The DARPA Spectrum Challenge is a competition to demonstrate a radio protocol that can best use a given communication channel in the presence of other dynamic users and interfering signals. The Challenge is not focused on developing new radio hardware, but instead is targeted at finding strategies for guaranteeing successful communication in the presence of other radios that may have conflicting co-existence objectives.

Challenge timeline:

- **During the Qualification Hurdles** (March 2013), the ISIS team, Team MarmotE qualified rank 5 out of the 90 teams that initially registered.
- The contestants in the Preliminary Event (September 2013) included the 15 highest-scoring teams and three wildcard teams.
- The Final Challenge competition (March 2014) is slated to follow the same structure as the preliminaries but award twice the prize money.

**RULES**

**Competitive tournament:** In each match, two teams battle to dominate the spectrum, with the winner being the first to transmit files of random data (or to successfully transmit the test file). The challenge conditions directly applicable to military communications, where radios must deliver high-priority data in congested and often contested electromagnetic environments.

**Cooperative tournament:** In each match, three teams work together to share the spectrum and transmit their random data files in the shortest time. Teams can not coordinate in advance on how to share the spectrum, so they have to develop and implement algorithms that enable their software-defined radios to communicate at a high rate while leaving spectrum for the other two teams to do the same. This tournament simulates conditions that might be encountered during coalition operations, and also has possible future commercial applications, such as opportunistic, license-free exploitation of "TV White Spaces" for high data rate communications.

**OUTLOOK: FINAL CHALLENGE**

To help competitors see how their software compared with other teams’ designs, WINLAB developed data visualization technology for DARPA that showed the specific radio frequencies each team used and their progress in transmitting the test file. Based on color-coded spectrum occupancy patterns, watchers could see how the radios interacted and infer each team’s likely strategies in real time.

**ISIS TECHNOLOGY**

- Proprietary physical layer design featuring
  - Highly power efficient, interference-robust single-carrier transmission
  - Extremely robust, innovative synchronization schemes relying on novel algebraic constructions
  - Open-loop variable-rate retransmission algorithm for received power accumulation
  - Optimized transmit spectrum
  - Innovations enable reliable operation under very low signal-to-noise ratio conditions while effectively hindering the communication of the competing team in cooperative setting

Software-defined implementation in GNU Radio

- FOSS software development toolkit that provides signal processing blocks to implement software defined radios

MarmotE modules:

- High-performance real-time signal processing blocks
- SIMD optimizations for resource-critical tasks
- Contributions to GNU Radio code base