

Absolute calibration of GNSS time transfer systems at CNES

Kanj Amale¹², Valat David¹, Delporte Jérôme¹

¹CNES, Toulouse, France

²BIPM, Sèvres, France

Email: amale.kanj@cnes.fr

Nowadays, the GNSS time transfer is the most widespread technique for remote atomic clock comparison used for the International Atomic Clock (TAI) calculation. In order to insure the TAI links accuracy and long-term stability, calibration of the GNSS reception chain composed by a receiver, an antenna, and a cable is a must. Since 2005, French Space Agency (CNES) has developed an absolute calibration technique based on the Naval Research Laboratory (NRL) approach.

The results of the application of this technique have shown that accuracy around 1 nanosecond for the whole chain can be achieved. The main idea is based on determining independently the electrical delay of each reception chain component with simulated signals to eliminate the broadcast signal propagation noise. The receiver is calibrated using GNSS signals generated by a satellite simulator while the calibration of the antenna is done using an anechoic chamber with a Vector Network Analyzer (VNA) signals.

We present several calibration results of GNSS receivers and antennas using the absolute technique. For the antennas, we use a specific transportable anechoic chamber developed last year. Different methods to validate the calibration results are also shown, including the comparison of the results obtained with 2 different types of GNSS simulator.

With the upcoming Galileo system, it is necessary to adapt the technique to calibrate the Galileo timing receivers. Results of our investigations concerning this subject will be presented as well during the conference.