

# NORTHWEST EMC

## Logic PD

Torpedo + Wireless -31 SOM

FCC 15.407:2016

Report # LGPD0192



NVLAP Lab Code: 200881-0

*This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America. This Report may only be duplicated in its entirety*

# CERTIFICATE OF TEST

**Last Date of Test: April 26, 2016**  
**Logic PD**  
**Model: Torpedo + Wireless -31 SOM**

## Radio Equipment Testing

### Standards

Specification	Method
FCC 15.407:2016	ANSI C63.10:2013, KDB 789033 D02 V1, KDB 905462 D02 V1R2

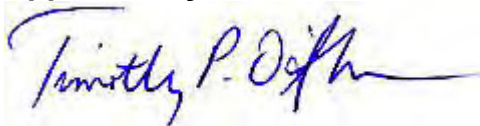
### Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for testing the new UNII rule changes.
6.5, 6.6, 12.7	Spurious Radiated Emissions	Yes	Pass	
6.8	Frequency Stability	Yes	Pass	
12.2	Duty Cycle	Yes	Pass	
12.4.1	Emission Bandwidth	No	N/A	Not tested. Applicable to the 5.2, 5.3 and 5.6 GHz bands only.
12.5	Maximum Power Spectral Density	Yes	Pass	
12.4.2	Occupied Bandwidth	Yes	Pass	
12.4.2	Band Edge	Yes	Pass	
12.3.2.4	Maximum Conducted Output Power	Yes	Pass	
KDB 789033 -H	Measurement of Emission at Elevation Angle Higher Than 30 Degrees From Horizon	No	N/A	Not required unless the EUT is a Master device used outdoors.

### Deviations From Test Standards

None

### Approved By:



Tim O'Shea, Operations Manager

*Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.*

# REVISION HISTORY

Revision Number	Description	Date	Page Number
00	None		

# ACCREDITATIONS AND AUTHORIZATIONS

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## United States

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**FCC** - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

**A2LA** - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

**NVLAP** - Each laboratory is accredited by NVLAP to ISO 17025

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## Canada

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**IC** - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

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## European Union

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**European Commission** – Validated by the European Commission as a Notified Body under the R&TTE Directive.

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## Australia/New Zealand

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**ACMA** - Recognized by ACMA as a CAB for the acceptance of test data.

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## Korea

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**MSIP / RRA** - Recognized by KCC's RRA as a CAB for the acceptance of test data.

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## Japan

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**VCCI** - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

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## Taiwan

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**BSMI** – Recognized by BSMI as a CAB for the acceptance of test data.

**NCC** - Recognized by NCC as a CAB for the acceptance of test data.

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## Singapore

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**IDA** – Recognized by IDA as a CAB for the acceptance of test data.

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## Israel

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**MOC** – Recognized by MOC as a CAB for the acceptance of test data.

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## Hong Kong

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**OFCA** – Recognized by OFCA as a CAB for the acceptance of test data.

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## Vietnam

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**MIC** – Recognized by MIC as a CAB for the acceptance of test data.

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## SCOPE

For details on the Scopes of our Accreditations, please visit:

<http://www.nwemc.com/accreditations/>

<http://gsi.nist.gov/global/docs/cabs/designations.html>

# MEASUREMENT UNCERTAINTY

## Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

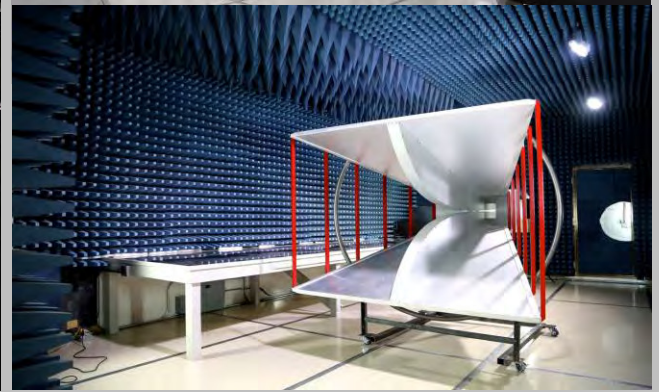
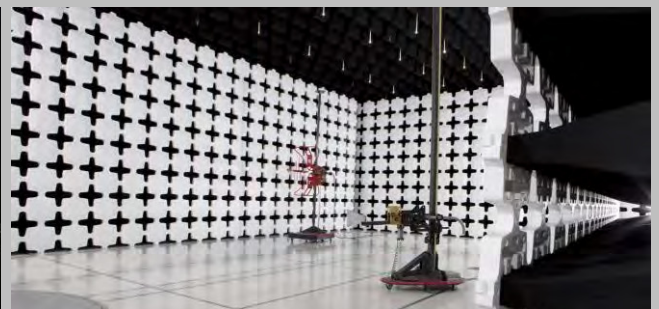
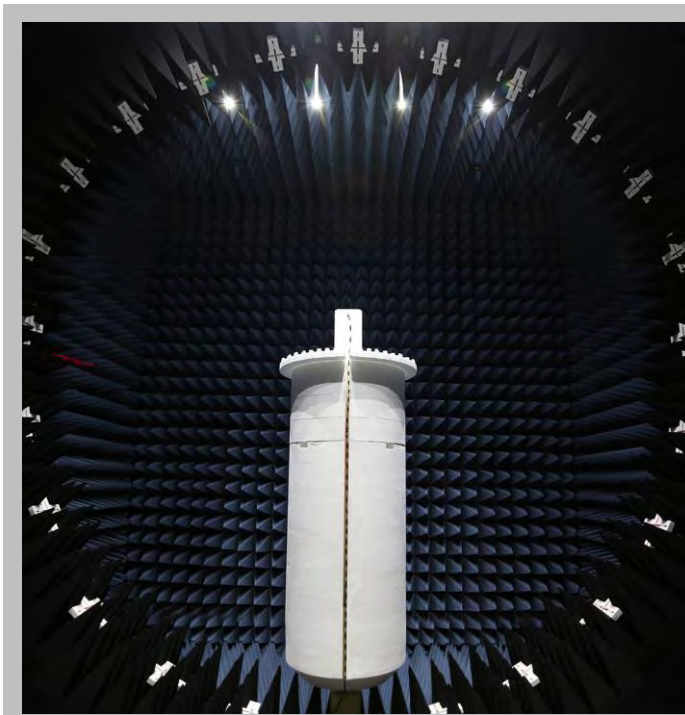
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

<b>Test</b>	<b>+ MU</b>	<b>- MU</b>
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

# FACILITIES



<b>California</b> Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	<b>Minnesota</b> Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	<b>New York</b> Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	<b>Oregon</b> Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	<b>Texas</b> Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	<b>Washington</b> Labs NC01-05 19201 120 <sup>th</sup> Ave NE Bothell, WA 98011 (425)984-6600
<b>NVLAP</b>					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
<b>Industry Canada</b>					
2834B-1, 2834B-3	2834E-1	N/A	2834D-1, 2834D-2	2834G-1	2834F-1
<b>BSMI</b>					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
<b>VCCI</b>					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
<b>Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRR, MIC, MOC, NCC, OFCA</b>					
US0158	US0175	N/A	US0017	US0191	US0157



# PRODUCT DESCRIPTION

## Client and Equipment Under Test (EUT) Information

<b>Company Name:</b>	Logic PD
<b>Address:</b>	411 Washington Avenue North, Suite 400
<b>City, State, Zip:</b>	Minneapolis, MN 55401
<b>Test Requested By:</b>	Adam Ford
<b>Model:</b>	Torpedo + Wireless -31 SOM
<b>First Date of Test:</b>	April 25, 2016
<b>Last Date of Test:</b>	April 27, 2016
<b>Receipt Date of Samples:</b>	April 25, 2016
<b>Equipment Design Stage:</b>	Production
<b>Equipment Condition:</b>	No Damage

## Information Provided by the Party Requesting the Test

<b>Functional Description of the EUT:</b>
Wireless module to be tested to the new UNII rules.
<b>Testing Objective:</b>
To demonstrate compliance of the 802.11 radio under the new UNII rule part changes for FCC 15.407 for operation in the 5.8 GHz band.

# CONFIGURATIONS

## Configuration LGPD0192- 1

Software/Firmware Running during test	
Description	Version
TeraTerm	Unknown

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Wireless Module	Logic PD	1026947	1415M00058

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
AC Adapter (Development Board)	SCEPTRE	AD2405A/PS2D-5038APL6A	None
AC Adapter (Laptop)	Dell	LA909PS0-00	None
Development Board	Logic PD	DM3730 Torpedo	2012M00624
GPS Antenna	Unknown	None	None
Laptop	Dell	Latitude	Unknown

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Cable (Laptop)	No	1m	No	AC Adapter (Laptop)	AC Mains
AC Power Cable (Development Board)	No	2.5m	No	AC Adapter (Development Board)	AC Mains
DC Cable (Laptop)	No	1m	No	AC Adapter (Laptop)	Laptop
DC Power Cable (Development Board)	No	1.8m	Yes	AC Adapter (Development Board)	Development Board
MicroUSB Cable	No	1m	No	Laptop	Development Board
w.fl - SMA Cable x2	Unknown	.1m	No	Wireless Module	Terminated



# CONFIGURATIONS

## Configuration LGPD0192- 2

Software/Firmware Running during test	
Description	Version
TeraTerm	Unknown

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Wireless Module	Logic PD	1026947	1415M00058
Isolated Magnetic Dipole (x2)	Ethertronics Incorporated	1000418	None

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
AC Adapter (Development Board)	SCEPTRE	AD2405A/PS2D-5038APL6A	None
AC Adapter (Laptop)	Dell	LA909PS0-00	None
Development Board	Logic PD	DM3730 Torpedo	2012M00624
GPS Antenna	Unknown	None	None
Laptop	Dell	Latitude	Unknown

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Cable (Laptop)	No	1m	No	AC Adapter (Laptop)	AC Mains
AC Power Cable (Development Board)	No	2.5m	No	AC Adapter (Development Board)	AC Mains
DC Cable (Laptop)	No	1m	No	AC Adapter (Laptop)	Laptop
DC Power Cable (Development Board)	No	1.8m	Yes	AC Adapter (Development Board)	Development Board
MicroUSB Cable	No	1m	No	Laptop	Development Board
w.fl - SMA Cable x2	Unknown	.1m	No	Wireless Module	Terminated

# CONFIGURATIONS

## Configuration LGPD0192- 3

Software/Firmware Running during test	
Description	Version
TeraTerm	Unknown

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Wireless Module	Logic PD	1026947	1415M00058
Chip Antennas (x2)	Pulse	W3006	None

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
AC Adapter (Development Board)	SCEPTRE	AD2405A/PS2D-5038APL6A	None
AC Adapter (Laptop)	Dell	LA909PS0-00	None
Development Board	Logic PD	DM3730 Torpedo	2012M00624
GPS Antenna	Unknown	None	None
Laptop	Dell	Latitude	Unknown

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Cable (Laptop)	No	1m	No	AC Adapter (Laptop)	AC Mains
AC Power Cable (Development Board)	No	2.5m	No	AC Adapter (Development Board)	AC Mains
DC Cable (Laptop)	No	1m	No	AC Adapter (Laptop)	Laptop
DC Power Cable (Development Board)	No	1.8m	Yes	AC Adapter (Development Board)	Development Board
MicroUSB Cable	No	1m	No	Laptop	Development Board
w.fl - SMA Cable x2	Unknown	.1m	No	Wireless Module	Terminated

# MODIFICATIONS

## Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	4/25/2016	Maximum Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	4/25/2016	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	4/25/2016	Band Edge	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	4/25/2016	Maximum Conducted Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
5	4/25/2016	Frequency Stability	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
6	4/25/2016	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
7	4/26/2016	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

# SPURIOUS RADIATED EMISSIONS

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

## CHANNELS OF OPERATION

Channel 149: 5745 MHz

Channel 157: 5785 MHz

Channel 165: 5825 MHz

## MODULATION OF OPERATION

6 Mbps

36 Mbps

54 Mbps

MCS0

MCS7

## POWER SETTINGS INVESTIGATED

5 VDC

## CONFIGURATIONS INVESTIGATED

LGPD0192 - 3

## FREQUENCY RANGE INVESTIGATED

Start Frequency | 30 MHz

Stop Frequency | 40000 MHz

## SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

## TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Cable	Northwest EMC	TTBJ141-KMKM-72	MNQ	9/18/2015	12 mo
Amplifier - Pre-Amplifier	Miteq	JSW45-26004000-40-5P	AVN	9/18/2015	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	3/1/2016	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	3/1/2016	12 mo
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	12/7/2015	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	3/1/2016	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	12/7/2015	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AJA	6/3/2014	24 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	12/10/2015	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	12/7/2015	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	1/6/2016	24 mo
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36 mo
Power Sensor	Agilent	N8481A	SQN	8/17/2015	12 mo
Meter - Power	Agilent	N1913A	SQL	8/17/2015	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIB	8/12/2014	24 mo
Antenna	AH Systems	3115	AJO	NCR	0 mo
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2016	12 mo


## MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

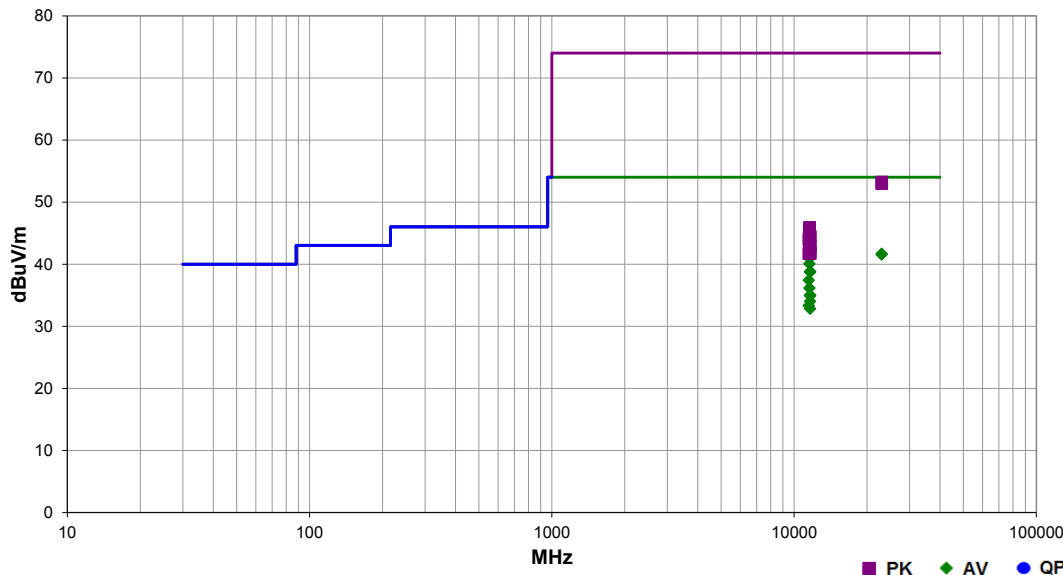
## TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT were tested. The EUT was configured for the lowest, a middle, and the highest transmit frequency in each operational band. For each configuration, the spectrum was scanned throughout the specified range. Measurements were made to satisfy the three requirements of 47 CFR 15.407: Field strength under 1GHz, Restricted Bands of 47 CFR 15.205, and EIRP of 47 CFR 15.407.

While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10:2009). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

<b>Work Order:</b>	LGPD0192	<b>Date:</b>	04/26/16	
<b>Project:</b>	None	<b>Temperature:</b>	21.7 °C	
<b>Job Site:</b>	MN05	<b>Humidity:</b>	38% RH	
<b>Serial Number:</b>	1415M00058	<b>Barometric Pres.:</b>	1016 mbar	
<b>EUT:</b>	Torpedo + Wireless -31 SOM			
<b>Configuration:</b>	3			
<b>Customer:</b>	Logic PD			
<b>Attendees:</b>	None			
<b>EUT Power:</b>	5 VDC			
<b>Operating Mode:</b>	Transmit			
<b>Deviations:</b>	None			
<b>Comments:</b>	Pulse Chip Antenna, 5 VDC supplied by AC/DC adapter. AC/DC adapted using 110VAC/60Hz			

<b>Test Specifications</b>	<b>Test Method</b>						
FCC 15.407:2016	ANSI C63.10:2013						
<b>Run #</b>	19	<b>Test Distance (m)</b>	3	<b>Antenna Height(s)</b>	1 to 4(m)	<b>Results</b>	Pass



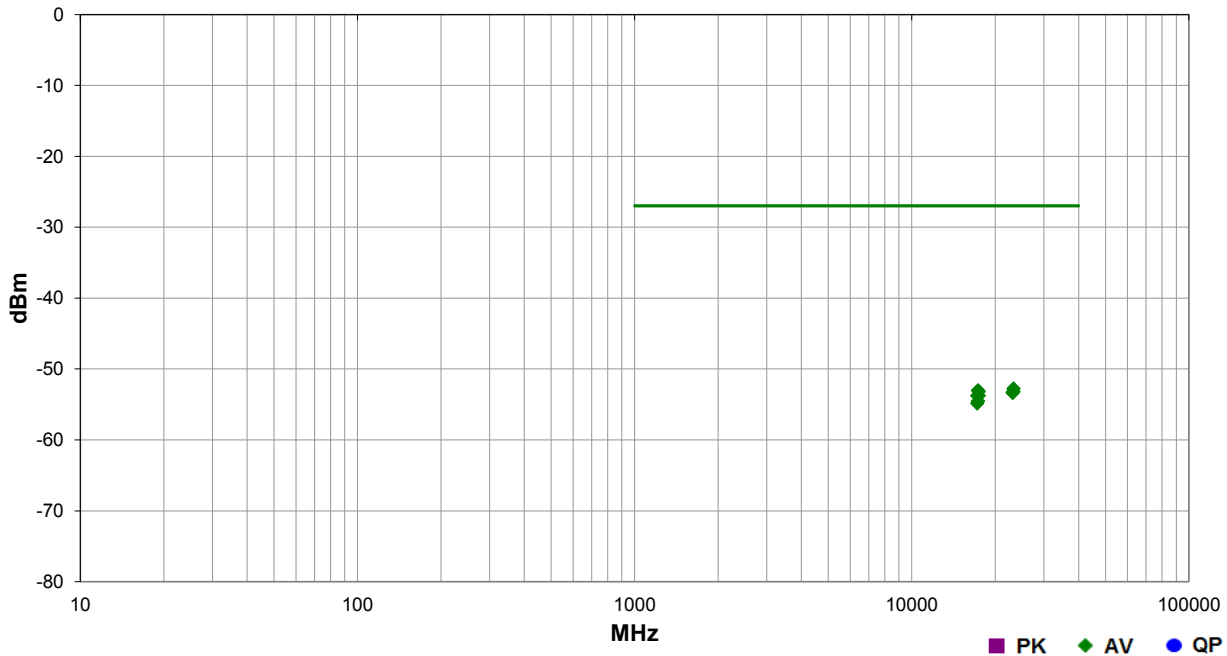
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
22977.790	27.7	14.0	1.6	112.1	3.0	0.0	Horz	AV	0.0	41.7	54.0	-12.3	Ch. 149: 5745 MHz 6 Mbps, EUT Vert
22980.040	27.6	14.0	1.6	98.1	3.0	0.0	Vert	AV	0.0	41.6	54.0	-12.4	Ch. 149: 5745 MHz 6 Mbps, EUT On Side
11570.010	43.5	-2.3	1.8	6.0	3.0	0.0	Horz	AV	0.0	41.2	54.0	-12.8	Ch. 157: 5785 MHz MCS0, EUT Vert
11569.970	43.4	-2.3	1.8	6.0	3.0	0.0	Horz	AV	0.0	41.1	54.0	-12.9	Ch. 157: 5785 MHz MCS7, EUT Vert
11569.950	43.4	-2.3	1.8	6.0	3.0	0.0	Horz	AV	0.0	41.1	54.0	-12.9	Ch. 157: 5785 MHz 36 Mbps, EUT Vert
11570.030	43.3	-2.3	1.8	6.0	3.0	0.0	Horz	AV	0.0	41.0	54.0	-13.0	Ch. 157: 5785 MHz 54 Mbps, EUT Vert
11569.970	42.4	-2.3	1.7	63.0	3.0	0.0	Horz	AV	0.0	40.1	54.0	-13.9	Ch. 157: 5785 MHz 6 Mbps, EUT Vert
11649.960	41.1	-2.3	1.8	343.9	3.0	0.0	Horz	AV	0.0	38.8	54.0	-15.2	Ch. 165: 5825 MHz 6 Mbps, EUT Vert
11649.990	41.0	-2.3	1.5	322.9	3.0	0.0	Horz	AV	0.0	38.7	54.0	-15.3	Ch. 165: 5825 MHz 6 Mbps, EUT On Side
11490.050	40.7	-3.3	1.8	63.0	3.0	0.0	Horz	AV	0.0	37.4	54.0	-16.6	Ch. 149: 5745 MHz 6 Mbps, EUT Vert
11569.970	38.5	-2.3	1.0	15.1	3.0	0.0	Vert	AV	0.0	36.2	54.0	-17.8	Ch. 157: 5785 MHz 6 Mbps, EUT On Side
11650.010	37.3	-2.3	1.0	21.0	3.0	0.0	Vert	AV	0.0	35.0	54.0	-19.0	Ch. 165: 5825 MHz 6 Mbps, EUT On Side
11650.050	37.2	-2.3	1.0	347.0	3.0	0.0	Vert	AV	0.0	34.9	54.0	-19.1	Ch. 165: 5825 MHz 6 Mbps, EUT Vert
11649.980	36.3	-2.3	1.0	232.0	3.0	0.0	Vert	AV	0.0	34.0	54.0	-20.0	Ch. 165: 5825 MHz 6 Mbps, EUT Horz
11490.050	36.6	-3.3	1.0	16.1	3.0	0.0	Vert	AV	0.0	33.3	54.0	-20.7	Ch. 149: 5745 MHz 6 Mbps, EUT On Side
22980.980	39.3	14.0	1.6	98.1	3.0	0.0	Vert	PK	0.0	53.3	74.0	-20.7	Ch. 149: 5745 MHz 6 Mbps, EUT On Side
22978.990	39.0	14.0	1.6	112.1	3.0	0.0	Horz	PK	0.0	53.0	74.0	-21.0	Ch. 149: 5745 MHz 6 Mbps, EUT Vert
11649.950	35.1	-2.3	2.6	328.0	3.0	0.0	Horz	AV	0.0	32.8	54.0	-21.2	Ch. 165: 5825 MHz 6 Mbps, EUT Horz
11570.100	48.2	-2.3	1.8	6.0	3.0	0.0	Horz	PK	0.0	45.9	74.0	-28.1	Ch. 157: 5785 MHz 36 Mbps, EUT Vert
11570.080	48.2	-2.3	1.8	6.0	3.0	0.0	Horz	PK	0.0	45.9	74.0	-28.1	Ch. 157: 5785 MHz 54 Mbps, EUT Vert
11569.830	48.2	-2.3	1.8	6.0	3.0	0.0	Horz	PK	0.0	45.9	74.0	-28.1	Ch. 157: 5785 MHz MCS7, EUT Vert
11569.690	48.2	-2.3	1.8	6.0	3.0	0.0	Horz	PK	0.0	45.9	74.0	-28.1	Ch. 157: 5785 MHz MCS0, EUT Vert
11569.940	48.0	-2.3	1.7	63.0	3.0	0.0	Horz	PK	0.0	45.7	74.0	-28.3	Ch. 157: 5785 MHz 6 Mbps, EUT Vert
11649.930	46.7	-2.3	1.8	343.9	3.0	0.0	Horz	PK	0.0	44.4	74.0	-29.6	Ch. 165: 5825 MHz 6 Mbps, EUT Vert
11650.020	46.7	-2.3	1.5	322.9	3.0	0.0	Horz	PK	0.0	44.4	74.0	-29.6	Ch. 165: 5825 MHz 6 Mbps, EUT On Side
11489.830	47.3	-3.3	1.8	63.0	3.0	0.0	Horz	PK	0.0	44.0	74.0	-30.0	Ch. 149: 5745 MHz 6 Mbps, EUT Vert
11569.930	45.5	-2.3	1.0	15.1	3.0	0.0	Vert	PK	0.0	43.2	74.0	-30.8	Ch. 157: 5785 MHz 6 Mbps, EUT On Side
11650.160	45.2	-2.3	1.0	347.0	3.0	0.0	Vert	PK	0.0	42.9	74.0	-31.1	Ch. 165: 5825 MHz 6 Mbps, EUT Vert
11650.220	45.1	-2.3	1.0	21.0	3.0	0.0	Vert	PK	0.0	42.8	74.0	-31.2	Ch. 165: 5825 MHz 6 Mbps, EUT On Side
11649.780	44.1	-2.3	1.0	232.0	3.0	0.0	Vert	PK	0.0	41.8	74.0	-32.2	Ch. 165: 5825 MHz 6 Mbps, EUT Horz
11490.380	45.0	-3.3	1.0	16.1	3.0	0.0	Vert	PK	0.0	41.7	74.0	-32.3	Ch. 149: 5745 MHz 6 Mbps, EUT On Side
11649.830	44.0	-2.3	2.6	328.0	3.0	0.0	Horz	PK	0.0	41.7	74.0	-32.3	Ch. 165: 5825 MHz 6 Mbps, EUT Horz

## SPURIOUS RADIATED EMISSIONS

<b>Work Order:</b> LGPD0192	<b>Date:</b> 04/26/16	
<b>Project:</b> None	<b>Temperature:</b> 21.7 °C	
<b>Job Site:</b> MN05	<b>Humidity:</b> 38% RH	
<b>Serial Number:</b> 1415M00058	<b>Barometric Pres.:</b> 1016 mbar	
<b>Tested by:</b> Jared Ison		
<b>EUT:</b> Torpedo + Wireless -31 SOM		
<b>Configuration:</b> 3		
<b>Customer:</b> Logic PD		
<b>Attendees:</b> None		
<b>EUT Power:</b> 5 VDC		
<b>Operating Mode:</b> Transmit		
<b>Deviations:</b> None		
<b>Comments:</b> Pulse Chip Antenna, 5 VDC supplied by AC/DC adapter. AC/DC adapted using 110VAC/60Hz		

<b>Test Specifications</b>	<b>Test Method</b>
FCC 15.407:2016	ANSI C63.10:2013

<b>Run #</b>	20	<b>Test Distance (m)</b>	3	<b>Antenna Height(s)</b>	1 to 4(m)	<b>Results</b>	Pass
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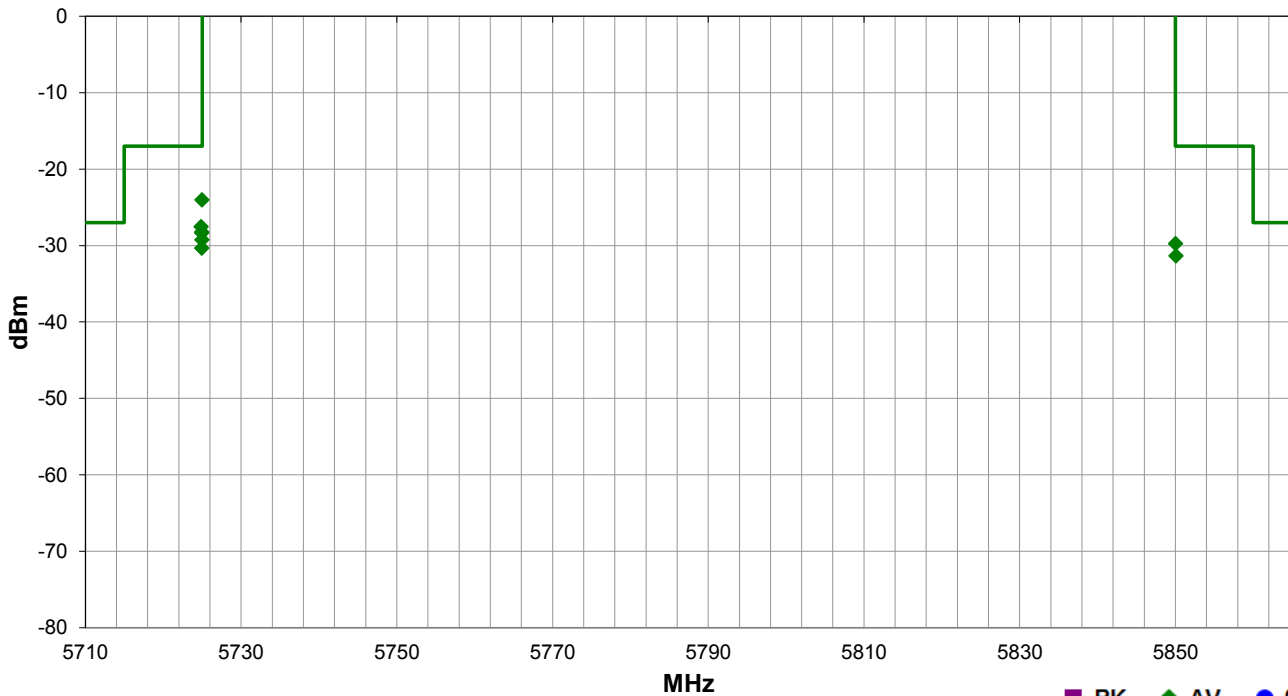
Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
23299.810	1.6	329.9	Horz	AV	5.28E-09	-52.8	-27.0	-25.8	Ch. 165: 5825 MHz 6 Mbps, EUT Vert
17355.030	2.1	355.9	Horz	AV	4.98E-09	-53.0	-27.0	-26.0	Ch. 157: 5785 MHz 6 Mbps, EUT Vert
23298.770	1.6	325.9	Vert	AV	4.81E-09	-53.2	-27.0	-26.2	Ch. 165: 5825 MHz 6 Mbps, EUT On Side
17476.040	1.9	330.9	Vert	AV	4.81E-09	-53.2	-27.0	-26.2	Ch. 165: 5825 MHz 6 Mbps, EUT On Side
23138.800	1.6	197.0	Horz	AV	4.71E-09	-53.3	-27.0	-26.3	Ch. 157: 5785 MHz 6 Mbps, EUT Vert
23139.530	1.6	288.0	Vert	AV	4.61E-09	-53.4	-27.0	-26.4	Ch. 157: 5785 MHz 6 Mbps, EUT On Side
17234.790	2.1	34.1	Horz	AV	4.19E-09	-53.8	-27.0	-26.8	Ch. 149: 5745 MHz 6 Mbps, EUT Vert
17476.320	1.4	358.0	Horz	AV	4.18E-09	-53.8	-27.0	-26.8	Ch. 165: 5825 MHz 6 Mbps, EUT Vert
17355.410	1.3	45.0	Vert	AV	3.54E-09	-54.5	-27.0	-27.5	Ch. 157: 5785 MHz 6 Mbps, EUT On Side
17234.380	1.5	43.0	Vert	AV	3.26E-09	-54.9	-27.0	-27.9	Ch. 149: 5745 MHz 6 Mbps, EUT On Side

# SPURIOUS RADIATED EMISSIONS

<b>Work Order:</b>	LGPD0192	<b>Date:</b>	04/26/16	
<b>Project:</b>	None	<b>Temperature:</b>	21.5 °C	
<b>Job Site:</b>	MN05	<b>Humidity:</b>	32.9% RH	
<b>Serial Number:</b>	1415M00058	<b>Barometric Pres.:</b>	1015 mbar	
<b>EUT:</b>	Torpedo + Wireless -31 SOM			
<b>Configuration:</b>	3			
<b>Customer:</b>	Logic PD			
<b>Attendees:</b>	None			
<b>EUT Power:</b>	5 VDC			
<b>Operating Mode:</b>	Transmit			
<b>Deviations:</b>	None			
<b>Comments:</b>	Pulse Chip Antenna, 5 VDC supplied by AC/DC adapter. AC/DC adapted using 110VAC/60Hz			

<b>Test Specifications</b>	<b>Test Method</b>
FCC 15.407:2016	ANSI C63.10:2013

<b>Run #</b>	27	<b>Test Distance (m)</b>	1	<b>Antenna Height(s)</b>	1 to 4(m)	<b>Results</b>	Pass
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Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
5724.977	1.6	343.9	Horz	AV	3.94E-06	-24.0	-17.0	-7.0	Ch. 149: 5745 MHz 6 Mbps, EUT On Side
5724.883	1.6	260.0	Vert	AV	1.76E-06	-27.5	-17.0	-10.5	Ch. 149: 5745 MHz 6 Mbps, EUT Vert
5724.970	1.6	260.0	Horz	AV	1.50E-06	-28.2	-17.0	-11.2	Ch. 149: 5745 MHz 6 Mbps, EUT Vert
5724.970	1.6	322.9	Vert	AV	1.47E-06	-28.3	-17.0	-11.3	Ch. 149: 5745 MHz 6 Mbps, EUT On Side
5724.997	1.6	318.0	Horz	AV	1.19E-06	-29.2	-17.0	-12.2	Ch. 149: 5745 MHz 6 Mbps, EUT Horz
5850.017	1.6	246.9	Horz	AV	1.06E-06	-29.8	-17.0	-12.8	Ch. 165: 5825 MHz 6 Mbps, EUT On Side
5724.950	1.6	66.1	Vert	AV	9.24E-07	-30.3	-17.0	-13.3	Ch. 149: 5745 MHz 6 Mbps, EUT Horz
5850.083	1.6	253.0	Vert	AV	7.32E-07	-31.4	-17.0	-14.4	Ch. 165: 5825 MHz 6 Mbps, EUT Vert



## SPURIOUS RADIATED EMISSIONS

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

### CHANNELS OF OPERATION

Channel 149: 5745 MHz

Channel 157: 5785 MHz

Channel 165: 5825 MHz

### MODULATION OF OPERATION

6 Mbps

36 Mbps

54 Mbps

MCS0

MCS7

### POWER SETTINGS INVESTIGATED

5 VDC

### CONFIGURATIONS INVESTIGATED

LGPD0192 - 2

### FREQUENCY RANGE INVESTIGATED

Start Frequency | 30 MHz

Stop Frequency | 40000 MHz

### SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

### TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Antenna	AH Systems	SAS-588	AJO	NCR	0 mo
Cable	Northwest EMC	TTBJ141-KMKM-72	MNQ	9/18/2015	12 mo
Amplifier - Pre-Amplifier	Miteq	JSW45-26004000-40-5P	AVN	9/18/2015	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	3/1/2016	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	3/1/2016	12 mo
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	12/7/2015	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	3/1/2016	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	12/7/2015	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AJA	6/3/2014	24 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	12/10/2015	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	12/7/2015	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	1/6/2016	24 mo
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36 mo
Power Sensor	Agilent	N8481A	SQN	8/17/2015	12 mo
Meter - Power	Agilent	N1913A	SQL	8/17/2015	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIB	8/12/2014	24 mo
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2016	12 mo


### MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

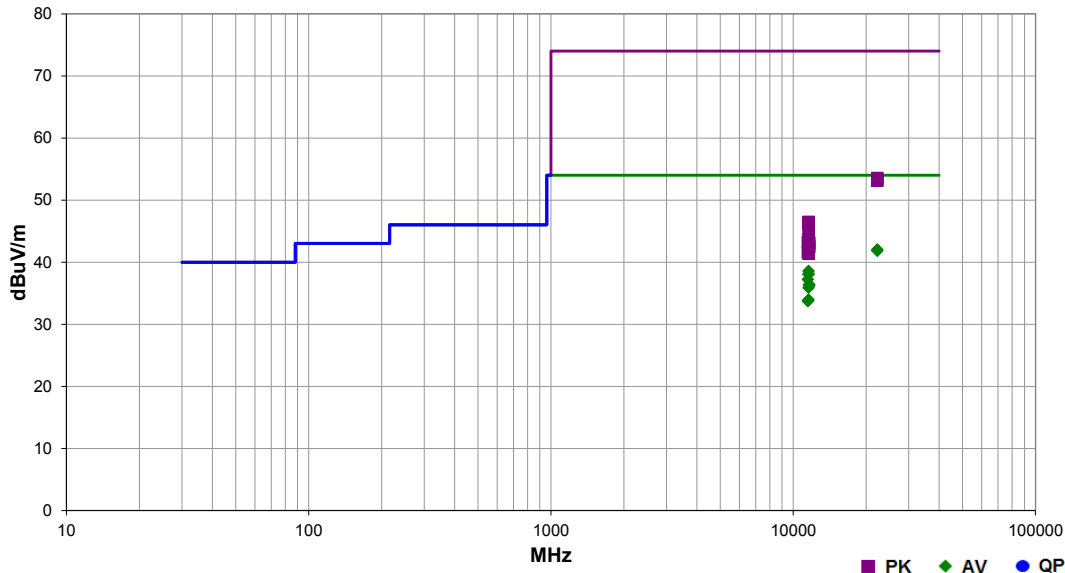
## TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT were tested. The EUT was configured for the lowest, a middle, and the highest transmit frequency in each operational band. For each configuration, the spectrum was scanned throughout the specified range. Measurements were made to satisfy the three requirements of 47 CFR 15.407: Field strength under 1GHz, Restricted Bands of 47 CFR 15.205, and EIRP of 47 CFR 15.407.

While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10:2009). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

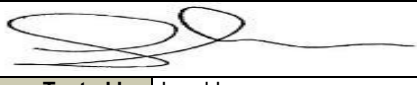
<b>Work Order:</b>	LGPD0192	<b>Date:</b>	04/26/16	
<b>Project:</b>	None	<b>Temperature:</b>	21.3 °C	
<b>Job Site:</b>	MN05	<b>Humidity:</b>	39.6% RH	
<b>Serial Number:</b>	1415M00058	<b>Barometric Pres.:</b>	1014 mbar	
<b>EUT:</b>	Torpedo + Wireless -31 SOM			
<b>Configuration:</b>	2			
<b>Customer:</b>	Logic PD			
<b>Attendees:</b>	None			
<b>EUT Power:</b>	5 VDC			
<b>Operating Mode:</b>	Transmit			
<b>Deviations:</b>	None			
<b>Comments:</b>	Isolated Magnetic Dipole Antenna. 5 VDC supplied by AC/DC adapter. AC/DC adapter using 110VAC/60Hz.			

<b>Test Specifications</b>	<b>Test Method</b>						
FCC 15.407:2016	ANSI C63.10:2013						
<b>Run #</b>	9	<b>Test Distance (m)</b>	3	<b>Antenna Height(s)</b>	1 to 4(m)	<b>Results</b>	Pass



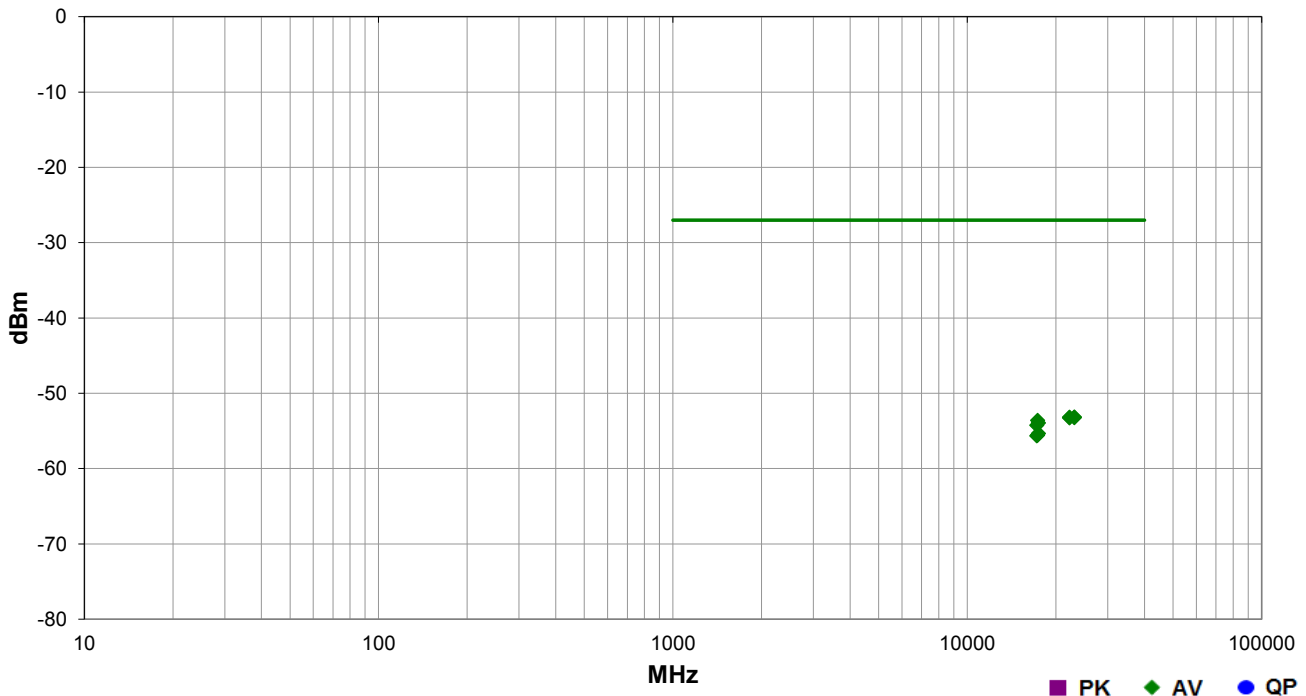
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
22249.070	28.5	13.5	1.6	112.1	3.0	0.0	Horz	AV	0.0	42.0	54.0	-12.0	Ch. 149: 5745 MHz 6 Mbps, EUT On Side
11569.970	44.3	-2.3	1.8	347.9	3.0	0.0	Horz	AV	0.0	42.0	54.0	-12.0	Ch. 157: 5785 MHz 6 Mbps, EUT On Side
11569.980	44.2	-2.3	1.8	8.1	3.0	0.0	Horz	AV	0.0	41.9	54.0	-12.1	Ch. 157: 5785 MHz 36 Mbps, EUT On Side
11569.970	44.2	-2.3	1.8	8.1	3.0	0.0	Horz	AV	0.0	41.9	54.0	-12.1	Ch. 157: 5785 MHz MCS0, EUT On Side
22247.870	28.3	13.5	1.6	279.9	3.0	0.0	Vert	AV	0.0	41.8	54.0	-12.2	Ch. 149: 5745 MHz 6 Mbps, EUT Horz
11570.030	44.1	-2.3	1.8	8.1	3.0	0.0	Horz	AV	0.0	41.8	54.0	-12.2	Ch. 157: 5785 MHz 54 Mbps, EUT On Side
11570.000	44.1	-2.3	1.8	8.1	3.0	0.0	Horz	AV	0.0	41.8	54.0	-12.2	Ch. 157: 5785 MHz MCS7, EUT On Side
11569.930	40.9	-2.3	2.8	10.0	3.0	0.0	Vert	AV	0.0	38.6	54.0	-15.4	Ch. 157: 5785 MHz 6 Mbps, EUT Horz
11570.020	40.4	-2.3	2.8	138.1	3.0	0.0	Vert	AV	0.0	38.1	54.0	-15.9	Ch. 157: 5785 MHz 6 Mbps, EUT Vert
11569.970	40.4	-2.3	1.6	343.9	3.0	0.0	Vert	AV	0.0	38.1	54.0	-15.9	Ch. 157: 5785 MHz 6 Mbps, EUT On Side
11489.970	40.5	-3.3	1.6	317.0	3.0	0.0	Vert	AV	0.0	37.2	54.0	-16.8	Ch. 149: 5745 MHz 6 Mbps, EUT Horz
11649.960	38.7	-2.3	2.8	347.0	3.0	0.0	Vert	AV	0.0	36.4	54.0	-17.6	Ch. 165: 5825 MHz 6 Mbps, EUT Horz
11650.030	38.5	-2.3	1.6	46.0	3.0	0.0	Horz	AV	0.0	36.2	54.0	-17.8	Ch. 165: 5825 MHz 6 Mbps, EUT On Side
11570.050	38.2	-2.3	1.6	66.1	3.0	0.0	Horz	AV	0.0	35.9	54.0	-18.1	Ch. 157: 5785 MHz 6 Mbps, EUT Horz
11570.080	36.3	-2.3	2.7	232.0	3.0	0.0	Horz	AV	0.0	34.0	54.0	-20.0	Ch. 157: 5785 MHz 6 Mbps, EUT Vert
11489.920	37.0	-3.3	1.0	47.1	3.0	0.0	Horz	AV	0.0	33.7	54.0	-20.3	Ch. 149: 5745 MHz 6 Mbps, EUT On Side
22249.310	40.0	13.5	1.6	112.1	3.0	0.0	Horz	PK	0.0	53.5	74.0	-20.5	Ch. 149: 5745 MHz 6 Mbps, EUT On Side
22248.460	39.6	13.5	1.6	279.9	3.0	0.0	Vert	PK	0.0	53.1	74.0	-20.9	Ch. 149: 5745 MHz 6 Mbps, EUT Horz
11569.980	48.8	-2.3	1.8	8.1	3.0	0.0	Horz	PK	0.0	46.5	74.0	-27.5	Ch. 157: 5785 MHz 36 Mbps, EUT On Side
11569.970	48.8	-2.3	1.8	8.1	3.0	0.0	Horz	PK	0.0	46.5	74.0	-27.5	Ch. 157: 5785 MHz 54 Mbps, EUT On Side
11569.800	48.6	-2.3	1.8	8.1	3.0	0.0	Horz	PK	0.0	46.3	74.0	-27.7	Ch. 157: 5785 MHz MCS0, EUT On Side
11570.130	48.5	-2.3	1.8	347.9	3.0	0.0	Horz	PK	0.0	46.2	74.0	-27.8	Ch. 157: 5785 MHz 6 Mbps, EUT On Side
11569.710	48.5	-2.3	1.8	8.1	3.0	0.0	Horz	PK	0.0	46.2	74.0	-27.8	Ch. 157: 5785 MHz MCS7, EUT On Side
11570.130	46.5	-2.3	1.6	343.9	3.0	0.0	Vert	PK	0.0	44.2	74.0	-29.8	Ch. 157: 5785 MHz 6 Mbps, EUT On Side
11569.880	46.0	-2.3	2.8	10.0	3.0	0.0	Vert	PK	0.0	43.7	74.0	-30.3	Ch. 157: 5785 MHz 6 Mbps, EUT Horz
11490.070	46.5	-3.3	1.6	317.0	3.0	0.0	Vert	PK	0.0	43.2	74.0	-30.8	Ch. 149: 5745 MHz 6 Mbps, EUT Horz
11650.370	45.4	-2.3	2.8	347.0	3.0	0.0	Vert	PK	0.0	43.1	74.0	-30.9	Ch. 165: 5825 MHz 6 Mbps, EUT Horz
11569.920	45.1	-2.3	2.8	138.1	3.0	0.0	Vert	PK	0.0	42.8	74.0	-31.2	Ch. 157: 5785 MHz 6 Mbps, EUT Vert
11650.050	44.8	-2.3	1.6	46.0	3.0	0.0	Horz	PK	0.0	42.5	74.0	-31.5	Ch. 165: 5825 MHz 6 Mbps, EUT On Side
11570.300	44.0	-2.3	1.6	66.1	3.0	0.0	Horz	PK	0.0	41.7	74.0	-32.3	Ch. 157: 5785 MHz 6 Mbps, EUT Horz
11490.190	44.9	-3.3	1.0	47.1	3.0	0.0	Horz	PK	0.0	41.6	74.0	-32.4	Ch. 149: 5745 MHz 6 Mbps, EUT On Side
11569.980	43.7	-2.3	2.7	232.0	3.0	0.0	Horz	PK	0.0	41.4	74.0	-32.6	Ch. 157: 5785 MHz 6 Mbps, EUT Vert

## SPURIOUS RADIATED EMISSIONS

<b>Work Order:</b>	LGPD0192	<b>Date:</b>	04/26/16	
<b>Project:</b>	None	<b>Temperature:</b>	21.3 °C	
<b>Job Site:</b>	MN05	<b>Humidity:</b>	39.6% RH	
<b>Serial Number:</b>	1415M00058	<b>Barometric Pres.:</b>	1014 mbar	
<b>EUT:</b>	Torpedo + Wireless -31 SOM			
<b>Configuration:</b>	2			
<b>Customer:</b>	Logic PD			
<b>Attendees:</b>	None			
<b>EUT Power:</b>	5 VDC			
<b>Operating Mode:</b>	Transmit			
<b>Deviations:</b>	None			
<b>Comments:</b>	Isolated Magnetic Dipole Antenna. 5 VDC supplied by AC/DC adapter. AC/DC adapter using 110VAC/60Hz.			


<b>Test Specifications</b>	<b>Test Method</b>
FCC 15.407:2016	ANSI C63.10:2013

<b>Run #</b>	10	<b>Test Distance (m)</b>	3	<b>Antenna Height(s)</b>	1 to 4(m)	<b>Results</b>	Pass
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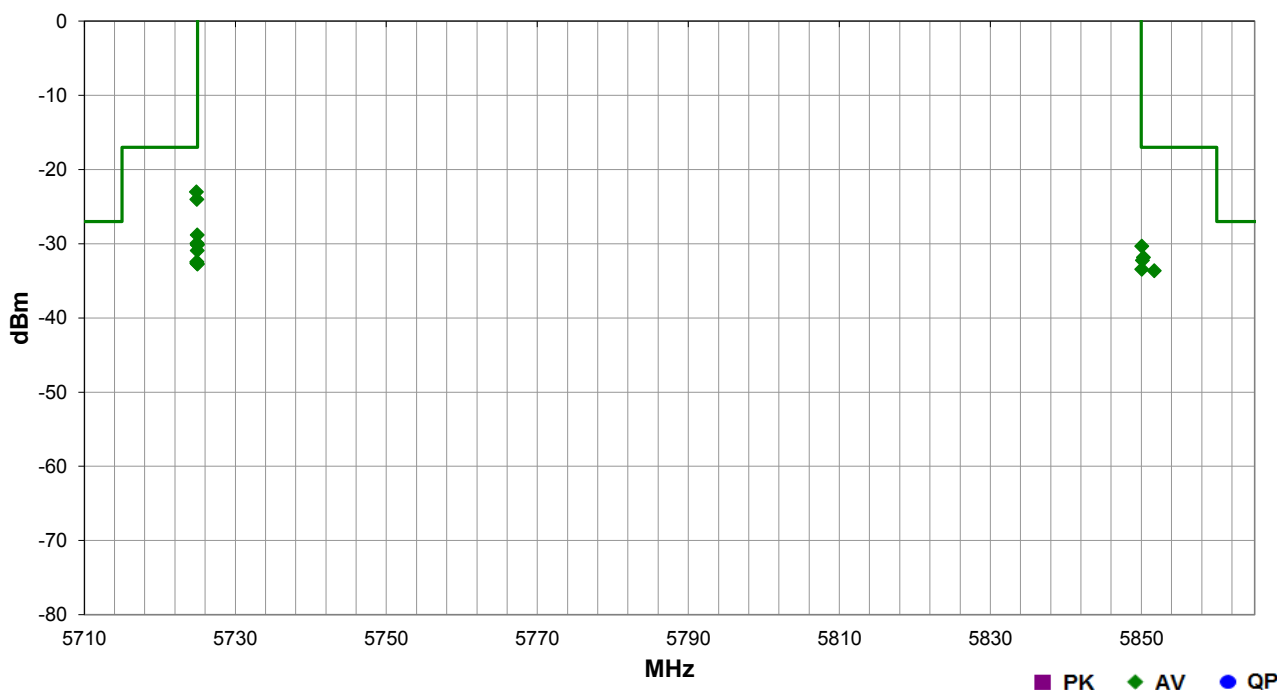
Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
23138.340	1.6	55.1	Horz	AV	4.82E-09	-53.2	-27.0	-26.2	Ch. 157: 5785 MHz 6 Mbps, EUT On Side
22251.560	1.6	156.1	Horz	AV	4.80E-09	-53.2	-27.0	-26.2	Ch. 165: 5825 MHz 6 Mbps, EUT On Side
23141.750	1.6	82.0	Vert	AV	4.71E-09	-53.3	-27.0	-26.3	Ch. 157: 5785 MHz 6 Mbps, EUT Horz
22250.050	1.6	169.0	Vert	AV	4.69E-09	-53.3	-27.0	-26.3	Ch. 165: 5825 MHz 6 Mbps, EUT Horz
17355.280	1.5	337.9	Horz	AV	4.35E-09	-53.6	-27.0	-26.6	Ch. 157: 5785 MHz 6 Mbps, EUT On Side
17474.830	1.5	340.9	Horz	AV	4.02E-09	-54.0	-27.0	-27.0	Ch. 165: 5825 MHz 6 Mbps, EUT On Side
17234.530	1.4	337.9	Horz	AV	3.74E-09	-54.3	-27.0	-27.3	Ch. 149: 5745 MHz 6 Mbps, EUT On Side
17475.100	3.2	358.9	Vert	AV	2.91E-09	-55.4	-27.0	-28.4	Ch. 165: 5825 MHz 6 Mbps, EUT Horz
17353.530	1.4	339.0	Vert	AV	2.77E-09	-55.6	-27.0	-28.6	Ch. 157: 5785 MHz 6 Mbps, EUT Horz
17234.320	1.6	40.1	Vert	AV	2.71E-09	-55.7	-27.0	-28.7	Ch. 149: 5745 MHz 6 Mbps, EUT Horz

## SPURIOUS RADIATED EMISSIONS

<b>Work Order:</b>	LGPD0192	<b>Date:</b>	04/26/16	
<b>Project:</b>	None	<b>Temperature:</b>	21 °C	
<b>Job Site:</b>	MN05	<b>Humidity:</b>	34.4% RH	
<b>Serial Number:</b>	1415M00058	<b>Barometric Pres.:</b>	1015 mbar	
<b>EUT:</b>	Torpedo + Wireless -31 SOM			
<b>Configuration:</b>	2			
<b>Customer:</b>	Logic PD			
<b>Attendees:</b>	None			
<b>EUT Power:</b>	5 VDC			
<b>Operating Mode:</b>	Transmit			
<b>Deviations:</b>	None			
<b>Comments:</b>	Isolated Magnetic Dipole Antenna. 5 VDC supplied by AC/DC adapter. AC/DC adapter using 110VAC/60Hz.			

<b>Test Specifications</b>	FCC 15.407:2016	<b>Test Method</b>	ANSI C63.10:2013
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<b>Run #</b>	26	<b>Test Distance (m)</b>	1	<b>Antenna Height(s)</b>	1 to 4(m)	<b>Results</b>	Pass
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Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
5724.860	1.6	325.9	Horz	AV	4.96E-06	-23.0	-17.0	-6.0	Ch. 149: 5745 MHz MCS0, EUT Horz
5724.923	1.6	194.0	Horz	AV	3.94E-06	-24.0	-17.0	-7.0	Ch. 149: 5745 MHz 6 Mbps, EUT Horz
5724.967	1.6	264.0	Horz	AV	1.31E-06	-28.8	-17.0	-11.8	Ch. 149: 5745 MHz 6 Mbps, EUT On Side
5724.927	1.6	325.9	Horz	AV	1.01E-06	-29.9	-17.0	-12.9	Ch. 149: 5745 MHz 36 Mbps, EUT Horz
5724.990	1.6	235.9	Vert	AV	9.68E-07	-30.1	-17.0	-13.1	Ch. 149: 5745 MHz 6 Mbps, EUT Vert
5724.953	1.6	243.0	Vert	AV	9.68E-07	-30.1	-17.0	-13.1	Ch. 149: 5745 MHz 6 Mbps, EUT On Side
5850.067	1.6	181.1	Horz	AV	9.22E-07	-30.4	-17.0	-13.4	Ch. 165: 5825 MHz 6 Mbps, EUT Horz
5724.963	1.6	279.0	Vert	AV	8.05E-07	-30.9	-17.0	-13.9	Ch. 149: 5745 MHz 6 Mbps, EUT Horz
5850.283	1.6	265.9	Horz	AV	6.53E-07	-31.9	-17.0	-14.9	Ch. 165: 5825 MHz 6 Mbps, EUT On Side
5850.143	1.6	306.0	Vert	AV	5.95E-07	-32.3	-17.0	-15.3	Ch. 165: 5825 MHz 6 Mbps, EUT Vert
5724.917	1.6	325.9	Horz	AV	5.70E-07	-32.4	-17.0	-15.4	Ch. 149: 5745 MHz 54 Mbps, EUT Horz
5724.910	1.6	325.9	Horz	AV	5.44E-07	-32.6	-17.0	-15.6	Ch. 149: 5745 MHz MCS7, EUT Horz
5724.987	1.6	20.0	Horz	AV	5.32E-07	-32.7	-17.0	-15.7	Ch. 149: 5745 MHz 6 Mbps, EUT Vert
5850.067	1.6	140.0	Vert	AV	4.51E-07	-33.5	-17.0	-16.5	Ch. 165: 5825 MHz 6 Mbps, EUT Horz
5851.730	1.6	159.1	Vert	AV	4.32E-07	-33.6	-17.0	-16.6	Ch. 165: 5825 MHz 6 Mbps, EUT On Side

# FREQUENCY STABILITY

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

## TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	12
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Meter - Multimeter	Fluke	117	MLS	1/20/2014	36
Chamber - Temperature/Humidity	Cincinnati Sub Zero (CSZ)	ZPH-32-3.5-SCT/AC	TBF	10/21/2015	12
Thermometer	Omega Engineering, Inc.	HH311	DUB	11/3/2014	36
Power Supply - DC	EZ Digital Co., Ltd.	GP-4030D	TQK	NCR	0

## TEST DESCRIPTION

A direct connect measurement was made between the EUT's antenna cable and a spectrum analyzer. The spectrum analyzer is equipped with a precision frequency reference that exceeds the stability requirement of the EUT.

Measurements were made at the edges of the main transmit bands as called out on the data sheets. Testing was done with an absence of modulation in a CW mode of operation.

The primary supply voltage was varied from 85 % to 115% of the nominal voltage Using a temperature chamber, the transmit frequency was recorded at the extremes of the specified temperature range (-30 ° to +50° C) and at 10°C intervals.


Where a ppm limit applies:  $\text{ppm} = (\text{Measured Frequency} / \text{Measured Nominal Frequency} - 1) * 1,000,000$

Per the requirements of FCC 15.407:

“Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user’s manual.”

No specific limits are provided in either FCC 15.407, the product specific rule part, or FCC 2.1055, the equipment authorization procedure for testing frequency stability. While there are no limits called out, any results less than 100ppm will still allow the radio to be operating within the band.

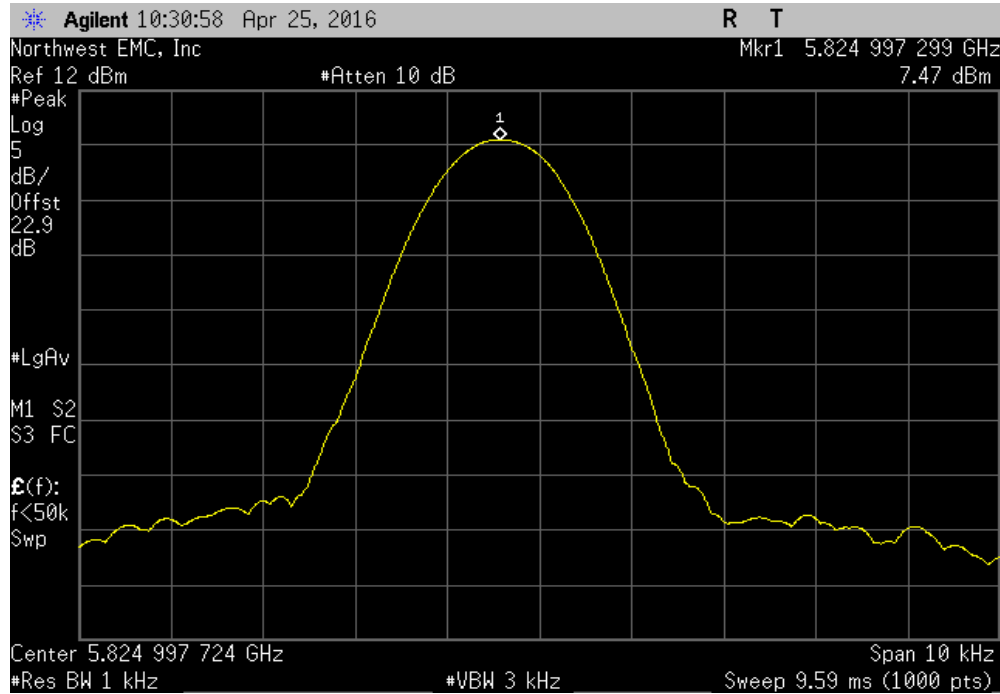
# FREQUENCY STABILITY

EUT: <b>Torpedo + Wireless -31 SOM</b>		Work Order: <b>LGPD0192</b>	
Serial Number: <b>1415M00058</b>		Date: <b>04/25/16</b>	
Customer: <b>Logic PD</b>		Temperature: <b>23°C</b>	
Attendees: <b>None</b>		Humidity: <b>43%</b>	
Project: <b>None</b>		Barometric Pres.: <b>970.5 mbar</b>	
Tested by: <b>Jared Ison</b>		Power: <b>5 VDC</b>	
		Job Site: <b>MN08</b>	
<b>TEST SPECIFICATIONS</b>			
FCC 15.407:2016		Test Method: <b>ANSI C63.10:2013</b>	
<b>COMMENTS</b>			
Transmitting using an unmodulated carrier.			
<b>DEVIATIONS FROM TEST STANDARD</b>			
None			
Configuration #	1	Signature 	

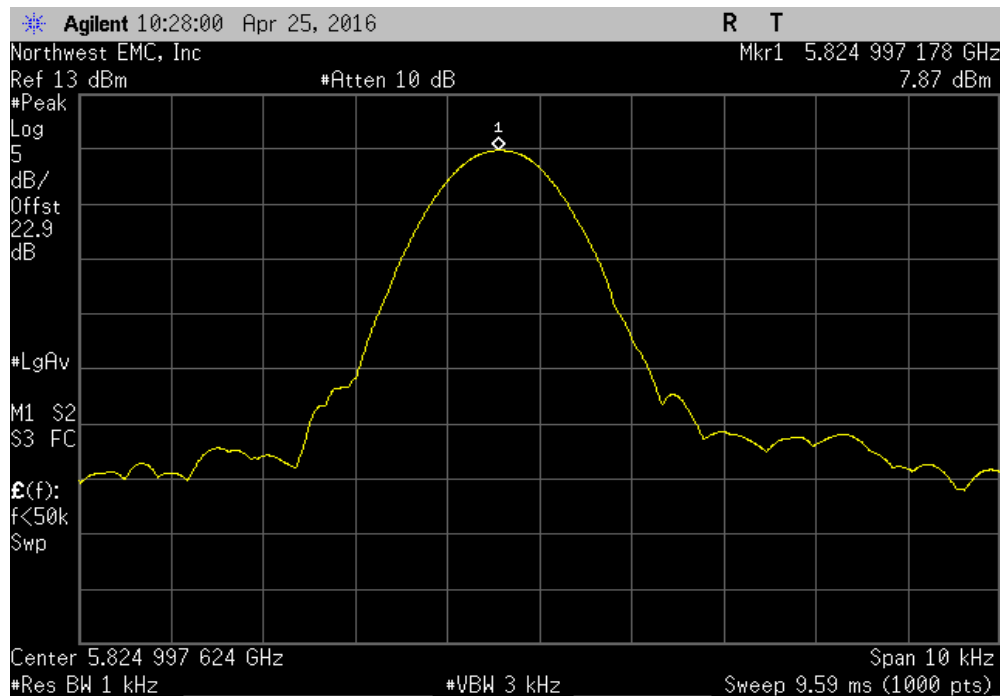
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
5725 MHz - 5825 MHz - High Channel, 5825 MHz					
Voltage: 115%	5824.997299	5825	0.5	100	Pass
Voltage: 100%	5824.997178	5825	0.5	100	Pass
Voltage: 85%	5824.997276	5825	0.5	100	Pass
Temperature: +50°	5824.99752	5825	0.4	100	Pass
Temperature: +40°	5824.99787	5825	0.4	100	Pass
Temperature: +30°	5824.997655	5825	0.4	100	Pass
Temperature: +20°	5824.997216	5825	0.5	100	Pass
Temperature: +10°	5824.997336	5825	0.5	100	Pass
Temperature: 0°	5824.998058	5825	0.3	100	Pass
Temperature: -10°	5824.998912	5825	0.2	100	Pass
Temperature: -20°	5824.999657	5825	0.1	100	Pass
Temperature: -30°	5825.000542	5825	0.1	100	Pass

# FREQUENCY STABILITY

5725 MHz - 5825 MHz - High Channel, 5825 MHz, Voltage: 115%						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	5824.997299	5825	0.5	100	Pass	



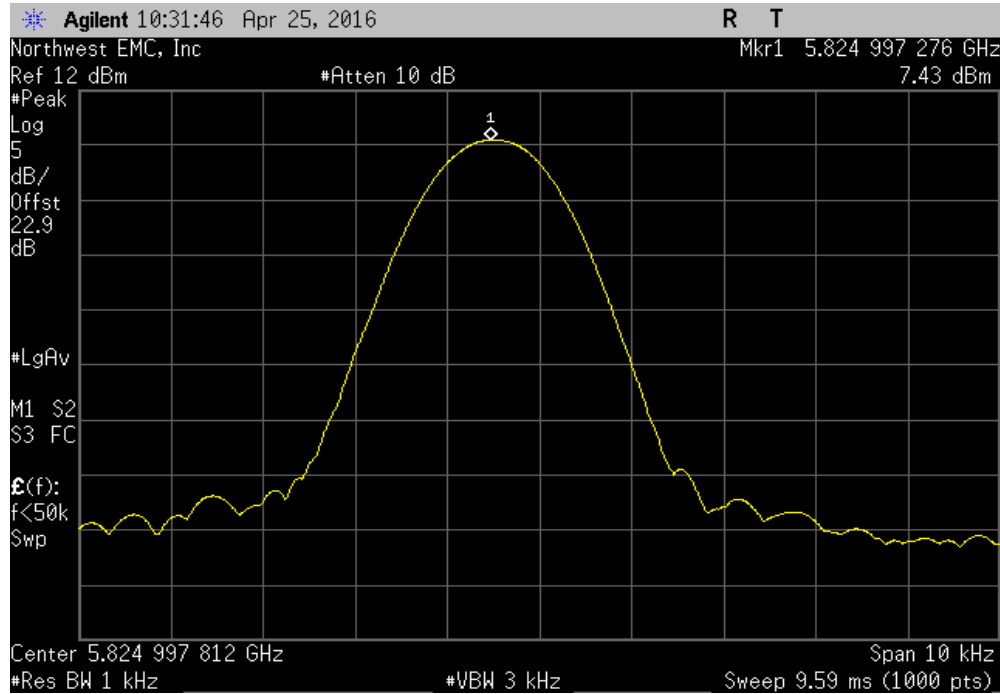
5725 MHz - 5825 MHz - High Channel, 5825 MHz, Voltage: 100%						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	5824.997178	5825	0.5	100	Pass	



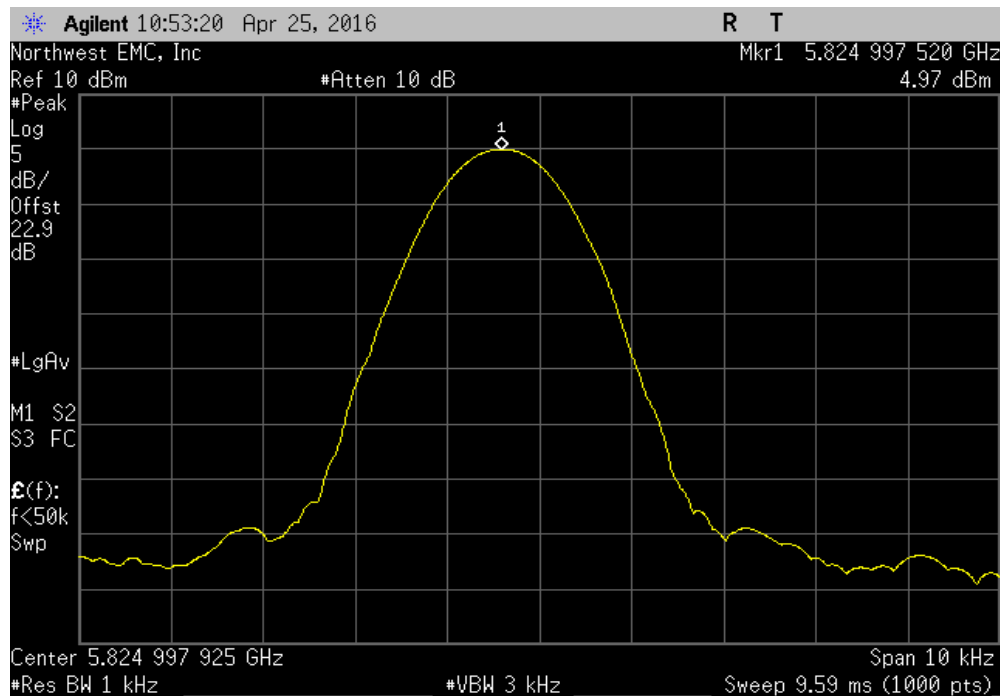


# FREQUENCY STABILITY

5725 MHz - 5825 MHz - High Channel, 5825 MHz, Voltage: 85%						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	5824.997276	5825	0.5	100	Pass	

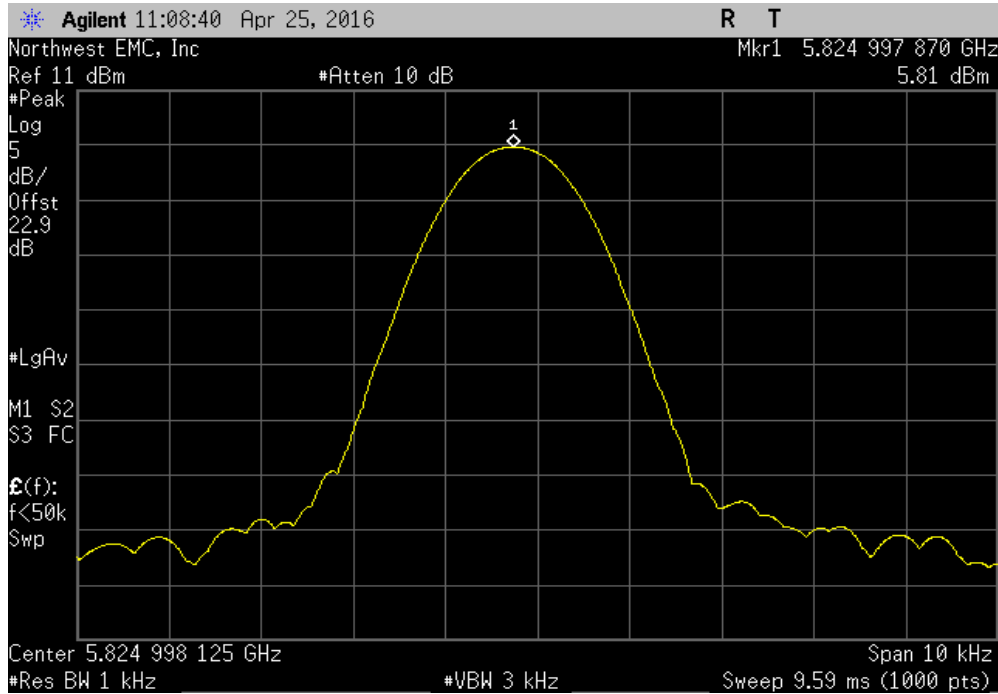


5725 MHz - 5825 MHz - High Channel, 5825 MHz, Temperature: +50°						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	5824.99752	5825	0.4	100	Pass	

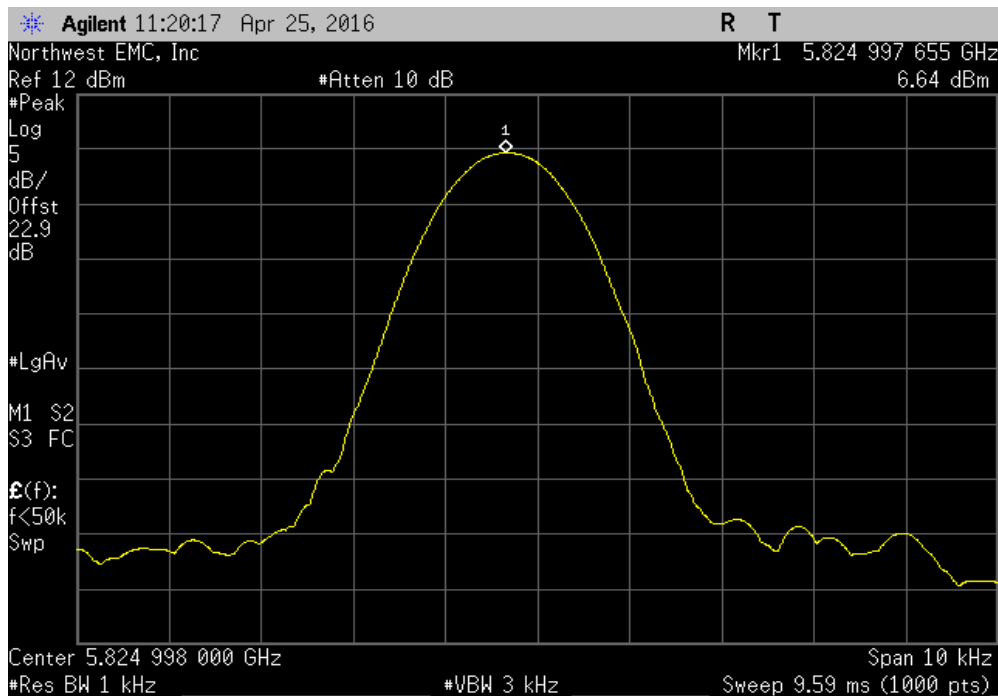


# FREQUENCY STABILITY

5725 MHz - 5825 MHz - High Channel, 5825 MHz, Temperature: +40°						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	5824.99787	5825	0.4	100	Pass	

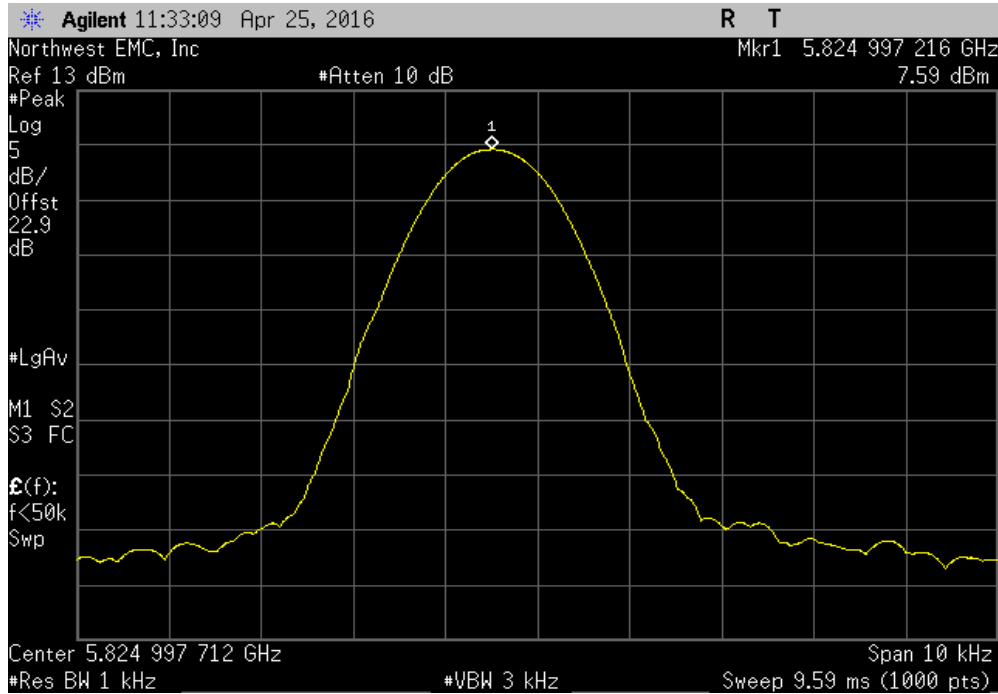


5725 MHz - 5825 MHz - High Channel, 5825 MHz, Temperature: +30°						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	5824.997655	5825	0.4	100	Pass	

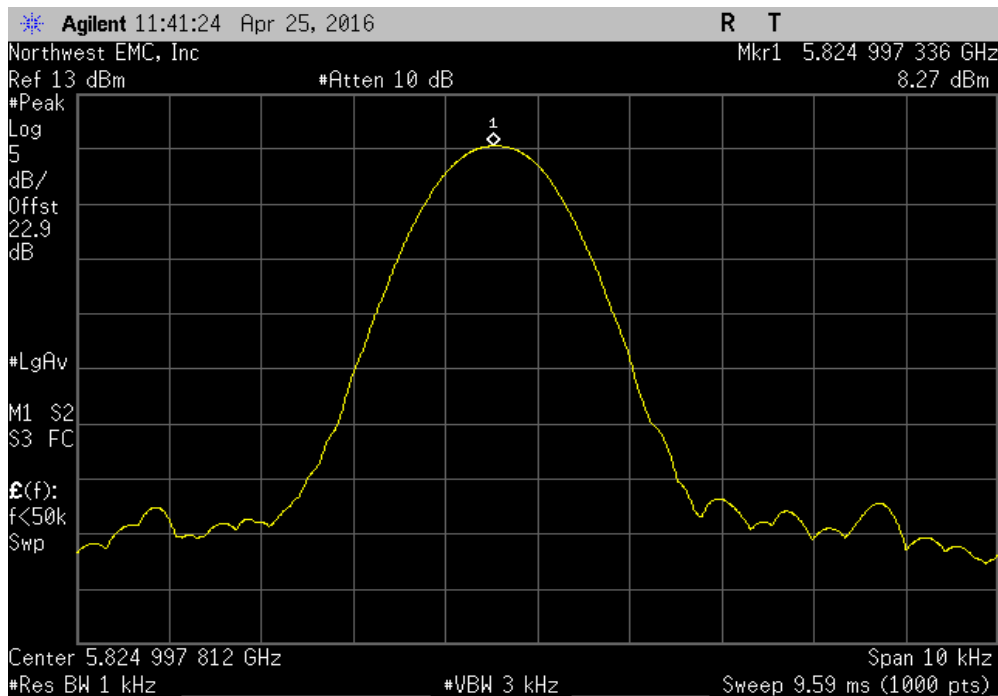


# FREQUENCY STABILITY

5725 MHz - 5825 MHz - High Channel, 5825 MHz, Temperature: +20°						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	5824.997216	5825	0.5	100	Pass	

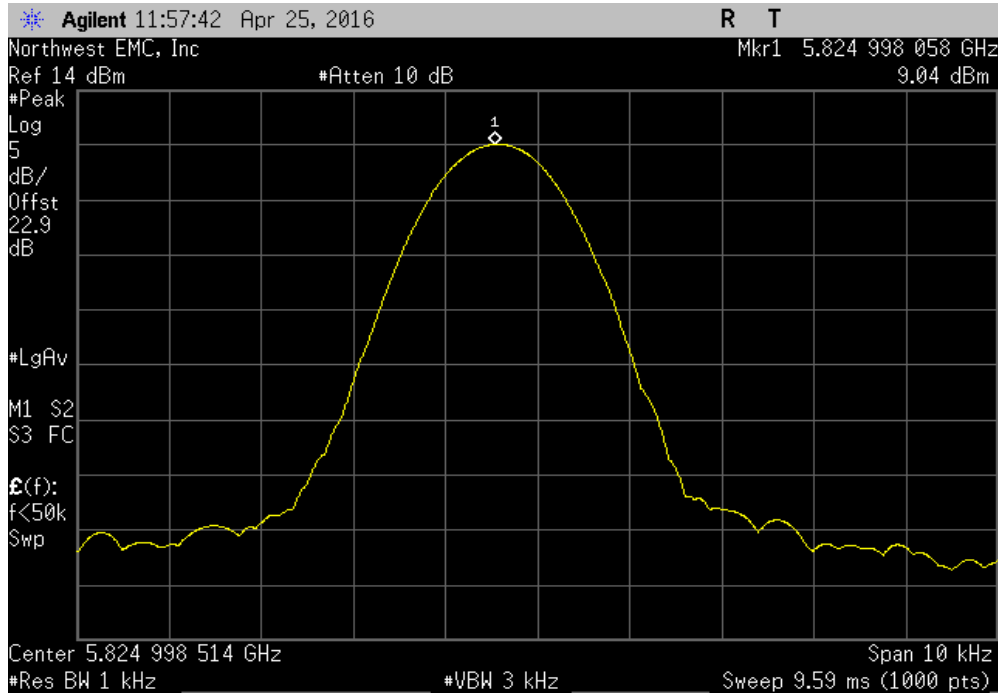


5725 MHz - 5825 MHz - High Channel, 5825 MHz, Temperature: +10°						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	5824.997336	5825	0.5	100	Pass	

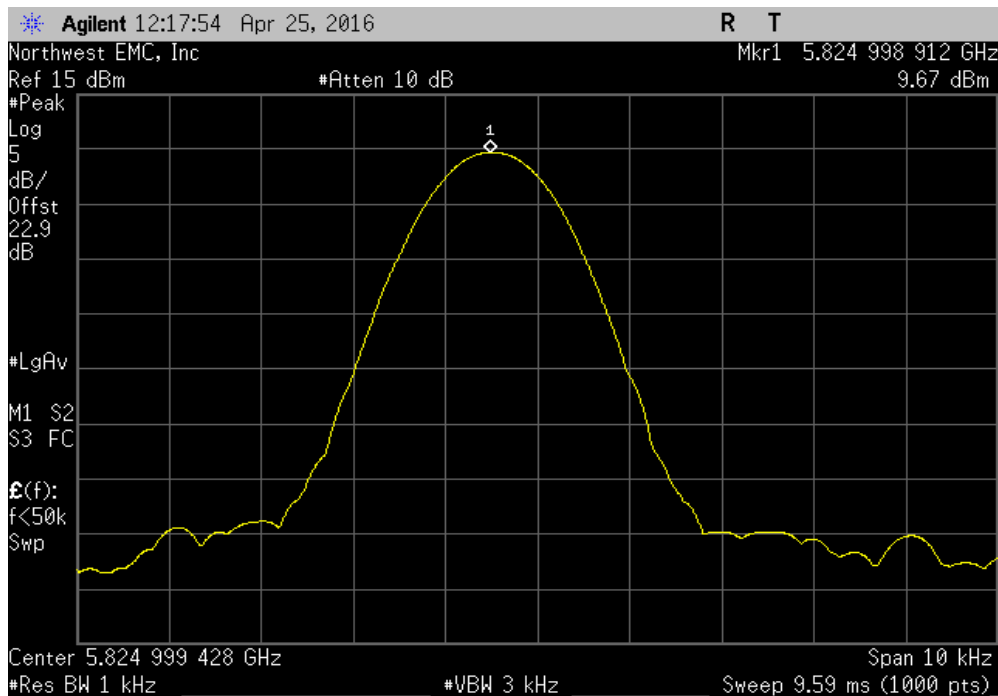


# FREQUENCY STABILITY

5725 MHz - 5825 MHz - High Channel, 5825 MHz, Temperature: 0°						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	5824.998058	5825	0.3	100	Pass	

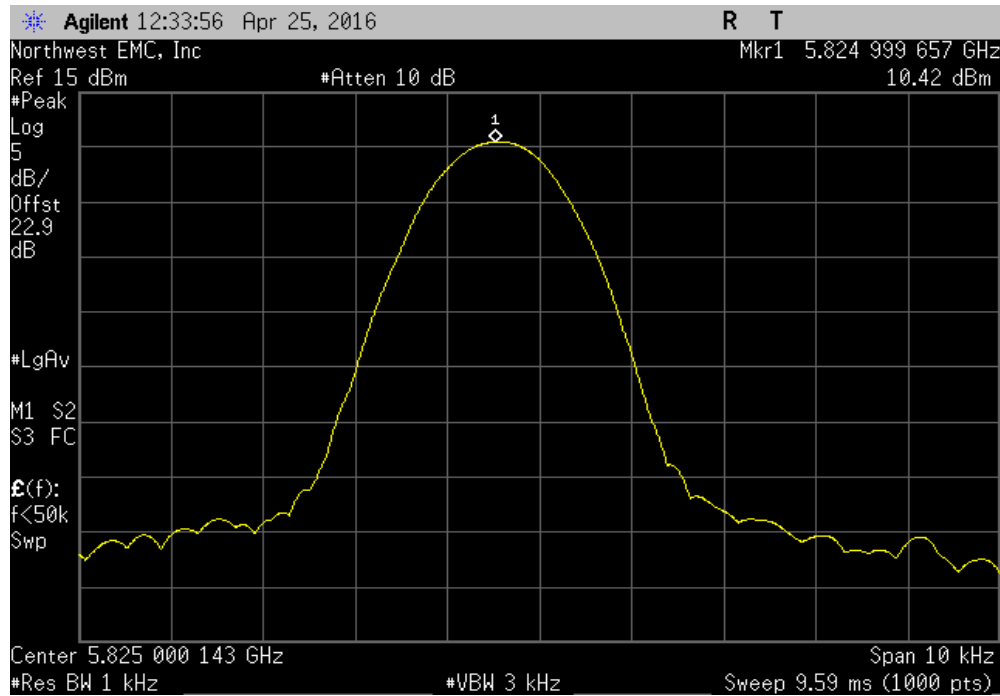


5725 MHz - 5825 MHz - High Channel, 5825 MHz, Temperature: -10°						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	5824.998912	5825	0.2	100	Pass	

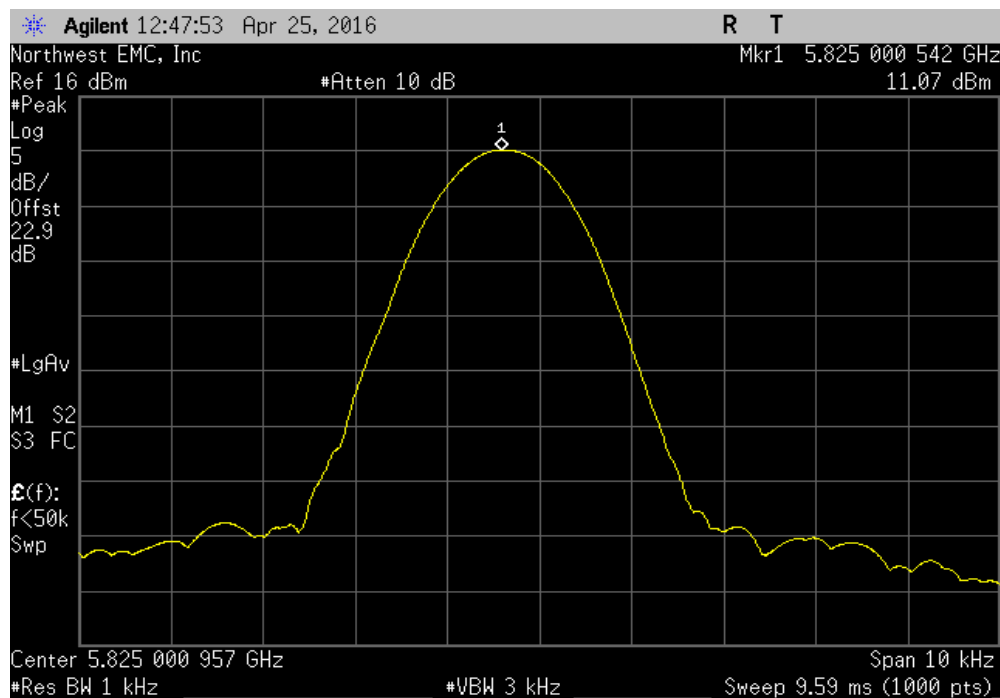


# FREQUENCY STABILITY

5725 MHz - 5825 MHz - High Channel, 5825 MHz, Temperature: -20°						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	5824.999657	5825	0.1	100	Pass	



5725 MHz - 5825 MHz - High Channel, 5825 MHz, Temperature: -30°						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	5825.000542	5825	0.1	100	Pass	



# DUTY CYCLE

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

## TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
Meter - Multimeter	Fluke	117	MLS	1/20/2014	36
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	12

## TEST DESCRIPTION

The Duty Cycle (x) of the single channel operation of the radio as controlled by the provided test software was measured for each of the EUT operating modes.

There is no compliance requirement to be met by this test, so therefore no Pass / Fail criteria.

The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum. A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used.


The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

If the transmit duty cycle < 98 percent, burst gating may have been used during some of the other tests in this report to only take the measurement during the burst duration.

# DUTY CYCLE

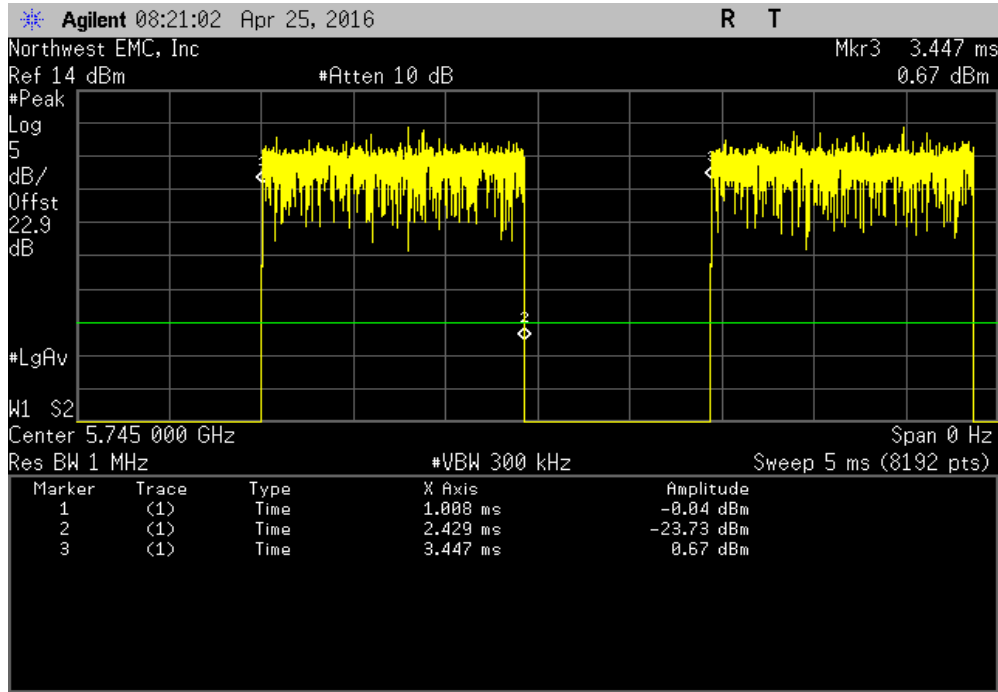


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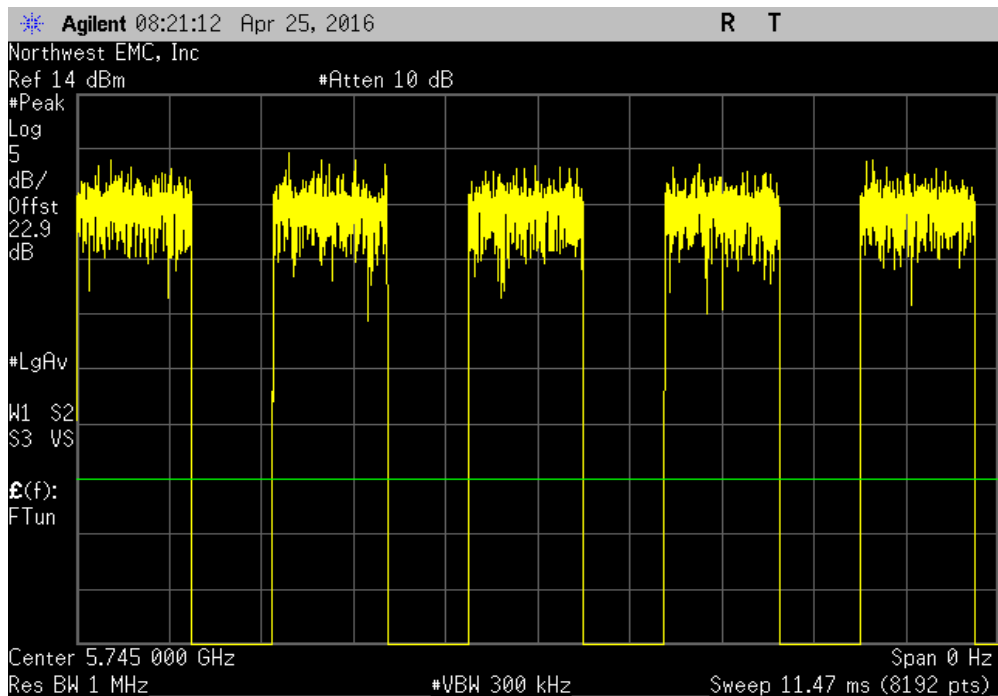
EUT: <b>Torpedo + Wireless -31 SOM</b>		Work Order: <b>LGPD0192</b>					
Serial Number: <b>1415M00058</b>		Date: <b>04/25/16</b>					
Customer: <b>Logic PD</b>		Temperature: <b>23°C</b>					
Attendees: <b>Adam Ford</b>		Humidity: <b>43%</b>					
Project: <b>None</b>		Barometric Pres.: <b>970.5 mbar</b>					
Tested by: <b>Jared Ison</b>		Power: <b>5 VDC</b>					
TEST SPECIFICATIONS		Test Method					
FCC 15.407:2016		ANSI C63.10:2013					
COMMENTS							
None							
DEVIATIONS FROM TEST STANDARD							
None							
Configuration #	1	Signature 					
		Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
5725 - 5825 MHz Band							
Low Channel, Ch 149 - 5745 MHz							
	802.11(a) 6 Mbps	1.421 ms	2.439 ms	1	58.3	N/A	N/A
	802.11(a) 6 Mbps	N/A	N/A	5	N/A	N/A	N/A
	802.11(a) 36 Mbps	248.7 us	1.267 ms	1	19.6	N/A	N/A
	802.11(a) 36 Mbps	N/A	N/A	5	N/A	N/A	N/A
	802.11(a) 54 Mbps	172.8 us	1.191 ms	1	14.5	N/A	N/A
	802.11(a) 54 Mbps	N/A	N/A	5	N/A	N/A	N/A
	802.11(n) MCS0	1.329 ms	2.347 ms	1	56.6	N/A	N/A
	802.11(n) MCS0	N/A	N/A	5	N/A	N/A	N/A
	802.11(n) MCS7	160.8 us	1.179 ms	1	13.6	N/A	N/A
	802.11(n) MCS7	N/A	N/A	5	N/A	N/A	N/A
Mid Channel, Ch 157 - 5785 MHz							
	802.11(a) 6 Mbps	1.421 ms	2.439 ms	1	58.2	N/A	N/A
	802.11(a) 6 Mbps	N/A	N/A	5	N/A	N/A	N/A
	802.11(a) 36 Mbps	248.7 us	1.267 ms	1	19.6	N/A	N/A
	802.11(a) 36 Mbps	N/A	N/A	5	N/A	N/A	N/A
	802.11(a) 54 Mbps	172.9 us	1.191 ms	1	14.5	N/A	N/A
	802.11(a) 54 Mbps	N/A	N/A	5	N/A	N/A	N/A
	802.11(n) MCS0	1.329 ms	2.347 ms	1	56.6	N/A	N/A
	802.11(n) MCS0	N/A	N/A	5	N/A	N/A	N/A
	802.11(n) MCS7	160.5 us	1.179 ms	1	13.6	N/A	N/A
	802.11(n) MCS7	N/A	N/A	5	N/A	N/A	N/A
High Channel, Ch 165 - 5825 MHz							
	802.11(a) 6 Mbps	1.421 ms	2.439 ms	1	58.2	N/A	N/A
	802.11(a) 6 Mbps	N/A	N/A	5	N/A	N/A	N/A
	802.11(a) 36 Mbps	248.7 us	1.267 ms	1	19.6	N/A	N/A
	802.11(a) 36 Mbps	N/A	N/A	5	N/A	N/A	N/A
	802.11(a) 54 Mbps	172.9 us	1.191 ms	1	14.5	N/A	N/A
	802.11(a) 54 Mbps	N/A	N/A	5	N/A	N/A	N/A
	802.11(n) MCS0	1.329 ms	2.347 ms	1	56.6	N/A	N/A
	802.11(n) MCS0	N/A	N/A	5	N/A	N/A	N/A
	802.11(n) MCS7	160.8 us	1.179 ms	1	13.6	N/A	N/A
	802.11(n) MCS7	N/A	N/A	5	N/A	N/A	N/A

# DUTY CYCLE

5785 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 6 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
1.421 ms	2.439 ms	1	58.3	N/A	N/A	



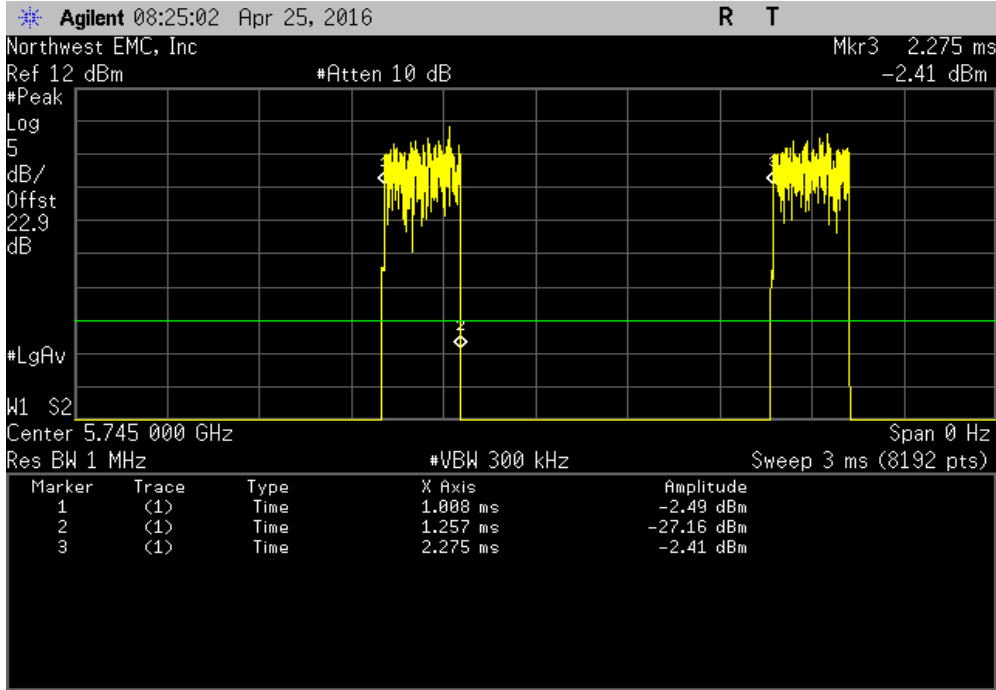
5785 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 6 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	



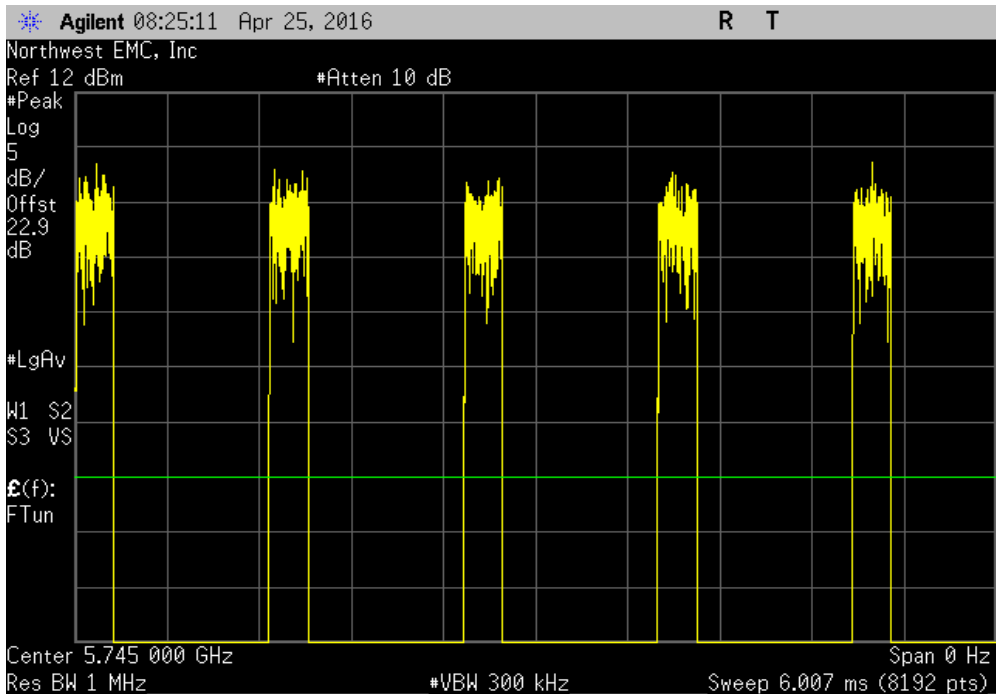


# DUTY CYCLE

5785 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 36 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
248.7 us	1.267 ms	1	19.6	N/A	N/A	

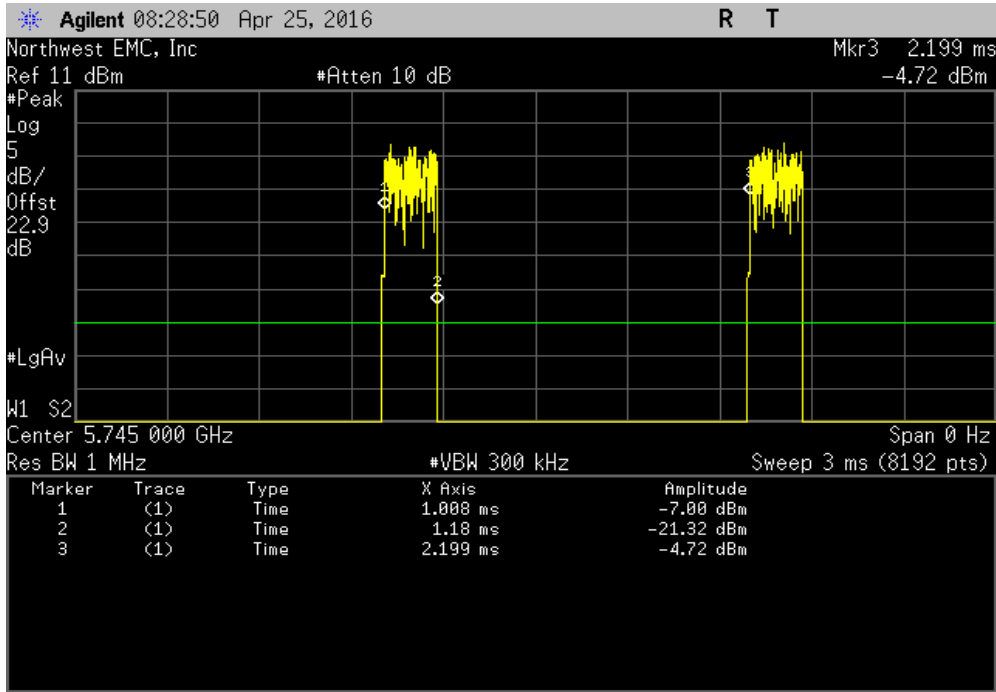


5785 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 36 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

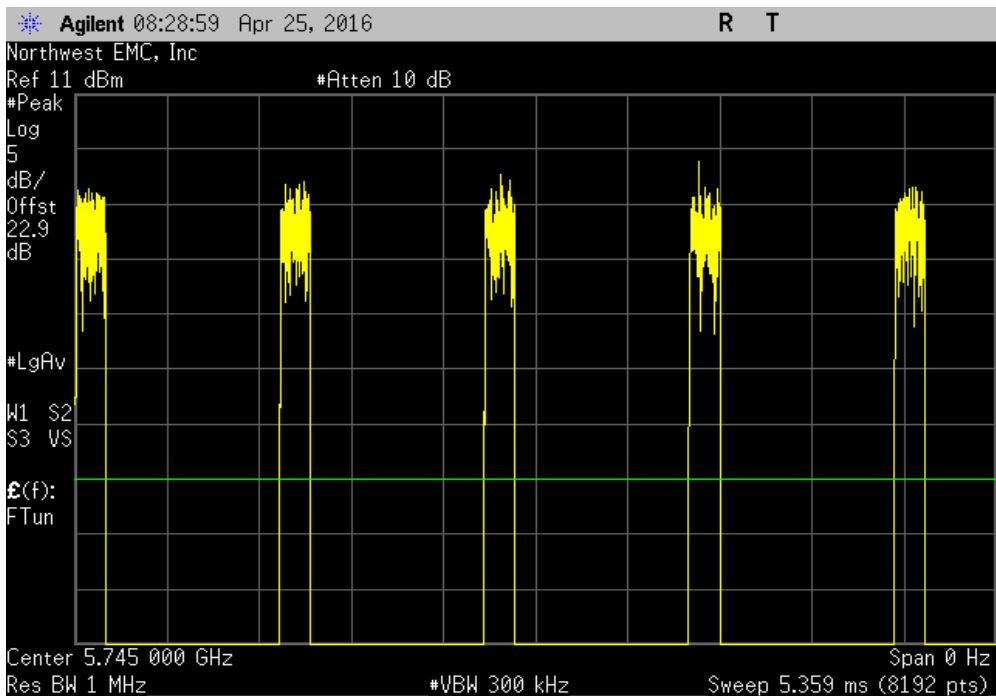


# DUTY CYCLE

5785 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 54 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
172.8 us	1.191 ms	1	14.5	N/A	N/A	

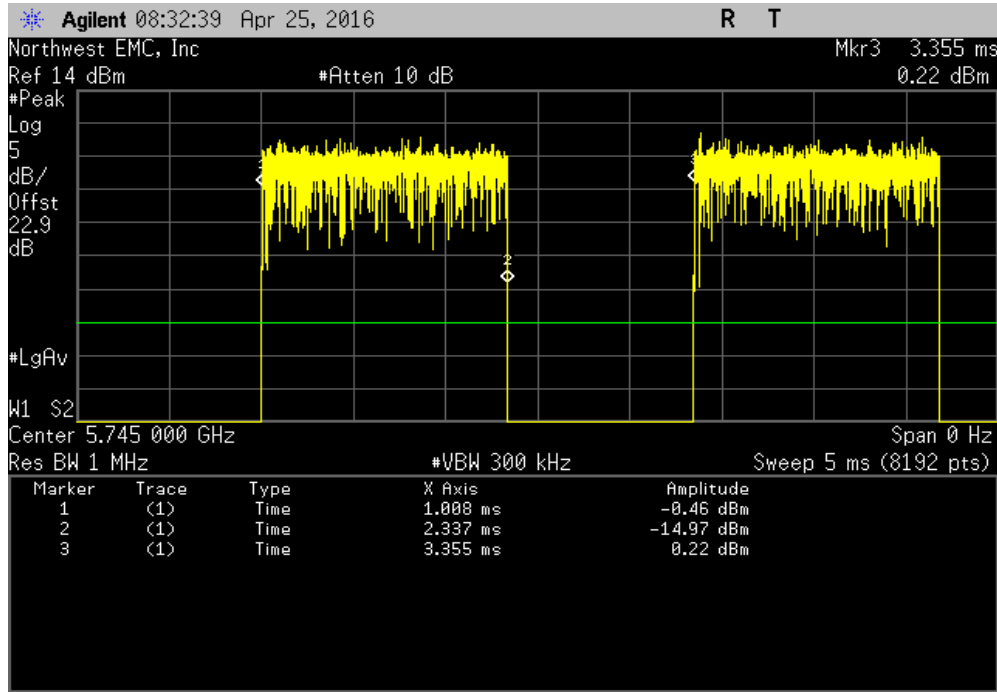


5785 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 54 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

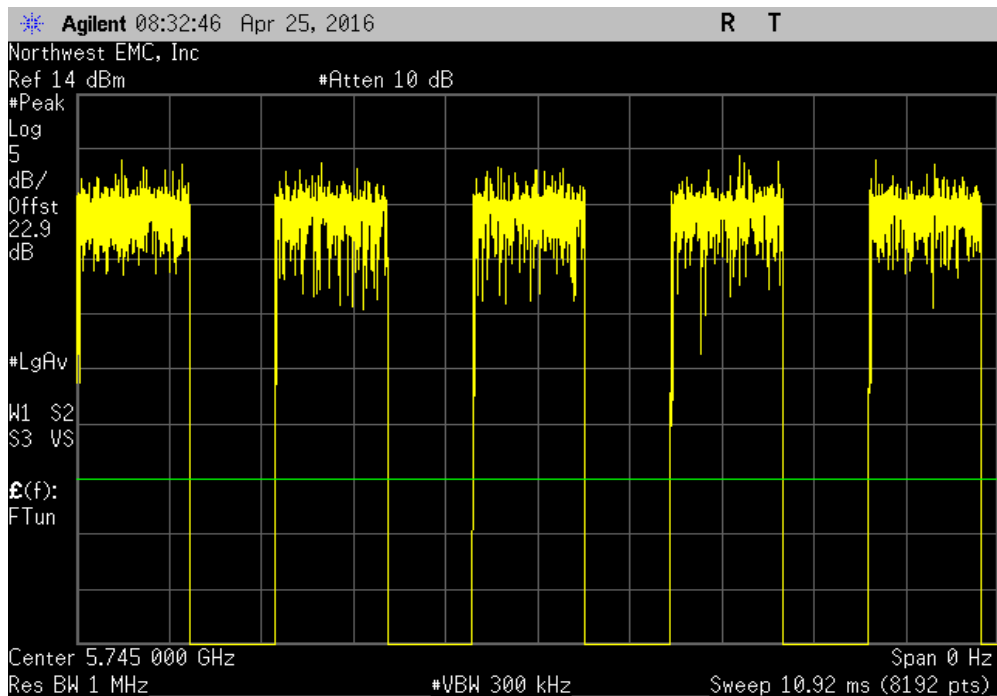


# DUTY CYCLE

5785 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(n) MCS0						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
1.329 ms	2.347 ms	1	56.6	N/A	N/A	

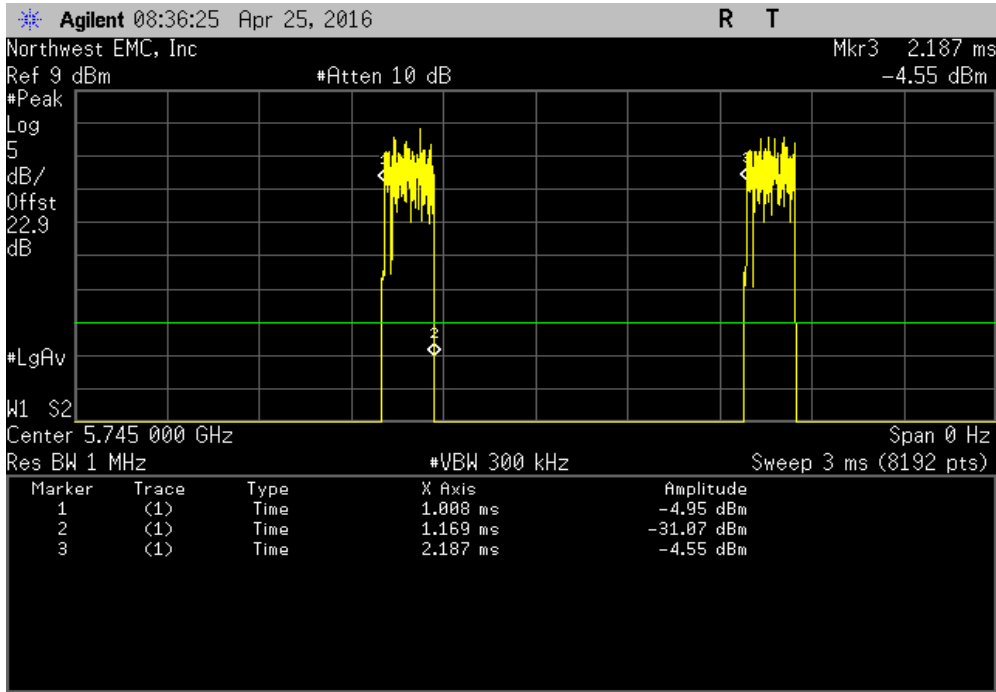


5785 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(n) MCS0						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

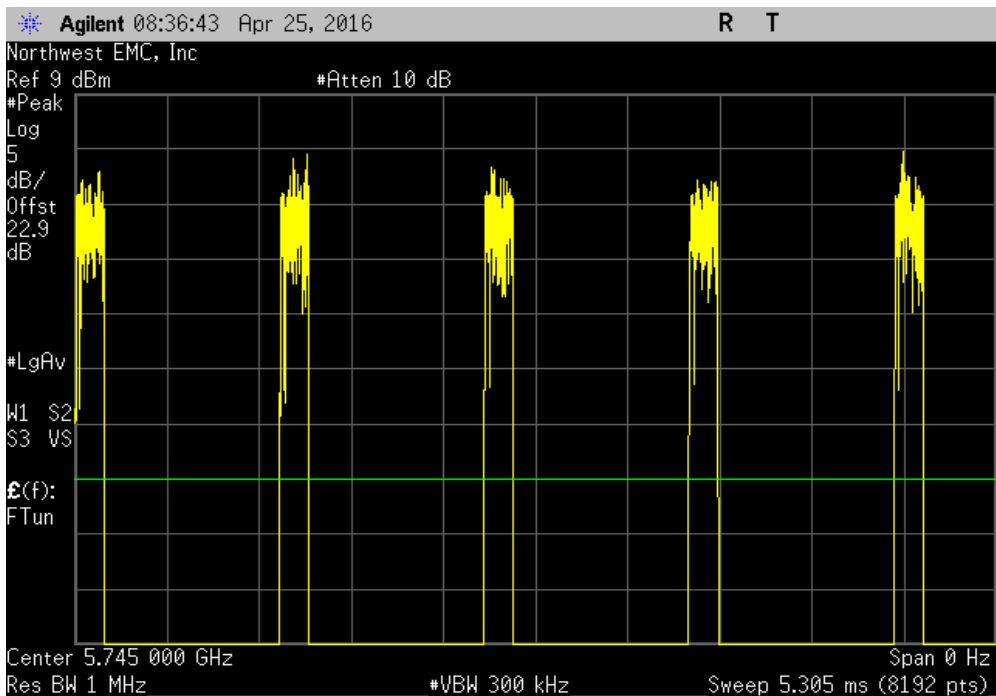


# DUTY CYCLE

5785 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(n) MCS7						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
160.8 us	1.179 ms	1	13.6	N/A	N/A	

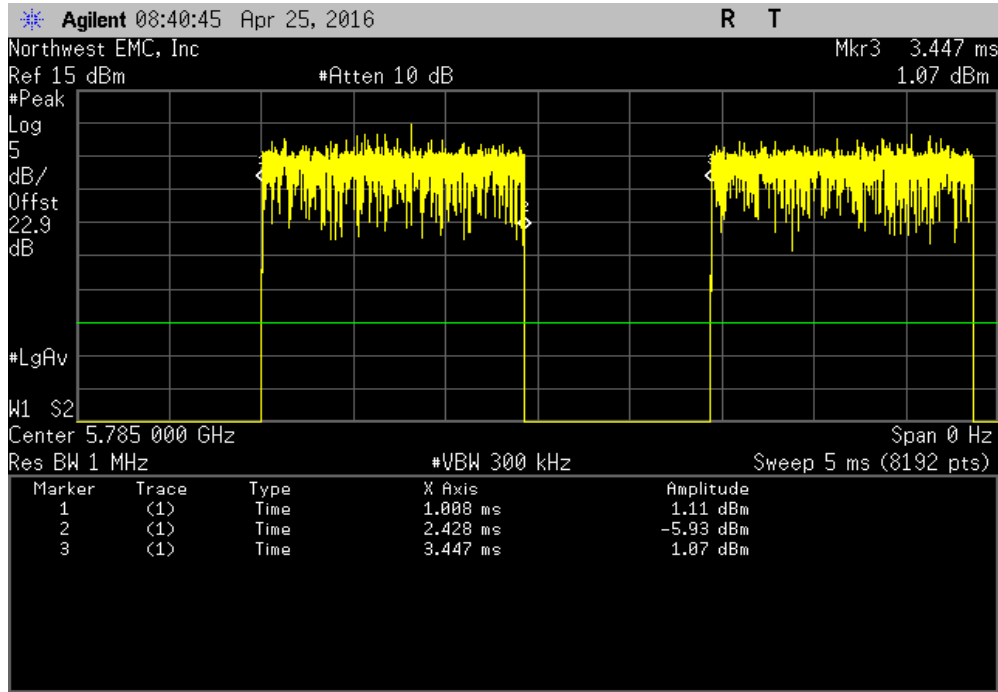


5785 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(n) MCS7						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

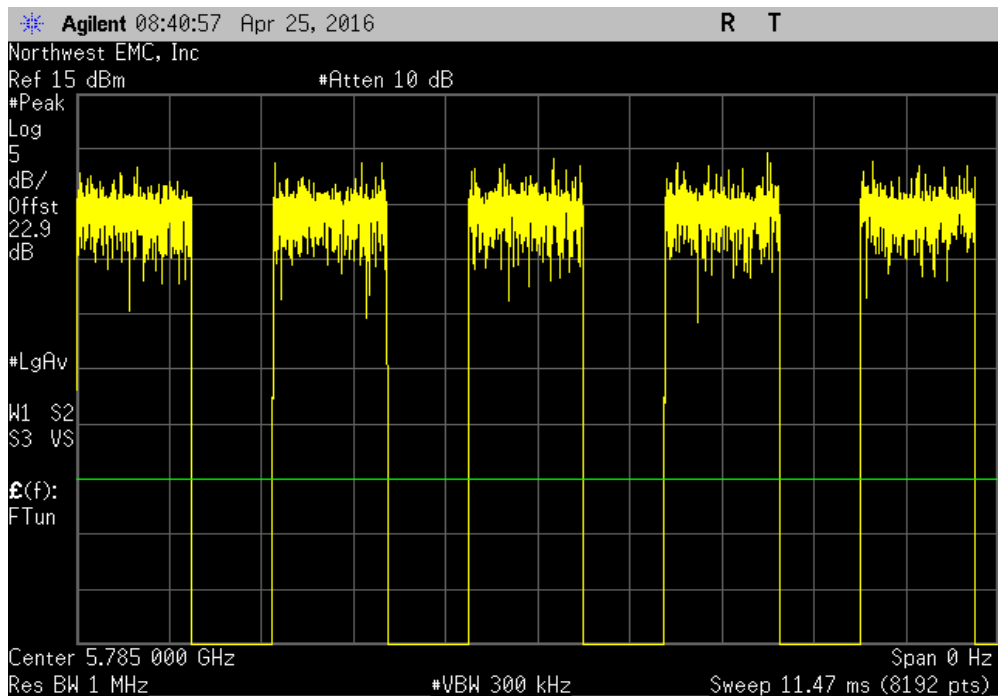


# DUTY CYCLE

5785 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(a) 6 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
1.421 ms	2.439 ms	1	58.2	N/A	N/A	

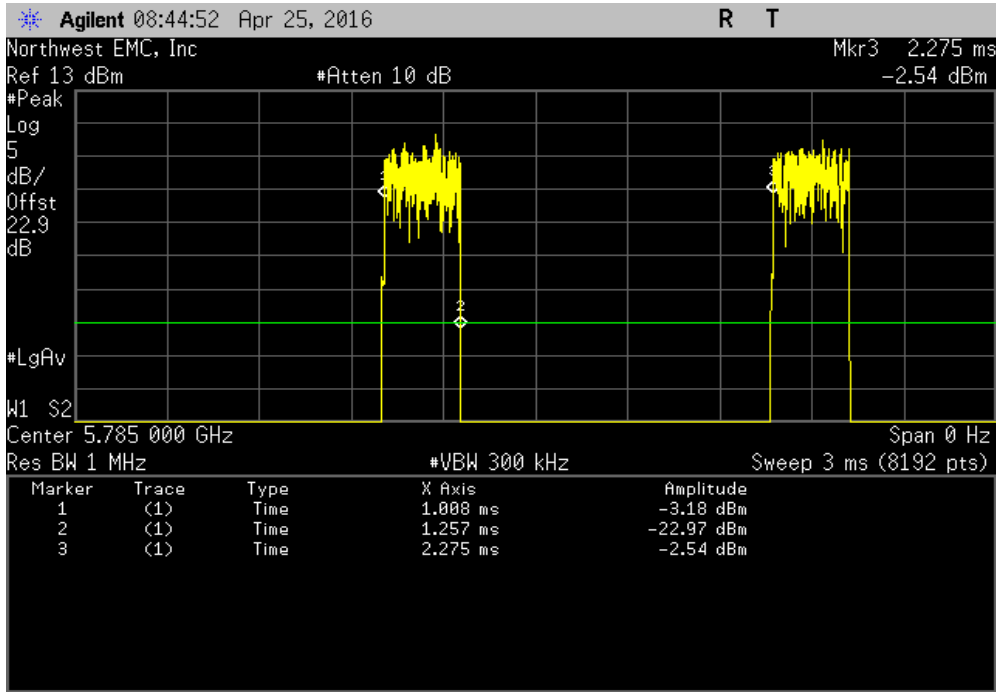


5785 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(a) 6 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

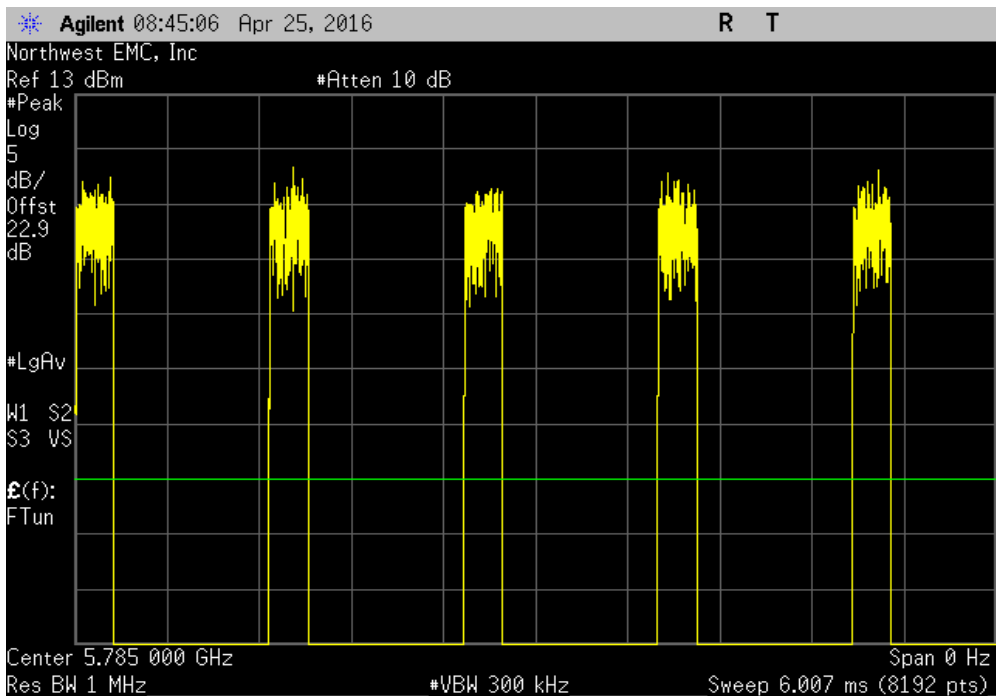


# DUTY CYCLE

5785 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(a) 36 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
248.7 us	1.267 ms	1	19.6	N/A	N/A	

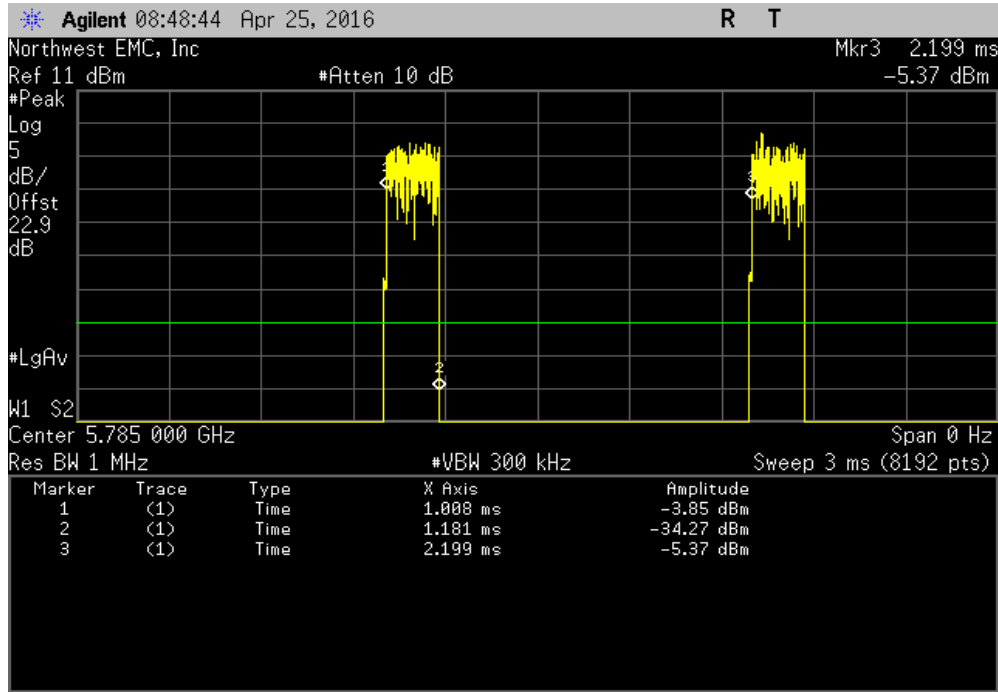


5785 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(a) 36 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

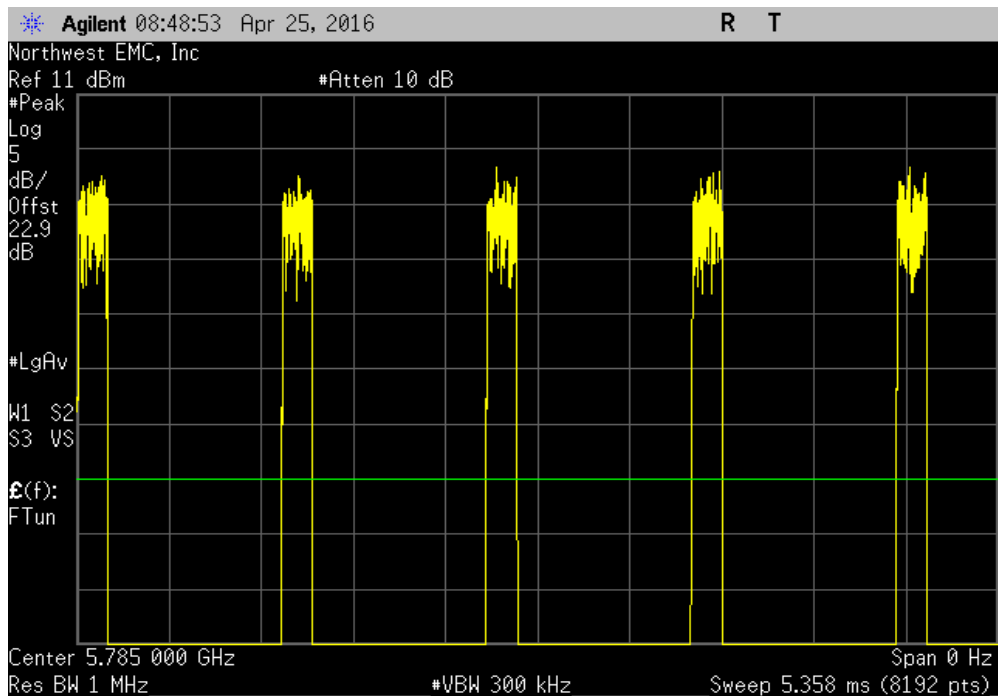


# DUTY CYCLE

5785 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(a) 54 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
172.9 us	1.191 ms	1	14.5	N/A	N/A	

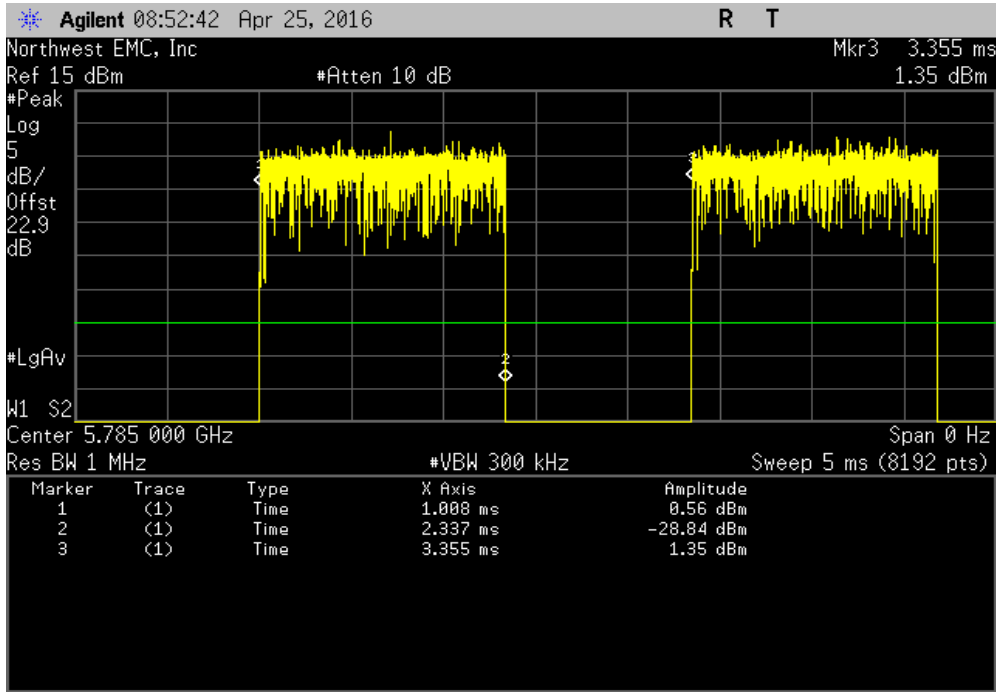


5785 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(a) 54 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

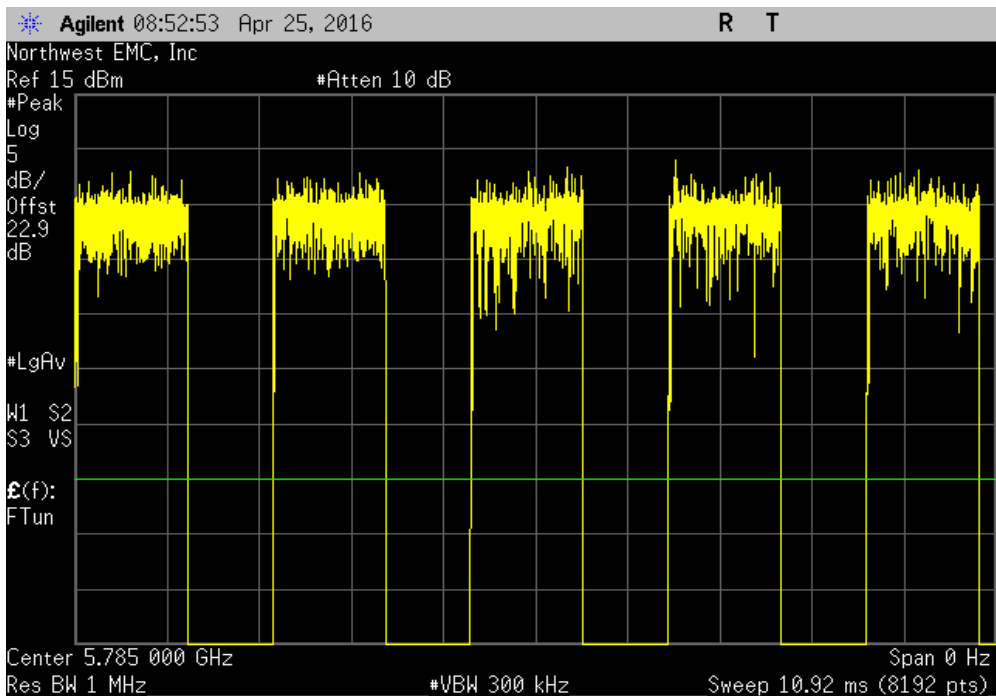


# DUTY CYCLE

5785 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(n) MCS0						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
1.329 ms	2.347 ms	1	56.6	N/A	N/A	



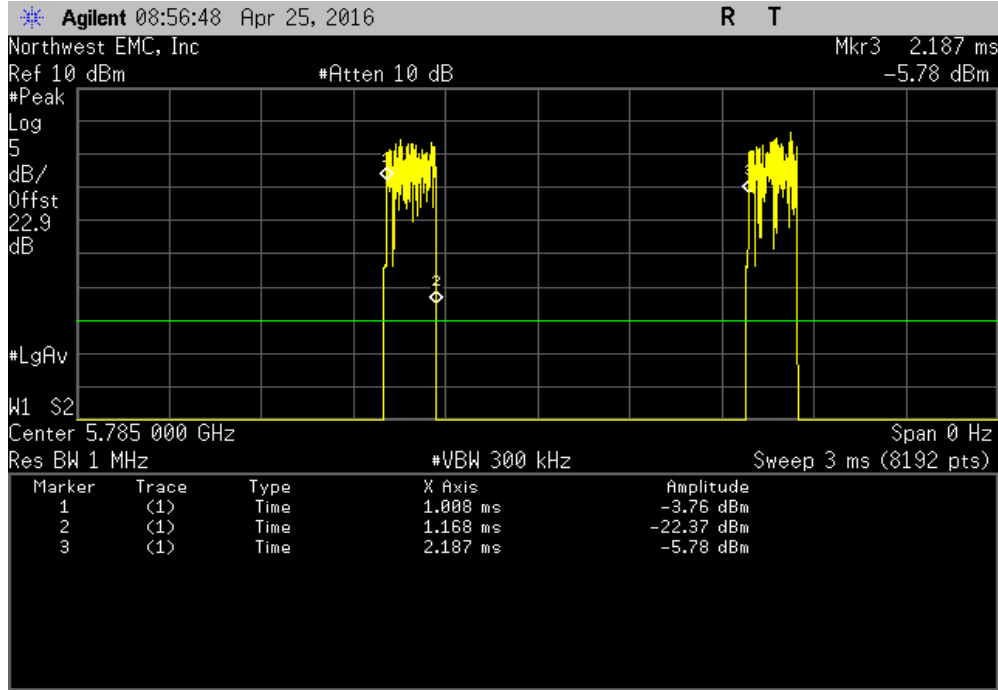
5785 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(n) MCS0						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	



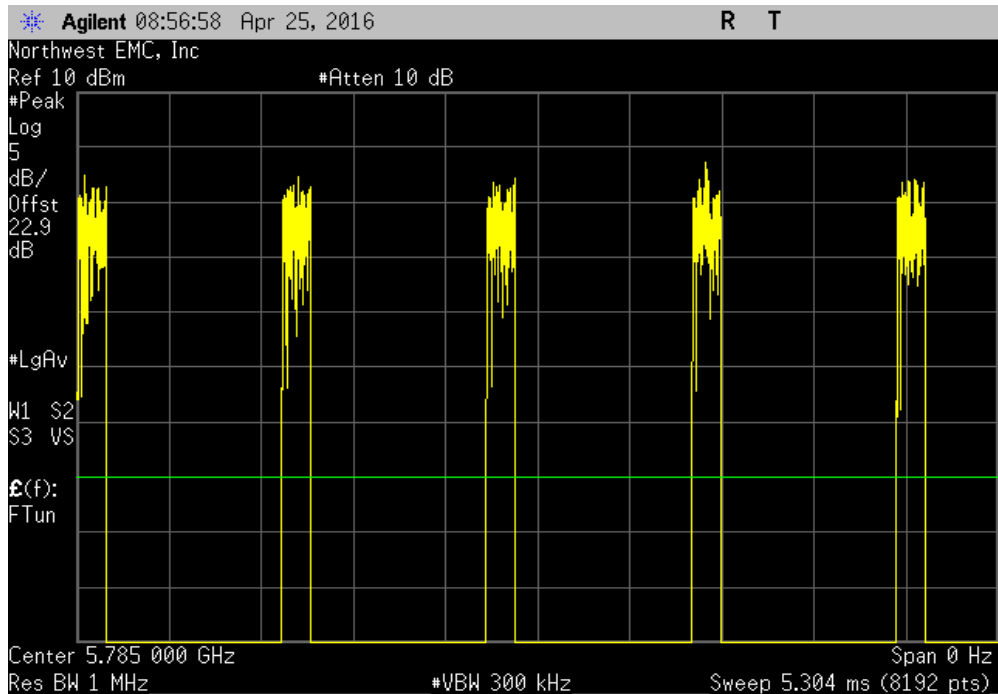


# DUTY CYCLE

5785 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(n) MCS7						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
160.5 us	1.179 ms	1	13.6	N/A	N/A	

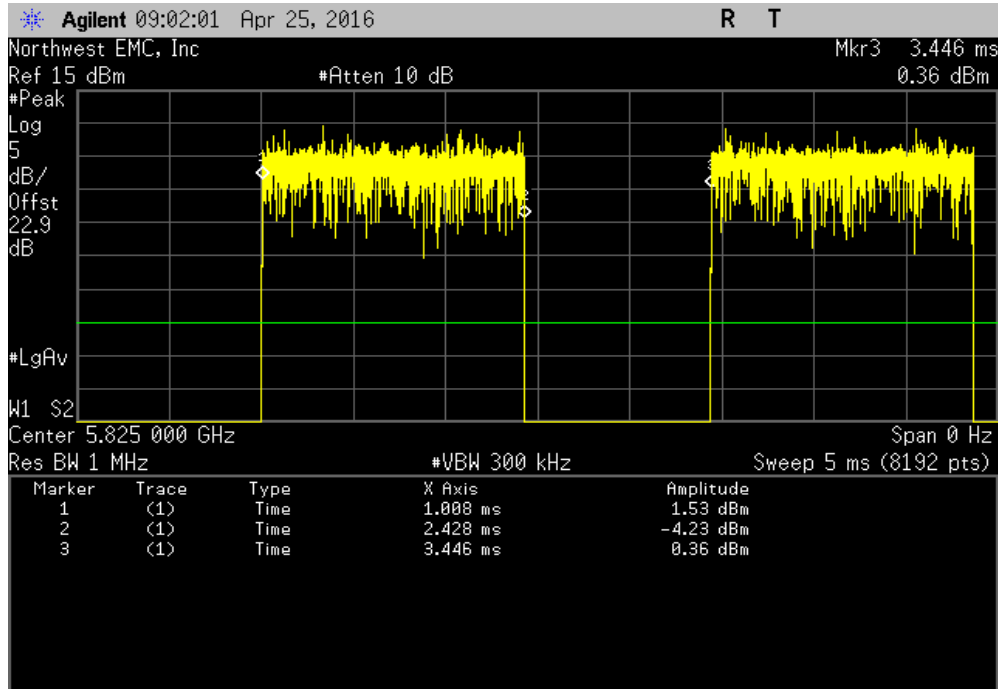


5785 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(n) MCS7						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

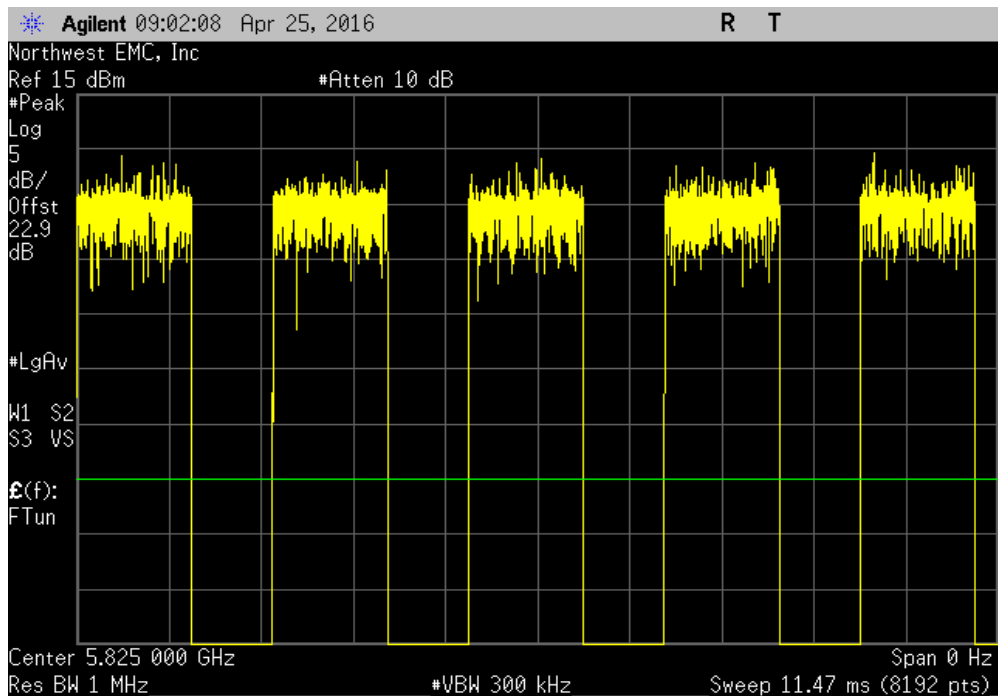


# DUTY CYCLE

5785 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(a) 6 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
1.421 ms	2.439 ms	1	58.2	N/A	N/A	

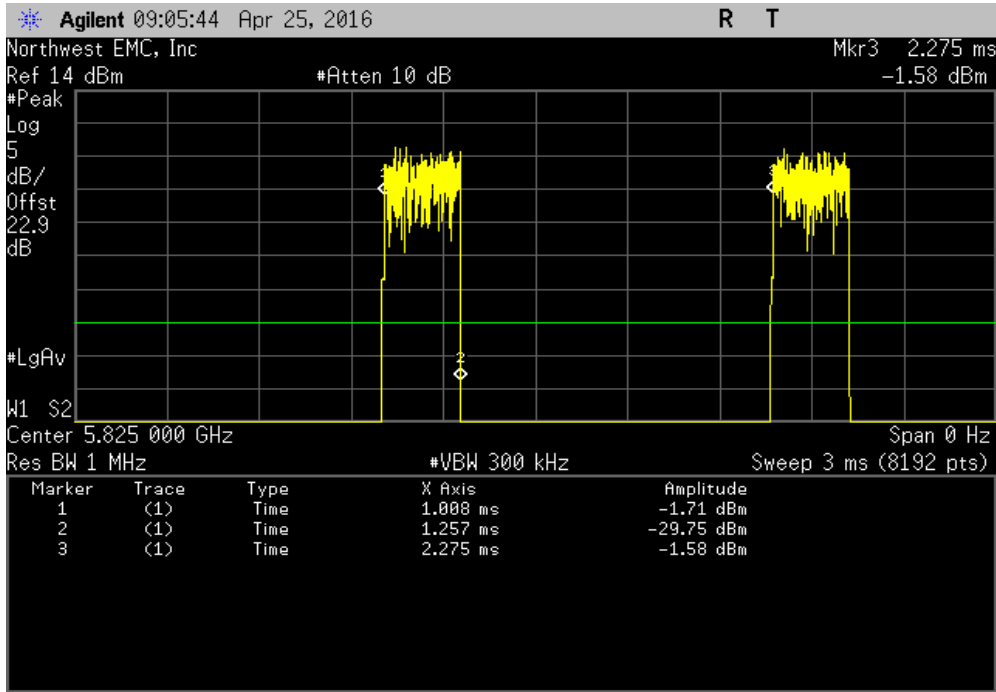


5785 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(a) 6 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

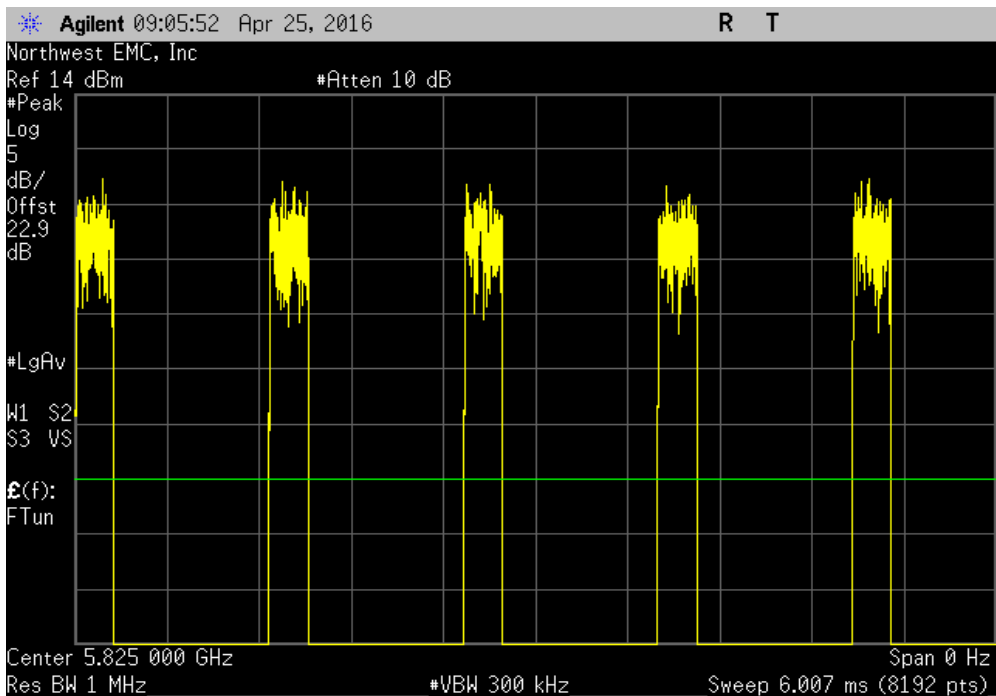


# DUTY CYCLE

5785 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(a) 36 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
248.7 us	1.267 ms	1	19.6	N/A	N/A	

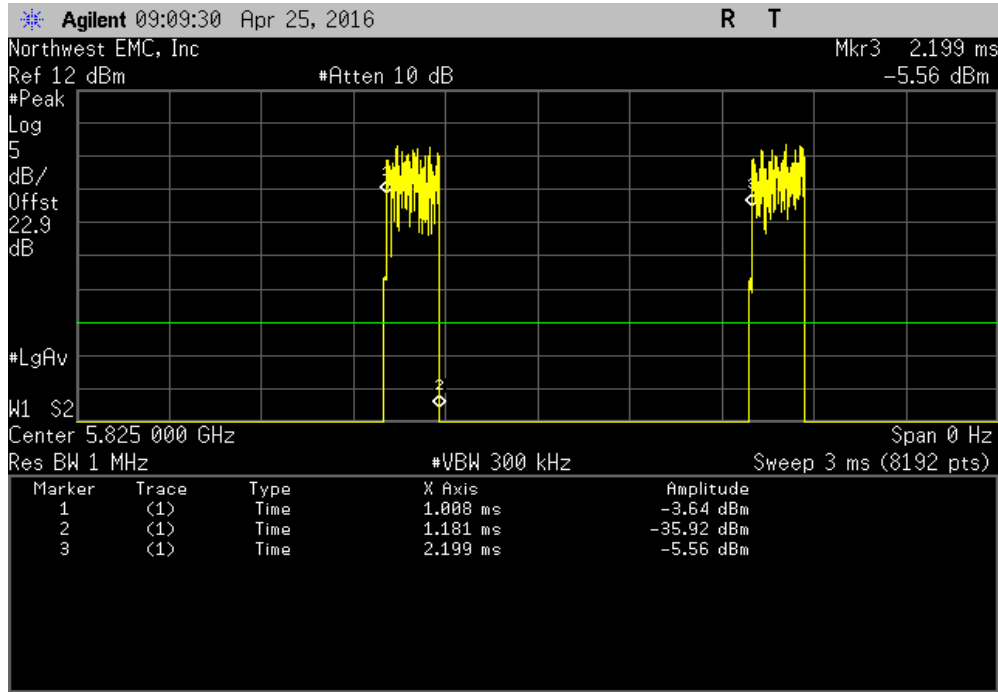


5785 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(a) 36 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

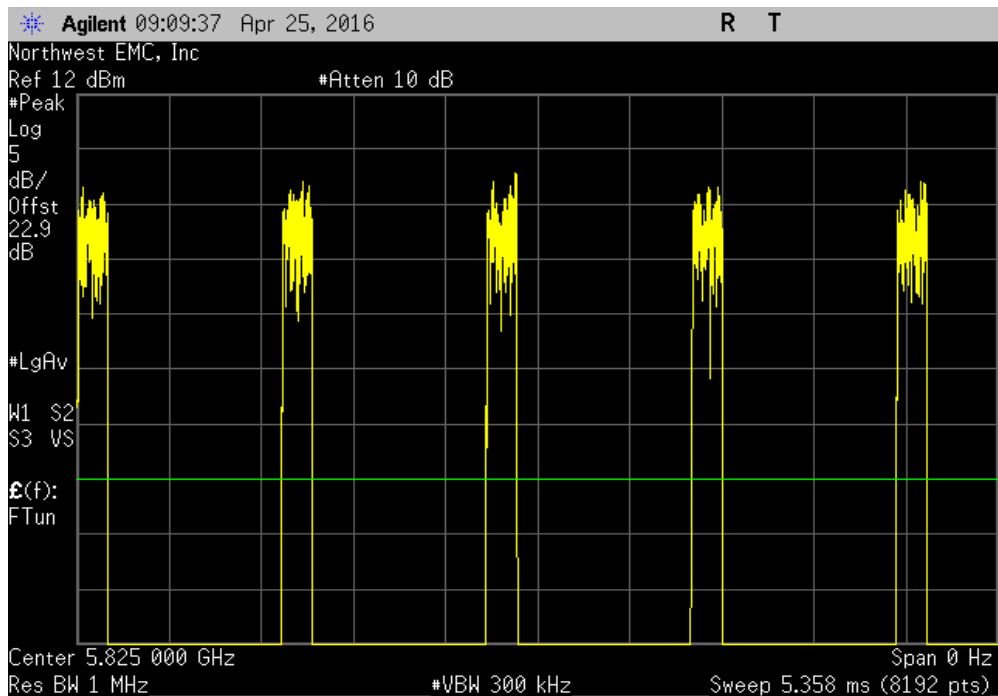


# DUTY CYCLE

5785 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(a) 54 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
172.9 us	1.191 ms	1	14.5	N/A	N/A	

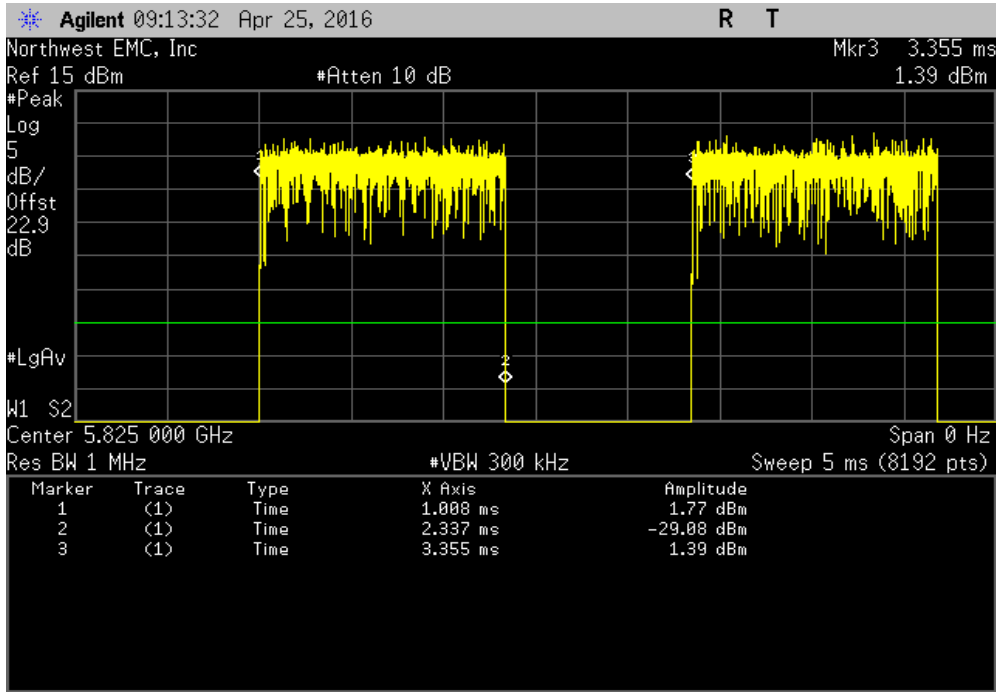


5785 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(a) 54 Mbps						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

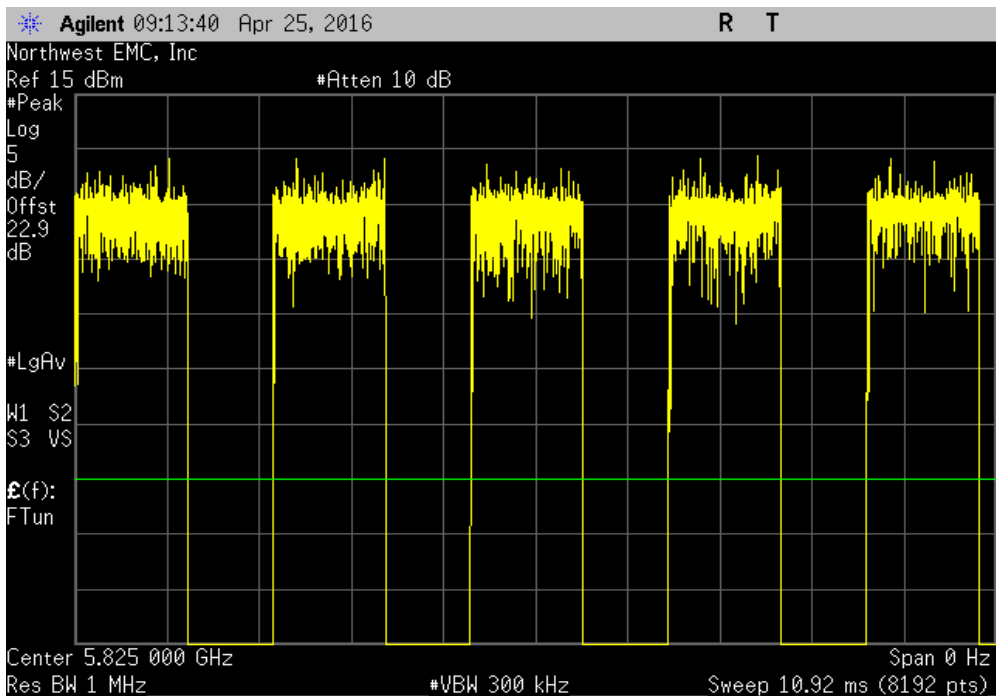


# DUTY CYCLE

5785 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(n) MCS0						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
1.329 ms	2.347 ms	1	56.6	N/A	N/A	

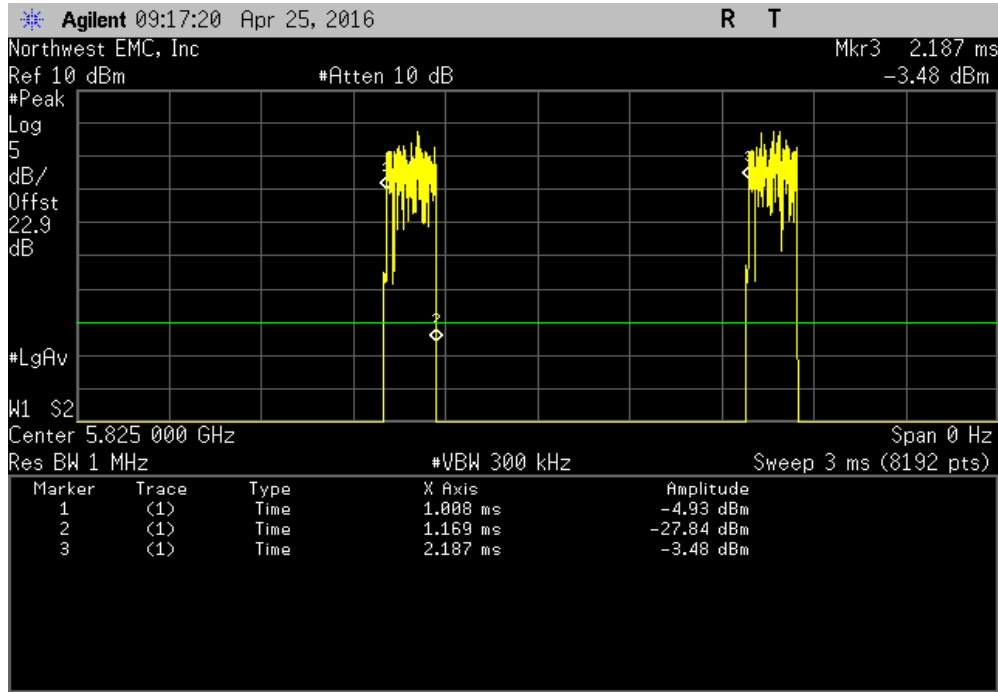


5785 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(n) MCS0						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

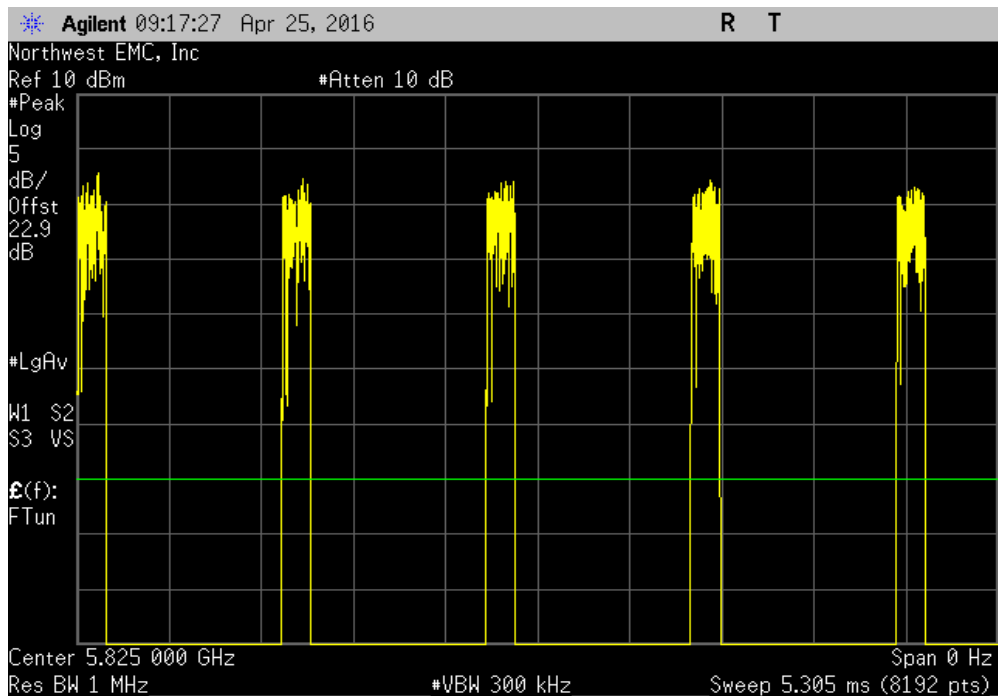


# DUTY CYCLE

5785 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(n) MCS7						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
160.8 us	1.179 ms	1	13.6	N/A	N/A	



5785 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(n) MCS7						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	



# MAXIMUM POWER SPECTRAL DENSITY

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

## TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
Meter - Multimeter	Fluke	117	MLS	1/20/2014	36
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	12

## TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum. The radio was operated in the modes as shown in the following data sheets.

A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used. The reference level offset on the spectrum analyzer was adjusted to compensate for cable loss and the external attenuation used between the RF output and the spectrum analyzer input.

Prior to measuring maximum power spectral density, the emission bandwidth (B) was measured. The method of measuring the emission bandwidth and the associated data are found elsewhere in this test report

The maximum power spectral density was measured using ANSI C63.10, Method SA-2 (RMS detection and trace averaging across the on and off times of the EUT transmission and use of a duty cycle correction factor), consistent with the method used for maximum conducted output power.

The spectrum analyzer settings were set per the guidance as well as the following specifics:

-Resolution Bandwidth of 510 kHz

-RMS Detector

-Trace average 100 traces in power averaging mode


The peak power spectral density (PPSD) was determined to be the highest level found across the emission in the reference bandwidth after 100 sweeps of power averaging (not video averaging).

A duty cycle correction factor was added to the measurement using the results of the formula of  $10 \cdot \text{LOG}(1/D)$  where D is the duty cycle.

# MAXIMUM POWER SPECTRAL DENSITY



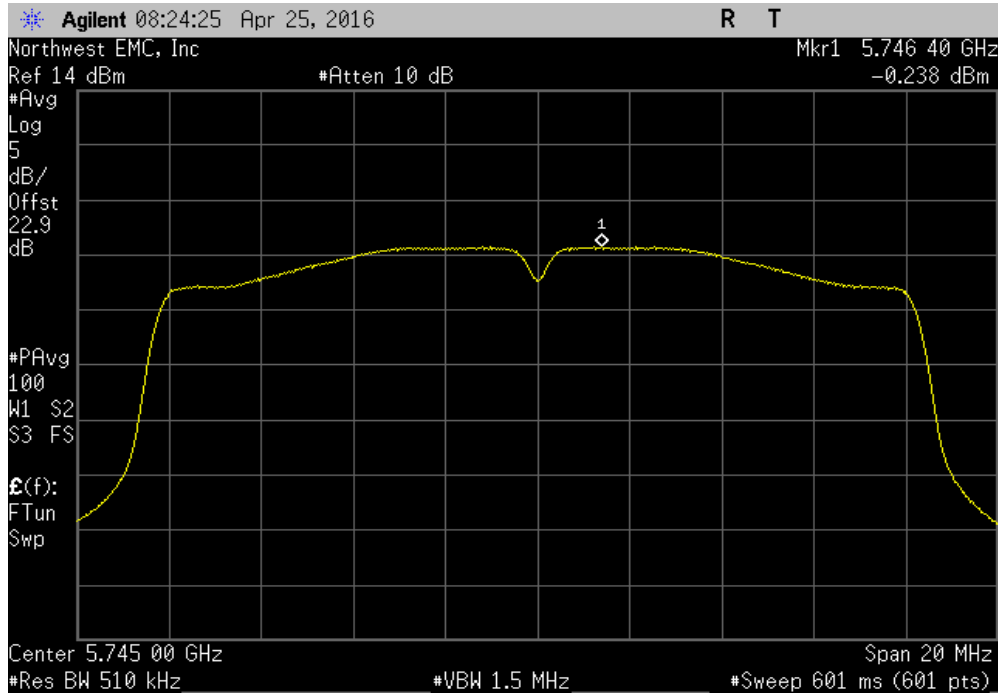
XMR 2015.01.14

EUT: <b>Torpedo + Wireless -31 SOM</b>		Work Order: <b>LGPD0192</b>				
Serial Number: <b>1415M00058</b>		Date: <b>04/25/16</b>				
Customer: <b>Logic PD</b>		Temperature: <b>23°C</b>				
Attendees: <b>Adam Ford</b>		Humidity: <b>43%</b>				
Project: <b>None</b>		Barometric Pres.: <b>970.5 mbar</b>				
Tested by: <b>Jared Ison</b>		Power: <b>5 VDC</b>				
Job Site: <b>MN08</b>						
<b>TEST SPECIFICATIONS</b>						
FCC 15.407:2016		ANSI C63.10:2013				
<b>TEST METHOD</b>						
<b>TEST SPECIFICATIONS</b>						
<b>COMMENTS</b>						
None						
<b>DEVIATIONS FROM TEST STANDARD</b>						
None						
Configuration #	1	Signature 				
		Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit ≤ (dBm / Ref BW)	Results
<b>5725 - 5825 MHz Band</b>						
<b>Low Channel, Ch 149 - 5745 MHz</b>						
	802.11(a) 6 Mbps	-0.238	2.3	2.1	30	Pass
	802.11(a) 36 Mbps	-7.152	7.1	-0.1	30	Pass
	802.11(a) 54 Mbps	-9.851	8.4	-1.5	30	Pass
	802.11(n) MCS0	-0.594	2.5	1.9	30	Pass
	802.11(n) MCS7	-10.999	8.7	-2.3	30	Pass
<b>Mid Channel, Ch 157 - 5785 MHz</b>						
	802.11(a) 6 Mbps	0.595	2.4	2.9	30	Pass
	802.11(a) 36 Mbps	-6.696	7.1	0.4	30	Pass
	802.11(a) 54 Mbps	-9.327	8.4	-0.9	30	Pass
	802.11(n) MCS0	0.143	2.5	2.6	30	Pass
	802.11(n) MCS7	-10.4	8.7	-1.7	30	Pass
<b>High Channel, Ch 165 - 5825 MHz</b>						
	802.11(a) 6 Mbps	0.778	2.4	3.1	30	Pass
	802.11(a) 36 Mbps	-6.398	7.1	0.7	30	Pass
	802.11(a) 54 Mbps	-9.006	8.4	-0.6	30	Pass
	802.11(n) MCS0	0.344	2.5	2.8	30	Pass
	802.11(n) MCS7	-10.088	8.7	-1.4	30	Pass

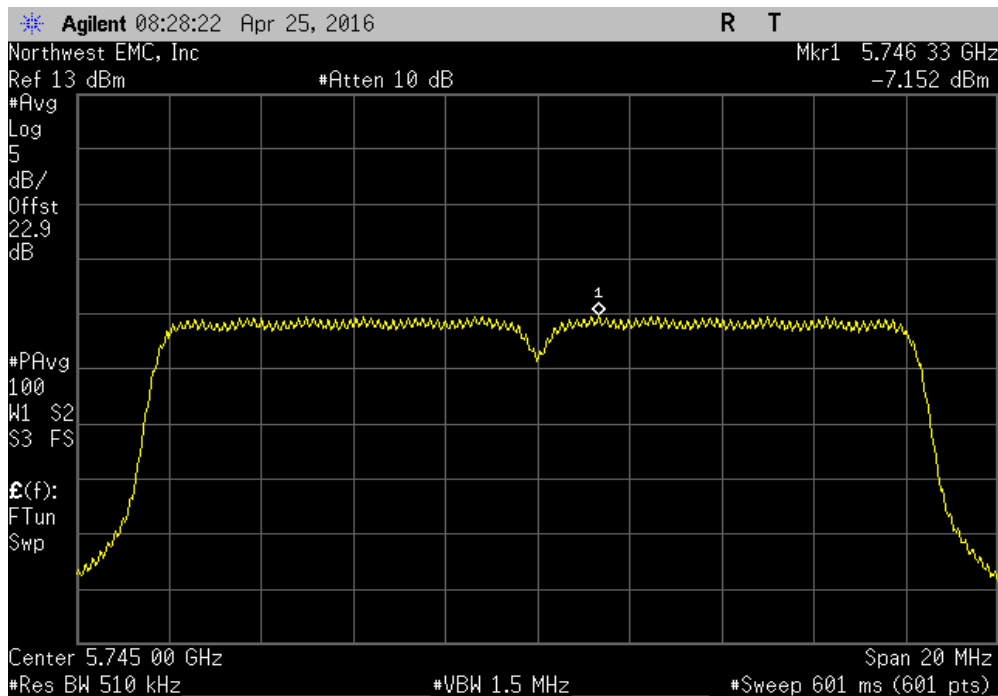


# MAXIMUM POWER SPECTRAL DENSITY

5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 6 Mbps						
Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit (dBm / Ref BW)	Results		
-0.238	2.3	2.1	30	Pass		

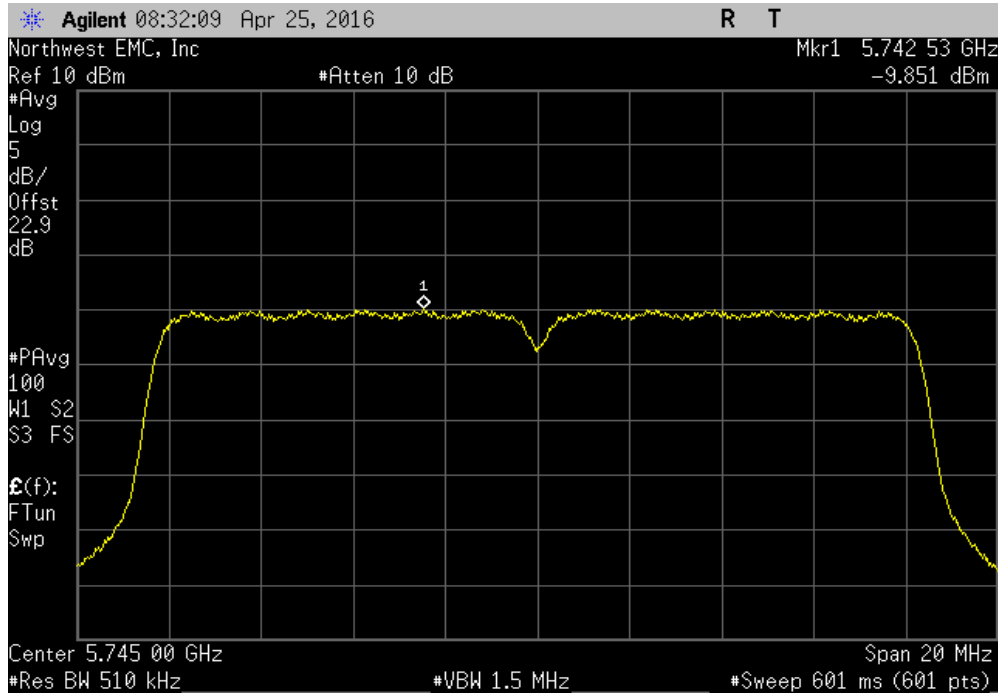


5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 36 Mbps						
Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit (dBm / Ref BW)	Results		
-7.152	7.1	-0.1	30	Pass		

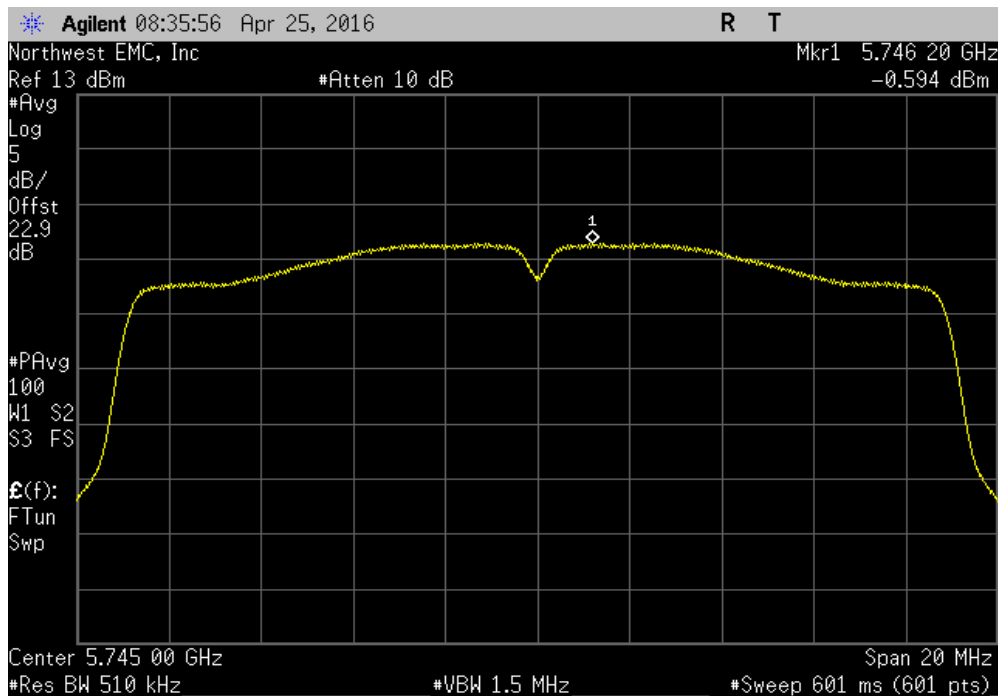


# MAXIMUM POWER SPECTRAL DENSITY

5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 54 Mbps						
Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit (dBm / Ref BW)	Results		
-9.851	8.4	-1.5	30	Pass		

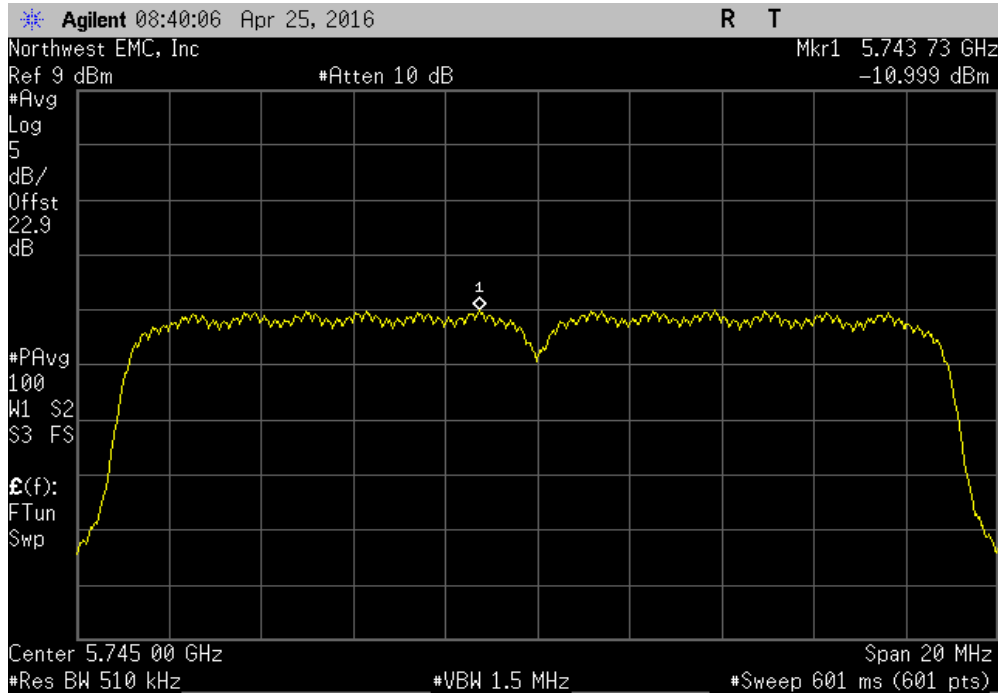


5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(n) MCS0						
Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit (dBm / Ref BW)	Results		
-0.594	2.5	1.9	30	Pass		

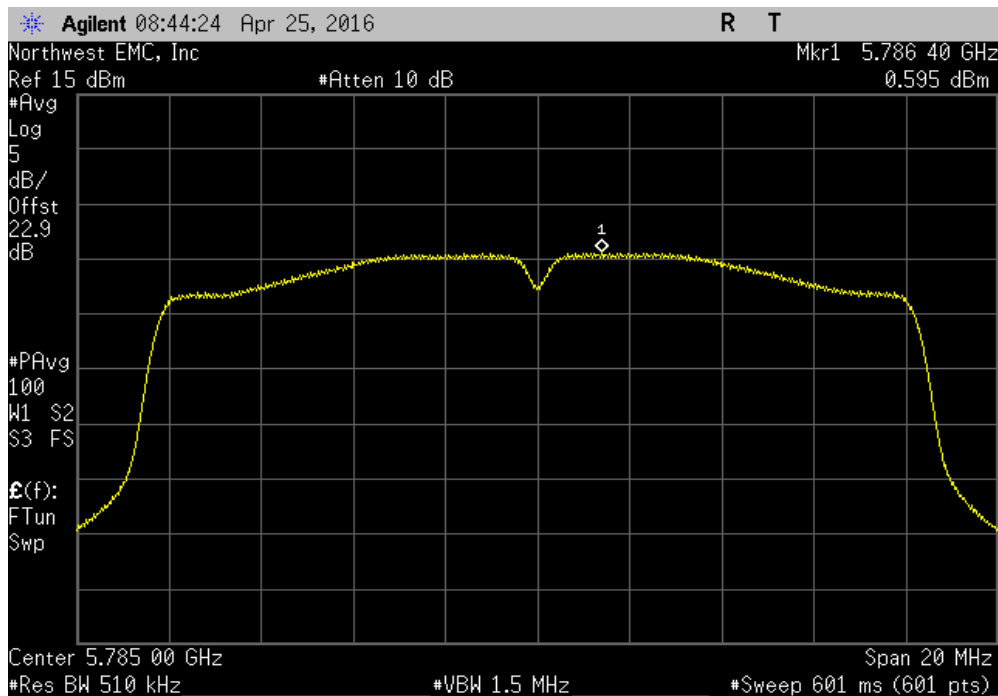


# MAXIMUM POWER SPECTRAL DENSITY

5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(n) MCS7						
Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit (dBm / Ref BW)	Results		
-10.999	8.7	-2.3	30	Pass		

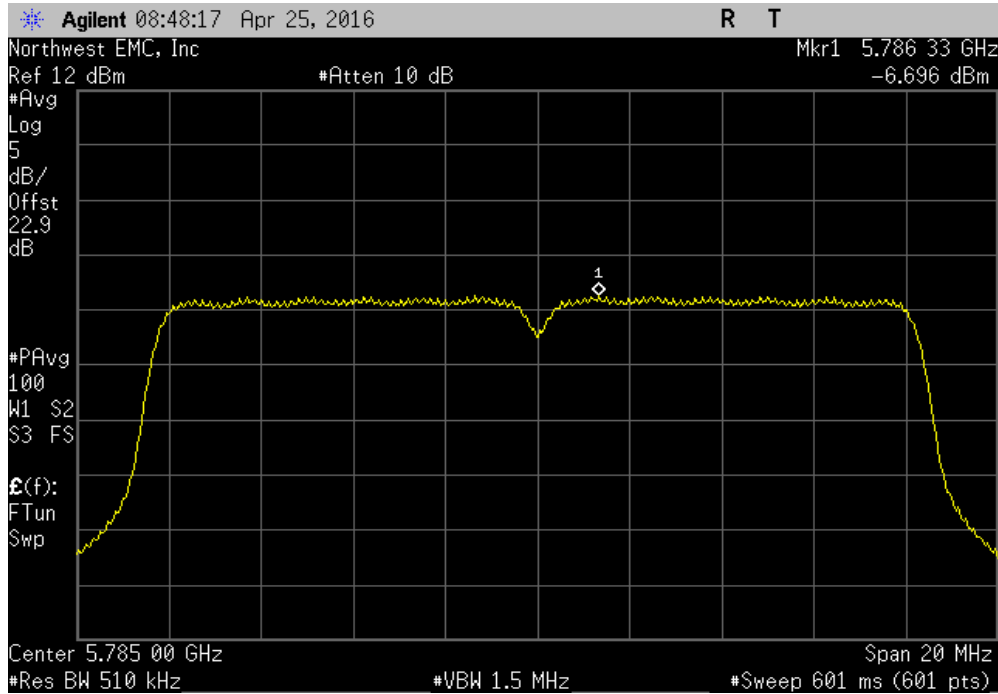


5725 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(a) 6 Mbps						
Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit (dBm / Ref BW)	Results		
0.595	2.4	2.9	30	Pass		

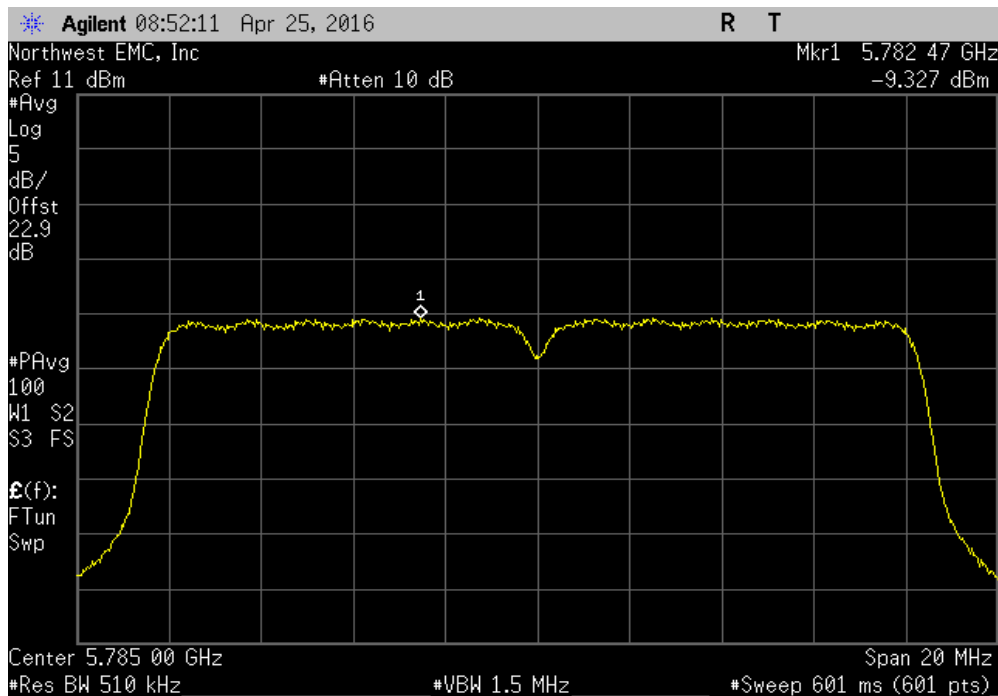


# MAXIMUM POWER SPECTRAL DENSITY

5725 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(a) 36 Mbps						
Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit (dBm / Ref BW)	Results		
-6.696	7.1	0.4	30	Pass		

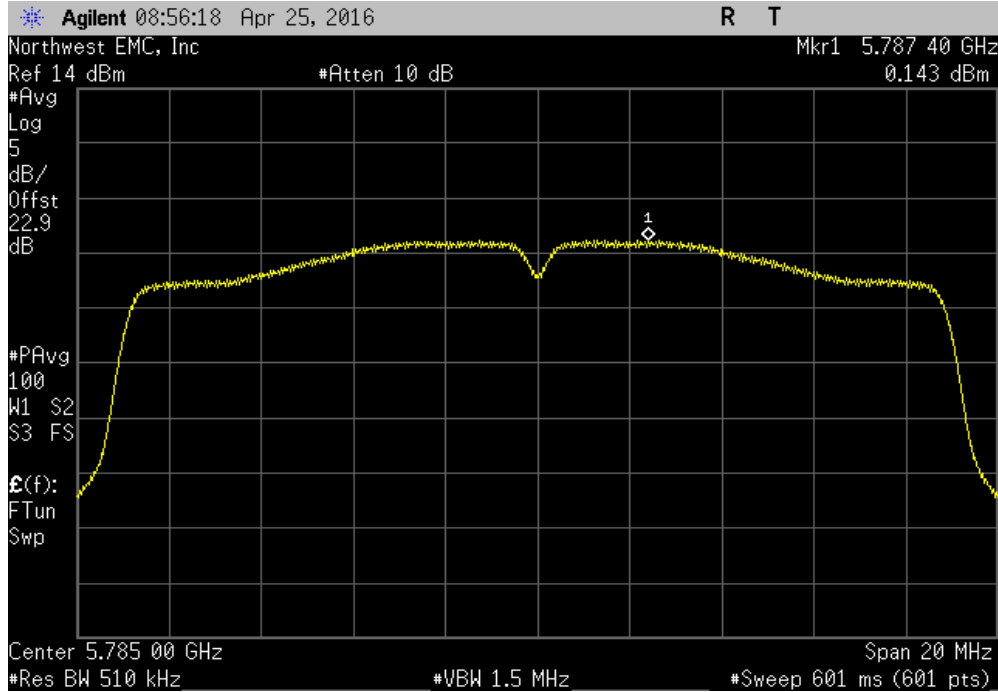


5725 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(a) 54 Mbps						
Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit (dBm / Ref BW)	Results		
-9.327	8.4	-0.9	30	Pass		

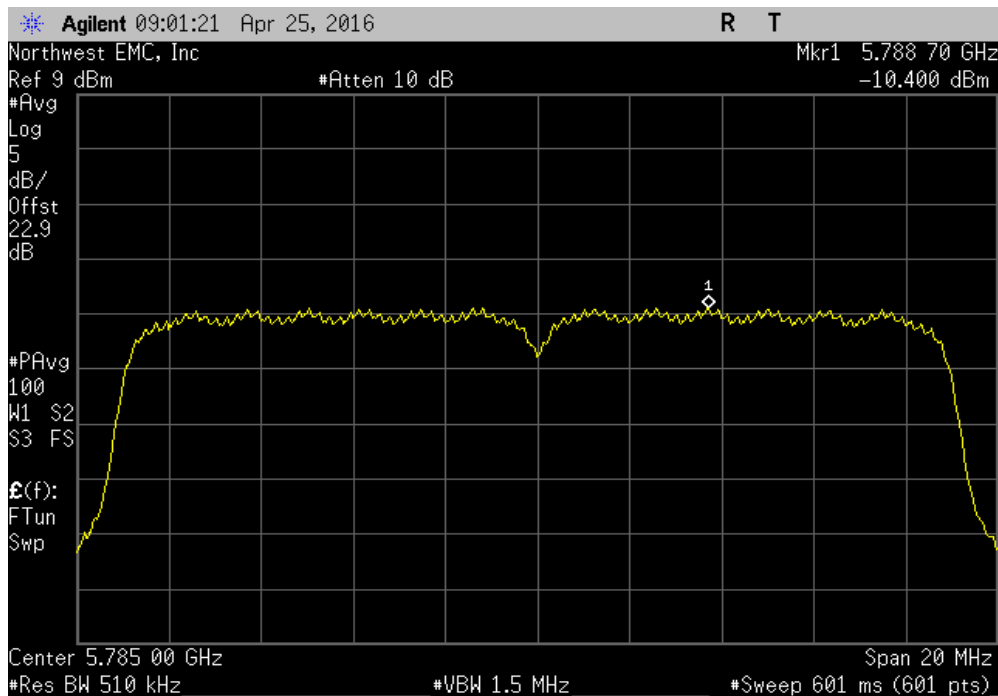


# MAXIMUM POWER SPECTRAL DENSITY

5725 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(n) MCS0						
Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit ε (dBm / Ref BW)	Results		
0.143	2.5	2.6	30	Pass		

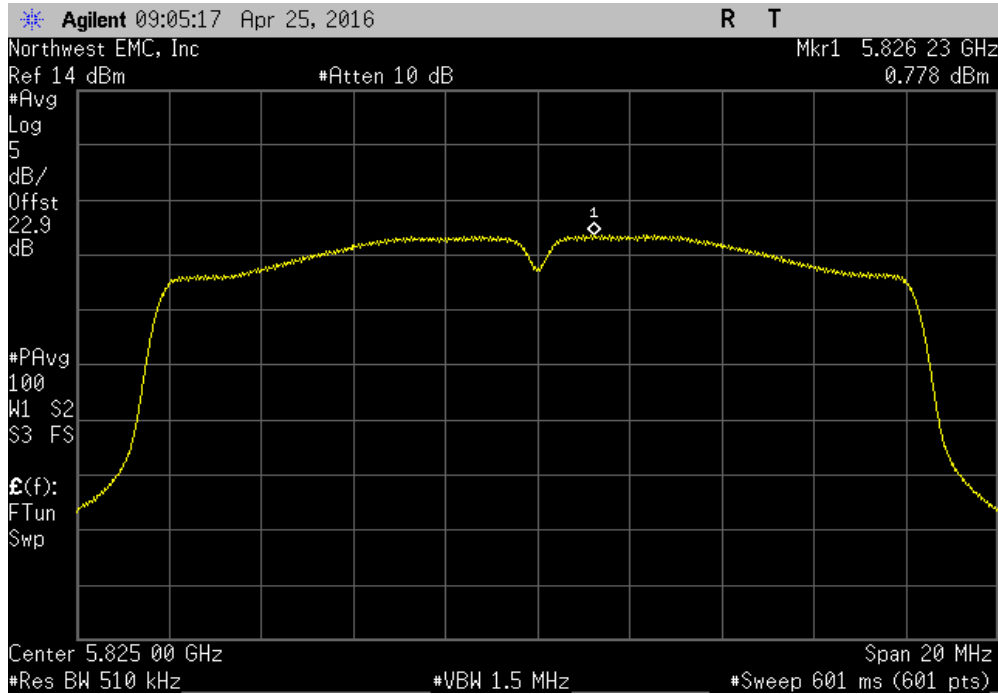


5725 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(n) MCS7						
Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit ε (dBm / Ref BW)	Results		
-10.4	8.7	-1.7	30	Pass		

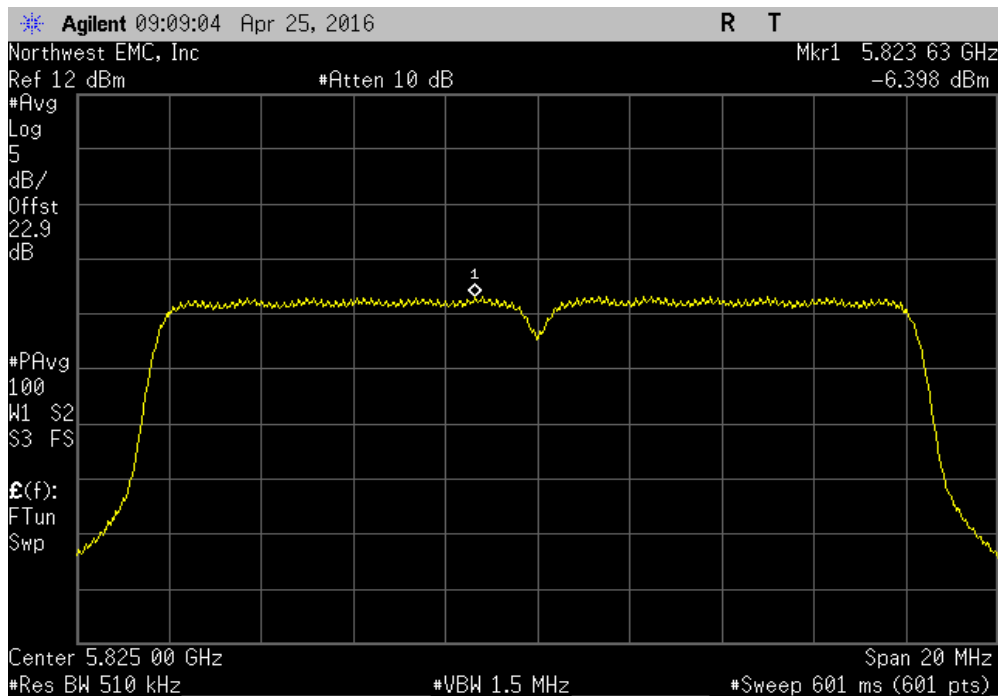


# MAXIMUM POWER SPECTRAL DENSITY

5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(a) 6 Mbps						
Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit (dBm / Ref BW)	Results		
0.778	2.4	3.1	30	Pass		

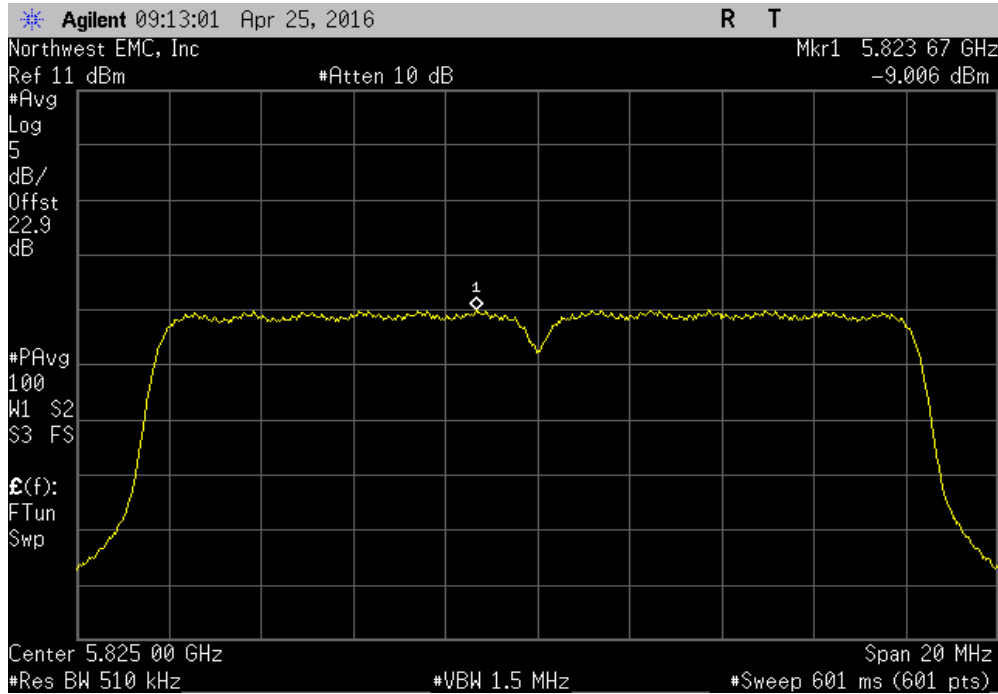


5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(a) 36 Mbps						
Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit (dBm / Ref BW)	Results		
-6.398	7.1	0.7	30	Pass		

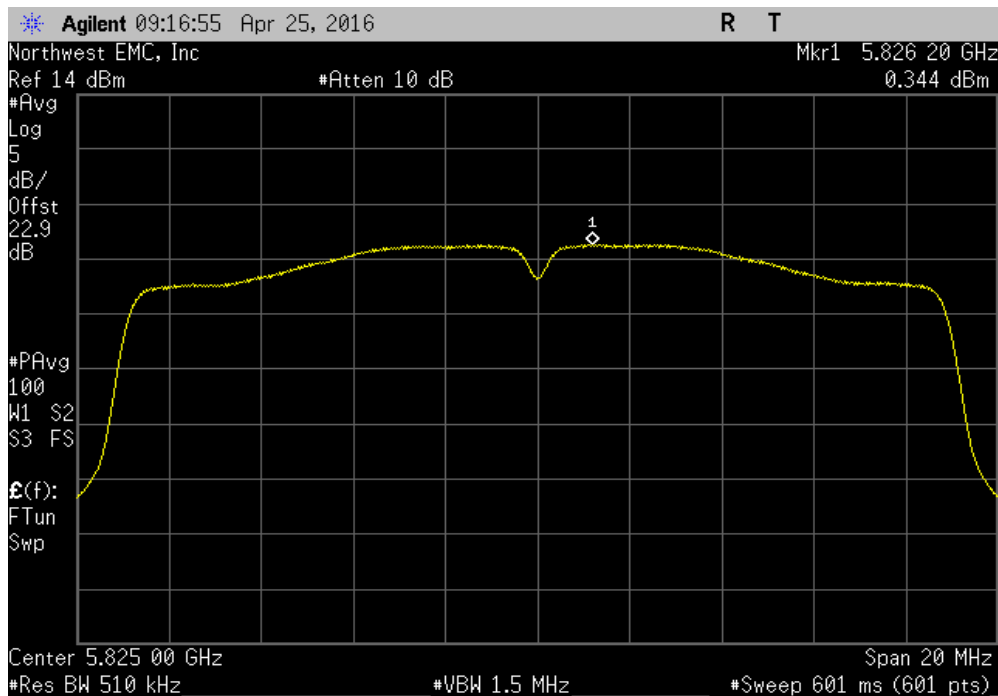


# MAXIMUM POWER SPECTRAL DENSITY

5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(a) 54 Mbps						
Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit (dBm / Ref BW)	Results		
-9.006	8.4	-0.6	30	Pass		

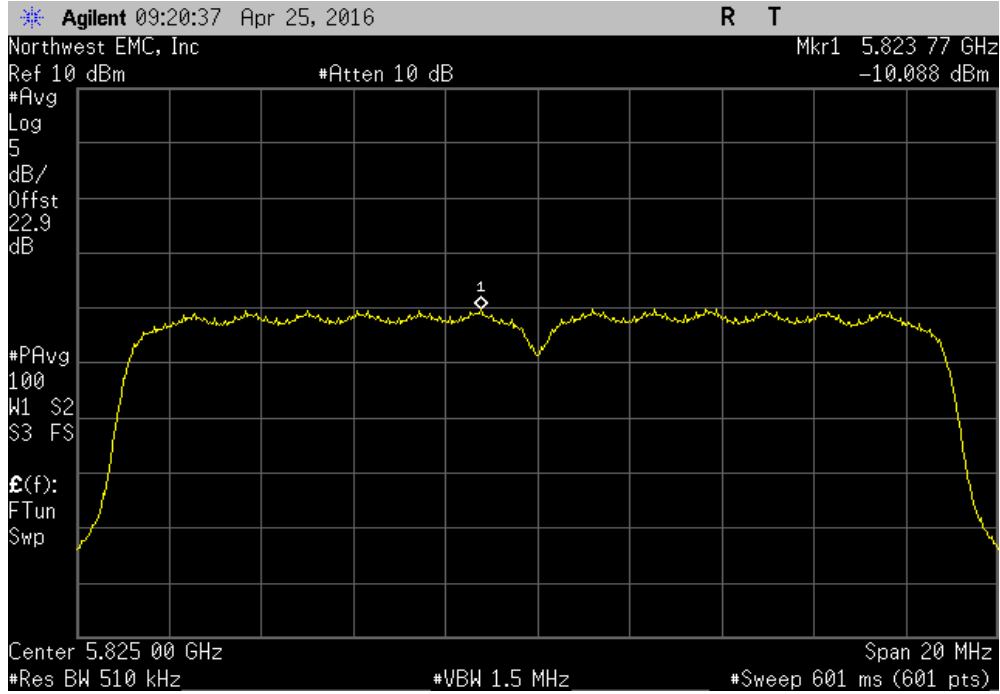


5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(n) MCS0						
Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit (dBm / Ref BW)	Results		
0.344	2.5	2.8	30	Pass		



# MAXIMUM POWER SPECTRAL DENSITY

5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(n) MCS7						
Power (dBm/MHz)	Duty Cycle Factor (dB)	Density (dBm/MHz)	Limit ε (dBm / Ref BW)	Results		
-10.088	8.7	-1.4	30	Pass		





# OCCUPIED BANDWIDTH

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

## TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
Meter - Multimeter	Fluke	117	MLS	1/20/2014	36
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	12

## TEST DESCRIPTION

The transmit frequencies and data rates listed in the datasheet were measured in each band utilized by the radio. The transmit power was set to its default maximum.

A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used. The reference level offset on the spectrum analyzer was adjusted to compensate for cable loss and the external attenuation used between the RF output and the spectrum analyzer input.

Per ANSI C63.10, the spectrum analyzer settings were as follows:

-RBW = 100 kHz

-VBW =  $\geq 3x$  RBW

-Detector = Peak

-Trace mode = max hold


The spectrum analyzer occupied bandwidth measurement function was then used to measure the 6 dB emission bandwidth.

The 99.9% (approximate 26 dB) emission bandwidth (EBW) was also measured at the same time to be used for setting the channel power integration bandwidth during conducted output power testing.

# OCCUPIED BANDWIDTH

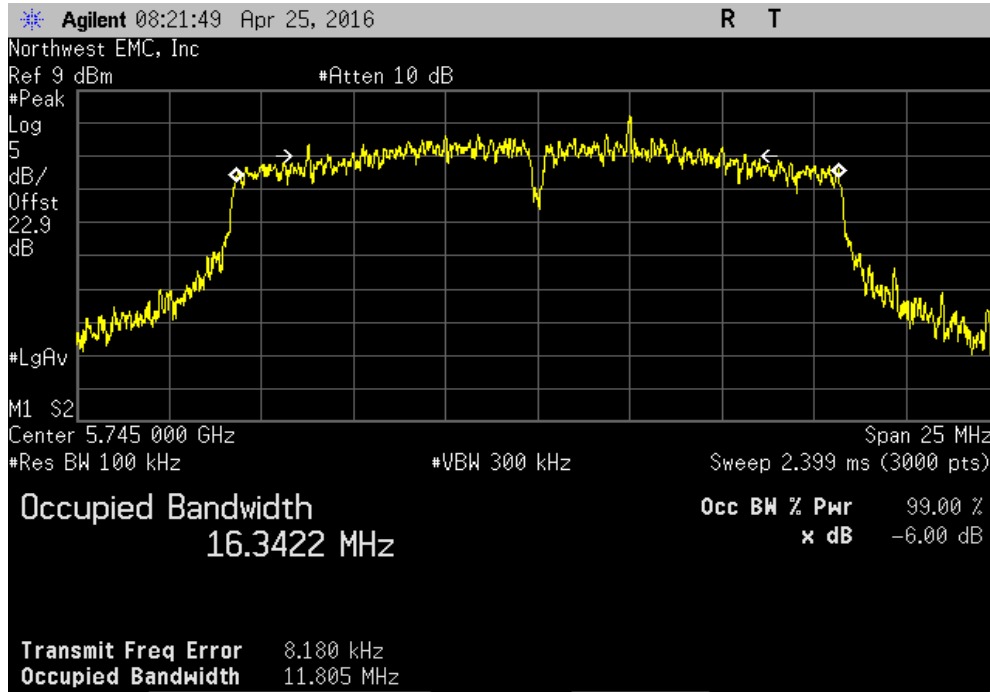


XMR 2015.01.14

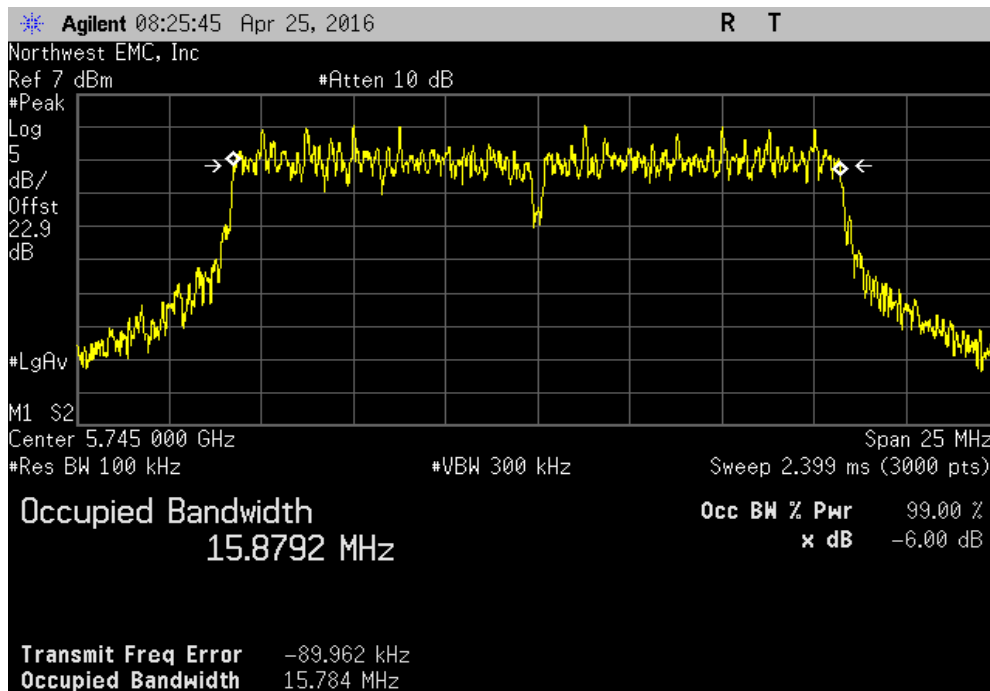
EUT: <b>Torpedo + Wireless -31 SOM</b>		Work Order: <b>LGPD0192</b>	
Serial Number: <b>1415M00058</b>		Date: <b>04/25/16</b>	
Customer: <b>Logic PD</b>		Temperature: <b>23°C</b>	
Attendees: <b>Adam Ford</b>		Humidity: <b>43%</b>	
Project: <b>None</b>		Barometric Pres.: <b>970.5 mbar</b>	
Tested by: <b>Jared Ison</b>	Power: <b>5 VDC</b>	Job Site: <b>MN08</b>	
<b>TEST SPECIFICATIONS</b>			
FCC 15.407:2016		Test Method: <b>ANSI C63.10:2013</b>	
<b>COMMENTS</b>			
None			
<b>DEVIATIONS FROM TEST STANDARD</b>			
None			
Configuration #	1	Signature 	
		Value	Limit (>) Result
<b>5725 - 5825 MHz Band</b>			
<b>Low Channel, Ch 149 - 5745 MHz</b>			
	802.11(a) 6 Mbps	11.805 MHz	500 kHz Pass
	802.11(a) 36 Mbps	15.784 MHz	500 kHz Pass
	802.11(a) 54 Mbps	15.906 MHz	500 kHz Pass
	802.11(n) MCS0	14.407 MHz	500 kHz Pass
	802.11(n) MCS7	16.682 MHz	500 kHz Pass
<b>Mid Channel, Ch 157 - 5785 MHz</b>			
	802.11(a) 6 Mbps	16.295 MHz	500 kHz Pass
	802.11(a) 36 Mbps	16.229 MHz	500 kHz Pass
	802.11(a) 54 Mbps	15.7 MHz	500 kHz Pass
	802.11(n) MCS0	12.226 MHz	500 kHz Pass
	802.11(n) MCS7	17.261 MHz	500 kHz Pass
<b>High Channel, Ch 165 - 5825 MHz</b>			
	802.11(a) 6 Mbps	16.242 MHz	500 kHz Pass
	802.11(a) 36 Mbps	15.881 MHz	500 kHz Pass
	802.11(a) 54 Mbps	16.029 MHz	500 kHz Pass
	802.11(n) MCS0	14.229 MHz	500 kHz Pass
	802.11(n) MCS7	16.735 MHz	500 kHz Pass

# OCCUPIED BANDWIDTH

5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 6 Mbps						
				Value	Limit	Result
				11.805 MHz	500 kHz	Pass

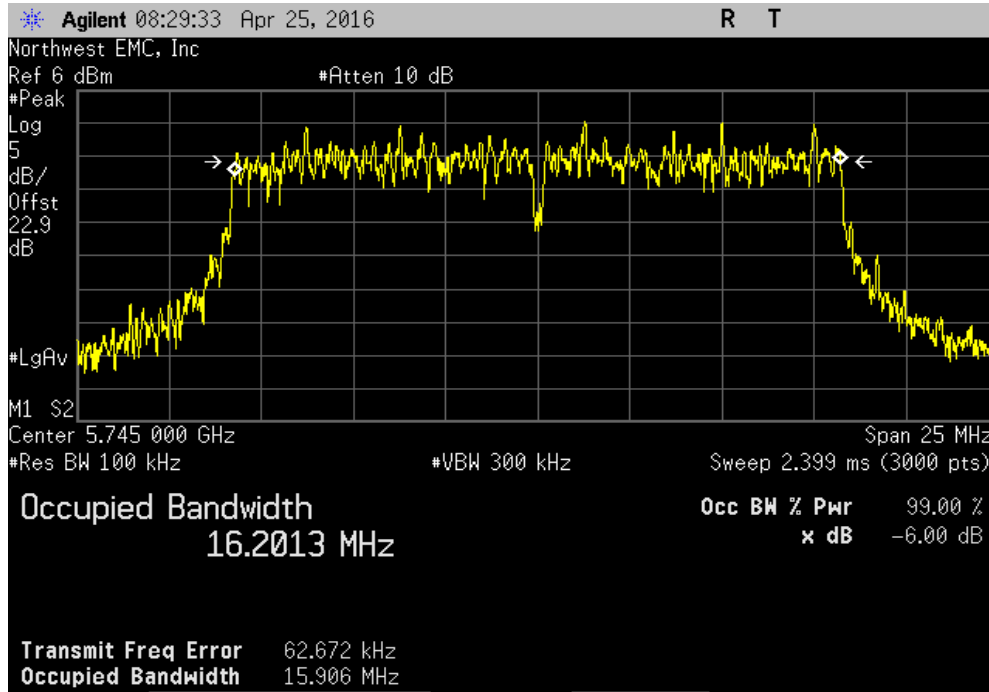


5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 36 Mbps						
				Value	Limit	Result
				15.784 MHz	500 kHz	Pass

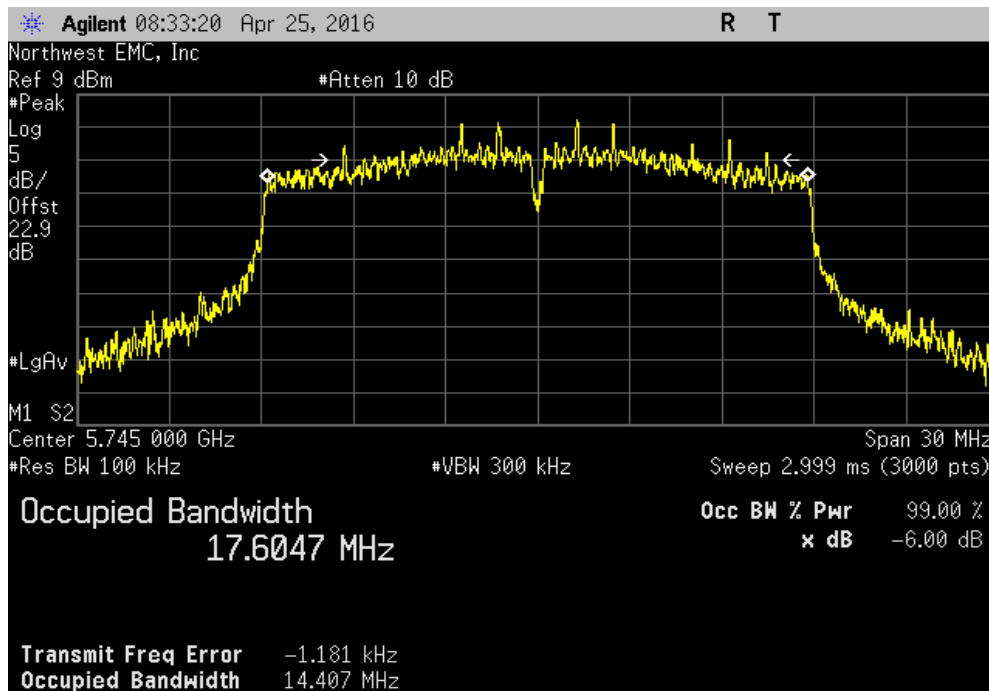


# OCCUPIED BANDWIDTH

5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 54 Mbps						
				Value	Limit	Result
					(>)	
				15.906 MHz	500 kHz	Pass

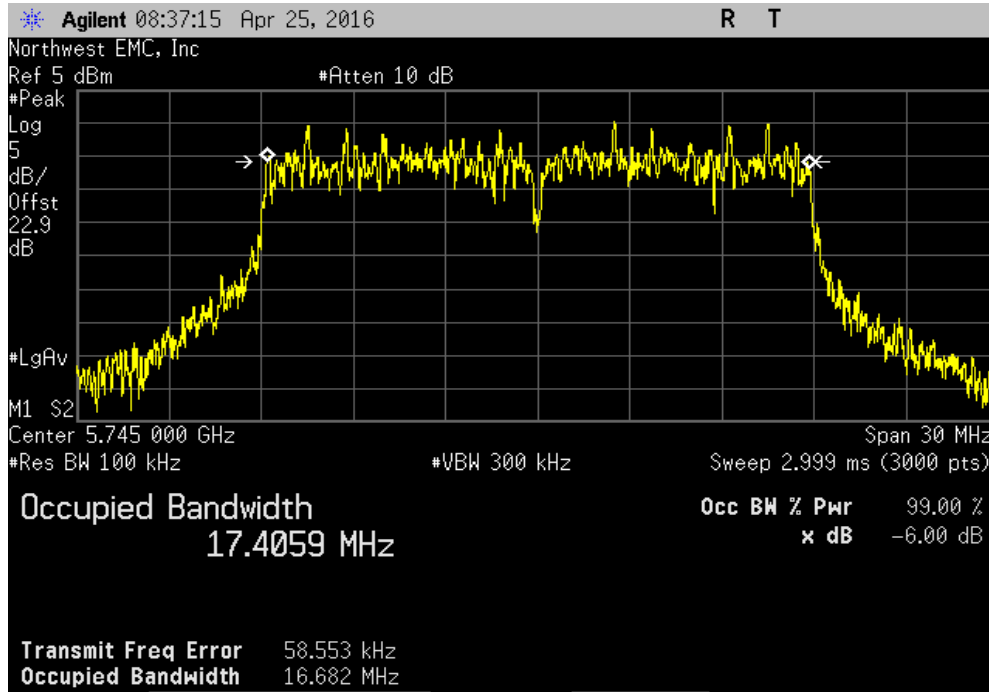


5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(n) MCS0						
				Value	Limit	Result
					(>)	
				14.407 MHz	500 kHz	Pass

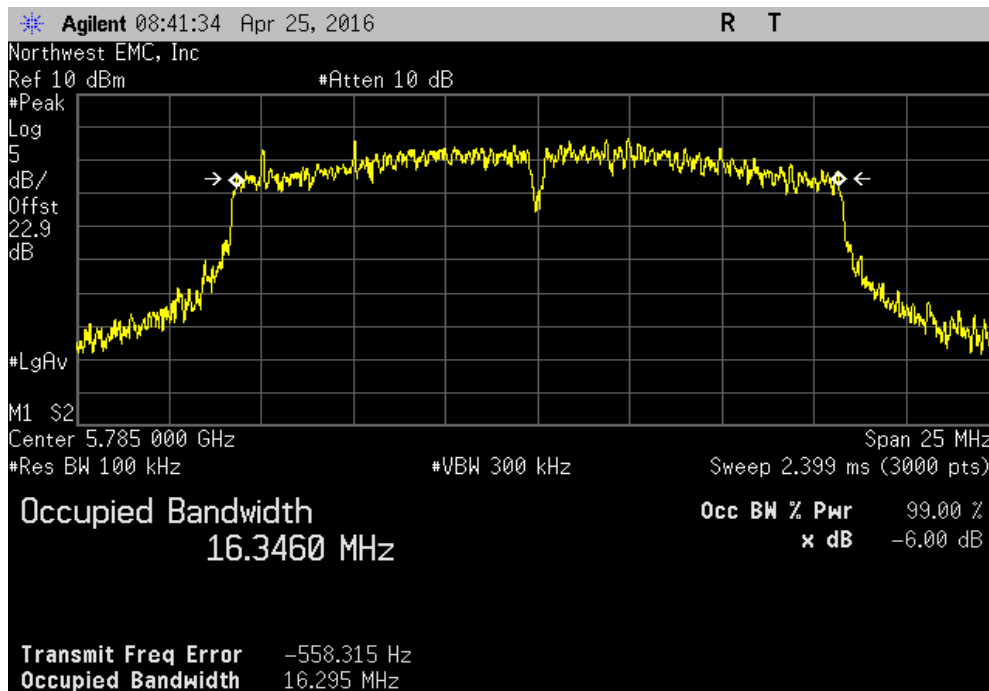


# OCCUPIED BANDWIDTH

5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(n) MCS7						
				Value	Limit	Result
				16.682 MHz	500 kHz	Pass

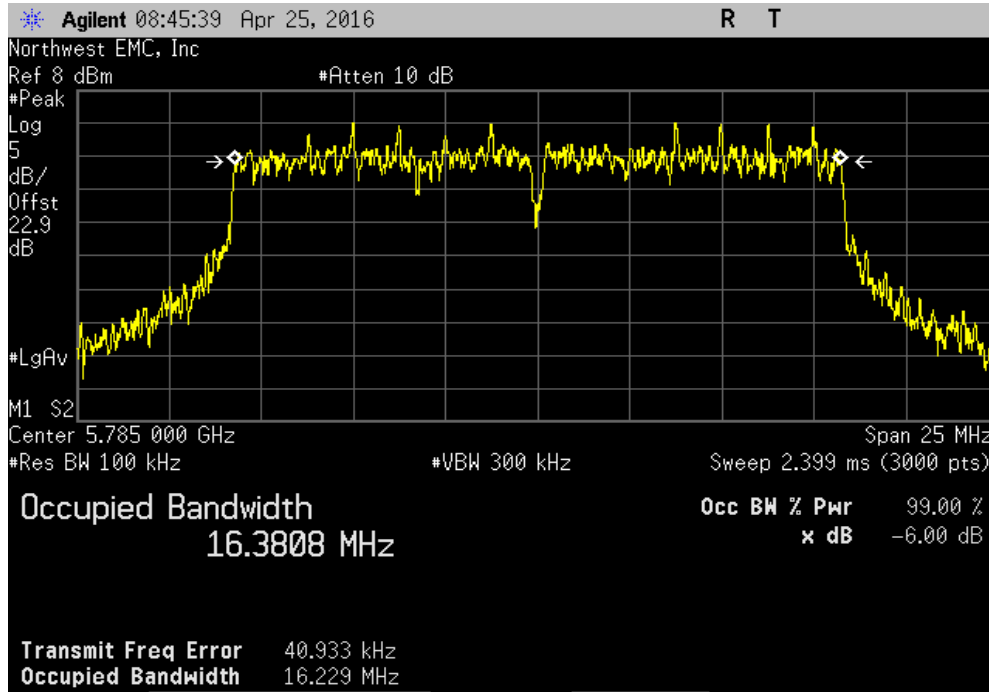


5725 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(a) 6 Mbps						
				Value	Limit	Result
				16.295 MHz	500 kHz	Pass

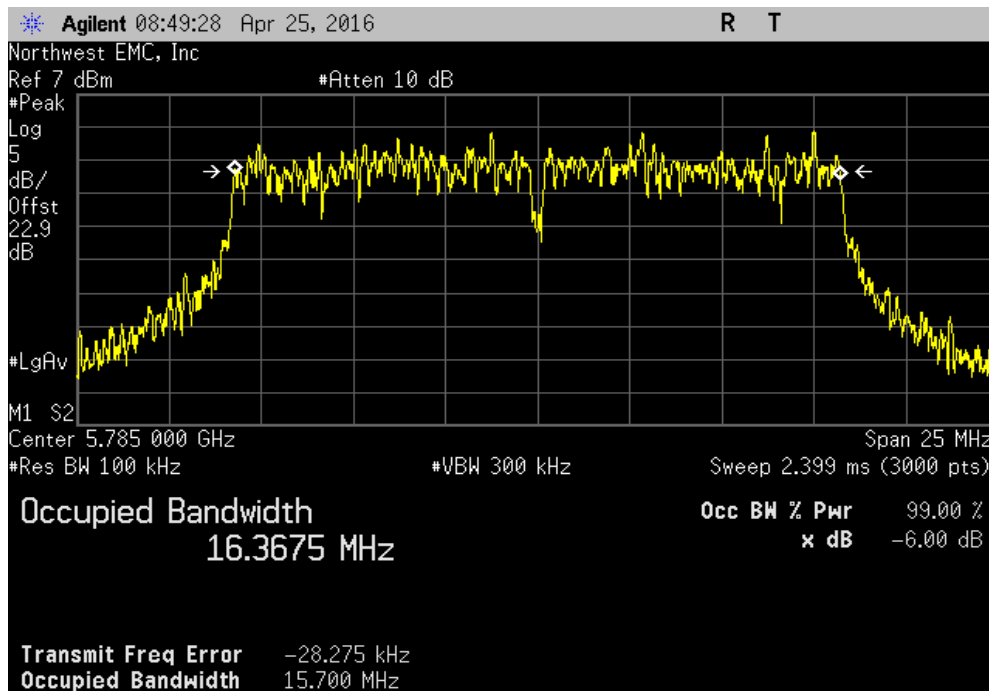


# OCCUPIED BANDWIDTH

5725 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(a) 36 Mbps						
				Value	Limit	Result
				16.229 MHz	500 kHz	Pass

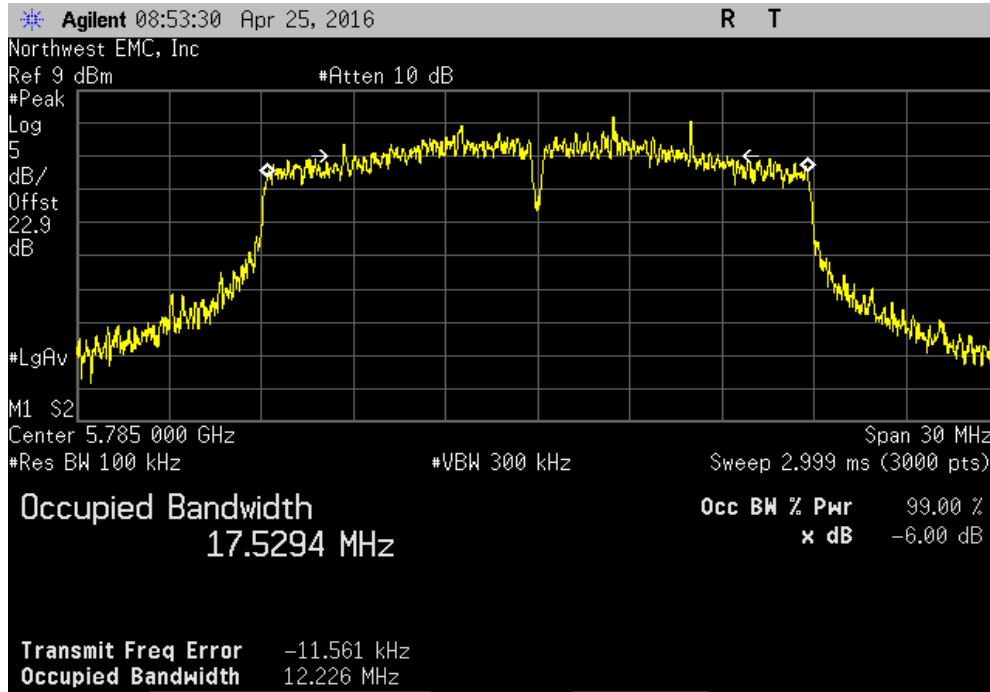


5725 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(a) 54 Mbps						
				Value	Limit	Result
				15.7 MHz	500 kHz	Pass

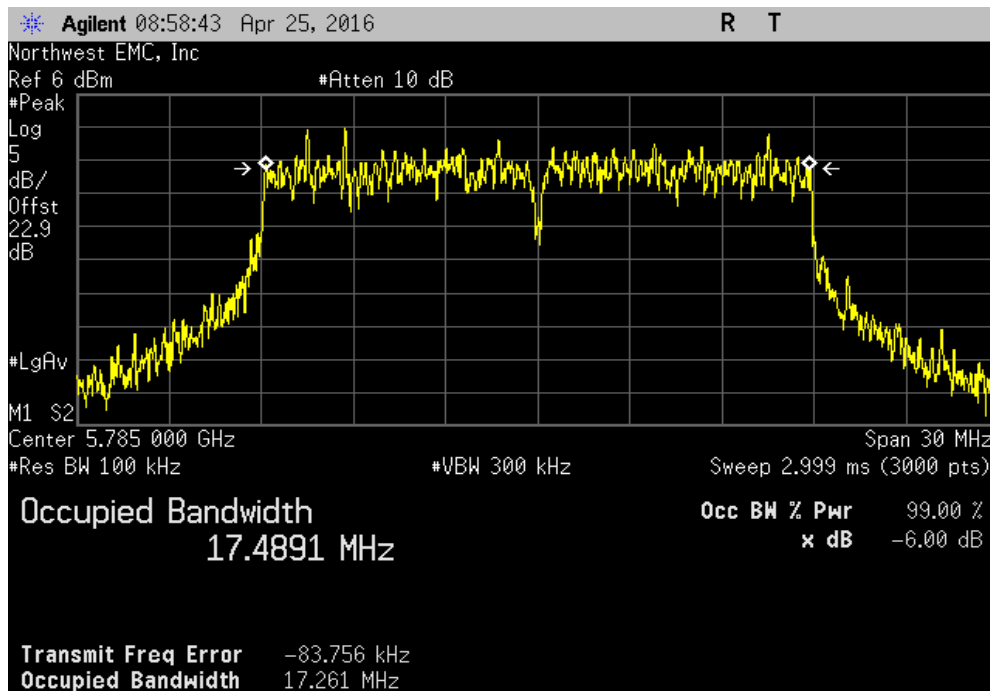


# OCCUPIED BANDWIDTH

5725 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(n) MCS0						
				Value	Limit	Result
				12.226 MHz	500 kHz	Pass

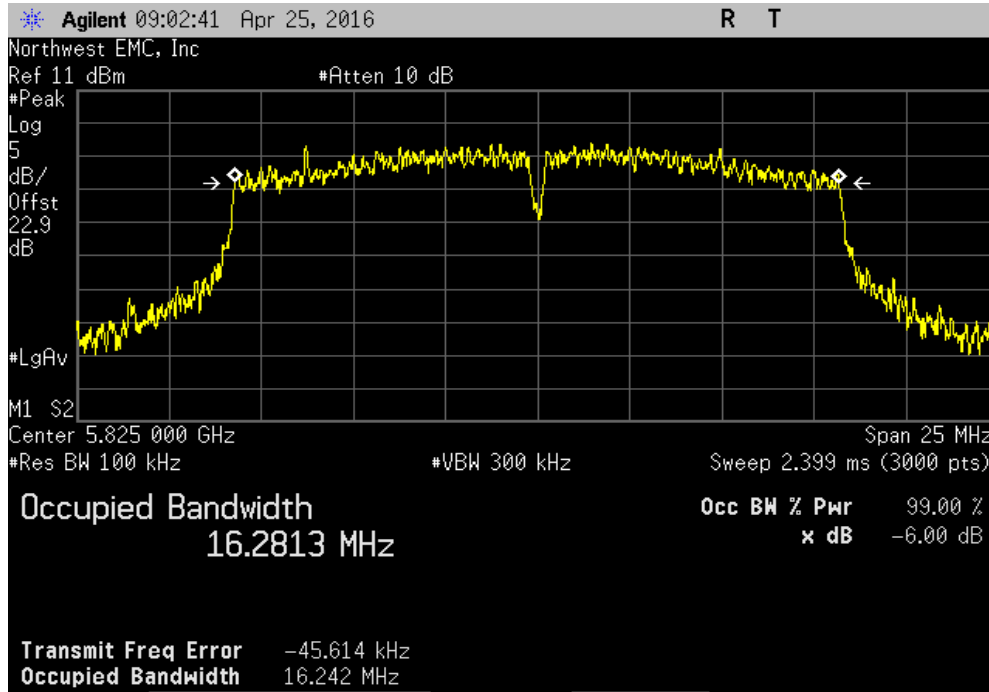


5725 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(n) MCS7						
				Value	Limit	Result
				17.261 MHz	500 kHz	Pass

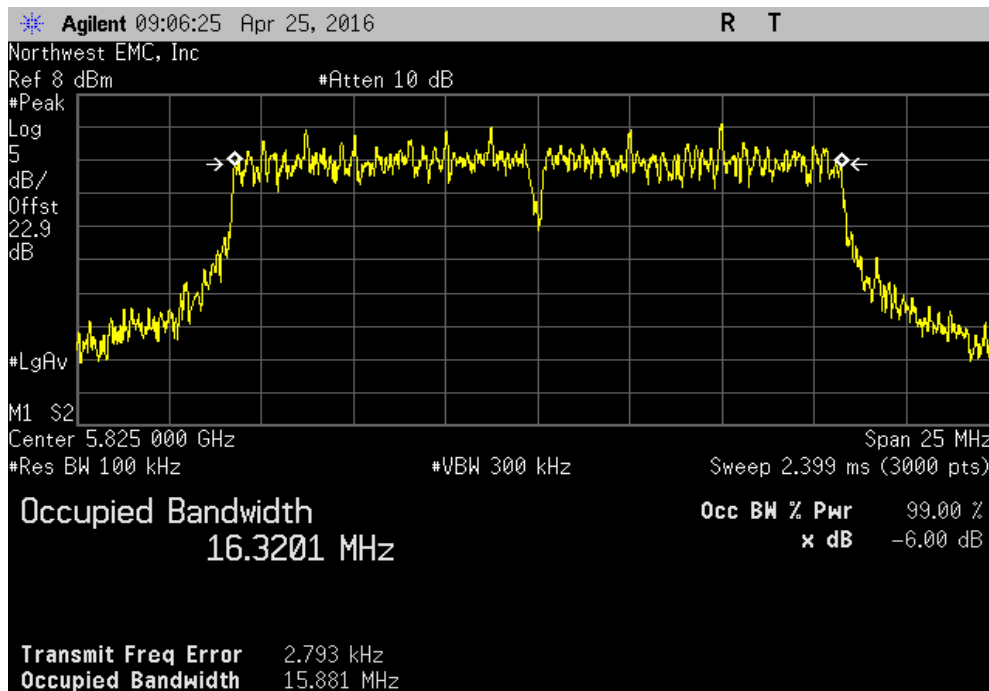


# OCCUPIED BANDWIDTH

5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(a) 6 Mbps			
	Value	Limit (>)	Result
	16.242 MHz	500 kHz	Pass



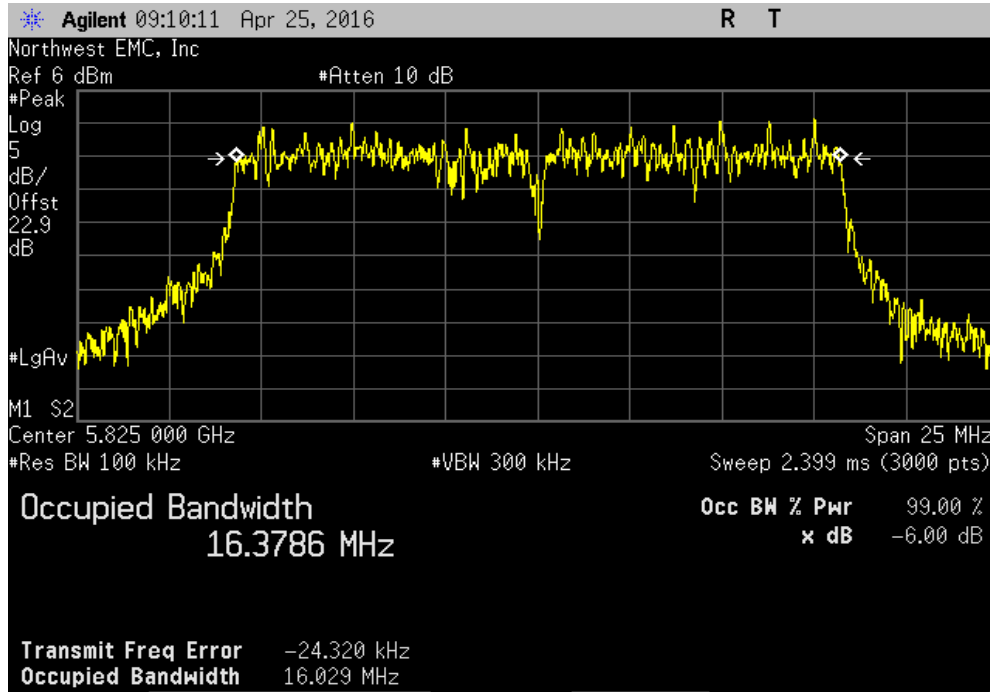
5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(a) 36 Mbps			
	Value	Limit (>)	Result
	15.881 MHz	500 kHz	Pass



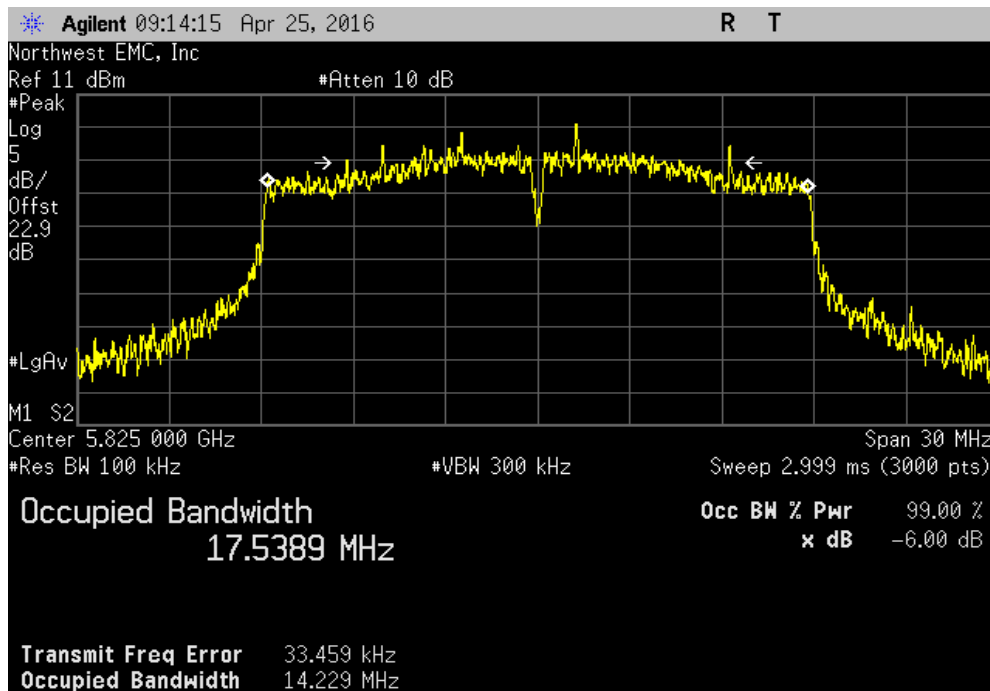


# OCCUPIED BANDWIDTH

5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(a) 54 Mbps						
				Value	Limit	Result
				16.029 MHz	500 kHz	Pass

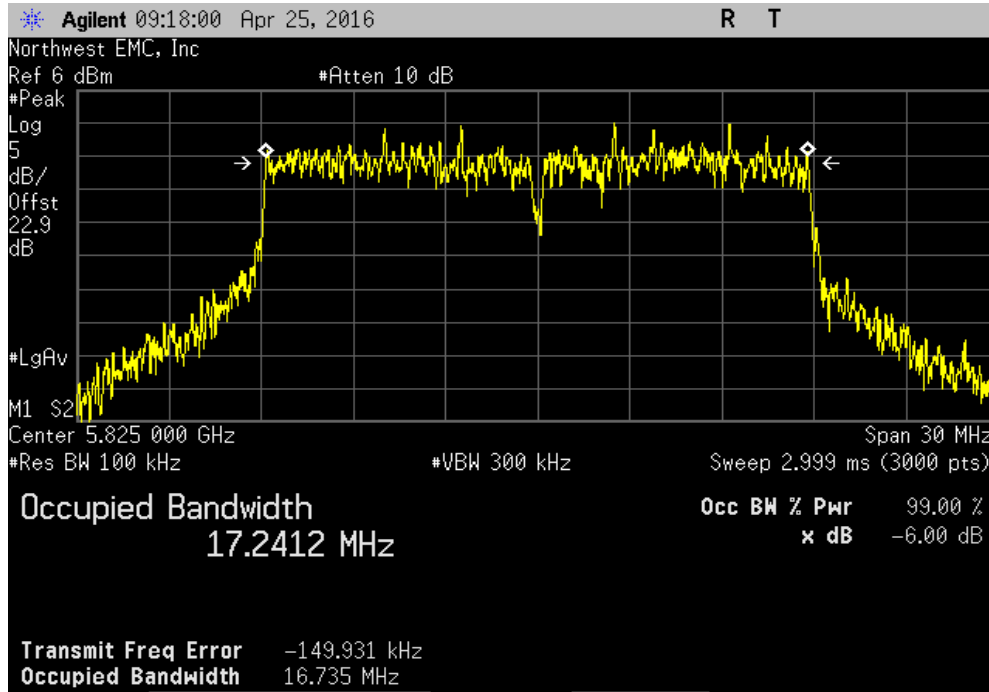


5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(n) MCS0						
				Value	Limit	Result
				14.229 MHz	500 kHz	Pass



# OCCUPIED BANDWIDTH

5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(n) MCS7						
				Value	Limit	Result
				16.735 MHz	500 kHz	Pass



# BAND EDGE

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

## TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
Meter - Multimeter	Fluke	117	MLS	1/20/2014	36
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	12

## TEST DESCRIPTION

The 99% occupied bandwidth of the carrier was measured to ensure that no part of the emission of the carrier operating in a non-DFS band was operating in a band where DFS testing is required. This test is done with the U-NII-1 band (5.2 GHz band) to ensure no portion of the carrier is contained within the U-NII-2A band and with the U-NII-3 band (5.8 GHz band) to ensure no portion of the carrier is contained in the U-NII-2C band.


The transmit frequencies and data rates listed in the datasheet were measured. The transmit power was set to its default maximum.

A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used. The reference level offset on the spectrum analyzer was adjusted to compensate for cable loss and the external attenuation used between the RF output and the spectrum analyzer input.

# BAND EDGE

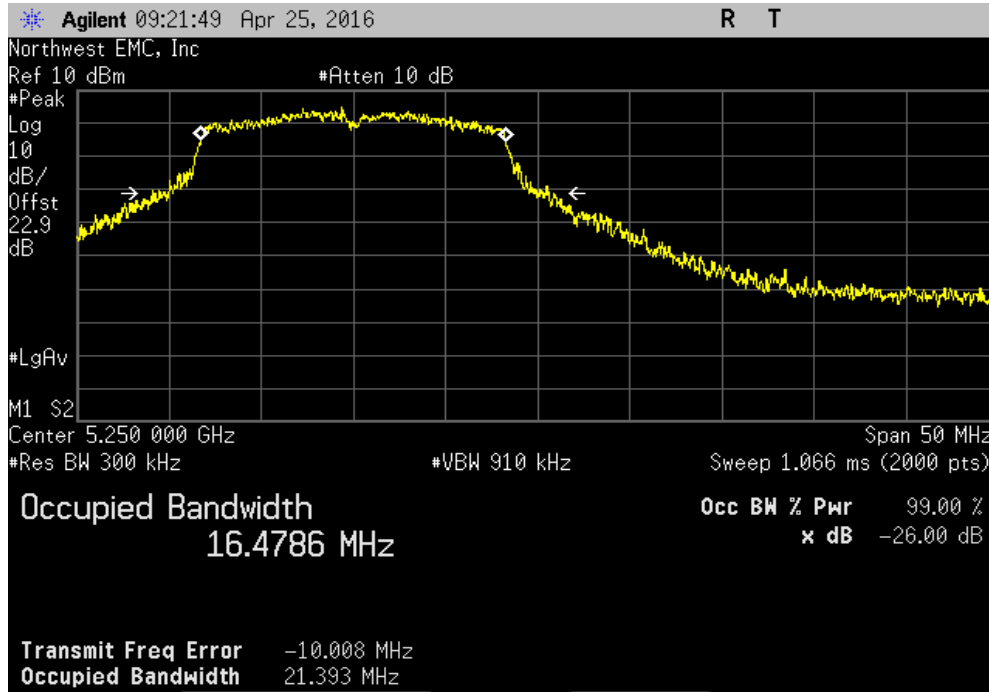


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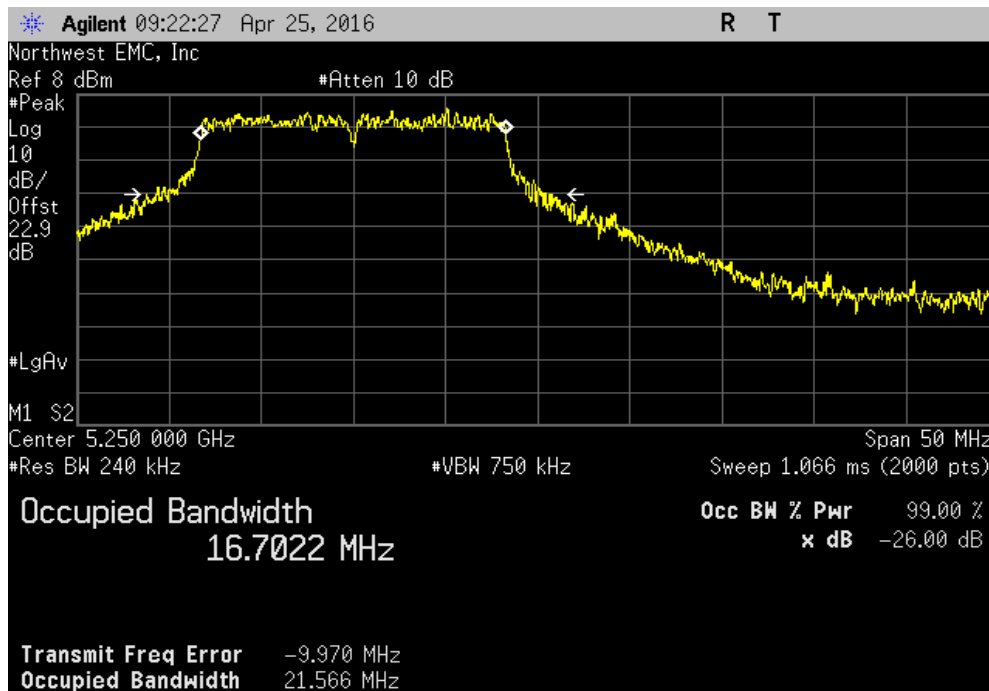
EUT: <b>Torpedo + Wireless -31 SOM</b>		Work Order: <b>LGPD0192</b>		
Serial Number: <b>1415M00058</b>		Date: <b>04/25/16</b>		
Customer: <b>Logic PD</b>		Temperature: <b>23°C</b>		
Attendees: <b>Adam Ford</b>		Humidity: <b>43%</b>		
Project: <b>None</b>		Barometric Pres.: <b>970.5 mbar</b>		
Tested by: <b>Jared Ison</b>	Power: <b>5 VDC</b>	Job Site: <b>MN08</b>		
TEST SPECIFICATIONS		Test Method		
FCC 15.407:2016		ANSI C63.10:2013		
COMMENTS				
None				
DEVIATIONS FROM TEST STANDARD				
None				
Configuration #	1	Signature 		
		OBW Within Band	Band Edge (MHz)	Result
5150 - 5250 MHz Band				
High Channel, Ch 48 - 5240 MHz				
	802.11(a) 6 Mbps	Yes	5250	Pass
	802.11(a) 36 Mbps	Yes	5250	Pass
	802.11(a) 54 Mbps	Yes	5250	Pass
	802.11(n) MCS0	Yes	5250	Pass
	802.11(n) MCS7	Yes	5250	Pass
5725 - 5825 MHz Band				
Low Channel, Ch 149 - 5745 MHz				
	802.11(a) 6 Mbps	Yes	5725	Pass
	802.11(a) 36 Mbps	Yes	5725	Pass
	802.11(a) 54 Mbps	Yes	5725	Pass
	802.11(n) MCS0	Yes	5725	Pass
	802.11(n) MCS7	Yes	5725	Pass

# BAND EDGE

5150 - 5250 MHz Band, High Channel, Ch 48 - 5240 MHz, 802.11(a) 6 Mbps			
	OBW Within Band	Band Edge (MHz)	Result
	Yes	5250	Pass

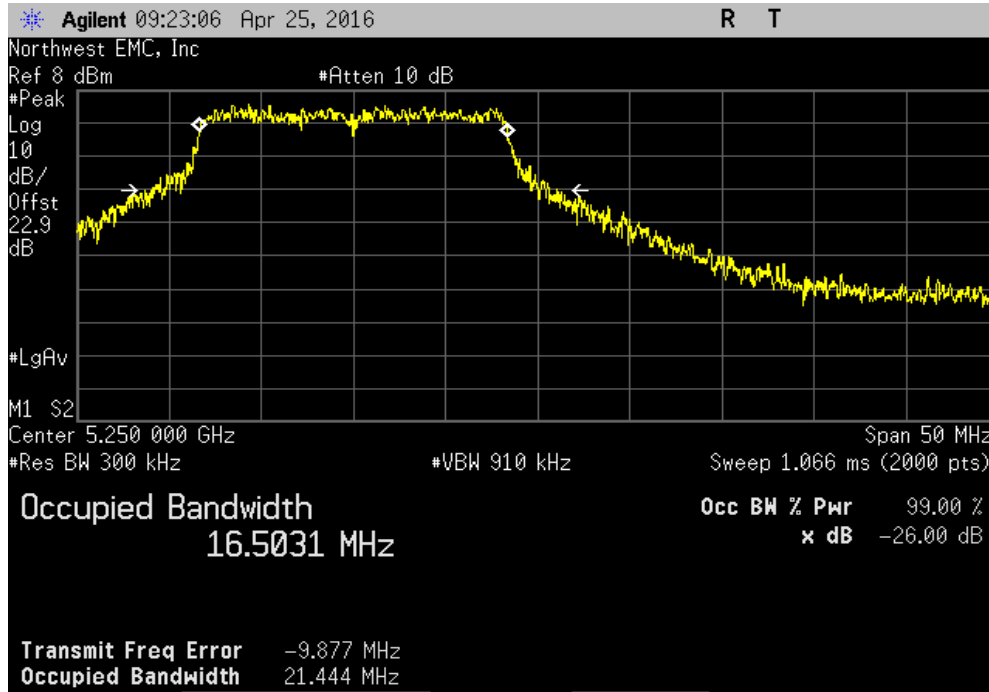


5150 - 5250 MHz Band, High Channel, Ch 48 - 5240 MHz, 802.11(a) 36 Mbps			
	OBW Within Band	Band Edge (MHz)	Result
	Yes	5250	Pass

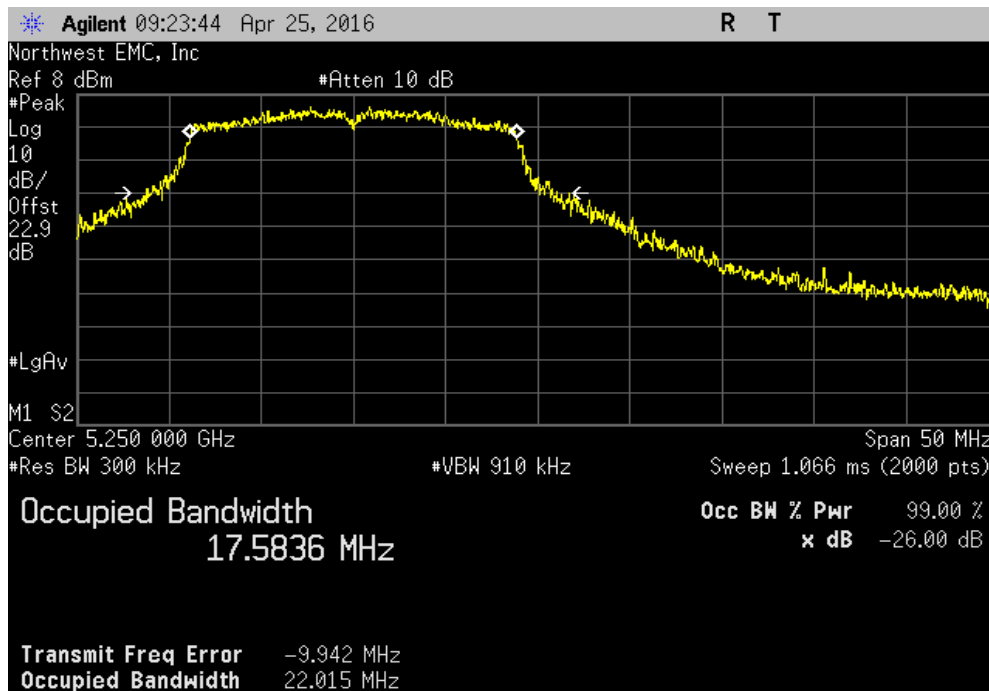


# BAND EDGE

5150 - 5250 MHz Band, High Channel, Ch 48 - 5240 MHz, 802.11(a) 54 Mbps			
	OBW Within Band	Band Edge (MHz)	Result
	Yes	5250	Pass

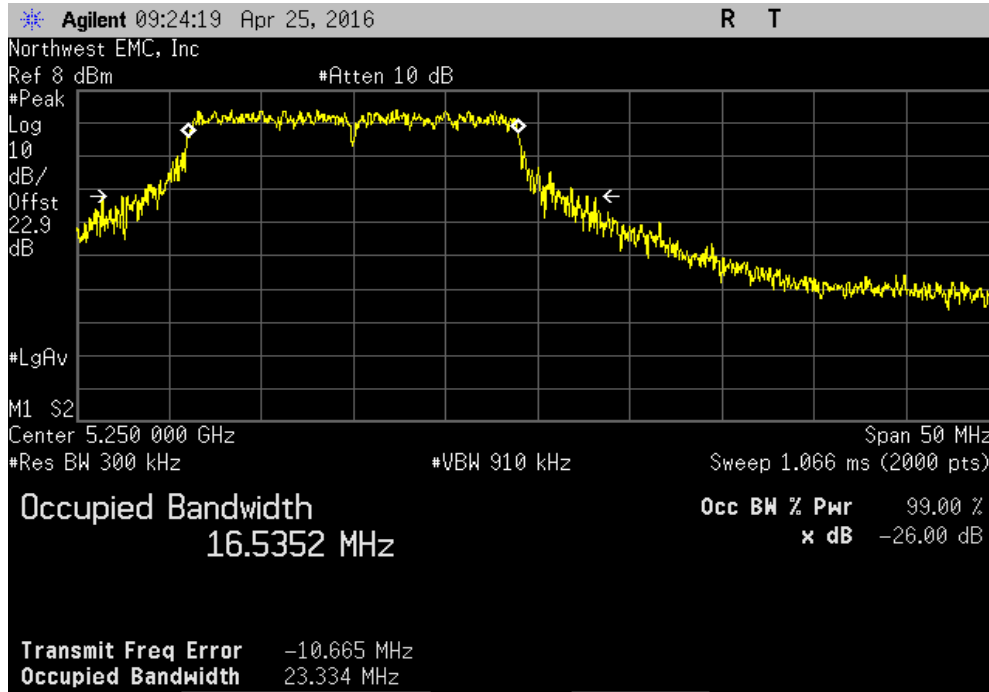


5150 - 5250 MHz Band, High Channel, Ch 48 - 5240 MHz, 802.11(n) MCS0			
	OBW Within Band	Band Edge (MHz)	Result
	Yes	5250	Pass

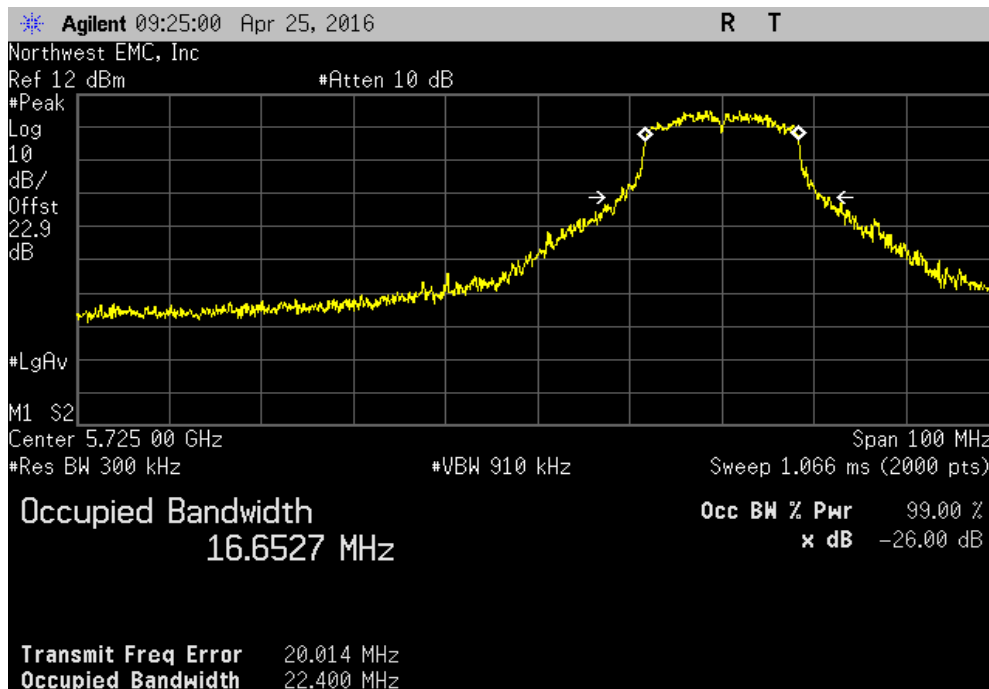


# BAND EDGE

5150 - 5250 MHz Band, High Channel, Ch 48 - 5240 MHz, 802.11(n) MCS7						
	OBW	Band Edge				
	Within Band	(MHz)	Result			
	Yes	5250	Pass			

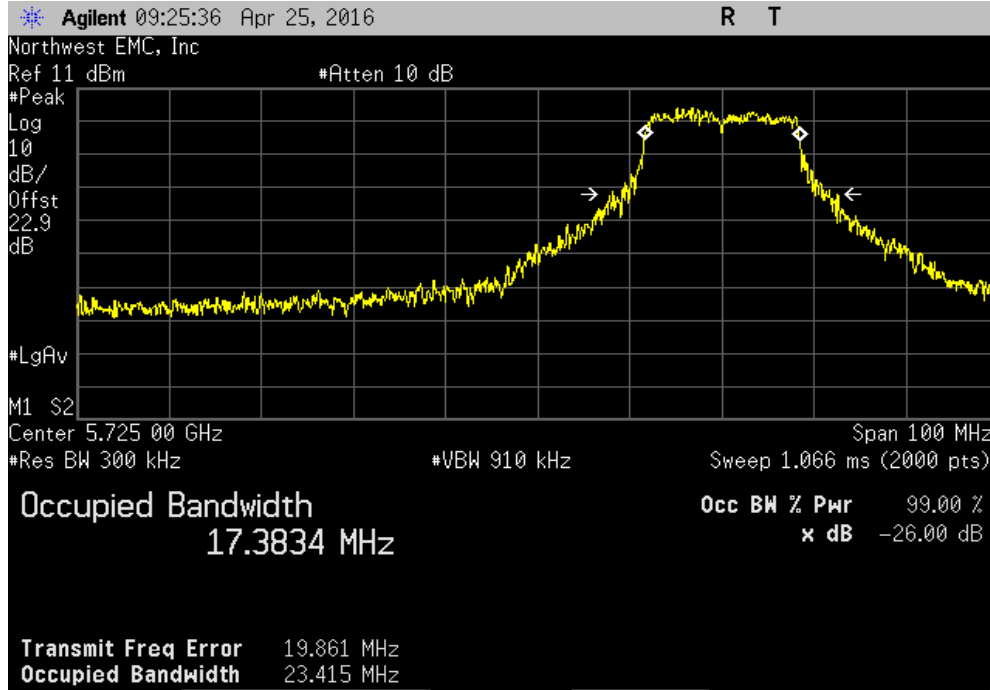


5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 6 Mbps						
	OBW	Band Edge				
	Within Band	(MHz)	Result			
	Yes	5725	Pass			

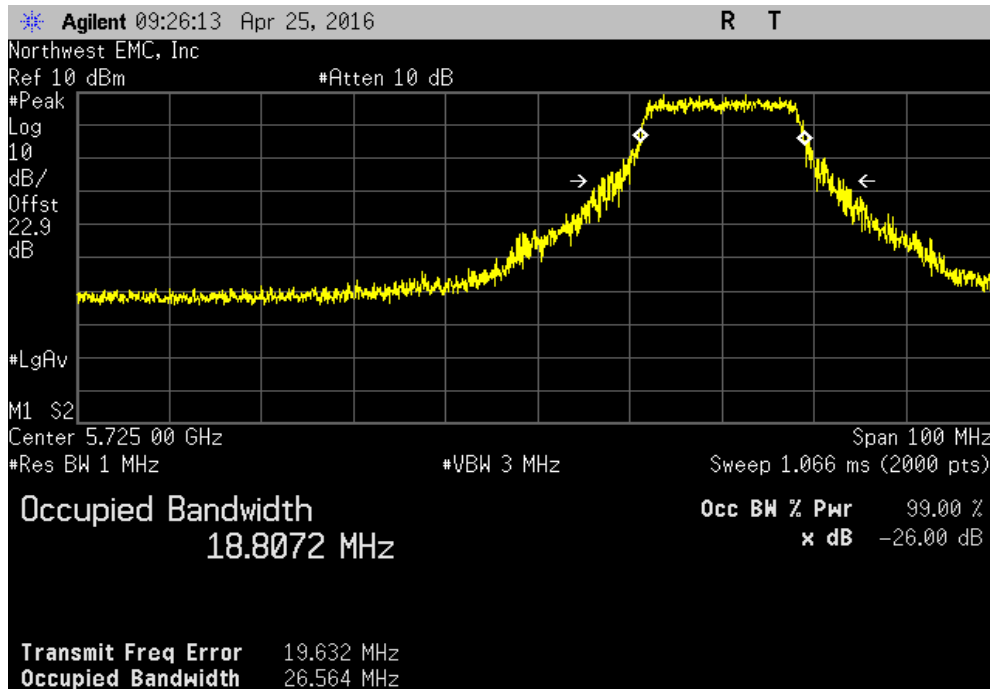


# BAND EDGE

5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 36 Mbps						
				OBW Within Band	Band Edge (MHz)	Result
				Yes	5725	Pass



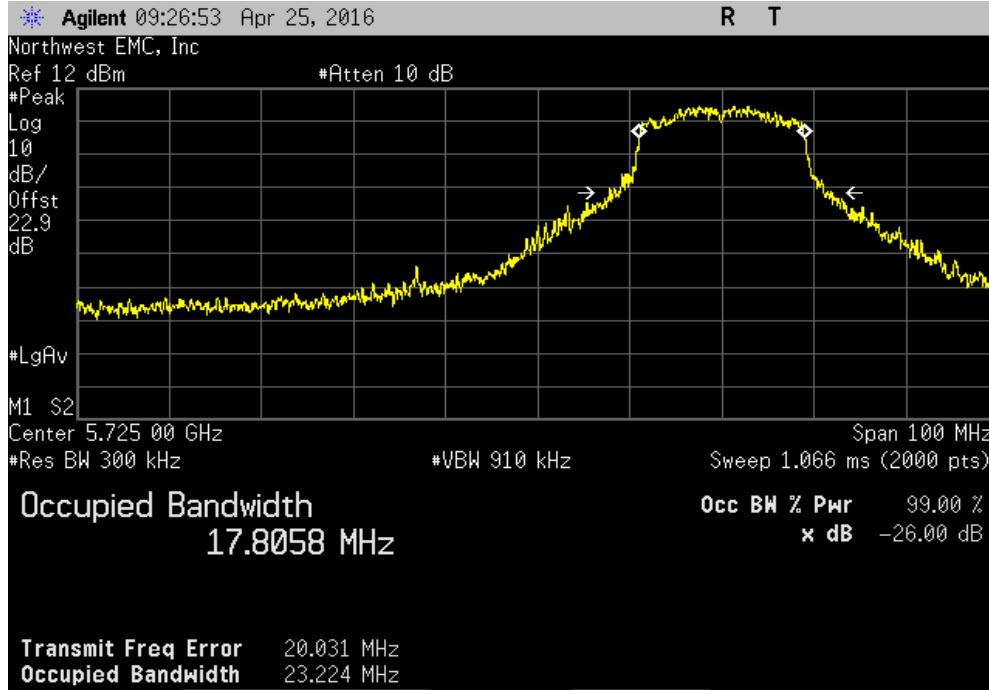
5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 54 Mbps						
				OBW Within Band	Band Edge (MHz)	Result
				Yes	5725	Pass



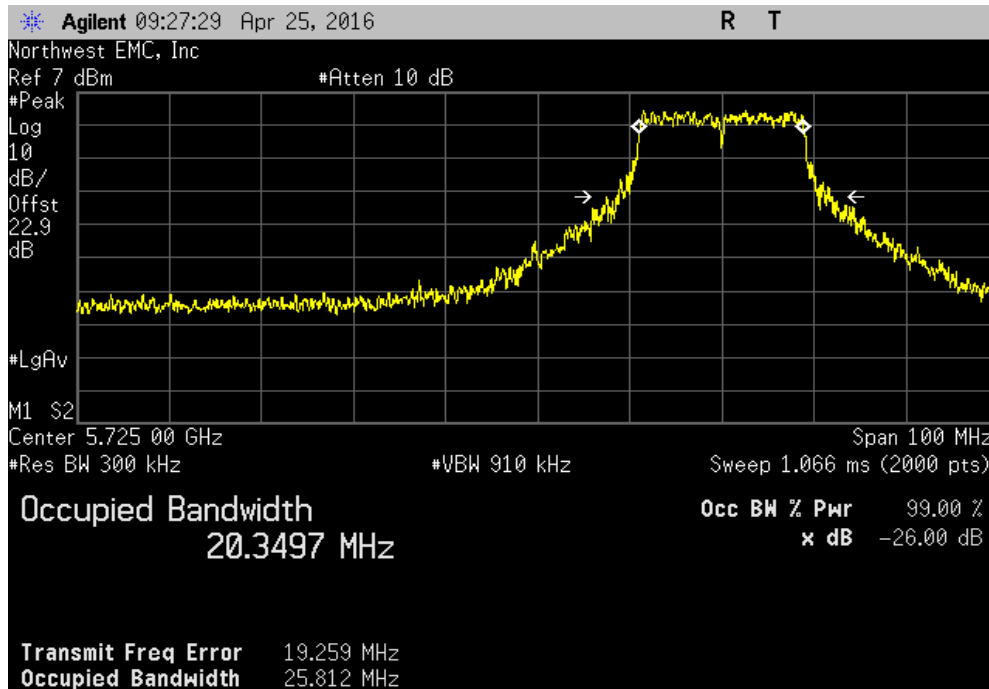


# BAND EDGE

5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(n) MCS0						
				OBW Within Band	Band Edge (MHz)	Result
				Yes	5725	Pass



5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(n) MCS7						
				OBW Within Band	Band Edge (MHz)	Result
				Yes	5725	Pass



# MAXIMUM CONDUCTED OUTPUT POWER

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

## TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Meter - Multimeter	Fluke	117	MLS	1/20/2014	36
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	12

## TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum. The radio was operated in the modes as shown in the following data sheets.

A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used. The reference level offset on the spectrum analyzer was adjusted to compensate for cable loss and the external attenuation used between the RF output and the spectrum analyzer.

Prior to measuring maximum transmit power, the emission bandwidth (B) and the transmission pulse duration (T) were measured. The method of measuring the emission bandwidth and the associated data are found elsewhere in this test report. The transmission pulse duration (T) was measured using a zero span on the spectrum analyzer to see the pulses in the time domain.

The maximum conducted output power was measured using ANSI C63.10, Method SA-2 (RMS detection and trace averaging across the on and off times of the EUT transmission and use of a duty cycle correction factor).

The spectrum analyzer settings were set per the guidance as well as the following specifics:


- RMS Detector
- Trace average 100 traces in power averaging mode.
- Power was integrated across "B", by using the channel power function of the analyzer.

A duty cycle correction factor was added to the measurement using the results of the formula of  $10 \cdot \text{LOG}(1/D)$  where D is the duty cycle.

# MAXIMUM CONDUCTED OUTPUT POWER

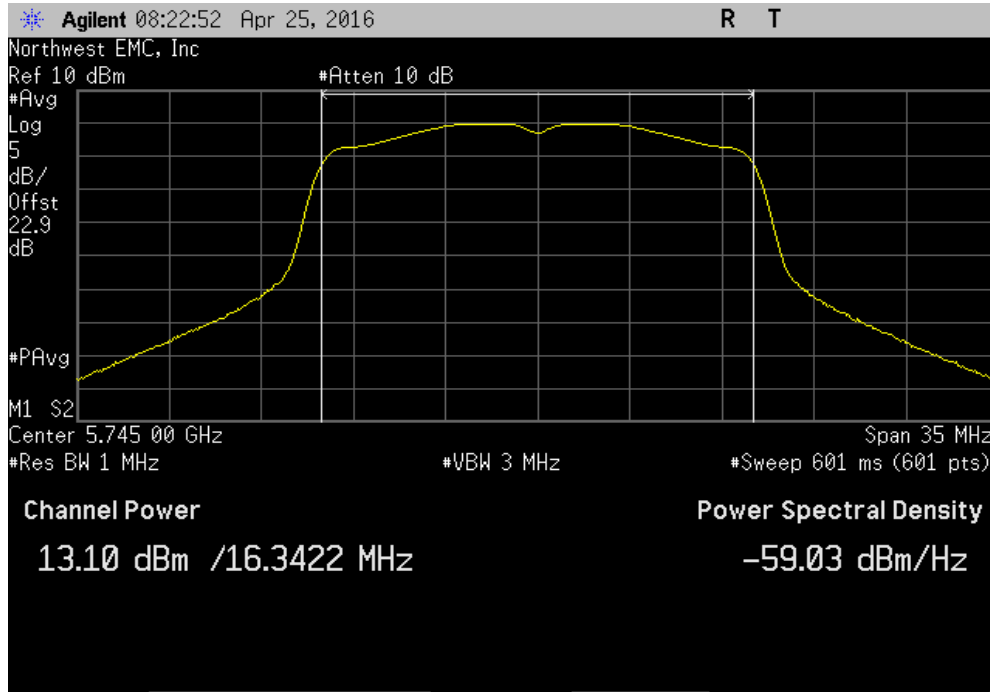


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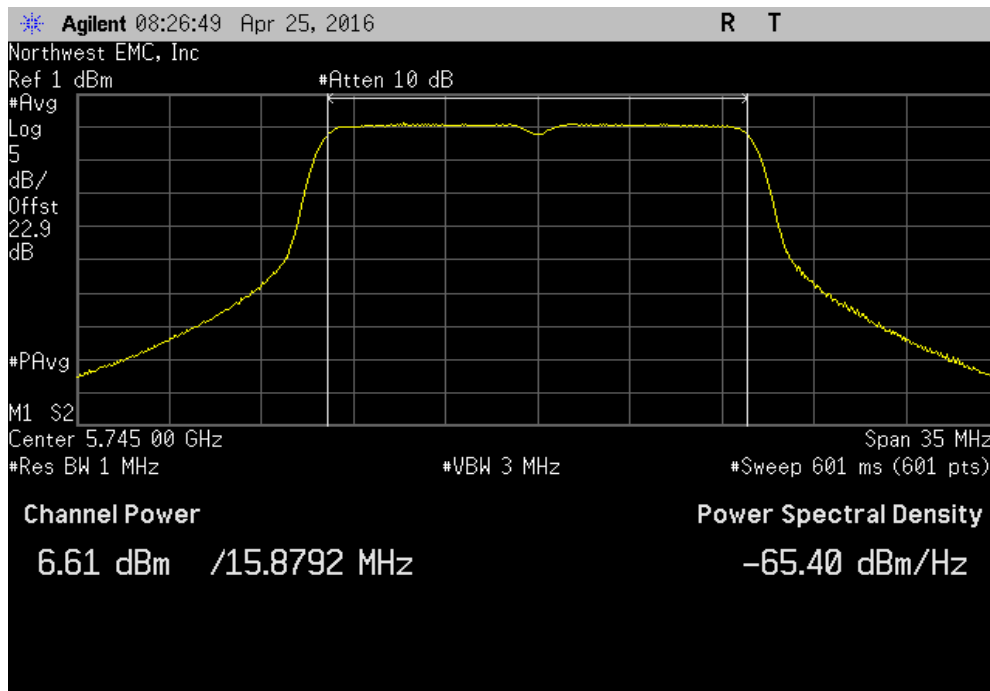
EUT: <b>Torpedo + Wireless -31 SOM</b>		Work Order: <b>LGPD0192</b>				
Serial Number: <b>1415M00058</b>		Date: <b>04/25/16</b>				
Customer: <b>Logic PD</b>		Temperature: <b>23°C</b>				
Attendees: <b>Adam Ford</b>		Humidity: <b>43%</b>				
Project: <b>None</b>		Barometric Pres.: <b>970.5 mbar</b>				
Tested by: <b>Jared Ison</b>		Power: <b>5 VDC</b>				
Job Site: <b>MN08</b>						
<b>TEST SPECIFICATIONS</b>						
FCC 15.407:2016		Test Method: <b>ANSI C63.10:2013</b>				
<b>COMMENTS</b>						
Using the channel and modulation combination that produced the highest output power, a measurement was captured using original Peak detector method in order to match verified power against the original grant.						
<b>DEVIATIONS FROM TEST STANDARD</b>						
None						
Configuration #	1	Signature 				
		Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results
<b>5725 - 5825 MHz Band</b>						
Low Channel, Ch 149 - 5745 MHz						
	802.11(a) 6 Mbps	13.1	2.3	15.4	30	Pass
	802.11(a) 36 Mbps	6.612	7.1	13.7	30	Pass
	802.11(a) 54 Mbps	4.134	8.4	12.5	30	Pass
	802.11(n) MCS0	12.906	2.5	15.4	30	Pass
	802.11(n) MCS7	2.982	8.7	11.6	30	Pass
Mid Channel, Ch 157 - 5785 MHz						
	802.11(a) 6 Mbps	13.726	2.4	16.1	30	Pass
	802.11(a) 36 Mbps	7.414	7.1	14.5	30	Pass
	802.11(a) 54 Mbps	4.709	8.4	13.1	30	Pass
	802.11(n) MCS0	13.515	2.5	16	30	Pass
	802.11(n) MCS7	3.607	8.7	12.3	30	Pass
High Channel, Ch 165 - 5825 MHz						
	802.11(a) 6 Mbps	13.97	2.4	16.3	30	Pass
	802.11(a) 36 Mbps	7.586	7.1	14.7	30	Pass
	802.11(a) 54 Mbps	5.044	8.4	13.4	30	Pass
	802.11(n) MCS0	13.782	2.5	16.3	30	Pass
	802.11(n) MCS7	3.907	8.7	12.6	30	Pass
				Value (dBm)	Limit (dBm)	Results
<b>Peak Detector Method</b>						
	High Channel, Ch 165 - 5825 MHz					
	802.11(n) MCS0			15.37	30	Pass

# MAXIMUM CONDUCTED OUTPUT POWER

5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 6 Mbps					
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results	
13.1	2.3	15.4	30	Pass	

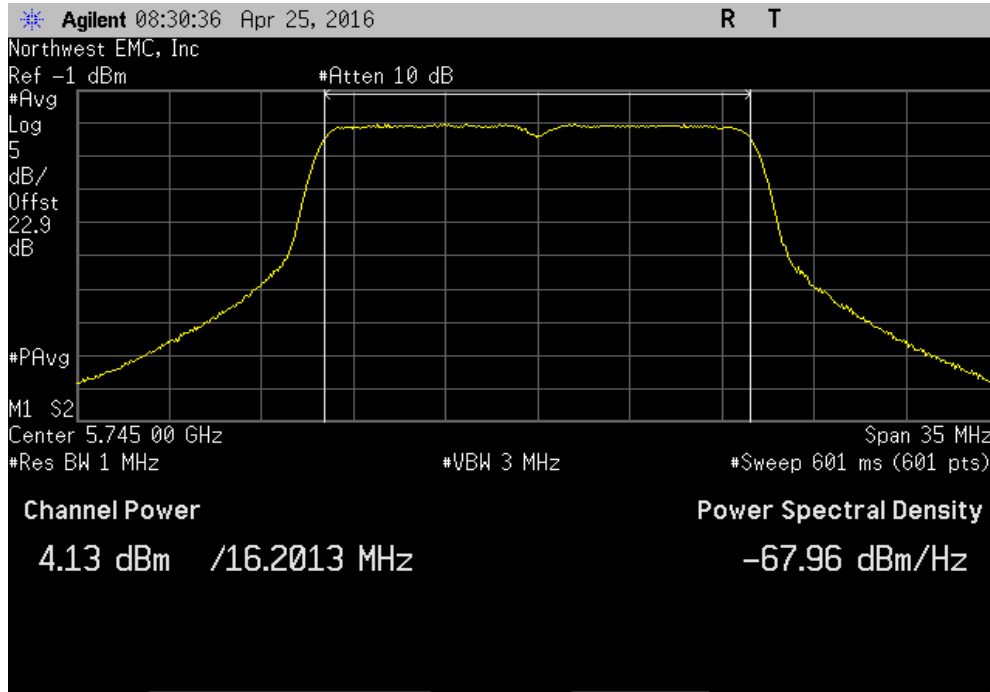


5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 36 Mbps					
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results	
6.612	7.1	13.7	30	Pass	

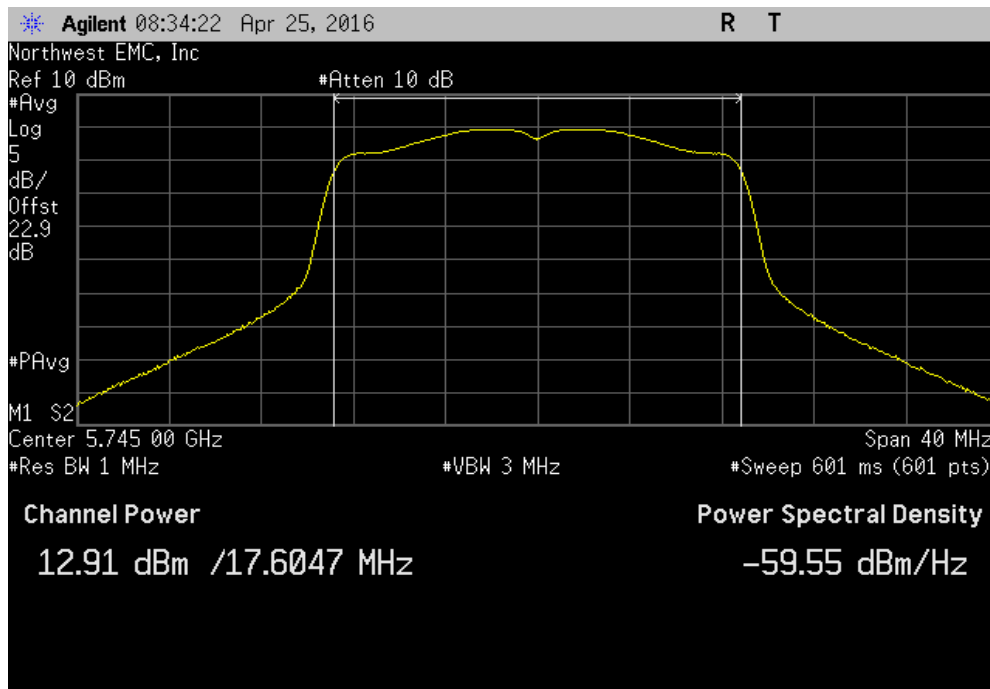


# MAXIMUM CONDUCTED OUTPUT POWER

5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(a) 54 Mbps					
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results	
4.134	8.4	12.5	30	Pass	

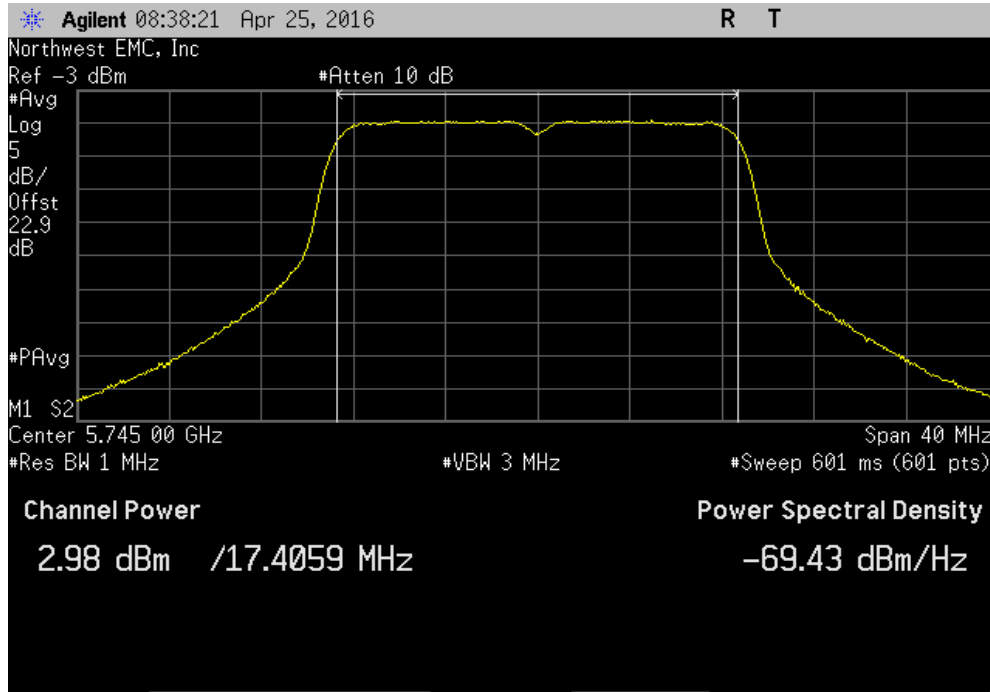


5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(n) MCS0					
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results	
12.906	2.5	15.4	30	Pass	

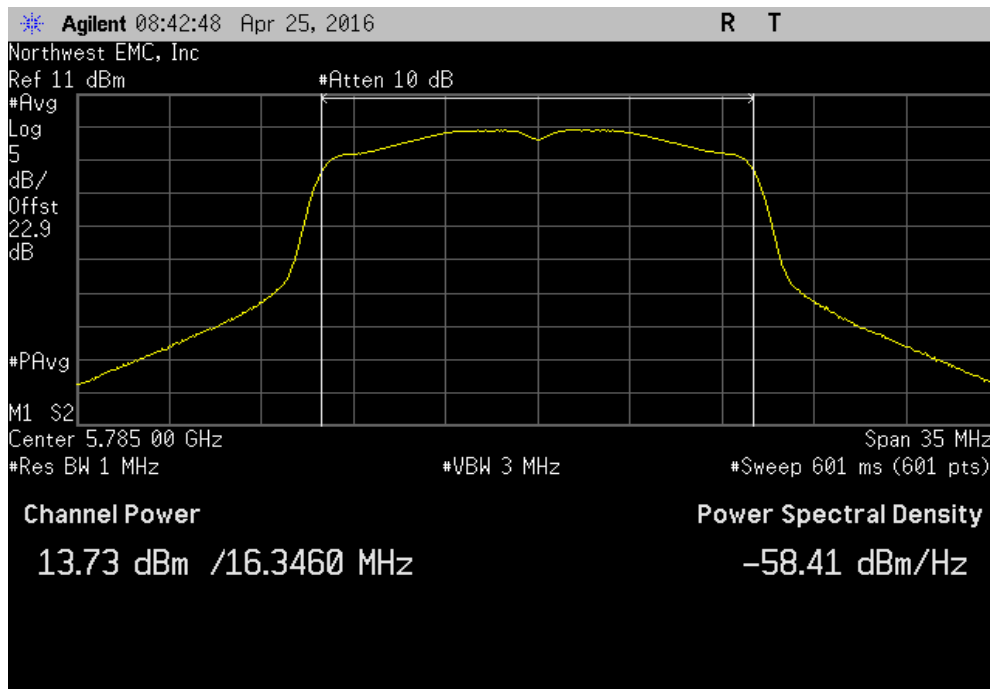


# MAXIMUM CONDUCTED OUTPUT POWER

5725 - 5825 MHz Band, Low Channel, Ch 149 - 5745 MHz, 802.11(n) MCS7					
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results	
2.982	8.7	11.6	30	Pass	

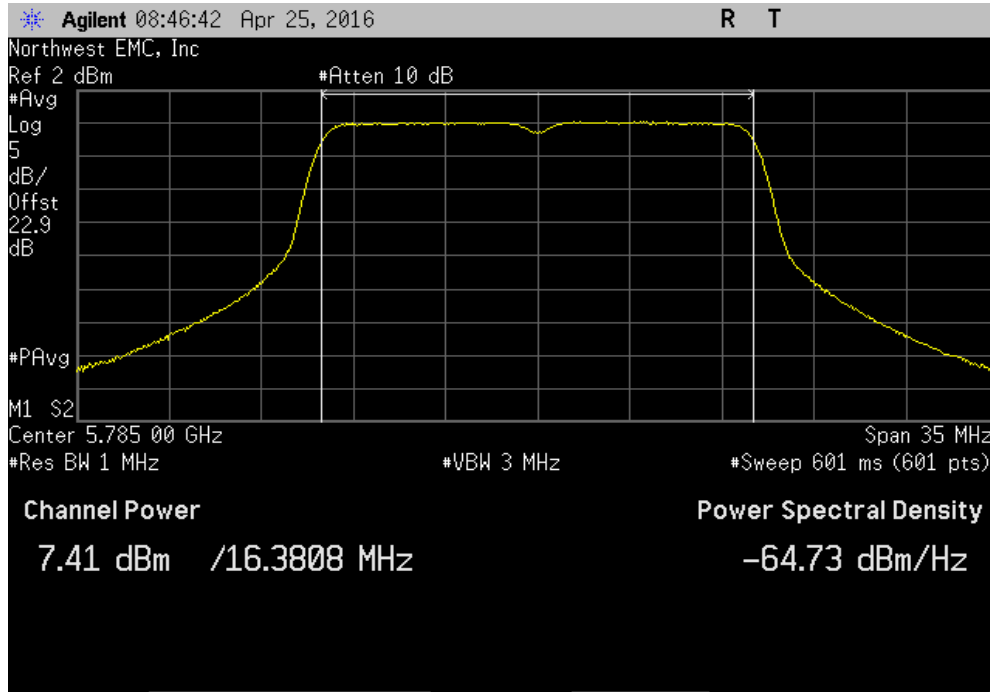


5725 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(a) 6 Mbps					
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results	
13.726	2.4	16.1	30	Pass	

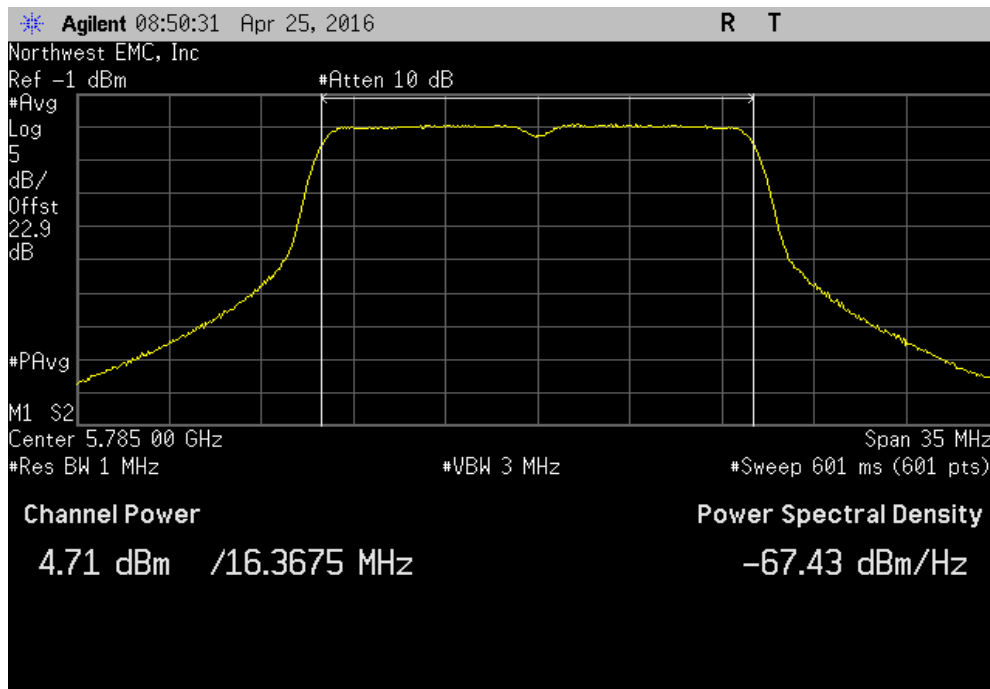


# MAXIMUM CONDUCTED OUTPUT POWER

5725 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(a) 36 Mbps					
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results	
7.414	7.1	14.5	30	Pass	

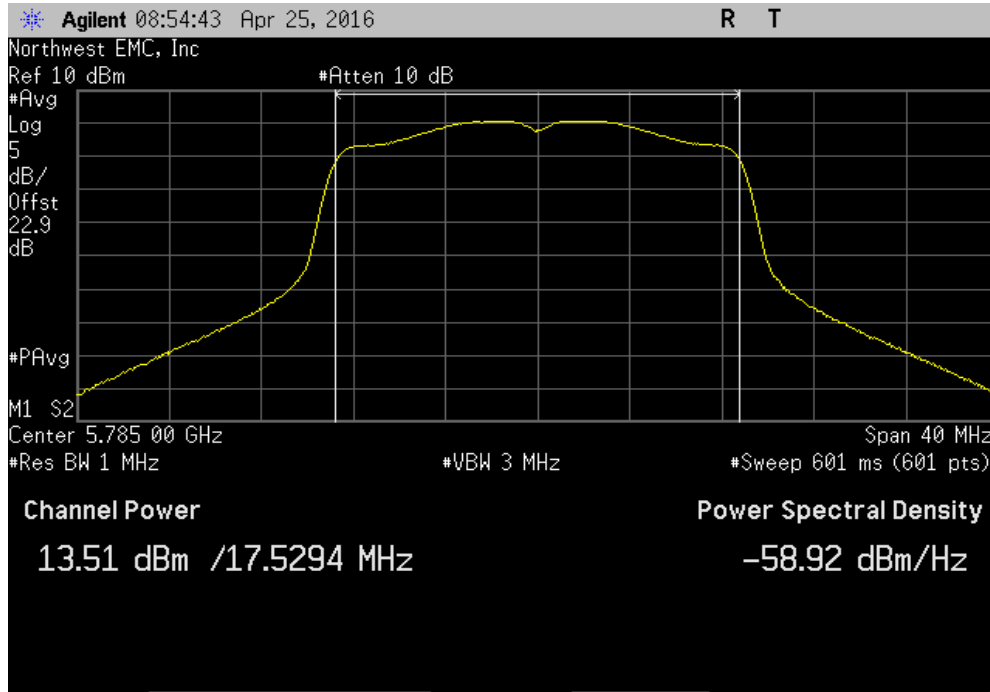


5725 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(a) 54 Mbps					
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results	
4.709	8.4	13.1	30	Pass	

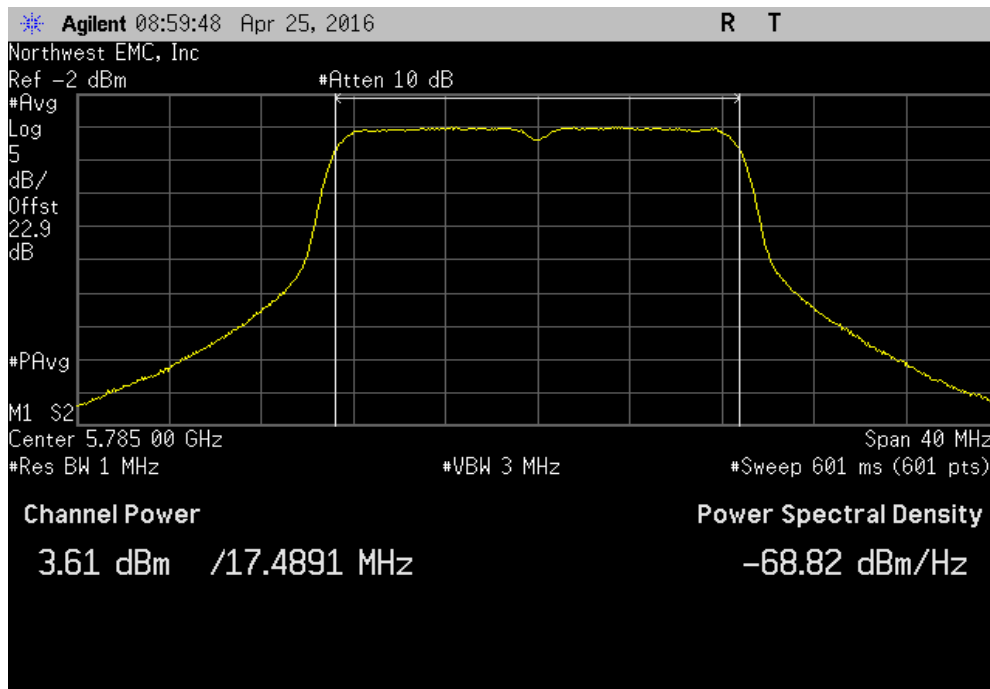


# MAXIMUM CONDUCTED OUTPUT POWER

5725 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(n) MCS0					
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results	
13.515	2.5	16	30	Pass	



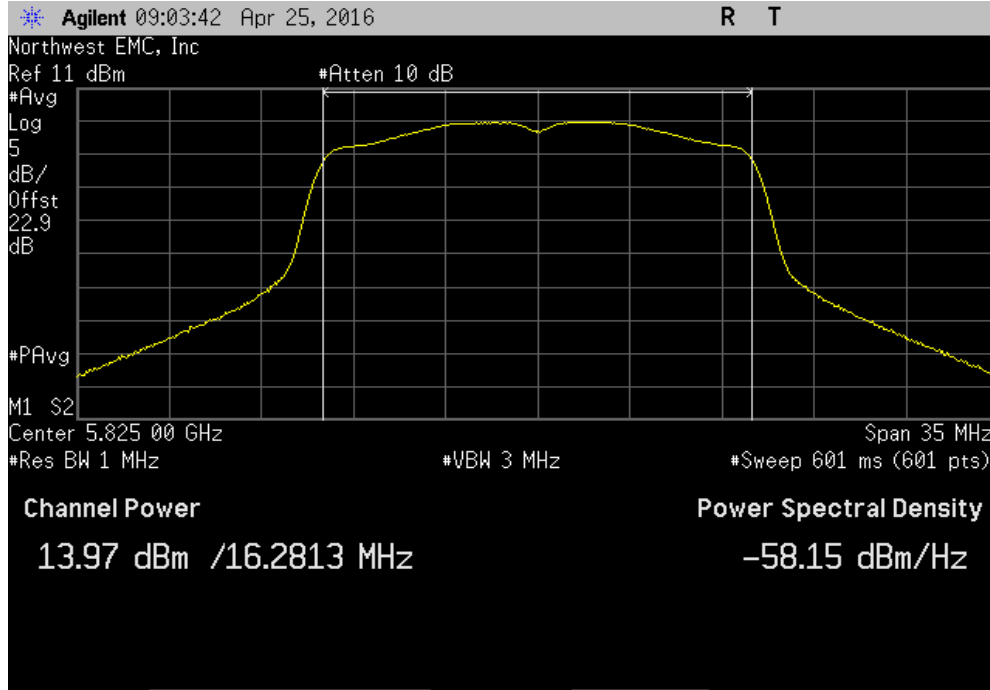
5725 - 5825 MHz Band, Mid Channel, Ch 157 - 5785 MHz, 802.11(n) MCS7					
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results	
3.607	8.7	12.3	30	Pass	



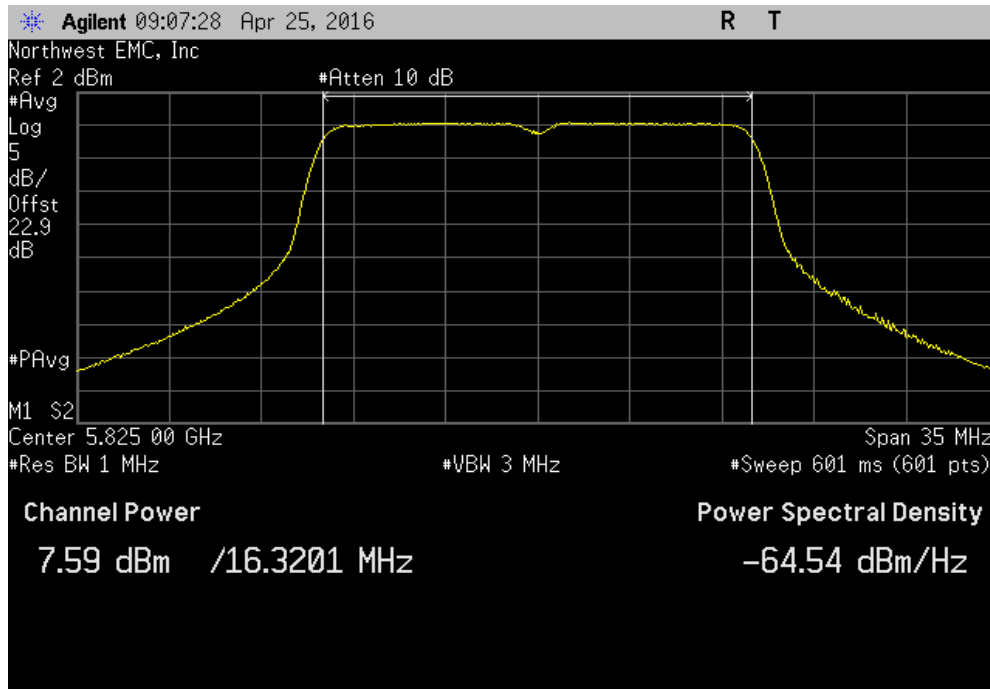


# MAXIMUM CONDUCTED OUTPUT POWER

5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(a) 6 Mbps					
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results	
13.97	2.4	16.3	30	Pass	

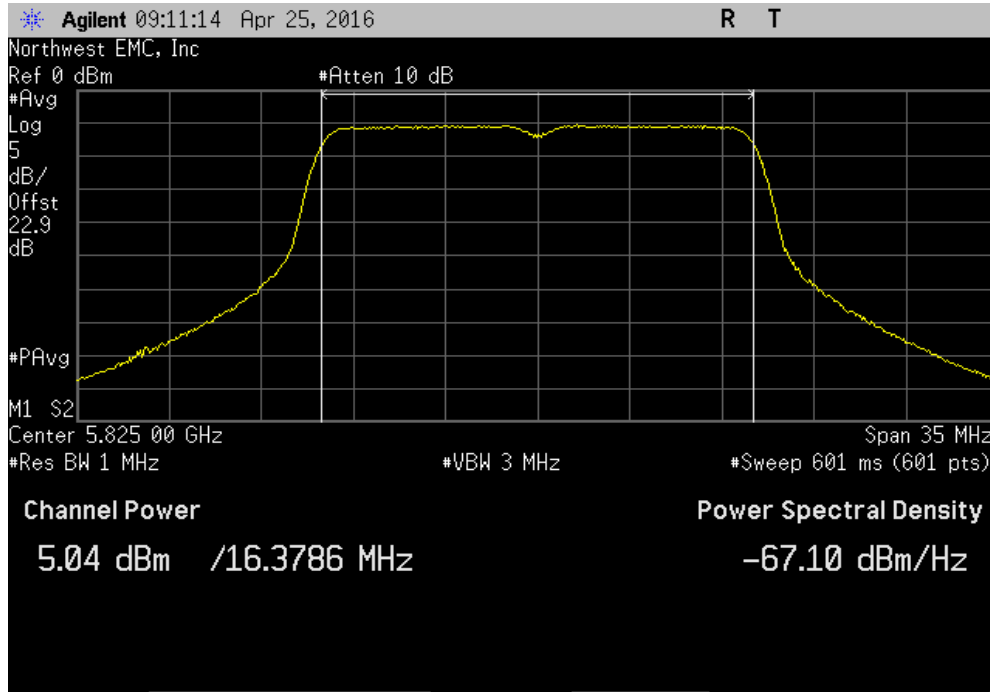


5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(a) 36 Mbps					
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results	
7.586	7.1	14.7	30	Pass	

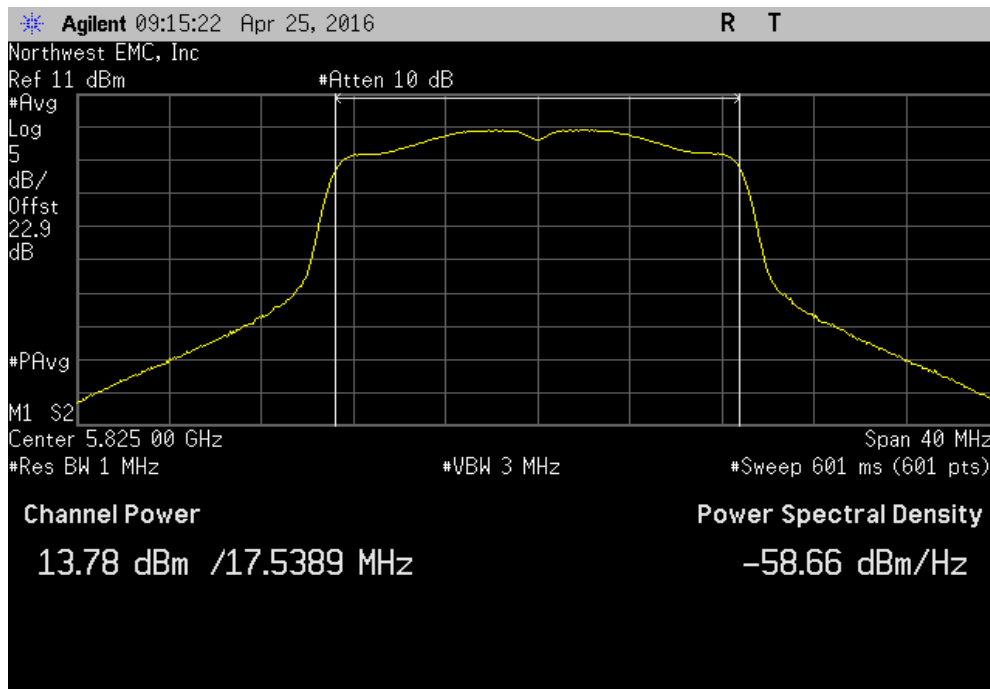


# MAXIMUM CONDUCTED OUTPUT POWER

5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(a) 54 Mbps					
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results	
5.044	8.4	13.4	30	Pass	

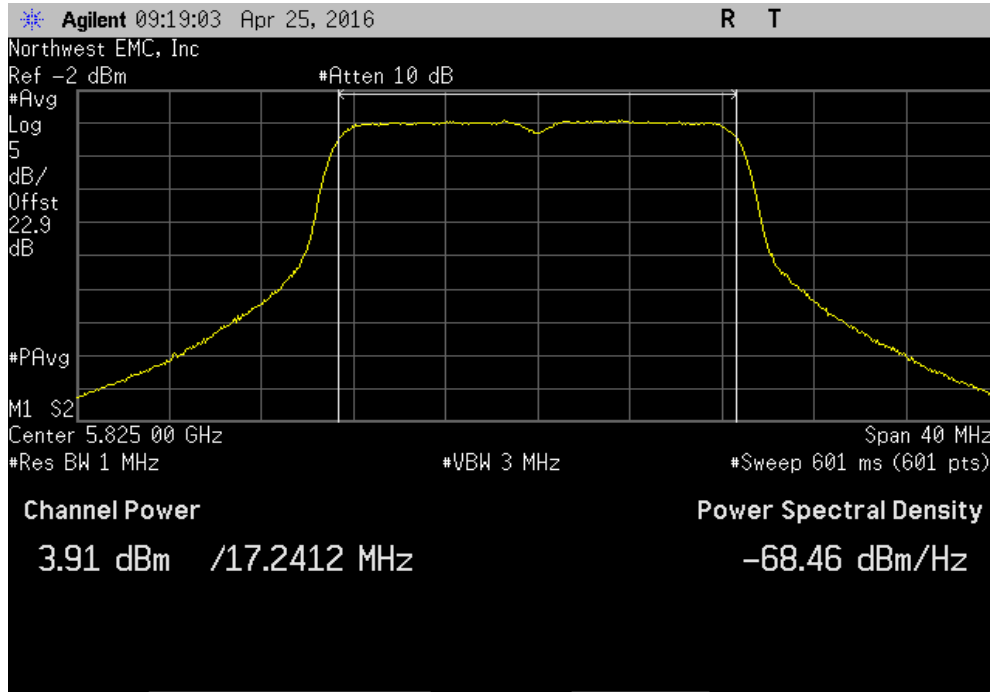


5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(n) MCS0					
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results	
13.782	2.5	16.3	30	Pass	



# MAXIMUM CONDUCTED OUTPUT POWER

5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(n) MCS7					
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results	
3.907	8.7	12.6	30	Pass	



5725 - 5825 MHz Band, High Channel, Ch 165 - 5825 MHz, 802.11(n) MCS0					
Value (dBm)	Limit (dBm) (<)	Results			
15.37	30	Pass			

