



Exhibit A - Antenna Patterns

Umbra-11 through Umbra-14

FCC Form 312 Schedule S



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1.0 Objective

To supplement the information provided in Form 312 Schedule S, the following are Umbra's space station antenna diagrams as required from question S8(e).

2.0 Uplink – S-Band Command and Control Data

2.1.1 SPACE STATION RECEIVING ANTENNA RADIATION PATTERN (Phi = 0)

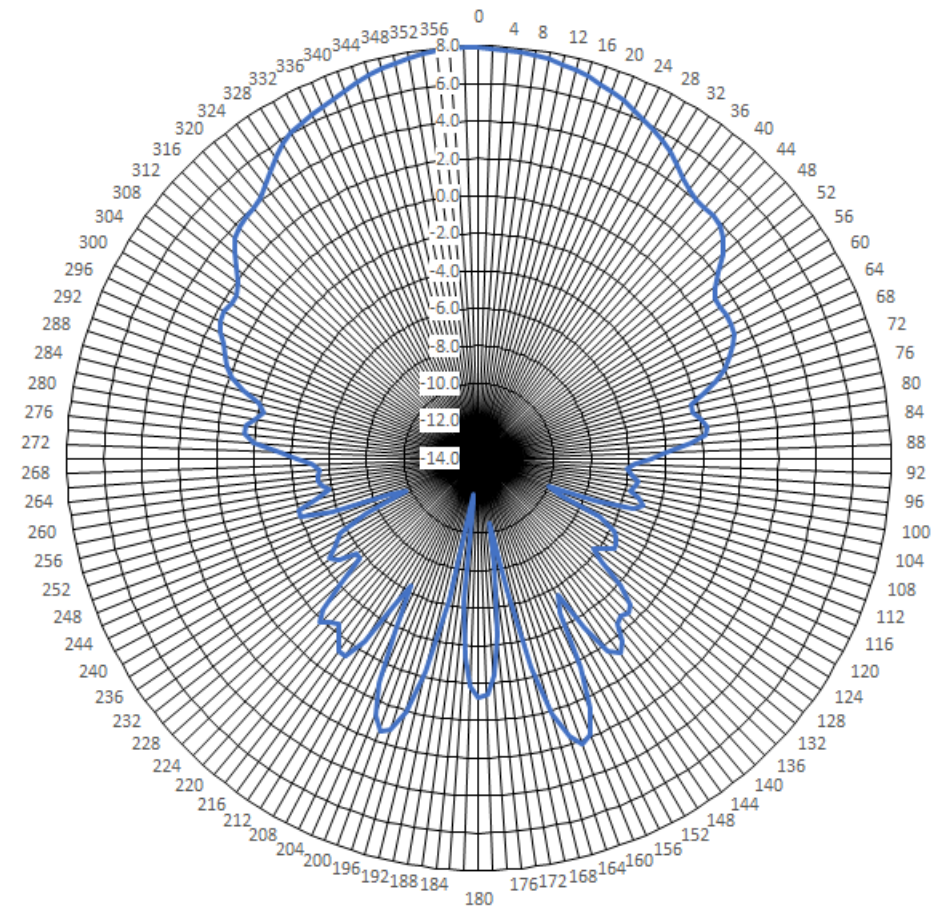


FIGURE 1: S-BAND SPACE ANTENNA H-PLANE (2025-2110 MHZ)

2.1.2

SPACE STATION RECEIVING ANTENNA RADIATION PATTERN (Phi = 90)

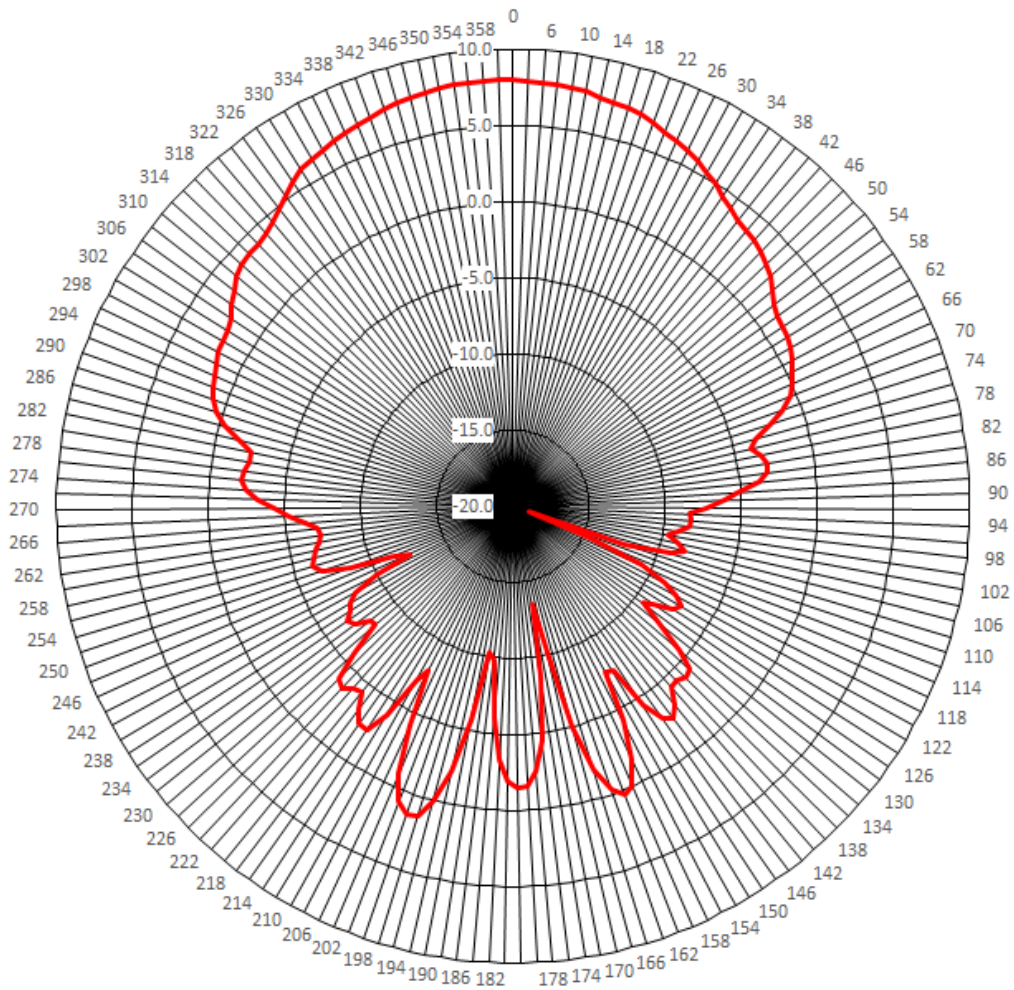


FIGURE 2: S-BAND SPACE ANTENNA V-PLANE (2025-2110 MHZ)

2.2 EARTH STATION TRANSMITTING ANTENNA RADIATION PATTERN – provided for reference.

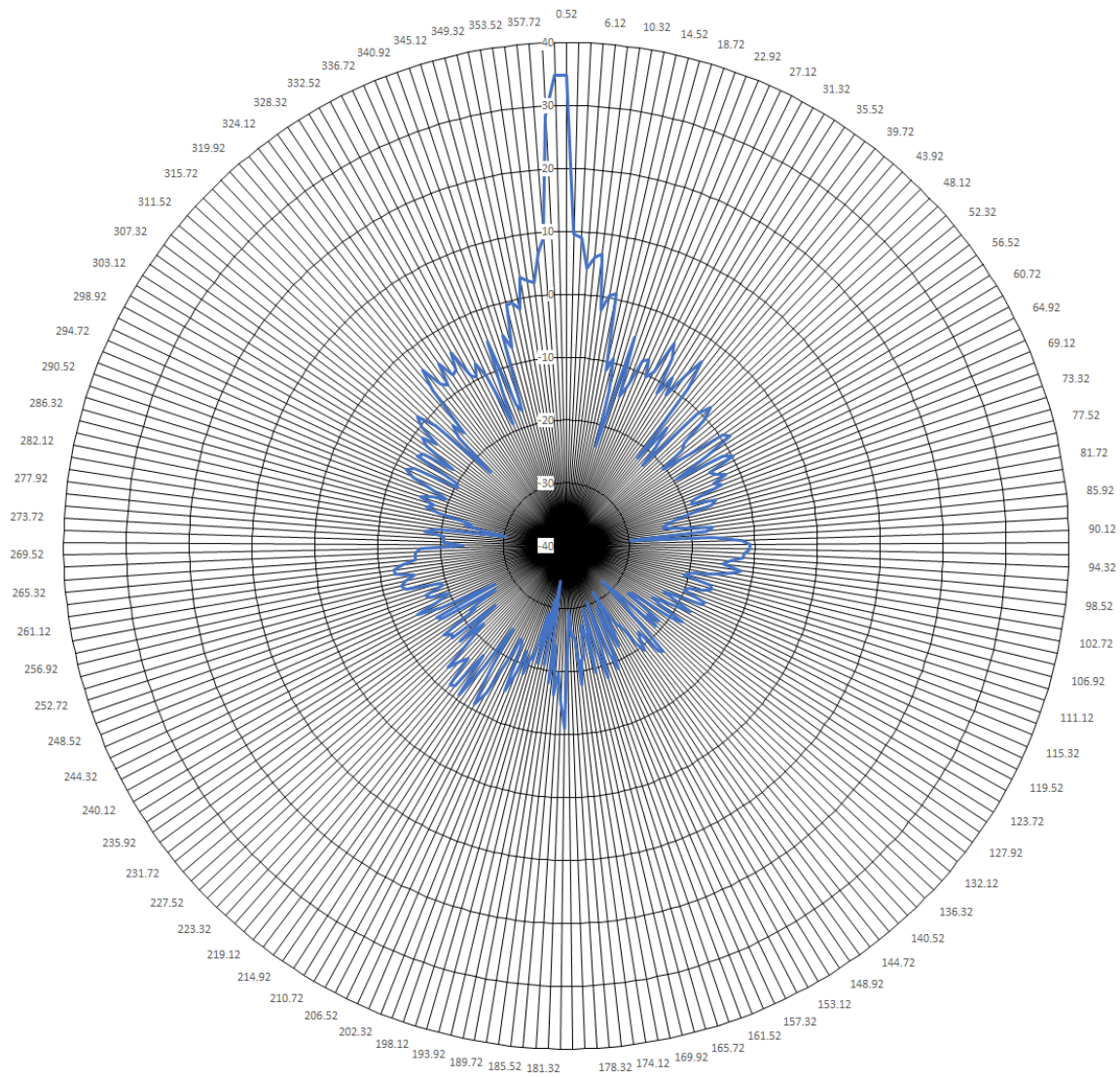


FIGURE 3: S-BAND GROUND ANTENNA (2025-2110 MHZ)

3.0 Downlink – S-Band TT&C Data

3.1.1 SPACE STATION TRANSMITTING ANTENNA RADIATION PATTERN (Phi = 0)

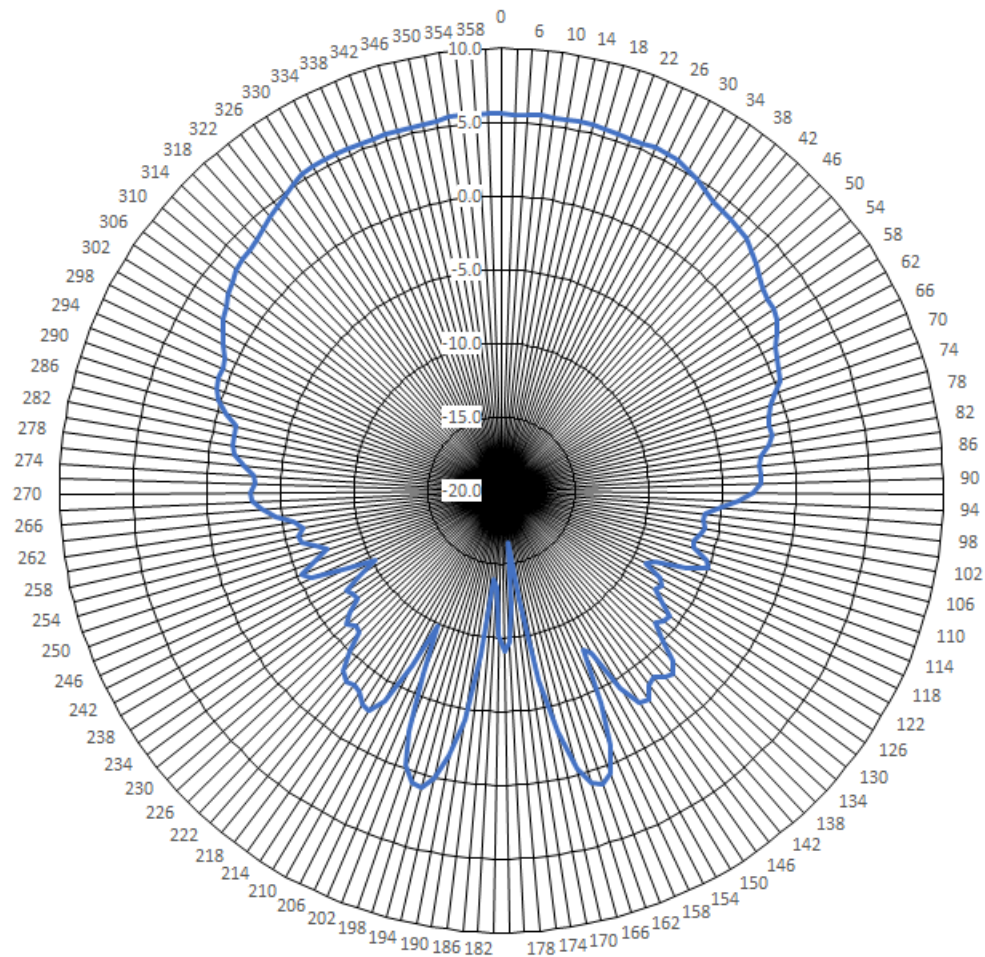


FIGURE 4: S-BAND SPACE ANTENNA H-PLANE (2200-2290 MHZ)

3.1.2 SPACE STATION RECEIVING ANTENNA RADIATION PATTERN (Phi = 90)

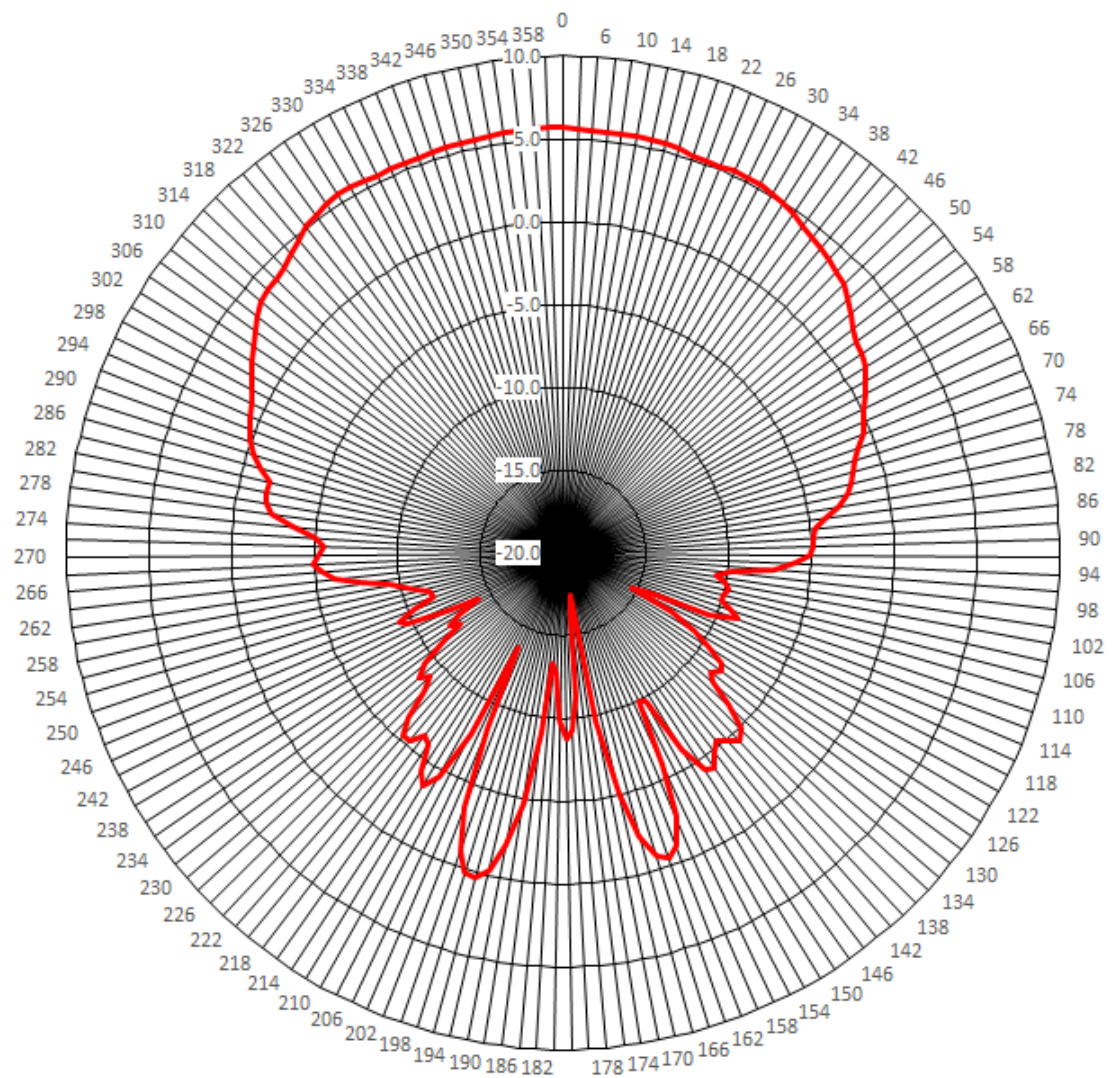


FIGURE 5: S-BAND SPACE ANTENNA V-PLANE (2200-2290 MHZ)

3.2 EARTH STATION RECEIVING ANTENNA RADIATION PATTERN – provided for reference.

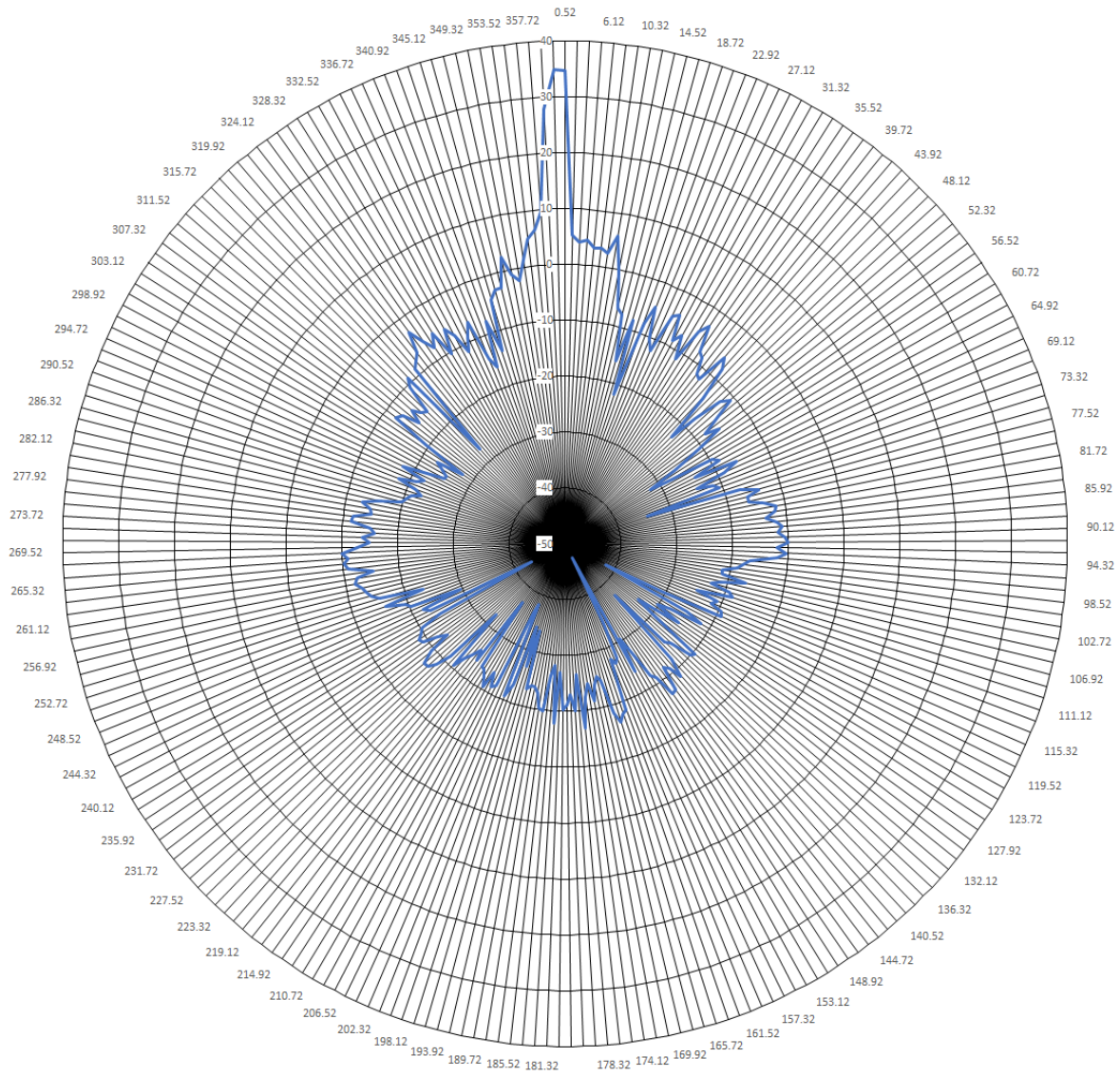


FIGURE 6: S-BAND GOUND ANTENNA (2200-2290 MHZ)

4.0 Downlink – X-Band Mission Data

The antenna patterns for Umbra-11 through Umbra-14 covered in 4.1.1 and 4.1.2

4.1.1 SPACE STATION TRANSMITTING ANTENNA RADIATION PATTERN (18° , $\Phi = 0$)

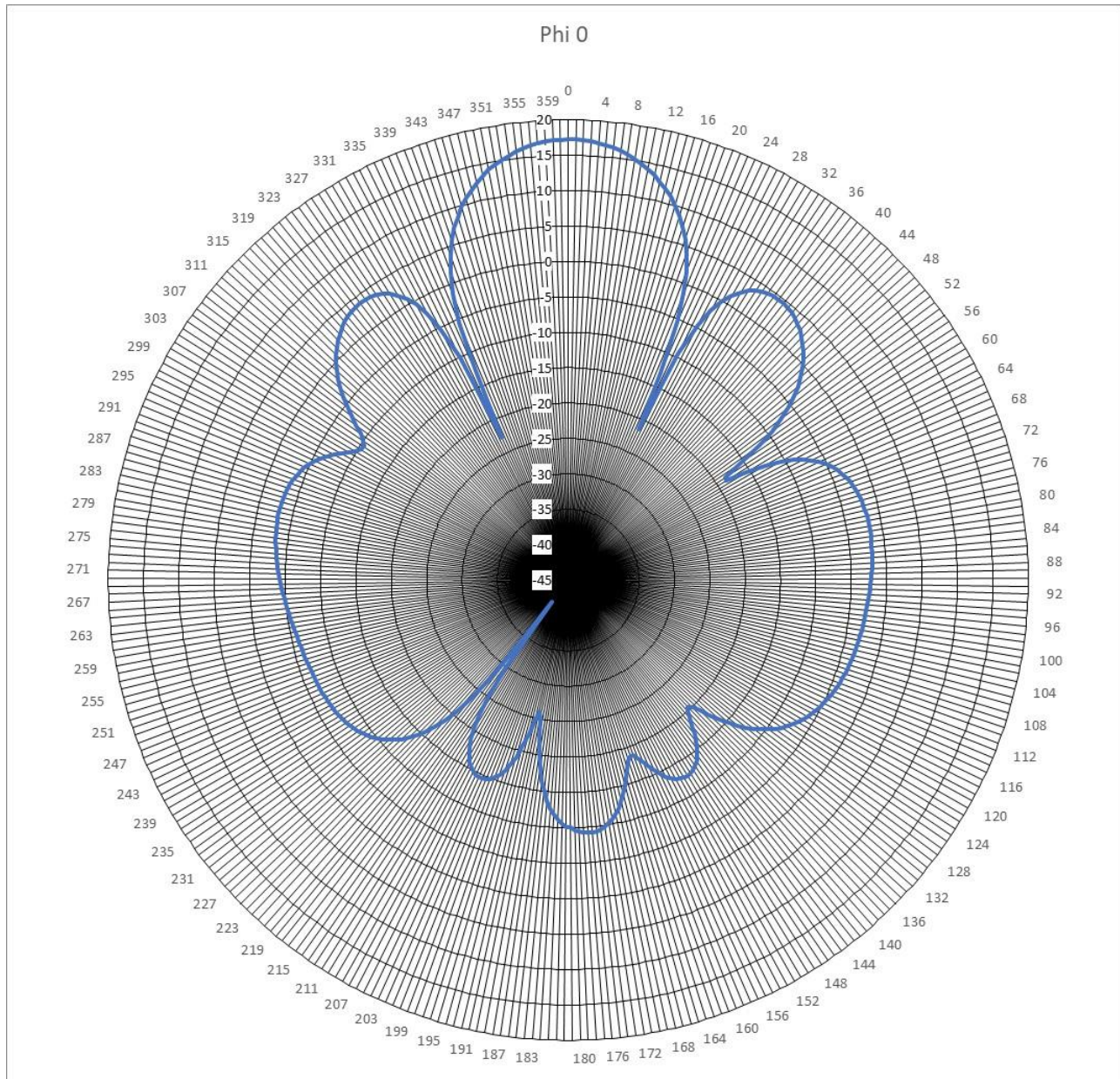


FIGURE 7: X-BAND SPACE ANTENNA 18° HPBW, $\Phi: 90$ (8025-8400 MHZ)

4.1.2 SPACE STATION TRANSMITTING ANTENNA RADIATION PATTERN (18°, Phi = 90)

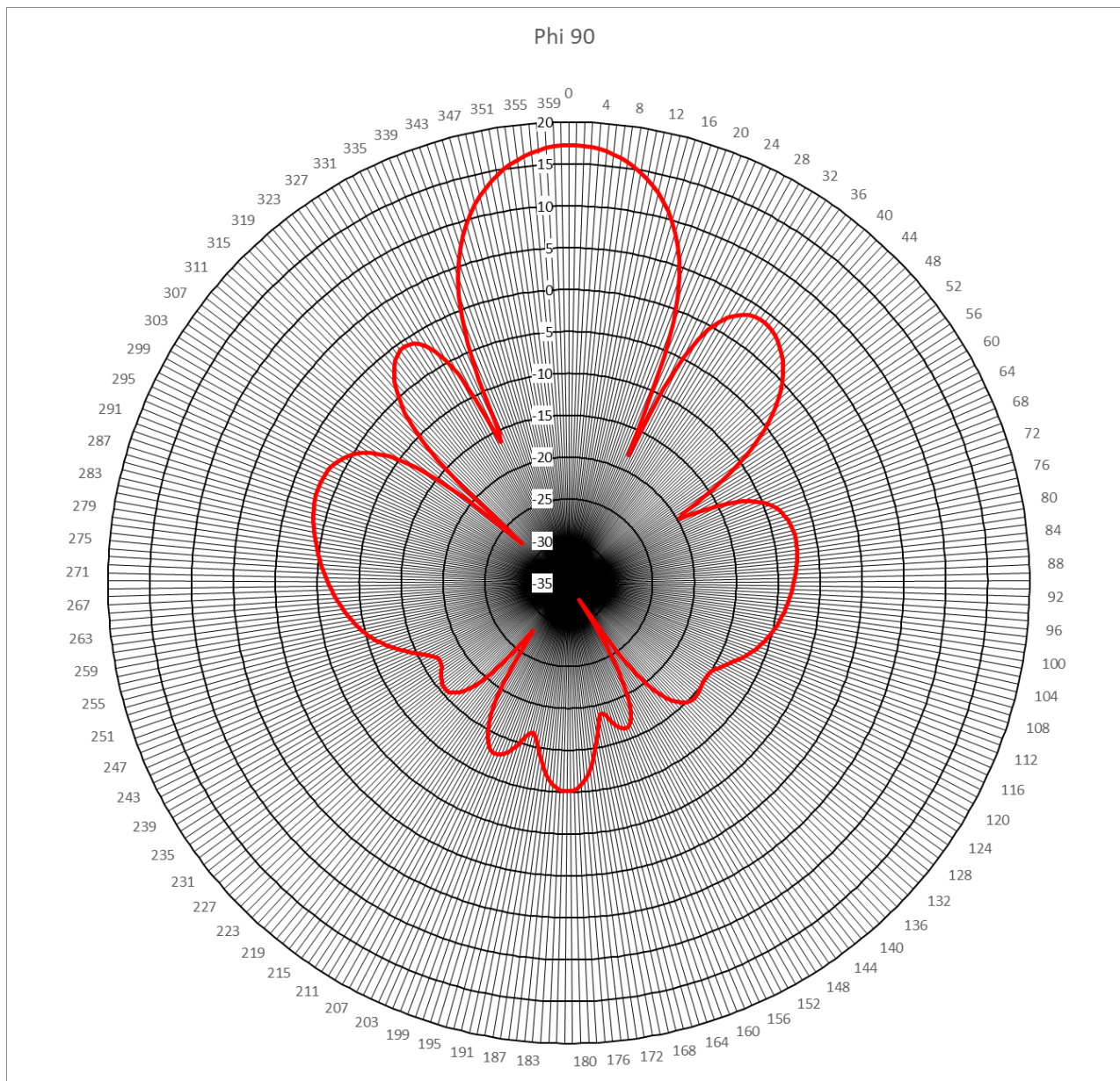


FIGURE 8: X-BAND SPACE ANTENNA 18° HPBW, Phi: 90 (8025-8400 MHZ)

4.2 EARTH STATION RECEIVING ANTENNA RADIATION PATTERN – provided for reference.

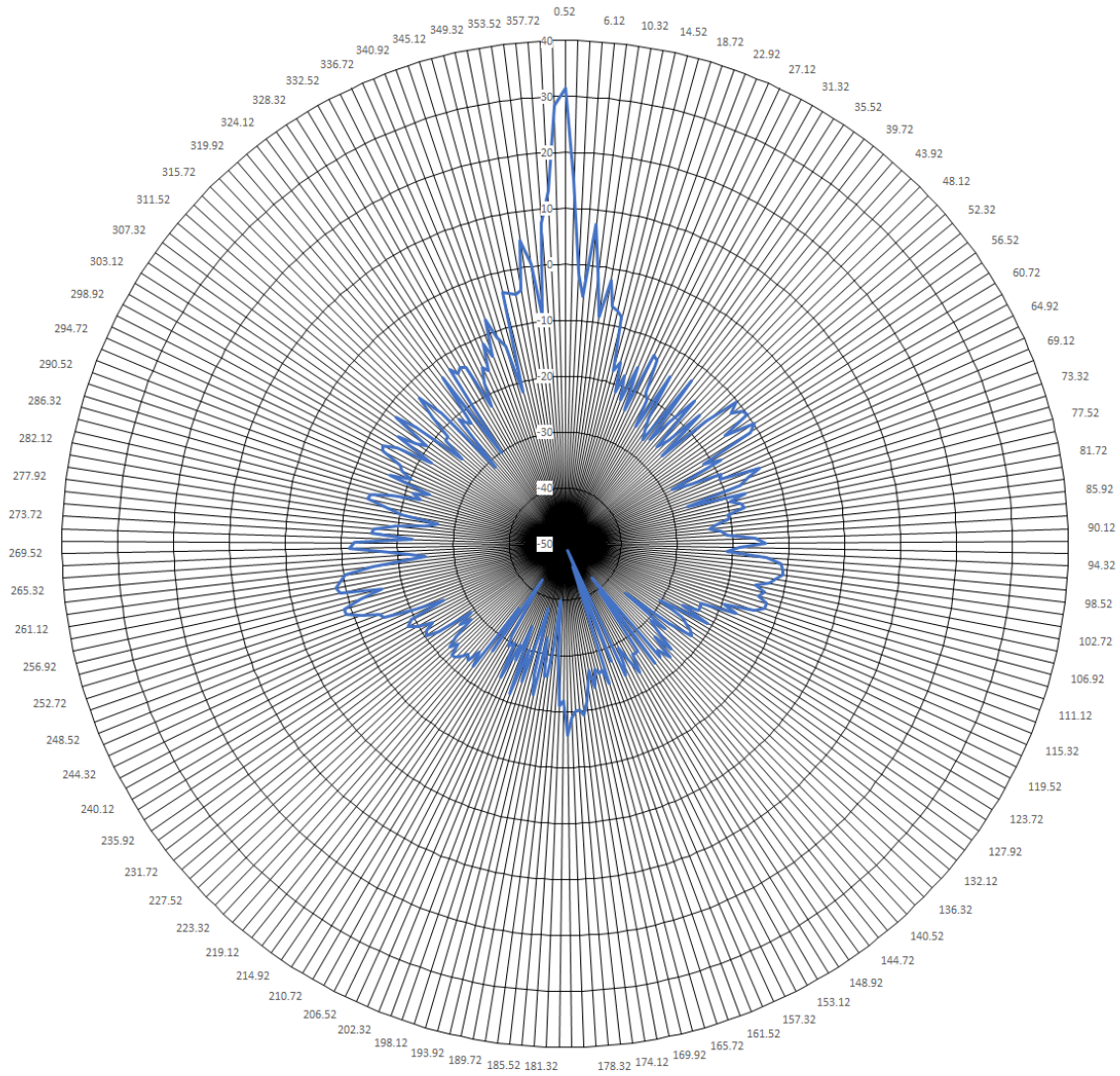


FIGURE 9: X-BAND GROUND ANTENNA (8025-8400 MHZ)

5.0 SAR Payload Radiation Pattern

5.1.1 SPACE STATION TRANSMITTING ANTENNA – SAR summary

5.1.2 SPACE STATION TRANSMITTING ANTENNA RADIATION PATTERN IN POLAR FORMAT (H-PLANE)

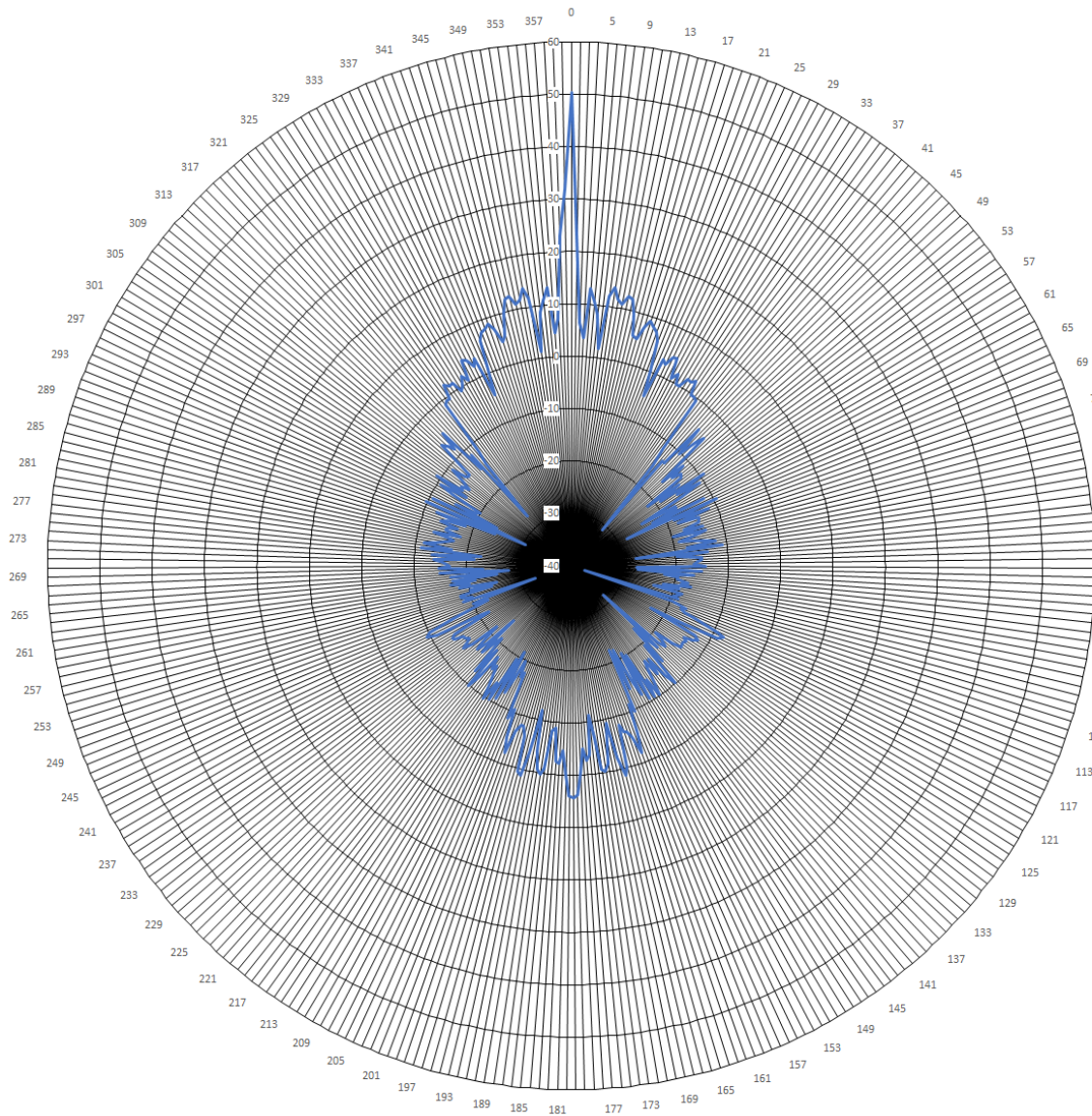


FIGURE 10: UMBRA SAR SPACE ANTENNA H-PLANE

5.1.3 SPACE STATION TRANSMITTING ANTENNA RADIATION PATTERN IN POLAR FORMAT (V-PLANE)

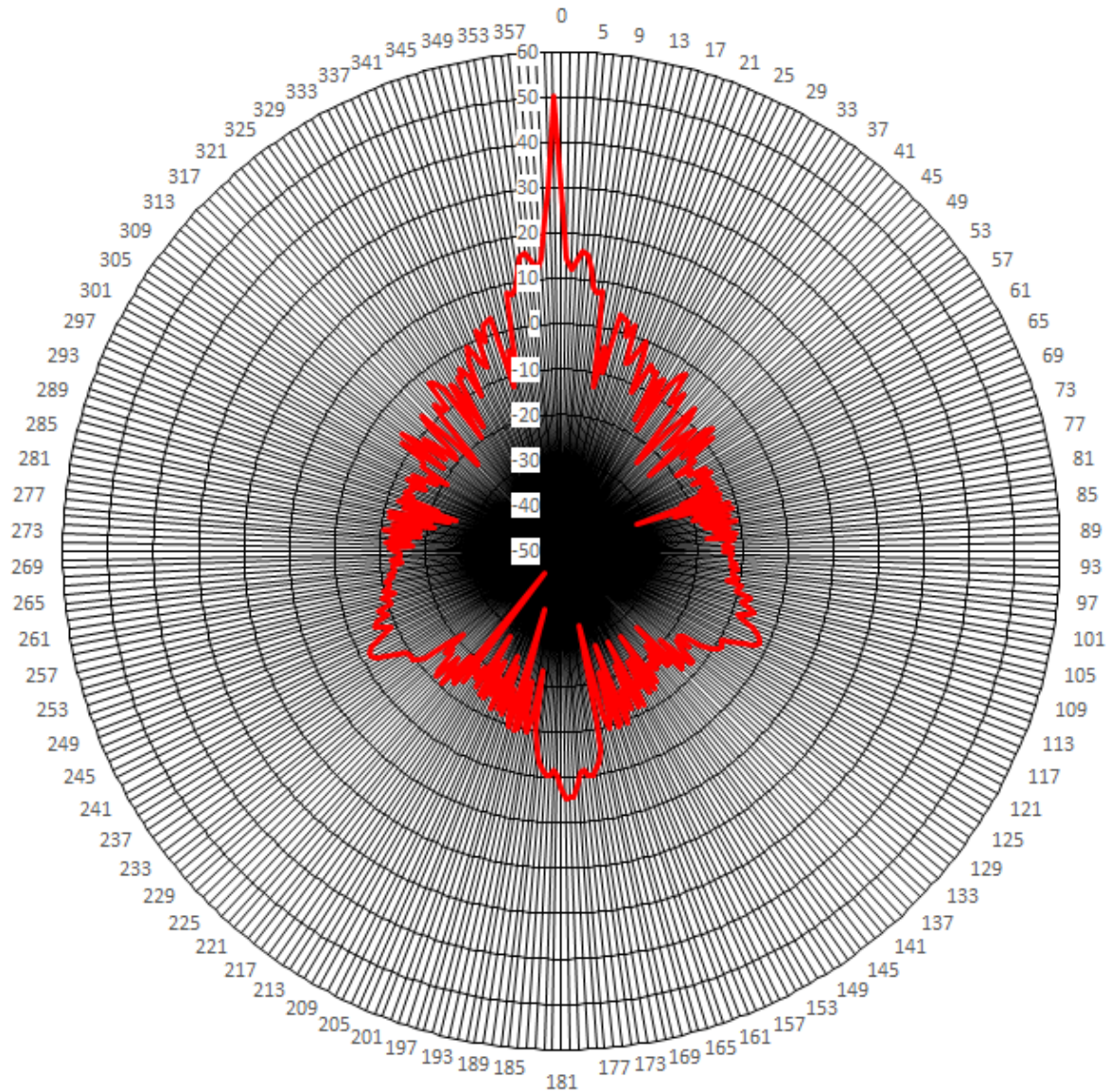


FIGURE 11: UMBRA SAR SPACE ANTENNA V-PLANE