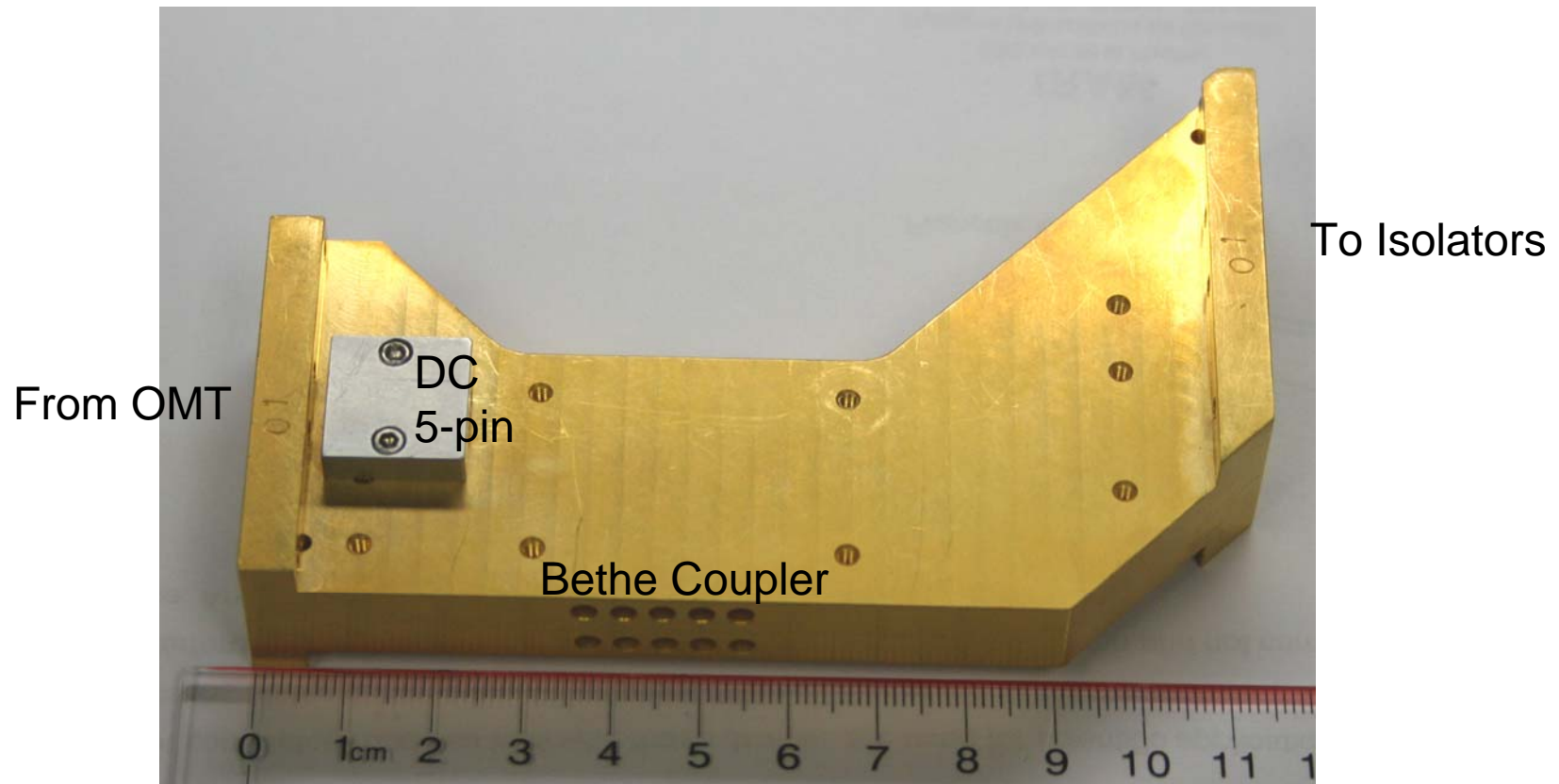


KFPA Noise Calibration Module (NCM)

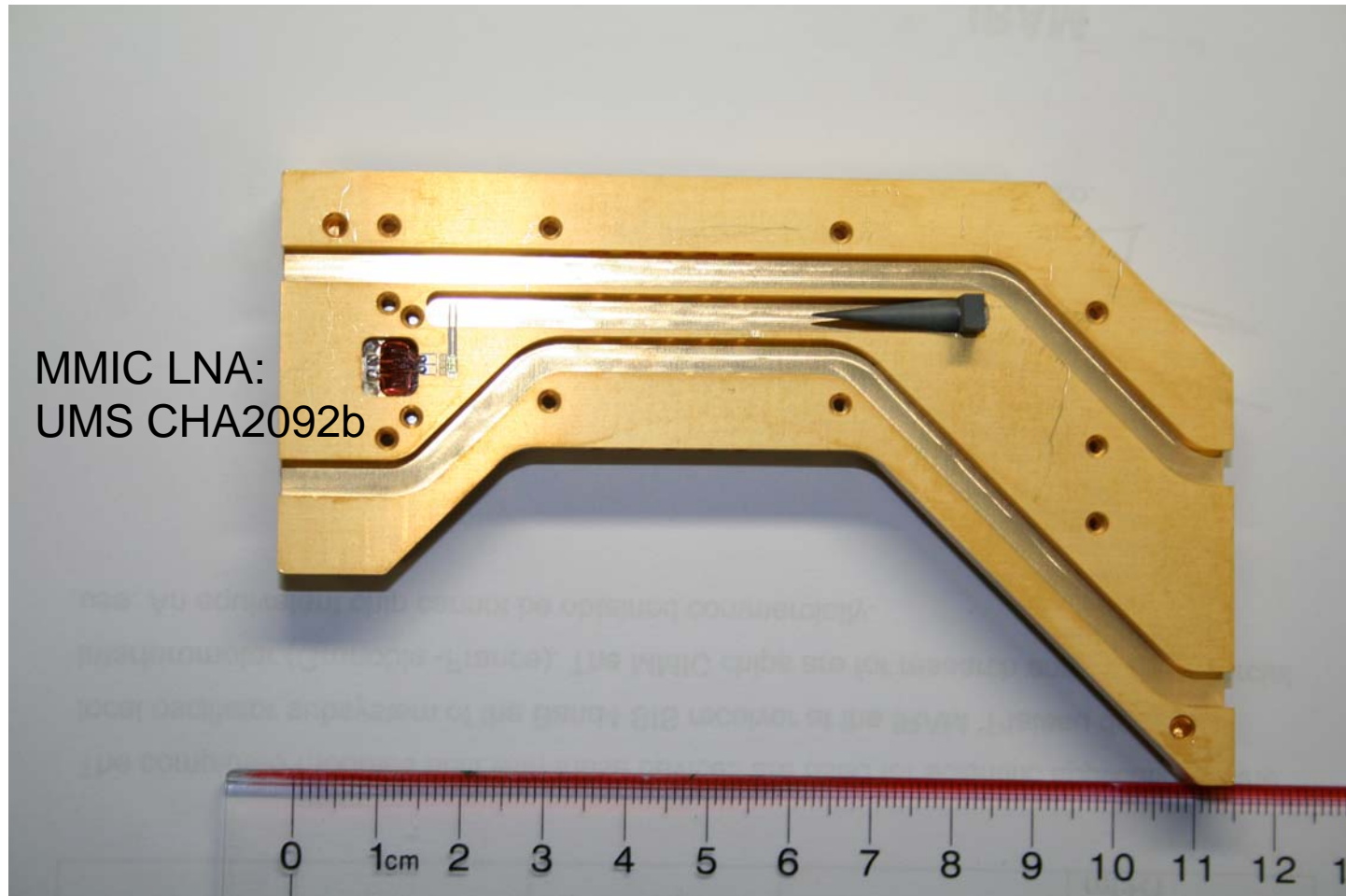
Eric Bryerton – NRAO CDL



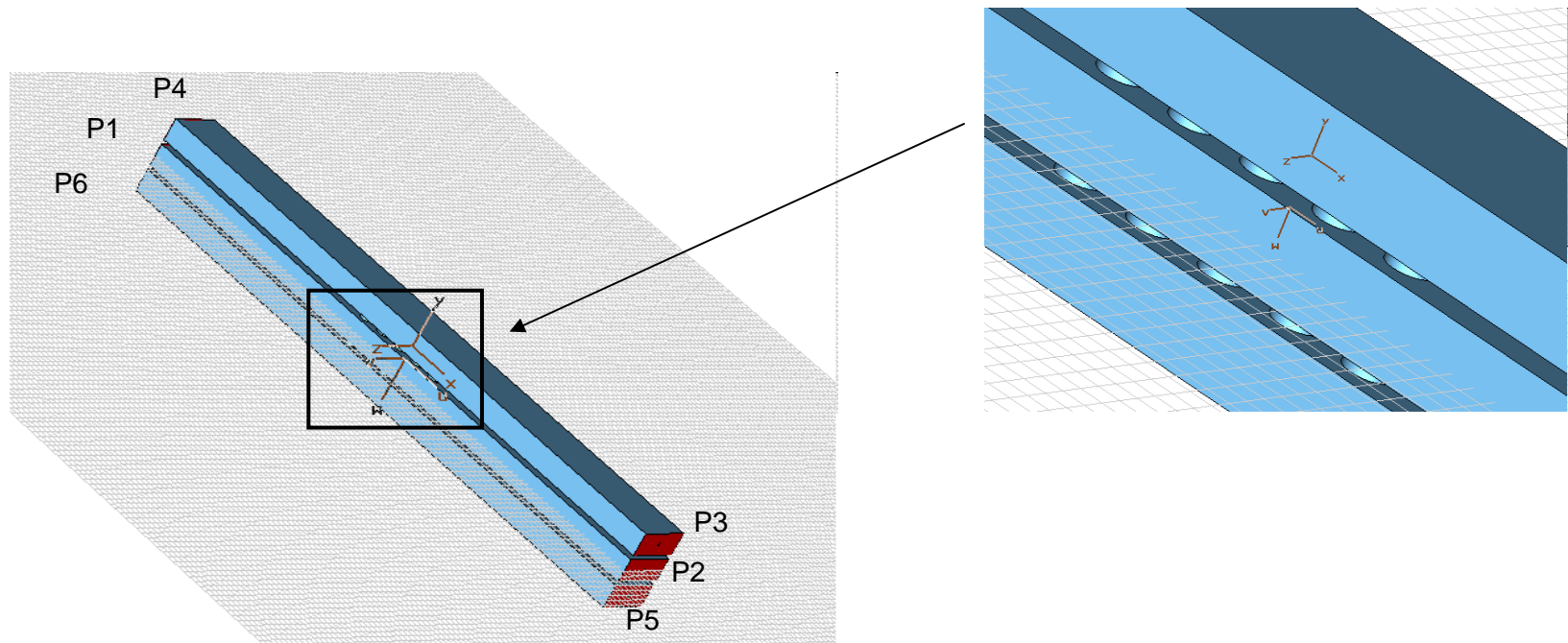
KFPA-7 NCM Compliance Matrix

Item	Specification	Verification Method / Notes on Compliance
RF In/Out	WR-42, UG595/U Flange Equivalent	By design. See KFPA NCM chassis drawing.
RF Channel Isolation	40dB minimum	By simulation [see Fig. 4]. Level too low to be measured accurately.
Equivalent Injected Noise	1.5-6.0K	Unit testing. Unit #1 was non-compliant below 18.5 GHz, see Figs. 10-12, when constant bias is applied across the entire band. If bias is adjusted, injected noise can be tuned to be between 1.5-6.0K over any 2 GHz bandwidth.
Dissipated Power	15mW maximum	Unit testing. Single-pixel unit was compliant, see Section 4.
Response Time	100us max rise/fall	By design. Test block testing [1] showed response time limited by bias supply. RC time constants of bias circuits, both on and off MMIC, are significantly less than this time.
Stability	+/-3% over 4 hours	Testing of test block [1].
NOT CAL	TTL Low -> Injected Noise ON	By design. See Monitor and Control interface specification in section 2.

KFPA NCM



6-Port Bethe Coupler



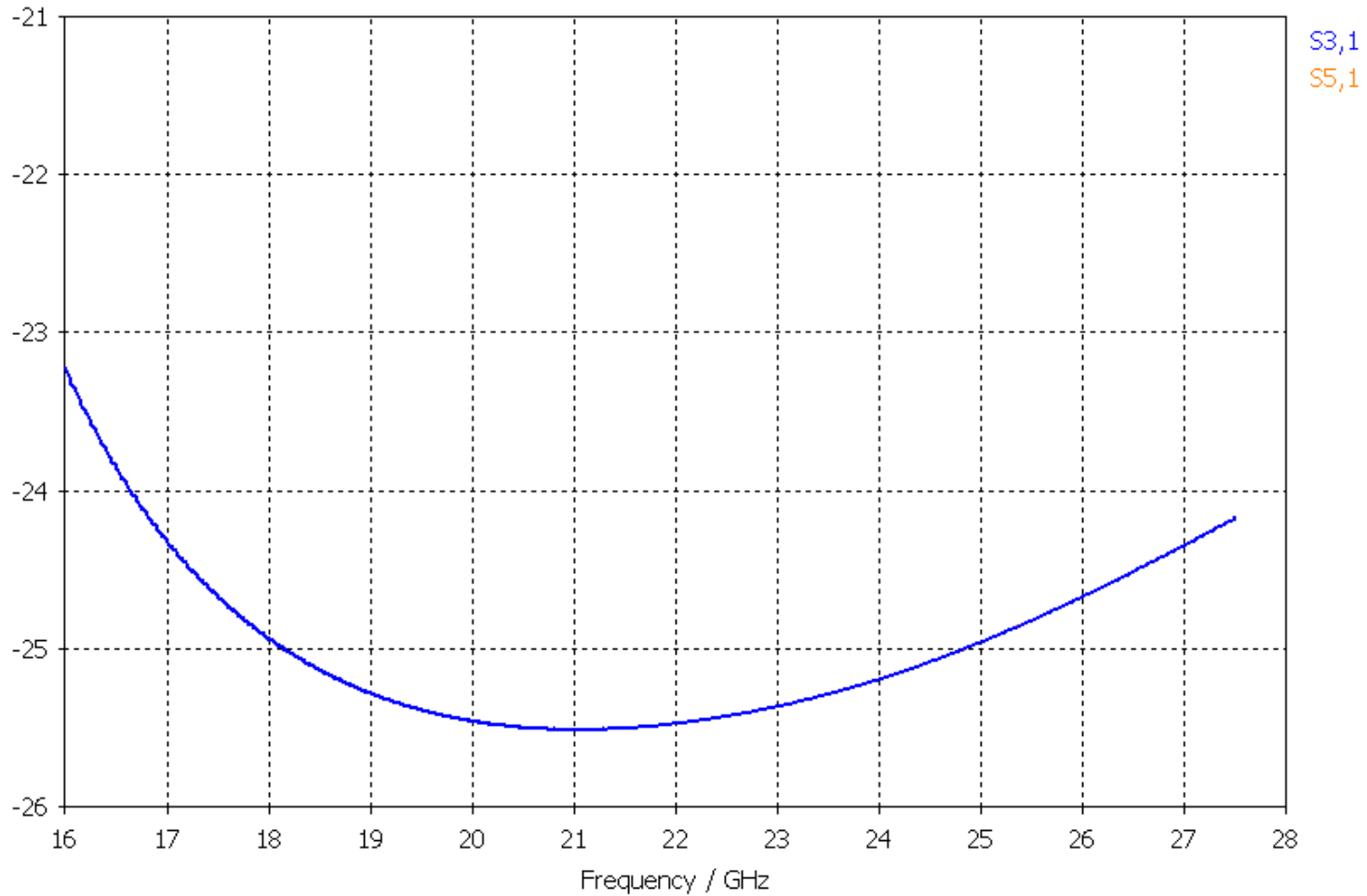
P1: noise source

P2: load for uncoupled noise cal power

P4->P3, P6->P5: main signal path (OMT->isolator)

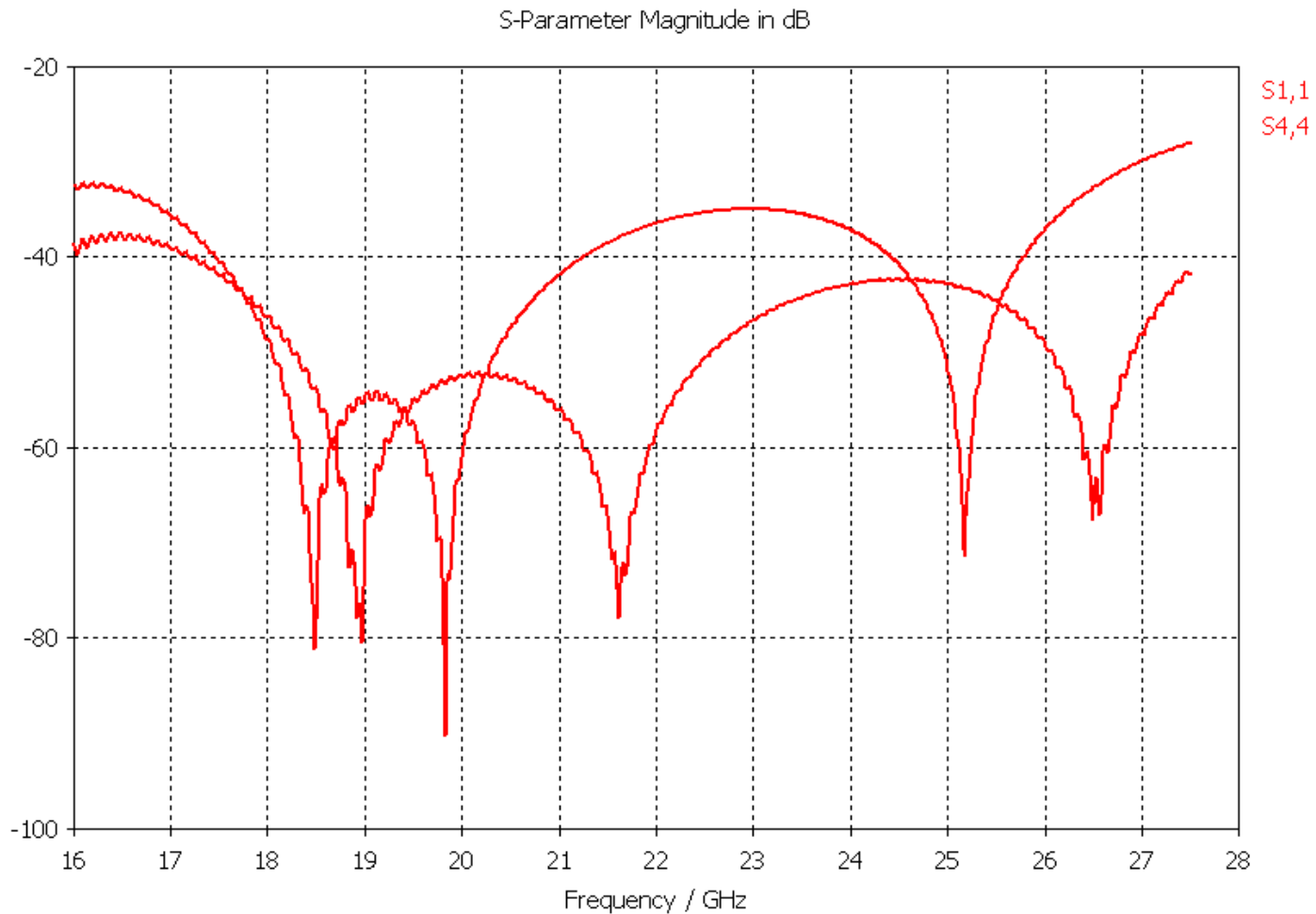
6-Port Bethe Coupler

S-Parameter Magnitude in dB



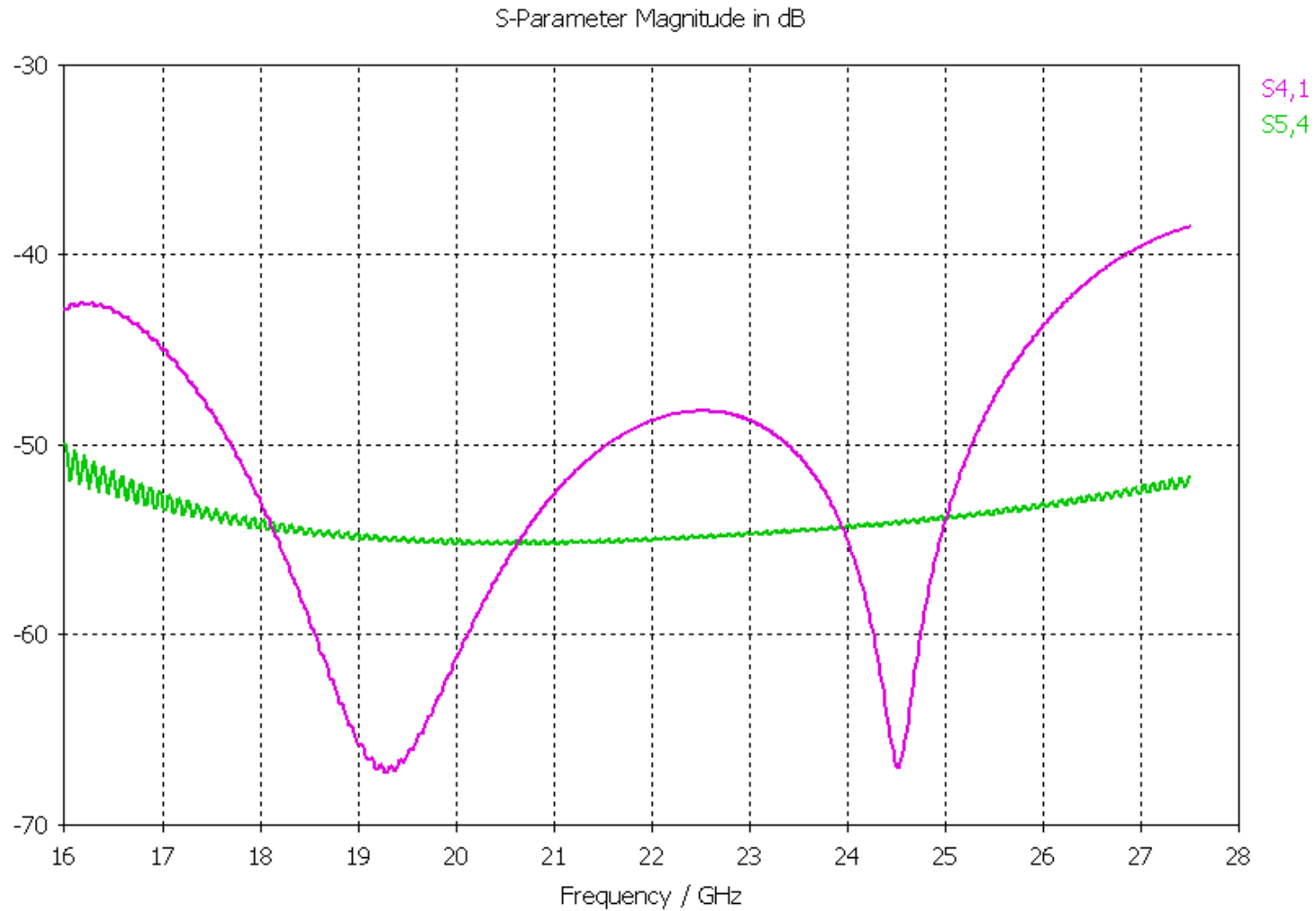
Coupling = -25 +/- 1 dB

6-Port Bethe Coupler



Input Return Loss > 30dB

6-Port Bethe Coupler

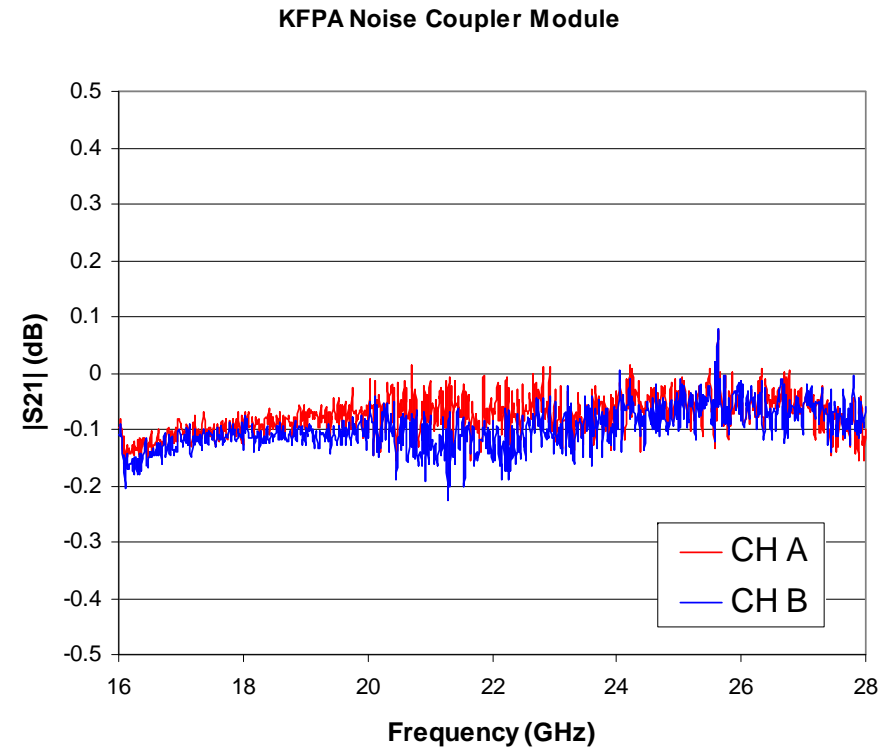
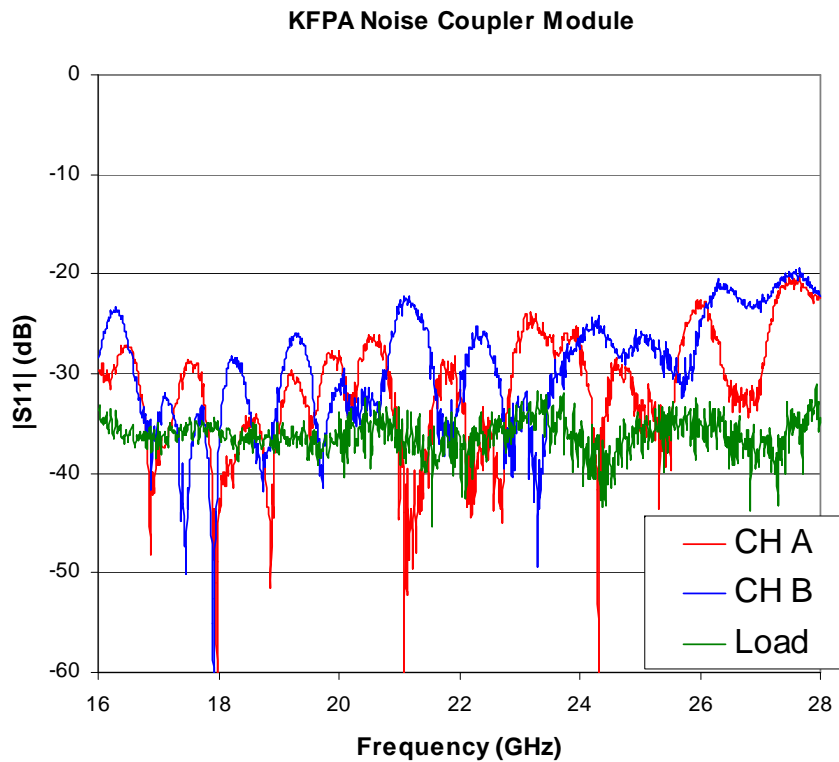


Directivity > 20dB (S₃₁/S₄₁)

Channel-to-Channel Isolation > 50dB

KFPA Noise Calibration Module #1

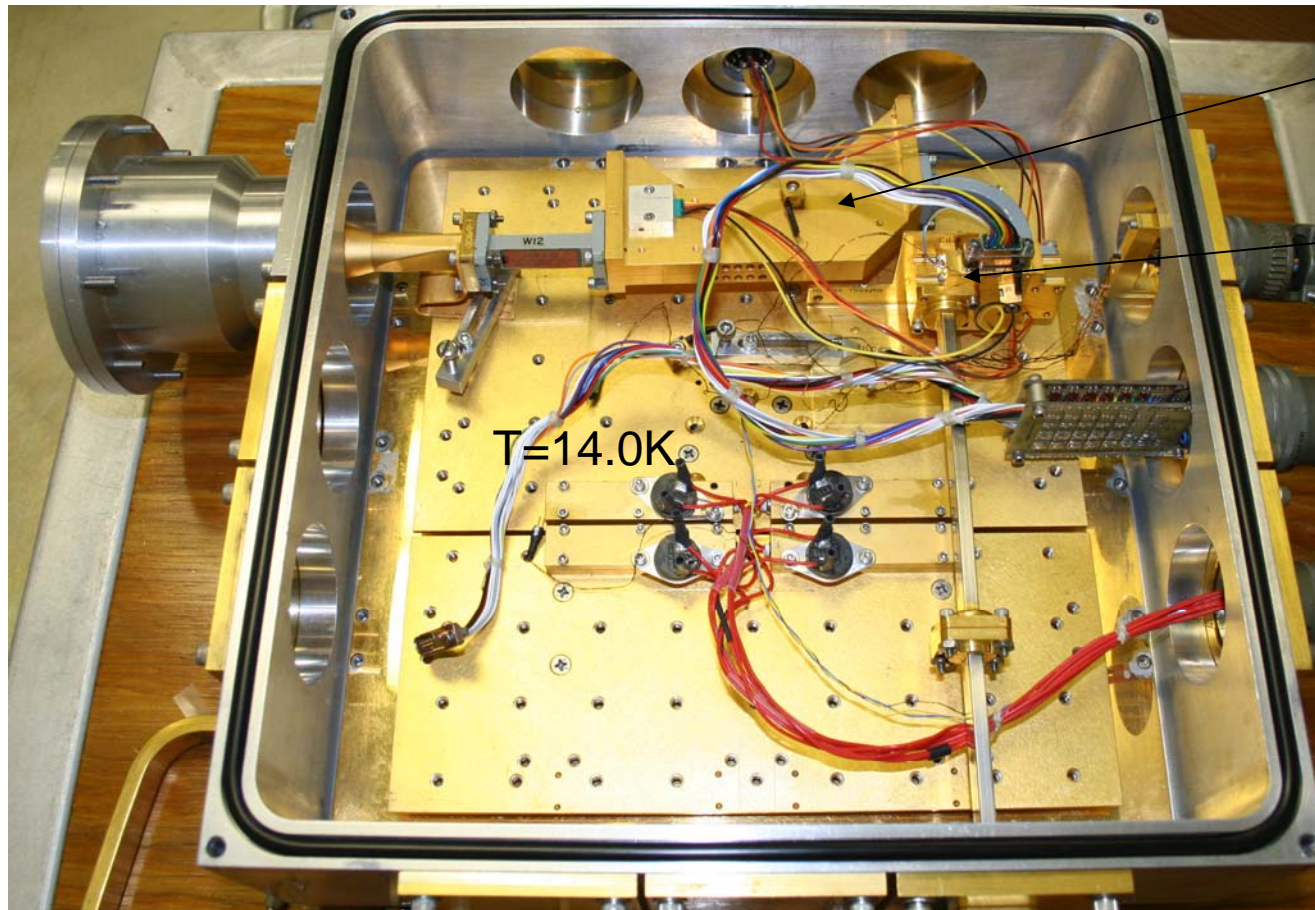
S-parameter Measurements



KFPA Noise Calibration Module #1

Noise Measurements

297K / 77K
Load



Noise Cal
Module
(T=33.0K)

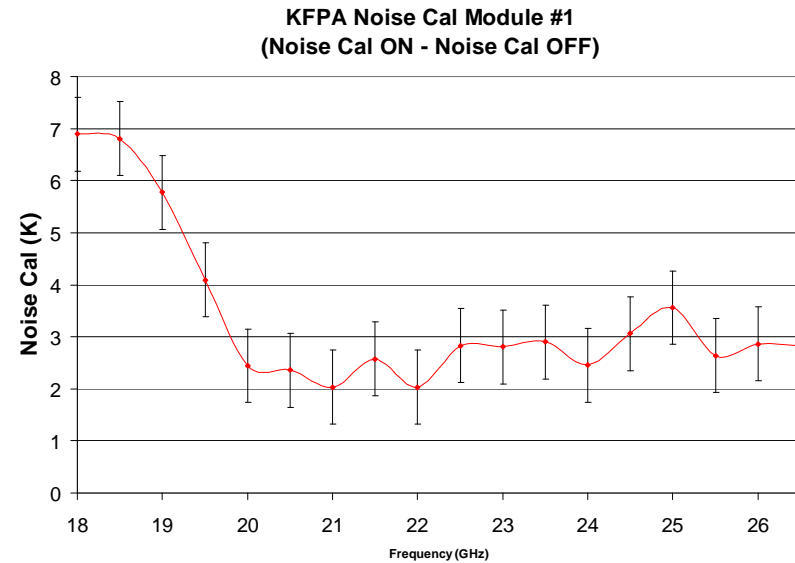
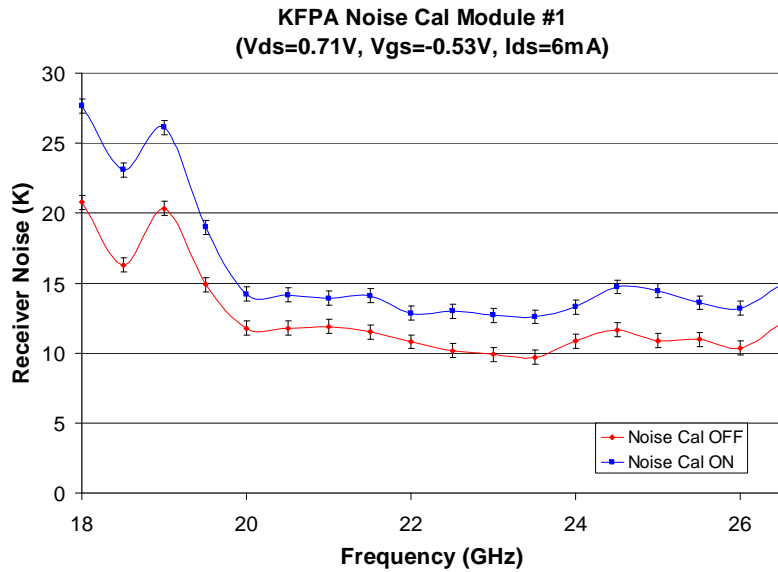
LNA
(T=25.3K)

T=14.0K

Downconverter + Detector

KFPA Noise Calibration Module #1

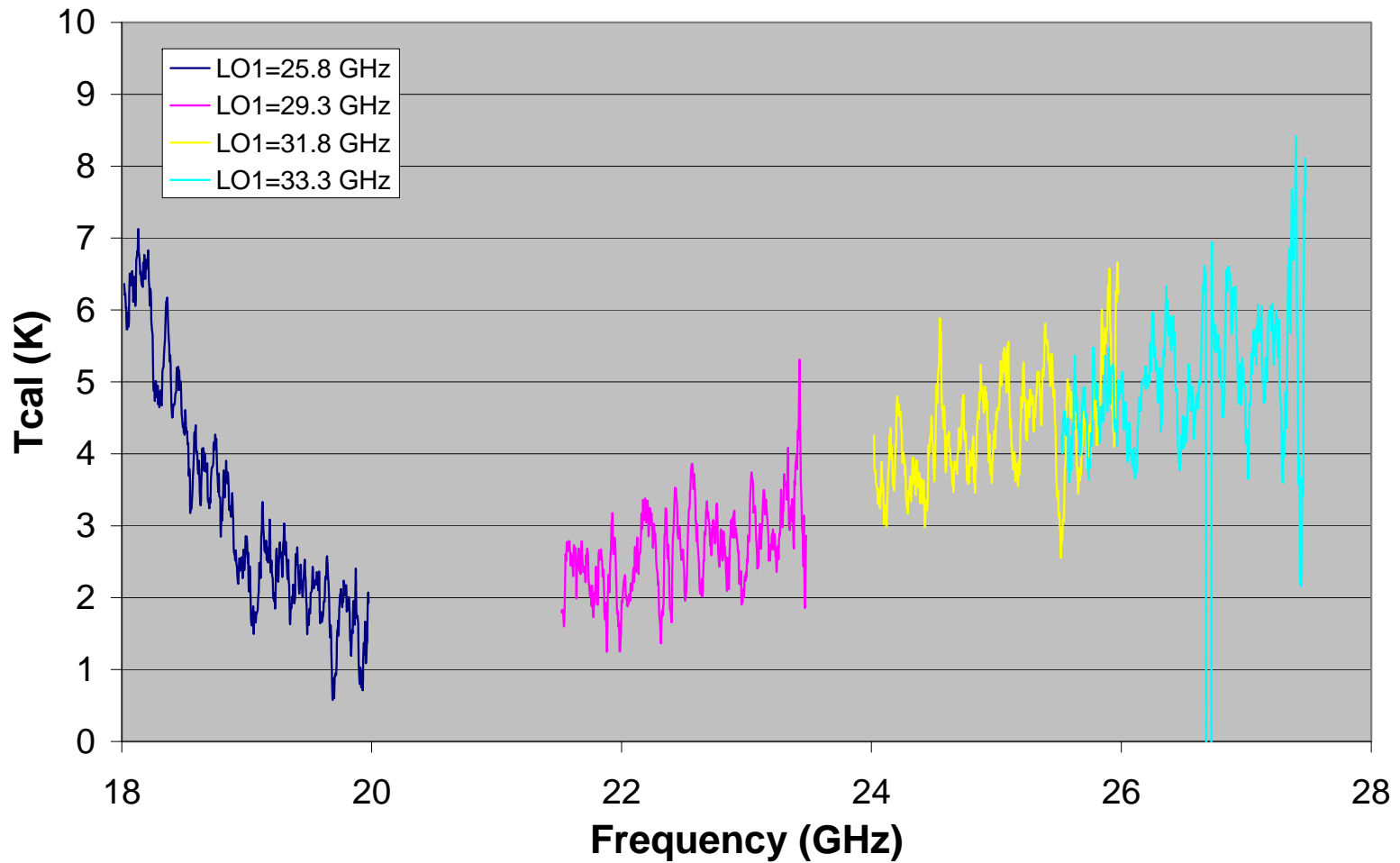
Noise Measurements



VDS=0.71V, VGS=-0.53V, IDS=6mA

KFPA-1 Laboratory Tcal Measurements

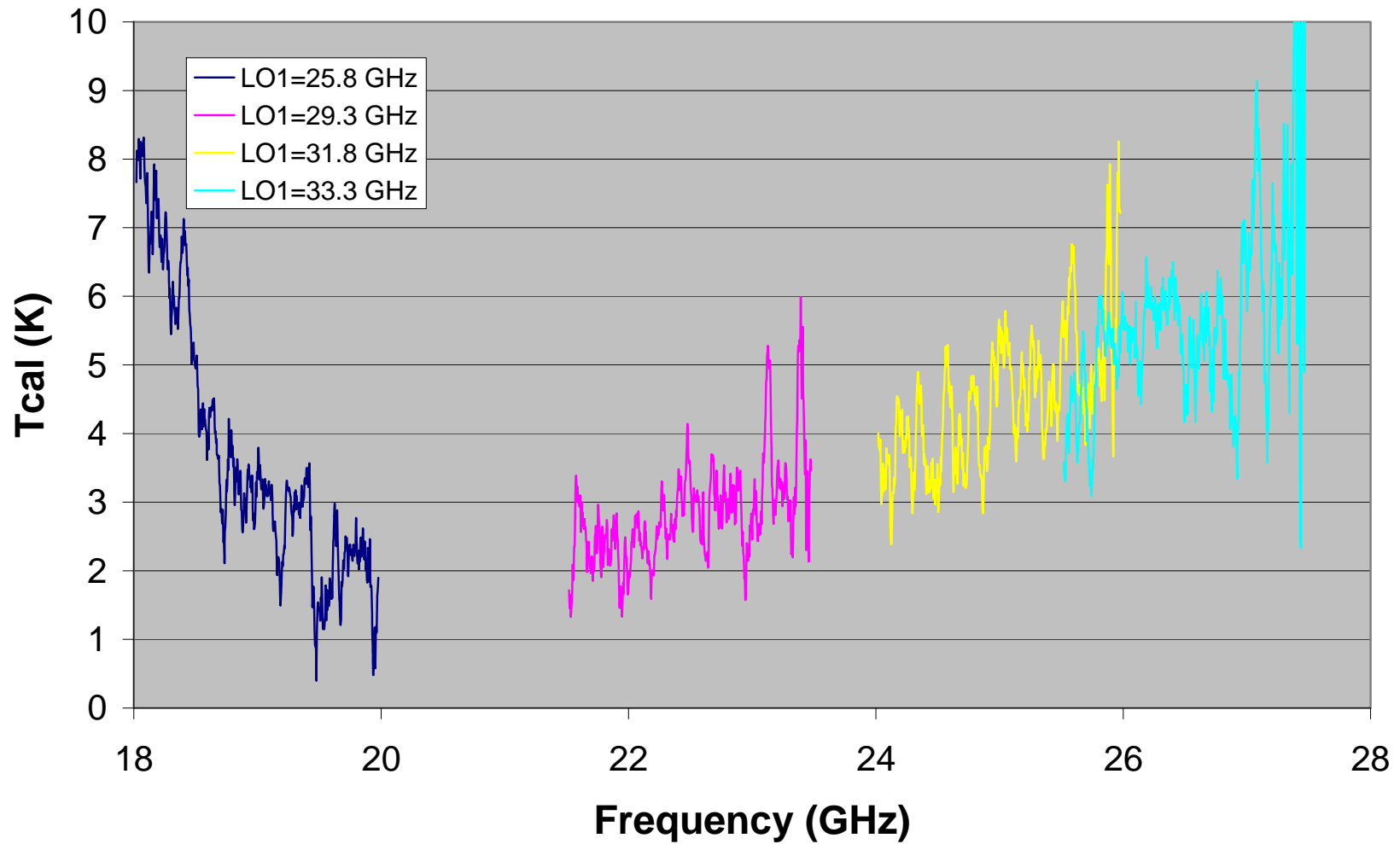
KFPA LCP



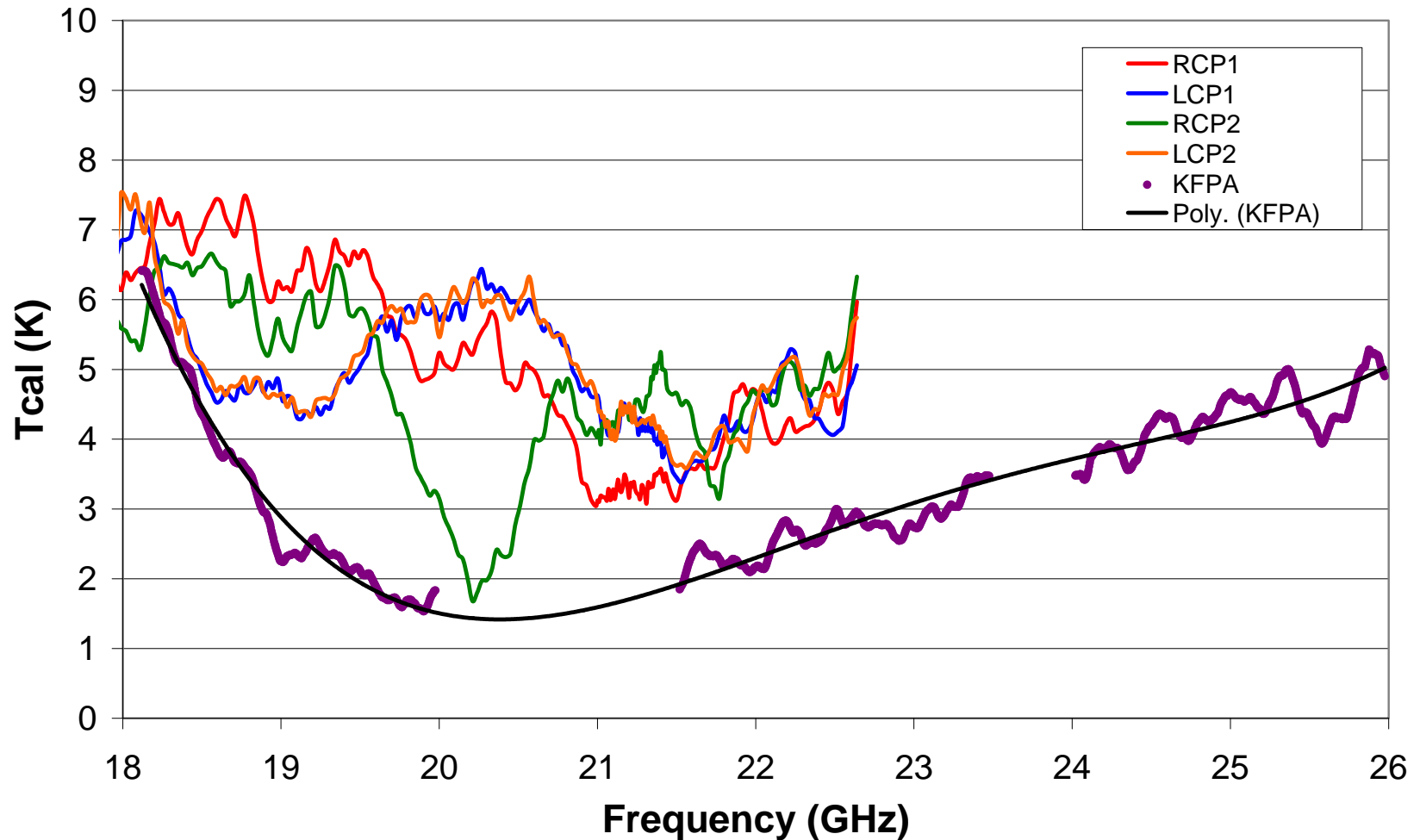
VDS = 0.667V

KFPA-1 Laboratory Tcal Measurements

KFPA RCP

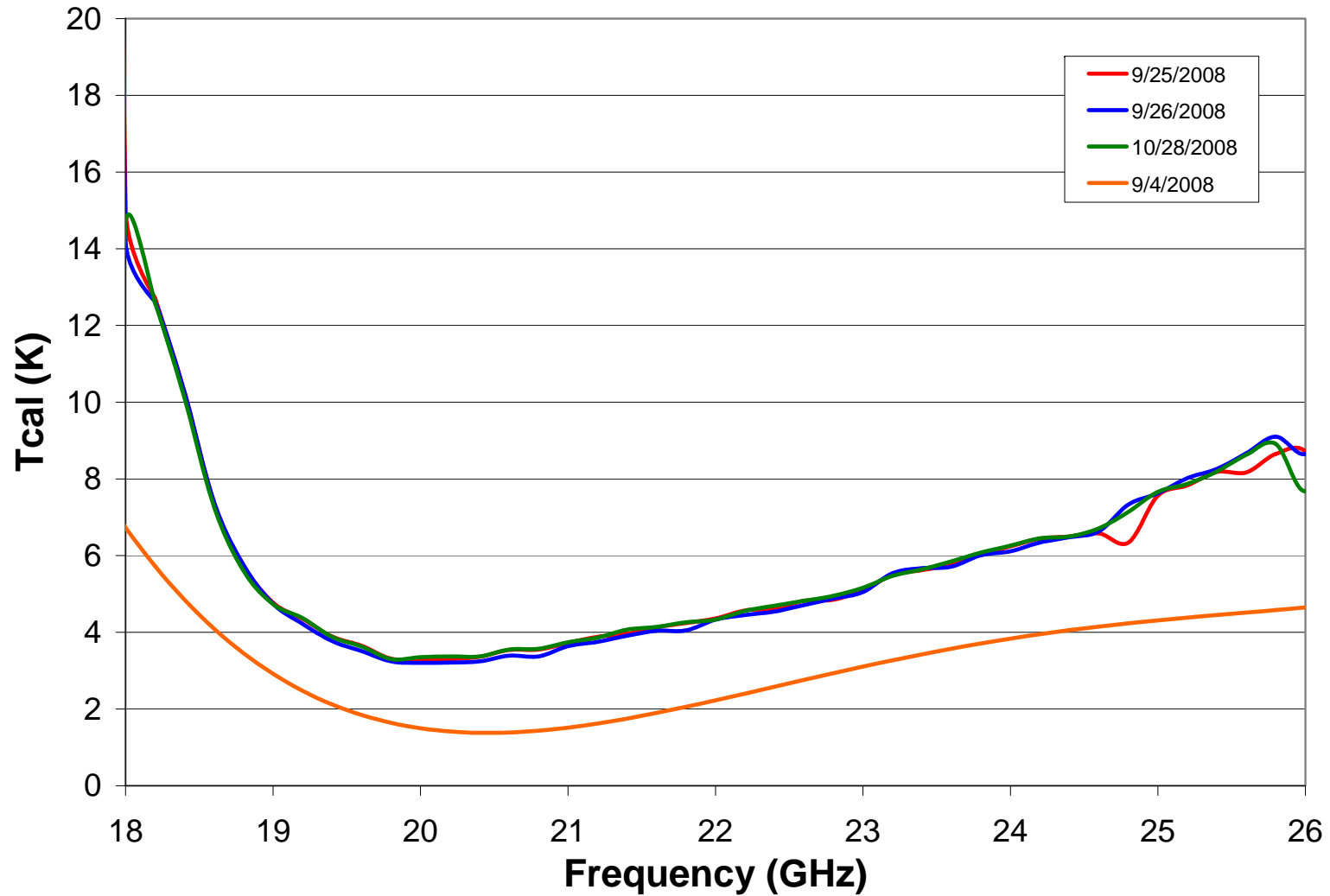


Measured Tcal of Current GBT K-Band Receiver vs. KFPA



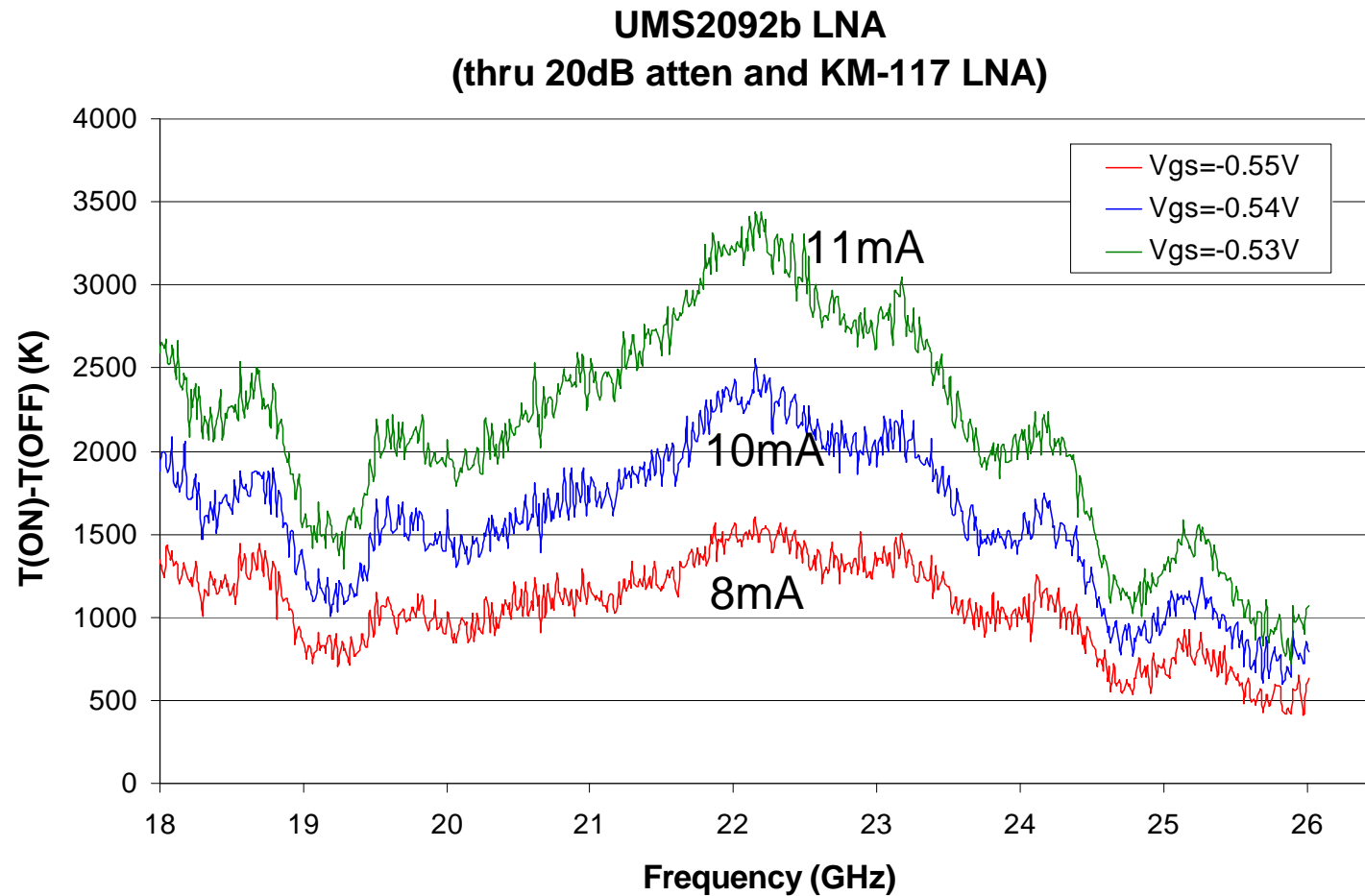
The standard deviation of the difference between the actual measurement and 4th degree polynomial fit is 7.5% of the measured value

KFPA-1 Laboratory Tcal Measurements



Between 9/4/08 and 9/25/08, NCM VDS bias was increased.

Noise Cal Test Block Measurements



$V_{DS} = 0.85V \rightarrow P_{DC} = 6.8mW$ for bottom trace

KFPA-7 NCM Production Schedule

31-Jan-09	CDR approval, production can begin
13-Mar-09	NCM blocks machined (using NRAO-CV machine shop)
27-Mar-09	NCM blocks plated
17-Apr-09	Units 1-3 assembled
8-May-09	Testing of units 1-3 complete; deliver units 1-3
8-May-09	Units 4-5 assembled
22-May-09	Testing of units 4-5 complete; deliver units 4-5
22-May-09	Units 6-7 assembled
5-June-09	Testing of units 6-7 complete; deliver units 6-7

KFPA-7 NCM Compliance Matrix

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