



TCB Workshop

Unlicensed National Information Infrastructure Devices (U-NII)/Dynamic Frequency Selection (DFS)

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May 19-21, 2004

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R&O U-NII devices



> New Rules FCC 03-287 (Docket No. 03-122),

- ▶ Effective date, February 19, 2004
- ▶ http://hraunfoss.fcc.gov/edocs_public/attachmatch/FC-C-03-287A1.pdf
- ▶ Adds 255 MHz of spectrum 5.47-5.725 GHz to current UNII bands.
- ▶ Dynamic Frequency Selection (DFS) for devices in the 5.25-5.35 GHz band and 5.47-5.725 GHz band.
- ▶ Interim DFS Test procedure is in the Appendix of the Rules.
- ▶ Transmit power control (TPC) 5.47-5.725 GHz band.
 - ▶ No test required.

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R&O U-NII devices (continued)



- **Test procedure will be updated in the near future**
 - ▶ Do not deviate from accepted procedure
 - ▶ FCC will not approve devices tested with non-NTIA approved test methods
 - ▶ Contact NTIA to participate in test procedure discussions.
 - ▶ Charles Glass - cglass@ntia.doc.gov
 - ▶ May 18 meeting could change test procedure.
 - ▶ NTIA provides approved test-bed description, software scripts, and schematics needed to operate and build specific test equipment.
 - ▶ Frank Sanders - fsanders@its.bldrdoc.gov
 - ▶ Complex test requires specialized equipment and software.

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R&O U-NII devices (continued)



- **Transition dates from Feb. 19, 2004; equipment operating in 5.25-5.35 GHz**
 - ▶ 1 year, Certification filings must comply w/ new rules
 - ▶ 2 years, All devices imported and marketed must comply
- **Note Code (ND):**
 - ▶ This UNII device complies with the Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS) requirements in Section 15.407(h).
- **New technology**
 - ▶ TCB cannot approve any device operating under the new rules.

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Dynamic Frequency Selection (DFS) Defined



- **Section 15.407(h)(2): Radar Detection Function of Dynamic Frequency Selection (DFS).** U-NII devices operating in the 5.25-5.35 GHz and 5.47-5.725 GHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems. The minimum DFS detection threshold for devices with a maximum e.i.r.p. of 200 mW to 1 W is -64 dBm. For devices that operate with less than 200 mW e.i.r.p. the minimum detection threshold is -62 dBm. The detection threshold is the received power averaged over 1 microsecond referenced to a 0 dBi antenna. The DFS process shall be required to provide a uniform spreading of the loading over all the available channels.

Transmit Power Control (TPC) Defined



- **Section 15.407(h)(1): Transmit power control (TPC).** U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.
- **TPC threshold will be determined as technology develops.**
- **Only a statement that the device has TPC is required to be submitted in the filing.**

Master (Access Point) Requirements



- a) The Master device shall use a Radar Interference Detection function in order to detect radar signals with a level above the *Interference Detection Threshold* in the frequency ranges 5250 – 5350 MHz and 5470 – 5725 MHz. Radar detection is not required in the frequency range 5150 – 5250 MHz or 5725 – 5825 MHz.
- b) The Master device initiates an unlicensed U-NII network by transmitting control signals that will enable other unlicensed U-NII devices to Associate (participate in a wireless network) with the Master device.
- c) Before initiating a network on a Channel, the master shall perform a *Channel Availability Check* for a certain duration (*Channel Availability Check Time*) to ensure that there is no radar operating on the Channel, using the Radar Interference Detection function described under a).

Master (Access Point) Requirements (Continued)



- d) During normal operation, the Master shall monitor the operating channel (*In-Service Monitoring*) to ensure that there is no radar operating on the channel, using the Radar Interference Detection function described under a).
- e) If the Master device has detected a radar signal, during In-Service Monitoring as described under d), the operating Channel of the unlicensed U-NII network is made unavailable. The Master shall instruct all associated devices to stop transmitting on this Channel, which they shall do within the *Channel Move Time*. The Aggregate Transmissions during the *Channel Move Time* should be limited to the *Channel Closing Transmission Time*.
- f) A Master device shall not attempt to initiate a network on a Channel in the frequency range 5600-5650 MHz during a period defined as the *Non-Occupancy Period* after a radar has been detected in that Channel, regardless of the outcome of any In-Service Monitoring or Channel Availability Check procedures. The *Non-Occupancy Period* commences at the time the radar was detected in the Channel.

Client Device Requirements



- a) An unlicensed U-NII Client device shall not transmit before having received an appropriate enabling signal from a Master device.
- b) An unlicensed U-NII Client device shall stop all its transmissions whenever instructed by a Master device to which it is associated. The device shall not resume any transmissions until it has again received enabling signals from a Master device.
- c) An unlicensed U-NII Client device that incorporates a Radar Interference Detection function shall inform the Master device and stop its networks transmission if it detects a radar.

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 (required for band 5250-5350 MHz and 5470-5725 MHz)	√	Not required	√
Interference Detection Threshold	√	Not required	√
Channel Availability Check Time	√	Not required	Not required
Uniform Spreading	√	Not required	Not required

Applicability of DFS requirements during normal operation



Requirement	Operational Mode		
	Master	Client (without radar detection)	Client (with radar detection)
Interference Detection Threshold	√	Not required	√
Channel Closing Transmission Time	√	√	√
Channel Move Time	√	√	√

DFS Response requirement values



Parameter	Value
Non-occupancy period	30 minutes
Channel Availability Check Time	60 s
Channel Move Time	10 s
Channel Closing Transmission Time	260 ms

Channel Move Time



- When a radar signal is detected it must stop data transmission and then move to a new channel. The data transmission must stop within 200 mS. Additional transmission time is afforded to allow the master and client to communicate control signals to facilitate operation on the new channel. While the data transmission must stop within 200 mS of detecting the radar, the aggregate duration of all signals, signals that include data transmission and control signals, may not exceed 260 mS.

Parameters of DFS test signals



Radar test signal	Pulse repetition frequency PRF [pps]	Pulse width W [μs]	Burst length L [ms] / No. of pulses (Note 1)	Burst Period B [sec] (Note 2)	Hopping Rate (Note 4)
Fixed Frequency Radar signal 1	700	1	26 / 18	10	Na
Fixed Frequency Radar signal 2	1800	1	5 / 10	2	Na
Frequency Hopping Radar	3000	1	100/300	10	1 kHz

Parameters of DFS test signals (Continued)



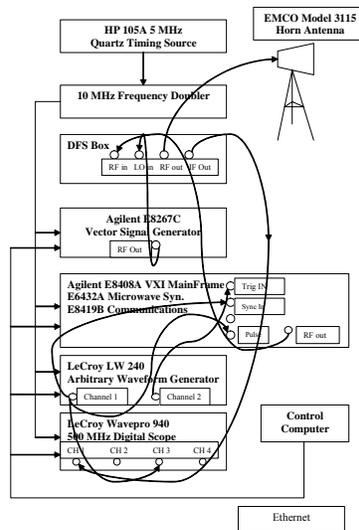
- Note 1: This represents the number of pulses seen at the unit under test (UUT) per radar scan $N = \frac{\{\text{antenna beamwidth (deg)}\} \times \{\text{pulse repetition rate (pps)}\}}{\{\text{scan rate (deg/s)}\}}$
- Note 2: Burst period represents the time between successive scans of the radar beam
 $B = 360/\{\text{scan rate (deg/s)}\}$
- Note 3: Radar bandwidth is less than that of the unlicensed U-NII device.
- Note 4: The characteristics of this frequency hopping radar do not correspond to any specific system. It can hop across the 5250-5725 MHz band. The frequencies will be selected by using a random without replacement algorithm until all 475 frequencies have been used. After all have been used, the pattern is reset and a new random set is generated.

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Radar Transmitter Diagram



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NTIA Test Setup – Radar Simulator Rack

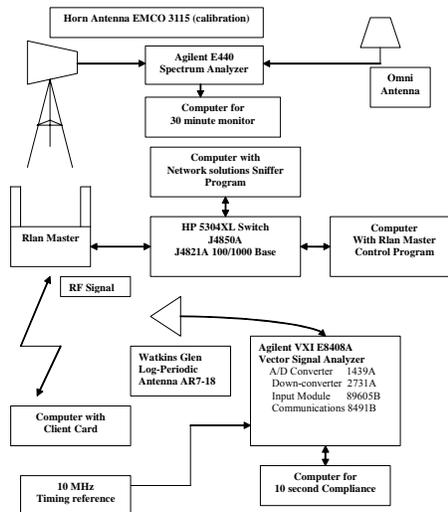


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DFS Timing Monitoring Diagram

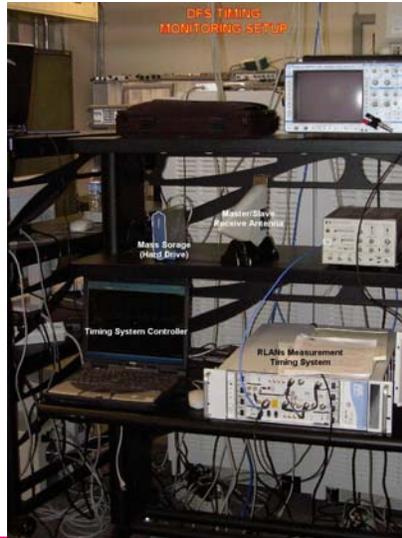


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NTIA Test Setup - DFS Timing Monitor Setup



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Class II Permissive Change



- **Class II permissive change for existing equipment**
 - ▶ Allowed only for software change
 - ▶ No EMC or RF safety issues permitted
 - ▶ No end-user software upgrade permitted
 - ▶ Any hardware change requires NEW AUTHORIZATION

- **Currently, a Class II permissive change application or a new Certification for a UNII device under the new DFS and TPC requirements described in the Report & Order in FCC 03-287 (ET Docket No. 03-122) can not be authorized by a TCB. SDR devices also cannot be authorized by a TCB. These devices are considered new technologies.**

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EMC – ie: no increase in output power

RF Safety – ie: change from mobile to portable

End-user software changes that change transmit parameters (ie: frequency bands) require a filing as a software defined radio

Question 1: A UNII device has been previously certified with the 5.150-5.350 GHz band. Now the manufacturer would like to enable the firmware on the device to include the 5.725-5.825 GHz band. There is no hardware change on the device but only to enable the firmware option. This UNII device will be used as mobile device only. Can the manufacturer file this change as a Class II permissive change?

Answer 1: Yes, the above change can be filed as a Class II permissive change provided the additional band is added by only a software change and no component changes or hardware modifications to the original device. In addition, this software change must be made by the Grantee (responsible party) or another party under the Grantee's control. If the software changes can be made by the end user or some party not under the control of the Grantee, the device must be reapproved as a Software Defined Radio under a separate FCC ID number from the original device. Finally, test data showing compliance in the new band must be provided in the Class II permissive change application. In this manner, it can be determined that EMC and SAR issues are not affected in the new band.

Question 2: A UNII device has been previously certified with the 5.15-5.35GHz and 5.725–5.825 GHz bands. Now the manufacturer would like to enable the firmware on the device to include the new 5.470–5.725 band with dynamic frequency selection (DFS) and transmitter power control (TPC) described in the Report & Order in FCC 03-287 (ET Docket No. 03-122). There is no hardware change on the device but only to enable the firmware option. This UNII device will be used as mobile device only. Can the manufacturer file this change as a Class II permissive change?

Answer 2: Yes, this change can be made as a Class II permissive change provided the additional band is added by only a software change and no component changes or hardware modifications to the original device. In addition, this software change must be made by the Grantee (responsible party) or another party under the Grantee's control. If the software changes can be made by the end user or some party not under the control of the Grantee, the device must be reapproved as a Software Defined Radio under a separate FCC ID number from the original device. Also test data showing compliance with the new DFS and TPC requirements must be submitted for all applicable bands in the Class II permissive change application.

Currently, a Class II permissive change application or a new Certification for a UNII device under the new DFS and TPC requirements described in the Report & Order in FCC 03-287 (ET Docket No. 03-122) can not be authorized by a TCB. SDR devices also cannot be authorized by a TCB. These devices are considered new technologies.

U-NII/DFS Issues



- **Test Procedure is not final**
 - ▶ R&O has Interim Test Procedure
 - ▶ Probability of Detection
- **Test Set-up Complexity and Cost**
- **Alternative Test Procedure Proposals must be approved by NTIA before filing an application**
 - ▶ Lengthens the equipment authorization process
- **Modular Approval**
 - ▶ Draft – needs final approval
- **DFS test report guidelines**
 - ▶ Draft – needs final approval