



INTERNATIONAL TELECOMMUNICATION UNION

**ITU-T**

**M.562**

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

**MAINTENANCE :  
INTERNATIONAL TELEPHONE CIRCUITS**

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**TYPES OF CIRCUIT AND CIRCUIT SECTION**

**ITU-T Recommendation M.562**

(Extract from the *Blue Book*)

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## NOTES

1 ITU-T Recommendation M.562 was published in Fascicle IV.1 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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## **TYPES OF CIRCUIT AND CIRCUIT SECTION**

### **1 General**

1.1 The purpose of this Recommendation is to describe the terms “circuit section” and “circuit”, as they are used in the Series M Recommendations, taking into consideration analogue, digital, and mixed analogue/digital constitutions.

1.2 The circuit types described in this Recommendation differ somewhat from those in Recommendation G.101 [1], in order to emphasize distinctions that are useful in setting forth maintenance procedures.

### **2 Circuit sections**

Each of the first three section types listed below corresponds to one of the three channel types defined in Recommendation M.300. Each of the last two circuit section types corresponds to one of the two terminal types also defined in Recommendation M.300.

#### *2.1 Analogue circuit section*

An analogue circuit section comprises two analogue channels, one for each direction of transmission.

#### *2.2 Mixed circuit section*

A mixed circuit section comprises two mixed channels, one for each direction of transmission.

#### *2.3 Digital circuit section*

A digital circuit section comprises two digital channels, one for each direction of transmission.

#### *2.4 Mixed analogue/digital terminal circuit section*

A mixed analogue/digital terminal circuit section comprises the two directions of transmission, for one equivalent voice-frequency signal, through a PCM multiplex equipment. In the analogue to digital direction, the mixed analogue/digital terminal circuit section extends from the audio input of the PCM multiplex equipment, to the associated 64 kbit/s time slot appearance at the digital output. In the digital to analogue direction, the mixed analogue/digital terminal circuit section extends from the 64 kbit/s time slot appearance of a particular channel at the digital input to the PCM multiplex equipment, to the associated audio output.

#### *2.5 Digital terminal circuit section*

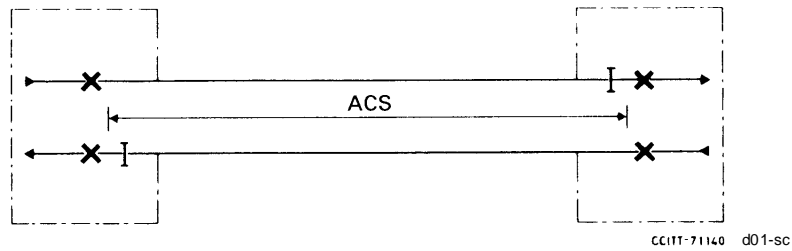
A digital terminal circuit section comprises the two directions of transmission, for one equivalent voice-frequency signal, through a digital terminal. For each direction of transmission, the digital terminal circuit section extends from a particular 64 kbit/s time slot appearance, in the input bit sequence to the digital terminal, to the corresponding 64 kbit/s time slot appearance in the output bit sequence of the digital terminal.

### **3 Circuits**

International circuits comprise various combinations of national and international circuit sections, together with ancillary equipment as required. The following circuit types are defined in terms of their constituent circuit sections, as a basis for recommending appropriate maintenance procedures.

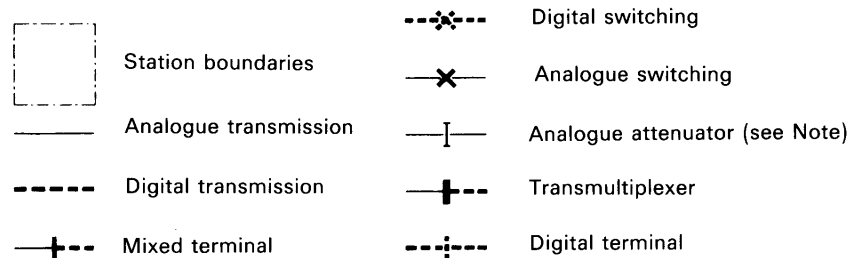
### 3.1 Analogue circuit

An analogue circuit comprises one or more analogue circuit sections. These circuits terminate at both ends in analogue switching machines. A schematic drawing is shown in Figure 1/M.562.



*Symbols and nomenclature used in Figures 1/M.562 to 3/M.562*

- ACS – Analogue circuit section
- MCS – Mixed analogue/digital circuit section
- DCS – Digital circuit section
- MTCS – Mixed analogue/digital terminal circuit section
- DTCS – Digital terminal circuit section



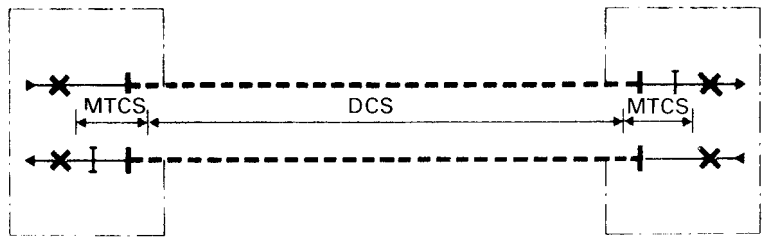
*Note* – The use of this symbol in the figures indicates the location of any analogue attenuation required to meet the CCITT transmission plan.

FIGURE 1/M.562

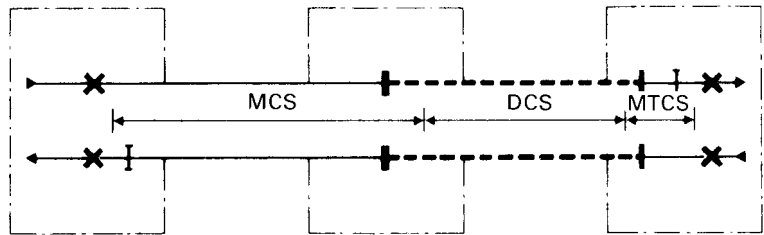
#### Analogue circuit

### 3.2 Mixed analogue/digital circuit

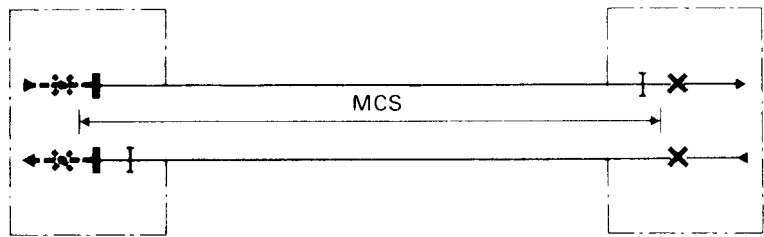
A mixed analogue/digital circuit comprises any combination of circuit sections that includes one or more analogue to digital, or digital to analogue, conversion processes. Mixed analogue/digital circuits may terminate at either end in analogue or digital switching machines. Combinations of various types of circuit sections that are acceptable in making up mixed analogue/digital circuits are constrained by the need to avoid excessive transmission impairments. These constraints are discussed in § 5 below. Examples of permitted mixed analogue/digital circuit configurations are shown schematically in Figure 2/M.562.



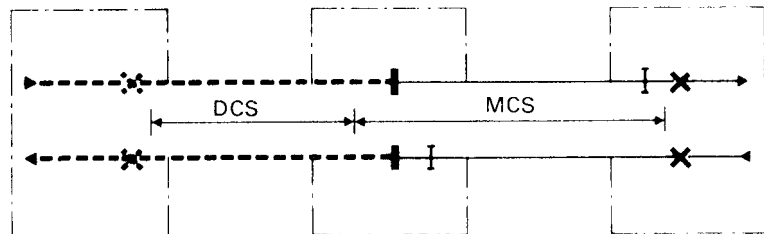
a) Analogue switching at each end; digital transmission; mixed terminals



b) Analogue switching at each end; both analogue and digital transmission, with transmultiplexer at transmission interface; mixed terminal



c) Digital switching at one end, with analogue switching at the other end; analogue transmission; transmultiplexer

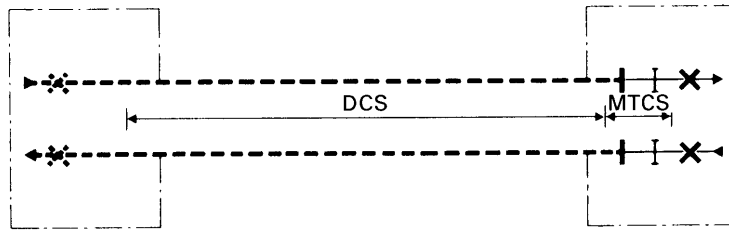


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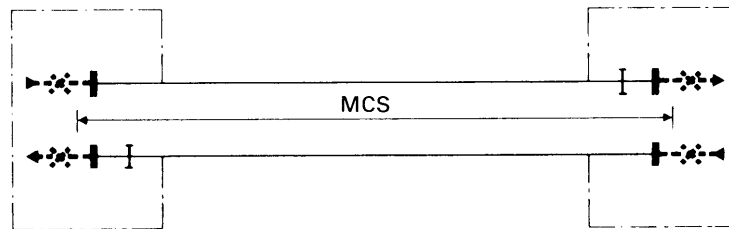
d) Digital switching at one end, with analogue switching at the other end; both digital and analogue transmission, with transmultiplexer at transmission interface

FIGURE 2/M.562

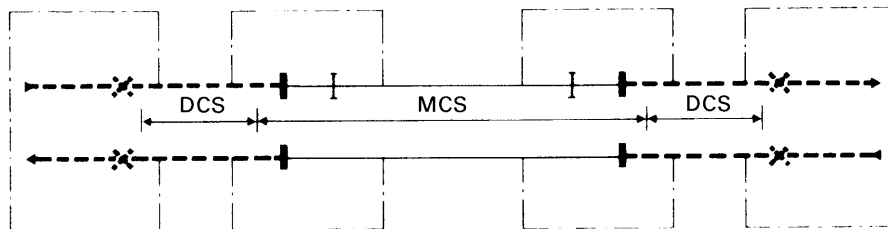
Mixed analogue/digital circuits



e) Digital switching at one end, with analogue switching at the other end; digital transmission; mixed terminal



f) Digital switching; analogue transmission: transmultiplexer



g) Digital switching; both digital and analogue transmission; transmultiplexers at the transmission interfaces

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Note – Explanation of symbols and nomenclature is given in Figure 1/M.562.

FIGURE 2/M.562 (cont.)

**Mixed analogue/digital circuits**

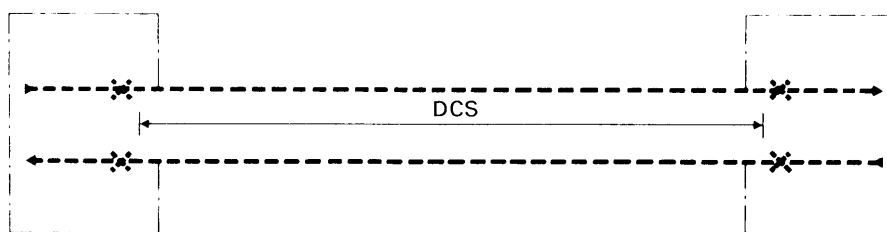
3.3 Digital circuit

A digital circuit comprises one or more digital circuit sections. In addition to the digital circuit section(s), a digital circuit may include one or more digital terminal circuit sections. These circuits terminate at both ends in digital switching machines. A schematic drawing is shown in Figure 3/M.562.

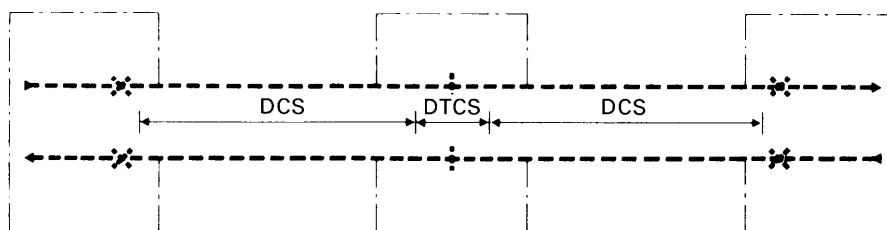
**4 Allocation of losses in mixed analogue/digital circuits**

In Figure 2/M.562, the attenuators needed to control any variability in the analogue portions of the circuits, arising from loss variations with time, or attenuation distortion, are shown symmetrically for both directions of transmission. However, in practice, such arrangements may require nonstandard levels at the boundaries between circuit sections.

Administrations are advised that should they prefer to adopt an asymmetric arrangement, e.g., by putting all the loss into the receive direction at only one end of a circuit or circuit section, then, provided that the loss is small, e.g., a total of not more than 1 dB, the small amount of asymmetry that results in the international portion of the connection will be acceptable, bearing in mind the small number of international circuits encountered in most actual connections.



a) Digital circuit



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b) Digital circuit with digital terminal circuit section

Note – Explanation of symbols and nomenclature is given in Figure 1/M.562.

FIGURE 3/M.562

### Digital circuits

## 5 Number of unintegrated PCM digital processes

### 5.1 General principle

It is recognized that in the mixed analogue/digital period, there could be a considerable presence of unintegrated digital processes in the worldwide telephone network. Consequently, it is important that the incorporation of these processes should take place in such a way that when integration of functions can occur, unnecessary items of equipment will not remain in the all-digital network.

### 5.2 Restrictions due to transmission impairments

In the mixed analogue/digital period, it may be necessary to include a substantial number of unintegrated digital processes in international telephone connections. To ensure that the resulting transmission impairments (quantization, attenuation and group-delay distortion) introduced by such processes do not accumulate to the point where overall transmission quality can be appreciably impaired, it is recommended that the planning rule given in Recommendation G.113, § 3 [2], be complied with. The effect of this rule is to limit the number of unintegrated digital processes in both the national and international parts of telephone connections.

In the case of all-digital connections, transmission impairments can also accumulate due to the incorporation of digital processes (e.g., digital pads). The matter of accumulating such impairments under all-digital conditions is also dealt with in Recommendation G.113, § 3 [2].

### References

- [1] CCITT Recommendation *The transmission plan*, Vol. III, Rec. G.101.
- [2] CCITT Recommendation *Transmission Impairments*, Vol. III, Rec. G.113.