



EchoNous, Inc.

Thor Radio Module AC WLAN and Bluetooth and BLE

FCC 15.247:2019

802.11bgn Radio

Report # ECHN0015.1 Rev 1



NVLAP LAB CODE: 200630-0
NVLAP LAB CODE: 200629-0

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government. This Report shall not be reproduced, except in full without written approval of the laboratory.

EAR-Controlled Data - This document contains technical data whose export and reexport/retransfer is subject to control by the U.S. Department of Commerce under the Export Administration Act and the Export Administration Regulations. The Department of Commerce's prior written approval may be required for the export or re-export/retransfer of such technical data to any foreign person, foreign entity or foreign organization whether in the United States or abroad.

CERTIFICATE OF TEST



Last Date of Test: December 27, 2019

EchoNous, Inc.

EUT: Thor Radio Module AC WLAN and Bluetooth and BLE

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2019	ANSI C63.10:2013
FCC 15.247:2019	ANSI C63.10:2013, KDB 558074, KDB 662911

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
11.6	Duty Cycle - Chain 1	Yes	Pass	
11.6	Duty Cycle - Chain 2	Yes	Pass	
11.6	Duty Cycle - 2x2 Chains	Yes	Pass	
11.8.2	Occupied Bandwidth - Chain 1	Yes	Pass	
11.8.2	Occupied Bandwidth - Chain 2	Yes	Pass	
11.8.2	Occupied Bandwidth - 2x2 Chains	Yes	Pass	
11.9.2.2.4	Output Power - Chain 1	Yes	Pass	
11.9.2.2.4	Output Power - Chain 2	Yes	Pass	
11.9.2.2.4	Output Power - 2x2 Chains	Yes	Pass	
11.9.2.2.4	Equivalent Isotropic Radiated Power (EIRP) - Chain 1	Yes	Pass	
11.9.2.2.4	Equivalent Isotropic Radiated Power (EIRP) - Chain 2	Yes	Pass	
11.9.2.2.4	Equivalent Isotropic Radiated Power (EIRP) - 2x2 Chains	Yes	Pass	
11.10.2	Power Spectral Density - Chain 1	Yes	Pass	
11.10.2	Power Spectral Density - Chain 2	Yes	Pass	
11.10.2	Power Spectral Density - 2x2 Chains	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	
11.12.1, 11.13.2, 6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Rod Munro, 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
01	Reduction of analyzer screen captures to only those required to demonstrate compliance to the testing objectives.	2020-03-10	Various

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

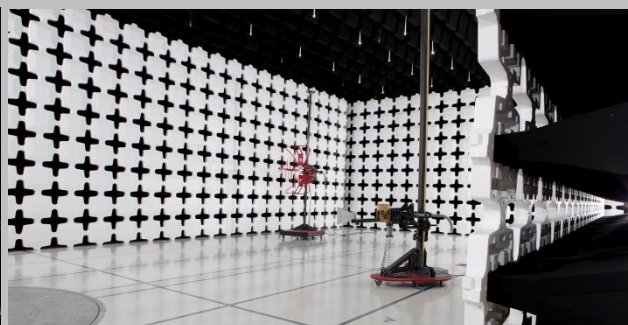
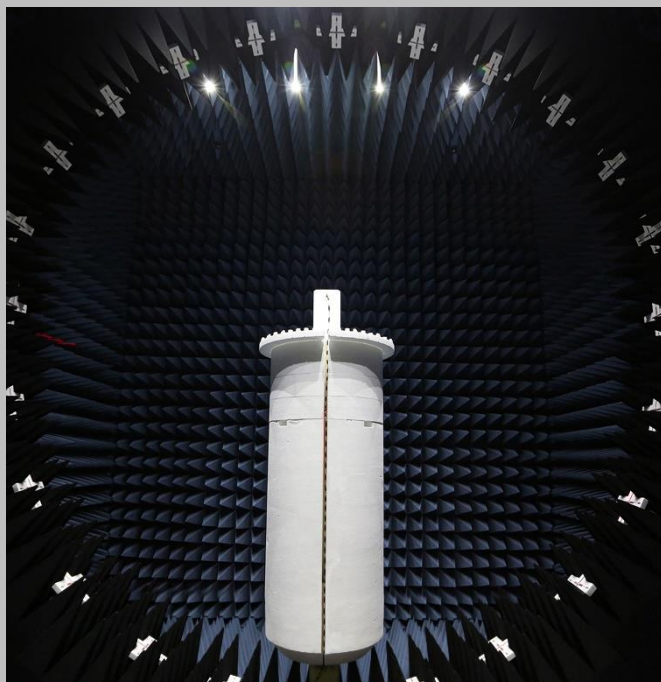
For details on the Scopes of our Accreditations, please visit:

<https://www.nwemc.com/emc-testing-accreditations>

FACILITIES



California Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Oregon Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 th 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

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.

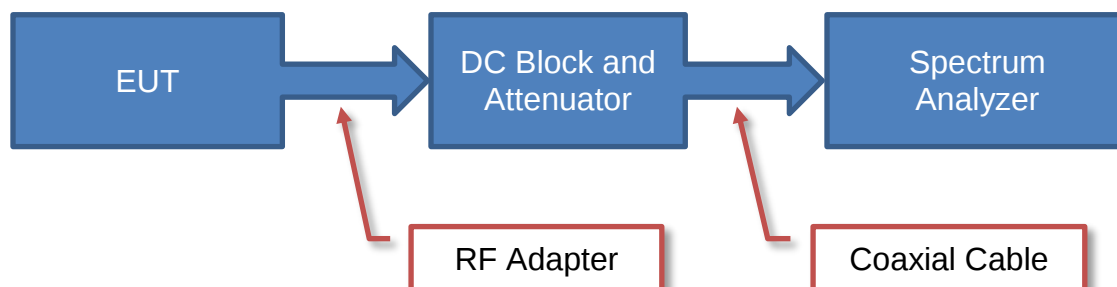
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable 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	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)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

Test Setup Block Diagrams

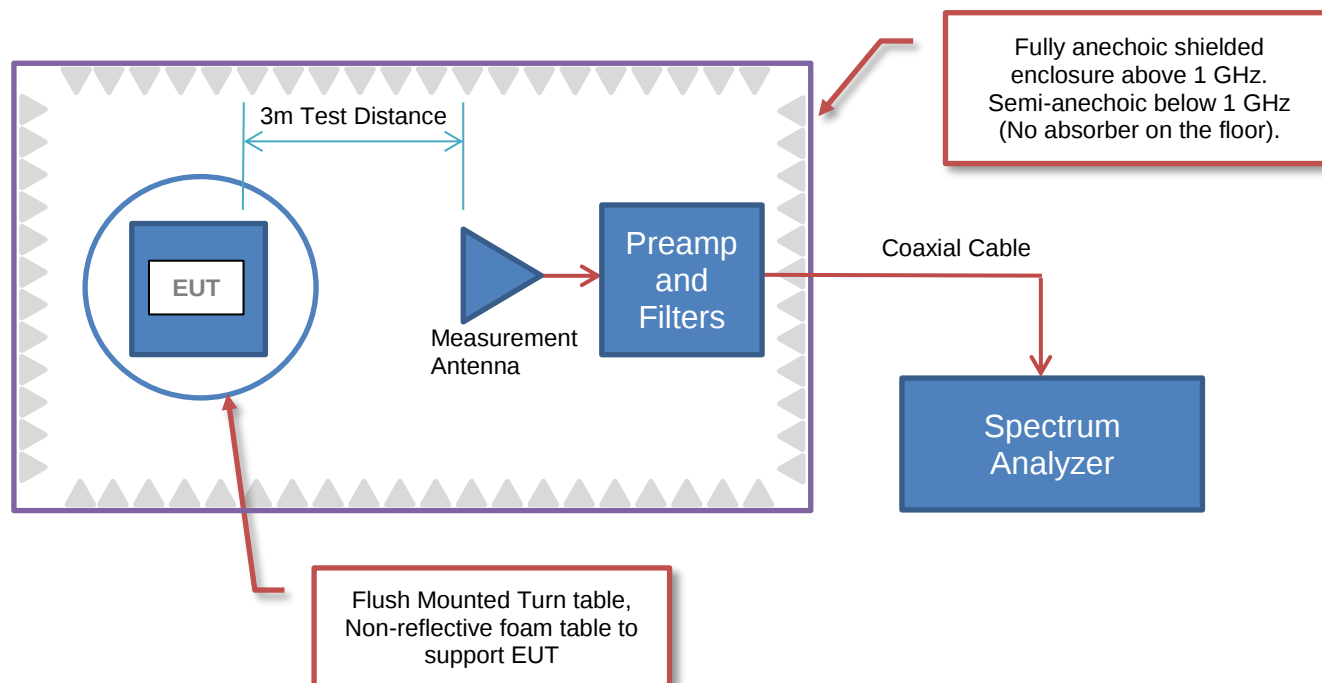
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	EchoNous, Inc.
Address:	8310 154th Ave NE, Bldg. B, Ste. 200
City, State, Zip:	Redmond, WA 98052
Test Requested By:	Sanchit Chirania
EUT:	Thor Radio Module AC WLAN and Bluetooth and BLE
First Date of Test:	July 17, 2019
Last Date of Test:	December 27, 2019
Receipt Date of Samples:	July 16, 2019
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Qualcomm Snapdragon 835 WLAN with Bluetooth 5.0 and BLE for QCA6174 based NFA324 Foxconn Module, 2x2 802.11ac with MU-MIMO
Testing Objective:
To demonstrate compliance of the 802.11 radio under FCC 15.247 for operation in the 2.4 GHz band.

CONFIGURATIONS



Configuration ECHN0015- 1

Software/Firmware Running during test	
Description	Version
Qualcomm Radio Control Tool	4

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Thor Radio Module AC WLAN and Bluetooth 5.0 and BLE	Qualcomm	Thor 1.0	Pre-production #1

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Laptop #1	Lenovo	E590	PF-1KP4WR

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
USB-C Cable	No	1.2m	No	USB-C Connector (Laptop)	USB-C Connector (Thor Radio Module)

Configuration ECHN0015- 4

Software/Firmware Running during test	
Description	Version
Qualcomm Radio Control Tool	4

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Thor Radio Module AC WLAN and Bluetooth 5.0 and BLE	EchoNous, Inc.	Thor 1.0	H1UR1944002-03

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Laptop #1	Lenovo	E590	PF-1KP4WR

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
USB-C Cable	No	1.2m	No	USB-C Connector (Laptop)	USB-C Connector (Thor Radio Module)
USB-C Cable	No	2.0m	No	Thor Radio Module AC WLAN and Bluetooth 5.0 and BLE	Unterminated

CONFIGURATIONS



Configuration ECHN0015- 10

Software/Firmware Running during test	
Description	Version
Qualcomm Radio Control Tool	4

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Thor Radio Module AC WLAN and Bluetooth 5.0 and BLE	EchoNous, Inc.	Thor 1.0	30

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Laptop #1	Lenovo	E590	PF-1KP4WR
USB-C Hub	Monprice	15249	None

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
USB-C Cable	No	2.0m	No	Thor Radio Module AC WLAN and Bluetooth 5.0 and BLE	Unterminated
USB-C	Yes	0.1m	No	Laptop	USB-C Hub
USB-C	Yes	1.4m	No	AC/DC Adapter	USB-C Hub
USB-C	Yes	2.0m	No	USB-C Hub	Thor Radio Module AC WLAN and Bluetooth 5.0 and BLE

CONFIGURATIONS



Configuration ECHN0015- 12

Software/Firmware Running during test	
Description	Version
Qualcomm Radio Control Tool	4

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Thor Radio Module AC WLAN and Bluetooth 5.0 and BLE	Qualcomm	Thor 1.0	Pre-production #1

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Laptop #1	Lenovo	E590	PF-1KP4WR
50 Ohm Terminator	Anne-50+	3 1432	N/A

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
USB-C Cable	No	1.2m	No	USB-C Connector (Laptop)	USB-C Connector (Thor Radio Module)
U.FL Patch Cable	Yes	0.1m	No	50 Ohm Terminator	Antenna Port

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-07-17	Occupied Bandwidth	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	2019-07-23	Spurious Conducted Emissions	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	2019-08-01	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.
4	2019-08-09	Equivalent Isotropic Radiated Power (EIRP)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2019-08-09	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2019-08-09	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	2019-08-09	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.
8	2019-12-02	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
9	2019-12-27	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.

POWER SETTINGS



The EUT was tested using the power settings provided by the manufacturer:

SETTINGS FOR ALL TESTS IN THIS REPORT

Chain	Modulation Types	Channel Bandwidths	Channel	Position	Frequency (MHz)	Power Setting
A	1 Mbps	20	1	Low Channel	2412	18
			6	Mid Channel	2437	18
			13	High Channel	2472	18
A	11 Mbps	20	1	Low Channel	2412	18
			6	Mid Channel	2437	18
			13	High Channel	2472	18
A	6 Mbps	20	1	Low Channel	2412	16.5
			6	Mid Channel	2437	16.5
			13	High Channel	2472	16.5
A	36 Mbps	20	1	Low Channel	2412	16
			6	Mid Channel	2437	16
			13	High Channel	2472	16
A	54 Mbps	20	1	Low Channel	2412	15.5
			6	Mid Channel	2437	15.5
			13	High Channel	2472	15.5
A	MCS0	20	1	Low Channel	2412	16.5
			6	Mid Channel	2437	16.5
			13	High Channel	2472	16.5
A	MCS7	20	1	Low Channel	2412	15
			6	Mid Channel	2437	15
			13	High Channel	2472	15
A	MCS0	40	1/5	Low Channel	2422	16
			5/9	Mid Channel	2437	16
			9/13	High Channel	2462	16
A	MCS7	40	1/5	Low Channel	2422	14.5
			5/9	Mid Channel	2437	14.5
			9/13	High Channel	2462	14.5
B	1 Mbps	20	1	Low Channel	2412	18
			6	Mid Channel	2437	18
			13	High Channel	2472	18
B	11 Mbps	20	1	Low Channel	2412	18
			6	Mid Channel	2437	18
			13	High Channel	2472	18
B	6 Mbps	20	1	Low Channel	2412	16.5
			6	Mid Channel	2437	16.5
			13	High Channel	2472	16.5
B	36 Mbps	20	1	Low Channel	2412	16
			6	Mid Channel	2437	16
			13	High Channel	2472	16
B	54 Mbps	20	1	Low Channel	2412	15.5
			6	Mid Channel	2437	15.5
			13	High Channel	2472	15.5
B	MCS0	20	1	Low Channel	2412	16.5
			6	Mid Channel	2437	16.5
			13	High Channel	2472	16.5
B	MCS7	20	1	Low Channel	2412	15
			6	Mid Channel	2437	15
			13	High Channel	2472	15
B	MCS0	40	1/5	Low Channel	2422	16
			5/9	Mid Channel	2437	16
			9/13	High Channel	2462	16
B	MCS7	40	1/5	Low Channel	2422	14.5
			5/9	Mid Channel	2437	14.5
			9/13	High Channel	2462	14.5
AB	MCS8	20	1	Low Channel	2412	16
			6	Mid Channel	2437	16
			13	High Channel	2472	16

POWER SETTINGS



AB	MCS15	20	1	Low Channel	2412	15
			6	Mid Channel	2437	15
			13	High Channel	2472	15
AB	MCS8	40	1/5	Low Channel	2422	16
			5/9	Mid Channel	2437	16
			9/13	High Channel	2462	16
AB	MCS15	40	1/5	Low Channel	2422	14.5
			5/9	Mid Channel	2437	14.5
			9/13	High Channel	2462	14.5

POWERLINE CONDUCTED EMISSIONS

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Receiver	Rohde & Schwarz	ESCI	ARH	2019-05-02	2020-05-02
LISN	Solar Electronics	9252-50-R-24-BNC	LIP	2019-08-28	2020-08-28
Cable - Conducted Cable Assembly	Northwest EMC	EVG, HHD, RKT	EVGA	2019-01-07	2020-01-07

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

ECHN0015-10

MODES INVESTIGATED

On, 802.11b, Continuous Tx 1 Mbps Mid Ch. 2437 MHz

POWERLINE CONDUCTED EMISSIONS



EUT:	Thor Radio Module AC WLAN and Bluetooth and BLE	Work Order:	ECHN0015
Serial Number:	30	Date:	2019-12-27
Customer:	EchoNous, Inc.	Temperature:	20.3°C
Attendees:	None	Relative Humidity:	36.9%
Customer Project:	None	Bar. Pressure:	1026 mb
Tested By:	Cole Ghizzone	Job Site:	EV07
Power:	5.0 VDC via 110VAC/60Hz	Configuration:	ECHN0015-10

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2019	ANSI C63.10:2013

TEST PARAMETERS

Run #:	18	Line:	High Line	Add. Ext. Attenuation (dB):	0
--------	----	-------	-----------	-----------------------------	---

COMMENTS

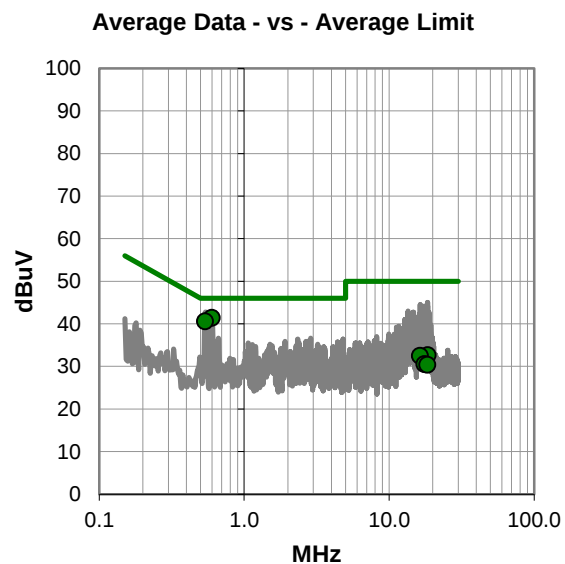
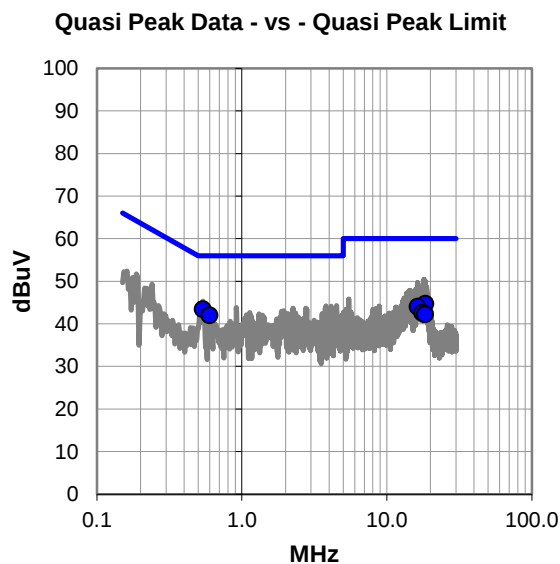
None

EUT OPERATING MODES

On, 802.11b, Continuous Tx 1 Mbps Mid Ch. 2437 MHz

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #18

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.5	23.500	19.9	43.4	56.0	-12.6
0.6	22.100	19.9	42.0	56.0	-14.0
18.5	23.900	20.8	44.7	60.0	-15.3
16.4	23.400	20.6	44.0	60.0	-16.0
17.5	22.000	20.6	42.6	60.0	-17.4
18.4	21.500	20.7	42.2	60.0	-17.8

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.6	21.500	19.9	41.4	46.0	-4.6
0.5	20.700	19.9	40.6	46.0	-5.4
18.5	11.800	20.8	32.6	50.0	-17.4
16.4	11.900	20.6	32.5	50.0	-17.5
17.5	9.900	20.6	30.5	50.0	-19.5
18.4	9.700	20.7	30.4	50.0	-19.6

CONCLUSION

Pass



Tested By

POWERLINE CONDUCTED EMISSIONS



EUT:	Thor Radio Module AC WLAN and Bluetooth and BLE	Work Order:	ECHN0015
Serial Number:	30	Date:	2019-12-27
Customer:	EchoNous, Inc.	Temperature:	20.3°C
Attendees:	None	Relative Humidity:	36.9%
Customer Project:	None	Bar. Pressure:	1026 mb
Tested By:	Cole Ghizzone	Job Site:	EV07
Power:	5.0 VDC via 110VAC/60Hz	Configuration:	ECHN0015-10

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2019	ANSI C63.10:2013

TEST PARAMETERS

Run #:	19	Line:	Neutral	Add. Ext. Attenuation (dB):	0
--------	----	-------	---------	-----------------------------	---

COMMENTS

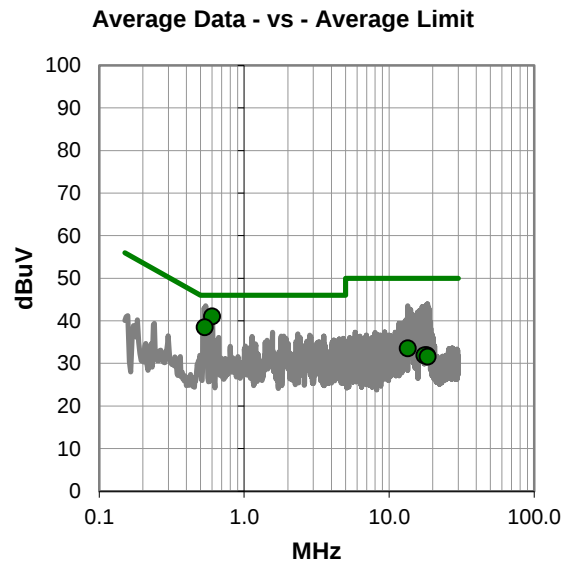
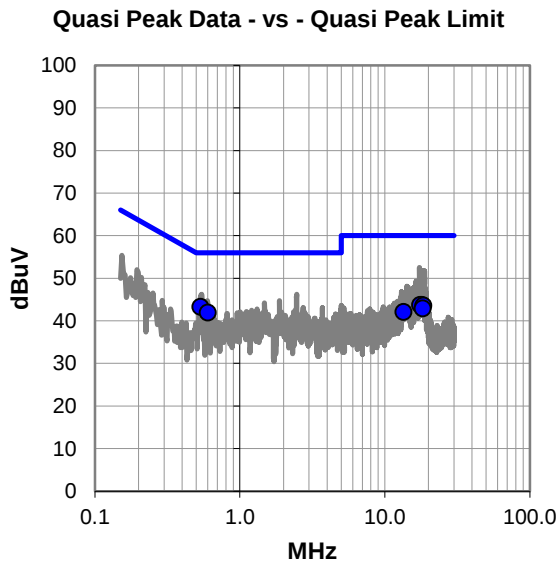
None

EUT OPERATING MODES

On, 802.11b, Continuous Tx 1 Mbps Mid Ch. 2437 MHz

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #19

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.5	23.400	19.9	43.3	56.0	-12.7
0.6	22.000	19.9	41.9	56.0	-14.1
18.0	23.100	20.6	43.7	60.0	-16.3
17.5	23.100	20.6	43.7	60.0	-16.3
18.4	22.900	20.7	43.6	60.0	-16.4
18.3	22.300	20.6	42.9	60.0	-17.1
13.5	21.700	20.4	42.1	60.0	-17.9

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.6	21.100	19.9	41.0	46.0	-5.0
0.5	18.600	19.9	38.5	46.0	-7.5
13.5	13.100	20.4	33.5	50.0	-16.5
18.3	11.300	20.6	31.9	50.0	-18.1
18.0	11.300	20.6	31.9	50.0	-18.1
17.5	11.300	20.6	31.9	50.0	-18.1
18.4	10.900	20.7	31.6	50.0	-18.4

CONCLUSION

Pass



Tested By

DUTY CYCLE - MIMO



XMIT 2019.06.11

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
Generator - Signal	Agilent	N5183A	TIA	25-Apr-18	25-Apr-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	29-Mar-19	29-Mar-20
Attenuator	Fairview Microwave	SA4014-20	TKV	18-Jan-19	18-Jan-20
Block - DC	Fairview Microwave	SD3379	AMU	18-Jan-19	18-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	5-May-19	5-May-20

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.

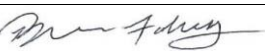
The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

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 - MIMO



TbTb 2018.09.13 XMt 2019.06.11

EUT: Thor Radio Module AC WLAN and Bluetooth and BLE				Work Order: ECHN0015					
Serial Number: Pre-production #1				Date: 1-Aug-19					
Customer: EchoNous, Inc.				Temperature: 22.7 °C					
Attendees: None				Humidity: 51.4% RH					
Project: None				Barometric Pres.: 1019 mbar					
Tested by: Brian Fahey & Jeff Alcoke			Power: 3.7 VDC			Job Site: NC0A			
TEST SPECIFICATIONS				Test Method					
FCC 15.247:2019				ANSI C63.10:2013					
COMMENTS									
Reference level offset: RF measurement cable, 20 dB attenuator, and DC Block = 21.4 dBm. The port not being measured is terminated with a 50ohm terminator.									
DEVIATIONS FROM TEST STANDARD									
None									
Configuration #	12	Signature  							
				Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
2x2 Chain_1									
20 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
Low Channel 1, 2412 MHz		967.644 us	1.063 ms	1	91	N/A	N/A		
Low Channel 1, 2412 MHz		N/A	N/A	11	N/A	N/A	N/A		
Mid Channel 6, 2437 MHz		967.444 us	1.063 ms	1	91	N/A	N/A		
Mid Channel 6, 2437 MHz		N/A	N/A	11	N/A	N/A	N/A		
High Channel 11, 2462 MHz		967.521 us	1.064 ms	1	90.9	N/A	N/A		
High Channel 11, 2462 MHz		N/A	N/A	11	N/A	N/A	N/A		
802.11(n) MCS15									
Low Channel 1, 2412 MHz		135.916 us	229.06 us	1	59.3	N/A	N/A		
Low Channel 1, 2412 MHz		N/A	N/A	10	N/A	N/A	N/A		
Mid Channel 6, 2437 MHz		135.788 us	230 us	1	59	N/A	N/A		
Mid Channel 6, 2437 MHz		N/A	N/A	9	N/A	N/A	N/A		
High Channel 11, 2462 MHz		135.71 us	228.996 us	1	59.3	N/A	N/A		
High Channel 11, 2462 MHz		N/A	N/A	9	N/A	N/A	N/A		
40 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
Low Channel 1/5, 2422 MHz		487.913 us	582.1 us	1	83.8	N/A	N/A		
Low Channel 1/5, 2422 MHz		N/A	N/A	9	N/A	N/A	N/A		
Mid Channel 4/8, 2437 MHz		488.179 us	581.122 us	1	84	N/A	N/A		
Mid Channel 4/8, 2437 MHz		N/A	N/A	10	N/A	N/A	N/A		
High Channel 7/11, 2452 MHz		488.401 us	583.117 us	1	83.8	N/A	N/A		
High Channel 7/11, 2452 MHz		N/A	N/A	9	N/A	N/A	N/A		
802.11(n) MCS15									
Low Channel 1/5, 2422 MHz		88.074 us	182.969 us	1	48.1	N/A	N/A		
Low Channel 1/5, 2422 MHz		N/A	N/A	6	N/A	N/A	N/A		
Mid Channel 4/8, 2437 MHz		88.524 us	185.983 us	1	47.6	N/A	N/A		
Mid Channel 4/8, 2437 MHz		N/A	N/A	6	N/A	N/A	N/A		
High Channel 7/11, 2452 MHz		88.463 us	184.031 us	1	48.1	N/A	N/A		
High Channel 7/11, 2452 MHz		N/A	N/A	6	N/A	N/A	N/A		
2x2 Chain_2									
20 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
Low Channel 1, 2412 MHz		968.128 us	1.062 ms	1	91.1	N/A	N/A		
Low Channel 1, 2412 MHz		N/A	N/A	11	N/A	N/A	N/A		
Mid Channel 6, 2437 MHz		968.428 us	1.074 ms	1	90.2	N/A	N/A		
Mid Channel 6, 2437 MHz		N/A	N/A	10	N/A	N/A	N/A		
High Channel 11, 2462 MHz		968.128 us	1.065 ms	1	90.9	N/A	N/A		
High Channel 11, 2462 MHz		N/A	N/A	11	N/A	N/A	N/A		
802.11(n) MCS15									
Low Channel 1, 2412 MHz		136.071 us	228.978 us	1	59.4	N/A	N/A		
Low Channel 1, 2412 MHz		N/A	N/A	9	N/A	N/A	N/A		
Mid Channel 6, 2437 MHz		135.954 us	229 us	1	59.4	N/A	N/A		
Mid Channel 6, 2437 MHz		N/A	N/A	9	N/A	N/A	N/A		
High Channel 11, 2462 MHz		136.176 us	230.037 us	1	59.2	N/A	N/A		
High Channel 11, 2462 MHz		N/A	N/A	9	N/A	N/A	N/A		
40 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
Low Channel 1/5, 2422 MHz		488.846 us	581.953 us	1	84	N/A	N/A		
Low Channel 1/5, 2422 MHz		N/A	N/A	9	N/A	N/A	N/A		
Mid Channel 4/8, 2437 MHz		488.856 us	584 us	1	83.7	N/A	N/A		
Mid Channel 4/8, 2437 MHz		N/A	N/A	9	N/A	N/A	N/A		
High Channel 7/11, 2452 MHz		488.663 us	581.022 us	1	84.1	N/A	N/A		
High Channel 7/11, 2452 MHz		N/A	N/A	9	N/A	N/A	N/A		
802.11(n) MCS15									
Low Channel 1/5, 2422 MHz		88.8 us	179.936 us	1	49.4	N/A	N/A		
Low Channel 1/5, 2422 MHz		N/A	N/A	6	N/A	N/A	N/A		
Mid Channel 4/8, 2437 MHz		88.595 us	181.061 us	1	48.9	N/A	N/A		
Mid Channel 4/8, 2437 MHz		N/A	N/A	6	N/A	N/A	N/A		
High Channel 7/11, 2452 MHz		88.662 us	179.94 us	1	49.3	N/A	N/A		
High Channel 7/11, 2452 MHz		N/A	N/A	6	N/A	N/A	N/A		

DUTY CYCLE - SISO



XMI 2019.06.11

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
Generator - Signal	Agilent	N5183A	TIA	25-Apr-18	25-Apr-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	29-Mar-19	29-Mar-20
Attenuator	Fairview Microwave	SA4014-20	TKV	18-Jan-19	18-Jan-20
Block - DC	Fairview Microwave	SD3379	AMU	18-Jan-19	18-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	5-May-19	5-May-20

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.

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 - SISO



EUT: Thor Radio Module AC WLAN and Bluetooth and BLE				Work Order: ECHN0015					
Serial Number: Pre-production #1				Date: 17-Jul-19					
Customer: EchoNous, Inc.				Temperature: 22.4 °C					
Attendees: None				Humidity: 55.9% RH					
Project: None				Barometric Pres.: 1014 mbar					
Tested by: Brian Fahey & Jeff Alcock			Power: 3.7 VDC		Job Site: NC0A				
TEST SPECIFICATIONS				Test Method					
FCC 15.247:2019				ANSI C63.10:2013					
COMMENTS									
Reference level offset: RF measurement cable, 20 dB attenuator, and DC Block = 21.4 dBm.									
DEVIATIONS FROM TEST STANDARD									
None									
Configuration #	1	Signature  							
				Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
CHAIN_1									
20 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(b) 1 Mbps									
Low Channel 1, 2412 MHz				12.205 ms	12.319 ms	1	99.1	N/A	N/A
Low Channel 1, 2412 MHz				N/A	N/A	6	N/A	N/A	N/A
Mid Channel 6, 2437 MHz				12.204 ms	12.311 ms	1	99.1	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				12.206 ms	12.308 ms	1	99.2	N/A	N/A
High Channel 11, 2462 MHz				N/A	N/A	5	N/A	N/A	N/A
802.11(b) 11 Mbps									
Low Channel 1, 2412 MHz				1.284 ms	1.375 ms	1	93.3	N/A	N/A
Low Channel 1, 2412 MHz				N/A	N/A	6	N/A	N/A	N/A
Mid Channel 6, 2437 MHz				1.284 ms	1.376 ms	1	93.3	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				1.284 ms	1.383 ms	1	92.8	N/A	N/A
High Channel 11, 2462 MHz				N/A	N/A	6	N/A	N/A	N/A
802.11(g) 6 Mbps									
Low Channel 1, 2412 MHz				2.028 ms	2.135 ms	1	95	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				2.027 ms	2.132 ms	1	95.1	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				2.021 ms	2.135 ms	1	94.6	N/A	N/A
High Channel 11, 2462 MHz				N/A	N/A	6	N/A	N/A	N/A
802.11(g) 36 Mbps									
Low Channel 1, 2412 MHz				354.8 us	451.9 us	1	78.5	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				355.2 us	450.1 us	1	78.9	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				355 us	451 us	1	78.7	N/A	N/A
High Channel 11, 2462 MHz				N/A	N/A	5	N/A	N/A	N/A
802.11(g) 54 Mbps									
Low Channel 1, 2412 MHz				242.8 us	339 us	1	71.6	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				243.1 us	338 us	1	71.9	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				242.7 us	339 us	1	71.6	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				1.887 ms	1.992 ms	1	94.7	N/A	N/A
Low Channel 1, 2412 MHz				N/A	N/A	6	N/A	N/A	N/A
Mid Channel 6, 2437 MHz				1.887 ms	1.994 ms	1	94.6	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				1.886 ms	1.993 ms	1	94.7	N/A	N/A
High Channel 11, 2462 MHz				N/A	N/A	5	N/A	N/A	N/A
802.11(n) MCS7									
Low Channel 1, 2412 MHz				223 us	318 us	1	70.1	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				223.1 us	320 us	1	69.7	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				222.9 us	317.9 us	1	70.1	N/A	N/A
High Channel 11, 2462 MHz				N/A	N/A	5	N/A	N/A	N/A
40 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS0									
Low Channel 1/5, 2422 MHz				924.439 us	1.033 ms	1	89.5	N/A	N/A
Low Channel 1/5, 2422 MHz				N/A	N/A	6	N/A	N/A	N/A
Mid Channel 4/8, 2437 MHz				920.3 us	1.034 ms	1	89	N/A	N/A
Mid Channel 4/8, 2437 MHz				N/A	N/A	6	N/A	N/A	N/A
High Channel 7/11, 2452 MHz				920.3 us	1.039 ms	1	88.6	N/A	N/A
High Channel 7/11, 2452 MHz				N/A	N/A	6	N/A	N/A	N/A
802.11(n) MCS7									
Low Channel 1/5, 2422 MHz				120 us	222.9 us	1	53.8	N/A	N/A
Low Channel 1/5, 2422 MHz				N/A	N/A	5	N/A	N/A	N/A
Mid Channel 4/8, 2437 MHz				120.1 us	222 us	1	54.1	N/A	N/A
Mid Channel 4/8, 2437 MHz				N/A	N/A	5	N/A	N/A	N/A
High Channel 7/11, 2452 MHz				120.3 us	222.1 us	1	54.2	N/A	N/A
High Channel 7/11, 2452 MHz				N/A	N/A	5	N/A	N/A	N/A
CHAIN_2									
20 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(b) 1 Mbps									
Low Channel 1, 2412 MHz				12.205 ms	12.311 ms	1	99.1	N/A	N/A
Low Channel 1, 2412 MHz				N/A	N/A	6	N/A	N/A	N/A
Mid Channel 6, 2437 MHz				12.205 ms	12.314 ms	1	99.1	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				12.206 ms	12.312 ms	1	99.1	N/A	N/A
High Channel 11, 2462 MHz				N/A	N/A	5	N/A	N/A	N/A
802.11(b) 11 Mbps									
Low Channel 1, 2412 MHz				1.284 ms	1.388 ms	1	92.5	N/A	N/A
Low Channel 1, 2412 MHz				N/A	N/A	6	N/A	N/A	N/A
Mid Channel 6, 2437 MHz				1.284 ms	1.374 ms	1	93.4	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				1.284 ms	1.389 ms	1	92.5	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				2.028 ms	2.136 ms	1	94.9	N/A	N/A

		Low Channel 1, 2412 MHz	N/A	N/A	6	N/A	N/A	N/A
		Mid Channel 6, 2437 MHz	2.026 ms	2.14 ms	1	94.7	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	2.026 ms	2.141 ms	1	94.6	N/A	N/A
		High Channel 11, 2462 MHz	N/A	N/A	6	N/A	N/A	N/A
802.11(g) 36 Mbps		Low Channel 1, 2412 MHz	355.6 us	452.1 us	1	78.7	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	355.3 us	450.1 us	1	78.9	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	355.4 us	451 us	1	78.8	N/A	N/A
		High Channel 11, 2462 MHz	N/A	N/A	6	N/A	N/A	N/A
802.11(g) 54 Mbps		Low Channel 1, 2412 MHz	243.3 us	340 us	1	71.6	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	243.4 us	338.1 us	1	72	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	243.3 us	337.9 us	1	72	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	1.888 ms	1.986 ms	1	95	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	1.886 ms	1.99 ms	1	94.8	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	1.887 ms	1.995 ms	1	94.6	N/A	N/A
		High Channel 11, 2462 MHz	N/A	N/A	5	N/A	N/A	N/A
802.11(n) MCS7		Low Channel 1, 2412 MHz	223.2 us	330.1 us	1	67.6	N/A	N/A
		Low Channel 1, 2412 MHz	N/A	N/A	6	N/A	N/A	N/A
		Mid Channel 6, 2437 MHz	223.6 us	321.1 us	1	69.6	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	223.4 us	320.1 us	1	69.8	N/A	N/A
		High Channel 11, 2462 MHz	N/A	N/A	5	N/A	N/A	N/A
40 MHz								
2400 MHz - 2483.5 MHz Band								
802.11(n) MCS0		Low Channel 1/5, 2422 MHz	926.991 us	1.034 ms	1	89.7	N/A	N/A
		Low Channel 1/5, 2422 MHz	N/A	N/A	5	N/A	N/A	N/A
		Mid Channel 4/8, 2437 MHz	920.3 us	1.036 ms	1	88.8	N/A	N/A
		Mid Channel 4/8, 2437 MHz	N/A	N/A	5	N/A	N/A	N/A
		High Channel 7/11, 2452 MHz	920.3 us	1.022 ms	1	90	N/A	N/A
		High Channel 7/11, 2452 MHz	N/A	N/A	5	N/A	N/A	N/A
802.11(n) MCS7		Low Channel 1/5, 2422 MHz	120.4 us	223.9 us	1	53.8	N/A	N/A
		Low Channel 1/5, 2422 MHz	N/A	N/A	5	N/A	N/A	N/A
		Mid Channel 4/8, 2437 MHz	125.6 us	242.2 us	1	51.9	N/A	N/A
		Mid Channel 4/8, 2437 MHz	N/A	N/A	5	N/A	N/A	N/A
		High Channel 7/11, 2452 MHz	120.1 us	222 us	1	54.1	N/A	N/A
		High Channel 7/11, 2452 MHz	N/A	N/A	5	N/A	N/A	N/A

OCCUPIED BANDWIDTH - MIMO



XMI 2019.06.11

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
Generator - Signal	Agilent	N5183A	TIA	25-Apr-18	25-Apr-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	29-Mar-19	29-Mar-20
Attenuator	Fairview Microwave	SA4014-20	TKV	18-Jan-19	18-Jan-20
Block - DC	Fairview Microwave	SD3379	AMU	18-Jan-19	18-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	5-May-19	5-May-20

TEST DESCRIPTION

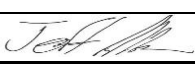
The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The EUT was set to the channels and modes listed in the datasheet.

The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The 99.0% occupied bandwidth was also measured at the same time which can be needed during Output Power depending on the applicable method.

OCCUPIED BANDWIDTH - MIMO



TbTb 2018.09.13 XMM 2019.06.11

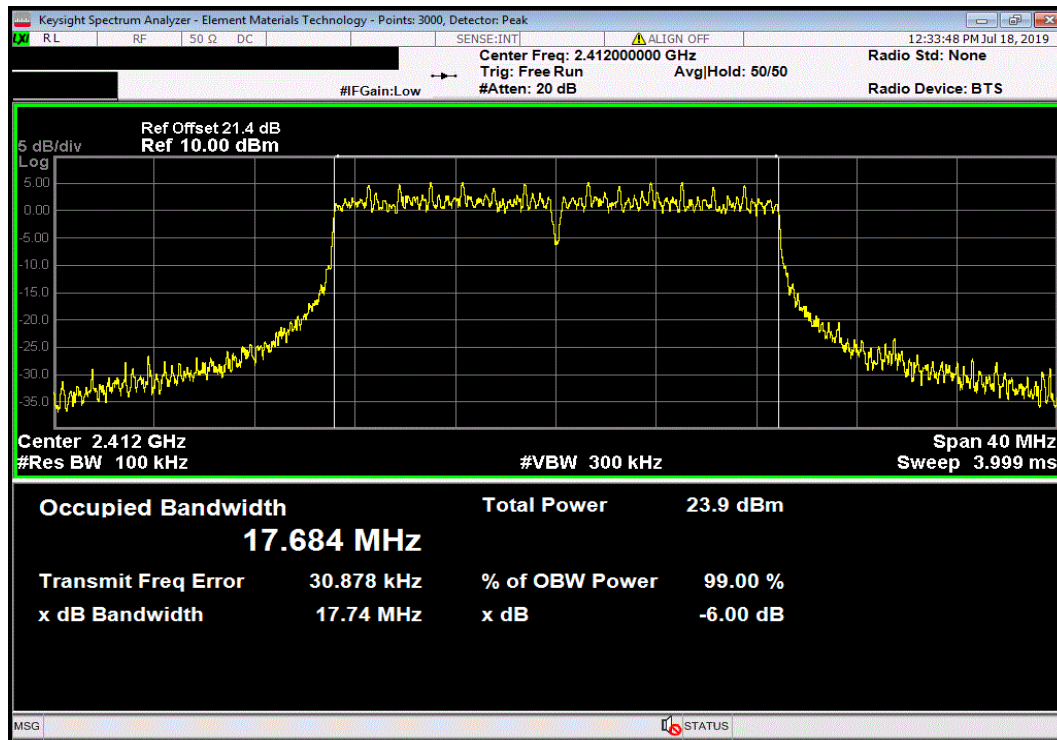
EUT: Thor Radio Module AC WLAN and Bluetooth and BLE		Work Order: ECHN0015	
Serial Number: Pre-production #1		Date: 23-Jul-19	
Customer: EchoNous, Inc.		Temperature: 22.6 °C	
Attendees: None		Humidity: 50.2% RH	
Project: None		Barometric Pres.: 1022 mbar	
Tested by: Brian Fahey & Jeff Alcock		Job Site: NC0A	
Power: 3.7 VDC			
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2019		ANSI C63.10:2013	
COMMENTS			
Reference level offset: RF measurement cable, 20 dB attenuator, and DC Block = 21.4 dBm. The port not being measured is terminated with a 50ohm terminator.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	12	Signature  	
		Value	Limit (>)
			Result
2x2 Chain_1			
20 MHz			
2400 MHz - 2483.5 MHz Band			
802.11(n) MCS8			
Low Channel 1, 2412 MHz			
Mid Channel 6, 2437 MHz			
High Channel 11, 2462 MHz			
802.11(n) MCS15			
Low Channel 1, 2412 MHz			
Mid Channel 6, 2437 MHz			
High Channel 11, 2462 MHz			
40 MHz			
2400 MHz - 2483.5 MHz Band			
802.11(n) MCS8			
Low Channel 1/5, 2422 MHz			
Mid Channel 4/8, 2437 MHz			
High Channel 7/11, 2452 MHz			
802.11(n) MCS15			
Low Channel 1/5, 2422 MHz			
Mid Channel 4/8, 2437 MHz			
High Channel 7/11, 2452 MHz			
2x2 Chain_2			
20 MHz			
2400 MHz - 2483.5 MHz Band			
802.11(n) MCS8			
Low Channel 1, 2412 MHz			
Mid Channel 6, 2437 MHz			
High Channel 11, 2462 MHz			
802.11(n) MCS15			
Low Channel 1, 2412 MHz			
Mid Channel 6, 2437 MHz			
High Channel 11, 2462 MHz			
40 MHz			
2400 MHz - 2483.5 MHz Band			
802.11(n) MCS8			
Low Channel 1/5, 2422 MHz			
Mid Channel 4/8, 2437 MHz			
High Channel 7/11, 2452 MHz			
802.11(n) MCS15			
Low Channel 1/5, 2422 MHz			
Mid Channel 4/8, 2437 MHz			
High Channel 7/11, 2452 MHz			

OCCUPIED BANDWIDTH - MIMO



TbTtX 2018.09.13 XMt 2019.06.11

2x2 Chain_2, 20 MHz, 2400 MHz - 2483.5 MHz Band, 802.11(n) MCS15, Low Channel 1, 2412 MHz						
				Value	Limit	Result
					(>)	
				17.743 MHz	500 kHz	Pass



OCCUPIED BANDWIDTH - SISO



XMIT 2019.06.11

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
Generator - Signal	Agilent	N5183A	TIA	25-Apr-18	25-Apr-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	29-Mar-19	29-Mar-20
Attenuator	Fairview Microwave	SA4014-20	TKV	18-Jan-19	18-Jan-20
Block - DC	Fairview Microwave	SD3379	AMU	18-Jan-19	18-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	5-May-19	5-May-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The EUT was set to the channels and modes listed in the datasheet.

The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The 99.0% occupied bandwidth was also measured at the same time which can be needed during Output Power depending on the applicable method.

OCCUPIED BANDWIDTH - SISO



TbTx 2018.09.13 XMt 2019.06.11

EUT: Thor Radio Module AC WLAN and Bluetooth and BLE	Work Order: ECHN0015
Serial Number: Pre-production #1	Date: 17-Jul-19
Customer: EchoNous, Inc.	Temperature: 22.4 °C
Attendees: None	Humidity: 54.9% RH
Project: None	Barometric Pres.: 1014 mbar
Tested by: Brian Fahey and Jeff Alcock	Power: 3.7 VDC
Job Site: NC0A	
TEST SPECIFICATIONS	Test Method
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS
Reference level offset: RF measurement cable, 20 dB attenuator, and DC Block = 21.4 dBm.

DEVIATIONS FROM TEST STANDARD
None

Configuration #	1	Signature		
-----------------	---	-----------	---	--

	Value	Limit (>)	Result
--	-------	--------------	--------

CHAIN_1	20 MHz	2400 MHz - 2483.5 MHz Band			
		802.11(b) 1 Mbps			
		Low Channel 1, 2412 MHz	8.559 MHz	500 kHz	Pass
		Mid Channel 6, 2437 MHz	8.566 MHz	500 kHz	Pass
		High Channel 11, 2462 MHz	8.576 MHz	500 kHz	Pass
		802.11(b) 11 Mbps			
		Low Channel 1, 2412 MHz	8.439 MHz	500 kHz	Pass
		Mid Channel 6, 2437 MHz	8.648 MHz	500 kHz	Pass
		High Channel 11, 2462 MHz	8.604 MHz	500 kHz	Pass
		802.11(g) 6 Mbps			
		Low Channel 1, 2412 MHz	16.368 MHz	500 kHz	Pass
		Mid Channel 6, 2437 MHz	16.37 MHz	500 kHz	Pass
		High Channel 11, 2462 MHz	16.356 MHz	500 kHz	Pass
		802.11(g) 36 Mbps			
		Low Channel 1, 2412 MHz	16.477 MHz	500 kHz	Pass
		Mid Channel 6, 2437 MHz	16.485 MHz	500 kHz	Pass
		High Channel 11, 2462 MHz	16.44 MHz	500 kHz	Pass
		802.11(g) 54 Mbps			
		Low Channel 1, 2412 MHz	16.485 MHz	500 kHz	Pass
		Mid Channel 6, 2437 MHz	16.509 MHz	500 kHz	Pass
		High Channel 11, 2462 MHz	16.476 MHz	500 kHz	Pass
		802.11(n) MCS0			
		Low Channel 1, 2412 MHz	17.58 MHz	500 kHz	Pass
		Mid Channel 6, 2437 MHz	17.597 MHz	500 kHz	Pass
		High Channel 11, 2462 MHz	17.18 MHz	500 kHz	Pass
		802.11(n) MCS7			
		Low Channel 1, 2412 MHz	17.728 MHz	500 kHz	Pass
		Mid Channel 6, 2437 MHz	17.713 MHz	500 kHz	Pass
		High Channel 11, 2462 MHz	17.684 MHz	500 kHz	Pass
	40 MHz	2400 MHz - 2483.5 MHz Band			
		802.11(n) MCS0			
		Low Channel 1/5, 2422 MHz	36.369 MHz	500 kHz	Pass
		Mid Channel 4/8, 2437 MHz	36.344 MHz	500 kHz	Pass
		High Channel 7/11, 2452 MHz	35.757 MHz	500 kHz	Pass
		802.11(n) MCS7			
		Low Channel 1/5, 2422 MHz	36.509 MHz	500 kHz	Pass
		Mid Channel 4/8, 2437 MHz	36.482 MHz	500 kHz	Pass
		High Channel 7/11, 2452 MHz	36.404 MHz	500 kHz	Pass

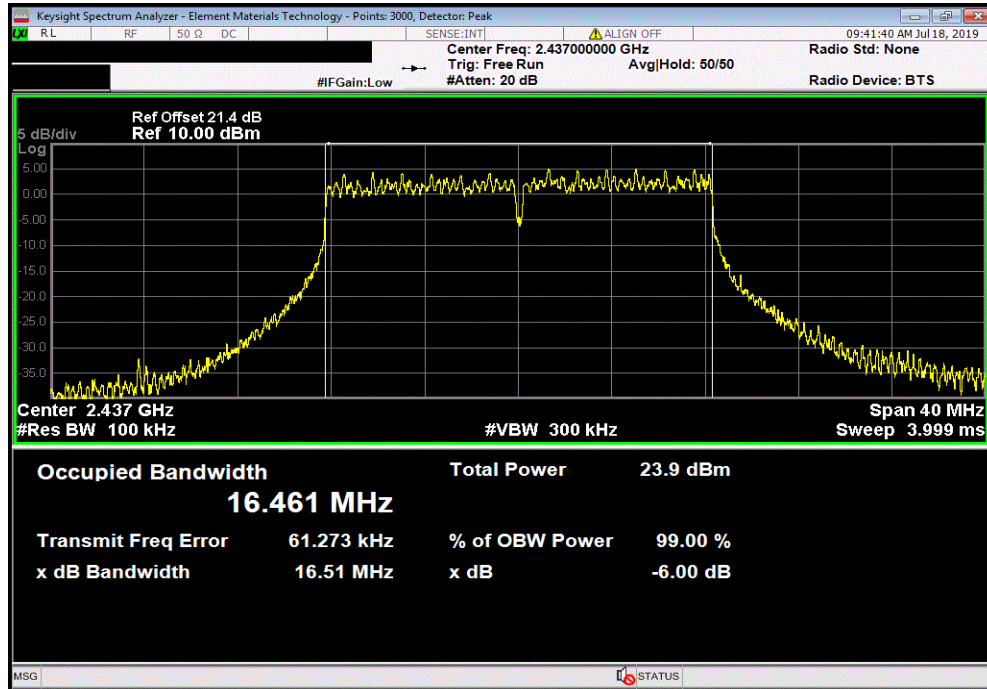
CHAIN_2	20 MHz	2400 MHz - 2483.5 MHz Band			
		802.11(b) 1 Mbps			
		Low Channel 1, 2412 MHz	9.057 MHz	500 kHz	Pass
		Mid Channel 6, 2437 MHz	9.066 MHz	500 kHz	Pass
		High Channel 11, 2462 MHz	8.581 MHz	500 kHz	Pass
		802.11(b) 11 Mbps			
		Low Channel 1, 2412 MHz	8.626 MHz	500 kHz	Pass
		Mid Channel 6, 2437 MHz	8.933 MHz	500 kHz	Pass
		High Channel 11, 2462 MHz	8.902 MHz	500 kHz	Pass
		802.11(g) 6 Mbps			
		Low Channel 1, 2412 MHz	16.36 MHz	500 kHz	Pass
		Mid Channel 6, 2437 MHz	16.381 MHz	500 kHz	Pass
		High Channel 11, 2462 MHz	16.377 MHz	500 kHz	Pass
		802.11(g) 36 Mbps			
		Low Channel 1, 2412 MHz	16.47 MHz	500 kHz	Pass
		Mid Channel 6, 2437 MHz	16.502 MHz	500 kHz	Pass
		High Channel 11, 2462 MHz	16.484 MHz	500 kHz	Pass
		802.11(g) 54 Mbps			
		Low Channel 1, 2412 MHz	16.507 MHz	500 kHz	Pass
		Mid Channel 6, 2437 MHz	16.503 MHz	500 kHz	Pass
		High Channel 11, 2462 MHz	16.494 MHz	500 kHz	Pass
		802.11(n) MCS0			
		Low Channel 1, 2412 MHz	17.582 MHz	500 kHz	Pass
		Mid Channel 6, 2437 MHz	17.6 MHz	500 kHz	Pass
		High Channel 11, 2462 MHz	17.579 MHz	500 kHz	Pass
		802.11(n) MCS7			
		Low Channel 1, 2412 MHz	17.706 MHz	500 kHz	Pass
		Mid Channel 6, 2437 MHz	17.736 MHz	500 kHz	Pass
		High Channel 11, 2462 MHz	17.731 MHz	500 kHz	Pass
	40 MHz	2400 MHz - 2483.5 MHz Band			
		802.11(n) MCS0			
		Low Channel 1/5, 2422 MHz	36.347 MHz	500 kHz	Pass
		Mid Channel 4/8, 2437 MHz	36.37 MHz	500 kHz	Pass
		High Channel 7/11, 2452 MHz	36.314 MHz	500 kHz	Pass
		802.11(n) MCS7			
		Low Channel 1/5, 2422 MHz	36.492 MHz	500 kHz	Pass
		Mid Channel 4/8, 2437 MHz	36.486 MHz	500 kHz	Pass
		High Channel 7/11, 2452 MHz	36.466 MHz	500 kHz	Pass

OCCUPIED BANDWIDTH - SISO

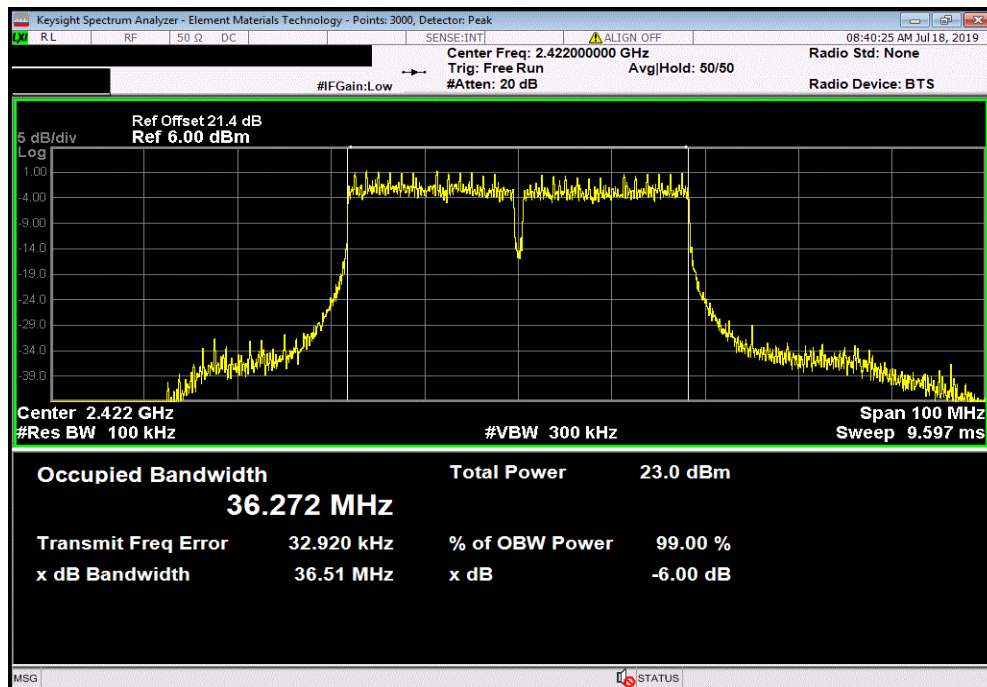


TMTx 2018.09.13 XMI 2019.06.11

CHAIN_1, 20 MHz, 2400 MHz - 2483.5 MHz Band, 802.11(g) 54 Mbps, Mid Channel 6, 2437 MHz						
				Limit		
				Value	(>)	Result
				16.509 MHz	500 kHz	Pass



CHAIN_1, 40 MHz, 2400 MHz - 2483.5 MHz Band, 802.11(n) MCS7, Low Channel 1/5, 2422 MHz						
				Limit		
				Value	(>)	Result
				36.509 MHz	500 kHz	Pass



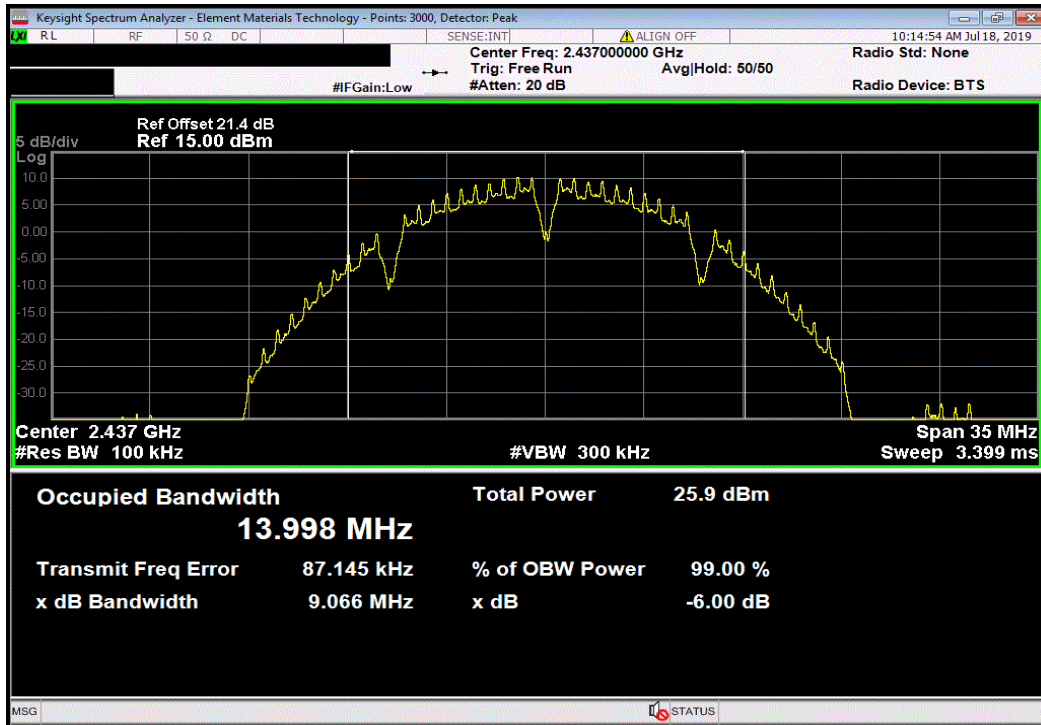
OCCUPIED BANDWIDTH - SISO



TbTx 2018.09.13 XMt 2019.06.11

CHAIN_2, 20 MHz, 2400 MHz - 2483.5 MHz Band, 802.11(b) 1 Mbps, Mid Channel 6, 2437 MHz

					Value	Limit (>)	Result
					9.066 MHz	500 kHz	Pass



OUTPUT POWER - MIMO



XMI 2019.06.11

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
Generator - Signal	Agilent	N5183A	TIA	25-Apr-18	25-Apr-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	29-Mar-19	29-Mar-20
Attenuator	Fairview Microwave	SA4014-20	TKV	18-Jan-19	18-Jan-20
Block - DC	Fairview Microwave	SD3379	AMU	18-Jan-19	18-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	5-May-19	5-May-20

TEST DESCRIPTION

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



EUT: Thor Radio Module AC WLAN and Bluetooth and BLE				Work Order: ECHN0015					
Serial Number: Pre-production #1				Date: 9-Aug-19					
Customer: EchoNous, Inc.				Temperature: 22.3 °C					
Attendees: None				Humidity: 53.9% RH					
Project: None				Barometric Pres.: 1017 mbar					
Tested by: Brian Fahey and Jeff Alcock			Power: 3.7 VDC		Job Site: NC0A				
TEST SPECIFICATIONS				Test Method					
FCC 15.247:2019				ANSI C63.10:2013					
COMMENTS									
Reference level offset: RF measurement cable, 20 dB attenuator, and DC Block = 21.4 dBm. Per FCC KDB 662911 SectionE, 1), the sum of both individual port measurements were compared to the limit as shown in the power summing table. The port not being measured is terminated with a 50ohm terminator.									
DEVIATIONS FROM TEST STANDARD									
None									
Configuration #	12	Signature  		Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Out Pwr (mW)	Out Pwr (dBm)	Limit (dBm)	Result
2x2 Chain 1									
20 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
Low Channel 1, 2412 MHz				12.813	0.4	21.0	13.213	30	Pass
Mid Channel 6, 2437 MHz				12.43	0.4	19.2	12.83	30	Pass
High Channel 11, 2462 MHz				12.158	0.4	18.0	12.558	30	Pass
802.11(n) MCS15									
Low Channel 1, 2412 MHz				10.211	2.3	17.8	12.511	30	Pass
Mid Channel 6, 2437 MHz				10.185	2.3	17.7	12.485	30	Pass
High Channel 11, 2462 MHz				9.759	2.3	16.1	12.059	30	Pass
40 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
Low Channel 1/5, 2422 MHz				12.336	0.8	20.6	13.136	30	Pass
Mid Channel 4/8, 2437 MHz				11.965	0.8	18.9	12.765	30	Pass
High Channel 7/11, 2452 MHz				12.038	0.8	19.2	12.838	30	Pass
802.11(n) MCS15									
Low Channel 1/5, 2422 MHz				8.944	3.2	16.4	12.144	30	Pass
Mid Channel 4/8, 2437 MHz				8.737	3.2	15.6	11.937	30	Pass
High Channel 7/11, 2452 MHz				8.765	3.2	15.7	11.965	30	Pass
2x2 Chain 2									
20 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
Low Channel 1, 2412 MHz				13.54	0.4	24.8	13.94	30	Pass
Mid Channel 6, 2437 MHz				13.196	0.4	22.9	13.596	30	Pass
High Channel 11, 2462 MHz				12.791	0.4	20.8	13.191	30	Pass
802.11(n) MCS15									
Low Channel 1, 2412 MHz				10.587	2.3	19.4	12.887	30	Pass
Mid Channel 6, 2437 MHz				10.373	2.3	18.5	12.673	30	Pass
High Channel 11, 2462 MHz				9.932	2.3	16.7	12.232	30	Pass
40 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
Low Channel 1/5, 2422 MHz				12.774	0.8	22.8	13.574	30	Pass
Mid Channel 4/8, 2437 MHz				12.474	0.8	21.3	13.274	30	Pass
High Channel 7/11, 2452 MHz				12.32	0.8	20.5	13.12	30	Pass
802.11(n) MCS15									
Low Channel 1/5, 2422 MHz				9.167	3.1	16.9	12.267	30	Pass
Mid Channel 4/8, 2437 MHz				8.907	3.1	15.9	12.007	30	Pass
High Channel 7/11, 2452 MHz				8.731	3.1	15.2	11.831	30	Pass
2x2 MIMO, Power Summing Table									
20 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
Low Channel 1, 2412 MHz				Chain_1 Value (mW)	Chain_2 Value (mW)	Summed Value (mW)	Summed Value (dBm)	Limit (dBm)	Results
Mid Channel 6, 2437 MHz				21.0	24.8	45.7	16.6	30	Pass
High Channel 11, 2462 MHz				19.2	22.9	42.1	16.2	30	Pass
				18.0	20.8	38.9	15.9	30	Pass
802.11(n) MCS15									
Low Channel 1, 2412 MHz				17.8	19.4	37.3	15.7	30	Pass
Mid Channel 6, 2437 MHz				17.7	18.5	36.2	15.6	30	Pass
High Channel 11, 2462 MHz				16.1	16.7	32.8	15.2	30	Pass
40 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
Low Channel 1/5, 2422 MHz				20.6	22.8	43.4	16.4	30	Pass
Mid Channel 4/8, 2437 MHz				18.9	21.3	40.2	16.0	30	Pass
High Channel 7/11, 2452 MHz				19.2	20.5	39.7	16.0	30	Pass
802.11(n) MCS15									
Low Channel 1/5, 2422 MHz				16.4	16.9	33.2	15.2	30	Pass
Mid Channel 4/8, 2437 MHz				15.6	15.9	31.5	15.0	30	Pass
High Channel 7/11, 2452 MHz				15.7	15.2	31.0	14.9	30	Pass

OUTPUT POWER - SISO



XMIT 2019.06.11

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
Generator - Signal	Agilent	N5183A	TIA	25-Apr-18	25-Apr-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	29-Mar-19	29-Mar-20
Attenuator	Fairview Microwave	SA4014-20	TKV	18-Jan-19	18-Jan-20
Block - DC	Fairview Microwave	SD3379	AMU	18-Jan-19	18-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	5-May-19	5-May-20

TEST DESCRIPTION

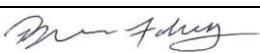
The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set 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 - SISO



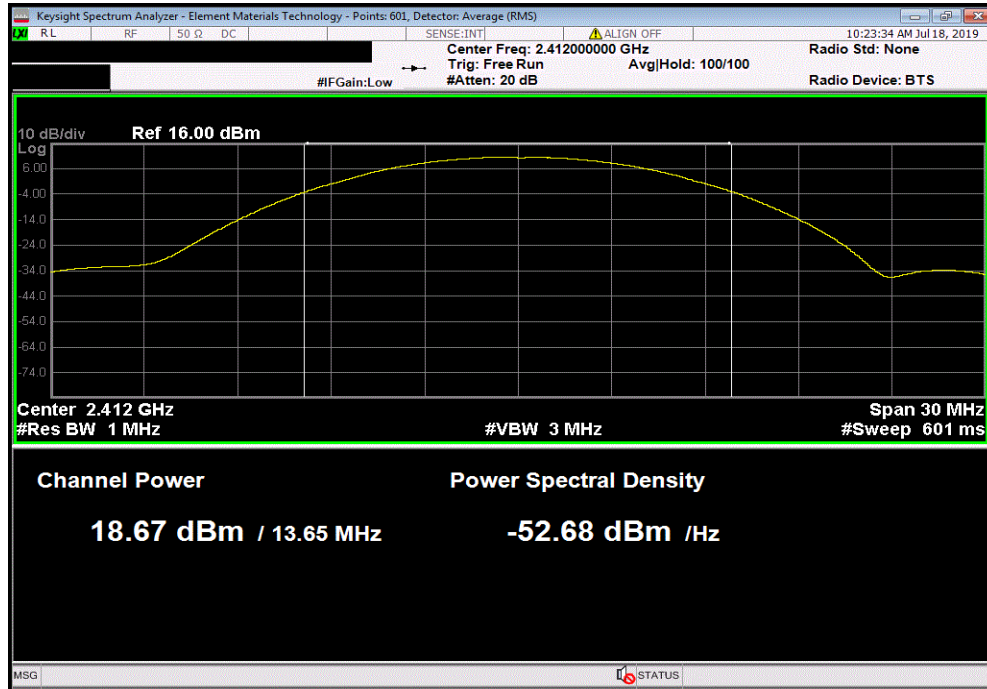
EUT: Thor Radio Module AC WLAN and Bluetooth and BLE			Work Order: ECHN0015				
Serial Number: Pre-production #1			Date: 17-Jul-19				
Customer: EchoNous, Inc.			Temperature: 22.4 °C				
Attendees: None			Humidity: 56.5% RH				
Project: None			Barometric Pres.: 1014 mbar				
Tested by: Brian Fahey & Jeff Alcoke		Power: 3.7 VDC		Job Site: NC0A			
TEST SPECIFICATIONS		Test Method					
FCC 15.247:2019		ANSI C63.10:2013					
COMMENTS							
Reference level offset: RF measurement cable, 20 dB attenuator, and DC Block = 21.4 dBm.							
DEVIATIONS FROM TEST STANDARD							
None							
Configuration #	1	Signature  					
			Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Out Pwr (dBm)	Limit (dBm)	Result
CHAIN_1							
20 MHz							
2400 MHz - 2483.5 MHz Band							
802.11(b) 1 Mbps							
Low Channel 1, 2412 MHz			18.265	0	18.3	30	Pass
Mid Channel 6, 2437 MHz			18.157	0	18.2	30	Pass
High Channel 11, 2462 MHz			17.886	0	17.9	30	Pass
802.11(b) 11 Mbps							
Low Channel 1, 2412 MHz			17.982	0.3	18.3	30	Pass
Mid Channel 6, 2437 MHz			17.886	0.3	18.2	30	Pass
High Channel 11, 2462 MHz			17.648	0.3	18	30	Pass
802.11(g) 6 Mbps							
Low Channel 1, 2412 MHz			16.762	0.2	17	30	Pass
Mid Channel 6, 2437 MHz			16.564	0.2	16.8	30	Pass
High Channel 11, 2462 MHz			16.245	0.2	16.5	30	Pass
802.11(g) 36 Mbps							
Low Channel 1, 2412 MHz			15.418	1.1	16.5	30	Pass
Mid Channel 6, 2437 MHz			15.207	1	16.2	30	Pass
High Channel 11, 2462 MHz			14.872	1	15.9	30	Pass
802.11(g) 54 Mbps							
Low Channel 1, 2412 MHz			14.487	1.5	15.9	30	Pass
Mid Channel 6, 2437 MHz			14.413	1.4	15.8	30	Pass
High Channel 11, 2462 MHz			14.065	1.5	15.5	30	Pass
802.11(n) MCS0							
Low Channel 1, 2412 MHz			16.724	0.2	17	30	Pass
Mid Channel 6, 2437 MHz			16.572	0.2	16.8	30	Pass
High Channel 11, 2462 MHz			16.263	0.2	16.5	30	Pass
802.11(n) MCS7							
Low Channel 1, 2412 MHz			13.95	1.5	15.5	30	Pass
Mid Channel 6, 2437 MHz			13.883	1.6	15.5	30	Pass
High Channel 11, 2462 MHz			13.55	1.5	15.1	30	Pass
40 MHz							
2400 MHz - 2483.5 MHz Band							
802.11(n) MCS0							
Low Channel 1/5, 2422 MHz			16.001	0.5	16.5	30	Pass
Mid Channel 4/8, 2437 MHz			15.76	0.5	16.3	30	Pass
High Channel 7/11, 2452 MHz			15.744	0.5	16.3	30	Pass
802.11(n) MCS7							
Low Channel 1/5, 2422 MHz			12.651	2.7	15.3	30	Pass
Mid Channel 4/8, 2437 MHz			12.569	2.7	15.2	30	Pass
High Channel 7/11, 2452 MHz			12.557	2.7	15.2	30	Pass
CHAIN_2							
20 MHz							
2400 MHz - 2483.5 MHz Band							
802.11(b) 1 Mbps							
Low Channel 1, 2412 MHz			18.881	0	18.9	30	Pass
Mid Channel 6, 2437 MHz			18.47	0	18.5	30	Pass
High Channel 11, 2462 MHz			17.924	0	18	30	Pass
802.11(b) 11 Mbps							
Low Channel 1, 2412 MHz			18.668	0.3	19	30	Pass
Mid Channel 6, 2437 MHz			18.252	0.3	18.5	30	Pass
High Channel 11, 2462 MHz			17.66	0.3	18	30	Pass
802.11(g) 6 Mbps							
Low Channel 1, 2412 MHz			17.279	0.2	17.5	30	Pass
Mid Channel 6, 2437 MHz			16.898	0.2	17.1	30	Pass
High Channel 11, 2462 MHz			16.511	0.2	16.8	30	Pass
802.11(g) 36 Mbps							
Low Channel 1, 2412 MHz			15.954	1	17	30	Pass
Mid Channel 6, 2437 MHz			15.639	1	16.7	30	Pass
High Channel 11, 2462 MHz			15.171	1	16.2	30	Pass
802.11(g) 54 Mbps							
Low Channel 1, 2412 MHz			15.087	1.5	16.5	30	Pass
Mid Channel 6, 2437 MHz			14.807	1.4	16.2	30	Pass
High Channel 11, 2462 MHz			14.339	1.4	15.8	30	Pass
802.11(n) MCS0							
Low Channel 1, 2412 MHz			17.277	0.2	17.5	30	Pass
Mid Channel 6, 2437 MHz			16.918	0.2	17.1	30	Pass
High Channel 11, 2462 MHz			16.506	0.2	16.7	30	Pass
802.11(n) MCS7							
Low Channel 1, 2412 MHz			14.504	1.7	16.2	30	Pass
Mid Channel 6, 2437 MHz			14.25	1.6	15.8	30	Pass
High Channel 11, 2462 MHz			13.75	1.6	15.3	30	Pass
40 MHz							
2400 MHz - 2483.5 MHz Band							
802.11(n) MCS0							
Low Channel 1/5, 2422 MHz			16.518	0.5	17	30	Pass
Mid Channel 4/8, 2437 MHz			16.203	0.5	16.7	30	Pass
High Channel 7/11, 2452 MHz			15.891	0.5	16.3	30	Pass
802.11(n) MCS7							
Low Channel 1/5, 2422 MHz			13.156	2.7	15.8	30	Pass
Mid Channel 4/8, 2437 MHz			12.909	2.8	15.8	30	Pass
High Channel 7/11, 2452 MHz			12.588	2.7	15.3	30	Pass

OUTPUT POWER - SISO

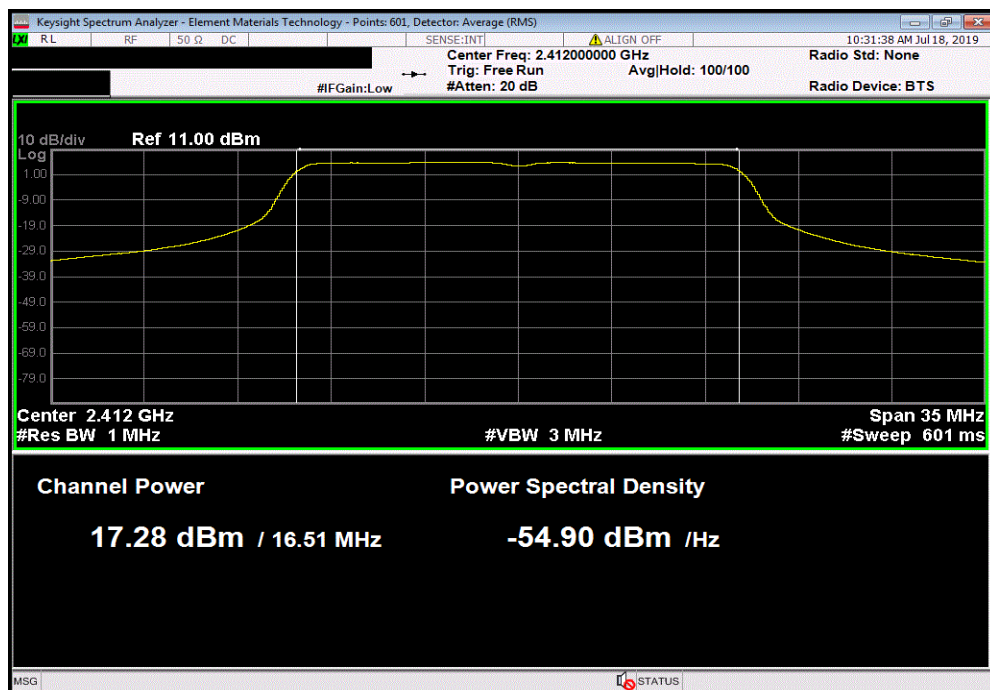


TMTx 2018.09.13 XMI 2019.06.11

CHAIN_2, 20 MHz, 2400 MHz - 2483.5 MHz Band, 802.11(b) 11 Mbps, Low Channel 1, 2412 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Out Pwr (dBm)	Limit (dBm)	Result	
	18.668	0.3	19	30	Pass	



CHAIN_2, 20 MHz, 2400 MHz - 2483.5 MHz Band, 802.11(g) 6 Mbps, Low Channel 1, 2412 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Out Pwr (dBm)	Limit (dBm)	Result	
	17.279	0.2	17.5	30	Pass	

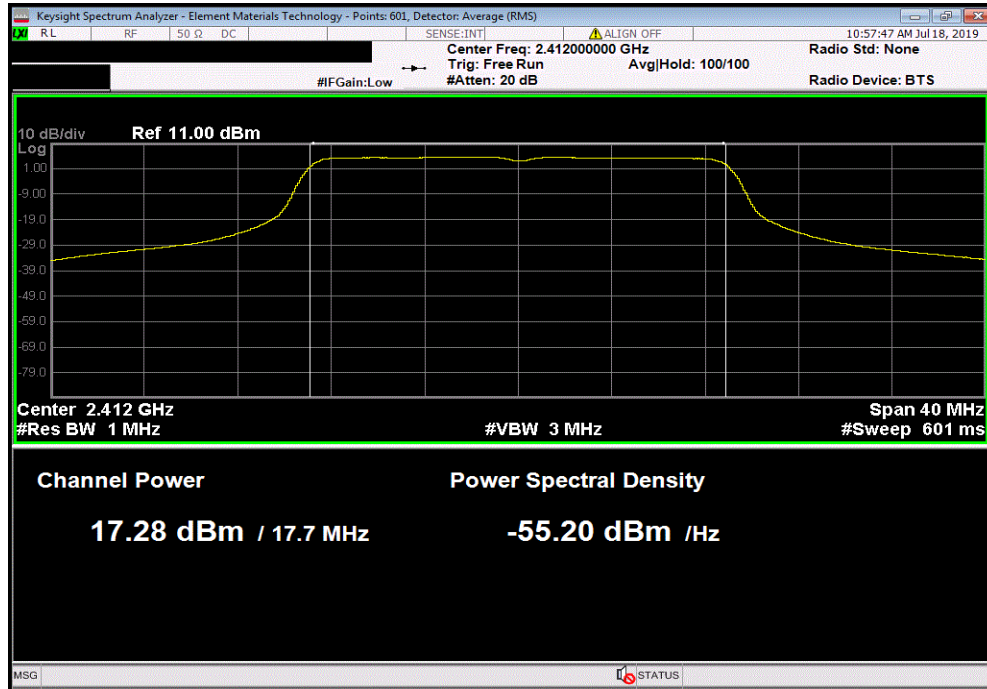


OUTPUT POWER - SISO

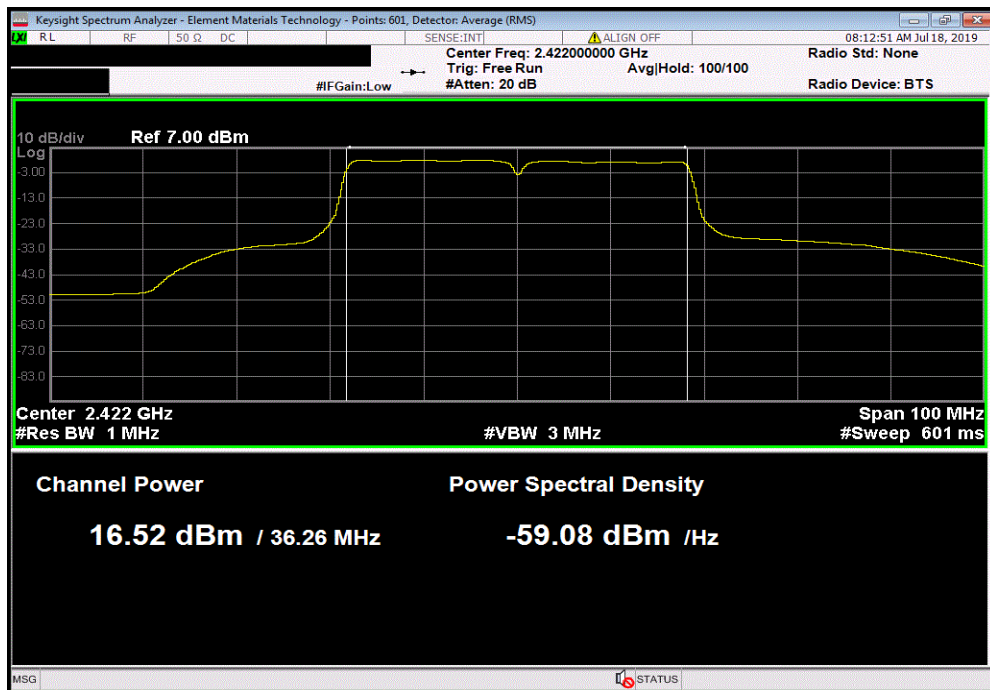


TMTx 2018.09.13 XMI 2019.06.11

CHAIN_2, 20 MHz, 2400 MHz - 2483.5 MHz Band, 802.11(n) MCS0, Low Channel 1, 2412 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Out Pwr (dBm)	Limit (dBm)	Result	
	17.277	0.2	17.5	30	Pass	



CHAIN_2, 40 MHz, 2400 MHz - 2483.5 MHz Band, 802.11(n) MCS0, Low Channel 1/5, 2422 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Out Pwr (dBm)	Limit (dBm)	Result	
	16.518	0.5	17	30	Pass	



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP) - MIMO



XMit 2019.06.11

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
Generator - Signal	Agilent	N5183A	TIA	25-Apr-18	25-Apr-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	29-Mar-19	29-Mar-20
Attenuator	Fairview Microwave	SA4014-20	TKV	18-Jan-19	18-Jan-20
Block - DC	Fairview Microwave	SD3379	AMU	18-Jan-19	18-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	5-May-19	5-May-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. 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 gain of the EUT was then added to the conducted output power to derive the EIRP values.

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP) - MIMO



EUT: Thor Radio Module AC WLAN and Bluetooth and BLE					Work Order: ECHN0015				
Serial Number: Pre-production #1					Date: 9-Aug-19				
Customer: EchoNous, Inc.					Temperature: 22.3 °C				
Attendees: None					Humidity: 54.6% RH				
Project: None					Barometric Pres.: 1017 mbar				
Tested by: Brian Fahey and Jeff Alcock				Power: 3.7 VDC		Job Site: NC0A			
TEST SPECIFICATIONS				Test Method					
FCC 15.247:2019				ANSI C63.10:2013					
COMMENTS									
Reference level offset: RF measurement cable, 20 dB attenuator, and DC Block = 21.4 dBm. Per FCC KDB 662911 SectionE), 1), the sum of both individual port measurements were compared to the limit as shown in the power summing table. The port not being measured is terminated with a 50ohm terminator.									
DEVIATIONS FROM TEST STANDARD									
None									
Configuration #	12	Signature							
			Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
2x2 Chain 1									
20 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
Low Channel 1, 2412 MHz			12.813	0.4	13.2	-1.29	11.9	36	Pass
Mid Channel 6, 2437 MHz			12.43	0.4	12.8	-1.29	11.5	36	Pass
High Channel 11, 2462 MHz			12.158	0.4	12.6	-1.29	11.3	36	Pass
802.11(n) MCS15									
Low Channel 1, 2412 MHz			10.211	2.3	12.5	-1.29	11.2	36	Pass
Mid Channel 6, 2437 MHz			10.185	2.3	12.5	-1.29	11.2	36	Pass
High Channel 11, 2462 MHz			9.759	2.3	12	-1.29	10.7	36	Pass
40 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
Low Channel 1/5, 2422 MHz			12.336	0.8	13.1	-1.29	11.8	36	Pass
Mid Channel 4/8, 2437 MHz			11.965	0.8	12.7	-1.29	11.4	36	Pass
High Channel 7/11, 2452 MHz			12.038	0.8	12.8	-1.29	11.5	36	Pass
802.11(n) MCS15									
Low Channel 1/5, 2422 MHz			8.944	3.2	12.1	-1.29	10.8	36	Pass
Mid Channel 4/8, 2437 MHz			8.737	3.2	12	-1.29	10.7	36	Pass
High Channel 7/11, 2452 MHz			8.765	3.2	11.9	-1.29	10.7	36	Pass
2x2 Chain 2									
20 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
Low Channel 1, 2412 MHz			13.54	0.4	13.9	-2.95	11	36	Pass
Mid Channel 6, 2437 MHz			13.196	0.4	13.6	-2.95	10.7	36	Pass
High Channel 11, 2462 MHz			12.791	0.4	13.2	-2.95	10.3	36	Pass
802.11(n) MCS15									
Low Channel 1, 2412 MHz			10.587	2.3	12.8	-2.95	9.9	36	Pass
Mid Channel 6, 2437 MHz			10.373	2.3	12.6	-2.95	9.7	36	Pass
High Channel 11, 2462 MHz			9.932	2.3	12.2	-2.95	9.3	36	Pass
40 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
Low Channel 1/5, 2422 MHz			12.774	0.8	13.5	-2.95	10.6	36	Pass
Mid Channel 4/8, 2437 MHz			12.474	0.8	13.2	-2.95	10.3	36	Pass
High Channel 7/11, 2452 MHz			12.32	0.8	13.1	-2.95	10.1	36	Pass
802.11(n) MCS15									
Low Channel 1/5, 2422 MHz			9.167	3.1	12.2	-2.95	9.3	36	Pass
Mid Channel 4/8, 2437 MHz			8.907	3.1	12	-2.95	9.1	36	Pass
High Channel 7/11, 2452 MHz			8.731	3.1	11.8	-2.95	8.9	36	Pass
2x2 MIMO, Power Summing Table									
20 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
			Chain_1 Value (mW)	Chain_2 Value (mW)	Summed Value (mW)	Summed Value (dBm)	Limit (dBm)	Results	
Low Channel 1, 2412 MHz			15.5	12.6	28.1	14.5	36	Pass	
Mid Channel 6, 2437 MHz			14.1	11.7	25.9	14.1	36	Pass	
High Channel 11, 2462 MHz			13.5	10.7	24.2	13.8	36	Pass	
802.11(n) MCS15									
Low Channel 1, 2412 MHz			13.2	9.8	23.0	13.6	36	Pass	
Mid Channel 6, 2437 MHz			13.2	9.3	22.5	13.5	36	Pass	
High Channel 11, 2462 MHz			11.7	8.5	20.3	13.1	36	Pass	
40 MHz									
2400 MHz - 2483.5 MHz Band									
802.11(n) MCS8									
Low Channel 1/5, 2422 MHz			15.1	11.5	26.6	14.3	36	Pass	
Mid Channel 4/8, 2437 MHz			13.8	10.7	24.5	13.9	36	Pass	
High Channel 7/11, 2452 MHz			14.1	10.2	24.4	13.9	36	Pass	
802.11(n) MCS15									
Low Channel 1/5, 2422 MHz			12.0	8.5	20.5	13.1	36	Pass	
Mid Channel 4/8, 2437 MHz			11.7	8.1	19.9	13.0	36	Pass	
High Channel 7/11, 2452 MHz			11.7	7.8	19.5	12.9	36	Pass	

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP) - SISO



XMM 2019.06.11

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
Generator - Signal	Agilent	N5183A	TIA	25-Apr-18	25-Apr-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	29-Mar-19	29-Mar-20
Attenuator	Fairview Microwave	SA4014-20	TKV	18-Jan-19	18-Jan-20
Block - DC	Fairview Microwave	SD3379	AMU	18-Jan-19	18-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	5-May-19	5-May-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. 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 gain of the EUT was then added to the conducted output power to derive the EIRP values.

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP) - SISO



EUT: Thor Radio Module AC WLAN and Bluetooth and BLE					Work Order: ECHN0015					
Serial Number: Pre-production #1					Date: 17-Jul-19					
Customer: EchoNous, Inc.					Temperature: 23 °C					
Attendees: None					Humidity: 49.9% RH					
Project: None					Barometric Pres.: 1015 mbar					
Tested by: Brian Fahey and Jeff Alcock				Power: 3.7 VDC		Job Site: NC0A				
TEST SPECIFICATIONS					Test Method					
FCC 15.247:2019					ANSI C63.10:2013					
COMMENTS										
Reference level offset: RF measurement cable, 20 dB attenuator, and DC Block = 21.4 dBm.										
DEVIATIONS FROM TEST STANDARD										
None										
Configuration #	1	Signature  								
				Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
CHAIN_1										
20 MHz										
2400 MHz - 2483.5 MHz Band										
802.11(b) 1 Mbps										
Low Channel 1, 2412 MHz				18.265	0	18.3	-1.29	17.0	36	Pass
Mid Channel 6, 2437 MHz				18.157	0	18.2	-1.29	16.9	36	Pass
High Channel 11, 2462 MHz				17.886	0	17.9	-1.29	16.6	36	Pass
802.11(b) 11 Mbps										
Low Channel 1, 2412 MHz				17.982	0.3	18.3	-1.29	17.0	36	Pass
Mid Channel 6, 2437 MHz				17.886	0.3	18.2	-1.29	16.9	36	Pass
High Channel 11, 2462 MHz				17.648	0.3	18	-1.29	16.7	36	Pass
802.11(g) 6 Mbps										
Low Channel 1, 2412 MHz				16.762	0.2	17	-1.29	15.7	36	Pass
Mid Channel 6, 2437 MHz				16.564	0.2	16.8	-1.29	15.5	36	Pass
High Channel 11, 2462 MHz				16.245	0.2	16.5	-1.29	15.2	36	Pass
802.11(g) 36 Mbps										
Low Channel 1, 2412 MHz				15.418	1.1	16.5	-1.29	15.2	36	Pass
Mid Channel 6, 2437 MHz				15.207	1	16.2	-1.29	14.9	36	Pass
High Channel 11, 2462 MHz				14.872	1	15.9	-1.29	14.6	36	Pass
802.11(g) 54 Mbps										
Low Channel 1, 2412 MHz				14.487	1.5	15.9	-1.29	14.6	36	Pass
Mid Channel 6, 2437 MHz				14.413	1.4	15.8	-1.29	14.6	36	Pass
High Channel 11, 2462 MHz				14.065	1.5	15.5	-1.29	14.2	36	Pass
802.11(n) MCS0										
Low Channel 1, 2412 MHz				16.724	0.2	17	-1.29	15.7	36	Pass
Mid Channel 6, 2437 MHz				16.572	0.2	16.8	-1.29	15.5	36	Pass
High Channel 11, 2462 MHz				16.263	0.2	16.5	-1.29	15.2	36	Pass
802.11(n) MCS7										
Low Channel 1, 2412 MHz				13.95	1.5	15.5	-1.29	14.2	36	Pass
Mid Channel 6, 2437 MHz				13.883	1.6	15.5	-1.29	14.2	36	Pass
High Channel 11, 2462 MHz				13.55	1.5	15.1	-1.29	13.8	36	Pass
40 MHz										
2400 MHz - 2483.5 MHz Band										
802.11(n) MCS0										
Low Channel 1/5, 2422 MHz				16.001	0.5	16.5	-1.29	15.2	36	Pass
Mid Channel 4/8, 2437 MHz				15.76	0.5	16.3	-1.29	15	36	Pass
High Channel 7/11, 2452 MHz				15.744	0.5	16.3	-1.29	15	36	Pass
802.11(n) MCS7										
Low Channel 1/5, 2422 MHz				12.651	2.7	15.3	-1.29	14.1	36	Pass
Mid Channel 4/8, 2437 MHz				12.569	2.7	15.2	-1.29	13.9	36	Pass
High Channel 7/11, 2452 MHz				12.557	2.7	15.2	-1.29	13.9	36	Pass
CHAIN_2										
20 MHz										
2400 MHz - 2483.5 MHz Band										
802.11(b) 1 Mbps										
Low Channel 1, 2412 MHz				18.881	0	18.9	-2.95	16	36	Pass
Mid Channel 6, 2437 MHz				18.47	0	18.5	-2.95	15.6	36	Pass
High Channel 11, 2462 MHz				17.924	0	18	-2.95	15	36	Pass
802.11(b) 11 Mbps										
Low Channel 1, 2412 MHz				18.668	0.3	19	-2.95	16.1	36	Pass
Mid Channel 6, 2437 MHz				18.252	0.3	18.5	-2.95	15.6	36	Pass
High Channel 11, 2462 MHz				17.66	0.3	18	-2.95	15	36	Pass
802.11(g) 6 Mbps										
Low Channel 1, 2412 MHz				17.279	0.2	17.5	-2.95	14.6	36	Pass
Mid Channel 6, 2437 MHz				16.898	0.2	17.1	-2.95	14.2	36	Pass
High Channel 11, 2462 MHz				16.511	0.2	16.8	-2.95	13.8	36	Pass
802.11(g) 36 Mbps										
Low Channel 1, 2412 MHz				15.954	1	17	-2.95	14	36	Pass
Mid Channel 6, 2437 MHz				15.639	1	16.7	-2.95	13.7	36	Pass
High Channel 11, 2462 MHz				15.171	1	16.2	-2.95	13.3	36	Pass
802.11(g) 54 Mbps										
Low Channel 1, 2412 MHz				15.087	1.5	16.5	-2.95	13.6	36	Pass
Mid Channel 6, 2437 MHz				14.807	1.4	16.2	-2.95	13.3	36	Pass
High Channel 11, 2462 MHz				14.339	1.4	15.8	-2.95	12.8	36	Pass
802.11(n) MCS0										
Low Channel 1, 2412 MHz				17.277	0.2	17.5	-2.95	14.5	36	Pass
Mid Channel 6, 2437 MHz				16.918	0.2	17.1	-2.95	14.2	36	Pass
High Channel 11, 2462 MHz				16.506	0.2	16.7	-2.95	13.8	36	Pass
802.11(n) MCS7										
Low Channel 1, 2412 MHz				14.504	1.7	16.2	-2.95	13.3	36	Pass
Mid Channel 6, 2437 MHz				14.25	1.6	15.8	-2.95	12.9	36	Pass
High Channel 11, 2462 MHz				13.75	1.6	15.3	-2.95	12.4	36	Pass
40 MHz										
2400 MHz - 2483.5 MHz Band										
802.11(n) MCS0										
Low Channel 1/5, 2422 MHz				16.518	0.5	17	-2.95	14	36	Pass
Mid Channel 4/8, 2437 MHz				16.203	0.5	16.7	-2.95	13.8	36	Pass
High Channel 7/11, 2452 MHz				15.891	0.5	16.3	-2.95	13.4	36	Pass
802.11(n) MCS7										
Low Channel 1/5, 2422 MHz				13.156	2.7	15.8	-2.95	12.9	36	Pass
Mid Channel 4/8, 2437 MHz				12.909	2.8	15.8	-2.95	12.8	36	Pass
High Channel 7/11, 2452 MHz				12.588	2.7	15.3	-2.95	12.3	36	Pass

POWER SPECTRAL DENSITY - MIMO



XMI 2019.06.11

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
Generator - Signal	Agilent	N5183A	TIA	25-Apr-18	25-Apr-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	29-Mar-19	29-Mar-20
Attenuator	Fairview Microwave	SA4014-20	TKV	18-Jan-19	18-Jan-20
Block - DC	Fairview Microwave	SD3379	AMU	18-Jan-19	18-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	5-May-19	5-May-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The maximum power spectral density measurements was measured using the channels and modes as called out on the following data sheets.

Per the procedure outlined in ANSI C63.10 the peak power spectral density was measured in a 3 kHz RBW.

POWER SPECTRAL DENSITY - MIMO



EUT: Thor Radio Module AC WLAN and Bluetooth and BLE		Work Order: ECHN0015				
Serial Number: Pre-production #1		Date: 9-Aug-19				
Customer: EchoNous, Inc.		Temperature: 22.3 °C				
Attendees: None		Humidity: 52.8% RH				
Project: None		Barometric Pres.: 1017 mbar				
Tested by: Brian Fahey and Jeff Alcock		Job Site: NC0A				
Power: 3.7 VDC						
TEST SPECIFICATIONS		Test Method				
FCC 15.247:2019		ANSI C63.10:2013				
COMMENTS						
Reference level offset: RF measurement cable, 20 dB attenuator, and DC Block = 21.4 dBm. Per FCC KDB 662911 Section E), 2), c), the summed PSD value is calculated by adding the value of 10*LOG(number of antennas) dB or 3.0 dB to each of the single port measurements in MIMO mode. The port not being measured is terminated with a 50ohm terminator.						
DEVIATIONS FROM TEST STANDARD						
None						
Configuration #	12	Signature  				
		Value dBm/3kHz	Summing Factor (dB)	Density dBm/3kHz	Limit < dBm/3kHz	Results
2x2 Chain_1						
20 MHz						
2400 MHz - 2483.5 MHz Band						
802.11(n) MCS8						
Low Channel 1, 2412 MHz		-11.861	3.0	-8.9	8	Pass
Mid Channel 6, 2437 MHz		-12.222	3.0	-9.2	8	Pass
High Channel 11, 2462 MHz		-12.874	3.0	-9.9	8	Pass
802.11(n) MCS15						
Low Channel 1, 2412 MHz		-14.32	3.0	-11.3	8	Pass
Mid Channel 6, 2437 MHz		-14.222	3.0	-11.2	8	Pass
High Channel 11, 2462 MHz		-14.285	3.0	-11.3	8	Pass
40 MHz						
2400 MHz - 2483.5 MHz Band						
802.11(n) MCS8						
Low Channel 1/5, 2422 MHz		-15.89	3.0	-12.9	8	Pass
Mid Channel 4/8, 2437 MHz		-14.473	3.0	-11.5	8	Pass
High Channel 7/11, 2452 MHz		-15.348	3.0	-12.3	8	Pass
802.11(n) MCS15						
Low Channel 1/5, 2422 MHz		-18.523	3.0	-15.5	8	Pass
Mid Channel 4/8, 2437 MHz		-18.251	3.0	-15.2	8	Pass
High Channel 7/11, 2452 MHz		-18.063	3.0	-15.1	8	Pass
2x2 Chain_2						
20 MHz						
2400 MHz - 2483.5 MHz Band						
802.11(n) MCS8						
Low Channel 1, 2412 MHz		-11.515	3.0	-8.5	8	Pass
Mid Channel 6, 2437 MHz		-11.722	3.0	-8.7	8	Pass
High Channel 11, 2462 MHz		-12.504	3.0	-9.5	8	Pass
802.11(n) MCS15						
Low Channel 1, 2412 MHz		-13.407	3.0	-10.4	8	Pass
Mid Channel 6, 2437 MHz		-13.441	3.0	-10.4	8	Pass
High Channel 11, 2462 MHz		-13.93	3.0	-10.9	8	Pass
40 MHz						
2400 MHz - 2483.5 MHz Band						
802.11(n) MCS8						
Low Channel 1/5, 2422 MHz		-14.192	3.0	-11.2	8	Pass
Mid Channel 4/8, 2437 MHz		-15.085	3.0	-12.1	8	Pass
High Channel 7/11, 2452 MHz		-14.569	3.0	-11.6	8	Pass
802.11(n) MCS15						
Low Channel 1/5, 2422 MHz		-15.985	3.0	-13.0	8	Pass
Mid Channel 4/8, 2437 MHz		-17.021	3.0	-14.0	8	Pass
High Channel 7/11, 2452 MHz		-15.663	3.0	-12.7	8	Pass

POWER SPECTRAL DENSITY - SISO



XMIT 2019.06.11

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
Generator - Signal	Agilent	N5183A	TIA	25-Apr-18	25-Apr-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	29-Mar-19	29-Mar-20
Attenuator	Fairview Microwave	SA4014-20	TKV	18-Jan-19	18-Jan-20
Block - DC	Fairview Microwave	SD3379	AMU	18-Jan-19	18-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	5-May-19	5-May-20

TEST DESCRIPTION

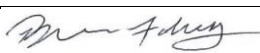
The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The power spectral density was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The maximum power spectral density measurements was measured using the channels and modes as called out on the following data sheets.

Per the procedure outlined in ANSI C63.10 the peak power spectral density was measured in a 3 kHz RBW.

POWER SPECTRAL DENSITY - SISO



EUT: Thor Radio Module AC WLAN and Bluetooth and BLE		Work Order: ECHN0015	
Serial Number: Pre-production #1		Date: 17-Jul-19	
Customer: EchoNous, Inc.		Temperature: 22.5 °C	
Attendees: None		Humidity: 56.5% RH	
Project: None		Barometric Pres.: 1014 mbar	
Tested by: Brian Fahey and Jeff Alcock		Power: 3.7 VDC	
Job Site: NC0A			
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2019		ANSI C63.10-2013	
COMMENTS			
Reference level offset: RF measurement cable, 20 dB attenuator, and DC Block = 21.4 dBm.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature  	
		Value dBm/3kHz	Limit < dBm/3kHz
			Results
CHAIN_1			
20 MHz			
2400 MHz - 2483.5 MHz Band			
802.11(b) 1 Mbps			
Low Channel 1, 2412 MHz		-4.48	8
Mid Channel 6, 2437 MHz		-4.122	8
High Channel 11, 2462 MHz		-3.79	8
802.11(b) 11 Mbps			
Low Channel 1, 2412 MHz		-1.278	8
Mid Channel 6, 2437 MHz		-2.982	8
High Channel 11, 2462 MHz		-2.368	8
802.11(g) 6 Mbps			
Low Channel 1, 2412 MHz		-8.142	8
Mid Channel 6, 2437 MHz		-8.24	8
High Channel 11, 2462 MHz		-6.56	8
802.11(g) 36 Mbps			
Low Channel 1, 2412 MHz		-8.431	8
Mid Channel 6, 2437 MHz		-8.431	8
High Channel 11, 2462 MHz		-9.222	8
802.11(g) 54 Mbps			
Low Channel 1, 2412 MHz		-10.103	8
Mid Channel 6, 2437 MHz		-9.343	8
High Channel 11, 2462 MHz		-10.07	8
802.11(n) MCS0			
Low Channel 1, 2412 MHz		-7.462	8
Mid Channel 6, 2437 MHz		-9.042	8
High Channel 11, 2462 MHz		-7.689	8
802.11(n) MCS7			
Low Channel 1, 2412 MHz		-10.041	8
Mid Channel 6, 2437 MHz		-10.278	8
High Channel 11, 2462 MHz		-9.742	8
40 MHz			
2400 MHz - 2483.5 MHz Band			
802.11(n) MCS0			
Low Channel 1/5, 2422 MHz		-11.898	8
Mid Channel 4/8, 2437 MHz		-12.932	8
High Channel 7/11, 2452 MHz		-12.597	8
802.11(n) MCS7			
Low Channel 1/5, 2422 MHz		-14.57	8
Mid Channel 4/8, 2437 MHz		-13.884	8
High Channel 7/11, 2452 MHz		-14.414	8
CHAIN_2			
20 MHz			
2400 MHz - 2483.5 MHz Band			
802.11(b) 1 Mbps			
Low Channel 1, 2412 MHz		-3.557	8
Mid Channel 6, 2437 MHz		-4.034	8
High Channel 11, 2462 MHz		-4.192	8
802.11(b) 11 Mbps			
Low Channel 1, 2412 MHz		-0.661	8
Mid Channel 6, 2437 MHz		-0.322	8
High Channel 11, 2462 MHz		-2.838	8
802.11(g) 6 Mbps			
Low Channel 1, 2412 MHz		-6.785	8
Mid Channel 6, 2437 MHz		-6.844	8
High Channel 11, 2462 MHz		-7.779	8
802.11(g) 36 Mbps			
Low Channel 1, 2412 MHz		-8.33	8
Mid Channel 6, 2437 MHz		-8.875	8
High Channel 11, 2462 MHz		-9.132	8
802.11(g) 54 Mbps			
Low Channel 1, 2412 MHz		-8.469	8
Mid Channel 6, 2437 MHz		-9.396	8
High Channel 11, 2462 MHz		-9.625	8
802.11(n) MCS0			
Low Channel 1, 2412 MHz		-7.838	8
Mid Channel 6, 2437 MHz		-7.131	8
High Channel 11, 2462 MHz		-8.675	8
802.11(n) MCS7			
Low Channel 1, 2412 MHz		-9.757	8
Mid Channel 6, 2437 MHz		-10.222	8
High Channel 11, 2462 MHz		-10.72	8
40 MHz			
2400 MHz - 2483.5 MHz Band			
802.11(n) MCS0			
Low Channel 1/5, 2422 MHz		-12.045	8
Mid Channel 4/8, 2437 MHz		-11.803	8
High Channel 7/11, 2452 MHz		-11.046	8
802.11(n) MCS7			
Low Channel 1/5, 2422 MHz		-13.54	8
Mid Channel 4/8, 2437 MHz		-14.805	8
High Channel 7/11, 2452 MHz		-15.217	8

BAND EDGE COMPLIANCE - MIMO



XMIT 2019.06.11

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
Generator - Signal	Agilent	N5183A	TIA	25-Apr-18	25-Apr-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	29-Mar-19	29-Mar-20
Attenuator	Fairview Microwave	SA4014-20	TKV	18-Jan-19	18-Jan-20
Block - DC	Fairview Microwave	SD3379	AMU	18-Jan-19	18-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	5-May-19	5-May-20

TEST DESCRIPTION

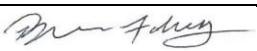
The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in each available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

An RMS detector was used to match the method called out for Output Power. Because the reference level was taken with an RMS detector, the attenuation requirement is -30 dBc.

BAND EDGE COMPLIANCE - MIMO



EUT: Thor Radio Module AC WLAN and Bluetooth and BLE		Work Order: ECHN0015	
Serial Number: Pre-production #1		Date: 9-Aug-19	
Customer: EchoNous, Inc.		Temperature: 22.2 °C	
Attendees: None		Humidity: 54.9% RH	
Project: None		Barometric Pres.: 1017 mbar	
Tested by: Brian Fahey and Jeff Alcock		Power: 3.7 VDC	
Job Site: NC0A		TEST SPECIFICATIONS	
FCC 15.247:2019		Test Method	
ANSI C63.10:2013		COMMENTS	
Reference level offset: RF measurement cable, 20 dB attenuator, and DC Block = 21.4 dBm. The port not being measured is terminated with a 50ohm terminator.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	12	Signature  	
		Value (dBc)	Limit ≤ (dBc) Result
2x2 Chain_1			
20 MHz			
2400 MHz - 2483.5 MHz Band			
802.11(n) MCS8			
Low Channel 1, 2412 MHz			
		-32.1	-30 Pass
High Channel 11, 2462 MHz			
		-44.4	-30 Pass
802.11(n) MCS15			
Low Channel 1, 2412 MHz			
		-33.7	-30 Pass
High Channel 11, 2462 MHz			
		-45.01	-30 Pass
40 MHz			
2400 MHz - 2483.5 MHz Band			
802.11(n) MCS8			
Low Channel 1/5, 2422 MHz			
		-33.19	-30 Pass
High Channel 7/11, 2452 MHz			
		-36.57	-30 Pass
802.11(n) MCS15			
Low Channel 1/5, 2422 MHz			
		-31.56	-30 Pass
High Channel 7/11, 2452 MHz			
		-37.87	-30 Pass
2x2 Chain_2			
20 MHz			
2400 MHz - 2483.5 MHz Band			
802.11(n) MCS8			
Low Channel 1, 2412 MHz			
		-31.75	-30 Pass
High Channel 11, 2462 MHz			
		-42.3	-30 Pass
802.11(n) MCS15			
Low Channel 1, 2412 MHz			
		-32.95	-30 Pass
High Channel 11, 2462 MHz			
		-46.98	-30 Pass
40 MHz			
2400 MHz - 2483.5 MHz Band			
802.11(n) MCS8			
Low Channel 1/5, 2422 MHz			
		-32.08	-30 Pass
High Channel 7/11, 2452 MHz			
		-36.63	-30 Pass
802.11(n) MCS15			
Low Channel 1/5, 2422 MHz			
		-31.33	-30 Pass
High Channel 7/11, 2452 MHz			
		-42.21	-30 Pass

BAND EDGE COMPLIANCE - SISO



XMIT 2019.06.11

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
Generator - Signal	Agilent	N5183A	TIA	25-Apr-18	25-Apr-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	29-Mar-19	29-Mar-20
Attenuator	Fairview Microwave	SA4014-20	TKV	18-Jan-19	18-Jan-20
Block - DC	Fairview Microwave	SD3379	AMU	18-Jan-19	18-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	5-May-19	5-May-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in each available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

An RMS detector was used to match the method called out for Output Power. Because the reference level was taken with an RMS detector, the attenuation requirement is -30 dBc.

BAND EDGE COMPLIANCE - SISO



TbTx 2018.09.13 XMM 2019.06.11

EUT: Thor Radio Module AC WLAN and Bluetooth and BLE		Work Order: ECHN0015	
Serial Number: Pre-production #1		Date: 23-Jul-19	
Customer: EchoNous, Inc.		Temperature: 22.7 °C	
Attendees: None		Humidity: 49.9% RH	
Project: None		Barometric Pres.: 1022 mbar	
Tested by: Brian Fahey and Jeff Alcock		Power: 3.7 VDC	
Job Site: NC0A			
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2019		ANSI C63.10:2013	
COMMENTS			
Reference level offset: RF measurement cable, 20 dB attenuator, and DC Block = 21.4 dBm. Only Chain_2 was tested because it produced the highest conducted output power.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Brian Fahey</i> <i>Jeff Alcock</i>	
		Value (dBc)	Limit ≤ (dBc)
CHAIN_2			
20 MHz			
2400 MHz - 2483.5 MHz Band			
802.11(b) 1 Mbps			
Low Channel 1, 2412 MHz		-44.08	-30
High Channel 11, 2462 MHz		-58.98	-30
802.11(b) 11 Mbps			
Low Channel 1, 2412 MHz		-42.01	-30
High Channel 11, 2462 MHz		-58.91	-30
802.11(g) 6 Mbps			
Low Channel 1, 2412 MHz		-32.06	-30
High Channel 11, 2462 MHz		-47.64	-30
802.11(g) 36 Mbps			
Low Channel 1, 2412 MHz		-33.29	-30
High Channel 11, 2462 MHz		-48.11	-30
802.11(g) 54 Mbps			
Low Channel 1, 2412 MHz		-33.86	-30
High Channel 11, 2462 MHz		-48.22	-30
802.11(n) MCS0			
Low Channel 1, 2412 MHz		-31.35	-30
High Channel 11, 2462 MHz		-46.03	-30
802.11(n) MCS7			
Low Channel 1, 2412 MHz		-32.87	-30
High Channel 11, 2462 MHz		-48.01	-30
40 MHz			
2400 MHz - 2483.5 MHz Band			
802.11(n) MCS0			
Low Channel 1/5, 2422 MHz		-32.1	-30
High Channel 7/11, 2452 MHz		-40.13	-30
802.11(n) MCS7			
Low Channel 1/5, 2422 MHz		-31.29	-30
High Channel 7/11, 2452 MHz		-42.48	-30

SPURIOUS CONDUCTED EMISSIONS - MIMO



XMIT 2019.06.11

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
Generator - Signal	Agilent	N5183A	TIA	25-Apr-18	25-Apr-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	29-Mar-19	29-Mar-20
Attenuator	Fairview Microwave	SA4014-20	TKV	18-Jan-19	18-Jan-20
Block - DC	Fairview Microwave	SD3379	AMU	18-Jan-19	18-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	5-May-19	5-May-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

SPURIOUS CONDUCTED EMISSIONS - MIMO



EUT: Thor Radio Module AC WLAN and Bluetooth and BLE		Work Order: ECHN0015				
Serial Number: Pre-production #1		Date: 23-Jul-19				
Customer: EchoNous, Inc.		Temperature: 22.6 °C				
Attendees: None		Humidity: 50.2% RH				
Project: None		Barometric Pres.: 1022 mbar				
Tested by: Brian Fahey and Jeff Alcoke		Job Site: NC0A				
Power: 3.7 VDC						
TEST SPECIFICATIONS		Test Method				
FCC 15.247:2019		ANSI C63.10:2013				
COMMENTS						
Reference level offset: RF measurement cable, 20 dB attenuator, and DC Block = 21.4 dBm. The port not being measured is terminated with a 50ohm terminator.						
DEVIATIONS FROM TEST STANDARD						
None						
Configuration # 12 Signature  						
		Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
2x2 Chain_1						
20 MHz						
2400 MHz - 2483.5 MHz Band						
802.11(n) MCS8						
Low Channel 1, 2412 MHz		Fundamental	2413.3	N/A	N/A	N/A
Low Channel 1, 2412 MHz		30 MHz - 12.5 GHz	2386.68	-44.66	-30	Pass
Low Channel 1, 2412 MHz		12.5 GHz - 25 GHz	23588.39	-47.84	-30	Pass
Mid Channel 6, 2437 MHz		Fundamental	2438.29	N/A	N/A	N/A
Mid Channel 6, 2437 MHz		30 MHz - 12.5 GHz	9747.5	-49.84	-30	Pass
Mid Channel 6, 2437 MHz		12.5 GHz - 25 GHz	23687.58	-47.89	-30	Pass
High Channel 11, 2462 MHz		Fundamental	2455.77	N/A	N/A	N/A
High Channel 11, 2462 MHz		30 MHz - 12.5 GHz	3829.92	-50.35	-30	Pass
High Channel 11, 2462 MHz		12.5 GHz - 25 GHz	24063	-47.6	-30	Pass
802.11(n) MCS15						
Low Channel 1, 2412 MHz		Fundamental	2405.78	N/A	N/A	N/A
Low Channel 1, 2412 MHz		30 MHz - 12.5 GHz	5063.06	-49.23	-30	Pass
Low Channel 1, 2412 MHz		12.5 GHz - 25 GHz	23571.6	-46.2	-30	Pass
Mid Channel 6, 2437 MHz		Fundamental	2444.53	N/A	N/A	N/A
Mid Channel 6, 2437 MHz		30 MHz - 12.5 GHz	3799.47	-49.01	-30	Pass
Mid Channel 6, 2437 MHz		12.5 GHz - 25 GHz	23864.61	-46.27	-30	Pass
High Channel 11, 2462 MHz		Fundamental	2455.77	N/A	N/A	N/A
High Channel 11, 2462 MHz		30 MHz - 12.5 GHz	9115.7	-49.41	-30	Pass
High Channel 11, 2462 MHz		12.5 GHz - 25 GHz	23629.59	-46.7	-30	Pass
40 MHz						
2400 MHz - 2483.5 MHz Band						
802.11(n) MCS8						
Low Channel 1/5, 2422 MHz		Fundamental	2405.78	N/A	N/A	N/A
Low Channel 1/5, 2422 MHz		30 MHz - 12.5 GHz	9794.69	-46.94	-30	Pass
Low Channel 1/5, 2422 MHz		12.5 GHz - 25 GHz	23789.83	-44.91	-30	Pass
Mid Channel 4/8, 2437 MHz		Fundamental	2448.3	N/A	N/A	N/A
Mid Channel 4/8, 2437 MHz		30 MHz - 12.5 GHz	3103.73	-46.88	-30	Pass
Mid Channel 4/8, 2437 MHz		12.5 GHz - 25 GHz	23951.59	-44.63	-30	Pass
High Channel 7/11, 2452 MHz		Fundamental	2447.03	N/A	N/A	N/A
High Channel 7/11, 2452 MHz		30 MHz - 12.5 GHz	3831.44	-46.98	-30	Pass
High Channel 7/11, 2452 MHz		12.5 GHz - 25 GHz	24058.42	-44.66	-30	Pass
802.11(n) MCS15						
Low Channel 1/5, 2422 MHz		Fundamental	2405.77	N/A	N/A	N/A
Low Channel 1/5, 2422 MHz		30 MHz - 12.5 GHz	5962.8	-45.76	-30	Pass
Low Channel 1/5, 2422 MHz		12.5 GHz - 25 GHz	23963.8	-43.35	-30	Pass
Mid Channel 4/8, 2437 MHz		Fundamental	2448.31	N/A	N/A	N/A
Mid Channel 4/8, 2437 MHz		30 MHz - 12.5 GHz	3193.55	-45.73	-30	Pass
Mid Channel 4/8, 2437 MHz		12.5 GHz - 25 GHz	24041.63	-43.08	-30	Pass
High Channel 7/11, 2452 MHz		Fundamental	2447.03	N/A	N/A	N/A
High Channel 7/11, 2452 MHz		30 MHz - 12.5 GHz	3924.31	-46.3	-30	Pass
High Channel 7/11, 2452 MHz		12.5 GHz - 25 GHz	24537.6	-43.99	-30	Pass
2x2 Chain_2						
20 MHz						
2400 MHz - 2483.5 MHz Band						
802.11(n) MCS8						
Low Channel 1, 2412 MHz		Fundamental	2417.02	N/A	N/A	N/A
Low Channel 1, 2412 MHz		30 MHz - 12.5 GHz	2386.68	-40.08	-30	Pass
Low Channel 1, 2412 MHz		12.5 GHz - 25 GHz	24085.89	-48.21	-30	Pass
Mid Channel 6, 2437 MHz		Fundamental	2438.29	N/A	N/A	N/A
Mid Channel 6, 2437 MHz		30 MHz - 12.5 GHz	3135.7	-50.22	-30	Pass
Mid Channel 6, 2437 MHz		12.5 GHz - 25 GHz	24504.03	-47.64	-30	Pass
High Channel 11, 2462 MHz		Fundamental	2455.78	N/A	N/A	N/A
High Channel 11, 2462 MHz		30 MHz - 12.5 GHz	3867.98	-51.03	-30	Pass
High Channel 11, 2462 MHz		12.5 GHz - 25 GHz	23798.99	-47.49	-30	Pass
802.11(n) MCS15						
Low Channel 1, 2412 MHz		Fundamental	2413.29	N/A	N/A	N/A
Low Channel 1, 2412 MHz		30 MHz - 12.5 GHz	3135.7	-47.62	-30	Pass
Low Channel 1, 2412 MHz		12.5 GHz - 25 GHz	23869.19	-45.91	-30	Pass
Mid Channel 6, 2437 MHz		Fundamental	2444.53	N/A	N/A	N/A
Mid Channel 6, 2437 MHz		30 MHz - 12.5 GHz	3817.74	-48.97	-30	Pass
Mid Channel 6, 2437 MHz		12.5 GHz - 25 GHz	24043.16	-45.77	-30	Pass
High Channel 11, 2462 MHz		Fundamental	2455.77	N/A	N/A	N/A
High Channel 11, 2462 MHz		30 MHz - 12.5 GHz	3816.22	-49.4	-30	Pass
High Channel 11, 2462 MHz		12.5 GHz - 25 GHz	23794.41	-47.05	-30	Pass
40 MHz						
2400 MHz - 2483.5 MHz Band						
802.11(n) MCS8						
Low Channel 1/5, 2422 MHz		Fundamental	2413.3	N/A	N/A	N/A
Low Channel 1/5, 2422 MHz		30 MHz - 12.5 GHz	3852.75	-47.77	-30	Pass
Low Channel 1/5, 2422 MHz		12.5 GHz - 25 GHz	23687.58	-44.56	-30	Pass
Mid Channel 4/8, 2437 MHz		Fundamental	2439.54	N/A	N/A	N/A
Mid Channel 4/8, 2437 MHz		30 MHz - 12.5 GHz	3819.26	-46.79	-30	Pass
Mid Channel 4/8, 2437 MHz		12.5 GHz - 25 GHz	23791.36	-44.32	-30	Pass
High Channel 7/11, 2452 MHz		Fundamental	2454.54	N/A	N/A	N/A
High Channel 7/11, 2452 MHz		30 MHz - 12.5 GHz	3738.57	-47.36	-30	Pass
High Channel 7/11, 2452 MHz		12.5 GHz - 25 GHz	24145.4	-44.86	-30	Pass
802.11(n) MCS15						
Low Channel 1/5, 2422 MHz		Fundamental	2413.31	N/A	N/A	N/A
Low Channel 1/5, 2422 MHz		30 MHz - 12.5 GHz	9817.53	-46.49	-30	Pass
Low Channel 1/5, 2422 MHz		12.5 GHz - 25 GHz	23693.69	-43.37	-30	Pass
Mid Channel 4/8, 2437 MHz		Fundamental	2439.54	N/A	N/A	N/A
Mid Channel 4/8, 2437 MHz		30 MHz - 12.5 GHz	3228.57	-45.41	-30	Pass
Mid Channel 4/8, 2437 MHz		12.5 GHz - 25 GHz	23644.85	-42.61	-30	Pass
High Channel 7/11, 2452 MHz		Fundamental	2449.52	N/A	N/A	N/A
High Channel 7/11, 2452 MHz		30 MHz - 12.5 GHz	3837.53	-45.42	-30	Pass
High Channel 7/11, 2452 MHz		12.5 GHz - 25 GHz	23873.76	-43.61	-30	Pass

SPURIOUS CODUCTED EMISSIONS - SISO



XMIT 2019.06.11

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
Generator - Signal	Agilent	N5183A	TIA	25-Apr-18	25-Apr-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVK	29-Mar-19	29-Mar-20
Attenuator	Fairview Microwave	SA4014-20	TKV	18-Jan-19	18-Jan-20
Block - DC	Fairview Microwave	SD3379	AMU	18-Jan-19	18-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	5-May-19	5-May-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

SPURIOUS CONDUCTED EMISSIONS - SISO



EUT: Thor Radio Module AC WLAN and Bluetooth and BLE		Work Order: ECHN0015				
Serial Number: Pre-production #1		Date: 23-Jul-19				
Customer: EchoNous, Inc.		Temperature: 23.2 °C				
Attendees: None		Humidity: 51.8% RH				
Project: None		Barometric Pres.: 1022 mbar				
Tested by: Brian Fahey and Jeff Alcocke		Power: 3.7 VDC				
Job Site: NC0A						
TEST SPECIFICATIONS		Test Method				
FCC 15.247:2019		ANSI C63.10:2013				
COMMENTS						
Reference level offset: RF measurement cable, 20 dB attenuator, and DC Block = 21.4 dBm. Only the worst case Chain_2 was measured because it produced the highest Output Power.						
DEVIATIONS FROM TEST STANDARD						
None						
Configuration #	1	Signature  				
		Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
CHAIN_2						
20 MHz						
2400 MHz - 2483.5 MHz Band						
802.11(b) 1 Mbps						
Low Channel 1, 2412 MHz		Fundamental	2412.54	N/A	N/A	N/A
Low Channel 1, 2412 MHz		30 MHz - 12.5 GHz	3874.07	-55.43	-30	Pass
Low Channel 1, 2412 MHz		12.5 GHz - 25 GHz	23869.19	-53.11	-30	Pass
Mid Channel 6, 2437 MHz		Fundamental	2436.53	N/A	N/A	N/A
Mid Channel 6, 2437 MHz		30 MHz - 12.5 GHz	7272.07	-55.15	-30	Pass
Mid Channel 6, 2437 MHz		12.5 GHz - 25 GHz	23921.07	-52.22	-30	Pass
High Channel 11, 2462 MHz		Fundamental	2461.53	N/A	N/A	N/A
High Channel 11, 2462 MHz		30 MHz - 12.5 GHz	4746.4	-54.38	-30	Pass
High Channel 11, 2462 MHz		12.5 GHz - 25 GHz	23620.44	-52.27	-30	Pass
802.11(b) 11 Mbps						
Low Channel 1, 2412 MHz		Fundamental	2411.71	N/A	N/A	N/A
Low Channel 1, 2412 MHz		30 MHz - 12.5 GHz	3890.81	-55.55	-30	Pass
Low Channel 1, 2412 MHz		12.5 GHz - 25 GHz	23693.69	-52.57	-30	Pass
Mid Channel 6, 2437 MHz		Fundamental	2436.72	N/A	N/A	N/A
Mid Channel 6, 2437 MHz		30 MHz - 12.5 GHz	3802.51	-54.9	-30	Pass
Mid Channel 6, 2437 MHz		12.5 GHz - 25 GHz	24427.73	-52.43	-30	Pass
High Channel 11, 2462 MHz		Fundamental	2461.7	N/A	N/A	N/A
High Channel 11, 2462 MHz		30 MHz - 12.5 GHz	3179.85	-53.71	-30	Pass
High Channel 11, 2462 MHz		12.5 GHz - 25 GHz	22857.4	-52.02	-30	Pass
802.11(g) 6 Mbps						
Low Channel 1, 2412 MHz		Fundamental	2413.3	N/A	N/A	N/A
Low Channel 1, 2412 MHz		30 MHz - 12.5 GHz	2386.68	-49.81	-30	Pass
Low Channel 1, 2412 MHz		12.5 GHz - 25 GHz	24124.04	-48.53	-30	Pass
Mid Channel 6, 2437 MHz		Fundamental	2438.31	N/A	N/A	N/A
Mid Channel 6, 2437 MHz		30 MHz - 12.5 GHz	3796.42	-50.58	-30	Pass
Mid Channel 6, 2437 MHz		12.5 GHz - 25 GHz	23730.31	-48.13	-30	Pass
High Channel 11, 2462 MHz		Fundamental	2455.78	N/A	N/A	N/A
High Channel 11, 2462 MHz		30 MHz - 12.5 GHz	3823.83	-49.81	-30	Pass
High Channel 11, 2462 MHz		12.5 GHz - 25 GHz	23844.77	-47.98	-30	Pass
802.11(g) 36 Mbps						
Low Channel 1, 2412 MHz		Fundamental	2413.3	N/A	N/A	N/A
Low Channel 1, 2412 MHz		30 MHz - 12.5 GHz	3143.31	-49.76	-30	Pass
Low Channel 1, 2412 MHz		12.5 GHz - 25 GHz	24566.6	-48.46	-30	Pass
Mid Channel 6, 2437 MHz		Fundamental	2438.3	N/A	N/A	N/A
Mid Channel 6, 2437 MHz		30 MHz - 12.5 GHz	3837.53	-49.89	-30	Pass
Mid Channel 6, 2437 MHz		12.5 GHz - 25 GHz	23744.05	-47.4	-30	Pass
High Channel 11, 2462 MHz		Fundamental	2455.78	N/A	N/A	N/A
High Channel 11, 2462 MHz		30 MHz - 12.5 GHz	3819.26	-50.01	-30	Pass
High Channel 11, 2462 MHz		12.5 GHz - 25 GHz	23827.98	-46.99	-30	Pass
802.11(g) 54 Mbps						
Low Channel 1, 2412 MHz		Fundamental	2413.3	N/A	N/A	N/A
Low Channel 1, 2412 MHz		30 MHz - 12.5 GHz	4703.78	-50.44	-30	Pass
Low Channel 1, 2412 MHz		12.5 GHz - 25 GHz	22404.16	-47.15	-30	Pass
Mid Channel 6, 2437 MHz		Fundamental	2438.29	N/A	N/A	N/A
Mid Channel 6, 2437 MHz		30 MHz - 12.5 GHz	3779.68	-48.81	-30	Pass
Mid Channel 6, 2437 MHz		12.5 GHz - 25 GHz	23753.2	-47.09	-30	Pass
High Channel 11, 2462 MHz		Fundamental	2455.78	N/A	N/A	N/A
High Channel 11, 2462 MHz		30 MHz - 12.5 GHz	10737.06	-49.45	-30	Pass
High Channel 11, 2462 MHz		12.5 GHz - 25 GHz	23597.55	-47.16	-30	Pass
802.11(n) MCS0						
Low Channel 1, 2412 MHz		Fundamental	2413.3	N/A	N/A	N/A
Low Channel 1, 2412 MHz		30 MHz - 12.5 GHz	2386.68	-49.11	-30	Pass
Low Channel 1, 2412 MHz		12.5 GHz - 25 GHz	24056.89	-48.6	-30	Pass
Mid Channel 6, 2437 MHz		Fundamental	2438.29	N/A	N/A	N/A
Mid Channel 6, 2437 MHz		30 MHz - 12.5 GHz	9747.5	-50.6	-30	Pass
Mid Channel 6, 2437 MHz		12.5 GHz - 25 GHz	23684.53	-48.46	-30	Pass
High Channel 11, 2462 MHz		Fundamental	2455.78	N/A	N/A	N/A
High Channel 11, 2462 MHz		30 MHz - 12.5 GHz	3759.89	-49.83	-30	Pass
High Channel 11, 2462 MHz		12.5 GHz - 25 GHz	23890.55	-47.77	-30	Pass
802.11(n) MCS7						
Low Channel 1, 2412 MHz		Fundamental	2413.29	N/A	N/A	N/A
Low Channel 1, 2412 MHz		30 MHz - 12.5 GHz	3778.16	-47.88	-30	Pass
Low Channel 1, 2412 MHz		12.5 GHz - 25 GHz	24870.28	-46.72	-30	Pass
Mid Channel 6, 2437 MHz		Fundamental	2438.3	N/A	N/A	N/A
Mid Channel 6, 2437 MHz		30 MHz - 12.5 GHz	3901.47	-48.49	-30	Pass
Mid Channel 6, 2437 MHz		12.5 GHz - 25 GHz	23864.61	-46.23	-30	Pass
High Channel 11, 2462 MHz		Fundamental	2455.78	N/A	N/A	N/A
High Channel 11, 2462 MHz		30 MHz - 12.5 GHz	3064.15	-49.09	-30	Pass
High Channel 11, 2462 MHz		12.5 GHz - 25 GHz	23774.57	-46.34	-30	Pass
40 MHz						
2400 MHz - 2483.5 MHz Band						
802.11(n) MCS0						
Low Channel 1/5, 2422 MHz		Fundamental	2413.3	N/A	N/A	N/A
Low Channel 1/5, 2422 MHz		30 MHz - 12.5 GHz	3759.89	-48.25	-30	Pass
Low Channel 1/5, 2422 MHz		12.5 GHz - 25 GHz	23934.81	-44.44	-30	Pass
Mid Channel 4/8, 2437 MHz		Fundamental	2448.3	N/A	N/A	N/A
Mid Channel 4/8, 2437 MHz		30 MHz - 12.5 GHz	3839.05	-46.83	-30	Pass
Mid Channel 4/8, 2437 MHz		12.5 GHz - 25 GHz	23850.87	-44.55	-30	Pass
High Channel 7/11, 2452 MHz		Fundamental	2449.54	N/A	N/A	N/A
High Channel 7/11, 2452 MHz		30 MHz - 12.5 GHz	3712.69	-46.59	-30	Pass
High Channel 7/11, 2452 MHz		12.5 GHz - 25 GHz	23940.91	-44.76	-30	Pass
802.11(n) MCS7						
Low Channel 1/5, 2422 MHz		Fundamental	2413.3	N/A	N/A	N/A
Low Channel 1/5, 2422 MHz		30 MHz - 12.5 GHz	3828.39	-46.03	-30	Pass
Low Channel 1/5, 2422 MHz		12.5 GHz - 25 GHz	23827.98	-43.95	-30	Pass
Mid Channel 4/8, 2437 MHz		Fundamental	2420.78	N/A	N/A	N/A
Mid Channel 4/8, 2437 MHz		30 MHz - 12.5 GHz	8407.78	-45.21	-30	Pass
Mid Channel 4/8, 2437 MHz		12.5 GHz - 25 GHz	24095.04	-43.04	-30	Pass
High Channel 7/11, 2452 MHz		Fundamental	2447.03	N/A	N/A	N/A
High Channel 7/11, 2452 MHz		30 MHz - 12.5 GHz	3840.57	-45.89	-30	Pass
High Channel 7/11, 2452 MHz		12.5 GHz - 25 GHz	23893.6	-43.36	-30	Pass

SPURIOUS RADIATED EMISSIONS



PSA-ESCI 2019.05.10

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

802.11 bgn, 20 MHz bandwidth: Low Ch. 1 = 2412 MHz, Mid Ch. 6 = 2437 MHz, High Ch. 11 = 2462 MHz.

40 MHz bandwidth: High Ch. 9 = 2452 MHz. See power table for software power settings.

POWER SETTINGS INVESTIGATED

3.7 VDC

CONFIGURATIONS INVESTIGATED

ECHN0015 - 4

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26.5 GHz
-----------------	--------	----------------	----------

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
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	24-Mar-2019	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AXR	2-Oct-2018	24 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIZ	7-Feb-2018	24 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	0 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AHV	NCR	0 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AIV	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	18-Nov-2019	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	18-Nov-2019	12 mo
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-08001200-30-10P	PAO	19-Nov-2019	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	19-Nov-2019	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	31-Jul-2019	12 mo
Cable	N/A	Bilog Cables	EVA	18-Nov-2019	12 mo
Cable	N/A	Double Ridge Horn Cables	EVB	18-Nov-2019	12 mo
Cable	None	Standard Gain Horns Cable	EVF	19-Nov-2019	12 mo
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	EVY	31-Jul-2019	12 mo
Attenuator	Coaxicom	3910-20	AXZ	15-Feb-2019	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	LFD	15-Feb-2019	12 mo
Filter - High Pass	Micro-Tronics	HPM50111	HFO	18-Nov-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 $10 \cdot \text{LOG}(\text{dc})$.

SPURIOUS RADIATED EMISSIONS

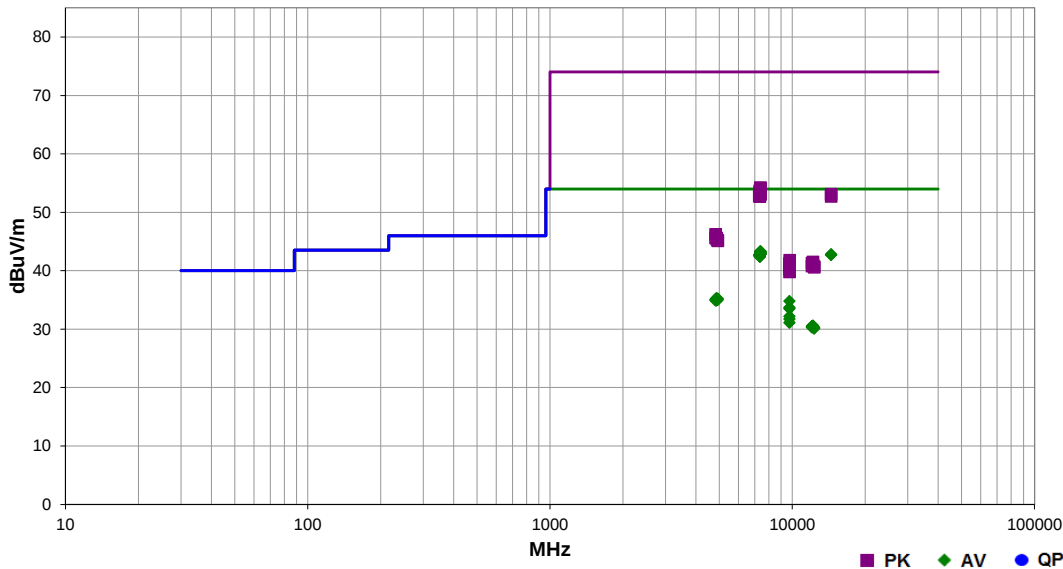


EmiRS 2019.08.15.1 PSA-ESCI 2019.05.10

Work Order:	ECHN0015	Date:	2-Dec-2019	
Project:	None	Temperature:	20.9 °C	
Job Site:	EV01	Humidity:	33.6% RH	
Serial Number:	H1UR1944002-03	Barometric Pres.:	1024 mbar	
EUT: Thor Radio Module AC WLAN and Bluetooth and BLE				Tested by: Brian Fahey & Jeff Alcocke
Configuration:	4			
Customer:	EchoNous, Inc.			
Attendees:	None			
EUT Power:	3.7 VDC			
Operating Mode:	802.11 bgn, 20 MHz bandwidth: Low Ch. 1 = 2412 MHz, Mid Ch. 6 = 2437 MHz, High Ch. 11 = 2462 MHz. 40 MHz bandwidth: High Ch. 9 = 2452 MHz.			
Deviations:	None			
Comments:	See comments below for Channel, Chain, Bandwidth, Data rate, EUT orientation. Note: All emissions were noise floor, no Duty Cycle correction factor needs to be applied.			

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

Run #	43	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	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
7386.750	28.4	14.9	1.5	0.0	3.0	0.0	Horz	AV	0.0	43.3	54.0	-10.7	High Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
7387.625	28.4	14.9	1.5	0.0	3.0	0.0	Horz	AV	0.0	43.3	54.0	-10.7	High Ch., Chain_12, 20MHz, MCS8, EUT Horz
7387.033	28.3	14.9	1.5	360.0	3.0	0.0	Vert	AV	0.0	43.2	54.0	-10.8	High Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
7387.308	28.3	14.9	1.5	21.0	3.0	0.0	Horz	AV	0.0	43.2	54.0	-10.8	High Ch., Chain_2, 20MHz, 11Mbps, EUT Horz
7384.167	28.3	14.9	1.5	42.0	3.0	0.0	Horz	AV	0.0	43.2	54.0	-10.8	High Ch., Chain_2, 20MHz, MCS7, EUT Horz
7384.333	28.2	14.9	1.5	21.0	3.0	0.0	Horz	AV	0.0	43.1	54.0	-10.9	High Ch., Chain_2, 20MHz, 1Mbps, EUT Horz
7385.808	28.2	14.9	1.5	0.0	3.0	0.0	Horz	AV	0.0	43.1	54.0	-10.9	High Ch., Chain_12, 20MHz, MCS15, EUT Horz
7374.380	28.2	14.7	1.5	0.0	3.0	0.0	Horz	AV	0.0	42.9	54.0	-11.1	High Ch., Chain_1, 20MHz, 11Mbps, EUT Horz
7388.170	28.0	14.9	1.5	0.0	3.0	0.0	Horz	AV	0.0	42.9	54.0	-11.1	High Ch., Chain_1, 20MHz, 6Mbps, EUT Horz
7391.210	28.0	14.9	1.5	0.0	3.0	0.0	Horz	AV	0.0	42.9	54.0	-11.1	High Ch., Chain_1, 20MHz, 36Mbps, EUT Horz
7391.960	27.9	15.0	1.5	0.0	3.0	0.0	Horz	AV	0.0	42.9	54.0	-11.1	High Ch., Chain_1, 20MHz, MCS0, EUT Horz
7389.710	28.0	14.9	1.5	0.0	3.0	0.0	Horz	AV	0.0	42.9	54.0	-11.1	High Ch., Chain_1, 20MHz, MCS7, EUT Horz
14472.970	26.9	15.9	1.5	0.0	3.0	0.0	Vert	AV	0.0	42.8	54.0	-11.2	Low Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
7378.670	27.9	14.9	1.5	0.0	3.0	0.0	Horz	AV	0.0	42.8	54.0	-11.2	High Ch., Chain_1, 20MHz, 54Mbps, EUT Horz
7376.000	27.9	14.9	1.5	0.0	3.0	0.0	Horz	AV	0.0	42.8	54.0	-11.2	High Ch., Chain_1, 20MHz, MCS8, EUT Horz
7388.580	27.9	14.9	1.5	0.0	3.0	0.0	Horz	AV	0.0	42.8	54.0	-11.2	High Ch., Chain_1, 20MHz, MCS15, EUT Horz
7357.833	28.3	14.5	1.5	21.0	3.0	0.0	Horz	AV	0.0	42.8	54.0	-11.2	High Ch., Chain_2, 40MHz, MCS0, EUT Horz
7310.533	28.8	13.9	1.5	360.0	3.0	0.0	Vert	AV	0.0	42.7	54.0	-11.3	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
7310.600	28.8	13.9	1.5	0.0	3.0	0.0	Horz	AV	0.0	42.7	54.0	-11.3	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
14469.930	26.8	15.9	1.5	360.0	3.0	0.0	Horz	AV	0.0	42.7	54.0	-11.3	Low Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
7354.617	28.1	14.5	1.5	227.0	3.0	0.0	Horz	AV	0.0	42.6	54.0	-11.4	High Ch., Chain_12, 40MHz, MCS15, EUT Horz
7353.583	28.1	14.5	1.5	289.0	3.0	0.0	Horz	AV	0.0	42.6	54.0	-11.4	High Ch., Chain_12, 40MHz, MCS8, EUT Horz
7349.830	28.0	14.5	1.5	0.0	3.0	0.0	Horz	AV	0.0	42.5	54.0	-11.5	High Ch., Chain_1, 40MHz, MCS0, EUT Horz
7349.040	28.0	14.5	1.5	0.0	3.0	0.0	Horz	AV	0.0	42.5	54.0	-11.5	High Ch., Chain_1, 40MHz, MCS7, EUT Horz
7357.475	28.0	14.5	1.5	92.0	3.0	0.0	Horz	AV	0.0	42.5	54.0	-11.5	High Ch., Chain_2, 40MHz, MCS7, EUT Horz
7350.000	27.9	14.5	1.5	0.0	3.0	0.0	Horz	AV	0.0	42.4	54.0	-11.6	High Ch., Chain_1, 40MHz, MCS8, EUT Horz
7351.540	27.9	14.5	1.5	0.0	3.0	0.0	Horz	AV	0.0	42.4	54.0	-11.6	High Ch., Chain_1, 40MHz, MCS15, EUT Horz
4872.667	29.1	6.2	1.5	0.0	3.0	0.0	Vert	AV	0.0	35.3	54.0	-18.7	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
4926.242	28.6	6.6	1.5	0.0	3.0	0.0	Vert	AV	0.0	35.2	54.0	-18.8	High Ch., Chain_1, 20MHz, 1Mbps, EUT Vert

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
4822.433	29.3	5.8	1.5	360.0	3.0	0.0	Vert	AV	0.0	35.1	54.0	-18.9	Low Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
4923.717	28.5	6.5	1.5	360.0	3.0	0.0	Horz	AV	0.0	35.0	54.0	-19.0	High Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
4873.742	28.7	6.2	1.5	360.0	3.0	0.0	Horz	AV	0.0	34.9	54.0	-19.1	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
4821.592	29.1	5.8	1.5	0.0	3.0	0.0	Horz	AV	0.0	34.9	54.0	-19.1	Low Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
9748.142	35.9	-1.1	2.2	344.0	3.0	0.0	Vert	AV	0.0	34.8	54.0	-19.2	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
7385.575	39.3	14.9	1.5	360.0	3.0	0.0	Vert	PK	0.0	54.2	74.0	-19.8	High Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
7391.080	39.3	14.9	1.5	0.0	3.0	0.0	Horz	PK	0.0	54.2	74.0	-19.8	High Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
7388.217	39.1	14.9	1.5	0.0	3.0	0.0	Horz	PK	0.0	54.0	74.0	-20.0	High Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
7387.880	39.1	14.9	1.5	0.0	3.0	0.0	Horz	PK	0.0	54.0	74.0	-20.0	High Ch., Chain_1, 20MHz, 54Mbps, EUT Horz
7345.170	39.2	14.5	1.5	0.0	3.0	0.0	Horz	PK	0.0	53.7	74.0	-20.3	High Ch., Chain_1, 40MHz, MCS8, EUT Horz
7383.742	38.8	14.9	1.5	0.0	3.0	0.0	Horz	PK	0.0	53.7	74.0	-20.3	High Ch., Chain_12, 20MHz, MCS8, EUT Horz
9748.100	34.8	-1.1	1.4	343.0	3.0	0.0	Vert	AV	0.0	33.7	54.0	-20.3	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
7356.192	39.1	14.5	1.5	92.0	3.0	0.0	Horz	PK	0.0	53.6	74.0	-20.4	High Ch., Chain_1, 20MHz, MCS7, EUT Horz
7396.080	38.5	15.0	1.5	0.0	3.0	0.0	Horz	PK	0.0	53.5	74.0	-20.5	High Ch., Chain_1, 20MHz, MCS0, EUT Horz
7381.330	38.6	14.9	1.5	0.0	3.0	0.0	Horz	PK	0.0	53.5	74.0	-20.5	High Ch., Chain_1, 20MHz, MCS15, EUT Horz
7383.658	38.6	14.9	1.5	0.0	3.0	0.0	Horz	PK	0.0	53.5	74.0	-20.5	High Ch., Chain_12, 20MHz, MCS15, EUT Horz
9748.142	34.6	-1.1	1.6	92.0	3.0	0.0	Horz	AV	0.0	33.5	54.0	-20.5	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
7366.960	38.7	14.7	1.5	0.0	3.0	0.0	Horz	PK	0.0	53.4	74.0	-20.6	High Ch., Chain_1, 40MHz, MCS0, EUT Horz
7386.867	38.5	14.9	1.5	21.0	3.0	0.0	Horz	PK	0.0	53.4	74.0	-20.6	High Ch., Chain_2, 20MHz, 1Mbps, EUT Horz
7387.975	38.5	14.9	1.5	42.0	3.0	0.0	Horz	PK	0.0	53.4	74.0	-20.6	High Ch., Chain_2, 20MHz, MCS7, EUT Horz
7396.040	38.3	15.0	1.5	0.0	3.0	0.0	Horz	PK	0.0	53.3	74.0	-20.7	High Ch., Chain_1, 20MHz, 36Mbps, EUT Horz
7381.000	38.4	14.9	1.5	0.0	3.0	0.0	Horz	PK	0.0	53.3	74.0	-20.7	High Ch., Chain_1, 20MHz, MCS8, EUT Horz
7355.267	38.8	14.5	1.5	227.0	3.0	0.0	Horz	PK	0.0	53.3	74.0	-20.7	High Ch., Chain_12, 40MHz, MCS15, EUT Horz
7382.670	38.3	14.9	1.5	0.0	3.0	0.0	Horz	PK	0.0	53.2	74.0	-20.8	High Ch., Chain_1, 20MHz, 6Mbps, EUT Horz
7357.775	38.7	14.5	1.5	289.0	3.0	0.0	Horz	PK	0.0	53.2	74.0	-20.8	High Ch., Chain_12, 40MHz, MCS8, EUT Horz
14473.150	37.2	15.9	1.5	0.0	3.0	0.0	Vert	PK	0.0	53.1	74.0	-20.9	Low Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
7390.170	38.2	14.9	1.5	0.0	3.0	0.0	Horz	PK	0.0	53.1	74.0	-20.9	High Ch., Chain_1, 20MHz, MCS7, EUT Horz
7384.900	38.2	14.9	1.5	21.0	3.0	0.0	Horz	PK	0.0	53.1	74.0	-20.9	High Ch., Chain_2, 20MHz, 1Mbps, EUT Horz
7358.350	38.4	14.6	1.5	21.0	3.0	0.0	Horz	PK	0.0	53.0	74.0	-21.0	High Ch., Chain_2, 40MHz, MCS0, EUT Horz
7311.217	39.0	13.9	1.5	360.0	3.0	0.0	Vert	PK	0.0	52.9	74.0	-21.1	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
7310.333	39.9	13.9	1.5	0.0	3.0	0.0	Horz	PK	0.0	52.8	74.0	-21.2	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
14470.780	36.8	15.9	1.5	360.0	3.0	0.0	Horz	PK	0.0	52.7	74.0	-21.3	Low Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
7346.170	38.2	14.5	1.5	0.0	3.0	0.0	Horz	PK	0.0	52.7	74.0	-21.3	High Ch., Chain_1, 40MHz, MCS7, EUT Horz
7347.380	38.2	14.5	1.5	0.0	3.0	0.0	Horz	PK	0.0	52.7	74.0	-21.3	High Ch., Chain_1, 40MHz, MCS15, EUT Horz
9748.008	33.3	-1.1	1.5	354.0	3.0	0.0	Horz	AV	0.0	32.2	54.0	-21.8	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT on Side
9748.175	32.8	-1.1	2.0	236.0	3.0	0.0	Horz	AV	0.0	31.7	54.0	-22.3	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
9748.108	32.2	-1.1	2.2	163.0	3.0	0.0	Vert	AV	0.0	31.1	54.0	-22.9	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT on Side
12184.810	29.8	0.8	1.5	0.0	3.0	0.0	Horz	AV	0.0	30.6	54.0	-23.4	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
12185.870	29.7	0.8	1.5	360.0	3.0	0.0	Vert	AV	0.0	30.5	54.0	-23.5	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
12058.480	29.5	1.0	1.5	360.0	3.0	0.0	Horz	AV	0.0	30.5	54.0	-23.5	Low Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
12309.620	29.6	0.7	1.5	0.0	3.0	0.0	Vert	AV	0.0	30.3	54.0	-23.7	High Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
12061.730	29.3	1.0	1.5	360.0	3.0	0.0	Vert	AV	0.0	30.3	54.0	-23.7	Low Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
12309.780	29.4	0.7	1.5	0.0	3.0	0.0	Horz	AV	0.0	30.1	54.0	-23.9	High Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
4822.925	40.4	5.8	1.5	360.0	3.0	0.0	Vert	PK	0.0	46.2	74.0	-27.8	Low Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
4872.850	39.4	6.2	1.5	360.0	3.0	0.0	Horz	PK	0.0	45.6	74.0	-28.4	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
4822.000	39.8	5.8	1.5	0.0	3.0	0.0	Horz	PK	0.0	45.6	74.0	-28.4	Low Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
4874.975	39.2	6.2	1.5	0.0	3.0	0.0	Vert	PK	0.0	45.4	74.0	-28.6	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
4923.633	38.7	6.5	1.5	0.0	3.0	0.0	Vert	PK	0.0	45.2	74.0	-28.8	High Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
4926.217	38.5	6.6	1.5	360.0	3.0	0.0	Horz	PK	0.0	45.1	74.0	-28.9	High Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
9748.417	42.9	-1.1	2.2	344.0	3.0	0.0	Vert	PK	0.0	41.8	74.0	-32.2	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
12182.840	40.7	0.8	1.5	0.0	3.0	0.0	Horz	PK	0.0	41.5	74.0	-32.5	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
12061.240	40.3	1.0	1.5	360.0	3.0	0.0	Horz	PK	0.0	41.3	74.0	-32.7	Low Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
9748.275	42.3	-1.1	1.6	92.0	3.0	0.0	Horz	PK	0.0	41.2	74.0	-32.8	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
9748.525	42.3	-1.1	1.4	343.0	3.0	0.0	Vert	PK	0.0	41.2	74.0	-32.8	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
12182.730	40.1	0.8	1.5	360.0	3.0	0.0	Vert	PK	0.0	40.9	74.0	-33.1	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
12058.380	39.8	1.0	1.5	360.0	3.0	0.0	Vert	PK	0.0	40.8	74.0	-33.2	Low Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
12310.140	40.0	0.7	1.5	0.0	3.0	0.0	Vert	PK	0.0	40.7	74.0	-33.3	High Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
12312.370	39.9	0.7	1.5	0.0	3.0	0.0	Horz	PK	0.0	40.6	74.0	-33.4	High Ch., Chain_1, 20MHz, 1Mbps, EUT Horz
9748.133	41.5	-1.1	2.0	236.0	3.0	0.0	Horz	PK	0.0	40.4	74.0	-33.6	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT Vert
9747.600	41.4	-1.1	1.5	354.0	3.0	0.0	Horz	PK	0.0	40.3	74.0	-33.7	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT on Side
9746.842	40.9	-1.1	2.2	163.0	3.0	0.0	Vert	PK	0.0	39.8	74.0	-34.2	Mid Ch., Chain_1, 20MHz, 1Mbps, EUT on Side

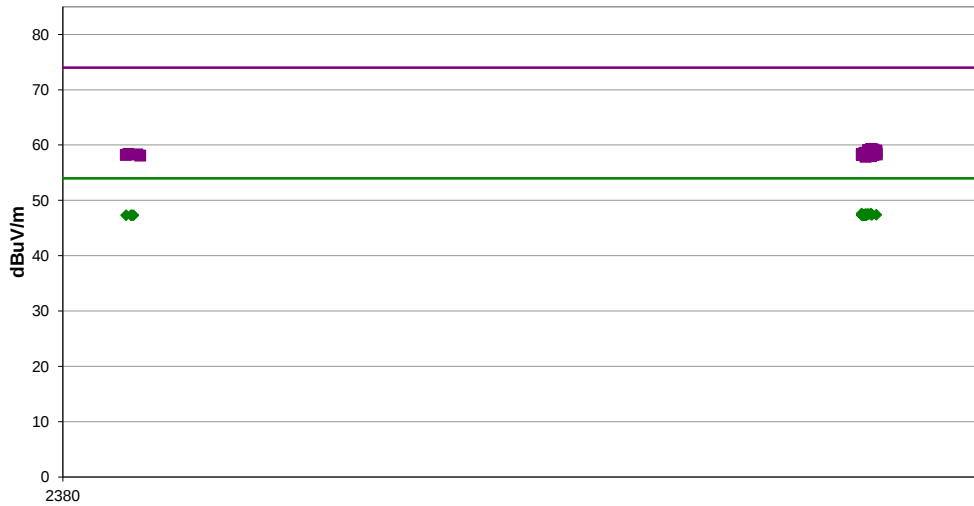
SPURIOUS RADIATED EMISSIONS



Work Order:	ECHN0015	Date:	2-Dec-2019	
Project:	None	Temperature:	20.9 °C	
Job Site:	EV01	Humidity:	33.6% RH	
Serial Number:	H1UR1944002-03	Barometric Pres.:	1024 mbar	Tested by: Brian Fahey & Jeff Alcock
EUT:	Thor Radio Module AC WLAN and Bluetooth and BLE			
Configuration:	4			
Customer:	EchoNous, Inc.			
Attendees:	None			
EUT Power:	3.7 VDC			
Operating Mode:	802.11 bgn, 20 MHz bandwidth: Low Ch. 1 = 2412 MHz, High Ch. 11 = 2462 MHz. 40 MHz bandwidth: High Ch. 9 = 2452 MHz.			
Deviations:	None			
Comments:	See comments below for Channel, Chain, Bandwidth, Data rate, EUT orientation. Note: All emissions were noise floor, no Duty Cycle correction factor needs to be applied.			

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

Run #	47	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	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
2483.500	31.4	-3.8	1.5	358.0	3.0	20.0	Horz	AV	0.0	47.6	54.0	-6.4	High Ch, Chain_1, 40MHz, MCS0, EUT Horz
2484.727	31.3	-3.7	1.3	189.0	3.0	20.0	Horz	AV	0.0	47.6	54.0	-6.4	High Ch, Chain_1, 40MHz, MCS0, EUT Vert
2483.973	31.3	-3.8	1.5	177.0	3.0	20.0	Vert	AV	0.0	47.5	54.0	-6.5	High Ch, Chain_1, 40MHz, MCS0, EUT on Side
2484.737	31.2	-3.7	1.0	0.0	3.0	20.0	Horz	AV	0.0	47.5	54.0	-6.5	High Ch, Chain_1, 20MHz, 1Mbps, EUT Horz
2484.230	31.2	-3.7	1.0	0.0	3.0	20.0	Horz	AV	0.0	47.5	54.0	-6.5	High Ch, Chain_1, 20MHz, 36Mbps, EUT Horz
2484.387	31.2	-3.7	1.5	360.0	3.0	20.0	Horz	AV	0.0	47.5	54.0	-6.5	High Ch, Chain_12, 20MHz, MCS15, EUT Horz
2483.540	31.2	-3.8	1.5	157.0	3.0	20.0	Vert	AV	0.0	47.4	54.0	-6.6	High Ch, Chain_1, 40MHz, MCS0, EUT Horz
2484.087	31.2	-3.8	1.5	296.0	3.0	20.0	Vert	AV	0.0	47.4	54.0	-6.6	High Ch, Chain_1, 40MHz, MCS0, EUT Vert
2483.610	31.2	-3.8	1.5	37.0	3.0	20.0	Horz	AV	0.0	47.4	54.0	-6.6	High Ch, Chain_1, 40MHz, MCS0, EUT on Side
2483.670	31.2	-3.8	1.0	0.0	3.0	20.0	Vert	AV	0.0	47.4	54.0	-6.6	High Ch, Chain_1, 20MHz, 6Mbps, EUT Horz
2483.830	31.2	-3.8	1.0	360.0	3.0	20.0	Horz	AV	0.0	47.4	54.0	-6.6	High Ch, Chain_1, 20MHz, 6Mbps, EUT Horz
2484.880	31.1	-3.7	1.0	360.0	3.0	20.0	Horz	AV	0.0	47.4	54.0	-6.6	High Ch, Chain_1, 20MHz, 54Mbps, EUT Horz
2484.180	31.1	-3.7	1.0	0.0	3.0	20.0	Horz	AV	0.0	47.4	54.0	-6.6	High Ch, Chain_1, 20MHz, MCS0, EUT Horz
2484.073	31.2	-3.8	1.0	360.0	3.0	20.0	Horz	AV	0.0	47.4	54.0	-6.6	High Ch, Chain_1, 20MHz, MCS7, EUT Horz
2484.203	31.1	-3.7	2.0	302.0	3.0	20.0	Horz	AV	0.0	47.4	54.0	-6.6	High Ch, Chain_2, 20MHz, 1Mbps, EUT Horz
2484.770	31.1	-3.7	1.0	360.0	3.0	20.0	Horz	AV	0.0	47.4	54.0	-6.6	High Ch, Chain_1, 20MHz, MCS15, EUT Horz
2485.443	31.1	-3.7	1.5	360.0	3.0	20.0	Horz	AV	0.0	47.4	54.0	-6.6	High Ch, Chain_12, 40MHz, MCS8(256-QAM), EUT Horz
2483.590	31.1	-3.8	1.0	360.0	3.0	20.0	Horz	AV	0.0	47.3	54.0	-6.7	High Ch, Chain_1, 20MHz, 11Mbps, EUT Horz
2483.877	31.1	-3.8	1.5	358.0	3.0	20.0	Horz	AV	0.0	47.3	54.0	-6.7	High Ch, Chain_1, 40MHz, MCS7, EUT Horz
2483.593	31.1	-3.8	1.5	111.0	3.0	20.0	Horz	AV	0.0	47.3	54.0	-6.7	High Ch, Chain_2, 40MHz, MCS0, EUT Horz
2483.620	31.1	-3.8	1.0	0.0	3.0	20.0	Horz	AV	0.0	47.3	54.0	-6.7	High Ch, Chain_1, 20MHz, MCS8, EUT Horz
2483.753	31.1	-3.8	1.5	358.0	3.0	20.0	Horz	AV	0.0	47.3	54.0	-6.7	High Ch, Chain_1, 40MHz, MCS8, EUT Horz
2484.007	31.1	-3.8	1.5	358.0	3.0	20.0	Horz	AV	0.0	47.3	54.0	-6.7	High Ch, Chain_1, 40MHz, MCS15, EUT Horz
2388.663	31.3	-4.0	1.5	111.0	3.0	20.0	Horz	AV	0.0	47.3	54.0	-6.7	Low Ch, Chain_1, 20MHz, 1Mbps, EUT Horz
2388.770	31.3	-4.0	1.5	111.0	3.0	20.0	Vert	AV	0.0	47.3	54.0	-6.7	Low Ch, Chain_1, 20MHz, 1Mbps, EUT Horz
2388.983	31.3	-4.0	1.5	111.0	3.0	20.0	Vert	AV	0.0	47.3	54.0	-6.7	Low Ch, Chain_1, 20MHz, 6Mbps, EUT Horz
2388.050	31.3	-4.0	1.5	111.0	3.0	20.0	Horz	AV	0.0	47.3	54.0	-6.7	Low Ch, Chain_1, 20MHz, 6Mbps, EUT Horz
2483.550	31.1	-3.8	1.5	360.0	3.0	20.0	Horz	AV	0.0	47.3	54.0	-6.7	High Ch, Chain_12, 20MHz, MCS8(256-QAM), EUT Horz
2483.550	31.1	-3.8	1.5	360.0	3.0	20.0	Horz	AV	0.0	47.3	54.0	-6.7	High Ch, Chain_12, 20MHz, MCS9(256-QAM), EUT Horz
2483.677	31.1	-3.8	1.5	360.0	3.0	20.0	Horz	AV	0.0	47.3	54.0	-6.7	High Ch, Chain_12, 40MHz, MCS15, EUT Horz
2483.993	31.1	-3.8	1.5	360.0	3.0	20.0	Horz	AV	0.0	47.3	54.0	-6.7	High Ch, Chain_12, 40MHz, MCS9(256-QAM), EUT Horz
2484.757	43.0	-3.7	1.5	37.0	3.0	20.0	Horz	PK	0.0	59.3	74.0	-14.7	High Ch, Chain_1, 40MHz, MCS0, EUT on Side
2485.057	42.9	-3.7	1.5	360.0	3.0	20.0	Horz	PK	0.0	59.2	74.0	-14.8	High Ch, Chain_12, 40MHz, MCS9(256-QAM), EUT Horz
2484.350	42.8	-3.7	1.5	360.0	3.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	High Ch, Chain_12, 40MHz, MCS15, EUT Horz
2485.450	42.7	-3.7	1.5	358.0	3.0	20.0	Horz	PK	0.0	59.0	74.0	-15.0	High Ch, Chain_1, 40MHz, MCS0, EUT Horz

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
2484.857	42.7	-3.7	1.5	360.0	3.0	20.0	Horz	PK	0.0	59.0	74.0	-15.0	High Ch, Chain_12, 20MHz, MCS8(256-QAM), EUT Horz
2485.170	42.5	-3.7	1.0	360.0	3.0	20.0	Horz	PK	0.0	58.8	74.0	-15.2	High Ch, Chain_1, 20MHz, MCS15, EUT Horz
2483.867	42.4	-3.8	1.5	358.0	3.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	High Ch, Chain_1, 40MHz, MCS15, EUT Horz
2484.070	42.4	-3.8	1.5	360.0	3.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	High Ch, Chain_12, 40MHz, MCS8(256-QAM), EUT Horz
2485.207	42.2	-3.7	1.5	296.0	3.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	High Ch, Chain_1, 40MHz, MCS0, EUT Vert
2485.470	42.2	-3.7	1.5	360.0	3.0	20.0	Horz	PK	0.0	58.5	74.0	-15.5	High Ch, Chain_12, 20MHz, MCS15, EUT Horz
2484.550	42.1	-3.7	1.5	157.0	3.0	20.0	Vert	PK	0.0	58.4	74.0	-15.6	High Ch, Chain_1, 40MHz, MCS0, EUT Horz
2484.267	42.1	-3.7	1.5	177.0	3.0	20.0	Vert	PK	0.0	58.4	74.0	-15.6	High Ch, Chain_1, 40MHz, MCS0, EUT on Side
2484.243	42.1	-3.7	1.0	0.0	3.0	20.0	Horz	PK	0.0	58.4	74.0	-15.6	High Ch, Chain_1, 20MHz, 1Mbps, EUT Horz
2484.680	42.1	-3.7	1.0	360.0	3.0	20.0	Horz	PK	0.0	58.4	74.0	-15.6	High Ch, Chain_1, 20MHz, 11Mbps, EUT Horz
2484.183	42.1	-3.7	1.5	358.0	3.0	20.0	Horz	PK	0.0	58.4	74.0	-15.6	High Ch, Chain_1, 40MHz, MCS7, EUT Horz
2483.873	42.2	-3.8	1.0	0.0	3.0	20.0	Horz	PK	0.0	58.4	74.0	-15.6	High Ch, Chain_1, 20MHz, MCS8, EUT Horz
2388.347	42.4	-4.0	1.5	111.0	3.0	20.0	Horz	PK	0.0	58.4	74.0	-15.6	Low Ch, Chain_1, 20MHz, 1Mbps, EUT Horz
2483.520	42.2	-3.8	1.5	360.0	3.0	20.0	Horz	PK	0.0	58.4	74.0	-15.6	High Ch, Chain_12, 20MHz, MCS9(256-QAM), EUT Horz
2485.487	42.0	-3.7	1.0	360.0	3.0	20.0	Horz	PK	0.0	58.3	74.0	-15.7	High Ch, Chain_1, 20MHz, 6Mbps, EUT Horz
2484.777	42.0	-3.7	2.0	302.0	3.0	20.0	Horz	PK	0.0	58.3	74.0	-15.7	High Ch, Chain_2, 20MHz, 1Mbps, EUT Horz
2389.457	42.3	-4.0	1.5	111.0	3.0	20.0	Horz	PK	0.0	58.3	74.0	-15.7	Low Ch, Chain_1, 20MHz, 6Mbps, EUT Horz
2483.537	42.0	-3.8	1.0	0.0	3.0	20.0	Horz	PK	0.0	58.2	74.0	-15.8	High Ch, Chain_1, 20MHz, 36Mbps, EUT Horz
2484.830	41.9	-3.7	1.0	360.0	3.0	20.0	Horz	PK	0.0	58.2	74.0	-15.8	High Ch, Chain_1, 20MHz, 54Mbps, EUT Horz
2483.577	42.0	-3.8	1.0	0.0	3.0	20.0	Horz	PK	0.0	58.2	74.0	-15.8	High Ch, Chain_1, 20MHz, MCS0, EUT Horz
2485.083	41.9	-3.7	1.5	358.0	3.0	20.0	Horz	PK	0.0	58.2	74.0	-15.8	High Ch, Chain_1, 40MHz, MCS8, EUT Horz
2388.007	42.2	-4.0	1.5	111.0	3.0	20.0	Vert	PK	0.0	58.2	74.0	-15.8	Low Ch, Chain_1, 20MHz, 6Mbps, EUT Horz
2389.833	42.1	-4.0	1.5	111.0	3.0	20.0	Vert	PK	0.0	58.1	74.0	-15.9	Low Ch, Chain_1, 20MHz, 1Mbps, EUT Horz
2484.730	41.7	-3.7	1.0	0.0	3.0	20.0	Vert	PK	0.0	58.0	74.0	-16.0	High Ch, Chain_1, 20MHz, 6Mbps, EUT Horz
2484.020	41.8	-3.8	1.0	360.0	3.0	20.0	Horz	PK	0.0	58.0	74.0	-16.0	High Ch, Chain_1, 20MHz, MCS7, EUT Horz
2484.760	41.7	-3.7	1.5	111.0	3.0	20.0	Horz	PK	0.0	58.0	74.0	-16.0	High Ch, Chain_2, 40MHz, MCS0, EUT Horz
2484.020	41.7	-3.8	1.3	189.0	3.0	20.0	Horz	PK	0.0	57.9	74.0	-16.1	High Ch, Chain_1, 40MHz, MCS0, EUT Vert