SkyWire
COMMUNICATIONS, INC.

HAZARD STUDY SUMMARY

UPLINK SPECS

Truck Designation:	World One
Frequency(Hz):	1.4 - 1.45E+10
Antenna Model:	Andrew ESA 2.4 VSM
Antenna Diameter (m):	2.4
Antenna Area (m ^ 2):	4.52
Antenna efficiency:	0.68
Amplifier Model:	MCL 300W Ku TWTA
Amplifier Config.:	Single Thread or Phase Combined

POWER LEVELS

	Watts	dB
Nominal at Output Flange:		
Phase Combined:	479.00	24.1
Single Thread:	260.00	22.0
Line Loss:		
Max. at antenna input flange:		
Phase Combined:	480.00	24.7
Single Thread:	260.00	22.0
Antenna Gain@ 14.5 Ghz(dB)		50.10

NEAR FIELD CALCULATIONS

Extent of near field (Rnf)
In Meters: 68.4

Maximum near-field
density(Snf) in mW/cm ^ 2:
Phase combined: 28.8
Single Thread: 15.64

TRANSITION ZONE
Zone midpoint (M) 116

Transition Zone Power
density(St) in mW/cm ^ 2:
Phase Comb: 17.0
Single Thread: 9.2

FAR FIELD CALCULATIONS

Beginning of Far Field(Rff)
In Meters: 164.16

Far-field power density(Sff)
in mW/cm ^ 2:
Phase Combined: 14.5
Single Thread: 7.86

EDGE OF PRIMARY REFLECTOR
Power density (W) for edge of
primary reflector in mW/cm ^ 2:
Phase Combined: 10.6
Single Thread: 5.7

EXHIBIT 1

ENGINEERING STATEMENT CONCERNING THE APPLICATION OF SKYWIRE COMMUNICATIONS, INCORPORATED, FOR A LICENSE FOR A TRANSMIT/RECEIVE Ku-BAND TEMPORARY FIXED EARTH STATION.

RADIATION HAZARD STUDY

1. INTRODUCTION

This study has been performed by SkyWire Communications, Inc. to establish the potential radiation hazard that could exist in the vacinity of a transmit/receive 14/12 Ghz temporary fixed earth station which employs a 2.4 meter Andrew model ESA-2.4 VSM antenna.

OST Bulletin 65 specifies a maximum exposure level over a 6-minute period of an average power level of 5mW/cm^2. This study examines the near-field, far-field, and transition zones as well as the edge of the main reflector. These are the areas that are most likely to present a hazard to the general public.

The occasion of this study is to provide all necessary documentation for SkyWire's application for temporary fixed earth station authorization for HPA type, output, and antenna gain in both half and full transponder analog video mode, as described on the submitted FCC form

The amplification system consists of two MCL 300-watt High Power Amplifiers feeding a variable phase combiner. Calculations are made for single-thread(one HPA through the phase combiner) and two amplifiers combined. Power levels are nominal based on MCL test data and actual measurements.

2. POWER LEVELS

NOMINAL OUTPUT OF PHASE COMBINER AT FLANGE:
24.1 DBW (479 WATTS)

NOMINAL OUTPUT OF ONE HPA AT FLANGE FOR SINGLE THREAD OPERATION:
22.0DBW (260 WATTS)

LINE LOSS:
2.1 DB (VERTICAL FEED HORN)

MAXIMUM POWER LEVEL AT ANTENNA INPUT FLANGE:
Phase combiner: 24.7DBW(480 Watts)
Single Thread: 22.0DBW(260 Watts)

ANTENNA GAIN AT 14.2 gHZ: 50.1 DBI - DIAMETER: 2.4 METERS

3. NEAR-FIELD CALCULATIONS

The near-field or Fresnel region is defined by the equation:

R(nf)=D^2/4(L)

where:
R(nf) = extent of near-field
D = antenna diameter
L = wavelength (at 14 Ghz)

R(nf) = (2.40m)^2/4(.021m)

R(nf) = 68.4 meters

The maximum power density in the near-field is defined by:

S(nf) = 16NP/Pi(D^2)

where:
S(nf) = maximum near-field density
N = apeture efficeincy(.68)
P = power at antenna input flange(479 watts)
D = antenna diameter (2.4m)

FOR PHASE COMBINER

16(.68)(479 watts)/3.14(2.40m)^2

S(nf) = 288.09 watts/meter^2

or

S(nf) = 28.8 mW/cm^2

This is above the maximum allowable level of 5mW/cm^2.

FOR SINGLE THREAD:

16(.68)(260 watts)/3.14(2.40m)^2

S(nf) = 156.37W/M^2

or

S(nf) = 15.64 mW/cm^2

This is above the maximum allowable level of 5 mW/cm^2

4. FAR-FIELD CALCULATIONS

The distance to the beginning of the far-field is given by:

R(ff) = 0.6(D^2)/L

where:
R(ff) = distance to the beginning of the far-field
D = antenna diameter
L = wavelength

R(ff) = 0.6(2.40m)^2/.021m

R(ff) = 164.16 meters

The far-field density is given by:

S(ff) = PG/4Pi(R^2)

where:

S(ff) = on-axis power density
P = power at the input flange (479 watts)
G = antenna gain (50.1 dbi)
R = distance of interest (here, R(ff))

FOR PHASE COMBINER:

S(ff) = (479 watts)(102.3E3)/4(3.14)(164.16m)^2

S(ff) = 144.8 W/M^2

or

S(ff) = 14.5 mW/cm^2

This is above the maximum allowable level of 5 mW/cm^2.

FOR SINGLE THREAD:

S(ff) = (260 watts)(102.3E3)/4(3.14)(1364.16m)^2

S(ff) = 78.6 W/M^2

or

7.86 mW/cm^2

This is above the maximum allowable level of 5 mW/cm^2.

5. TRANSITION ZONE

For analysis purposes, the maximum power density of the near-field is calculated, and this value is assumed for every location in the transition zone.

FOR PHASE COMBINER:

The value calculated above is 28.0 mW/cm^2. This is well above the maximum level of 5 mW/cm^2.
The power density at the beginning of the far-field calculated above is 14.50 mW/cm^2, above the maximum of 5 mW/cm^2.

FOR SINGLE THREAD:

The value calculated above is 15.64 mW/cm^2. This is well above the maximum level of 5 mW/cm^2.
The power density at the beginning of the far-field calculated above is 7.86mW/cm^2. This is above the maximum level of 5mW/cm^2.

Power density in the near-field decreases inversely with distance; power density in the far-field decreases inversely with the square of the distance. Power density in the transition zone between the near and far fields decreases with not quite the square of the distance.

Power density in the transition zone is given by:

$$S(t) = (S(nf))(R(nf))/R(d)$$

where:

S(t) = power density in the transition zone
S(nf) = near field density(calculated above)
R(nf) = extent of near-field (calculated above)
R(d) = distance to the point of interest (in the transition zone)

a distance of 116 meters is used for R(d) in this case, which is about midpoint of the transition zone.

FOR PHASE COMBINER:

$$S(t) = (288.09 \text{ watts/meter}^2)(68.4 \text{ meters})/116 \text{ meters}$$

$$S(t) = 169.9 \text{ watts/meter}^2$$

or

$$S(t) = 17.0 \text{ mW/cm}^2$$

This is above the maximum allowable level of 5 mW/cm^2.

FOR SINGLE THREAD:

$$S(t) = (156.4 \text{ watts/meter}^2)(68.4)/116 \text{ meters}$$

$$S(t) = 92.2 \text{ W/M}^2$$

or

$$9.2 \text{ mW/cm}^2$$

This is above the maximum allowable limit of 5mW/cm^2.

6. EDGE OF PRIMARY REFLECTOR

Power density at the edge of the primary reflector, assuming even distribution, is given by:

$$W = P/A$$

where:

P = power at the input flange
A = area of the primary reflector

FOR PHASE COMBINER:

$$W = 479 \text{ watts}/4.52 \text{ meter}^2$$

$$W = 106 \text{ W/M}^2$$

or

$$W = 10.6 \text{ mW/cm}^2$$

This is above the limit of 5 mW/cm^2.

FOR SINGLE THREAD:

$$W = 260 \text{ watts} / 4.5 \text{ meter}^2$$

$$W = 57.7 \text{ W/M}^2$$

or

$$W = 5.7 \text{ mW/cm}^2$$

This is above the limit of 5 mW/cm^2.

7. CONCLUSION

All of the values calculated above are above the limit of 5 mW/cm^2, as would be expected for an antenna of this size.

The RPGL limit of 5mW/cm^2 (main beam) will be met at a distance of 279 meters for the phase combiner. The single thread is 206 meters. This was calculated by setting the far-field equation in Section 4 equal to 5mW/cm^2 or 50W/m^2, and solving for distance.

The antenna is mounted on top of a vehicle with it's base about 10 feet above ground level. In addition, the antenna is typically aimed at satellites greater than 15 degrees above the horizon. The solid volume encompassing the near-field and far-field will be above the area where the general public will be (on the ground) during transmission.

The roof area adjacent to the antenna is hazardous. This area is accessed only by SkyWire Communications Inc. Personnel, and ONLY when the transmitter is disabled. They are instructed to the hazard that exists, and to stay off the roof during transmisions. They will be provided with a copy of this study. This area will also be posted with standard radiation hazard signs.

Prepared by:

SKYWIRE COMMUNICATIONS, INCORPORATED.

Joseph J. Silvio

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SkyWire Engineer

EXHIBIT TWO

FREQUENCY CO-ORDINATION LIMITS

This application is for a Temporary - Fixed Earth Station, for Domestic - Fixed Satellite Service. For each individual transmit/recieve event, the exact parameters of the following:

(b) Range of Satellite Arc

(c) Antenna Elevation Angle

(d) Earth Station Azimuth

will be dependent upon the physical location of the above listed Earth Station at the time of the event. Although the above mentioned locations will vary, ALL transmit/receive events will be to the Domestic-Fixed Satellite Arc, and ALL locations will be within the accepted geographic limits for this service.

ALL transmissions will be between 14.0 - 14.5 Ghz, with a Maximum EIRP Density (as listed) of 74.8 dBW/4Mhz.

ALL receive signals will be between 11.7 - 12.2 Ghz, with a receive gain of 48 dBI @ 11.5 Ghz.

SkyWire Communications, Inc.

Temporary Fixed Earth Station

EXHIBIT IV - ENGINEERING STATEMENT FOR FCC-

This Engineering Statement has been prepared on behalf of SkyWire Communications, Inc., to supply certain calculations of Maximum EIRP (dBw) and Maximum EIRP Density (dBw/4kHz), as requested in FCC Form #493, page 3, paragraph 16 (d) and (e).

The applicant proposes to employ a Andrew Corporation model ESA-24-VSM-Ku-1 dual offset type linearly polarized Ku-band antenna. The true diameter of the antenna is 2.4 meters, and lists a gain of 50.1 dBi @ 14.25 GHz. The transmitting equipment will consist of two MCL Inc. Model MCL10999 High Power Amplifiers, whose combined output will be limited to 480 watts. The maximum input power at the antenna flange is 24.7dBW.(NOTE: All power level figures are for levels through the phase combiner, as calculated and listed in Exhibit 1, "RADIATION HAZARD STUDY")

The maximum allowed power into an earth station antenna for full transponder operation with an analog television carrier is 500 watts or 26.99dBW, rounded to 27 dBW. The maximum Effective Isotropic Radiated Power (EIRP) in dBW is found by the expression:

(Antenna Input) + (Antenna Gain) = EIRP

(24.7 dBW) + (50.1 dB) = EIRP

74.8 dBW = EIRP

Two emissions of NTSC Video & Audio are proposed for this temporary fixed earth station. The first is 36MOF8W, and the second is 24MOF8W, both centered at 14.25 GHz. The maximum EIRP density in dBW/4kHz is found by the expression:

For36MOF8W:

(Max. EIRP) - (Transmit gain) - 10log(assigned bandwith/4000))
(74.8 dBW) - (50.1 dB) - (10log(36,000,000/4000)
(24.7 dBW) - 39.54
-14.84dBW/4kHz

For 24MOF8W:

(74.8 dBW) - (50.1 dB) - (10log(24,000,000/4000))
(24.7dBW) - 37.78
-13.08dBW/4kHz

The maximum permissable power density into an earth station antenna for an analog carrier is: -8.0dBW/4kHz. Hence, this applicant's proposal is well within the FCC limit of 27.0dBW maximum power into an earth station antenna, as well as the limit of -8.0dBW/4kHz maximum power density into an earth station antenna. If further comparison to present standards is desired, the reader is referred to the Earth Station processing standards for the FCC's Satellite Engineering Branch.

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SkyWire Communications, Inc.