CTC Laboratories, Inc.

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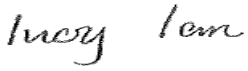
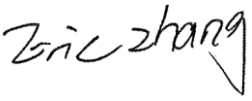
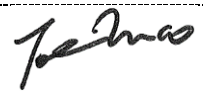
TEST REPORT

For DFS

Report No. ·····:	**CTC20221783E05**
FCC ID·····:	**WNA-HP46E-R**
Applicant·····:	**Shenzhen Skyworth Digital Technology Co.,LTD**
Address·····:	14/F,Block A,Skyworth Building,Gaoxin Ave.1.S.,Nanshan District,Shenzhen,China
Manufacturer ·····:	Shenzhen Skyworth Digital Technology Co.,LTD
Address·····:	14/F,Block A,Skyworth Building,Gaoxin Ave.1.S.,Nanshan District,Shenzhen,China
Product Name·····:	**4K UHD Streaming TV Box**
Trade Mark·····:	STRONG, SKYWORTH, MECOOL, THOMSON
Model/Type reference·····:	Leap-S3
Listed Model(s) ·····:	LEAP-S3, HP46E, HP4618, KM7 PLUS, THA 200, THA200
Standard·····:	**FCC CFR Title 47 Part 15 Subpart C Section 15.247**
Date of receipt of test sample…:	Oct. 11, 2022
Date of testing……..:	Oct. 11, 2022 ~ Oct. 28, 2022
Date of issue……....:	Nov. 30, 2022
Result……:	**PASS**

Compiled by: (Printed name+signature)	Lucy Lan	
Supervised by: (Printed name+signature)	Eric Zhang	
Approved by: (Printed name+signature)	Totti Zhao	

Testing Laboratory Name……:	**CTC Laboratories, Inc.**
Address……:	1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Shenzhen, Guangdong, China

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1. TEST SUMMARY

1.1 Test Standards

The tests documented in this report were performed in accordance with FCC CFR 47 CFR Part 15, Subpart E, KDB 905462 D02.

1.2 Report version

Revised No.	Date of issue	Description
01	Nov. 30, 2022	Original

1.3 Test Description

CFR 47 Part 15 Subpart E 15.407 (h), KDB 905462 D02			
Test Item	**Test require**	**Result**	**Test Engineer**
DFS Detection Threshold	FCC 15.407, KDB 905462 D02	Pass	Lucy Lan
Channel Availability Check Time	FCC 15.407, KDB 905462 D02	N/A	N/A
Non-Occupancy Period	FCC 15.407, KDB 905462 D02	Pass	Lucy Lan
U-NII Detection Bandwidth	FCC 15.407, KDB 905462 D02	N/A	N/A
Channel Closing Transmission Time	FCC 15.407, KDB 905462 D02	Pass	Lucy Lan
Channel Move Time	FCC 15.407, KDB 905462 D02	Pass	Lucy Lan
Statistical Performance Check	FCC 15.407, KDB 905462 D02	N/A	N/A

Note:
1. The measurement uncertainty is not included in the test result.
2. N/A: Means this test item is not applicable for this device according to the technology characteristic of device.

1.4 Test Facility

Address of the report laboratory

CTC Laboratories, Inc.

Add: 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Shenzhen, Guangdong, China

Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

A2LA-Lab Cert. No.: 4340.01

CTC Laboratories, Inc. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in th e identified field of testing.

Industry Canada (Registration No.: 9783A, CAB Identifier: CN0029)

CTC Laboratories, Inc. EMC Laboratory has been registered by Certification and Engineer Bureau of Indus try Canada for the performance of with Registration NO.: 9783A on Jan, 2016.

FCC (Registration No.: 951311, Designation Number CN1208)

CTC Laboratories, Inc. EMC Laboratory has been registered and fully described in a report filed with the (F CC) Federal Communications Commission. The acceptance letter from the FCC is maintained inour files. Registration 951311, Aug 26, 2017.

1.5 Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the CTC Laboratories, Inc. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Below is the best measurement capability for CTC Laboratories, Inc.

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.42 dB	(1)
Transmitter power Radiated	2.14 dB	(1)
Conducted spurious emissions 9kHz~40GHz	1.60 dB	(1)
Radiated spurious emissions 9kHz~40GHz	2.20 dB	(1)
Conducted Emissions 9kHz~30MHz	3.20 dB	(1)
Radiated Emissions 30~1000MHz	4.70 dB	(1)
Radiated Emissions 1~18GHz	5.00 dB	(1)
Radiated Emissions 18~40GHz	5.54 dB	(1)
Occupied Bandwidth	---------	(1)

Note (1): This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

1.6 Environmental conditions

Normal Condition	Temperature	22 °C ~ 28°C
	Relative humidity	50% ~ 65%
	Voltage	The equipment shall be the nominal voltage for which the equipment was designed.
Extreme Condition	Temperature	Measurements shall be made over the extremes of the operating temperature range as declared by the manufacturer
	Voltage	Measurements shall be made over the extremes of the operating temperature range as declared by the manufacturer

Normal Condition	T_N=Normal Temperature	22 °C ~ 28°C
Extreme Condition	T_L=Lower Temperature	0 °C
	T_H=Higher Temperature	45 °C

2. GENERAL INFORMATION

2.1 General Description of EUT

Product Name:	4K UHD Streaming TV Box			
Trade Mark:	STRONG, SKYWORTH, MECOOL, THOMSON			
Model/Type reference:	Leap-S3			
Listed Model(s):	LEAP-S3, HP46E, HP4618, KM7 PLUS, THA 200, THA200			
Model Difference:	All these models are identical in the same PCB, layout and electrical circuit, Different is trade mark and model number.			
Power supply:	DC12V 1A from AC/DC Adapter			
Adapter model 1:	RJ-SKY120100U60S[Note1] Input: 100-240V~ 50/60Hz 0.5A Output: 12Vdc/1A			
Adapter model 2:	YS-SKY120100U00P[Note2] Input: 100-240V~ 50/60Hz 05A Output: 12Vdc/1A			
Hardware version:	54024			
Software version:	P2.0.3_20220929			
Antenna 1 and 2 type:	PCBA Antenna			
Antenna 1 & 2 gain:	2.2dBi			
Technical index for 5G WIFI				
Operation Band:	☒U-NII-1	☒U-NII-2A	☒U-NII-2C	☒U-NII-3
Operation Frequency Range:	U-NII-1:	5150MHz~5250MHz		
	U-NII-2A:	5250MHz~5350MHz		
	U-NII-2C:	5470MHz~5600MHz; 5650MHz~5725MHz		
	U-NII-3:	5725MHz~5850MHz		
Support bandwidth:	802.11a	☒ 20MHz		
	802.11n	☒ 20MHz	☒ 40MHz	
	802.11ac	☒ 20MHz	☒ 40MHz	☒ 80MHz	☐ 160MHz
Modulation:	802.11a: OFDM (BIT/SK, QPSK, BPSK, 16QAM) 802.11n: OFDM (BIT/SK, QPSK, BPSK, 16QAM, 64QAM) 802.11ac: OFDM (BIT/SK, QPSK, BPSK, 16QAM, 64QAM, 256QAM)			
Bit Rate of Transmitter:	802.11a: 6/9/12/18/24/36/48/54 Mbps 802.11n: up to 300Mbps 802.11ac: at most 866.7 Mbps			

Note:
1. RJ-SKY120100AXXS,(A = E or B , stands for different plug, E means for Europe plug, B means for UK plug, M or U means for US plug.XX = 00-99. stands for customer code)
2. YS-SKY120100N0XP (N = E, B ,1character indicate difference plug type: E denote EU plug, B denote UK plug,X = 0-9, 1 digit, only for marketing purpose, no impact on safety)

Operation Frequency List:

Band (MHz)	20MHz Bandwidth		40MHz Bandwidth		80MHz Bandwidth	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
U-NII-1	36	5180	38	5190	42	5210
	40	5200				
	44	5220	46	5230		
	48	5240				
U-NII-2A	52	5260	54	5270	58	5290
	56	5280				
	60	5300	62	5310		
	64	5320				
U-NII-2C	100	5500	102	5510	106	5530
	104	5520				
	108	5540	110	5550		
	112	5560				
	116	5580				
	132	5660	134	5670		
	136	5680				
	140	5700				
U-NII-3	149	5745	151	5755	155	5775
	153	5765				
	157	5785	159	5795		
	161	5805				
	165	5825				

2.2 Measurement Instruments List

Tonscend JS0806-2 Test system					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	Spectrum Analyzer	Keysight	N9020A	MY46471737	Dec.23, 2022
2	Spectrum Analyzer	Rohde & Schwarz	FUV40-N	101331	Mar. 15, 2023
3	MXG Vector Signal Generator	Agilent	N5182A	MY47420864	Dec.23, 2022
4	Signal Generator	Agilent	E8257D	MY46521908	Dec.23, 2022
5	Power Sensor	Agilent	U2021XA	MY5365004	Mar. 15, 2023
6	Power Sensor	Agilent	U2021XA	MY5365006	Mar. 15, 2023
7	Simultaneous Sampling DAQ	Agilent	U2531A	TW54493510	Mar. 15, 2023
8	Climate Chamber	TABAI	PR-4G	A8708055	Dec.23, 2022
9	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	116410	Dec.23, 2022
10	Climate Chamber	ESPEC	MT3065	/	Dec.23, 2022
11	300328 v2.2.2 test system	TONSCEND	v2.6	/	/

Note: The cable loss has calculated in test result which connection between each test instruments.

2.3 Accessory Equipment information

Equipment Information			
Name	Model	S/N	Manufacturer
Notebook	ThinkBook 14 G3ACL	/	Lenovo
GPON Terminal	EG8247Q (FCC ID: QISEG8247Q)	/	HUAWEI
Displayer	EW3270-T	EW3270U	BenQ
Cable Information			
Name	Shielded Type	Ferrite Core	Length
Lan Cable	Without	Without	1.5M

3. Dynamic Frequency Selection

3.1 Applicability of DFS requirements

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

Requirement	Operational Mode		
	☐Master	☑Client Without Radar Detection	☐Client With Radar Detection
Non-Occupancy Period	Yes	Not required	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

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	☐Master Device 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 with multiple bandwidth modes	☐Master Device 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 each of the bonded 20 MHz channels and the channel center frequency.		

3.2 Limits

(1) DFS Detection Thresholds

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. Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

(2) DFS Response Requirements

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 facilitating 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.	

3.3 Parameters of 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.

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	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot10^6}{\text{PRI}_{\mu\text{sec}}}\right)\right\}$	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.

For example if in Short Pulse Radar Type 1 Test B a PRI of 3066 μsec is selected, the number of pulses would be Round up $\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot10^6}{3066}\right)\right\}$ = Round up {17.2} = 18.

Table 5a - Pulse Repetition Intervals Values for Test A

Pulse Repetition Frequency Number	Pulse Repetition Frequency (Pulses Per Second)	Pulse Repetition Interval (Microseconds)
1	1930.5	518
2	1858.7	538

3	1792.1	558
4	1730.1	578
5	1672.2	598
6	1618.1	618
7	1567.4	638
8	1519.8	658
9	1474.9	678
10	1432.7	698
11	1392.8	718
12	1355.0	738
13	1319.3	758
14	1285.3	778
15	1253.1	798
16	1222.5	818
17	1193.3	838
18	1165.6	858
19	1139.0	878
20	1113.6	898
21	1089.3	918
22	1066.1	938
23	326.2	3066

The aggregate is the average of the percentage of successful detections of Short Pulse Radar Types 1-4. For example, the following table indicates how to compute the aggregate of percentage of successful detections.

Radar Type	Number of Trials	Number of Successful Detections	Minimum Percentage of Successful Detection
1	35	29	82.9%
2	30	18	60%
3	30	27	90%
4	50	44	88%
Aggregate (82.9% + 60% + 90% + 88%)/4 = 80.2%			

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

The parameters for this waveforms 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 wave forms, then each additional waveform must also be unique and not repeated from the previous waveforms.

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

For the Frequency Hopping Radar Type, the same Burst parameters are used for each wave form. The hopping sequence is different for each wave form 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 5250–5724MHz.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.

3.4 Test Setup

SYSTTEMITEST CONFIGURATON

Description of Test Configuration:

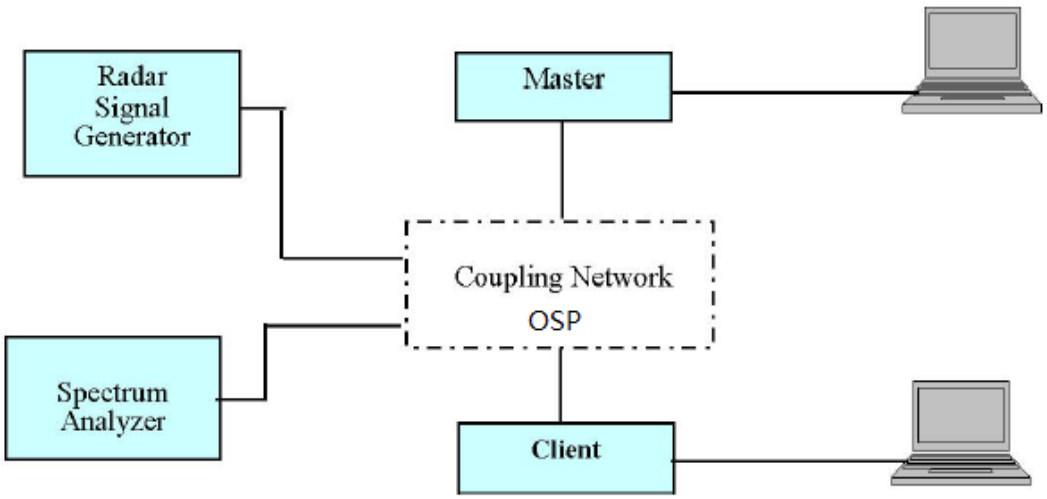
The EUT was configured for testing in an engineering mode which was provided by the manufacturer.

Stream the test file from the Master Device to the Client Device for IP based systems or frame based systems which dynamically allocate the talk/listen ratio.

Software to ping the client is used to simulate data transfer with a minimum channel loading of approximately 17% or greater.EUT Exercise Software

The test was performed under: DOS command, which was provided by the manufacturer.

System Block Diagram



Conducted Method

7.2.1 Setup for Master with injection at the Master

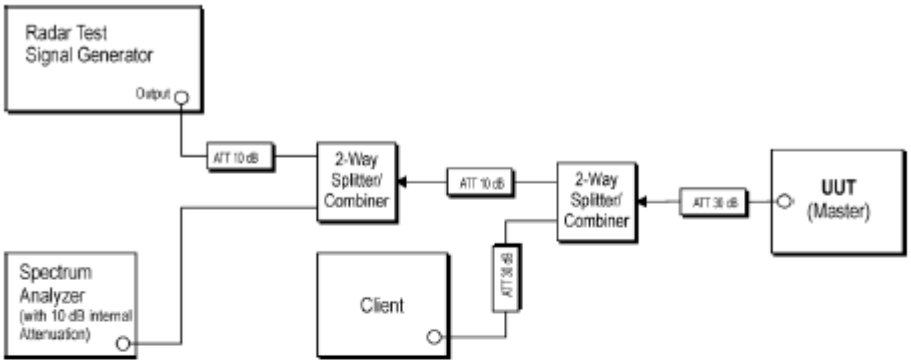


Figure 2: Example Conducted Setup where UUT is a Master and Radar Test Waveforms are injected into the Master

7.2.2 Setup for Client with injection at the Master

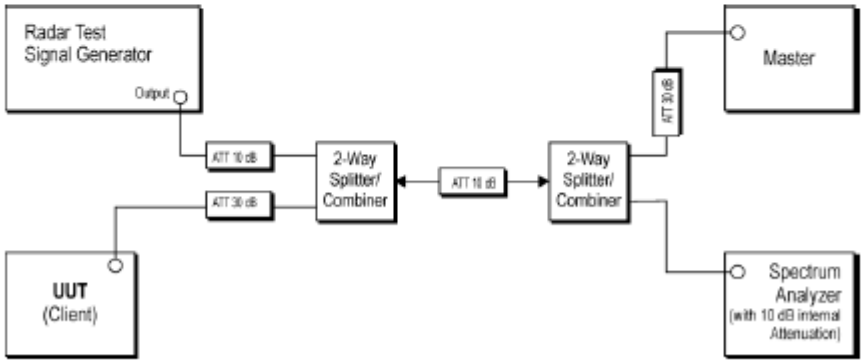


Figure 3: Example Conducted Setup where UUT is a Client and Radar Test Waveforms are injected into the Master

7.2.3 Setup for Client with injection at the Client

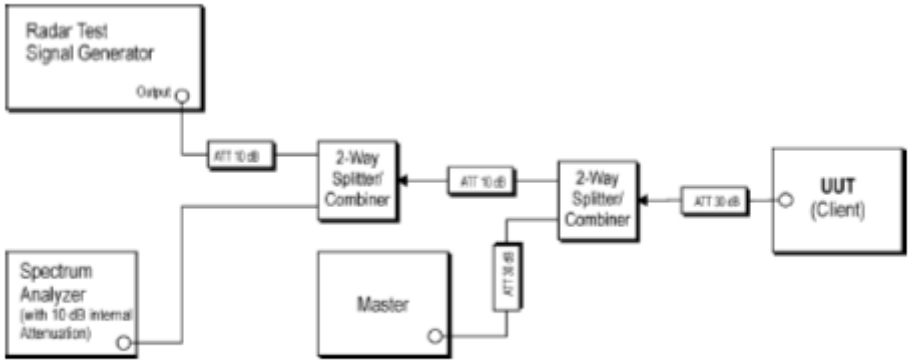


Figure 4: Example Conducted Setup where UUT is a Client and Radar Test Waveforms are injected into the Client

3.5 Test Procedure

Please refer to KDB 905462 D02 U-NII DFS Compliance Procedures New Rules v02 Clause 7.8.

6.5.4 In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period

These tests define how the following DFS parameters are verified during In-Service Monitoring;
- Channel Closing Transmission Time
- Channel Move Time
- Non-Occupancy Period

The steps below define the procedure to determine the above mentioned parameters when a radar Burst with a level equal to the DFS Detection Threshold + 1dB is generated on the Operating Channel of the U- NII device (In- Service Monitoring).

a) One frequency will be chosen from the Operating Channels of the UUT within the 5250-5350 MHz or 5470-5725 MHz bands. For 802.11 devices, the test frequency must contain control signals. This can be verified by disabling channel loading and monitoring the spectrum analyzer. If no control signals are detected, another frequency must be selected within the emission bandwidth where control signals are detected.
b) In case the UUT is a U-NII device operating as a Client Device (with or without DFS), a U-NII device operating as a Master Device will be used to allow the UUT (Client device) to Associate with the Master Device. In case the UUT is a Master Device, a U-NII device operating as a Client Device will be used and it is assumed that the Client will Associate with the UUT (Master). In both cases for conducted tests, the Radar Waveform generator will be connected to the Master Device. For radiated tests, the emissions of the Radar Waveform generator will be directed towards the Master Device. If the Master Device has antenna gain, the main beam of the antenna will be directed toward the radar emitter. Vertical polarization is used for testing.
c) 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.
d) At time T0 the Radar Waveform generator sends a Burst of pulses for one of the Radar Type 0 in Table 5 at levels defined in Table 3, on the Operating Channel. 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.
e) Observe the transmissions of the UUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the UUT during the observation time (Channel Move Time). Measure and record the Channel Move Time and Channel Closing Transmission Time if radar detection occurs. Figure 17 illustrates Channel Closing Transmission Time.
f) When operating as a Master Device, monitor the UUT for more than 30 minutes following instant T2 to verify that the UUT does not resume any transmissions on this Channel. Perform this test once and record the measurement result.
g) In case the UUT is a U-NII device operating as a Client Device with In-Service Monitoring, perform steps a) to f).

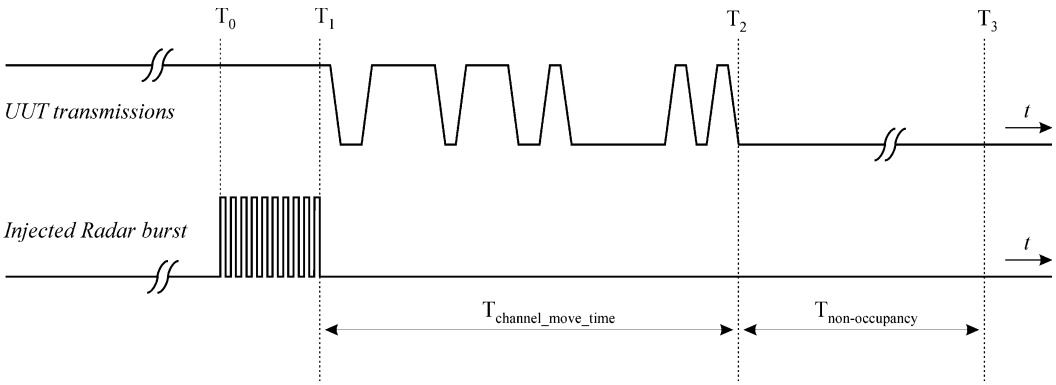


Figure 17: Example of Channel Closing Transmission Time & Channel Closing Time

3.6 Test Result

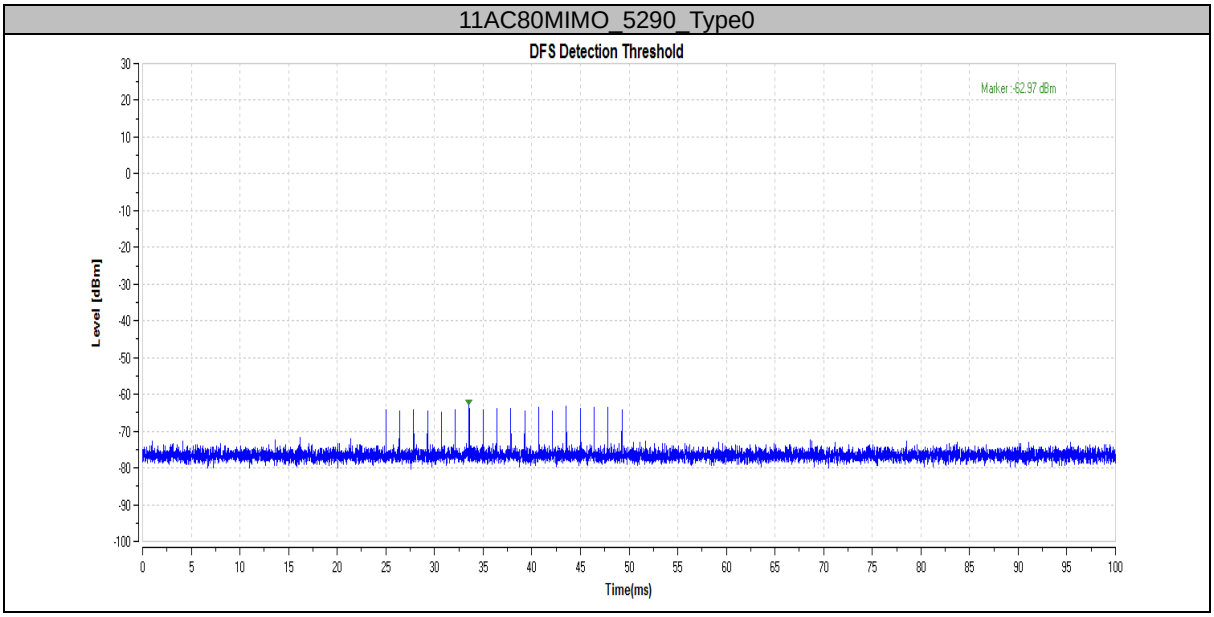
3.6.1 DFS DETECTION THRESHOLD

The EUT operates in 5230-5350 MHZ and 5470-5723 MHZ range
The maximum conducted output power of EUT is 21.6dbm antenna gain is 2.2dBi, the Maximum EIRP=21.6+2.2=23.8dBm, Therefore the required interference threshold level is -64dbm, the required radiated threshold at antenna port is -64dbm.The calibrated radiated DFS detection threshold level is set to-64dBm, threshold level=-64dBm + antenna gain=-59dBm.

DFS Threshold Level		
DFS Threshold Level Value	Limit	Result
-62.97dBm	⩽ -61.8dBm	Pass

Note:EUT'Maxmun.E.I.R.P>200 mw

11AC80MIMO_5290_Type0



3.6.2 DFS In-Service Monitoring

DFS In-Service Monitoring (5290 MHz;80 MHz)

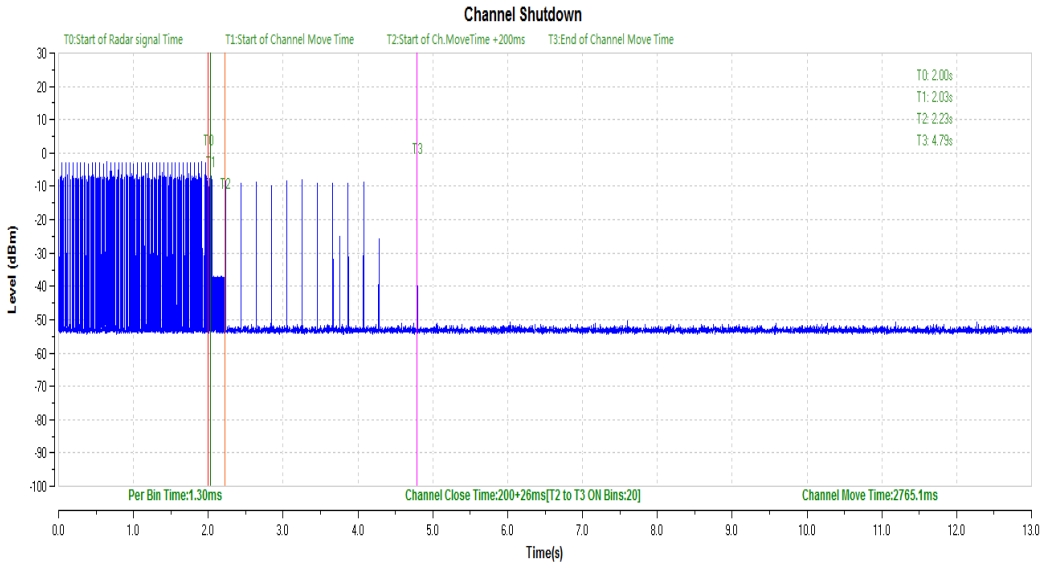
Test according to FCC title 47 part 15 §15.407(h), KDB 905462 D02 U-NII DFS Compliance Procedures New Rules v02

TestMode	Channel	CCT[ms]	Limit[ms]	CMT[ms]	Limit[ms]	Verdict
11AC80MIMO	5290	200+26	200+60	2765.1	10000	PASS

TestMode	Channel	Result	Limit[s]	Verdict
80M	5290	see test graph	>=1800	PASS

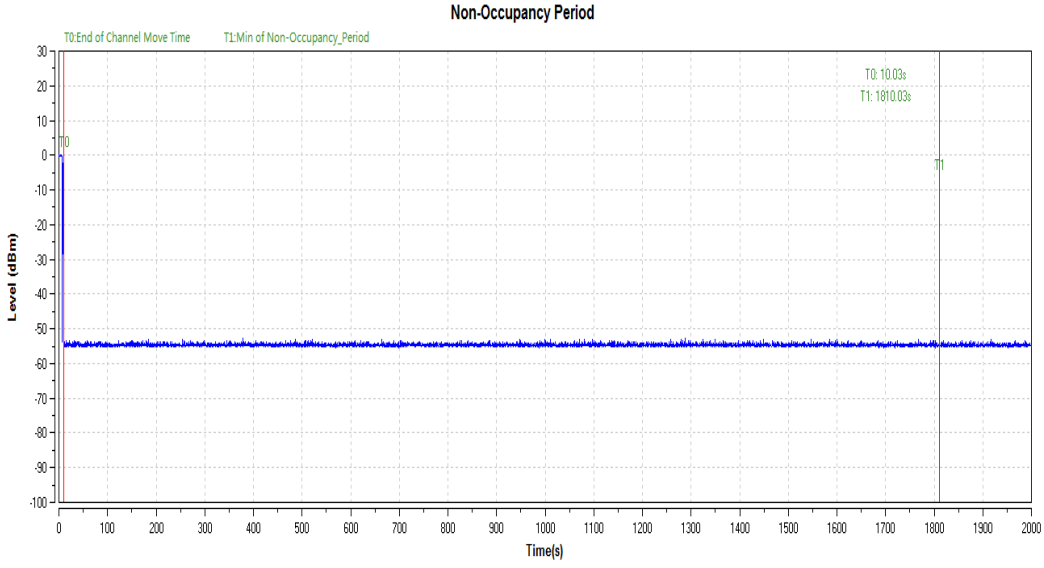
CMT: Channel Move Time
CCT: Channel Closing Transmission Time

11AC80MIMO_5290



Non-Occupancy Period

11AC80MIMO_5290



EUT TEST PHOTOS