

Report No.: WSCT-ANAB-R&E240700031A-Wi-Fi2



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Report No.: WSCT-ANAB-R&E240700031A-Wi-Fi2 For Question, Please Contact with WSCT www.wsct-cert.com Band Edge NVNT ac20 5260MHz Low Ant1 Spectrum Analyzer 1 Swept SA Input Z: 50 Ω Corr CCorr Freq Ref: Int (S) PNO: Fast Gate: Off IF Gain: Low Sig Track: Off KEYSIGHT Input: RF #Atten: 30 dB Preamp: Off 1 2 3 4 5 6 M W W W W W Align: Auto PNNNNN Mkr1 5.261 2 GHz Ref Lvi Offset 1.57 dB Ref Level 20.00 dBm 8.55 dBm Scale/Div 10 dB Start 5.0800 GHz #Res BW 1.0 MHz #Video BW 3.0 MHz Stop 5.2800 GHz Sweep 1.00 ms (1001 pts) Function Width Function Value -46.20 dBm -43.07 dBm Band Edge NVNT ac20 5320MHz High Ant1 + Input Z: 50 Ω Corr CCorr Freq Ref: Int (S) #Atten: 30 dB Preamp: Off KEYSIGHT Input: RF  $M \Leftrightarrow W \Leftrightarrow W \Leftrightarrow W$ Align: Auto PNNNNN Mkr1 5.322 6 GHz 1 Spectrum Ref Lvi Offset 1.62 dB Ref Level 20.00 dBm 6.13 dBm Scale/Div 10 dB



Start 5.3000 GHz #Res BW 1.0 MHz

**?** Jul 16, 2024 ....

Function Width

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Stop 5.5000 GHz Sweep ~1.28 ms (1001 pts)

\*\*

Function Value

#Video BW 3.0 MHz



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Please Contact with WSCT www.wsct-cert.com Band Edge NVNT ac80 5210MHz Low Ant1 Spectrum Analyzer 1 Swept SA Input Z: 50 Ω Corr CCorr Freq Ref: Int (S) PNO: Fast Gate: Off IF Gain: Low Sig Track: Off KEYSIGHT Input: RF 1 2 3 4 5 6 M W W W W W Align: Auto PNNNNN Mkr1 5.203 6 GHz Ref LvI Offset 1.50 dB Ref Level 20.00 dBm 1.34 dBm Scale/Div 10 dB DL1 -27.00 Start 5.0900 GHz #Res BW 1.0 MHz #Video BW 3.0 MHz Stop 5.2900 GHz Sweep 1.00 ms (1001 pts) Function Value Band Edge NVNT ac80 5290MHz Low Ant1 + Input Z: 50 Ω Corr CCorr Freq Ref: Int (S) #Atten: 30 dB Preamp: Off KEYSIGHT Input: RF M \*\* \*\* \*\* \*\* P N N N N N Align: Auto Mkr1 5.285 7 GHz 1 Spectrum Ref Lvi Offset 1.60 dB Ref Level 20.00 dBm 2.05 dBm Scale/Div 10 dB Start 5.0700 GHz #Res BW 1.0 MHz Stop 5.3700 GHz #Sweep 1.00 s (1001 pts) #Video BW 3.0 MHz Function Value Function Width Function



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# 7.10 DYNAMIC FREQUENCY SELECTION (DFS) 7.10.1 DFS OVERVIEW

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A U-NII network will employ a DFS function to detect signals from radar systems and to avoid co-channel operation with these systems. This applies to the 5250-5350 MHz and/or 5470-5725 MHz bands. Within the context of the operation of the DFS function, a U-NII device will operate in either *Master Mode* 

or *Client Mode*. U-NII devices operating in *Client Mode* can only operate in a network controlled by a U-NII device operating in *Master Mode*.

Tables 1 and 2 shown below summarize the information contained in sections 5.1.1 and 5.1.2

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

Requirement	Operation	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

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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

Master Device or Client with	Client Without Radar Detection
	Not required
All BW modes must be tested	Not required
The decision will and DVV and In	The state of the serial section of the state of the serial section of the section o
	Test using the widest
available	BW mode available for
	the link
Any single BW mode	Not required
	Radar Detection  All BW modes must be tested  Test using widest BW mode available

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.

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The operational behavior and individual DFS requirements that are associated with these modes are represented by the control of the control o

#### **DFS Detection Thresholds**

**Table 3** below provides the *DFS Detection Thresholds* for *Master Devices* as well as *Client Devices* incorporating *In-Service Monitoring*.

# 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	-62 dBm
power spectral density < 10 dBm/MHz	
EIRP < 200 milliwatt that do not meet the power spectral density	-64 dBm
requirement	

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.

# **Response Requirements**

**Table 4** provides the response requirements for *Master* and *Client Devices* incorporating DFS.

#### 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 to facilitate a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. Note 3: During the U-NII Detection Bandwidth detection test, radar type 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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#### RADAR TEST WAVEFORMS

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This section provides the parameters for required test waveforms, minimum percentage of successful of 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.

#### Short Pulse Radar Test Waveforms

Table 5	Chant	Dulce	Dadan	Toot	Waveforms
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			27 1 67 1	2.51	
Radar	Pulse Width	PRI	Number of Pulses	Minimum	Minimum
Type	(µsec)	(µsec)		Percentage of	Number of
				Successful	Trials
				Detection	
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique	[(1)]	60%	30
		PRI values	$\left[\left(\frac{360}{360}\right)\right]$		
		randomly selected	Davadua (300)		
		from the list of 23	Roundup { (19·10 <sup>6</sup> )}		
		PRI values in Table			
		5a	$\left(\left\langle \text{PRI}_{\mu \text{sec}} \right\rangle \right)$		
		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 (I	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

Roundup  $\left\{ \left( \frac{1}{360} \right) \cdot \left( \frac{19 \cdot 10^6}{3066} \right) \right\}$  = Round up  $\{17.2\} = 18$ .

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Table 5a - Pulse Repetition Intervals Values for Test A

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Pulse Repetition	Pulse Repetition Frequency	Pulse Repetition
Frequency	(Pulses Per Second)	Interval
Number		(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

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.

П	Radar Type	Number of Trials	Number of Successful	Minimum Percentage			
			Detections	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%						

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## Long Pulse Radar Test Waveform

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Table 6 – Long Pulse Radar Test Waveform									
Radar Pulse Chirp PRI Number Number Minimum									
Type	Width	Width	(µsec)	of Pulses	of Bursts	Percentage of	Number of		
	(µsec)	(MHz)		per Burst		Successful	Trials		
				1		Detection			
5	50-100	5-20	1000-	1-3	8-20	80%	30		
			2000						

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 / *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 / *Burst Count*) (Total *Burst* Length) + (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.

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- 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).

Figure 1 provides a graphical representation of the Long Pulse Radar Test Waveform.

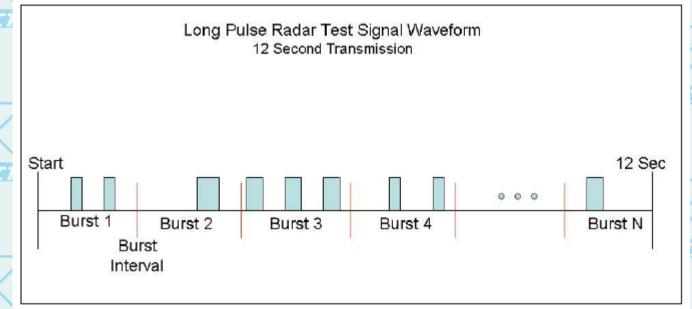
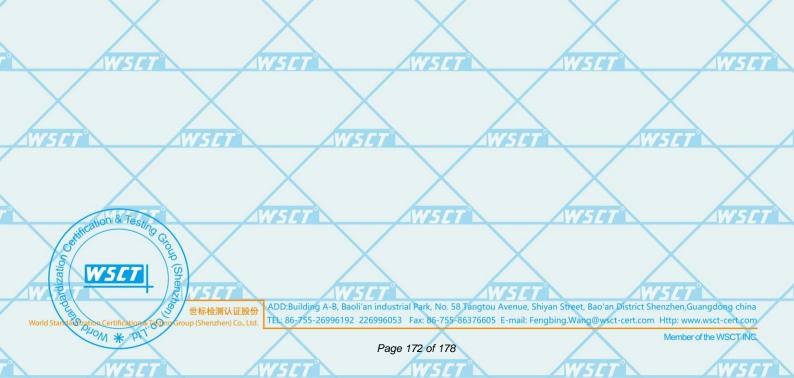


Figure 1: Graphical Representation of a Long Pulse Radar Type Waveform





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# **Frequency Hopping Radar Test Waveform**

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J.		Table / - Frequency Hopping Radar Test Waveform										
	Radar	Pulse	PRI	Pulses	Hopping	Hopping	Minimum	Minimum				
	Type	Width	(µsec)	per	Rate	Sequence	Percentage of	Number of				
		(µsec)		Hop	(kHz)	Length	Successful	Trials				
				_		(msec)	Detection					
	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: 4

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

	frequencies are chosen for the so	et. For selection of a random fre	equency, the frequencies r	emaining within the	group
	are always treated as equally lik				
	WSGT	WSET WSE	7° W5		WSET
WE	WSIT	WSET	WSET	WSGT	
	WSET	WSET	T WS	77	WSET
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World S	世标检测认证股份 Standardzation Certifications TeeDrog Group (Shenzhen) Co., Ltd.	ADD:Building A-B, Baoli'an industrial Park, No. TEL: 86-755-26996192 226996053 Fax: 86-75			

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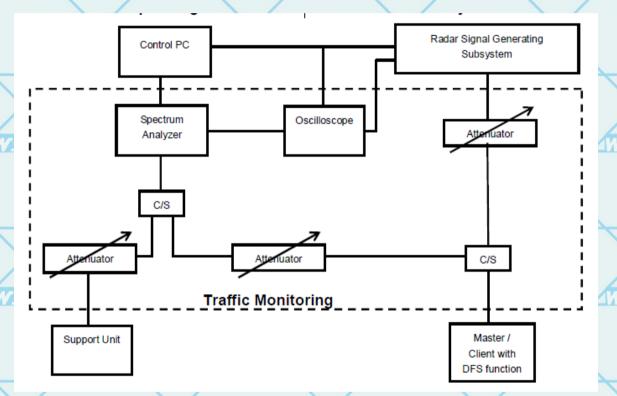
# 7.10.2 TEST PROCEDURE

## **DFS MEASUREMENT SYSTEM**

A complete DFS Measurement System consists of two subsystems:

- (1) The Radar Signal Generating Subsystem and
- (2) The Traffic Monitoring Subsystem.

The control PC is necessary for generating the Radar waveforms in Table 10, 11 and 12. The traffic monitoring subsystem is specified to the type of unit under test (UUT).



The test transmission will always be from the Master Device to the Client Device. While the Client device is set up to associate with the Master device and play the MPEG file (6 y Magic Hours) from Master device, the designated MPEG test file and instructions are located at: http://ntiacsd.ntia.doc.gov/dfs/.

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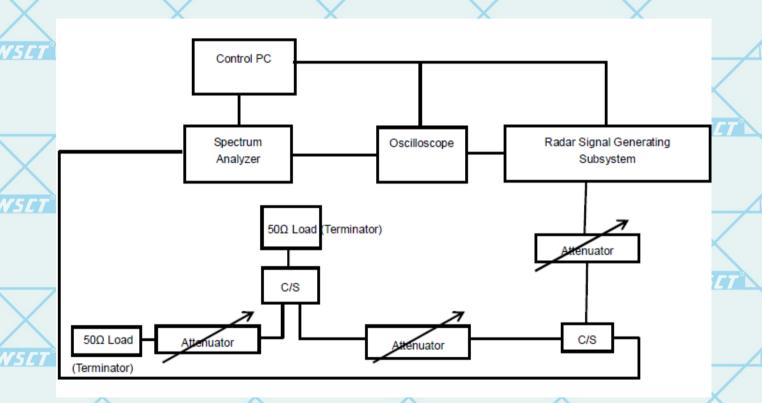
## CALIBRATION OF DFS DETECTION THRESHOLD LEVEL

The measured channel is 5260MHz. The radar signal was the same as transmitted channels, and injected into the antenna port of Client Device with Radar Detection, measured the channel closing transmission time and channel move time.

## **SLAVE WITHOUT RADAR DETECTION MODE**

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The antenna gain is -4dBi and required detection threshold is -65dBm (= -62 +1 - 4)dBm. The calibrated conducted detection threshold level is set to -65dBm.



**DEVIATION FROM TEST STANDARD** 

No deviation.

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## 7.10.3 TEST RESULT

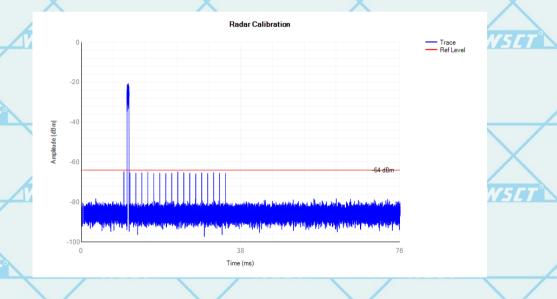
Test Items	Remark	Result
Channel Closing Transmission Time	Applicable	PASS
Channel Move Time	Applicable	PASS

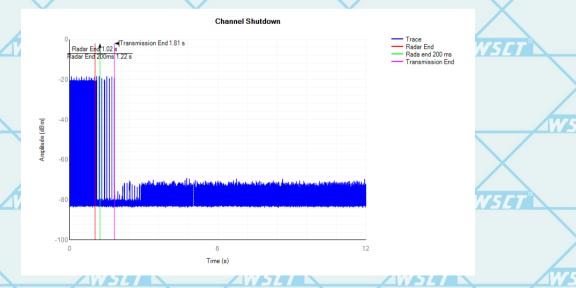
Note: This phone can only be used as a slave without radar detection function, and no signal was recovered in 30 minutes for Non-Occupancy period.

## Measurement Record (the wost case)

## Measurement data below:

	5320MHz		
Test Items	Value (s)	Limit (s)	Test Result
Channel Closing Transmission Time	0.02	1	Pass
Channel Move Time	0.7853	10	Pass





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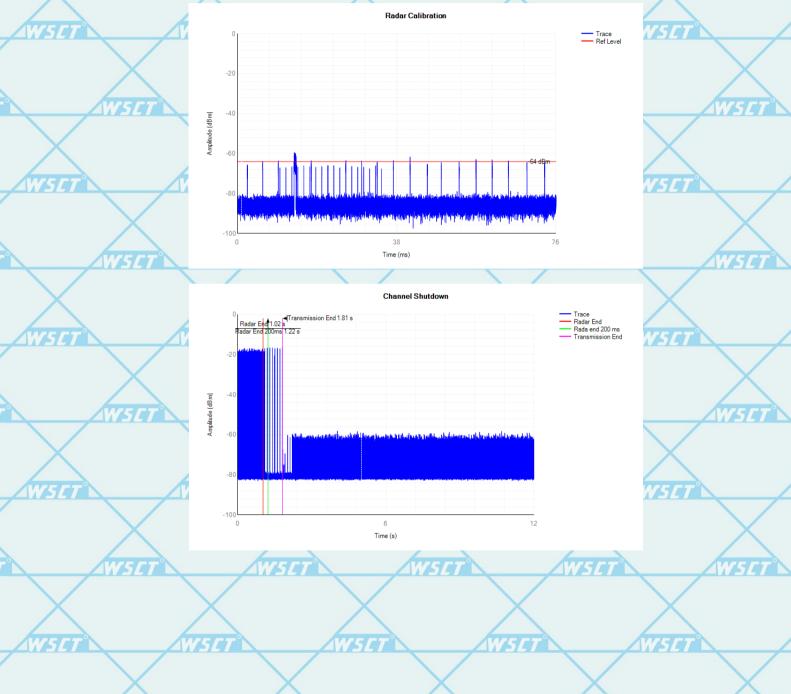
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Measurement data below:

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		5500MHZ			
	Test Items	Value (s)	Limit (s)	Test Result	CCTT
	Channel Closing Transmission Time	0.0152	1	Pass	
,	Channel Move Time	0.7877	10	Pass	



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#### **Test Setup Photographs** 8

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Please refer to Annex "Set Up Photos-15E" for test setup photos

\*\*\*\*\*END OF REPORT\*\*\*\*

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