Updated requirements for Dynamic Frequency Selection (DFS) in the European Union

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Note: The intent of this article is to share some proposed changes for the European Union's new dynamic frequency selection (DFS) requirements. However, in order to provide some general background information on this subject, the article begins with an excerpt from the article "Dynamic Frequency Selection and the 5 GHz Band," written by Mark Briggs and originally published in Conformity in December 2005.

> The advent of the 802.11a wireless market and the constant push to open up new spectrum for unlicensed use created a requirement for Dynamic Frequency Selection (DFS), a mechanism to allow unlicensed devices to share spectrum with existing radar systems. The regulatory requirements for DFS, along with requirements for Transmit Power Control (TPC) and uniform channel loading have been adopted in the US, Europe and Japan and are being considered by many other regulatory domains looking at adopting the 5GHz bands for unlicensed, and possibly licensed devices.
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> ETSI standard EN 301 893 V1.2.3 [1],the European Union's harmonized radio standard for unlicensed devices operating in the 5150 – 5350 MHz and 5470 – 5725 MHz frequency bands, was one of the first standards to reference DFS. It specifies the types of waveforms that systems operating in the 5250 – 5350 MHz and 5470 – 5725 MHz bands should detect.

In November 2008 the European Union's Official Journal (OJ) published a list of standards for the Radio and Telecommunications Terminal Equipment Directive (R&TTED). The list indicated that the radio spectrum standards for devices using the 5150-5350MHz and 5470-5725MHz unlicensed bands (e.g. WiFi 802.11a/n devices) remain as previously published - this is EN 301 893 V1.4.1 and EN 301 893 V1.3.1, with EN 301 489 V1.3.1 superseded by v1.4.1 on March 31st 2009.

The previous listing OJ listing had indicated that the V1.3.1 and V1.4.1 standards did not adequately address protection for meteorological radars using the 5600-5650MHz band and added the following requirements for that sub-band:

- Detection of interleaved radar waveforms (no previous requirement to detect non-constant pulse periods);
- Detection of pulse widths of 0.8us (previously minimum width was 1.0us);
- A 10-minute Channel Availability Check (CAC)

The requirements only applied in the sub-band and as an alternative, devices could be configured to not use the sub-band (e.g. blocking out channels 120 through 130 for 802.11an devices).

The **most recent listing** updates the footnote to EN 301 893 V1.4.1. This new note requires that devices subject to the radar detection requirements[1] in the 5250 – 5350MHz and 5470-5725MHz bands will need to be evaluated for their capability to detect interleaved radars across all DFS bands if they are to be placed on the market after **April 1, 2009**. The requirements for using the 5600-5650 MHz band remain unchanged (10-minute Channel Availability Check and ability to detect 0.8us pulse widths).

While the footnote does suggest that EN 301 893 V1.5.1 contains assessment methods to evaluate these DFS requirements, it also notes that these assessment methods are only ***proposed***. The implication[2] is that, until EN 301 893 V1.5.1 is harmonised, devices requiring radar detection capabilities in either of the DFS bands (5250-5350MHz and 5470-5725MHz) will need a Notified Body opinion if they are placed on the European market after April 1st 2009.

Implementation dates for extending the requirements for detection of 0.8us across the entire DFS bands and, ultimately, the detection of 0.5us pulse widths are still under consideration. Our information would suggest the following timetable for the phase-in of the new requirements:

Date	**Harmonised standard(s)**	**Requirements beyond those detailed in EN 301 893 V1.4.1**
July 1, 2008	EN 301 893 V1.4.1 EN 301 893 V1.3.1	In the 5600-5650MHz band devices must • Have a 10 minute CAC • Detect interleaved radars • Detect 0.8us pulse widths
March 31, 2009	EN 301 893 V1.4.1	In the 5600-5650MHz band devices must • Have a 10 minute CAC • Detect interleaved radars • Detect 0.8us pulse widths
April 1, 2009	EN 301 893 V1.4.1	In the 5600-5650MHz band devices must • Have a 10 minute CAC • Detect interleaved radars • Detect 0.8us pulse widths For the 5250-5350MHz and 5470-5600/5650-5725MHz bands devices need to: • Be able to detect interleaved radars
Proposed *April 1, 2010*	*TBD – possibly* *EN 301 893 V1.5.1*	*As above plus, for both 5250-5350MHz and 5470-5725MHz bands:* • *Detect **0.8us** pulse widths*
Proposed *April 1, 2012*	*TBD – possibly* *EN 301 893 V1.6.1*	*As above plus, for both 5250-5350MHz and 5470-5725MHz bands:* • *Detect **0.5us** pulse widths*
Italicized information is not official - only proposed. *EN 301 893 V1.5.1 is no longer a draft standard and the final version was released in December 2008.*		

[1] Client devices operating above 200mW eirp and all master devices

[2] The R&TTED requires the manufacturer to obtain a Notified Body opinion on the compliance status of radio transmitting devices that have not been fully assessed against a harmonized standard.

Additional Resources and Information

For a description of the operation of a system with DFS capability and definitions of some of the DFS terms used in this article please refer to Elliott's information on DFS, also published by Conformity Magazine.

Other articles and resources include:

- http://www.conformity.com/artman/publish/article_213.shtml
- Elliott's DFS page on our website
- In January 2007 Elliott presented a 1-hour webinar on DFS. While the audio record is no longer avail able the slides can be downloaded from our web site.
- European Union Official Journal R&TTED listing (2008/C 280/06) can be downloaded: http://ec.europa.eu/enterprise/newapproach/standardization/harmstds/reflist/radiotte.html

Table 1: EN 301 893 V1.4.1 vs EN 301 893 V1.5.1 DFS Requirements

Parameter	EN 301 893 V1.4.1 Requirement	EN 301 893 V1.5.1 Requirement
Minimum channel availability check time (CAC time)	60s	60s outside 5600-5650MHz 10 minutes for 5600-5650MHz sub-band
Off-channel channel availability check time	Off-channel CAC not implemented in this standard.	4 hours outside 5600-5650MHz 24 hours for 5600-5650MHz sub-band
Channel Move time	10s (maximum)	10s (maximum)
Channel Closing Time	260ms (maximum)	1s (maximum)
Interference Detection Threshold	-64dBm Transmit power ³ 200mW -62dBm Transmit power < 200mW	DFS Detection Threshold (dBm) = -62 + 10 - EIRP Spectral Density (dBm/MHz) + G (dBi)Shall not be lower than -64 dBm assuming a 0 dBi receive antenna gain.
Non-occupancy period	30 minutes (minimum)	30 minutes (minimum)

Note – Slave devices (aka client devices) do not need radar detection capabilities unless they have an output power (eirp) that exceeds 200mW. All devices need to demonstrate compliance with the channel move and channel closing times.

The off-channel CAC mechanism allows for non-continuous monitoring of one channel while operating on another channel in order for a device to be able to quickly move from one channel to another.

Table 2: EN 301 893 V1.4.1 Radar Parameters					
	Pulse Width (µs)	prf (pps)	Pulses per burst	Pulse Modulation	Success Rate
Type 1	1	750	15	None	> 60%
Type 2	1, 2 or 5	200,300,500, 800 or 1000	10	None	> 60%
Type 3	10 or 15	200,300, 500, 800 or 1000	15	None	> 60%
Type 4	1, 2, 5, 10 or 15	1200, 1500 or 1600	15	None	> 60%
Type 5	1, 2, 5, 10 or 15	2300, 3000, 3500 or 4000	25	None	> 60%
Type 6	20, 30	2000, 3000 or 4000	20	5 MHz (±2.5MHz) chirp	> 60%

Table 3: EN 301 893 V1.5.1 Radar Parameters						
	Pulse Width (µs)	prf (pps)	Pulses per burst[3]	Pulse Modulation	Bursts per waveform	Success Rate
Reference[1]	1	700	18	None	1	N/A
Type 1	0.8[4] – 5	200 - 1000	10	None	1	> 60%
Type 2	0.8[4] – 15	200 – 1600	15	None	1	> 60%
Type 3	0.8[4] – 15	2300 – 4000	25	None	1	> 60%
Type 4	20-30	2000 – 4000	20	± 2 . 5 M H z chirp	1	> 60%
Type 5[2]	0.8[4] – 2	300 – 400	10	None	2 or 3	> 60%
Type 6[2]	0.8[4] – 2	400 – 1200	15	None	2 or 3	> 60%

[1] The reference waveform is used for validating channel availability check and channel closing times.

[2] For waveforms 5 and 6 the radar bursts shall be interleaved. The difference between the pulse periods shall be 20 - 50 pps for type 5 and 80 - 400 pps for type 6. The pulse width and number of pulses per burst is the same for all bursts within the waveform.

[3] For the CAC and Off-Channel CAC requirements, the minimum number of pulses (for each PRF) for any of the radar test signals to be detected in the band 5 600 MHz to 5 650 MHz shall be 18.

[4] Until April 1st 2010 the minimum pulse width to be detected by devices operating outside of the 5600-5650MHz band is 1us. Devices that use the 5600-5650MHz band shall be capable of detecting pulse widths of 0.8us.

Additional notes:

Devices capable of operating in the 5600-5650MHz band can omit channels in that band from the usable channels at start-up.The minimum percentage of spectrum in any band that the device must be capable of using is 60 %.

Conclusion

Please note that the assessment methods listed in the footnotes are only proposed at this stage and until EN301 893 V1.5.1 is harmonized, manufacturers will be required to obtain a European Union Notified Body Opinion for devices operating in the 5150-5350MHz and 5470-5725MHz DFS bands which have radar detection capabilities (client devices which exceed 200mW EIRP and all master devices). In preparation for this requirement Elliott Laboratories has established the DFS testing capabilities to evaluate products against EN 301 893 V1.5.1 and has been working with independent 3rd party Notified Bodies to establish a short-term solution for the EU. In regards to a long-term solution Elliott Laboratories is well beyond initiating efforts to become an independent Notified Body focused towards the EU's R&TTE (targeted for completion by end of Q1 2009).

We hope that the information provided here is useful in helping you prepare for challenges posed by the new European Union's DFS requirements. It has been found that manufacturers who prepare and address upcoming changes in advance, generally have little or no problems meeting new DFS requirements. Thus minimizing significant impact on the product release process and maintaining current compliance on previously released products. However, manufacturers who fail to prepare properly, or who come into the process with unrealistic expectations about the time requirements and challenges associated with the DFS testing and certification process are generally disappointed in the end. We urge all manufacturers affected by these requirements to take the time to educate themselves and prepare accordingly.

For more information about how this change affects your products or for a price quote to test your product for DFS, please contact us at info@elliottlabs.com or call at 408-245-7800.

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