ULTRA WIDEBAND DIRECT CHAOTIC COMMUNICATIONS

Alexander Dmitriev, Andrey Panas, Sergey Starkov

Institute of Radio Engineering and Electronics,
Russian Academy of Sciences
Moscow, 101999, Mokhovaya St. 11-7, Russia
chaos@mail.cplire.ru

Recently, there are user needs to transmit more and more information volume with a high data rate. To realize the needs, it is necessary to use more wide frequency bands. But available frequency bands are licensed except for two (rather narrowband) bands. To solve the problem there are at least two ways. The first of them is connected with the use of more high-frequency bands. But in this case, numerous technical problems are emerged. The basic idea of the another way is to reuse the frequency bands utilized. In practice, this way means the use of ultra wideband (UWB) signals having a low power spectral density.

In spring 2002, the Federal Communication Commission (FCC) allowed the use of ultra wideband signals for communication in USA. Now similar processes are going in other countries.

At first, the idea of using ultra wideband signals implied forming ultra short pulse (several hundreds ps) like “spikes”. But in this case, there are synchronization and technical problems to use these signals. Chaotic signals are another opportunity. Such signals have a number of features that make it attractive for communications. Among these features are: wideband and ultra wideband oscillations (naturally spread spectrum); a large variety and control possibility of chaotic modes in oscillators; simplicity of oscillators; self synchronization and others. We propose to use chaotic signals as UWB signals.

The main idea of direct chaotic communications (DCC) is generation of chaotic carrier and its modulation by information signal directly in microwave band. Information component is put into the UWB chaotic carrier using the stream of chaotic radio pulses. In the simplest case, the presence of the pulse in assigned time position corresponds to “1”, and the absence of the pulse in the same position to “0”. To retrieve the information, a most simple non coherent receiver is used.

In the report, we describe the structure and capabilities of ultra wideband direct chaotic communication system intended for both high and low rate information transmission (extension of IEEE 802.15.3 and 802.15.4 standards, correspondingly). We also demonstrate experimental prototypes of DCC for both cases in 3.0-5.0 GHz frequency band and show results on wireless experiments, demonstrating transmission rate from 1 kbps up to 100 mbps.

In conclusion, we compare DCC with other ultra wideband systems.