



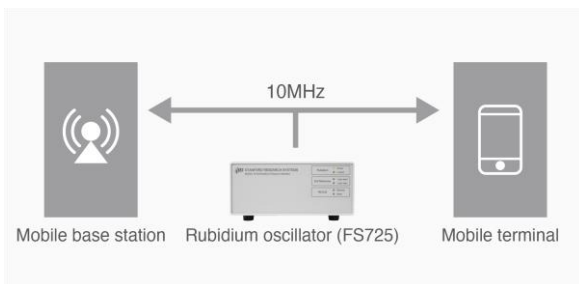
Time synchronization of devices at two remote locations. TB-1 used for field verification of 6G mobile communication system

Associate Professor Minseok Kim of Niigata University (at the time of the interview in March 2022) is working on his research theme of radio propagation measurements in outdoor mobile communication environments. He was selected for a research and development project by the Ministry of Internal Affairs and Communications (commonly known as “National Project”) and is contributing to the development of next-generation mobile communication systems.

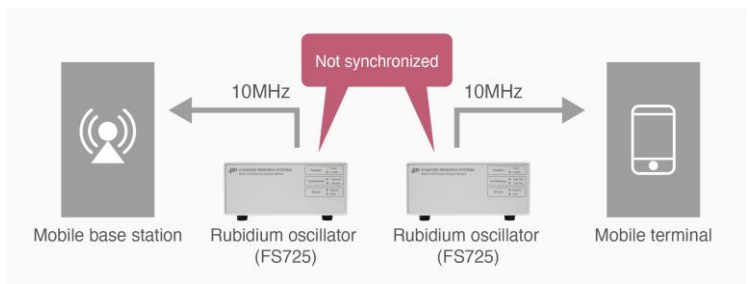
Furuno’s TB-1 Field Time Sync Generator was used to generate a precise one-second pulse synchronized to UTC between two remote locations, for the research and field test of 6G mobile base stations and mobile terminals.

Background (problem)

In mobile communications research, devices that simulate mobile base stations and mobile terminals must be time synchronized for evaluation. In the laboratory environment, the signal from one rubidium oscillator can be distributed to each device, so that they are synchronized with the same reference signal. However, for field evaluation such as outdoor environments, it is necessary to synchronize mobile base stations and mobile terminals in different locations. In field evaluations, the signal from a single rubidium oscillator cannot be distributed due to the long distance between sites. In addition, using rubidium oscillators at each location cannot provide the accurate synchronized signals because they are independent to each other. Cesium oscillators, which are more accurate than rubidium oscillators, were considered, but they are too expensive and difficult to transport. This led to the adoption of the TB-1 Field Time Sync Generator at each location, which provides the same time synchronization source between two remote sites.



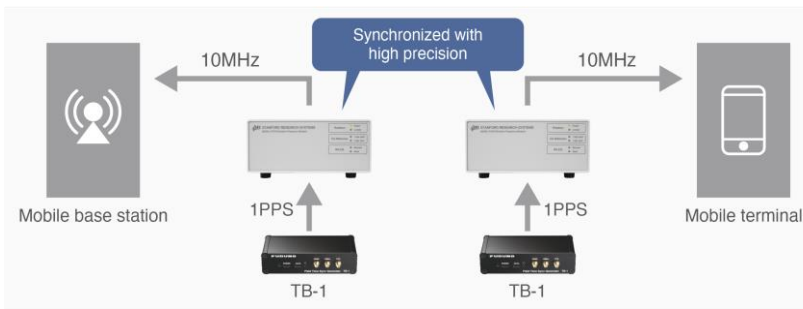
Time synchronization in the laboratory (Synchronized by one rubidium oscillator signal because distance between the base station and the terminal is short.)



In remote outdoor locations, if individual rubidium oscillators are used, the timing of rubidium oscillators will be different from each other.

Solution

To synchronize the signal from rubidium oscillators (FS725) that will be used in mobile base station and mobile terminals, a high-precision time signal (1 second pulse synchronized to UTC) generated by TB-1 is applied to each rubidium as a reference signal. We confirmed that the rubidium oscillators can be synchronized with high precision using this method.



Even between remote outdoor locations, rubidium oscillators are synchronized to each other with high precision through TB-1.

Synchronization between rubidium oscillators was confirmed in the laboratory.

Field Evaluation

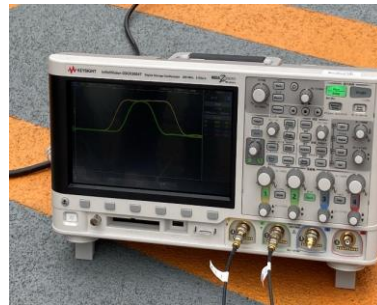
After confirming the synchronization of rubidium in the laboratory, a field evaluation was conducted in the area around Kannai Station in Yokohama. TB-1 enabled us to measure the radio propagation characteristics in the actual use environment.



Transmission point



Receiver's point



Trigger synchronous measurement

Comments by Associate Professor Minseok Kim

In my R&D, field measurements of radio propagation characteristics are very important, and highly synchronized reference signals between transmitter and receiver are essential to ensure the accuracy of the propagation channel measurements. Thanks to TB-1, we are able to achieve signal synchronization with high precision. As a result, we succeeded in measuring the millimeter wave band (24 GHz and 60 GHz), which is expected to be the frequency for 5G and Beyond 5G, in the area around Yokohama Kannai Station.

Such an experiment is rare in the world, and we expect that the analysis of the measurement data would be very valuable to the researchers. We would like to thank Furuno for the technical support in our research.

Related Products

Field Time Sync Generator

MODEL **TB-1**



**Just connect to your usual instrument.
Light, fast, accurate! Palm sized "Atomic Clock"**

TB-1 provides a 1 pulse per second (1PPS) and a 10MHz reference frequency, both synchronized with UTC.



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