simulations of an actual frequency hopping signal. The hardware configuration for an example frequency hopping *Radar Waveform* generator is shown in **Figure 10**.

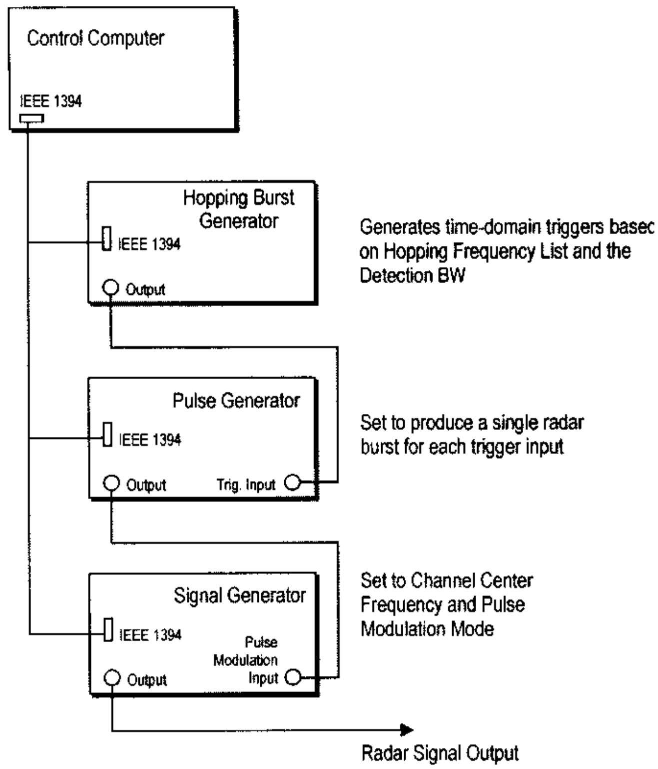

Figure 10: Example Simulated Frequency Hopping Radar Generator System

Conceptual Description of Simulated Frequency Hopping Generator

Time-domain simulation: The simulated hopping system generates the same number of hops, using identical pulse parameters, at the identical timing compared to the actual hopping waveform, using a fixed frequency within the *U-NII Detection Bandwidth*. Thus the detectable RF energy received by the UUT is identical in both instances.

Frequency-domain simulation: Multiple trials are made, each at a different fixed frequency. The frequencies selected for each trial lie within the *U-NII Detection Bandwidth*. Thus the UUT receives RF energy throughout the *U-NII Detection Bandwidth.*

Figure 11 and **Figure 12** below show the comparison between an example frequency hopping waveform and the corresponding simulated hopping waveform. The horizontal axis is time and the vertical axis is frequency (although the figures depict 3 pulses per hop, the actual Frequency Hopping Radar Type 6 waveform contains 9 pulses per hop).

Referring to the actual hopping signal, the hops that are outside the *U-NII Detection Bandwidth* are shown as three dots in **Figure 11** and **Figure 12** and the hops that are within the *U-NII*

Detection Bandwidth are shown as three lines. The center of the lines indicates the frequency of the hop. Note that three hops fall within the *U-NII Detection Bandwidth.*

Referring to the simulated hopping signal, the hops that are generated are shown as three lines. Note that three hops are generated, and each hop is at the same frequency.

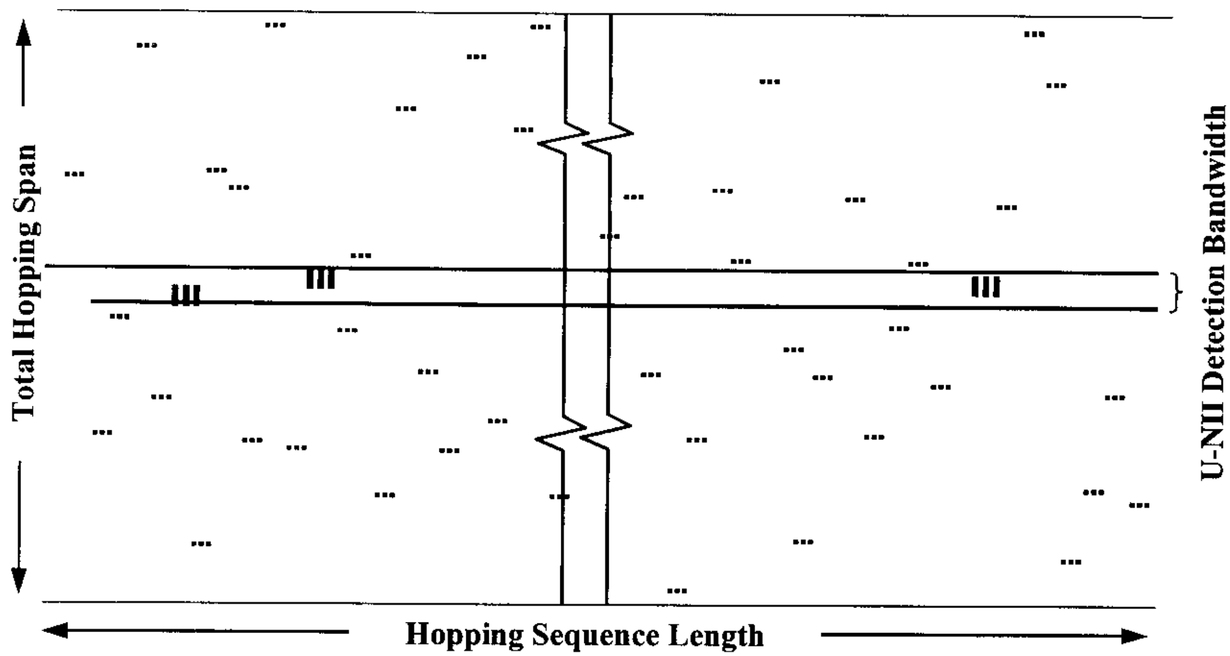

Figure 11: Frequency Hopping Sequence

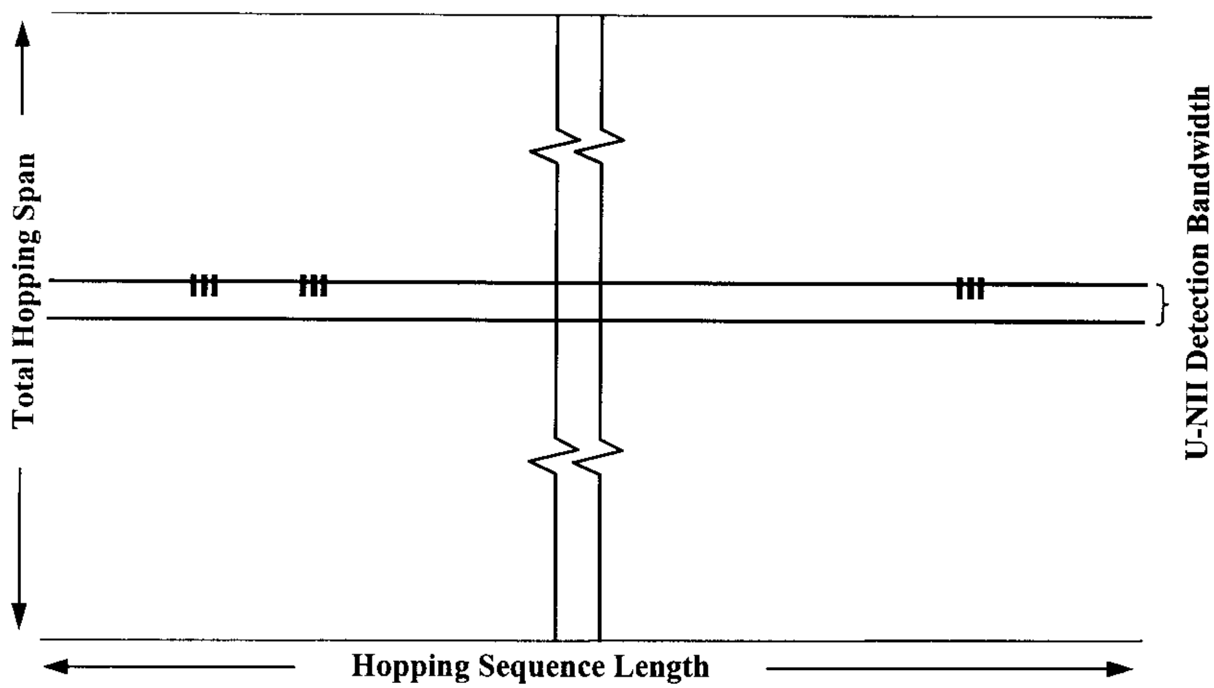

Figure 12: Time Domain Simulation of a Frequency Hopping Sequence

The frequency hopping *Burst* generator is a programmable pulse generator that is used to provide a trigger to generate the *Burst* pattern trigger pulses and the monitoring system.

The pulse generator is configured to generate a single *Burst* of pulses (refer to **Table 7** for the frequency hopping waveform parameters) whenever triggered by the hopping *Burst* generator and is used as the modulation input for the RF signal generator, set to pulse modulation.

7.5 Setting the Test Signal Level

The radar test signal level is set at the *Master Device,* or the Client Device with *In-Service Monitoring*, as appropriate for the particular test. This device is known as the Radar Detection Device (RDD). The RDD consists of the applicable device and the device antenna assembly that has the lowest antenna assembly gain of all available antenna assemblies. Depending on the UUT, the following configurations exist:

- When the *Master Device* is the UUT, the *Master Device* is the RDD.
- When a *Client Device* without *In-Service Monitoring* is the UUT, the *Master Device* is the RDD.
- When a *Client Device* with *In-Service Monitoring* is the UUT, and is tested for response to the *Master Device* detections, the *Master Device* is the RDD.
- When a *Client Device* with *In-Service Monitoring* is the UUT, and is tested for independent response to detections by the *Client Device*, the *Client Device* is the RDD.

A spectrum analyzer is used to establish the test signal level for each radar type. During this process, there are no transmissions by either the *Master Device* or *Client Device*. The spectrum analyzer is switched to the zero span (time domain) mode at the frequency of the *Radar Waveform* generator. The peak detector function of the spectrum analyzer is utilized. The spectrum analyzer resolution bandwidth (RBW) and video bandwidth (VBW) are set to at least 3 MHz.

The signal generator amplitude and/or step attenuators are set so that the power level measured at the spectrum analyzer is equal to the *DFS Detection Threshold* that is required for the tests. The signal generator and attenuator settings are recorded for use during the test.

Data demonstrating that the test signal level is correctly set for each radar type (1-6) will be recorded and reported.

7.6 DFS MONITORING

The DFS monitoring subsystem shown in **Figure 13** is used to verify that the UUT has vacated the *Channel* in the specified time (*Channel Closing Transmission Time* and *Channel Move Time*) and does not transmit on a *Channel* for 30 minutes after the detection and *Channel* move (*Non-*

Occupancy Period). It is also used to monitor UUT transmissions upon start-up (*Channel Availability Check Time*).

7.6.1 Method #1

The test setup of the Method #1 DFS monitoring subsystem is shown in **Figure 13**. This subsystem consists of two major functional blocks. One measures RF transmissions for a time period of 12 or 24 seconds and the other measures RF transmissions for a time period of 30 minutes.

The 12 and 24 -second measurement is made with a VSA controlled by a computer. A log-periodic antenna, or equivalent directional antenna, connected to the VSA is used to receive the UUT transmissions. Upon receiving a trigger signal from the signal generator system (AWG from the Method #1 system and Pulse Generator from the Method #2 system), the VSA will digitize the UUT transmissions for 12 or 24 seconds and stored. The stored data are time tagged and the UUT transmissions can be reviewed in voltage vs. time format using the software in the computer controlling the VSA or in a suitable computer program to verify that the UUT complies with the limits.[10]

The 30 minute measuring time is made with a spectrum analyzer connected to an omni antenna. Since the power of the UUT transmissions are well above the noise floor of the analyzer, a preamplifier and tracking pre-selector are not required for this measurement. The analyzer is set to zero span, tuned to the center frequency of the UUT operating *Channel*, with a peak detector function, and a 32 minute sweep time. If any UUT transmissions occur within the observation time, they are detected and recorded.

[10] An example computer program is available at http://ntiacsd.ntia.doc.gov/dfs/.

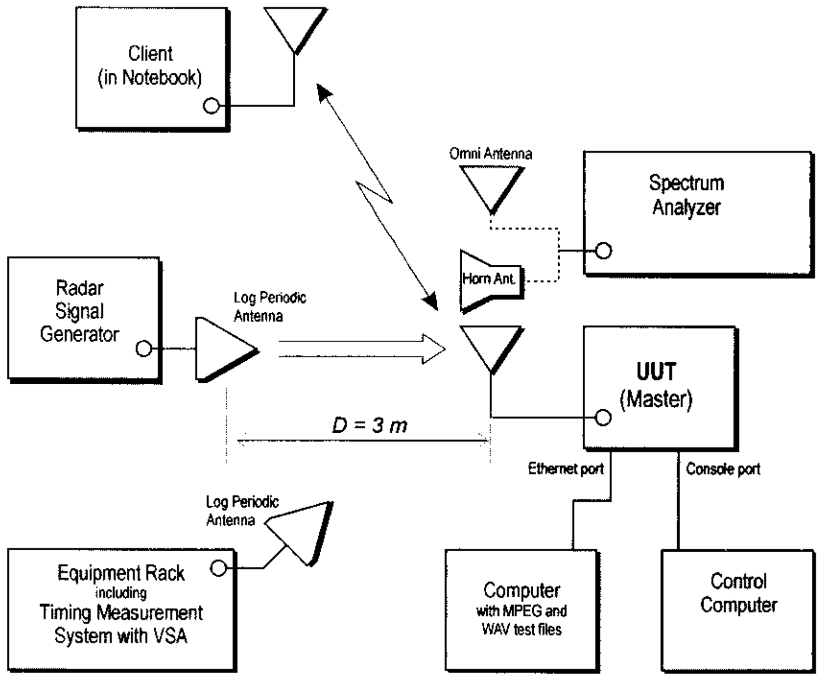

Figure 13: Example DFS Timing Monitoring Diagram for Method #1

7.6.2 Method #2

The test setup of the Method #2 DFS monitoring subsystem is shown in **Figure 14**. This provides coarser timing measurements than Method #1 and provides an upper bound measurement of the aggregate duration of the *Channel Closing Transmission Time.*

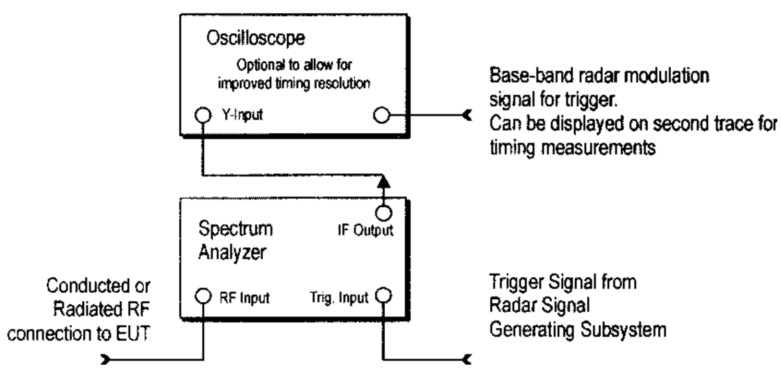

Figure 14: Example DFS Timing Monitoring Diagram for Method #2

With the spectrum analyzer set to zero span tuned to the center frequency of the UUT operating channel at the radar simulated frequency, peak detection, and max hold, the dwell time per bin is given by:

Dwell = S / B

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 *Channel Closing Transmission Time* is calculated by:

$$C = N * Dwell$$

where **C** is the Closing Time, **N** is the number of spectrum analyzer sampling bins showing a U-NII transmission and **Dwell** is the dwell time per bin.

7.7 CHANNEL LOADING

System testing will be performed with the designated MPEG test file that streams full motion video at 30 frames per second for *Channel* loading.[11] If the designated MPEG test file is not utilized then an equivalent test file will be used, subject to FCC approval.

7.7.1 IP Based Systems

The MPEG test file will be transferred from the *Master Device* to the *Client Device* for all test configurations.

7.7.2 Frame Based Systems

The MPEG test file will be transferred from the *Master Device* to the *Client Device* for all test configurations. For frame based systems with a fixed talk/listen ratio, the ratio will be set to 45%/55% during the entirety for all test performed for DFS functionality of a manufacturer's device under test. For frame based systems that dynamically allocate the talk/listen ratio, the MPEG test file will be transferred from the *Master Device* to the *Client Device* for all test configurations.

7.7.3 Other Systems

Systems that do not employ IP or frame based architectures, or that represent a combination of the two, must submit their *Uniform Channel Spreading* methodology used in the compliance measurements to the FCC for evaluation.

7.8 TEST PROCEDURES

The tests in this section are run sequentially and the UUT must pass all tests successfully. If the UUT fails any one of the tests it will count as a failure of compliance. To show compliance, all tests must be performed with waveforms randomly generated as specified with test results meeting the required percentage of successful detection criteria. All test results must be reported to the FCC. One frequency will be chosen from the operating *Channels* of the UUT within the 5250-5350 MHz or 5470-5725 MHz bands.

7.8.1 U-NII Detection Bandwidth

Set up the generating equipment as shown in **Figure 8**, or equivalent. Set up the DFS timing monitoring equipment as shown in **Figure 13** or **Figure 14**. Set up the overall system for either radiated or conducted coupling to the UUT.

[11] The designated MPEG test file and instructions are located at: http://ntiacsd.ntia.doc.gov/dfs/.

Adjust the equipment to produce a single *Burst* of the Short Pulse Radar Type 1 in **Table 5** at the center frequency of the UUT *Operating Channel* at the specified *DFS Detection Threshold* level found in **Table 3**.

Set the UUT up as a standalone device (no associated Client or Master, as appropriate) and no traffic. Frame based systems will be set to a talk/listen ratio of 0%/100% during this test.

Generate a single radar *Burst*, and note the response of the UUT. Repeat for a minimum of 10 trials. The UUT must detect the *Radar Waveform* using the specified *U-NII Detection Bandwidth* criterion shown in **Table 4**.

Starting at the center frequency of the UUT operating *Channel*, increase the radar frequency in 1 MHz steps, repeating the above test sequence, until the detection rate falls below the *U-NII Detection Bandwidth* criterion specified in **Table 4**. Record the highest frequency (denote as F_H) at which detection is greater than or equal to the *U-NII Detection Bandwidth* criterion. Recording the detection rate at frequencies above F_H is not required to demonstrate compliance.

Starting at the center frequency of the UUT operating *Channel*, decrease the radar frequency in 1 MHz steps, repeating the above test sequence, until the detection rate falls below the *U-NII Detection Bandwidth* criterion specified in **Table 4**. Record the lowest frequency (denote as F_L) at which detection is greater than or equal to the *U-NII Detection Bandwidth* criterion. Recording the detection rate at frequencies below F_L is not required to demonstrate compliance.

The *U-NII Detection Bandwidth* is calculated as follows:

$$\textit{U-NII Detection Bandwidth} = F_H - F_L$$

The *U-NII Detection Bandwidth* must meet the *U-NII Detection Bandwidth* criterion specified in **Table 4**, otherwise, the UUT does not comply with DFS requirements. This is essential to ensure that the UUT is capable of detecting *Radar Waveforms* across the same frequency spectrum that contains the significant energy from the system. In the case that the *U-NII Detection Bandwidth* is greater than or equal to the 99 percent power bandwidth for the measured F_H and F_L, the test can be truncated and the *U-NII Detection Bandwidth* can be reported as the measured F_H and F_L.

7.8.2 Performance Requirements Check

The following tests must be performed for U-NII device certification: Initial *Channel Startup Check* with a radar *Burst* at start of *Channel Availability Check* and with a radar *Burst* at end of *Channel Availability Check*; *In-Service Monitoring*; and the 30 minute *Non-Occupancy Period.*

7.8.2.1 Initial Channel Availability Check Time

The Initial *Channel Availability Check Time* tests that the UUT does not emit beacon, control, or data signals on the test *Channel* until the power-up sequence has been completed and the U-NII device checks for *Radar Waveforms* for one minute on the test *Channel.* This test does not use any *Radar Waveforms* and only needs to be performed one time.

a) The U-NII devices will be powered on and be instructed to operate on the appropriate U-NII *Channel* that must incorporate DFS functions. At the same time the UUT is powered on, the spectrum analyzer will be set to zero span mode with a 1 MHz RBW and 3 MHz VBW on the *Channel* occupied by the radar (Ch_r) with a 2.5 minute sweep time. The spectrum analyzer's sweep will be started at the same time power is applied to the U-NII device.

b) The UUT should not transmit any beacon or data transmissions until at least 1 minute after the completion of the power-on cycle.

This measurement can be used to determine the length of the power-on cycle if it is not supplied by the manufacturer. If the spectrum analyzer sweep is started at the same time the UUT is powered on and the UUT does not begin transmissions until it has completed the cycle, the power-on time can be determined by comparing the two times.

7.8.2.2 Radar Burst at the Beginning of the Channel Availability Check Time

The steps below define the procedure to verify successful radar detection on the test *Channel* during a period equal to the *Channel Availability Check Time* and avoidance of operation on that *Channel* when a radar *Burst* with a level equal to the *DFS Detection Threshold* + 1 dB occurs at the beginning of the *Channel Availability Check Time*. This is illustrated in **Figure 15**.

a) The *Radar Waveform* generator and UUT are connected using the applicable test setup described in the sections on configuration for Conducted Tests (7.2) or Radiated Tests (7.3) and the power of the UUT is switched off.

b) The UUT is powered on at T_0. T_1 denotes the instant when the UUT has completed its power-up sequence (T_{power_up}). The *Channel Availability Check Time* commences on Ch_r at instant T_1 and will end no sooner than $T_1 + T_{ch\_avail\_check}$.

c) A single *Burst* of one of the Short Pulse Radar Types 1-4 will commence within a 6 second window starting at T_1. 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.

d) Visual indication or measured results on the UUT of successful detection of the radar *Burst* will be recorded and reported. Observation of Ch_r for UUT emissions will continue for 2.5 minutes after the radar *Burst* has been generated.

e) Verify that during the 2.5 minute measurement window no UUT transmissions occurred on Ch_r. The *Channel Availability Check* results will be recorded.

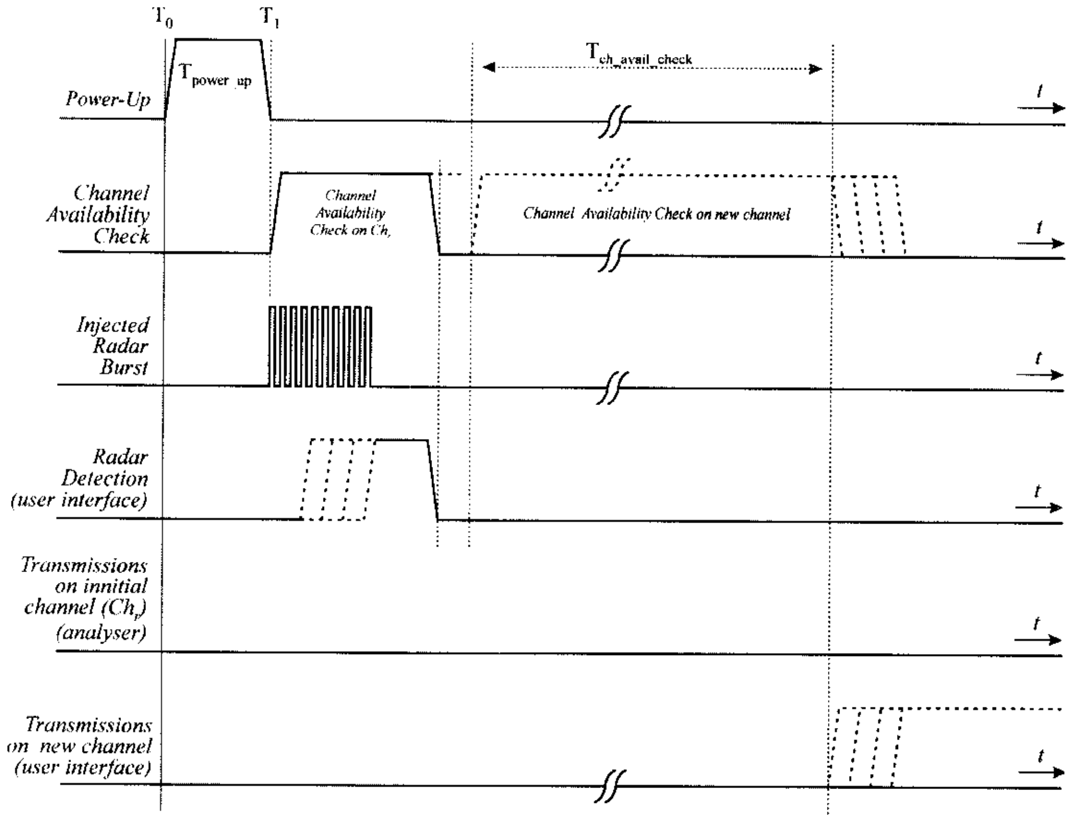

Figure 15: Example of timing for radar testing at the beginning of the Channel Availability Check Time

7.8.2.3 Radar Burst at the End of the Channel Availability Check Time

The steps below define the procedure to verify successful radar detection on the test *Channel* during a period equal to the *Channel Availability Check Time* and avoidance of operation on that *Channel* when a radar *Burst* with a level equal to the *DFS Detection Threshold* + 1dB occurs at the end of the *Channel Availability Check Time*. This is illustrated in **Figure 16.**

a) The *Radar Waveform* generator and UUT are connected using the applicable test setup described in the sections for Conducted Tests (7.2) or Radiated Tests (7.3) and the power of the UUT is switched off.

b) The UUT is powered on at T_0. T_1 denotes the instant when the UUT has completed its power-up sequence (T_{power_up}). The *Channel Availability Check Time* commences on Ch_r at instant T_1 and will end no sooner than $T_1 + T_{ch\_avail\_check}$.

c) A single *Burst* of one of the Short Pulse Radar Types 1-4 will commence within a 6 second window starting at T_1 + 54 seconds. 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.

d) Visual indication or measured results on the UUT of successful detection of the radar *Burst* will be recorded and reported. Observation of Ch_r for UUT emissions will continue for 2.5 minutes after the radar *Burst* has been generated.

e) Verify that during the 2.5 minute measurement window no UUT transmissions occurred on Ch_r. The *Channel Availability Check* results will be recorded.

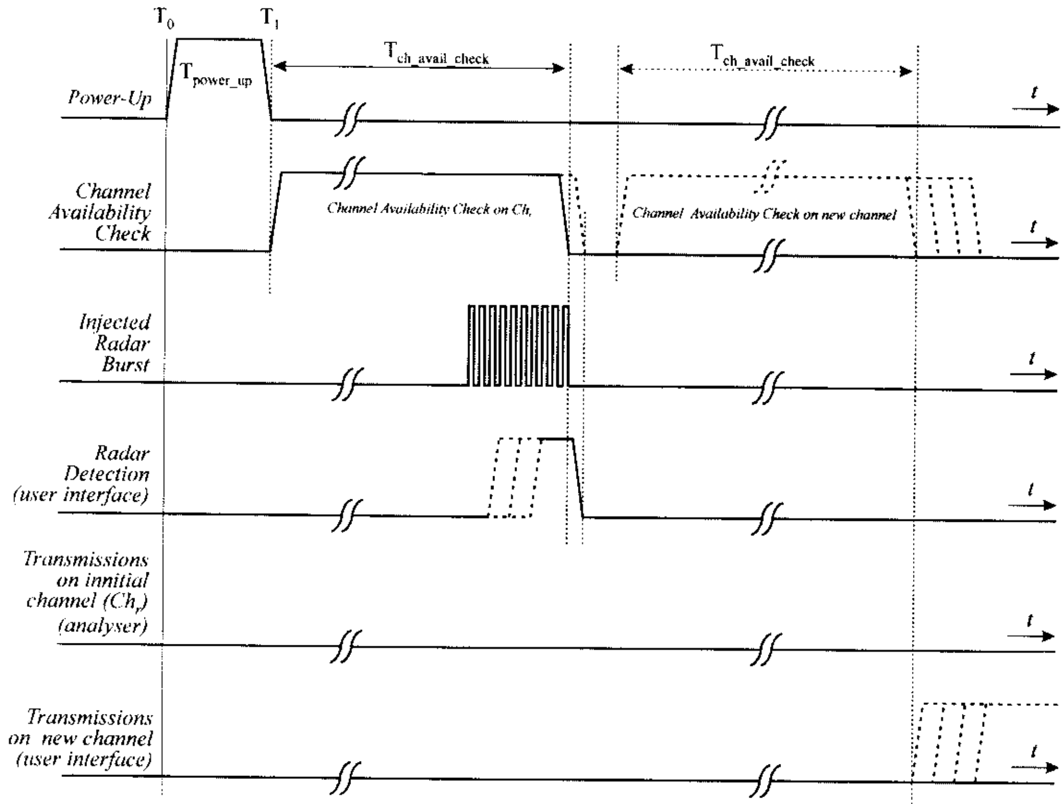

Figure 16: Example of timing for radar testing towards the end of the Channel Availability Check Time

7.8.3 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.

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 MPEG test file from the *Master Device* to the Client Device on the test *Channel* for the entire period of the test.

d) At time T_0 the *Radar Waveform* generator sends a *Burst* of pulses for one of the Short Pulse Radar Types 1-4 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 T_2 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).

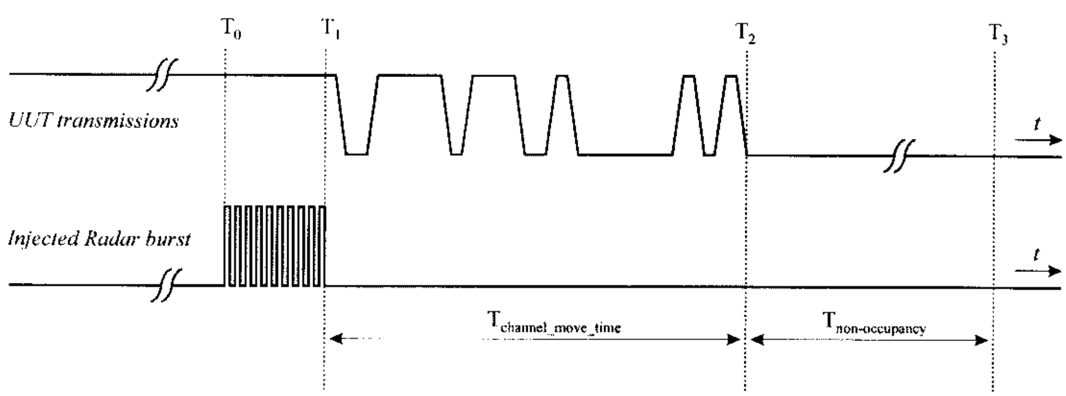

Figure 17: Example of Channel Closing Transmission Time & Channel Closing Time

7.8.4 Statistical Performance Check

The steps below define the procedure to determine the minimum percentage of successful detection requirements found in **Tables 5-7** 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.

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 MPEG test file from the *Master Device* to the Client Device on the test *Channel* for the entire period of the test.

d) At time T_0 the *Radar Waveform* generator sends the individual waveform for each of the Radar Types 1-6 in **Tables 5-7**, 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 Burst on the *Operating Channel* for duration greater than 10 seconds for Short Pulse Radar Types 1-4 and 6 to ensure detection occurs.

f) Observe the transmissions of the UUT at the end of the Burst on the *Operating Channel* for duration greater than 22 seconds for Long Pulse Radar Type 5 to ensure detection occurs.

g) In case the UUT is a U-NII device operating as a *Client Device* with *In-Service Monitoring*, perform steps a) to f).

7.8.4.1 Short pulse radar Test

Once the performance requirements check is complete, statistical data will be gathered, to determine the ability of the device to detect the radar test waveforms (Short Pulse Radar Types 1-4) found in **Table 5**. The device can utilize a test mode to demonstrate when detection occurs to prevent the need to reset the device between trials. The percentage of successful detection is calculated by:

$$\frac{TotalWaveformDetections}{TotalWaveformTrials} \times 100 = \text{Percentage of Successful Detection } \textit{Radar Waveform} \text{ N} = P_d N$$

In addition an aggregate minimum percentage of successful detection across all Short Pulse Radar Types 1-4 is required and is calculated as follows:

$$\frac{P_d 1 + P_d 2 + P_d 3 + P_d 4}{4}$$

The minimum number of trails, minimum percentage of successful detection and the aggregate minimum percentage of successful detection are found in **Table 5**.

7.8.4.2 Long Pulse Radar Test

Statistical data will be gathered to determine the ability of the device to detect the Long Pulse Radar Type 5 found in **Table 6**. The device can utilize a test mode to demonstrate when detection occurs to prevent the need to reset the device between trials. The percentage of successful detection is calculated by:

$$\frac{TotalWaveformDetections}{TotalWaveformTrials} \times 100$$

7.8.4.3 Frequency Hopping Radar Test

Statistical data will be gathered to determine the ability of the device to detect the Frequency Hopping radar test signal (radar type 6) found in **Table 7**. The device can utilize a test mode to demonstrate when detection occurs to prevent the need to reset the device between trial runs. The probability of successful detection is calculated by:

$$\frac{TotalWaveformDetections}{TotalWaveformTrials} \times 100$$

8. DFS TEST REPORT GUIDLINES

The following items will be included in test reports for DFS testing of U-NII devices as indicated in the sections below. This section covers the minimum requirements that will be submitted on the DFS test results.

8.1 Complete description of the U-NII device

1. The operating frequency range(s) of the equipment.
2. The operating modes (Master and/or Client) of the U-NII device.
3. For Client devices, indicate whether or not it has DFS capabilities and indicate the FCC identifier for the Master U-NII Device that is used with it for DFS testing.
4. List the highest and the lowest possible power level (equivalent isotropic radiated power (EIRP)) of the equipment.
5. List all antenna assemblies and their corresponding gains.
    a. If radiated tests are to be performed, the U-NII Device should be tested with the lowest gain antenna assembly (regardless of antenna type). The report should indicate which antenna assembly was used for the tests. For devices with adjustable output power, list the output power range and the maximum EIRP for each antenna assembly.
    b. If conducted tests are to be performed, indicate which antenna port/connection was used for the tests and the antenna assembly gain that was used to set the *DFS Detection Threshold* level during calibration of the test setup.
        i. Indicate the calibrated conducted *DFS Detection Threshold* level.
        ii. For devices with adjustable output power, list the output power range and the maximum EIRP for each antenna assembly.
        iii. Indicate the antenna connector impedance. Ensure that the measurement instruments match (usually 50 Ohms) or use a minimum loss pad and take into account the conversion loss.

c. Antenna gain measurement verification for tested antenna.
    i. Describe procedure
    ii. Describe the antenna configuration and how it is mounted
    iii. If an antenna cable is supplied with the device, cable loss needs to be taken into account. Indicate the maximum cable length and either measure the gain with this cable or adjust the measured gain accordingly. State the cable loss.

6. Test sequences or messages that should be used for communication between Master and *Client Devices*, which are used for loading the *Channel.*
    a. Stream the test file from the *Master Device* to the *Client Device f*or IP based systems or frame based systems which dynamically allocate the talk/listen ratio.
    b. For frame based systems with fixed talk/listen ratio, set the ratio to 45%/55% and stream the test file from the *Master* to the *Client.*
    c. For other system architectures, supply appropriate *Channel* loading methodology.
7. Transmit Power Control description
    Provide a description.
8. System architectures, data rates, U-NII *Channel* bandwidths.
    a. Indicate the type(s) of system architecture (e.g. IP based or Frame based) that the U-NII device employs. Each type of unique architecture must be tested.
9. The time required for the *Master Device* and/or *Client Device* to complete its power-on cycle.
10. Manufacturer statement confirming that information regarding the parameters of the detected *Radar Waveforms* is not available to the end user.
11. *Uniform Channel Spreading* requirement for *Master Devices*. For *Master Devices*, indicate how the master provides, on aggregate, uniform *Channel* loading of the spectrum across all *Channels.*

8.2 Complete description of the Radar Waveform calibration

12. Description of calibration setup
    a. Block diagram of equipment setup, clearly identifying if a radiated or conducted method was used.
13. Description of calibration procedure
    a. Verify *DFS Detection Threshold* levels
        i. Indicate *DFS Detection Threshold* levels used.
        ii. Consider output power range and antenna gain.
    b. For the Short Pulse Radar Types, spectrum analyzer plots of the burst of pulses on the *Channel* frequency should be provided.
    c. For the Long Pulse Radar Type, spectrum analyzer plot of a single burst (1-3 pulses) on the *Channel* frequency should be provided.
    d. Describe method used to generate frequency hopping signal.
    e. The *U-NII Detection Bandwidth*
    f. For the Frequency Hopping waveform, a spectrum analyzer plot showing 9 pulses on one frequency within the *U-NII Detection Bandwidth* should be provided.

g. Verify use of vertical polarization for testing when using a radiated test method.

14. When testing a *Client Device* with radar detection capability, verify that the *Client Device* is responding independently based on the *Client Device's* self-detection rather than responding to the *Master Device.* If required, provide a description of the method used to isolate the client from the transmissions from the *Master Device* to ensure *Client Device* self detection of the *Radar Waveform.*

8.3 Complete description of test procedure

15. Description of deviations to the procedures or equipment described in this document.

16. Description of DFS test procedure and test setup used to monitor the U-NII device and *Radar Waveform* transmissions. Provide a block diagram of the signal monitoring equipment setup.
    a. List of equipment
    b. Test setup photos

17. Description of DFS test procedure and test setup used to generate the *Radar Waveforms.*
    a. Block diagram of equipment setup
    b. List of equipment
    c. Test setup photos
    d. For each of the waveforms that were used for each signal type, supply the characteristics (pulse width, pulse repetition interval, number of pulses per burst, modulation).
    e. For selecting the waveform parameters from within the bounds of the signal type, describe how they were selected (i.e., random selection using uniform distribution).

18. The DFS tests are to be performed on U-NII *Channel(s)* at the smallest U-NII *Channel* bandwidth (worst case).
    i. List each *Channel* frequency that was used for the tests.
    ii. Data Sheet showing the *U-NII Detection Bandwidth* for the *Channel(s)* used during the test.
    iii. Plot of RF measurement system showing its nominal noise floor in the same bandwidth which is used to perform the *Channel Availability Check*, initial radar bursts, *In-Service Monitoring*, and 30 minute *Non-Occupancy Period* tests.

19. Timing plot(s) showing compliance with the *Channel Availability Check Time* requirement of 60 seconds at start up.
    a. The plot should show the Initial $T_{power-up}$ time.
    b. The plot should include the Initial $T_{power-up}$ period in addition to 60 second period.

20. Timing plot(s) showing compliance with the Initial DFS radar detection requirements during the 60 second initial *Channel Availability Check* at start up.
    a. Plot for DFS radar detection for *Radar Waveforms* applied 6 seconds after the Initial $T_{power-up}$ time period. The minimum length of the plot should be 1.5 minutes after the $T_{power-up}$ time period. The plot should show the radar burst at the

appropriate time. This test is only required once and the Short Pulse radar Type 1 should be used for the test.

b. Plot for DFS radar detection for *Radar Waveforms* applied 6 seconds before end of the 60 second *Channel Availability Check* Time. The minimum length of the plot should be 1.5 minutes $T_{power-up}$ time period. The plot should show the radar burst at the appropriate time. This test is only required once the Short Pulse Radar Type 1 should be used for the test.

c. The minimum time resolution of the plots should be sufficient to show the *Radar Waveform* bursts (overall, not individual pulses within the burst).

21. Verification that when the device is "off" that the RF energy emitted is below the FCC rules for unintentional radiators:
For the plots of U-NII RF activity versus time, the device is considered to be "off" or not transmitting when intentional U-NII signals (beacons, data packets or transmissions, or control signals) are below the FCC rules for unintentional radiation due to device leakage, oscillator noise, clocks, and other unintentional RF generators.

22. Spectrum Analyzer, VSA, or some other data gathering Instrument plots showing compliance with the *Channel Move Time* requirements during in the *In-Service Monitoring* testing for the Short and Long Pulse Radar Types. The plots need to show U-NII device transmissions on the *Channel* in the form of RF activity on the vertical axis versus time on the horizontal axis. Only one 10 second plot needs to be reported for the Short Pulse Radar Types 1-4 and one for the Long Pulse Radar Type in a 22 second plot. The plot for the Short Pulse Radar Types should start at the end of the radar burst. The Long Pulse Radar Type plot only needs to show the device ceased transmissions within the 10 second window after detection has occurred. The plot for the Long Pulse Radar Type should start at the beginning of the 12 second waveform. However, the *Channel Move Time* will be calculated based on the plot of the Short Pulse Radar type.

The plots need to show U-NII device transmissions on the *Channel* in the form of RF activity on the vertical axis versus time on the horizontal axis. Sufficient resolution should be used.
Only one 10 second plot needs to be reported for the Short Pulse Radar Types 1-4 and one for the Long Pulse Radar Type test in a 22 second plot. The plot for the Short Pulse Radar Types should start at the end of the radar burst. The *Channel Move Time* will be calculated based on the plot of the Short Pulse Radar Type. The Long Pulse Radar Type plot only needs to show the device ceased transmissions within the 10 second window after detection has occurred. The plot for the Long Pulse Radar Type should start at the beginning of the 12 second waveform.

a. The plots and/or data must show the U-NII Device's compliance with the 200 milliseconds limit on data transmission and compliance with the 260 milliseconds aggregate limit found in **Table 4**.
b. Indicate the total number of times the test was performed.
c. Indicate a detect/not detect for each waveform within a signal type and the number of failures and the number of successful radar detection times within the time limit. Sample data sheets are shown in **Tables 8-10**.

d. Verify compliance with the minimum percentage of successful detection requirements found in **Tables 5-7**.

23. Spectrum Analyzer plot(s) showing compliance with the 30 minute *Non-Occupancy Period* requirement.
Only one plot is required. This is a separate test that is performed in addition to the other *In-Service Monitoring* tests. However, any type of *Radar Waveform* can be used for this test.

Table 8: Sample Detection Data Sheet for Radar Types 1, 5, and 6
(Use a Separate Data Sheet for Each Radar Type)

Radar Type	Trial #	Detection Yes / No	Trial #	Detection Yes / No
1, 5 or 6	1		16	
	2		17	
	3		18	
	4		19	
	5		20	
	6		21	
	7		22	
	8		23	
	9		24	
	10		25	
	11		26	
	12		27	
	13		28	
	14		29	
	15		30	

Table 9: Sample Data Sheet for Radar Types 2, 3, or 4
(Use a Separate Data Sheet for Each Radar Type)

Radar Type	Trial #	Number Pulses per Burst	Pulse Width (μs)	PRI (μs)	Detection
					Yes / No
2, 3, or 4	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				

Table 10: Sample Parameter Data Sheet for Radar Type 5
(Use a separate data sheet for each trial)

RADAR TYPE 5						
Trial Number:						
Number of Bursts in Trial:						
Burst	**Number of Pulses**	**Pulse Width (µsec)**	**Chirp Width (MHz)**	**Pulse 1-to-2 Spacing (µsec)**	**Pulse 2-to-3 Spacing (µsec)**	**Starting Location Within Interval (µsec)**
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						