass
High	2483.5 To 25000	DH5	-81.0	0.7	10.0	0.0	-70.3	24.96	54	29.04	Pass
Hopping	30 To 1000	DH5	-76.2	0.7	10.0	0.0	-65.5	29.75	54	24.25	Pass
Hopping	2483.5 To 25000	DH5	-78.1	0.7	10.0	0.0	-67.4	27.84	54	26.16	Pass



Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 DH5 2402 MHz Peak Band 1

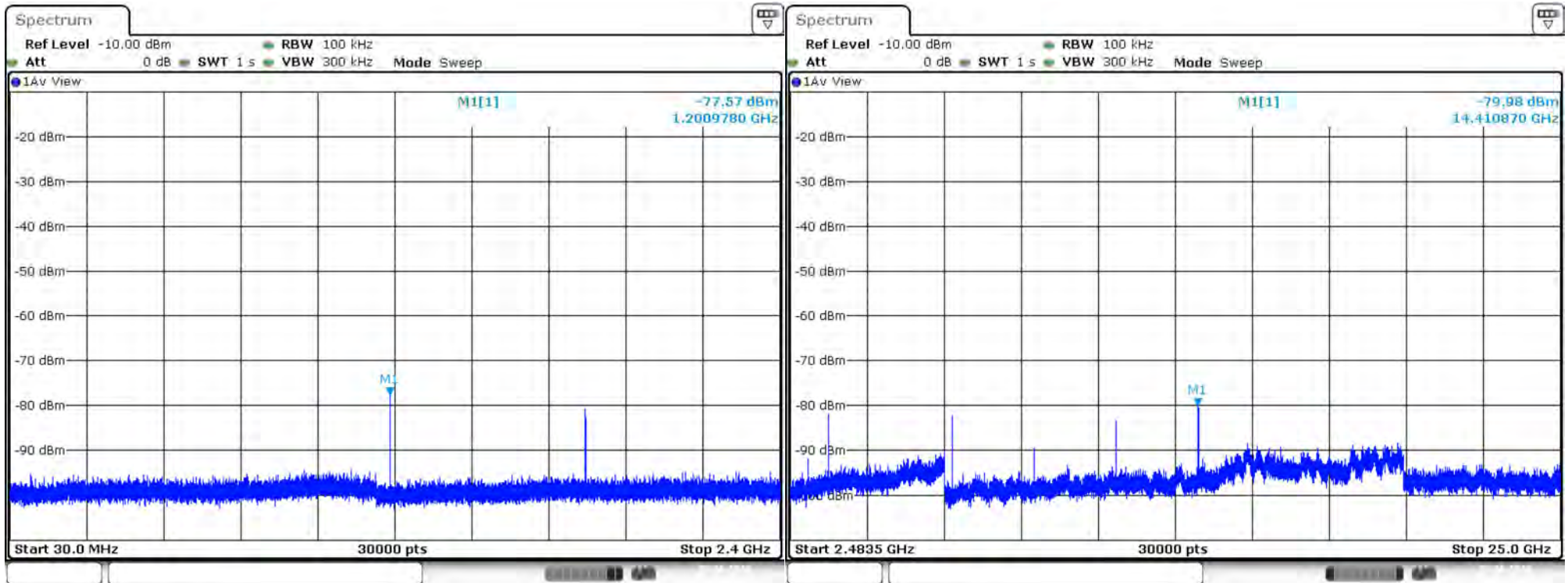
Plot2 DH5 2402 MHz Peak Band 2



Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 DH5 2402 MHz Average Band 1

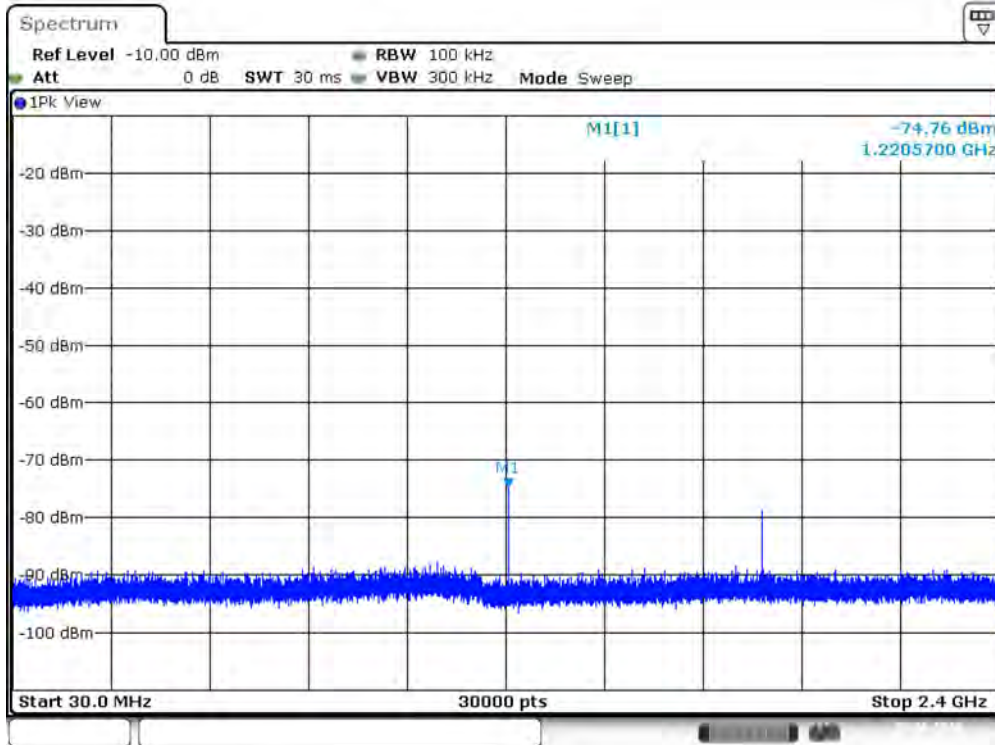
Plot2 DH5 2402 MHz Average Band 2



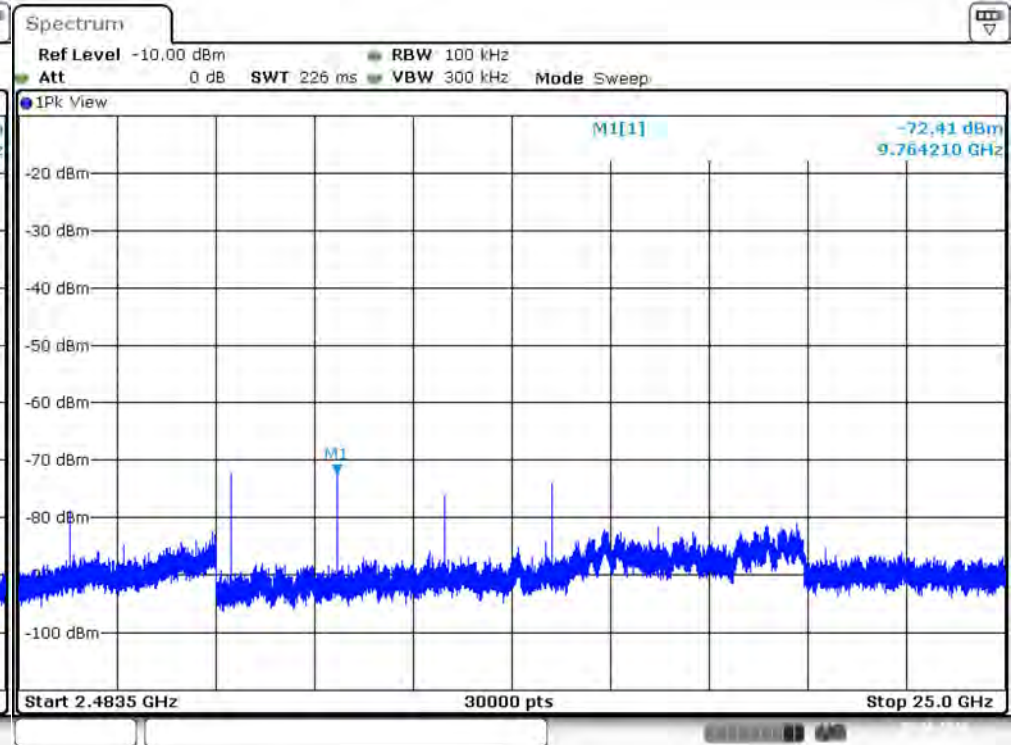
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 DH5 2441 MHz Peak Band 1



Plot2 DH5 2441 MHz Peak Band 2

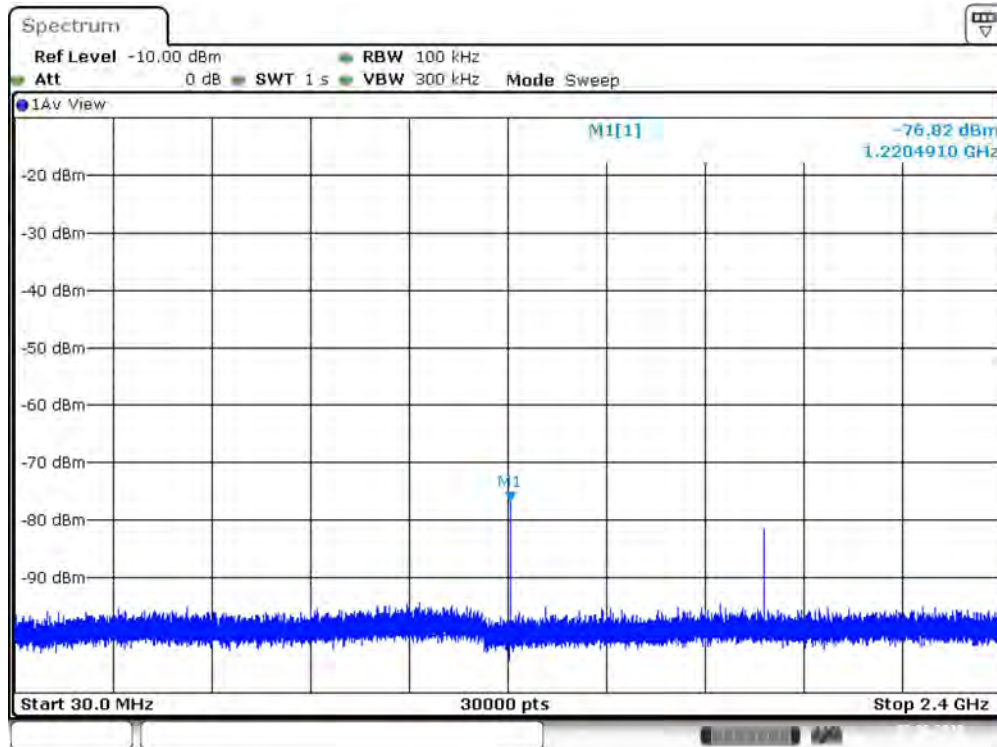




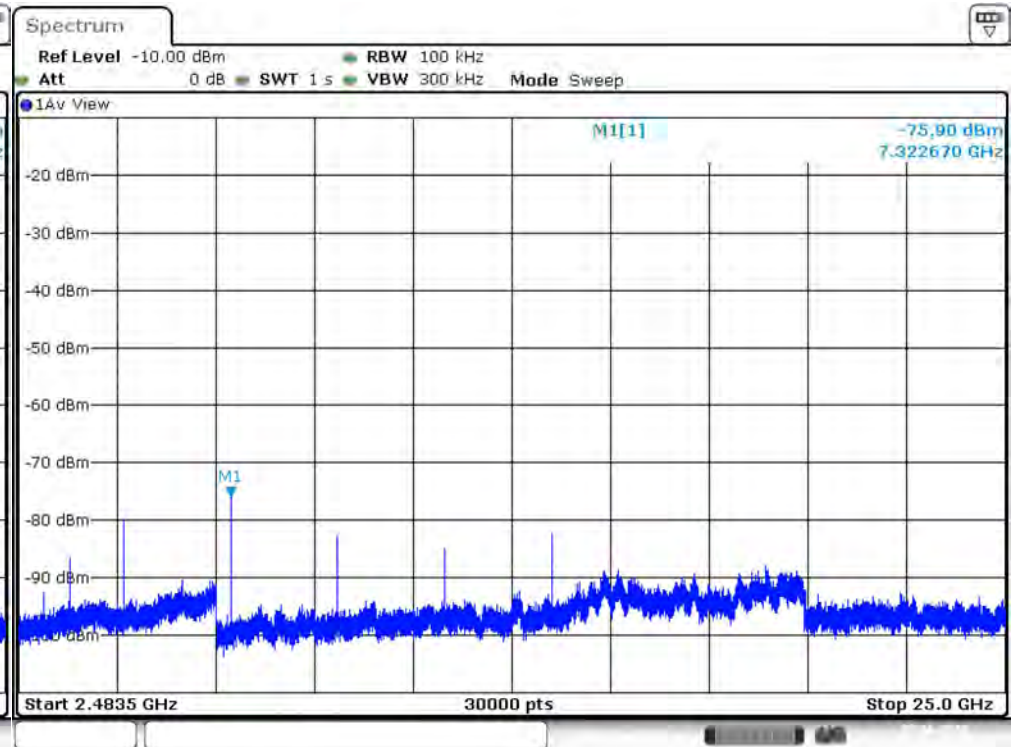
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 DH5 2441 MHz Average Band 1



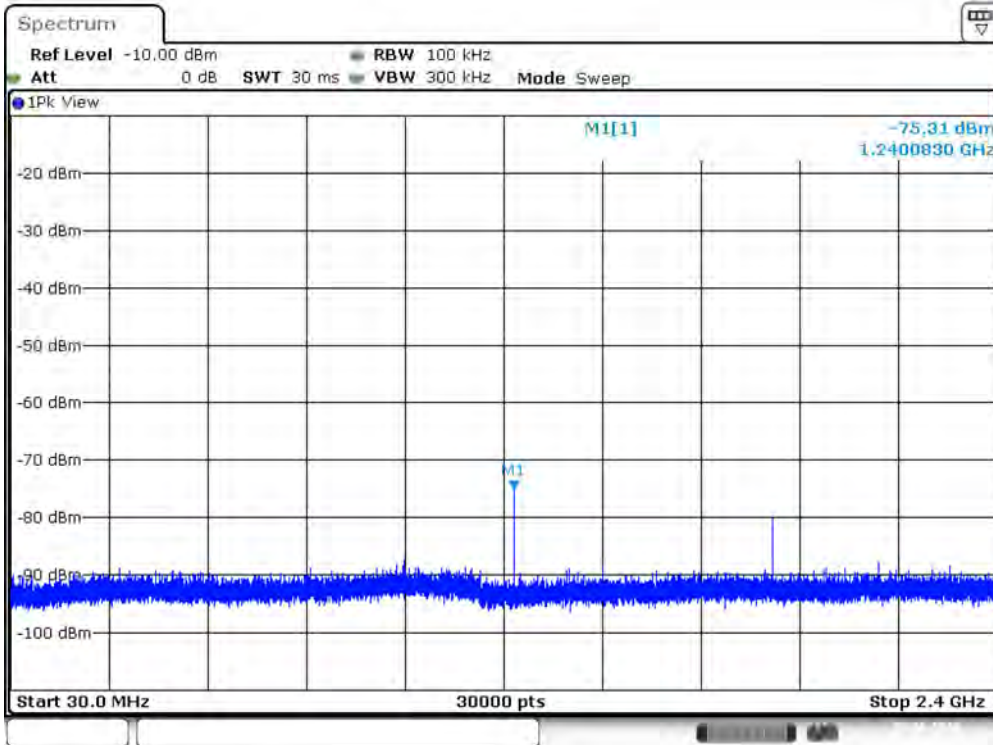
Plot2 DH5 2441 MHz Average Band 2



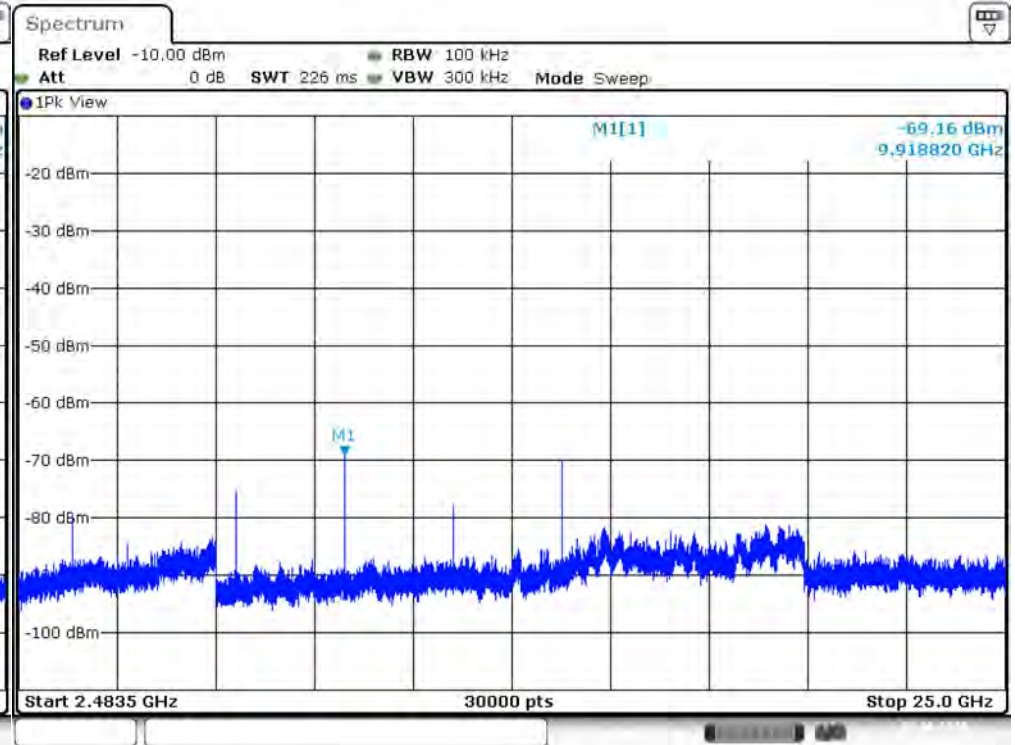
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 DH5 2480 MHz Peak Band 1



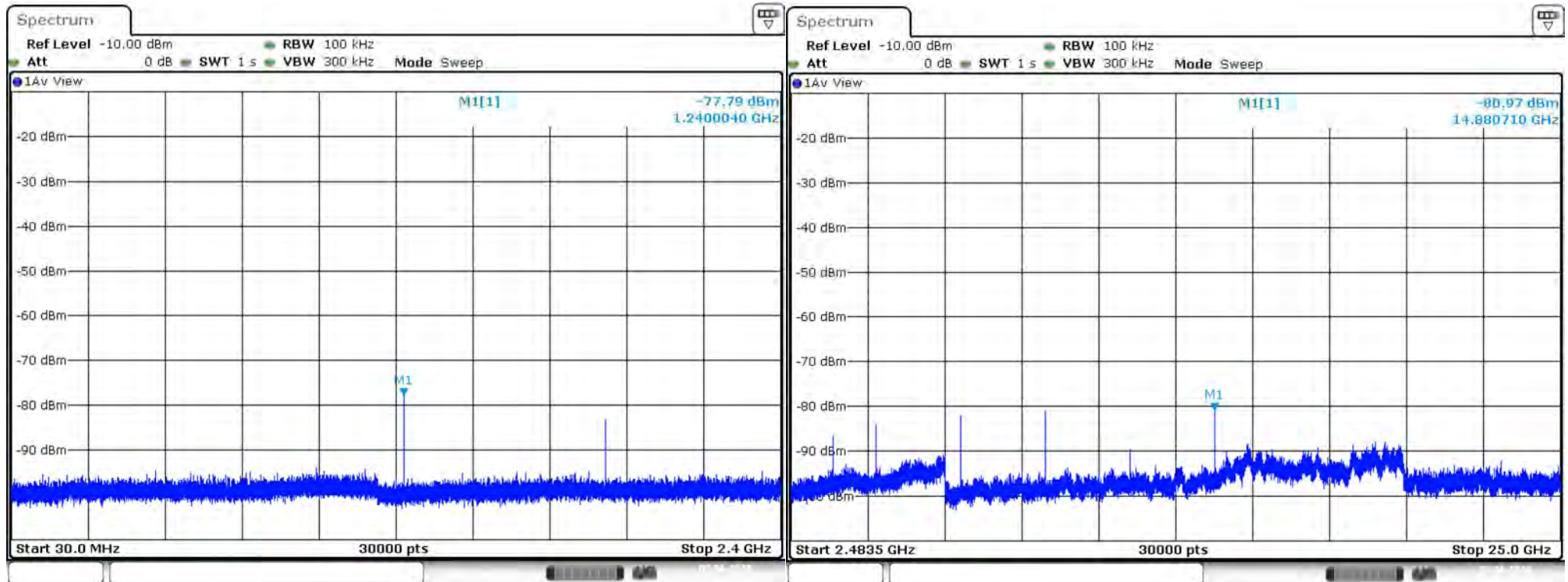
Plot2 DH5 2480 MHz Peak Band 2



Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 DH5 2480 MHz Average Band 1

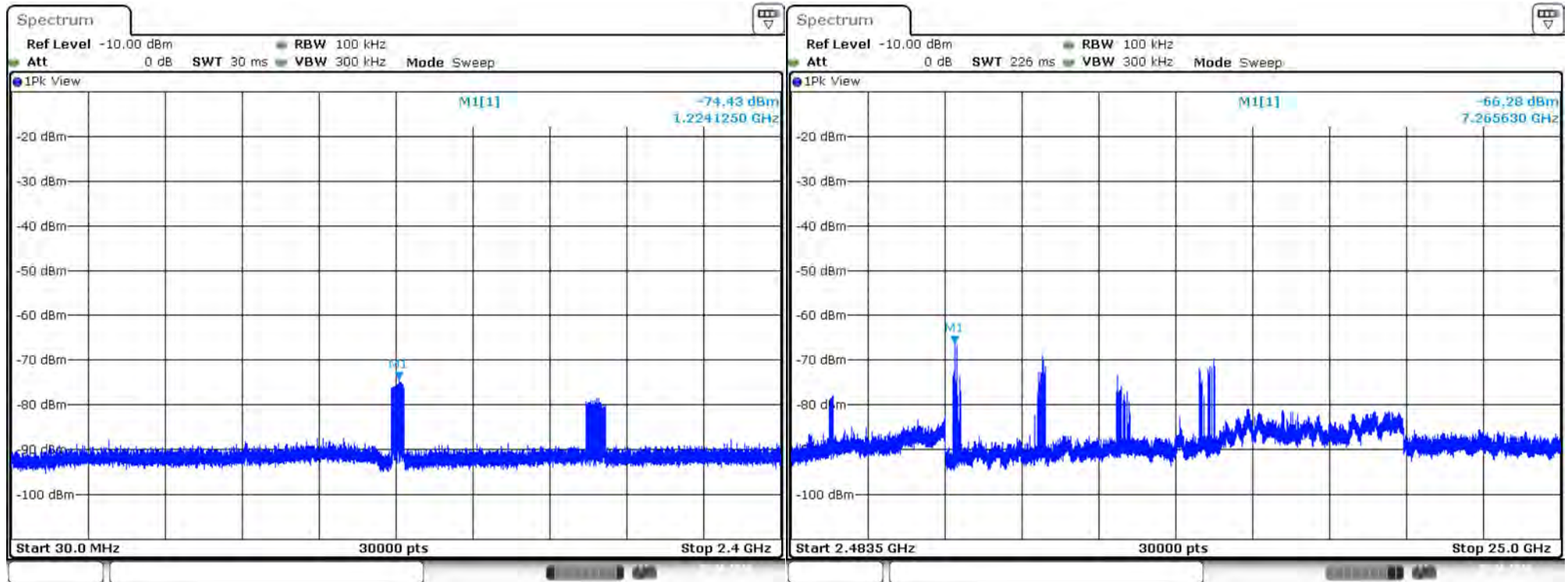
Plot2 DH5 2480 MHz Average Band 2



Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 DH5 Hopping Peak Band 1

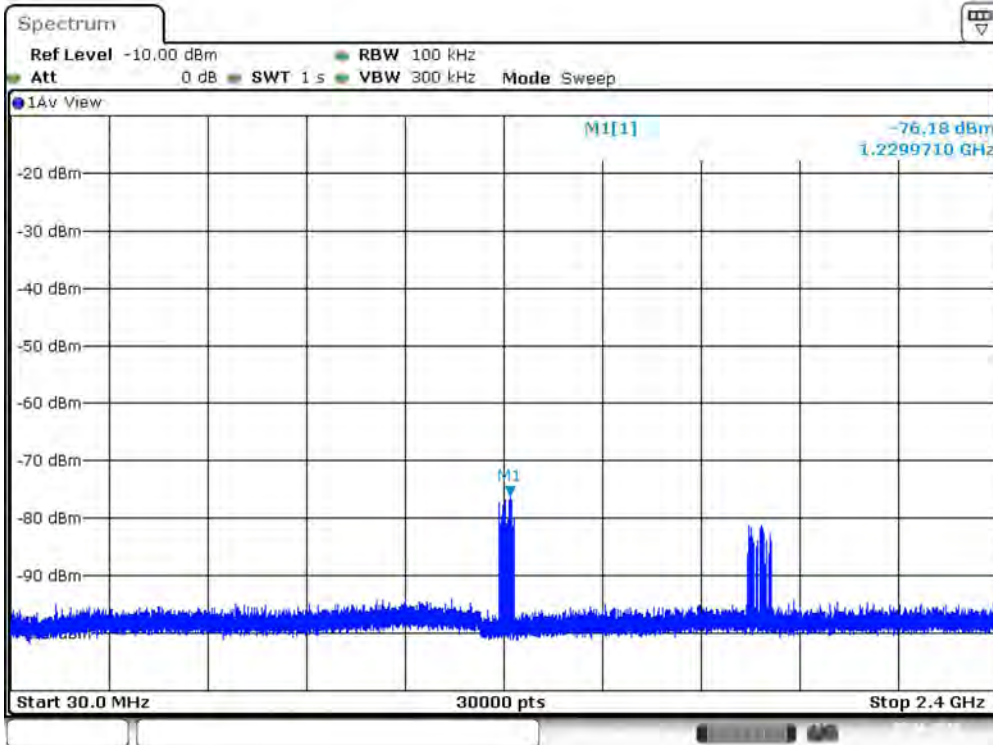
Plot2 DH5 Hopping Peak Band 2



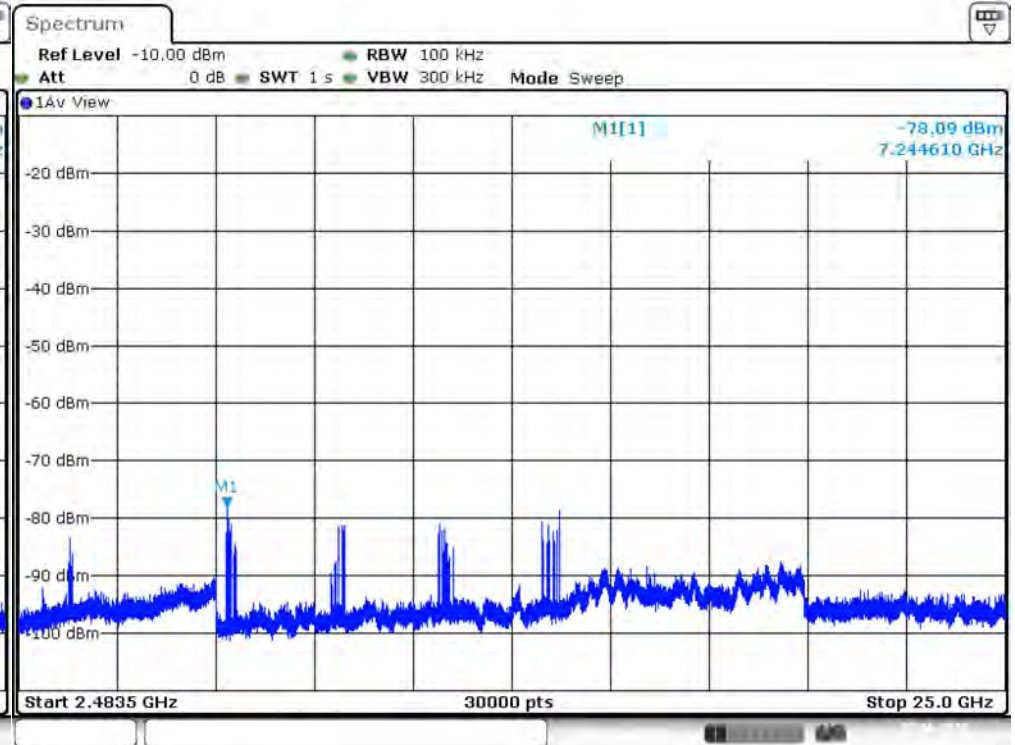
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 DH5 Hopping Average Band 1



Plot2 DH5 Hopping Average Band 2



Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Spurious Summary Table (Enhanced Rate: 2 Mbps)

Channel	Band Range (MHz)	Mode	Raw Measurement (dBm)	Test Cable Loss (dB)	Pad ATTN (dB)	EUT Antenna Gain At Harmonic Frequency (dBi)	Corrected Reading (dBm)	Convert to E-Field at 3 meters (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Result
Low	30 To 1000	2DH5	-76.8	0.7	10.0	0.0	-66.1	29.15	74	44.85	Pass
Low	2483.5 To 25000	2DH5	-65.9	0.7	10.0	0.0	-55.2	40.03	74	33.97	Pass
Mid	30 To 1000	2DH5	-75.5	0.7	10.0	0.0	-64.8	30.40	74	43.60	Pass
Mid	2483.5 To 25000	2DH5	-71.8	0.7	10.0	0.0	-61.1	34.16	74	39.84	Pass
High	30 To 1000	2DH5	-76.5	0.7	10.0	0.0	-65.8	29.48	74	44.52	Pass
High	2483.5 To 25000	2DH5	-72.3	0.7	10.0	0.0	-61.6	33.59	74	40.41	Pass
Hopping	30 To 1000	2DH5	-75.8	0.7	10.0	0.0	-65.1	30.13	74	43.87	Pass
Hopping	2483.5 To 25000	2DH5	-67.7	0.7	10.0	0.0	-57.0	38.18	74	35.82	Pass

Spurious Summary Table (Enhanced Rate: 2 Mbps)

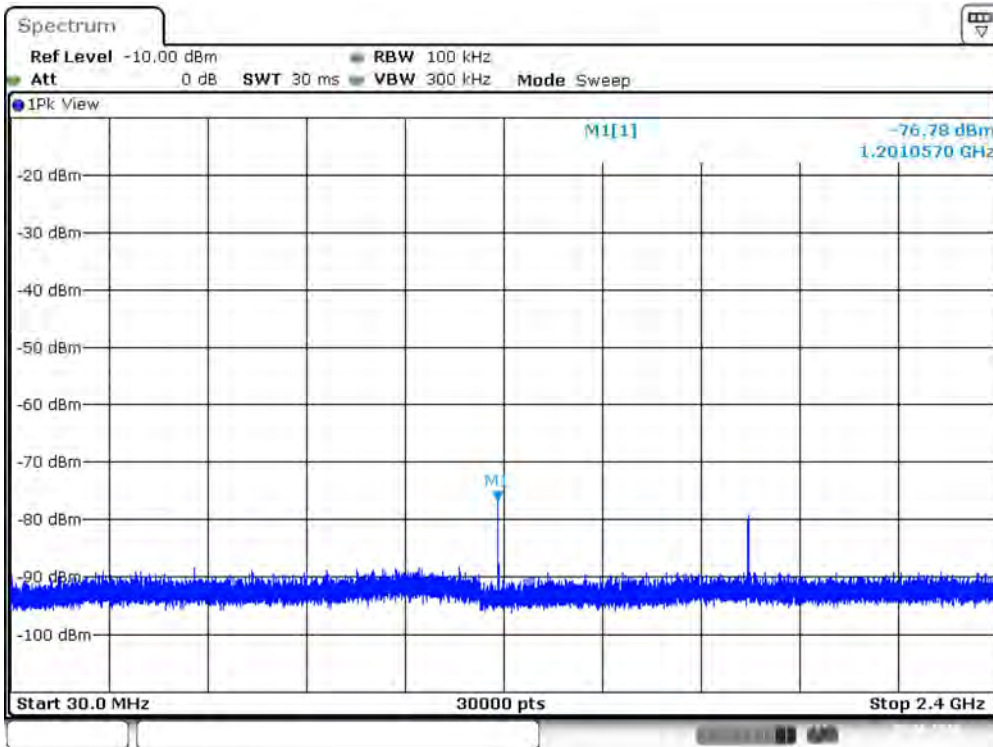
Channel	Band Range (MHz)	Mode	Raw Measurement (dBm)	Test Cable Loss (dB)	Pad ATTN (dB)	EUT Antenna Gain At Harmonic Frequency (dBi)	Corrected Reading (dBm)	Convert to E-Field at 3 meters (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Result
Low	30 To 1000	2DH5	-79.3	0.7	10.0	0.0	-68.6	26.67	54	27.33	Pass
Low	2483.5 To 25000	2DH5	-79.3	0.7	10.0	0.0	-68.6	26.65	54	27.35	Pass
Mid	30 To 1000	2DH5	-79.6	0.7	10.0	0.0	-68.9	26.31	54	27.69	Pass
Mid	2483.5 To 25000	2DH5	-80.3	0.7	10.0	0.0	-69.6	25.58	54	28.42	Pass
High	30 To 1000	2DH5	-80.4	0.7	10.0	0.0	-69.7	25.52	54	28.48	Pass
High	2483.5 To 25000	2DH5	-80.3	0.7	10.0	0.0	-69.6	25.60	54	28.40	Pass
Hopping	30 To 1000	2DH5	-78.6	0.7	10.0	0.0	-67.9	27.38	54	26.62	Pass
Hopping	2483.5 To 25000	2DH5	-71.8	0.7	10.0	0.0	-61.1	34.10	54	19.90	Pass



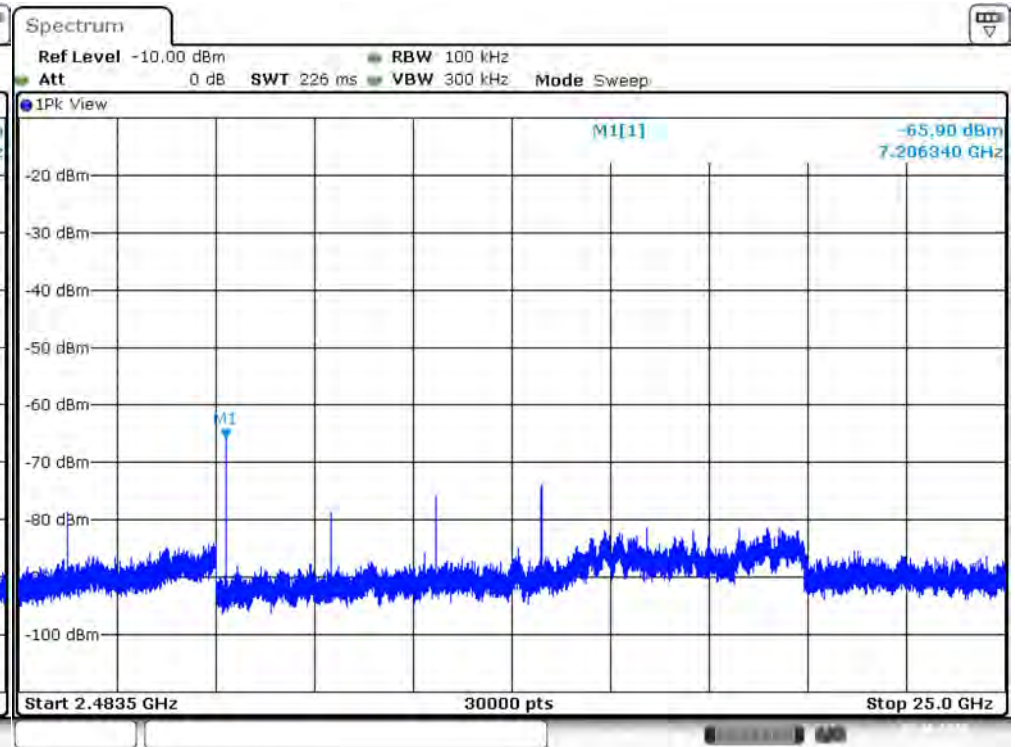
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 2DH5 2402 MHz Peak Band 1



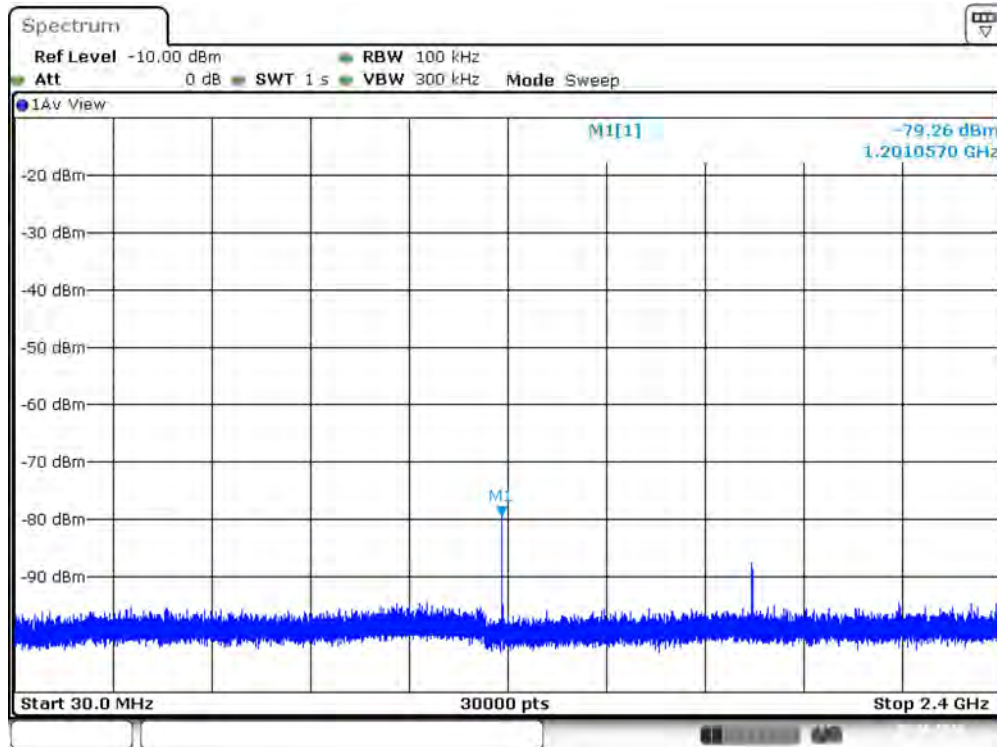
Plot2 2DH5 2402 MHz Peak Band 2



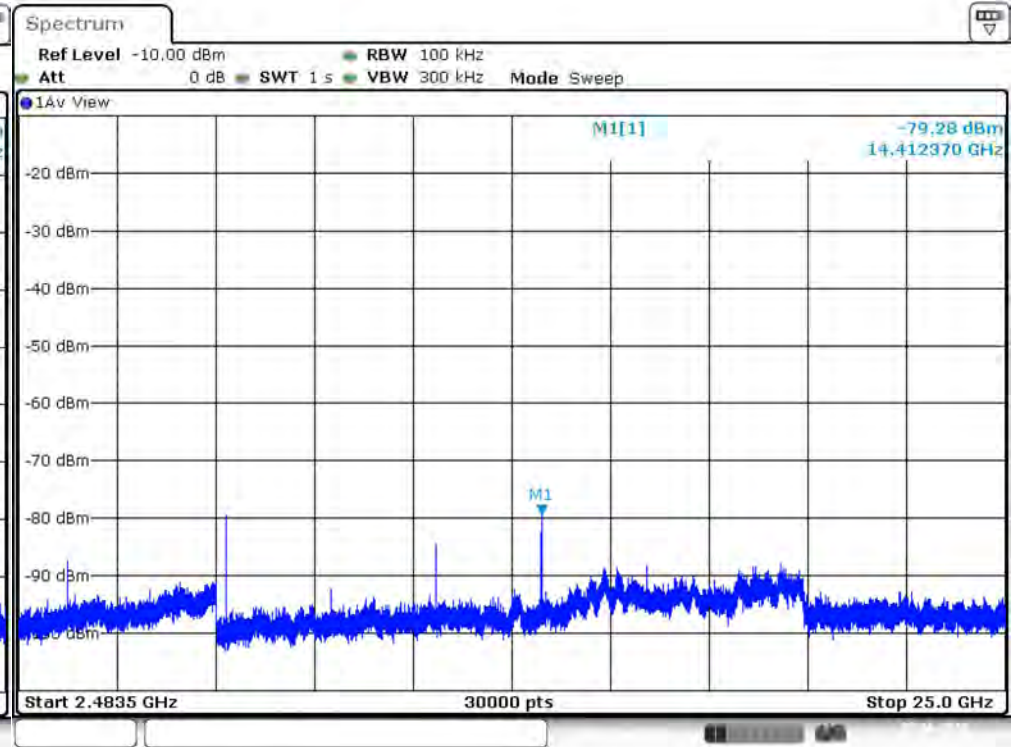
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 2DH5 2402 MHz Average Band 1



Plot2 2DH5 2402 MHz Average Band 2

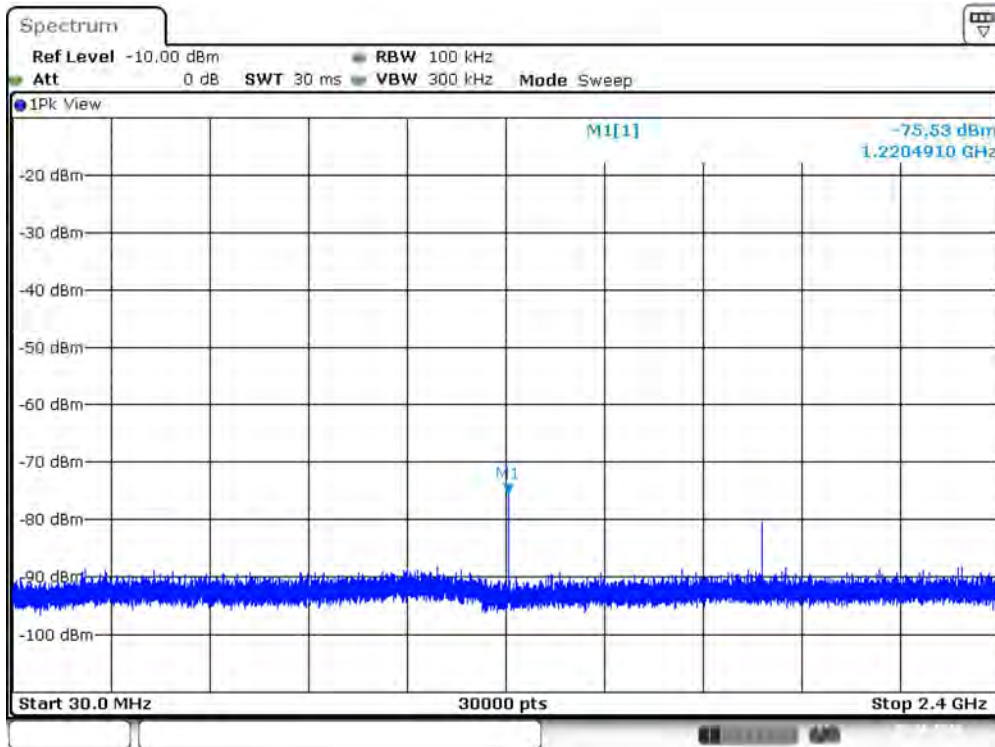




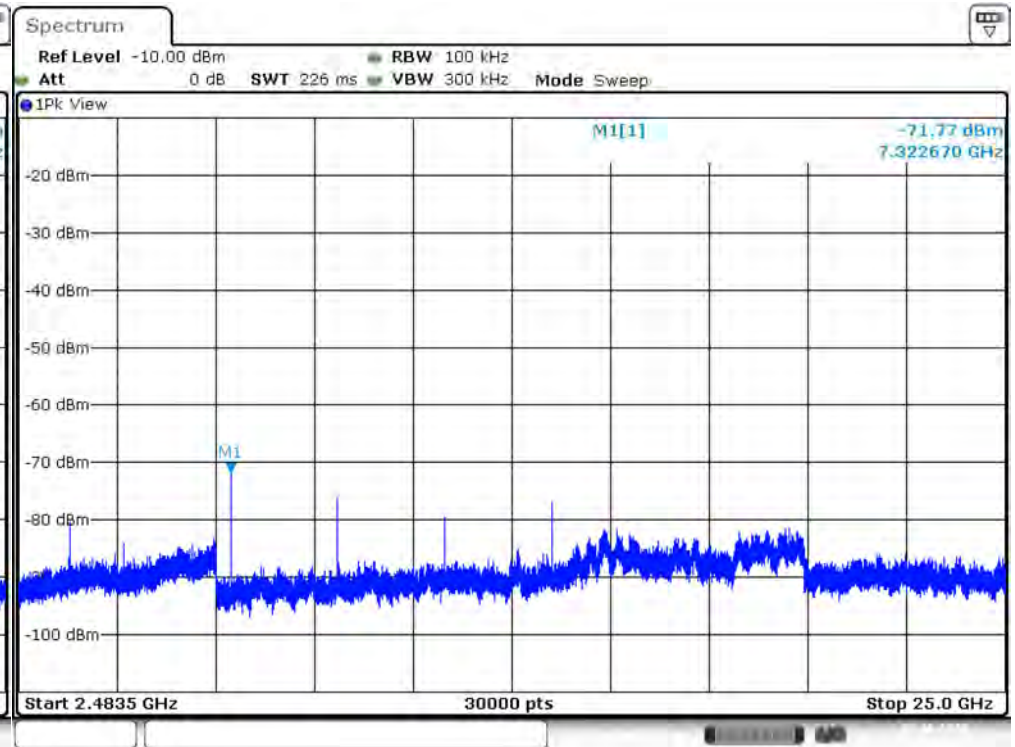
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 2DH5 2441 MHz Peak Band 1



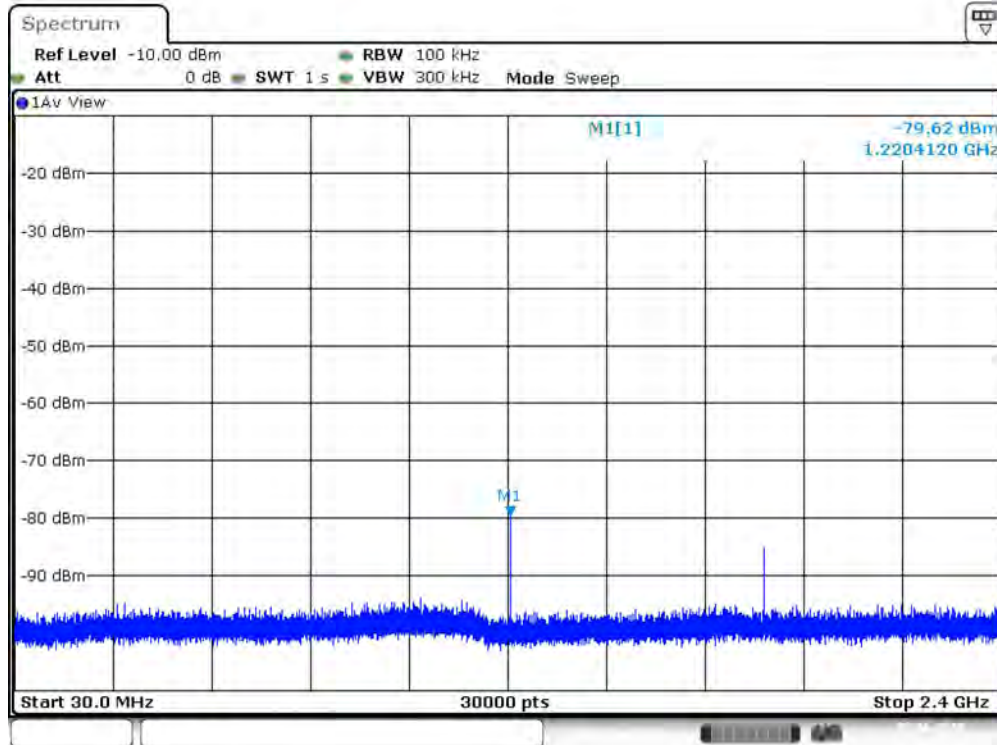
Plot2 2DH5 2441 MHz Peak Band 2



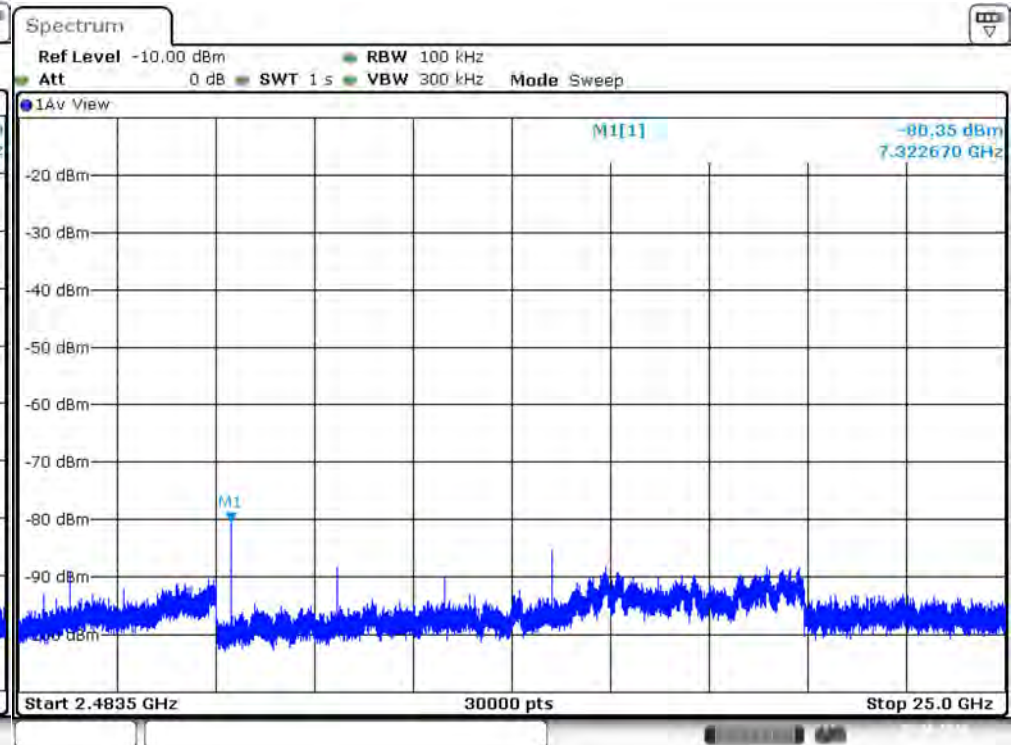
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 2DH5 2441 MHz Average Band 1



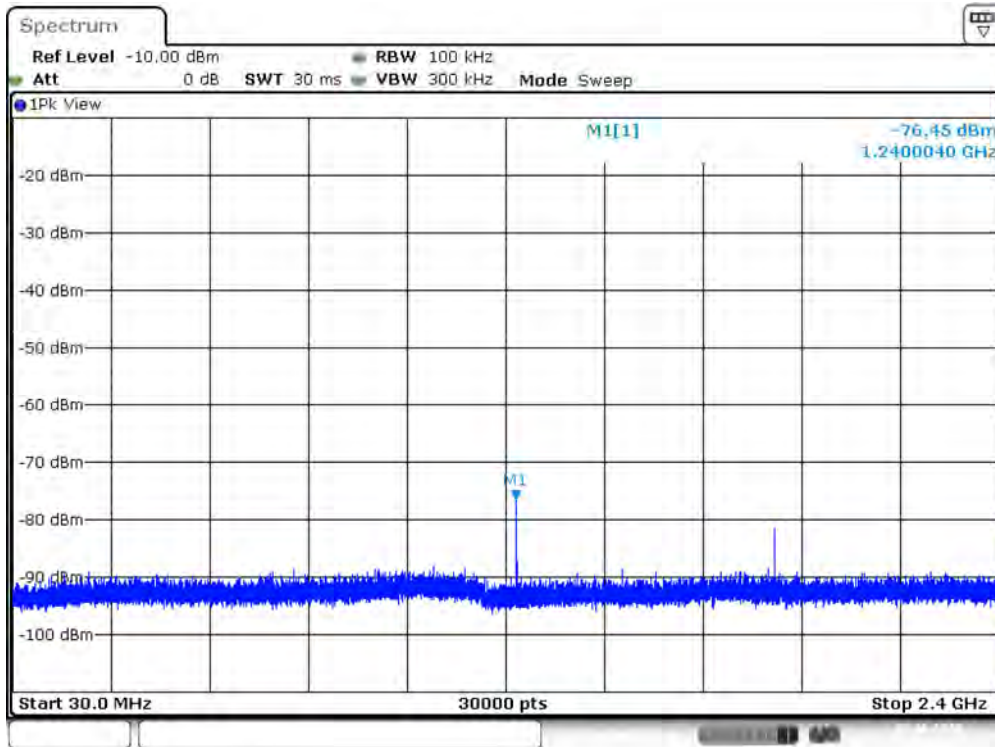
Plot2 2DH5 2441 MHz Average Band 2



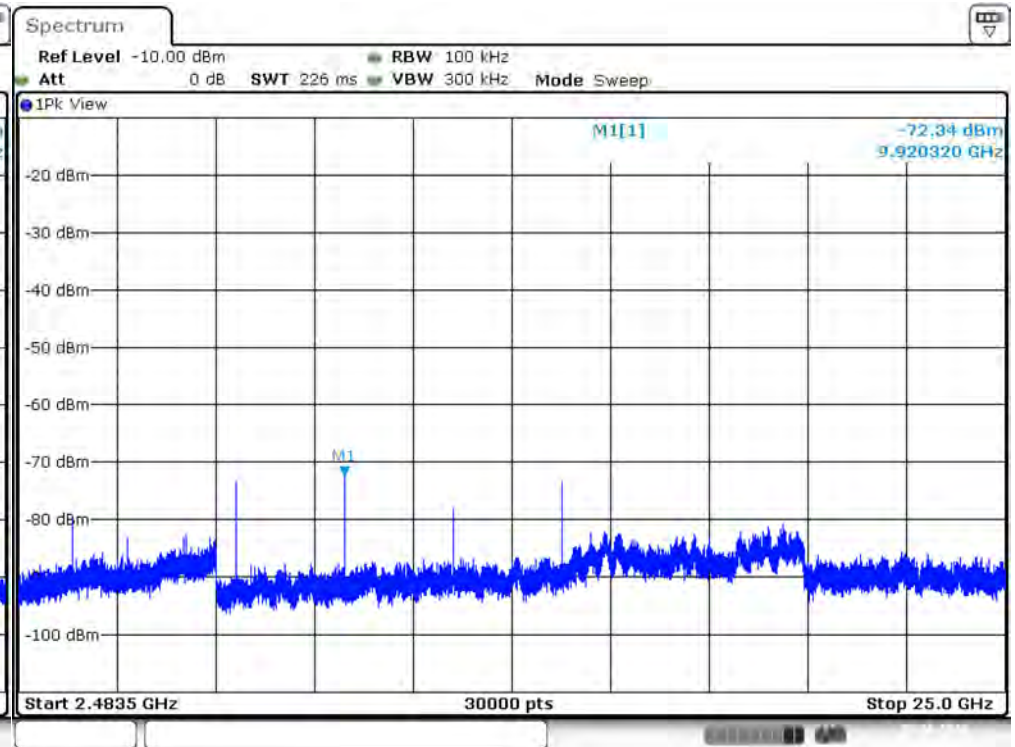
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 2DH5 2480 MHz Peak Band 1



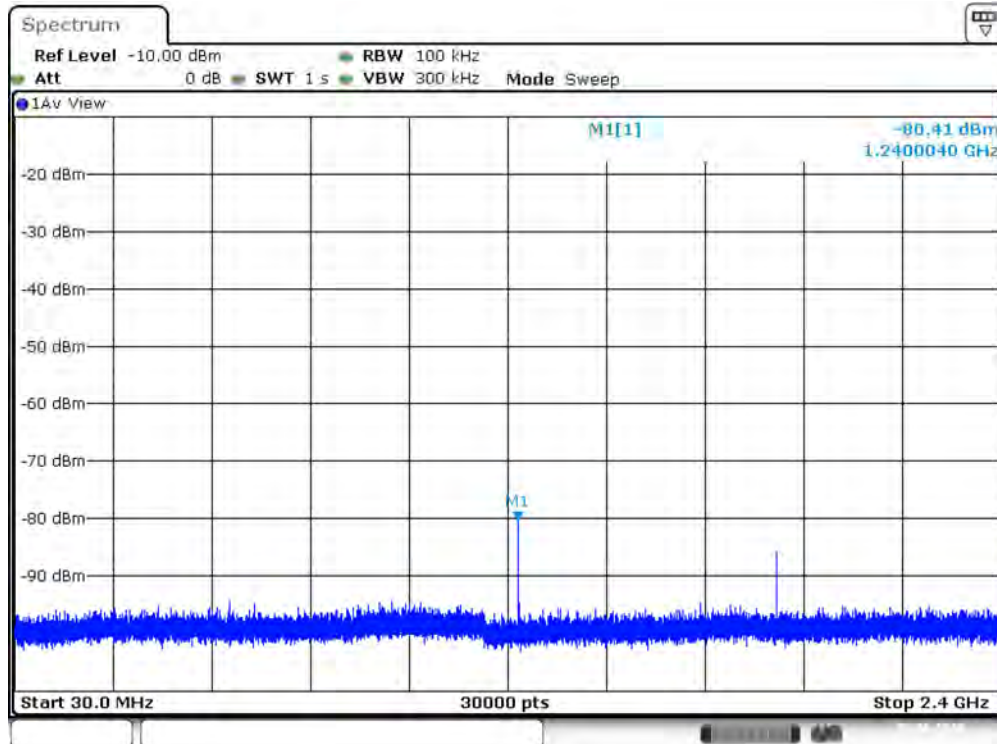
Plot2 2DH5 2480 MHz Peak Band 2



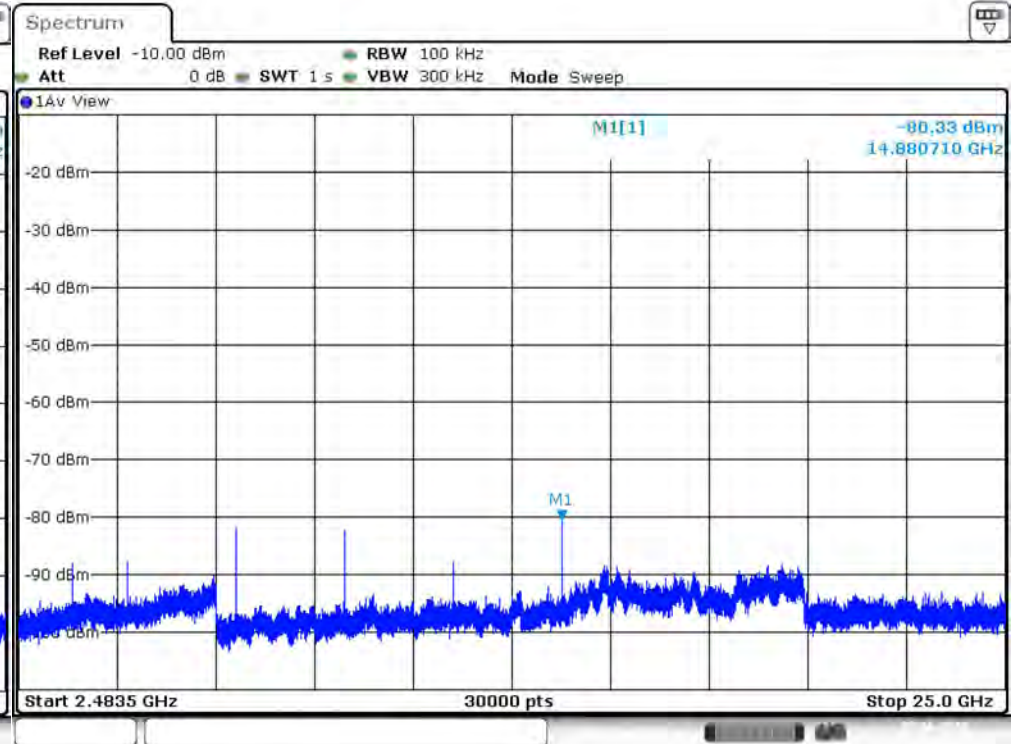
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 2DH5 2480 MHz Average Band 1



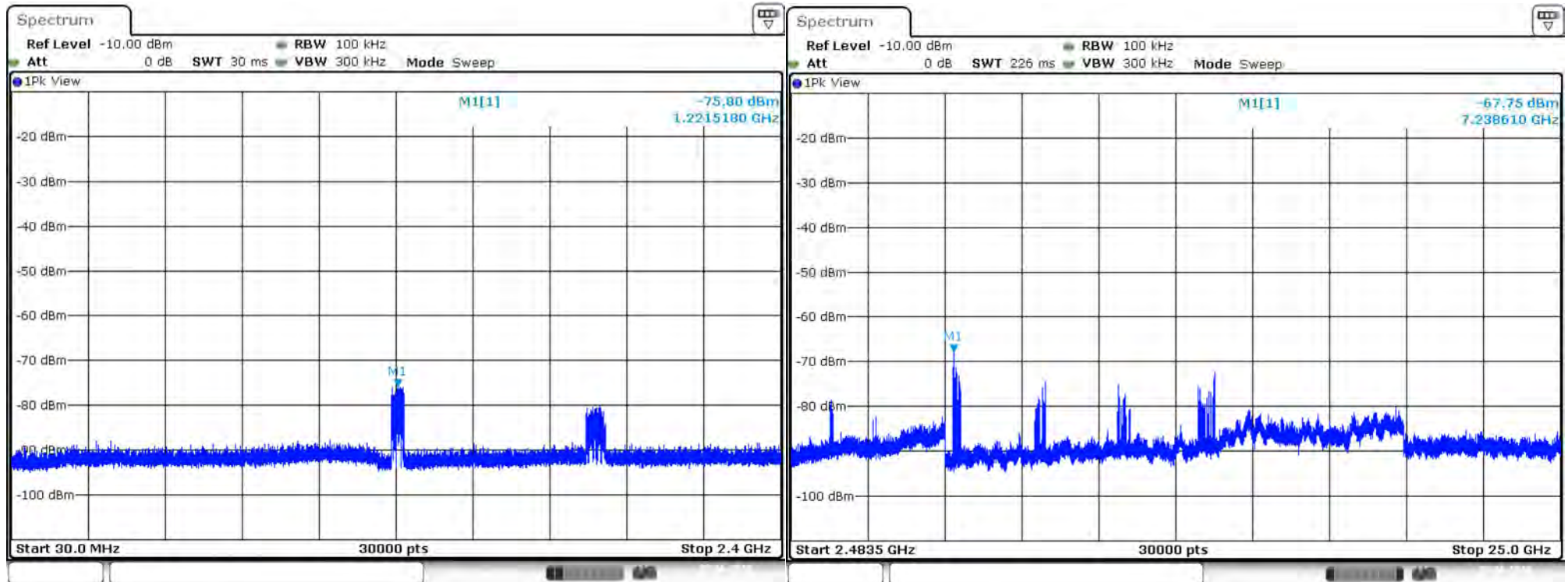
Plot2 2DH5 2480 MHz Average Band 2



Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 2DH5 Hopping Peak Band 1

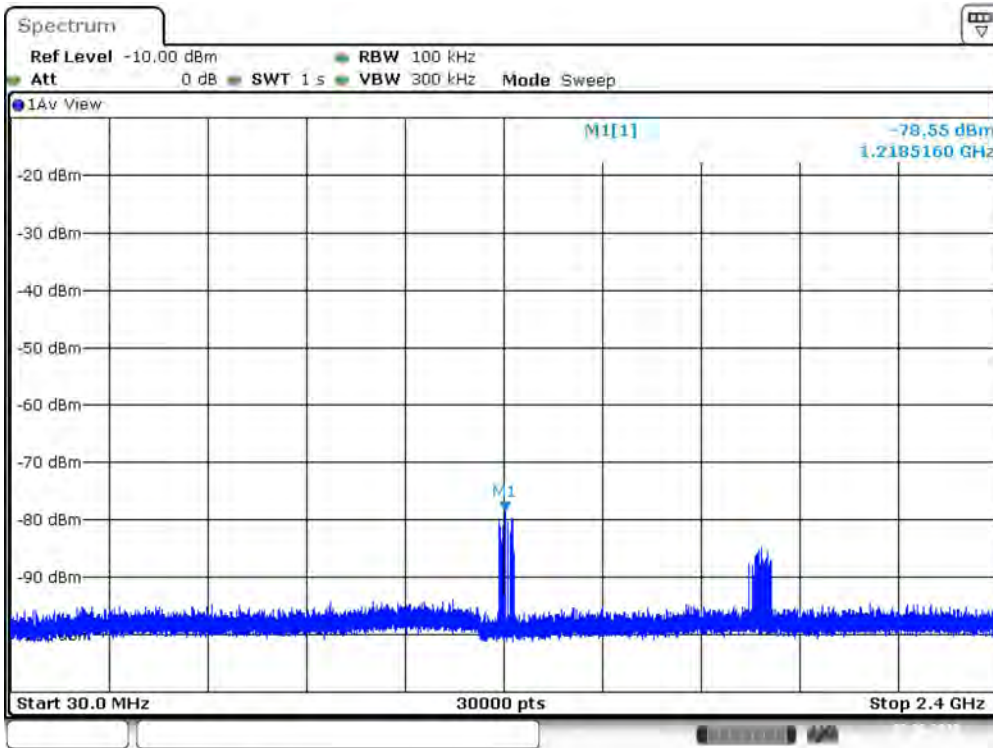
Plot2 2DH5 Hopping Peak Band 2



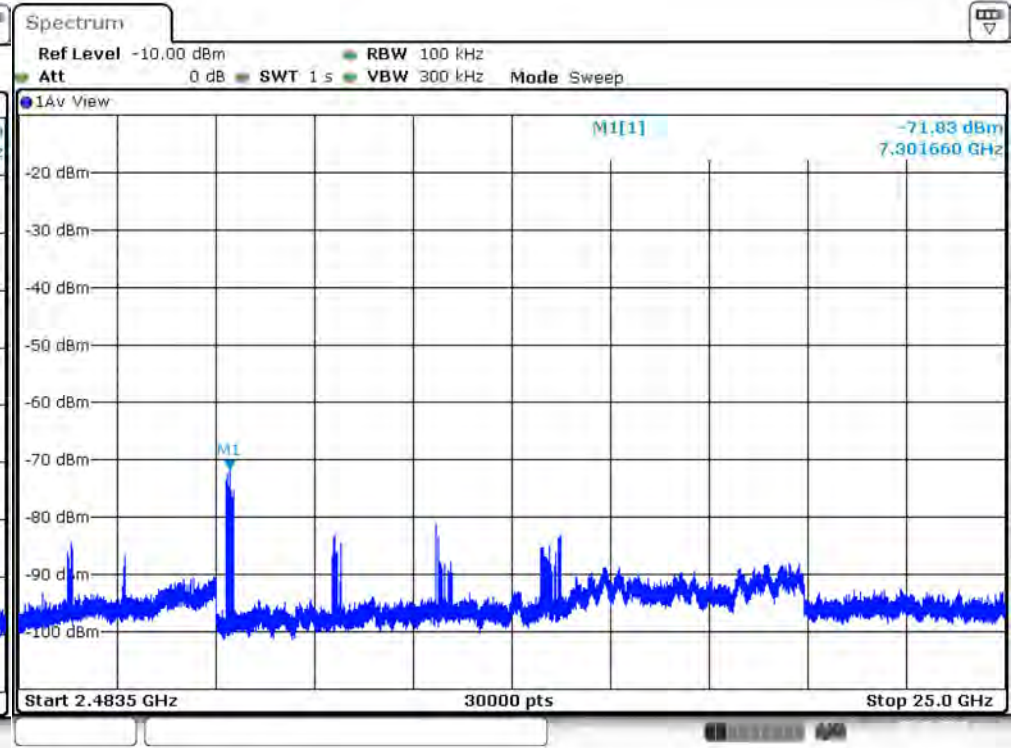
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 2DH5 Hopping Average Band 1



Plot2 2DH5 Hopping Average Band 2



Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Spurious Summary Table (Enhanced Rate: 3 Mbps)

Channel	Band Range (MHz)	Mode	Raw Measurement (dBm)	Test Cable Loss (dB)	Pad ATTN (dB)	EUT Antenna Gain At Harmonic Frequency (dBi)	Corrected Reading (dBm)	Convert to E-Field at 3 meters (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Result
Low	30 To 1000	3DH5	-76.5	0.7	10.0	0.0	-65.8	29.39	74	44.61	Pass
Low	2483.5 To 25000	3DH5	-64.7	0.7	10.0	0.0	-54.0	41.24	74	32.76	Pass
Mid	30 To 1000	3DH5	-76.2	0.7	10.0	0.0	-65.5	29.71	74	44.29	Pass
Mid	2483.5 To 25000	3DH5	-69.1	0.7	10.0	0.0	-58.4	36.84	74	37.16	Pass
High	30 To 1000	3DH5	-76.6	0.7	10.0	0.0	-65.9	29.35	74	44.65	Pass
High	2483.5 To 25000	3DH5	-71.8	0.7	10.0	0.0	-61.1	34.16	74	39.84	Pass
Hopping	30 To 1000	3DH5	-76.2	0.7	10.0	0.0	-65.5	29.77	74	44.23	Pass
Hopping	2483.5 To 25000	3DH5	-70.4	0.7	10.0	0.0	-59.7	35.53	74	38.47	Pass

Spurious Summary Table (Enhanced Rate: 3 Mbps)

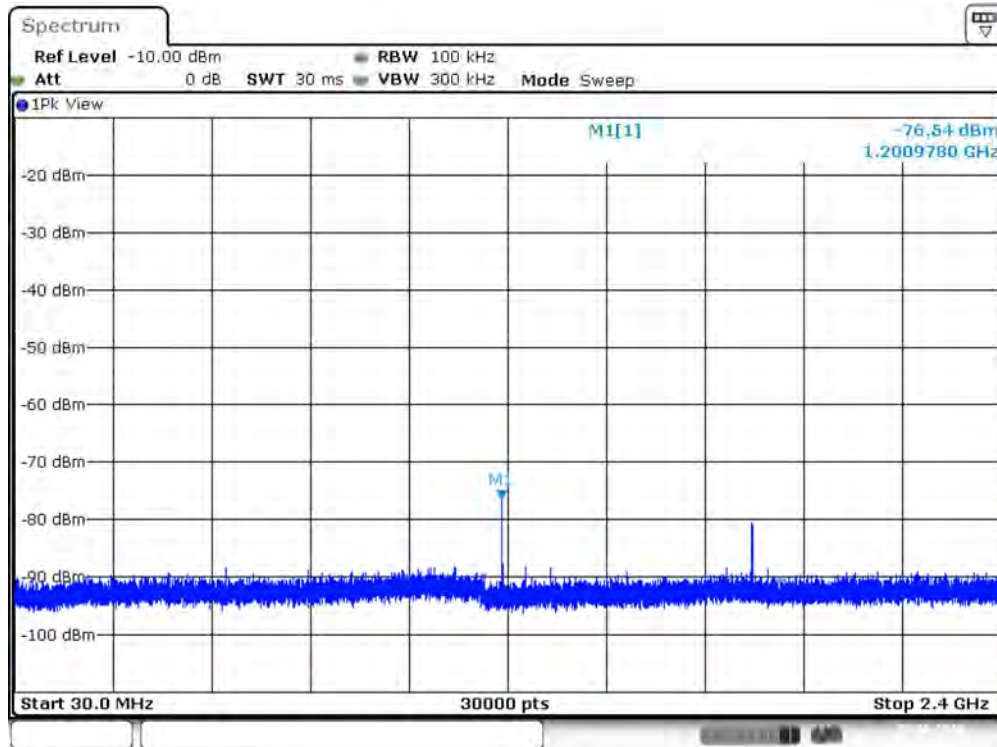
Channel	Band Range (MHz)	Mode	Raw Measurement (dBm)	Test Cable Loss (dB)	Pad ATTN (dB)	EUT Antenna Gain At Harmonic Frequency (dBi)	Corrected Reading (dBm)	Convert to E-Field at 3 meters (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Result
Low	30 To 1000	3DH5	-79.7	0.7	10.0	0.0	-69.0	26.22	54	27.78	Pass
Low	2483.5 To 25000	3DH5	-76.5	0.7	10.0	0.0	-65.8	29.41	54	24.59	Pass
Mid	30 To 1000	3DH5	-79.1	0.7	10.0	0.0	-68.4	26.79	54	27.21	Pass
Mid	2483.5 To 25000	3DH5	-77.3	0.7	10.0	0.0	-66.6	28.64	54	25.36	Pass
High	30 To 1000	3DH5	-78.9	0.7	10.0	0.0	-68.2	26.99	54	27.01	Pass
High	2483.5 To 25000	3DH5	-80.2	0.7	10.0	0.0	-69.5	25.74	54	28.26	Pass
Hopping	30 To 1000	3DH5	-79.7	0.7	10.0	0.0	-69.0	26.19	54	27.81	Pass
Hopping	2483.5 To 25000	3DH5	-74.0	0.7	10.0	0.0	-63.3	31.89	54	22.11	Pass



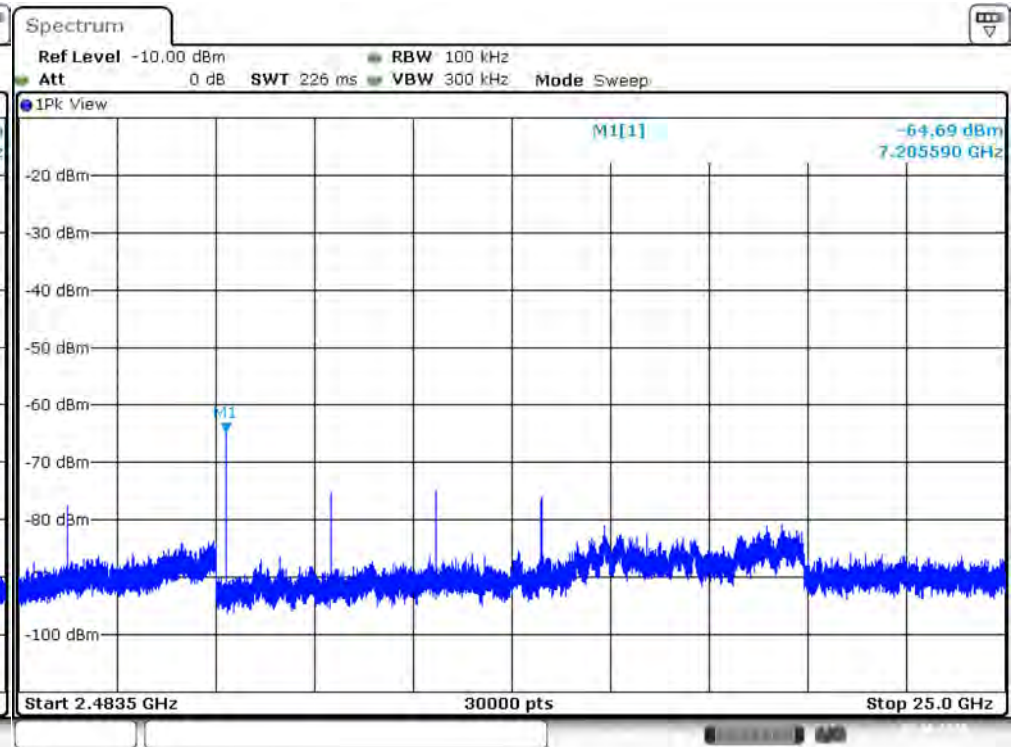
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 3DH5 2402 MHz Peak Band 1



Plot2 3DH5 2402 MHz Peak Band 2

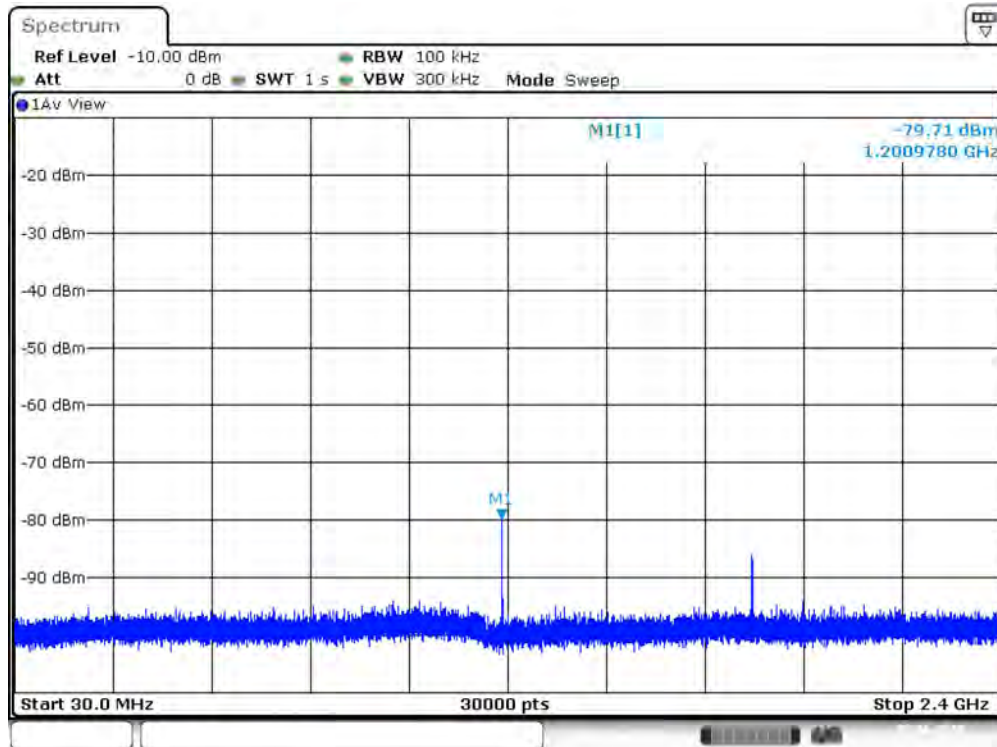




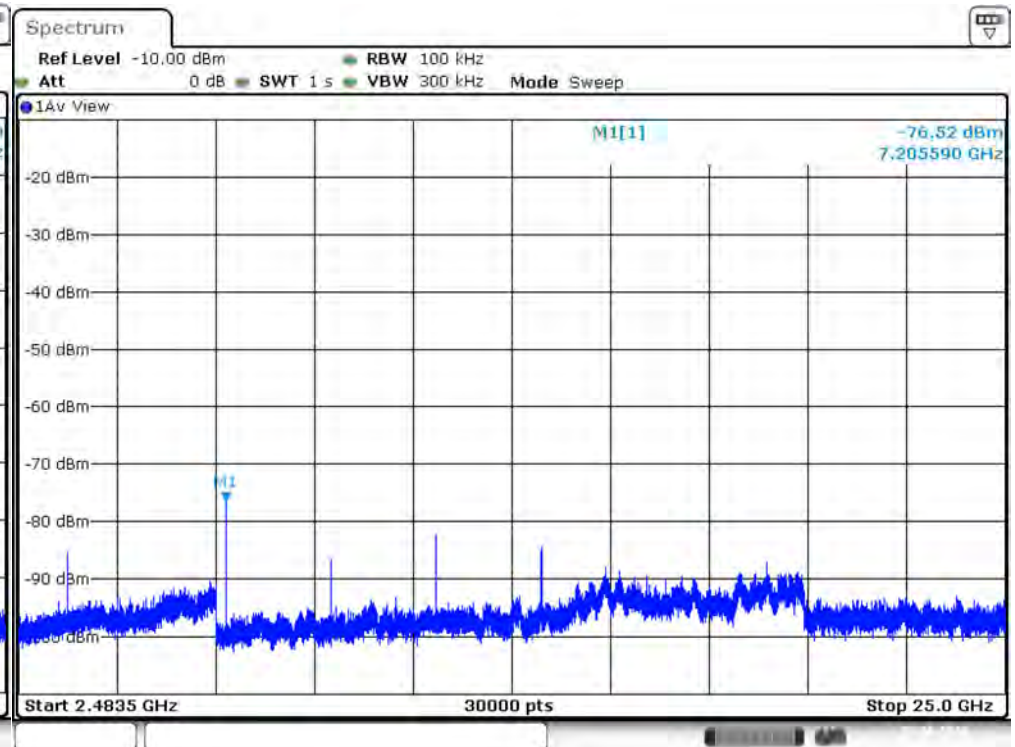
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 3DH5 2402 MHz Average Band 1



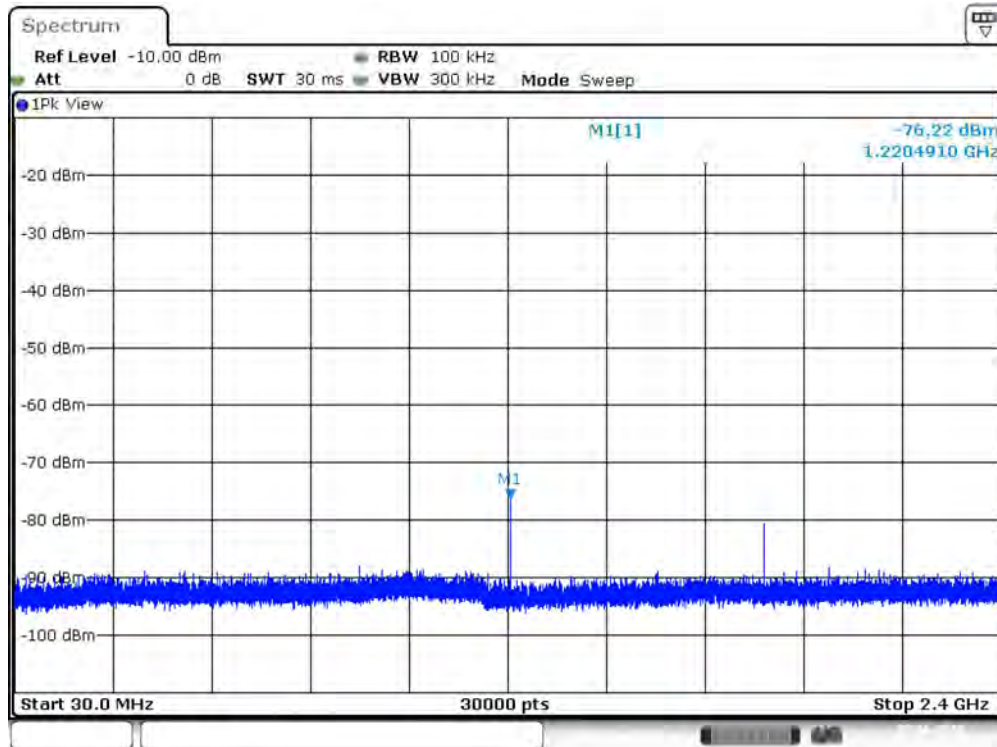
Plot2 3DH5 2402 MHz Average Band 2



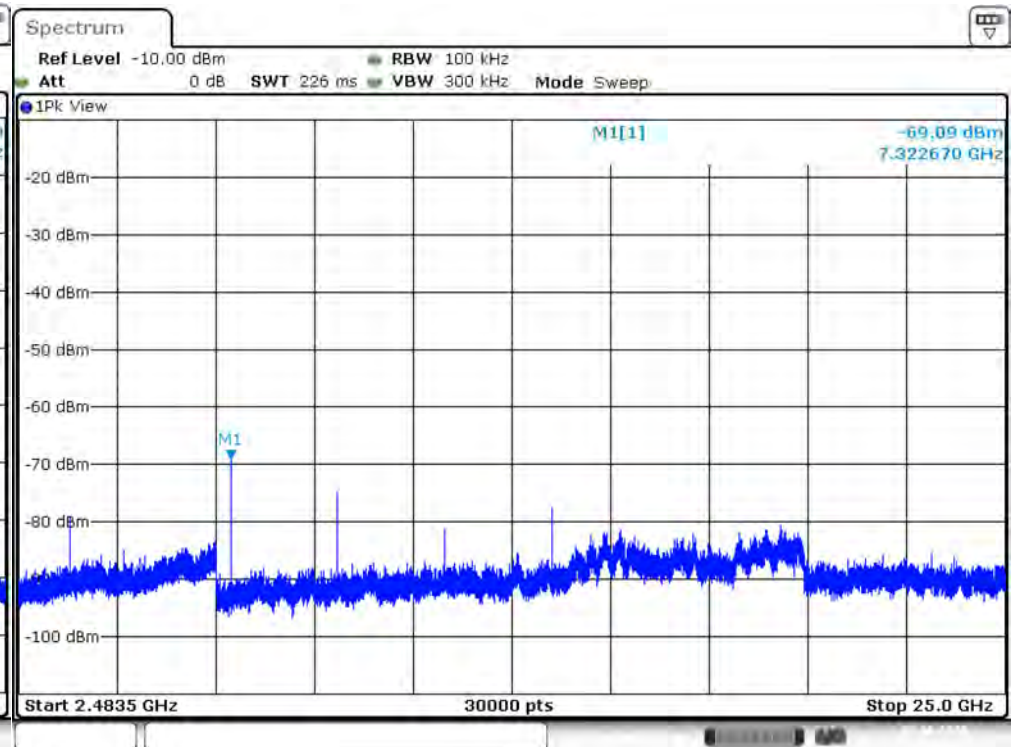
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 3DH5 2441 MHz Peak Band 1



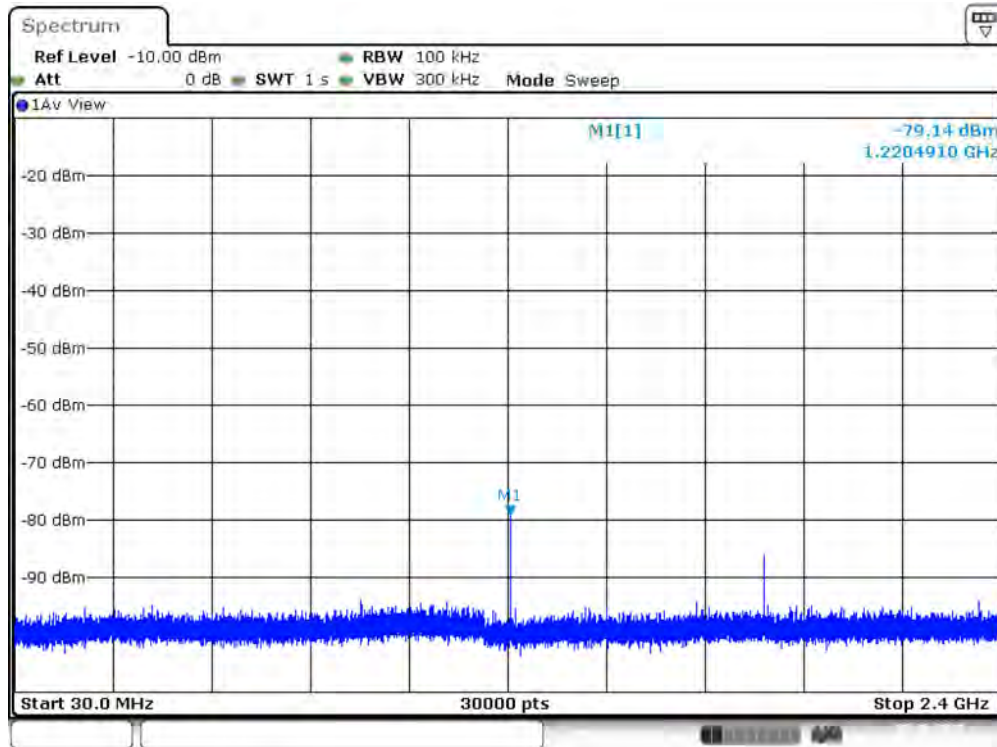
Plot2 3DH5 2441 MHz Peak Band 2



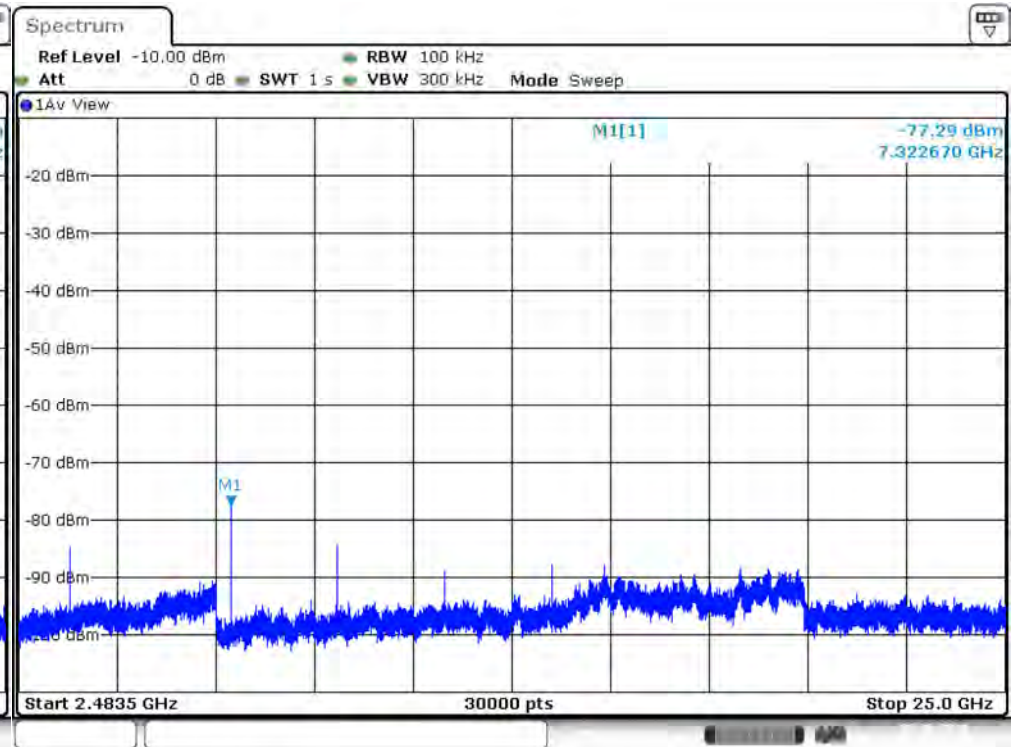
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 3DH5 2441 MHz Average Band 1



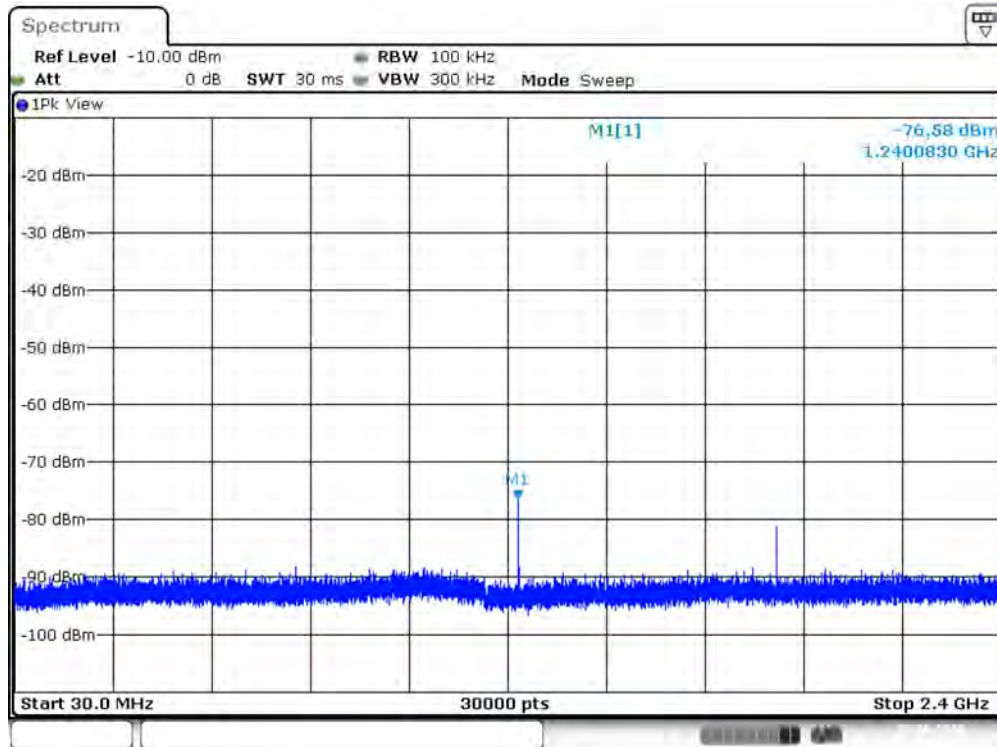
Plot2 3DH5 2441 MHz Average Band 2



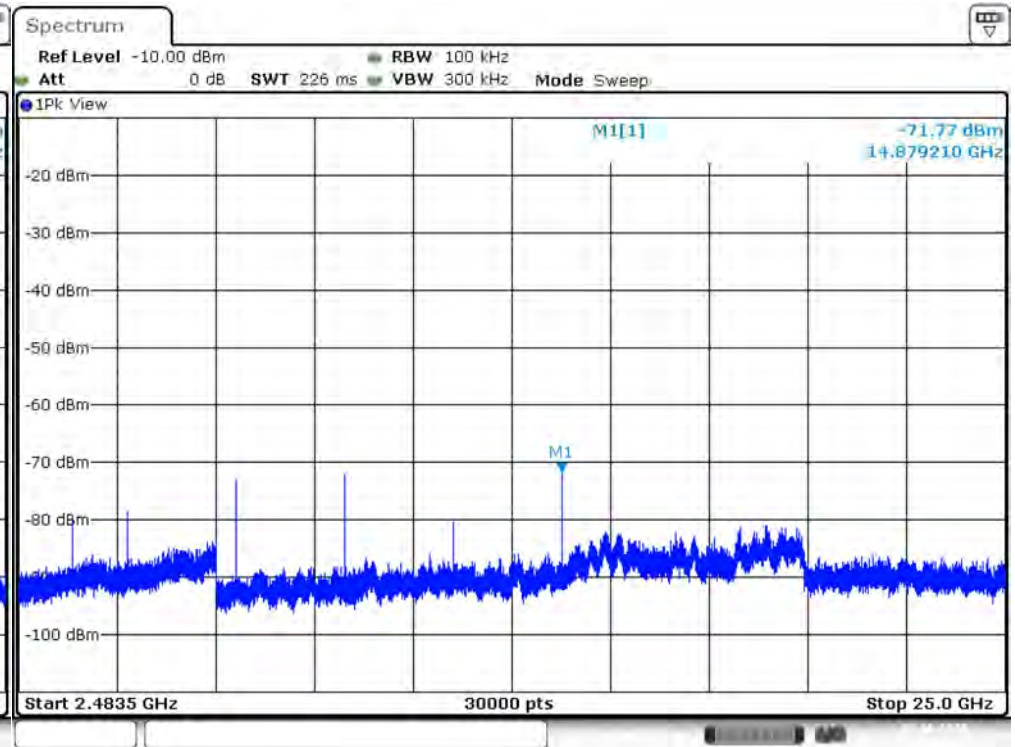
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 3DH5 2480 MHz Peak Band 1



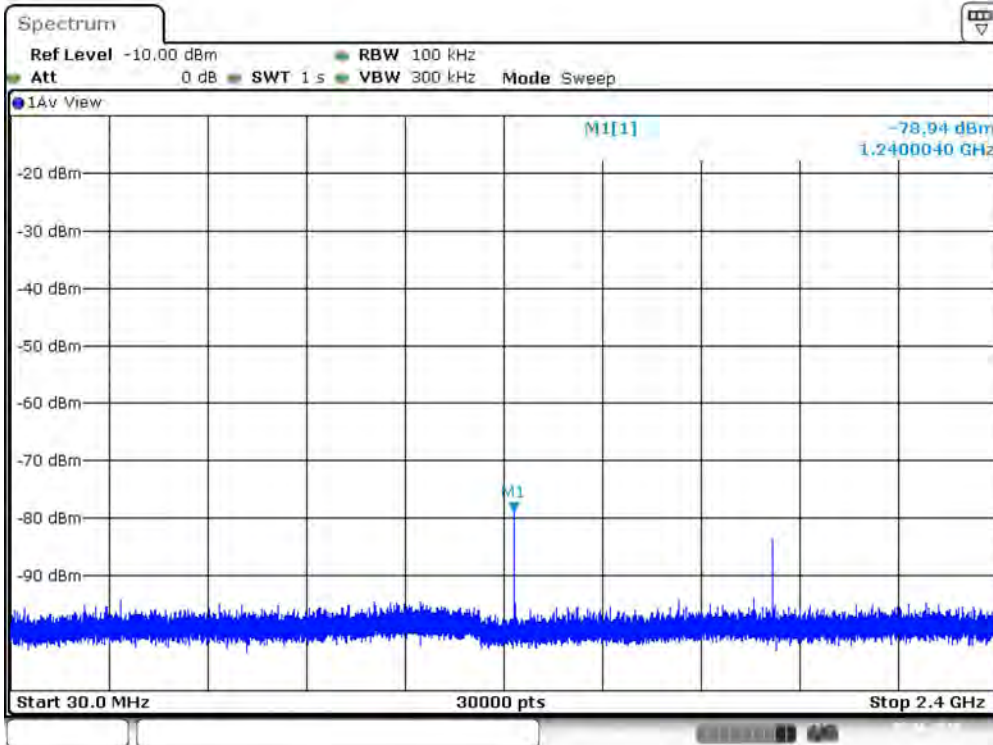
Plot2 3DH5 2480 MHz Peak Band 2



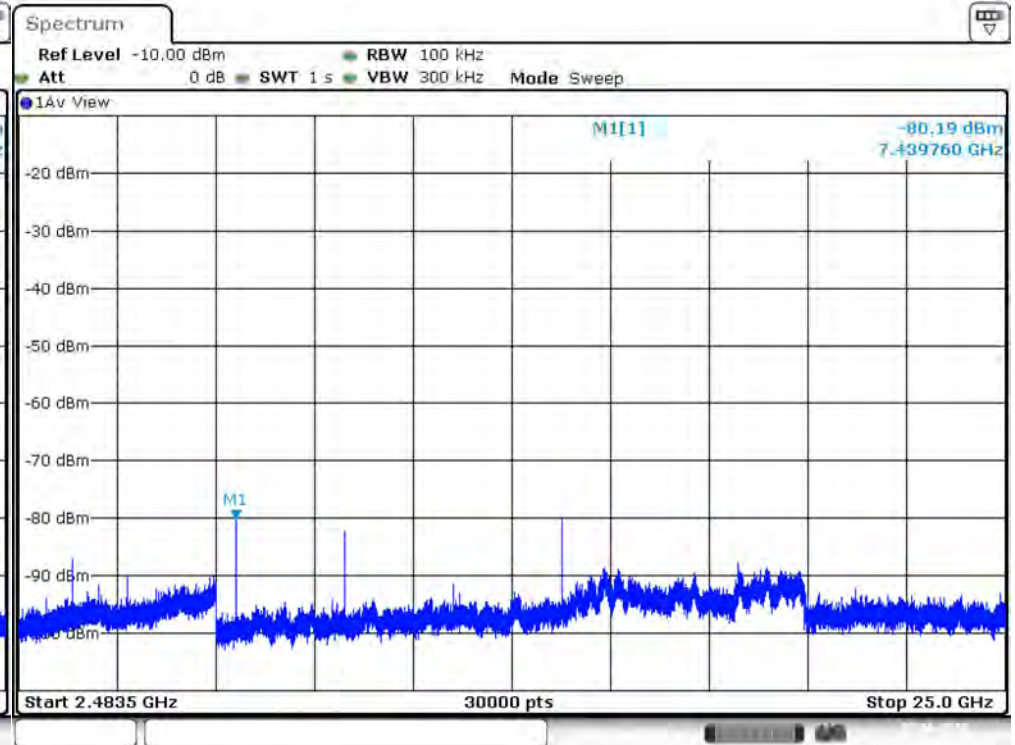
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 3DH5 2480 MHz Average Band 1



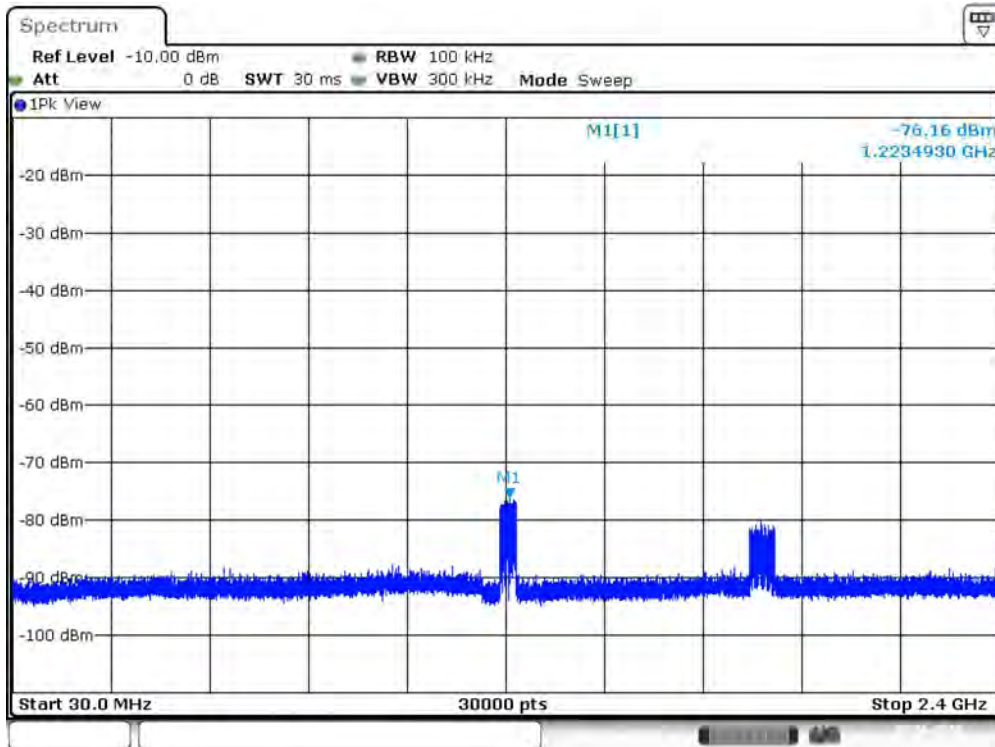
Plot2 3DH5 2480 MHz Average Band 2



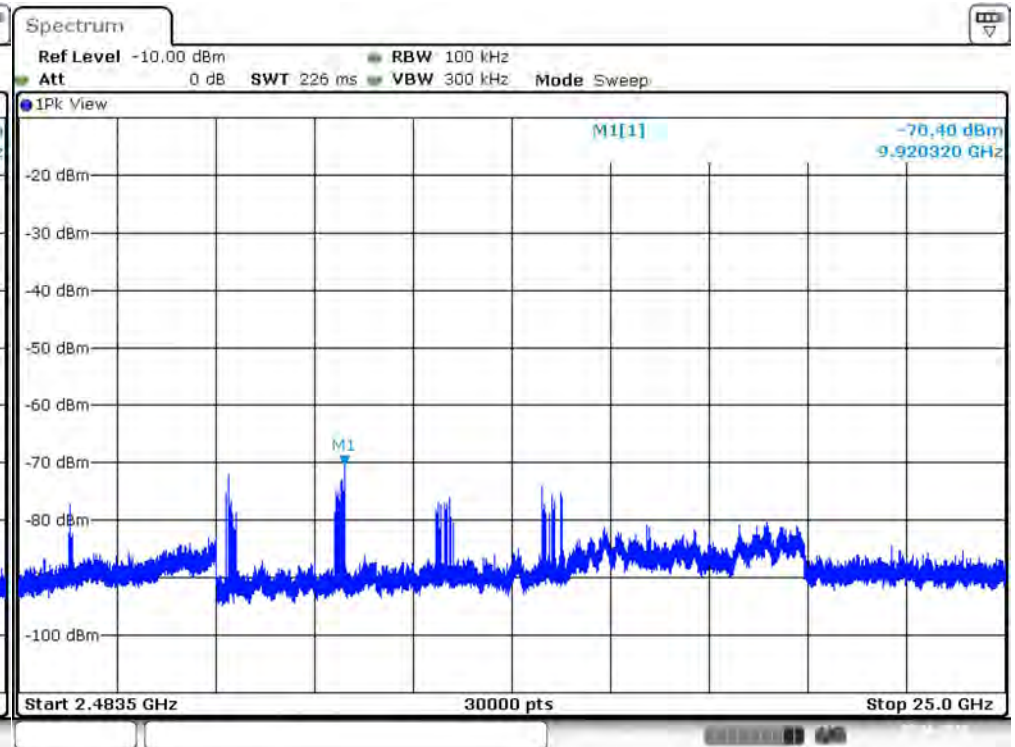
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 3DH5 Hopping Peak Band 1



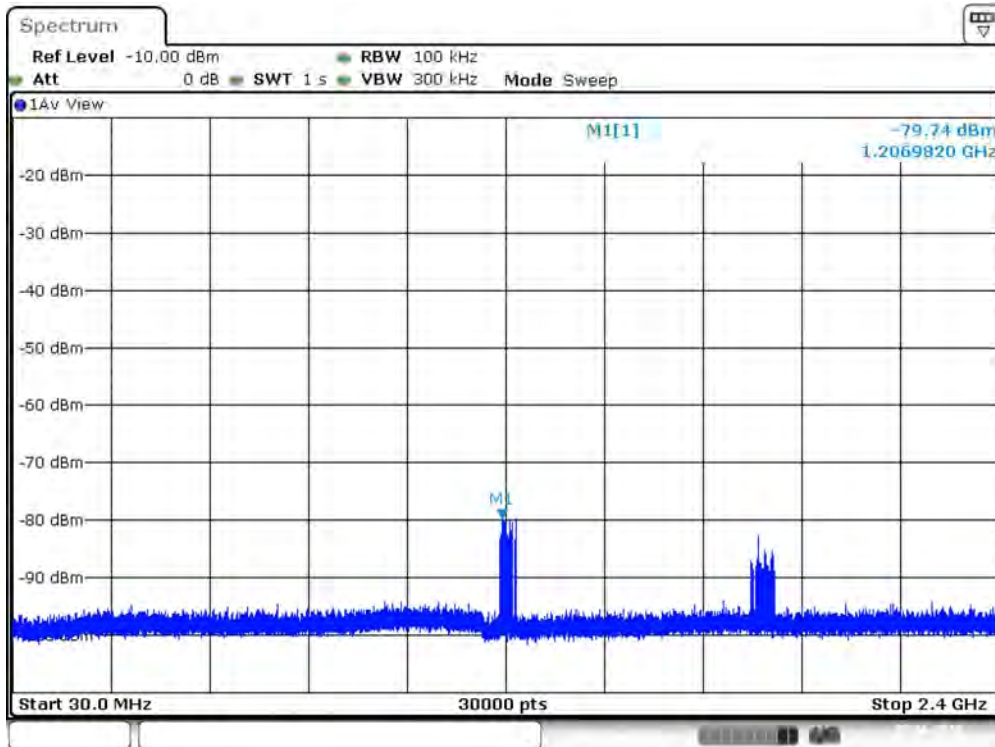
Plot2 3DH5 Hopping Peak Band 2



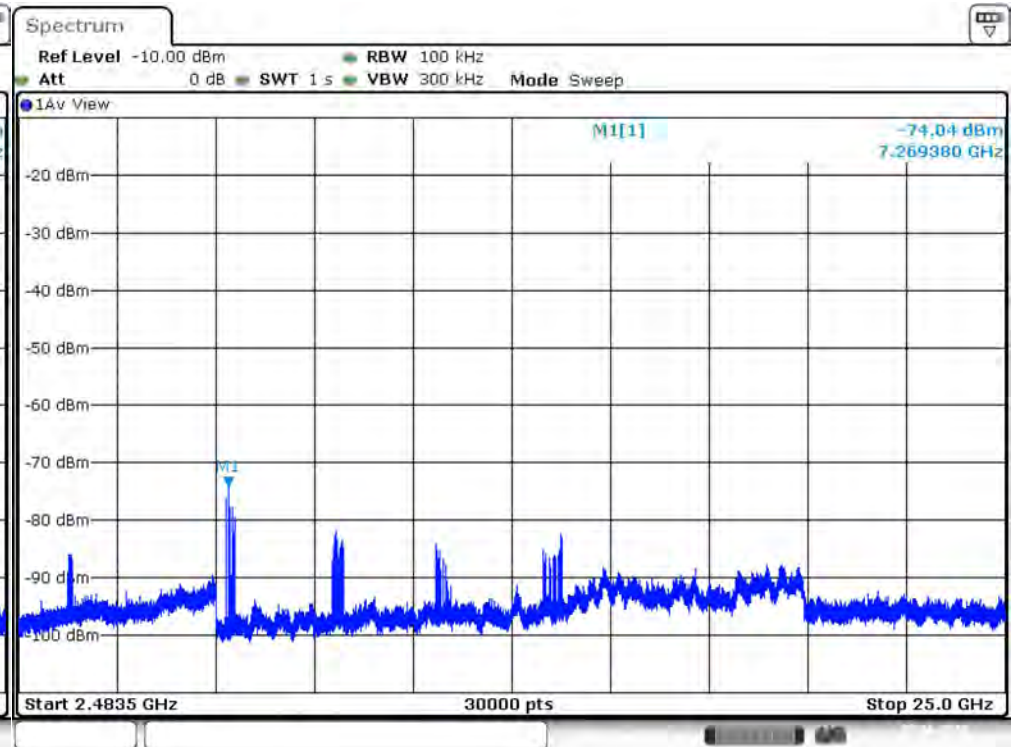
Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report

FCC ID: A94BMD0011 IC: 3232A-BMD0011



Plot1 3DH5 Hopping Average Band 1



Plot2 3DH5 Hopping Average Band 2



# Average Time of Occupancy Requirements:

FCC 15.247 (a) (1) (iii), IC RSS-247 5.1 (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.

## Test setup details

The EUT is controlled via the USB cable with Blue Suite software which is used to set the test modes of EUT. The EUT is programmed to operate at fixed frequencies at the low, middle, and high end of the authorized frequency band.

Using zero span mode on the channel center frequency the transmit pulse width was measured for each of the following modes, DH1, DH3 & DH5 with the maximum payload size for basic and enhanced data rates.

$$\begin{aligned} \text{Dwell Time} &= (\text{TX Pulse Width}) * (\text{Hop Rate}) / (\# \text{ of Channels}) / (\# \text{ of slots}) * 31.6 \\ &= (\text{TX Pulse Width}) * 1600 / 79 / (\# \text{ of Slots}) * 31.6 \\ &= (\text{TX Pulse Width}) * 640 / (\# \text{ Slots}) \end{aligned}$$

$$\text{Hop Rate} = 1600 \text{ hops / S}$$

$$\# \text{ of channels} = 79$$

$$\# \text{ of slots} = \text{number of slots used per packet in a given mode: DH1} = 2, \text{ DH3} = 4, \text{ DH5} = 6$$

$$31.6 \text{ Seconds} = (79 \text{ channels}) * 0.4 \text{ Seconds}$$

$$8 \text{ Seconds} = (20 \text{ channels}) * 0.4 \text{ Seconds}$$



# Test Results:

TX Pulse Width (xDH1)									
Channel	Frequency (MHz)	Mode	Pulse Width (mS)	Number of pulses in 3.16 S	Number of pulses in 31.6 S	Time of occupancy (mS)	Limit (mS)	Margin (mS)	Result
Middle	2441	DH1	0.388	33	330	128.2	400	271.84	Pass
Middle	2441	2-DH1	0.398	33	330	131.5	400	268.55	Pass
Middle	2441	3-DH1	0.398	33	330	131.5	400	268.55	Pass

Number of pulses in 31.6 s = Number of pulses in 3.16 s \* 10

Time of occupancy = Pulse Width \* Number of pulses in 31.6 s

TX Pulse Width (xDH3)									
Channel	Frequency (MHz)	Mode	Pulse Width (mS)	Number of pulses in 3.16 S	Number of pulses in 31.6 S	Time of occupancy (mS)	Limit (mS)	Margin (mS)	Result
Middle	2441	DH3	1.646	16	160	263.3	400	136.71	Pass
Middle	2441	2-DH3	1.653	16	160	264.5	400	135.48	Pass
Middle	2441	3-DH3	1.649	16	160	263.9	400	136.09	Pass

Number of pulses in 31.6 s = Number of pulses in 3.16 s \* 10

Time of occupancy = Pulse Width \* Number of pulses in 31.6 s

TX Pulse Width (xDH5)									
Channel	Frequency (MHz)	Mode	Pulse Width (mS)	Number of pulses in 3.16 S	Number of pulses in 31.6 S	Time of occupancy (mS)	Limit (mS)	Margin (mS)	Result
Middle	2441	DH5	2.889	11	110	317.7	400	82.26	Pass
Middle	2441	2-DH5	2.895	11	110	318.5	400	81.53	Pass
Middle	2441	3-DH5	2.895	11	110	318.5	400	81.53	Pass

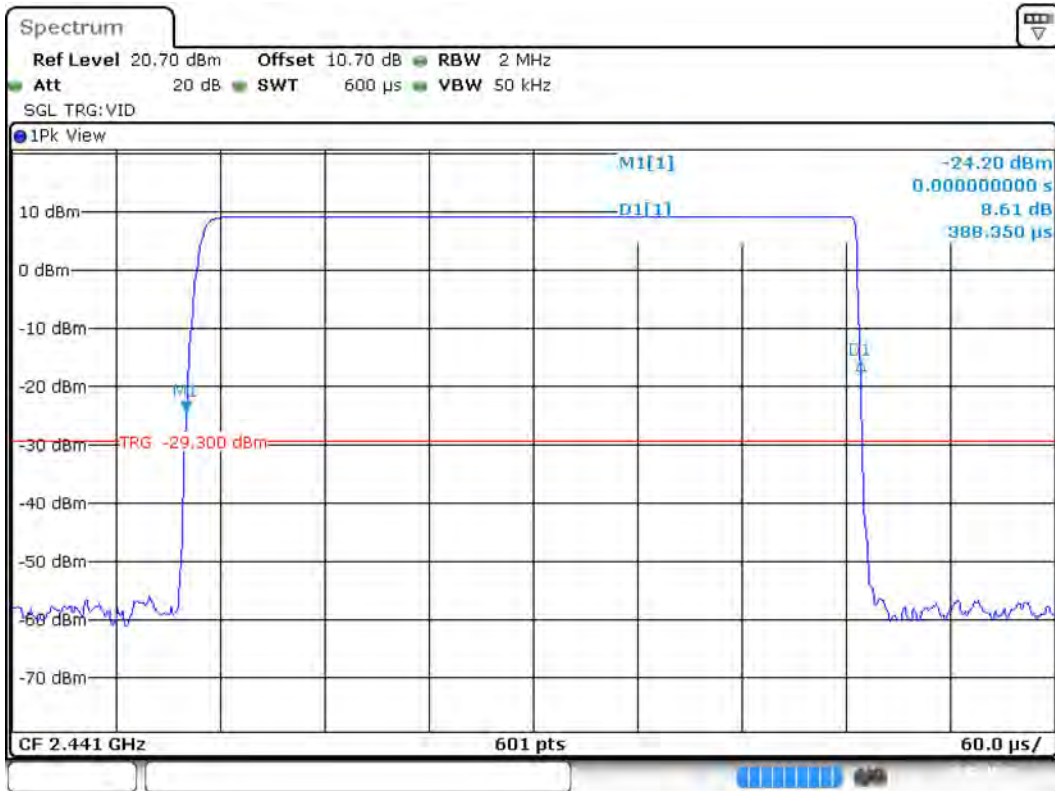
Number of pulses in 31.6 s = Number of pulses in 3.16 s \* 10

Time of occupancy = Pulse Width \* Number of pulses in 31.6 s

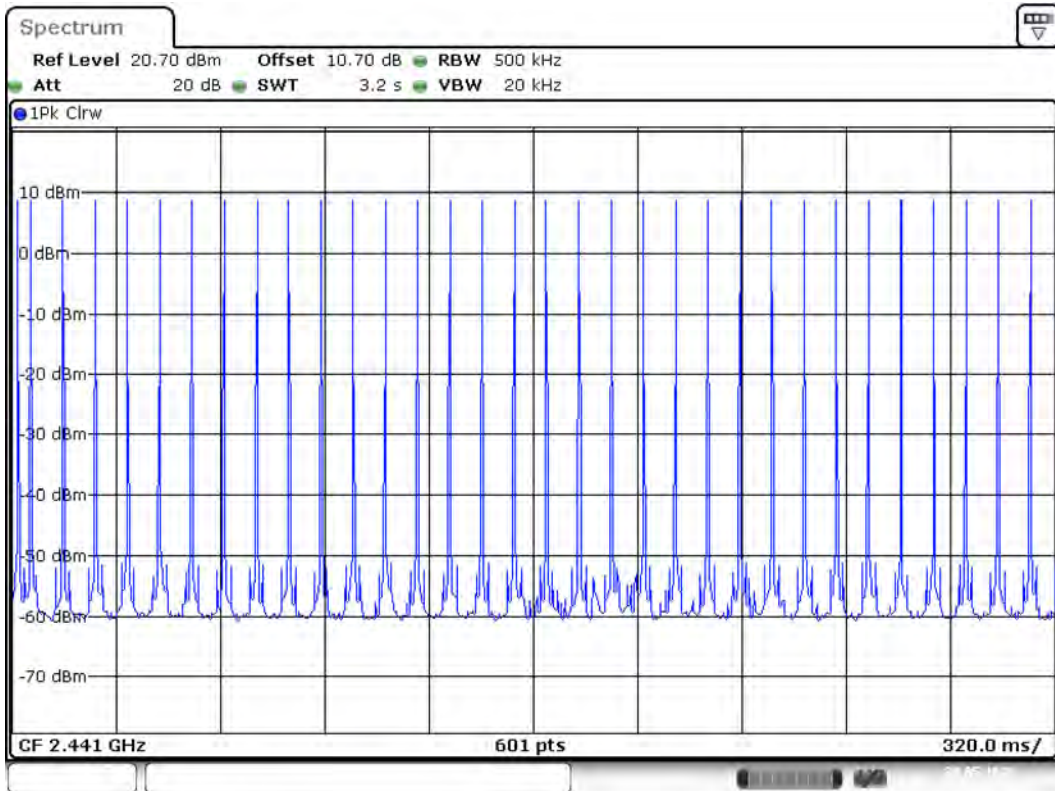


Certificate # 1514.1

# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report



Plot1 2441 TX pulse width DH1

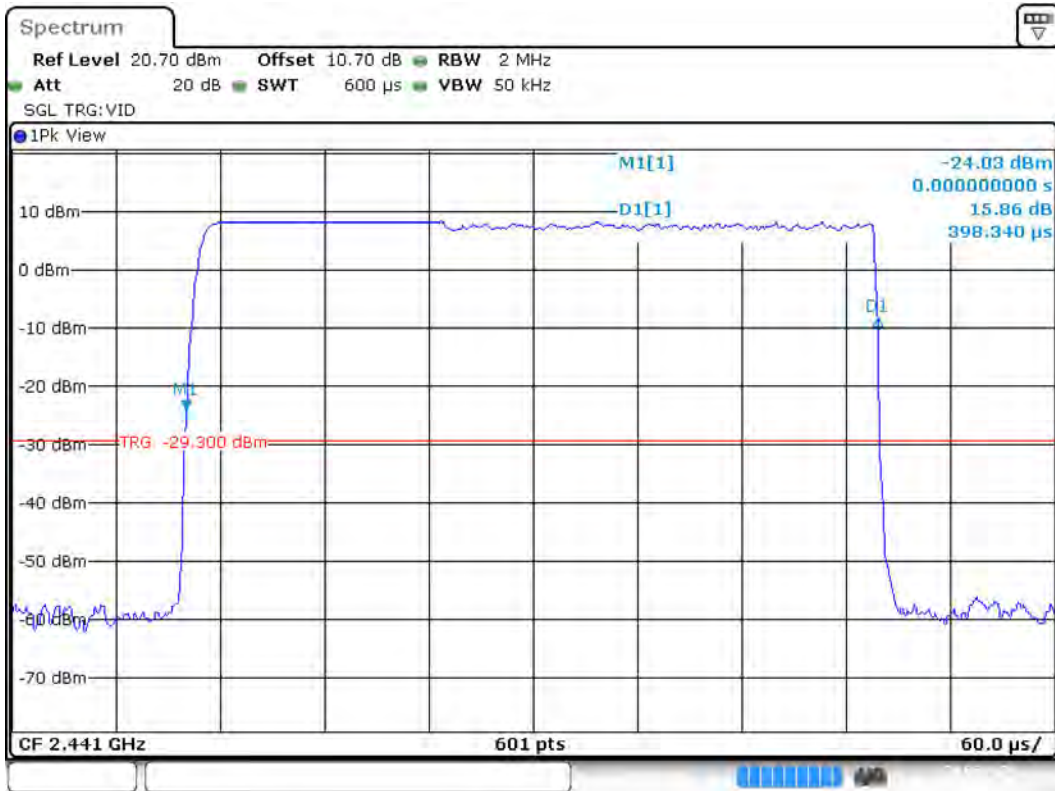


Plot10 2441 TX pulse count DH1

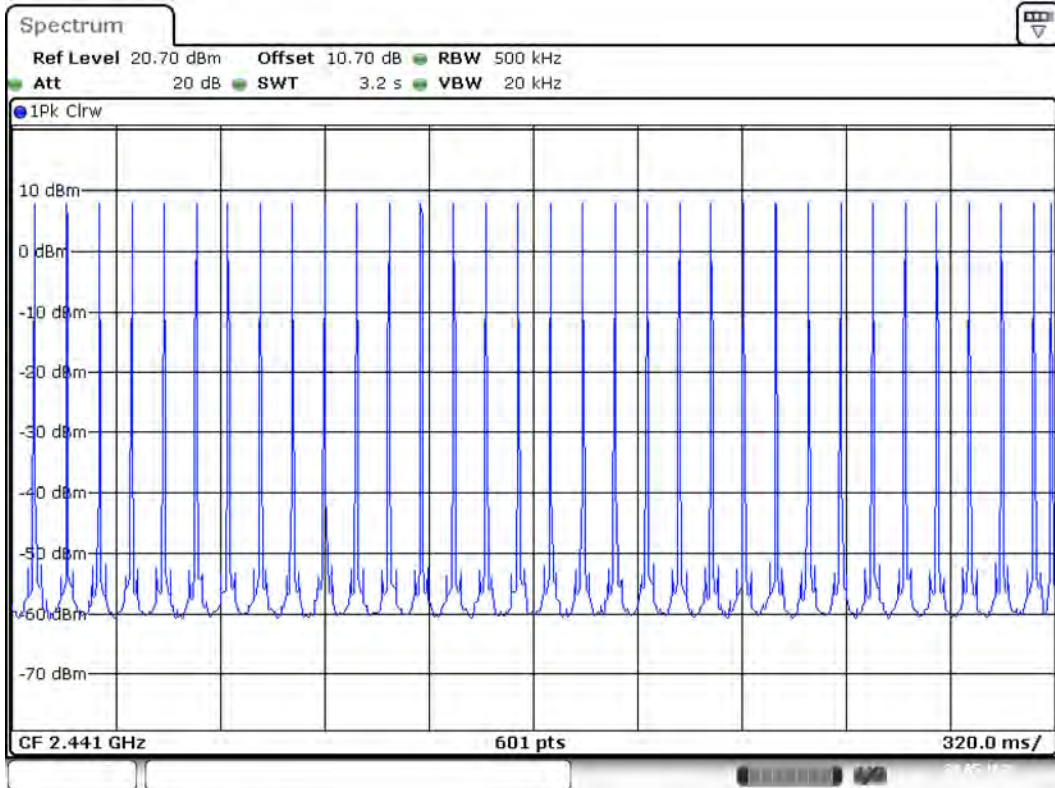


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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report



Plot2 2441 TX pulse width 2DH1

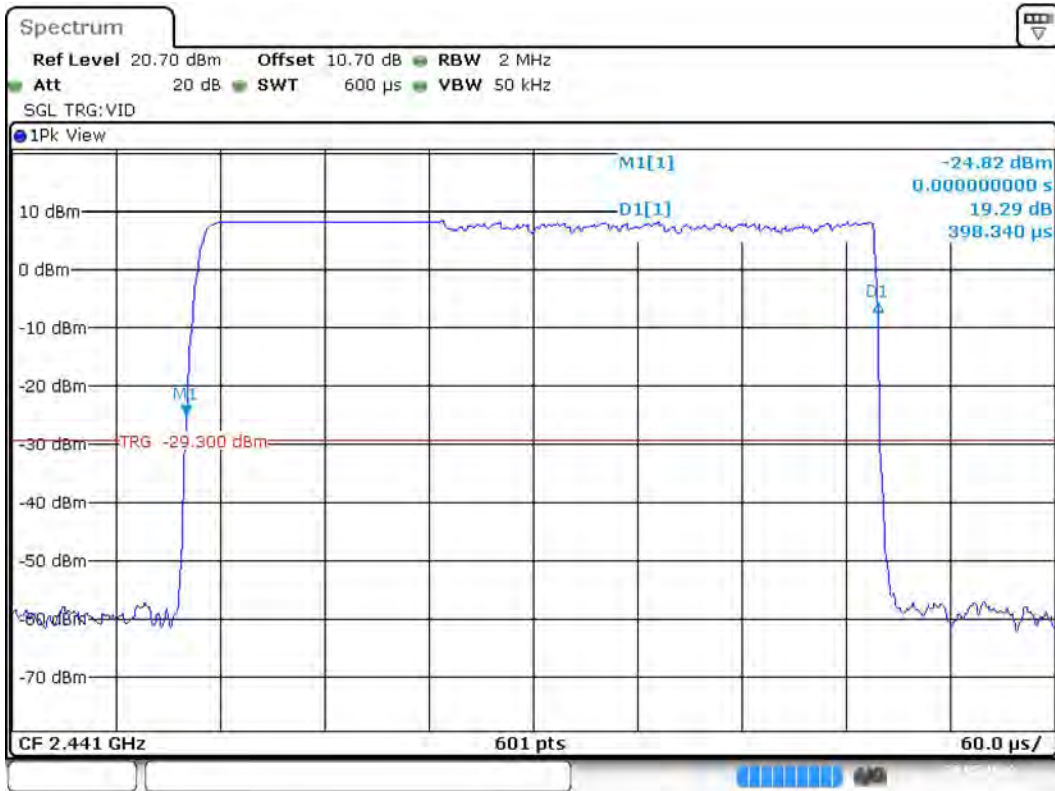


Plot11 2441 TX pulse count 2DH1

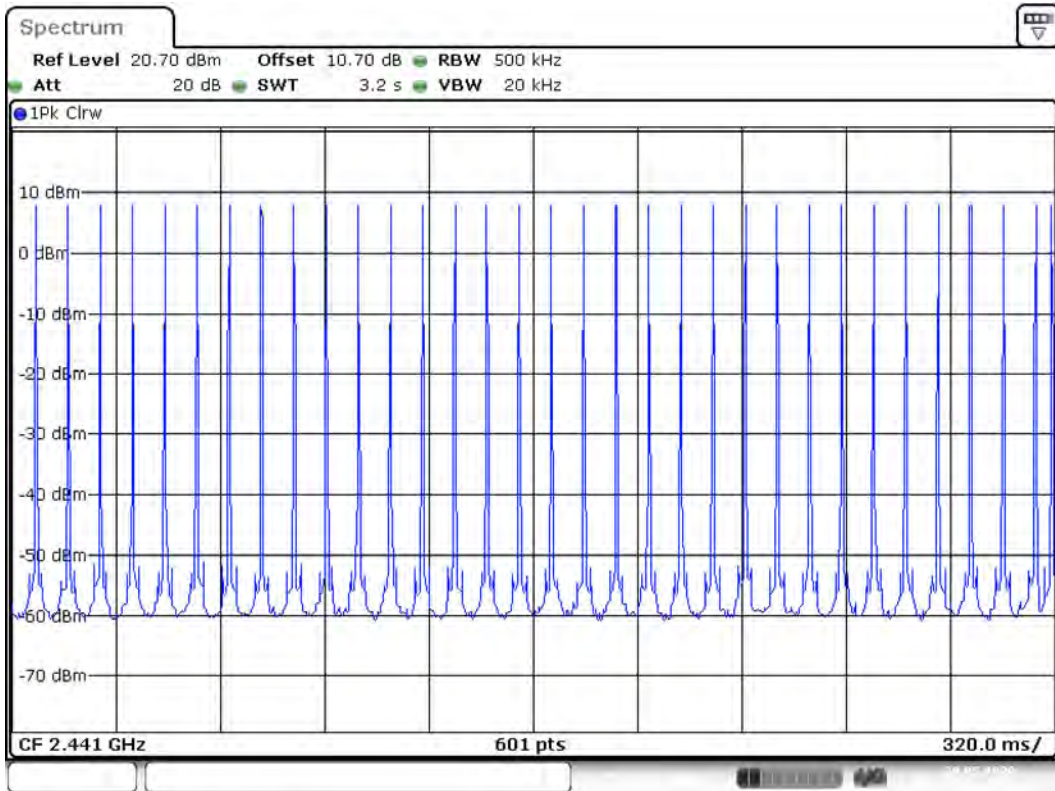


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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report



Plot3 2441 TX pulse width 3DH1

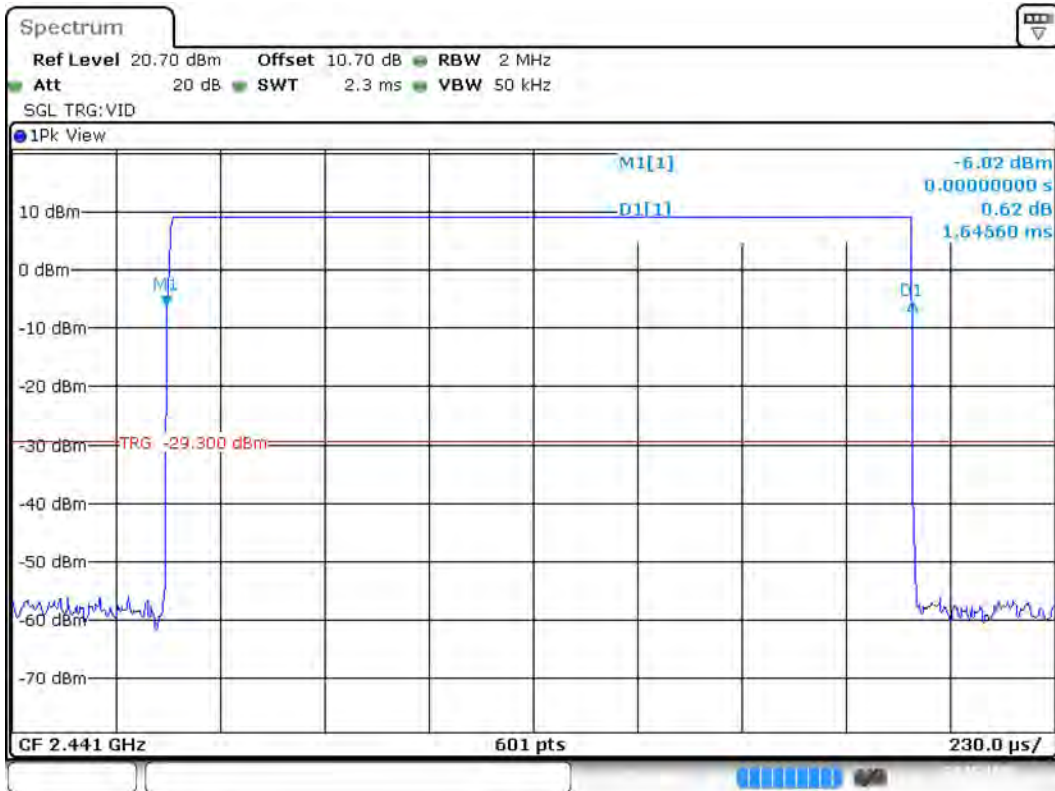


Plot12 2441 TX pulse count 3DH1

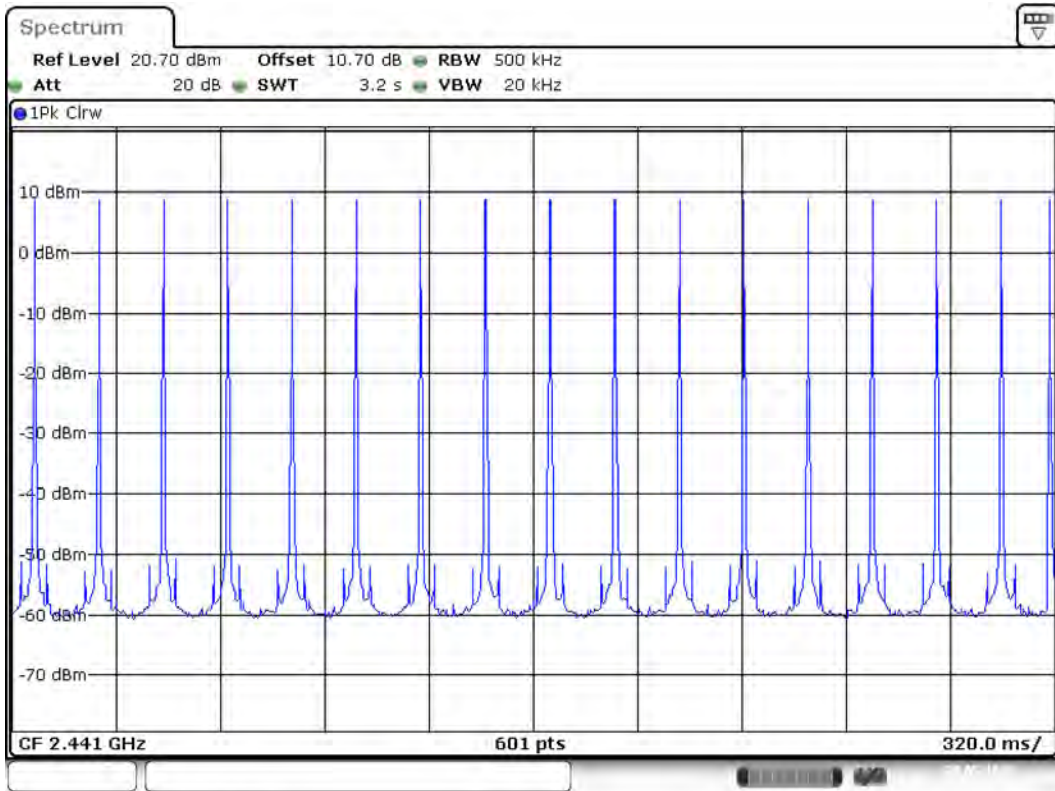


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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report



Plot4 2441 TX pulse width DH3

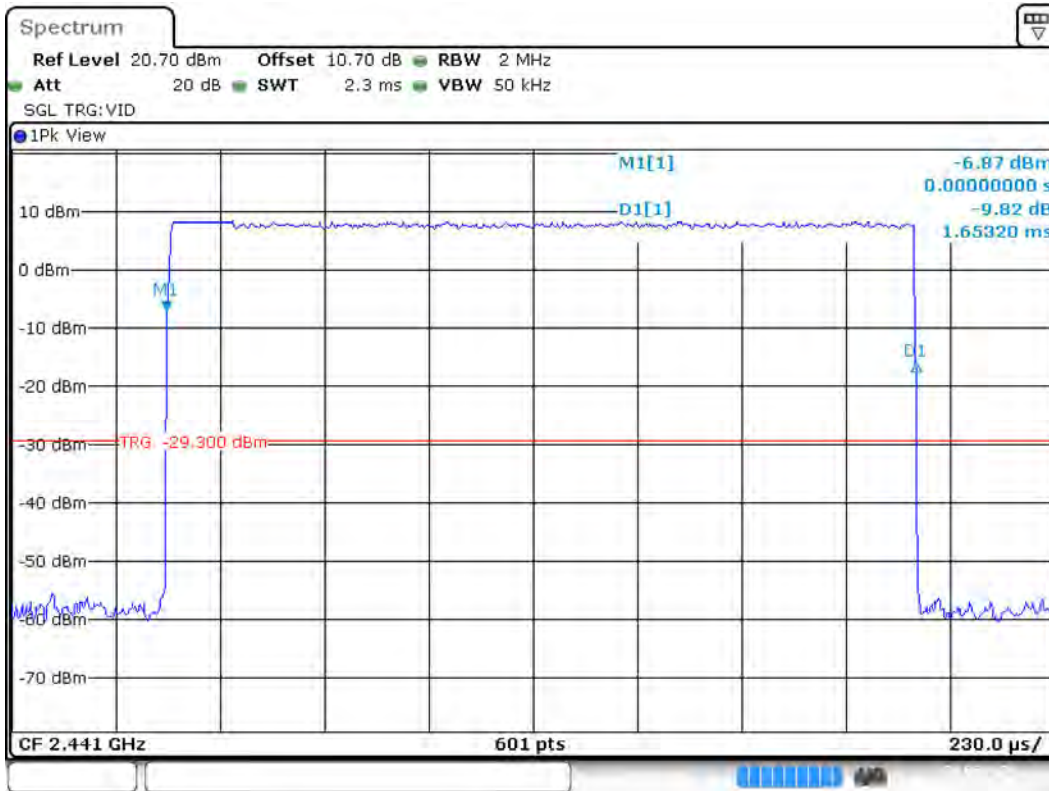


Plot13 2441 TX pulse count DH3

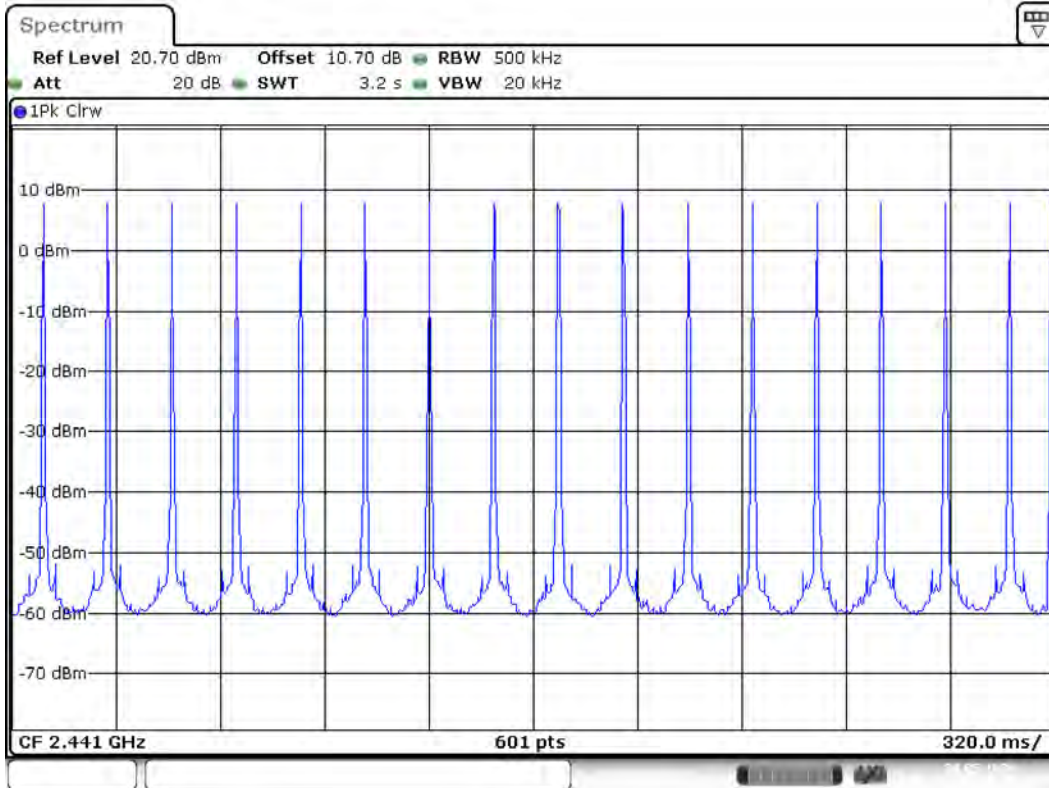


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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report



Plot5 2441 TX pulse width 2DH3

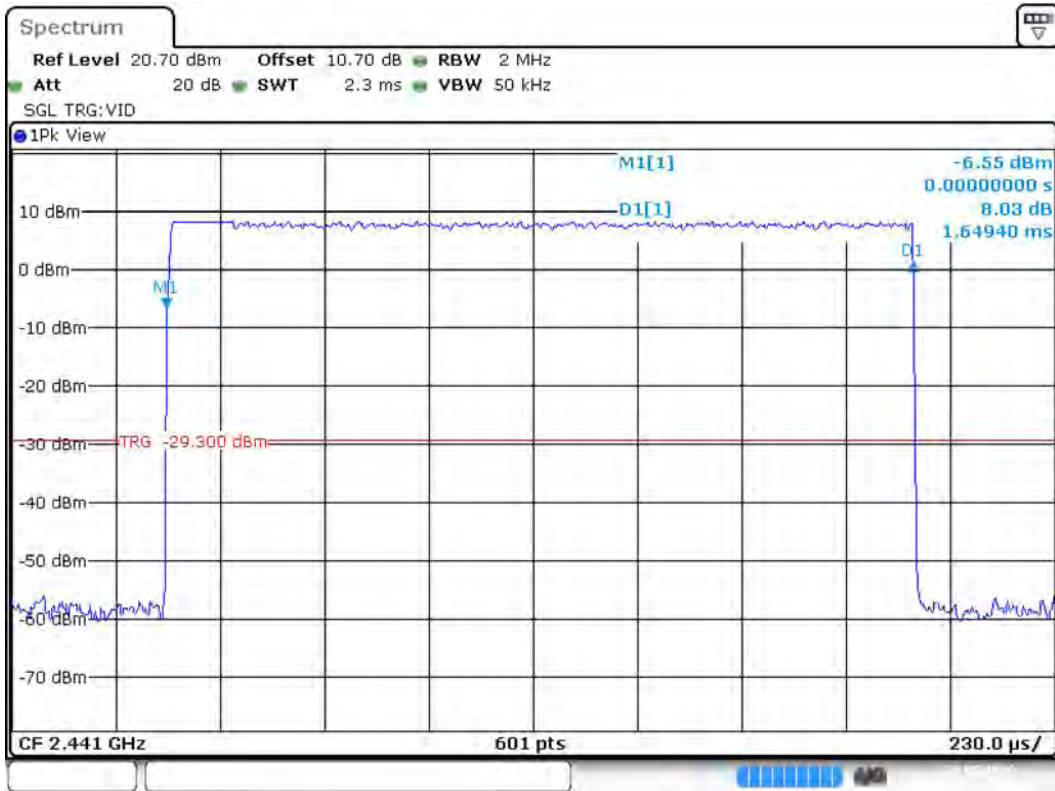


Plot14 2441 TX pulse count 2DH3

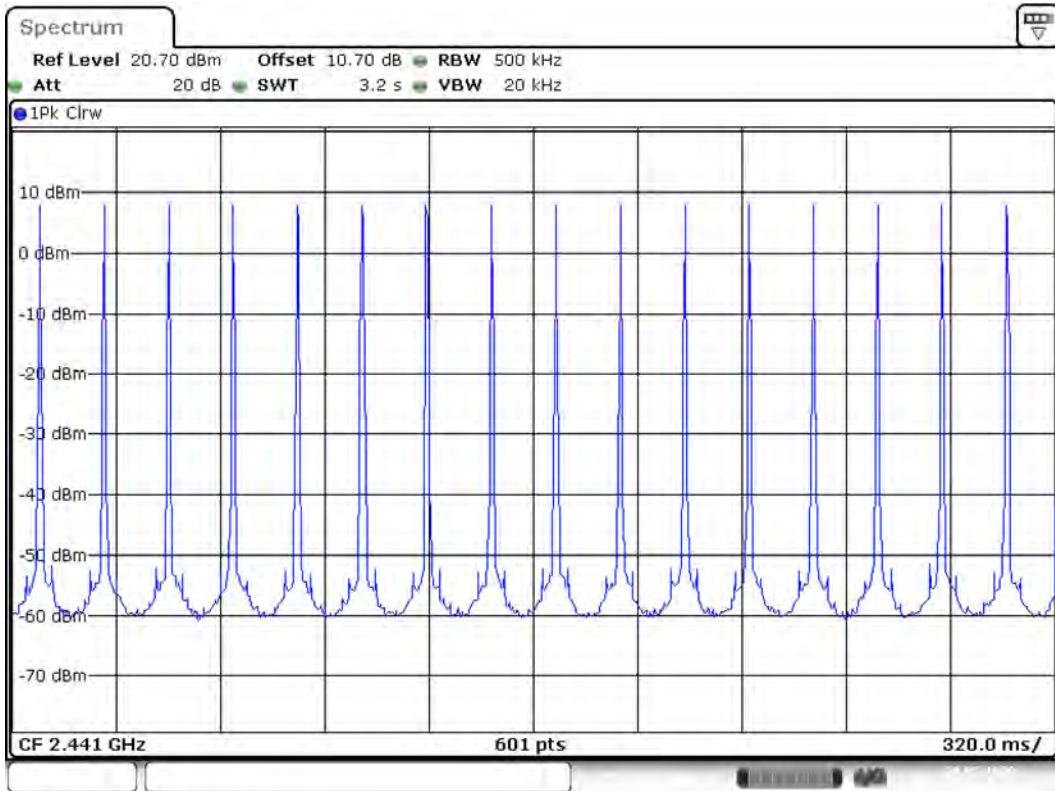


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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report



Plot6 2441 TX pulse width 3DH3

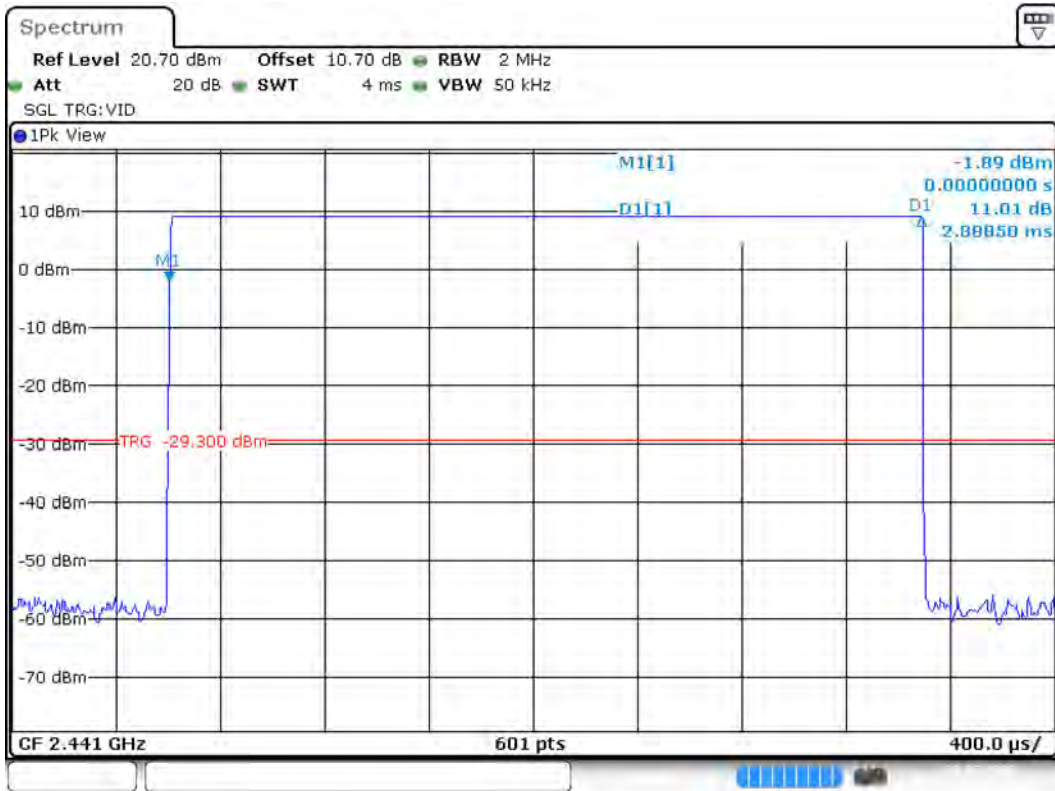


Plot15 2441 TX pulse count 3DH3

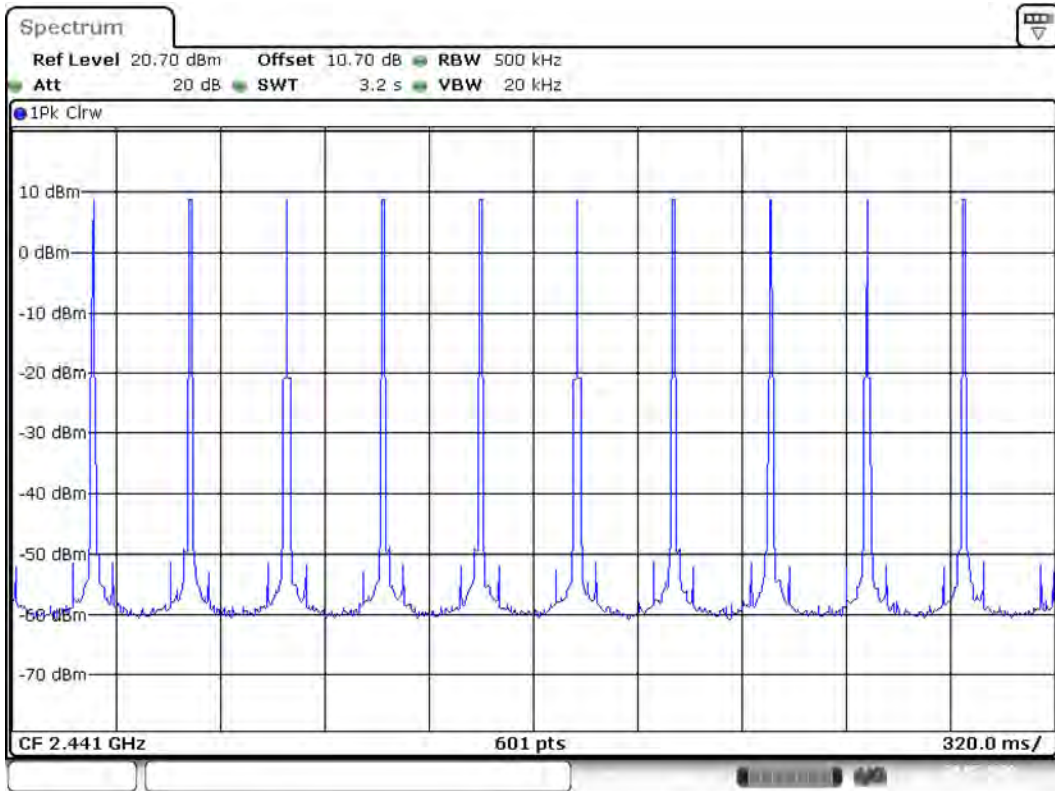


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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report



Plot7 2441 TX pulse width DH5



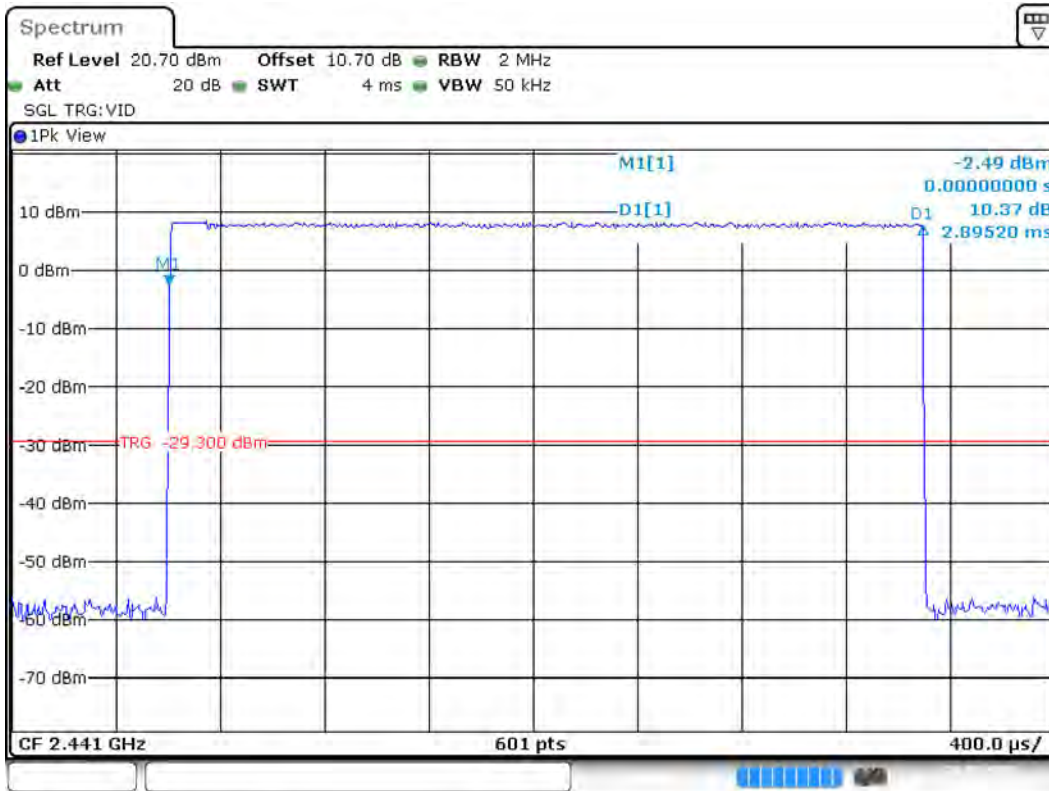
Plot16 2441 TX pulse count DH5



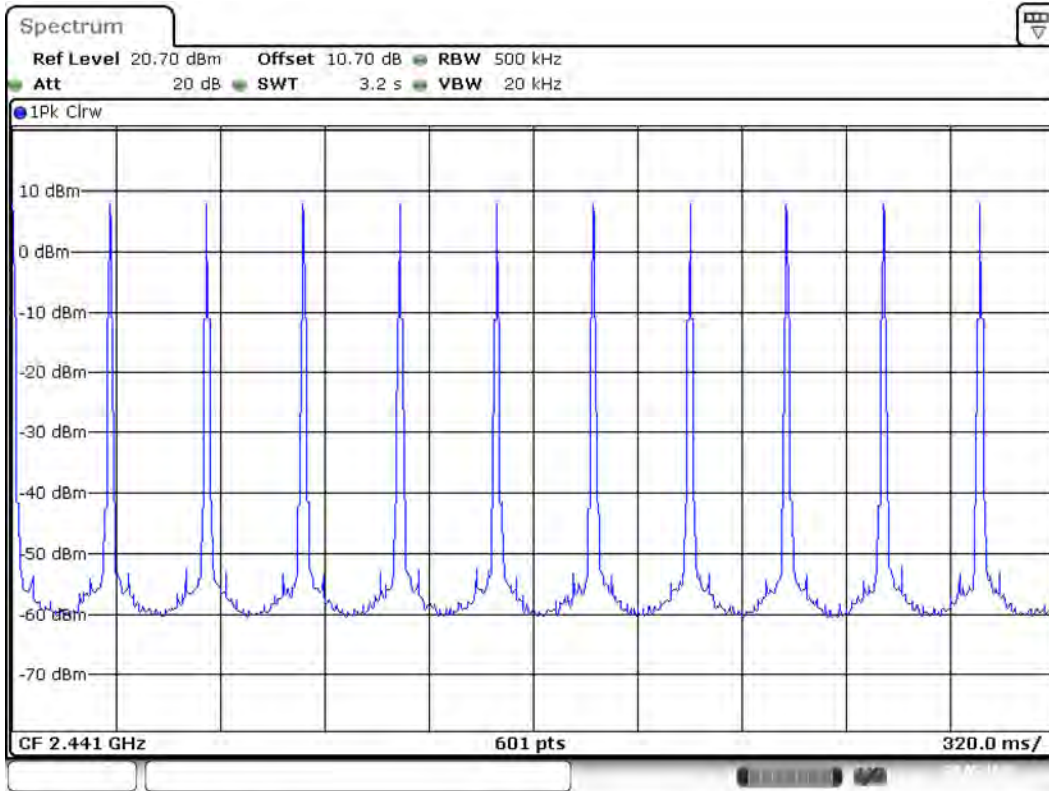


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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report



Plot8 2441 TX pulse width 2DH5

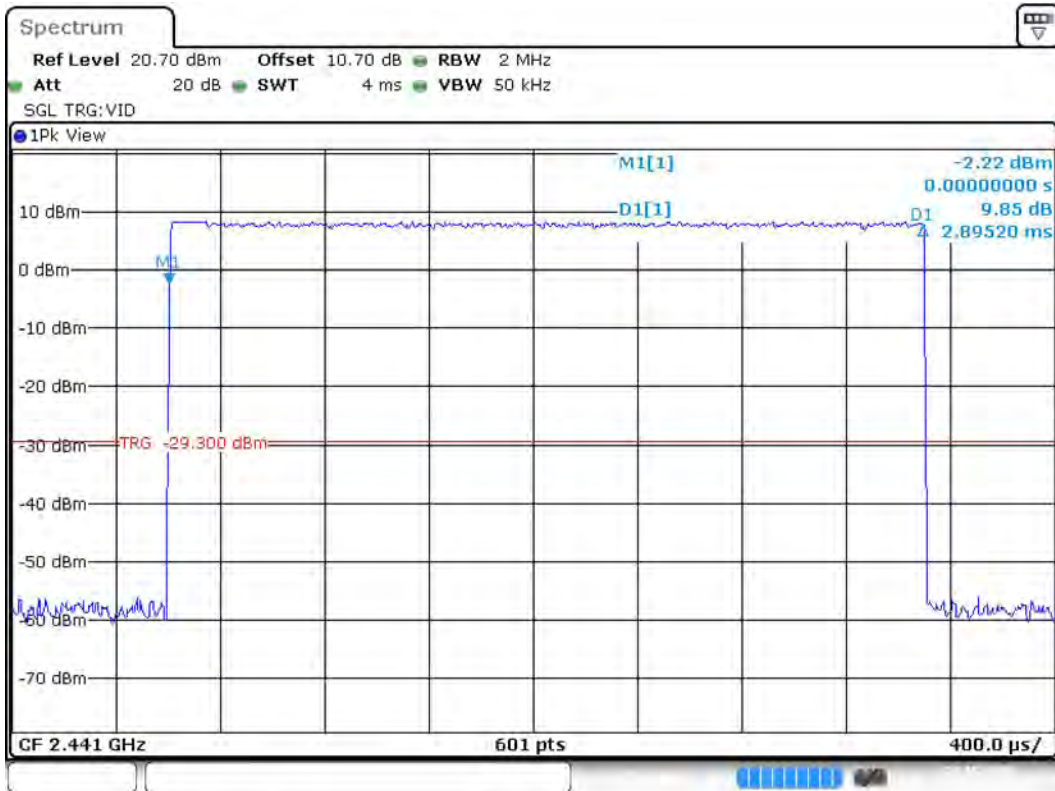


Plot17 2441 TX pulse count 2DH5

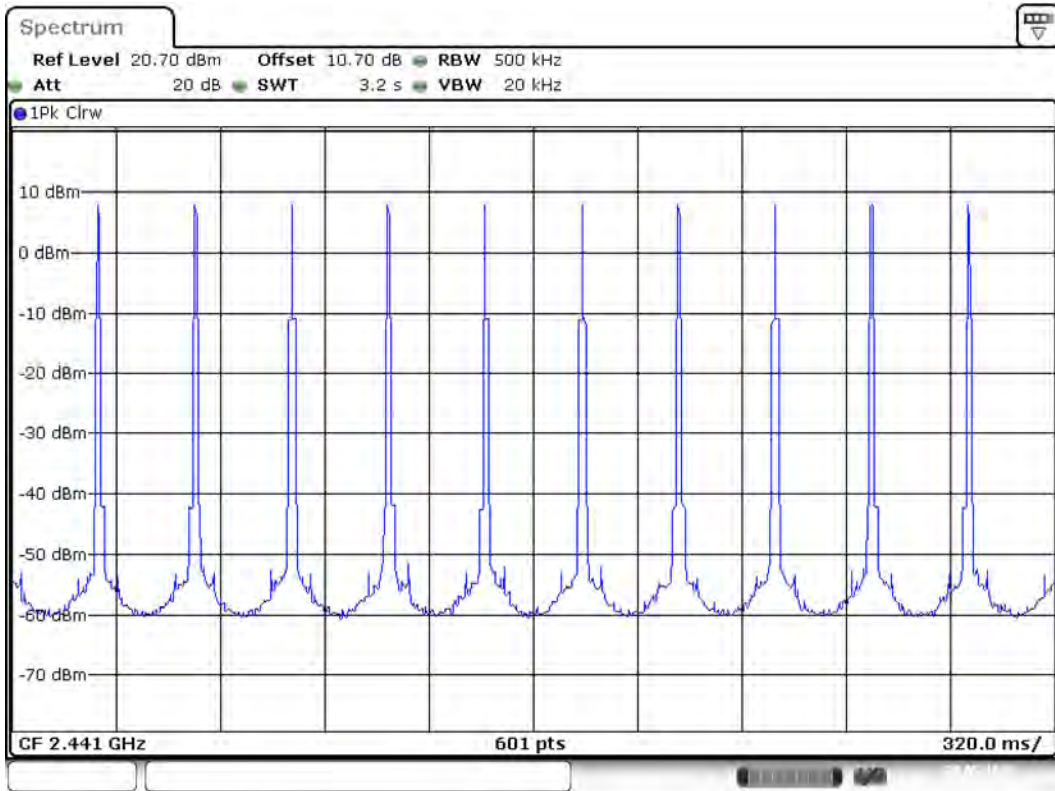


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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report



Plot9 2441 TX pulse width 3DH5



Plot18 2441 TX pulse count 3DH5

# Number of Hopping Channels

## Requirements:

FCC 15.247 (a) (1) (iii), IC RSS-247 5.1 (4)

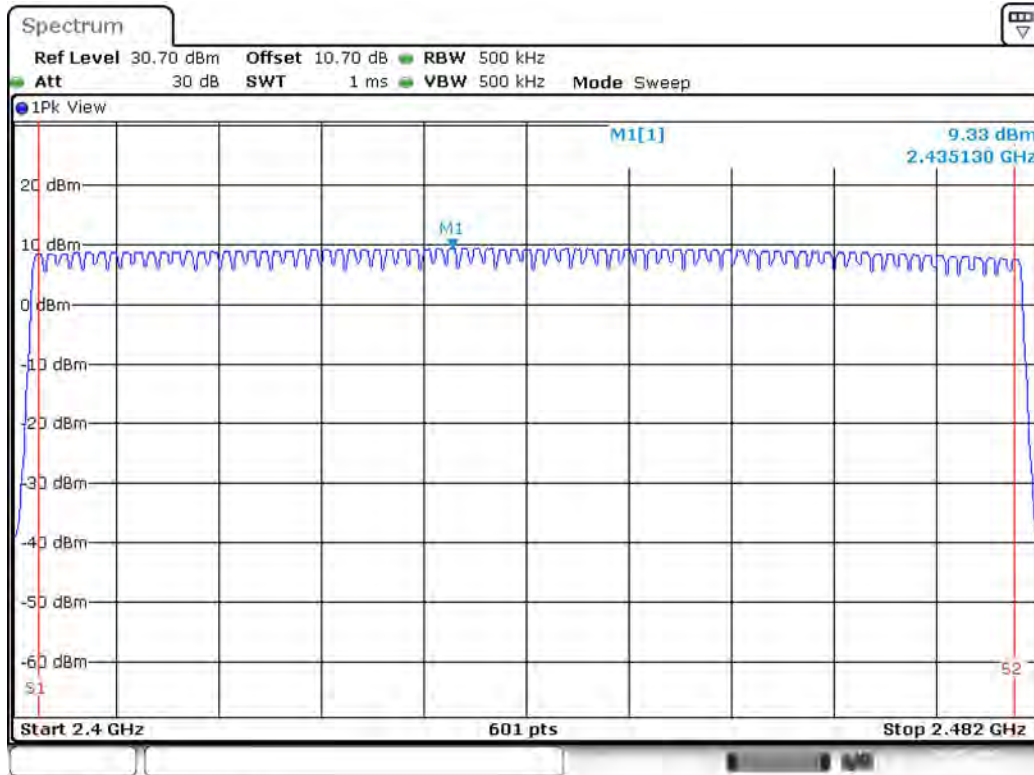
Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

## Test Setup:

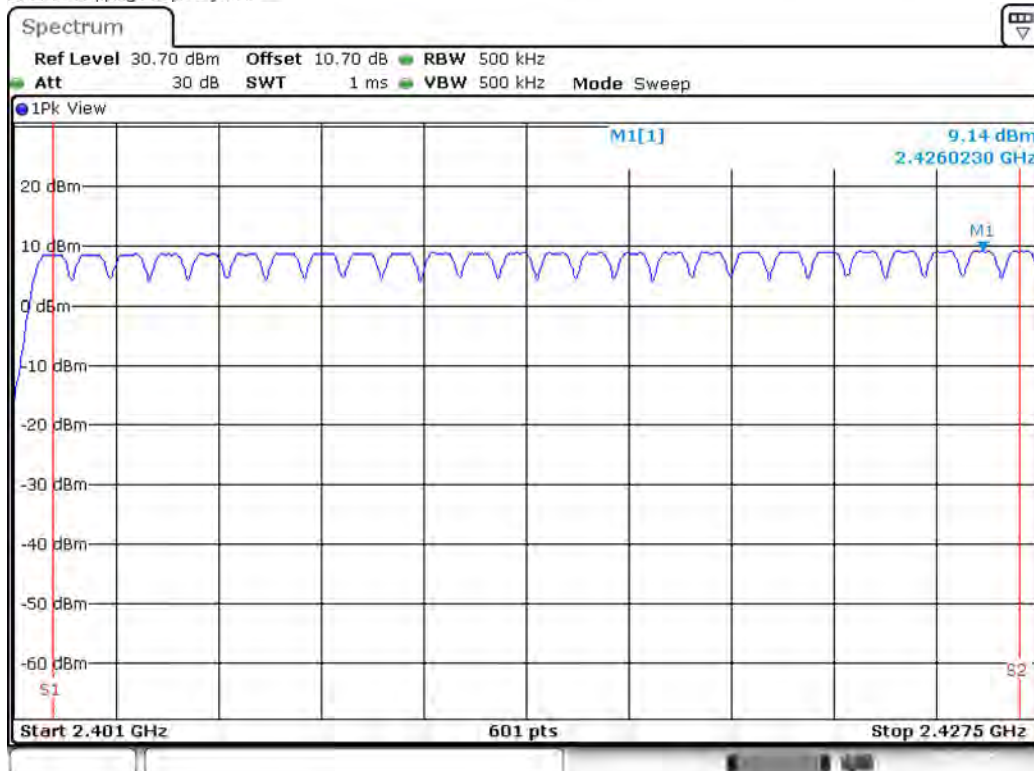
EUT is controlled by Blue Suite software to enable testing of the spurious output in specific operational modes.

Measurements are made with the EUT in normal operation (hopping through all available channels) in basic and enhanced data rate modes.

# Test Results:



Plot1 79 Hopping Frequency DH5

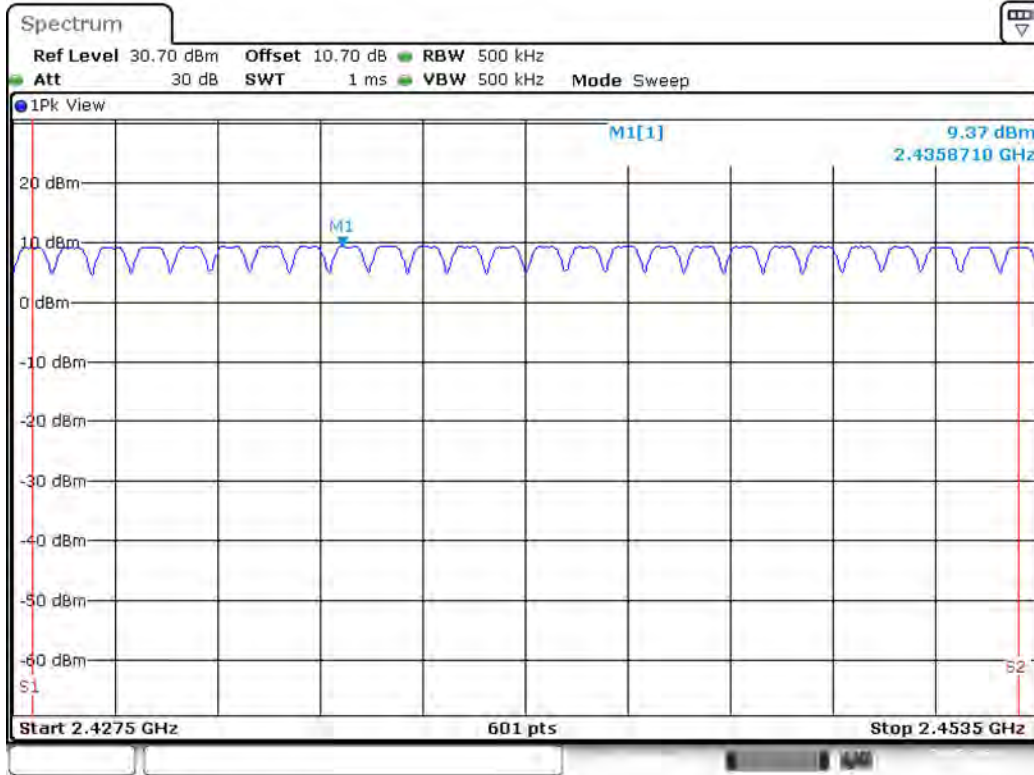


Plot2 1st segment DH5 (26 Frequencies)

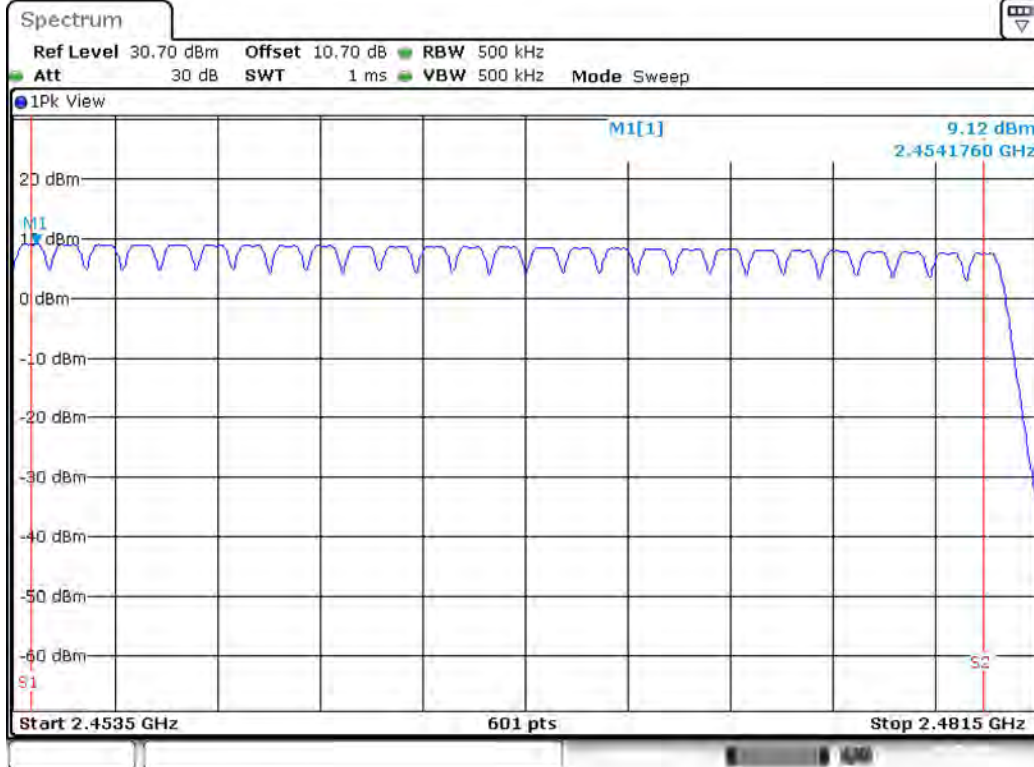


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# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DSS Test Report



Plot3 2nd segment DH5 (26 Frequencies)



Plot4 3rd segment DH5 (27 Frequencies)



## Conducted Measurements Resources Used

TN	Description	Model	S/N	Manufacturer	Most Recent Service	Service Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	22-Apr-2020	22-Apr-2021
2414	Band Reject Filter (2.4GHz)	BRM50702-07	003	Micro-Tronics	10-Apr-2020	10-Apr-2021

Date(s) of test: 18-MAY-2020 to 5-JUN-2020



# End of Report