Dynamic Frequency Selection (DFS) Test and Compliance Issues - Update

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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

  Note Code "ND" use is optional for both master and client devices

- 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
    - Client Beacon Test

- Pre Grant sample call for devices with radar detection capability
  - Expedited Review for qualified candidates
  - Sample monitoring by NTIA to continue

Expedited Review Candidates – Required Information

FCC ID(s) of Previously Granted DFS Devices	FCC ID of New Application
Technology: (i.e.; 802.11x, frame based, MIMO, smart antenna, etc.)	
Bandwidth information and differences	
Antenna information and differences for the minimum gain antennas	
Differences in DFS functioning, circuitry, software, etc.	
Differences between the products such as TX power, modulation, receivers, processing circuitry, etc.	
Names of the test labs for the various Grants	

UNII & DFS Reminders

- Uniform Spreading – manufacturer's attestation statement required

- Include test frequencies used for statistical performance tests in the Test Report

- DFS threshold is based on highest EIRP of all of the bands

  – The same threshold applies to all bands

- For a Class II permissive change the power cannot be increased when adding new bands

- The 5.15-5.25 and 5.25-5.35 bands require two line items

- UNII undesired emissions must be measured with a Peak Detector (Section 15.407(b))

DFS Device Types - Update

- 802.11 based
  - DFS Standard 802.11h not finalized to date
  - Wi-Fi Alliance has adopted near-final 802.11h

- Frame Based Systems (Proprietary point-to-point systems)
  - Fixed talk/listen ratio of 45%/55% (FCC 06-96)
    - Tolerance +/- 10%
    - Lab testing has indicated that this is not a critical setting in determining DFS statistical performance
  - Fixed & dynamic talk listen ratio: stream movie

- Miscellaneous - TBD

DFS Client Beacon Test - Procedure Update

- KDB Publication #848637

- 802.11 clients not permitted to transmit beacons on DFS frequencies
  - Test required since Oct. 11, 2007

- Part 1: Non-associated test (Stand-alone client)
  - This test is no longer required
  - New requirement: The application must include a letter exhibit from the manufacturer stating that the client software and associated drivers will not permit transmission of beacon signals on DFS frequencies

DFS Client Beacon Test - Procedure Update (Cont.)

- Part 2: Associated test (Client link established with the master on a test frequency)
  - 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
  - Analyzer plot must be in the Test Report
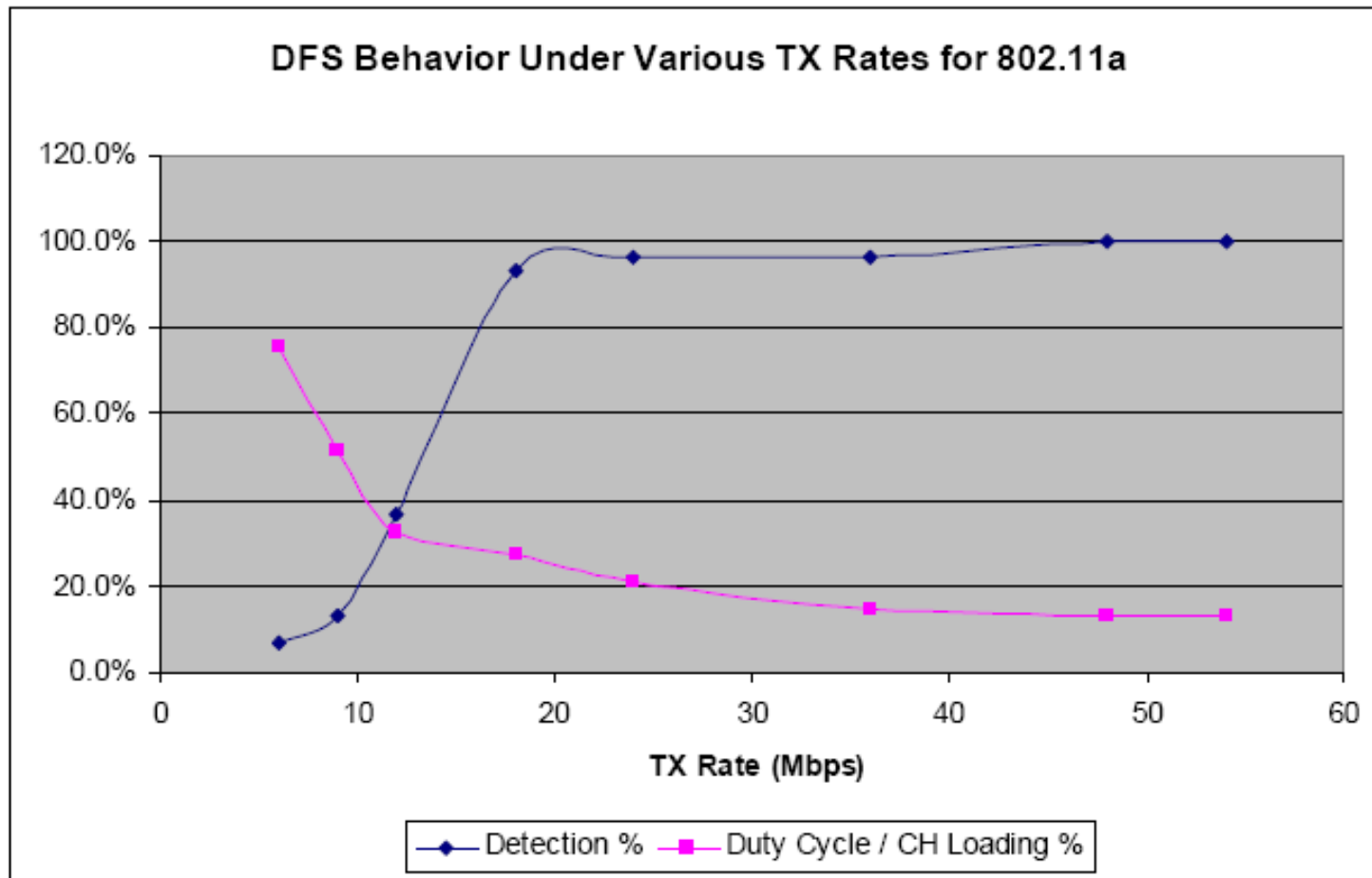   - Single 30 min. sweep on original client test frequency

Channel Loading

- Test the device at the minimum data rate which streams data smoothly and provides consistent statistical test data
  - This utilizes the maximum transmission time
  - Video smooth streaming: 29 frames/sec. w/ no pixilation
  - Any codec/media player is acceptable
  - Bin 1 used to determine statistical data consistency
- Effect noticed when data transmission rate is less than 25 Mbps
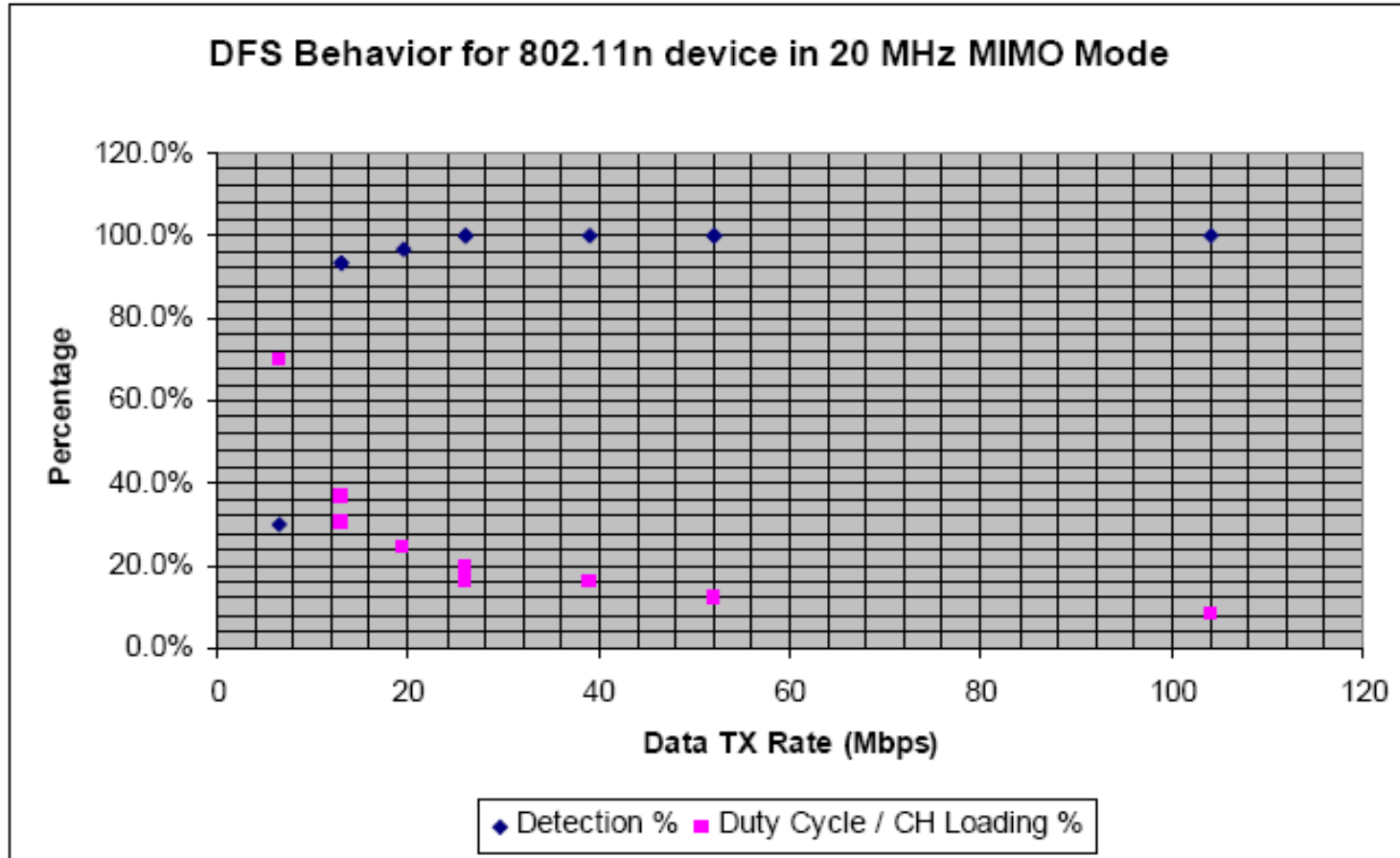
Channel Loading (Cont.)
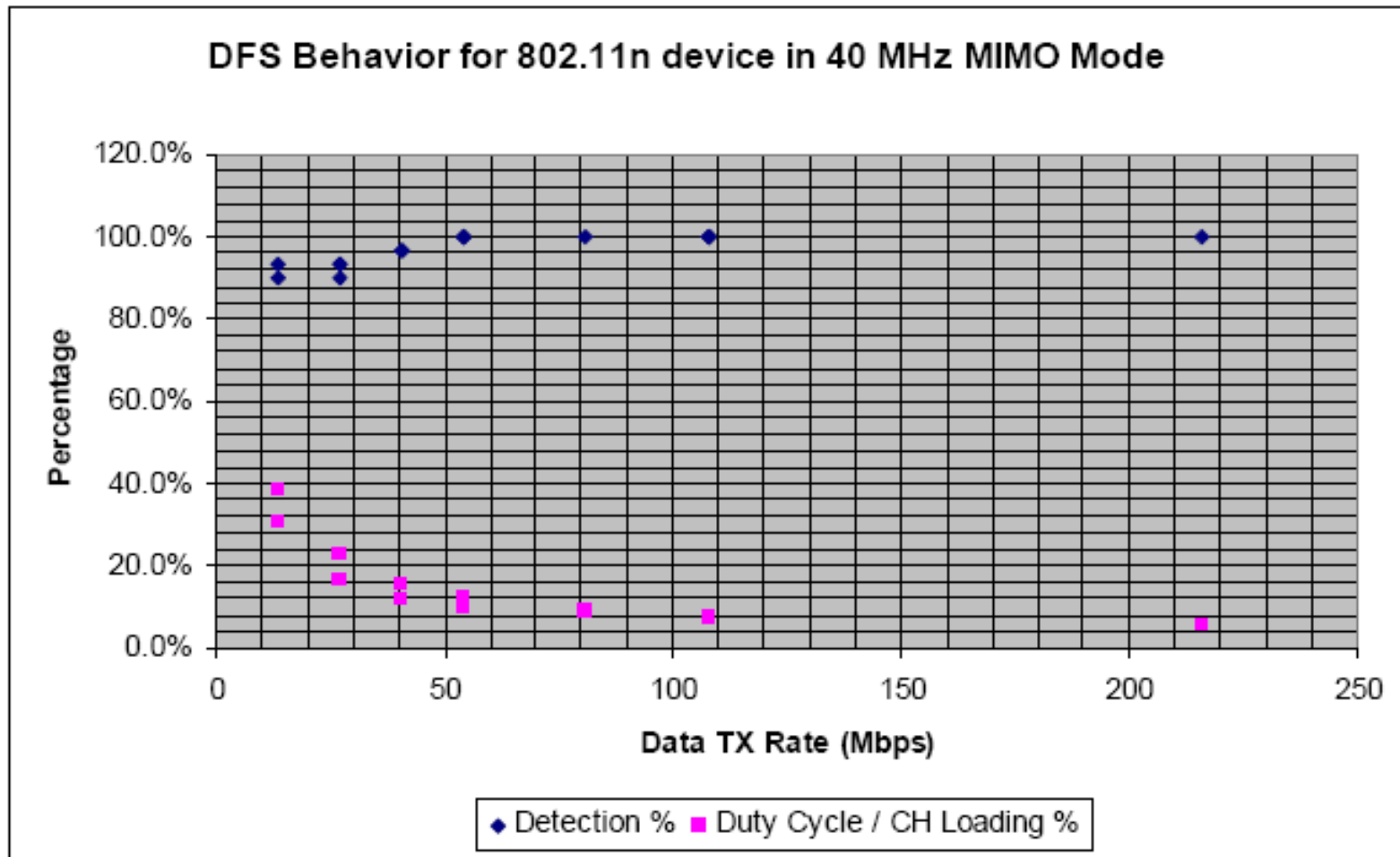
Test Result for Manufacturer A

DFS Behavior Under Various TX Rates for 802.11a

Channel Loading (Cont.)

Test Result from Manufacturer B

DFS Behavior for 802.11n device in 20 MHz MIMO Mode

Channel Loading (Cont.)

DFS Behavior for 802.11n device in 40 MHz MIMO Mode

Legend: ♦ Detection %   ■ Duty Cycle / CH Loading %

Test Mode for Test Samples

- KDB publication #594340

- Test Procedure (FCC 09-96) Section 7.1

- 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.

- Display radar detections

- Easily switch between normal and test mode

- Device should be setup to start on a known frequency in normal mode

Test Issues

- Multiple Bandwidths
  - Non-MIMO: ALL BWs to be tested in full (Radar detection BW and statistical tests)
  - MIMO
    - ALL BWs to be tested in full (Radar detection BW and statistical tests)
    - Only required to have one transmission chain operating
  - Use lowest data rate that data streams smoothly
- Remaining tests performed in either BW (channel move time, CAC tests, 30-min non-occupancy, etc.)

Test Issues (Cont.)

- 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 and the center channel of 40 MHz devices
  - FCC Lab also changes radar frequencies for statistical tests (Bin1 to Bin6)
- Do not test perform all statistical tests with the radar on-tune with the master device and then expect to pass FCC testing

Test Issues (Cont.)

- Radiated Testing vs. Conducted Testing
  - Threshold not correct
    - Must account for cable losses & manufacturer's tolerance in antenna gain
  - Include minimum gain antenna w/ sample requests
  - It is highly recommended that a Bin 1 signal be used for a radiated test to verify that the threshold is correct before proceeding with conducted tests
- The number of non-compliance issues with samples tested at the FCC Lab is falling as manufacturers continue to improve DFS performance

Questions and Answers

Thanks!