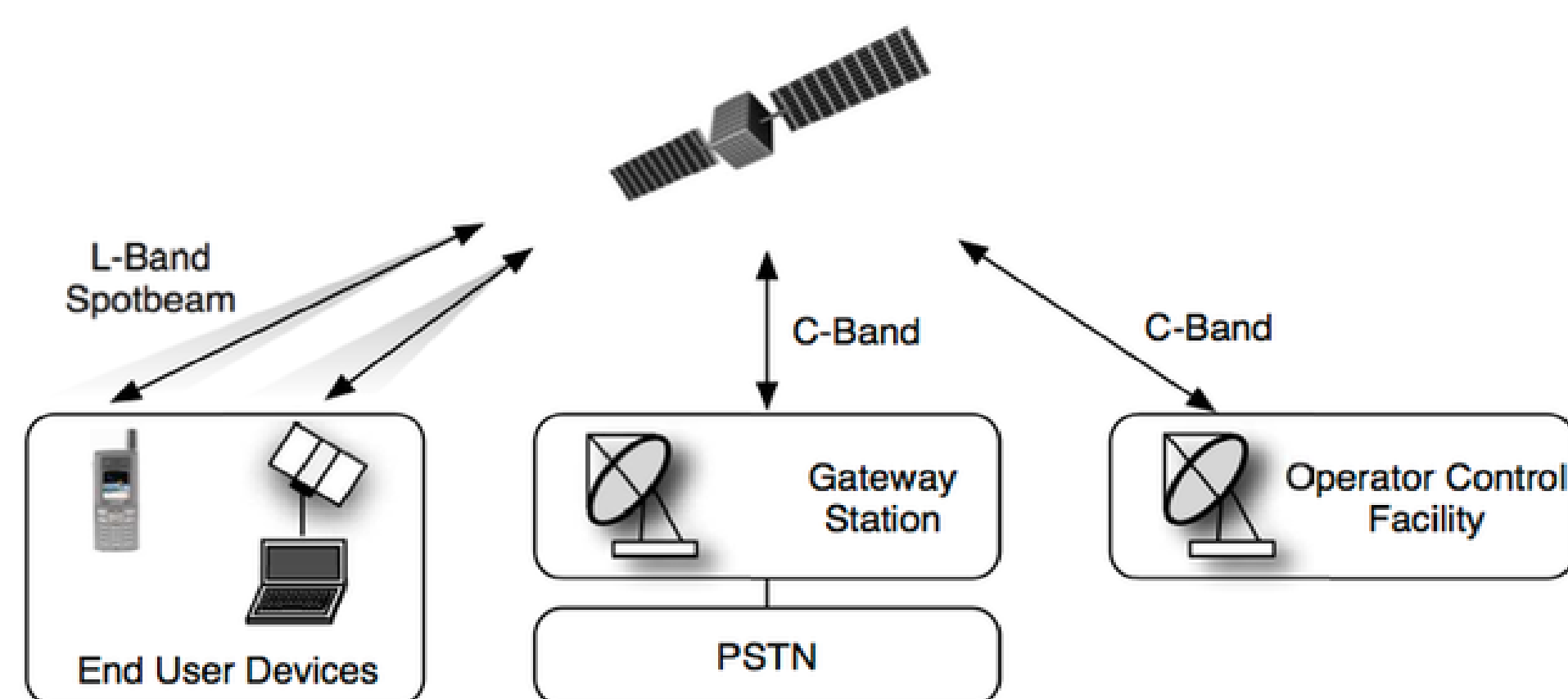




Motivation

- Ensuring confidentiality in broadcast communication systems is hard since eavesdropping can be easily facilitated.

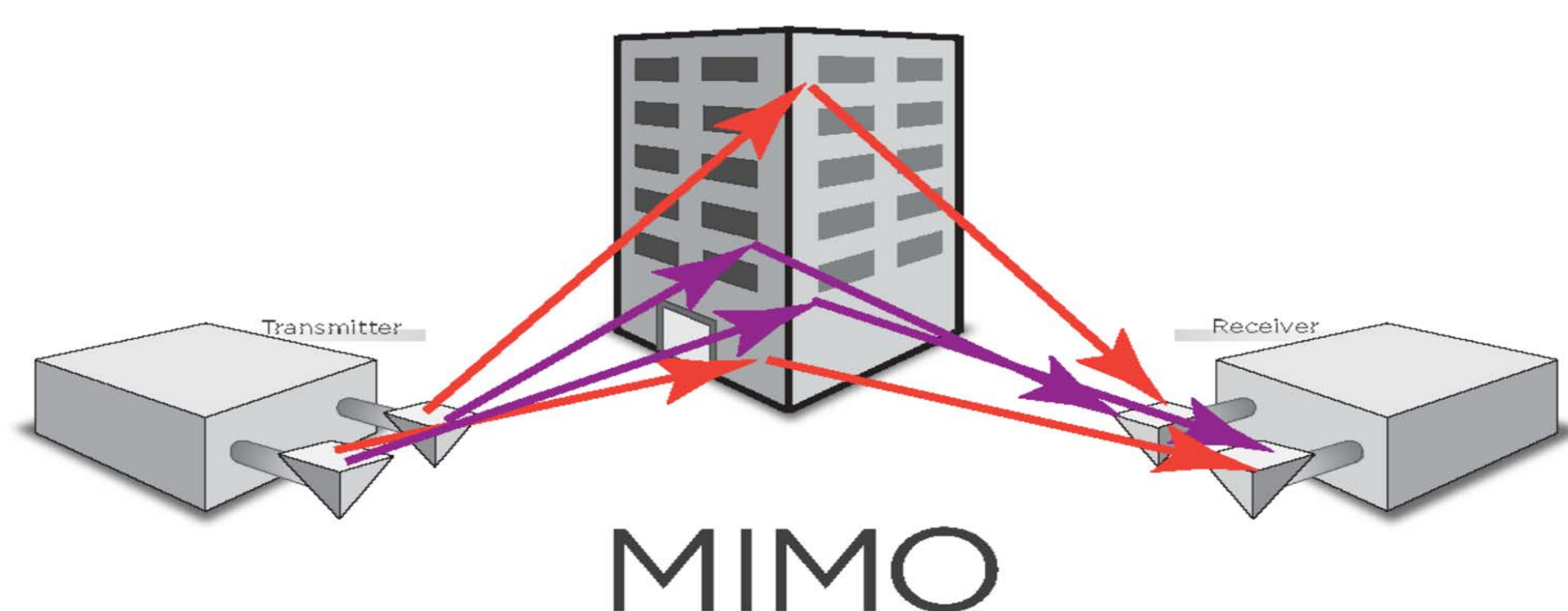


Objective

- Construct successful OFDM communication system with low bit error rate using GNURadio.
- Integrate OFDM system into existing beamforming based secret communication system by adjusting code within GNURadio files using Python and C++.

What is MIMO?

- Multiple antennas at the transmitter and receiver.
- Increases capacity by exploiting parallel links that form due to multipath propagation.
- When combined with OFDM, it achieves the greater spectral efficiency and therefore, delivers higher capacity/throughput.



MIMO

What is OFDM?

- Modulation technique used for transmitting large amounts of digital data over a radio spectrum.

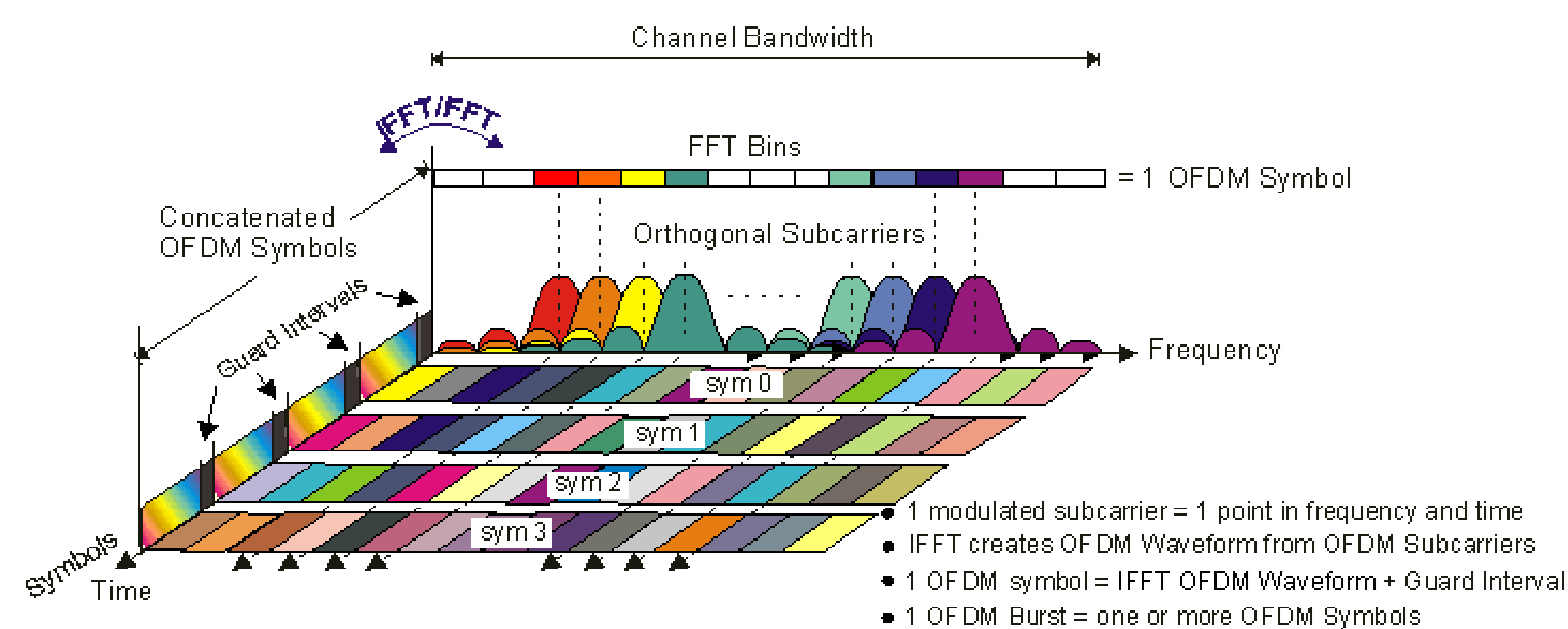


Fig 1 OFDM scheme

- In the frequency domain, multiple adjacent subcarriers, or tones are independently modulated with complex data.
- An Inverse Fast Fourier Transform is performed on the subcarriers to produce OFDM symbols in the time-domain.
- Guard intervals are inserted between each of the symbols to prevent inter-symbol interference at the receiver due to multi-path spread in the radio channel.
- Multiple symbols can be linked to create the final OFDM burst signal
- Fast Fourier Transform is performed on the OFDM symbols to recover the original data bits.

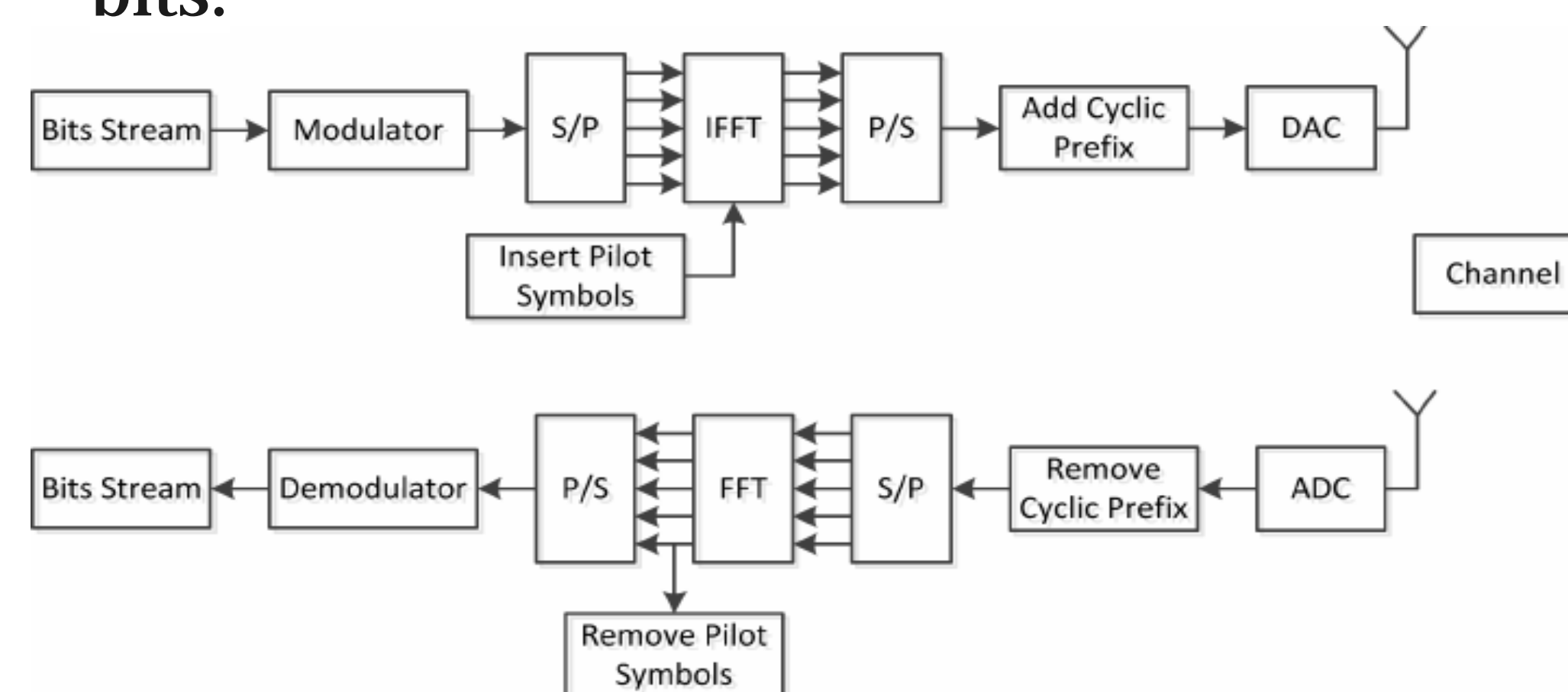
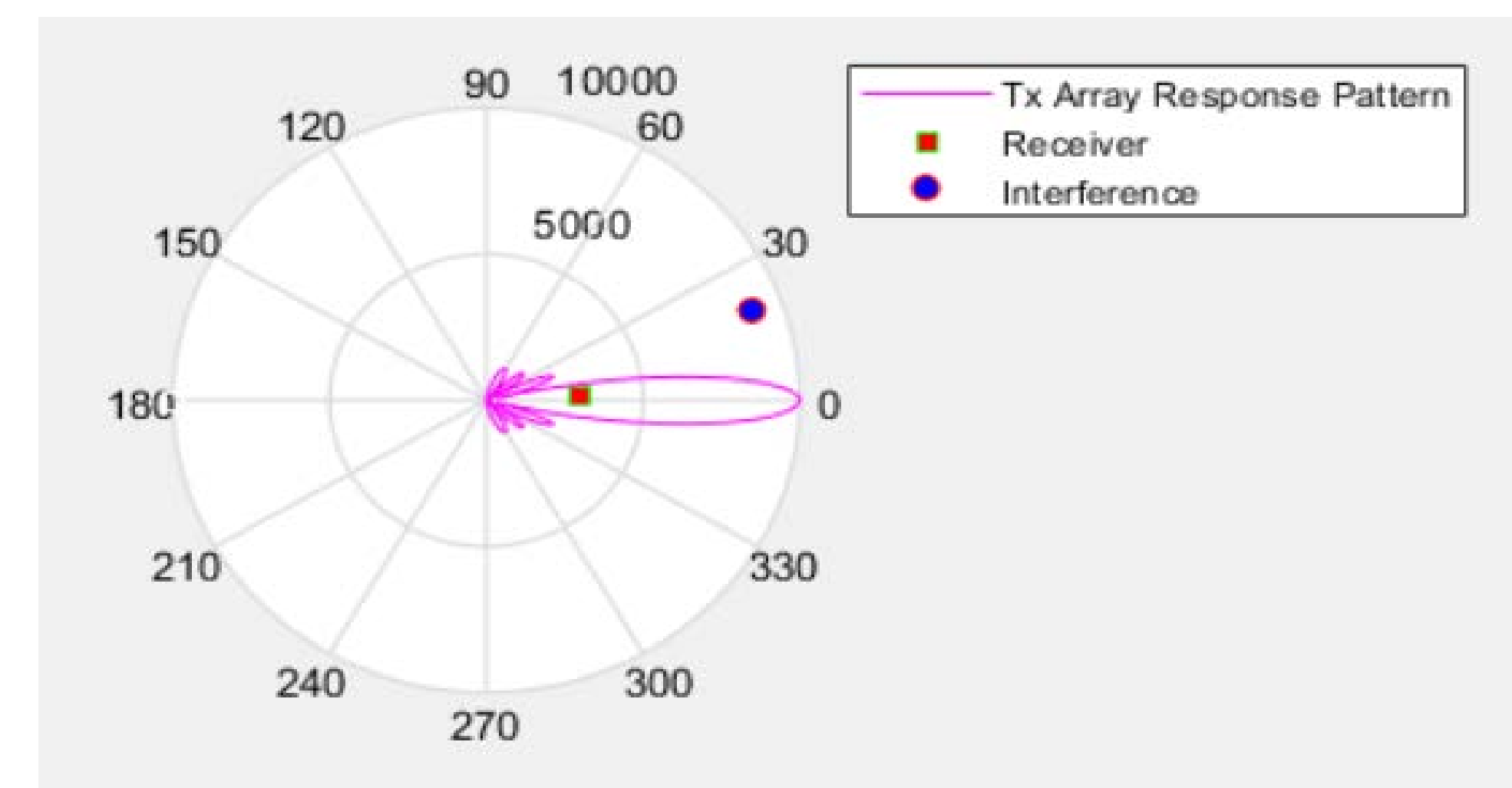


Fig 2 OFDM block diagram

Model Beamforming using OFDM

- Constructed a model beamforming OFDM communication system scheme in MATLAB.



BER = 0.02%; No. of Bits = 30714; No. of errors = 6
BER = 0.02%; No. of Bits = 30714; No. of errors = 7

- Shows actual beamforming and low bit error rate.

Results

<p>SentText.txt</p> <pre>Line Text 1 :Apple-Banana-Coconut-Duratin-Elderberry-Fig-Grapes\n Line Text 2 :Apple-Banana-Coconut-Duratin-Elderberry-Fig-Grapes\n Line Text 3 :Apple-Banana-Coconut-Duratin-Elderberry-Fig-Grapes\n Line Text 4 :Apple-Banana-Coconut-Duratin-Elderberry-Fig-Grapes\n Line Text 5 :Apple-Banana-Coconut-Duratin-Elderberry-Fig-Grapes\n Line Text 6 :Apple-Banana-Coconut-Duratin-Elderberry-Fig-Grapes\n Line Text 7 :Apple-Banana-Coconut-Duratin-Elderberry-Fig-Grapes\n Line Text 8 :Apple-Banana-Coconut-Duratin-Elderberry-Fig-Grapes\n</pre>	<p>ReceivedText.txt</p> <pre>..... Line Text 1 :Apple-Banana-Fig-Grapes Line Text 2 :Apple-Banana-Coconut-Duratin-Elderberry-Fig-Grapes Line Text 3 :Applelderberry-Fig-Grapes Line Text 4 :Apple-Banana-Coconut-Duratin-Elderberry-Fig-Grapes Line Text 5 :Apple-Banana-Coconut-Duratin-Elderberry-Fig-Grapes Line Text 6 :Apple-Banana-Coconut-Duratin-Elderberry-Fig-Grapes Line Text 7 :Apple-Banana-Coconut-Duratin-Elderberry-Fig-Grapes Line Text 8 :Apple-Banana-Coconut-Duratin-Elderberry-Fig-Grapes</pre>
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Fig 3. Sent text

Fig 4. Received text

504 sent - 433 rcvd = 14.1% error rate.

Future Work

- Embed successful low error rate OFDM system into existing beamforming communication system

References

- http://rfmw.em.keysight.com/wireless/helpfiles/89600b/webhelp/subsystems/wlan-ofdm/content/ofdm_basicprinciplesoverview.htm
- https://en.wikipedia.org/wiki/Orthogonal_frequency_division_multiplexing
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