

TEST REPORT

Product : Handheld UHF Reader
Trade mark : CHAINWAY
Model/Type reference : C76
Serial Number : N/A
Report Number : EED32K00243605
FCC ID : 2AC6AC76
Date of Issue : Mar. 28, 2019
Test Standards : 47 CFR Part 15 Subpart E
Test result : PASS

Prepared for:

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Date:

Mar. 28, 2019

Check No.:3096338075



2 Version

Version No.	Date	Description
00	Mar. 28, 2019	Original

3 Test Summary

Test Item	Test Requirement	Test method	Result
Non-Occupancy Period	47 CFR Part 15 Subpart E Section 15.407 (h)(2)(iv)	KDB 905462 D02	PASS
DFS Detection Threshold	47 CFR Part 15 Subpart E Section 15.407 (h)(2)	KDB 905462 D02	N/A
Channel Availability Check Time	47 CFR Part 15 Subpart E Section 15.407 (h)(2)(ii)	KDB 905462 D02	N/A
U-NII Detection Bandwidth	47 CFR Part 15 Subpart E Section 15.407 (h)(2)	KDB 905462 D02	N/A
Channel Closing Transmission Time	47 CFR Part 15 Subpart E Section 15.407 (h)(2)(iii)	KDB 905462 D02	PASS
Channel Move Time	47 CFR Part 15 Subpart E Section 15.407 (h)(2)(iii)	KDB 905462 D02	PASS

Remark:

The tested sample and the sample information are provided by the client.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radiated Frequency.

CH: In this whole report CH means channel.

Volt: In this whole report Volt means Voltage.

Temp: In this whole report Temp means Temperature.

Humid: In this whole report Humid means humidity.

Press: In this whole report Press means Pressure.

N/A: In this whole report not application.

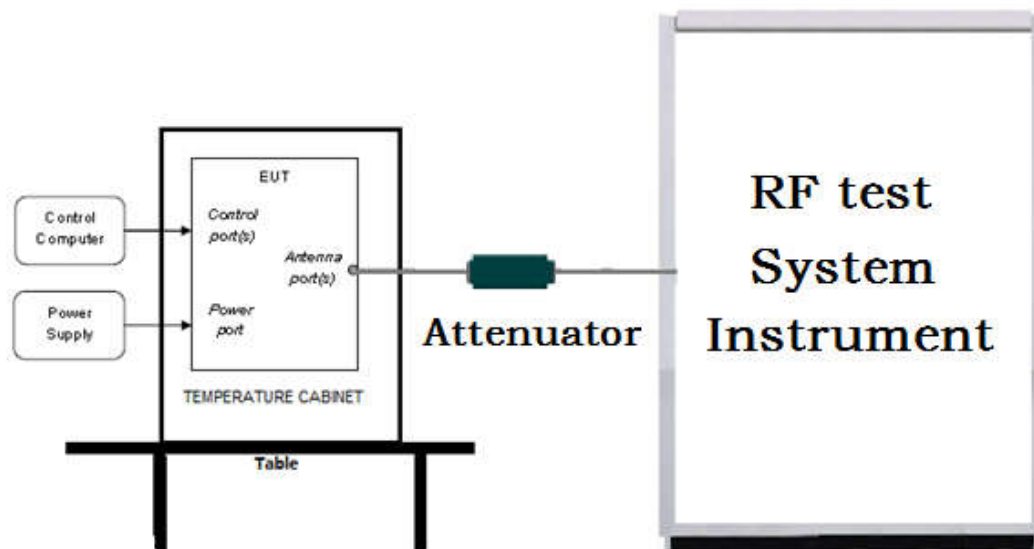
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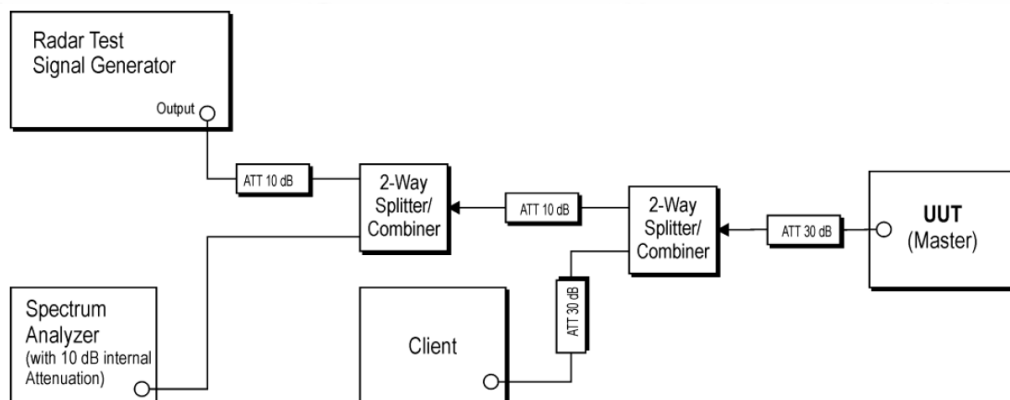
5 Test Requirement

5.1 Test setup

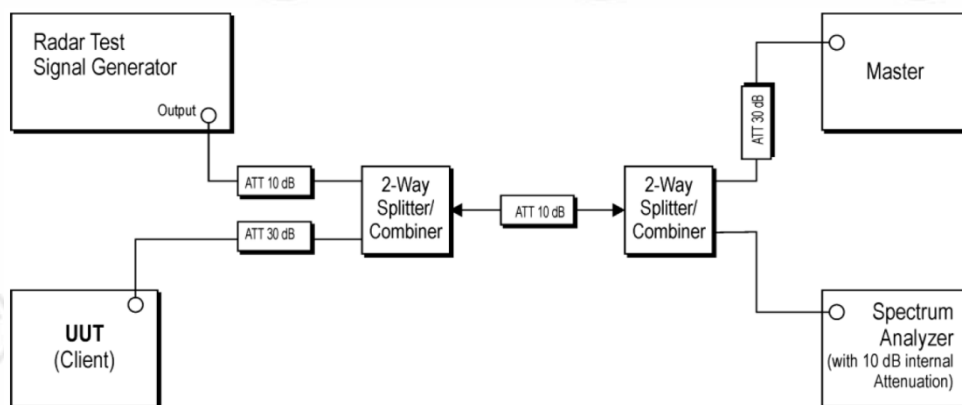
5.1.1 For Conducted test setup



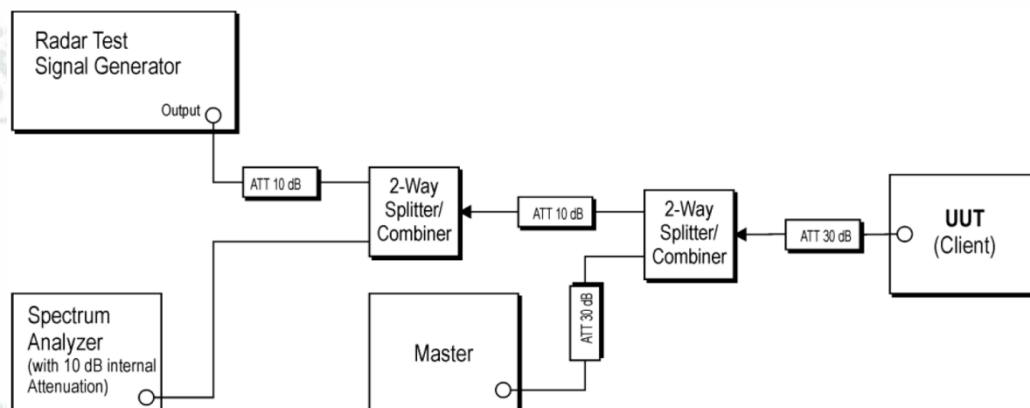
5.1.2 Setup for Master with injection at the Master



5.1.3 Setup for Client with injection at the Master



5.1.4 Setup for Client with injection at the Client



5.2 Test Environment

Operating Environment:	
Temperature:	24°C
Humidity:	48% RH
Atmospheric Pressure:	1010 mbar

5.3 Test Condition

5.3.1 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.

a) 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	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.					

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.

b) 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.

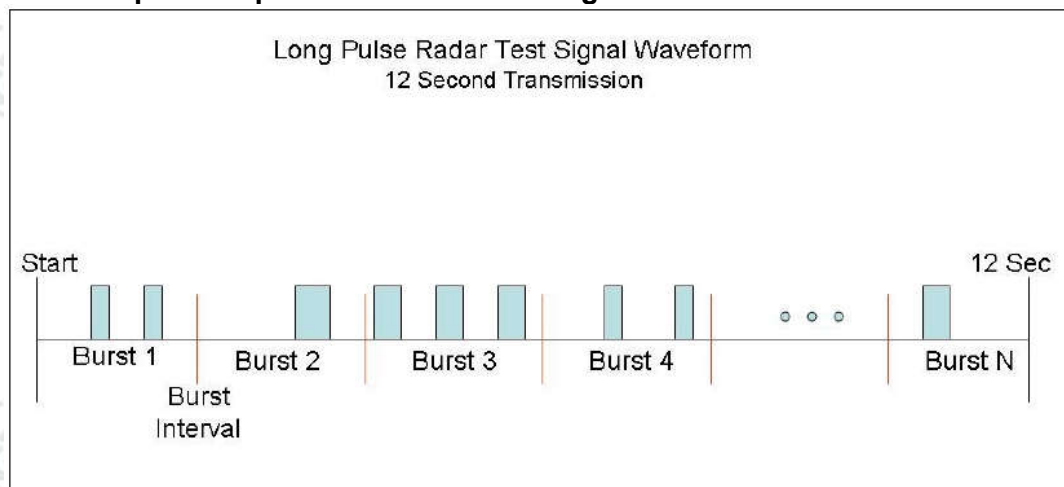
Each waveform is defined as follows:

- 1) The transmission period for the Long Pulse Radar test signal is 12 seconds.
- 2) There are a total of 8 to 20 Bursts in the 12 second period, with the number of Bursts being randomly chosen. This number is Burst Count.
- 3) Each Burst consists of 1 to 3 pulses, with the number of pulses being randomly chosen. Each Burst within the 12 second sequence may have a different number of pulses.
- 4) The pulse width is between 50 and 100 microseconds, with the pulse width being randomly chosen. Each pulse within a Burst will have the same pulse width. Pulses in different Bursts may have different pulse widths.
- 5) Each pulse has a linear frequency modulated chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a transmission period will have the same chirp width. The chirp is centered on the pulse. For example, with a radar frequency of 5300 MHz and a 20 MHz chirped signal, the chirp starts at 5290 MHz and ends at 5310 MHz.
- 6) If more than one pulse is present in a Burst, the time between the pulses will be between 1000 and 2000 microseconds, with the time being randomly chosen. If three pulses are present in a Burst, the random time interval between the first and second pulses is chosen independently of the random time interval between the second and third pulses.
- 7) The 12 second transmission period is divided into even intervals. The number of intervals is equal to Burst Count. Each interval is of length $(12,000,000 / \text{Burst Count})$ microseconds. Each interval contains one Burst. The start time for the Burst, relative to the beginning of the interval, is between 1 and $[(12,000,000 / \text{Burst Count}) - (\text{Total Burst Length}) + (\text{One Random PRI Interval})]$ microseconds, with the start time being randomly chosen. The step interval for the start time is 1 microsecond. The start time for each Burst is chosen randomly.

A representative example of a Long Pulse Radar Type waveform:

- 1) The total test waveform length is 12 seconds.
- 2) Eight (8) Bursts are randomly generated for the Burst Count.
- 3) Burst 1 has 2 randomly generated pulses.
- 4) The pulse width (for both pulses) is randomly selected to be 75 microseconds.
- 5) The PRI is randomly selected to be at 1213 microseconds.
- 6) Bursts 2 through 8 are generated using steps 3 – 5.
- 7) Each Burst is contained in even intervals of 1,500,000 microseconds. The starting location for Pulse 1, Burst 1 is randomly generated (1 to 1,500,000 minus the total Burst 1 length + 1 random PRI interval) at the 325,001 microsecond step. Bursts 2 through 8 randomly fall in successive 1,500,000 microsecond intervals (i.e. Burst 2 falls in the 1,500,001 – 3,000,000 microsecond range).

Graphical representation of the Long Pulse Radar Test Waveform.



c) 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.

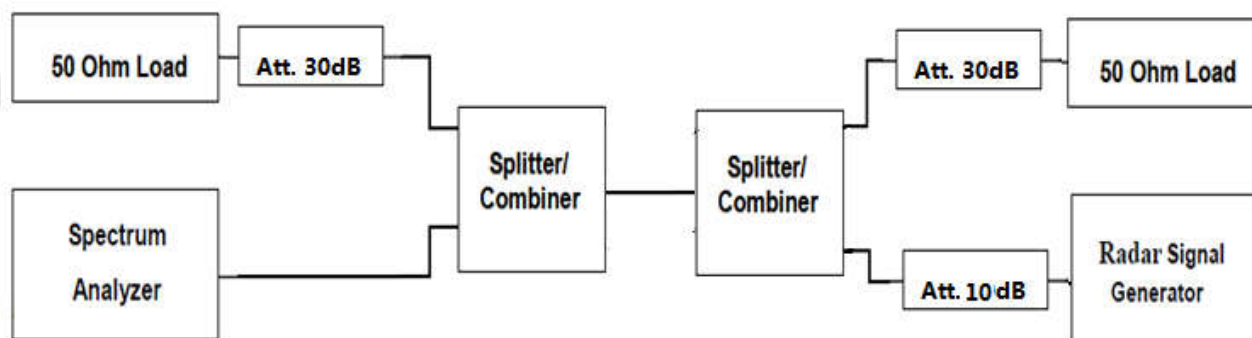
The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues 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.

d) Radar Waveform Calibration

The following equipment setup was used to calibrate the conducted radar waveform. A spectrum analyzer was used to establish the test signal level for each radar type. During this process there were replace 50ohm terminal from master and client device and no transmissions by either the master or client device. The spectrum analyzer was switched to the zero span (time domain) at the frequency of the radar waveform generator. Peak detection was utilized. The spectrum analyzer resolution bandwidth (RBW) and video bandwidth (VBW) were set to 3MHz and 3 MHz.

The signal generator amplitude was set so that the power level measured at the spectrum analyzer was - 61dBm due to the interference threshold level is not required.

Conducted Calibration Setup



5.3.2 Technical requirement

a) Applicability of DFS Requirements

Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operation Mode		
	Master	Client without Radar Detection	Client with Radar Detection
Non-Occupancy Period	Yes	Not require	Yes
DFS Detection Threshold	Yes	Not require	Yes
Channel Availability Check Time	Yes	Not require	Not require
U-NII Detection Bandwidth	Yes	Not require	Yes

Applicability of DFS requirements during normal operation

Requirement	Operation Mode		
	Master	Client without Radar Detection	Client with Radar Detection
DFS Detection Threshold	Yes	Not require	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
U-NII Detection Bandwidth	Yes	Not require	Yes

b) Requirements of Client Devices

- a) A Client Device will not transmit before having received appropriate control signals from a Master Device.
- b) A Client Device will stop all its transmissions whenever instructed by a Master Device to which it is associated and will meet the Channel Move Time and Channel Closing Transmission Time requirements. The Client Device will not resume any transmissions until it has again received control signals from a Master Device.
- c) If a Client Device is performing In-Service Monitoring and detects a Radar Waveform above the DFS Detection Threshold, it will inform the Master Device. This is equivalent to the Master Device detecting the Radar Waveform and d) through f) of section 5.1.1 apply.
- d) Irrespective of Client Device or Master Device detection the Channel Move Time and Channel Closing Transmission Time requirements remain the same.
- e) The client test frequency must be monitored to ensure no transmission of any type has occurred for 30 minutes. Note: 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.

C) DFS Detection Thresholds and Response Requirement

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

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP $\geq$ 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.	

DFS Response Requirement Values

Parameter	Value
<i>Non-occupancy period</i>	Minimum 30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds See Note 1.
<i>Channel Closing Transmission Time</i>	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
<i>U-NII Detection Bandwidth</i>	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.
Note 1: <i>Channel Move Time</i> and the <i>Channel Closing Transmission Time</i> should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. Note 2: The <i>Channel Closing Transmission Time</i> is comprised of 200 milliseconds starting at the beginning of the <i>Channel Move Time</i> plus any additional intermittent control signals required to facilitate a <i>Channel</i> 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 <i>U-NII Detection Bandwidth</i> 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.	

6 General Information

6.1 Client Information

Applicant:	Shenzhen Chainway Information Technology Co., Ltd.
Address of Applicant:	9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an, Shenzhen
Manufacturer:	Shenzhen Chainway Information Technology Co., Ltd.
Address of Manufacturer:	9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an, Shenzhen
Factory:	Shenzhen Chainway Information Technology Co., Ltd.
Address of Factory:	9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an, Shenzhen

6.2 General Description of EUT

Product Name:	Handheld UHF Reader
Model No.:	C76
Trade Mark:	CHAINWAY
Location for use:	indoor
EUT Supports Radios application:	BT 4.0 Single mode: 2402MHz to 2480MHz; 2.4GHz Wi-Fi: 802.11b/g/n(HT20)(HT40): 2412MHz ~2462 MHz; 5GHz Wi-Fi: U-NII-1: 5.15-5.25GHz; U-NII-2A: 5.25-5.35GHz; U-NII-2C: 5.470-5.725GHz; U-NII-3: 5.725-5.850GHz; 802.11a; 802.11n(20MHz/40MHz); RFID: 902MHz to 928MHz; NFC: 13.56MHz; GPS: 1559MHz to 1610MHz
Power Supply:	Adapter: Model: GME10D-050200FUu Input: 100-240V~ 50/60Hz, 0.28A Output: 5V---2A
USB cable:	100cm(Unshielded)
Sample Received Date:	Sep. 05, 2018
Sample tested Date:	Sep. 12, 2018 to Feb. 20, 2019

6.3 Product Specification subjective to this standard

Operation Frequency:	IEEE 802.11a/n(20M): 5150MHz ~5250 MHz IEEE802.11n(40M): 5150MHz ~5250 MHz IEEE 802.11a/n(20M): 5250MHz ~5350 MHz IEEE802.11n(40M): 5250MHz ~5350 MHz IEEE 802.11a/n(20M): 5470MHz ~5725 MHz IEEE802.11n(40M): 5470MHz ~5725 MHz IEEE 802.11a/n(20M): 5725MHz ~5850 MHz IEEE802.11n(40M): 5725MHz ~5850 MHz
Channel Numbers:	IEEE 802.11a/n(20M): 5150MHz ~5250MHz/ 4 channel IEEE 802.11n(40M): 5150MHz ~5250MHz/ 2 channel IEEE 802.11a/n(20M): 5250MHz ~5350 MHz/ 4 channel IEEE802.11n(40M): 5250MHz ~5350 MHz/ 2 channel IEEE 802.11a/n(20M): 5470MHz ~5725 MHz/ 8 channel IEEE802.11n(40M): 5470MHz ~5725 MHz/ 3 channel IEEE 802.11a/n(20M): 5725MHz ~5850MHz/ 5 channel IEEE 802.11n(40M): 5725MHz ~5850MHz/ 2 channel
Operation Mode:	Client Without Radar Detection function
Type of Modulation:	802.11a; 802.11n(20MHz/40MHz); OFDM(64QAM, 16QAM, QPSK, BPSK)
Sample Type:	Portable device
Firmware version:	C76E_LWG_M0_V0.4.6_S171219

Hardware version:	C70SEA_MB_V11
Test Power Grade:	N/A
Test Software of EUT:	N/A
Antenna Type and Gain:	WiFi: Antenna type: PFC, Antenna gain: 0.43dBi
Test Voltage:	AC 120V, 60Hz

Operation Frequency each of channel

For 802.11a/n(20M) Operation in the 5150MHz ~5250 MHz band			
Channel	Frequency	Channel	Frequency
36	5180MHz	44	5220MHz
40	5200MHz	48	5240MHz
For 802.11a/n(20M) Operation in the 5250MHz ~5350 MHz band			
Channel	Frequency	Channel	Frequency
52	5260MHz	60	5300MHz
56	5280MHz	64	5320MHz
For 802.11a/n(20M) Operation in the 5470MHz ~5725 MHz band			
Channel	Frequency	Channel	Frequency
100	5500MHz	116	5580MHz
104	5520MHz	132	5660MHz
108	5540MHz	136	5680MHz
112	5560MHz	140	5700MHz
For 802.11a/n(20M) Operation in the 5725MHz ~5850 MHz band			
Channel	Frequency	Channel	Frequency
149	5745MHz	162	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz	NA	NA

For 802.11n(40M) Operation in the 5150MHz ~5250 MHz band			
Channel	Frequency	Channel	Frequency
38	5190MHz	46	5230MHz
For 802.11n(40M) Operation in the 5250MHz ~5350 MHz band			
Channel	Frequency	Channel	Frequency
54	5270MHz	62	5310MHz
For 802.11n(40M) Operation in the 5470MHz ~5725 MHz band			
Channel	Frequency	Channel	Frequency
102	5510MHz	134	5670MHz
110	5550MHz	NA	NA
For 802.11n(40M) Operation in the 5725MHz ~5850 MHz band			
Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

6.4 Description of Support Units

The EUT has been tested with associated equipment below.

Associated equipment name		Manufacture	model	serial number	Supplied by	Certification
AE1	Phone	Apple	A1367	TTF20120027	CTI	FCC
AE2	Router	HuaWei	WS550	K8E8W1531400 2784	CTI	FCC
AE3	PC	Apple	MMGF2 ZP/A	ODN20170212	CTI	FCC

6.5 Test Location

All tests were performed at:

Centre Testing International Group Co., Ltd.

Hongwei Industrial Zone, Bao'an 70 District, Shenzhen, Guangdong, China 518101

Telephone: +86 (0) 755 33683668 Fax: +86 (0) 755 33683385

No tests were sub-contracted.

6.6 Deviation from Standards

None.

6.7 Abnormalities from Standard Conditions

None.

6.8 Other Information Requested by the Customer

None.

6.9 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.9×10^{-8}
2	RF power, conducted	0.46dB (30MHz-1GHz)
		0.55dB (1GHz-18GHz)
3	Radiated Spurious emission test	4.3dB (30MHz-1GHz)
		4.5dB (1GHz-12.75GHz)
4	Conduction emission	3.5dB (9kHz to 150kHz)
		3.1dB (150kHz to 30MHz)
5	Temperature test	0.64°C
6	Humidity test	3.8%
7	DC power voltages	0.026%

7 Equipment List

RF test system					
Equipment	Manufacturer	Model No.	Serial Number	Cal. Date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
Signal Generator	Keysight	E8257D	MY53401106	03-13-2018	03-12-2019
Spectrum Analyzer	Keysight	N9010A	MY54510339	03-13-2018	03-12-2019
Signal Generator	Keysight	N5182B	MY53051549	03-13-2018	03-12-2019
High-pass filter	Sinoscite	FL3CX03WG1 8NM12-0398-002	---	01-10-2018 01-08-2019	01-09-2019 01-07-2020
High-pass filter	MICRO-TRONICS	SPA-F-63029-4	---	01-10-2018 01-08-2019	01-09-2019 01-07-2020
DC Power	Keysight	E3642A	MY54426035	03-13-2018	03-12-2019
PC-1	Lenovo	R4960d	---	03-13-2018	03-12-2019
BT&WI-FI Automatic control	R&S	OSP120	101374	03-13-2018	03-12-2019
RF control unit	JS Tonscend	JS0806-2	15860006	03-13-2018	03-12-2019
RF control unit	JS Tonscend	JS0806-1	15860004	03-13-2018	03-12-2019
RF control unit	JS Tonscend	JS0806-4	158060007	03-13-2018	03-12-2019
BT&WI-FI Automatic test software	JS Tonscend	JS1120-2	---	03-13-2018	03-12-2019
Temperature/Humidity Indicator	biaozhi	HM10	1804186	10-13-2017 10-12-2018	10-12-2018 10-11-2019

8 Radio Technical Requirements Specification

Reference documents for testing:

No.	Identity	Document Title
1	FCC Part15E	Subpart E—Unlicensed National Information Infrastructure Devices
2	FCC KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02	Compliance Measurement Procedures For Unlicensed-National Information Infrastructure Devices Operating In The 5250-5350 Mhz And 5470-5725 Mhz Bands Incorporating Dynamic Frequency Selection
3	FCC KDB 905462 D04 Test Mode New Rules v01	OPERATIONAL MODES SUGGESTED FOR DFS TESTING
4	FCC KDB 905462 D06 802.11 Channel Plans New Rules v02	OPERATION IN U-NII BANDS –802.11 CHANNEL PLAN (§15.407)

Test Results List:

FCC Part15E	Test method	Test item	Operation Mode verdict		
			Master	Client without Radar Detection	Client with Radar Detection
47 CFR Part 15 Subpart E Section 15.407 (h)(2)(iv)	905462 D02	Non-Occupancy Period	--	PASS	--
47 CFR Part 15 Subpart E Section 15.407 (h)(2)	905462 D02	DFS Detection Threshold	--	Not require	--
47 CFR Part 15 Subpart E Section 15.407 (h)(2)(ii)	905462 D02	Channel Availability Check Time	--	Not require	--
47 CFR Part 15 Subpart E Section 15.407 (h)(2)	905462 D02	U-NII Detection Bandwidth	--	Not require	--
47 CFR Part 15 Subpart E Section 15.407 (h)(2)(iii)	905462 D02	Channel Closing Transmission Time	--	PASS	--
47 CFR Part 15 Subpart E Section 15.407 (h)(2)(iii)	905462 D02	Channel Move Time	--	PASS	--

Channel Loading/Data Streaming

Timing plots are required with calculations demonstrating a minimum channel loading of approximately 17% or greater.

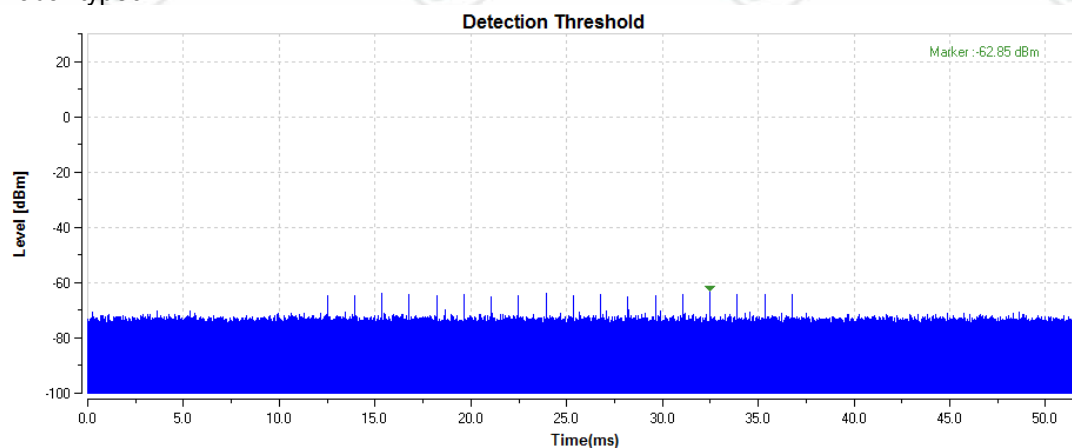
Master DFS Threshold Level

DFS Threshold level: -63 dBm

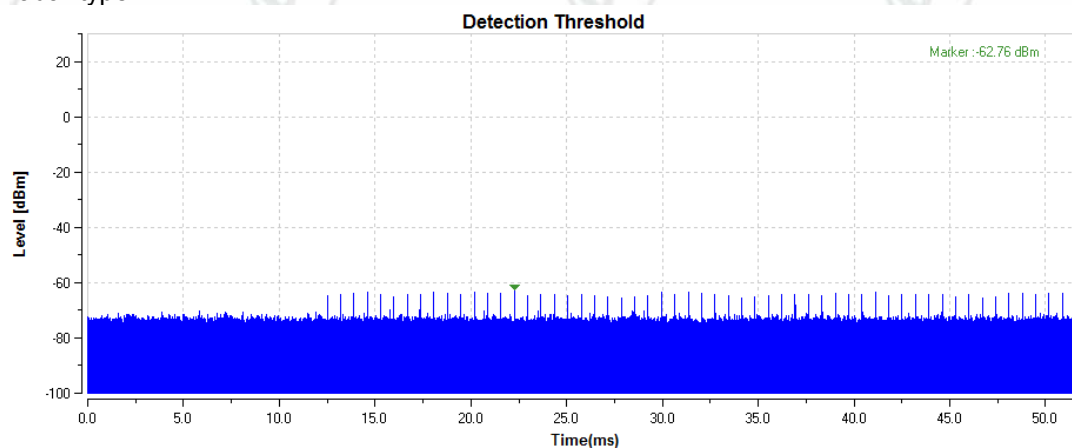
The Interference Radar Detection Threshold Level is $(-64\text{dBm}) + 1\text{ dB} = -63\text{ dBm}$. That has been taken into account the master output power range and antenna gain.

Calibration plots for each of the required radar waveforms

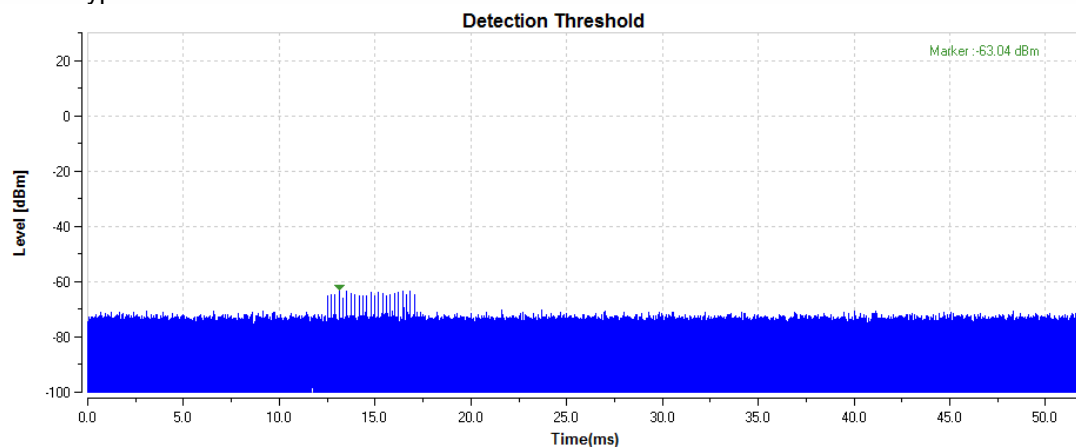
Radar type0



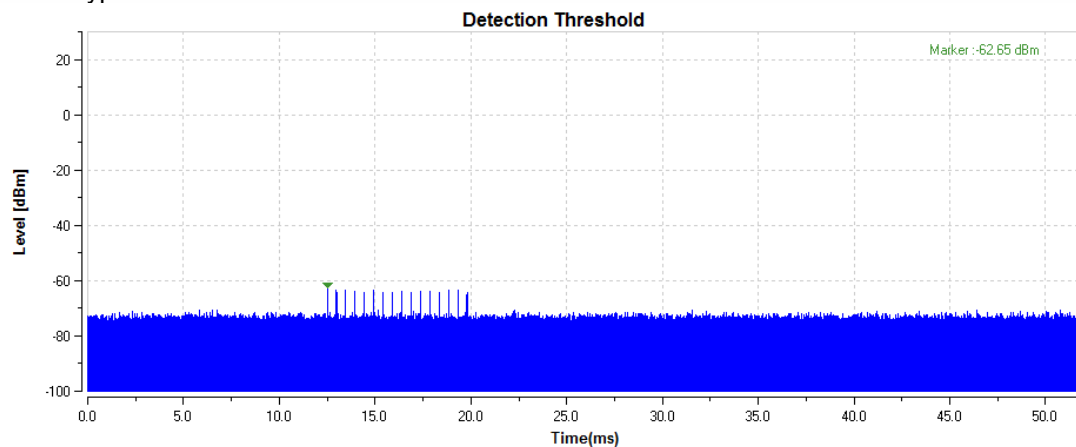
Radar type1



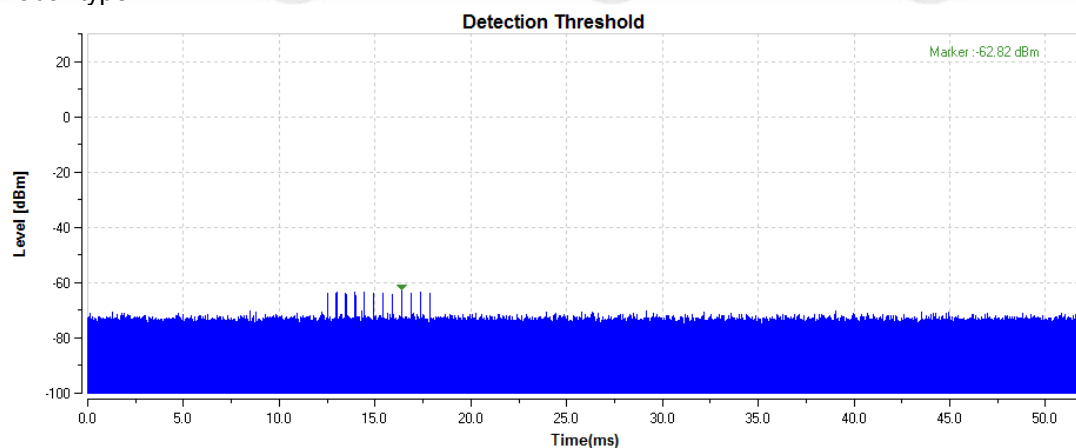
Radar type2



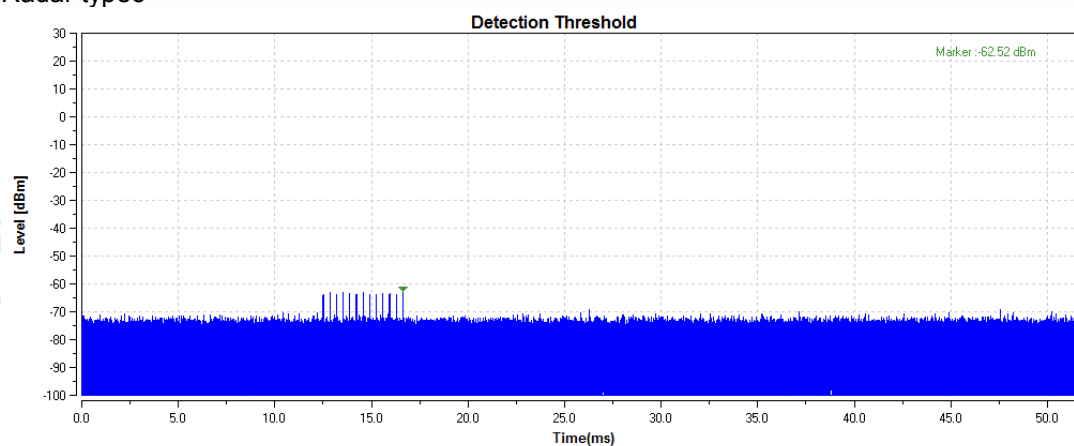
Radar type3



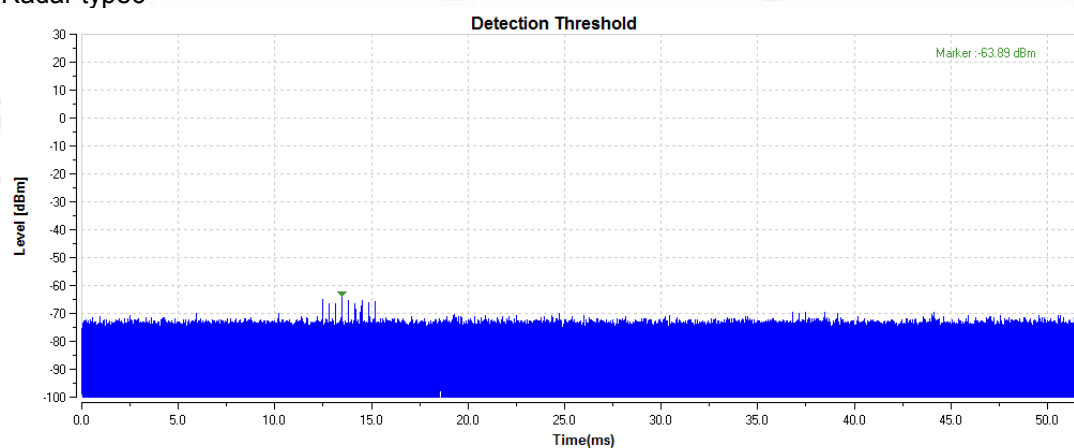
Radar type4



Radar type5



Radar type6

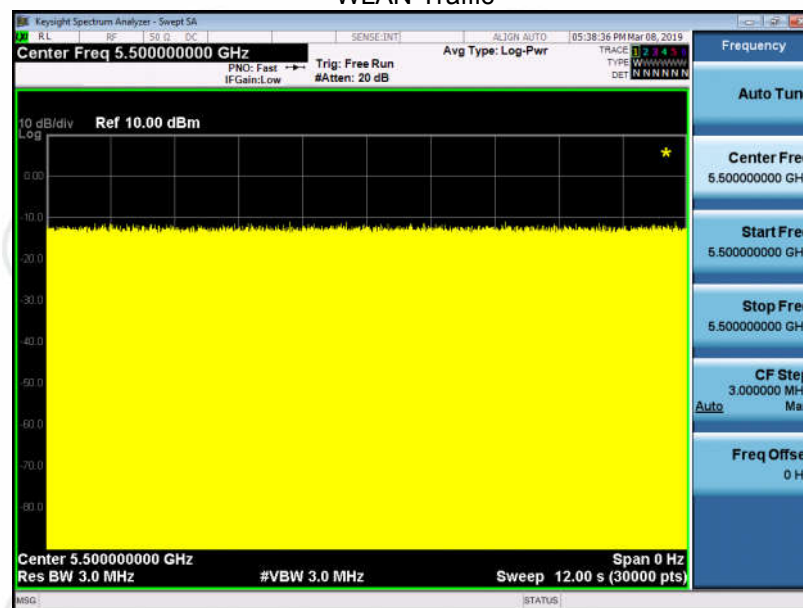


8.1. Conducted test procedure

- 1) One frequency will be chosen from the Operating Channels of the UUT within the 5250-5350 MHz or 5470-5725MHz bands.
- 2) The Client Device (EUT) is set up the above diagram and communications between the Master device and the Client is established.
- 3) Stream the channel loading test file from the Master Device to the Client Device on the test Channel for the entire period of the test.
- 4) An additional 1 dB is added to the radar test signal to ensure it is at or above the DFS Detection Threshold, accounting for equipment variations/errors.
- 5) Observe the transmissions of the UUT at the end of the Burst on the Operating Channel for duration greater than 12 seconds for Radar Type 0 to ensure detection occurs.
- 6) After the initial radar burst the channel is monitored for 30 minutes to ensure no transmissions or beacons occur. A second monitoring setup is used to verify that the Master and Client have both moved to different channels.

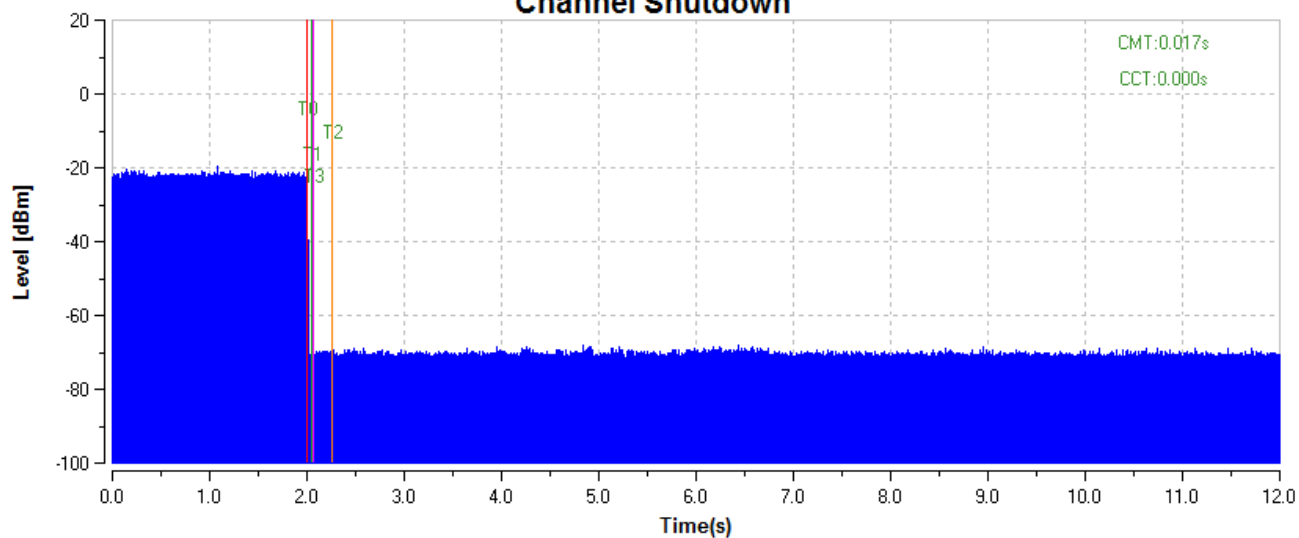
8.2. Test Results

WLAN Traffic



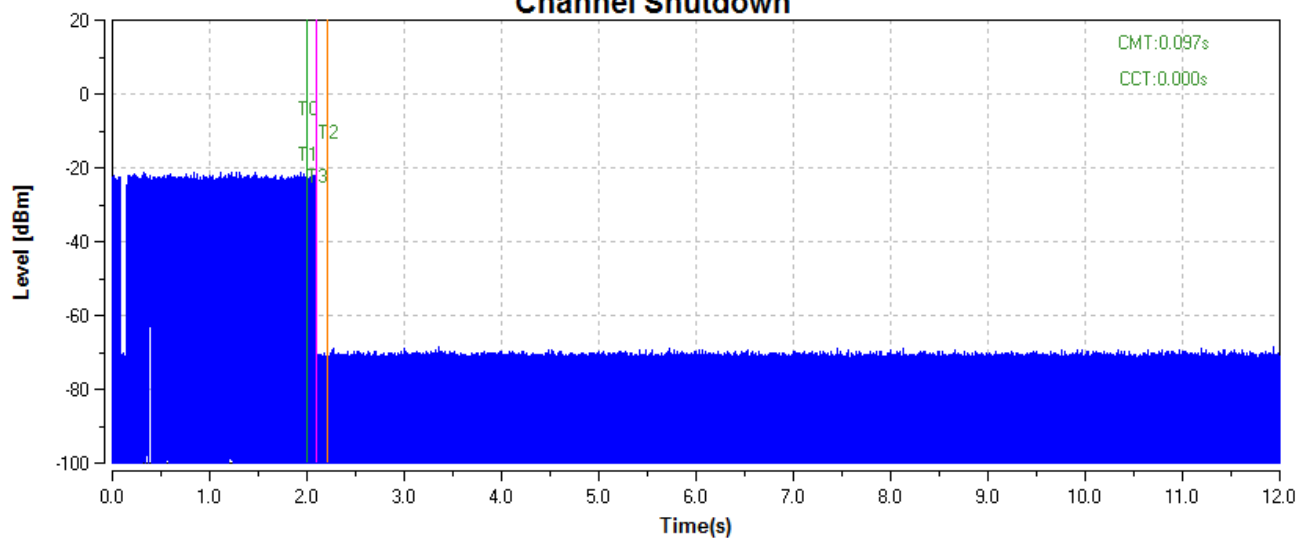
Radar Type 0 Channel Move Time

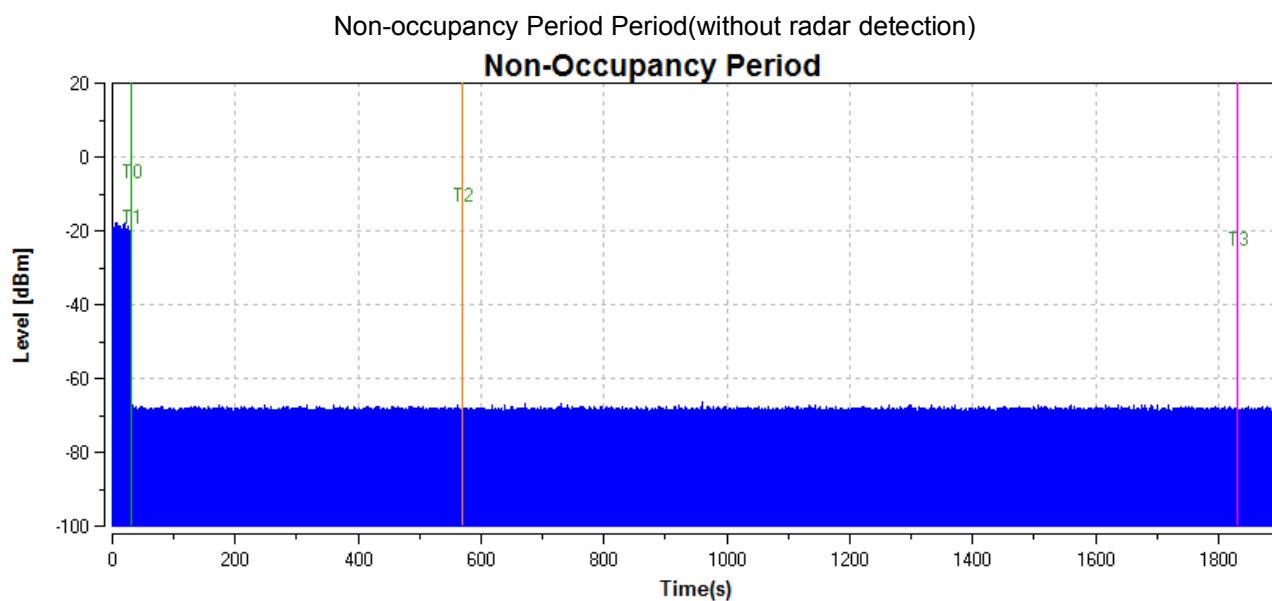
Channel Shutdown



Radar Type 0 Channel Closing Transmission

Channel Shutdown





Verdict:

To verify whether channel is unavailable to be operated in 30 minutes.

$1.8\text{ks} = 1800\text{s} = 1800\text{ s/min} / 60 = 30\text{minute}$

PHOTOGRAPHS OF EUT Constructional Details

Refer to Report No.EED32K00243601 for EUT external and internal photos.

*** End of Report ***

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