

SDR in ORBIT: LTE-U

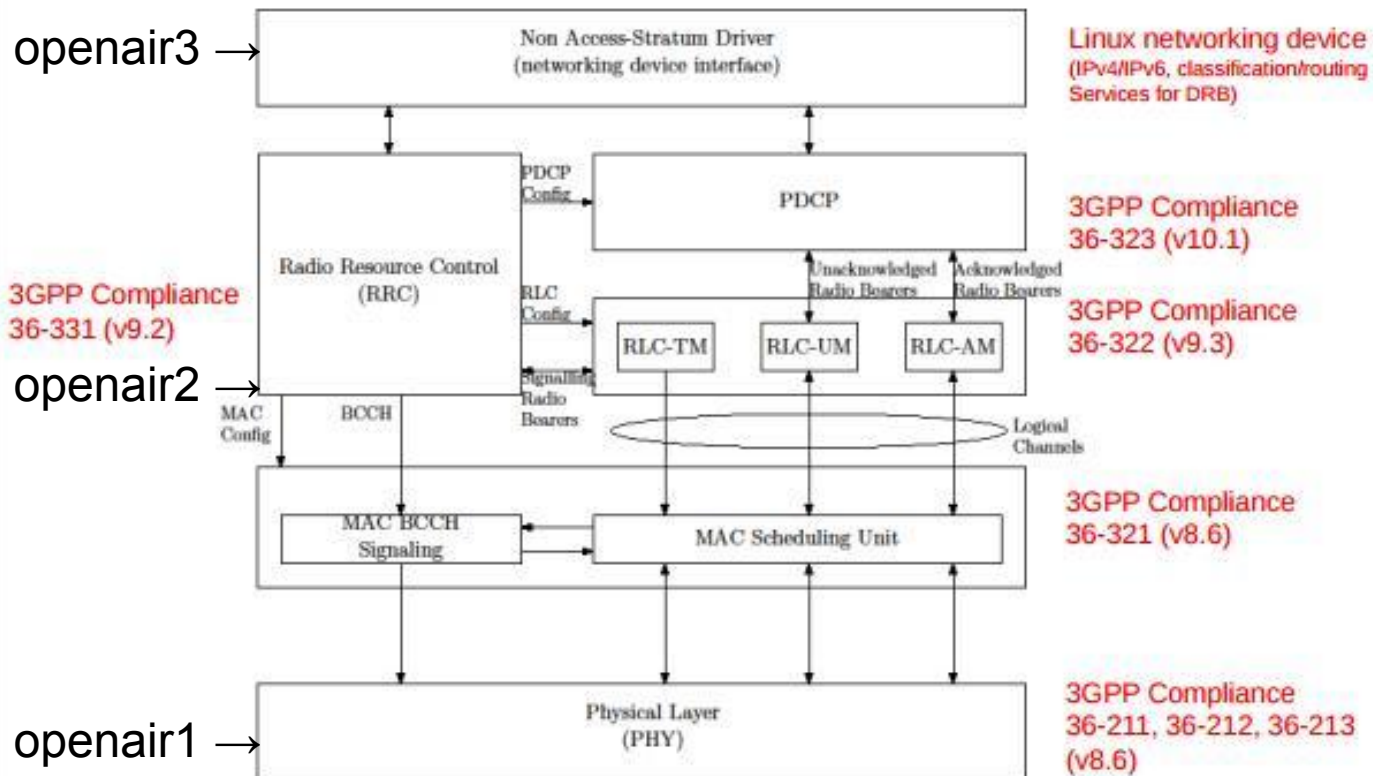
Demetrios Lambropoulos, Cat Le, Steven Cheng
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OpenAirInterface

OpenAirInterface is divided into several repositories.

- OpenAir1
- OpenAir2
- OpenAir3
- OpenAiro
- OpenAir-CN
- Targets

OpenAirLTE PHY/MAC Protocol Stack



OpenAir1

- Contains channel simulation, sounding and physical(PHY) abstraction software(SW).
- Sensing/Localization Techniques
- PHY modeling tools
- Propagating Measurement and Modelling
- Basic DSP Routines for implementing LTE specifications.

EMOS - Sounding SW

- Eurecom's Multi-Input Multi-Output(MIMO) Openair Sounder (EMOS)
- Allows multiuser MIMO channel measurements in real time
- Can store measurements from both user equipment(UE) and evolved NodeB(eNB)

PHY Abstraction SW

- Contains all real-time/simulation signal processing
- Also contains unitary testbenches for the different channel coders and decoders
- Modulation/demodulation includes FFT/SC-FDMA front-end processing

Channel Simulation SW

- Contains simulation routines to test PHY
- Testbenches for unitary simulation of physical channels, and full system simulation, such as PHY, MAC (medium access control), RLC (radio link control), RRC (radio resource control), PDCP (packet data convergence protocol)

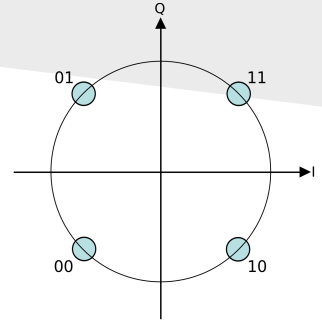
Signal-to-Noise Ratio (SNR)

- “Noise” is measured when there is no signal transmitting at the base station.
- “Signal with noise” is measured when the base station is transmitting signal.

$$\text{SNR} = \frac{\text{Signal with noise} - \text{Noise}}{\text{Noise}}$$

Quadrature Phase Shift Keying(QPSK)

- Two bits modulated = 4 possible carrier shifts (45, 135, 225, 315 degrees)
- Same bandwidth as PSK with double the information carried
- QPSK can be used with QAM (quadrature amplitude modulation) in downlink.



Spectrum Analyzer

- Worked as a team with the other software defined radio (SDR) groups
- Experience with Tektronix SA2600 spectrum analyzer
- Attached 30dB attenuator to connect the node's transmitters to spectrum analyzer.
- Varied gain from 0-100dB on frequencies of 500MHz to 5GHz

Next Week

- Continue on OpenAir2 (Data Link - Layer 2)
- Analyze the spectrum graphs.
- Write a program in C/C++ for SNR calculator.