GEONETCast Americas (GNC-A) Guide: Equipment Specification, Component Identification and Selection Discussion

Version 2.2.0: June 11, 2014

Note: Please be sure to check for updates of this document by visiting: http://www.geonetcastamericas.noaa.gov under the Users/About Receive Stations Tab

Introduction

This document is intended to provide an overview of a GEONETCast Americas ground station, its components, and helpful discussion to relating the experience of those who have installed one or more stations in an operational setting. Annex 4 lists makes and models of equipment used in several successful ground stations.

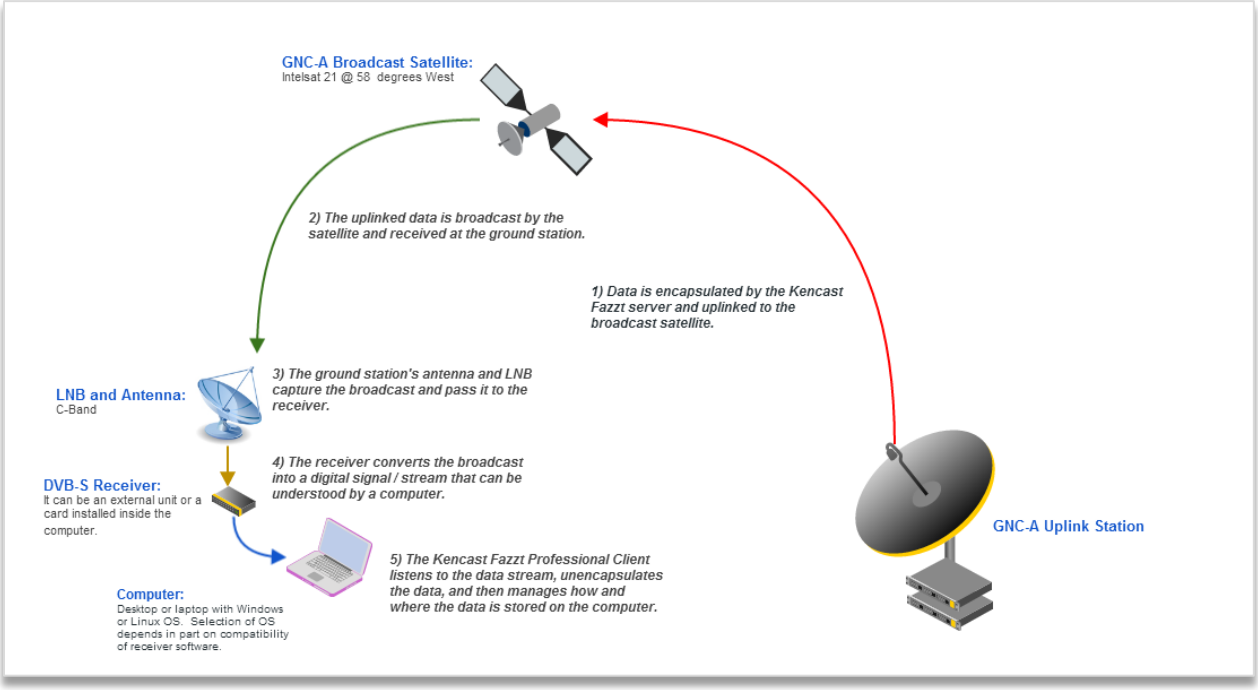
While the guide can be utilized to price out basic components, please realize that the full cost to install can be much more than a computer, antenna, receiver, and software. The emphasis here is a baseline specification. Typically each site installation will face unique challenges or have requirements that go beyond the baseline. To successfully install a station might require the consultancy of structural engineers, specialized equipment to filter out terrestrial radio frequency interference, and creative solutions to account for topography or dense urban areas.

The guide should be enough to start the design and pricing of a basic project or single site installation. For those with experience installing similar systems, the technical specifications should answer all basic questions. Those with little or no experience may need to seek advice of a professional, or those within the GEONETCast Americas community, to determine if your site installation and operation has needs that extend beyond the baseline specifications outline here.

Simplified Component Diagram

The following diagram is intended to help those unfamiliar with satellite broadcast systems, or specifically GEONETCast Americas (GNC-A), understand and identify the basic components required to receive data. The component specifications and discussion (informal hints and experience) can be found in the following section.

SEE ANNEX 1 FOR ENLARGED VERSION.



Components

Computer

Basic Specification

- Any computer, with a Windows or Linux operating system (OS), purchased in the last 4 years should suffice.
- Specific OS selection will depend upon software associated with DVB-S / DVB-S2 receiver and Fazzt Client. See discussion.
- While 1GB of RAM will suffice for operation of receiver software and Fazzt; 2GB+ or greater is highly recommended, however, specific memory requirements will depend upon your operational needs.
- Highly recommend operating the Fazzt client through a recent installation of Firefox or Chrome; instead of Internet Explorer.
- Highly recommend getting a very large (1 terabyte or greater) disk drive or even a second, very large disk drive to store downloaded data. This will ease the burden of managing and deleting older, downloaded content.

Discussion

In theory a GNC-A station can run on Linux or Windows, however there are two critical pieces of software that

will be utilized in the station computer. This software dictates the operating system (OS) utilized.

There is the Kencast Fazzt Professional Client, which is used to un-encapsulate received data packets. The client also manages 'subscriptions' to broadcast channels / sub-channels, as well as actual data that is downloaded. Kencast will work on both Windows and Linux; check with Kencast to determine latest supported OS versions. GNC-A stations have been successfully installed with the Fazzt client on Windows XP, Vista, 7, Server 2003 and Server 2008. GNC-A has not attempted a Linux installation.

The second bit of software necessary to successfully operate a GNC-A ground station is that which comes with the DVB-S / DVB-S2 receiver. Often times the receiver software limits your station to older versions of Windows, although that is not universally the case, as there are some receivers available that work with Linux.

Outside of the OS, the specifics of your selected computer largely involve your operational needs, the criticality of the station, and functionally how the downloaded data will be utilized or shared on a local network. If sharing on a location network, 2-3 network cards may be required. Some sort of network attached storage may be required. If operating visualization software to utilize the downloaded data, then more memory, processor, and a faster graphics card will be necessary. That said, GNC-A stations have been set up on extremely minimal computers -- $300 laptops. These are great for basic needs and demonstration, but are probably not suitable for most important operations.

Datacast Client

Basic Specification

- Kencast Fazzt Professional Client
- This is a firm requirement. There is no substitute available.
- Available from, and details at, http://www.kencast.com

Discussion

Fazzt operates on most versions of Windows (untested by GNC-A and partners with Windows 8), and the Fazzt client is designed to operate on Linux as well. However, Linux deployments are so far untested by GNC-A or used in a GNC-A field station. This is largely due to the fact that many DVB-S receiver drivers are compatible only with Windows.

The Kencast Fazzt Professional Client provides a number of receive and data management utilities for GNC-A receive stations, but the critical role of the Client is to un-encapsulate data broadcast by GNC-A. Data management can be performed by other software or custom scripts, although Fazzt provides a number of convenient features.

Receiver

Basic Specification

- Type- DVB-S (DVB-S2 if backwards compatible with DVB-S); with support for IP Data
- Input Freq.- 950-1450 MHz
- Input Symbol Rate- 2-45 Msymbols/s
- Input Filtering- Digital Nyquist filter with 0.2-0.35 roll-off
- Coding- Viterbi 1/2, 2/3, 3/4, 5/6, 7/8, and R/S 188/204
- Throughput- >10 Mbps

- LNB Power- Supply power to LNB, 13-18 Volts DC, 400 mA
- DVB Data- ETSI EN 301-192

Discussion

Any DVB-S or DVB-S2 (with backward capability) receiver meeting the above specification is adequate. There are many models available, but be very careful that the purchased receiver is compatible with the intended operating system (OS) of your computer. The market for DVB-S receivers is small, and cheap receivers are just that; cheap. Depending upon the criticality of your receive station for operations or as a main communication line, a $70 receiver may cost you more in terms of hassle and outages than it saves in initial investment.

As an example a GEONETCast Americas field partner, the IEPAS program at UCAR JOSS, is moving all its sites to a more expensive but durable receiver as the standard. It is using the Novra S75+. The price is ~$300-400. The Novra S75+ also utilizes Ethernet (instead of USB or a PCI card slot) to interface with the receive station computer. By not relying on a USB port, drivers do not have to be updated and there is somewhat more independence from OS versions. As an external receiver, there is not the installation and upgrade issues associated with a PCI card.

Low Noise Block Downconverter (LNB)

Specification:

- Type- C-Band (3.4 – 4.2 GHz) Noise Temperature- <35 K
- Gain- > 60 dB

Discussion

The LNB sits at the feed horn / focal point of the antenna. Various models are available. As a reference many recently deployed GNC-A stations have utilized the Norsat 3525 C-Band (3.4-4.2 GHz) PLL LNB. A PLL (Phase-Locked Loop) LNB will in theory provide better frequency stability and is more suitable for data applications than a DRO (Dielectric Resonator Oscillator) LNB. The cost is typically somewhat more for the PLL, but in the context of overall station equipment and installation budget, the cost difference between a PLL and DRO LNB is minimal. If using a 1.8 meter dish or receiving in a less than ideal location, investment in a PLL LNB is likely worthwhile.

Antenna

Basic Specification

- 2.4 meter, or 1.8 meter in some locations
- Frequency- 3.625-4.20 GHz
- Gain- > 37.5 dBi
- Noise Temperature- <40 K
- X-Pol Isolation- > 27 dB, on axis
- Receive (Rx) only is suitable.
  Transmit and receive antennas will of course work as well.

Discussion

Until recently all deployed dishes have been 2.4 meters, however the replacement of IS9 by IS21 (the commercial satellite utilized by GNC-A) has allowed for the use of 1.8 meter dishes. While the difference

between 2.4m and 1.8m may not sound significant, the slightly smaller dish simplifies shipping and installation logistics (and thereby costs) significantly. A 1.8m dish is highly recommended, if your location supports it. Annex 2 contains a graphic (produced by Knight Sky, http://www.knight-sky.com/) outlining the signal strength of the foot print for a 2.4 meter dish. Areas in blue are good. A similar image from Knight Sky is in Annex 3. It shows the signal strength of the foot print for a 1.8 meter dish. Again, areas in blue are good. If you compare the two images, there is a lot of similarity. For most users in the Americas and Caribbean, a 1.8m dish will suffice. As general guidance the closer to the equator and nearer to 58 degrees west longitude, the better the signal; not accounting for terrestrial interference, topography, and such. The very north western edges of North America, particularly at higher latitudes, will need to double check with Intelsat or a dish provider before investing in a 1.8m dish. Similarly locations in the far eastern Caribbean may need to seek further guidance.

As anecdote a 1.8m dish has been successful setup outside Washington, DC. The signal lock was difficult to obtain (due to local conditions), but once acquired, very few packet losses occurred. At the same time if your installation is 'mission critical' consider dealing with the logistical headache of a 2.4m dish, as it is less likely to be affected by terrestrial interference or 'see' adjacent satellites. The gain of the dish will be better as well.

When selecting a dish, aside from the specifications of gain, noise, size, etc., you can choose a solid model (typically fiberglass) or a mesh / perforated dish. A solid dish is recommended, and currently installed at most GNC-A sites, due to the significantly longer life span, easier maintenance, and better ability to reject 'interference' from adjacent satellites in the view of the dish. Mesh dishes deform more easily (such as in wind), are harder to setup with a correct shape, and simply are not designed with the same operable life in mind as a solid dish. Mesh dishes do not survive high winds any better than solid dishes, as at catastrophic wind speeds, the mesh acts like a solid surface. Having less mass and structure, the mesh dish will deform, most likely, at lower (albeit still damaging) wind speeds.

Speaking of wind, when selecting a dish, examine the technical specifications for wind loading information. The more critical your station, and the more likely your location is to receive damaging winds, the more important this will be for your consideration. You should see two values under wind loading; operational and survival. Operational simply means the dish deforms or shakes or otherwise will not reliably pull a signal at wind speeds exceeding the operational wind loading value. Survival is fairly descriptive. Exceed this and the dish is severely damaged or destroyed.

Other considerations for the antenna, but which are not a strict specification, include whether or not to get an offset feed or not. An antenna with an offset feed is more difficult to 'aim' and setup initially. However, any hired professional should be able to as easily install an offset feed, as a centered feed antenna. Offset antennas do resist terrestrial interference slightly better than center feed antennas.

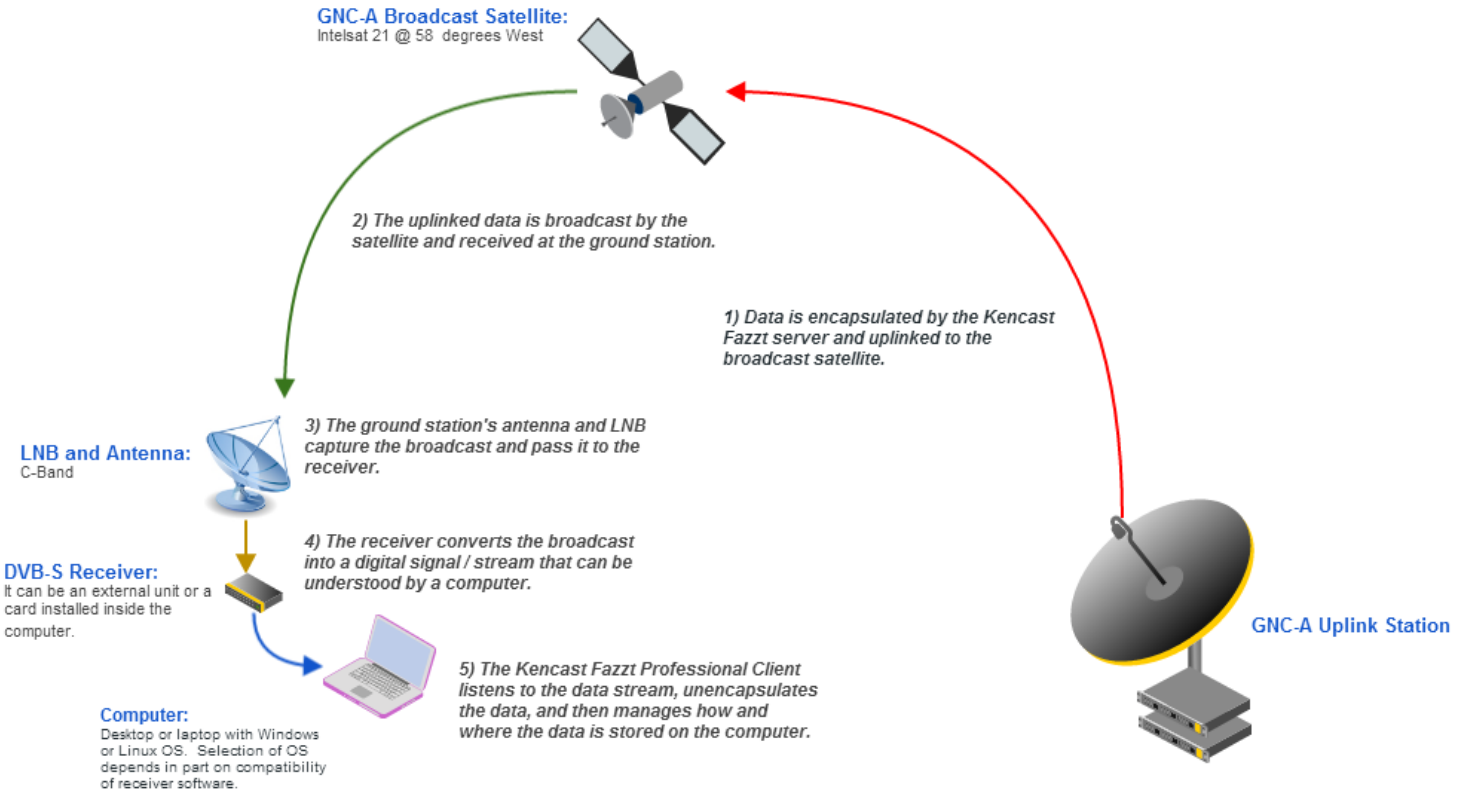
A final consideration for the dish antenna is the mounting. There are a variety of types (pole in concrete, non-penetrating roof mount, etc. etc.). The type you select will depend upon your location and available space, installation location and view of the satellite, as well as likely environmental conditions (wind, snow/ice, etc.). Consider also adding wind bracing to the dish, if operating in a high wind location.

For reference GNC-A partners have deployed stations using these two models:

- General Dynamics SATCOM Technologies 1252 Series 2.4M
- General Dynamics SATCOM Technologies 1183 Series 1.8M

Annex 1

GNC-A Ground Station Simplified Component Diagram


GNC-A Broadcast Satellite:
Intelsat 21 @ 58 degrees West
2) The uplinked data is broadcast by the satellite and received at the ground station.
1) Data is encapsulated by the Kencast Fazzt server and uplinked to the broadcast satellite.
LNB and Antenna:
C-Band
3) The ground station's antenna and LNB capture the broadcast and pass it to the receiver.
4) The receiver converts the broadcast into a digital signal / stream that can be understood by a computer.
DVB-S Receiver:
It can be an external unit or a card installed inside the computer.
5) The Kencast Fazzt Professional Client listens to the data stream, unencapsulates the data, and then manages how and where the data is stored on the computer.
GNC-A Uplink Station
Computer:
Desktop or laptop with Windows or Linux OS. Selection of OS depends in part on compatibility of receiver software.

Annex 2

IS21 C-Band Coverage Estimate for 2.4 Receive Antenna

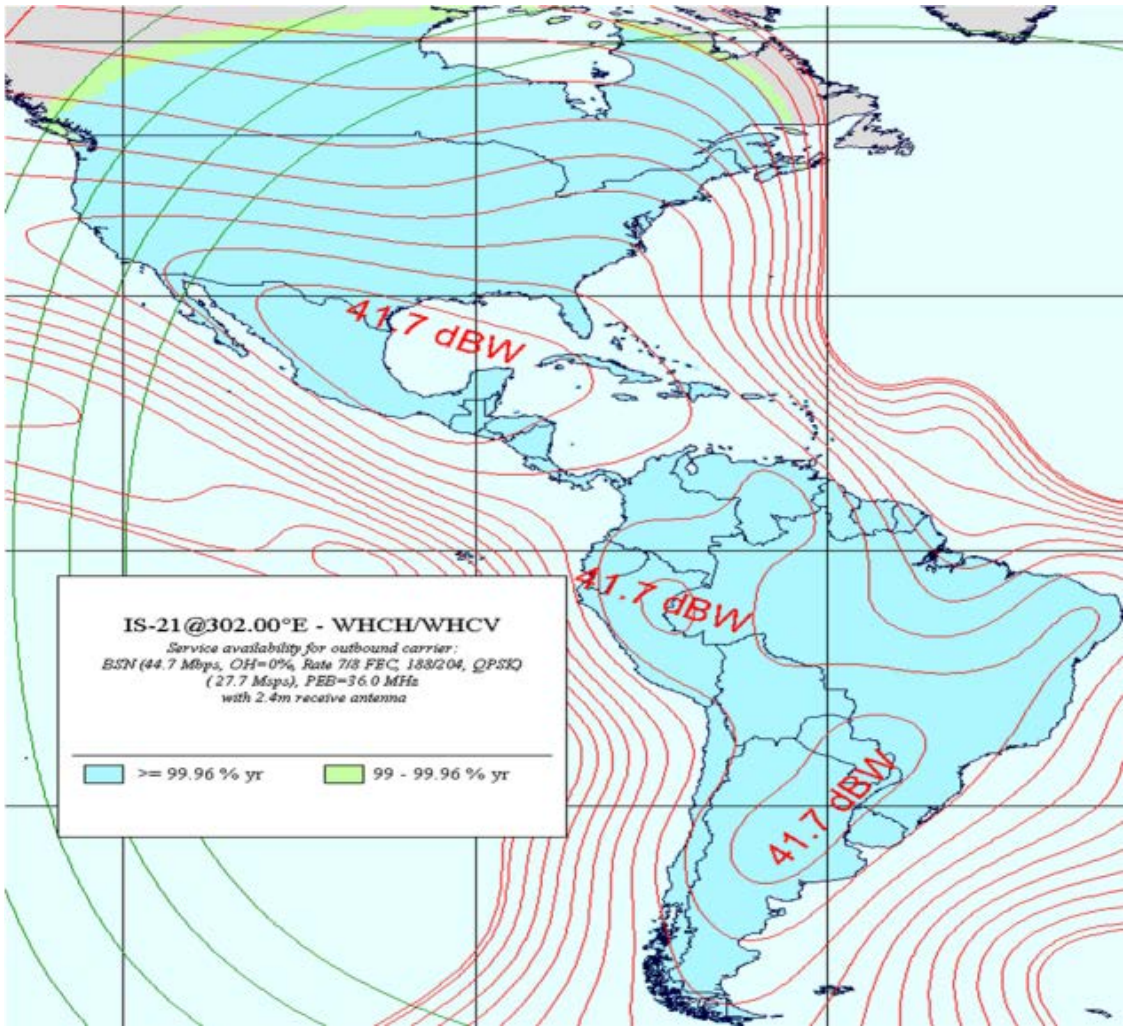
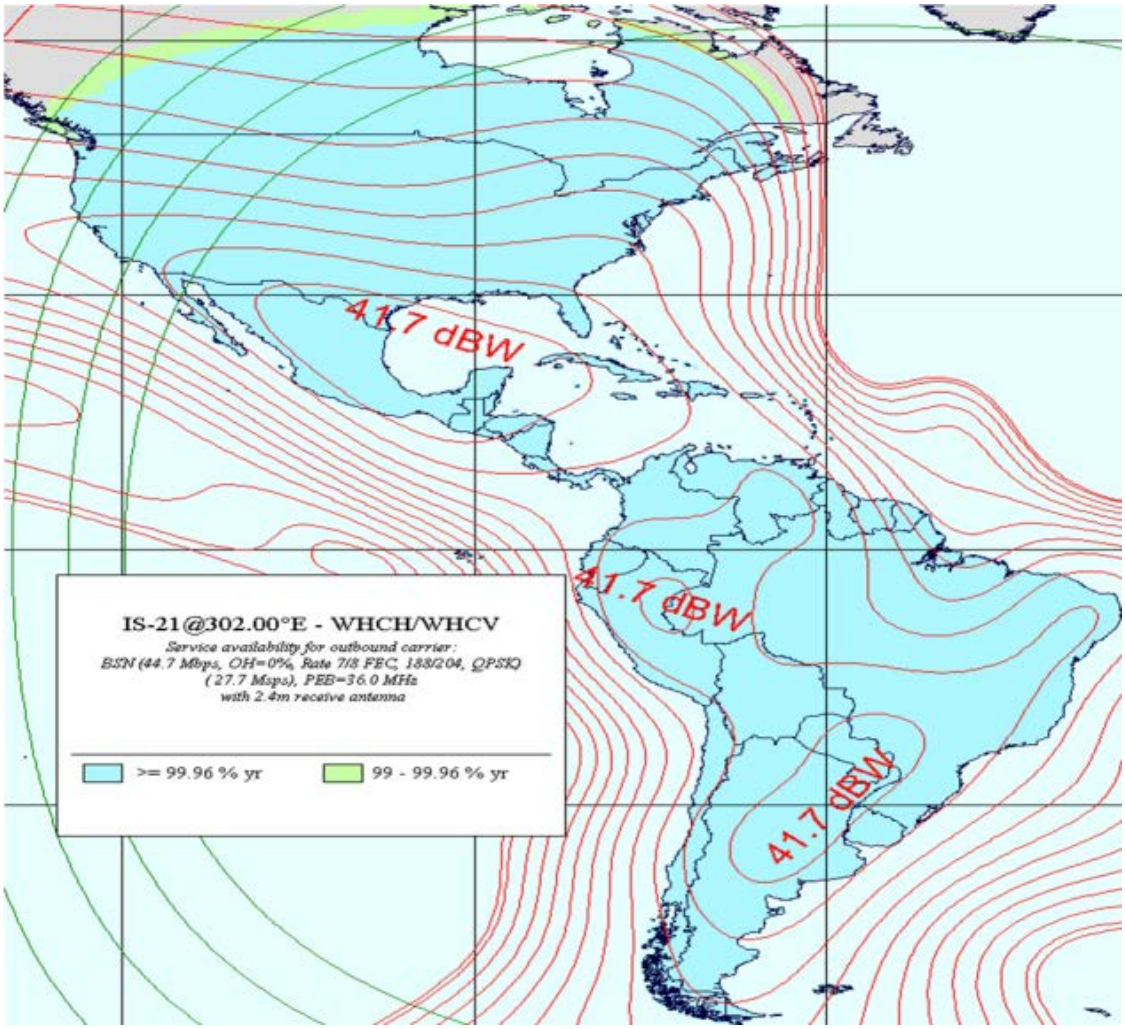


IMAGE PROVIDED BY KNIGHT SKY HTTP://WWW.KNIGHT-SKY.COM/. FOR PURCHASE DECISIONS AND STATION PLACEMENT, REFER TO INTELSAT FOR UPDATES, AS WELL AS SEEK PROFESSIONAL GUIDANCE.

Annex 3

IS21 C-Band Coverage Estimate for 1.8 Receive Antenna



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Annex 4

Example Station Equipment List

The following is not an endorsement of specific equipment, but rather represents makes and models that have been used by GNC-A partners in successful installations. Utilize the list as a guide to look up general pricing and for station design considerations.

Antenna

General Dynamics SATCOM Technologies 1252 Series 2.4M

LNB

Norsat 3525 C-Band (3.4-4.2 GHz) PLL LNB

DVB-S Receiver

Novra S75+

Datacast Client

Kencast Fazzt Professional Client

Computer

Windows 7 Pro
Intel Core i5 Processor
4GB Memory
2x 500GB Hard Drive
2x Ethernet Ports / Network Cards

Dish Mount

Baird PL-2 Non-Penetrating Support System

Other Equipment Considerations and Costs

Co-axial Cable (Length dependent upon distance of dish from receiver. 100-200' normal.)
Caulking, electrical tape, and cable ties.
Grease for dish mounting and nuts.
Weight (sand, brick, etc) to hold non-penetrating support / mount. Concrete for platform.
(For ground sunk pole systems, additional concrete will be needed.)
Structural engineer, if mounting dish on roof or attaching to other structure.
Wind bracing for antenna, if in high wind areas.
Satellite finder and signal meter.
Various tools.