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# How to Start on Microwave EME Using Homebrew Dish and Equipment

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# First JT65B EME 144MHz in 2007



- EME communication has fascinated me from the very beginning of my amateur radio hobby
- HF never was for me, I have always looked for challenge, ultimate DX and for... microwave EME
- In 2007 I was able to make first EME contact JT65B 144MHz using a set of 4 x 9 el yagi F9FT, only 50w PWR from FT-847. At the time using QRP and these yagi set temporary mounted on balcony carried out about 30 QSOs JT65B.

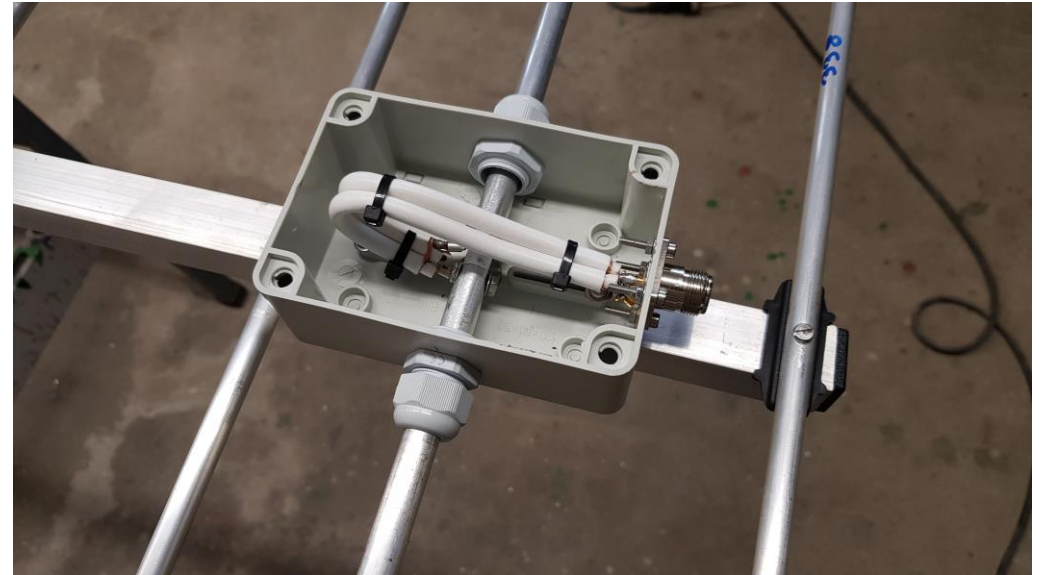
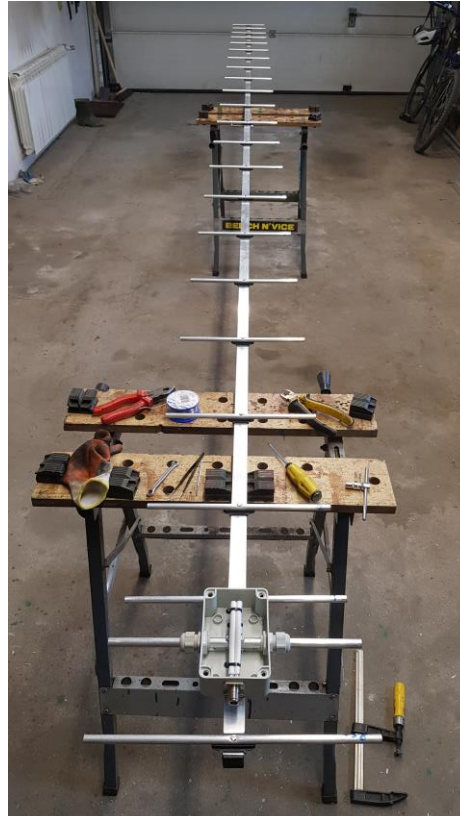


# First CW EME 432MHZ

In 2019 I decided return to the EME and to build 8x23 432MHz yagi set. The single antenna was made based on the DK7ZB study with gain of approximately 17dBd at a length of 560cm. A set of 8 yagi should has a theoretical gain about 26dbd. Using 400W from the shack and these yagi array I was able to start in ARRL EME 2019 with results 14 QSO random CW. I was not focused on any results because it was my first start but I was bit surprised to earn 4th place in the SO 432MHz CW only category.

# Homebrew 8 x 23 432MHz yagi set

- More details on DK7ZB website <https://www.qsl.net/dk7zb/70cm-longyagi/23-ele.htm>
- Boom length 560cm, aluminium square profile 25x25x2mm
- The elements have 12 mm, 10 mm diameter.
- The 2x75-Ohm-coax-cable in the box with the N-socket for the DK7ZB-match



# Is microwave EME your goal? So, you should try to build the dish...

- In 2020, I have started new EME project, 6.4m (31 feet) dish with  $f/d$  0.4
- I wondered long time how to build new EME system suitable for multiband operation from 70cm up to 9cm, using garage tools, without spend a lots of money.
- There is a lot of better way to achive the same results or even more. Im just only an amateur...
- My construction arent perfect, there are some things to do improve
- The dish work flawlessly since November 2021
- This presentation shows that anyone can to try microwave EME



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# Garage workshop, handy tools, enough to start new EME project



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- Reflector ribs, were made using 120kg of aluminium angles 20x20x2mm as compromise between strenght and lightness of the structure.
  - Oriented Strand Board, durable and convenient base for forming reflector ribs.
  - Ribs conception based on Chris SP7DCS great solution. More details on Chris website <https://sp7dcs.pzk.pl/details6dish.html>

# Ribs construction



Pre-bent aluminium angle, by hand...



A set of already prepared elements for the ribs. All elements of aluminium angles 20x20x2mm.

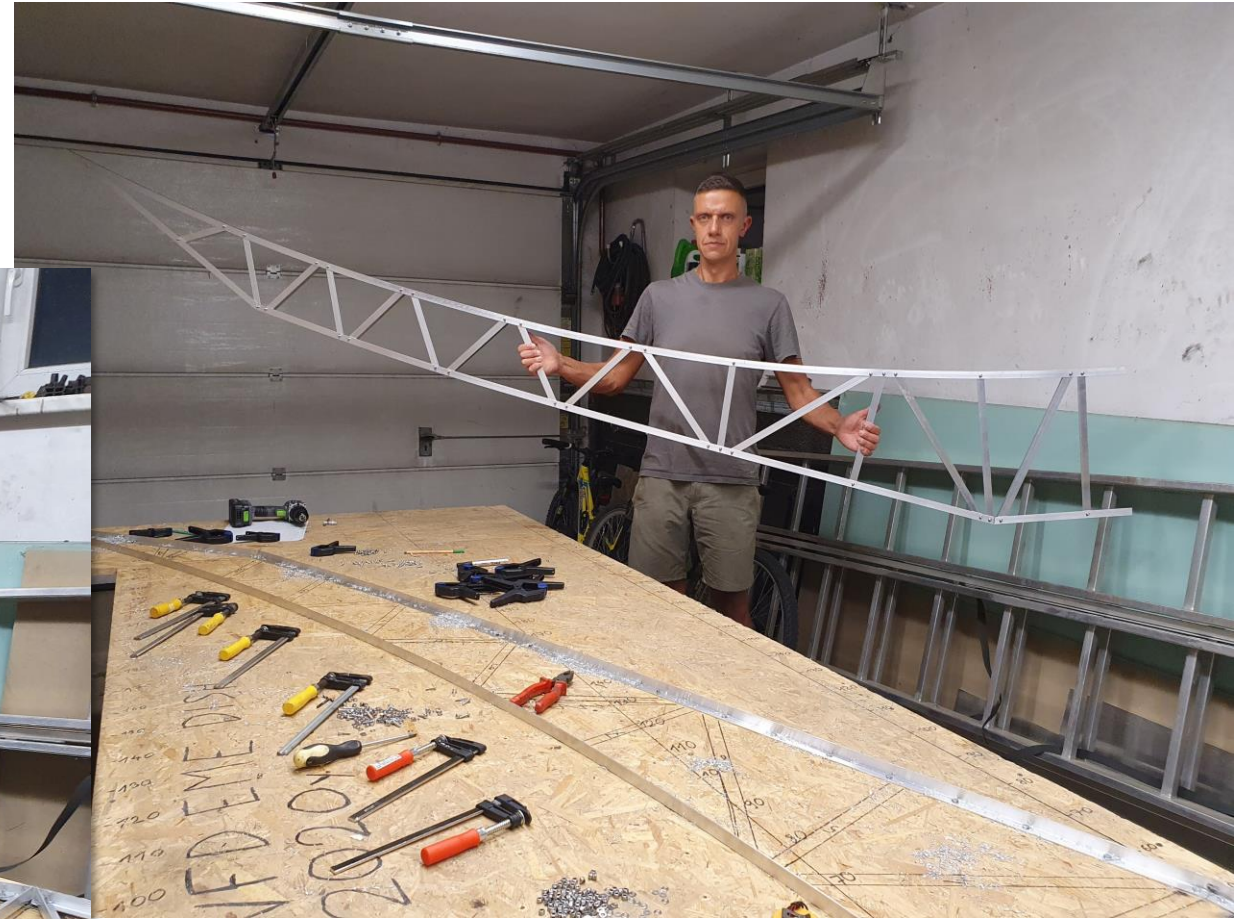


Template for the production of ribs, also made of aluminium angles 20x20x2mm.

# Ribs construction



Internal ribs junctions were made by drilling through two angles and screwing using stainless screws.



Yeah... the first rib just done, a lot of fun! 😊



# Ribs construction



Each of ribs had two cut areas. I welded this using TIG

# The hub



The HUB, central part of the dish. Aluminium plate 6mm thickness. Front side wheel 60cm diameter, back side wheel 100cm, distance between wheels 45cm.



# Dish assembly



All of ribs are screwed with stainless steel screws.



Pre-assembled 6.4m dish and set of 8 x 23 432MHz on the tower.

# Covering by mesh



Fixing the mesh with cable ties. A lot of boring job but almost done... Mesh holes dimensions 8x8x0.8mm should be suitable up to 9cm.



The mesh was cut into a triangle using hand scissors.

# Covering by mesh



Finally, I painted the dish by green using roof paint, to be more friendly for my neighborhood.

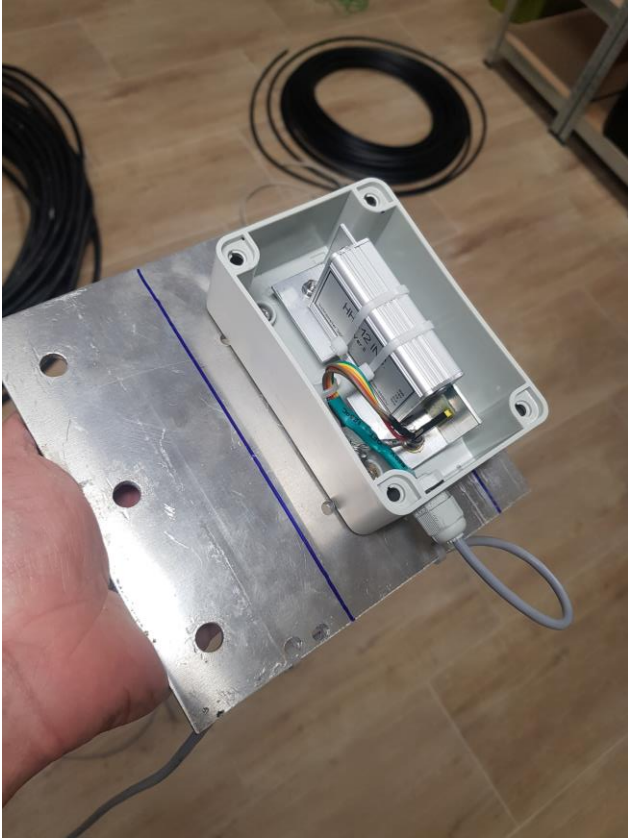
# Azimuth drive



Mini crane main bearing, surplus part obtained from internet junk shop. Bearing with a diameter of 51cm. Load capacity several ton...



# EME dish control



EL reading, inclinometer  
HH-12INC DF1SR



AZ reading, absolute encoder  
HH-12 DF1SR



On the left AZ drive, 230V AC 180W engine  
with gear ratio 1:1200. On the right absolute  
encoder HH-12 enclosure.

# EME dish control



Homemade OE5JFL controller, working perfectly with 50m length CAT6 cable, tracking resolution 0.2 degree



EL drive, actuator GNT 3500N, 36" 230V



# Rising up the dish



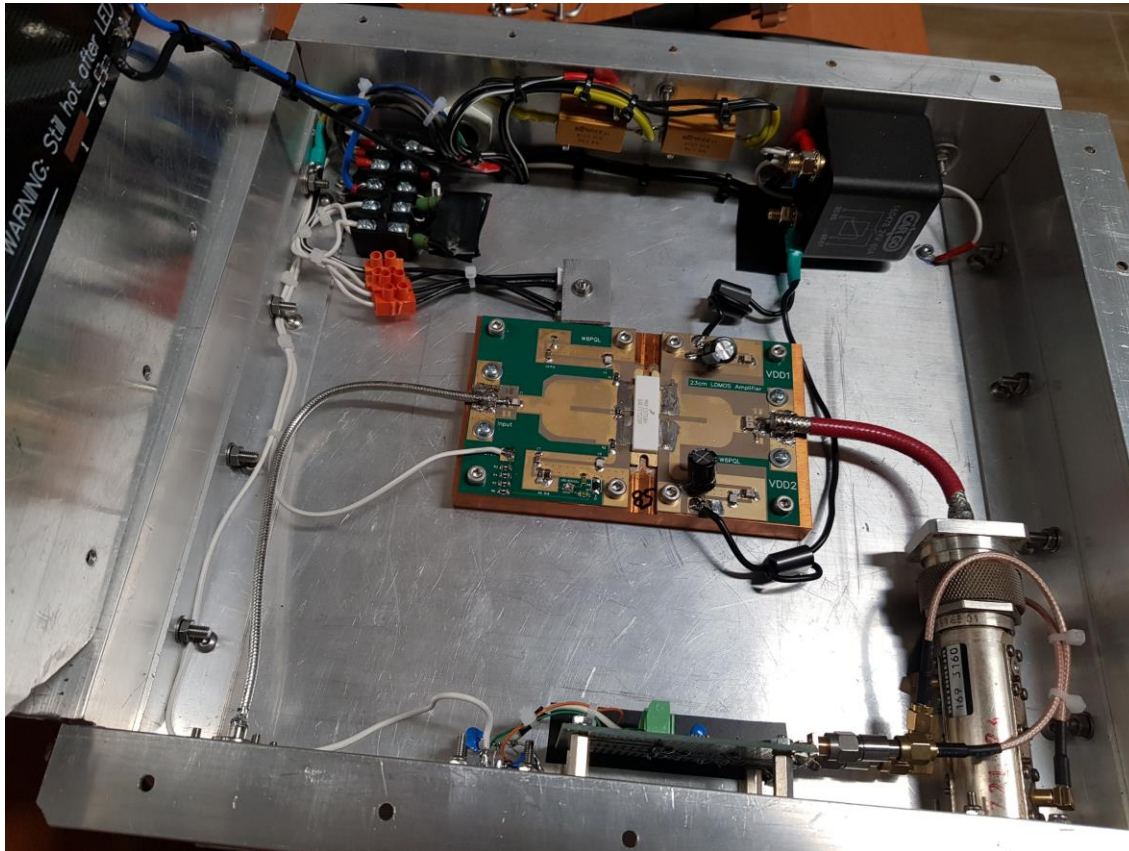
Obviously rising the dish using crane is most convenient and safety solution. There are also some other quite good solutions, the cheapest way is to build the simple ramp with manual winch.

## 432 MHz loop feed



Rotary „pancake” 432MHz loop feed, ATF54143 LNA (later added second stage PGA103+) 7/16 Spinner relay, Sun Y measurements showed dish advantages, 6.4m dish has much better results than set of 8 x 23 yagi.

# 1296MHz SSPA



Well known W6PQL 600W 23cm pallet amplifier. The 3D printer heating plate helps keep the interior of the amplifier dry on frosty and humid days, when amp is not in use.

## 1296MHz feed & SSPA



Septum feed and 600W 23cm amplifier. G4DDK homemade LNA. There is only short 1/2" coax jumper ended both side 7/16 plugs, between SSPA output connector and TX port of the feed.

## 13cm feed & SSPA



13 cm septum feed, relay box with LNA and 150W SSPA

# 13cm feed & SSPA



13cm WA6PY LNA 0.3dB NF 33dB gain.  
Aluminium enclosure with protection SMA  
relay.

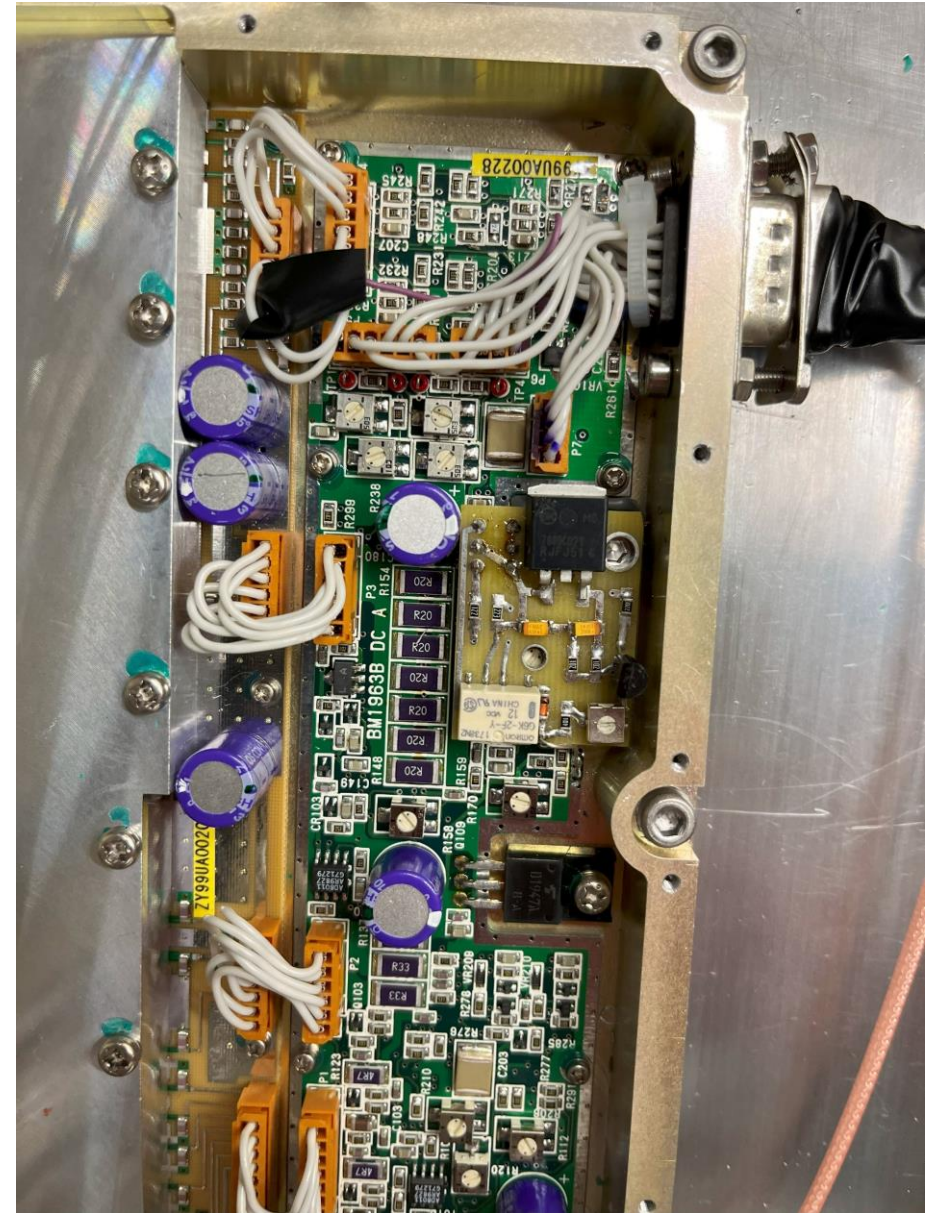
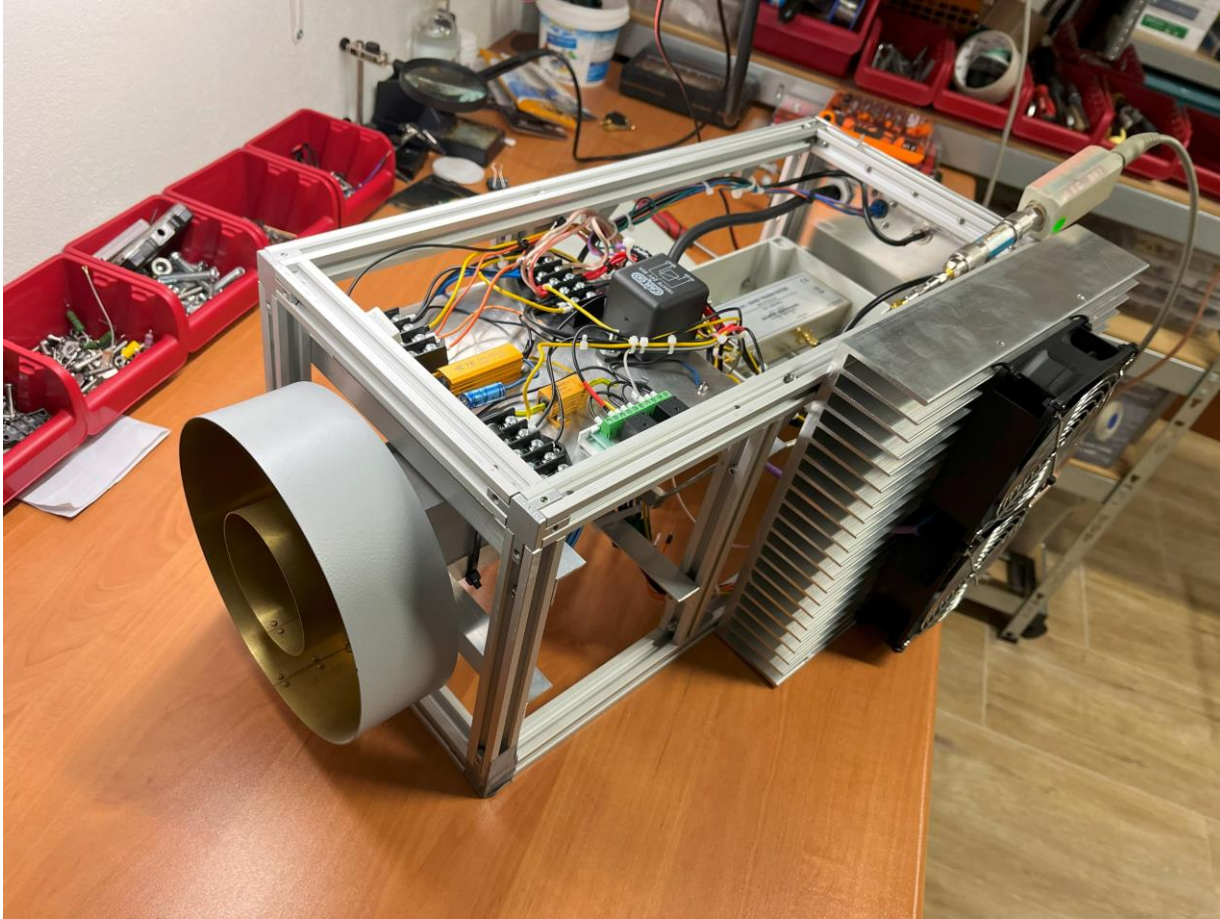


2 x BLF6G22-180PN UMTS SSPA  
surplus board. Surplus part, easy  
adaptation to use on 13cm.



The original amp was dedicated to run  
with UMTS service, but after simple  
modification this works also pretty well  
on 13cm.  
With only 50mW drive, output PWR as  
follow:  
2300MHz 180W  
2320MHz 150W  
2400MHz 60W

## 9cm feed & SSPA



9 cm septum feed, DG0VE LNA 0.55dB NF 17dB gain, 3400MHz/432MHz Kuhne TRV, modified UM2683B Toshiba SSPA.

## 2021 – 2024 EME activity

From November 2021 most of my EME operation 70cm – 9cm occurs using CW mode. Some SSB and digital QSOs also went into my log.

I didn't any initials statistic yet, but using my HB 6.4m dish I was able to make 668 QSOs since November 2021. 90% CW random style.

I love pure random CW EME operation but due to less and less activity I've started increase also digital operation.

To make 23cm QSO using Q65 mode with single yagi stations gets a lot of fun!

Sometimes there are harsh winters in JN99XN...





## Next EME project on the way...



3.2m prime focus solid Andrew dish for future 3cm/6cm EME operation and 8.4GHz DSN

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# Special thanks to my awesome friends...

**George DF1SR**  
**Norbert DL4DTU**  
**Jac PA3DZL**  
**Jan PA0PLY**  
**Ingolf SM6FHZ**  
**Andrzej SP6JLW**  
**Jacek SP6OPN**  
**Chris SP7DCS**  
**Paul WA6PY**  
**John WA9FWD**

Guys, you are great. I wouldn't have achieved anything without your help...

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# Thank you for watching

If you are interested in further details  
please contact me

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73 de Rafael SP9VFD

*I prepared this presentation  
at the honest request of  
Allen K2UYH and dedicate  
this paper to his memory*

