10 GHz 10W F1JGP
1 and 2 stages amplifiers

Target

- This is **THE** really cheapest alternative to the 10 GHz DB6NT very expensive PA buying equivalent
- Minimum of writing (bla-bla)
- Maximum of details and pictures
- Directly the essential to know and especially the final DC and RF measures

Abstract

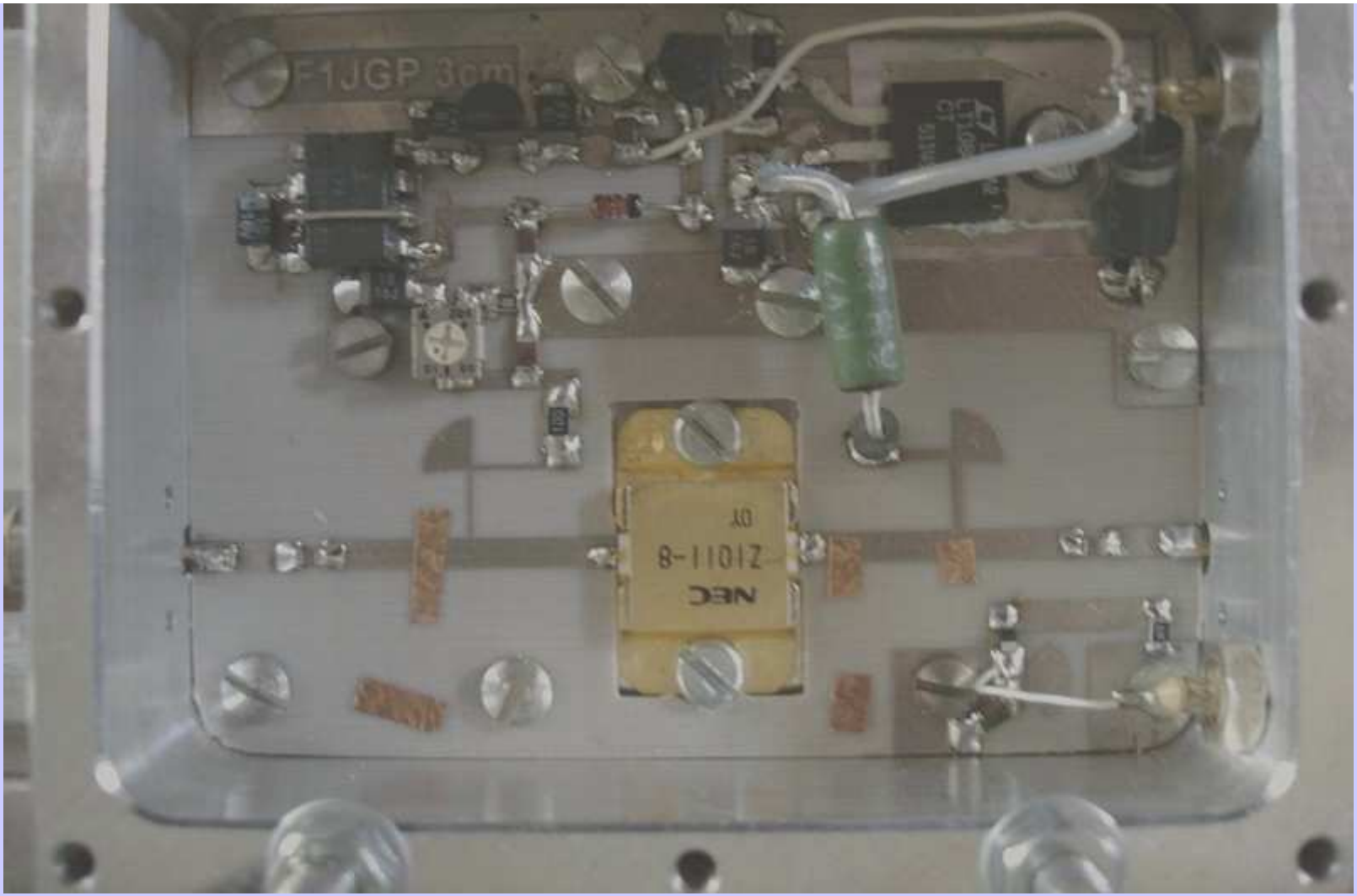
F1JGP 1 stage amplifier

- electrical scheme
- ICL7660 (no availability) substitution by an ICL7662 : what does it change ?
- housing
- linear scalar analysis WITHOUT, then WITH stubing
- power meas hardware
- final P1dBc measurements
- conclusions

F1JGP 2 stages amplifier : exactly same development

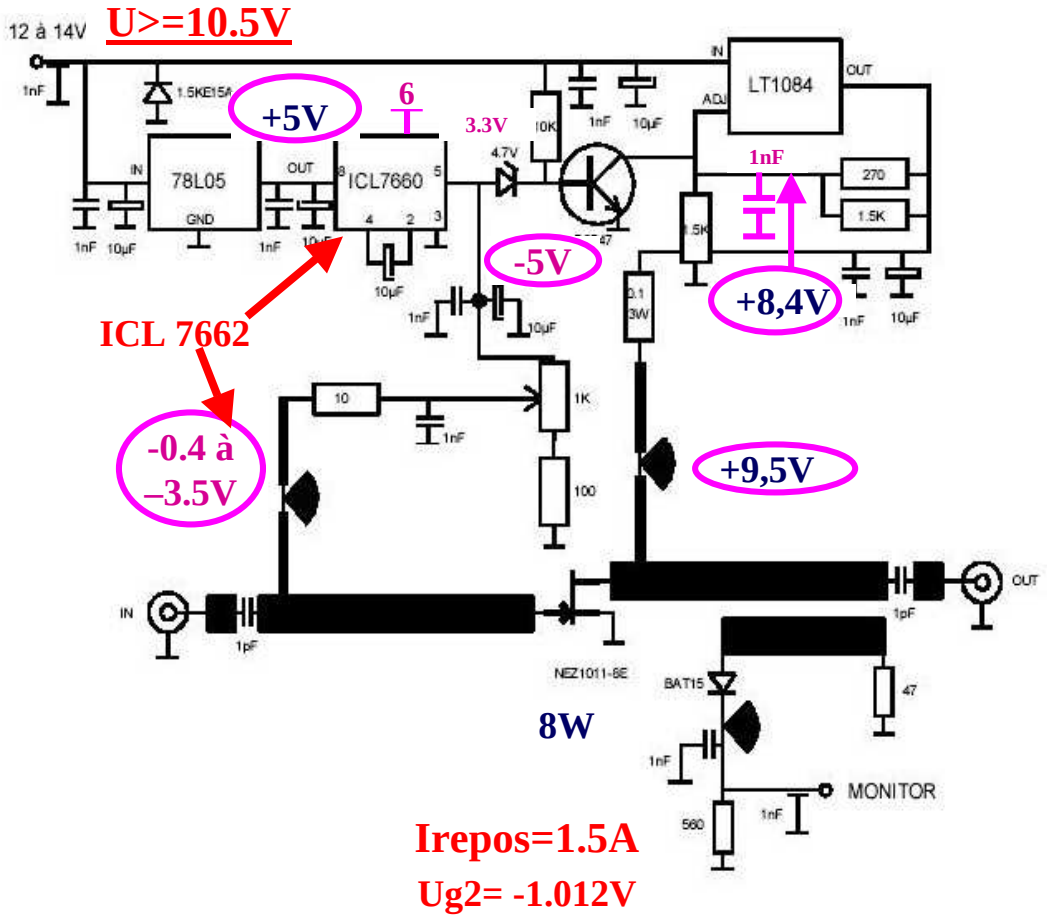
+ mounting and DC quiet current procedure explanation

10 GHz 10W F1JGP - 1 stage amp



10 GHz 10W F1JGP 1 stage amp

Electrical scheme and hardware list :



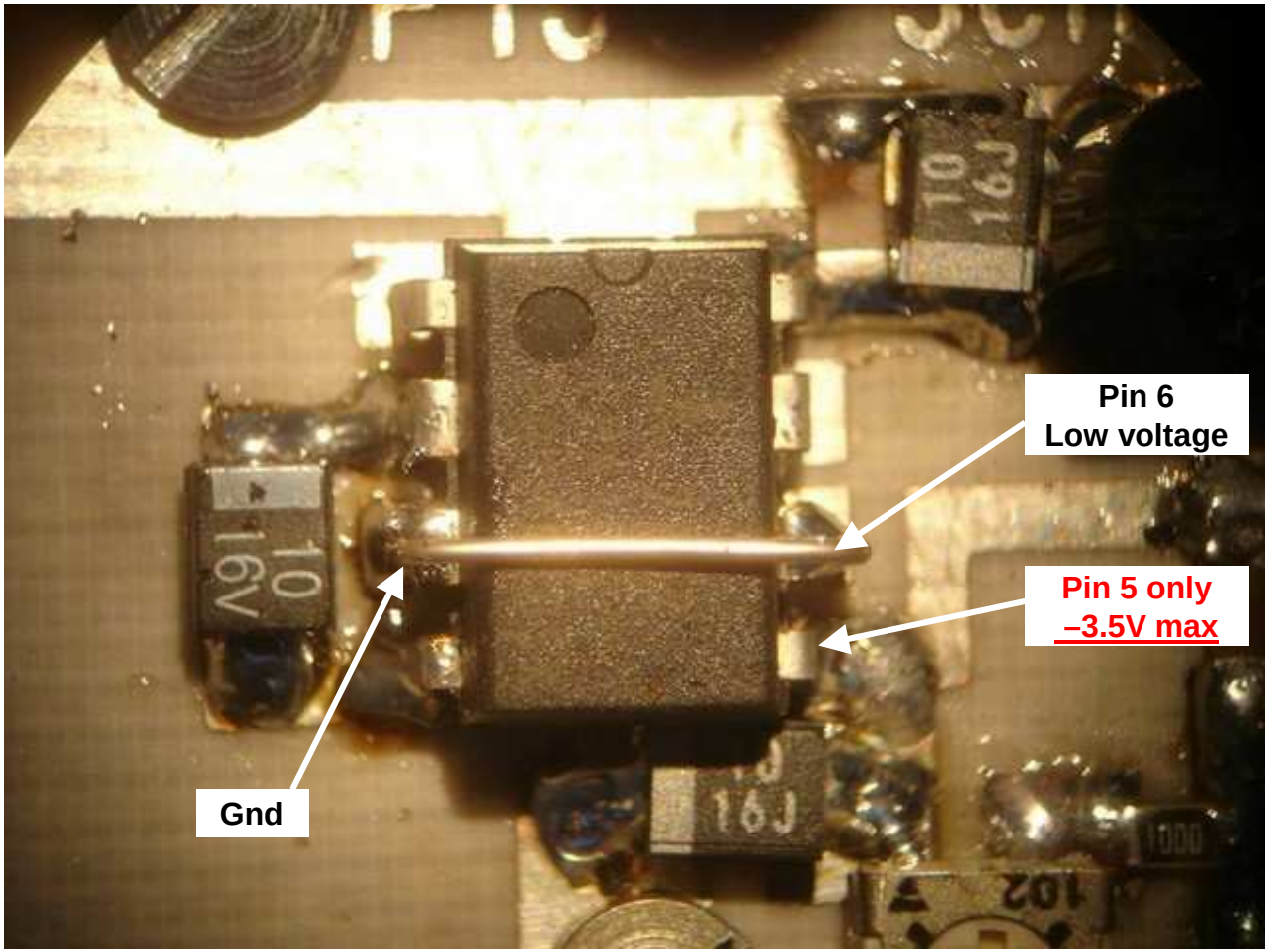
17 LISTE DU MATERIEL:

C1,C2, C3, C4, C5, C6	10µF	CMS 805
C14, C15	1pF	CMS ATC100
C7, C8, C9, C10, C11, C12, C13	1nF	CMS 805
R1	270	CMS 805
R2, R3	1.5k	CMS 805
R4	10	CMS 805
R5	100	CMS 805
R6	1k	ajustable cms cermet série 3314G
R7	0.1	3W Bobinée
R8	1,5k	CMS 805
R9	680	CMS 805
R10	47	CMS 805
T1	BC547	ou npn équivalent
T2	NEZ1011-8E	ou tout transistor 10W bande X
D1	4,7V	zener
D2	BAT15	detection
D3	1.5KE15A	à souder sur le bypass d'alim
IC1	ICL7660	
IC2	78L05	
IC3	LT1084	
BOITIER FER ETAME		schubert 74 x 55 x30
2 PRISES SMA CI		à souder sur le boitier
2 BYPASS	1nF	à souder sur le boitier
CIRCUIT EPOXY	Téflon	F1JGP

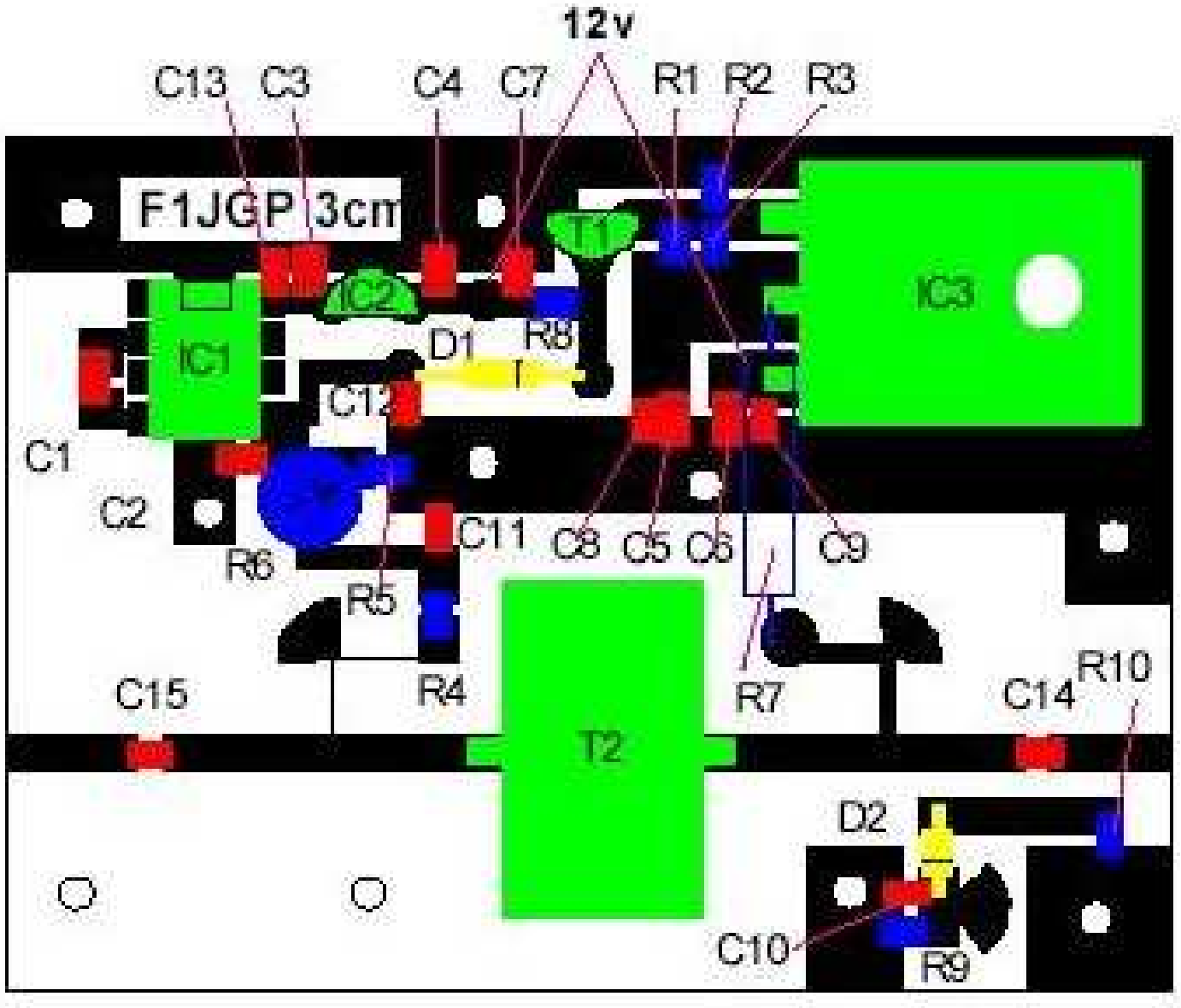
10 GHz 10W F1JGP 1 stage amp

ICL7660 possible replacement by an ICL7662 :

- In opposite of the ICL7660, Pin 6 (low voltage) of ICL7662 **MUST** absolutely be connected to ground
- Max negative output only –3.5V instead of –4.8V → **4.7V zener diode must be lowered to 3.3V**
- AND total intensity varying a little between +11 and +15V ! !

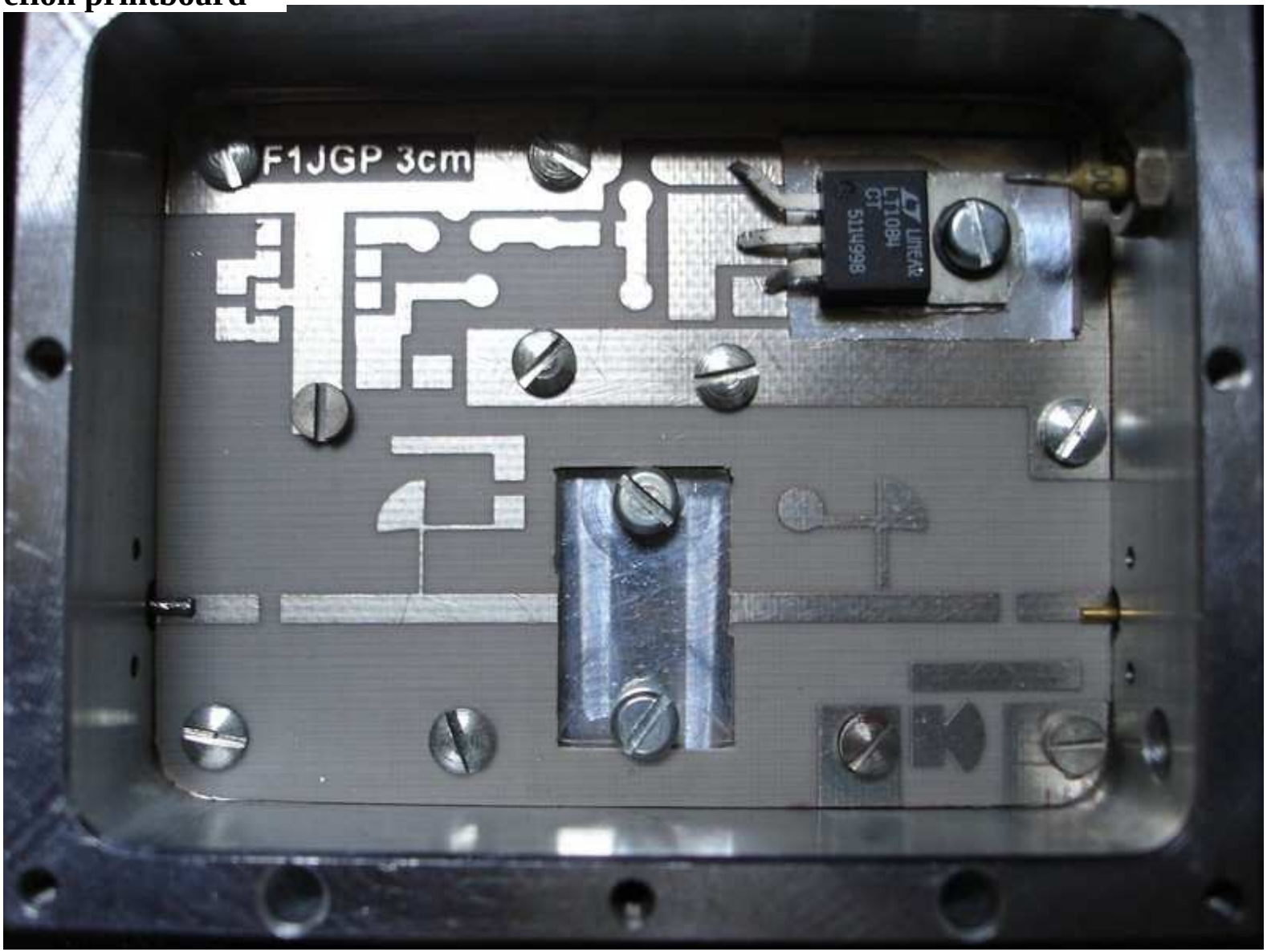


10 GHz 10W F1JGP 1 stage amp



10 GHz 10W F1JGP 1 stage amp

Teflon printboard

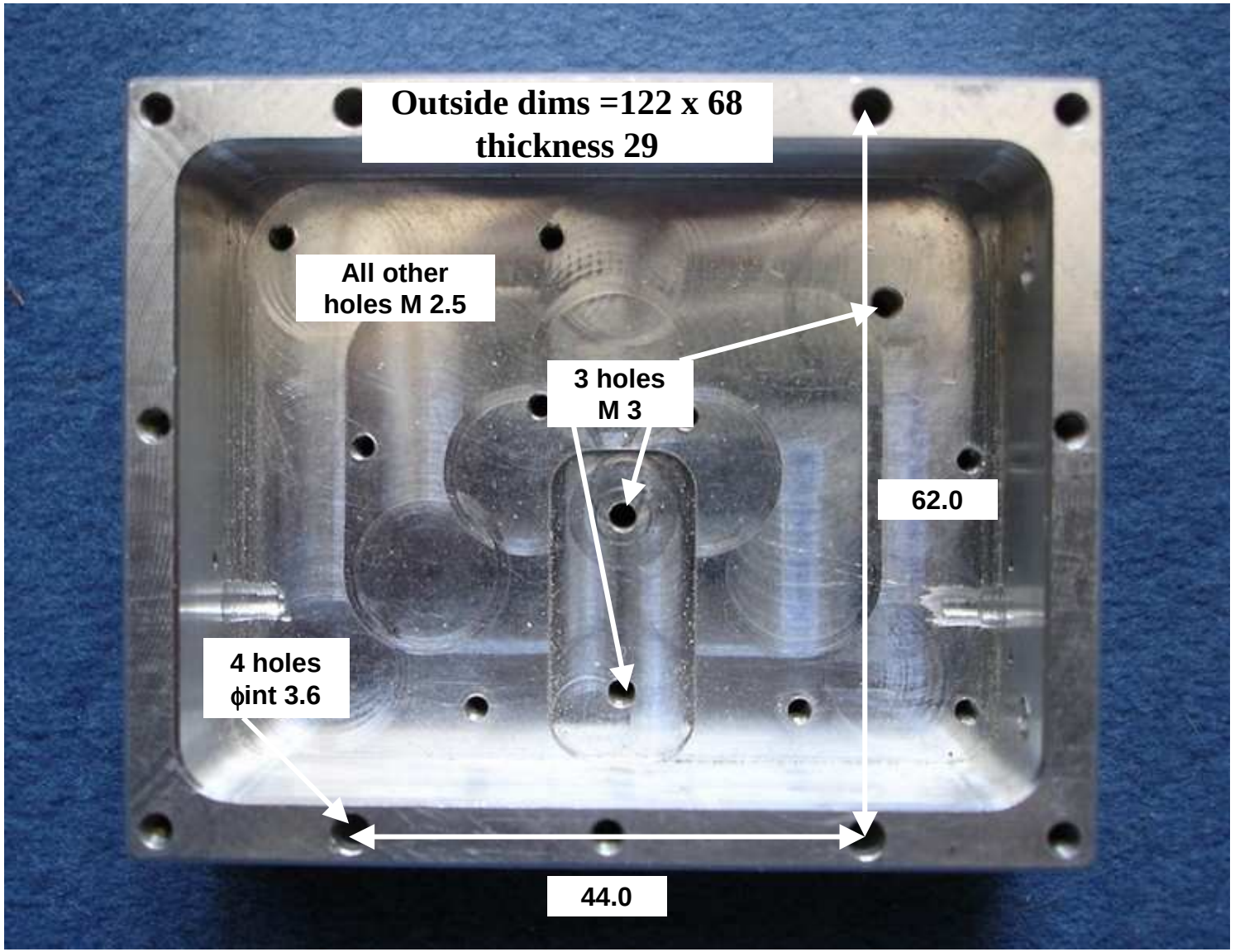


10 GHz 10W F1JGP 1 stage amp

Box bottom – dims in mm

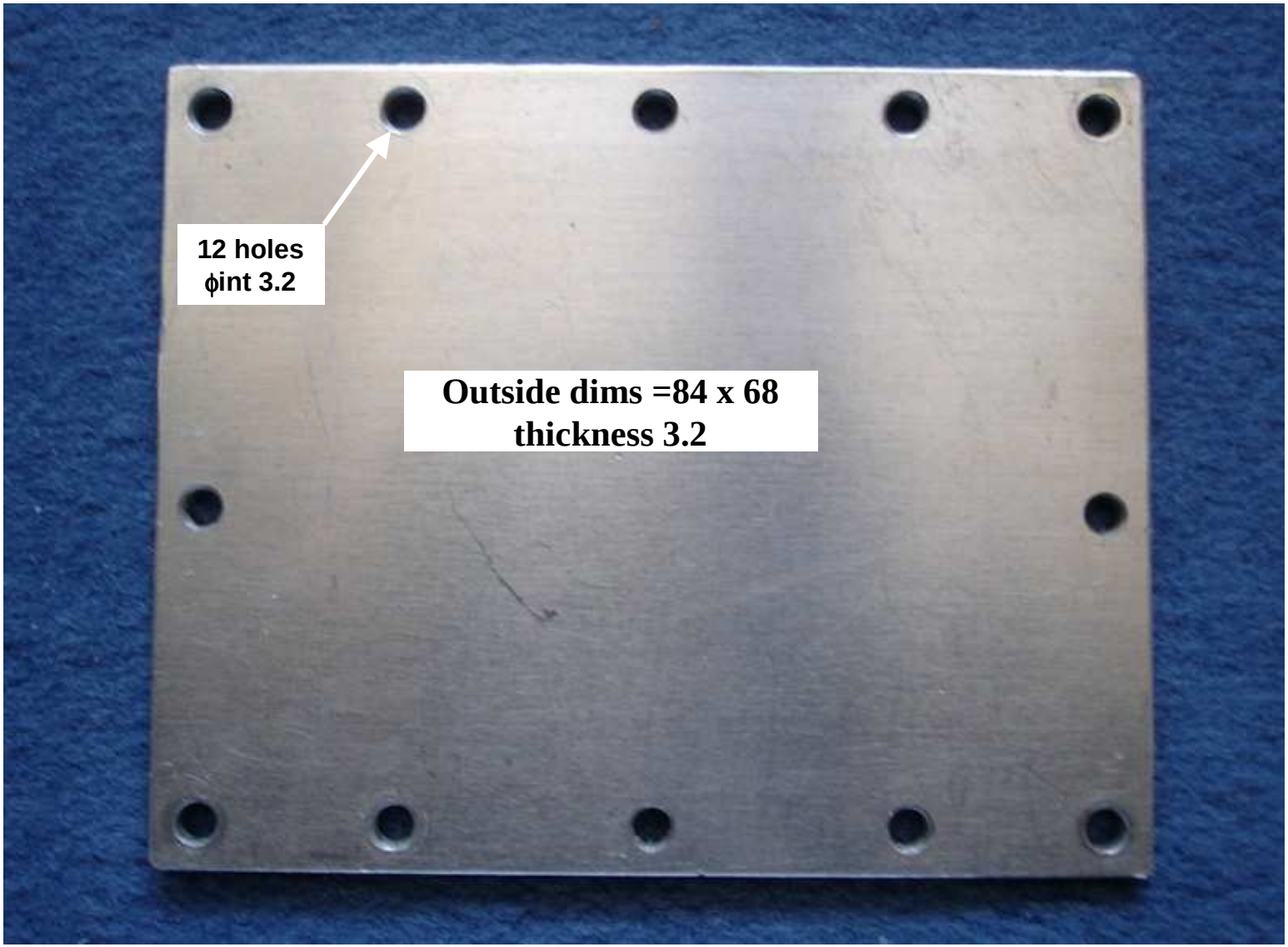
10 GHz 10W F1JGP 1 stage amp

Box inside view



10 GHz 10W F1JGP 1 stage amp

Box cover – dims in mm

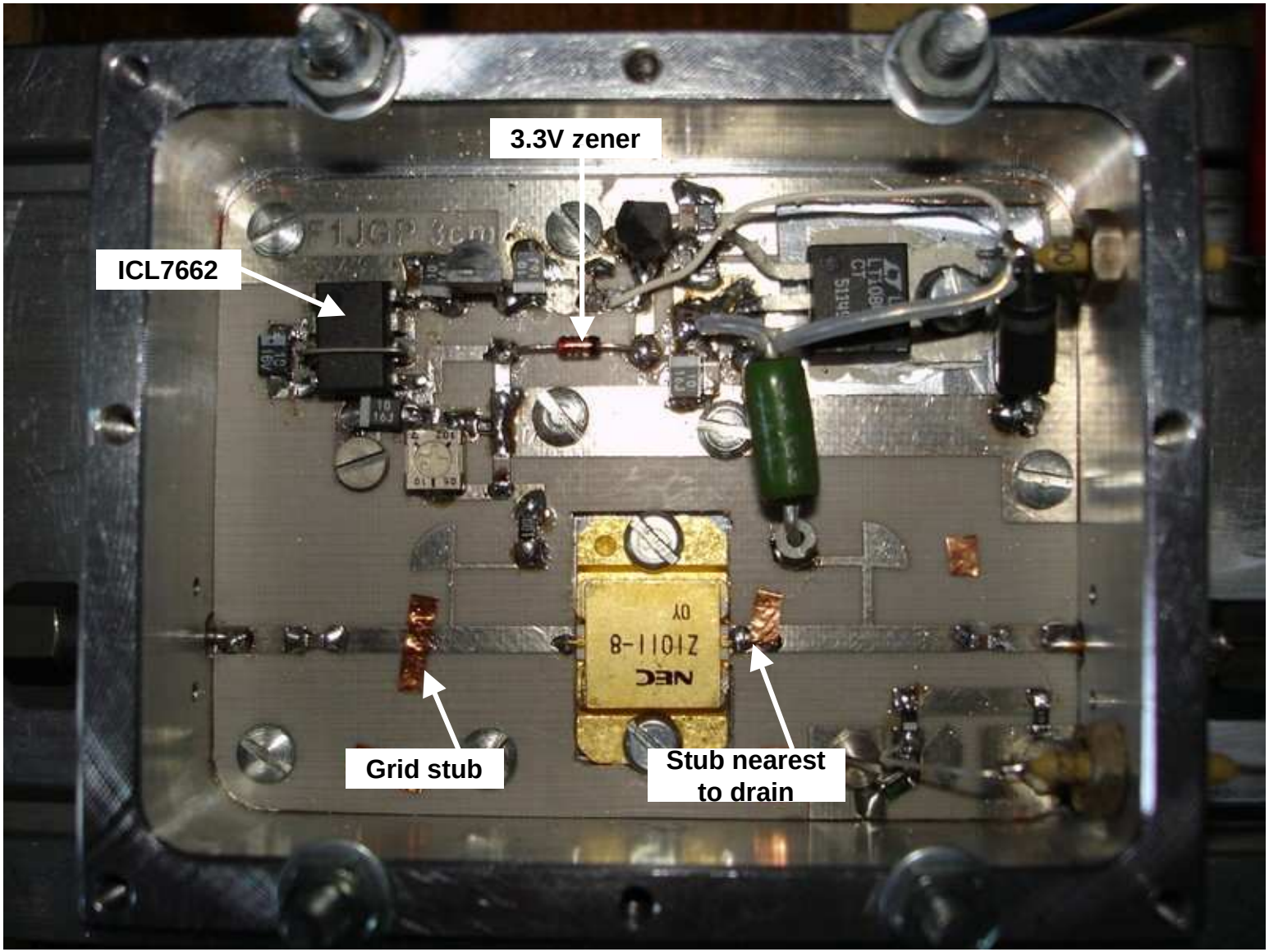


10 GHz 10W F1JGP 1 stage amp

Broadband scalar analysis in linear mode at Pin= 0 dBm without stubs

10 GHz 10W F1JGP 1 stage amp

F6AJW's whole amp : 2 stubs for optimised lin gain à 10.35 GHz

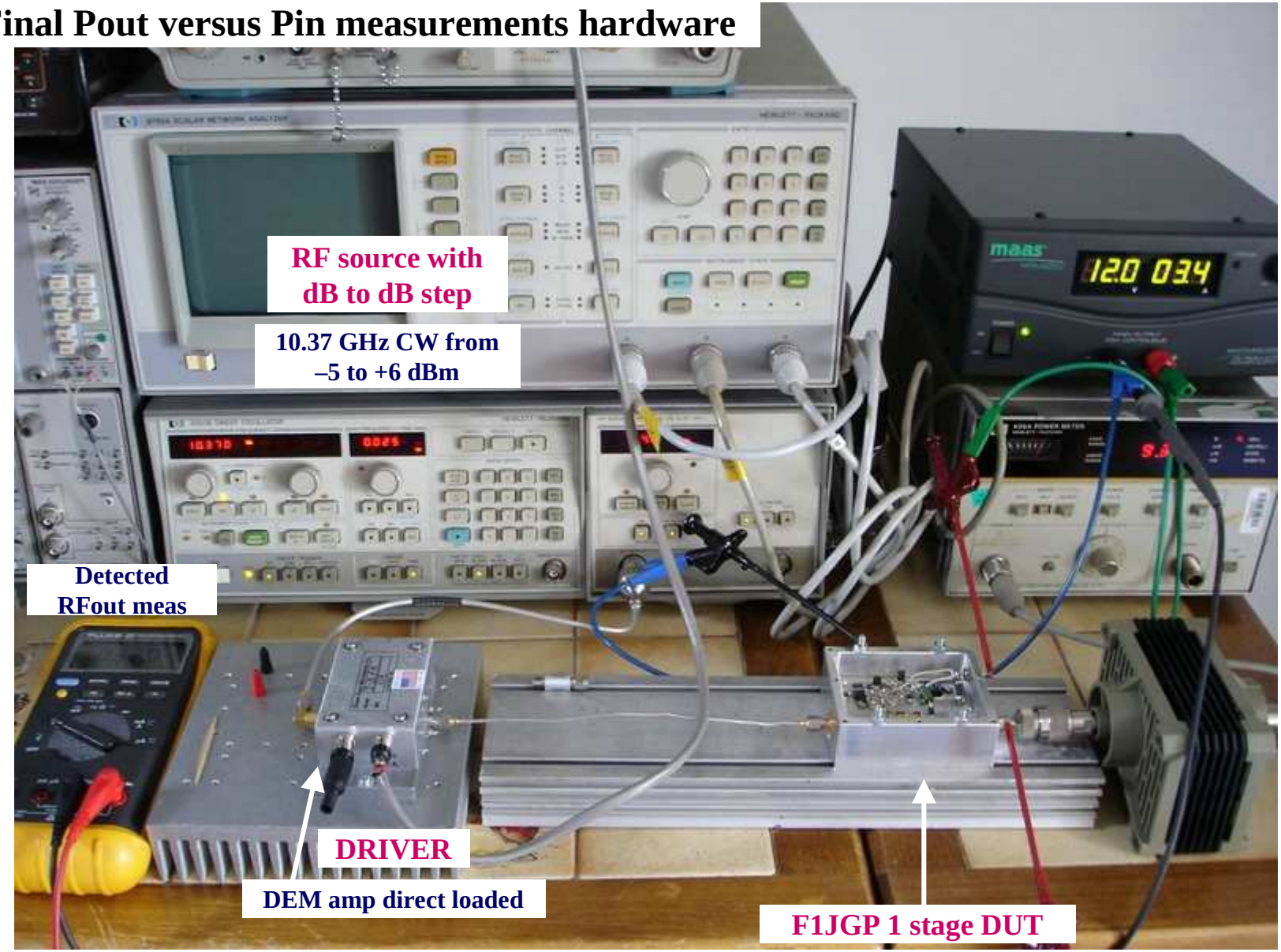


10 GHz 10W F1JGP 1 stage amp

Broadband linear mode scalar analysis at Pin= 0 dBm with 2 soldered stubs

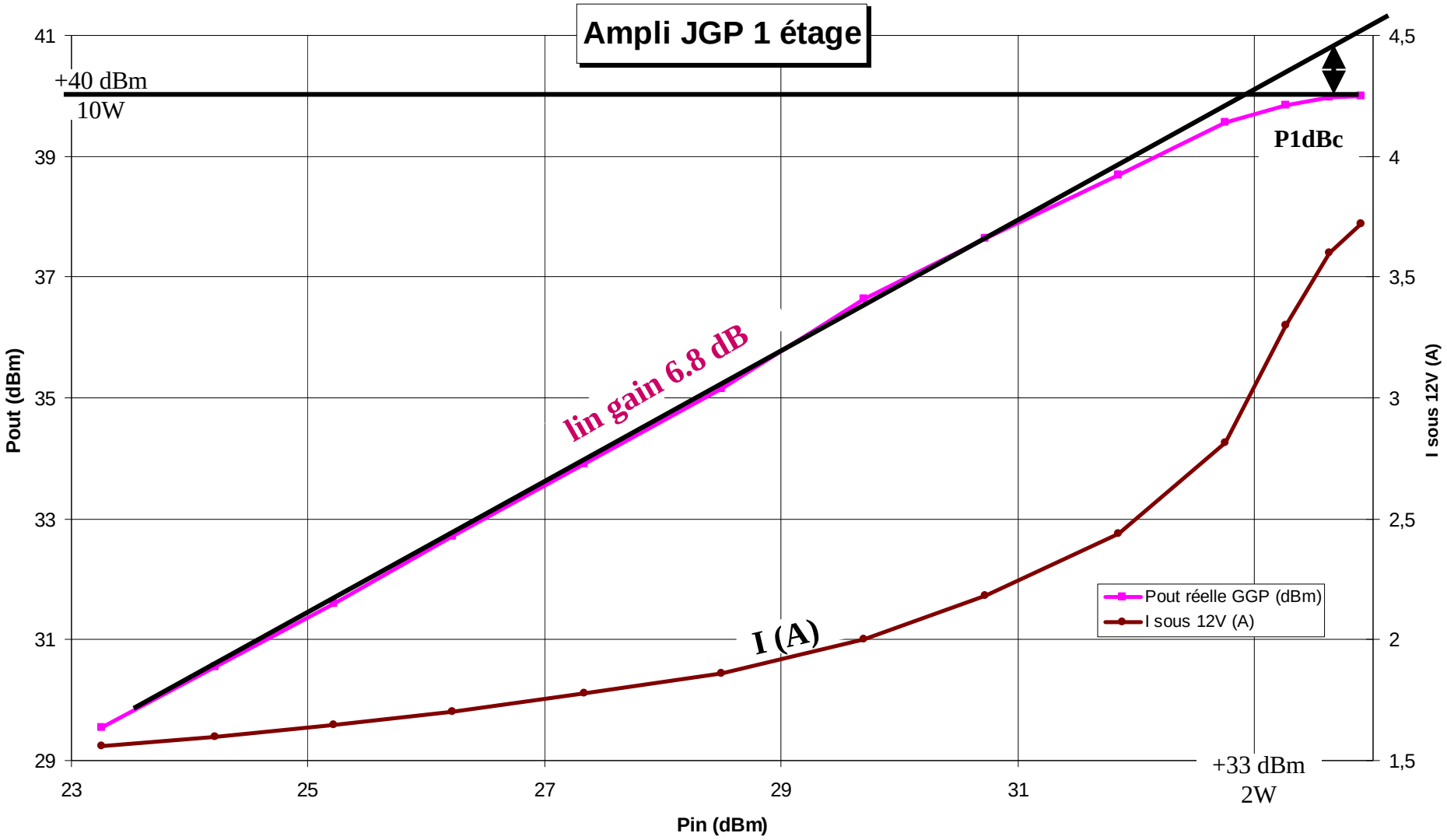
10 GHz 10W F1JGP 1 stage amp

Final Pout versus Pin measurements hardware



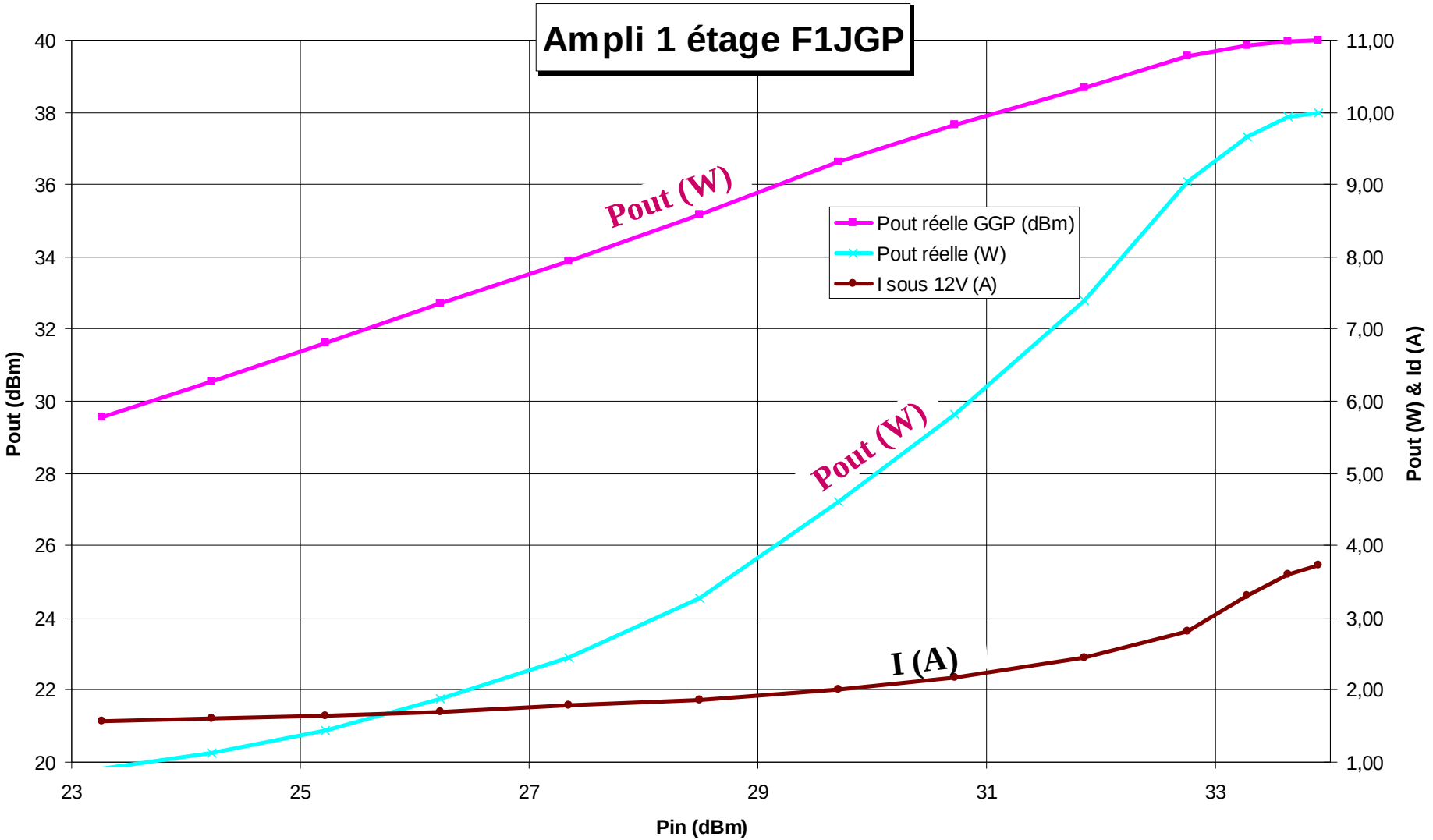
10 GHz 10W F1JGP 1 stage amp

F6AJW's amplifier : Pout and total DC intensity & U=12V



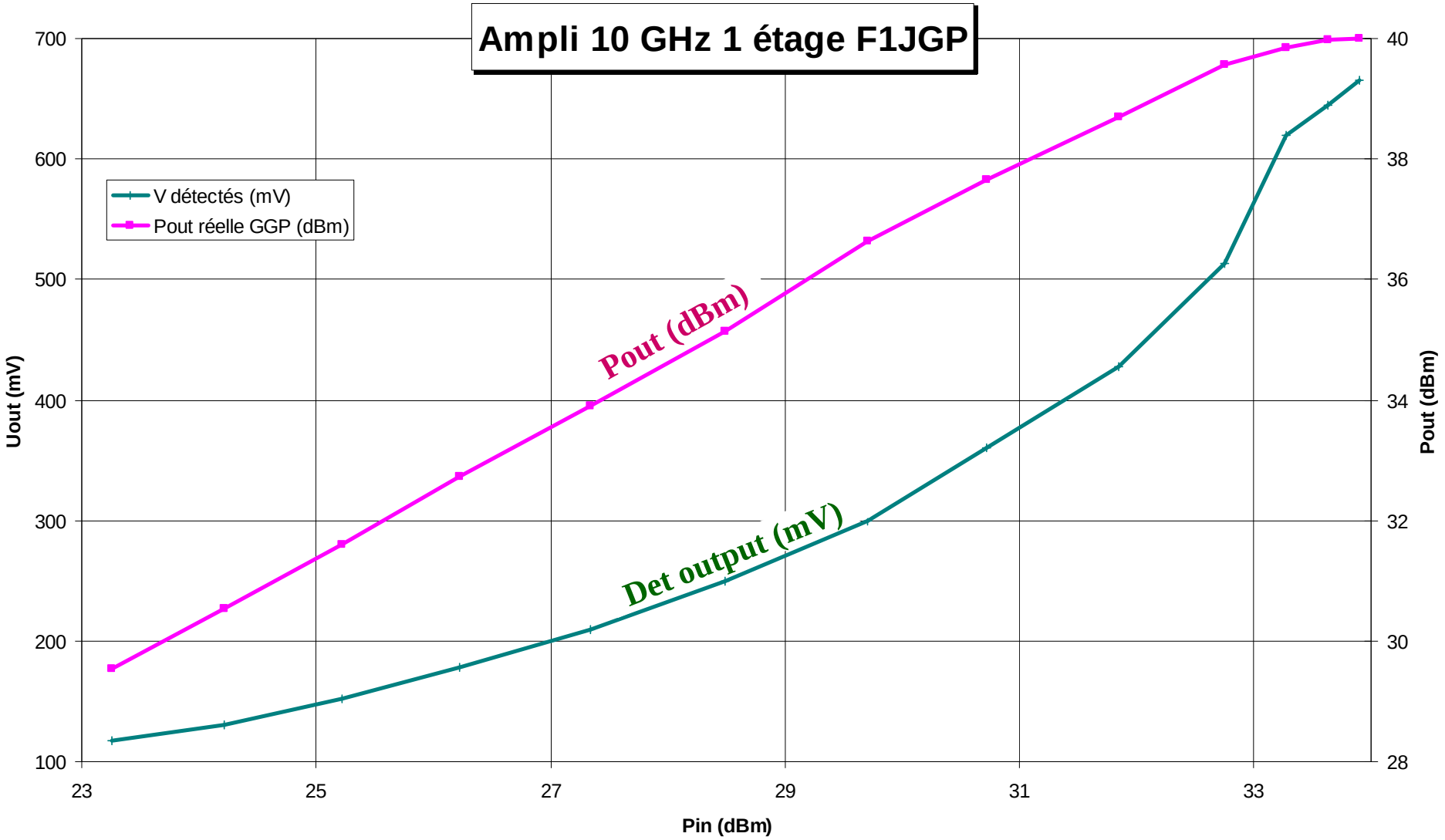
10 GHz 10W F1JGP 1 stage amp

F6AJW's amplifier : Pout (dBm and W) and I DC (A)



10 GHz 10W F1JGP 1 stage amp

F6AJW's amplifier : detected DC output versus Poutput

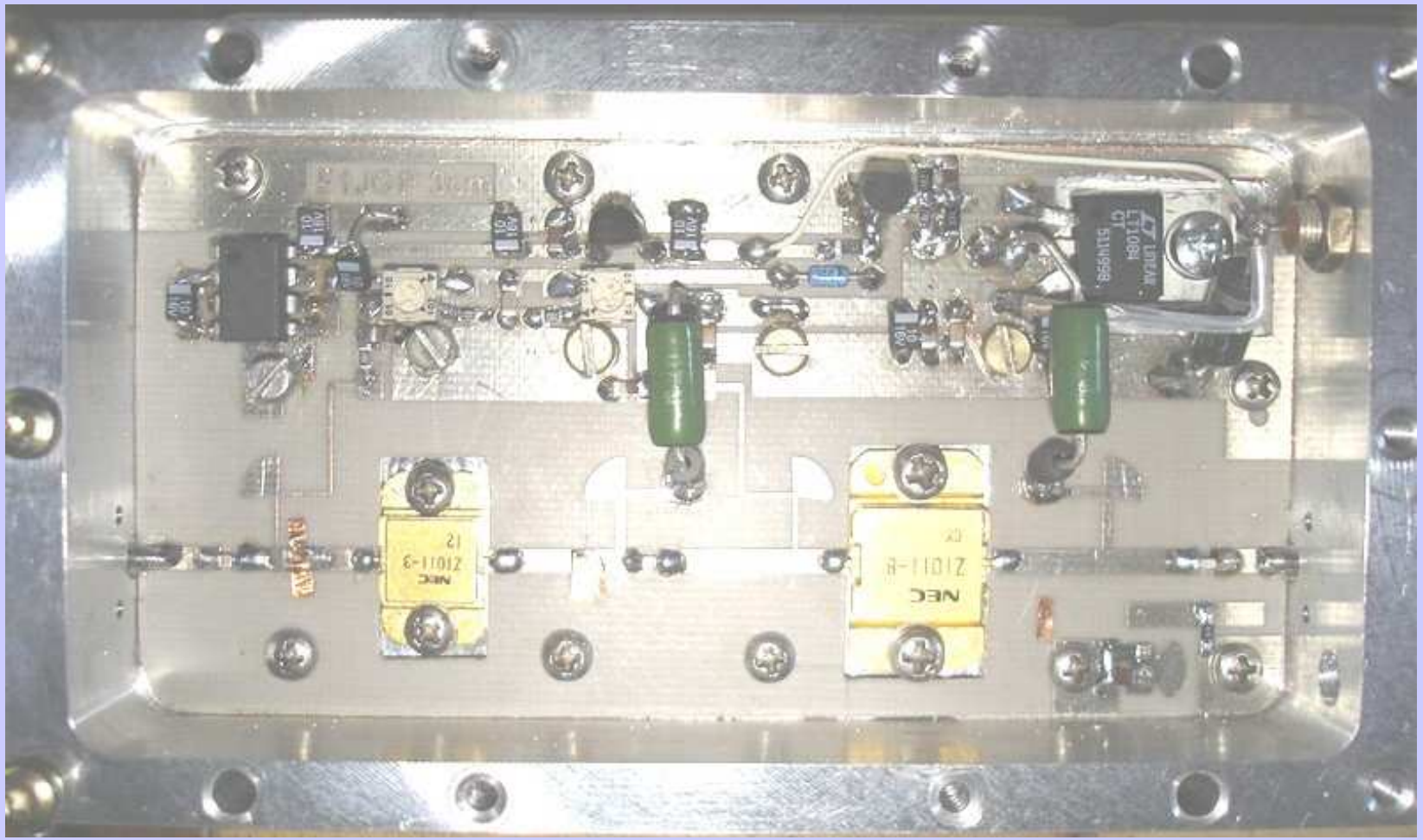


10 GHz 10W F1JGP 1 stage amp

F6AJW's amplifier : conclusion

- P1dBc up to +40 dBm or 10W à Pin= +33 dBm (2W)
- Lin gain 6.8 dB
- Drain stub at nearest position of drain output
- Imax DC=3.8A
- U detected output à 8Wout = 600 mV

10 GHz 10W F1JGP - 2 stages amp

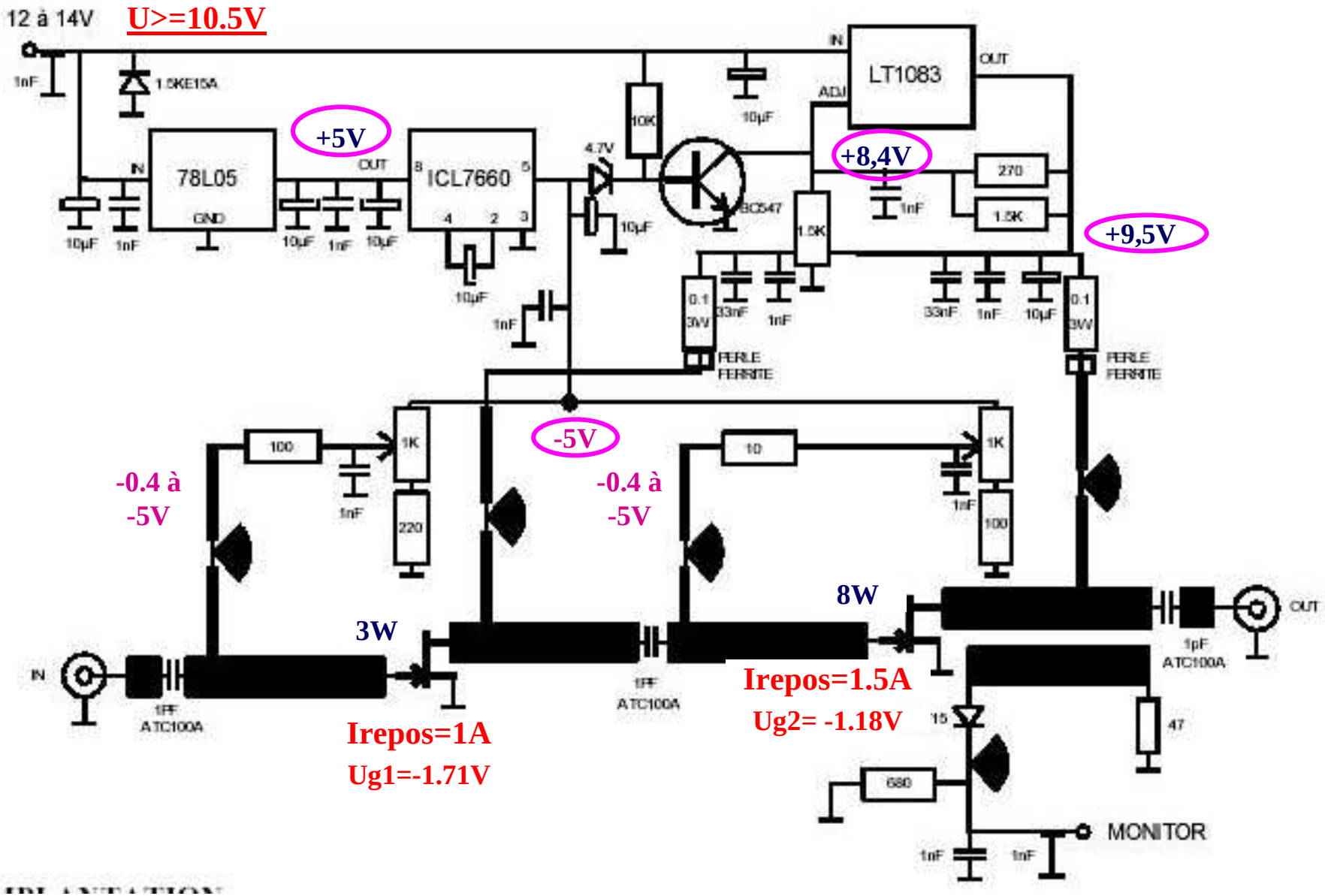


10 GHz 10W F1JGP 2 stages amp

Composants à commander chez :

	Prix	Qui ?	eMail
Circuit imprimé 1 ou 2 étages	55€ /2	F1JGP	patrick.fouqueau@wanadoo.fr
Boîtier fraisé 2 étages + couvercle	48€	F5FMW Arthur PAIS - LOUMET- 81350 SAINT GREGOIRE	hansdb@hotmail.com
NEZ1011-3E	90€	idem	hansdb@hotmail.com
FLM0910-8F	190€	idem	hansdb@hotmail.com
Absorbant sur couvercle	?	?	?
CMS, R, C, NPN, régulateur low-drop, etc …	?	SMG Diffusion Electronique Diffusion Lextronic, etc	f1ge@orange.fr

10 GHz 10W F1JGP 2 stages amp



10 GHz 10W F1JGP 2 stages amp

Hardware list :

Désignation	valeur	remarques
C1,C2, C3, C4, C5, C6, C7	10µF	CMS 805
C19, C20, C21	1pF	CMS ATC100
C8, C9, C10, C11, C12, C13, C14, C15, C18	1nF	CMS 805
C16, C17	33nF	CMS 805
R1, R5	100	CMS 805
R2	220	CMS 805
R3, R4	1k	ajustable cms cermet série 3314G
R6	10	CMS 805
R7	10k	CMS 805
R8, R9	1,5k	CMS 805
R10	270	CMS 805
R11	680	CMS 805
R12	47	CMS 805
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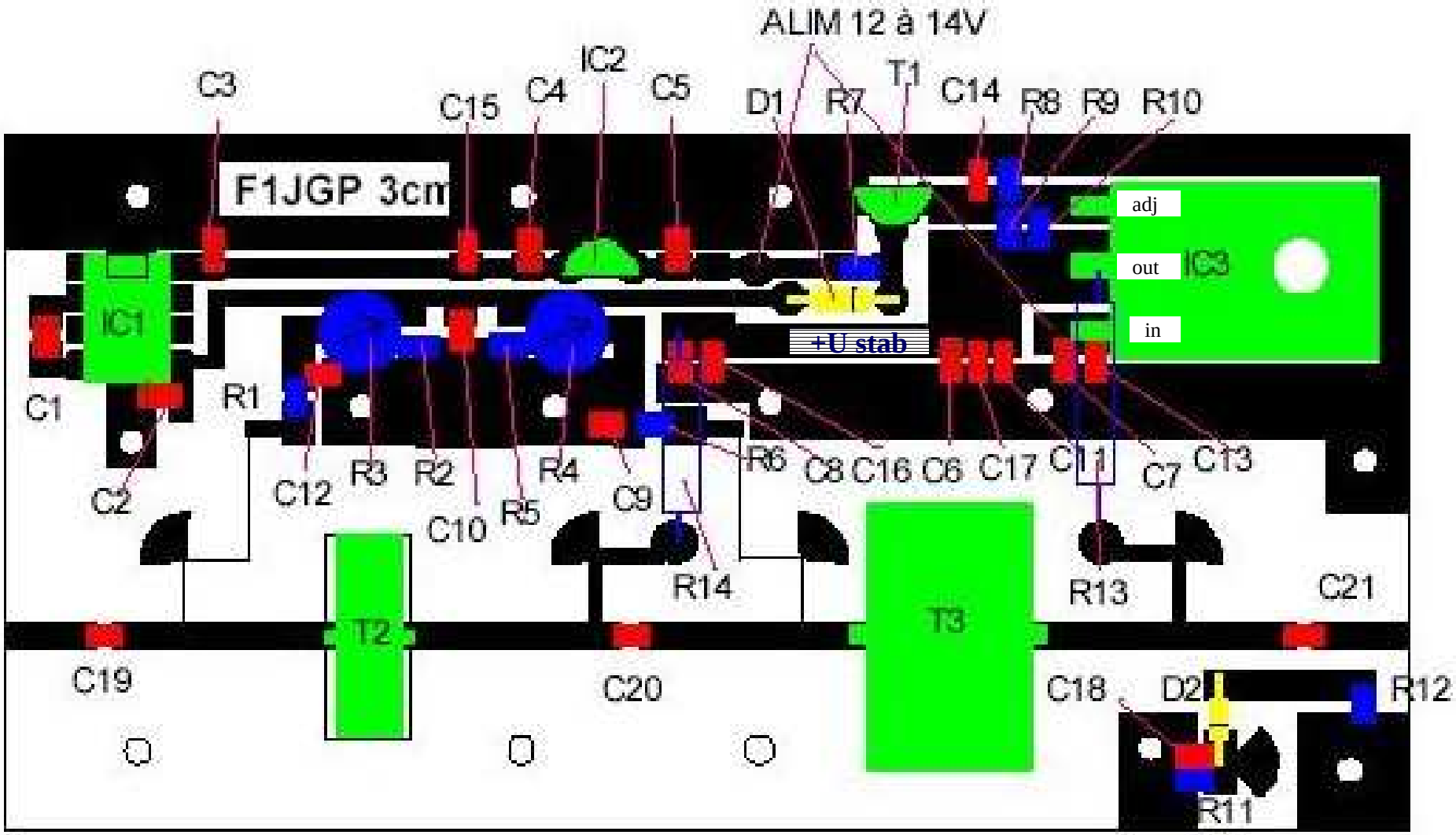
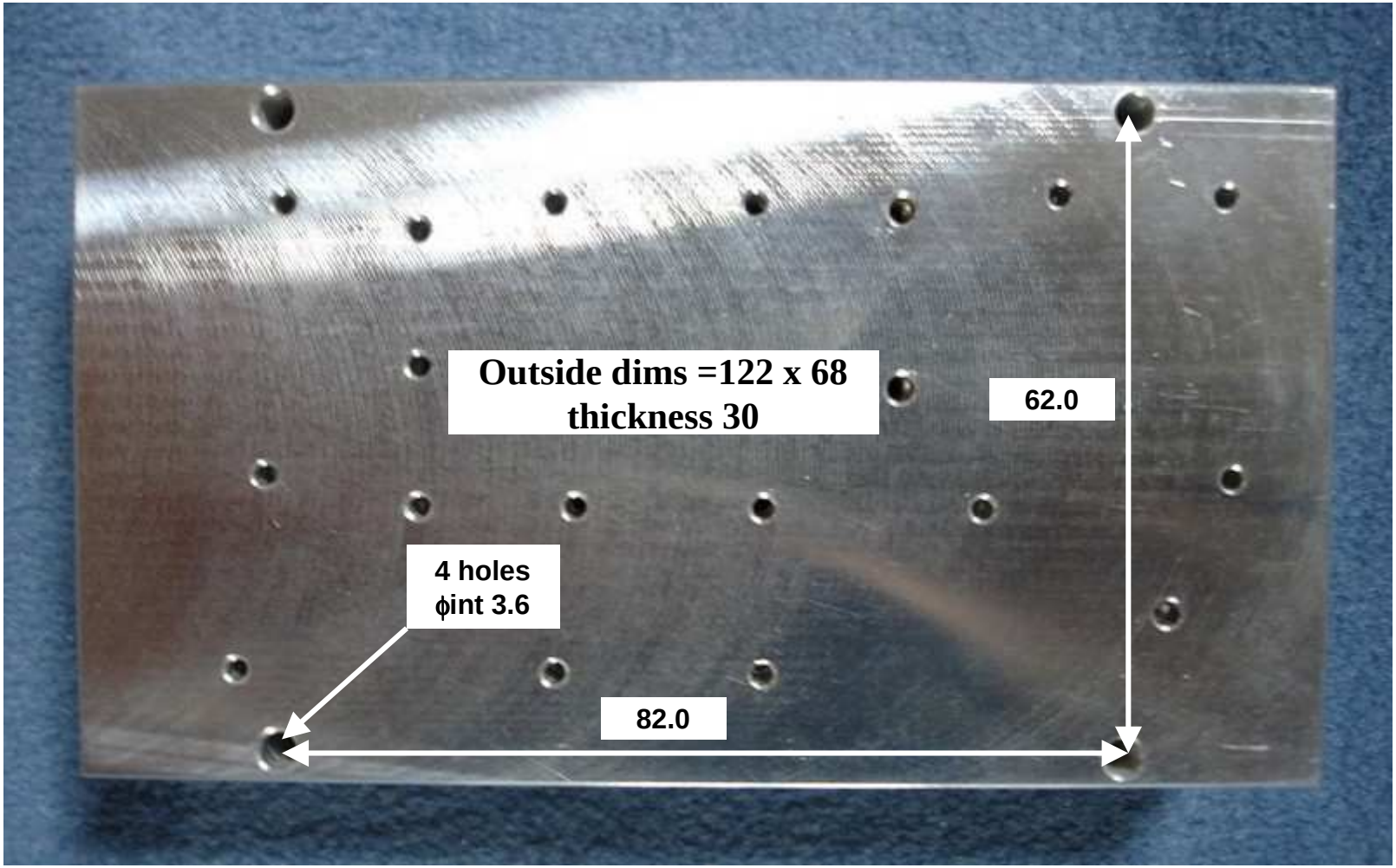
D2	BAT15	detection
D3	1.5KE15A	à souder sur le bypass d'alim
IC1	ICL7660	
IC2	78L05	
IC3	LT1083	
BOITIER FER ETAME		schubert 111 x 55 x30
2 PRISES SMA CI		à souder sur le boitier
2 BYPASS	1nF	à souder sur le boitier
CIRCUIT EPOXY	Téflon	F1JGP

10 GHz 10W F1JGP 2 stages amp



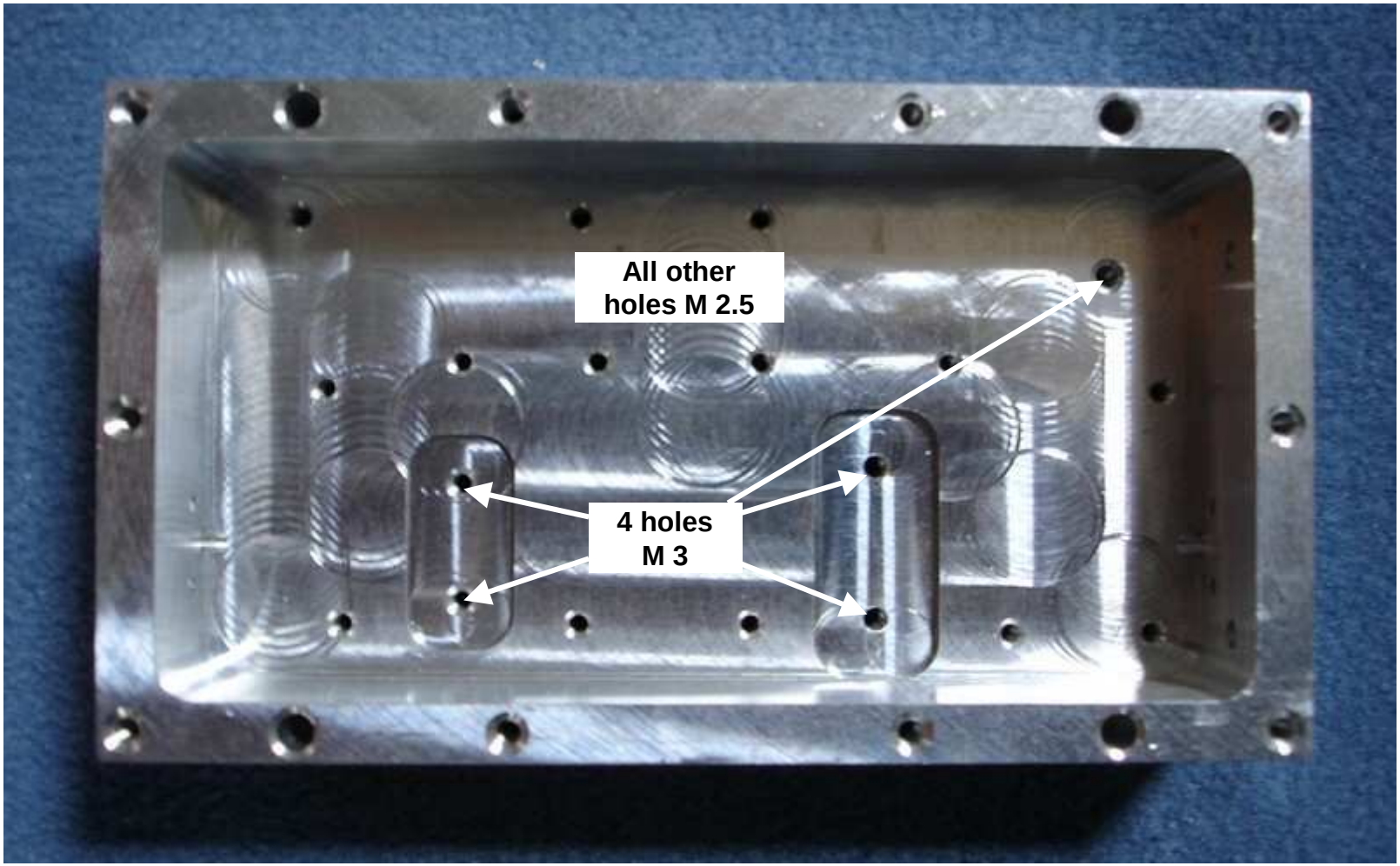
10 GHz 10W F1JGP 2 stages amp

Box bottom – dims in mm



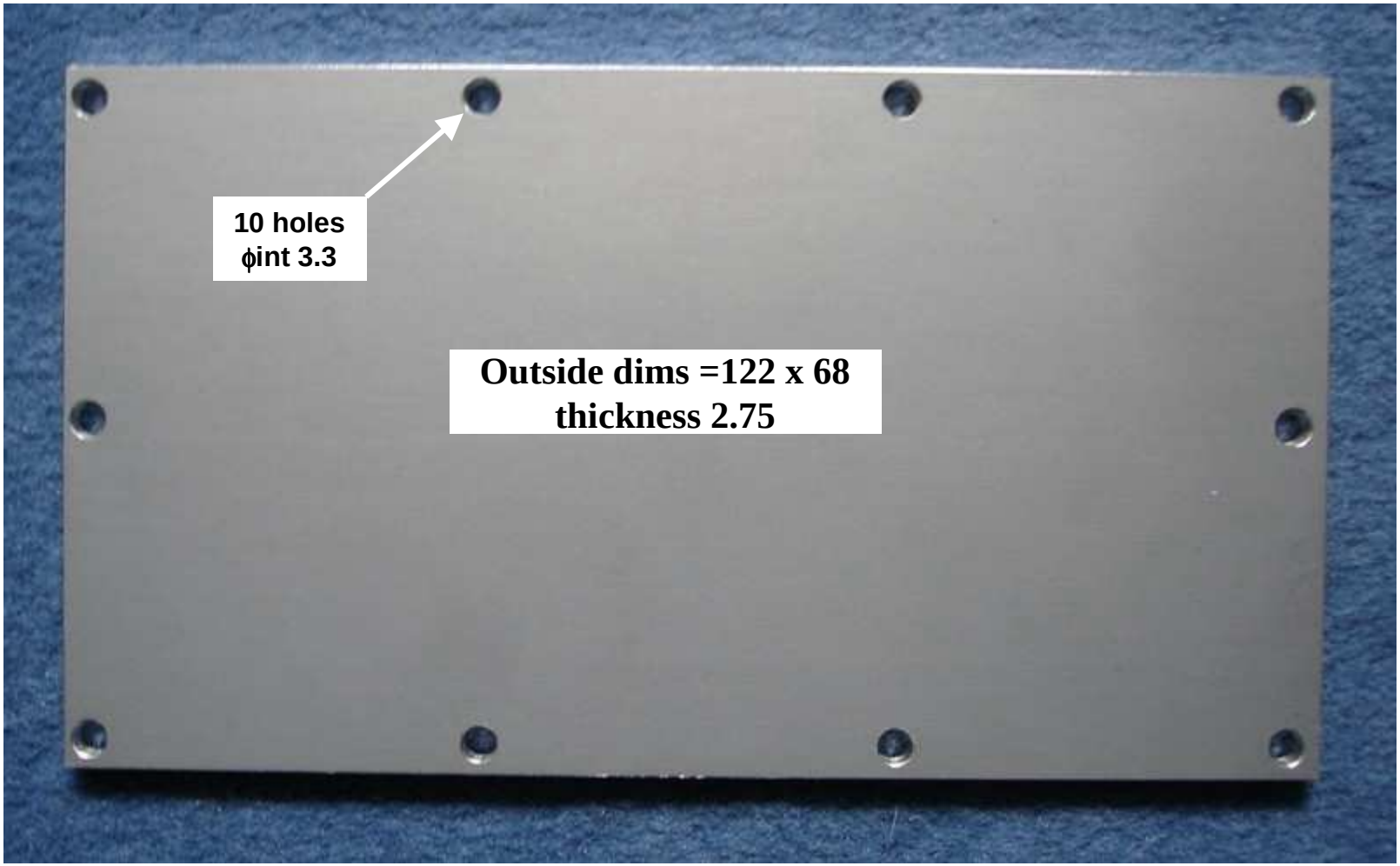
10 GHz 10W F1JGP 2 stages amp

Box inside view



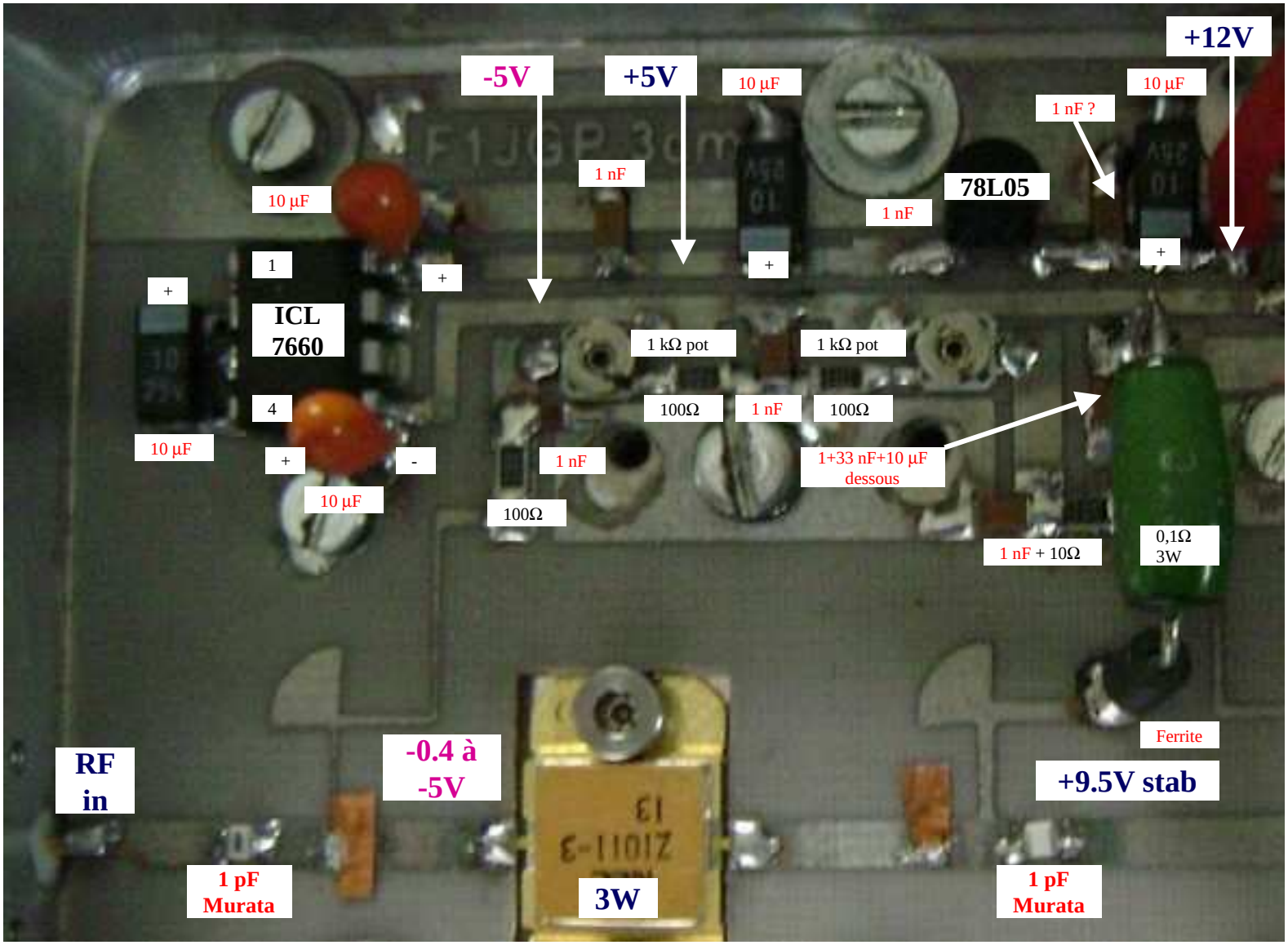
10 GHz 10W F1JGP 2 stages amp

Box cover – dims in mm



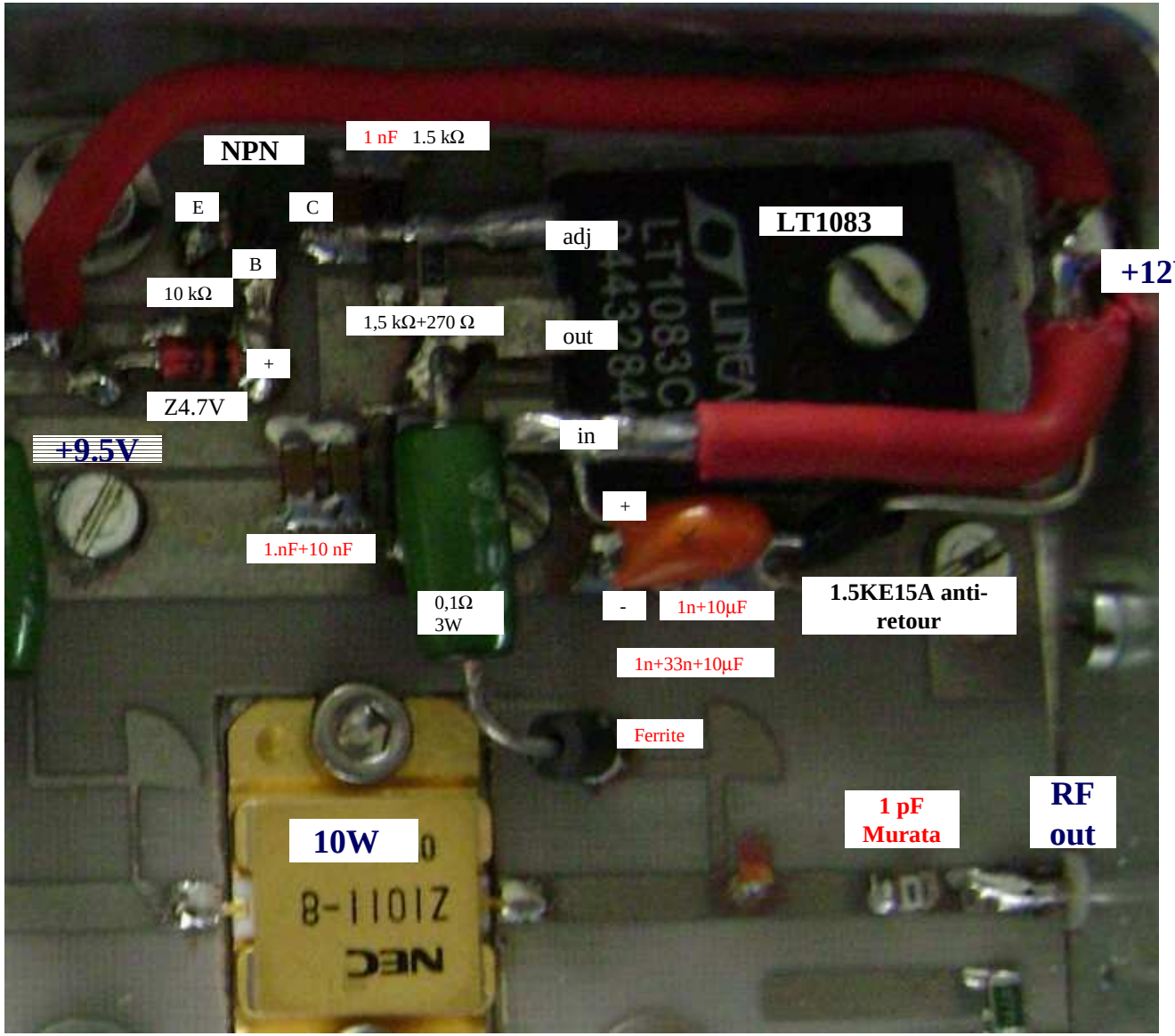
10 GHz 10W F1JGP 2 stages amp

F6ACA's amplifier : zoom on 1st stage



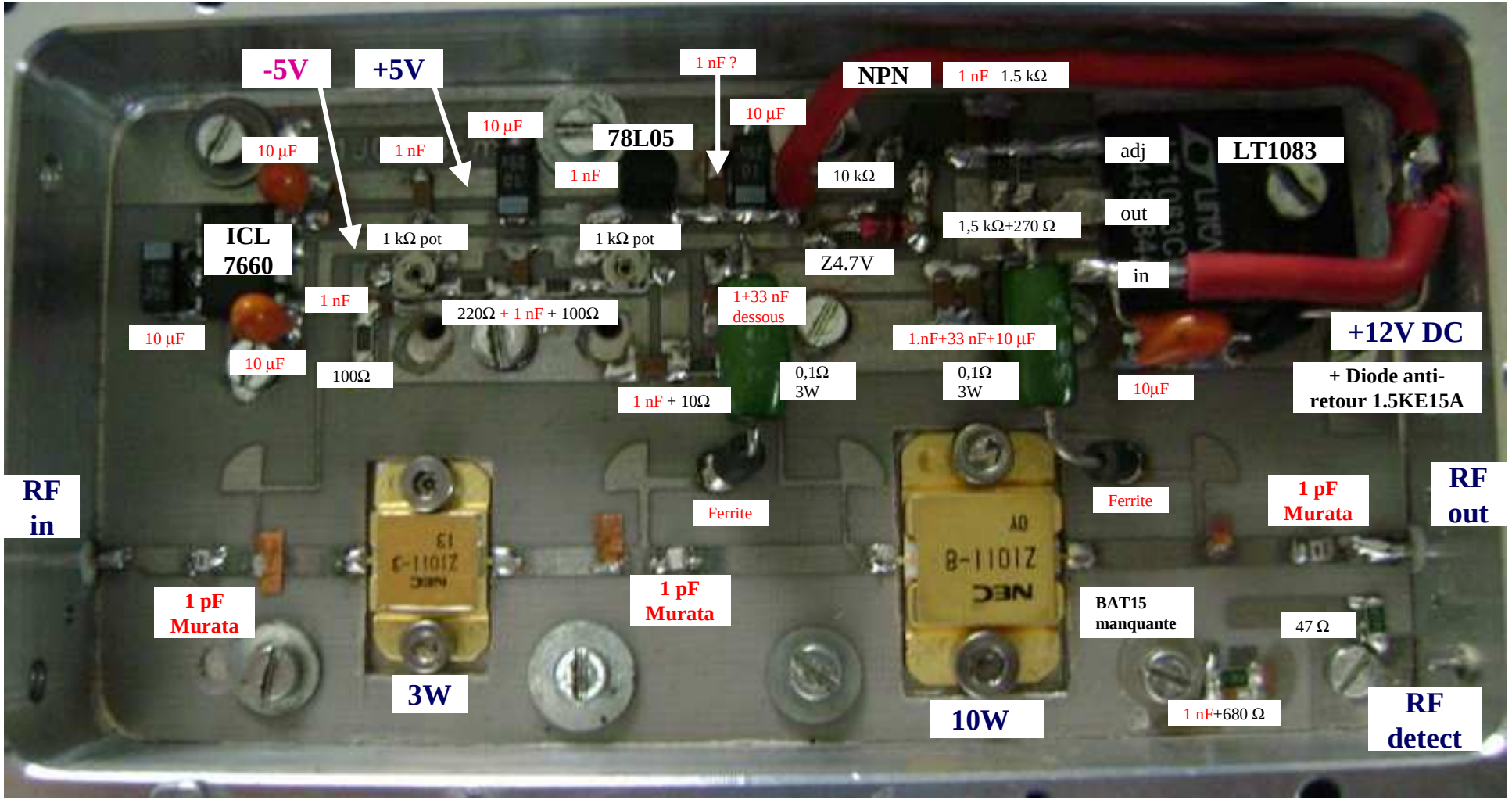
10 GHz 10W F1JGP 2 stages amp

F6ACA's amplifier : zoom on 2nd stage



10 GHz 10W F1JGP 2 stages amp

F6ACA's whole amplifier



10 GHz 10W F1JGP 2 stages amp

Whole mounting and DC procedure

- Réduire de moitié la longueur des pattes grille et drain
- Grille = patte bizotée à 45°
- Fixer par vis et souder les pattes avec fer à souder débranché du secteur
- Deux potars à U négative maximale (-4.6V) pour pincer totalement les FETs lors de la mise en tension

a/ règlage courant repos : d'abord l'étage final seul (pas le 1er seul)

- Dessouder le drain du 1er étage
- Appliquer directement 12V, I limitée à 1.2 A et règler **Ic=1.5A sur le 2ème étage**
- **Valeur relevée Irepos=1.5A, Ug2=-1.18V**
- Ressouder drain 1er étage
- Règler les 2 étages ensemble à courant total 1A supplémentaire
- Ic 1er étage = Itotale – I du 2ème étage

b/ règlage courant repos : 2 étages simultanément

- Ressouder drain 1er étage
- Règler les 2 étages ensemble à **courant total avec 1A supplémentaire** (total 2.5A)
- Ug1 relevée = -1.71V
- Ic 1er étage = I totale – I du 2ème étage

Si l'on dessoude le drain du 2ème étage pour régler le courant repos du 1er, celui-ci autooscille (impossible de le pincer totalement).

Valeur relevée Irepos>=1.5A, Ug1=-1.57V

10 GHz 10W F1JGP 2 stages amp

Remarques complémentaires

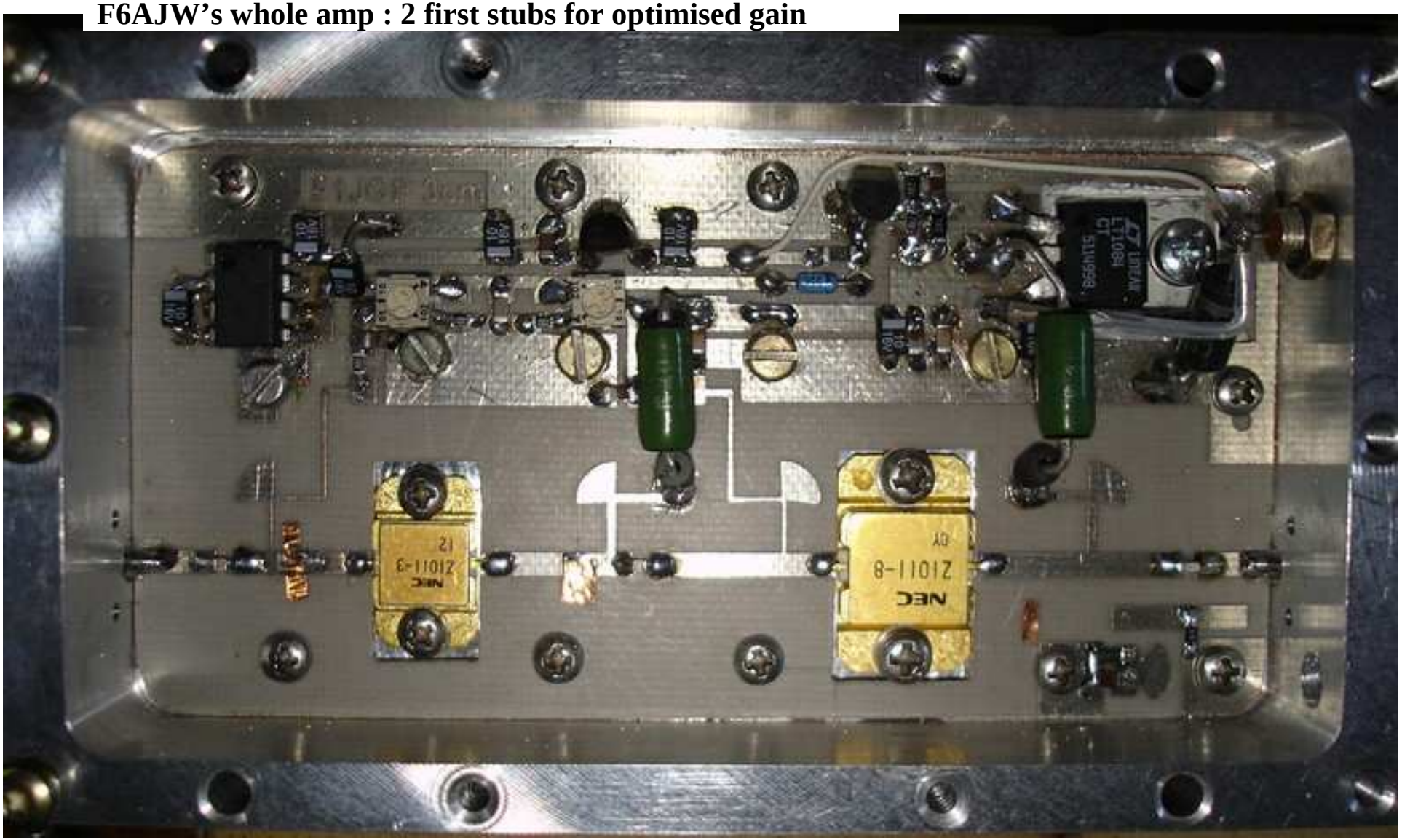
- Utiliser l'alimentation directement à 12V
- 2ème étage : augmenter Ic_repos de 1.5 à 2A et voir l'influence
- **Ne pas régler le courant repos du 1er étage avec le drain du 2ème FET en l'air (oscillation).**
- Vérifier I repos total = constante pour 10.5V<U alime <14V
- bien serrer les vis de fixation des fiches SMA à embase carrée
- Gain RF tributaire du bon serrage des vis de masse !
- Rajout d'une 10 µF sur pin adj du LT1083 (ou 4)

A vérifier ultérieurement l'influence :

- Exemplaire SANS COLLE à l'Ag
- Fixation des FETs SANS pâte conductrice

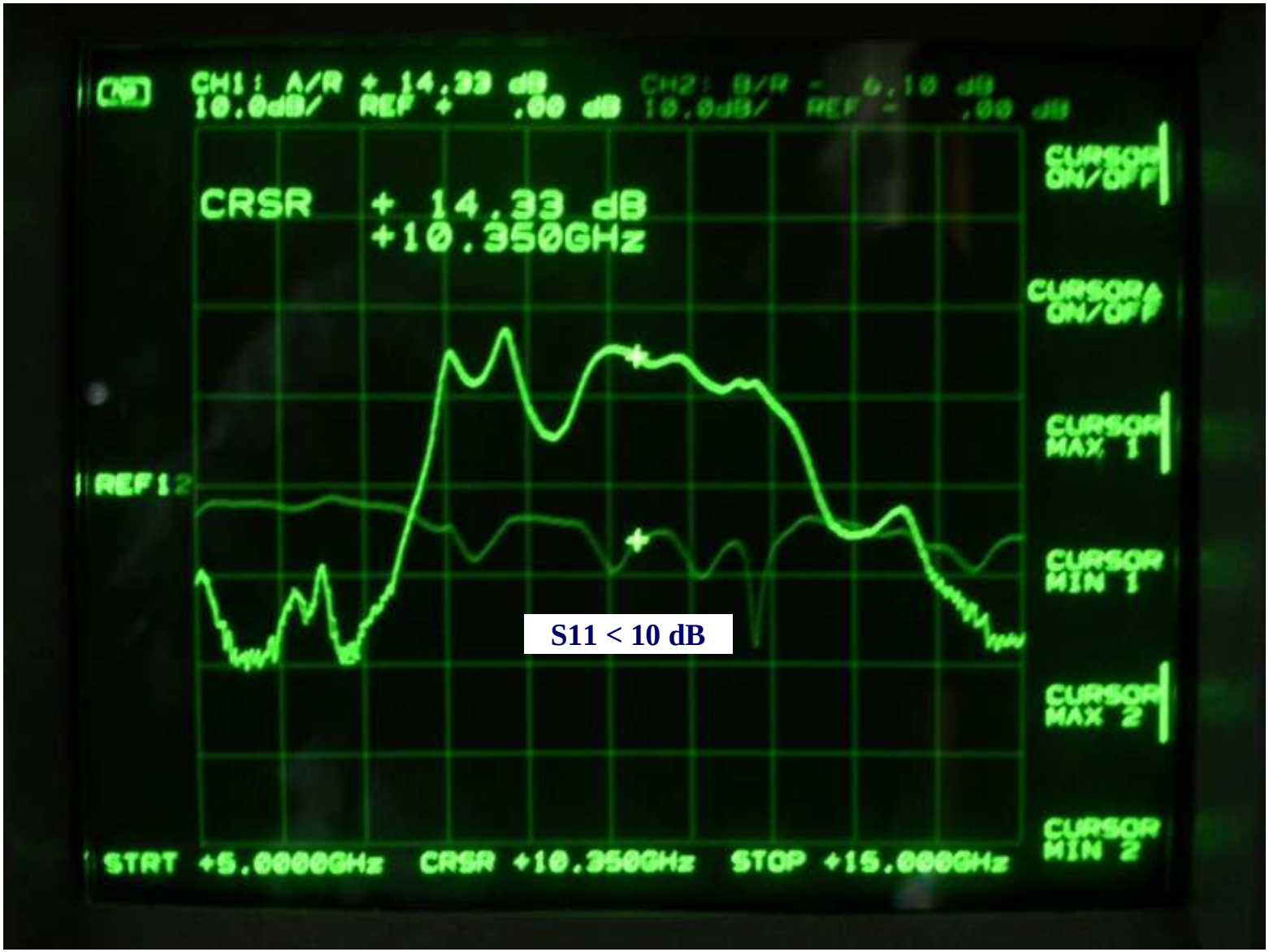
10 GHz 10W F1JGP 2 stages amp

F6AJW's whole amp : 2 first stubs for optimised gain



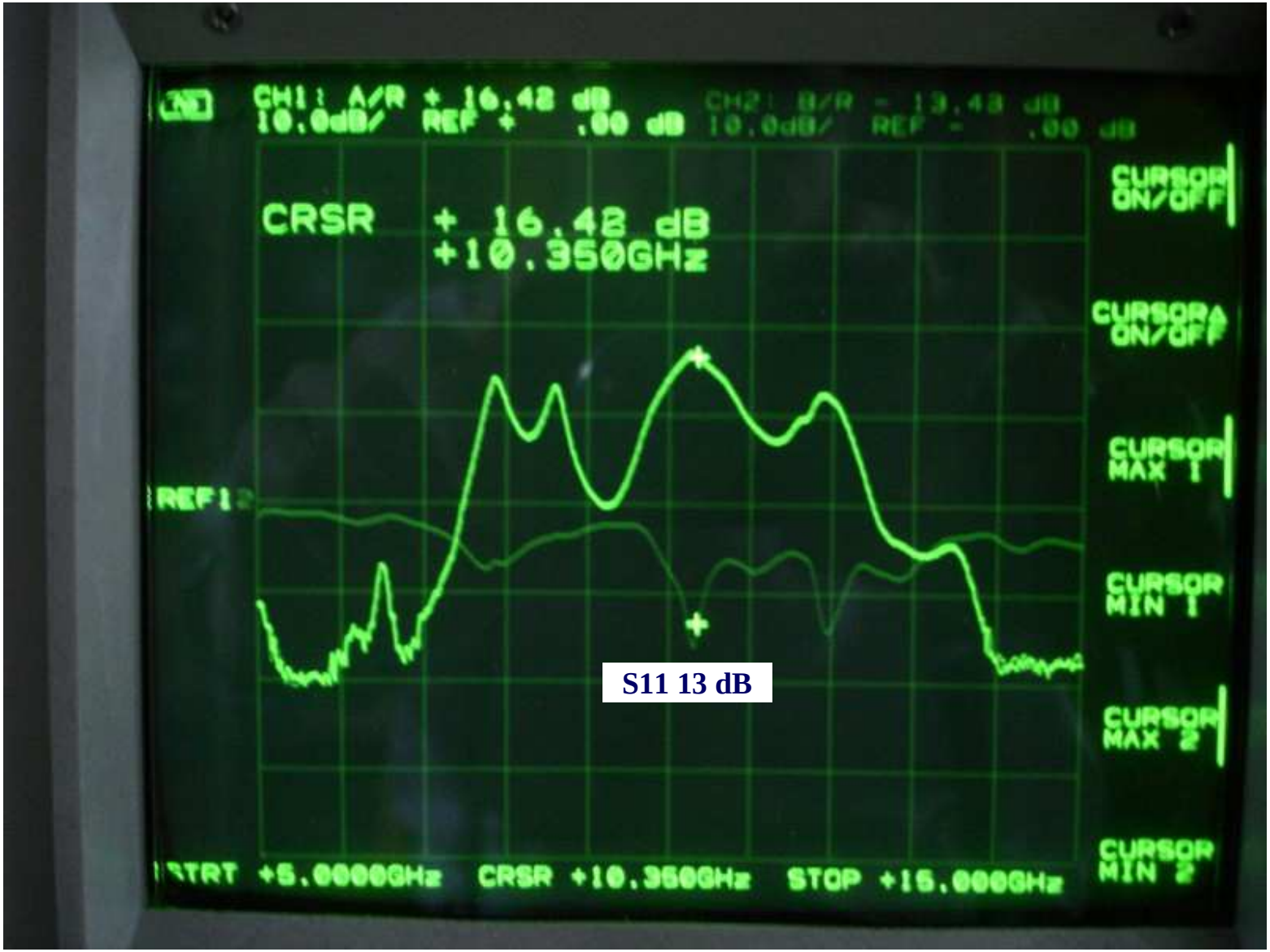
10 GHz 10W F1JGP 2 stages amp

Broadband scalar analysis in linear mode at Pin= 0 dBm without stubs



10 GHz 10W F1JGP 2 stages amp

Broadband linear mode scalar analysis at Pin= 0 dBm with 1st stubs (no soldered)

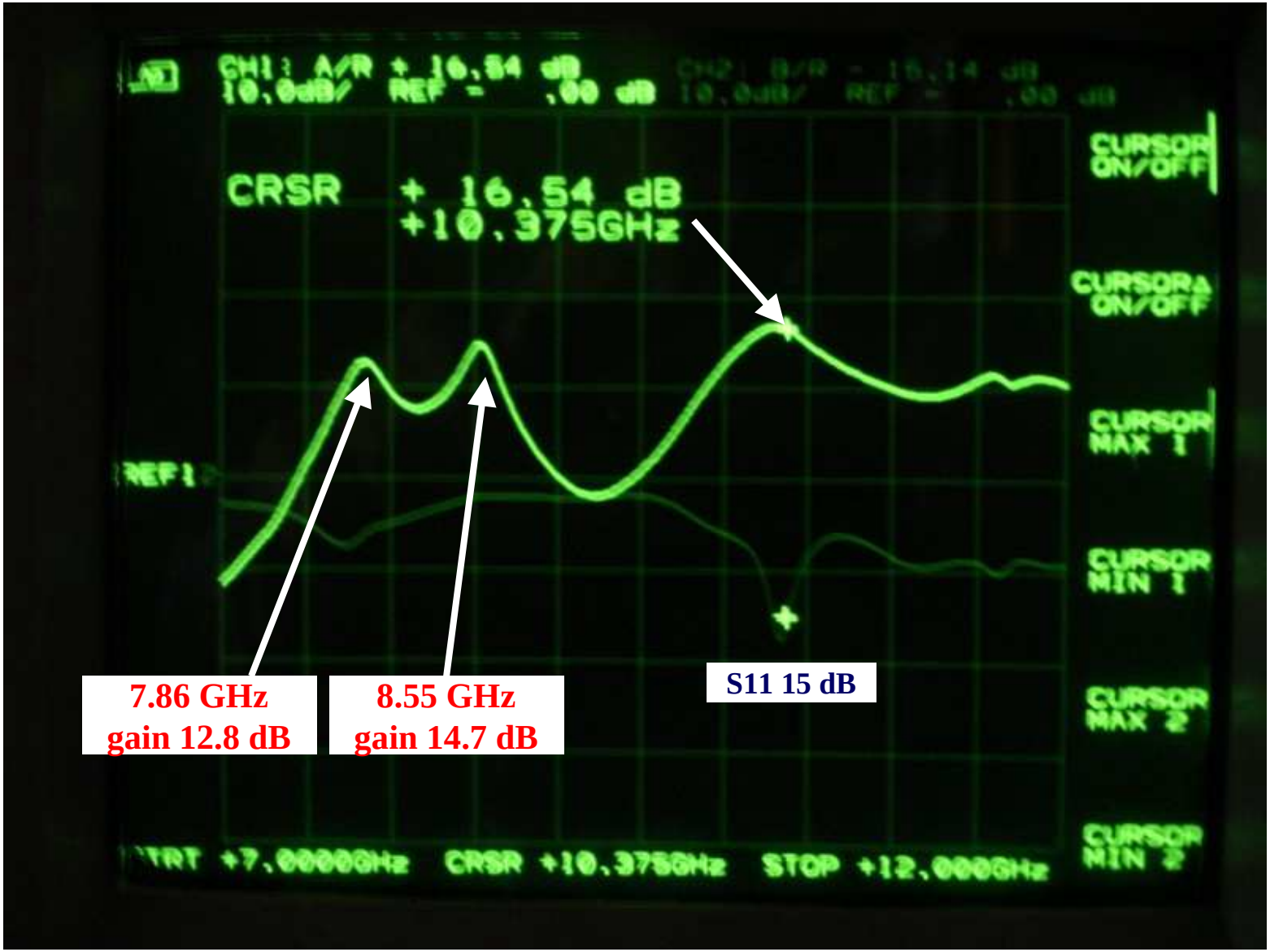


10 GHz 10W F1JGP 2 stages amp

Broadband linear mode scalar analysis at Pin= 0 dBm with 3 cupper stubs soldered

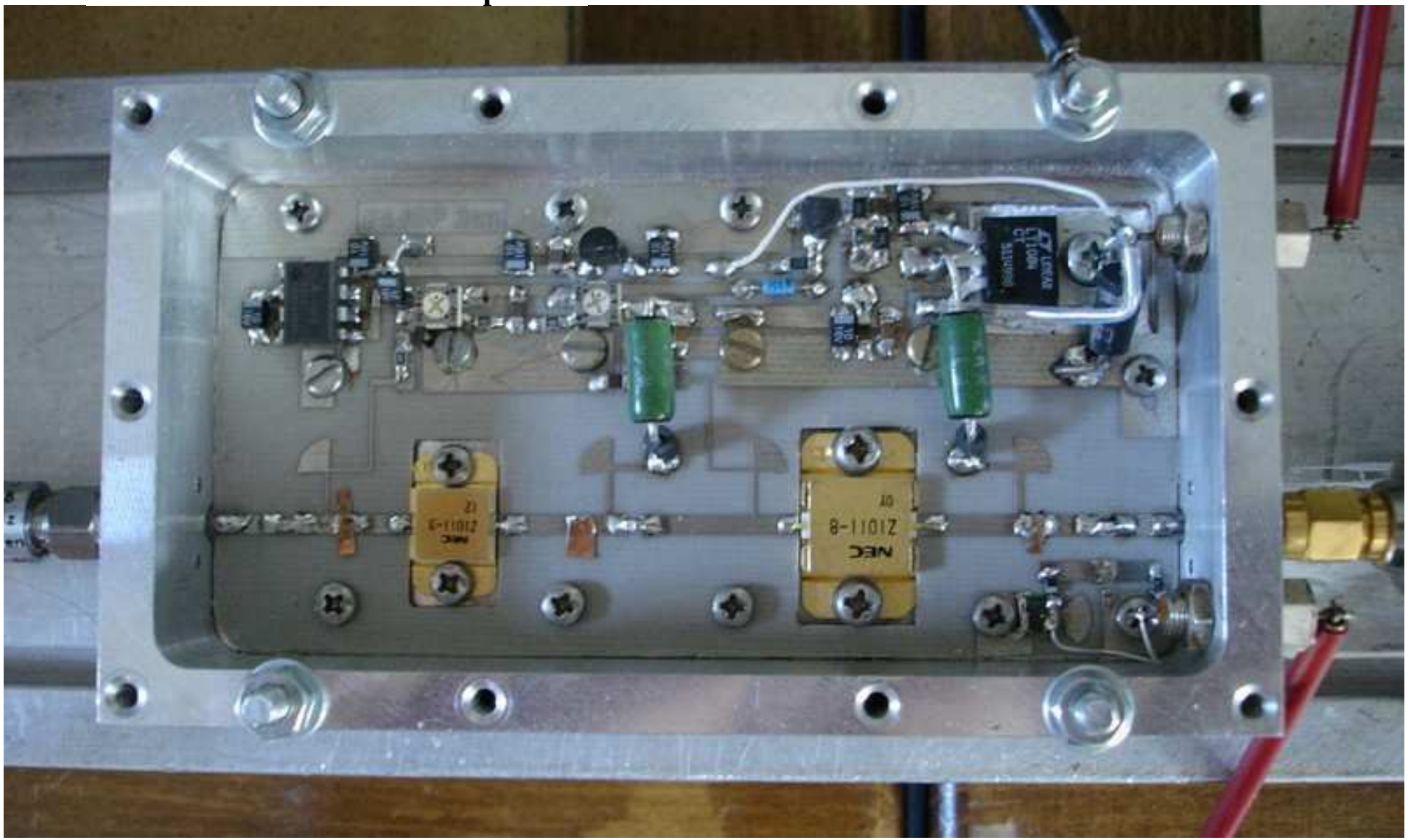
10 GHz 10W F1JGP 2 stages amp

Broadband zoom at Pin= 0 dBm with 3 cupper stubs soldered



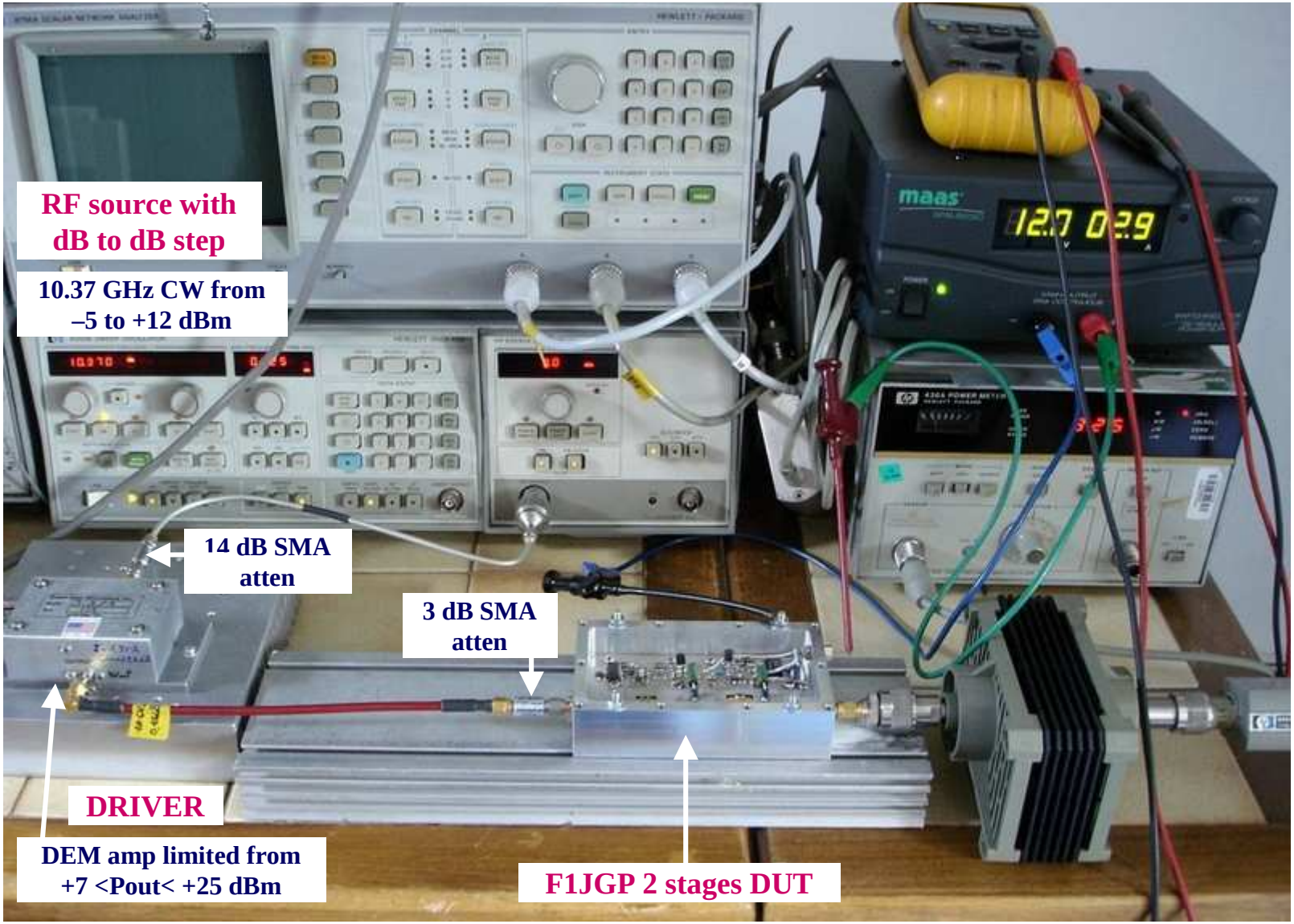
10 GHz 10W F1JGP 2 stages amp

Whole finished F6AJW's amplifier



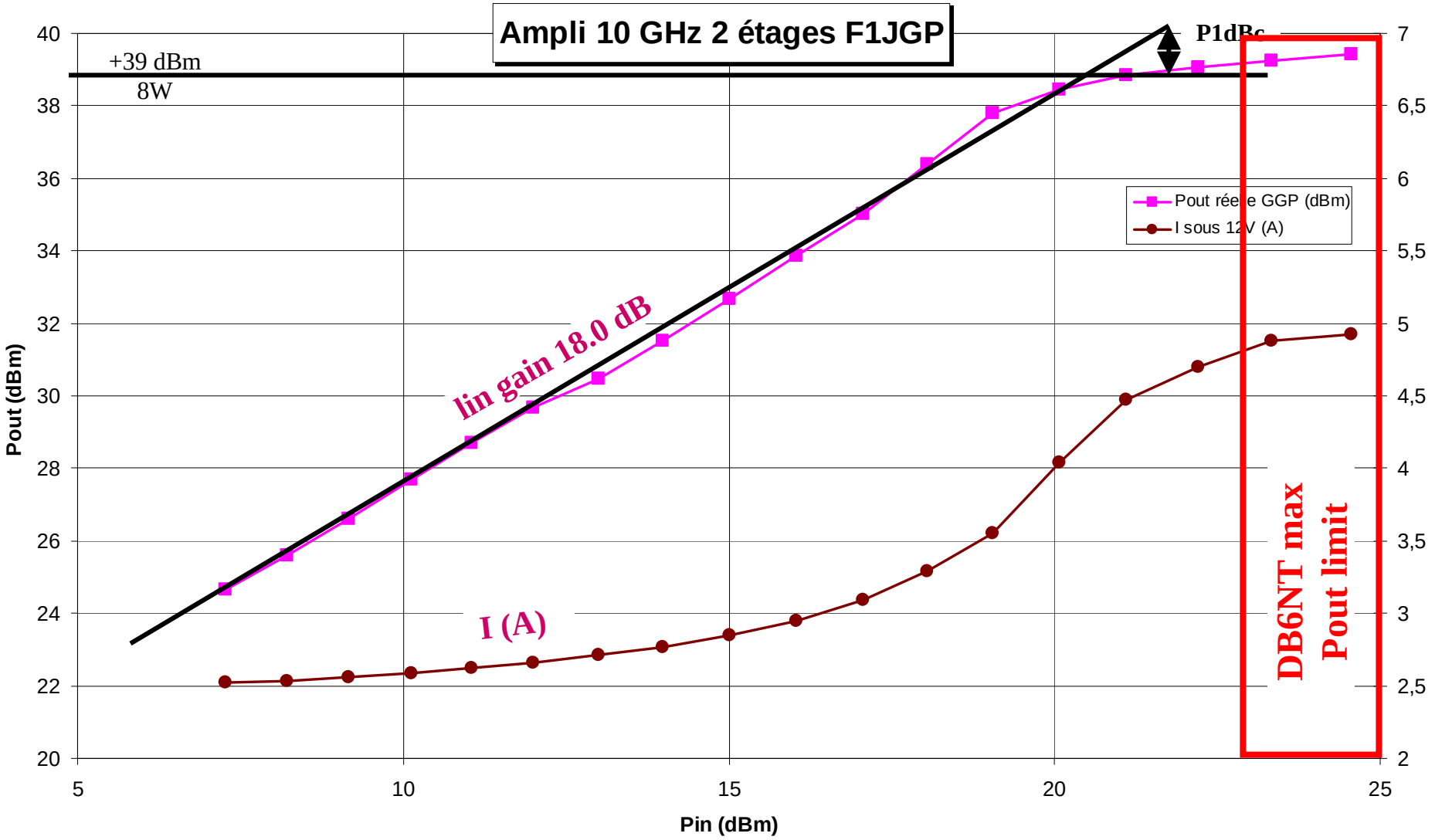
10 GHz 10W F1JGP 2 stages amp

Final Pout versus Pin measurements hardware



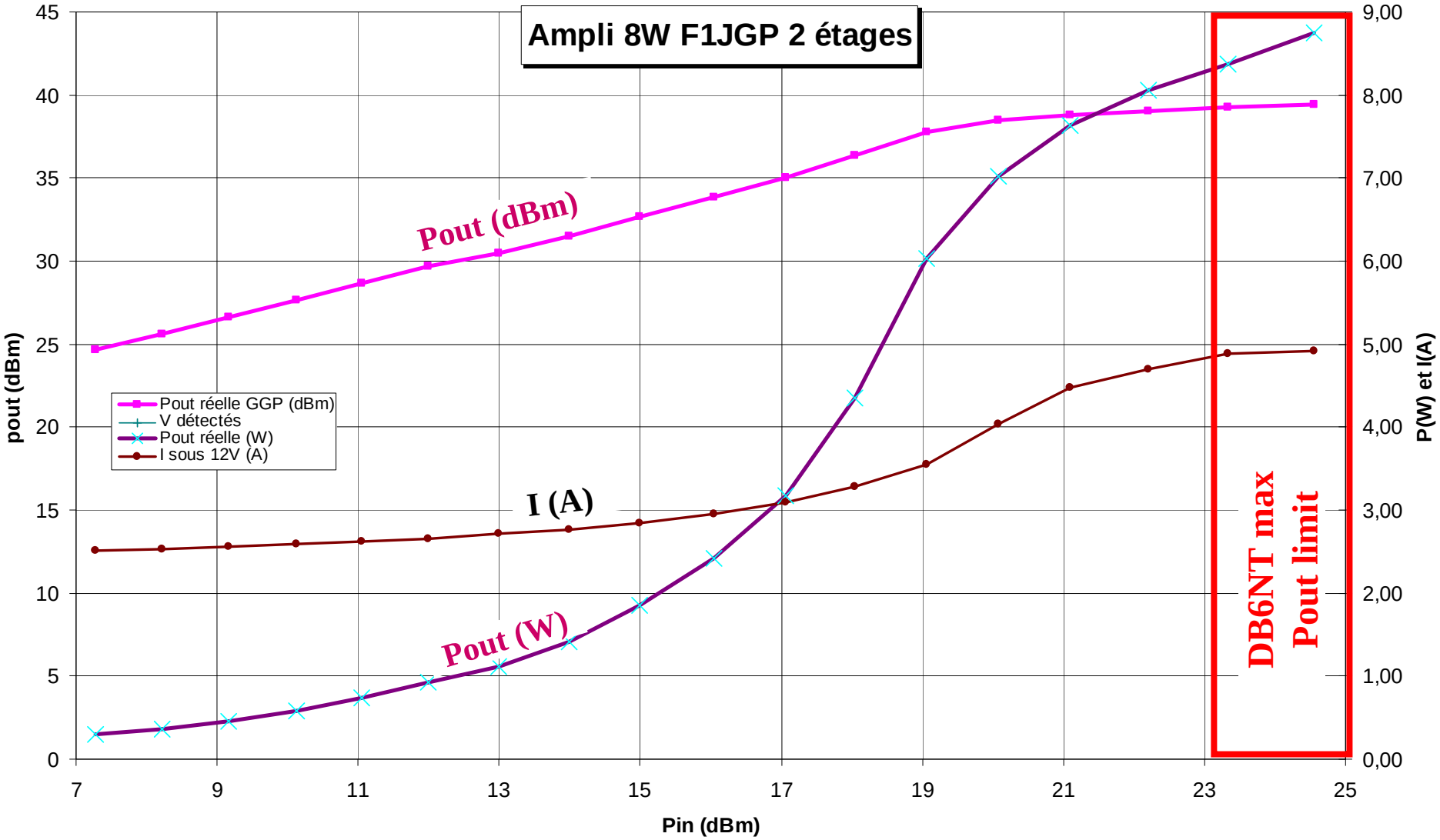
10 GHz 10W F1JGP 2 stages amp

F6AJW's amplifier : Pout and total DC intensity (stable from 10.7 to 15V)



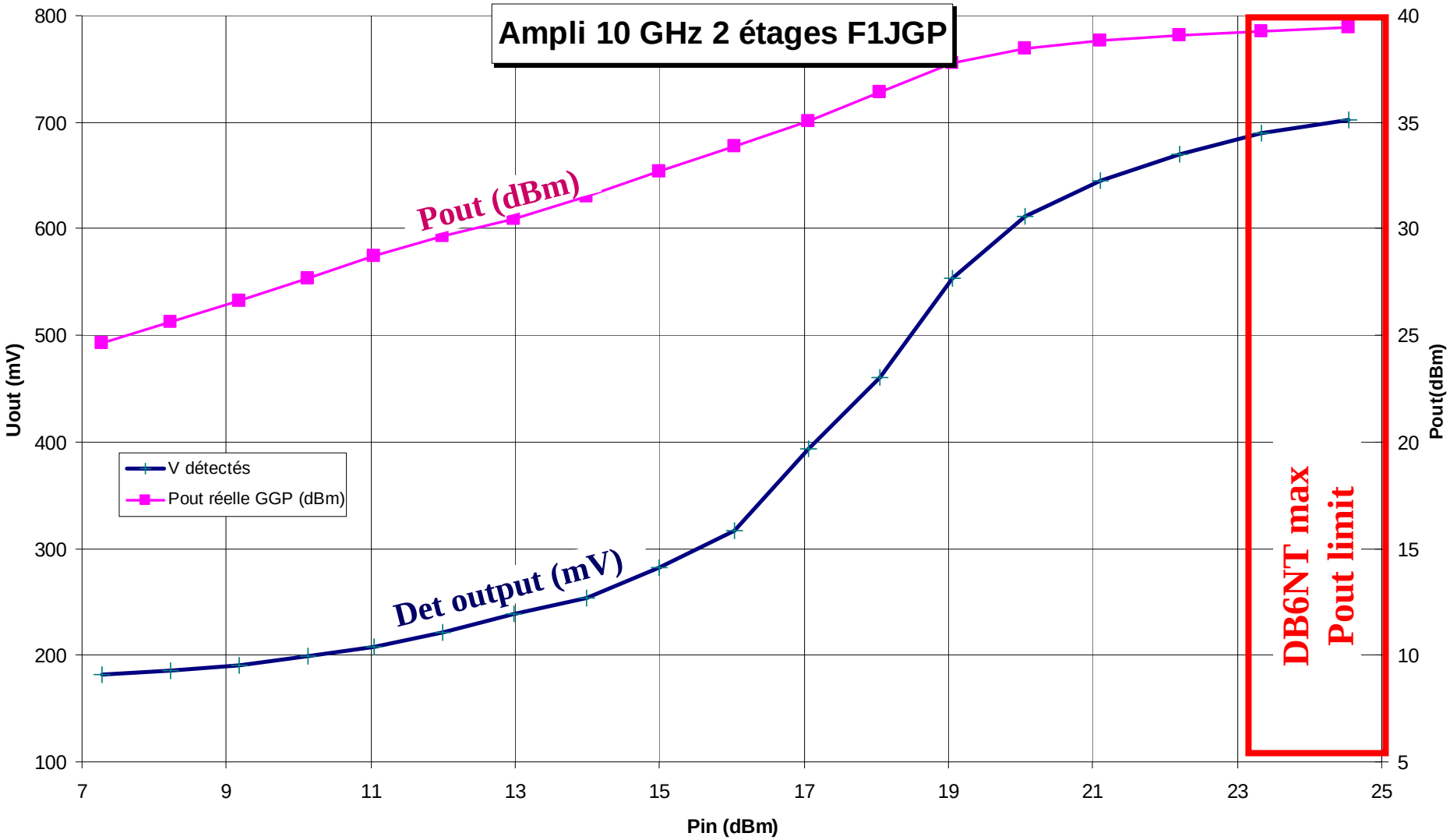
10 GHz 10W F1JGP 2 stages amp

F6AJW's amplifier : Pout (dBm and W) and I DC (A)



10 GHz 10W F1JGP 2 stages amp

F6AJW's amplifier : detected DC output versus Poutput



10 GHz 10W F1JGP 2 stages amp

F6AJW's amplifier : conclusion

- Perfectly matched for the 21 / 23 dBm output of a DB6NT transverter
- Lin gain 18 dB
- P1dBc = +39 dBm or 8W
- Stable P1dBc from 11 to 14 V DC
- P3dBc = +39.7 dBm = 9.3 W (vy narrow to Psat)
- Imax DC=5A
- U detected output à 8Wout = 670 mV

Further parameters to verify :

- Teflon circuit only directly screwed (no conductive Ag paste)
- Power FETs directly screwed WITHOUT any conductive paste