

FCC DFS Test Report

Report No.: RWAX202300107E

Applicant: FocusAI Inc

Address: 530 Lakeside Dr, Ste 180, Sunnyvale, CA 94085, United States.

Product Name: FocusAI Dome Camera FD10

Product Model: FD10

Multiple Models: N/A

Trade Mark: N/A

FCC ID: 2BDXBFD10

Standards: FCC CFR Title 47 Part 15E (§15.407)

Test Result: Complied

Issue Date: 2024/02/27

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Revision History

Version No.	Issued Date	Description
00	2024/02/27	Original

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1 General Information

1.1 Client Information

Applicant:	FocusAI Inc
Address:	530 Lakeside Dr, Ste 180, Sunnyvale, CA 94085, United States.
Manufacturer:	FocusAI Inc
Address:	530 Lakeside Dr, Ste 180, Sunnyvale, CA 94085, United States.

1.2 Product Description of EUT

The EUT is FocusAI Dome Camera FD10 that contains 2.4G and 5G WLAN radios, this report covers the full testing of the Dynamic Frequency Selection (DFS) function of 5G WLAN radio.

Sample Serial number	4A-1 (assigned by WATC)
Sample Received Date	2023/11/1
Sample Status	Good Condition
Frequency Range	5250 MHz - 5350MHz 5470 MHz - 5725MHz
Maximum Conducted Output Power	5250 MHz - 5350MHz: 17.72dBm 5470 MHz - 5725MHz: 19.48dBm
Maximum EIRP	5250 MHz - 5350MHz: 20.62dBm 5470 MHz - 5725MHz: 22.48dBm
Modulation Technology	OFDM, OFDMA
Spatial Streams	MIMO (2TX, 2RX)
Antenna Gain [#]	Band2: Ant0: 2.90dBi; Ant1: 2.40dBi; Band3: Ant0: 3.0dBi; Ant1: 2.90dBi
DFS Operational Mode	Client without Radar detection
Power Supply	DC 48V from POE
Operating temperature [#]	-20 deg.C to +50 deg.C
Adapter Information	N/A
Modification	Sample No Modification by the test lab

1.3 Related Submittal(s)/Grant(s)

FCC Part 15, Subpart C, Equipment Class: DTS, FCC ID: 2BDXBFD10

1.4 Laboratory Location

World Alliance Testing and Certification (Shenzhen) Co., Ltd

No. 1002, East Block, Laobing Building, Xingye Road 3012, Xixiang street, Bao'an District, Shenzhen, Guangdong, People's Republic of China

Tel: +86-755-29691511, Email: qa@watc.com.cn

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 463912, the FCC Designation No. : CN5040.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0160.

1.5 Test Methodology

FCC CFR 47 Part 15E(15.407(h))

KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02

2 Description of Measurement

2.1 Test Configuration

Test Mode:		
EUT Operation Mode:	The system was configured for testing in Engineering Mode, which was provided by the manufacturer.	
Exercise software [#] :	N/A	
Test Bandwidth	Mode	Data rate
80MHz	802.11ax-VHT80	MCS0
The data package for loading the channel during In-service monitoring compliance testing streamed from the Access Point to the Client using the software “LanTest”.		

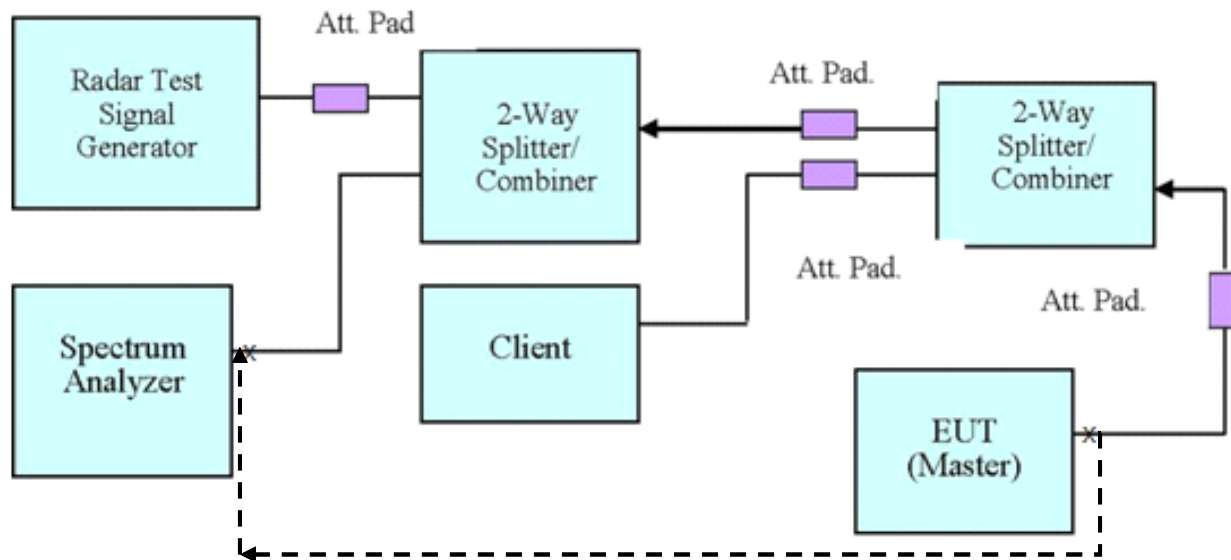
2.2 Test Auxiliary Equipment

Manufacturer	Description	Model	Serial Number
SHENZHEN GOSPELL DIGITAL TECHNOLOGY CO.,LTD SWITCHING GIGABIT POWER SUPPLY	POE	G0566-480-100	/
Lenovo	PC	TIANY1510Pro-18ICB	R3NO28B21001
Lenovo	LED display	L2364A	U310FZR9
Lenovo	Keyboard	EKAB-536A	811A19A5
DELL	Mouse	Ms116P	Ms116P
Instek	DC Power Supply	GPS-3030DD	EM832096
DELL	Notebook	Latitude	11429208685
Grandstream Networks,Inc	Router	GWN7665 (FCC ID: YZZGWN7665)	C074AD251F0A
Unknown	DC cable	/	/

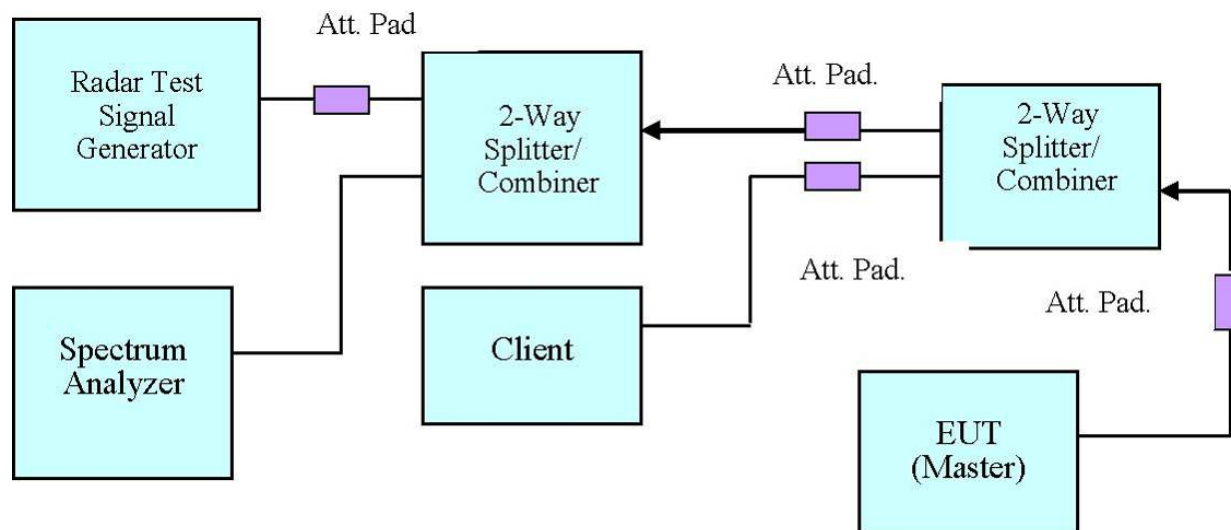
2.3 Test Setup

DFS measurement system consists of two subsystems: (1) The radar signal generating subsystem and (2) the traffic monitoring subsystem.

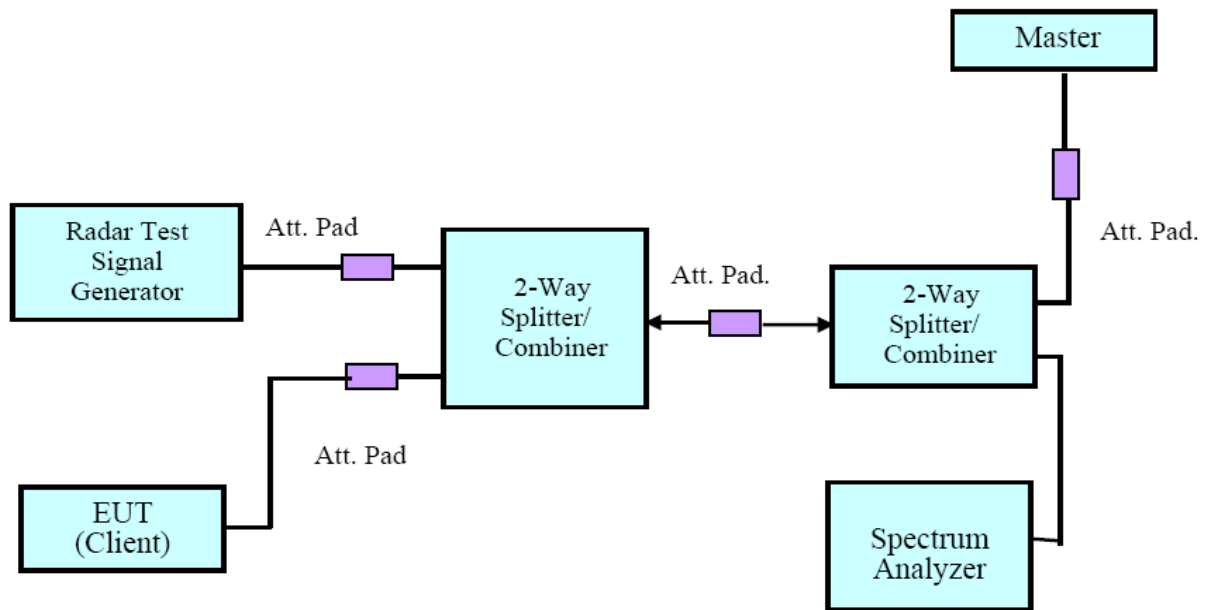
Conducted Method:



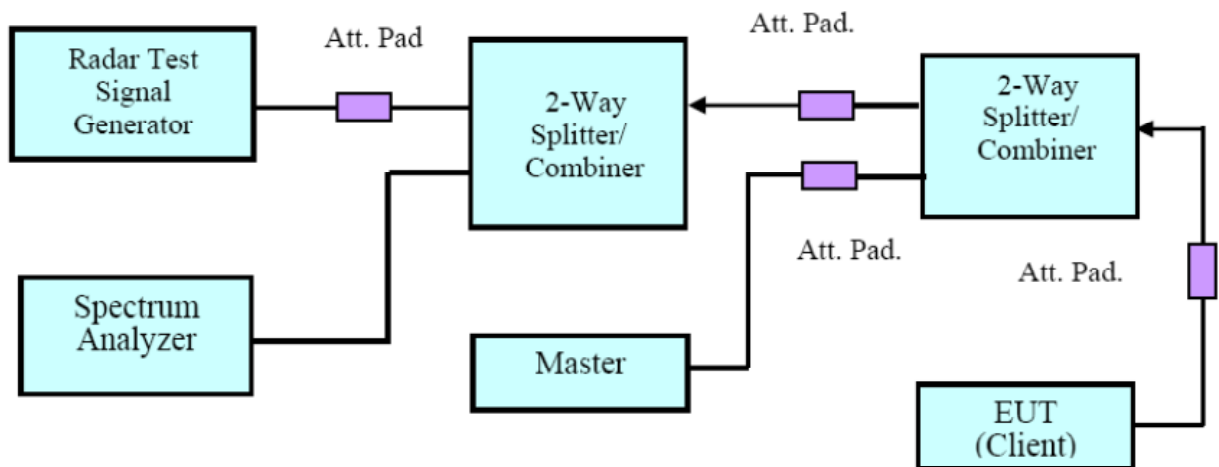
Setup for Radar Waveform calibration



Setup for Master with injection at the Master



Setup for Client with injection at the Master



Setup for Client with injection at the Client

2.4 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.

2.5 Measurement Method

Description of Test	Measurement Method
Radar Waveform calibration	KDB 905462 D02 V02 7.5
UNII Detection Bandwidth	KDB 905462 D02 V02 7.8.1
Initial Channel Availability Check Time (CAC)	KDB 905462 D02 V02 7.8.2.1
Radar Burst at the Beginning of the CAC	KDB 905462 D02 V02 7.8.2.2
Radar Burst at the End of the CAC	KDB 905462 D02 V02 7.8.2.3
Channel Move Time	KDB 905462 D02 V02 7.8.3
Channel Closing Transmission Time	KDB 905462 D02 V02 7.8.3
Non-Occupancy Period	KDB 905462 D02 V02 7.8.3
Statistical Performance Check	KDB 905462 D02 V02 7.8.4

2.6 Measurement Equipment

Manufacturer	Description	Model	Management No.	Calibration Date	Calibration Due Date
Keisight	MXASiganlAnalyzer	N9020B	MY63320284	2023/8/18	2024/8/9
ROHDE & SCHWARZ	VECTOR SIGNAL GENERATOR	SMBV100A	256300	2023/9/12	2024/9/11
LIFT MEASURING TECHNOLOGY	SwitchBox	SMV-1003	Unknown	2023/8/18	2024/8/9

Note: All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or International standards.

3 Test Results

3.1 Test Summary

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

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

3.2 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
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		

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

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP $\geq$ 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
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: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

Table 4: DFS Response Requirement Values

Parameter	Value
<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.
Note 1: <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. Note 2: 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 move</i> (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 <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.	

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 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	$\text{Roundup} \left\{ \left(\frac{1}{360} \right) \cdot \left(\frac{19 \cdot 10^6}{\text{PRI}_{\mu\text{sec}}} \right) \right\}$	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

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

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

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

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

3.3 DFS Test Data

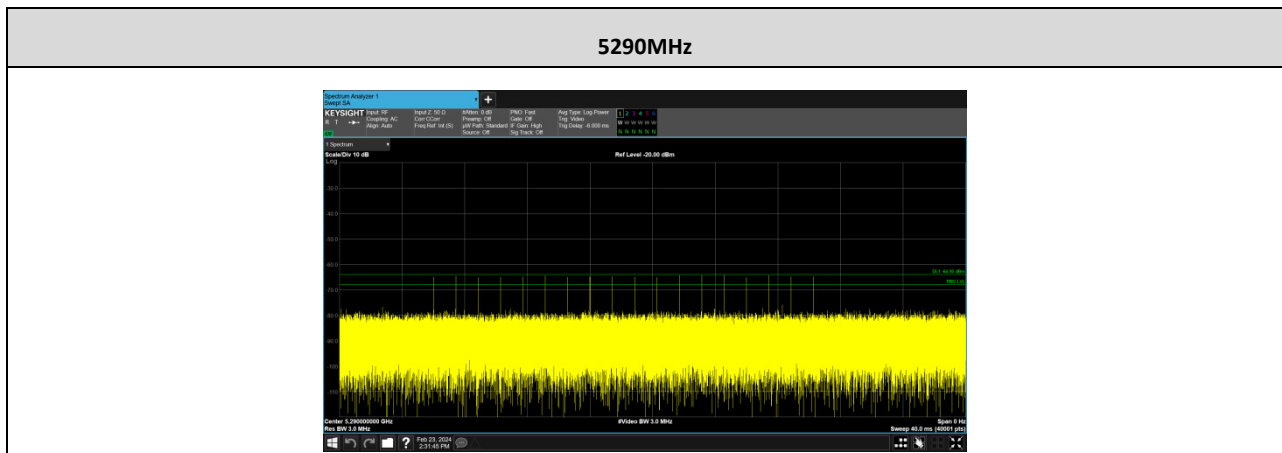
Test Date:	2024-02-23	Test By:	Ryan Zhang
Environment condition:	Temperature: 24°C; Relative Humidity: 36%; ATM Pressure: 101.0kPa		

3.3.1 Dynamic Frequency Selection

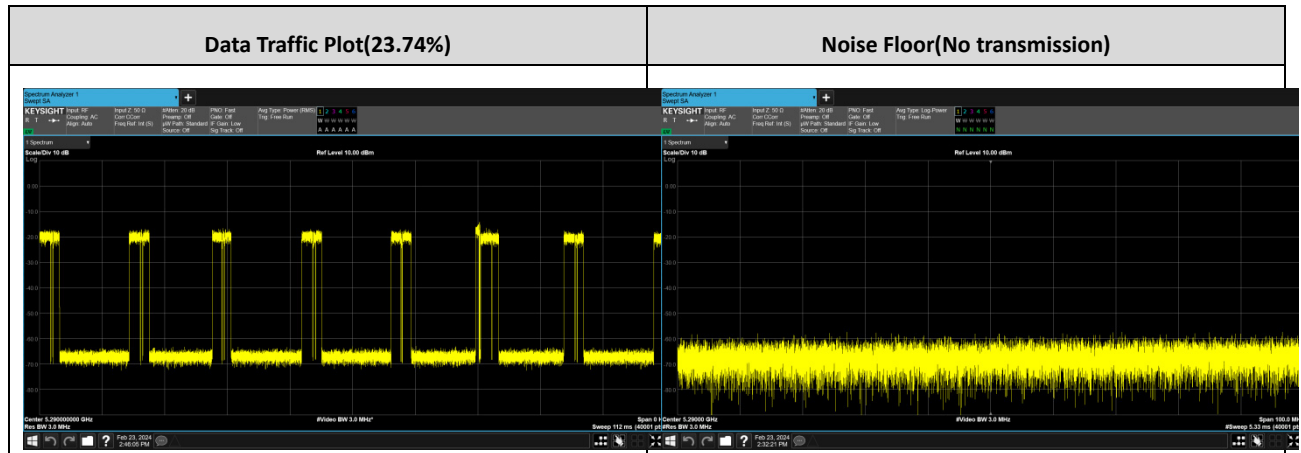
BW/Frequency	Test Item	Test Result(ms)	Limit(ms)	Result
80MHz/5290MHz	Channel Move Time	572.8	10000	PASS
	Channel Closing Transmission Time	27.6	<200+60ms	PASS
	Non-Occupancy Period	30	No transmission	True

Test Plots:

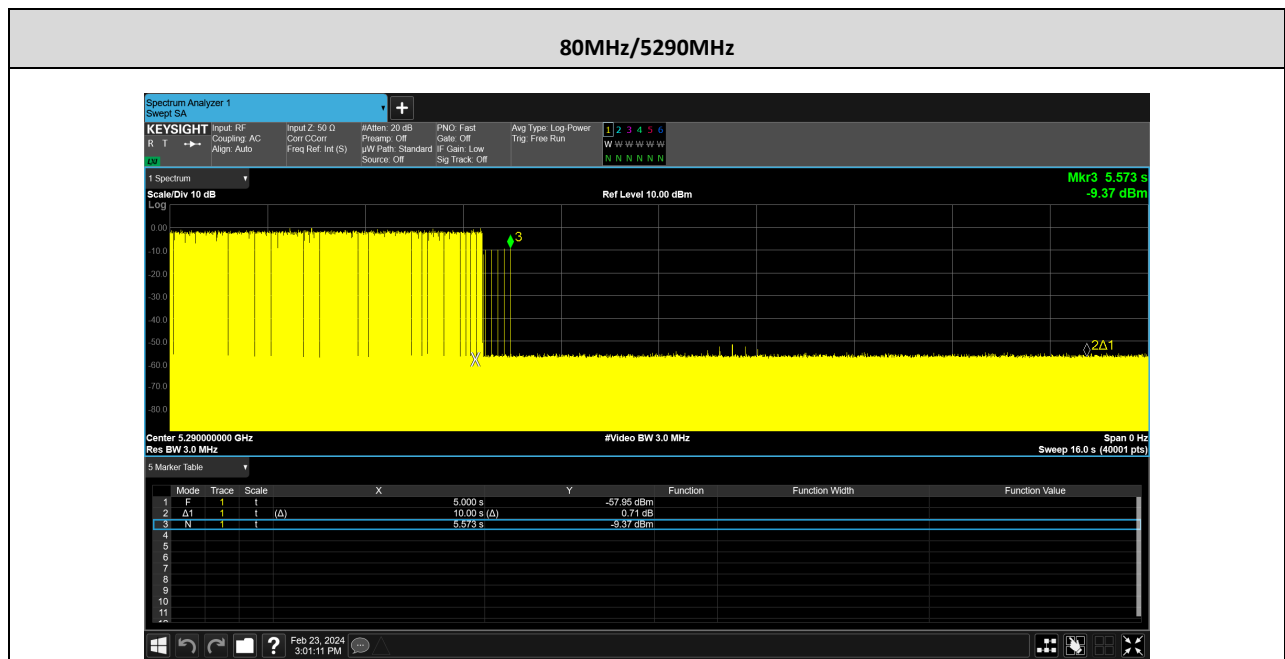
Radars Waveform calibration Plot



Data Traffic



IEEE 802.11ax

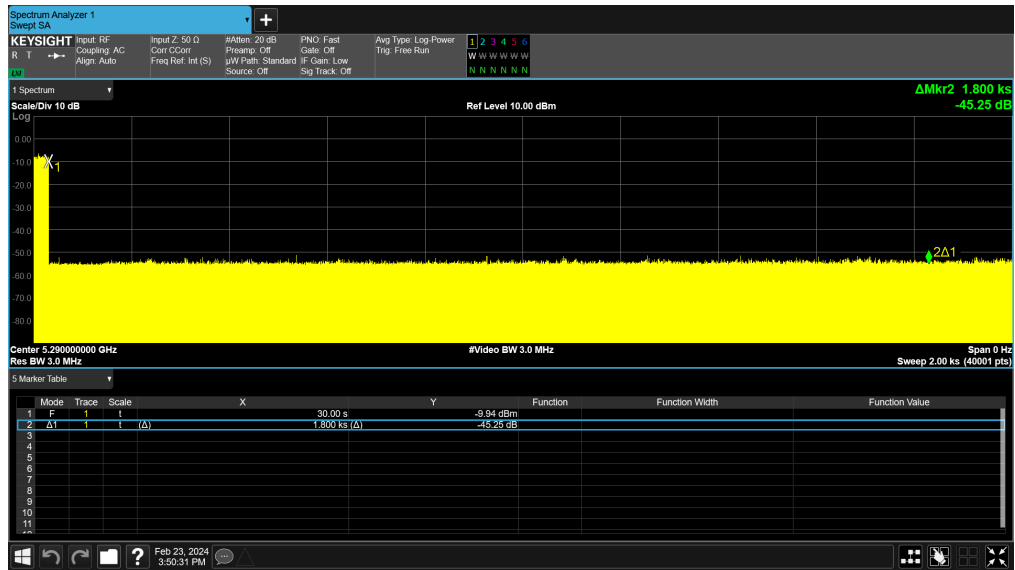


Note:

- 1) Mark1 Time: 5000ms, Mark2 Time:15000ms, On time Points:69
- 2) Dwell = Sweep Time/Sweep Points = 0.4ms, C = N x Dwell = 69 x 0.4 = 27.6 ms

Non-Occupancy Period

80MHz/5290MHz



4 Test Setup Photo

Please refer to the attachment RWAX202300107 Test Setup photo.

5 E.U.T Photo

Please refer to the attachment RWAX202300107 External Photo and RWAX202300107 Internal Photo.

---End of Report---