

TIGR Framework

- ▶ Rapid prototyping framework for performance validation and proof-of-concept of the novel communication techniques
- ▶ Offered by SDR technology based on general purpose hardware
- ▶ Transmitter and receiver node are composed of a host commodity computer and Universal Software Radio Peripheral (USRP)

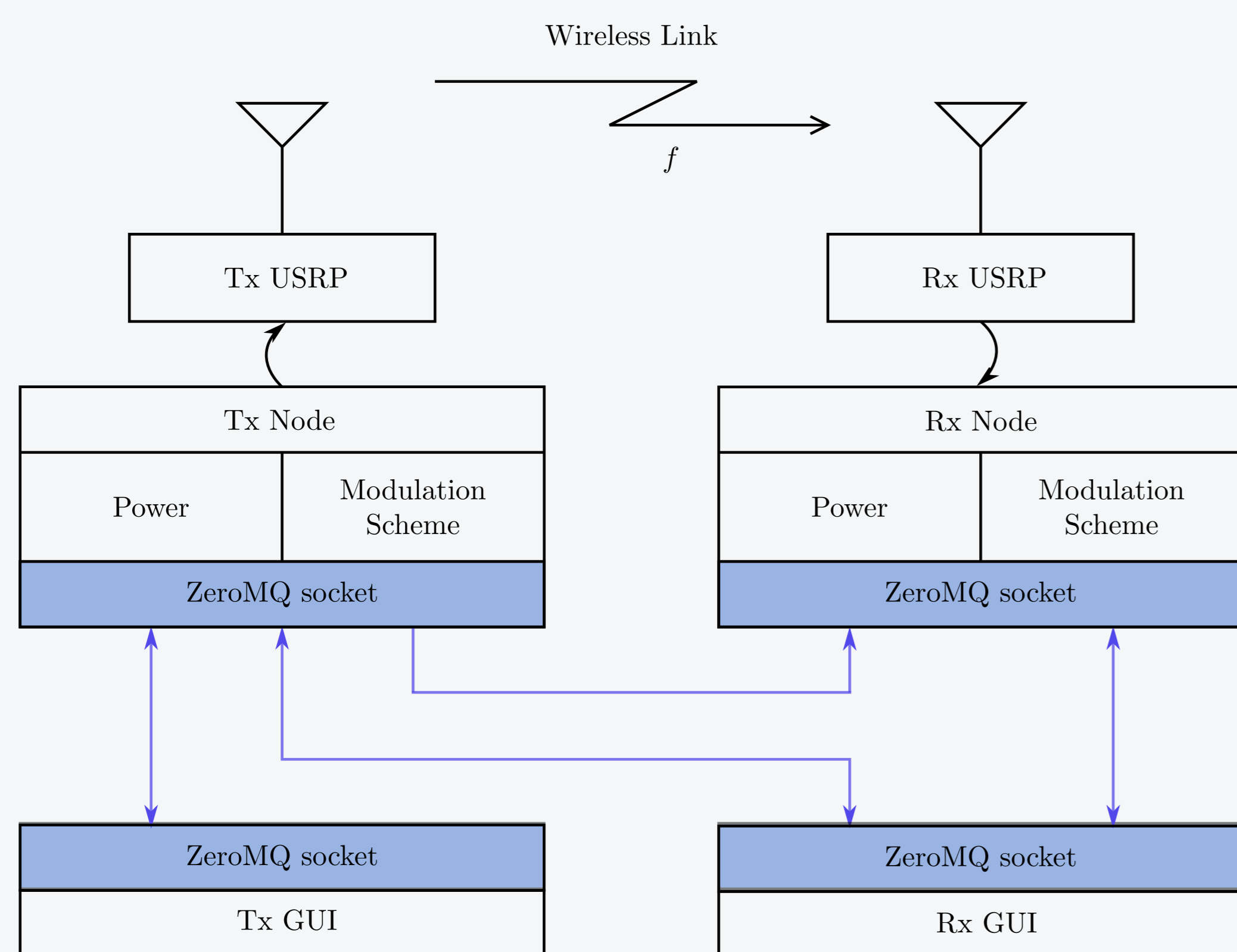


Figure: The framework overview

- ▶ A modular, GNU Radio based reconfigurable SDR framework extends PHY layer functionalities of current wireless standards

Bandwidth (<i>static</i>)	Variable, up to 8MHz
FFT length (<i>static</i>)	64 – 1024
Frame length (<i>static</i>)	Variable
Carrier frequency (<i>dynamic</i>)	2400 – 2483MHz
Modulations (<i>dynamic</i>)	BPSK, QPSK, 8-PSK, 16-QAM, 32-QAM, 64-QAM, 128-QAM, 256-QAM
Power (<i>dynamic</i>)	Up to 20 mW

Table: The set of reconfigurable system parameters

Control and Feedback

- ▶ The control and feedback mechanisms allow for estimation of link quality and optimal assignment of predefined transmission parameters
- ▶ Low latency backbone implemented by ZeroMQ

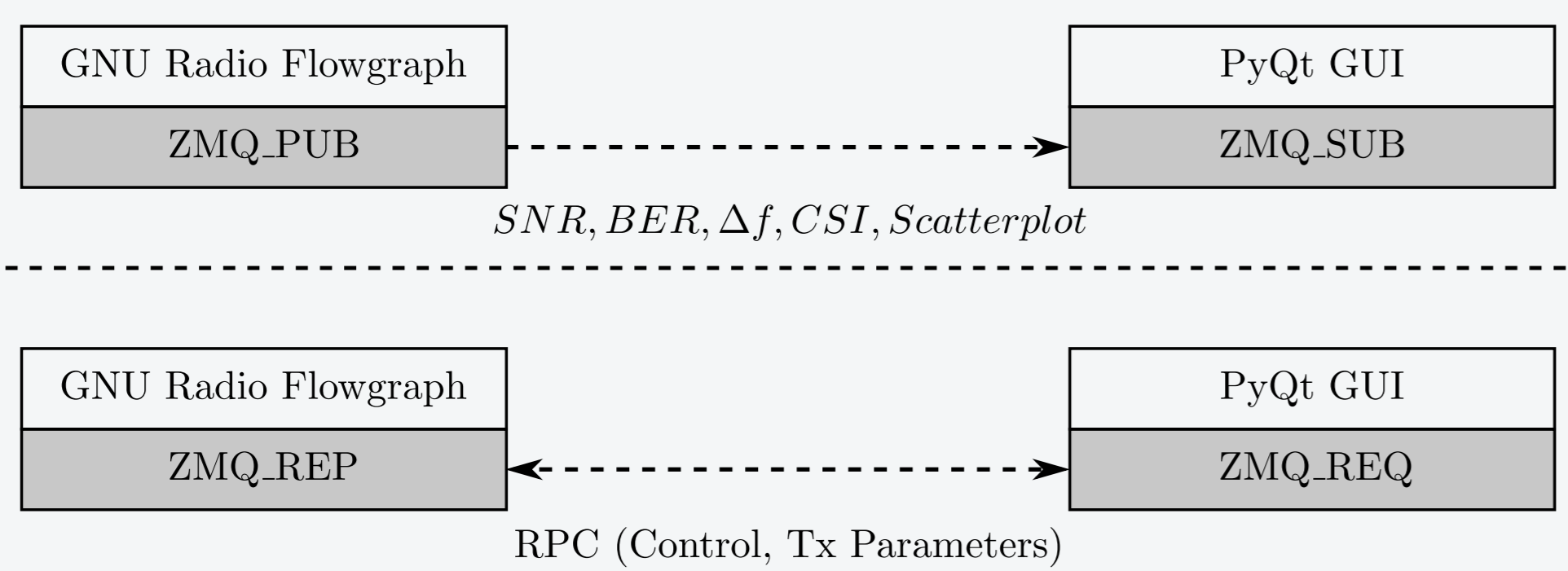


Figure: ZeroMQ communication model within TIGR.

Graphical User Interface (GUI)

- ▶ The transmitter's GUI
 - ▶ Static transmission parameters
 - ▶ Current rate and power allocation over subchannels
- ▶ The receiver's GUI
 - ▶ Estimated signal parameters (SNR, CSI, BER, CFO)
 - ▶ Interactive interface for on-the-fly configuration

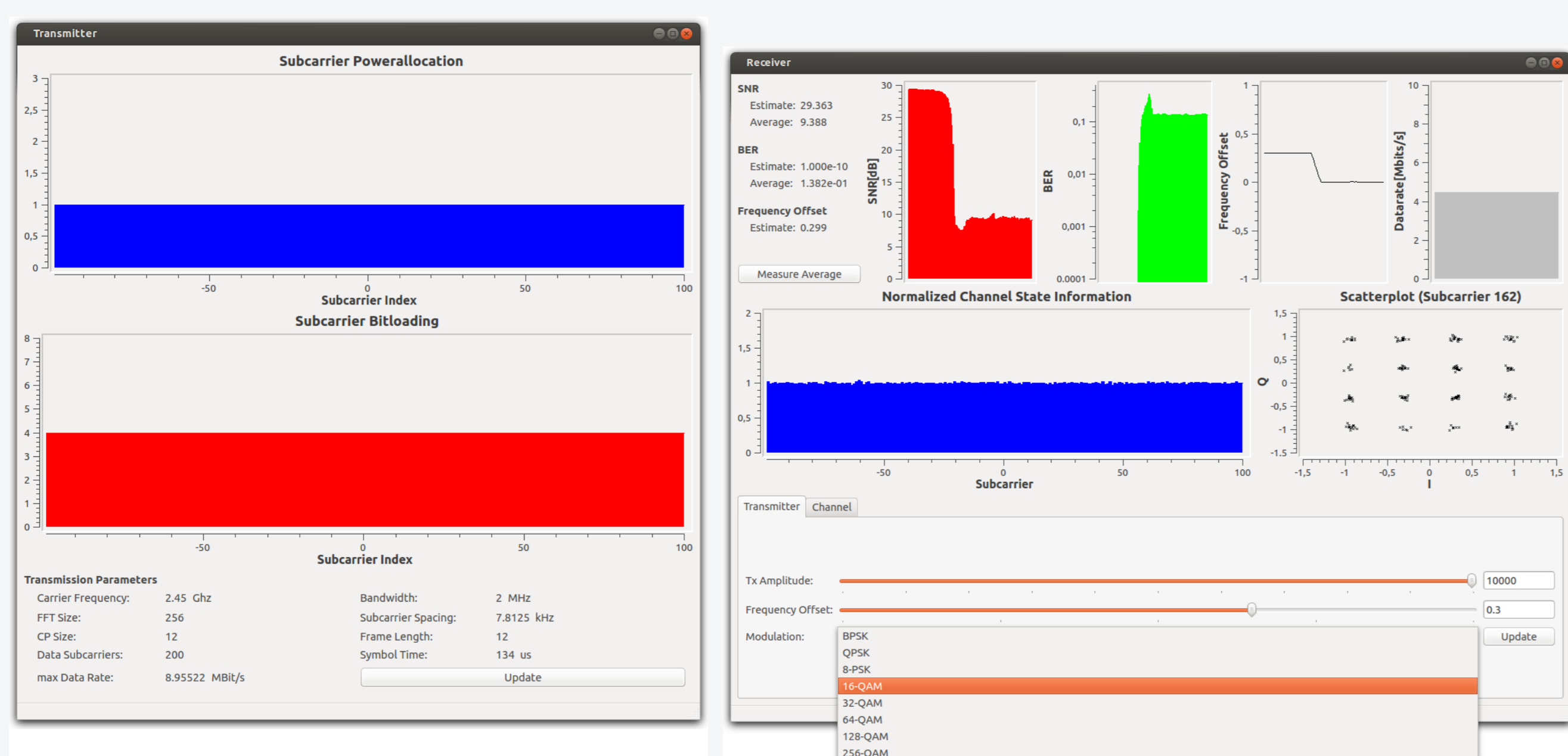


Figure: The transmitter's and receiver's GUIs with interactive control interface

Filter Bank Multicarrier (FBMC)

- ▶ FBMC is an alternative multicarrier technique that offers superior adjacent channel leakage ratio (ACLR) properties and increased spectral efficiency compared to OFDM
- ▶ A possible PHY-layer candidate for the fifth generation of mobile telecommunications technology (5G) standards
- ▶ Prior to transmission, the symbols are overlapped in time domain
- ▶ Near perfect reconstruction at the receiver

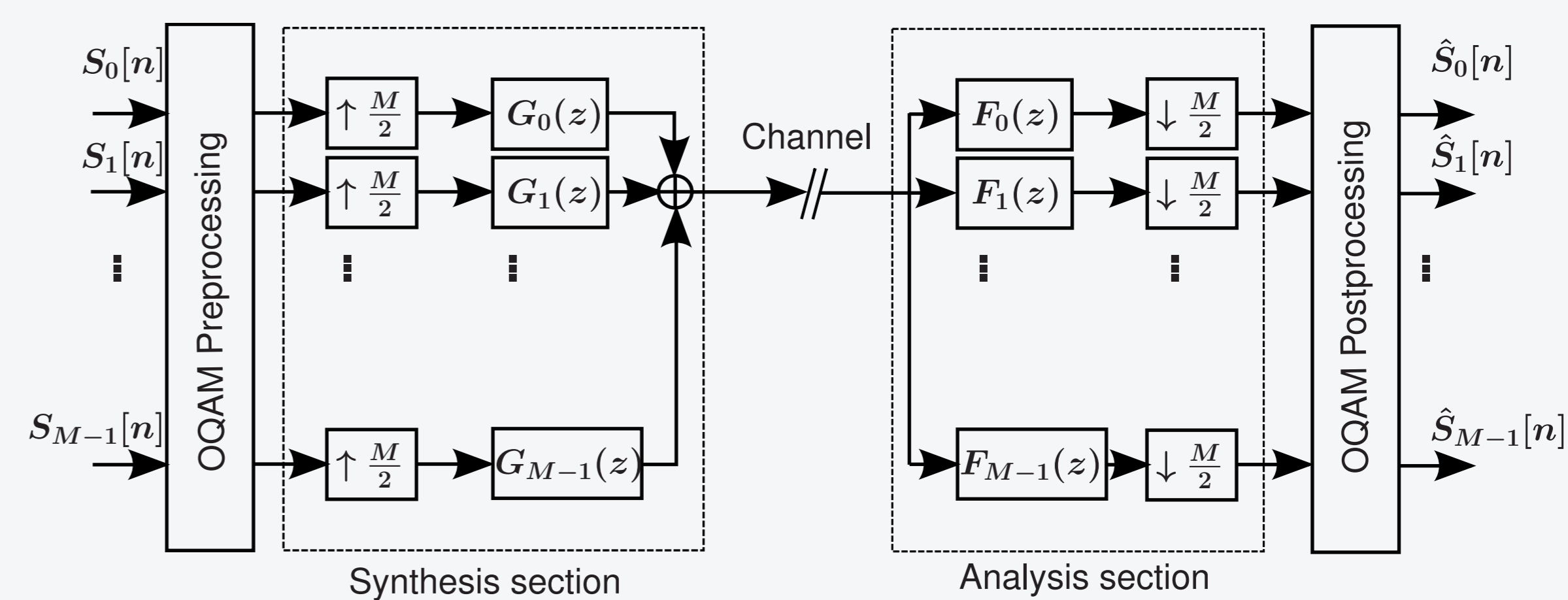
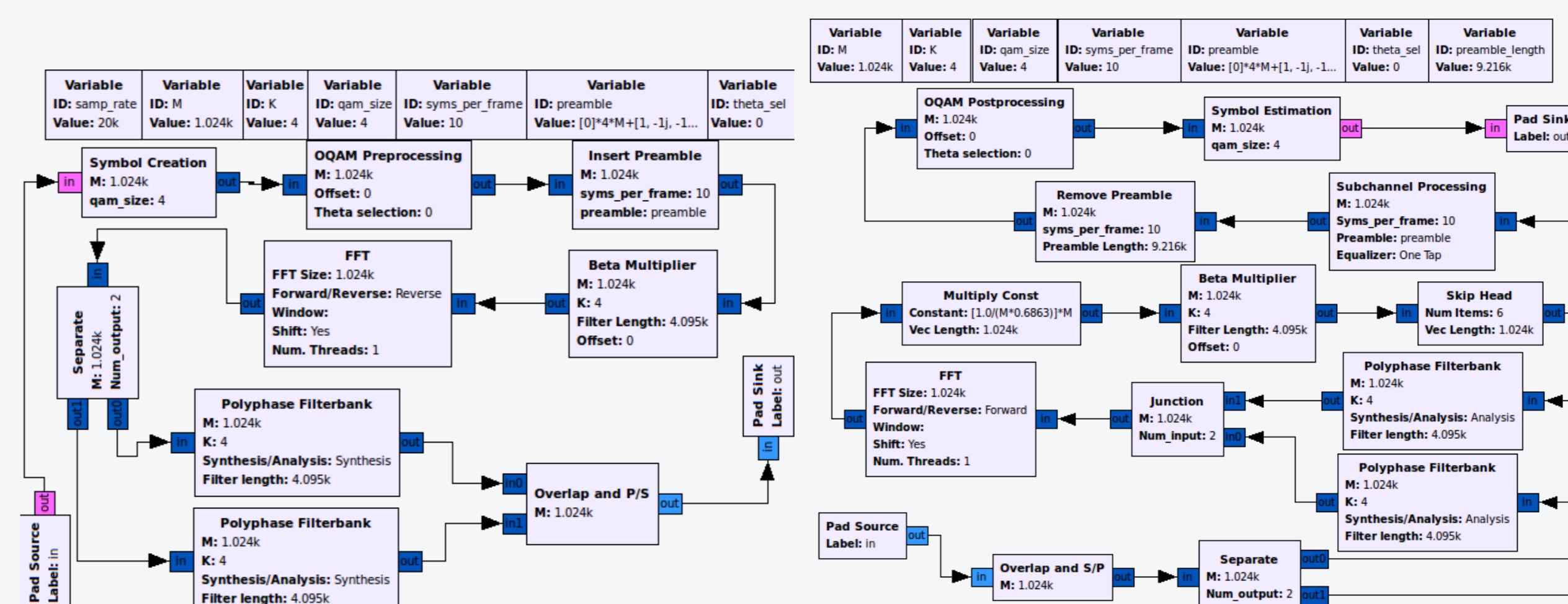


Figure: FBMC transceiver.

TIGR Implementation

- ▶ GNU Radio Companion (GRC) model of the FBMC transceiver
- ▶ Interactive reconfiguration of system parameters



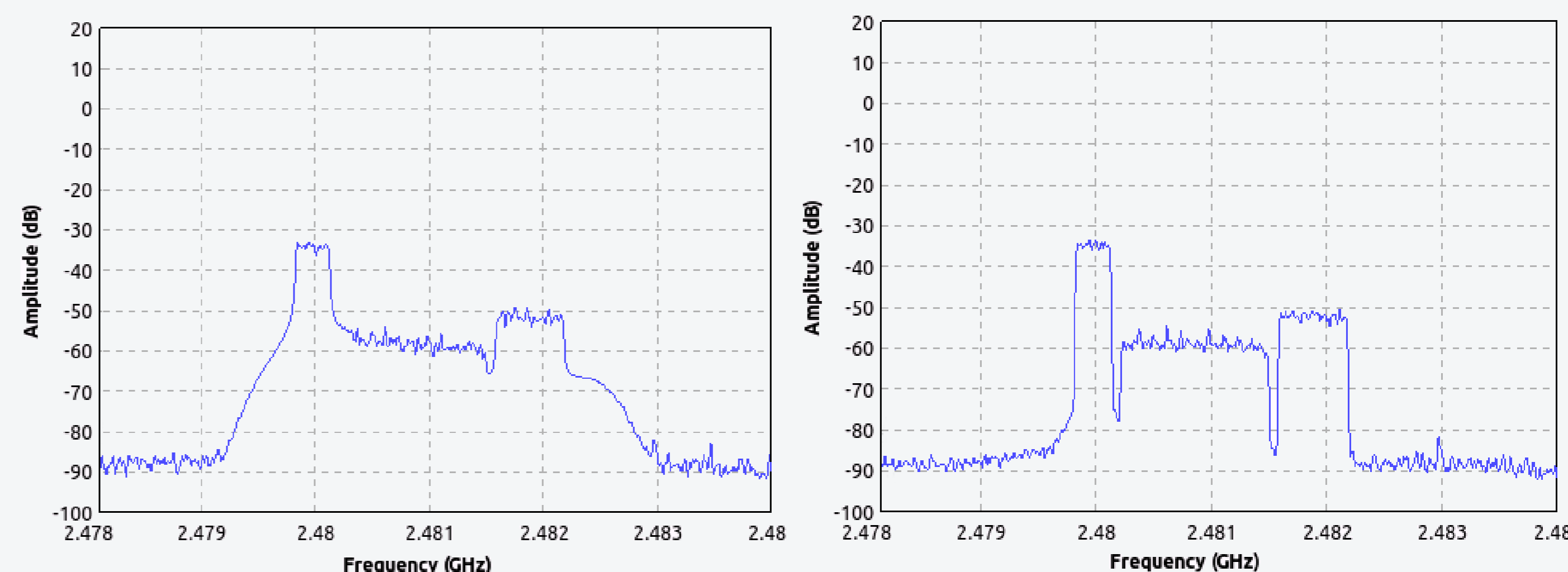
(a) FBMC transmitter.

(b) FBMC receiver.

- ▶ The high reconfigurability of TIGR further allows for future easy integration and evaluation of other 5G PHY layer candidates

Preliminary Experimental Results

- ▶ Over-the-air validation of spectral properties
- ▶ Experimentation in different RF scenarios



(a) OFDM interference source.

(b) FBMC interference source.

- ▶ FBMC introduces less interference in comparison to OFDM, thus inducing a lower BER

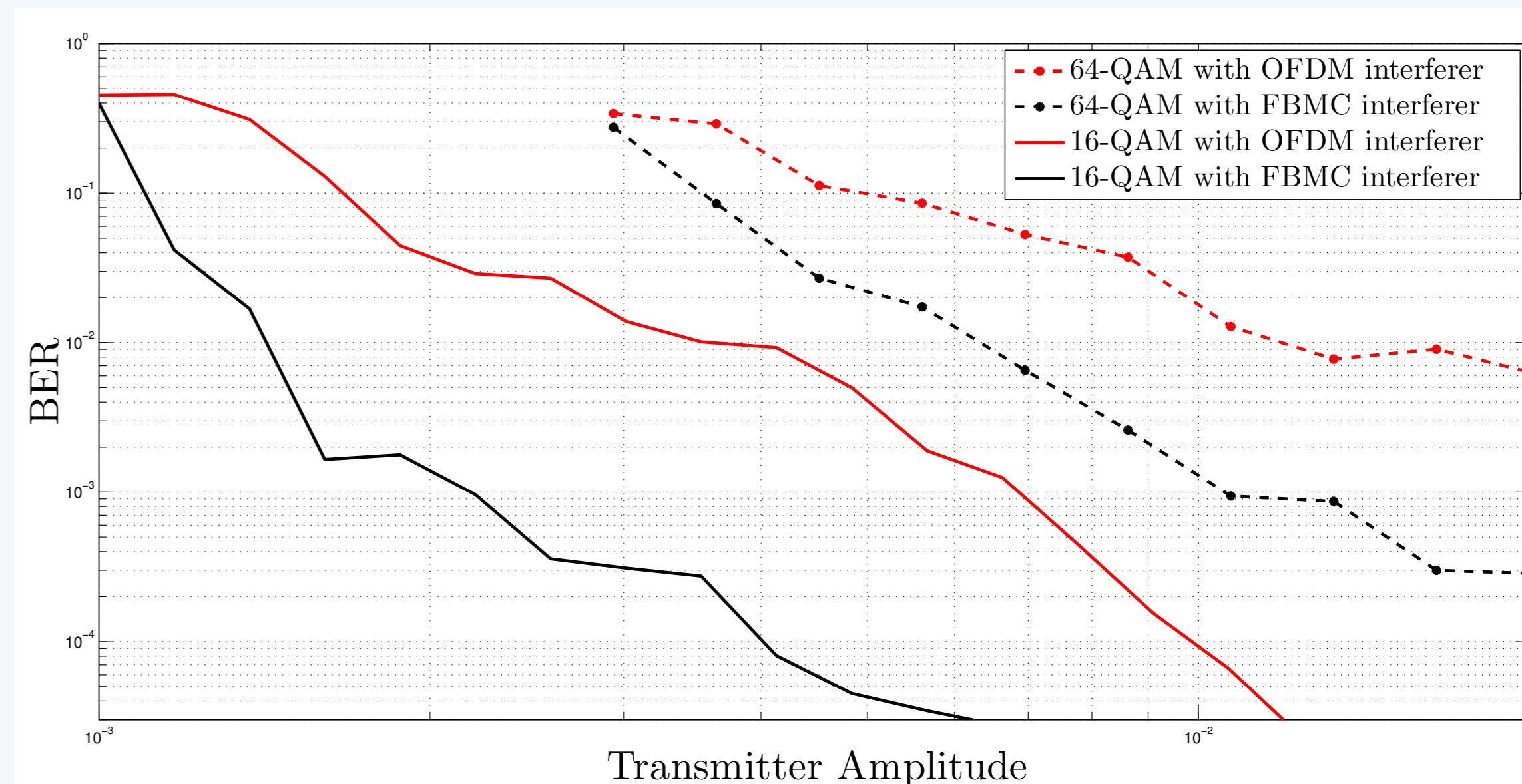


Figure: BER vs. transmit amplitude in the presence of OFDM and FBMC interferers.