Eleanor Lott

From: Trang Nguyen
Sent: Thursday, December 04, 2014 1:56 PM
To: Eleanor Lott
Cc: Trang Nguyen
Subject: please upload updated RF Rad Haz study FCC earth station application seslic2014112900877
Attachments: Exhibit A2 - Harris CapRock Communications - for range 5925-6125.pdf

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From: Raul Magallanes [mailto:raul@rmtelecomlaw.com]
Sent: Thursday, December 04, 2014 12:31 PM
To: Trang Nguyen; eleanor.lot@fcc.gov
Cc: 'Alberto Cortes Neri'
Subject: RE: please correct RE: you mean RE: need clarification on a pending FCC earth station application seslic2014112900877

Dear Trang,

Attached please find second radiation hazard study with center frequency 6025 Mhz.

E48 should be as follows:

55.85 dBW for 2M80G7W for band 6185-6425 MHz (E43/44)
58.86 dBW for 5M60G7W for band 6185-6425 MHz (E43/44)

55.85 dBW for 2M80G7W for band 5925-6125 MHz (E43/44)
58.86 dBW for 5M60G7W for band 5925-6125 MHz (E43/44)

E49 should be changed to **27.4dBW/4MHz** in all instances

Best Regards

Raul Magallanes
Magallanes Law Firm
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(281) 317-1397 phone | (281) 271-8085 fax
www.rmtelecomlaw.com | raul@rmtelecomlaw.com

From: Trang Nguyen [mailto:Trang.Nguyen@fcc.gov]
Sent: Thursday, December 04, 2014 10:26 AM
To: 'raul@rmtelecomlaw.com'; eleanor.lot@fcc.gov
Cc: Trang Nguyen
Subject: please correct RE: you mean RE: need clarification on a pending FCC earth station application seslic2014112900877

Please take a look at the submitted frequency coordination study regarding the max. eirp level. The coordination shows that it was coordinated with max. eirp density of 27.4 dBW/4kHz. You will have to lower the proposed eirp density level for each carrier in the schedule B to correspond to the coordinated eirp density level 27.4 dBW/4kHz. Presently, the schedule B, item E 49 shows 27.54 dBW/4kHz for all carriers which exceeds the coordinated level. You must also **lower your eirp level, item E 48, so that the corresponding eirp density level be at 27.4 dBW/4kHz**.

Also,

Because you specified 2 different transmit ranges: 5925-6125 and 6186-6425, the center transmit gain frequency must be specified for each range. Is there another RF rad haz study that reflect transmit frequency in range 5925-6125? Then that study should be included.

From: Raul Magallanes [mailto:raul@rmtelecomlaw.com]
Sent: Thursday, December 04, 2014 10:25 AM
To: Trang Nguyen; eleanor.lot@fcc.gov
Subject: RE: you mean RE: need clarification on a pending FCC earth station application seslic2014112900877

Dear Trang,

Yes, thanks for pointing that discrepancy. A new radiation hazard study has been generated with the center frequency of 6250MHz or 6.25GHz. This now matches with the current value in E41/42 and falls within the ranges of E43/44 of 5925-6125 and 6185-6425.

Best Regards,

Raul Magallanes
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Telecommunications Law
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From: Trang Nguyen [mailto:Trang.Nguyen@fcc.gov]
Sent: Thursday, December 04, 2014 6:41 AM
To: 'raul@rmtelecomlaw.com'; eleanor.lot@fcc.gov
Cc: Trang Nguyen
Subject: you mean RE: need clarification on a pending FCC earth station application seslic2014112900877

For the frequency, you mean 6.175 GHz? However, the listed proposed transmit frequencies listed in the Schedule B, Item 43/44 , are in 5925-6125, 6185-6425. There is no listing of a transmit frequency in the 6175 MHz. Therefore, 6175 MHz as the transmit center frequency for antenna gain still poses problem. Information in Item 41/42 must link with Item 43/44. Therefore, the transmit antenna gain must either be within the range 5925-6125 or 6185-6425 to make sense.

Thanks,
Trang

From: Raul Magallanes [mailto:raul@rmtelecomlaw.com]
Sent: Wednesday, December 03, 2014 11:46 PM
To: Trang Nguyen; eleanor.lot@fcc.gov
Subject: need clarification on a pending FCC earth station application seslic2014112900877

Please correct item E41/42 to 42.0 dBi @ 6175 MHz.

Radiation Hazard Study

Prodelin 2.4m C (1244)

This study analyzes the potential Radio Frequency (RF) human exposure levels caused by the Electro Magnetic (EM) fields of the above-captioned antenna. The mathematical analysis performed below complies with the methods described in the Federal Communications Commission Office of Engineering and Technology Bulletin No. 65 (1985 rev. 1997) R&O 96-326.

Maximum Permisible Exposure

There are two separate levels of exposure limits. The first applies to persons in the general population who are in an uncontrolled environment. The second applies to trained personnel in a controlled environment. According to 47 C.F.R. § 1.1310, the Maximum Permissible Exposure (MPE) limits for frequencies above 1.5 GHz are as follows:

- General Population / Uncontrolled Exposure 1.0 mW/cm2
- Occupational / Controlled Exposure 5.0 mW/cm2

The purpose of this study is to determine the power flux density levels for the earth station under study as compared with the MPE limits. This comparison is done in each of the following regions:

1. Far-field region
2. Near-field region
3. Transition region
4. The region between the feed and the antenna surface
5. The main reflector region
6. The region between the antenna edge and the ground

Input Parameters

The following input parameters were used in the calculations:

Parameter	Value	Unit	Symbol
Atenna Diameter:	2.4	m	D
Antenna Transmit Gain:	42.00	dBi	G
Trasmit Frequency:	6025	MHz	f
Feed Flange Diameter:	13.10	cm	d
Power Input to the Antenna:	55.00	W	P

Calculated Parameters

The following values were calculated using the above input parameters and the corresponding formulas.

Parameter	Value	Unit	Symbol	Formula
Anenna Surface Area:	4.52	m^2	A	$\pi D^2/4$
Area of Feed Flange:	134.78	cm^2	a	$\pi d^2/4$
Antenna Efficiency:	0.69		η	$G\lambda^2/(\pi^2 D^2)$
Gain Factor:	15848.93		g	$10^{G/10}$
Wavelength:	0.0498	m	λ	$300/f$

Behavior of EM Fields as a Function of Distance

The behavior of the characteristics of EM fields varies depending on the distance from the radiating antenna. These characteristics are analyzed in three primary regions: the near-field region, the far-field region and the transition region. Of interest also are the region between the antenna main reflector and the subreflector, the region of the main reflector area and the region between the main reflector and ground.

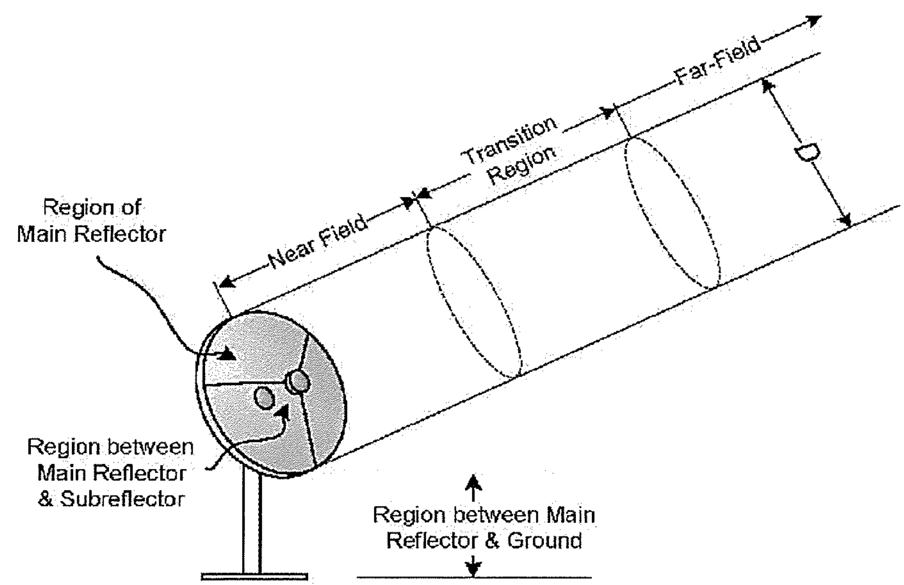

Figure 1. EM Fields as a Function of Distance

For parabolic aperture antennas with circular cross sections, such as the antenna under study, the near-field, far-field and transition region distances are calculated as follows:

Parameter	Value	Unit	Formula
Near Field Distance:	28.920	m	$R_{nf} = D^2/(4\lambda)$
Distance to Far Field:	69.408	m	Rff = 0.60D2/(λ)
Distance of Trasition Region	28.920	m	Rt = Rnf

The distance in the transition region is between the near and far fields. Thus, Rnf ≤ Rt ≤ Rff . However, the power density in the transition region will not exceed the power density in the near-field. Therefore, for purposes of the present analysis, the distance of the transition region can equate the distance to the near-field.

Power Flux Density Calculations

The power flux density is considered to be at a maximum through the entire length of the near-field. This region is contained within a cylindrical volume with a diameter, D, equal to the diameter of the antenna. In the transition region and the far-field, the power density decreases inversely with the square of the distance. The following equations are used to calculate power density in these regions.

Parameter	Value	Unit	Symbol	Formula
Power Density in the Near-Field	3.361	mW/cm^2	S_{nf}	$16.0\ \eta\ P/(\pi D^2)$
Power Density in the Far-Field	1.440	mW/cm^2	S_{ff}	$GP/(4\pi R_{ff}^2)$
Power Density in the Trans. Region	3.361	mW/cm^2	S_t	$S_{nf} R_{nf} / (R_t)$

The region between the main reflector and the subreflector is confined within a conical shape defined by the feed assembly. The most common feed assemblies are waveguide flanges. This energy is determined as follows:

Parameter	Value	Unit	Symbol	Formula
Power Density at the Feed Flange	1632.3	mW/cm^2	S_{fa}	$4P / a$

The power density in the main reflector is determined similarly to the power density at the feed flange; except that the area of the reflector is used.

Parameter	Value	Unit	Symbol	Formula
Power Density at Main Reflector	4.863	mW/cm^2	$S_{surface}$	$4P / A$

The power density between the reflector and ground, assuming uniform illumination of the reflector surface, is calculated as follows:

Parameter	Value	Unit	Symbol	Formula
Power Density between Reflector and Ground	1.216	mW/cm^2	S_g	P / A

Table 1 summarizes the calculated power flux density values for each region. In a controlled environment, the only regions that exceed FCC limitations are shown below. These regions are only accessible by trained technicians who, as a matter of procedure, turn off transmit power before performing any work in these areas.

Power Densities	**mW/cm2**	**Controlled Environment (5 mW/cm2)**
Far Field Calculation	1.440	Satisfies FCC Requirements
Near Field Calculation	3.361	Satisfies FCC Requirements
Transition Region	3.361	Satisfies FCC Requirements
Region between Main and Subreflector	1632.3	Exceeds Limitations
Main Reflector Region	4.863	Satisfies FCC Requirements
Region between Main Reflector and Ground	1.216	Satisfies FCC Requirements

Table 1. Power Flux Density for Each Region

In conclusion, the results show that the antenna, in a controlled environment, and under the proper mitigation procedures, meets the guidelines specified in 47 C.F.R. § 1.1310.

Radiation Hazard Study

Prodelin 2.4m C (1244)

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Input Parameters

The following input parameters were used in the calculations:

Parameter	Value	Unit	Symbol
Atenna Diameter:	2.4	m	D
Antenna Transmit Gain:	42.00	dBi	G
Trasmit Frequency:	6250	MHz	f
Feed Flange Diameter:	13.10	cm	d
Power Input to the Antenna:	55.00	W	P

Calculated Parameters

The following values were calculated using the above input parameters and the corresponding formulas.

Parameter	Value	Unit	Symbol	Formula
Anenna Surface Area:	4.52	m^2	A	$\pi D^2/4$
Area of Feed Flange:	134.78	cm^2	a	$\pi d^2/4$
Antenna Efficiency:	0.64		η	$G\lambda^2/(\pi^2 D^2)$
Gain Factor:	15848.93		g	$10^{G/10}$
Wavelength:	0.0480	m	λ	$300/f$

Behavior of EM Fields as a Function of Distance

The behavior of the characteristics of EM fields varies depending on the distance from the radiating antenna. These characteristics are analyzed in three primary regions: the near-field region, the far-field region and the transition region. Of interest also are the region between the antenna main reflector and the subreflector, the region of the main reflector area and the region between the main reflector and ground.

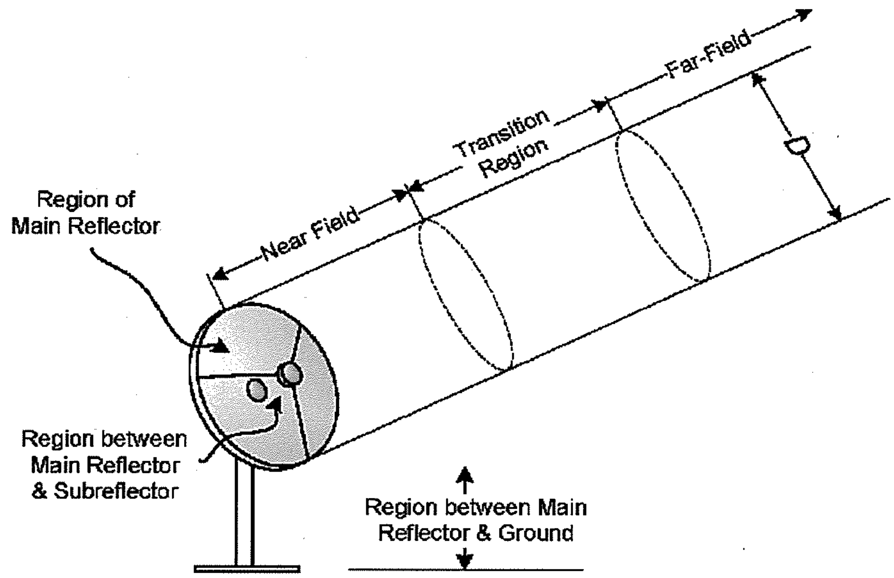

Figure 1. EM Fields as a Function of Distance

For parabolic aperture antennas with circular cross sections, such as the antenna under study, the near-field, far-field and transition region distances are calculated as follows:

Parameter	Value	Unit	Formula
Near Field Distance:	30.000	m	$R_{nf} = D^2/(4\lambda)$
Distance to Far Field:	72.000	m	Rff = 0.60D2/(λ)
Distance of Trasition Region	30.000	m	Rt = Rnf

The distance in the transition region is between the near and far fields. Thus, Rnf ≤ Rt ≤ Rff . However, th power density in the transition region will not exceed the power density in the near-field. Therefore, for purposes of the present analysis, the distance of the transition region can equate the distance to the near-field.

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The power flux density is considered to be at a maximum through the entire length of the near-field. This region is contained within a cylindrical volume with a diameter, D, equal to the diameter of the antenna. In the transition region and the far-field, the power density decreases inversely with the square of the distance. The following equations are used to calculate power density in these regions.

Parameter	Value	Unit	Symbol	Formula
Power Density in the Near-Field	3.124	mW/cm^2	S_{nf}	$16.0\ \eta\ P/(\pi D^2)$
Power Density in the Far-Field	1.338	mW/cm^2	S_{ff}	$GP/(4\pi R_{ff}^2)$
Power Density in the Trans. Region	3.124	mW/cm^2	S_t	$S_{nf} R_{nf} /(R_t)$

The region between the main reflector and the subreflector is confined within a conical shape defined by the feed assembly. The most common feed assemblies are waveguide flanges. This energy is determined as follows:

Parameter	Value	Unit	Symbol	Formula
Power Density at the Feed Flange	1632.3	mW/cm^2	S_{fa}	$4P\ /\ a$

The power density in the main reflector is determined similarly to the power density at the feed flange; except that the area of the reflector is used.

Parameter	Value	Unit	Symbol	Formula
Power Density at Main Reflector	4.863	mW/cm^2	$S_{surface}$	$4P\ /\ A$

The power density between the reflector and ground, assuming uniform illumination of the reflector surface, is calculated as follows:

Parameter	Value	Unit	Symbol	Formula
Power Density between Reflector and Ground	1.216	mW/cm^2	S_g	$P\ /\ A$

Table 1 summarizes the calculated power flux density values for each region. In a controlled environment, the only regions that exceed FCC limitations are shown below. These regions are only accessible by trained technicians who, as a matter of procedure, turn off transmit power before performing any work in these areas.

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In conclusion, the results show that the antenna, in a controlled environment, and under the proper mitigation procedures, meets the guidelines specified in 47 C.F.R. § 1.1310.