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**SPECIFICATIONS OF SIGNALLING SYSTEM R2
INTERREGISTER SIGNALLING**

SIGNALLING CODE

ITU-T Recommendation Q.441

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation Q.441 was published in Fascicle VI.4 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2 In this Recommendation, the expression “Administration” is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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4.2 SIGNALLING CODE

4.2.1 *Multifrequency combinations*

Each interregister signal consists of the simultaneous sending of 2 out of a range of 6, 5 or 4 in-band frequencies (multifrequency combination). The band of the interregister signalling frequencies does not overlap with the frequency band generally used for line-signalling.

This *2-out-of-n* code allows erroneous signals consisting of less or more than two frequencies to be detected and identified as faulty.

To make the system suitable for application on 2-wire links, two different sets of 6 frequencies are defined for the composition of the forward and the backward signals.

Table 5/Q.441 shows all multifrequency combinations which can be derived from the maximum of 6 signalling frequencies per direction provided by the system. For reference purposes each multifrequency combination of a given direction is identified by a serial number. The numerical value of this serial number can be calculated by adding the respective index and weight allocated to the two frequencies making up the combination.

The number of multifrequency combinations depends upon the number of signalling frequencies used. When the maximum of 6 signalling frequencies are used, 15 multifrequency combinations are available.

System R2 is designed for operation on international links with 15 multifrequency combinations in each direction. However, it can be used in national networks with a reduced number of signalling frequencies and still permit international/national end-to-end working of System R2 signalling in the case of incoming international traffic (see Figure 13/Q.441).

The reduction naturally cuts the number of multifrequency combinations available but has the economic advantage of effecting savings in equipment. The resulting reduction in facilities is of less importance in automatic than semi-automatic service.

TABLE 5/Q.441

Multifrequency combinations

Combinations		Frequencies (Hz)						
No.	Numeral value = $x + y$	Forward direction (signals of Groups I and II)	1380	1500	1620	1740	1860	1980
		Backward direction (signals of Groups A and B)	1140	1020	900	780	660	540
		Index (x)	f_0	f_1	f_2	f_3	f_4	f_5
		Weight (y)	0	1	2	4	7	11
1	0 + 1		x	y				
2	0 + 2		x		y			
3	1 + 2			x	y			
4	0 + 4		x			y		
5	1 + 4			x		y		
6	2 + 4				x	y		
7	0 + 7		x				y	
8	1 + 7			x			y	
9	2 + 7				x		y	
10	3 + 7					x	y	
11	0 + 11		x					y
12	1 + 11			x				y
13	2 + 11				x			y
14	3 + 11					x		y
15	4 + 11						x	y

The following versions might be considered:

- a)* 6 forward frequencies (15 multifrequency combinations) and
5 backward frequencies (10 multifrequency combinations);
- b)* 6 forward frequencies (15 multifrequency combinations) and
4 backward frequencies (6 multifrequency combinations);
- c)* 5 forward frequencies (10 multifrequency combinations) and
5 backward frequencies (10 multifrequency combinations);
- d)* 5 forward frequencies (10 multifrequency combinations) and
4 backward frequencies (6 multifrequency combinations).

In the forward direction the highest signalling frequency may be omitted (i.e. multifrequency combinations 1 to 10 remain). In the backward direction either the lowest or both the lowest and next lowest signalling frequency may be omitted (i.e. multifrequency combinations 1 to 10 or 1 to 6, respectively, remain).

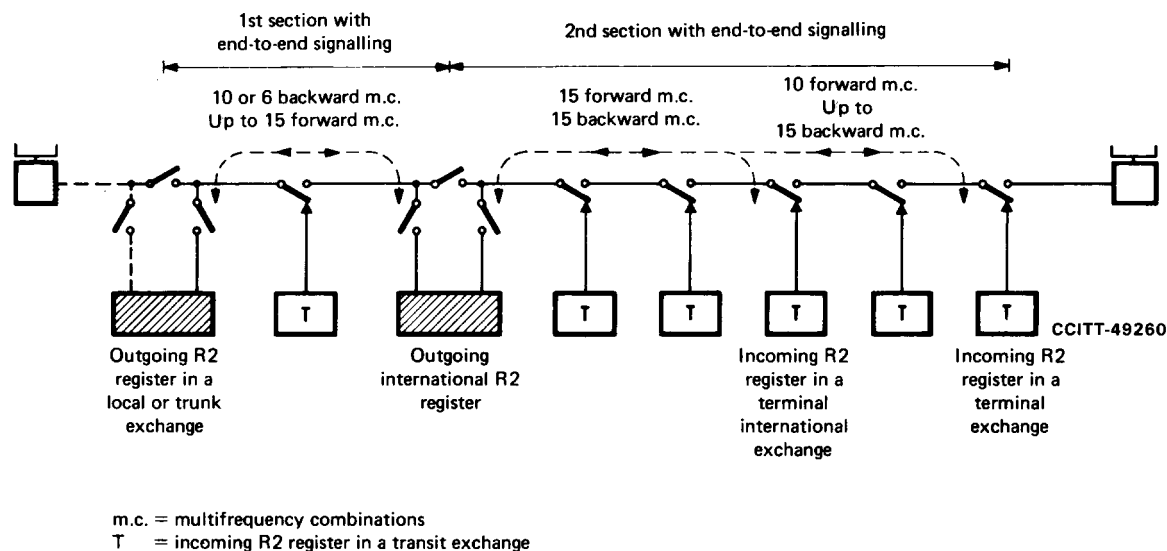


FIGURE 13/Q.441
An international two-section multi-link connection

4.2.2 Allocation of interregister signals

The signal coding consists of the association of the defined meaning of interregister telephone signals to the multifrequency combinations transmitted over the links. Certain combinations are left spare for the allocation of national or international signals. (For signalling procedures, see Recommendations Q.460 to Q.480.)

4.2.2.1 Multiple meaning

The meaning of both the forward and backward multifrequency combinations can change after transmission of certain backward signals. The changed meaning is specific to the signal which caused or announced the change. In certain cases a change back to the original meaning is possible. The meaning of certain forward multifrequency combinations may also vary depending on their position in the signalling sequence.

4.2.2.2 Meanings of the forward multifrequency combinations

There are two groups of meanings allocated to the forward multifrequency combinations. The Group I meanings are indicated in Table 6/Q.441 and the Group II meanings in Table 7/Q.441. The change from Group I to Group II meanings takes place when requested by the backward signals A-3 or A-5. Change back to Group I meanings is only possible when the change to Group II meanings was in response to signal A-5.

The first forward signal transmitted in international working is used for additional routing information. It enables a distinction to be made between terminal and transit calls. In the case of terminal calls it carries the language or discriminating digit whereas, for transit calls, it serves the dual purpose of providing a country code indicator and to indicate whether an echo suppressor is required or not.

The above arrangements obviate the need for two different seizing signals (line signals) to distinguish between transit and terminal traffic on links terminated in a transit exchange.

4.2.2.3 Meanings of the backward multifrequency combinations

There are two groups of meanings allocated to the backward multifrequency combinations. The Group A meanings are indicated in Table 8/Q.441 and the Group B meanings in Table 9/Q.441. The change to Group B meanings is announced by the backward signal A-3. No change back is possible once a change to the Group B meanings of the backward multifrequency combinations has been indicated.

4.2.2.4 Integration of national and international signalling codes

The utilization of Signalling System R2 in national networks is facilitated by the provision, in the specified signalling code, of signals specially assigned for national use. Under the specified code, specific national meanings are allocated to some of these signals, others are available for the allocation of national meanings at the discretion of each Administration.

National allocations must not conflict with the present specifications in order to ensure end-to-end interregister signalling i.e. the direct dialogue between the outgoing international R2 register (in the originating country) and incoming R2 registers, in the national network of the destination country.

The specified signalling code allows for a reduction of signalling frequencies in national networks (see § 4.2.1 above).

4.2.3 Forward signals

4.2.3.1 Group I forward signals

Compelled interregister signalling must always begin with a Group I forward signal. For the signal codes see Table 6/Q.441.

TABLE 6/Q.441
Group I forward signals

Combination (a)	Designation of the signal (b)	Meaning of the signal		Remarks (e)
		(c)	(d)	
1	I-1	Language digit: French	Digit 1	Col. (c) – These signals make up the first signal transmitted on an international link when it terminates in the country of destination of the call. When a link terminates in an international transit centre, however, these signals may be transmitted on the link after the country code indication and the country code. See also Recommendation Q.107.
2	I-2	Language digit: English	Digit 2	
3	I-3	Language digit: German	Digit 3	
4	I-4	Language digit: Russian	Digit 4	
5	I-5	Language digit: Spanish	Digit 5	
6	I-6	Spare (language digit)	Digit 6	
7	I-7	Spare (language digit)	Digit 7	
8	I-8	Spare (language digit)	Digit 8	
9	I-9	Spare (discriminating digit)	Digit 9	
10	I-10	Discriminating digit	Digit 0	
11	I-11	Country code indicator, outgoing half-echo suppressor required	Access to incoming operator (Code 11)	Col. (c) – First signal on an international link when it terminates in an international transit centre. Col. (d) – Other than the first signal on an international link.
12	I-12	Country code indicator, no echo suppressor required	i) Access to delay operator (Code 12) ii) Request not accepted	
13	I-13	Test call indicator (call by automatic test equipment)	i) Access to test equipment (Code 13) ii) Satellite link not included	
14	I-14	Country code indicator, outgoing half-echo suppressor inserted	i) Incoming half-echo suppressor required ii) Satellite link included	
15	I-15	Signal is not used	i) End-of-pulsing (Code 15) ii) End of identification	

The *signals I-1 to I-10* are numerical signals indicating:

- a) the *address* required for setting up the call (country code, national significant number); such address signals are sent by an outgoing R2 register or an outgoing international R2 register, either spontaneously and immediately after the seizure of the link or in response to one of the backward signals A-1, A-2, A-7 or A-8;
- b) the country code (and possibly the area code as well) of the *location of the outgoing international R2 register*, in response to signals requesting the origin of the call. For national traffic, the telephone number of the calling subscriber's line (see Recommendation Q.480);
- c) for automatic working the *discriminating digit* or, in the case of semi-automatic working, the service language to be used by the operator (i.e. *language digit*).

The *signal I-11* is a non-numerical address signal. The meaning of the signal is dependent on its position within the sequence of address signals specified in Recommendation Q.107.

- a) *Country code indicator, outgoing half-echo suppressor required*

When signal I-11 is transmitted as the first forward signal it indicates that:

- i) a country code will follow (international transit);
- ii) the call requires echo suppressors;
- iii) the outgoing half-echo suppressor has to be inserted.

The use of this signal in international working is subject to bilateral agreement and is made in conformity with Recommendation Q.479.

- b) *Access to incoming operator (code 11)*

When signal I-11 is preceded by the language digit (and possibly by one further address digit) it indicates the address of the incoming operator's position and is then always followed by signal I-15 alone.

For international working this signal is to be used only in conformity with Recommendation Q.107 *bis*. It can be used in national traffic only if the incoming R2 registers are equipped to receive all six forward frequencies. The necessary specifications are then the responsibility of the Administration concerned.

The *signal I-12* is a non-numerical address signal. The meaning of the signal is dependent on its position in the sequence of address signals specified in Recommendation Q.107.

- a) *Country code indicator, no echo suppressor required*

When signal I-12 is transmitted as the first forward signal it indicates that:

- i) a country code will follow (international transit);
- ii) the call may not require any echo suppressor (see Recommendation Q.479).

- b) *Access to delay operator (code 12)*

When signal I-12 is preceded by the language digit (and possibly by one further address digit) it indicates that the call must be routed to the delay operator's position, either to a particular operator, or one of those operating a particular group of positions. It is then followed by further digits and the signal I-15 or by the signal I-15 alone.

In international working this signal is to be used in conformity with Recommendation Q.107 *bis*. It can be used in national traffic only if the incoming R2 registers are equipped to receive all six forward frequencies. The necessary specifications are then the responsibility of the Administrations concerned.

c) *Request not accepted*

An outgoing international R2 register which receives a signal A-9 or A-10, the use of which is exclusively national, or which receives by signal A-13 a request to which it is unable to reply, should indicate by transmitting signal I-12 that it cannot answer the query (see Recommendation Q.480). This signal may be similarly used in national traffic to indicate that response to signal A-9 or A-10 is not possible.

The meaning of the non-numerical signal I-13 is dependent on its position in the sequence of address signals specified in Recommendation Q.107.

a) *Test call indicator*

When in international working the signal I-13 is transmitted as the first forward signal it occupies the position of the language or discriminating digit. It serves then as a test call indicator and must be followed by the complete test equipment address information as specified in b) below.

b) *Access to test equipment (code 13)*

To access automatic test equipment the second signal I-13 (the address digit) must be followed by two digits *xy* and the signal I-15.

c) *Satellite link not included*

In response to signal A-13, the meaning of the signal I-13 is that up to the outgoing R2 register no satellite link is included.

The meaning of the non-numerical *signal I-14* is dependent on its position in the sequence of address signals specified in Recommendation Q.107.

a) *Country code indicator, outgoing half-echo suppressor inserted*

When signal I-14 is transmitted as the first forward signal it indicates that:

- i) a country code will follow (international transit);
- ii) the call requires echo suppressors;
- iii) the outgoing half-echo suppressor has already been inserted.

This signal is to be used in international working and only in conformity with Recommendation Q.479.

b) *Incoming half-echo suppressor required*

In response to signal A-14, the meaning of the signal I-14 is that an incoming half-echo suppressor is necessary.

c) *Satellite link included*

In response to signal A-13, the meaning of the signal I-14 is that up to the outgoing R2 register a satellite link is included in the connection.

The non-numerical *signal I-15* indicates the end of a sequence of forward interregister signals. It is never sent as the first signal on an international link.

a) *End-of-pulsing*

In international working, signal I-15 is used to indicate that there are no more address signals to follow (see Recommendations Q.107 and Q.473).

b) *End of identification*

In national traffic, signal I-15 may be used to indicate that transmission of the sequence identifying the calling subscribers line is terminated (see Recommendation Q.480, § 5.8.2).

4.2.3.2 *Group II forward signals*

The Group II forward signals are calling party's category signals sent by outgoing R2 registers or by outgoing international R2 registers in reply to the backward signals A-3 or A-5 and give information whether national or international working applies. For the signal codes see Table 5/Q.441.

It is useful to identify calls according to type or function:

- i) to indicate whether the forward transfer facility is required in international traffic;
- ii) for adequate control of switching operations;
- iii) to enable any additional meanings for the signals A-5 used in a national network but not internationally accepted (for example, to change the meanings of one or more following signals, forward or backward) to be made inoperative for incoming international calls;
- iv) for maintenance purposes.

The meanings of the calling party's category signals are detailed below:

- a) The *signal II-1, subscriber without priority* indicates that the call is set up from a subscriber's line and is non-priority.
- b) The *signals II-2 and II-9, subscriber with priority* indicate that the call is set up from a subscriber's line to which priority treatment of calls has been accorded. Signal II-2 is specified for national working only since there are no Recommendations regarding priority calls in automatic international working (see Recommendation Q.480).
- c) The *signal II-3, maintenance equipment* indicates that the call comes from maintenance equipment.
- d) The *signal II-5, operator* indicates that the call is set up from an operator's position.
- e) The *signals II-6 and II-8, data transmission* indicate that the call will be used for data transmission.
- f) The *signal II-7, subscriber* indicates that the call is set up from a subscriber's line, an operator's position or from maintenance equipment and that no forward transfer signal will be used.
- g) The *signal II-10, operator with forward transfer facility* indicates that the call is set up from an operator's position with possibility of recourse to the forward transfer facility. Its use must be subject to bilateral agreement (see Annex A to the present Specifications).

The signal II-4 and the signals II-11 to II-15 are spare. The meaning of signal II-4 will be decided later by international agreement.

TABLE 7/G.441

Group II forward signals

Combination (a)	Designation of the signal (b)	Meaning of the signal (c)	Remarks (d)
1 2 3 4 5 6	II-1 II-2 II-3 II-4 II-5 II-6	Subscriber without priority Subscriber with priority Maintenance equipment Spare Operator Data transmission	} These signals are solely used for national working
7 8 9 10	II-7 II-8 II-9 II-10	Subscriber (or operator without forward transfer facility) Data transmission Subscriber with priority Operator with forward transfer facility	} These signals are used for international working
11 12 13 14 15	II-11 II-12 II-13 II-14 II-15	} Spare for national use	

Note - Signals II-7 to II-10 are used solely for international working. The rest of the Group II signals only apply for national working and are translated to signals II-7 to II-10 in the outgoing international R2 registers (see Recommendation Q.480). This enables the System R2 register at an incoming exchange to distinguish between national and international calls.

4.2.4 Backward signals

4.2.4.1 Group A backward signals

Group A backward signals (for signal codes see Table 8/Q.441) are required to acknowledge Group I forward signals and under certain conditions, Group II forward signals. Besides that functional part of the compelled procedure, the Group A signals convey signalling information as detailed below:

- The signal A-1, *send next digit* ($n + 1$) requests transmission of the next digit ($n + 1$) after reception of digit n . The latest address signal sent is assumed to have the rank n within the signal sequence specified in Recommendation Q.107.
- The signal A-2, *send last but one digit* ($n - 1$) requests the transmission of digit ($n - 1$) after reception of digit n . The latest address signal sent is assumed to have the rank n within the signal sequence specified in Recommendation Q.107. This signal must not be used on a satellite link.

TABLE 8/Q.441

Group A backward signals

Combination (a)	Designation of the signal (b)	Meaning of the signal (c)
1	A-1	Send next digit ($n + 1$)
2	A-2	Send last but one digit ($n - 1$)
3	A-3	Address-complete, changeover to reception of Group B signals
4	A-4	Congestion in the national network
5	A-5	Send calling party's category
6	A-6	Address-complete, charge, set-up speech conditions
7	A-7	Send last but two digit ($n - 2$)
8	A-8	Send last but three digit ($n - 3$)
9	A-9	} Spare for national use
10	A-10	
11	A-11	Send country code indicator
12	A-12	Send language or discrimination digit
13	A-13	Send nature of circuit
14	A-14	Request for information on use of an echo suppressor (is an incoming half-echo suppressor required ?)
15	A-15	Congestion in an international exchange or at its output

- c) The *signal A-3, address-complete, changeover to reception of Group B signals* indicates that the incoming R2 register at the incoming end needs no additional address digit and is about to go over to transmission of a Group B signal conveying information about the condition of the equipment at the incoming exchange or the condition of the called subscriber's line (see Recommendation Q.442).
- d) The *signal A-4, congestion in the national network* indicates:
- i) congestion of national links;
 - ii) congestion in selection stages of terminal international or national exchanges;
 - iii) occurrence of time-out or abnormal release of a System R2 register produced for any reason.
- For exception to these rules see n) below. See also signal B-4 and Recommendation Q.442.
- e) The *signal A-5, send calling party's category* requests transmission of a Group II signal.
- f) The *signal A-6, address-complete, charge - set-up speech conditions* indicates that the R2 register at the incoming end needs no additional digit, but will not send Group B signals. The call has to be charged on answer (see Recommendation Q.442).
- g) The *signal A-7, send last but two digit ($n - 2$)* requests the sending of digit ($n - 2$) after reception of digit n . The latest address signal sent is to have the rank n within the signal sequence specified in Recommendation Q.107. This signal must not be used on a satellite link.
- h) The *signal A-8, send last but three digit ($n - 3$)* requests the sending of digit ($n - 3$) after reception of digit n . The latest address signal sent is to have the rank n within the signal sequence specified in Recommendation Q.107. This signal must not be used on a satellite link.
- i) The *signals A-9 to A-10* are spares available for allocation of national meanings. The use of signals A-9 and A-10 in national networks can be decided by each Administration. These signals must not be used on international satellite links.

- j) The *signal A-11, send country code indicator* requests the country code indicator (transit indication) in acknowledgment of any forward signal. The signal is used in international transit calls only (see Recommendation Q.462). This signal must not be used on a satellite link.
- k) The *signal A-12, send language or discriminating digit* requests the language digit or the discriminating digit in acknowledgment of any forward signal. This signal must not be used on a satellite link.
- l) The *signal A-13, send nature of circuit* requests information regarding the nature of the circuits involved in the connection so far, i.e. satellite link (see Recommendation Q.480). This signal should only be used on a satellite link by bilateral agreement.
- m) The *signal A-14, request for information on use of echo suppressor* (is an incoming half-echo suppressor required?) indicates that an incoming international exchange acknowledges the discrimination digit or the language digit and that it is possible to insert an incoming half-echo suppressor in that incoming international exchange if required. This signal must not be used on a satellite link.
- n) The *signal A-15, congestion in an international exchange or at its output* indicates:
 - i) congestion on international links;
 - ii) congestion in selection stages at an international transit exchange or at a terminal international exchange and/or its outgoing links;
 - iii) occurrence of time-out or abnormal release of a System R2 register produced for any reason (see Recommendation Q.442).

4.2.4.2 Group B backward signals

Any Group B backward signal (for signal codes see Table 9/Q.441) acknowledges a Group II forward signal and is always preceded by the address-complete signal A-3 which indicates that the incoming R2 register has received all the Group I forward signals it requires from the outgoing international R2 register. Besides that functional part of the compelled procedure the Group B signals convey information about the condition of switching equipment in the incoming exchange, or about the condition of the called subscriber's line, to the outgoing international R2 register which can then take the necessary action as specified in Recommendation Q.474.

TABLE 9/Q.441
Group B backward signals

Combination (a)	Designation of the signal (b)	Meaning of the signal (c)
1	B-1	Spare for national use
2	B-2	Send special information tone
3	B-3	Subscriber line busy
4	B-4	Congestion (encountered after changeover from Group A signals to Group B signals)
5	B-5	Unallocated number
6	B-6	Subscriber's line free, charge
7	B-7	Subscriber's line free, no charge
8	B-8	Subscriber's line out of order
9	B-9	
10	B-10	
11	B-11	Spare for national use
12	B-12	
13	B-13	
14	B-14	
15	B-15	

The following Group B signals are specified:

- a) The *signal B-1 is spare* for national use and its meaning must be compatible with that of signal B-6 (see Recommendation Q.474).
- b) The *signal B-2, send special information tone* indicates that the special information tone should be returned to the calling party. This tone indicates that the called number cannot be reached for reasons not covered by other specific signals and that the unavailability is of a long term nature (see also Recommendation Q.35).
- c) The *signal B-3, subscriber's line busy* indicates that the line or lines connecting the called subscriber to the exchange are engaged.
- d) The *signal B-4, congestion* indicates that congestion condition is encountered after the changeover from Group A signals to Group B signals. The signal B-4 shall be sent in the conditions specified for signal A-4 [see § 4.2.4.1, d) and Recommendation Q.474, § 5.3.5.1].
- e) The *signal B-5, unallocated number* indicates that the number received is not in use (e.g. an unused country code, an unused trunk code or subscriber number that has not been allocated).
- f) The *signal B-6, subscriber's line free, charge* indicates that the called party's line is free and that the call has to be charged on answer.
- g) The *signal B-7, subscriber's line free, no charge* indicates that the called party's line is free but is not to be charged on answer. This signal permits non-chargeable calls without the need for transferring "no charge" information by line signals.
- h) The *signal B-8, subscriber's line out of order* indicates that the subscriber's line is out-of-service or faulty.
- i) *Signals B-9 and B-10* are spare for national use. Their meaning must not be incompatible with the sending of special information tone to the calling party (see Recommendation Q.474).
- j) *Signals B-11 to B-15* are spare for national use. Their meaning can be allocated as required. Sending of these signals into the international network must be prevented.

To deviate from this rule will result in the actions defined in Recommendation Q.474.