

DFS Test report

Report No.: HP190708DC001-FDF

FCC ID: 2ACYT-MT7668U

Product Name wireless module

Test Model: MT7668U

Applicant: SHENZHEN Hitevision Technology Co., Ltd.

Address: No. 8, Qinglan 1st Road, Pingshan Shenzhen China

Test Date: 2019-7-12~2019-7-25

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Issued By: Hwa-Hsing (Dongguan) Testing Co., Ltd.

FCC Designation Number: CN1255

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Test Location: No.101, Bld N1,Yuyuan 2Rd, Yuyuan Industrial Park, HuangJiang Town, Dongguan, China

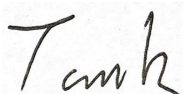
Standards: FCC Part 15, Subpart E, Section 15.407,

FCC 14-30; FCC public notices 06-96

KDB 905462 D03 UNII Clients Without Radar Detection New Rules v01r02

The above equipment has been tested by **HWA-HSING**, 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 :



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, Date:

Aug. 20, 2019

Approved by :



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, Date:

Aug. 20, 2019

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non-compliance to the specification.

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Release control record

Issue no.	Reason for change	Date issued
HP190708DC001-FDF	Original release.	Aug. 20, 2019

1. EUT General Information

1.1 General Description of EUT

Product Name	wireless module
Brand Name	N/A
Test Model	MT7668U
FCC ID:	2ACYT-MT7668U
DFS Operational Mode	Client without radar detection
Status of EUT	Engineering prototype
Power Supply Rating	DC5V from USB
Modulation Type	DSSS: DBPSK, DQPSK,CCK OFDM: 256QAM, 64QAM, 16QAM, QPSK, BPSK
Modulation technology	DSSS, OFDM
Transfer Rate	802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n: up to 300.0Mbps 802.11ac : up to 867Mbps
DFS Operating Frequency	5260 ~ 5320MHz, 5500 ~ 5700MHz,
Number of Channel (DFS Frequency band)	5260 ~ 5320MHz: 4 channels for 802.11a, 802.11n (20MHz) 2 channels for 802.11n, 11ac (40MHz) 1 channel for 802.11ac (80MHz) 5500 ~ 5700MHz: 11 channels for 802.11a, 802.11n (20MHz) 4 channels for 802.11n (40MHz) 2 channel for 802.11ac (80MHz)
Maximum Output Power	17.26 dBm for 5250 ~ 5350MHz (Maximum AVG Power) 20.26 dBm for 5470 ~ 5725MHz (Maximum AVG Power)
Antenna Type	5260 ~ 5320MHz: Dipole antenna with 3.81dBi gain 5500 ~ 5700MHz: Dipole antenna with 3.50dBi gain
Antenna Connector	SMA connector
Accessory Device	N/A

Note:

- The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.
- The product's RLAN function supports MIMO function with 2 antennas:

Support mode	Transmit and receive mode	Transmit and Receive Chain
802.11a	MIMO	2TX,2RX
802.11n HT20	MIMO	2TX,2RX
802.11n HT40	MIMO	2TX,2RX
802.11ac VHT20	MIMO	2TX,2RX
802.11ac VHT40	MIMO	2TX,2RX
802.11ac VHT80	MIMO	2TX,2RX

3. Channel list of DFS band:

For 5250 ~ 5350MHz

802.11a, 802.11a c 20MHz, 802.11n (20MHz):

Channel	Frequency	Channel	Frequency
52	5260 MHz	56	5280 MHz
60	5300 MHz	64	5320 MHz

802.11a c 40MHz, 802.11n (40MHz):

Channel	Frequency	Channel	Frequency
54	5270 MHz	62	5310 MHz

802.11ac (80MHz):

Channel	Frequency	Channel	Frequency
58	5290MHz	--	--

For 5470 ~ 5725MHz

802.11a, 802.11a c 20MHz, 802.11n (20MHz):

Channel	Frequency	Channel	Frequency
100	5500 MHz	104	5520 MHz
108	5540 MHz	112	5560 MHz
116	5580 MHz	120	5600 MHz
124	5620 MHz	128	5640 MHz
132	5660 MHz	136	5680 MHz
140	5700 MHz	--	--

802.11a c 40MHz, 802.11n (40MHz):

Channel	Frequency	Channel	Frequency
102	5510 MHz	110	5550 MHz
118	5590 MHz	134	5670 MHz

802.11ac (80MHz):

Channel	Frequency	Channel	Frequency
106	5530MHz	122	5610MHz

1.2 Operating frequency bands and mode of EUT

Table 1: Operating frequency bands and mode of EUT

Operational Mode	Operating Frequency Range	
	5250~5350MHz	5470~5725MHz
Client without radar detection	V	V

Note: The EUT has disabled the 5600-5650MHz band

1.3 EUT software and firmware version

Table 2: The EUT software/firmware version

No.	Product	Model No.	Software/Firmware Version
1	newline wireless module	MT7668U	FWv.63770

1.4 Description of available antennas to the EUT

Table 3: Antenna list

No..	Brand	Model	Connector Type	Ant Type	Frequency range (MHz to MHz)	Maximum Gain(dBi)
1	HongHe	MR-7-183	SMA	Dipole	5250 - 5350	5.13
					5470 - 5725	5.32

1.5 Transmit power control (TPC)

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 EIRP of less than 500 mW.

Maximum EIRP of this device is less than 500mW which less than 500mW, therefore it's not require TPC function.

1.6 Statement of the manufacturer

This device (Client) is without radar detection, then the 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.

2. U-NII DFS rule requirements

2.1 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 6: Applicability of DFS requirements prior to use a channel

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

Table 7: Applicability of DFS requirements during normal operation

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

2.2 Test limits and radar signal parameters

2.2.1 Detection threshold values

Table 8:

DFS Detection Thresholds for Master Devices and Client Devices with Radar Detection

Maximum Transmit Power	Value (See Note 1 and 2)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 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.

Table 9: 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	100% of the UNII transmission power bandwidth. See Note 3.

Note 1: The instant that the Channel Move Time and the Channel Closing Transmission Time begins is as follows:

- For the Short Pulse Radar Test Signals this instant is the end of the Burst.
- For the Frequency Hopping radar Test Signal, this instant is the end of the last radar Burst generated.
- For the Long Pulse Radar Test Signal this instant is the end of the 12 second period defining the Radar Waveform.

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 1 is used and for each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.

2.2.2 Parameters of DFS test signals

Table 10: 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 μs, with a minimum increment of 1 μs, excluding PRI values selected in Test A	$\text{Roundup} \left\{ \begin{array}{l} \left(\frac{1}{360} \right) \cdot \\ \left(\frac{19 \cdot 10^6}{\text{PRI}_{\text{sec}}} \right) \end{array} \right\}$	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 11: 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

Table 12: 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

2.3 Test & support equipment list

2.3.1 Test instruments

Table 1: Test instruments list.

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Spectrum Keysight	N9020A	MY51240612	2018/10/29	2019/10/28
Spectrum Analyzer Rohde&Schwarz	FSV-40N	101783	2018/12/11	2019/12/10
Power Meter 10Hz~18GHz Tonscend	JS0806-2	188060126	2018-11-10	2019-11-09
Signal generator Keysight	N5182A	GB40051020	2018/10/29	2019/10/28
Signal generator Keysight	N5182A	MY47420944	2018/10/29	2019/10/28
Test Software Tonscend	JS0806-2	NA	NA	NA
Hygrothermograph Yuhuaze	HTC-1	NA	2018/10/30	2019/10/29
Spectrum Keysight	N9020A	MY51240612	2018/10/29	2019/10/28

2.3.2 Description of support units

Table2: Support Unit information.

No.	Product	Brand	Model name	FCC ID number	Maximum antenna Gain(dBi)	Maximum Transmit Power
1	Wireless AP Router	ASUS	RT-AC1200	MSQ-RT1D00	4.4	<200 mW

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

Table3: Software/Firmware information.

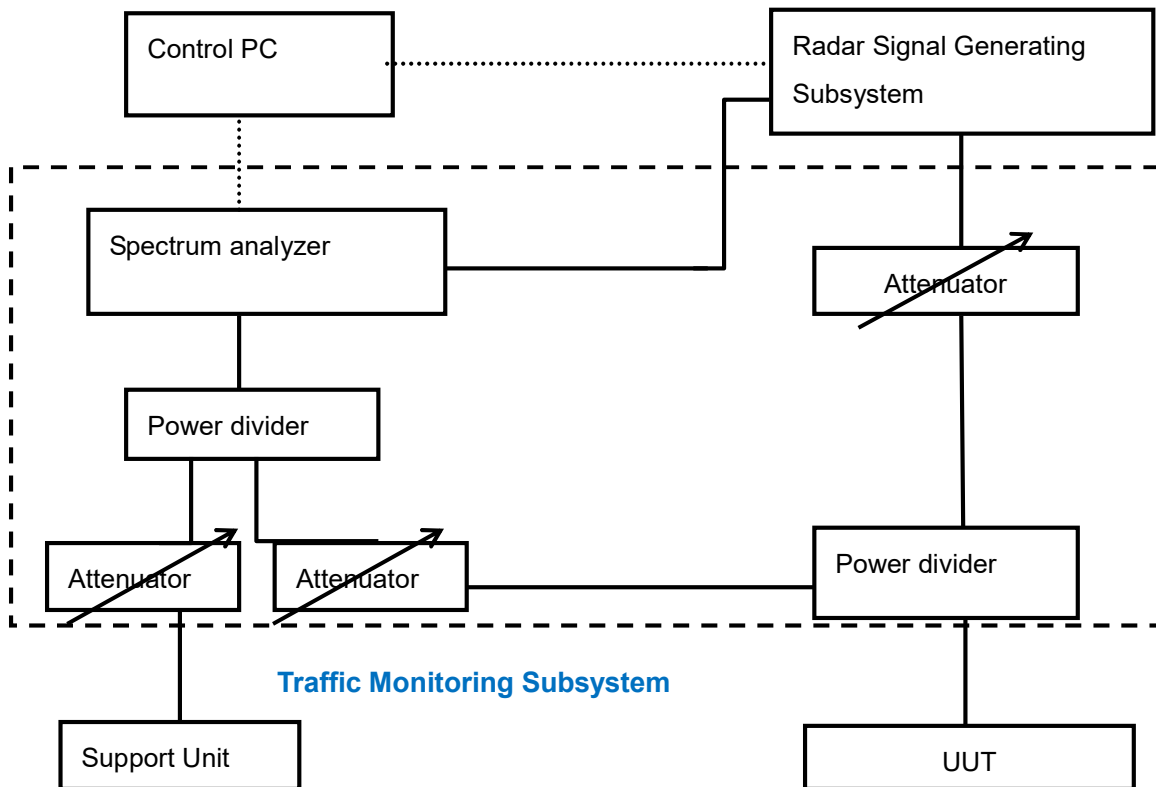
No.	Product	Model No.	Software/Firmware Version
1.	Wireless AP	RT-AC120	V3.0.0.4.378_10571

2.4 Test procedure

2.4.1 DFS measurement system

A complete DFS Measurement System consists of Radar signal generate system to generating the radar waveforms in Table 10, 11 and 12. The traffic monitoring system is specified to the type of unit under test (UUT).

Conducted setup configuration of DFS Measurement System

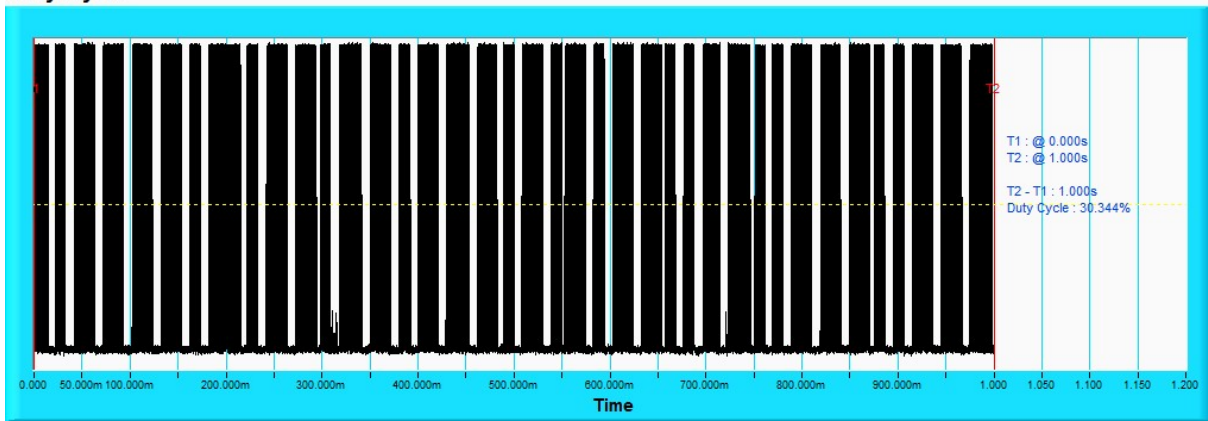


2.4.2 Channel Loading

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.	N/A
b)	Software to ping the client is permitted to simulate data transfer but must have random ping intervals.	N/A
c)	Timing plots are required with calculations demonstrating a minimum channel loading of approximately 17% or greater.	Apply
d)	Unicast or Multicast protocols are preferable but other protocols may be used. The appropriate protocol used must be described in the test procedures.	N/A

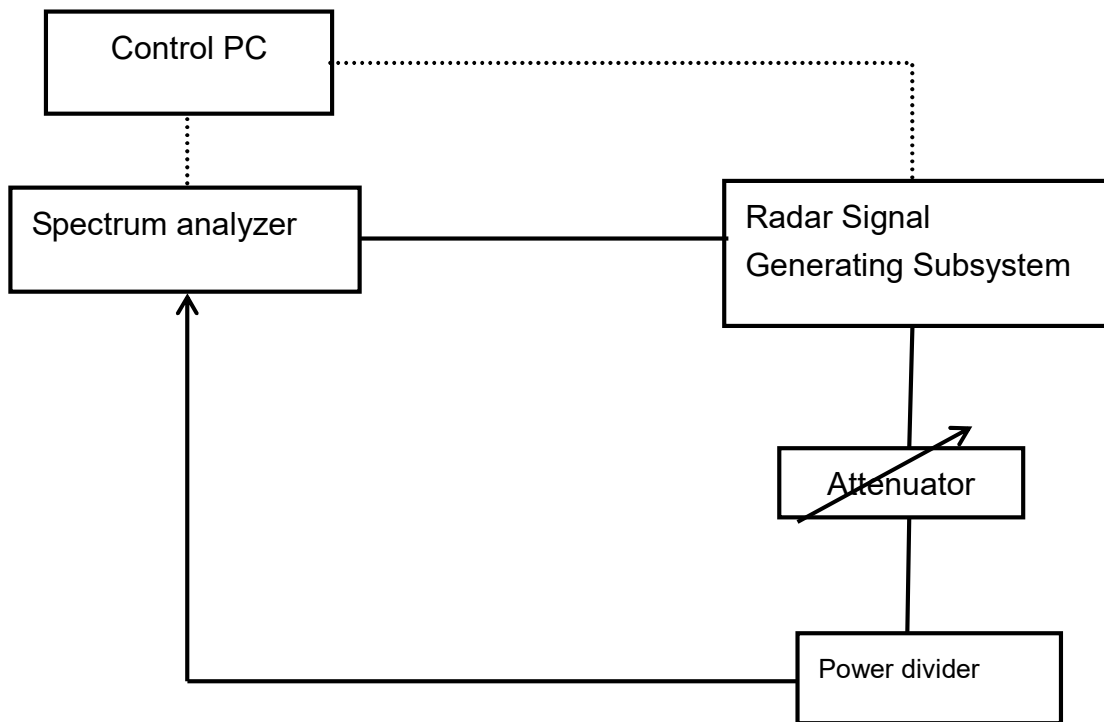
Duty Cycle



2.4.3 Calibration of DFS detection threshold level

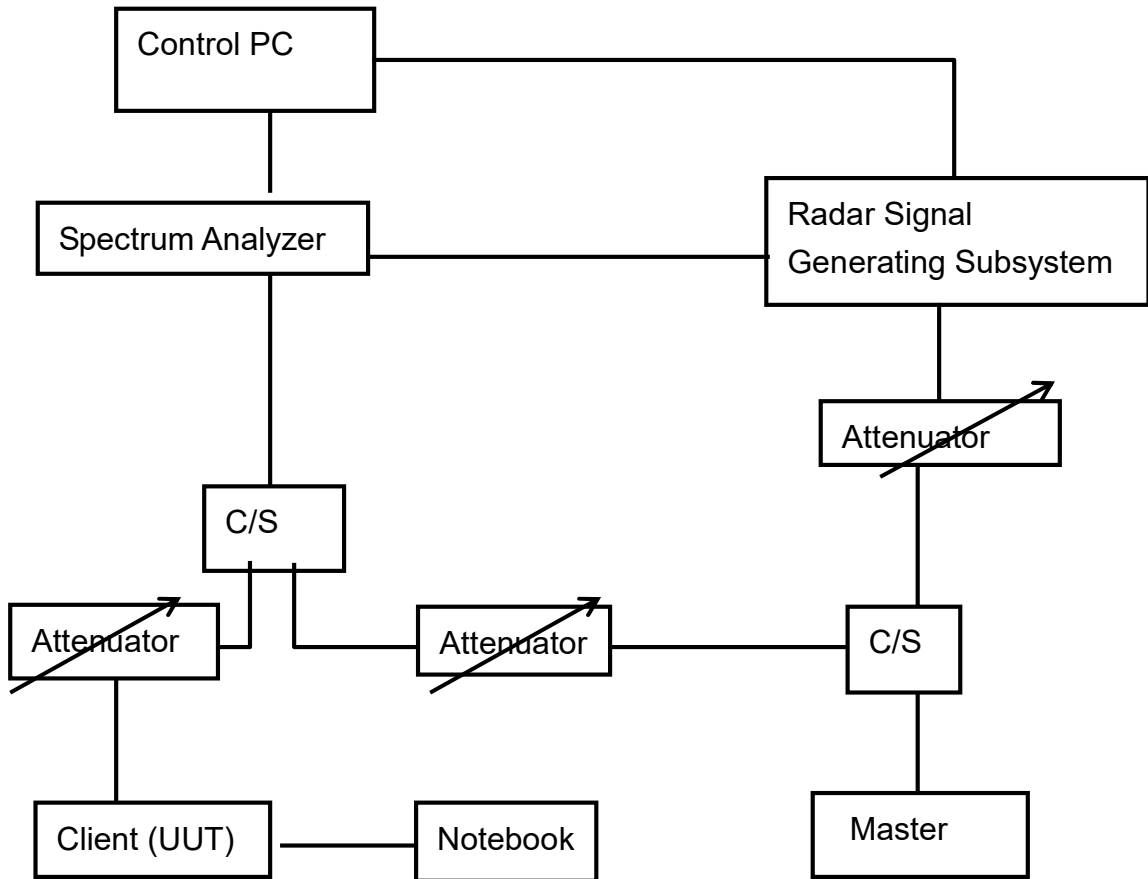
The measured channel is 5290MHz and 5530 MHz in 80MHz Bandwidth. The radar signal was the same as transmitted channels, and injected into the antenna port of AP (master) or Client Device with Radar Detection, measured the channel closing transmission time and channel move time. The Master maximum transmit power was less than 200mW. The Master antenna gain is 4.4dBi and required detection threshold is -57.6dBm ($=-62+4.4$)dBm.

Conducted setup configuration of Calibration of DFS Detection Threshold Level



2.4.4 Conducted test setup configuration

2.4.4.1 Client without radar detection mode



Note: The UUT is a U-NII Device operating in Client mode without radar detection. The radar test signals are injected into the Master Device.

2.4.5 Deviation from test standard

No deviation.

3. Test results

3.1 Summary of test results

Clause	Test Parameter	Remarks	Pass/Fail
15.407	DFS Detection Threshold	Not Applicable	N/A
15.407	Channel Availability Check Time	Not Applicable	N/A
15.407	Channel Move Time	Applicable	Pass
15.407	Channel Closing Transmission Time	Applicable	Pass
15.407	Non- Occupancy Period	Applicable	Pass
15.407	Uniform Spreading	Not Applicable	N/A
15.407	U-NII Detection Bandwidth	Not Applicable	N/A
15.407	Non-associated test	Applicable	Pass
15.407	Non-Co-Channel test	Applicable	Pass

No.	Test Parameter	Operation mode	Test Channel	Pass/Fail
1	Channel Move Time	802.11ac 80MHz	CH58&CH106	Pass
2	Channel Closing Transmission Time	802.11ac 80MHz	CH58&CH106	Pass
3	Non- Occupancy Period	802.11ac 80MHz	CH58&CH106	Pass
4	Non-associated test	802.11ac 80MHz	CH58&CH106	Pass
5	Non-Co-Channel test	802.11ac 80MHz	CH58&CH106	Pass

Note: Test procedure from KDB 905462 D02 UNII DFS Compliance Procedures New Rules v01r02.

3.2 Detailed test results

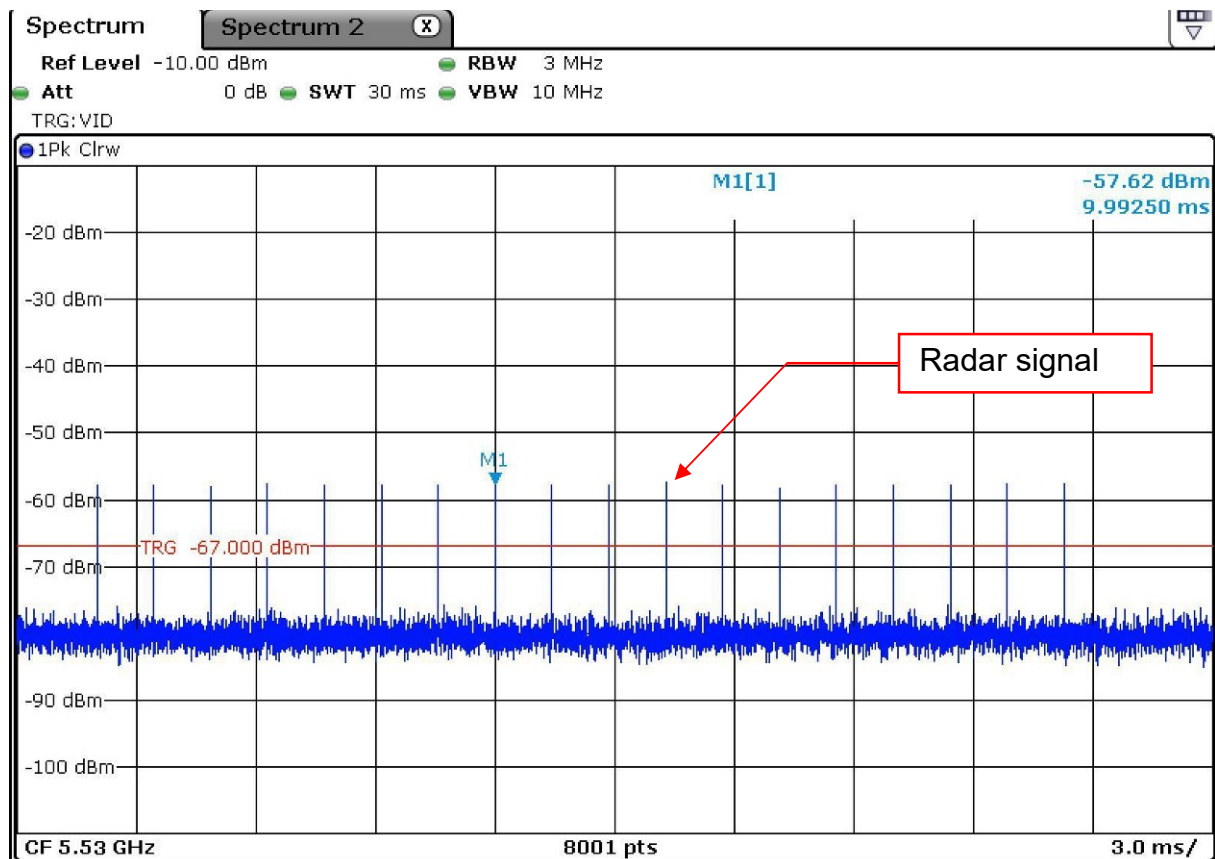
Test Mode: Device operating in Client without Radar Detection mode

The radar test signals are injected into the Master Device.

This test was investigated for widest bandwidth (80MHz). The following plots was done on 80MHz as a representative:

DFS detection threshold

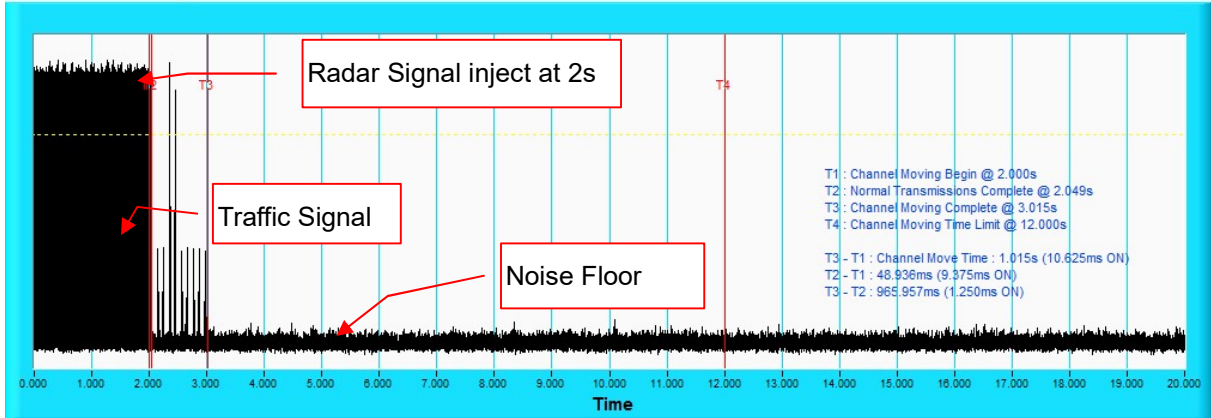
The Required detection threshold is -57.60dBm (= -62 +4.4)dBm. The conducted radar burst level is set to -57.60dBm.



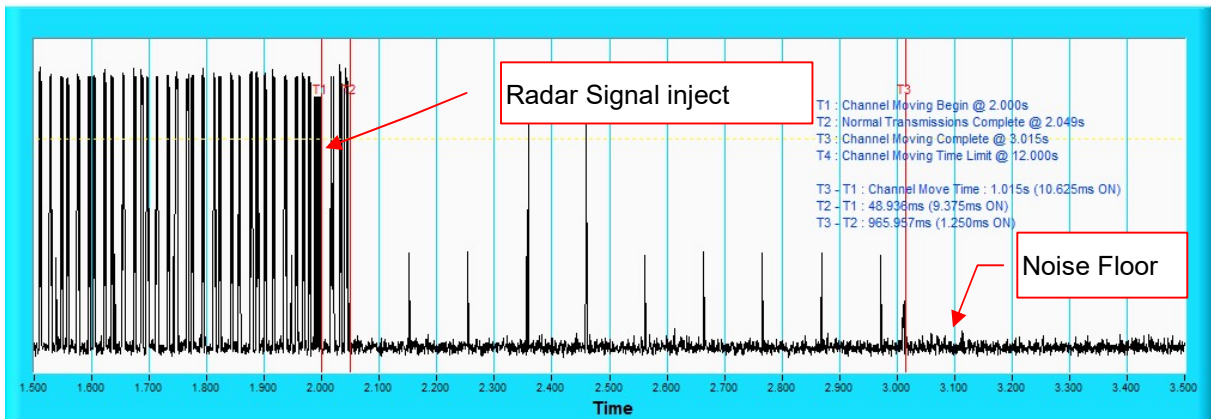
Radar Signal (Type 0)

3.3 Channel Closing Transmission and Channel Move Time

11ac (80 MHz) 5530MHz



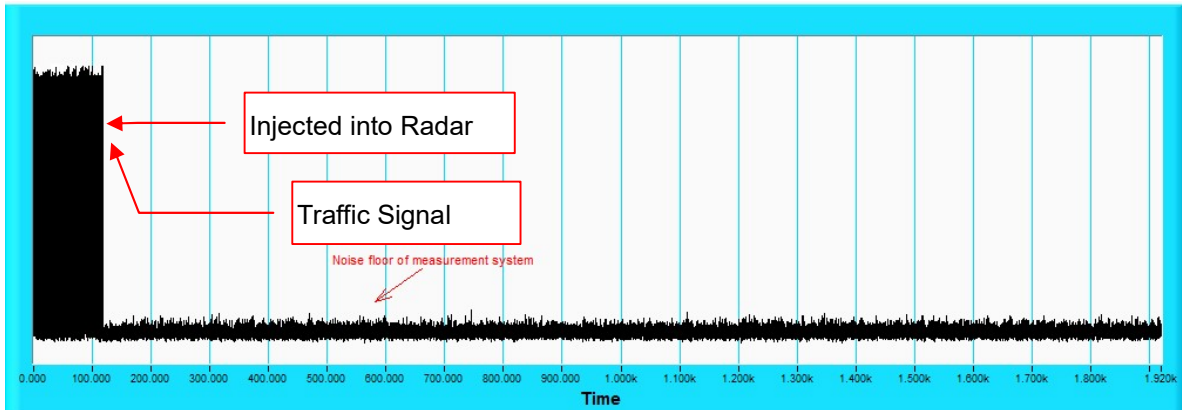
NOTE: T1 denotes the start of Channel Move Time upon the end of the last Radar burst at 2s.
T2 denotes the data transmission time of 200ms from T1. T4 denotes the 10 second from T1 to observe the aggregate duration of transmissions.



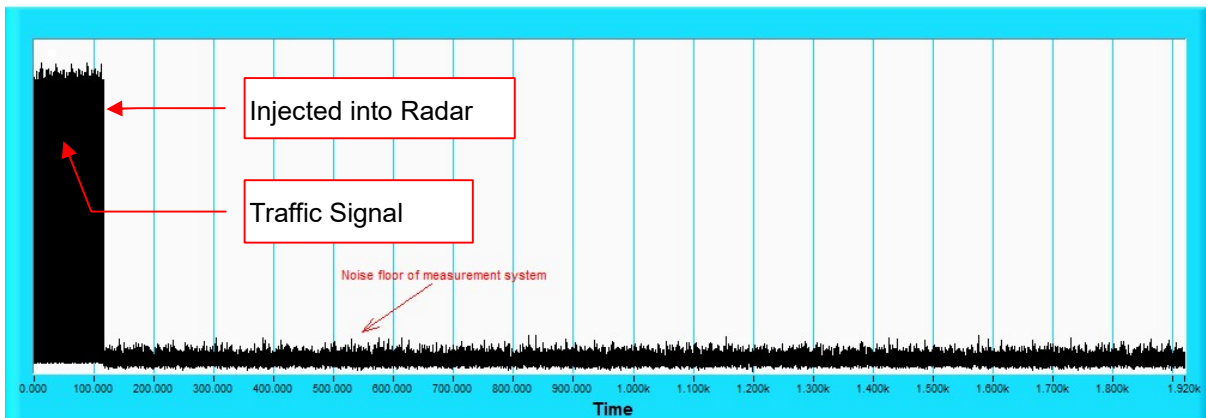
NOTE: An expanded plot for the device vacates the channel.

3.4 Non- occupancy period

11ac (80 MHz) 5290MHz:

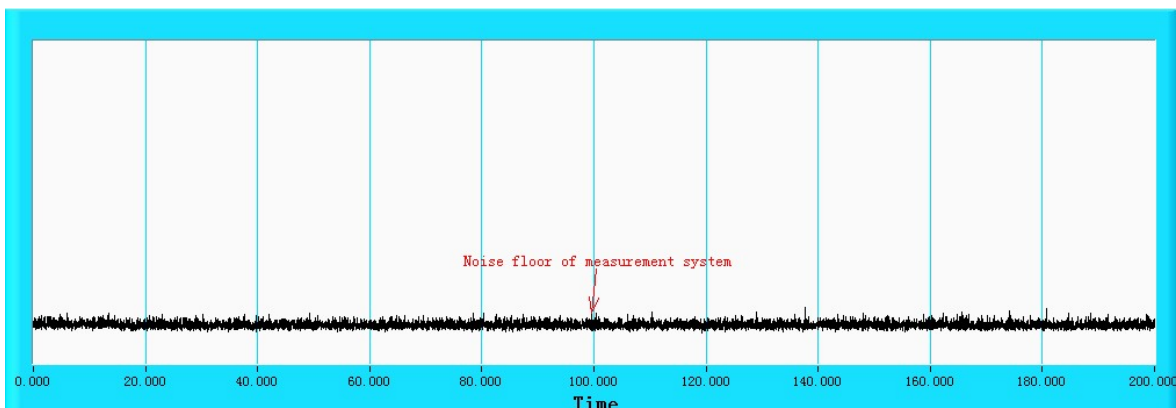


11ac (80 MHz) 5530MHz:



3.5 Non-associated test

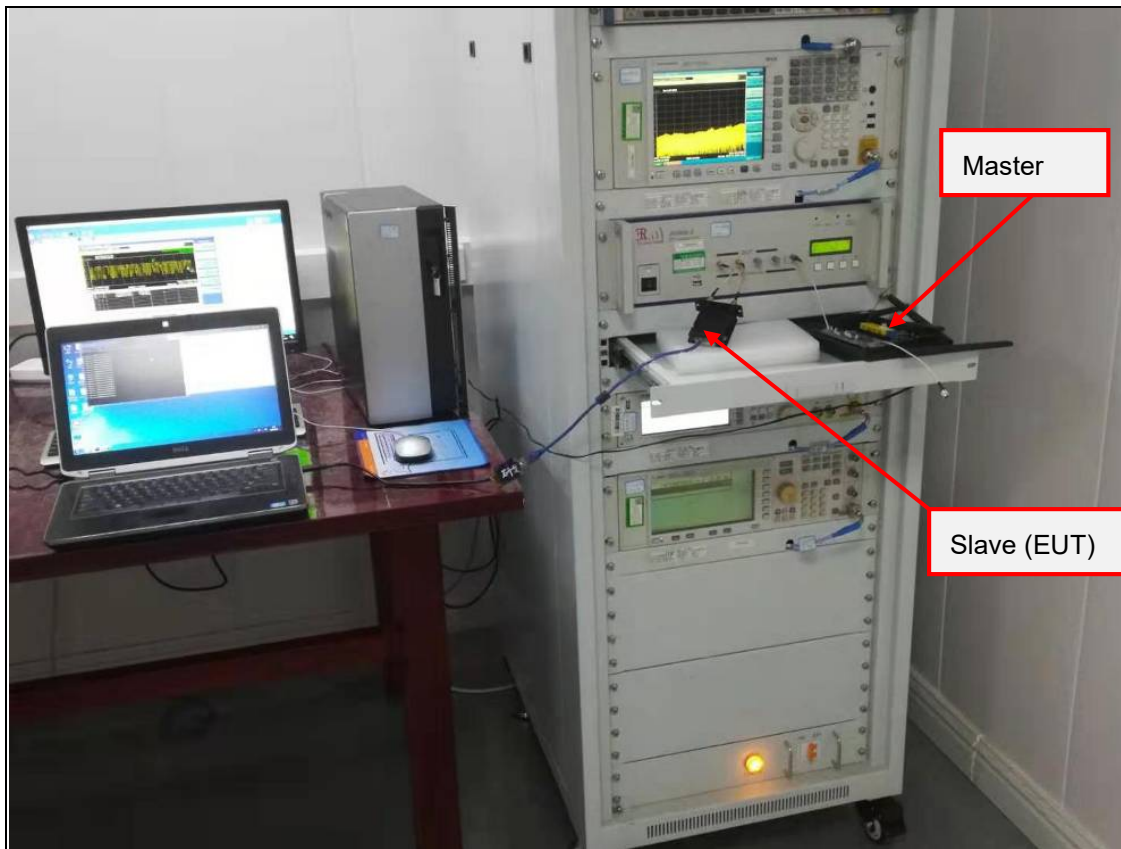
After the master off, during the 30 minutes observation time, The UUT did not make any transmissions in the DFS band after UUT power up.



3.6 Non- co-channel test

The UUT was investigated after radar was detected the channel and made sure no co-channel operation with radars.

3.7 Photographs of the test configuration



4. Appendix A - Modifications recorders for engineering changes to the EUT by the LAB

No any modifications are made to the EUT by the lab during the test.

5. Appendix B– Information on the Testing Laboratories

We, [Hwa-Hsing \(Dongguan\) Co., Ltd.](#), A global provider of TESTING and CERTIFICATION services for consumer products, electronic products and wireless information technology products. Adhering to the core values “HONEST and TRUSTWORTHY, OBJECTIVE and IMPARTIALITY, RIGOROUS and AFFICIENT”, commitment to provide professional, perfect and efficient comprehensive ONE-STOP solution of TESTING and CERTIFICATION services for Manufacturers, Buyers, Traders, Brands, Retailers. Assist client to better manage risk, protect their brands, reduce costs and cut time to over 150 markets in global. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

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

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