RADIO TEST REPORT
FCC 47 CFR PART 15 SUBPART E

Test Standard	**FCC Part 15.407**
Product name	**Digital Device**
Brand Name	**Philips**
Model No.	**9290035625, 9290035626**
Test Result	**Pass**
Statements of Conformity	**Determination of compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.**

The test Result was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were given in ANSI C63.10: 2013 and compliance standards.

The test results of this report relate only to the tested sample (EUT) identified in this report.
The test Report of full or partial shall not copy. Without written approval of Compliance Certification Services Inc.(Wugu Laboratory)

Approved by:

Shawn Wu
Supervisor

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	August 2, 2023	Initial Issue	ALL	Doris Chu
01	August 14, 2023	See the following Note Rev. (01)	P.5-6, P.10, P.17, P.23, P.15, P.4	Doris Chu
02	August 17, 2023	See the following Note Rev. (02)	P.4	Doris Chu
03	August 18, 2023	See the following Note Rev. (03)	P.4	Doris Chu

Rev. (01)
1. Modify Frequency Range in section 1.2.
2. Modify antenna type to Monopole in section 1.3.
3. Modify test configuration and test procedure in section 4.2.
4. Modify test channel and method in section 4.3.1.
5. Modify the radar level disagrees to -64 in page 15 and 17.
6. Add Serial Number and modify Model Discrepancy in section 1.1.

Rev. (02)
1. Modify Serial Number in section 1.1.

Rev. (03)
1. Remove HW Version in section 1.1.

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Table of contents

1. GENERAL INFORMATION 4
1.1 EUT INFORMATION 4
1.2 EUT CHANNEL INFORMATION 5
1.3 ANTENNA INFORMATION 6
1.4 MEASUREMENT UNCERTAINTY 6
1.5 FACILITIES AND TEST LOCATION 7
1.6 INSTRUMENT CALIBRATION 7
1.7 SUPPORT AND EUT ACCESSORIES EQUIPMENT 8
1.8 TEST METHODOLOGY AND APPLIED STANDARDS 8
2. TEST SUMMARY 9
3. DESCRIPTION OF TEST MODES 10
3.1 THE EUT CHANNEL NUMBER OF OPERATING CONDITION 10
4. TEST RESULT 11
4.1 TEST LIMIT 11
4.2 TEST PROCEDURE 15
4.3 TEST SETUP 19
APPENDIX-A TEST PHOTO A-1
APPENDIX 1 - PHOTOGRAPHS OF EUT

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1. GENERAL INFORMATION

1.1 EUT INFORMATION

Applicant	Signify (China) Investment Co., Ltd. Building no.9, Lane 888, Tianlin Road, Minhang District, Shanghai, 200233, China
Manufacturer	Signify (China) Investment Co., Ltd. Building no.9, Lane 888, Tianlin Road, Minhang District, Shanghai, 200233, China
Equipment	Digital Device
Model Name	9290035625, 9290035626
Model Discrepancy	**Model** / **Difference** 9290035625: 1.without Battery components 2. without level shift IC 3. Zigbee Antenna model: RFFPA203007IMAB402 WiFi Antenna model: RFFPA203006IMLB403 9290035626: 1. with Battery components 2.with level shift IC 3. Zigbee Antenna model: RFFPA203007IMAB401 WiFi Antenna model: RFFPA203006IMLB402
Brand Name	Philips
Received Date	June 2, 2023
Date of Test	June 17, 2023
Power Supply	1. Power from Power Adapter. I/P: 100-240VAC, 0.6A, 50-60Hz O/P: 12.0VDC, 2.0A, 24.0W 2. Power from Battery. (DC 3.7V) (for 9290035626)
SW Version	V1.0.02R25
Serial Number	9290035626: 74F6BF

Remark:
1. For more details, please refer to the User's manual of the EUT.
2. Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.
3. Disclaimer: The variant model numbers / trademarks are assessed as identical in hardware and software to each other, hence all variants are fully covered by the test results in this test report without further verification test.

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1.2 EUT CHANNEL INFORMATION

<table>
<tr><td>Frequency Range</td><td>
<table>
<tr><th></th><th>Mode</th><th>Frequency Range (MHz)</th></tr>
<tr><td rowspan="6">UNII 2a</td><td>IEEE 802.11a</td><td>5260 ~ 5320 MHz</td></tr>
<tr><td>IEEE 802.11n HT20</td><td>5260 ~ 5320 MHz</td></tr>
<tr><td>IEEE 802.11ac VHT20</td><td>5260 ~ 5320 MHz</td></tr>
<tr><td>IEEE 802.11n HT40</td><td>5270 ~ 5310 MHz</td></tr>
<tr><td>IEEE 802.11ac VHT40</td><td>5270 ~ 5310 MHz</td></tr>
<tr><td>IEEE 802.11ac VHT80</td><td>5290 MHz</td></tr>
<tr><td rowspan="6">UNII 2c</td><td>IEEE 802.11a</td><td>5500 ~ 5700 MHz</td></tr>
<tr><td>IEEE 802.11n HT20</td><td>5500 ~ 5700 MHz</td></tr>
<tr><td>IEEE 802.11ac VHT20</td><td>5500 ~ 5700 MHz</td></tr>
<tr><td>IEEE 802.11n HT40</td><td>5510 ~ 5670 MHz</td></tr>
<tr><td>IEEE 802.11ac VHT40</td><td>5510 ~ 5670 MHz</td></tr>
<tr><td>IEEE 802.11ac VHT80</td><td>5530 ~ 5610 MHz</td></tr>
</table>
</td></tr>
<tr><td>Modulation Type</td><td>1. IEEE 802.11a mode: OFDM
2. IEEE 802.11n HT 20 MHz mode: OFDM
3. IEEE 802.11n HT 40 MHz mode: OFDM
4. IEEE 802.11ac VHT 20 MHz mode: OFDM
5. IEEE 802.11ac VHT 40 MHz mode: OFDM
6. IEEE 802.11ac VHT 80 MHz mode: OFDM</td></tr>
</table>

Remark:
1. Refer as ANSI C63.10: 2013 clause 5.6.1 Table 4 for test channels

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1.3 ANTENNA INFORMATION

Antenna Type	☒ Monopole ☐ PCB ☐ Dipole ☐ Coils
Antenna Gain	5250~5350: 9290035625: Gain: 2.27 dBi 9290035626: Gain: 2.66 dBi 5470~5725: 9290035625: Gain: 2.27 dBi 9290035626: Gain: 2.66 dBi
Antenna connector	IPEX

Notes:
1. The antenna(s) of the EUT are permanently attached and there are no provisions for connection to an external antenna. So the EUT complies with the requirements of §15.203.

1.4 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Channel Bandwidth	± 2.7 %
RF output power (Spectrum)	± 2.440 dB
Power Spectral density	± 2.739 dB

Remark:
1.This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2
2. ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report.

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1.5 FACILITIES AND TEST LOCATION

All measurement facilities used to collect the measurement data are located at

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan.

☐ No. 12, Ln. 116, Wugong 3rd Rd., Wugu Dist., New Taipei City, Taiwan 24803

CAB identifier: TW1309

Test site	Test Engineer	Remark
DFS	Jerry Chang	-

Remark: The lab has been recognized as the FCC accredited lab. under the KDB 974614 D01 and is listed in the FCC pubic Access Link (PAL) database, FCC Registration No. :444940, the FCC Designation No.:TW1309

1.6 INSTRUMENT CALIBRATION

Dynamic Frequency Selection					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Cable	Woken	SUMITOMO	13	2023-03-02	2024-03-01
Cable	Woken	SUMITOMO	12	2023-03-02	2024-03-01
Cable	Woken	SUMITOMO	11	2023-03-02	2024-03-01
Cable	Woken	SUMITOMO	10	2023-03-02	2024-03-01
Cable	Woken	SUMITOMO	9	2023-03-02	2024-03-01
Cable	Woken	SUMITOMO	7	2023-03-02	2024-03-01
Cable	Woken	SUMITOMO	6	2023-03-02	2024-03-01
Cable	Woken	SUMITOMO	5	2023-03-02	2024-03-01
Cable	Woken	SUMITOMO	4	2023-03-02	2024-03-01
EXA Signal Analyzer	Keysight	N9010B	MY55460167	2022-09-07	2023-09-06
Attenuator	E-INSTRUMENT	EPA-600H	EC1400050	2022-06-28	2023-06-27
Power Divider	Solvang Technology	STI08-0015	008	2022-07-26	2023-07-25
Power Divider	Solvang Technology	STI08-0015	009	2022-07-26	2023-07-25
Power Divider	Marvelous Microwave	MVE8586	16011206	2022-07-20	2023-07-19
Vector Signal Generator	KEYSIGHT	N5182B/N5182BX07	MY61252828/ MY59362552	2023-02-01	2024-01-31
Software	GPIBShot,DFS Test Software,DFS Radar Profiles 2022 Update 1.0				

Remark:
1. Each piece of equipment is scheduled for calibration once a year.
2. N.C.R. = No Calibration Required.

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1.7 SUPPORT AND EUT ACCESSORIES EQUIPMENT

EUT Accessories Equipment						
No.	**Equipment**	**Brand**	**Model**	**Series No.**	**FCC ID**	**IC**
	N/A					

Support Equipment						
No.	**Equipment**	**Brand**	**Model**	**Series No.**	**FCC ID**	**IC**
1	NB	Lenovo	TP00075A	N/A	N/A	N/A
2	NB	Lenovo	TP00075A	N/A	N/A	N/A
3	AP	ASUS	RT-AX88U	N/A	MSQ-RTAXHP00	3568A-RTAXHP00

1.8 TEST METHODOLOGY AND APPLIED STANDARDS

The test methodology, setups and results comply with all requirements in accordance with ANSI C63.10:2013 and KDB 905462 D02.

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2. TEST SUMMARY

FCC Standard Sec.	Chapter	Test Item	Result
15.203	1.3	Antenna Requirement	Pass
15.407(h)	4.1	Dynamic Frequency Selection	Pass

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3. DESCRIPTION OF TEST MODES

3.1 THE EUT CHANNEL NUMBER OF OPERATING CONDITION

<table>
<tr><td>Operation mode</td><td>1. IEEE 802.11a mode: 6Mbps
2. IEEE 802.11n HT 20 MHz mode: MCS0
3. IEEE 802.11n HT 40 MHz mode: MCS0
4. IEEE 802.11ac VHT 20 MHz mode: MCS0
5. IEEE 802.11ac VHT 40 MHz mode: MCS0
6. IEEE 802.11ac VHT 80 MHz mode: MCS0</td></tr>
<tr><td>Operating Frequency</td><td>
<table>
<tr><th></th><th>Mode</th><th>Frequency Range (MHz)</th></tr>
<tr><td rowspan="6">UNII 2a</td><td>IEEE 802.11a</td><td>5260 ~ 5320 MHz</td></tr>
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<tr><td>IEEE 802.11ac VHT80</td><td>5530 ~ 5610 MHz</td></tr>
</table>
</td></tr>
</table>

Remark:
1. EUT pre-scanned data rate of output power for each mode, the worst data rate were recorded in this report.

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4. TEST RESULT

4.1 TEST LIMIT

FCC according to §15.407 (h), 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.

IC according RSS-247 section 6.3, and it harmonized with FCC Part 15 DFS rules.

The EIRP refer section 4.3 output power measurement in this report.

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 Device or Client with Radar Detection	Client Without Radar Detection
DFS Detection Threshold	Yes	Not required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required

Additional requirements for devices with multiple bandwidth mods	Master Device or Client with Radar Detection	Client Without Radar Detection
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 each of the bonded 20 MHz channels and the channel center frequency.		

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

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP ≥ 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.
Note3: 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
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 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.

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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	
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{\text{PRI}_{\mu\text{sec}}}\right)\right\}$	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

Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.

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Table 6 – Long Pulse Radar Test Signal

Radar Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per Burst	Number of Bursts	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 Signal

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

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4.2 TEST PROCEDURE

Overview Of EUT With Respect To §15.407 (H) Requirements

The firmware installed in the EUT during testing was:

Firmware Rev: V1.0.02R25

The EUT operates over the 5250-5350 MHz range as a Client Device that does not have radar detection capability.

The EUT uses one transmitter connected to two 50-ohm coaxial antenna ports via a diversity switch. Only one antenna port is connected to the test system since the EUT has one antenna only.

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

WLAN traffic is generated by streaming the video file TestFile.mp2 “6 ½ Magic Hours” from the Master to the Slave in full motion video mode using the media player with the V2.61 Codec package.

The EUT utilizes the 802.11ac architecture, with a nominal channel bandwidth of 80 MHz.

The rated output power of the Master unit is < 23dBm (EIRP). Therefore the required interference threshold level is -62 dBm. After correction for antenna gain and procedural adjustments, the required conducted threshold at the antenna port is –62 + 5 = -57dBm.

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

Manufacturer’s Statement Regarding Uniform Channel Spreading

The end product implements an automatic channel selection feature at startup such that operation commences on channels distributed across the entire set of allowed 5GHz channels. This feature will ensure uniform spreading is achieved while avoiding non-allowed channels due to prior radar events.

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TEST AND MEASUREMENT SYSTEM

System Overview

The measurement system is based on a conducted test method.

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 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 FCC 06-96 APPENDIX. The frequency of the signal generator is incremented in 1 MHz steps from FL to FH 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 set to display 8001 bins on the horizontal axis. The time-domain resolution is 2 msec / bin with a 16 second sweep time, meeting the 10 second short pulse reporting criteria. 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. The time-domain resolution is 3 msec / bin with a 24 second sweep time, meeting the 22 second long pulse reporting criteria and allowing a minimum of 10 seconds after the end of the long pulse waveform.

Should multiple RF ports be utilized for the Master and/or Slave devices (for example, for diversity or MIMO implementations), 50 ohm termination would be removed from the splitter so that connection can be established between splitter and the Master and/or Slave devices.

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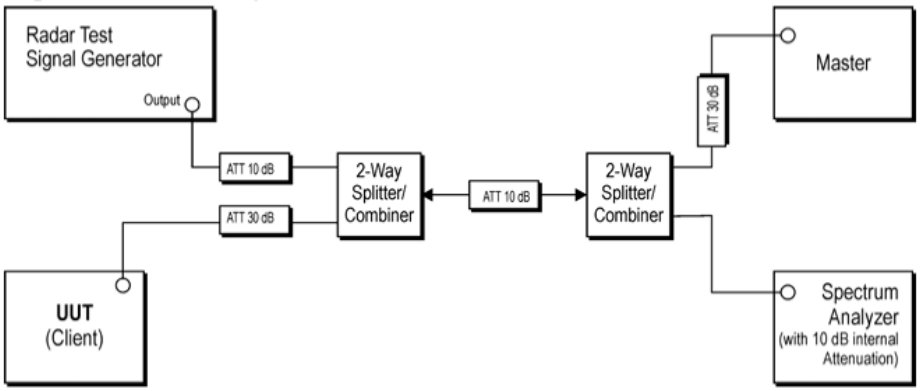
Conducted Method System Block Diagram



System Calibration

Connect the spectrum analyzer to the test system in place of the master device. Set the signal generator to CW mode. Adjust the amplitude of the signal generator to yield a measured level of –64 dBm on the spectrum analyzer.

Without changing any of the instrument settings, reconnect the spectrum analyzer to the Common port of the Spectrum Analyzer Combiner/Divider and connect a 50 ohm load to the Master Device port of the test system.

Measure the amplitude and calculate the difference from –64 dBm. Adjust the Reference Level Offset of the spectrum analyzer to this difference. Confirm that the signal is displayed at –64 dBm. Readjust the RBW and VBW to 3 MHz, set the span to 10 MHz, and confirm that the signal is still displayed at –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.

Set the signal generator to produce a radar waveform, trigger a burst manually and measure the level on the spectrum analyzer. Readjust the amplitude of the signal generator as required so that the peak level of the waveform is at a displayed level equal to the required or desired interference detection threshold. Separate signal generator amplitude settings are determined as required for each radar type.

Adjustment Of Displayed Traffic Level

Establish a link between the Master and Slave, adjusting the Link Step Attenuator as needed to provide a suitable received level at the Master and Slave devices. Stream the video test file to generate WLAN traffic. Confirm that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold. Confirm that the displayed traffic is from the Master Device. For Master Device testing confirm that the displayed traffic does not include Slave Device traffic. For Slave Device testing confirm that the displayed traffic does not include Master Device traffic.

If a different setting of the Master Step Attenuator is required to meet the above conditions, perform a new System Calibration for the new Master Step Attenuator setting.

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Channel Loading

System testing will be performed with channel-loading using means appropriate to the data types that are used by the unlicensed device. The following requirements apply:

a) The data file must be of a type that is typical for the device (i.e., MPEG-2, MPEG-4, WAV, MP3, MP4, AVI, etc.) and must generally be transmitting in a streaming mode.

b) Software to ping the client is permitted to simulate data transfer but must have random ping intervals.

c) Timing plots are required with calculations demonstrating a minimum channel loading of approximately 17% or greater. For example, channel loading can be estimated by setting the spectrum analyzer for zero span and approximate the Time On/ (Time On + Off Time). This can be done with any appropriate channel BW and modulation type.

d) Unicast or Multicast protocols are preferable but other protocols may be used. The appropriate protocol used must be described in the test procedures.

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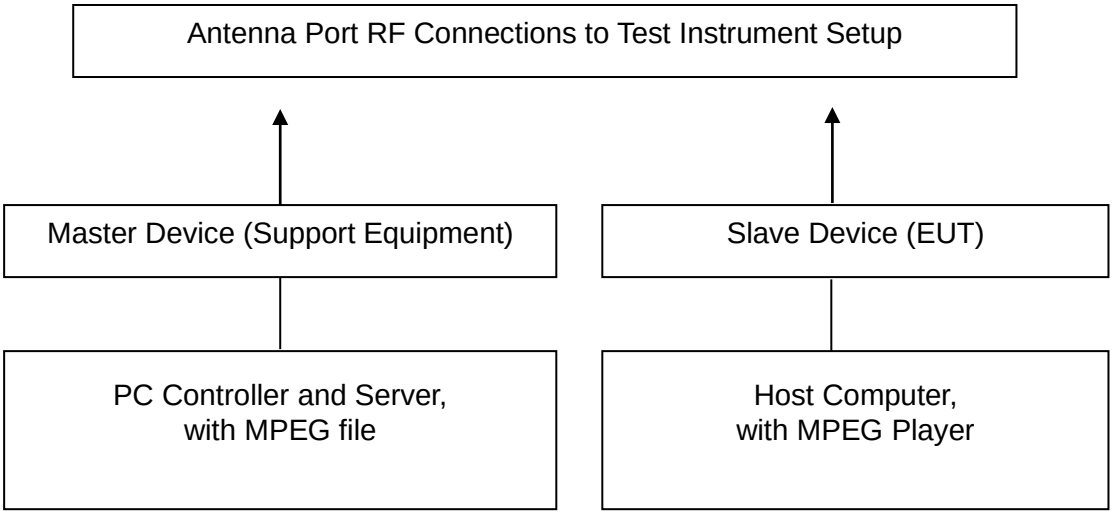
4.3 TEST SETUP



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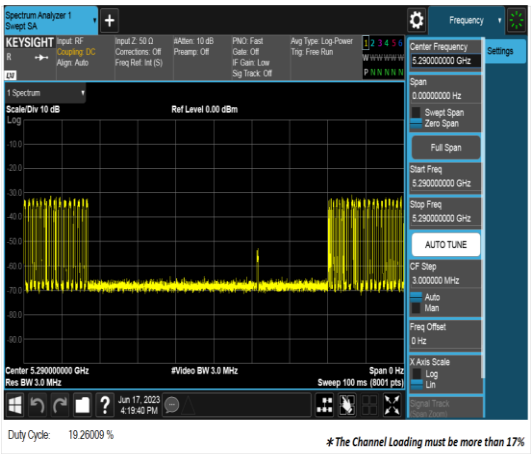
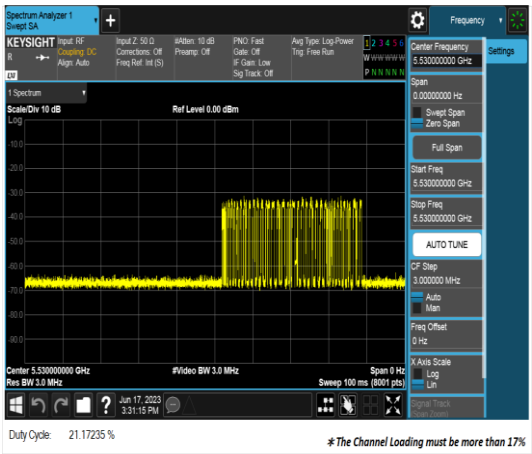
4.3.1 Test Result

Temperature:	23.6℃	**Test date:**	June 17, 2023
Humidity:	53% RH	**Tested by:**	Jerry Chang

IEEE 802.11ac VHT80 MHz Duty Cycle	
5290	**5530**
	

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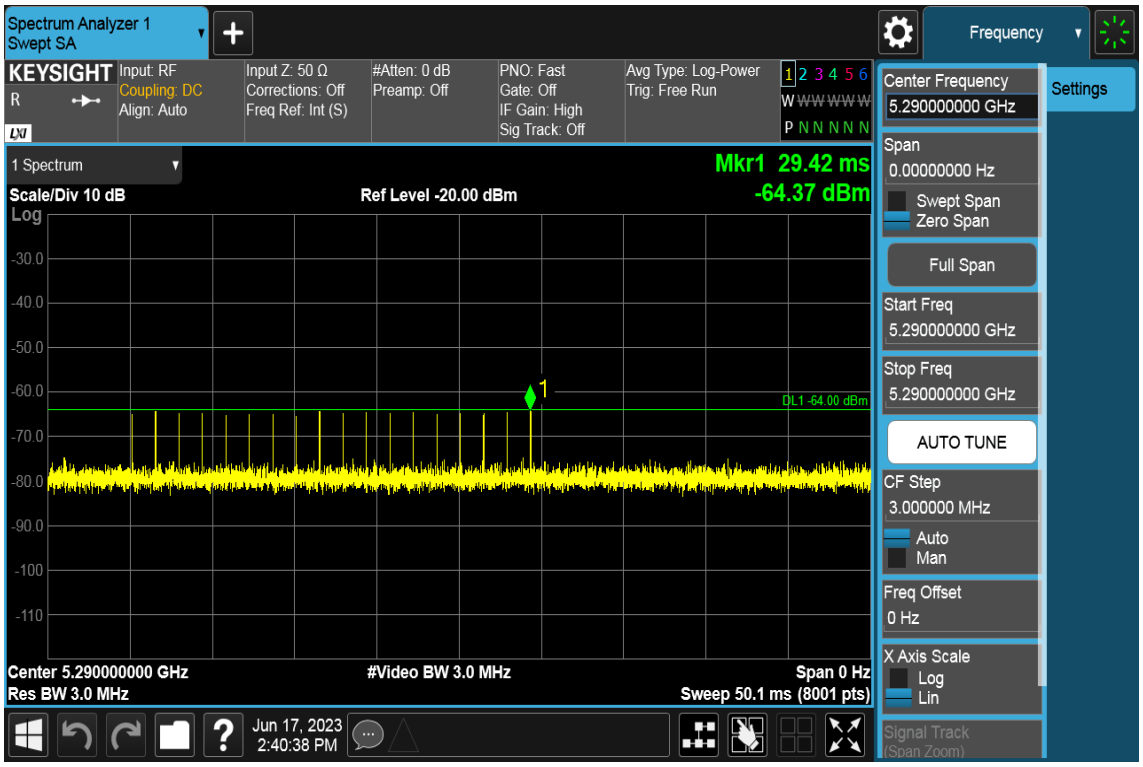
PLOT OF WLAN TRAFFIC FROM SLAVE
Band 2
<u>IEEE 802.11ac VHT80 mode / 5290 MHz</u>
<u>Radar Waveforms</u>
Sample of short Pulse Radar Type 0



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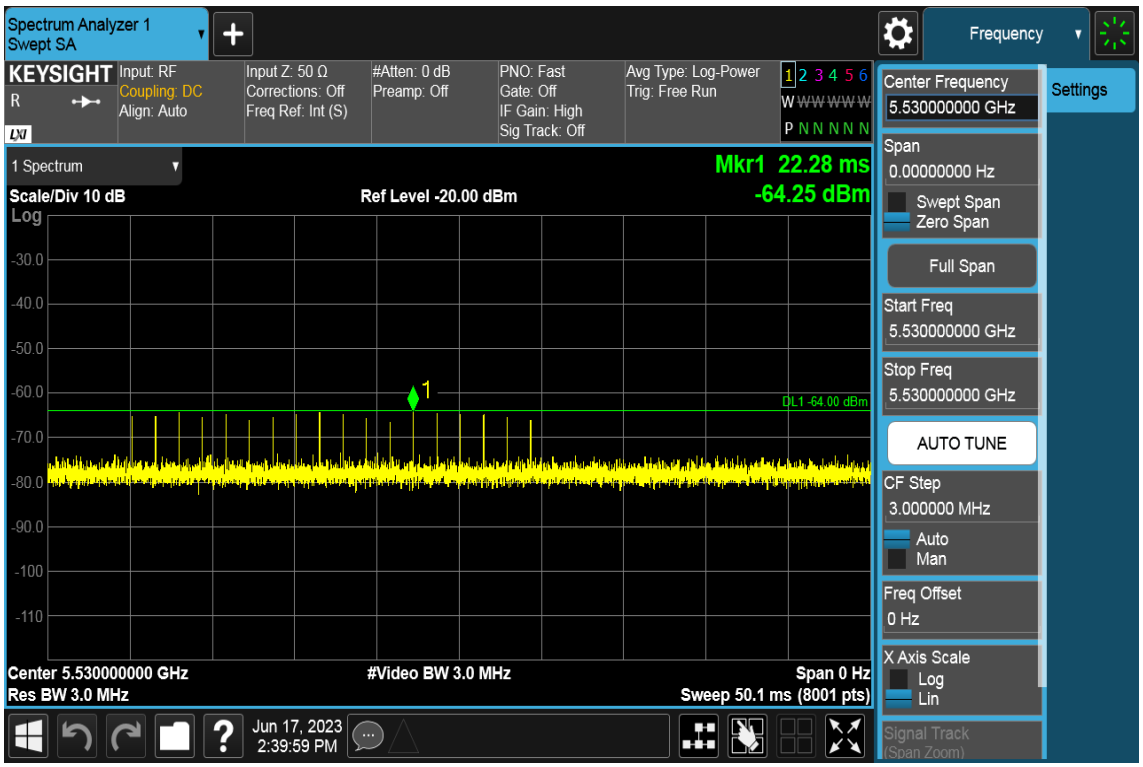
Band 3
<u>IEEE 802.11ac VHT80 mode / 5530 MHz</u>
<u>Radar Waveforms</u>
Sample of short Pulse Radar Type 0



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TEST CHANNEL AND METHOD

All tests were performed at a channel center frequency of 5290 MHz and 5530 MHz utilizing a conducted test method.

CHANNEL MOVE TIME AND CHANNEL CLOSING TRANSMISSION TIME

GENERAL 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).

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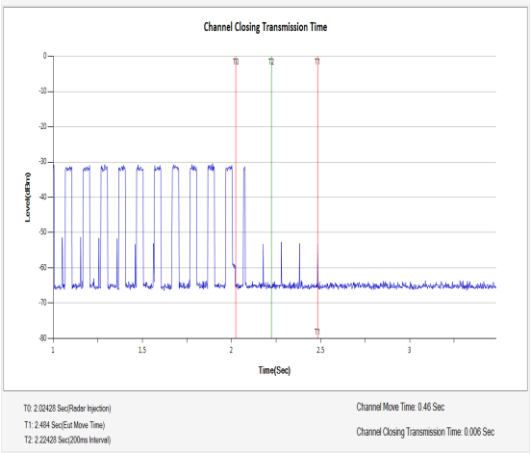
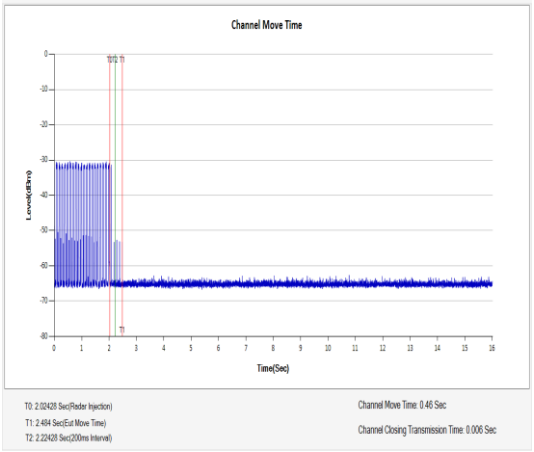
Band 2

IEEE 802.11ac VHT80 mode / 5290 MHz

Type 0 Channel Move Time Results & Channel Closing Transmission Time Results

Compliance.

Channel Shutdown Result				
Detection Threshold Level (dBm)			-64	
Modulation Mode	**Freq. (MHz)**	**Radar Test Signal**	**Channel Closing Transmission Time(ms) 200ms~10sec**	**Channel Move Time(s)**
VHT80	5290	0	6	0.460
Limit			60 ms	10 sec
Result			**Complied**	

Channel Close Time	Channel Move Time
	

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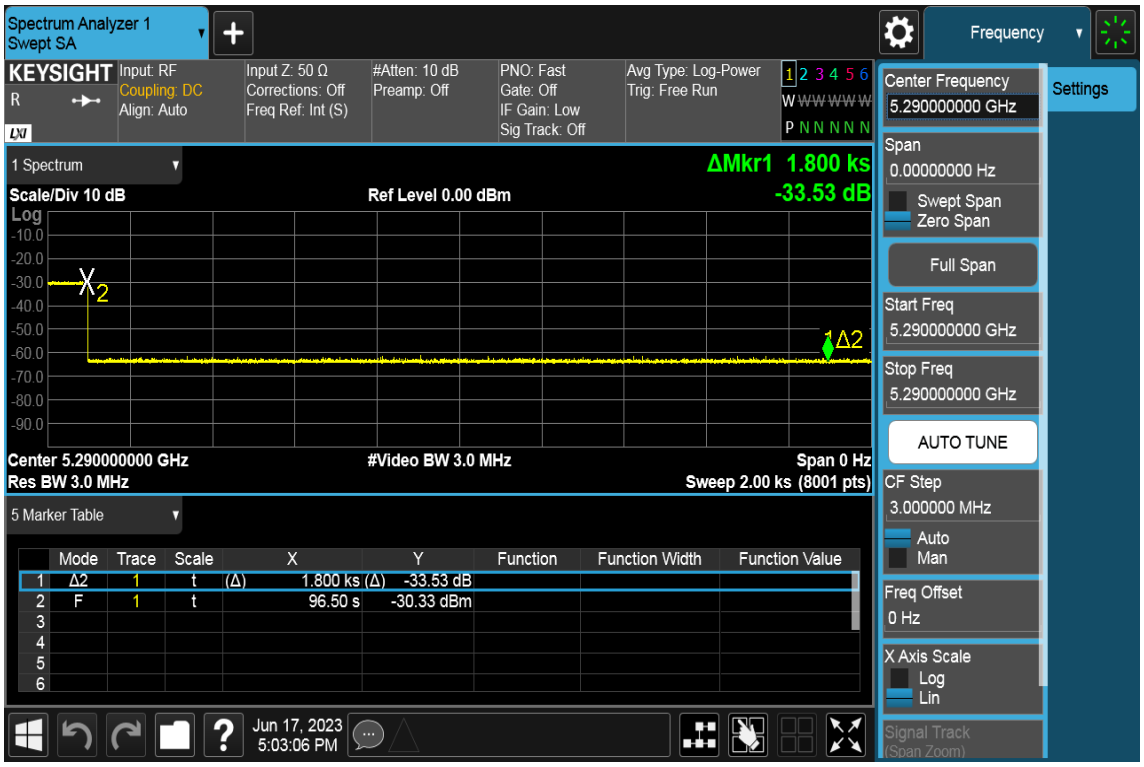
Non-Occupancy Period



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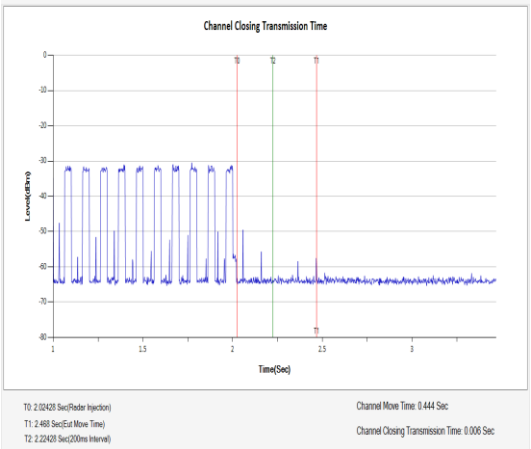
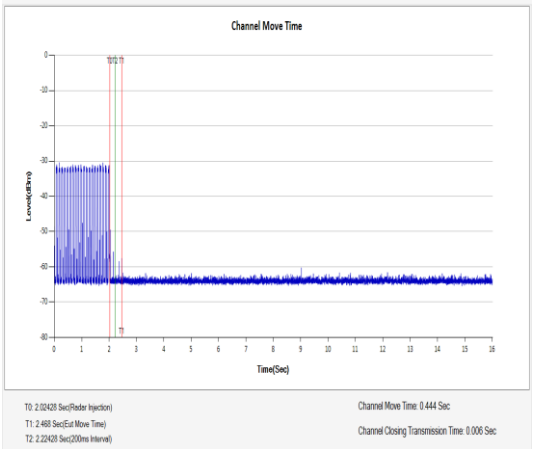
Band 3

IEEE 802.11ac VHT80 mode / 5530 MHz

Type 0 Channel Move Time Results & Channel Closing Transmission Time Results

Compliance.

Channel Shutdown Result				
Detection Threshold Level (dBm)			-64	
Modulation Mode	**Freq. (MHz)**	**Radar Test Signal**	**Channel Closing Transmission Time(ms) 200ms~10sec**	**Channel Move Time(s)**
VHT80	5530	0	6	0.444
Limit			60 ms	10 sec
Result			**Complied**	

Channel Close Time	Channel Move Time
	

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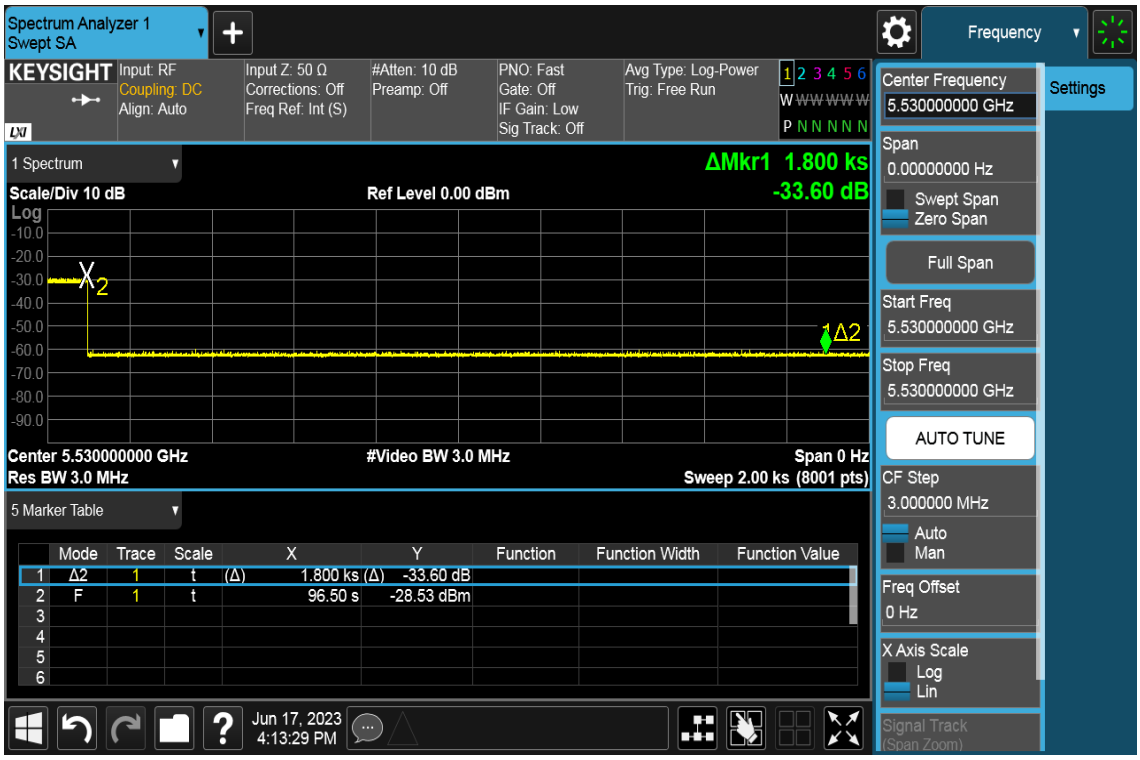
Non-Occupancy Period



--End of Test Report--

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