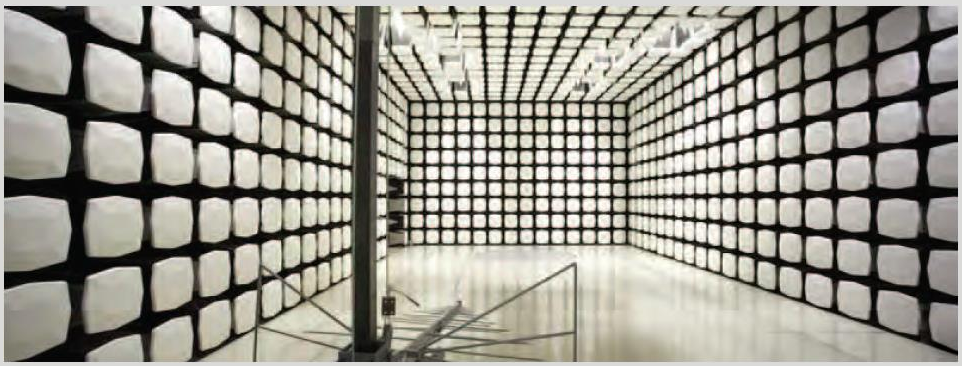
A-dec, Inc.

A-dec Gateway

FCC 15.407:2021
RSS-247 Issue 2:2017
802.11 Radio

Report: A-DE0169.3 Rev. 1, Issue Date: March 4, 2022



ACCREDITED
CERT #3310.02

CERTIFICATE OF TEST

Last Date of Test: December 20, 2021
A-dec, Inc.
EUT: A-dec Gateway

Radio Equipment Testing

Standards

Specification	Method
FCC 15.407:2021	ANSI C63.10:2013, KDB 789033, KDB 905462 D02
RSS-247 Issue 2:2017	ANSI C63.10:2013, KDB 789033, KDB 905462 D02

Results

Method Clause	Test Description	Applied	Results	Comments
KDB 905462 (D02) -7.5	DFS Testing - Test Signal Level	No	N/A	Not required if EUT is a "Client" without radar detection.
KDB 905462 (D02) -7.7	DFS Testing - Channel Loading and Channel Utilization	Yes	Pass	
KDB 905462 (D02) -7.8.1	DFS Testing - Detection Bandwidth	No	N/A	Not required if EUT is a "Client" without radar detection.
KDB 905462 (D02) -7.8.2	DFS Testing - Channel Availability Check	No	N/A	Not required if EUT is a "Client" without radar detection.
KDB 905462 (D02) -7.8.3	DFS Testing – Channel Move Time	Yes	Pass	
KDB 905462 (D02) -7.8.3	DFS Testing - Closing Time	Yes	Pass	
KDB 905462 (D02) -7.8.3	DFS Testing - Non Occupancy Period	Yes	Pass	
KDB 905462 (D02) -7.8.4	DFS Testing - Statistical Performance	No	N/A	Not required if EUT is a "Client" without radar detection.
N/A	DFS Testing - DFS Product Information	Yes	N/A	A1 Product Information filled out by the manufacturer and included in the test report.

Deviations From Test Standards

None

Approved By:

Kyle Holgate, 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	Removed the antenna and power settings from the report, as all the information needed is in the annex	2022-03-04	11
	Swapped out the Master for the Client version	2022-03-04	14
	Comments were added indicating what the markers represent.	2022-03-04	26, 29
	Updated the test description to indicate FCC type 0 short radar pulse was used and added comments indicating what the markers represent	2022-03-04	30

ACCREDITATIONS AND AUTHORIZATIONS

element
2021.09.01

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 - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

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 – Recognized as an EU Notified Body validated for the EMCD and RED Directives.

United Kingdom

BEIS – Recognized by the UK as an Approved Body under the UK Radio Equipment and UK EMC Regulations.

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.

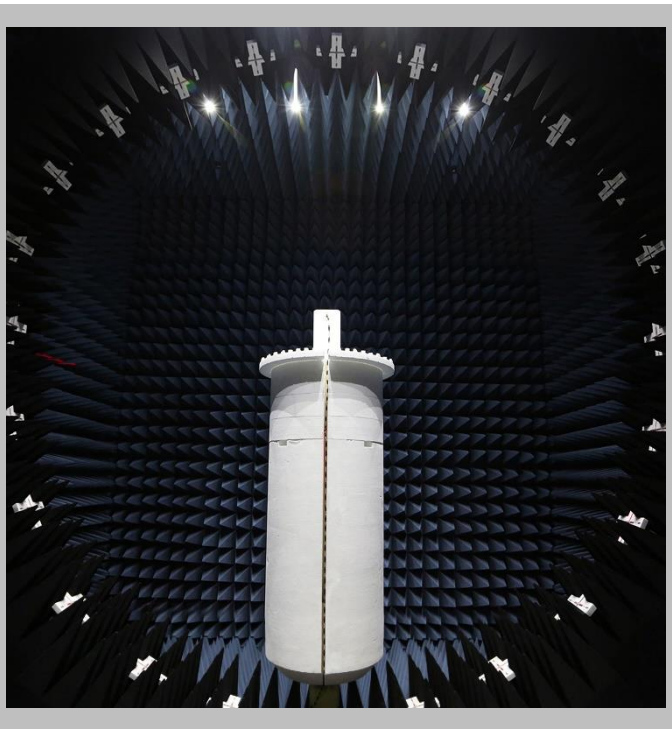
SCOPE

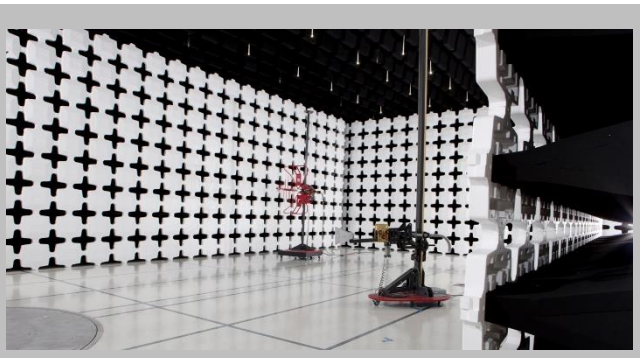
For details on the Scopes of our Accreditations, please visit:

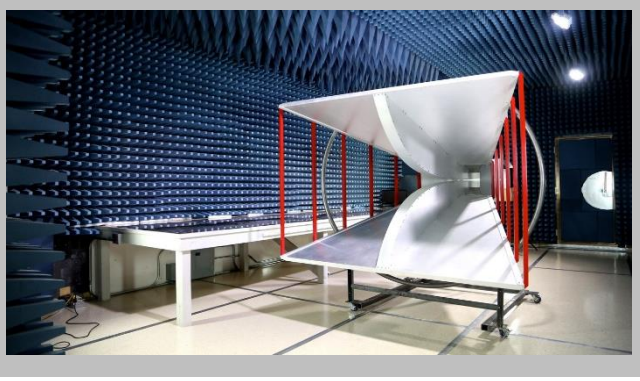
California Minnesota Oregon Texas Washington

FACILITIES

California	Minnesota	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-11 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
A2LA				
Lab Code: 3310.04	Lab Code: 3310.05	Lab Code: 3310.02	Lab Code: 3310.03	Lab Code: 3310.06
Innovation, Science and Economic Development Canada				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

Measurement Uncertainty

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

A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found in the table below. A lab specific value may also be found in the applicable test description section. 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)	3.2 dB	-3.2 dB

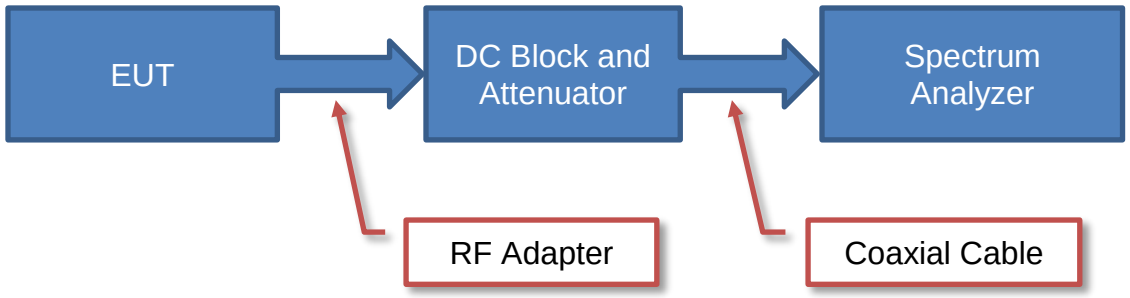
TEST SETUP BLOCK DIAGRAMS

Measurement Bandwidths

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

Unless otherwise stated, measurements were made using the bandwidths and detectors specified. No video filter was used.

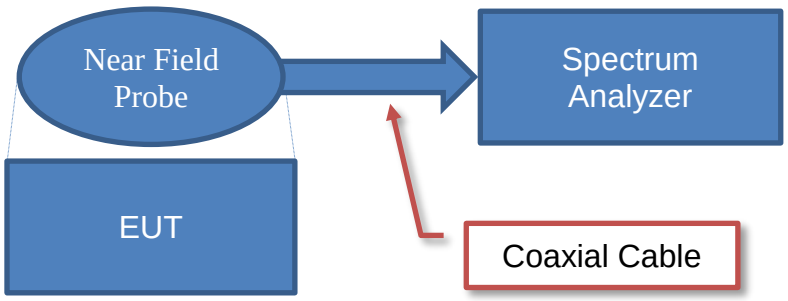
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

Near Field Test Fixture Measurements

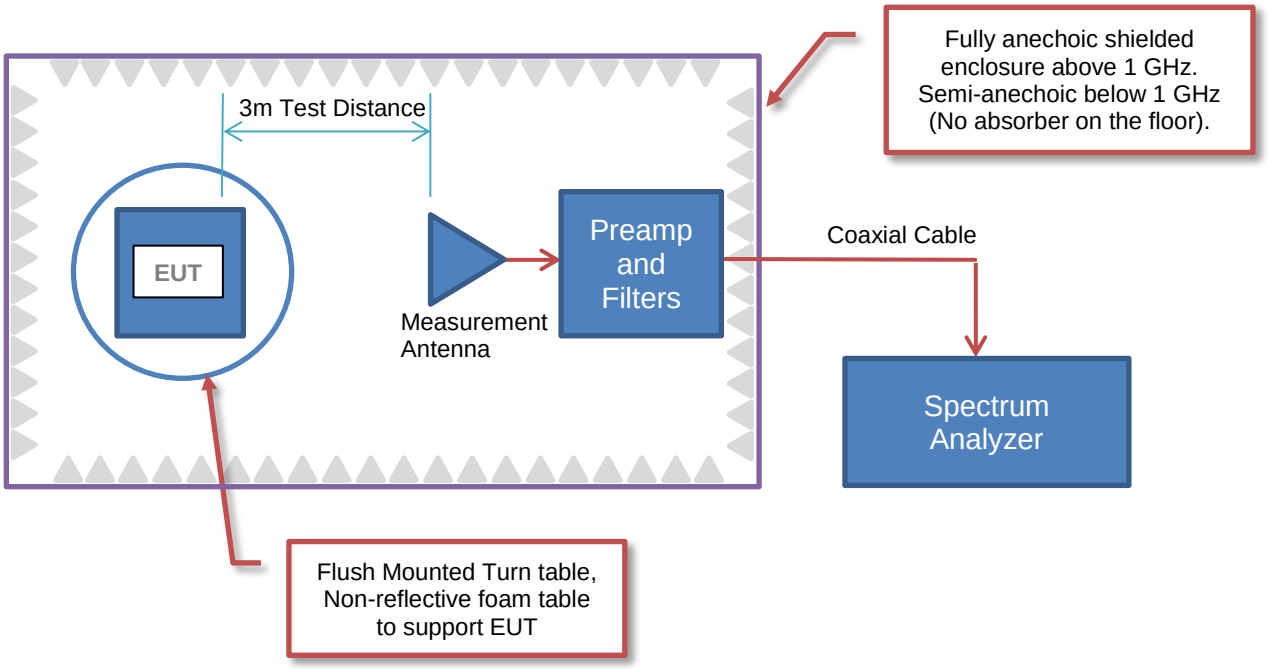


Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

TEST SETUP BLOCK DIAGRAMS

Emissions Measurements



Sample Calculation (logarithmic units)

Radiated Emissions:

Measured Level (Amplitude)		Factor: Antenna Factor		Factor: Cable Factor		Factor: Amplifier Gain		Distance Adjustment Factor		External Attenuation		Field Strength
42.6	+	28.6	+	3.1	-	40.8	+	0.0	+	0.0	=	**33.5**

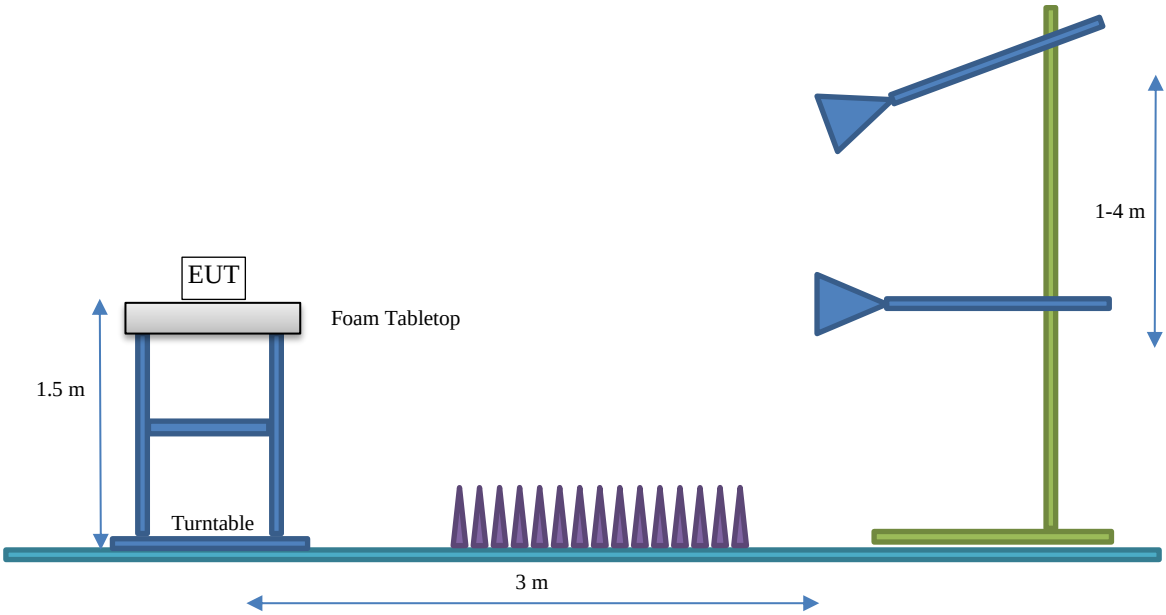
Conducted Emissions:

Measured Level (Amplitude)		Factor: Transducer Factor		Factor: Cable Factor		External Attenuation		Adjusted Level
26.7	+	0.3	+	0.1	+	20.0	=	**47.1**

TEST SETUP BLOCK DIAGRAMS

Bore Sighting (>1GHz)

The diameter of the illumination area is the dimension of the line tangent to the EUT formed by 3 dB beamwidth of the measurement antenna at the measurement distance. At a 3 meter test distance, the diameter of the illumination area was 3.8 meters at 1 GHz and greater than 2.1 meters up to 6 GHz. Above 1 GHz, when required by the measurement standard, the antenna is pointed for both azimuth and elevation to maintain the receive antenna within the cone of radiation from the EUT. The specified measurement detectors were used for comparison of the emissions to the peak and average specification limits.



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	A-dec, Inc.
Address:	2601 Crestview Dr Building 4
City, State, Zip:	Newberg, OR 97132-9528
Test Requested By:	Russell Perkins
EUT:	A-dec Gateway
First Date of Test:	December 20, 2021
Last Date of Test:	December 20, 2021
Receipt Date of Samples:	November 22, 2021
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
A small network gateway that connects to our products data networks, and rolls system information up to the cloud using Ethernet or WiFi.

Testing Objective:
To demonstrate compliance of the 802.11 radio for operation in the 5.3 GHz, 5.6 GHz and 5.8 GHz band(s).

CONFIGURATIONS

Configuration A-DE0169- 5

Software/Firmware Running During Test	
Description	**Version**
iPerf 3	3.7

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Wireless Access Point / IoT Device	A-dec, Inc.	43.0531.00	521A000122

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
ITE Power Supply	GlobTek, Inc.	GTM96180-1130-6-0	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Serial to USB	Yes	2.0 m	No	Lab PC	Wireless Access Point / IoT Device

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2021-12-20	Channel Loading and Channel Utilization	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	2021-12-20	Channel Move Time	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	2021-12-20	Closing Time	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	2021-12-20	Non Occupancy Period	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

INTRODUCTION & CLIENT DEVICE DFS CONFORMANCE

Overview

For a Client Device without DFS, the Channel Move Time and Channel Closing Transmission Time requirements are verified with one Short Pulse Radar and one Long Pulse Radar. Non-occupancy period can be confirmed with either short or long pulses.

Channel Closing Transmission Time: The total duration of transmissions, consisting of data signals and the aggregate of control signals, by a U-NII device during the Channel Move Time.

Channel Move Time: The time to cease all transmissions on the current Channel upon detection of a Radar Waveform above the DFS Detection Threshold. A Client Device will not transmit before having received appropriate control signals from a Master Device. A Client Device will stop all its transmissions whenever instructed by a Master Device to which it is associated and will meet the Channel Move Time and Channel Closing Transmission Time requirements. The Client Device will not resume any transmissions until it has again received control signals from a Master Device.

Non-Occupancy Period: Time during which both the client and master device shall not make any transmissions on a channel after a radar signal was detected on that channel. It should at least the minimum requirements but it can be more.

Applicability of DFS Requirements Prior to Use of a Channel			
Requirement	**Operational Mode**		
	Master	**Client (without DFS)**	**Client (with DFS)**
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

Applicability of DFS requirements during normal operation		
Requirement	**Operational Mode**	
	Master Device or Client with Radar Detection	**Client Without Radar Detection**
DFS Detection Threshold	Yes	Not required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required

Additional requirement for devices with multiple bandwidth modes	**Operational Mode**	
	Master Device or Client with Radar Detection	**Client Without Radar Detection**
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		

INTRODUCTION & CLIENT DEVICE DFS CONFORMANCE

DFS Detection Thresholds for Master or Client Devices Incorporating DFS	
Maximum Transmit Power	**Value (See Notes 1, 2, and 3)**
EIRP ≥ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. Note 3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

DFS Response Requirement Values	
Parameter	**Value**
Non-occupancy	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds (See Note 1)
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. (See Notes 1 and 2).
U-NII Detection Bandwidth	Minimum 100% of the UNII 99% transmission power bandwidth. (See Note 3).
Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. Note 3: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

INTRODUCTION & CLIENT DEVICE DFS CONFORMANCE

Short Pulse Radar Test Waveforms					
Radar Type	Pulse Width (µsec)	PRI (µsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a Test B: 15 unique PRI values randomly selected within the range of 518-3066 µsec, with a minimum increment of 1 µsec, excluding PRI values selected in Test A	(See KDB section 6.1)	60%	30
2	1 - 5	150 - 230	23 - 29	60%	30
3	6 -10	200 - 500	16 – 18	60%	30
4	11 - 20	200 - 500	12 -16	60%	30
Aggregate (Radar Types 1-4)				80%	120
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

Long Pulse Radar Test Waveforms							
Radar Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50 - 100	5 - 20	1000 - 2000	1 - 3	8 - 20	80%	30

Frequency Hopping Radar Test Waveform							
Radar Type	Pulse Width (µsec)	PRI (µsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70%	30

Setting the Test Signal Level

The radar test signal level is set at the Master Device, or the Client Device with In-Service Monitoring, as appropriate for the particular test. This device is known as the Radar Detection Device (RDD). The RDD consists of the applicable device and the device antenna assembly that has the lowest antenna assembly gain of all available antenna assemblies. Depending on the UUT, the following configurations exist:

- When the Master Device is the UUT, the Master Device is the RDD.
- When a Client Device without Radar Detection is the UUT, the Master Device is the RDD.
- When a Client Device with Radar Detection is the UUT, and is tested for response to the Master Device detections, the Master Device is the RDD.
- When a Client Device with Radar Detection is the UUT, and is tested for independent response to detections by the Client Device, the Client Device is the RDD.

A spectrum analyzer is used to establish the test signal level for each radar type. During this process, there are no transmissions by either the Master Device or Client Device. The spectrum analyzer is switched to the zero span (time domain) mode at the frequency of the Radar Waveform generator. The peak detector function of the spectrum analyzer is utilized. The spectrum analyzer resolution bandwidth (RBW) and video bandwidth (VBW) are set to at least 3 MHz.

The signal generator amplitude and/or step attenuators are set so that the power level measured at the spectrum analyzer is equal to the DFS Detection Threshold that is required for the tests. The signal generator and attenuator settings are recorded for use during the test.

Data demonstrating that the test signal level is correctly set for each radar type (0-6) will be recorded and reported.

DFS TESTING - CHANNEL LOADING / CHANNEL UTILIZATION

XMit 2020.12.30.0

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
Block - DC	Fairview Microwave	SD3379	AMX	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-10	AWR	2021-07-16	2022-07-16
Attenuator	Aeroflex/Weinschel	3053	RKG	NCR	NCR
Attenuator	Aeroflex/Weinschel	3053	RKF	NCR	NCR
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Generator - Signal	Benchforge Manufacturing	Colt	TIN	NCR	NCR
Access Point	Cisco	AIR-SAP2602E-A-K9	TIY	NCR	NCR
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAI	2021-07-02	2022-07-02
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAJ	2021-07-02	2022-07-02
Attenuator	Fairview Microwave	SA26B-10	TWG	2021-03-14	2022-03-14
Attenuator	Fairview Microwave	SA26B-20	TWJ	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	2021-07-06	2022-07-06

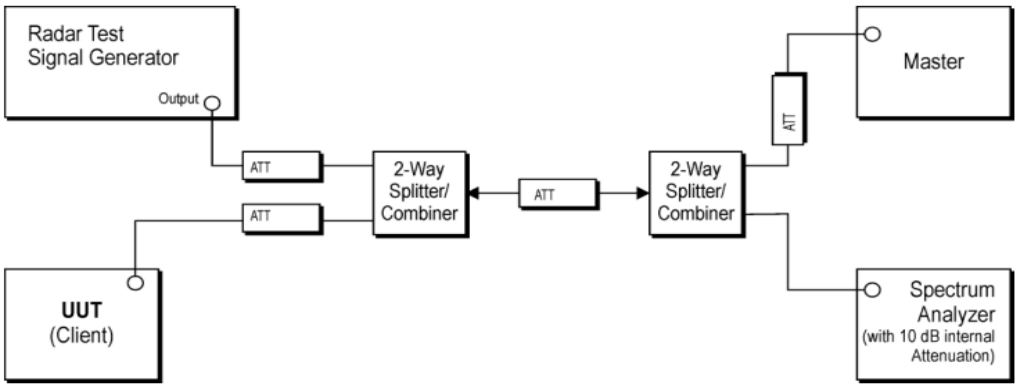
TEST DESCRIPTION

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

The master and client were connected using the conducted method described in FCC KDB 905462 DO2, 7.2.2 via a series of splitters and attenuators.

The communication traffic was configured to 17% or greater.

Setup for Client with injection at the Master



DFS TESTING - CHANNEL LOADING / CHANNEL UTILIZATION

XMit 2020.12.30.0

EUT:	**A-dec Gateway**			**Work Order:**	**A-DE0169**
Serial Number:	**521A000122**			**Date:**	**20-Dec-21**
Customer:	**A-dec, Inc.**			**Temperature:**	**19.2 °C**
Attendees:	**None**			**Humidity:**	**41.1% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**24 VDC via 110VAC/60Hz**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.407:2021	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

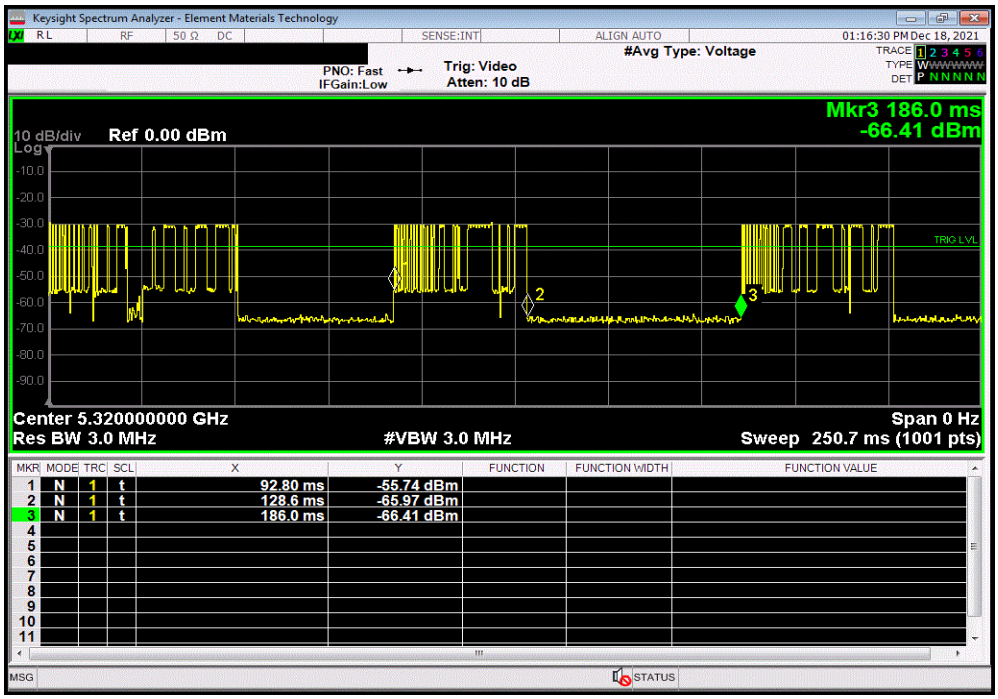
Configuration #	**5**	*Signature*

	Pulse Width (mS)	Period (mS)	Laoding Value (%)	Limit (%)	Result
40 MHz BW, Ch 60.62, 5310 MHz, MCS7					
Duty Cycle	35.8	93.2	38.41201717	≥ 17	Pass
2 mS	N/A	N/A	N/A	N/A	N/A
10 mS	N/A	N/A	N/A	N/A	N/A
25 mS	N/A	N/A	N/A	N/A	N/A
100 mS	N/A	N/A	N/A	N/A	N/A
10 Sec	N/A	N/A	N/A	N/A	N/A

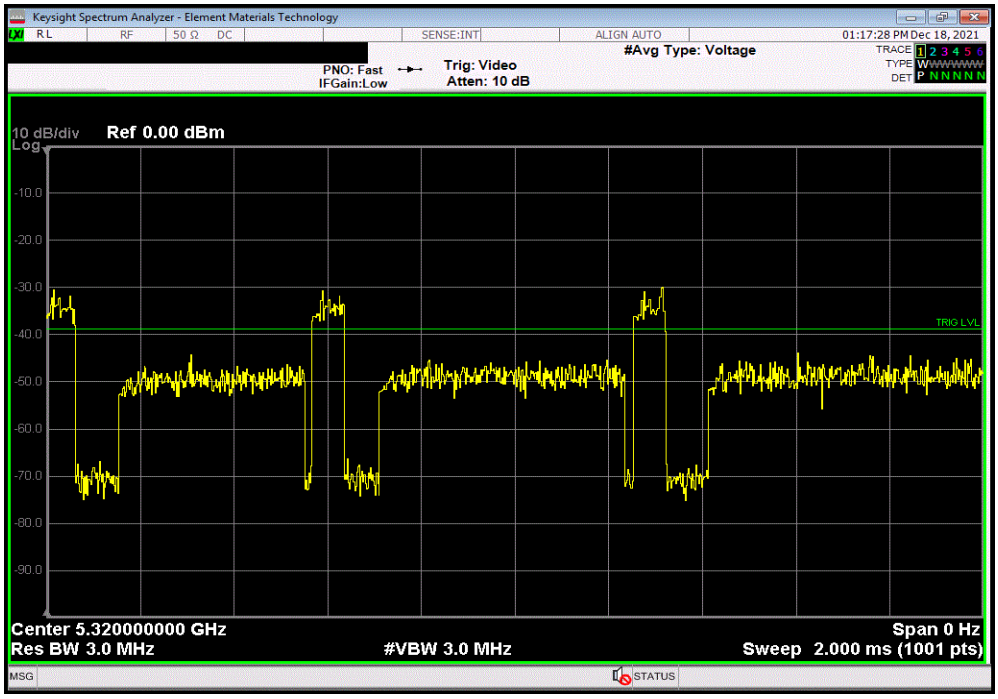
DFS TESTING - CHANNEL LOADING / CHANNEL UTILIZATION

XMit 2020.12.30.0

40 MHz BW, Ch 60.62, 5310 MHz, MCS7, Duty Cycle						
		Pulse Width (mS)	Period (mS)	Laoding Value (%)	Limit (%)	Result
		35.8	93.2	38	≥ 17	Pass



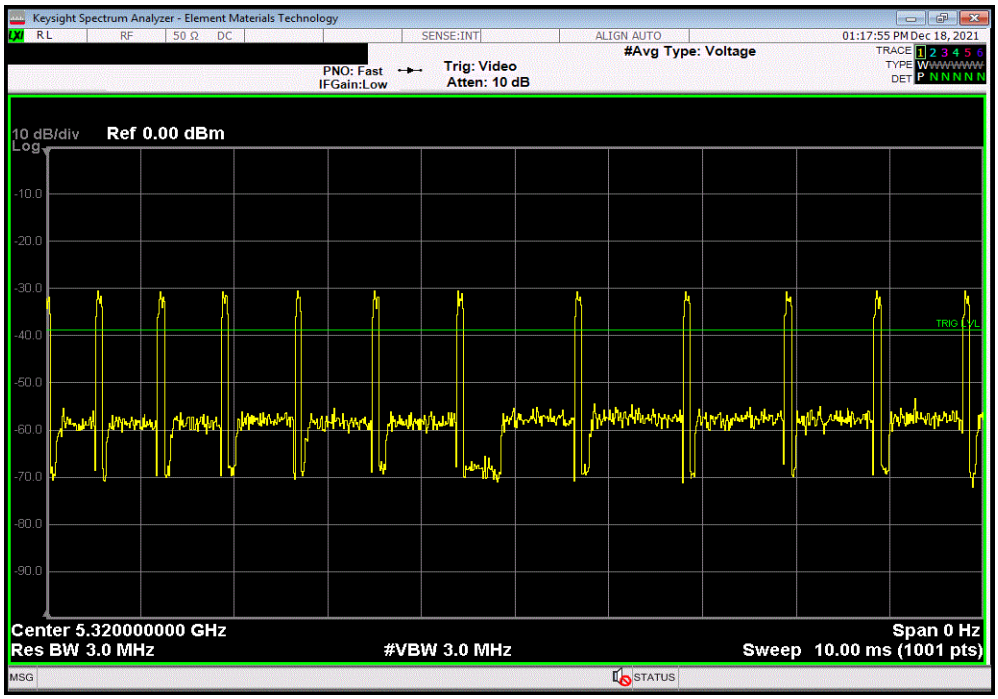
40 MHz BW, Ch 60.62, 5310 MHz, MCS7, 2 mS						
		Pulse Width (mS)	Period (mS)	Laoding Value (%)	Limit (%)	Result
		N/A	N/A	N/A	N/A	N/A



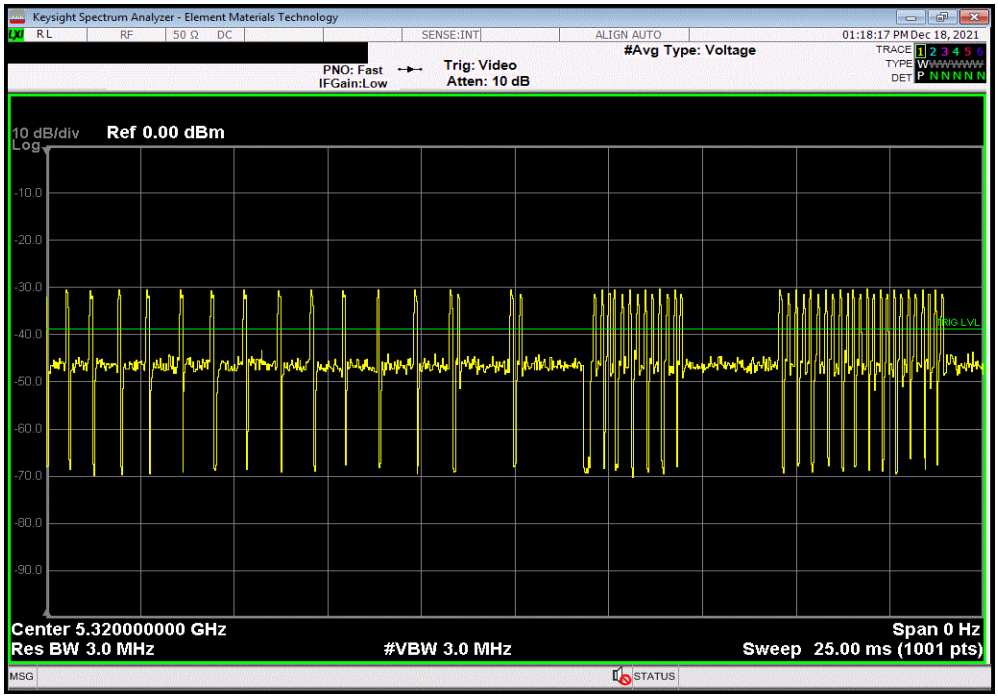
DFS TESTING - CHANNEL LOADING / CHANNEL UTILIZATION

XMit 2020.12.30.0

40 MHz BW, Ch 60.62, 5310 MHz, MCS7, 10 mS						
		Pulse Width (mS)	Period (mS)	Laoding Value (%)	Limit (%)	Result
		N/A	N/A	N/A	N/A	N/A



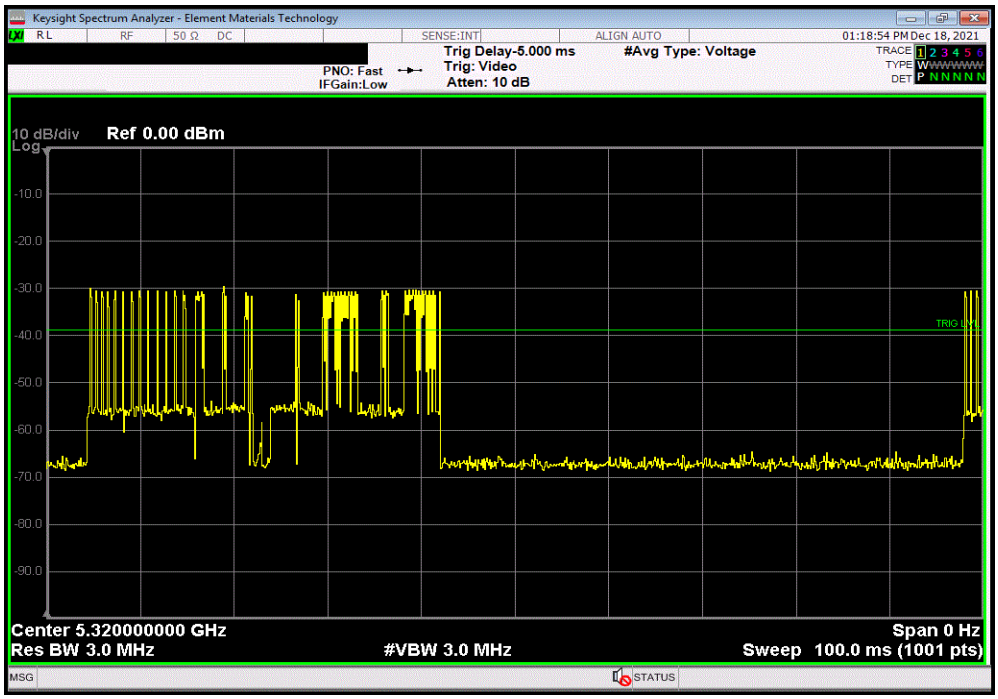
40 MHz BW, Ch 60.62, 5310 MHz, MCS7, 25 mS						
		Pulse Width (mS)	Period (mS)	Laoding Value (%)	Limit (%)	Result
		N/A	N/A	N/A	N/A	N/A



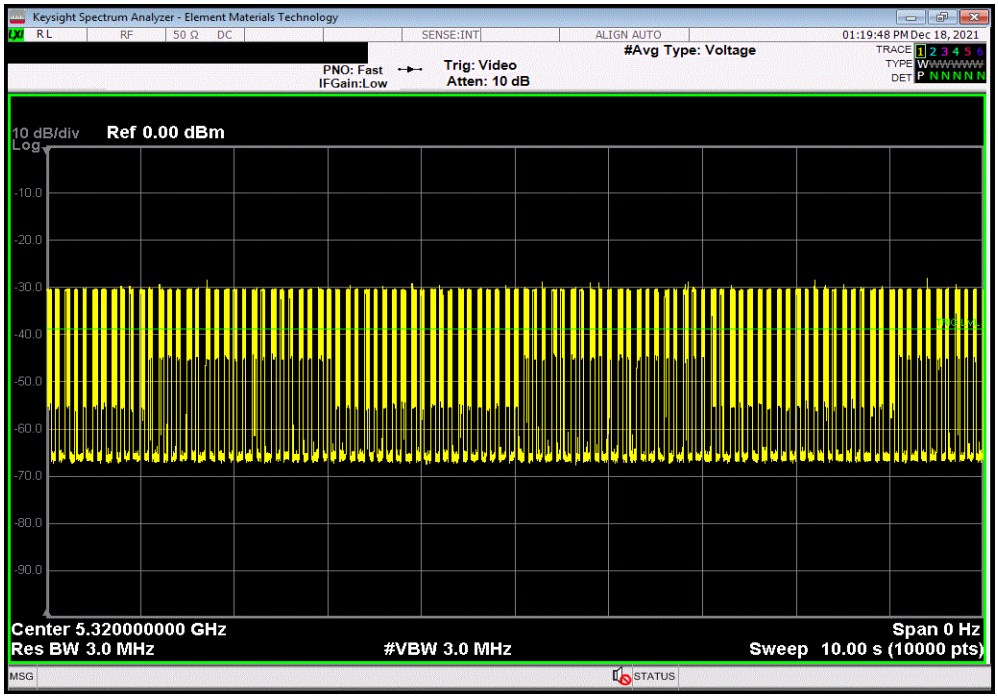
DFS TESTING - CHANNEL LOADING / CHANNEL UTILIZATION

XMit 2020.12.30.0

40 MHz BW, Ch 60.62, 5310 MHz, MCS7, 100 mS						
		Pulse Width (mS)	Period (mS)	Laoding Value (%)	Limit (%)	Result
		N/A	N/A	N/A	N/A	N/A



40 MHz BW, Ch 60.62, 5310 MHz, MCS7, 10 Sec						
		Pulse Width (mS)	Period (mS)	Laoding Value (%)	Limit (%)	Result
		N/A	N/A	N/A	N/A	N/A



DFS TESTING - MOVE TIME

XMit 2020.12.30.0

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
Block - DC	Fairview Microwave	SD3379	AMX	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-10	AWR	2021-07-16	2022-07-16
Attenuator	Aeroflex/Weinschel	3053	RKG	NCR	NCR
Attenuator	Aeroflex/Weinschel	3053	RKF	NCR	NCR
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Generator - Signal	Benchforge Manufacturing	Colt	TIN	NCR	NCR
Access Point	Cisco	AIR-SAP2602E-A-K9	TIY	NCR	NCR
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAI	2021-07-02	2022-07-02
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAJ	2021-07-02	2022-07-02
Attenuator	Fairview Microwave	SA26B-10	TWG	2021-03-14	2022-03-14
Attenuator	Fairview Microwave	SA26B-20	TWJ	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	2021-07-06	2022-07-06

TEST DESCRIPTION

The master and client were connected using the conducted method described in FCC KDB 905462 D02, 7.2.2 via a series of splitters and attenuators which allows the radar signals to be injected and monitored.

The radar waveform generator was configured to send Short Pulse Radar Type 0 waveforms. The amplitude level of the radar pulse was verified prior to testing by temporarily replacing the master device with the analyzer. An additional 1dB was added to the radar signal to ensure it is at or above the DFS threshold for the master device.

The master device was then returned to the test setup.

A data stream was established between the EUT and the master device. The radar waveform was injected into the system. The transmissions of the EUT were then monitored for duration greater than 10 seconds.

DFS TESTING - MOVE TIME

XMit 2020.12.30.0

EUT:	A-dec Gateway			**Work Order:**	A-DE0169
Serial Number:	521A000122			**Date:**	20-Dec-21
Customer:	A-dec, Inc.			**Temperature:**	19.2 °C
Attendees:	None			**Humidity:**	41.2% RH
Project:	None			**Barometric Pres.:**	1018 mbar
Tested by:	Jeff Alcoke	**Power:**	24 VDC via 110VAC/60Hz	**Job Site:**	EV06

TEST SPECIFICATIONS	**Test Method**
FCC 15.407:2021	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Data stream between client and master was established using iPerf3. The master device changes channel upon detection of the radar pulse. The EUT moves channels with the master. In the system response screen caputres, the marker delta indicates when the radar was injected, and when transmissions ceased.

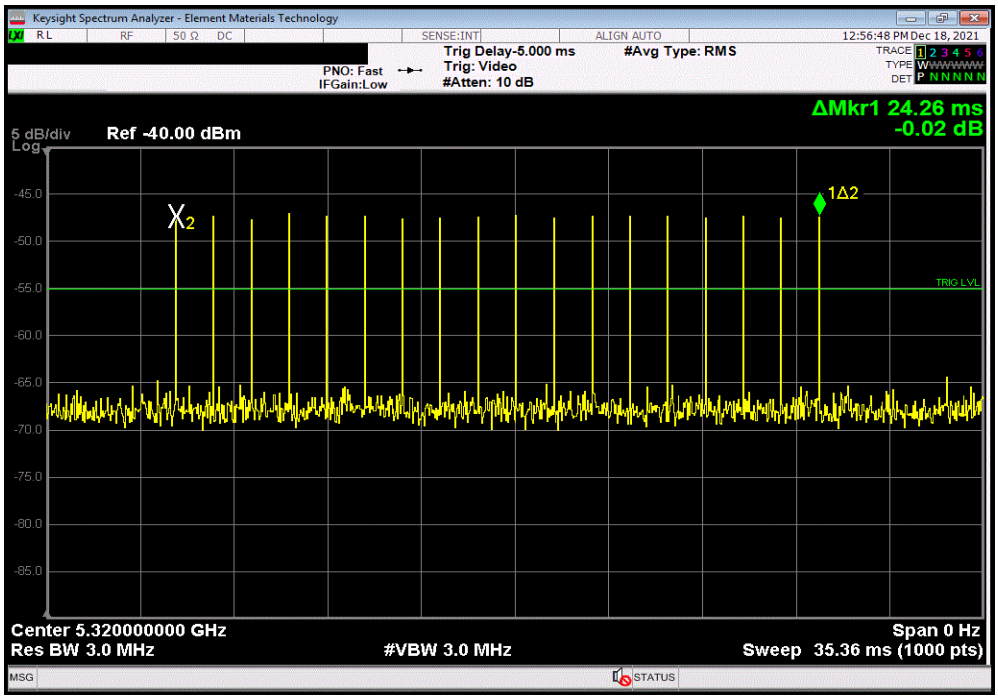
DEVIATIONS FROM TEST STANDARD

None

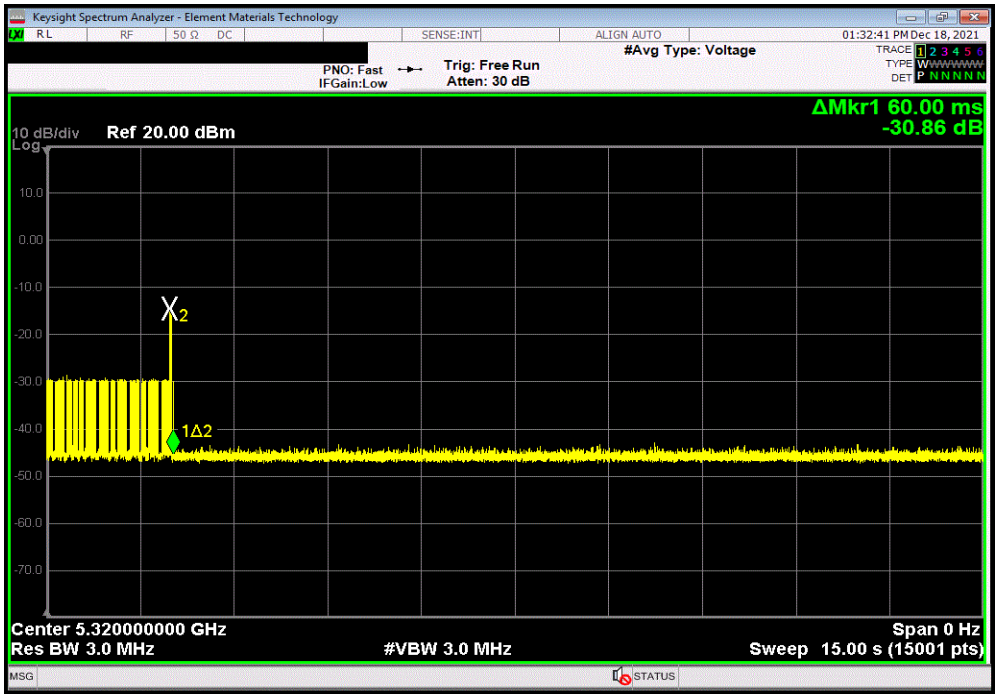
Configuration #	**5**	*Signature*

	Value (Sec)	**Limit (Sec)**	**Result**
FCC Short Pulse Radar - Type 0			
Verification	N/A	N/A	N/A
40 MHz BW, Ch. 60/64, 5310 MHz, MCS7			
System response	0.06	≤ 10	Pass
40 MHz BW, Ch. 132/136, 5670 MHz, MCS7			
System response	0.014	≤ 10	Pass

FCC Short Pulse Radar - Type 0, Verification						
				Value (Sec)	Limit (Sec)	Result
				N/A	N/A	N/A



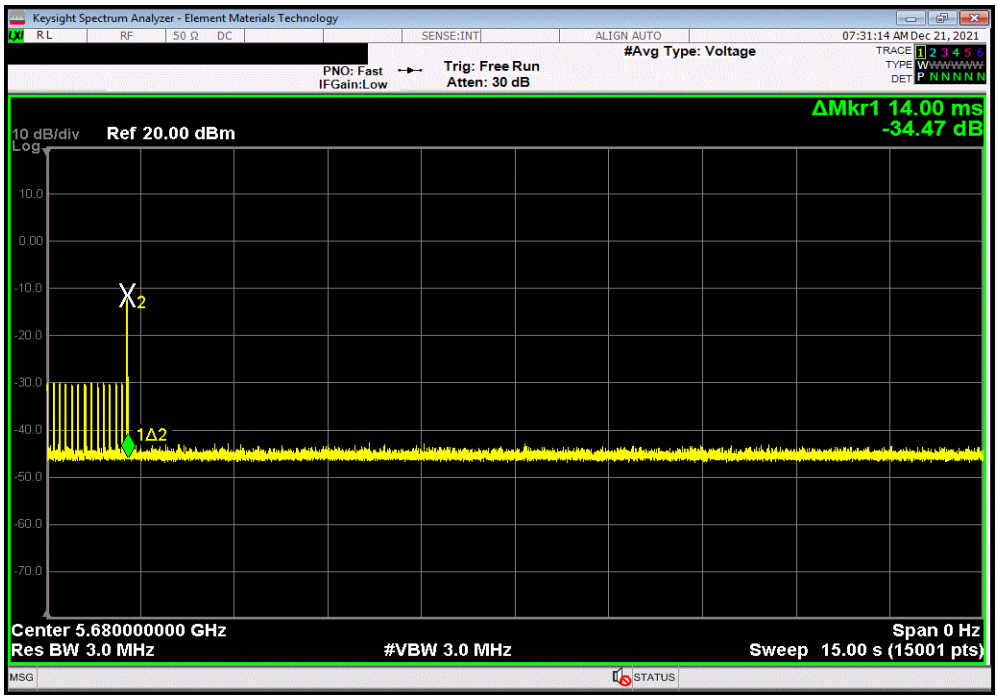
40 MHz BW, Ch. 60/64, 5310 MHz, MCS7, System response						
				Value (Sec)	Limit (Sec)	Result
				0.06	≤ 10	Pass



DFS TESTING - MOVE TIME

XMit 2020.12.30.0

40 MHz BW, Ch. 132/136, 5670 MHz, MCS7, System response						
				Value (Sec)	Limit (Sec)	Result
				0.014	≤ 10	Pass



DFS TESTING - CLOSING TIME

XMit 2020.12.30.0

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
Block - DC	Fairview Microwave	SD3379	AMX	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-10	AWR	2021-07-16	2022-07-16
Attenuator	Aeroflex/Weinschel	3053	RKG	NCR	NCR
Attenuator	Aeroflex/Weinschel	3053	RKF	NCR	NCR
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Generator - Signal	Benchforge Manufacturing	Colt	TIN	NCR	NCR
Access Point	Cisco	AIR-SAP2602E-A-K9	TIY	NCR	NCR
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAI	2021-07-02	2022-07-02
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAJ	2021-07-02	2022-07-02
Attenuator	Fairview Microwave	SA26B-10	TWG	2021-03-14	2022-03-14
Attenuator	Fairview Microwave	SA26B-20	TWJ	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	2021-07-06	2022-07-06

TEST DESCRIPTION

The master and client were connected using the conducted method described in the FCC KDB 905462 D02, 7.2.2 via a series of splitters and attenuators which allows the radar signals to be injected and monitored.

The radar waveform generator was configured to send Short Pulse Radar Type 0 waveforms. The amplitude of the radar pulse verified prior to testing by temporarily replacing the master device with the analyzer, setting the power level according to Table 3 and Section 7.5.

Where required, an approved Media file was streamed through the master and client or an alternative method to load the channel may be used instead. Channel loading requirements were also verified prior to testing. Configuration and status of the master and client devices were then monitored using the spectrum analyzer. The Closing Time test was performed by starting a transmission between the master and client device, and then injecting the appropriate radar signals. All transmission signals between the master and client in the first 200mS are allowed. After this time period, the number of transmissions signals are counted and multiplied by the pulse width value(s). This aggregate is then added to the 200mS allowance for the final value and compared to the specified limit.

DFS TESTING - CLOSING TIME

XMit 2020.12.30.0

EUT:	A-dec Gateway			**Work Order:**	A-DE0169
Serial Number:	521A000122			**Date:**	20-Dec-21
Customer:	A-dec, Inc.			**Temperature:**	19 °C
Attendees:	None			**Humidity:**	41.7% RH
Project:	None			**Barometric Pres.:**	1018 mbar
Tested by:	Jeff Alcoke	**Power:**	24 VDC via 110VAC/60Hz	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.407:2021	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

No intermittent control signals were observed beyond the 200 mS window during the Channel Move Time, therefore no additional aggregate was added to the final value. The master device changes channels upon detection of the radar waveform. The EUT moves channels with the master. In the system response captures, the marker delta indicates when the radar was injected and 200ms after the injection.

DEVIATIONS FROM TEST STANDARD

None

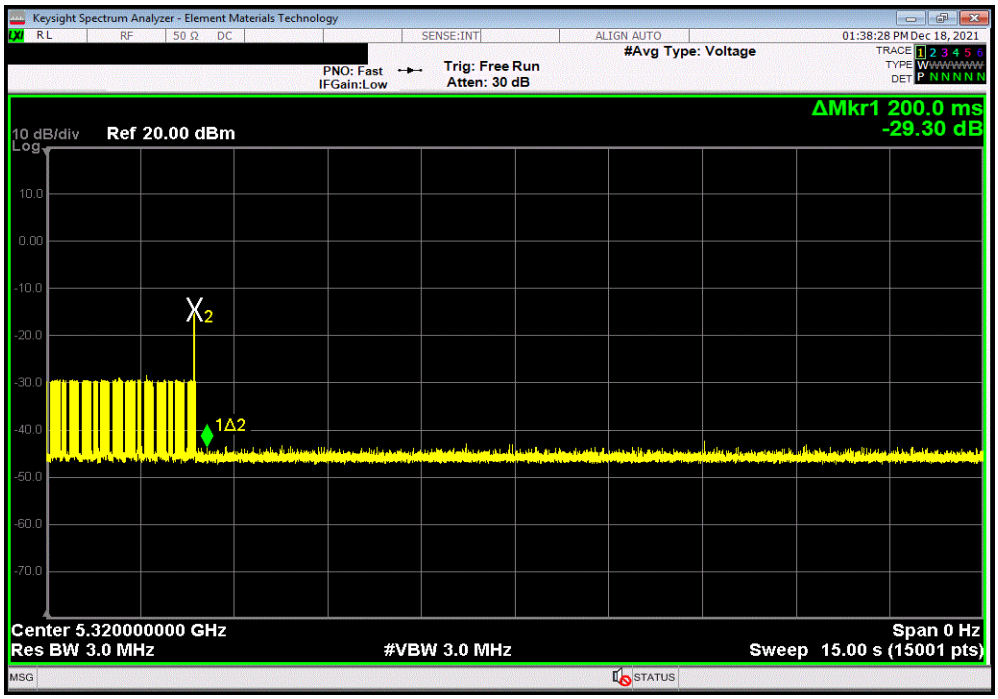
Configuration #	5	*Signature*

	# of Signals	Pulse Width	Value (mS)	Limit (mS)	Result
40 MHz BW, Ch. 60/64, 5310 MHz, MCS7					
System response	0	N/A	200	≤ 260	Pass
40 MHz BW, Ch. 132/136, 5670 MHz, MCS7					
System response	0	N/A	200	≤ 260	Pass

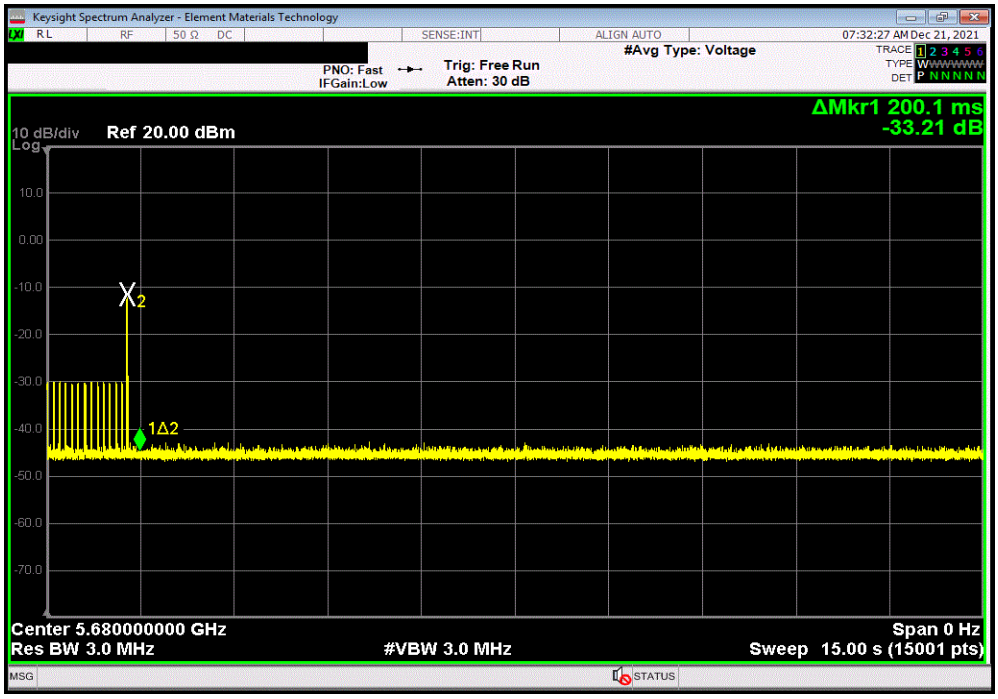
DFS TESTING - CLOSING TIME

XMit 2020.12.30.0

40 MHz BW, Ch. 60/64, 5310 MHz, MCS7, System response						
	# of Signals		Pulse Width	Value (mS)	Limit (mS)	Result
	0		N/A	200	≤ 260	Pass



40 MHz BW, Ch. 132/136, 5670 MHz, MCS7, System response						
	# of Signals		Pulse Width	Value (mS)	Limit (mS)	Result
	0		N/A	200	≤ 260	Pass



DFS TESTING - NON OCCUPANCY PERIOD

XMit 2020.12.30.0

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
Block - DC	Fairview Microwave	SD3379	AMX	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-10	AWR	2021-07-16	2022-07-16
Attenuator	Aeroflex/Weinschel	3053	RKG	NCR	NCR
Attenuator	Aeroflex/Weinschel	3053	RKF	NCR	NCR
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Generator - Signal	Benchforge Manufacturing	Colt	TIN	NCR	NCR
Access Point	Cisco	AIR-SAP2602E-A-K9	TIY	NCR	NCR
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAI	2021-07-02	2022-07-02
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAJ	2021-07-02	2022-07-02
Attenuator	Fairview Microwave	SA26B-10	TWG	2021-03-14	2022-03-14
Attenuator	Fairview Microwave	SA26B-20	TWJ	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	2021-07-06	2022-07-06

TEST DESCRIPTION

The master and client were connected using the conducted method described in the FCC KDB procedure via a series of splitters and attenuators which allows the communication and injected radar signals to be monitored simultaneously. The spectrum analyzer was configured to monitor the frequency for at least 30 minutes. The Short Pulse Radar Type 0 was injected and the channel was monitored to make sure the master and client devices vacated the channel and did not use it again for a period of time equal to or greater than 30 minutes.

DFS TESTING - NON OCCUPANCY PERIOD

XMit 2020.12.30.0

EUT:	A-dec Gateway			**Work Order:**	A-DE0169
Serial Number:	521A000122			**Date:**	20-Dec-21
Customer:	A-dec, Inc.			**Temperature:**	19 °C
Attendees:	None			**Humidity:**	41.7% RH
Project:	None			**Barometric Pres.:**	1018 mbar
Tested by:	Jeff Alcoke	**Power:**	24 VDC via 110VAC/60Hz	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.407:2021	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

The master device changes channels upon detection of the radar waveform. The EUT moves channels with the master. No control signals were observed during the 30 min observation period. The marker delta indiates when the radar pulse was injected, and when the 30 min observation period has concluded.

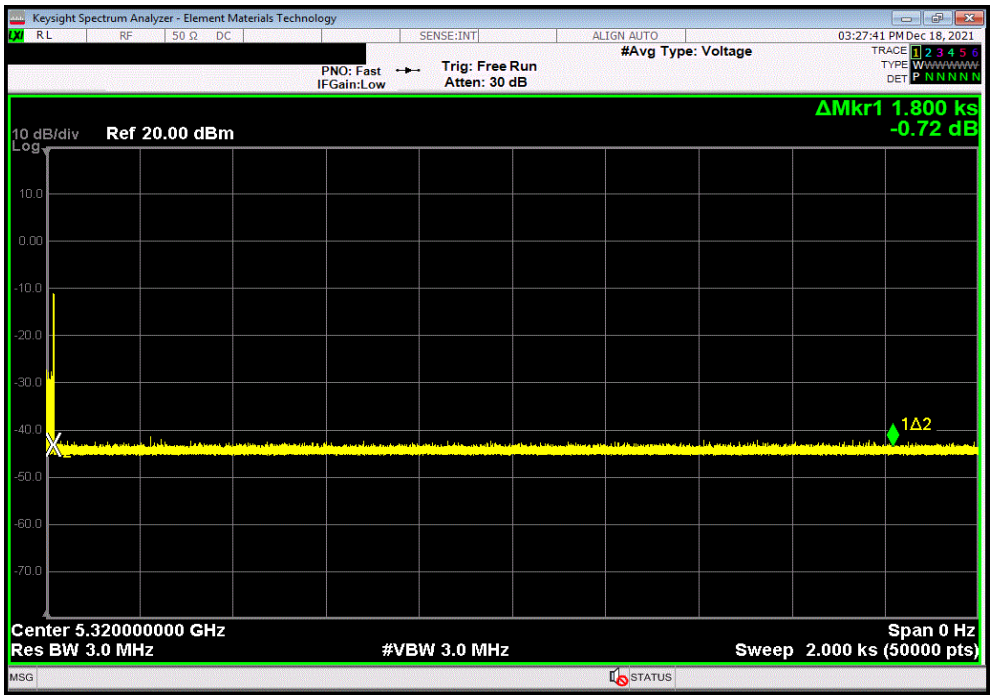
DEVIATIONS FROM TEST STANDARD

None

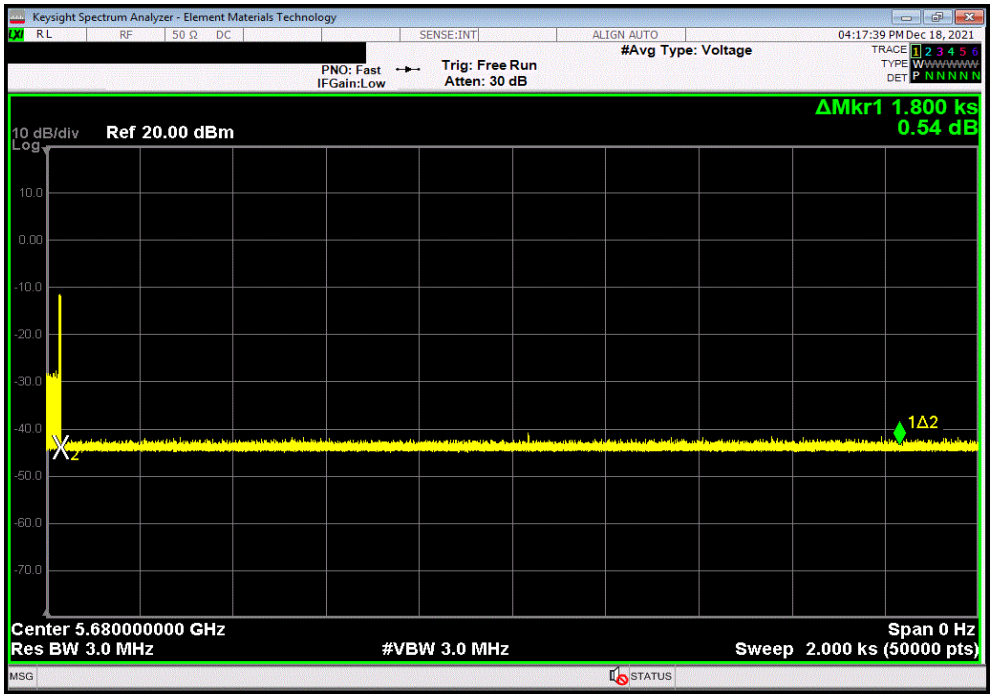
Configuration #	5	*Signature*

	Value (min)	Limit (min)	Result
40 MHz BW, Ch. 60/64, 5310 MHz, MCS7			
System response	≥ 30	≥ 30	Pass
40 MHz BW, Ch. 132/136, 5670 MHz, MCS7			
System response	≥ 30	≥ 30	Pass

40 MHz BW, Ch. 60/64, 5310 MHz, MCS7, System response						
				Value (min)	Limit (min)	Result
				≥ 30	≥ 30	Pass



40 MHz BW, Ch. 132/136, 5670 MHz, MCS7, System response						
				Value (min)	Limit (min)	Result
				≥ 30	≥ 30	Pass



APPENDIX

Rev 1-31-2017

DFS PRODUCT INFORMATION

Information Provided by the Party Requesting the Test

Example answers have been given (italicized) to help you understand what information is required. Please replace "Your answer here" with information specific to your product.

Section 1

The following information must be provided prior to the start of testing:

List all antenna assemblies and their corresponding gains.

1. If radiated tests are to be performed, the U-NII Device should be tested with the lowest gain antenna assembly (regardless of antenna type). The report should indicate which antenna assembly was used for the tests. For devices with adjustable output power, list the output power range and the maximum EIRP for each antenna assembly.
2. If conducted tests are to be performed, indicate which antenna port/connection was used for the tests and the antenna assembly gain that was used to set the DFS Detection Threshold level during calibration of the test setup.
    a. Indicate the calibrated conducted DFS Detection Threshold level.
    b. For devices with adjustable output power, list the output power range and the maximum EIRP for each antenna assembly.
    c. Indicate the antenna connector impedance. Ensure that the measurement instruments match (usually 50 Ohms) or use a minimum loss pad and take into account the conversion loss.
3. Antenna gain measurement verification for tested antenna.
    a. Describe procedure
    b. Describe the antenna configuration and how it is mounted
    c. If an antenna cable is supplied with the device, cable loss needs to be taken into account. Indicate the maximum cable length and either measure the gain with this cable or adjust the measured gain accordingly. State the cable loss.

Example: *The client device (EUT) has one 50 ohm antenna port. The antenna assembly gain of the client device was measured by the antenna manufacturer. The maximum gain in the 5 GHz bands is 4.2 dBi.*

Linear Polarization SMD mount ceramic antenna soldered to PCB, not user removable. 5 GHz 5.2 dBi Mounted 0.6in from transmitter on same PCB as transmitter. Antenna cable length and loss 0.6in PCB trace 50ohm feedline, no loss Spacing distance from operator is >20 cm.

Functional Description of the EUT (Equipment Under Test):

Example: 802.11abgn SISO radio with 1 stream and 1 antenna.

A-dec Gateway PCB (43.0521.00) is designed to enable 802.11a/b/g/n/ac W-LAN + Bluetooth 5.0, Single input, single output (SISO) radio with 1 stream and 1 antenna.

The operating modes (Master and/or Client) of the U-NII device.

Example*: Client device with no ad-hoc capability, with both 802.11a and 802.11n (20/40MHz)*

The module by default supports active scanning and ad-hoc mode with 802.11AC/AN radio that supports 20/40/80 MHz Bandwidths. RF-related settings including modes are set via firmware and are not accessible for change via the UI.

For Client devices, indicate whether or not it has DFS Radar detection capabilities.

Example: *The client device has no radar detection and no ad-hoc capability.*

The client device has no radar detection and no ad-hoc mode.

System architectures, data rates, U-NII Channel bandwidths. 1. Indicate the type(s) of system architecture (e.g. IP based or Frame based) that the U-NII device employs. Each type of unique architecture must be tested. ***Example:*** *The client device (EUT) employs IP based system architecture.*
The client device (EUT) employs IP based system architecture.

Applicable only to devices with Radar detection capabilities: The time required for the Master Device or Client Device (with radar detection) to complete its power-on cycle.
No radar detection capabilities.

Section 2

The following information must be provided prior to the completion of a test report:

Hardware, Firmware, and OS Versions: ***Example:*** *Hardware version: 0.1.5.6* *Firmware version: 12.6.8* *OS versions: CPM 7.8.2.1*
Gateway hardware version: 43.0521.00 Rev. 6 A-dec Cirrus firmware version: v00.02.102

The operating frequency band(s) of the equipment. ***Example:*** *5150 – 5250 MHz, 5250 - 5350 MHz (DFS Band),etc*
5180-5850 MHz

List the highest and the lowest possible power level (equivalent isotropic radiated power (EIRP) of the equipment. ***Example:*** *The maximum EIRP of the 5 GHz equipment is 24.4 dBm conducted.*
The maximum EIRP of the 5 GHz equipment is 16.7 dBm conducted.

Test sequences or messages that should be used for communication between Master and Client Devices, which are used for loading the Channel. 1. Stream the test file from the Master Device to the Client Device for IP based systems or frame based systems which dynamically allocate the talk/listen ratio. 2. For frame based systems with fixed talk/listen ratio, set the ratio to 45%/55% and stream the test file from the Master to the Client. 3. For other system architectures, supply appropriate Channel loading methodology. ***Example:*** *Testing was performed with an audio file streamed from the Master Device to the Client Device. Channel loading was greater than 64%.*
1. Establish a data stream through use of iPerf: a. On the Client Device (receiver of data), the command is: **iperf3 -s** b. On the Master Device (sender of data), the command is: **iperf3 -c <ip> -u -t 9999** i. -u indicates that the client should use UDP for transfer (no error checking/retransmit) ii. -t 9999 makes the iperf3 stream last as long as is needed for testing. iii. Determine (at time of test) the IP address – it is dependent on the network setup of the test environment, so that remains as a "fill in".

Transmit Power Control description. ***Example:*** *This device does not exceed 27dBm EIRP, so no transmit power control is implemented.*
This device does not exceed 27dBm EIRP, so no transmit power control is implemented.

DFS PRODUCT INFORMATION

Applicable only to devices with Radar detection capabilities: Manufacturer statement confirming that information regarding the parameters of the detected Radar Waveforms is not available to the end user.
No radar detection capabilities.

Applicable only to Master devices: Uniform Channel Spreading requirement for Master Devices. For Master Devices, indicate how the master provides, on aggregate, uniform Channel loading of the spectrum across all Channels.
Not a master device.

For Client devices, indicate the FCC (and IC) identifier for the Master U-NII Device that is used with it for DFS testing. ***Example:*** *A DFS-compliant Master device was used for testing. It's the CISCO Model AIR-AP1252AG-A-K9, FCC ID:LDK102061, IC: 2461B-102061*
A DFS- compliant Master device was used for testing: CISCO Model AIR-SAP2602E-A-K9, FCC ID:LDK102080, IC: 2461B-102080

End of Test Report