FCC RF Test Report
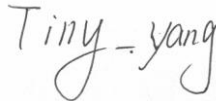
For

Resonian, Inc

Test Standards: Part 15 Subpart E §15. 407

Product Description: Android TV Box

Tested Model: RSTV-A4K-16

Additional Model No.:   N/A

Brand Name: Kinetic TV

FCC ID: 2ARUM-RSTVA4K166769

Classification   (NII)Unlicensed National Information Infrastructure

Report No.:   EC1811012F01

Tested Date: 2018-11-26 to 2018-12-03

Issued Date: 2018-12-03

Prepared By:

Tiny - yang

Tiny Yang/ Engineer

Approved By:

Bacon Wu

Bacon Wu / RF Manager

Hunan Ecloud Testing Technology Co., Ltd.

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Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	2018.12.03	Valid	Original Report

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Page 2 of 24

TABLE OF CONTENTS

Summary of Dynamic Frequency Selection Test

UNII	Bandwidth and Channel	Description	Measured	Limit	Result
UNII Band 2-A 5250-5350MHz & UNII Band 2-C 5470-5725MHz	80MHz (CH58) 5290MHz	Channel Move Time	1.22 s	10 sec	Pass
		Channel Closing Transmission time	<200ms + 9.0 ms (aggregate)	200 ms + aggregate of 60 ms over remaining 10 s period	Pass
		Non-Occupancy Period and Client Beacon Test	No transmission or Beacons occurred	30 minutes	Pass
	80MHz (CH106) 5530MHz	Channel Move Time	1.22 s	10 sec	Pass
		Channel Closing Transmission time	<200ms + 7.0 ms (aggregate)	200 ms + aggregate of 60 ms over remaining 10 s period	Pass
		Non-Occupancy Period and Client Beacon Test	No transmission or Beacons occurred	30 minutes	Pass

Note: Since the product is client without radar detection function, only Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period Test are required to be performed.

1 Test Laboratory

1.1 Test facility

CNAS (accreditation number: L11138)

Hunan Ecloud Testing Technology Co., Ltd. has obtained the accreditation of China National Accreditation

Service for Conformity Assessment (CNAS).

FCC (Designation number: CN1244 , Test Firm Registration Number: 793308)

Hunan Ecloud Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission

list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA (Certificate Code : 4895.01)

Hunan Ecloud Testing Technology Co., Ltd. has been listed by American Association for Laboratory

Accreditation to perform electromagnetic emission measurement.

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Page 5 of 24

2   General Description

2.1 Applicant

Resonian, Inc
15615 Alton PKWY STE 450 Irvine, CA 92618/ USA

2.2 Manufacturer

Shenzhen SDMC Technology Co.,Ltd
7/F,W2-A,Hi-Tech,Industrial Park,Nanshan District,Shenzhen,China,518027

2.3 General Description Of EUT

Product	Android TV Box
Model No.	RSTV-A4K-16
Additional No.	N/A
Difference Description	N/A
Fcc Id	2ARUM-RSTVA4K166769
HW Version	8.2.23
SW Version	8.0.0
Power Supply	5Vdc (adapter)
Modulation Technology	256QAM,64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Type	802.11a/n/ac : OFDM
Operating Frequency	U-NII-1:5150~5250MHz U-NII-2A:5250~5350MHz U-NII-2C:5470~5725MHz U-NII-3:5725~5850MHz
MAX. EIRP	802.11a : 16.77 dBm (0.0475 W) 802.11n HT20 : 19.51 dBm (0.0893 W) 802.11n HT40 : 19.16 dBm (0.0825 W) 802.11ac VHT20 : 18.98 dBm (0.0791 W) 802.11ac VHT40 : 18.82 dBm (0.0763 W) 802.11ac VHT80 : 18.84 dBm (0.0765 W)
MAX. PSD	802.11a : 4.83 dBm/MHz 802.11n HT20 : 6.55 dBm/MHz 802.11n HT40 : 4.79 dBm/MHz 802.11ac VHT20 : 7.17 dBm/MHz 802.11ac VHT40 : 4.89 dBm/MHz 802.11ac VHT80 : 1.74 dBm/MHz
Antenna Type	Ant A: Integral Antenna with 2.14dBi gain Ant B: Integral Antenna with 2.54dBi gain
I/O Ports	Refer to user's manual
Cable Supplied	USB cable: Unshielded, detachable, 1.0m

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Page 6 of 24

NOTE:

1. The EUT was powered by the following adapters:

ADAPTER 1	
BRAND:	SUNUN
MODEL:	SA12V-050200U
INPUT:	AC 100-240V, 50/60Hz,0.4A
OUTPUT:	DC 5V, 2A
DC LINE:	N/A

2. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

3. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

2.4 Modification of EUT

No modifications are made to the EUT during all test items.

2.5 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ⬧ FCC Part 15 Subpart E §15.407
- ⬧ FCC KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02
- ⬧ FCC KDB 905462 D03 UNII Clients Without Radar Detection New Rules v01r02

3 Test Configuration of Equipment Under Test

3.1 Carrier Frequency and Channel

U-NII-1

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
36	5180 MHz	44	5220 MHz
38	5190 MHz	46	5230 MHz
40	5200 MHz	48	5240 MHz
42	5210 MHz		

U-NII-2A

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
52	5260 MHz	60	5300 MHz
54	5270 MHz	62	5310 MHz
56	5280 MHz	64	5320 MHz
58	5290 MHz		

U-NII-2C

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
100	5500 MHz	112	5560 MHz
102	5510 MHz	116	5580 MHz
104	5520 MHz	132	5660 MHz
106	5530 MHz	134	5670 MHz
108	5540 MHz	136	5680 MHz
110	5550 MHz	140	5700 MHz

U-NII-3

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
149	5745 MHz	159	5795 MHz
151	5755 MHz	161	5805 MHz
153	5765 MHz	163	5815 MHz
155	5775 MHz	165	5825 MHz
157	5785 MHz		

TDWR

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
118	5590 MHz	124	5620 MHz
120	5600 MHz	126	5630 MHz
122	5610 MHz	128	5640 MHz

3.2 Test Mode

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 (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.

3.3 Support Equipment

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	Motorola	MX1200YZ	2AF5PMX1200	N/A	Unshielded, 1.8 m
2.	Notebook	Lenovo	E540	FCC DoC	N/A	shielded cable DC O/P 1.8 m unshielded AC I/P cable1.2 m
3.	Flat Panel Monitor	DELL	P2317H	N/A	N/A	N/A

3.4 Test tool software version

Item	Trade Name	Model Name	FW Version
1.	KEY-SIGHT	N7607B Signal Studio	3.0.0.0

3.5 Test Setup

Master Modes
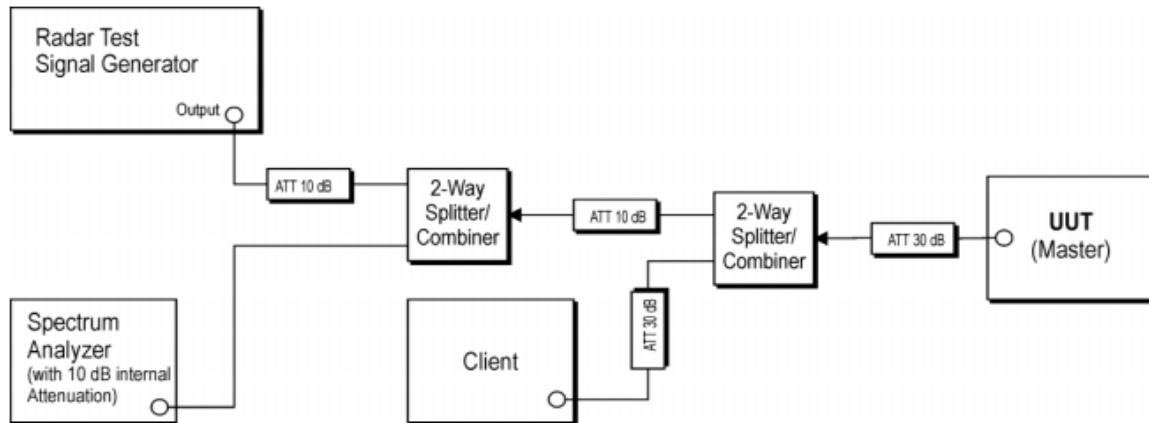
Client with injection at the Client Modes
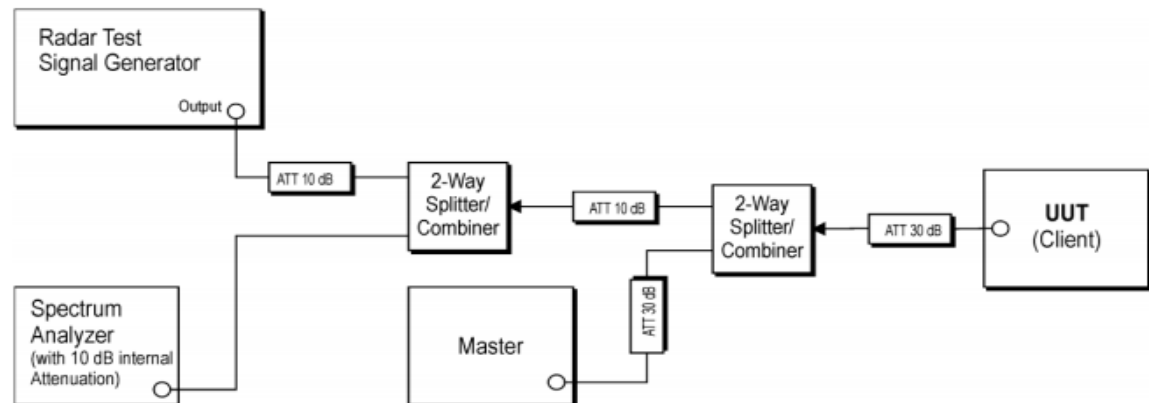
Client with injection at the Master Modes

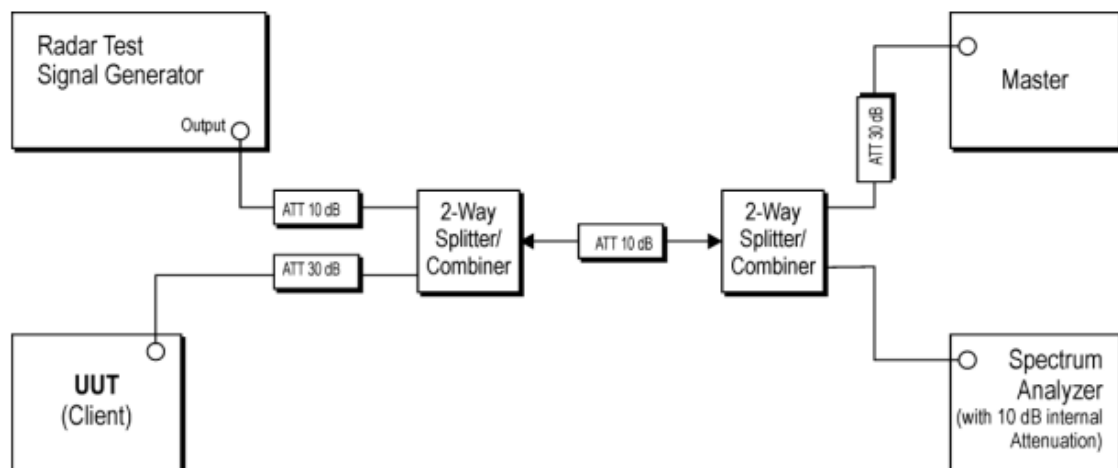## 3.6 DFS Detection Thresholds for Master Devices and Client Devices with Radar Detection

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.	

The radar Detection Threshold, lowest antenna gain is the parameter of Interference radar DFS detection threshold, The Interference Detection Threshold is the (-62dBm) + (0) [dBi]+ 1 dB= -61 dBm.

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Page 11 of 24

4 Requirements and Parameters for DFS Test

4.1 Applicability of DFS Requirements

EUT is client and operates as client without radar detection function.

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	Client Without Radar Detection	Client With Radar Detection
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required	Yes
Client Beacon Test	N/A	Yes	Yes

Additional requirements for devices with multiple bandwidth modes	Operational Mode	
	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 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.

4.2 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 99% 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 transmission.

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 *Channel* changes (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 is used and for each frequency step the minimum percentage of detection is 90%. Measurements are performed with no data traffic.

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FCC ID : 2ARUM-RSTVA4K166769

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Page 14 of 24

4.3 Short Pulse Radar Test Waveforms

As the EUT is a Client Device with no Radar Detection, only one type radar pulse is required for the testing. Radar Pulse type 0 was used in the evaluation of the Client device for the purpose of measuring the Channel Move Time and the Channel Closing Transmission Time.

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Trials
0	1	1428	18	60%	30
1	1	Test A Test B	$\text{Roundup}\left\{ \begin{array}{c} \left(\dfrac{1}{360}\right) \cdot \\ \left(\dfrac{19 \cdot 10^6}{\text{PRI}_{\mu sec}}\right) \end{array} \right\}$	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.					

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

A minimum of 30 unique waveforms are required for each of the short pulse radar types 2 through 4. For short pulse radar type 1, the same waveform is used a minimum of 30 times. 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.

The aggregate is the average of the percentage of successful detections of short pulse radar types 1-4.

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Page 15 of 24

4.4 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.

4.5 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.
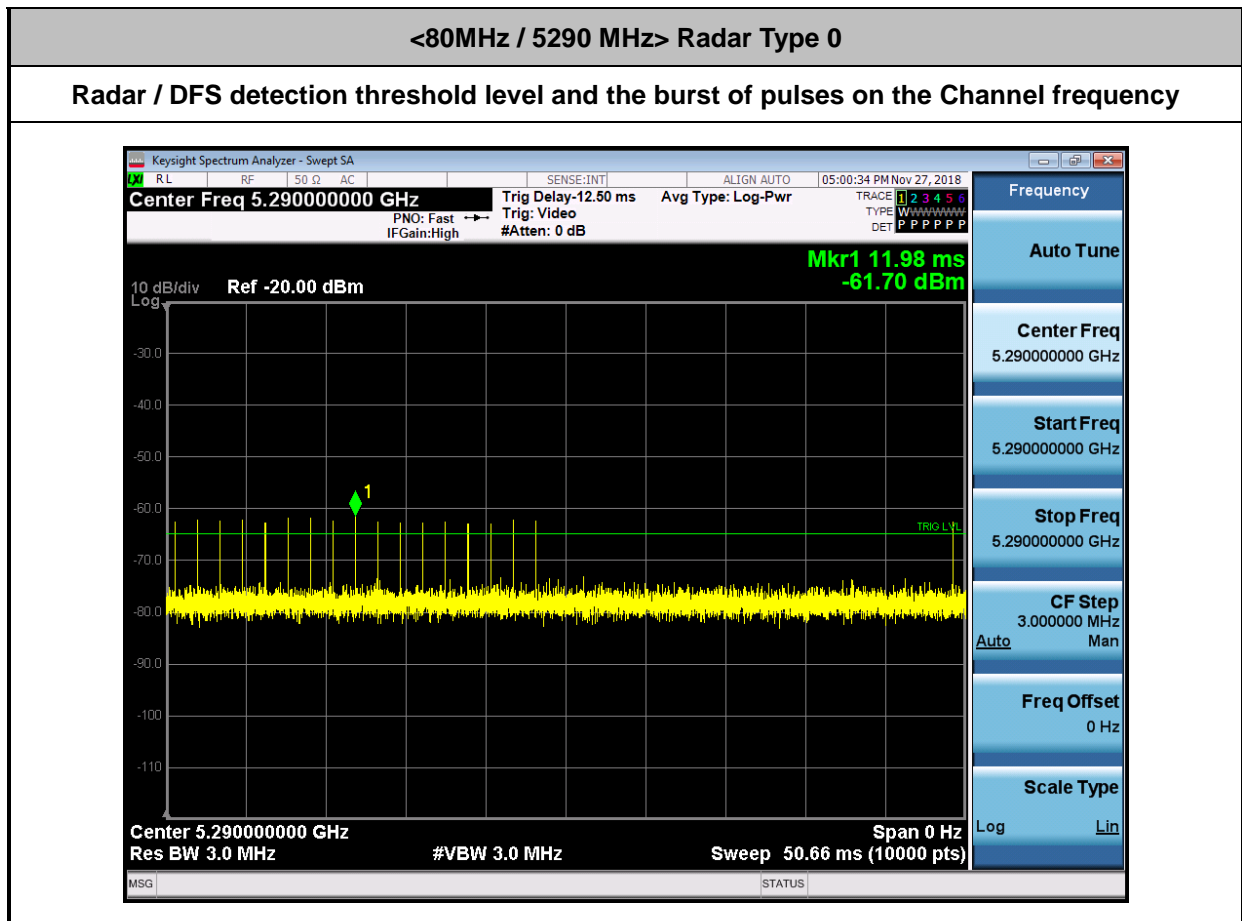
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Page 16 of 24

5 Calibration Setup and DFS Test Results

5.1 Calibration of Radar Waveform

5.1.1 Radar Waveform Calibration Procedure

The Interference **Radar Detection Threshold Le**vel is -62dBm that had been taken into account the output power range. The following equipment setup was used to calibrate the radiated Radar Waveform. A vector signal generator was utilized to establish the test signal level for radar type 0. During this process there were 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 used. The spectrum analyzer resolution bandwidth (RBW) and video bandwidth (VBW) were set to 3 MHz to measure the type 0 radar waveform. The RF cable loss is 0.3dB and 2.96dBm on the frequency 5290MHz and 5530MHz. The vector signal generator amplitude was set so that the power level measured at the spectrum analyzer was *(-62dBm) + 0.3* dB= -61.7 dBm and *(-62dBm) + 2.96* dB= -59.04 dBm. Capture the spectrum analyzer plots on short pulse radar waveform.

5.1.2 Radar Waveform Calibration Result

<80MHz / 5290 MHz> Radar Type 0
Radar / DFS detection threshold level and the burst of pulses on the Channel frequency

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FCC ID : 2ARUM-RSTVA4K166769
www.hn-ecloud.com

Page 17 of 24

<80MHz / 5530 MHz> Radar Type 0
Radar / DFS detection threshold level and the burst of pulses on the Channel frequency
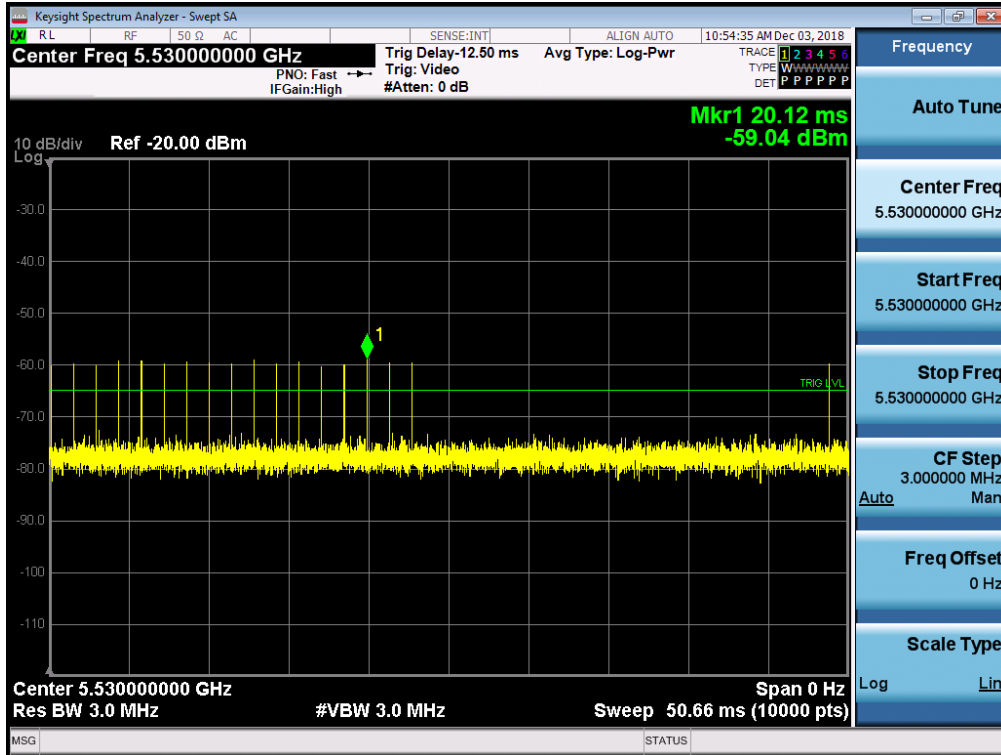
5.2 In-Service Monitoring: Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period

5.2.1 Limit of In-Service Monitoring

The EUT has In-Service Monitoring function to continuously monitor the radar signals, If radar is detected, it must leave the channel (Shutdown). The Channel Move Time to cease all transmissions on the current Channel upon detection of a Radar Waveform above the DFS Detection Threshold within 10 sec. The total duration of 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 Channel changes (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.

Non-Occupancy Period time is 30 minute during which a Channel will not be utilized after a Radar Waveform is detected on that Channel. The non-associated Client Beacon Test is during the 30 minutes observation time. The EUT should not make any transmissions in the DFS band after EUT power up.

5.2.2 Test Procedures

1. The radar pulse generator is setup to provide a pulse at frequency that the Master and Client are operating. A type 0 radar pulse with a 1us pulse width and a 1428 us PRI is used for the testing.

2. The vector signal generator is adjusted to provide the radar burst (18 pulses) at a level of approximately -62dBm at the antenna of the Master device.

3. A trigger is provided from the pulse generator to the DFS monitoring system in order to capture the traffic and the occurrence of the radar pulse.

4. A U-NII device operating as a Client Device will associate with the Master at Channel. The MPEG file "TestFile.mpg" specified by the FCC is streamed from the "file computer" through the Master to the Client Device and played in full motion video using Media Player Classic Ver. 6.4.8.6 in order to properly load the network for the entire period of the test.

5. 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. At time T0 the Radar Waveform generator sends a Burst of pulse of the radar waveform at Detection Threshold + 1dB.

6. Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel. Measure and record the transmissions from the EUT during the observation time (Channel Move Time). One 12 seconds plot is reported for the Short Pulse Radar Types 1. The plot for the Short Pulse Radar Types start at the end of the radar burst. The Channel Move Time will be calculated based on the zoom in 600ms plot of the Short Pulse Radar Type.

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www.hn-ecloud.com

Page 19 of 24

7. Measurement of the aggregate duration of the Channel Closing Transmission Time method. With the spectrum analyzer set to zero span tuned to the center frequency of the EUT operating channel at the radar simulated frequency, peak detection, and max hold, the dwell time per bin is given by: **Dwell (0.4ms)= S (12000ms) / B (30000)**; where Dwell is the dwell time per spectrum analyzer sampling bin, S is the sweep time and B is the number of spectrum analyzer sampling bins. An upper bound of the aggregate duration of the intermittent control signals of Channel Closing Transmission Time is calculated by: **C (ms)= N X Dwell (0.4 ms)**; where C is the Closing Time, N is the number of spectrum analyzer sampling bins (intermittent control signals) showing a U-NII transmission and Dwell is the dwell time per bin.

Measure the EUT for more than 30 minutes following the channel move time to verify that no transmissions or beacons occur on this Channel.

5.2.3 Result of Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period for Client Beacon Test

Test Mode :	Client without radar detection	Temperature :	27.3℃
Test Engineer :	Tiny Yang	Relative Humidity :	47%

BW / Channel	Test Item	Test Result	Limit	Pass/Fail
80MHz / 5290 MHz	**Channel Move Time**	**1.22 s**	**＜ 10s**	**Pass**
	Channel Closing Transmission Time	**200ms + 9.0 ms**	**＜ 260ms**	**Pass**
	Non-Occupancy Period	**≥ 30**	**≥ 30 min**	**Pass**

BW / Channel	Test Item	Test Result	Limit	Pass/Fail
80MHz / 5530 MHz	**Channel Move Time**	**1.22 s**	**＜ 10s**	**Pass**
	Channel Closing Transmission Time	**200ms + 7.0 ms**	**＜ 260ms**	**Pass**
	Non-Occupancy Period	**≥ 30**	**≥ 30 min**	**Pass**

Note: 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 seconds period. The aggregate duration of control signals will not count quiet periods in between transmissions.

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FCC ID : 2ARUM-RSTVA4K166769
www.hn-ecloud.com

Page 20 of 24

5.2.4 Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period for Client Beacon Test Plots

<80MHz / 5290 MHz> In-Service Monitoring
Channel Move Time &   **Channel Closing Transmission Time**

Non-Occupancy Period
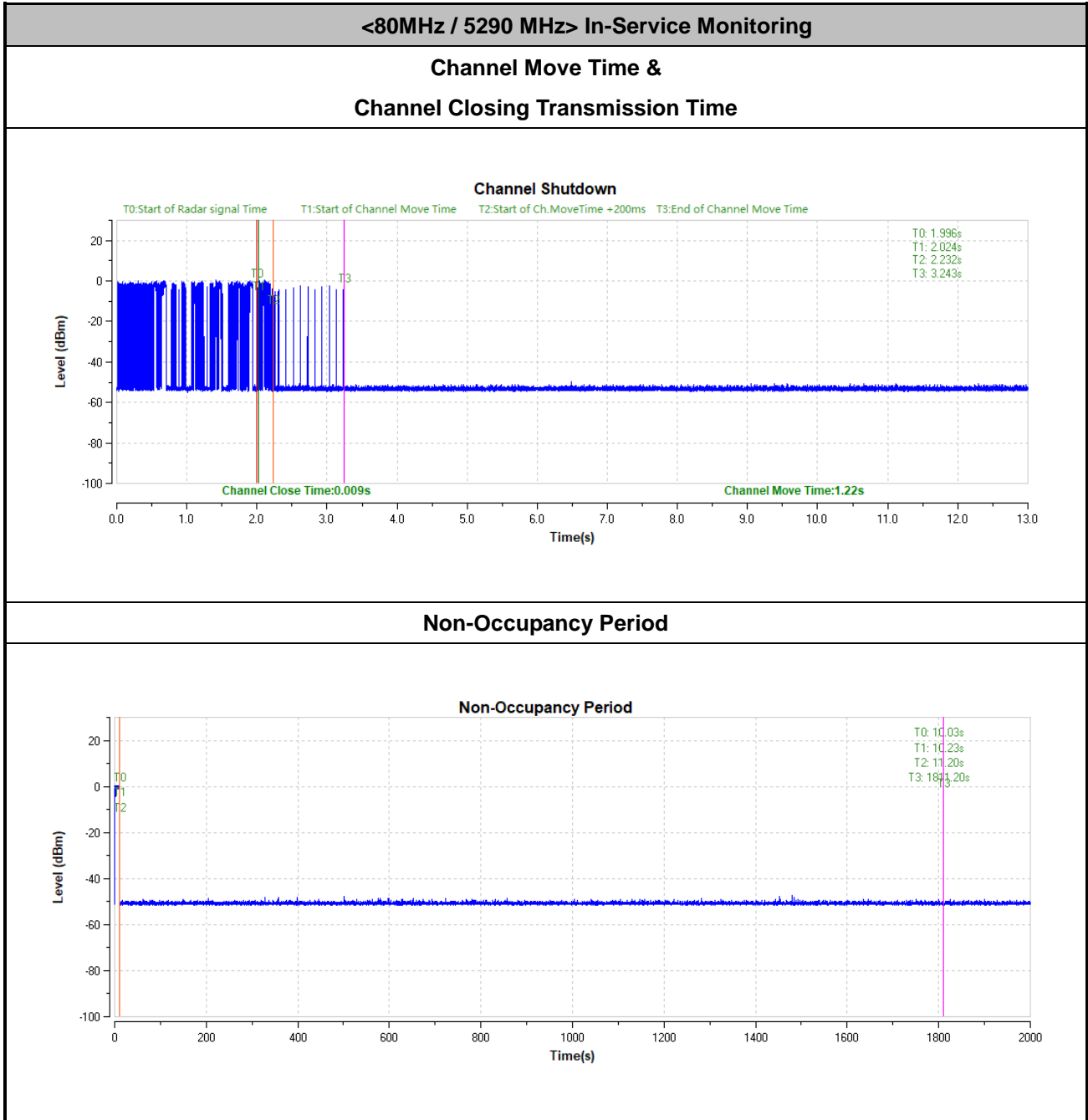
\<80MHz / 5530 MHz\> In-Service Monitoring
Channel Move Time &
Channel Closing Transmission Time

Channel Shutdown

T0:Start of Radar signal Time   T1:Start of Channel Move Time   T2:Start of Ch.MoveTime +200ms   T3:End of Channel Move Time

T0: 1.996s
T1: 2.024s
T2: 2.232s
T3: 3.243s

Channel Close Time:0.007s   Channel Move Time:1.22s

Non-Occupancy Period

Non-Occupancy Period

T0:Start of Channel Move Time   T1:Start of Ch.MoveTime +200ms   T2:End of Channel Move Time   T3:Min of Non-Occupancy_Period

T0: 10.03s
T1: 10.23s
T2: 11.13s
T3: 1811.13s
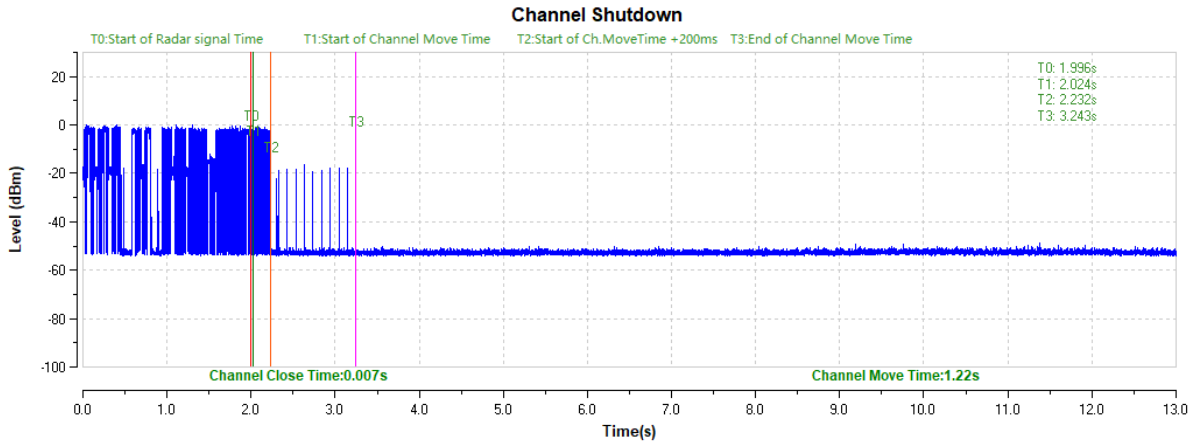
6 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Due Date	Remark
Spectrum Analyzer	Keysight	N9010A	MY56070788	2018-03-02	2019-03-01	Conducted
Signal Generator (Interferer)	Keysight	N5182B	MY56200384	2018-04-10	2019-04-09	Conducted
Signal Generator (Blocker)	Keysight	N5171B	MY56200661	2018-03-15	2019-03-14	Conducted

Appendix A. Setup Photographs

---End of the report---

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Page 24 of 24