Development of instruments for dual-band beacon (DBB) experiment of total electron content (TEC)

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asurement of total electron content (TEC). We are measuring the TEC by using dual-band beacon (DBB) technique. It is to transfer two radio signals at coherent but different frequencies. In the ionospheric plasma, the radio wave's propagation velocity is related to the frequency. By detecting the phase variation between two signals, we can estimate TEC through the radio propagation path. Conventional DBB experiments were carried out using the DBB transmitter on the low Earth orbit (LEO) satellites and receivers on the ground. The most commonly used frequencies are 150MHz and 400MHz. We developed GNU Radio Beacon Receiver (GRBR), the digital receiver, based on the software-defined radio technology. Our new development is the digital receiver GRBR-2, which measures the new beacon signal (401MHz/966MHz) from FORMOSAT-7/COSMIC-2 satellites launched in 2019. Observations with GRBR-2 have already been continued in Indonesia, Thailand, and Vietnam since September 2019. The DBB experiment were also conducted from sounding rockets to the ground. For the new rocket experiment planned in 2022, we are now developing a DBB transmitter and antennas on board of the rocket. On the other hand, recently, TEC observations using Global Navigation Satellite System (GNSS) signals become very popular. While the deployment of GNSS by USA, China, Russia, and the EU progress, the price of receivers have dropped dramatically. This situation helps us to develop a new GNSS-TEC receiver system for multiple-point measurements of the ionospheric. In the lecture we will discuss the current status of our developments.

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