

Namaste Antenna Requirements

Version 1

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Version 2

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Single Geostationary Payload

ANTREQ 1. **Inclusion**

The antenna may or may not be included when the ground station is purchased.

1.1 An antenna and support structure that meets emergency communications applications specifications shall be provided with the ground station unless other arrangements have been made or unless providing the antenna and support structure exceeds the amount budgeted for the ground station.

1.2 Specifications on antenna requirements shall be supplied with the ground station.

ANTREQ 2. **Storage and Shipping**

The supplied antenna and support structure shall be easy to store and transport.

Commercial packaging is expected to provide necessary protection for amateur radio applications.

For emergency communications applications, storage and shipping requirements will affect the design. If the antenna is not easy to transport and cannot be reasonably stored or shipped without damage, then it is not useful in emergency communications. Requirements under investigation.

2.1 Antenna shall weigh less than 30lbs.

2.2 Antenna and support structure shall fit into a container that can fit into the trunk of a car.

ANTREQ 3. **Setup**

The supplied antenna and support structure shall be easy to set up as fixed or portable device. Learning how to deploy the antenna and support structure for fixed and portable use must be as easy as possible. Instructions need to be easily available for fixed and portable use and need to be as language-independent as possible.

3.1 Deployment Procedures for fixed and portable use will be included with, and preferably printed on, the supplied antenna and support structure.

3.2 A design that meets the requirements shall require an operator familiar with the procedure less than 5 minutes to set up in a typical portable application, which consists of outdoors on level ground.

3.3 Deployment Procedures for fixed and portable use shall consist of simple illustrations and no explanatory text.

ANTREQ 3. Downlink Technical

The figure of merit for receiver performance at the system level shall be G/T, the ratio of antenna gain in dB to system equivalent noise temperature in degrees Kelvin.

Signal to noise ratio is proportional to G/T.

There are many open questions that affect G/T. These are under investigation.

Namaste Downlink G/T and RF Level Analysis (Partial and Preliminary)

"Downlink design must meet G/T requirements and deliver sufficient carrier power to the downconverter and demodulator. The G/T analysis considers the total received noise due to the antenna, waveguide, low noise amplification, and subsequent stages. This is evaluated against the net antenna gain as measured at the same reference point in the earth station RF receive section. The gain budget technique is then used to verify signal level in the same manner as for the uplink." - The Satellite Communication Ground Segment and Earth Station Handbook

$$N_o = k \cdot T_{eq} \cdot B$$

N_o = noise spectral density in watts per hertz

k = boltzman's constant

T_{eq} = equivalent noise temperature in Kelvin

B = bandwidth of interest

$$T_{sys} = (T_a/L_r) + ((L_r-1)/L_r) \cdot 290 + T_{re}$$

T_a = antenna temperature assumed to be equal to or greater than 50K. See below.

L_r = the loss factor for the input receive waveguide or transmission line, and is greater than or equal to 1

290 = assumed physical temperature of the waveguide

T_{re} = equivalent noise temperature of the receiver including noise added by stages downstream of the LNA. 120K – 150K is currently assumed.

It is critical to control waveguide loss and to use low noise amplifiers.

Antenna temperature for reflector antennas is generally under 50K for dishes larger than about 40 wavelengths.

E.g. 3m at C band. We have to limit to 1m. What is the effect on the noise temperature when you reduce the diameter of the reflector to 1/3 of the diameter of 40 wavelengths?

The situation for very broad-beam antennas such as those used for mobile communications is that antenna temperature is often greater than T_{re} . A simple mobile antenna will allow ground noise to enter at nearly the same gain as the desired signal.

G/T budget

The evaluation of G/T at this point is the ratio of the gain to the system noise temperature measured at the same point in the receiving system. For example, at the input to the LNA. Remember to reduce the antenna gain by the amount of waveguide loss.

ANTREQ 4. Uplink Technical

The figure of merit for transmitter performance at the system level shall be EIRP, the effective isotropic radiated power.

There are many open questions that affect EIRP. These are under investigation.

ANTREQ 5. Antenna polarization shall be x.

The system requires a particular polarization to work. Antenna polarization is not known at this time.