

## RECOMMENDATION ITU-R F.751-2

**TRANSMISSION CHARACTERISTICS AND PERFORMANCE  
REQUIREMENTS OF RADIO-RELAY SYSTEMS FOR SYNCHRONOUS  
DIGITAL HIERARCHY-BASED NETWORKS**

(Question ITU-R 160/9)

(1992-1994-1997)

The ITU Radiocommunication Assembly,

*considering*

- a) that ITU-T Recommendations G.707, G.708 and G.709 specify the bit rates, the multiplexing structure and the detailed mappings associated with the synchronous digital hierarchy (SDH);
- b) that ITU-T Recommendations G.781, G.782 and G.783 specify the general characteristics and functions of synchronous multiplexing equipment and ITU-T Recommendation G.784 specifies the management of SDH equipment and networks;
- c) that ITU-T Recommendations G.703 and G.957 specify the physical parameters of the electrical and optical interfaces of SDH equipment;
- d) that Recommendation ITU-R F.750 specifies architectures and functional aspects of SDH digital radio-relay systems (DRRSs);
- e) that specific transmission features of the radio-relay systems may be required for the transport of SDH bit rates meeting the performance requirements and efficient spectrum utilization;
- f) that the coexistence of SDH-DRRSs with the existing radio systems is required in the present radio channelling schemes,

*recommends*

- 1 that SDH-DRRSs comply with the requirements described in Annex 1.

## ANNEX 1

**1 Introduction****1.1 Scope**

Annex 1 defines the transmission characteristics and performance requirements for the SDH-DRRSs.

**2 Applications of SDH digital radio-relay systems (SDH-DRRSs)****2.1 Network interfaces**

The connection between radio and SDH networks shall be at standardized interface points. The preferred connection is to make the TT' points (Recommendation ITU-R F.596) coincide with the network node interface (NNI) points identified in ITU-T Recommendation G.708.

## 2.2 Transport capacity

### 2.2.1 High capacity SDH-DRRSs

SDH-DRRSs in the long-haul or core network typically operate at STM-1,  $n \times$  STM-1 or STM- $n$  transmission rates. They are typically deployed in the lower (2-12 GHz) frequency bands.

High capacity SDH-DRRSs in short-haul or access networks typically operate at the STM-1 or  $n \times$  STM-1 transmission rates. They are usually deployed in frequency bands higher than 12 GHz.

### 2.2.2 Medium capacity SDH-DRRSs

In circumstances when traffic requirements are below those of an STM-1 signal, and to most effectively utilize the available radio bandwidth, radio-relay systems typically operate at the STM-RR transmission rate with a VC-3 traffic payload (see § 6 of Annex 1 to Recommendation ITU-R F.750).

### 2.2.3 Low capacity SDH-DRRSs

SDH-DRRSs with payload transport capacity below VC-3, e.g.  $n \times$  VC-12, are under study.

## 3 Radio-frequency channel arrangements and compatibility with existing systems

### 3.1 High capacity SDH-DRRSs

SDH-DRRSs shall be compatible with the existing radio-frequency channelling arrangements (see Recommendation ITU-R F.746). This will allow administrations to introduce new synchronous digital radio systems without major disruption of existing radio networks employing analogue radio systems and/or plesiochronous digital radio systems. These have generally been based on analogue radio systems and digital systems operating at bit rates up to 140 Mbit/s. The transmission of 155 Mbit/s signals within these channelling arrangements requires an increase in the bits/Hz spectrum efficiency of radio equipment which may have a consequential impact on the choice of modulation method and on the design of filter circuits.

Examples of possible arrangements which allow transmission of the basic STM-1 rate and multiple STM-1 rates within existing radio-frequency channel plans are given in Table 1.

TABLE 1

Examples of possible arrangements which allow transmission of the basic STM-1 rate and multiple STM-1 rates within existing radio-frequency channel spacing

| Channel spacing (MHz) | Capacity                           | Examples of modulation method (1), (2)         |
|-----------------------|------------------------------------|------------------------------------------------|
| 20                    | 1 $\times$ STM-1                   | 256-QAM, 512-QAM                               |
| 28, 29, 29.65, 30     | 1 $\times$ STM-1                   | 64-QAM, 128-QAM, 256-QAM                       |
| 28, 29, 29.65, 30     | 2 $\times$ STM-1                   | 128-QAM (CC), 256-QAM (CC)                     |
| 40                    | 1 $\times$ STM-1                   | 32-QAM, 64-QAM                                 |
| 40                    | 2 $\times$ STM-1                   | 32-QAM (CC), 64-QAM (CC), 512-QAM              |
| 55, 56, 60            | 1 $\times$ STM-1                   | 16-QAM, 32-QAM                                 |
| 55, 56, 60            | 2 $\times$ STM-1                   | 16-QAM (CC), 32-QAM (CC), 64-QAM (CC), 256-QAM |
| 80                    | 2 $\times$ STM-1                   | 64-QAM                                         |
| 80                    | 4 $\times$ STM-1, 1 $\times$ STM-4 | 64-QAM (CC)                                    |
| 110, 112              | 1 $\times$ STM-1                   | QPSK (4-QAM)                                   |
| 110, 112              | 2 $\times$ STM-1                   | 16-QAM, 32-QAM                                 |
| 110, 112              | 4 $\times$ STM-1, 1 $\times$ STM-4 | 16-QAM (CC), 32-QAM (CC)                       |
| 220                   | 4 $\times$ STM-1, 1 $\times$ STM-4 | 16-QAM, 32-QAM                                 |

(1) The term QAM is intended to also encompass forward error correction or coded modulation techniques (like TCM).

(2) In this table CC is used as the abbreviation for "band re-use in the co-channel mode".