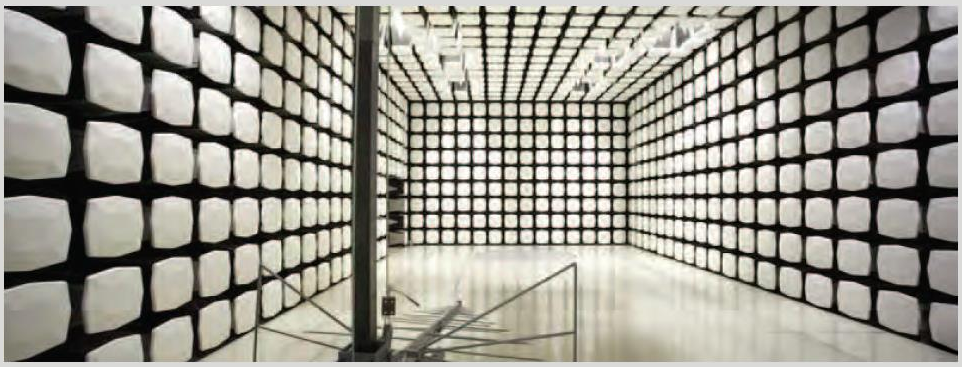
American Portwell Technology

Dual Band Wireless-AC 3160 Module

FCC 15.247:2019

802.11abgn, ac SISO Radio

Report # AMRN0006



NVLAP LAB CODE: 201049-0

CERTIFICATE OF TEST

Last Date of Test: May 1, 2019
American Portwell Technology
Model: Dual Band Wireless-AC 3160 Module

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2019	ANSI C63.10:2013, KDB 558074

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for C2PC based on product description
6.5, 6.6, 11.12.1, 11.13.2	Spurious Radiated Emissions	Yes	Pass	
11.6	Duty Cycle	Yes	Pass	
11.8.2	Occupied Bandwidth	No	N/A	Not required for C2PC based on product description
11.9.2.2.4	Output Power	Yes	Pass	
11.9.2.2.4	Equivalent Isotropic Radiated Power	Yes	Pass	
11.10.2	Power Spectral Density	No	N/A	Not required for C2PC based on product description
11.11	Band Edge Compliance	No	N/A	Not required for C2PC based on product description
11.11	Spurious Conducted Emissions	No	N/A	Not required for C2PC based on product description

Deviations From Test Standards

None

Approved By:

Jeremiah Darden, 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. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

United States

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 Element to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

European Union

European Commission – Within Element, we have a EU Notified Body validated for the EMCD and RED Directives.

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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.

Singapore

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

Israel

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

Hong Kong

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

Vietnam

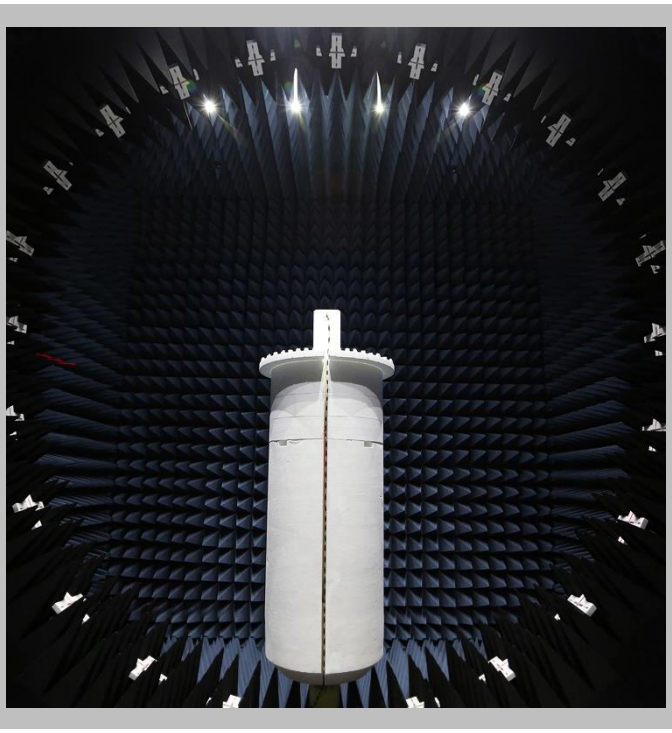
MIC – Recognized by MIC as a CAB for the acceptance of test data.

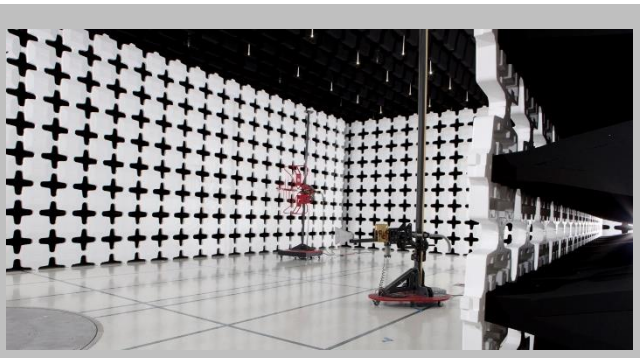
SCOPE

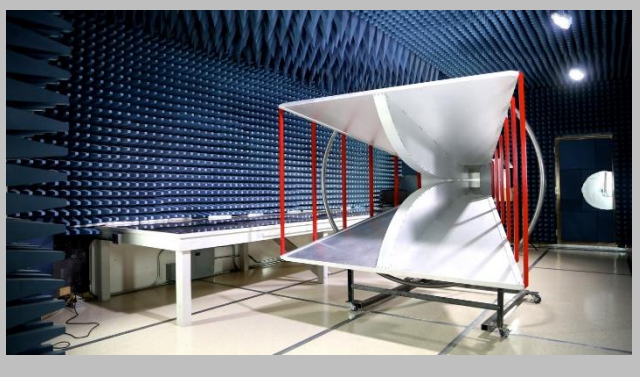
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

FACILITIES

California	Minnesota	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP				
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

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.

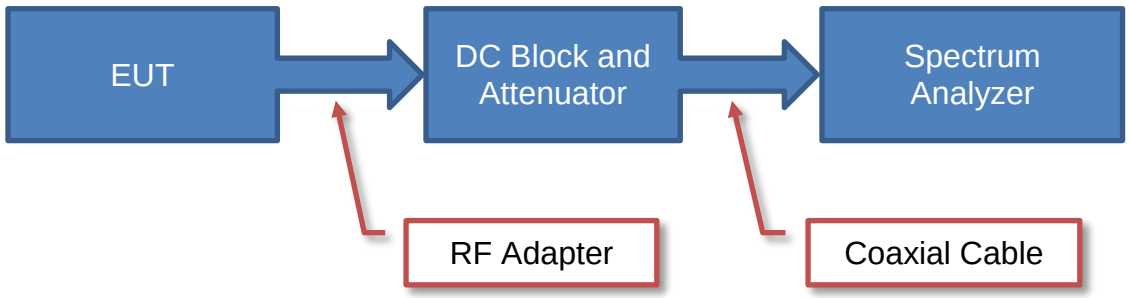
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable 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.

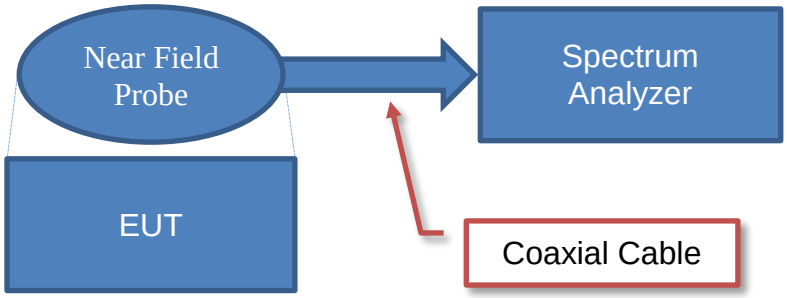
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.1 dB	-5.1 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

TEST SETUP BLOCK DIAGRAMS

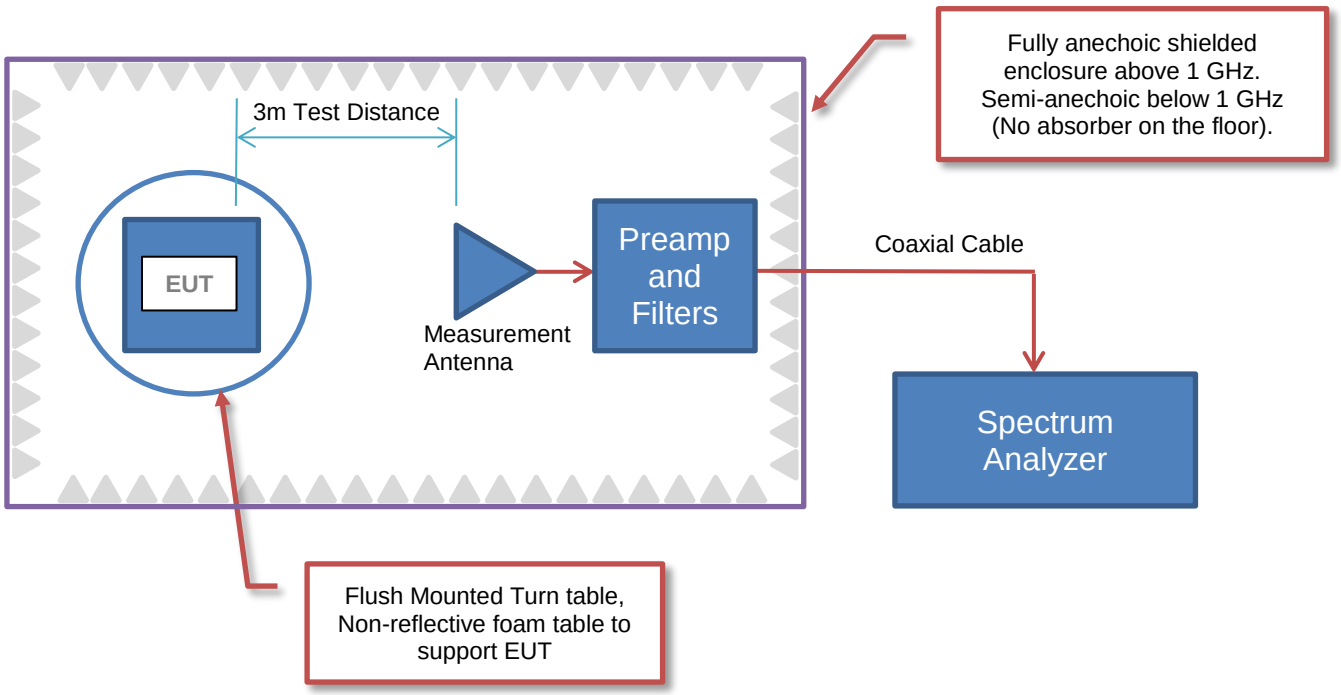
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



POWER TABLE

US – DTS (2.4GHz) Transmit Power Table

Mode	BW (MHz)	Chanel Frequency (MHz)	RF Output Power at Main RF (dBm)
802.11b	20	2412	16.5
		2437	16.5
		2462	16.5
802.11g	20	2412	14.5
		2437	16.5
		2462	14.5
802.11n	20	2412	14.5
		2437	16.5
		2462	14.5
802.11n	40	2422	13
		2437	16.5
		2452	14

PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	American Portwell Technology
Address:	44200 Christy Street
City, State, Zip:	FREMONT, CA 94538
Test Requested By:	Brian Zhang
Model:	Dual Band Wireless-AC 3160 Module
First Date of Test:	April 30, 2019
Last Date of Test:	May 1, 2019
Receipt Date of Samples:	April 30, 2019
Equipment Design Stage:	Prototype
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
The equipment under test (EUT) consists of an Intel Atom Nano 6060 motherboard combined with an Intel dual band wireless module, 2.5" SATA 128 GB SSD, 8Gb DDR3L memory and GPIO connection for enabling and disabling the WiFi. The dual band wireless radio is a pre-certified unit (FCC ID: 2AMLS-MWISP). This report is to support the C1PC or C2PC change of the antennas to an omni version with a lower gain than the one on the current grant of 2dBi. The radio module was tested outside of its normal aluminum chassis in a standalone configuration, where applicable.

Testing Objective:
To demonstrate compliance of the 802.11 radio under FCC 15.247 for operation in the 2.4 GHz band for a C1PC or C2PC.

CONFIGURATIONS

Configuration AMRN0006- 1

Software/Firmware Running during test	
Description	**Version**
Intel DRTU Tool	1.7.7-02972

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
WiFi Radio Module	American Portwell Technology	810301	APT31600958

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
WISP Module	American Portwell Technology	MWISP6060	1903G01160
LCD Monitor	NEC	E224Wi-BK	41103516NA
USB Mouse	Microsoft	1113	91705-523-2412291-21449
USB Keyboard	Lenovo	KB1021	0002649
AC/DC Adapter	FSP Group Inc.	9NA0605338	H8311001100
Wireless Switch	Unknown	Unknown	None
USB Hub	Toshiba	PA3627U-1ETC	EG7000152

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Power (Monitor)	No	2.4m	No	AC Mains	LCD Monitor
DisplayPort	Yes	1.75m	No	LCD Monitor	WISP Module
USB (Mouse)	Yes	1.85m	Yes	USB Mouse	WISP Module
USB (Keyboard)	Yes	1.75m	No	USB Keyboard	WISP Module
AC Power (Adapter)	No	1.7m	No	AC Mains	AC/DC Adapter
DC Power (Adapter)	No	1.0m	Yes	AC/DC Adapter	WISP Module
Wireless Switch Control	No	1.45m	No	Wireless Switch	WISP Module
u.FL to RP-SMA 1	Yes	0.17m	No	WiFi Radio Module	50 ohm termination
USB (USB Hub)	Yes	1.5m	No	SB Hub	WiFi Radio Module

CONFIGURATIONS

Configuration AMRN0006- 2

Software/Firmware Running during test	
Description	**Version**
Intel DRTU Tool	1.7.7-02972

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
WiFi Radio Module	American Portwell Technology	810301	APT31600958

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
WISP Module	American Portwell Technology	MWISP6060	1903G01160
AC/DC Adapter	FSP Group Inc.	9NA0605338	H8311001100
Wireless Switch	Unknown	Unknown	None
Dipole Antenna x2	Aristotle Enterprises Inc.	RFA-25-L2M2	None

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
LCD Monitor	NEC	E224Wi-BK	41103516NA
USB Mouse	Microsoft	1113	91705-523-2412291-21449
USB Keyboard	Lenovo	KB1021	0002649
USB Hub	Toshiba	PA3627U-1ETC	EG7000152

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Power (Monitor)	No	2.4m	No	AC Mains	LCD Monitor
DisplayPort	Yes	1.75m	No	LCD Monitor	WISP Module
USB (Mouse)	Yes	1.85m	Yes	USB Mouse	WISP Module
USB (Keyboard)	Yes	1.75m	No	USB Keyboard	WISP Module
AC Power (Adapter)	No	1.7m	No	AC Mains	AC/DC Adapter
DC Power (Adapter)	No	1.0m	Yes	AC/DC Adapter	WISP Module
Wireless Switch Control	No	1.45m	No	Wireless Switch	WISP Module
u.Fl to RP-SMA x2	Yes	0.17m	No	WiFi Radio Module	RP-SMA to SMA cable
RP-SMA to SMA x2	Yes	0.5m	No	u.FL to RP-SMA cable	Dipole Antenna
USB (USB Hub)	Yes	1.5m	No	SB Hub	WiFi Radio Module

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-04-30	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2019-04-30	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2019-04-30	Equivalent Isotropic Radiated Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2019-05-01	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

PSA-ESCI 2019.02.26

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.

MODES OF OPERATION

Continuously Transmitting at Low Ch 1 (2412MHz), Mid Ch 6 (2437MHz), High Ch 11 (2462MHz)
Continuously Transmitting at Low Ch 1(2412MHz), High Ch 11 (2462MHz)

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

AMRN0006 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26500 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
Attenuator	Weinschel Corp	4H-20	AWB	17-Mar-2019	12 mo
Filter - High Pass	Micro-Tronics	HPM50111	HGC	17-Mar-2019	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	HHV	3-Aug-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	JSDWK42-18004000-60-5P	PAM	10-Oct-2018	12 mo
Antenna - Double Ridge	A.H. Systems, Inc.	SAS-574	AXW	21-Aug-2018	24 mo
Cable	Northwest EMC	18-40GHz	TXE	10-Oct-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	PAL	9-Oct-2018	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AJG	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	PAK	9-Oct-2018	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AJF	NCR	0 mo
Cable	Northwest EMC	8-18GHz	TXD	17-Mar-2019	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAJ	17-Mar-2019	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AJL	11-Oct-2018	24 mo
Cable	Northwest EMC	1-8.2 GHz	TXC	17-Mar-2019	12 mo
Amplifier - Pre-Amplifier	Fairview Microwave	FMAM63001	PAS	24-Jan-2019	12 mo
Antenna - Biconilog	ETS Lindgren	3143B	AYF	10-May-2018	24 mo
Cable	Northwest EMC	RE 9kHz - 1GHz	TXB	22-Aug-2018	12 mo
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	27-Feb-2019	12 mo

TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual 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 if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements at the edges of the allowable band may be presented in an alternative method as provided for in the ANSI C63.10 Marker-Delta method. This method involves performing an in-band fundamental measurement followed by a screen capture of the fundamental and out-of-band emission using reduced measurement instrumentation bandwidths. The amplitude delta measured on this screen capture is applied to the fundamental emission value to show the out-of-band emission level as applied to the limit.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of 10*LOG(dc).

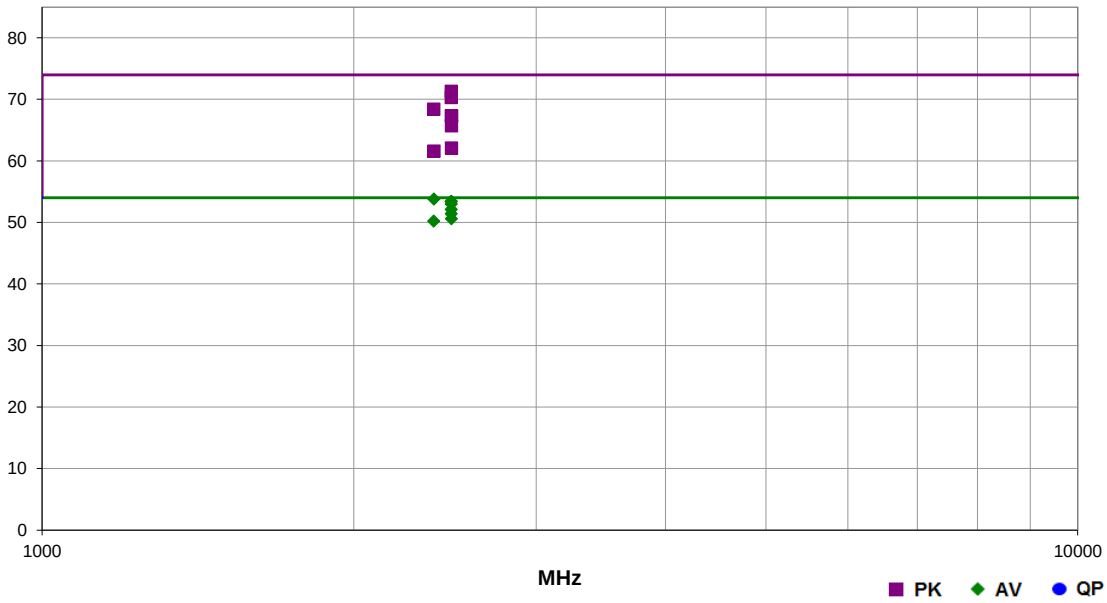
SPURIOUS RADIATED EMISSIONS

EmiR5 2018.09.26 PSA-ESCI 2019.02.26

Work Order:	AMRN0006	**Date:**	1-May-2019		
Project:	None	**Temperature:**	22.5 °C		
Job Site:	TX02	**Humidity:**	52.8% RH		
Serial Number:	APT31600958	**Barometric Pres.:**	1015 mbar	**Tested by:**	Jonathan Kiefer
EUT:	Dual Band Wireless-AC 3160 Module				
Configuration:	2				
Customer:	American Portwell Technology				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Continuously Transmitting at Low Ch 1(2412MHz), High Ch 11 (2462MHz)				
Deviations:	None				
Comments:	See Power Table for output power settings used. See data table comments for EUT channel, orientation and data rate information. Transmit Band Edge for 20 MHz channel bandwidths. MCS7 data rate was used since it was the worst-case from previous testing. Since MCS7 duty cycle is <98%, a correction factor of 0.5 dB was added to the average field strength values, using the formula of 10*log(1/DC). 10*log(1/0.887) = 0.5 dB.				

Test Specifications	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

Run #	13	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2389.657	36.5	-3.2	3.1	98.0	0.5	20.0	Horz	AV	0.0	53.8	54.0	-0.2	Low Ch 1, EUT Horz, MCS7
2483.523	35.6	-2.7	4.0	34.9	0.5	20.0	Vert	AV	0.0	53.4	54.0	-0.6	High Ch 11, EUT Horz, MCS7
2483.627	35.6	-2.7	1.3	255.9	0.5	20.0	Vert	AV	0.0	53.4	54.0	-0.6	High Ch 11, EUT Vert, MCS7
2483.623	35.2	-2.7	3.9	135.0	0.5	20.0	Vert	AV	0.0	53.0	54.0	-1.0	High Ch 11, EUT On Side, MCS7
2483.630	34.3	-2.7	1.0	90.0	0.5	20.0	Horz	AV	0.0	52.1	54.0	-1.9	High Ch 11, EUT Horz, MCS7
2483.663	33.6	-2.7	4.0	55.0	0.5	20.0	Horz	AV	0.0	51.4	54.0	-2.6	High Ch 11, EUT On Side, MCS7
2483.500	54.0	-2.7	4.0	55.0	0.0	20.0	Horz	PK	0.0	71.3	74.0	-2.7	High Ch 11, EUT On Side, MCS7
2484.587	32.8	-2.7	1.3	250.9	0.5	20.0	Horz	AV	0.0	50.6	54.0	-3.4	High Ch 11, EUT Vert, MCS7
2484.323	53.0	-2.7	1.0	90.0	0.0	20.0	Horz	PK	0.0	70.3	74.0	-3.7	High Ch 11, EUT Horz, MCS7
2389.407	32.9	-3.2	1.3	280.9	0.5	20.0	Vert	AV	0.0	50.2	54.0	-3.8	Low Ch 1, EUT Horz, MCS7
2389.193	51.6	-3.2	3.1	98.0	0.0	20.0	Horz	PK	0.0	68.4	74.0	-5.6	Low Ch 1, EUT Horz, MCS7
2485.217	50.0	-2.7	4.0	34.9	0.0	20.0	Vert	PK	0.0	67.3	74.0	-6.7	High Ch 11, EUT Horz, MCS7
2484.977	50.0	-2.7	1.3	255.9	0.0	20.0	Vert	PK	0.0	67.3	74.0	-6.7	High Ch 11, EUT Vert, MCS7
2484.443	48.4	-2.7	3.9	135.0	0.0	20.0	Vert	PK	0.0	65.7	74.0	-8.3	High Ch 11, EUT On Side, MCS7
2484.567	44.8	-2.7	1.3	250.9	0.0	20.0	Horz	PK	0.0	62.1	74.0	-11.9	High Ch 11, EUT Vert, MCS7
2389.777	44.8	-3.2	1.3	280.9	0.0	20.0	Vert	PK	0.0	61.6	74.0	-12.4	Low Ch 1, EUT Horz, MCS7

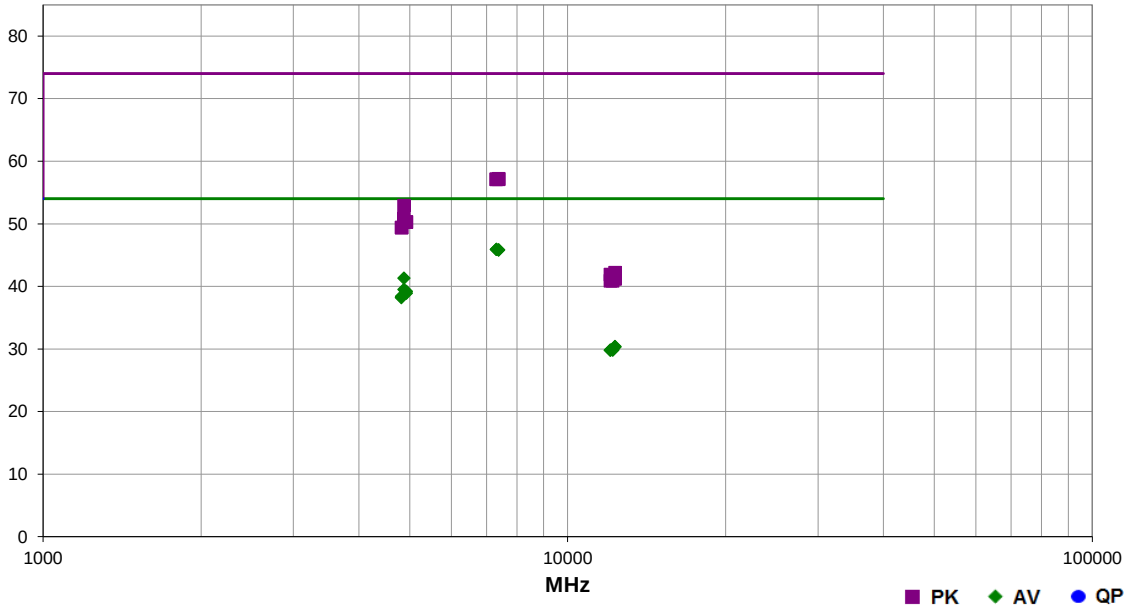
SPURIOUS RADIATED EMISSIONS

EmiR5 2018.09.26 PSA-ESCI 2019.02.26

Work Order:	AMRN0006	**Date:**	1-May-2019		
Project:	None	**Temperature:**	22.5 °C		
Job Site:	TX02	**Humidity:**	52.8% RH		
Serial Number:	APT31600958	**Barometric Pres.:**	1015 mbar	**Tested by:**	Jonathan Kiefer
EUT:	Dual Band Wireless-AC 3160 Module				
Configuration:	2				
Customer:	American Portwell Technology				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Continuously Transmitting at Low Ch 1 (2412MHz), Mid Ch 6 (2437MHz), High Ch 11 (2462MHz)				
Deviations:	None				
Comments:	See Power Table for output power settings used. See data table comments for EUT channel, orientation and data rate information. Harmonics for 20 MHz channel bandwidths. Since MCS7 duty cycle is <98%, a correction factor of 0.5 dB was added to the average field strength values, using the formula of 10*log(1/DC). 10*log(1/0.887) = 0.5 dB.				

Test Specifications	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

Run #	14	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7313.333	30.1	15.3	1.3	267.0	0.5	0.0	Horz	AV	0.0	45.9	54.0	-8.1	Mid Ch 6, EUT Horz, MCS7
7312.775	30.1	15.3	3.8	175.0	0.5	0.0	Vert	AV	0.0	45.9	54.0	-8.1	Mid Ch 6, EUT Horz, MCS7
7388.000	30.0	15.3	1.3	61.0	0.5	0.0	Horz	AV	0.0	45.8	54.0	-8.2	High Ch 11, EUT Horz, MCS7
7386.550	30.0	15.3	1.3	34.9	0.5	0.0	Vert	AV	0.0	45.8	54.0	-8.2	High Ch 11, EUT Horz, MCS7
4875.042	33.7	7.1	2.5	114.0	0.5	0.0	Horz	AV	0.0	41.3	54.0	-12.7	Mid Ch 6, EUT Horz, MCS7
4875.233	31.9	7.1	3.1	225.0	0.5	0.0	Vert	AV	0.0	39.5	54.0	-14.5	Mid Ch 6, EUT Horz, MCS7
4925.167	31.5	7.2	1.2	336.0	0.5	0.0	Horz	AV	0.0	39.2	54.0	-14.8	High Ch 11, EUT Horz, MCS7
4926.208	31.2	7.2	1.5	112.9	0.5	0.0	Vert	AV	0.0	38.9	54.0	-15.1	High Ch 11, EUT Horz, MCS7
4822.375	31.0	6.9	3.3	6.0	0.5	0.0	Vert	AV	0.0	38.4	54.0	-15.6	Low Ch 1, EUT Horz, MCS7
4821.558	30.8	6.9	2.7	178.9	0.5	0.0	Horz	AV	0.0	38.2	54.0	-15.8	Low Ch 1, EUT Horz, MCS7
7386.742	41.9	15.3	1.3	34.9	0.0	0.0	Vert	PK	0.0	57.2	74.0	-16.8	High Ch 11, EUT Horz, MCS7
7310.058	41.8	15.3	1.3	267.0	0.0	0.0	Horz	PK	0.0	57.1	74.0	-16.9	Mid Ch 6, EUT Horz, MCS7
7308.958	41.8	15.3	3.8	175.0	0.0	0.0	Vert	PK	0.0	57.1	74.0	-16.9	Mid Ch 6, EUT Horz, MCS7
7386.792	41.8	15.3	1.3	61.0	0.0	0.0	Horz	PK	0.0	57.1	74.0	-16.9	High Ch 11, EUT Horz, MCS7
4874.183	45.8	7.1	2.5	114.0	0.0	0.0	Horz	PK	0.0	52.9	74.0	-21.1	Mid Ch 6, EUT Horz, MCS7
4873.100	43.7	7.1	3.1	225.0	0.0	0.0	Vert	PK	0.0	50.8	74.0	-23.2	Mid Ch 6, EUT Horz, MCS7
12311.290	30.8	-0.9	1.2	7.0	0.5	0.0	Horz	AV	0.0	30.4	54.0	-23.6	High Ch 11, EUT Horz, MCS7
12311.380	30.7	-0.9	1.3	315.0	0.5	0.0	Vert	AV	0.0	30.3	54.0	-23.7	High Ch 11, EUT Horz, MCS7
4923.467	43.1	7.2	1.2	336.0	0.0	0.0	Horz	PK	0.0	50.3	74.0	-23.7	High Ch 11, EUT Horz, MCS7
4925.158	43.1	7.2	1.5	112.9	0.0	0.0	Vert	PK	0.0	50.3	74.0	-23.7	High Ch 11, EUT Horz, MCS7
12187.420	30.6	-1.2	2.1	267.9	0.5	0.0	Horz	AV	0.0	29.9	54.0	-24.1	Mid Ch 6, EUT Horz, MCS7
12061.370	30.7	-1.4	1.3	123.0	0.5	0.0	Horz	AV	0.0	29.8	54.0	-24.2	Low Ch 1, EUT Horz, MCS7

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
12060.210	30.7	-1.4	1.3	115.0	0.5	0.0	Vert	AV	0.0	29.8	54.0	-24.2	Low Ch 1, EUT Horz, MCS7
12187.470	30.5	-1.2	1.3	284.0	0.5	0.0	Vert	AV	0.0	29.8	54.0	-24.2	Mid Ch 6, EUT Horz, MCS7
4823.333	42.5	6.9	2.7	178.9	0.0	0.0	Horz	PK	0.0	49.4	74.0	-24.6	Low Ch 1, EUT Horz, MCS7
4822.967	42.5	6.9	3.3	6.0	0.0	0.0	Vert	PK	0.0	49.4	74.0	-24.6	Low Ch 1, EUT Horz, MCS7
12308.910	43.1	-0.9	1.2	7.0	0.0	0.0	Horz	PK	0.0	42.2	74.0	-31.8	High Ch 11, EUT Horz, MCS7
12058.320	43.4	-1.5	1.3	123.0	0.0	0.0	Horz	PK	0.0	41.9	74.0	-32.1	Low Ch 1, EUT Horz, MCS7
12185.890	42.6	-1.2	2.1	267.9	0.0	0.0	Horz	PK	0.0	41.4	74.0	-32.6	Mid Ch 6, EUT Horz, MCS7
12307.840	42.1	-0.9	1.3	315.0	0.0	0.0	Vert	PK	0.0	41.2	74.0	-32.8	High Ch 11, EUT Horz, MCS7
12059.560	42.4	-1.5	1.3	115.0	0.0	0.0	Vert	PK	0.0	40.9	74.0	-33.1	Low Ch 1, EUT Horz, MCS7
12185.230	42.1	-1.2	1.3	284.0	0.0	0.0	Vert	PK	0.0	40.9	74.0	-33.1	Mid Ch 6, EUT Horz, MCS7

DUTY CYCLE

XMit 2019.02.26

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.	Cal. Due
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	10-Oct-18	10-Oct-19
Block - DC	Fairview Microwave	SD3379	AMM	17-Mar-19	17-Mar-20
Attenuator	Fairview Microwave	SA4018-20	TYW	17-Mar-19	17-Mar-20
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-19	19-Mar-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. 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.

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

element

TbtTx 2018.09.13 XMit 2019.02.26

EUT:	Dual Band Wireless-AC 3160 Module			**Work Order:**	AMRN0006
Serial Number:	APT31600958			**Date:**	30-Apr-19
Customer:	American Portwell Technology			**Temperature:**	22.4 °C
Attendees:	None			**Humidity:**	56.2% RH
Project:	None			**Barometric Pres.:**	1016 mbar
Tested by:	Jonathan Kiefer	**Power:**	110VAC/60Hz	**Job Site:**	TX09

TEST SPECIFICATIONS	Test Method
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

See Power Table for output power settings used. Ref Offset 21.4 dB (20dB attenuator+DC Block+Cable).

DEVIATIONS FROM TEST STANDARD

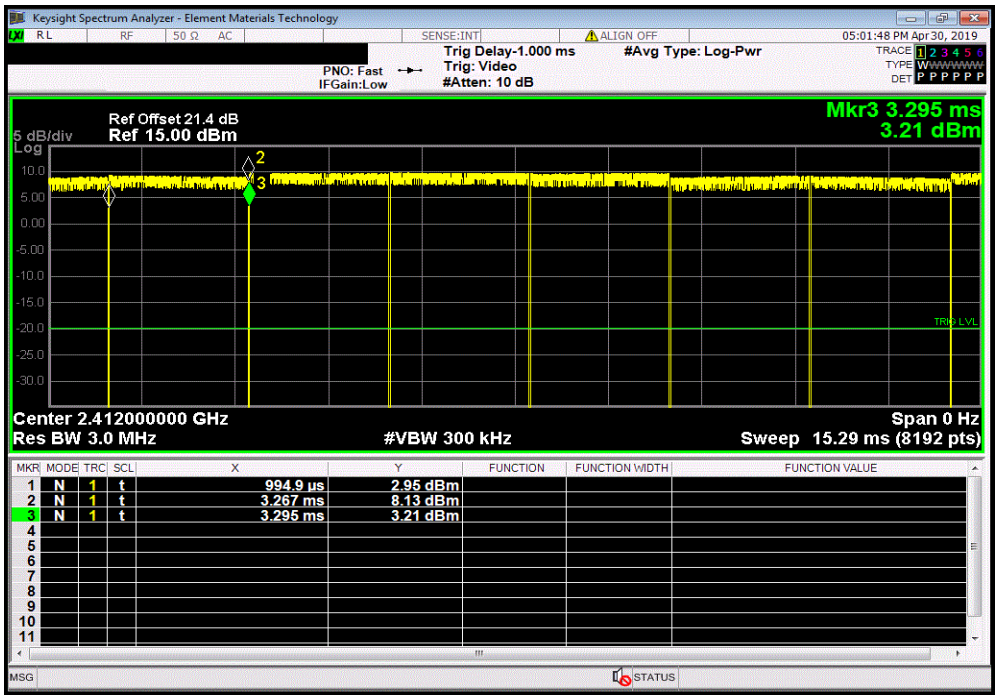
None

Configuration #	1	Signature	Jonathan Kiefer

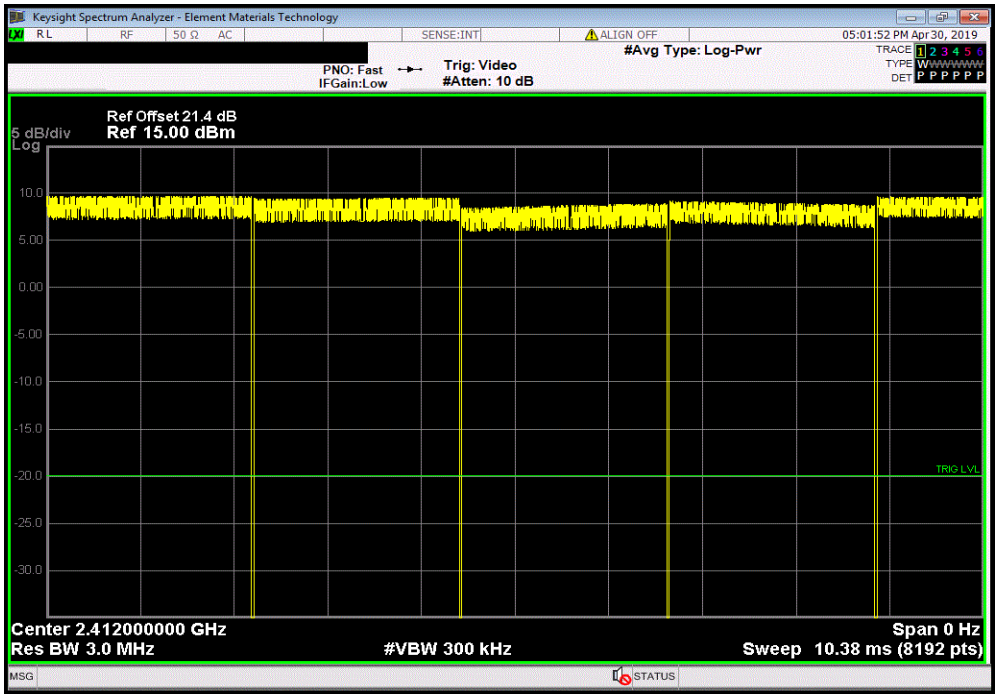
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
Chain A						
2400 MHz - 2483.5 MHz Band						
20 MHz BW						
802.11(b) 1 Mbps						
Low Channel 1, 2412 MHz	2.272 ms	2.3 ms	1	98.8	N/A	N/A
Low Channel 1, 2412 MHz	N/A	N/A	5	N/A	N/A	N/A
Mid Channel 6, 2437 MHz	1.12 ms	1.147 ms	1	97.6	N/A	N/A
Mid Channel 6, 2437 MHz	N/A	N/A	5	N/A	N/A	N/A
High Channel 11, 2462 MHz	1.12 ms	1.148 ms	1	97.5	N/A	N/A
High Channel 11, 2462 MHz	N/A	N/A	5	N/A	N/A	N/A
802.11(g) 6 Mbps						
Low Channel 1, 2412 MHz	1.123 ms	1.154 ms	1	97.3	N/A	N/A
Low Channel 1, 2412 MHz	N/A	N/A	5	N/A	N/A	N/A
Mid Channel 6, 2437 MHz	1.123 ms	1.151 ms	1	97.5	N/A	N/A
Mid Channel 6, 2437 MHz	N/A	N/A	5	N/A	N/A	N/A
High Channel 11, 2462 MHz	1.123 ms	1.153 ms	1	97.4	N/A	N/A
High Channel 11, 2462 MHz	N/A	N/A	5	N/A	N/A	N/A
802.11(n) MCS0						
Low Channel 1, 2412 MHz	1.123 ms	1.153 ms	1	97.4	N/A	N/A
Low Channel 1, 2412 MHz	N/A	N/A	5	N/A	N/A	N/A
Mid Channel 6, 2437 MHz	1.123 ms	1.153 ms	1	97.4	N/A	N/A
Mid Channel 6, 2437 MHz	N/A	N/A	6	N/A	N/A	N/A
High Channel 11, 2462 MHz	1.123 ms	1.152 ms	1	97.5	N/A	N/A
High Channel 11, 2462 MHz	N/A	N/A	6	N/A	N/A	N/A
802.11(n) MCS7						
Low Channel 1, 2412 MHz	227 us	255 us	1	89	N/A	N/A
Low Channel 1, 2412 MHz	N/A	N/A	5	N/A	N/A	N/A
Mid Channel 6, 2437 MHz	227 us	256 us	1	88.7	N/A	N/A
Mid Channel 6, 2437 MHz	N/A	N/A	5	N/A	N/A	N/A
High Channel 11, 2462 MHz	227 us	256 us	1	88.7	N/A	N/A
High Channel 11, 2462 MHz	N/A	N/A	5	N/A	N/A	N/A
40 MHz BW						
802.11(n) MCS0						
Low Channel 1, 2412 MHz	936 us	971 us	1	96.4	N/A	N/A
Low Channel 1, 2412 MHz	N/A	N/A	5	N/A	N/A	N/A
Mid Channel 6, 2437 MHz	936 us	970.7 us	1	96.4	N/A	N/A
Mid Channel 6, 2437 MHz	N/A	N/A	6	N/A	N/A	N/A
High Channel 11, 2462 MHz	936.8 us	972.4 us	1	96.3	N/A	N/A
High Channel 11, 2462 MHz	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(b) 1 Mbps, Low Channel 1, 2412 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.272 ms	2.3 ms	1	98.8	N/A	N/A

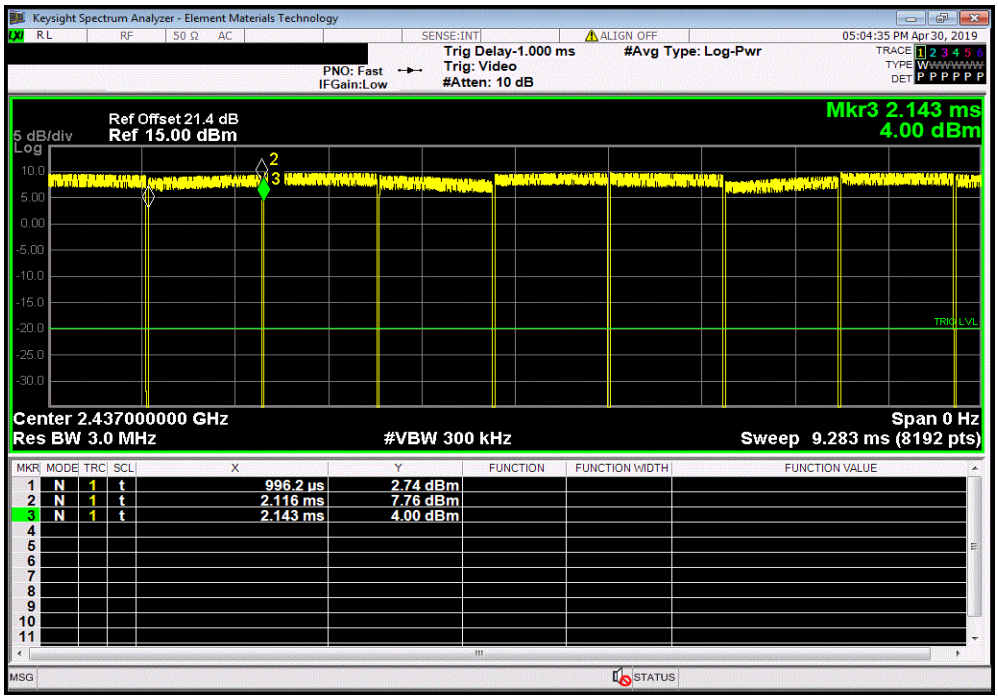


Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(b) 1 Mbps, Low Channel 1, 2412 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



DUTY CYCLE

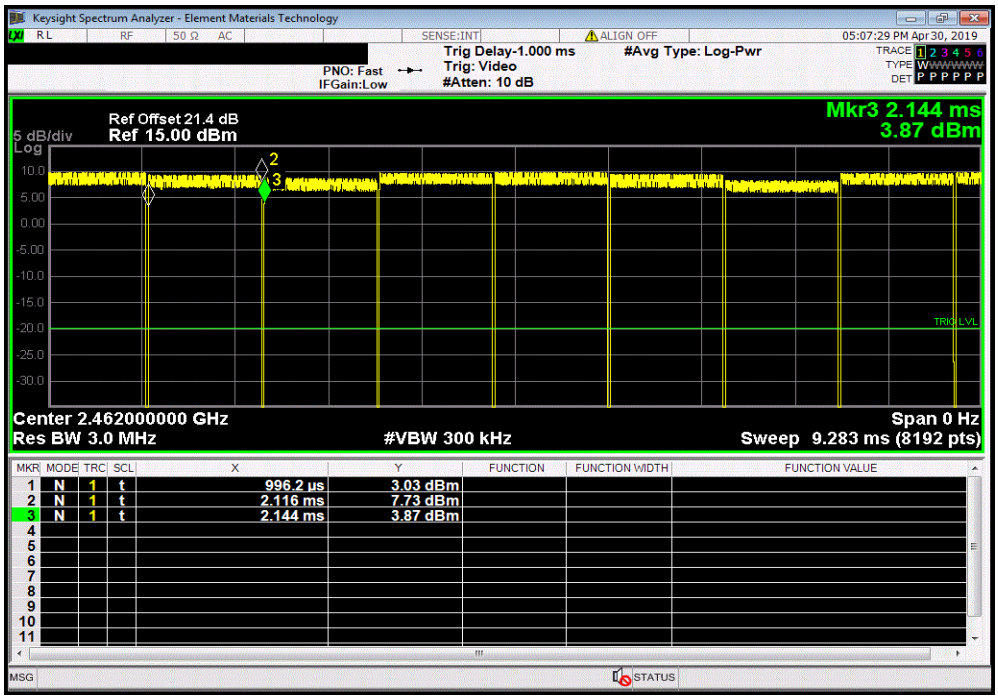
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(b) 1 Mbps, Mid Channel 6, 2437 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.12 ms	1.147 ms	1	97.6	N/A	N/A



Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(b) 1 Mbps, Mid Channel 6, 2437 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

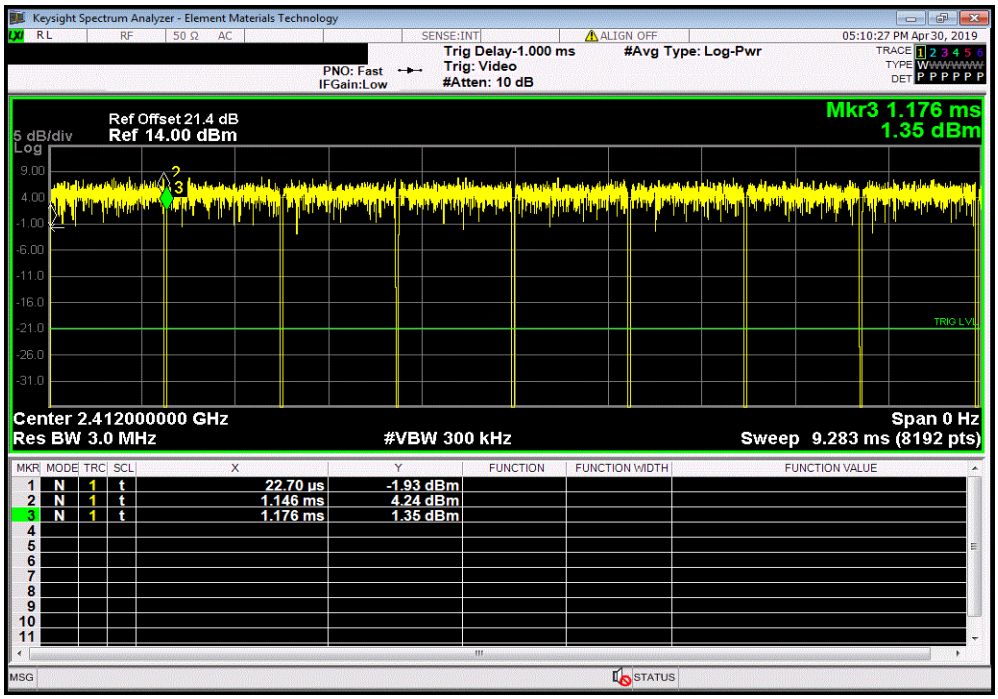
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(b) 1 Mbps, High Channel 11, 2462 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.12 ms	1.148 ms	1	97.5	N/A	N/A



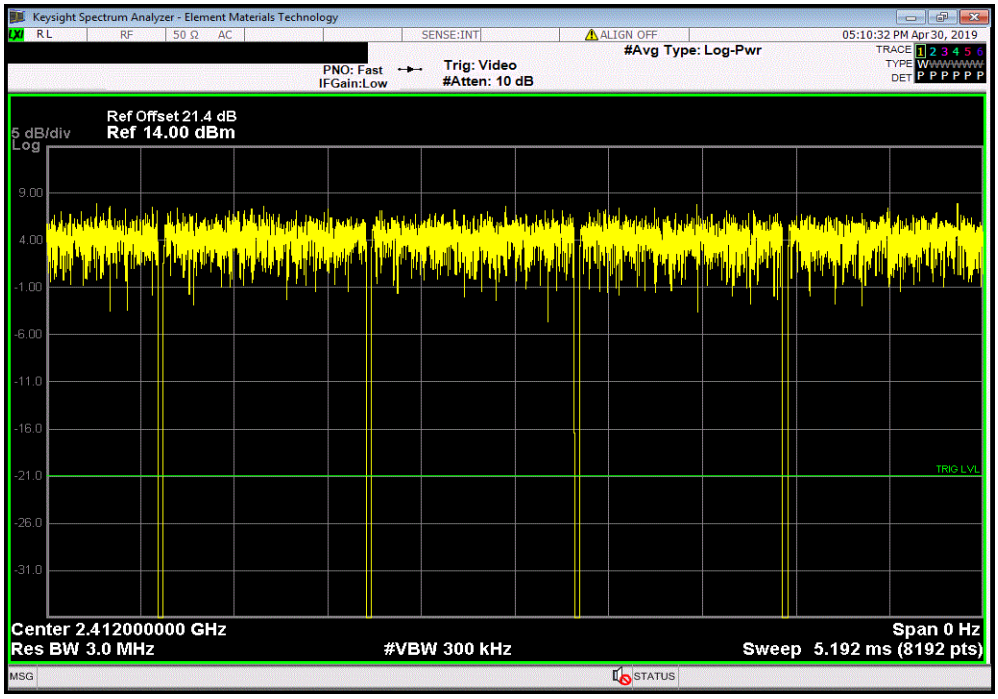
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(b) 1 Mbps, High Channel 11, 2462 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(g) 6 Mbps, Low Channel 1, 2412 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.123 ms	1.154 ms	1	97.3	N/A	N/A

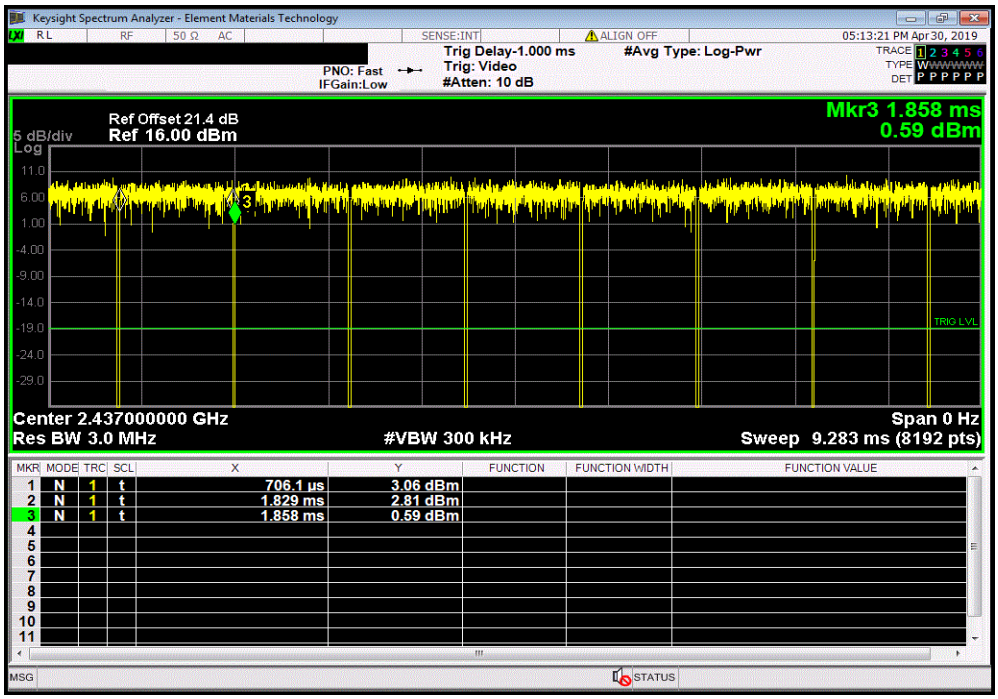


Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(g) 6 Mbps, Low Channel 1, 2412 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



DUTY CYCLE

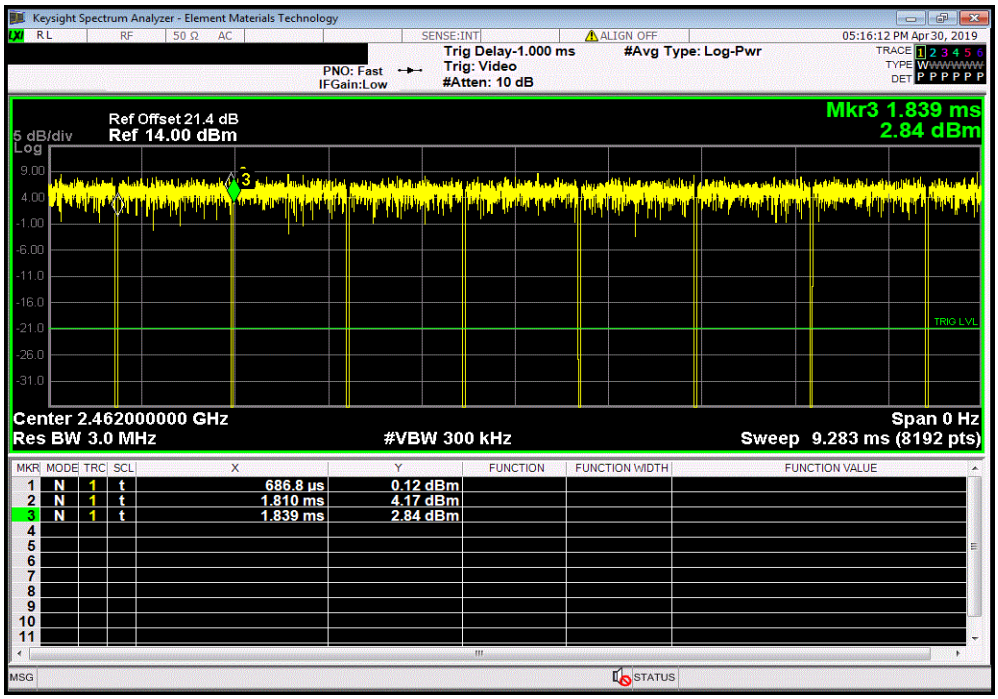
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(g) 6 Mbps, Mid Channel 6, 2437 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.123 ms	1.151 ms	1	97.5	N/A	N/A



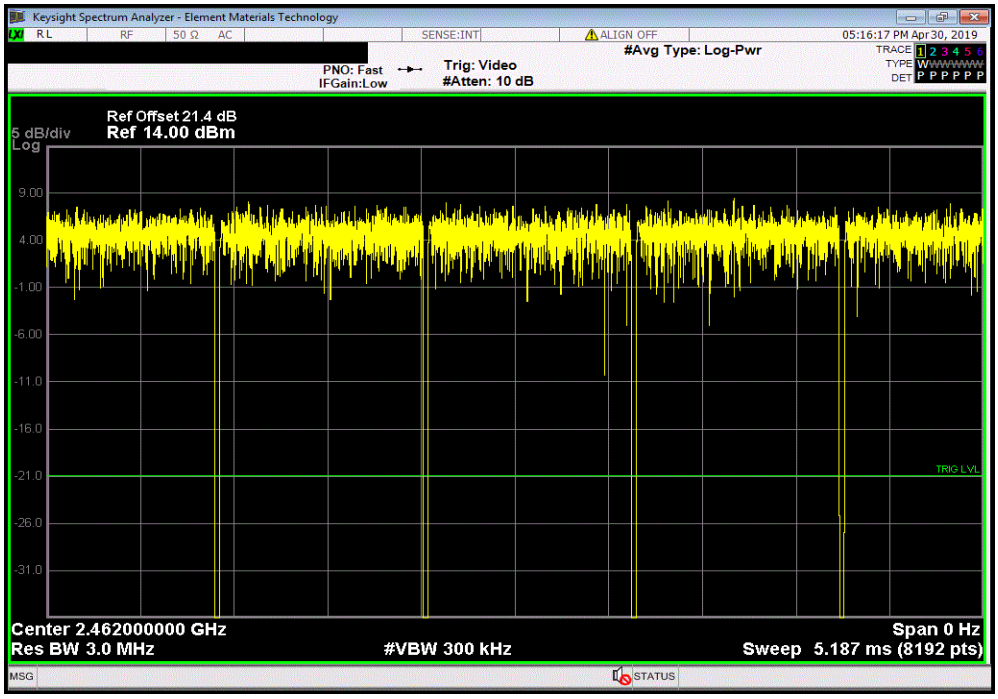
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(g) 6 Mbps, Mid Channel 6, 2437 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(g) 6 Mbps, High Channel 11, 2462 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.123 ms	1.153 ms	1	97.4	N/A	N/A

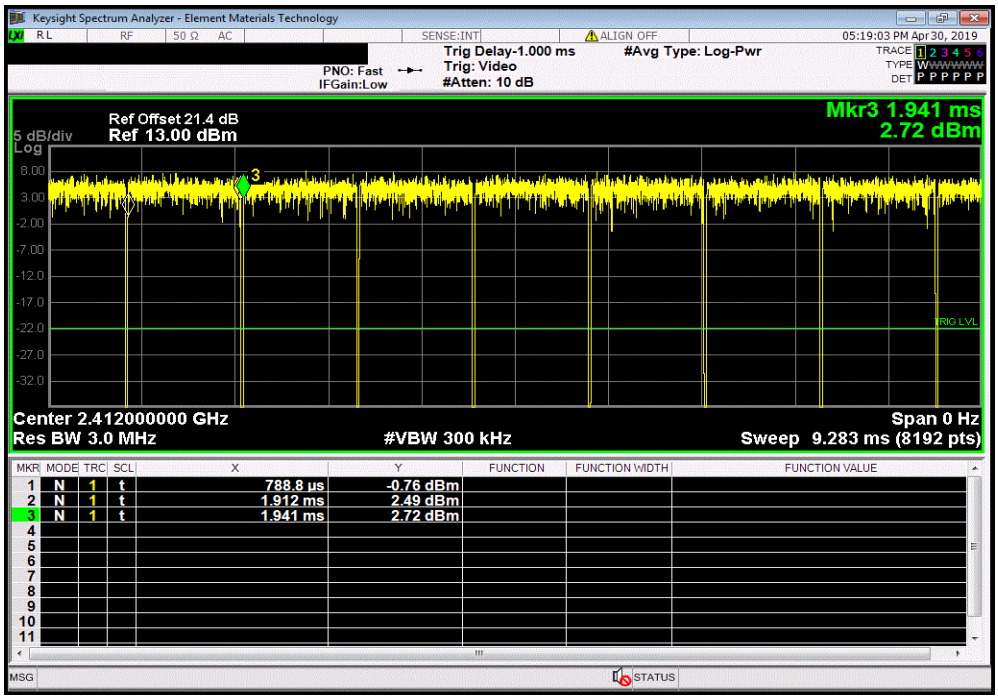


Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(g) 6 Mbps, High Channel 11, 2462 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

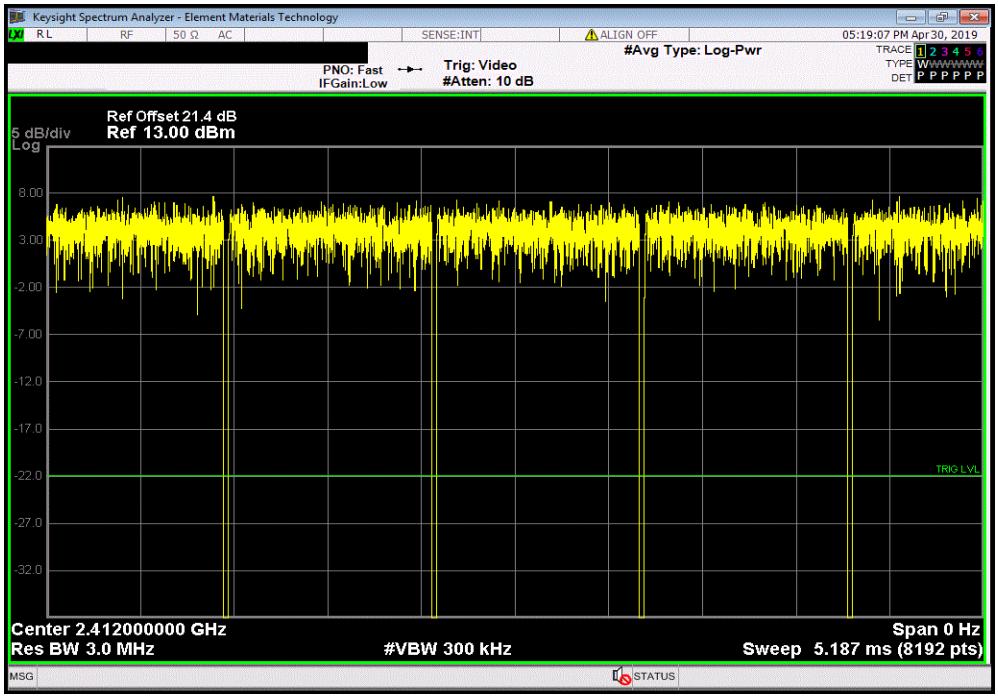


DUTY CYCLE

Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS0, Low Channel 1, 2412 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.123 ms	1.153 ms	1	97.4	N/A	N/A

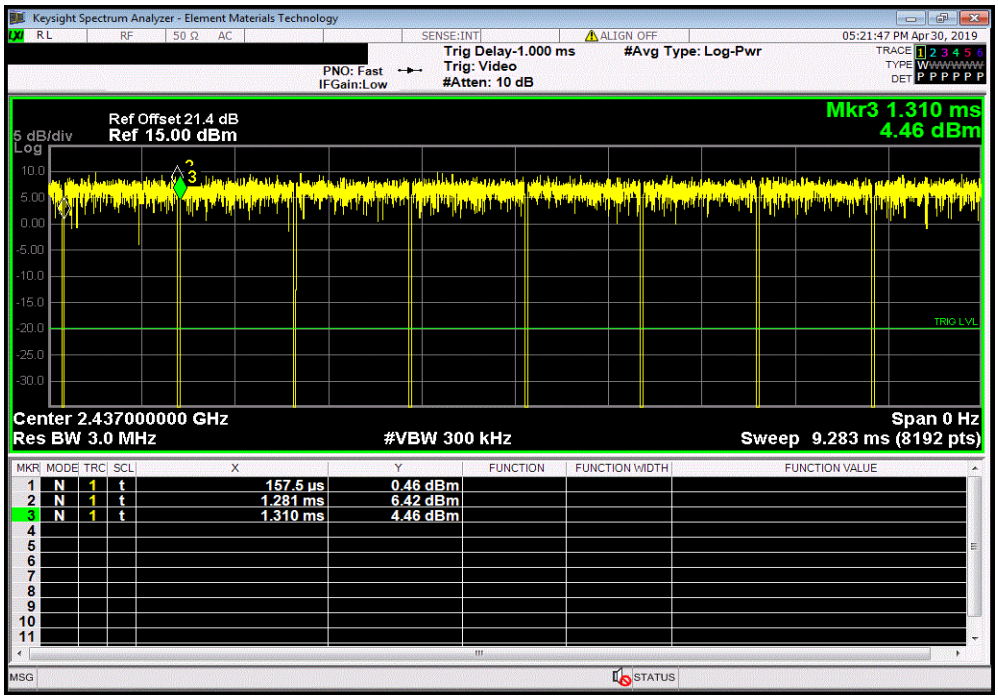


Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS0, Low Channel 1, 2412 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

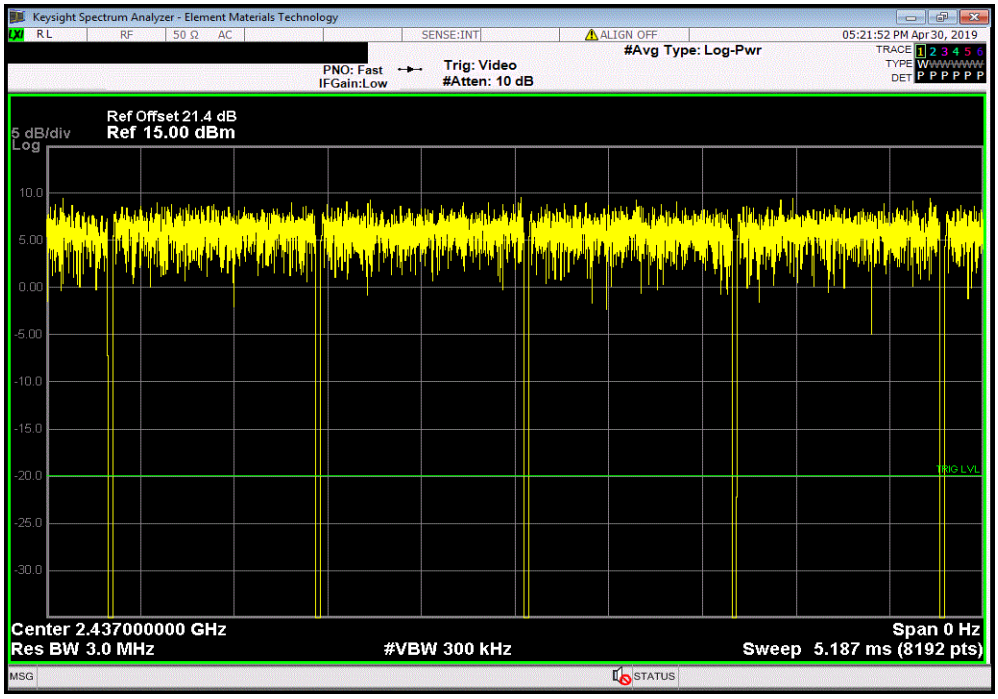


DUTY CYCLE

Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS0, Mid Channel 6, 2437 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.123 ms	1.153 ms	1	97.4	N/A	N/A

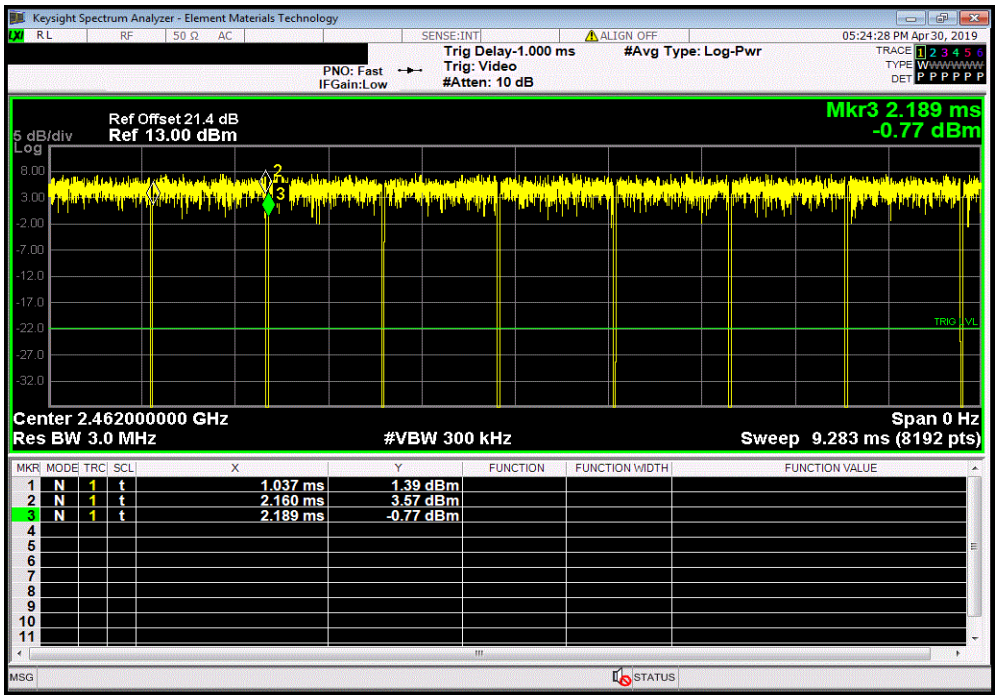


Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS0, Mid Channel 6, 2437 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	6	N/A	N/A	N/A

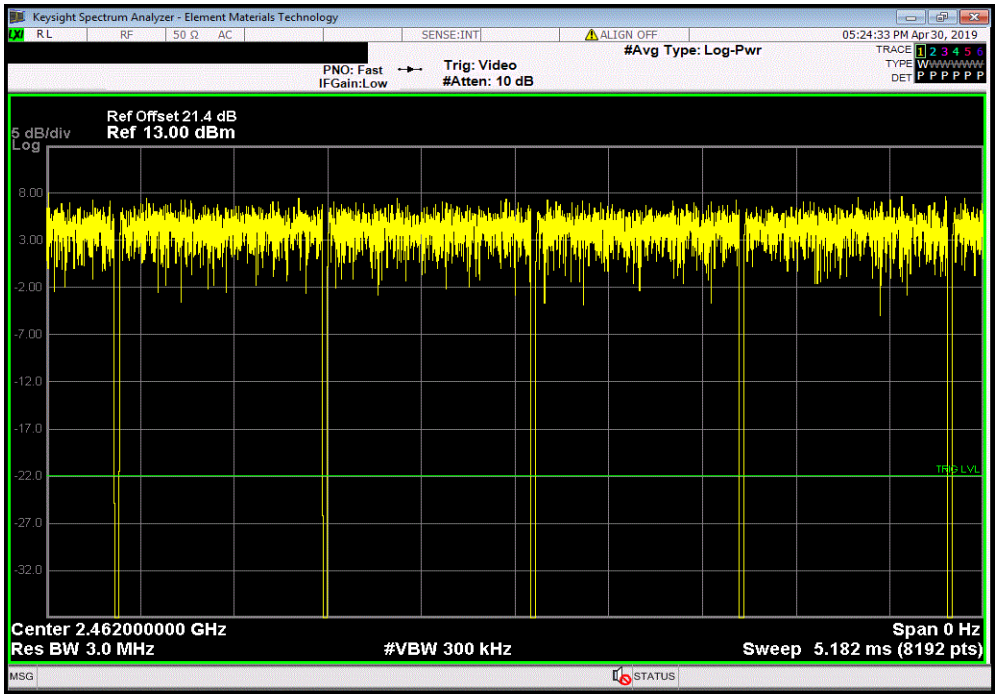


DUTY CYCLE

Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS0, High Channel 11, 2462 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.123 ms	1.152 ms	1	97.5	N/A	N/A

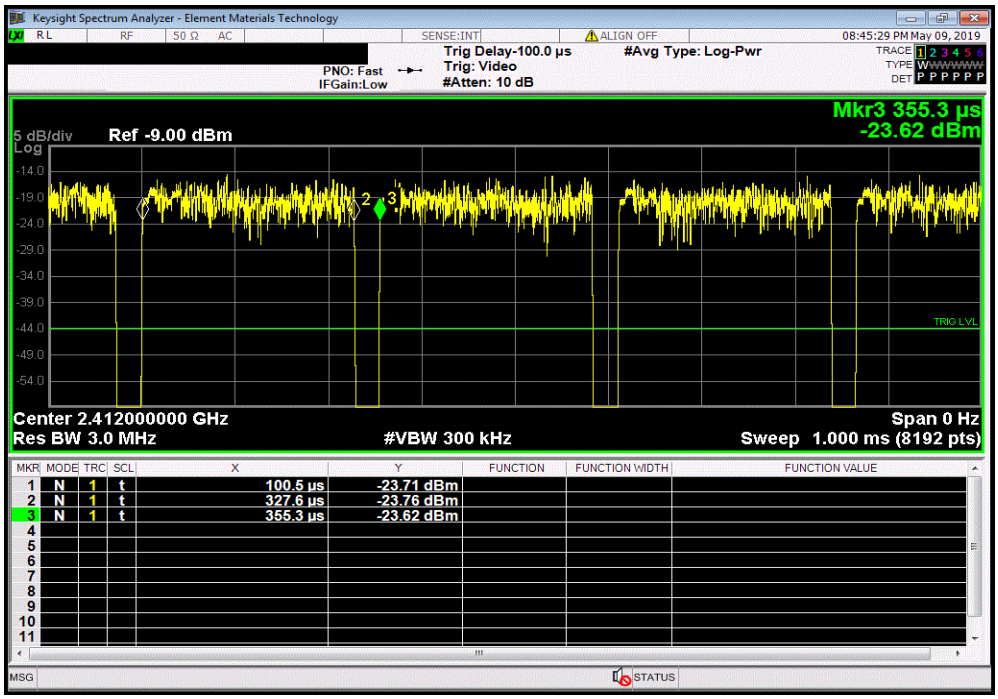


Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS0, High Channel 11, 2462 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	6	N/A	N/A	N/A



DUTY CYCLE

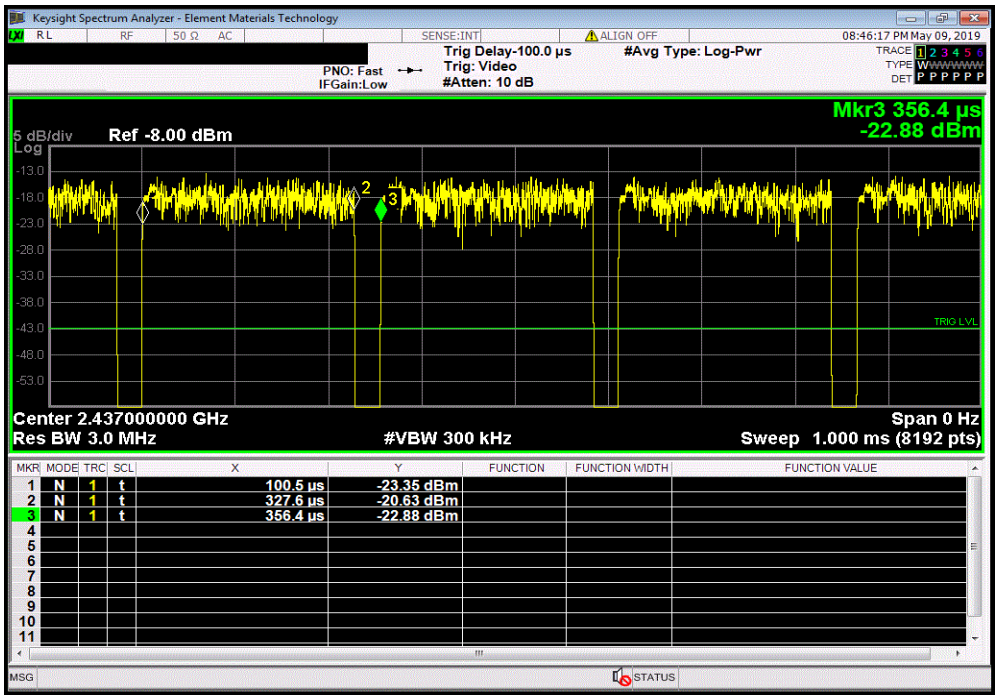
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS7, Low Channel 1, 2412 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	227 us	255 us	1	89.0	N/A	N/A



Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS7, Low Channel 1, 2412 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

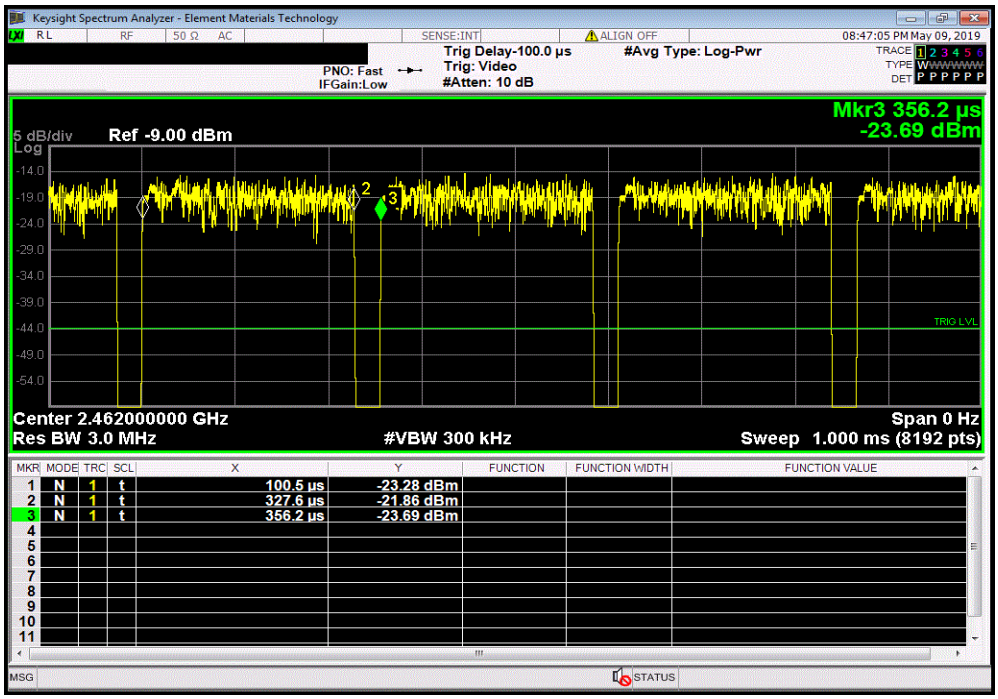
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS7, Mid Channel 6, 2437 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	227 us	256 us	1	88.7	N/A	N/A



Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS7, Mid Channel 6, 2437 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

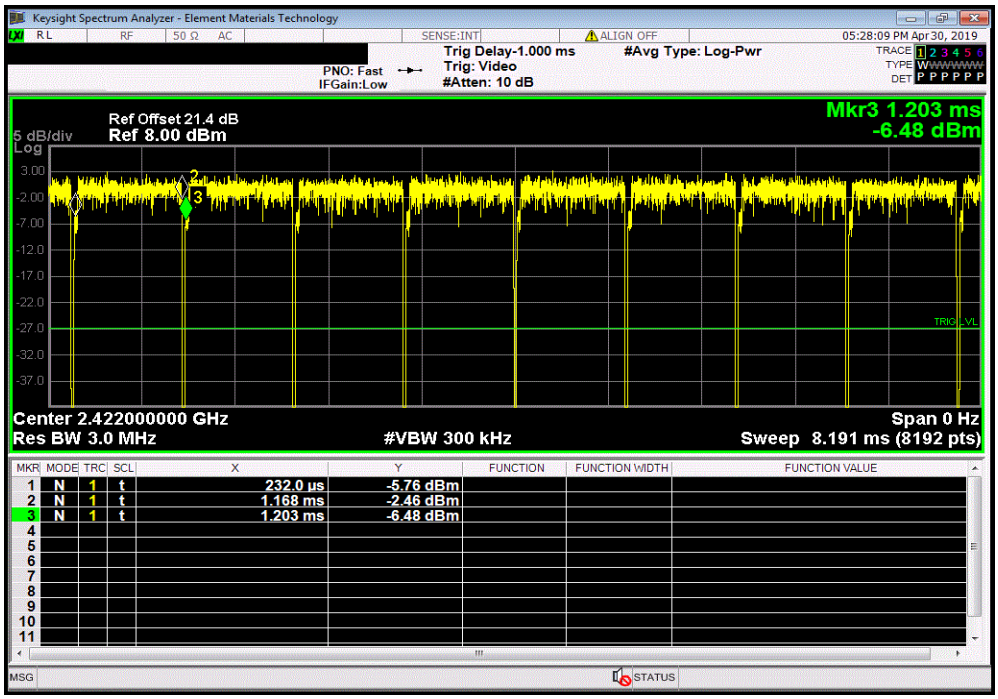
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS7, High Channel 11, 2462 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	227 us	256 us	1	88.7	N/A	N/A



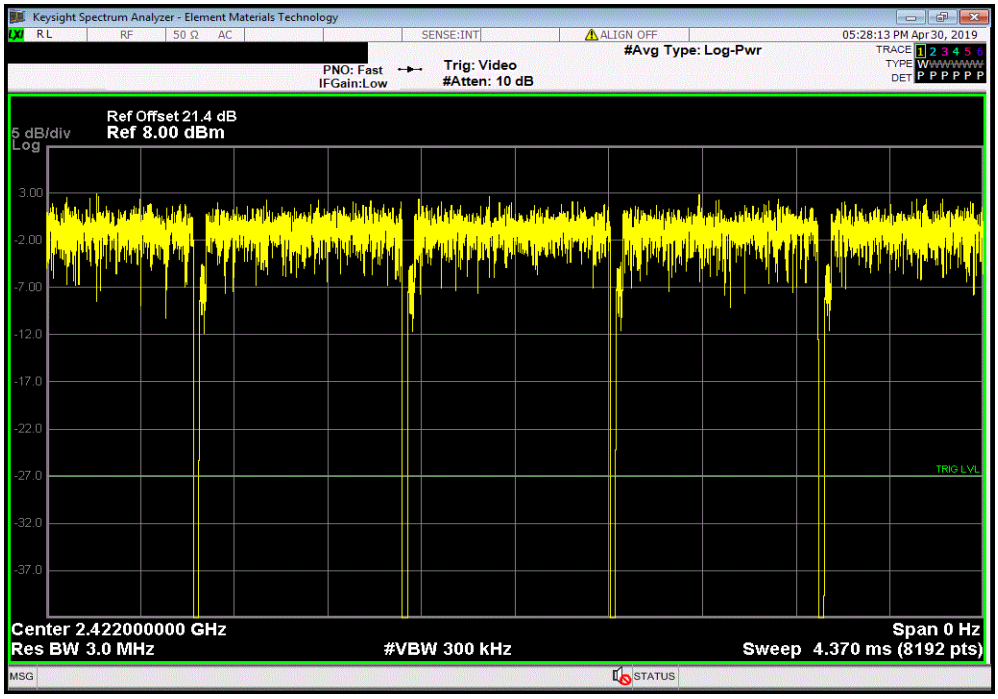
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS7, High Channel 11, 2462 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

Chain A, 2400 MHz - 2483.5 MHz Band, 40 MHz BW, 802.11(n) MCS0, Low Channel 1, 2412 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	936 us	971 us	1	96.4	N/A	N/A

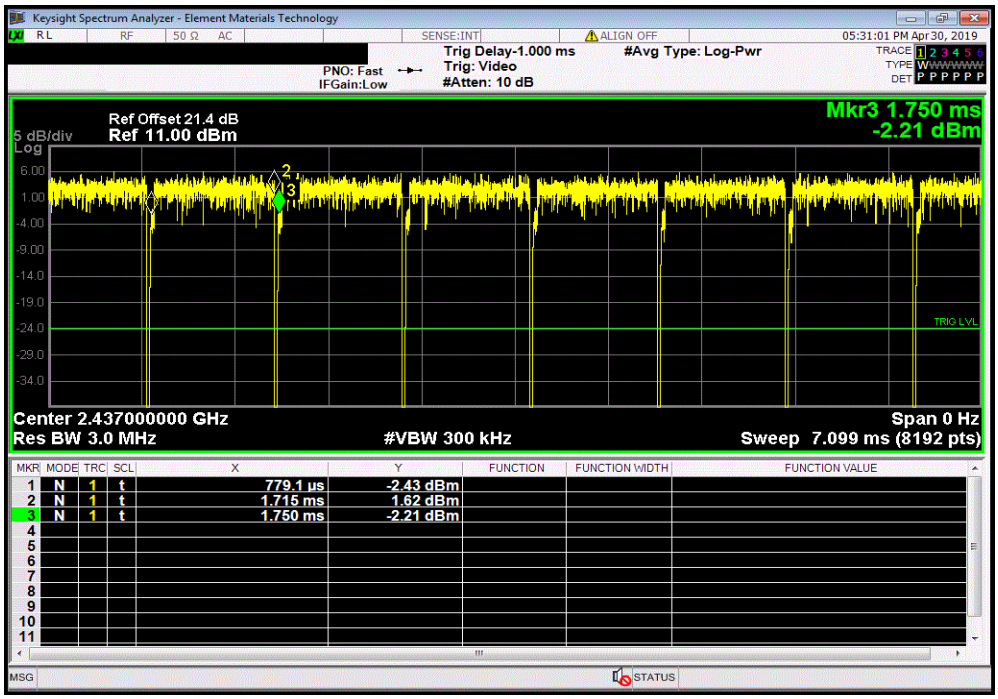


Chain A, 2400 MHz - 2483.5 MHz Band, 40 MHz BW, 802.11(n) MCS0, Low Channel 1, 2412 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



DUTY CYCLE

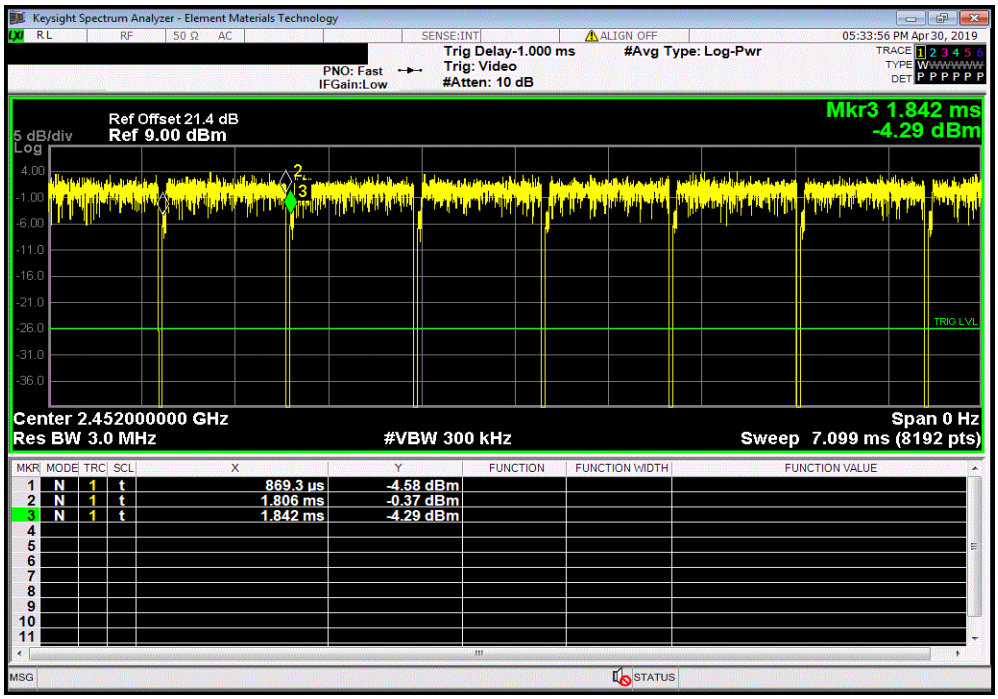
Chain A, 2400 MHz - 2483.5 MHz Band, 40 MHz BW, 802.11(n) MCS0, Mid Channel 6, 2437 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	936 us	970.7 us	1	96.4	N/A	N/A



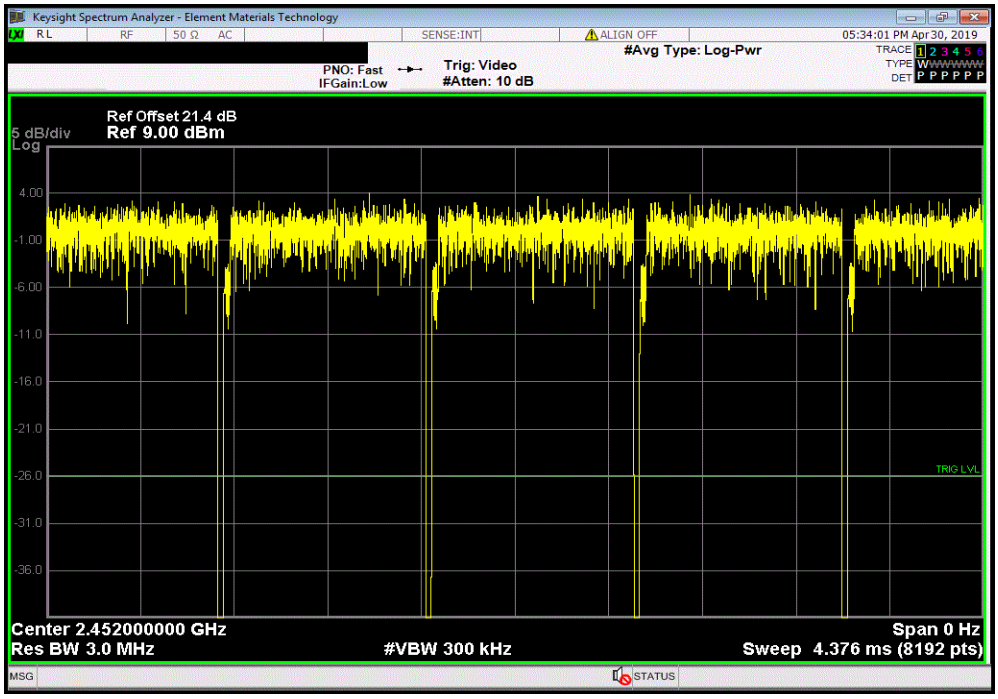
Chain A, 2400 MHz - 2483.5 MHz Band, 40 MHz BW, 802.11(n) MCS0, Mid Channel 6, 2437 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	6	N/A	N/A	N/A

DUTY CYCLE

Chain A, 2400 MHz - 2483.5 MHz Band, 40 MHz BW, 802.11(n) MCS0, High Channel 11, 2462 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	936.8 us	972.4 us	1	96.3	N/A	N/A



Chain A, 2400 MHz - 2483.5 MHz Band, 40 MHz BW, 802.11(n) MCS0, High Channel 11, 2462 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



OUTPUT POWER

XMit 2019.02.26

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.	Cal. Due
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	10-Oct-18	10-Oct-19
Block - DC	Fairview Microwave	SD3379	AMM	17-Mar-19	17-Mar-20
Attenuator	Fairview Microwave	SA4018-20	TYW	17-Mar-19	17-Mar-20
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-19	19-Mar-20

TEST DESCRIPTION

The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

Prior to measuring output power; the emission bandwidth (B) and the transmission pulse duration (T) were measured. Both are required to determine the method of measuring Maximum Conducted Output Power. The transmission pulse duration (T) was measured using a zero span on the spectrum analyzer to see the pulses in the time domain.

The method AVGSA-2 in section 11.9.2.2.4 of ANSI C63.10:2013 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

OUTPUT POWER

element

TbtTx 2018.09.13 XMit 2019.02.26

EUT:	Dual Band Wireless-AC 3160 Module			**Work Order:**	AMRN0006
Serial Number:	APT31600958			**Date:**	30-Apr-19
Customer:	American Portwell Technology			**Temperature:**	22.5 °C
Attendees:	None			**Humidity:**	55.6% RH
Project:	None			**Barometric Pres.:**	1016 mbar
Tested by:	Jonathan Kiefer	**Power:**	110VAC/60Hz	**Job Site:**	TX09

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

See Power Table for output power settings used. Measurements were mae on the same data rates that were identified in the original FCC grant test report as worst case for each radio type (802.11b, 802.11g, 802.11n20, 802.11n40). Ref Offset 21.4 dB (20 dB attenuator+DC block+cable). External dipole antennas are used. Assembly gain = 2.0 dBi antenna gain - 0.9 dB cable loss = 1.1 dBi.

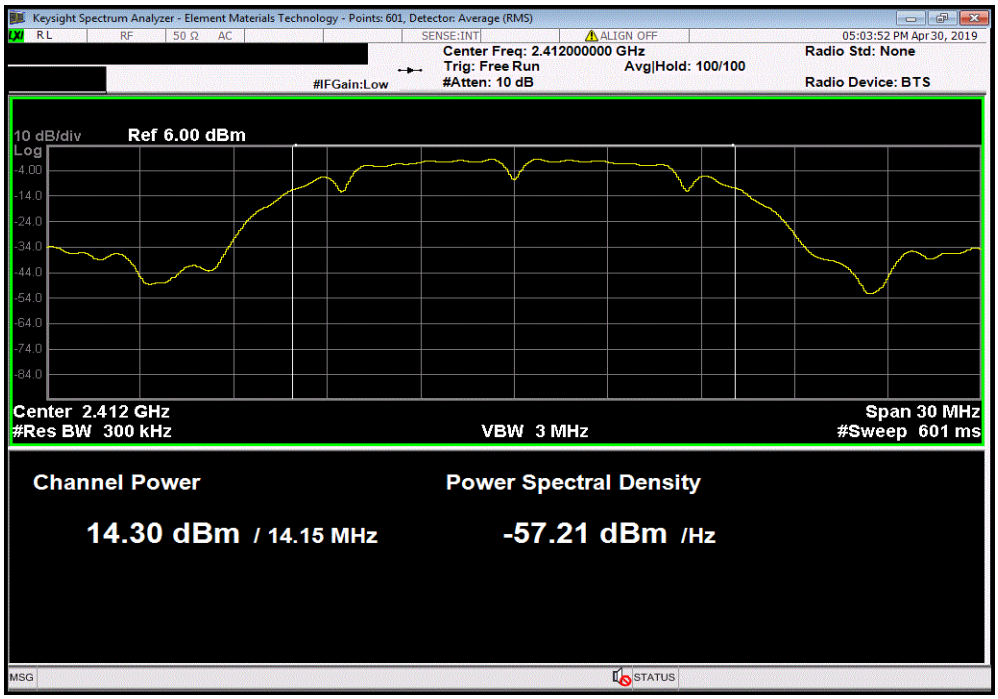
DEVIATIONS FROM TEST STANDARD

None

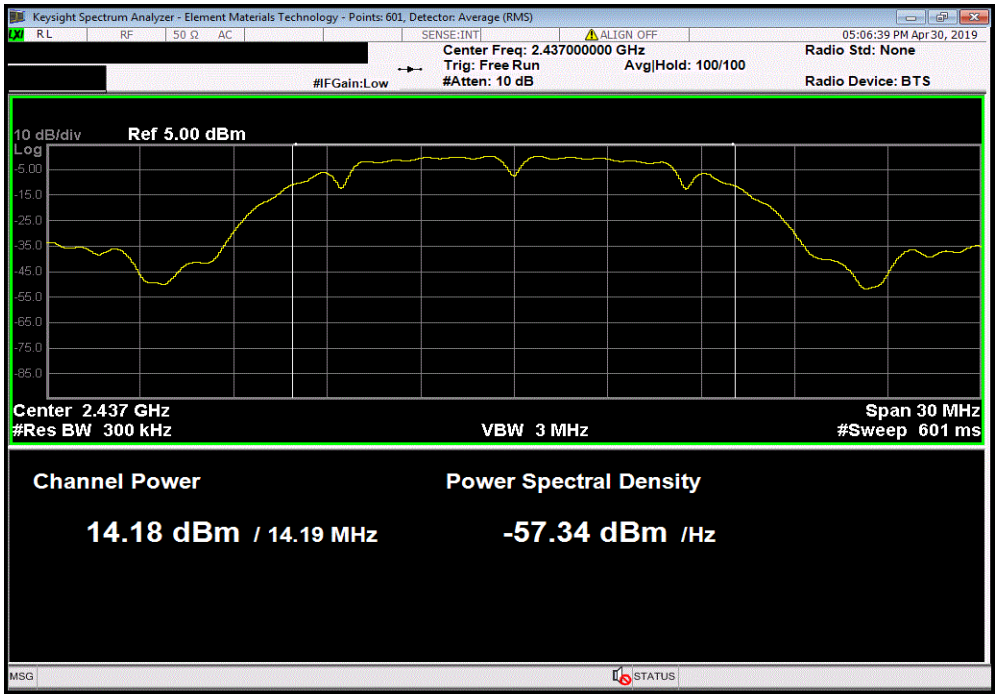
Configuration #	1	*Signature* Jonathan Kiefer

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results
Chain A					
2400 MHz - 2483.5 MHz Band					
20 MHz BW					
802.11(b) 1 Mbps					
Low Channel 1, 2412 MHz	14.302	0.1	14.4	30	Pass
Mid Channel 6, 2437 MHz	14.176	0.1	14.3	30	Pass
High Channel 11, 2462 MHz	14.25	0.1	14.4	30	Pass
802.11(g) 6 Mbps					
Low Channel 1, 2412 MHz	12.074	0.1	12.2	30	Pass
Mid Channel 6, 2437 MHz	13.934	0.1	14	30	Pass
High Channel 11, 2462 MHz	12.43	0.1	12.5	30	Pass
802.11(n) MCS0					
Low Channel 1, 2412 MHz	12.139	0.1	12.3	30	Pass
Mid Channel 6, 2437 MHz	13.887	0.1	14	30	Pass
High Channel 11, 2462 MHz	12.367	0.1	12.5	30	Pass
40 MHz BW					
802.11(n) MCS0					
Low Channel 1, 2422 MHz	10.65	0.2	10.8	30	Pass
Mid Channel 6, 2437 MHz	13.747	0.2	13.9	30	Pass
High Channel 11, 2452 MHz	11.831	0.2	12	30	Pass

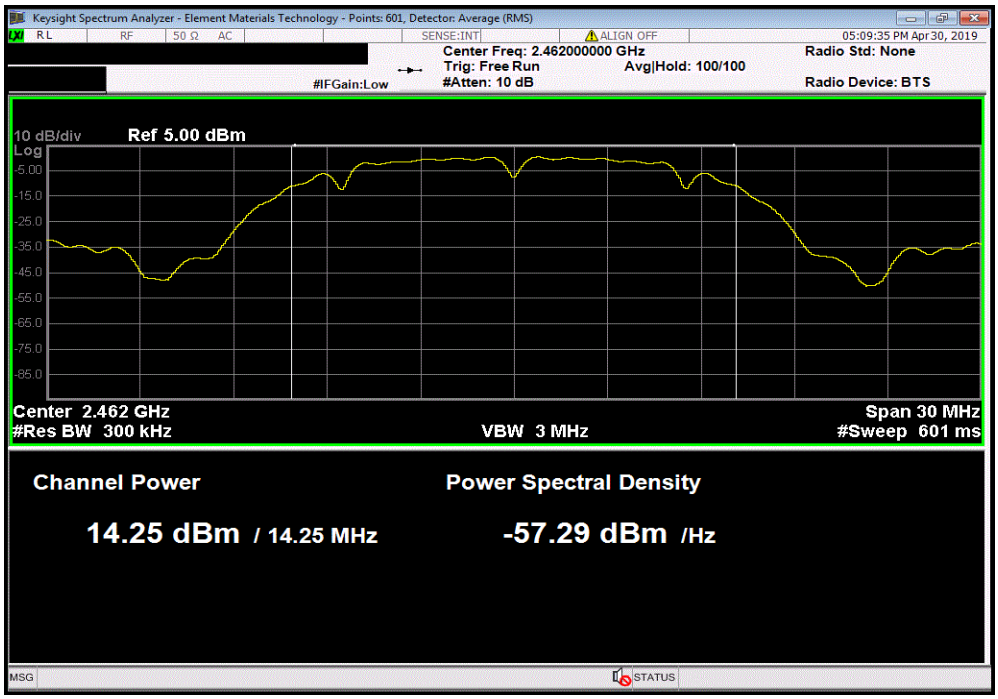
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(b) 1 Mbps, Low Channel 1, 2412 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	14.302	0.1		14.4	30	Pass



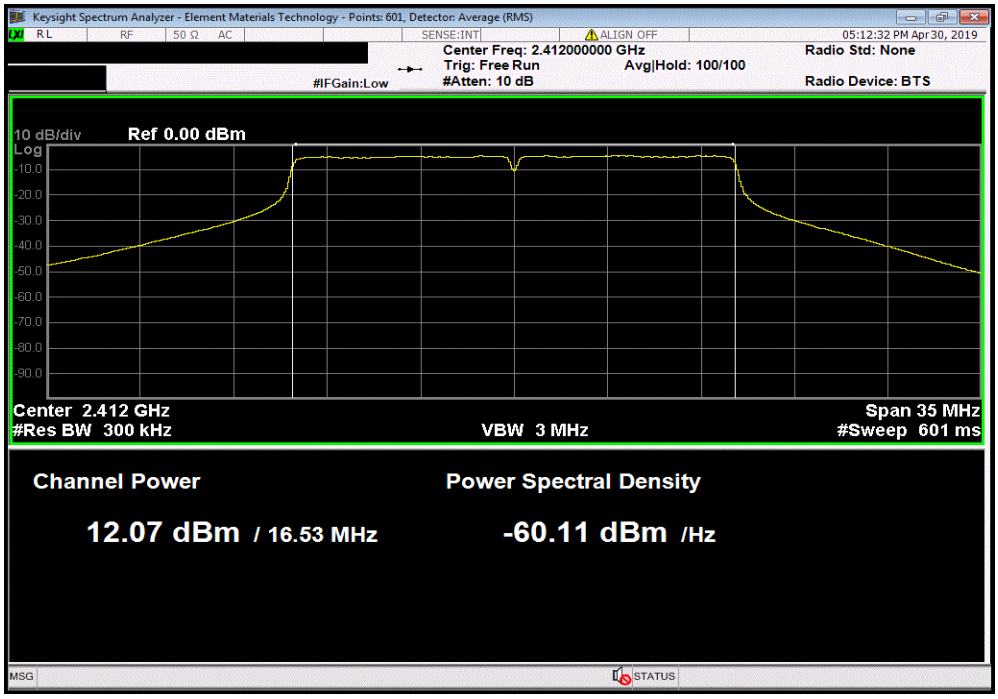
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(b) 1 Mbps, Mid Channel 6, 2437 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	14.176	0.1		14.3	30	Pass



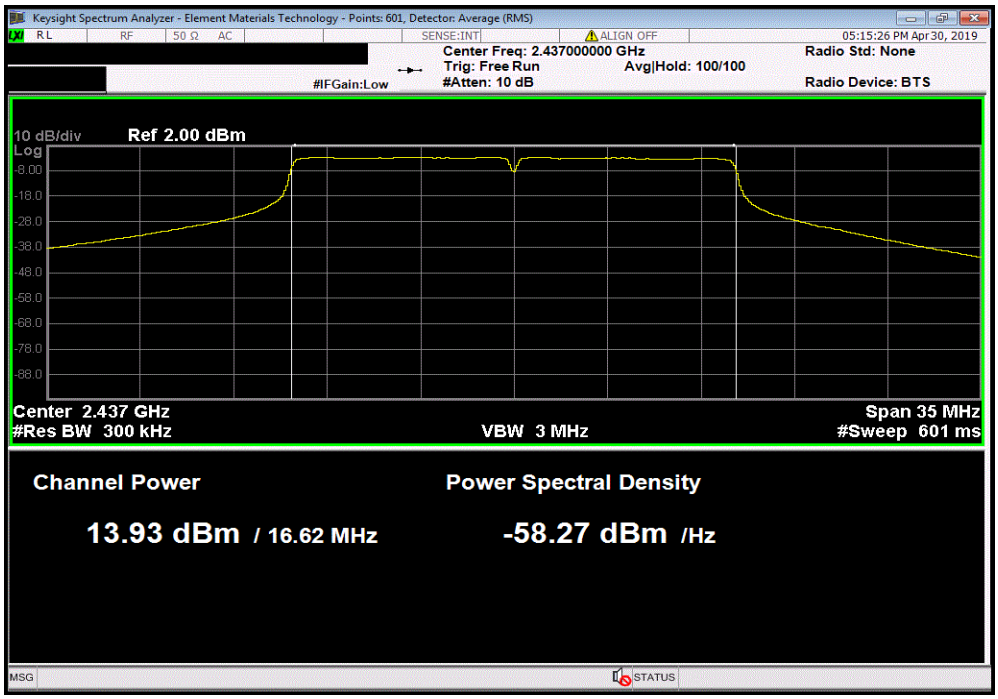
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(b) 1 Mbps, High Channel 11, 2462 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	14.25	0.1		14.4	30	Pass



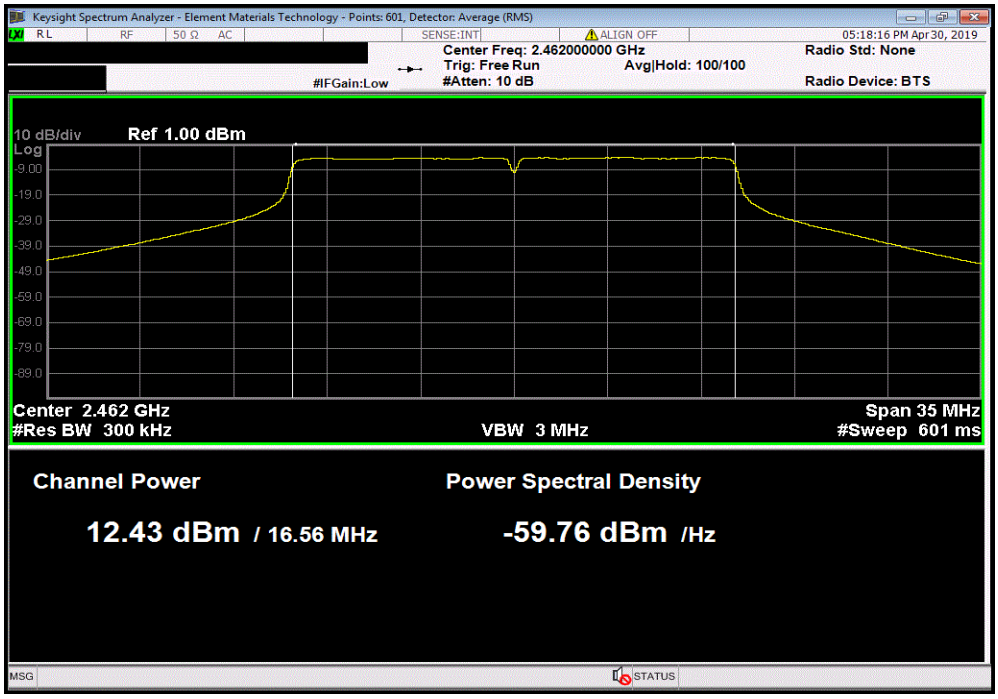
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(g) 6 Mbps, Low Channel 1, 2412 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	12.074	0.1		12.2	30	Pass



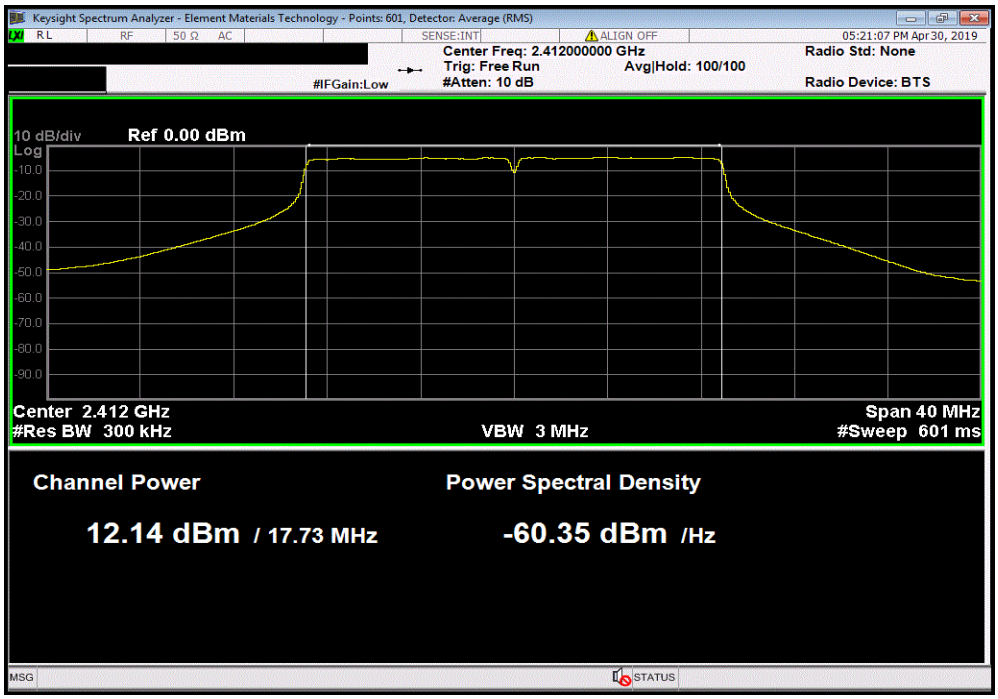
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(g) 6 Mbps, Mid Channel 6, 2437 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	13.934	0.1		14	30	Pass



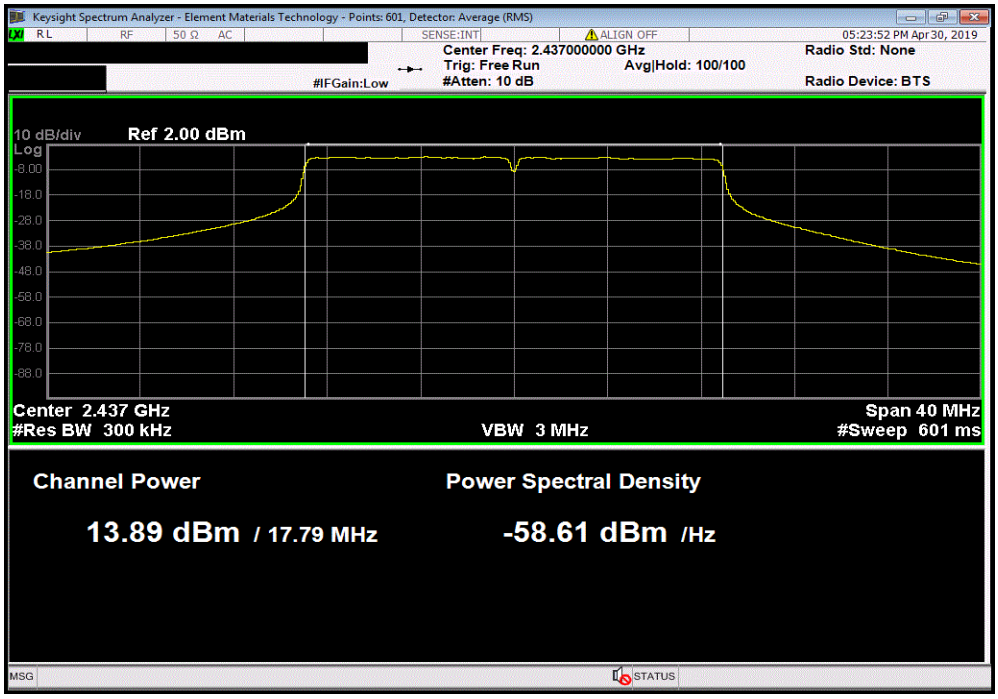
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(g) 6 Mbps, High Channel 11, 2462 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	12.43	0.1		12.5	30	Pass



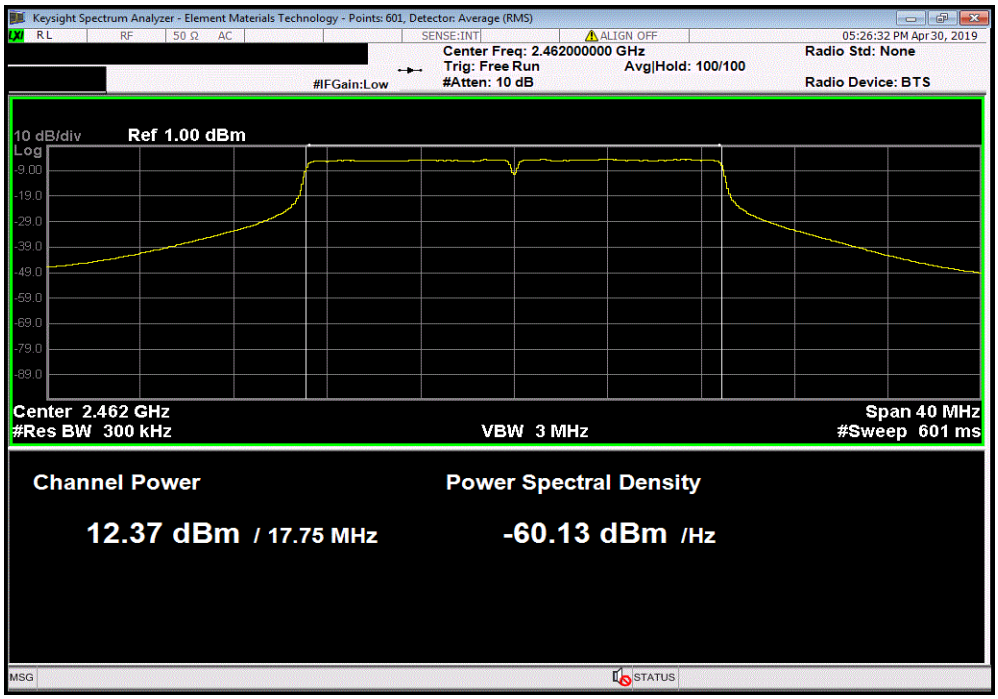
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS0, Low Channel 1, 2412 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	12.139	0.1		12.3	30	Pass



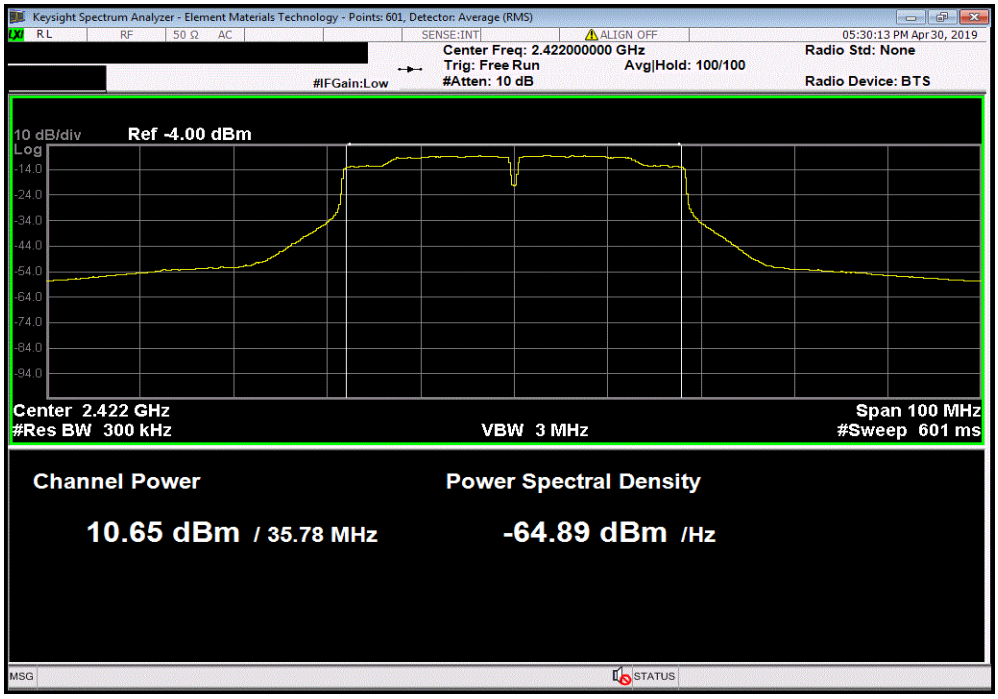
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS0, Mid Channel 6, 2437 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	13.887	0.1		14	30	Pass



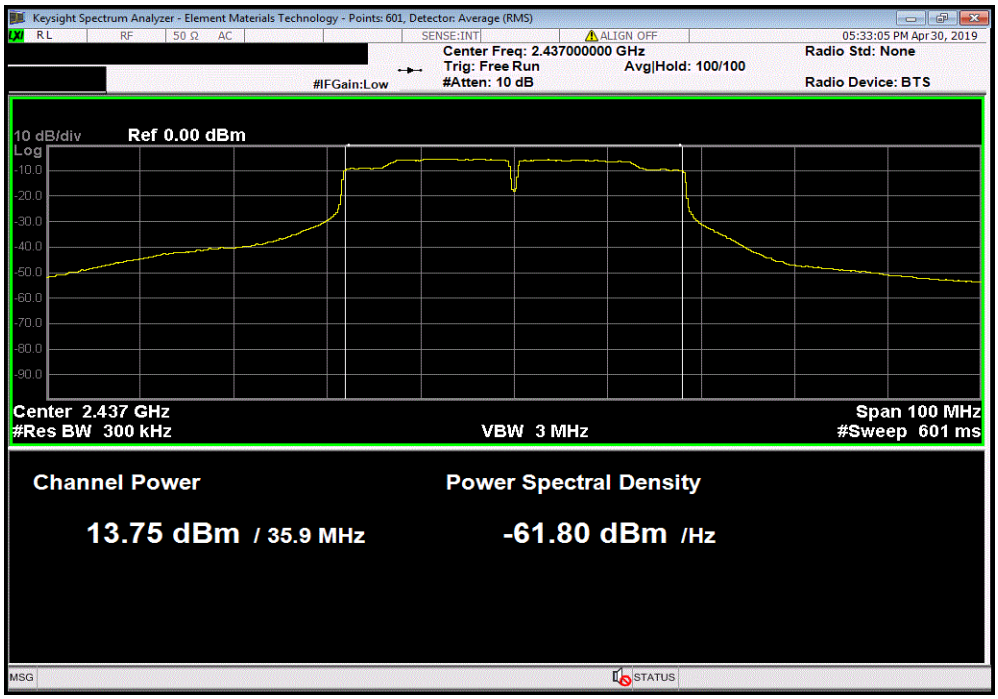
Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS0, High Channel 11, 2462 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	12.367	0.1		12.5	30	Pass



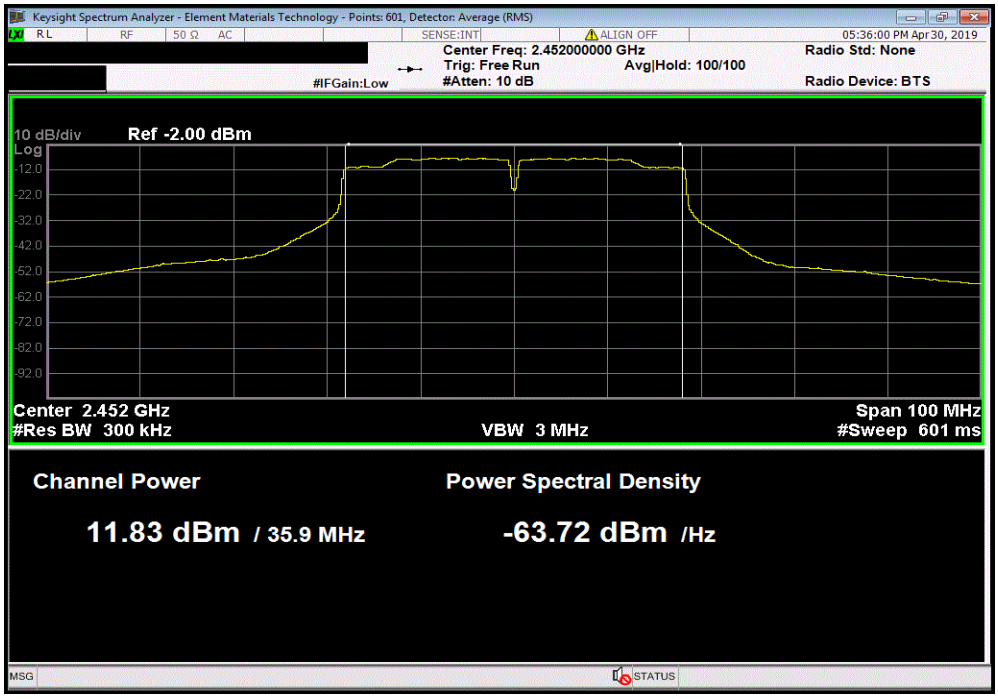
Chain A, 2400 MHz - 2483.5 MHz Band, 40 MHz BW, 802.11(n) MCS0, Low Channel 1, 2422 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	10.65	0.2		10.8	30	Pass



Chain A, 2400 MHz - 2483.5 MHz Band, 40 MHz BW, 802.11(n) MCS0, Mid Channel 6, 2437 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	13.747	0.2		13.9	30	Pass



Chain A, 2400 MHz - 2483.5 MHz Band, 40 MHz BW, 802.11(n) MCS0, High Channel 11, 2452 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	11.831	0.2		12	30	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

XMit 2019.02.26

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.	Cal. Due
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	10-Oct-18	10-Oct-19
Block - DC	Fairview Microwave	SD3379	AMM	17-Mar-19	17-Mar-20
Attenuator	Fairview Microwave	SA4018-20	TYW	17-Mar-19	17-Mar-20
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-19	19-Mar-20

TEST DESCRIPTION

The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

Prior to measuring output power; the emission bandwidth (B) and the transmission pulse duration (T) were measured. Both are required to determine the method of measuring Maximum Conducted Output Power. The transmission pulse duration (T) was measured using a zero span on the spectrum analyzer to see the pulses in the time domain.

The method AVGSA-2 in section 11.9.2.2.4 of ANSI C63.10:2013 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

The antenna assembly gain is added to the measured power to derive the EIRP value.

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element

TbtTx 2018.09.13 XMit 2019.02.26

EUT:	Dual Band Wireless-AC 3160 Module			**Work Order:**	AMRN0006
Serial Number:	APT31600958			**Date:**	30-Apr-19
Customer:	American Portwell Technology			**Temperature:**	22.5 °C
Attendees:	None			**Humidity:**	55.6% RH
Project:	None			**Barometric Pres.:**	1016 mbar
Tested by:	Jonathan Kiefer	**Power:**	110VAC/60Hz	**Job Site:**	TX09

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

See Power Table for output power settings used. Measurements were mae on the same data rates that were identified in the original FCC grant test report as worst case for each radio type (802.11b, 802.11g, 802.11n20, 802.11n40). Ref Offset 21.4 dB (20 dB attenuator+DC block+cable). External dipole antennas are used. Assembly gain = 2.0 dBi antenna gain - 0.9 dB cable loss = 1.1 dBi.

DEVIATIONS FROM TEST STANDARD

None

Configuration #	1	*Signature*	Jonathan Kiefer

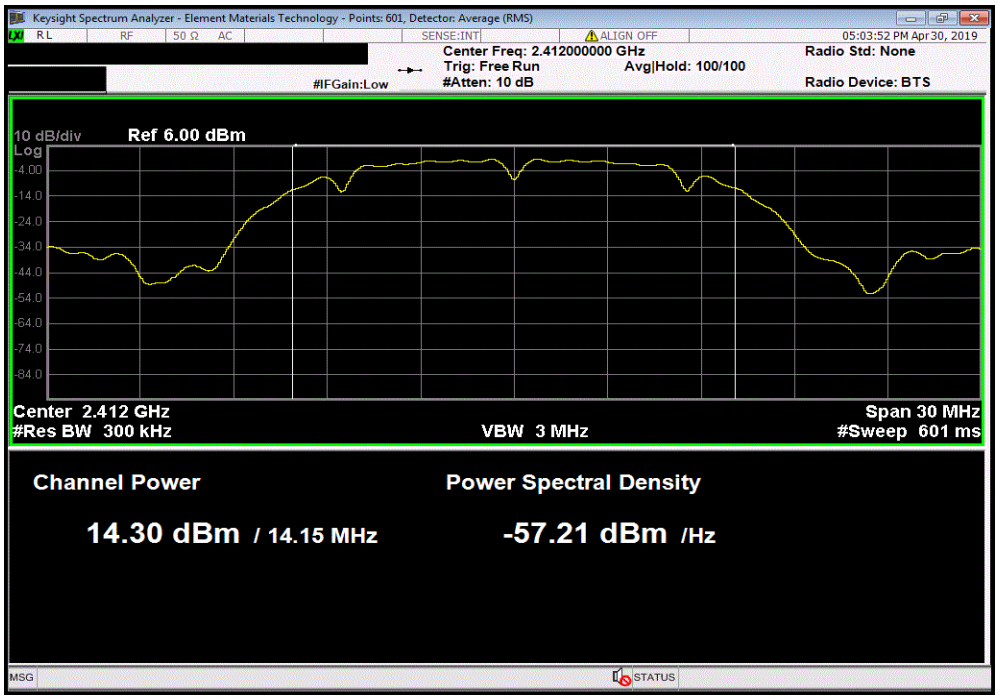
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Assembly Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Results
Chain A							
2400 MHz - 2483.5 MHz Band							
20 MHz BW							
802.11(b) 1 Mbps							
Low Channel 1, 2412 MHz	14.302	0.1	14.402	1.1	15.502	36	Pass
Mid Channel 6, 2437 MHz	14.176	0.1	14.276	1.1	15.376	36	Pass
High Channel 11, 2462 MHz	14.25	0.1	14.35	1.1	15.45	36	Pass
802.11(g) 6 Mbps							
Low Channel 1, 2412 MHz	12.074	0.1	12.174	1.1	13.274	36	Pass
Mid Channel 6, 2437 MHz	13.934	0.1	14.034	1.1	15.134	36	Pass
High Channel 11, 2462 MHz	12.43	0.1	12.53	1.1	13.63	36	Pass
802.11(n) MCS0							
Low Channel 1, 2412 MHz	12.139	0.1	12.239	1.1	13.339	36	Pass
Mid Channel 6, 2437 MHz	13.887	0.1	13.987	1.1	15.087	36	Pass
High Channel 11, 2462 MHz	12.367	0.1	12.467	1.1	13.567	36	Pass
40 MHz BW							
802.11(n) MCS0							
Low Channel 1, 2422 MHz	10.65	0.2	10.85	1.1	11.95	36	Pass
Mid Channel 6, 2437 MHz	13.747	0.2	13.947	1.1	15.047	36	Pass
High Channel 11, 2452 MHz	11.831	0.2	12.031	1.1	13.131	36	Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

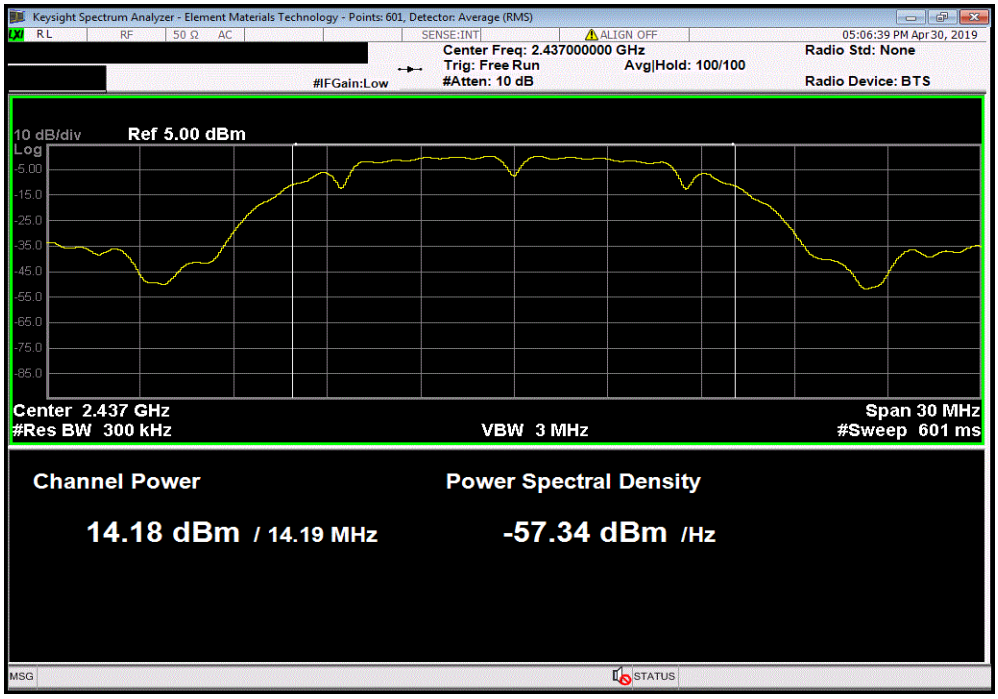
element

TbtTx 2018.09.13 XMit 2019.02.26

Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(b) 1 Mbps, Low Channel 1, 2412 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Assembly Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Results
14.302	0.1	14.402	1.1	15.502	36	Pass

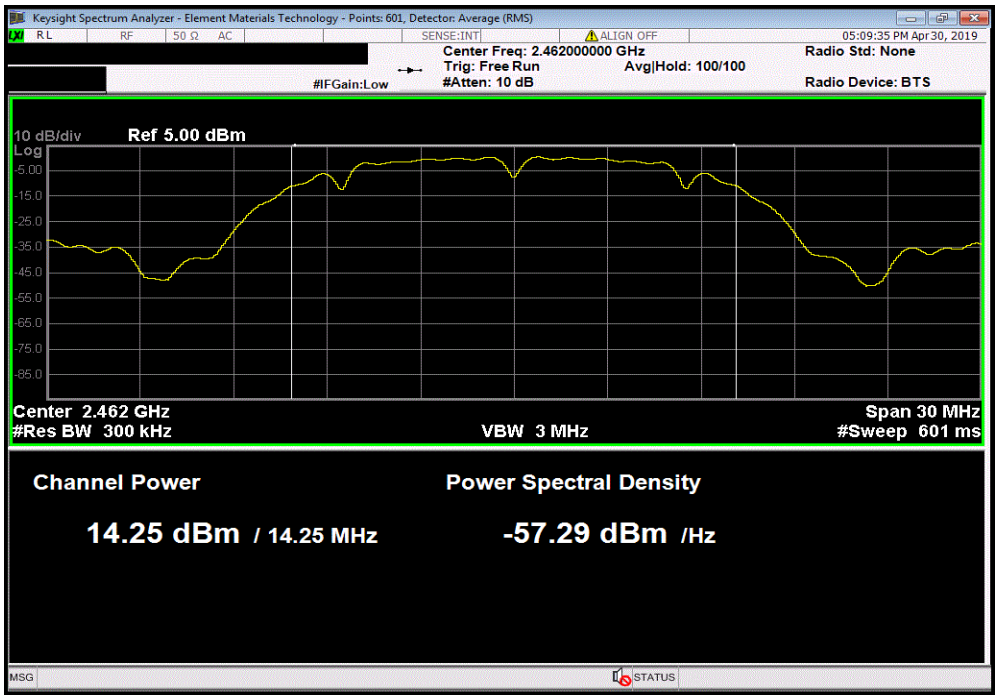


Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(b) 1 Mbps, Mid Channel 6, 2437 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Assembly Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Results
14.176	0.1	14.276	1.1	15.376	36	Pass

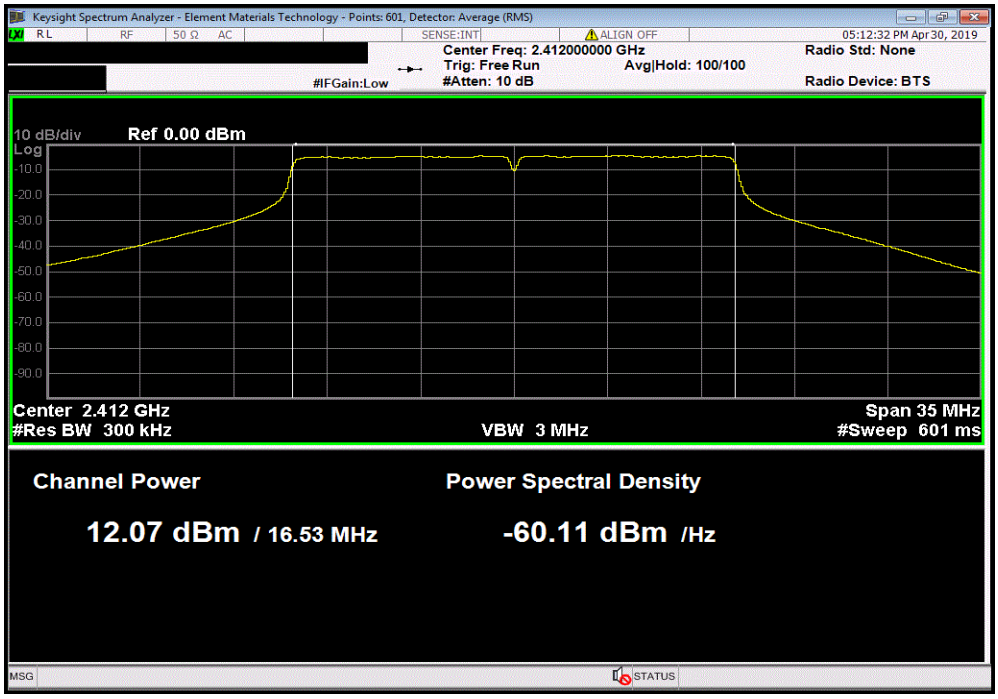


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(b) 1 Mbps, High Channel 11, 2462 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Assembly Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Results
14.25	0.1	14.35	1.1	15.45	36	Pass



Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(g) 6 Mbps, Low Channel 1, 2412 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Assembly Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Results
12.074	0.1	12.174	1.1	13.274	36	Pass

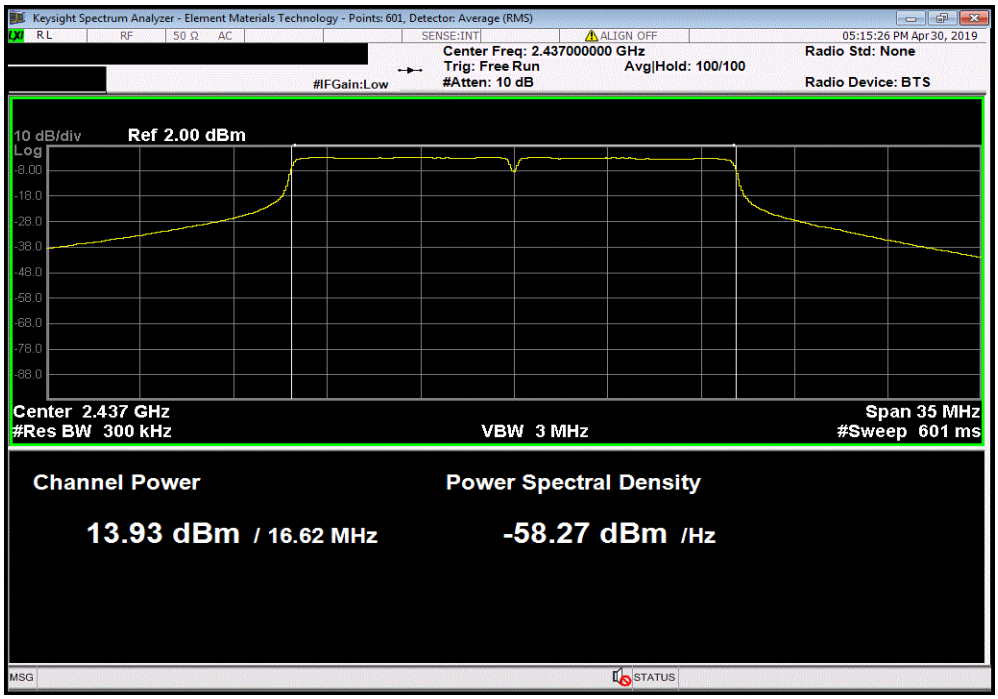


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

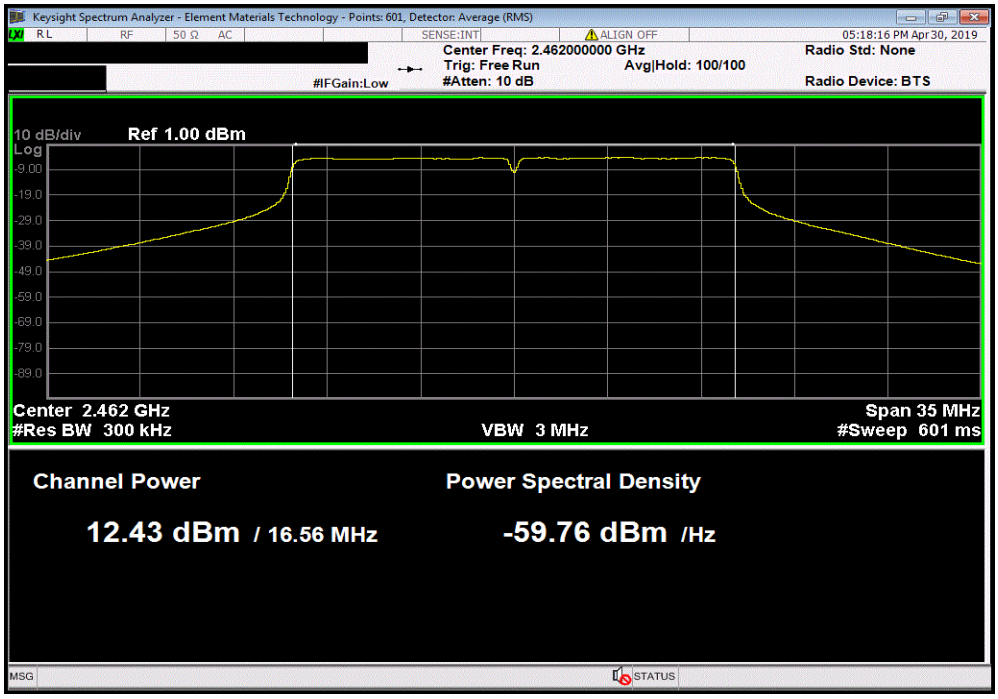
element

TbtTx 2018.09.13 XMit 2019.02.26

Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(g) 6 Mbps, Mid Channel 6, 2437 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Assembly Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Results
13.934	0.1	14.034	1.1	15.134	36	Pass

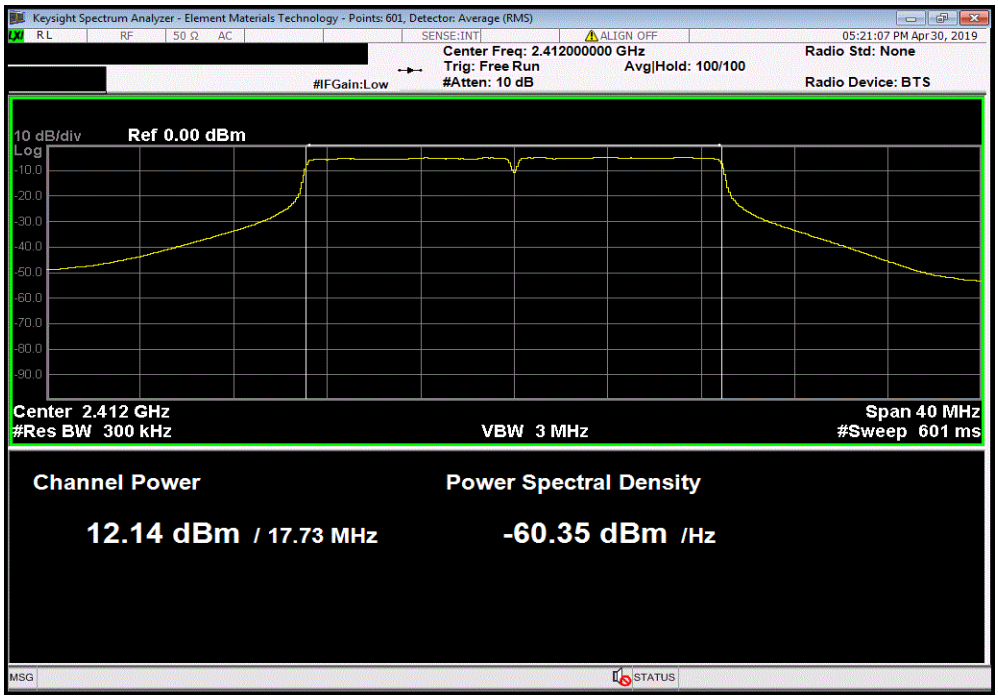


Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(g) 6 Mbps, High Channel 11, 2462 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Assembly Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Results
12.43	0.1	12.53	1.1	13.63	36	Pass

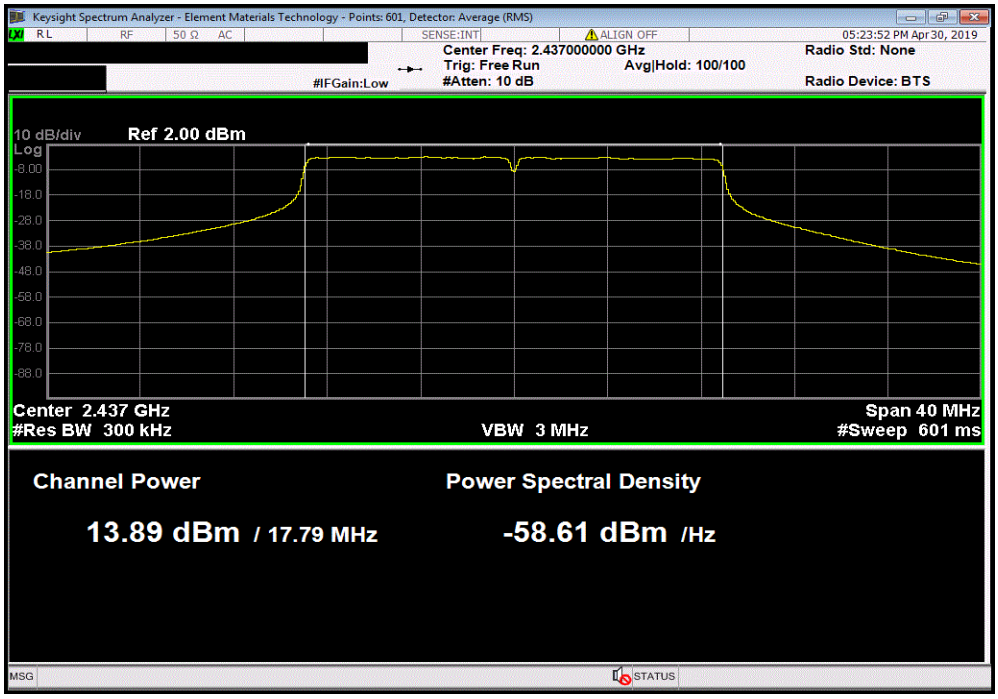


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS0, Low Channel 1, 2412 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Assembly Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Results
12.139	0.1	12.239	1.1	13.339	36	Pass

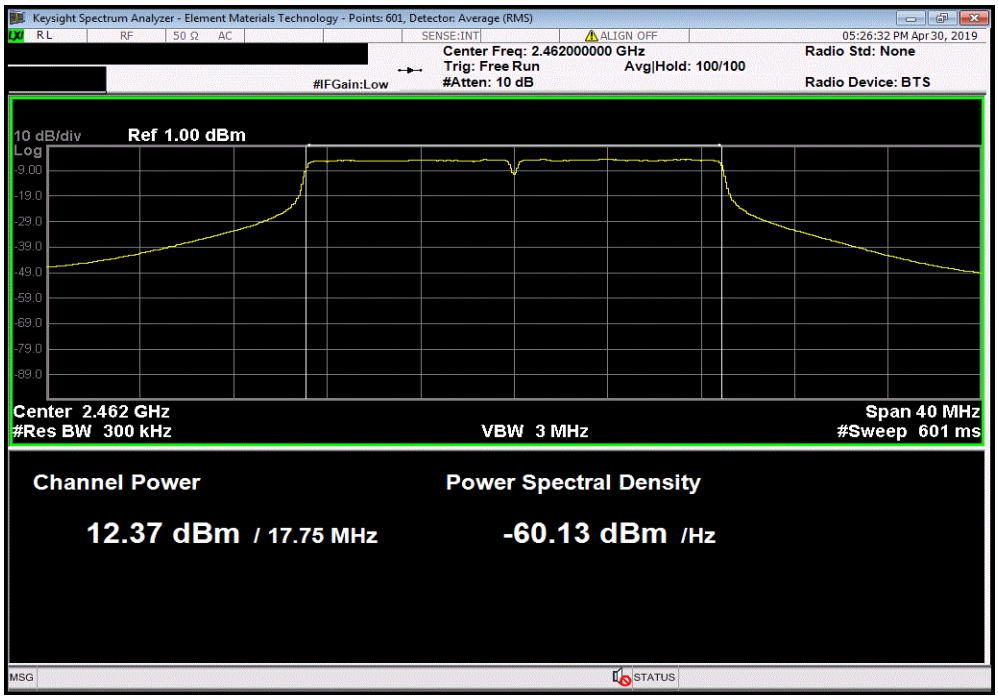


Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS0, Mid Channel 6, 2437 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Assembly Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Results
13.887	0.1	13.987	1.1	15.087	36	Pass

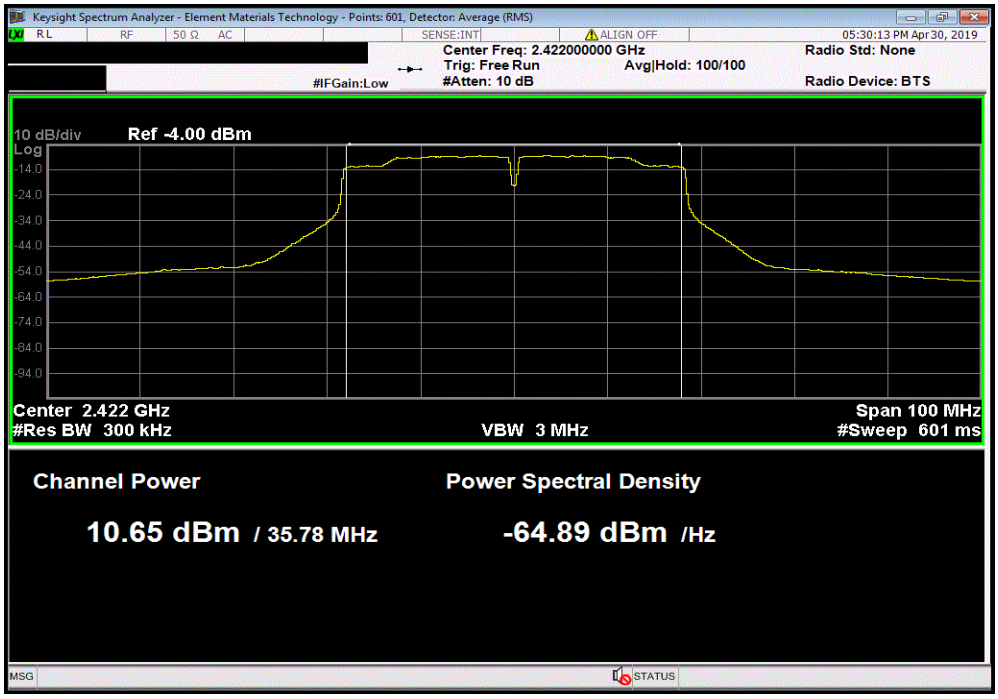


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

Chain A, 2400 MHz - 2483.5 MHz Band, 20 MHz BW, 802.11(n) MCS0, High Channel 11, 2462 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Assembly Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Results
12.367	0.1	12.467	1.1	13.567	36	Pass



Chain A, 2400 MHz - 2483.5 MHz Band, 40 MHz BW, 802.11(n) MCS0, Low Channel 1, 2422 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Assembly Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Results
10.65	0.2	10.85	1.1	11.95	36	Pass

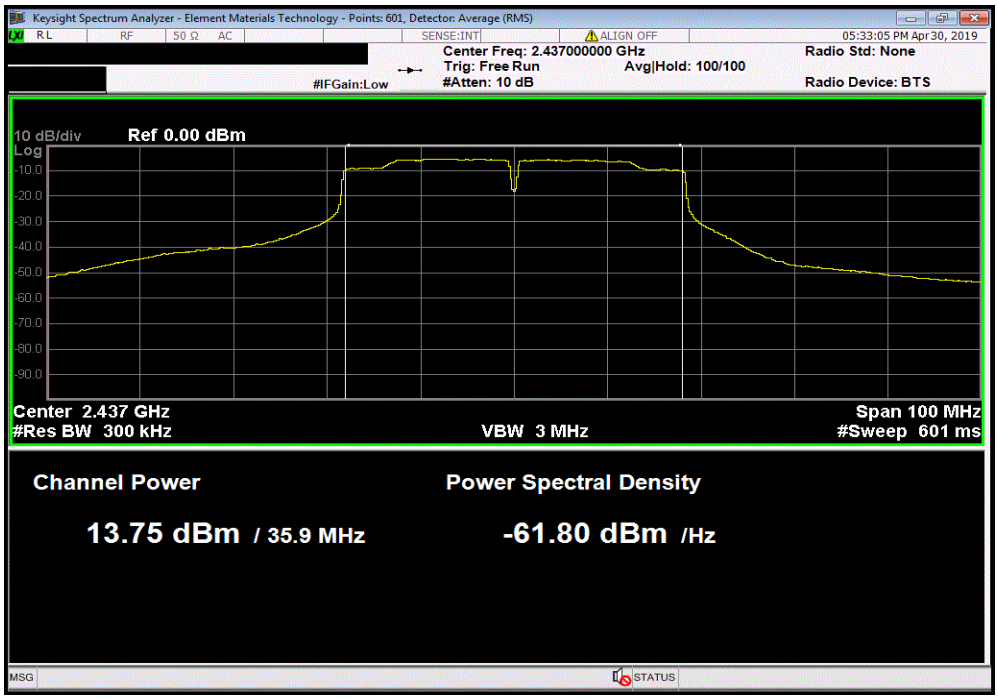


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element

TbtTx 2018.09.13 XMit 2019.02.26

Chain A, 2400 MHz - 2483.5 MHz Band, 40 MHz BW, 802.11(n) MCS0, Mid Channel 6, 2437 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Assembly Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Results
13.747	0.2	13.947	1.1	15.047	36	Pass



Chain A, 2400 MHz - 2483.5 MHz Band, 40 MHz BW, 802.11(n) MCS0, High Channel 11, 2452 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Assembly Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Results
11.831	0.2	12.031	1.1	13.131	36	Pass