MOSCAD Operation with Radio Repeaters

1. Interfaces

The basic MOSCAD models are configured either for Direct FM or FSK interface to the radio. The connection of a single radio to MOSCAD is possible by means of communication port 3 in the CPU module that includes a plug-in radio interface board. Two plug-in interface boards are available: FSK (biphase), and Direct FM. The functional interface is software configurable via the Programming Toolbox.

Table 1: MOSCAD radio interfaces

Physical Interface	Functional Interface	Data Rates (bps)	Remarks
FSK	Conventional Radio, Trunking Radio, Radio Remote Control	1800, 2400	
Direct FM	Conventional Radio (VHF/UHF) with Direct FM	2400, 3600, 4800	Note 1

Note 1: Direct FM interface plug-in board can not be used in conventional radio networks (VHF/UHF) that are using standard R/T or R/A repeaters.

2. Conventional Radio

The conventional radio can operate with Direct FM or with FSK interface.

The FSK interface allows Half-Duplex operation over any conventional radio network irrespective of whether the radio network includes the RF repeaters or is working on direct communications.

It is possible to interface to MOSCAD by means of Direct FM in conventional radio networks where there is a direct communications between the base station and the RTUs. If the network is using standard RF repeaters the FSK model should be used (unless the data can be regenerated at the repeater site).

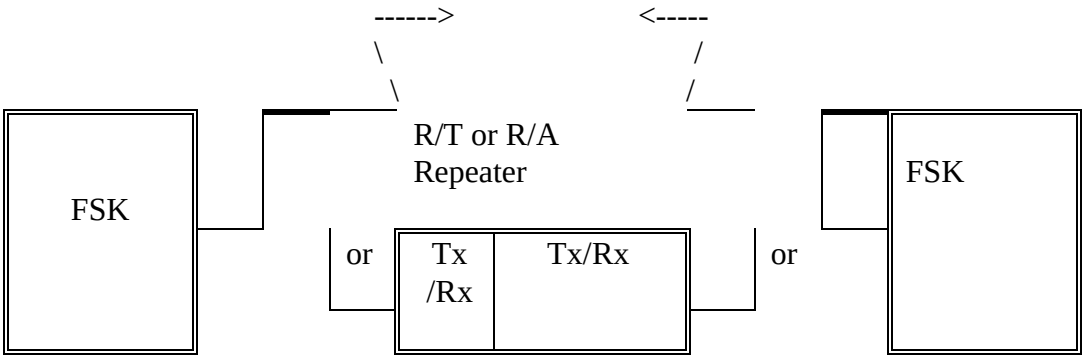

Fig 1. Conventional Radio Repeater

3. Trunking Radio

FSK is the only possible mode of operation for the trunking networks. Direct FM can not be used in a trunking network as these operate via trunking repeaters which do not support this mode.

4. Direct FM versus FSK

The advantage of the Direct FM interface method compared to the FSK is that Direct FM allows higher speed data transfer by means of a VHF/UHF conventional radio with an external Direct FM port.

The main disadvantage of this method is that most of the existing Radio Repeaters including trunking do not support Direct FM.

5. MOSCAD Built-in Radio

The MOSCAD is designed to operate with a number of built-in Motorola radio transceivers. The interfaces and the possible data rates for each radio are given in the table below. It should be emphasized that the radio transceivers in the table are not the standard Motorola models, but models adapted for data transmission.

Table 2: MOSCAD radio interface list

Radio Type	Physical Interface	Channel Data Rate	Standard Repeater R/T, R/A	Remarks
MaxTrac VHF/UHF 25 kHz	Direct FM	2400/3600/4800	No	Tested
	FSK	1800/2400	Yes	Tested
MaxTrac VHF 12.5 kHz	FSK	1800	Yes	Note 1
MaxTrac Smartnet VHF/UHF 25 kHz	FSK	1800/2400	Yes	Tested
MaxTrac Smartnet 800 MHz	FSK	1800/2400	Yes	Tested
RNet 450 UHF	FSK	1800	Yes	Note 1
RNet 150 VHF	FSK	1800	Yes	Note 1
DARCOM 9000 HR2, 12.5 kHz	Direct FM	2400/3600	DARCOM	Note 1
	FSK	1800	DARCOM	Note 1

Note 2: Data rates for some radio types have not yet been verified by actual tests, and this will be verified in the near future.

6. Store and Forward Repeaters

The RTU is capable of operating in Store-and-Forward (S&F) mode. In this mode the RTU receives information from other RTUs, stores it in the memory and then transmits it to the control center or other site when the communication channel is available, and vice versa.

The S&F repeater method can be utilized for radio networks in two ways:

- Single channel S&F repeater

- R/A repeater with S&F capability

In a MOSCAD based SCADA system it is possible to have up to nine S&F repeaters. It should be noted that a S&F repeater configuration is not the best solution for near-real time SCADA systems, where the system response time is a critical parameter.

6.1 Single channel Store & Forward repeater

The Single channel S&F repeater is implemented by means of a MOSCAD RTU configured with a single radio. This configuration can be used to extend the radio coverage range in a single channel network working without RF repeaters. The MOSCAD is storing the message and retransmitting (forwarding) it when the channel is free.

This mode of operation should be used only for RTUs which are out of the RF coverage and only when complying with FCC rules.

Fig 2. Single Channel Store & Forward Repeater

6.2 R/A Repeater with Store & Forward Capability

In the R/A repeater configuration two MOSCAD units acts as an S&F communications node between two separate radio networks.

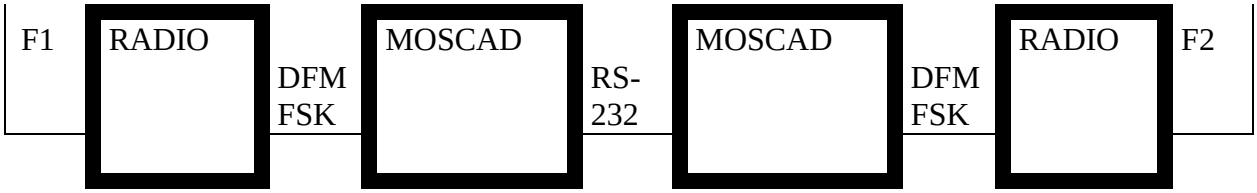

Fig 3. R/A Repeater with Store & Forward Capability