**LINK BUDGET CALCULATIONS FOR HIGH ALTITUDE WEATHER BALLOON**

LINK DISTANCE: 500Km (LOS)

**Free space loss:**

D = 500Km

F = 433MHz

LFS = 32.45 + 20log(500) + 20log(433) = (32.45 + 53.97 + 52.73) dB = **139.15 dB**

**On board antenna:**

Half wave dipole:

Gdipole = **5 dBi**

**GCS antenna:**

3 director 1 reflector Yagi Uda antenna driven by half wave folded dipole:

Gyagi = **12 dBi**

**FOR BALLOON TO GCS COMMUNICATION:**

**PA LNA on balloon as well as GCS.**

PballoonTX = **27 dBm**

LTX **= 2 dB**

LRX **= 2 dB**

Lmisc **= 1 Db**

GRX\_LNA **= 14 dB**

**LINK BUDGET:**

PRX = PTX + GRX\_LNA + GTX + GRX – LTX – LFS – Lmisc – LRX

PRX = **27** + **14** + **5** + **12** – **2** – **139.15** – **1** – **2** = **- 86.15 dBm**

RX sensitivity (50 kbps) **= -109 dBm**

Margin **= 109 – 86.15 = 22.85 dBm**

**FOR GCS TO BALLOON COMMUNICATION:**

**PA LNA on balloon as well as GCS.**

PGCS\_TX = **30 dBm**

LTX **= 2 dB**

LRX **= 2 dB**

Lmisc **= 1 Db**

GRX\_LNA **= 14 dB**

**LINK BUDGET:**

PRX = PTX + GRX\_LNA + GTX + GRX – LTX – LFS – Lmisc – LRX

PRX = **30** + **14** + **12** + **5** – **2** – **139.15** – **1** – **2** = **- 83.15 dBm**

RX sensitivity (50 kbps) **= -109 dBm**

Margin **= 109 – 83.15 = 25.85 dBm**