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TEST REPORT

Report Reference No.....: CHTEW19030072 Report verification:

Project No.....: SHT1902011601EW

FCC ID.....: BXZSH2

Applicant's name.....: Ascom (Sweden) AB

P/O address: Grimbodalen 2 P.O. Box 8783, Gothenburg, SE-

40276 Sweden

Manufacturer...... Shenzhen Chuangwei Electronic Appliance Tech Co., Ltd.

Street, Bao'an District, Shenzhen, P.R. China

Test item description: Ascom Myco 3

Trade Mark Ascom

Model/Type reference...... SH2-ABAA

Listed Model(s) SH2-XXXX("X"=A-Z represents different appearance colors,

sales areas and sales channels, and is only used for propaganda purposes. The change of "X" does not affect product safety and

electromagnetic compatibility)

Standard: FCC CFR Title 47 Part 15 Subpart E Section 15.407

Date of receipt of test sample........ Feb 21, 2019

Date of testing...... Feb 22, 2019- Mar 12, 2019

Date of issue...... Mar 13, 2019

Result...... PASS

Compiled by

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Testing Laboratory Name: Shenzhen Huatongwei International Inspection Co., Ltd

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The test report merely correspond to the test sample.

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1. TEST STANDARDS AND REPORT VERSION

1.1. Test Standards

The tests were performed according to following standards: FCC Rules Part 15.407: General technical requirements.

ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices

KDB905462 D02 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

KDB905462 D03 v01r02: U-NII CLIENT DEVICES WITHOUT RADAR DETECTION CAPABILITY

KDB905462 D04 v01: OPERATIONAL MODES SUGGESTED FOR DFS TESTING

1.2. Report Version

Revision No.	Date of issue	Description
N/A	2019-03-13	Original

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2. TEST DESCRIPTION

Test Item	FCC Rule	Result	Test Engineer	
Channel move time	15.407(i) PASS		Xiaokang Tan	
Channel closing transmission time	15.407(i)	PASS	Xiaokang Tan	

Remark: The measurement uncertainty is not included in the test result.

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3. **SUMMARY**

3.1. Client Information

Applicant:	Ascom (Sweden) AB
Mailing Address	Grimbodalen 2, SE-417 49 Göteborg, Sweden
P/O Address:	Grimbodalen 2 P.O. Box 8783,Gothenburg, SE-40276 Sweden
Manufacturer:	Shenzhen Chuangwei Electronic Appliance Tech Co., Ltd.
Address:	4F & 6F, Overseas plant south, Skyworth Industrial Park, Shiyan Street, Bao'an District, Shenzhen, P.R. China

3.2. Product Description

Name of EUT	Ascom Myco 3	Ascom Myco 3				
Trade Mark:	Ascom	Ascom				
Model No.:	SH2-ABAA					
Listed Model(s):	sales areas and sales of purposes. The change of	SH2-XXXX("X"=A-Z represents different appearance colors, sales areas and sales channels,and is only used for propaganda purposes. The change of "X" does not affect product safety and electromagnetic compatibility)				
Power supply:	DC 3.8V					
5G WIFI						
Supported type:	⋈ 802.11a⋈ 802.11ac(HT20)	⋈ 802.11n(HT20)⋈ 802.11ac(HT40)	⋈ 802.11n(HT40)⋈ 802.11ac(HT80)			
Function:	☐ Outdoor AP ☑ Client	☐ Indoor AP	☐ Fixed P2P			
DFS type:	☐ master devices ☐ Slave devices with I ☐ Slave devices without					
Modulation:	BPSK, QPSK, 16QAM,	64QAM				
Operation frequency:	Band II:	5250MHz~5350MHz				
	⊠ Band III:	5470MHz~5725MHz				
Supported Bandwidth	20MHz:	802.11ac, 802.11n, 802	2.11a			
	40MHz:	802.11ac, 802.11n				
	80MHz:	802.11ac				
Antenna type:	LDS Antenna	LDS Antenna				
Antenna gain:	2.0dBi					

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3.3. Operation state

> Frequency list

According to section 15.31(m), regards to the operating frequency range over 10 MHz, must select three channel which were tested. the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the above gray bottom.

	Test Channel	20MHz		40MHz		80MHz	
Band		Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
	CH _L	52	5260	54	5270	-	-
II	CH _M	56	5280	-	-	58	5290
	CH _H	64	5320	62	5310	-	-
	CH _L	100	5500	102	5510	106	5530
III	CH _M	120	5600	118	5590	122	5610
	CH _H	140	5700	134	5670	138	5690

Data Rated

Preliminary tests were performed in different data rate, and found which the below bit rate is worst case mode, so only show data which it is a worst case mode.

Mode	Data rate (worst mode)
802.11a	6Mbps
802.11n(HT20)/ac(HT20)	MCS0
802.11n(HT40)/ac(HT40)	MCS0
802.11ac(HT80)	MCS0

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3.4. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- o supplied by the manufacturer
- supplied by the lab

	Manufacturer:	Wistron NeWeb Corporation
Wireless AP	Model No. :	WRT32X
	FCC ID :	Q87-WRT3200ACM
Notabook	Manufacturer:	Dell Inc.
Notebook	Model No. :	Inspiron 13-5368

3.5. Modifications

No modifications were implemented to meet testing criteria.

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4. TEST ENVIRONMENT

4.1. Address of the test laboratory

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.

Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

Phone: 86-755-26748019 Fax: 86-755-26748089

4.2. Test Facility

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 3902.01

Shenzhen Huatongwei International Inspection Co., Ltd. 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: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 762235

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files.

IC-Registration No.:5377B-1

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No.: 5377B-1.

ACA

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

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4.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15~35°C
Relative Humidity:	30~60 %
Air Pressure:	950~1050mba

4.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors in calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according 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 Shenzhen Huatongwei International Inspection Co., Ltd. quality system according to 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.

Here after the best measurement capability for Shenzhen Huatongwei International Inspection Co., Ltd. is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.63 dB	(1)
Conducted spurious emissions 9kHz~40GHz	0.63 dB	(1)
Occupied Bandwidth	69 Hz	(1)
Frequency error	69 Hz	(1)

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

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4.5. Equipments Used during the Test

•	TS8997 Test system						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)	
•	Signal and spectrum Analyzer	R&S	FSV40	100048	2018/10/28	2019/10/27	
•	Signal generator	R&S	SMB100A	177956	2018/10/28	2019/10/27	
•	Vector signal generator	R&S	SMBV100A	260790	2018/08/21	2019/08/20	
•	OSP	R&S	OSP120	101317	N/A	N/A	
•	System Rack	R&S	SCA-24U	000480	N/A	N/A	
•	10dB Attenuator	R&S	10dB Attenuator-1	N/A	2018/11/15	2019/11/14	
0	10dB Attenuator	R&S	10dB Attenuator-2	N/A	2018/11/15	2019/11/14	
0	10dB Attenuator	R&S	10dB Attenuator-3	N/A	2018/11/15	2019/11/14	
0	10dB Attenuator	R&S	10dB Attenuator-4	N/A	2018/11/15	2019/11/14	
•	Test software	R&S	EMC32	N/A	N/A	N/A	

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5. DFS TEST INFORMATION

5.1. DFS test requirement

The following table from FCC KDB905462 D02 UNII DFS Compliance procedures new rules list the applicable requirements for the DFS testing.

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

	Operational Mode				
Requirement	Master	Client Without	Client With Radar		
	Master	Radar Detection	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

	Operational Mode			
Requirement	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 (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.

Master Devices

- a) The Master Device will use DFS in order to detect Radar Waveforms with received signal strength above the DFS Detection Threshold in the 5250~5350 MHz and 5470~5725 MHz bands. DFS is not required in the 5150~5250 MHz or 5725~5825 MHz bands.
- b) Before initiating a network on a Channel, the Master Device will perform a Channel Availability Check for a specified time duration (Channel Availability Check Time) to ensure that there is no radar system operating on the Channel, using DFS described under subsection a) above.
- c) The Master Device initiates a U-NII network by transmitting control signals that will enable other U-NII devices to Associate with the Master Device.
- d) During normal operation, the Master Device will monitor the Channel (In-Service Monitoring) to ensure that there is no radar system operating on the Channel, using DFS described under a).
- e) If the Master Device has detected a Radar Waveform during In-Service Monitoring as described under d), the Operating Channel of the U-NII network is no longer an Available Channel. The Master Device

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will instruct all associated Client Device(s) to stop transmitting on this Channel within the Channel Move Time. The transmissions during the Channel Move Time will be limited to the Channel Closing Transmission Time.

- f) Once the Master Device has detected a Radar Waveform it will not utilize the Channel for the duration of the Non-Occupancy Period.
- g) If the Master Device delegates the In-Service Monitoring to a Client Device, then the combination will be tested to the requirements described under d) through f) above.

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.

Table 4: DFS Response Requirement Values

Paramenter	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.

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5.2. 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.

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

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.

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5.3. 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)	I Nullibel of Fulses		Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
		Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a	$\operatorname{Roundup} \left\{ \left(\frac{1}{360} \right) \cdot \left(\frac{19 \cdot 10^6}{\operatorname{PRI}_{\mu \operatorname{sec}}} \right) \right\}$		
1	1	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		60%	30
2	1-5	150-230	23-29	60%	30
3	6-	200-500	16-18	60%	30
4	11-	200-500	12-16	60%	30
	Aggre	gate (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
$$\left\{ \left(\frac{1}{360} \right) \cdot \left(\frac{19 \cdot 10^6}{3066} \right) \right\}_{\text{= Round up } \{17.2\} = 18.}$$

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Table 5a - Pulse Repetition Intervals Values for Test A

Table 5a - Pulse Repetition Intervals Values for Test A						
Pulse Repetition Frequency	Pulse Repetition Frequency	Pulse Repetition Interval				
Number	(Pulses Per Second)	(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	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	878				
20	1113.6	898				
21	1089.3	918				
22	1066.1	938				
23	326.2	3066				

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 waveforms, then each additional waveform must also be unique and not repeated from the previous waveforms.

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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:

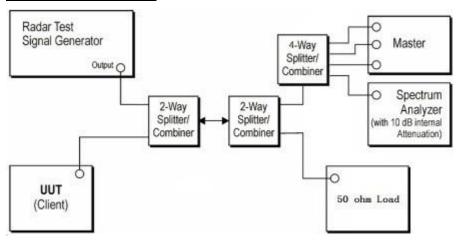
The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250–5724MHz.Next,the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until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

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6. TEST CONDITIONS AND RESULTS

6.1. Calibration of Radar Waveform

TEST CONFIGURATION



TEST PROCEDURE

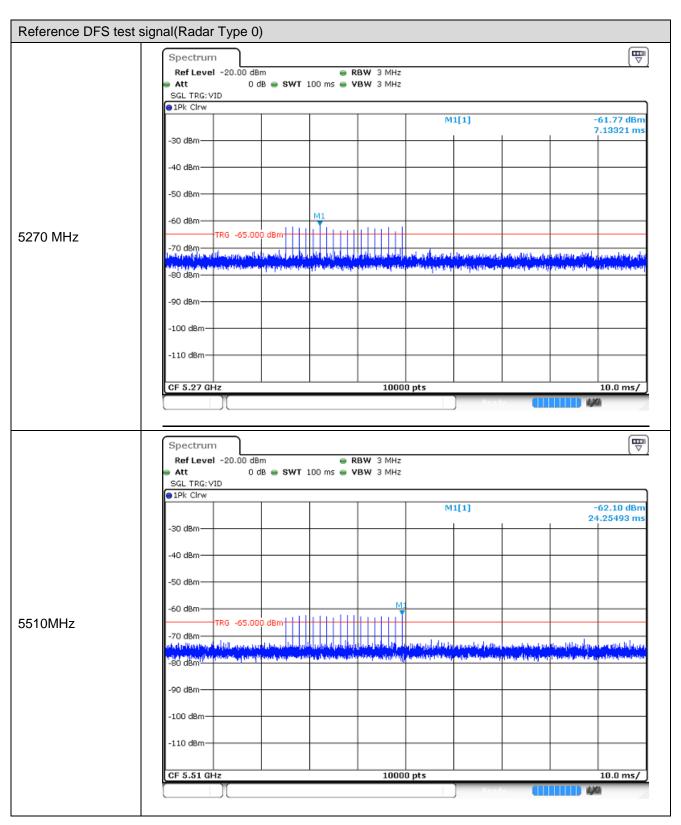
- A 50 ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected to place of the master
- b) The interference Radar Detection Threshold Level is -62dBm + 0dBi +1dB = -61dBm that had been taken into account the output power range and antenna gain.
- c) The following equipment setup was used to calibrate the conducted 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 spans (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 3MHz. The spectrum analyzer had offset -1.0dB to compensate RF cable loss 1.0dB.
- d) The vector signal generator amplitude was set so that the power level measured at the spectrum analyzer was -62dBm + 0dBi +1dB = -61dBm. Capture the spectrum analyzer plots on short pulse radar waveform.

TEST MODE:

Please refer to the clause 3.3

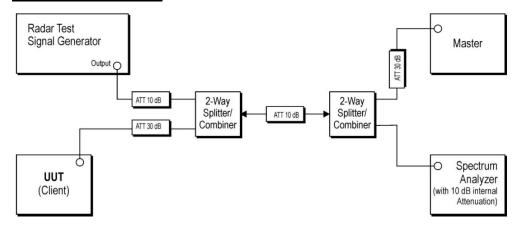
TEST RESULTS

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6.2. Channel Move Time, Channel Closing Transmission Time TEST CONFIGURATION



TEST PROCEDURE

- a) 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 1428us PRI is used for the testing.
- b) The vector signal generator is adjusted to provide the radar burst (18 pulses) at the level of approximately -61dBm at the antenna port of the master device
- c) 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.
- d) EUT will associate with the master at channel. The file "iperf.exe" specified by the FCC is streamed from the PC 2 through the master and the client device to the PC 1 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.
- e) When 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.
- f) Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel Measure and record the transmissions from the UUT during the observation time (Channel Move Time). One 15 seconds plot is reported for the Short Pulse Radar Type 0. 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
- g) Measurement of the aggregate duration of the Channel Closed 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 (0.3ms) =S (12000ms) / B (4000); where Dwell is the dwell time per spectrum analyzer sampling bin, S is 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 (0.3ms); 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.

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h) Measurement the EUT for more than 30 minutes following the channel move time to verify that no transmission or beacons occur on this channel.

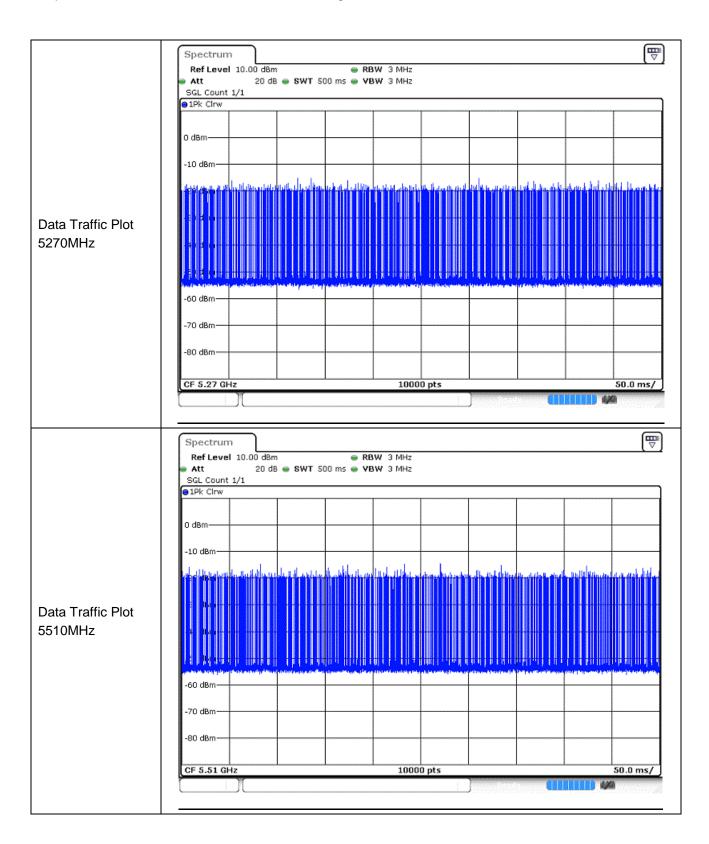
TEST MODE:

Please refer to the clause 3.3

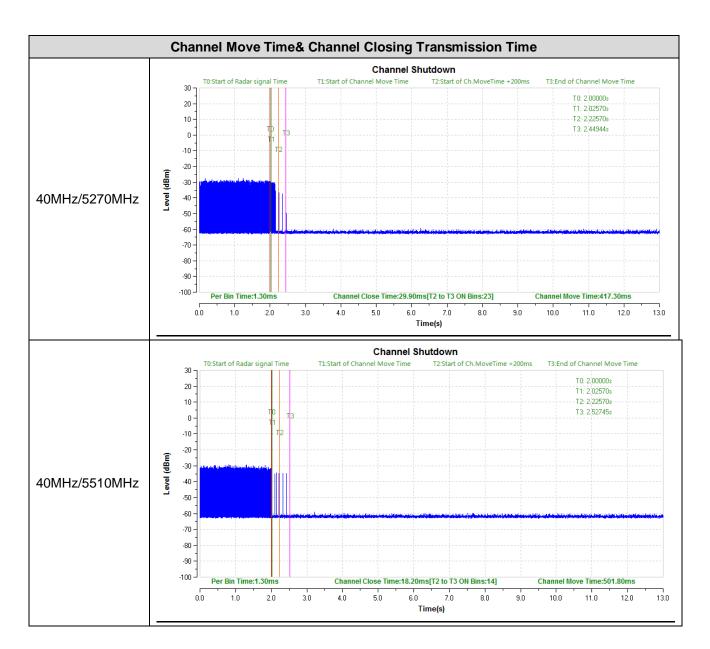
TEST RESULTS

BW/Channel	Test Item	Test Result	Limit	Result
40MHz/5270MHz	Channel Move Time	0.417s	< 10s	Pass
	Channel Closing Transmission Time	29.9ms	< 60ms	Pass
40MHz/5510MHz	Channel Move Time	0.502s	< 10s	Pass
	Channel Closing Transmission Time	18.2ms	< 60ms	Pass

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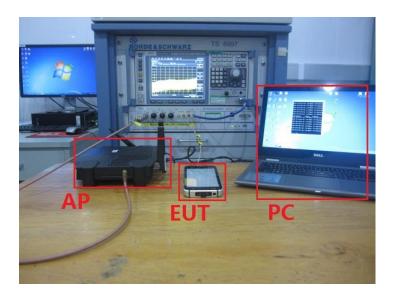


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7. Test Setup Photos of the EUT



8. External and Internal Photos of the EUT

Reference to the test report No.: CHTEW19030068

-----End of Report-----