The proposed document “COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVCIES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION” contains a large number of editorial and technical errors. Many of the editorial errors have significant technical implications. All of these errors need to be corrected. Recommended corrections and changes are given below.

Some errors are general in that there are multiple instances throughout the proposed document. These are described below as General Comment [Alphabetic Character].

Each specific recommended change to the proposed document is given in order of appearance in the proposed document, whether or not it is associated with a general comment. All of the general comments are given first, followed by all of the specific recommended changes.

General Comment A

T_0 and T_1 have one meaning in Figures 15 and 16, but a different meaning in Figure 17. Knowing the effort required to change the figures, changes to the text ought to be made instead. Symbols T_0 through T_3 each have the identical, vague definition in Section 4.2 and ought to be removed. Clarification of their definitions would require changes to Figures 15 through 17.

General Comment B

FCC 03-287 accurately describes two types of Client Device (Client without radar detection and Client with radar detection). The proposed document uses various and different terms to describe these two types, however these new terms are less accurate. The new terms ought to be replaced with the original terms, modified only by using capital letters at the beginning of each word in the term. The specific instances cited below are those that were found from reading the document. A text search ought to be made to discover if there are any other instances, and if so, they ought to be corrected as well.

General Comment C

Section 7 contains many erroneous statements and conflicting references, for example:

Section 7.1 erroneously claims that requirements are specified in Section 7.8, however only procedures are specified in Section 7.8. Requirements are specified in Sections 5 and 6

The radar pulse types cited for the U-NII Detection bandwidth test in Section 7.1 conflict with the type specified in Table 4 of the requirements section.

In Section 7.4 the footnote referencing the Compliance Certification Services alternate hopping test system is missing.

Section 7.8 TEST PROCEDURES has the same title as Section 7 TEST PROCEDURES

The first sentence of the first paragraph in Section 7.8 is not accurate.

Section 7.8.2 and 7.8.4 titles are not accurate.

The first paragraph of Section 7.8.2 is not accurate.

In Section 7.8.4.1 the first phrase of the first sentence is not accurate.

Section 7.9 does not exist but is referenced within section 7.1.

General Comment D

The Long Pulse Radar Type is defined inconsistently in different portions of the document, as well as in practice.

In both Table 6 and the representative example in section 6.2, the spacing of the pulses is defined as the PRI. In the software as developed and implemented by the NTIA, the spacing of the pulses is also defined as the PRI.

In the “Each waveform is defined as follows:” clause of section 6.2 and in Table 10, the spacing of the pulses is also defined as the time between the pulses, which is equal to (PRI – Pulse Width).

The spacing of the pulses ought to be defined consistently and simply as PRI.

General Comment E

Section 8.2 number 13c specifies that for the Long Pulse Radar Type a spectrum analyzer plot of a single burst (1 –3 pulses) should be provided.

In our experience, as well as through discussions with personnel from both NTS and Agilent Technologies, a known good chirped pulse will be displayed incorrectly on a scalar spectrum analyzer and will appear to be out of specification. There is an inherent problem in attempting to validate a vector-modulated signal with a scalar signal analyzer. Unfortunately, without independent validation by a vector signal analyzer, the artifacts of the scalar measurement technique cannot simply be ignored.

A scalar analyzer measurement of the vector-modulated pulse shows turn-on and turn-off transient that, in the case of the NTIA-designed system, are not real. Since these transients could be created by a signal generating system that is improperly designed, they can only be ignored for signal generating systems that have also been validated using a vector signal analyzer.

The transients that are displayed by the spectrum analyzer could be produced by a signal generating system that has imperfect synchronization between the start of the amplitude modulation component and the start of the frequency modulation component of the baseband modulating signal. Such a condition could conceivably be caused by an improper vector pulse definition.

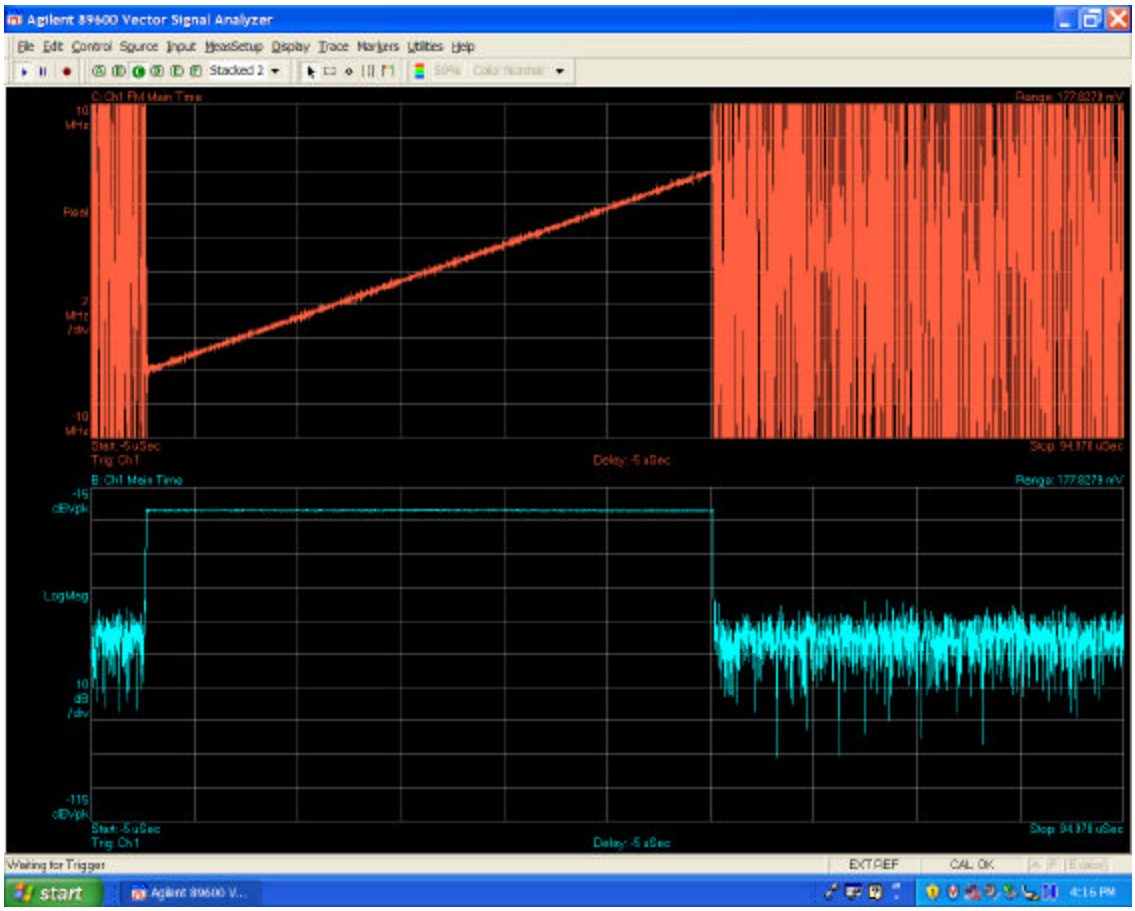
Imperfect synchronization could also (and would probably far more likely) be caused by a system consisting of a scalar signal generator that allows simultaneous Pulse Modulation and Frequency Modulation. In such a system the critical relative timing of the two modulation components will invariably be influenced by the timing of the outputs from the modulating sources as well as propagation delays within the signal generator. The relative timing of the two baseband sources will also depend on various propagation delays within and between those sources. Such parameters are not going to be guaranteed by instrument manufacturers as being stable over time and temperature.

The following plots show that the NTIA signal generating system would be reported as not producing the correct waveform if the currently proposed procedure in Section 8.2 number 13c is followed.

If a laboratory is using the Agilent E8267C vector signal generator and the NTIA software, the generating system has already been validated with a vector signal analyzer by the NTIA. Requiring a vector signal analyzer plot of this previously validated system constitutes an undue burden for test laboratories.

If a laboratory chooses not to use the Agilent E8267C vector signal generator and the NTIA software, then submission of vector signal analyzer plots of the chirped pulse is necessary to validate the signal generating system.

The following vector signal analyzer plot is excerpted from http://ntiacsd.ntia.doc.gov/dfs/Sample_Radar_Calibration_Plots.doc as published on the NTIA web site.



Bin 5 waveform (Bin5001). RF output of the Agilent E8267C Vector Signal Generator using the RF output from the DFS Test Box and measured on the Agilent 89641A Vector Signal Analyzer. View showing the pulse width and demodulated chirp of Burst 5 out of 18 with the pri randomly chosen but the same between pulses 1 and 2 and between pulses 2 and 3. This will be changed.

Following is the parameter file ouput from the new NTIA software (with independently randomized PRI) for a Long Pulse Type 5 waveform that begins with a burst of 3 pulses. This enables simple video triggering of the spectrum analyzer to view the triplet burst without having to gate out earlier bursts.

Two scalar signal analyzer (spectrum analyzer) plots of Burst #1 are shown; the first is of a single pulse and the second is the entire triple-pulse burst.

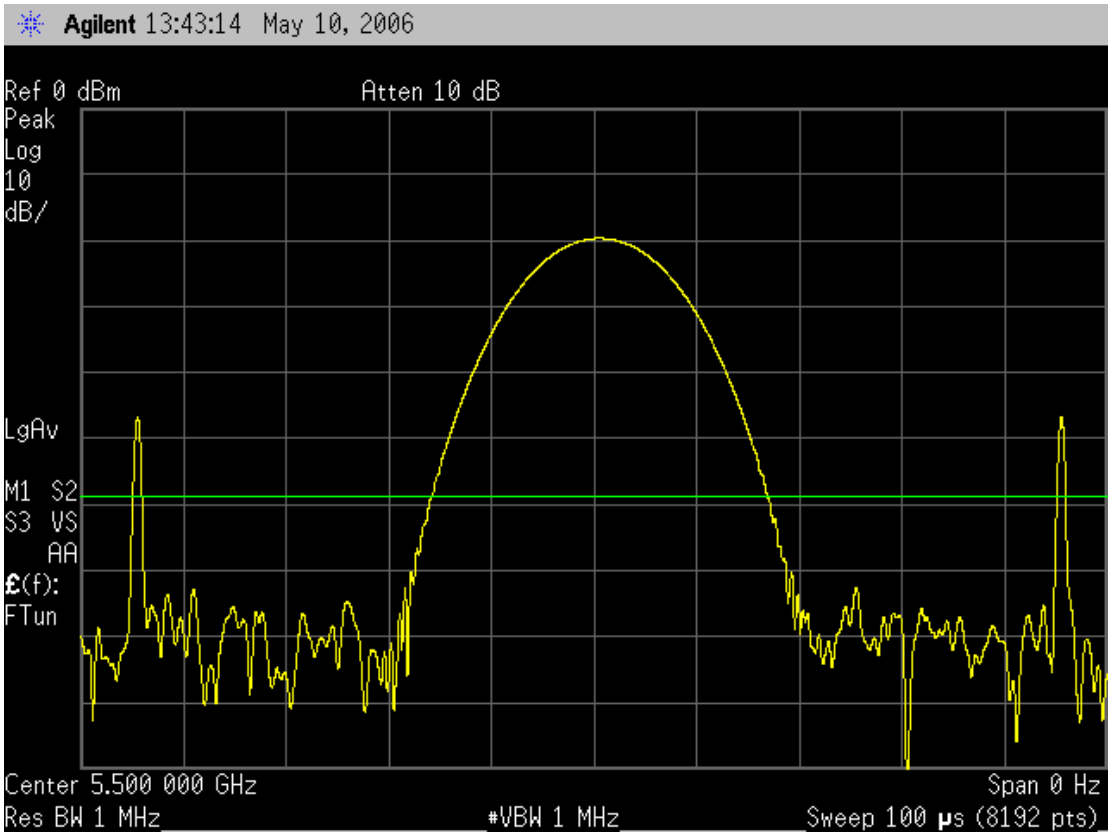
Random DFS waveform parameters (NewBin5) 10-May-2006 08:52:34

Waveform Num = 2
Num of Bursts = 12
Burst Interval (us) = 1000000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	698041	3	9.0	90	1805	1439	1365	698041	0	999999
2	1031585	1	18.0	95	1366	0	0	1734235	1000000	1999999
3	556507	2	13.0	85	1897	1961	0	2292108	2000000	2999999
4	1577962	1	18.0	75	1944	0	0	3873928	3000000	3999999
5	432578	1	16.0	60	1116	0	0	4308450	4000000	4999999
6	1380919	1	16.0	60	1105	0	0	5690485	5000000	5999999
7	334795	3	20.0	70	1354	1684	1222	6026385	6000000	6999999
8	1777597	2	6.0	60	1347	1366	0	7808242	7000000	7999999
9	727722	1	7.0	85	1100	0	0	8538677	8000000	8999999
10	1225879	1	12.0	50	1146	0	0	9765656	9000000	9999999
11	624736	2	16.0	50	1497	1540	0	10391538	10000000	10999999
12	962194	2	18.0	80	1567	1086	0	11356769	11000000	11999999

Total number of pulses in waveform = 20

Spectrum analyzer plot of single pulse within Burst #1.

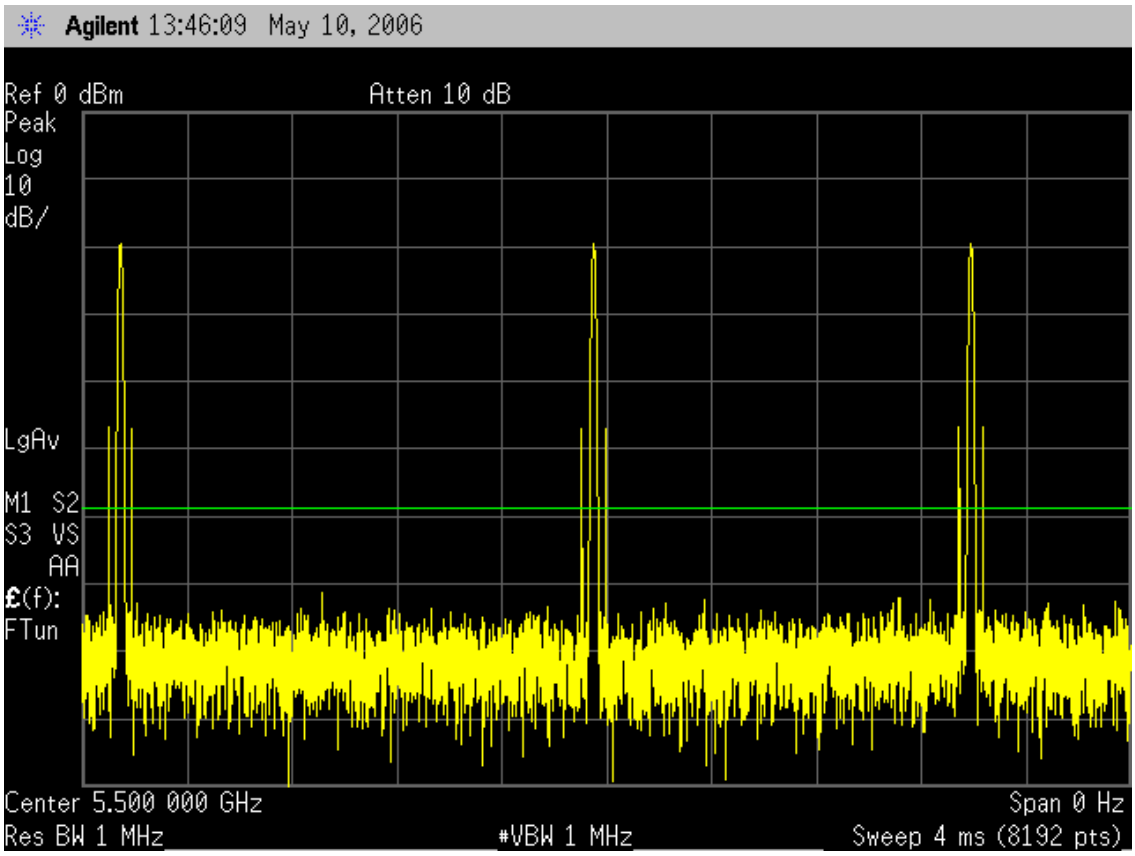


RF output of the Agilent E8267C Vector Signal Generator measured on the Agilent E4446A Spectrum Analyzer. Pulse Width = 90 usec, Chirp Width = 9 MHz as created and downloaded by the NTIA software.

The linear FM chirp shows the expected qualitative response as it sweeps through the resolution bandwidth filter of the spectrum analyzer.

For this signal generating system the transients at the beginning and end of this pulse are known to be artifacts, however these transients could be produced by other very conceivable signal generating systems.

Spectrum analyzer plot of 3-pulse Burst #1.



RF output of the Agilent E8267C Vector Signal Generator measured on the Agilent E4446A Spectrum Analyzer. Pulse Width = 90 usec, Chirp Width = 9 MHz, PRI 1-to-2 = 1805 usec, PRI 2-to-3 = 1439 usec as created and downloaded by the NTIA software.

General Comment F

A separate U-NII Detection Bandwidth test ought to be performed for each Channel Bandwidth that the device employs, since the performance at one Channel Bandwidth does not predict the performance at any other Channel Bandwidth. Similarly, the Frequency Hopping Radar Test ought to be performed for each Channel Bandwidth that the device employs.

While perfectly reasonable engineering justification can be, and is, used to claim that the smallest Channel Bandwidth is worst-case for all of the other parameters, this is not the case for either the U-NII Detection Bandwidth or the statistical performance test of the Frequency Hopping Radar Type. The U-NII Detection Bandwidth must be consistent with the Transmitter's 99% power bandwidth, for each Channel Bandwidth implemented.

Testing only at the smallest U-NII Detection Bandwidth will not guarantee that the spectrum is protected over the range occupied by the largest designed Channel Bandwidth, nor will it guarantee that the device will comply with the 70% detection requirement given in Table 7 when the device is configured to the largest, or any other, Channel Bandwidth.

Testing only at the largest U-NII Detection Bandwidth will not guarantee that the device will comply with the 70% detection requirement given in Table 7 when the device is configured to the smallest, or any other, Channel Bandwidth.

Specific Recommended Changes

Section 4.2 Symbols
Delete P_dN
This symbol does not appear to be used anywhere within the document; text searches do not work on the scanned document. If it is indeed not used, it needs to be removed from the list of definitions.

Section 4.2 Symbols
Delete symbols T_0, T_1, T_2, and T_3

Table 1
Change
"Client (without DFS)"
to
"Client Without Radar Detection"

Change
"Client (with DFS)"
to
"Client With Radar Detection"

Table 2
Change
"Client (without DFS)"
to
"Client Without Radar Detection"

Change
"Client (with DFS)"
to
"Client With Radar Detection"

Section 5.1.2 c)
Change
"If a *Client Device* is performing *In-Service Monitoring* and detects a *Radar Waveform*…"
to
"If a *Client Device* With Radar Detection detects a *Radar Waveform*…"

Section 5.2
Change
"…*Client Devices* incorporating *In-Service Monitoring*."
to
"…*Client Devices* With Radar Detection."

Table 3
Change
"Table 3: DFS Detection Thresholds for Master or Client Devices Incorporating DFS"
to
"Table 3: DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection"

Table 4
Channel Availability Check Time Value
Change
"60 seconds"
to
"Minimum 60 seconds"

Table 4
Channel Move Time Value
Change
"10 seconds"
to
"Maximum 10 seconds"

Table 4
Channel Closing Transmission Time Value
Change
"200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period."
to
"Maximum 200 milliseconds + a maximum aggregate of 60 milliseconds over the remainder of the *Channel Move Time* period."

Table 4 Note 2
Change
"…(an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate..."
to
"…(a maximum aggregate of 60 milliseconds) during the remainder of the *Channel Move Time* period. The aggregate..."

Section 6.2, Each waveform is defined as follows: 6)
Change
"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"
to
"If more than one pulse is present in a *Burst*, the PRI will be between 1000 and 2000 microseconds, with the PRI being randomly chosen. If three pulses are present in a *Burst*, the random PRI from the first to the second pulse is chosen independently of the random PRI from the second to the third pulse."

Section 7.1
Change the text to:

"For a *Master Device*, the *U-NII Detection Bandwidth* conformance test specified in Section 7.8.1 will be performed utilizing the Short Pulse Radar Type 1 defined in Table 5. The *Channel Availability Check* conformance test specified in Section 7.8.2 will be performed utilizing one Short Pulse Radar Type defined in Table 5. The *Channel Move Time* and *Channel Closing Transmission Time* conformance tests specified in Section 7.8.3 will be performed utilizing one Short Pulse Radar Type defined in Table 5 and the Long Pulse Radar Type defined in Table 6. The *Non-Occupancy Period* conformance test specified in Section 7.8.3 will be performed utilizing one Short Pulse Radar Type defined in Table 5. The statistical performance tests specified in Section 7.8.4 will be performed utilizing all Radar Types (1-6).

For a *Client Device* Without Radar Detection, the *Channel Move Time* and *Channel Closing Transmission Time* conformance tests specified in Section 7.8.3 will be performed utilizing one Short Pulse Radar Type defined in Table 5.

For a *Client Device* With Radar Detection, two configurations must be tested.
1) The *Client Device* detects the *Radar Waveform*. The *Channel Move Time* and *Channel Closing Transmission Time* conformance tests specified in Section 7.8.3 will be performed utilizing one Short Pulse Radar Type defined in Table 5 and the Long Pulse Radar Type defined in Table 6. The *Non-Occupancy Period* conformance test specified in Section 7.8.3 will be performed utilizing one Short Pulse Radar Type defined in Table 5. The Statistical Performance tests specified in Section 7.8.4 will be performed utilizing all Radar Types (1-6). During this test, it must be ensured that the *Client Device* is responding independently based on the *Client Device's* self-detection rather than responding to detection by the *Master Device*. The signal level of the simulated radar signal as received by the *Client Device* must be set in accordance with the *DFS Detection Threshold* specified by the DFS technical requirements (Table 3).
2) The *Master Device* detects the *Radar Waveform*. The *Channel Move Time* and *Channel Closing Transmission Time* conformance tests specified in Section 7.8.3 will be performed utilizing one Short Pulse Radar Type defined in Table 5. During this test, it must be ensured that the *Client Device* is responding to detection by the *Master Device* rather than self-detection by the *Client Device*.

For all tests of *Client Devices* (with or without Radar Detection), the *Master Device* to which the *Client Device* is associated must meet the DFS conformance requirements.

Some of the tests may be performed more readily if a test mode for a *Master Device* (or *Client Device* With Radar Detection) is provided that overrides the *Channel* selection mechanism for the *Uniform Spreading* requirement to allow a specific *Channel* to be set for startup (*Channel Availability Check*). In this mode it is preferable that the *Master Device* will continue normal operation upon starting (i.e. perform *Channel Availability Check* on the chosen *Channel* and begin normal operation if no *Radar Waveform* is detected – or respond normally if a *Radar Waveform* is detected during the *Channel Availability Check* or *In-Service Monitoring* on the chosen *Channel*). However, this mode of operation is not required to successfully complete the testing.

Other tests may be performed more readily if a test mode for a *Master Device* (or a *Client Device* With Radar Detection) is provided that overrides the *Channel* move mechanism and simply provides a display that the *Radar Waveform* was detected. In this mode it is preferable that the UUT will continue operation on the same *Channel* upon detecting a *Radar Waveform*. However, this mode of operation is not required to successfully complete the testing.

Once a UUT is powered on, it will not start its normal operating functions immediately, as it will have to finish its power-up cycle first (Tpower_up). As such, the UUT, as well as any other device used in the setup, may be equipped with a feature that indicates its status during the testing, including, for example, power-up mode, normal operation mode*, Channel Availability Check* status and radar detection events.

The test transmission will always be from the *Master Device* to the *Client Device*."

Section 7.4, Footnote numbers 4 and 5
The link to the CCS alternative hopping system is missing.
Insert the following link
http://cert.ccsemc.com/pub/
as an additional footnote

Section 7.5, second bullet item
Change
“When a *Client Device* without *In-Service Monitoring* is the UUT..."
to
“When a *Client Device* Without Radar Detection is the UUT..."

Section 7.5, third bullet item
Change
“When a *Client Device* with *In-Service Monitoring* is the UUT..."
to
“When a *Client Device* With Radar Detection is the UUT..."

Section 7.5, fourth bullet item
Change
“When a *Client Device* with *In-Service Monitoring* is the UUT..."
to
“When a *Client Device* With Radar Detection is the UUT..."

Section 7.7.3
Change
"...submit their *Uniform Channel Spreading* methodology..."
to
"...submit their proposed channel loading methodology..."

Change
“7.8 TEST PROCEDURES”
to
“7.8 DFS CONFORMANCE TEST PROCEDURES”

Section 7.8
Change the text to:

“The order in which most of the tests are performed is arbitrary, except that the *U-NII Detection Bandwidth* Test must be performed prior to the statistical performance tests of the Frequency Hopping Radar Type defined in Table 7.

The *U-NII Detection Bandwidth* Test is performed for all different *Channel* bandwidths that the device employs. The Frequency Hopping Radar Test is performed for all different *Channel* bandwidths that the device employs. All remaining tests are performed with the device configured to the lowest *Channel* bandwidth that the device employs.

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.”

Section 7.8.1
Add the following paragraph at the end of this section:

“The *U-NII Detection Bandwidth* test is repeated for each different *Channel* Bandwidth that the device employs.”

Section 7.8.2
Change
“7.8.2 Performance Requirements Check”
to
“7.8.2 Channel Availability Check”

Section 7.8.2
Change the text to:

“The Initial *Channel Availability Check Time* test must be performed first, in order to establish the timing of the *Channel Availability Check* and to verify that the UUT transmits on the chosen *Channel* in the absence of a radar signal.

The two remaining tests in this section define the procedures 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 during the *Channel Availability Check*. These two tests may be performed in either order.”

Section 7.8.2.1 a)
Change
"... 1 MHz RBW..."
to
"... 3 MHz RBW..."
to be consistent with the RBW requirements in the rest of the procedure.

Section 7.8.2.2
Change the first paragraph to:

“The steps below define the procedures to verify successful radar detection on the test *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. T_0 and T_1 below refer to Figure 15.”

Section 7.8.2.3
Change the first paragraph to:

“The steps below define the procedures to verify successful radar detection on the test *Channel* when a radar *Burst* with a level equal to the *DFS Detection Threshold* + 1 dB occurs at the end of the *Channel Availability Check* Time. This is illustrated in Figure 16. T_0 and T_1 below refer to Figure 16.”

Section 7.8.3
Change
“The steps below define the procedure…(I*n-Service Monitoring*).”
to
“The steps below define the procedure…(*In-Service Monitoring*). T_0 and T_2 below refer to Figure 17.”

Section 7.8.4
Change
“7.8.4 Statistical Performance Check”
to
“7.9 Statistical Performance Tests”

In old section 7.8.4 / new section 7.9, paragraph b)
Change
“…*Client Device* (with or without DFS)…”
to
“…*Client Device* (with or without Radar Detection)…”

In old section 7.8.4 / new section 7.9, paragraph d)
Change
“At Time T_0 the *Radar Waveform* generator…”
to
“At Time T_0 as shown in Figure 17 the *Radar Waveform* generator…”

Change
“Section 7.8.4.1 Short pulse radar Test”
to
“Section 7.9.1 Short Pulse Radar Test”

In old section 7.8.4.1 / new section 7.9.1, first paragraph
Change
"Once the performance requirements check is complete, statistical data will be gathered..."
to
"Statistical data will be gathered..."

Change
“Section 7.8.4.2 Long Pulse radar Test”
to
“Section 7.9.2 Long Pulse Radar Test”

Change
“Section 7.8.4.3 Frequency Hopping Radar Test”
to
“Section 7.9.3 Frequency Hopping Radar Test”

In old section 7.8.4.3 / new section 7.9.3, first paragraph
Change
"Statistical data will be gathered..."
to
"The *U-NII Detection Bandwidth* test must be performed prior to the Frequency Hopping Radar Test. Statistical data will be gathered..."

In old section 7.8.4.3 / new section 7.9.3
Add the following paragraphs at the end of this section:

“If the Method #2 Simulated Frequency Hopping Radar Waveform Generating Subsystem is utilized, the number of trials must be an integer multiple of (F_H – F_L +1) in order to yield the proper uniformly-distributed simulation in the frequency domain. The minimum number of trials is the smallest such integer multiple that yields a number greater than or equal to 30.

The Frequency Hopping Radar Test is repeated for each different *Channel* Bandwidth that the device employs. For each different *Channel* Bandwidth the associated *U-NII Detection Bandwidth* is used to evaluate the applicability of the hopping sequence in accordance with Footnote 3 and to generate the frequency hopping radar waveform in accordance with Section 7.4.1.3.”

Section 8.1 number 3
Change
"...indicate whether or not it has DFS capabilities..."
to
"... indicate whether or not it has radar detection capability..."

Section 8.1 number 8
Add b:
“b. Indicate all of the *Channel* Bandwidths that the device employs.”

Section 8.2 number 13c
Change
“For the Long Pulse Radar Type, spectrum analyzer plot of a single burst (1-3) pulses) on the *Channel* frequency should be provided.”
to
“For the Long Pulse Radar Type, if the Method #1 vector signal generator and the NTIA software is not utilized, vector spectrum analyzer plots of a single burst (1-3) pulses) on the *Channel* frequency should be provided.”

Section 8.2 number 13e
Change
“The *U-NII Detection Bandwidth*”
to
“The *U-NII Detection Bandwidth(s)*.”

Section 8.2 number 13f
Change
“…one frequency within the *U-NII Detection Bandwidth* should be provided.”
to
“…one frequency within the smallest *U-NII Detection Bandwidth* should be provided.”

Section 8.3 number 18
Change
“The DFS tests are to be performed on U-NII *Channel(s)* at the smallest *Channel* bandwidth (worst-case).”
to
“The *U-NII Detection Bandwidth* and Frequency Hopping Radar DFS tests are to be performed on U-NII *Channel(s)* at each *Channel* bandwidth that the device employs. All remaining DFS tests are to be performed on U-NII *Channel(s)* at the smallest *Channel* bandwidth (worst-case).”

Section 8.3 number 18 ii
Change
“Data Sheet showing the *U-NII Detection Bandwidth* for the *Channel(s)* used during the test.”
to
“Data Sheet showing all *U-NII Detection Bandwidth(s)* for the *Channel(s)* used during the test.”

Section 8.3 number 22a
Change
"...and compliance with the 260 milliseconds aggregate limit found in Table 4."
to
"...and compliance with the 60 milliseconds aggregate limit found in Table 4."

Table 8
Change
"(Use a Separate Data Sheet for Each Radar Type)"
to
"(Use a Separate Data Sheet for Each Radar Type)
(For Radar Type 6 use a Separate Data sheet for each Channel Bandwidth)"

Table 10
Change
"…Pulse 1-to-2 Spacing (usec)…"
to
"…Pulse 1-to-2 PRI (usec)…"

Table 10
Change
"…Pulse 2-to-3 Spacing (usec)…"
to
"…Pulse 2-to-3 PRI (usec)…"