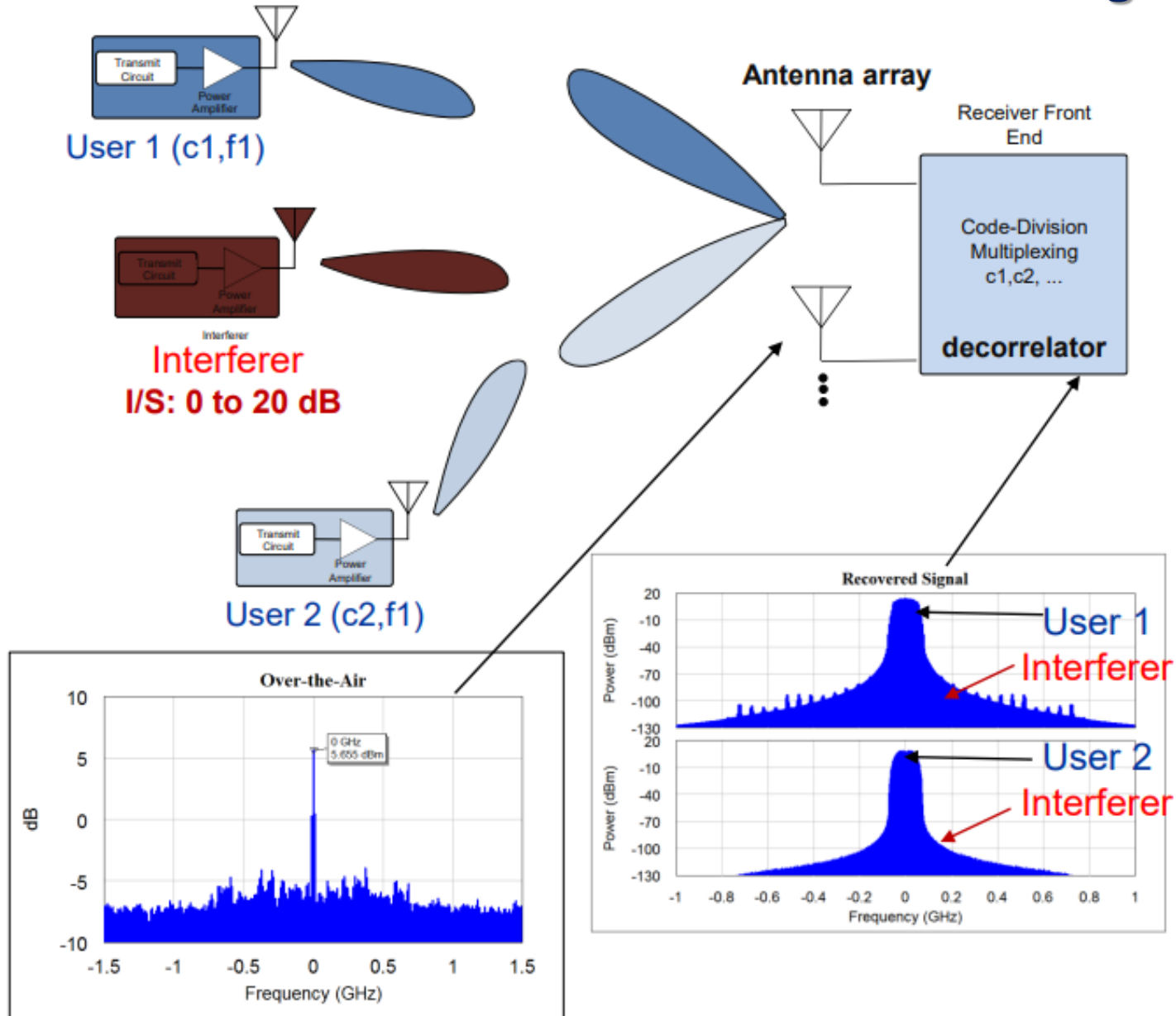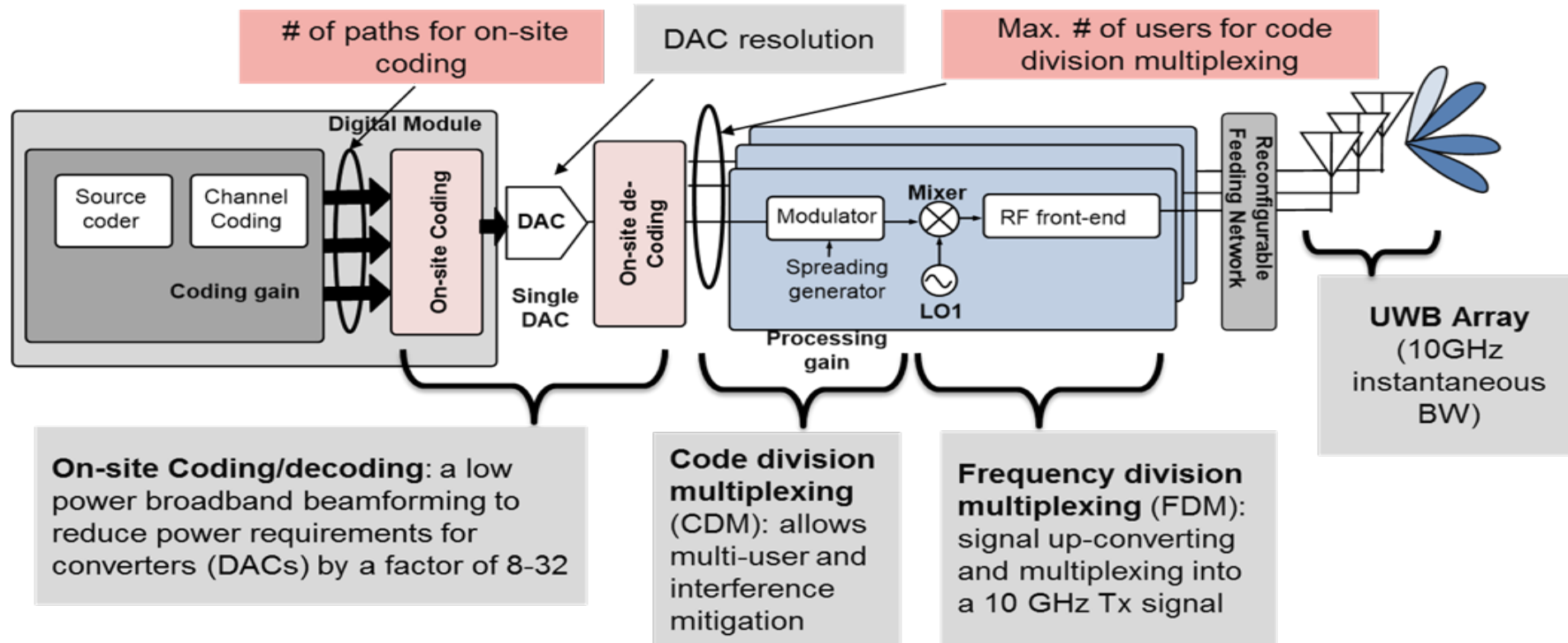# Secure Multi-User Communication in Contested Environment using Coding

High Data-rate Direct RF Sampling MIMO Work station

Complete Software Radio Transceiver Design Operating across 10s of GHz

Key Features:

1- Channel coding: using Turbo codes (coding gain): error detection and correction

2- On-site coding/decoding (DAC reduction): allows combining multi-user data into a single DAC.

3- Spread spectrum modulation (jamming mitigation and multi-user): each user data has its unique code

4-Channelization: different LOs, signals are up-converted over several frequency bands across the 10 GHz BW.

5-Frequency multiplexing: to cover 10 GHz BW

6- UWB antenna array (10:1 BW)

Multi-user environment with Narrowband Interference (Turbo Codes added to CDMA)
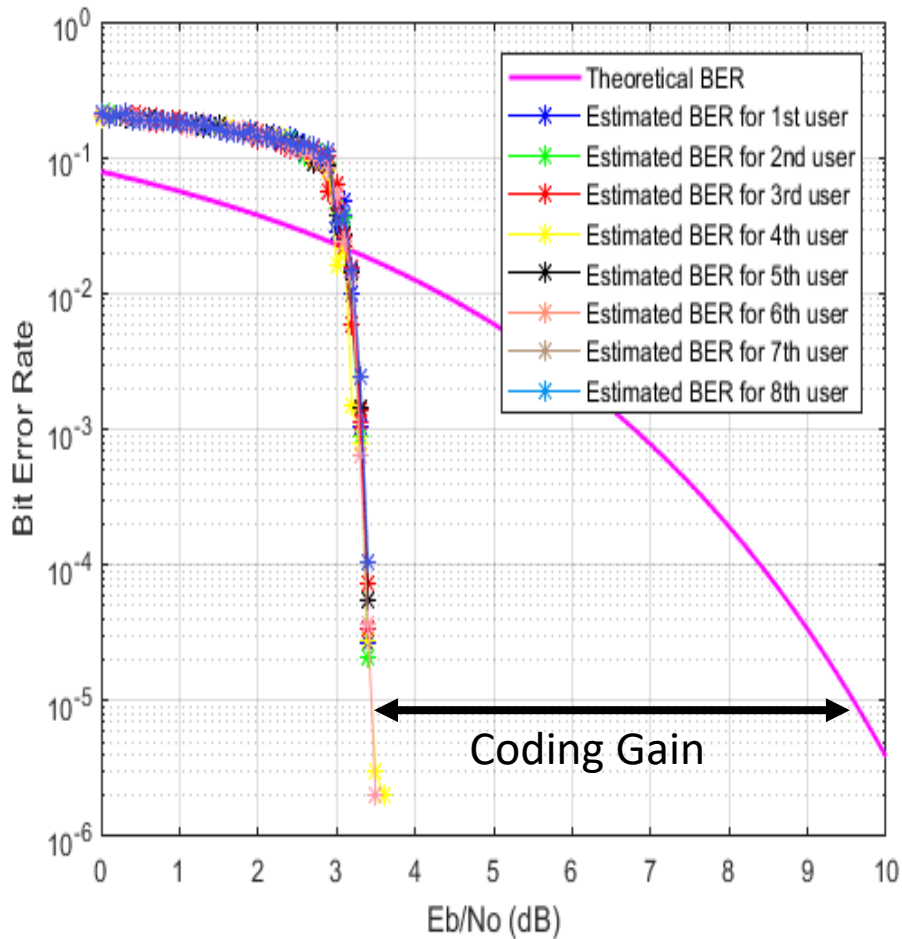
- This hybrid scheme allows for reliable communications under harsh environment.

- A narrow band interferer is present

- Interferer-to-Signal Ratio (ISR) is 8 dB.

Even in this situation, i.e. users communicating using the same channel in presence of interference, the total degradation per user is only 3 dB.

Bit Error Rate Measurements: *Processing Gain*

- CDM decreases spectral density

- Energy used in transmitting the signal is spread across a wider bandwidth, and appears as noise.

- We can communicate well below noise floor using wideband signals

Theoretical Process Gain
= 10*log(127)
= 21 dB

* Process gain was measured by varying the transmitted power and keeping everything else constant.