



Dynamic Frequency Selection (DFS) Test and Compliance Issues

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DFS General Information

- U-NII Frequency Bands:
5.15-5.35, 5.47-5.725, and 5.725-5.825 GHz
- Dynamic Frequency Selection (DFS) and Transmit Power Control (TPC):
5.25-5.35 GHz and 5.47-5.725 GHz
Transition Period over – DFS now required
- Legacy Bands
5.15-5.25 and 5.725-5.825 GHz
DFS and TPC not required



TCB Exclusions

- TCBs cannot authorize DFS devices with radar detection capability
- TCBs can authorize DFS client devices without radar detection capability
 - Must not have an “ad-hoc” or “peer-to-peer” mode
 - Tests: Channel Move Time & Channel Closing Transmission Time
- Pre Grant sample call for devices with radar detection capability
 - Sample monitoring by NTIA to continue
 - DFS interference issues in Europe

http://www.wmo.ch/pages/prog/www/TEM/SG-RFC06/Eumetnet_RLAN%20vs%20Radar%205%20GHz.doc



DFS Reminders

- Part 15 non-channelized radio service – Grant must list lowest and highest carrier frequency for each band
- IP or Frame Based – include in Operational Description or Test Report
- DFS threshold is based on device EIRP



Class II Permissive Changes

- Software only to add or remove bands
- Adding DFS Bands
 - Note code ND: This device complies with the TPC and DFS requirements in Section 15.407(h)
 - If additional frequencies or bands are added the application should also include additional EMC and RF exposure reports
- Removing DFS Band 5.25-5.35 GHz
 - Band edge data required to show that the 20dB BW remains in the 5.15-5.25 GHz band per Section 15.215(c)
 - If the emission is narrow and far enough from the band edge, testing may not be required



DFS Device Types

- 802.11 based
 - DFS Standard 802.11h not finalized at this date
 - Clients must be tested w/ approved masters
- Proprietary point-to-point systems
 - One application covers master & client
 - Client tested w/ master (approved master device not required for testing)
 - Application should include master and client data
 - Test Samples should be supplied w/ 30-50 dB attenuation on the client antenna
- Miscellaneous - TBD



Channel Loading/Data Streaming

- Use NTIA approved MPEG2
- NTIA approved WAV file now available for devices that won't stream MPEG2 file
- Alternative streaming techniques
 - Must be approved by NTIA and the FCC
 - Pings not permitted
 - Submit proposal to FCC
 - State the type of device and explain streaming methodology
 - Streaming methodology should replicate type of data that is typical for the device (ie: E-mail; FTP)
 - Include timing plots and estimate of loading (%)
 - Note: channel loading percentage is not specified in the Rules or test procedure, the approved MPEG2 file was measured to be about 17 to 20% loading
- Test the device at the minimum data rate which streams data smoothly – this utilizes the maximum transmission time



Client 30 Minute Non-occupancy - New Test Procedure

- Clients not permitted to transmit beacons on DFS frequencies
 - Previously, a manufacturer's attestation statement stating that there are no beacon transmissions in the DFS bands
 - New test approved and required on applications submitted after Oct. 11, 2007
 - The procedure will be added to the KDB
- Part 1: Non-associated test
 - Master device should be off
 - Monitor the analyzer on the test mode frequency that you have selected for testing
 - Power up the client for 30 min to make sure no beacons have been transmitted



Client 30 Minute Non-occupancy - New Test Procedure (Con't)

- Part 2: Associated test
 - Associate the client and master and stream the movie as specified for non-occupancy test
 - Transmit Radar Bin1
 - Monitor the test frequency to make sure no beacons have been transmitted for 30 min.
 - Note: If the client moves with the master, nothing should show up on the client non-occupancy test and the device is compliant. For devices that shut down (rather than moving channels), no beacons should appear.



Test Issues

- FCC Lab performs ONLY radiated tests on master devices using the minimum cable length specified by the manufacturer
- Uniform Spreading
 - No test defined or required
 - Manufactures attestation statement required
- Channel Closing Transmission Time
 - Test procedure requires Bin1 and Bin 5
- Professional installers cannot have access to any DFS settings except for the capability to block channels that are potential interference problems
 - the block channels must be based on any interference received since radar frequencies are not public information



Test Issues (Con't)

- Multiple Bandwidths
 - Non-MIMO: All tests to be performed in full on ALL BWs
 - MIMO
 - ALL BWs to be tested in full
 - Only requires to have one transmission chain operating
 - Use lowest data rate to achieve smooth data streaming



Test Issues (Con't.)

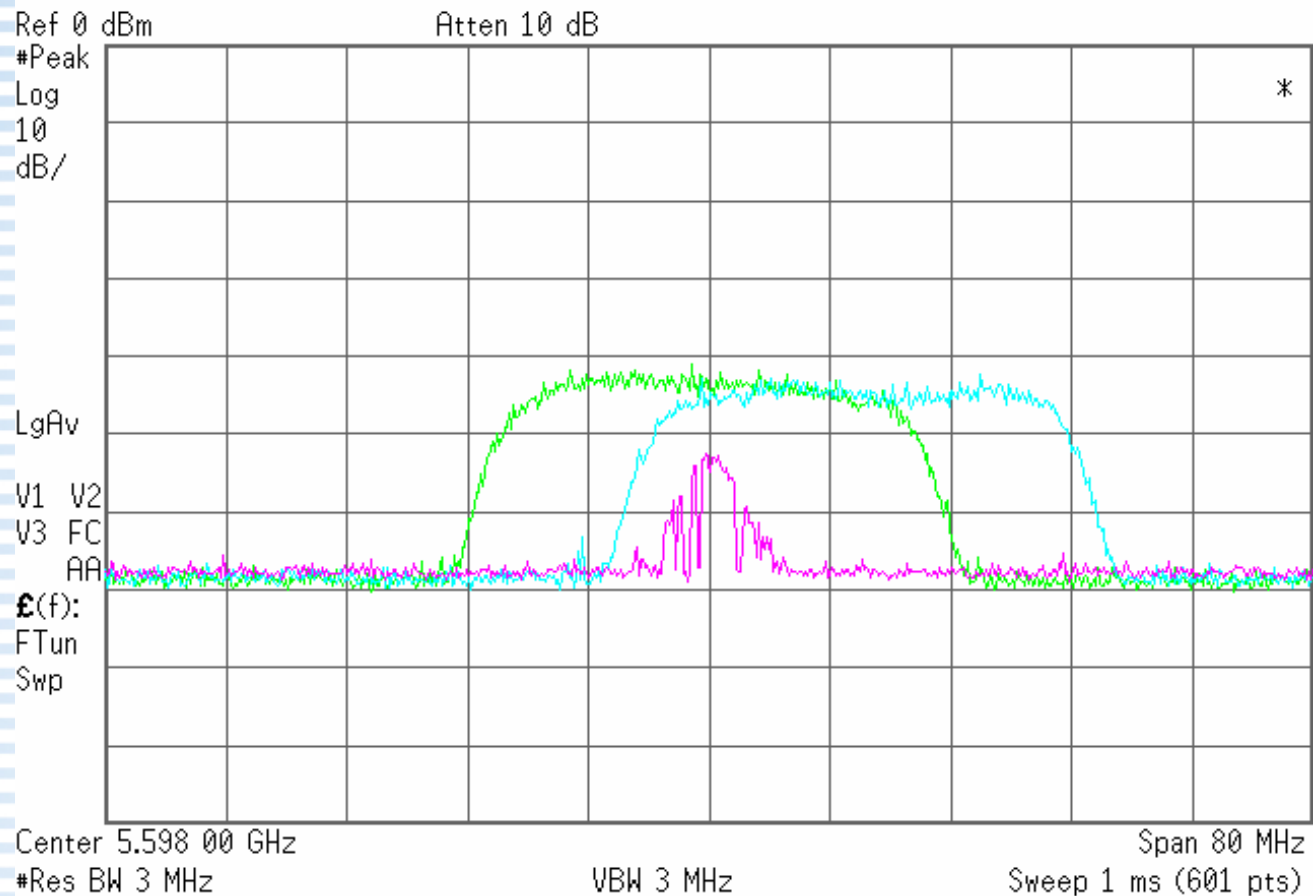
- Radar Detection BW
 - Detection BW > 80% Power BW (from EMC Test Report or analyzer 99% BW)
- Radar test frequencies
 - Device must respond to radars within the 80% Power BW which is the minimum permissible radar detection BW
 - FCC Lab typically tests at any radar frequency at least 1 MHz within the 80% power BW
 - FCC Lab also changes radar frequencies for statistical tests (Bin1 to Bin5)



Test Issues – Overlapping Channels

● Overlapping Channel frequency plans

Agilent 20:26:35 May 6, 2007





Test Issues – Overlapping Channels (Con't.)

- The plot shows the radar and device channel frequency set to 5598 MHz. The radar was detected and the channel frequency moved to 5608 MHz.
- Section 15.407(h)(2): avoid co-channel operation with radars
- Channel: the amount of spectrum used by a master device and any associated client device (Reference FCC 06-96)
- Must meet the In-Service Monitoring requirements of Section 15.407(h)(2)(ii) - The U-NII device may start using the channel if no radar signal with a power level greater than the interference threshold values listed in paragraph (h)(2) of this part, is detected within 60 seconds.



Test Issues – Overlapping Channels (Con't.)

- Tested by blocking all channels except for two overlapping channels and then rebooting in normal mode. The single radar burst was transmitted, detected, and the overlapping channel selected as an available channel. The radar burst was retransmitted 45 seconds later. The device detected it and blocked the overlapping channel.
- Conclusion: This device was compliant with the overlapping channel frequency plan



DFS Compliance Problem Areas

- Radiated Testing vs Conducted Testing
 - Threshold not correct
 - Must account for cable losses
 - Manufacturers tolerance in antenna gain
 - Include minimum gain antenna w/ sample requests
- Non-linearity in statistical tests across the radar detection BW
- 40 MHz BW (Channel Bonding) compliance issues – statistical tests differ greatly when compared to 20 MHz BW mode
- Channel Move Time – packet transmission to stop within 200 ms
- 30 Minute Non-occupancy – no emissions permitted



Test Modes for FCC Sample Requests

- Test Modes are only for compliance testing and cannot be accessed by the end user
- Suggested capabilities:
 - 1) Ability to turn on/off test mode in order to verify normal operation under normal DFS tests.
 - 2) Display radar detection(s).
 - 3) Upon radar detection, the test mode should disable the 30 minute non-occupancy period and return the device to the original test frequency within a few seconds. It is acceptable to disable the channel move upon radar detection while in test mode. This will keep the device on the test frequency.



Test Modes for FCC Sample Requests (Con't)

- 4) Ability to reset "blocked" frequency list. It is also useful to be able to edit the "blocked" frequency list.
 - 5) Ability to turn on/off Channel Availability Check Time if device has to reboot as part of its normal DFS operation when radar is detected.
- Test mode interfaces:
 - 1) Terminal interface – ASCII text output
 - 2) Web based interface - This requires an automatic refresh of the web page at an interval sufficient enough so that it will not slow down test time.



Questions and Answers

Thanks!