

Using the Amateur Radio Service to advance the Cognitive Radio/White Space Agenda

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Tetherless Access

Overview

- Review of ARS history of SS and SDR
- Review of SDR Components
- Conclusions & Recommendations

Amateur Radio Service (ARS) as a Research Metaphor

- Been around for almost 100 years
- Spectrum allocations treated as 'commons'
- Minimal power rule
- Self policing. Self certification of equipment
- None of the problems with experimental license (approval process)

ARS Spectrum Allocations

- 50-54 MHz
- 144-148 MHz
- 219-220 MHz
- 222-225 MHz
- 420-450 MHz
- 902-928 MHz
- 1240-1300 MHz
- 2390-2450 MHz
- 3.3-3.5 GHz
- 5.650-5.925 GHz

ARS Spread Spectrum R&D

- Took place from 1992-1997
- Used Special Temporary Authorization (STA)
- Robert Buaas STA
- Tucson Amateur Packet Radio (TAPR) STA
- Results supported the use of spectrum overlay

TAPR Statement of Direction - 1996

“TAPR believes that the technical facts support our conviction that conventional and spread spectrum systems can coexist without detriment to conventional systems on all frequencies from MF to EHF. To this end, TAPR will begin to research spread spectrum systems that will develop technology for future deployment.”

ARS Source Material

- “The ARRL Spread Spectrum Sourcebook” - ARRL <www.arrl.org>
- “Spread Spectrum Update: Tales from the Rebel Alliance” - TAPR <www.tapr.org>
- ARRL/TAPR Digital Communications Conference Proceedings - <www.tapr.org>

Regulatory Issues

- The regulatory issues with respect to access to the radio spectrum are the biggest barriers to the development and deployment of advanced broadband wireless systems in the US and most of the developed world today!

Chairman Kennard in '99

- “All of the new technologies -- mobile phones, faxed, wireless computers -- are consuming spectrum faster than we can make it available, and we are in danger of a spectrum drought. We need to find spectrum to build the web of wireless applications that will continue to fuel our economic growth. The demand for spectrum is simply outstripping supply.”

Chairman Kennard's Proposals

- Establish as a goal that spectrum become like any other commodity that flows fluidly in the marketplace.
- Look to technology to provide better spectrum management tools, for example, ultrawideband and software-define radios.
- Promote greater spectrum efficiency

Regulatory Precursors

- SS NOI in '81
- Introduced notion of wideband technologies (aka spread spectrum)
- Introduced 'spectrum overlay' as part of spectrum management toolkit
- NPRM in '84, R&O in '85
- SDR NOI, UWB NPRM, Work of TAC

Why Software Defined Radios

- Dale Hatfield, WØIFO,

Chief, Office of Engineering and Technology,
Federal Communications Commission

“This could stimulate a whole new generation of amateur innovation that not only includes the more spectrally efficient systems I mentioned earlier, but also radios that could adapt to their environment as well.”

Speech to AMRAD's 25th Anniversary Dinner June 17, 2000

Why Software Define Radios?

- **Comments of ARRL:** “ARRL is most interested in this proceeding, not only because of the utility of the Amateur Radio Service as a testing ground for different configurations of SDRs, but also because of the potential long-term opportunities for SDRs to effect substantial changes, even conceptual changes, in traditional frequency assignment and spectrum allocations decision making in all services.”

ARRL comments to the Notice of Inquiry Regarding Software Defined Radios dated June 14, 2000 (ET Docket No. 00-47 released March 21, 2000).

False Scarcity

- Paper by Paul Baran in 1994.
- Discussed use of spectrum as an open commons
- Defined a set of heuristic rules for ‘smart radios’, which could be used for proposed initiative

CR 'Rules of the Road'

Courtesy of Paul Baran - 1994

- Rule #1. Keep away from the big bullies in the playground. (Avoid the strongest signals.)
- Rule #2. Share your toys. (Minimize your transmitted power. Use the shortest hop distances feasible. Minimize average power density per Hertz.)
- Rule #3. If you have nothing to say, keep quiet.

CR 'Rules of the Road' (2)

- Rule #4. Don't pick on the big kids. (Don't step on strong signals. You're going to get clobbered.)
- Rule #5. Don't get too close to your neighbor. Even the weakest signals are very strong when they are shouted in your ear.

CR 'Rules of the Road' (3)

- Rule #6. If you feel you absolutely must beat up somebody, be sure to pick someone smaller than yourself. (Now this is a less obvious one, as weak signals represent far away transmissions; so your signals will likely be attenuated the same amount in the reverse direction and probably not cause significant interference.)

CR 'Rules of the Road' (4)

- Rule #7. Lastly, don't be a cry baby. (If you insist on using obsolete technology that is highly sensitive to interfering signals, don't expect much sympathy when you complain about interfering signals in a shared band.)

Conclusions

Amateur Radio Contributions to Initiative

- No FCC regulatory action required to deploy SDR's as Cognitive Radios
- Some early ground-breaking examples now available
- Start experimental program run in similar fashion as TAPR SS STA program to assist FCC

Use Existing Platforms

- GNU Radio <gnuradio.org.
- FlexRadio <flex-radio.com>
- HPSDR <openhpsdr.org>