DFS PORTION of FCC 47 CFR PART 15 SUBPART E
DFS PORTION of INDUSTRY CANADA RSS-247 ISSUE 2

CERTIFICATION TEST REPORT

FOR

802.11a/b/g/n (HT20) 4x4 MASTER DEVICE with BLE and NFC

MODEL NUMBER: S19

FCC ID: SBVRM019
IC: 5373A-RM019

REPORT NUMBER: 12934025-E4V2

ISSUE DATE: JANUARY 16, 2020

Prepared for

SONOS INC.
614 CHAPALA ST.
SANTA BARABARA, CA, 93101, U.S.A.

Prepared by

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	01/09/20	Initial Issue	--
V2	01/16/20	Test Date updated Section 3 updated	Henry Lau

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FORM NO: CCSUP4701J
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SONOS INC.
614 CHAPALA ST.
SANTA BARABARA, CA, 93101, U.S.A.

EUT DESCRIPTION: 802.11a/b/g/n (HT20) 4x4 MASTER DEVICE with BLE and NFC

MODEL: S19

SERIAL NUMBER: A100 48-A6-B8-B0-06-15 15:D

DATE TESTED: OCTOBER 14, 2019

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
DFS Portion of CFR 47 Part 15 Subpart E	Complies
DFS Portion of INDUSTRY CANADA RSS-247 Issue 2	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For
UL Verification Services Inc. By:

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Project Engineer
CONSUMER TECHNOLOGY DIVISION
UL Verification Services Inc.

Prepared By:

Douglas Anderson

DOUG ANDERSON
Test Engineer
CONSUMER TECHNOLOGY DIVISION
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with the DFS portion of FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, FCC KDB 789033, KDB 905462 D02 and D03 and RSS-247 Issue 2.

3. REFERENCE DOCUMENTS

Measurements of transmitter parameters as referenced in this report are documented in UL Verification Services report number 12934025-E3V2.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. Specific facilities are also identified in the test results sections.

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code: 2324A.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

5. CALIBRATION AND UNCERTAINTY

5.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

5.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty level has been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Time	± 0.02 %

The Uncertainty figure is valid to a confidence level of 95%.

6. DYNAMIC FREQUENCY SELECTION

6.1. OVERVIEW

6.1.1. LIMITS

INDUSTRY CANADA

IC RSS-247 is closely harmonized with FCC Part 15 DFS rules. The deviations are as follows:

RSS-247 Issue 2

Note: For the band 5600–5650 MHz, no operation is permitted.

Until further notice, devices subject to this annex shall not be capable of transmitting in the band 5600–5650 MHz. This restriction is for the protection of Environment Canada weather radars operating in this band.

FCC

§15.407 (h), FCC KDB 905462 D02 "COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVICES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION" and KDB 905462 D03 "U-NII CLIENT DEVICES WITHOUT RADAR DETECTION CAPABILITY".

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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	Client **(without DFS)**	Client **(with DFS)**
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required	Yes

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar DFS	Client (without DFS)
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 all 20 MHz channel blocks and a null frequency between the bonded 20 MHz channel blocks.		

Table 3: Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value (see notes)
E.I.R.P. ≥ 200 mill watt	-64 dBm
E.I.R.P. < 200 mill watt and power spectral density < 10 dBm/MHz	-62 dBm
E.I.R.P. < 200 mill watt that do not meet 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:** E.I.R.P. 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	30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds (See Note 1)
Channel Closing Transmission Time	200 milliseconds + approx. 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.	

Table 5 – Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (usec)	PRI (usec)	Pulses	Minimum Percentage of Successful Detection	Minimum 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: {(1/360) x (19 x 10^6 PRI_{usec})}	60%	30
		Test B: 15 unique PRI values randomly selected within the range of 518-3066 usec. With a minimum increment of 1 usec, 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.					

Table 6 – Long Pulse Radar Test Signal

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

Table 7 – Frequency Hopping Radar Test Signal

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

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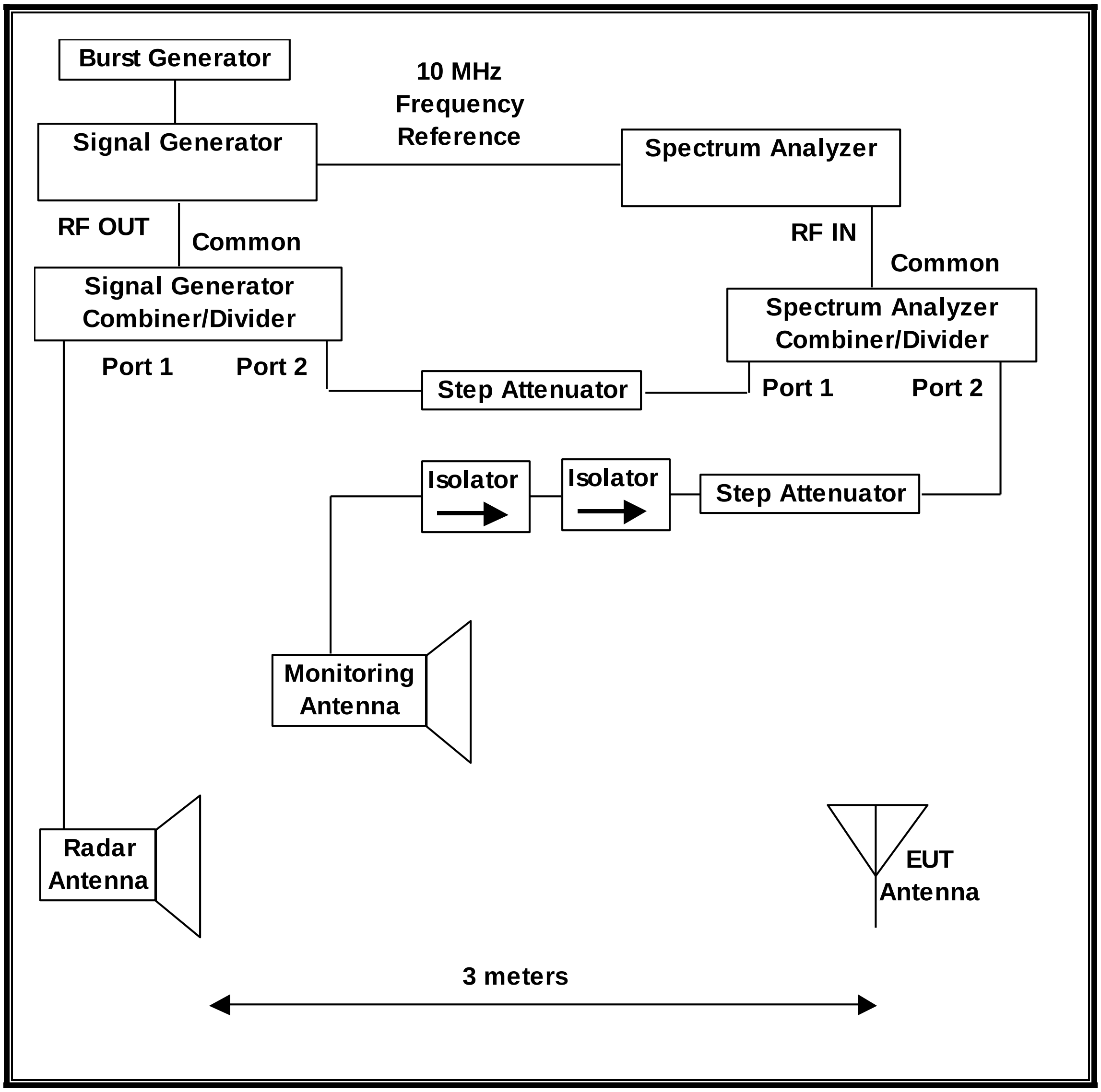
6.1.2. TEST AND MEASUREMENT SYSTEM

RADIATED METHOD SYSTEM BLOCK DIAGRAM



SYSTEM OVERVIEW

The short pulse and long pulse signal generating system utilizes the NTIA software. The Vector Signal Generator has been validated by the NTIA. The hopping signal generating system utilizes the CCS simulated hopping method and system, which has been validated by the DoD, FCC and NTIA. The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution.

The short pulse types 1, 2, 3 and 4, and the long pulse type 5 parameters are randomized at run-time.

The hopping type 6 pulse parameters are fixed while the hopping sequence is based on the August 2005 NTIA Hopping Frequency List. The initial starting point randomized at run-time and each subsequent starting point is incremented by 475. Each frequency in the 100-length segment is compared to the boundaries of the EUT Detection Bandwidth and the software creates a hopping burst pattern in accordance with Section 7.4.1.3 Method #2 Simulated Frequency Hopping Radar Waveform Generating Subsystem of KDB 905462 D02. The frequency of the signal generator is incremented in 1 MHz steps from F_L to F_H for each successive trial. This incremental sequence is repeated as required to generate a minimum of 30 total trials and to maintain a uniform frequency distribution over the entire Detection Bandwidth.

The signal monitoring equipment consists of a spectrum analyzer. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection and max hold.

SYSTEM CALIBRATION

A 50-ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected to a horn antenna via a coaxial cable, with the reference level offset set to (horn antenna gain – coaxial cable loss). The signal generator is set to CW mode. The amplitude of the signal generator is adjusted to yield a level of –64 dBm as measured on the spectrum analyzer.

Without changing any of the instrument settings, the spectrum analyzer is reconnected to the Common port of the Spectrum Analyzer Combiner/Divider. The Reference Level Offset of the spectrum analyzer is adjusted so that the displayed amplitude of the signal is –64 dBm.

The spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device. The interference detection threshold may be varied from the calibrated value of –64 dBm and the spectrum analyzer will still indicate the level as received by the Master Device.

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ADJUSTMENT OF DISPLAYED TRAFFIC LEVEL

A link is established between the Master and Slave and the distance between the units is adjusted as needed to provide a suitable received level at the Master and Slave devices. Traffic that meets or exceeds the minimum channel loading requirement is attained by streaming the audio test file and client provided ConTx traffic generation software from the Master device to the Slave device. The monitoring antenna is adjusted so that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**ID No.**	**Cal Due**
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	T459	01/24/20
Signal Generator, MXG X-Series RF Vector	Agilent	N5182B	T1633	02/08/20
Arbitrary Waveform Generator	Agilent / HP	33220A	T190	01/31/20

6.1.3. TEST AND MEASUREMENT SOFTWARE

The following test and measurement software was utilized for the tests documented in this report:

TEST SOFTWARE LIST		
Name	**Version**	**Test / Function**
Aggregate Time-PXA	3.1	Channel Loading and Aggregate Closing Time
FCC 2014 Detection Bandwidth-PXA	3.1.1	Detection Bandwidth in 5 MHz Steps
In Service Monitoring-PXA	4.1	In-Service Monitoring (Probability of Detection)
PXA Read	3.1	Signal Generator Screen Capture
SGXProject.exe	1.7	Radar Waveform Generation and Download

6.1.4. TEST ROOM ENVIRONMENT

The test room temperature and humidity shall be maintained within normal temperature of 15~35 °C and normal humidity 20~75% (relative humidity).

ENVIRONMENT CONDITION

Parameter	Value
Temperature	24.6 °C
Humidity	30 %

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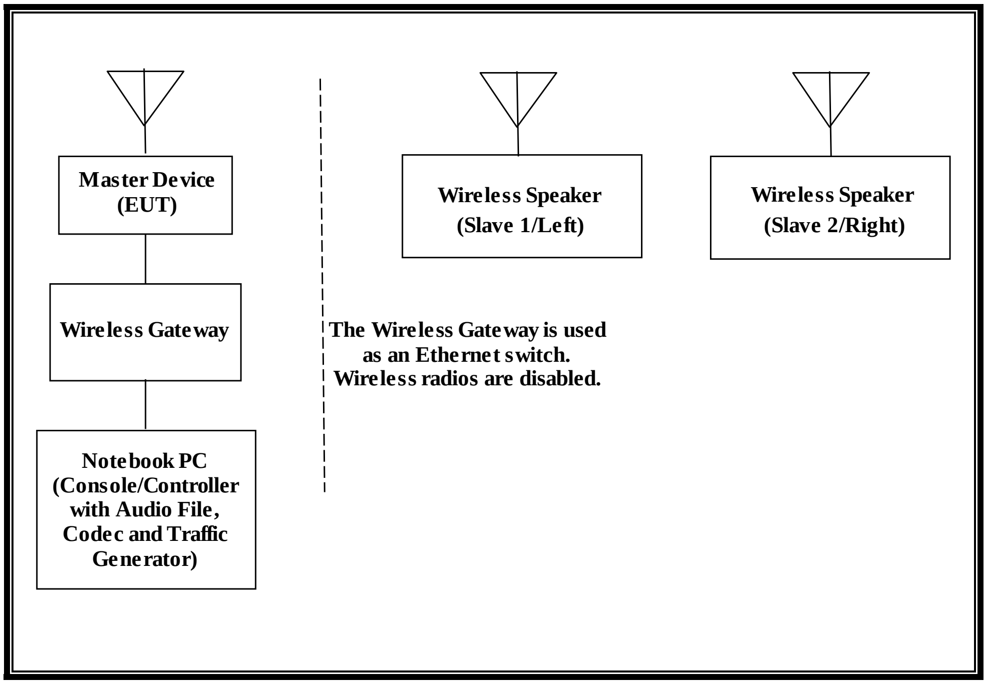
6.1.5. SETUP OF EUT

RADIATED METHOD EUT TEST SETUP



SUPPORT EQUIPMENT

The following support equipment was utilized for the tests documented in this report:

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Wireless Speaker (Slave 1/Left)	Sonos	Play: 1	1806W 78-28-CA-B4-FD-0A-G	SBVRM012
Wireless Speaker (Slave 2/Right)	Sonos	Play 1	1806W 78-28-CA-B4-FC-F0-7	SBVRM012
Notebook PC (EUT Console/Controller)	Lenovo	Type 20L8-S1GA00	PC1555EF 19/05	DoC
AC Adapter (Notebook PC)	Lenovo	ADLX65YDC2A	8SSA10M13944D1	DoC
Wireless Gateway	Cisco Meraki	Z3-HW	Q2TN-P2ZP-BF39	UDX-60053010
AC Adapter (Gateway)	Cisco	MA-PWR-	CR374Y727 53	DoC

6.1.6. DESCRIPTION OF EUT

For FCC the EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges.

For IC the EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges, excluding the 5600-5650 MHz range.

The EUT is a Master Device.

The highest power level within these bands is 24.8 dBm EIRP in the 5250-5350 MHz band and 24.84 dBm EIRP in the 5470-5725 MHz band.

The highest gain antenna assembly utilized with the EUT has a gain of 7.08 dBi in the 5250-5350 MHz band and 6.57 dBi in the 5470-5725 MHz band. The lowest gain antenna assembly utilized with the EUT has a gain of 1.9 dBi in the 5250-5350 MHz band and 1.9 dBi in the 5470-5725 MHz band.

Four antennas are utilized to meet the diversity and MIMO operational requirements.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is –64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is –64 + 1 = -63 dBm.

The calibrated radiated DFS Detection Threshold level is set to –64 dBm. The tested level is lower than the required level hence it provides a margin to the limit.

The EUT uses four transmitter/receiver chains, each connected to an antenna to perform radiated tests.

WLAN traffic is generated by streaming the audio test file “5_GHz_Audio_Test_File.WAV” from the Master to the Slave using a client provided proprietary media player. In addition, to meet the minimum loading requirements a data stream was transferred from the Master to the Slave using the client provided proprietary “ConTx” traffic generator.

TPC is not required since the maximum EIRP is less than 500 mW (27 dBm).

The EUT utilizes the 802.11a/n architecture. One nominal channel bandwidth, 20 MHz, is implemented.

The software used in the EUT during testing was Sonos Desktop Controller 11.0 Build 55070060audio_pipeline_20.

UNIFORM CHANNEL SPREADING

This function is not required per KDB 905462.

OVERVIEW OF MASTER DEVICE WITH RESPECT TO §15.407 (h) REQUIREMENTS

The Master Device is a Sonos wireless sound bar, FCC ID: SBVRM019. The minimum antenna gain for the Master Device is 1.9 dBi.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is –64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is –64 + 1 = -63 dBm.

The calibrated radiated DFS Detection Threshold level is set to –64 dBm. The tested level is lower than the required level hence it provides a margin to the limit.

The software installed in the Master Device is Sonos Desktop Controller 11.0 Build 55070060audio_pipeline_20.

6.2. RESULTS FOR 20 MHz BANDWIDTH

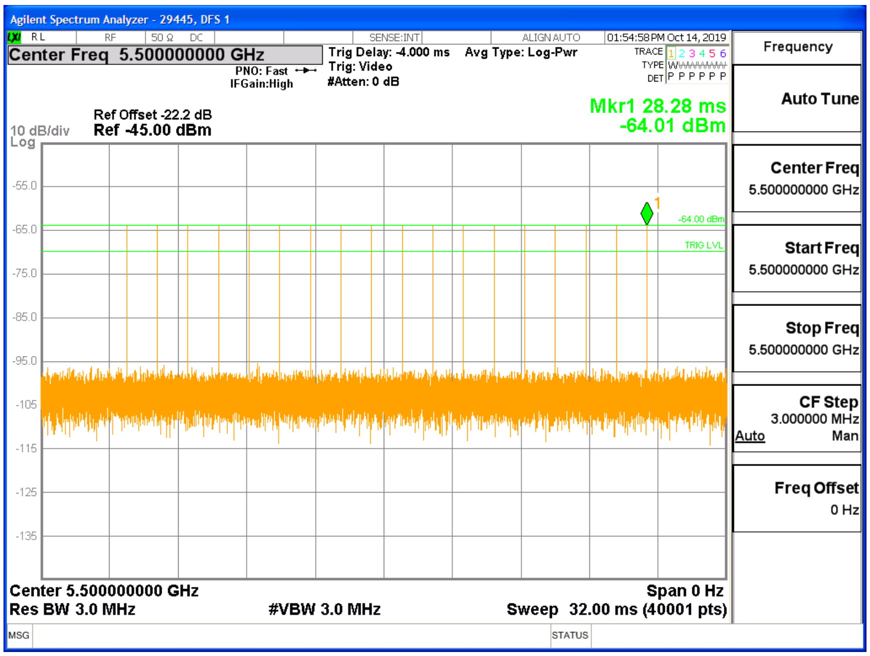
6.2.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5500 MHz.

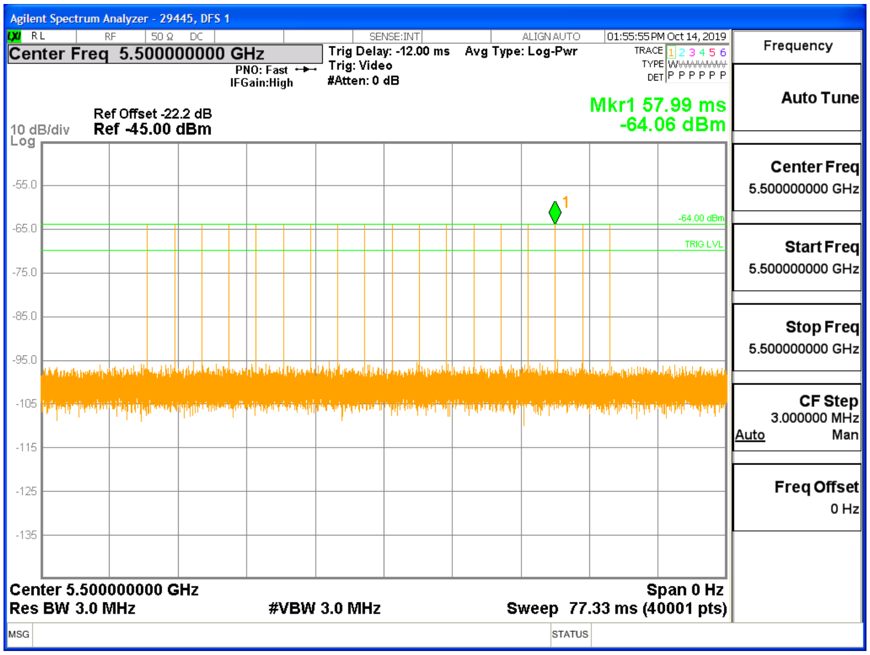
6.2.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

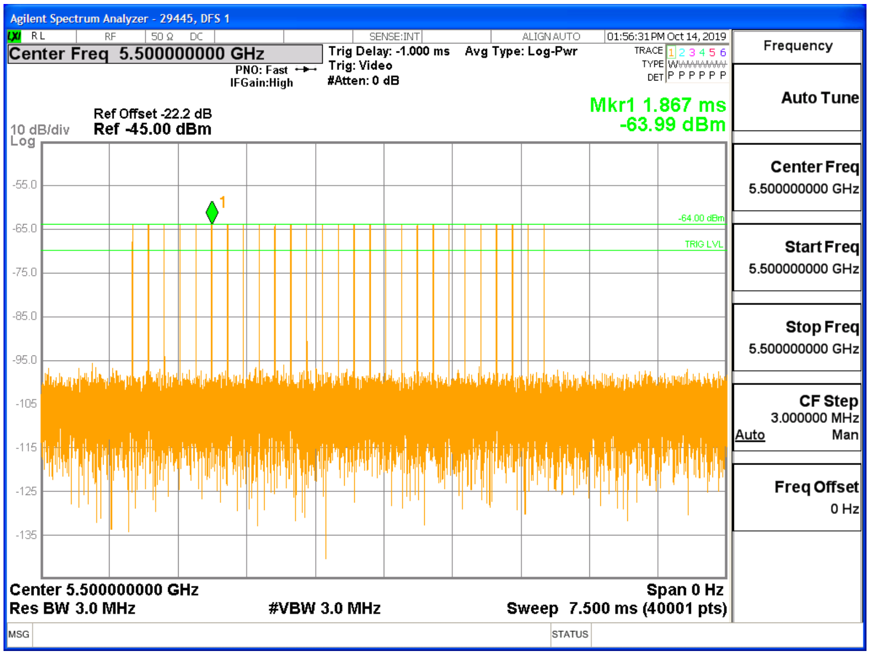
SHORT PULSE RADAR TYPE 0



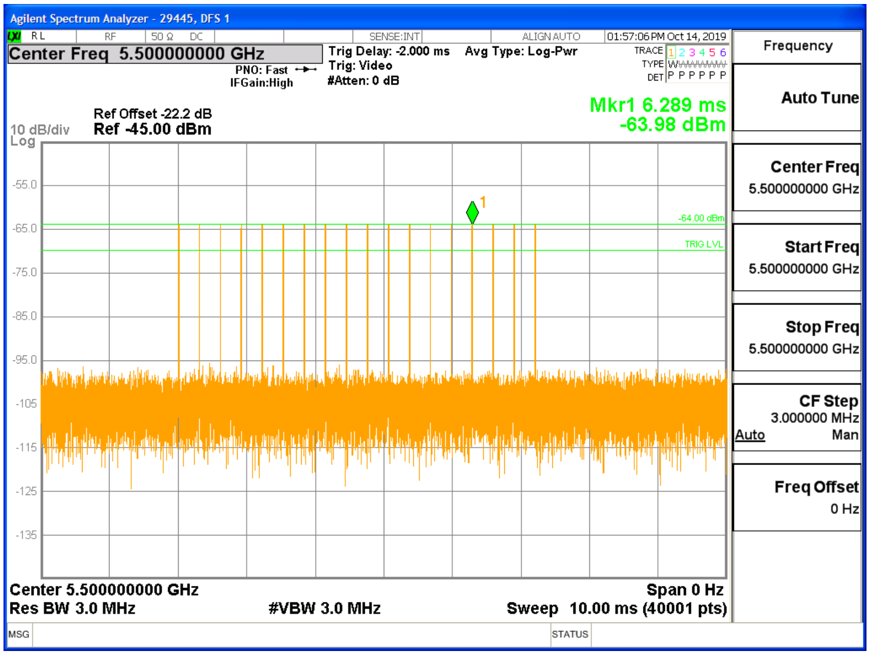
SAMPLE OF RADAR TYPE 1



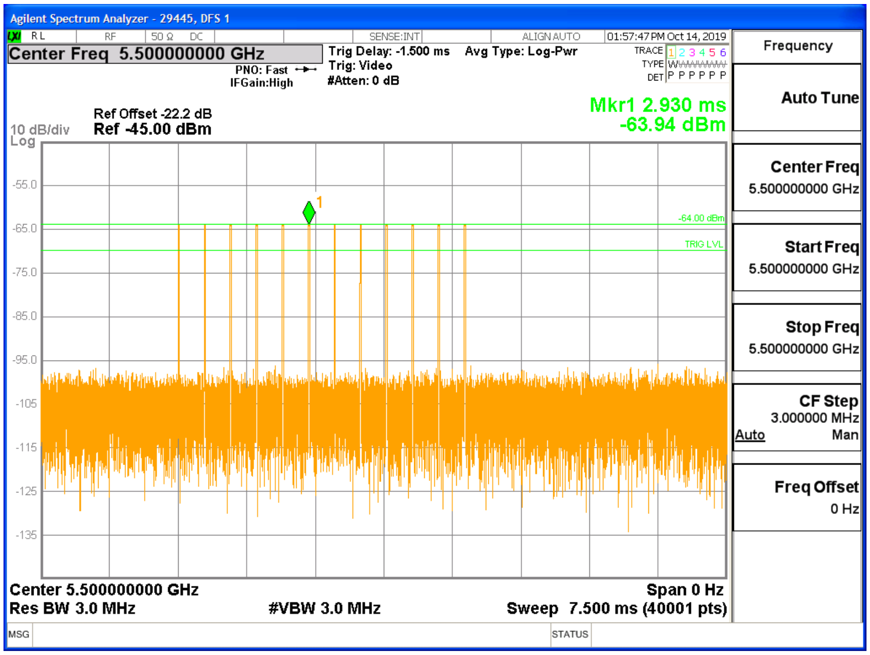
SAMPLE OF RADAR TYPE 2



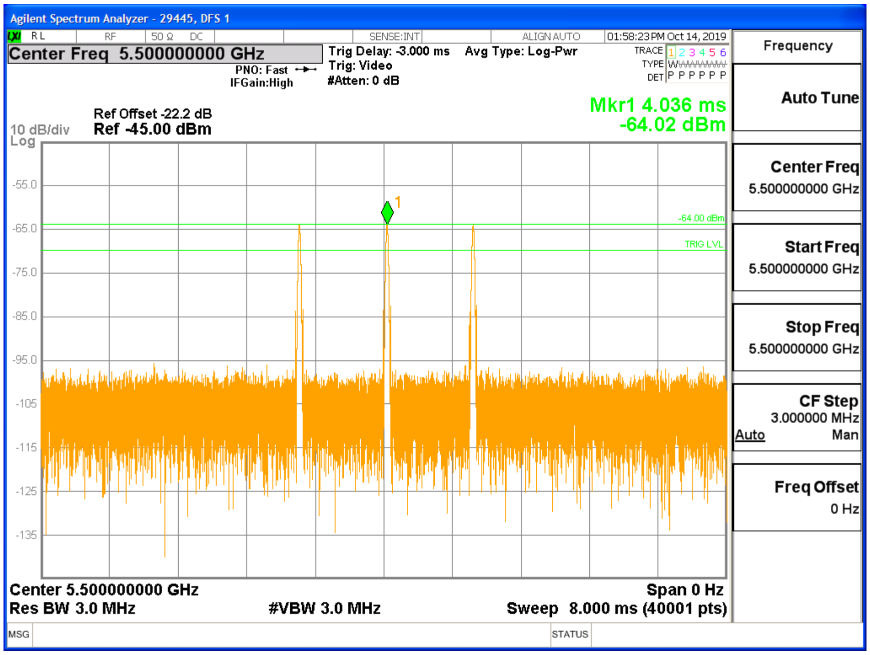
SAMPLE OF RADAR TYPE 3



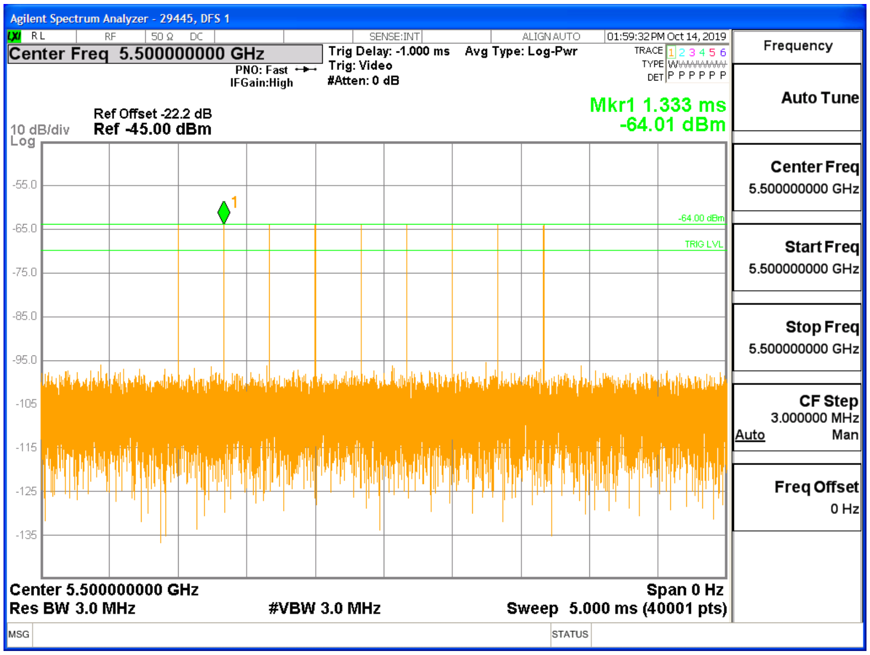
SAMPLE OF RADAR TYPE 4



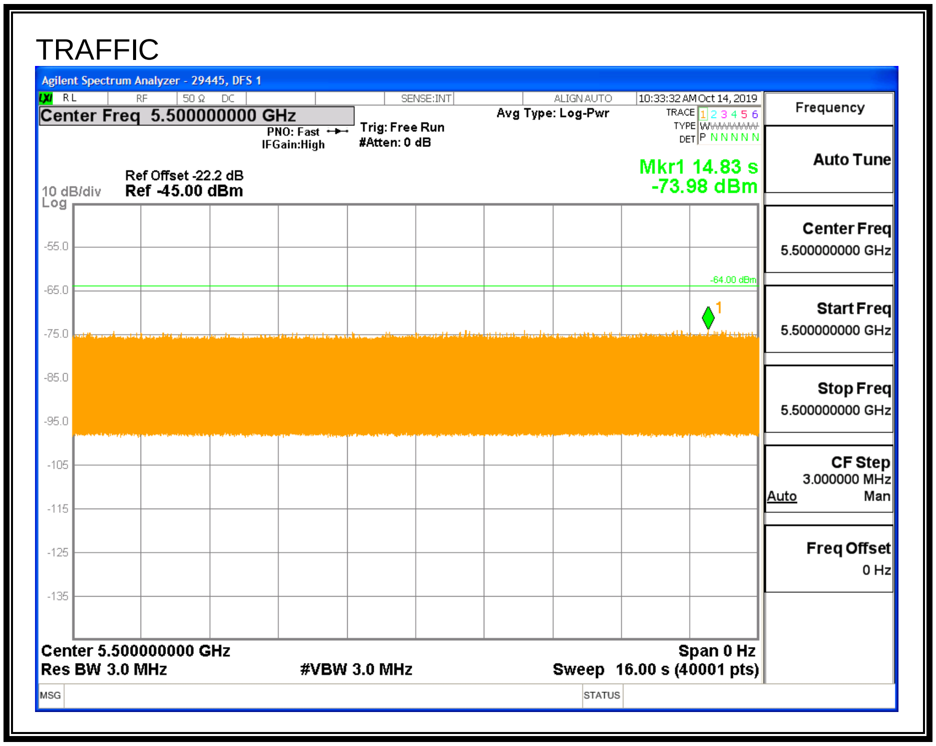
SAMPLE OF SINGLE BURST OF RADAR TYPE 5



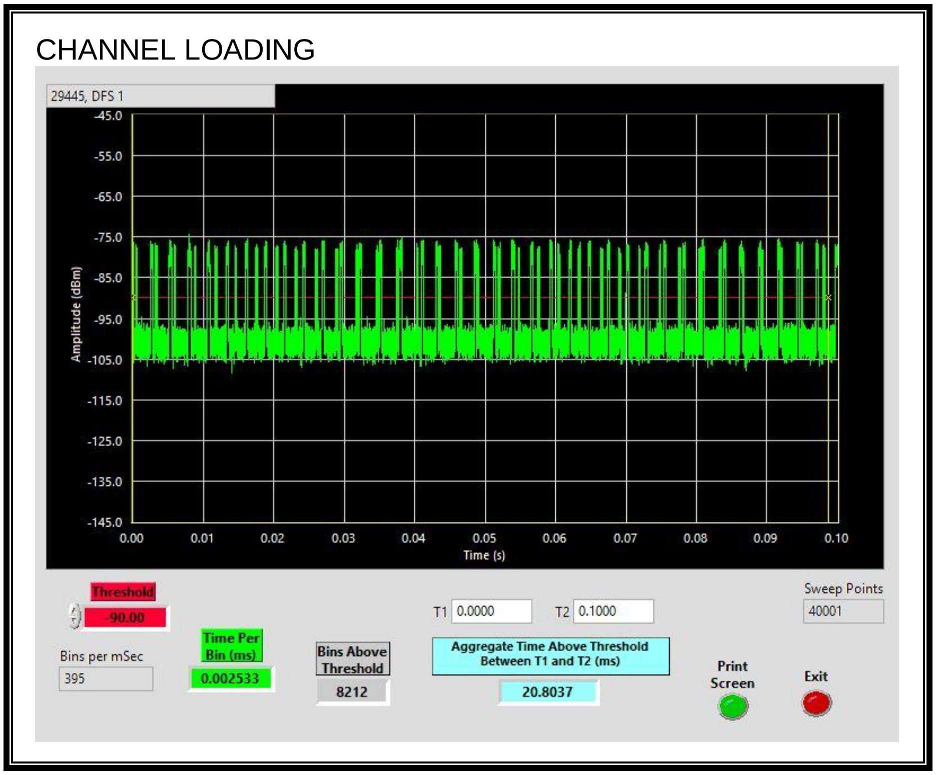
SINGLE BURST OF RADAR TYPE 6



TRAFFIC


TRAFFIC
Agilent Spectrum Analyzer - 29445, DFS 1
Center Freq 5.500000000 GHz
PNO: Fast
IFGain:High
Trig: Free Run
#Atten: 0 dB
Avg Type: Log-Pwr
10:33:32 AM Oct 14, 2019
Ref Offset -22.2 dB
10 dB/div Ref -45.00 dBm
Log
Mkr1 14.83 s
-73.98 dBm
-64.00 dBm
Center 5.500000000 GHz
Res BW 3.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 16.00 s (40001 pts)
Frequency
Auto Tune
Center Freq
5.500000000 GHz
Start Freq
5.500000000 GHz
Stop Freq
5.500000000 GHz
CF Step
3.000000 MHz
Auto
Man
Freq Offset
0 Hz

CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 20.8%

6.2.3. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

A link was established on a non-DFS channel then a software command was issued to the EUT. to change to the test channel. The time from the software command to the re-initialization of traffic was measured as the time required for the EUT to complete the CAC period.

PROCEDURE FOR TIMING OF RADAR BURST

A link was established on a non-DFS channel then a software command was issued to the EUT. to change to the test channel. A radar signal was triggered within 0 to 6 seconds after the beginning of the CAC period. Transmissions on the channel were monitored on the spectrum analyzer and a plot was captured

The Non-Occupancy list was cleared. A link was established on a non-DFS channel then a software command was issued to the EUT. to change to the test channel. A radar signal was triggered within 54 to 60 seconds after the beginning of the CAC period. Transmissions on the channel were monitored on the spectrum analyzer and a plot was captured

QUANTITATIVE RESULTS

No Radar Triggered

Timing of Software Command (sec)	Timing of Start of Traffic (sec)	Total CAC Period (sec)
0	60.12	60.12

Radar Near Beginning of CAC

Timing of Software Command (sec)	Timing of Radar Burst (sec)	Radar Relative to Beginning of CAC (sec)
0	1.088	1.088

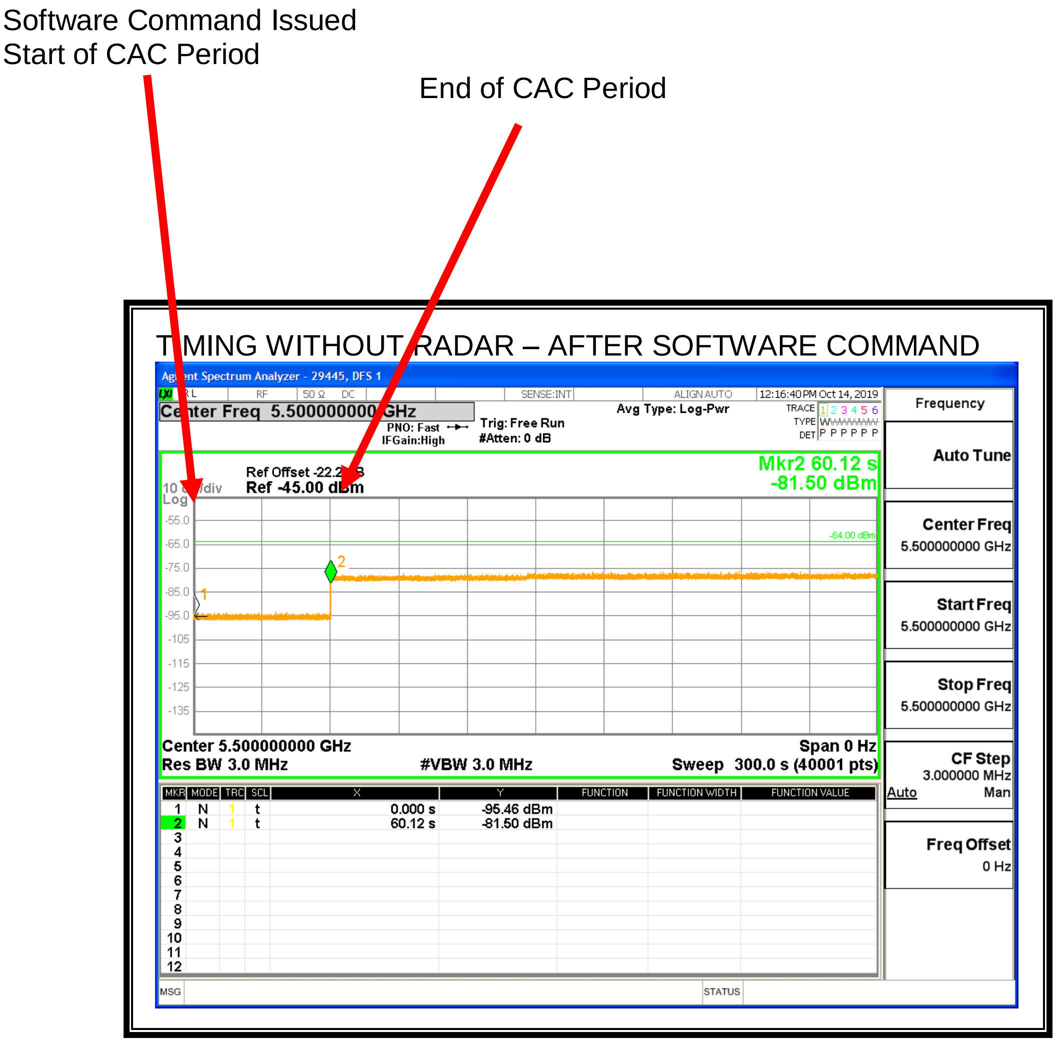
Radar Near End of CAC

Timing of Software Command (sec)	Timing of Radar Burst (sec)	Radar Relative to Beginning of CAC (sec)
0	58.29	58.29

QUALITATIVE RESULTS

Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within 54 to 60 second window	EUT indicates radar detected	No transmissions on channel

TIMING WITHOUT RADAR DURING CAC

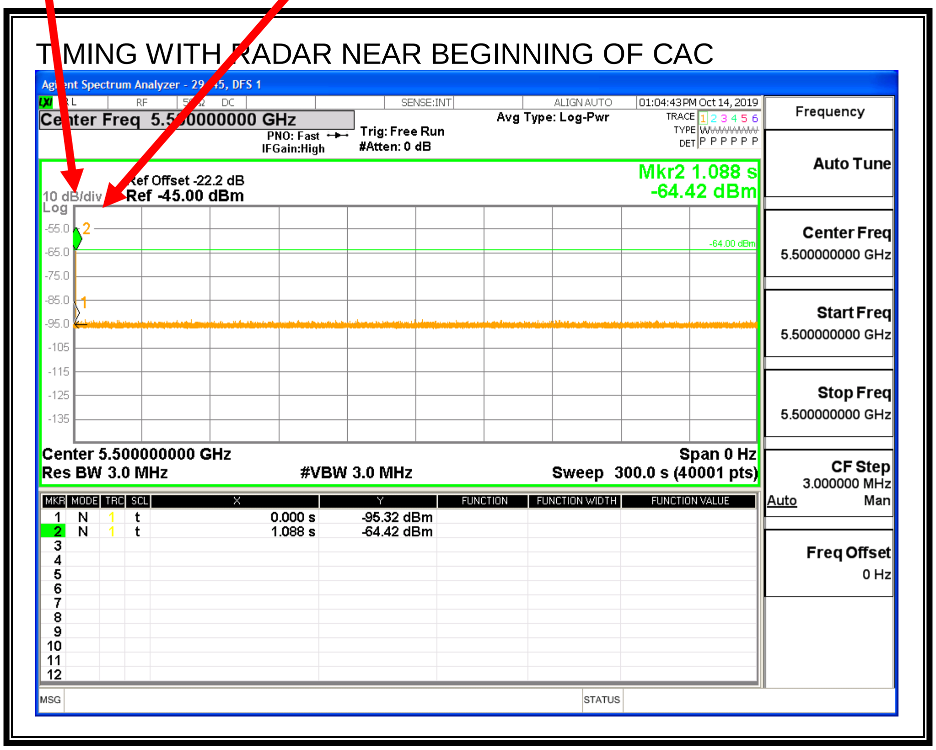


Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

TIMING WITH RADAR NEAR BEGINNING OF CAC

Software Command Issued
Start of CAC Period

Radar Signal Applied

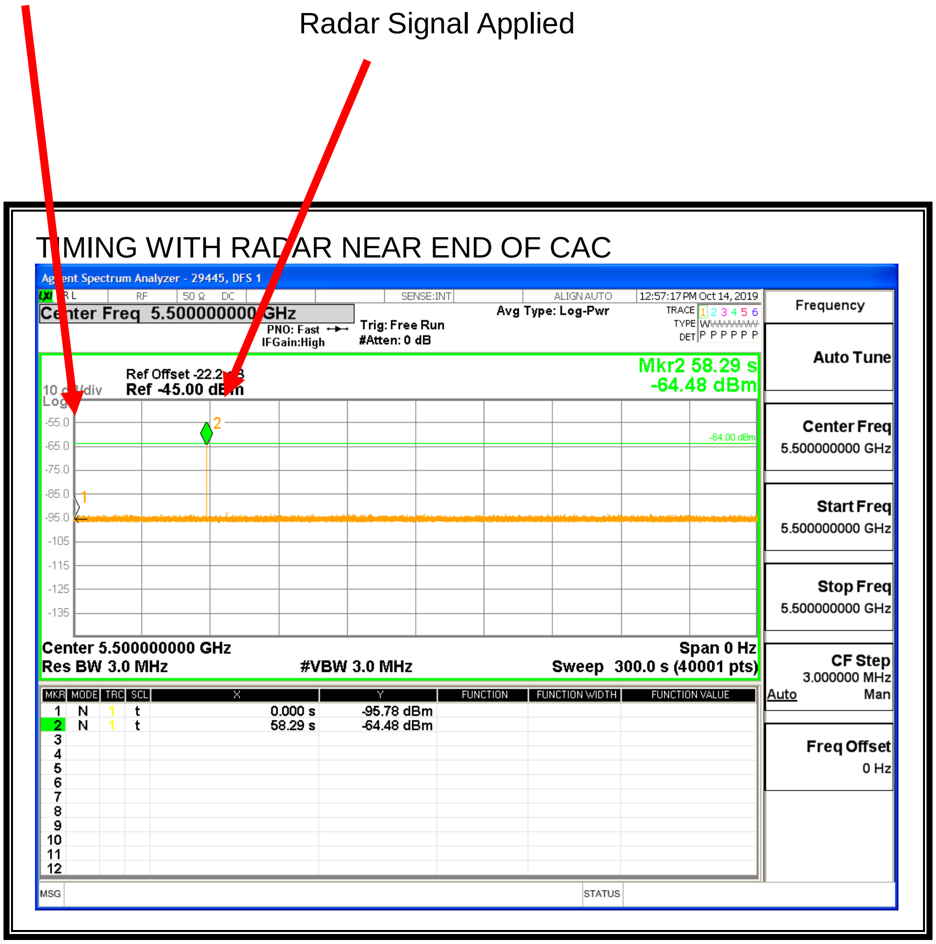


No EUT transmissions were observed after the radar signal.

TIMING WITH RADAR NEAR END OF CAC

Software Command Issued
Start of CAC Period

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

6.2.4. OVERLAPPING CHANNEL TESTS

RESULTS

The channel spacing is not less than the channel bandwidth therefore the EUT does not have an overlapping channel plan.

6.2.5. MOVE AND CLOSING TIME

REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =
(Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

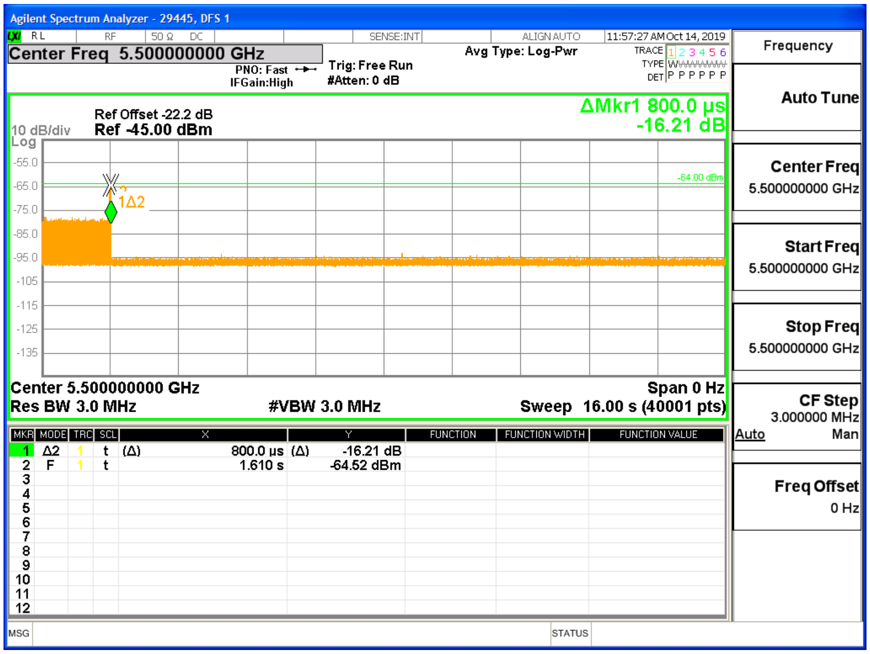
RESULTS

Channel Move Time (sec)	Limit (sec)
0.0008	10

Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
0	60

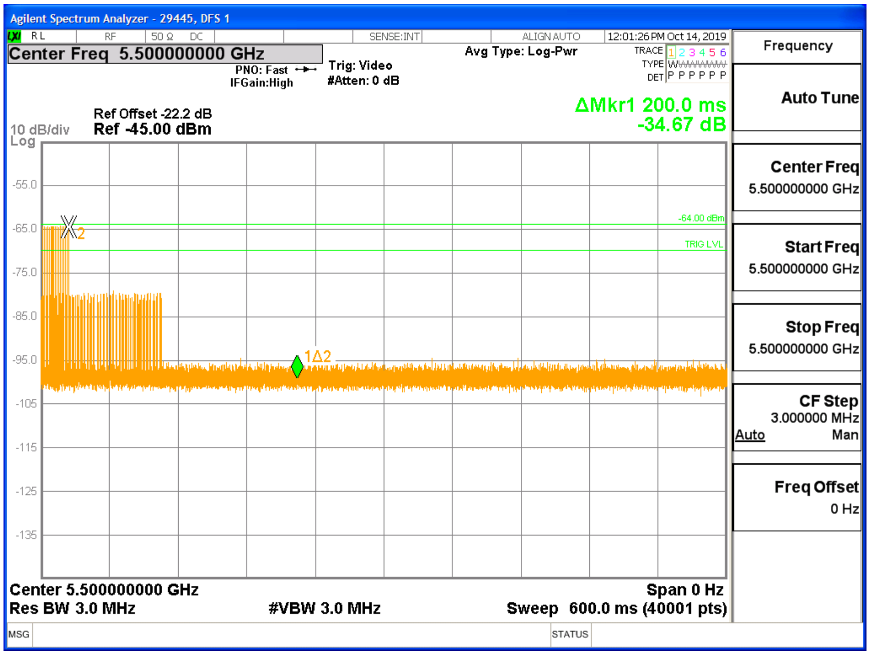
MOVE TIME

MOVE TIME



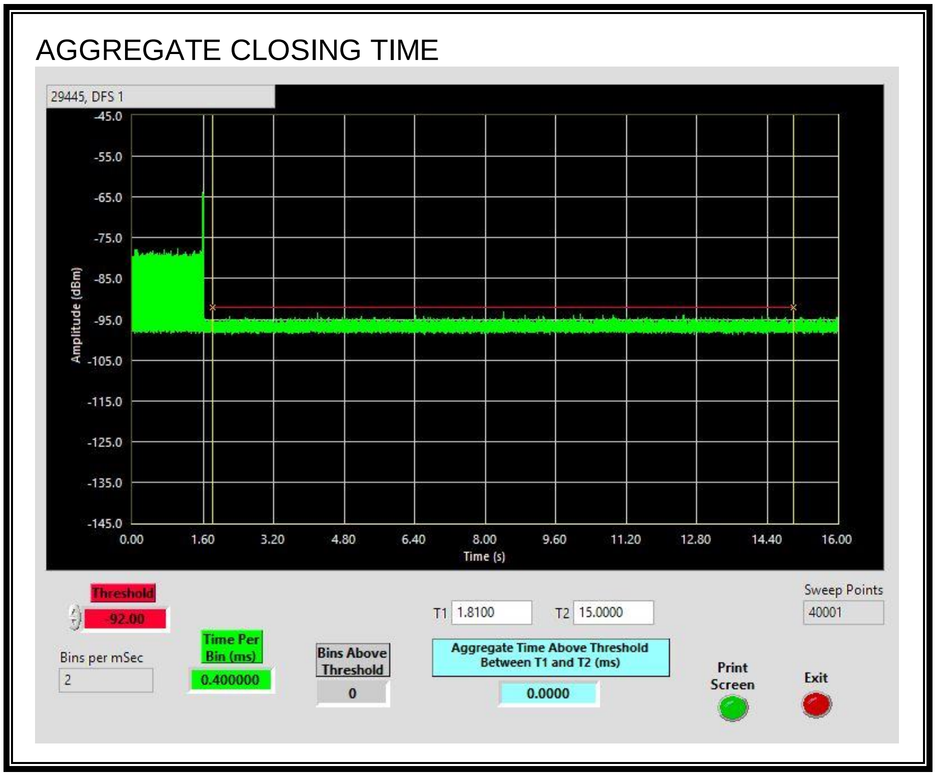
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

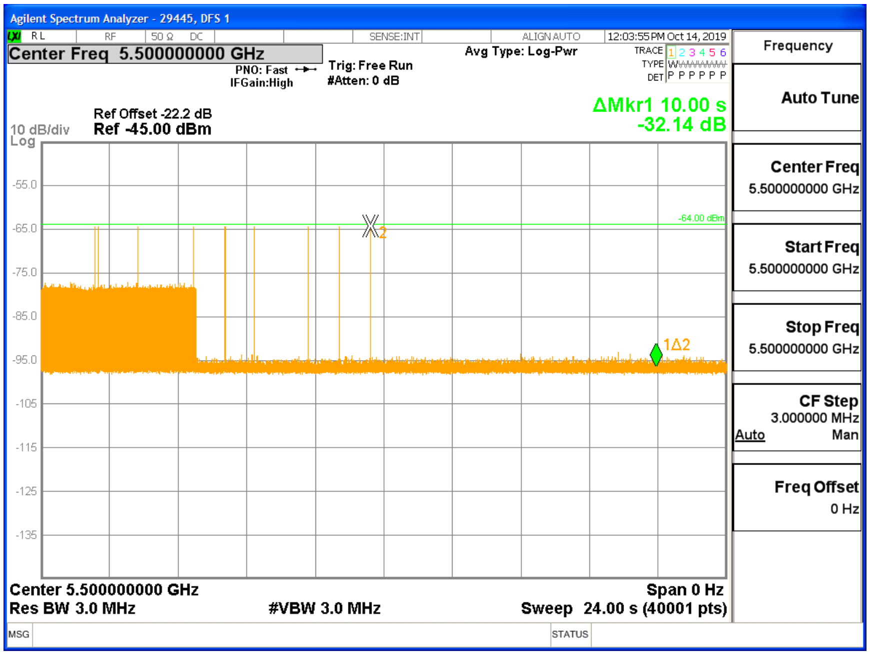
No transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR

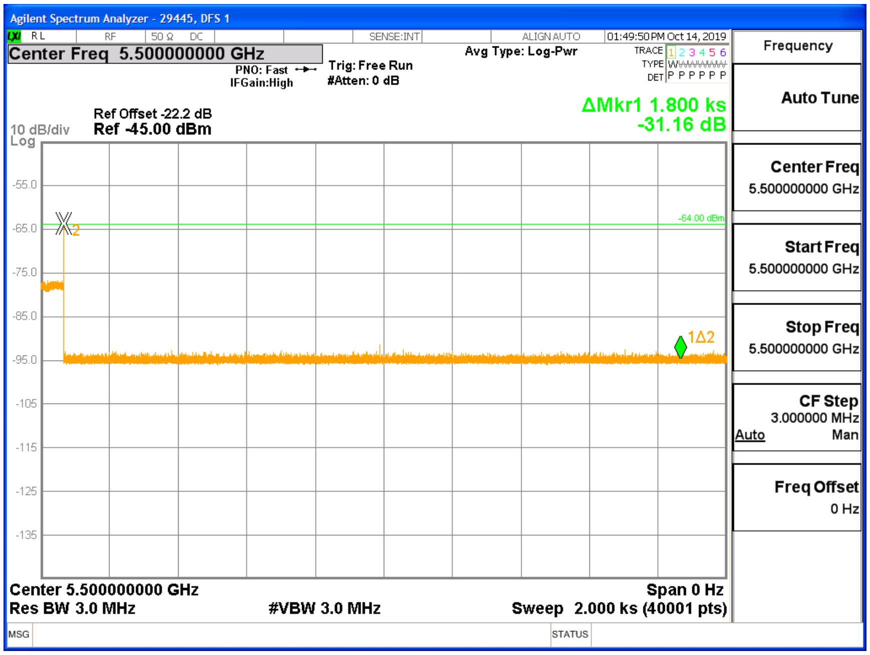


6.2.6. NON-OCCUPANCY PERIOD

RESULTS

No EUT transmissions were observed on the test channel during the 30-minute observation time.

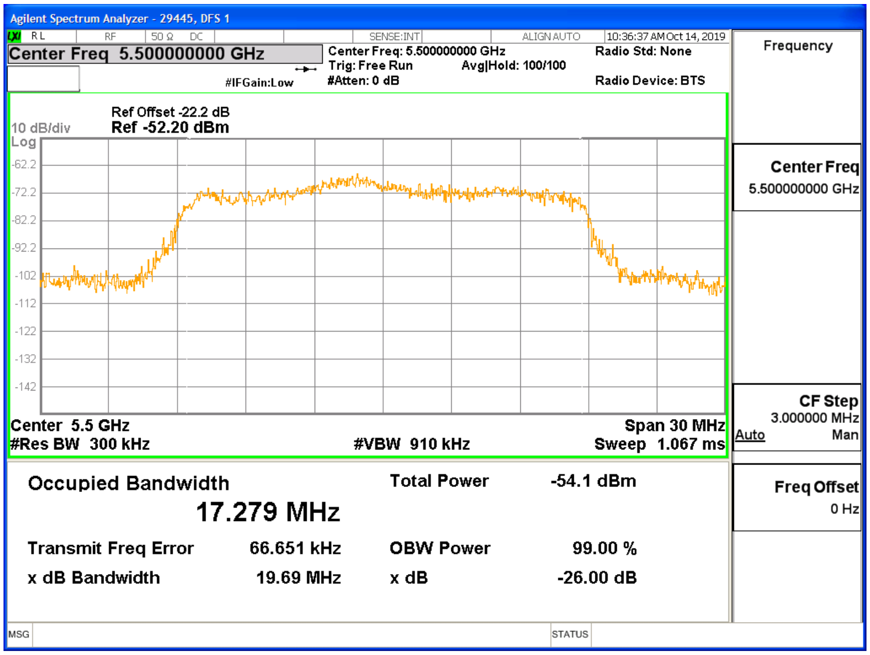
NON-OCCUPANCY PERIOD



6.2.7. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER BANDWIDTH

99% BANDWIDTH



RESULTS

F_L (MHz)	F_H (MHz)	Detection Bandwidth (MHz)	99% Power Bandwidth (MHz)	Ratio of Detection BW to 99% Power BW (%)	Minimum Limit (%)
5489	5511	22	17.279	127.3	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results			29445	DFS 1
FCC Type 0 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst				
Frequency (MHz)	**Number of Trials**	**Number Detected**	**Detection (%)**	**Mark**
5488	1	0	0	
5489	10	9	90	FL
5490	10	10	100	
5495	10	9	90	
5500	10	10	100	
5505	10	10	100	
5510	10	10	100	
5511	10	10	100	FH
5512	2	0	0	

6.2.8. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail	Detection Bandwidth FL	Detection Bandwidth FH	OBW	Test Location	Employee Number	In-Service Monitoring Version
FCC Short Pulse Type 1	30	100.00	60	Pass	5489	5511	17.28	DFS 1	29445	v4.1
FCC Short Pulse Type 2	30	100.00	60	Pass	5489	5511	17.28	DFS 1	29445	v4.1
FCC Short Pulse Type 3	30	100.00	60	Pass	5489	5511	17.28	DFS 1	29445	v4.1
FCC Short Pulse Type 4	30	96.67	60	Pass	5489	5511	17.28	DFS 1	29445	v4.1
Aggregate		99.17	80	Pass				DFS 1	29445	v4.1
FCC Long Pulse Type 5	30	86.67	80	Pass	5489	5511	17.28	DFS 1	29445	v4.1
FCC Hopping Type 6	46	100.00	70	Pass	5489	5511		DFS 1	29445	v4.1

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 1

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Test (A/B)	Frequency (MHz)	Successful Detection (Yes/No)
1001	1	3066	18	A	5501	Yes
1002	1	758	70	A	5508	Yes
1003	1	598	89	A	5507	Yes
1004	1	738	72	A	5504	Yes
1005	1	558	95	A	5508	Yes
1006	1	678	78	A	5508	Yes
1007	1	838	63	A	5509	Yes
1008	1	778	68	A	5493	Yes
1009	1	938	57	A	5491	Yes
1010	1	658	81	A	5507	Yes
1011	1	618	86	A	5496	Yes
1012	1	858	62	A	5501	Yes
1013	1	578	92	A	5499	Yes
1014	1	698	76	A	5501	Yes
1015	1	798	67	A	5490	Yes
1016	1	2192	25	B	5510	Yes
1017	1	1953	28	B	5501	Yes
1018	1	2038	26	B	5494	Yes
1019	1	1930	28	B	5490	Yes
1020	1	950	56	B	5492	Yes
1021	1	2324	23	B	5511	Yes
1022	1	1474	36	B	5489	Yes
1023	1	2977	18	B	5491	Yes
1024	1	2256	24	B	5507	Yes
1025	1	1341	40	B	5508	Yes
1026	1	2103	26	B	5508	Yes
1027	1	2671	20	B	5499	Yes
1028	1	1015	52	B	5505	Yes
1029	1	1712	31	B	5490	Yes
1030	1	1538	35	B	5500	Yes

TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
2001	4.1	173	27	5501	Yes
2002	1.9	164	28	5490	Yes
2003	4.3	188	23	5508	Yes
2004	2.2	227	24	5504	Yes
2005	4.8	216	23	5490	Yes
2006	3	178	25	5508	Yes
2007	1.9	172	24	5509	Yes
2008	4.4	219	23	5492	Yes
2009	1.4	179	23	5496	Yes
2010	2.2	192	29	5510	Yes
2011	1.6	156	25	5496	Yes
2012	2.5	173	25	5498	Yes
2013	2.1	222	26	5511	Yes
2014	1.4	206	25	5494	Yes
2015	3.3	221	27	5493	Yes
2016	2.8	166	23	5495	Yes
2017	2.8	228	25	5502	Yes
2018	4.7	220	26	5507	Yes
2019	3	162	28	5504	Yes
2020	5	201	29	5494	Yes
2021	3.5	191	28	5505	Yes
2022	3.9	153	23	5496	Yes
2023	4.7	227	29	5497	Yes
2024	3.1	193	28	5490	Yes
2025	2.3	153	27	5510	Yes
2026	5	166	26	5494	Yes
2027	4.4	211	23	5500	Yes
2028	3.9	201	24	5493	Yes
2029	1.6	169	28	5492	Yes
2030	2.8	152	24	5507	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3					
Waveform	**Pulse Width (us)**	**PRI (us)**	**Pulses Per Burst**	**Frequency (MHz)**	**Successful Detection (Yes/No)**
3001	9.7	306	18	5499	Yes
3002	9.2	267	17	5510	Yes
3003	7.3	327	18	5505	Yes
3004	7	301	18	5494	Yes
3005	9.4	256	16	5510	Yes
3006	7.3	494	16	5495	Yes
3007	8	462	16	5490	Yes
3008	6.2	344	17	5493	Yes
3009	7	325	16	5499	Yes
3010	9.5	353	16	5495	Yes
3011	8.7	346	16	5509	Yes
3012	7.3	387	18	5498	Yes
3013	6.7	275	17	5497	Yes
3014	9.8	329	18	5495	Yes
3015	9.4	364	17	5491	Yes
3016	6.5	430	18	5498	Yes
3017	8.4	477	17	5497	Yes
3018	7.9	439	16	5510	Yes
3019	6	499	18	5491	Yes
3020	9.8	473	17	5509	Yes
3021	8.1	428	18	5510	Yes
3022	6	415	18	5492	Yes
3023	6.7	383	18	5505	Yes
3024	9	265	16	5501	Yes
3025	9.8	496	18	5495	Yes
3026	8.2	273	18	5492	Yes
3027	7.4	267	16	5498	Yes
3028	8.2	308	16	5492	Yes
3029	9.5	447	16	5493	Yes
3030	8.5	250	17	5497	Yes

TYPE 4 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 4					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
4001	15.7	284	12	5505	Yes
4002	18.3	351	15	5503	Yes
4003	13.6	398	13	5505	Yes
4004	12.4	359	13	5501	Yes
4005	17.3	419	14	5506	Yes
4006	16.6	393	12	5510	Yes
4007	12.7	348	16	5505	Yes
4008	17.3	335	15	5507	Yes
4009	18.8	303	14	5495	Yes
4010	14.8	436	15	5499	Yes
4011	16.7	299	12	5497	Yes
4012	13.1	445	14	5499	Yes
4013	11.3	321	16	5491	Yes
4014	13	479	15	5496	Yes
4015	11.6	368	13	5490	Yes
4016	13.8	421	13	5502	No
4017	12.8	456	16	5503	Yes
4018	11.2	271	13	5501	Yes
4019	19.8	318	14	5509	Yes
4020	18.7	280	12	5506	Yes
4021	14.4	340	13	5492	Yes
4022	13.7	314	16	5509	Yes
4023	14.7	269	15	5506	Yes
4024	14.5	256	13	5495	Yes
4025	15.9	475	12	5501	Yes
4026	11.9	357	16	5494	Yes
4027	13.8	471	16	5499	Yes
4028	15.1	366	12	5506	Yes
4029	17.5	492	15	5507	Yes
4030	19.2	400	14	5508	Yes

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5		
Trial	**Frequency (MHz)**	**Successful Detection (Yes/No)**
1	5500	Yes
2	5500	Yes
3	5500	Yes
4	5500	Yes
5	5500	Yes
6	5500	Yes
7	5500	Yes
8	5500	Yes
9	5500	Yes
10	5500	Yes
11	5499	Yes
12	5495	Yes
13	5497	Yes
14	5499	Yes
15	5497	Yes
16	5498	Yes
17	5497	Yes
18	5499	Yes
19	5497	Yes
20	5495	Yes
21	5503	No
22	5505	Yes
23	5502	No
24	5505	Yes
25	5503	No
26	5505	Yes
27	5502	Yes
28	5505	Yes
29	5503	No
30	5505	Yes

Note: The Type 5 randomized parameters tested are shown in a separate document.

TYPE 6 DETECTION PROBABILITY

Data Sheet for FCC Hopping Radar Type 6				
1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop				
NTIA August 2005 Hopping Sequence				
Trial	Starting Index Within Sequence	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	547	5489	4	Yes
2	1022	5490	7	Yes
3	1497	5491	5	Yes
4	1972	5492	5	Yes
5	2447	5493	4	Yes
6	2922	5494	7	Yes
7	3397	5495	7	Yes
8	3872	5496	3	Yes
9	4347	5497	4	Yes
10	4822	5498	4	Yes
11	5297	5499	5	Yes
12	5772	5500	7	Yes
13	6247	5501	4	Yes
14	6722	5502	8	Yes
15	7197	5503	3	Yes
16	7672	5504	6	Yes
17	8147	5505	5	Yes
18	8622	5506	3	Yes
19	9097	5507	5	Yes
20	9572	5508	5	Yes
21	10047	5509	4	Yes
22	10522	5510	5	Yes
23	10997	5511	2	Yes
24	11472	5489	4	Yes
25	11947	5490	6	Yes

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TYPE 6 DETECTION PROBABILITY (CONT.)

Data Sheet for FCC Hopping Radar Type 6				
1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop				
NTIA August 2005 Hopping Sequence				
Trial	Starting Index Within Sequence	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
26	12422	5491	10	Yes
27	12897	5492	5	Yes
28	13372	5493	6	Yes
29	13847	5494	6	Yes
30	14322	5495	3	Yes
31	14797	5496	7	Yes
32	15272	5497	3	Yes
33	15747	5498	4	Yes
34	16222	5499	3	Yes
35	16697	5500	2	Yes
36	17172	5501	5	Yes
37	17647	5502	3	Yes
38	18122	5503	7	Yes
39	18597	5504	6	Yes
40	19072	5505	4	Yes
41	19547	5506	2	Yes
42	20022	5507	3	Yes
43	20497	5508	5	Yes
44	20972	5509	4	Yes
45	21447	5510	3	Yes
46	21922	5511	6	Yes

6.3. BRIDGE MODE RESULTS

Per KDB 905462, Section 5.1 (footnote 1):

Networks Access Points with Bridge and/or MESH modes of operation are permitted to operate in the DFS bands but must employ a DFS function. The functionality of the Bridge mode as specified in §15.403(a) must be validated in the DFS test report. Devices operating as relays must also employ DFS function. The method used to validate the functionality must be documented and validation data must be documented. Bridge mode can be validated by performing a test statistical performance check (Section 7.8.4) on any one of the radar types. This is an abbreviated test to verify DFS functionality. MESH mode operational methodology must be submitted in the application for certification for evaluation by the FCC.

This device does not support Bridge Mode therefore this test was not performed.