Ericsson Microwave Outlook

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Microwave and satellite coexistence done right

Satellite mega-constellations already use E-band, and more deployments are coming. WRC-27 will decide the power limits needed to keep microwave links protected. This article describes how that protection is achieved.

E-band backhaul continues to grow. Transceivers operating at 70/80 GHz nowadays account for a substantial percentage of the global installed base and are deployed in every region, according to previous editions of Ericsson Microwave Outlook. With 10 GHz of spectrum, E-band supports the multi-gigabit backhaul capacity needed for 5G and future 6G networks.

Satellite network operators want to use E-band spectrum for feeder links, the high-capacity connections between satellites and gateway ground stations. Satellite user terminals connect to satellites primarily in the Ku band (10.7–14.5 GHz) and Ka band (17.7–31.0 GHz) for broadband connectivity, while sub-3 GHz bands are primarily used for direct to mobile device connectivity. E-band is used only for connections between satellites and gateway ground stations. However, the scale is significant. Thousands of Non-Geostationary Orbit (NGSO) satellites, including Low Earth Orbit (LEO) and Medium Earth Orbit (MEO) satellites, already carry E-band radios, and gateway stations are operating in several markets. With up to 56,000 NGSO satellites planned across multiple constellations, alongside Geo-Stationary Orbit (GSO) satellites sharing the same spectrum, as many as 90 satellites may transmit simultaneously on the same frequency toward the same area where E-band backhaul links are deployed (see Figure 2).

About 90 satellites may transmit simultaneously on the same E-band frequency toward the same area.

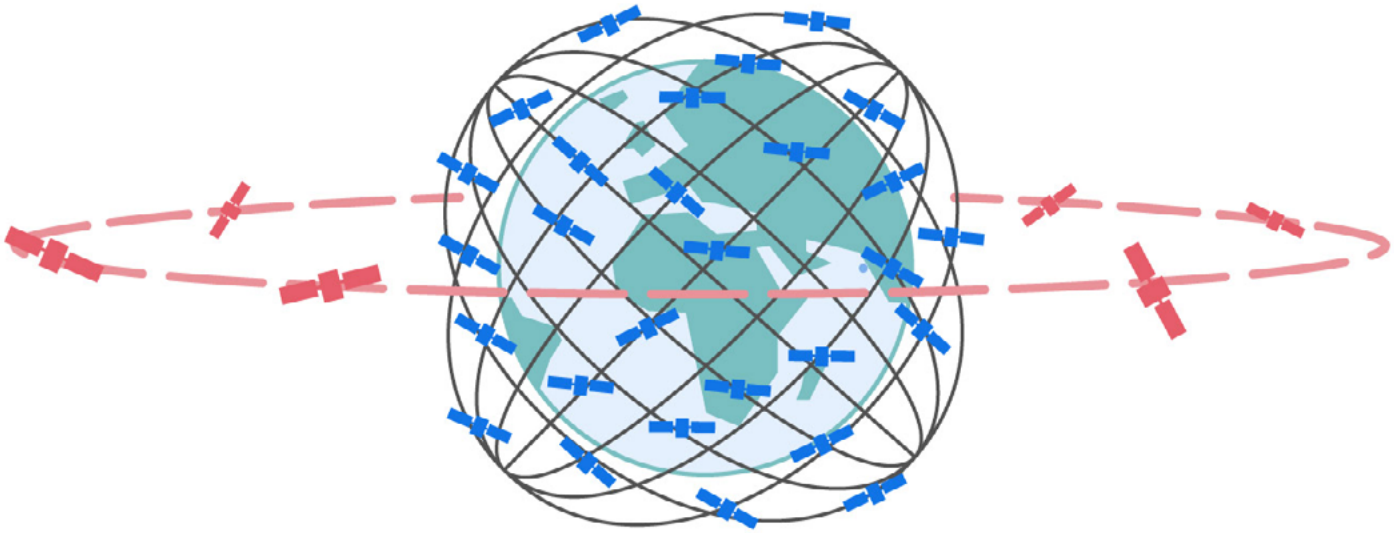


Figure 2. Global NGSO (blue) and GSO (red) satellite coverage with multiple orbital planes. Source: Ericsson (2026)

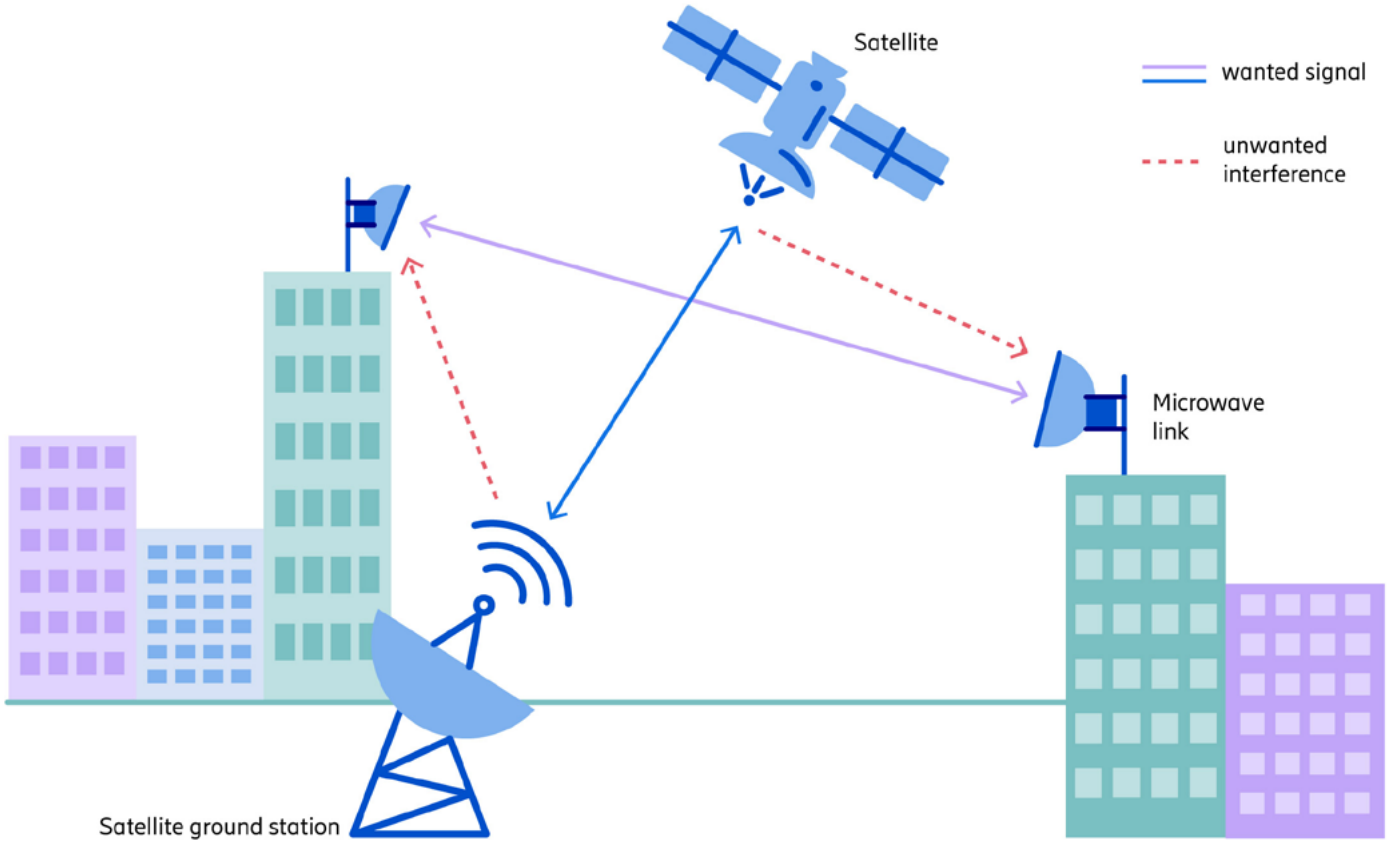


Figure 3. Interference geometry between satellite systems and a fixed service E-band link

Source: Ericsson (2026)

The interference challenge

Two satellite downlink paths are relevant, as shown in Figure 3. NGSO satellites transmit between 71 and 76 GHz. As they orbit, NGSO satellites periodically cross through the narrow main beam of a Fixed Service (FS) microwave antenna. Each crossing lasts a few seconds and can produce an intense interference spike. GSO satellites remain fixed on the geostationary arc and produce constant interference to microwave links, with the highest levels affecting links pointing toward the arc. A third path comes from satellite ground stations transmitting in 81-86 GHz, radiating high power that couples into nearby microwave receivers.

Geometry drives everything. A microwave antenna at 0 degrees elevation has additional protection against satellite downlink interference than one at 10 degrees. Two effects combine: the antenna pattern rolls off steeply away from boresight, and the longer atmospheric path at low angles attenuates the satellite signal. Most E-band links point near the horizon and benefit from both effects.

A manageable challenge

Spectrum sharing is not new to microwave backhaul. Wi-Fi and NR Unlicensed have moved into parts of the 6 GHz backhaul band, raising real questions about interference to licensed links. These devices have power limits, and some countries require automated frequency coordination for standard-power operation. However, they operate without individual frequency assignments or known deployment locations. Managing aggregate interference from many uncoordinated transmitters can be challenging.

The satellite case is different. Here, the interference comes from a licensed system, not from an open population of consumer devices. The satellite network operator declares its constellation in advance, including the number of satellites, their power levels, and antenna characteristics, while staying individually accountable for it. The set of emitters is bounded and known, so the aggregate energy reaching the ground can be computed and capped in advance, rather than managed after the fact. That is what a Power Flux Density (PFD) mask does: it limits how much interference a satellite may deliver to the Earth's surface, protecting microwave links while still enabling satellite operations. This approach has precedent. PFD masks have protected fixed links from satellite downlink interference for decades in many bands, including Ku and Ka, as established in Article 21 of the ITU Radio Regulations. At E-band, the same PFD approach applies to satellite downlinks in 71-76 GHz. What is new about 71-76 GHz is the band, not the method. The question is where to set the numbers.

Satellite ground stations present a separate challenge. They can transmit at high power, and their interference propagates near the horizon, exactly where microwave antennas point. Satellite uplink is regulated by existing Equivalent Isotropically Radiated Power (EIRP) limits and studies show that a 27-50 km separation is needed between satellite ground stations and microwave receivers in worst-case alignment.

Regulatory studies and protection criteria

Scheduled for November 2027, the World Radiocommunication Conference (WRC-27) will establish PFD limits for satellite downlinks in E-band. The PFD limits will be incorporated into Article 21 of the Radio Regulations. These limits will cover all satellite services sharing these bands (fixed-satellite, mobile-satellite, and broadcasting-satellite) as mandated by Resolution 775 (Rev.WRC-23). In addition, Appendix 7 of the Radio Regulations may need to be modified to facilitate international coordination with satellite ground stations considering the new band. Studies are being carried out in ITU-R Working Party 5C, with contributions from administrations including Europe, China, Canada, India, the Russian Federation, and the United States. The satellite and mobile communications industries are also actively engaged. The draft Conference Preparatory Meeting (CPM) text was finalized in May 2026.

Two protection criteria have been agreed:

- **Long-term:** The aggregate interference-to-noise ratio (I/N) at the microwave receiver must stay below -10 dB for more than 20 percent of the time.
- **Short-term:** I/N must not exceed +11 dB for more than 0.00128 percent of the time (about one second per day).

The long-term criterion limits how much satellite interference can eat into a link's fade margin day after day. The short-term criterion caps the brief peaks that may cause momentary outages. If PFD limits are set too loose, operators face reduced margins on exposed links, lower availability, or shorter hops.

The proposed PFD limits depend on elevation angle: they are strict at low angles, where microwave antennas point, and more relaxed at high angles, where antenna gain toward the satellite drops off.

What our simulations show

Both the short- and long-term protection criteria must be met simultaneously. The nature of each satellite type, however, determines which one is reached first. There are multiple proposals for PFD masks being discussed, ranging from strict to relaxed, depending on system assumptions. The PFD limit considered in this study is one proposed by the FS industry.

GSO satellites are stationary. They produce constant interference toward all microwave links in their footprint, with the highest levels affecting links whose beams point toward the geostationary arc. No variation means no short-term peaks, so meeting the long-term criterion automatically satisfies the short-term one. Our simulations with satellites at 1-degree spacing show that aggregate GSO I/N stays well below -10 dB at most orientations (Figure 4). The worst cases are specific azimuths where the microwave antenna beam points straight at the arc. Larger antennas have higher gain toward the arc and therefore collect more GSO interference. The simulation uses a 0.6 m antenna, a very common size in E-band deployments, making the 0.6 m antenna the critical case for GSO protection.

NGSO is different. Satellites move constantly, producing random interference and brief spikes each time one crosses the microwave main beam, which is captured by the short-term protection criterion. Our simulations confirm that the considered PFD mask satisfies both the long-term and the short-term criteria, although the margin is tight at certain azimuth orientations, as shown in Figure 5 where the dashed red region represents the protection criteria.

Figure 5 shows the scenario when the FS receiver is placed on the equator and pointing in different azimuth directions, with satellites distributed across all orbital planes. The worst case occurs when the microwave antenna is on the equator pointing either east or west: every satellite orbit crosses the equator regardless of inclination, so the equatorial receiver is exposed to satellites from all orbital shells simultaneously. Moving the receiver toward higher latitudes reduces the number of visible shells and increases the margin.

The simulations use a 0.2 m antenna. Antenna size determines which protection criterion is more stringent. Smaller antennas have higher sidelobes that collect more aggregate interference from all visible satellites, pushing toward the long-term limit. Larger antennas shift the constraint toward the short-term criterion: their higher main beam gain amplifies each beam-crossing spike, particularly when the antenna is pointed toward an orbit where crossings are most frequent.

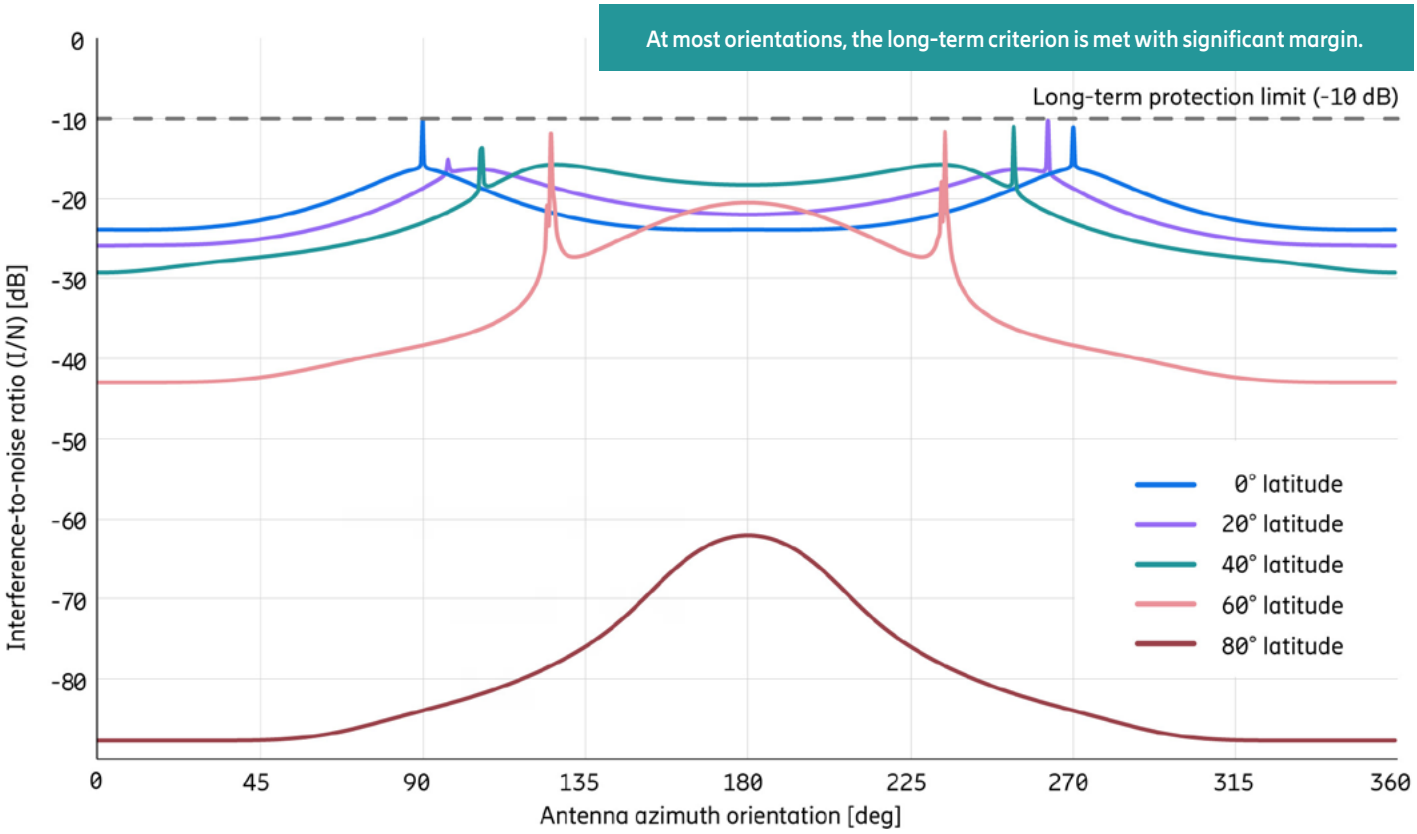


Figure 4. Simulated I/N from aggregate GSO interference at different FS locations and azimuth orientations

Source: Ericsson (2026)

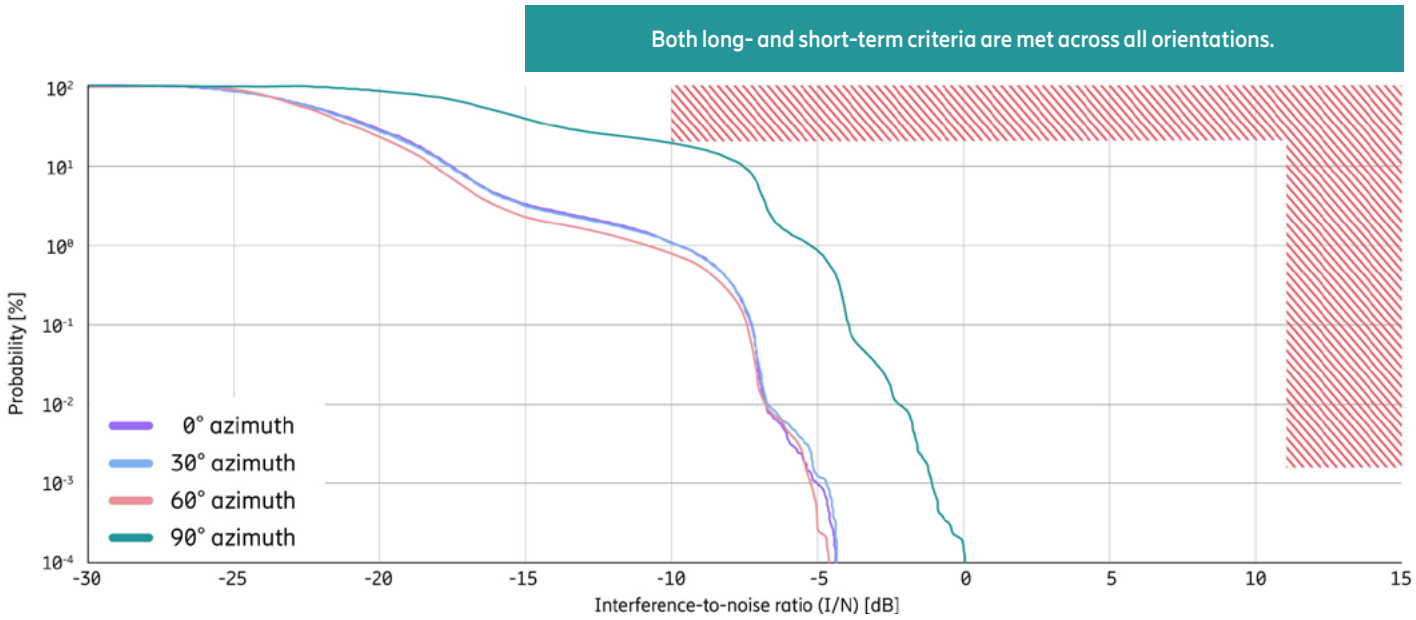


Figure 5. Simulated complementary cumulative probability distribution of I/N from NGSO systems at different azimuth angles

Source: Ericsson (2026)

Simulation assumption		
Parameter	GSO (Figure 4)	NGSO (Figure 5)
FS antenna	0.6 m / 51 dBi	0.2 m / 41.5 dBi
FS elevation angle	10°	10°
Frequency	75.75 GHz	75.75 GHz
Antenna pattern	ITU-R F.1245	ITU-R F.1245
Satellite systems	GSO at 1° spacing, full arc (360 satellites)	NGSO with 54 shells (~19700 satellites)
Atmospheric attenuation	Included	Included

Conclusion

The high atmospheric loss at E-band for low-elevation satellite communications makes this type of operation unlikely. This opens a path forward: stricter PFD at low-elevation angles need not constrain satellite communications in practice, and our simulations show that PFD limits can be set to satisfy the FS protection criteria.

While the final values for the PFD mask remain to be agreed at WRC-27, the evidence from ITU-R studies is clear: coexistence between satellite mega-constellations and E-band microwave is possible. The satellite scenario has known parameters and predictable geometry, making it suitable for precise engineering. With a well-calibrated PFD mask at WRC-27, Communication Service Providers (CSP) can invest in high-capacity E-band backhaul with confidence that the spectrum will stay protected.

Ultimately, the two services are complementary. E-band microwave delivers carrier-grade, multi-gigabit transport in urban and suburban areas for 5G and future 6G networks. Satellite feeder links at E-band support broadband services reaching areas beyond terrestrial network coverage. Well-designed regulatory limits let both thrive in the same spectrum, each serving the areas where it is most needed.

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