Cognitive Radio / TV White Space Standardisation

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IEEE 802.11af White-Fi

WiFi extension to TV White Space

• Objective:
  • Define modifications to both the 802.11 physical layers (PHY) and the 802.11 Medium Access Control Layer (MAC), to meet the legal requirements for channel access and coexistence in the TV White Space.
  • Use the OFDM PHYs with 5-, 10- and 20-MHz channel widths to specify the basis for a system that the regulators can approve for operation in the TV white spaces bands.

• Status:
  • Started in Jan 2010
  • Passed working group letter ballot and is now resolving comments
  • 802.11af Draft 2.2 specification went through 20 day peer review by 802.11 working group to assist producing an improved draft for recirculation letter ballot in January 2013.
  • Initial sponsor ballot is planned to start from July 2013 and RevCom/Standards Board approval is planned for June 2014.
### OFFICIAL IEEE 802.11 WORKING GROUP PROJECT TIMELINES - 2012-09-26

#### IN PROCESS - Standards, Amendments, and Recommended Practices

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IEEE 802.22 WRAN

Long range WiFi

- Enabling Rural Broadband Wireless Access Using Cognitive Radio Technology in TV Whitespaces
- Specification finished and published.
  - IEEE 802.22-2011(TM) Standard for Cognitive Wireless Regional Area Networks (RAN) for Operation in TV Bands was Published as an Official IEEE Standard on July 1st 2011.
  - Long range, cell radius 17-33 km (100km)
  - PHY-Optimized for long channel response times and highly frequency selective fading channels.
  - Sensing and geo-location.

More Info:
IEEE 802.22-10/0073r03
IEEE 802.19

Task Group 1: Wireless Coexistence in the TV White Space

• Scope: The standard specifies radio technology independent methods for coexistence among dissimilar or independently operated TV Band Device (TVBD) networks and dissimilar TV Band Devices.

• Purpose: The purpose of the standard is to enable the family of IEEE 802 Wireless Standards to most effectively use TV White Space by providing standard coexistence methods among dissimilar or independently operated TVBD networks and dissimilar TVBDs. This standard addresses coexistence for IEEE 802 networks and devices and will also be useful for non IEEE 802 networks and TVBDs.

• Status:
  • Draft DF3.02 passed working group letter ballot in November 2012 and the TG1 started in November resolving comments and updating the draft accordingly.
  • One third of the comments have been resolved so far and the TG1 will continue comment resolutions in a meeting on January 14-17, 2013.
  • Group agreed to uses IETF PAWS protocols as interface between Coexistence Manager and TVWS database.

• Timeline:
  • The first objective is to have an updated draft in a working group re-circulation ballot from the March 2013 meeting.
  • Subsequently, the draft is expected to be submitted to sponsor ballot in September 2013 and final approval is due in autumn 2014.

• Note: Vice Chair Mika Kasslin from NRC
IEEE DySPAN SC

Radio Interface for White Space Dynamic Spectrum Access Radio Systems Supporting Fixed and Mobile Operation

• The scope of the DySPAN-SC includes the following:
  • Dynamic spectrum access radio systems and networks with the focus on improved use of spectrum
  • New techniques and methods of dynamic spectrum access including the management of radio transmission interference
  • Coordination of wireless technologies including network management and information sharing amongst networks deploying different wireless technologies.

• Groups:
  • 1900.4: Architectural Building Blocks Enabling Network-Device Distributed Decision Making for Optimized Radio Resource Usage in Heterogeneous Wireless Access Networks
  • 1900.5: Policy-based control architectures and corresponding policy language requirements for managing the functionality and behavior of dynamic spectrum access networks.
  • 1900.6: Spectrum Sensing Interfaces and Data Structures for Dynamic Spectrum Access and other Advanced Radio Communication Systems (chair: Michael Gundlach NSN)
  • 1900.7: Radio Interface for White Space Dynamic Spectrum Access Radio Systems Supporting Fixed and Mobile Operation

• Status:
  • 1900.6: Spectrum Sensing Interfaces draft standard exist, sponsor ballot possibly in January 2013
The overall goals of this working group are to:

1. Standardize a mechanism for discovering a white space database.
2. Standardize a method for communicating with a white space database.
3. Standardize the data formats to be carried over the defined database communication method.
4. Ensure that the discovery mechanism, database access method, and query/response formats have appropriate security levels in place.

By "standardize" is not meant that the working group will necessarily develop new technologies.

Status:
- Use cases and requirements document is more or less finalized, just some editorials before publishing.
- Currently working on the solution document, which is halfway through.
- Stable draft expected late summer, finalization of the work by the end of the year.
- The solution document is going to specify an application protocol which runs on top of HTTPS to access the database and perform all the actions required by the regulators, and get the channel list.

Chairs: Brian Rosen and Gabor Bajko (Nokia)
ETSI BRAN

Harmonized standard EN 301 598

• White Space Devices (WSD); Wireless Access Systems operating in the 470 MHz to 790 MHz frequency band;
• Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive.
• EC mandate (TVWS just one issue)
• Limits of operation will be defined by a TVWS database, rather than by regulations:
  • The correct information exchanges between TVWS database, Master Device, and Slave Device
  • That the device is behaving correctly according to the information given
• Work started in Feb 2012, proceeding well, draft to be completed early 2013.
Weighless SIG

M2M

• Proprietary TVWS standard developed mainly for machine to machine communication, but spreading also to broadband.
• Main driver is a UK-based company Neul.
• Features:
  • A broadband downlink using single carrier modulation within a 6-8MHz TV channel.
  • A narrowband uplink with 96 uplink channels per downlink channel to accommodate the lower terminal transmit power while maintaining a balanced link budget.
  • Efficient MAC-level protocols that result in small headers per transmission and hence little overhead even when the payload is only a few bytes long
• Has been proposed to ETSI RRS, which is now working on the relevant use cases.
ECC SE 43

- CEPT has been defining technical and operational requirements for WSDs.
  - Technical reports, no direct regulatory power, but can be used by administrations and basis for further regulatory work
  - ECC Report 159 and complementary reports 185 & 186
- Work was done in two phases with all stakeholders involved:
  - Administrations, industry, operators, PMSE and broadcasters
- A concept of variable WSD-power depending on the TV reception conditions
- Studies on sensing were showing that a reliable detection of TV-transmissions would require very low sensing thresholds, which are unpractical at the moment.
- Therefore CEPT considers the geo-location as the most reliable technique for WSDs in 470-790 MHz band.
- SE43 work was completed in December 2012
- WG FM will take over the activities on TVWSD (FM 53)
Ofcom

UK activities on White Spaces

• Ofcom is facilitating access to white spaces, because they believe there are significant benefits to consumers.
• Simultaneous they will appropriately protect DTT and PMSE and try to minimise the regulatory burden.
• Ofcom would like to move faster than the rest of the Europe. Therefore they have been preparing their own regulatory framework and standard as *Voluntary National Standard (VNS)*.
  • They have involved all the relevant stakeholders and have been running a TV White Space Technical Group with regular teleconferences.
• Consultation on TVWS ending in Jan 2013.
• Will harmonise to European standards and regulation when this becomes available.
• Ofcom have been contributing heavily in the ETSI BRAN work

Source: Ofcom
Some Conclusions

- CR/TVWS standardisation is spread to several organisations around the world.
- There is no single technology which would be obvious for TVWS use. → Market fragmentation by different applications which use different technologies.
- Also other radio technologies like LTE and Wimax can, have been, and will be used for TVWS.
- In Europe the UK will probably be the first with larger scale operational use of unlicensed TVWS and will show if the concept flies and has real business use.
- ASA/LSA is another area with growing interest.