

20th International EME conference Trenton 2024

Construction of 8m offset dish for EME operation

"One man show"

OK1DFC - ZDENEK SAMEK



Construction steps:

- Dismantling of existing 10m prime focus dish - 07/2019
- Design and calculations of new offset dish 8m diameter 12/2020
- Mast 10 -11/2019
- AZ and EL 06/2020
- Antenna hub 06/2021
- Balancing boom 10/2020
- Construction and design of the mirror 09/2020
- Rib production 07- 08/2021
- Line-up 09/2021
- Feed holder 09/2021
- Feeds 10/2021
- Test and operation 10/2021

Dismantling

- July 2019
- Dismantling the antenna
- Transport to QTH DG5CST



New antenna project

X-axis = 7825mm

Y-axis = 8248mm

Max. mirror depth = 1100mm

Max. depth of inner ellipsoid = 270mm

F/D = **0.457**

Offset angle = **18.45°**

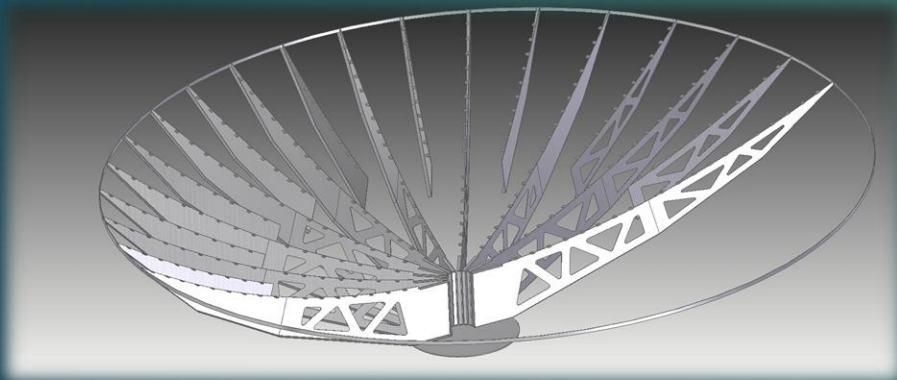
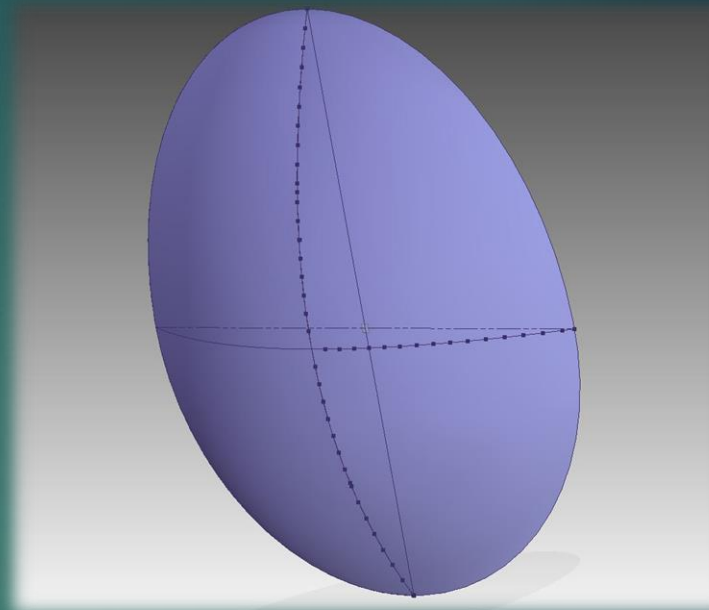
Feed angle at the focal point = **36.9°**

Gain at **1296MHz** = 38.6dBi

Offset from 12,6m PF diameter dish

18 PCs of the main ribs

36 PCs of auxiliary ribs



Offsetová parabola 7825 x 8248mm OK1DFC

		Pozice ramene od 0° po 10° do 180°																		
		360°	350°	340°	330°	320°	310°	300°	290°	280°	270°	260°	250°	240°	230°	220°	210°	200°	190°	180°
		0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°	160°	170°	
Pozice bodu křivky od středu elipsy po 250mm na ose X	250	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	500	16	16	16	16	17	17	17	18	18	18	18	18	18	17	17	17	17	17	17
	750	35	35	36	36	37	38	39	40	40	41	41	41	40	40	39	39	38	38	38
	1000	62	62	63	64	66	67	69	70	71	72	72	72	72	71	70	69	68	68	68
	1250	96	96	98	99	102	104	107	109	111	112	113	113	113	112	110	109	108	108	107
	1500	137	138	139	142	145	149	153	157	160	162	163	164	163	162	160	159	157	156	156
	1750	184	185	188	191	196	202	207	212	217	220	223	224	223	222	220	218	216	215	215
	2000	239	240	243	248	254	262	269	277	283	288	292	293	294	292	290	288	286	284	284
	2250	299	300	305	311	319	329	339	349	358	365	370	373	374	373	371	368	366	364	364
	2500	366	368	373	381	392	404	417	429	441	451	458	463	465	464	463	460	457	455	455
	2750	439	441	447	457	470	486	502	518	533	546	556	562	566	567	565	563	560	558	558
	3000	517	520	528	540	556	575	592	615	634	650	663	672	678	680	680	678	675	673	672
	3250	602	605	614	629	647	671	695	719	743	763	780	793	801	805	806	804	802	801	800
	3500	691	695	706	724	746	773	802	832	861	886	907	924	935	942	944	944	943	941	941
	3750	787	791	804	824	851	883	917	953	987	1018	1045	1066	1081	1091	1096	1097	1097	1096	1095
4000	888	893	907	931	962	999	1039	1081												
4250	993	999	1016	1043	1079															
4500																				
		Souřadnice hodnot Y (depth mm) pro parabolickou křivku																		

Pozice bodu křivky od
středu elipsy po 250mm
na ose X

Souřadnice hodnot Y (depth mm) pro parabolickou křivku

Mast

- Steel pipe 600mm diameter - 10mm wall thickness
- 20mm base plate
- 16mm top plate for AZ gearbox
- Length 3600mm



Azimuth and Elevation

Choice of gearboxes

12" - elevation torque = 750kg/m - load in axis 47ton - load perpendicular to axis 19ton

14" - azimuth torque = 800kg/m - axial load 55ton - perpendicular load 22 ton



Dish hub

- Easy mounting of ribs
- Rotation of the whole antenna around the centre
- Sufficient rigidity



Balancing boom

- Sufficient robustness and load capacity
- Possibility of installing 300kg counterweights
- Possibility of total assembly in parts
- Easy installation of the centre section

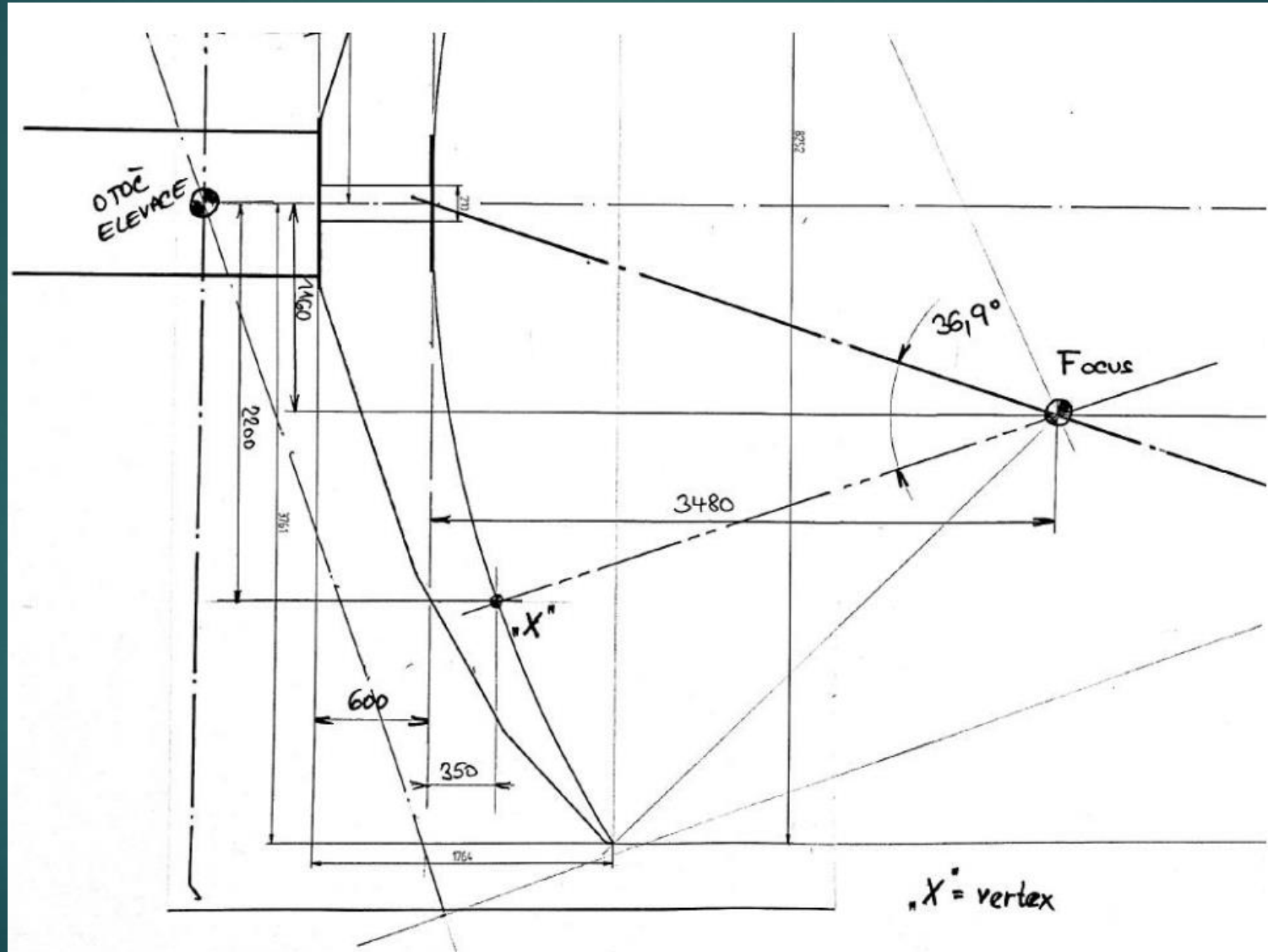


Construction and design of the mirror

- Inspiration 7m offset OE5JFL and 2,4m offset for MW
- Choosing the right F/D
- Dish in the dish antenna design
- Box corpus
- Easy mast mounting
- Easy installation of expansion ribs
- Easy mesh installation



Geometry



Construction and design of the mirror



Production of ribs

- The original intention of laser cutting but.....
- Final design - welded aluminum U-profile construction
- Main ribs U 25x25/2mm
- Auxiliary U23x25/1.5mm
- U20x20/2mm reinforcements
- Special jig with changing geometry for welding



Production of ribs



Composition

- Installation without scaffolding and ladders
- Installation using simple fixtures
- Box construction
- Perimeter reinforcement
- Internal reinforcement



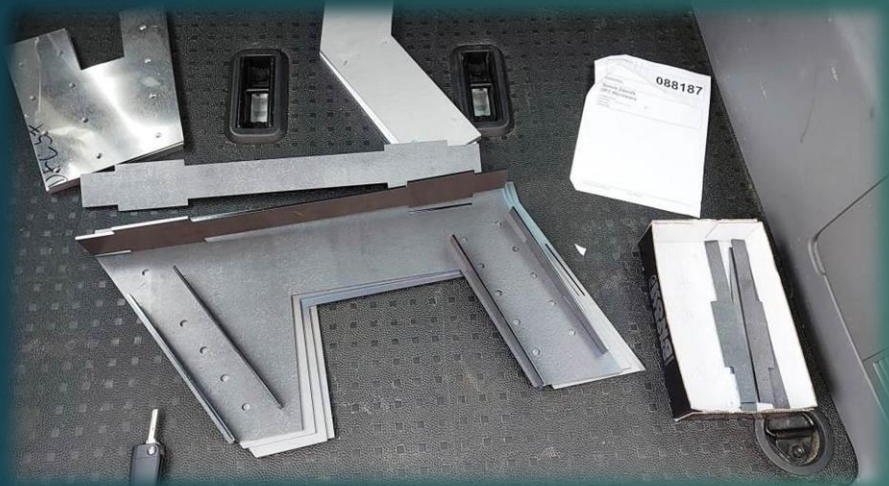
Composition



Composition



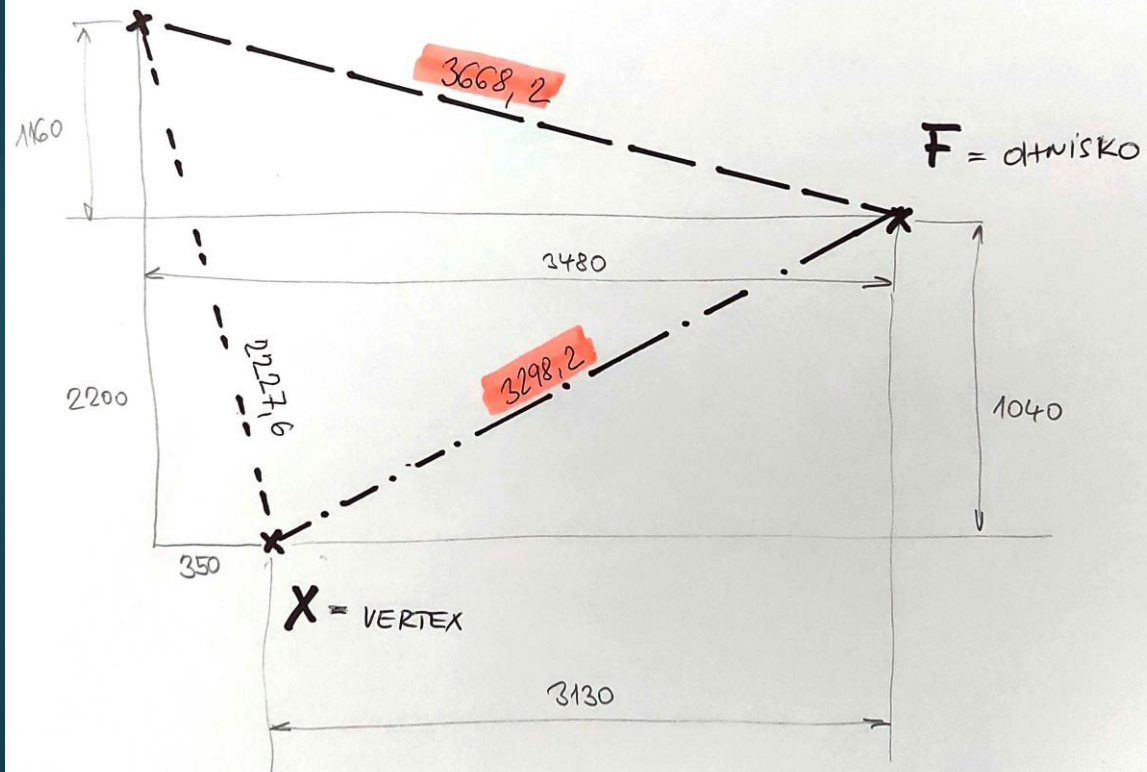
Feed holder



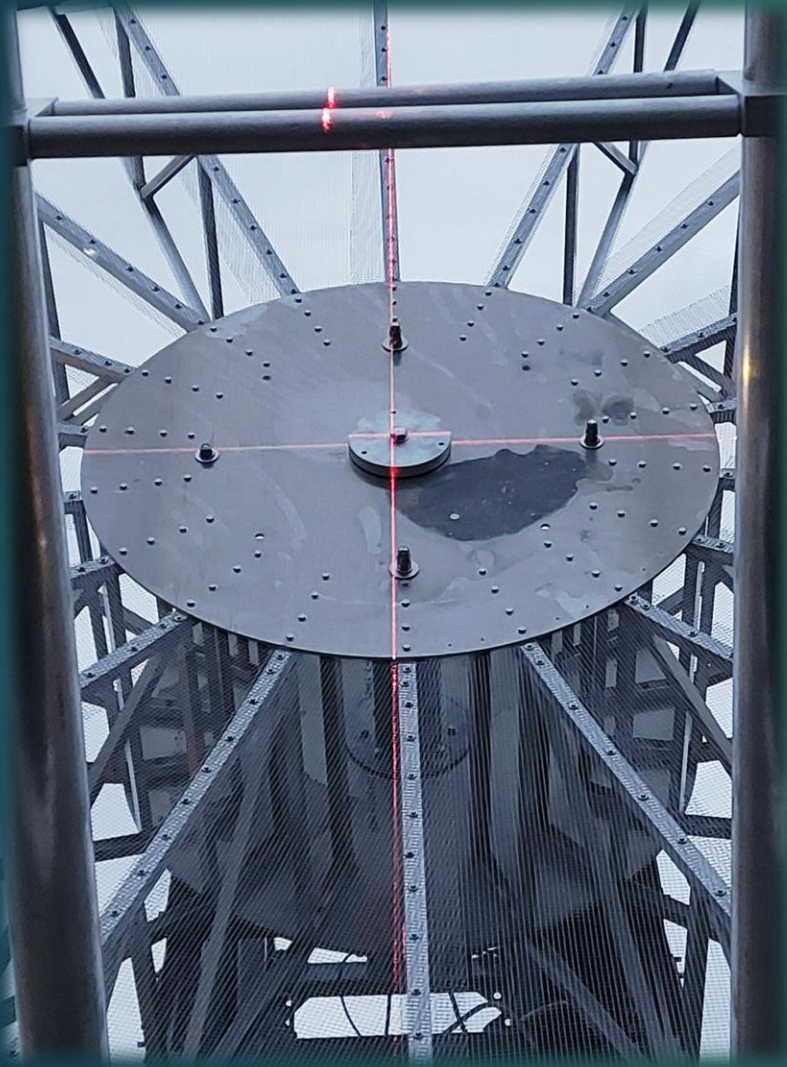
Feed holder

OHNISKO PRO $F/D = 0,475$

S = posunutý střed paraboly

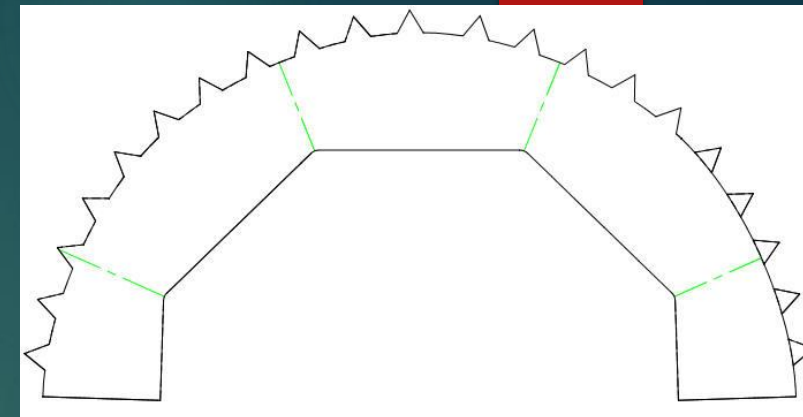


Feed - optical calibration

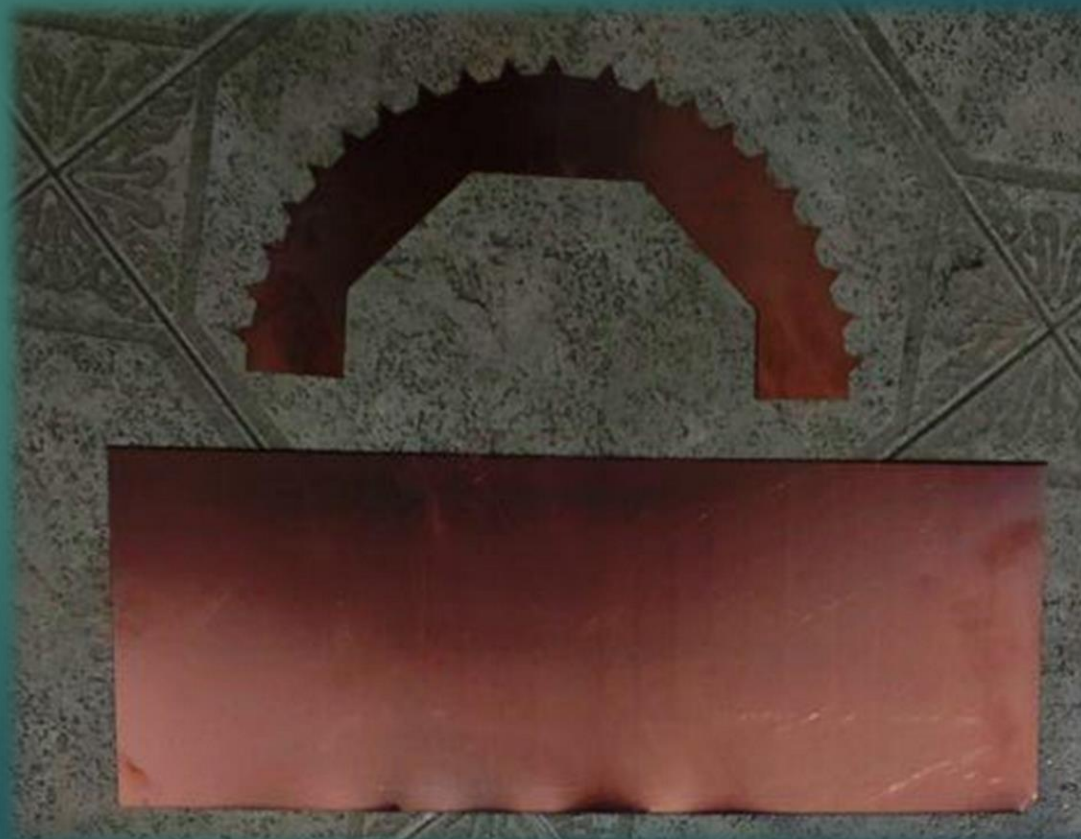
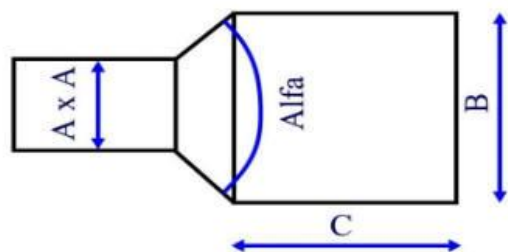


Feeds

- Construction of flare
- Flare design W2IMU
- $F/D = 0.457$
- 1296 and 2320 MHz
- 432 MHz loop feed



	MHz	λ m	λ cm
input	Frequency:	1296	0,231481
input	F/D	0,457	23,14815
	Dimension "B"	0,2486 m	248,6 mm
	Feed half angle:	41,52894 $\alpha/2^\circ$	83,05787 α°
	Dimension "C"	0,294388 m	294,4 mm
	Dimension "A x A"	0,143 m	143 mm
	TE11	0,424111	
	TM11	0,203852	



Feeds

- First test feed F/D 0,6 from previous use of 2,4m offset
- Sun noise 14,5dB - equivalent to 5m PF dish
- Smallest station in QSO 25W and 2m dish





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Final setup and operation of 8m offset dish



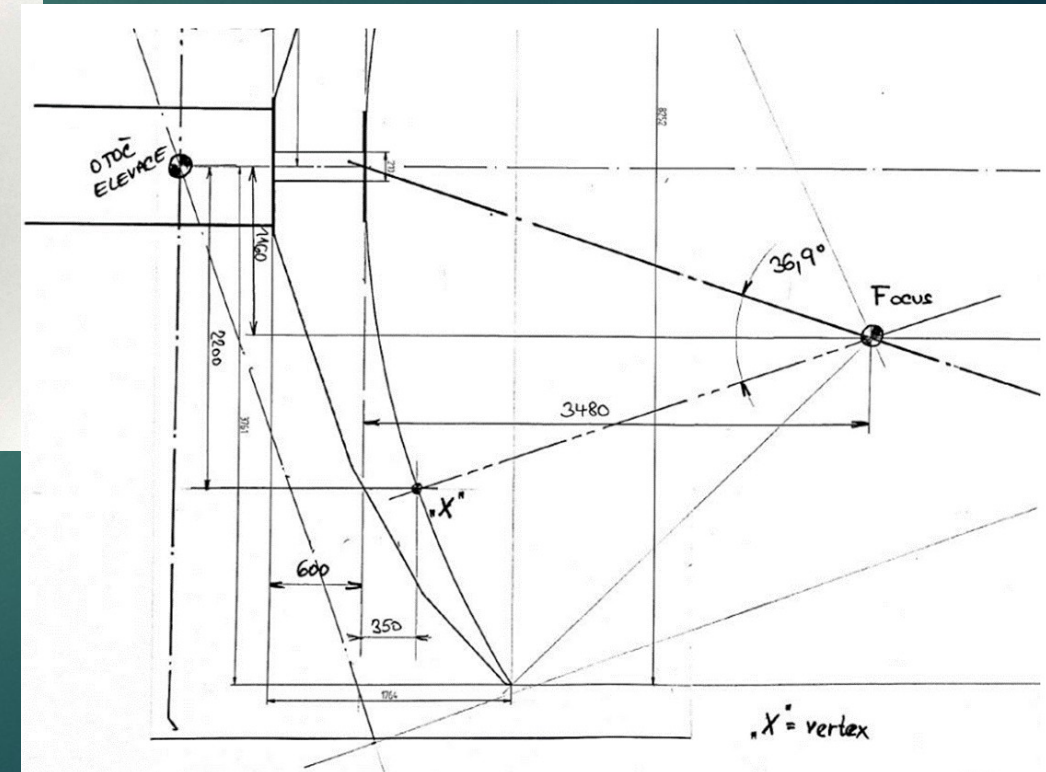
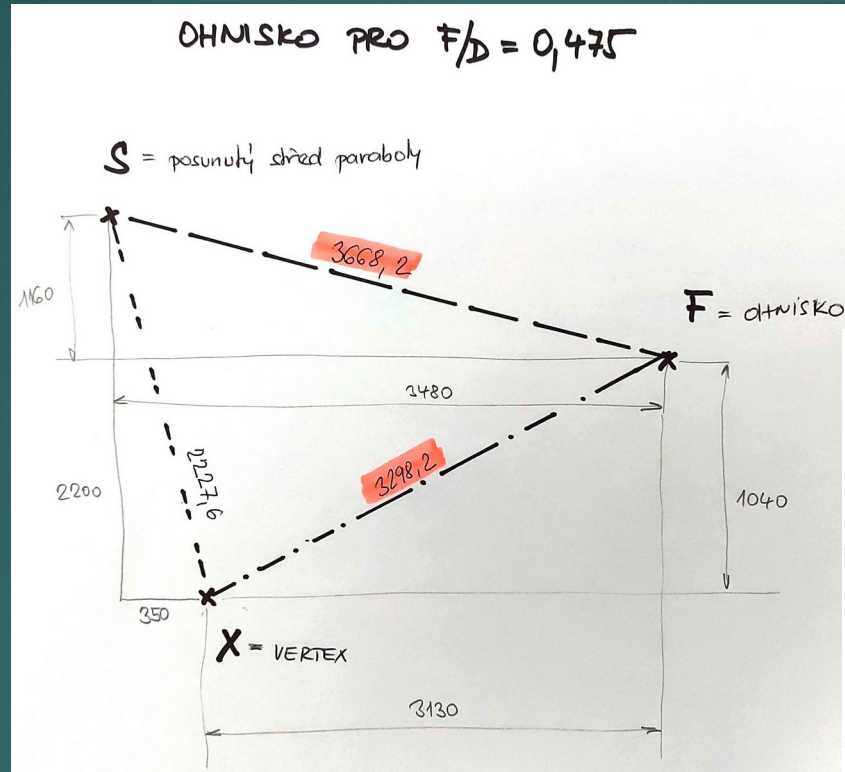
Setup procedure:

- Status of the dish after completion 10/2021
- Calculation of the exact position of the dish focus
- Production of setting jig
- Production of anchoring elements of the jig fixture
- Adjusting the feed holder to the focal point
- Feed axis offset angle setting
- Measuring the Sun's noise
- Measuring Moon Noise
- CW, SSB and Q65 echo test
- EME connections realized after feedhorn adjustment
- Production of feedhorn for 432 MHz
- Test of the dish for 432 MHz band

Antenna and focus adjustment

03/2022

- Calculation of the exact position of the parabola focus



Antenna and focus adjustment

03/2022

- Production of setting jig
- Production of anchoring elements of the fixture
- Adjusting the feed holder to the focal point



Antenna and focus adjustment

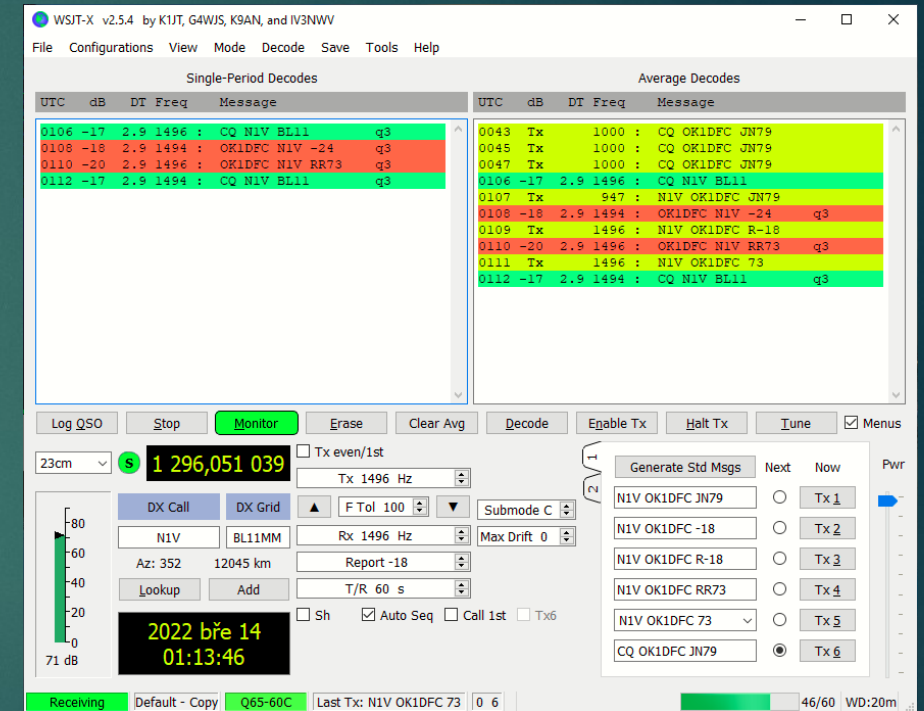
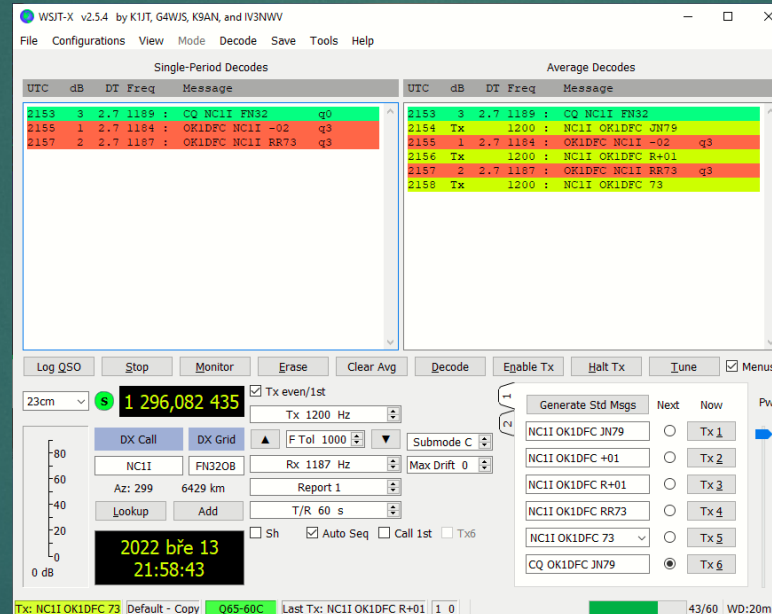
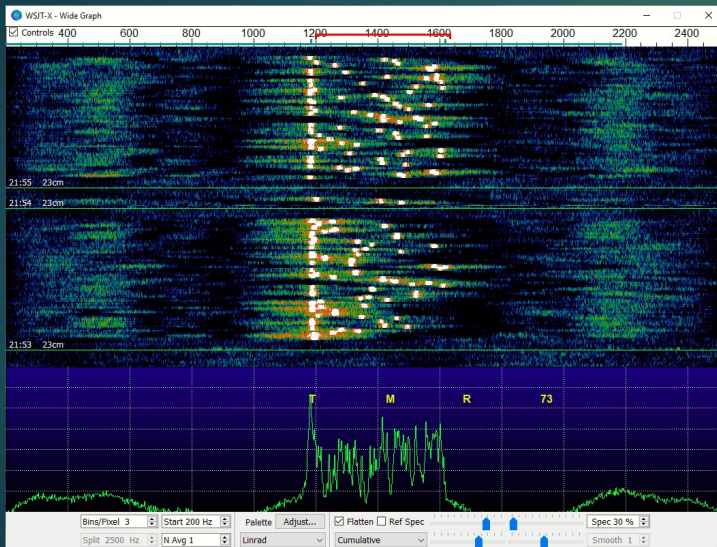
03/2022

- Feed axis offset angle adjustment 36.9°
- Measuring the Sun's noise
- **22.5dB - 123 SFU**
- Measuring Moon Noise
- **1,1dB - clear sky**



After dish and focus adjustment

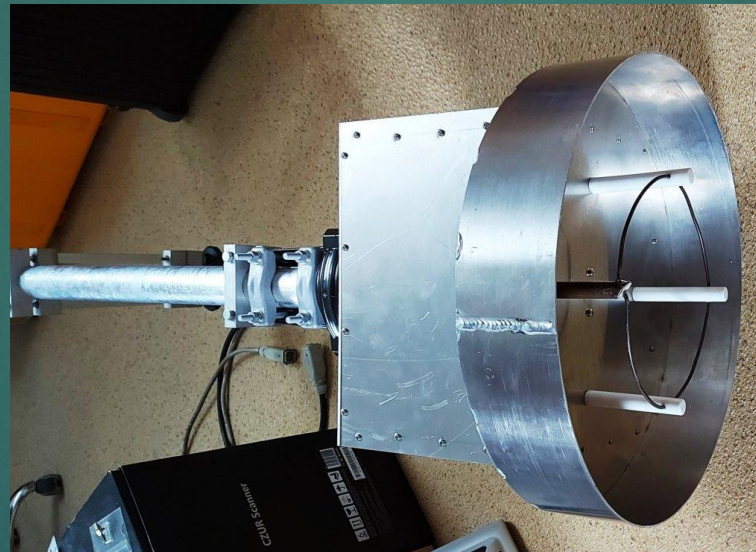
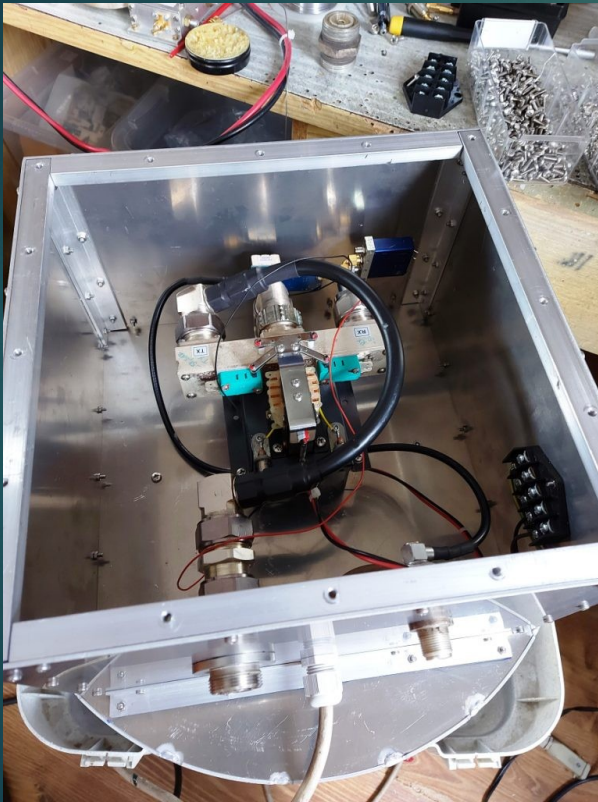
- Self echo test CW - 599, SSB - 57 and Q65 +02 DB, - 10W easily detectable CW signal
- EME QSO realized with **NC1I** and **N1V**



- CW smallest station 180cm offset and 50W RF 539
- Q65 3m dish and **3W** RF !!! -18DB - **PA0TBR**

Dish and focus adjustment 03/2022

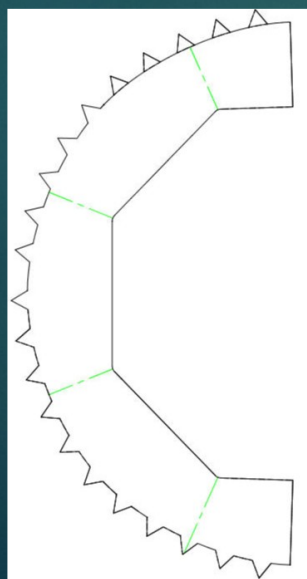
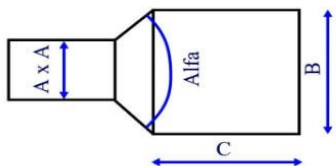
- Production of the 432 MHz feedhorn - Loop feed



Feeds

- Construction of 1296 MHz feed - septum OK1DFC
- Funnel W2IMU
- F/D = **0.457**
- 1296 and 2320 MHz

	MHz	λ m	λ cm
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Dish and focus adjustment

03/2022

- 432 MHz dish test
- Smallest station 10el. Single Yagi and 100W -27 DB
- Sun **20dB** at SFU 123, up to 18° angle of elevation

WSJT-X v2.5.4 by K1JT, G4WJS, K9AN, and IV3NWX

File Configurations View Mode Decode Save Tools Help

Single-Period Decodes

UTC	dB	DT	Freq	Message
1114	-13	2.9	1501	: CQ HS0ZOP OK03 q3
1116	-13	2.9	1499	: OK1DFC HS0ZOP -20 q3
1124	-13	2.7	1055	: CQ HS0ZOP OK03 q3
1126	-15	2.6	1055	: OK1DFC HS0ZOP -21 q3
1128	-16	2.7	1055	: OK1DFC HS0ZOP RRR q3
1131	-23	2.6	1080	: HS0ZOP PA2V JO22 q0

Average Decodes

UTC	dB	DT	Freq	Message
1114	-13	2.9	1501	: CQ HS0ZOP OK03 q3
1114	-13	2.9	1501	: CQ HS0ZOP OK03
1115	Tx		2184	: HS0ZOP OK1DFC JN79
1116	-13	2.9	1499	: OK1DFC HS0ZOP -20 q3
1117	Tx		1501	: HS0ZOP OK1DFC R-13
1119	Tx		1501	: HS0ZOP OK1DFC R-13
1121	Tx		1501	: HS0ZOP OK1DFC R-13
1123	Tx		1501	: HS0ZOP OK1DFC R-13
1124	-13	2.7	1055	: CQ HS0ZOP OK03 q3
1124	-13	2.7	1055	: CQ HS0ZOP OK03
1125	Tx		1501	: HS0ZOP OK1DFC JN79
1126	-15	2.6	1055	: OK1DFC HS0ZOP -21 q3
1127	Tx		1055	: HS0ZOP OK1DFC R-15
1128	-16	2.7	1055	: OK1DFC HS0ZOP RRR q3
1129	Tx		1055	: HS0ZOP OK1DFC 73
1129	Tx		1055	: HS0ZOP OK1DFC 73

Log QSO Stop Monitor Erase Clear Avg Decode Enable Tx Halt Tx Tune Menus

70cm S 432,080 635 Tx even/1st Tx 1055 Hz

DX Call DX Grid HS0ZOP OK03GR F Tol 100 Rx 1055 Hz Submode B Max Drift 0

Az: 84 8568 km Report -15 T/R 60 s

Lookup Add Sh Auto Seq Call 1st Tx6

2022 dub 10 11:31:59

Generate Std Msgs Next Now

HS0ZOP OK1DFC JN79	Tx 1
HS0ZOP OK1DFC -15	Tx 2
HS0ZOP OK1DFC R-15	Tx 3
HS0ZOP OK1DFC RRR73	Tx 4
HS0ZOP OK1DFC 73	Tx 5
CQ OK1DFC JN79	Tx 6

Receiving Default - Copy Q65-60B Last Tx: HS0ZOP OK1DFC 73 1 0 59/60 WD:20m

Conclusion

Thank you for your attention -
Questions ?????