FIBER TYPEs

Fiber Types

As regards fibers made of glass, there are two main types. These two main types are called, respectively, multi mode fiber and single mode fiber. Fibers made of plastic exist as well.

Multi Mode Fiber

Figure 1

Here the two types of multimode fiber are shown. Reprinted with permission of EXFO

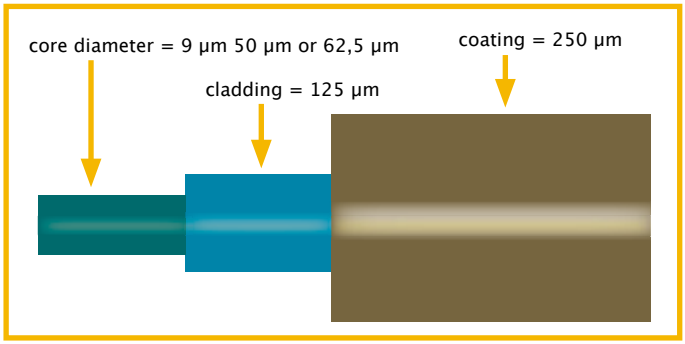
Multi mode equipment is cheaper and is therefore still in use. The limitation of multimode is due to a maximum distance of 2 kilometers and a maximum speed of 1 Gbit. Multi mode is defined in local networks as OM1, OM2, OM3 and OM4, of which OM1 has the lowest bandwidth, and OM4 the highest. These fibers are defined in the standard ISO 11801.

ITU-T (International Telecommunication Union) has also defined multi mode fiber, and within this standard it is designated as G.651.

There are several core sizes, but today, the size 50µm is used most frequently. Earlier, the size 62,5µm was widely used. Remember, do not, under any circumstances, mix up these two types, as doing so will lead to a big loss.

The loss in a 50µm fiber is appr. 2,5dB pr. km. Concerning multi mode fiber, wavelengths of 850nm and 1300nm are commonly used.

Figure 2



Single Mode Fiber

In the world of local networks single mode fiber is defined as either OS1 or OS2 types, of which OS2 is the better one. Within the ITU-T standard a single mode fiber is designated G.652, which is available in four variants, G652A, G652B, G.652C plus the one you should use today, G.652D.

Besides G.652D which is said to be the standard, there are many variants. For long distance communications we use the G.655 standard. A relatively new type is G.557, a fiber, that withstands a very small bend radius. This type is produced by several makers and it is sold under different names, such as Bendbright which is, probably, the most well known brand. Bendbright is produced by Draka. In addition to the smaller bend radius, it is easier to install this type of cable in an Optical Distribution Frame (ODF).

The size of the fiber rack is now getting smaller, and the cassettes are shrinking in size. This may very well influence the whole FTTH (Fiber To The Home) trade in countries, just getting started within the field of fiber optics.

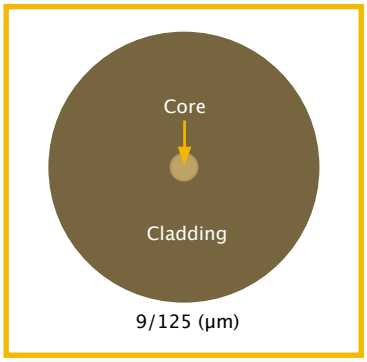
Single mode fiber has no limitations as regards to bandwidth. The bandwidth is, in fact, unlimited. Today, the limit for a wavelength is 40 Gbit and it is expected, that the 100 Gbit standard will be defined before the end of 2008.

November, 2007, Verizon launched the first 100Gbit test distance of 506 km, using only one colour. However, systems exist, such as Wavelength Division Multiplexing (WDM) that makes it possible to transmit data in one single fiber, using more colours at the same time(dealt with later in this book). Using systems like WDM makes it possible to handle considerable quantities of data, measured in terabits.

The need for these mega (or rather, tera) “highways” is clearly illustrated by the fact, that the total sum of traffic on the internet in 2005 was the same as the traffic from Youtube.com alone, in 2007.

Nobody dares to predict, how it will end. Everyone agrees, there will be a need for tera big “highways” in the future.

Figure 3



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When discussing the bandwidth, a look into a datasheet will show no limitations at all. Yet, there are other parameters of interest. One of the most important subjects to consider is the attenuation in fiber cables. Attenuation is defined as optical loss pr. km, measured in dB. Today, the loss is 0,2dB/km in a standard single mode fiber, at 1550nm wavelength – and 0,4dB/km at 1310nm. Therefore, 1310nm is used at short distances and, normally, 1550nm at long distances. Besides, equipment for 1310nm is somewhat cheaper than equipment for 1550nm.

Now it is possible to lay out fiber cables at distances up to 300 km, before it will be necassary to install amplifiers, and the prices for these components are on their way down, as a result of an increasing availability of these products.

Single mode fiber has a core diameter of appr. 9µm which is a lot less, than the core in a multi mode fiber. The reason for the expression “appr.” is due to the fact, that the core is dependent on the wavelength. This is the reason, why you will see data sheets in which the same fiber is stated to have different core sizes. Please remember, allways to use the same sizes.