

47 GHz EME OK1DFC

ZDENĚK SAMEK - OK1DFC



The first echo in the 47 GHz band was heard
by **Sergey RW3BP** in July 2004 (**100W RF**).

The attempt was also heard by **AD6FP**,
W5LUA, **VE4MA** and **VE7CLD** in August 2004.

First CW! QSOs were made in the 47 GHz
band:

RW3BP and **AD6FP**, **W5LUA** and **VE4MA**

RW3BP configuration



**Offset dish 2.4 m
100 W output power
50 MW ERP
CS/MN 1 dB**



VE4MA configuration



offset dish 2.4 m
9 W output power
CS/MN 1 dB

W5LUA configuration



**2.4 m offset antenna
30 W output power
C/S-M/N - 1dB**

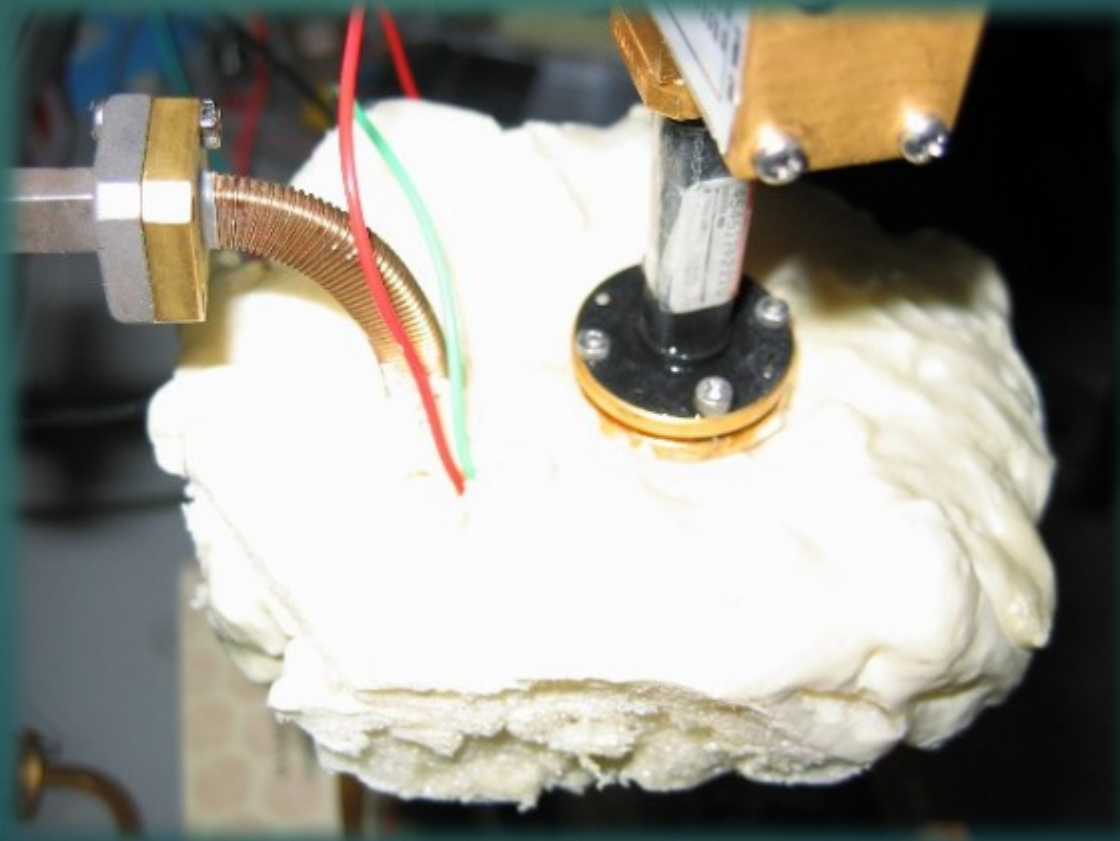
Ex AD6FP - K6MG configuration



**1.8 m offset antenna
30 W output power
New 140W TWT
1 dB moon noise**

Nitrogen-cooled VLNA K6MG

1.5 dB NF @ 77° K (4 dB @ 290 K).



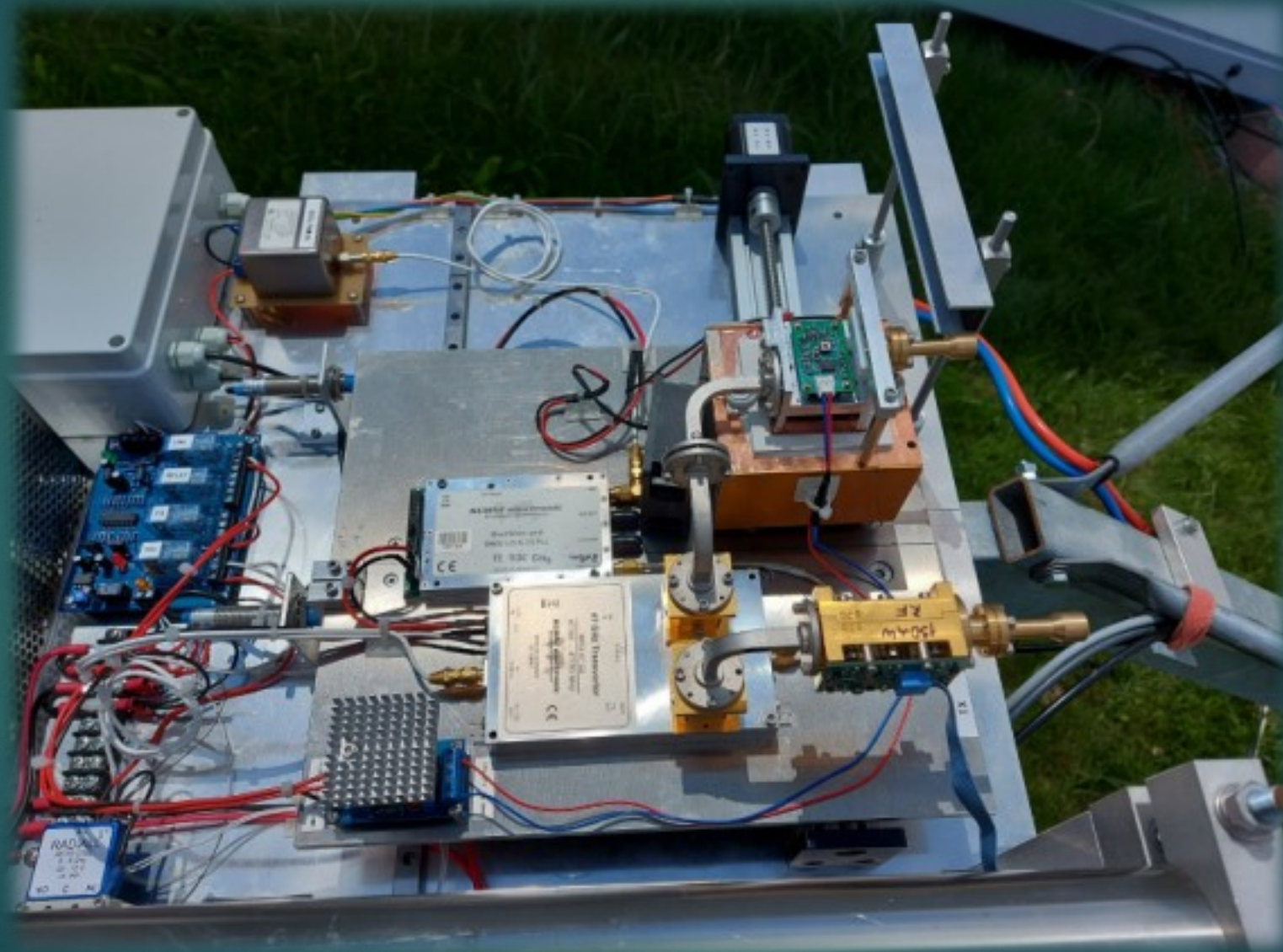
47 GHz - OK1DFC configuration

- ❑ 2.6 m offset antenna
- ❑ W2IMU F/D 0.6 feedhorn
- ❑ Dish calibrated to 36 GHz, one 5 mm thick AlSiMg element, stream-formed
- ❑ VLNA 2.4dB N/F - 24dB gain JA8CMY
- ❑ SSPA 2W RF out
- ❑ TRV DB6NT
- ❑ GPS LO DB6NT

$$\text{❑ } \text{SN/CS} = 8.6 \text{ dB}$$

$$\text{❑ } \text{MN/CS} = 0.85 \text{ dB}$$

47 GHz - OK1DFC configuration



47 GHz as problems multiply

	10 GHz	24 GHz	47 GHz
<i>Frequency stability</i>		2.5 x	5 x + phase noise
<i>Distribute</i>	~ 100 Hz	200+ Hz	400+ Hz
<i>Doppler</i>	up to 20 kHz	~ 60 kHz	~120 kHz
<i>route attenuation</i>	289 dB	297 dB	~ 303 dB
<i>ATT O2</i>	-	0.02 dB/km	0.4 dB/km
<i>ATT H2O</i>	-	0.3 dB/km	0.15 dB/km

47 GHz - parabolic antenna I.

- ▶ First test with Prodelin offset 2.4m
 - ▶ Glass laminate with integrated grid 1.5x1.5 m
 - ▶ 4 pieces of mirrors
 - ▶ Adjustment accuracy of 0.1°.
-
- ❑ SN/CS = **7.5 dB**
 - ❑ MN/CS = **0.7 dB**



47 GHz - parabolic antenna II.

- ▶ Second version offset 260cm
 - ▶ AlSiMg dural 5mm
 - ▶ 1 piece mirror
 - ▶ AZ/EL adjustment accuracy 0.01°
-
- ❑ SN/CS = **8.6 dB**
 - ❑ MN/CS = **0.85 dB**



47 GHz - parabolic antenna

	10 GHz	24 GHz	47 GHz
<i>Radiation diagram with 2.6 m</i>	0,77°	0,33°	0,17°
<i>Aiming accuracy</i>	+/-0,2°	+/-0,05°	Continuous monitoring + CCD optical inspection
<i>Gain</i>	47.54 dBi	54.85 dBi	60.69 dBi 10W RF = 10MW ERP
<i>Surface accuracy of 0.1λ</i>	(λ=28.9 mm) 3 mm	(λ=12.4 mm) 1.2 mm	(λ=6.24 mm) 0.6 mm !!!

Less displacement of the "precision" platter advantage - disadvantage

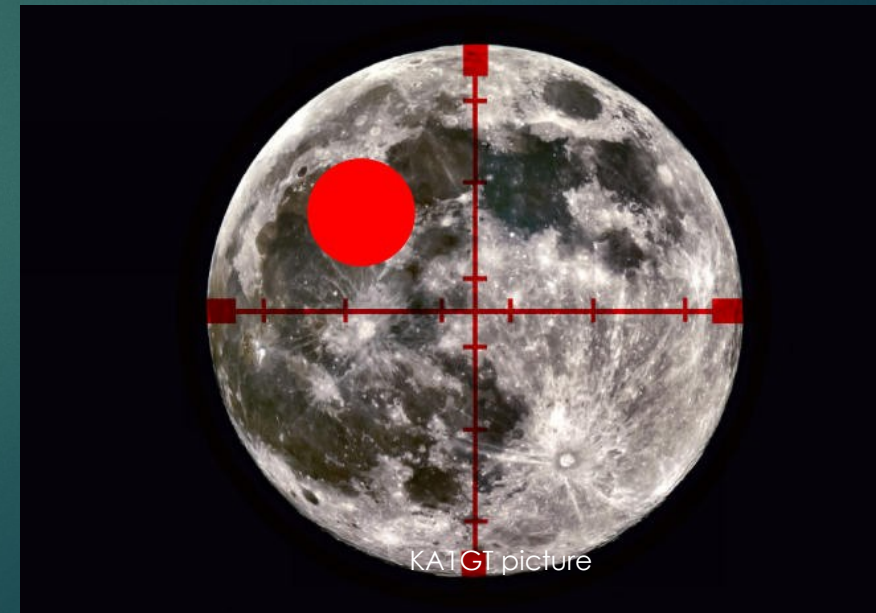
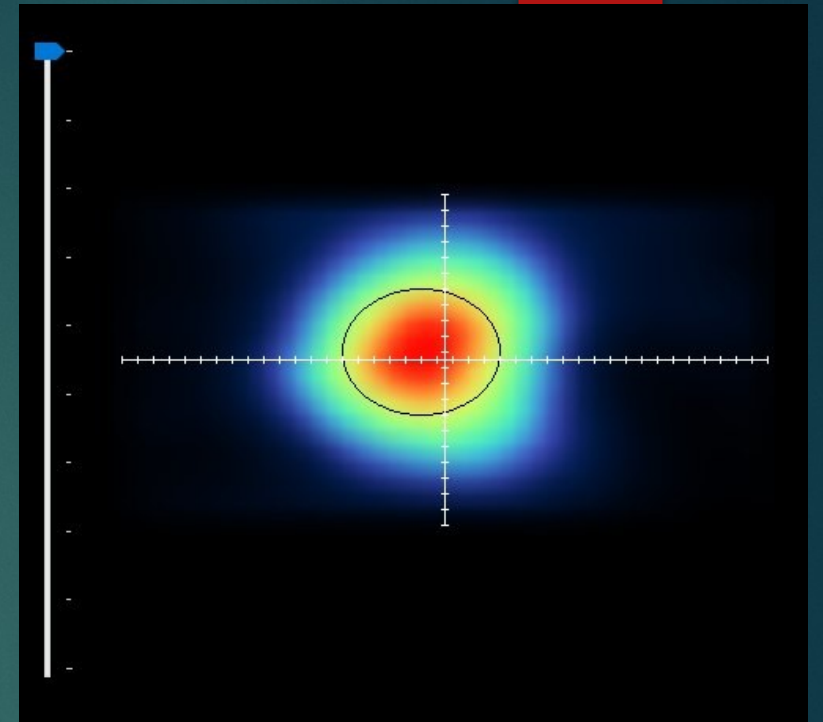
47 GHz - routing

❑ The angular diameter of the Sun in the sky is $31' 59.2''$ = about 0.5° .

❑ The angular diameter of the Moon varies according to its distance from Earth and ranges from $29.4'$ to $34.1'$, or 0.5° again.

❑ OK1DFC dish 0.16°

- ▶ F1EHN SW
- ▶ Resolution 0.01° US Digital Encoders
- ▶ Threshold-free gearboxes
- ▶ DC motor speed control - smooth operation
- ▶ Camera

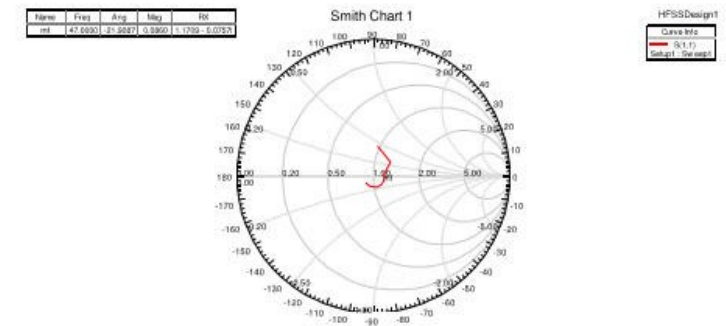
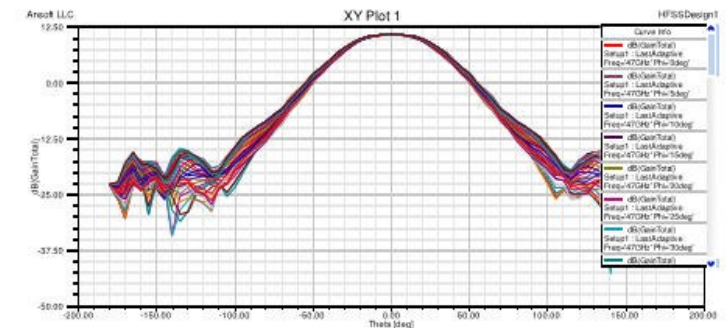
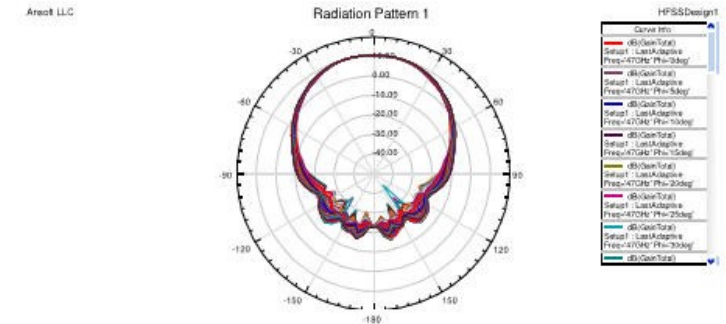
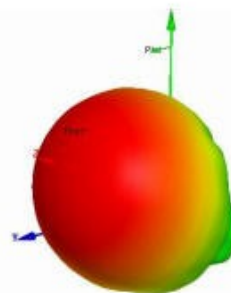
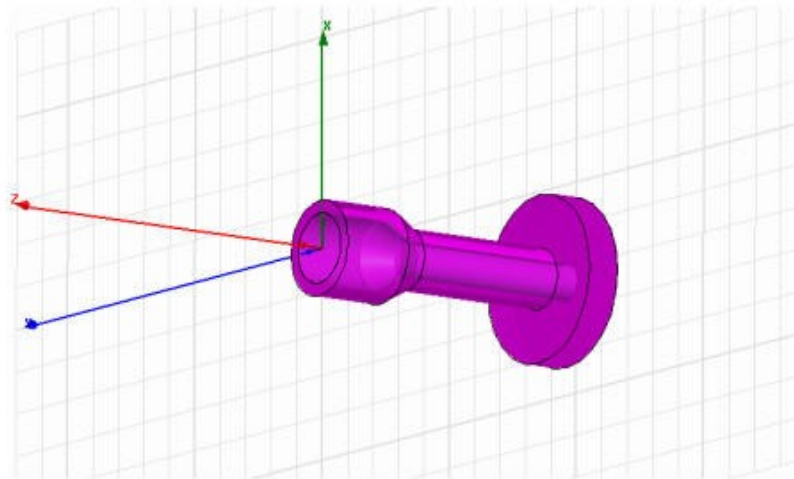


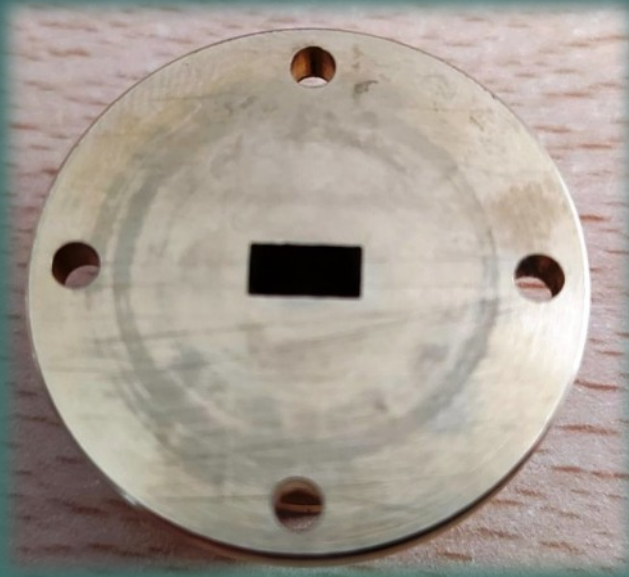
47 GHz - the cuckold of the W2IMU band.



- F/D 0.8 & 0.6
- Model TNX OK2AQ

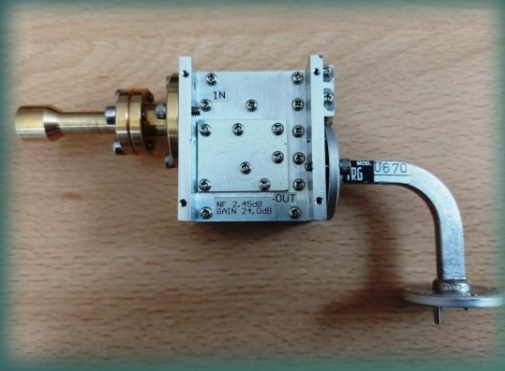
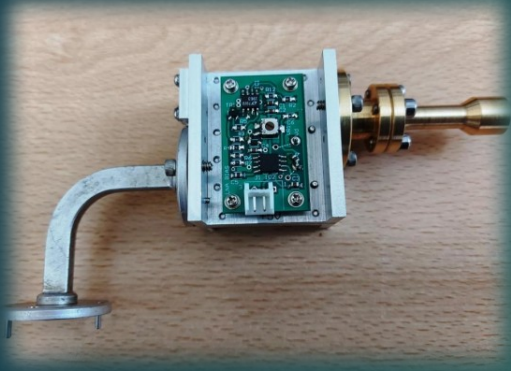
Dual mode feed W2IMU
for offset dish $f/d = 0,6$ OK1DFC on frequency 47 GHz
analyzed by Mirek Kasal OK2AQ



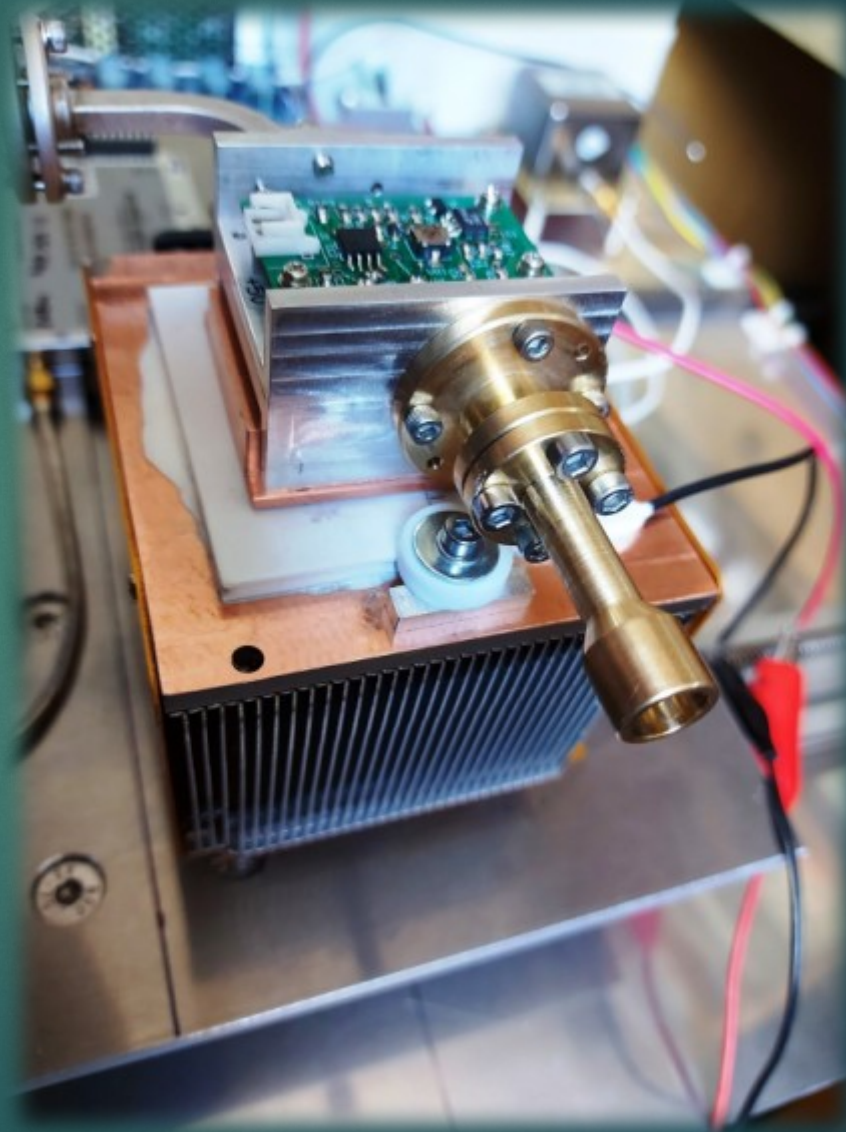


47 GHz - WR19 transition to circular waveguide

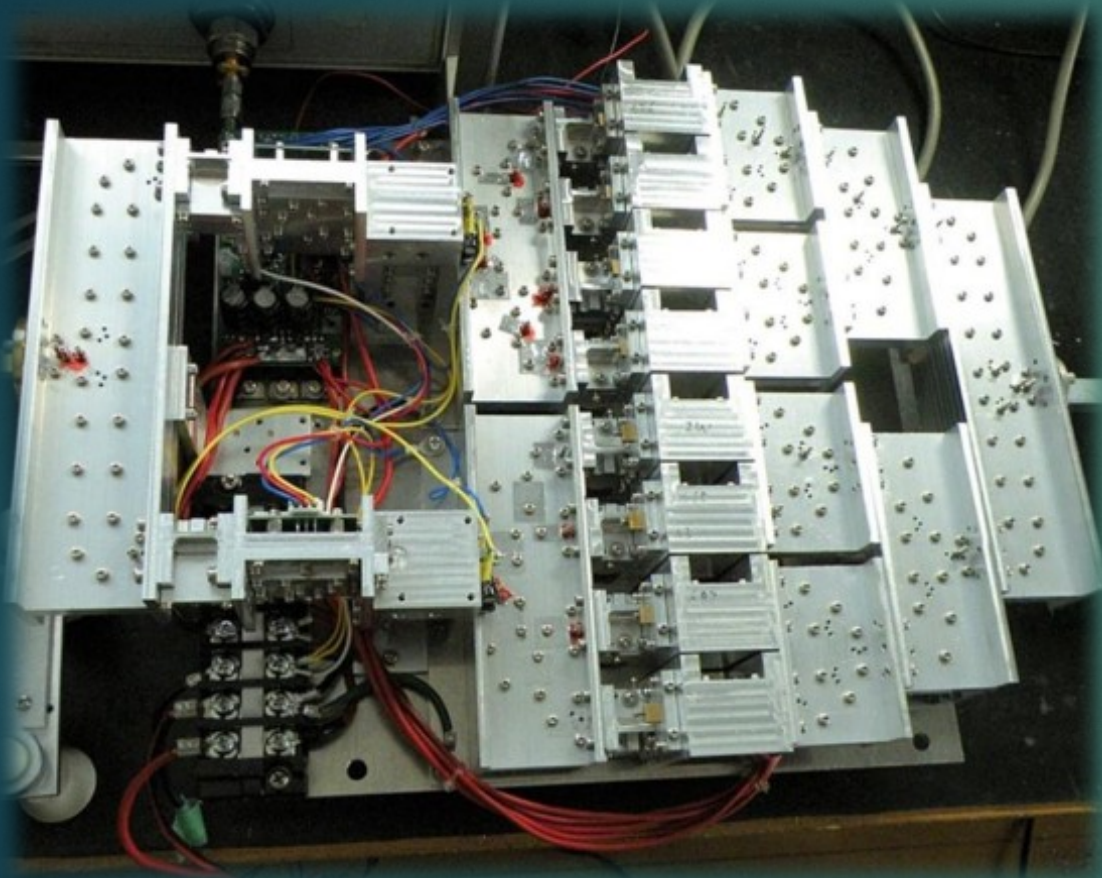
47 GHz - VLNA



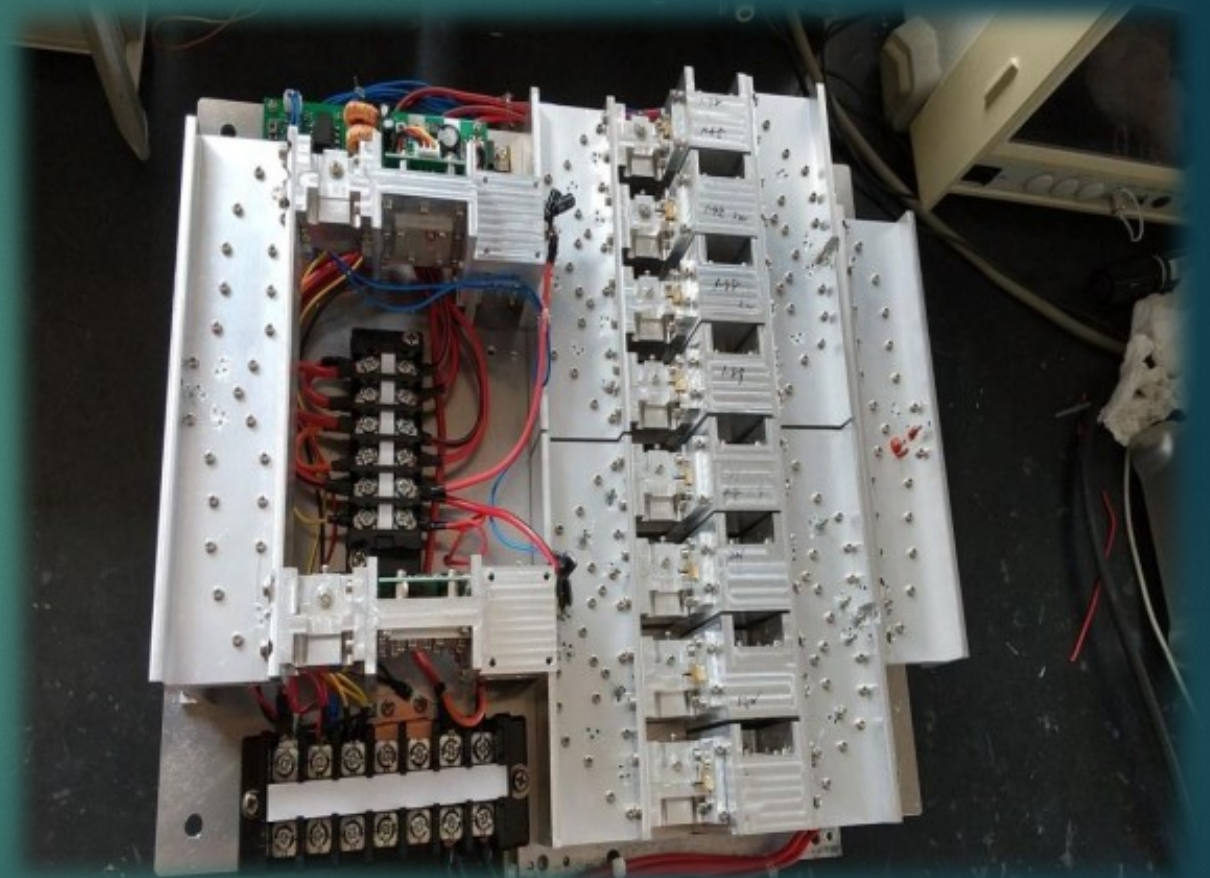
- ❑ WR19 waveguide
- ❑ 2.4dB N/F
- ❑ Gain 24dB
- ❑ Peltier cell as cooling down to -20°C



47 GHz - SSPA 10W RF



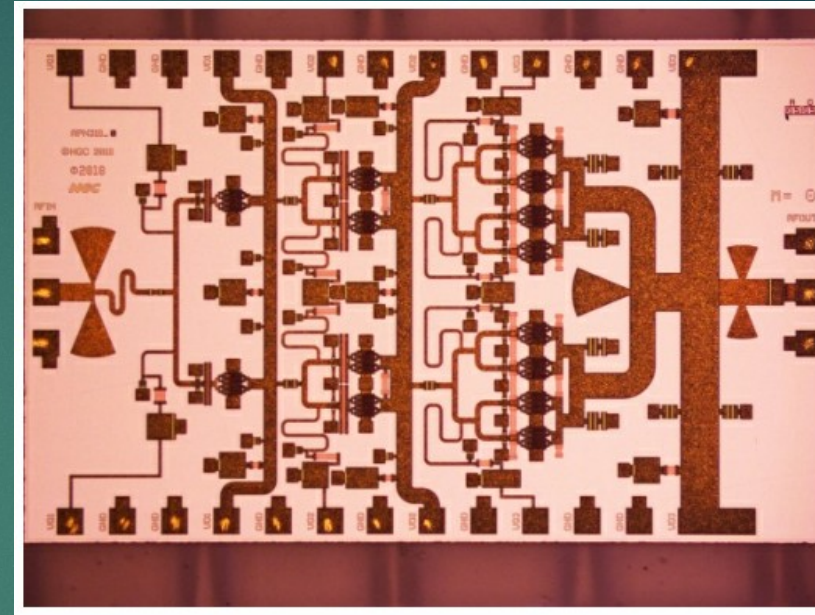
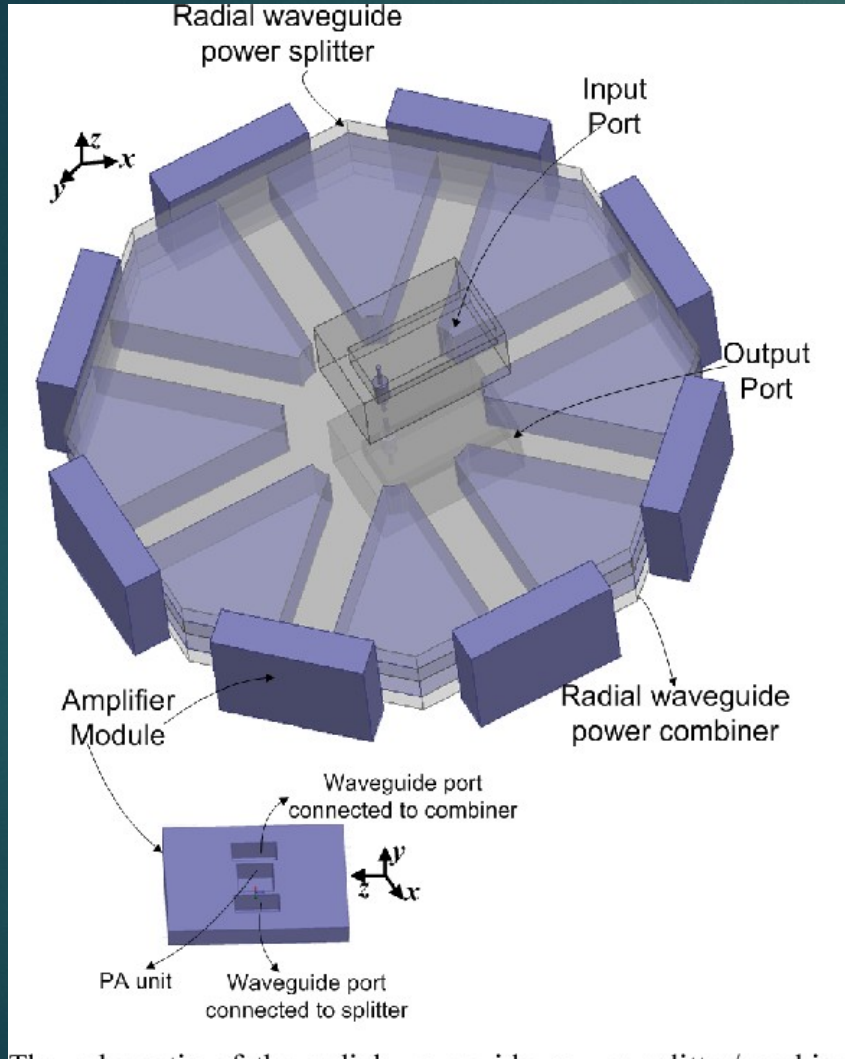
JA1WQF - 10W RF



8xTGA4046

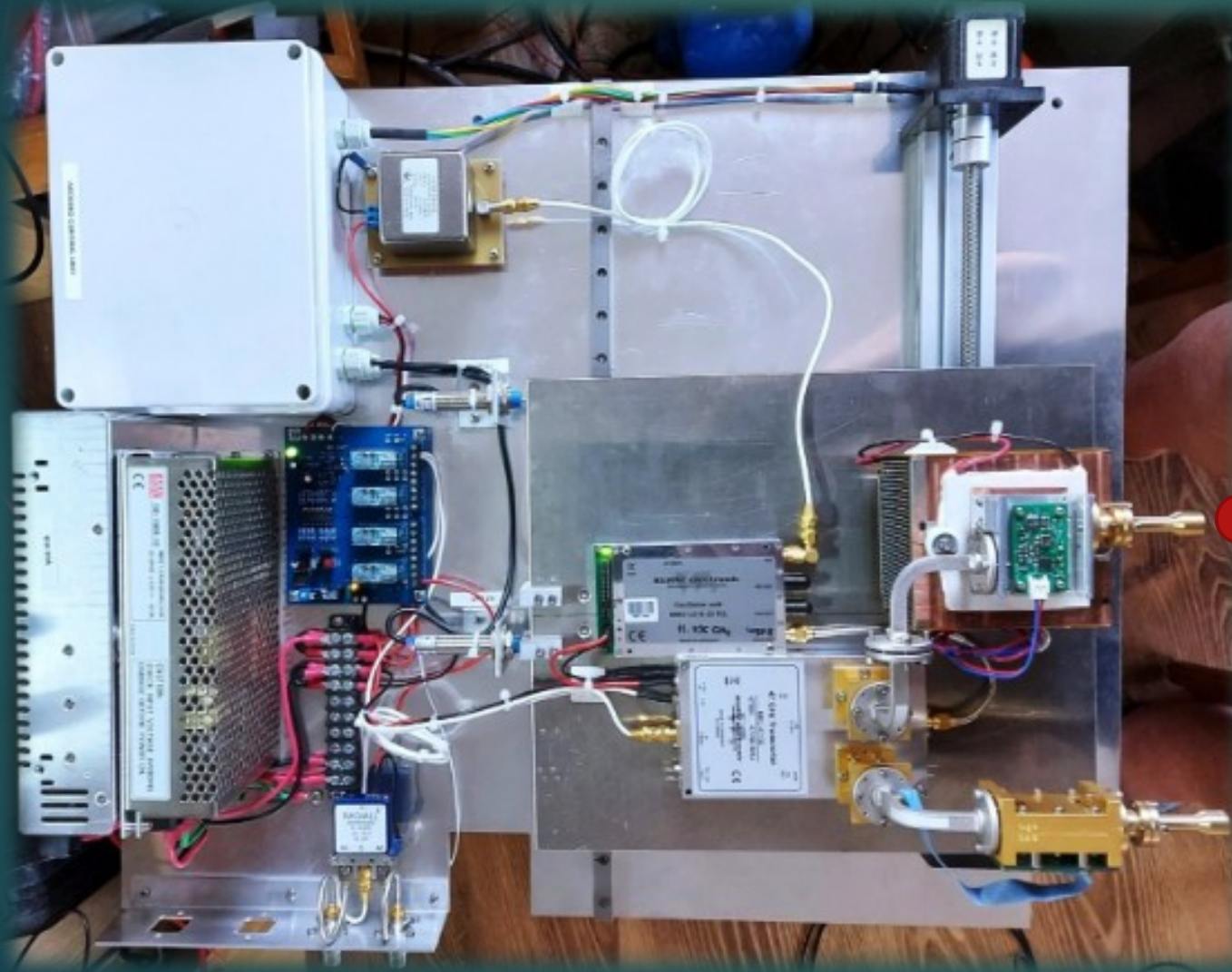
JA1WQF - 12W RF

47 GHz - SSPA 25W 8xAPN318



- **APN318** - \$380 USD
- 3.2x2.2 mm
- 47-51 GHz
- 3.2 W - CW
- Impulse 10W
- 16dB gain
- 28V DC/1.62A

47 GHz RX/TX switch

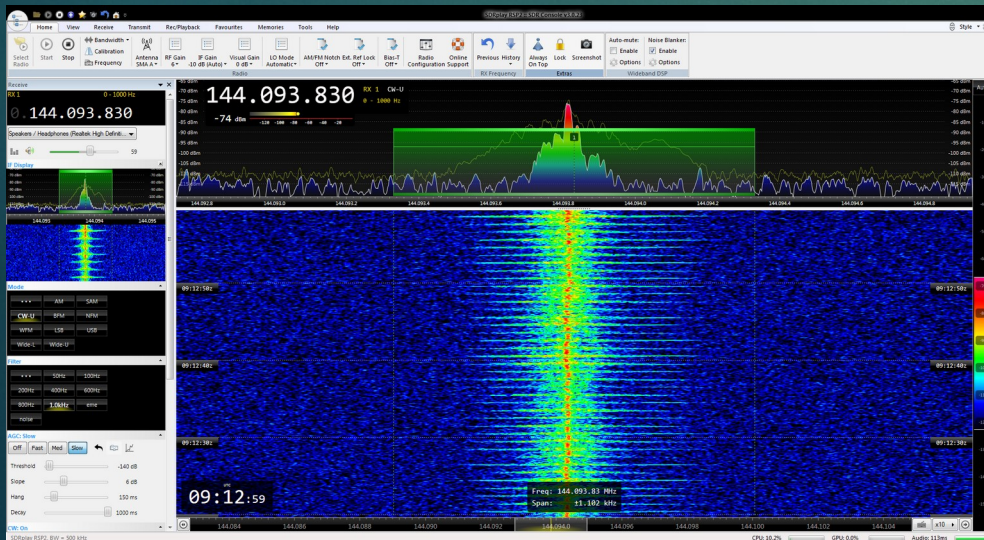
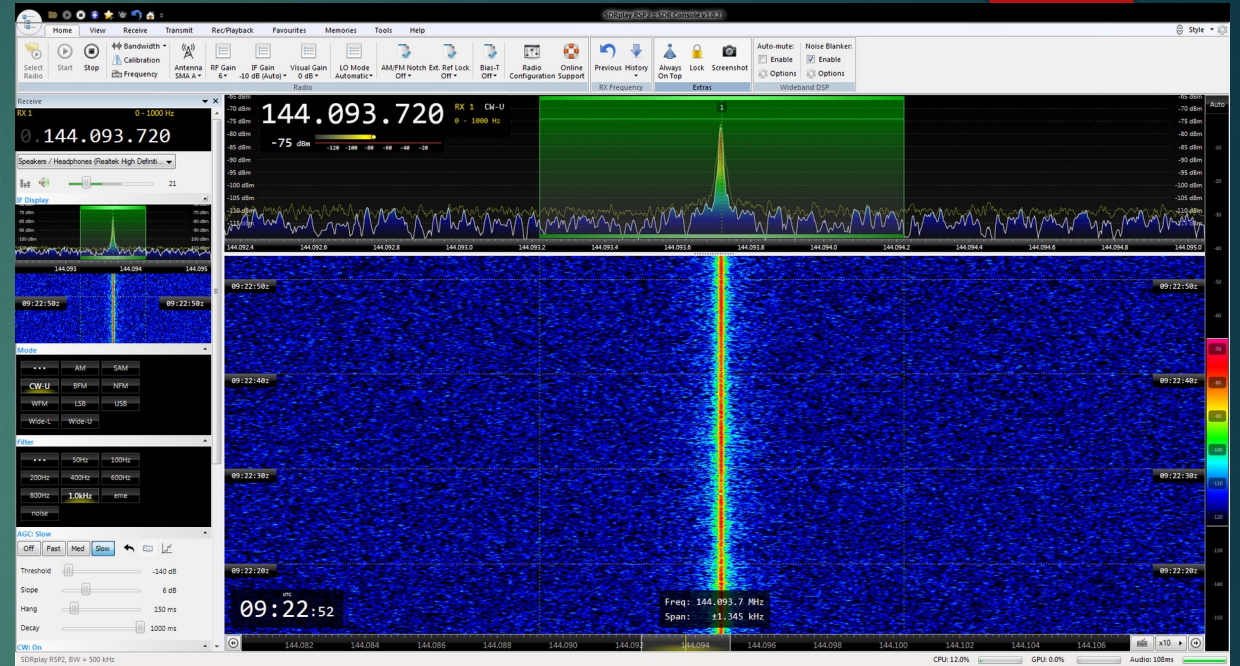
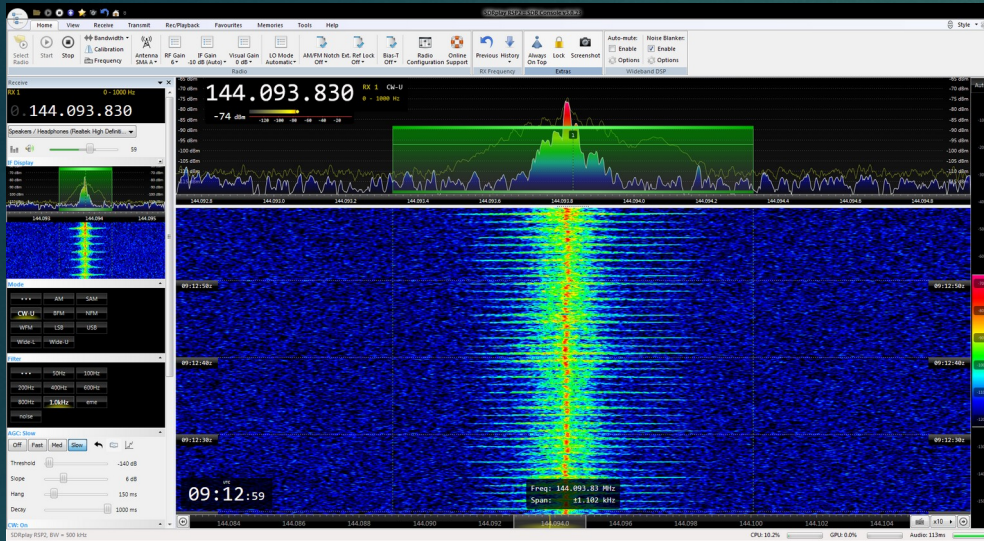


F point



Profi Militech waveguide switch -
0.2dB ATT and price ???????? MORE

47 GHz - LO stability



- GPS LO BG7TGL disciplined oscillator
- GPS disciplined oscillator LO Bodnar
- MORION - double stabilized TCXO oscillator

47 GHz station today

Station	Antenna	Nf	Pwr	Sunnoise	Altitude /temp	Moonnoise	altitude/temp/humid	CS/G	date of measurement	with the WG switch	Moon temperature	Comments
AD6FP	1.8 mtr shift	1.5 dB cooled	140	9.2 dB								
DC7KY	2.4 mtr shift	2.2 @17C	20	9.5 dB	15 ?	0.69 dB				yes		Copied by W5LUA
DL7YC	2.4 mtr 0.4 pf	2 dB	1	10.5 dB	50 degrees	1.0 dB	60 degrees			yes		Copied by W5LUA
EA3HMJ	1.2 mtr shift	2.6 dB	2	7.7 dB	43 degree	0.6 dB	64deg/11C/94%		6-10-2020	z	274 K	new LNA
JA1WQF	2.4 mtr cassegrain	1.65 dB	10	9.3 dB	>27 degrees	1 dB	>27 degrees	2.8 dB	12-11-2020	yes		Copied by W5LUA
LX1DB	3.0 mtr 0.3 pf	2.2dB Spacek	?	7.1 dB	19C 63%	0.45 dB		0.8 dB				
OK1DFC	2.4 mtr shift	2.4 dB	0,1	7.7 dB	25 degrees/14C	0.77 dB	25 degrees/8C/46%				253 K	
DL/PA0EHG	1.8 mtr 0.4 pf	2.5 dB	4	8.1 dB	22deg/13C	tbd		1.5 dB	28-10-2020	z	K	
RW3BP	2.4 mtr shift	8 dB DSB		4.9 dB		0.6 dB						QRT
VE4MA	2 feet shift	4 dB	?	5.5 dB		0.3 dB						
W5LUA	2.4 mtr shift	2.85	25	8.2	45 degrees/28C	0.72 dB	60 degrees/28C/75%				228 K	new LNA

47GHz 2.4m Cassegrain

IMU Long horn+flared feed
Peltier cooling VNA

JA1WQF

JA1WQF receives and decodes W5LUA.

WSJT-X v2.1.2 by K1JT

File Configurations View Mode Decode Save Tools Help

Single-Period Decodes

UTC	dB	DT	Freq	Message
1143	-23	2.2	1059	:
1144	-22	2.7	1089	:*
1145	-22	4.4	900	:*
1146	-23	2.7	994	:* JA1WQF W5LUA EM13
1147	-23	2.6	1040	:
1148	-23	0.7	927	:
1149	-24	-0.3	1081	:

Average Decodes

UTC	dB	DT	Freq	Message
1146	-23	2.7	994	:* JA1WQF W5LUA EM13

Log QSO Stop Monitor Erase Decode Enable Tx Halt Tx Tune ☒ Menus

6mm S 47,088.150 629 ☐ Tx even/1st

Az: 44 10365 km

☐ Sh ☐ Tx6

2020 2 10 11:49:57

Next Now

W5LUA JA1WQF QM05	☐	Tx 1
W5LUA JA1WQF -15	☐	Tx 2
W5LUA JA1WQF R-15	☐	Tx 3
W5LUA JA1WQF RR73	☐	Tx 4
W5LUA JA1WQF 73	☐	Tx 5
CQ JA1WQF QM05	☒	Tx 6

Receiving QRA64 D 57/60



**Thank you for your
attention**

Questions????