



The "Dual" company has been producing antennas for more than 30 years.

Our focus is on:

- wide bandwidth,
- designs that work equally well in all weather conditions,
- very low SWR and superior G/T, F/B and F/S ratios across the entire frequency band,
- excellent mechanical properties, and
- uncompromised durability.

We do not use amateurish programs like **EZNEC Pro/4**, **4NEC2**, **EZNEC**, **MMANA AO** or **YO**. We perform the design work using **the latest professional full-3D electromagnetic modelling software**. This enables us to accurately include the influence of the boom, insulators, baluns, feed point, connections, etc

Our designs are optimised using the Particle Swarm algorithm, which is considered one of the best global optimization algorithms. We also use the classic Nelder-Mead Simplex algorithm for fine-tuning. Our optimization runs frequently exceed 1 million evaluations.

We rely on solid physics, not on "clever" tinkering with antenna elements or spacings. By paying the greatest attention to all of the important details, we are able to consistently produce top performance designs.

Our antennas are precision physical instruments, they are real **"Precision Antennas" (PA)**.

PA144-11-6BG

Electrical Specifications

Frequency Range:	144 - 145 MHz
Free Space Forward Gain:	14.8 dBi
Front to Back Ratio:	30 dB
3 dB Horizontal Beamwidth:	35°
3 dB Vertical Beamwidth:	38°
G/T for Tsky=290K-Tearth=5400K	-5.66 dB
Polarization:	Horizontal
Nominal Input Impedance:	50 Ohms
SWR Across Entire Band:	< 1.2
Maximum Power Input:	500 W
Matching Method:	Direct feed through common mode choke (current balun)
Connector:	"N"

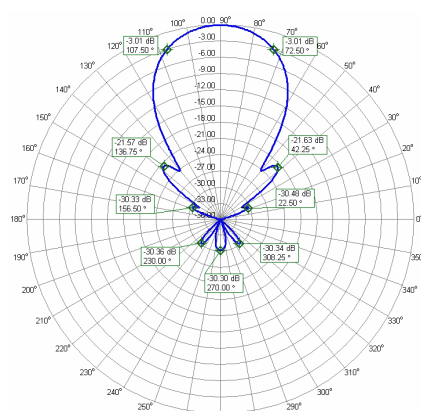
Maximum Power Input options (by order)

"P" N Input connector, RG142 Teflon balun cable:	1500 W (PA144-11-6BGP)
"E" 7/16 DIN Input connector RG142 Teflon balun cable:	1500 W (PA144-11-6BGE)
"EX" 7/16 DIN Input connector RG115 Teflon balun cable:	5000 W (PA144-11-6BGEX)

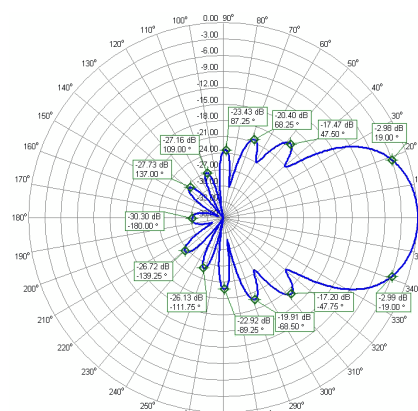
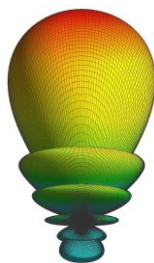
Mechanical Specifications

Number of Elements:	11
Element Diameter:	8 mm Aluminum tube
Dipole Diameter:	8 mm Hard Copper tube
Longest Element:	1040 mm
Element Mounting Position:	Below the Boom
Balun and Connector:	Included
Boom Length:	5.68 m
Boom Size:	Tapered Boom 40x40 mm, 30x30 mm
Number of Boom Pieces:	4
Guy rope support:	Yes, Included
Mounting Mast Diameter:	43 - 70 mm 1-1/4" - 2-3/4"
Survival Wind Speed:	160 km/h
Net Weight:	7.6 kg
Gross Weight:	9.7 kg
Transportation Length:	1.5 m

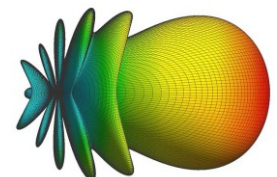
Radiation Patterns



Azimuth

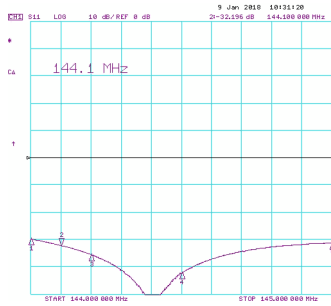


Elevation

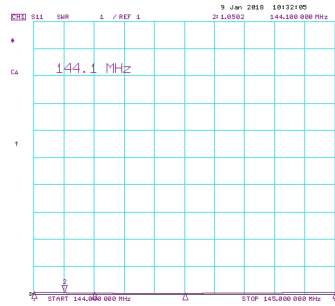


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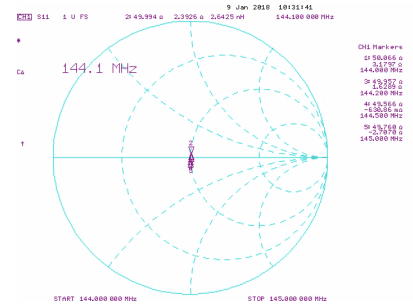
PA144-11-6BG Measured characteristics with calibrated HP8753ES Network Analyzer.



Measured Return Loss (S11)
at antenna connector



Measured SWR
at antenna connector



Smith Chart

Stacking Distances

Horizontal Stacking Distances. G/T Reference Tsky=290 K Tearth=5400 K

2 Antennas	3.30 m. Gain 17.70 dBi (+2.9 dB), G/T -8.77 dB
4 Antennas	3.40 m. Gain 20.7 dBi (+5.9 dB), G/T -5.72 dB
8 Antennas	3.50 m. Gain 23.7 dBi (+8.9 dB), G/T -2.68 dB

Vertical Stacking Distances for BEST G/T. G/T Reference Tsky=290 K Tearth=5400 K

2 Antennas	3.05 m. Gain 17.7 dBi (+2.9 dB), G/T -8.69 dB
4 Antennas	3.10 m. Gain 20.7 dBi (+5.9 dB), G/T -5.23 dB
8 Antennas	3.15 m. Gain 23.7 dBi (+8.9 dB), G/T -2.01 dB

Stacking Distances 4 antennas in "H" configuration for BEST G/T

3300 mm / 3050mm. Gain 20.6 dBi G/T -5.66dB. Used by [VE7BQH Antenna performance table](#)

elevation	pattern	loss	total	G/T
0 deg.	2845.0 K	0.4 K	2841.6 K	-13.90 dB
5 deg.	1741.7 K	0.4 K	1739.8 K	-11.77 dB
10 deg.	891.4 K	0.4 K	890.6 K	-8.86 dB
15 deg.	539.9 K	0.4 K	539.6 K	-6.68 dB
20 deg.	484.3 K	0.4 K	484.0 K	-6.21 dB
25 deg.	473.5 K	0.4 K	473.2 K	-6.11 dB
30 deg.	427.1 K	0.4 K	426.9 K	-5.66 dB
35 deg.	387.7 K	0.4 K	387.6 K	-5.24 dB
40 deg.	375.8 K	0.4 K	375.7 K	-5.11 dB
45 deg.	368.2 K	0.4 K	368.1 K	-5.02 dB
50 deg.	354.8 K	0.4 K	354.7 K	-4.86 dB
55 deg.	344.1 K	0.4 K	344.0 K	-4.73 dB
60 deg.	336.9 K	0.4 K	336.9 K	-4.63 dB
65 deg.	330.2 K	0.4 K	330.2 K	-4.55 dB
70 deg.	326.0 K	0.4 K	325.9 K	-4.49 dB
75 deg.	325.0 K	0.4 K	325.0 K	-4.48 dB
80 deg.	324.2 K	0.4 K	324.1 K	-4.47 dB
85 deg.	322.1 K	0.4 K	322.1 K	-4.44 dB
90 deg.	321.0 K	0.4 K	320.9 K	-4.42 dB



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Vertical Stacking Distances 8 antennas 3150mm for BEST G/T

G/T Reference Tsky=290 K Tearth=5400 K. G/T=-2.01 dB

Used by [VE7BQH Antenna performance table](#)

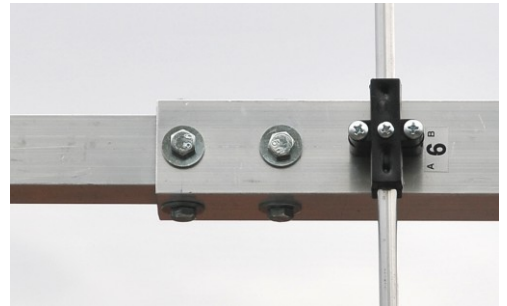
elevation	pattern	noise temperature	loss	total	G/T
0 deg.	2845.0 K	0.5 K	2840.6 K	-10.80 dB	
5 deg.	587.8 K	0.5 K	587.3 K	-3.96 dB	
10 deg.	466.8 K	0.5 K	466.5 K	-2.96 dB	
15 deg.	422.2 K	0.5 K	422.0 K	-2.52 dB	
20 deg.	398.9 K	0.5 K	398.7 K	-2.27 dB	
25 deg.	384.6 K	0.5 K	384.5 K	-2.12 dB	
30 deg.	375.2 K	0.5 K	375.0 K	-2.01 dB	
35 deg.	369.1 K	0.5 K	368.9 K	-1.94 dB	
40 deg.	364.6 K	0.5 K	364.4 K	-1.88 dB	
45 deg.	350.1 K	0.5 K	350.0 K	-1.71 dB	
50 deg.	334.1 K	0.5 K	334.0 K	-1.51 dB	
55 deg.	327.4 K	0.5 K	327.4 K	-1.42 dB	
60 deg.	322.2 K	0.5 K	322.1 K	-1.35 dB	
65 deg.	318.8 K	0.5 K	318.7 K	-1.30 dB	
70 deg.	318.0 K	0.5 K	317.9 K	-1.29 dB	
75 deg.	317.6 K	0.5 K	317.5 K	-1.29 dB	
80 deg.	316.7 K	0.5 K	316.7 K	-1.27 dB	
85 deg.	315.5 K	0.5 K	315.4 K	-1.26 dB	
90 deg.	314.9 K	0.5 K	314.8 K	-1.25 dB	

Assembly instruction

Join the boom.

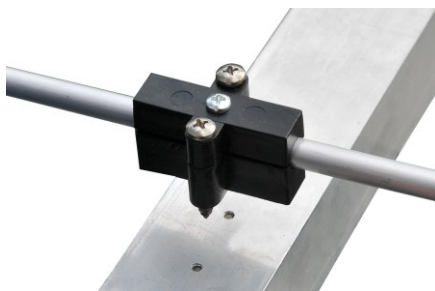


Not all pictures are related to the particular antenna.



Put the boom on the flat surface. Because of length you should tighten screws lightly for the first moment. Then look along the boom to see if any distortion occurs. When you are satisfied tighten firmly. Before tightening all screws, apply thread lock like Loctite 243 or Permatex Threadlocker BLUE.

Attach the elements (number to number).



Not all pictures are related to the particular antenna.

Starting with 1, paying special attention on orientation. Required torque 2.2 Nm.

If needed align elements and screw tightly. Elements must stand in one plane. Before tightening all screws, apply thread lock.



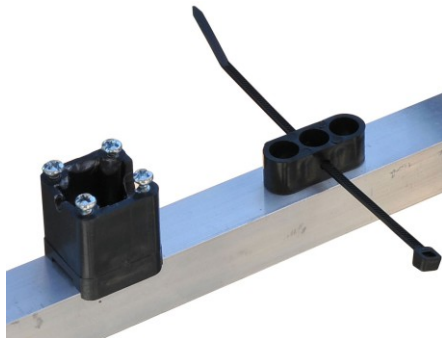
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Attach the dipole.



Screw connector to connector holder.



Not all pictures are related to the particular antenna.



Fasten balun with plastic zip tie to balun holder.


Assemble and attach antenna mounting bracket.

Attach snap hook - carabiner to support boom without unscrewing turnbuckles.



Put the boom on temporary mast. Wait a couple of hours and re adjust turnbuckles. Apply thread lock.




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Raise the antenna. Measure SWR. It must be as predicted or very close on all frequencies. Low SWR is a sign that you assembled everything correctly. Best DX - EME.



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