THE DRAWINGS CONTAINED IN THIS RECOMMENDATION HAVE BEEN DONE IN AUTOCAD.

Recommendation U.20

TELEX AND GENTEX SIGNALLING ON RADIO CHANNELS (SYNCHRONOUS 7—UNIT SYSTEMS AFFORDING ERROR CORRECTION BY AUTOMATIC REPETITION)

(Geneva, 1956; amended at New Delhi, 1960, Geneva, 1964, Mar del Plata, 1968, and Geneva, 1972)

The CCITT,

considering

(a) that numerous radiotelegraph circuits working in association with 5—unit start—stop apparatus make use of error—correcting synchronous systems having a special error—detecting 7—unit code enabling errors to be corrected by a request for a repetition (ARQ system);

(b) that when they are usable for switched communications, on the radio section these synchronous systems use two combinations α and ß, which characterize the permanent conditions of start polarity and stop polarity respectively in the start—stop part of the connection (see Recommendation S.13 [1]);

(c) that the special make—up of these systems is such that a change in the significant condition at the input to the system is not reproduced at the output with a constant delay;

(d) that the experience acquired with telex and gentex switching through these radiotelegraph systems seems sufficient to justify the laying down of general rules specifying signalling arrangements for manual, semi—automatic and automatic working in such international radio channels,

unanimously declares the view

that the signals, enumerated in Recommendation U.1, to be used in setting up international telex and gentex calls over radio channels comprising synchronous systems with error correction by automatic repetition should be characterized as follows:

1 Free line condition

1.1 Successive α combinations on the forward and backward paths.

2 Call

2.1 Transition from combination α to combination ß on the forward signalling path. Reception of two consecutive ß signals over the forward signalling path shall be interpreted as a calling signal.

2.2 On circuits automatically operated in both directions, reception of a single ß signal at the end of the circuit remote from the calling subscriber must cause the outgoing equipment on this circuit at that end to be marked busy immediately. This busy condition must be applied until two α signals are received.

2.3 If the motor of the FRXD (fully automatic reperforator transmitter distributor) or equivalent motor—driven storage device is not already running, it must be started without delay, in order to accept the subsequent selection signals. Furthermore, if the motor of the storage device at the called end is not already working, it must be started.

2.4 It is desirable that, in the busy hour at least, the starting of the motor of the storage device should not be dependent on the calling signal for each call. One simple method of meeting this requirement is to provide a device that delays the switching off of the motor until about 5 minutes after the call has been cleared.

3 Call—confirmation signal

3.1 Transition from combination α to combination ß on the backward signalling path. The reception of two consecutive ß signals over the backward signalling path shall be interpreted as a call—confirmation signal.

3.2 The return of this signal can be initiated either by the switching equipment or by the radio equipment. Not more than one second shall elapse at the incoming end between the moment when two ß signals have been received and the return of the first ß signal of the call—confirmation signal.

3.3 With manual switching the call—confirmation signal shall be returned independently of the operator's answer.

3.4 For retest purposes radio circuits may be considered faulty when the call—confirmation signal is not received within three seconds.

4 Signals preceding selection

4.1 *Proceed—to—select signal*

4.1.1 *Semi—automatic working*

4.1.1.1 If the automatic switching equipment at the receiving end can receive the selection information immediately after the sending of the call—confirmation signal, the call—confirmation signal shall constitute the proceed—to—select signal.

4.1.1.2 If the automatic switching equipment at the receiving end cannot receive the selection information immediately after the sending of the call—confirmation signal, a distinct *proceed—to—select* signal, combination No. 22, shall be returned over the backward signalling path after the call—confirmation signal. For 99% of calls in the busy hour, this signal must be returned not more than 3 seconds after the transmission of the call—confirmation signal begins. (For some existing systems this delay will be 4 seconds.)

4.1.2 *Fully—automatic working*

4.1.2.1 The proceed—to—select signal, combination No. 22, returned over the backward signalling path shall always be distinct from the call—confirmation signal and should be returned within the limits specified under semi—automatic working.

4.2 *Proceed—to—transmit signal*

4.2.1 On the backward signalling path teleprinter signals indicating the called operator's position.

4.2.2 The sending of the proceed—to—select or the proceed—to—transmit signal should be delayed until two consecutive ß signals have been correctly received over the backward signalling path. Two consecutive ß signals can be presumed to have been or to be received when four ß signals have been accepted by the storage of the error—correcting equipment at the sending end. (This allows for the loss of one ß signal as an undetected error.)

4.2.3 The receiving equipment shall be arranged so that when two ß signals are received and followed immediately by teleprinter signals [representing the call—confirmation and proceed—to—select (or proceed—to—transmit) signals in rapid succession] the recognition of the two ß signals as the call—confirmation signal will allow the teleprinter signals to be preceded by 140 ms (minimum) of stop polarity.

4.2.4 Measures should be taken so that, if proceed—to—select or proceed—to—transmit signals are relayed by the FRXD (or equivalent storage device), the switching equipment does not return these signals until the motor has reached its full speed.

5 Selection signals

5.1 For manual working, teleprinter signals over the forward signalling path.

5.2 For semi—automatic working, teleprinter signals over the forward signalling path, as follows:

- the prepare—for—digits signal shall be combination No. 30 (figure—shift);
- digits of the called subscriber's number (preceded by transit access codes, if required) in International Telegraph Alphabet No. 2;
- end—of—selection signal, combination No. 26. This may be followed by another combination characterizing the class of traffic in the incoming country.

5.3 For fully—automatic working: teleprinter signals over the forward signalling path, as follows:

— the prepare—for—digits signal shall be combination No. 30 (figure—shift);

— digits of the called subscriber's number (preceded by transit access codes, if required) in International Telegraph Alphabet No. 2;

— if an end—of—selection signal is required, this should be combination No. 26. This may be followed by another combination characterizing the class of traffic in the incoming country.

5.4 The transmission of the selection signals should be delayed if the motor of the FRXD has not yet gained speed.

5.5 Where the incoming system uses a uniform numbering plan so that the number of digits in the number can be determined from the initial digit, the outgoing Administration must transmit an end—of—selection signal if this is required by the incoming country. Where the incoming system has a non—uniform numbering scheme the end—of—selection signal cannot be made obligatory. However, for such a system it may be advantageous to use this signal subject to the agreement of the outgoing Administration, in those cases where the outgoing system can readily insert the signal. To avoid undue occupation of trunks and equipment, Administrations should take all reasonable steps to ensure that selection signals are transmitted over radio circuits without undue delay.

6 Call—connected signal

6.1 Manual working: the code **DF** over the backward signalling path.

6.2 Semi—automatic working: either answerback signals or the signals defined for fully—automatic working below.

6.3 Fully—automatic working: combination No. 32, followed by 11 to 13 combinations No. 29 (letter—shift) followed by the obtained subscriber's answerback code. The insertion of the combinations No. 29 must not cause mutilation of the subsequent signals in the sequence.

6.4 In the case of transit operation where the first circuit in the connection is an ARQ radio circuit and the second circuit in the connection uses Type A or B signalling to a country that returns the answerback automatically, the number of combinations No. 29 of the radio call—connected signal may be reduced to eight to avoid mutilating the answerback.

7 Idle circuit condition

7.1 Combinations ß on the forward and backward signalling paths.

8 Clearing

8.1 *Clearing signal*

8.1.1 The appearance of α combinations in the direction in which the clearing signal is sent. Reception of two consecutive α signals will have to be interpreted as a clearing signal.

8.1.2 On recognition of the clearing signal received over the radio circuit any text remaining in the store, at the point where the clearing signal is recognized, must be destroyed.

8.1.3 On recognition of the clearing signal received over the land line, any text remaining in store, at the point where the clearing signal is recognized, must be transmitted before the α signals are sent over the radio path.

8.2 *Clear—confirmation signal*

8.2.1 The appearance of α combinations in the direction opposite to that from which the clearing signal was sent. Reception of two consecutive α signals will be interpreted as a clear—confirmation signal when a clearing signal of 7 α signals has been accepted by the storage of the radio equipment without a request for repetition. The transmission of 7 α signals in this way ensures that, allowing for the loss of one α signal as an undetected error, the clearing signal can be presumed to have been received and recognized at the distant end.

8.2.2 For radio circuits using an eight—character cycle with four characters stored, a sequence of 8 α signals shall be used in place of the above sequence of 7 α signals. For radio circuits using an eight—character cycle with seven characters stored, a sequence of 11 α signals shall be used in place of the above sequence of 7 α signals.

8.2.3 It is desirable that the equipment shall be arranged so that the clearing and clear—confirmation signals do not cause spurious characters (including combinations No. 32) to be transmitted over the radio path. Where electronic storage devices are used it is possible to arrange for these spurious characters to be suppressed in the storage device. Where electro—mechanical storage devices are used, the generation of spurious characters by the clear—confirmation signal can be minimized by arranging that when the clearing signal is received over the radio circuit, the input to the storage device is blocked.

8.2.4 In order to ensure that, on transit calls, switching equipment and possibly the subscriber's teleprinter set are not unnecessarily held because of delay in transmitting the clearing and clear—confirmation signals over the radio path, the radiotelegraph equipment should return the clear—confirmation signal to the switching equipment without waiting for the exchange of clearing and clear confirmation signals over the radio path.

8.3 *Guard delay*

8.3.1 The circuit shall be guarded on release as specified in Recommendation U.1 except that the delay shall be measured from the moment when the equipment has both:

a) transmitted 7 α signals over the radio path without request for repetition;

b) has received two consecutive α signals over the other signalling path.

8.3.2 During the guard period the free line condition shall be maintained on both signalling paths of the international circuit.

8.3.3 Because it is possible for the circuit to be opened for traffic at one end before the equipment at the other end has completed the transmission of the 7 α signals, it is possible that an incoming call may be received before the 7 α signals have been transmitted. Where this occurs, the call should be accepted but the call—confirmation signal should not be returned until the transmission of the 7 α signals has been completed. (See § 8.2.2 above.)

9 Register congestion

9.1 Semi—automatic working: the return of a signal indicating congestion may be allowed; the **NC** sequence with the standard form of service signal should be used to indicate the situation.

9.2 Fully—automatic working: the return of a signal indicating congestion is prohibited.

10 Service signals

10.1 Teleprinter signals (**OCC**, **NC**, **NCH**, **NA**, **NP**, **DER**, **ABS**) preceded by the carriage—return, line—feed and letter—shift signals and followed by line—feed (preferably together with carriage—return) and then immediately by the clearing signal in all cases.

11 Both—way working

11.1 For both—way ARQ radio circuits used in the fully—automatic telex and gentex services, the following action to minimize the incidence of head—on collision is recommended:

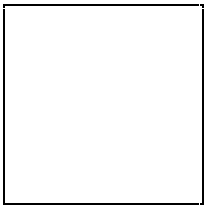
a) that inverse order testing, or a close approximation to it by testing the route in small groups of circuits in fixed order, always starting the search from the same initial position, should be adopted at opposite ends of a both—way group of trunk circuits.

b) that calls should be offered in such a way that each circuit is tested once only for the minimum period of time necessary to ascertain whether it is free or busy, and the outgoing selectors should not have facilities for delayed hunting.

11.2 The absence of the proceed—to—select signal will serve to detect a head—on collision when the group of circuits is totally occupied or very nearly totally occupied. The two calls will then be cleared down unless there are still free circuits in the route.

Note — The recognition of the calling, call—confirmation, clearing and clear—confirmation signals requires the detection of two consecutive signals ß or α as specified. The detection device should, in new equipment, be arranged to recognize two consecutive signals even though these may be separated by a period of automatic correction, i.e. the discrimination involves counting. In some existing equipments the detection device requires that the two signals to be recognized shall occur in consecutive character periods, i.e. the discrimination involves timing. The transmission of the call—confirmation, clearing and clear—confirmation signals requires that the appropriate number of ß or α signals shall be offered to the storage of the radio equipment without a request for repetition, i.e. the control should be by a timing device that is reset when automatic correction occurs.

FIGURE 1/U.20 - CCITT 48381



Reference

[1] CCITT Recommendation *Use on radio circuits of 7—unit synchronous systems giving error correction by automatic repetition*, Rec. S.13