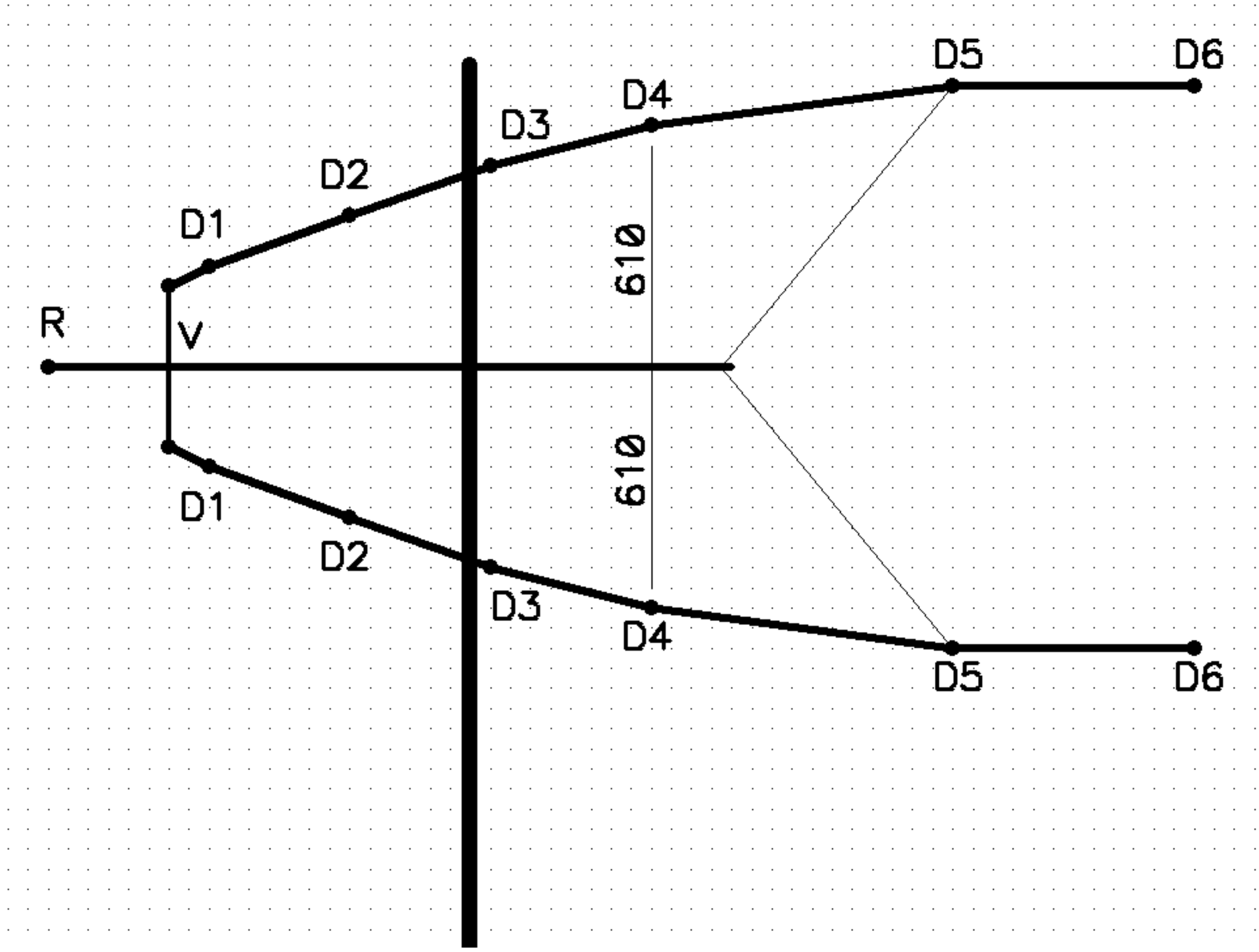
Решил обновить антенны 1978-1981гг.
Разобрал их на материалы, трубы отдельно, элементы отдельно.
Получил DUBUS 1/2017 со статьей YU7XL и начал с 144.

Использовал 2 траверсы Ø14мм длиной 3 метра (из двух частей) и третью длиной 1,5 метра между ними,
латунную трубку для вибратора - Ø10мм,
алюминиевые элементы для рефлектора и директоров D1-D6 — **Ø4мм**.
Алюминиевые элементы для рефлектора и директоров D1-D6 пропустил через **центры** траверс, закрепил с помощью металлических втулок к траверсе. * все элементы заземлены в центре.



Вибратор сделал из латунной трубки Ø10мм. H=806мм по центрам, V=220мм.

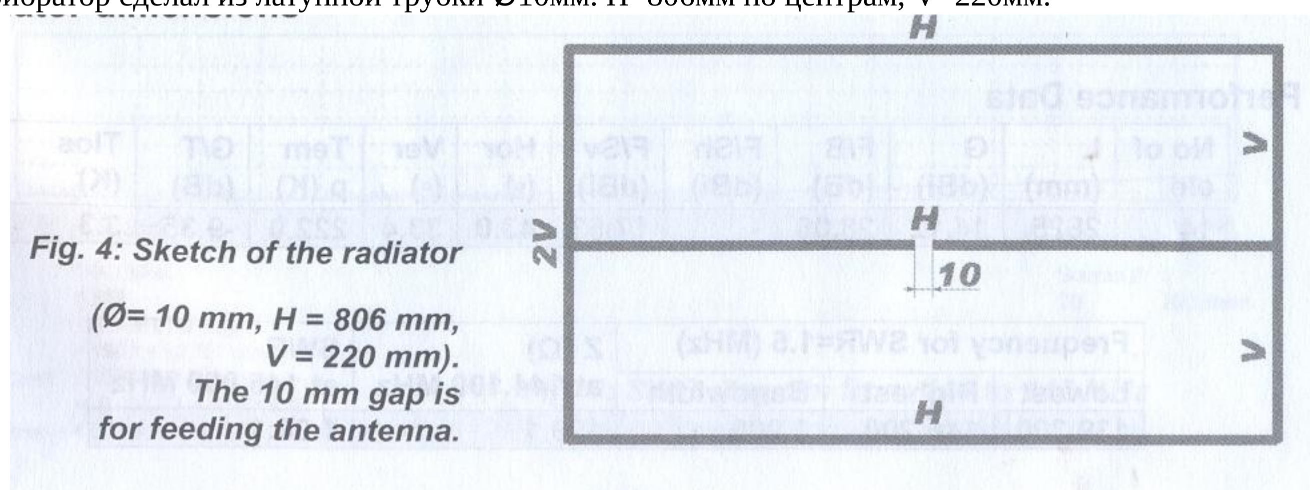
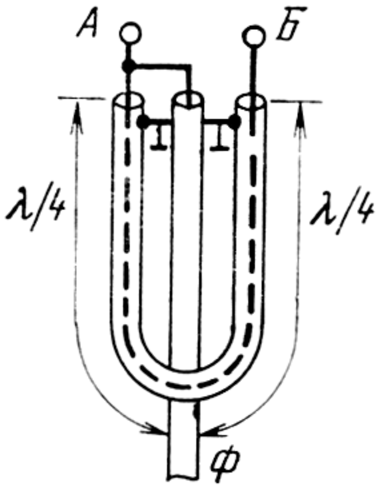


Fig. 4: Sketch of the radiator (Ø= 10 mm, H = 806 mm, V = 220 mm). The 10 mm gap is for feeding the antenna.

В центре поставил изолятор из оргстекла с отверстием Ø14мм под среднюю траверсу и разъем СР50-165ФВ.
Вибратор имеет сопротивление 200 Ом, поэтому сделал согласование при помощи U-колена.



Кабель RG58C/U, 660мм плюс 20-30мм на разделку.

Сборка:
- все три траверсы закрепил к вертикальной секции мачты Ø40мм вблизи D3,
- продел изолятор вибратора через среднюю траверсу и скрепил его с концами верхней и нижней траверс. Под рукой оказалась пара крепежных узлов из пластика (избежал электрохимической коррозии при контакте латуни вибратора и алюминия траверсы), но можно с тем же успехом использовать металлические,
- зафиксировал вибратор и вставил все элементы,
- натянул капроновым шнуром все три траверсы до обеспечения размера ±655мм.

Свои размеры пересчитал под имеющиеся материалы:

	R	**V**	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**
Позиция, мм	**0**	**217**	**408**	**715**	**1096**	**1574**	**2258**	**2825**
Длина, мм	**1041**	**806**	**942**	**944**	**959**	**938**	**922**	**912**
Высота, мм	**0**	**±220**	**±235**	**±380**	**±510**	**±610**	**±665**	**±655**
Шаг, мм		**247**	**161**	**307**	**381**	**478**	**684**	**567**

Автор антенны — Slobodan Bukvic, YU7XL, привел параметры этой антенны X21410XL7Q в сравнении с другими в таблице:

Comparison

The following table shows the X21410XL7Q data inserted in part of the VE7BQH table, where it belongs according to its boom length.

TYPE of Antenna	SINGLE Antenna				FOUR Antennas in H-Stack					
	L (λ)	GAIN (dBd)	Z (ohm)	VSWR BW	E (m)	H (m)	Ga (dBd)	T_{los} (K)	Ta (K)	G/T (dB)
X21410XL7Q	1.36	11.97	199.1	1.08:1	3.88	3.38	17.25	3.0	236.4	-4.33
Vine 6 FD	1.10	9.69	48.3	1.18:1	2.64	2.21	15.67	8.2	238.4	-5.95
G0KSC 6LFA	1.13	9.69	49.3	1.04:1	2.60	2.19	15.64	4.0	236.9	-5.96
DD0VF 6	1.16	9.73	27.2	1.07:1	2.63	2.22	15.71	5.5	240.1	-5.94
M2 2M7	1.28	9.94	204.9	1.14:1	2.65	2.26	15.76	3.7	245.0	-5.98
G0KSC 7LFA	1.39	10.62	48.0	1.19:1	2.84	2.49	16.53	1.8	248.9	-5.28
DG7YBN 7	1.44	10.59	47.2	1.70:1	2.88	2.47	16.55	4.5	242.7	-5.15
Vine 7 FD	1.45	10.56	47.9	1.14:1	2.83	2.46	16.47	8.2	238.6	-5.16
G4CQM 7	1.50	10.76	50.7	2.31:1	2.89	2.53	16.69	7.9	239.9	-4.96
CT1FFU 7	1.54	10.82	28.0	1.02:1	2.87	2.50	16.70	2.8	237.7	-4.96
DK7ZB 7	1.57	11.11	28.4	1.64:1	3.16	2.84	17.13	5.8	272.6	-5.07
IK0BZY 6	1.63	11.11	19.5	2.27:1	3.10	2.77	17.04	4.8	266.5	-5.07
G4CQM 10 UZ2	1.67	10.74	45.1	1.26:1	2.89	2.51	16.68	5.7	235.9	-4.90
DG7YBN 8	1.68	10.94	47.5	1.16:1	2.91	2.56	16.84	3.5	238.8	-4.79
I4GBZ 7	1.69	11.41	48.4	2.27:1	3.18	2.86	17.26	5.7	278.9	-5.04
G0KSC 8LFA	1.79	11.06	50.0	1.24:1	3.15	2.40	16.95	3.6	222.2	-4.37
W1JR 8 MOD	1.80	11.14	50.0	1.14:1	3.07	2.75	16.99	5.3	256.7	-4.95
DJ9BV 1.8	1.80	11.34	77.5	1.34:1	3.16	2.80	17.28	5.5	261.2	-4.74
K1FO 10	1.84	11.34	29.4	1.44:1	3.10	2.78	17.27	4.3	257.7	-4.69
Vine 8 FD	1.85	11.18	51.4	1.12:1	3.00	2.63	17.06	8.5	232.3	-4.45
YU7EF 8	1.87	11.31	48.5	1.21:1	3.04	2.71	17.23	3.8	242.1	-4.46
BQH8B	1.88	11.60	50.0	1.29:1	3.28	2.97	17.62	7.2	259.3	-4.37
UR5EAZ 9	1.89	11.32	49.2	1.01:1	3.07	2.75	17.26	3.6	249.7	-4.56
G4CQM 8	1.91	11.52	49.5	1.11:1	3.15	2.83	17.45	5.1	248.5	-4.35
KF2YN Boxkite9	1.92	13.98	49.2	1.28:2	4.45	3.70	19.95	5.6	228.6	-1.48
CT1FFU 8	1.94	11.28	27.1	1.05:1	2.96	2.62	17.10	2.9	232.3	-4.41
G0KSC 8OWL	1.95	11.63	48.9	1.26:1	3.13	2.82	17.55	4.6	235.7	-4.02
I0JXX 8	2.04	12.11	200.1	3.00:1	3.46	3.17	18.10	9.3	257.3	-3.86
DG0OPK 9	2.07	11.45	28.4	1.11:1	3.04	2.72	17.34	5.7	231.9	-4.16
DK7ZB 8	2.09	12.01	28.0	1.26:1	3.40	3.10	18.02	4.8	253.6	-3.87
G0KSC 9OWA	2.09	11.99	49.1	1.30:1	3.33	3.04	17.96	4.9	247.0	-3.82
RA3AQ 9S	2.12	12.04	47.1	1.08:1	3.35	3.06	18.02	4.7	246.5	-3.75
M2 9SSB	2.12	11.96	200.6	1.26:1	3.33	3.04	17.92	10.8	245.9	-3.84

Z(ohms) - measured on 144.100 MHz - Bandwidth – VSWR measured on 145.000 MHz

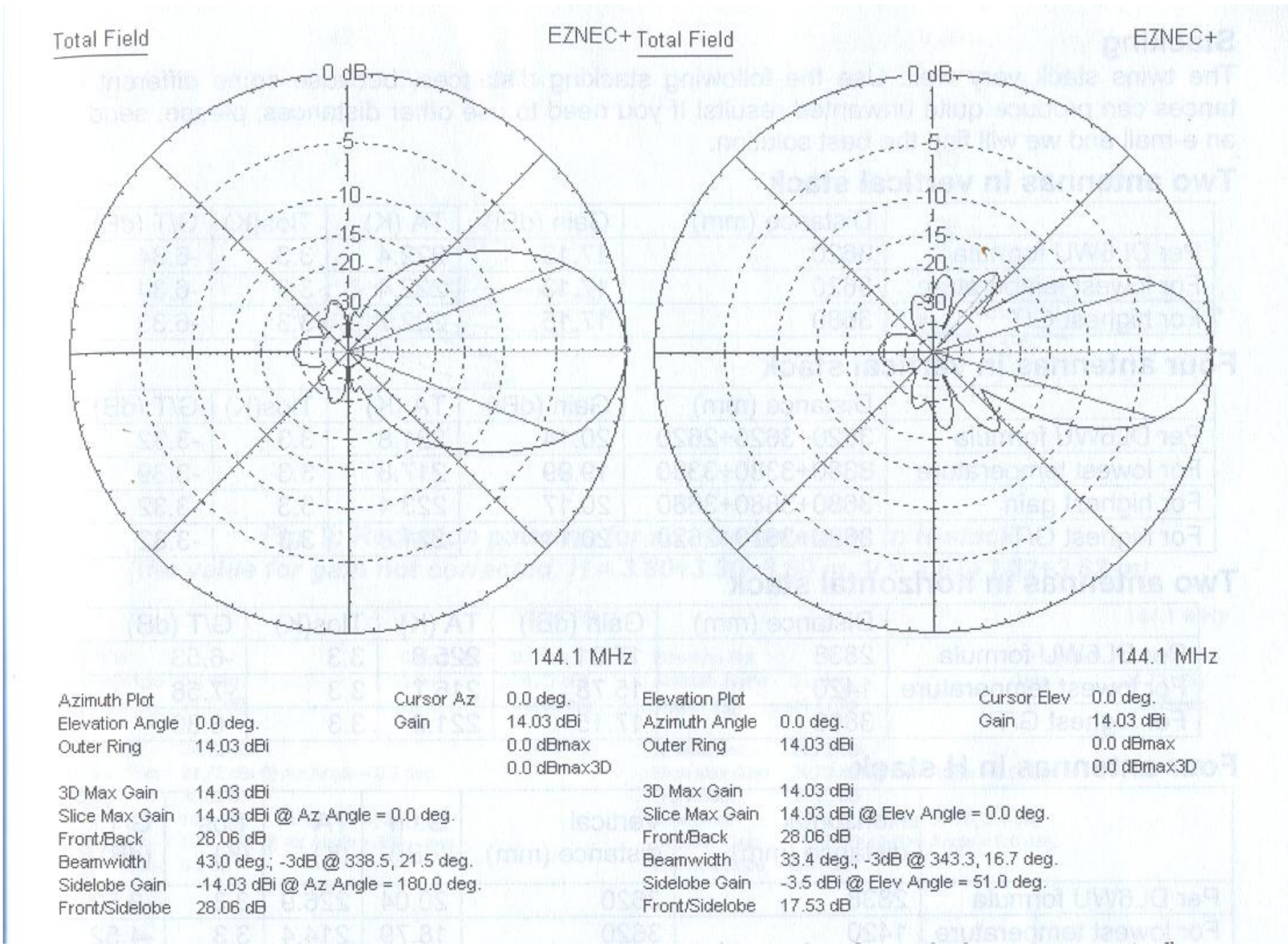
Performance Data

No of ele	L (mm)	G (dBi)	F/B (dB)	F/Sh (dBi)	F/Sv (dBi)	Hor (◦)	Ver (◦)	Temp (K)	G/T (dB)	Tlos (K)
14	2825	14.12	28.06	-	17.53	43.0	33.4	222.0	-9.35	3.3

Frequency for SWR=1.5 (MHz)			Z (Ω) at 144.100 MHz	SWR at 145.000 MHz
Lowest	Highest	Bandwidth		
139.300	146.200	6.900	199.1	1.08:1

Усиление 11,97dBd (или 14,7dBi).

Задние лепестки сильно подавлены:



Мои впечатления:
1) КСВ<1,2 от 142 до 148МГц при измерениях на разъеме вибратора с коротким кабелем.
2) С длинным кабелем РК50-7-17 8 метров КСВ<1,15.
3) Для усиления 12dBd антенна получилась очень легкая.
4) Не потребовалось никаких дополнительных растяжек.
5) Задние лепестки действительно подавлены сильно.
У меня под боком всегда «грохочет» LY2WR, а тут отвернул антенну и его как будто бы и нет.

73!
Владимир Чепыженко, EU2AA

Прикрепил сканы страниц DUBUS 1/2017 со статьей YU7XL.

Twin-boom Yagi Antennas for 144 MHz

by Slobodan Bukvic, YU7XL - yu7xl@mts.rs, www.qslnet.de/member/yu7xl

Introduction

You have a small garden and no room for a big antenna? A good answer could be the twin-boom antenna. The characteristics of a 10 m long Yagi can be achieved with a 6.5 to 7 m long twin-boom antenna.

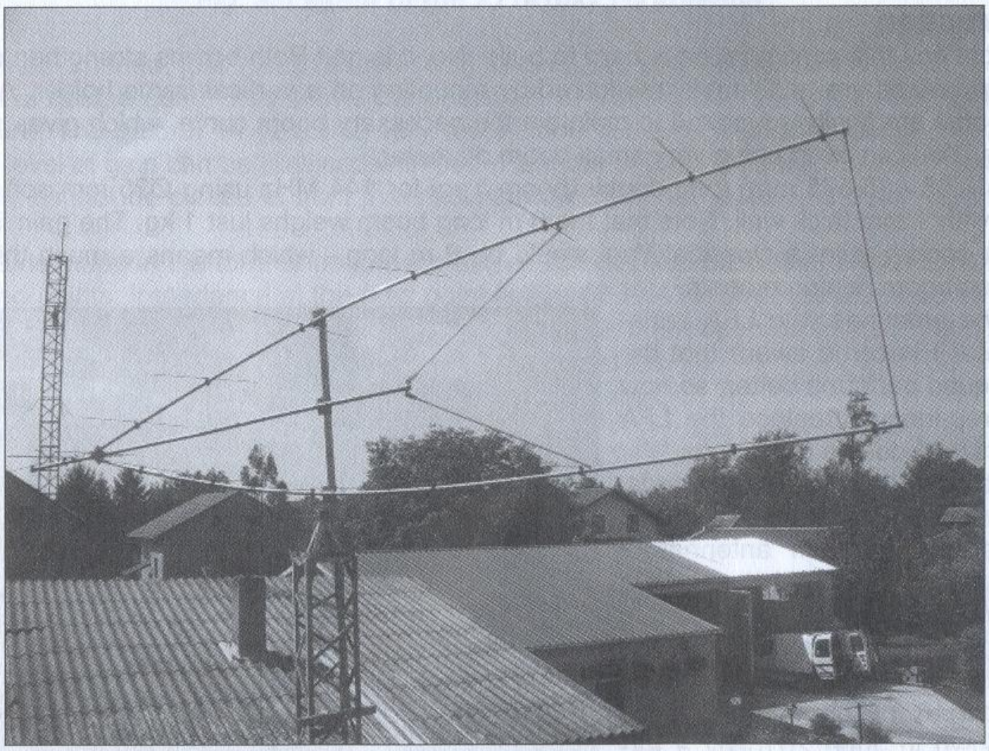


Fig. 1: Antenna X21705XL1 under test

This is an unusual approach to making high gain antennas. The idea is to build two vertically stacked Yagi antennas, whose stacking distance is small. The reflector, the radiator (and sometimes the first director) are common to both Yagis. Some time ago I mentioned this antenna type in Dubus. Now I am going to describe such an antenna for 144 MHz.

Advantages

The small stacking distance does not give a big increase in gain. It is usually around 1 dB over a single Yagi (maximum 1.5 dB), but there are other benefits of such a configuration:

- Because the radiator is common for both antennas, there is no need for a phasing harnes sand its loss is therefore eliminated.
- The small stacking distance means good antenna temperature characteristics. Due to this fact, their G/T ratio usually is about 2 dB or better than the classic style Yagis, particularly for short antennas.

- The vertical radiation pattern is narrower than the horizontal (and much cleaner). Every Dxer loves this.
- Close stacking enables a better SWR curve and bigger working bandwidth.

As you can see, the booms should be slightly bent toward each other alongside for best performance. The vertical distance after bending is not critical, so a little error in the bend is unimportant. However the element distance/position is given on the centreline between the booms and should be projected vertically onto both booms precisely.

The Driven Element

I have designed many twin-boom antennas with open, folded or LFA radiators, but found the double quad the best shape of radiator. With such a radiator, the antenna gives up to 0.5 dB of additional gain in comparison to other radiator forms.

Construction

You might say this configuration is hard to build. No, it is not! Both booms strengthen each other, and both booms are additionally reinforced by mounting on a vertical frame holder. At the ends, both booms are finally squeezed to maintain the necessary boom curve, which gives some more strength. You can even use a very small boom diameter.

I built a 2.68 λ (5.575 mm) long double boom Yagi for 144 MHz using Ø25 mm soft Aluminium tubing, with 1 mm thick wall. Note that the 6 m long boom weighs just 1 kg. The gain is nearly 16 dBi. For such a gain, a classical Yagi would be 8 m long - which means a much thicker boom tube, plus boom reinforcements.

I built the antennas with LFA radiators. Later I became aware that the double quad performs better, so now I am preparing to replace the LFA radiators with double quad ones.

The photos speak more than words. You can see my EME system, which consists of four such antennas. I started working EME with them in October 2016 and it is too early to speak about experiences. However, I can compare them to my previous antennas, 16 x 9 ele hybrids, which were blown in June 2016 by a tornado (who says there have never been tornados in my area?). For me they are performing very well. The only drawback is the lack is XPOL, which is naturally not possible with this antenna type.

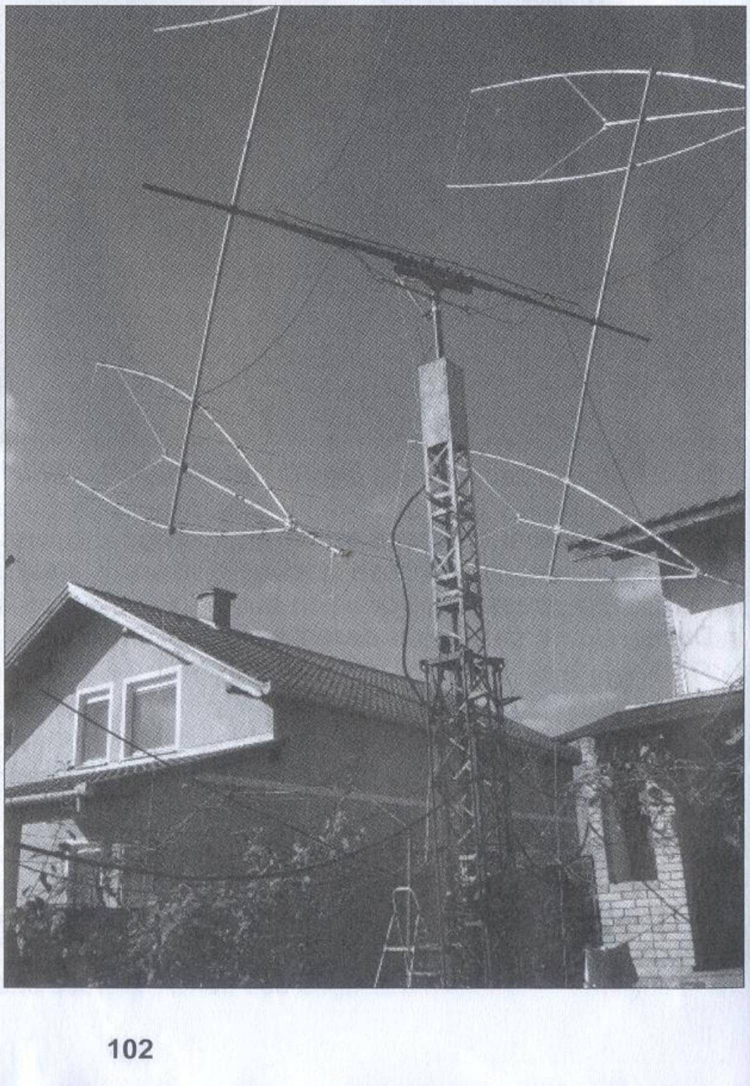


Fig. 2: Four antennas stacked vertically at 5.00 m and horizontally at 4.40 m

X21410XL7Q - Antenna Details

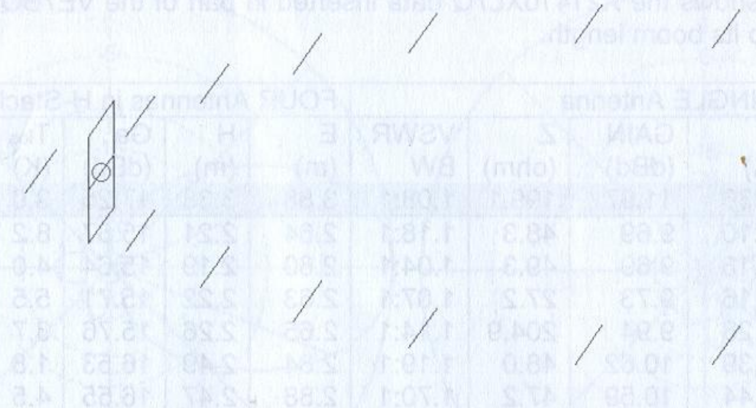


Fig. 3: Layout of the X21410XL7Q antenna

This is a small antenna, just 2.825 metres (1.36 λ) long, but very efficient because its radiator is in the form of double quad. This allows the possibility of placing the antenna in front of the support structure. The gain of 14.12 dBi is very respectable for such a short antenna. With classic Yagis, this level of gain can be obtained with boom lengths of 2.0 λ or more. However, a 4 m long Yagi usually cannot be placed in front the stacking frame without ropes and other support components.

The radiator is made in the form of double rectangle. The middle horizontal rod has a 10 mm gap –for the feed points. Impedance at the feed point is 200 Ω. This means that you have to use ½ λ balun to connect the 50 Ω coax feed. Boom corrections have not been calculated. I suggest you use insulated elements, placed at least 10 mm above the boom.

Dimensions

	Ref	De	D1	D2	D3	D4	D5	D6
Position	**0**	**247**	**408**	**715**	**1096**	**1574**	**2258**	**2825**
Length	**1016**	**806**	**919**	**921**	**935**	**915**	**899**	**889**
Height	**0**	**±220**	**±235**	**±380**	**±510**	**±610**	**±665**	**±655**

Dimensions in mm, the elements are 10 mm diameter, no boom correction included. Heights are measured from the centreline.

Radiator dimensions

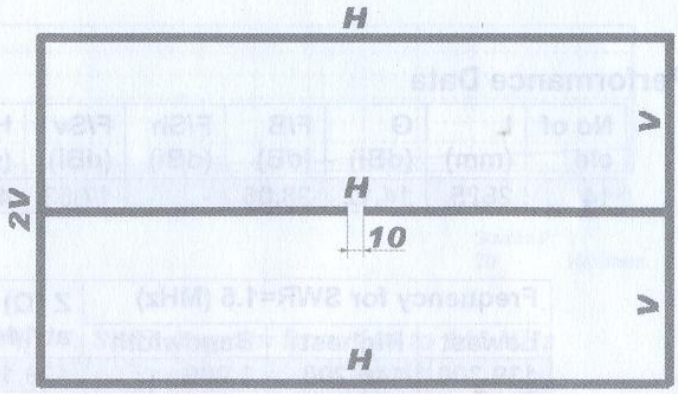


Fig. 4: Sketch of the radiator

(Ø= 10 mm, H = 806 mm, V = 220 mm). The 10 mm gap is for feeding the antenna.

Comparison

The following table shows the X21410XL7Q data inserted in part of the VE7BQH table, where it belongs according to its boom length.

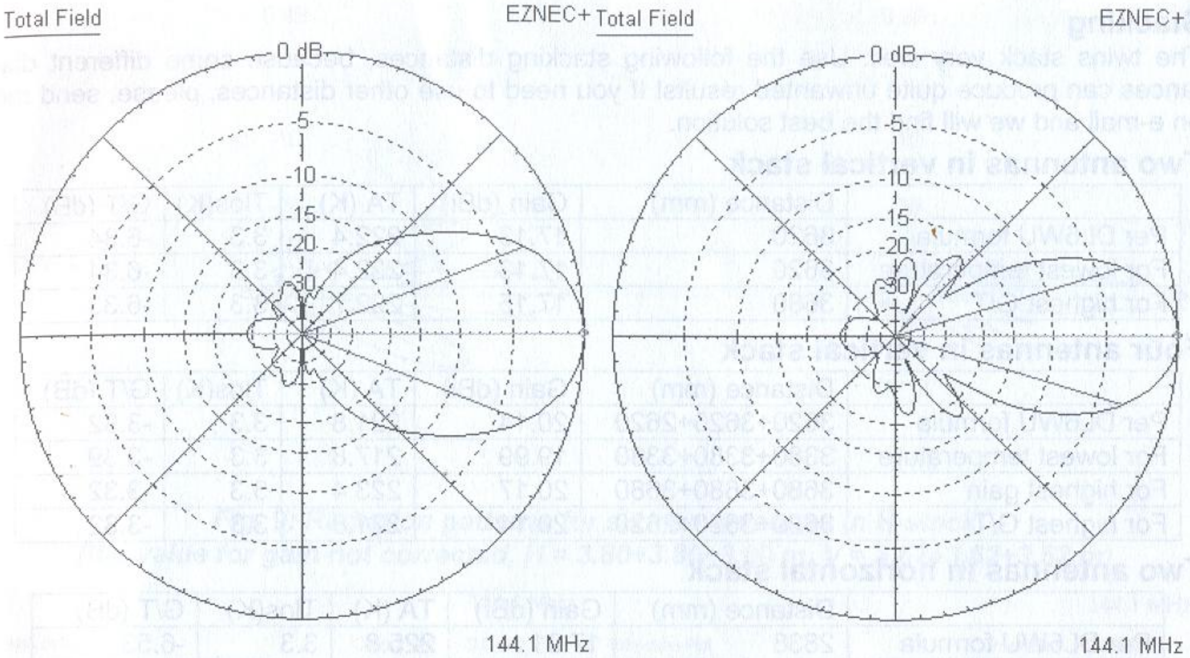
TYPE of Antenna	SINGLE Antenna L (λ)	GAIN (dBd)	Z (ohm)	VSWR BW	FOUR Antennas in H-Stack E (m)	H (m)	Ga (dBd)	Tlos (K)	Ta (K)	G/T (dB)
X21410XL7Q	1.36	11.97	199.1	1.08:1	3.88	3.38	17.25	3.0	236.4	-4.33
Vine 6 FD	1.10	9.69	48.3	1.18:1	2.64	2.21	15.67	8.2	238.4	-5.95
G0KSC 6LFA	1.13	9.69	49.3	1.04:1	2.60	2.19	15.64	4.0	236.9	-5.96
DD0VF 6	1.16	9.73	27.2	1.07:1	2.63	2.22	15.71	5.5	240.1	-5.94
M2 2M7	1.28	9.94	204.9	1.14:1	2.65	2.26	15.76	3.7	245.0	-5.98
G0KSC 7LFA	1.39	10.62	48.0	1.19:1	2.84	2.49	16.53	1.8	248.9	-5.28
DG7YBN 7	1.44	10.59	47.2	1.70:1	2.88	2.47	16.55	4.5	242.7	-5.15
Vine 7 FD	1.45	10.56	47.9	1.14:1	2.83	2.46	16.47	8.2	238.6	-5.16
G4CQM 7	1.50	10.76	50.7	2.31:1	2.89	2.53	16.69	7.9	239.9	-4.96
CT1FFU 7	1.54	10.82	28.0	1.02:1	2.87	2.50	16.70	2.8	237.7	-4.96
DK7ZB 7	1.57	11.11	28.4	1.64:1	3.16	2.84	17.13	5.8	272.6	-5.07
IK0BZY 6	1.63	11.11	19.5	2.27:1	3.10	2.77	17.04	4.8	266.5	-5.07
G4CQM 10 UZ2	1.67	10.74	45.1	1.26:1	2.89	2.51	16.68	5.7	235.9	-4.90
DG7YBN 8	1.68	10.94	47.5	1.16:1	2.91	2.56	16.84	3.5	238.8	-4.79
I4GBZ 7	1.69	11.41	48.4	2.27:1	3.18	2.86	17.26	5.7	278.9	-5.04
G0KSC 8LFA	1.79	11.06	50.0	1.24:1	3.15	2.40	16.95	3.6	222.2	-4.37
W1JR 8 MOD	1.80	11.14	50.0	1.14:1	3.07	2.75	16.99	5.3	256.7	-4.95
DJ9BV 1.8	1.80	11.34	77.5	1.34:1	3.16	2.80	17.28	5.5	261.2	-4.74
K1FO 10	1.84	11.34	29.4	1.44:1	3.10	2.78	17.27	4.3	257.7	-4.69
Vine 8 FD	1.85	11.18	51.4	1.12:1	3.00	2.63	17.06	8.5	232.3	-4.45
YU7EF 8	1.87	11.31	48.5	1.21:1	3.04	2.71	17.23	3.8	242.1	-4.46
BQH8B	1.88	11.60	50.0	1.29:1	3.28	2.97	17.62	7.2	259.3	-4.37
UR5EAZ 9	1.89	11.32	49.2	1.01:1	3.07	2.75	17.26	3.6	249.7	-4.56
G4CQM 8	1.91	11.52	49.5	1.11:1	3.15	2.83	17.45	5.1	248.5	-4.35
KF2YN Boxkite9	1.92	13.98	49.2	1.28:2	4.45	3.70	19.95	5.6	228.6	-1.48
CT1FFU 8	1.94	11.28	27.1	1.05:1	2.96	2.62	17.10	2.9	232.3	-4.41
G0KSC 8OWL	1.95	11.63	48.9	1.26:1	3.13	2.82	17.55	4.6	235.7	-4.02
I0JXX 8	2.04	12.11	200.1	3.00:1	3.46	3.17	18.10	9.3	257.3	-3.86
DG0OPK 9	2.07	11.45	28.4	1.11:1	3.04	2.72	17.34	5.7	231.9	-4.16
DK7ZB 8	2.09	12.01	28.0	1.26:1	3.40	3.10	18.02	4.8	253.6	-3.87
G0KSC 9OWA	2.09	11.99	49.1	1.30:1	3.33	3.04	17.96	4.9	247.0	-3.82
RA3AQ 9S	2.12	12.04	47.1	1.08:1	3.35	3.06	18.02	4.7	246.5	-3.75
M2 9SSB	2.12	11.96	200.6	1.26:1	3.33	3.04	17.92	10.8	245.9	-3.84

Z(ohms) - measured on 144.100 MHz - Bandwidth – VSWR measured on 145.000 MHz

Performance Data

No of ele	L (mm)	G (dBi)	F/B (dB)	F/Sh (dBi)	F/Sv (dBi)	Hor (◦)	Ver (◦)	Temp (K)	G/T (dB)	Tlos (K)
14	2825	14.12	28.06	-	17.53	43.0	33.4	222.0	-9.35	3.3

Frequency for SWR=1.5 (MHz)			Z (Ω) at 144.100 MHz	SWR at 145.000 MHz
Lowest	Highest	Bandwidth		
139.300	146.200	6.900	199.1	1.08:1



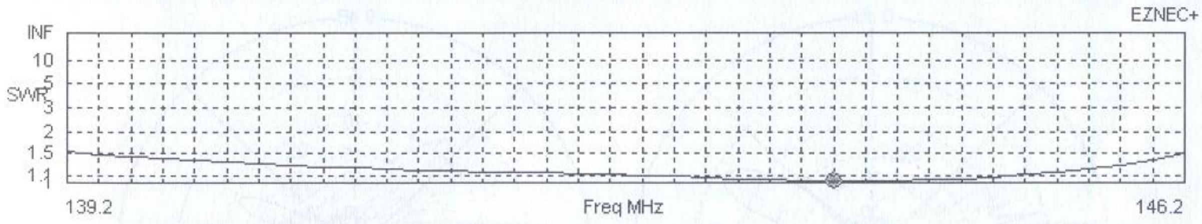
Azimuth Plot | Cursor Az 0.0 deg.
Elevation Angle 0.0 deg. | Gain 14.03 dBi
Outer Ring 14.03 dBi | 0.0 dBmax
0.0 dBmax3D

3D Max Gain 14.03 dBi
Slice Max Gain 14.03 dBi @ Az Angle = 0.0 deg.
Front/Back 28.06 dB
Beamwidth 43.0 deg.; -3dB @ 338.5, 21.5 deg.
Sidelobe Gain -14.03 dBi @ Az Angle = 180.0 deg.
Front/Sidelobe 28.06 dB

Elevation Plot | Cursor Elev 0.0 deg.
Azimuth Angle 0.0 deg. | Gain 14.03 dBi
Outer Ring 14.03 dBi | 0.0 dBmax
0.0 dBmax3D

3D Max Gain 14.03 dBi
Slice Max Gain 14.03 dBi @ Elev Angle = 0.0 deg.
Front/Back 28.06 dB
Beamwidth 33.4 deg.; -3dB @ 343.3, 16.7 deg.
Sidelobe Gain -3.5 dBi @ Elev Angle = 51.0 deg.
Front/Sidelobe 17.53 dB

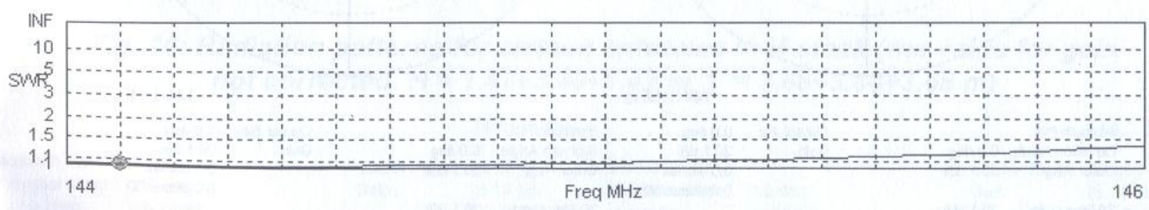
Fig. 5: Radiation patterns for a single antenna (the value for gain is not corrected).



Freq 144 MHz
SWR 1.019
Z 197.4 at 0.75 deg.
= 197.4 + j 2.597 ohms
Refl Coeff 0.009234 at 134.58 deg.
= -0.006481 + j 0.006578
Ret Loss 40.7 dB

Source # 1
Z0 200 ohms

Fig. 6: SWR diagram for SWR = 1.5 (losses included for AI)



Freq 144.1 MHz
SWR 1.015
Z 199.1 at 0.79 deg.
= 199.1 + j 2.757 ohms
Refl Coeff 0.007289 at 108.21 deg.
= -0.002277 + j 0.006924
Ret Loss 42.7 dB

Source # 1
Z0 200 ohms

Fig. 7: SWR diagram from 144 to 146 MHz (losses included for AI)

Stacking

The twins stack very well. Use the following stacking distances, because some different distances can produce quite unwanted results! If you need to use other distances, please, send me an e-mail and we will find the best solution.

Two antennas in vertical stack

	Distance (mm)	Gain (dBi)	TA (K)	Tlos(K)	G/T (dB)
Per DL6WU formula	3620	17.13	222.4	3.3	-6.34
For lowest temperature	3620	17.13	222.4	3.3	-6.34
For highest G/T	3680	17.15	222.7	3.3	-6.33

Four antennas in vertical stack

	Distance (mm)	Gain (dBi)	TA (K)	Tlos(K)	G/T (dB)
Per DL6WU formula	3620+3620+2620	20.14	221.8	3.3	-3.32
For lowest temperature	3380+3380+3380	19.99	217.8	3.3	-3.39
For highest gain	3680+3680+3680	20.17	223.4	3.3	-3.32
For highest G/T	3620+3620+2620	20.14	221.8	3.3	-3.32

Two antennas in horizontal stack

	Distance (mm)	Gain (dBi)	TA (K)	Tlos(K)	G/T (dB)
Per DL6WU formula	2838	17.01	225.8	3.3	-6.53
For lowest temperature	1420	15.78	216.7	3.3	-7.58
For highest G/T	3800	17.15	221.0	3.3	-6.30

Four antennas in H stack

	Horizontal distance (mm)	Vertical distance (mm)	Gain (dBi)	TA (K)	Tlos (K)	G/T (dB)
Per DL6WU formula	2838	3620	20.04	226.9	3.3	-3.52
For lowest temperature	1420	3620	18.79	214.4	3.3	-4.52
For highest G/T	3800	3680	20.19	221.7	3.3	-3.27

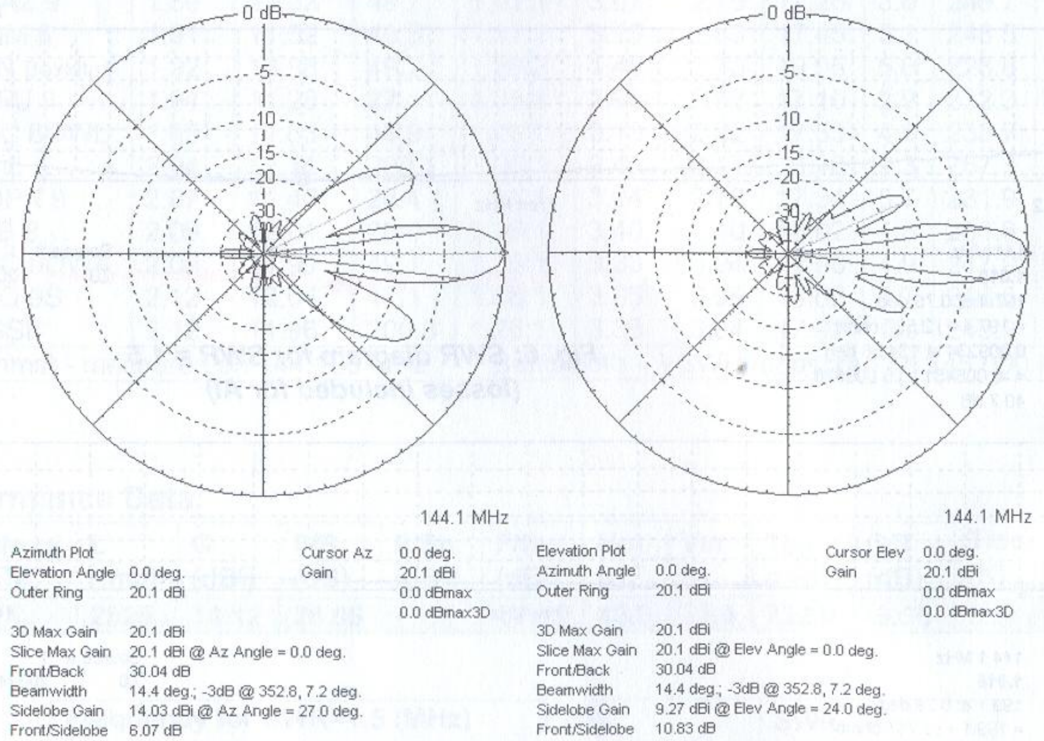


Fig. 8: Radiation patterns for four antennas in H-stack (the value for gain is not corrected, H = 3.8 m, V = 3.68 m)

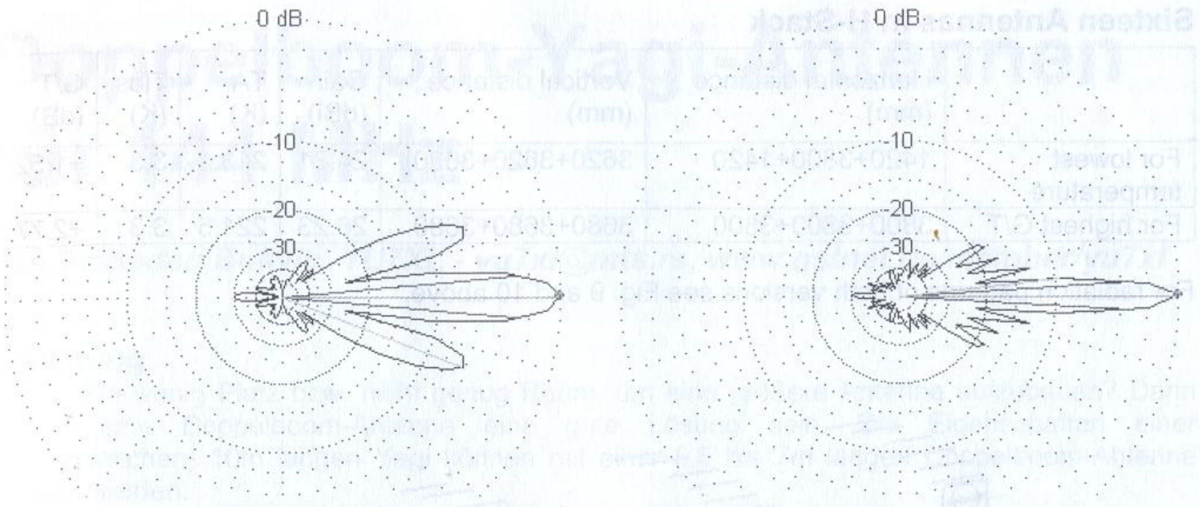


Fig. 9: Radiation patterns for sixteen antennas in H-stack (the value for gain not corrected, H = 3.80+3.80+3.80 m, V = 3.62+3.62+3.62 m)

144.1 MHz

Azimuth Plot		Cursor Az	0.0 deg.
Elevation Angle	0.0 deg.	Gain	24.72 dBi
Outer Ring	24.72dBi		0.0 dBmax
3D Max Gain	24.72 dBi		
Slice Max Gain	24.72 dBi @ Az Angle = 0.0 deg.		
Front/Back	30.05 dB		
Beamwidth	10.4 deg.; -3dB @ 354.8, 5.2 deg.		
Sidelobe Gain	18.52 dBi @ Az Angle = 339.0 deg.		
Front/Sidelobe	6.2 dB		

144.1 MHz

Elevation Plot		Cursor Elev	0.0 deg.
Azimuth Angle	0.0 deg.	Gain	24.72 dBi
Outer Ring	24.72dBi		0.0 dBmax
3D Max Gain	24.72 dBi		
Slice Max Gain	24.72 dBi @ Elev Angle = 0.0 deg.		
Front/Back	30.05 dB		
Beamwidth	6.8 deg.; -3dB @ 356.6, 3.4 deg.		
Sidelobe Gain	15.28 dBi @ Elev Angle = 6.0 deg.		
Front/Sidelobe	9.44 dB		

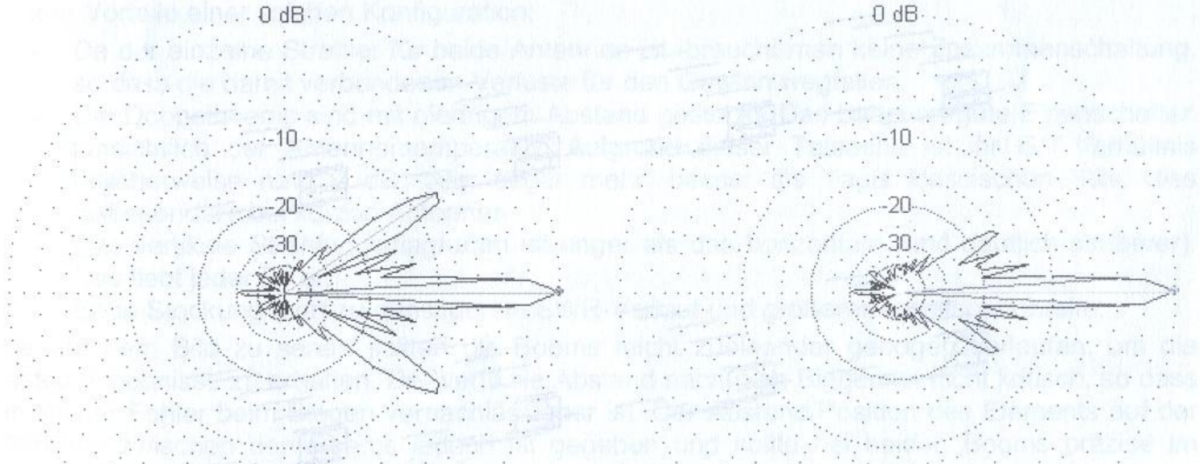


Fig. 10: Radiation patterns for sixteen antennas in H-stack (the value for gain not corrected, H = 1.42+3.80+1.42 m, V = 3.68+3.68+3.68 m)

144.1 MHz

Azimuth Plot		Cursor Az	0.0 deg.
Elevation Angle	0.0 deg.	Gain	26.14 dBi
Outer Ring	26.14dBi		0.0 dBmax
3D Max Gain	26.14 dBi		
Slice Max Gain	26.14 dBi @ Az Angle = 0.0 deg.		
Front/Back	30.97 dB		
Beamwidth	6.6 deg.; -3dB @ 356.7, 3.3 deg.		
Sidelobe Gain	18.99 dBi @ Az Angle = 33.0 deg.		
Front/Sidelobe	7.15 dB		

144.1 MHz

Elevation Plot		Cursor Elev	0.0 deg.
Azimuth Angle	0.0 deg.	Gain	26.14 dBi
Outer Ring	26.14dBi		0.0 dBmax
3D Max Gain	26.14 dBi		
Slice Max Gain	26.14 dBi @ Elev Angle = 0.0 deg.		
Front/Back	30.97 dB		
Beamwidth	6.8 deg.; -3dB @ 356.6, 3.4 deg.		
Sidelobe Gain	16.27 dBi @ Elev Angle = 6.0 deg.		
Front/Sidelobe	9.87 dB		

Sixteen Antennas in H-Stack

	Horizontal distance (mm)	Vertical distance (mm)	Gain (dBi)	TA (K)	Tlos (K)	G/T (dB)
For lowest temperature	1420+3800+1420	3620+3620+3620	24.81	213.1	3.3	+1.52
For highest G/T	3800+3800+3800	3680+3680+3680	26.23	221.5	3.3	+2.77

For radiation patterns of both versions see Fig. 9 and 10 above.

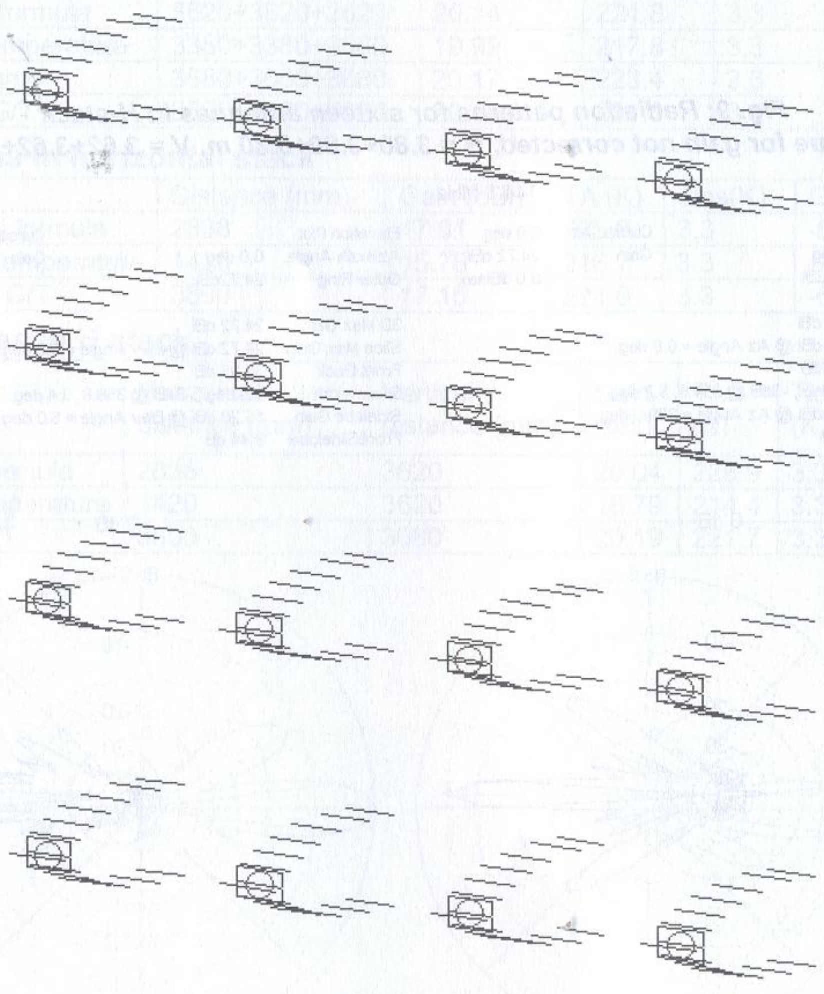


Fig. 11: Layout of the stack of 16 antennas

Conclusion

This antenna is made of Al tubing with 10 mm diameter. Also available are versions with other boom diameters. (5, 6 or 8 mm, or inch sizes). Just send me an e-mail, if you need something different from the versions presented here. Also, if you make this antenna, please send me your experiences and photos. Thank you very much. You won't be disappointed with this antenna, I am sure. Good DX!
73, Slobodan Bukvic, YU7XL