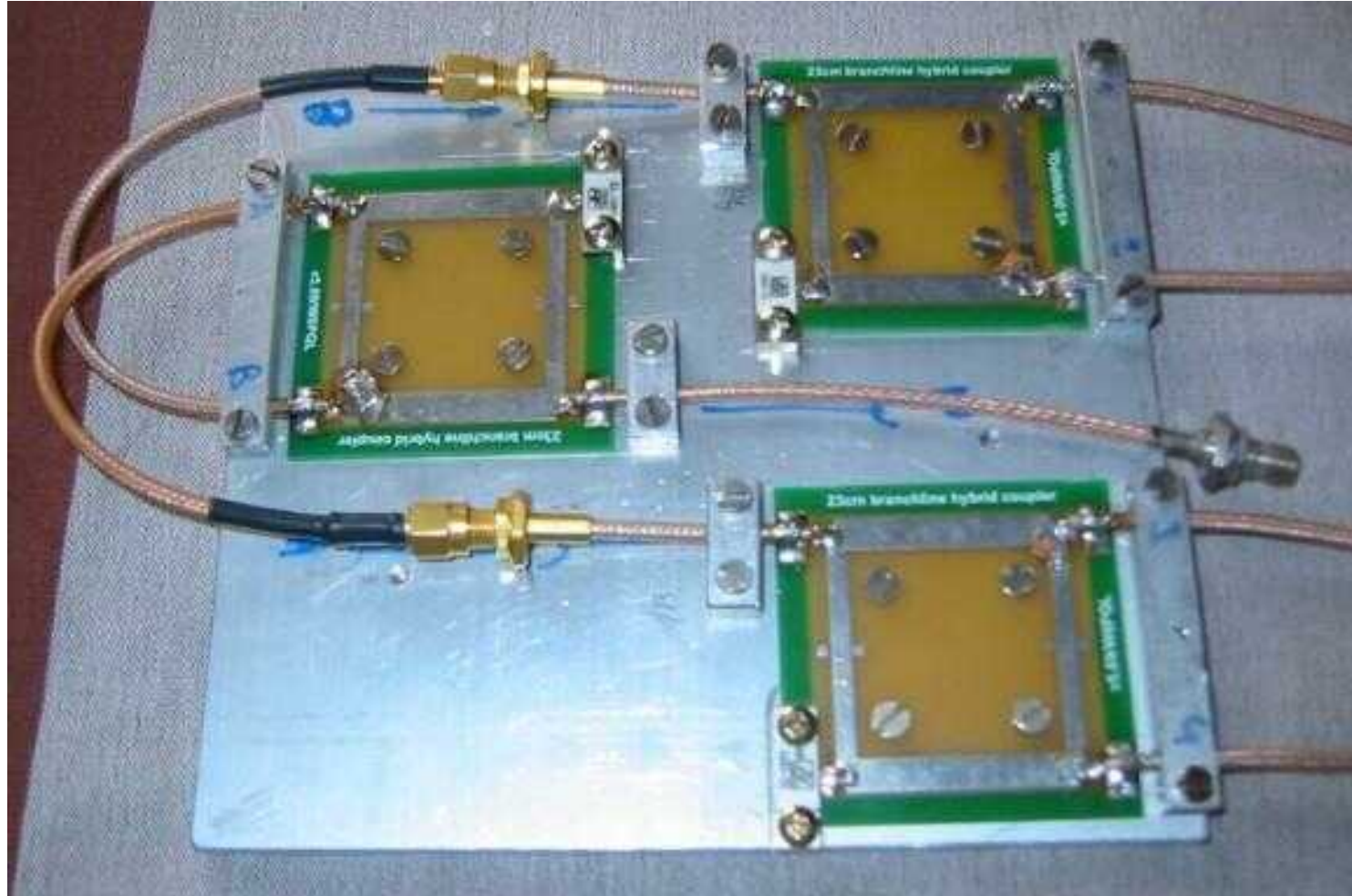


OK1KIR

Hybrids for the PA combining

www.ok1kir.cz

23 cm 4xSSPA input hybrids

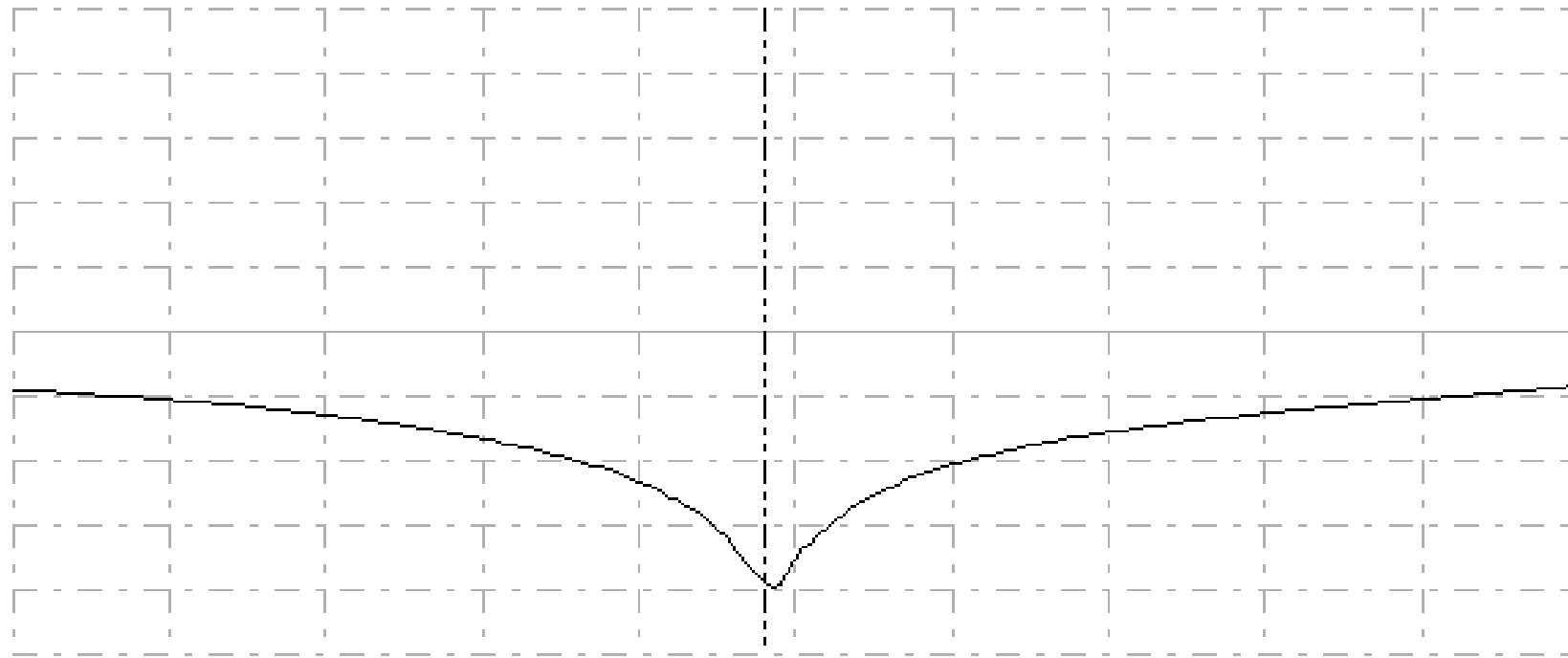


Hybrids on 1296 MHz

hybrid 23cm na spoji

Reference Level = -10 dBm

Vertical div. = 10 dB



M1

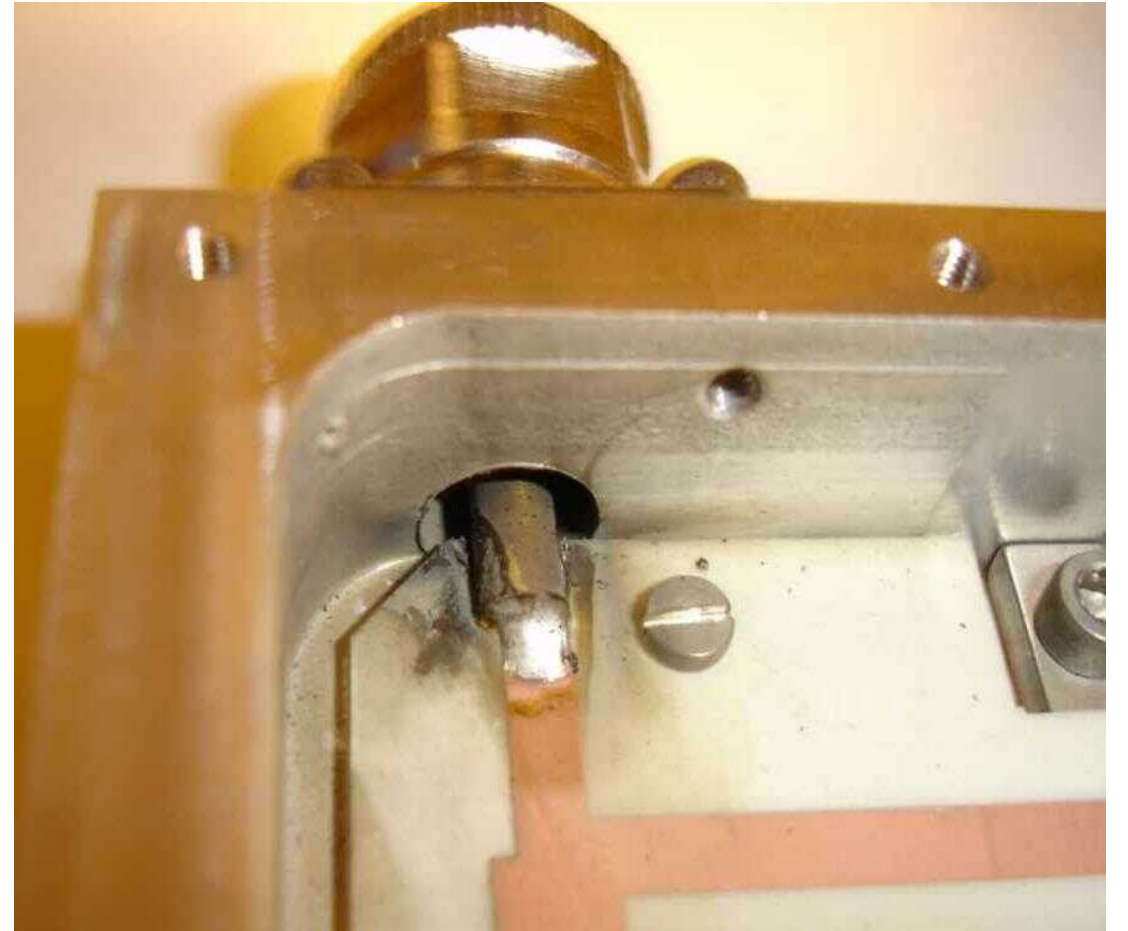
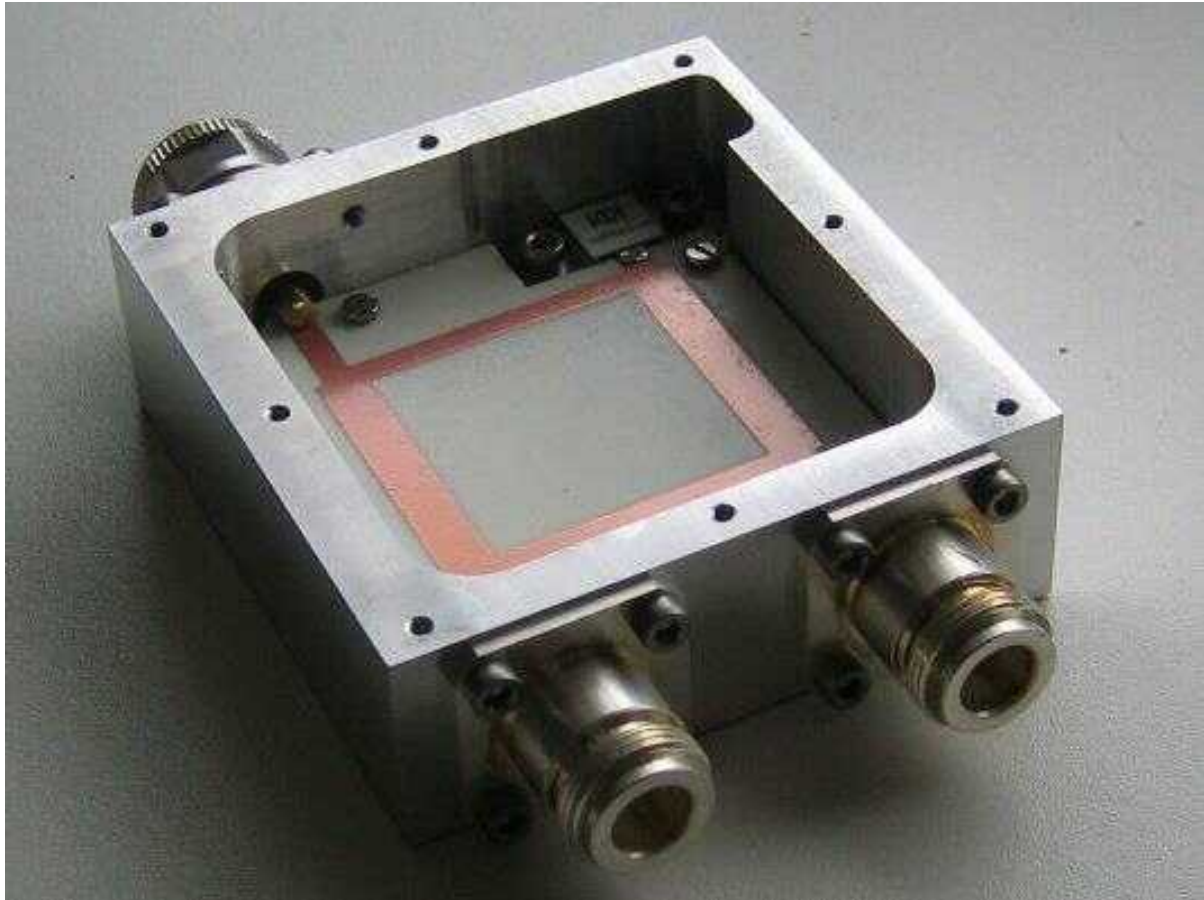
Start Frequency = 1.2 GHz
Center Frequency = 1.3 GHz
M1 1.296 GHz

Stop Frequency = 1.4 GHz
Span = 200 MHz
M1 -48.69819 dBm

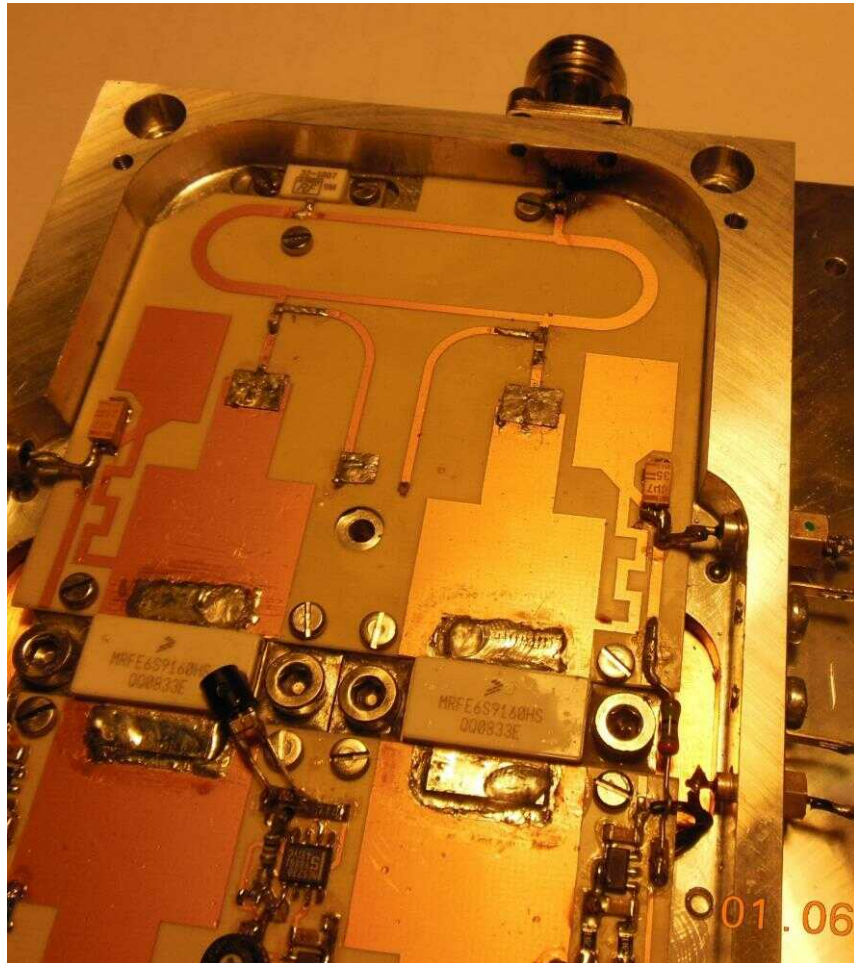
Hybrids on the PCB

- Measured with NA R3763B, SMA PSW type load resistance > 35dB
- Hybrid No. A
 - Attenuation in - No.3 - 3,62 dB, phase +29,9°
 - No.4 - 4,18 dB, phase -60,00°
 - No.3 - No.4 47 dB see graph
- Hybrid No. B
 - Attenuation in - No.1 - 4,1dB, phase 29,6°
 - No.2 - 3,8dB, phase 61,2°
 - No.1 - No.2 46dB
- Separation attenuations were originally a bit lower, but after tuning with a small tiny piece of copper sheet they are exactly at 1296MHz.
- Hybrid IN - A, B not yet connected and thus not measured. I have to measure each pair separately first and then put everything together.

G4CCH association 2x 250 W



OK1KIR SSPA 250W failures in 2014 and 2016



Original combining solution

3-dB Coupler (90° Hybrid) 340 – 512 MHz K 63 70 21, K 63 70 27

KATHREIN
Antennen · Electronic

The 3-dB coupler can be used:

- as a decoupled power splitter with a ratio of 1:1,
- for the decoupled combining of two transmitters with frequency spacing as narrow as desired (at 3 dB loss),
- for the decoupled combining of two receivers with frequency spacing as narrow as desired,
- for the decoupled combining of two transmitter/receiver units, whose integrated duplexers are within the same frequency range,
- as a frequency-independent 90° phase shifter,
- as a component to form combiners.



K 63 70 27

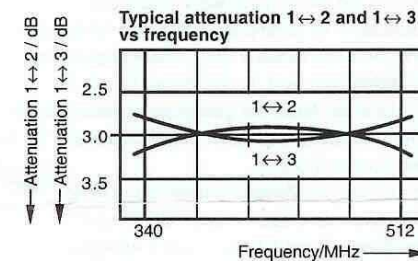
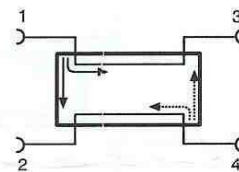
Function:

The 3-dB coupler has four ports, two of which are decoupled from each other. For example effective power entering into port 1 is distributed into ports 2 and 3. Port 4 is decoupled and without power if ports 2 and 3 are ideally matched. In practice an absorber of suitable power at port 4 is to be planned in accordance with the mismatch of ports 2 and 3.

Decoupled combining can be achieved via the diagonally opposite ports 2 and 3 or 1 and 4.

Customized versions:

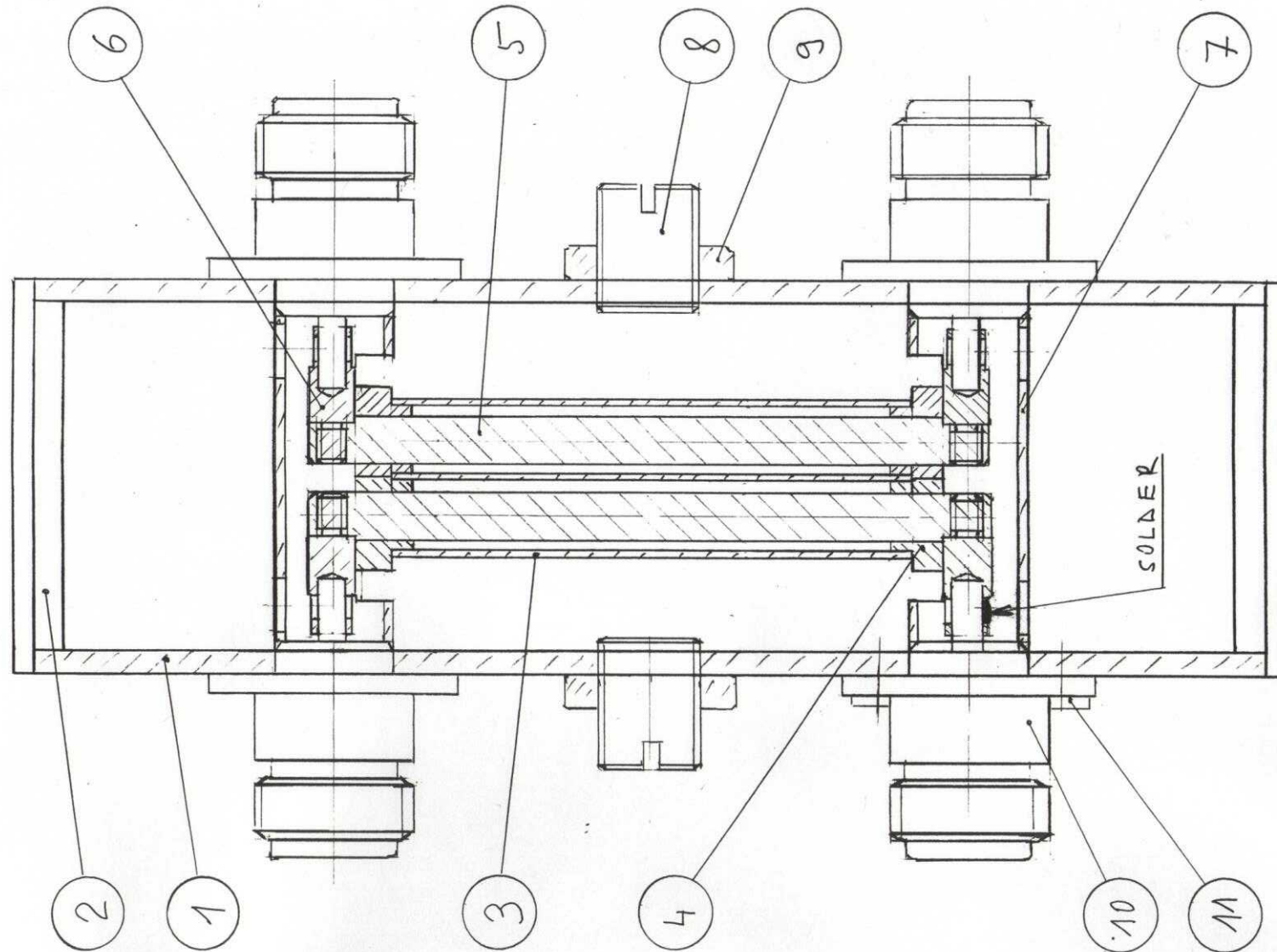
On request couplers with a coupling attenuation of between 3 dB and 10 dB are available.



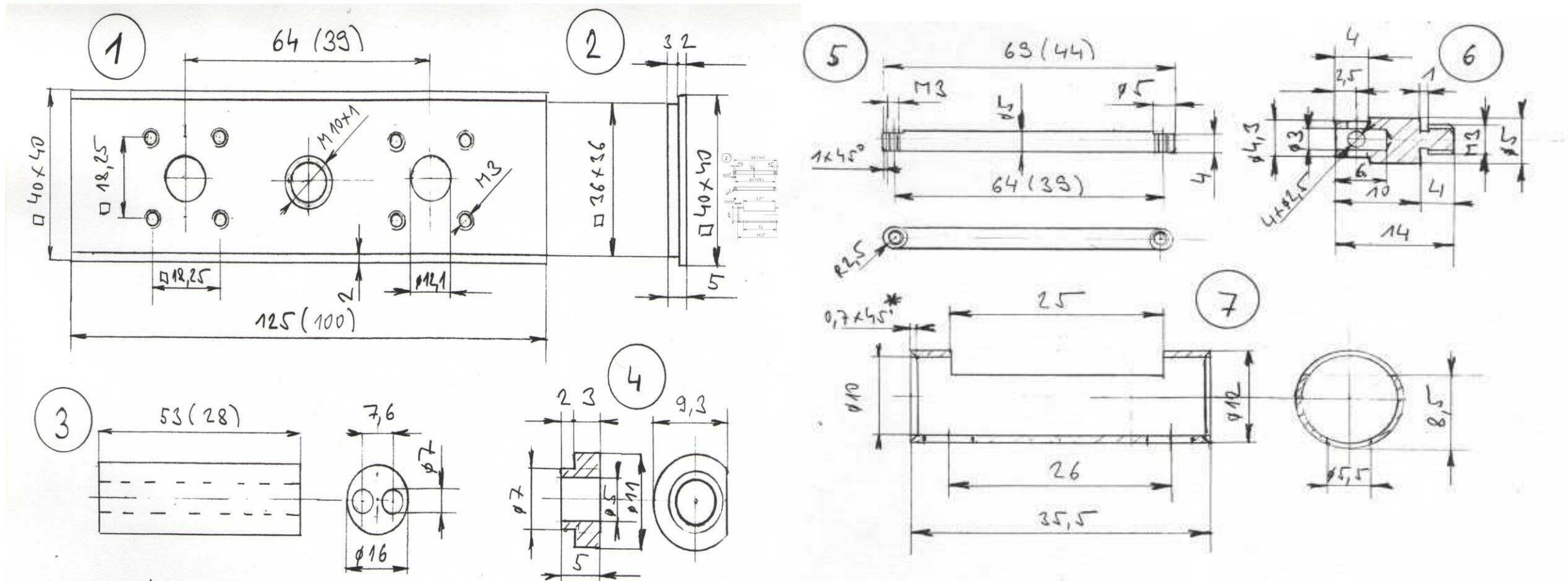




1296 and 2300 MHz versions - N connectors



1296 and 2300 MHz versions with N connectors - details



Hybrid 1296 (2300) MHz parts list

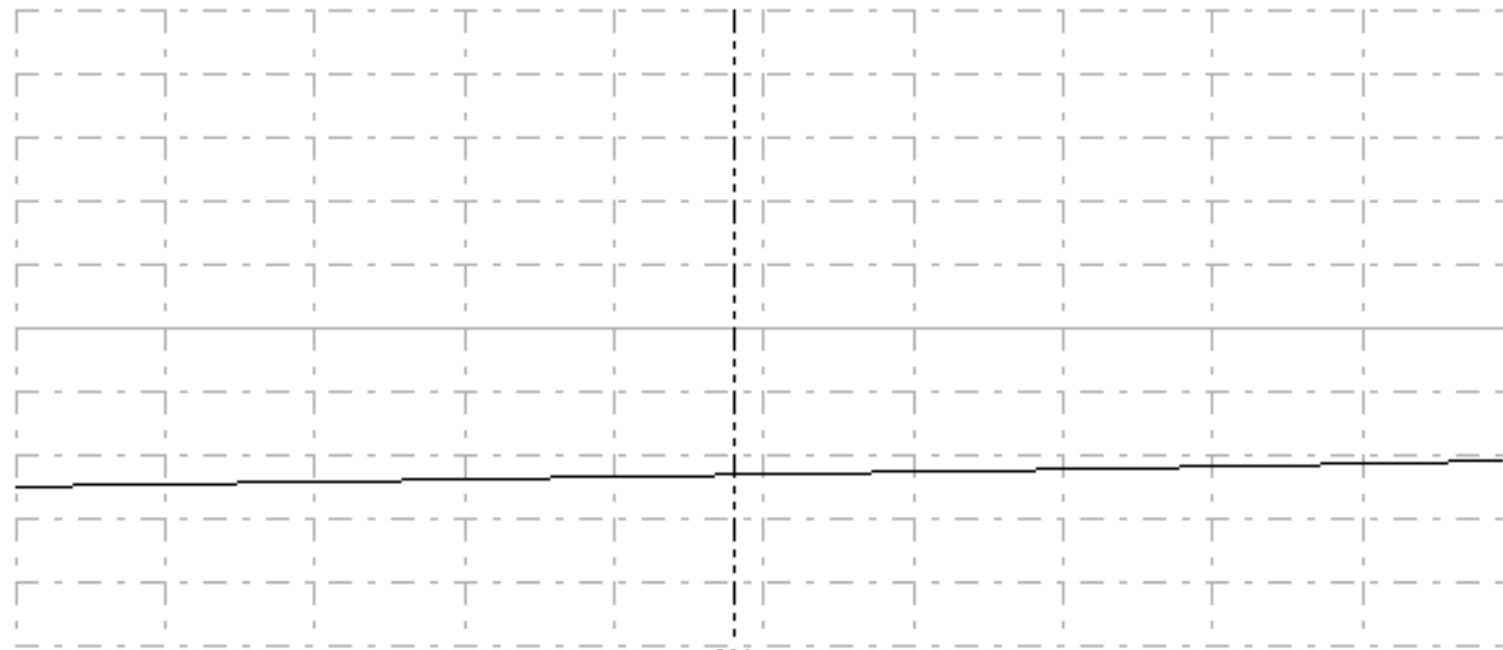
90° HYBRID 1296 (2300) MHz (conversion from profi to 450 MHz Kathrein K 63 70 27)				
From	Name	ks	Material	Note
1	Body	1	AlMg	
2	cap	2	AlMg	
3	Internal wiring	1	brass (+Ag)	
4	isolator	4	PTFE	
5	Inner conductor	2	brass (+Ag)	
6	Line transition -N	4	brass (+Ag)	
7	Shading	2	brass (+Ag)	* See below
8	Tuning screw M10x1	2	brass (+Ag)	minimal influence - may not be
9	Nuts M10x1	2	brass (+Ag)	see 8
10	N connector	4	SUHNER	Type 23N-50-0-1
11	Screw	16	stainless steel	M3 x 5
* shrink 0.7 x 45° according to the connectors so that when they are tightened to the body the shielding tube is firmly clamped by their faces (0.2 mm clearance before tightening)				

Hybrid 23cm N-connectors insulation

hybrid 23cm vzduch. sep

Reference Level = 0 dBm

Vertical div. = 10 dB



Start Frequency = 1,2 GHz
Center Frequency = 1,3 GHz
M1 1,296 GHz

Stop Frequency = 1,4 GHz
Span = 200 MHz
M1 -22,93965 dBm

LogMag - Trans. taken on 2010.05.04 at 09:51

Hybrid 23cm N-connectors coupling

hybrid 23cm vzduch utlum

Reference Level = 0 dBm

Vertical div. = 10 dB

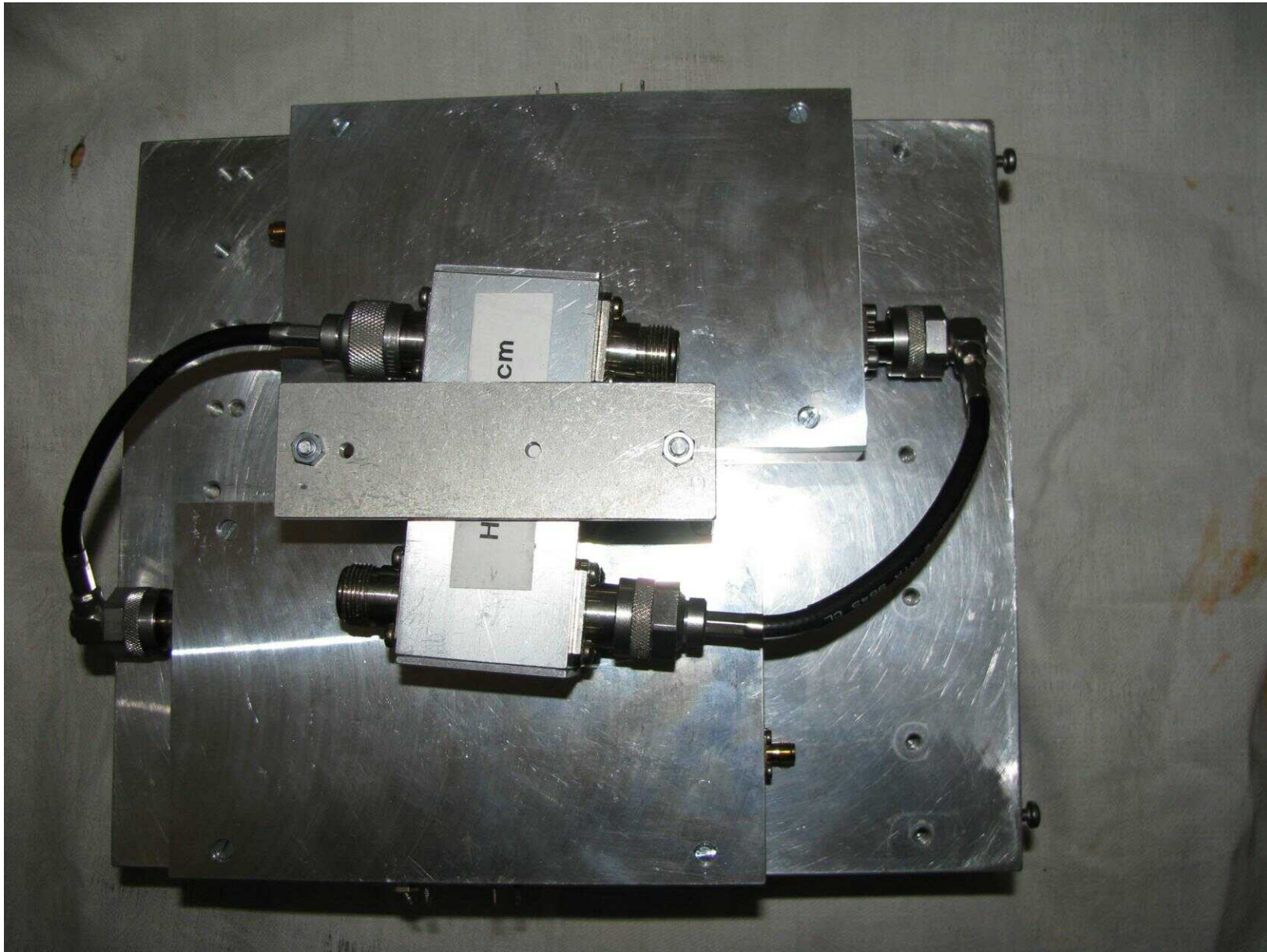


Start Frequency = 1,2 GHz
Center Frequency = 1,3 GHz
M1 1,296 GHz

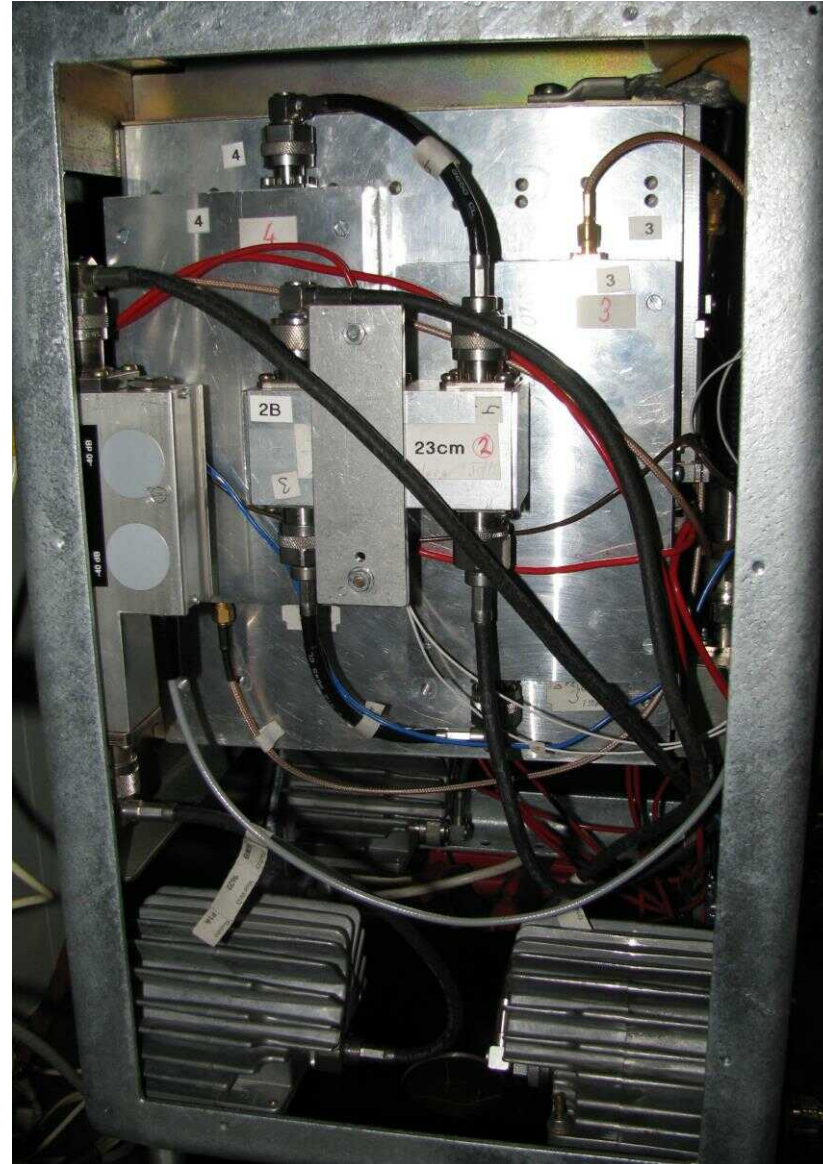
Stop Frequency = 1,4 GHz
Span = 200 MHz
M1 -3,566865 dBm

LogMag - Trans. taken on 2010.05.04 at 09:53

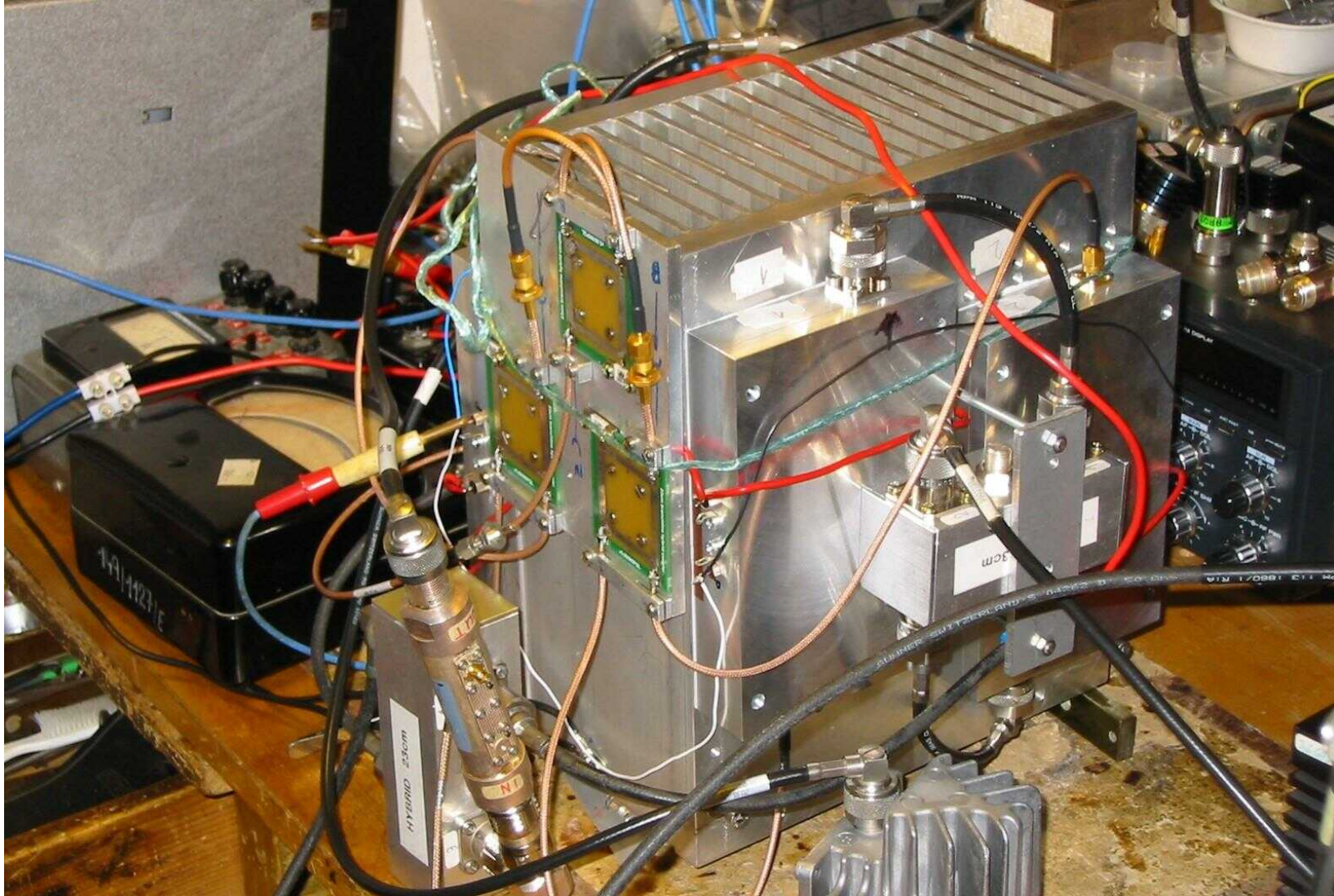
Hybrid 1296 MHz with N - 2x250 W SSPA on heatsink



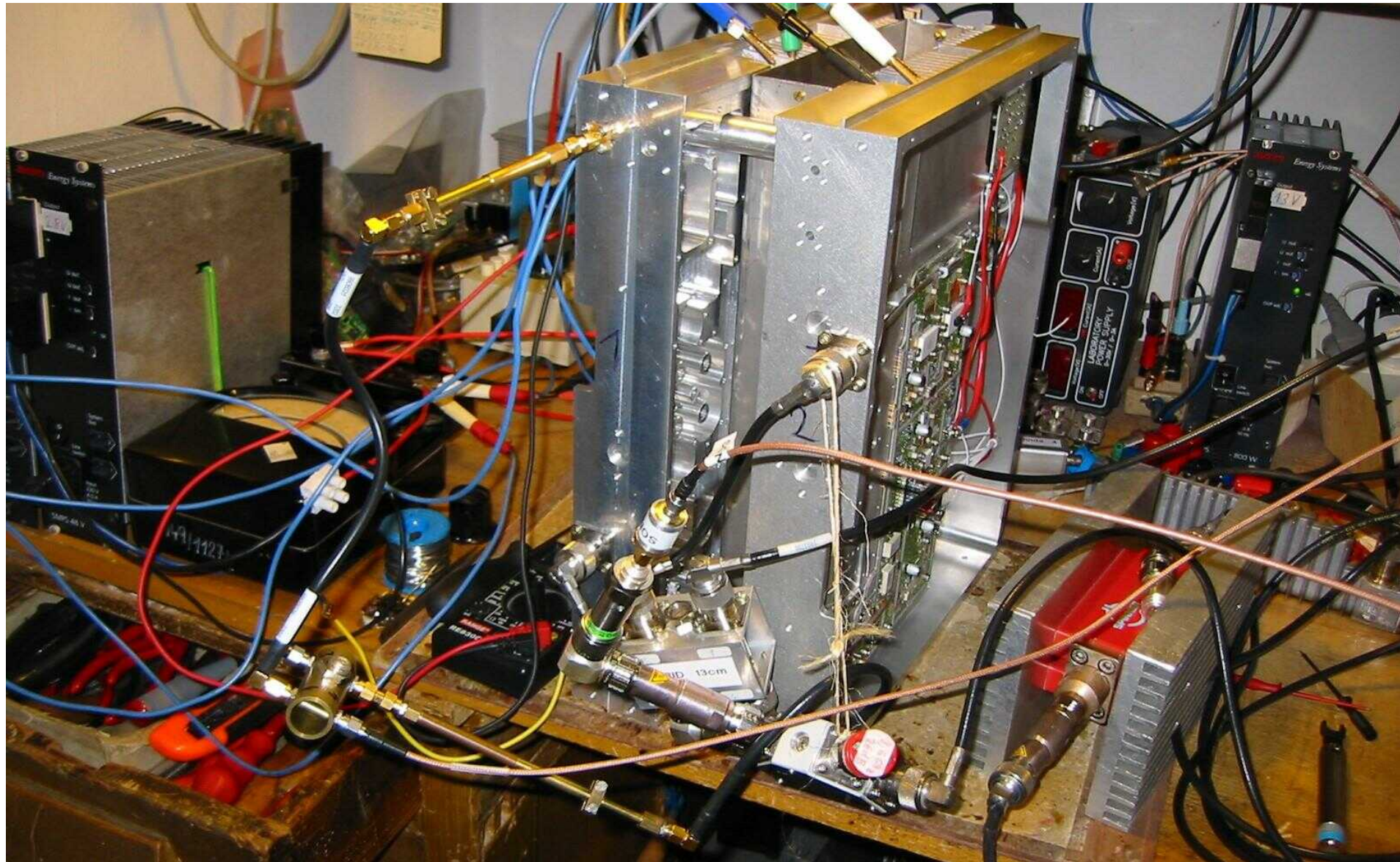
2x SSPA association with version N



Association 4x SSPA all with N



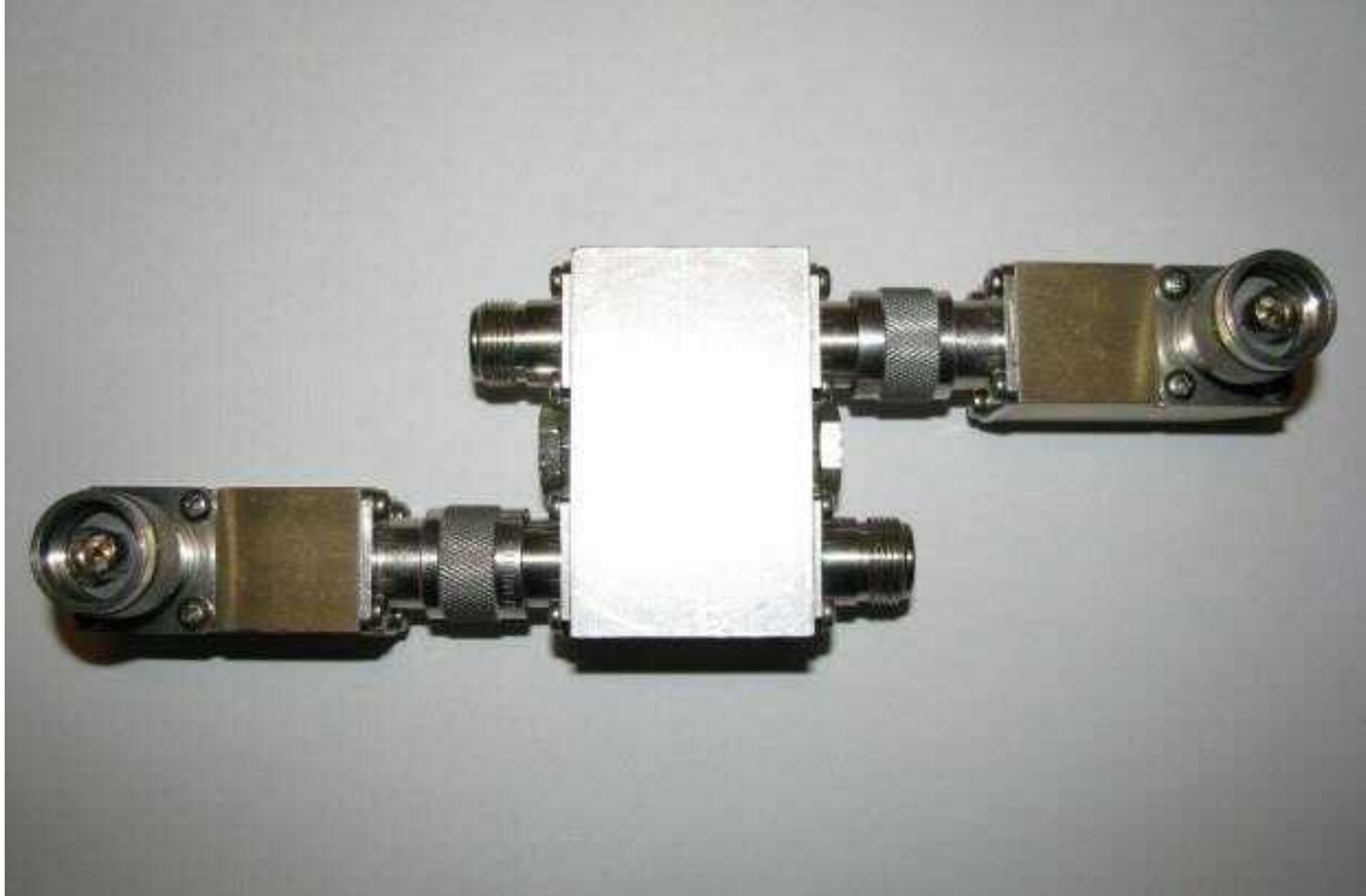
13 cm 2x 200W



13 cm hybrid with N for 2x 200 W



13 cm SSPA 2x 200 W hybrid with N and air lines



Hybrids 2300 MHz with N or SMA connectors

Hybrid large with N connectors

21.12.2019

Hybrid small with SMA connectors

21.12.2019

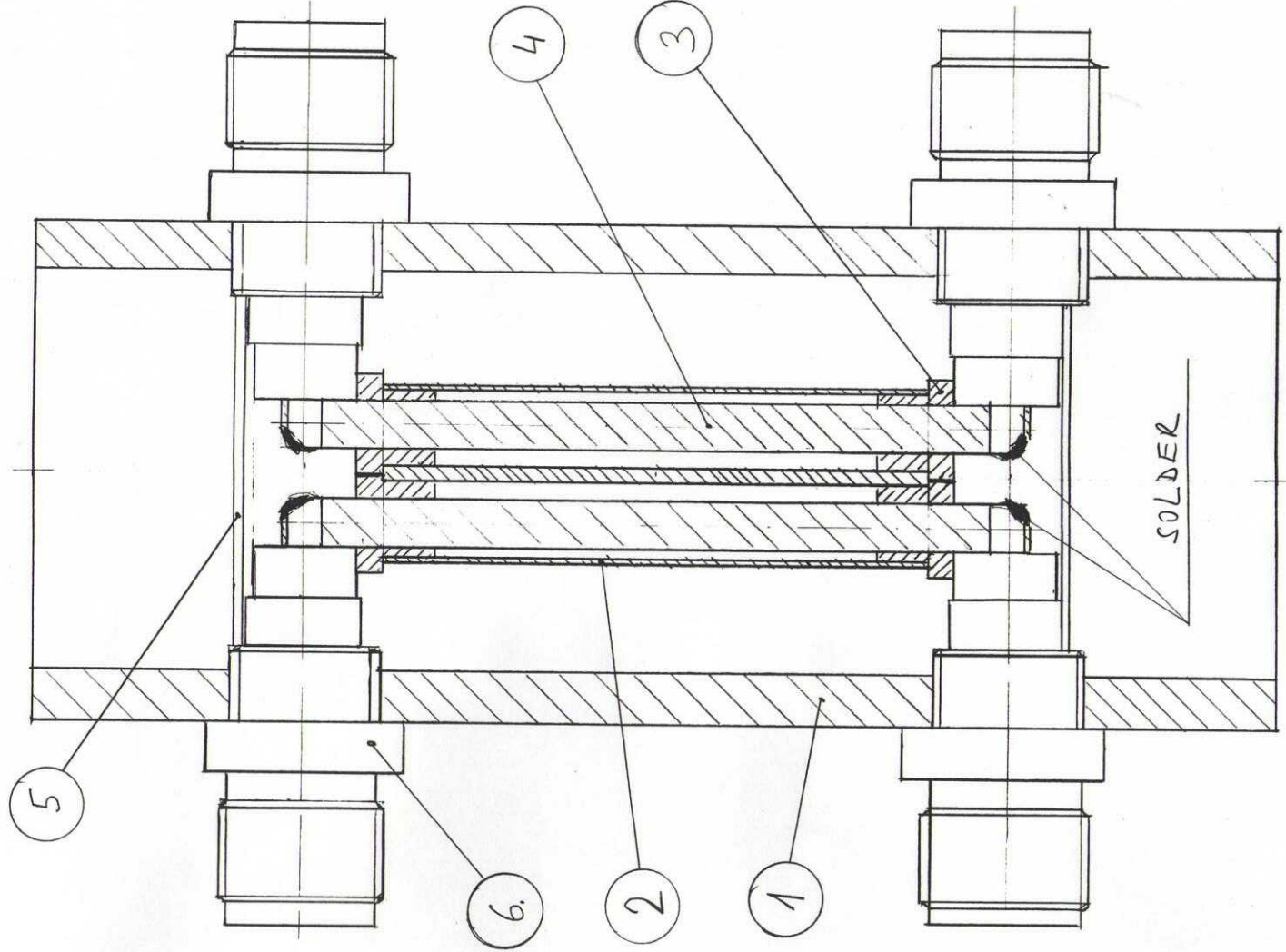
PSW	2300-2400MHz	{dB}	in its entirety
	1	-22,6	
	2	-22,1	
	3	-21,9	
	4	-20,2	

PSW	2300-2400MHz	{dB}	in its entirety
	1	-33,4	
	2	-25,7	
	3	-26	
	4	-24,5	

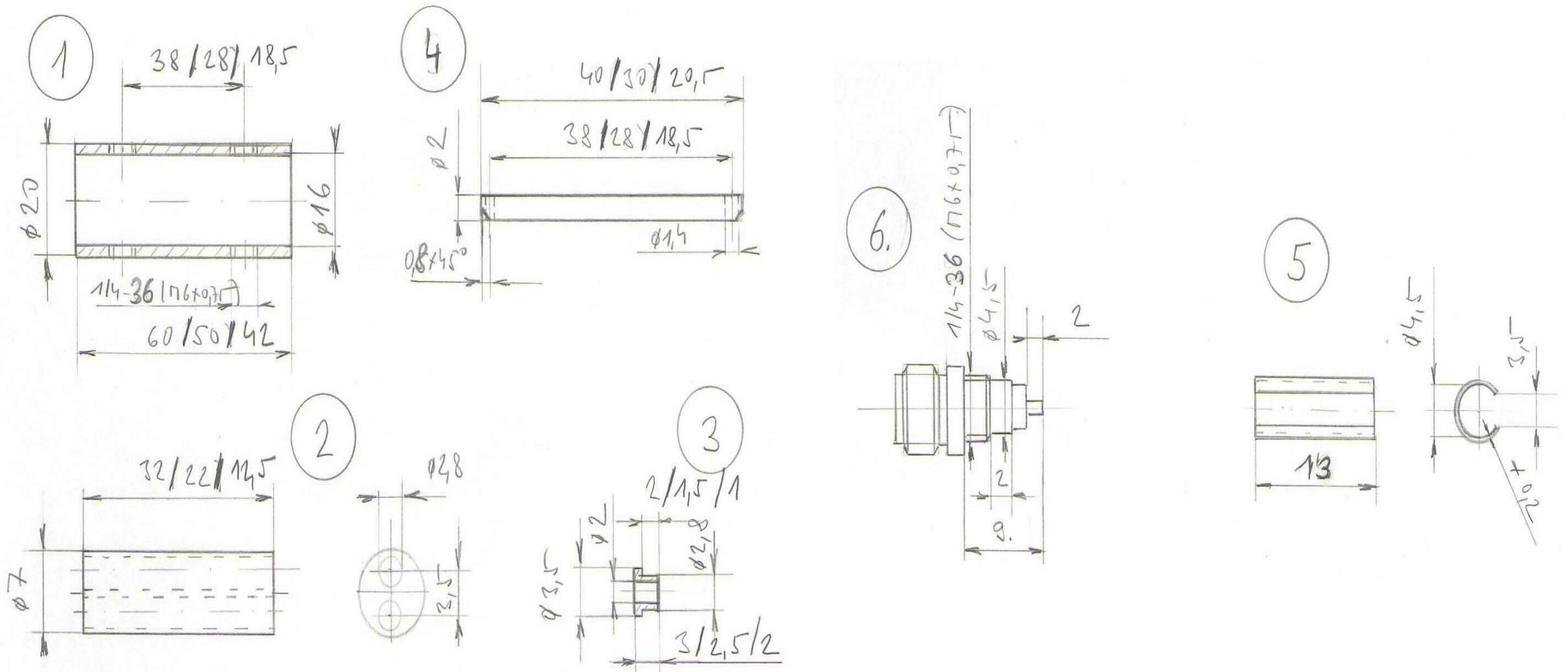
Transmis sion	2300-2400MHz	{dB}	Angle
	1-2	-2.6 to -2.7	-120°
	1-4	-23.7 to -24.8	-108°
	2-4	-2.6 to -2.7	-122°
	2-3	-22.8 to -23	-107°
	3-4	-3.5 to -3.6	+152°
	1-2	-3.6 to -3.7	+143°
		Top - bottom	

Transmis sion	2300-2400MHz	{dB}	Angle
	1-2	-2.8 to 2.7	-155°
	1-4	-3.2 to -3.3	-61°
	2-4	-31 to -32	-73°
	2-3	-3.4 to -3.2	-68°
	3-4	-34 to -35	+32°
	1-2	-2.7 to 2.8	-155°
		Top - bottom	

Hybrid 2300, 3400 and 5760 MHz - SMA connectors



Hybrids 2300, 3400 and 5760 MHz - details



Hybrid 2300, 3400 and 57600 MHz - parts list

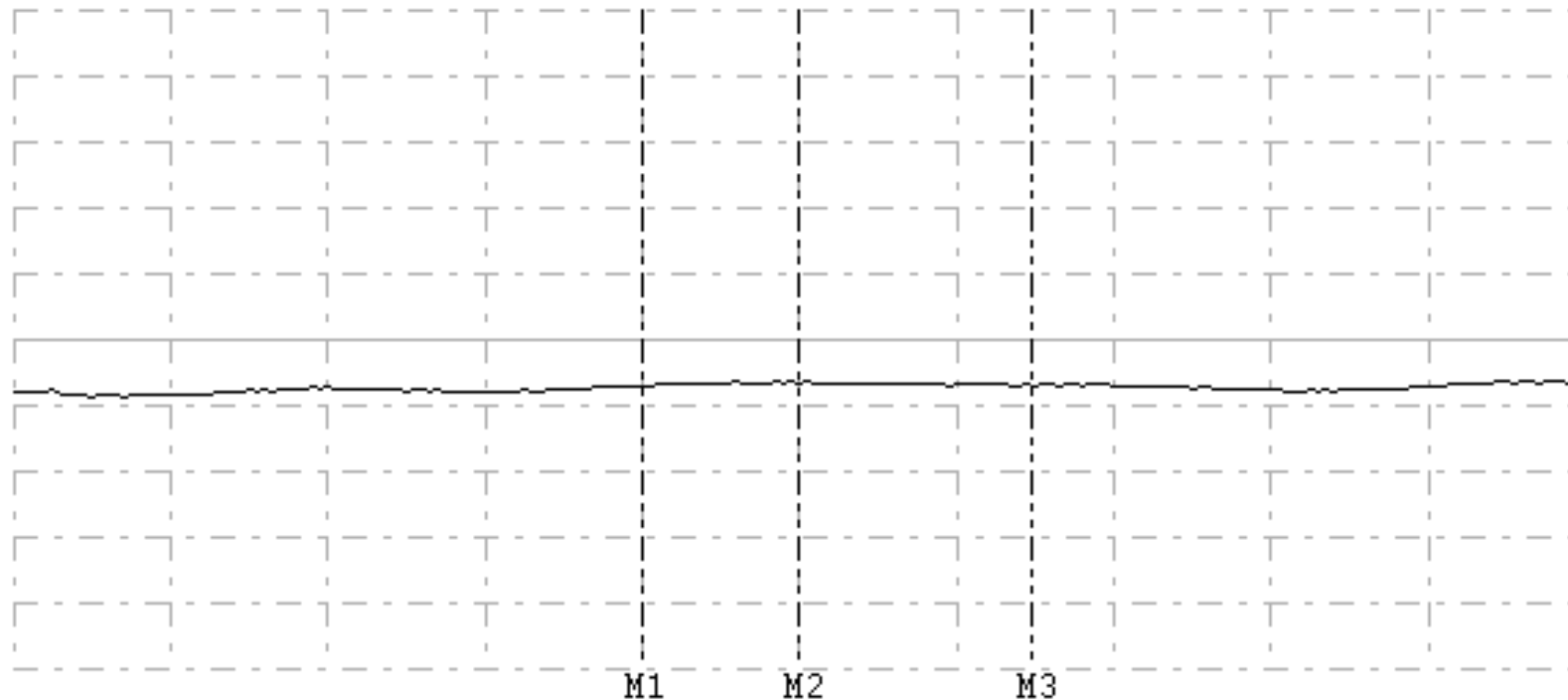
	Name	ks	Material	Note
1	Body	1	brass (+Ag)	
2	Internal wiring	1	brass (+Ag)	
3	isolate	4	PTFE	
4	Inner conductor	2	brass (+Ag)	
5	srish	2	phosphorbronze (+Ag)	13 x 11 x 0.2 mm
6	SMA connector	4	SUHNER	when there is no tapping 1/4 - 36 rethread to M6x0,75

Hybrid 13cm N-connectors coupling

hybrid 13cm UMTS_DAT dir 1

Reference Level = -3 dBm

Vertical div. = 1 dB



Start Frequency = 2,1 GHz

Stop Frequency = 2,6 GHz

Center Frequency = 2,35 GHz

Span = 500 MHz

M1 2,3 GHz

M1 -3,678191 dBm

M2 2,35 GHz

M2 -3,651656 dBm

M3 2,424 GHz

M3 -3,674587 dBm

LogMag - Trans. taken on 2013.02.06 at 21:13

Hybrid 13cm N-connectors insulation

hybrid A1 2_4

Reference Level = 0 dBm

Vertical div. = 10 dB



M1

Start Frequency = 2,2 GHz

Center Frequency = 2,35 GHz

M1 2,203 GHz

M2 2,4145 GHz

M2

Stop Frequency = 2,5 GHz

Span = 300 MHz

M1 -20,37357 dBm

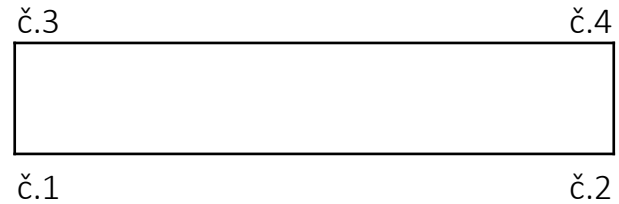
M2 -19,49543 dBm

LogMag - Trans. taken on 2011.01.13 at 10:44

Hybrid 3400 MHz measurement

Hybrid measurement at 3.4 GHz

15.02.2011



frequency = 3400MHz

span = 100MHz

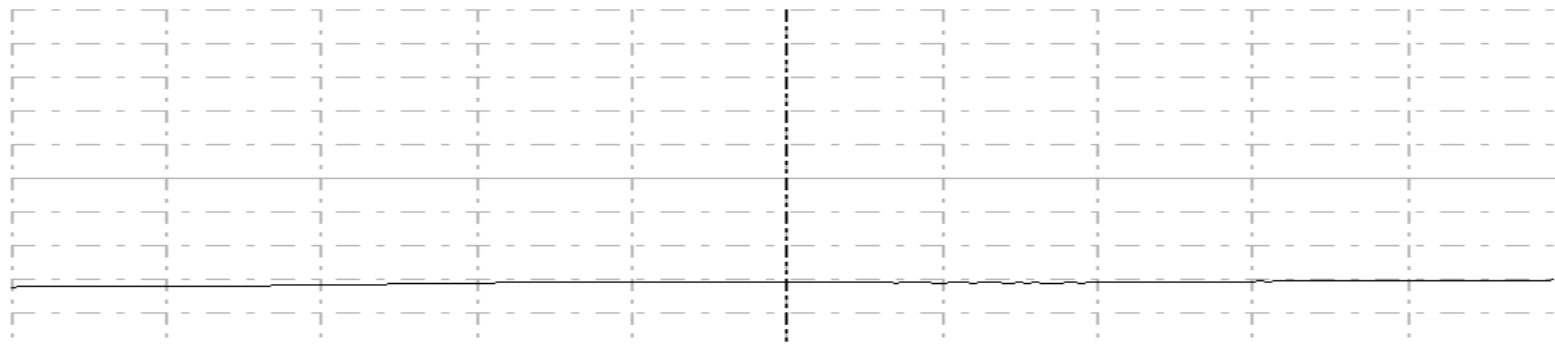
outlets	attenuation[dB]	
1-2	2,7	dB change +/-0.1dB
3-4	2,8	dB change +/-0.1dB
2-3	23	dB change +/-0.5dB
1-4	23	dB change +/-0.5dB

so practically straight !!!

Hybrid 3400 MHz SMA- connectors

hybrid 9cm vazba
Reference Level = 0 dBm

Vertical div. = 1 dB



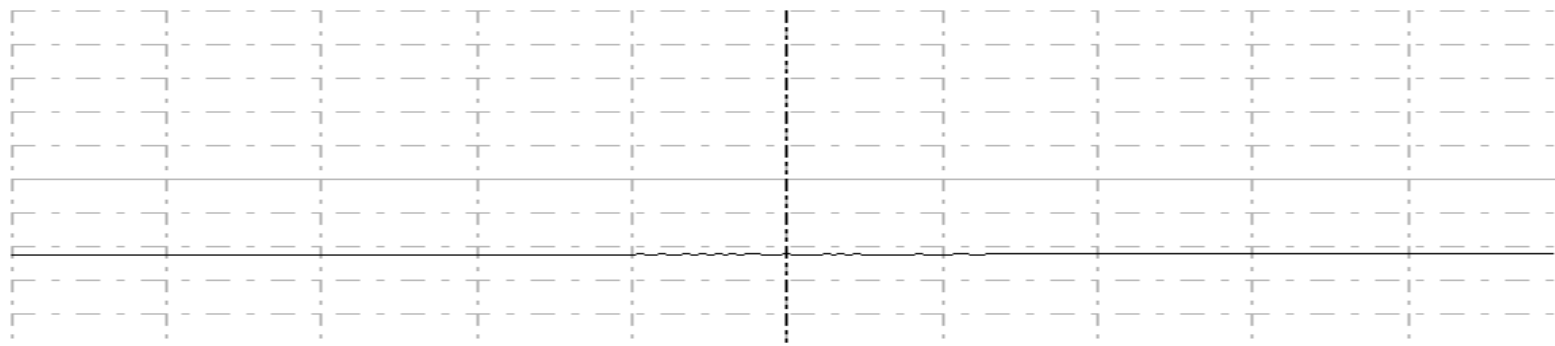
Start Frequency = 3,3 GHz
Center Frequency = 3,4 GHz
M1 3,4 GHz

M1
Stop Frequency = 3,5 GHz
Span = 200 MHz
M1 -3,063583 dBm

LogMag - Trans. taken on 2011.02.16 at 11:46

hybrid 9cm isolace
Reference Level = 0 dBm

Vertical div. = 10 dB

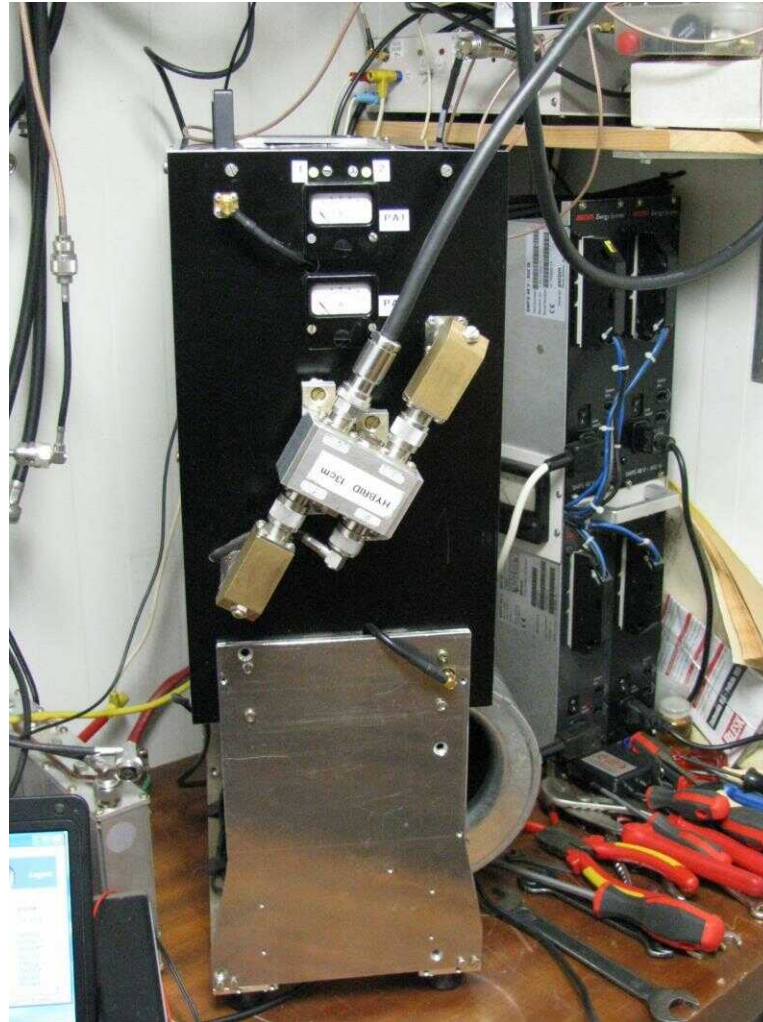


Start Frequency = 3,3 GHz
Center Frequency = 3,4 GHz
M1 3,4 GHz

M1
Stop Frequency = 3,5 GHz
Span = 200 MHz
M1 -22,14488 dBm

LogMag - Trans. taken on 2011.02.16 at 11:03

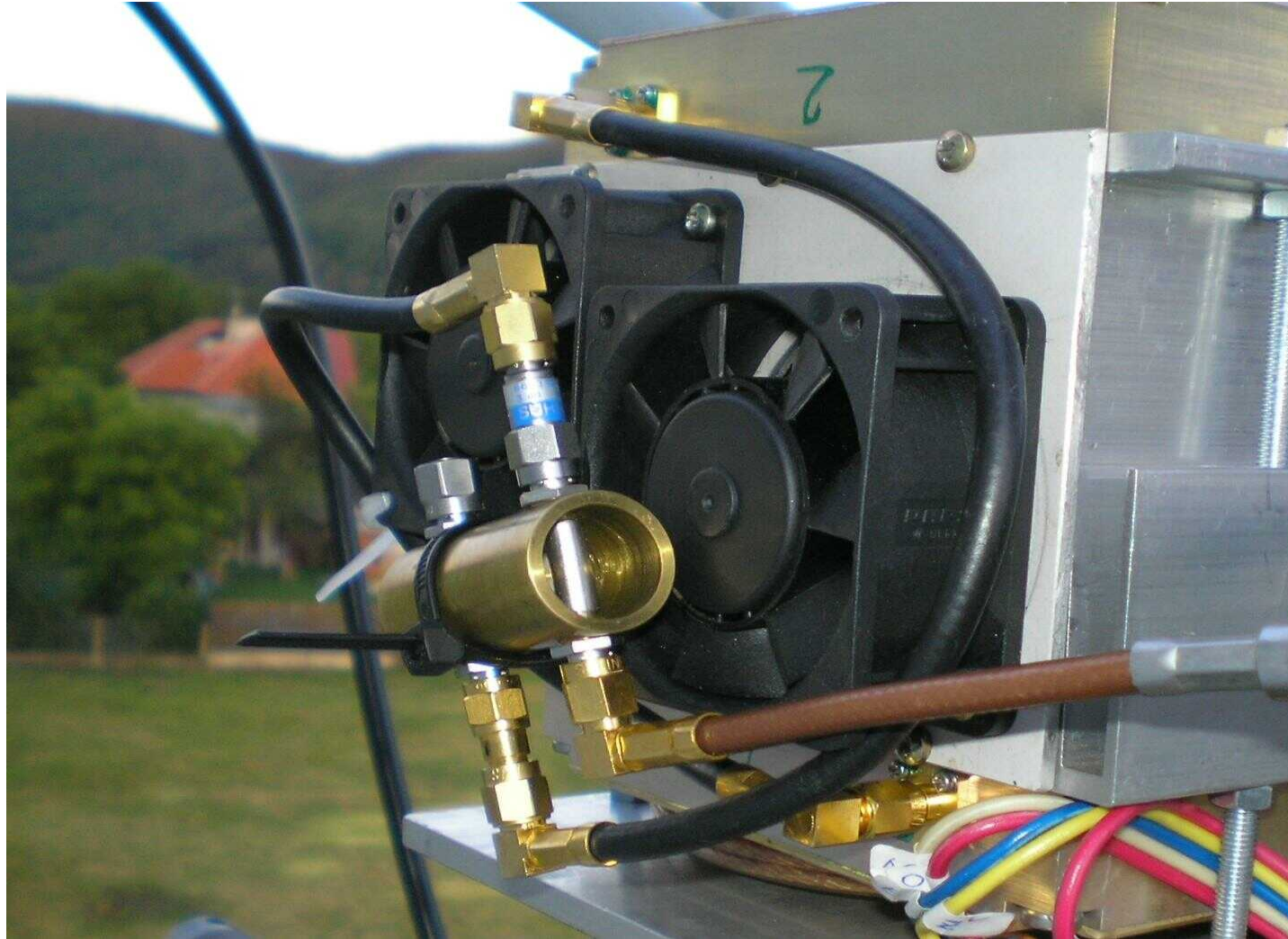
2300 MHz version with N at SSPA output



Hybrids 6 cm -SMA



Hybrid 9 cm - SMA



Hybrids 13 cm - SMA input N output

