

Required Frequency Rejection in 39 GHz Millimeter-Wave Small Cell Systems

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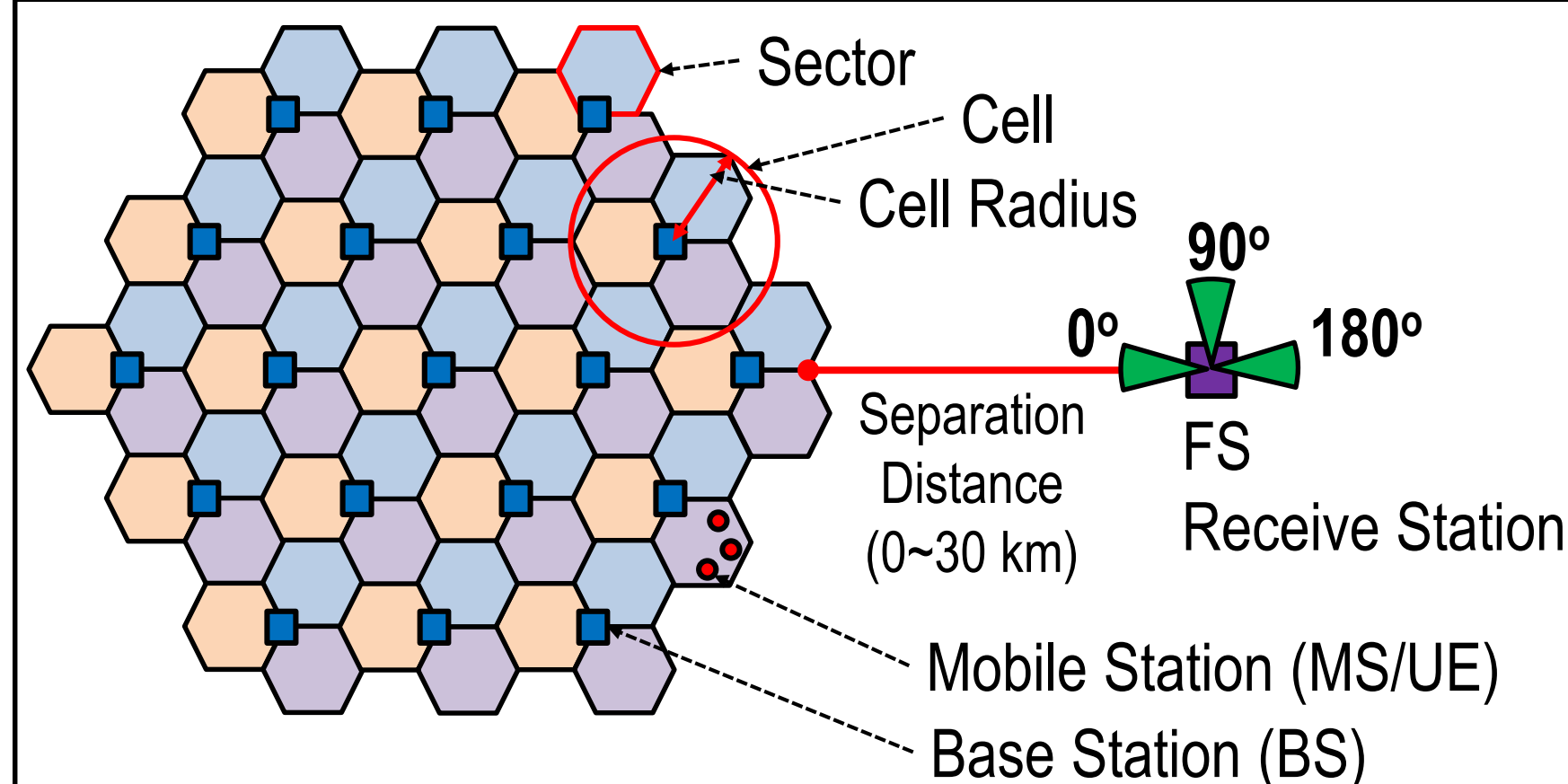


Objective and Methodologies

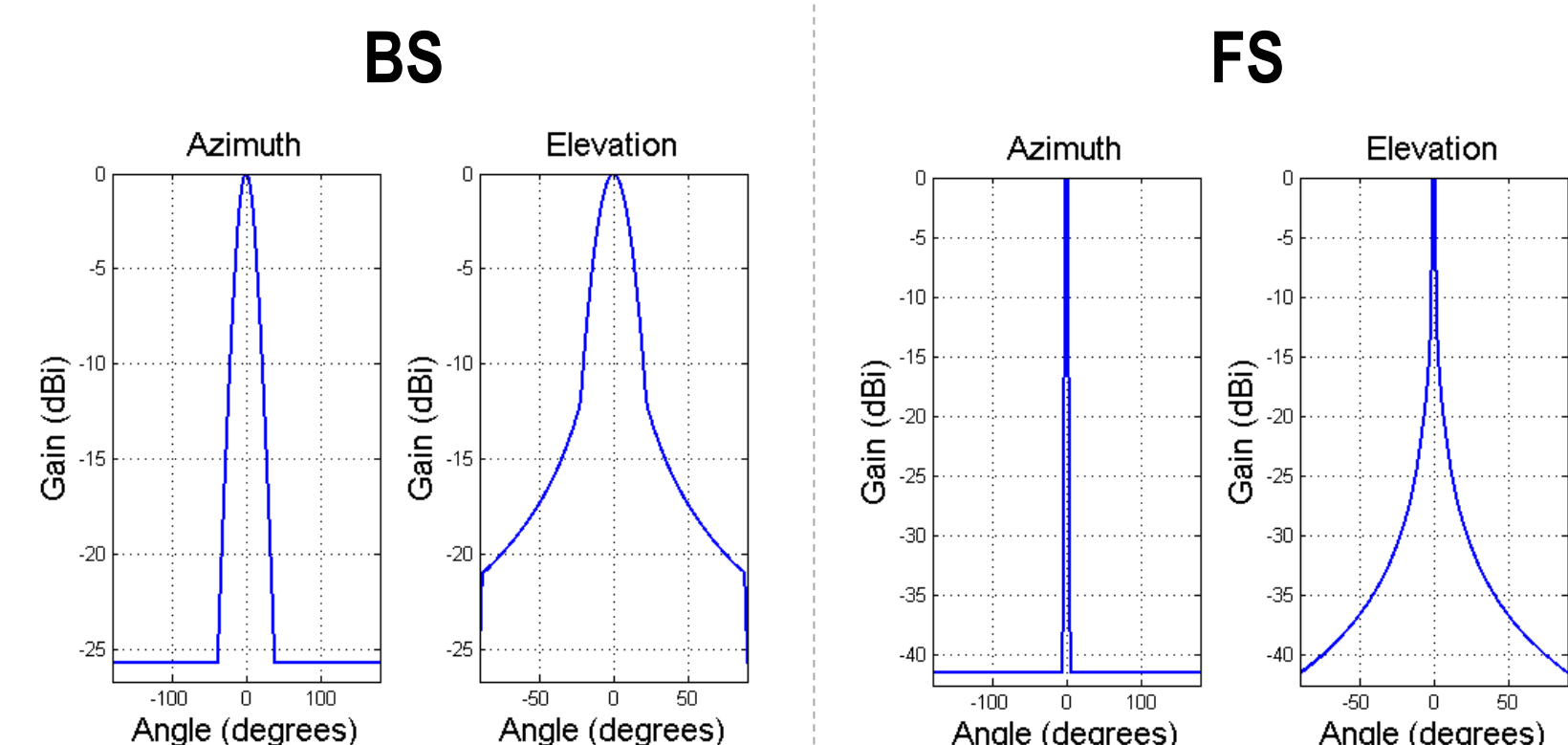
Objective

- To numerically identify how much interferences will be generated for fixed service (FS) stations.
- To determine the **required frequency rejection** as a function of separation distance that allows compatible operation of small cell systems and FS systems.
- Required frequency rejection (in dB) = calculated interference (in dB) – tolerated interference power (in dB)

Simulation Topology



Antenna Radiation Patterns

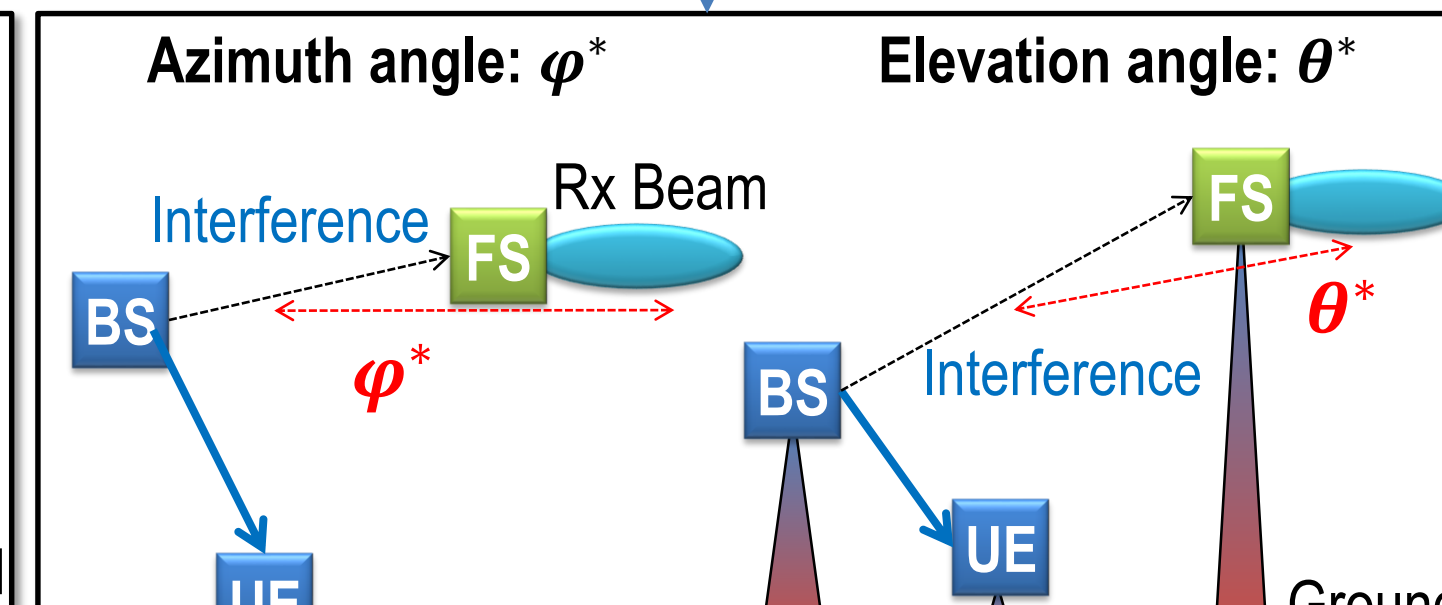
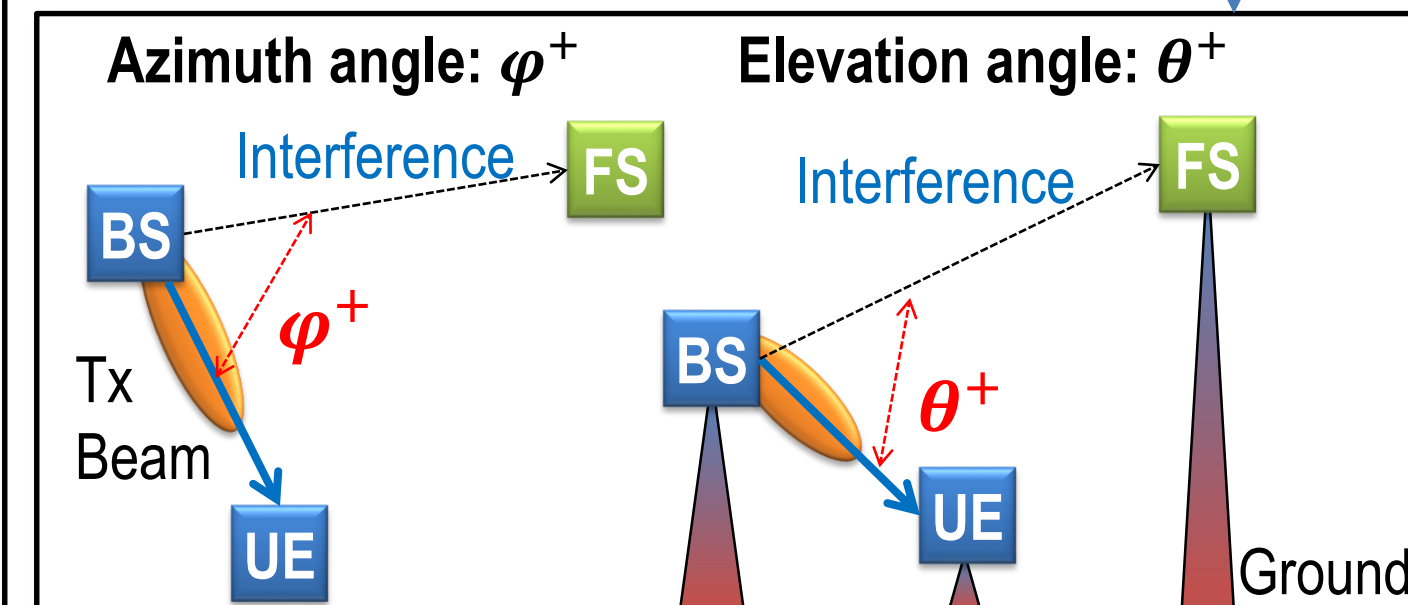


Interference Calculation Procedure

Downlink Interference (Interference to FS Receive Station from BS)

- By the transmission from each BS i to its associated UE j (interference to FS k)

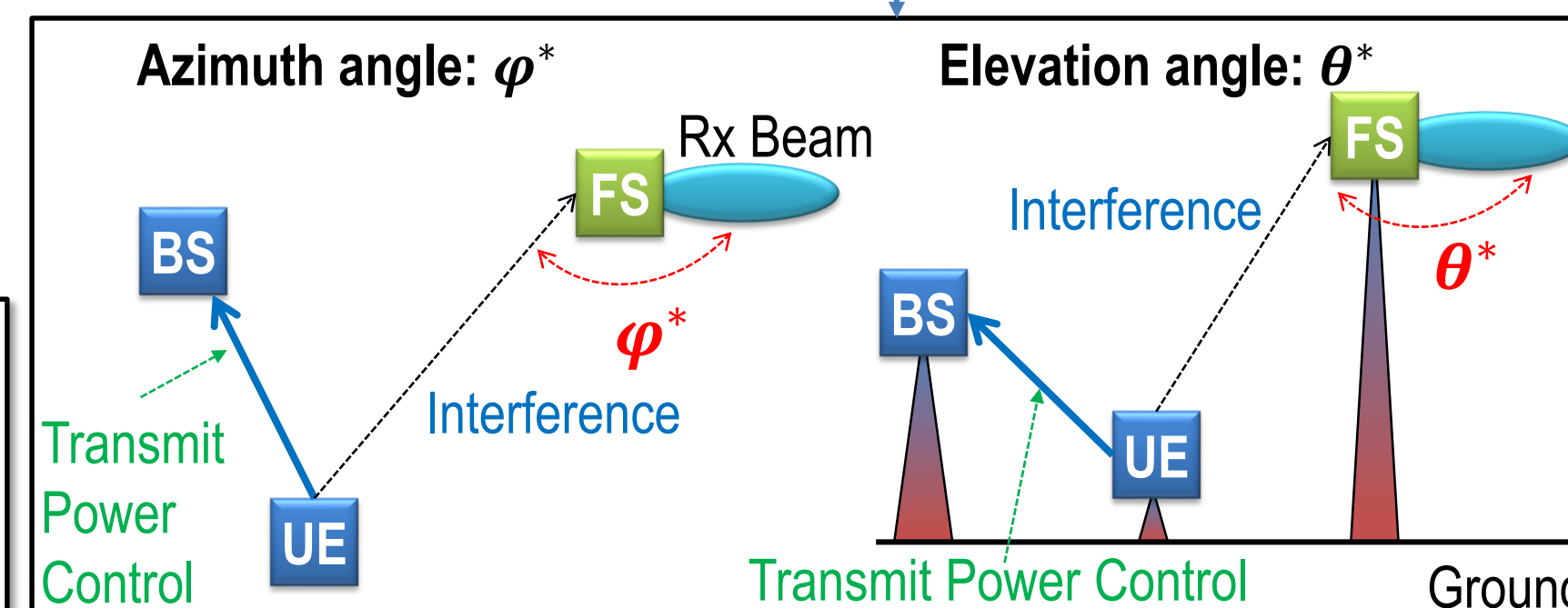
$$I_{i \rightarrow j} = P_i + G_i(\varphi^+, \theta^+) - PL(d_{i \rightarrow k}) + G_k(\varphi^*, \theta^*)$$



Uplink Interference (Interference to FS Receive Station from MS/UE)

- By the transmission from each UE j to its associated BS i (interference to FS k)

$$I_{j \rightarrow i} = P_j^* + G_j(0,0) - PL(d_{j \rightarrow k}) + G_k(\varphi^*, \theta^*)$$



Transmit Power Control at MS/UE

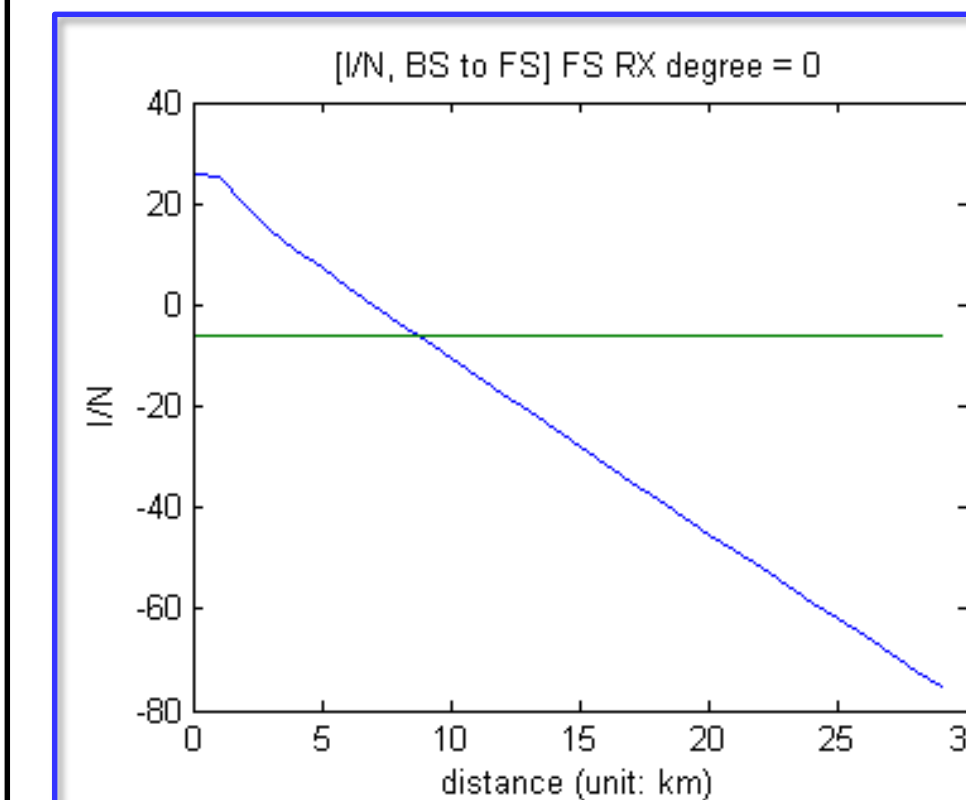
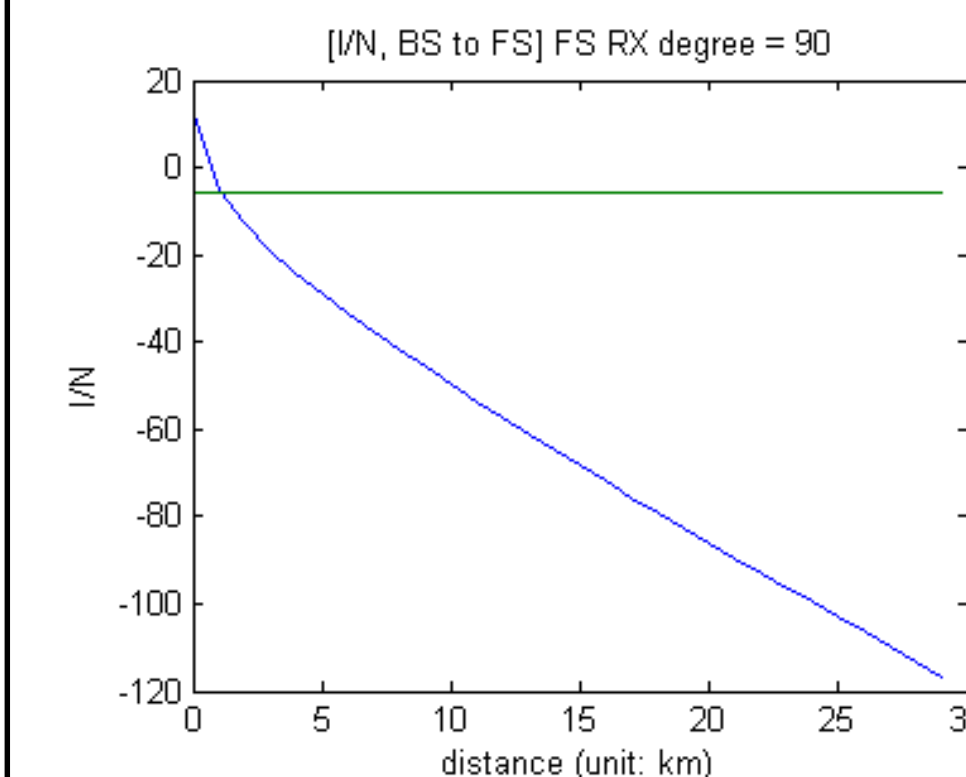
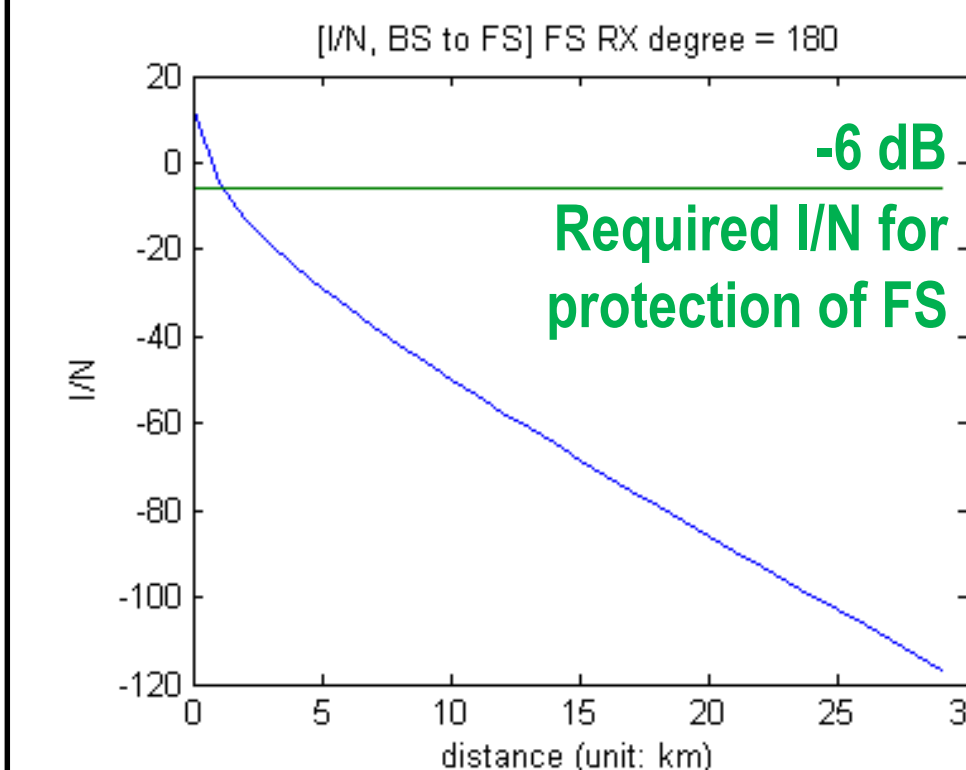
$$P_{max} \times \min \left[1, \max \left\{ R_{min}, \left(\frac{PL}{PL_{x-ile}} \right)^{\gamma} \right\} \right]$$

39 GHz Specific Settings

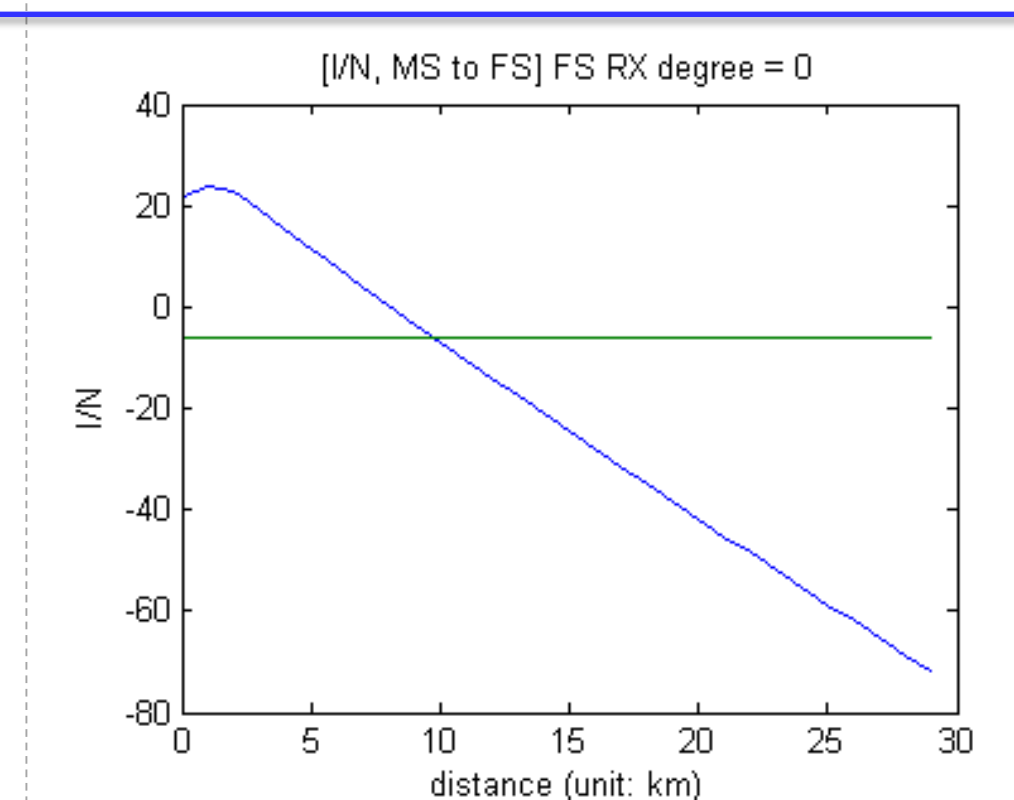
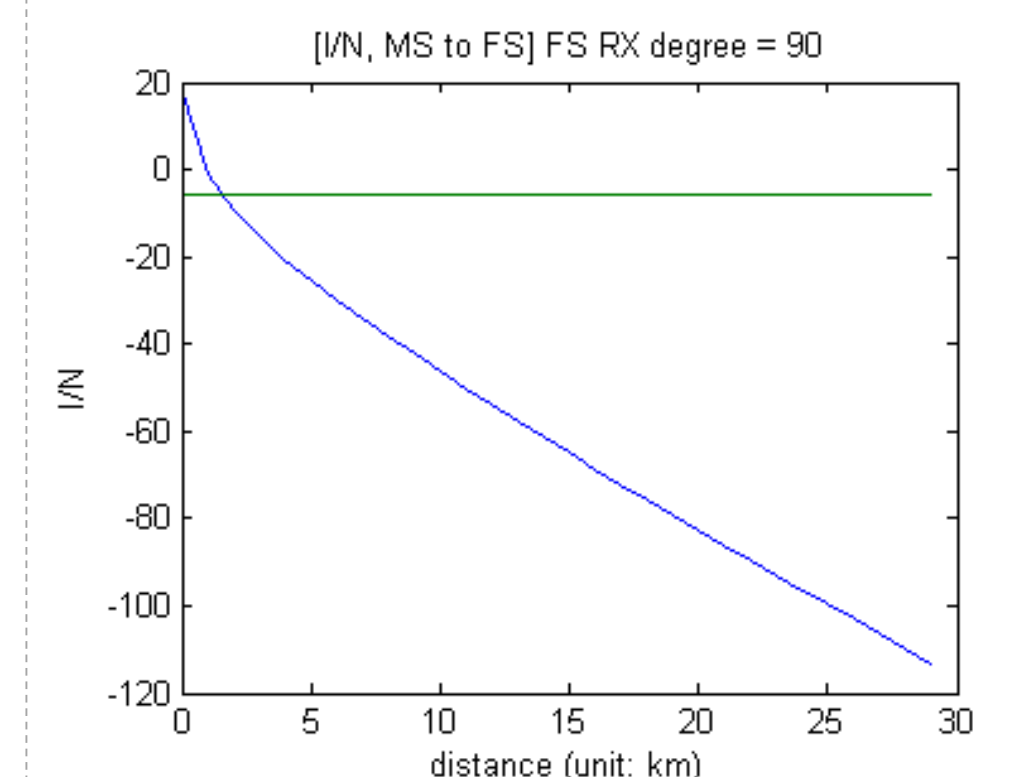
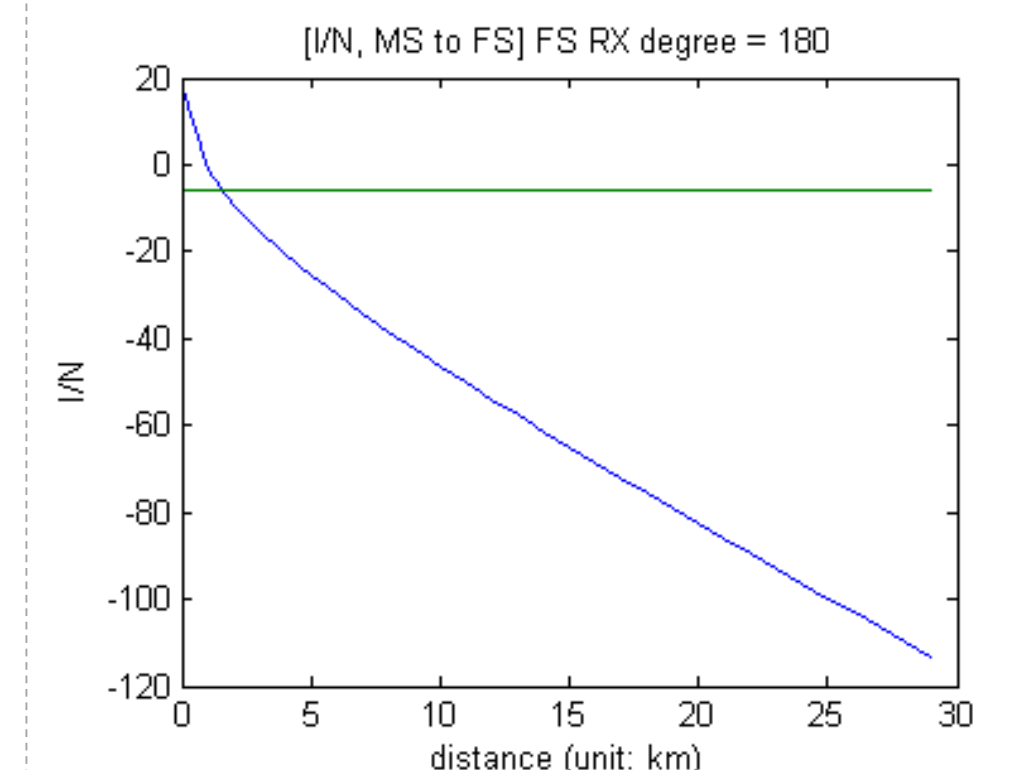
- Path loss (LOS): $92.44 + 20\log_{10}(f) + 10\log_{10}(d)$ where $f=39$
- Oxygen attenuation: ITU-R P.676-10
- Rain attenuation: FCC Bulletin No 70, ITU-R P.535-15, P.837-6, P.838-2

Simulation Results

Downlink Interference



Uplink Interference



Worst Case Orientation
(FS RX Degree = 0)