A17.1.2 Principal propagation mechanisms

Recommendation ITU-R P.452 presents in its overall description a summary of the principal propagation mechanisms. It explains that interference may arise through a range of propagation mechanisms whose individual dominance depends on climate, radio frequency, time percentage of interest, distance and path topography. At any one time a single mechanism or more than one may be present. The principal interference propagation mechanisms are as follows:

- **Line-of-sight** (Figure 467): The most straightforward interference propagation situation is when a line of sight (LoS) transmission path exists under normal (i.e. wellmixed) atmospheric conditions. However, an additional complexity can come into play when subpath diffraction causes a slight increase in signal level above that normally expected. Also, on all but the shortest paths (i.e. paths longer than about 5 km) signal levels can often be significantly enhanced for short periods of time by multipath and focusing effects resulting from atmospheric stratification (see Figure 468).

- **Diffraction** (Figure 467): Beyond LoS and under normal conditions, diffraction effects generally dominate wherever significant signal levels are to be found. For services where anomalous short-term problems are not important, the accuracy to which diffraction can be modelled generally determines the density of systems that can be achieved. The diffraction prediction capability must have sufficient utility to cover smooth earth, discrete obstacle and irregular (unstructured) terrain situations.

- **Tropospheric scatter** (Figure 467): This mechanism defines the “background” interference level for longer paths (e.g. more than 100-150 km) where the diffraction field becomes very weak. However, except for a few special cases involving sensitive receivers or very high power interferers (e.g. radar systems), interference via troposcatter will be at too low a level to be significant.

- **Surface ducting** (Figure 468): This is the most important short-term propagation mechanism that can cause interference over water and in flat coastal land areas, and can give rise to high signal levels over long distances (more than 500 km over the sea). Such signals can exceed the equivalent “freespace” level under certain conditions.

- **Elevated layer reflection and refraction** (Figure 468): The treatment of reflection and/or refraction from layers at heights up to a few hundred metres is of major importance as these mechanisms enable signals to overcome the diffraction loss of the terrain very effectively under favourable path geometry situations. Again the impact can be significant over quite long distances (up to 250300 km).

- **Hydrometeor scatter** (Figure 468): Hydrometeor scatter can be a potential source of interference between terrestrial link transmitters and earth stations because it may act virtually omnidirectionally, and can therefore have an impact off the greatcircle interference path. However, the interfering signal levels are quite low and do not usually represent a significant problem.