

## DFS Test Report

**Report No.:** REBBUI-WTW-P22100653-2

**Test Model:** RTL8851BE

**Received Date:** 2022/10/25

**Test Date:** 2023/1/31

**Issued Date:** 2023/4/27

**Applicant:** Realtek Semiconductor Corp.

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**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch  
Hsin Chu Laboratory

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**Test Location:** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,  
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## Table of Contents

Release Control Record .....	3
1 Certificate of Conformity .....	4
2 Dynamic Frequency Selection .....	5
2.1 Test Limits and Radar Signal Parameters .....	6
2.2 EUT Information .....	9
2.3 Test Instruments .....	10
2.4 Description of Support Units .....	10
2.5 Test Procedure .....	11
2.6 Deviation from Test Standard .....	11
2.7 Test Setup Configuration .....	12
2.8 List of Measurements .....	13
2.9 Test Result .....	14
2.9.1 Interference Threshold Values Injected into Master .....	14
2.9.2 Channel Shutdown .....	15
3 Photographs of the Test Configuration .....	17
Appendix - Information of the Testing Laboratories .....	18



### Release Control Record

Issue No.	Description	Date Issued
REBBUI-WTW-P22100653-2	Original release.	2023/4/27

## 1 Certificate of Conformity

**Product:** 11ax RTL8851BE Combo module

**Brand:** REALTEK

**Test Model:** RTL8851BE

**Sample Status:** Engineering sample

**Applicant:** Realtek Semiconductor Corp.

**Test Date:** 2023/1/31

**Standards:** Draft EN 301 893 V2.1.50 (2022-12)

**Test Item:** Dynamic Frequency Selection  
(Clause 4.2.6)

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 EMC characteristics under the conditions specified in this report.

**Prepared by :**                     Vito Lung                    , **Date:**                     2023/4/27                      
Vito Lung / Specialist

**Approved by :**                                         , **Date:**                     2023/4/27                      
May Chen / Manager

## 2 Dynamic Frequency Selection

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

### Applicability of DFS requirements

Requirement	Operational Mode		
	Master	Slave (without radar detection)	Slave (with radar detection)
Channel Availability Check	✓	Not required	✓ (see note 2)
Off-Channel CAC (see note 1)	✓	Not required	✓ (see note 2)
In-Service Monitoring	✓	Not required	✓
Channel Shutdown	✓	✓	✓
Non-Occupancy Period	✓	Not required	✓
Uniform Spreading	✓	Not required	Not required

NOTE 1: Where implemented by the manufacturer.

NOTE 2: A slave with radar detection is not required to perform a CAC or Off-Channel CAC at initial use of the channel but only after the slave has detected a radar signal on the Operating Channel by In-Service Monitoring and the Non-Occupancy Period resulting from this detection has elapsed.

The radar detection requirements specified in EN 301 893 clauses 4.2.6.2.2 to 4.2.6.2.4 assume that the centre frequencies of the radar signals fall within the central 80 % of the Occupied Channel Bandwidth of the RLAN channel.

## 2.1 Test Limits and Radar Signal Parameters

### DFS requirement values

Parameter	Value
Channel Availability Check Time	60 s (see note 1)
Minimum Off-Channel CAC Time	6 minutes (see note 2)
Maximum Off-Channel CAC Time	4 hours (see note 2)
Channel Move Time	10 s
Channel Closing Transmission Time	1 s
Non-Occupancy Period	30 minutes

NOTE 1: For channels whose nominal bandwidth falls completely or partly within the band 5 600 MHz to 5 650 MHz, the Channel Availability Check Time shall be 10 minutes.

NOTE 2: For channels whose nominal bandwidth falls completely or partly within the band 5 600 MHz to 5 650 MHz, the Maximum Off-Channel CAC Time shall be within the range 1 to 24 hours.

### Interference threshold values

EIRP Spectral Density dBm/MHz	Value (see notes 1 and 2)
10	-62 dBm

NOTE 1: This is the level at the input of the receiver of a RLAN device with a maximum EIRP density of 10 dBm/MHz and assuming a 0 dBi receive antenna. For devices employing different EIRP spectral density and/or a different receive antenna gain G (dBi) the DFS threshold level at the receiver input follows the following relationship:

DFS Detection Threshold (dBm) = -62 + 10 · EIRP Spectral Density (dBm/MHz) + G (dBi),  
however the DFS threshold level shall not be lower than -64 dBm assuming a 0 dBi receive antenna gain.

NOTE 2: Slave devices with a maximum e.i.r.p. of less than 23 dBm do not have to implement radar detection unless these devices are used in fixed outdoor point to point or fixed outdoor point to multipoint applications.

### Parameters of the reference DFS test signal

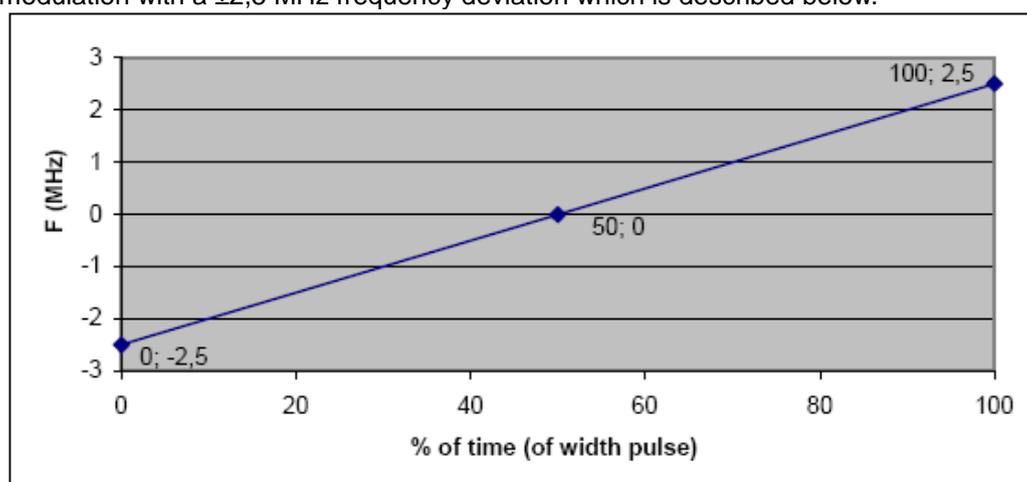
Pulse width W [µs]	Pulse repetition frequency PRF [pps]	Pulses per burst [PPB]
1	700	18

### Parameters of radar test signals

Radar Test Signal # (see notes 1 to 3)	Pulse width W [ $\mu$ s]		Pulse Repetition Frequency (pps)		Number of different PRFs	Pulses per Burst for each PRF (PPB) (see notes 5)
	Min	Max	Min	Max		
1	0.5	5	200	1000	1	10 (see note 6)
2	0.5	15	200	1600	1	15 (see note 6)
3	0.5	15	2300	4000	1	25
4	20	30	2000	4000	1	20
5	0.5	2	300	400	2/3	10 (see note 6)
6	0.5	2	400	1200	2/3	15 (see note 6)

NOTE 1: Radar test signals 1 to 4 are constant PRF based signals. See figure D.1. These radar test signals are intended to simulate also radars using a packet based Staggered PRF. See figure D.2.

NOTE 2: Radar test signal 4 is a modulated radar test signal. The modulation to be used is a chirp modulation with a  $\pm 2,5$  MHz frequency deviation which is described below.



NOTE 3: Radar test signals 5 and 6 are single pulse based Staggered PRF radar test signals using 2 or 3 different PRF values. For radar test signal 5, the difference between the PRF values chosen shall be between 20 pps and 50 pps. For radar test signal 6, the difference between the PRF values chosen shall be between 80 pps and 400 pps. See figure D.3

NOTE 4: Apart for the Off-Channel CAC testing, the radar test signals above shall only contain a single burst of pulses. See figures D.1, D.3 and D.4. For the Off-Channel CAC testing, repetitive bursts shall be used for the total duration of the test. See figures D.2 and D.5. See also clause 4.2.6.2.3, 5.4.8.2.1.4.2 and 5.4.8.2.1.4.3.

NOTE 5: The total number of pulses in a burst is equal to the number of pulses for a single PRF multiplied by the number of different PRFs used.

NOTE 6: For the CAC and Off-Channel CAC requirements, the minimum number of pulses (for each PRF) for any of the radar test signals to be detected in the band 5 600 MHz to 5 650 MHz shall be 18.

**Detection probability**

Parameter	Detection Probability (Pd)	
	Channels whose nominal bandwidth falls partly or completely within the 5600 MHz to 5650 MHz band	Other channels
CAC, Off-Channel CAC	99,99 %	60 %
In-Service Monitoring	60 %	60 %

NOTE: Pd gives the probability of detection per simulated radar burst and represents a minimum level of detection performance under defined conditions. Therefore Pd does not represent the overall detection probability for any particular radar under real life conditions.

## 2.2 EUT Information

### Operating Frequency Bands and Mode of EUT

Operational Mode	Operating Frequency Range	
	5250~5350MHz	5470~5725MHz
Slave without Radar Detection	✓	✓

### EUT Software and Firmware Version

No.	Product	Model No.	Software/Firmware Version
1	11ax RTL8851BE Combo module	RTL8851BE	6001.19.102.0

### Description of Available Antennas to the EUT

Antenna NO.	RF Chain NO.	Brand	Model	Antenna Net Gain(dBi)	Frequency range	Antenna Type	Connector Type	Cable Length (mm)
1	Chain 1	REALTEK	RTK-ANT-0022	3.4	2.4~2.4835 GHz	PIFA	IPEX4	300mm
				5	5.15~5.85 GHz			
	Chain 2	REALTEK	RTK-ANT-0022	3.4	2.4~2.4835 GHz	PIFA	IPEX4	
				5	5.15~5.85 GHz			
2	Chain 1	Aristotle	RFA-27-C38H1-MHF4300	3	2.4~2.4835 GHz	Dipole	IPEX4	300mm
				5	5.15~5.85 GHz			
	Chain 2	Aristotle	RFA-27-C38H1-MHF4300	3	2.4~2.4835 GHz	Dipole	IPEX4	
				5	5.15~5.85 GHz			
3	Chain 1	LYNwave	ALX22F-120AA0-00	3.2	2.4~2.4835 GHz	Monopole	IPEX4	200mm
				4	5.15~5.85 GHz			
	Chain 2	LYNwave	ALX22F-120AA0-00	3.2	2.4~2.4835 GHz	Monopole	IPEX4	
				4	5.15~5.85 GHz			

\*The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

### 2.3 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Test Receiver ESR7 R&S	ESR7	102026	2022/4/15	2023/4/14
MXG X-Series RF Vector Signal Generator Keysight	N5182B	MY53052700	2022/7/18	2023/7/17
Programmable Step Attenuator 0-110 dB DC-18 GHz SMA(f/f) Agilent	8496H-002	MY42143989	2022/11/4	2023/11/3

- Note:**
1. The test was performed in DFS-2 room.
  2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
  3. Tested Date: 2023/1/31

### 2.4 Description of Support Units

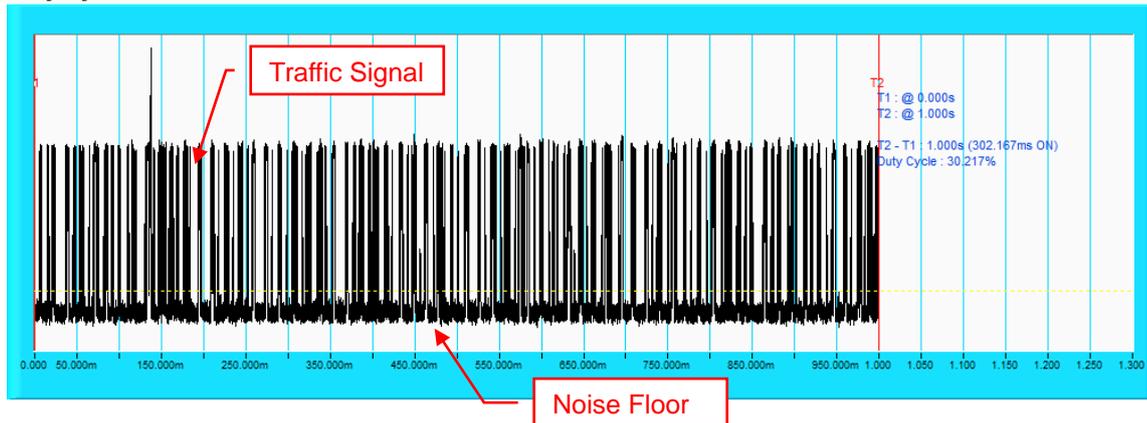
No.	Product	Brand	Model No.	Software/Firmware Version	Spec.
1	Wireless-AX6000 Dual Band Gigabit Router	ASUS	RT-AX88U	3.0.0.4.384	Maximum EIRP Spectral Density is 16.96dBm/MHz Antenna gain is 2.24dBi.

**NOTE:** This device was functioned as a  Master  Slave device during the DFS test.

## 2.5 Test Procedure

The measured channel is 5300MHz and 5500MHz in 20MHz Bandwidth, 5290MHz and 5530MHz in 80MHz Bandwidth. The radar signal was the same as transmitted channels, and injected into the antenna port of AP (master) with  $-61.76\text{dBm}$  power level, measured the channel shutdown. The slave transmitted the test data to master, the transmitted duty cycle is 30.217%.

### Duty Cycle



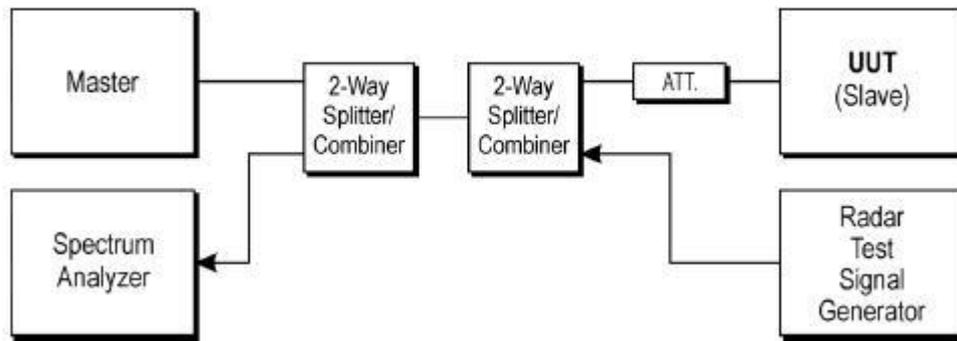
**NOTE:** T1 denotes the start of duty cycle period is 0<sup>th</sup> second. T2 denotes the end of duty cycle period is 1<sup>th</sup> second.  $T2 - T1 = 1$  seconds. Duty Cycle = 30.217%

Note: Traffic signal: from slave transmit to master.

## 2.6 Deviation from Test Standard

No deviation.

## 2.7 Test Setup Configuration



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

## 2.8 List of Measurements

Clause	Test Parameter	Remarks	Pass/Fail
4.2.6.2.2	Channel Availability Check Time	Not Applicable	NA
4.2.6.2.3	Off-Channel CAC	Not Applicable	NA
4.2.6.2.4	In-Service Monitoring	Not Applicable	NA
4.2.6.2.5	Channel Shutdown	Applicable	Pass
4.2.6.2.6	Non- Occupancy Period	Not Applicable	NA
4.2.6.2.7	Uniform Spreading	Not Applicable	NA

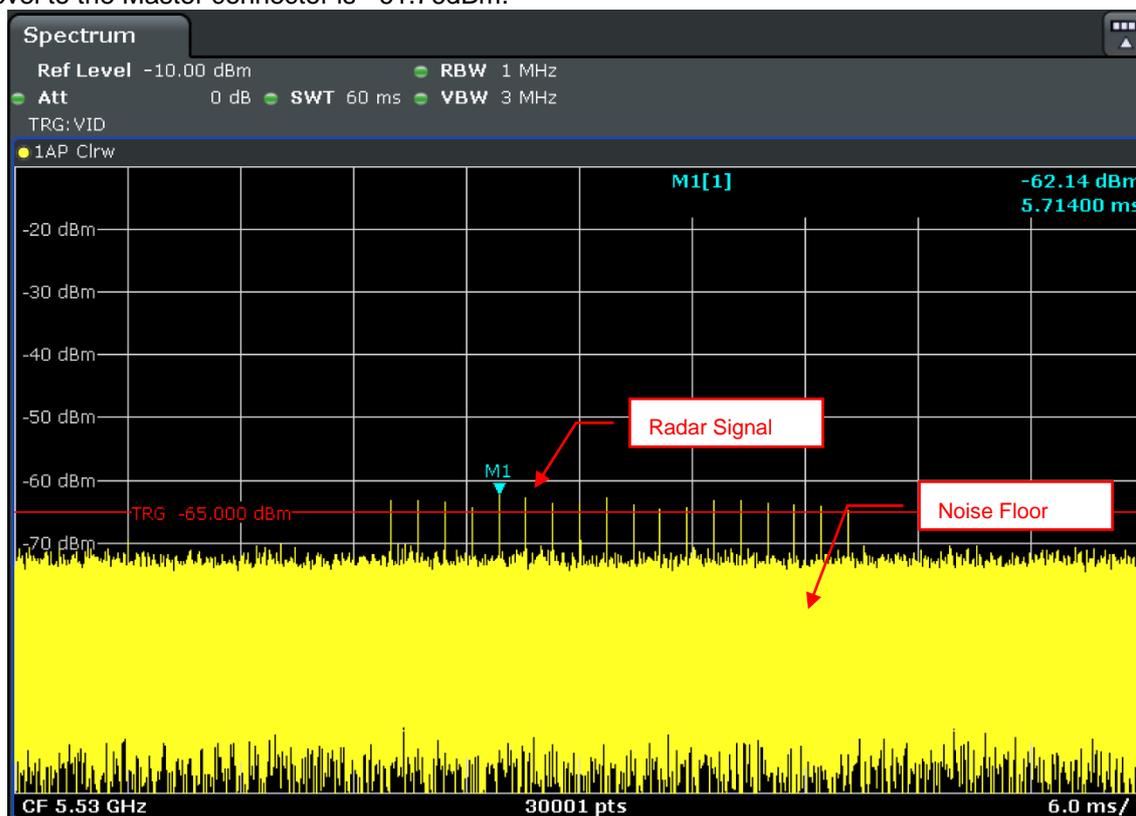
Note:

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

## 2.9 Test Result

### 2.9.1 Interference Threshold Values Injected into Master

The Master Maximum EIRP Spectral Density is 16.96dBm/MHz and antenna gain is 2.24dBi  
 DFS Detection Threshold =  $-62 + 10 - \text{EIRP Spectral Density (16.96dBm/MHz)} + G (0\text{dBi}) = -68.96\text{dBm}$ .  
 For an interference threshold level of  $-64\text{dBm}$  and the Master antenna gain is 2.24dBi. Then the radar Burst signal level to the Master connector is  $-61.76\text{dBm}$ .

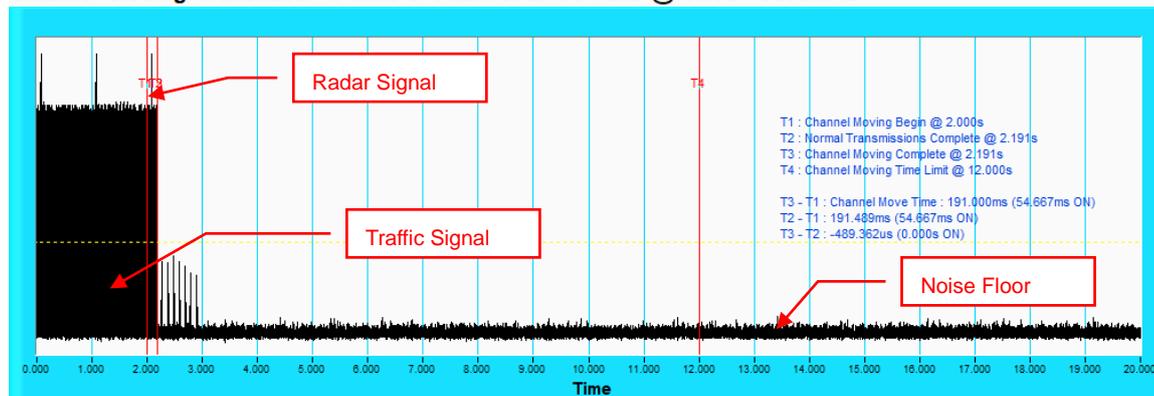


Reference DFS test signal

## 2.9.2 Channel Shutdown

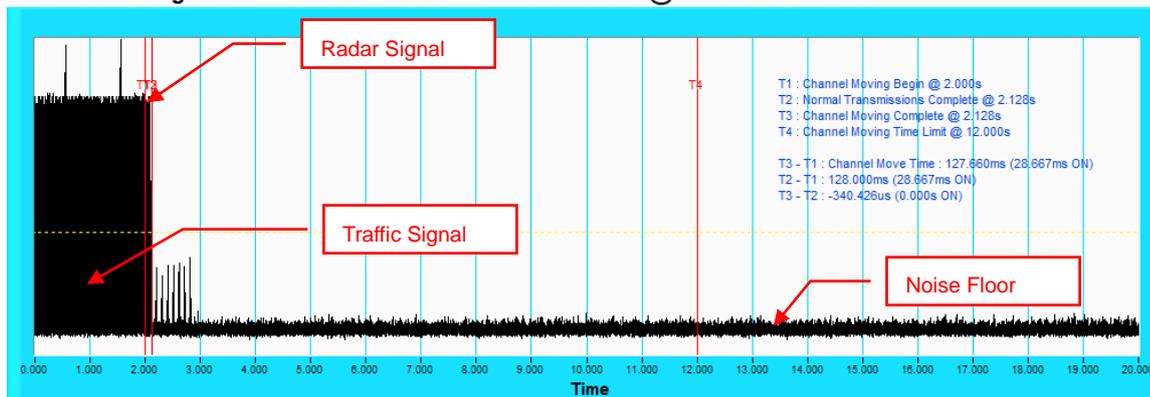
### 802.11ax (HE20) mode

#### Channel Closing Transmission Time & Channel Move Time @ CH60 - 5300MHz



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

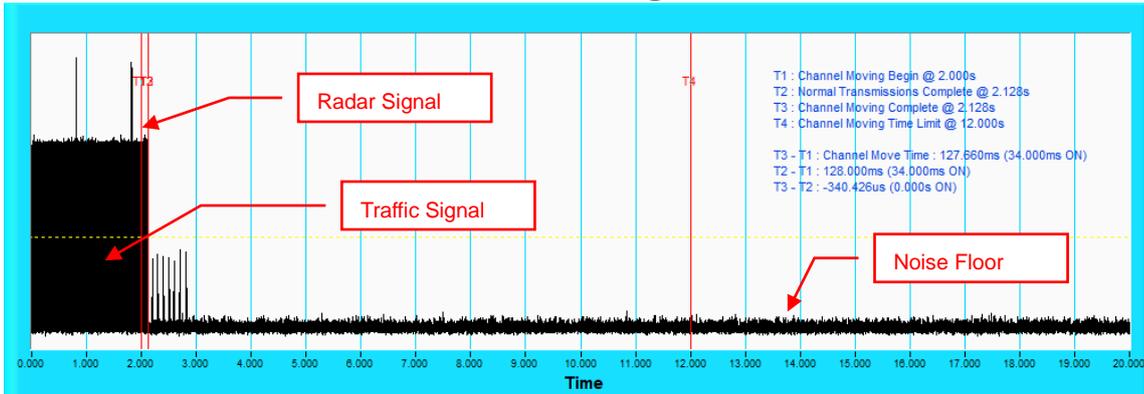
#### Channel Closing Transmission Time & Channel Move Time @ CH100 - 5500MHz



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

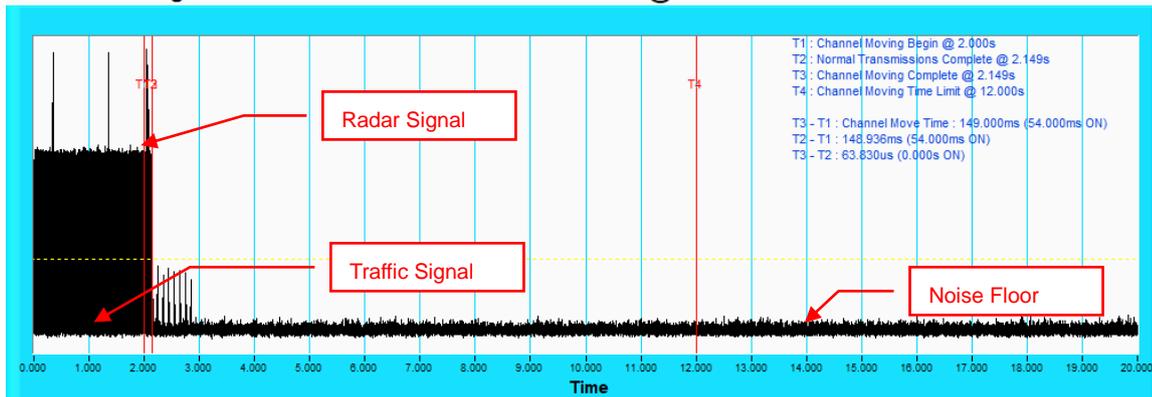
## 802.11ax (HE80) mode

### Channel Closing Transmission Time & Channel Move Time @ CH58 - 5290MHz



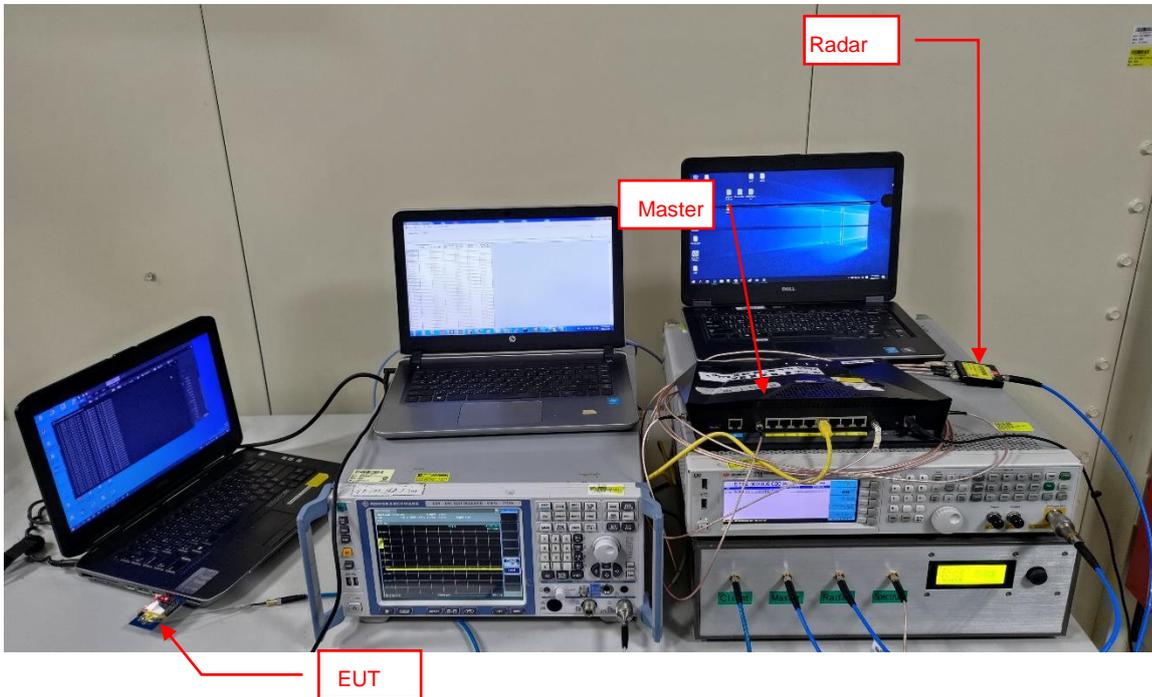
**NOTE:** T1 denotes the start of Channel Move Time upon the end of the last Radar burst. T2 denotes the data transmission complete time. T3 denotes the end of Channel Move Time. T4 denotes the 10 second from T1 to observe the aggregate duration of transmissions.

### Channel Closing Transmission Time & Channel Move Time @ CH106 - 5530MHz



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

### 3 Photographs of the Test Configuration



## Appendix - 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 accredited and approved according to ISO/IEC 17025.

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

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