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

CERTIFICATION TEST REPORT

FOR

WIRELESS SMART SPEAKER

MODEL NUMBER: S36

FCC ID: SBVRM036
ISED ID: 5373A-RM036

REPORT NUMBER: R13687586-D1

ISSUE DATE: 2021-11-17

Prepared for
SONOS
614 CHAPALA STREET
SANTA BARBARA
CA, 93101, USA

Prepared by
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ACCREDITED
CERT #0751.06

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2021-05-28	Initial Issue	Samuel Bryson
V2	2021-11-17	Revised firmware version in section 7.1.6	Brian T. Kiewra
V3	2022-02-07	Removed Photos, Fixed Radar Plots	Samuel Bryson

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Sonos
614 Chapala Street
Santa Barbara
CA, 93101, USA

EUT DESCRIPTION: Wireless Smart Speaker

MODEL: S36

SERIAL NUMBER: F0-F6-C1-10-07-24:E

DATE TESTED: 2021-05-10 TO 2021-05-11

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

UL LLC 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.

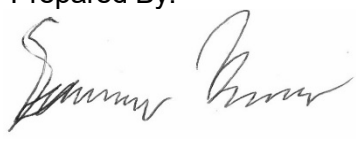
The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. 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 LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC 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 A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For
UL LLC By:

Edgard Rincand
Operations Leader
CONSUMER TECHNOLOGY DIVISION
UL Verification Services Inc.

Prepared By:



Samuel Bryson
Laboratory Technician
CONSUMER TECHNOLOGY DIVISION
UL LLC

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 KDB 789033, KDB 905462 D02 and D03 and RSS-247 Issue 2.

3. SUMMARY OF TEST RESULTS

Requirement Description	Result	Remarks
DFS Portion of FCC 47 CFR PART 15 SUBPART E	Complies	
DFS Portion of ISED CANADA RSS-247 ISSUE 2	Complies	

4. REFERENCE DOCUMENTS

Measurements of transmitter parameters as referenced in this report and all other manufacturer's declarations relevant to the RF test requirements are documented in UL LLC report number R13687586-E3.

This report contains data provided by the customer which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

5. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 2800 Suite B, Perimeter Park Dr., Morrisville, NC 27560.

UL LLC is accredited A2LA, certification # 0751.06, for all testing performed within the scope of this report.

6. DECISION RULES AND MEASUREMENT UNCERTAINTY

6.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

6.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement).

7. DYNAMIC FREQUENCY SELECTION

7.1. OVERVIEW

7.1.1. LIMITS

INNOVATION, SCIENCE and ECONOMIC DEVELOPMENT CANADA (ISED)

ISED 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”.

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

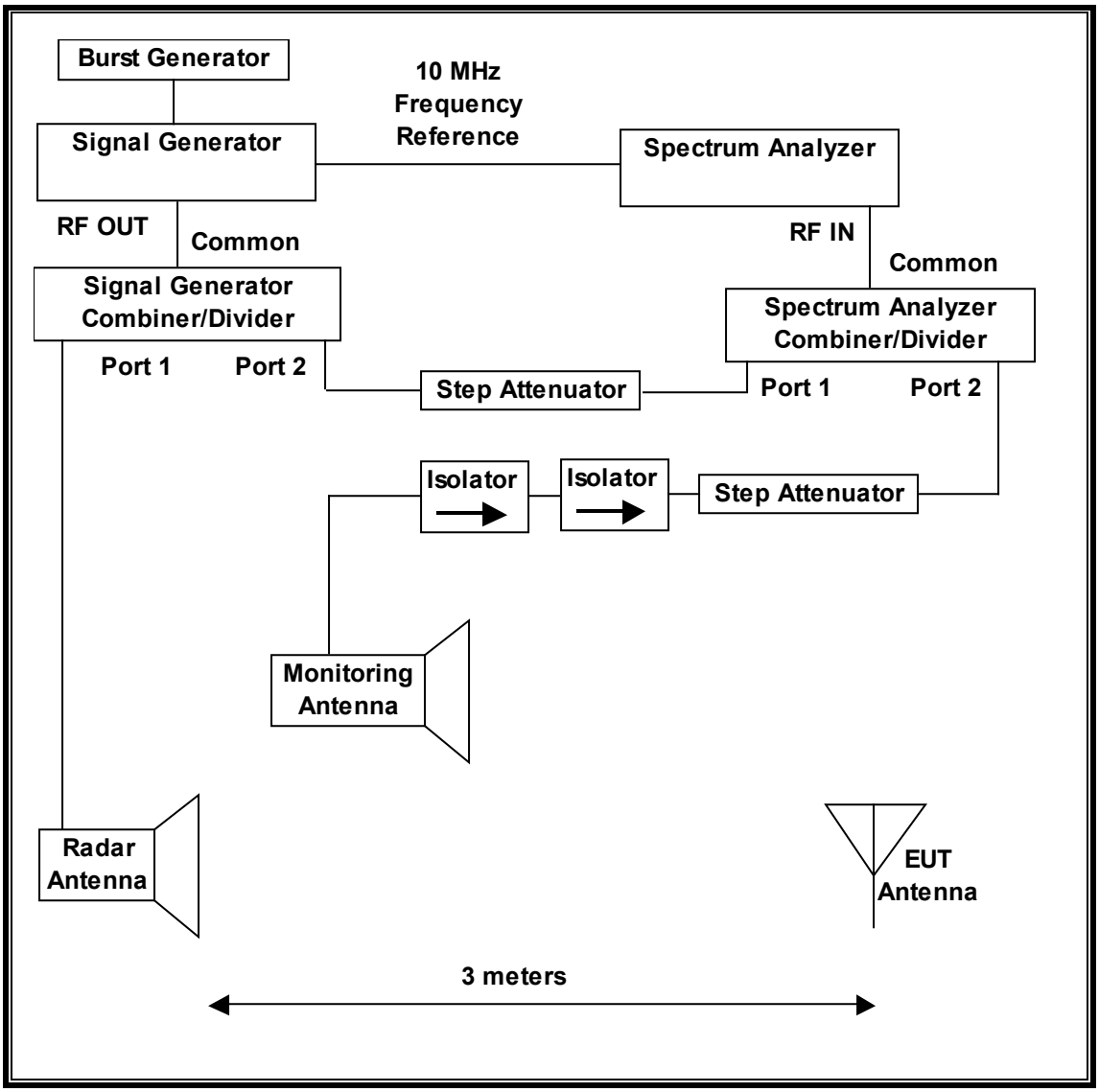
Radar Waveform Type	Pulse Width (μsec)	Chirp Width (MHz)	PRI (μsec)	Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

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

7.1.2. 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.

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. For master testing, WLAN Traffic that meets or exceeds the minimum channel loading requirement is attained by streaming the FCC audio test file and client provided proprietary traffic generation software, “Cont Tx”, from the Master device to the Slave device. For slave testing, WLAN Traffic is attained by streaming the FCC audio test file from the Support Device to the Master Device on the 2.4GHz band and to the EUT on the 5GHz Band.

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 DFS tests documented in this report:

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**ID No.**	**Cal Due**
Spectrum Analyzer, PXA, 3Hz to 8.4GHz	Keysight	N9030A	SA0021	05/27/21
Signal Generator, MXG X-Series RF Vector	Agilent	N5182B	SIG003	04/06/22
Arbitrary Waveform Generator	Agilent	33220A	FG0107	08/20/21

7.1.3. 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	In-Service Monitoring (Probability of Detection)
PXA Read	3.1	Signal Generator Screen Capture
SGXProject.exe	1.7	Radar Waveform Generation and Download

7.1.4. TEST ROOM ENVIRONMENT

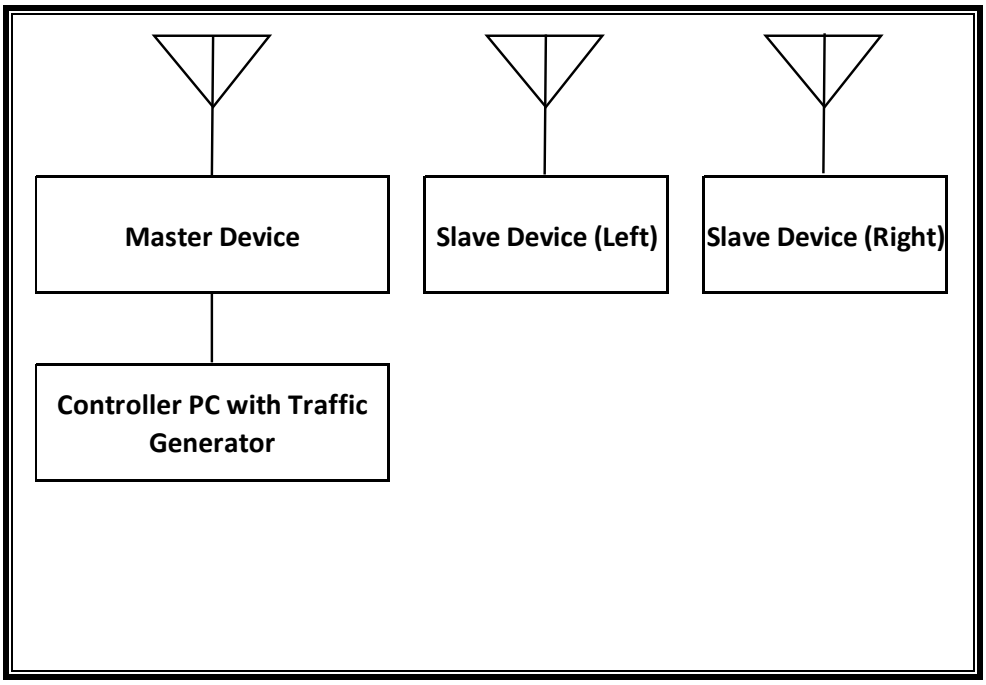
The test room temperature and humidity shall be maintained within normal temperature of 15~35 °C and normal humidity 20~75% (relative humidity).

ENVIRONMENT CONDITION

Parameter	Value
Temperature	23.8 to 24.3 °C
Humidity	33.0 to 52.0 %

7.1.5. 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**
Client/Satellite/Support	Sonos	S13	78-28-CA-C2-94-56:1	
Client/Satellite/Support	Sonos	S12	94-9F-3E-8B-9D-5E:A	
Sonos "S36" Test PC #1	Lenovo	T480S Think Pad	PC1555EN	N/A
Test PC #1 PS	Lenovo	ADLX65YLC2A	N/A	N/A

7.1.6. DESCRIPTION OF EUT

For FCC and ISED 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 25.96 dBm EIRP in the 5250-5350 MHz band and 24.99 dBm EIRP in the 5470-5725 MHz band.

The antenna(s) gain and type, ‘as provided by the manufacturer’ are as follows:

The highest gain antenna assembly utilized with the EUT has a gain of 4.8 dBi in the 5250-5350 MHz band and 5.1 dBi in the 5470-5725 MHz band. The lowest gain antenna assembly utilized with the EUT has a gain of 4.3 dBi in the 5250-5350 MHz band and 4.3 dBi in the 5470-5725 MHz band.

Two 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 two transmitter/receiver chains, each connected to an antenna to perform radiated tests.

The Slave device associated with the EUT during these tests does not have radar detection capability.

WLAN traffic that meets or exceeds the minimum required channel loading requirement is attained by streaming the FCC audio test file and client provided proprietary traffic generation software, “Cont Tx”, from the Master device to the Slave device.

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.

Channel puncturing is not supported.

The firmware installed in the EUT is Sonos S2 Version 13.1.

UNIFORM CHANNEL SPREADING

This function is not required per KDB 905462 for Master devices.

This is requirement not applicable to Slave Devices.

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

The Master Device is a Sonos S36, FCC ID: SBVRM036. The minimum antenna gain for the Master Device is 3.7 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 access point is Version 13.3 (build 65116140mailine_integ).

7.2. RESULTS FOR 20 MHz BANDWIDTH

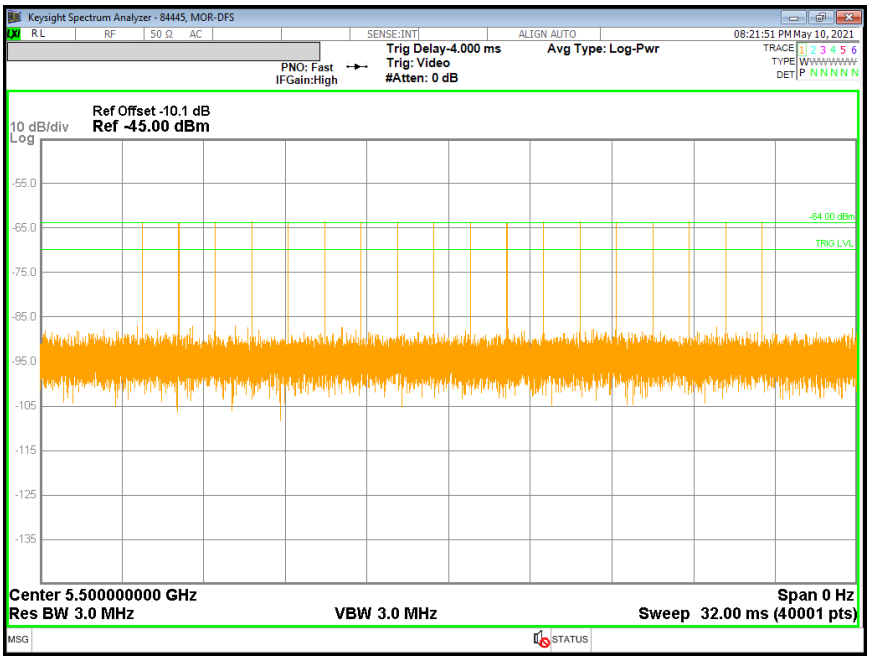
7.2.1. TEST CHANNEL

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

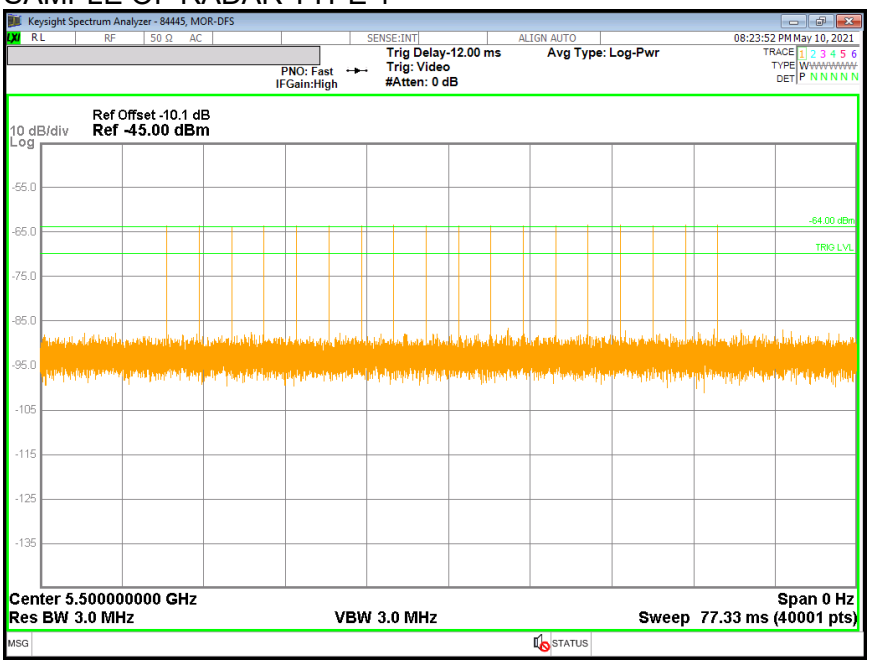
7.2.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

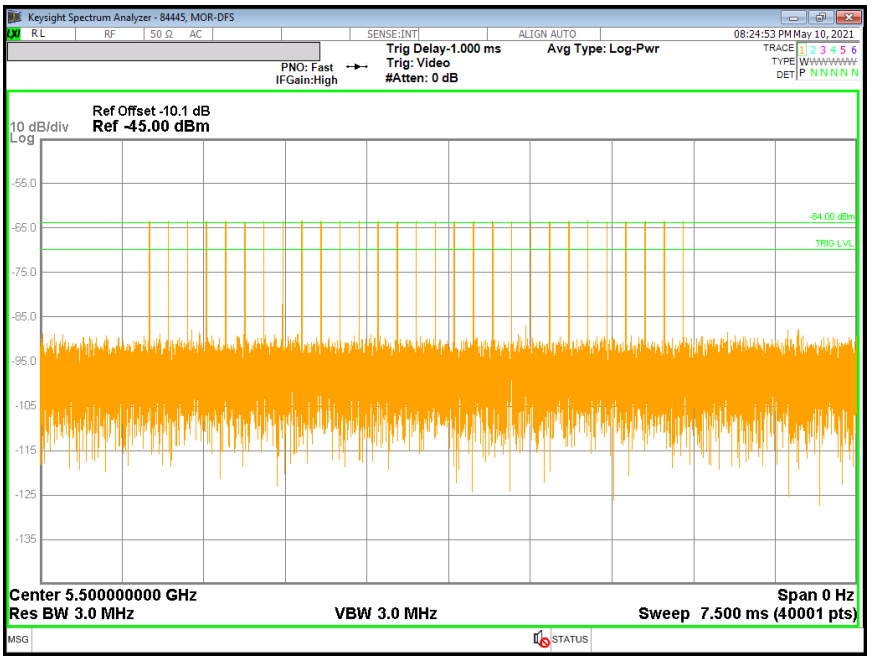
SHORT PULSE RADAR TYPE 0



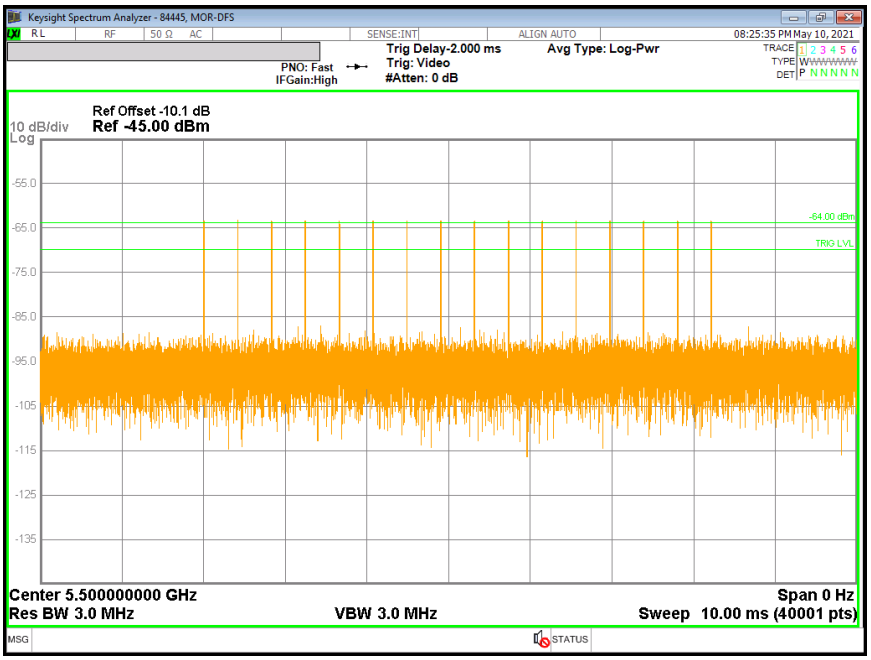
SAMPLE OF RADAR TYPE 1



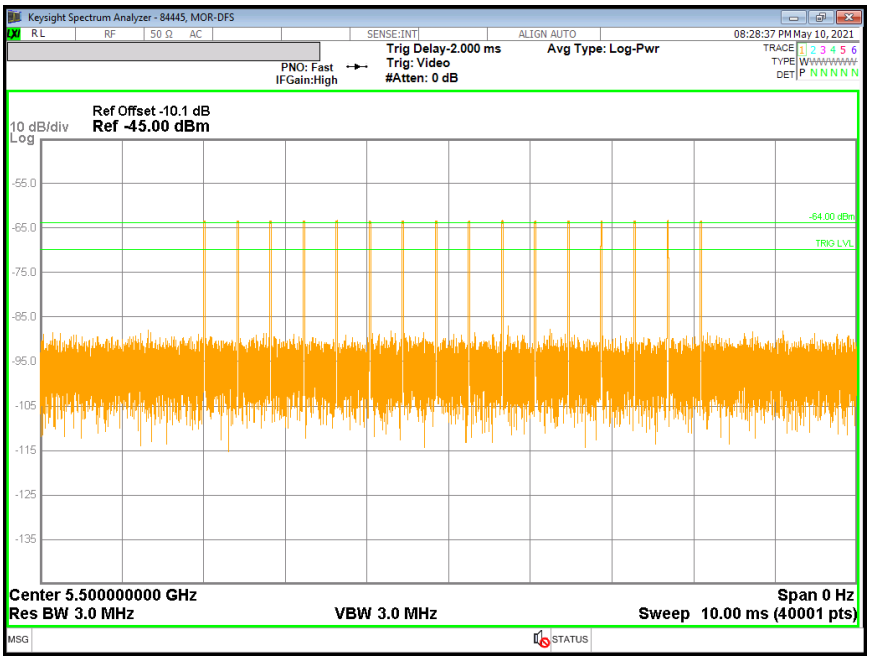
SAMPLE OF RADAR TYPE 2



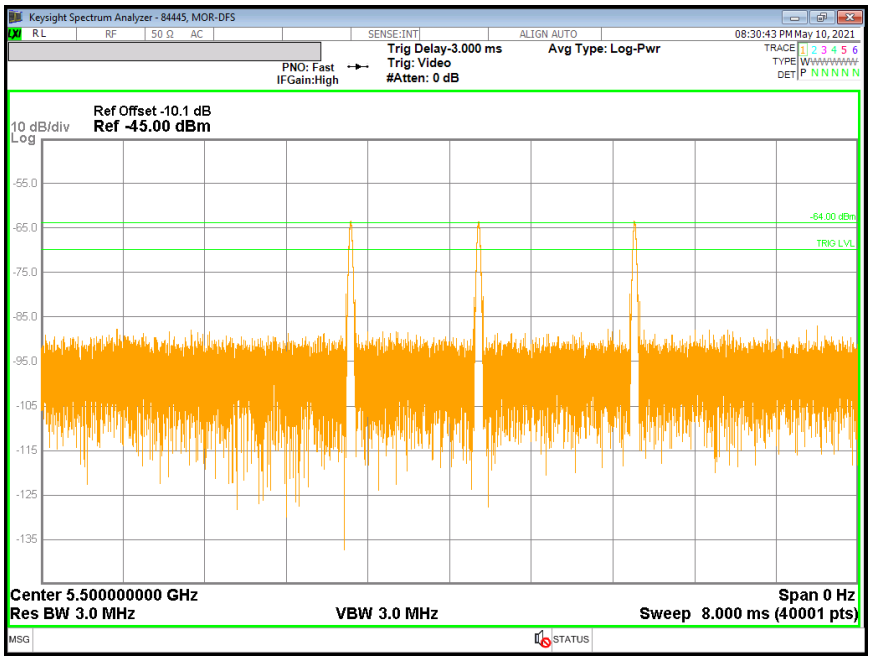
SAMPLE OF RADAR TYPE 3



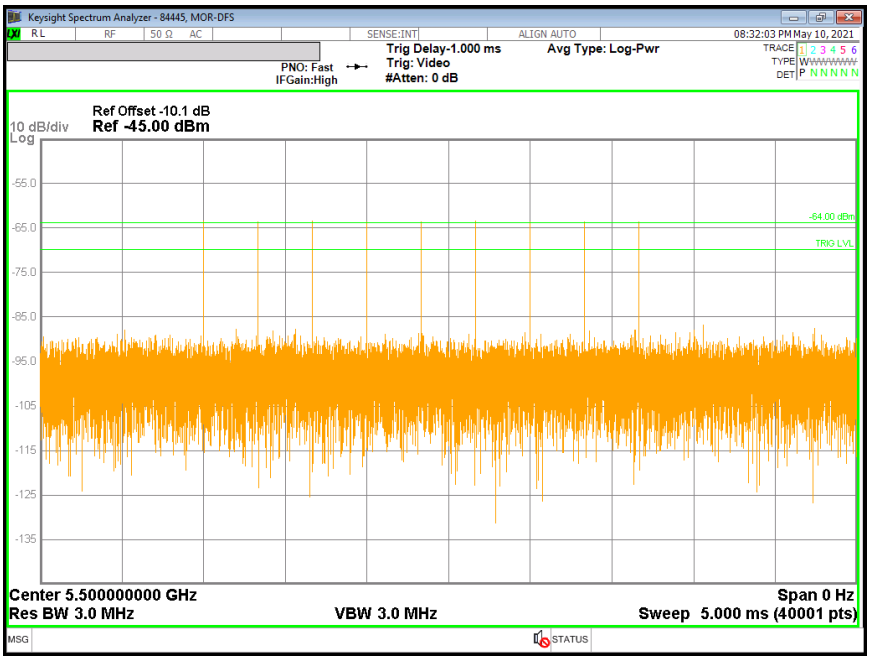
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

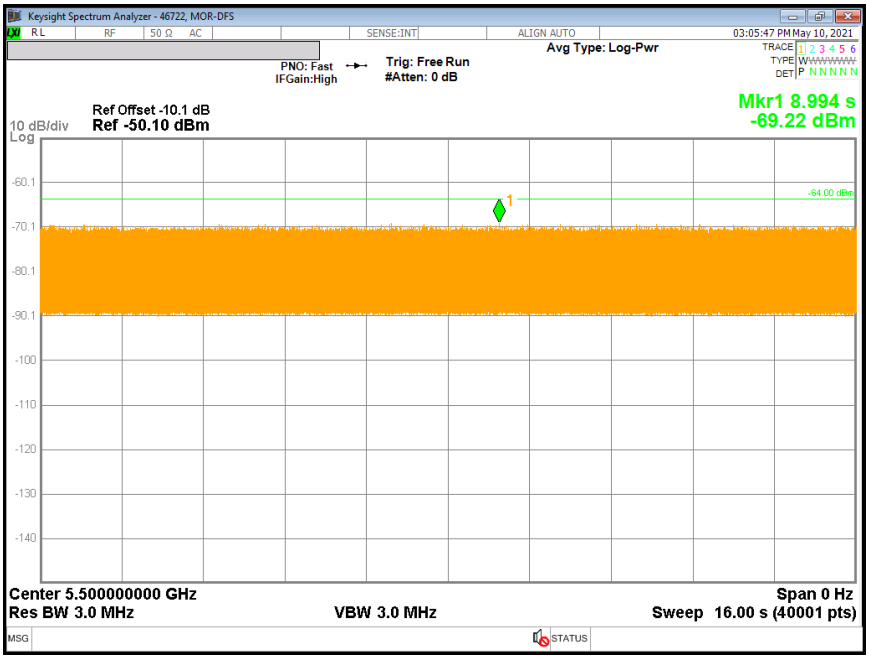


SINGLE BURST OF RADAR TYPE 6

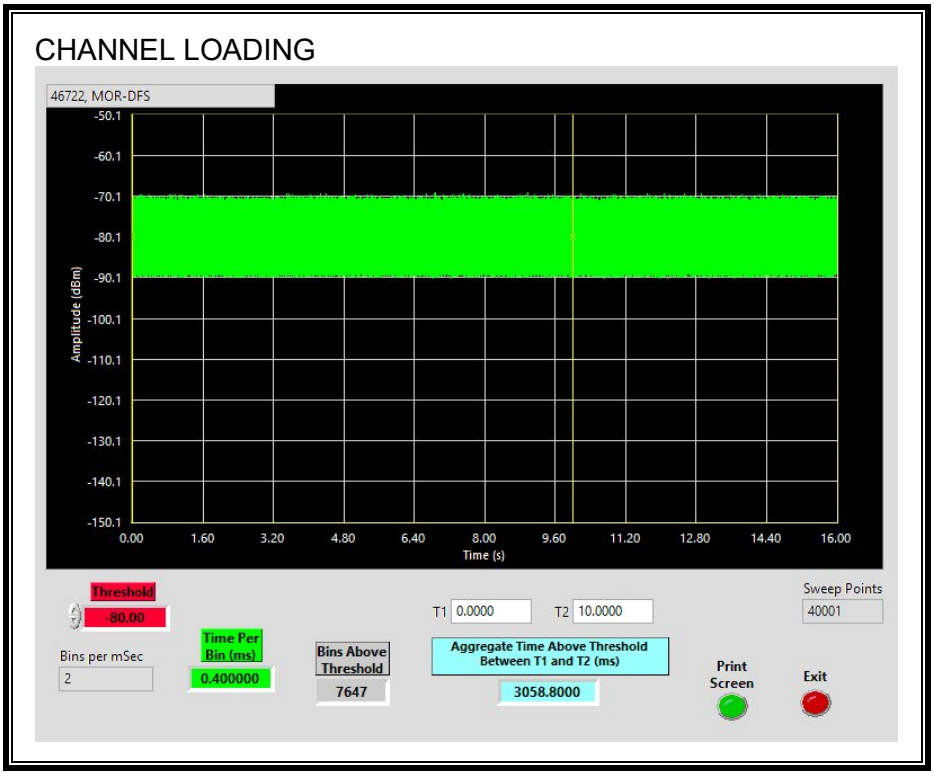


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 30.59%

7.2.3. 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 Reboot (sec)	Timing of Start of Traffic (sec)	Total Power-up Cycle Time (sec)	Initial Power-up Cycle Time (sec)
0	60.4	60.4	0.4

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
0	1.155	1.2	0.8

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
0	58.49	58.5	58.1

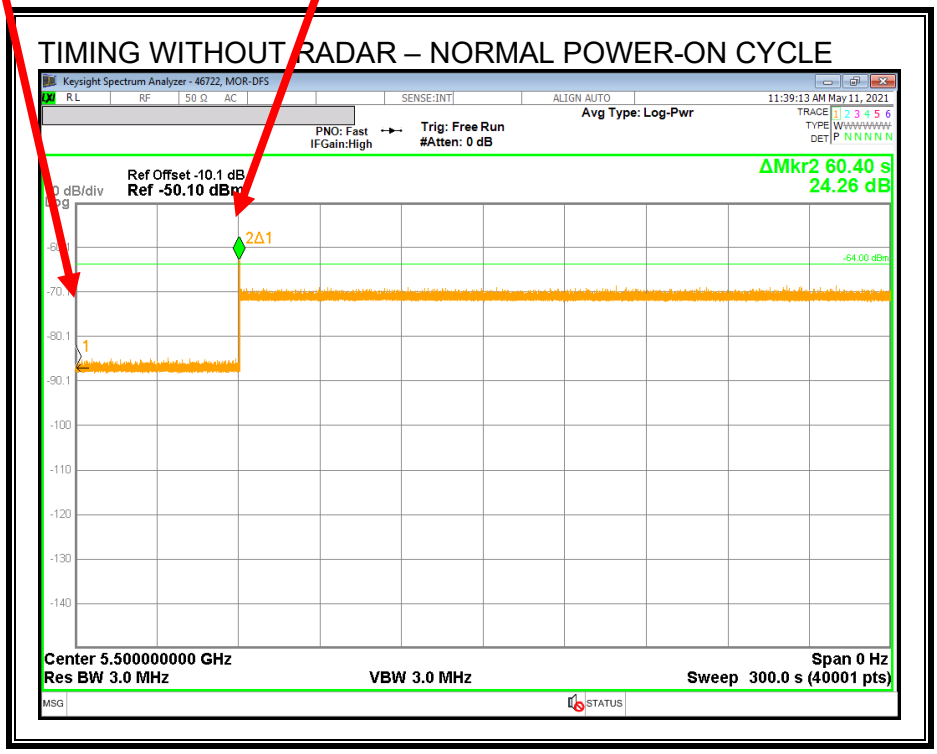
QUALITATIVE RESULTS

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

Software Command Issued
Start of CAC

End of CAC Period

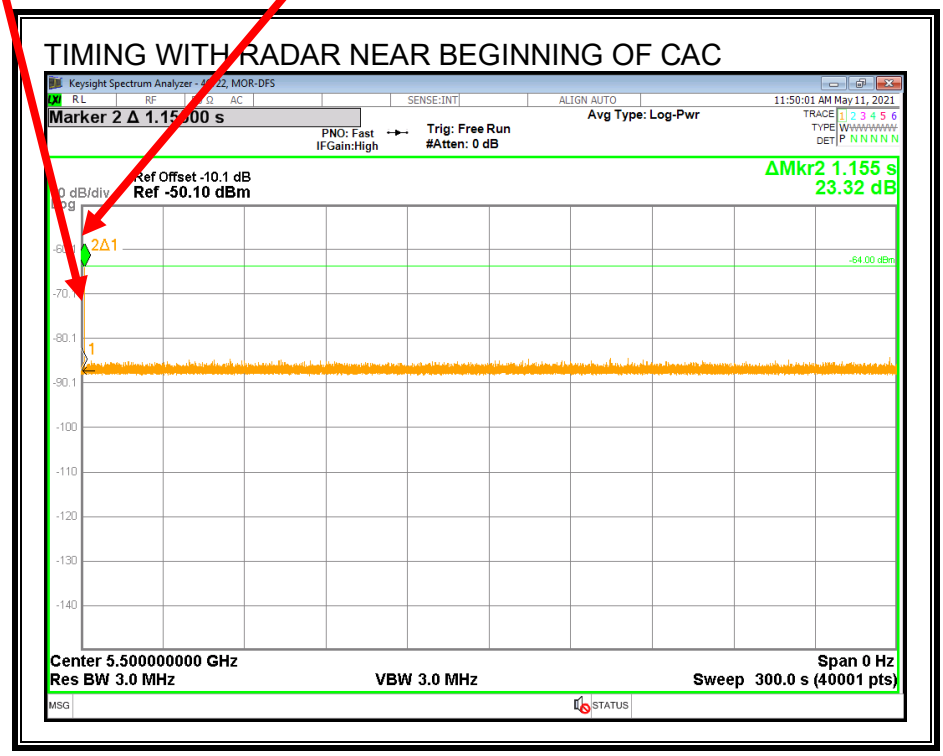


Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

TIMING WITH RADAR NEAR BEGINNING OF CAC

Software Command Issued
Start of CAC Period

Radar Signal Applied

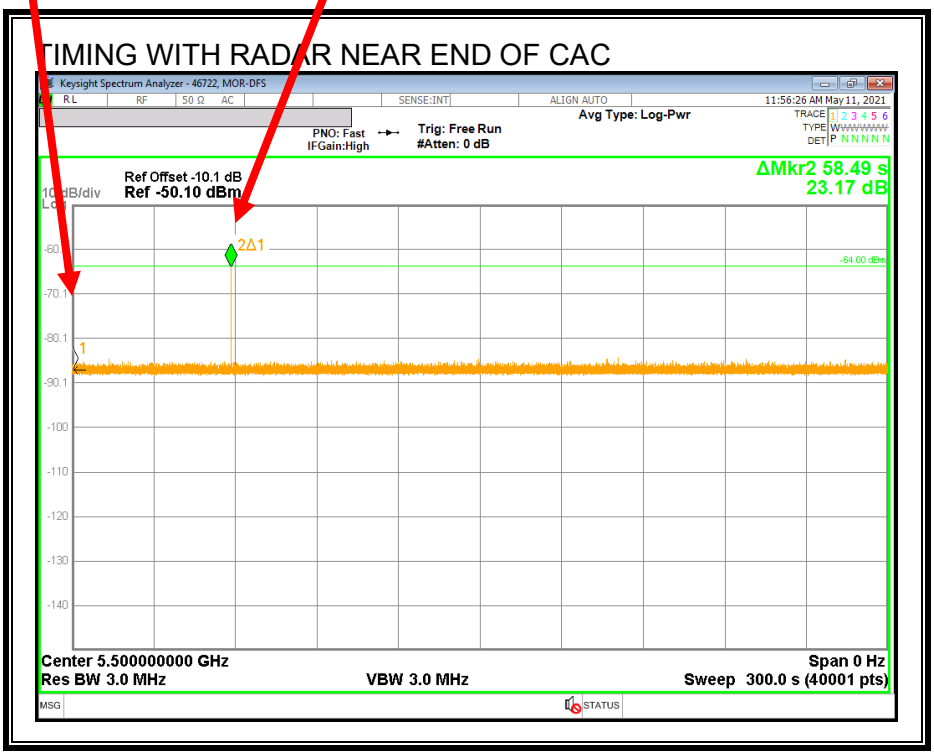


No EUT transmissions were observed after the radar signal.

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.

7.2.4. OVERLAPPING CHANNEL TESTS

RESULTS

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

7.2.5. 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).

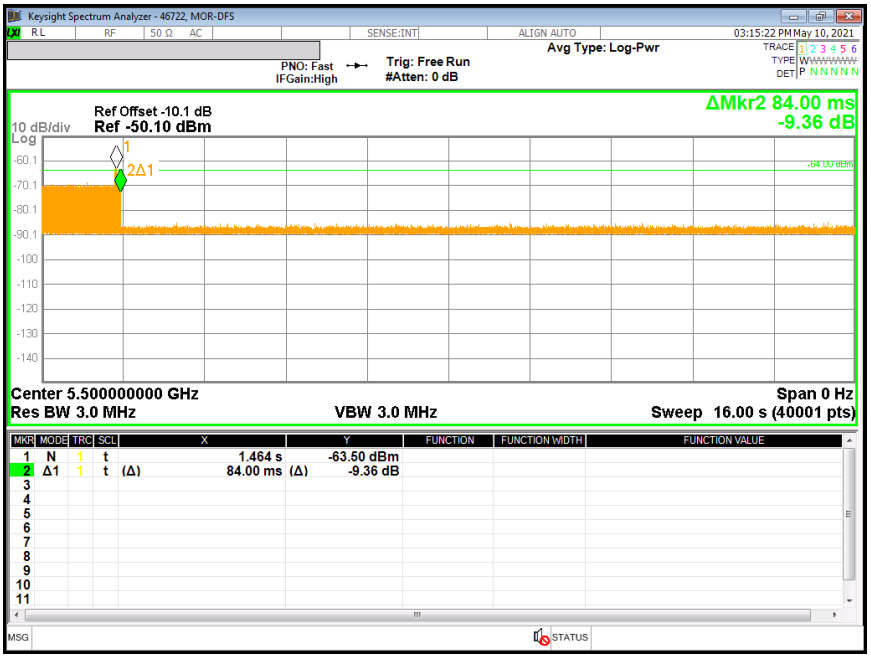
RESULTS

Channel Move Time (sec)	Limit (sec)
0.084	10

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

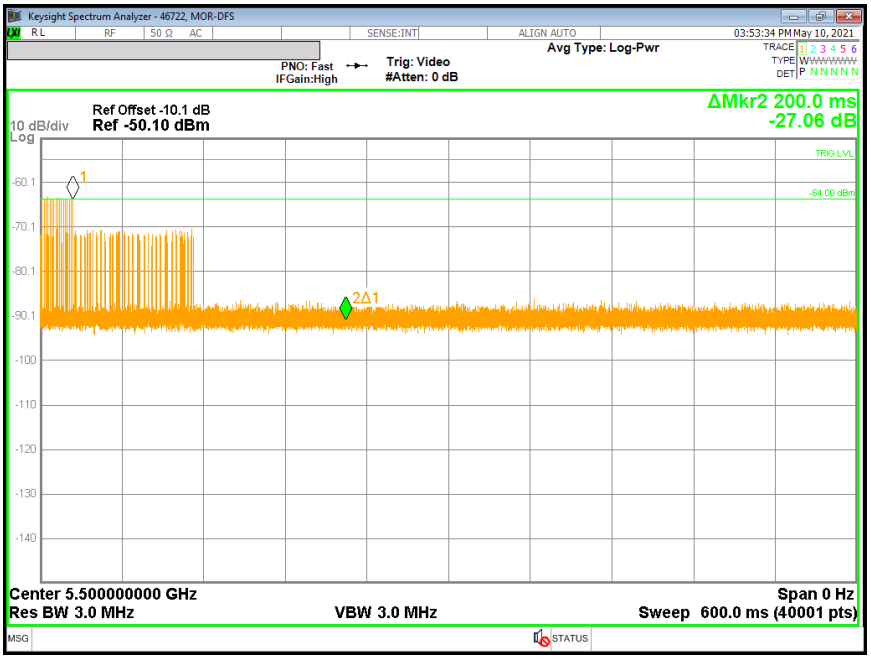
MOVE TIME

MOVE TIME



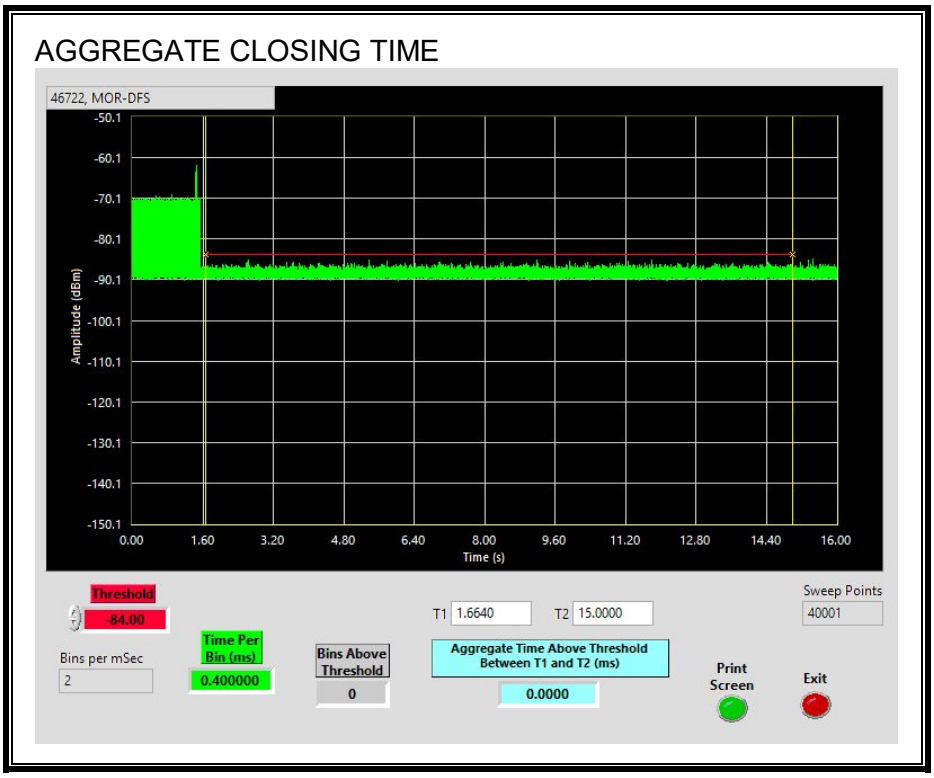
CHANNEL CLOSING TIME

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

7.2.6. NON-OCCUPANCY PERIOD

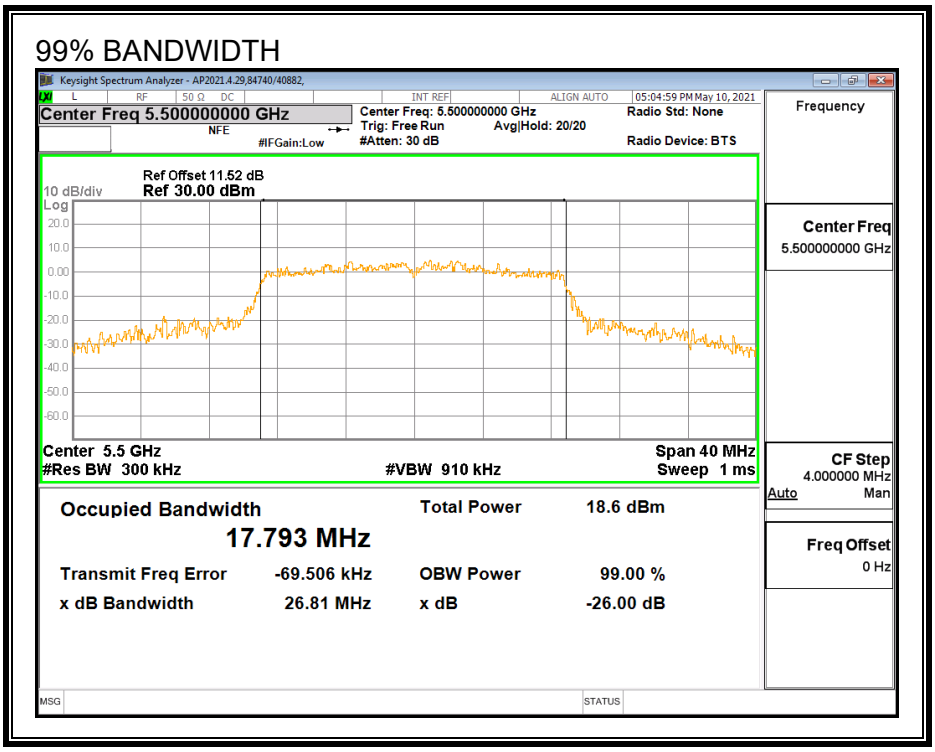
RESULTS

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

NON-OCCUPANCY PERIOD

7.2.7. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER 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 (%)
5490	5510	20	17.793	112.4	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results 84445 MOR-DFS

FCC Type 0 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst

Frequency (MHz)	Number of Trials	Number Detected	Detection (%)	Mark
5489	3	0	0	
5490	10	10	100	FL
5495	10	10	100	
5500	10	10	100	
5505	10	10	100	
5510	10	10	100	FH
5511	4	0	0	

7.2.8. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail	Detection Bandwidth FL	Detection Bandwidth FH	80% of Det BW FL5	80% of Det BW FH5	OBW	Test Location	Employee Number	In-Service Monitoring Version
FCC Short Pulse Type 1	30	100.00	60	Pass	5490	5510			17.79	MOR-DFS	84445	v4.0
FCC Short Pulse Type 2	30	100.00	60	Pass	5490	5510			17.79	MOR-DFS	84445	v4.0
FCC Short Pulse Type 3	30	100.00	60	Pass	5490	5510			17.79	MOR-DFS	84445	v4.0
FCC Short Pulse Type 4	30	96.67	60	Pass	5490	5510			17.79	MOR-DFS	84445	v4.0
Aggregate		99.17	80	Pass								
FCC Long Pulse Type 5	30	96.67	80	Pass	5490	5510			17.79	MOR-DFS	84445	v4.0
FCC Hopping Type 6	42	100.00	70	Pass	5490	5510				MOR-DFS	84445	v4.0
FCC FIXED	30	100.00	60	Pass						MOR-DFS	84445	v4.0

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	5496	Yes
1002	1	778	68	A	5509	Yes
1003	1	918	58	A	5502	Yes
1004	1	698	76	A	5504	Yes
1005	1	878	61	A	5500	Yes
1006	1	678	78	A	5498	Yes
1007	1	658	81	A	5499	Yes
1008	1	938	57	A	5493	Yes
1009	1	598	89	A	5500	Yes
1010	1	718	74	A	5492	Yes
1011	1	558	95	A	5492	Yes
1012	1	618	86	A	5507	Yes
1013	1	798	67	A	5507	Yes
1014	1	738	72	A	5507	Yes
1015	1	518	102	A	5507	Yes
1016	1	557	95	B	5493	Yes
1017	1	1060	50	B	5494	Yes
1018	1	1210	44	B	5501	Yes
1019	1	1842	29	B	5497	Yes
1020	1	927	57	B	5497	Yes
1021	1	1690	32	B	5494	Yes
1022	1	2257	24	B	5505	Yes
1023	1	601	88	B	5506	Yes
1024	1	1298	41	B	5494	Yes
1025	1	1124	47	B	5508	Yes
1026	1	1951	28	B	5500	Yes
1027	1	1907	28	B	5497	Yes
1028	1	1669	32	B	5508	Yes
1029	1	1754	31	B	5507	Yes
1030	1	1645	33	B	5492	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	4.2	175	29	5500	Yes
2002	3.3	173	26	5507	Yes
2003	4.1	187	25	5493	Yes
2004	1.3	151	25	5505	Yes
2005	4.4	168	28	5509	Yes
2006	4	179	25	5496	Yes
2007	1.1	200	29	5506	Yes
2008	3.1	216	26	5496	Yes
2009	2.5	203	27	5499	Yes
2010	4.7	223	28	5496	Yes
2011	4.4	214	25	5492	Yes
2012	2.7	200	24	5491	Yes
2013	4.8	196	29	5510	Yes
2014	1.3	185	27	5501	Yes
2015	3.6	228	29	5500	Yes
2016	4.5	184	25	5493	Yes
2017	2.9	150	27	5496	Yes
2018	2	191	24	5493	Yes
2019	2.8	161	23	5498	Yes
2020	2.2	206	26	5498	Yes
2021	3.1	223	26	5497	Yes
2022	2.7	153	23	5507	Yes
2023	2	175	26	5498	Yes
2024	1.8	190	28	5503	Yes
2025	1.2	178	24	5494	Yes
2026	3.4	197	26	5499	Yes
2027	3.1	189	23	5509	Yes
2028	3.6	174	29	5506	Yes
2029	3.5	170	26	5491	Yes
2030	4.1	159	25	5500	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	7.3	414	16	5496	Yes
3002	8.2	276	16	5494	Yes
3003	6.6	289	18	5505	Yes
3004	7.6	416	16	5500	Yes
3005	8.4	323	16	5510	Yes
3006	7.8	462	18	5500	Yes
3007	8.8	398	17	5500	Yes
3008	8.3	300	16	5508	Yes
3009	7.6	366	18	5509	Yes
3010	7.4	413	18	5498	Yes
3011	6.9	375	17	5493	Yes
3012	9	435	17	5499	Yes
3013	8.7	409	16	5504	Yes
3014	9.2	364	16	5504	Yes
3015	9.1	484	16	5499	Yes
3016	9.7	452	17	5502	Yes
3017	7.9	452	16	5500	Yes
3018	8.8	315	16	5498	Yes
3019	9.4	460	17	5502	Yes
3020	6.3	336	18	5503	Yes
3021	7.1	495	18	5504	Yes
3022	6.5	265	17	5493	Yes
3023	7.5	319	16	5492	Yes
3024	7	471	18	5491	Yes
3025	6.3	420	17	5510	Yes
3026	6.1	334	17	5493	Yes
3027	9.7	295	16	5496	Yes
3028	7.7	355	16	5509	Yes
3029	9.6	463	18	5510	Yes
3030	7.9	285	18	5490	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	19.8	405	16	5490	Yes
4002	16.5	373	15	5505	Yes
4003	12.5	255	12	5494	Yes
4004	14.4	486	16	5505	Yes
4005	15.6	381	15	5500	Yes
4006	18.1	257	15	5498	Yes
4007	19.8	298	14	5501	Yes
4008	18.4	437	12	5497	Yes
4009	11.4	491	16	5507	Yes
4010	19.6	392	12	5507	Yes
4011	18	340	12	5499	Yes
4012	17.5	254	13	5497	Yes
4013	16.3	467	15	5494	No
4014	12.1	409	12	5509	Yes
4015	16.2	383	12	5494	Yes
4016	12.4	456	14	5490	Yes
4017	17	325	15	5494	Yes
4018	13.6	293	14	5494	Yes
4019	18.7	426	15	5499	Yes
4020	16.3	407	14	5507	Yes
4021	12.8	302	14	5497	Yes
4022	15.2	428	13	5501	Yes
4023	16.9	469	13	5507	Yes
4024	15.5	358	15	5506	Yes
4025	17.7	411	15	5503	Yes
4026	16.7	312	15	5507	Yes
4027	15.1	261	15	5498	Yes
4028	19.5	308	16	5497	Yes
4029	18.3	387	14	5510	Yes
4030	18.3	330	15	5494	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	No
11	5499	Yes
12	5494	Yes
13	5496	Yes
14	5498	Yes
15	5499	Yes
16	5499	Yes
17	5497	Yes
18	5499	Yes
19	5499	Yes
20	5497	Yes
21	5505	Yes
22	5504	Yes
23	5503	Yes
24	5500	Yes
25	5506	Yes
26	5504	Yes
27	5506	Yes
28	5506	Yes
29	5504	Yes
30	5506	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	513	5490	6	Yes
2	988	5491	4	Yes
3	1463	5492	4	Yes
4	1938	5493	5	Yes
5	2413	5494	7	Yes
6	2888	5495	6	Yes
7	3363	5496	3	Yes
8	3838	5497	3	Yes
9	4313	5498	5	Yes
10	4788	5499	5	Yes
11	5263	5500	5	Yes
12	5738	5501	4	Yes
13	6213	5502	2	Yes
14	6688	5503	6	Yes
15	7163	5504	5	Yes
16	7638	5505	4	Yes
17	8113	5506	7	Yes
18	8588	5507	3	Yes
19	9063	5508	4	Yes
20	9538	5509	4	Yes
21	10013	5510	6	Yes
22	10488	5490	5	Yes
23	10963	5491	1	Yes
24	11438	5492	5	Yes
25	11913	5493	5	Yes
26	12388	5494	5	Yes
27	12863	5495	3	Yes
28	13338	5496	4	Yes
29	13813	5497	6	Yes
30	14288	5498	1	Yes
31	14763	5499	6	Yes
32	15238	5500	3	Yes
33	15713	5501	5	Yes
34	16188	5502	4	Yes
35	16663	5503	3	Yes
36	17138	5504	3	Yes
37	17613	5505	5	Yes
38	18088	5506	7	Yes
39	18563	5507	4	Yes
40	19038	5508	4	Yes
41	19513	5509	1	Yes
42	19988	5510	4	Yes

7.3. BRIDGE MODE RESULTS

Per KDB 905462 D02, Section 5.1 (footnote 2):

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 where they act as master and client must also employ DFS function for the master. 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.

8. SETUP PHOTOS

Please refer to R13687586-EP2 for setup photos

END OF TEST REPORT