
Working Together to
Improve EMECalc
EME
2012
Cambridge

The latest improvements in VK3UM's EMECalc software

- Better Spillover estimation giving more accurate G/T value.
- More accurate Moon temperature estimate.

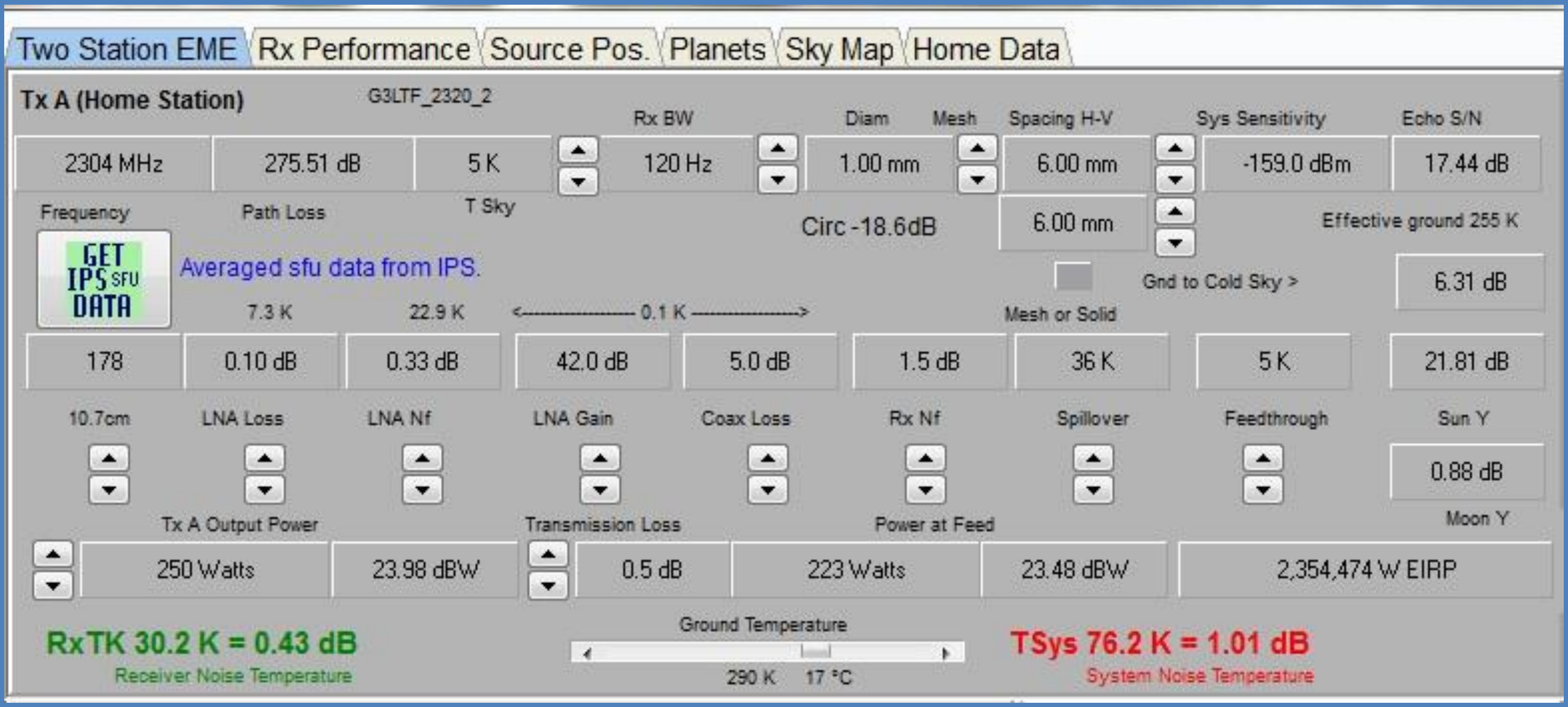
Components of Tsys

Losses ahead of the LNA

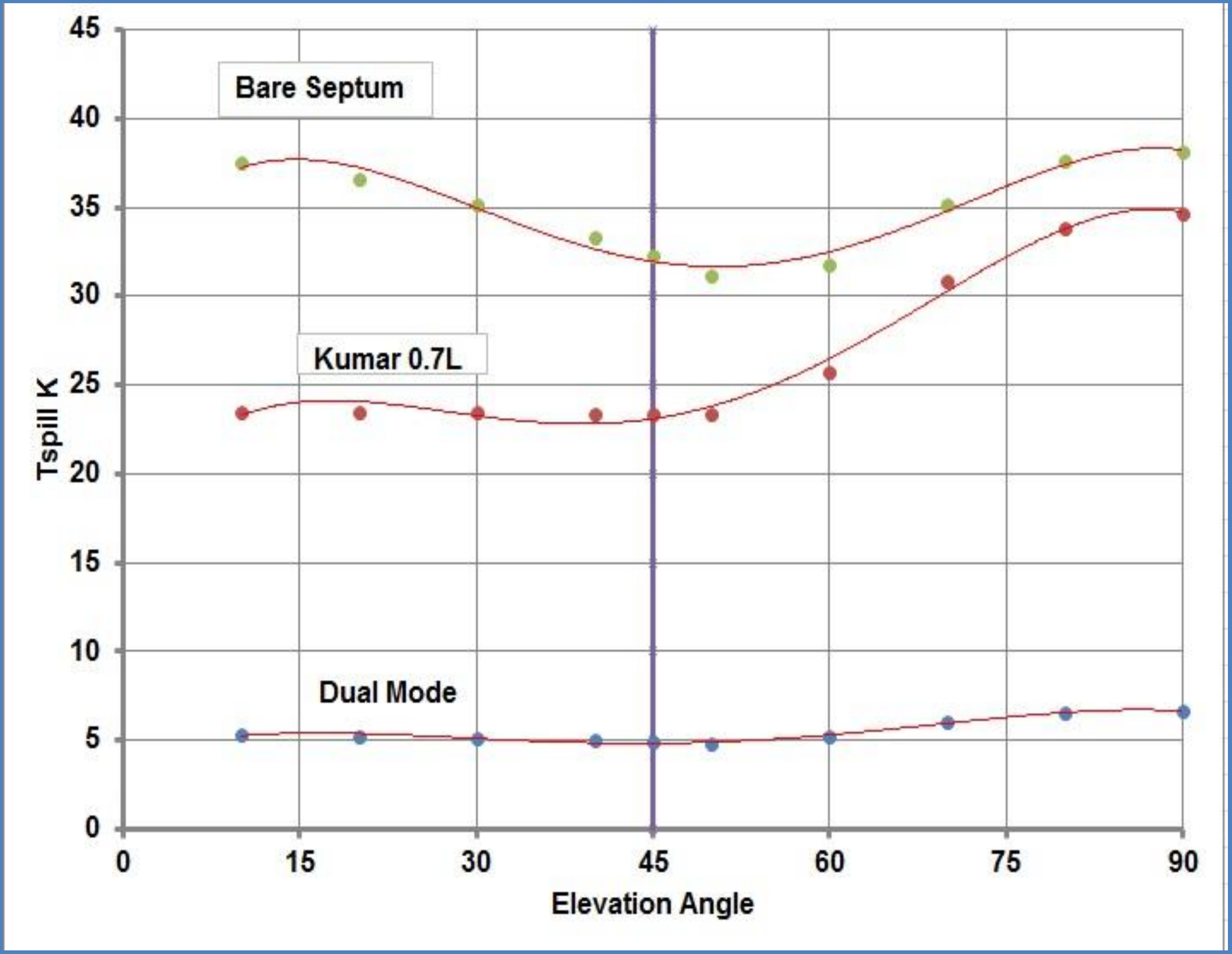
LNA Noise Figure and second stage contribution

Spillover Ts

Mesh Feedthrough



Spillover contribution varies with Elevation
Examples at 0.4 f/D, 290K



Using W1GHZ's on-line Antenna Book modelling……

- Until Version 10, the spillover temperature at 45 deg elevation was derived for each f/D as:

  Ts=290*spillover% * 0.75

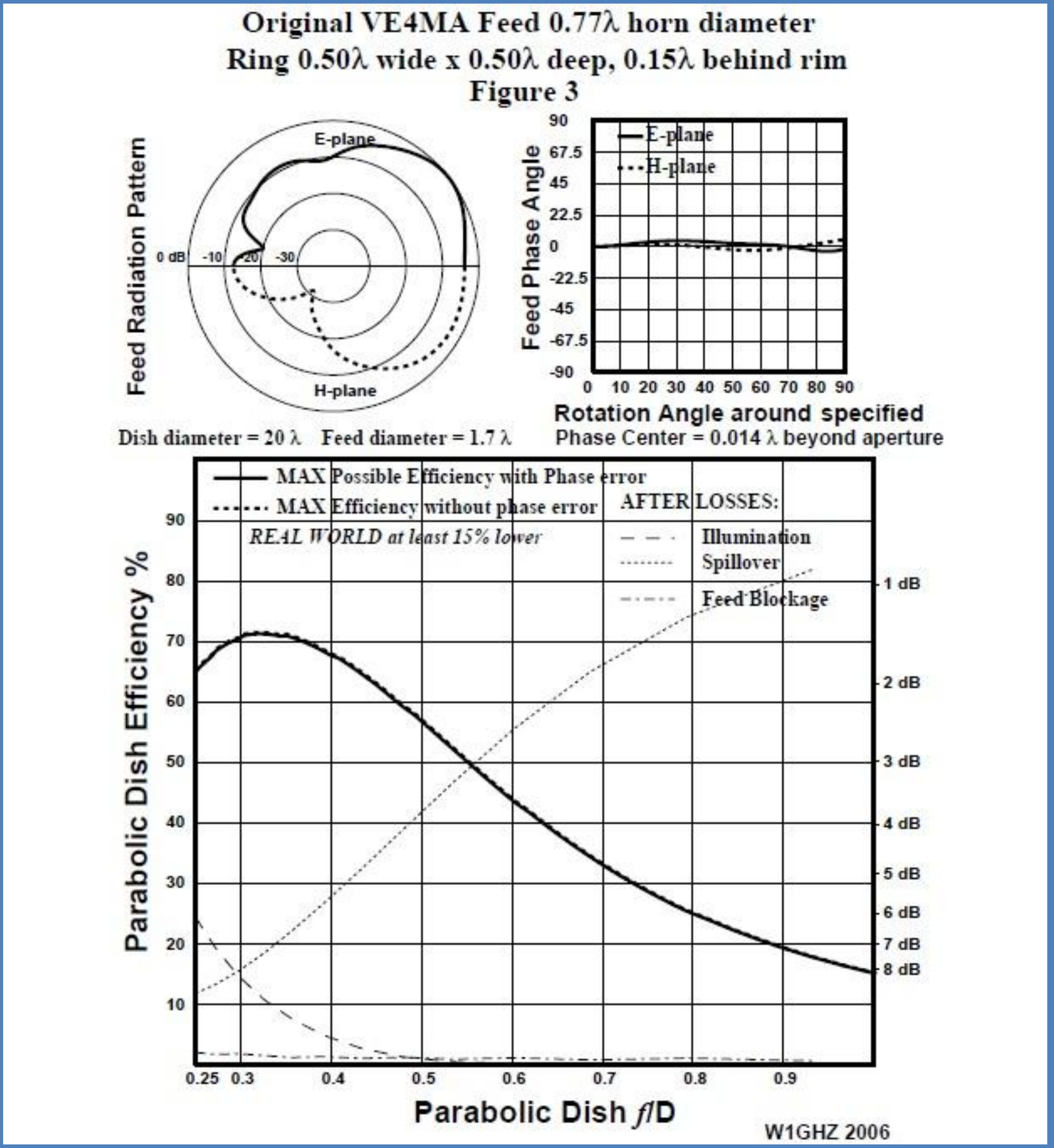
- The 0.75 was a guestimate of the amount of spillover "seeing" the ground, temperature 290K

  The 0.75 is called factor Y

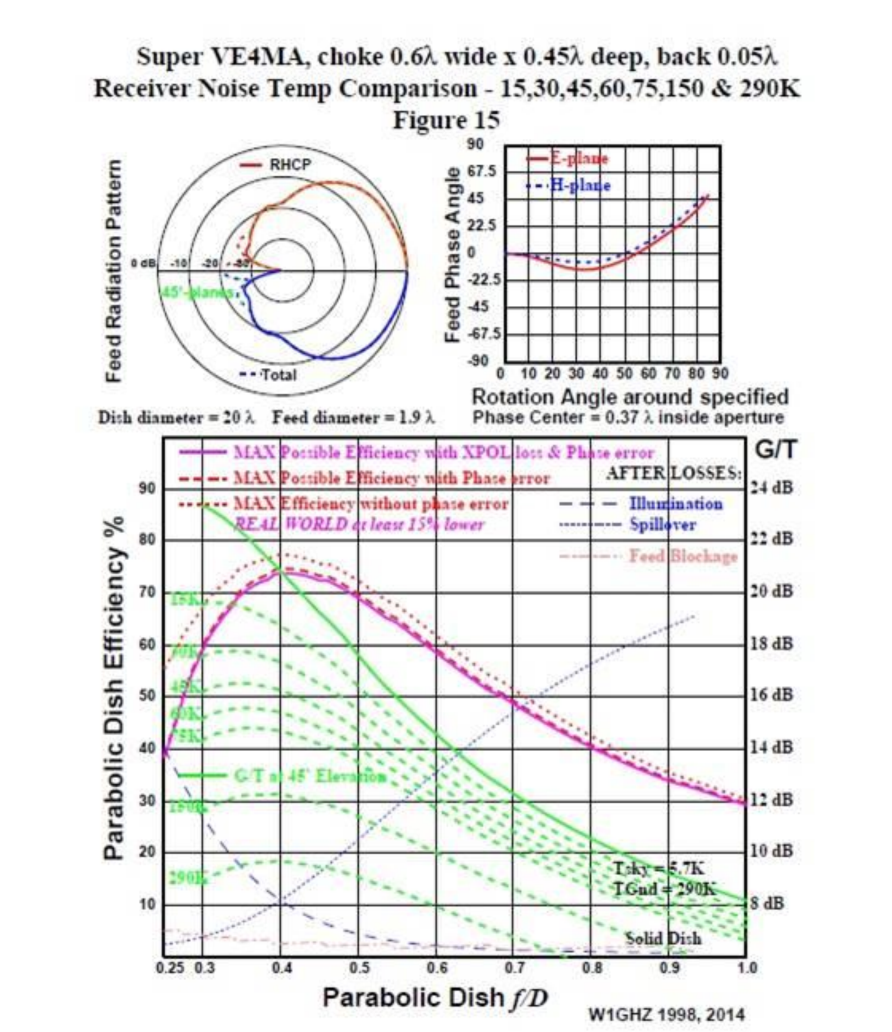
- Paul's EME2014 paper "Feedhorn analysis for parabolic dish G/T" inspired an improved method

- Dmitry, RA3AQ's paper

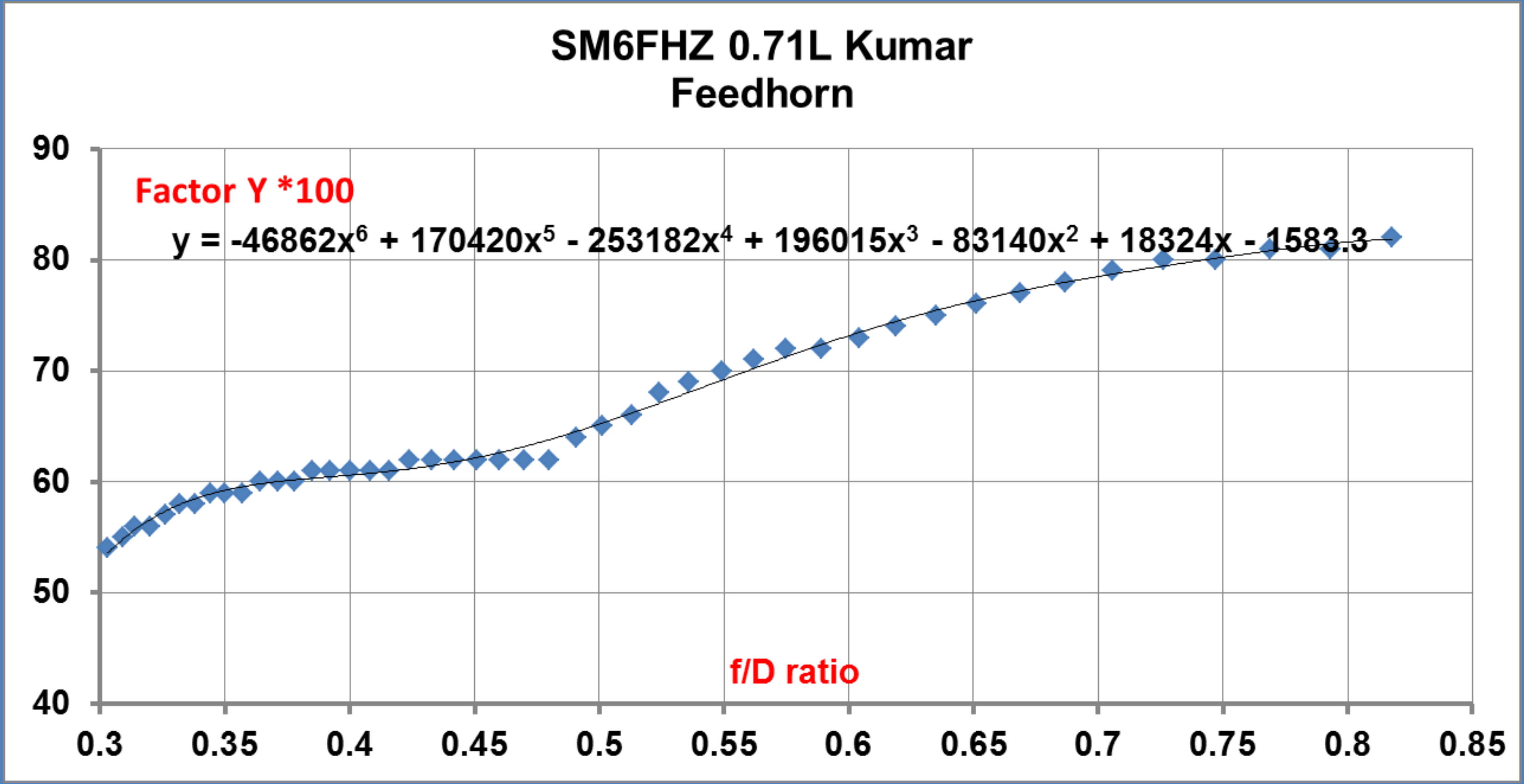
  provided the same analysis



Curves in the W1GHZ EME2014 paper are for specific dish sizes and Trx but we can obtain a value for factor **Y** for the range of f/D ratios



A typical result for **factor Y** versus f/D at 45 deg elevation. Using this (in place of "0.75") has greatly improved the accuracy of G/T estimates



How EMECalc V10 calculates Tspill

Spillover temperature contribution Ts is calculated for each feed and f/D as :

Ts=Tg*spillover%*(6th order polynomial of Y)

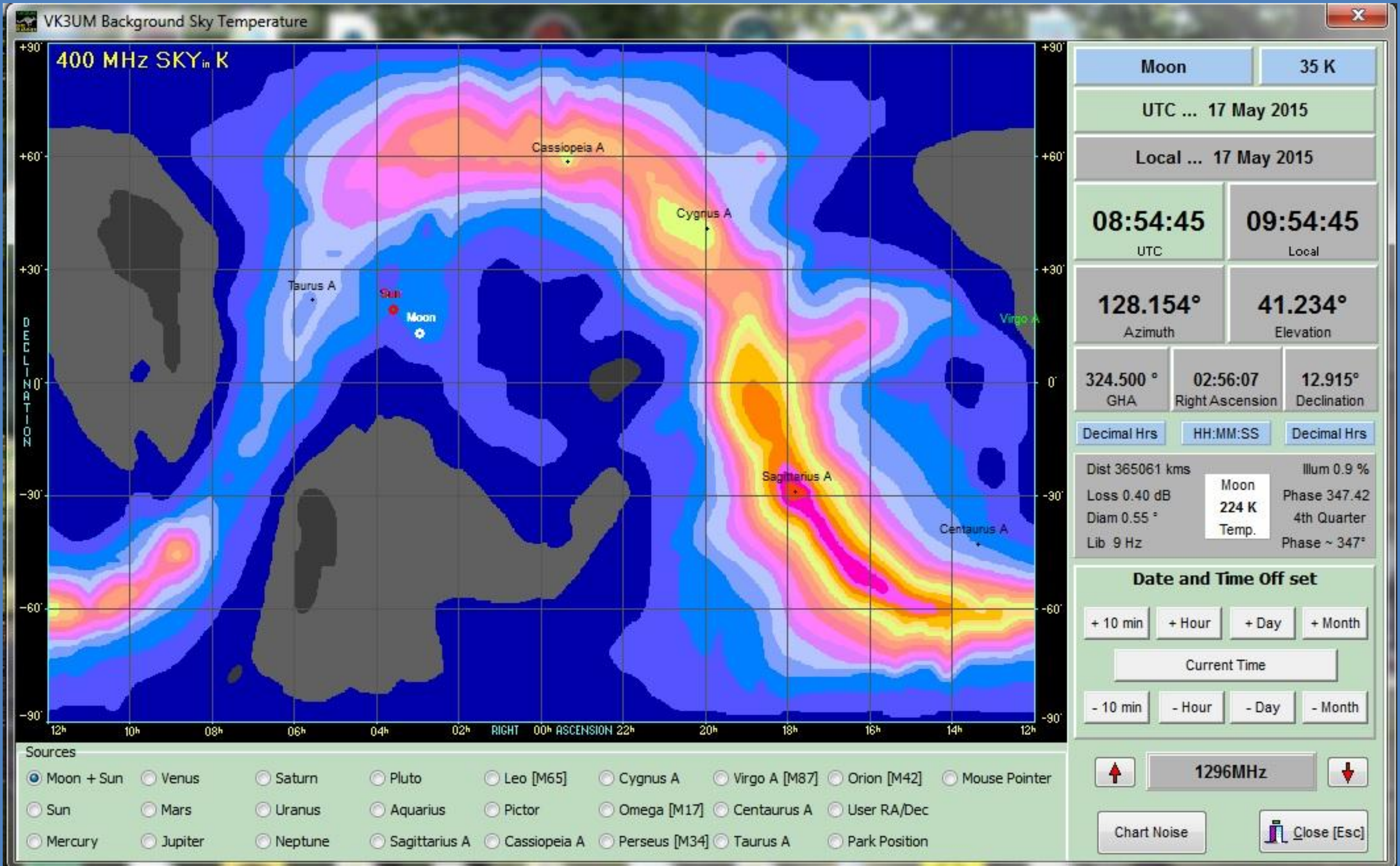
Tg is ground temperature taken from the slider selected value

A more accurate Moon Temperature Estimate in EMECalc

Measuring G/T with Moon Noise

- To measure G/T we need two temperature reference points, one cold, one hot.
- Cold sky is relatively easy……

VK3UM - Sky noise display



Measuring G/T with Moon Noise

- To measure G/T we need two temperature reference points, one cold, one hot.
- Cold sky is relatively easy.
- **Hot sources –**

Ground - House wall, Tree in full leaf –must fill the near field

Sun – unpredictable flux vs frequency

Radio stars - predictable flux but weak

<u>Moon</u> – higher flux but variable with distance and phase

Moon noise characteristics

- The level of moon noise received varies with frequency, moon phase and distance

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- At 2320MHz with 6m dish and Tsys = 73K moon noise variation **0.98 to 0.76dB**
- At 3400MHz with 6m dish and Tsys = 95K moon noise variation **1.45 to 1.12dB**

- So we need to state the conditions of our measurements.

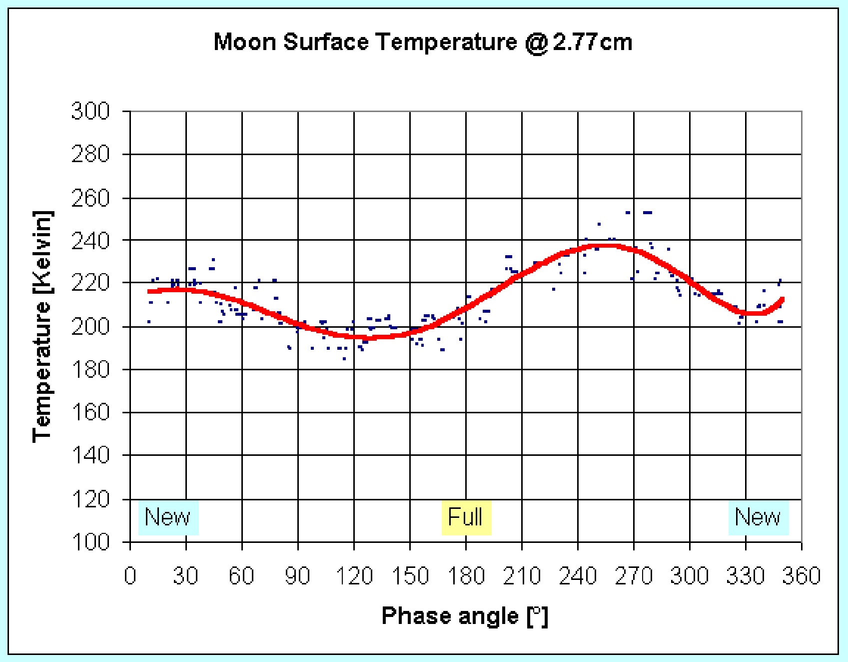
Moon Temperature vs phase and frequency

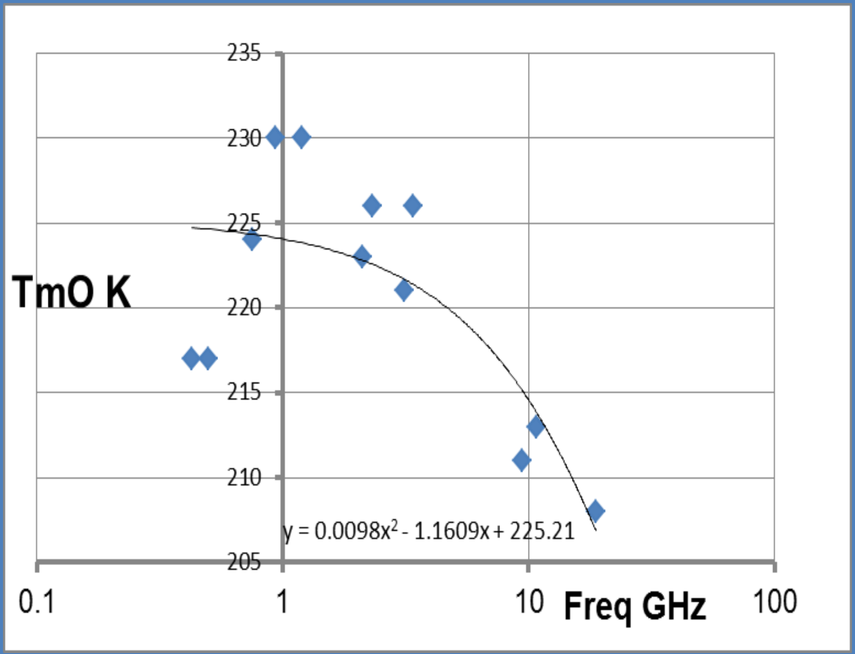
C.Monstein, Zurich 2001

Moon temperature vs Phase

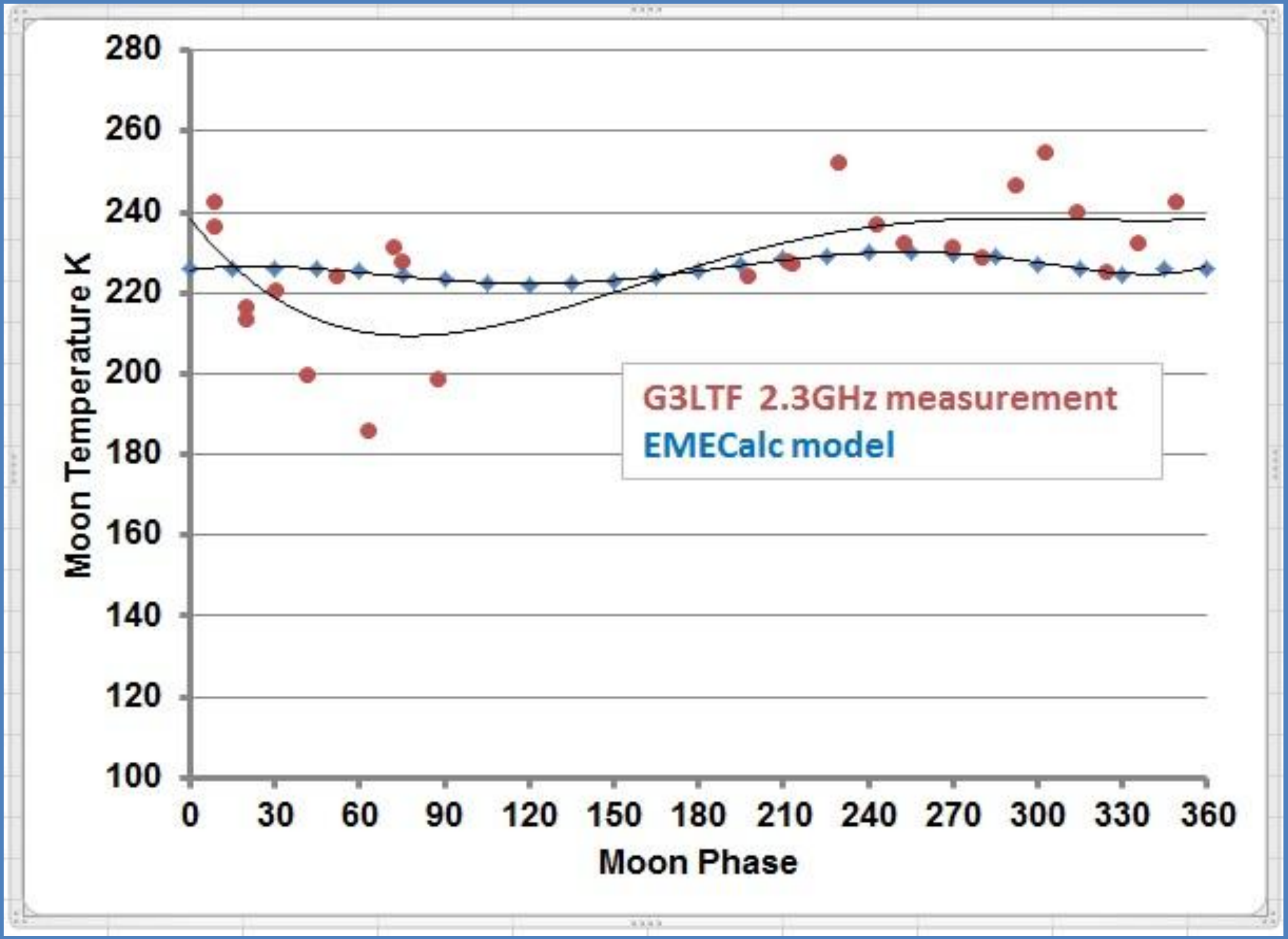
Mean temperature vs

Frequency (several sources)

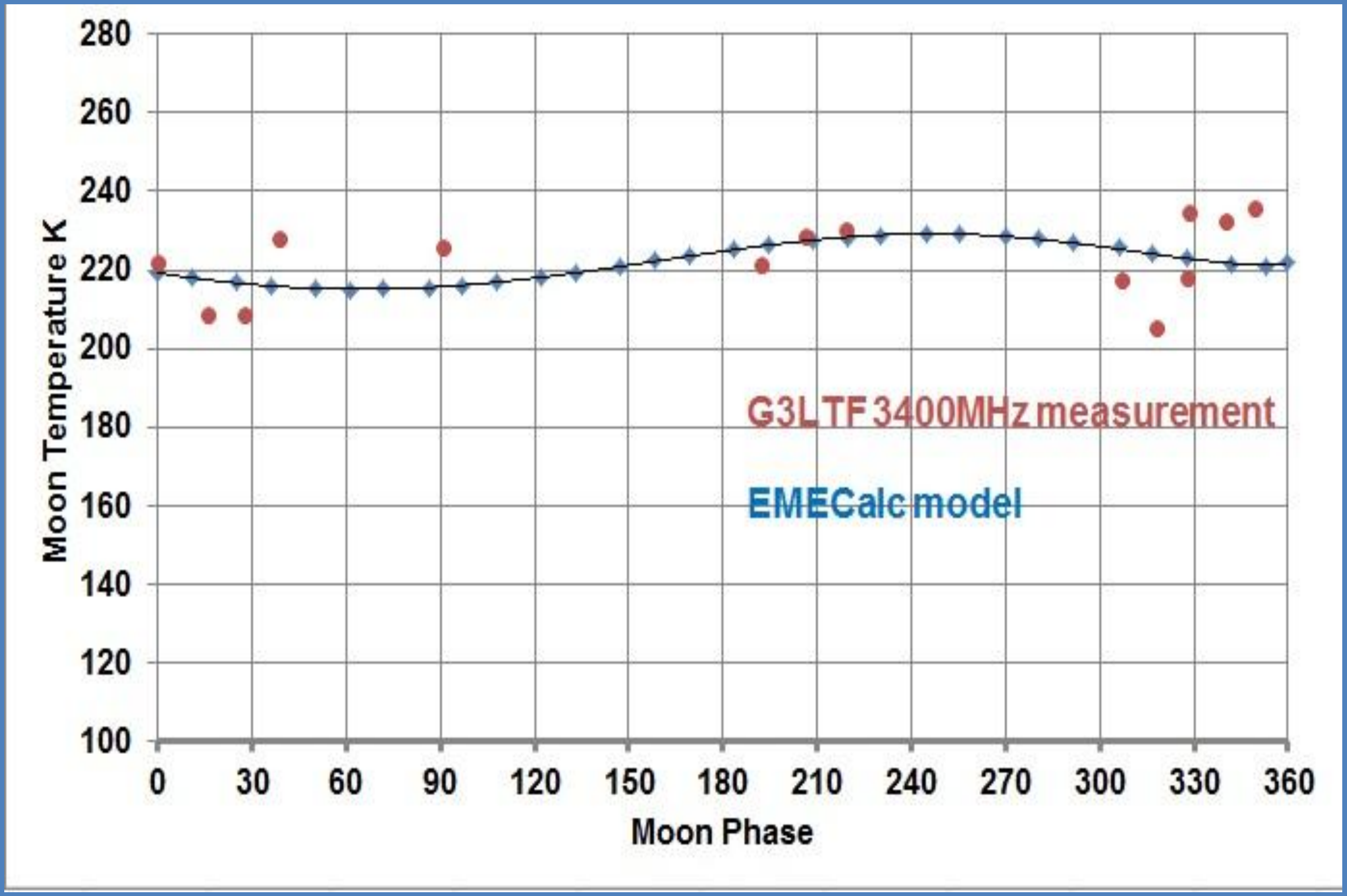




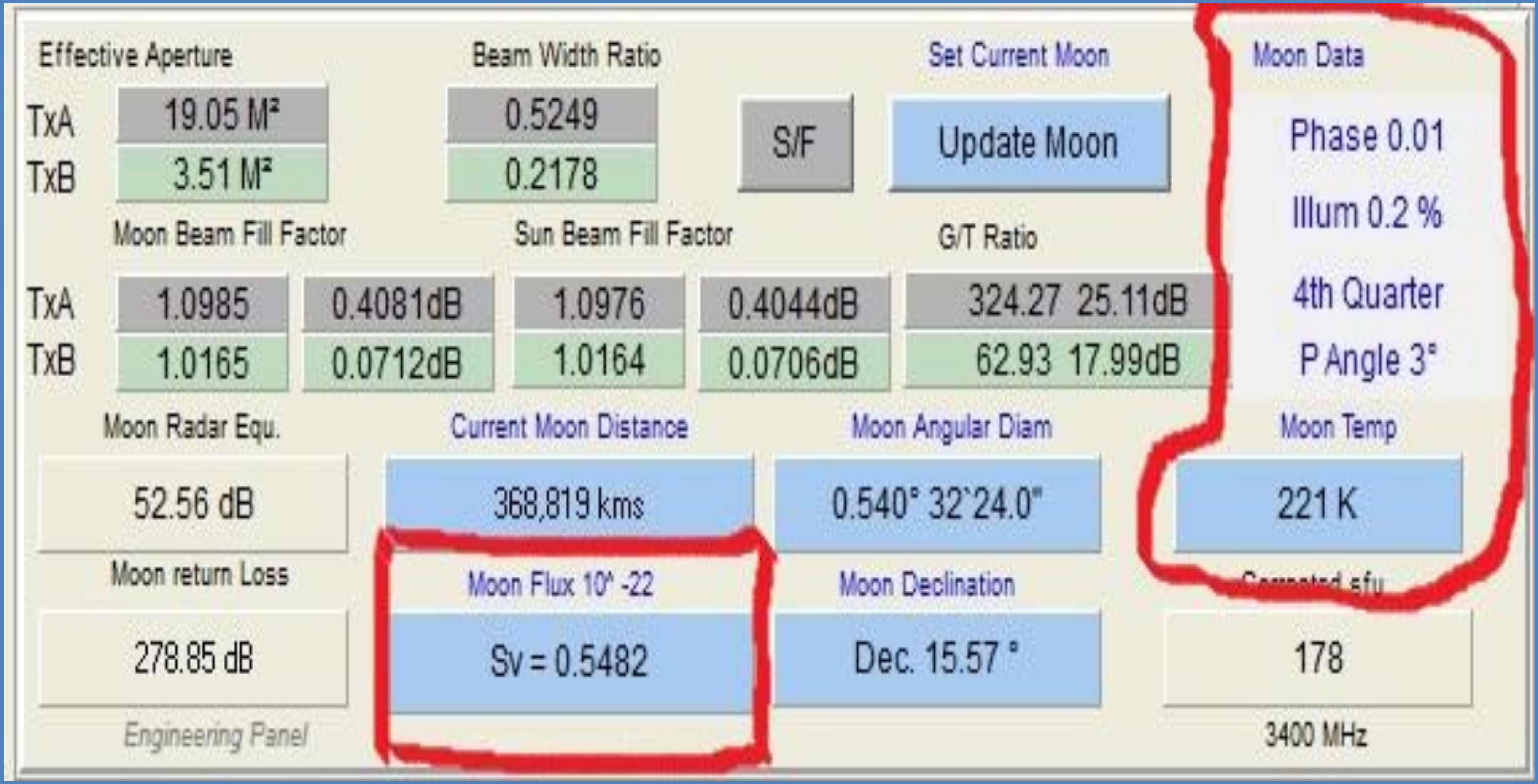
2.3GHz measurement referenced to Cygnus: Mean value 226K

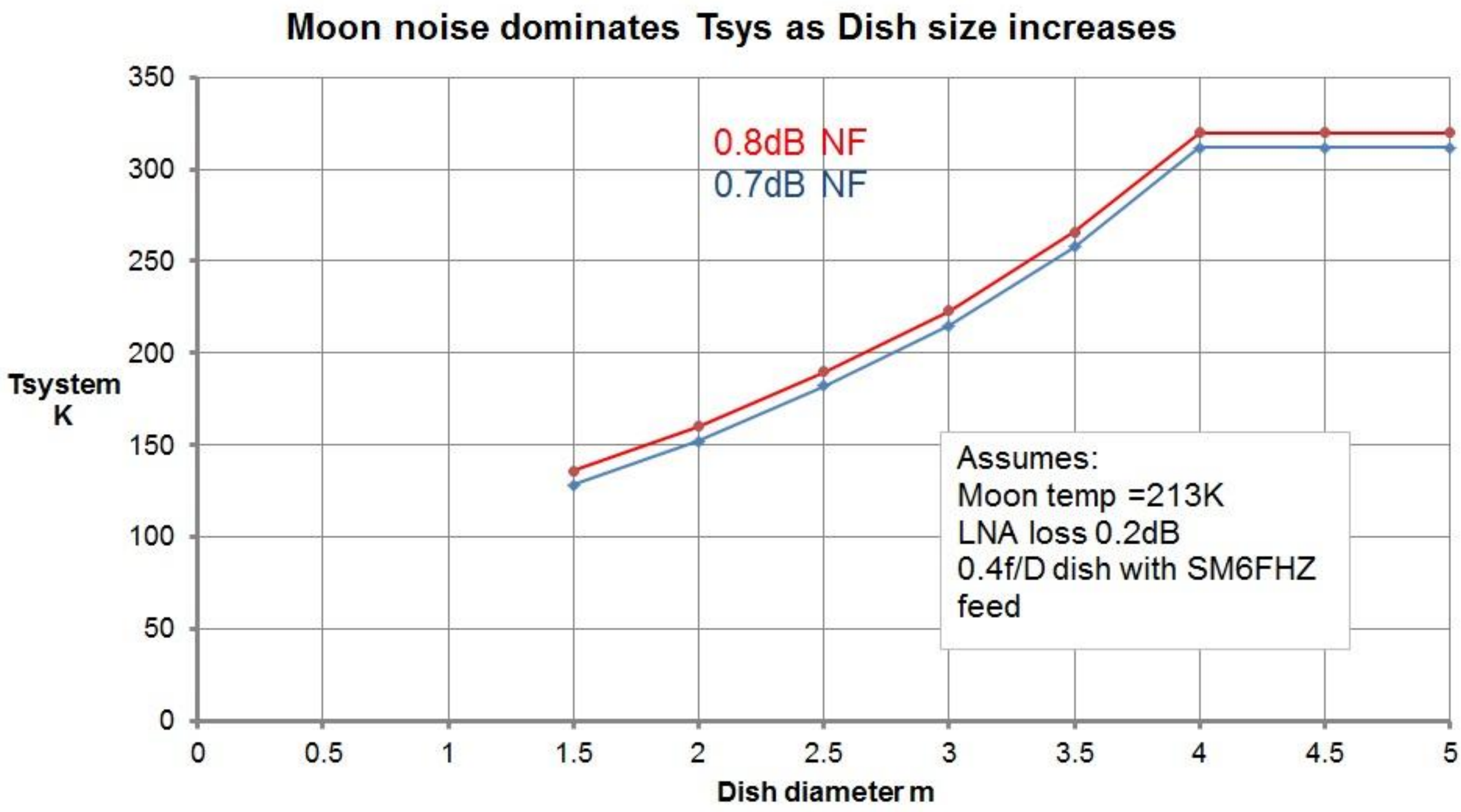


3.4GHz measurement referenced to Taurus: Mean value 223K



Moon Data in EMECalc is now better, but still work in progress.




Moon noise dominates Tsys as Dish size increases
0.8dB NF
0.7dB NF
Assumes:
Moon temp =213K
LNA loss 0.2dB
0.4f/D dish with SM6FHZ feed
Tsystem K
Dish diameter m
350
300
250
200
150
100
50
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

Acknowlegements

Doug, VK3UM

Paul, W1GHZ

Ingolf, SM6FHZ