

Global Regulatory Activity in SDR

SDR Forum Technical Conference November 17th 2003 Orlando

<http://www.intel.com/labs/radio/>

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Software Defined Radios

- SDR represents a disruptive technology that can enable many spectrum management policy reforms.
- This inflection point in technology must be met with an inflection point in regulations to realize its full potential.



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Major Regulatory Implications

- Spectrum management issues
 - Regulations to enable “Overlay” sharing on opportunistic basis.
- Device certification issues
 - How to certify a device that changes in field ?
 - Security mechanisms for software updates
 - Industry vs. regulations
 - Operating parameters need to be defined as a function of operating environment
 - Power as a function of threshold, etc
- Competitive issues
 - How “Open” should interfaces be?
 - Third party software vendors

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Software Defined Radios

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**Initial area of
regulatory
concern**

**Next area of
regulatory
interest**

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Agile Radio Zeitgeist

“the potential of this technology is immense - it cannot be overstated”

“Isn’t this just an excuse for spectrum regulators not to do their job?”

*Mike Chartier paraphrase of Scott Harris (who was being facetious @);
May 2003 Cognitive Radio Workshop*

responsive to these increased technological capabilities, the Commission’s spectrum policies can and should remain technology agnostic, but they should not be technology antagonistic.”

*Spectrum Policy Task Force Report;
ET Docket No. 02- 135; November 2002*

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1G US SDR Proceeding

- 1999 Discussions within FCC Technological Advisory Committee
- March 17, 2000 Notice of Inquiry
- December 7, 2000 Notice of Proposed Rulemaking
- September 13, 2001 First Report and Order (including new rules)

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1G US SDR Proceeding

- Rules Focused on Certification:
 - Definition of SDR for the purposes of the new regulation;
 - Distinguishes between users applications and radio software, “any party may install software applications on a device that are separate from the software that controls the radio frequency operating parameters.”
 - New Class III Permissive Change for Post-authorization radio software changes
 - Allows electronic labeling

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1G US SDR Proceeding

- Security:



Federal Communications Commission

Security/Integrity Issues - 1

- “We continue to believe that the best approach is to rely on a general requirement that manufacturers take adequate steps to prevent unauthorized changes to the software that drives their equipment.
- This will allow manufacturers flexibility to develop innovative software defined transmitting equipment while at the same time providing for oversight of the adequacy of such steps through the equipment authorization process.
- Accordingly, we are adopting the proposal in the *Notice* that manufacturers must take steps to prevent unauthorized software changes to a software defined radio.”

New FCC Software Defined Radio Policy; October 17, 2001

Michael J. Marcus- Associate Chief for Technology

Office of Engineering and Technology

Federal Communications Commission

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1G US SDR Proceeding

- Security:



Federal Communications Commission

Security/Integrity Issues - 2

- “The precise methods of ensuring the integrity of the software in a radio will be left to the manufacturer, and the manufacturer must document the methods in the application for equipment authorization.
- However, it is possible that we may have to specify more detailed security requirements at a later date as software defined radio
- We encourage information w
- Electronic lab

“The SDR Forum has indicated that it is continuing to develop methods for the security and authentication of radio software and that it will report its findings to the Commission.”

New FCC Software Defined Radio Policy; October 17, 2001

Michael J. Marcus- Associate Chief for Technology
Office of Engineering and Technology
Federal Communications Commission

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1.5G US SDR Proceeding

- Security:

- The SDR Forum prepared and delivered a Report on Issues and Activity in the Area of Security for Software Defined Radio.
- Key points:
 - The technology needed to ensure the security of SDR equipment already exists and its effectiveness has been proven in other sensitive areas.
 - Manufacturers continue to have strong market incentives to implement effective and reliable security safeguards. Equipment manufacturers and wireless system operators well know that any security breach will directly result in lost revenue, lost subscribers, and the possibility of FCC enforcement action. The SDR Forum is confident that the added cost of state-of-the-art security will be well below the added value of the additional security.
 - The Commission’s decision to forgo specific technical mandates was correct and should be continued.

Industry must be diligent in developing and deploying solutions to forbear regulatory action.

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EC SDR Proceeding

- November 2001, Germany introduced a proposal to set-up a TCAM subgroup to study the regulatory aspects of Software Defined Radio, and whether the R&TTE Directive effectively can deal with such products.

Accordingly a TCAM working group on SDR was established, chaired by

Separate Apps /Comms now a given

"Downloading software, which doesn't influence the radio characteristics of equipment but some other function is, for the purposes of this survey irrelevant. An update/installation of user application software⁴, or even a transmission protocol which does not affect the equipment's physical layer or its ability to avoid interference, is not SDR and is not taken into account in this questionnaire. Furthermore, it should be noted that these software changes are not radio-specific and are common to all software-based electronic systems."

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EC SDR Proceeding

US & EU conformity difference; *Manufacturer vs. user liability for non-conformance*

US

- Manufacture responsible for devices operation (*"Any U-NII device that operates in the 5.15-5.25 GHz band shall use a transmitting antenna that is an integral part of the device. FCC Part 15-15.407 (d)"*)

When applied to SDR, it naturally followed then that;



"Manufacturers must take steps to prevent unauthorized software changes to a software defined radio."

EU

- Manufacture responsible for compliance as designed and manufactured (*"manufacturer must take all measures necessary in order that the manufacturing process ensures compliance of the manufactured products"*) and used as intended (*"manufacturer or the person responsible for placing the apparatus on the market provides information for the user on the intended use of the apparatus."*)

However such an EU rule would represent an expansion of manufacture liability

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Japan

• MPHPT SDR Activities

• Objectives:

- Necessary requirements for rule making in order to obtain effective utilization of radio spectrum
- Necessary certification system for SDR
- TELEC commissioned by MPHPT in 2000 & 2001
 - Organized study group of external experts.
 - Current state of SDR
 - Test of SDR equipment.
 - Alteration of function or performance by software change
 - Questions caused by illegal modification, prevention methods and study on software key
 - Study of test and conformity certification procedures with technical regulations for SDR equipment.

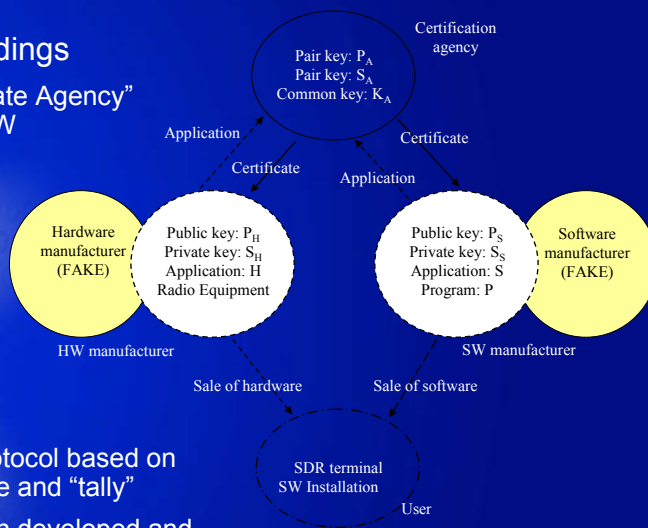
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Japan

• TELEC Study Findings

- Proposes “Certificate Agency” authorize SW & HW



- Propose a new protocol based on electronic signature and “tally”
- Prototype has been developed and well-worked

MPHPT is considering regulation for introduction of software-defined radio

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Recent Global Roundtable



Software-Defined Radio

SOFTWARE-DEFINED RADIO (SDR) REGULATOR'S FORUM – Monday 15 September 2003

Excellent Resource
More in depth presentations on this material
available on web site

<http://www.radio.gov.uk/topics/research/topics/converge-new-emerging/sdr/sdr-index.htm>

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Potentially Different Approaches to Security Regulation

**Manufacture not
responsible for
Un-authorized software**

ITU REGION 1

**Manufacture must take
steps to prevent
Un-authorized software**

ITU REGION 2

**Certificate authority
controls
Software downloads**

ITU REGION 3

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2G SDR Proceedings

- Spectrum reform
 - Deploying SDR/Agile/Smart radios to enable innovative spectrum management techniques (Overlays)
- Global Circulation
 - Beginning a framework of coordinated regulatory treatment.

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2G SDR Proceedings

- 5Ghz DFS & TPC
- Unlicensed Devices in TV bands
 - (FCC 02-380)
- Second FCC SDR proceeding, Cognitive radio
 - (03-108)

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5Ghz WRC Resolution Inflection point

- Employs new spectrum allocation technique; using smart radios (*First manifestation of "Cognitive" functions DFS & TPC*) to enable "Overlay rights".
- EC lead critical for success in industry/DoD compromise & WRC resolution
- ETSI Standard "quite complete and mature"^[1]

^[1] IEEE Comment to FCC 5 GHz NPRM @ 18



Unlicensed Devices in TV bands (FCC 02-380)

- Proposes using smart radios to find and access vacant TV channels
- Radical reform for FCC
- Comments & Reply Comments filed



Second FCC SDR proceeding, Cognitive radio (03-108)

- First generation focused on interference prevention, FCC now would like to create incentives for deployment.
- Workshop held May 19th
- Item expected end of year, could be either NOI or NPRM.

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Changing Global Mindsets

ITU process to WRC '07

ITU-T Study Group 5.3 DELIVERABLES FOR IMT2000 & BEYOND
SEQUENCED FOR A WORK MANAGEMENT PERSPECTIVE
OF WORKFLOW & DEPENDENCIES AS RELATES TO WRC 07 (2003-2007)

Meeting	Start Date	End Date
10	1st 2003	18th 2nd 2003
11	2nd 2003	17th 3rd 2003
12	1st 2004	18th 1st 2004
13	2nd 2004	19th 2nd 2004
14	1st 2005	18th 2nd 2005

Vision
Recommendation
Oct 2002

WRC'07 / Agenda 1.4 / RESOLUTION 228 - Studies on frequency-related matters for the future development of IMT-2000 and systems beyond IMT-2000 as defined by ITU-R, -which considering at j) "that many countries have not yet made available spectrum already identified in the Radio Regulations for IMT-2000, due to various reasons, including the use of this spectrum by existing services," resolved at 5 that such studies **"should include sharing and compatibility studies with services already having allocations in potential spectrum for the future development of IMT-2000 and systems beyond IMT-2000 taking into account the needs of other services;"**^[1]

....recognized at e) "the need, in many developing countries and countries with large areas of low-population density, for the cost-effective implementation of IMT-2000, the future development of IMT-2000 and systems beyond IMT-2000, and that the propagation characteristics of frequency bands below those identified in No. 5.317A result in larger cells;" and further at j) "that frequencies below those identified for IMT-2000 in No. 5.317A are extensively used by terrestrial services with applications other than IMT-2000 and systems beyond IMT-2000,"^[2] resolved **"to invite ITU-R to conduct regulatory and technical studies on the usage of frequencies below those identified for IMT-2000 in No. 5.317A for the future development of IMT-2000 and systems beyond IMT-2000, notably assessing their advantages and disadvantages"**

Outside ITU

(21)

WRC -07

[June 2007]

Note: (11 -14) designates start & due date by meeting no.

ITU-R SDR ACTIVITY

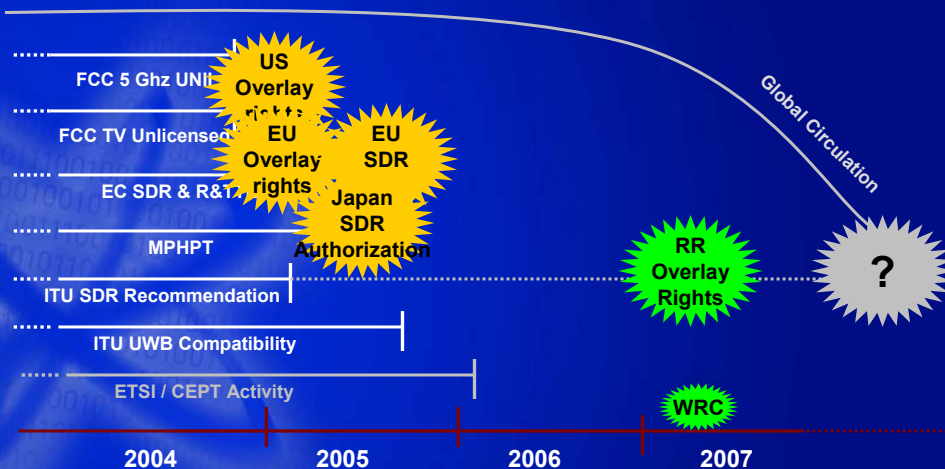
Working Document towards Preliminary draft new [REPORT/Recommendation]: Software Defined Radio [imt.sdr]

- Opportunities:
 - Promote innovative spectrum management
 - Access to new spectrum
 - “Impedance” matching spectrum to service.
 - Global circulation
 - Allow frequency agile devices to migrate
 - Coordinate certification regimes
 - Encourage standards activity
 - Justifies forbearance by regulators

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Changing Global Mindsets



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Global Circulation



- Advance Research Projects Agency (DARPA) neXt Generation (XG) program.
 - Seeks to build a policy based framework to enable global SDR circulation.
- Policy-Based “Metalanguage”
 - Translates Policy Rules Into Radio Behavior Controls
 - Control Operating Rules Based on Policies and Situations



XG Program Components

Measurements (Temporal, Spectral, Dimensional, Energy Characteristics) and **Policy-Based Controls** (Control of Features, Priorities, Allocations, Exclusions, ...) feed into the **XG Protocol Set**.

The **XG Protocol Set** leads to **Initial XG Implementation**, which then leads to **Military & Civil Communications and Sensor Applications** and **Transition to Military Use**.

The Primary Product XG Program is **Not a New Radio**, but a **Set of Advanced Technologies** for Dynamic Spectrum Access.

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Summary

- 1G efforts centered around codifying the fact that there is a regulatory distinction between Apps and other software.
 - Done- in US & EU
- 1.5G has focused on regulatory forbearance of security mechanisms to protect radio software.
 - Vigilance @ FCC
 - Maintain R&TTE flexibility
- 2G efforts are focusing on enabling innovative spectrum management techniques (Overlays) .
 - Spectrum Policy Task Force Report germinated three expeditious smart radio proceedings.
 - ITU-R interests in spectrum sharing coinciding nicely with 8F Recommendation.
- Certification issues still critical to global SDR circulation.
 - Potential goal of ITU-R recommendation
 - Potential ETSI activity to drive coordination