

## Analysis of Ear Hole Acoustic Feature by Method of Spreading Measurement Errors over a Wide Frequency Range

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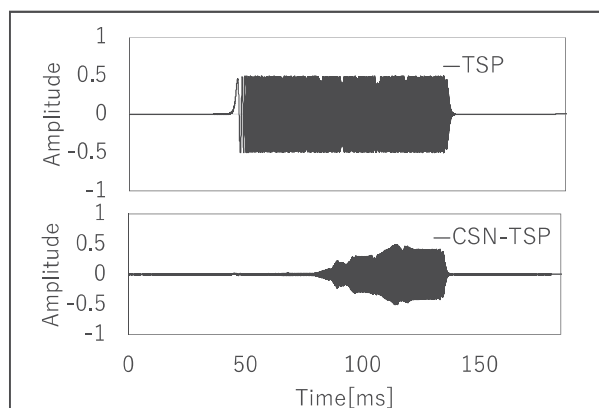
**Introduction:** The System achieved personal authorization by using a build-in microphone to record a sound wave reproduced from an earphone and distinguishing the personal differences in sound person by person.<sup>1)</sup> And this system will be indispensable in the Internet society. We reported that the acoustical authentication accuracy improved were obtained by using earphone has wide range frequency characteristics. However, it is difficult to create an earphone with ideal characteristics. So, I measured the ear hole acoustic characteristics by using the CSN-TSP signal which is TSP signal with the inverse frequency characteristic of the earphone. Thereby, it is considered that the frequency characteristics of the earphones can be corrected and ideal measurement of the ear hole acoustic characteristics can be performed.

**Experiments:** Measurement was made using an earphone with a build-in microphone made in our laboratory which equipped with BA type driver ED-27303-000 and Microphone SPO103NC3-3. The sound pressure level at the ear is about 60 dB (A), performed synchronous addition 5 times. The ear hole acoustic characteristics of the left ear of one subject (a male in his twenties) were measured. After the measurement, ECIR (Ear Canal Impulse Response) was derived by the cross spectrum method. Figure 1 shows the amplitude characteristics of TSP and CSN-TSP which were used measurement.

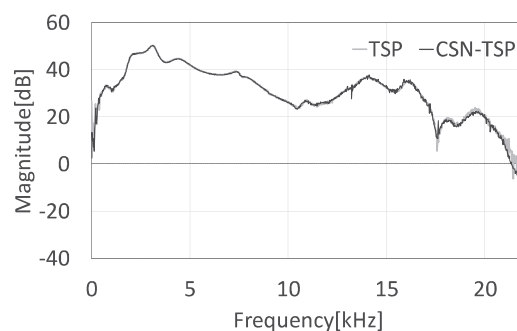
**Results and discussion:** Figure 2 shows the frequency magnitude characteristics of ECIR using TSP and CSN-TSP signal measurement method. In figure 2, it can be seen that using the CSN-TSP method makes it possible to measure the feature quantity without being buried in noise even when the frequency over than 20 kHz.

### References:

1. Shohei Yano, *et al.*, *IEICE Transactions A*, **2017**, 161-168.



**Figure 1. The Amplitude Characteristics of TSP and CSN-TSP**



**Figure 2. The Frequency Magnitude Characteristics of ECIR Using TSP and CSN-TSP Signal Measurement Method**