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EXPERIMENT NO. 3

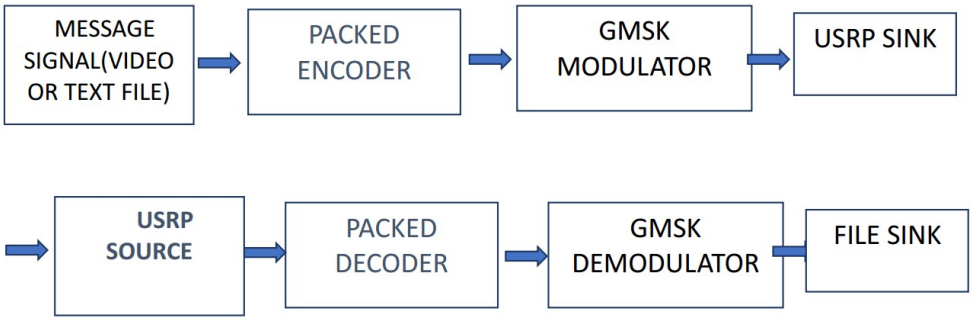
TRANSMITTING AND RECEIVING TEXT/VIDEO FILE BY USING GMSK MODULATION AND DEMODULATION TECHNIQUE

Content

GMSK modulation

Gaussian Minimum Shift Keying (GMSK) is a form of modulation used in a variety of digital radio communications systems. It has advantages of being able to carry digital modulation while still using the spectrum efficiently.

GMSK Architecture for Transmitter and Receiver



TRANSMITTING AND RECEIVING TEXT FILE

Modulated & Demodulated output of GMSK in Frequency Domain

Observation:

1. File Source block takes as input a text file. The Packet Encoder block takes as input the ASCII codes of the characters in the text file and groups the bit sequences into data packets depending on the Samples/Symbol (assign 2 samples to each symbol) and Bits/Symbol (assign 2 bits to each symbol).

2. GMSK Mod block performs the Gaussian filtering and MSK modulation. The input is byte stream and the output is a complex modulated signal at baseband.

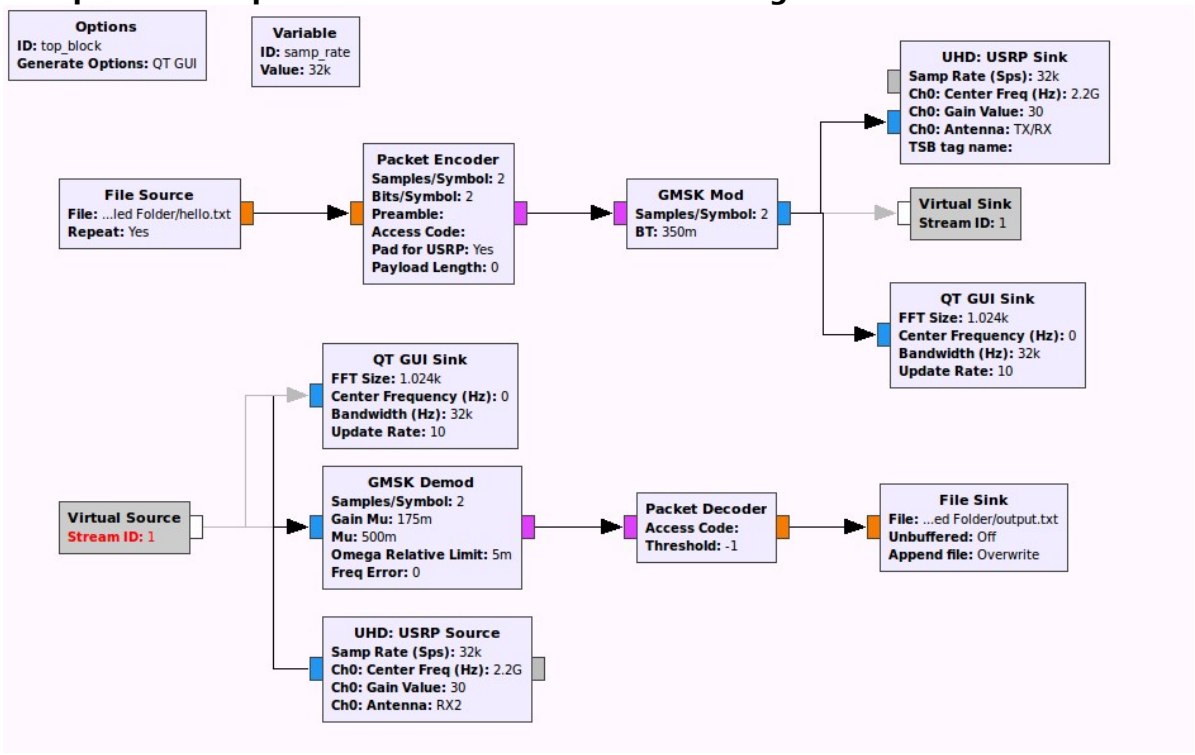
3. The modulated signal is sent to the UHD: USRP Sink which transmits the signal over wireless channel through RX/TX antenna at a centre frequency of 2.2 GHz. The signal is received at the RX antenna and processed by the UHD: USRP Source. The modulated signal is sent to the GMSK Demod block, which in turn returns a packet data stream. The Packet Decoder takes as input the packet data stream and returns the bit stream of ASCII coded characters which are stored in a text file using File Sink.

The GMSK implementation on USRP is affected by S/N ratio, bit rate, and carrier frequency of GMSK modulator.

Transmitter			
	Observation	**Comment**	**Definition**
Variable Block	Value = 32000Hz	Sampling rate	declare variables globally
Packet Encoder	Samples/Symbol : 2 Bits/Symbol: 2	This should be more than 1 samples/symbol for better probability of receving the data correctly.	Packetize data. Packet bytes go in, they get wrapped into a packet of a given payload length with a header, access code, and preamble.
GMSK Mod	Samples/symol: 2 BT : 350m	The BT product parameter represents bandwidth multiplied by time. This parameter is a nonnegative scalar.	Hierarchical bock for gaussian minimum shift key modulation. The input is a byte stream and the output is the complex modulated signal at baseband.
UHD:USRP Sink	Samp Rate: 32000Hz Center Freq: 2.2G Gain Value: 30 Antenna: TX/RX	Gain should be not too high otherwise transmitted signal will be have too much noise.	

Receiver			
	Observation	**Comment**	**Definition**
Variable Block	Value = 32KHz	Sampling rate	declare variables globally
Packet Decoder	Threshold: -1	It produces output only when signal is greater than -1	decoding packet data, manage the data in a file control system, and display the contents of the packets.
GMSK Demod	Samples/Symbol : 2 Gain Mu: 175m Mu: 500m Omega Relative Limit: 5m		Hierarchical block for Gaussian Minimum Shift Key (GMSK) demodulation. The input is the complex modulated signal at baseband.
UHD:USRP Source	Samples/Symbol: 44.1KHz Center Freq : 2.2G Gain Value: 30 Antenna: RX2	Gain should be in optimal range otherwise there will be more noise in received signal	

The Complete block representation for Text Transmission using USRP

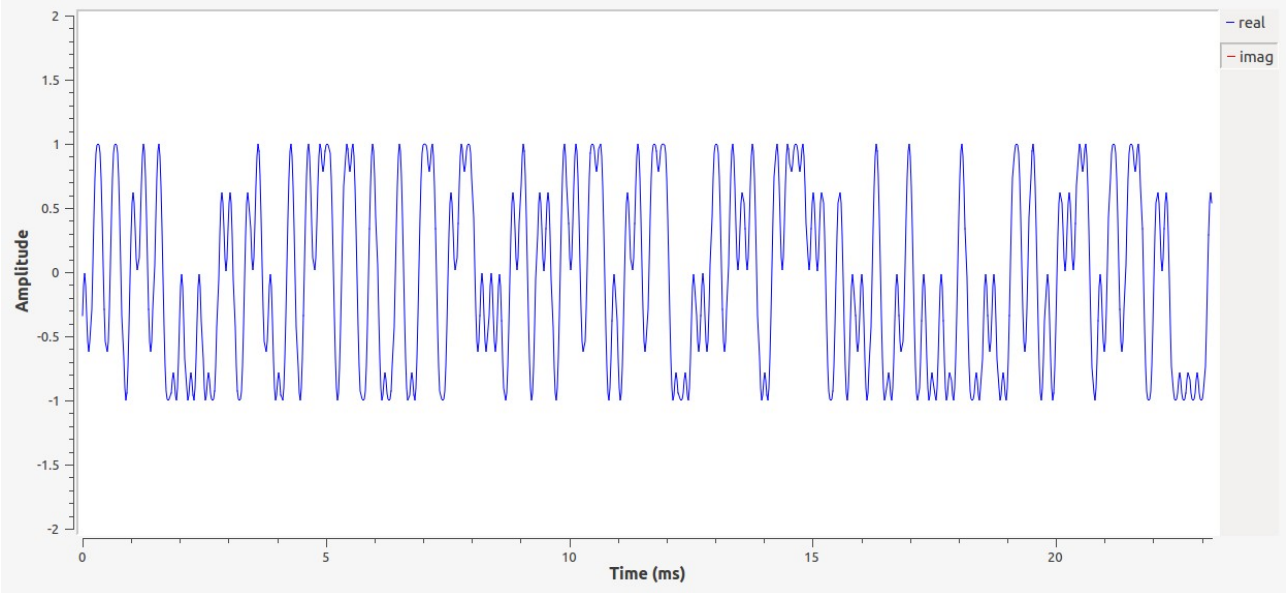


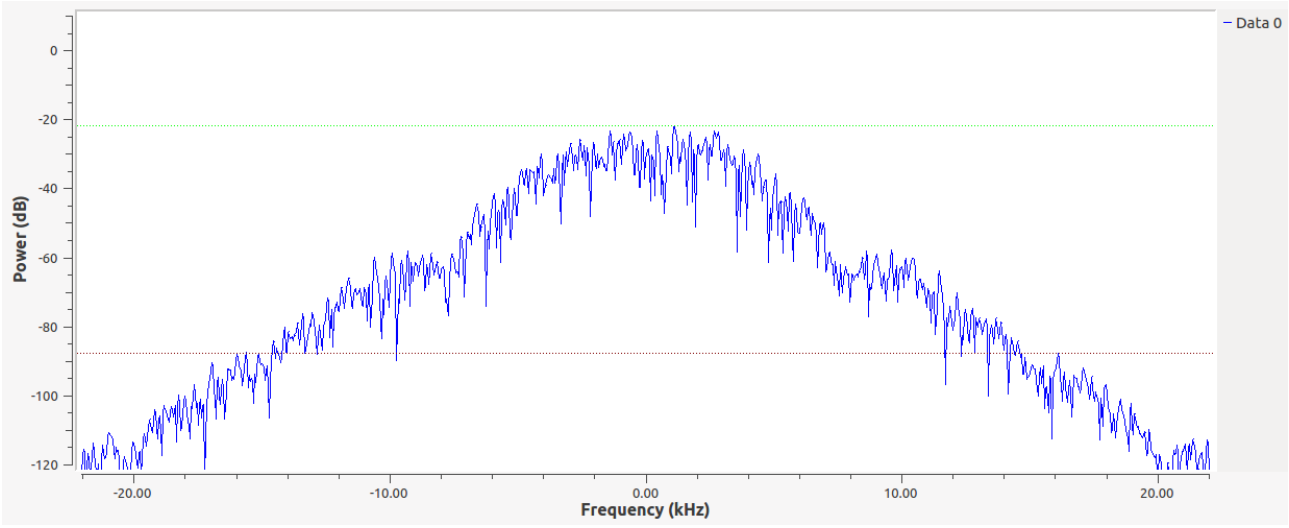
Conclusion:

In text transmission, the characters in the text file were received precisely and stored in the text file. Since the characters were allowed to repeat at the input, we received multiple repeated versions of the same text.

TRANSMITTING AND RECEIVING Video FILE

Modulated & Demodulated output of GMSK in Frequency Domain





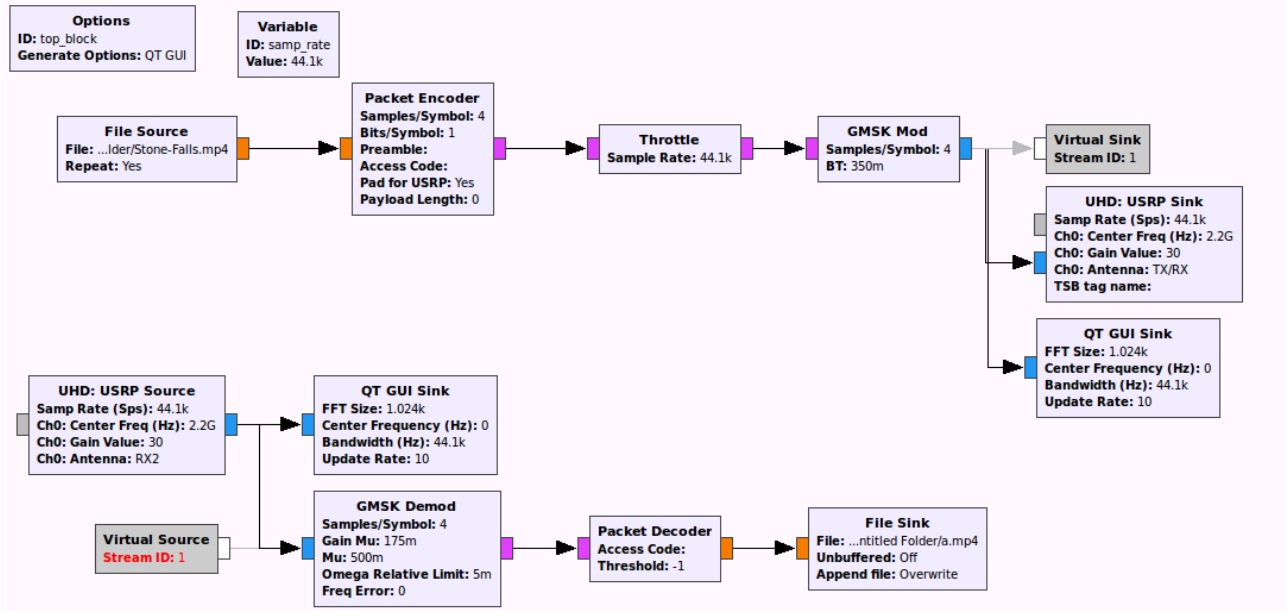
Observation:

For transmission of video file the block diagram is the similar to the one used for text transmission. However a Throttle is inserted in the transmission forward path to compensate for the increased computation power for processing video files. Hence the GMSK signal is modulated in the same way as in text transmission.

Transmitter			
	Observation	**Comment**	**Definition**
Variable Block	Value = 44.1KHz	Sampling rate	declare variables globally
Packet Encoder	Samples/Symbol : 4 Bits/Symbol: 1 Pad for USRP: Yes	This should be 4 samples/symbol for better probability of receving the data correctly.	Packetize data. Packet bytes go in, they get wrapped into a packet of a given payload length with a header, access code, and preamble.
GMSK Mod	Samples/symol: 4 BT : 350m	The BT product parameter represents bandwidth multiplied by time. This parameter is a nonnegative scalar.	Hierarchical bock for gaussian minimum shift key modulation. The input is a byte stream and the output is the complex modulated signal at baseband.
UHD:USRP Sink	Samp Rate: 44.1KHz Center Freq: 2.2G Gain Value: 30 Antenna: TX/RX		

Receiver			
	Observation	**Comment**	**Definition**
Variable Block	Value = 44.1kHz	Sampling rate	declare variables globally
Packet Decoder	Threshold: -1	It produces output only when signal is greater than -1	decoding packet data, manage the data in a file control system, and display the contents of the packets.
GMSK Demod	Samples/Symbol : 4 Gain Mu: 175m Mu: 500m Omega Relative Limit: 5m	This should be 4 samples/symbol for better probability of receving the data correctly.	Hierarchical block for Gaussian Minimum Shift Key (GMSK) demodulation. The input is the complex modulated signal at baseband.
UHD:USRP Source	Samples/Symbol: 32000Hz Center Freq : 2.2G Gain Value: 30 Antenna: RX2		

The Complete block representation for Video Transmission using USRP



Conclusion:

The received video file was stored in another (.mp4) file
although a few instants in the video file were found missing in the received file.