

ATTACHMENT B

**UMFUS Compatibility Showing
(Quincy, WA; Call Sign E170153)**

1. Section 25.136(a)(4) assessment – 27.5-28.35 GHz

1.1. Section 25.136(a)(4)(i) – Number of earth stations

As of November 2020, there are no other earth stations licensed or proposed in the 27.5-28.35 GHz band in the relevant license area.

1.2. Section 25.136(a)(4)(ii) and (iii) – Power Flux Density (“PFD”) contour population and highway/event/railway/port coverage

1.2.1. Assumptions

The Section 25.136 PFD was determined using the publicly available software program Visualyse and based upon the Table 1 technical parameters for the Jupiter 3 earth station.

Parameter	Value
Latitude/longitude	47° 14' 42.3"N / 119° 48' 48.6"W
Frequency (GHz)	28
Channel bandwidth (MHz)	470
Transmit power (dBW)	6.4
Antenna midline height above ground (m)	6.5
Antenna size (m)	9.2
On-axis antenna Gain (dBi)	66.6
Clear sky EIRP (dBW)	73
Antenna radiation pattern	Manufacturer calculated off-axis gain pattern (see Figure 1)
Clutter	Recommendation ITU-R P.452-16, Park lands
Terrain	NASA SRTM data 30 m resolution ¹

Table 1. Jupiter 3 gateway earth station technical parameters at 28 GHz

Figure 1 shows the sum of the manufacturer’s calculated co-polarized and cross-polarized off-axis gain patterns. Measured antenna patterns are not available for the off-axis angles of importance because of the size of the antenna²; hence, calculated antenna patterns provided by the manufacturer are used.

¹ <http://dwtkns.com/srtm30m/>

² See 47 C.F.R. § 25.132(d)

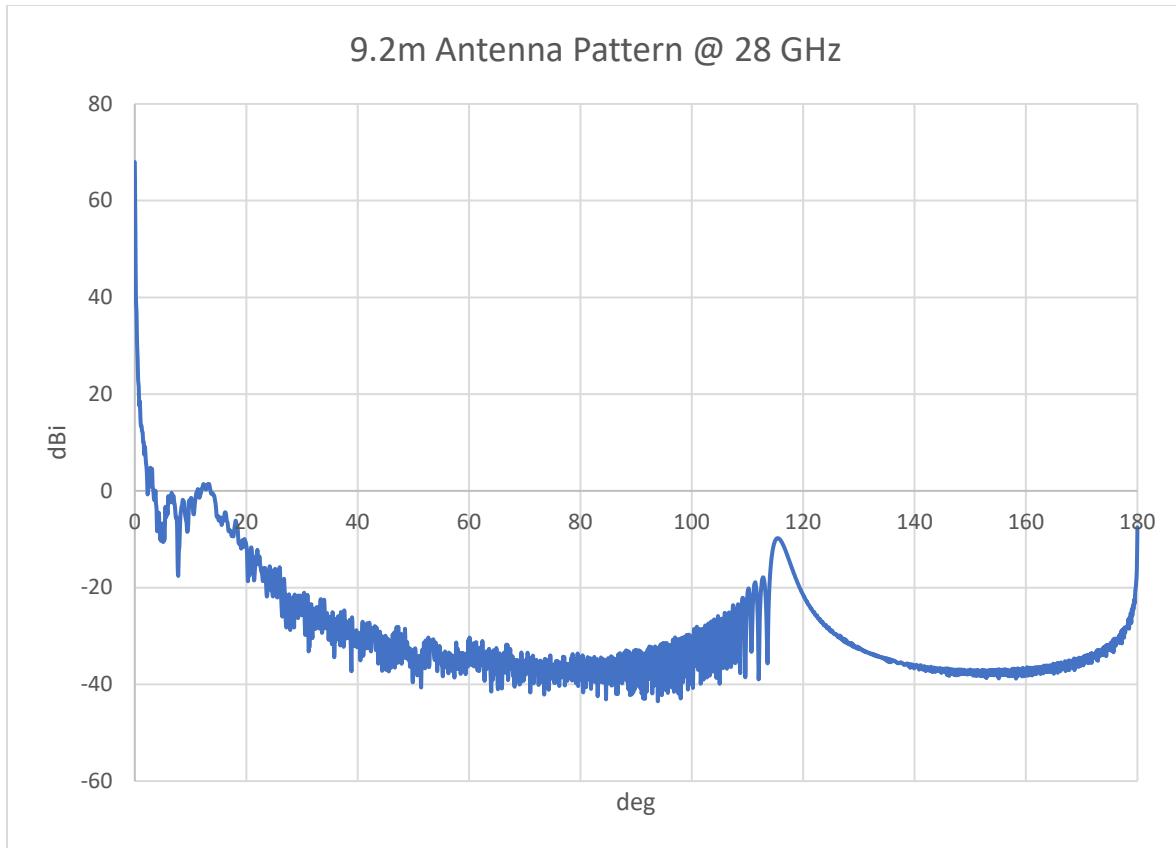


Figure 1. General Dynamics calculated off-axis gain pattern at 28 GHz

The earth station uses adaptive modulation and coding as well as uplink power control to maintain the desired availability. The percentage of time that the earth station will exceed the clear sky levels is small. Using Recommendation ITU-R P.618, Hughes has determined that the power levels are within 1 dB of the clear sky input power for 98.71% of the time and within 2 dB of the clear sky input power for 99.54% of the time.

Further, the earth station is licensed for clear sky EIRP levels pursuant to Section 25.204(e) of the Commission's rules.

1.2.2. Results for 27.5-28.35 GHz

Visualyse Version 7 software was run using the Recommendation ITU-R P.452-16 propagation model option to generate the Section 25.136 contour for the 28 GHz band where the earth station generates a PFD, at 10 meters above ground level, of greater than or equal to $-77.6 \text{ dBm/m}^2/\text{MHz}$. The resulting PFD contour is shown in Figure 2 (and further specified in a KMZ file submitted with this application).



Figure 2. Section 25.136 pfd contour around the Quincy earth station in the 27.5-28.35 GHz band

The 27.5-28.35 GHz PFD contour does not cover any major roads (*i.e.*, Interstate, Other Freeways and Expressways, or Other Principal Arterial, according to the Federal Highway Administration HEPGIS map or Other Freeways and Expressways, or Other Principal Arterials identified by the Washington State Department of Transportation). The PFD contour also does not contain any major event venue, urban mass transit route, passenger railroad, or cruise ship port according to a visual inspection in Google Earth.

The population covered by the 27.5-28.35 GHz PFD contour was determined using the actual area method, where the population within the contour was calculated based on the proportion of the census geographic area covered by the PFD contour. Figure 3 shows the PFD contour overlaid on a census block map of the service area, with census block ID numbers depicted.



Figure 3. 27.5-27.85 GHz pfd contour overlaid on labeled census blocks

Table 2 provides the percentage of area of each census block covered by the contour, the associated population covered, and sums the population covered. The population covered is 3 and meets the population coverage limit of 450 persons.

Census Tract	Census Block	Block Population	Total Block Area	Area Covered	Weighted Population
010500	1070	15	2675742	15410.7	0.1
010500	1077	15	819544	1658.7	0.0
010500	1078	0	76384	1306.3	0.0
010500	1079	5	862810	63732.3	0.4
010500	1081	2	1437442	421.2	0.0
010500	1094	0	2198	315.6	0.0
010500	1095	0	4425	719.0	0.0
010500	1096	0	1166594	154695.5	0.0
010500	1097	0	80660	10747.4	0.0
010500	1112	0	137466	168.7	0.0
010500	1113	3	22203	3355.6	0.5
010500	1189	0	94256	8172.2	0.0
010600	1000	24	150256	12861.5	2.1
Total					3

Table 2. Population coverage of 27.5-27.85 GHz pfd contour

1.3. Section 25.136(a)(4)(iv) – Coordination

As demonstrated in the attached Coordination Report (Attachment A), coordination of the modified earth station operations was completed through Comsearch pursuant to Sections 25.136(a)(4)(iv) and 101.103(d) of the Commission’s rules.

2. Section 25.136(d)(4) assessment – 47.2-48.2 GHz

2.1. Section 25.136(d)(4)(i) – Number of earth stations

As of November 2020, there are no other earth stations licensed or proposed in the 47.2-48.2 GHz band in the relevant license area.

2.2. Section 25.136(d)(4)(ii) and (iii) – PFD contour population and highway/event/railway/port coverage

2.2.1. Assumptions

The Section 25.136 PFD was determined using the publicly available software program Visualyse and based upon the Table 5 technical parameters for the Jupiter 3 earth station.

Parameter	Value
Latitude/longitude	47° 14' 42.3"N / 119° 48' 48.6"W
Frequency (GHz)	47
Channel bandwidth (MHz)	470
Transmit power (dBW)	1.15
Antenna midline height above ground (m)	6.5
On-axis antenna Gain (dBi)	70.85
Clear sky EIRP (dBW)	72
Antenna radiation pattern	Manufacturer calculated off-axis gain pattern
Clutter	Recommendation ITU-R P.452-16, Park lands
Terrain	NASA SRTM data 30 m resolution ³

Table 3. Jupiter 3 gateway earth station technical parameters at 47 GHz

Figure 6 provides a plot of the manufacturer’s calculated combined co-polarized and cross-polarized off-axis gain patterns. Measured antenna patterns are not available for the off-axis angles of importance because of the size of the antenna; hence, calculated antenna patterns provided by the manufacturer are used.

³ <http://dwtkns.com/srtm30m/>

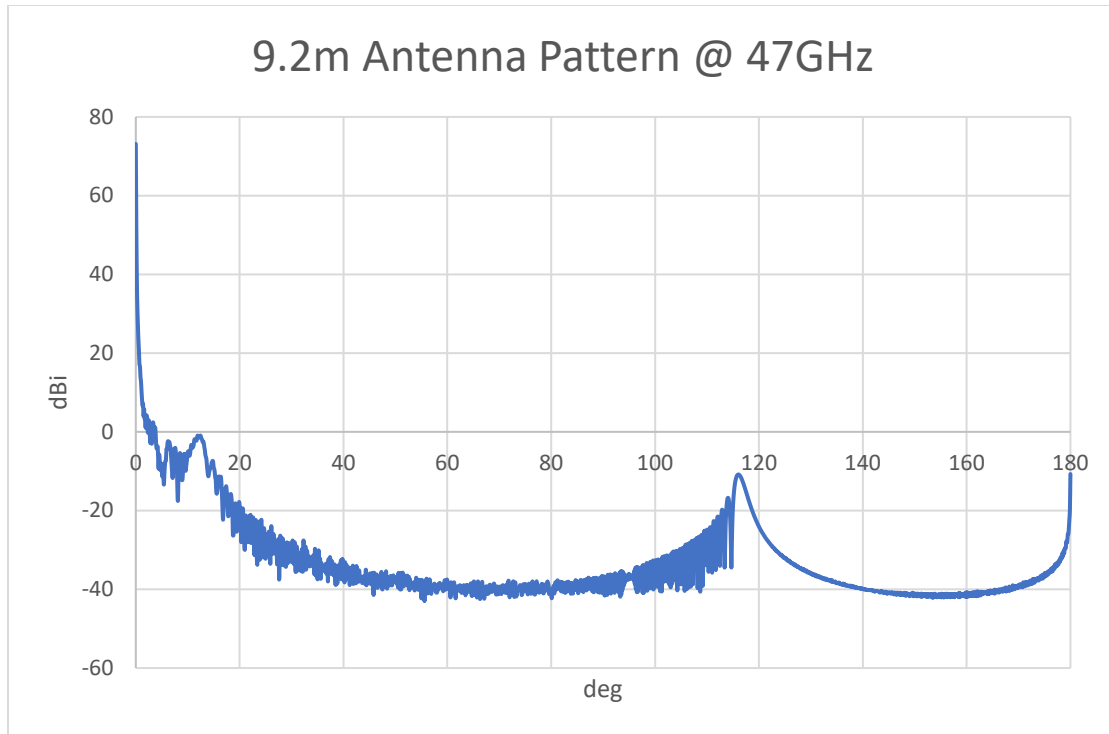


Figure 4. General Dynamics calculated off-axis gain pattern at 47 GHz

The earth station uses adaptive modulation and coding as well as uplink power control to maintain the desired availability. The percentage of time that the earth station will exceed the clear sky levels is small. Using Recommendation ITU-R P.618, Hughes has determined that the power levels are within 1 dB of the clear sky input power for 95.47% of the time and within 2 dB of the clear sky input power for 98.26% of the time.

Further, the earth station is licensed for clear sky EIRP levels pursuant to Section 25.204(e) of the Commission's rules.

2.2.2. Results

Visualyse Version 7 software was run using the Recommendation ITU-R P.452-16 propagation model option to generate the Section 25.136 contour for the 47 GHz band where the earth station generates a pfd, at 10 meters above ground level, of greater than or equal to $-77.6 \text{ dBm/m}^2/\text{MHz}$. The resulting PFD contour is shown in Figure 7 (and further specified in a KMZ file submitted with this application).



Figure 5. Section 25.136 pfd contour around the Quincy earth station in the 47 GHz band

The 47 GHz PFD contour does not cover any major roads (*i.e.*, Interstate, Other Freeways and Expressways, or Other Principal Arterial according to the Federal Highway Administration HEPGIS map, or highways designated as Other Freeways and Expressways, or Other Principal Arterials by the Washington State Department of Transportation). The PFD contour also does not contain any major event venue, urban mass transit route, passenger railroad, or cruise ship port according to a visual inspection in Google Earth.

The population covered by the 47 GHz PFD contour was determined using the actual area method, where the population within the contour was calculated based on the proportion of the census geographic area covered by the PFD contour. Figure 8 shows the 47 GHz PFD contour overlaid on a census block map of the service area, with census block ID numbers depicted.

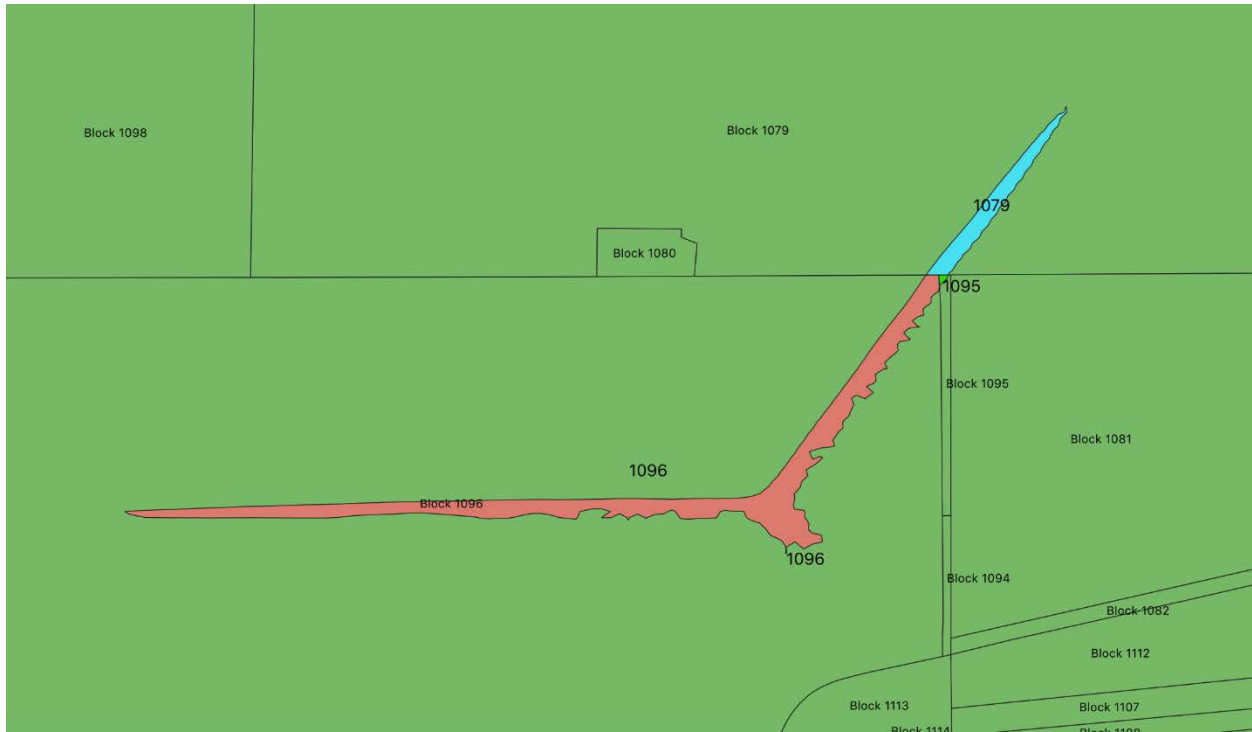


Figure 6. 47 GHz pfd contour overlaid on labeled census blocks

Table 6 provides the percentage of area of each census block covered by the contour, the associated population covered, and sums the population covered. The population coverage limit of 2250 persons is met.

Census Tract	Census Block	Block Population	Total Block Area	Area Covered	Weighted Population
010500	1095	0	4425	117	0
010500	1096	0	1166594	31220	0
010500	1079	5	862810	5530	0.03
Total					1

Table 4. Population coverage of 47 GHz pfd contour

2.3. Section 25.136(d)(4)(iv) – Coordination

As demonstrated in the attached Coordination Report (Attachment B), coordination of the modified parameters for the earth station was completed through Comsearch pursuant to Sections 25.136(d)(4)(iv) and 101.103(d) of the Commission’s rules.

3. Section 25.136(e)(3) assessment – 50.4-51.4 GHz

Operations in the 50.4-51.4 GHz band are grandfathered pursuant to 47 C.F.R. § 25.136(e)(3). The proposed modifications create no significant increase in interference risk to terrestrial operations with respect to PFD contour coverage of populations and major roads and venues, as shown below.

3.1. PFD contour population and highway/event/railway/port coverage

3.1.1. Assumptions

The Section 25.136 PFD was determined using the publicly available software program Visualyse and based upon the Table 7 technical parameters for the Jupiter 3 earth station.

Parameter	Old site	New site
Latitude/longitude	47°14'43.40"N / 119°48'58.70"W	47° 14' 42.3"N / 119° 48' 48.6"W
Frequency (GHz)	51	51
Channel bandwidth (MHz)	470	470
Transmit power (dBW)	0	0
Antenna midline height above ground (m)	6.5	6.5
On-axis antenna Gain (dBi)	72	72
Clear sky EIRP (dBW)	72	72
Antenna radiation pattern	Manufacturer calculated off-axis gain pattern	Manufacturer calculated off- axis gain pattern
Clutter	Recommendation ITU- R P.452-16, Park Lands	Recommendation ITU-R P.452- 16, Park Lands
Terrain	NASA SRTM data 30 m resolution ⁴	NASA SRTM data 30 m resolution ⁵

Table 7. Jupiter 3 gateway earth station technical parameters at 51 GHz

Figure 9 provides a plot of the manufacturer’s calculated combined co-polarized and cross-polarized off-axis gain patterns. Measured antenna patterns are not available for the off-axis angles of importance because of the size of the antenna; hence, calculated antenna patterns provided by the manufacturer are used.

⁴ <http://dwtkns.com/srtm30m/>

⁵ <http://dwtkns.com/srtm30m/>

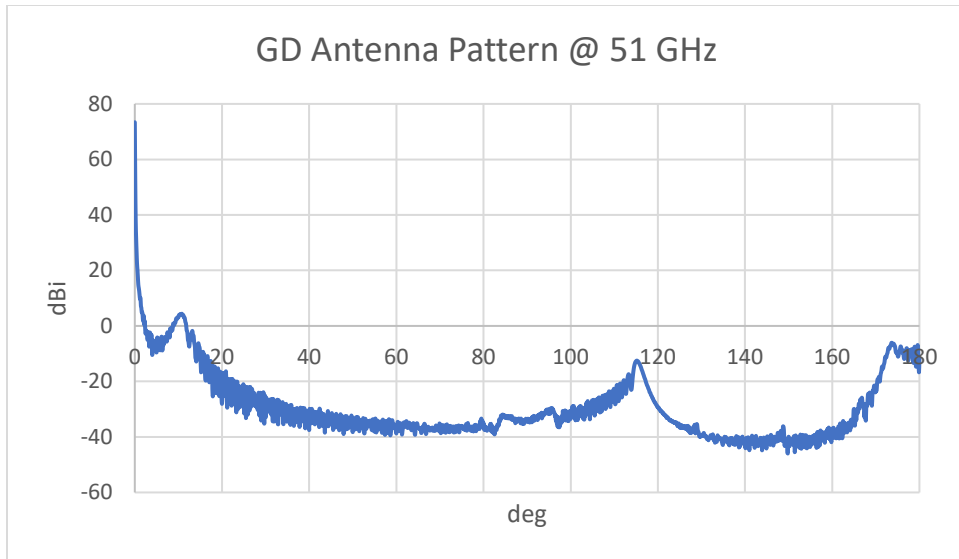
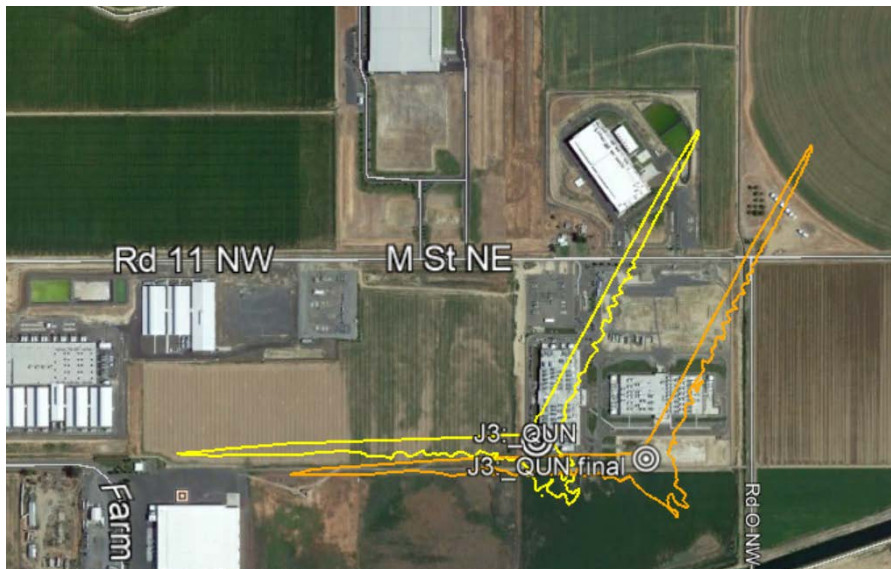


Figure 9. General Dynamics calculated off-axis gain pattern at 51 GHz

3.1.2. Results

Visualyse Version 7 software was run using the Recommendation ITU-R P.452-16 propagation model option to generate the Section 25.136 contour for the 50 GHz band where the earth station generates a pfd, at 10 meters above ground level, of greater than or equal to $-77.6 \text{ dBm/m}^2/\text{MHz}$. The resulting PFD contours for the old and new sites are shown in yellow and orange, respectively, in Figure 10.



Neither PFD contour covers: (i) any major roads (*i.e.*, Interstate, Other Freeways and Expressways, or Other Principal Arterial according to the Federal Highway Administration HEPGIS map, or highways designated as Other Freeways and Expressways, or Other Principal Arterials by the Washington State Department of Transportation); or (ii) any major event venue, urban mass transit route, passenger railroad, or cruise ship port, according to a visual inspection in Google Earth.