TEST REPORT

Report No.:	BCTC2306556831-3E
Applicant:	NINGBO AUDITORYWORKS CO., LTD.
Product Name:	Wireless 2K Live Streaming Camera
Model/Type reference:	AW-VM33
Tested Date:	2023-07-03 to 2023-07-13
Issued Date:	2023-07-13

Shenzhen BCTC Testing Co., Ltd.

FCC ID: 2BAHR-VM33

Product Name:	Wireless 2K Live Streaming Camera
Trademark:	N/A
Model/Type reference:	AW-VM33 AW-VMxxxxx, AW-LS300 ("x" can be 0-9, A-Z, a-z or blank, indicate different enclosure color, performance, sales area or customer)
Prepared For:	NINGBO AUDITORYWORKS CO., LTD.
Address:	3-314 Lingqiao Road 229, Haishu District, Ningbo City, Zhejiang Province, China
Manufacturer:	NINGBO AUDITORYWORKS CO., LTD.
Address:	3-314 Lingqiao Road 229, Haishu District, Ningbo City, Zhejiang Province, China
Prepared By:	Shenzhen BCTC Testing Co., Ltd.
Address:	1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Zhancheng, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China
Sample Received Date:	2023-07-03
Sample tested Date:	2023-07-03 to 2023-07-13
Issue Date:	2023-07-13
Report No.:	BCTC2306556831-3E
Test Standards:	47 CFR FCC Part 15.407 KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02 KDB 905462 D03 UNII Clients Without Radar Detection New Rules v01r02
Test Results:	PASS
Remark:	This is WIFI-5GHz band radio test report.

Tested by:

Brave Zeng/ Project Handler

Approved by:

Zero Zhou/Reviewer

Table Of Content

(Note: N/A Means Not Applicable)

1. Version

Report No.	Issue Date	Description	Approved
BCTC2306556831-3E	2023-07-13	Original	Valid

2. Test Summary

The Product has been tested according to the following specifications:

Conformance Test Specifications					
Report Clause	**Ref. Std. Clause**	**Description**	**Measured**	**Limit**	**Result**
UNII Detection Bandwidth	7.8.1	DFS: UNII Detection Bandwidth Measurement	N/A	100% of the 99% BW	N/A
Channel Availability Check	7.8.2.1	DFS: Initial Channel Availability Check Time	N/A	CAC ≥ 60 sec	N/A
Channel Availability Check	7.8.2.2	DFS: Radar Burst at the Beginning of the Channel Availability Check Time	N/A	Detection Threshold: -62dBm	N/A
Channel Availability Check	7.8.2.3	DFS: Radar Burst at the End of the Channel Availability Check Time	N/A	Detection Threshold: -62dBm	N/A
In-service Monitoring	7.8.3	DFS: In-Service Monitoring for Channel Move Time (CMT)	CMT ≤ 10sec	CMT ≤ 10sec	Complied
In-service Monitoring	7.8.3	DFS: In-Service Monitoring for Channel Closing Transmission Time (CCTT)	CCTT ≤ 60 ms starting at CMT 200ms	CCTT ≤ 60 ms starting at CMT 200ms	Complied
In-service Monitoring	7.8.3	DFS: In-Service Monitoring for Non-Occupancy Period (NOP)	NOP > 30 min	NOP ≥ 30 min	Complied
Statistical Performance Check	7.8.4	DFS: Statistical Performance Check	Complied	Table 5 - 7 (KDB 905462)	N/A

3. Measurement Uncertainty

The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	UNII Detection Bandwidth	± 2.10 dB
2	Channel Availability Check	± 0.32 dB
3	In-service Monitoring	± 0.41 dB
4	Statistical Performance Check	± 3.22 dB

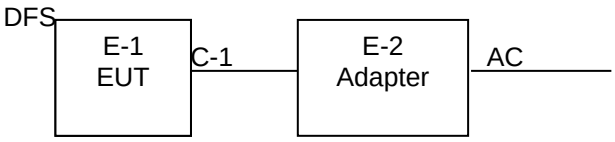
4. Product Information And Test Setup

4.1 Product Information

Model/Type reference:	AW-VM33 AW-VMxxxxx, AW-LS300 ("x" can be 0-9, A-Z, a-z or blank, indicate different enclosure color, performance, sales area or customer)
Model differences:	All models are the same circuit and RF modules, with differences in model name, housing color, performance, sales region, or customer.
Hardware Version:	1.3
Software Version:	V1.0.0.0.R.230524
Operation Frequency:	Band 2A: 5260MHz~5320MHz Band 2C: 5500MHz~5700MHz
Channel Separation:	802.11a:20MHz 802.11n: 20MHz/40MHz 802.11ac: 20MHz/40MHz/80MHz
Type of Modulation:	OFDM with BPSK/QPSK/16QAM/64QAM/256QAM
Antenna Type:	Internal antenna
Antenna Gain:	1.94 dBi
Ratings:	DC 5V From Adapter DC 3.7V From Battery

4.2 Test Setup Configuration

See test photographs attached in *EUT TEST SETUP PHOTOGRAPHS* for the actual connections between Product and support equipment.



4.3 Test Setup Configuration

No.	Device Type	Brand	Model	Series No.	Note
E-1	Wireless 2K Live Streaming Camera	N/A	AW-VM33	Ref. the Section 4.1	EUT
E-2	Adapter	UGREEN	CD122	N/A	Auxiliary

Item	Shielded Type	Ferrite Core	Length	Note
C-1	N/A	N/A	0.3M	DC cable unshielded

Notes:
1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.
3.The product is a client device without radar detection function and is a passive device.

5. Test Facility And Test Instrument Used

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at Shenzhen BCTC Testing Co., Ltd. Address: 1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Zhancheng, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.
FCC Test Firm Registration Number: 712850
FCC Designation Number: CN1212
ISED Registered No.: 23583
ISED CAB identifier: CN0017

5.2 Test Instrument Used

Equipment	Manufacturer	Model#	Serial#	Last Cal.	Next Cal.
Signal Analyzer20kHz-26.5GHz	Keysight	N9020A	MY49100060	May 15, 2023	May 14, 2024
Signal Generator	Keysight	N5182B	MY56200519	May 15, 2023	May 14, 2024
6 axis Robot 6	/	SAR	/	/	/
WIFI6 router WIFI6	DENSO	VS087A4-AV6-NNN	/	/	/

6. Dynamic Frequency Selection (DFS) Test Result

6.1 DFS Parameters

Table D.1: DFS 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 periods. See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 100% of the 99% power bandwidth See Note 3.
Note 1: The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows: 1)For the Short pulse radar Test Signals this instant is the end of the *Burst*. 2)For the Frequency Hopping radar Test Signal, this instant is the end of the last radar *Burst* generated. 3)For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission. 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 *Channel* changes (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 1 is used and for each frequency step the minimum percentage of detection is 90%. Measurements are performed with no data traffic.	

Table D.2: Interference threshold values	
Maximum Transmit Power	**Value (see note)**
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 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 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.	

6.2 Applicability of DFS Requirements Prior to Use of a Channel

Requirement	DFS 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
Uniform Spreading	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

6.3 Applicability of DFS Requirements during Normal Operation

Requirement	DFS Operational mode		
	Master	Client without radar detection	Client with radar detection
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

6.4 Uniform Spreading

Manufacturer Declare the Uniform Spreading:
☒For the 5250-5350 MHz and 5470-5725 MHz bands, the Master device provides, on aggregate, uniform loading of the spectrum across all devices by selecting an operating channel among the available channels using a Gaussian random algorithm.

6.5 User Access Restrictions

User Access Restrictions
☒DFS controls (hardware or software) related to radar d etection are NOT accessible to the user. Manufacturer statement confirming that information regarding the parameters of the detected Radar Waveforms is not available to the end user.

6.6 Channel Loading/Data Streaming

☒IP Based (Load Based) - stream the test file from the Master to the Client
The client device is link with the master device and plays the WAV audio file from master device to client device. Test file download in NTIA website (http://ntiacsd.ntia.doc.gov/dfs/)
The client device is link with the master device and plays the MPEG file (6 1/2 Magic Hours) from master device to client device. Test file download in NTIA website (http://ntiacsd.ntia.doc.gov/dfs/)
Alternative streaming e.g., FTP with about 17 to 20% loading and submit proposal to FCC.
☒Frame Based - stream the test file from the Master to the Client.
fixed talk/listen ratio, set the ratio to 45%/55%

6.7 Radar Test Waveform Calibration

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. For short pulse radar type 1, the same waveform is used a minimum of 30 times. 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. The aggregate is the average of the percentage of successful detections of short pulse radar types 1-4.

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 Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

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 FM chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a Burst will have the same chirp width. Pulses in different Bursts may have different chirp widths. 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 time between the first and second pulses is chosen independently of the time 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 independently.

Frequency Hopping Radar Test Waveform:

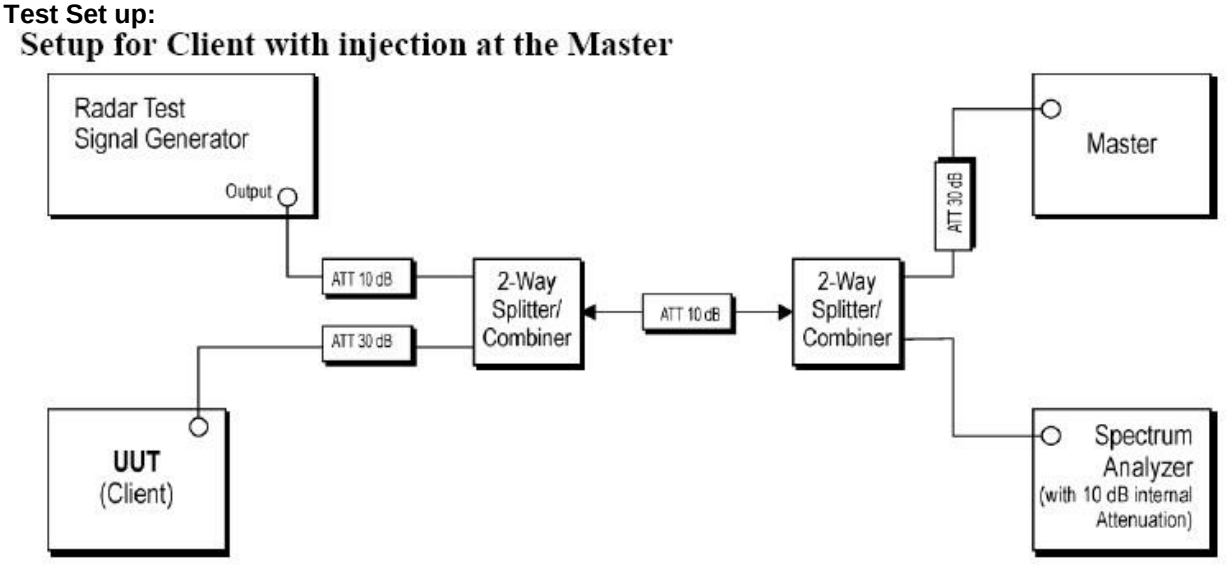
Radar Type	Pulse Width (μsec)	PRI (μsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (ms)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	9	0.333	300	70%	30

The FCC Type 6 waveform uses a static waveform with 100 bursts in the instruments ARB. In addition, the RF list mode is operated with a list containing 100 frequencies from a randomly generated list and it had be ensured that at least one of the random frequencies falls into the UNII Detection Bandwidth of the DUT. Each burst from the waveform file initiates a trigger pulse at the beginning that switches the RF list from one item to the next one.

DFS Threshold Level:

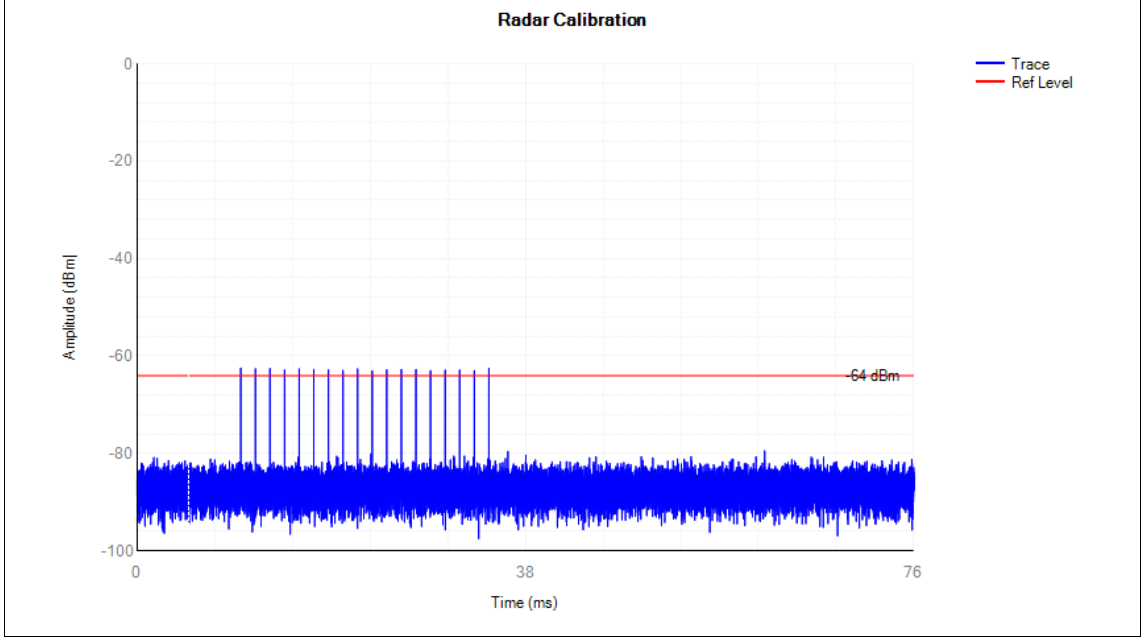
DFS Threshold Level	
DFS Threshold level: -62 dBm	☒atthe antenna connector
	☐ in front of the antenna
The Interference **Radar Detection Threshold Level** is -62 dBm. That had been taken into account the output power range and antenna gain.	

Test Set up:

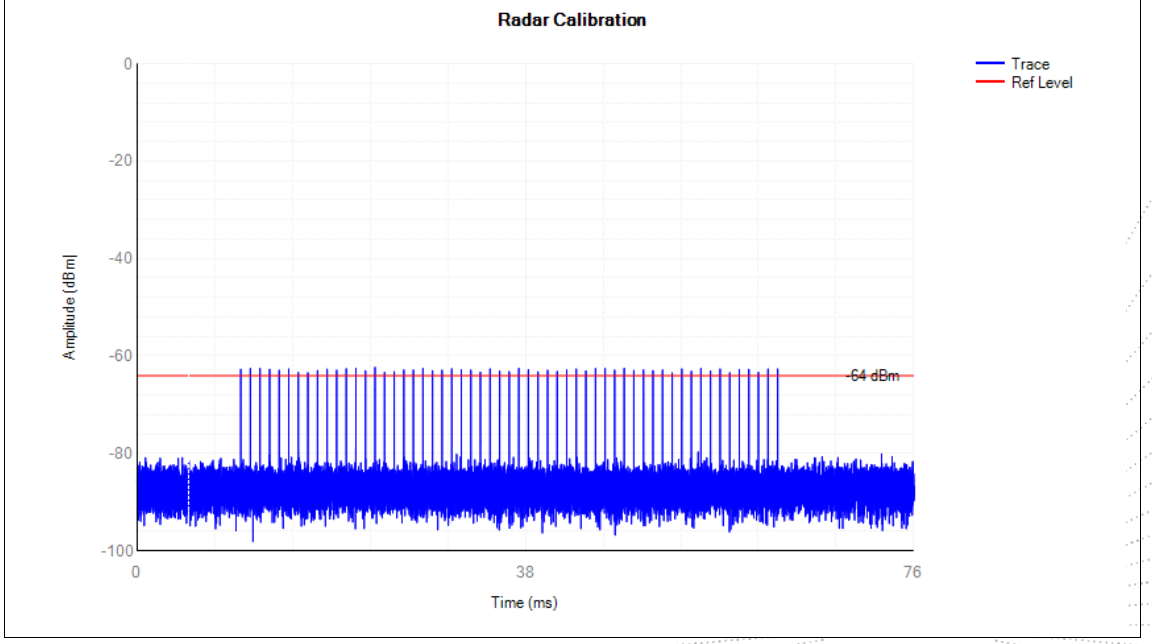


Test result:

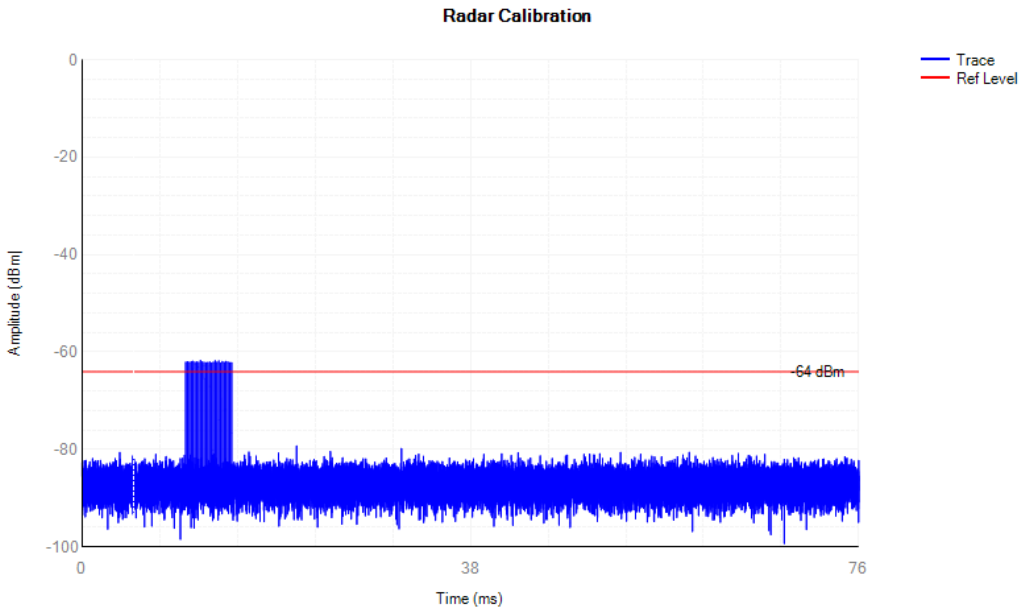
Test Graphs
DFS_FCC _Ref 0



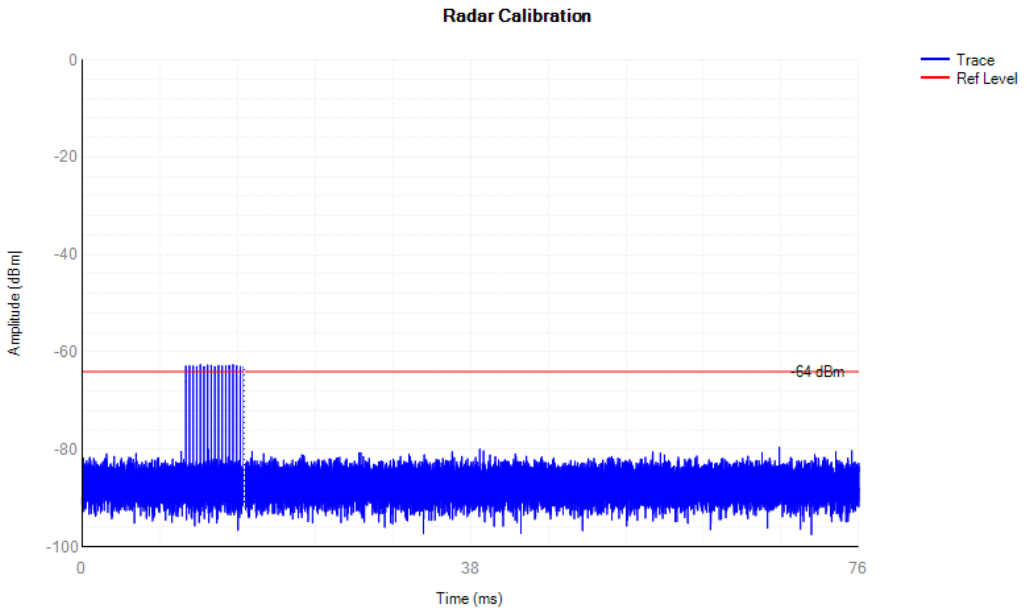
Test Graphs
DFS_FCC_Ref 1



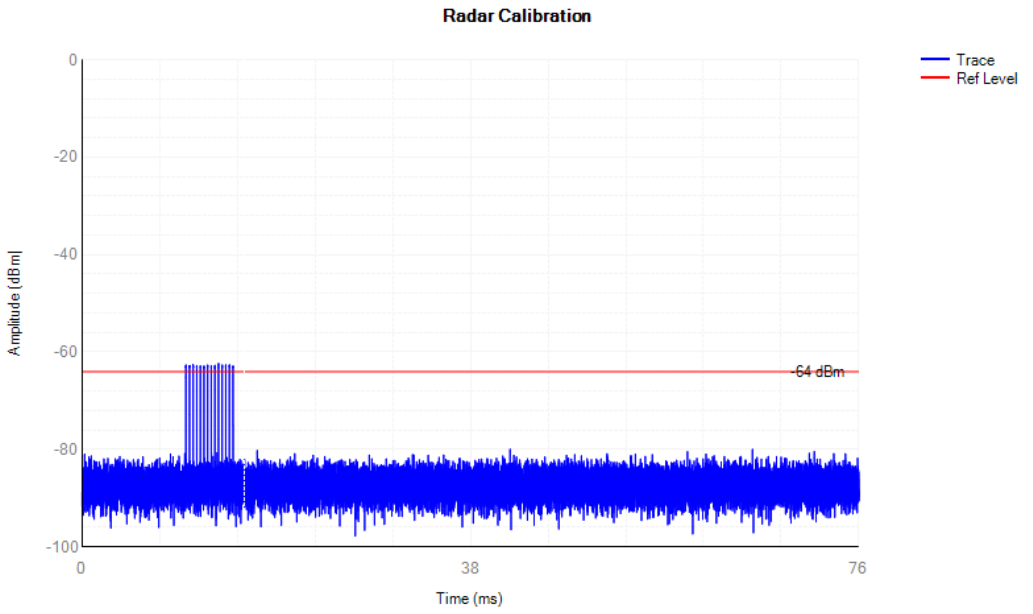
Test Graphs
DFS_FCC_Ref 2



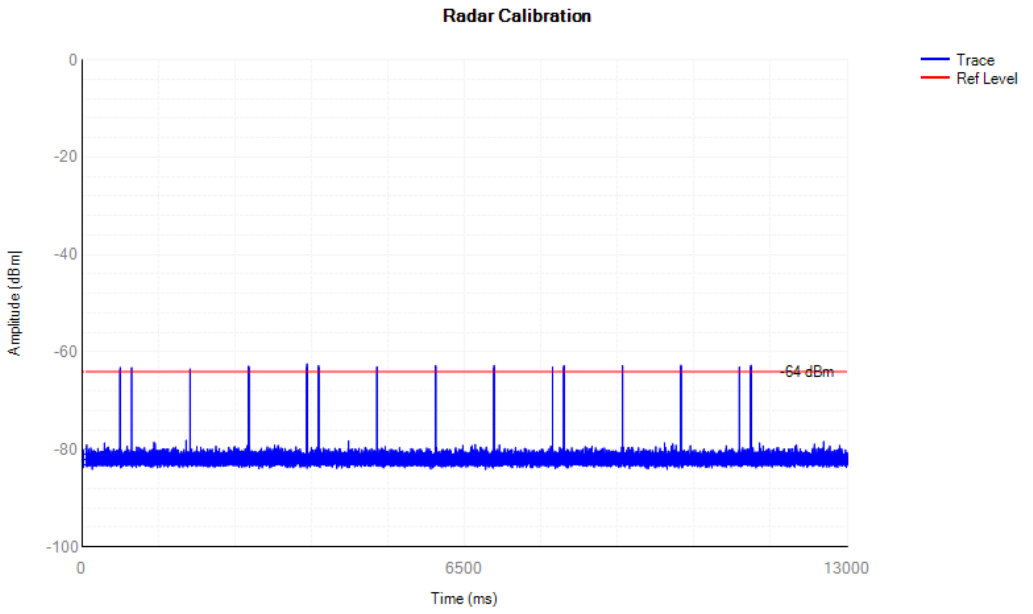
Test Graphs
DFS_FCC_Ref 3



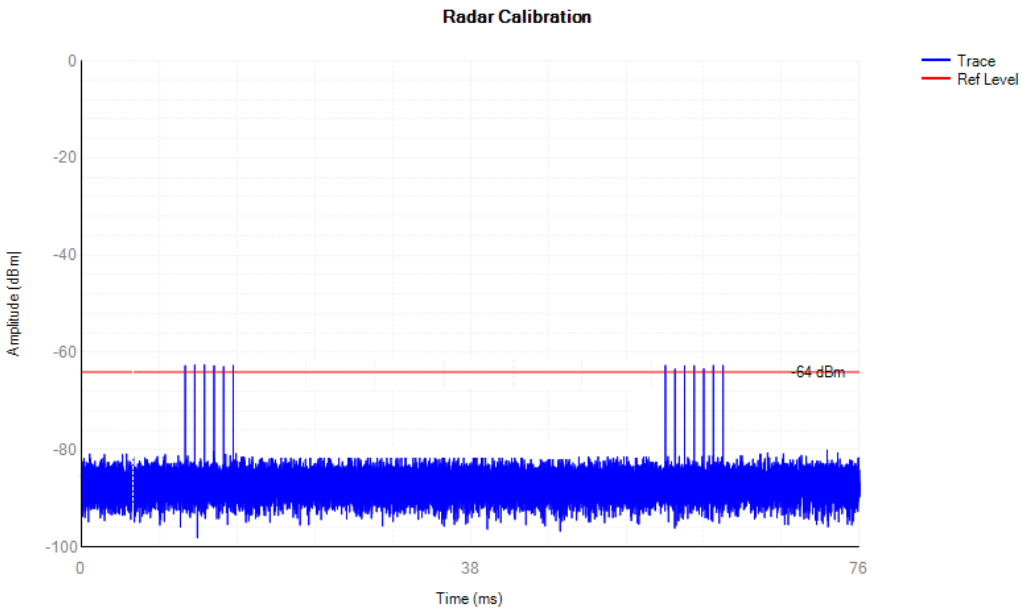
Test Graphs
DFS_FCC_Ref 4



Test Graphs
DFS_FCC_Ref 5



Test Graphs
DFS_FCC_Ref 6



6.8 UNII Detection Bandwidth

UNII Detection Bandwidth Limit:

Channel Bandwidth (MHz)	99% Power Bandwidth (MHz)	UNII Detection Bandwidth (MHz)
20	N/A	N/A
40	N/A	N/A
80	N/A	N/A
UNII Detection Bandwidth is minimum 100% of the 99% power bandwidth. A single radar Burst is generated for a minimum of 10 trials, and the response of the UUT is noted. The UUT must detect the Radar Waveform 90% or more of the time.		

Measuring Instruments:

Refer a test equipment and calibration data table in this test report.

Test Procedures:

Test Method
Refer as KDB905462 D02 UNII DFS Compliance Procedures New Rules v02, clause 7.8.1 for UNII Detection Bandwidth test. During the U-NII Detection Bandwidth detection test, radar type 1 is used and for each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic. The EUT is set up as a standalone device (no associated Client and no traffic). The radar frequency is increased in 1 MHz steps, repeating the above test sequence, until the detection rate falls below 90%. The highest frequency at which detection is greater than or equal to 90% is denoted as FH. The radar frequency is decreased in 1 MHz steps, repeating the above test sequence, until the detection rate falls below 90%. The lowest frequency at which detection is greater than or equal to 90% is denoted as FL. UNII Detection Bandwidth = FH -FL

Test result: Not required

6.9 In-service Monitoring

In-service Monitoring Limit:

In-service Monitoring Limit	
Channel Move Time	10 sec
Channel Closing Transmission Time	200 ms + an aggregate of 60 ms over remaining 10 sec periods.
Non-occupancy period	Minimum 30 minutes

Measuring Instruments:

Refer a test equipment and calibration data table in this test report

Test Procedures:

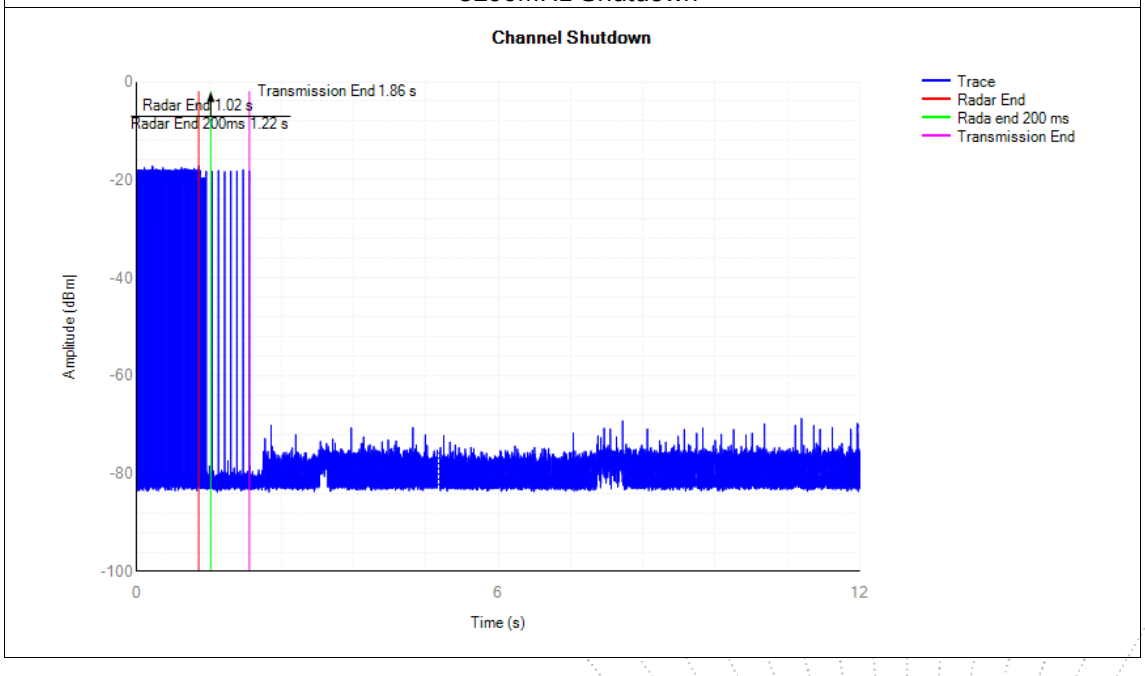
Test Method
☒Refer as KDB905462 D02 UNII DFS Compliance Procedures New Rules v02, clause 7.8.3 verified during In-Service Monitoring; Channel Closing Transmission Time, Channel Move Time. Client Device will associate with the EUT. Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the EUT during the observation time (Channel Move Time). Compare the Channel Move Time and Channel Closing Transmission Time limits.
☒Refer as KDB905462 D02 UNII DFS Compliance Procedures New Rules v02, clause 8.3 verified during In-Service Monitoring; Channel Closing Transmission Time, Channel Move Time. One 10 sec plot needs to be reported for the Short Pulse Radar Types 1-4 and one for the Long Pulse Radar Type in a 22 sec plot. And zoom-in a 600 ms plot verified channel closing time for the aggregate transmission time starting from 200ms after the end of the radar signal to the completion of the channel move.
☒Refer as KDB905462 D02 UNII DFS Compliance Procedures New Rules v02, clause 7.8.3 verified during In-Service Monitoring; Non-Occupancy Period. Client Device will associate with the EUT. Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the EUT during the observation time (Non-Occupancy Period). Compare the Non-Occupancy Period limits.

Note：The test data shows only the worst mode and maximum bandwidth.

Test Result of In-service Monitoring:

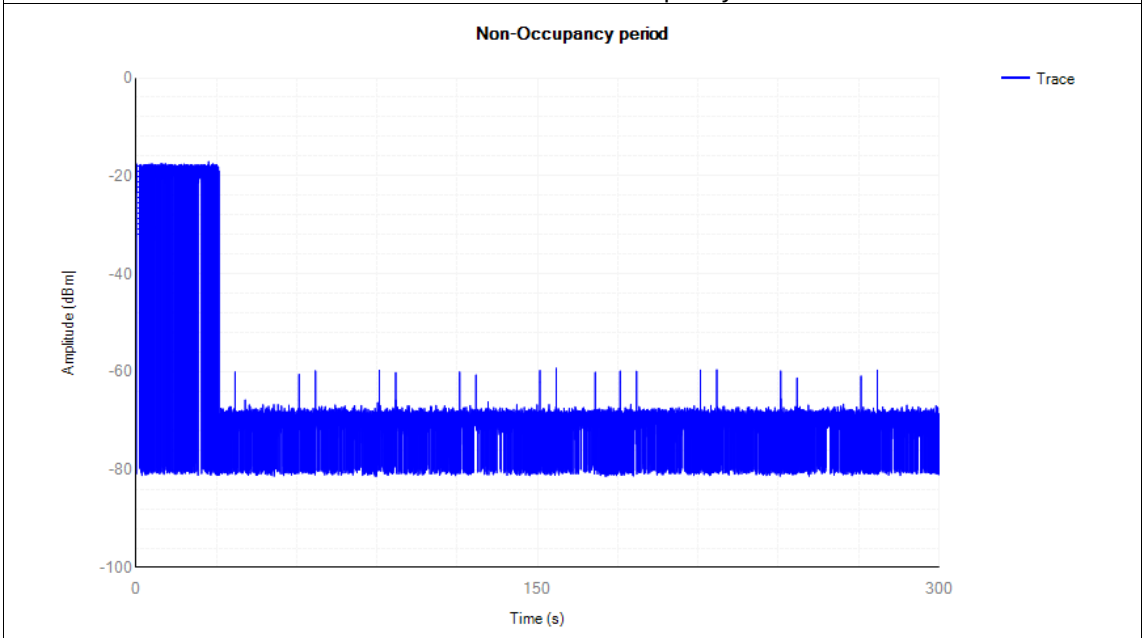
Channel Closing Transmission Time and Channel Move Time Result						
Mode	**Frequency (MHz)**	**Channel Move Time (s)**	**Limit Channel Move Time (s)**	**Close Transmission Time (s)**	**Limit Close Transmission Time (s)**	**Verdict**
VHT80	5290	0.8405	10	0.0456	1	Pass

Test Graphs
5290MHz Shutdown



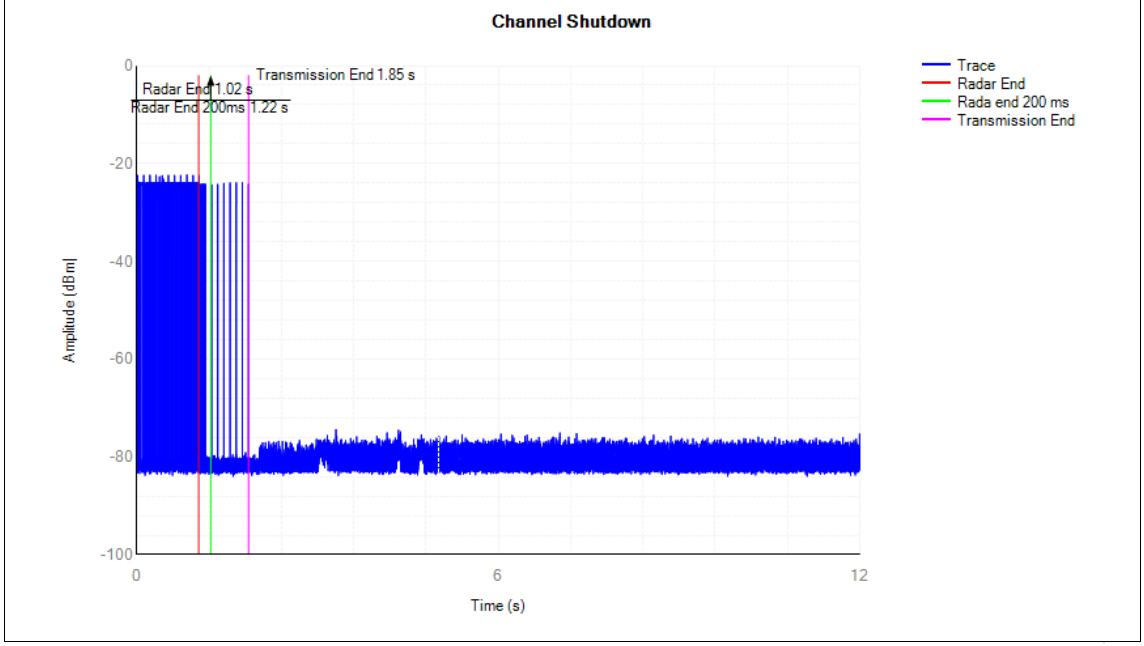
Non-Occupancy Period Result				
Modulation Mode	Freq. (MHz)	Non-Occupancy Period		
		Measured	Limit	Verdict
VHT80	5290	>30min	30min	PASS
1850 sec Timing Plot				

Test Graphs
5290MHz Non-Occupancy



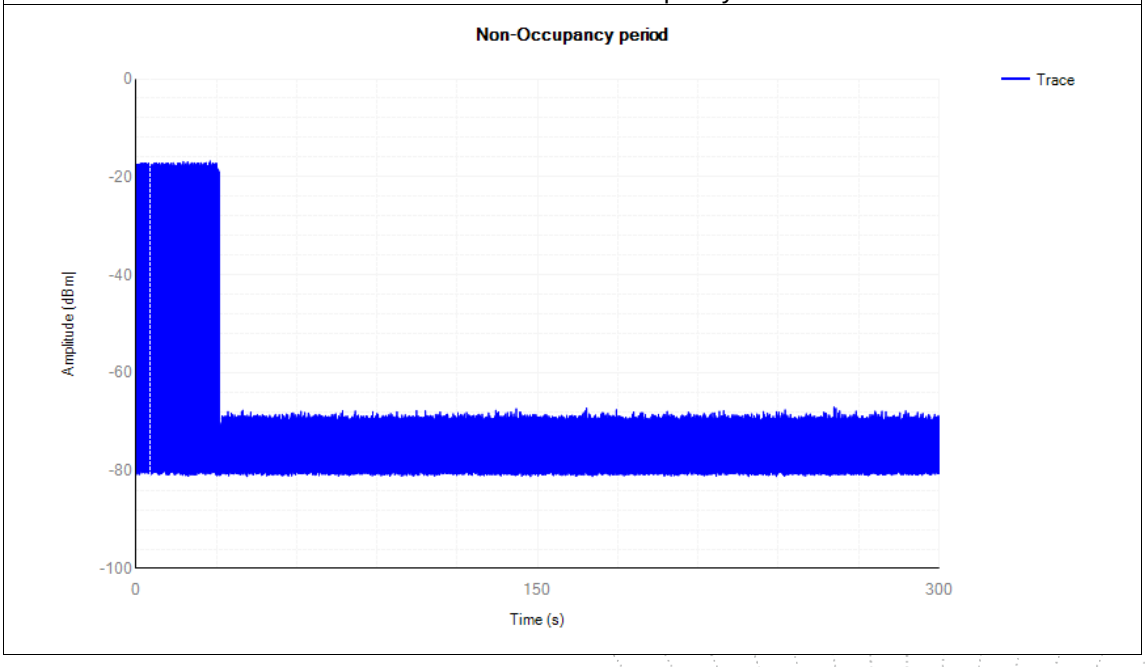
Channel Closing Transmission Time and Channel Move Time Result						
Mode	**Frequency (MHz)**	**Channel Move Time (s)**	**Limit Channel Move Time (s)**	**Close Transmission Time (s)**	**Limit Close Transmission Time (s)**	**Verdict**
VHT80	5530	0.8281	10	0.028	1	Pass

5530MHz Shutdown



Non-Occupancy Period Result				
Modulation Mode	Freq. (MHz)	Non-Occupancy Period		
		Measured	Limit	Verdict
VHT80	5530	>30min	30min	PASS
1850 sec Timing Plot				

Test Graphs
5530MHz Non-Occupancy



7. EUT Photographs

EUT Photo 1

NOTE: Appendix-Photographs Of EUT Constructional Details

8. EUT Test Setup Photographs

DFS

STATEMENT

1. The equipment lists are traceable to the national reference standards.

2. The test report can not be partially copied unless prior written approval is issued from our lab.

3. The test report is invalid without the "special seal for inspection and testing".

4. The test report is invalid without the signature of the approver.

5. The test process and test result is only related to the Unit Under Test.

6. Sample information is provided by the client and the laboratory is not responsible for its authenticity.

7. The quality system of our laboratory is in accordance with ISO/IEC17025.

8. If there is any objection to this test report, the client should inform issuing laboratory within 15 days from the date of receiving test report.

Address:
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P.C.: 518103

FAX：0755-33229357

Website：http://www.chnbctc.com

E-Mail：bctc@bctc-lab.com.cn

※※※※※ **END** ※※※※※