

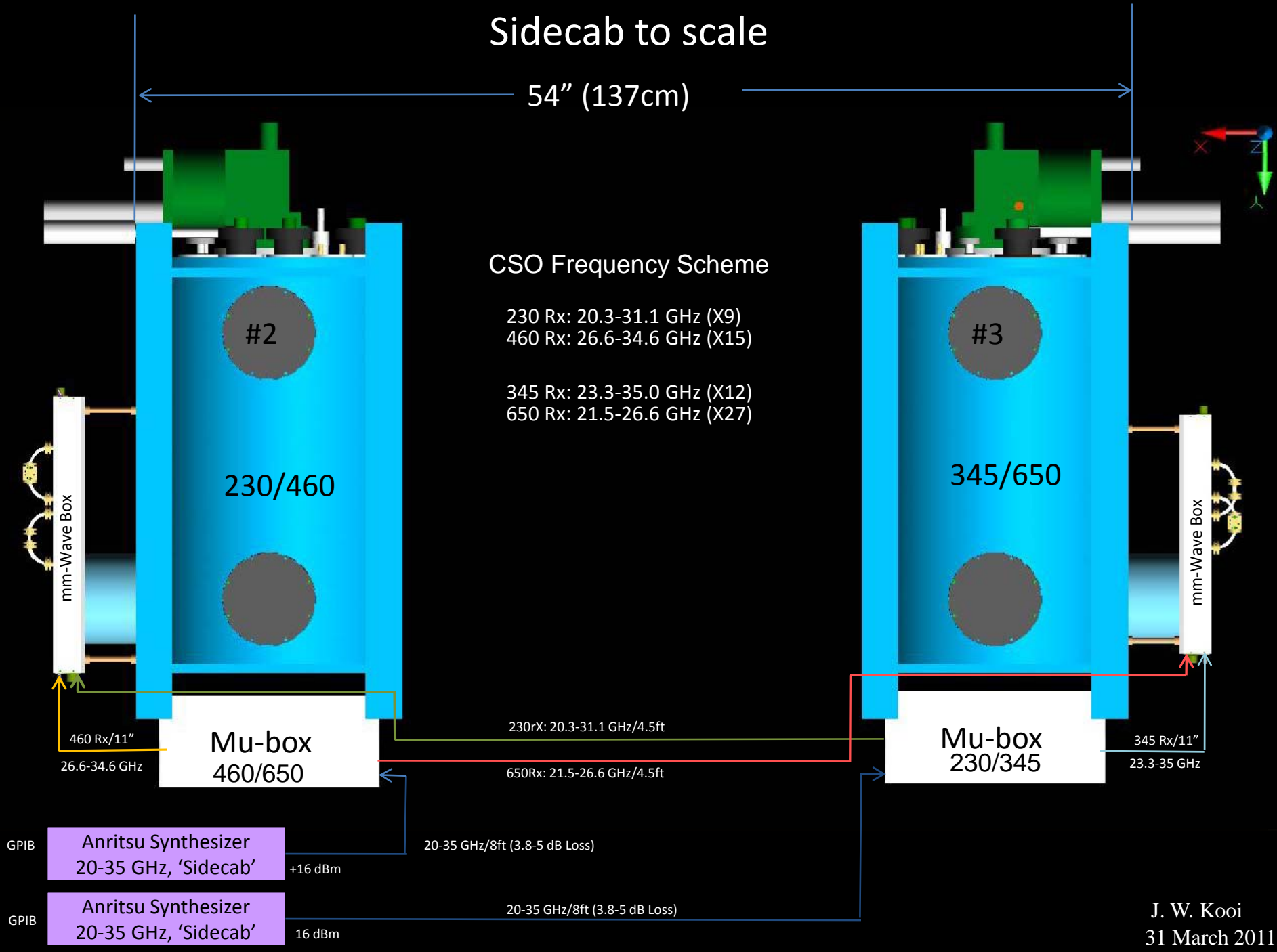
# Sidecab to scale

54" (137cm)

## CSO Frequency Scheme

230 Rx: 20.3-31.1 GHz (X9)  
460 Rx: 26.6-34.6 GHz (X15)

345 Rx: 23.3-35.0 GHz (X12)  
650 Rx: 21.5-26.6 GHz (X27)



Optical beam  
(from M4)

Mm-wave box, thermally weakly  
coupled to Cryostat

230/460

Bal JPL PA  
(next slide)

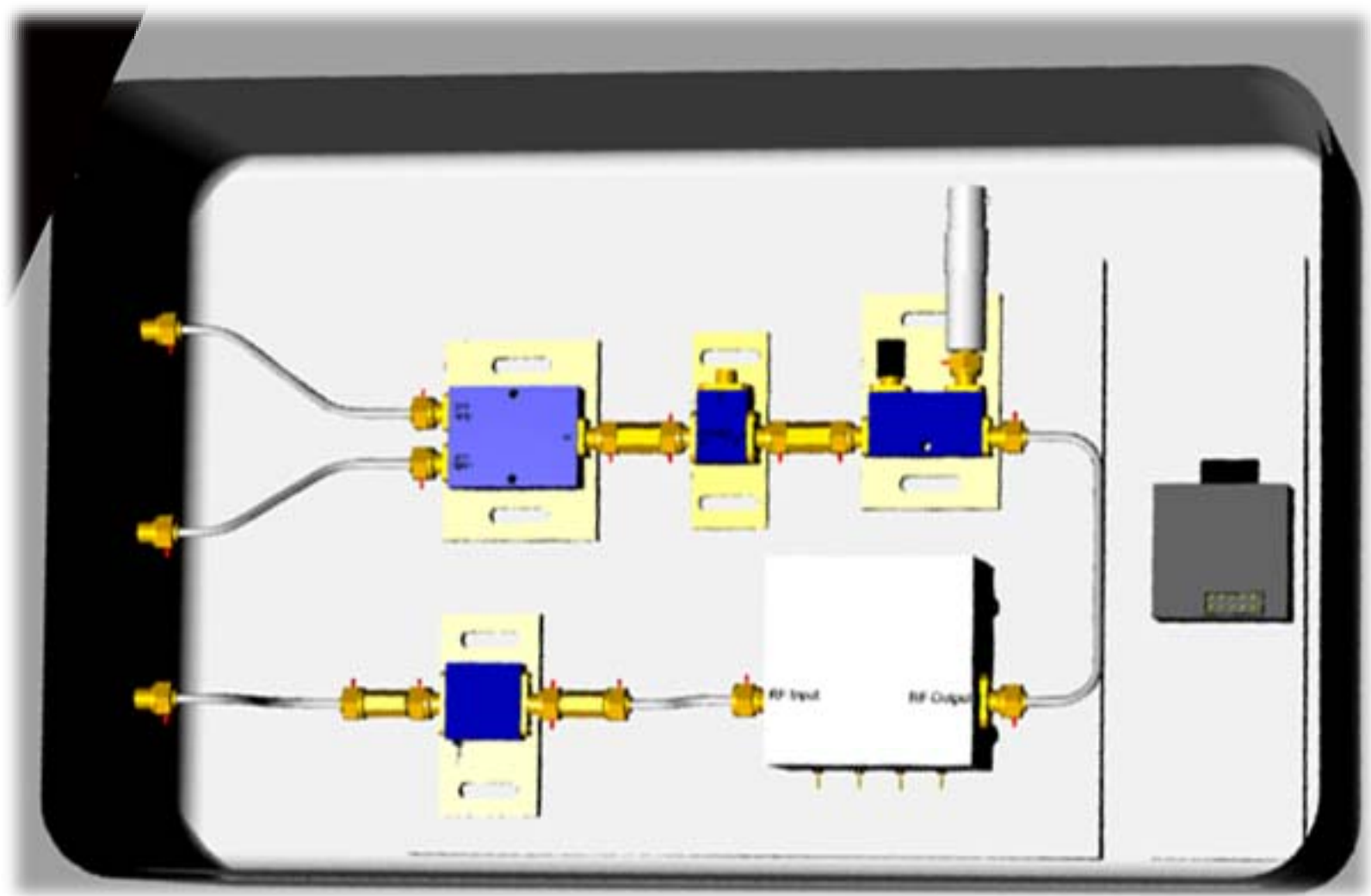
Mu-box  
460/650

M5

345/650

Mu-box  
230/345

## MU-Box Layout (BLF)



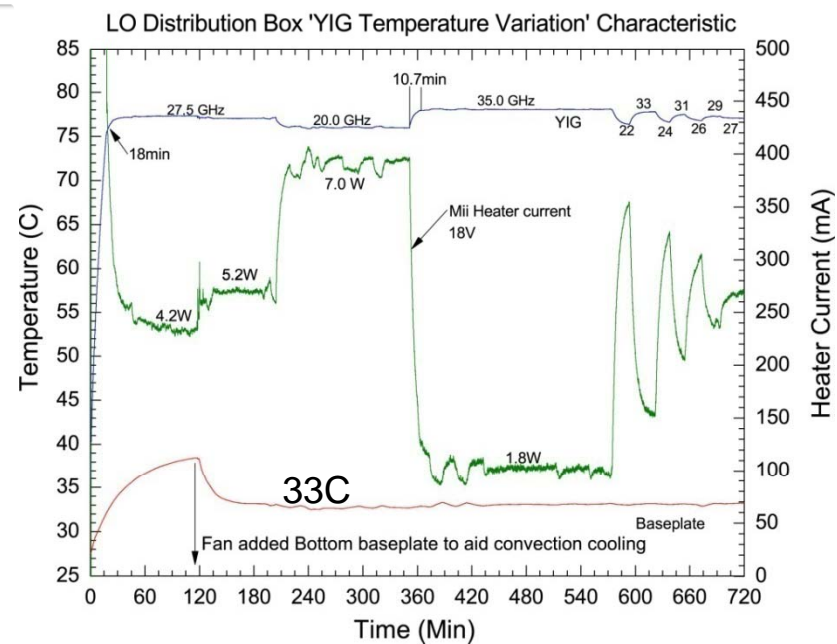
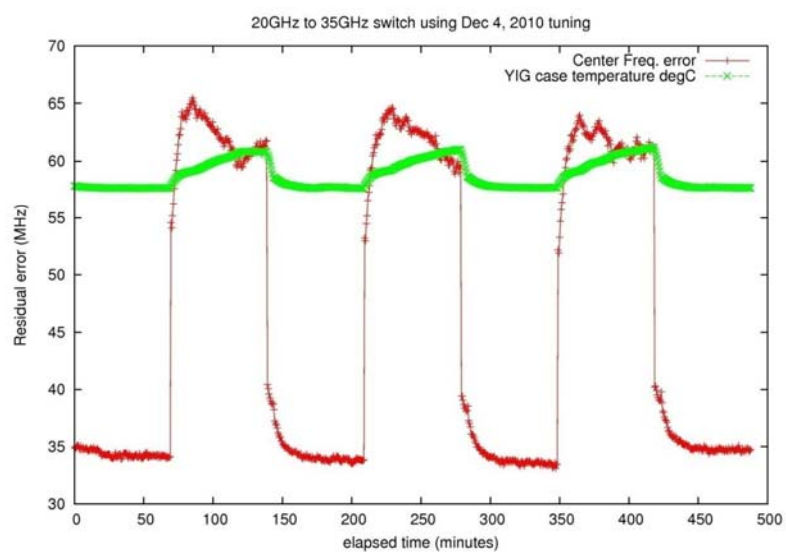
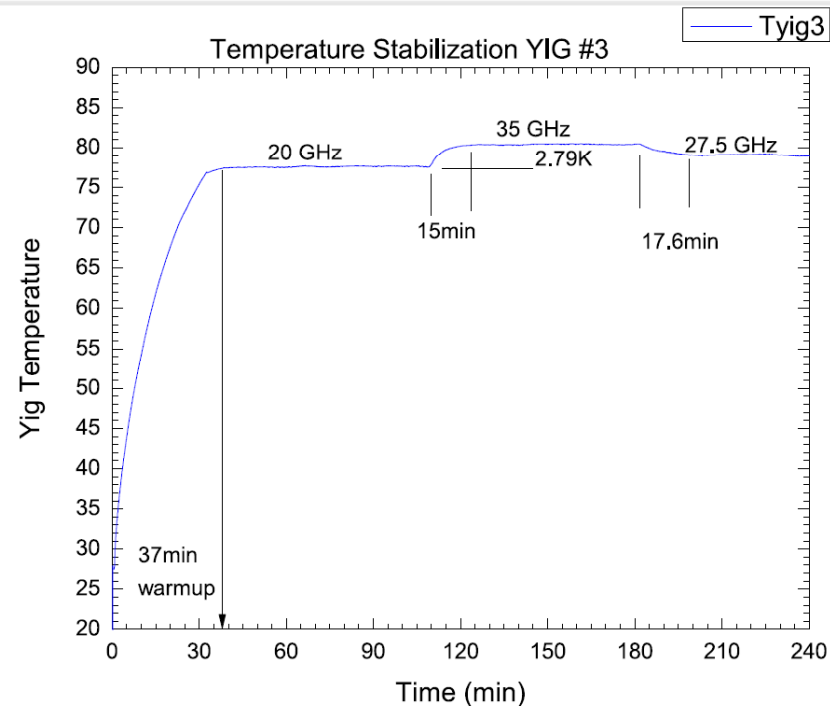
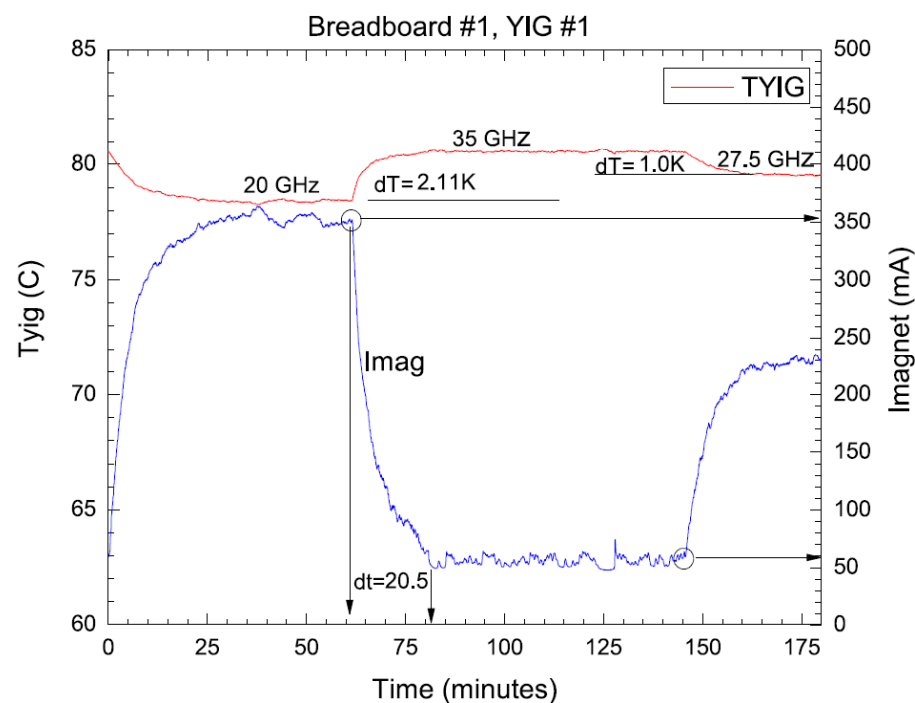


Mu-Box

YIG,  
80 C

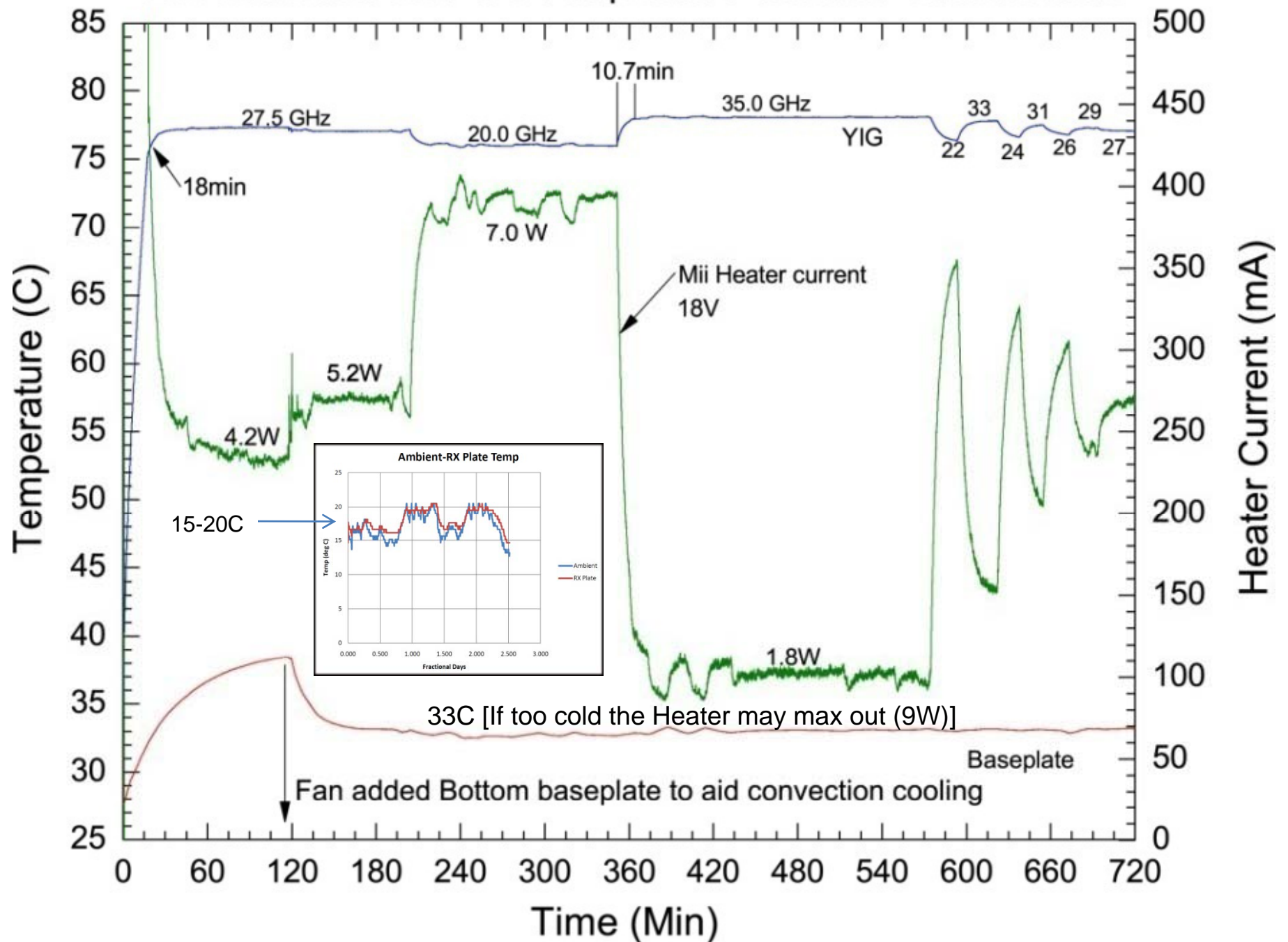
20-35 GHz

USB interface

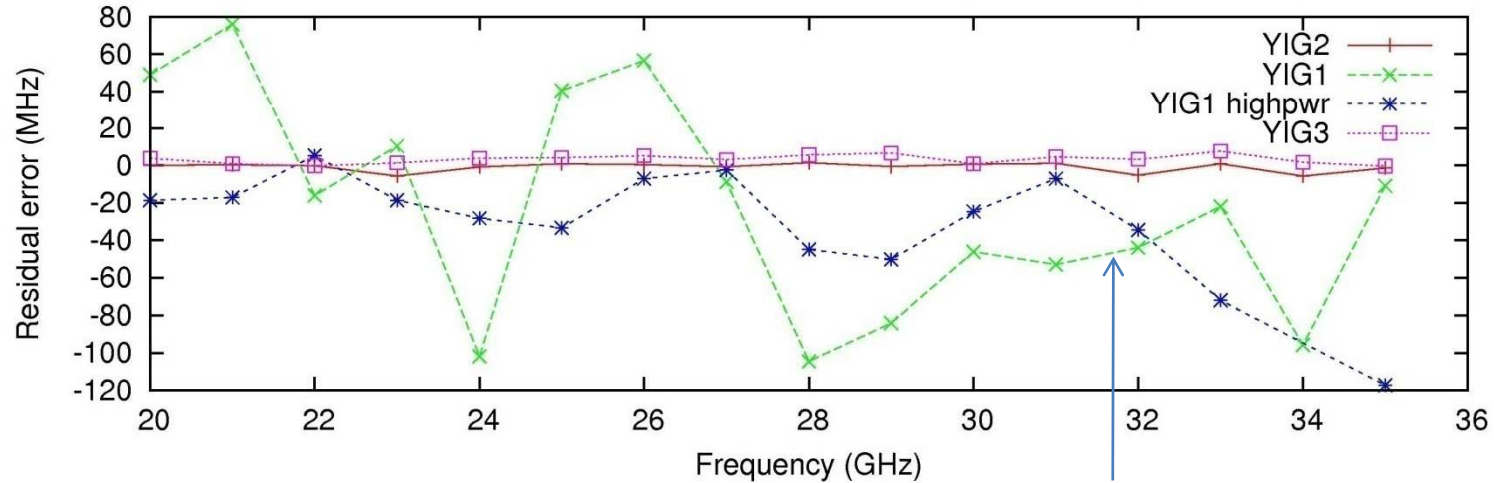
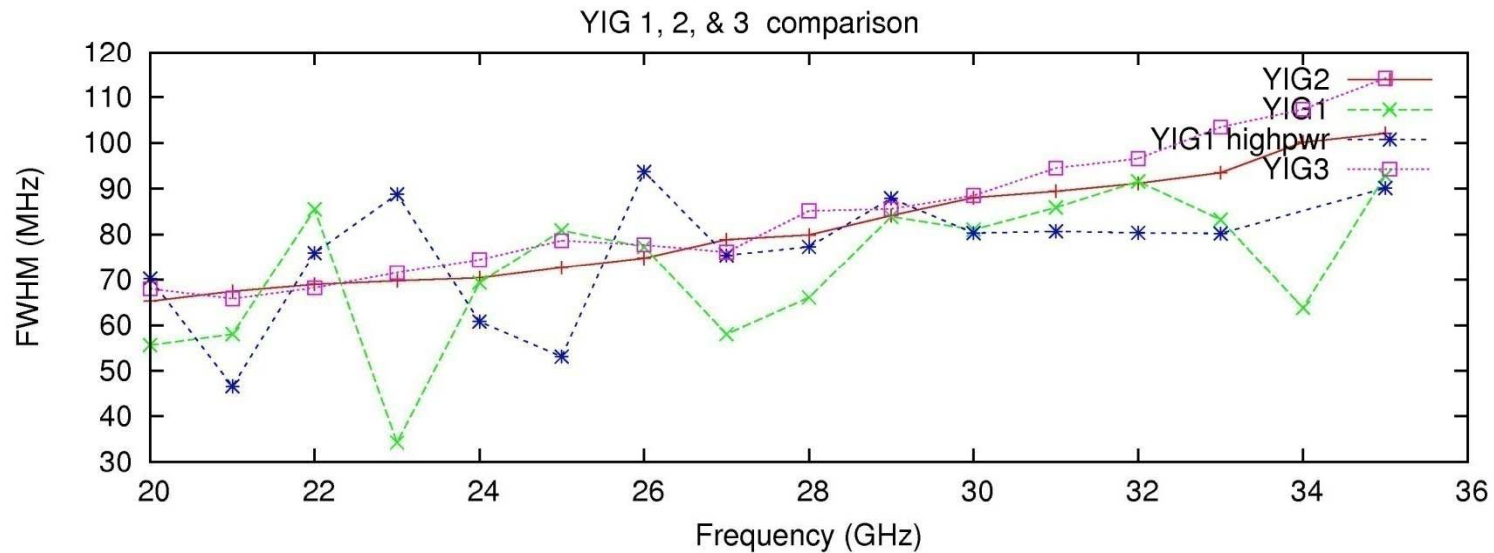




# LO Distribution Box 'YIG Temperature Variation' Characteristic

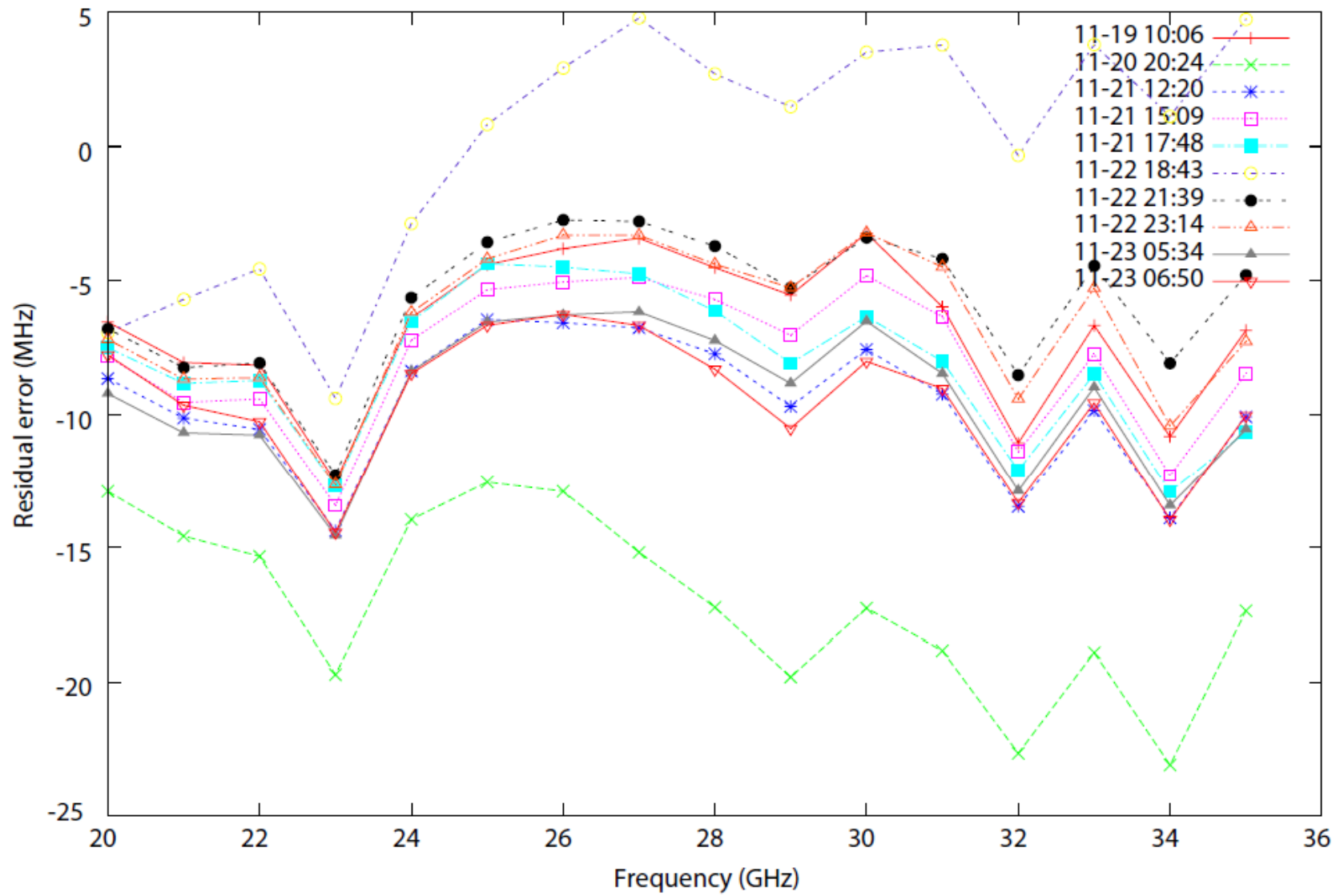


# YIG Tuning Characteristics

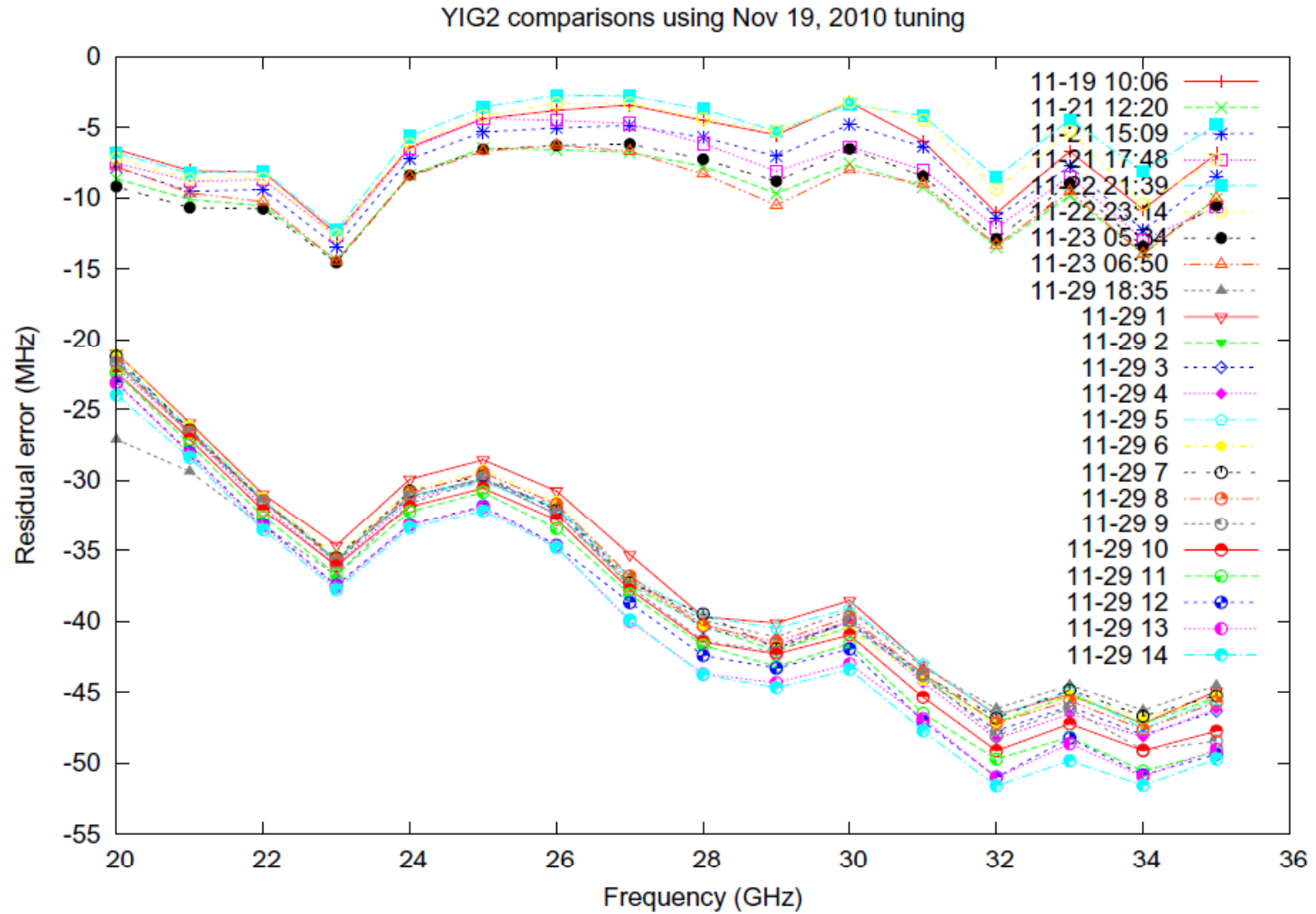


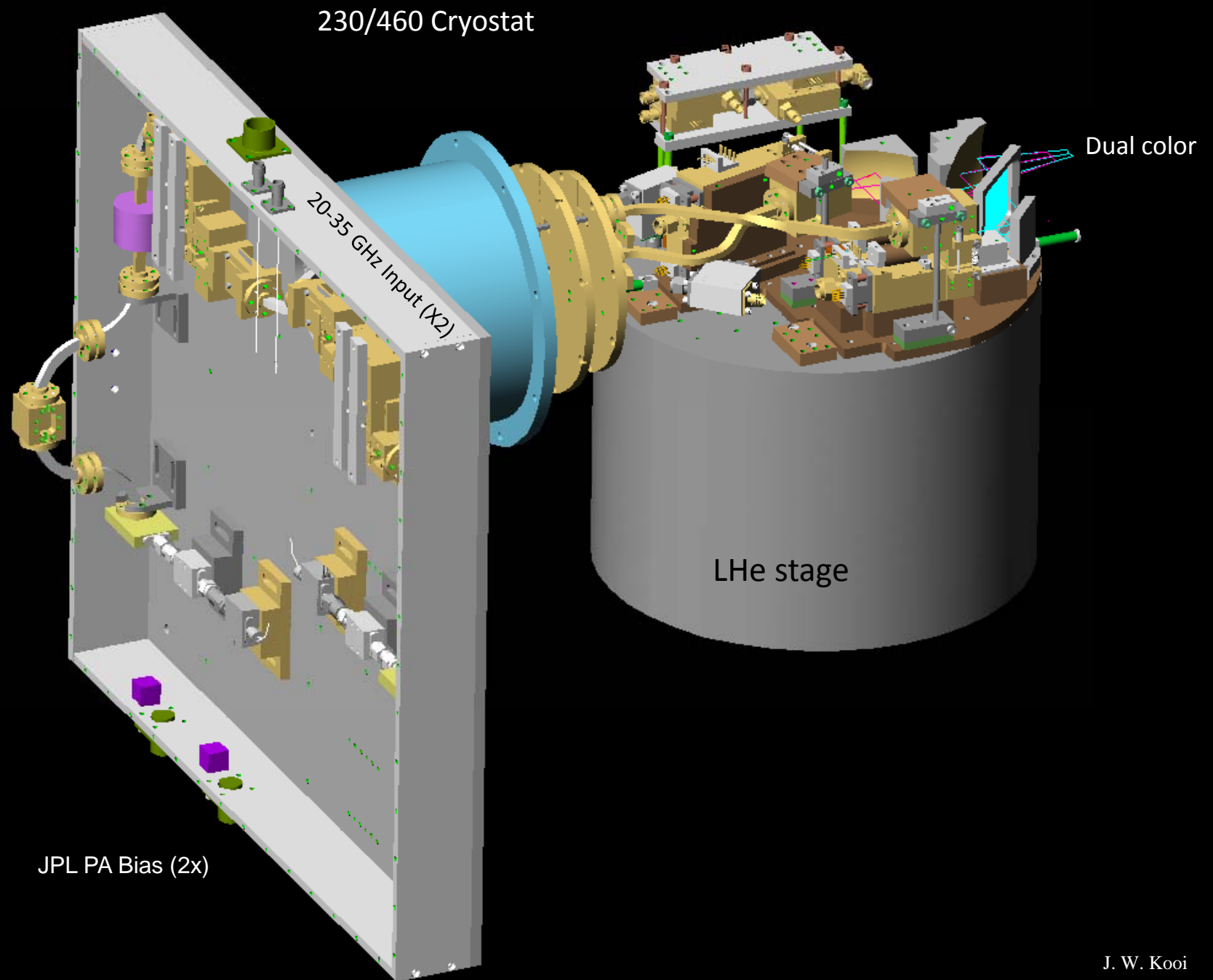
YIG 1 was overheated (100C),  
Been send back for repair. Under warranty  
Setting re-adjusted by micro-lambda

YIG2 comparisons using Nov 19, 2010 tuning

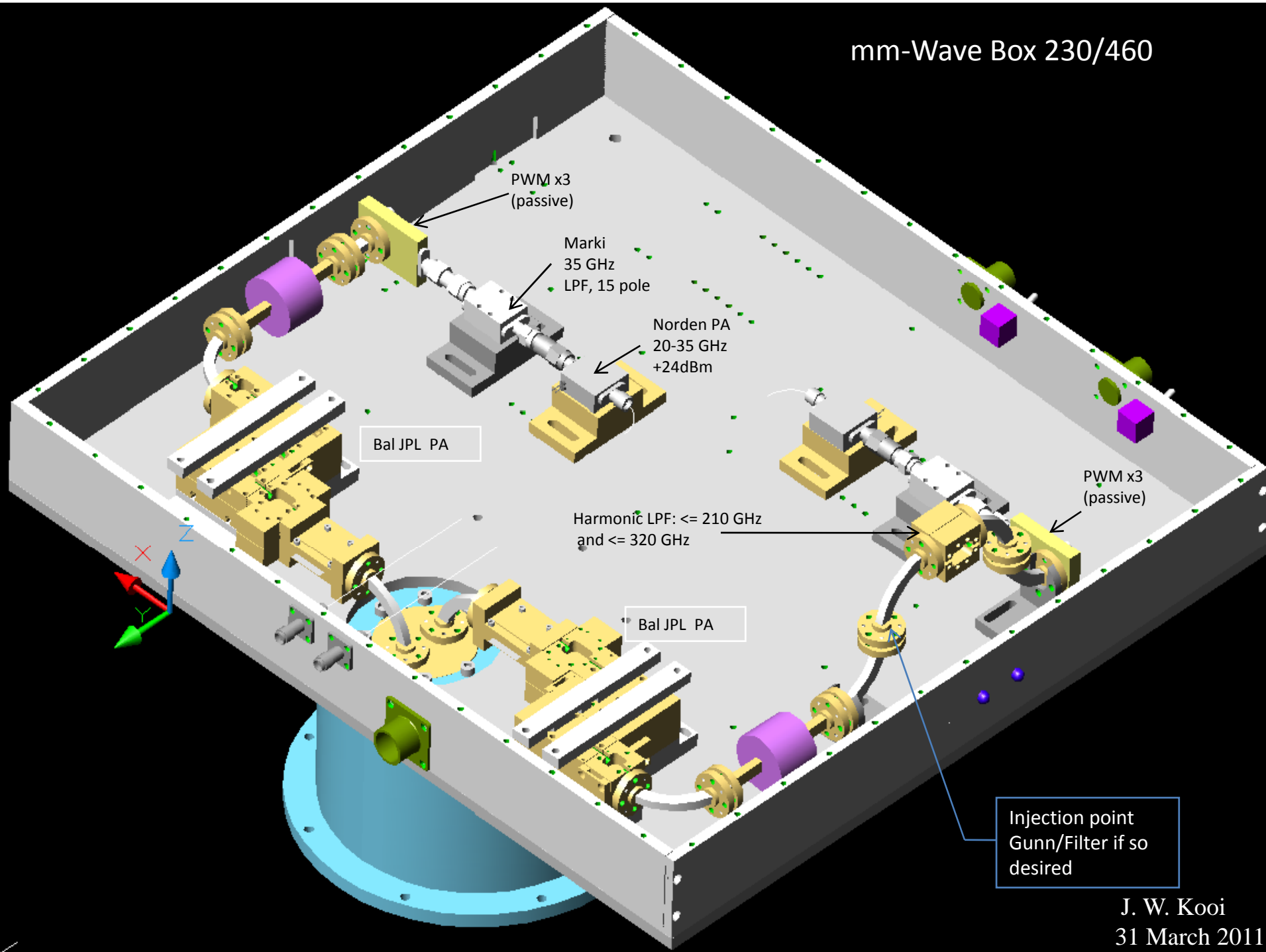


# YIG Drift Characteristics



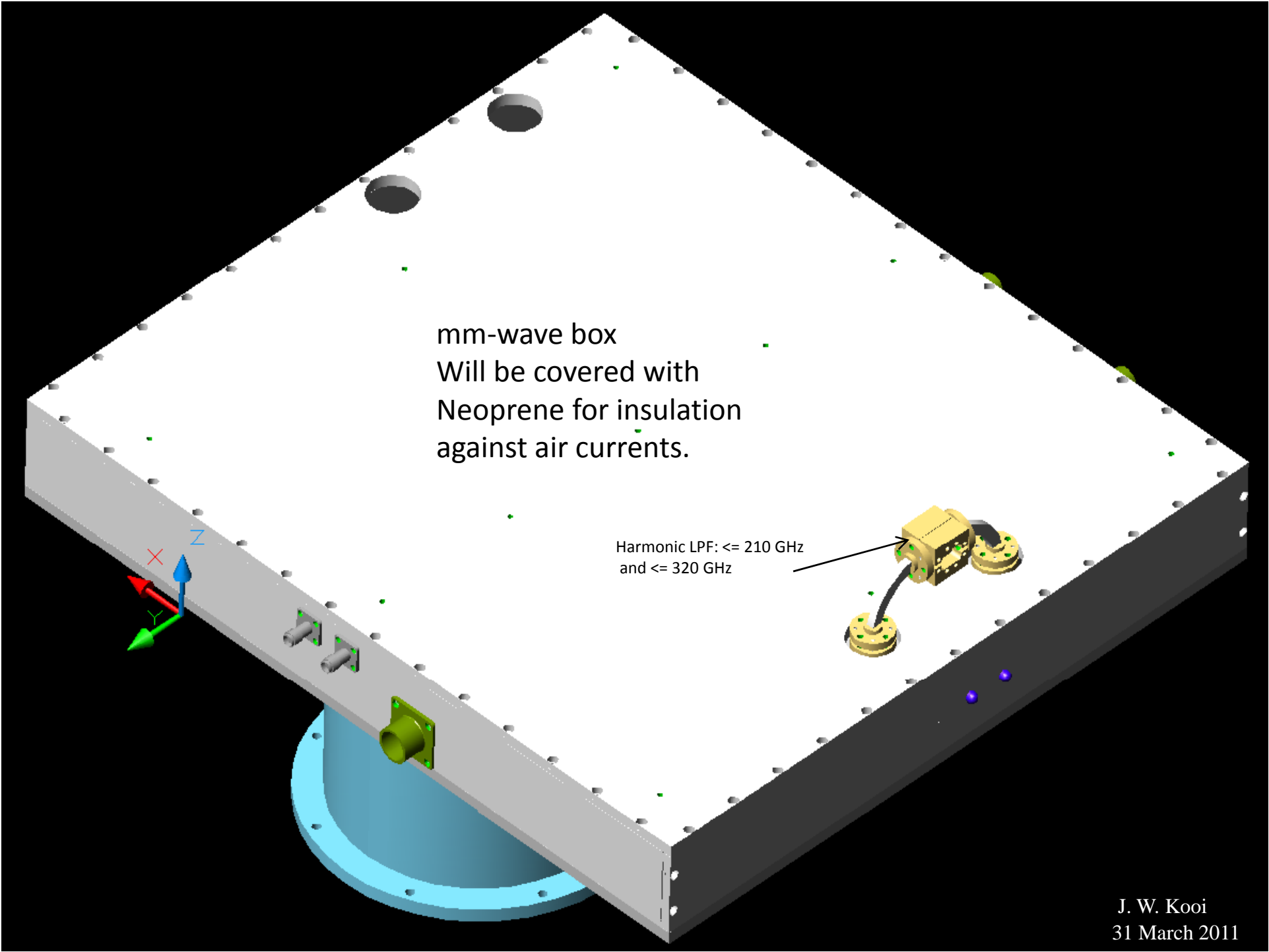


# mm-Wave Box 230/460



J. W. Kooi  
31 March 2011





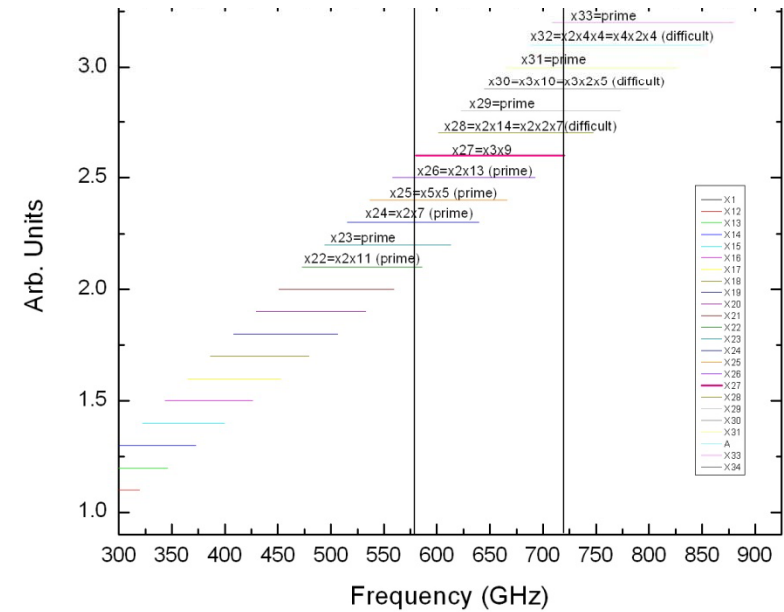
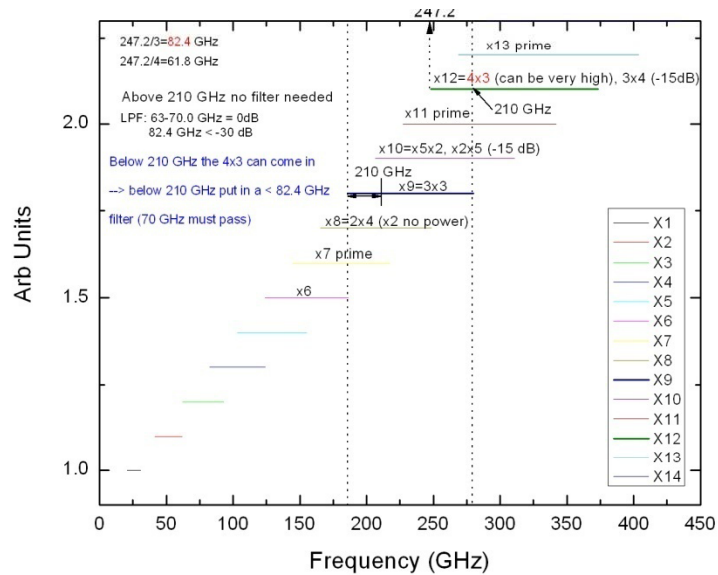
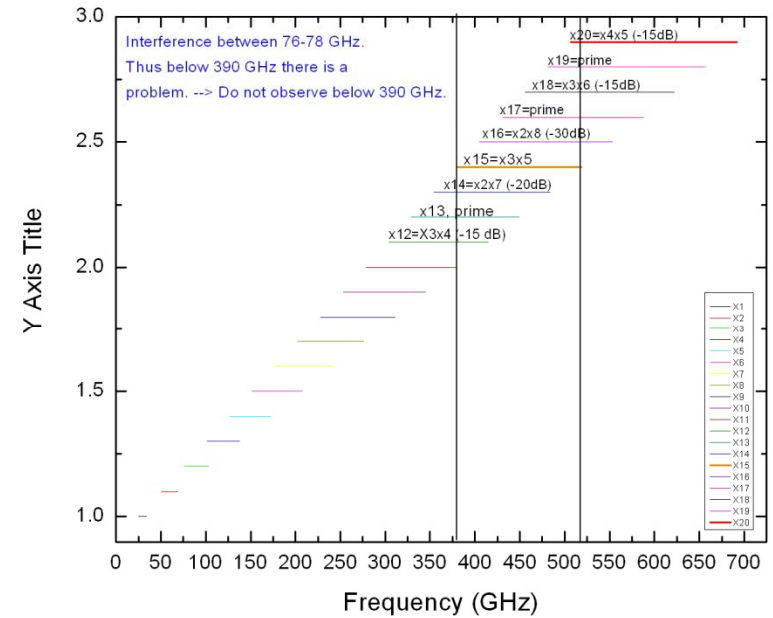
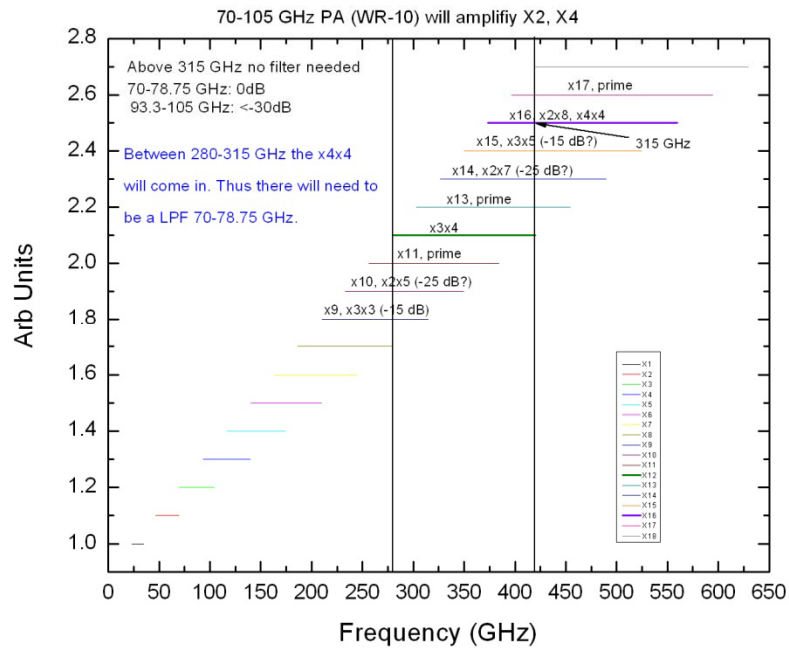
A 3D CAD model of a rectangular mm-wave box. The top surface is white, while the side and bottom surfaces are grey. The box is mounted on a blue cylindrical base. The top surface features two large circular cutouts, several smaller holes, and a few green dots. A yellow component, identified as a harmonic LPF, is mounted on the right side of the top surface. A cable connects this component to another yellow component on the bottom surface. On the left side, a green arrow points upwards, and a red 'X' is visible. A coordinate system with red, green, and blue arrows is shown in the bottom-left corner. Text is overlaid on the top surface of the box.

mm-wave box  
Will be covered with  
Neoprene for insulation  
against air currents.

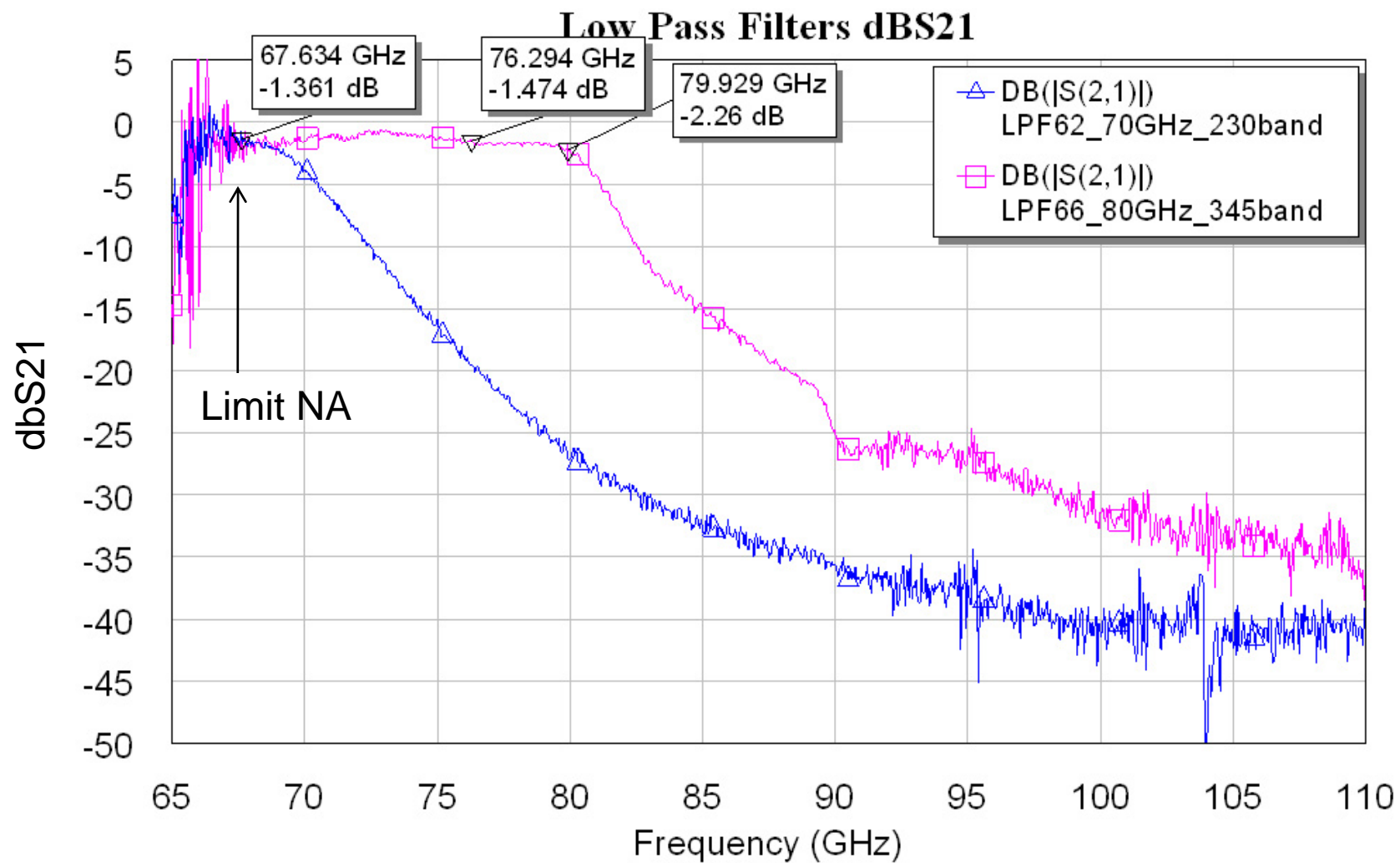
Harmonic LPF:  $\leq 210$  GHz  
and  $\leq 320$  GHz



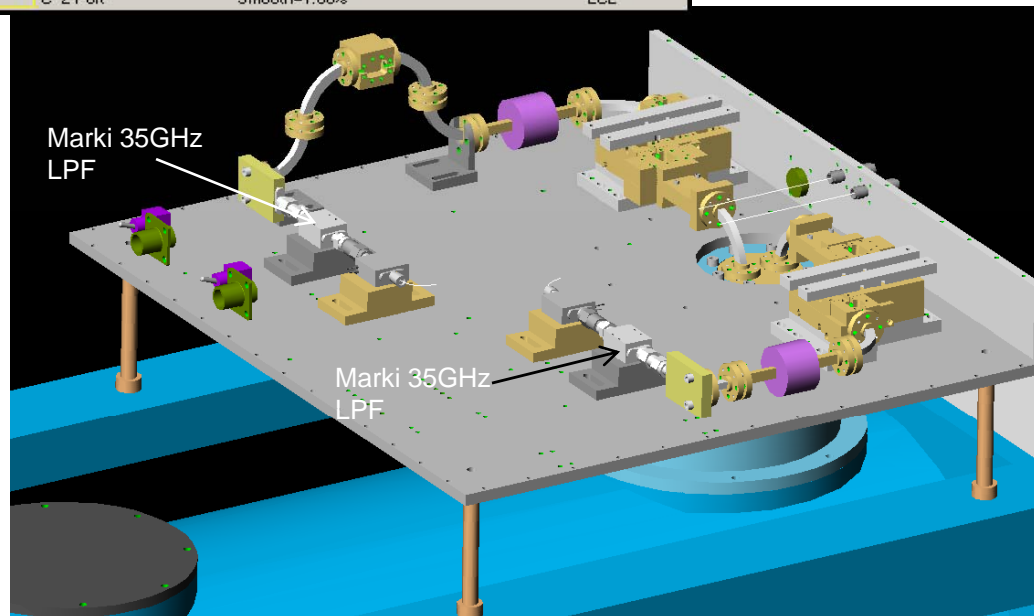
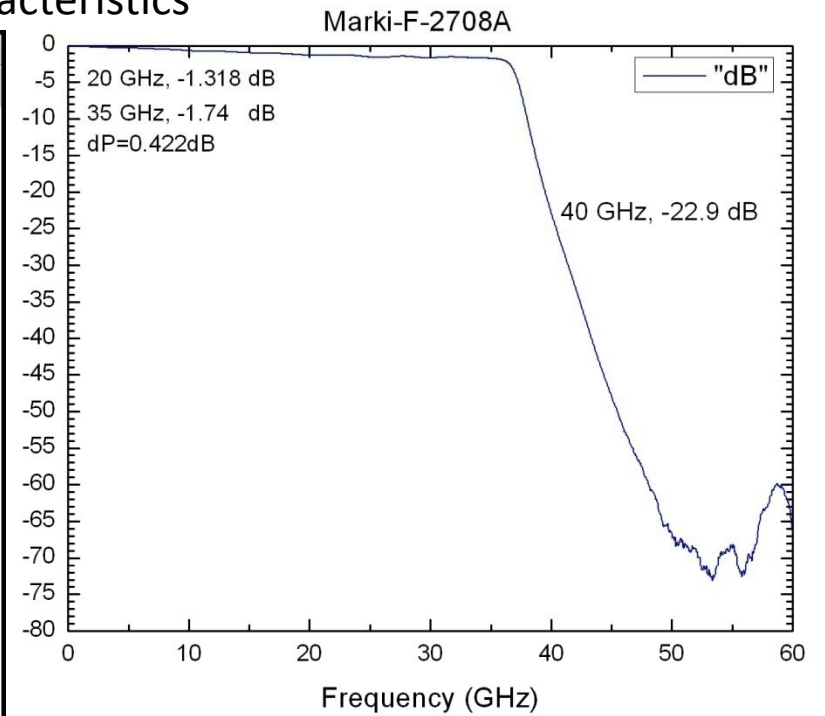
# Harmonic Analyses



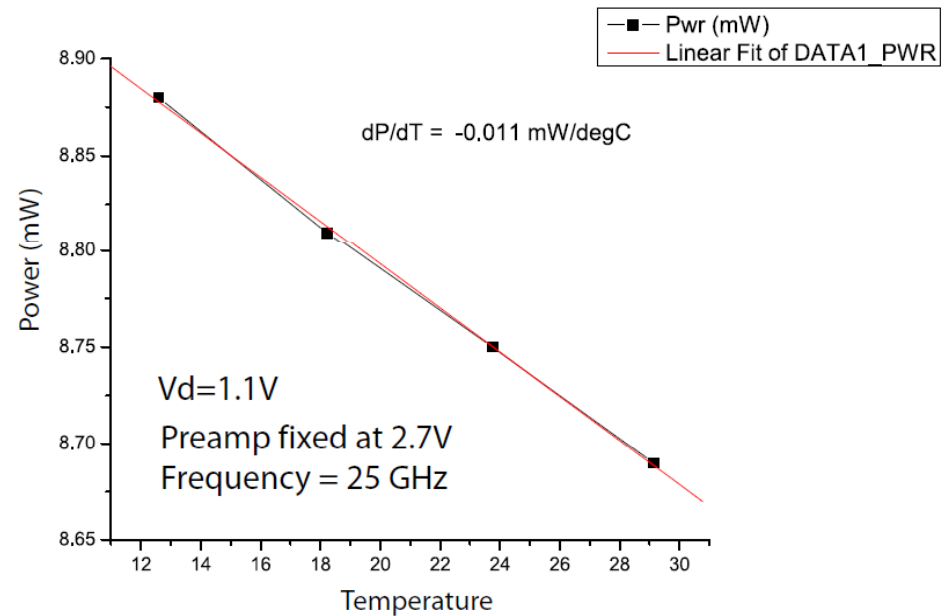
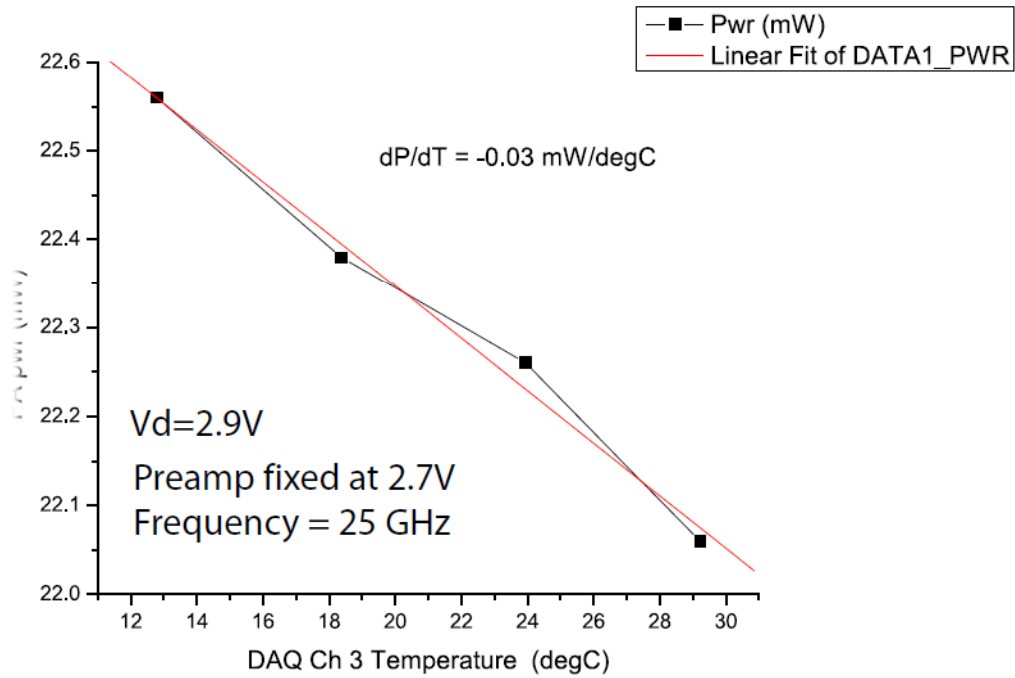
## Measured 210 and 320 GHz LPF



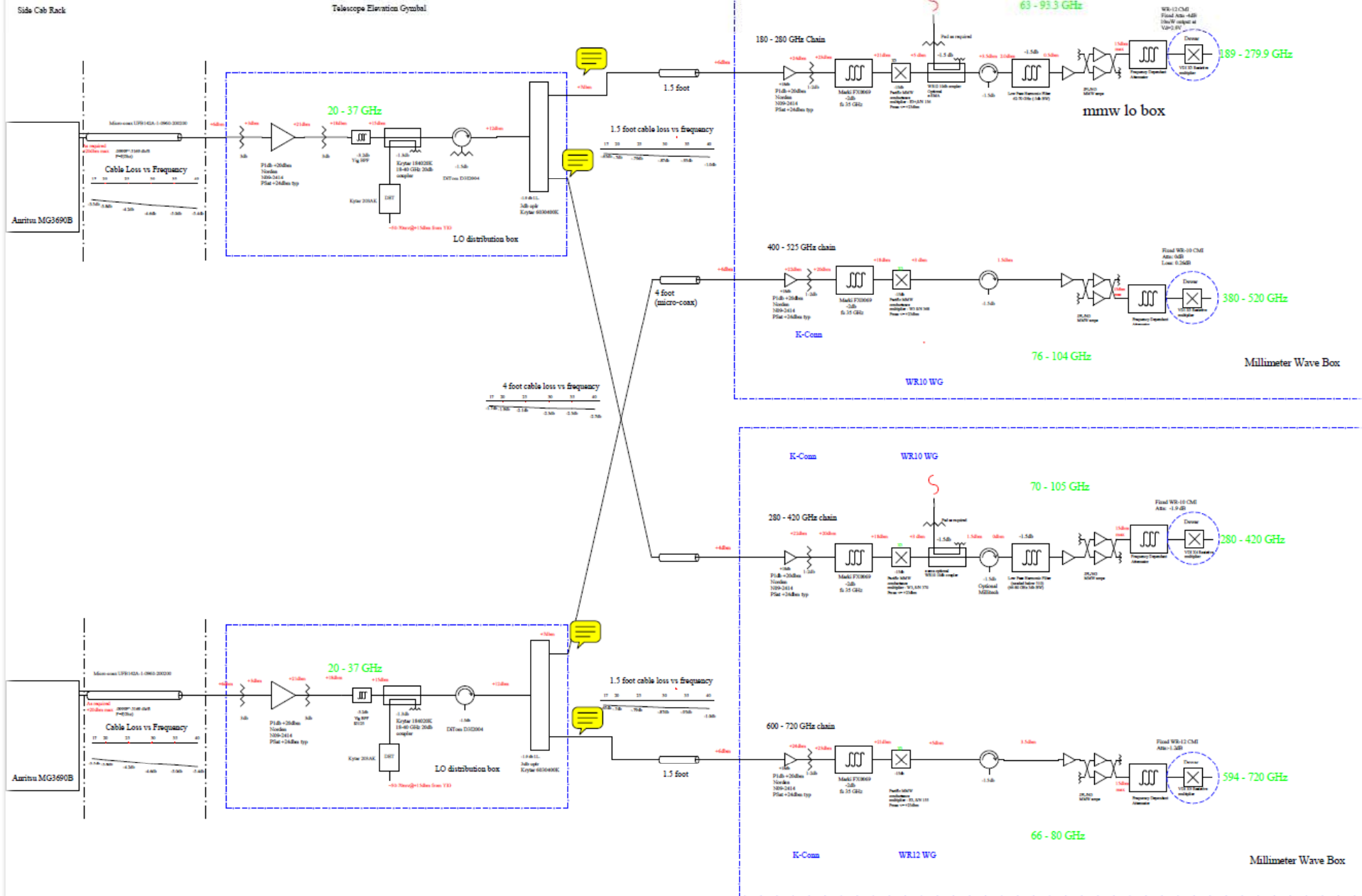
# MARKI 35 GHz Filter Characteristics



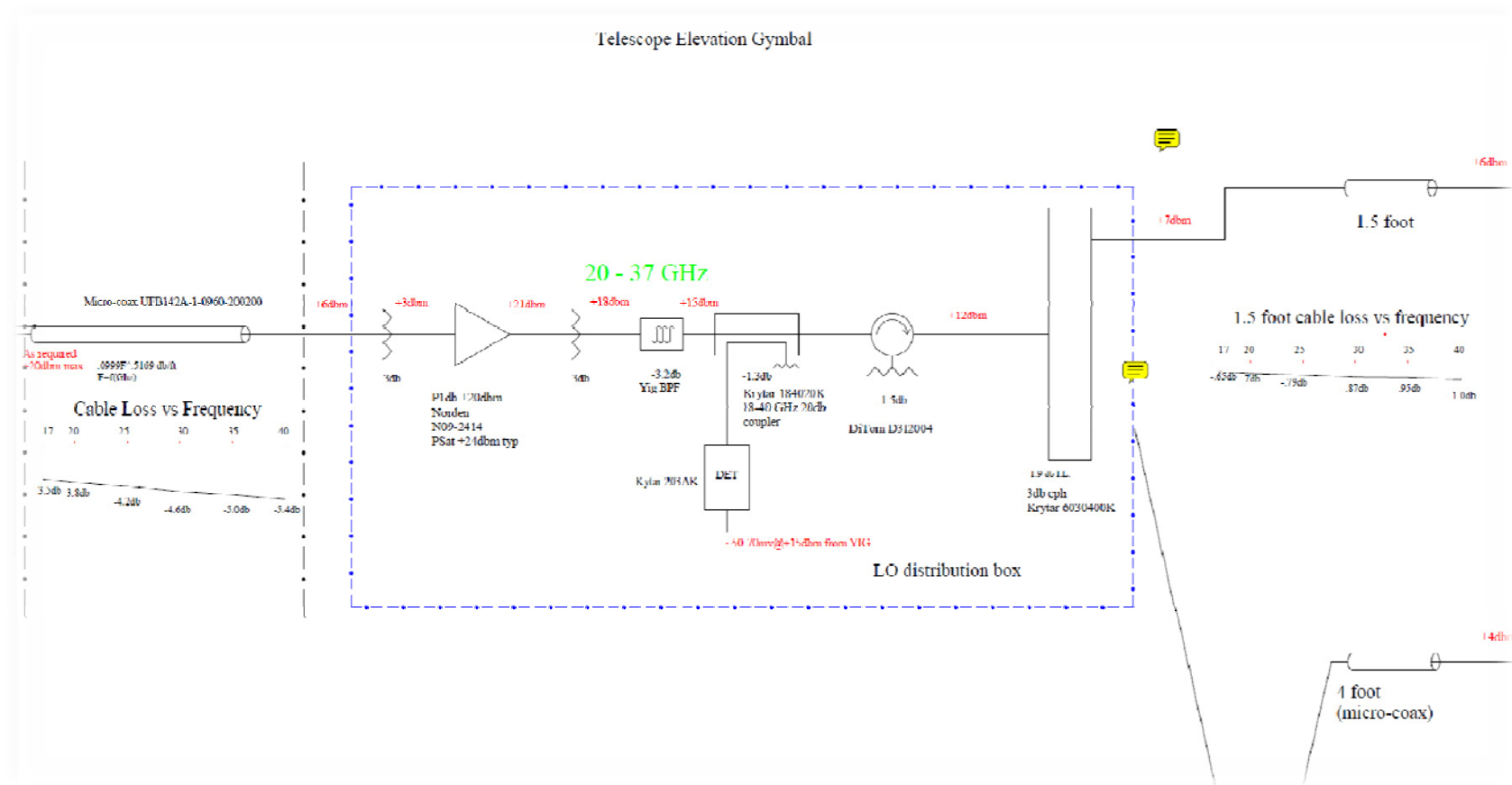
# Thermal behavior JPL Power Amplifiers



# CSO Synthesized LO

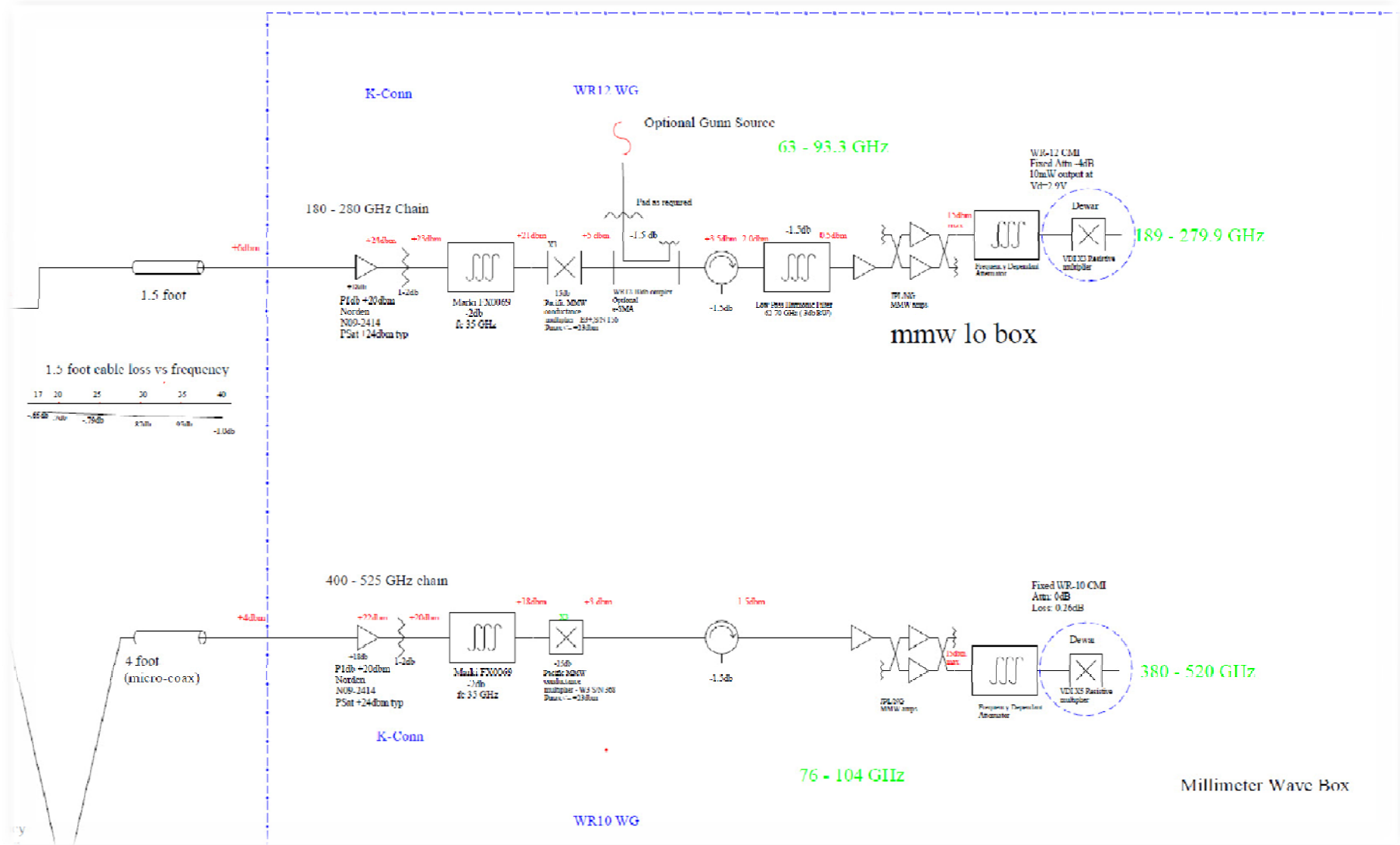


# CSO 'mu' Boxes (YIG filter + conditioning for dual colour)





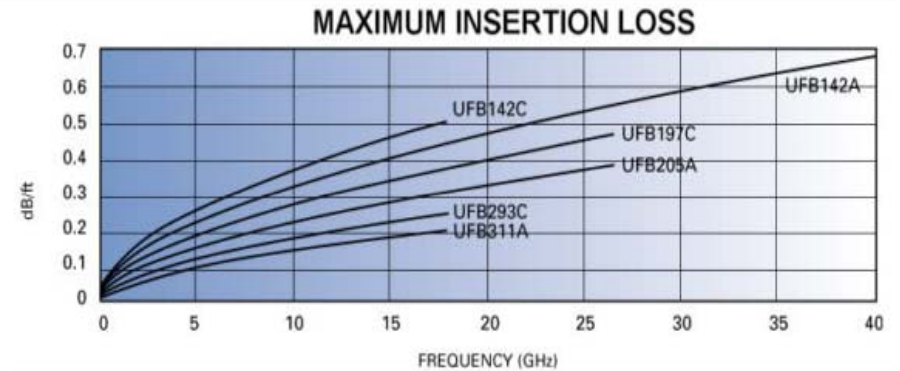
## CSO mmWave Layout (x4) [230, 345, 460, 650 Rx]



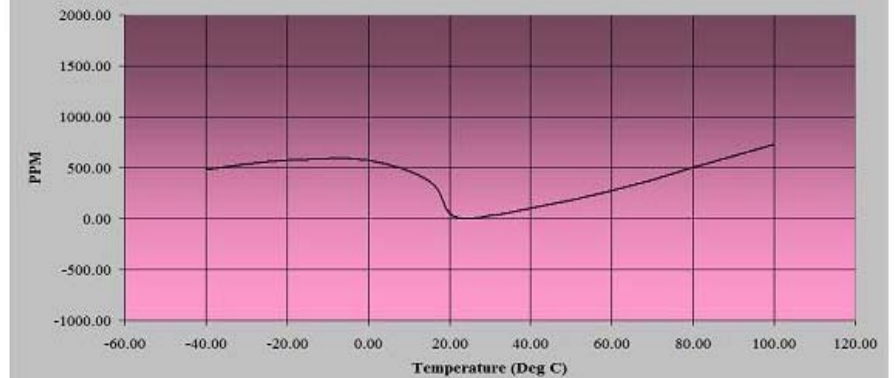
# Micro Coax

## 8ft/UFB142A

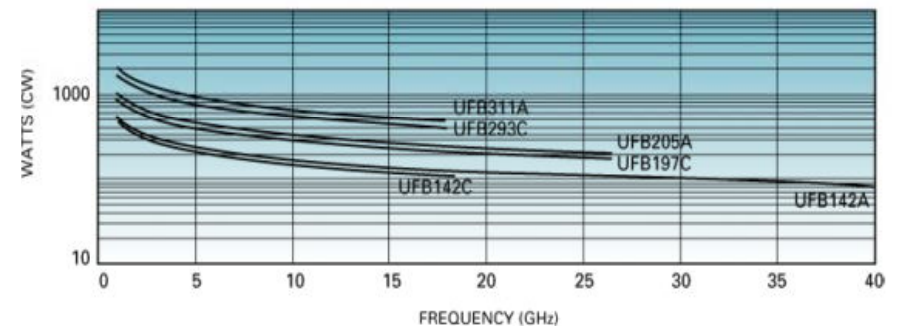
Insertion Loss Chart



Ultra Low Loss  
Phase Stability vs. Temperature



POWER HANDLING



Impedance( ohms)	50
Frequency Range (GHz)	0.05 - 40
Velocity of Propagation	83%
Capacitance, pF/ft. (pF/meter)	24.5 ( 80.38)
Shielding Effectiveness, dB @ 1GHz	>100
Typical Insertion Loss , dB/ft. (dB/meter)	Frequency

### ELECTRICAL CHARACTERISTICS

1.0 GHz	0.12 (0.39)
10.0 GHz	0.38 (1.25)
18.0 GHz	0.51 (1.67)
26.5 GHz	0.62 (2.03)
40.0 GHz	0.77 (2.53)
50.0 GHz	N/A ( )

Phase Stability Versus Flexure

10 GHz: 1°  
18 GHz: 1°

VSWR

Based on connector selections.

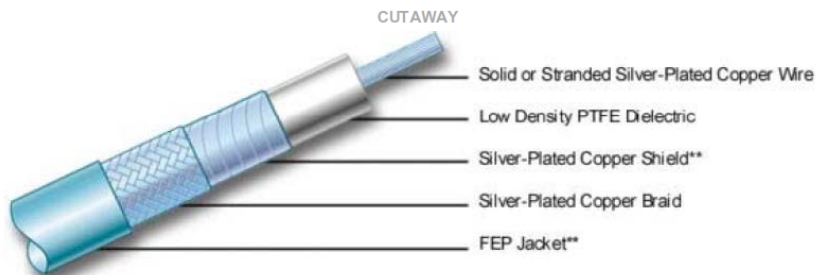
### ENVIRONMENTAL CHARACTERISTICS

Temperature Range(Deg C)

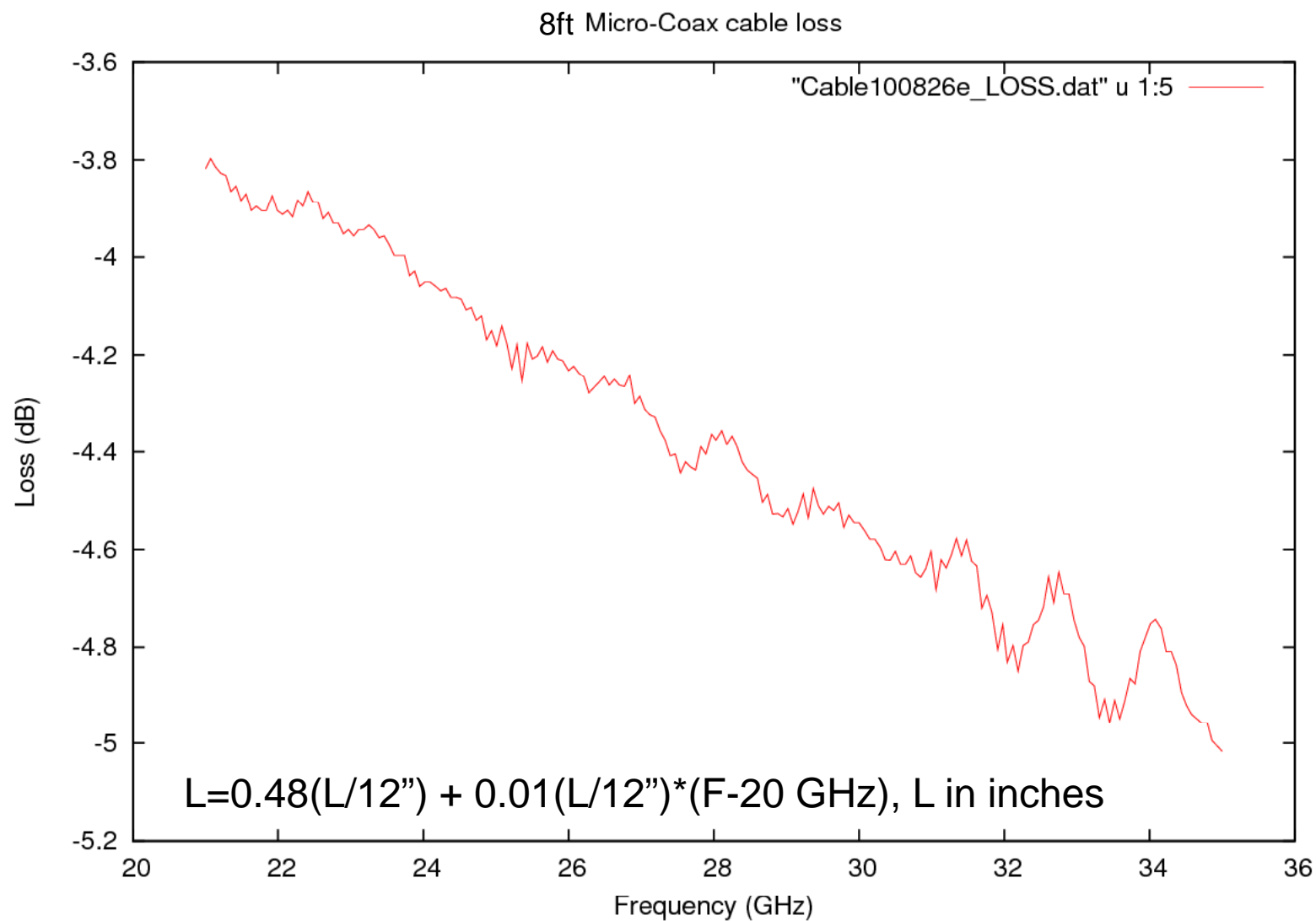
-65/+165

### MATERIALS

Outer jacket	Fluorinated Ethylene Propylene (FEP)
Braid	SPC Alloy Braid
Outer Conductor	Silver plated copper tape
Dielectric	ULD PTFE
Center Conductor	7 Strand SPC



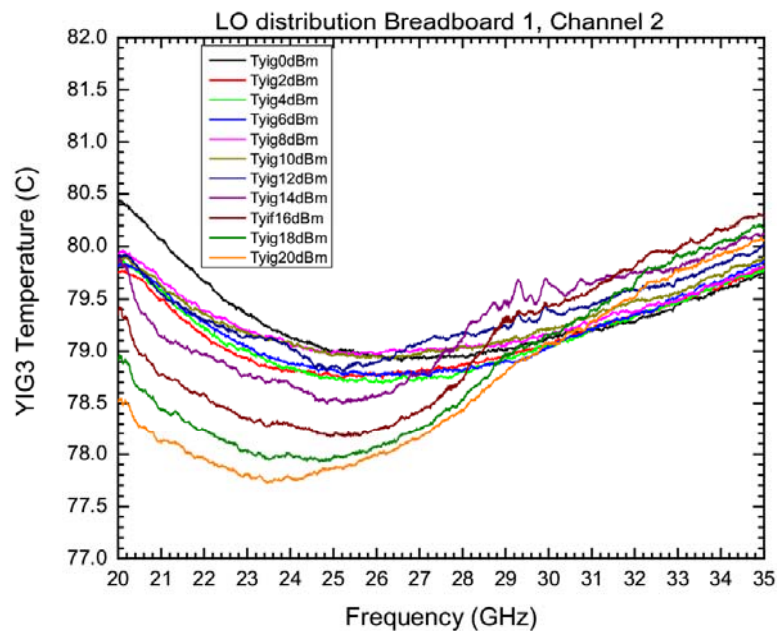
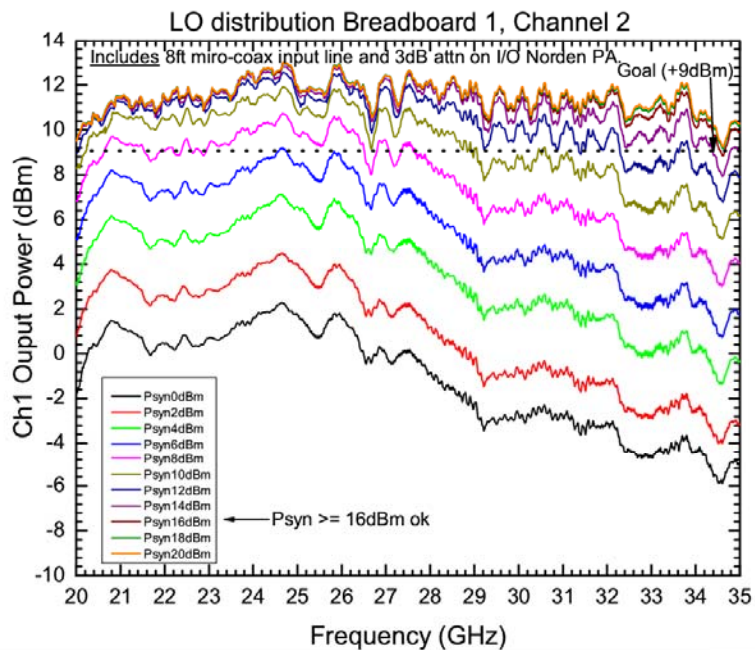
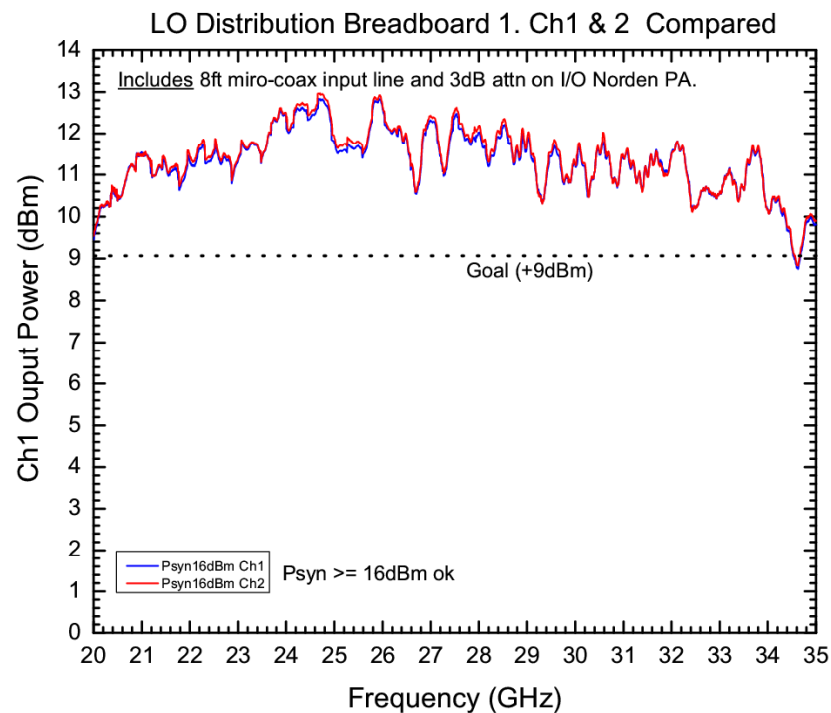
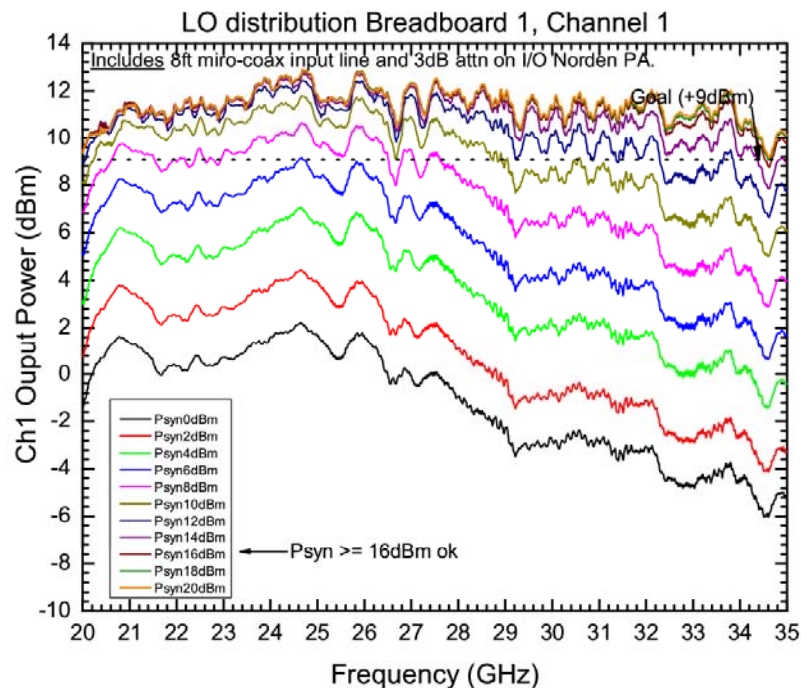
\*\*Not typical for UGN070D



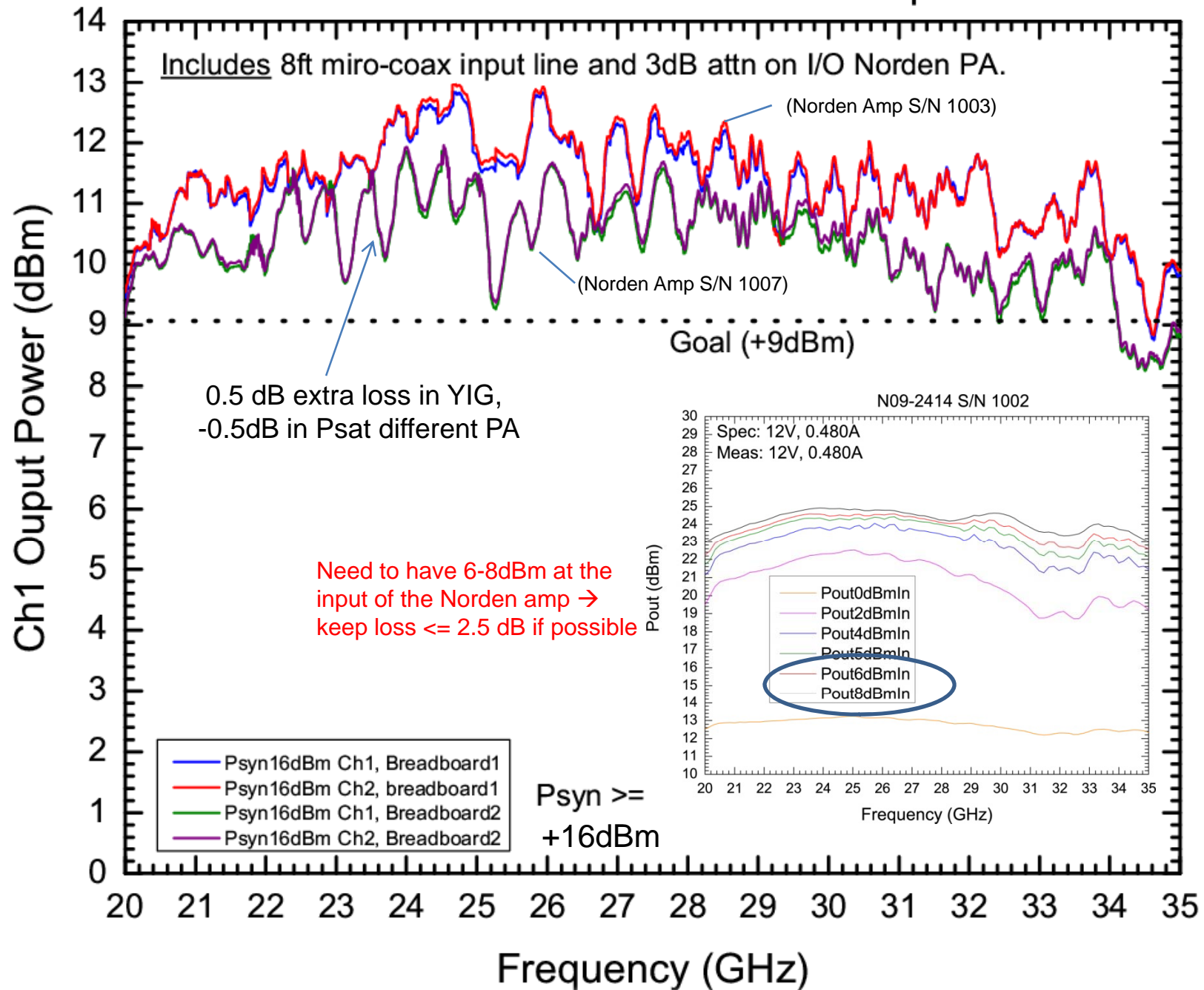
Breadboard 1

Norden N09-2414, S/N 1003

## Measured Output Power muBox #1 (Norden Amp S/N 1003)



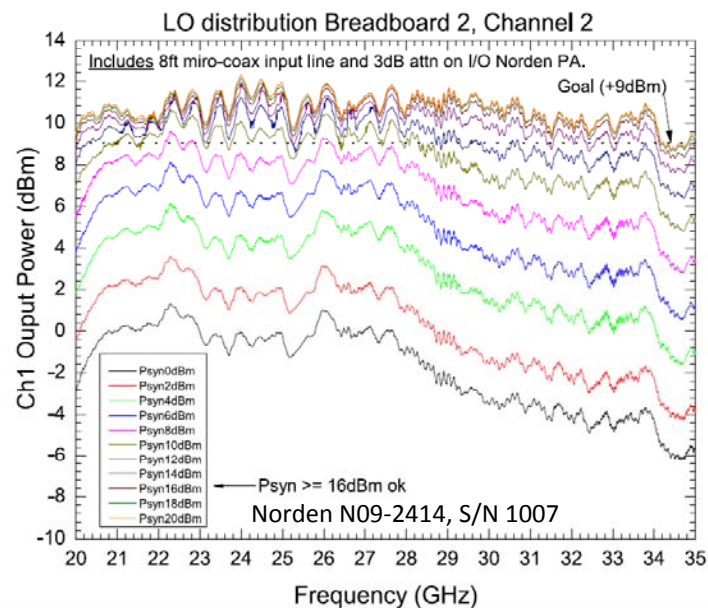
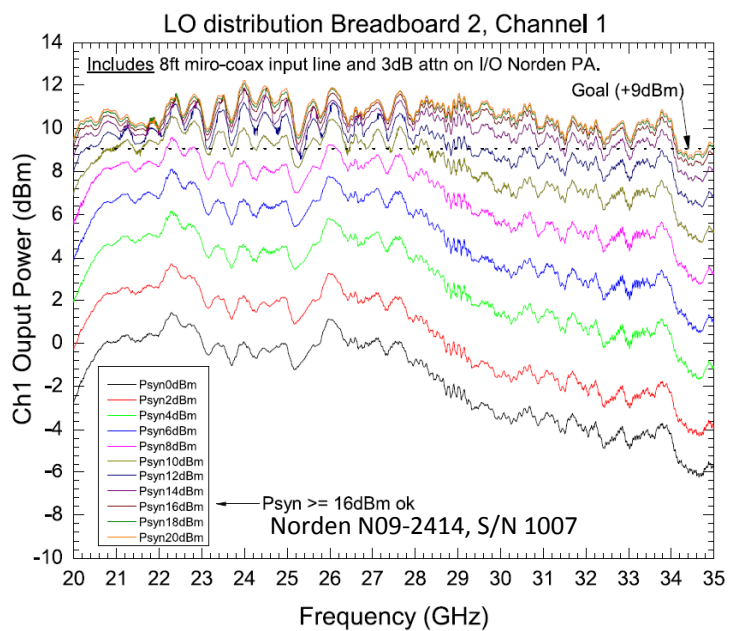
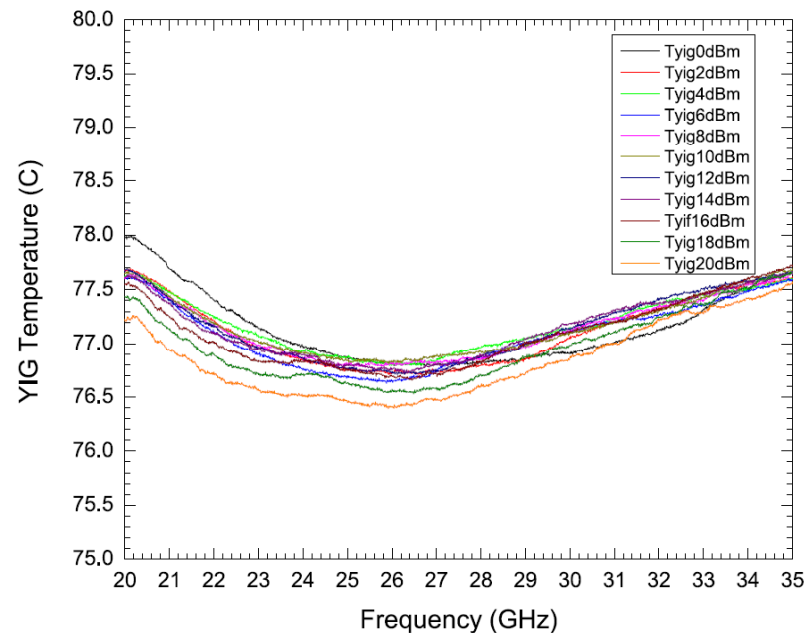
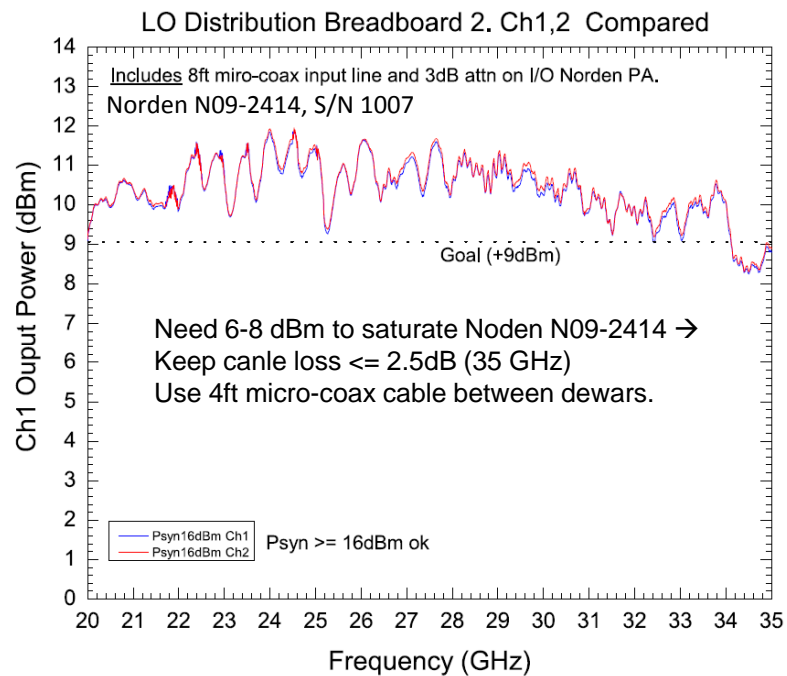
# LO Distribution Breadboard 1 & 2 Compared



Breadboard 2  
Norden N09-2414, S/N 1007

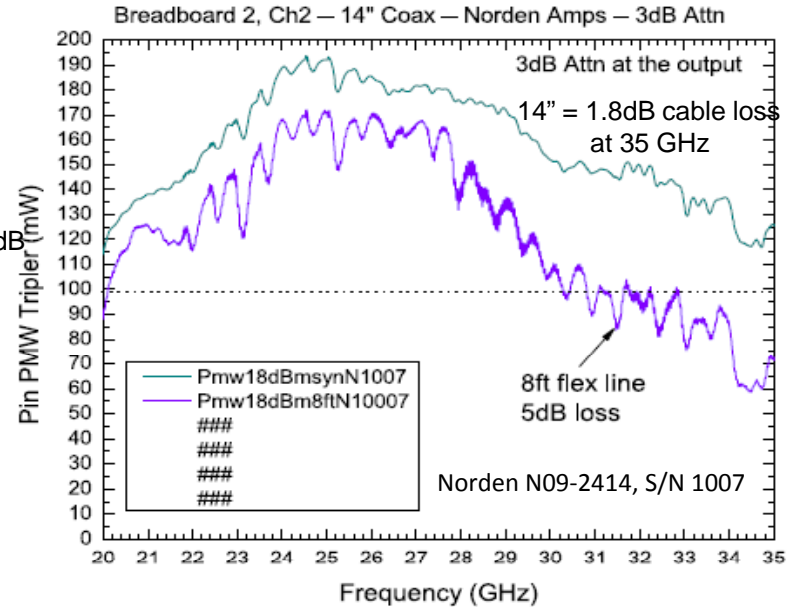
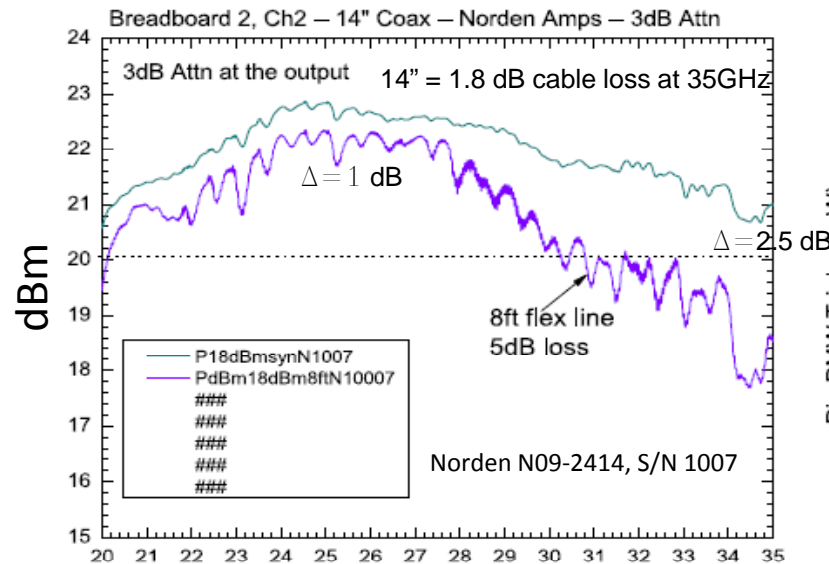


## Output muBox #2



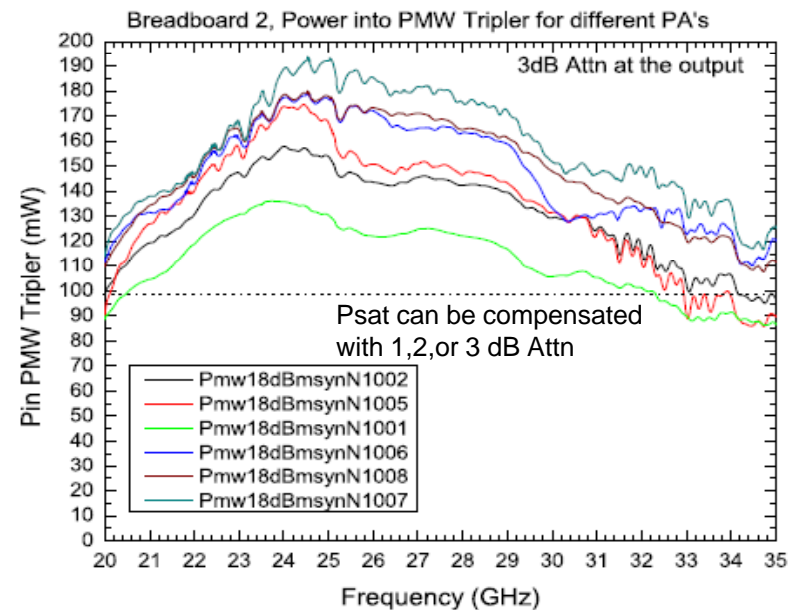
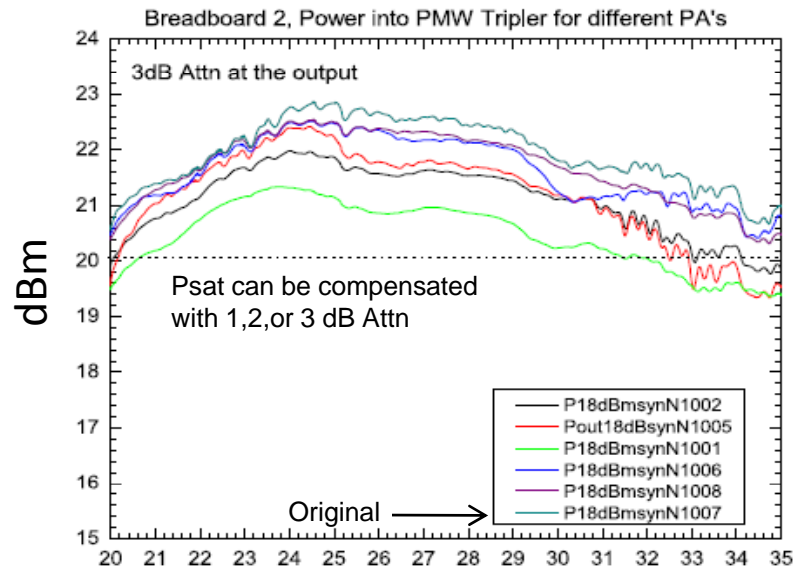


## At output muBox #2



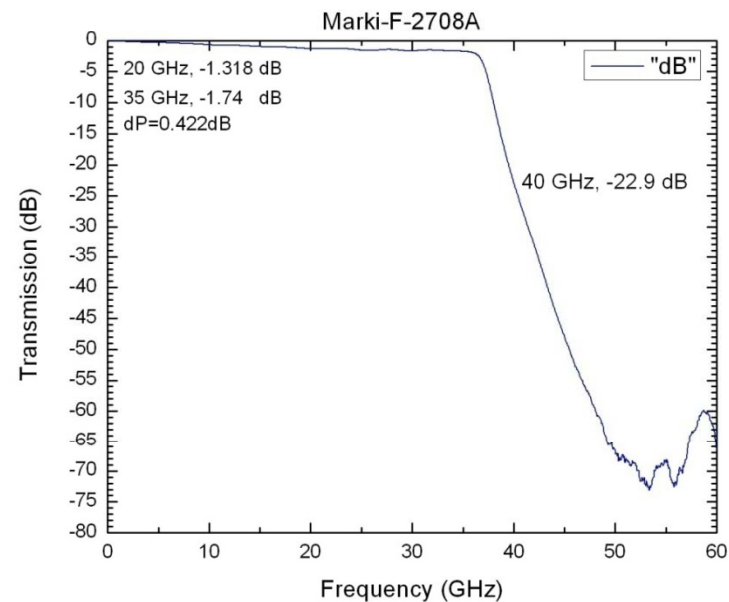
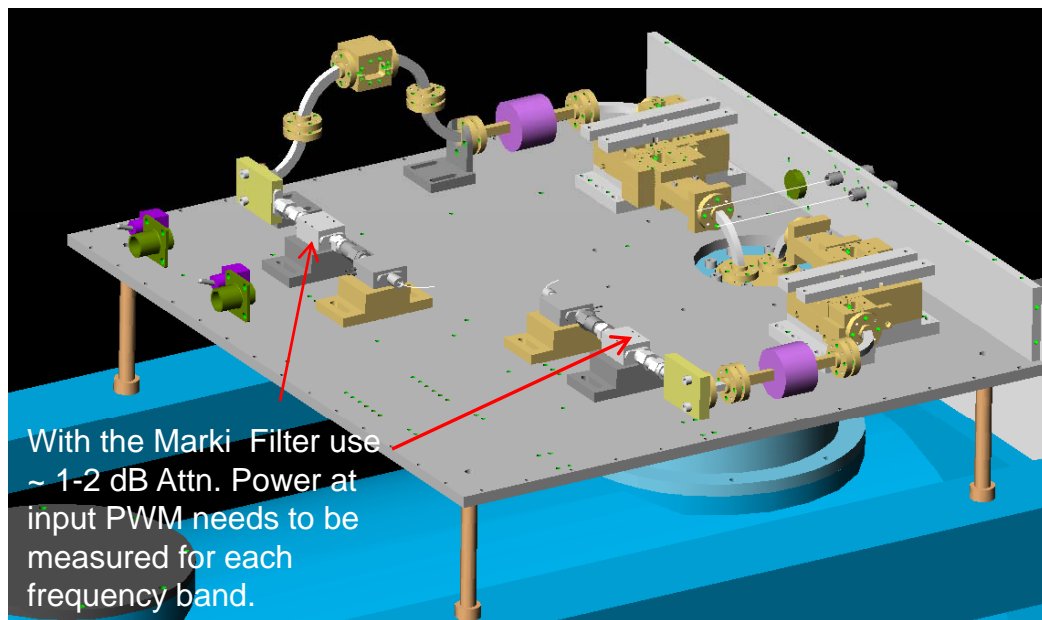
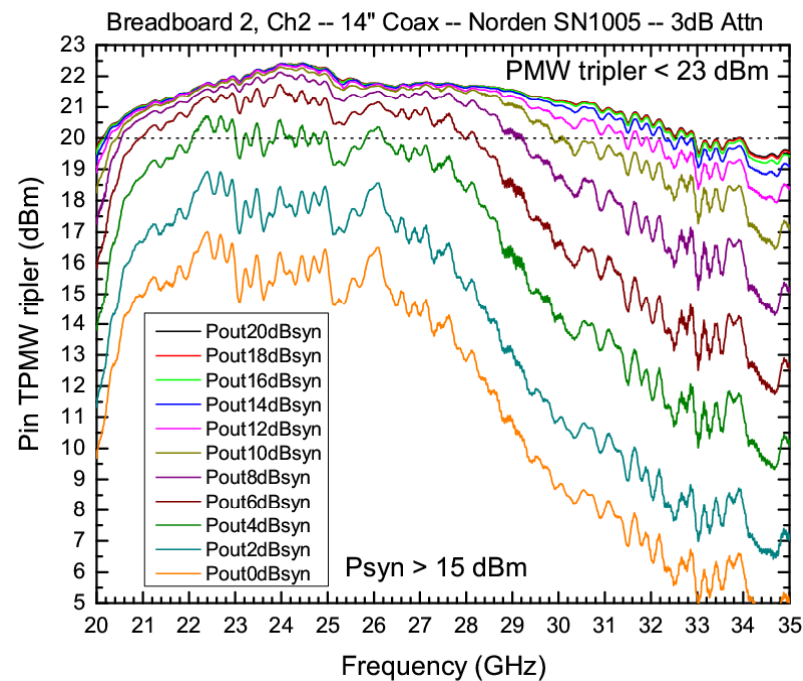
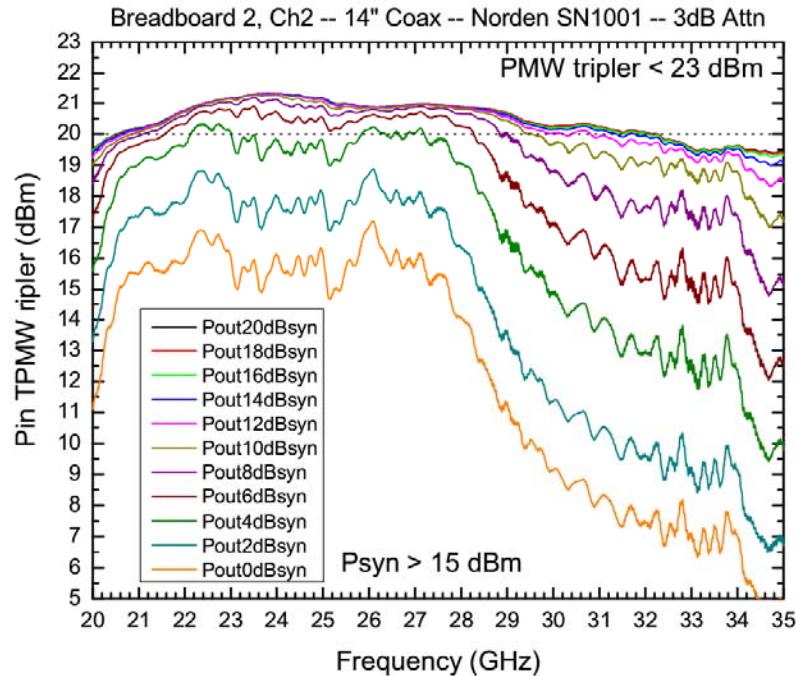
14" RfCoax: At 20 GHz: 1 dB, 35 GHz: 1.8 dB

These numbers are the total loss of the cable. (Divide by 14/12 = 1.167 to get dB/ft.)



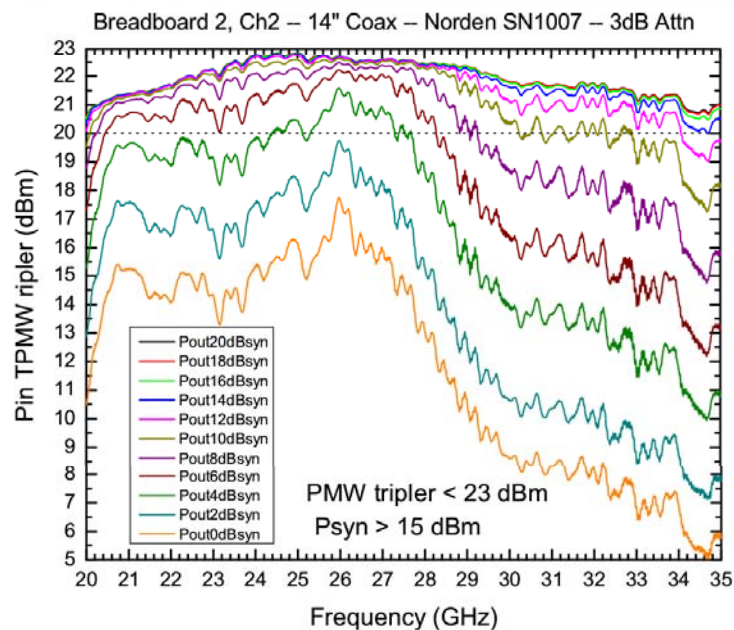
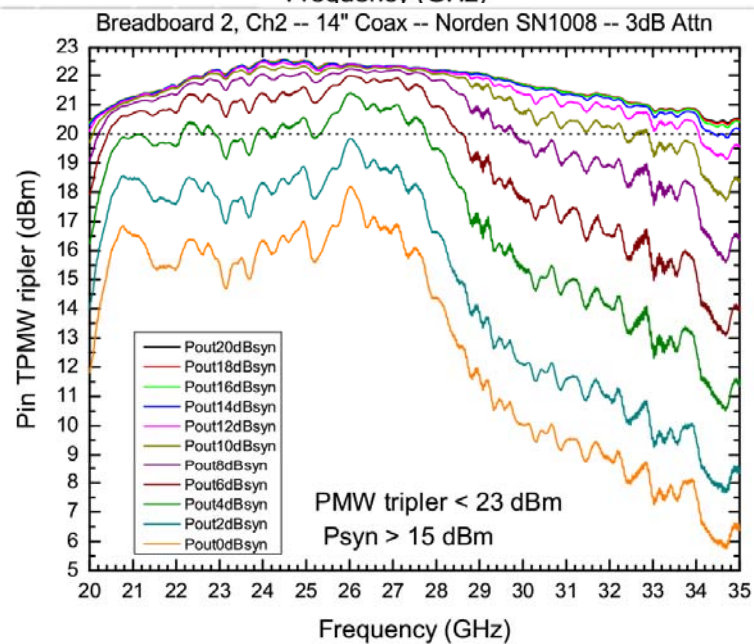
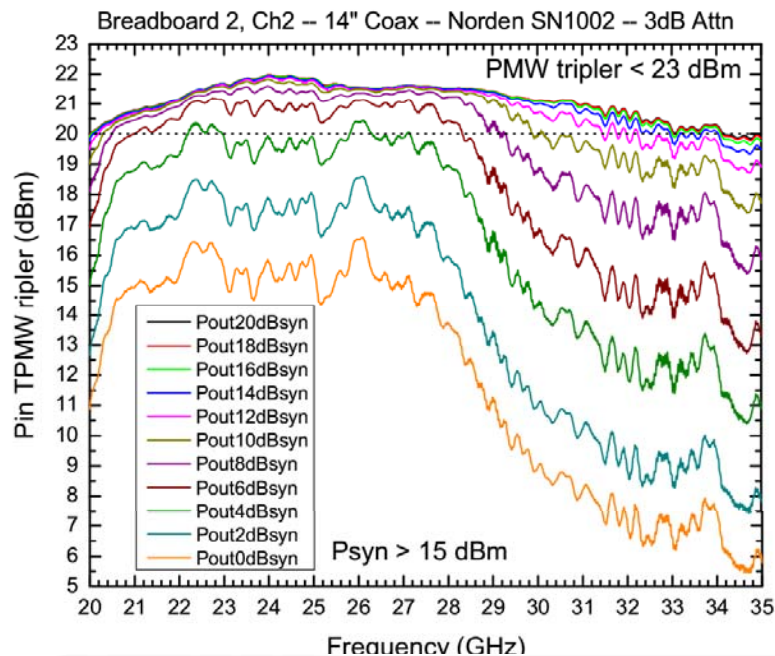
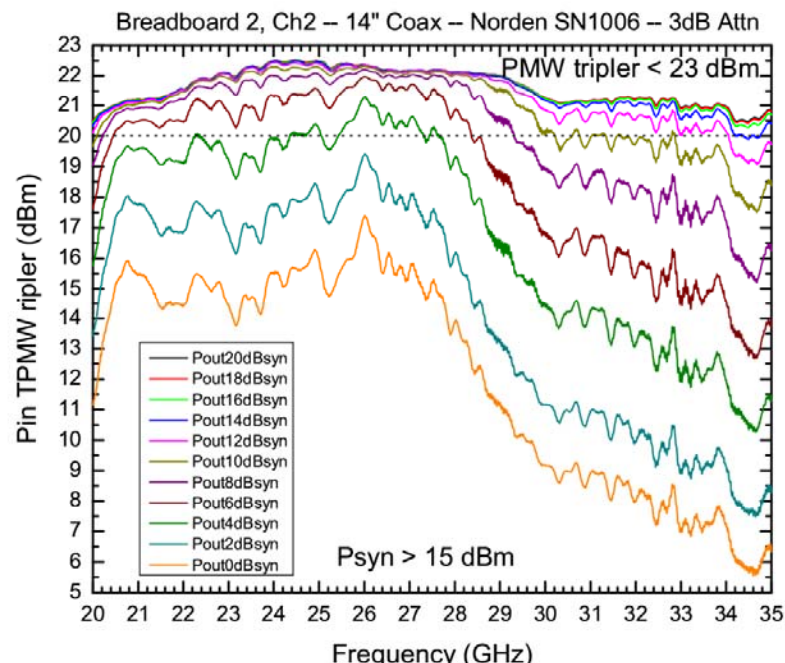
Output power going to PMW Tripler with a 14" RF Coax interconnect (Incl a 3dB Attn).

14 dB RF Coax ~1.8 dB attn at 35 GHz



# Output power going to PMW Tripler with a 14" RFcoax interconnect (Incl 3dB Attn)

14 dB RF Coax ~1.8 dB attn at 35 GHz



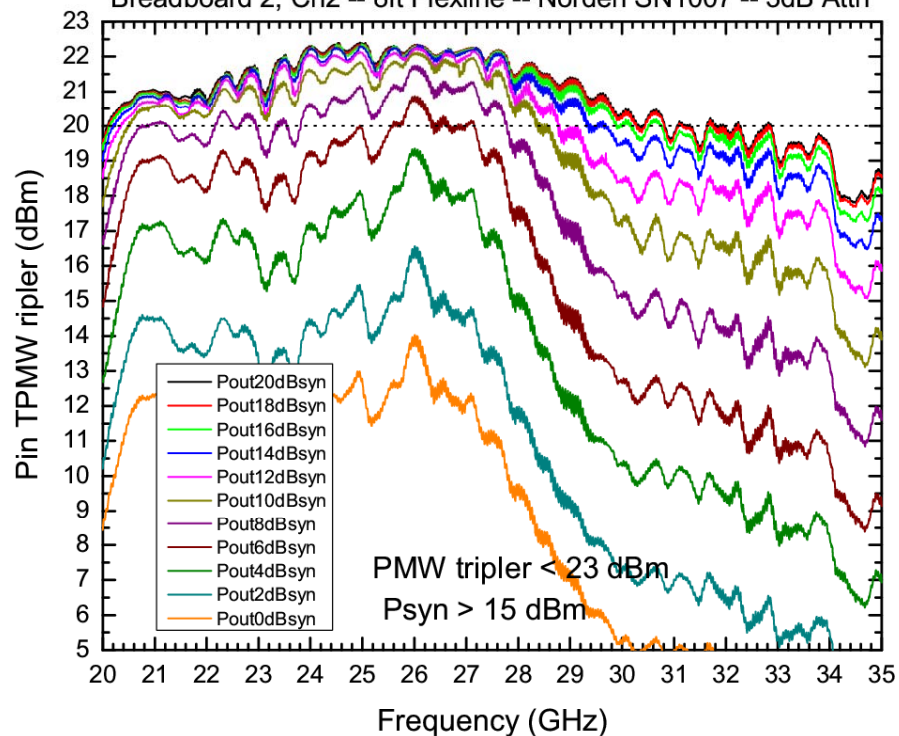


## Output power going to PMW Tripler with a 14" RF Coax interconnect (Incl 3dB Attn)

14dB RF Coax = 1.8dB attn at 35 GHz

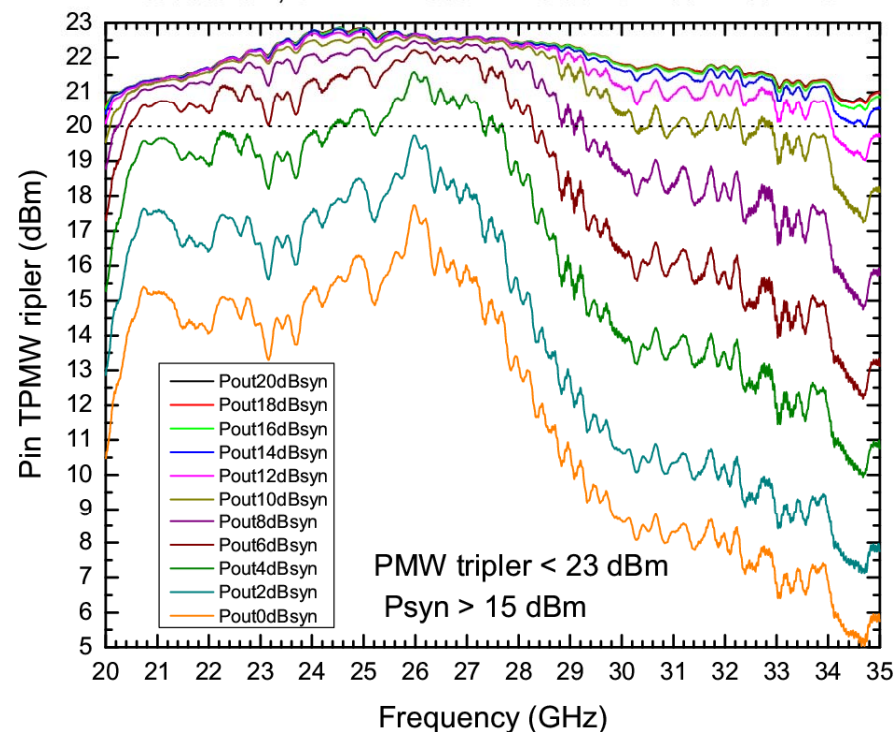
### 8ft Microcoax, 5dB loss at 35 GHz (too much)

Breadboard 2, Ch2 – 8ft Flexline – Norden SN1007 – 3dB Attn

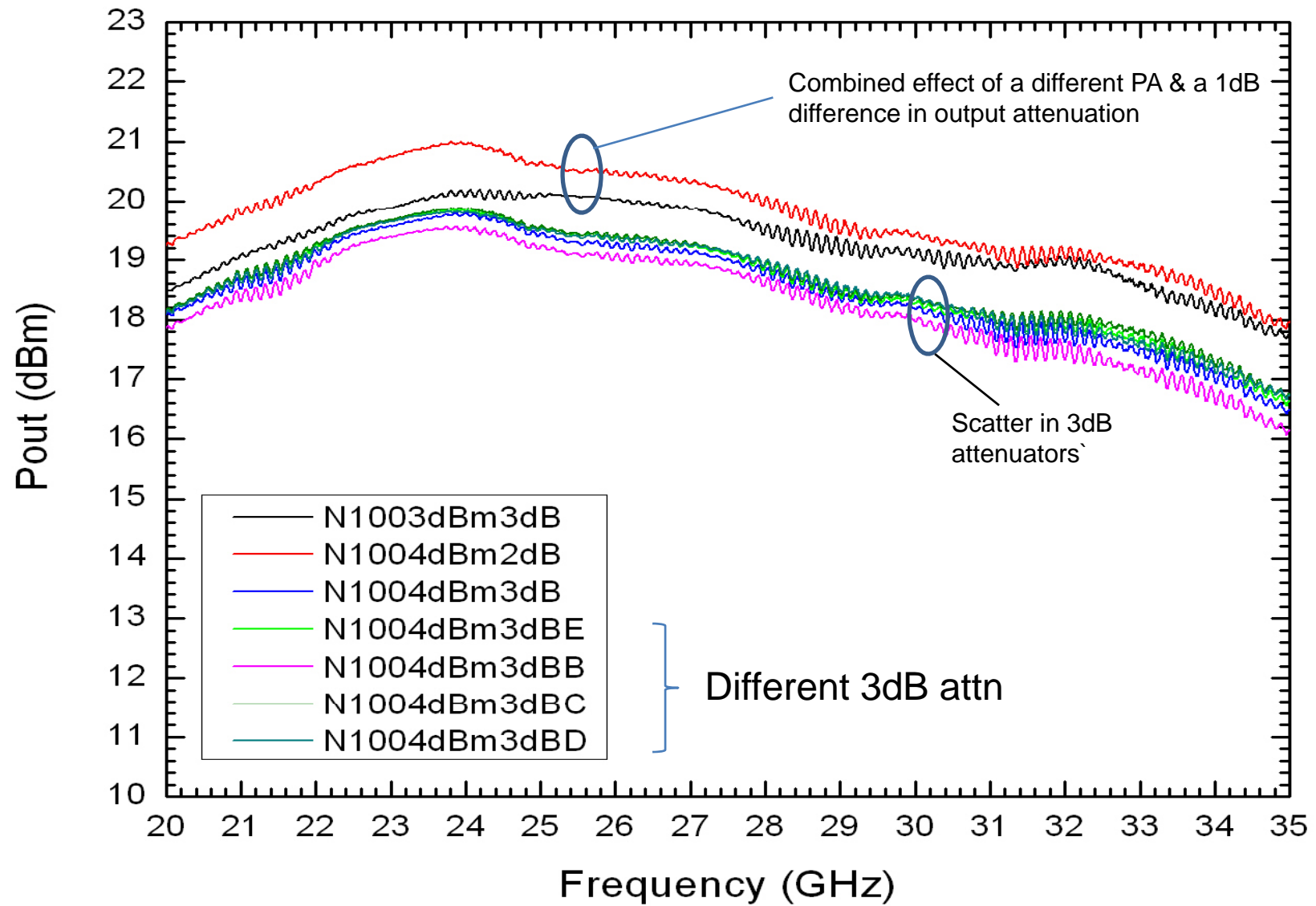


### Comparison with 14" RFcoax interconnect

Breadboard 2, Ch2 – 14" Coax – Norden SN1007 – 3dB Attn



# N09-2414 S/N1004 with different attn on output

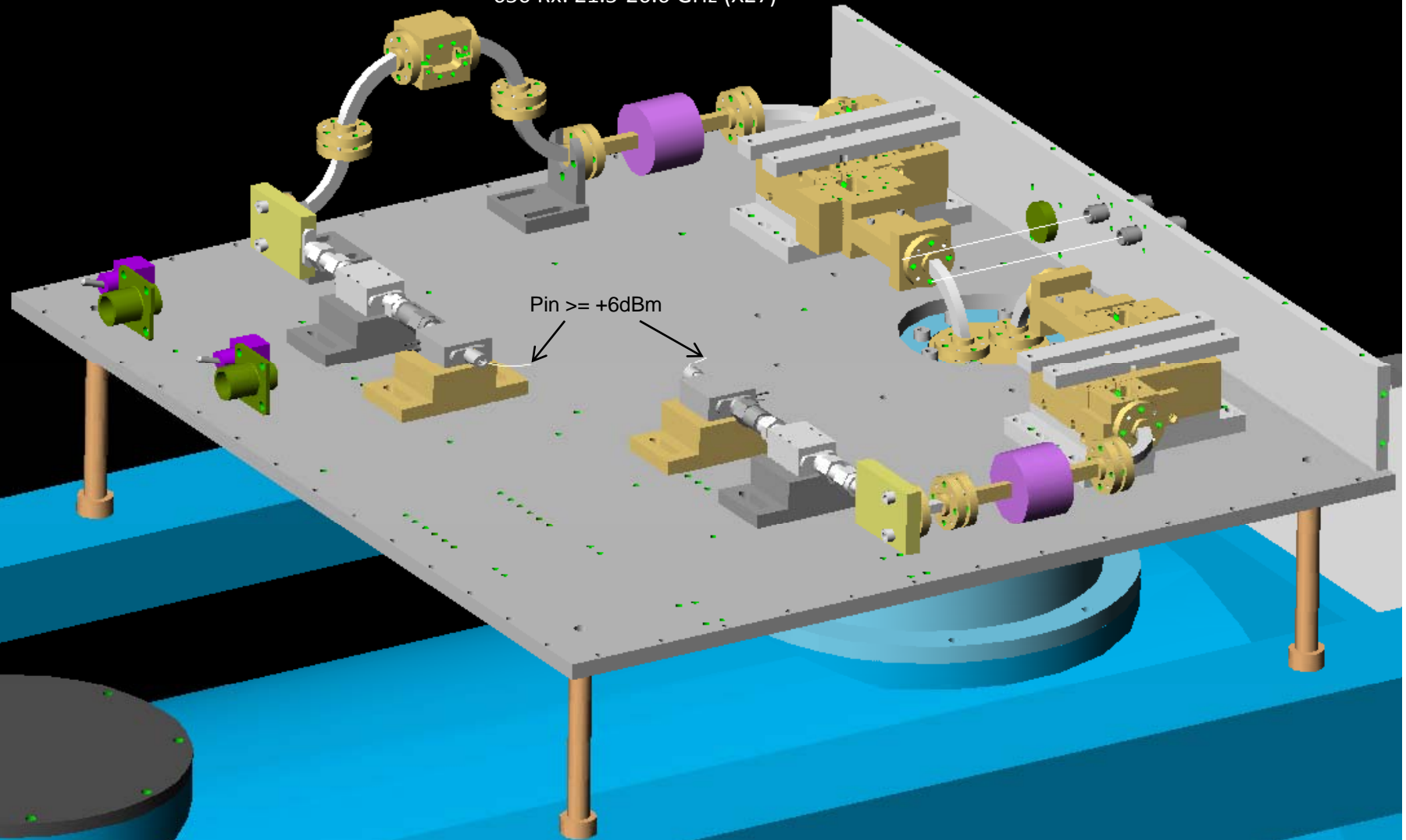


## Loss Calculations

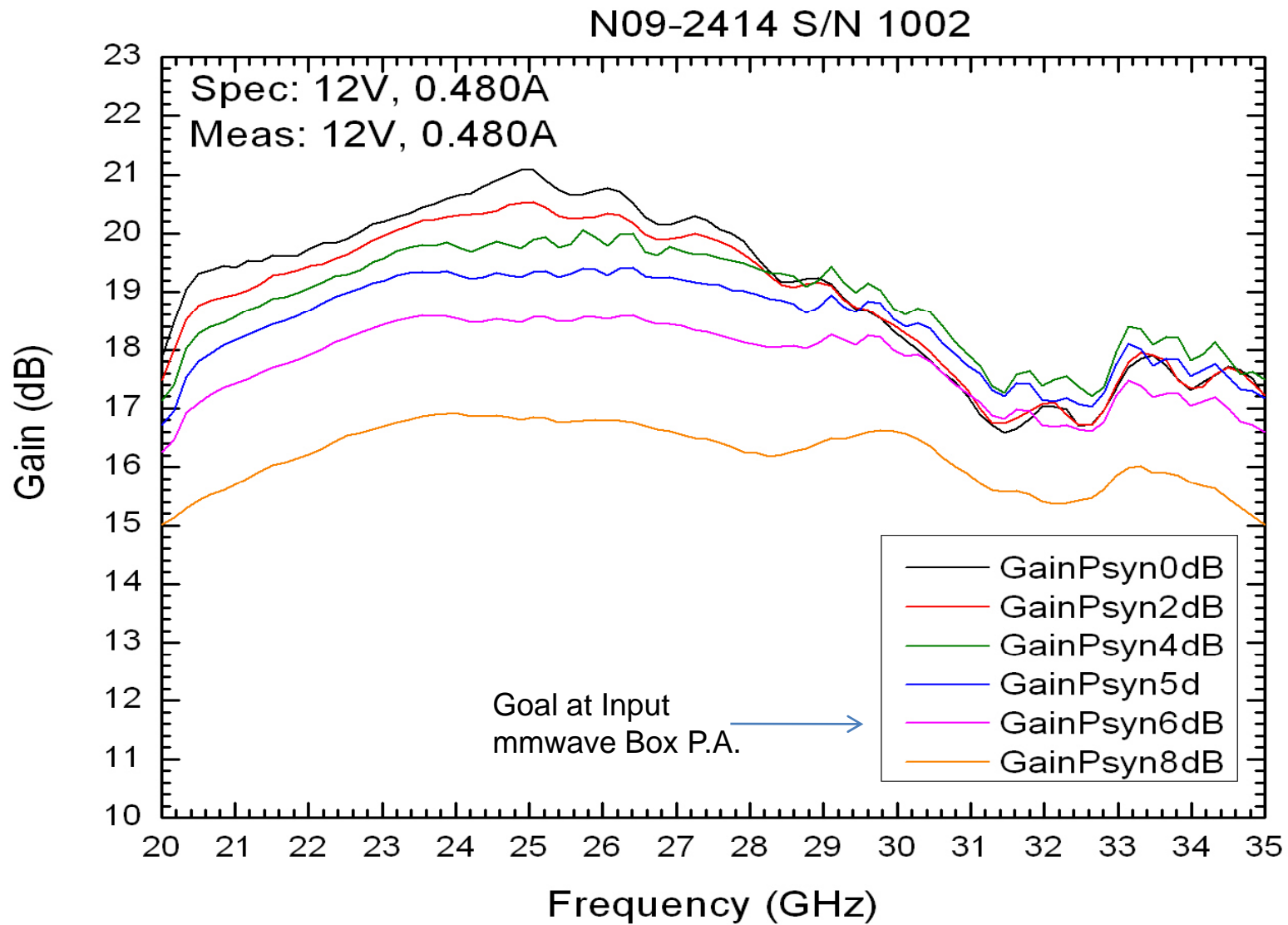
mmWave Box N09-2414 P.A. Input Requirement:  $\geq +6\text{dBm}$

230 Rx: 20.3-31.1 GHz (X9)  
460 Rx: 26.6-34.6 GHz (X15)

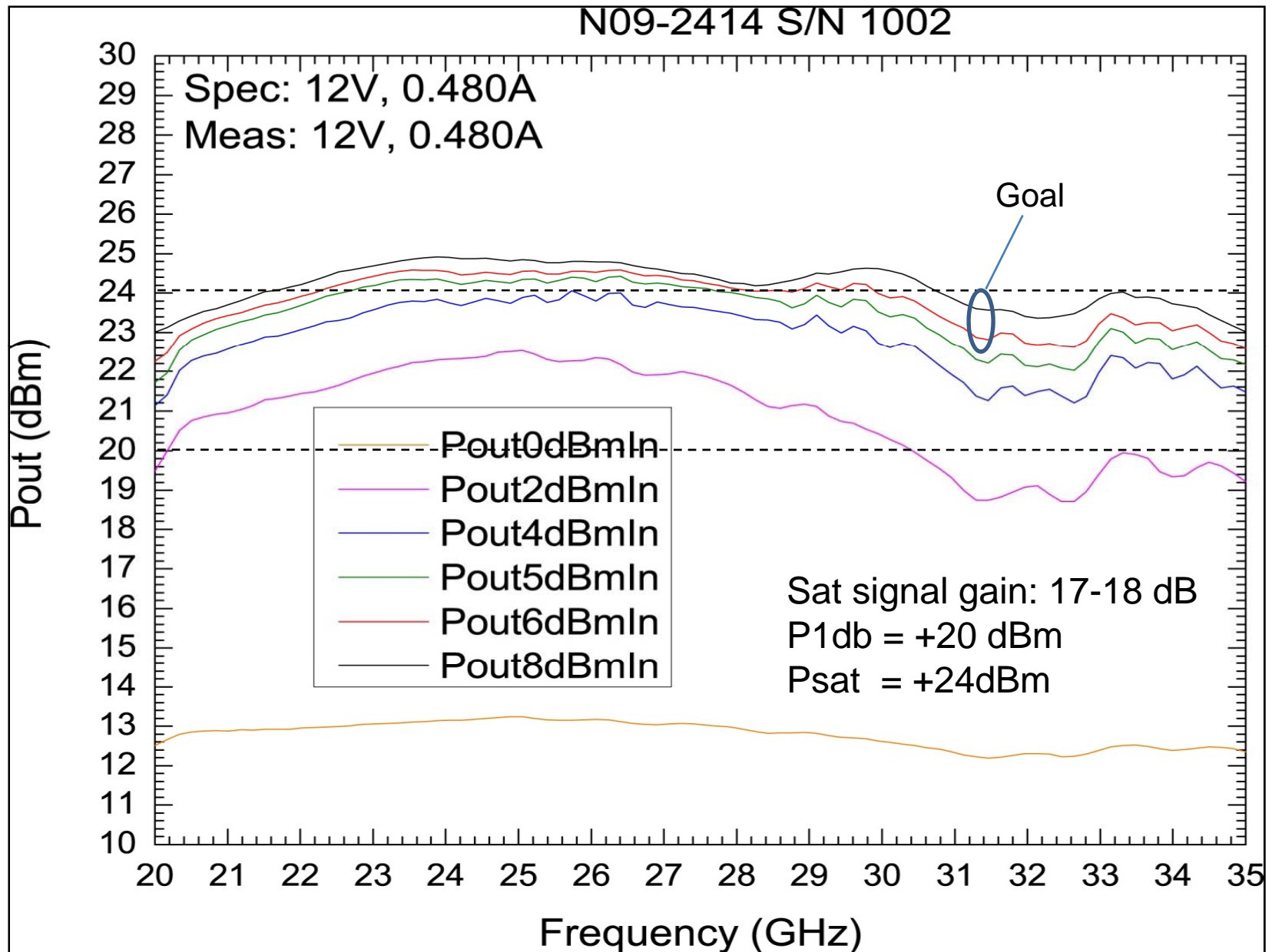
345 Rx: 23.3-35.0 GHz (X12)  
650 Rx: 21.5-26.6 GHz (X27)



# Gsat Characteristics for N09-2414



# Psat Characteristics for N09-2414

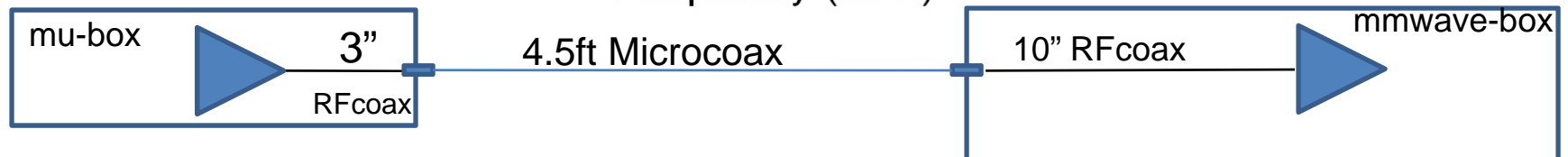
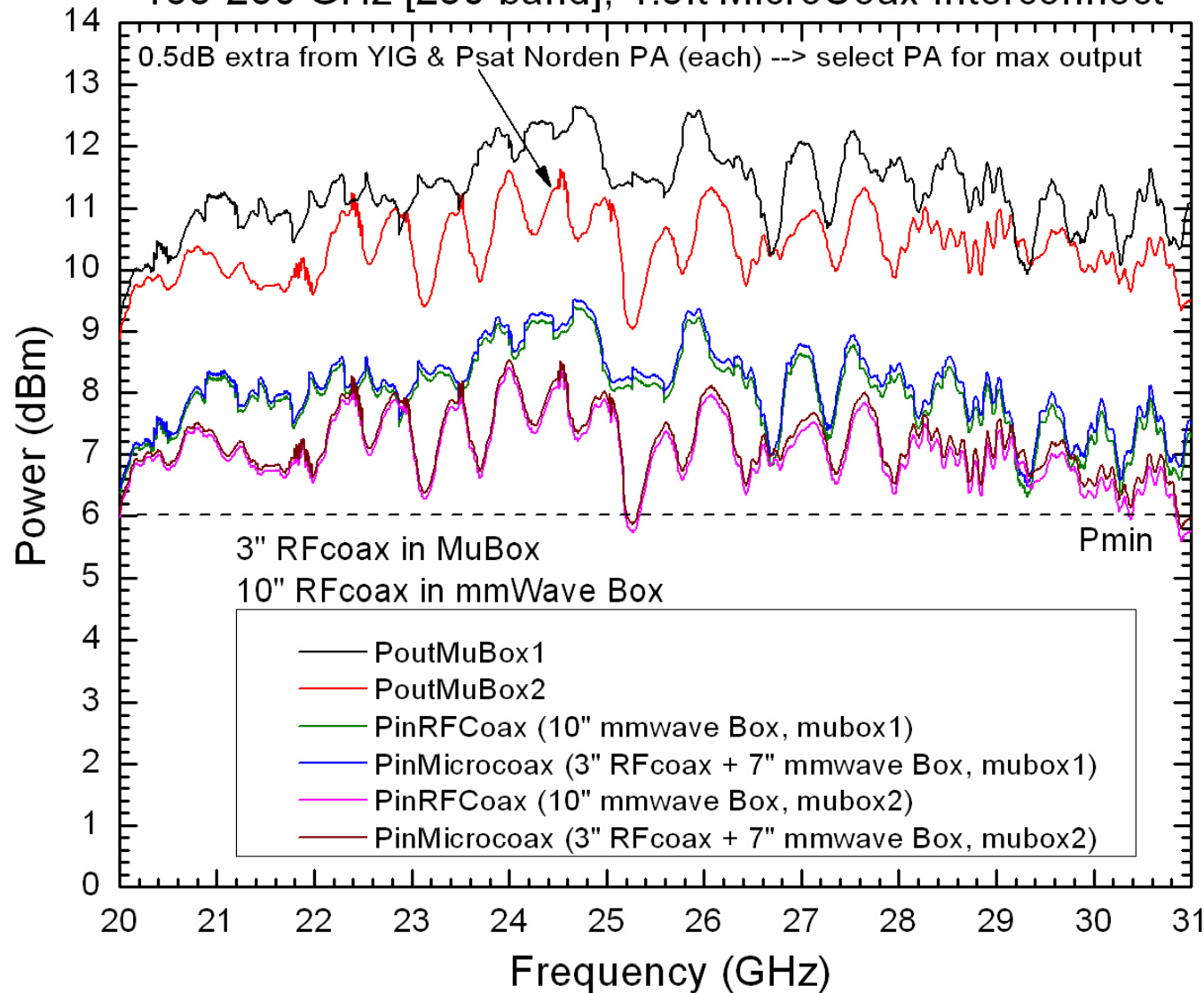




# Measured Loss Calculations

230 Rx: 20.3-31.1 GHz (X9)

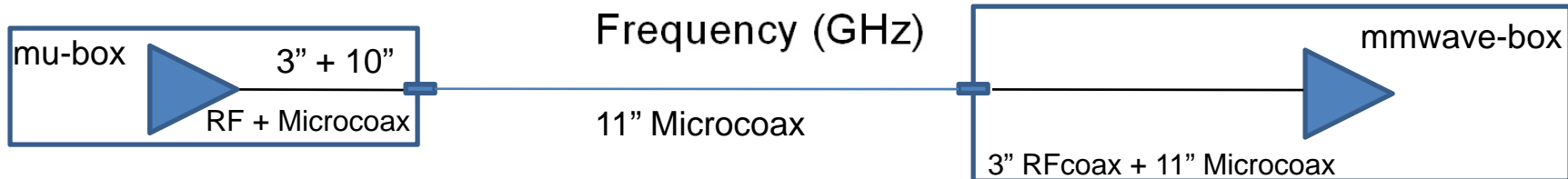
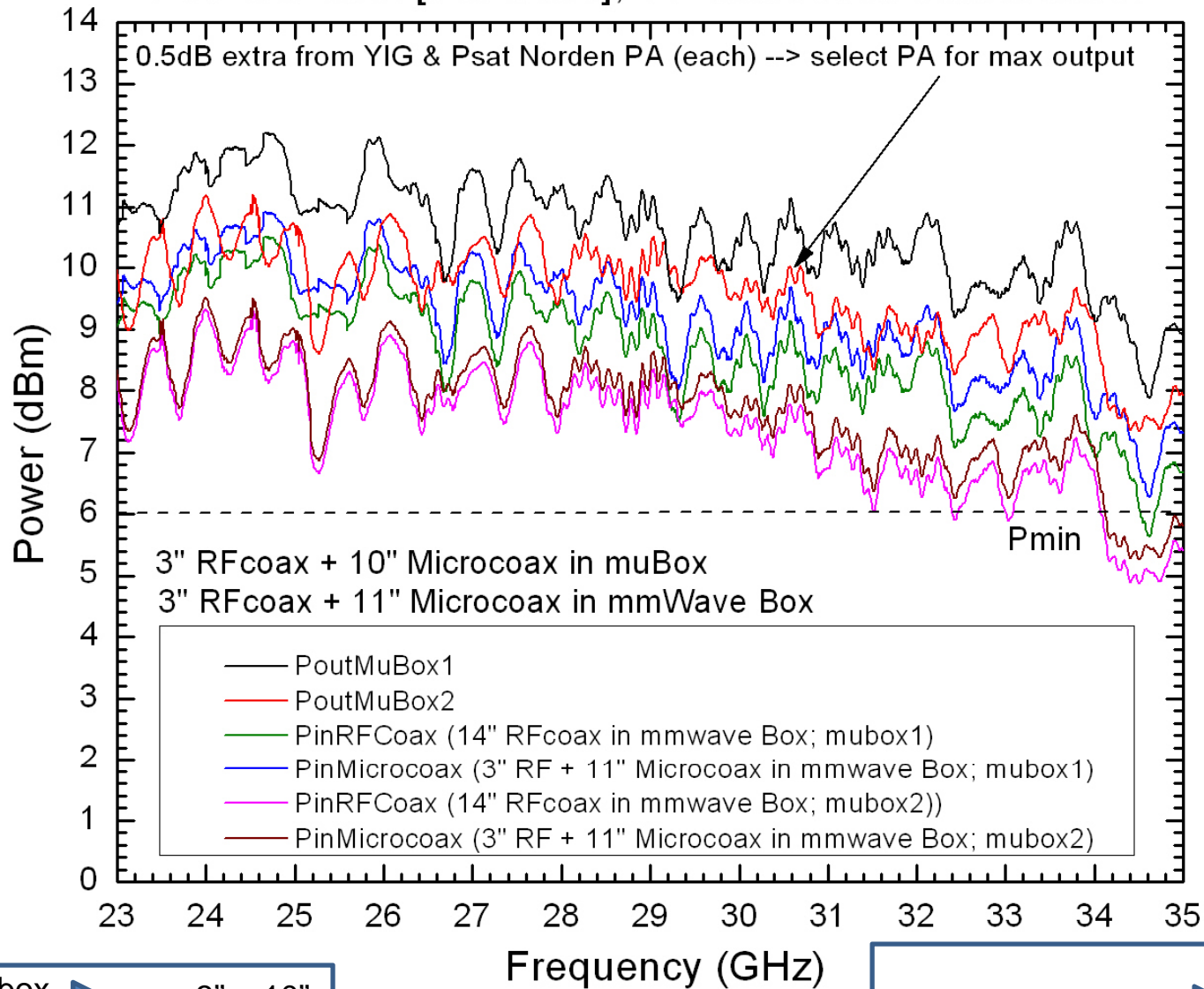
## 183-280 GHz [230 band], 4.5ft MicroCoax Interconnect



# Measured Loss Calculations

345 Rx: 23.3-35.0 GHz (X12)

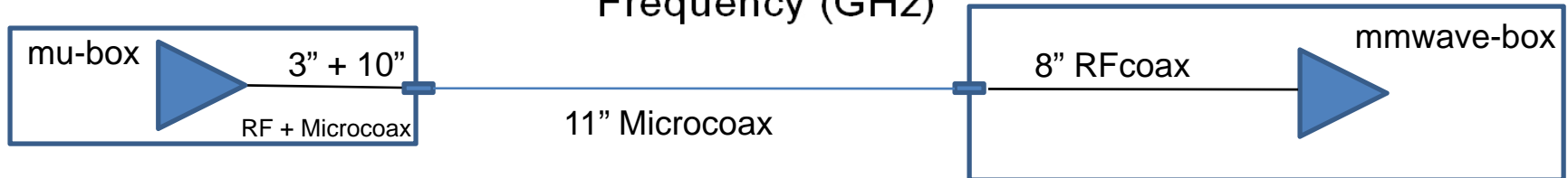
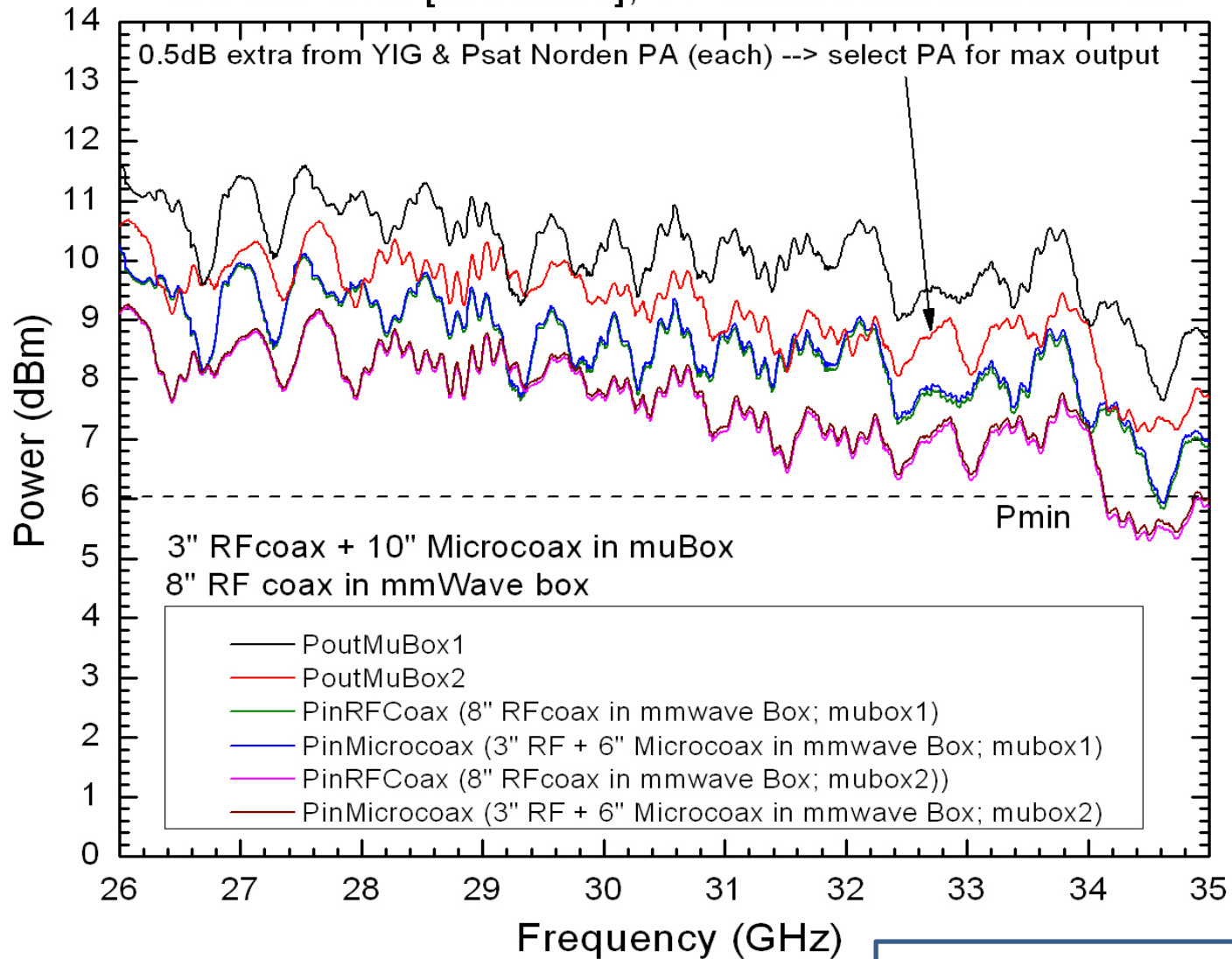
## 280-420 GHz [345 band], 11" Microcoax Interconnect



# Measured Loss Calculations

460 Rx: 26.6-34.6 GHz (X15)

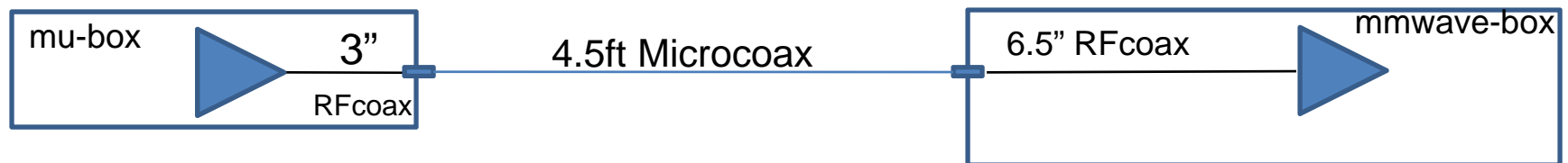
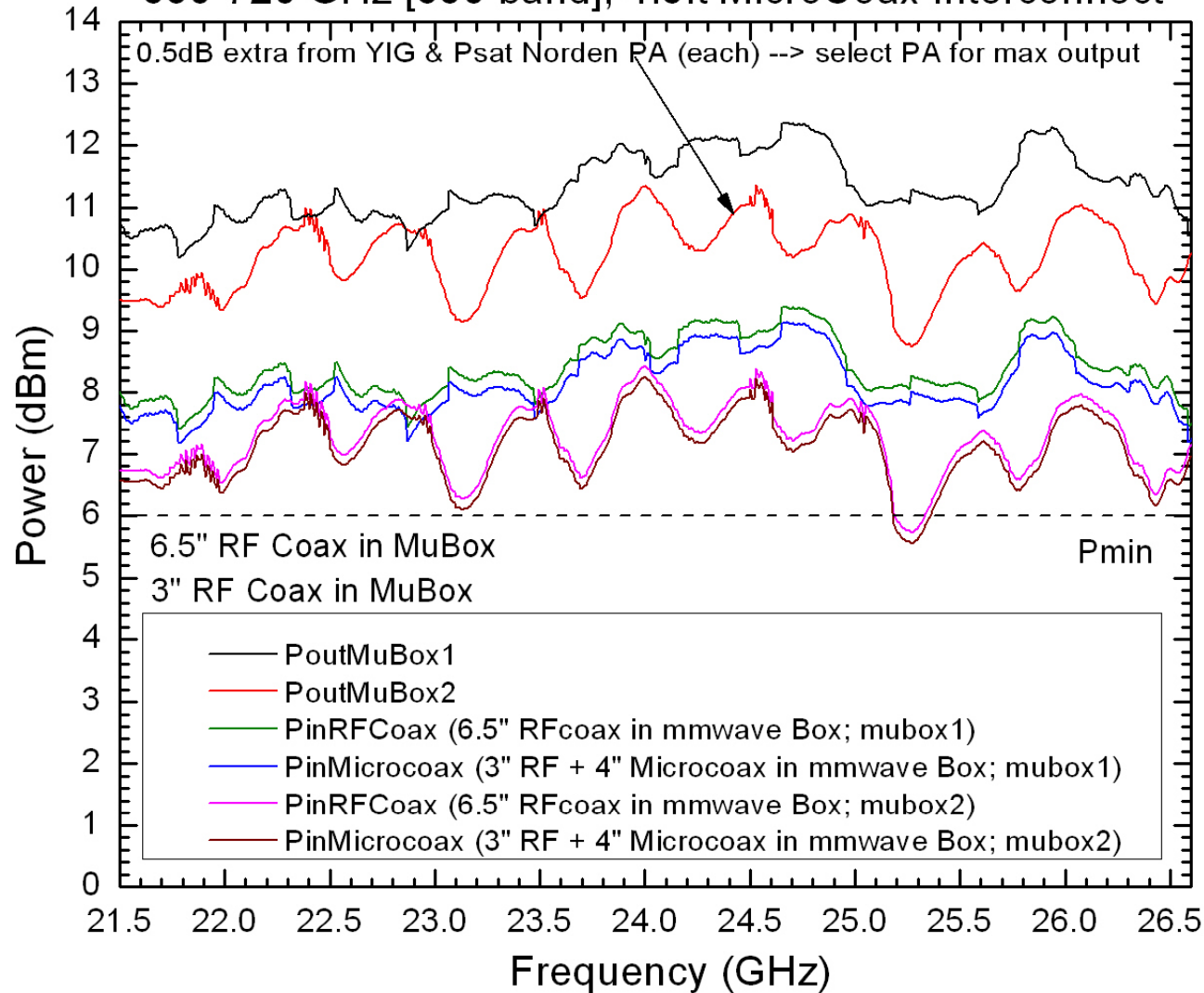
## 400-520 GHz [460 band], 11" MicroCoax Interconnect



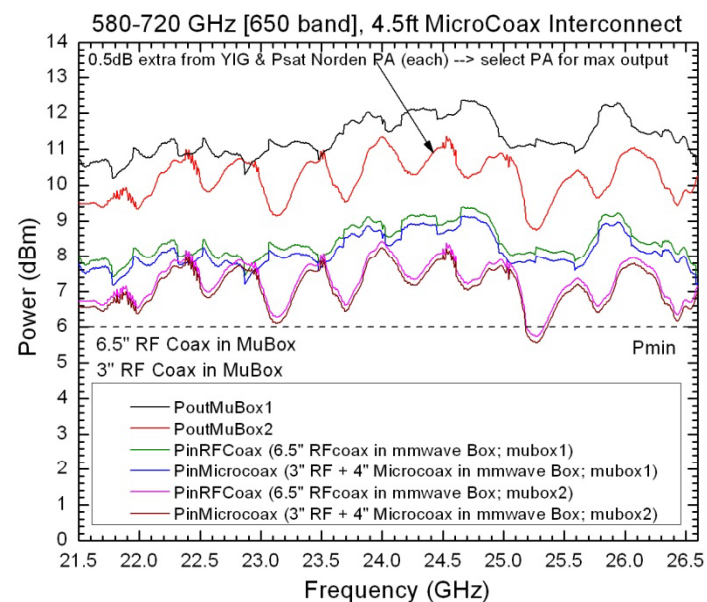
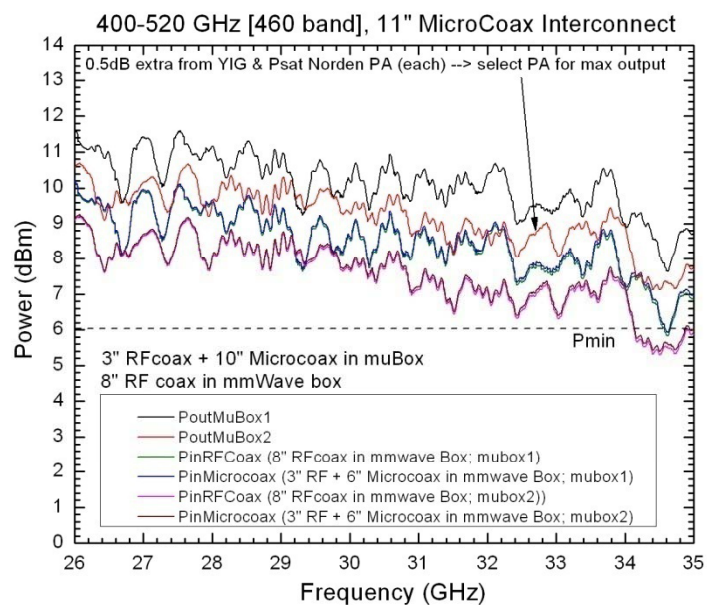
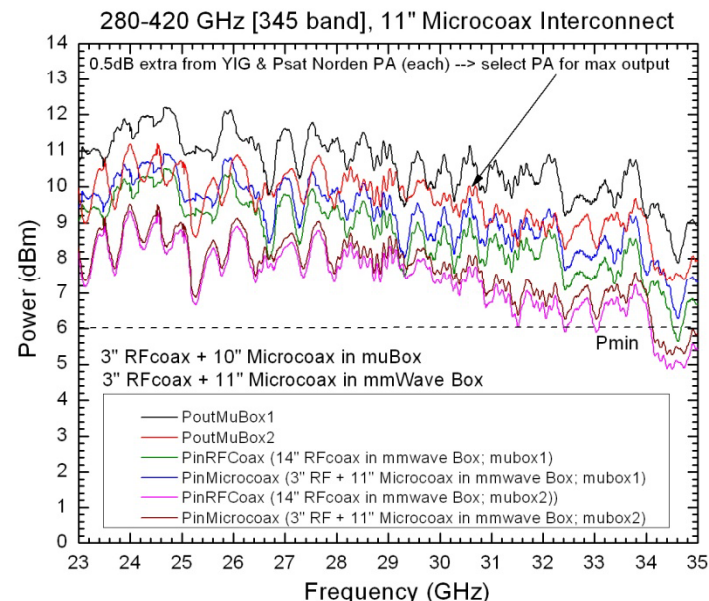
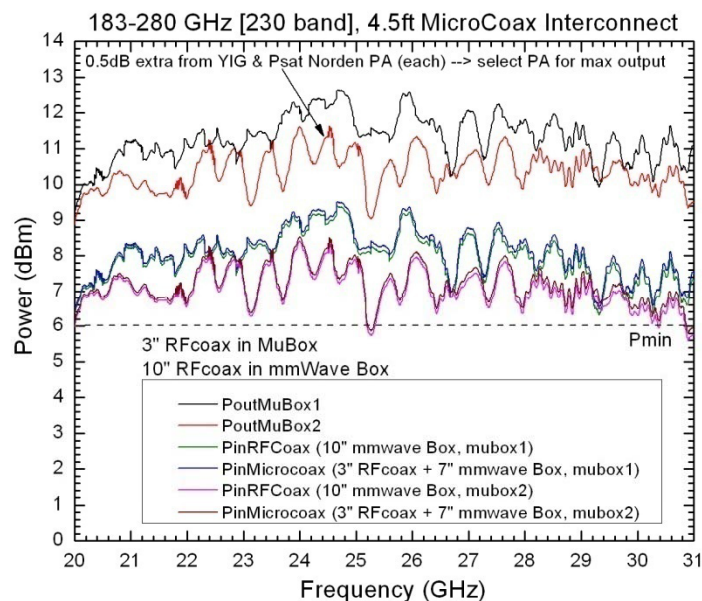
# Measured Loss Calculations

650 Rx: 21.5-26.6 GHz (X27)

## 580-720 GHz [650 band], 4.5ft MicroCoax Interconnect



# Pin Norden Amp mmWave Box Summary (Measured data)





# Total (Measured) Coaxial Loss for each Frequency Band

