



# Technical Note - TN-66

**Subject:** Parallel Operating Systems

**Description:** Digital and Analog Data Systems

## Introduction

This document describes how to use digital data radio equipment in an existing Point To Multi Point data radio communication system alongside existing radio equipment which is transmitting data via analogue modulation.

The digital data radio equipment can be used to supplement the existing analogue equipment (system expansion), to improve the capacity and capability of the system (system enhancement), or to replace old and unserviceable equipment (system maintenance). The objective is to introduce digital data equipment while not having to cease operation of any remaining serviceable analogue equipment.

## Options

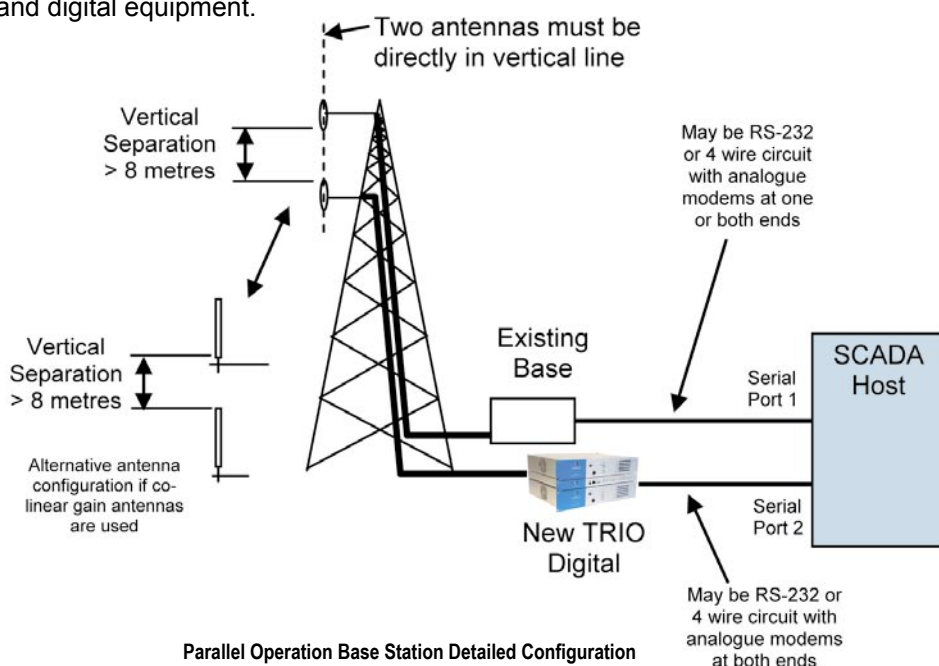
There are several possible ways to achieve the objective. The optimum solution is determined by a number of factors. The first important factor is radio channel frequencies. If additional radio frequencies are available then the analogue and digital systems will be able to independently operate in parallel on separate channels. If additional frequencies are not available then the existing radio channel can be time shared between the analogue and digital equipment.

## Base Station

A new TRIO digital base station needs to be installed at a suitable location which will provide coverage to all the remote sites that are being equipped with digital data radio equipment. This will usually be at the same location as the existing analogue base station and operate in parallel to the existing base station.

If a separate radio channel is being used for the new digital data base station, then it would be best if the new frequencies can be assigned approx. 300-400kHz away from the existing frequencies so that the duplexers of each base stations will provide inherent protection against interference from the transmitter of the other channel.

For example if the existing radio channel has a transmitter frequency of 455.000 Mhz then the new transmitter frequency could be 455.300 MHz. This is not absolutely essential but may effect the placement of the antenna for the new radio channel and / or the need for additional filtering on the receiver circuits of both the existing and new radio channels.



The antenna of the new base station should be installed at a similar height to the existing one – some radio system engineering issues need to be considered when installing the new antenna system and this should be undertaken by experienced personnel. TRIO recommends 6dBd gain co-linear type antenna for the base station. The Base station then needs to be interfaced to a new serial data port on the serial communications controller of the Host SCADA system. This interface will be RS-232 at up to 38,400bps.

### Remote sites

In an existing operational system which currently uses analogue data radio modem technology, the remote sites which are to be upgraded to digital operation will have their old radio modem equipment replaced with the new digital data radio modem equipment.

If the antenna and power supply subsystems at the remote locations are suitable then it is only necessary to connect the new digital data radio modems up to these existing antenna and power supply subsystems in place of the older radio modem equipment.

The TRIO E Series radio modems have industry standard N Type (female/socket) antenna connectors and industry standard Phoenix power supply connectors. Power supply voltage is nominal 13.8Vdc and may vary from 11Vdc to 16Vdc. Antenna connectors, power supply connectors and power supply voltage may need to be changed to suit the new equipment.

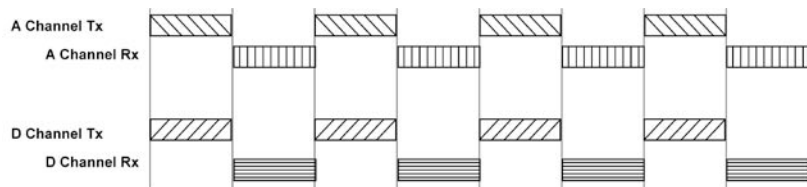
The existing antennas should be adequate unless they are known to be causing problems with the existing radio modems. TRIO recommends 6 element (9dBd) or 15 element (13dBd) directional Yagi type antennas for most remote sites.

The remote digital data radio modems need to be interfaced to a serial data port on the existing Remote Terminal (RTU) Equipment. This interface will be RS-232 at up to 38,400bps. The E Series radio modems use an industry standard DB9 connector for this purpose.

### SCADA Host

In the Host SCADA communications control subsystem, the data base needs to be changed to reflect that the RTU equipment being used with digital radios will now be accessed from the new serial data port connected to the new Base station.

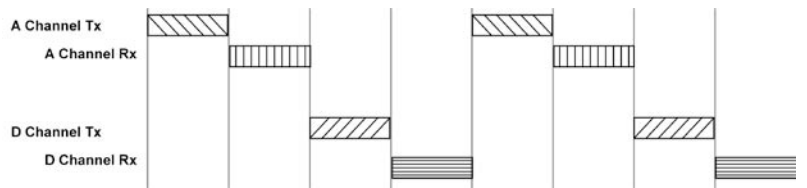
If the digital radio equipment is operating on a separate radio channel then the SCADA Host may independently and simultaneously poll RTU equipment on both channels.



Poll & Response timing when

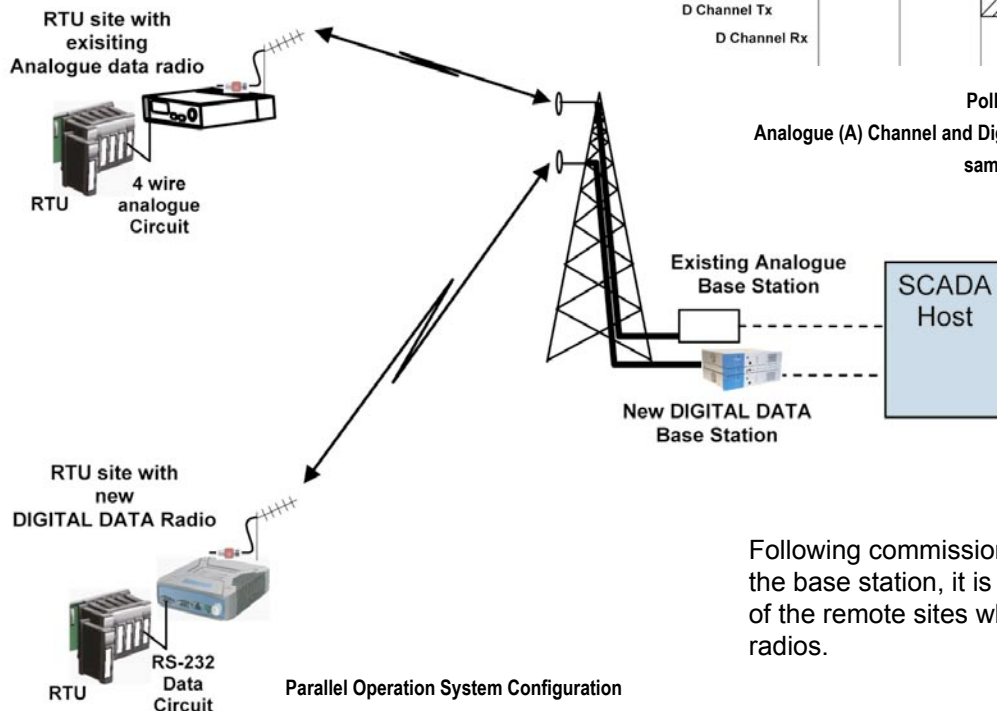
Analogue (A) Channel and Digital (D) Channel have DIFFERENT frequencies

If one radio channel is being time shared between the existing analogue radio equipment and the new digital radio equipment then the SCADA Host should treat all RTU equipment as if it were on a single channel and poll each RTU sequentially, waiting for the response before initiating the next poll, regardless of which serial data port was used for either poll.



Poll & Response timing when

Analogue (A) Channel and Digital (D) Channel have SAME frequencies where the same radio channel is shared.



In the above case, the two base stations can only operate in half-duplex mode so that only one base station transmitter is active at any one time. Where separate radio channels are available, both stations can transmit simultaneously in full duplex mode.

Following commissioning of all the new remote sites and the base station, it is then possible to commence polling of the remote sites which have been upgraded to digital radios.