

# OgierElectronics

## Frequency Selection

If there are no other constraints, the higher frequency bands are preferred because more spectrum is available, which in turn means that there is more capacity. In addition there are fewer other equipments operating in those bands and the antennas tend to be directional, which means that the possibility of interference is remote. This together, with effective co-ordination allows us to unconditionally guarantee interference free operation.

The other feature of high frequency transmission that is especially important in military systems is that the technology is very advanced, which means that equipment is not freely available. This together with the use of narrow beam antennas means that they are far less vulnerable to unauthorised reception or deliberate jamming.

These are the major benefits in using the 31 GHz and 58 GHz bands. Against this, the higher frequency bands and especially those above 10 GHz are more susceptible to signal loss due to rain fade; the higher the frequency, the greater the loss. In some parts of the Middle East this is not a major problem, but elsewhere, especially the tropics, the range of the high frequency links can be very limited.

It should be noted that all our equipments are set up to provide a specified availability under all weather conditions. No links are supplied with less than 99.95% availability, i.e. a loss of signal due to heavy rainfall for up to 5 hours a year, but we can supply equipment with availabilities of 99.99% or even higher.

Typically the range of a 31 GHz link is up to 10 km in Europe, 15 km in the Middle East but as low as 5 km in the tropics where 100 mm/hr of rainfall can frequently occur. The range of the 58 GHz equipment is even shorter because as well as rainfall, oxygen absorbs the microwave signal. Typically 94% of the signal is lost every kilometre due to this effect alone. The overall result is that 58 GHz links are only suitable for short ranges of 1 km or less.

Thus, if very long ranges are required, it is necessary to use lower frequencies. The ideal is the 4.5 to 5 GHz band because it is substantially unaffected by weather. In most countries, it is also protected by licensing in that it is not a public or licence exempt band and therefore has improved immunity against interference. The ranges of the 5 GHz links can be as long as 100 km for single channel equipment or 80 km for multichannels.

Clearly there are other frequencies in which transmissions could be made, most notably the licence exempt bands around 2.4 and 5.8 GHz. Although we manufacture equipment in these bands and there are many advantages in using them, the major disadvantage is that they can be used by anyone and there are generally fairly lax controls on the characteristics of equipment at these frequencies.

This means that interference is a serious problem in cities and towns, and becoming increasingly so as more and more domestic items including laptops and other equipment use these frequencies. The issue is discussed in more detail in another download but in summary, we only recommend the use of these bands for very short range links in cities or for ranges of up to 2 km in the countryside. Even so, no-one can guarantee interference immunity.

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