

Real-time HF channel simulator

Real-time HF channel simulator is hardware-software implementation based on DSP technology with controlling from PC.

It processes voice band analog signal between output of any HF modem modulator and input of HF modem demodulator. It simulates RF part of transmitter, ionosphere channel and RF part of receiver.

HF channel simulator is build according to hint 549 CCIR (CCIR, "HF ionosphere channel simulator", XIII Plenary Assembly, CCIR, vol III, Report No. 549.).

General block-scheme of HF channel simulator signal processing algorithm is presented on Fig.1. Scheme of operation of HF channel simulator with HF modems is presented on Fig.2

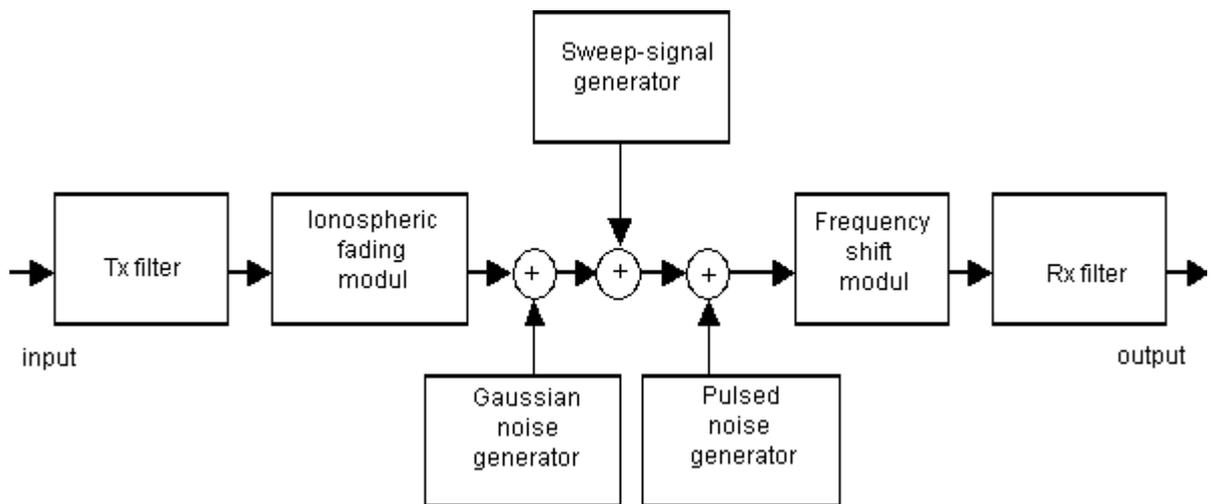


Fig.1. Block-scheme of HF channel simulator signal processing algorithm.

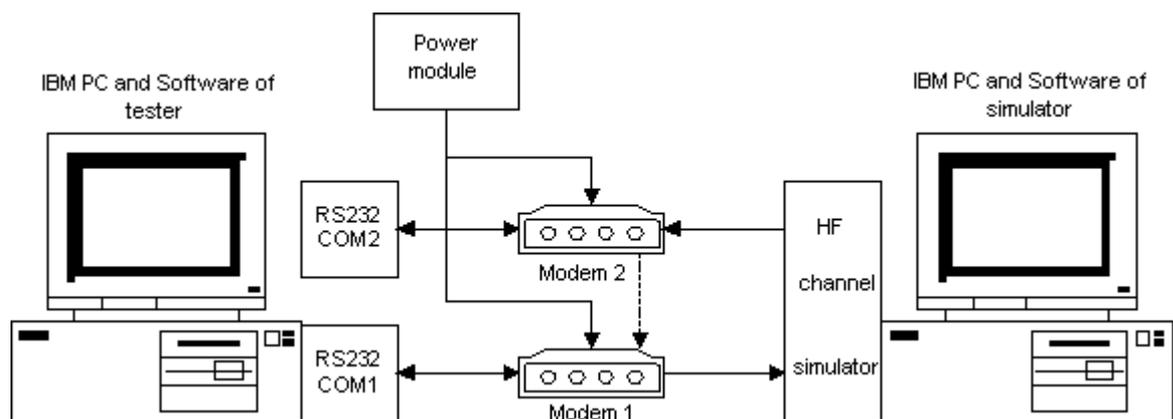


Fig. 2. Operation of HF channel simulator with HF modems during testing.

Real time processing hardware part of HF channel simulator is based on DSP TMS320C67 from Texas Instruments. HF simulator uses standard TI DSP starter kit DSK6711 supplied by Spectrum Digital.

The program controlling HF channel simulator works on PC under operating system Windows NT4.0/2000/XP. HF channel simulator is controlled through PC LPT Port connected to DSK TMS320C6711. HF simulator PC software screen-shot is presented on Fig. 3.

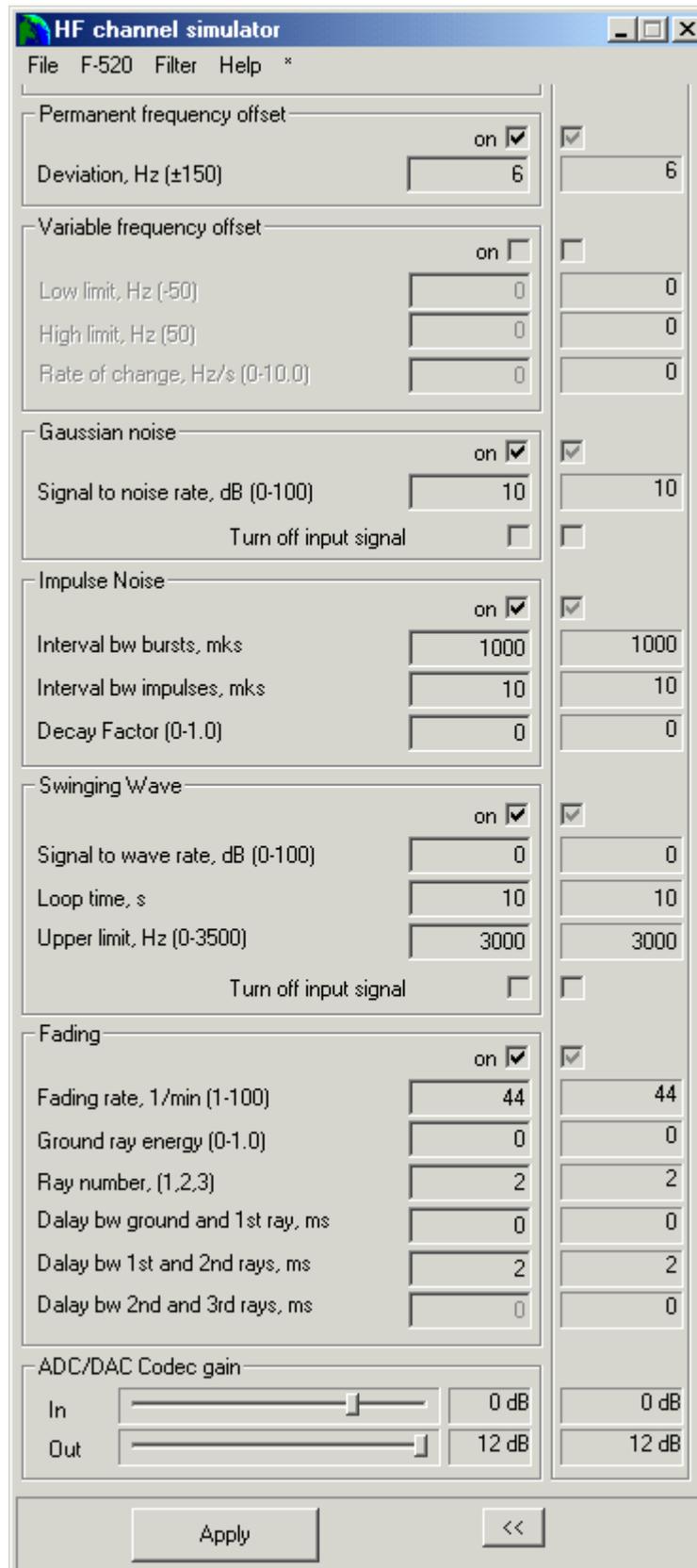


Fig. 3. HF simulator PC software screen-shot

HF channel simulated features:

1. The effect of the radio set band limited transmit and receive filters;
2. The effect of Rayleigh fading caused by multipath propagation through the ionosphere;
3. The effect of additive white gaussian noise;
4. The effect of interfering continuous sine wave signal that sweeps the transmitted signal spectrum;
5. The effect of impulsive noise;
6. The effect of the constant frequency offset.

The effect of the radio set band limited transmit and receive filters

A filter settles up on given gain-frequency characteristic and group time delay.

The effect of Rayleigh fading caused by multipath propagation through the ionosphere

1. The number of fade per minutes (1, ..., 100).
2. The number of the paths through the ionosphere (0, 1, 2, 3).
3. The relative delay between the ground wave and sky waves ($< 5\text{ms}$).
4. The proportion of the ground wave energy within the total received signal energy (0 – 100%).

The effect of additive white gaussian noise

The signal to the Gaussian noise ratio (in dB).

The effect of interfering continuous sine wave signal that sweeps the transmitted signal spectrum

1. The signal to interfering sweep signal ratio (in dB).
2. The time needed for the interfering continuous sine wave to sweep the whole band of the signal spectrum (in ms).
3. The upper limit frequency of the sweeping sine wave ($< 4\text{kHz}$).

The effect of impulsive noise

1. The interval between two adjacent impulsive noise bursts (in ms);
2. The interval between two adjacent impulsive noise pulses in a bursts (in ms);
3. Decay factor of the amplitude envelope of impulsive noise bursts (0 – 100%).

The effect of the constant frequency offset

The frequency offset ($\pm 150\text{ Hz}$).