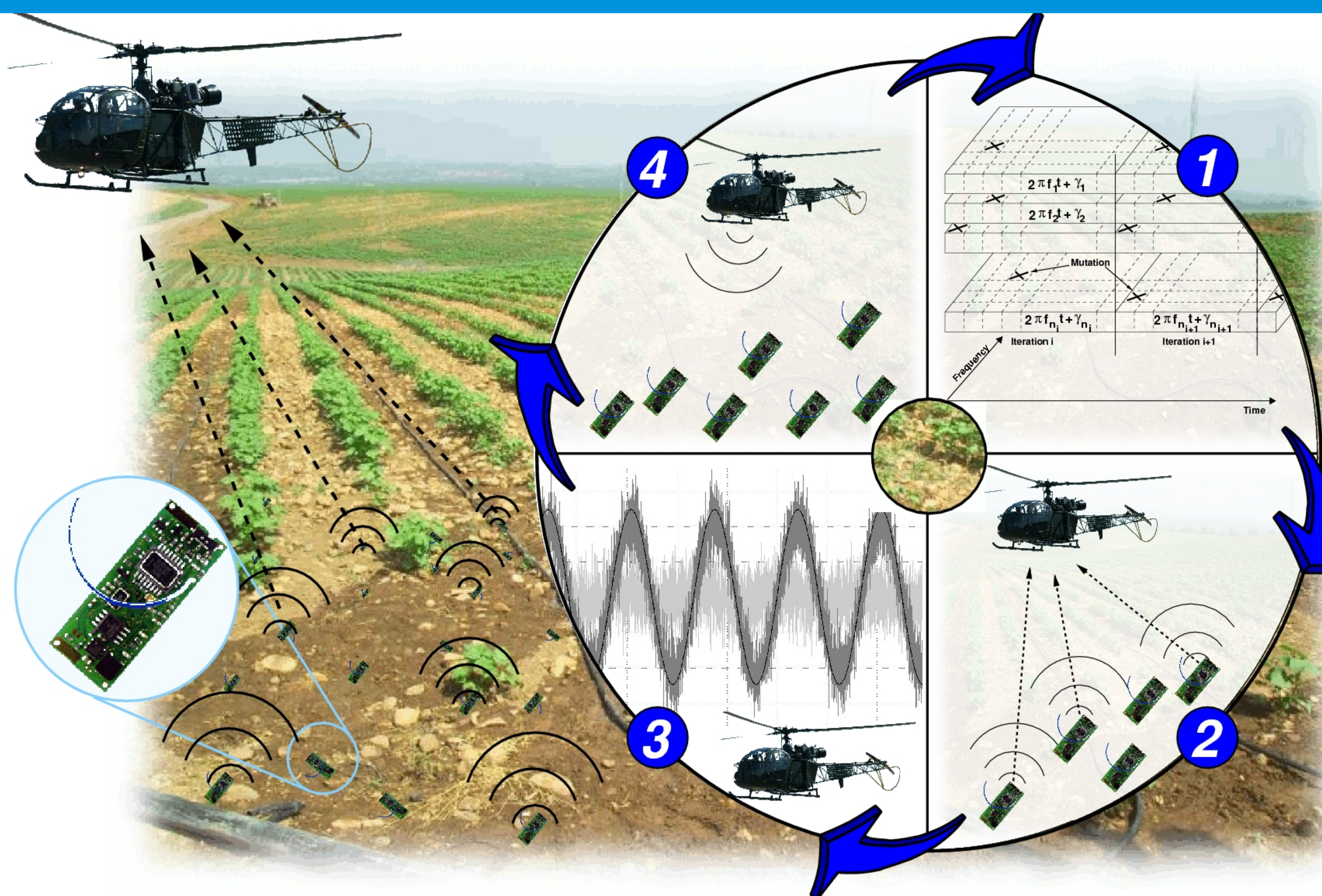


Distributed beamforming with software radios

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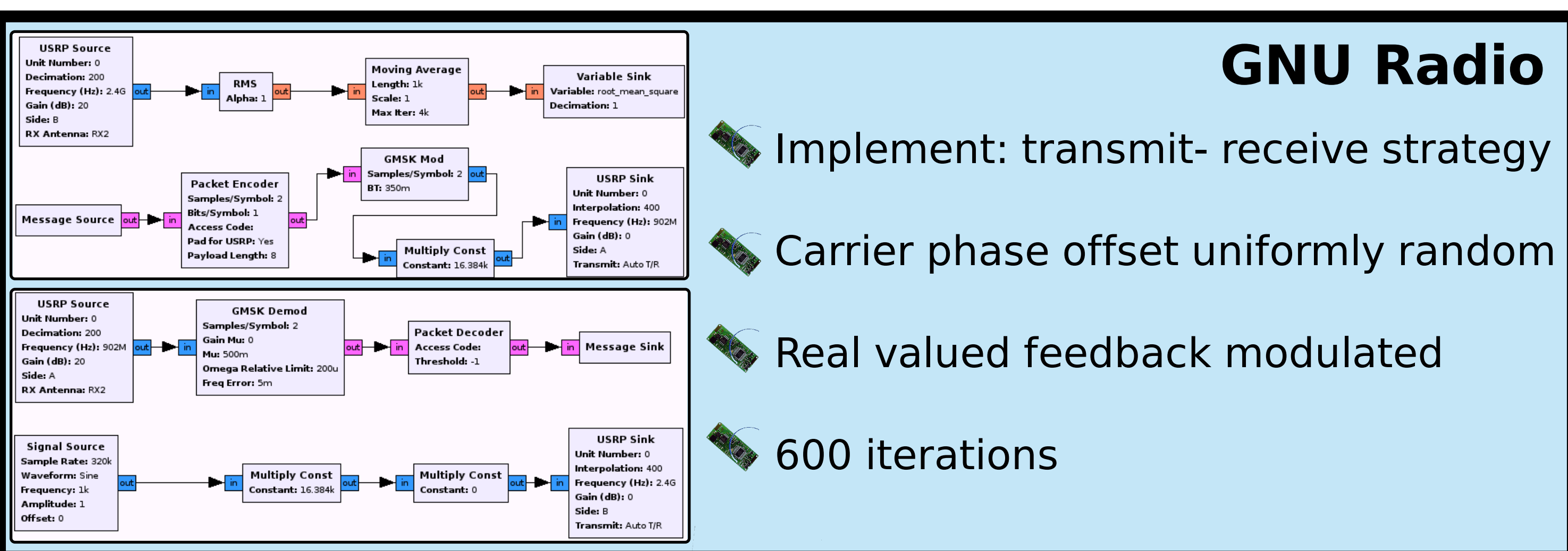
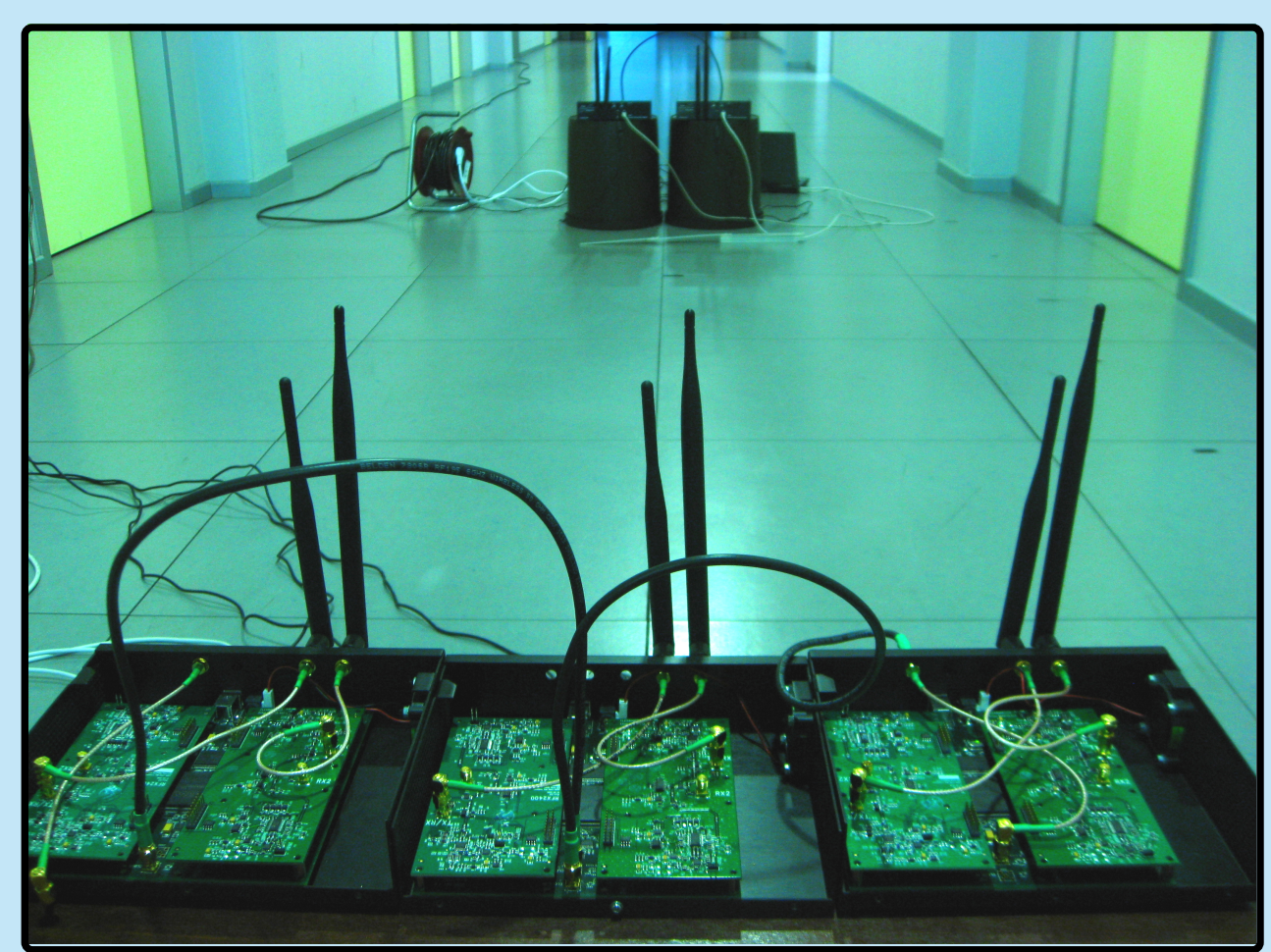
Iterative process

- Phase 1:**
Random adaptation of carrier phase and frequency
- Phase 2:**
Transmit to destination as distributed beamformer
- Phase 3:**
Receiver estimates phase synchronisation of received superimposed signal
- Phase 4:**
Receiver broadcasts feedback to the network

Instrumentation

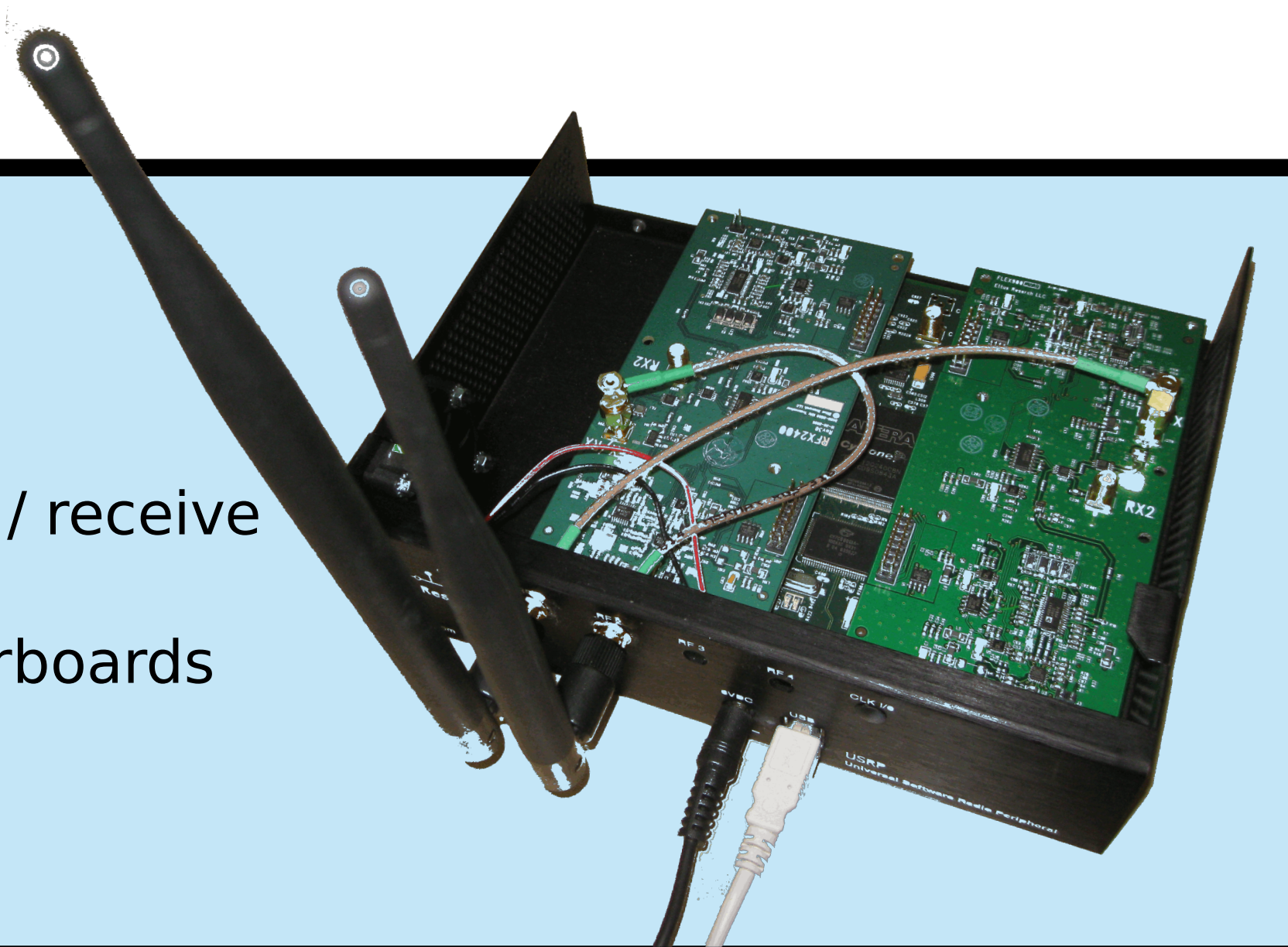
Experimental setting

- 4 transmit devices
- Transmission: 2.4 GHz, 1.5dBi
- Feedback: 900 MHz, 3 dBi
- Distance: 3m, 12, 24m, 45m



USRP software radio

- Clock synchronised
- Separate boards for transmit / receive
- RFX2400 and RFX900 motherboards
- USRP2



Experimental results

3 meters distance:

Gain (single link): --
Gain (unsynchronised): 3.99 dB
Iteration of best amplitude: 224.4

12 meters distance:

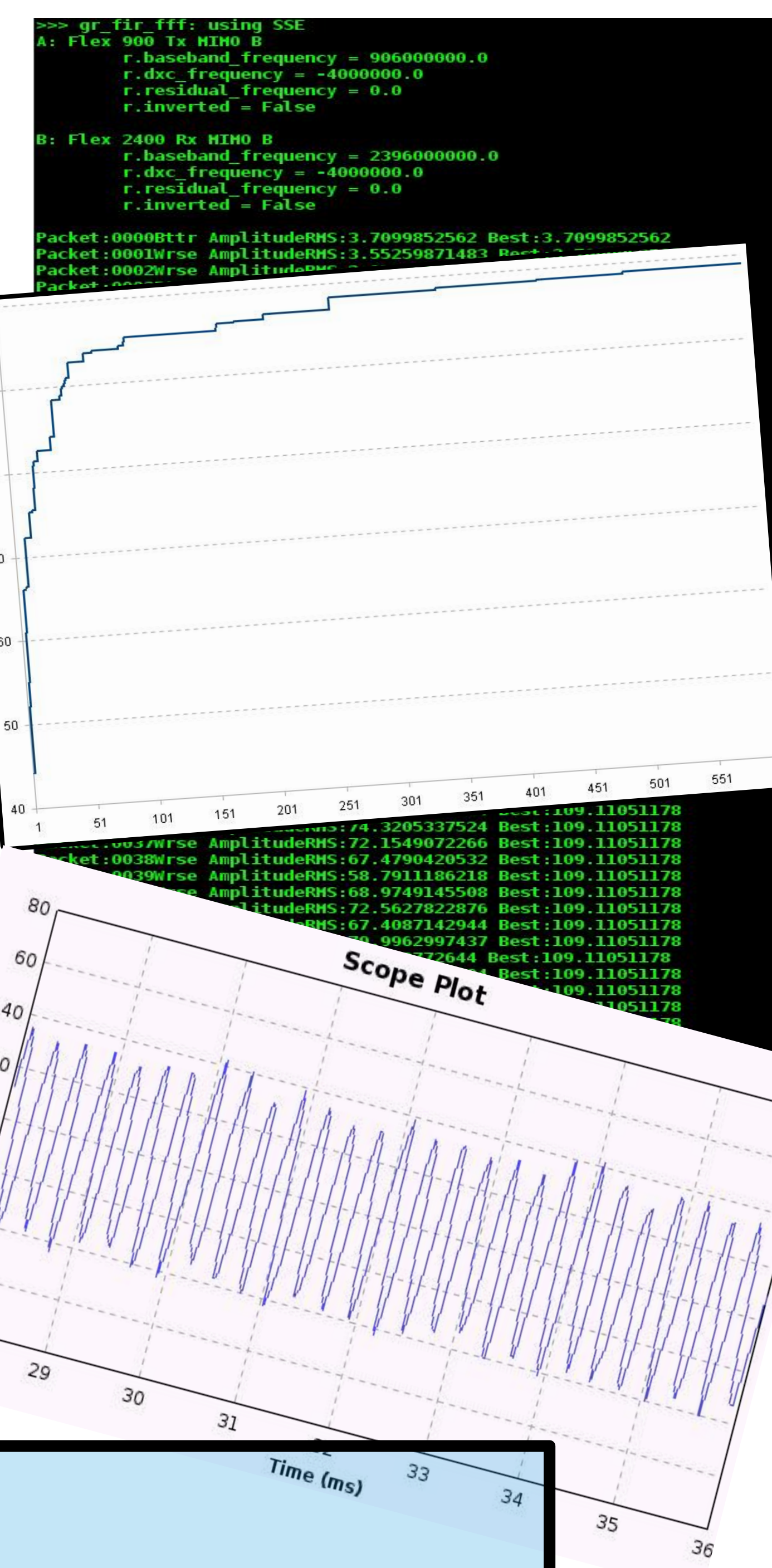
Gain (single link): 4.39 dB
Gain (unsynchronised): 3.6 dB
Iteration of best amplitude: 334.3

24 meters distance:

Gain (single link): --
Gain (unsynchronised): 3.35 dB
Iteration of best amplitude: 337.3

45 meters distance:

Gain to single link: 1.54 dB
Gain to unsynchronised: 2.84 dB
Iteration of best amplitude: 414.1



Future work

- Improve synchronisation performance
- Reduce randomness in the synchronisation process
- Utilisation of the FPGA
- Synchronisation via GPS
- Consider movement of nodes
- Utilise TX/RX port of USRP daughterboards
- BER for data transmission

