# REPORT 1157

## INTEGRATION OF PUBLIC MOBILE RADIOCOMMUNICATION SYSTEMS

(Question 52/8)

(1990)

### 1. Introduction

This Report describes the general principles for the integration of public mobile radiocommunication (terrestrial) systems. Recommendation 622, Report 742 and Report 1051 are considered helpful in designing integrated public mobile radiocommunication systems. The integration between terrestrial and satellite systems has been discussed in Report 1177.

### 2. Concept of system integration

#### 2.1 Model

Among public mobile communication systems, land, maritime, aeronautical and satellite mobile systems are candidates for integration.

A model of a public mobile radiocommunication system is shown in Figure 1. This model is composed of a mobile/portable station, a base station, a mobile switching service centre (MSC) and an operational and maintenance (O & M) facility. Control functions such as signalling, location registration, hand over, numbering and charging are also important for system operation. These components or functions can be combined in several ways and their careful integration can contribute to system economy and operational simplicity.

#### 2.2 Integration level

Integration levels among terrestrial systems are classified as follows:

i) Total compatibility

When all the equipment and the O & M facilities are fully compatible with respect to every service, there is total compatibility. This compatibility, in which all services are provided by an integrated system, is the highest level.

ii) Partial compatibility

When diverse systems do not share all components or control procedures, there is partial compatibility. Within the concept of the partial compatibility, various integration levels are possible.

A practicable integration level should be determined by taking into account regulatory, operational, and technical characteristics. Report AZ/8 gives more detail on these and other issues.

## 3. Considerations for system integration

### 3.1 Operational characteristics

i) Different frequency bands are assigned to each service according to the present Radio Regulations. However, most suitable frequency bands should be discussed from a technical point of view.

ii) Service quality, such as blocking probability, speech quality and delay differs between mobile service access systems. Where the quality of service differs significantly from the PSTN standards, care must be taken that customers do not blame the PSTN operator for poor quality.

iii) Parameters related to the call processing, service areas and so on differ according to the requirements of each system.

iv) The charging rate depends on system cost and generally varies from service to service.

v) A common numbering plan should be used for all services.

vi) O & M facility compatibility contributes to the economic system production and operation.

### 3.2 Technical characteristics

i) The technical characteristics of transceivers depend on the assigned frequency. The transmitting power and the receiver sensitivity are determined according to the required zone radius and the required speech quality.

ii) The environmental specifications of the mobile stations are determined according to the circumstances of each service.

iii) The cell structure and channel re-use are designed according to the traffic densities, required frequency efficiencies, propagation characteristics and quality requirements.

iv) The location of a base station is determined according to the required service area, the geographical features and propagation characteristics.

v) The control channel configuration is designed according to traffic density, signalling reliabilities and frequency efficiency.

4. Practicable integration level

The practicable integration level should be determined considering the following items:

- equipment;
- control procedures;
- operational features.

Based on the Japanese experience, an example of an integrated system of land, maritime and aeronautical services is shown in Annex I of this report.

5. Conclusion

This report illustrates the general principles for the integration of public mobile radiocommunication systems.

Practicable integration levels, frequency bands for integrated systems, operational considerations and relationships with satellite systems are matters for further study.

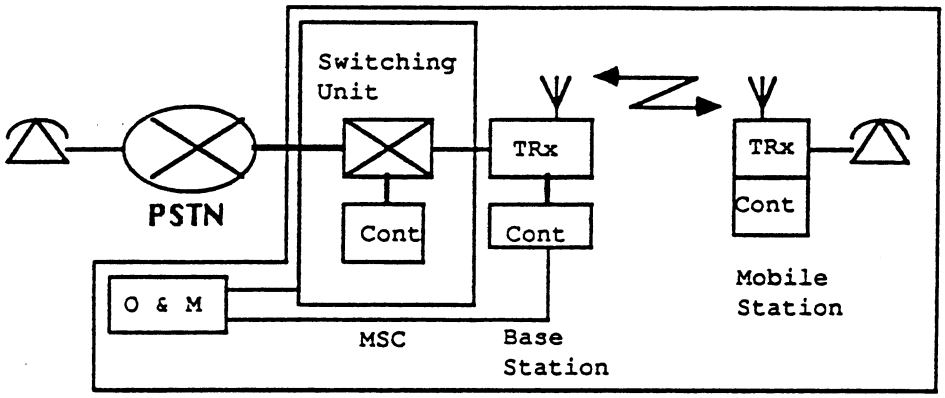


FIGURE 1

System configuration (terrestrial systems)

ANNEX I

INTEGRATION OF PUBLIC MOBILE RADIOCOMMUNICATION SYSTEMS IN JAPAN

The aeronautical (Report 1051) and the maritime mobile systems [Kuramoto and Ogawa, 1987] were integrated into the public land mobile telephone system (Report 742) in May 1986 and November 1988, respectively. In this integrated system, control procedures, O & M facilities and related equipment are shared in order to improve system economy and to simplify system operation.

1. System configuration

The system configuration is shown in Figure 2.

The system is composed of the following equipment:

- mobile stations/portable stations dedicated to each service;
- base stations dedicated for each service;
- mobile switching service centre comprising a mobile control unit and a switching unit;
- operation and maintenance (O & M) facilities.

2. General characteristics

The operational and technical characteristics of the integrated system are based on Recommendation 622.

The major characteristics of this integrated system are shown in Table I.

3. Integration level

Most items, except for the radio frequencies, have been integrated. The detailed integration levels are as follows.

3.1 Equipment

The following equipment is compatible:

- switching unit and mobile control unit;
- telephone part of the mobile station;
- O & M equipment.

The following equipment remains dedicated because of differences in assigned frequencies, locations of base station and coverage areas:

- transceivers in mobile/portable stations or base stations.

3.2 Control procedure

The control procedure for the radio-path is compatible except for the control channel scheme and the service quality parameters. In the maritime and aeronautical systems, the paging channel and access channel are combined into one radio control channel because of low traffic.

The control procedure between base stations and switching unit is compatible.

3.3 Operational features

The following elements are shared:

- charging principle, except for the charging rate;
- numbering plan (commonly used in the newly introduced public land mobile telephone system, as well as in the above-mentioned system);
- supervision and control of all equipment, radio paths and wire lines;
- O & M.

REFERENCE

KURAMOTO, M. and OGAWA, K. [October, 1987] - Integration of mobile communication systems in NTT. Fifth World Telecommunication Forum, Vol. III, pages 51-59.

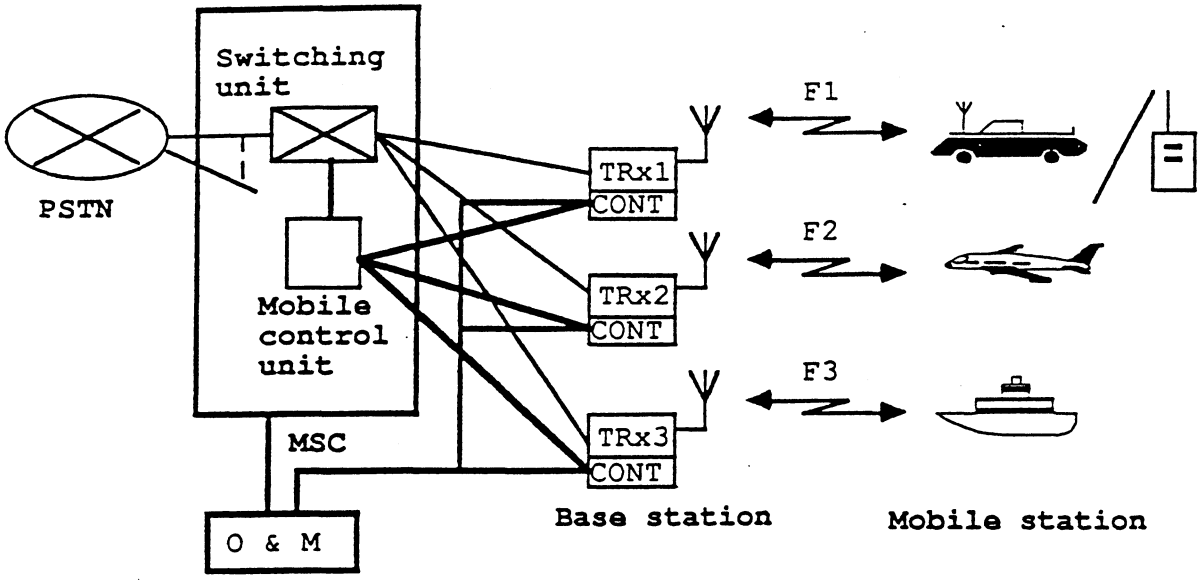


FIGURE 2 - Configuration of the integrated system

TABLE I - Technical characteristics of the integrated system

| ITEM | LAND | MARITIME | AERONAUTICAL |
|---|---|---|---|
| Frequency (MHz) | 800-900 | 250 | 800-900 |
| Channel spacing (kHz) | 25 | 12.5 interleave | 25 |
| Maximum base station e.r.p.(W) | 50 | 40 | 130 |
| Nominal mobile station transmitting power(W) | 5 | 5 | 10 |
| Zone radius (km) | 3 -10 | 50 - 100 | 400 |
| Numbering plan | Common | | |