Request for Special Temporary Authority

O3b Limited ("O3b"), pursuant to Section 25.120 of the Commission's rules,[1] hereby respectfully requests special temporary authority ("STA") to operate two earth stations at the same location in Quantico, Virginia (collectively, the "Quantico Integration Earth Station") that will communicate with the satellite system operated by O3b. In this filing, O3b seeks a 30-day STA for the period between September 24, 2018 and October 24, 2018. O3b proposes to operate the Quantico Integration Earth Station during this term in accordance with the parameters specified in the attached Schedule B, which subsequently will be filed with a license application for the Quantico Integration Earth Station that O3b will be filing soon (the "Quantico Integration Earth Station License Application").

The STA requested herein will be used to integrate and test new 0.2m earth station terminals, all of which are technically identical, before they are deployed to customers or demonstration sites. No more than two of these new 0.2m earth station terminals will be operated at one time. As discussed below, grant of the requested authority is in the public interest as it will allow O3b to properly evaluate new terminals before deployment to customer sites.

Test Details and Public Interest Showing

The Quantico Integration Earth Station will communicate with O3b's UK-authorized, Ka-band, Medium Earth Orbit, non-geostationary satellite orbit ("NGSO") Fixed-Satellite Service ("FSS") system.[2]

The frequencies to be used by the Quantico Integration Earth Station are:

- 28.35-28.40 GHz (uplink)
- 18.3 -18.6 GHz (downlink)

The Quantico Integration Earth Station antennas will be mounted on fixed platforms. Although the pointing angle of the antennas will change as O3b's in-orbit satellites are tracked, the platform will remain stationary during operation.

The Quantico Integration Earth Station will consist of one 0.2m earth station terminals. Each earth station terminal will consist of one 0.2m GetSat antennas. O3b has previously been granted an STA to operate the same 0.2m earth station terminal at the O3b facility in Manassas, Virginia.[3]

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[1] 47 C.F.R. § 25.120.

[2] The FCC has granted market access to the current O3b 16 satellite constellation and authorized the expansion of the constellation to up to 42 satellites. *See* O3b Limited, Call Sign S2935, File No. SAT-AMD-20171109-00154 (granted June 4, 2018) ("Market Access Grant").

[3] *See* O3b Limited, OET File No. 1076-EX-ST-2018, granted August 17, 2018 ("O3b GetSat STA").

Grant of this STA request will serve the public interest, convenience and necessity by allowing O3b to integrate and test new 0.2m earth station terminals and prepare them for commercial use before they are deployed to customers or demonstration sites. An STA will also permit O3b to conduct customer demonstrations at the Quantico facility should the need arise. This will ensure that customers around the globe continue to receive high quality service from O3b.

Earth Station Technical Parameters

The following documents containing technical details of the operations proposed under the requested STA are attached hereto:

- FCC Form 312, Schedule B. O3b proposes to operate the Quantico Integration Earth Station during this 30-day term in accordance with the parameters specified in the attached Schedule B.
- Compliance with Article 22. A demonstration that the proposed operations will meet the EPFD levels in Table 22-2 of Article 22, Section II, and Resolution 76 of the ITU Radio Regulations.
- Radiation Hazard Study. The radiation hazard analysis for the GetSat antenna is provided. As described therein, O3b will follow procedures to mitigate potential radiation hazards in controlled and uncontrolled environments.

Further, O3b incorporates by reference the following technical parameters previously provided by O3b:

- Schedule S. In its Petition, O3b submitted a Schedule S describing its satellite system's technical characteristics.[4] The Schedule S correctly described the O3b satellite system for that application, and numerically enveloped all of the necessary parameters for future earth station applications. O3b will operate its Quantico Integration Earth Station within the parameters described in O3b's Schedule S.
- U.S. Government Coordination. O3b has completed all necessary coordination with U.S. government satellite networks operating in Ka-band, including GSO and NGSO networks, as well as their associated specific earth stations filed under 9.7A and 9.7B of the ITU Radio Regulations through other administrations. O3b has also completed coordination, according to US footnote 334 of the FCC table of frequency allocations, with the U.S. government, and this US334 coordination agreement specifically provides for additional earth stations in U.S. territory operating with O3b's satellites, such as the Quantico Integration Earth Station. As

[4] *See* Market Access Grant, Schedule S.

a result, O3b's existing US334 coordination agreement covers the use of the Quantico Integration Earth Station as requested in this STA request.

Proposed Spectrum Use

O3b's proposed Quantico Integration Earth Station operations in shared bands are consistent with the Commission's rules and policies. O3b addresses each of these bands below.

UPLINK

28.35-28.4 GHz – Secondary uplink band shared with primary GSO FSS stations.

In the 28.35-28.4 GHz band, there is a primary allocation for GSO FSS systems and a secondary allocation for NGSO FSS systems. O3b's Quantico Integration Earth Station transmissions in this band will be consistent with their secondary status vis-à-vis GSO FSS transmissions. The Commission has allowed similar secondary use of frequencies in the Ka-band uplink allocated to GSO FSS on a primary basis where applicants are prepared to accept interference from primary operations and can demonstrate that their proposed operations are not likely to cause harmful interference to primary operations.[5] O3b satisfies both of these standards.

As a secondary user of the 28.35-28.4 GHz band in the United States, O3b makes no claim of protection from interference from U.S.-licensed GSO FSS networks in this band segment. As for O3b's uplink operations in the 28.35-28.4 GHz band, the ITU has developed uplink equivalent power flux density limits ("$EPFD_{up}$") limits to protect co-frequency GSO FSS operations from unacceptable interference from NGSO FSS systems operating in the same frequencies. Specifically, in accordance with Article 22 of the ITU Radio Regulations, if the applicable $EPFD_{up}$ limits are met, the NGSO FSS satellite system is considered to have met its obligations to protect GSO FSS networks from unacceptable interference.

O3b previously demonstrated that earth stations operating above 13° N.L. when operating at the authorized power levels will meet the applicable ITU $EPFD_{up}$ limits in all frequency ranges where these limits apply, due to the inherent angular separation between the O3b and geostationary orbits when viewed from the Earth at latitudes away from the equator.[6] The Quantico Integration Earth Station is located further north in latitude than the Hawaii Gateway Earth Station,[7] which results in an even greater angular separation between the O3b and geostationary orbits as viewed from the Earth and an even greater assurance that the applicable ITU $EPFD_{up}$ limits will be met by O3b's proposed operations. The proposed Quantico Integration Earth Station operations, therefore, also will meet the applicable ITU $EPFD_{up}$ limits.

[5] *Northrop Grumman Space & Missions Systems Corporation*, 24 FCC Rcd 2330, at ¶¶ 72-73 (Int'l Bur. 2009); *contactMEO Communications*, LLC, 21 FCC Rcd 4035, at ¶¶ 23-24, (Int'l Bur., 2006).

[6] *See* Market Access Grant, Technical Annex at 15-18.

[7] The Quantico Integration Earth Station latitude is 38° 30′ 49.9″ N.

In any event, O3b confirms that its operations will be on a secondary basis relative to U.S.-licensed GSO FSS networks in the same band.

DOWNLINK

18.3-18.6 GHz – Non-conforming downlink band shared with primary GSO FSS stations.

The 18.3-18.6 GHz band is allocated in the United States on a primary basis to GSO FSS and on a secondary basis to the NGSO FSS.[8] In the 18.3-18.6 GHz downlink band, the ITU has developed downlink equivalent power flux density ("$EPFD_{down}$") limits to protect GSO FSS networks from unacceptable interference from NGSO FSS systems operating in the same frequencies. Specifically, in accordance with Article 22 of the ITU Radio Regulations, if the applicable $EPFD_{down}$ limits are met, the NGSO FSS satellite system is considered to have met its obligations to protect GSO FSS networks from unacceptable interference.

O3b's system meets the applicable ITU $EPFD_{down}$ limits in all frequency ranges where these limits apply.[9] As an example of how these limits will be satisfied, O3b provided $EPFD_{down}$ calculations for transmissions to its Hawaii Gateway Earth Station.[10] O3b also showed how the $EPFD_{down}$ limits can be satisfied at all latitudes.[11] O3b is able to satisfy the limits by taking advantage of the inherent angular separation of the O3b and the GSO orbits when viewed from the surface of the Earth at latitudes away from the equator.[12] Based on these prior showings, it can be seen that transmissions to O3b's Quantico Integration Earth Station will be within the $EPFD_{down}$ limits.

Conclusion

The requested STA will allow O3b to evaluate and demonstrate O3b system's operational capabilities and will not result in harmful interference to other authorized spectrum users. Accordingly, and for good cause shown, O3b respectfully requests that its STA be granted in time for it to commence testing under this 30-day STA on September 24, 2018.

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[8] *See* NGSO Order at ¶ 10 and Appendix B.

[9] *See* ITU Radio Regulations, Article 22. *See also* O3b Hawaii Gateway License Application, File No. SES-LIC-20100723-00952, Technical Attachment at A.10.1 for a discussion of O3b's compliance with the operational limits in Article 22 of the ITU Radio Regulations. *See also* Letter from Brian D. Weimer, to Marlene H. Dortch, in re O3b Application for Hawaii Gateway Earth Station, File No. SES-LIC-20100723-00952 (Apr. 22, 2011), Annex A.

[10] O3b Hawaii License Application, FCC File No. SES-LIC-20100723-00952, Technical Attachment at A.10.1.

[11] *See* id.

[12] *See* id.

ANNEX 1:

FCC Form 312, Schedule B

SATELLITE EARTH STATION AUTHORIZATIONS
FCC Form 312 - Schedule B:(Technical and Operational Description)

Location of Earth Station Site E1: Site Identifier: Quantico E2: Contact Name: Network Operations Center E3. Street: 3250 Catlin Ave.	E5. Call Sign: E6. Phone Number: 703-366-1500 E7. City: Quantico	
E4. State: Virginia E10. Area of Operation: Fixed E11. Latitude: 38° 30′ 49.9″ N E12. Longitude: 77° 18′ 39.4″ W E13. Lat/Lon Coordinates are: E14. Site Elevation (AMSL): 12 m	E8. County: Prince Williams County E9. Zip Code: 22134 ○ NAD-27 ◉ NAD-83	N/A

E15. If the proposed antenna(s) operate in the Fixed Satellite Service (FSS) with geostationary satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a) and (b) as demonstrated by the manufacturer's qualification measurement? If NO, provide a technical analysis showing compliance with two-degree spacing policy.	○ Yes ○ No N/A
E16. If the proposed antenna(s) do not operate in the Fixed Satellite Service (FSS), or if they operate in the Fixed Satellite Service (FSS) with non-geostationary satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a2) and (b) as demonstrated by the manufacturer's qualification measurements?	◉ Yes ○ No N/A
E17. Is the facility operated by remote control? If YES, provide the location and telephone number of the control point.	○ Yes ◉ No
E18. Is frequency coordination required? If YES, attach a frequency coordination report as	◉ Yes ○ No
E19. Is coordination with another country required? If YES, attach the name of the country(ies) and plot of coordination contours as	○ Yes ◉ No
E20. FAA Notification - (See 47 CFR Part 17 and 47 CFR part 25.113(c)) Where FAA notification is required, have you attached a copy of a completed FCC Form 854 and or the FAA's study regarding the potential hazard of the structure to aviation? **FAILURE TO COMPLY WITH 47 CFR PARTS 17 AND 25 WILL RESULT IN THE RETURN OF THIS APPLICATION.**	○ Yes ◉ No

POINTS OF COMMUNICATION

Satellite Name: | | Eq. If you selected OTHER, please enter the following:	
E21. Common Name:	E22. ITU Name:
E23. Orbit Location:	E24. Country:

POINTS OF COMMUNICATION (Destination Points)

E25. Site Identifier:

E26. Common Name:	E27. Country:

ANTENNA

Site ID	E28. Antenna Id	E29. Quantity	E30. Manufacturer	E31. Model	E32. Antenna Size	E41/42. Antenna Gain Transmit and/or Receive (___dBi at_____GHz)
Quantico	GetSat .2m	1	GetSat	Micro Sat	.2m	Receive Gain (32.0 dBi at 18.48 GHz)
						Transmit Gain (34.1 dBi at 28.28 GHz)

E28. Antenna Id	E33/34. Diameter Minor/Major(meters)	E35. Above Ground Level (meters)	E36. Above Sea Level (meters)	E37. Building Height Above Ground Level (meters)	E38. Total Input Power at antenna flange (Watts)	E39. Maximum Antenna Height Above Rooftop (meters)	E40. Total EIRP for al carriers (dBW)
GetSat	.2/.2	2	12	NA	15.85	NA	45.6

FREQUENCY

E28. Antenna Id	E43/44. Frequency Bands(MHz)	E45. T/R Mode	E46. Antenna Polarization(H,V,L,R)	E47. Emission Designator	E48. Maximum EIRP per Carrier(dBW)	E49. Maximum ERIP Density per Carrier(dBW/4kHz)
GetSat .2m	18300 18600	R	Left and Right Circular	50M0G7D	0.0	0.0
E50. Modulation and Services QPSK, 8PSK, 16PSK, 32PSK and Internet						
GetSat .2m	28350 28400	T	Left and Right Circular	50M0G7D	45.6	9.8
E50. Modulation and Services QPSK, 8PSK, 16PSK, 32PSK and Internet						

FREQUENCY COORDINATION

E28. Antenna Id	E51. Satellite Orbit Type	E52/53. Frequency Limits(MHz)	E54/55. Range of Satellite Arc E/W Limit	E56. Earth Station Azimuth Angle Eastern Limit	E57. Antenna Elevation Angle Eastern Limit	E58. Earth Station Azimuth Angle Western Limit	E59. Antenna Elevation Angle Western Limit	E60. Maximum EIRP Density toward the Horizon(dBW/4kHz)
GetSat .2m	Non-Geostationary	18300 18600	0.0	130.0	10.0	230.0	10.0	0.0
GetSat .2m	Non-Geostationary	28350 28400	0.0	130.0	10.0	230.0	10.0	-24.26

REMOTE CONTROL POINT LOCATION

E61. Call Sign NOTE: Please enter the callsign of the controlling station, not the callsign for which this application is being filed.			E65. Phone Number
E62. Street Address			
E63. City	E67. County	E64/68. State/Country	E66. Zip Code

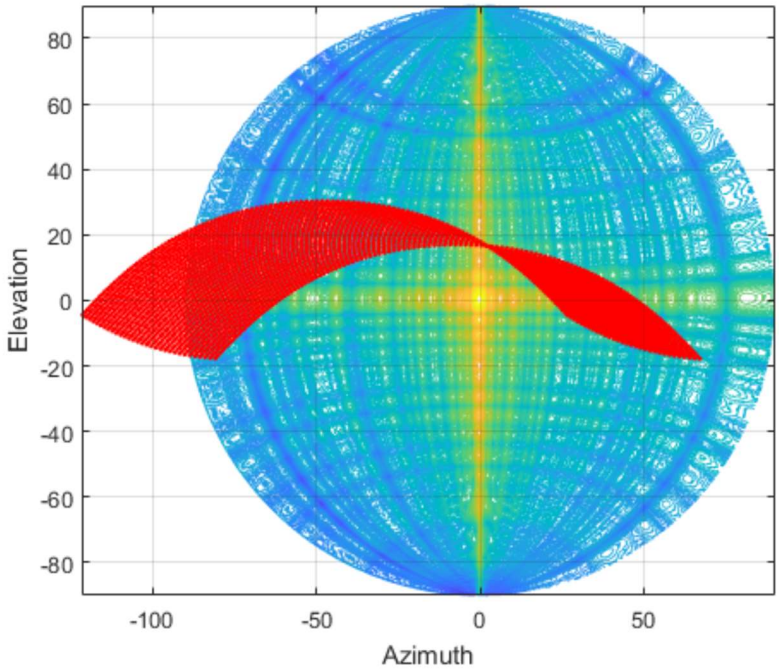
ANNEX 2:

Compliance with Article 22

The following plot illustrates the GETSAT antenna pattern in azimuth and elevation dimensions.

The below analysis shows the GSO arc, as it appears from the location where the GETSAT antenna will be operating, is superimposed on to the antenna pattern. There are multiple instances of the GSO arc shown because the GETSAT antenna will be moving to follow O3b satellites. At each increment along the O3b orbit, the GSO arc is correspondingly superimposed onto the GETSAT antenna pattern.

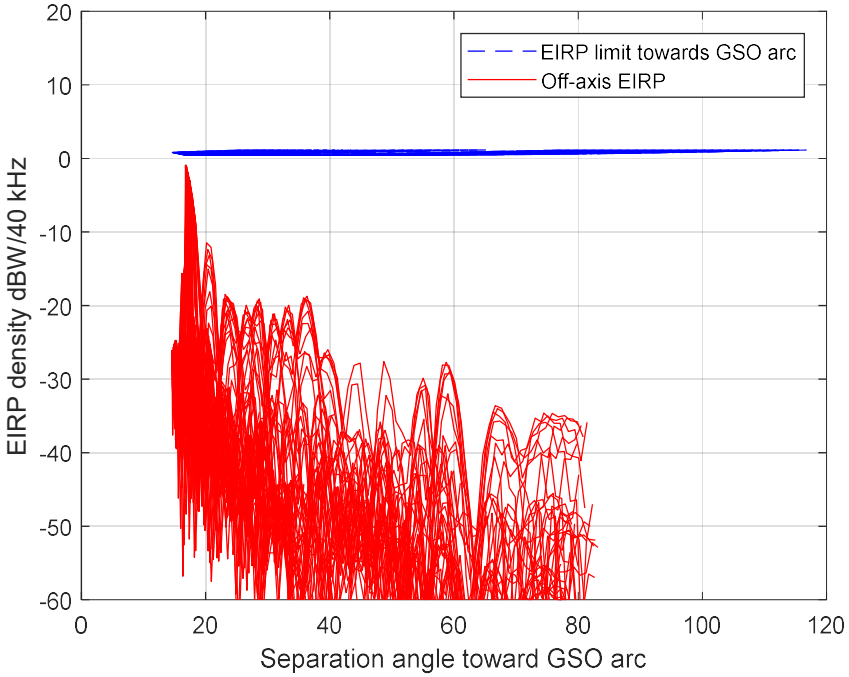
This analysis determines the GETSAT antenna gain in the direction of the GSO arc as the antenna moves to follow the O3b satellite.



The EPFD ↑ limit is −162 dBW/m^2/40 kHz. The spreading loss determined by the equation

$$spreading\ loss\ (dB) = 10log_{10}(4\pi d^2)$$

where d is the distance to a point on the GSO arc from the location on the Earth of the transmitting earth station, in one instance it is around 37,422 km. The resulting spreading loss is 162.4 dB-m^2. From this, the allowed off-axis EIRP from the GETSAT antenna can be determined by adding the spreading loss to the EPFD limit. The following plot illustrates both the EPFD limit in the form of an off-axis EIRP density limit and the corresponding EIRP density from the GETSAT antenna that, when controlling the input power spectral density, is below the limit.



As seen by the plot above, the GETSAT operations are compliant with the EPFD↑ limits.

ANNEX 3:

Radiation Hazard Study

Radiation Hazard Analysis

0.24 Meter -
Quantico, Virginia 22134

Introduction

A radiation hazard anaylsis is presented for a 0.24 meter Ka band aperture antenna to be demonstrated at a U.S. Government facility in Quantico, VA. This Radiation Analysis calculates the non-ionizing radiation levels expected to be emitted from the earth station on a worse cases basis and is performed in accordance with the Federal Communications Commissions Office of Engineering and Technology (OET) Bulletin, No. 65.

Requirements

OET 65 outlines the maximum permissible exposure limits in two cases for operation in this frequency range.

1. The first case is the maximum level that a person may be exposed to in the general population. The exposure limit is defined as a non-ionizing power level equal to 1 milliwatt per centimeter squared averaged over a thirty minute period.
2. The second case is a controlled environment where the maximum permissible exposure limit must not exceed 5 milliwatts per centimeter squared averaged over any six minute period.

Summary

The results indicate that no significant hazard will be presented to the general population and will be fully mitigated in the controlled area by the use of procedures that require the removal of transmit power before accessing the area around the main reflector.

Analysis

This analysis was performed on seven zones. The results of this is shown in Radiation Hazard Zones. The Table labeled Input Values provides the input data used to perform the analysis. The table labeled OET 65 Calculated Values provides the intermediate calculation used to perform the assessment in accordance with OET 65. The Analysis is performed for each of the seven radiation zones as shown in figure 1 – Analysis Zones. These zones are:

1. Point between the feed and the sub-reflector
2. The power at the surface of the antenna
3. The power level between the main reflector and ground
4. The near-field or Fresnel region in which the maxima can be reached before the field starts to diminish with distance
5. The Transition region where power begins to decrease inversely with distance from the antenna
6. The Far Field or Fraunhofer region where power decreases inversely with the square of the distance. This is the point at which the antenna beam is fully collimated
7. The off axis level in the near field. This is defined as the area outside of the main beam removed and at least one antenna diameter removed from the main beam

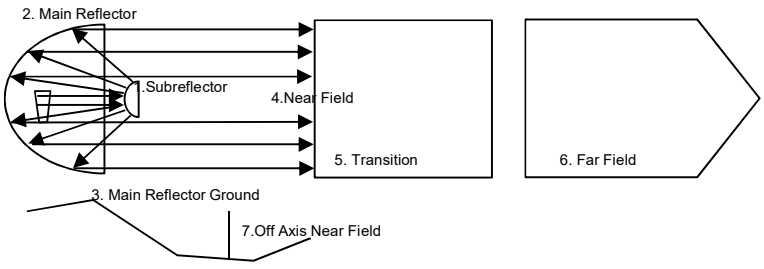


Figure 1 – Analysis Zones

Radiation Hazard Analysis

Operator:	***SES Networks***		
Location Designation:	***Quantico***	*FCC ID:*	
County:	***Prince William***	*SES ID:*	
Town:	***Quantico,***	*STA:*	
State/Zip:	***Virginia***	***22134***	

Input Values	*Value*	*Unit*
D = Aperture Diameter	*0.24*	*Meters*
d = Subreflector Diameter	*0*	*Meters*
η = Apperture Efficeny	*60%*	*percentage*
FCC Designation	*Ka*	*Band*
F = Frequency	*29500*	*MHz*
P = Transmitter Power Watts:	*25*	*Watts*
p = Number Transmitters:	*1*	
R_{ua} *= closest point to uncontrolled area*	*10*	*meters*
Elevation angle at closest point R_{ua}	*20*	*Degrees*

Band	*Frequency GHz*
L	*1000-2000*
S	*2000-4000*
C	*4000-8000*
X	*8000-12500*
Ku	*12500-18000*
K	*18000-25500*
Ka	*26500-40000*
O	*40000-50000*
V	*50000-75000*

OET 65 Calculated Values	*Formula*	*Value*	*Unit*
λ= Wavelength	c / F	*0.0102*	*meters*
P_1 *= Total Antenna Input Power*	*P*p*	*25*	*watts*
G = Antenna Gain	$G=\frac{4\pi\eta A}{\lambda^2}$	*3294.84169*	*linear*
Antenna Gain dB	$10\log_{10}(G)$	*35.17834552*	*dBi*
A = Area of reflector	$\pi(\frac{D}{2})^2$	*0.045216*	*meters* ^{2}
a = area of subreflector	$\pi(\frac{d}{2})^2$	*0*	*meters* ^{2}
R_{nf} *= Near-Field Region*	$R_{nf}=\frac{D^2}{4\lambda}$	*1.42*	*meters*
Transition Region	$>R_{nf}<R_{ff}$	*1.416* *3.3984*	*>meters* *<meters*
R_{ff} *= Far Field Region*	$R_{ff}=\frac{0.6\,D^2}{\lambda}$	*3.3984*	*meters*
		1	*Meters AGL*

	Radiation Analysis Zone	*Formula*	*Level*	*Value*	*Exposure Limits* *General Public* $<1mW/cm^2$	*Occupational* $<5mW/cm^2$
1	*Power Subreflector*	$\frac{4P_t}{a}$	*N/A*	*mW/cm* ^{2}	*N/A*	*N/A*
2	*Antenna Surface*	$\frac{4P_t}{A}$	*221.161*	*mW/cm* ^{2}	*>FCC MPE See Note 1*	*>FCC MPE See Note 2*
3	*Main Reflector Ground*	$\frac{P_t}{A}$	*55.290*	*mW/cm* ^{2}	*>FCC MPE See Note 1*	*>FCC MPE See Note 2*
4	*Snf =Near-Field Power Density*	$S_{nf}=\frac{16\eta P_t}{\pi D^2}=4\eta(\frac{P_t}{A})$	*265.393*	*mW/cm* ^{2}	*>FCC MPE See Note 1*	*>FCC MPE See Note 2*
5	*Max Transition Power Density*	$S_t=\frac{S_{nf}R_{nf}}{R_{nf}}$	*265.393*	*mW/cm* ^{2}	*>FCC MPE See Note 1*	*>FCC MPE See Note 2*
6	*Max Far field Power Density*	$S_{ff}=\frac{P_tG}{4\pi R^2}$	*56.785*	*mW/cm* ^{2}	*>FCC MPE See Note 3*	*>FCC MPE See Note 2*
7	*Off Access Level Near Field*	$S_{ua}=S_{nf}-20dB$	*2.65393*	*mW/cm* ^{2}	*CC MPE See Not*	*<FCC MPE*

Notes

1. *The antenna is installed in a controlled location access is restricted to authorized personnel only. The area is marked with RF Radiation Hazard signage. Area not accessible to the general public.*
2. *Inside the controlled area, MPE levels exceed the MPE exposure for occupational levels. The levels will be reduced to safe MPE by removing power to the transmitters when work is performed on or around the antenna. This area can only be accessed by qualified personnel.*
3. *The far field develops 1 meters above ground level at the minimum elevation angle which is not accessable to the general public.*