RECOMMENDATION ITU-R F.762-2

MAIN CHARACTERISTICS OF REMOTE CONTROL AND MONITORING SYSTEMS FOR HF RECEIVING AND TRANSMITTING STATIONS

(Question ITU-R 149/9)

(1992-1994-1995)

The ITU Radiocommunication Assembly,

considering

a) that various constraints (man-made noise, areas required for antenna fields) make it necessary to choose sites for installing HF receiving and transmitting stations far from urban areas;

b) that it is necessary to limit operating costs;

c) that several administrations have consequently adopted remote control and monitoring techniques for the operation and supervision of HF stations;

d) that, in general, the remote control and monitoring system must have the following characteristics:

– reliability;

– flexibility;

– local and remote operation facilities;

– real-time operation;

– storage of the equipment control state so that it will remain unchanged in the event of breaks in the control circuit due to fault conditions;

– use of minimum number of lines;

e) that the information available in current documentation allows consideration to be given to standardizing the main characteristics of HF station remote control and monitoring systems, which are:

– digital mode operation;

– a preference for serial data streams;

– type of modulation;

– sampling data rate for remote monitoring, and response time for remote controls;

– protocols (synchronization, address, equipment control, bit control, word length and format);

– relevant data rate, according to ITU-T Recommendations;

– error performance (optional error detection and correction codes should be specified),

recommends

1 that the main functions to be controlled and monitored in each receiving and transmitting station should be the following:

a) functions on each transmitter and each receiver:

– all the functions which can be controlled and measured from the equipment front panel can normally also be controlled and monitored remotely, and remote signalling is provided for all remotely controlled functions;

b) functions on other equipment in the station:

- control of the antenna switching matrix linking the transmitters (or receivers) to the fixed antennas, rotatable antennas and dummy loads;
- rotatable antenna control;
- beam selection control in the case of reception stations using a circular antenna array giving a large number of high gain directional beams;
- station power supply.

Examples of the main functions to be provided are given in Tables 1 and 2, which indicate whether the function concerns remote control (RC) and associated remote signalling (RS), or solely remote surveillance (R Surv.);

TABLE 1

Transmitting stations

Functions	Facilities	RC	RS
For each transmitter			
Transmitter power supply	On/Off/Standby	X	X
Class of emission	A1A, A2A, A1B, A2B, A3E, F1B, F2B, F7B, H2A, H2B, H3E, J3E, J7B, R3C, R3E, R7B, B8E, B9W	X	X
Frequency tuning	HF band; at least 100 Hz increments	X	X
Transmitted RF level	Meter indication of forward and reflected power or voltage standing wave ratio		X
Diagnostic	Self test and fault reporting		X
For the station			
Line input selection	According to operational requirements	X	X
Antenna selection	According to operational requirements	X	X
Rotatable antenna control	360° azimuth	X	X
Station power supply	Off		X

2 that the general system transmission characteristics should be as follows:

- for any system, the information in the remote control message is contained in a code word comprising a certain number of information bits, plus additional bits used for the procedure and for transmission error detection/ correction;
- the information in the remote monitoring message is contained in a code word similar to that of the remote control message;
- the remote control protocol has a message priority basis, e.g. priority one – emergency shut-down conditions;
- these messages can be transmitted using private point-to-point links or the public switched network;
- EIA (Electronic Industries Association) standard RS232C interfaces are used on the equipment being controlled remotely;

– any delay introduced by the remote control function and verification of the response must be acceptable. A digital transmission rate of 1 200 bit/s is generally fast enough, even for controlling the local oscillator of a receiver where a minimum response time is required (particularly in the maritime mobile service);

– the remote control and monitoring system must be protected against power cuts.

Annex 1 describes the various types of remote control and monitoring systems and Annex 2 gives an example of a protocol for remote control/remote monitoring messages.

TABLE 2

Receiving stations

Functions	Facilities	RC	RS
For each receiver			
Receiver power supply	On/Off	X	X
AGC	Carrier (fast/slow); single sideband (fast/slow); Off	X	X
RF/IF gain	At least 5 dB steps over a range of at least 100 dB	X	X
Class of emission	A1A, A2A, A1B, A2B, A3E, F1B, F2B, F7B, H2A, H2B, H3E, J3E, J7B, R3C, R3E, R7B, B8E, B9W	X	X
BFO tuning range	3 000 Hz in 10 Hz increments	X	X
High stability BFO	On/Off	X	X
AFC	On/Off	X	X
Antenna attenuator	On/Off	X	X
Frequency tuning	HF band; at least 10 Hz increments	X	X
IF filter selection	Minimum 3 positions	X	X
Received RF/AF levels	Meter indications		X
AF output	Meter indications		X
AFC deviation	Meter indications		X
Receiver blocking (simplex operation)	On/Off	X	X
Diagnostic	Self test and fault reporting		X
For the station			
Line output selection	According to operational requirements	X	X
Antenna selection	According to operational requirements	X	X
Antenna array control	Selection of directional beam	X	X
Rotatable antenna control	360° azimuth	X	X
Station power supply	Off		X

NOTE 1 – Analogue values (levels-power-azimuths) must be sampled prior to transmission; on reception, the information will be restored by digital-to-analogue conversion.

ANNEX 1

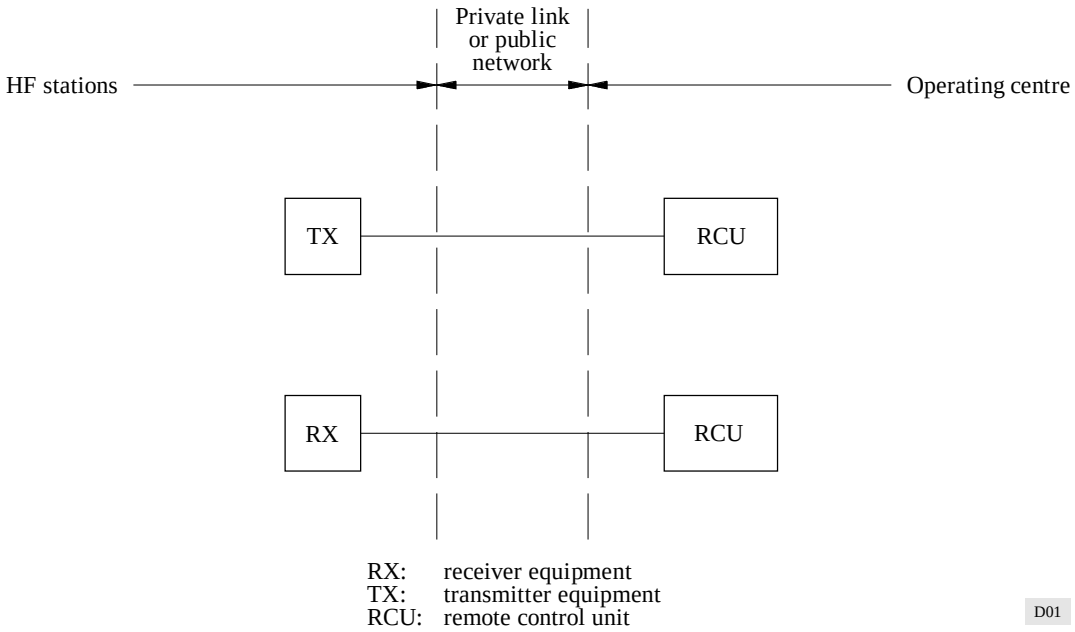
Various types of remote control and monitoring systems

1 Extended control system

There is one remote control (and monitoring) unit per equipment.

FIGURE 1

Extended control system



The possibility of controlling the equipment locally is retained for maintenance operations.

The ability of the latest data transmission techniques to concentrate large amounts of information has confined the use of systems of this type to single equipment applications.

2 Multiplexed control system

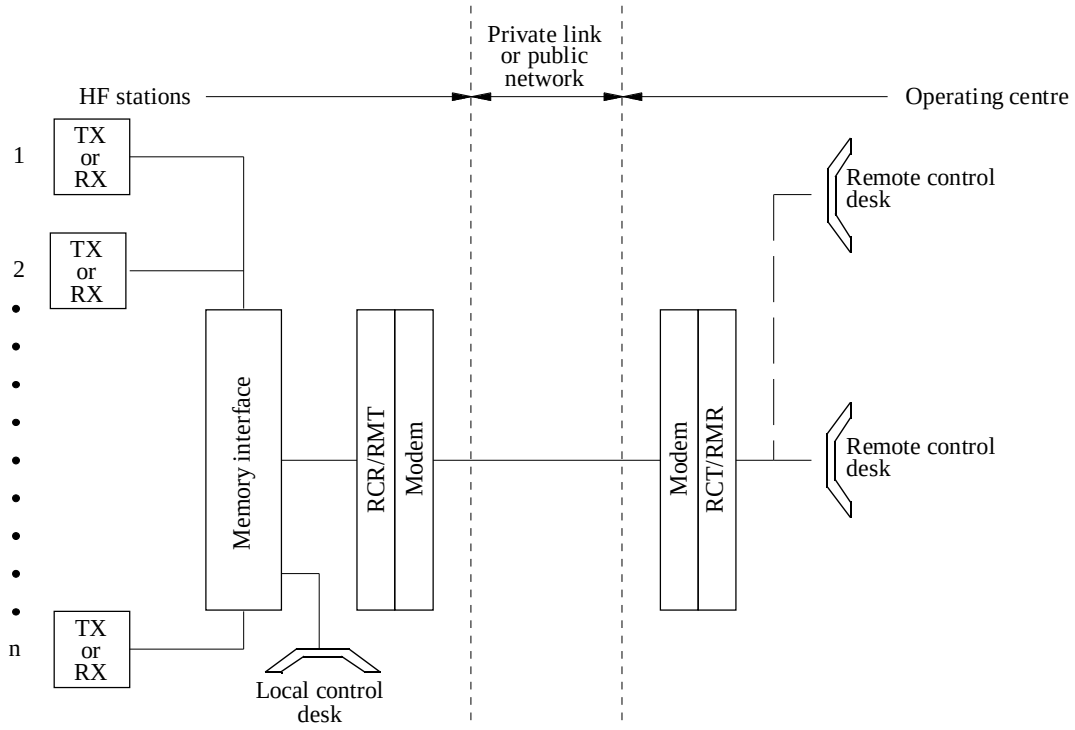
A remote control (and monitoring) desk provides control and monitoring of several equipments, and displays all information received from the station.

Several receiving and transmitting stations can be controlled and monitored remotely from the same operating centre, irrespective of whether these stations belong to the mobile service, fixed service, or both.

The installations to be controlled remotely are fitted with an interface which sends the control signals to the equipment. These signals are held in memory until the interface receives a new instruction. In the event of a power outage, the instructions are retained in memory.

FIGURE 2

Multiplexed control system



RCT/RMR: remote control transmitter-remote monitoring receiver

RCR/RMT: remote control receiver-remote monitoring transmitter D02

The functions provided are those performed by the remote control desk operator. If the stations contain a large number of equipments, and if the operating workload is excessive for a single operator, several remote control desks may be installed. However, the system allows only a single equipment to be controlled remotely at any one time.

3 Computer control system

Compared with the previous system, this system allows for fully automatic operation of the stations by integrating the remote control and monitoring functions with the management functions: statistics, link planning, message processing, data bases, etc.

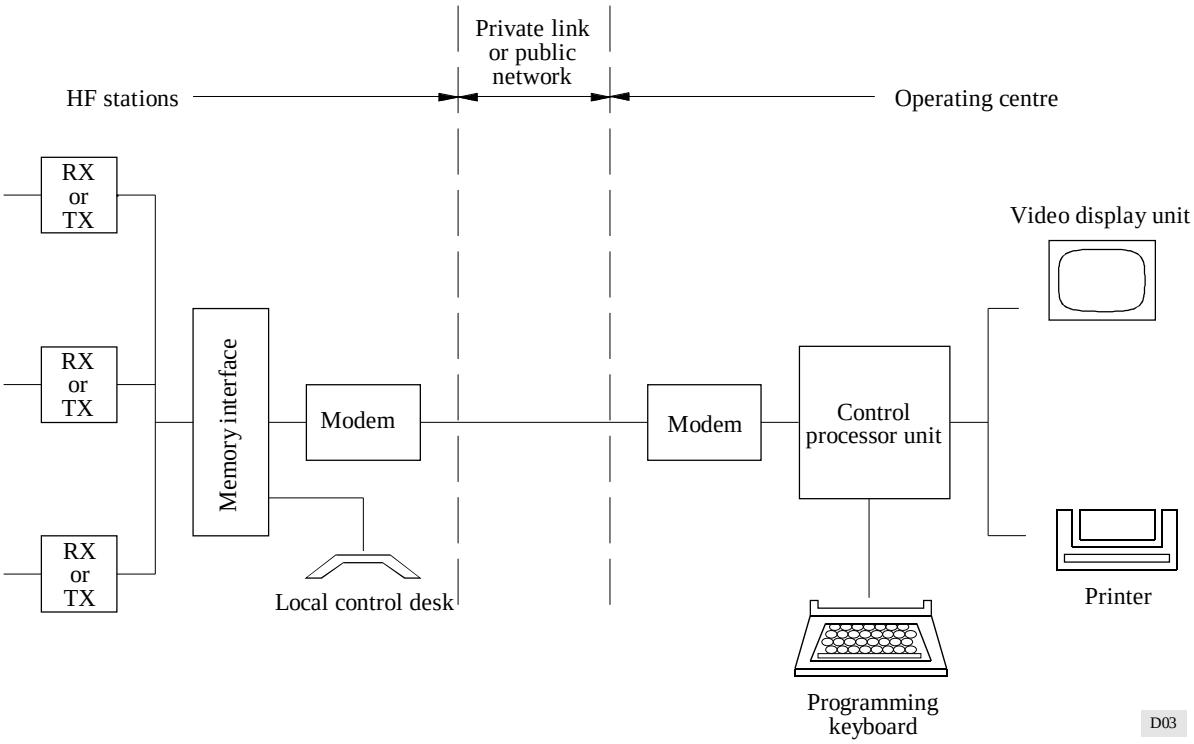
Each equipment can be controlled either by a program in the CPU or by direct keyboard input.

The control and operating state of each equipment and associated information concerning the stations are displayed on the VDU. If the volume of information to be displayed is excessive, then it is possible to use either several VDUs or one VDU by requesting the display of the desired information.

A printer provides event logging by continuously recording the operational data: instructions, station operating characteristics, alarm messages.

FIGURE 3

Computer control system



The role of the operator is simply to handle alarms from the computer terminals in accordance with a predetermined priority sequence. By using computer-based techniques, the following functions are possible:

– real-time monitoring of equipment availability,
– automatic equipment switch-on/switch-off,
– automatic frequency selection,
– operational flexibility,
– automatic operation with predefined parameters,
– automatic surveillance,
– automatic change of equipment configuration.

ANNEX 2

Example of a protocol for remote control/remote monitoring messages

1 The link between the remote control and monitoring system and the equipments requiring remote control and monitoring is a serial digital duplex link based on standard RS232C interfaces, using the ASCII code with words of 8 bits comprising 7 wanted bits and a parity (or odd parity) bit.

2 It may operate either in asynchronous mode, with the possibility of selecting transmission speed (values from 150 to 19 200 bit/s), or in synchronous mode.

In asynchronous mode, bit synchronization is effected at the beginning of the character by a run-in bit.

In synchronous mode, synchronization is effected by reception of a “SYNC” character.

3 The message necessarily begins with a specific character (CR: Carriage Return) and necessarily ends with a specific character (LF: Line Feed).

4 There are three types of messages:

a) remote control message;

b) spontaneous remote monitoring message, sent from the equipment to the remote control system, in order to draw attention to a change in the state of the equipment;

c) cyclical remote monitoring message, sent periodically from the equipment to the remote control system.

Each wanted message is made of:

– between 1 and 6 characters identifying the message (example: F for frequency);

– a series of characters identifying the value of the message data.

For each type of message, the characters identifying a message are contained in the message.

5 Remote control messages are acknowledged by the equipment. To indicate that the remote control command has been taken into account, the equipment transmits an acknowledgement/remote signalling message, which is the same as the remote control message except that the alphabetical letters identifying the type of command are in lower case. Remote monitoring messages are not acknowledged.

6 There are three optional possibilities:

– Addition of a second “SYNC” character for operation in synchronous mode.

– Addition of an addressing character for controlling several equipments over a single remote control line. All the messages transmitted include the address of the equipment and received messages are only taken into account if they contain that address.

– Addition of parity characters for the purposes of error detection (one to four according to the message length).

If no error is detected, an acknowledgement of receipt is sent by remote signalling to the remote control system; otherwise, no acknowledgement of receipt is sent, in which case the remote control message is repeated after a specified lapse of time.

Similarly, the remote control system must transmit an acknowledgement of receipt for each equipment remote monitoring message; if no acknowledgement of receipt is transmitted, the equipment will repeat its remote monitoring message.

7 In short, the general format of a remote control message is as follows: