



# Regulatory Aspects of Software Defined Radio



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Presented by:  
Eng. Sami H. O. Salih  
NTC, Sudan  
sami@ntc.org.sd

## .... Motto ....

- *Anywhere*
- *Anytime*
- *Anywave*



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## **Part (I)** About SDR:

Contain General View of SDR systems, Standardizations, Benefits, and Areas of uses.

## **Part (II)** SDR Regulations:

Regulatory Issues and Concepts.

# **Part (I)**

## About SDR:

- ✓ General Overview
- ✓ Definitions
- ✓ Standardizations Bodies
- ✓ Basic SDR
- ✓ Areas of Successful SDR Examples

## Overview

- ❑ A Software-Defined Radio (SDR) system is a radio communication system where components that have typically been implemented in hardware (e.g. mixers, filters, amplifiers, modulators/demodulators, detectors. etc.) are instead implemented using software on a personal computer or other embedded computing devices.
- ❑ Devices such as digital signal processors (DSPs) and field programmable gate arrays (FPGAs) use software to provide them with the required signal processing functionality.
- ❑ This technology offers greater flexibility and potentially longer product life, since the radio can be upgraded very cost effectively with software.

## Definitions



### **Software Defined Radio System:**

A radio system in which radio frequency operating parameters including, but not limited to, frequency range, modulation type, or output power, can be set or altered by making a change in software, after the normal installation process and without making any changes to hardware components.

### **Cognitive Radio System:**

A radio system that is aware of its environment and internal state and can make decisions about, and adjust, its operating characteristics based on this information and predefined objectives.

Proposed By: [Radiocommunication Study Groups](#)

## Standardizations Bodies

### ❖ SDR Forum

The SDR Forum is an open, non-profit corporation dedicated to supporting the development, deployment, and use of open architectures for advanced wireless systems.

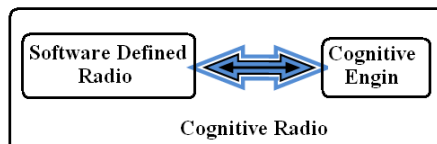
#### Software Defined Radio:

Radio in which some or all of the physical layer functions are Software Defined.

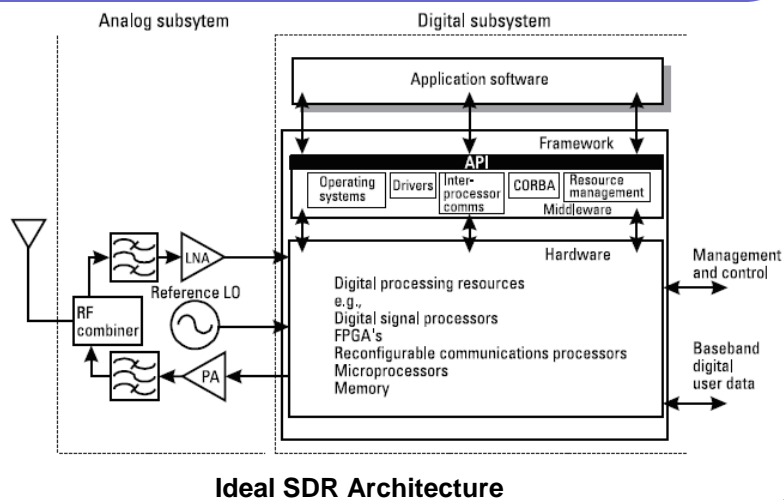


## Different Terms

- ❑ **Digital Radio;** the baseband signal processing is invariably implemented on a DSP.
- ❑ **Software Radio;** an ideal SR directly samples the antenna output.
- ❑ **Software Defined Radio;** SDR is a presently realizable version of SR.
- ❑ **Cognitive Radio;** combines SDR with a CE to get the feature of self configuring



## Basic SDR



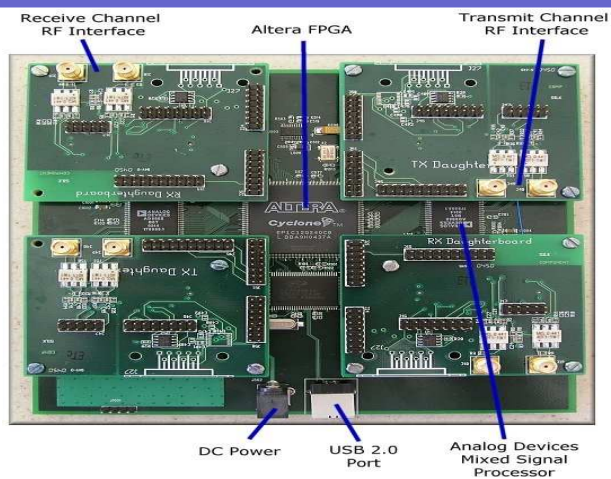
## Benefits of SDR

- **Manufacturers**
  - ✓ Grouping of H/W platform sets
  - ✓ Cost reduction
  - ✓ Ability to S/W improvements
- **Operators**
  - ✓ New services
  - ✓ Services upgrades on existing systems
  - ✓ Flexible coverage / Dynamic Frequency Allocation
- **Customers**
  - ✓ Services personalization
  - ✓ Improve roaming
  - ✓ Reduction of CPE Obsolescence

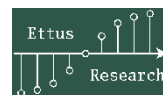
## Successful SDR Examples

- Educational / Practice.
- Measurements.
- Multifunctional Systems.

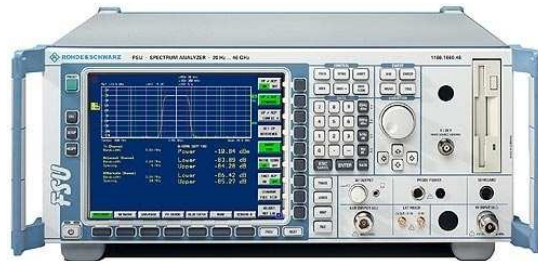
## SDR Kit



Universal  
Software Radio  
Peripheral (USRP)



## Spectrum Analyzer



## SDR BTS

### Flexent® OneBTS™ Base Station For TDMA PCS Networks



Lucent Technologies' Flexent® OneBTS™ Base Station for TDMA PCS Networks is a high capacity and high coverage base station for stand-alone and co-located indoor configurations. The Flexent OneBTS common platform architecture leverages market proven hardware and software technologies developed for the Flexent TDMA platforms. This innovative base station uses a Multiple Carrier Power Amplifier (MCPA) that supports seamless IS-136 voice growth in the 1900 MHz spectrum. Initial configurations will support up to 10 ANSI-136 carriers per sector with future releases supporting up to 20 ANSI-136 carriers per sector to deliver maximum spectral efficiency and substantially reduce your cost per carrier.

**Lucent Technologies**  
Bell Labs Innovations



## **Part (II)**

### **SDR Regulations;**

- ✓ Regulatory issues of SDR
- ✓ Regulatory Concepts
- ✓ Conclusion & Future Recommendations

## **Regulatory Concepts**

There are four broad areas of inquiry that comprise common areas of foundation information about SDR that are applicable on a global basis of regulatory review;

- 1. Technology***
- 2. Spectrum Efficiency and Sharing***
- 3. Specifications and Type Approval***
- 4. Interoperability***



## Technology

- ❑ It is evident that SDR is sufficiently developed to move forward with the introduction of regulation, or the modification or removal of regulations as the case may be, to allow SDR products to enter the marketplace.
- ❑ SDR becomes real specially with the rapid increasing on Microprocessor's processing power, SDR be

## Spectrum Efficiency and Sharing

**Spectrum:** is a basic natural resource. However Radio Spectrum has some specific characteristics:

- Can be Reused.
- Various parts depend on propagation characteristics.

Telecommunication market is increasing dramatically, specially on mobile/wireless, and the Consequence of that is:

**Scarcity of Radio Spectrum is Increasing**

## Cont. . .

- ❑ It is common to think that SDR as a new radio implementation technology could help radio spectrum users and regulators to get the most out of any given set of spectrum allocations.
- ❑ The answer,

**“ Critical deployed mass ”**

## Specifications and Type Approval

SDR terminal will just download the software required by a specific system and then act as any terminal of that system.

The problems is;

- ❑ **Ability to modify the software of a radio after manufacturing/licensing.**
- ❑ **Intellectual Propriety Rights.**

**So, what the type approval process will actually approve ?  
H/W platform, S/W, OR every possible Combination in-between.**

## Cont. . .

The prospect of an evolving radio platform raises questions about type approval. In remarks before the SDR Forum, the U.S. Federal Communications Commission (FCC) described type certification of software radios as presenting “regulatory issues.” These include the following:

1. For which service(s) is an SDR approved ?
2. Is a new approval needed for each change to an already approved SDR unit ?
3. How does the FCC enforce the equipment authorization rules for SDRs ?
4. How can an unauthorized use of an SDR be prevented ?

## Interoperability

- ❑ SDR doesn't develop new services, nor changing protocols, it's just alternative way of designing existing systems with the concept of platform sharing.
- ❑ The practical aspects of the wide scale use of SDR as an interoperability mechanism must recognize that there must be a sufficient 'critical mass' of SDR-capable equipment for all impacted services being deployed in the marketplace over time.
- ❑ There is a learning curve and a transition period that must be acknowledged.

## Conclusion & Future Recommendations

- From the perspective of keeping pace with an ever-changing air interface environment and enabling multi-technology roaming, SDR has key advantages for the network operator.
- Demand for more Spectrum lead to Applying SDR approaches widely.
- Regulatory bodies must starts to put frameworks to manage SDR systems.
- SDR techniques seem to have considerable potential in solving today's disarrayed frequency allocation and therefore more efficient and flexible frequency management in future.
- Corporations with academics/organization is recommended.

## SDR Conglomerate



Electronic Systems Research Centre  
(ESRC)



Telematic Research Group

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# Thank

# You

Eng. Sami H. O. Salih  
National Telecom Corp. (NTC)  
Department of DAN  
<http://sami.h.o.salih.googlepages.com>