



Panel Session on

Green Wireless Technology

Organizer:

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Panelists:

Nuno Borges Carvalho; Instituto de Telecom., Universidade de Aveiro, Portugal

Luca Roselli; Dept. of Electrical Engineering and Information, Univ. of Perugia, Italy

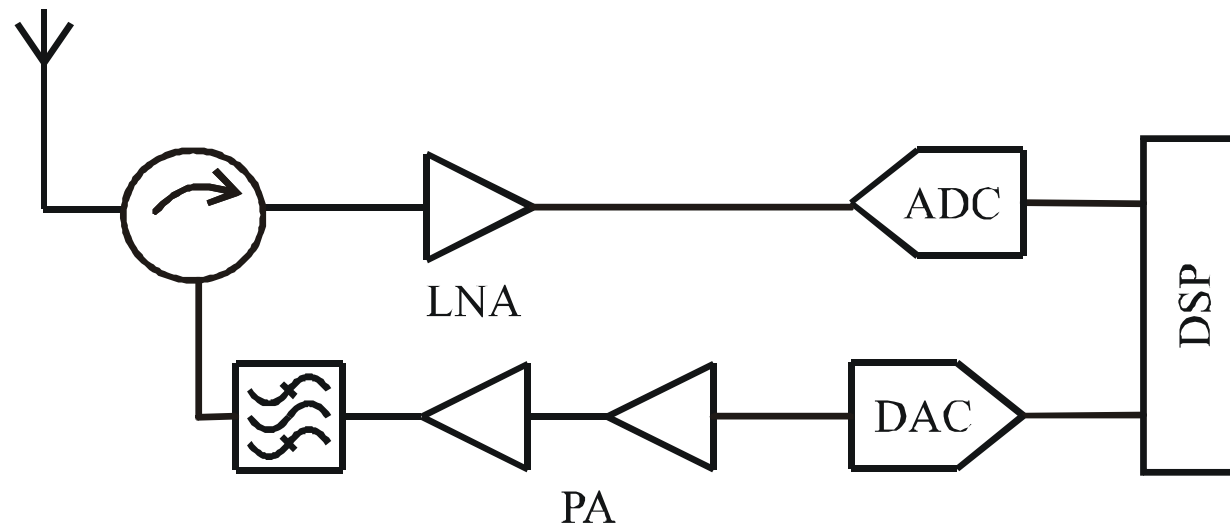
Sandeep Gupta; IMPACT Lab, Arizona State University, Tempe, AZ, USA.

The use of SDR

The use of SDR, will allow a good compromise between efficiency and communication performance.

The goal:

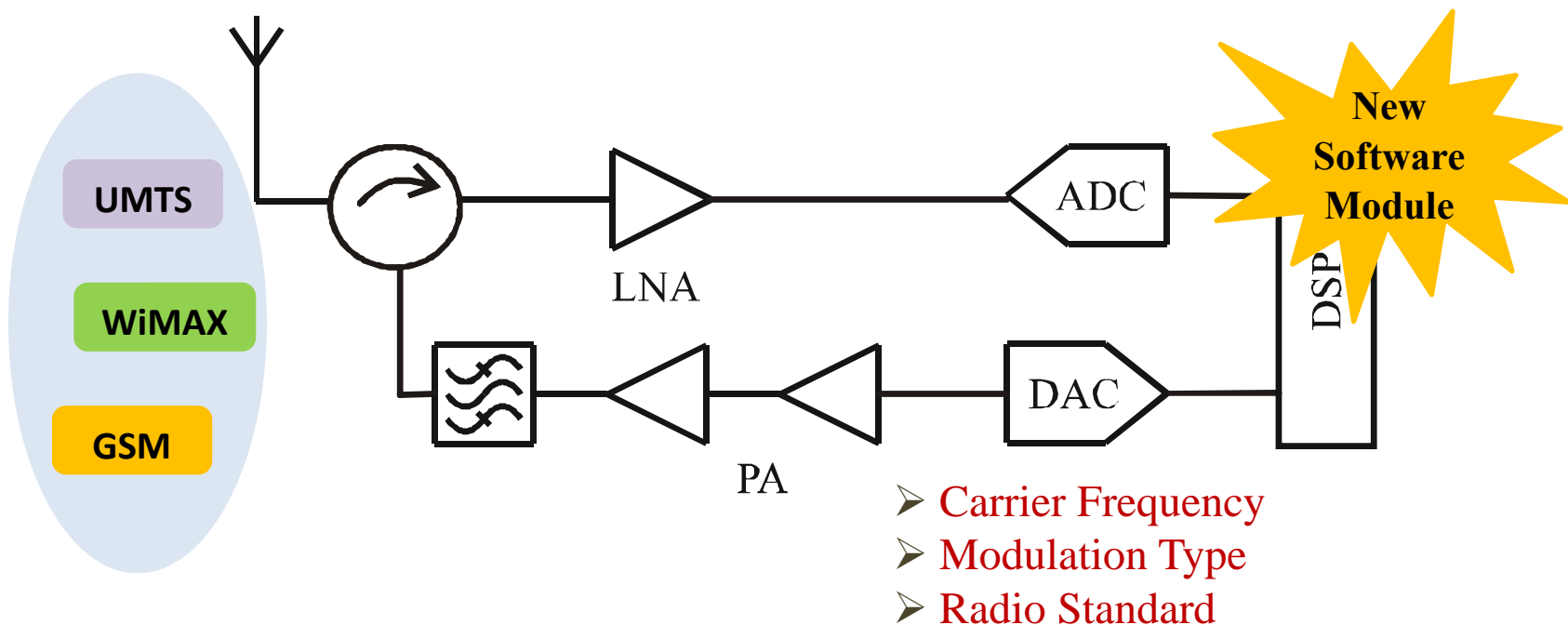
All Digital Transceiver



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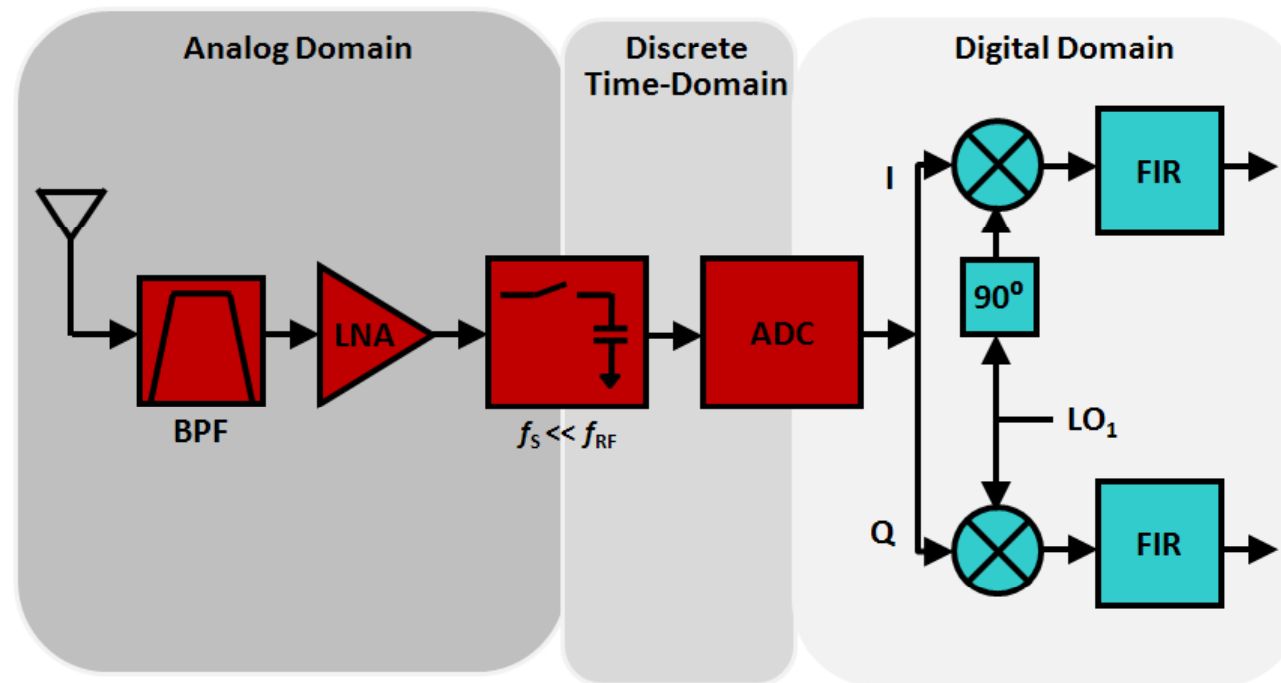
The goal:

All Digital Transceiver



All Digital Transceiver

Receiver

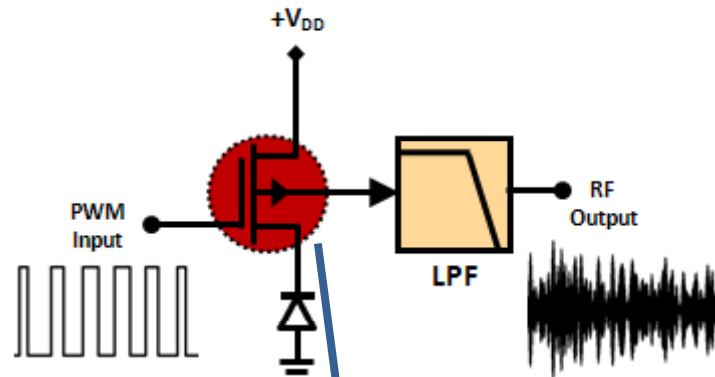


- ❖ Takes the fact that S/H circuit translates the signal to 1st Nyquist zone
- ❖ Digital processing capabilities exploited → multi-band reception
- ❖ Mandatory BPF to avoid overlap of signals → tunable or bank of filters
 - ❖ Analog BW of ADC must include RF carrier

All Digital Transceiver

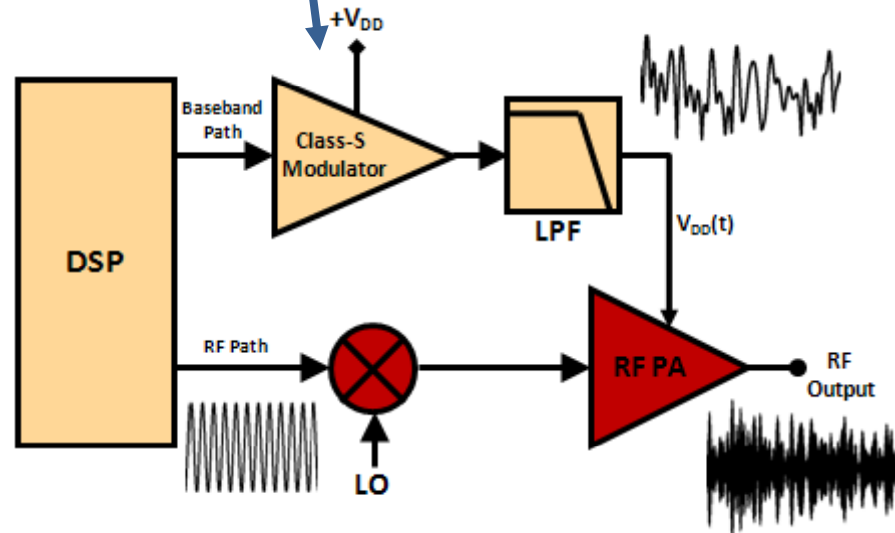
Transmitter

Visionary solution pointed the use of PWM to create an all-digital TX



Ideally will consume no DC power and achieve an efficiency of 100%, actually it consumes

Unfortunately is not possible to design such PA with high efficiency to operate at high frequencies



❖ Been used in digital versions of EER, known as Polar TX's

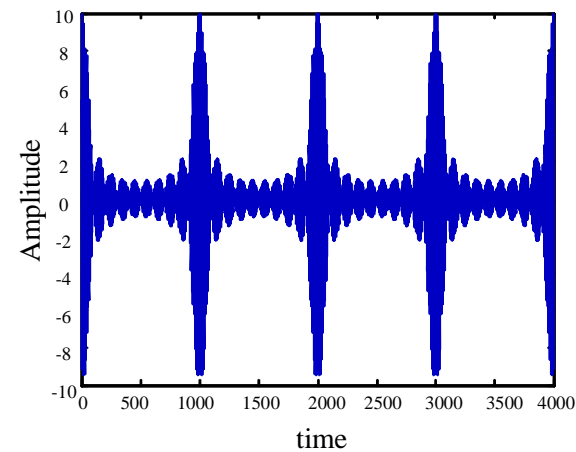
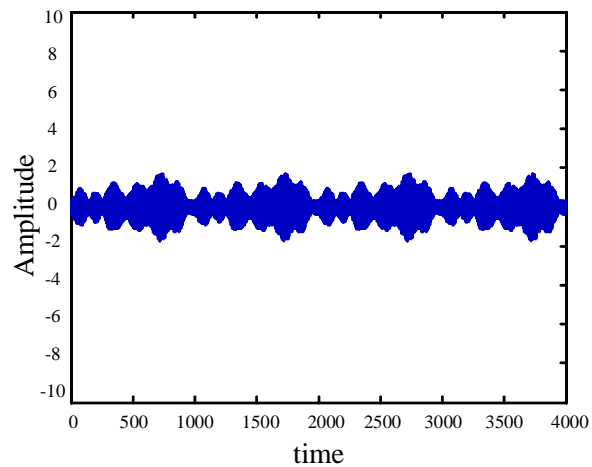
❖ Time misalignment can be compensated in digital domain

Main Technological Drawbacks

Signal Statistical Behavior

Peak to Average Power Ratio is a relationship between the maximum value of the peak power and the average power of the signal.

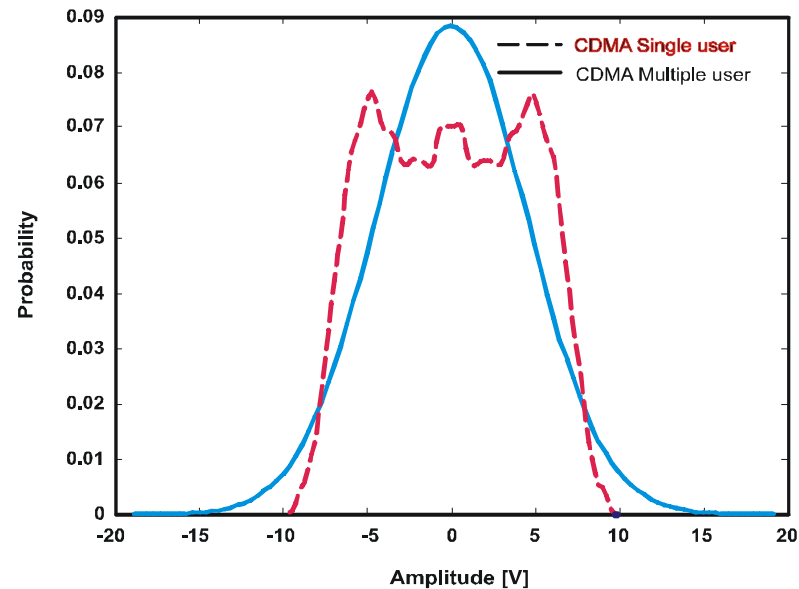
$$PAPR = \frac{\max_{0 \leq t \leq NT} |x(t)|^2}{1/NT \int_0^{NT} |x(t)|^2 dt}$$



Main Technological Drawbacks

Signal Statistical Behavior

A single user CDMA signal has a low PAPR,

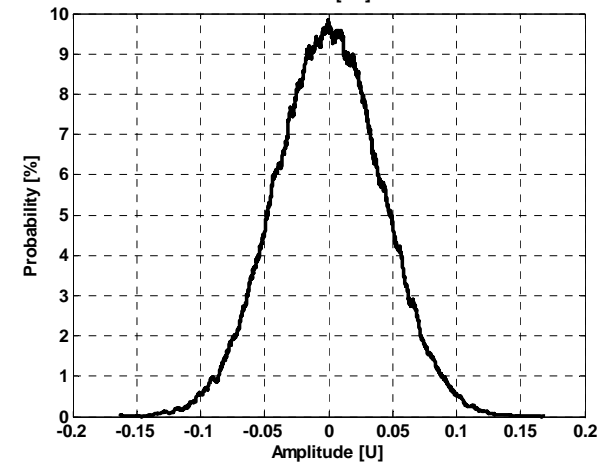
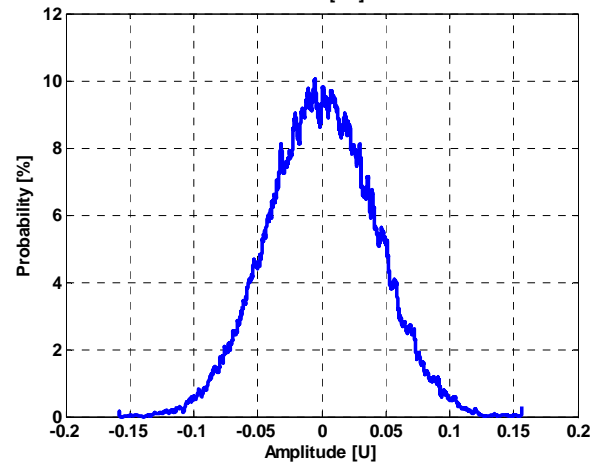
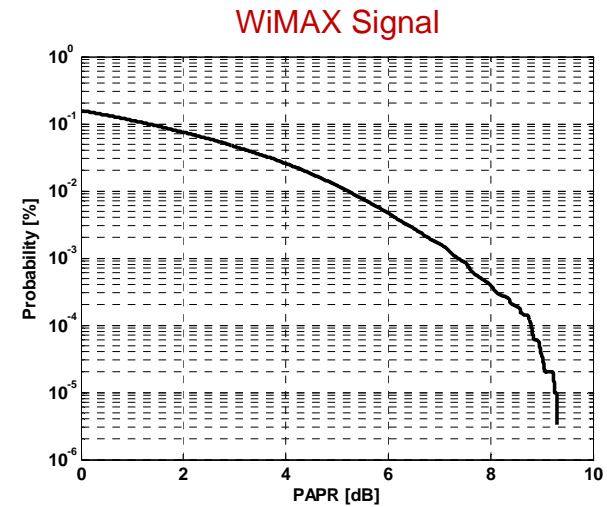
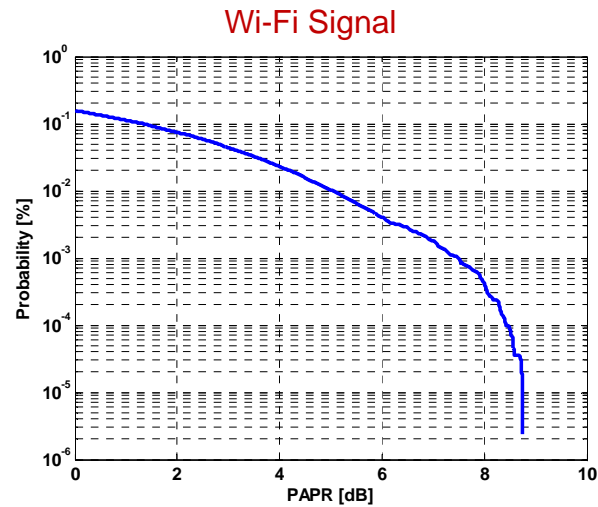


but a multi-user CDMA signal presents a high value of PAPR, since when adding users in a CDMA transceiver we are actually moving the signals statistics to Gaussian like.

Main Technological Drawbacks

Signal Statistical Behavior

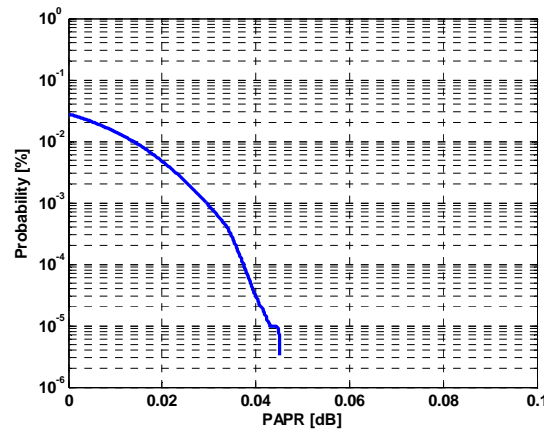
Typical Systems that work over OFDM include Wi-Fi, WiMAX, DVB – X



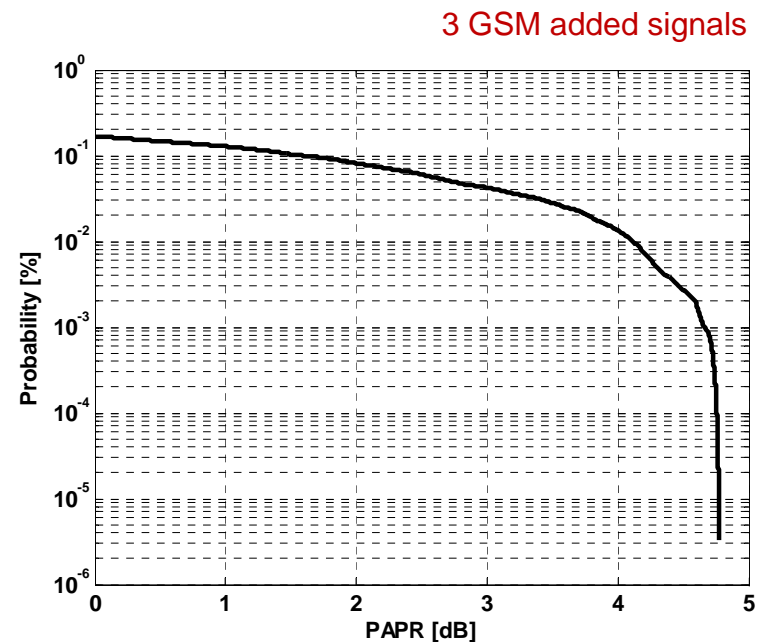
Main Technological Drawbacks

Signal Statistical Behavior

When a large number of modulated signals are added, the PAPR rises significantly. For instance 3 GSM signals added become.



Single GSM Channel



3 GSM added signals

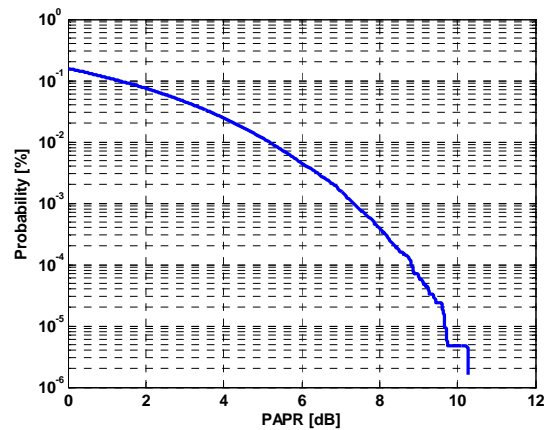
This fact imposes a very complex problem to Power Amplifiers.

Main Technological Drawbacks

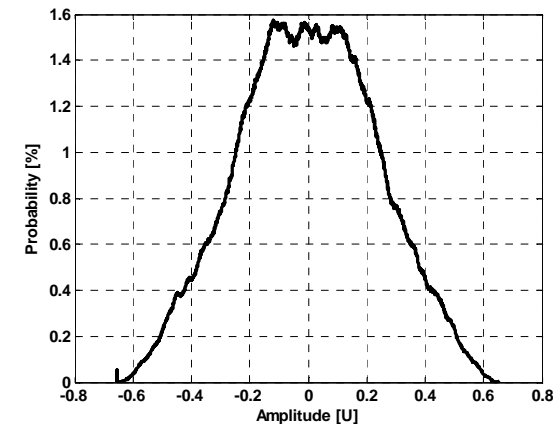
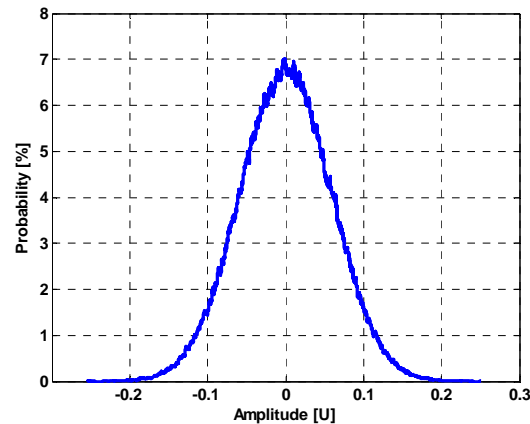
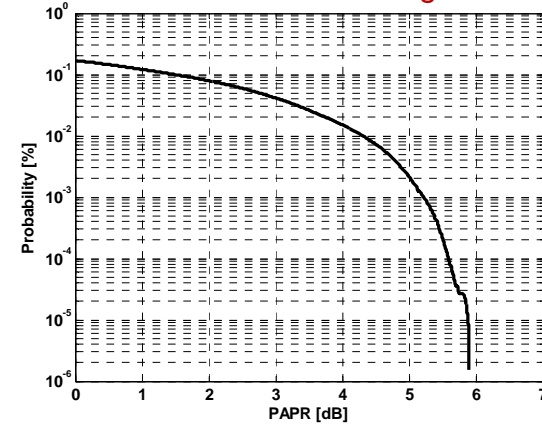
Signal Statistical Behavior

In multi-mode transceivers the use of Wi-Fi + Wimax, or GSM1800 + UMTS can degrade and increase significantly the value of PAPR.

Wi-Fi + WiMAX Signals



3xGSM1800 + UMTS Signals

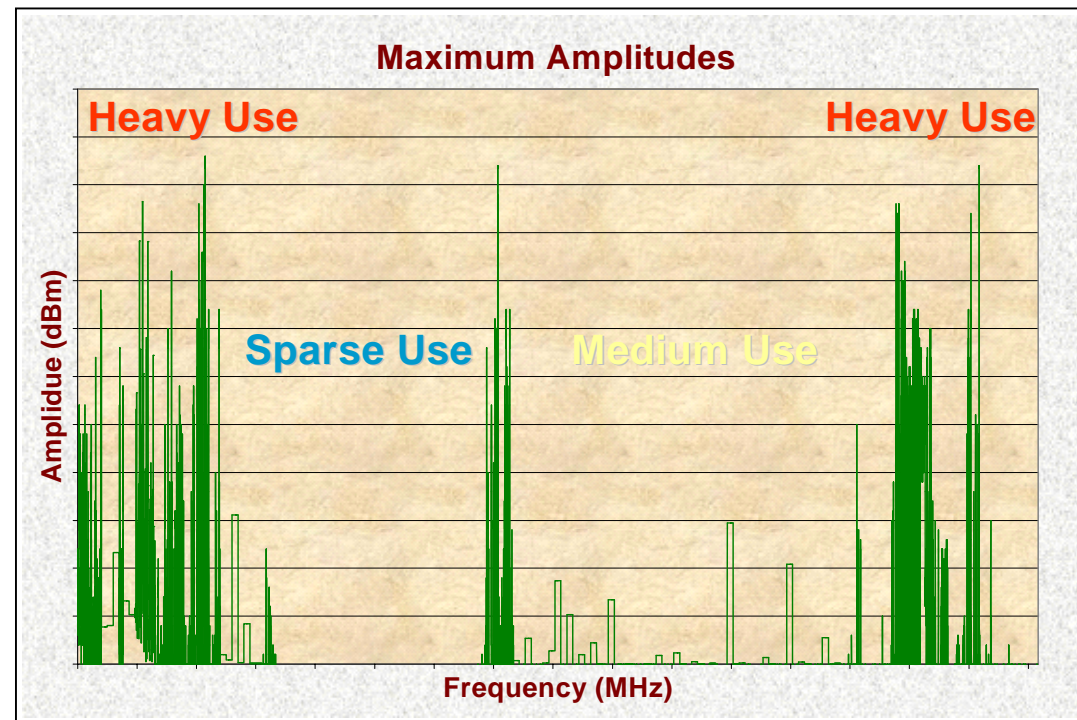


Main Technological Drawbacks

Interference Mitigation

Use of Opportunistic Radios is a viable solution for re-use of spectrum using cognitive solutions.

Interference minimization is a must in this type of multi-mode multi-standard radios.



Technology Design Focus

More Focus should be put on the design of:

- **Power Amplifiers**
- **Analog to Digital Converters**
- **Adaptable Filters**
- **Digital to Analog Converters** including PWM

