TEST REPORT

CERTIFICATE OF CONFORMITY

Standard:	**47 CFR FCC Part 15, Subpart E (Section 15.407)**
Report No.:	RFBEFM-WTW-P24110678
FCC ID:	ARS-CRD29
Product:	Wi-Fi module
Brand:	Philips
Model No.:	CRD29
Received Date:	2024/11/28
Test Date:	2024/12/23 ~ 2024/12/27
Issued Date:	2025/1/21
Applicant:	TOP VICTORY ELECTRONICS (TAIWAN) CO., LTD.
Address:	10F, No. 230, Liancheng Rd., Zhonghe City, Taipei County 23553, Taiwan
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan
FCC Registration / Designation Number:	788550 / TW0003

Approved by: Jeremy Lin , **Date:** 2025/1/21

Jeremy Lin / Project Engineer

This test report consists of 27 pages in total. It may be duplicated completely for legal use with the approval of the applicant. It should not be reproduced except in full, without the written approval of our laboratory. The test results in the report only apply to the tested sample. The test results in this report are traceable to the national or international standards.

Prepared by : Celine Chou / Senior Specialist

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RFBEFM-WTW-P24110678	Original release.	2025/1/21

1 Certificate

Product:	Wi-Fi module
Brand:	Philips
Test Model:	CRD29
Sample Status:	Engineering sample
Applicant:	TOP VICTORY ELECTRONICS (TAIWAN) CO., LTD.
Test Date:	2024/12/23 ~ 2024/12/27
Standard:	47 CFR FCC Part 15, Subpart E (Section 15.407)
Measurement procedure:	KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02 KDB 905462 D03 UNII Clients Without Radar Detection New Rules v01r02

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

2 Summary of Test Results

47 CFR FCC Part 15, Subpart E (Section 15.407)			
Clause	Test Item	Result	Remark
15.407(h)	U-NII Detection Bandwidth	N/A	Not Applicable
15.407(h)	Channel Availability Check Time	N/A	Not Applicable
15.407(h)	Channel Closing Transmission and Channel Move Time	Pass	Applicable
15.407(h)	Non-Occupancy Period	N/A	Not Applicable
15.407(h)	Statistical Performance Check	N/A	Not Applicable
15.407(h)	Non-Associated Test	Pass	Applicable

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Wi-Fi module
Brand	Philips
Test Model	CRD29
DFS Firmware/software version	Android version:13 Kernel version: 5.15.78 android13-8-abFB02.02T_CRD32 #1 Wed Apr 10 03:35:39 UTC 2024
Operational Mode	Client without radar detection
Operating Frequency Band	5.25 GHz ~ 5.35 GHz 5.47 GHz ~ 5.725 GHz

Note: The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Antenna Description of EUT

1. The antenna information is listed as below.

Antenna No.	RF Chain No.	Brand	Model	Antenna Net Gain (dBi)	Frequency Range	Antenna Type	Connector Type	*Cable Length
1(WIFI)	0/1	TPV	368GAAWA1950YL	2.99	2.4 GHz ~ 2.4835 GHz	Dipole	R-SMA	70mm
				3.73	5.15 GHz ~ 5.85 GHz	Dipole	R-SMA	70mm
2(WIFI)	0/1	TPV	SLK-GJ-P2808A-L-200I-B	2.01	2.4 GHz ~ 2.4835 GHz	PIFA	ipex(MHF)	200mm
				2.74	5.15 GHz ~ 5.85 GHz	PIFA	ipex(MHF)	200mm
3(WIFI)	0/1	TPV	SLK-GJ-P2808B-R-550I-G	2.90	2.4 GHz ~ 2.4835 GHz	PIFA	ipex(MHF)	550mm
				2.79	5.15 GHz ~ 5.85 GHz	PIFA	ipex(MHF)	550mm
4(WIFI)	0/1	TPV	SLK-GJ-T3018-R-507I-G	1.99	2.4 GHz ~ 2.4835 GHz	PIFA	ipex(MHF)	507mm
				1.72	5.15 GHz ~ 5.85 GHz	PIFA	ipex(MHF)	507mm
5(BT)	2	TPV	368GAAWA1920YL	2.22	2.4 GHz ~ 2.4835 GHz	PCB	ipex(MHF)	35mm

* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

3.3 EUT Power Level

Highest Power Level						
Signal Mode	Frequency Band (MHz)	Conducted Power		Gain (dBi)	EIRP	
		(mW)	(dBm)		(mW)	(dBm)
CDD	5250-5350	27.58	14.41	3.73	65.102	18.14
	5470-5725	26.581	14.25	3.73	62.744	17.98

4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.1 Channel Closing Transmission and Channel Move Time

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
EMI Test Receiver R&S	ESR7	101451	2024/4/1	2025/3/31
MXG Vector signal generator Keysight	N5182B	MY53052282	2024/1/8	2025/1/7

Notes:

1. The test was performed in DFS room.
2. Tested Date: 2024/12/23 ~ 2024/12/27

4.2 Non-Associated Test

Refer to section 4.1 to get the tested date and information of the instruments.

5 Limits of Test Items

5.1 Working Modes and Required Test Items

The manufacturer shall state whether the UUT is capable of operating as a Master and/or a Client. If the UUT is capable of operating in more than one operating mode then each operating mode shall be tested separately. See tables 1 and 2 for the applicability of DFS requirements for each of the operational modes.

Table 1: Applicability of DFS Requirements Prior To Use a Channel

Requirement	Operational Mode		
	Master	Client without radar detection	Client with radar detection
Non-Occupancy Period	✓	✓ note	✓
DFS Detection Threshold	✓	Not required	✓
Channel Availability Check Time	✓	Not required	Not required
U-NII Detection Bandwidth	✓	Not required	✓
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.			

Table 2: Applicability of DFS Requirements during Normal Operation.

Requirement	Operational Mode	
	Master or Client with radar detection	Client without radar detection
DFS Detection Threshold	✓	Not required
Channel Closing Transmission Time	✓	✓
Channel Move Time	✓	✓
U-NII Detection Bandwidth	✓	Not required

Additional requirements for devices 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 (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.		

5.2 Test Limits and Radar Signal Parameters

Detection Threshold Values

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 ≥ 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
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.	

Parameters of DFS Test Waveforms

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.

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 μ sec, with a minimum increment of 1 μ sec, excluding PRI values selected in Test A	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot10^6}{\text{PRI}_{\mu\text{sec}}}\right)\right\}$	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.					

Table 6: 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

Three subsets of trials will be performed with a minimum of ten trials per subset. The subset of trials differ in where the Long Pulse Type 5 Signal is tuned in frequency.

a) the Channel center frequency
b) tuned frequencies such that 90% of the Long Pulse Type 5 frequency modulation is within the low edge of the UUT Occupied Bandwidth
c) tuned frequencies such that 90% of the Long Pulse Type 5 frequency modulation is within the high edge of the UUT Occupied Bandwidth

It include 10 trails for every subset, the formula as below,

For subset case 1: the center frequency of the signal generator will remain fixed at the center of the UUT Channel.

For subset case 2: to retain 90% frequency overlap between the radar signal and the UUT Occupied Bandwidth, the center frequency of the signal generator will vary for each of the ten trials in subset case 2. The center frequency of the signal generator for each trial is calculated by:

$FL+(0.4*Chirp\ Width\ [in\ MHz])$

For subset case 3: to retain 90% frequency overlap between the radar signal and the UUT Occupied Bandwidth, the center frequency of the signal generator will vary for each of the ten trials in subset case 3. The center frequency of the signal generator for each trial is calculated by:

$FH-(0.4*Chirp\ Width\ [in\ MHz])$

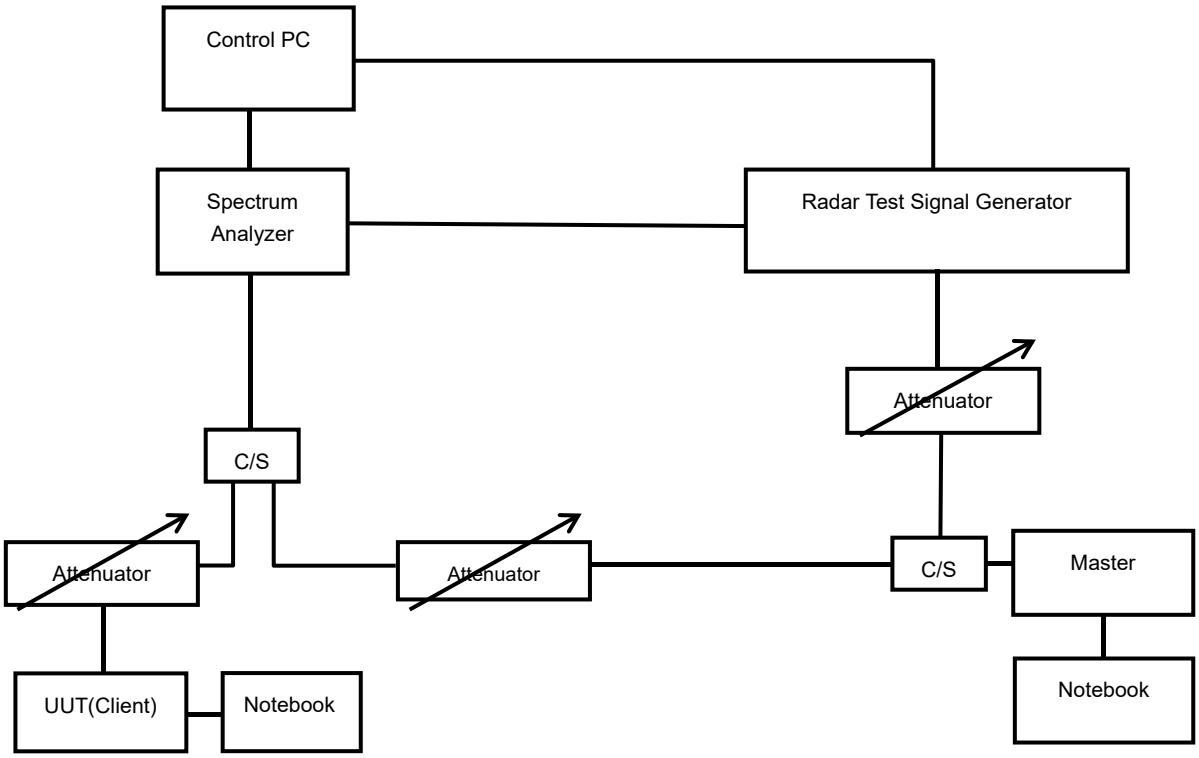
Table 7: Frequency Hopping Radar Test Waveform

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

6 Test Arrangements

6.1 Test Setup

Conducted measurement
Client Mode



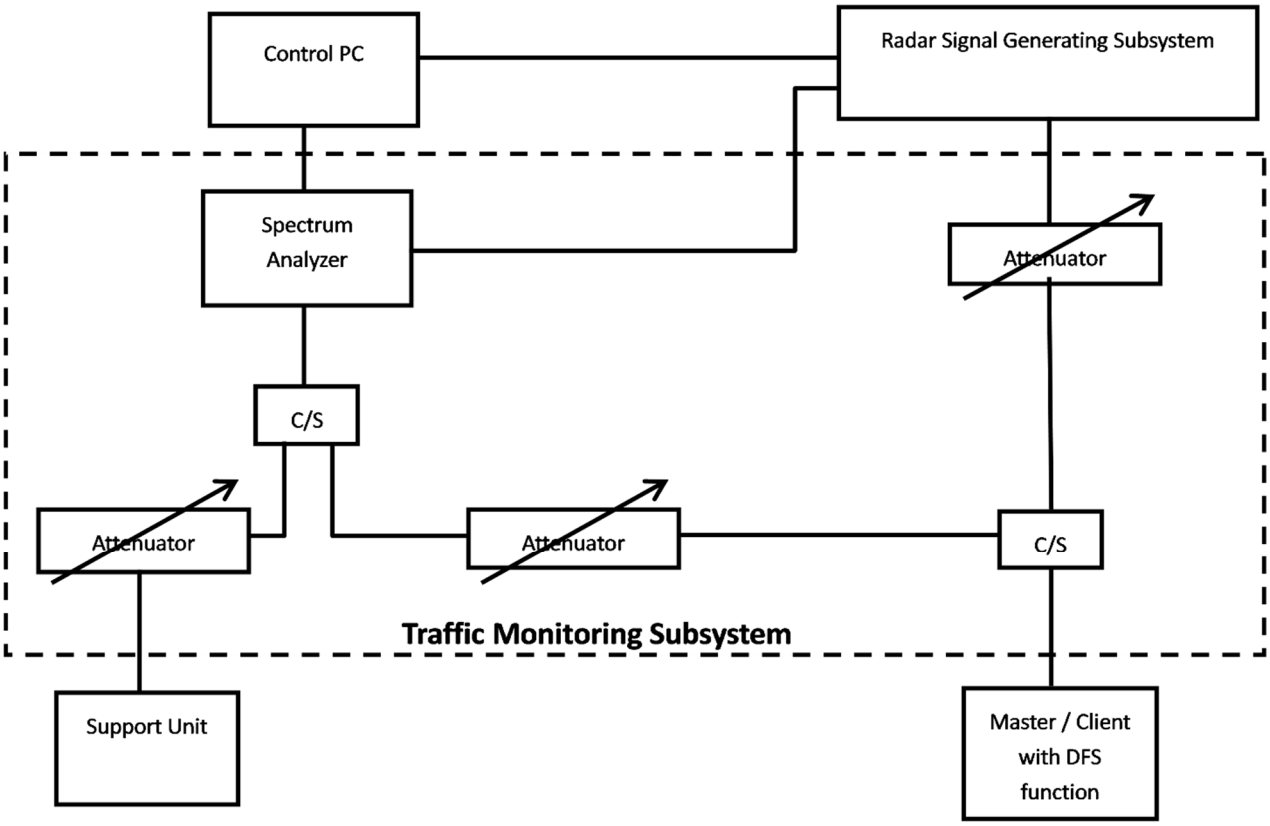
The UUT is a RLAN device operating in Client mode, without Radar Interference Detection function. The radar test signals are injected into the master device.

6.2 Test Procedure

6.2.1 DFS Measurement System

A complete DFS Measurement System consists of two subsystems: (1) the Radar Signal Generating system and (2) the Traffic Monitoring system. The control PC is necessary for generating the Radar waveforms in Table 5, 6 and 7. The traffic monitoring subsystem is specified to the type of unit under test (UUT).

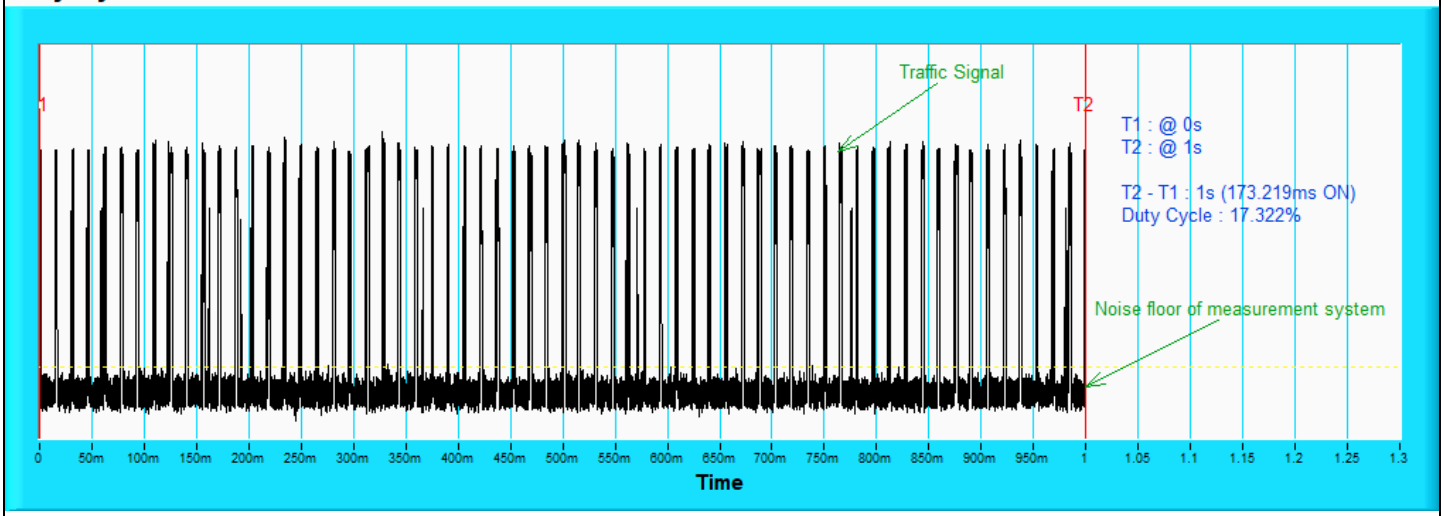
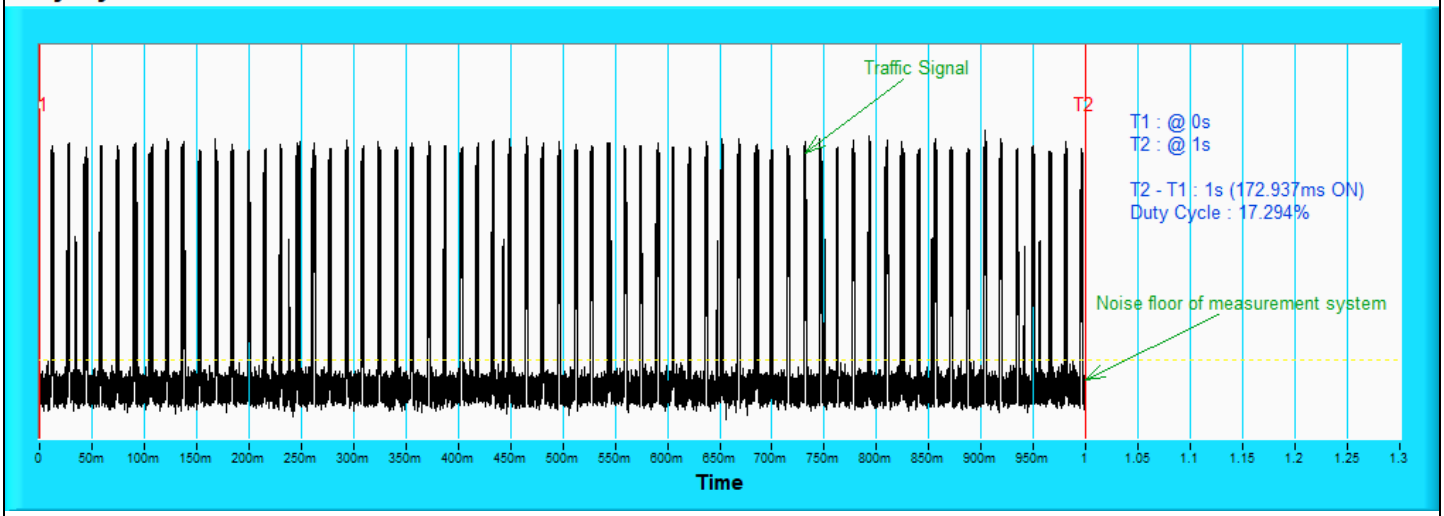
Conducted Setup Configuration of DFS Measurement System



Channel Loading

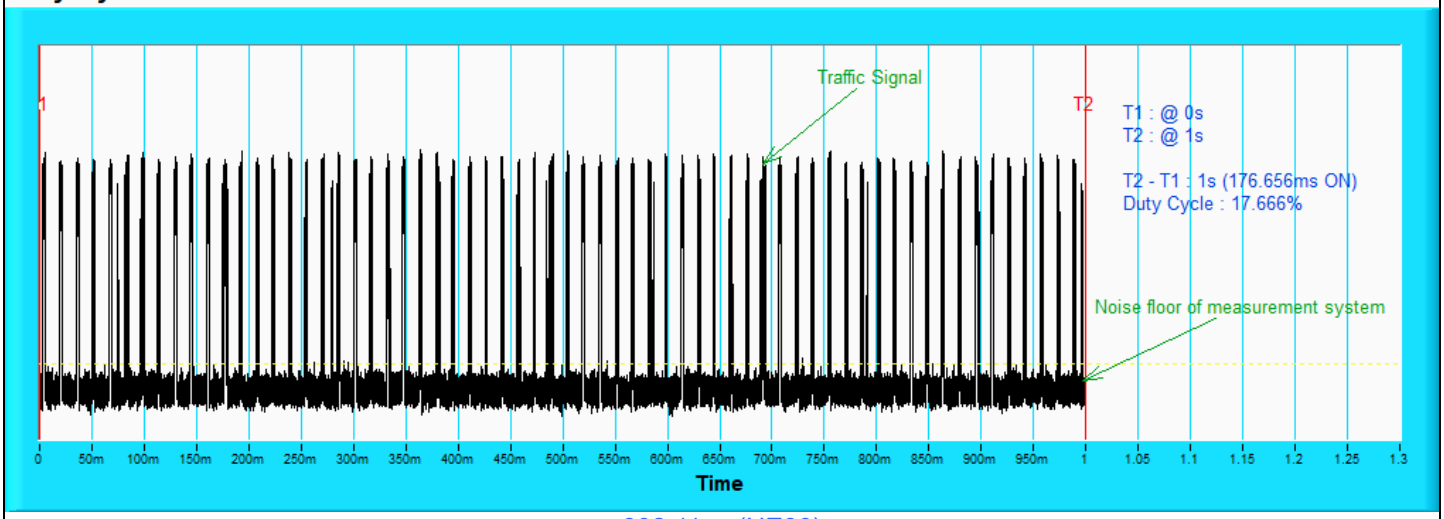
System testing will be performed with channel-loading using means appropriate to the data types that are used by the unlicensed device. The following requirements apply:

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

Plots of Channel Loading
Duty Cycle

802.11ax (HE20)
Duty Cycle

802.11ax (HE40)

Plots of Channel Loading

Duty Cycle



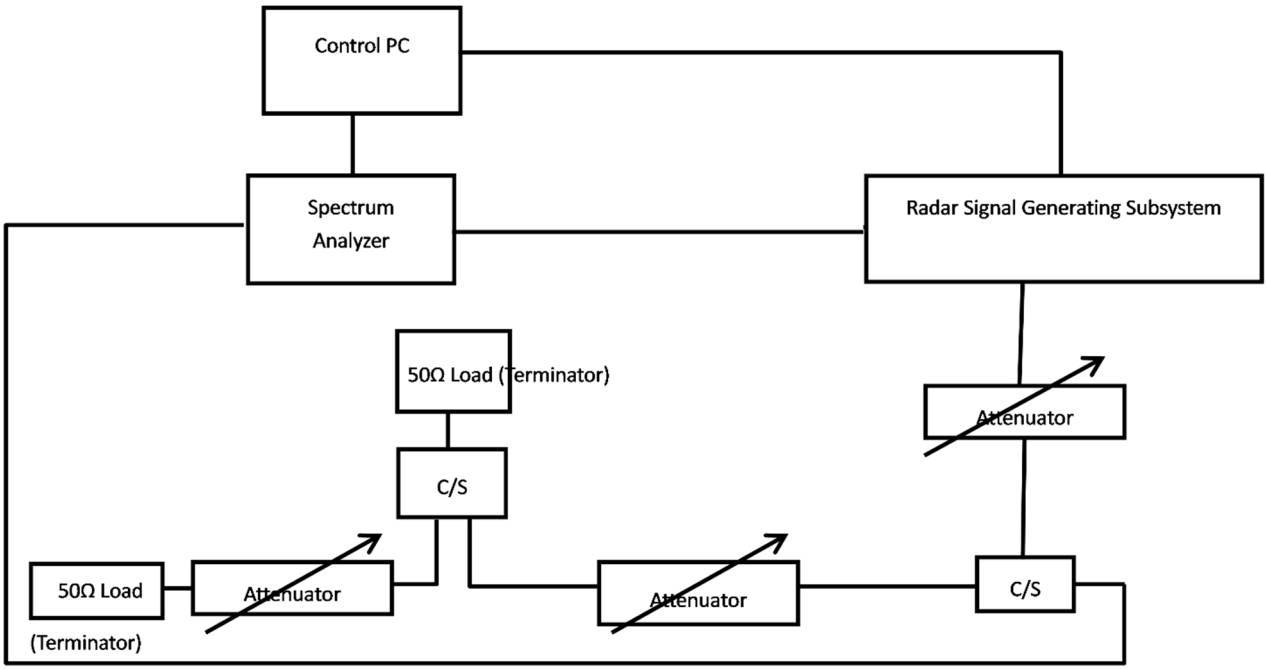
802.11ax (HE80)

6.2.2 Calibration of DFS Detection Threshold Level

The measured channel is chosen from the operating channels of the UUT within the DFS band and using the all bandwidth mode available for the link. The radar signal was the same as transmitted channels, and injected into the antenna of AP (master) or Client Device with Radar Detection, measured the channel closing transmission time and channel move time.

Conducted Setup Configuration of Calibration of DFS Detection Threshold Level

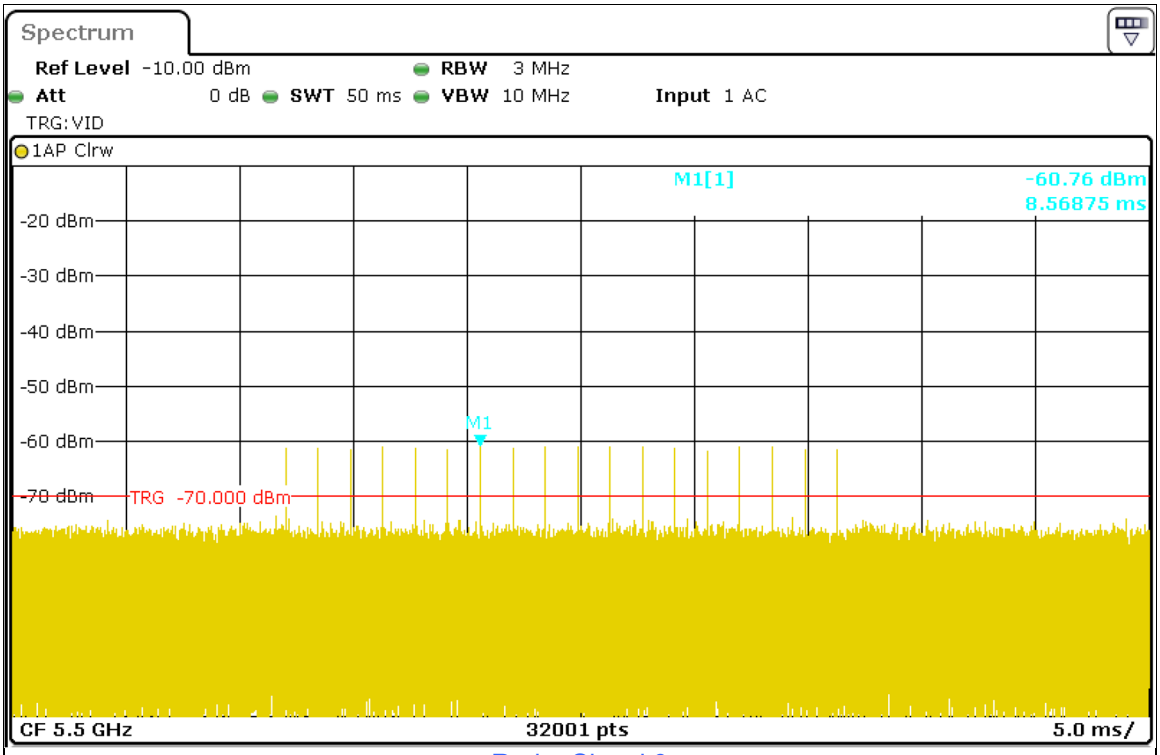
The calibrated conducted detection threshold level is set to -64 dBm. The tested level is lower than required level hence it provides margin to the limit.



6.2.3 DFS Detection Threshold

Test Mode: Device Operating in Client without radar detection Mode
Client with injection at the Master. (The radar test waveforms are injected into the Master Device)

The antenna net gain is 2.24 dBi.
DFS Detection Threshold = -64 dBm + 2.24 dBi + 1 dB = -60.76 dBm
The calibrated conducted detection threshold level is lower than -60.76 dBm.



Radar Signal 0

6.2.4 DFS Companion Device

Companion Device Information					
Product	**Brand**	**Model No.**	**FCC ID**	**Specification**	**Software/Firmware Version**
802.11ax wireless Router	ASUS	RT-AX88U	MSQ-RTAXHP00	5G Ant Min gain : 2.24 dBi Maximum EIRP : 26.30 dBm	3.0.0.4.384_5329-gd8d34a4

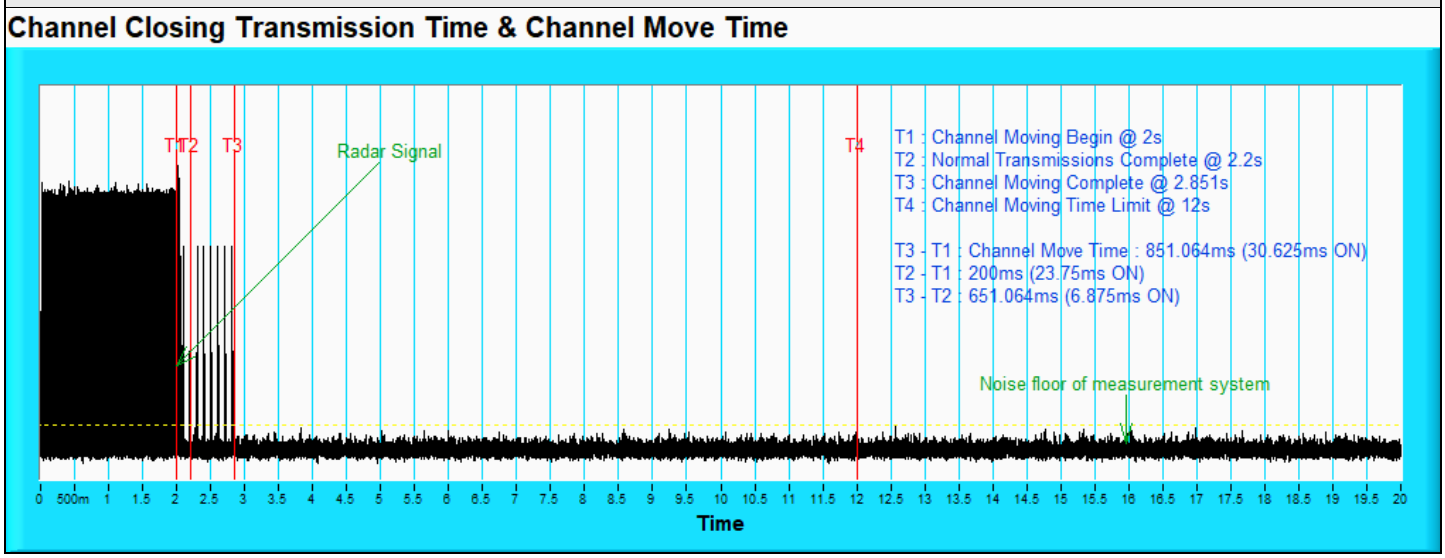
Note: This device was functioned as a Master device during the DFS test.

7 Test Results of Test Item

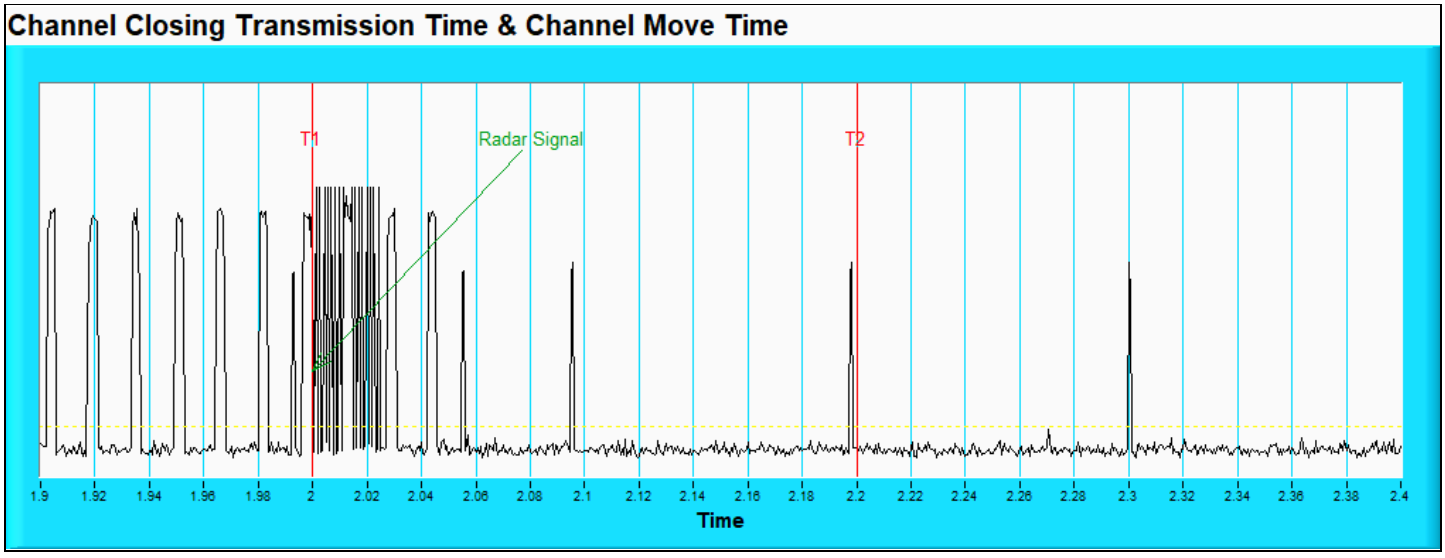
7.1 Channel Closing Transmission and Channel Move Time

Environmental Conditions:	25°C, 60% RH	Tested By:	Stan Shih

BW20-Radar signal 0

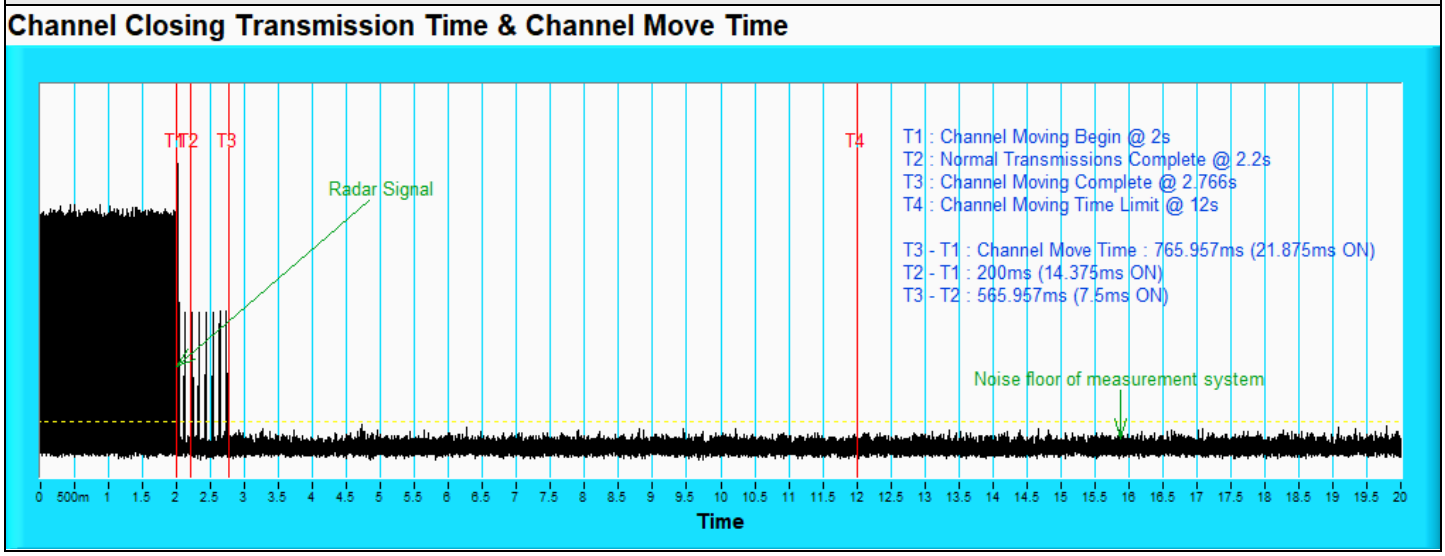


Note: T1 denotes the start of Channel Move Time upon the end of the last Radar burst. T2 denotes the data transmission time of 200 ms from T1. T3 denotes the end of Channel Move Time. T4 denotes the 10 second from T1 to observe the aggregate duration of transmissions.

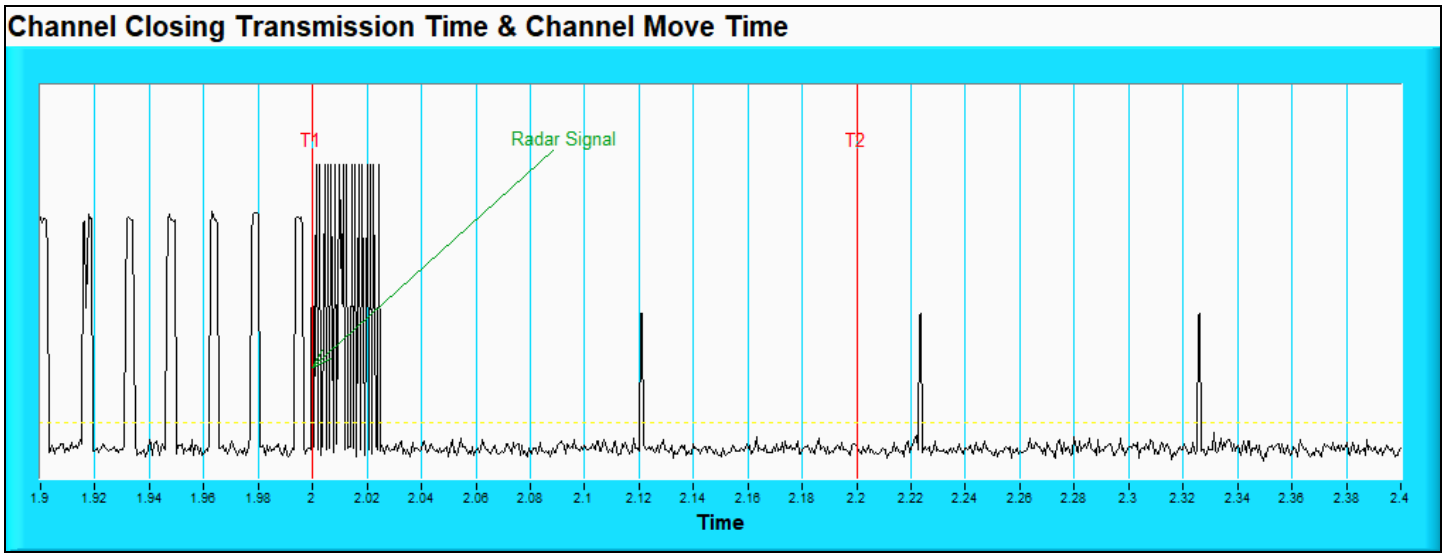


Note: Zoom in of the first 500 ms after radar signal applied.

BW40-Radar signal 0

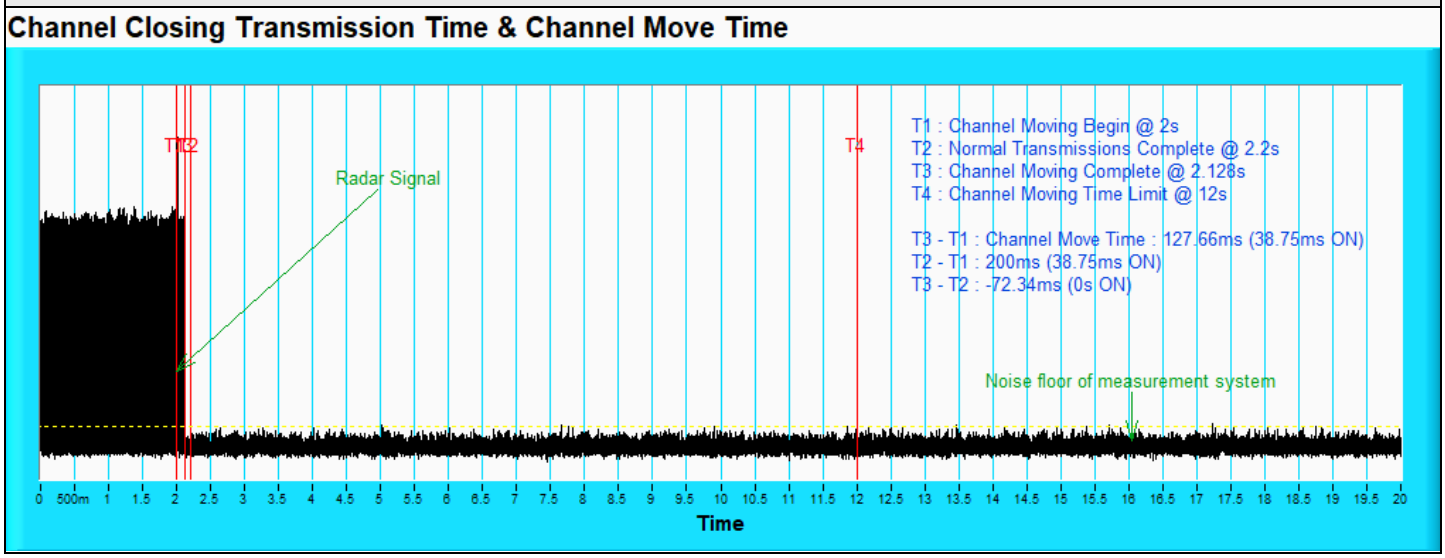


Note: T1 denotes the start of Channel Move Time upon the end of the last Radar burst. T2 denotes the data transmission time of 200 ms from T1. T3 denotes the end of Channel Move Time. T4 denotes the 10 second from T1 to observe the aggregate duration of transmissions.

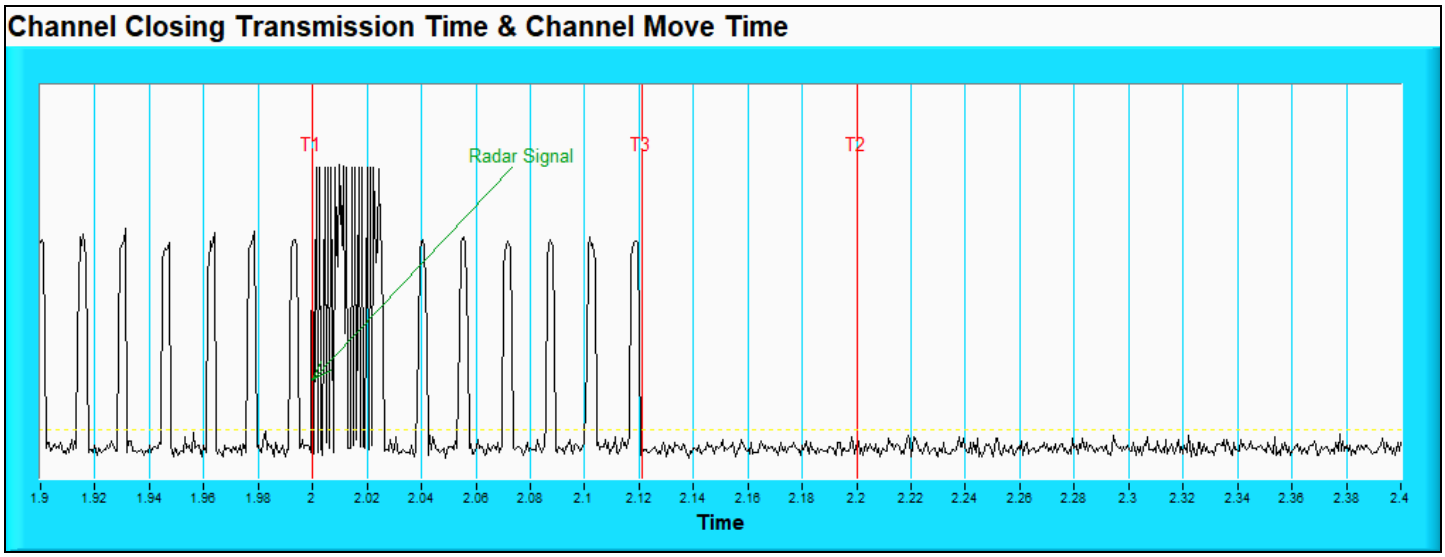


Note: Zoom in of the first 500 ms after radar signal applied.

BW80-Radar signal 0



Note: T1 denotes the start of Channel Move Time upon the end of the last Radar burst. T2 denotes the data transmission time of 200 ms from T1. T3 denotes the end of Channel Move Time. T4 denotes the 10 second from T1 to observe the aggregate duration of transmissions.

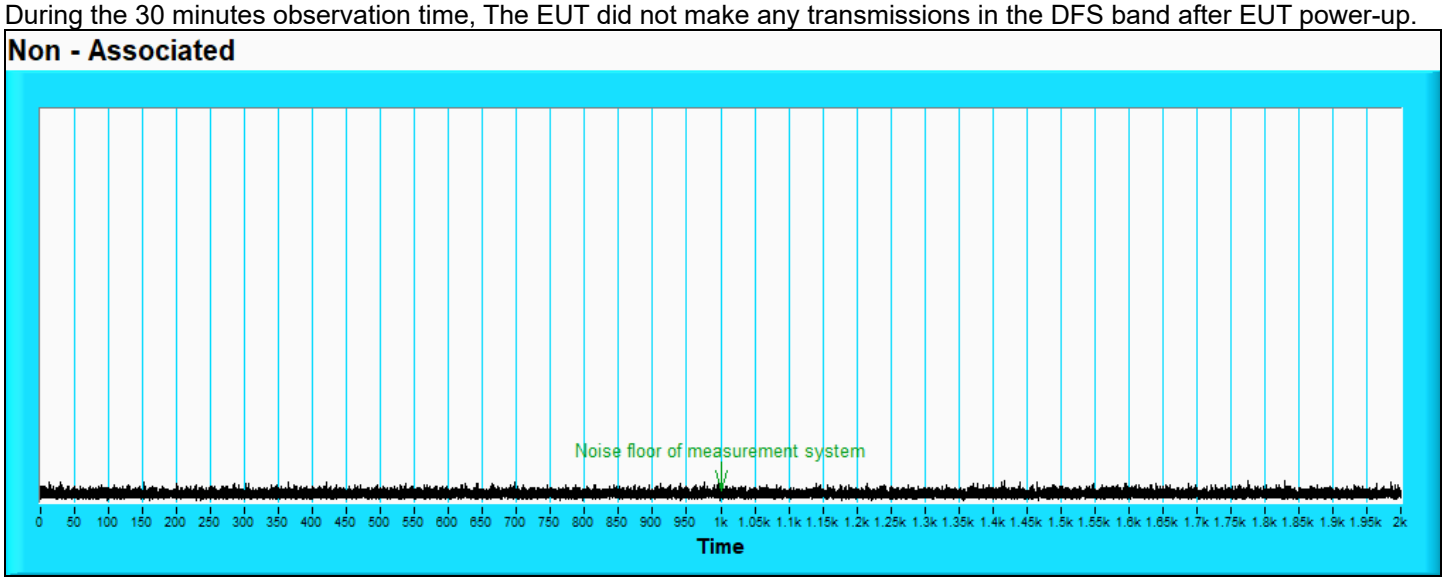


Note: Zoom in of the first 500 ms after radar signal applied.

7.2 Non-Associated Test

Environmental Conditions:	25°C, 60% RH	Tested By:	Stan Shih

Master was off.
During the 30 minutes observation time, The EUT did not make any transmissions in the DFS band after EUT power-up.



8 Declaration of Conformity by the Manufacturer

8.1 Transmit Power Control (TPC)

U-NII devices operating in DFS Bands (5.25 to 5.35 GHz and 5.47 to 5.725 GHz) 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.

Maximum e.i.r.p. of this device is 65.102 mW which is less than 500 mW, therefore it's not required TPC function.

Applicable	e.i.r.p.	FCC 15.407 (h)(1)
	>500 mW	The TPC mechanism is required for system with an e.i.r.p. of above 500 mW
√	<500 mW	The TPC mechanism is not required for system with an e.i.r.p. of less 500 mW

8.2 Statement of Manufacturer

Manufacturer statement confirming that information regarding the parameters of the detected Radar Waveforms is not available to the end user. And the device doesn't have ad-hoc mode on DFS frequency band.

9 Pictures of Test Arrangements

Please refer to the attached file (DFS Test Setup Photo)

10 Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Lin Kou EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
Fax: 886-3-3270892

Email: service.adt@bureauveritas.com
Web Site: http://ee.bureauveritas.com.tw

The address and road map of all our labs can be found in our web site also.

--- END ---