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August 3, 2000

Magalie Roman Salas  
Secretary  
Federal Communications Commission  
445 Twelfth St., S.W.  
Washington, D.C. 20554

RECEIVED

AUG 3 2000

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

Re: **FCC Notice of Inquiry Regarding Software Defined  
Radios; ET Docket No. 00-47**

Dear Ms. Salas:

I am writing to inform you that Terry Williams of AirNet Communications Corporation ("AirNet"), Dick Blake (consultant to AirNet), and I (counsel to AirNet) made *ex parte* presentations on Wednesday, August 2, 2000 to the FCC's Office of Engineering and Technology ("OET") and to the Public Safety and Private Wireless Division ("PSPWD") of the Wireless Telecommunications Bureau in the above-referenced proceeding. OET staff present were: Dale Hatfield, OET Chief; Julius Knapp, Chief, OET Policy and Rules Division; and Hugh Van Tuyl, OET Senior Engineer; PSPWD staff present were: D'wana Terry, PSPWD Chief; Herb Zeiler, PSPWD Deputy Chief; and Ramona Melson, Zenji Nakazawa, and Jeanne Kowalski.

During the FCC meetings, AirNet discussed the attached presentation. Please contact me if you have any questions.

Respectfully submitted,



Michele C. Farquhar  
Counsel for  
AirNet Communications Corporation

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August 3, 2000

Page 2

cc: Dale Hatfield

Julius Knapp

Hugh Van Tuyl

D'wana Terry

Herb Zeiler

Ramona Melson

Jeanne Kowalski

Zenji Nakazawa

Enclosure



The 6511 Economy E-Parts

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# AirNet Communications Corporation

**Presentation to the FCC**

**August 2, 2000**

**Reference Notice of Inquiry ET Docket No. 00-47**

*AirNet Confidential and Proprietary*

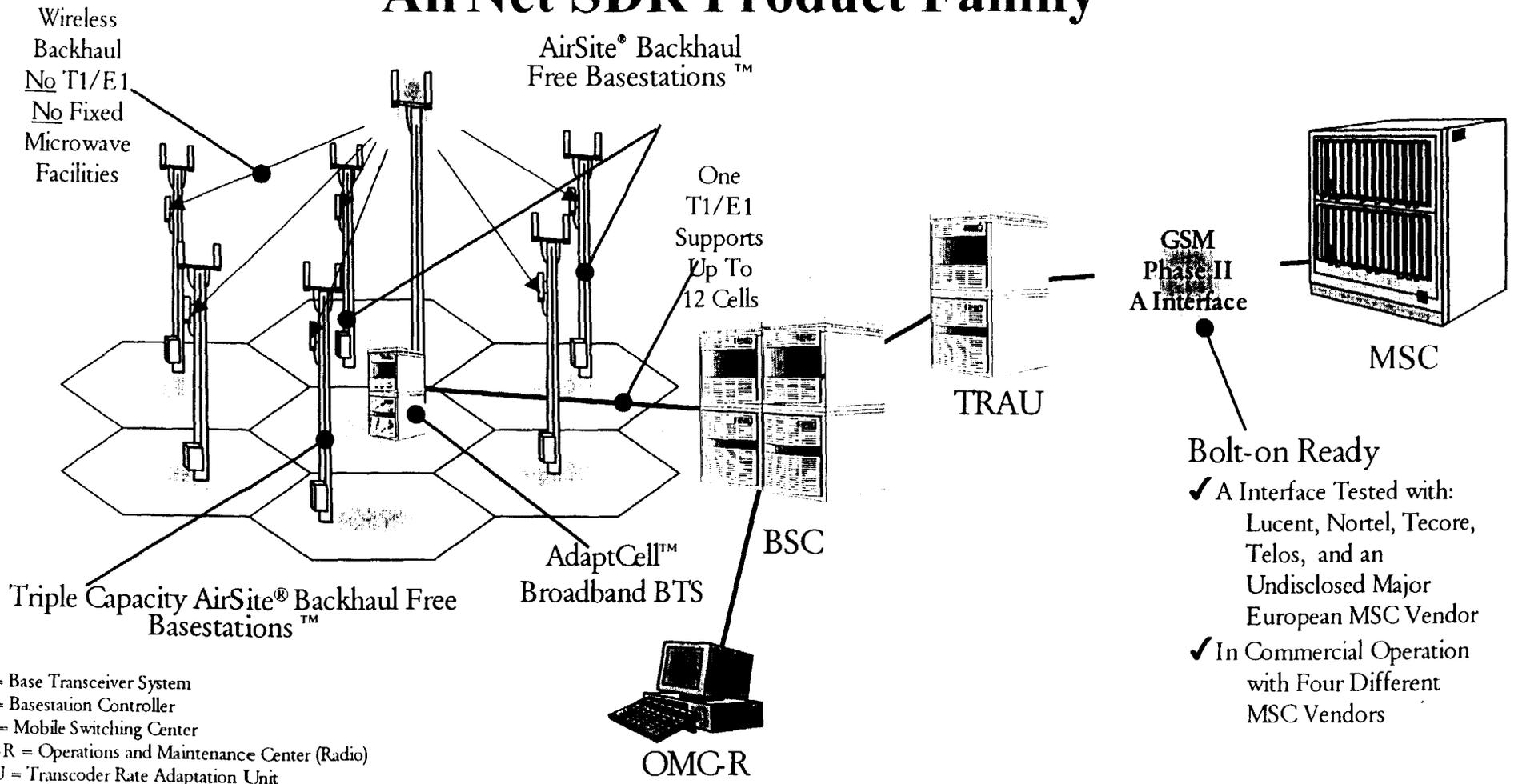
## FCC/AirNet Agenda

- **Introductions**
- **AirNet NOI Technology Presentation**
  - ◆ **AirNet Overview**
  - ◆ **State of the Art**
  - ◆ **Interoperability**
  - ◆ **Spectrum Efficiency/Sharing**
  - ◆ **Approval Regulation**
  - ◆ **Recommendations**
- **Conclusion**

## Company Overview

- **Founded in 1994**
  - ◆ **Headquartered in Melbourne, Florida USA**
  - ◆ **Over 300 Employees, primarily wireless software engineers**
  
- **Harris Corporation Technology Spin-Off**
  - ◆ **Broadband software-defined basestation technology**
  
- **Develops, Manufactures, and Markets Advanced GSM Basestation Products to GSM Operators Worldwide**
  - ◆ **Leading-edge broadband, software-defined basestation**
  - ◆ **AirSite<sup>®</sup> backhaul-free basestation<sup>™</sup>**
  - ◆ **Twenty Service Providers, Shipped first product in May 1997**
  
- **Strong Patent Portfolio – total 68 (36 issued, 32 filed)**

## AirNet SDR Product Family

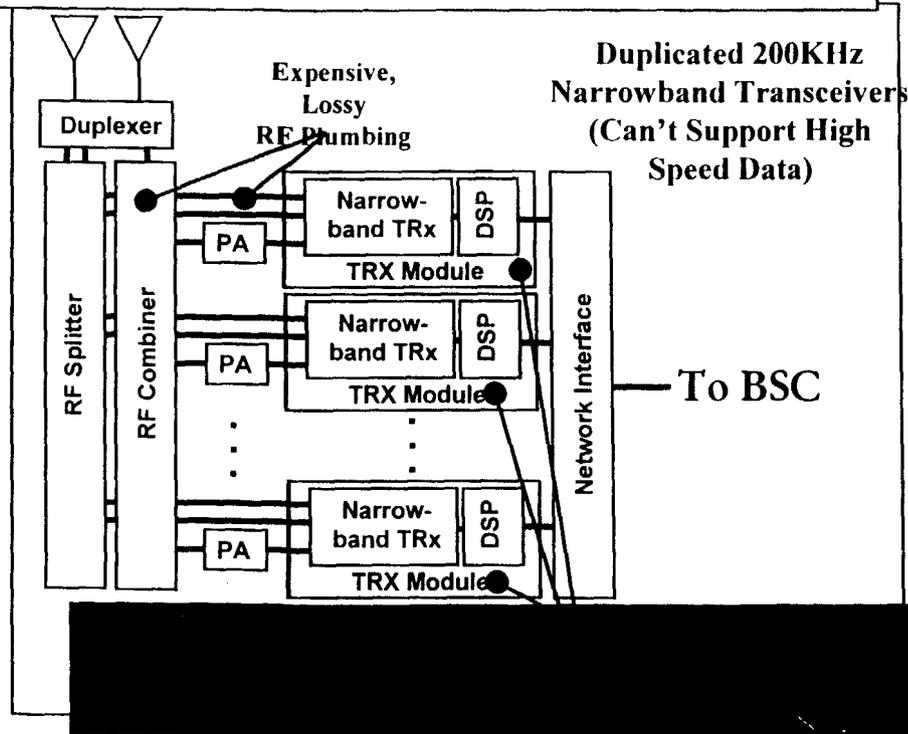


BTS = Base Transceiver System  
BSC = Base Station Controller  
MSC = Mobile Switching Center  
OMC-R = Operations and Maintenance Center (Radio)  
TRAU = Transcoder Rate Adaptation Unit

# The AirNet Broadband Advantage

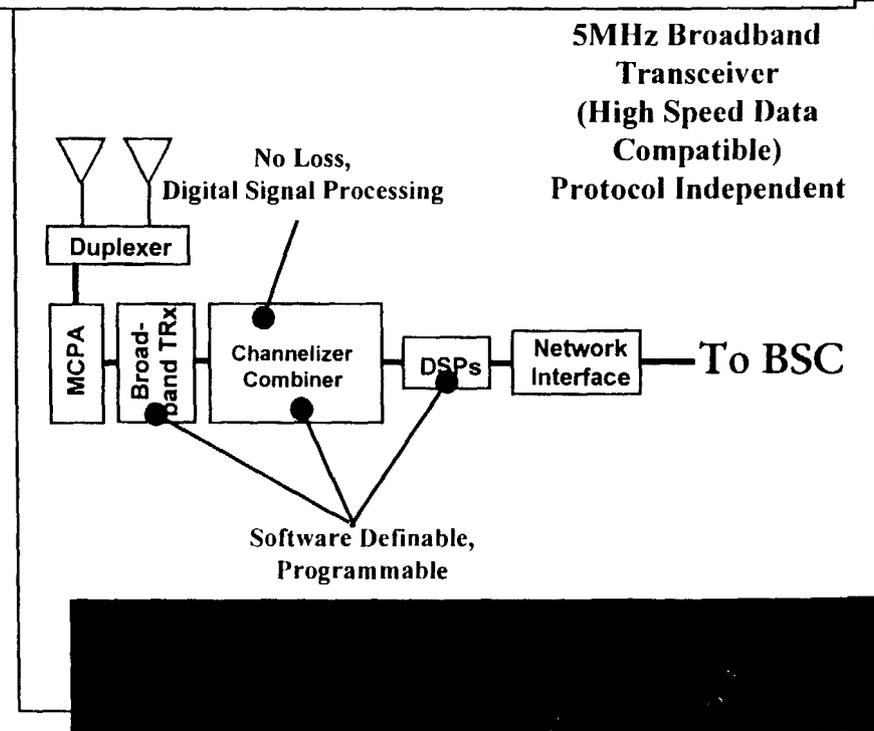
## Traditional Narrowband Hardware Basestation

- ◆ Standard Specific
- ◆ "Throw it Away for High-Speed Data"
- ◆ Expensive, Lossy RF Plumbing
- ◆ Proprietary Hardware at Bottom of Cost-Reduction Curve
- ◆ Most Hardware, Lowest Reliability, Highest Cost

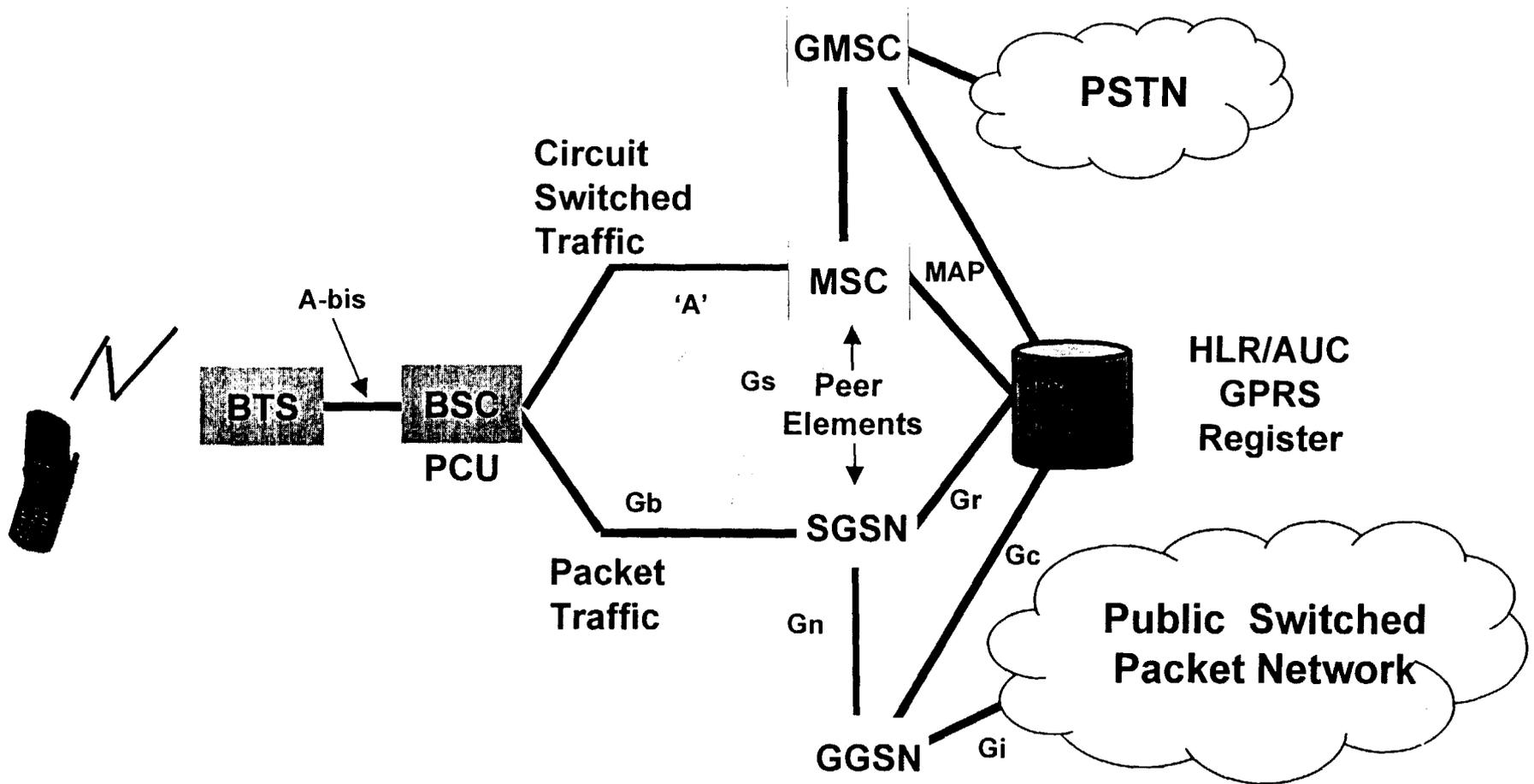


## AirNet Broadband, Software-Defined Basestations

- ◆ Multi-Protocol "Future Proof"
- ◆ Software Definable, High-Speed Data Ready
- ◆ Loss Free, Digital RF Combining/Splitting
- ◆ Digital Intensive Architecture Follows Digital Price Curve
- ◆ Least Hardware, Highest Reliability, Lowest Cost
- ◆ Only Viable Platform for Adaptive Antennas



# Architecture - GSM with GPRS



## The AirNet SDR Evolution

- **Evolution from 2G to GPRS, EDGE and WCDMA**
  - ◆ **Overlay solutions to minimize initial investments**
  - ◆ **Software Defined Radio Attributes**
    - ⇒ **Allows support of all desired protocols based on market needs and terminal availability**
    - ⇒ **Dynamic allocation of traffic/data resources in DSP**
    - ⇒ **Provide services according to actual load**
    - ⇒ **Offers smooth simultaneous roll-out of GSM/EDGE**
    - ⇒ **No investments outside of software, reduced cost and size**
    - ⇒ **Software radio allows for new modulation, symbol rate, coding**
    - ⇒ **Variations to data coding schemes affect software only**
    - ⇒ **Superior digital filtering of adjacent/alternate channels**
    - ⇒ **Allows for better frequency re-use and AirSite<sup>®</sup> backhauls**
  - ◆ **Only reasonable way to migrate to 3G, no hardware/software throw-away.**

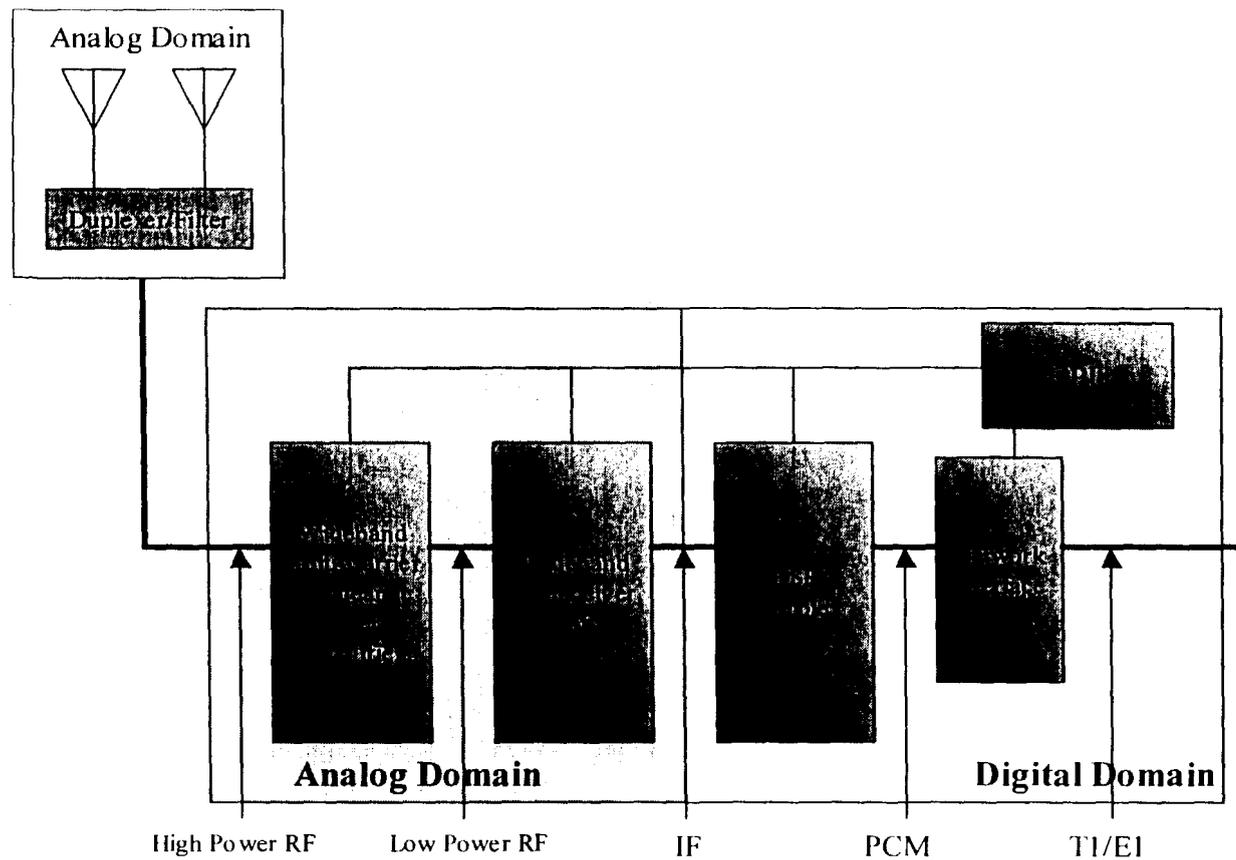
## State of the Art

**AirNet is the only manufacturer in the world actively developing and deploying commercial SDR base stations using Digital Signal Processing (DSP) techniques to control power, frequency, modulation, and signaling protocols and provide multi-mode multi-band wireless services.**

**In 1998 the AirNet SDR technology became the only base station sub-system ever to be awarded the prestigious “GSM World Award” by over 200 worldwide service providers.**



# High Level Architecture of an SDR Base Station



## Major Components of SDR Base Station

- ◆ **Duplexer/Filter**
  - ⇒ Duplexer provides the ability to transmit and receive radio frequency (RF) signal using a common antenna
  
- ◆ **Wideband Multi-Carrier Power Amplifier/Wideband Transceiver Unit**
  - ⇒ Wideband Multi-Carrier Power Amplifier (MCPA) provides linear amplification of multiple transmitted radio carrier signals.
  - ⇒ Wideband Transceiver Unit (WTU) provides upconversion and downconversion of a 5 MHz bandwidth of spectrum containing multiple radio carriers between the radio frequency (RF) and the intermediate frequency (IF).

## Major Components of an SDR Base Station (Cont..)

- ◆ **DSP Complex contains one or more DSPs to support:**
  - ⇒ **Channelizer function receives the wideband IF from the WTU that has been digitized by the A/D converters and extracts all of the radio carriers and downconverts them to baseband signals.**
  - ⇒ **Combiner function receives the baseband signals and upconverts each radio carrier to a unique IF signal and simultaneously combines all IF signals into a single wideband digital signal. The single wideband IF signal is fed to the WTU.**
  - ⇒ **Demodulation/modulation functions.**
  - ⇒ **Equalization.**
  - ⇒ **Error correction and interleaving.**
  - ⇒ **Power control for both uplink and downlink.**
  - ⇒ **Diversity signal processing.**
  - ⇒ **Synchronization.**

## Major Components of an SDR Base Station (Cont.)

### ◆ CPU

- ⇒ Program the center frequency of the radio carriers via software by configuring the WTU and the DSP Complex.
- ⇒ Call processing and mobility management functions.
- ⇒ OA&M functions such as software download and supervision.
- ⇒ Central clocking and synchronization for all sub-unit operations.

## Interoperability

- ◆ **SDR can provide interoperability today between different services by supporting multiple protocols and other radio parameters such as modulation, frequency, and power.**
- ◆ **The technology exists today to develop an SDR system that will provide a more efficient wireless radio system using DSP techniques and provide multi-mode and multi-band services between e.g., public mobile services and personal communication services.**
- ◆ **Interoperability will be a driving force for the evolution from 1G to 2G to 2G+ to 3G. Legacy 1G cellular systems can be retired but analog terminals can remain in service.**
- ◆ **There is nothing inherent in SDR that will encourage uniformity of standards.**

## Spectrum Efficiency & Sharing

### ◆ SPECTRUM EFFICIENCY

- ⇒ SDR will not be a panacea for eliminating spectrum shortages in the near term.
- ⇒ Spectrum efficiency is generally limited today by the RF parameters of the existing standards.
- ⇒ In the future with the advent of digital RF sampling at the antenna and more efficient modulation techniques for new standards, spectrum efficiency can be significantly improved.

## **Spectrum Efficiency & Sharing (Cont...)**

### **◆ SPECTRUM SHARING**

- ⇒ **Improved spectrum efficiency through spectrum sharing (searching for idle or unused quiet channels) is realistic.**
- ⇒ **In the near term, spectrum sharing should be limited to well defined frequency bands of similar technologies.**
- ⇒ **Dynamic Channel Allocation and Reuse requires additional standards work.**

## FCC Regulations

- ◆ **AirNet believes that changes to radio software can be effectively self-regulated and FCC approval is not required unless software changes are made that impair the RF performance as required by the FCC.**
- ◆ **AirNet suggests that re-certification is required only when software or hardware changes are made that degrade the RF interference beyond the limits established by the FCC.**

## Proposed Recommendations

- ◆ **Consider FCC rule change proposals to permit experimental licensing for SDR.**
- ◆ **Consider the release of a NOI that would permit the same type of openness (channel spacing/interference) as permitted in Part 24 to be applied to other bands that SDR type architectures could operate.**
- ◆ **Coordinate with the Asian and European regulators to harmonize certification.**
- ◆ **Continue to support open network interfaces and air interfaces.**

## Conclusion

- ◆ **Software Defined Radio technology is economically available and in commercial deployment today.**
- ◆ **SDR technology benefits U.S. and international consumers, wireless operators, and wireless infrastructure manufacturers.**
- ◆ **SDRs can improve interoperability.**
- ◆ **SDRs do not warrant regulation changes or re-certification for software upgrades.**