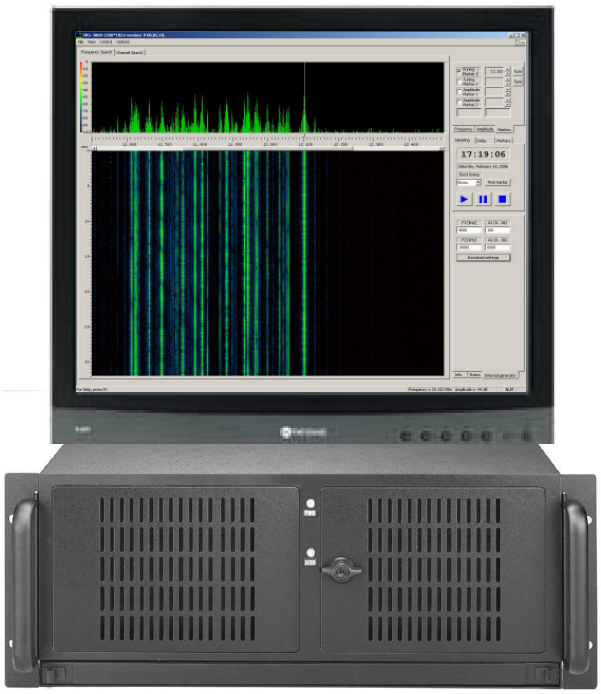
Interception capability of the SRS-3000 scanning receiver



CONTENT

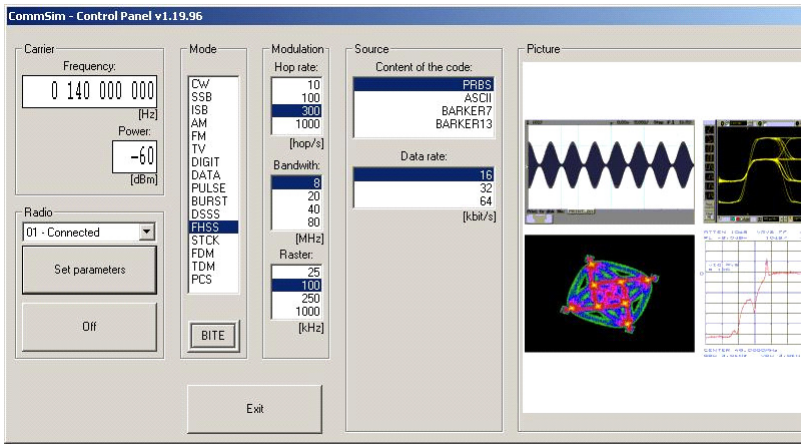
Introduction

The SRS-3000 is a frequency-agile, lightweight HF/VHF/UHF receiver designed for limited space and high-mobility application for ground and air environment. Its compact size, broad tuning range and high-level remote control functionality make it ideal for multitude of system application, including commercial frequency management and military EW/SIGINT/COMINT missions. The receiver couples high scan speed, high frequency and time resolution, high dynamic range, and excellent selectivity to provide superior performance over many much other receivers. The equipment can be used for high-speed spectrum management missions as a stand alone receiver system or as a building block of high-grade, multi-functional integrated systems.

Test signal generation

Frequency hoping signals

To demonstrate the signal interception capability of the SRS-3000 scanning receiver FH signals were generated by the Sagax SGJ-3000 signal generator. This generator has functionality to generate FH signals with up to 1000 hops/sec and bandwidth up to 40MHz. The control panel of the generator could be seen in following figure.

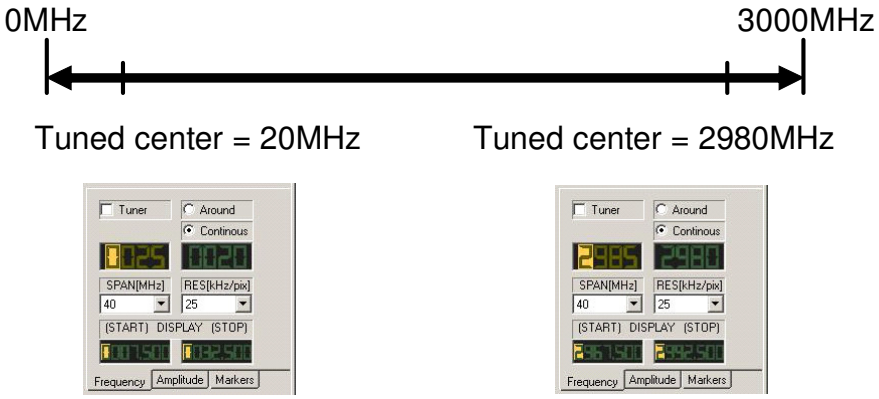


As we can see the basic parameters of the FH signal are the hop rate (10hop/sec, 100hop/sec, 300hop/sec and 1000hop/sec), the full bandwidth (8MHz, 20MHz, 40MHz, 80MHz) and the raster of the frequency points (25KHz, 100KHz, 250KHz, 1000KHz). As this generator is used for testing of signal intelligence demodulator/decoding systems and training of the operators of such a system the carrier could be modulated with real signals with known content too at 16kbps, 32kbps or 64kbps signaling rate.

Frequency and bandwidth characteristics

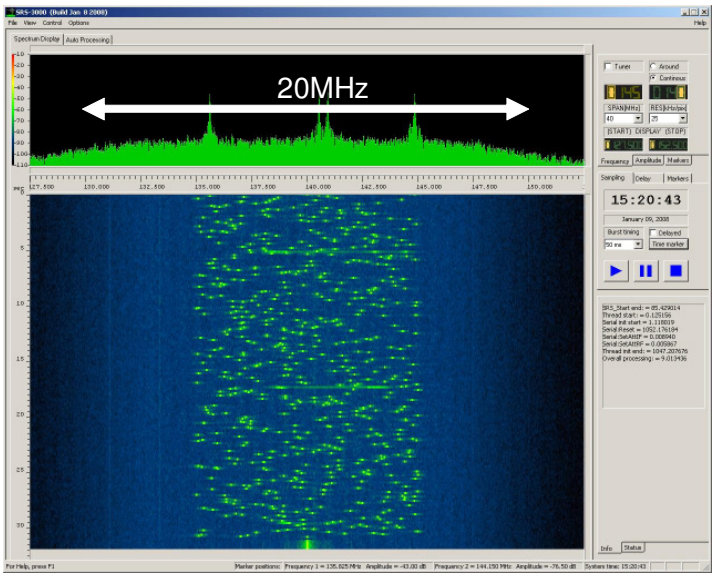
Reception frequency band

The receiver has got 40MHz instantaneous digital signal processing bandwidth. Based on that value the center frequency of the front-end tuner could be tuned to 20MHz at lower end and 2980MHz at higher end. In this way the signal reception in the **10MHz to 2290MHz** frequency band is provided. This is demonstrated in the following figure.



Instantaneous bandwidth

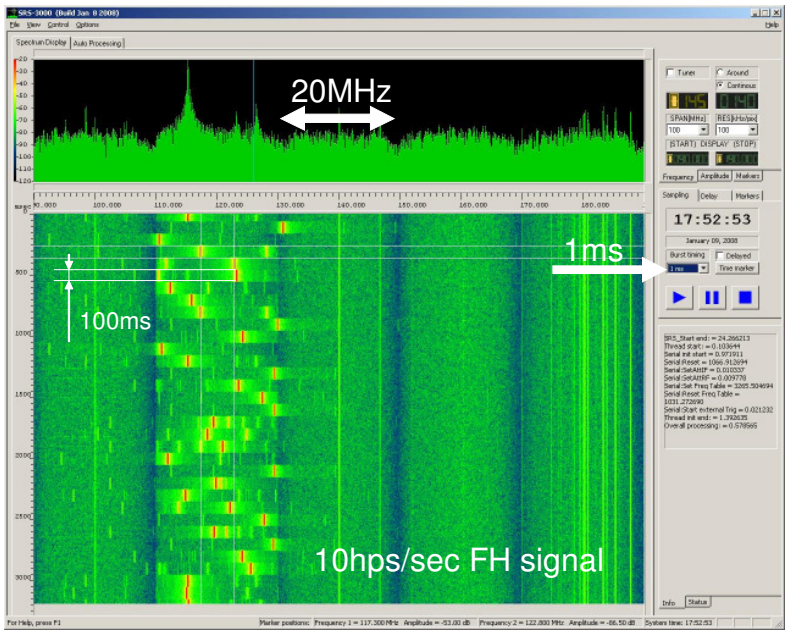
The Nyquist bandwidth of the digital receiver is 40MHz, but this theoretical bandwidth could not be used in real practice. The bandwidth is limited by the anti-aliasing filters in the receiver chain. In this case the practically useable instantaneous bandwidth of the receiver which is determined by the IF filter of the front-end tuner is **20MHz(3dB)**. It could be examined in the following figure.



Scanning speed

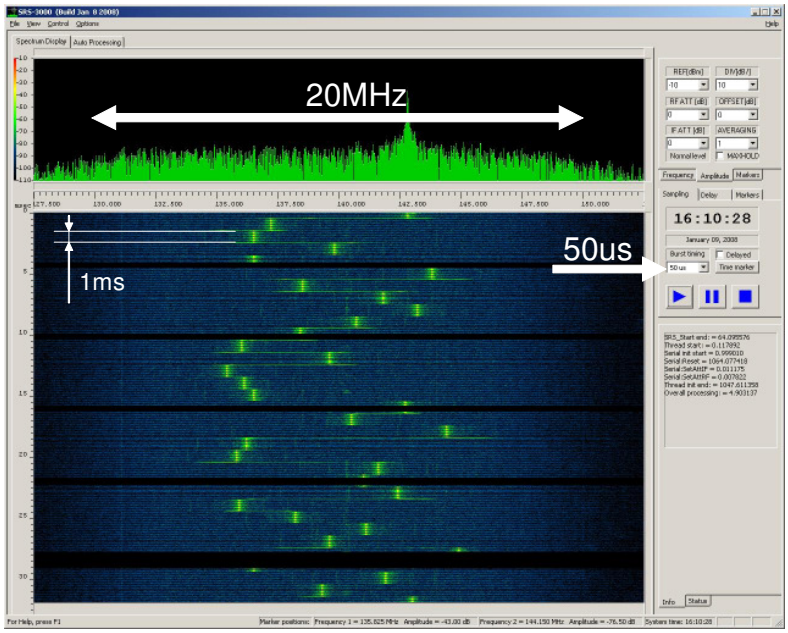
Scan rate

The scan rate of the receiver is determined by the instantaneous bandwidth of the digital tuner and the tuning speed of the front-end tuner. In our case the digital tuner has 20MHz(3dB) instantaneous bandwidth and the front-end tuner is able to step to the next frequency with 1ms/step speed. The wideband scanning is based on the 20MHz tuner steps as it is matched to the digital receiver and the spectrum is estimated in every milli-seconds, in this way we need 5 steps to cover a 100MHz bandwidth and so on. These parameters give us 20MHz/1ms scan rate which is **20GHz/sec** normalized value. The feature is demonstrated in the following picture with a 10hps/sec FH signal in the band.

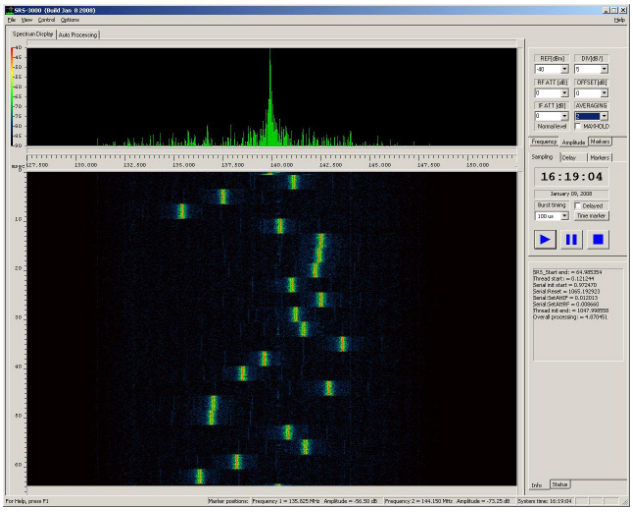


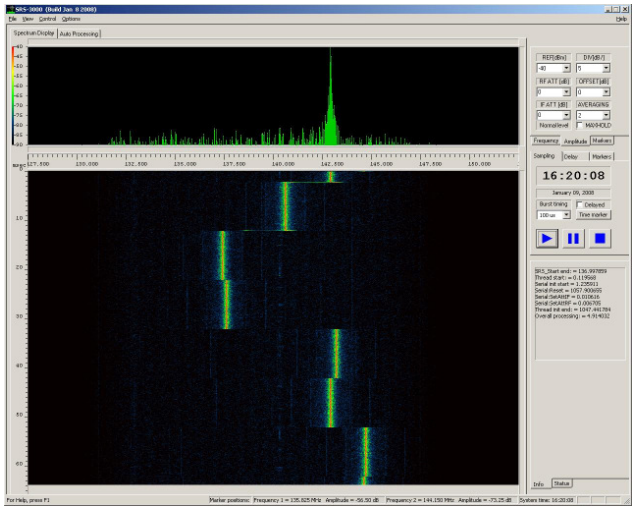
Interception rate

When the receiver is used for intercepting and classification of the discovered signal the receiver could be tuned to the interested signal and with its instantaneous bandwidth the signal could be captured. In this mode of operation the frequency step of the front-end tuner is not required so the spectrum estimation process is done in the digital processor part of the receiver only. The speed of the digital receiver is significantly higher than the tuning speed of the front-end tuner. In our case the time resolution is 50us. Based on the practical 3dB bandwidth the resolution scanning speed is 20MHz/50us which is equal to **400GHz/sec** normalized scanning speed.
This kind of high-speed operation enables us to exactly measure the parameters of FH signals up to 1000 hops/sec as it is demonstrated in the following figure where the length of the 1ms burst could be measured with this 50us resolution.

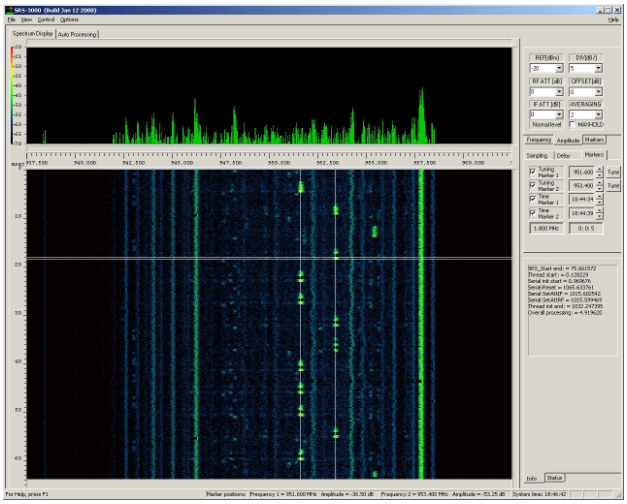


This high measurement resolution is enough to provide fingerprinting data for classification of the different radio equipment to provide more data for the intelligence operators. The following pictures show reception of 300hops/sec and 100hops/sec signals in high-resolution interception mode with 100us time resolution and 20MHz bandwidth which has 200GHz/sec normalized equivalent scanning speed.

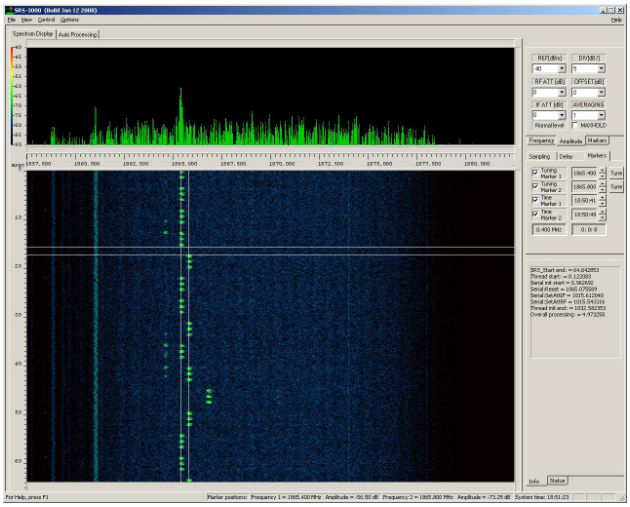




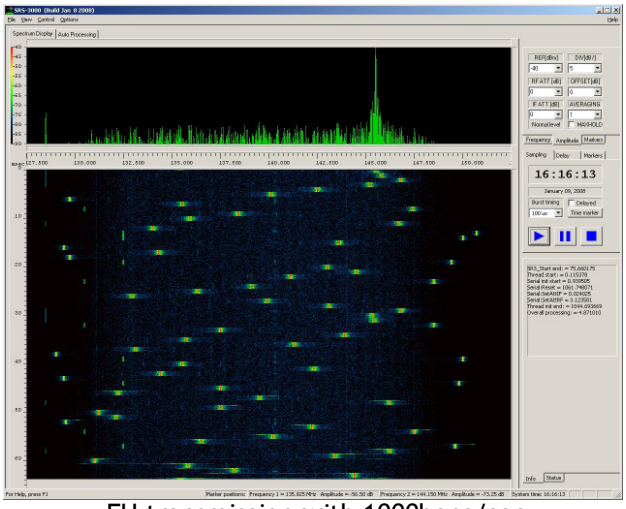
Other examples



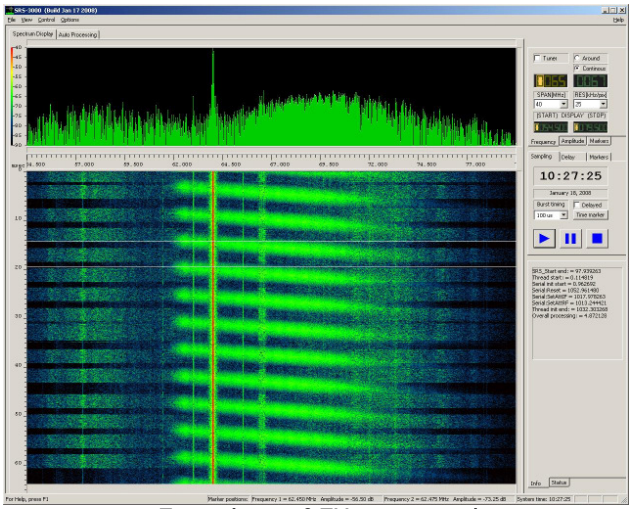
Frequency hopped GSM burst in 900MHz band



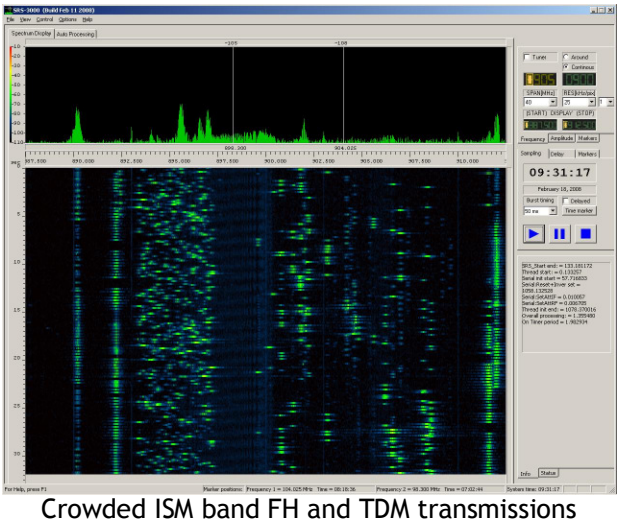
Frequency hopped GSM burst in 1800MHz band



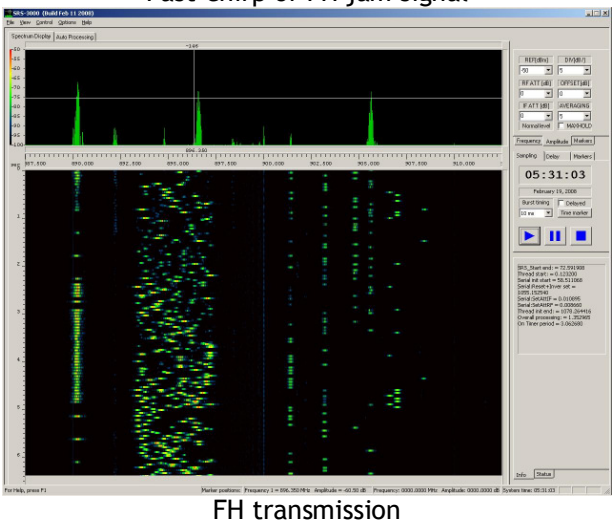
FH transmission with 1000hops/sec



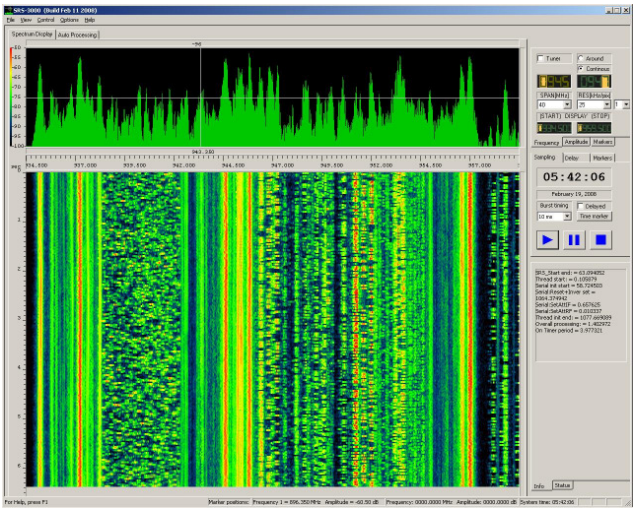
Fast-chirp of FH jam signal



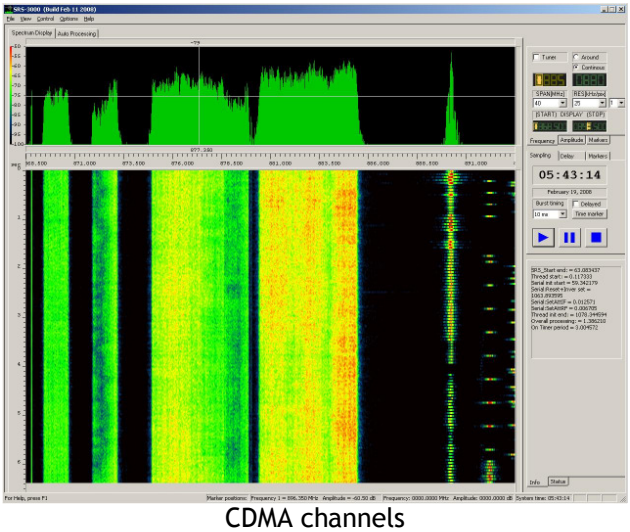
Crowded ISM band FH and TDM transmissions



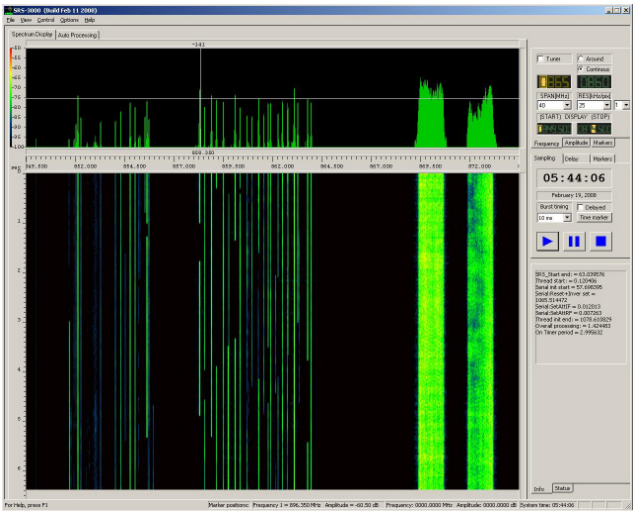
FH transmission



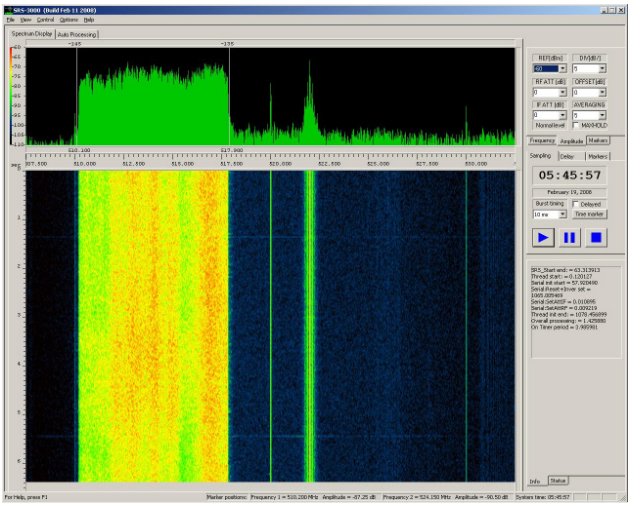
PCS downlink band



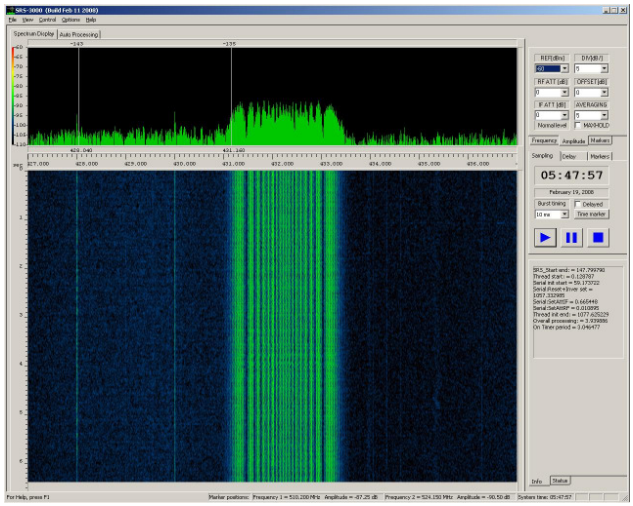
CDMA channels



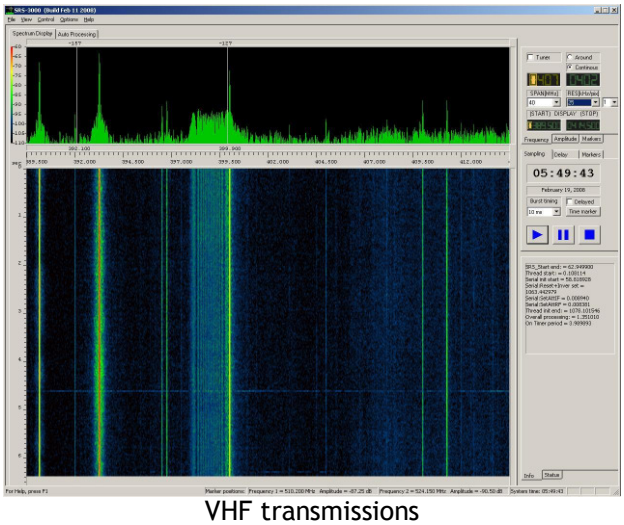
Narrow-band FM



DVB-T broadcast



Spread-spectrum transmitter



VHF transmissions