

Exhibit D1
to E110149 MOD

RADIATION CALCULATIONS FOR 5.60 meter EARTH STATION			
Nomenclature	Formula	Value	Unit
INPUT PARAMETERS			
M = Antenna Aperture Major Axis m = Antenna Aperture Minor Axis d = Diameter of Feed Mouth f = frequency		5.60 5.60 0.029 30	meters meters meters GHz
P = Max Power into Antenna		125.0	Watts
n = Aperture Efficiency		51%	
k = Wavelength @ 30.0 GHz		0.0100	meters
CALCULATED VALUES			
A = Area of Reflector	$\pi \times M \times m / 4$	24.630	meters ²
l = Length of Near Field	$M^2 / 4k$	785	meters
L = Beginning of Far Field	$0.6M^2 / k$	1883	meters
G = Antenna Gain @ 30 GHz	$n(4 \times \pi \times A) / k^2$	1,580,691	(62.0) dBi
a = Area of Feed Mouth	$\pi \times d^2 / 4$	0.0007	meters ²
POWER DENSITY CALCULATIONS			
Region	Maximum Power Density in Region		Hazard Assessment (FCC MPE Limit = 5 mW/cm ²)
	Formula	Value (mW/cm ²)	
1 Near Field	$4nP/A$	1.04	< FCC MPE Limit
2 Far Field	$GP / (4(\pi)L^2)$	0.44	< FCC MPE Limit
3 Transition	<= Nr Fld Region	1.04	< FCC MPE Limit
4 Near Reflector Surface	$4P/A$	2.03	< FCC MPE Limit
5 Between Reflector & Ground	P/A	0.51	< FCC MPE Limit
6 Between Subreflector and Feed	$4P/a$	75698.0	> FCC MPE Limit (See Attachment)

Exhibit D2
to MOD E110149

RADIATION CALCULATIONS FOR 8.10 meter EARTH STATION			
Nomenclature	Formula	Value	Unit
INPUT PARAMETERS			
M = Antenna Aperture Major Axis		8.10	meters
m = Antenna Aperture Minor Axis		8.10	meters
d = Diameter of Feed Mouth		0.029	meters
f = frequency		30	GHz
P = Max Power into Antenna		200.0	Watts
n = Aperture Efficiency		52%	
k = Wavelength @ 30.0 GHz		0.0100	meters
CALCULATED VALUES			
A = Area of Reflector	$\pi \times M \times m / 4$	51.530	meters ²
l = Length of Near Field	$M^2 / 4k$	1641	meters
L = Beginning of Far Field	$0.6M^2 / k$	3939	meters
G = Antenna Gain @ 30 GHz	$n(4 \times \pi \times A) / k^2$	3,371,896	(65.3) dBi
a = Area of Feed Mouth	$\pi \times d^2 / 4$	0.0007	meters ²
POWER DENSITY CALCULATIONS			
Region	Maximum Power Density in Region		Hazard Assessment (FCC MPE Limit = 5 mW/cm ²)
	Formula	Value (mW/cm ²)	
1 Near Field	$4nP/A$	0.81	< FCC MPE Limit
2 Far Field	$GP / (4(\pi)L^2)$	0.35	< FCC MPE Limit
3 Transition	<= Nr Fld Region	0.81	< FCC MPE Limit
4 Near Reflector Surface	$4P/A$	1.55	< FCC MPE Limit
5 Between Reflector & Ground	P/A	0.39	< FCC MPE Limit
6 Between Subreflector and Feed	$4P/a$	121116.7	> FCC MPE Limit (See Attachment 1)

Exhibit D3
to E110149 MOD

RADIATION CALCULATIONS FOR 9.20 meter EARTH STATION			
Nomenclature	Formula	Value	Unit
INPUT PARAMETERS			
M = Antenna Aperture Major Axis m = Antenna Aperture Minor Axis d = Diameter of Feed Mouth f = frequency		9.20 9.20 0.029 30	meters meters meters GHz
P = Max Power into Antenna		200.0	Watts
n = Aperture Efficiency		49%	
k = Wavelength @ 30.0 GHz		0.0100	meters
CALCULATED VALUES			
A = Area of Reflector	$\pi M m / 4$	66.476	meters ²
l = Length of Near Field	$M^2 / 4k$	2117	meters
L = Beginning of Far Field	$0.6M^2 / k$	5082	meters
G = Antenna Gain @ 30 GHz	$n(4\pi M m) / k^2$	4,098,950	(66.1) dBi
a = Area of Feed Mouth	$\pi d^2 / 4$	0.0007	meters ²
POWER DENSITY CALCULATIONS			
Region	Maximum Power Density in Region		Hazard Assessment (FCC MPE Limit = 5 mW/cm ²)
	Formula	Value (mW/cm ²)	
1 Near Field	$4nP/A$	0.59	< FCC MPE Limit
2 Far Field	$GP / (4(\pi)L^2)$	0.25	< FCC MPE Limit
3 Transition	<= Nr Fld Region	0.59	< FCC MPE Limit
4 Near Reflector Surface	$4P/A$	1.20	< FCC MPE Limit
5 Between Reflector & Ground	P/A	0.30	< FCC MPE Limit
6 Between Subreflector and Feed	$4P/a$	121116.7	> FCC MPE Limit (See Attachment 1)

Exhibit D4
to E110149 MOD

RADIATION CALCULATIONS FOR 0.66 meter EARTH STATION			
Nomenclature	Formula	Value	Unit
INPUT PARAMETERS			
M = Antenna Aperture Major Axis m = Antenna Aperture Minor Axis d = Diameter of Feed Mouth f = frequency		13.20 13.20 0.029 30	meters meters meters GHz
P = Max Power into Antenna		200.0	Watts
n = Aperture Efficiency		44%	
k = Wavelength @ 30.0 GHz		0.0100	meters
CALCULATED VALUES			
A = Area of Reflector	$\pi M m / 4$	136.848	meters ²
l = Length of Near Field	$M^2 / 4k$	4359	meters
L = Beginning of Far Field	$0.6M^2 / k$	10462	meters
G = Antenna Gain @ 30 GHz	$n(4\pi M m) / k^2$	7,577,072	(68.8) dBi
a = Area of Feed Mouth	$\pi d^2 / 4$	0.0007	meters ²
POWER DENSITY CALCULATIONS			
Region	Maximum Power Density in Region		Hazard Assessment (FCC MPE Limit = 5 mW/cm ²)
	Formula	Value (mW/cm ²)	
1 Near Field	$4nP/A$	0.26	< FCC MPE Limit
2 Far Field	$GP / (4(\pi)L^2)$	0.11	< FCC MPE Limit
3 Transition	<= Nr Fld Region	0.26	< FCC MPE Limit
4 Near Reflector Surface	$4P/A$	0.58	< FCC MPE Limit
5 Between Reflector & Ground	P/A	0.15	< FCC MPE Limit
6 Between Subreflector and Feed	$4P/a$	121116.7	> FCC MPE Limit (See Attachment 1)