EUMETCast, Satellite Antenna Pointing Guide

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1 INTRODUCTION

The purpose of this manual is to guide a user through the EUMETCast Services Satellite Antenna pointing:

EUMETCast Europe: Ku-Band DVB-S2 (BAS & HVS)

EUMETCast Africa/Americas: C-Band DVB-S.

2 PREREQUISITES

Before performing the antenna pointing please ensure the following have been addressed:

- A properly sized antenna according to the recommendations (see TD15: EUMETCast-Broadcast System for Environmental Data) is installed;
- A recommended DVB-S2 device is available for the EUMETCast Europe Service or a recommended DVB-S/S2 device is available for the EUMETCast Africa/Americas Service;
- If the available recommended device is portable (DVB-Router or USB), the use of a laptop close to the antenna is highly recommended for measuring the signal parameters during the pointing procedure. In this a case power supply close to the antenna is also needed for the DVB-S/S2 device;
- The chosen install location should be unobstructed by trees, branches, buildings, telephone lines, electrical wires, power line, radio & television towers, radars etc. All are possible sources of interference;
- The line-of-sight view to the particular satellite is free of obstacles and obstructions;
- The mast supporting the antenna is rigidly mounted and level;
- The reflector part of the satellite antenna (dish) is not warped;
- The LNB is at the correct distance from the centre of the dish and properly oriented;

3 OUTDOOR AND INDOOR EQUIPMENT

The quality of the outdoor and indoor equipment is very important. All required equipment should be chosen carefully to avoid unnecessary expense later.

3.1 Satellite Dish

The following are highly recommended:

- A good quality dish;
- A parabolic reflector made of material with minimum bending (e.g. reinforced plastic, aluminium, steel, sufficient thickness);
- Dish diameter according to the recommendations (see TD15: EUMETCast-Broadcast System for Environmental Data) ;

- The location must allow the correct orientation of the dish to the satellite. Use the compass;
- No obstacles are between the dish and the satellite;
- Ice/Snow protection (heated dish) in order to keep your satellite dish clear of ice and snow;
- A rain protector for the LNB, especially on small Ku-Band dishes (0.90-1.2 m) ;
- Proper mounting is very important especially in areas susceptible to high winds;
- Lightning protection;

3.2 Feed and LNB

The LNB is a crucial analogue component for reception of the weak satellite signals and for delivering the down-converted L-band signal to the DVB-S/S2 receiver. That's why the user should check the existing LNB and decide if there is a need for it to be replaced. The LNB must also match the antenna geometry (F/D ratio, focal distance).

The noise figure of the LNB is a measurement of how much noise the LNB will add to the signal you may be intending to receive. The gain is a measure of the amplification factor. The lower the noise figure of the LNB and the higher the gain the better the LNB will be able to receive weaker signals. Although high gain LNBs might be useful to compensate losses from long antenna cables, it is more efficient to use low loss cables in this case. The cross-polar isolation is a measure of how much the signals from neighbouring transponders on the different polarisation are suppressed.

For the Ku-Band Universal LNBs some companies advertise the "0.1dB" noise figure specification. This is utterly meaningless. Once the noise figure is below 0.6dB right across both bands (Hi and Lo), then lowering it further would make no discernible difference to reception. With low price consumer LNBs a quality selection by specification cannot be made. It is better to just test different LNBs if the result is not satisfactory. High priced quality LNBs can give an improvement in link margin of 0.5 dB compared to the average consumer device.

In order to increase the link margin it is more cost effective to invest in a larger dish compared to a high priced LNB.

For EUMETCast Europe, EUMETSAT suggests a Universal LNB (HD Reception) which can feed the DVB-S2 receiver in the full Ku band range (10.7 to 12.75 GHz).

For EUMETCast Africa/Americas, EUMETSAT suggests a C-Band LNB which can feed the DVB-S/S2 receiver in the full C-band range (3.4 – 4.2 MHz).

Note: In order to avoid interferences on EUMETCast Africa/Americas, a high performance pre-LNB filter is needed to provide rejection of unwanted out-of-band interference signals, while the low in-band insertion loss preserves system's noise figure. Experience showed that this is especially needed for antenna installations close to an airport.

Where a user has two or more receivers, EUMETSAT suggests the use of a multi output LNB (eg dual, quad LNB) or multi-switches. EUMETSAT does not recommend a satellite signal

splitter as these attenuate the signal and may impact the signalling from the receivers to the LNB.

3.3 Cabling - Connectors

It is recommended that the user checks the existing wiring and F connectors. Be sure that the cable is in a good condition showing no signs of damage or kinking. Ensure that the inner core and braiding are not shorted and that both have electrical continuity. If the user finds that the wiring needs replacing EUMETSAT suggests using only high-quality cable with proper insulation. It is recommended that the cable length be less than 20 meters to prevent signal loss.

The user should also check that the F-connectors are fitted correctly. If the copper insulation touches the inner copper wire, or if the F-connector doesn't touch the outer braid, strong interference can occur resulting in degradation in signal quality.

3.4 EUMETCast Service DVB-S/S2 Devices

All the EUMETCast recommended DVB-S/S2 devices can be found on the EUMETSAT WEB site.

http://www.eumetsat.int/website/home/Data/DataDelivery/EUMETCast/ReceptionStationSetup/index.html

4 POINTING PROCEDURE

Adjusting the satellite dish for best reception is very important, even for small antennas, as over time the pointing will degrade due to wind load.

To understand the importance of a correct adjusting please see 'Appendix A Signal Loss vs Antenna Pointing Error Diagrams'.

For new installations you will need to find the exact elevation, azimuth and skew that gives you the optimal reception. In order to get a clear signal, you need a clear path from your dish to the satellite - no trees or buildings in the way.

There are three steps to successfully installing the satellite dish and optimising it for DVB-S/S2 reception on EUMETCast Satellites.

The first step involves finding your "look angle", the direction in which the dish needs to be pointed to receive the signal. This can be done by utilising the website http://www.dishpointer.com/, where to find the "look angle", you enter your location and the required satellite. Alternatively you can call a local technician for assistance.

The second step is aligning the satellite dish/antenna to the satellite using the azimuth and elevation angles. Use a compass or get the direction from Google maps to select the azimuth. Select the elevation by using the elevation angle scale on the mount bracket. Use a dish pointer tool to optimise the signal. Connect the DVB-S/S2 device and check if you have selected the correct transponder and that EUMETCast can be received.

The third step is optimizing your reception. We suggest a laptop is used in close proximity to the dish and your already configured DVB-S/S2 receiver (see §4 Pointing Procedure), or alternatively remote control software, to enable you to see and optimise the reception via the instantaneous changes in levels.

Depending on your DVB-S/S2 receiver, follow the corresponding setup guide to configure the receiver for the DVB-S/S2 downlink. Make sure you already receive EUMETCast data and read the link margin, EsNo or C/N (or other quality parameter) while moving the dish.

Try moving the dish slightly towards the East or West to find the maximum link margin and fix the azimuth. Then move it fractionally up or down to get the best link margin value. Repeat both steps several times. Then tighten the screws. Sometimes tightening the screws will de-point the dish again. You may have to try several times.

For the DVB-S2 reception, the 'skew' angle of the LNB is very important. The 'skew' angle represents the horizontal/vertical plane of the LNB. When a satellite dish is facing towards a satellite at due South, the plane of the LNB will be vertical (straight down). As the dish is moved around either East or West to receive other Satellites the LNB will need to be tilted (rotated), clockwise for West and counter clockwise for East (as viewed from the rear of the dish). The best way to adjust the LNB skew is to set it at zero degree and then to rotate it in very small steps both ways while keeping an eye on the link margin. Adjust for optimal link margin.

If the user's LNB supports focussing, the user should try to find the best focus point to get the higher possible link margin, towards the dish or away from it.

4.1 DVB-S2 Reception Optimization using Ayecka SR1 Device

1. Check the cabling (+ F-connectors) and LNB condition. An LNB with focusing and tilting capabilities is highly recommended.

2. Install the Virtual COM drivers on a windows laptop and use it close to the antenna for optimizing the reception (connecting the LNB direct to the SR1 and checking the tuner signal measurements, using the SR1 usb connector and putty).
Note: Check the latest EUMETSAT SR1 Setup Guide at EUMETSAT Web Site

3. Move slightly the dish to find the maximum signal strength and fix the azimuth. Then move it fractionally up or down to get the best signal strength. You have to repeat both steps several times. Then tighten the screws. Sometimes tightening the screws will de-point the dish again.
Note: Sometimes this procedure takes more than 1 hour.

For the DVB-S2 reception, the 'skew' angle of the LNB is very important. The 'skew' angle represents the horizontal/vertical plane of the LNB. When a satellite dish is facing towards a satellite at due South, the plane of the LNB will be vertical (straight down). As the dish is moved around either East or West to receive other Satellites the LNB will need to be tilted (rotated), clockwise for West and counter clockwise for East (as viewed from the rear of the dish). The best way to adjust the LNB skew is to set it at zero degree and then to rotate it in very small steps both ways while keeping an eye on the link margin. Adjust for optimal signal strength.

If your LNB supports focussing, you should try to find the best focus point to get the higher possible signal strength, moving the LNB towards the dish or away from it.

Note: Measurement Checking

Check that **1.Tuner Status**, **2.Demodulator Status** & **3.Transport Status** are locked, then check **5. Demodulator Es/No** and **A. Demodulator Link Margin**

```
RX Status 1, Configuration 1
============================
1. Tuner Status                       Locked
2. Demodulator Status                 Locked
3. Transport Status                   Locked             <-------- It Should be Locked
4. Demodulator Frequency Offset       -715 KHz
5. Demodulator Es/N0                  12.2 dB            <-------- It Should be > 10 dB
6. Signal Input Level                 -41.0 dBm
7. Demodulator BER                    0.00 e-7
8. Bad Frame Count                    4
9. Bad Packet Count                   3
A. Demodulator Link Margin            6.3 dB             <-------- It Should be > 5 dB
B. Modulation Order and Code Rate     DVB-S2 8PSK 3/5    <-------- at 8PSK 3/5
C. Link Adaptation                    ACM
D. Pilots                             On
E. Frame Type                         Normal
F. Roll Off                           20%
G. FPGA                               Loaded
```

Figure 1 Ayecka SR1 Measurement Checking - EUMETCast Europe Ku-Band

4.2 DVB-S2 Reception Optimization using NOVRA S300E Device

1. Check the cabling (+ F-connectors) and LNB condition. An LNB with focusing and tilting capabilities is fully suggested.

2. Install Novra's Console Software on a windows laptop and use it, close to the antenna, for optimizing the reception (connecting the LNB direct to the NOVRA S300E and checking the tuner signal measurements).
Note: Check the latest NOVRA S300E Setup Guide at EUMETSAT Web Site

3. Move slightly the dish to find the maximum signal strength and fix the azimuth. Then move it fractionally up or down to get the best signal strength.
You have to repeat both steps several times. Then tighten the screws. Sometimes tightening the screws will de-point the dish again.
Note: Sometimes this procedure takes more than 1 hour.

For the DVB-S2 reception, the 'skew' angle of the LNB is very important. The 'skew' angle represents the horizontal/vertical plane of the LNB. When a satellite dish is facing towards a satellite at due South, the plane of the LNB will be vertical (straight down). As the dish is moved around either East or West to receive other Satellites the LNB will need to be tilted (rotated), clockwise for West and counter clockwise for East (as viewed from the rear of the dish). The best way to adjust the LNB skew is to set it at zero degree and then to rotate it in very small steps both ways while keeping an eye on the link margin. Adjust for optimal signal strength.

If your LNB supports focussing, you should try to find the best focus point to get the higher possible signal strength, moving the LNB towards the dish or away from it.

Note: Measurement Checking

Check that Status, Signal & Data Status are Green, then check the Carrier to Noise (It should be > 10 dB)

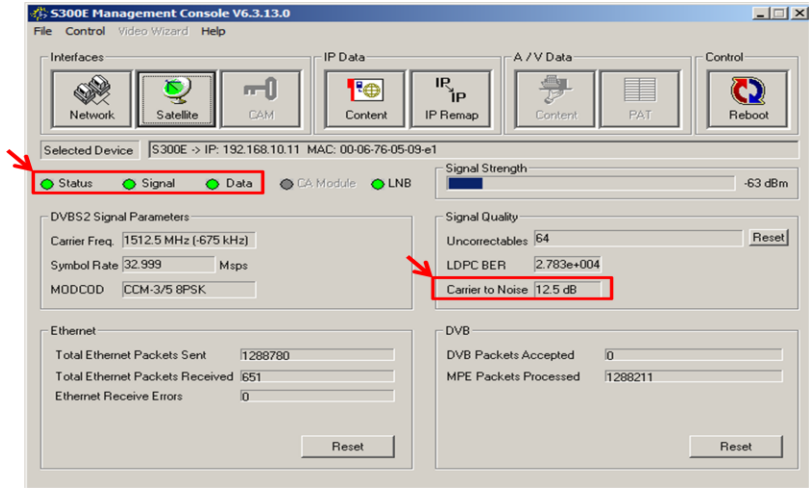


Figure 2 NOVRAS300E Measurement Checking - EUMETCast Europe Ku-Band

4.3 DVB-S2 Reception Optimization using TBS-5925 USB Device

1. Check the cabling (+ F-connectors) and LNB condition. An LNB with focusing and tilting capabilities is fully suggested.

2. Install the TBS-5925 USB drivers and IPtool (or BDADataEx) on a windows laptop close to the antenna, for optimizing the reception (connecting the LNB direct to the TBS-5925 and checking the tuner signal measurements with IPtool (or BDADataEx).

Note: Check the latest TBS-5925 USB Setup Guide at EUMETSAT Web Site

3. Move slightly the dish to find the maximum signal strength and fix the azimuth. Then move it fractionally up or down to get the best signal strength.
You have to repeat both steps several times. Then tighten the screws. Sometimes tightening the screws will de-point the dish again.
Note: Sometimes this procedure takes more than 1 hour.

For the DVB-S2 reception, the 'skew' angle of the LNB is very important. The 'skew' angle represents the horizontal/vertical plane of the LNB. When a satellite dish is facing towards a satellite at due South, the plane of the LNB will be vertical (straight down). As the dish is moved around either East or West to receive other Satellites the LNB will need to be tilted (rotated), clockwise for West and counter clockwise for East (as viewed from the rear of the dish). The best way to adjust the LNB skew is to set it at zero degree and then to rotate it in very small steps both ways while keeping an eye on the link margin. Adjust for optimal signal strength.

If your LNB supports focussing, you should try to find the best focus point to get the higher possible signal strength, moving the LNB towards the dish or away from it.

Note: Measurement Checking

IPTOOL **BDADataEx**

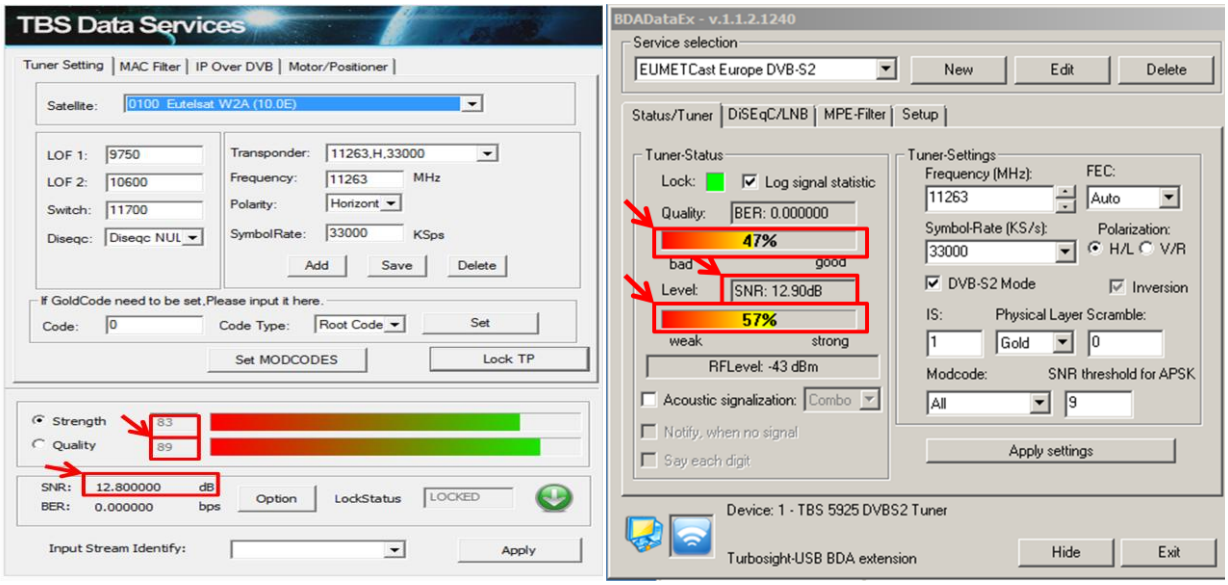
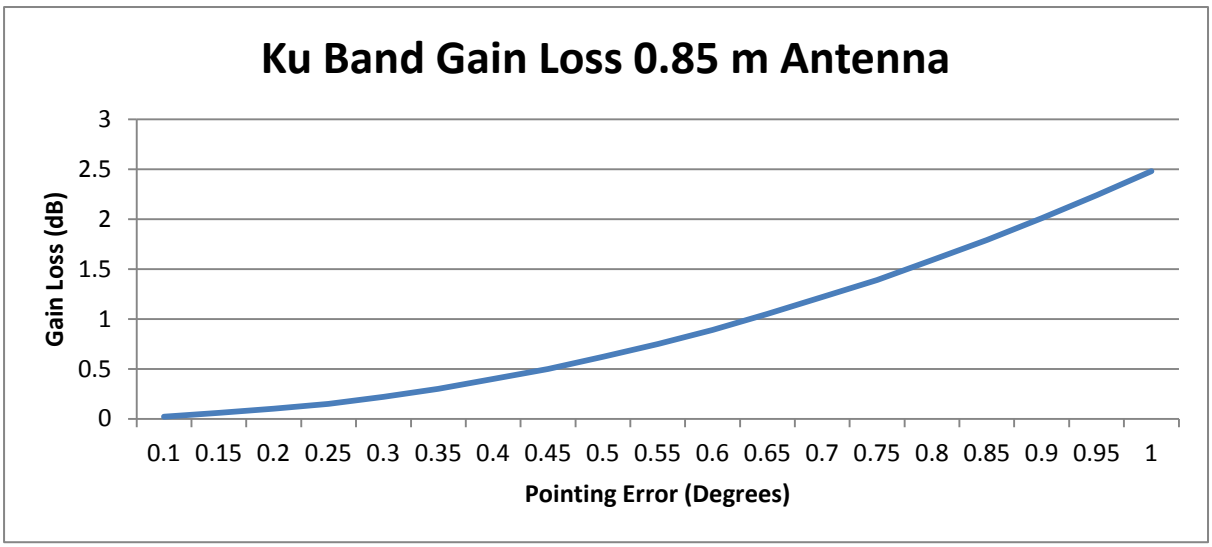


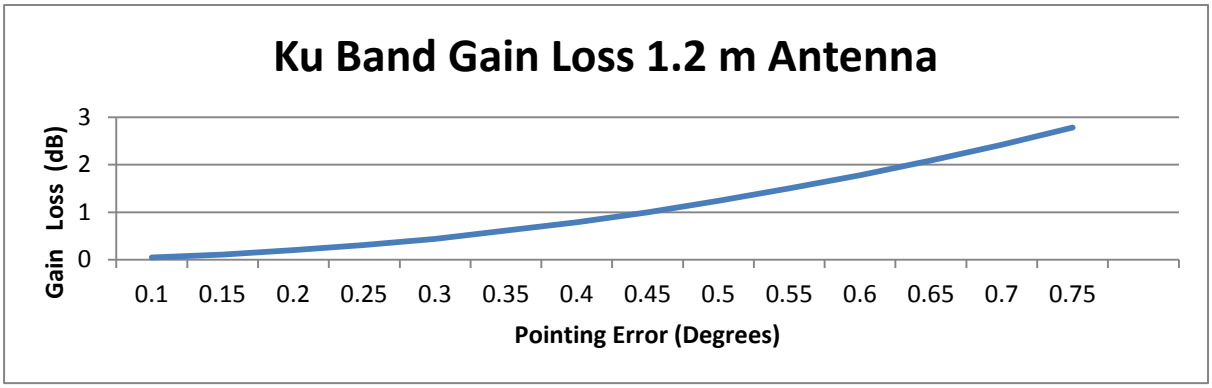
Figure 3 TBS-5925 Measurement Checking - EUMETCast Europe Ku-Band

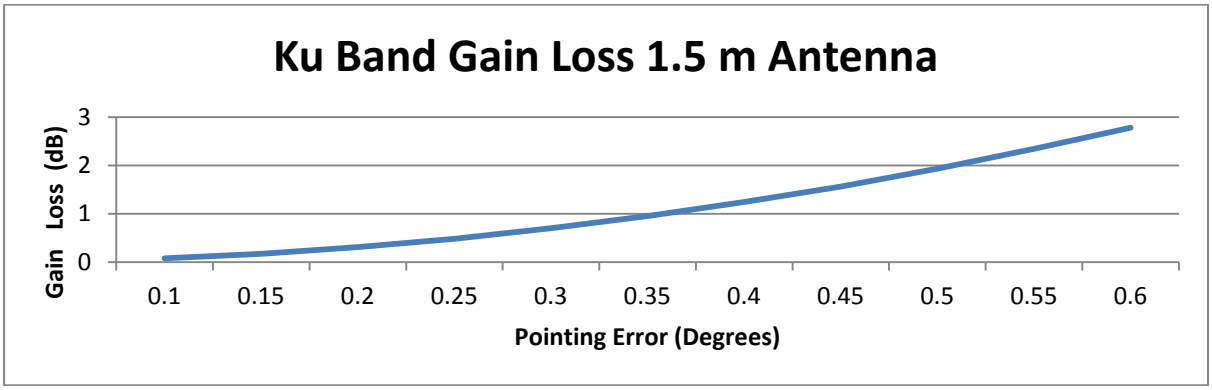
5 ACRONYMS

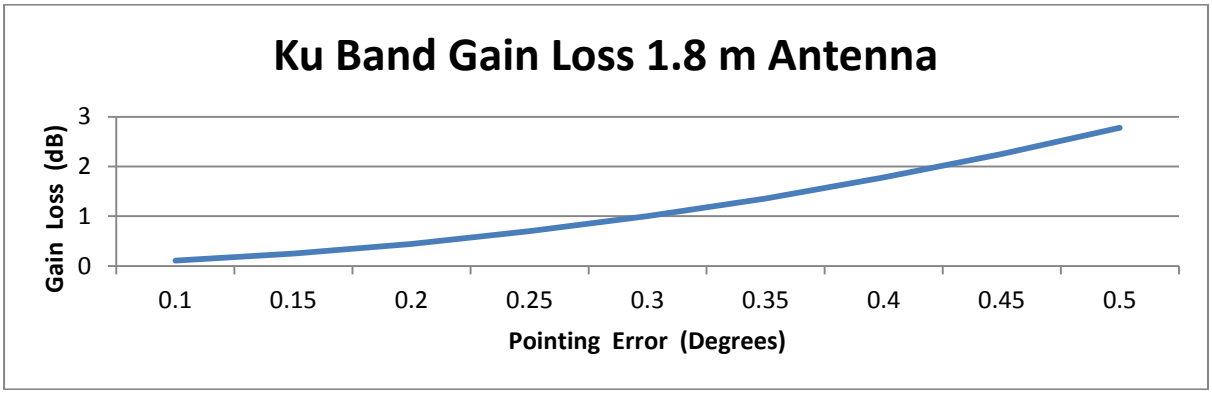
C/N	Carrier-to-noise ratio
BAS	Basic Service
DVB-S, DVB-S2	Digital Video Broadcast, a broadcast standard
EUMETCast	EUMETSAT multicast based broadcast system
EUMETSAT	European Meteorological Satellite Organisation
HD	High Definition
HVS	High Volume Service
LNB	low-noise block downconverter

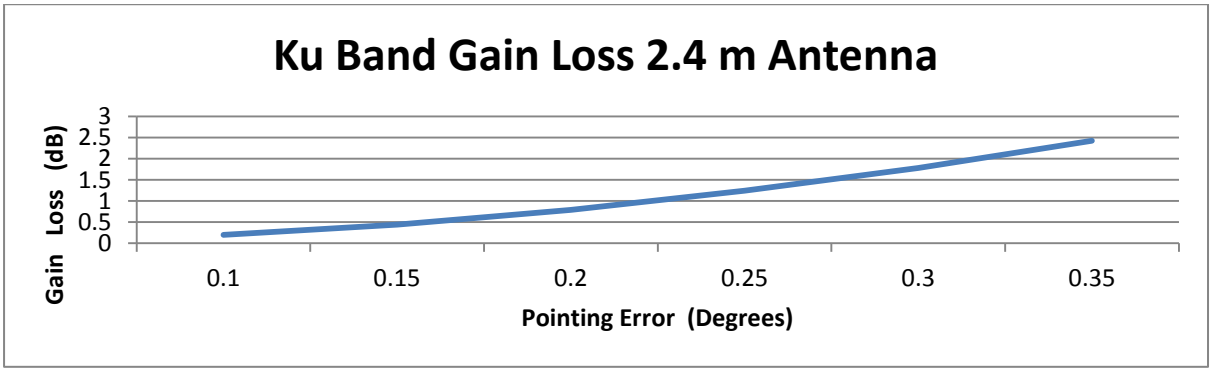
APPENDIX A SIGNAL LOSS VS ANTENNA POINTING ERROR DIAGRAMS

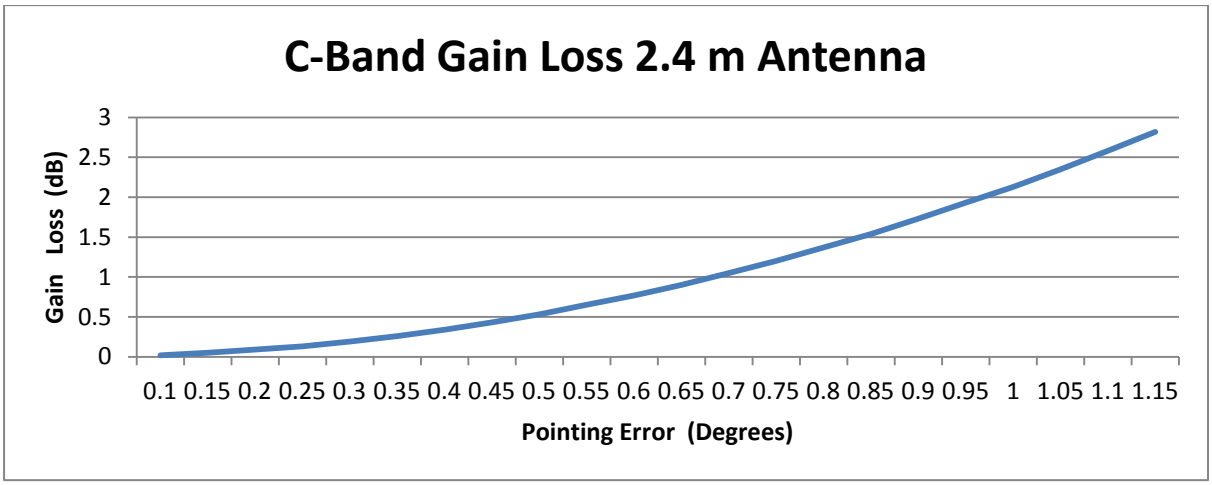


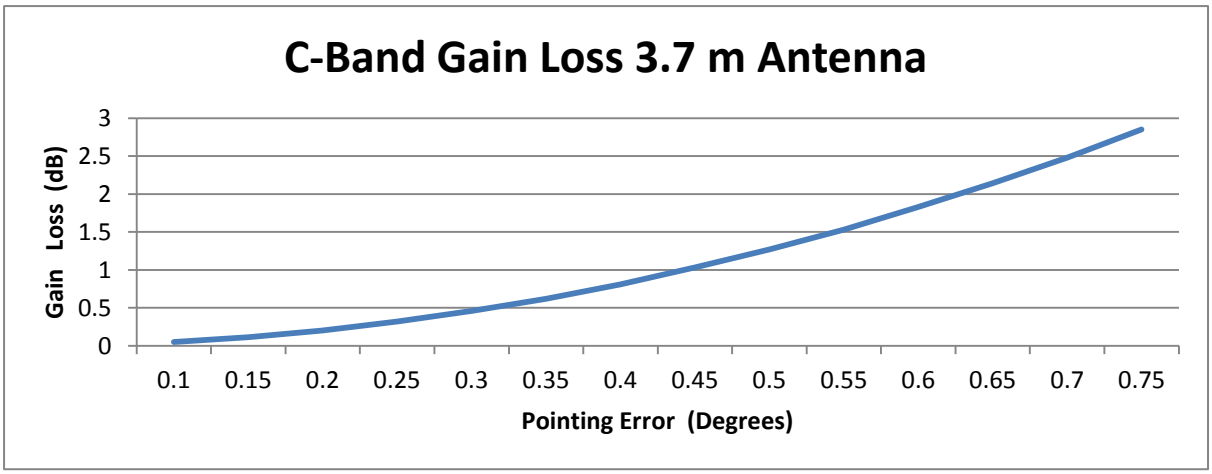





Ku Band Gain Loss 1.8 m Antenna
Gain Loss (dB)
0
1
2
3
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Pointing Error (Degrees)


Ku Band Gain Loss 2.4 m Antenna
Gain Loss (dB)
0
0.5
1
1.5
2
2.5
3
0.1
0.15
0.2
0.25
0.3
0.35
Pointing Error (Degrees)


C-Band Gain Loss 2.4 m Antenna
Gain Loss (dB)
0
0.5
1
1.5
2
2.5
3
0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75 0.8 0.85 0.9 0.95 1 1.05 1.1 1.15
Pointing Error (Degrees)


C-Band Gain Loss 3.7 m Antenna
Gain Loss (dB)
0
0.5
1
1.5
2
2.5
3
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
0.75
Pointing Error (Degrees)