Ademco, Inc.

Fuji Thermostat

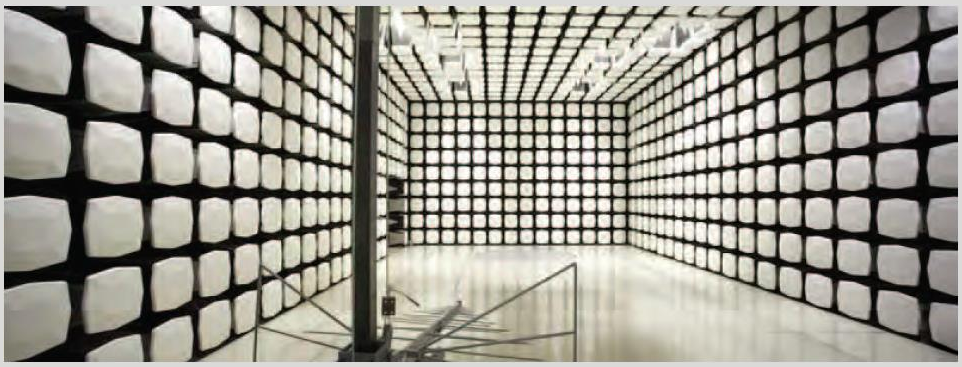
FCC 15.407:2024

RSS-247 Issue 3:2023

RSS-Gen Issue 5:2018+A1:2019+A2:2021

Wi-Fi 802.11 a/b/g/n SISO Radio – DFS

Report: ADEM0044.4 Rev. 1, Issue Date: September 10, 2024



ACCREDITED
CERT #3310.05

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2023.04.17

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CERTIFICATE OF TEST

Last Date of Test: August 15, 2024
Ademco, Inc.
EUT: Fuji Thermostat

Radio Equipment Testing

Standards

Specification	Method
FCC 15.407:2024	FCC KDB 905462 D02 v02:2022
RSS-247 Issue 3:2023	
RSS-Gen Issue 5:2018+A1:2019+A2:2021	

Results

Test Description	Result	Specification Section(s)	Method Section(s)	Comments
Test Signal Level	N/A	15.407(h)	KDB 905462 – 7.5	Not required if EUT is a "Client" without radar detection.
Channel Loading and Channel Utilization	Pass	15.407(h)	KDB 905462 – 7.7	
Detection Bandwidth	N/A	15.407(h)	KDB 905462 – 7.8.1	Not required if EUT is a "Client" without radar detection.
Channel Availability Check	N/A	15.407(h)(2)(ii)	KDB 905462 – 7.8.2	Not required if EUT is a "Client" without radar detection.
Move Time	Pass	15.407(h)(2)(iii)	KDB 905462 – 7.8.3	
Closing Time	Pass	15.407(h)	KDB 905462 – 7.8.3	
Non Occupancy Period	Pass	15.407(h)(2)(iv)	KDB 905462 – 7.8.3	
Statistical Performance	N/A	15.407(h)	KDB 905462 – 7.8.4	Not required if EUT is a "Client" without radar detection.

Deviations From Test Standards

None

Approved By:

Trevor Buls

Trevor Buls, Principal EMC Test Engineer
Signed for and on behalf of Element

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		
01	Clarified software version info, clarified channel loading measurement.	2024-09-10	3, 18, 22

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 - 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

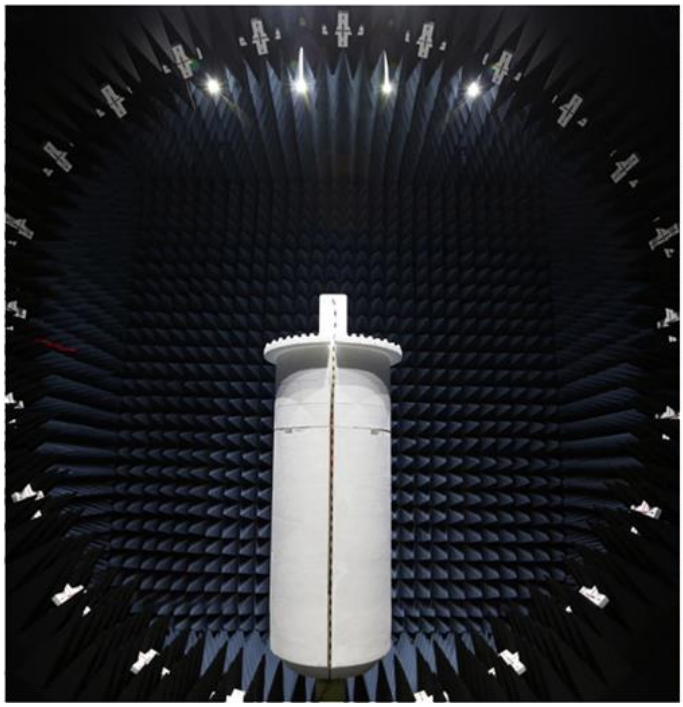
element
2024.08.21

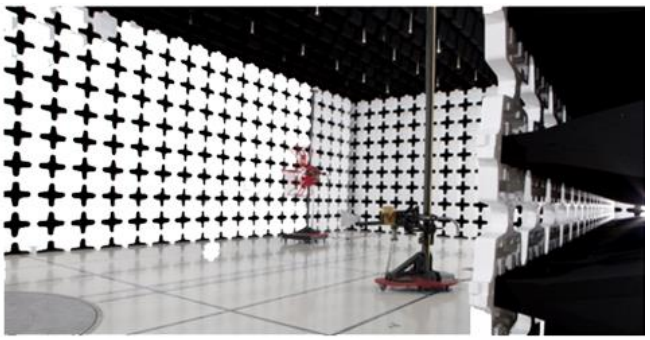
Testing was performed at the following location(s)

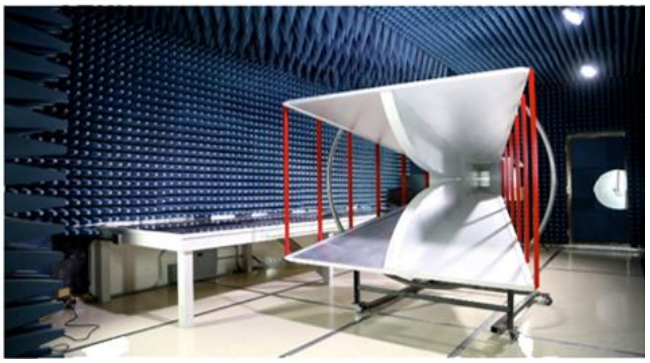
	Location	Labs (1)	Address	A2LA (2)	ISED (3)	BSMI (4)	VCCI (5)	CAB (6)	FDA (7)
☐	California	OC01-17	41 Tesla Irvine, CA 92618 (949) 861-8918	3310.04	2834B	SL2-IN-E-1154R	A-0029	US0158	TL-55
☒	Minnesota	MN01-11	9349 W Broadway Ave. Brooklyn Park, MN 55445 (612) 638-5136	3310.05	2834E	SL2-IN-E-1152R	A-0109	US0175	TL-57
☐	Oregon	EV01-12	6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	3310.02	2834D	SL2-IN-E-1017	A-0108	US0017	TL-56
☐	Plano Texas	PT01-15	1701 E Plano Pkwy, Ste 150 Plano, TX 75074 (972) 509-2566	214.19	32637	SL2-IN-E-057R	A-0426	US0054	N/A
☐	Texas	TX01-09	3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	3310.03	2834G	SL2-IN-E-1158R	N/A	US0191	TL-54
☐	Washington	NC01-05	19201 120th Ave NE Bothell, WA 98011 (425) 984-6600	3310.06	2834F	SL2-IN-E-1153R	A-0110	US0157	TL-67
☐	Offsite	N/A	See Product Description	N/A	N/A	N/A	N/A	N/A	N/A

See data sheets for specific labs

(1) The lab designations denote individual rooms within each location. (OC01, OC02, OC03, etc.)
(2) A2LA Certificate No.
(3) ISED Company No.
(4) BSMI No.
(5) VCCI Site Filing No.
(6) CAB Identifier. Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA
(7) FDA ASCA No.







MEASUREMENT UNCERTAINTY

element
MU 2023-09-21

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.

Various Measurements

Test	All Labs (+/-)
Frequency Accuracy (%)	0.0007
Amplitude Accuracy (dB)	1.2
Conducted Power (dB)	1.2
Radiated Power via Substitution (dB)	0.7
Temperature (degrees C)	0.7
Humidity (% RH)	2.5
Voltage (AC) (%)	1
Voltage (DC) (%)	0.7

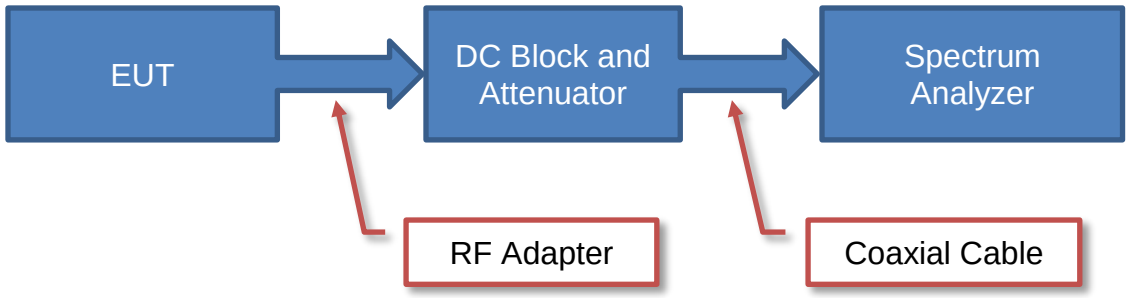
TEST SETUP BLOCK DIAGRAMS

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.

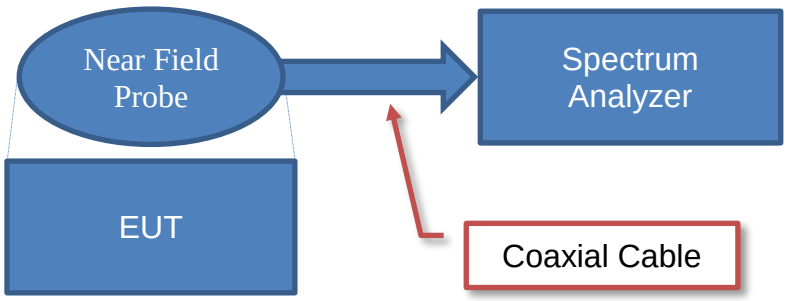
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

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

Near Field Test Fixture Measurements

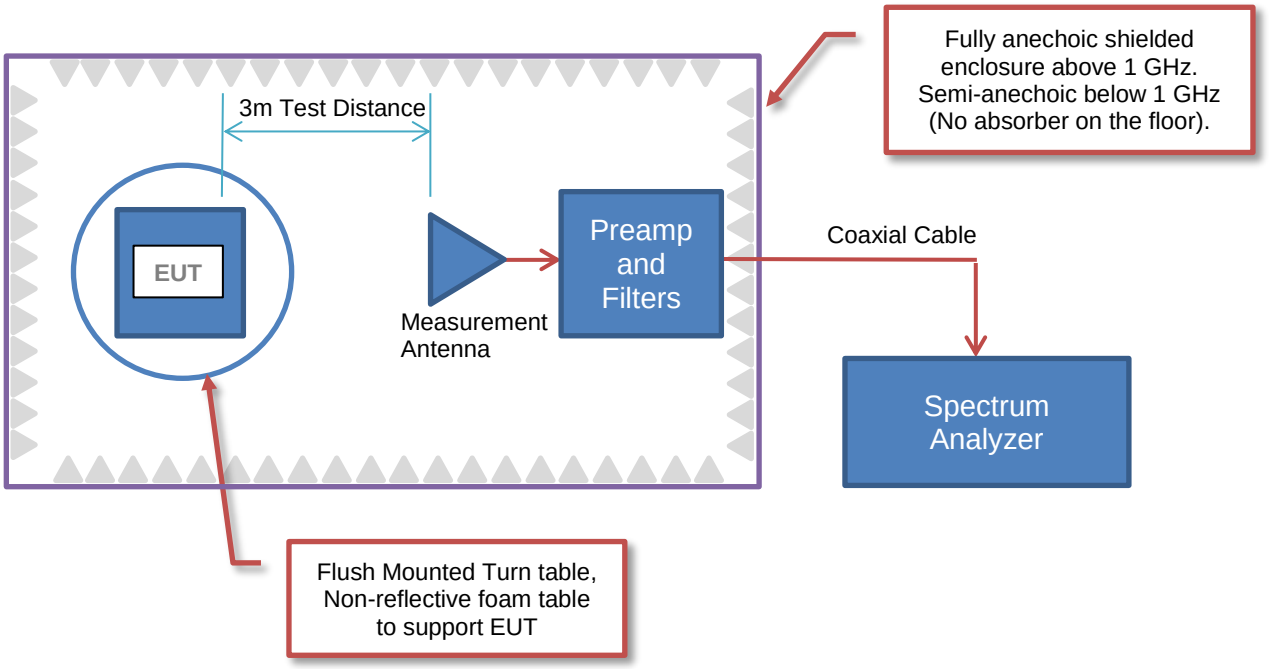


Sample Calculation (logarithmic units)

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**

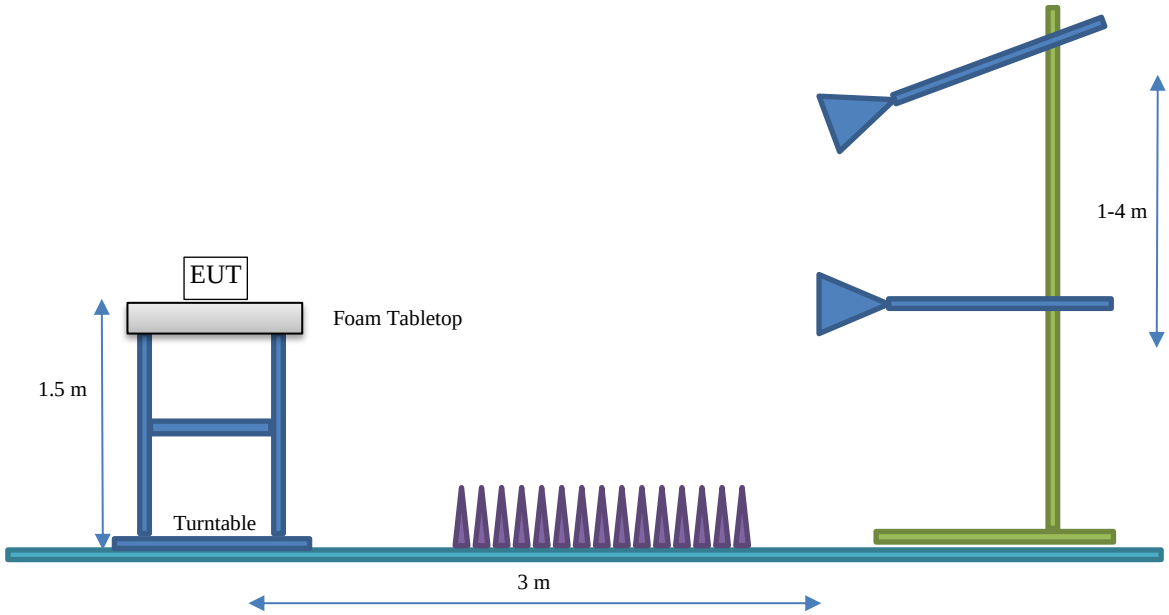
Radiated Power (ERP/EIRP) – Substitution Method:

Measured Level into Substitution Antenna (Amplitude dBm)		Substitution Antenna Factor (dBi)		EIRP to ERP (if applicable)		Measured power (dBm ERP/EIRP)
10.0	+	6.0	-	2.15	=	**13.9/16.0**

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:	Ademco, Inc.
Address:	251 Little Falls Drive
City, State, Zip:	Wilmington, DE 19808
Test Requested By:	Christian Fouth
EUT:	Fuji Thermostat
First Date of Test:	August 15, 2024
Last Date of Test:	August 15, 2024
Receipt Date of Samples:	July 19, 2024
Equipment Design Stage:	Prototype
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Fuji is a Wi-Fi (802.11 a/b/g/n 1x1, 2.4GHz & 5GHz) /BLE 5.0 enabled thermostat with only one antenna. This report is specific to DFS requirements.

Testing Objective:
To demonstrate compliance of the Dynamic Frequency Selection (DFS) functionality for the Wi-Fi 802.11 a/b/g/n SISO radio under FCC 15.407 and RSS-247 for operation in the 5.3 GHz and 5.6 GHz band(s).

CONFIGURATIONS

Configuration ADEM0044-5

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Thermostat	Resideo	TH2320WF4010	52202030005130

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AC Adapter	CUI Inc	48A-24-500	None
Laptop	Dell	Precision 5550	D1NQ6D3

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Leads	No	1.7 m	No	AC Adapter	Thermostat

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2024-08-15	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	2024-08-15	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	2024-08-15	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	2024-08-15	Non Occupancy Period	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

WTD 1-31-2017

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.

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.	

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.

POWER SETTINGS AND ANTENNAS

The power settings, antenna gain value(s) and cable loss (if applicable) used for the testing contained in this report were provided by the customer and will affect the validity of the results. Element assumes no responsibility for the accuracy of this information. The power settings below reflect the maximum power that the EUT is allowed to transmit at during normal operation.

ANTENNA GAIN (dBi)

Type	Provided by:	Frequency Range (MHz)	Gain (dBi)
PCB Trace	Ademco	5150-5850	2.2

The EUT was tested using the power settings provided by the manufacturer which were based upon:

☐ Test software settings
☒ Rated power settings

SETTINGS FOR ALL TESTS IN THIS REPORT

Modulation Types	Channel Bandwidths (MHz)	Band	Channel Position	Frequency (MHz)	Power Setting (dBm)
54 Mbps	20	UNII 2A	Mid (60)	5300	14
54 Mbps	20	UNII 2C	Low (112)	5560	16.5

DFS PRODUCT INFORMATION

Rev 1-31-2017

Information Provided by the Party Requesting the Test

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.

The client device (EUT) has one dual band PCB antenna. The antenna assembly gain of the client device was measured to be a maximum of 2.22 dBi in the 5 GHz bands.

Functional Description of the EUT (Equipment Under Test):

Thermostat with dual-band Wi-Fi (802.11 a/b/g/n 1x1 SISO) and BLE 5.0 with 1 antenna.

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

Client with no ad-hoc capability with both 802.11a and 802.11n, 20 MHz BW only.

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

The device is a client device and has no radar detection and no ad-hoc capability.

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.

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.

Not Applicable

DFS PRODUCT INFORMATION

Section 2

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

Hardware, Firmware, and OS Versions:
Hardware version: DVT Rev 2 Radio Firmware version: MPTool 2.2.0.1 Non-Radio Firmware Version: XTR V5 Software Version: V6.2C

The operating frequency band(s) of the equipment.
UNII-1, UNII-2A, UNII-2C, and UNII-3 (5150.0–5250.0 MHz, 5250.0–5350.0 MHz, 5470.0-5725 MHz, and 5725.0 - 5850.0 MHz)

List the highest and the lowest possible power level (equivalent isotropic radiated power (EIRP) of the equipment.
The maximum output power of the 5 GHz equipment was measured at 18.1 dBm conducted. The minimum power measured was 11.8 dBm. Power settings vary by channel and modulation, but are fixed in firmware.

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.
Testing was performed with an iperf session passing data between the EUT and a laptop over a local network.

Transmit Power Control description.
This device does not exceed 500 mW EIRP, so no transmit power control is implemented.

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.
Not Applicable

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 Applicable

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

CHANNEL LOADING AND CHANNEL UTILIZATION

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

TEST DESCRIPTION

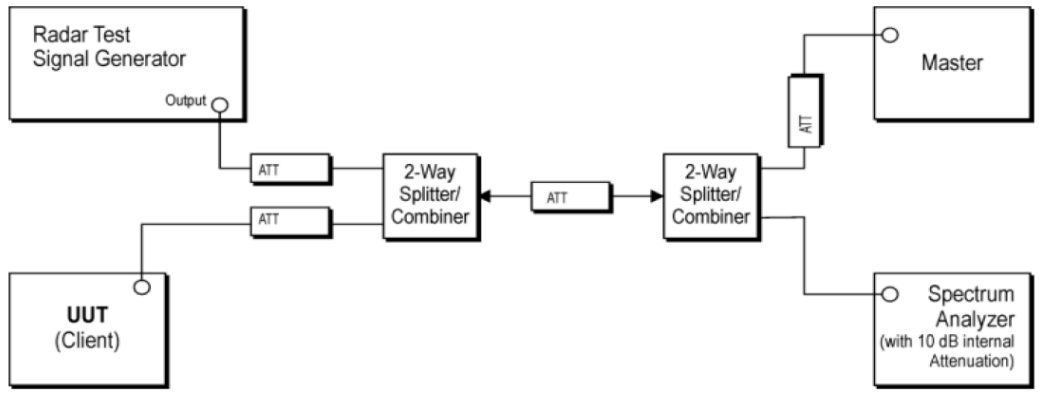
Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this 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 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 D02, 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



TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TEV	2024-05-06	2027-05-06
Access Point	Cisco	AIR-AP1252AG-A-K9	TIV	NCR	NCR
Power Supply	Cisco	AIR-PWR-SPLY1	TIVA	NCR	NCR
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Meter - Power	ETS Lindgren	7002-008	SRA	2024-02-19	2025-02-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2024-05-22	2025-05-22
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05
Attenuator	S.M. Electronics	SA26B-20	RFW	2024-01-31	2025-01-31
Attenuator	Fairview Microwave	SA4014-20	AQI	2023-09-05	2024-09-05
Attenuator	INMET	64671 6A-10dB	AUI	2023-08-25	2024-08-25
Attenuator	Aeroflex/Weinschel	3053	RKM	2024-06-18	2025-06-18
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAE	2023-10-08	2024-10-08
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAF	2023-10-08	2024-10-08

CHANNEL LOADING AND CHANNEL UTILIZATION

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

EUT:	Fuji Thermostat	Work Order:	ADEM0044
Serial Number:	52202030005130	Date:	2024-08-15
Customer:	Ademco, Inc.	Temperature:	22°C
Attendees:	None	Relative Humidity:	57.1%
Customer Project:	None	Bar. Pressure (PMSL):	1008 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	110VAC/60Hz	Configuration:	ADEM0044-5

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.407:2024	FCC KDB 905462 D02 v02:2022
RSS-247 Issue 3:2023	FCC KDB 905462 D02 v02:2022

COMMENTS

Duty cycle was calculated using output from power sensor capable of 1 million samples per second. Analyzer captures were provided for reference.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

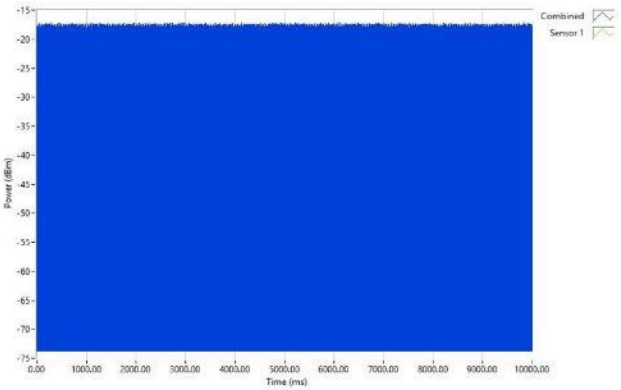
Tested By

TEST RESULTS

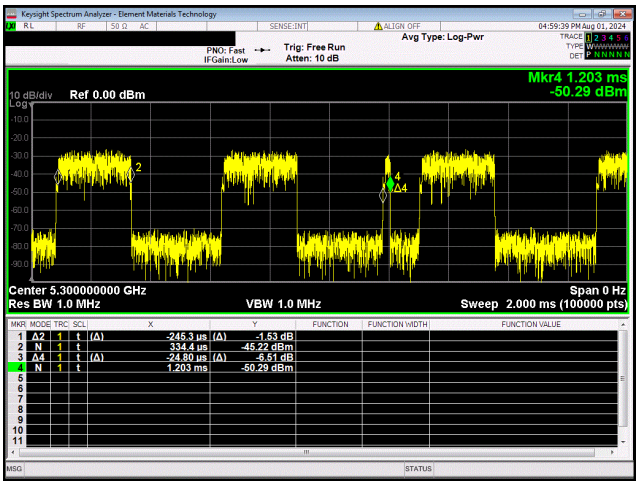
	Loading Value (%)	Limit ≥ (%)	Result
20 MHz BW, 5300 MHz, 54 Mbps			
Duty Cycle	38.759	17	Pass
2ms	N/A	N/A	N/A
10ms	N/A	N/A	N/A
25ms	N/A	N/A	N/A
100ms	N/A	N/A	N/A
10sec	N/A	N/A	N/A
20 MHz BW, 5560 MHz, 54 Mbps			
Duty Cycle	37.695	17	Pass
2ms	N/A	N/A	N/A
10ms	N/A	N/A	N/A
25ms	N/A	N/A	N/A
100ms	N/A	N/A	N/A
10sec	N/A	N/A	N/A

CHANNEL LOADING AND CHANNEL UTILIZATION

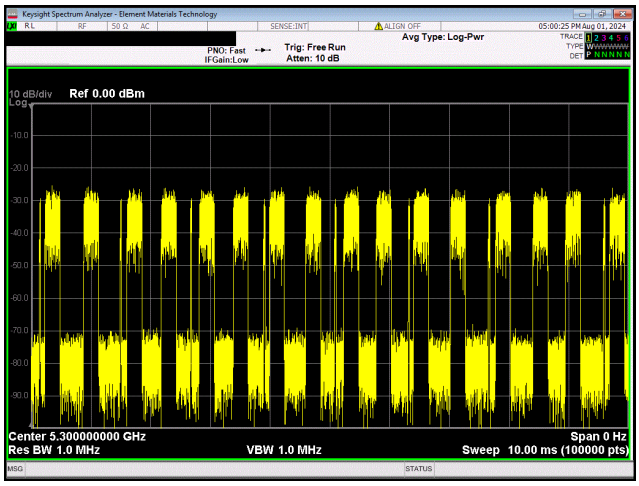
element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



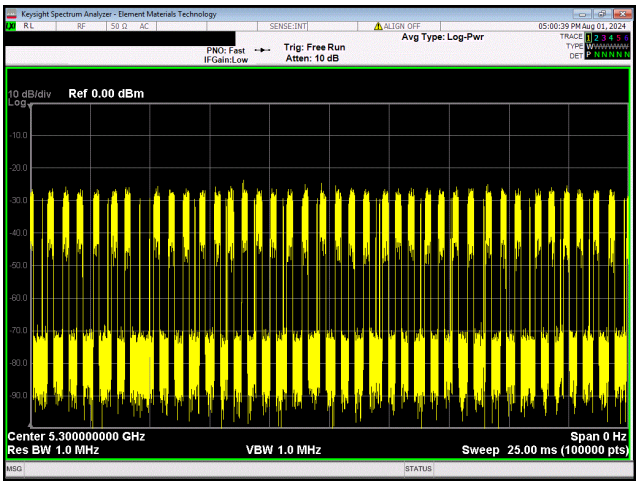
20 MHz BW, 5300 MHz, 54 Mbps
Duty Cycle



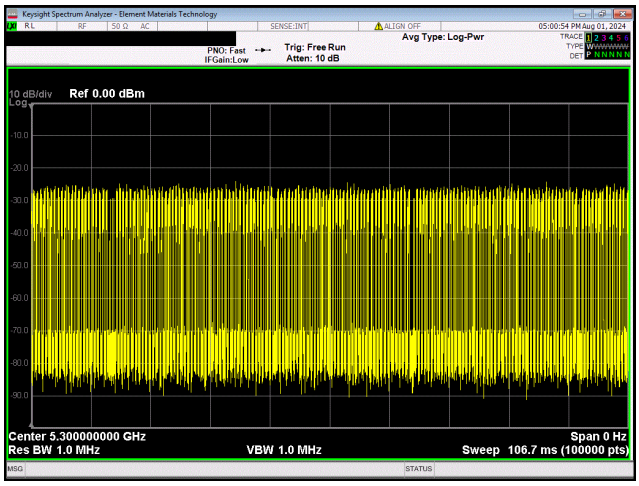
20 MHz BW, 5300 MHz, 54 Mbps
2ms



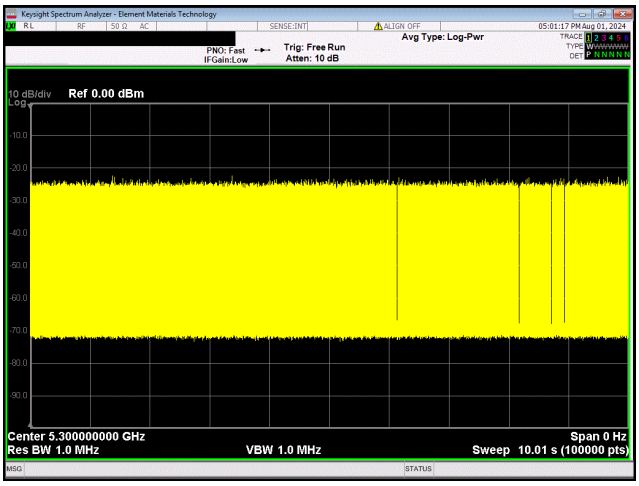
20 MHz BW, 5300 MHz, 54 Mbps
10ms



20 MHz BW, 5300 MHz, 54 Mbps
25ms



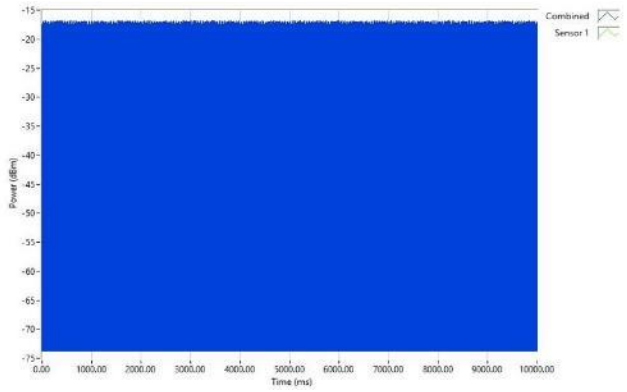
20 MHz BW, 5300 MHz, 54 Mbps
100ms



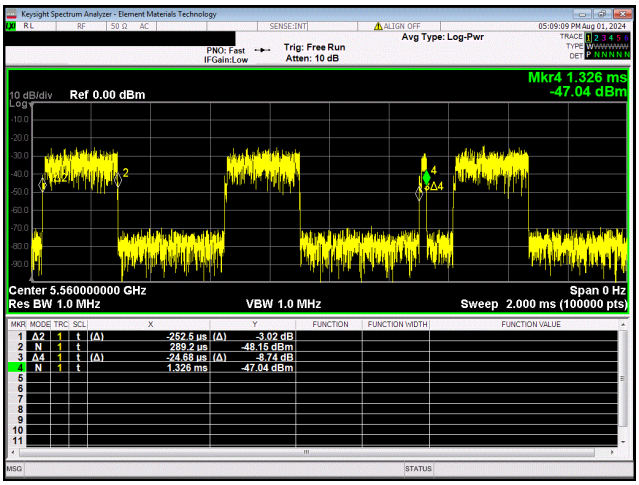
20 MHz BW, 5300 MHz, 54 Mbps
10sec

CHANNEL LOADING AND CHANNEL UTILIZATION

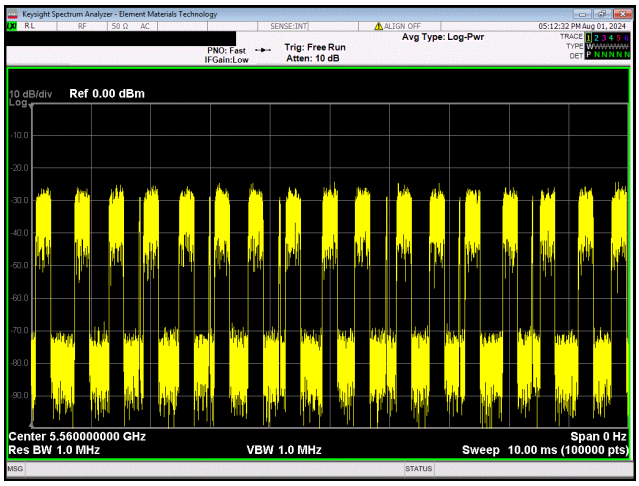
element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



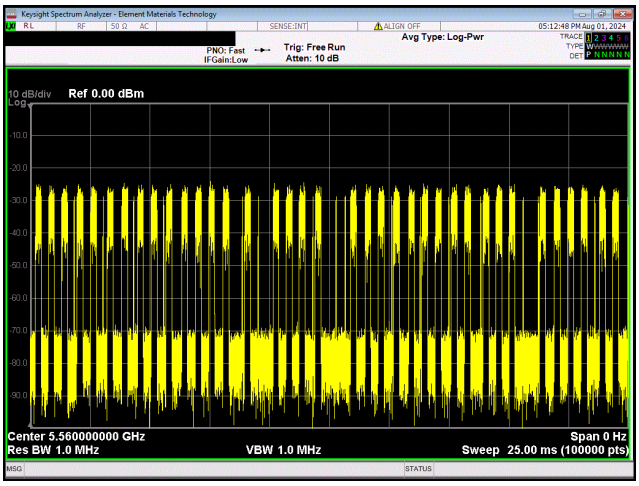
20 MHz BW, 5560 MHz, 54 Mbps
Duty Cycle



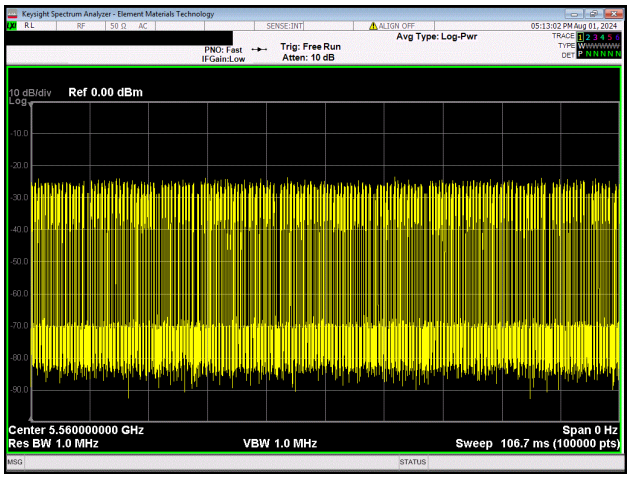
20 MHz BW, 5560 MHz, 54 Mbps
2ms



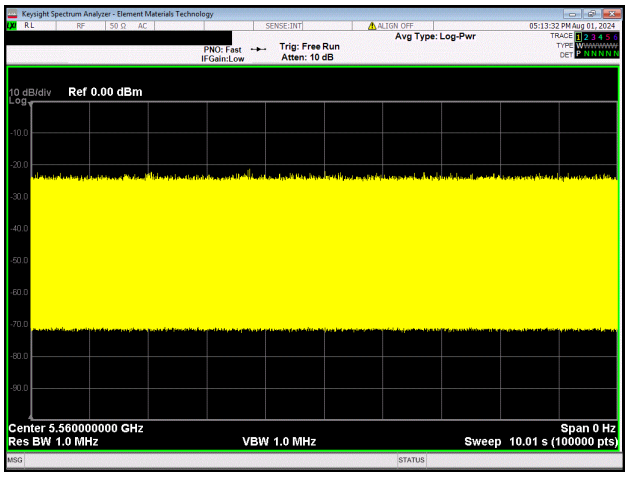
20 MHz BW, 5560 MHz, 54 Mbps
10ms



20 MHz BW, 5560 MHz, 54 Mbps
25ms



20 MHz BW, 5560 MHz, 54 Mbps
100ms



20 MHz BW, 5560 MHz, 54 Mbps
10sec

MOVE TIME

element
TbtTx 2023.12.06.3
TbtTx 2023.12.06.3
WTD.2024.01.16.0

TEST DESCRIPTION

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 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. The amplitude was increased above the required DFS threshold to ensure the master device used as test equipment would sense the DFS waveform. As stated above, the equipment under test is a client without radar detection, not a master or client with radar detection. The EUT relies on the master to sense the DFS waveform so the amplitude of the DFS waveform will not impact the EUT.

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 a duration greater than 10 seconds.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TEV	2024-05-06	2027-05-06
Access Point	Cisco	AIR-AP1252AG-A-K9	TIV	NCR	NCR
Power Supply	Cisco	AIR-PWR-SPLY1	TIVA	NCR	NCR
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Meter - Power	ETS Lindgren	7002-008	SRA	2024-02-19	2025-02-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2024-05-22	2025-05-22
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05
Attenuator	S.M. Electronics	SA26B-20	RFW	2024-01-31	2025-01-31
Attenuator	Fairview Microwave	SA4014-20	AQI	2023-09-05	2024-09-05
Attenuator	INMET	64671 6A-10dB	AUI	2023-08-25	2024-08-25
Attenuator	Aeroflex/Weinschel	3053	RKM	2024-06-18	2025-06-18
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAE	2023-10-08	2024-10-08
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAF	2023-10-08	2024-10-08

MOVE TIME

element
TbtTx 2023.12.06.3
TbtTx 2023.12.06.3
WTD.2024.01.16.0

EUT:	Fuji Thermostat	Work Order:	ADEM0044
Serial Number:	52202030005130	Date:	2024-08-15
Customer:	Ademco, Inc.	Temperature:	22.1°C
Attendees:	None	Relative Humidity:	56.8%
Customer Project:	None	Bar. Pressure (PMSL):	1008 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	110VAC/60Hz	Configuration:	ADEM0044-5

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.407:2024	FCC KDB 905462 D02 v02:2022
RSS-247 Issue 3:2023	FCC KDB 905462 D02 v02:2022

COMMENTS

Radar pulse generated by N7607C Signal Studio for DFS and DAA 2024 Update 1.0 Version 3.2.1.0, Version date 2022.0801, release date June 2024 using signal generator listed in the equipment list.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

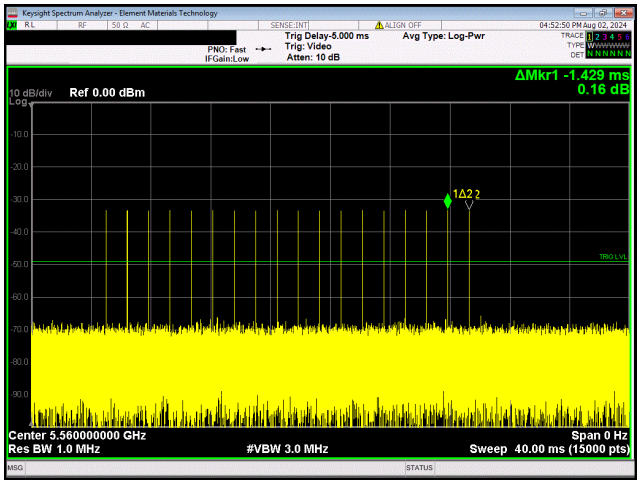
Tested By

TEST RESULTS

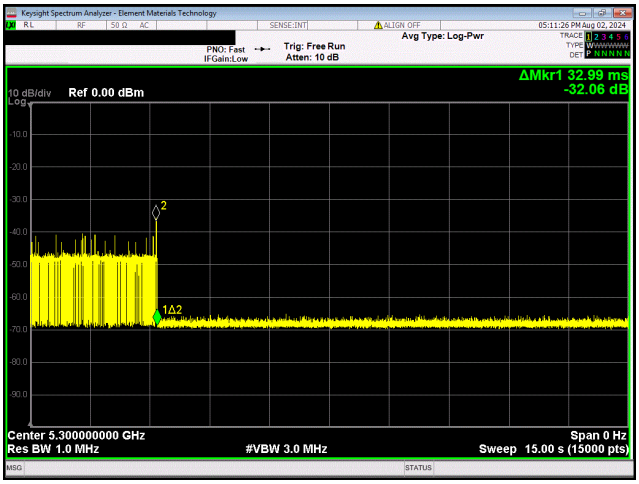
	Value (sec)	Limit (sec)	Result
FCC Short Pulse Radar - Type 0			
Verification	N/A	N/A	N/A
20 MHz BW, 5300 MHz, 54 Mbps			
System Response	0.003299	10	Pass
20 MHz BW, 5560 MHz, 54 Mbps			
System Response	0.10882	10	Pass

MOVE TIME

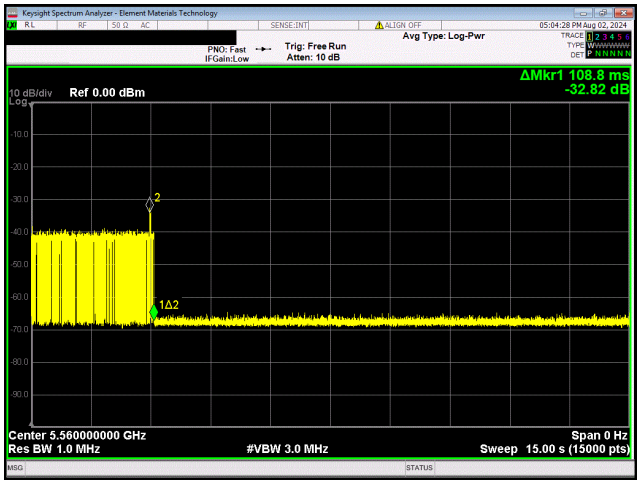
element
TbtTx 2023.12.06.3
TbtTx 2023.12.06.3
WTD.2024.01.16.0



FCC Short Pulse Radar - Type 0 Verification



20 MHz BW, 5300 MHz, 54 Mbps System Response



20 MHz BW, 5560 MHz, 54 Mbps System Response

CLOSING TIME

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

TEST DESCRIPTION

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 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 radar signals to be injected and monitored. For master devices, the detection level was set prior to testing by temporarily replacing the master device with the analyzer and setting the power level according to Table 3 and Section 7.5.

Where required, an iperf session was used to stream data 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.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TEV	2024-05-06	2027-05-06
Access Point	Cisco	AIR-AP1252AG-A-K9	TIV	NCR	NCR
Power Supply	Cisco	AIR-PWR-SPLY1	TIVA	NCR	NCR
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Meter - Power	ETS Lindgren	7002-008	SRA	2024-02-19	2025-02-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2024-05-22	2025-05-22
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05
Attenuator	S.M. Electronics	SA26B-20	RFW	2024-01-31	2025-01-31
Attenuator	Fairview Microwave	SA4014-20	AQI	2023-09-05	2024-09-05
Attenuator	INMET	64671 6A-10dB	AUI	2023-08-25	2024-08-25
Attenuator	Aeroflex/Weinschel	3053	RKM	2024-06-18	2025-06-18
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAE	2023-10-08	2024-10-08
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAF	2023-10-08	2024-10-08

CLOSING TIME

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

EUT:	Fuji Thermostat	Work Order:	ADEM0044
Serial Number:	52202030005130	Date:	2024-08-15
Customer:	Ademco, Inc.	Temperature:	22.1°C
Attendees:	None	Relative Humidity:	56.3%
Customer Project:	None	Bar. Pressure (PMSL):	1008 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	110VAC/60Hz	Configuration:	ADEM0044-5

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.407:2024	FCC KDB 905462 D02 v02:2022
RSS-247 Issue 3:2023	FCC KDB 905462 D02 v02:2022

COMMENTS

All transmissions ceased in under the 200 ms threshold allowed.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

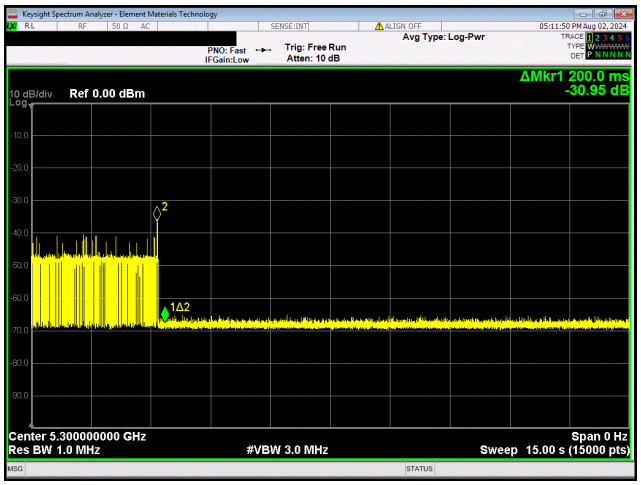
Tested By

TEST RESULTS

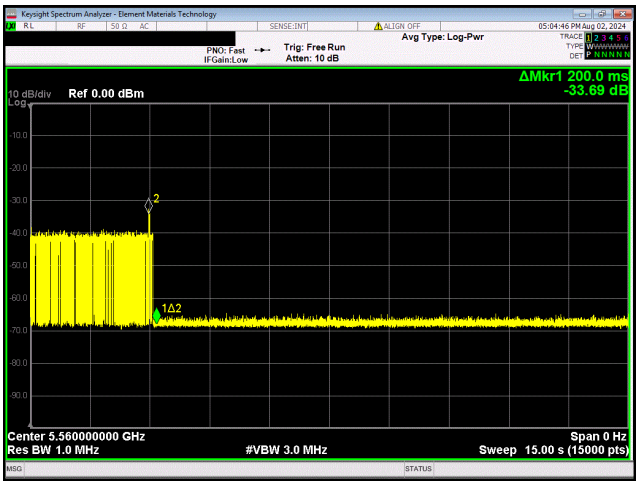
	# of Pulses after 200 ms	Pulse Width (ms)	Value (ms)	Limit (ms)	Result
20 MHz BW, 5300 MHz, 54 Mbps					
System Response	0	N/A	< 200	260	Pass
20 MHz BW, 5560 MHz, 54 Mbps					
System Response	0	N/A	< 200	260	Pass

CLOSING TIME

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



20 MHz BW, 5300 MHz, 54 Mbps
System Response



20 MHz BW, 5560 MHz, 54 Mbps
System Response

NON OCCUPANCY PERIOD

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

TEST DESCRIPTION

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 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 sweep the frequency for at least 30 minutes. The appropriate radar signal 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.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TEV	2024-05-06	2027-05-06
Access Point	Cisco	AIR-AP1252AG-A-K9	TIV	NCR	NCR
Power Supply	Cisco	AIR-PWR-SPLY1	TIVA	NCR	NCR
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Meter - Power	ETS Lindgren	7002-008	SRA	2024-02-19	2025-02-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2024-05-22	2025-05-22
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05
Attenuator	S.M. Electronics	SA26B-20	RFW	2024-01-31	2025-01-31
Attenuator	Fairview Microwave	SA4014-20	AQI	2023-09-05	2024-09-05
Attenuator	INMET	64671 6A-10dB	AUI	2023-08-25	2024-08-25
Attenuator	Aeroflex/Weinschel	3053	RKM	2024-06-18	2025-06-18
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAE	2023-10-08	2024-10-08
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAF	2023-10-08	2024-10-08

NON OCCUPANCY PERIOD

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

EUT:	Fuji Thermostat	Work Order:	ADEM0044
Serial Number:	52202030005130	Date:	2024-08-15
Customer:	Ademco, Inc.	Temperature:	22°C
Attendees:	None	Relative Humidity:	56.2%
Customer Project:	None	Bar. Pressure (PMSL):	1008 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	110VAC/60Hz	Configuration:	ADEM0044-5

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.407:2024	FCC KDB 905462 D02 v02:2022
RSS-247 Issue 3:2023	FCC KDB 905462 D02 v02:2022

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

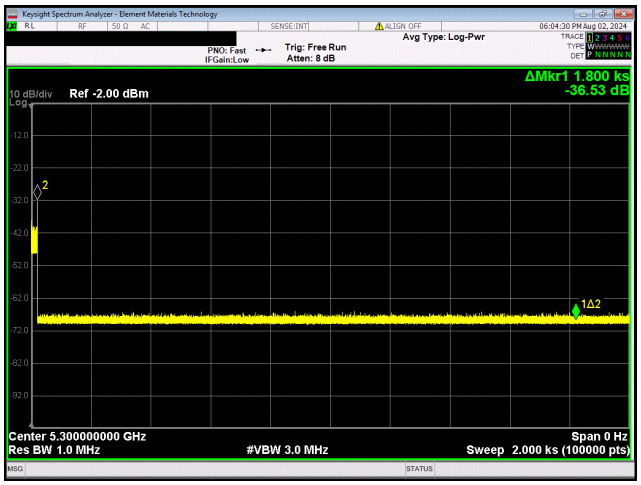
Tested By

TEST RESULTS

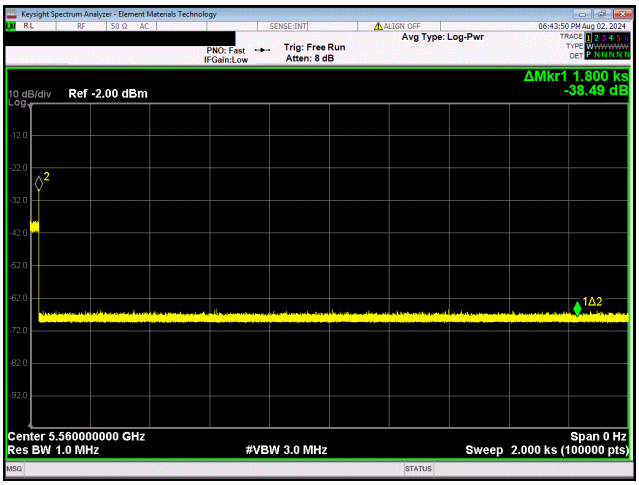
	Value (min)	Limit (min)	Result
20 MHz BW, 5300 MHz, 54 Mbps			
System Response	≥30	≥30	Pass
20 MHz BW, 5560 MHz, 54 Mbps			
System Response	≥30	≥30	Pass

NON OCCUPANCY PERIOD

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



20 MHz BW, 5300 MHz, 54 Mbps
System Response



20 MHz BW, 5560 MHz, 54 Mbps
System Response

End of Test Report