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TI-Rail Video Monitor

1 SYSTEM DESIGN

1.1 Function and Features

The function of the system is to transmit a PAL or NTSC video signal from the trackside to trains in order that pictures of the platforms can be displayed in their driving cabs continuously from a point 150 metres before the platform of each station to 150 metres after the platform. The total continuous coverage can be up to 500 metres.

The system is based on that currently in operational use by railway and mass transit subway companies. It has been designed specifically for railway environments and has passed all the applicable environmental specifications for temperature, sealing, vibration and shock. The results of the tests conducted by the independent Test House, the British Standards Institution, can be provided if required. These include simulated life, total immersion and high speed water jets.

The equipment has also passed all the EMC tests specified for railway operation. Again, they were performed by an independent European Union approved Test House, Radio Frequency Investigations. The results demonstrate that the equipment provides all the immunity required of trainborne and trackside equipment and that it produces emissions so low that they will not interfere with any other equipment, including safety and emergency radios.

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The equipment provides broadcast levels of video quality, a requirement which we believe to be essential for a safety related system. It includes features that automatically switch the screen on only when it is required and so avoids the display of poor quality pictures outside the coverage area.

The transmission frequencies used on adjacent platforms and at adjacent stations are different to guarantee interference free operation. The frequency switching is automatic.

The system can be supplied to operate on any band suggested by the Regulator. In this way, railway company can operate the equipment in a licenced band, and so be confident that other unlicenced radios will never interfere with the transmissions. This assurance can not be provided if unlicenced bands are used, even if there is no apparent interference when the equipment is first installed.

1.2 Options

There are two system options. Both provide broadcast levels of video quality. One equipment is analogue, the other digital.

The analogue system uses wideband FM and is appropriate for line of sight paths, whereas the digital system uses OFDM modulation to the Digital Video Broadcast – Terrestrial (DVB-T) standard and is ideally suited to longer, non line of sight paths. It should be noted that all the world's terrestrial broadcasters use the DVB-T standard, which is the only one specifically designed for video transmission. All other digital transmission protocols are designed for general purpose data.

The choice between the two options depends on the topology of the stations and the platforms and on the frequency allocated by the Regulator for the system. Both options use the same enclosures and the same basic electronics. The difference between the two is that MPEG2 compression and OFDM modulation modules are used in the digital system whereas FM modulator and pre-emphasis modules are used in the analogue system.

The equipment is capable of transmitting the video on a number of different frequency channels. This allows mutual interference to be eliminated between transmitters installed on the same station for different directions, and between transmitters installed on adjacent stations. A Beacon, near the start of the coverage area sends commands to the Receiver to instruct it to select the transmission frequencies appropriate to the platform at which the train is stopping. It also sends an instruction that switches on the display, thereby inhibiting it from showing poorer quality pictures before the coverage area.

The beacon signal is coded with an Up or Down Track data bit. Receivers are similarly coded, Up or Down, and thus will only respond to Beacons with the same code. This facility is built into the equipment to cater for conditions where different trains at the same platform require different videos. The facility may not be required initially, but we propose to retain it should it be required at some time in the future.

The system uses space diversity. The signals are received in two parallel Trainborne Antennas to provide a high level of robustness against obscuration, unwanted reflections and other propagation effects.

Squelch is incorporated into the Receiver to switch off the display when the carrier to noise level falls below a fixed threshold. This is used to define the end of the coverage area. Note: the Beacons could be instructed to send a "display-off" command if a shorter coverage is required on some trains, or if there are anomalous propagation effects which may degrade the performance of the squelch. Again, this facility is probably not required in the basic system.

Although the system is designed to function automatically, a manual override is available which allows the operator to display the video even if the train is outside the coverage area. Other control facilities that relate to the display are outside the scope of the transmission system.

Built in test (BIT) is provided in the Video and Beacon Transmitters and in the Receiver to test for correct operation.

1.3 Equipment

The system elements to be supplied by Ogier Electronics are shown in the Block Diagram of Figure 1.3.

The units to be supplied for each platform comprise:

The Main Transmitter
The Secondary Transmitter
The Beacon

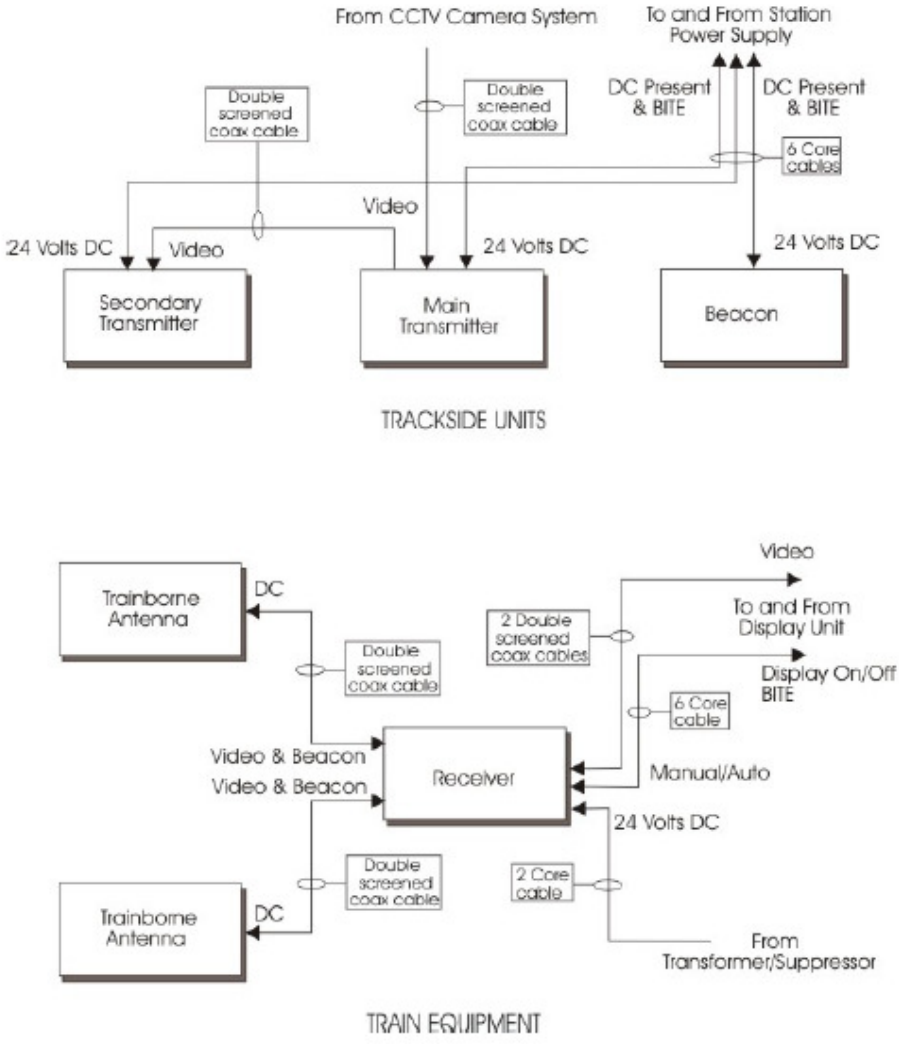
The units to be supplied for each cab comprise:

2 Trainborne Antennas
The Receiver

The other elements of the system not supplied by Ogier Electronics are:

The Display
The Platform Power Supply
The Trainborne Power Supply
Interconnecting Cables

Figure 1.3 shows the interconnecting cables, several of which are multicore. The numb cores shown is the minimum required but other cores may be included for potential growt



TRANSMISSION SYSTEM FIGURE 1.3

It should be noted that the power handling requirements of the DC lines are higher than those for the BITE outputs, especially for the Transmitter and the Beacon. Because of this, different cables may be used for the DC and BITE. However these issues are outside the scope of this document.

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