By Les Simmonds

Digital Multi Channel Fibre Optic Multiplexer Test

This is the eleventh in a series of objective video testing articles where we will test a high performance Digital 4 Channel Video Fibre Optic Video Multiplexer over 100 kilometres of fibre and compare it with 150 metres of high performance RG59/U coaxial cable.

We will test the Australian designed and manufactured Optical Systems Design (OSD) OSD 870 Digital 4 Channel Video Fibre Optic Video Multiplexer and Belden 1505F RG59/U Precision Video Coaxial Cable and our tests will include video signal tests from the European Video Transmission Standard EN 50132-5:2001 which applies to both transmission technologies.

This European Standard specifies the minimum requirements for the specification and testing of the performance of a video transmission channel involving transmitter, receiver or intermediate devices associated with the selected transmission media, for use in CCTV surveillance systems. It covers the transmission of colour and black and white video signals in accordance with CCIR Report 624-4, 625 lines, 50 fields per second.

The Optical Systems Design OSD 870 Digital 4 Channel Video Fibre Optic Video Multiplexer system has a video bandwidth in excess of 10 MHz per channel, a signal-to-noise-ratio greater than 67 dB, uses uncompressed 10 bit video encoding which allows for broadcast studio quality video transmission and has a built in video equalising amplifier for each video channel on the transmitter to compensate for coaxial cable losses in prior to the OSD 870 input. The OSD 870 operating distance may be doubled to 200 kilometres if the OSD 870 receiver is supplied with an Avalanche Photodiode Detector (APD).

Belden 1505F RG59/U Precision Video Coaxial Cable is the RG59/U used around broadcast and professional studios when RG59/U coaxial cable is required. The Belden 1505F is superior to most of the RG59 series coaxial cable installed in CCTV installations by the security industry.

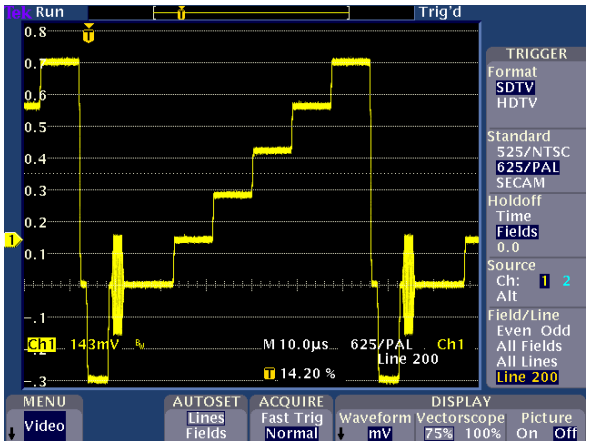
Sounds like an interesting test with 100 kilometres of optical fibre up against 150 metres of coaxial cable! We will also question the majority of CCTV camera manufacturers who specify their cameras capable of working without video equalisation up to 250 metres with RG59 series coaxial cable.

In a previous issue of SEM we wrote “The displayed waveform shows approximately 2.7 dB pre-emphasis at 5 MHz which would be required to compensate for 150 metres of RG59/U coaxial cable. This image may cause some to question me and maybe even question some of the old rules of thumb used in the CCTV industry. (Source: Belden Master Catalogue – Attenuation vs. Frequency for Belden Broadband Coaxial Products)”. We've always disputed the industry RG59/U coaxial cable rule of thumb of 200 or 250 metres without an outboard or in camera equalising amplifier and now having carried out these objective tests we are even more concerned as 75 metres may turn out to be the RG59/U coaxial cable limit without video equalisation to maintain a satisfactory colour video image.

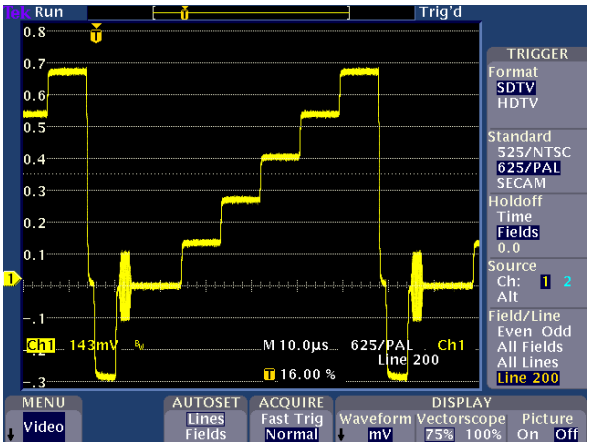
First we set up the single mode fibre optical attenuation at 27 dB loss which represents a loss over single mode fibre equivalent to 108 kilometres based on 0.25 dB loss per kilometre which is a very generous figure. For example, Corning specifies 0.20 to 0.22 dB per kilometre for their SMF-28e single mode optical fibre when operated at 1550 nm. Based on Cornings maximum loss of 0.22 dB per kilometre at 1550 nm this test was carried out over 122 kilometres.

The optical attenuation methodology we used is the standard optical attenuation for such tests and we have no doubt that we were working over more than 100 kilometres with the OSD 870 and the single mode fibre for this test.

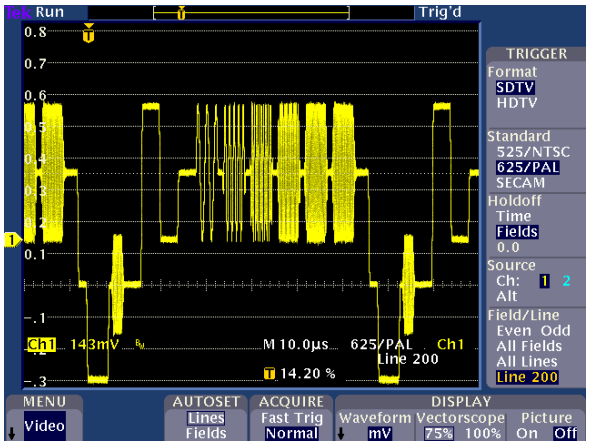
The test setup complied with the European Video Transmission Standard EN 50132-5:2001. We connected the test signal generator to input one on the OSD 870 transmitter and our oscilloscope, waveform monitor and recording equipment to output one of the OSD 870 receiver. The RG59/U coaxial cable was connected in the same manner to the single coaxial cable input and single



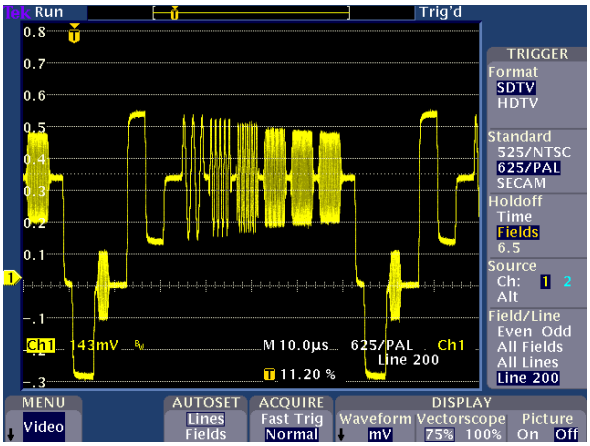
OSD 870 fibre optic system 5 Step Greyscale waveform which is very similar to the output of the test signal generator.



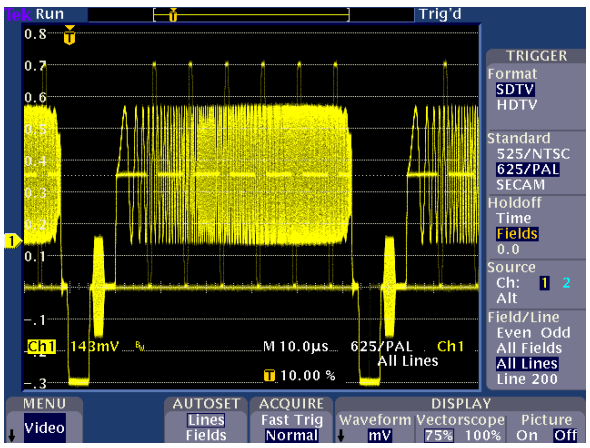
150 metres of RG59/U coaxial cable 5 Step Greyscale waveform showing low video level, rounding of the greyscale steps and horizontal sync pulse and low colour burst.



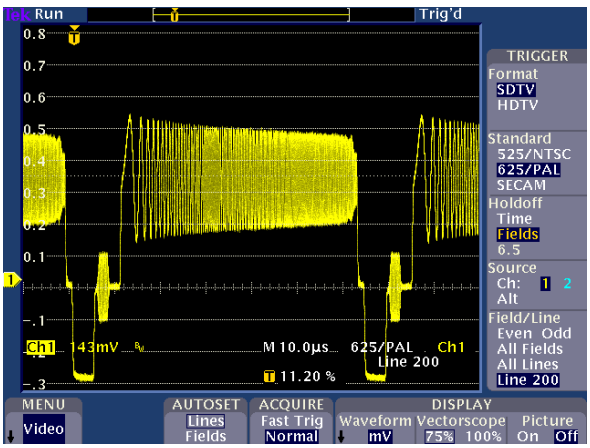
OSD 870 fibre optic system Multiburst waveform frequencies of 0.5 MHz, 1.0 MHz, 2.0 MHz, 4.0 MHz, 4.8 MHz and 5.8 MHz with the 4.8 MHz burst at +0.3 dB.



150 metres of RG59/U coaxial cable Multiburst waveform frequencies of 0.5 MHz, 1.0 MHz, 2.0 MHz, 4.0 MHz, 4.8 MHz and 5.8 MHz with the 4.8 MHz burst at -3.0 dB.



OSD 870 fibre optic system 0.5 MHz to 6 MHz Sweep waveform with markers set at 1 MHz, 2 MHz, 3 MHz, 4 MHz, 5 MHz and 6 MHz with the 5 MHz at +0.3 dB.



150 metres of RG59/U coaxial cable 0.5 MHz to 6 MHz Sweep waveform with no markers showing 5 MHz at -3.0 dB.

coaxial cable output.

The OSD 870 fibre optic system displayed the 5 Step Greyscale very similar to the output of the test signal generator. Hold on! That's after 100 kilometres of digital video transmission! Where a 150 metres of precision RG59/U coaxial cable showed; low video level, rounding of the greyscale steps and horizontal sync pulse which indicated loss of high frequency response (more of that later) and probably the most serious problem is the colour burst at 4.43 MHz is reduced from 300 mV to 229 mV, which is also related to the loss of high frequency response.

When we switched to Multiburst we found the OSD 870 fibre optic system over 100 kilometres dis-

played Multiburst with a very slight high frequency emphasis of about +0.3 dB at 4.8 MHz and the 150 metres of coaxial cable showed a loss of about -3.0 dB at 4.8 MHz which is the second burst from the right. The 0.5 MHz to 6 MHz sweep displayed the same characteristics as the Multiburst, but shows all frequencies between the bursts. The markers on the OSD 870 waveform are set at 1 MHz, 2 MHz, 3 MHz, 4 MHz, 5 MHz and 6 MHz and we didn't switch the oscilloscope to all lines to show the markers on the coaxial cable waveform. That's what can happen when you get too excited about the test results during a test.

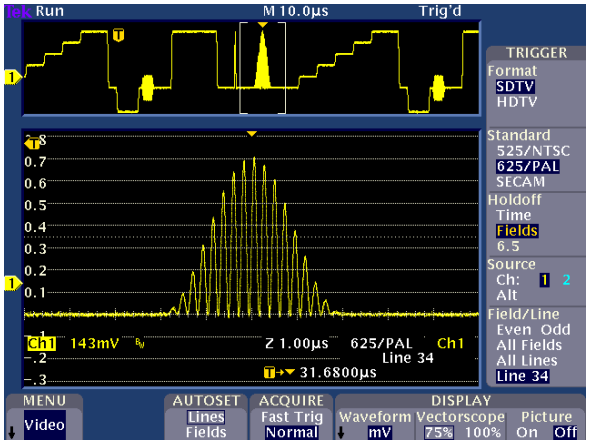
The Modulated 20T Pulse is a tough call for any video system, but the OSD 870 fibre optic system over 100 kilometres was almost perfect and the coaxial cable system showed a video level loss (video level at 580 mV) and low chrominance to luminance amplitude displayed as the arch at the bottom of the Modulated 20T Pulse. The OSD 870 fibre optic system over 100 kilometres displayed an almost perfect 2T Pulse and the 150 metres of coaxial cable showed some problems on the right side of the 2T Pulse.

We have also included a close up of the colour burst for 150 metres of RG59/U coaxial cable which clearly shows the reduction of colour burst level to 229 mV from the PAL standard and accepted good engineering practice colour burst level of 300 mV.

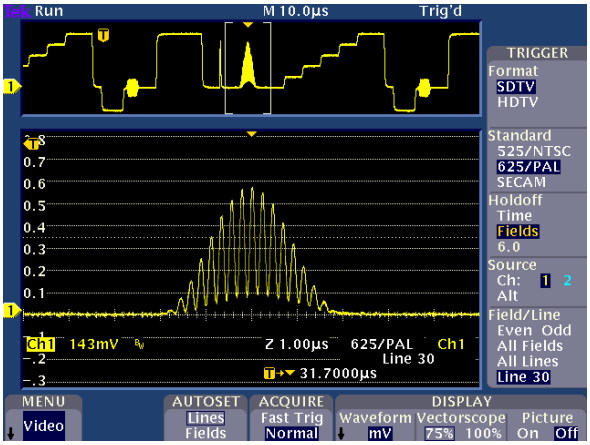
It should be noted that coaxial cable has no electronics so all video signal losses are directly related to the cable only.

The OSD 870 fibre optic system is a credit to Optical Systems Design who has been in this business since 1987 and the design engineers responsible for this and other OSD fibre optic products. OSD's managing director, John Wise, has been in the fibre optic industry since 1977 which is about the time it became a viable industry and has a very high credibility and integrity rating in the industry. OSD also provide system design facilities for their various fibre optic products to consultants, installers and end users.

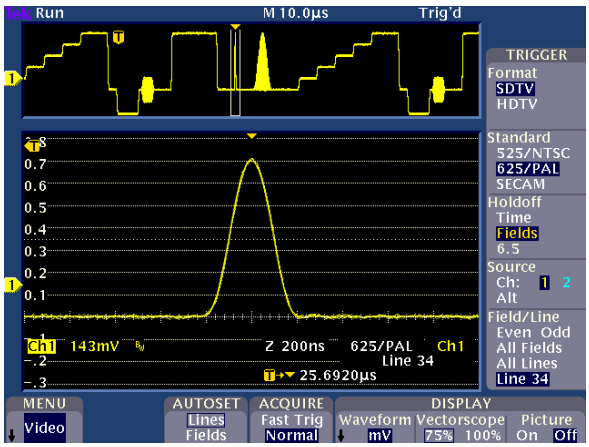
This issue has been devoted to a shootout between 100 kilometres of OSD digital video fibre optic transmission and 150 metres of high quality Belden RG59/U coaxial cable transmission and it shows that a fibre optic transmission system is well worth the few extra dollars it costs for any video transmission over 75 metres.



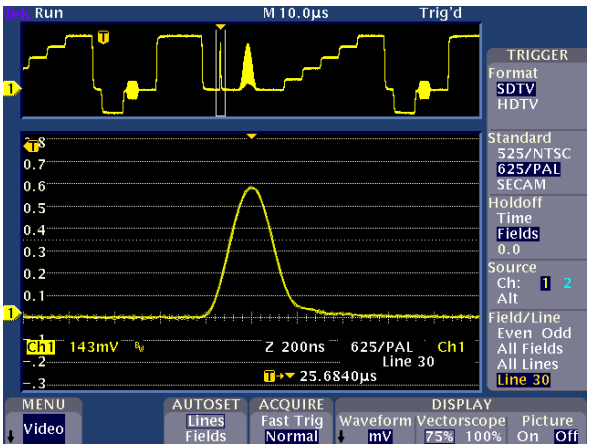
OSD 870 fibre optic system Modulated 20T Pulse waveform with an almost perfect result.



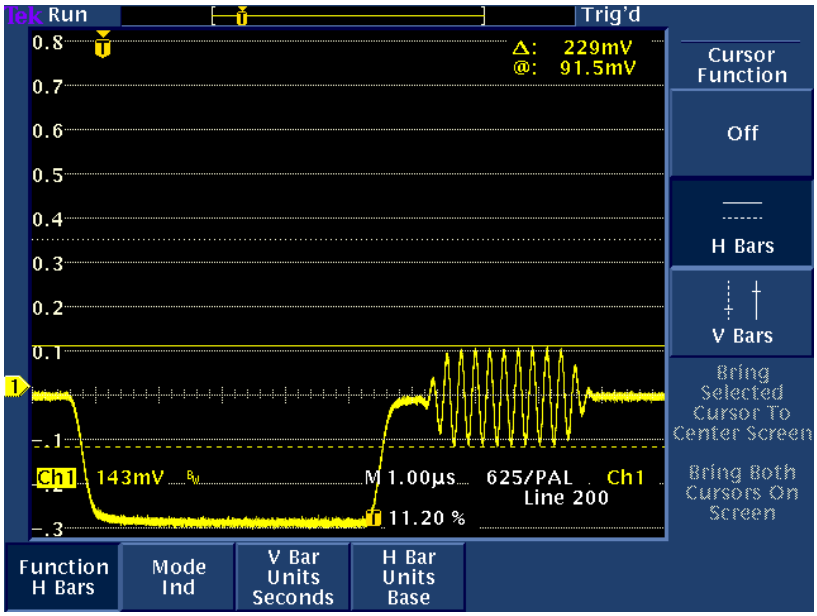
150 metres of RG59/U coaxial cable Modulated 20T Pulse waveform showing video level loss and low chrominance to luminance amplitude.



OSD 870 fibre optic system 2T Pulse waveform with an almost perfect result.



150 metres of RG59/U coaxial cable 2T Pulse waveform showing low video level and problems on the right hand side of the 2T Pulse.



150 metres of RG59/U coaxial cable waveform showing low colour burst level of 229 mV.

Acknowledgements:
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This article was originally published in Security Electronics Magazine Australia.