EVLA Front-End CDR

C-Band (4-8 GHz)

EVLA Receiver

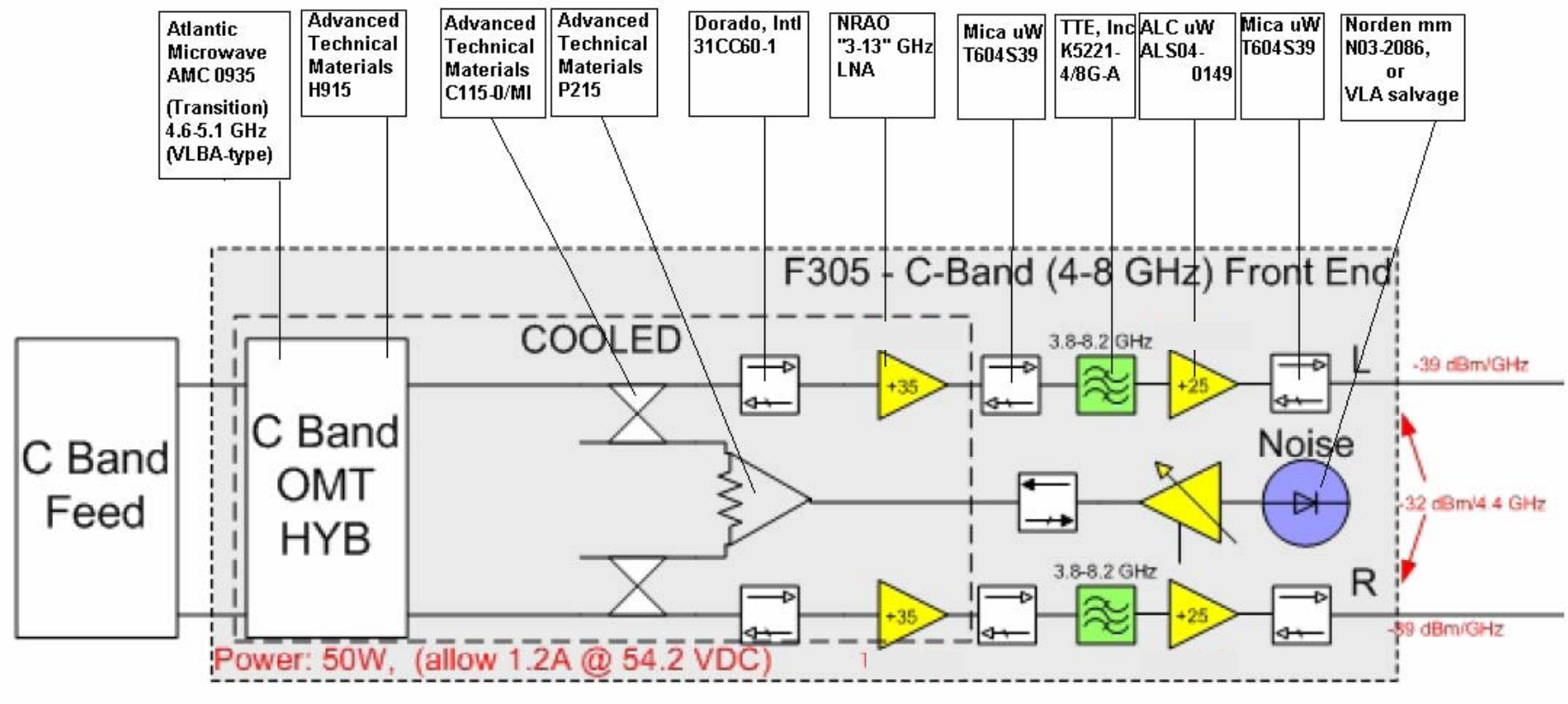
EVLA C-BAND PERFORMANCE PROJECT BOOK REQUIREMENTS

5.0 Receiver Parameters (Summary)

TABLE 5-1 : EVLA RECEIVER PARAMETERS

Frequency (GHz)	1.2 - 2[1]	2 – 4		8 – 12	12 – 18	18 – 26.5	26.5 – 40	40 - 50
Band[2]	"L"	"S"		"X"	"Ku"	"K"	"Ka"	"Q"
Tsys (°K)	26	26		30	37	59	53	74 - 116
Tsky[3] (°K)	12	12		10	12	25	13	26 - 68
Trcvr[4] (°K)	14	15		20	25	34	40	48
Feed Type[5]	Compact	Compact		Conical	Conical	Conical	Conical	Conical
Efficiency[6]	0.45	0.62		0.56	0.54	0.51	0.39	0.34
Location[7]	-84.1°	101.6°		-156.3°	47.6°	25.9°	-16.9°	4.5°
Polarizer Type[8]	QR, Hyb.	QR, Hyb.		note[9]	PS,W-B	PS,W-B	PS,W-B	SS
LO Frequency (GHz)	NA	NA		NA	NA	15–18	12–16.7	16.7-20
LO Multiplier[10] (GHz)	NA	NA		NA	X 2	X 2	X 3	X 3
Frequency Output	1 – 2	2 – 4		8 – 12	8 – 18	8 – 16.5	8 – 18	8 - 18
Output Power[11] (dBm)	-33	-34		-32	-35	-36	-34	-38
Est. Headroom[12] (dB)	35	36		30	28	21	23	15
Output to Module[13]	T302	T302		T304	T303	T303	T303	T303
Refrigerator Model[14]	1020	350		22	350	350	350	22
Details: 5.1.7.	1	2		4	5	6	7	8

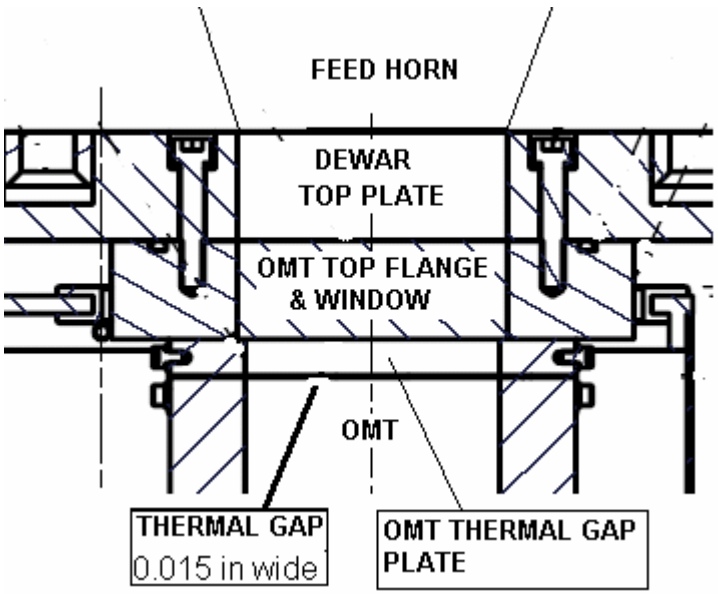
C-band Block Diagram

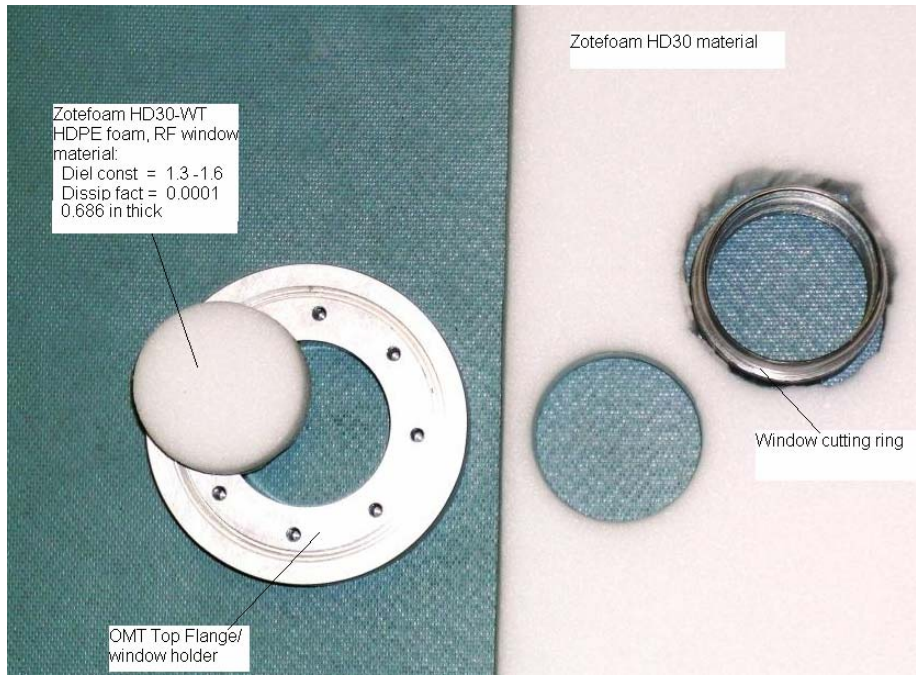


Estimated EVLA C-Band T_{Rx}, Output Power & Headroom

EVLA C-Band Rx (RHH : 28 March 2006)	P (1dB) (dBm)	P (1%) (dBm)	Temp (K)	NF/C (dB)	Loss/Gain (dB)	Loss/Gain (linear)	Delta T (K)	Trx (K)	BW (MHz)	Pnoise (dBm)	Pnoise dBm/GHz	Headroom (dB)
										for Tsky of		
										10.0		
										(K)		
									6000	-90.8	-98.6	
Weather Window			300		-0.02	0.9954	1.385			-90.3		
Feed Horn			300		-0.05	0.9886	3.490			-89.2		
Vacuum Window			300		-0.001	0.9998	0.070			-89.1		
Quad-Ridge OMT			15		-0.1	0.9772	0.355			-89.1		
Coax Cable			15		-0.1	0.9772	0.363			-89.1		
Hybrid Phase Shifter			15		-0.2	0.9550	0.752			-89.1		
Coax Cable			15		-0.1	0.9772	0.389			-89.1		
Cal Coupler (IL)			15		-0.2	0.9550	0.806			-89.1		
Cal Coupler (Branch)			300	-30	0	1.0000	0.300			-89.1		
Isolator			15		-0.5	0.8913	2.186			-89.1		
LNA	-10	-22	4		35	3162.2777	5.360			-53.0		31.0
Stainless Steel Coax			157.5		-2	0.6310	0.039	15.50		-55.0		
Coax Cable			300		-1	0.7943	0.052			-56.0		
Switch			300		0	1.0000	0.000			-56.0		
Isolator			300		-0.5	0.8913	0.031			-56.5		
Filter (3.8-8.2 GHz)			300		-1	0.7943	0.074		4400	-58.8	-65.3	
Post-Amp	15	3	229.6	2.5	28	630.9573	0.274			-30.8		33.8
Isolator			300		-0.5	0.8913	0.000	15.93		-31.3		

Vacuum/RF Window



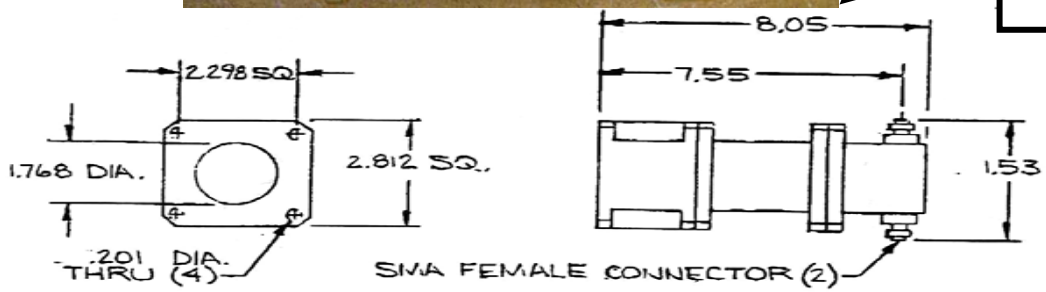


Interim AMC (narrow band) Polarizer #1

Note length,

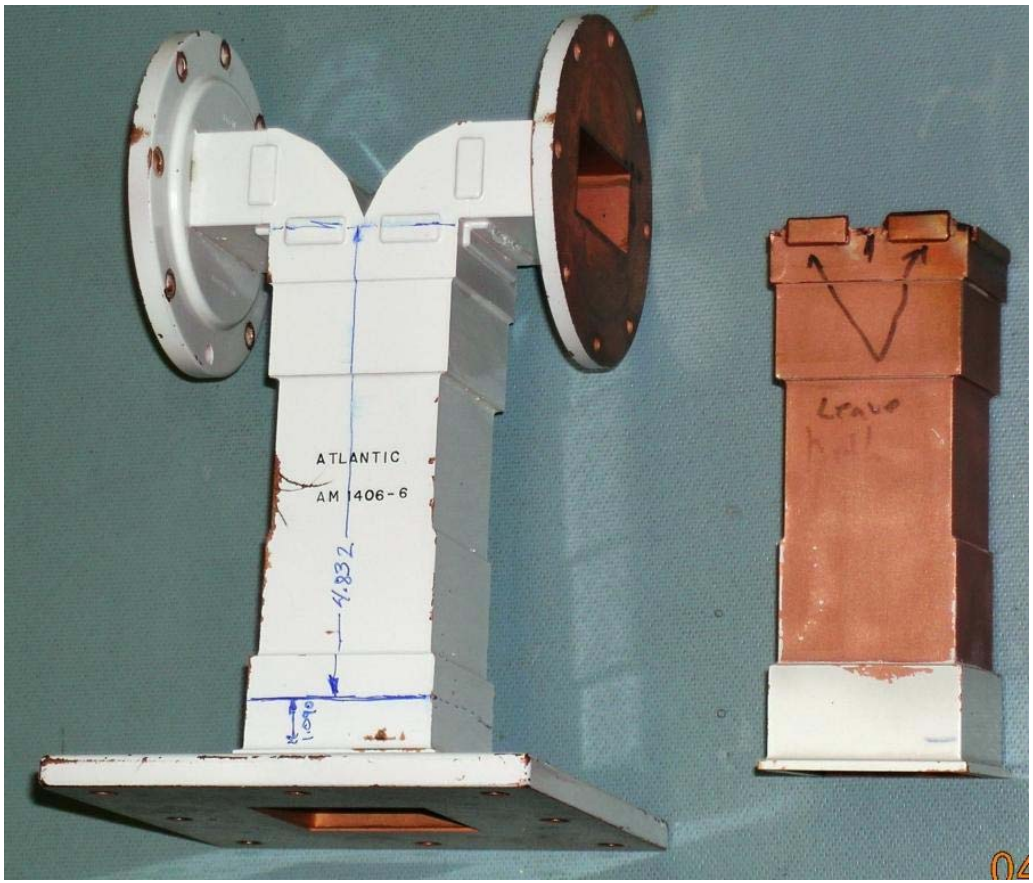
vs.

Production OMT



FULL FREQUENCY:	4.6 - 5.1 GHz	PRIME FREQUENCY:	4.8 - 5.0 GHz
VSWR:	1.21 Max.	VSWR:	1.15 Max.
ELLIPTICITY:	0.6 dB Max.	ELLIPTICITY:	0.25 Max.
ISOLATION:	25 dB Min.	ISOLATION:	28 dB Min.
MATERIAL:	Aluminum	MATERIAL:	Aluminum
FINISH:	Gold plated	FINISH:	Gold plated

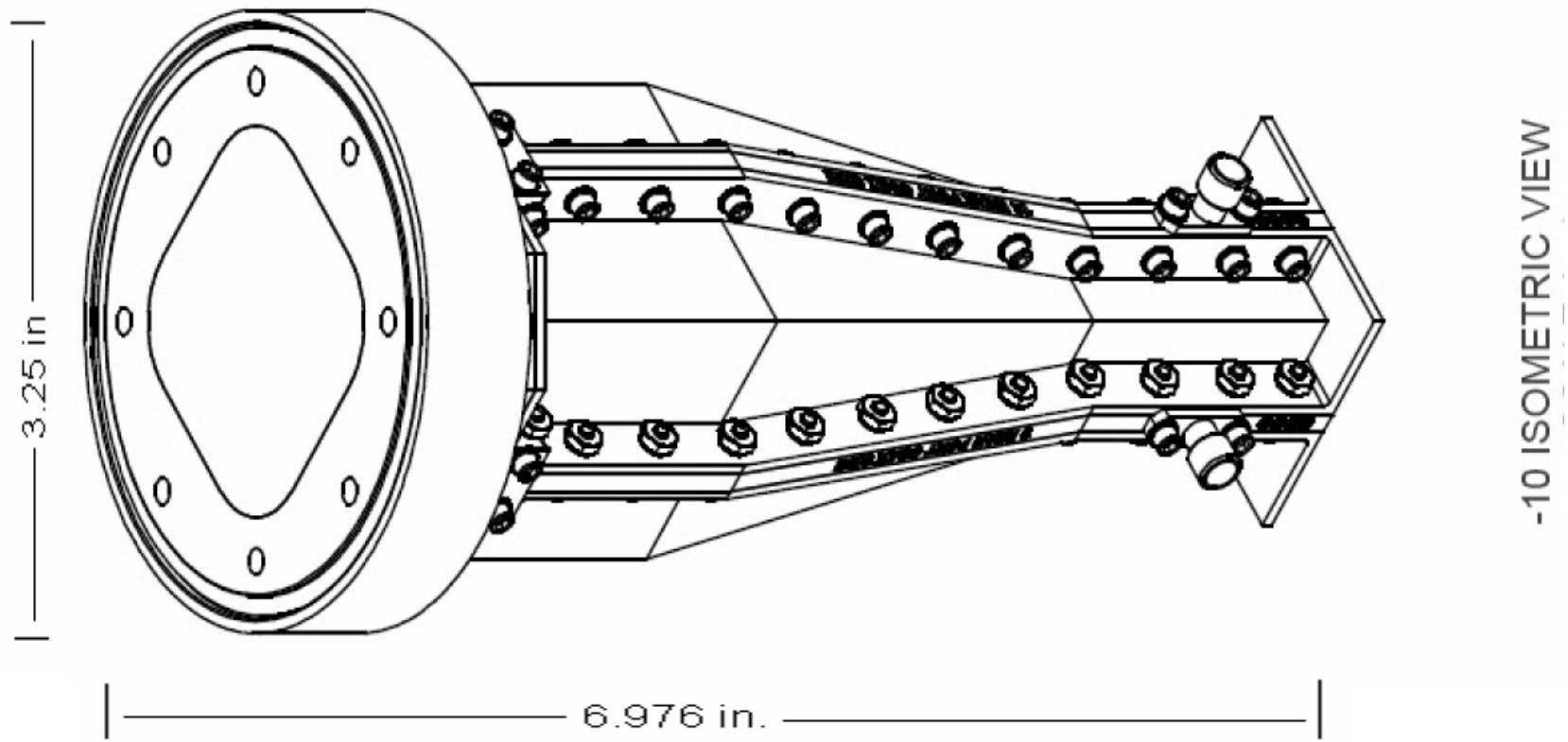
Interim VLA (salvaged), modified AMC Polarizer



Salvaged VLA polarizer—modified:

- 4.5 – 5 GHz only.
- Cut-off flanges
- Add new flanges
- Add PAL coax adapters
- Add PAL sq →circ adapter

NRAO (wide-band) Production OMT



Dewar components 1

90 deg hybrid

ATM H915

Cal Coupler

ATM C115-0/MI

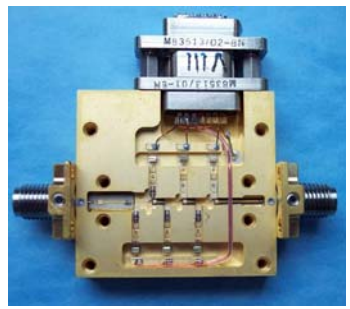
Cal Splitter

ATM P215

Cryo Isolator

DORADO 31CC60-1

Cryo LNA



NRAO: "C" LNA

FQ:	4-8 GHz	FQ:	4-8 GHz	FQ:	4-8 GHz	FQ:	4-8 GHz	FQ:	4-8 GHz
VSWR:	1.30	VSWR:	1.25/1.25	VSWR:	1.35/1.25	VSWR:	1.25	VSWR:	*/*
ISO:	18 dB			ISO:	20 dB	ISO:	20 dB	GAIN:	35 dB
COUPL:	3.2+/-.7	COUPL:	30+/-1.25					NOISE T:	4 K
INS LOSS:	TBD dB	INS LOSS:	0.25 dB	INS LOSS:	0.50 dB	INS LOSS:	.3dB@12K		
				AMP BAL	+/-0.2 dB				
				PH BAL:	+/-2.0 Deg				
		FQ SENS:	+/-0.75 dB						

Dewar components 2

SS Coax

Re-formable Coax

SMA Bulkhead

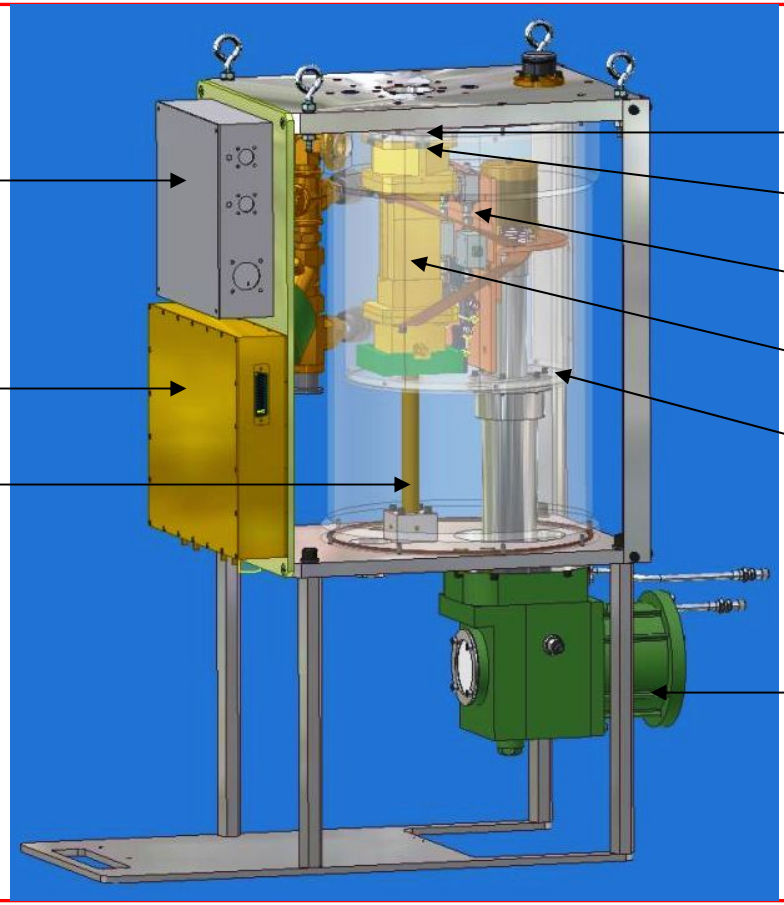
RF-COAX
S086MMSS-22

RF-Connection
SMA-M/SMA-M .141

AMP/TYCO
1054874-1

FQ:	< 18 GHz	FQ:	< 18 GHz	FQ:	< 18 GHz				
VSWR:	1.29	VSWR:		VSWR:	1.18				
LENGTH:	18-22 IN	LENGTH:	4, 6 IN						
INS LOSS:	2 dB (est)	INS LOSS:	< 0.35 dB	INS LOSS:	0.42 dB				

DEWAR PACKAGING 2



RF Box Components

Isolator

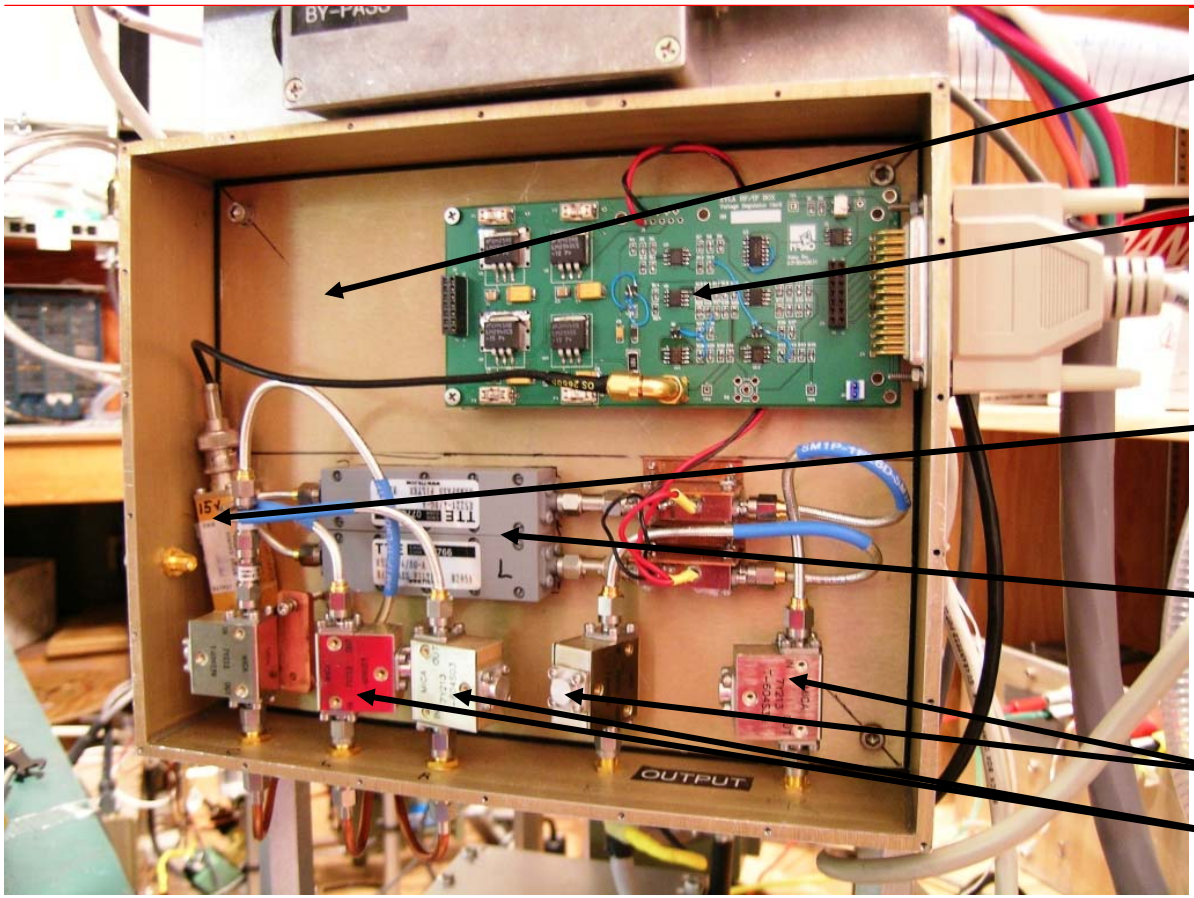
BPF

Post-amp

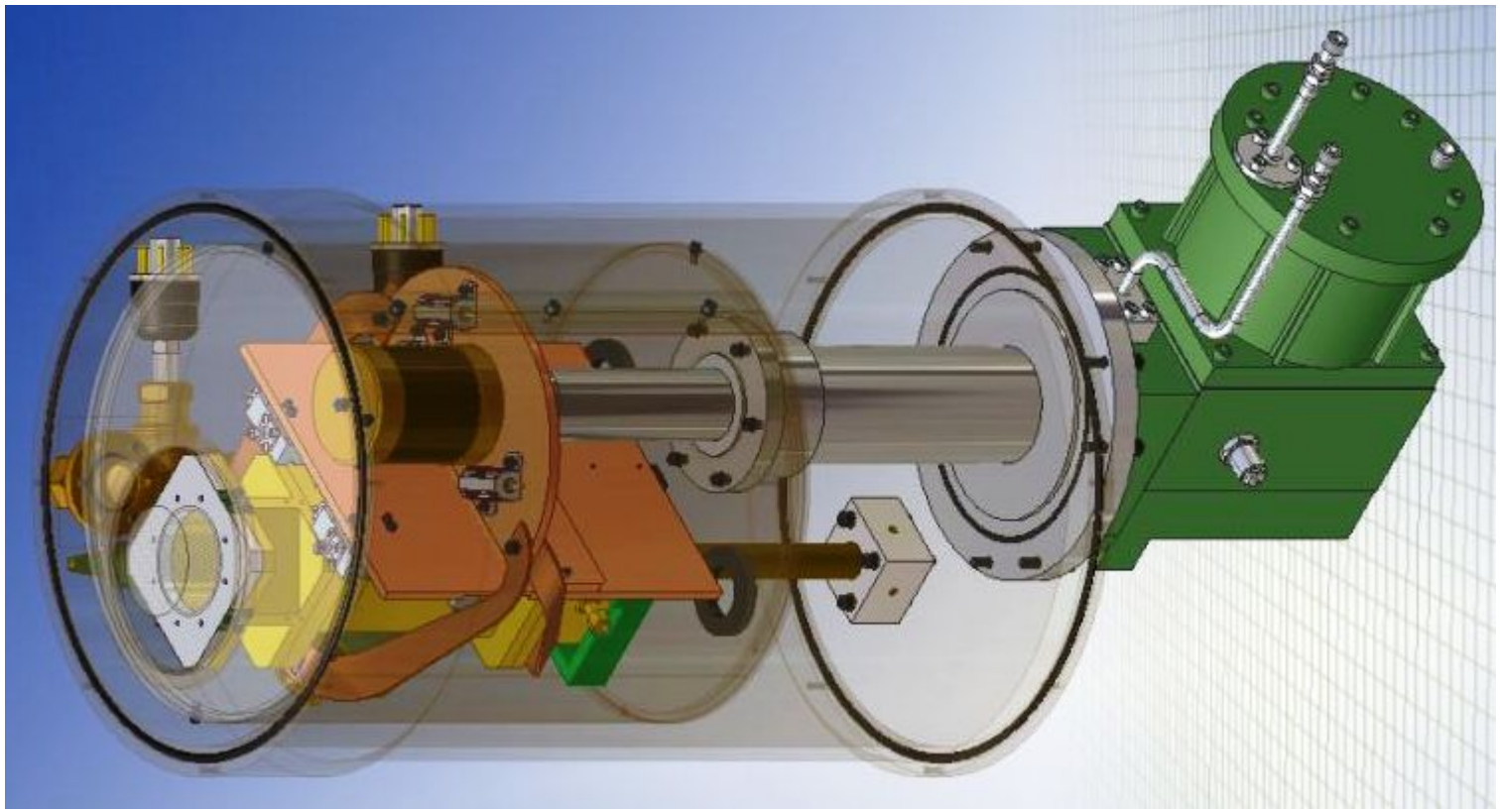
Noise Source

MICA 604-S39		**TTE K5221-4/8-G-A**		**ALC ALS04--149**		**VLA SALVAGE/ NORDEN N03-2086**	
FQ:	4-8 GHz	FQ:	4-8 GHz	FQ:	4-8 GHz	FQ:	4-8 GHz ?
VSWR:	1.3:1	VSWR:	1.5/1.5	VSWR:	2.0/2.0	ENR:	31 dB
ISO:	18 dB			GAIN:	28+/-2 dB		
COUPL:	3.2+/-.7				(+/-0.5 in 1G)		
INS LOSS:	< 0.5 dB	INS LOSS:	< 1 dB				
				NF:	< 4 dB, 2 typ		
		AMP FLAT:	0.5 dB	P1dB:	>+10dBm, 15 typ		

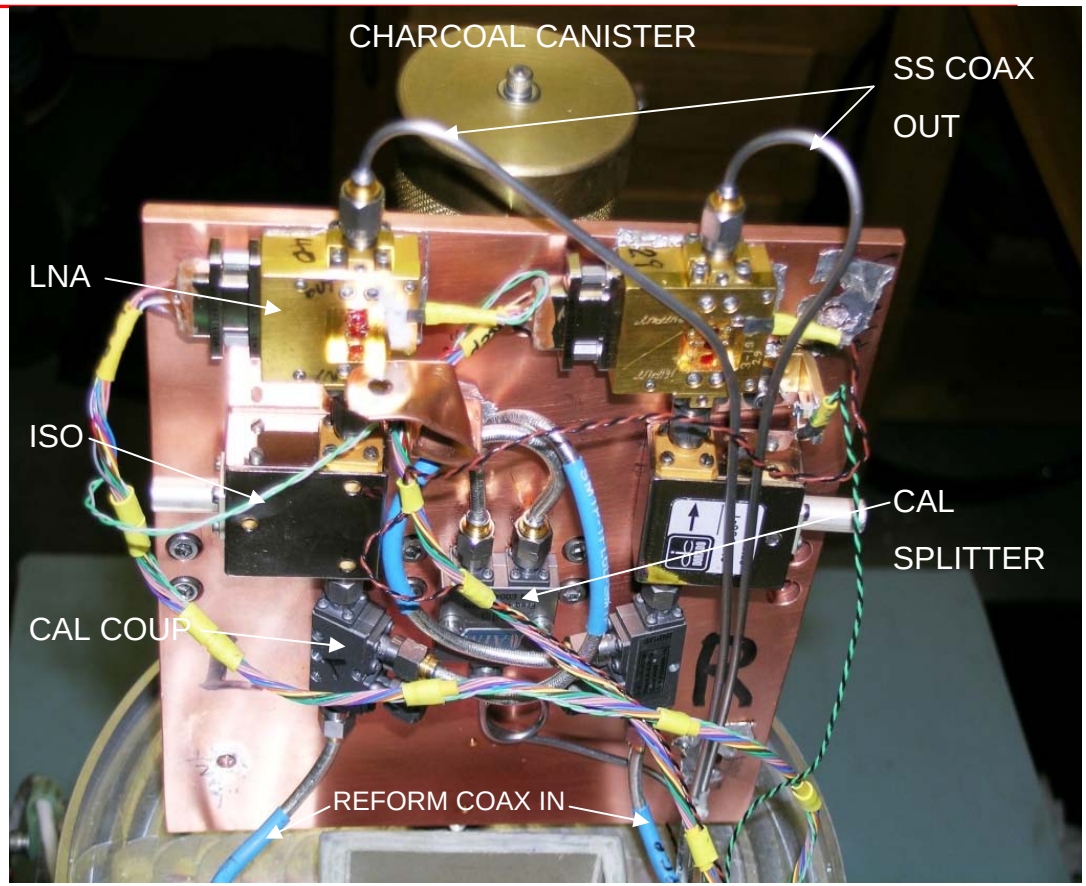
RF Box Packaging



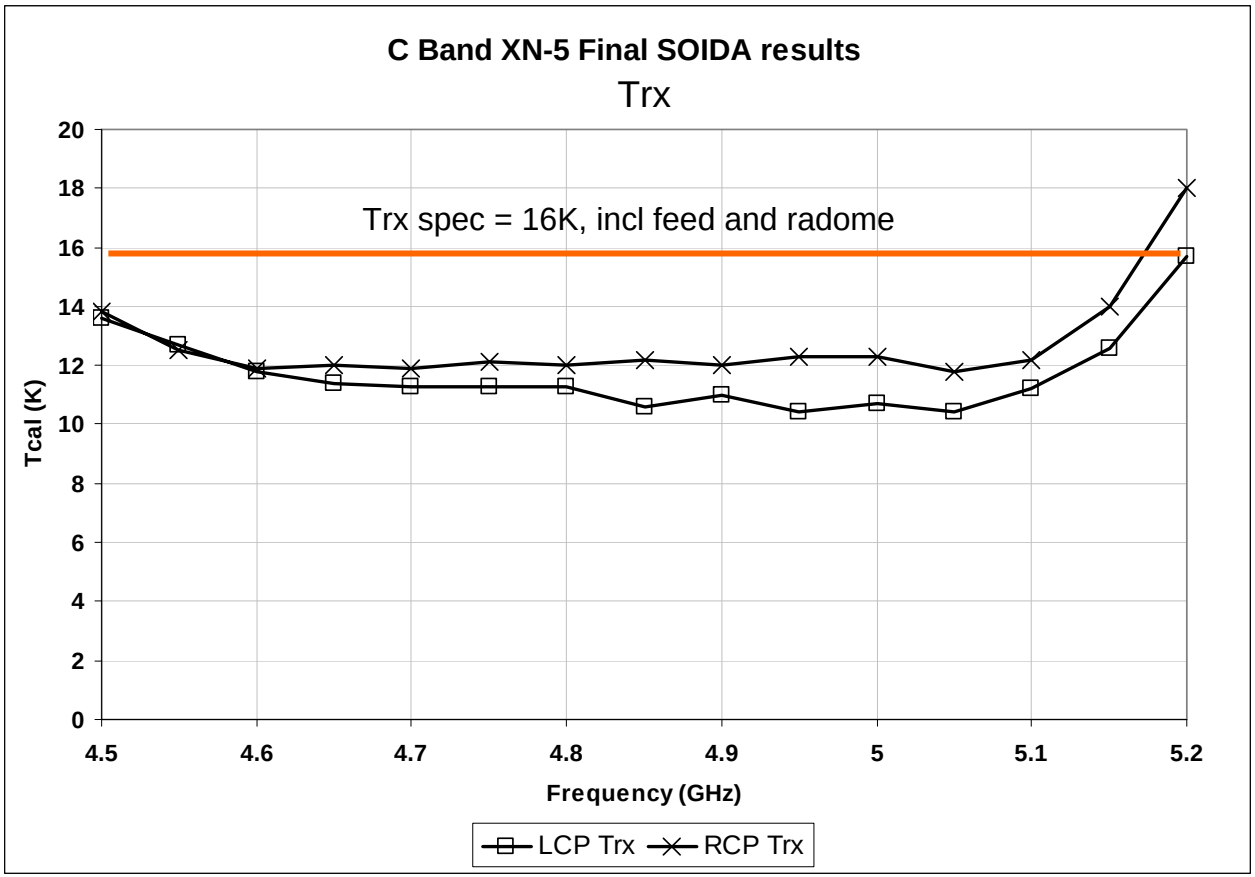
Common Dewar Design



DEWAR PACKAGING: THE COLD PLATE



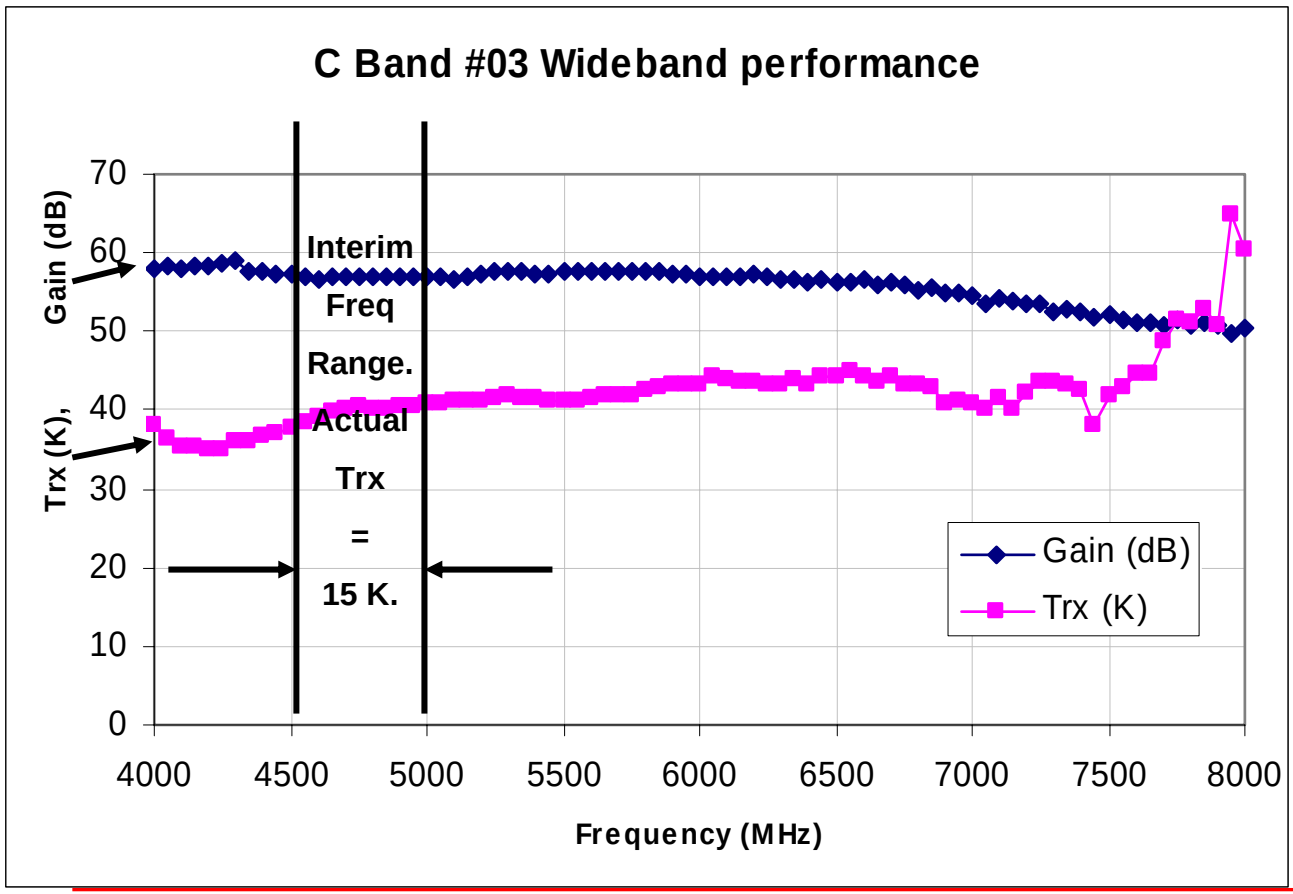
EVLA C-BAND NARROW-BAND PERFORMANCE



OTHER RESULTS:

SN	R	L
2	14	15
3	15	18
4	19	14

EVLA C-BAND WIDE-BAND PERFORMANCE



TEST CONDITIONS:

- RCP LNA= 3-13 GHz, SN18, not 4 – 8 GHz optomized.
- Dewar cool (12/50 K)
- SOIDA signal injected via cal port (after the 4.5-5.0 GHz AMC pol)
- .086 SS coax, 22 in long used to inject test CW has 2+ dB loss, not calibrated out.
- **Test demonstrates <u>flatness,</u> <u>not absolute Trx</u>.**

EVLA C-BAND Preliminary Conclusions

- Interim (4.6 – 5.1 GHz) receivers meet noise temp and amp/phase stability goals.
- Full EVLA BW (4 – 8 GHz) tests show no BW limiting factors after polarizer.
- Interim receiver production keeping pace with antenna refurbishment schedule.
- EVLA full-bandwidth version awaits only the 4 – 8 GHz OMT design completion.
- 4 – 8 GHz OMT design completion will follow 1 – 2 GHz OMT design evaluation (in-progress).
- No technical or production problems anticipated.

Summary

- M&S Budget - $237.3K already spent out of $603.0K allotment
  - **Remaining large ticket items**
    - **Quad-ridge OMT's**
    - **LNA's**
    - **Cables**
    - **New Card Cages**
- Many of the significant components have already been ordered and received for the entire build with component prices at or below our original estimates.
- To keep within the EVLA Project spend profile, it was felt that the upgraded design was low risk and that we could confidently proceed with mass production.
- **We hope the FE CDR Panel agrees with this action…**