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FCC ID : RX3-WBU058BGA

DFS TEST REPORT

Product : WLAN and BT Wireless Module

Model Name : WBU058-BGA-V11

Series Model : WBU058-BGA-V13, WBU058-BGA-V15

FCC ID : RX3-WBU058BGA

Test Regulation: FCC 47 CFR Part 15 Subpart E (Section 15.407)

Received Date : 2024/8/9

Test Date : 2024/09/05 ~ 2024/09/06

Issued Date : 2024/10/7

Applicant: Hon Hai Precision Industry Co., Ltd.

No.151, Sec. 1, Nankan Rd., Lujhu Dist., Taoyuan City 33859,

Taiwan

Issued By: Underwriters Laboratories Taiwan Co., Ltd.

Building A, B and E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong

Township, Hsinchu County, Taiwan





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REVISION HISTORY

Original Test Report No.: 4791426387A-US-R3-V0

Revision	Test report No.	Date	Page revised	Contents
Original	4791426387A-US-R3-V0	2024/10/7	-	Initial issue
	-			
	-			
	-			

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Test Results

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1. Attestation of Test Results

APPLICANT: Hon Hai Precision Industry Co., Ltd.

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HON HAI PRECISION IND. CO., LTD **MANUFACTURER:**

No.151, Sec. 1, Nankan Rd., Lujhu Dist., Taoyuan City 33859, Taiwan

EUT DESCRIPTION: WLAN and BT Wireless Module

BRAND: FOXCONN

MODEL: WBU058-BGA-V11

WBU058-BGA-V13, WBU058-BGA-V15 **SERIES MODEL:**

Engineering Verification Test Sample SAMPLE STAGE:

DATE of TESTED: 2024/09/05 ~ 2024/09/06

APPLICABLE STANDARDS

STANDARD

FCC 47 CFR PART 15 Subpart E (Section 15.407) **PASS**

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. 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 NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

Approved and Authorized By:

Cindy Hsin Date: 2024/10/7

Eric Lee **Project Handler**

Senior Laboratory Engineer

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2. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02, FCC KDB 905462 D06 802 11 Channel Plans v02, KDB 905462 D03 UNII Clients Without Radar Detection New Rules v01r02.

3. Facilities and Accreditation

Test Location Underwriters Laboratories Taiwan Co., Ltd.	
Address	Building A, B and E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398.

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4. Measurement Uncertainty

For statement of conformity, Simple acceptance (Section 3.1.4 of IEC Guide 115) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor k=2.

Determining compliance based on the results of the compliance measurement, not considering measurement instrumentation uncertainty.

Measurement	Frequency	Uncertainty
DFS Generated Signal Levels (Conducted)	5GHz - 6GHz	2.1 dB
DFS Generated Signal Levels (Radiated)	5GHz - 6GHz	3.7 dB

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5. Equipment under Test

5.1. Description of EUT

Product WLAN and BT Wireless Module	
Brand Name	FOXCONN
Model Name	WBU058-BGA-V11
Series Model	WBU058-BGA-V13, WBU058-BGA-V15
Normal Voltage	3.3Vdc from Host

Sample ID	Conducted Test: 7472206 Radiated Test: 7528177
Operating Frequency Range 5250~5350MHz 5470~5725MHz	
Operational Mode	☐ Client with radar detection
Operational Wode	☐ Client without radar detection
TDC F4'	⊠ with TPC
TPC Function	□ without TPC
Wd D J	⊠ with 5600 ~ 5650MHz
Weather Band	□ without 5600 ~ 5650MHz

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5.2. EUT Software and Firmware Version

Software/Firmware Version

5.4.274-ge3a2c9526d58-dirty #1 Mon Jul 22 01:49:22 UTC 2024

5.3. Support Equipment

No.	Equipment	Brand Name	Model Name	FCC ID	Remark
1	Smart WiFi Router	ASUS	RT-AX88U	K6ITHP00052	MSQ-RTAXHP00

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5.4. Description of Available Antennas

Ant. No.	Transmitter Circuit	Frequency Range	Brand Name	Model Name	Maximum Gain (dBi)	Ant. Type	Connector Type
WLAN ANT1	Chain0	2.412~2.472GHz 5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz 5.925~6.425GHz 6.425~6.525GHz 6.525~6.875GHz 6.875~7.125GHz	FOXCONN	WBU058- BGA	2.412~2.472GHz: 3.91 5.15~5.25GHz: 4.11 5.25~5.35GHz: 5.18 5.47~5.725GHz: 4.62 5.725~5.85GHz: 4.28 5.925~6.425GHz: 3.34 6.425~6.525GHz: 3.35 6.525~6.875GHz: 4.88 6.875~7.125GHz: 4.72	Printing	N/A
WLAN ANT2	Chain1	2.412~2.472GHz 5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz 5.925~6.425GHz 6.425~6.525GHz 6.525~6.875GHz 6.875~7.125GHz	FOXCONN	WBU058- BGA	2.412~2.472GHz: 4.94 5.15~5.25GHz: 3.8 5.25~5.35GHz: 3.76 5.47~5.725GHz: 3.36 5.725~5.85GHz: 3.34 5.925~6.425GHz: 3.07 6.425~6.525GHz: 3.39 6.525~6.875GHz: 4.01 6.875~7.125GHz: 2.97	Printing	N/A

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual, the laboratory shall not be held responsible.

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5.5. EUT Maximum Conducted Power

802.11a

Engagement Bond (MHz)	MAX. Power				
Frequency Band (MHz)	Output Power(dBm)	Output Power(mW)			
5250~5350	11.37	13.71			
5470~5725	11.47	14.03			

802.11ac (VHT20)

Engagoney Bond (MHz)	MAX. Power		
Frequency Band (MHz)	Output Power(dBm)	Output Power(mW)	
5250~5350	10.72	11.80	
5470~5725	10.95	12.45	

802.11ac (VHT40)

Fraguency Pand (MUz)	MAX. Power			
Frequency Band (MHz)	Output Power(dBm)	Output Power(mW)		
5250~5350	10.65	11.61		
5470~5725	10.76	11.91		

802.11ac (VHT80)

Engguenay Pand (MHz)	MAX. Power			
Frequency Band (MHz)	Output Power(dBm)	Output Power(mW)		
5250~5350	10.55	11.35		
5470~5725	10.80	12.02		

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802.11ax (HE20)

Fraguency Pand (MHz)	MAX. Power		
Frequency Band (MHz)	Output Power(dBm)	Output Power(mW)	
5250~5350	10.82	12.08	
5470~5725	10.98	12.53	

802.11ax (HE40)

Engagement Bond (MHz)	MAX.	Power
Frequency Band (MHz)	Output Power(dBm)	Output Power(mW)
5250~5350	10.97	12.50
5470~5725	10.81	12.05

802.11ax (HE80)

Engguenay Dand (MHz)	MAX.	Power	
Frequency Band (MHz)	Output Power(dBm)	Output Power(mW)	
5250~5350	10.88	12.25	
5470~5725	10.95	12.45	

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5.6. EUT Maximum E.I.R.P. Power

802.11a

Engagement Bond (MHz)	MAX.	Power
Frequency Band (MHz)	Output Power(dBm)	Output Power(mW)
5250~5350	16.55	45.19
5470~5725	16.09	40.64

802.11ac (VHT20)

Everyoner Dand (MHz)	MAX.	Power
Frequency Band (MHz)	Output Power(dBm)	Output Power(mW)
5250~5350	15.90	38.91
5470~5725	15.57	36.06

802.11ac (VHT40)

Fraguency Pand (MUz)	MAX.	Power	
Frequency Band (MHz)	Output Power(dBm)	Output Power(mW)	
5250~5350	15.83	38.28	
5470~5725	15.38	34.51	

802.11ac (VHT80)

Engagement Dand (MHz)	MAX. Power		
Frequency Band (MHz)	Output Power(dBm)	Output Power(mW)	
5250~5350	15.73	37.41	
5470~5725	15.42	34.83	

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802.11ax (HE20)

Engage on Dond (MHz)	MAX.	Power
Frequency Band (MHz)	Output Power(dBm)	Output Power(mW)
5250~5350	16.00	39.81
5470~5725	15.60	36.31

802.11ax (HE40)

Engagement Dand (MHz)	MAX. Power		
Frequency Band (MHz)	Output Power(dBm)	Output Power(mW)	
5250~5350	16.15	41.21	
5470~5725	15.43	34.91	

802.11ax (HE80)

Engageney Bond (MHz)	MAX.	Power
Frequency Band (MHz)	Output Power(dBm)	Output Power(mW)
5250~5350	16.06	40.37
5470~5725	15.57	36.06

5.7. Test Condition

Test Item	Test Site No.	Environmental	Input Power	Test Date	Tested by
DFS	SR4	23~25°C/ 63~67%RH	3.3Vdc	2024/09/05~ 2024/09/06	Rex Chen

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6. Test Equipment

Test Equipment List								
Equipment Manufacturer Model No. Serial No. Cal. Date								
	Antenna Port Conducted Measurement							
Spectrum Analyzer	Spectrum Analyzer Keysight N9010A MY56070834 2023/10/11 2024/10/10							
Signal Generator	Keysight	N5182B	MY57300028	2023/10/23	2024/10/22			

UL Software

Software	Test Item	Version
N7607B Signal Studio	DFS Radar Profiles	3.0.0.0
ISMointor10	DFS measurement	10.0.0.0

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7. Test Result

7.1. Transmit Power Control (TPC)

Requirements

U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

Test Data

Applicable	EIRP	FCC 15.407 (h)(1)
	>500mW	The TPC mechanism is required for system with an EIRP of above 500mW
\checkmark	<500mW	The TPC mechanism is not required for system with an EIRP of less 500mW

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7.2. Dynamic Frequency Selection (DFS)

7.2.1. Applicability of DFS Requirements

Applicability of DFS Requirements Prior to use of a Channel:

	Operational Mode			
Requirement	Master	Client Without Radar Detection	Client with Radar Detection	
Non-Occupancy Period	Yes	Yes note	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	

Note: Per KDB 905462 D03 UNII Clients Without Radar Detection New Rules v01r02 section (b)(5/6), If the client moves with the master, the device is considered compliant if nothing appears in the client non-occupancy period test. For devices that shut down (rather than moving channels), no beacons should appear. An analyzer plot that contains a single 30-minute sweep on the original channel.

Applicability of DFS Requirements during Normal Operation:

	Operational Mode			
Requirement	Master 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	Operational Mode			
with multiple bandwidth modes	Master 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 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 frequencies between the bonded 20 MHz channel blocks.

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7.2.2. DFS Detection Thresholds and Response Requirement

Below table provides the DFS Detection Thresholds for Master Devices as well as Client Devices incorporating In-Service Monitoring.

DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection;

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 and 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.

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.)
I I I I I I I I I I I I I I I I I I I	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.

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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.

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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7.2.3. Radar Test Waveforms

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance. Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

Short Pulse Radar Test Waveforms:

Radar Type	Pulse Width (µsec)	PRI (μsec) Number of Pulse		Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note1	See Note1
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	Roundup $ \begin{bmatrix} \left(\frac{1}{360}\right). \\ \left(\frac{19 \cdot 10^6}{\text{PRI}_{\mu \text{sec}}}\right) \end{bmatrix} $	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
Aggrega	ite (Radar Type	es 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.

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

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse Radar Type waveforms. If more than 30 waveforms are used for the Long Pulse Radar Type waveforms, then each additional waveform must also be unique and not repeated from the previous waveforms.

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

For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm: The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 - 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely

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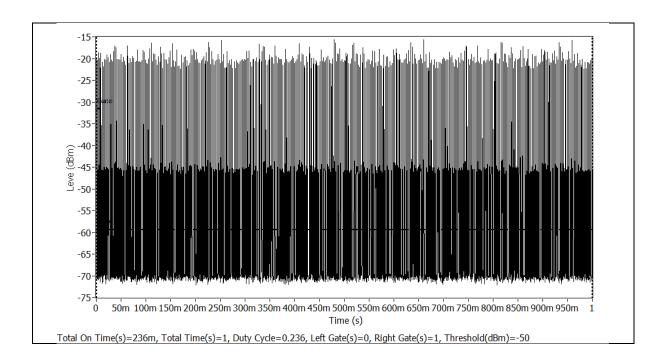


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7.2.4. Channel Loading / Data Streaming

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.
 V c) Timing plots are required with calculations demonstrating a minimum channel loading of approximately 17% or greater.
 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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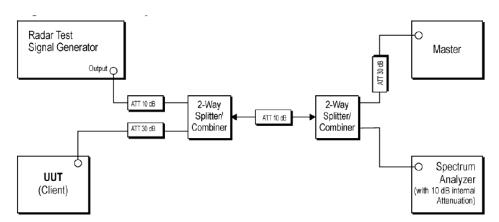
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7.2.5. Test Setup



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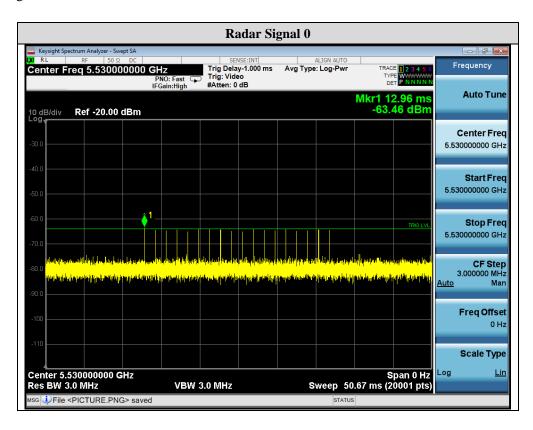
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7.2.6. Test Result

DFS Detection Threshold

For detection threshold level of -64dBm, the required Radar Signal at antenna port was set to -64dBm + Ant Gain (0 dBi) + 1dB = -63 dBm. That had been taken into account the output power range and antenna gain.



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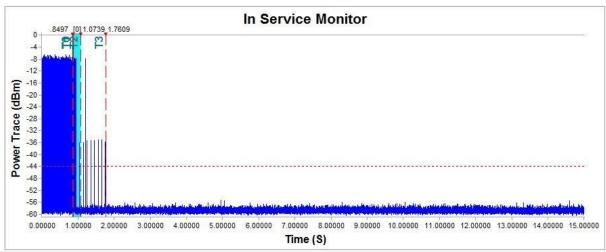
FCC ID : RX3-WBU058BGA

Channel Move Time & Channel Closing Transmission Time

802.11a

Ch100

Channel Move Time(s)	Limit(s)	Result
0.9	10	PASS
Channel Closing Transmission Time(ms)	Limit(ms)	Result
9.74	60	PASS



Time Index Info

T0: 0.8497 S (Radar Injection Start)
T1: 0.8737 S (Radar Injection Stop)
T2: 1.0739 S (200msec Interval)
T3: 1.7609 S (Channel Move Time)

ion Start) Time Per Bin: 0.7499625

T2~T3 Bins Over Threshold: = 13 Bins

Channel Move Time: 0.8872056 S Channel Close Time: 0.0097495 S

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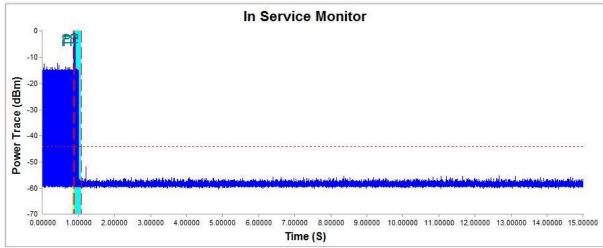
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FCC ID : RX3-WBU058BGA

802.11ax (HE80)

Ch106

Channel Move Time(s)	Limit(s)	Result
0	10	PASS
Channel Closing Transmission Time(ms)	Limit(ms)	Result
13.49	60	PASS



Time Index Info-

T0: 0.8790 S (Radar Injection Start)
T1: 0.9030 S (Radar Injection Stop)
T2: 1.1032 S (200msec Interval)
T3: 0.9030 S (Channel Move Time)

Time Per Bin:0.7499625

T2~T3 Bins Over Threshold:

= 18 Bins

Channel Move Time: 0.0 S

Channel Close Time: 0.0134993 S

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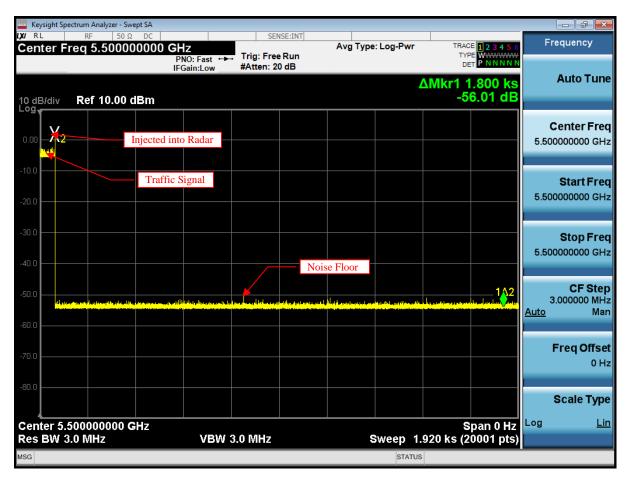
FCC ID : RX3-WBU058BGA

Non-Occupancy Period

During the 30 minutes observation time, UUT did not make any transmissions on a channel after a radar signal was detected on that channel by either the Channel Availability Check or the In-Service Monitoring

802.11a

Ch100



Note:

1. 5500MHz has been monitored in 30 minutes period. In this period, no any transmission occurs.

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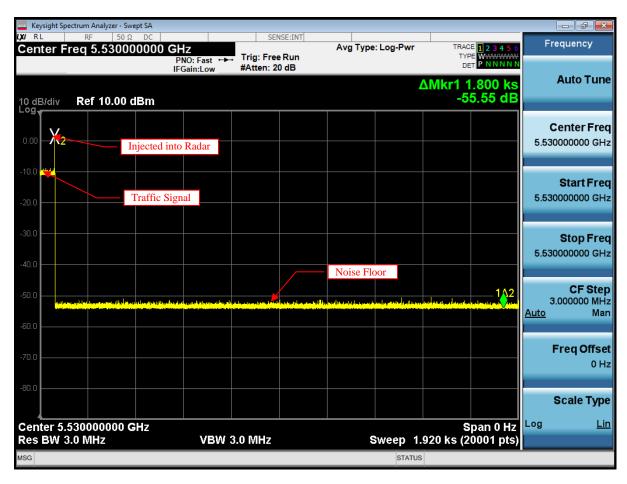


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FCC ID : RX3-WBU058BGA

802.11ax (HE80)

Ch106



Note:

1. 5530MHz has been monitored in 30 minutes period. In this period, no any transmission occurs.

END OF REPORT

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