

## FCC PART 15.407

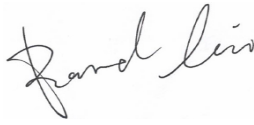

## TEST REPORT

For

### Hangzhou YuShu Technology Co., Ltd.

306 Room, Building 1, 88 Dongliu Rd, XiXing Street, Binjiang District, Hangzhou, ZheJiang, China

**FCC ID: 2A5PE-YUSHU006**

<b>Report Type:</b> Original Report	<b>Product Name:</b> Quadruped Robot
<b>Report Number:</b>	RKSA240325003-00E
<b>Report Date:</b>	2024-08-30
<b>Reviewed By:</b>	Bard Liu 
<b>Approved By:</b>	Oscar Ye 
<b>Test Laboratory:</b>	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road, Kunshan, Jiangsu province, China Tel: +86-512-86175000 Fax: +86-512-88934268 <a href="http://www.baclcorp.com.cn">www.baclcorp.com.cn</a>

Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Kunshan). This report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, or any agency of the U.S. Government.

## **TABLE OF CONTENTS**

<b>REPORT REVISION HISTORY .....</b>	<b>3</b>
<b>GENERAL INFORMATION .....</b>	<b>4</b>
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) .....	4
OBJECTIVE.....	5
TEST METHODOLOGY.....	5
MEASUREMENT UNCERTAINTY .....	5
TEST FACILITY .....	5
<b>SYSTEM TEST CONFIGURATION .....</b>	<b>6</b>
DESCRIPTION OF TEST CONFIGURATION.....	6
EQUIPMENT MODIFICATIONS.....	6
EUT EXERCISE SOFTWARE.....	6
SUPPORT EQUIPMENT LIST AND DETAILS .....	6
EXTERNAL I/O CABLE .....	6
<b>SUMMARY OF TEST RESULTS.....</b>	<b>7</b>
TEST EQUIPMENT LIST AND DETAILS .....	8
<b>APPLICABLE STANARDS .....</b>	<b>9</b>
SYSTEM BLOCK DIAGRAM .....	13
CONDUCTED METHOD.....	14
RADIATED METHOD .....	15
TEST PROCEDURE .....	15
<b>APPLICABLE STANARDS .....</b>	<b>16</b>
TEST DATA: SEE APPENDIX.....	16
<b>CHANNEL MOVE TIME AND CHANNEL CLOSING TRANSMISSION TIME.....</b>	<b>17</b>
TEST DATA: SEE APPENDIX.....	17
<b>NON-OCCUPANCY PERIOD .....</b>	<b>18</b>
TEST DATA: SEE APPENDIX.....	18
<b>EUT PHOTOGRAPHS .....</b>	<b>19</b>
<b>TEST SETUP PHOTOGRAPHS.....</b>	<b>20</b>
<b>APPENDIX - TEST DATA .....</b>	<b>21</b>
ENVIRONMENTAL CONDITIONS & TEST INFORMATION .....	21
DFS DETECTION THRESHOLDS.....	21
CHANNEL MOVE TIME AND CHANNEL CLOSING TRANSMISSION TIME .....	21
NON-OCCUPANCY PERIOD.....	21
DFS DETECTION THRESHOLDS.....	21
CHANNEL MOVE TIME AND CHANNEL CLOSING TRANSMISSION TIME .....	23
NON-OCCUPANCY PERIOD.....	24

REPORT REVISION HISTORY

Number of Revisions	Report No.	Version	Issue Date	Description
0	RKSA240325003-00E	R1V1	2024-08-30	Initial Release

## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

Applicant:	Hangzhou YuShu Technology Co., Ltd.		
Product Name:	Quadruped Robot		
Tested Model:	B2		
Power Supply:	DC 50.4V from battery		
RF Function:	WIFI		
Operating Frequency:	5G Wi-Fi B2: 5260~5320 MHz, B3: 5500~5700 MHz		
Maximum Output Power:	Mode:	5G Wi-Fi B2:	5G Wi-Fi B3:
	802.11a:	17.97 dBm	16.94 dBm
	802.11ac20:	20.74 dBm	19.82 dBm
	802.11ac40:	19.74 dBm	17.73 dBm
	802.11ac80:	17.69 dBm	19.07 dBm
	802.11ax20:	20.79 dBm	19.01 dBm
	802.11ax40:	19.76 dBm	17.79 dBm
	802.11ax80:	17.70 dBm	19.10 dBm
Channel Number:	5G Wi-Fi B2: 7, B3: 21		
Channel Separation:	802.11a/ac/n/ax20: 20 MHz, 802.11ac/n/ax40: 40 MHz, 802.11ac/ax80: 80 MHz		
Modulation Type:	OFDM, OFDMA		
Antenna Type:	Omni antenna		
★Maximum Antenna Gain:	Band 2: 2.93 dBi; Band 3: 3.01 dBi		

*Note: The maximum antenna gain was provided by the applicant.*

*All measurement and test data in this report was gathered from production sample serial number: RKSA240325003-1 (Assigned by the BACL (Kunshan)). The EUT supplied by the applicant was received on 2024-03-25.)*

**Objective**

This type approval report is prepared for *Hangzhou YuShu Technology Co., Ltd.* in accordance with

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts E of the Federal Communications Commission's rules.

The objective is to determine compliance with FCC Part 15, Subpart E, section 15.407 Dynamic Frequency Selection (DFS) for devices operating in the bands 5250-5350 MHz, 5470-5725 MHz.

**Test Methodology**

FCC KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02.

Each test item follows test standards and with no deviation.

**Measurement Uncertainty**

Item	Uncertainty
Occupied Bandwidth	0.5kHz
Temperature	1.0°C
Humidity	6%

**Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu Province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) is accredited in accordance with ISO/IEC 17025:2017 by NVLAP (Lab code: 600338-0), and the lab has been recognized as the FCC accredited lab under the KDB 974614 D01, the FCC Designation No. : CN5055.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The EUT was configured for testing in an engineering mode which was provided by the manufacturer.

### Equipment Modifications

No modifications were made to the EUT.

### EUT Exercise Software

No exercise software was used to test.

The worst case was performed under:

### Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Dell	Note Book	L530	R9-OFYHDK
Lenovo	PC	TIANYI510Pro-18ICB	M7094N11
Ruckus	Access Point	T300 (FCC ID: S9GT300)	211404000213

### External I/O Cable

Cable Description	Length(m)	From Port	To Port
/	/	/	/

## SUMMARY OF TEST RESULTS

The following result table represents the list of measurements required under the CFR §47 Part 15.407(h), KDB: 905462 D02 UNII DFS Compliance Procedures New Rules v02

Items	Description of Test	Result
Detection Bandwidth	UNII Detection Bandwidth	Not Applicable (See Note 1)
Performance Requirements Check	Initial Channel Availability Check Time (CAC)	Not Applicable (See Note 1)
	Radar Burst at the Beginning of the CAC	Not Applicable (See Note 1)
	Radar Burst at the End of the CAC	Not Applicable (See Note 1)
In-Service Monitoring	Channel Move Time	Compliant
	Channel Closing Transmission Time	Compliant
	Non-Occupancy Period	Compliant
Radar Detection	Statistical Performance Check	Not Applicable (See Note 1)

Note 1: EUT is a client without radar detection.

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	SIGNAL ANALYZER	FSV40	101116	2024-04-24	2025-04-23
Rohde & Schwarz	VECTOR SIGNAL GENERATOR	SMBV100A	261558	2024-04-25	2025-04-24
Tonscend Corporation	RF Control Unit	JS0806-2	JS0806001	2024-04-24	2025-04-23
Tonscend Corporation	RF Test System	JS1120-3	N/A	N/A	N/A

**Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).



## APPLICABLE STANDARDS

### DFS Requirement

CFR § 47 Part 15.407(h)

FCC KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02

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

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
<i>Non-Occupancy Period</i>	Yes	Not required	Yes
<i>DFS Detection Threshold</i>	Yes	Not required	Yes
<i>Channel Availability Check Time</i>	Yes	Not required	Not required
<i>U-NII Detection Bandwidth</i>	Yes	Not required	Yes

**Table 2: Applicability of DFS requirements during normal operation**

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
<i>DFS Detection Threshold</i>	Yes	Not required
<i>Channel Closing Transmission Time</i>	Yes	Yes
<i>Channel Move Time</i>	Yes	Yes
<i>U-NII Detection Bandwidth</i>	Yes	Not required

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client Without Radar Detection
<i>U-NII Detection Bandwidth and Statistical Performance Check</i>	All BW modes must be tested	Not required
<i>Channel Move Time and Channel Closing Transmission Time</i>	Test using widest BW mode available	Test using the widest BW mode available for the link
<i>All other tests</i>	Any single BW mode	Not required
<b>Note:</b> Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		

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

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP $\geq$ 200 milliwatt	-64 dBm
EIRP $<$ 200 milliwatt and power spectral density $<$ 10 dBm/MHz	-62 dBm
EIRP $<$ 200 milliwatt that do not meet the power spectral density requirement	-64 dBm
<p><b>Note 1:</b> This is the level at the input of the receiver assuming a 0 dBi receive antenna.</p> <p><b>Note 2:</b> 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.</p> <p><b>Note3:</b> EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.</p>	

**Table 4: DFS Response Requirement Values**

Parameter	Value
<i>Non-occupancy period</i>	Minimum 30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds See Note 1.
<i>Channel Closing Transmission Time</i>	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
<i>U-NII Detection Bandwidth</i>	Minimum 100% of the U- NII 99% transmission power bandwidth. See Note 3.
<p><b>Note 1:</b> <i>Channel Move Time</i> and the <i>Channel Closing Transmission Time</i> should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.</p> <p><b>Note 2:</b> The <i>Channel Closing Transmission Time</i> is comprised of 200 milliseconds starting at the beginning of the <i>Channel Move Time</i> plus any additional intermittent control signals required to facilitate a <i>Channel</i> 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.</p> <p><b>Note 3:</b> During the <i>U-NII Detection Bandwidth</i> 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.</p>	

**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 $\left\{ \left( \frac{1}{360} \right) \cdot \left( \frac{19 \cdot 10^6}{\text{PRI}_{\mu\text{SEC}}} \right) \right\}$	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
<b>Note 1:</b> Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

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

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

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

**Table 5a - Pulse Repetition Intervals Values for Test A**

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

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

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

**Table 6 – Long Pulse Radar Test Waveform**

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

**Table 7 – Frequency Hopping Radar Test Waveform**

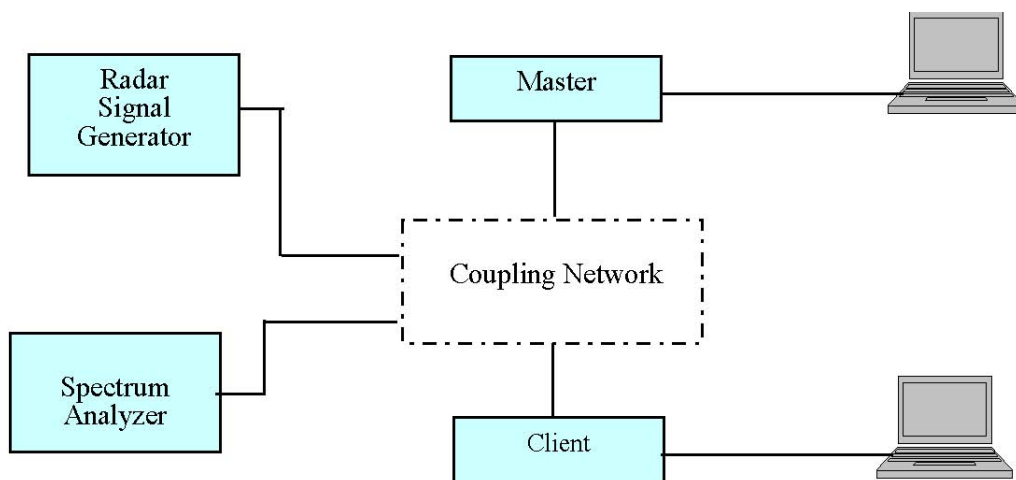
Radar Type	Pulse Width (μsec)	PRI (μsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70%	30

### DFS Measurement System

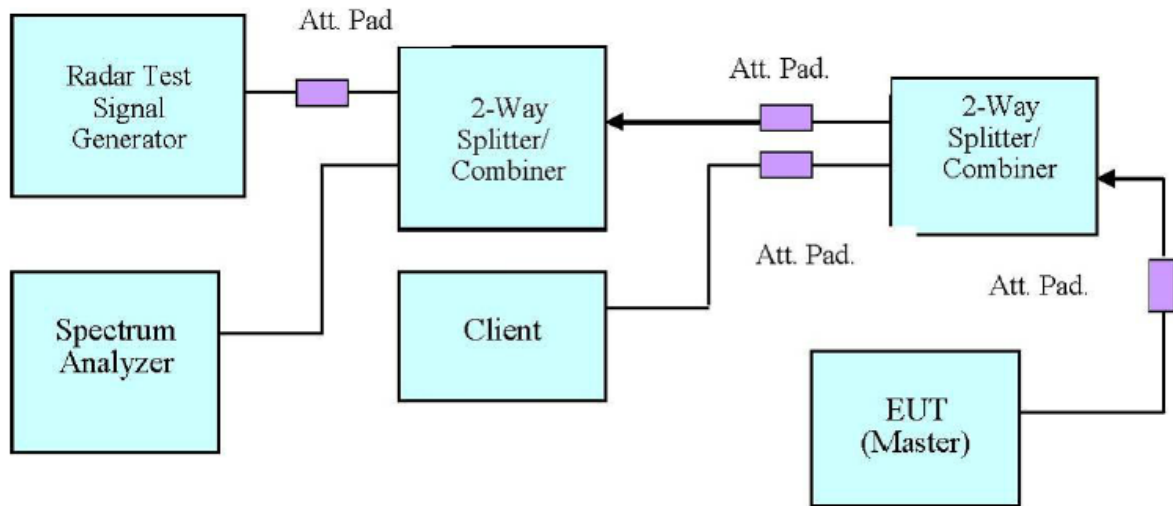
DFS measurement system consists of two subsystems:

- (1) The radar signal generating subsystem and
- (2) The traffic monitoring subsystem.

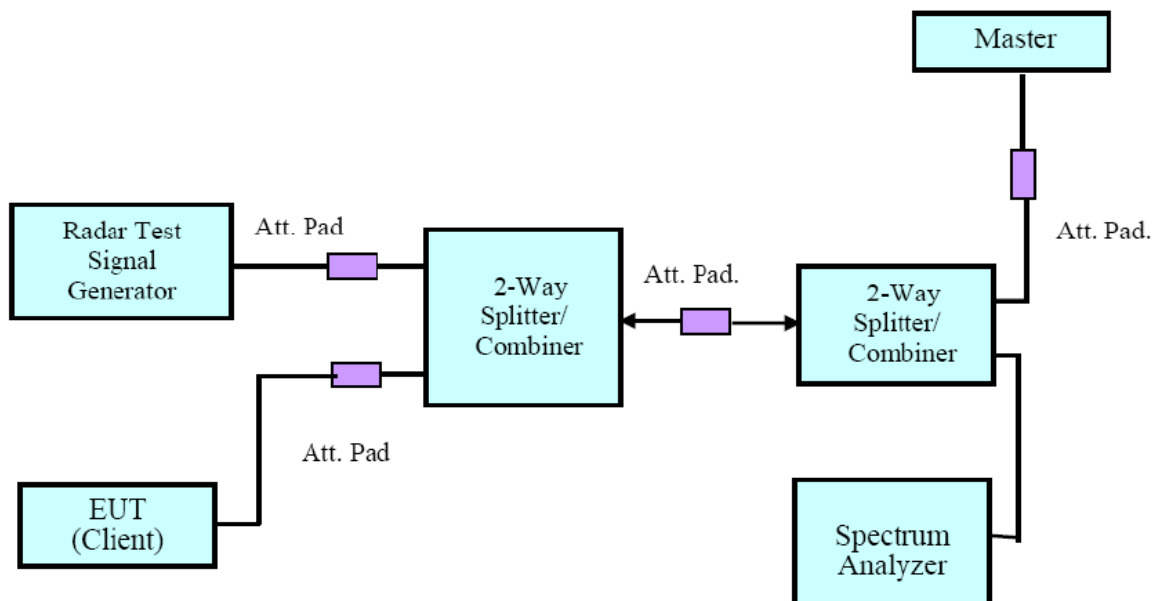
### System Block Diagram



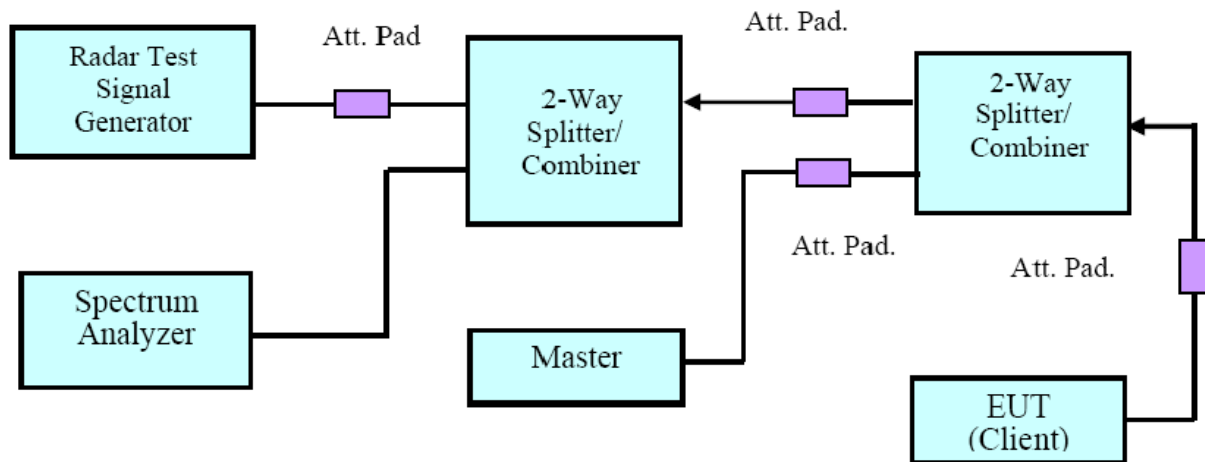
## Conducted Method



**Setup for Master with injection at the Master**

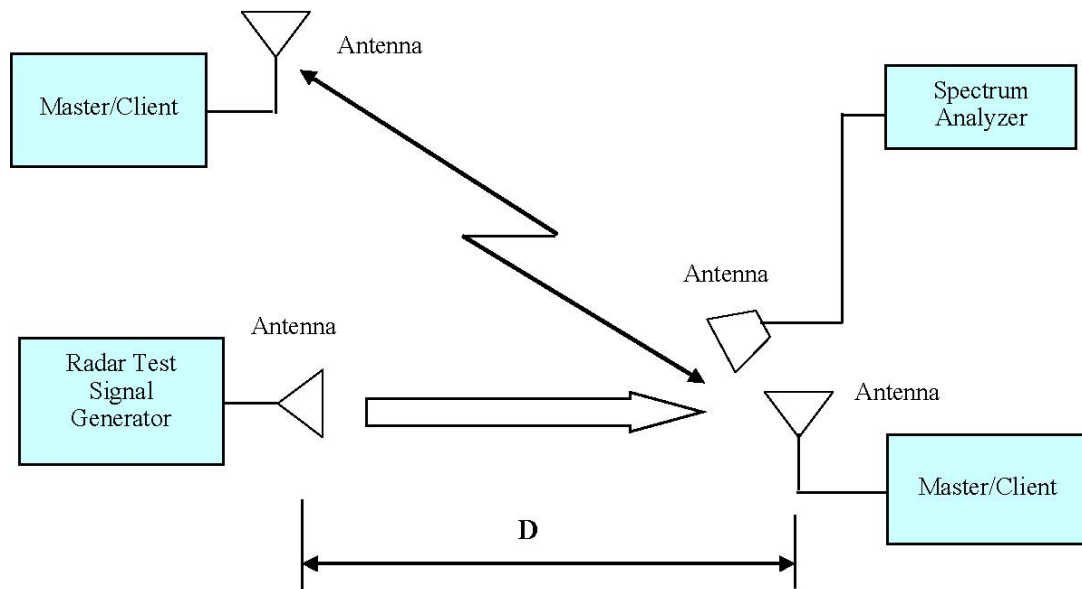


**Setup for Client with injection at the Master**



**Setup for Client with injection at the Client**

### Radiated Method



### Test Procedure

A spectrum analyzer is used as a monitor verifies that the EUT status including Channel Closing Transmission Time and Channel Move Time, and does not transmit on a Channel during the Non-Occupancy Period after the diction and Channel move. It is also used to monitor EUT transmissions during the Channel Availability Check Time.

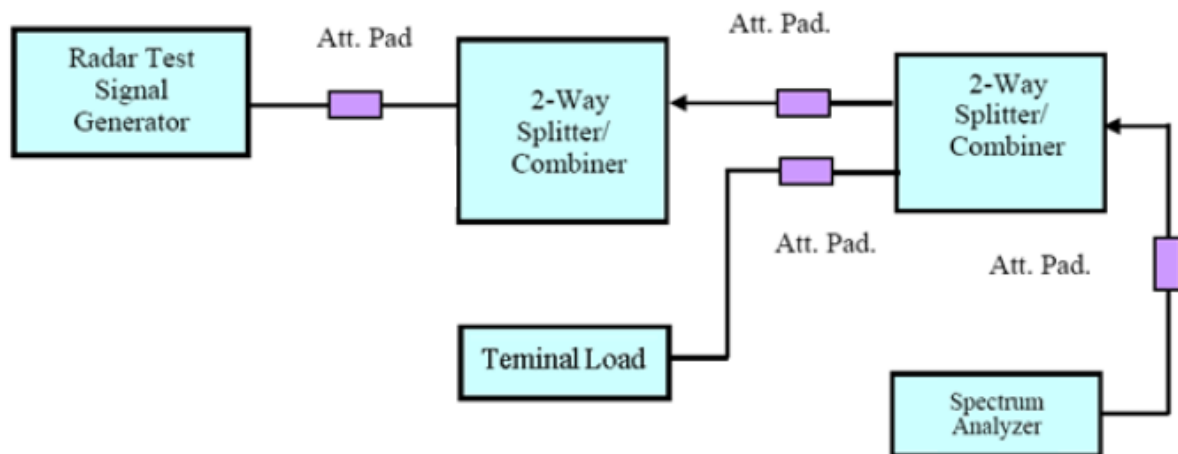
## APPLICABLE STANARDS

---

### Description of EUT

The calibrated radiated DFS detection threshold level is set to -64 dBm.

### Radar Waveform Calibration



Test Data: See Appendix



## **CHANNEL MOVE TIME AND CHANNEL CLOSING TRANSMISSION TIME**

---

### **Description of EUT**

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. Repeat using a long pulse radar type5 waveform.

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.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =  $N \times \text{Dwell Time}$

N is the number of spectrum analyzer bins showing a device transmission Dwell Time is the dwell time per bin (i.e.  $\text{Dwell Time} = S/B$ , S is the sweep time and B is the number of bin, i.e. 8192

**Test Data: See Appendix**

---

## **NON-OCCUPANCY PERIOD**

---

### **Test Procedure**

Measure the EUT for more than 30 minutes following the channel close/move time to verify that the EUT does not resume any transmissions on this channel. Provide one plot to demonstrate no transmission on the channel for the non-occupancy period (30 minutes observation time)

**Test Data: See Appendix**

## **EUT PHOTOGRAPHS**

---

Please refer to the attachment EXHIBIT A - EUT EXTERNAL PHOTOGRAPHS and EXHIBIT B - EUT INTERNAL PHOTOGRAPHS.

---

## **TEST SETUP PHOTOGRAPHS**

---

Please refer to the attachment EXHIBIT E - TEST SETUP PHOTOGRAPHS.

APPENDIX - TEST DATA

Environmental Conditions & Test Information

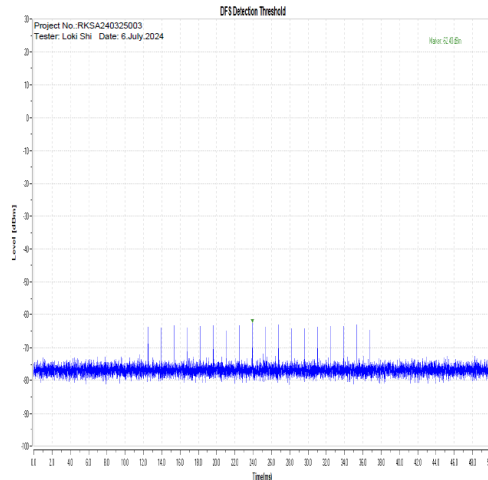
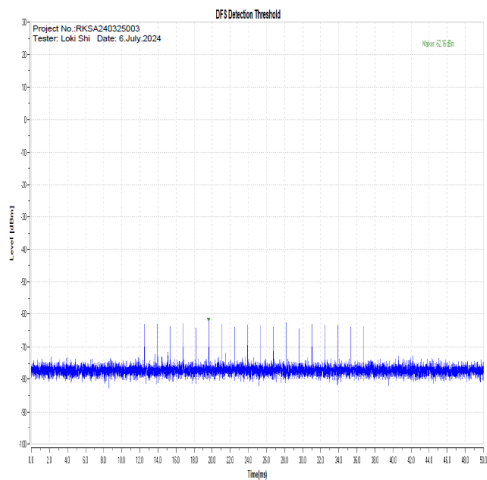
Test Item:	DFS DETECTION THRESHOLDS	CHANNEL MOVE TIME AND CHANNEL CLOSING TRANSMISSION TIME	NON-OCCUPANCY PERIOD
Temperature:	22.9 °C	22.9 °C	22.9 °C
Relative Humidity:	55 %	55 %	55 %
ATM Pressure:	100.9 kPa	100.9 kPa	100.9 kPa
Test Date:	2024-07-06	2024-07-06	2024-07-06
Test Engineer:	Loki Shi	Loki Shi	Loki Shi

DFS Detection Thresholds

Test Mode	Frequency(MHz)	Radar Type	Result (dBm)	Limit (dBm)	Verdict
80 MHz	5290	Type0	-62.16	-62.00	Pass
	5530	Type0	-62.40	-62.00	Pass

5290 MHz Bandwidth 80 MHz

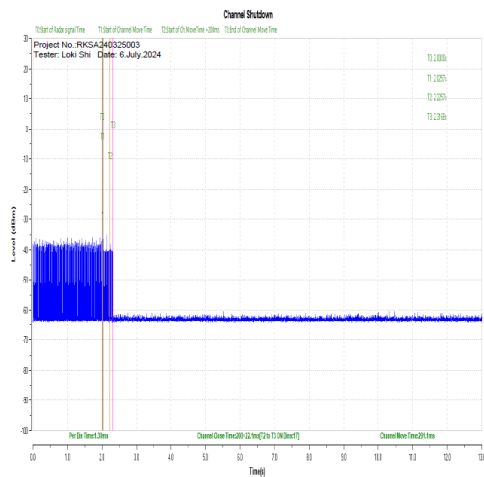
5530 MHz Bandwidth 80 MHz



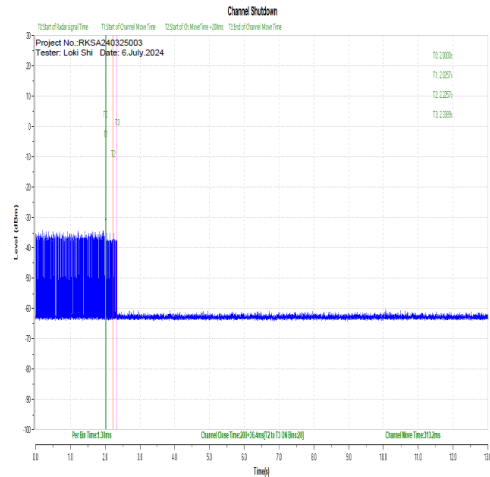
## CHANNEL MOVE TIME AND CHANNEL CLOSING TRANSMISSION TIME

Test Mode	Frequency(MHz)	CCTT (ms)	Limit (ms)	CMT (ms)	Limit (ms)	Verdict
80 MHz	5290	200+22.1	200+60	291.1	10000	PASS
	5530	200+36.4	200+60	313.2	10000	PASS

### 5290 MHz Bandwidth 80 MHz

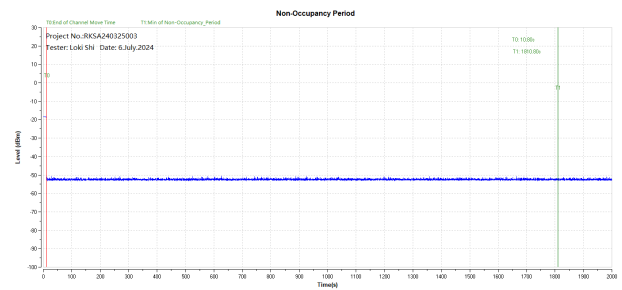
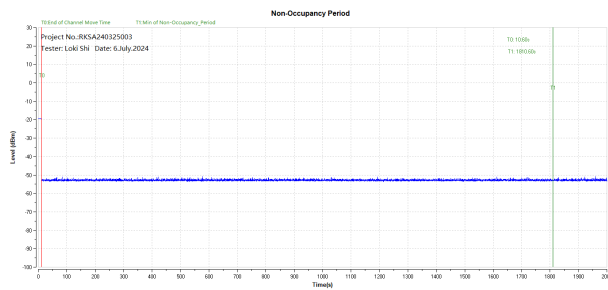


### 5530 MHz Bandwidth 80 MHz



**NON-OCCUPANCY PERIOD**

TestMode	Frequency[MHz]	Result	Limit[s]	Verdict
80 MHz	5290	see test graph	≥1800	Pass
	5530	see test graph	≥1800	Pass

**5290 MHz Bandwidth 80 MHz****5530 MHz Bandwidth 80 MHz**



## Declarations

1. The laboratory is not responsible for the authenticity of any information provided by the applicant. Information from the applicant that may affect test results is marked with “★”.
2. The test data was only valid for the test sample(s).
3. This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.
4. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.
5. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor  $k=2$  with the 95.45% confidence interval.

\*\*\*\*\* **END OF REPORT** \*\*\*\*\*