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EMSMN Lab. 2 – report

Terrestrial Digital Television Standard (DVB-T)

Please note your calculations of values indicated in the table

For DVB-T – RS(204,188); 204/188 = 1.0851

500080 * 1.0851 = 542640 bytes at RS encoder output

542640 bytes * 8 = 4341120 bits at RS encoder output

4341120 bits at RS encoder output * 2 = 8682240 bits at conv. Encoder and puncturer output because puncturer rate is 1/2

Mapper output: 1446984, because 8682240/6 = 1446984 due to QAM-64 modulation (2^6 = 64), which means 6 bits per symbol

N	No. of bytes at RS encoder output	No. of bits at conv. encoder output	No. of bits at puncturer output	No. of symbols at mapper output.
500080	542640	8682240	8682240	1446984

Your comments on signal at the output of the mapper:

It checks out with constellation type for QAM-64. We can observe the signal transitions between different symbols.

Your comments on signal at the input of the IFFT block:

It is the QAM-64 constellation with an addition of pilot and TPS signals used to simplify the reception of transmitted signal. They are BPSK (0 or 180 deg phase)

Your comments on the amplitude of signal at the output of the IFFT block:

We see many different amplitudes, upward to 150. It is not good for the hardware if the amplitude fluctuates.

According to my calculations:

- 826880 symbols will appear at the output of the mapper after changing the convolutional code rate from 1/2 to 7/8
- 1240320 symbols will appear at the output of the mapper after changing the convolutional code rate from 1/2 to 7/8 and the constellation size form 64-QAM to 16-QAM.

According to the experiments:

- 825552 symbols appeared at the output of the mapper after changing the convolutional code rate from 1/2 to 7/8
- 1239840 symbols appeared at the output of the mapper after changing the convolutional code rate from 1/2 to 7/8 and the constellation size form 64-QAM to 16-QAM.

Your comment on bandwidth and shape of the spectrum:

Spectrum is uniform on almost the whole bandwidth. It is uniform between -3 and 3 MHz. Outside of it's range, the signal's power is lower.

We can observe pilot signals that have higher power than other signals. Because the slope is steep near the edge of the bandwidth, the interference between different channels will be low. Thanks to that, the channels can be close to each other.

Operations that should be performed to signal in next stages of reception are:

- Extract the symbol with ofdm1 = sig(1:(2048 + 2048/8))
- Remove CP with ofdm2 = ofdm1(1/8 * 2048+1:end)
- Plot the FFT with stem(abs(fftshift(fft(ofdm2))))
- Calculate the constellation with ofdm_fft = fft(ofdm2) and plot with plot(ofdm_fft)
- Repeat above for each symbol

Your comment on reception of noisy signal:

The constellation still can be read from the plot, even with added noise. However, there might be some interference between symbols due to overlapping.

We can also see edge carrier signals. Without noise, their amplitude was 0, but when the noise was added, they appeared on the constellation (in the middle) and FFT.