
ABSTRACTS (MASTER THESIS)

Development of reception system for estimating ionospheric total electrons content from new beacon satellites

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Accurate measurement of the ionosphere helps to improve stability of satellite operations. Also it is useful to monitor the environment. For example, ground fluctuations by the earthquake fluctuates the total electron content (TEC) of the ionosphere. Radio-wave ray paths from the beacon satellite vary by the TEC. Because the effect is different at different frequencies, TEC can be estimated by analyzing the phase difference between signals at two different frequencies. Now 150MHz and 400MHz signals are used. However, beacon satellites are old, so only 3 satellites can now be used. There are plans for new beacon satellites. In this research, we developed a receiving system corresponding to the new beacon satellites.

The new type satellites are planned to be launched in September 2018; TBEx and COSMIC-2. Because transmitters on these satellites send signals at 150/400/965/1067 MHz. It is the necessary to correspond with higher and more frequencies than the current system. The current system has a stable operation record over a long term. We tried to develop the new receiver by using multiple SDR devices. So that we use then SDR boards to receive three frequencies.

In selecting a SDR, we examined the characteristics of SDRs and the beacon satellite transmitter. In addition, analysis frequency of system software also improves, we increased the speed. We developed prototype of the new receiver, and compared it with the current GRBR system as shown in Figure 1. This comparison experiment was successful, and we got similar results from both receivers. We also found that slight deviation of observation start timing of SDR does not have a big influence. However, we found that the data-loss is a severe problem. To avoid this problem, we needed to lower the spec by reducing data acquisition rate.

We were successfully developed the new digital receiver for the satellite-ground beacon experiment. However, there are three future tasks; further test of signals with frequencies other than 150MHz and 400 MHz, analysis method improvement that enables any frequency combination, and more stability with keeping higher data rates.

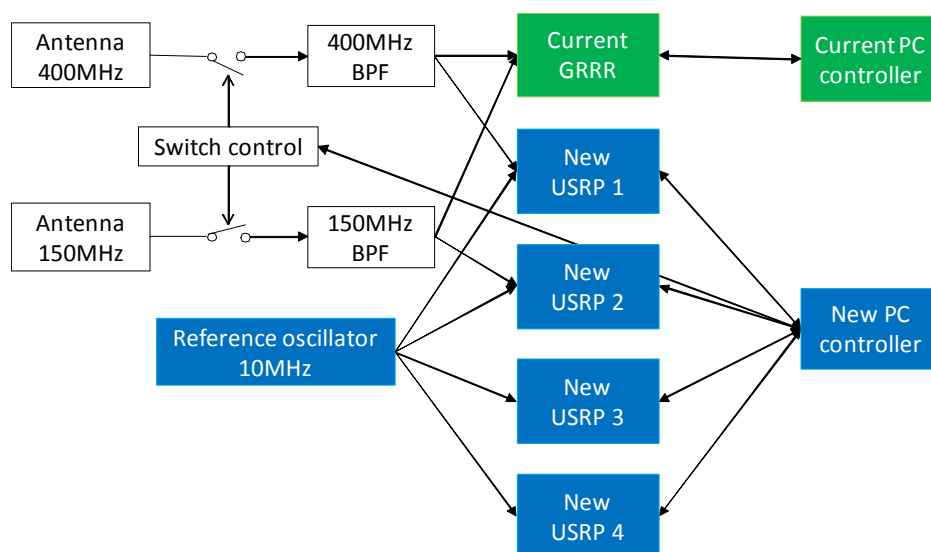


Figure 1. Block diagram for the comparison experiment between new and current beacon receivers.