TABLE 1

Errored bits in a frame of primary multiplex	Amplitude of pulse response			Duration of pulse response		
	A_1	A_2	A_3	t_1	t_2	t_3
	dBmO	dBmO	dBmO	µs	µs	µs
2	-22.1	-28.2	-33.8	320	160	130
3	-34.1	-40.2	-45.8	320	160	130
2 and 3	-10.1	-16.2	-21.8	320	160	130
2 and 3 and 4	-4.1	-10.2	-15.8	320	160	130
from 2 to 8, 2 discretization periods	+4.3	-6.7	-14.8	440	180	100
from 2 to 8, 3 discretization periods	+4.3	-4.9	-14.8	600	200	100
from 2 to 8, 4 discretization periods	+4.3	-4.7	-14.8	680	180	120
from 2 to 8, 5 discretization periods	+4.3	-6.7	-14.8	840	200	120
from 2 to 8, 6 discretization periods	+3.8	-4.3	-14.8	930	200	100
from 2 to 8, 7 discretization periods	+5.25	-8.7	-14.8	1100	180	140

Thus, when errors on a 2048 kbit/s digital path grow into bursts of 2 errors and more there is a certain probability that the value of the impulse noise in a PCM v.-f. channel exceeds -21 dBmO given in Recommendation M.1020, § 2.6.

With error bursts of 256 and more bits, the above-mentioned impulse noise will always be present.

The quantitative relationship between the number of bursts, the number of errors in them within a definite time interval and the number of impulse noise interferences and the BER in a v.-f. channel

(to draft Recommendation G.136)

SOURCE: THE USSR TELECOMMUNICATION ADMINISTRATION

TITLE: INTERRELATION BETWEEN ERRORS IN A DIGITAL CIRCUIT AND IMPULSE NOISE IN
VOICE-FREQUENCY CHANNELS OF THE PCM SYSTEM

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1.Introduction

Voice-frequency channels of PCM as well as FDM systems should be fit for transmitting various types of signals. It is well known that the transmission quality of discrete signals in voice-frequency channels is affected by impulse noise. At present, Recommendation G.712 has no requirements to voice- frequency PCM-channels regarding impulse noise. However, under real-life conditions in a v.-f. PCM channel impulse noise contributes to the error-rate of digital links. The present contribution gives the investigation results of impulse noise in v.-f. PCM-channels.

2.Influence of digital circuit errors on impulse noise in an idle v.-f. PCM-channel

Evaluation of error influence on digital links on the value of impulse noise in v.-f. channels was conducted experimentally on a channel equipment (satisfying Recommendation G.712) of a PCM transmission system (2048 kbit/s). With the help of an error simulator, errors had been introduced into one or several bits corresponding to a chosen idle v.-f. channel of a digital link (Figure 1). In the v.-f. channel impulse noise could be observed with the help of an oscillograph. The shape of the pulse response in the v.-f. channel is presented in Figure 2.

The parameters of pulse response are given in Table 1 (the values are chosen for the point of the relative zero level at a resistance of 600 ohm). These data allow us to formulate the following conclusions:

-the pulse amplitude of the response depends on the bit number which contains the error; the errors in the more significant bits cause a greater amplitude of the response;

-with single errors the maximum value of the pulse peak A_1 (in case of an error in the second bit) is -22.1 dBmO;

-with burst-building and with an increase in the number of errored bits in the code word of the prime digital path (2048 kbit/s) the response amplitude values A_1, A_2, A_3, ... grow, but their duration, as determined by the response of the channel's low frequency receiving filter, remains unchanged. This applies to the cases where in a prime digital path, the error bursts affect the digital stream for not more than one discretization period, i.e. the number of the errors in a burst does not exceed 256. With errors in code words occurring every 125 μs the superposition of responses takes place as a result of the receiving filter reaction on the error