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MEASURING SIGNAL FOR ELECTRIC ECHO ANALYSIS FOR THE TECHNICAL INFORMATION SECURITY TASKS

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There are number features in aims and methods of the electrical echo measurement for technical information security tasks. The presented abstracts are devoted to these features. The reasons for these differences and features are considered, a special measuring signal is proposed, its parameters are determined.

To obtain information about the electrical echo (EE) for the problems of technical information security (TIS), which are presented in [1], it is necessary to measure its parameters. Let's consider the existing measurement method.

EE has always been considered as an interference, so the aim of the measurements was, ultimately, its suppression. According to the recommendations of ITU-T G. 168 (V8), a circuit for echo measurement, contains a test signal generator and a receiving part. Receiving part consist of a band-pass filter, a multiplier, an exponential correction circuit and a level meter.

According to ITU-T G. 168 (V8), test signal consists of three elements. The first one is a harmonic signal with a frequency of 2100 Hz, a duration of 1.35 s, and an amplitude of -12 dBm0. It is designed to turn off all echo cancellers and echo suppressors in the channel for the measurement period. The second element is a pause, designed to characterize the background noise in the returned echo. Its duration is 80 ms. The third element is a white Gaussian noise signal, which is used to obtain the impulse response of the echo path.

The question may arise: if electrical echo measurements have been successfully carried out for a long time, why invent new signals? Let's note the main differences.

1. The existing test signal is intended for measurements in a well-defined communication channel. In TIS tasks, it is necessary, among other things, to determine the type of communication channel.

2. Low-delay EE in telephony is of no interest, because it does not cause inconvenience. But, for TIS tasks, any echo is interesting and it should be measured.

3. In telephone measurements, the nature of the EE is not interesting, the main thing is to suppress it. In TIS tasks, it is important to know where and how the echo originated.

4. Multiple echo with a small relative delay is not of interest in telephony, but can be very informative for TIS tasks.

5. For TIS problems, even a partially suppressed echo is of interest.

The rest of the tasks are similar. On the base of analysis by the task allows

us to formulate such requirements for the signal.

This signal should provide measurement of:

- the EE delay in the range from 200 μs to 1 s with an error no worse than 200 μs and a delay resolution no worse than 200 μs;
- the unevenness of the frequency response in the frequency band 300… 7,000 (perhaps even up to 14,000 Hz) in the range of values from +3 to -40 dB;
- frequency shift up to ±100 Hz;
- the EE level in the range from -20 to -60 dB relative to the level of the transmitted signal;
- the change in the specified parameters during the conversation.

At the stage of scientific researches is not required to ensure the hidden of measurements. The study of the phenomenon and the collection of static data can be carried out openly. Therefore, the measuring signal can be loud and conspicuous.

The formulated conditions and requirements for the signal have some contradictions. The problem is that with a long signal it is impossible to accurately the delay time measure, and a short signal with a wide spectrum will not pass through a narrow-band telephone channel. In addition, a short signal will have too little energy to be detected among noise and interference.

After studying the similar problems in radar, a noise-like signal was proposed, namely, a chirp signal. The parameters were chosen as shown below.

Frequency range. The frequency band in wired telephony and in GSM is 300…3400 Hz, in newer communication technologies 100…7000 Hz and even more. It is proposed the frequency variation of the chirp signal 200…4000 Hz.

Duration. Considering that the response time of echo suppressors is 0.2…0.5 s, it is advisable to choose the measurement signal duration less than this value. Let's choose a duration of 100 ms.

The base of signal will be equal to 380.

The program for the signal synthesis has been compiled. Tests on the model were carried out and showed good results. But the final conclusion about the signal capabilities can be made on the basis of an experimental study, the results of which are shown in [2].

References

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