

Observations of Type-3 solar radio bursts using the waveform receiver

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It has been proposed that type-3 solar radio bursts are excited by electron-cyclotron maser instabilities between electron beams along solar magnetic field lines ejected from solar flares and space plasma. Melrose and Dulk [1982] proposed that the time scale for the growth and decay of waves continue less than a millisecond. In contrast, ground observation, showed that the time scale was about 10 milliseconds. Previously measurements of solar radio bursts were mainly performed using spectrum observations, and the duration timescale of coherent waves remains unsolved.

In this research, we developed a waveform receiver using the digital down converter (DDC) developed for third-generation mobile phones for obtaining time and phase information of type-3 solar radio bursts. The waveform receiver consists of 80MSPS 14bits A/D Converter (ADC), over 100MSPS 16bits 4ch DDC, 20MSPS 32bits Digital I/O board. It is possible to obtain waveforms conserving the information of the phase precisely by digital processing with frequencies up to 40MHz and the bandwidth can be changed from 1.3kHz to 20MHz. The observation using this receiver was started from August 2007 at the IITATE observatory of Tohoku university from 25.3 to 29.5MHz and the bandwidth is 10kHz. Till now two type3 solar radio bursts has been observed.

As a result of analyzing of waveforms of type3 solar radio burst observed in December 31 2007 at 25.3MHz and the maximum intensity is 10^{-19} [W/m²/Hz], timescales of the pulsations of type-3 radio bursts are not 10ms, but the duration times are less than 1ms, and the pulsations are very impulsive waveforms, and waveforms separated by several tens of km along the magnetic field lines are quite different.