Avnet, Inc.

REVISED TEST REPORT TO 106506-3A

Secure Wi-Fi module
Model: AES-MS-MT3620-UFL-M-G Rev2

Tested to The Following Standards:

FCC Part 15 Subpart E Section(s)

15.407 (h)(2)
Radar Detection Function of Dynamic Frequency Selection (DFS)

Report No.: 106503-3B

Date of issue: May 12, 2023

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of testing for CKC Laboratories, Inc.

We strive to create long-term, trust-based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

Test Certificate # 803.01

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ADMINISTRATIVE INFORMATION

Test Report Information

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Project Number: 106506

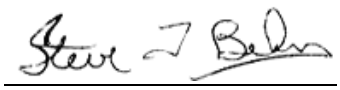
DATE OF EQUIPMENT RECEIPT: January 16, 2021
DATE(S) OF TESTING: January 16, 2021 and January 24, 2023

Revision History

Original: Testing of Secure Wi-Fi module, Model: : AES-MS-MT3620-UFL-M-G Rev2 to 15.407 (h)(2), Radar Detection Function of Dynamic Frequency Selection (DFS).
Revision A: Added Test Conditions for Channel Move Time, Channel Closing Time and Non-Occupancy Period Section.
Revision B: Added Test Conditions to Conditions During Test. Revised Nominal Input Voltage. Revised Test Data Summary, Measured Time.

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
110 North Olinda Place
Brea, CA 92823

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.20

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Canada	Japan
Canyon Park, Bothell, WA	US0103	US1024	3082C	A-0136
Brea, CA	US0103	US1024	3082D	A-0136
Fremont, CA	US0103	US1024	3082B	A-0136
Mariposa, CA	US0103	US1024	3082A	A-0136

*CKC's list of NIST designated countries can be found at: https://standards.gov/cabs/designations.html

SUMMARY OF RESULTS

Standard: FCC Part 15 Subpart E - 15.407(h)(2) (UNII) 5.25-5.35 GHz and 5.47-5.725 GHz bands

Requirement	Test Procedure Clause	Description	Modifications	Results
15.407(h)(2)	7.5	DFS Detection Threshold (Master & client with radar detection)	NA	NA1
15.407(h)(2)	7.8.1	UNII Detection Bandwidth (Master & client with radar detection)	NA	NA1
15.407(h)(2)(i)(A) 15.407(h)(2)(ii)	7.8.2.1 7.8.2.2 7.8.2.3	Channel Availability Check Time. (Master & client with radar detection)	NA	NA1
15.407(h)(2)(i)(B) 15.407(h)(2)(iii)	7.8.3	Channel Move Time, Channel Closing Time (Master, client with radar detection, client without radar detection)	NA	Pass
15.407(h)(2)(iv)	7.8.3	Non-Occupancy Period (Master & client with radar detection client without radar detection)	NA	Pass
5.1 Table 2*	7.8.4	Statistical Performance Check (Master & client with radar detection)	NA	NA1
7.7*	7.7	Channel Loading (Master and client with radar detection)	NA	NA1

NA = Not Applicable
NA1 = Not Applicable because EUT is a client device without Radar detection.
* KDB requirement.

ISO/IEC 17025 Decision Rule
The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions
No modifications were made during testing.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions
Test conditions: Streaming Test_Video.mp4 on loop. The video streams from support laptop 1 through router to EUT. Video is then displayed on support laptop 2 which is connected to the EUT via USB. Channel loading is 17.3%.

Test Procedure
The DFS testing presented in this report is perform in accordance with the following test procedure to meet the requirement 905462 D02 UNII DFS Compliance Procedures New Rules v02. April 8, 2016. Each clause of the test procedure is identified in specific section of this report.

Waveform information.
The waveforms used are commercially available pre-defined DFS waveform per Agilent N7607B Signal Studio for DFS radar profile. The waveforms meeting the following requirement.
USA: FCC15.407, FCC-13-22

EQUIPMENT UNDER TEST (EUT)

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
AES-MS-MT3620-UFL-M-G Rev2	Avnet, Inc.	Secure Wi-Fi module	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
PCB	Avnet, Inc.	AES-MS-MT3620-SK_PCB REV 2	4000300
Laptop	Dell	Inspron 15 5100	28081915454
Laptop	Toshiba	Portege R835-P81	XB089194H
AC2600 Smart Wi-Fi Router	Netgear	Nighthawk X4S	4H4E8550004AE

General Product Information:

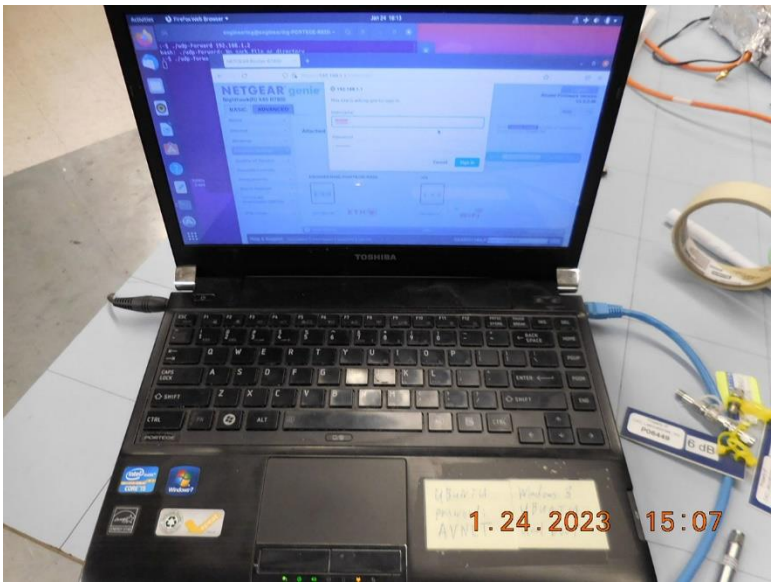
Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment Radio Module Radio Module
Operational Mode(s):	☐ Master ☐ Client with Radar Detection ☒ Client without Radar Detection
FCCID of Master Used for Testing:	Client mode was tested with FCC ID:PY315100319
Network Type:	☐ Bridge ☐...Mesh ☐ Access Point ☒ Client
System Architecture:	802.11VHT20
Operating Frequency Range(s):	☒ 5150-5250 MHz ☒ 5250-5350 MHz ☒ 5470-5725 MHz ☒ 5725-5850 MHz
Modulation Type(s):	MCS7, OFDM54M
Channel bandwidth(s):	☒ 20 MHz ☐ 40 MHz ☐ 80 MHz ☐ 160MHz contiguous ☐ 80 MHz+80MHz noncontiguous
Measured 99% BW:	5470-5725 MHz 802.11VHT20:
Maximum Duty Cycle:	98%
Highest Power (EIRP, dBm/Watt):	15.5dBm EIRP
Lowest Power (EIRP, dBm/Watt):	14.5dBm EIRP
Number of TX/RX Chains:	1
Antenna Type(s) and Gain:	External, Patch, 2.7dBi
Antenna cable loss	NA
Beamforming Capable:	NA
Antenna Connection Type:	External Connector
Antenna Impedance (ohm):	50
Nominal Input Voltage:	5Vdc
Boot up time from power cycle:	10 sec
Manufacturer Statement:	The manufacturer has confirmed that information regarding the parameters of the detected Radar Waveforms is not available to the end user.
Firmware / Software used for Test:	Azure Sphere OS v20.07
The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility.	

EUT Photo(s)

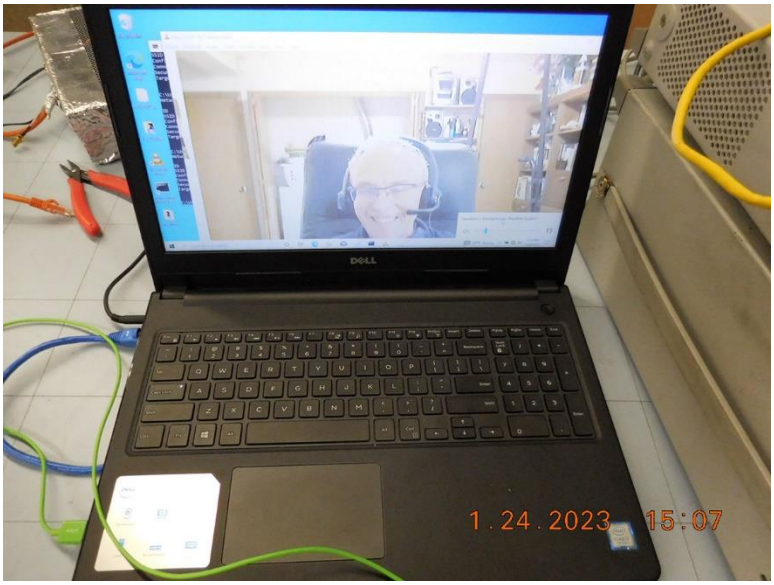
EUT Top Side

EUT Bottom Side

Support Equipment Photo(s)



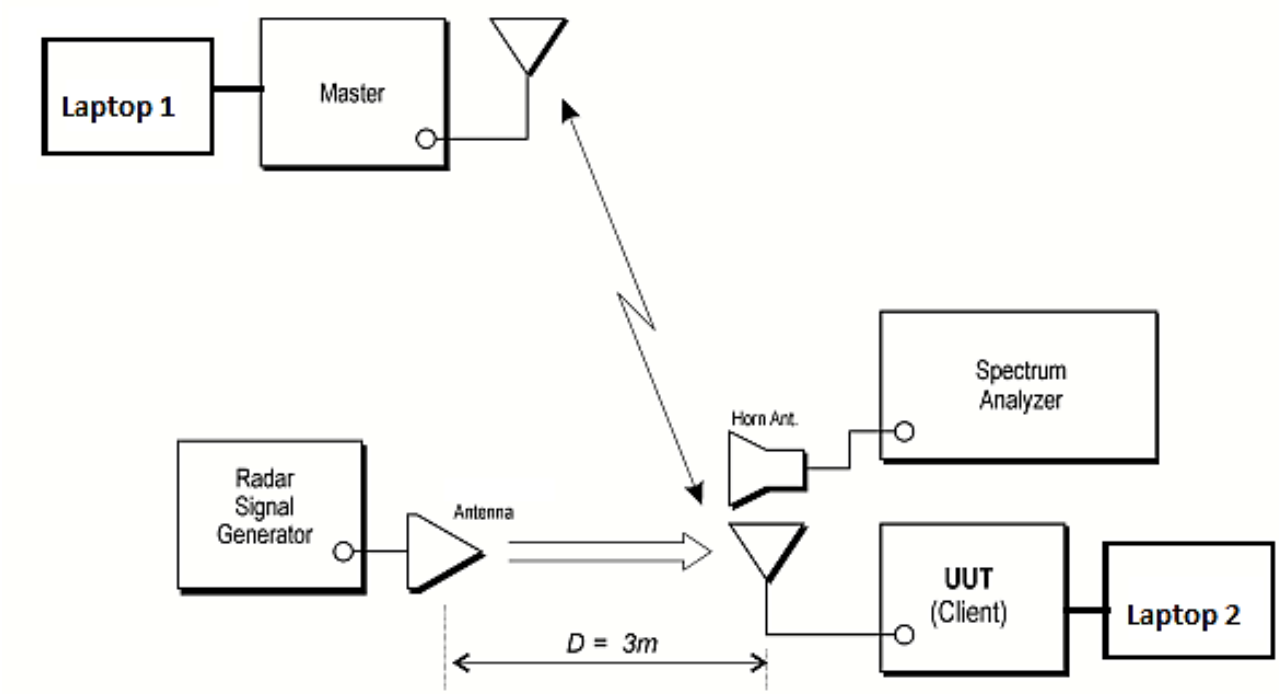
Support Laptop #1



Support Laptop #2

Master Support Router

Block Diagram of Test Setup(s)



Requirements

Table 1: Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
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

Table 2: 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 requirements for devices with multiple bandwidth modes	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 the 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.		

Table 3: DFS Detection Thresholds for Master Devices and Client Devices with Radar Detection

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. **Note3:** EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

Table 4: DFS Response Requirement Values

Parameter	Value
Non-occupancy period	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 U-NII 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.	

FCC Part 15 Subpart E

15.407(h)(2)(i)(B) Channel Move Time, Channel Closing Time
15.407(h)(2)(iv) Non-Occupancy Period

Channel Move / Closing Time and Non-Occupancy Period

- **Client without Radar Detection**

Test Setup/Conditions			
Test Locations:	Brea Lab A Brea Lab Bench Bothell Lab Bench	Test Engineer:	S. Pittsford
Test Method:	7.8.3	Test Date(s):	1/24/2023
Configuration:	1		
Test Setup:	Test conditions: Streaming Test_Video.mp4 on loop. The video streams from support laptop 1 through router to EUT. Video is then displayed on support laptop 2 which is connected to the EUT via USB. Channel loading is 17.3%. Radiated setup In-Service Monitoring was evaluated as illustrated in test setup diagram. The Test frequency contains control signals. A spectrum analyzer with Peak detector activated, set at zero span and RBW and VBW >3 MHz. Except for Non-Occupancy time, In-Service monitoring was evaluated with the Widest bandwidth mode. Radar burst at required test level was triggered and the time to vacate the channel and remained unoccupied was evaluated. Plot and Spectrum analyzer trace data was captured with maximum available BIN. Time above Threshold (T1 to T1+200ms) and (T1+200ms to Ts+10s) meet required maximum timing requirements. Test performed with widest BW mode available. 802.11 n20, radar inject and monitored at 5500MHz, the service channel of 802,11 n20 set at 5500MHz.		

Environmental Conditions			
Temperature (ºC)	20-22	Relative Humidity (%):	40-45%

Unless otherwise noted, all test performed under the listed environmental condition.

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
01412	Horn Antenna	EMCO	3115	6/8/2021	6/8/2023
02872	Spectrum Analyzer	Agilent	E4440A	11/29/2021	11/29/2023
03486	Horn Antenna	ETS	3115	6/8/2021	6/8/2023
03592	Vector Signal Generator	Keysight	N5182B	1/20/2022	1/20/2024

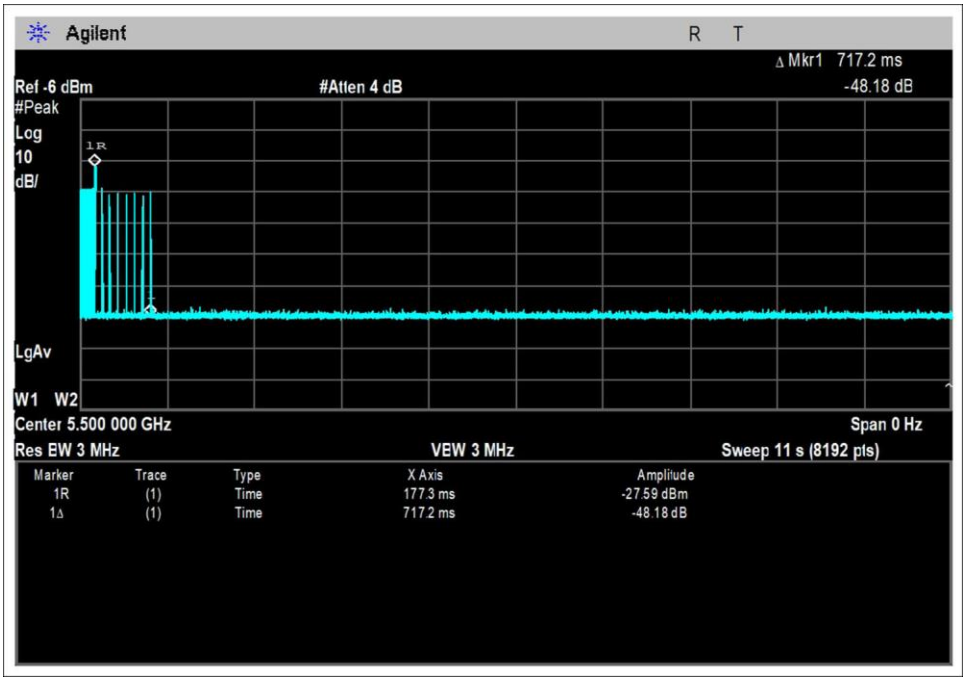
NCR = No Calibration Required

Test Data Summary						
Frequency (MHz)	**Protocol**	**Waveform Type**	**Channel Test**	**Measured Time**	**Limit**	**Results**
5500	802.11 n20	0	Move[1]	0.72s	<10 s	Pass
5500	802.11 n20	0	T1 - Closing[1,2]	190.2ms	<200ms	Pass
5500	802.11 n20	0	CS - Closing[1,2]	4.4ms	<60 ms/10s	Pass
5500	802.11 n20	0	Non-Occupancy[3]	NA	>30 min	Pass

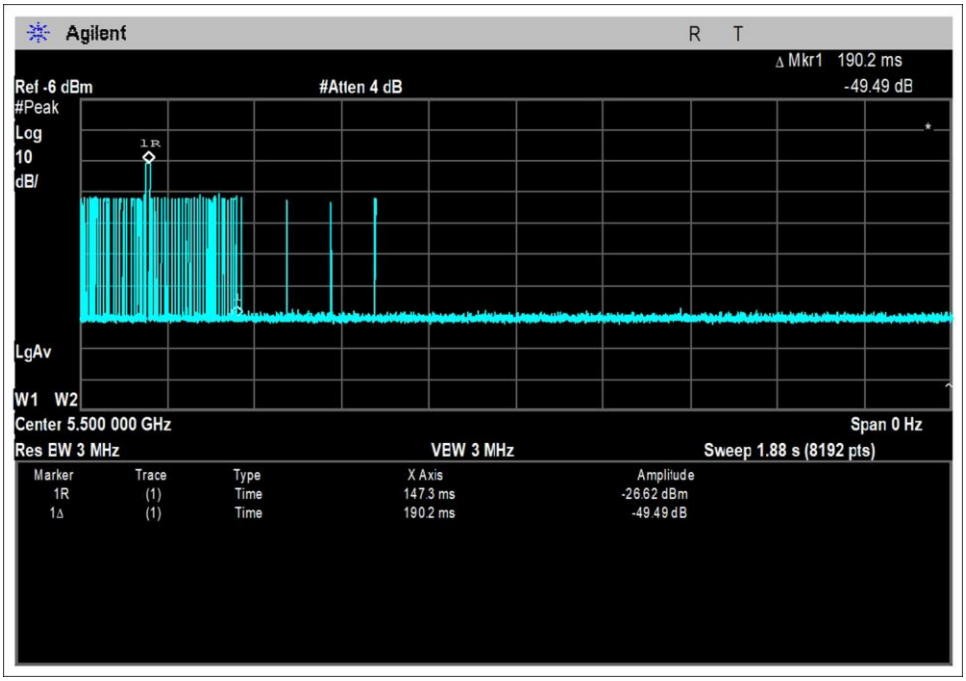
Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.
Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time 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. This test is required for Master and Client with Radar Detection.

Pass: No transmission within 30 minutes after Radar burst.

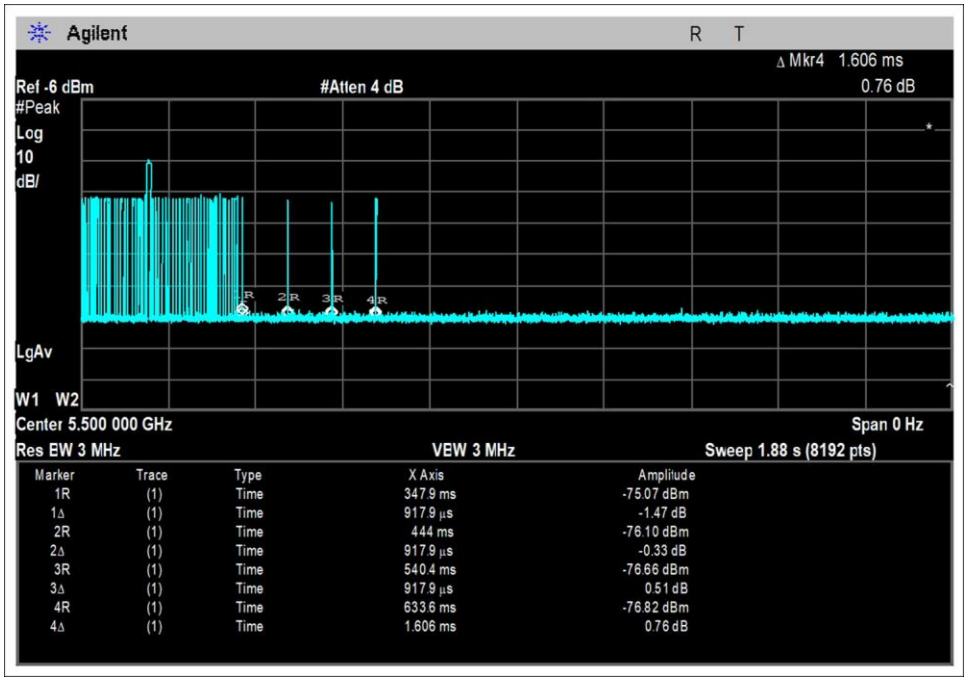
Plot(s)



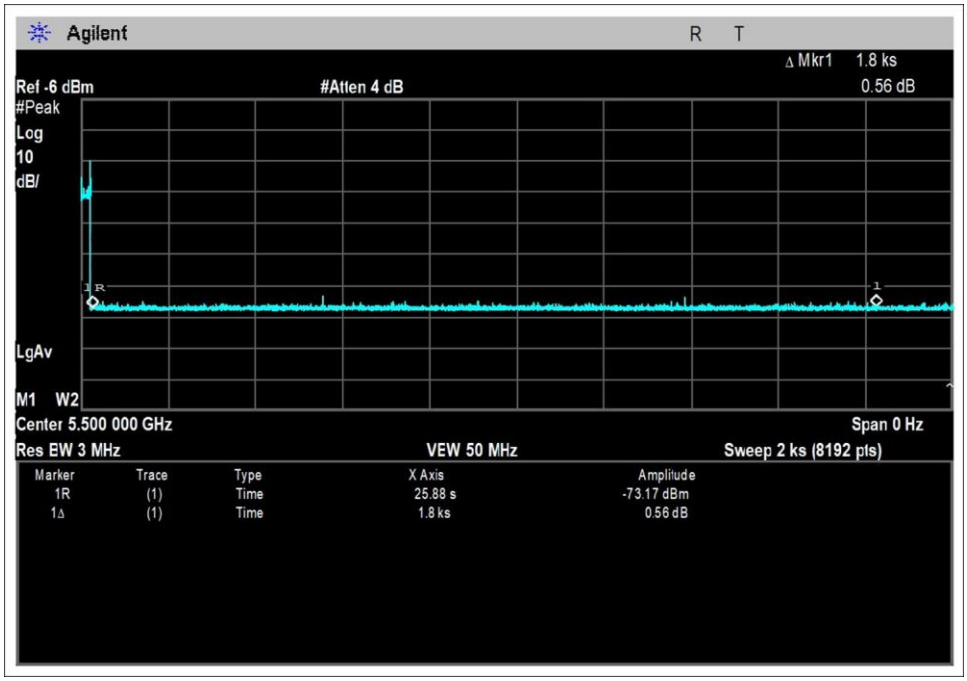
Move Time



200ms Close Time



Aggregate Over Remaining 10sec

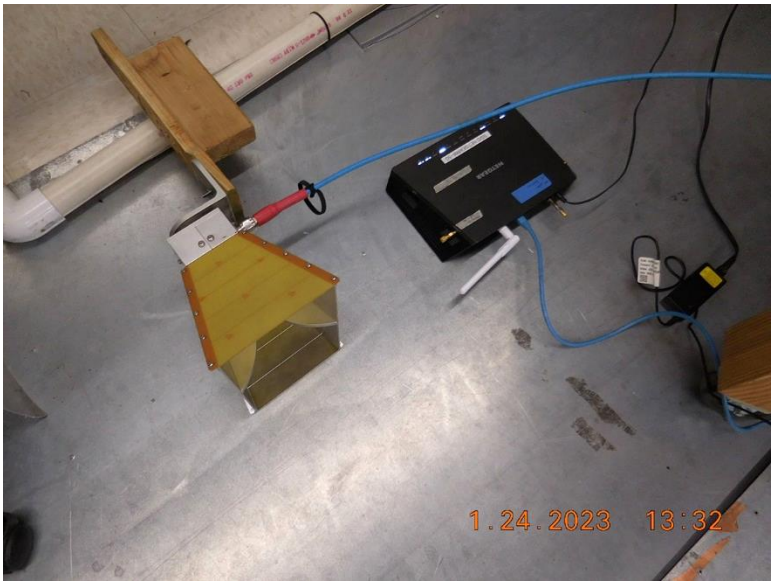


Non-Occupancy Time

Test Setup Photos

Radar Signal Antenna

Client UUT



Master and Analyzer Ant

Appendix A: Radar Waveform Requirement

The Waveform used for testing meets FCC requirement in accordance with section 6 of 905462 D02 UNII DFS Compliance Procedures New Rules v02

RADAR TEST WAVEFORMS

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance. Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

6.1 Short Pulse Radar Test Waveforms

Table 5 – 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	Roundup $\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{PRI_{\mu sec}}\right)\right\}$	60%	30
		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			
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.					

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4. If more than 30 waveforms are used for Short Pulse Radar Types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. If more than 30 waveforms are used for Short Pulse Radar Type 1, then each additional waveform is generated with Test B and must also be unique and not repeated from the previous waveforms in Tests A or B.

For example if in Short Pulse Radar Type 1 Test B a PRI of 3066 µsec is selected, the number of pulses would be =

$$\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^{6}}{3066}\right)\right\} = \text{Round up } \{17.2\} = 18.$$

Table 5a - Pulse Repetition Intervals Values for Test A

Pulse Repetition Frequency Number	Pulse Repetition Frequency (Pulses Per Second)	Pulse Repetition Interval (Microseconds)
1	1930.5	518
2	1858.7	538
3	1792.1	558
4	1730.1	578
5	1672.2	598
6	1618.1	618
7	1567.4	638
8	1519.8	658
9	1474.9	678
10	1432.7	698
11	1392.8	718
12	1355	738
13	1319.3	758
14	1285.3	778
15	1253.1	798
16	1222.5	818
17	1193.3	838
18	1165.6	858
19	1139	878
20	1113.6	898
21	1089.3	918
22	1066.1	938
23	326.2	3066

The aggregate is the average of the percentage of successful detections of Short Pulse Radar Types 1-4. For example, the following table indicates how to compute the aggregate of percentage of successful detections.

Radar Type	Number of Trials	Number of Successful Detections	Minimum Percentage of Successful Detection
1	35	29	82.9%
2	30	18	60%
3	30	27	90%
4	50	44	88%
Aggregate (82.9% + 60% + 90% + 88%)/4 = 80.2%			

6.2 Long Pulse Radar Test Waveform

Table 6 – Long Pulse Radar Test Waveform

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

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse Radar Type waveforms. If more than 30 waveforms are used for the Long Pulse Radar Type waveforms, then each additional waveform must also be unique and not repeated from the previous waveforms.

Each waveform is defined as follows:

1) The transmission period for the Long Pulse Radar test signal is 12 seconds.

2) There are a total of 8 to 20 *Bursts* in the 12 second period, with the number of *Bursts* being randomly chosen. This number is *Burst Count*.

3) Each *Burst* consists of 1 to 3 pulses, with the number of pulses being randomly chosen. Each *Burst* within the 12 second sequence may have a different number of pulses.

4) The pulse width is between 50 and 100 microseconds, with the pulse width being randomly chosen. Each pulse within a *Burst* will have the same pulse width. Pulses in different *Bursts* may have different pulse widths.

5) Each pulse has a linear frequency modulated chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a *transmission period* will have the same chirp width. The chirp is centered on the pulse. For example, with a radar frequency of 5300 MHz and a 20 MHz chirped signal, the chirp starts at 5290 MHz and ends at 5310 MHz.

6) If more than one pulse is present in a *Burst*, the time between the pulses will be between 1000 and 2000 microseconds, with the time being randomly chosen. If three pulses are present in a *Burst*, the random time interval between the first and second pulses is chosen independently of the random time interval between the second and third pulses.

7) The 12 second transmission period is divided into even intervals. The number of intervals is equal to *Burst Count*. Each interval is of length (12,000,000 / *Burst Count*) microseconds. Each interval contains one *Burst*. The start time for the *Burst*, relative to the beginning of the interval, is between 1 and [(12,000,000 / *Burst Count*) – (Total *Burst* Length) + (One Random PRI Interval)] microseconds, with the start time being randomly chosen. The step interval for the start time is 1 microsecond. The start time for each *Burst* is chosen randomly.

A representative example of a Long Pulse Radar Type waveform:
1) The total test waveform length is 12 seconds.
2) Eight (8) *Bursts* are randomly generated for the *Burst Count*.
3) *Burst* 1 has 2 randomly generated pulses.
4) The pulse width (for both pulses) is randomly selected to be 75 microseconds.
5) The PRI is randomly selected to be at 1213 microseconds.
6) *Bursts* 2 through 8 are generated using steps 3 – 5.
7) Each *Burst* is contained in even intervals of 1,500,000 microseconds. The starting location for Pulse 1, *Burst* 1 is randomly generated (1 to 1,500,000 minus the total *Burst* 1 length + 1 random PRI interval) at the 325,001 microsecond step. *Bursts* 2 through 8 randomly fall in successive 1,500,000 microsecond intervals (i.e. *Burst* 2 falls in the 1,500,001 – 3,000,000 microsecond range).

Figure 1 provides a graphical representation of the Long Pulse Radar Test Waveform.

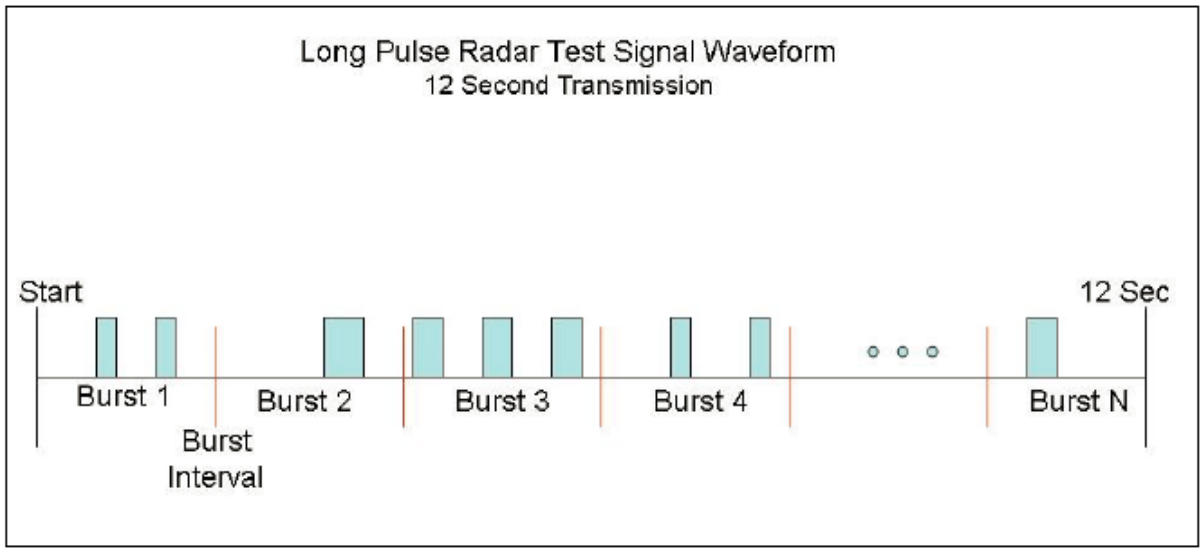


Figure 1: Graphical Representation of a Long Pulse Radar Type Waveform

6.3 Frequency Hopping Radar Test Waveform

Table 7 – 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

For the Frequency Hopping Radar Type, the same *Burst* parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm: [4]

The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

[4] If a segment does not contain at least 1 frequency within the *U-NII Detection Bandwidth* of the UUT, then that segment is not used.

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

Uncertainties reported are worst case for all CKC Laboratories' sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point, the measuring device is set into the linear mode and the scan time is reduced.