

Assignment 4

- 1) A broadcaster transmits its program over a geosynchronous satellite. The uplink and downlink carrier frequencies are 14 GHz and 12 GHz, respectively. The distance from the satellite to the gateway and the the receiver can both be approximated as 36,000 km. Assume that the uplink (the Gateway) antenna has a gain of 45 dBi, the receiver on the satellite has an antenna with a gain of 40 dBi and a noise temperature of 3500° K. The trnamitter onboard the satellite has a gain of 45 dBi and a power of 100 W. Receiver on the ground has an antenna gain of 15 dBi and a nosie temperature of 250° K. Modulation used is QPSK with a roll-off factor of 0.25 (error control coding is not used).
 - a) Find the required bandwidth if the bit rate is 3 Mbps.
 - b) Find the uplink transmitter power if the operator wants to have no more than one packet in error per hour.
- 2) A viewer receives TV signals with an $\frac{E_b}{N_0}$ of 16 dB. The modulation is 8-PSK and a (190, 188) RS code is used.
 - a) what is the packet error probability?
 - b) What is the number of packet errors per day if the rate of the MPEG encoder is 10 Mbps?
- 3) Assume that a Television station is transmitting an HDTV signal with a bit rate of 20 Mbps using 8PSK with roll-off factor 0.1. The requirement is that no more than one packet of TS be dropped in an hour. Assume that a packet is dropped if there is any error in it. The power of the transmitter is 50 W and the transmitter antenna gain is 15 dBi at a heighr of 30 meters. The receiver antenna has a gain of 5 dBi and noise temperature 2500° K and is installed at a height of 6 meters. The receiver has an LNB with NF=6 dB and $G_{LNA} = 20$ dB connected with a cable with 4 dB loss to an amplifier with 30 dB gain and NF=16. The receiver, including the receiver front end and the demodulator, has a noise figure of 10 dB. Assuming a pointing loss of 0.5 dB and implementation loss of 1.5 dB. a) Find the required bandwidth. b) If the transmission frequency is 700 MHz., find the maximum distance the station can cover with the required quality with the standard RS coding. c) If RS coding and convolutional coding (with soft decision decoding) are used.

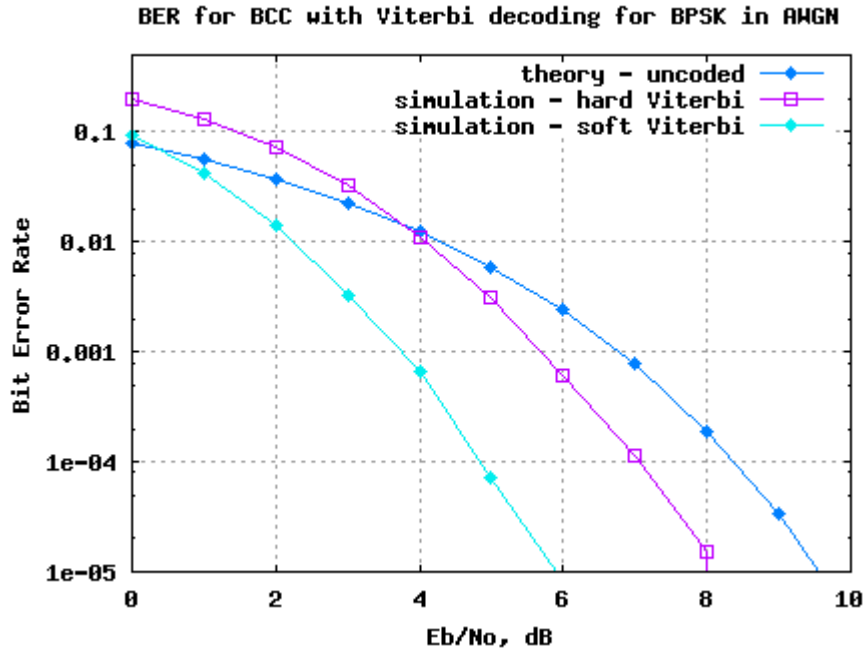


Figure 1: Performance of Convolutional code with Viterbi decoder.

- 4)
 - a) How many bits are in a TS?
 - b) Define PID.
 - c) Define PAT.
 - d) Define PMT.
 - e) Define CAT.
 - f) Define PCR.
 - g) What is the function of a multiplexer?
 - h) What is the main difference between ATSC and DVB standards?
 - i) Why is Zig-Zag scanning used?

- 5) Assume that MPEG-2 Transport stream packets are transmitted over IP using UDP (User Datagram Protocol). To each TS packet 8 bytes of UDP header and 20 bytes of IP header are added. How many hours of video, per day, can you download if your Internet connection can support a download rate of 30 Mbps and you would like to have videos with the highest possible Mean Opinion Score (MOS). If your computer's hard drive has a capacity of 1 Terabytes how often do you need to back it up?

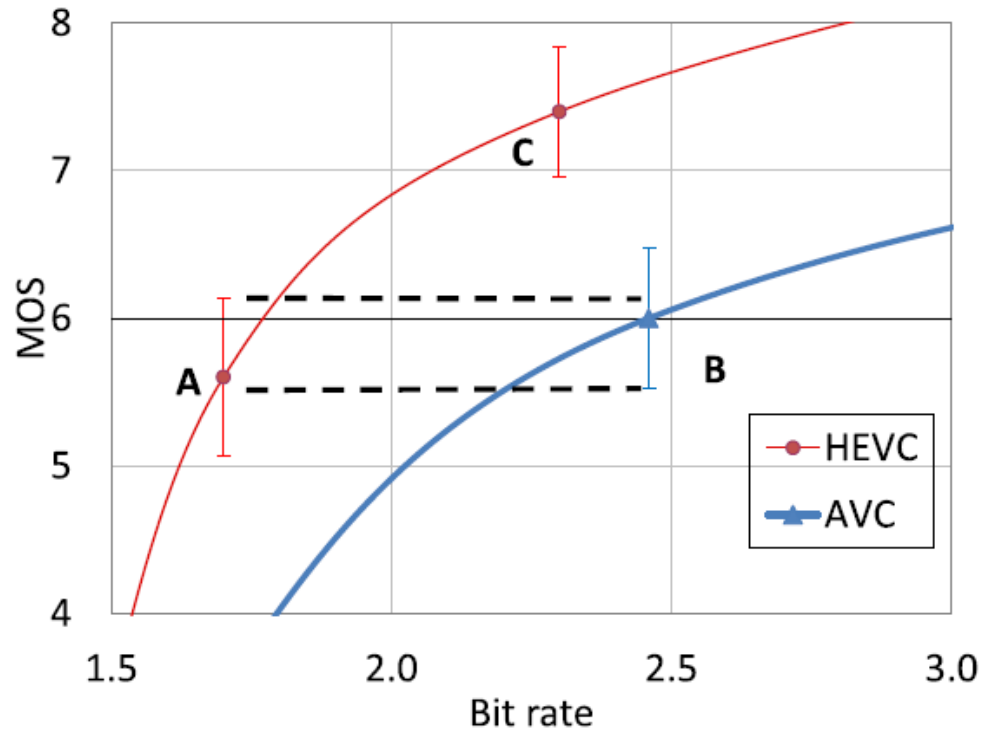


Figure 2: Video quality versus the bit rate in Mbps.