

Metal dust contamination is a significant reliability issue for high power connectors.

Behaviour of connectors at high power

Connectors have been found to sporadically fail in transmission systems which operate over about 100 mW (+20 dBm). Detailed studies have found metal particle contamination in every case. Such failure may take some time to occur.

The metal dust generally comes from wear particles caused when connectors are mated using a metal alignment sleeve in the through connector. Other dust contamination should be covered by normal cleaning procedures. A special termination cleaning kit may be required.

Choosing metal free connectors

So to improve the reliability of high power systems, it is recommended to minimise the incidence of metal wear particles on connector tips. This implies that ferrules must not be made of metal.

The recommendation particularly applies to test instruments, since they are usually the last item to be in contact with a connector. Unfortunately, many instruments (particularly power meters) use a metal interface adapter. Often this is anodised aluminium, which creates the worst number of wear particles and will almost certainly result in connector contamination.

To avoid this problem, Kingfisher instruments are commonly supplied with ceramic (eg metal-free) interchangeable connector adaptors (SC, FC, and ST).

Optical Safety Standards

The relevant international laser safety standard is usually IEC 60825-2 / AS 2211.2 'Safety of laser products Part 2: Safety of optical fibre communications systems (OFCS)' Specifically Annex D, table D.1

This is also referred to as IEC 825-1 IEC 825 1, IEC 60825, IEC60825, EN 60825 and EN60825.

Equivalent USA standards are administered by the FDA (Food & Drug Administration) under 21CFR1040.10

There are two safety classes directly relevant to Kingfisher Test Equipment:

Our infra-red test sources are all Class 1. This means they are eye safe **as long as magnifying devices are not used**. So our inspection microscopes have a built-in infra red safety filter.

Our visible laser sources are Class 2. This means that the "eye aversion response" will cause the user to look away before eye damage is caused.

Power meters don't emit light, but safety precautions need to be used relevant to the maximum light level that could be emitted from the fiber.

MMF Wavelength & fibre type	Hazard Level (Core diameter < 150 um)					
	1	1M	2	2M	3R	3B
633 nm	0.39 mW (-4.1 dBm)	3.9 mW (+5.9 dBm)	1 mW (0 dBm)	10 mW (+10 dBm)		500 mW (+27 dBm)
780 nm	0.57 mW (-2.5 dBm)	5.6 mW (+7.5 dBm)				500 mW (+27 dBm)
850 nm	0.78 mW (-1.1 dBm)	7.8 mW (+8.9 dBm)				500 mW (+27 dBm)
980 nm	1.42 mW (+1.53 dBm)	14.1 mW (+11.5 dBm)				500 mW (+27 dBm)
1310 nm	15.6 mW (+12 dBm)	156 mW (+21.9 dBm)				500 mW (+27 dBm)
1400 to 1600 nm	10 mW (+10 dBm)	384 mW (+25.8 dBm)				500 mW (+27 dBm)

SMF Wavelength & fibre type	Hazard Level					
	1	1M	2	2M	3R	3B
980 nm	1.42 mW (+1.53 dBm)	2.66 mW (+4.2 dBm)			7.26 mW (+8.5 dBm)	500 mW (+27 dBm)

	(+1.53 dBm)	(+4.2 dBm)			(+8.6 dBm)	(+27 dBm)
1310 nm	15.6 mW (+12 dBm)	42.8 mW (+16.3 dBm)			80 mW (+19 dBm)	500 mW (+27 dBm)
1420 nm	10 mW (+10 dBm)	115 mW (+20.6 dBm)				500 mW (+27 dBm)
1550 nm	10 mW (+10 dBm)	136 mW (+21.3 dBm)				500 mW (+27 dBm)